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PERMIT AMENDMENT APPLICATION

UNDER THE BRITISH COLUMBIA *MINES ACT*

MOUNT POLLEY MINE

Springer Expansion

PREPARED FOR

THE MINISTRY OF ENERGY, MINES AND LOW CARBON INNOVATION
and
The Ministry of Environment and Climate Change Strategy

PREPARED BY

MOUNT POLLEY MINING CORPORATION

July 5, 2024

EXECUTIVE SUMMARY

This permit amendment application is made on behalf of Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation, owner of Mount Polley mine and property. Mount Polley mine is an open pit copper/gold mine located in central British Columbia, 56 km northeast of Williams Lake (latitude 52° 33' N and longitude 121° 38' W) and the Mount Polley property consists of 43 mineral claims encompassing 16,478 hectares and five mining leases totalling 1,867 hectares.

This application is being submitted as a requirement under Section 10 of the *Mines Act* of British Columbia to apply for an amendment to Permit M-200, and the key benefit of this project will be to increase the mine life until 2031.

Key components include:

- mining of the C2 and Boundary zone pits;
- construction of the Southeast Rock Disposal Site;
- development of a temporary stockpiles for potentially acid generating waste;
- interim raise of the Tailings Storage Facility (TSF) to the 974 m elevation.

Consultants were retained to complete work deemed to be outside the expertise of in-house personnel. Studies address all proposed work and include storage of Potentially Acid Generating material (SRK Consulting and WSP Canada Inc.); geotechnical analysis of the proposed footprint (WSP Canada Inc.); and fish habitat assessment (Minnow Environmental).

Wide distribution of project information and consultations with the public and First Nations are key expectations of the mine project review process. Public consultation measures taken will be in compliance with the Ministry of Energy, Mines and Low Carbon Innovation (EMLI) Public Consultation Policy, and relevant guidance may also be obtained from the Provincial Policy for Consultation with First Nations.

All work presented has been completed during open discussion with EMLI and Ministry of Environment and Climate Change Strategy (ENV) representatives and reflects a comprehensive and accurate representation of planned mining and construction. Project planning and review conducted both internally by MPMC and externally by consultants retained (as outlined above) confirms that all aspects of the project are feasible and abide by the regulations of all governing bodies.

On August 4, 2014, a breach occurred in the Perimeter Embankment of the TSF; this event is referred to as the “breach”. The breach released tailings, water, and embankment construction materials to the downstream environments of Polley Lake, Hazeltine Creek, and Quesnel Lake. Following the breach, mine operations ceased. Restricted operations, with tailings being deposited in Springer Pit, commenced on August 4, 2015. On November 6, 2015, MPMC applied for an amendment to the M-200 to allow for a return to full operations, including the use of the TSF for tailings deposition. On June 23, 2016, this amendment was provided by EMLI, and on June 27, 2016, MPMC resumed deposition of tailings into the TSF.

On January 7, 2019, MPMC announced a decision to go on suspended operations (Care and Maintenance) beginning May 31 of that year, citing low metal prices. When entering Care and Maintenance, MPMC had been executing Phase 3 of 4 permitted phases for the Springer-Cariboo Pit. As noted in the August 25, 2021, communication regarding “Notice of Mount Polley Mine Restart”, operations were planned to restart in 2021. Restart was initiated in response to improving market conditions and, as of November 2021, MPMC has started to return to operations. Mining activities occurring on site follow the activities approved by the March 17, 2014, M-200 amendment Approving Cariboo Phase 4 Expansion and the June 23, 2016, M-200 amendment Approving Return to Full Operations and Use of the TSF.

Phase 4 contains ~16 Mt of material that will be processed by the mill, resulting in tailings material for deposition in the TSF. This material will come from mining the saddle between Cariboo and Springer Pits, and further developing the combined pit. Non acid generating (NAG) waste rock will be placed in the Southeast Rock Disposal Site (SERDS) or used in construction of the TSF dam, while potentially acid generating waste rock (PAG) will report to the Temporary Northwest PAG Stockpile.

The proposed Springer Expansion includes Phase 5, Phase 6, C2, and WX and will supplement ore production into the year 2031. The Springer Expansion (SP6-V4) pushes back the extents of the Phase 4 Springer pit, as well as deepens. Two starter pits (C2 and WX) will also be deepened in the later years of the Life of Mine. The WX and C2 pits will follow many of the same design principles as already existing in operating pits at Mount Polley mine.

The TSF is required to be raised to accommodate the Springer Expansion and in this application MPMC proposes an interim raise to 974 m. In a subsequent application MPMC will provide the designs for the final raise to 987 m which is associated with the Life of Mine.

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LIST OF ABBREVIATIONS

%	Percent
°C	Degrees Celsius
µg	micrograms
ABA	Acid-Base Accounting
ADP	Annual Discharge Plan
AET	Actual Evapotranspiration
AIA	archaeological impact assessment
AL	aquatic life
ANOVA	Analysis of Variance
AOP	area of potential
AP	Acid Potential
ARD	acid rock drainage
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC CSR	British Columbia Contaminated Sites Regulation
BC ENV	British Columbia Ministry of Environments
BEC	Biogeoclimatic Ecosystem Classification
C%	carbon percentage
CDA	Canadian Dam Association
CEMP	Comprehensive Environmental Management Plan
cm	centimeter
COI	communities of interest
CORMIX	Cornell Mixing Zone Expert System
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSM	conceptual site model
CSR	Contaminated Sites Regulations
DOC	dissolved organic carbon
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
ELU	end land use
EMA	Environmental Management Act
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EPN	Environmental Protection Notice
EPT	Ephemeroptera, Plecoptera, and Trichoptera

ERA	Environmental Risk Assessment
ESCP	Erosion and Sediment Control Plan
FN	First Nations
FSR	Forest Service Road
GIS	geographic information system
Golder	Golder Associates Ltd.
Ha	hectares
HCA	Heritage Conservation Act
HHRA	human health risk assessment
HROA	heritage resource overview assessment
HRWG	Habitat Remediation Working Group
HSRC	Health, Safety and Reclamation Code
ICH	Interior Cedar-Hemlock
IDZ	Initial Dilution Zone
km	Kilometer
km/hour	Kilometer per hour
kV	kilovolt
L/s	Liters per Second
LIMS	Laboratory information management system
LoM	Life of Mine
LOR	Limit of Reporting
LTWMP	Long-term Water Management Plan
M	Million
m3	cubic metres
m3/d	Cubic metres per day
m3/day	cubic meters per day
masl	metres above sea level
MBCA	Migratory Birds Convention Act
MDMER	Metal and Diamond Mining Effluent Regulations
MEM	Ministry of Energy and Mine
mg/kg	Milligrams per kilogram
mg/kg-dw	Milligrams per kilogram dry weight
mg/L	Milligrams per litre
mg-N/L	Milligrams nitrogen per litre
mg-P/L	Milligrams phosphorus per litre
ML/ARD	metal leaching and acid rock drainage
mm	millimetre

MMO	Major Mines Office
BC MoE	British Columbia Ministry of Environments
MPIC	Mount Polley Intrusive Complex
MPM	Mount Polley Mine
MPMC	Mount Polley Mining Corporation
MPRP	Mine Plan and Reclamation Plan
NAG	non-acid-generating
NEZ	Northeast Zone
NP	Neutralization potential
NPR	Neutralization Potential Ratio
NTU	Nephelometric Turbidity Unit
NW	Northwest Potentially acid generating
OMS	Operation Maintenance and Surveillance
Orica	Orica Canada Inc.
PAG	potentially-acid-generating
PET	Potential Evapotranspiration
PFR	preliminary field reconnaissance
PLC	Public Liaison Committee
QA/QC	Quality Assurance and Quality Control
QEP	qualified environmental professional
QP	Qualified Professional
RCP	reclamation and closure plan
RDS	rock disposal stockpile
RPD	Relative Percent Difference
S%	sulphur percentage
SAG	semi-autonomous grinding
SAR	Species-at-risk
SARA	Species at Risk Act
SERDS	Southeast Rock Dump Site
SMNEA	Southern Mountain National Ecological Area
SMP	Soil Management Plan
SPE	Springer Expansion
sph	stems per hectare
SRK	SRK Consulting (Canada) Inc.
SWE	Snow-water-equivalent
SWL	Static water level
SWWBM	site-wide water balance model

SWWQM	site-wide water quality model
t	tonne(s)
t/d	Tonnes per Day
TAR	Technical Assessment Report
TEM	Terrestrial Ecosystem Mapping
TIC	Total Inorganic Carbon
TRP	Trigger Response Plan
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
VRI	Vegetation Resources Inventory
WLFN	Williams Lake First Nation
WLRS	Water, Land and Resource Stewardship
WMP	Water Management Plan
WQG	Water Quality Guideline
WSP	WSP Canada Inc.
WSQG	Working Sediment Quality Guidelines
WTP	Water treatment plant
µS/cm	Convert Microsiemens per Centimeter

1 INTRODUCTION

1.1 Application Background

Mount Polley Mine is a copper gold mine operating in central British Columbia (BC), approximately 80 km southeast of Quesnel, BC, adjacent to Polley Lake and Hazeltine Creek, which flows into Quesnel Lake and then the Quesnel River.

Mount Polley Mining Corporation (MPMC) has prepared a joint *Mines Act* and *Environmental Management Act* Permit M-200 Amendment Application to support the Springer Expansion Project at the Mount Polley Mine that will extend the life of the mine until 2031. Mining of Phase 4 is anticipated to finish in approximately 2 years (early 2025), this represents the end of the permitted operational mining activities under permit M-200. However, the opportunity exists to extend the mine's life with the development of the "Springer Expansion" project (the Project). This proposed project falls within the existing mine boundary and would support an additional approximately 8 years of operation, depending on market conditions.

The full scope of the application includes the following:

- an expansion of the Springer Pit by mining the saddle between Cariboo and Springer pits, deepening both pits and creating two starter pits CX and W2.
- an extension of the South East Rock Disposal Site (SERDS),
- an extension to the duration of treated water discharge to Quesnel Lake to be throughout mining operations in 2031,
- interim raise in the elevation of the tailing storage facility (TSF) to 974 m from 970 m,
- and an extension of the Northwest Potentially Acid Generating (PAG) Stockpile disposal date,
- and a modernization of the Neutralizing Potential Ratio (NPR) to lower the ratio from 2 to 1.5.

These components are further described in Section 1.3.4.

The M-200 authorizes construction of the embankment to an elevation of 970 m. Construction to raise the embankment to 970 m was started in July 2022 and completed in 2023. The Springer Expansion will require and additional raise of the TSF. The TSF will be raised in a series of lifts over the course of several years, the first of which would include the interim increase to 974 m to avoid potential impacts to operations and support the full implementation of Phase 4, as well as future mining Phases 5 and 6. The design of the final TSF raise to 987 m is ongoing, but is not expected to be complete until later in 2024, and included in a separate application. In the interim, MPMC is proposing to raise the TSF to 974 m to maintain mining operations through 2024. A separate application will be submitted for the approval of the TSF raise to 987 m.

Some water management structures will extend beyond the M-200 boundary, and an extension of the M-200 boundary is required to cover the planned disturbance areas (see Section 5.1.2). To avoid duplication (i.e. environmental baseline information, management plans) and the development of a separate joint *Mines Act and Environmental Management Act* Permit M-200 Amendment Application, information regarding the interim raise to 974 m has been added to this application during the Response to Screening Comments Period with approval from EMLI and ENV.

1.1.1 Application Outline

This document's structure and content follows guidance provided in the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (EMPR and BC ENV 2019). Table 1.1-1 provides the application structure by section number and a high-level description of the information provided. The Joint Application Information Requirements table for the Springer Expansion and the TSF interim raise to 974 m is provided in Appendix 1-1 and Appendix 1-2, respectively. The section "Health and Safety" provided in the Joint Application Information Requirements was not required for this application and therefore no information has been included in this application; however, to maintain consistent numbering for sections (i.e., Health and Safety) and sub-sections that are not required in the application, the heading title has been retained in this application along with a statement and a rationale as to its exclusion.

Table 1.1-1: Application Structure

Section Number	Chapter Name	Description
1.0	Introduction and Project Overview	Provides the Project background information, including proponent identification, application background, mine overview and development proposal, regulatory framework, and the mine design and assessment team.
2.0	Baseline Information	Describes the baseline environmental conditions, and the results of any baseline characterization and monitoring studies regarding biophysical and socio-cultural components (such as meteorology and climate, geology, water quantity, water quality, aquatic resources, ecosystems, wildlife, land use, archaeology, and cultural use).
3.0	Mine Plan	Provides a detailed discussion on the Project Mine Plan, including mine facility designs and development occurring throughout the life of mine.
4.0	Reclamation and Closure Plan	Summarizes the reclamation planning, approaches, and methods used to meet the end land use and land capability objectives for the Project. Presents contingencies to address predicted challenges to achieving this objective.
5.0	Modelling, Mitigation, and Discharges	Provides an overview the qualitative hydrology and water quality assessments evaluating the potential effects of the Project. Detailing the operational efficiency and reliability of the water treatment plant.
6.0	Environmental Assessment Predictions	Accesses of potential Project residual effects on the environment and provides an evaluation of the risks on aquatic and terrestrial resources.

Table 1.1-1: Application Structure

Section Number	Chapter Name	Description
7.0	Environmental Monitoring	Summarizes the monitoring programs for the Project that support ongoing evaluation of the efficacy of proposed mitigations and evaluate on-going conditions of the receiving environment. Appendices attached to the Application, where the full monitoring program designs are located
8.0	Health and Safety	Information health and safety not required to be provided with the application.
9.0	Management Plans	Provides a summary of each management plan developed in support of the Project with reference to corresponding Appendices attached to the Application, where the full site-specific management plans are located.

1.2 Proponent Information

MPMC is a wholly-owned subsidiary of Imperial Metals Corporation, a Canadian mining company active in the acquisition, exploration, development, mining, and production of base and precious metals, with a focus on western North America. Key properties are: Mount Polley Mine; Huckleberry Mine, an open pit copper/molybdenum mine in west-central BC; Red Chris Mine (30% interest), an operating copper-gold property in northwest BC; and Ruddock Creek, a pre-development stage zinc/lead property in southeast BC.

The main contact information for MPMC is:

Imperial Metals Corporation
Don Parsons, Chief Compliance Officer
200 – 580 Hornby Street
Vancouver BC V6C 3B6
604.669.8959 | www.imperialmetals.com

1.3 Project Overview

1.3.1 Project History

The development of the Mount Polley Mine was approved by a Mine Development Certificate issued in October 1992 (Project Approval Certificate #96-07, now called Environmental Assessment Certificate #96 07). Clearing of the site and construction of the entire facility began in 1995, with the mill commissioned in June 1997. In July 1997, the Ministry of Energy, Mines, and Low Carbon Initiatives (EMLI) approved the Mount Polley Mine Reclamation and Closure plan, which resulted in the issuance of the M-200. The first full year of mining and milling at Mount Polley Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, reopening in December 2004, with mill production commencing in March 2005.

On August 4, 2014, a breach occurred in the Perimeter Embankment of the Tailing Storage Facility (TSF); this event is referred to as the "breach". The breach released tailings, water, and embankment construction materials to the downstream environments of Polley Lake, Hazeltine Creek, and Quesnel Lake.

Following the breach, mine operations ceased and the Freshet Embankment was constructed to elevation 950 m through the breach area to allow the capture and temporary storage of the 2015 and 2016 freshet flows in 2015. Restricted operation, with tailings being deposited in Springer Pit, commenced on August 4, 2015. As the mine returned to operation, an effluent permit was required and the Long-term Water Management Plan – Technical Assessment Report (the "Long-term Water Management Plan" or LTWMP) dated October 17, 2016, was produced to support the application process (Golder 2016). On November 6, 2015, MPMC applied for an amendment to the M-200 to allow for a return to full operations, including construction of the TSF to elevation 970 m (Golder 2015a) and the use of the TSF for tailings deposition. On June 23, 2016, this amendment was provided by EMLI, and on June 27, 2016, MPMC resumed deposition of tailings into the TSF. On April 26, 2017, the Minister of Environment and the Minister of Energy and Mines gave their consent to a material alteration of the Environmental Assessment Certificate (EAC) allowing for discharge to Quesnel Lake in accordance with the Long-term Water Management Plan for the remainder of the operational life of the mine (M. Polak and B. Bennett 2017):

> *"NOW THEREFORE:*
>
> *The undersigned Ministers pursuant to Condition 2 of the EAC hereby do consent to the Long-Term Water Management Plan, involving operational discharge to Quesnel Lake and discharge at closure involving passive water treatment at the mine site, as a material alteration to the EAC.".*

On January 7, 2019, MPMC announced a decision to go on suspended operations (Care and Maintenance) beginning May 31 of that year, citing low metal prices. Mount Polley Mine has been in care and maintenance since, which has resulted in an extension to the operational period needed to develop Phase 4, as permitted by the *Mine's Act* Permit M-200 (M-200).

As noted in the August 25, 2021, communication regarding "Notice of Mount Polley Mine Restart", operations were planned to restart in 2021. This was initiated in response to improving market conditions, and as of November 2021 MPMC has started to return to operations. Mining activities occurring on site follow the activities approved by the March 17, 2014, M-200 amendment *Approving Cariboo Phase 4 Expansion* and the June 23, 2016 M-200 amendment *Approving Return to Full Operations and Use of the Tailings Storage Facility*.

The opportunity exists to extend the mines life until approximately 2031, and the economic benefits to the community along with that, with the development of the Springer Expansion Project.

As for the TSF, by September 2018, construction of the TSF had been completed to elevation 968 m (Golder 2019). A feasibility design for raising the embankment of the TSF to an elevation of 984 m was completed in 2014 (Golder 2015b). The aim of the feasibility assessment was to identify potential considerations, constraints, or conflicts that may limit the elevation to which the TSF could be raised. The results of the study indicated that a raise of the facility is feasible. In 2021, MPMC updated the Life of Mine (LoM) plan, and a crest elevation of approximately 987 m was determined to be required to store the LoM tailings. An additional geotechnical investigation and laboratory testing is ongoing to assess potential strength gains from reconsolidation of the upper glaciolacustrine unit (UGLU) that sheared during the breach in 2014. This interim design to elevation 974 m was developed assuming no strength gains of the upper GLU that sheared in 2014. A remoulded undrained shear strength equal to the average minus one standard deviation of the measured values as part of the forensic investigation in 2014 was adopted as in previous analyses and designs (Golder 2015a, 2015c). An interim design elevation of 974 m was selected to enable short-term operations of the TSF.

1.3.2 Overview of Products and Markets, and Projected Project Benefits

The Project represents an additional ~8 years of mining at approximately 20,000 tonnes per day (t/d), consistent with that undertaken during previous years of operations and planned for the development of Phase 4, and the interim raise to 974 m will enable short-term operations of the TSF. Estimated material volumes associated with the operation phase of the Project are presented in Table 1.3-1.

Table 1.3-1: Estimated Material Volumes Associated with the Project

	Springer Expansion (Life of Mine) Material Tonnages (Mt)
Ore Processed by Mill	**52.7**
Waste Rock – Total	**158.7**
PAG	39.1
NAG	119.6
Tailings	**50**

When in operation, Mount Polley Mine supports the local economies of Likely, Horsefly, and Williams Lake through employment of residents and purchases in these communities. As the mine returns to operation, benefits to these communities, as well as the province, include:

- Direct support of 350 jobs with an average annual salary of $123,000 per annum.
- Indirect support of 700 jobs.
- $75 million per operating year in payments to suppliers in BC.

In addition to economic support within local communities MPMC has signed a Participation Agreement with the Williams Lake First Nation and is in negotiation with Xatśūll First Nation as well. The participation agreements are impact benefit agreements that consider financial support, education and training, employment, business and contract opportunities and environmental considerations. These agreements are expected to persist until the end of the mine life and provide continuous support for community members, initiatives and social services.

1.3.3 Location, Access, and Land and Resource Use

Mount Polley Mine is an open pit copper/gold mine located in central BC, 56 km northeast of Williams Lake (latitude 52° 33’ N and longitude 121° 38’ W) in BC’s Cariboo Region. The mine site location is displayed in Figure 1.3-1 and Figure 1.3-2.

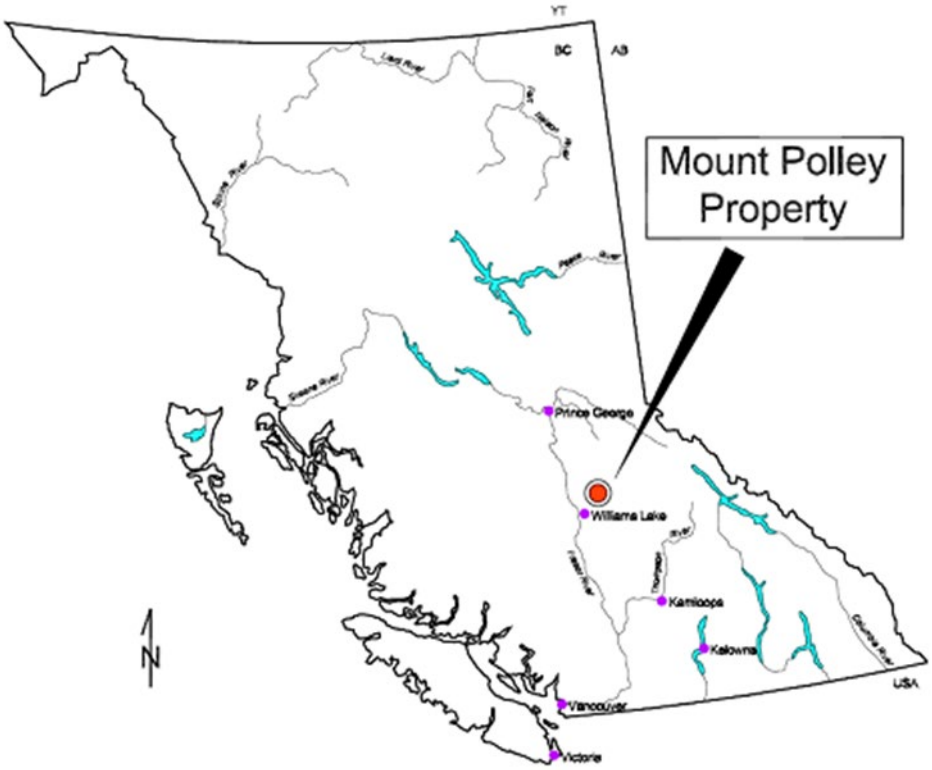

Figure 1.3-1: Location Map

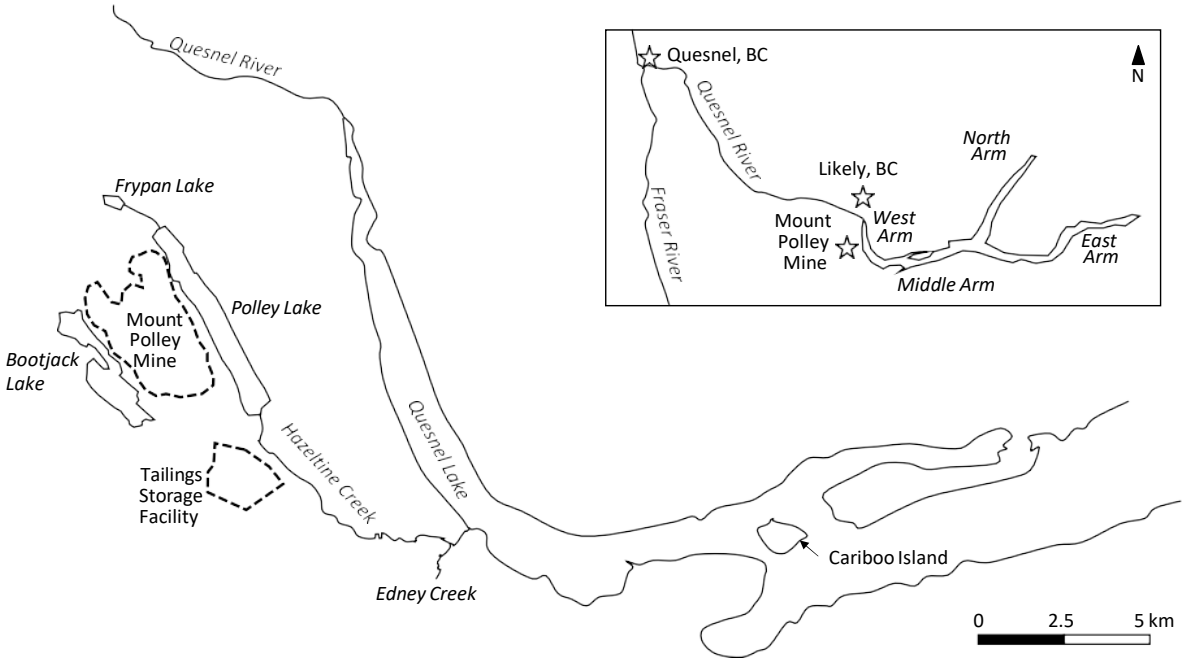

Figure 1.3-2: Mine Site Location

Currently, the property encompasses 24,096 hectares consisting of seven mining leases (2,007 hectares) and 52 mineral claims (22,089 hectares) and shown in Figure 1.3-3 below. A production royalty is payable on ore mined from Mining Lease 933970.

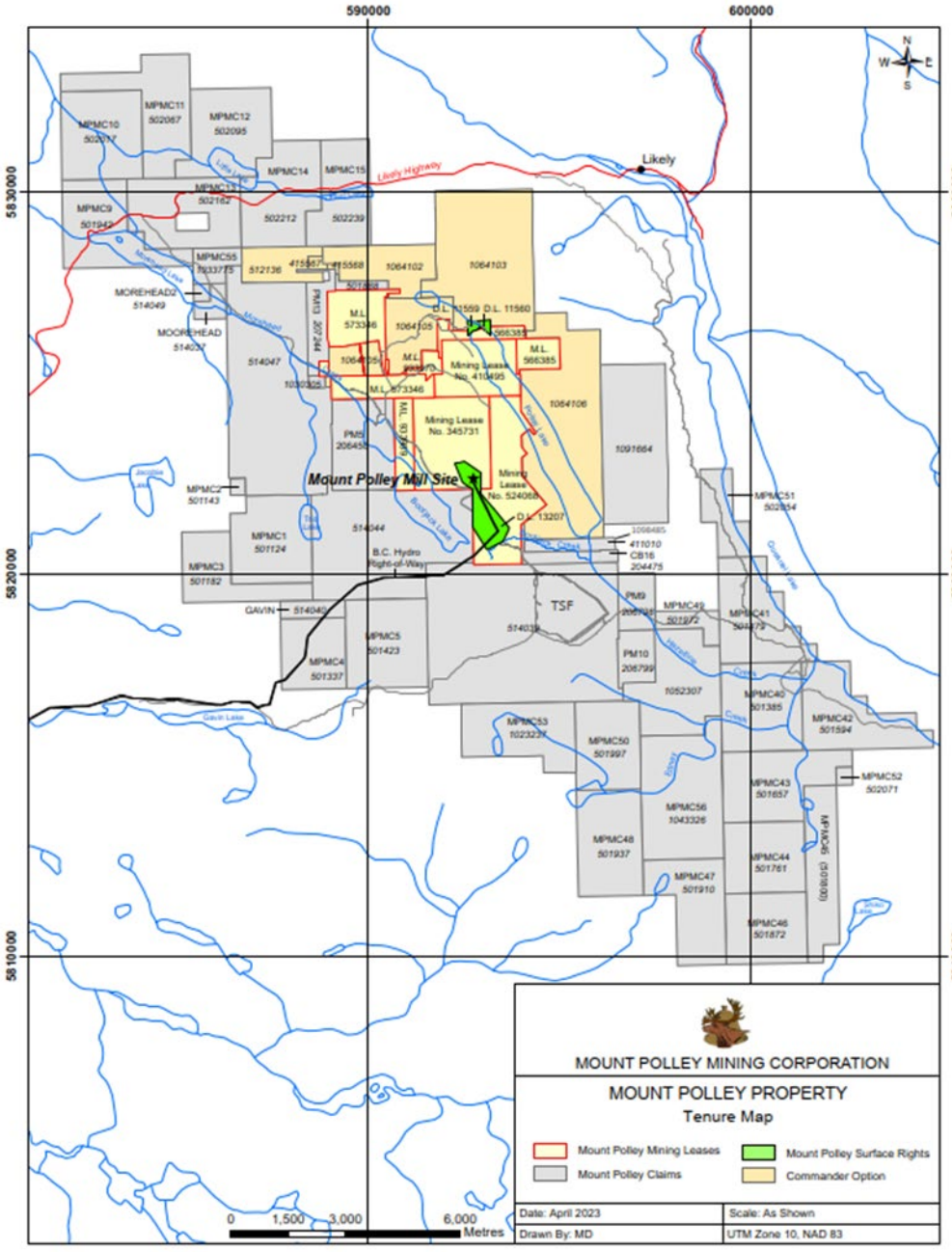

Figure 1.3-3: Figure of the Site Mining Tenures and Site Access

In October 2019, MPMC Corporation optioned seven adjacent mineral tenures (3,331 hectares) and the option was subsequently exercised on December 30, 2022. These claims are subject to a production royalty payable on ore mined from the claims and milled in the Mount Polley processing plant. There is no production royalty payable on the current tenures which are being mined.

Access to the mine occurs via the Morehead-Bootjack Forest and Service Road from Likely Road. Traffic is managed by existing traffic and access standard practices and procedures maintained by MPMC.

Regional public land uses associated with the area are fishing, hiking, camping, motorized vehicle use, skiing, snowmobiling, trapping, and hunting. Industrial uses, including forestry, sawmilling, ranching, and fisheries also occur in the area. These uses do not occur within the *Mines Act* M-200 permit boundary, where public access is prohibited under the *Mines* and *Trespass Act*.

Mount Polley Mine operates on the traditional territory of the Williams Lake First Nation and the Xatśūll First Nation. Traditional uses including plant and animal harvesting and fishing occur within the region and may, in the future, occur in areas near the Project. Current use of the Project footprint by Williams Lake First Nation and the Xatśūll First Nation citizens is restricted given that the area is within the existing M-200 permit boundary, which maintains public and worker safety. Representatives of these Nations are engaged through the Public Liaison Committee (PLC), permitting applications, and the terms of the Impact Benefit Agreements.

Contact water from the Mount Polley Mine is collected and treated via the Veolia ACTIFLO® system and discharged to Quesnel Lake. Known environmental uses of Quesnel Lake water, particularly with respect to the West Basin, were identified to determine the most sensitive water use for the receiving environment. The following environmental uses were identified for Quesnel Lake by Golder (2016) and remain applicable in the present day:

- Commercial, recreational, and aboriginal fisheries.
- Recreational uses such as scenery and wildlife viewing, swimming, boating, kayaking, canoeing, and waterskiing/tubing/wakeboarding, and in the winter, snowmobiling and ice fishing when ice conditions allow.
- Drinking and residential water use for domestic purposes.

1.3.4 Mine Components and Off-Site Infrastructure

This Project consists of six main components and the permit amendments associated with these components are summarized in Table 1.3-2 below.

Table 1.3-2: Summary of the Project Components and Permit Amendments

Project Component	Condition Reference	Condition	Scope and Function	Section
Springer Expansion	M-200	N/A	Expand Springer Pit to access additional resources. This will occur largely within existing mine footprints.	Section 3.3
SERDS Tailings Storage Facility	M-200 B.5.a.ii	The Permittee is authorized to construct the SERDS to a maximum elevation of 1,135 m.	Expand the SERDS to store tailings excavated from Springer Pit.	Section 3.3.4 and 3.5.4.1
Quesnel Lake Discharge [Operational]	PE-11678 1.2.3	This section applies to the discharge of treated effluent from the site runoff and seepage water collection and management systems to Quesnel Lake as sampled at the Treatment Plant Outlet (HAD-03). The site reference for this discharge is E304230. The discharge period is authorized until June 30, 2025 but it is needs to be extend to the Life of Mine[1].	To discharge to Quesnel Lake via the WTP for the extent of operations.	Appendix 5.3
Northwest PAG Stockpile Disposal Date	M-200 D.3.c.i.c	The Permittee shall permanently dispose of all PAG waste rock stored in the Temporary NW PAG dump by back filling the material into the Cariboo/Springer Pit, by December 31, 2027.	Allow the disposal of PAG at the completion of operations.	Section 3.3.3
Reduce the NPR ratio from 2.0 to 1.5	M-200 D.3.b.iii	The Permittee shall classify all waste rock, quarry rock, borrow materials and tailings as PAG if they have a NP/AP ratio of less than 2.0.	To improve efficiencies during the return to operations and reduce the disturbance associated with future operations, while maintaining protection of the receiving environment, MPMC is working with a Qualified Professional (QP) to determine the possibility of reducing the PAG NPR from 2 to	Appendix 5-1

[1] An application for amendment of PE-11678 to extend the discharge period has been applied for and is with BC ENV for processing. MPMC expects the permit validity period to be extended to the end of Life of Mine.

Table 1.3-2: Summary of the Project Components and Permit Amendments

Project Component	Condition Reference	Condition	Scope and Function	Section
			1.5. This reduction is anticipated to allow for the remaining permitted capacity (~30 Mt) of the Temporary NW PAG Stockpile to facilitate the volume of PAG associated with Springer Pit Mining.	
Tailings Storage Facility	M-200	N/A	Raise the elevation of the TSF on an interim basis to continue mining current approved phase and in preparation for future expansion to the Life of Mine where TSF will be raise to 987 m	Section 3.5.4.2, Appendix 1-3

PAG = Potentially Acid Generating; NAG = Non-acid Generating; NPR = Neutralization Potential Ratio; SERDS = Southeast Rock Disposal Site; WTP = Water Treatment Plant.

The detailed design report for the TSF interim raise to elevation 974 m is included in Appendix 1-3 and the TSF Site Characterization Report is included in Appendix 1-4.

1.3.5 Mine Development and Operations

Currently, operations at Mount Polley mine include the open-pit mining of the Springer and Cariboo pits, with an average daily mill throughput being 20,000t. The majority of mining occurs in the Springer and Cariboo Pit. The current plan in this application has a life of mine concluding in 2031 then rehandled PAG material back into the pit until end of 2033 as outlined in Section 3.3, Table 3.3-2.

The Springer Pit is currently mined to Phase 4 at a depth of 928m from surface. Dewatering from the Springer Pit will require establishing temporary sumps in the mine working usually at the lowest working bench. Electric or diesel pumps will convey water to a large sump located in the Cariboo pit. The Cariboo Pit will be pumped to the West collection ditch and then to the Perimeter Embankment Till Borrow Pond which acts as an influent pond for the water treatment plant.

The Springer Expansion involves four Phases: Phase 5, Phase 6, WX and C2. It pushes back the extents of the Phase 4 Springer pit as well as deepening it. Phase 5 is proposed to commence in 2024 and be completed in 2028 and involves a pushback of the east wall near the backfilled Bell pit. The pit is roughly 1446m long, 898m wide, a maximum of 396m deep. Access to the pit will be via temporary NW PAG Stockpile and off the Bootjack Forest Service Road.

Phase 6 is proposed to commence in 2027 and will be completed in 2031, and involves deepening the existing Springer Pit. The pit is roughly 842m long, 648m wide, a maximum of 348m deep. Access to the pit will be via the main haul road.

Two starter pits (WX and C2) will also be deepened in the later years of the life of mine commencing in 2029 and completed by 2013. The WX and C2 pits will follow the same design principles as already existing in operating pits at Mount Polley Mine. Additional Mine Plan details are provided in Section 3: Mine Plan.

The interim raise of the TSF to 974 m will allow MCMP to maintain mining operations through 2024. Engineering design is ongoing for a future application for the subsequent raise of the TSF to 987 m which will contain the LoM tailings as mining is advanced. The TSF water management infrastructure for the raise to 974 m will be designed in alignment with the ultimate embankment raise for 987 m. Some structures will extend beyond the M-200 boundary, and an extension of the M-200 boundary is required to cover the planned disturbance areas, as shown on the TSF water management infrastructure drawings.

1.3.6 Mine Design and Assessment Team

Table 1.3-3 identifies the professionals, reviewers, and authors with primary responsibility for preparing this Application. Each identified Qualified Professional author has provided a signed statement, where a signed report is not already included in the Application, specifying the section they are responsible for and confirming that the information is true and complete based on their professional knowledge and judgement. The signed statements are provided as Appendix 1-5. Minnow Environmental Inc. (Minnow) signed statements are provided in Appendix 2-6.

Table 1.3-3: Project Qualified Professional Team

Company	Project Team			
	Name	Registration Number	Role	Sections
MPMC	Mathieu O'Leary, Technical Services Superintendent	NA	Reviewer	All
WSP	Lee Nikl, MSc, RPBio, Senior Environmental Scientist, Fellow	601, RPBio	Reviewer	All
	Drew Kaiser, RPBio, Senior Principal Biologist	2332, RPBio	Reviewer	All
	Samantha Lundquist, BSc, BIT, Intermediate Environmental Scientist (under direct supervision of Lee Nikl, MSc, RPBio)	4010, BIT (author) 601, RPBio (responsible QP)	Author, Reviewer	All
	Jesse Maddaloni, MASc, P.Eng, Senior Mechanical Engineer	36620, P.Eng	Author, Reviewer	Section 2.6.1, 5.4, 5.6, 5.8
	Steve Mitchell, MASc, Water Quality Modeller (under direct supervision of Lee Nikl, MSc, RPBio)	601, RPBio (Lee Nikl)	Author, Reviewer	Sections 2.5.1, 6.2, 7.1
	Jordan Laskosky, MSc, P.Ag, Senior Mine Reclamation and Closure Consultant	4447, P.Ag	Author, Reviewer	Sections 2.3.5, 4.0, 7.5
	Jacqueline Foley, PL.Geo, MSc, Senior Principal Hydrogeologist	130626, PL.Geo	Author, Reviewer	Sections 2.8, 6.4, 7.2
	Barbara Wernick, MSc, RPBio, Senior Principal Environmental Scientist	1171, RPBio	Reviewer	Sections 2.7, 2.8, 2.9, 6.1
	Rachelle Smith, MSc, RPBio, Intermediate Biologist	3960, RPBio	Author	Sections 2.10, 6.2, 9.10
	Tanya Seebacher, MSc, RPBio, Terrestrial Biologist	2191, RPBio	Reviewer	Sections 2.10, 6.2, 9.10
	Christopher Dodd, BA, RPCA, Lead Archeologist	NA, RPCA	Author, Reviewer	Sections 2.12, 9.11
	Alannah Gray Hubbard, P.Eng, Lead Senior Geological Engineer	48028, P.Eng	Author, Reviewer	Sections 3.5.1, 3.5.5

Table 1.3-3: Project Qualified Professional Team

Company	Project Team			
	Name	Registration Number	Role	Sections
	Andrew McIntosh, M.Eng, Peng, Project Manager	210306, P.Eng	Author, Reviewer	Section 9.2
SRK Consulting	Shauna Litke, MASc, P.Eng, Senior Geochemistry Consultant	49392, P.Eng	Geochemistry Source Terms	Sections 2.4, 9.5
	Jonathon Doherty, P.Eng, Senior Geochemistry Consultant	56775, P.Eng	Geochemistry Source Terms	Sections 2.4, 9.5
	Stephen Day, P.Eng, Corporate Geochemistry Consultant	18467, P.Eng	Geochemistry Source Terms	Sections 2.4, 9.5
Minnow Environmental Ino.	Katharina Batchelar, MSc, RPBio, Aquatic Scientist	3103, RPBio	Hazeltine Creek Baseline	Sections 2.7, 2.8, 2.9
	Pierre Stecko, RPBio, Senior Aquatic Scientist, Managing Principal	1709, RPBio	Hazeltine Creek Baseline	Sections 2.7, 2.8, 2.9

MPMC = Mount Polley Mining Corporation.

1.3.7 Spatial Data

Figures displaying the permit boundary and project components including the Springer Expansion, the SERDS extension, and the temporary Northwest PAG stockpile are provided in Figure 1.3-4 and Figure 1.3-5. Figure 1.3-6 provides the projected disturbed areas overview for the configuration of these project components at the end of operations.

Temporary NW PAG Stockpile

Springer Pit Expansion

SERDS Extension

Polley Lake

Boojack Lake

Quesnel Lake

LEGEND

- QUESNEL LAKE DISCHARGE POINT
- PROJECT COMPONENT
- PROJECT COMPONENT

MOUNT POLLEY MINING CORPORATION

FIGURE 1.3-4
PERMIT BOUNDARY AND COMPONENTS

DATE: 2024-07-04 DRAWN: CDB

0 1,000 2,000

1:50,000 METRES

PATH: Y:\burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\23590\671\81100\81112\Doc zzz\02_PRODUCT\QNM\MXD\Report\23590\671_81100_81112_01_03_04_PERMIT_BOUNDARY_COMPONENTS.mxd PRINTED ON: 2024-07-04 AT: 3:18:45 PM



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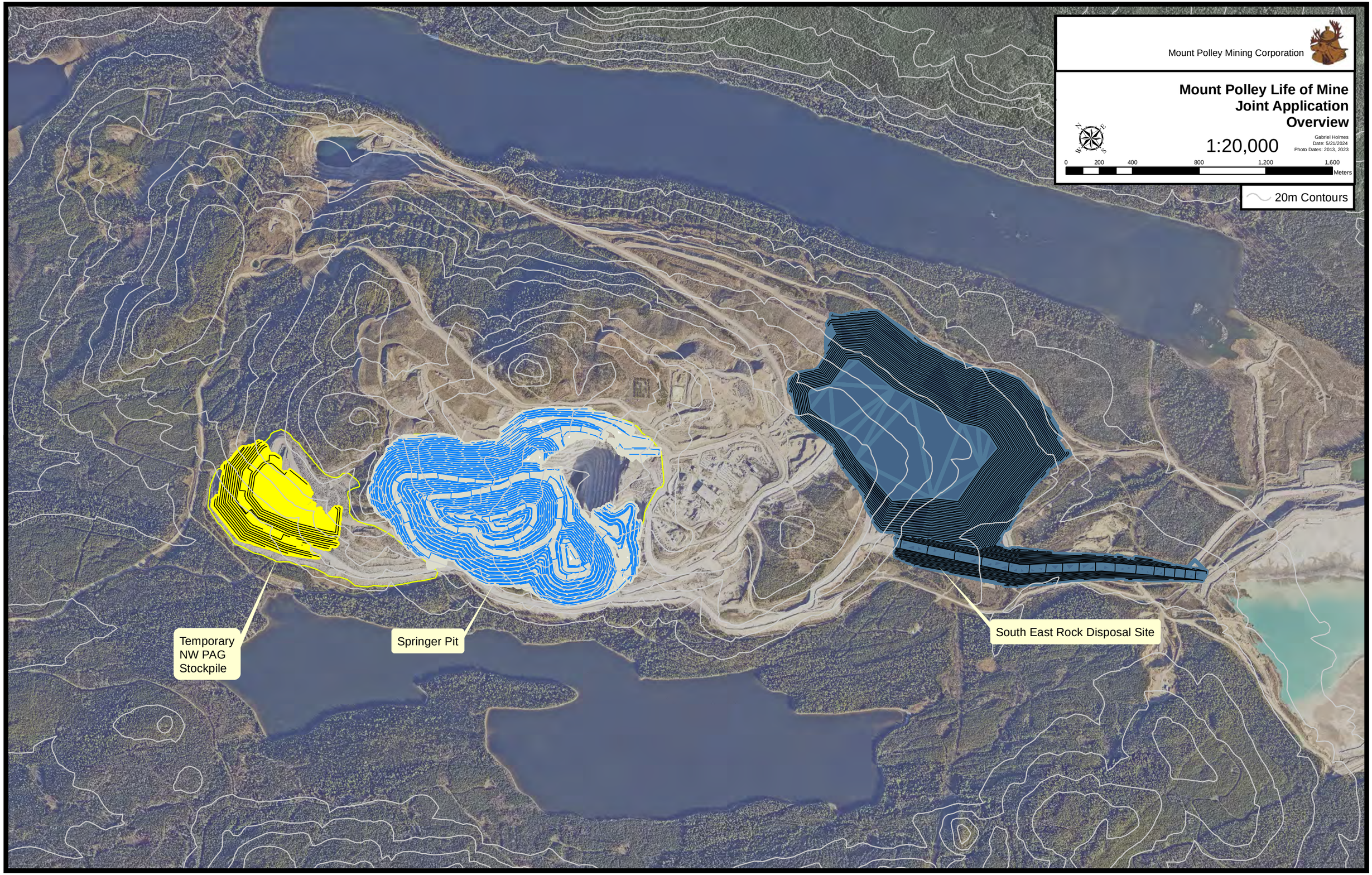
Mount Polley Mining Corporation
Mount Polley Life of Mine
Joint Application
Overview
1:20,000
Gabriel Holmes
Date: 5/21/2024
Photo Dates: 2013, 2023
0
200
400
800
1,200
1,600
Meters
20m Contours
Temporary
NW PAG
Stockpile
Springer Pit
South East Rock Disposal Site

1.3.8 Concordance with Environmental Assessment Certificate

MPMC was initially issued Mine Development Certificate M92-13 on October 6, 1992. This certificate continues in force as Project Approval Certificate M96-07 pursuant to the *Environmental Assessment Act* R.S.B.C. 1996 c. 119 and as Environmental Assessment Certificate M96-07 pursuant to the *Environmental Assessment Act* S.B.C 2002, c.43 (Certificate). This certificate was last amended on May 19, 2016.

The Project does not require an amendment to the M96-07, however the following conditions have been identified as relevant.

Condition 2: Imperial Metals [MPMC] shall, prior to any material alteration of the Development as described in the Application, obtain the written consent of the Minister and the Minister of Environment, Lands and Parks and the Minister may determine what constitutes a material alteration.

Condition 6: This Certificate is not a Mines Act Permit nor Part thereof, nor does it limit the ability of the Chief Inspector, District Inspector, or an Inspector of the Ministry of Energy, Mines, and Petroleum Resources to immediately enforce any requirements or exercise any discretion or authority under the Mines Act, its Code, or Orders or Directions thereunder.

Condition 8: Imperial Metals [MPMC] shall comply with all applicable orders, directions and conditions, and obtain and comply with all applicable tenures, licenses, regulations, approvals, standards and permits which may include or result from, but are not necessarily limited to, the following:

- *Commercial transport Act*
- *Environment management Act*
- *Fire Services Act*
- *Fisheries Act*
- *Gas Safety Act*
- *Health Act*
- *Heritage Conservation Act*
- *Highway Act*
- *Land Act*
- *Mineral Tenure Act*
- *Mines Act*

- *Mining Right of Way Act*
- *Municipal Act*
- *Pesticide Control Act*
- *Pipeline Act*
- *Power Engineers & Boiler & Pressure Vessel Safety Act*
- *Railway Act*
- *Transport of Dangerous Goods Act*
- *Utilities Commission Act*
- *Waste Management Act*
- *Water Act*

With regards to these conditions MPMC acknowledges the requirement to acquire authorization from the appropriate source. For this Project, MPMC is seeking an amendment to the M-200 and PE-11678, no additional amendments or authorizations are required to support the activities (Section 1.1).

1.4 Regulatory Framework

MPMC has permits that allow for operation and waste management. In addition, MPMC has certificates and similar instruments that enable provincial ministries to make decisions respecting permits (i.e., approximately equivalent to present day EAC). These include:

- M-200, issued by EMLI.
- *Environmental Management Act* Permits issued by Ministry of Environment and Climate Change Strategy (BC ENV) to authorize discharge into the receiving environment (Permits 11678, PE-11678, 15968, 15087, and 14590).
- *Environmental Assessment Act* Mine Development Certificate Project Approval Certificate M96-07 (M96-07), issued by the Environmental Assessment Office (EAO).

To support the implementation of the Project, and those related projects (Section 1.1.1) , MPMC is seeking an amendment to the M-200. The Project does not require changes to environmental discharge (Section 1.1.1) or relate to those conditions included in M96-07 (Section 1.3.8).

This Project does not require the alteration of a water way. This negates the need for permitting through the federal *Navigation Protection Act* or the *Fisheries Act*.

1.5 Indigenous Engagement

1.5.1 Background

MPMC operates in the recognized claimed traditional territory of the Williams Lake First Nation (WLFN) and the Xatśūll First Nation. The WLFN and the Xatśūll First Nation are members of the Secwepemc Nation located in the Cariboo region of the Central Interior region of BC. The traditional language of the WLFN and the Xatśūll First Nation is Secwepemc (or Shuswap). The WLFN reserve land area covers 1983.4 ha. The Xatśūll First Nation reserve land totals 2092.7 ha. Established and/or asserted traditional territories are provided in Figure 1.5-1. Land use is described in Section 1.3.3.

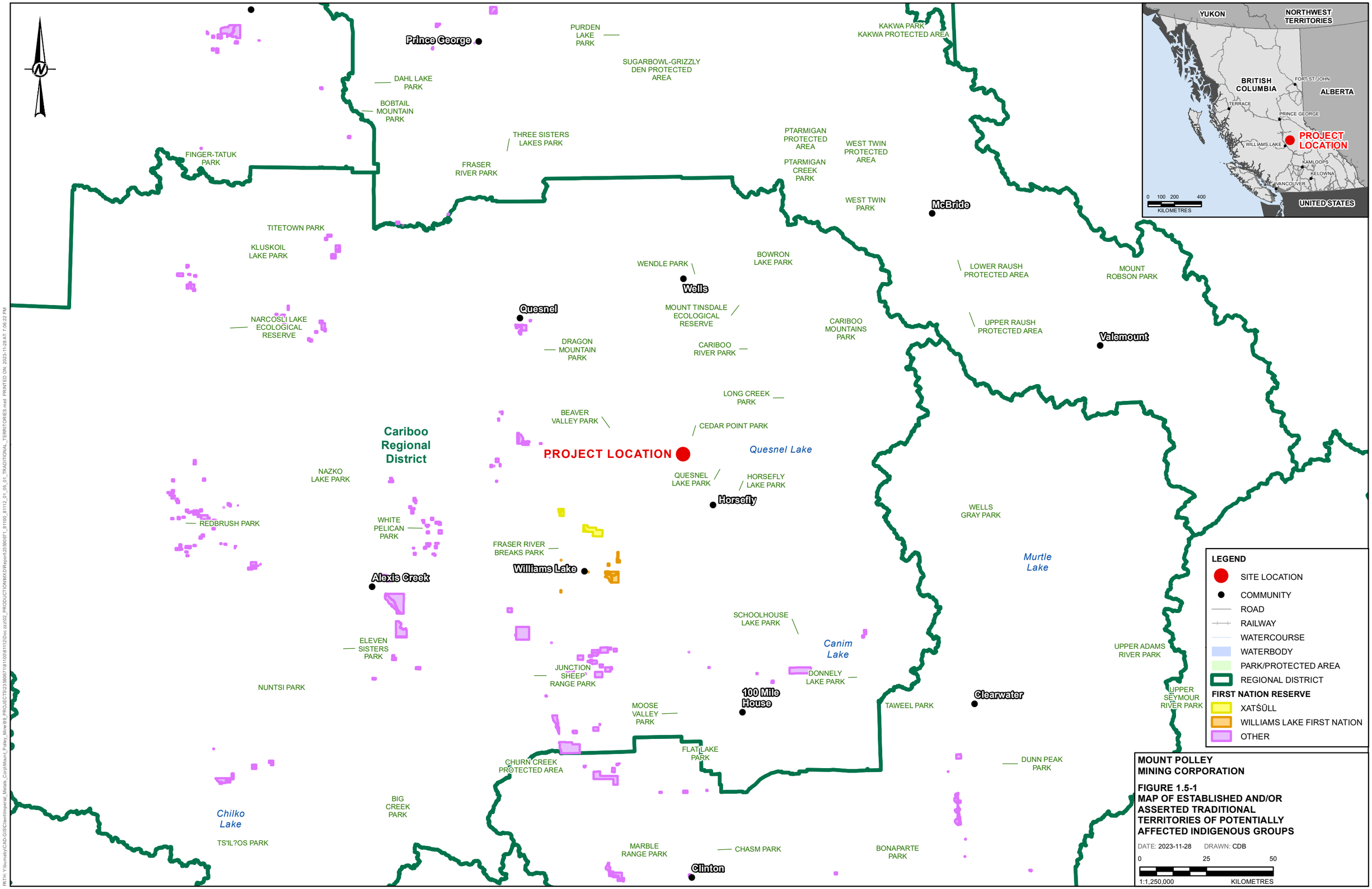

MOUNT POLLEY MINING CORPORATION

FIGURE 1.5-1
MAP OF ESTABLISHED AND/OR ASSERTED TRADITIONAL TERRITORIES OF POTENTIALLY AFFECTED INDIGENOUS GROUPS

DATE: 2023-11-28 DRAWN: CDB

0 25 50

1:1,250,000 KILOMETRES

PATH: Y:\Journals\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\23\99671\81100\81112\Doc zz\02_PRODUCTION\MXD\Report\23l99671_81100_81112_01_05_01_TRADITIONAL_TERRITORIES.mxd PRINTED ON: 2023-11-28 AT 7:06:22 PM

1.5.2 Asserted and Established Rights and Interests

In 2011 and 2012, MPMC executed Participation Agreements with the WLFN and the Xatśūll First Nation, respectively. WLFN renewed the Participation Agreement on April 12, 2022, with MPMC. Meetings with the WLFN have taken place since March 16, 2012, and since July 19, 2012, with the Xatśūll First Nation. Effective October 18, 2012, Joint Implementation Committee meetings have been held with representatives from MPMC, the WLFN, and the Xatśūll First Nation. Joint Implementation Committee meetings are held at minimum quarterly. These meetings and associated documentation (Terms of Reference, minutes, and action items) provide a well-defined, constructive forum in which issues, reviews, and comments relating to the current and anticipated future operations of the Mount Polley Mine may be discussed.

1.5.3 Engagement Efforts

A summary of the engagement regarding the discharge to Quesnel Lake thus far is provided in Table 1.5-1, and further details regarding these engagements will be provided in a Consultation Report.

Although the Quesnel Lake Interim Discharge Extension is a minor amendment, as defined by Section 1.2 of the Public Notification Regulation under the *Environmental Management Act*, additional consultation and engagement was requested by BC ENV on February 4, 2022, via email, and by members of the PLC during the January 27, 2022, PLC meeting. An Environmental Protection Notice (EPN) was also posted in the Williams Lake Tribune, and a Community Engagement Meeting was held March 28, 2022, in Likely. The PLC was given an opportunity to comment on the draft technical assessment report and comments were received from one PLC member.

As of writing, consultation is ongoing, and a separate consultation report will be produced.

Table 1.5-1: Summary of Quesnel Lake Interim Discharge Extension Engagement

Date	Attendees	Activity	Communication
January 19, 2022	Xatśūll First Nation	Xatśūll First Nation Open House	A poster regarding the Interim Quesnel Lake Discharge Extension was presented during the open house.
January 27, 2022	Public Liaison Committee	Quarterly PLC Meeting	As part of the quarterly PLC meeting the Interim Quesnel Lake Discharge Extension was introduced to members.
March 3, 2022	N/A	Environmental Protection Notice posted in the Williams Lake Tribune	An EPN regarding the Quesnel Lake Interim Discharge was posted to support public engagement.
March 28, 2022	Community of Likely and General Public invited	Community Open House	A presentation outlining the amendment application, poster stations, Questions and Answers

Table 1.5-1: Summary of Quesnel Lake Interim Discharge Extension Engagement

Date	Attendees	Activity	Communication
N/A	N/A	Public Feedback	Letters received by MPMC and BC ENV in response to the EPN (compiled in Consultation Report)
April 1, 2022 April 26, 2022	N/A	Public Liaison Committee Member Feedback	Document with comments from Mr. Doug Watt (PLC member)
June 30, 2025	-	-	-

BC ENV = Ministry of the Environment and Climate Change Strategy; EPN = Environmental Protection Notification; MPMC = Mount Polley Mining Corporation; N/A = Not Applicable; PLC = Public Liaison Committee.

MPMC commenced communications regarding the Project in July 2021 as part of those conversations intended to describe the mines plan to return to operation. These communications have included meetings with regulators through bi-weekly meetings and calls specific to the Project, introductions to the Project presented through community meetings, and discussions with additional stakeholders through the PLC. A summary of those communications is included in Table 1.5-2.

In 2022, MPMC and the Williams Lake First Nation renewed the participation agreement established in 2011. This agreement sets out commitments and obligations for both parties. MPMC will keep regulators informed on the progress of the Project, and feedback received from through the pre-application process will be documented and incorporated into the Application as applicable.

Table 1.5-2: Summary of Consultation Undertaken for the Project

Date	Type	Involvement	Communication
July 6, 2021	Kickoff meeting with regulatory stakeholders	MPMC, EMLI, BC ENV	Initial discussion with ministries regarding amendment applications
Aug 25, 2021	Restart Letter to EMLI	MPMC, EMLI	MPMC provides restart notice to EMLI for Phase 4 mining
Aug 25, 2021	Kickoff MMO Update	MPMC, EMLI, BC ENV, MMO	First bi-weekly update. Applications named and timelines proposed
Sept 8, 2021	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Joint Application process, list of applications
Sept 23, 2021	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Agreed on Joint and Single Applications
Oct 7, 2021	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Oct 21, 2021	Bi-Weekly Update	MPMC, EMLI , BC ENV	Project update
Oct 22, 2021	Co-Disposal EMLI	MPMC, MMO, EMLI (Victor Marques)	Discuss scope for the Project

Table 1.5-2: Summary of Consultation Undertaken for the Project

Date	Type	Involvement	Communication
Nov 4, 2021	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Nov 23, 2021	Co-Disposal EMLI	MPMC, EMLI	Conceptual SERDS Tailings Co-disposal Facility design discussed with EMLI. SERDS will be defined as Tailings Storage Facility
Dec 16, 2021	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
December 17, 2021	Pre-application and IRT	MPMC, EMLI	MPMC submission of the pre-application and IRT
Jan 13, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Jan 27, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Feb 10, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Feb 24, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Mar 10, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Mar 24, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
Mar 28, 2022	Community of Likely and General Public invited	Community open house in Likely, BC	Poster displayed included the Project.
April 6, 2022	IRT	MPMC, EMLI	EMLI provided geotechnical and reclamation comments on the pre-application and IRT
April 7, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
April 19, 2022	IRT	MPMC, EMLI	EMLI provided geoscience comments on the pre-application and IRT
April 21, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
May 5, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
May 19, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
June 2, 2022	Bi-Weekly Update	MPMC, EMLI, ENV, MMO	Project update
June 16, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update

Table 1.5-2: Summary of Consultation Undertaken for the Project

Date	Type	Involvement	Communication
June 22, 2022	MPMC: SERDs Co-Disposal Geoscience IRT Comments Discussion	MPMC, EMLI	Discussion regarding geoscience comments received on the IRT.
June 30, 2022	IRT	MPMC, EMLI	MPMC provided EMLI with updated IRT
June 30, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
July 14, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
July 28, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
August 8, 2022	IRT	MPMC, EMLI	EMLI notes no further comments on the IRT.
August 11, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
August 25, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
September 22, 2022	Bi-Weekly Update	MPMC, EMLI, BC ENV, MMO	Project update
October 6, 2022	Bi-Weekly Update	MPMC, BC ENV	Project update
October 20, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
November 3, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
November 17, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
December 1, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
December 15, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
January 12, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
January 26, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
February 23, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
March 8, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
March 23, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
April 6, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
April 20, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
May 4, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
May 18, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
June 1, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
June 15, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
June 29, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
July 13, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
July 27, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update

Table 1.5-2: Summary of Consultation Undertaken for the Project

Date	Type	Involvement	Communication
August 24, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
September 12, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
September 21, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
October 6, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
October 19, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
November 2, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
November 16, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
November 30, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
December 14, 2023	Bi-Weekly Update	MPMC, BC ENV	Project update
January 11, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
January 25, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
February 8, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
February 22, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
March 7, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
March 21, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
April 4, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
April 18, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
May 16, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
May 30, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
June 13, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update
June 27, 2024	Bi-Weekly Update	MPMC, BC ENV	Project update

EMLI = Ministry of Energy, Mines and Low Carbon Innovation; BC ENV = Ministry of Environment and Climate Change Strategy; IRT = Information Requirements Table; MMO = Major Mines Office; MPMC = Mount Polley Mining Corporation; SERDS = Southeast Rock Dump Site.

1.6 References

British Columbia Ministry of Energy, Mines and Petroleum Resources and Birtish Columbia Ministry of Environment and Climate Change Strategy (EMPR and BC ENV). 2019. Joint Application Information Requirements for Mines Act and Environmental Management Act Permits. Victoria, BC. September 2019.

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Golder 2015c. Mount Polley Mine 2015 Freshet Management Embankment Design. Mount Polley Tailings Storage Facility. Prepared for Mount Polley Mining Corporation. Document No. 1413803-088-R-Rev3-2000. May 8, 2015.

Golder. 2019b. 2018 tailings storage facility construction record report. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 1894924-075-R-Rev0-52292; 27 March 2019.

Golder Associates Ltd. (Golder). 2016."Mount Polley Mine: Long-term Water Management Plan. Permit Amendment Application under the Environmental Management Act: Technical Assessment Report," Golder Associates Report No. 1411734-162-R-Rev0-16000, Vancouver, BC, 2016.

M. Polak and B. Bennett. 2017 *Consent for Material Alteration – Pursuant to the Environmental Assessment Act,* Victoria, BC: Minister of Environment and Minister of Energy and Mines, 2017.

2 ENVIRONMENTAL BASELINE

2.1 Summary

The following section will summarize the environmental baseline conditions in areas of the Mount Polley Mine site affected by the proposed Springer Expansion project. The following environmental components were identified to be assessed for this baseline information section:

- Meteorology and climate
- Geology
- Soil
- Geochemistry
- Surface water and groundwater quantity
- Surface water and groundwater quality
- Sediment quality
- Fisheries and aquatic resources
- Terrestrial Biodiversity (Ecosystems and Wildlife)
- Land use
- Archaeology
- Cultural use

2.2 Meteorology and Climate

In 2022, WSP Canada Inc. (WSP) updated the climate baseline data for the Mount Polley Mine site, included in Appendix 2-1, to include the most recent climate data. The climate of the Mine Site was characterized in the Baseline Climate Update Report (Golder 2022) using historical measurements recorded at local climate stations, supported by data collected from the five nearby regional Environment and Climate Change Canada (ECCC) climate stations. The baseline climate update report is summarized below, and more details can be found in Golder 2022.

MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and direction (1997 to 2003). In 2012, this station was replaced with two stations: one near the mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall.

Five ECCC climate stations: Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, were selected to support and extend the long-term climate dataset for the Site due to their proximity to the Site, length of record, elevation range, and concurrent period of record with the local climate stations at the Site. In addition, the ECCC Prince George climate station was added to include an additional station with solar radiation data. Historical records were retrieved from ECCC's Historical Climate Data web server (ECCC 2022a). More recent records were compiled through e-mail correspondence with ECCC staff (ECCC 2022b).

The details of these stations are shown in Table 2.2-1. The locations of the mine weather stations are shown in Appendix 9-4, Figure 8.

Table 2.2-1: Local and Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[2]
Mill Site Weather Station	5822420	592495	1,118	-	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	-	R, T, RH, SR, E, WS	2012-2021[4]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	-	R, T, RH, SR, E, WS	2012-2021[4]
Likely (1094616)	5828785	599332	724	9	P, R, S, T	1974-1993
Williams Lake A (1098940)	5781820	564666	940	50	P, R, S, T, RH, SR	1961-2021[4]
Spokin Lake 4E (1097646)	5782274	589827	1,033	40	P, R, S, T	1983-2021[4]
Barkerville (1090660)	5880996	599515	1,283	59	P, R, S, T	1888-2021[3, 4]
Quesnel A[5] (1096630)	5873987	546720	545	80	P, R, S, T, RH	1946-2021[4]
Prince George A (1096450)	5971423	521103	691	163	P, R, S, T, RH, SR	1973-1995

1) UTM Coordinate system – Zone 10U.
2) Length of record from start year to end year may not reflect the number of complete years of data.
3) Provisional data for the period January 2016 to December 2021 were provided by ECCC.
4) Station still in operation.
5) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

ID = Identification; masl = metres above sea level; km = kilometre.
P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. The details of these stations are provided in Table 2.2-2, and their locations are shown in Appendix 9-4, Figure 8.

Table 2.2-2: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[1]	Easting (m E)[1]	Approximate Elevation (m)[2]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

1) UTM Coordinate system – Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

Masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

2.2.1 Air Temperature

Air temperature statistics for the Mine Site were developed using historical data from the nearby ECCC climate station in Likely approximately 9 km northeast of the Mine Site. The historical Likely data set was adjusted to the average elevation of the Site by applying the regional monthly lapse rate (Golder 2022). Data gaps were infilled using data from the four regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

Monthly and annual air temperature statistics for the Mine Site (1974-2021) are presented in Table 2.2-3. The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between –6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively.

Table 2.2-3: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**38.1**	**-39.8**

2.2.2 Precipitation

The MPMC precipitation dataset was extended and infilled using the available data record from the five regional stations as described below to derive a daily and 24-hour long-term synthetic precipitation dataset for the Mine Site. The Likely ECCC Station data were used to extend the precipitation record for the Mine Site given the station's length of record and proximity to the Mine Site.

Precipitation data gap infilling was completed following a priority sequence determined by analyzing measured daily rainfall from April to November for all climate stations; it was assumed that precipitation occurring between December and March occurred as snowfall. The regional climate station priority sequence considered the best-fit measured concurrent daily rainfall correlation (Rainfall Correlation), rainfall ranking correlation (Rainfall Rank), and percentage of time rain was recorded on the same day (Concurrent Daily Rain) between the raw data collected at the MPMC climate stations and each ECCC climate station (Golder 2022).

A precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the ECCC climate stations used to infill gaps. The adjustment was based on the April-to-November rainfall ranking factor of the raw ECCC climate station and Mine Site rainfall records.

The Mine Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Mine Site is estimated to be 612 mm with a standard deviation of 118 mm. Frequency analyses of the derived long-term precipitation time series for the Site were undertaken to generate the variability in monthly and annual precipitation of the Mine Site. Estimated annual wet and dry precipitation depths for a range of return periods are shown in Table 2.2-4.

Table 2.2-4: Long-Term Precipitation at the Mount Polley Mine Site

Month[1]	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	74.3	66.5	33.2	28.2
February	35.8	54.0	48.3	24.1	20.5
March	29.7	44.7	40.0	20.0	16.9
April	44.7	67.3	60.2	30.1	25.5
May	49.9	75.2	67.2	33.6	28.5
June	70.8	107	95.4	47.7	40.4
July	63.6	95.8	85.7	42.9	36.3
August	50.6	76.2	68.1	34.1	28.8
September	52.3	78.8	70.5	35.2	29.9
October	58.1	87.5	78.2	39.1	33.1
November	49.8	75.0	67.1	33.5	28.4
December	57.6	86.8	77.7	38.8	32.9
Annual Total[2]	**612**	**922**	**825**	**412**	**349**

1) Wet and Dry Monthly values assumed to follow the same monthly distribution as the Average.
2) Annual total precipitation depths were rounded to the nearest mm for presentation purposes; therefore, it may appear the sum of the monthly values do not equal the annual total.

2.2.3 Relative Humidity

Relative humidity data are available for the Site from 2019 to 2021 and for ECCC climate stations Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). The MPMC WS1 relative humidity record is more complete than WS2's record; therefore, WS1 data were used for the analysis and infilled with WS2 data where necessary and if available. However, relative humidity data for the Site are insufficient for characterizing long-term climatic conditions of the Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative relative humidity estimate for the Site. A long-term relative humidity time series for the Site was developed using ECCC Williams Lake A data infilled with ECCC Quesnel A data with an adjustment factor of 1.13 and 1.04 (Golder 2022).

Statistics for relative humidity are presented in Table 2.2-5. Mean annual relative humidity is 68.1%. Monthly mean values vary between 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity show little variation from the median indicating the Site experiences relatively constant relative humidity on a monthly basis from year to year.

Table 2.2-5: Derived Monthly and Annual Relative Humidity Statistics for the Site (1974-2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

2.2.4 Solar Radiation

Solar radiation data are available for the Mine Site from 2001 to 2003 and 2019 to 2021, and for ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data for the Mine Site are insufficient for characterizing climatic conditions of the Mine Site due to the short period of record, and as the data recorded in 2001 is incomplete and not concurrent with either ECCC climate station. Solar radiation statistics for the Site were determined from the ECCC Williams Lake data. Missing values were infilled by adjusting the Prince George records by a factor of 1.04 (Golder 2022).

Statistics for solar radiation for the Mine Site are presented in Table 2.2-6. Mean annual solar radiation is 135 W/m^2, with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July following the same seasonal pattern for monthly air temperature. The 25th and 75th percentiles show greatest variation in solar radiation occurs in the summer months when solar radiation is greatest during the year, and less variation in winter months when solar radiation is lowest.

Table 2.2-6: Estimated Solar Radiation Statistics for the Site (1974-2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

2.2.5 Evaporation

Evaporation monitoring data are available for the Mine Site from 2019 to 2021; however, the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Mine Site. Therefore, a mathematical model (Morton 1983) was used to calculate evaporation and evapotranspiration (actual and potential) for the Mine Site based on the long-term synthetic records for air temperature, relative humidity, and solar radiation. Evaporation is defined as free water evaporation, or the amount of evaporation from open/free water surfaces (i.e., the water is returned to the atmosphere from lakes, ponds, and watercourses). Potential evapotranspiration (PET) is the water loss that occurs from a vegetated natural surface if there is no deficiency of water in the soil for use by vegetation (Thornthwaite 1948). Actual evapotranspiration (AET) is the water loss that occurs from a vegetated natural surface considering the availability of water in the soil for use by vegetation. Estimated monthly and annual shallow lake evaporation, PET, and AET values are provided in Table 2.2-7, Table 2.2-8, and Table 2.2-9 respectively.

The mean annual shallow lake evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates vary between 0 mm in December to 138 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly evaporation occurs in July when evaporation is greatest, and lowest variation occurs in January and December when evaporation is lowest.

Table 2.2-7: Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**670**	**699**

The mean annual PET rate is estimated to be 863 mm, varying between 744 mm and 1022 mm. Mean monthly PET rates vary between 1 mm in December and January to 171 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly PET occurs in July when PET is greatest, and lowest variation occurs in January and December when PET is lowest.

Table 2.2-8: Estimated Monthly and Annual PET Statistics for the Mount Polley Mine Site (1974-2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

The mean annual AET rate is estimated to be 399 mm, varying between 319 mm and 449 mm. Mean monthly AET rates vary between 1 mm in December and January to 89 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly AET occurs in July when AET is greatest, and lowest variation occurs in January and December when AET is lowest. On an annual basis, AET at the Site is less than shallow lake evaporation and PET rates because AET is limited by the availability of water, particularly during the summer months when the air temperature is highest.

Table 2.2-9: Estimated Monthly and Annual AET Statistics for the Mount Polley Mine Site (1974-2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

2.2.6 Wind Speed and Direction

Hourly wind speed and direction data are available for the Mine Site from 1997 to 2003, and daily wind speed data are available from 2019 to 2021; however, the data are not continuous. The hourly wind speed and direction data available from 1997 to 2003 were used to develop wind rose plots. A wind rose depicts the relative frequency of wind from a given direction on a 16-point compass. Each ring on the wind rose represents a frequency of 2% of the data period. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a defined wind speed range. A wind rose is provided for the period of August 1997 to November 2003, and seasonal wind roses are presented to display seasonal variability in wind patterns, where the seasons have been defined as follows:

- Winter – December to February
- Spring – March to May
- Summer – June to August
- Autumn – September to November

Daily wind data recorded from 2019 to 2021 from WS1 and WS2 were wind speed only, no direction. The period of record for WS2 in 2020 are incomplete and are not included in the analysis. The relative frequency (%) of the magnitude of the daily wind speed data recorded at WS1 for 2019 and 2021 were compared to the relative frequency (%) of wind speed magnitude of the data from 1997 to 2003.

A wind rose plot for the Site depicting the relative frequency of mean hourly wind speed and direction, and the seasonal distribution, between 29 August, 1997 and 27 November, 2003 is shown in Figure 2.2-1.

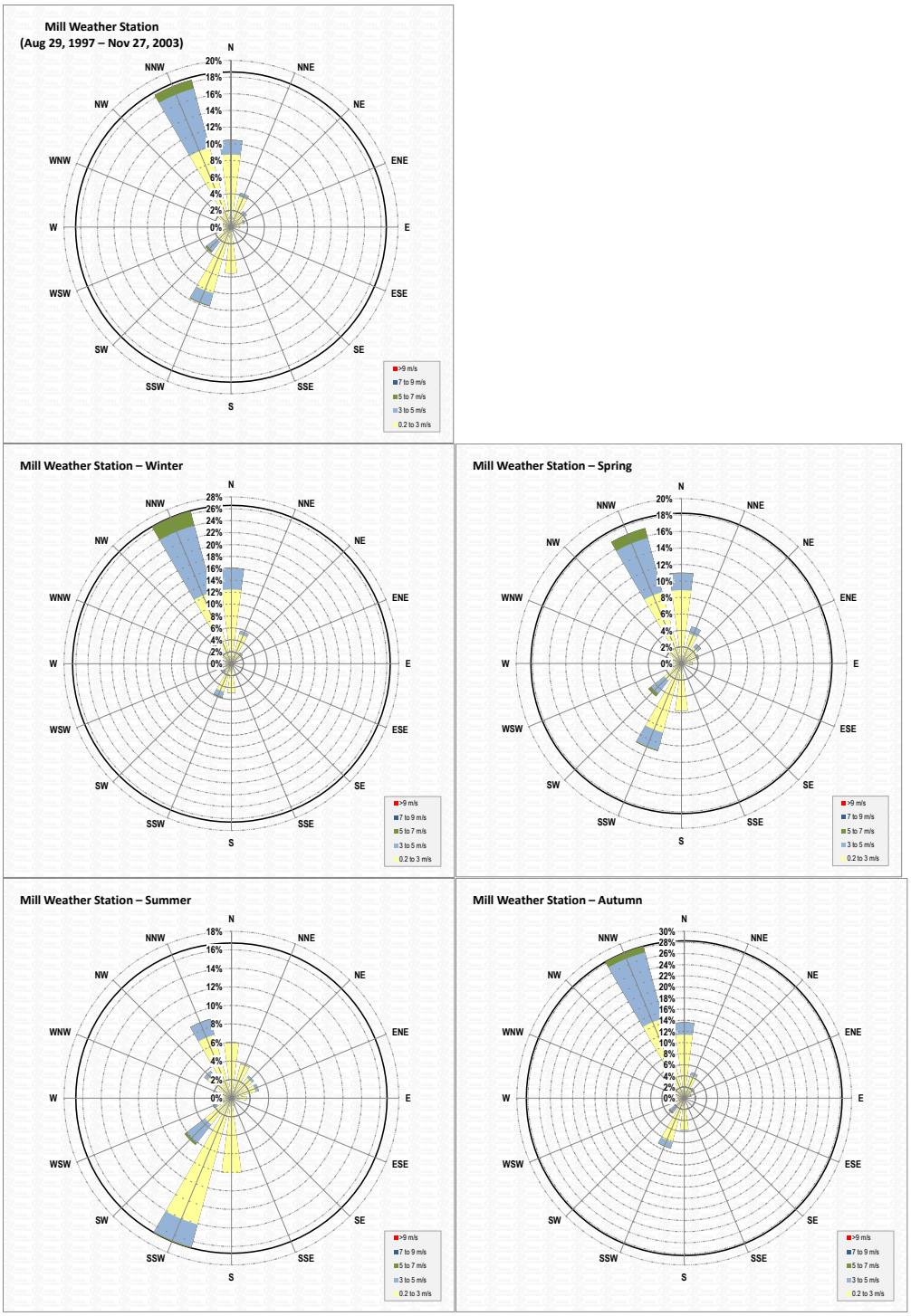

Spring = March, April, May; Summer = June, July, August; Autumn = September, October, November; Winter = December, January, February.

Figure 2.2-1: MPMC Station Monitoring Period and Seasonal Wind Roses – 29 August 1997 to 27 November 2003

Winds measured at the Mine Site typically blew from the north-northwest, north, and south-southwest directions, with minimal winds from the east and the west. The spring, autumn, and winter seasonal wind roses were consistent with the wind rose pattern for the entire monitoring period; however, during the summer months, the majority of winds were from the south-southwest. Similarly, wind speeds in spring, autumn, and winter were generally consistent with the wind rose for the entire monitoring period, while wind speeds in summer were generally lower.

Wind speed measured and seasonal distributions at the Mine Site from 2019 to 2021 were consistent with the relative frequency of wind speed magnitudes and the seasonal distributions recorded between 29 August 1997 and 27 November 2003 (Table 2.2-10). It is noted that the data from 2019 and 2021 are daily wind speed rather than hourly wind speed and only the relative frequency (%) of wind speed magnitude was compared.

Table 2.2-10: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station 29 August 1997 to 27 November 2003[1]	Weather Station 1 1 January 2019 to 31 December 2021[2]
calm	35%	28%
0.2 to 3 m/s	50%	56%
3 to 5 m/s	14%	13%
5 to 7 m/s	2%	3%
7 to 9 m/s	0%	0%
>9 m/s	0%	0%

1) Recorded as hourly wind speed.
2) Recorded as daily wind speed.

2.2.7 Snow Cover Properties

Snow cover data at the Mine Site are available monthly from manual measurements from 1997 to 2022, recorded as snow-water-equivalent (SWE). Measurements, although not continuous, are typically recorded at the beginning and end of a month, with the latter being representative of the monthly SWE. Snow cover monthly statistics, reported as SWE, are presented in Table 2.2-11. At 50% exceedance, snow begins accumulating in November and achieves its maximum in March, reducing to 0 mm in April. The 5th and 95th percentiles and standard deviation values demonstrate the variability in the amount of SWE at the Mine Site, with March having the greatest variability from year to year.

Table 2.2-11: Snow Water Equivalent for the Site (1997-2021)

Month	Number of Measurements	Mean (mm)	Minimum (mm)	Percentile					Maximum (mm)	Standard Deviation (mm)
				5%	25%	50%	75%	95%		
January	22	147	76	88	120	139	164	327	339	56
February	22	182	99	104	131	193	222	338	344	61
March	22	185	0	6	97	198	257	403	411	108
April	21	33	0	0	0	0	81	177	177	58
November	22	17	0	0	0	9	37	72	72	25
December	22	102	32	50	77	101	122	193	196	44

2.3 Geology

An understanding of the regional and local geology and the geochemical characteristics of the different mine materials (e.g., waste rock, ore) aids in developing an understanding of how these materials will weather, and to identify the processes that will control the release of constituents under ambient conditions. The following subsections (adapted from the Technical Assessment Report [TAR]) provide a summary of the mine geology and geochemical characteristics that were subsequently used to derive the geochemical source terms (refer to Appendix C of the TAR, Golder 2016a; SRK 2015) for inclusion into the site-wide water quality model (refer to Appendix D of the TAR, Golder 2016a). The subsections of Section 2.3 were written by SRK Consulting (Canada) Inc. (SRK).

2.3.1 Regional Geology

The mine is in Quesnellia, an accreted terrane in the Intermontane Belt of the Canadian Cordillera. Quesnellia is characterized by Triassic to Jurassic volcanic, sedimentary, and mafic to intermediate intrusive rocks formed in a west-facing arc that developed west of the continental margin of ancestral North America. The mine is within the Mount Polley Intrusive Complex (MPIC), situated in the Central Quesnel Belt, a region of Quesnellia roughly between latitudes 51.5° and 53.5°N (Figure 2.3-1 and Figure 2.3-2). In this area, the arc and a marginal basin immediately to its east were obducted eastwards onto the then continental margin in the late Early Jurassic. Continued crustal shortening in the Middle Jurassic resulted in regional metamorphism and southwest-verging back-folding of the now coupled arc-marginal basin and continental margin assemblages. The mine lies in the core of a broad regional, northwest-trending upright syncline at the western limit of this Middle Jurassic folding. Regional metamorphic grade at the mine is no more than zeolite facies.

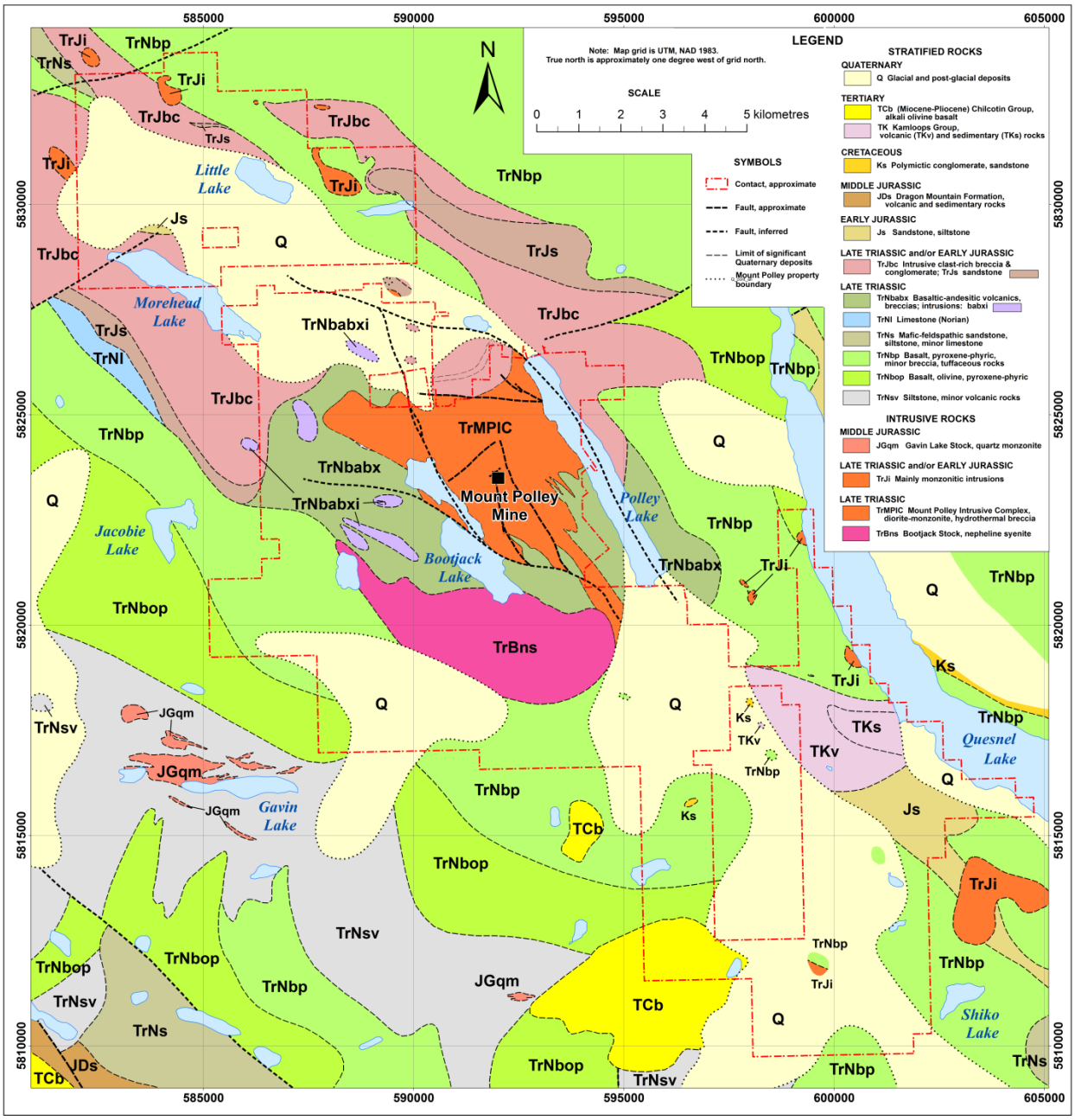

Source: Rees 2013.

Figure 2.3-1: Regional Geology of the Mount Polley Property

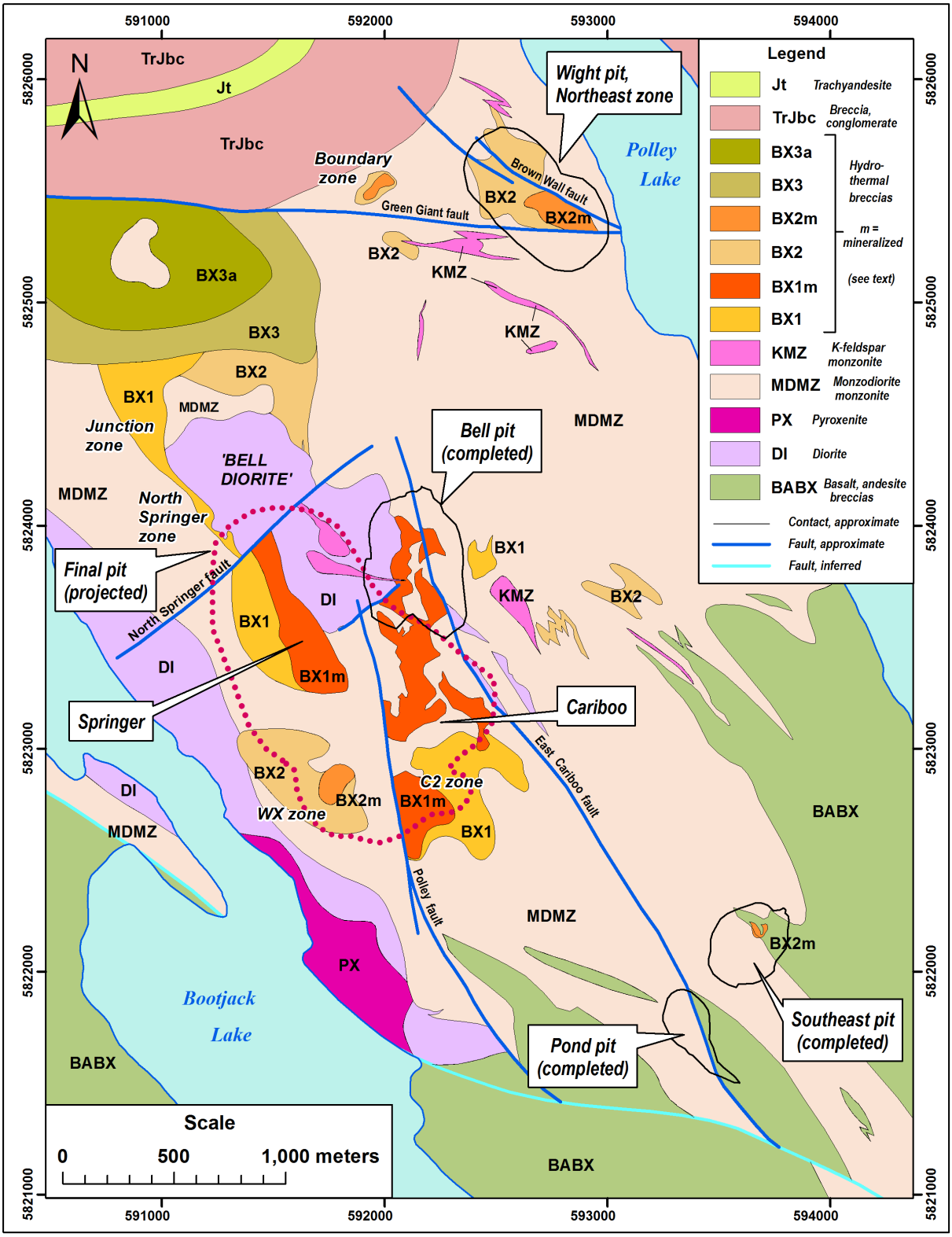

Source: Rees 2013.

Figure 2.3-2: Simplified Geology of the Mount Polley Intrusive Complex

Stratified Triassic rocks surrounding the site are assigned to the Nicola Group, the type-area of which is in southern Quesnellia, where the Nicola hosts other porphyry copper deposits such as the Highland Valley, Copper Mountain, and New Afton mines. The arc stratigraphy in the Mount Polley district extends from the Middle and Late Triassic Nicola Group into the Early Jurassic. From the base, the Nicola Group consists of Middle to early Late Triassic sedimentary and minor volcanic rocks, overlain by a thick Late Triassic succession of submarine, trachybasaltic volcanics and related tuffaceous sediments and volcaniclastic breccias.
The youngest assemblage, which extended into the Early Jurassic, consists of volcanic, plutonic, and sedimentary rocks representing a more mature stage of arc activity, and more differentiated magmatism, when the MPIC was formed. The youngest arc rocks are polymictic breccia and conglomerate that unconformably overlie the MPIC, and are products of late arc uplift and erosion. In the southern part of the Mount Polley property, Nicola Group country rocks are covered by post-accretion units, including outliers of unnamed Cretaceous sandstone and conglomerate, early Tertiary andesitic volcanic and sedimentary rocks of the Kamloops Group, and Miocene-Pliocene basaltic volcanics of the Chilcotin Group.

2.3.2 Deposit (Ore) Geology

Geological details of the Mount Polley deposit are found in Rees (2013) and the findings are summarized below.

The MPIC hosts the Mount Polley copper-gold porphyry deposit (Figure 2.3-1 and Figure 2.3-2). It is a Late Triassic magmatic centre approximately 6 km by 4 km, elongated in a north-northwest direction. It consists of alkalic, marginally silica-undersaturated intrusions and magmatic-hydrothermal breccias. The age of the deposit is approximately 205 million years based on uranium-lead isotopic dating; there is close agreement between age determinations from MPIC intrusions and minerals associated with sulphide mineralization. Mineralization occurs in almost all constituent rock types of the MPIC, and thus occurred late in its formation. Nearly all economic mineralization is in breccias, or in mineralized stockwork veins in adjacent wall rock intrusion. Country rocks of the Nicola Group closest to the MPIC are mafic to intermediate volcanic and subvolcanic coherent rocks, and related breccias, and may form components of mineralized hydrothermal breccias in the periphery of the MPIC.

2.3.3 Surficial Geology, Terrain, and Geohazard Mapping

The Site is located near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976). Within the Site, the plateau has somewhat stronger relief, with the Site rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north-south trending ridges of moderate elevation and relief. Local elevations range from 922 masl at Polley Lake to 1,266 masl at the top of Polley Mountain. The area is within the Quesnel Highlands Ecosection as described by Demarchi et al. (1990), and the area has been previously glaciated, which has resulted in the over-deepened Polley and Bootjack lakes.

2.3.4 Natural and Seismic Hazards Assessment

An assessment of geology of the Springer and Cariboo pits was conducted to support an interim pushback of for Phase 5 of mining as a Notice of Departure. The report is titled “Notice of Departure Support Springer Pit Interim Phase 5 Pushback (WSP 2023e). The results of the assessment determined that several major continuous faults are interpreted to exist in the Springer Pit expansion area, as shown on Figure 2.3-2 (WSP 2023e), and have been exposed along the current pit walls. The approximate surface traces of these major structures on the proposed Interim Phase 5 pushback design are shown in (WSP 2023e). The major structures that will intersect the Interim Phase 5 pushback design are as follows:

- The South Wishbone Fault is a vertical, northeast/southwest trending fault that truncates the mineralized breccia zone to the northwest (WSP 2023e). The Springer Pit wall has performed adequately in the area of the South Wishbone Fault previously with minor raveling along the fault (WSP 2023e). As a result, the South Wishbone Fault is not expected to be a slope stability issue.
- The Springer Fault is a steep, north-south trending, easterly-dipping fault with a dip of approximately 77 degrees. This fault is shown to terminate at the South Wishbone Fault and the Southwest Boundary Fault, to the northwest and southeast, respectively. It intersects the northwest side of the Interim Phase 5 pushback design at an oblique angle. The Springer Pit wall has performed adequately in the area of the Springer Fault previously with limited impact on the overall wall slope stability. As a result, the Springer Fault is not expected to be a slope stability issue.
- The Polley Fault is a wide, steep, north/south trending, easterly-dipping zone of poor quality rock that dips at approximately 73 degrees. The Polley Fault will intersect the central portion of the northeast wall of the Interim Phase 5 pushback design (WSP 2023e). The Polley Fault is a broad zone that raveling has occurred in as mining has progressed and it is anticipated that similar behaviour will occur in the Interim Phase 5 pushback design. As benches are excavated in the Polley Fault, each bench will need to be cleaned prior to excavating the next to maintain adequate catchment for the ravel material.

- The Polley South Boundary Fault is a northeast-southwest trending fault. This fault offsets the mineralized breccia zone and is shown to terminate at the Southwest Boundary Fault to the south. It is difficult to determine an exact fault trace in the current pit wall. It is anticipated that the Polley South Boundary Fault will intersect the Interim Phase 5 pushback design near the Polley and Cariboo South Boundary Faults. The confluence of these faults may cause an area of raveling, but should not affect the overall slope stability due to the oblique angles at which the faults intersect the wall.
- The Cariboo South Boundary Fault is a northeast-southwest trending fault that dips to the southwest at approximately 73 degrees. The fault is pervasive throughout the entire Springer Pit and does not truncate on any other faults. It is difficult to determine an exact fault trace in the current pit wall. It is anticipated that the Cariboo South Boundary Fault will intersect the Interim Phase 5 pushback design near the Polley and Polley South Boundary Faults. The confluence of these faults may cause an area of raveling but should not affect the overall slope stability due to the oblique angles at which the faults intersect the wall.
- The East Cariboo Fault is a northwest-southeast striking fault that dips steeply to the northeast at approximately 86 degrees. The East Cariboo Fault is anticipated to intersect the Interim Phase 5 pushback design in the east corner. Toppling instability has been observed to occur along the easterly dipping faults and joints in the upper weathered monzonite which is in the hanging wall of the East Cariboo Fault. Similar rock mass behavior is anticipated in the area of the Interim Phase 5 pushback as new benches are excavated.

2.3.5 Soil Survey and Soil Characterization for Reclamation

The following description is based on Meister (2010). Most soils at the Mine Site are derived from morainal deposits overlying bedrock. The soils are typically loam to sandy loam in texture and contain 15% to 35% (by volume) coarse fragment content (>2 mm diameter). The pH of the parent material ranges from 6.0 to 7.5 ($CaCl_2$ solution). This reflects the calcareous nature of the underlying bedrock. The calcareous horizon occurs generally at 120 to 150 centimetres (cm) in depth. The organic matter content of the mineral soil is low. The dominant soil development process is the downward translocation of clay particles, resulting in a Bt horizon (characterized by the accumulation of clay) and the development of Brunisolic Gray Luvisol soils. In areas where the Luvisolic soil development is weak, soils are therefore classified as Orthic or Eluviated Eutric Brunisols, reflecting a weaker rate of soil formation. In more acidic areas, the soils are classed as Dystric Brunisols. Detailed soil descriptions and terrain classification from inventories carried out for the Site are provided in Appendix C of the Five-Year Mine Plan and Reclamation Plan (MPRP; Appendix 4-1A).

2.4 Geochemical Characterization and Source Terms

This section provides a summary of the geochemical characterization and source terms for the Mount Polley Mine. A geochemical characterization and analysis of geochemical source terms was updated in 2023 by SRK Consulting, titled “Mount Polley Mine Geochemical Source Terms – 2023 Update” (SRK Consulting 2023, Appendix 2-2).

Supporting analyses for this application involves modelling of water quality at the site and in the receiving environment. Inputs to this model are geochemical source terms which are estimations of the chemistry of water in contact with materials and surfaces exposed by mining activity. Source terms mainly consider the potential for metal leaching and acid rock drainage (ML/ARD).

This section characterizes the materials that will be mined as part of the Project, including an assessment outlining the estimated time to onset of acid rock drainage and/or metal leaching and how it relates to the proposed timeline of the Project, and to describe the derivation and use of the source terms.

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit. The deposit has been mined from several mineralized zones (Springer, Cariboo, Bell, Southeast, Northeast, Boundary). The proposed extension of the existing Springer and Cariboo pits includes mining in three new zones: Springer Deep Zone, WX Zone, and C2 Zone). With the exception of the distinctive small Pond Zone skarn deposit, all other zones have common geological features including mainly a monzonitic plutonic host rock, association with breccia bodies in the intrusion, dominantly potassic hydrothermal alteration, lack of pronounced pyrite haloes, enrichment in copper and selenium relative to global norms, pervasive calcite, and natural oxide alteration. As a result, geochemical characteristics are consistent between zones, allowing a site- wide approach to geochemical characterization.

The PAG and non-PAG waste rock materials occur locally as pyrite zones but non-PAG dominates. The acid rock generating (ARD) potential was used to segregate waste rock, with non-PAG waste rock being placed in several waste rock dumps and PAG waste rock either deposited in completed pits that are projected to flood at the closure of the mine (in accordance with the management practice of subaqueous disposal) or placed in a temporary stockpile for final disposal in the Springer-Cariboo Pit. Based on review of operational processes and data, non-PAG waste rock is expected to be non-acidic in perpetuity.

Tailings are classified as non-PAG based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014.

Major geochemical sources were identified as waste rock stockpiles and the tailings. Other sources include backfilled waste rock, ore processing, pit walls, ore stockpiles, and magnetite stockpiles. Source terms were mainly developed from conceptual geochemical models then

interpretation of rock geochemical characteristics and seepage data rather than scale-up of laboratory kinetic test data. Pit wall source terms (including PAG walls) were obtained by scaling of kinetic test data. Source terms were not specifically developed for the magnetite stockpiles because they are small sources.

The geochemical characterization and source terms are provided in the Mount Polley Mine Geochemical Source Terms – 2023 Update (SRK Consulting 2023, Appendix 2-2). The updated ML/ARD management program is provided in Section 9.5 of this application.

Waste rock produced by mining has varying degrees of ARD potential which is managed by MPMC to limit the potential for development of ARD in the future. The metric used to date to classify waste rock is the total inorganic carbon neutralization potential (TIC-NP) to acid potential (AP) ratio (TIC-NP/AP) with TIC-NP/AP≤2 defining potentially ARD generating (PAG) materials. SRK Consulting (SRK) has been working with MPMC to refine acid-base accounting procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has resulted in development of site-specific acid-base accounting procedures for these specific geological zones that will be mined consistent with theoretical considerations and similar approaches used at other mining operations in BC. An assessment of the NPR to reduce the ratio from 2.0 to 1.5 is provided in the attached document prepared by SRK titled "Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones" (SRK 2023) attached in Appendix 5-1.

2.4.1 Geochemical Characterization

Additional information related to geochemical characterization of materials at the Mine Site can be found in Appendix L of the 5-Year MPRP (Appendix 4-1A). Information contained in this appendix, includes:

- Background of MPMC's geochemical characterization programs
- Information the distribution and ARD potential of the Mine Site
- Plans for PAG disposal
- Sampling procedures
- Responses to finding PAG in non-acid-generating (NAG) areas

Along with other information. Conceptual geochemical modeling of Mount Polley was conducted in 2023 by SRK (Appendix 2-2); information related to geochemical characterization and modelling can be found in the associated report.

Sampling methods for operations are outlined in the ML/ARD Management Plan (Appendix 9-6). Overviews of the geochemical characterizations reported by SRK (2023a; Appendix 2-2) are as follows:

Rock

Understanding of waste rock geochemical characteristics has been accumulated from a variety of sources including diamond drill core tested prior to mining, blast hole cuttings to inform waste rock management operations in the pit during operations, and post-depositional monitoring (Table 3; Appendix 2-2). The database is dominated by the data gathered to operationally characterize waste rock in the Springer Pit, including the Springer Deep Zone. However, the database is incomplete because some of the earlier data were lost, and blast hole data are lacking for Cariboo Pit and Bell Pit. For Cariboo Pit and Wight Pit, confirmatory post-depositional data partly address this gap. For Cariboo Pit, data gathered to operationally characterize waste rock during more recent mining operations in the pit from 2016 – 2019 also addresses this gap.

The inventory primarily contains static ARD potential data, though trace element scans are also available for all zones except the Boundary Pit. Drill core analyses were primarily performed by off-site laboratories and included total sulphur, sulphate, sulphide by difference, total carbonate, neutralization potential (NP by Sobek method), and paste pH. For some samples, a trace element scan was performed. On-site tests were total sulphur and total carbon. The former is assumed to be a proxy for sulphide sulphur because other forms of sulphur (including sulphate) are not common at MPM. The latter is assumed to be a proxy for reactive carbonate minerals.
The assumption is supported by the observed dominance of calcite, the lack of reported iron carbonate and the strong correlation and equivalence of total carbon and total inorganic carbon (TIC) (Figure 3; Appendix 2-2). The dominant plutonic geological setting supports the lack of non-carbonate carbon. As TC equals TIC, NP is represented by carbonate content as represented by TC (NP*).

Tailings

A summary of available data is presented in Table 5: Appendix 2-2. Monthly composite samples of tailings have been collected in the mill when processing since 1997. Tailings samples were also collected from the banks of Hazeltine Creek in 2014 after the TSF breach (“spilled tailings”) along eighteen parallel transects oriented perpendicular to the course of Hazeltine Creek, as described in SRK (2015). Two types of tailings-bearing samples were observed along Hazeltine Creek. They were classified in the field as ‘grey tailings’ and ‘magnetite sands.’
This classification was based on physical and mineralogical characteristics as follows:

- Grey tailings were dominantly grey in colour and had a finer texture (silty sand) than the magnetite sands. They had a strong reaction (referred to as “fizz”) with 10% HCl and did not contain sulphide minerals that were visible by examination with a hand lens.

Mineral identification was difficult due to small grain size, but the dominant minerals included potassium feldspar and plagioclase, with minor biotite mica and quartz.

- Magnetite sands were speckled pinkish-orange and black. They were strongly magnetic and coarser (sand) than the grey tailings. They had weak fizz and trace (less than 1%) sulphide minerals were infrequently noted. The dominant minerals identified included plagioclase feldspar and magnetite. Biotite mica and quartz appeared more abundant than in the grey tailings.

Similar to waste rock, total sulphur is assumed to be a proxy for sulphide sulphur because other forms of sulphur are not common in Mount Polley tailings (SRK 2015a).

Other Sources

Two other sources were identified as potentially requiring geochemical source terms.

Magnetite is recovered from MPM tailings to generate a concentrate for use as a dense medium in coal processing. The magnetite stockpiles are located adjacent to the ore processing plant.

Sulphur was imported in 2004 as part of evaluations of recovery of copper present as oxide. Excess sulphur was stored in a nearby stockpile, first in the Cariboo Pit (2006-2009) and then moved to a crushed rock pad beside the heap leach pad (2009-2018) when mining resumed in the Cariboo Pit. SRK (2022) found the elemental sulphur was composed of about 90% sulphur, and assumed the material had no neutralization potential. Oxidation of the sulphur generated sulphuric acid, which markedly increased the solubility of metals in the surrounding materials that would not otherwise be leachable at neutral pH. In 2018, the excess sulphur was relocated on top of the lined leach pad after evidence showed that water quality on the mine may be affected by contaminated drainage from below the sulphur stockpile (Litke et al. 2019). The affected drainage is seepage from the Northeast Zone (NEZ) Dump, located east of the Test Heap Leach Facility.

2.4.2 Geochemical Source Terms

The geochemical source terms information and analyses including methods, inputs, and model results are provided in Appendix 2-2 (SRK 2023).

2.5 Topography and Surface Drainage Features

The mine is drained by three main watersheds: Hazeltine Creek (30.2 km^2) at Quesnel Lake, Edney Creek (87.4 km^2) at Quesnel Lake, and the Morehead Lake (62.7 km^2) watersheds (Figure 2.5-1). The Hazeltine Creek watershed also conveys water from Polley Lake, and non-contact water from the east side of the mine and the area surrounding the TSF.
The Morehead Creek watershed encompasses the Bootjack Lake catchment area (11.2 km^2).
The watershed areas listed here exclude the mine, which covers part of the original watersheds.

Both the Hazeltine Creek and the Morehead Creek watersheds were significantly altered by historical (i.e., pre-Mount Polley Mine) water diversions. Bootjack Creek, a small remnant of which now flows into Polley Lake via a constructed diversion channel, historically conveyed water from Bootjack Lake to Hazeltine Creek. In 1913, flow from Bootjack Lake was reversed by miners (not associated with MPMC) damming the east end of Bootjack Lake and digging a new outlet westward to Morehead Creek. Around the same time, a water control structure was also built at the outlet of Polley Lake (Hazeltine Creek), and Hazeltine Creek water was diverted to Bullion Pit to support hydraulic placer mining. Flow from Polley Lake to Hazeltine Creek was restored with the abandonment of mining at Bullion Pit during World War II. However, the flow from Bootjack Lake to Hazeltine Creek was never restored.

Prior to the TSF breach, Edney Creek and Hazeltine Creek converged just prior to discharging into Quesnel Lake. The mouths of the two creeks were separated following the breach and interim remediation works. As of late summer, 2020, Edney Creek and Hazeltine Creek have been reconnected, with in-stream habitat features installed, as part of the conclusion of habitat construction works in the lower Hazeltine Creek and Edney Creek area.

MPMC has maintained a hydrological monitoring station on upper Hazeltine Creek (station H1) that was originally installed by the Water Survey of Canada (08KH027) in 1994. A second gauge (H2) was installed in July 2015 on the lower half of Hazeltine Creek. In general, the hydrology of Hazeltine Creek (and by extension, the mine area), can be described as snowmelt driven, with the majority of annual runoff occurring during the spring snowmelt in April and May (Knight Piesold Ltd. 2014).

The surface water drainage features located on the mine site are provided in Figure 2.5-2. A description of the current drainage system is provided in Section 4.5.1 of the WMP (Appendix 9-4). Figure 2.5-3 provides the proposed infrastructure topography cross-sections profiles of the Springer Expansion and the SERDS extension.

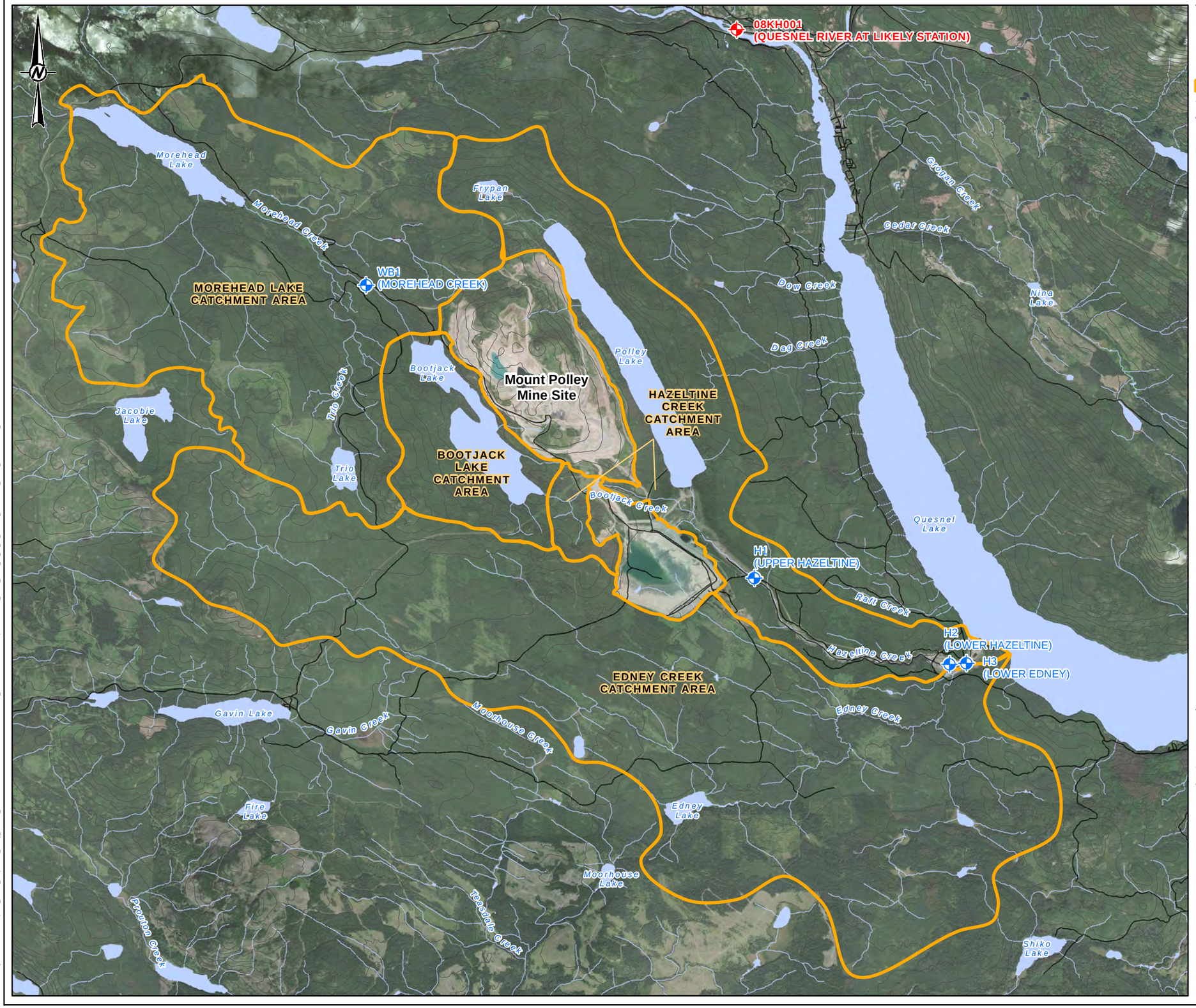

LEGEND

- MPMC HYDROMETRIC STATION
- ENVIRONMENT CANADA HYDROMETRIC STATIONS
- WATER CATCHMENT AREA
- CONTOUR (10m)
- ROAD
- WATERCOURSE
- WATERBODY

0 1.6 3.2

1:80,000 KILOMETRES

REFERENCES

1. CONTOURS, ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD.
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
MAJOR DRAINAGES AND FLOW MONITORING STATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	SC
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	PHASE	REV.	FIGURE
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Boundary Pit
Wright Pit / Underground
Wright Pit Clean Water Ditch
Wright Pit to Long Ditch
Joe's Creek Coffer Dam
North Bell Dump
Joe's Creek Pipe
Junction Zone Ditch
Temporary NW PAG Stockpile
9km Sump
9km and NW Sumps to Springer
NW Sump
NW Ditch
Gavin's Ditch
Springer Pit
Cariboo Pit Sump
Cariboo Pit to Springer Pit
SEZ Ditch
Long Ditch
Wright Pit to Mill
East RDS
#1 Ore Stockpile
Polley Lake
Mine Drainage to Springer
Springer to Water Treatment Plant
NEZ RDS
Mill
Mill Site Sump
West Ditch
Mill to Springer
Mine Drainage Creek Sump
Mine Drainage to West Ditch
SERDS
Long Ditch
Springer to Water Treatment Plant
CCS to Springer Pit
Bootjack Lake
SERDS Ditch
SERDS Ditch
Orica Ditch
TAR Ditch
Long Ditch Pipeline
Bootjack Creek Sump
Springer to Water Treatment Plant
Central Collection Sump
CCS to TSF
Springer to Water Treatment Plant
Breach Ditch
Upstream 1 to Settling Pond
Perimeter Embankment Till Borrow Pit
Main Pond to CCS
TSF Clean Water Ditch
Water Treatment Plant
Tailings Storage Facility
ABR Ditch
South Seepage Pond
South Pond to Main Pond
Main Embankment Seepage Pond
South Toe Drain Ditch

LEGEND

WATER COLLECTION SYSTEMS

- CLEAN WATER DITCH
- CONTACT WATER DITCH
- PIPELINE

0 600 1,200

1:30,000 METRES

REFERENCES

1. WATER MANAGEMENT INFRASTRUCTURE INFORMATION PROVIDED BY MOUNT POLLEY MINING CORPORATION (2016)
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CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE

MOUNT POLLEY MINE LAYOUT

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	SL
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	PHASE	REV.	FIGURE
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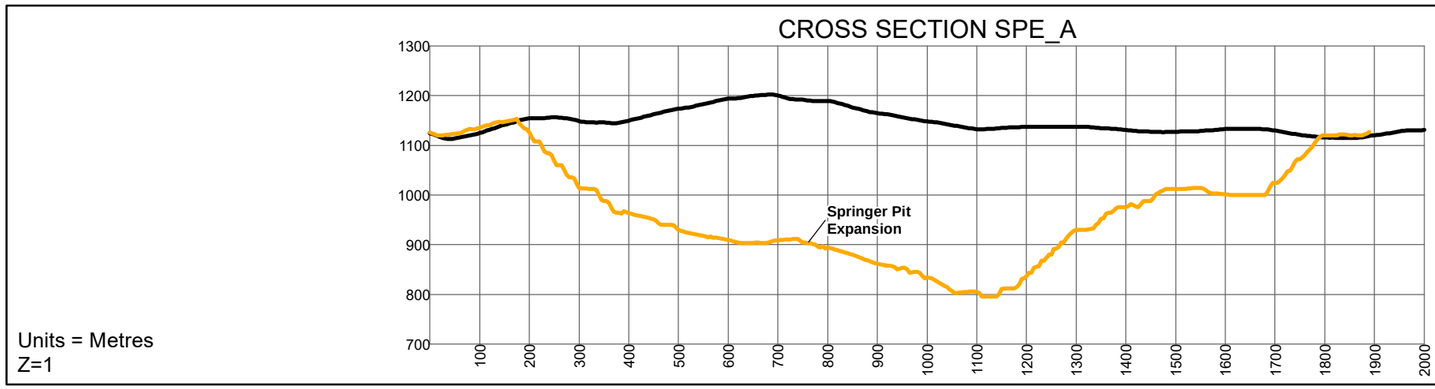

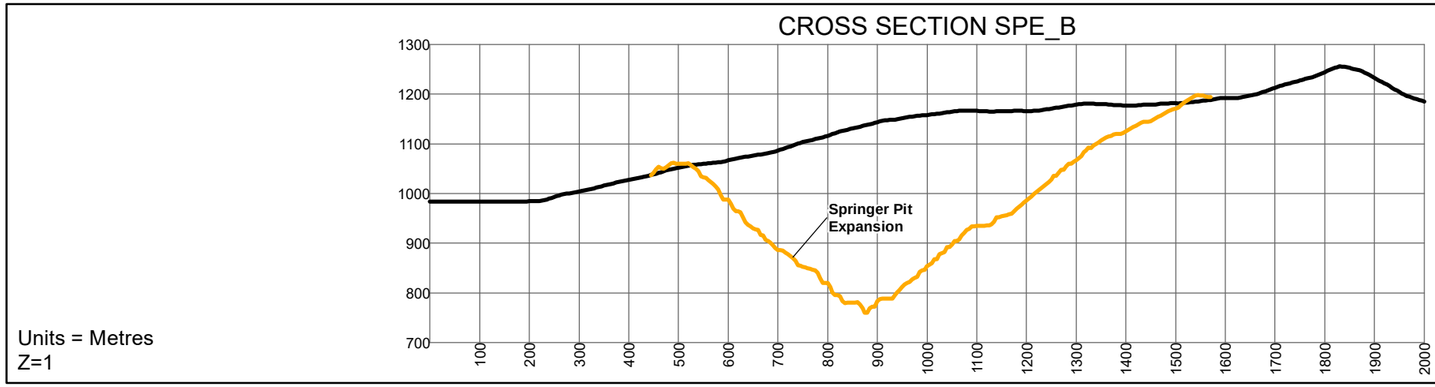

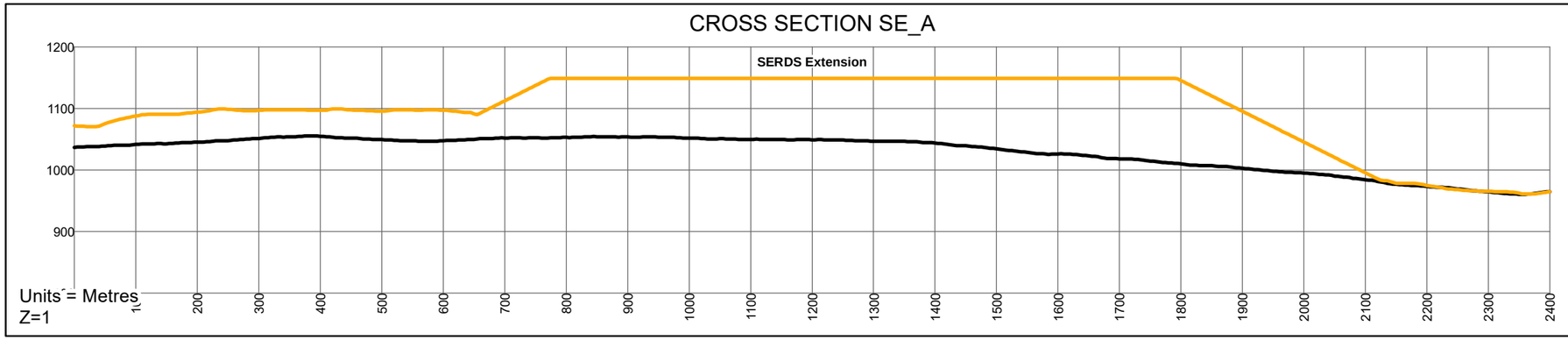

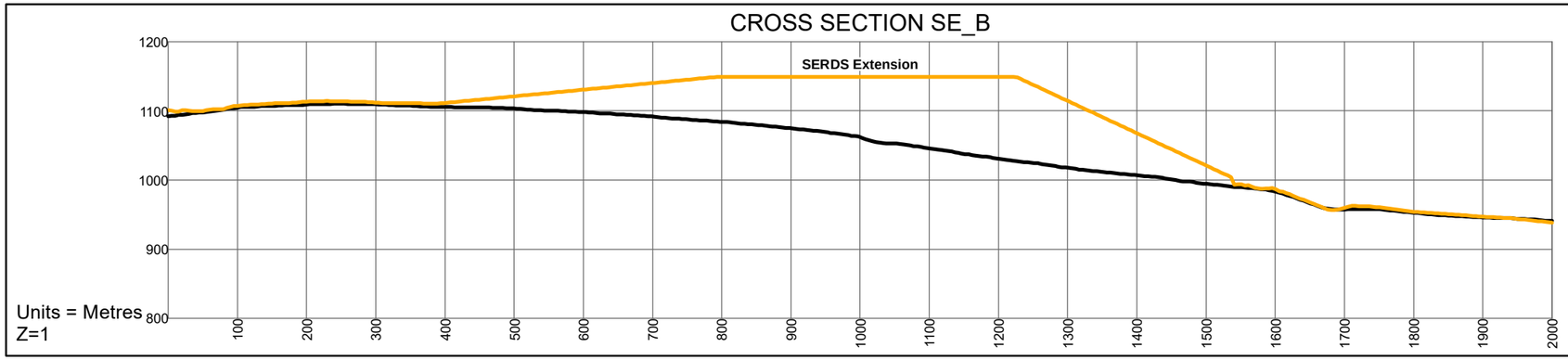

LEGEND

- CROSS-SECTION
- PROJECT COMPONENT
- PERMIT BOUNDARY
- WATERCOURSE
- WATERBODY

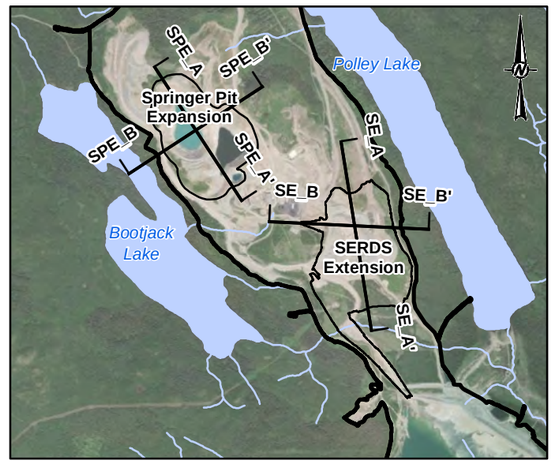

0 1,500 3,000

1:75,000 METRES

REFERENCES

1. PERMIT BOUNDARY PROVIDED BY MOUNT POLLEY MINING CORPORATION (2022).
2. BASE DATA CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE – BRITISH COLUMBIA.
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4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE

TOPOGRAPHY AND SURFACE DRAINAGE FEATURES IN THE MINE SITE AREA

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	SL
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	PHASE	REV.	FIGURE
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2.6 Water Quantity

2.6.1 Surface Water Quantity

The surface water quantity and hydrological information for Mount Polley Mine is provided in Section 3.2.2 of the Water Management Plan (WMP) located in Section 9.6 (Appendix 9-4; WSP 2023a). The WMP (2023) summarizes the Mine Site drainage and surface hydrology for the three main watersheds: Hazeltine Creek at Quesnel Lake, the Edney Creek at Quesnel Lake, and Morehead Lake watershed. The 2023 water balance calibration report is also included in Appendix 2-3.

2.6.2 Groundwater Quantity

In 2016, Golder Associates Ltd. (Golder), now WSP Canada Inc. (WSP) assessed groundwater flow for the following three open pits at the mine: Springer and Cariboo pits, Wight Pit and Boundary Pit. The analysis for each pit was described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a). Hydrogeological assessments for the pits were conducted as part of the TAR to provide estimates of seepage into and out of the pits. The hydrogeological model recalibration and update was completed by WSP in May 2024. Results are provided in WSP (2024) and summarized in section 5.5.2 herein.

2.7 Water Quality

The quality of surface and groundwater is summarized in this section. Monitoring in Quesnel Lake and of groundwater on the Mine Site is ongoing, following the methods outlined in the Comprehensive Environmental Monitoring Plan (CEMP; Appendix 7-1). Additional information regarding the on-going water monitoring programs is provided in Section 9.0 Management Plans. Historic and current surface water quality for the PAG stockpile and of NAG storage facilities that are intended to receive material with NPR between 2 and 1.6 are discussed in Section 2.6.3 of the Site-Wide Water Quality Report (Appendix B of the WMP; Appendix 9-4).

2.7.1 Surface Water Quality

2.7.1.1 Selection of Water Quality Guidelines

BC Water Quality Guidelines (WQGs) have been developed by BC ENV to be protective of various water uses, such as aquatic life, wildlife, drinking water sources, recreational contact, and agriculture (livestock watering and irrigation). Based on the uses identified for Quesnel Lake in Section 1.3.3, guidelines protective of aquatic life, wildlife, drinking water sources, and recreational contact are applicable to these receiving environments, and when WQGs for the protection of aquatic life are met, other water uses are expected to be protected (Table 2.7-1) because water quality guidelines are generally more conservative than the guidelines for other uses. An exception is for molybdenum, for which the WQG for the protection of wildlife is the lowest guideline.

Table 2.7-1: BC WQGs for Receiving Environment Uses

Parameter	Unit	Maximum BC Drinking Water Guidelines	Maximum BC WQGs		Chronic BC WQGs	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
General Water Quality Parameters						
pH	-	6.5-8.5	6.5-9	5-9.5	6.5-9	5-9.5
Dissolved Oxygen	mg/L	-	5[a]	-	8[a]	-
Total Dissolved Solids	mg/L	-	-	-	-	1000
Major Ions						
Calcium	mg/L	-	-	-	-	1000
Chloride	mg/L	250[b]	600	600	150	-
Fluoride	mg/L	1.5	1.1[I]	1.5	-	1.0
Sulphate	mg/L	500[b]	-	-	218[d]	1000
Nutrients						
Ammonia	Mg-N/L	-	1.29[e]	-	0.175[e]	-
Nitrate	mg-N/L	10	32.8	100	3	-
Nitrite	mg-N/L	1	0.060[f]	10	0.02[f]	-
Total Phosphorus	mg-P/L	0.01[c]	-	-	0.005–0.015	-
Total Metals						
Aluminum	mg/L	9.5	-	5	0.19[g]	-
Antimony	mg/L	0.006	-	-	0.009W	-
Arsenic	mg/L	0.01	-	-	0.005	0.025M
Barium	mg/L	-	-	-	1W	-
Beryllium	mg/L	0.004W	-	-	0.00013W	0.1
Boron	mg/L	5	-	-	1.2	5
Cadmium	mg/L	0.005	-	0.08	-	-
Chromium	mg/L	-	-	-	0.001W[h]	0.05W[h]
Cobalt	mg/L	-	0.11	-	0.004	1
Copper	mg/L	2	-	0.3	-	-
Iron	mg/L	-	1	-	-	-
Lead	mg/L	0.005	0.037[i]	0.1	0.0048[i]	-
Manganese	mg/L	-	1.1[j]	-	0.84[j]	-
Mercury	mg/L	0.001	-	0.003	0.00001[k]	-
Molybdenum	mg/L	0.088	46	-	7.6	0.034/0.284[l]
Nickel	mg/L	0.08	-	-	0.025W[m]	1
Selenium	mg/L	0.01	-	-	0.002	0.002
Silver	mg/L	-	0.0001[n]	-	0.00005[n]	-
Thallium	mg/L	0.002	-	-	0.0008W	-
Uranium	mg/L	-	-	-	-	0.2
Vanadium	mg/L	-	-	-	-	0.1
Zinc	mg/L	3	-	-	-	2

Table 2.7-1: BC WQGs for Receiving Environment Uses

Parameter	Unit	Maximum BC Drinking Water Guidelines	Maximum BC WQGs		Chronic BC WQGs	
			Aquatic Life	Wildlife	Aquatic Life	Wildlife
Dissolved Metals						
Cadmium	mg/L	-	0.00031[(q)]	-	0.00013[(q)]	-
Copper	mg/L	-	0.0070[(r)]	-	0.0022[(r)]	-
Iron	mg/L	-	0.35	-	-	-
Zinc	mg/L	-	28.4[(s)]	-	5.29[(s)]	-

Note:

(a) = Guideline for dissolved oxygen is the water column instantaneous minimum value for embryo / alevin life stages. The water column 30-day mean for embryo / alevin life stages is 8 mg/L.

(b) = Guideline is based on an aesthetic objective rather than a health-based objective.

I(c) = Hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10 mg/L, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

(d) = Hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determined base on site water.

(e) = pH and temperature dependent ammonia guideline: values selected from the BC WQGs for Nitrogen (Nitrate, Nitrite, and Ammonia) technical document based on a temperature of 20°C and 8.7 pH.

(f) = Chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 mg/L = 0.30, at Cl >10 mg/L = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 mg/L = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

(g) = Hardness, pH and dissolved organic carbon dependent total aluminum guideline: BC Max WQG (mg/L) = ((*e*^((0.645∗ln(DOC)+(2.255∗ln(hardness))+(1.995∗pH)+(−0.284 ∗(ln(hardness) ∗ pH))−9.898))/3)/1000

(h) = Guideline is for chromium VI (Cr(VI)).

(i) = Hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness <8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) – 4.704))/1000 at hardness >8 mg/L.

(j) = Hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

(k) = Mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

(l) = Molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034 mg/L) and non-ruminant (0.284 mg/L) wildlife.

(m) = Hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness <60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness >180 mg/L.

(n) = Hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.0015.

(o) = Hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

(p) = pH dependent dissolved aluminum guideline: BC Max WQG (mg/L) = 0.1 at pH ≥6.5, at pH <6.5 = exp(1.209-2.426*(pH)+0.286*(pH2)); BC 30-day WQG (mg/L) = 0.05 at pH ≥6.5, at pH <6.5 = exp(1.6-3.327*(median pH)+0.402*(median pH2), determined based on 7.0 pH.

(q) = Hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

(r) = Hardness, dissolved organic carbon, and pH dependent copper guideline is applied to total and dissolved fraction. The guideline is selected from the Copper Water Quality Guideline Look-up Table. The copper guideline is based on mean baseline hardness (54 mg/L), pH (8.8), and DOC (0.05 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

(s) = Zinc guideline for aquatic life is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

Physical parameters with WQGs such as dissolved oxygen, TSS, turbidity, and pH were not modelled.

W = working guideline; M = interim guideline; Min = Minimum concentration requirement based on life stage; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; TSS = total suspended solids.

2.7.1.2 Quesnel Lake

Water quality data collected routinely by MPMC from 2015 to present in Quesnel Lake are summarized here to characterize water quality at the point of discharge in Quesnel Lake and compare the water quality to reference locations.

Surface water quality sampling is conducted at a minimum four times per year at the following exposure locations (Figure 2.7-1):

- Stations QUL-57, QUL-58, and QUL-59, which are at the edge of the Initial Dilution Zone (IDZ) 100 m from the point of discharge. Per the CEMP, the objective of this sampling is to "verify that the discharge of treated effluent is not causing an exceedance of the applicable ambient BC Water Quality Guidelines at the edge of the IDZ, as required by the Permit, and to verify the discharge model, as described in the Annual Discharge Plan (ADP; MPMC 2018)".

Reference samples are collected from the following stations:

- **QUL-2a –** (four times per year) in the West Basin upstream of the mouth of Hazeltine Creek, to monitor for potential eastward flow of effluent due to seiche (wind-driven) events. Per the CEMP, QUL-2a is monitored for the purpose of model verification and is considered a Quesnel Lake reference site.
- **QUL-120a –** (twice per year) east of Cariboo Island in the main portion of the West Arm of Quesnel Lake. Per the CEMP, QUL-120a is monitored for the purpose of model verification and is considered a Quesnel Lake reference site.

Background concentrations were not readily available during model derivation as only one year (2015) of relevant water quality data for Quesnel Lake sites was available at that time, and sites nearest the discharge were potentially affected by the 2014 tailings breach. Considerable effort was made to source pre-breach background data on Quesnel Lake water quality; however, relevant data could not be located (McMahen 2015). Therefore, background conditions were defined based on the most distant upgradient site available, QUL-120a. MPMC continues to collect sample data from both QUL-120a and QUL-2a to fulfill reference requirements and regulatory expectations.

Between 2015 and 2022, all sampling events for these locations occurred as required by the applicable Discharge Management Plan (2015), or CEMP, as summarized in the Annual Environmental Reports. Further details on the monitoring program are provided in Section 9.0.

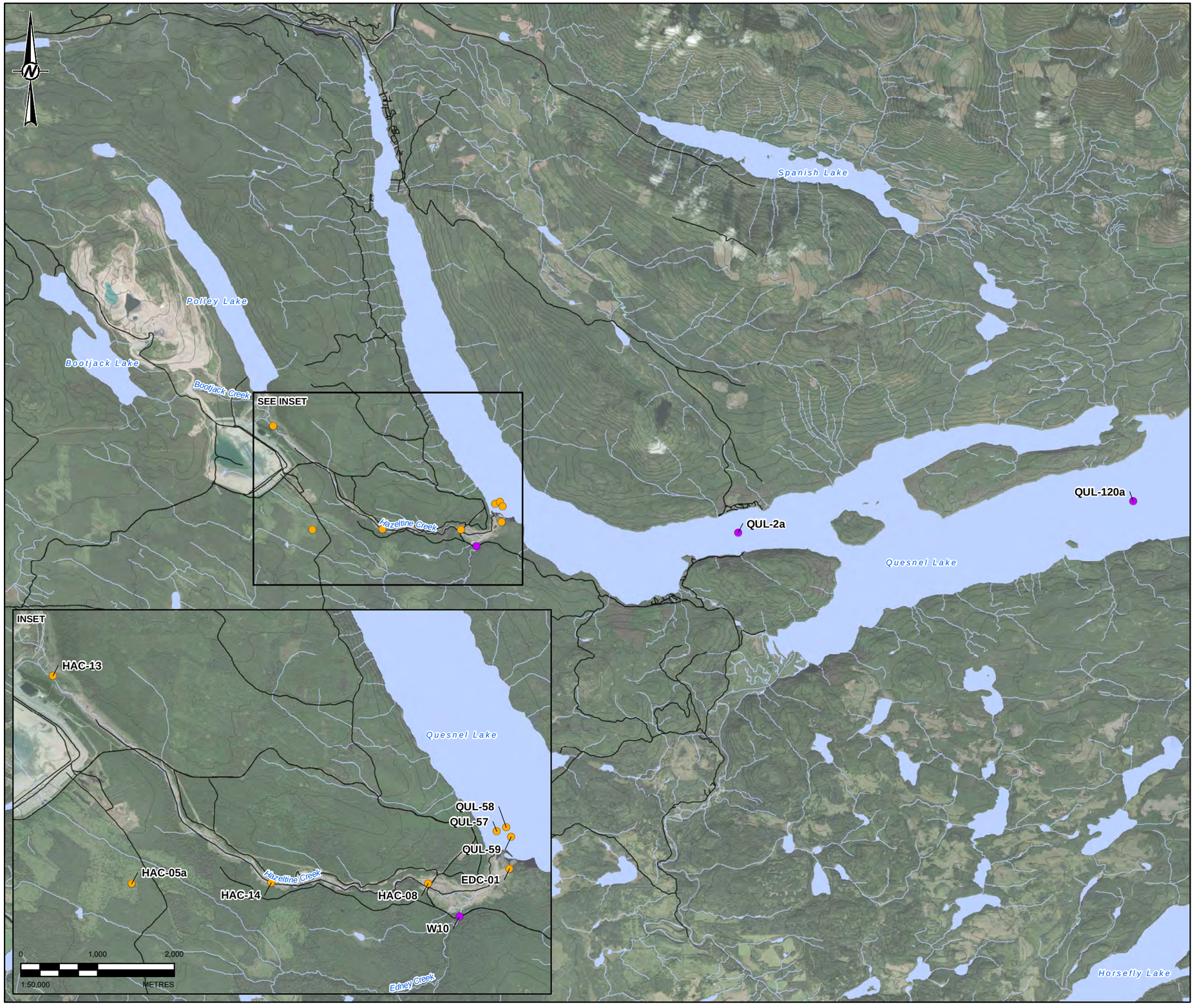

LEGEND

SAMPLING LOCATION

- EXPOSED
- REFERENCE
- ROAD
- CONTOUR (10m)
- WATERCOURSE
- WATERBODY

0 2,000 4,000

1:100,000 METRES

REFERENCES

1. BASE DATA CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE – BRITISH COLUMBIA.
2. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY.
3. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE

2015 TO 2023 WATER QUALITY SAMPLING LOCATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	KM
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	PHASE	REV.	FIGURE
23590671	81100/81112	0	**2.7-1**

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The water quality results for 2015 to present is provided in Appendix 2-4 and are screened against BC WQGs in Appendix 2-4 Tables 2-2A and 2-2B. Copper and selenium are discussed here because their concentrations in effluent from the WTP were greater than their respective BC WQGs. The remainder of measured parameters were consistently below their respective BC WQGs.

The monthly average concentrations from 2015 to 2022 for total and dissolved copper were plotted for the reference (QUL-2a and QUL-120a) and IDZ (QUL-57, QUL-58, and QUL-59) stations in Quesnel Lake (Figure 2.7-2). The copper concentrations at both reference and IDZ stations fluctuate throughout the year, with the highest average concentrations in early spring or late fall. Monthly average copper concentrations in samples collected at reference stations are generally within the same range of the monthly average copper concentrations for samples collected at the IDZ. The October average of 0.0013 mg/L dissolved copper observed at station QUL-59 in Figure 2.7-2 was influenced by a transient event observed at HAD-3 resulting in a copper concentration at QUL-59 of 0.0049 mg/L (see Table 6.1-1, 27 October 2021, and the Trigger Response Plan [MPMC 2018]). Mount Polley has attributed this transient event is likely due to three corresponding phenomena on Site; change in water chemistry in the Springer Pit during dewatering, overflow from the TSF booster station, and treatment plant optimization that relied on outdated site water storage chemistry. The monthly average for October at QUL-59 excluding the transient event is 0.00059 mg/L in comparison to 0.0013 mg/L.

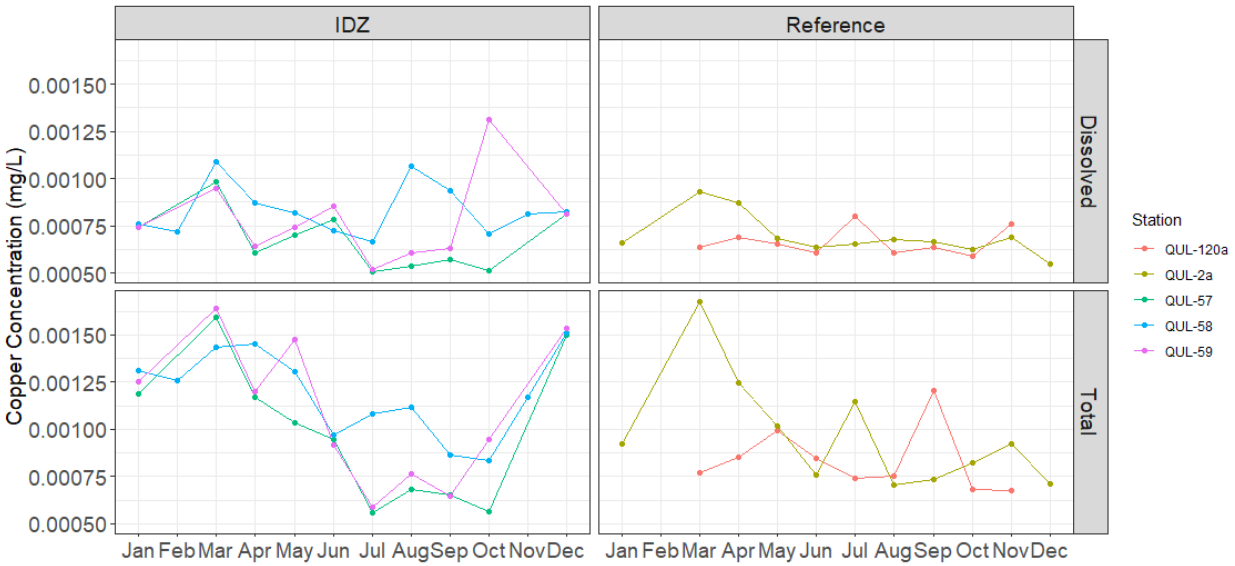

mg/L = milligrams per litre.

Figure 2.7-2: Monthly Average Copper Concentration from 2015 to 2022 at Stations Representing the IDZ (QUL 57, QUL 58, QUL 59) and the Reference Stations in Quesnel Lake (QUL 2a and QUL 120a)

The dissolved copper concentrations measured at IDZ stations (QUL-57, QUL-58, QUL-59) and the reference stations (QUL-2a, QUL-120a) in Quesnel Lake from 2015 to present were screened against chronic and acute BC WQGs (**Figure 2.7-3**, Appendix 2-4).Dissolved copper concentrations were consistently above the sample-specific long-term chronic BC WQG and below the short-term acute BC WQG.

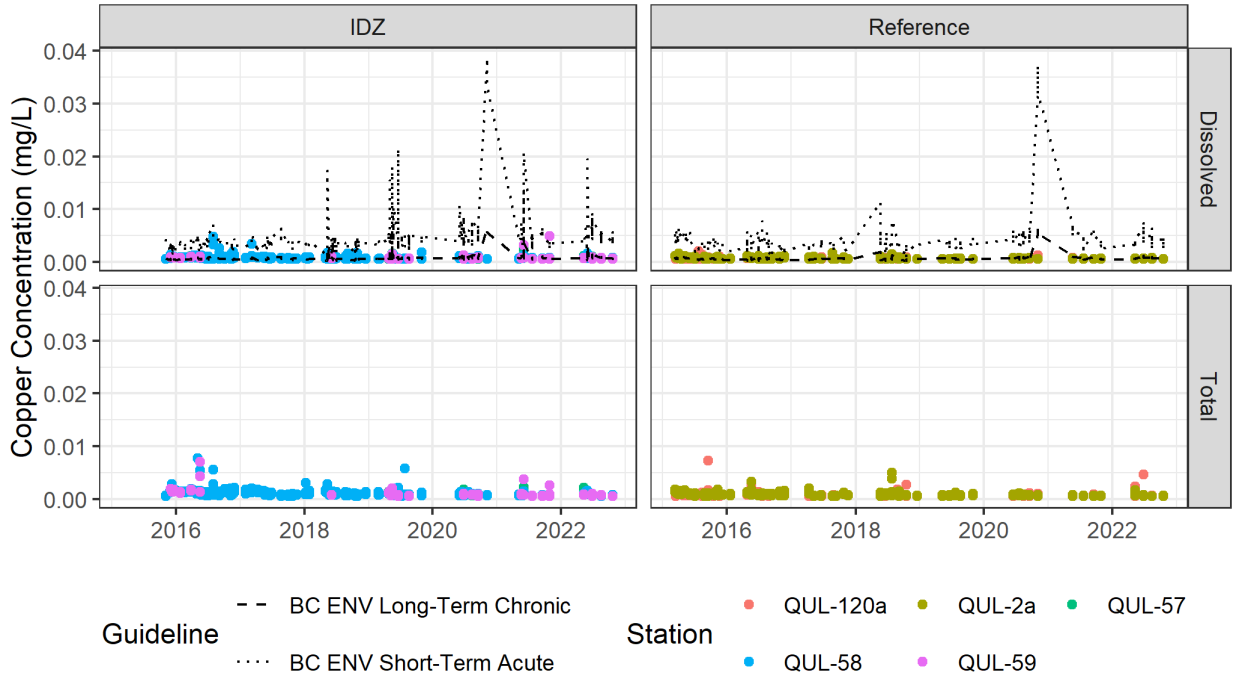

Notes: The BC ENV copper water quality guidelines are sample-specific and calculated using hardness, pH, and dissolved organic carbon dependent.

Figure 2.7-3 Copper Concentration from 2015 to Recent at Stations Representing the IDZ (QUL-57, QUL-58, QUL-59) and the Reference Stations in Quesnel Lake (QUL-2a, QUL-120a)

Boxplots were also generated with total and dissolved copper concentrations from samples collected from 2015 to 2022 at reference and IDZ stations (Figure 2.7-4). The boxplots display summary statistics for a large dataset and illustrate water quality parameter variability between monitoring locations (i.e., the larger the box, the larger the interquartile range and increased variability within the dataset). The boxes for the reference stations (QUL-2a, QUL-120a) overlap with the boxes for the IDZ stations (QUL-57, QUL-58, QUL-59) suggesting copper concentrations in Quesnel Lake at the edge of the IDZ are similar to the furthest reference station.

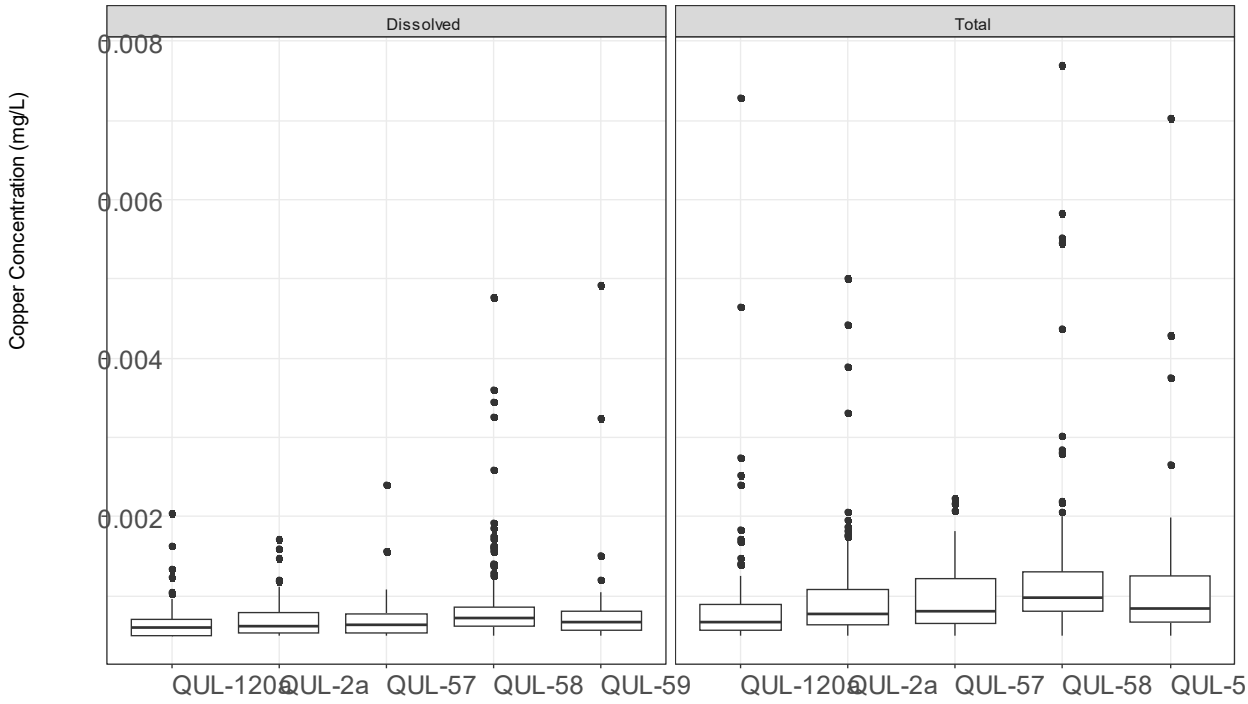

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.
Dissolved copper: QUL-120a (n = 166), QUL-2a (n = 204), QUL-57 (n = 79), QUL-58 (n = 345), QUL-59 (n = 86).

Total copper: QUL-120a (n = 166), QUL-2a (n = 204), QUL-57 (n = 79), QUL-58 (n = 345), QUL-59 (n = 86).

Mg/L = milligrams per litre.

Figure 2.7-4: Boxplot of Copper Concentrations from 2015 to 2022 Representing the IDZ (QUL-57, QUL-58, QUL-59) and the Reference Stations in Quesnel Lake (QUL-2a and QUL-120a)

The monthly average concentrations for total and dissolved selenium were similarly plotted as time series (Figure 2.7-5) and boxplots (Figure 2.7-6). Monthly average selenium concentrations were similar from month to month at both the edge of the IDZ and reference stations and were below the BC WQG. The samples collected from reference stations in March (in 2015, the only year from 2015 to 2020 when water quality monitoring was conducted in March) had a detection limit of 0.0005 mg/L, which is above the detected concentrations in samples collected in other months.

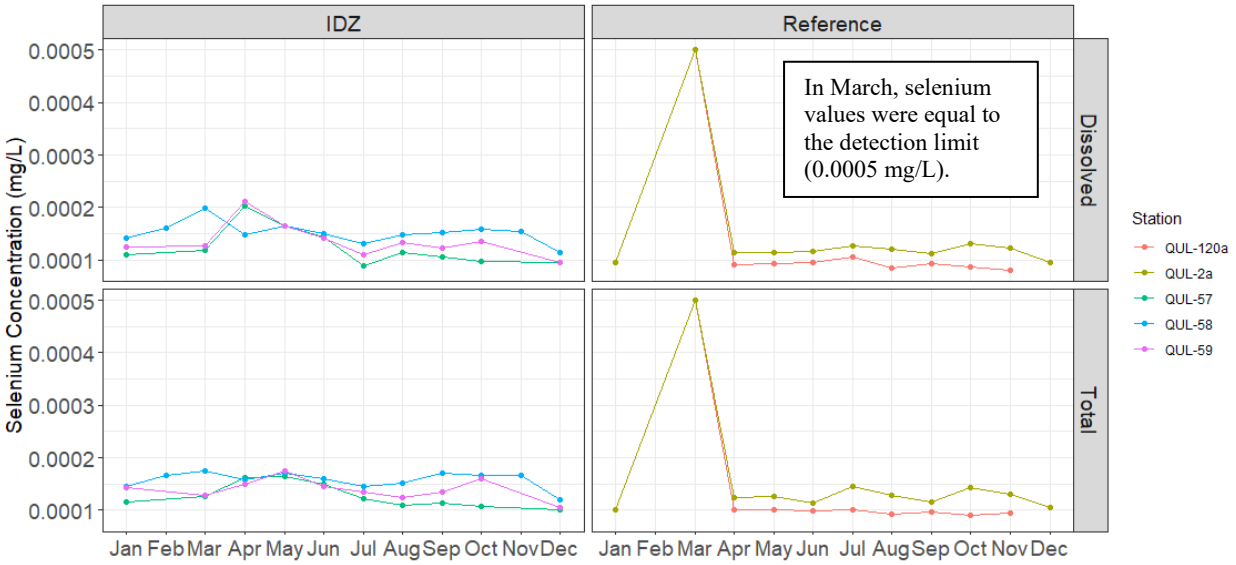

The value at reference sites in March was represented by one sampling event in which the detection limit was 0.0005 mg/L (i.e., the illustrated value is the detection limit).

Mg/L = milligrams per litre.

Figure 2.7-5: Monthly Average Selenium Concentration from 2015 to 2022 at Stations Representing the IDZ (QUL-57, QUL-58, QUL-59) and the Reference Stations in Quesnel Lake (QUL-2a and QUL-120a).

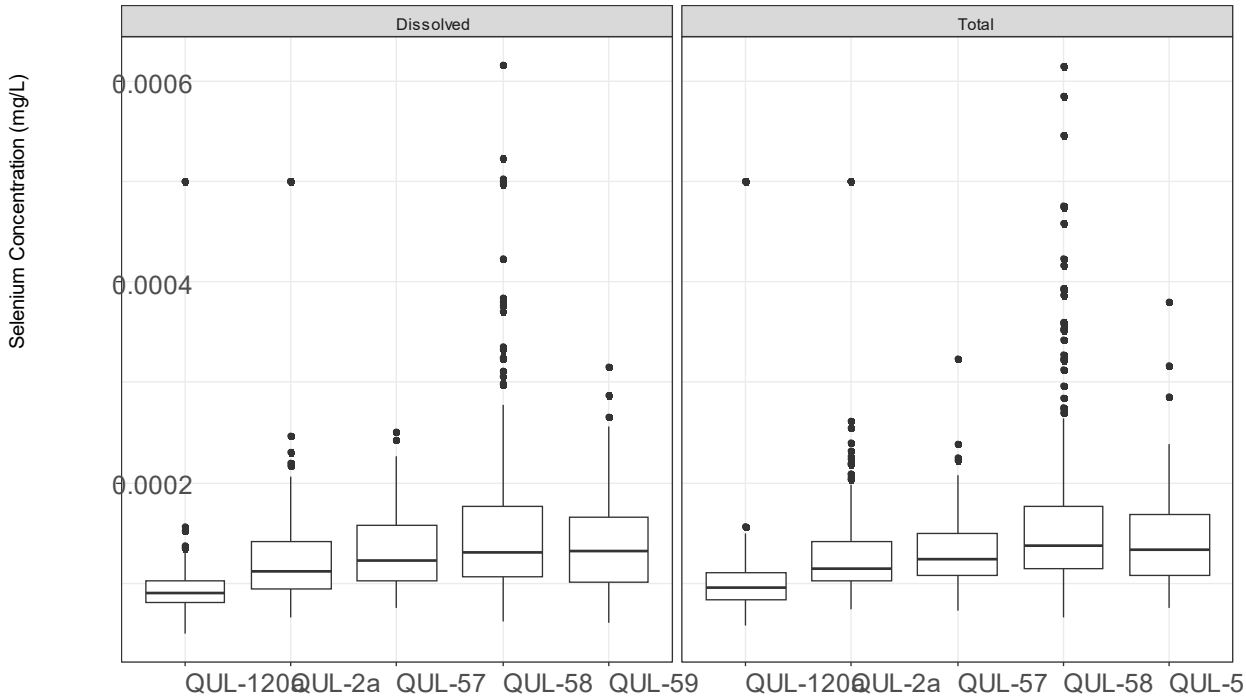

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Dissolved selenium: QUL-120a (n = 166), QUL-2a (n = 204), QUL-57 (n = 79), QUL-58 (n = 345), QUL-59 (n = 86).

Total selenium[a] QUL-120a (n = 33[a]), QUL-2a (n = 410), QUL-57 (n = 181), QUL-58 (n = 577), QUL-59 (n = 201).

mg/L = milligrams per litre.

Figure 2.7-6: Boxplot of Selenium Concentrations from 2015 to 2022 Representing the IDZ (QUL-57, QUL-58, QUL-59) and the Reference Stations in Quesnel Lake (QUL-2a and QUL-120a)

2.7.1.3 Hazeltine Creek

Water quality data collected routinely by MPMC from 2015 to present are summarized here and were originally presented in the 2021 and 2022 Mount Polley CEMP – Sediment and Aquatic Life reports (Appendix 2-4).

The objective of the effluent monitoring program is to verify that the discharged water chemistry and toxicity results meet the applicable regulatory limits at the point of discharge (Metal and Diamond Mine Effluent Regulations [MDMER] Schedule 4 and Section 1.2.4 of PE-11678, and that the discharge flow rate does not exceed the permitted rates of a maximum 52,000 m^3/day and an annual average of 29,000 m^3/day [Section 1.2.1 in PE-11678]). The influent is also sampled to allow for evaluation of treatment efficacy and identification of potential/emerging source control needs.

For effluent characterization, the following routinely monitored mine-influenced stations within Hazeltine Creek are reported on (HAC-05a and HAC-13 [Upper Hazeltine Creek], HAC-08 and HAC-14 [Lower Hazeltine Creek]) and compared to an associated reference area (lower Edney Creek at station W10). Sample collection and analysis methods are described in Appendix 2-5.

The water quality results for in Hazeltine Creek stations HAC-05a, HAC-08, HAC-13, HAC-14, and EDC-01a, and the reference location in Edney Creek (W10) from 2015 to present were screened against BC WQGs (Appendix 2-6). Copper and selenium are discussed here as their concentrations in effluent from the WTP were greater than the BC WQGs.

Total and dissolved copper concentrations from 2015 to present in Hazeltine Creek were consistently above copper concentrations in the associated reference location, Edney Creek (W10; Figure 2.7-7). Total copper concentrations were greatest at HAC-08 in 2016 with maximum total copper concentrations of approximately 1 mg/L, Mount Polley hypothesized that the elevated concentrations were likely related to spring runoff flows that conveyed higher total suspended solids (TSS) loads and associated copper to the WTP and discharge was ceased until copper concentrations met the effluent quality defined by the permit (see Table 6.1-1, April 2016 and the Trigger Response Plan [MPMC 2018]). Concentrations of dissolved copper were generally above the long-term chronic BC WQG and below the short-term acute BC WQG. Copper concentrations were relatively consistent from 2019 to recent, with some seasonal fluctuations associated with freshet.

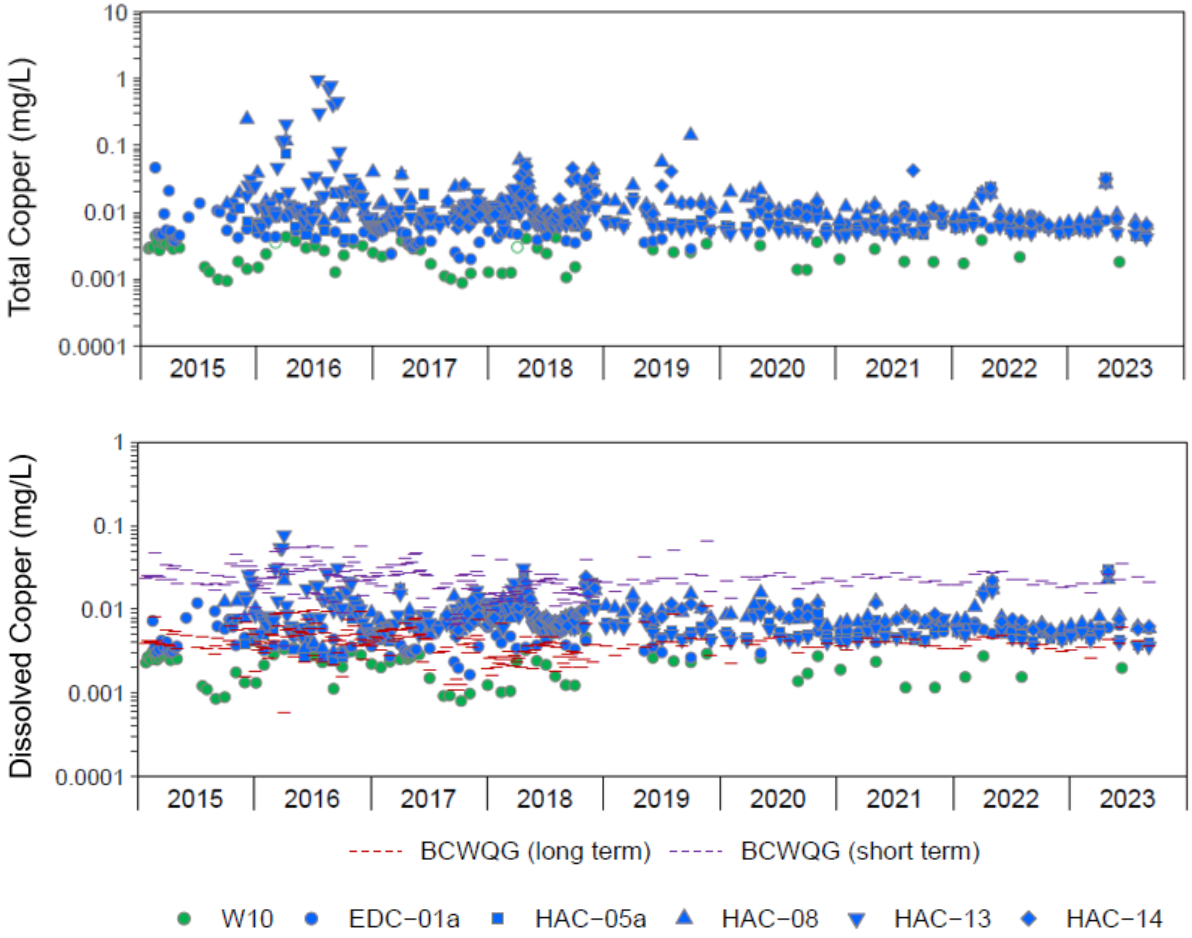

Note: mg/L = milligrams per litre, BC WQG = British Columbia Water Quality Guideline. Green represents reference stations and blue represents exposed stations. Concentrations reported the detection limit are open symbols at the detection limit. Values displayed for the BCWQG are condition specific (based on hardness, pH, and DOC calculated with Biotic Ligand Model). Monitoring station EDC-01 was relocated in Q4 2020 and renamed as EDC-01a for a new monitoring station. Figures are from Minnow 2023.

Figure 2.7-7: Total (top) and Dissolved (bottom) Copper Concentrations in Surface Water Samples from Hazeltine Creek (HAC13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10) from 2015 to Present

Total and dissolved selenium concentrations from 2015 to present in Hazeltine Creek were consistently higher than selenium concentrations in the associated reference location, Edney Creek (W10) and generally lower than the long-term chronic BC WQG (Figure 2.7-8). Exceptions occurred at HAC-05a and HAC-08 in 2016 and 2017 likely a result of residual breach-related influence on water quality in Hazeltine Creek.

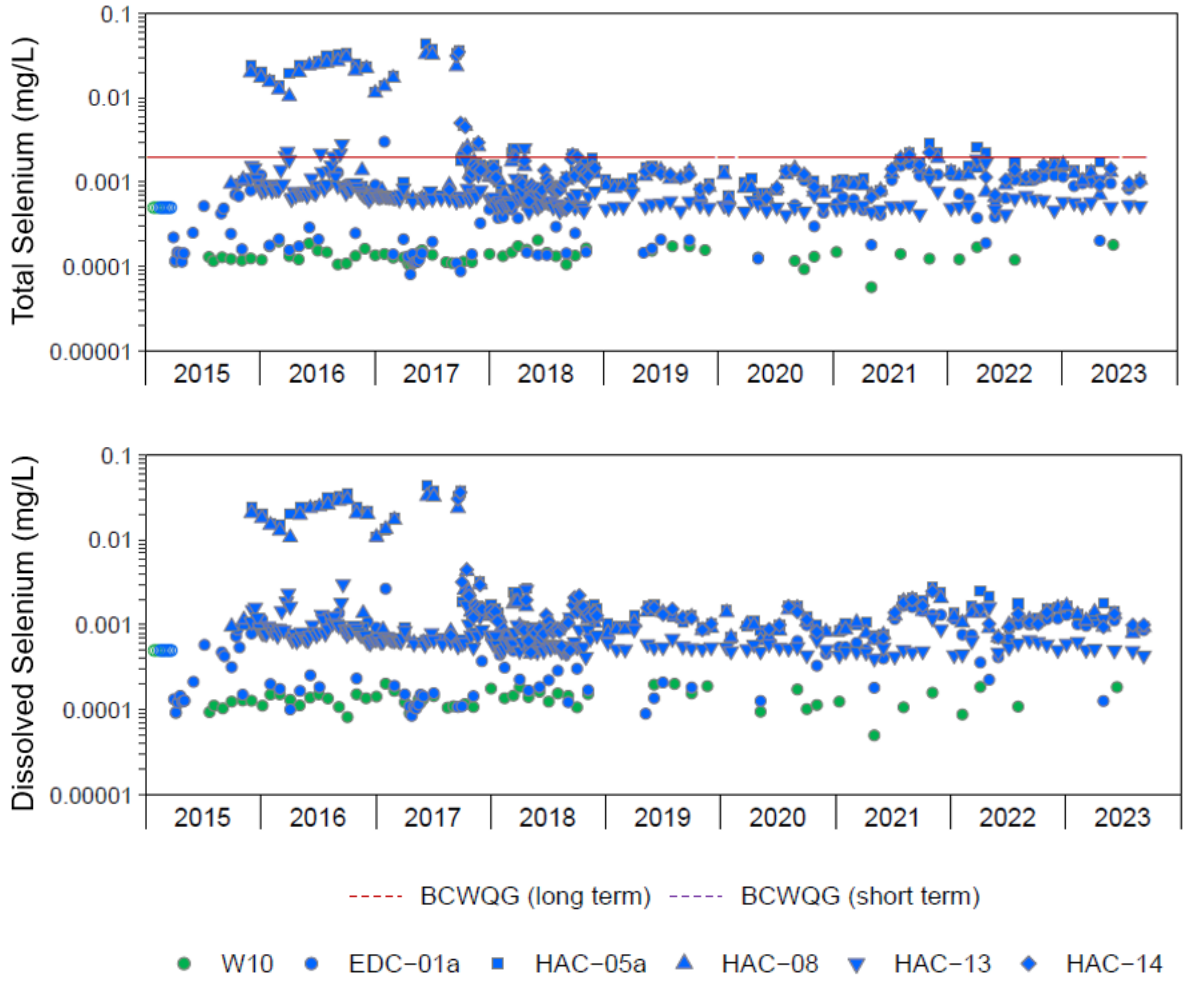

Note: mg/L = milligrams per litre, BC WQG = British Columbia Water Quality Guideline. Green represents reference stations and blue represents exposed stations. Concentrations reported the detection limit are open symbols at the detection limit. Total selenium BC WQG is 0.002 mg/L. Monitoring station EDC-01 was relocated in Q4 2020 and renamed as EDC-01a for a new monitoring station. Figures are from Minnow 2023.

Figure 2.7-8: Total (top) and Dissolved (bottom) Selenium Concentrations in Surface Water Samples from Hazeltine Creek (HAC13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10) from 2015 to Present

2.7.2 Groundwater Quality

Groundwater monitoring has been ongoing at the mine site since 1995 with the objectives to monitor direction, quantity, and quality of groundwater seepage near the mine (Appendix 2-7). The groundwater monitoring program outlined in the Annual Groundwater Monitoring Report (Appendix 2-7) consists of numerous multi-level monitoring wells (deep and shallow wells), and single wells surround the mine site. Sample collection and analysis methods are provided in Appendix 2-7. Monitoring locations were selected and assessed here to characterize existing groundwater quality near Springer Pit and are shown in Figure 2.7-9. Below is a summary of the selected groundwater monitoring wells and the sampling frequency:

- In 2022, the groundwater samples collected on the west side of Springer Pit (GW15-1a, GW15-1b, GW12-2a, GW12-2b, GW15-2a, GW15-2b) were sampled semi-annually (spring and fall) with the exception GW15-2a, GW12-2(a,b) which were sampled quarterly and GW15-2b which was sampled three times.
- In 2022, the groundwater samples collected on the east side of Springer Pit (GW96-7, GW16-8, GW16-7, GW05-01) were sampled more than quarterly with the exception of GW96-7 which was sampled once.



LEGEND

GROUNDWATER MONITORING WELL

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1:50,000 KILOMETRES

REFERENCE(S)

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2. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
GROUNDWATER QUALITY SAMPLING LOCATIONS

CONSULTANT

YYYY-MM-DD	2024-07-04
DESIGNED	KM
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	PHASE	REV.	FIGURE
23590671	81100/81112	0	2.7-9

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Samples collected at groundwater monitoring wells from 2015 to 2022 near Springer Pit were screened against BC contaminated sites regulation standards and BC WQGs to comment on the existing groundwater quality (BC CSR 2021). The groundwater quality for 2015 to present is provided in Appendix 2-8 and are screened against standards and guidelines in Appendix 2-8 Tables 2-6A to 2-6J. Copper and selenium are discussed here because their concentrations in effluent from the WTP are greater than a standard or guideline.

Copper concentrations in groundwater samples collected on the east side of Springer Pit were higher in 2015 and 2016 compared to the following years, where copper concentrations remained relatively similar (Figure 2.7-10). Copper concentrations in groundwater samples collected on the west side of Springer Pit remain relatively similar from 2015 to 2019 with increased variability in copper concentrations from 2020 to 2022.

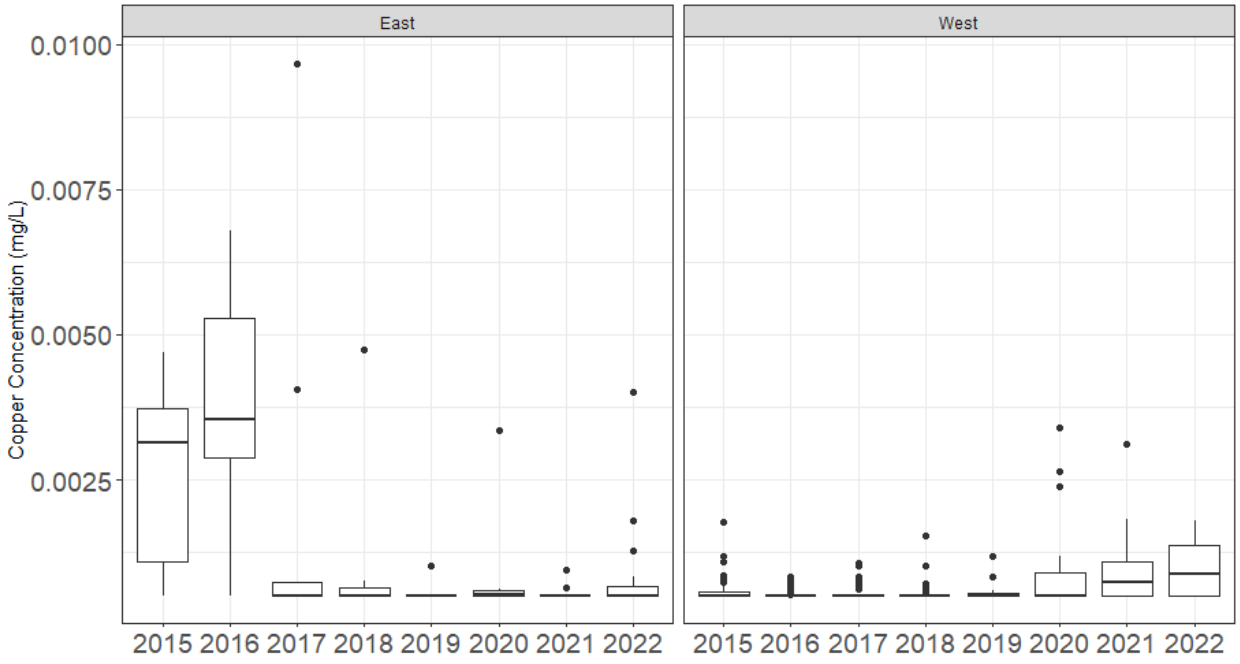

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.
East (2015 n = 6, 2016 n = 5, 2017 n = 9, 2018 n = 13, 2019 n = 9, 2020 n = 8, 2021 n = 9, 2022 n = 18)
West (2015 n = 38, 2016 n = 72, 2017 n = 60, 2018 n = 46, 2019 n = 19, 2020 n = 17, 2021 n = 16, 2022 n = 15)
mg/L = milligrams per litre.

Figure 2.7-10: Boxplot of Copper Concentrations from 2015 to 2022 Representing the Monitoring Wells on the East (GW96-7, GW16-8, GW16-7, GW05-01) and the West side of Springer Pit (GW15-1a, GW15-1b, GW12-2a, GW12-2b, GW15-2a, GW15-2b)

Selenium concentrations in groundwater samples collected on the east side of Springer Pit remain relatively consistent from 2015 to 2022 with exceedances of the BC WQG (0.002 mg/L) in samples collected in 2021 and 2022 (Figure 2.7-11). Selenium concentrations in groundwater sample collected on the west side of Springer Pit were greatest from 2015 to 2017 and decreased in 2018 with similar concentrations until 2022.

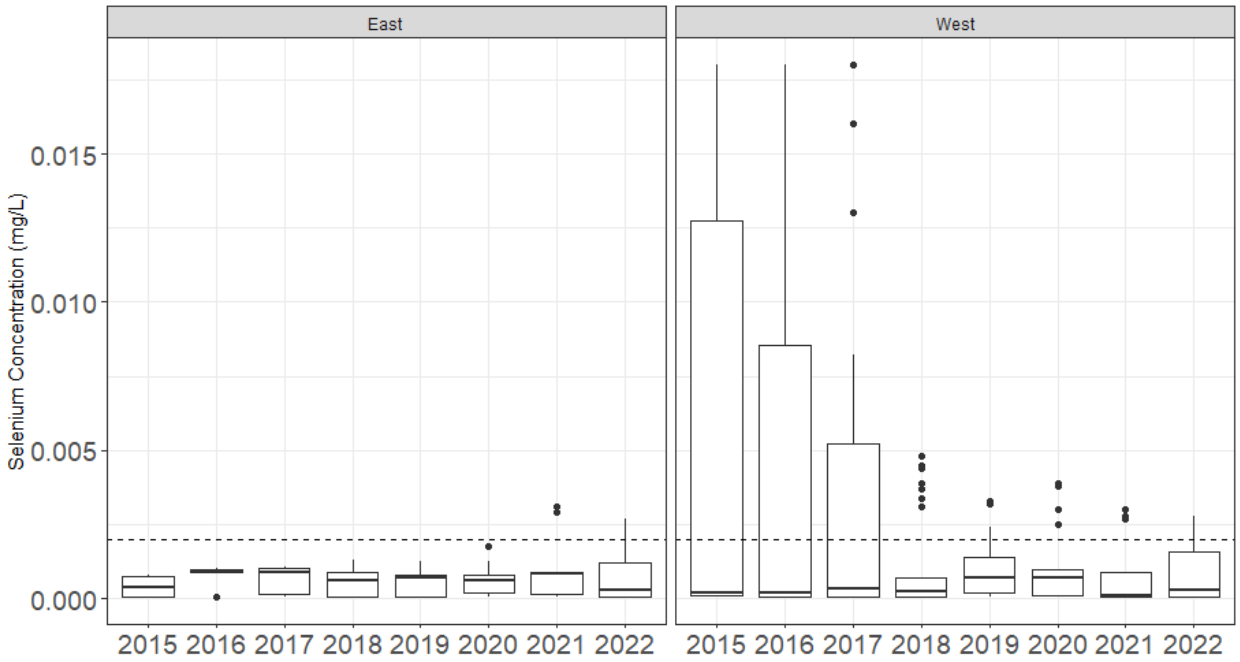

Note: Long-term chronic BC WQG for protection of aquatic health for selenium is shown (0.002 mg/L).
Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.
East (2015 n = 6, 2016 n = 5, 2017 n = 9, 2018 n = 13, 2019 n = 9, 2020 n = 8, 2021 n = 9, 2022 n = 18)

West (2015 n = 38, 2016 n = 72, 2017 n = 60, 2018 n = 46, 2019 n = 19, 2020 n = 17, 2021 n = 16, 2022 n = 15)
mg/L = milligrams per litre.

Figure 2.7-11: Boxplot of Selenium Concentrations from 2015 to 2022 Representing the Monitoring Wells on the East (GW96-7, GW16-8, GW16-7, GW05-01) and the West side of Springer Pit (GW15-1a, GW15-1b, GW12-2a, GW12-2b, GW15-2a, GW15-2b)

2.8 Sediment Quality

2.8.1.1 Quesnel Lake

Sediment quality and toxicity samples are routinely collected from exposed (QUL-LNF1, QUL-PNF) and reference (QUL-LREF1) locations in Quesnel Lake from 2014 to 2022 to determine the potential for mine influence as required by the CEMP (Appendix 7-1). Sediment quality and toxicity data are summarized below to characterize the potential for mine influence on sediments within Quesnel Lake.

As described by Minnow (2023; Appendix 2-5), sediment is currently collected from shallow near-field (QUL-LNF1) and reference (QUL-LREF1) and deep near-field (QUL-PNF) areas of Quesnel Lake (Figure 2.8-1), with the following objectives:

- Sediment from the shallow monitoring areas (QUL-LNF1 and QUL-LREF1) was collected to support 14-day *Hyalella azteca* toxicity testing from 2015 to 2022 and 10-day *C. dilutus* toxicity testing from 2015 to 2021, as required by the CEMP approval conditions dated March 14, 2019.
- Sediment was collected from the deep near-field area of Quesnel Lake (QUL-PNF), but not reference (QUL-PREF1), to support benthic invertebrate community monitoring in this area.

Sample collection and analysis methods are provided in Appendix 2-5. Raw sediment quality data and sediment toxicity data are provided in Appendix 2-9 and screened against working sediment quality guidelines (WSQGs). Copper and selenium are discussed below as they are indicators of potential mine influence.

Boxplots were generated using sediment quality data from Quesnel Lake reference stations (QUL-PREF1, QUL-LREF1, and QUL-LREF5) and stations representative of the exposed areas (QUL-PNF, QUL-PFF1, QULP-16, QUL-I, QUL-LNF1, and QUL-LFF), collected from 2015 to 2022. The yearly average copper concentrations in sediment samples collected at the reference stations were consistently lower than yearly average copper concentrations in sediment at the exposed stations, reflecting the influence of material deposited on the lakebed by the breach (Figure 2.8-2). Selenium concentrations are also higher in sediments from exposed stations compared to reference stations (Figure 2.8-3).

The increased sediment concentrations of these parameters in the exposed area reflect the entry of breach outwash materials in 2014 (Golder 2016b).

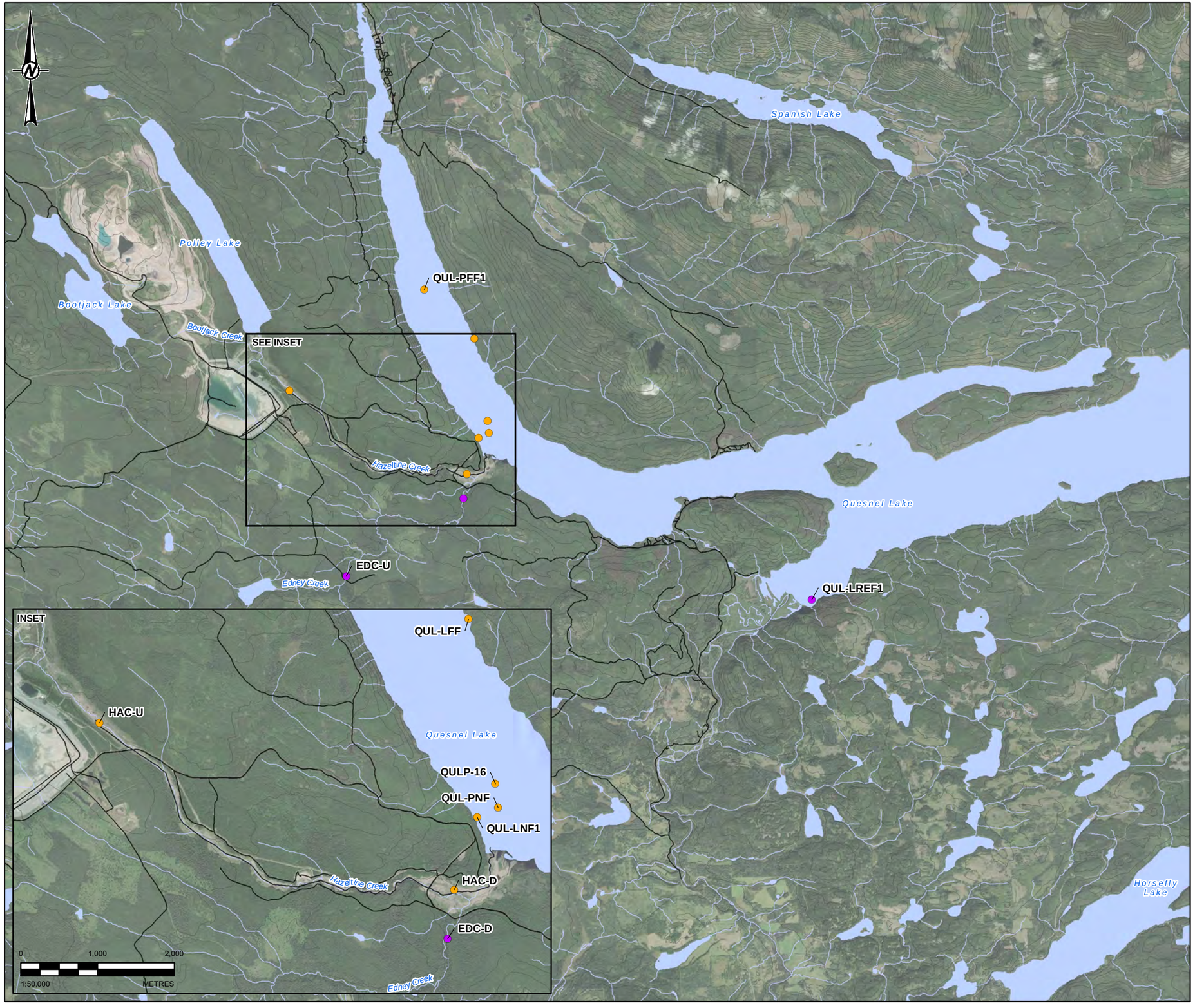

LEGEND

SAMPLING LOCATION

- EXPOSED
- REFERENCE
- ROAD
- CONTOUR (10m)
- WATERCOURSE
- WATERBODY

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1:100,000 METRES

REFERENCES

1. BASE DATA CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE – BRITISH COLUMBIA.
2. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY.
3. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE

2015 TO 2023 SEDIMENT QUALITY AND BENTHIC INVERTEBRATE SAMPLING LOCATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	KM
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

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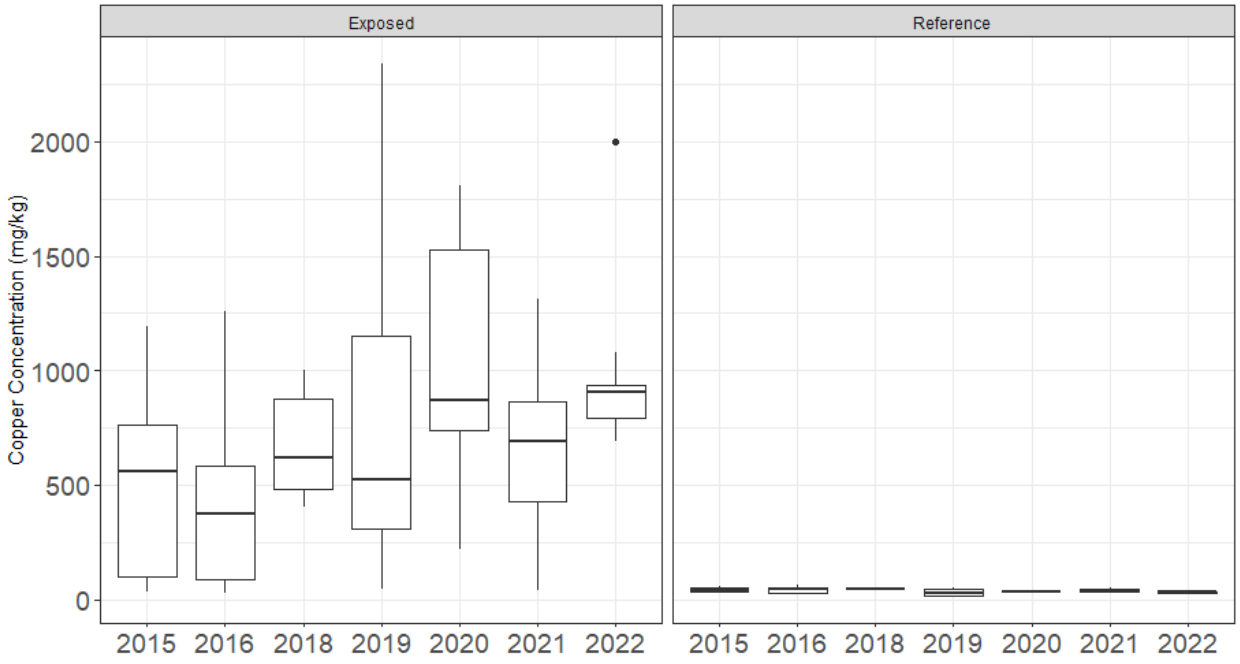

Note: Boxes represent the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 15, 2016 n = 52, 2017 n = 0, 2018 n = 10, 2019 n = 15, 2020 n = 5, 2021 n = 30, 2022 n = 10)

Reference (2015 n= 6, 2016 n = 15, 2017 n = 0, 2018 n = 5, 2019 n = 25, 2020 n = 10, 2021 n = 10, 2022 n = 5)

mg/kg = milligrams per kilogram.

Figure 2.8-2: Boxplot of Copper Concentrations in Sediment Collected from 2015 to 2022 at Quesnel Lake Reference Stations (QUL-PREF1, QUL-LREF1, and QUL-LREF5) and Stations Representative of Exposed Areas (QUL-PNF, QUL-PFF1, QULP-16, QUL-I, QUL-LNF1, and QUL-LFF)

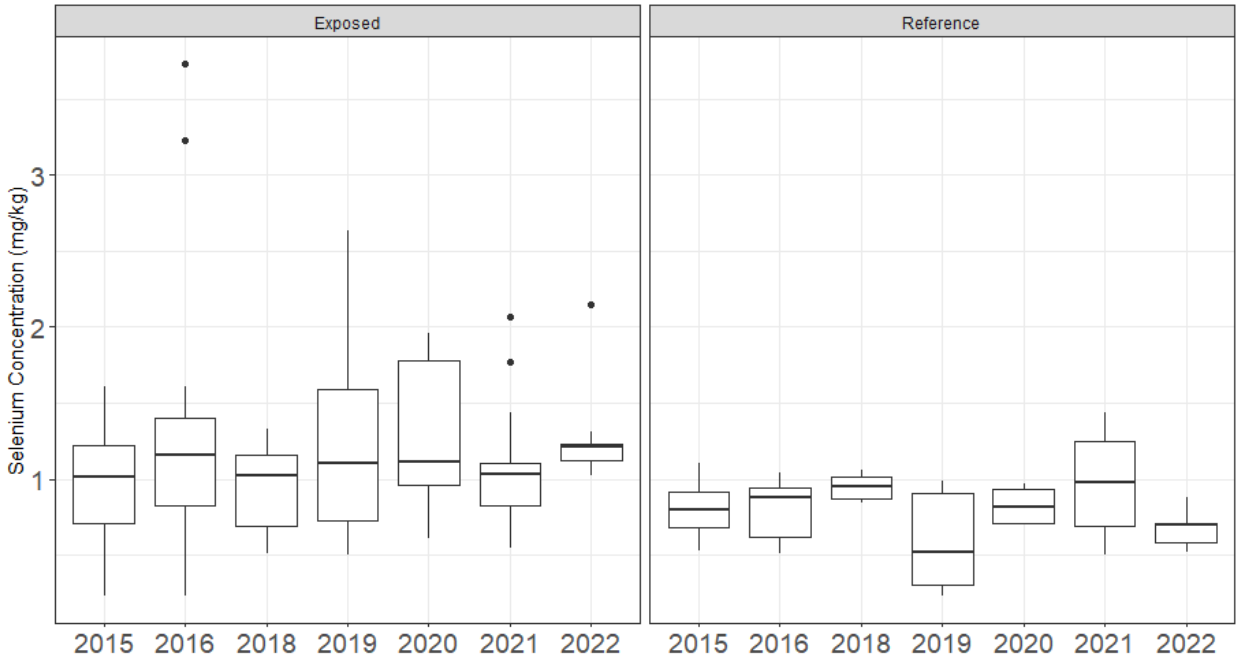

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 15, 2016 n = 52, 2017 n = 0, 2018 n = 10, 2019 n = 15, 2020 n = 5, 2021 n = 30, 2022 n = 10).

Reference (2015 n = 6, 2016 n = 15, 2017 n = 0, 2018 n = 5, 2019 n = 25, 2020 n = 10, 2021 n = 10, 2022 n = 5) .

mg/kg = milligrams per kilogram.

Figure 2.8-3: Boxplot of Selenium Concentrations in Sediment Collected from 2015 to 2022 at Quesnel Lake Reference Stations (QUL-PREF1, QUL-LREF1, and QUL-LREF5) and Stations Representative of Exposed Areas (QUL-PNF, QUL-PFF1, QULP-16, QUL-I, QUL-LNF1, and QUL-LFF)

Survival of *H. azteca* exposed to QUL-LNF1 sediments in 2022 showed a moderate response (44 to 45%), which is similar to results in 2020 (39%) and 2021 (46%). These results were much higher*H. azteca* survival in 2019, which had 0% survival for similar 14-day standard static tests (Figure 2.8-4, Appendix 2-5). Minnow (2023) states that copper concentrations within test water concentrations were 97-times higher than *in situ* concentrations in 2022, which was similar to previous toxicity test concentrations in 2020 (47-times) and 2021 (114-times), but much lower than in 2019 (175-times; Appendix 2-5). A relationship between percent survival and dissolved copper concentrations was observed in the overlying water, consistent with the fact that *H. azteca* have been documented to derive little nutrition from sediment and respond primarily to contaminants dissolved within the water. Overall, temporal trends of *H. azteca* survival suggest a residual breach-related influence on sediments within Quesnel Lake. However, Minnow (2023) state the substantial difference in copper concentrations in toxicity test waters compared to in situ concentrations may not accurately reflect conditions and furthermore potential for toxicity in Quesnel Lake.

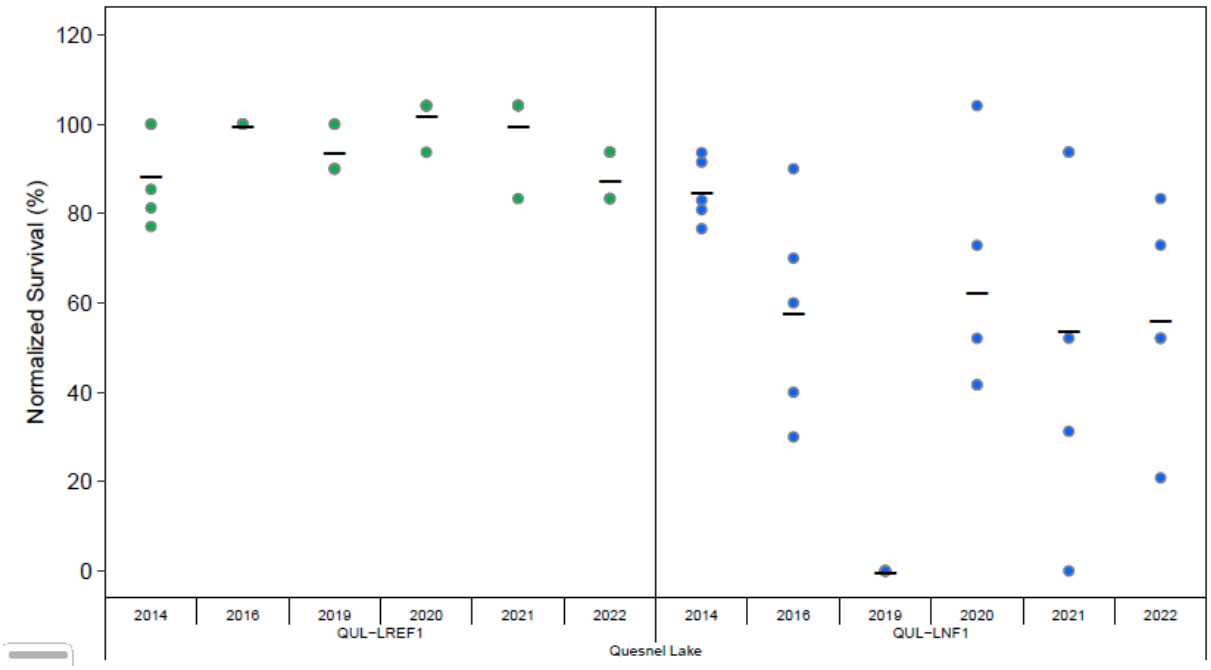

Note: Percent survival data were normalized to the control acceptance criteria, and the samples were calculated as a percentage of normalized control performance. Toxicity test conditions were standard 14-day standard static tests.

Figure 2.8-4: *Hyalella azteca* Survival Responses (14-day) for Sediment Toxicity Testing from from Reference (QUL-LREF1) and Exposed (QUL-LNF1) Samples in Quesnel Lake

2.8.1.2 Hazeltine Creek

As described by Minnow (Appendix 2-6), sediment quality has been monitored annually since the CEMP was initiated in 2018, at upper Hazeltine Creek (HAC-U) and lower Hazeltine Creek (HAC-D) with associated reference locations, upper Edney Creek (EDC-U) and lower Edney Creek (EDC-D), respectively. In addition, samples were intermittently collected prior to 2014 (prebreach monitoring) and 95th percentile values were calculated to compare recent conditions to prebreach conditions. These data are presented in Appendix 2-6 screened against WSQGs and compared to the 95th percentile of prebreach monitoring data.

Sample collection and analysis methods are provided in Appendix 2-6. Copper and selenium are discussed below as they are indicators of potential mine influence.

In upper Hazeltine Creek, mean concentrations of copper and selenium at HAC-U in sediments were significantly higher than reference sediments in 2022 than previously observed (2018 to 2021) (Figure 2.8-5; Appendix 2-6). However, this difference appeared to be related to a decrease in copper and selenium concentrations at the reference area (EDC-U) rather than an increase in concentrations in upper Hazeltine Creek. Copper sediment concentrations at HAC-U were greater than the upper WSQG consistently from 2019 to 2022 and selenium sediment concentrations at HAC-U were greater than the lower WSQG in 2019, 2021, and 2022.

The significantly higher selenium concentrations in HAC-U sediments observed in 2022 (compared to 2018 and 2020) coincided with significantly higher total organic carbon content (Figure 2.8-5) and lower sand content of the sediment at HAC-U in 2022. Minnow (2023) suggested that the temporal difference in copper and selenium may have been influenced by the opportunistic nature of the sampling when fine sediments were limited, rather than due to changes in mine influences in the creek.

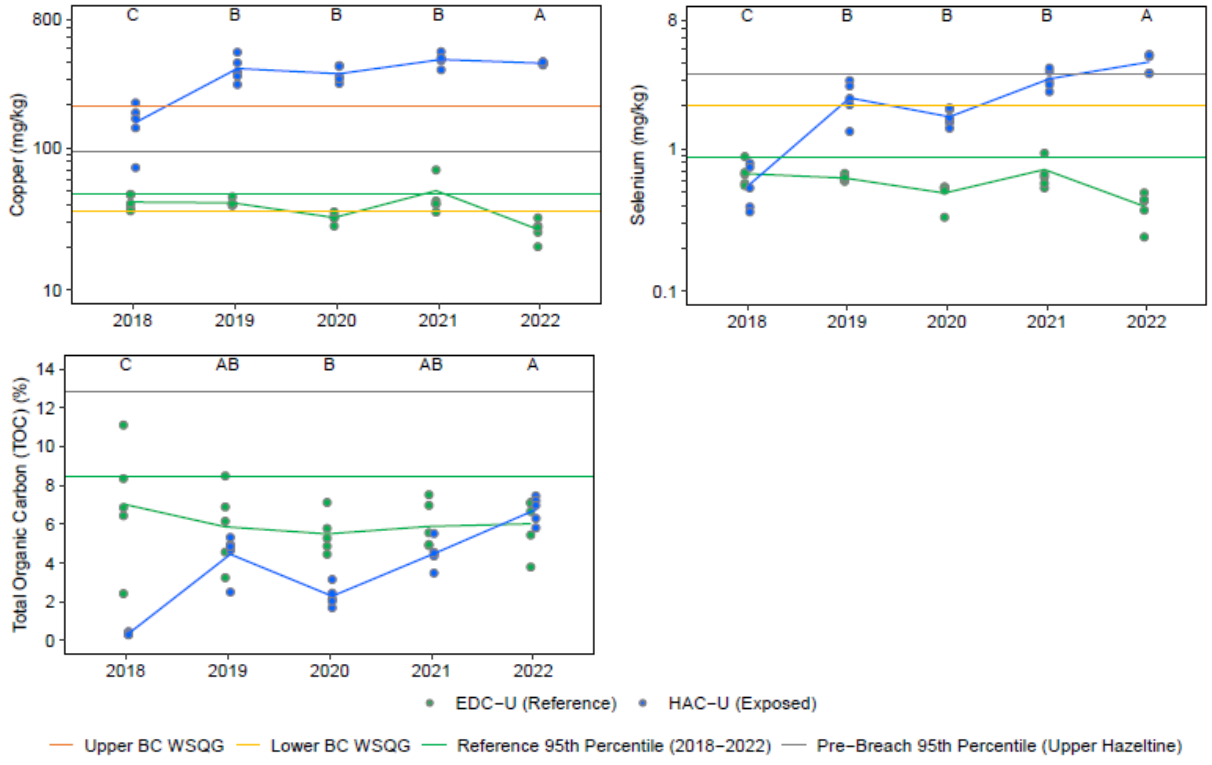

Note: Individual samples are plotted and lines join the least-squares estimated mean value for years included in statistical analysis. Statistical analyses were conducted using two-way analysis of variance (ANOVA) with Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have differences in concentrations (Exposed – Reference) that do not differ significantly (p – value <0.05) among years.

Figure 2.8-5: Sediment Copper, Selenium, and Total Organic Carbon Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

In lower Hazeltine Creek, mean sediment concentrations of copper and selenium were similar to or lower than those observed in 2018, indicating sediment concentrations of these analytes have not significantly increased from 2018 to 2022. Concentrations of copper in sediment at HAC-D were at or above the upper WSQGs from 2018 to 2022 and consistently greater than the analyte concentrations at the reference area in Edney Creek (EDC-D; Figure 2.8-6; Appendix 2-6). Sediment selenium concentrations at HAC-D were consistently below the lower WSQG from 2018 to 2022. The total organic carbon content of lower Hazeltine Creek sediments has remained unchanged relative to reference from 2018 to 2022.

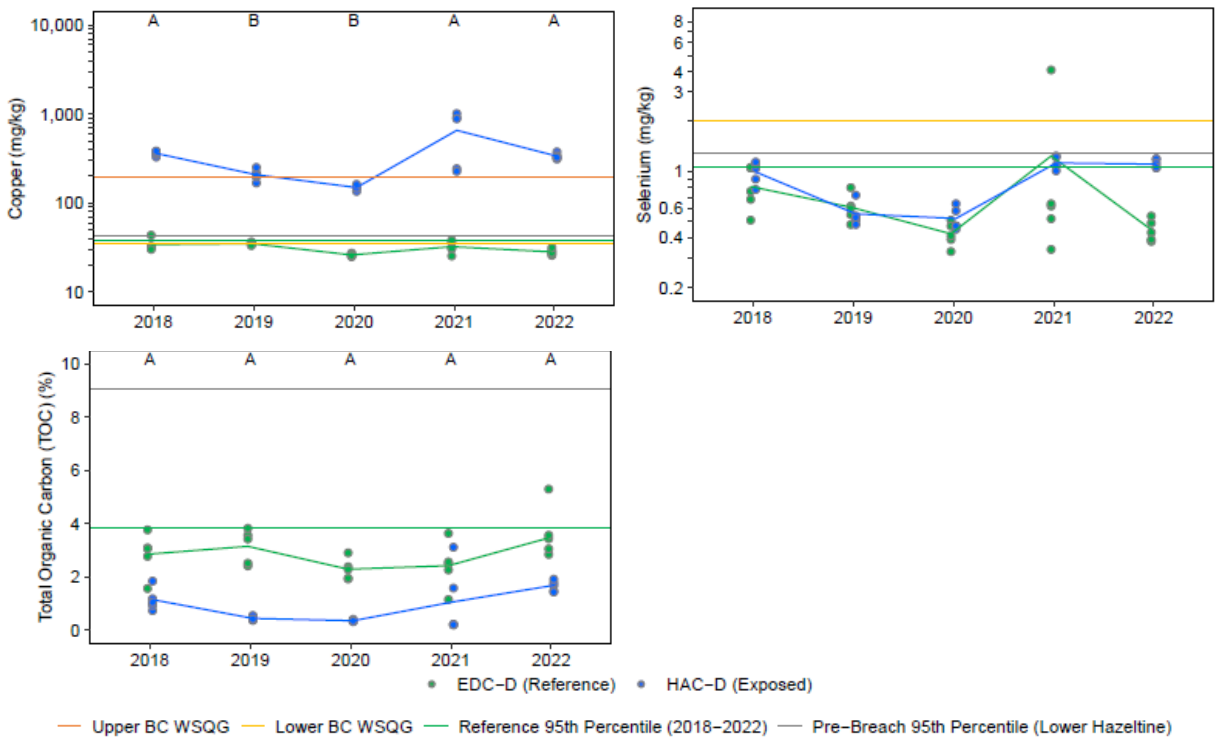

Note: Individual samples are plotted and lines join the least-squares estimated mean value for years included in statistical analysis. Statistical analyses were conducted using two-way ANOVA with Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have differences in concentrations (Exposed – Reference) that do not differ significantly (p – value <0.05) among years.

Figure 2.8-6: Sediment Copper, Selenium, and Total Organic Carbon Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

2.9 Fisheries and Aquatic Resources

2.9.1 Periphyton and Benthic Invertebrate Community Measures

Quesnel Lake

Benthic invertebrate sampling is conducted to assess the potential for effects of operational activities of the mine and to monitor the recovery of the benthic environment following the breach. Monitoring has been undertaken in the deep near-field area of Quesnel Lake (QUL-PNF) and a reference area (QUL-PREF1) since 2014, initially as part of the breach response. Since 2018, the monitoring program described in Section 7.4 and in the CEMP (Appendix 7-1) requires benthic invertebrate community monitoring every three years in deep areas of Quesnel Lake.

The results of the benthic invertebrate sampling program are provided in greater detail by Minnow (Appendix 2-5).

Table 2.9-1 presents a statistical comparison of benthic invertebrate community metrics for the deep near-field area (QUL-PNF) of Quesnel Lake from 2015 to 2022. Following the breach in 2014, the benthic invertebrate community was observed to have lower abundance and diversity than reference areas. Benthic invertebrate data collected since 2015 shows that the benthic invertebrate community has started to recover in the vicinity of Hazeltine Creek. Mean benthic invertebrate density at QUL-PNF has increased, with mean organism density in 2022 significantly higher than in 2014 and 2015. Organism densities have not changed significantly since 2018. Taxonomic richness in 2022 was statistically similar to results in 2014 to 2021.

The relative densities of the major taxonomic groups (including Chironomidae) have shown temporal stability since 2014, except for a temporary increase in Ephemeroptera, Plecoptera, and Trichoptera (EPT) proportions in 2019 (Appendix 2-6). Densities of Chironomidae at QUL-PNF have been temporally stable since 2016 and were significantly higher in 2018 to 2022 compared to 2014 and 2015. Compared to reference, densities and relative densities (%) of EPT (taxon known to be sensitive to habitat disturbances and water pollution) and Arachnida have been similar to reference in all years. Chironomidae (%) has been similar to reference since 2018 (and in 2014), while Oligochaeta (%) was lower than reference in 2015, 2016, and 2021 (for years when comparison to reference is possible). Since 2014, densities of EPT and Arachnida have been similar to reference, while densities of Chironomidae and Oligochaeta have been lower than reference (Appendix 2-6).

Table 2.9-1: Statistical Comparisons of Benthic Invertebrate Community Metrics for Deep Near field Area or Quesnel Lake, 2014 to 2022 (Table 5.19 of Appendix 2-5)

Parameter	P-value	Mean								MOD Relative to Baseline[(a)]							
		2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022
Density (#/m^2)	**<0.001**	36.4	216	590	1,061	1,899	915	1,473	995	B	*2.8*	*4.6*	*5.8*	*6.5*	*5.6*	*6.3*	*5.7*
Richness (# of Taxa)	**0.007**	2.2	4.6	6.2	7.0	8.2	8.2	6.6	6.2	B	ns	ns	*2.1*	*2.6*	*2.6*	ns	ns
Simpson's Evenness	**<0.001**	0.907	0.752	0.329	0.417	0.213	0.297	0.347	0.332	B	ns	*-3.8*	*-3.0*	*-5.3*	*-4.1*	*-3.7*	*-3.7*
Simpson's Diversity	**0.023**	0.362	0.670	0.438	0.592	0.378	0.568	0.502	0.486	B	ns	ns	ns	ns	n	ns	

(a) Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

Bold = P-value <0.1; *Italics* = MOD >± 2.

Hazeltine Creek

Benthic invertebrate and periphyton community and productivity have been monitored in Hazeltine Creek as well as the reference location in Edney Creek since the initiation of the CEMP in 2018. Upper Hazeltine Creek (HAC-R1, HAC-U) and reference in Upper Edney Creek (EDC-U) have been monitored annually since 2018 and lower Hazeltine Creek (HAC-D) and reference in lower Edney Creek (EDC-D) have been monitored every second year since 2017 for benthic invertebrates and 2019 for periphyton. Data are presented in Appendix 2-6.

Community measures for benthic invertebrates and periphyton (total density, taxon richness, and Simpson's Evenness and Simpson's Diversity) for samples collected from Hazeltine Creek were compared to reference locations and to pre-breach conditions (data collected in 2007).

Benthic invertebrate taxon richness at HAC-R1 in 2022 was significantly lower than pre-breach conditions but similar to reference conditions. Benthic invertebrate productivity (dry weight biomass) at HAC-R1 and HAC-U was consistent from 2019 to 2022 and was either similar to or higher than reference in each year from 2018 to 2022. The benthic invertebrate community of lower Hazeltine Creek in 2021 had lower density, taxon richness, and productivity (dry weight biomass) compared to pre-breach conditions and the reference area, as well as lower Simpson's Diversity compared to the reference area. Comparison of pre-breach conditions and the reference area to lower Hazeltine Creek indicate lower relative abundances of sensitive EPT taxa and Arachnida and higher relative abundance of Chironomidae in 2021. The differences in primary benthic community metrics and composition are consistent with expected effects from recent remediation works at HAC-D in 2021, suggesting the area remained in a state of recovery during sampling.

Periphyton productivity was characterized by chlorophyll-a concentrations and ash-free dry mass compared to reference and pre-breach data among years. Mean chlorophyll *a* concentrations in upper Hazeltine Creek in 2022 were below the BCWQG of 100 mg/m^2 and above the threshold for moderately enriched streams (BC ENV 2021). Both chlorophyll *a* and ash-free dry mass at the upper Hazeltine Creek areas (HAC-R1 and HAC-U) have been similar to or significantly higher than reference since 2018, and higher than pre-breach data since 2019 at HAC-R1, and since 2021 at HAC-U. The primary periphyton community metrics (density, richness, Simpson's Evenness, and Simpson's Diversity) in Upper Hazeltine Creek compared to reference areas in most years indicate relatively stable periphyton communities at the remediated upper Hazeltine Creek.

Mean chlorophyll *a* concentrations in lower Hazeltine Creek in 2021 were below the BCWQG and below the threshold indicative of moderately enriched streams (BC ENV 2021). Chlorophyll *a* and ash-free dry mass in lower Hazeltine Creek decreased significantly between 2019 and 2021, to values that were lower than or similar to reference in 2021 but higher than in 2017. The periphyton community at HAC-D was characterized in 2019 and 2021 by total density

higher than reference, Simpson's Evenness and Diversity similar to reference, and significantly lower total and diatom richness than the reference area. These results are indicative of ongoing periphyton community recovery and is consistent with the disturbance of this area for channel remediation works in 2021.

2.9.2 Plankton Communities

Phytoplankton and zooplankton sampling is undertaken in Quesnel Lake to evaluate the potential effects of MPMC operations and the TSF breach on plankton communities and productivity. Phytoplankton productivity is evaluated based on chlorophyll *a* concentrations. Zooplankton tissue quality monitoring provides an indication of lower trophic level exposure to parameters that are potentially influenced by the mine and an estimate of exposure by fish through diet.

There are currently two plankton monitoring sites in Quesnel Lake (Figure 3.3-1). Site QUL-ZOO-1 (exposed) is located in the centre of the West Basin and QUL-ZOO-7 (reference) is located in front of Horsefly Bay, as described in the CEMP (Appendix 7-1). Sampling at QUL-ZOO-8, a reference location at the junction of the north and east arms of Quesnel Lake, was discontinued in 2019. Phytoplankton and zooplankton monitoring in Quesnel Lake began after the breach, with annual phytoplankton and zooplankton monitoring beginning in 2016 and 2014, respectively. In 2020, sampling was undertaken monthly during summer. Single replicate phytoplankton and zooplankton samples and zooplankton tissue quality samples were collected in June and August at each monitoring area, and replicate (n = 5) samples were collected in July at each monitoring area.

Historically, chlorophyll *a* samples in Polley and Quesnel Lakes were generally collected two times (i.e., June and August) per growing season. In 2017, an additional sample was collected at QUL-58; no samples were collected at QUL-ZOO-8 due to unsafe conditions from wildfires. In 2018, some chlorophyll *a* samples were collected in July and September as samples were missed at QUL-58 and QUL-2a in June, and QUL-ZOO-1, -7, and -8 and QUL-2a in August due to the proximity of forest fires which affected visibility and air quality. In 2019, only one sample was collected from QUL-ZOO-8 as it was removed from the sampling program later in the year.

A summary of the results collected by Minnow is presented below and provided in detail in the 2022 Minnow report (Appendix 2-5).

Phytoplankton density at the exposed location (QUL-ZOO-1) was consistently higher than the reference location (QUL-ZOO-7) from 2019 to 2022. Higher densities of phytoplankton at QUL-ZOO-1 were attributed largely to greater densities of Chrysophytes and Dinoflagellates than at QUL-ZOO-7 (Appendix 2-5). Taxon richness was stable and similar to reference from 2019 to 2021 at QUL-ZOO-1; however, richness decreased significantly in 2022 to a mean result lower than previous monitoring years (2019 to 2022) and lower than the reference. At both QUL-ZOO-1 and QUL-ZOO-7, mean chlorophyll-*a* concentrations decreased significantly each year from 2019 to 2021 but were higher in 2022 relative to previous years.

The higher chlorophyll-*a* concentrations observed in 2019 to 2022 compared to previous years may have resulted from a combination of different sampling timing in June and August/September instead of July and changes in sampling methodology (Appendix 2-5).

Zooplankton density and Simpson's Evenness at the exposed location (QUL-ZOO-1) were consistently similar to the reference location (QUL-ZOO-7) from 2019 to 2022 but lower in 2021. Taxon richness was higher at QUL-ZOO-1 than at QUL-ZOO-7 in 2019, 2020, and 2022, but was lower in 2021. Simpson's Diversity at QUL-ZOO-1 was similar (2019 and 2021) or significantly higher (2020 and 2022) compared to QUL-ZOO-7. The relative density and density of dominant for zooplankton taxa groups have been similar at QUL-ZOO-1 and QUL-ZOO-7 for each of the monitoring years (2019 to 2022), with two exceptions. The relative density and density of Cyclopoida was lower at QUL-ZOO-1 than at QUL-ZOO-7 in 2019, and the relative density of copepod nauplii was higher at QUL-ZOO-1 than at QUL-ZOO-7 in each monitoring year and temporally stable at QUL-ZOO-1 from 2019 to 2022. The densities of major zooplankton taxonomic groups showed similar spatial and temporal patterns to relative density data (Appendix 2-5). Mean total zooplankton biomass (dry weight) was consistently similar between exposed (QUL-ZOO-1) and reference (QUL-ZOO-7) areas in Quesnel Lake from 2019 to 2022. The similar temporal changes in zooplankton biomass at both areas was likely driven by natural variability in environmental parameters similar between the two areas.

2.9.3 Fish and Fish Habitat

The following characterization of fish and fish habitat is primarily based on information provided in SNC-Lavalin (2015). This report was part of the Post-Event Environmental Impact Assessment Report (MPMC 2015) that evaluated the impact of the TSF foundation failure on the aquatic receiving environment.

Quesnel Lake supports a varied fish community, with approximately 20 documented fish species that include migratory salmonids (coho, chinook, and sockeye), resident salmonids (kokanee, rainbow trout, bull trout, and lake trout), and benthic and forage fish species (Table 2.9-2). The majority of these fish species inhabit the littoral and limnetic zones of the lake:

- Migratory salmonids typically use both the littoral and limnetic zones as rearing and foraging habitat for young-of-year and juvenile life stages until they smolt and migrate downstream towards the marine environment.
- Sockeye salmon are known to shoreline spawn in select littoral zone areas where suitable gravels and groundwater upwelling occurs.
- Resident salmonids may spawn in the littoral zone (with the exception of bull trout) and typically rely on littoral and limnetic habitat for rearing young-of-year and juveniles and foraging.

- Benthic and forage fish typically rely on littoral and benthic habitat for spawning, rearing, and foraging. Benthic species are usually only present in the limnetic zone for a short period of time after hatching and consequently rear in the pelagic column until settling to the benthic zone. Forage species may be present in the limnetic zone during foraging activities. Adult burbot will make vertical migrations from the benthic zone to the open water column in search of food (SNC-Lavalin 2015).

Bull trout is a Blue-listed species of special concern and is the only fish species at risk listed in the Cariboo region, based on the Ministry of Environment (BC ENV) Species and Ecosystems Explorer (BC CDC 2023). Coho salmon present in Quesnel Lake are part of the Interior Fraser Coho population that has been identified as "endangered" by the Committee on the Status of Endangered Wildlife in Canada. Coho is a species under consideration for addition to the *Species at Risk Act* (SNC-Lavalin 2015). A small subset of the Interior Fraser coho population spawns in Quesnel River and several other tributaries to Quesnel Lake (Cariboo Envirotech Ltd. 2009).

Table 2.9-2: Documented Fish Species in Quesnel Lake

Fish Group	Common Name	Scientific Name
Migratory salmonids	Sockeye salmon	*Oncorhynchus nerka*
	Coho salmon	*O. kisutch*
	Chinook salmon	*O. tshawytscha*
Resident salmonids	Kokanee	*O. nerka*
	Rainbow trout	*O. mykiss*
	Bull trout	*Salvelinus confluentus*
	Lake trout	*S. namaycush*
	Pygmy whitefish	*Prosopium coulteri*
	Mountain whitefish	*P. williamsoni*
	Lake whitefish	*Coregonus clupeaformis*
Benthic species	Burbot	*Lota lota*
	Largescale sucker	*Catostomus macrocheilus*
	Longnose sucker	*C. catostomus*
	Slimy sculpin	*Cottus cognatus*
Forage species	Northern pikeminnow	*Ptychocheilus oregonensis*
	Peamouth chub	*Mylocheilus caurinus*
	Lake chub	*Couesius plumbeus*
	Leopard dace	*Rhinichthys falcatus*
	Longnose dace	*R. cataractae*
	Redside shiner	*Richardsonius balteatus*

Source: Adapted from SNC-Lavalin (2015).

Foreshore inventory and mapping characterized the shore type near the mouth of Edney Creek as predominantly gravel beach (49% of the study area) and rocky shore (more than 35%), and aquatic vegetation, dominated by emergent grasses and herbaceous vegetation, covered 36% of the shoreline. Approximately 50% of the shoreline was ranked as high or very high value, 48% as moderate value, and less than 2% as low or very low value (Ecoscape 2012). High juvenile rearing values were identified along 20% of the shoreline (Ecoscape 2012).

2.9.4 Fish Habitat Remediation

The remediation of Hazeltine and Edney Creek following the TSF Breach has proceeded as described in the Remediation Plan (Golder 2019) and instream work has now concluded. Riparian planting has taken place and the riparian zone is growing well. The remediation of Hazeltine and Edney Creek is comprised of the following activities (Golder 2019):

- A preference for a diversity of habitat types through the creek (i.e., higher channel complexity), such as repeated sequences of riffle, run/glide, and pool habitat types.
- Relatively high percentages of pool habitat (up to 60% surface area of the creek).
- Instream cover provided by large woody debris to approach or exceed 20% the surface area within constructed pool habitat.
- Available spawning substrate sizes within all wetted areas of the creek, specifically greater than 25% spawning gravel cover.
- Self-sustaining riparian vegetation that provides cover, insect drop, and eventually large woody debris to Hazeltine and Edney Creeks.

Recent evaluations of baseline and post-breach conditions in Hazeltine Creek and Edney Creek concluded that the constructed fish habitat is performing as designed and expected for Rainbow Trout populations (WSP 2023a). Recent monitoring of adult Rainbow Trout has also described the successful return of spawning adults from Polley Lake to Hazeltine Creek to spawn during the spring seasons of 2018 – 2022 (Minnow 2022). Riparian vegetation is established, actively growing, and is providing overhead cover in upper sections of the creek where remediation efforts were first initiated after the breach (DWB 2022). Similarly, monitoring of lower Edney Creek by Minnow (2022) concluded that the constructed fish habitat is as good or better than unimpacted habitat and is effectively meeting design objectives. Based on fish usage and spawning survey data collected from 2016 to 2021, it appears that remediation objectives are being met for not only Rainbow Trout, but also Interior Fraser River Coho Salmon (Coho) and Sockeye Salmon (Sockeye) (Minnow 2022). Since the reopening of lower Hazeltine Creek to fall spawning fish, hundreds of spawning Sockeye Salmon have been observed each year since 2021 (Photo 2.9-1).



Photo 2.9-1: Sockeye Salmon in Lower Hazeltine Creek, September 13, 2021

2.9.4.1 Rainbow Trout Habitat Remediation

Quantification of habitat balances were carried out for Rainbow Trout in Hazeltine and Edney Creeks. These habitat balances were based on an evaluation of both productive capacity and productivity. To do this, annual estimates of Rainbow Trout abundance were generated to represent fisheries productivity for baseline and post-remediation conditions. A combination of previously collected field data and desktop modelling methods for habitat quality and population size were used to provide an outlook on the recovery trajectory of the Rainbow Trout populations relative to pre-breach (baseline) conditions for the population that utilizes the upper Hazeltine Creek immediately downstream of Polley Lake, as well as the population in lower Hazeltine Creek and Edney Creek, immediately upstream of Quesnel Lake. The objectives of this evaluation were achieved, in part, through a comparison of modelled abundance estimates generated from the as-constructed post-breach remediation case versus the historical baseline. The population models consider assessments of habitat quality (or suitability) as being related to carrying capacity inputs for each of the modelled scenarios.

The habitat data used for quantifying habitat quality for pre-disturbance and post-remediation conditions included depths, wetted and bankfull widths, abundance of channel unit habitat types (pool, run/glide, and riffle), substrate composition (proportion of organics, silt, sand, gravel, cobble, and boulder), abundance of instream cover (proportion of large boulders and woody debris), and abundance of riparian cover (proportion of forest, shrub, grass, and herbaceous layers). Data used for pre-disturbance habitat conditions were sourced from habitat tables and text in Bruce and Slaney (1991) and Minnow (2007), whereas data for post-remediation conditions were sourced from Minnow (2020), design and record drawings, and georeferenced drone imagery of the creek flown in August 2019 and 2021.

Using a standard habitat modelling method to rank the summarized information on each study reach, results demonstrated that habitat quality (productive capacity) for the post-remediation condition in upper and lower portions of the creeks ranked higher (each by a minimum of 1.3-times) than the pre-breach condition. This outcome reflected the specific habitat design targets for spawning and rearing habitat achieved through direct collaboration with environmental agencies and First Nations, as well as their technical advisors, through the Habitat Remediation Working Group (HRWG).

For each case or scenario that was examined, simulations based on age-based Leslie matrices of Rainbow Trout vital rates (mortality and fecundity rates) were executed to track the abundance of fish per age cohort over time, providing a direct link to changes in fisheries productivity. Although the effect of the breach was modelled as 100% failure of young-of-year recruitment over a 4-year (2014–2017) and 8-year period (2014–2021) for upper and lower reaches, respectively, the population models illustrated a relatively rapid recovery of the population upon reopening of Hazeltine and Edney creeks to spawning, suggesting that the foundation for a quick recovery of population sizes was in place. The recovery was provided by the remaining adult population size that persisted through the reconstruction period in both Polley and Quesnel Lakes, combined with the high-quality habitat features installed during remediation, and unobstructed stream conditions.

Modelled trajectories of the post-breach population and the initial field observations made in 2018 through 2021 in both Hazeltine Creek and Edney Creek provide evidence for a recovery of the Rainbow Trout populations in each habitat. For upper Hazeltine Creek, simulated population trajectories reach the natural range of baseline projections as early as 2023 and stabilize within 20 years of the breach. In lower Hazeltine Creek and Edney Creek, the extended construction period and unique life history characteristics of that population resulted in a delayed population recovery and stabilization, compared to the upper Hazeltine Creek population. While the simulated population trajectories reach baseline projections by 2029, the longer lifespan and later age at maturity of the Rainbow Trout that originate from Quesnel Lake may drive population sizes to fluctuate as the age structure stabilizes through, and potentially beyond the 40-year modelling period.

The predicted increase in abundance and gain in fish production from installed habitat features are expected to continue in the short-term under unobstructed creek conditions for spawning fish movements from their respective overwintering location. The magnitude of the difference in final abundance over the simulated study period ranged from 3.4 to 9.5-times higher for the post-remediation recovery scenarios relative to baseline for the upper and lower Hazeltine Creek populations, respectively.

Additional information on the evaluation of Rainbow Trout habitat remediation is provided in WSP (2023b)

2.9.4.2 Interior Fraser Coho and Sockeye Salmon Habitat Remediation

The evaluation of the quality and quantity of habitat for Interior Fraser Coho and Sockeye Salmon under baseline and post-remediation conditions used a habitat suitability modelling procedure to quantify improvements to the productive capacity of habitat for Coho and Sockeye. As was done for Rainbow Trout (WSP 2023a), this procedure included the application of a Habitat Suitability Index (HSI) (USFWS 1981), a commonly used model for quantifying species-specific habitat quality. The formula for the HSI attributes a biologically relevant value to physical habitat features on a numerical scale (i.e., 0-1) and is intended to provide a transparent, scientifically defensible tool to complement HRWG criteria for evaluating the productive capacity of the affected habitat and resulting construction design. The HSI model uses physical habitat variables (e.g., water depth, substrate composition, riparian cover, stream geomorphology) to express linear or curvilinear relationships depending on the response of a species to changing environmental conditions. Once a suitability curve is established based on species-specific environmental factors, the HSI is calculated. Subsequently, the HSI can be used in combination with spatial information to create a habitat quality map or a weighted usable area statistic, typically defined as a habitat unit (HU) (e.g., De Kerckhove et al. 2008; DFO 2015, 2016).

For Hazeltine and Edney Creek, the selected HSI model was based on that previously developed for Coho Salmon by McMahon (1983), and similar adaptations of that model for evaluating fish habitat (Bryant and Woodsmith 2009; Myers and Nieraeth 2016). It was assumed that this model was also applicable for mapping and quantifying spawning and rearing habitat for Sockeye Salmon, which share similar habitat requirements for spawning and rearing as Coho Salmon.

Results from the habitat suitability modelling indicate that the post-remediated habitat is of higher quality for Pacific Salmon species compared to pre-breach conditions. This is similar to the results for Rainbow Trout (WSP 2023b that saw a significant increase in HSI values and habitat units following remediation to lower Hazeltine and Edney Creek based on the design criteria determined and implemented under the guidance of the HRWG.

The HSI value for lower Hazeltine Creek and Edney Creek, based on weighted average, was 1.3-times greater for post-remediation habitat versus pre-breach baseline habitat for Coho and Sockeye Salmon. The pre-breach HSI value for above (Reach 7+8 in Minnow 2007) and below (Reach 9 in Minnow 2007) the Edney Creek confluence was 0.22, versus the post-remediation HSI value of 0.28 for Reach 5 and 6 of Hazeltine Creek and Edney Creek. The reach above the Edney Creek confluence for the pre-breach baseline was of higher quality (HSI value of 0.231) compared to the reach below the Edney Creek confluence (HSI value of 0.214). For the post-remediation habitat, the highest quality reach was Reach 5, which is also above the confluence (HSI value of 0.280); whereas the post-remediation HSI value downstream of the confluence in Reach 6 was 0.253.

The largest difference in calculated scores between pre-breach baseline and post-remediation habitat for the life stage components was the pool habitat, which was 2.67-times higher for post-remediation habitat. The canopy cover component was the only component with a lower score for post-remediation habitat versus baseline habitat. At the time of the 2021 drone survey, there was a significant portion of the area that was classified as grass or low shrub vegetation. It is expected that the canopy cover and riparian index will increase as the riparian zones quickly regenerate after the breach and remediation efforts to the creek.

When expressed as Habitat Units and assuming similar flow conditions, the total weighted useable area statistic for Coho and Sockeye Salmon increased under post-remediation conditions for all scenarios that were considered. This is similar to the results observed for Rainbow Trout in lower Edney Creek (WSP 2023c).

Under the baseline (pre-breach) scenarios, the weighted useable area ranged from a minimum of 208 habitat units for the Baseline Beaver-Obstructed Scenario to a maximum 1,167 habitat units for the Baseline Unobstructed Scenario. Under the post-remediation scenario, the weighted useable area was 1,656 habitat units for the Current Post-Remediation Scenario, and up to 1,750 habitat units for the Future Post-Remediation Scenario when riparian habitat returns to conditions observed under the pre-breach baseline. This equates to an 8-times increase in habitat units for the post-remediation habitat compared to the pre-breach (baseline) beaver-obstructed condition.

The Current Post-Remediation Scenario considered present creek conditions, including riparian habitat quality based on recent monitoring data. Recent aerial drone surveys indicate that there is currently a significant portion of the floodplain that is classified as grass or low shrub vegetation, which does not provide significant instream cover for fish, thus reducing the riparian habitat component scores of the HSI. As the canopy cover continues to recover, the riparian habitat component scores will increase as the vegetation along lower Hazeltine and Edney Creeks regenerates following the breach and remediation efforts. Higher component scores will ultimately translate into more weighted useable area. Under current conditions, the weighted

useable area was measured as 1,656 habitat units, with the potential to increase to 1,750 habitat units for the Future Post-Remediation Scenario as riparian habitat fully recovers.

In summary:

- The results of the HSI modelling confirmed the suitability of the HRWG design criteria and the construction work for enhancing the productive capacity of Hazeltine and Edney Creek for Pacific Salmon species.
- Comparison of baseline and post-remediation scenarios show a higher weighted useable area statistic post-remediation, and therefore, a higher productive capacity of habitat for the post-remediation versus pre-disturbance condition. Habitat units increased by up to 8 times in the post-remediated habitat, compared to pre-breach baseline conditions.
- Interior Fraser River Coho and Sockeye Salmon have been repeatedly observed in lower Hazeltine and Edney Creek since the remediated habitats have been reopened.

Additional information on the evaluation of Coho and Sockeye Salmon habitat remediation is provided in WSP (2023d).

2.9.5 Tissue Residues

Quesnel Lake

In Quesnel Lake, fish community and tissue quality monitoring has been conducted since 2015 to monitor potential effects of the breach and mine effluent discharges on the health of fish populations over time. Fish monitoring data have been collected in Quesnel Lake near Hazeltine Creek and Cedar Point, and at multiple reference areas in the north and east arms of Quesnel Lake. The fish monitoring program is described in Section 7.4 and detailed in the CEMP found in Appendix 7-1. Fish tissue samples from Quesnel Lake from 2015 to 2022 include the following species Lake Trout (*Salvelinus namaycush*), Burbot (*Lota lota*), Kokane (*Oncorhynchus nerka*), Peamouth Chub (*Mylocheilus caurinus*), Northern Pikeminnow (*Ptycheilus oregonensis*), Largescale sucker (*Catostomus macrocheilus*), and Redside Shiner (*Richardsonius balteatus*). Analysis of lake trout tissue data was performed as tissue samples were collected from fish captures in exposed and reference areas over multiple years.

Detailed results of the fish monitoring program are presented in the 2022 Minnow report (Appendix 2-4). Boxplots of lake trout tissue (kidney, liver, muscle, and ovary) concentrations collected in Quesnel Lake exposed and reference stations from 2015 to 2022 were generated to determine temporal trends. Copper concentrations in lake trout tissue samples collected at exposed and reference areas in Quesnel Lake remain relatively consistent from 2015 to 2022 (Figure 2.9-1). Selenium concentrations in lake trout tissue collected at exposed areas of Quesnel Lake have higher variability than observed in lake trout tissue from reference areas (Figure 2.9-2). The average selenium concentration from 2015 to 2022 remains relatively consistent from 2015 to 2022 at both exposed and reference areas.

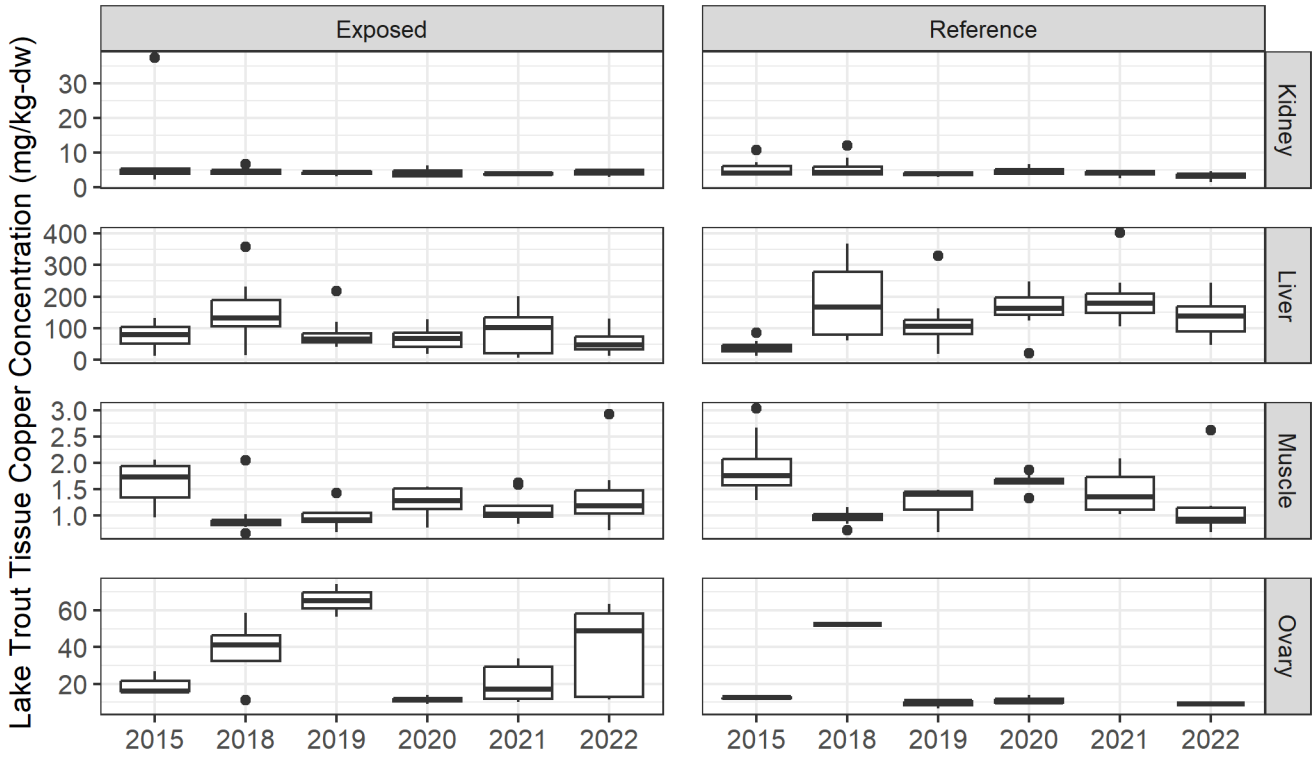

Boxes represent the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 9 [kidney], 10 [liver], 10 [muscle], 3 [ovary], 2018 n = 8 [kidney], 8 [liver], 8 [muscle], 4 [ovary], 2019 n = 9 [kidney], 9 [liver], 9 [muscle], 2 [ovary], 2020 n = 8 [kidney], 8 [liver], 8 [muscle], 4 [ovary], 2021 n = 8 [kidney], 8 [liver], 8 [muscle], 6 [ovary], 2022 n = 8 [kidney], 8 [liver], 8 [muscle], 5 [ovary])

Reference (2015 n = 10 [kidney], 10 [liver], 10 [muscle], 2 [ovary], 2018 n = 8 [kidney], 8 [liver], 8 [muscle], 1 [ovary], 2019 n = 8 [kidney], 8 [liver], 8 [muscle], 3 [ovary], 2020 n = 8 [kidney], 8 [liver], 8 [muscle], 3 [ovary], 2021 n = 8 [kidney], 8 [liver], 8 [muscle], 0 [ovary], 2022 n = 8 [kidney], 8 [liver], 8 [muscle], 1 [ovary])
mg/kg dw = milligrams per kilogram dry weight.

Figure 2.9-1: Boxplot of Copper Concentrations in Fish Tissue from Samples Collected from Exposed and Reference Areas in Quesnel Lake from 2015 to 2022

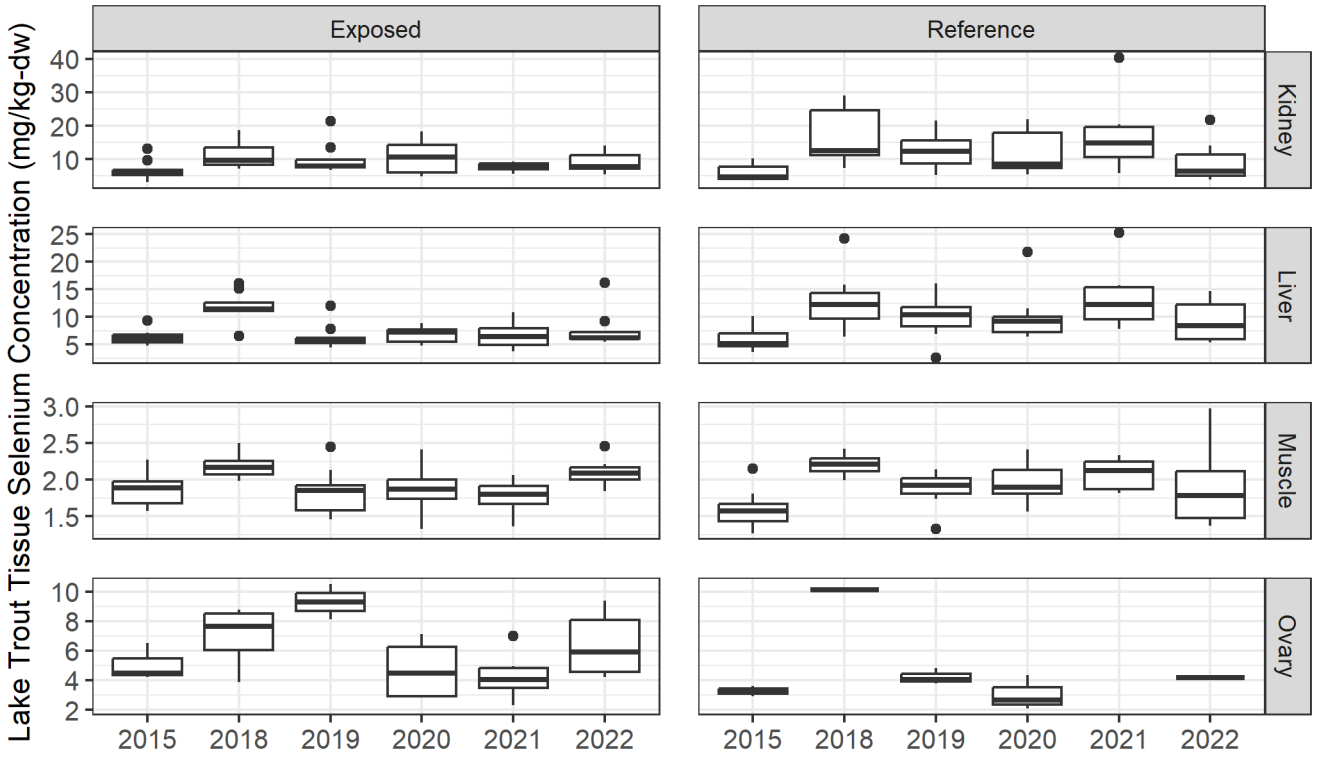

Boxes represent the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 9 [kidney], 10 [liver], 10 [muscle], 3 [ovary], 2018 n = 8 [kidney], 8 [liver], 8 [muscle], 4 [ovary], 2019 n = 9 [kidney], 9 [liver], 9 [muscle], 2 [ovary], 2020 n = 8 [kidney], 8 [liver], 8 [muscle], 4 [ovary], 2021 n = 8 [kidney], 8 [liver], 8 [muscle], 6 [ovary], 2022 n = 8 [kidney], 8 [liver], 8 [muscle], 5 [ovary])

Reference (2015 n = 10 [kidney], 10 [liver], 10 [muscle], 2 [ovary], 2018 n = 8 [kidney], 8 [liver], 8 [muscle], 1 [ovary], 2019 n = 8 [kidney], 8 [liver], 8 [muscle], 3 [ovary], 2020 n = 8 [kidney], 8 [liver], 8 [muscle], 3 [ovary], 2021 n = 8 [kidney], 8 [liver], 8 [muscle], 0 [ovary], 2022 n = 8 [kidney], 8 [liver], 8 [muscle], 1 [ovary])
mg/kg dw = milligrams per kilogram dry weight.

Figure 2.9-2: Boxplot of Selenium Concentrations in Fish Tissue from Samples Collected from Exposed and Reference Areas in Quesnel Lake from 2015 to 2022

Tabulated zooplankton tissue chemistry results from 2015 to 2022 are presented in Appendix 2-5. Boxplots of copper and selenium within zooplankton tissue samples collected from 2015 to 2022 at reference (QUL-ZOO-7, QUL-ZOO-8) and exposed (QUL-ZOO-1) monitoring stations within Quesnel Lake were plotted to visualize temporal trends. The copper concentrations in 2015 and 2016 at exposed stations in Quesnel Lake were greater than other years and a decreasing trend in copper concentration from 2016 to 2019 is seen (Figure 2.9-3). In 2016 at the reference stations, the copper concentrations increased significantly relative to other years and decreased in 2017 to a similar concentration seen in 2015. Concentrations of copper in zooplankton tissue in 2021 increase relative to previous years, however an increase in copper concentrations in the reference area was also observed. Copper concentrations in zooplankton are below the dietary threshold of 500 mg/kg (dry weight) for fish, indicating that zooplankton in the exposed areas do not pose a dietary risk to fish from consumption.

The selenium concentrations from 2015 to 2017 were greater than selenium concentrations from 2018 to 2022 at exposed stations in Quesnel Lake (Figure 2.9-4). At the reference stations, selenium concentrations increased in 2016 compared to other years and decreased in 2017 to similar concentrations seen in 2015.

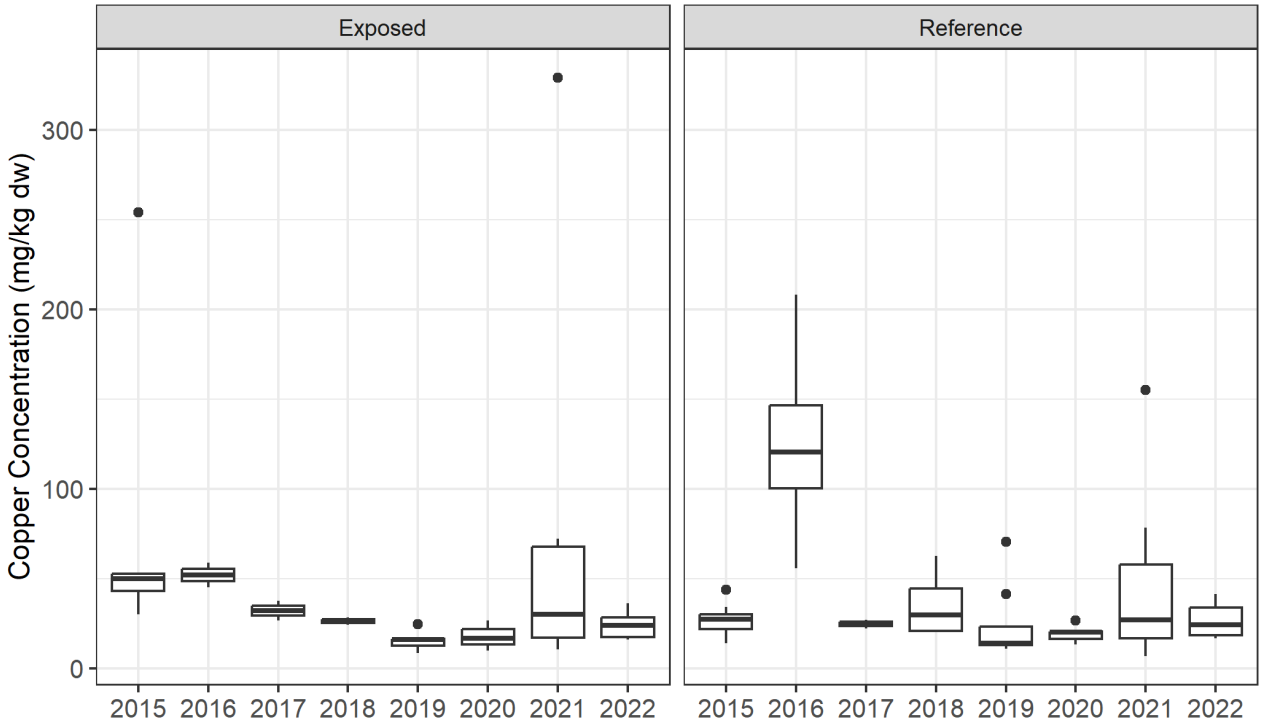

Note: Boxes represent the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 5, 2016 n = 2, 2017 n = 2, 2018 n = 2, 2019 n = 7, 2020 n = 7, 2021 n = 7, 2022 n = 7).

Reference (2015 n = 10, 2016 n = 4, 2017 n = 2, 2018 n = 4, 2019 n = 8, 2020 n = 7, 2021 n = 7, 2022 n = 7).

mg/kg dw = milligrams per kilogram dry weight.

Figure 2.9-3: Boxplot of Copper Concentrations in Zooplankton Tissue Samples Collected from Exposed (QUL-ZOO-1) and Reference (QUL-ZOO-7, QUL-ZOO-8) Stations in Quesnel Lake from 2015 to 2022

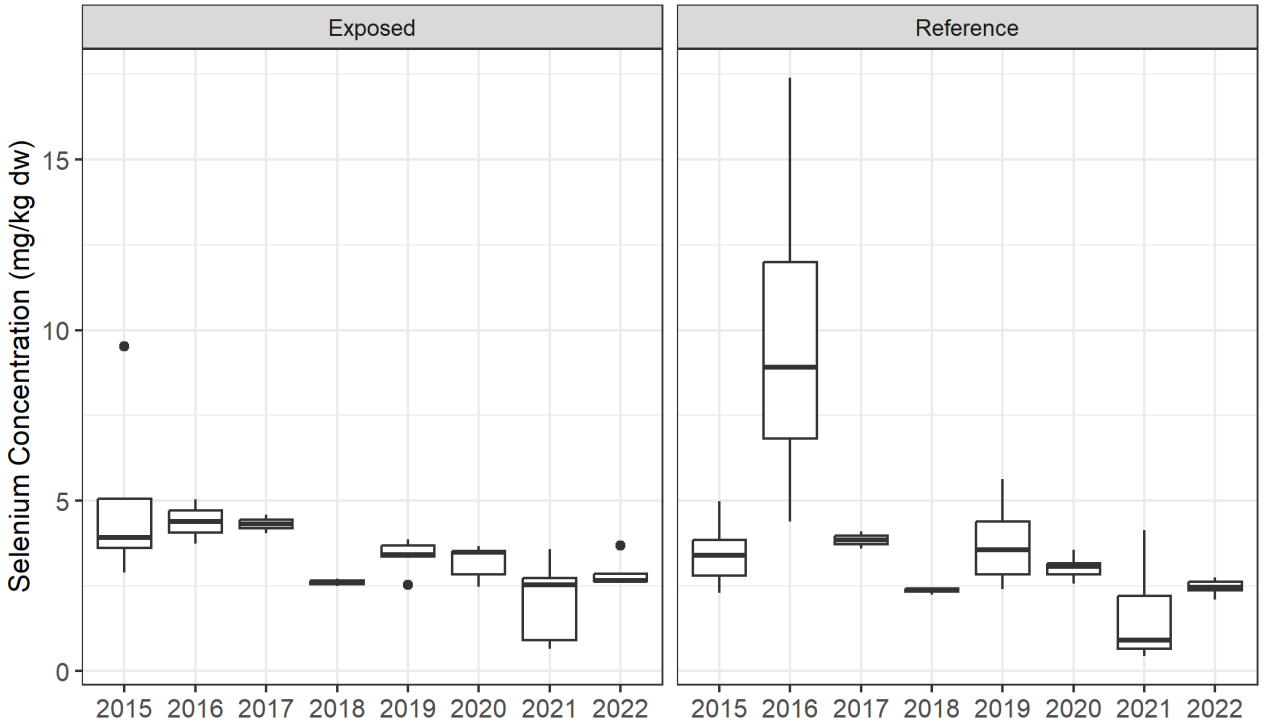

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution.

Exposed (2015 n = 5, 2016 n = 2, 2017 n = 2, 2018 n = 2, 2019 n = 7, 2020 n = 7, 2021 n = 7, 2022 n = 7).

Reference (2015 n = 10, 2016 n = 4, 2017 n = 2, 2018 n = 4, 2019 n = 8, 2020 n = 7, 2021 n = 7, 2022 n = 7).

mg/kg dw = milligrams per kilogram dry weight.

Figure 2.9-4: Boxplot of Selenium Concentrations in Zooplankton Tissue Samples Collected from Exposed (QUL-ZOO-1) and Reference (QUL-ZOO-7, QUL-ZOO-8) Stations in Quesnel Lake from 2015 to 2022

Hazeltine Creek

Benthic invertebrate and periphyton tissue quality has been monitored consistently in Hazeltine Creek and reference areas since the initiation of the CEMP in 2018 (Appendix 7-1). Upper Hazeltine Creek (HAC-R1, HAC-U) and associated reference in Edney Creek (EDC-U), as well as lower Hazeltine Creek (HAC-D) and associated reference in Edney Creek (EDC-D) have been monitored annually since 2018, with select monitoring prior to 2018 including pre-breach sample collected. Benthic invertebrate tissue quality samples collected since 2018 include two sample types: composite-taxa benthic samples (mixture of benthic invertebrate taxa representative of the sampling area) and single taxon samples (caddisfly). Copper and selenium tissue concentrations are discussed here as their concentrations in effluent from the WTP are greater than the BC WQGs.

Benthic invertebrate and periphyton tissue concentrations of copper and selenium in upper and lower Hazeltine Creek were higher than reference and increased over time and showed some evidence of moderately higher bioavailability and/or trophic transfer of selenium and copper in upper Hazeltine Creek, and selenium in lower Hazeltine Creek (Figure 2.9-5, Figure 2.9-6, Figure 2.9-7, Figure 2.9-8; Appendix 2-6). Copper benthic invertebrate tissue concentrations were elevated relative to reference in 2022, and higher than pre-breach in most tissues and sampling years; however, the difference relative to reference has been similar to reference over monitoring years except at HAC-U where concentrations in composite taxa-benthic invertebrate samples were higher in 2022 than 2018 to 2022 (relative to reference). Mean trophic transfer of copper was stable or decreasing over time and lower than pre-breach, except for in composite taxa-benthic invertebrates from HAC-U which had mean trophic transfer that increased over time and was higher than pre-breach. The temporal increase in trophic transfer and copper concentrations in benthic invertebrates in 2022 was limited to composite taxa-benthic invertebrate tissues from HAC-U and was not observed in caddisfly tissues from HAC-U nor in benthic invertebrate tissues from HAC-R1 of upper Hazeltine Creek, indicating a potentially localized increase (Appendix 2-6).

Selenium concentrations in most tissues (upper and lower Hazeltine Creek) have increased since 2018 compared to reference (except composite-taxa benthic invertebrate samples from lower Hazeltine Creek), suggesting a mine influence on tissue concentrations. Mean selenium concentrations in benthic invertebrate tissue have exceeded the BC interim guideline since 2020 and 2022 in upper (HAC-R1 and HAC-U) and lower (HAC-D) Hazeltine Creek, respectively, suggesting potential selenium-associated risks to aquatic life.

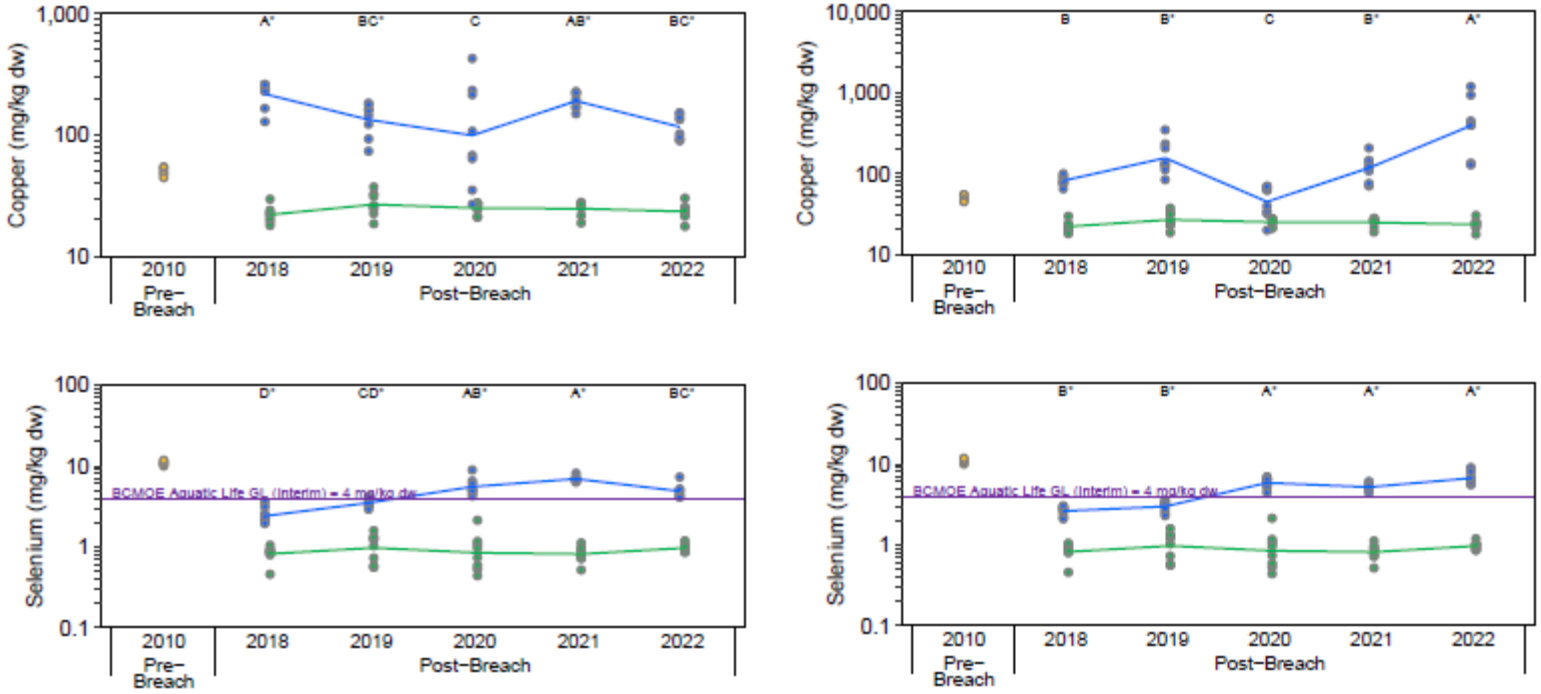

Note: Blue circles represented data from exposed locations in Hazeltine Creek, green circles represent reference data from Edney Creek, and yellow circles represent pre-breach data from Edney Creek. Concentrations below the detection limit are plotted as open symbols at the detection limit. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not less than the detection limit). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The mdoels were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p-value <0.05) amoung years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas were plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions.

Figure 2.9-5: Composite-Taxa Benthic Invertebrate Tissue Copper and Selenium Concentrations for Upper Hazeltine Creek Monitoring Stations HAC-R1 (left) and HAC-U (right) Compared to Pre-Breach Data in 2010 and the Reference Station in Upper Edney Creek (EDC-U) from 2018 to 2022

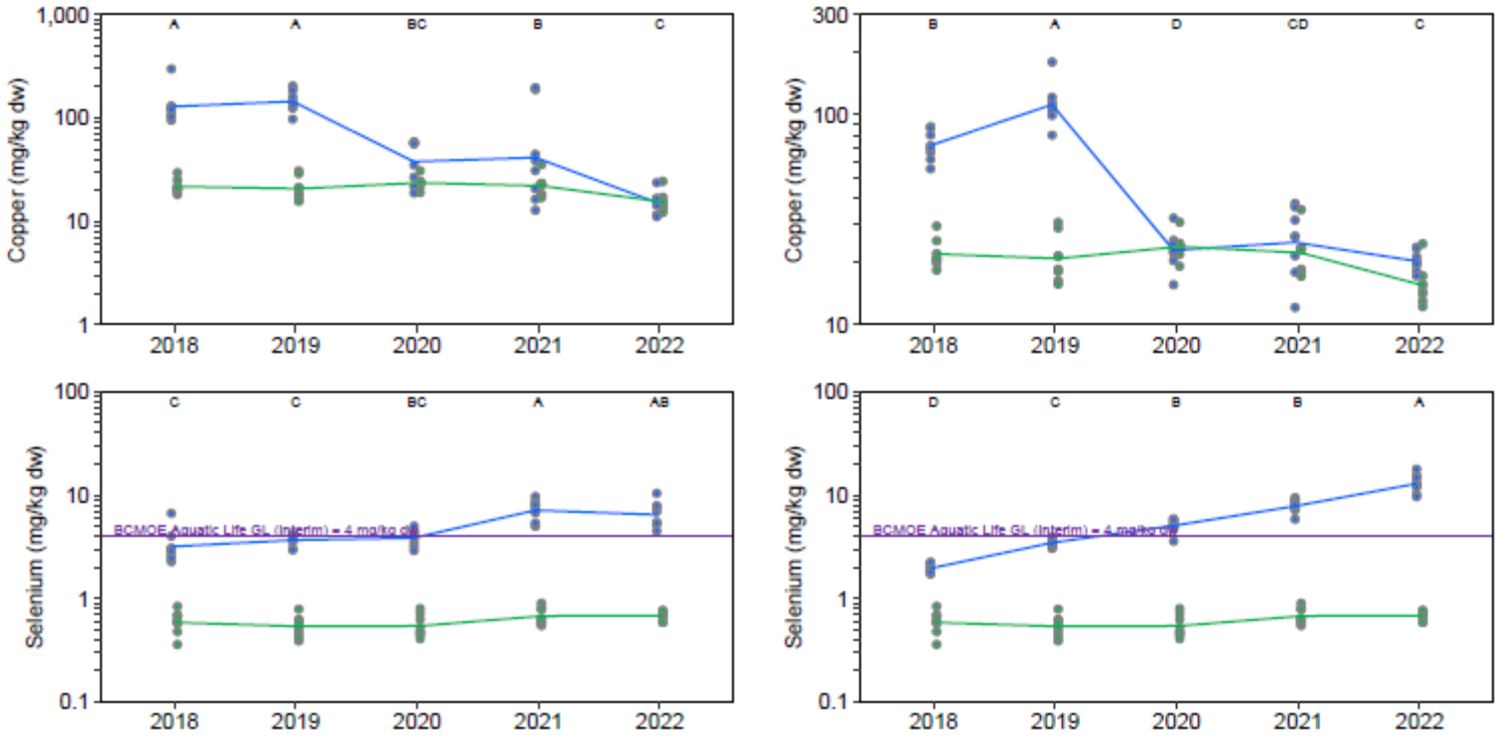

Note: Blue circles represented data from exposed locations in Hazeltine Creek, green circles represent reference data from Edney Creek, and yellow circles represent pre-breach data from Edney Creek. Concentrations below the detection limit are plotted as open symbols at the detection limit. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not less than the detection limit). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The mdoels were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p-value <0.05) amoung years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas were plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions.

Figure 2.9-6: Caddisfly Tissue Copper and Selenium Concentrations for Upper Hazeltine Creek Monitoring Stations HAC-R1 (left) and HAC-U (right) Compared to the Reference Station in Upper Edney Creek (EDC-U) from 2018 to 2022

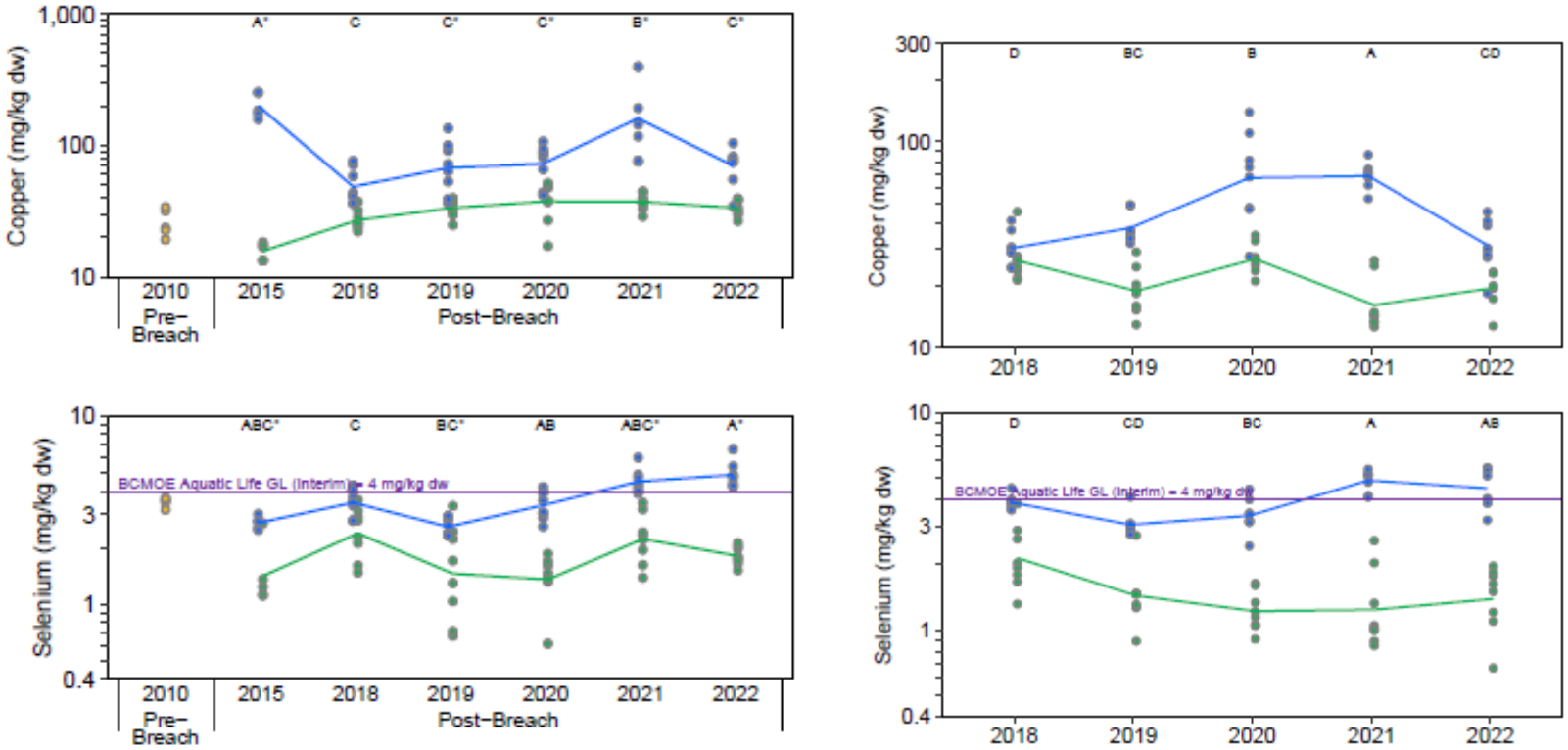

Note: Blue circles represented data from exposed locations in Hazeltine Creek, green circles represent reference data from Edney Creek, and yellow circles represent pre-breach data from Edney Creek.Concentrations below the detection limit are plotted as open symbols at the detection limit. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not less than the detection limit). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The mdoels were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p-value <0.05) amoung years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas were plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions.

Figure 2.9-7: Composite-Taxa Benthic Invertebrate Tissue (left) and Caddisfly Tissue (right) Copper and Selenium Concentrations for Lower Hazeltine Creek Monitoring Station (HAC-D) Compared to Available Pre-Breach data from 2010 and the Reference Station in Lower Edney Creek (EDC-D) from 2018 to 2022

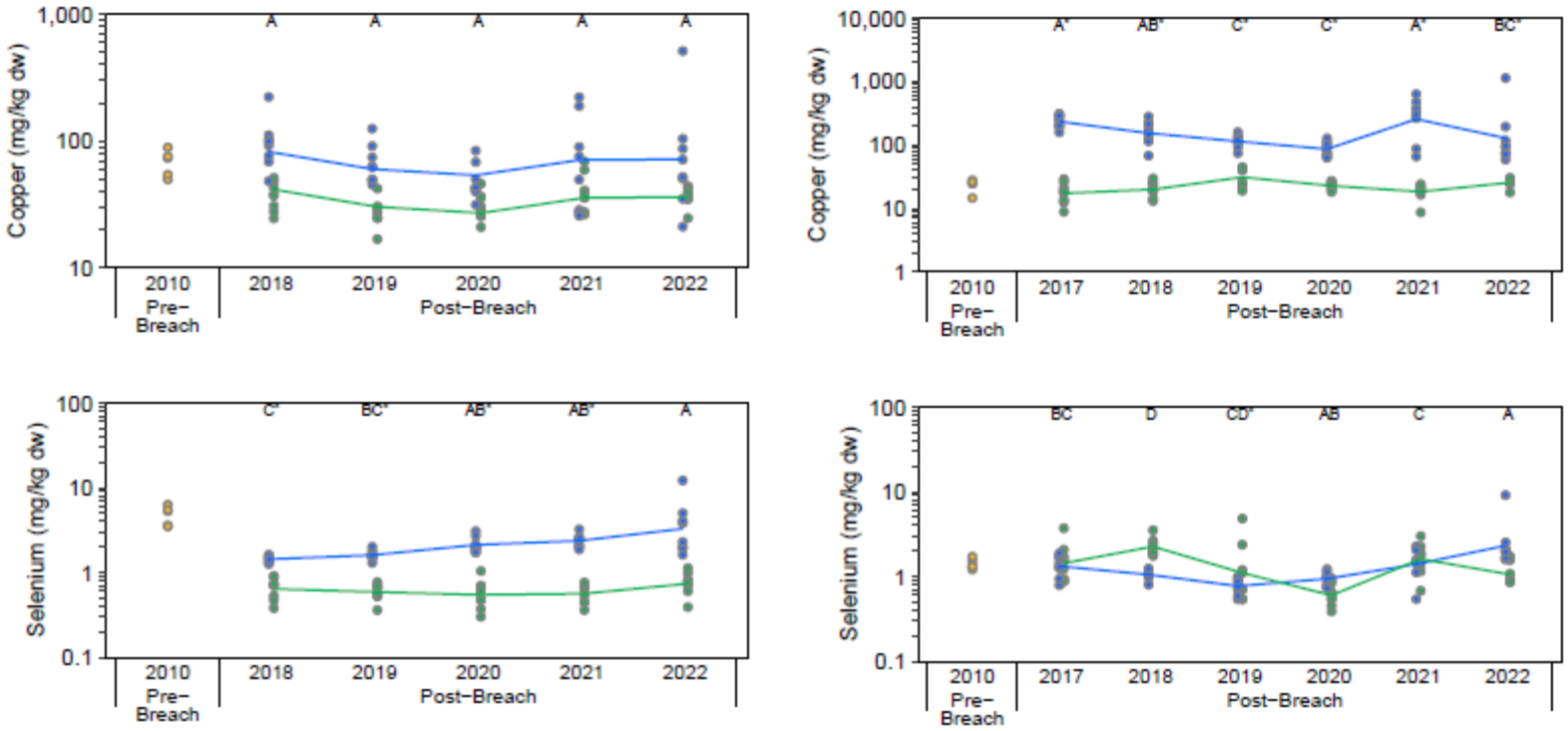

Note: Blue circles represented data from exposed locations in Hazeltine Creek, green circles represent reference data from Edney Creek, and yellow circles represent pre-breach data from Edney Creek. Concentrations below the detection limit are plotted as open symbols at the detection limit. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not less than the detection limit). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A, B, C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p-value <0.05) amoung years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas were plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions.

Figure 2.9-8: Periphyton Tissue Concentrations for Upper Hazeltine Creek (HAC-U; left) and Lower Hazeltine Creek (HAC-D; right) Compared to Available Pre-Breach data from 2010 and the Corresponding Reference Station in Upper Edney Creek (EDC-U) and Lower Edney Creek (EDC-D) from 2018 to 2022

2.10 Ecosystems and Wildlife

To characterize the baseline terrestrial conditions in the area within the Mine Site affected by the expansion of the SERDS resulting from the Springer Expansion, a background information review and two-day field reconnaissance was conducted by two WSP biologists on 8 and 9 August 2023. The objective of the reconnaissance was to verify and supplement information gathered during the background review and characterize terrestrial resources in the Project Area that could potentially be adversely affected by the proposed Project. Meander transects were traversed on foot throughout the Project Area. Information gathered included:

- Structure and composition of vegetation communities
- Wildlife habitat features
- Chance encounters with wildlife and wildlife sign
- Potential for habitat to support provincially and/or federally designated species
- Occurrence of invasive plants
- Presence/absence of aquatic features and wetted areas

Field descriptions and geo-referenced photos were collected to document and record the location of observed habitat features. Information derived from the reconnaissance survey was then used to describe the general habitat types available within the Project Area and to further refine the assessment of potential species at risk (SAR) presence.

Characterization of baseline terrestrial conditions within the TSF area to accommodate the TSF interim raise to 974 m was limited to a desktop assessment. Field surveys will be conducted in the Project footprint of the TSF final raise to 987 m and the findings will be included in a future application associated with the final Life of Mine.

The desktop review for the TSF interim raise to 974 m was based on publicly available information including government databases, web-based resource maps and inventories, and previous reports provided by MPMC. Information sources included:

- Background Reports Provided by MPMC:
  - The Mount Polley Mine Project Reclamation Plan (Hallam Knight Piésold Ltd. 1996)
  - 2021 Annual Reclamation Report for the Mount Polley Mine (MPMC 2022)
- Publicly Available Resources:
    - BC Conservation Data Centre (CDC) Species and Ecosystems Explorer (BC CDC 2023)
  - InvasivesBC database (Government of BC 2023a)
  - Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia

(Government of BC 2023b)

- iMapBC online mapping database (Government of BC 2023c)
- Habitat Wizard online mapping database (Government of BC 2023d)
- Federal Species at Risk Public Registry (Government of Canada 2023)
- Great Blue Heron Nesting Atlas (GBHMT 2023)
- Wildlife Tree Stewardship (WiTS) Atlas of Raptor Nests (WiTS 2023)

2.10.1 Ecosystems

2.10.1.1 Ecological Context

British Columbia has been classified into biogeoclimatic zones based on vegetation, geological, and climatic conditions and uses local climate and landform conditions to reflect the distribution and presence of specific plant communities and ecosystems.

Both the SERDS and interim TSF areas are located within the Interior Cedar-Hemlock (ICH) Biogeoclimatic Ecosystem Classification (BEC) zone, moist cool (mk) subzone, and horsefly (3) variant (ICHmk3). The ICHmk3 occurs in areas with elevations ranging from 780 m to 1,250 m along the eastern flank of the Fraser Plateau as well as in sections of the Quesnel Highland (Steen and Coupé 1997). Characteristic zonal (i.e., medium moisture and medium nutrient) forested areas are dominated by western redcedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), and lodgepole pine (*Pinus contorta* var. *latifolia*) while paper birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*) dominate areas previously burned by fires. The understorey is typically dominated by black huckleberry (*Vaccinium membranaceum*), falsebox (*Paxistima myrsinites*), feathermoss (*Pleurozium* sp.) and other low-growing herbs (Steen and Coupé 1997).

2.10.1.2 Vegetation

The Mine Site is primarily comprised of an anthropogenically disturbed rock disposal area and access roads associated with the Mount Polley Mine; however, the south and east portions of the SERDS expansion area contain more naturalized vegetated areas (Figure 2.10-1). A total of 11 field plots were sampled during the field reconnaissance to characterize vegetation present in these areas. Four of the sites (Site 1, 2, 5 and 12) surveyed were located in forested areas comprised of mature deciduous and coniferous trees, shrubs and forbs. Sites 3, 6, 7, 9, and 11 were in areas with young seral vegetation including coniferous and deciduous trees/shrubs, grasses and forbs. Two of the sites (8 and 10) had recent anthropogenic disturbance with surrounding vegetation sparse. Site 13 is part of the current SERDs with no vegetation present and Site 4 was not surveyed.

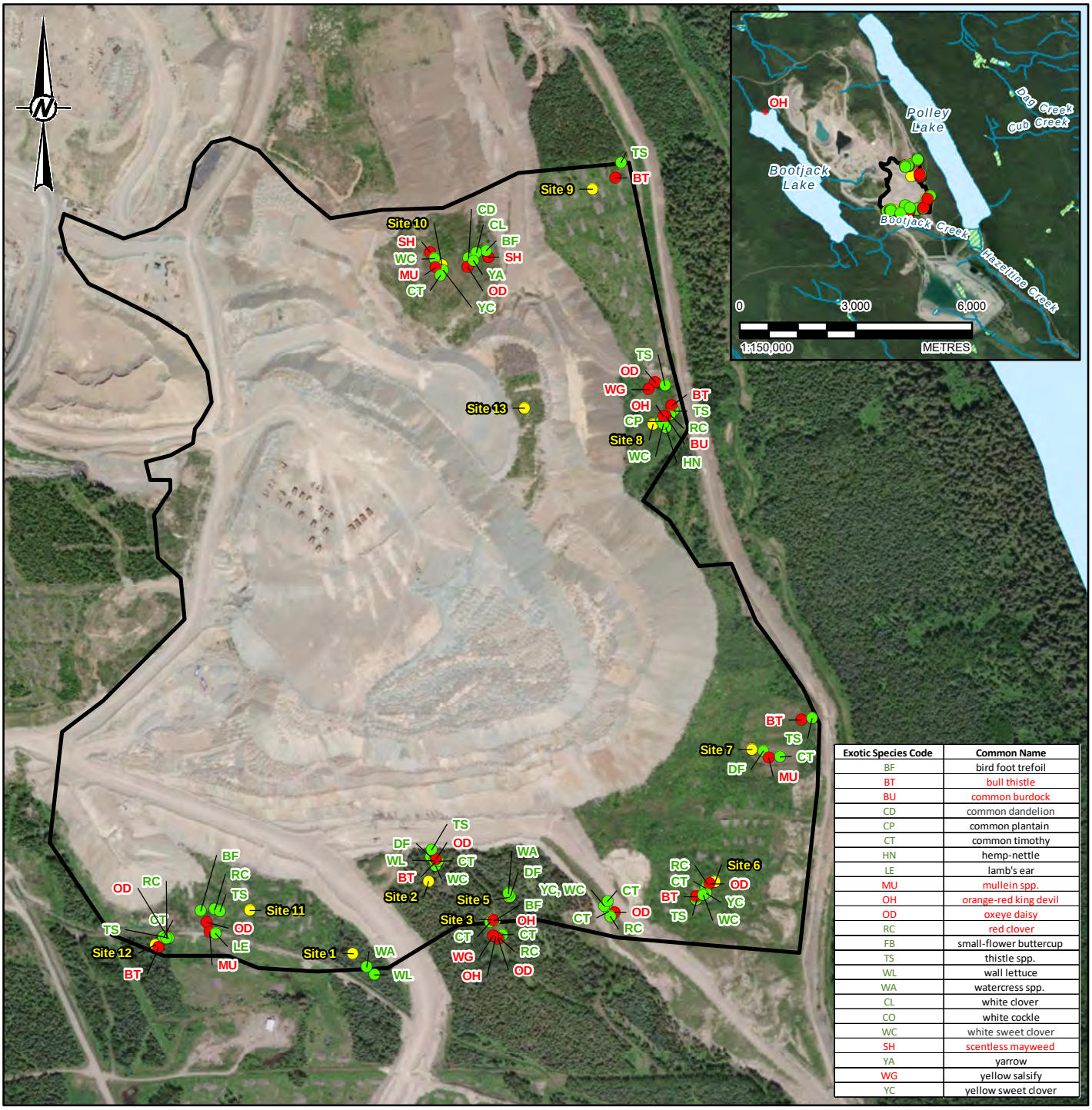

Exotic Species Code	Common Name
BF	bird foot trefoil
BT	bull thistle
BU	common burdock
CD	common dandelion
CP	common plantain
CT	common timothy
HN	hemp-nettle
LE	lamb's ear
MU	mullein spp.
OH	orange-red king devil
OD	oxeye daisy
RC	red clover
FB	small-flower buttercup
TS	thistle spp.
WL	wall lettuce
WA	watercress spp.
CL	white clover
CO	white cockle
WC	white sweet clover
SH	scentless mayweed
YA	yarrow
WG	yellow salsify
YC	yellow sweet clover

LEGEND

TERRESTRIAL SURVEY LOCATION

- INVASIVESBC SPECIES
- NON-REGULATED EXOTIC SPECIES
- SITE
- TERRESTRIAL SURVEY AREA
- WATERCOURSE
- WATERBODY
- WETLAND

0 200 400

1:10,000 METRES

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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
VEGETATION RESOURCES

CONSULTANT

wsp

YYYY-MM-DD	2023-11-28
DESIGNED	DS
PREPARED	CDB
REVIEWED	DS
APPROVED	TS

PROJECT NO.	CONTROL	REV.	FIGURE
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A total of 81 plant species were recorded during the field reconnaissance, including western redcedar, white spruce (*Picea glauca*), Douglas-fir, alder (*Alnus alnobetula),* black cottonwood (*Populus thrichocarpa*), sitka willow (*Salix sitchensis*), devil's club (*Oplopanax horridus*), oak fern (Gymnocarpium *dryopteris),* spiny wood fern (*Dryopteris expansa*), bunchberry (*Cornus canadensis*), hair cap moss (*Polytrichum* spp.) and horsetail (*equisetum* spp.). A list of plant species observed during the field reconnaissance can be found in Appendix 2-10.

The InvasivesBC provincial invasive plant mapping tool had no records of invasive plants occurring in or adjacent to the SERDS and TSF raise to 974 m areas (Government of BC 2023a). However, during the field reconnaissance, 23 exotic plant species were observed in the SERDS expansion area, and of these, 6 species are considered invasive plants of concern by the province or regionally noxious in the Cariboo region (Government of BC 2023b).

- Bull thistle (*Cirsium vulgare*) [Listed as an invasive plant of concern in BC (Government of BC 2023b)]
- Common burdock (*Arctium minus*) [Listed as regionally noxious in the Cariboo region (Government of BC 2023b)]
- Orange-red king devil (*Pilosella aurantiaca*), also known as orange hawkweed [Listed as regionally noxious in the Cariboo region (Government of BC 2023b)]
- Oxeye daisy (*Leucanthemum vulgare*) [Listed as regionally noxious in the Cariboo region (Government of BC 2023b)]
- Scentless mayweed (*Tripleurospermum inodorum*) [Listed as regionally noxious in the Cariboo region (Government of BC 2023b)]
- Yellow salsify (*Tragopogon dubius*) [Listed as an invasive plant of concern in BC (Government of BC 2023b)].

All invasive plants were identified in areas of anthropogenic disturbance such as adjacent to access roads. Other non-regulated exotic plant species were identified generally in disturbed areas, including bird foot trefoil (*Lotus corniculatus*), common dandelion (*Taraxacum officinale*), lamb's ears (*Stachys byzantina*), wall lettuce (*Mycelis muralis*), watercress (*Nasturtium* sp.), white sweet-clover (*Melilotus alba*) and yellow sweet-clover (*Melilotus officinalis*). Exotic agronomic species such as red clover (*Trifolium pratense*) and common timothy (*Phleum pratensis*), may have been used during previous reclamation activities within the SERDS expansion area. A list of non-native species can be found in Appendix 2-10.

Terrestrial Ecosystem Mapping (TEM) was not available for the SERDS expansion area; therefore, site series were determined based on vegetation characteristics and slope morphology observed during the field reconnaissance, as possible (

Table 2.10-1). Although site series were determined based on existing sites conditions, sites were highly disturbed due to legacy forest clearing and rockfall from the nearby rock deposits. Sites series could not be determined for the remaining sites due to anthropogenic disturbance.

Table 2.10-1: Site Series Observed during the Field Reconnaissance

Site Parameter	Site 1	Site 5	Site 12
BEC subzone/variant	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)
Map Code	RH	RD	RH
Site Series	07	06	07
Site Series Name	western redcedar / devil's club / common horsetail Site Series	western redcedar / devil's club / lady fern Site Series	western redcedar / devil's club / common horsetail Site Series
Slope (%)	12	13	>10
Aspect	140	36	-
Mesoslope position	Toe	Toe	Toe
BC List	Yellow	Yellow	Yellow

TEM data overlaps the eastern portion of the TSF raise to 974 m area; therefore, site series data presented in Table 2.10-2 was obtained from publicly available databases and was not collected by WSP (Government of BC 2023c).

Table 2.10-2: Site Series Obtained from Publicly Available Databases

BEC subzone/variant	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)	Interior cedar-hemlock moist cool subzone, Horsefly Variant (ICHmk3)
Map Code	RF	SO	RD
Site Series	01	04	06
Site Series Name	CwSxw – Falsebox – Knight's plume	CwSxw – Oak fern – Cat's tail moss	CwHw – Devil's club – Lady fern
Typical Situation	typically occurs on deep, medium-textured, mesic soils; gently to moderately sloping moraine	typically occurs on deep, medium-textured, subhygric soils; gentle lower slopes on moraine and fluvial deposits	typically occurs on deep, medium-textured, subhygric soils; gentle lower, moisture receiving slope positions with seepage
Modifiers	c,g,h,k,n,r,s,t,w[1]	c,g,k,n,s,t,w[1]	c,g,k,n,p,s,w[1]

[1] Soils
- c coarse-textured soils
- p peaty material
- s shallow soils

Topography
- g gullying occurring
- h hummocky terrain
- k cool aspect
- n fan
- r ridge
- t terrace
- w warm aspect

Vegetation Resources Inventory (VRI) spatial datasets overlap the SERDS expansion area and provide additional information on tree species reported in the area (Government of BC 2023c). Table 2.10-3 shows tree species listed under the VRI dataset compared with tree species identified during the field reconnaissance. The projected tree age for each specific site varied; however, age estimates of trees observed on site did not match VRI 'projected' tree age. For example, the VRI data for Sites 9 and 11 indicate the projected age as 173 years and 233 years, respectively. Old growth trees were not observed in the Site due to previous forest harvesting (Appendix 2-10). Conversely, Sites 1 and 5 had a VRI-projected age listed as 36 years while mature trees observed on these sites varied between 50 to 80 years.

The desktop review found no wetland habitat overlapping with the SERDS expansion area; however, a swamp ecosystem was observed at Site 5 while ephemerally wetted areas were observed at Sites 7 and 11 with cattail growing in the depression areas.

Table 2.10-3: Tree species listed from Vegetation Resources Inventory and species identified during field reconnaissance on 08 and 09 August 2023 in the SERDS expansion area.

Sites	VRI[1]	Survey
1	hybrid spruce (*Picea glauca* x *engelmannii*), Douglas-fir, western redcedar, poplar (*Populus* sp.) and subalpine fir (*Abies lasiocarpa*)	Douglas-fir, western redcedar, white spruce, alder, spruce sp. (*Picea* sp.).
2	hybrid spruce, Douglas-fir, trembling aspen	Douglas-fir, western redcedar, alder, black cottonwood
3		western redcedar, trembling aspen, lodgepole pine, black cottonwood, spruce sp.
5		Douglas-fir, western redcedar, alder, spruce sp.
6	hybrid spruce, Douglas fir, western redcedar, poplar	western redcedar, black cottonwood, trembling aspen, Douglas maple
7		western redcedar, black cottonwood, Douglas-fir, Douglas maple, trembling aspen, lodgepole pine
9	hybrid spruce, Douglas-fir, western redcedar	western redcedar, Douglas maple, Douglas-fir, white spruce, juniper (*Juniperus scopulorum*), trembling aspen, black cottonwood and lodgepole pine.
8 & 10	No VRI data	black cottonwood
11	hybrid spruce, western redcedar, poplar, subalpine fir	black cottonwood
12	Douglas-fir, spruce hybrid, poplar, subalpine fir	Douglas-fir, wester redcedar, alder, white spruce.

1) VRI data extracted from iMapBC under vegetated land cover (Government of BC 2023c).

VRI data for the TSF raise to 974 m area is based solely on information obtained from publicly available databases (Government of BC 2023c). VRI data indicates that forested regions south of the south embankment consist of western hemlock, aged 314 years, hybrid spruce, aged between 104 and 234 years, and black spruce, aged 154 years (Government of BC 2023c). Forested regions south of the main embankment consist of hybrid spruce aged between 54 and 114 years, and western redcedar, aged 12 years (Government of BC 2023c). Projected age estimates of trees from the VRI database were not confirmed in the field and therefore it is possible the existing vegetated land cover varies from the mapped data.
The desktop review found no wetland habitat overlapping the TSF raise to 974 m area; however, two wetlands are mapped approximately 70 m south of the existing south embankment and 115 m south of the main embankment (Government of BC 2023c).

2.10.1.3 Species at Risk

2.10.1.3.1 Ecological Communities

The BC Conservation Data Centre (BC CDC) query produced seven provincially listed (red- or blue-listed) ecological communities with the potential to occur regionally (BC CDC 2023). Based on a review of the listed ecological communities in comparison to the ecological communities observed during the field reconnaissance, none are expected to occur in the SERDS expansion area. A list of the provincially listed ecological communities with the potential to occur in the regional area from the BC CDC query is provided in Appendix 2-10.

The background desktop review found no element occurrence records of at-risk ecological communities mapped overlapping the SERDS expansion area and TSF raise to 974 m areas (Government of BC 2023a). However, further survey is required to confirm if site 1 and 12 in the SERDS expansion area belongs to the swamp site association Ws51 sitka willow – pacific willow – skunk cabbage, which is a provincial blue-listed ecological community (BC CDC 2023).

2.10.1.3.2 Vegetation

The BC CDC query for plant SAR produced two vascular, two non-vascular, and nine lichen species with the potential to occur regionally with either federal designation as Endangered, Threatened or Special Concern, or provincial red- or blue-listed designation (BC CDC 2023). A list of plant species returned in the BC CDC query is provided in Appendix 2-10. No plant species at risk were observed during the field reconnaissance; however, the field reconnaissance was not carried out during the appropriate floristic period for identification of at-risk plants. Potential of occurrence was not assessed for plants as species-specific surveys would be required during the appropriate seasons to confirm the potential for at-risk plants.

2.11 Land Status and Use

The majority of the mine footprint is located on Crown Lands, with the exception of one rural, private land parcel that overlaps the project area (PID 027-454-231), and three private land parcels that are outside of the project area on the northeast end of Bootjack Lake and the north end of Polley Lake (iMapBC 2023). Mineral claims consist of 342 units representing a total surface area of 8,550 ha (MPMC 1996). Mount Polley Mine is accessed via Likely Road and Morehead-Bootjack Forest Service Road (Figure 1.3-3). Transportation within the mine site is via access roads for light duty vehicles and large haul roads for heavy equipment.

Prior to mine operations, commercial forestry was the predominant land use activity within the project area. Significant portions of the project area were clearcut, and the cutblocks were replanted for either commercial timber use or a combination of silviculture and cattle grazing use (MPMC 1996). Six active forest harvest authorizations and twelve active forest cut blocks overlap the project area, all of which are owned by MPMC (iMapBC 2023). The nearest land represented by the Agricultural Land Reserve is located approximately 500 m south of the Tailings Storage Facility (iMapBC 2023).

Hunting, guiding and trapping are common recreational activities in the region, and the network of active forest service roads around the mine site is used by both locals and non-residents (MPMC 1996). The project area is entirely within the registered trapping area TR0502T056 (iMapBC 2023). The northern extent of the project area overlaps an active guide outfitter area, held by Brian Iverson. The southern extent of the project area overlaps an active range tenure, held by U2 Cattle Co. Ltd. (iMapBC 2023). Outdoor recreational activities around the mine site include lake fishing, camping, hiking, snowmobiling and cross-country skiing (MPMC 1996).

The campgrounds on Bootjack and Polley Lakes are used throughout the camping season and the forest service roads are used year-round for recreational purposes.

First nations with recognized claimed traditional territory for the Mount Polley Mine are the T'exelcemc (Williams Lake First Nation) and the Xatśūll First Nation. Pre-mining studies noted that the project area had low heritage resource potential due to the extensive disturbance from logging and earlier mining projects (MPMC 2021).

2.11.1 Wildlife

2.11.1.1 Herptiles

Amphibians in BC are grouped into either aquatic breeding obligates (frogs, toads, newts and mole salamanders [*Ambystomatidae*]) or terrestrial breeding obligates (lungless salamanders [*Plethodontidae*]; BC MoE 2014). Aquatic breeding obligates lay their eggs in freshwater including warm, shallow, roadside ditches and stormwater ponds (BC MoE 2020).
Adult amphibians occurring in terrestrial environments generally require moist habitat with cover objects such as logs, shrubs, tree hollows, and rock crevices to provide thermoregulatory and shelter sites.

Amphibian species with ranges that overlap the SERDS and TSF raise to 974 m areas include western toad (*Anaxyrus boreas*), Columbia spotted frog (*Rana luteiventris*), wood frog (*Rana sylvatica*), and long-toed salamander (*Ambystoma macrodactylum*). The field reconnaissance was conducted on August 8 and 9, 2023 during dry conditions. No evidence of amphibian breeding was noted; however, there is potential for breeding sites to develop within the SERDS expansion area earlier in the breeding season and during periods of heavy rainfall. A wetland with the potential to support amphibian breeding was also observed outside of the SERDS area approximately 700 m southeast of Site 5. Two adult western toads were observed during the field reconnaissance in a moist, forested area comprised of mature deciduous and coniferous trees, shrubs and forbs at Site 1 (Figure 2.11-1).

The TSF raise to 974 m area was not assessed during the August 2023 field reconnaissance; however, western toad and Columbia spotted frog have been documented to occur in Polley Flats, north of the Perimeter Embankment Till Borrow Pond (PETBP; Government of BC 2023c). While there are no documented occurrences of amphibians within the South Embankment Seepage Collection Pond or the Main Embankment Seepage Collection Pond, these ponds have the potential to support amphibian breeding. In addition, two wetlands are mapped approximately 70 m south of the existing south embankment and approximately 115 m south of the existing main embankment (Government of BC 2023c). Western toad is provincially yellow-listed and federally listed as Special Concern under Schedule 1 of the federal *Species at Risk Act* (SARA).

Reptile species with ranges that overlap the SERDS and TSF raise to 974 m areas include painte– turtle - Intermountain – Rocky Mountain Population (*Chrysemys picta* pop. 2), common garter snake (*Thamnophis sirtalis*) and western terrestrial garter snake (*Thamnophis elegans).* Suitable reptile habitat generally provides access to food sources (i.e., small mammals, amphibians, invertebrates), thermoregulatory habitat such as sunning outcrops and cover objects, shelter from predators, and access to hibernation sites (BC MoE 2014). Garter snakes may forage in vegetated areas of the Site, particularly where shrub cover is available. Suitable denning (hibernacula) habitat was not observed within the SERDS expansion area. No reptiles were observed during the field reconnaissance.



LEGEND

- WILDLIFE RESOURCE
- SITE
- POND
- SERDS TOE
- TERRESTRIAL SURVEY AREA
- WATERCOURSE
- WATERBODY
- WETLAND
- UNGULATE WINTER RANGE - APPROVED
- CARIBOU HERD BOUNDARY
- CRITICAL HABITAT FOR FEDERALLY LISTED SPECIES AT RISK - POSTED

SPECIES AND ECOSYSTEMS AT RISK - PUBLICLY AVAILABLE OCCURRENCES - CDC

- ANIMAL - VERTEBRATE

0 200 400
1:10,000 METRES

REFERENCE(S)

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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

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PROJECT
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SPRINGER PIT JOINT APPLICATION

TITLE
WILDLIFE RESOURCES

CONSULTANT

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PREPARED	CDB
REVIEWED	RS
APPROVED	TS

PROJECT NO.	CONTROL	REV.	FIGURE
23590671	81100/81112	0	2.11-1

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2.11.1.2 Birds

Passerine species use a variety of habitat types depending on life requisites, such as nesting and foraging. Suitable nesting sites are available throughout the SERDS and TSF raise to 974 m areas, such as in trees or shrubs. The nearest reported hotspot for bird sightings is “Gavin Lake” located approximately 7.5 km southwest of the mine site, where 89 species observations have been recorded (eBird, 2023).

Limited suitable nesting habitat for raptor species such as bald eagle (*Haliaeetus leucocephalus*) and red-tailed hawk (*Buteo jamaicensis*) was observed within the SERDS expansion area; however, raptor species likely forage in the area. A search of the *Wildlife Tree Stewardship Atlas* (WiTS 2018) and the *Great Blue Heron Nesting Atlas* (GBHMT 2018) did not return results of reported bald eagle, osprey (*Pandion haliaetus*), or great blue heron (*Ardea herodias*) nests within the SERDS or TSF raise to 974 m areas. The closest great blue heron colony (GBHE-502-005) was recorded approximately 6 km north of the Site. No stick nests were observed within the SERDS expansion area during the field reconnaissance; however, two wildlife trees containing cavities were observed at Sites 2 and 3 that may be used by woodpecker species for foraging (Figure 2.11-1). A group of snags was also observed at the north boundary of Site 2 that may contain wildlife habitat, and bird activity was noted in the area. Forested regions south of the south and main embankments, and north of the PETBP were not assessed during the field reconnaissance; however, these areas likely provide suitable nesting habitat for raptor species.

Mature forests in and adjacent to the SERDS and TSF raise to 974 m areas may provide suitable nesting and foraging habitat for grouse species. According to the Mount Polley Mine Project Reclamation Plan (Hallam Knight Piésold Ltd. 1996), ruffed grouse (*Bonasa umbellus*) were commonly found within the mine footprint in deciduous and mixed-wood forest and the dusky grouse (*Dendragapus obscurus*) (previously known as blue grouse) was commonly found in mature to old coniferous forests dominated by western redcedar and Douglas-fir. Waterfowl are not anticipated to be present within the SERDS expansion area due to limited suitable aquatic habitat; however, would likely be present in Polley Lake and adjacent wetland habitat. Based on aerial imagery, waterfowl may also be present in the South and Main Embankment Seepage Collection Ponds, the PETBP, and the South Till Borrow ponds.

Six bird species were observed within the SERDS expansion area during the field reconnaissance:

- Western tanager (*Piranga ludoviciana*)
- Warbling vireo (*Vireo gilvus*)
- Yellow-rumped warbler (*Setophaga coronata*)
- American robin (*Turdus migratorius*)
- Rufous hummingbird (*Selasphorus rufus*)

- Western wood-pewee (*Contopus sordidulus*)

The area was primarily dominated by deciduous trees and shrubs due to previous forest harvesting. Songbirds that are typically associated with young clearcuts and recent burns include chipping sparrow (*Spizella passerine*), dark-eyed junco (*Junco hyemalis*), Hammond's flycatcher (*Empidonax hammondii*), western wood-pewee, warbling vireo, orange-crowned warbler (*Vermivora celata*) and American robin (Hallam Knight Piésold Ltd. 1996).

Field verification was not completed in the TSF raise to 974 m areas in 2023 as the interim raise will primarily affect previously disturbed areas, but field surveys will be conducted in 2024 for the TSF raise to 987 m required for the LoM.

2.11.1.3 Mammals

Small mammals, such as insectivores (i.e., moles, shrews) and rodents (i.e., mice, rats), are expected to occur in and around the SERDS and TSF interim raise to 974 m areas. Two unidentified small mammal species were observed within the SERDS expansion area during the field reconnaissance. Deer mouse (*Peromyscus maniculatus*), northern red-backed vole (*Myodes rutilus*) and meadow vole (*Microtus pennsylvanicus*) are known to be the most common small mammals within the mine footprint (Hallam Knight Piésold Ltd. 1996). Insects, seeds, and berries provide suitable foraging material for small mammals. Several yellow pine chipmunks (*Neotamias amoenus*) and middens were observed during the field reconnaissance. Bats may forage over vegetated areas in and surrounding the Site and the group of snags observed at Site 2 may potentially provide bat roosting habitat. No bats were observed during the field reconnaissance.

Large mammals such as black bear (*Ursus americanus*), coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*) and moose (*Alces alces*) are expected to occur in and around the SERDS and TSF interim raise to 974 m areas. A female mule deer was observed at Site 1 during the field reconnaissance on August 9, 2023. Mule deer are not designated by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or listed under SARA, and provincially, they are a yellow-listed species ranked as S5.

Ungulate (caribou and moose) scat and tracks were observed at Sites 6 and 7. Ungulate scat and tracks were also observed at Sites 1, 8 and 11. Lichen species are an important forage species for caribou and were observed on rock and fallen tree branches at Sites 1, 3, 5 and 11. Furthermore, a mineral lick was identified adjacent to Beaver Lake Rd, approximately 315 m south of the existing south embankment near the TSF interim raise to 974 m area (Figure 2.11-1). Mineral licks are naturally occurring mineral deposits used by animals to obtain essential mineral nutrients. Mineral licks are frequented by ungulates throughout the year, but particularly during periods when bone, antler, horn, and muscle growth peak (i.e., spring and summer; MECCS 2018). Woodland caribou in BC occur in 52 populations that have been classified into three

ecotypes – mountain, northern and boreal – based primarily on feeding behaviour and habitat associations (Province of BC 2020). The Site overlaps with the Wells Gray North sub-population of the Southern Mountain population of caribou (*Rangifer tarandus* pop. 1). The Wells Gray North caribou subpopulation is located within the Southern Mountain National Ecological Area and are listed as Threatened by the COSEWIC and appear on Schedule 1 of the SARA, is provincially red-listed and ranked S1 (critically imperilled). The most recent population estimate for the Wells Gray North sub-population is 236 caribou (Province of BC 2020).

A female moose and her calf were observed outside of the Site in the wetland located approximately 700 m southeast of Site 5. Moose are not federally designated by COSEWIC or SARA and are considered a yellow-listed species ranked S5 in the province of BC. They are regionally important to various stakeholders such as outfitters and guides as well as to Indigenous peoples.

2.11.1.4 Invertebrates

Vegetated areas within the SERDS and TSF interim raise to 974 m areas are expected to a host a variety of invertebrates (i.e., insects, spiders, worms) which likely provide prey items for herptiles (i.e., frogs, salamanders), birds, and mammals. No invertebrates were identified during the field reconnaissance on August 8 and 9, 2023.

2.11.1.5 Species at Risk and Critical Habitat

The BC CDC query produced 96 wildlife species that could potentially be present within the SERDS and TSF interim raise to 974 m areas with either federal designation as Endangered, Threatened or Special Concern, or provincial designation as red- or blue- listed (BC CDC 2023). This included a total of 2 amphibians, 6 reptiles, 46 birds, 18 mammals, and 24 invertebrates. A full list of wildlife species returned in the BC CDC query is provided in Appendix 2-10.

The background desktop search did not return any occurrences of wildlife species at risk mapped overlapping the SERDS and TSF interim raise to 974 m areas (Government of BC 2023d). The closest non-sensitive occurrence record of a wildlife species at risk is woodland caribou (Southern Mountain population) mapped approximately 6 km east of the expansion areas. In addition, the Wells Gray North caribou herd boundary (Herd ID No. 11) directly overlaps a portion of the SERDS expansion area and the entire TSF interim raise to 974 m area (Figure 2.11-1).

Critical habitat is defined as “the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy, or in an action plan for the species” (Government of Canada 2002). Under the *Species at Risk Act*, critical habitat is federally protected from activities that result in the destruction or degradation of designated habitat.

The SERDS and TSF interim raise to 974 m areas overlap with designated critical habitat for woodland caribou (Southern Mountain population). The critical habitat polygon encompasses a 704,258-hectare area and is of the variant “unmapped range”, meaning that additional information about the specific location would be required to determine whether it is located within high elevation, low elevation or matrix critical habitat (Government of BC 2023c; Figure 2.11-1). The background desktop search did not return any occurrences of ungulate winter range overlapping the SERDS or TSF interim raise to 974 m areas. The closest record of ungulate winter range is for mule deer and is mapped approximately 6.2 km east of the SERDS expansion area and5.4 km east of the TSF interim raise to 974 m area (Government of BC 2023c; Figure 2.11-1).

2.12 Archaeology

Five archaeological assessments have previously been conducted at the Site, three of which directly overlap or bound the Springer Pit, SERDS, or TSF interim raise to 974 m areas and two of which are in close proximity. These previous assessments are summarized below.

Further, an archaeological preliminary field reconnaissance (PFR) was conducted by WSP in October 2023 and has been summarized below as it relates to the proposed Springer Expansion, SERDS, and TSF interim raise to 974 m areas.

2.12.1 Previous Archaeological Studies

Heritage Resource Overview Assessment – Points West (1989)

Points West Heritage Consulting conducted a heritage resource overview assessment in 1989 at the mine site (Points West 1989). The heritage resource overview assessment focused on the proposed impacts at the time, which partially overlaps the Project area. PFR was conducted during the heritage resource overview assessment but was limited to the east and south edges of Bootjack Lake, as well as the access road connecting the mine to Likely Road.

The majority of the 1989 study area was classified as having low archaeological potential, with some areas classified as having low-moderate archaeological potential (along the access road but outside the Project area) and one area classified as having moderate archaeological potential at the south end of Bootjack Lake (also outside the Project area).

Archaeological Impact Assessment – Permit 1996-143 – I.R. Wilson (1996)

I.R. Wilson Consultants Ltd. conducted an archaeological impact assessment (AIA) in 1996 at a proposed dam enhancement area at the south end of Bootjack Lake and at two areas along a proposed transmission line (I.R. Wilson 1996a). The eastern-most transmission line area is located west of the Project area, east of the south end of Bootjack Lake. This work was conducted under *Heritage Conservation Act* Permit 1996-143.

During the AIA of the dam enhancement area, archaeological site FdRj-5, a subsurface stone artifact scatter, was identified on the north bank of Bootjack Creek, approximately 50 m east and downstream from Bootjack Lake and 620 m southwest of the SERDS expansion area. Archaeological site FdRj-4, an isolated stone artifact, was identified on the north bank of Bootjack Creek, approximately 450 m east and downstream from Bootjack Lake and 540 m southwest of the SERDS expansion area.

Archaeological Impact Assessment – Permit 1996-236 – I.R. Wilson (1996)

I.R. Wilson Consultants Ltd. conducted an AIA in 1996 for a proposed pump station and water pipeline (I.R. Wilson 1996b). The pump station is located on the west shore of Polley Lake and the water pipeline extends southwest from the lake, then south along the east edge of the SERDS expansion area until intersecting with the tailings pond area and the TSF interim raise to 974 m area. Subsurface testing was placed at the substation location; however, no archaeological materials were identified. The water pipeline crossing at Bootjack Creek was described as another area that may have archaeological potential; however, further described as hummocky and ultimately not determined to require subsurface testing. No archaeological sites were identified along the water pipeline route.

Preliminary Field Reconnaissance – I.R. Wilson (2004)

I.R. Wilson Consultants Ltd. conducted a PFR in 2004 for newly proposed developments at the Site, including what is described as the northeast zone, an access road leading south from this area, and a proposed dump location at the south end (I.R. Wilson 2004). These areas are located along the west side of Mount Polley Lake along its northern half, with the proposed dump area entering the SERDS expansion area. No areas of archaeological potential or archaeological sites were identified during the PFR.

Preliminary Field Reconnaissance – Terra Archaeology (2009)

Terra Archaeology conducted a PFR in 2009 for 13 proposed drill locations and associated access roads, all located north of the Project area (Terra 2009). No areas of archaeological potential or archaeological sites were identified during the PFR.

2023 Preliminary Field Reconnaissance

In advance of this application, WSP conducted a PFR in October 2023 of the Springer Expansion, SERDS, and TSF interim raise to 974 m areas.

The vast majority of the Springer Expansion and SERDS areas was determined to have low archaeological potential due to steeply sloping or rocky and undulating terrain which has been heavily disturbed as a result of previous logging and mining activities. The area in the vicinity of Bootjack Creek, in the southeast portion of the SERDS expansion area, is the least disturbed (still with past logging disturbance observed) and is considered, in part, to have high archaeological potential given the presence of the Bootjack Creek, level areas along the top of the ravine in which the creek is located, and that this may have served as the best route for

people to travel between Bootjack Lake and Polley Lake. One area of potential (AOP) in which subsurface testing is recommended was identified during the PFR on the north side of Bootjack Creek; however, systematic survey along the entirety of the creek was not conducted at the time of the PFR and should be done during a subsequent AIA to determine if additional AOPs are present within the area.

The TSF interim raise to 974 m area was determined to have low archaeological potential due to the generally undifferentiated or low-lying terrain and the high degree of previous disturbance that has occurred, including the presence of large berms and other artificially built-up areas. No evidence of previously existing landforms that may have contained potential were observed in these heavily disturbed areas.

2.12.2 HCA Permitting and Further Archaeological Assessment

MPMC will prepare and submit a *Heritage Conservation Act* (HCA) Section 12.2 Inspection Permit and conduct an AIA under the Inspection permit in the vicinity of Bootjack Creek within the SERDS expansion area. The AIA will consist of a systematic survey to identify AOPs or evidence of archaeological features (e.g., cultural depressions, culturally modified trees). Surficial exposures encountered during the survey will also be inspected for archaeological materials. Subsurface testing at identified AOPs will then be carried out, including the AOP identified during the PFR. Subsurface tests will measure approximately 0.35 x 0.35 m and will generally be placed at 5 m spacing with sediment screened through ¼ inch mesh, with spacing potentially increasing depending on the size of the landform. A modest amount of larger subsurface test units (i.e., evaluative units), generally measuring 1 x 1 m, may be used to further evaluate an archaeological site should additional information be required to assess the site type and context. Should a large or complex archaeological site be identified, a larger mitigation program comprised of additional 1 x 1 m subsurface test units may be required by the Archaeology Branch under a separate S12.2 Investigation permit. Should an Investigation permit be required, similar application and reporting processes would apply. Based on the results of the PFR, it is not anticipated that these types of larger or complex sites will be found; however, that will be confirmed during the AIA.

Any archaeological materials recovered will be collected and archaeological sites will be recorded in the field. Archaeological site boundaries will be established using either the extent of positive subsurface tests, the extent of the landform, or the Project area boundary. Following the AIA, an interim report will be written outlining the results, provided to the Archaeology Branch for review, and further distributed to the appropriate Indigenous groups. All archaeological methods, including those described above, will be outlined in the Inspection permit which is reviewed by the Archaeology Branch and provided to the Indigenous groups for referral prior to issuance.

Should an archaeological site be identified, and avoidance of Project impacts not be possible, an HCA Section 12.4 (Alteration) permit would also be required to authorize impacts. Similar to the Inspection permit, the Alteration permit application would be provided to the Archaeology Branch for review, who in turn would provide to the appropriate Indigenous groups for referral. Additional archaeological work that may be required under the Inspection permit, following issuance of the Alteration permit, includes concurrent monitoring and sampling during site impacts as well as a post-impact assessment. All impacts conducted under the Alteration permit would also be summarized in a final Alteration permit report. Note that the above information is accurate as of the date of this permit application and is subject to change should the Archaeology Branch adjust their permitting process.

2.13 Cultural Use

There is currently no identified cultural use of the area impacted by the Springer Expansion, SERDS area, and TSF interim raise to 974 m area. The William Lake First Nation and the Xatśūll First Nation traditional territories overlap the area and both have been consulted on the proposed expansion and participated in the most recent PFR to assess heritage potential of the area affected by the proposed Springer Expansion and TSF interim raise to 974 m.

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3 MINE PLAN

3.1 Mine Plan Overview

Mount Polley is an alkalic porphyry copper/gold deposit hosted within brecciated plagioclase porphyry. While the principal copper-bearing mineral is chalcopyrite, other copper minerals are present, especially in oxidized zones. These other minerals include bornite, malachite, chrysocolla, and azurite. Gold is present principally as inclusions in copper sulphides and as free liberated grains. MPMC recovers copper and gold from porphyry-style mineralization by open pit using conventional truck and shovel operation. The plant is capable of processing 22,000 t/d of ore using standard mineral flotation technology. Mount Polley Mine is an established open pit with various smaller satellite pits which were mined from 1997 to 2017. The majority of mining currently occurs in the Springer and Cariboo Pit which is also the focus of the Life of Mine (LoM) plan. This application has the life of mine extending to 2031 then rehandled PAG material back into the pit until end of 2033.The open pit mining operation mines would on average 6.1 million tonnes of ore and 7.7 mining tonnes of waste per annum (peaking at 35.5 million tonnes in 2025).

3.2 Existing Development

Existing development and operations at Mount Polley mine include the open-pit mining of the Springer and Cariboo pits, with an average daily mill throughput being 20,000t. Additionally Mount Polley mine has acquired the onsite Mag plant to operate in the collection of magnetite. Figure 1.3-6 show the existing site conditions and infrastructure within the M-200 permit boundary including watercourse locations.

Current mine operations involve the permitted Phase 4 in the Springer and Cariboo pits.
The loading equipment is a combination of P&H 2300 shovel, Komatsu PC4000 and PC3000 diesel shovels, and the haulage fleet includes Caterpillar 785 and Caterpillar 789 trucks.
The primary crusher pocket has capacity to accept material from a 180t truck and ore is processed through a crushing circuit, a three-stage grinding circuit consisting of rod, ball and pebble mills, flotation and dewatering circuits to produce a copper/gold concentrate.
The Springer Pit is currently mined to Phase 4 at a depth of 928m from surface. Dewatering from the Springer pit will require establishing temporary sumps in the mine working usually at the lowest working bench. Electric or diesel pumps will convey water to a large sump located in the Cariboo pit. The Cariboo Pit will be pumped to the West collection ditch and then to the Perimeter Embankment Till Borrow Pond which acts as an influent pond for the water treatment plant.

In the Mount Polley mill, run-of-mine ore from the open pit is dumped into the feed pocket of the primary gyratory crusher to reduce the rock to a nominal 200mm. A hydraulic rock breaker is used to break the oversize material, and the crushed ore is discharged onto an apron feeder that feeds onto a conveyor to the coarse stockpile. Ore is reclaimed from underneath the stockpile by four vibrating feeders and conveyed to a vibrating screen.

In preparation for flotation, ore from the feed stockpile is conveyed to a grinding circuit, consisting of parallel rod mill/ball mill circuits and a pebble mill circuit; crusher product is first fed to a rod mill, and then to a ball mill. Ball mill discharge is pumped to cyclones, where the coarse particles are separated to return to the ball mill, while the finer particles proceed to the three pebble mills. Cyclones are again used to return oversize material to the mills, while the fines, now at the necessary size for mineral separation, are pumped to the flotation circuit.

The flotation circuit separates the valuable minerals from the waste rock, producing a concentrate. Initial separation is done in a rougher/scavenger circuit, where tailings flow by gravity to the TSF. Rougher concentrate is further upgraded in a cleaner circuit to produce the final product. Cleaner tailings are recycled to the rougher/scavenger circuit.

The concentrate is dewatered in two stages: settling reduces the water content to roughly 35-40%, while pressure filtration further reduces it to approximately 8%. Water removed is utilized as process water. Concentrate is stored in the load-out building and loaded on to 40t trucks for shipping.

3.3 Life of Mine Plan

Figure 3.3-1 illustrates the life of mine plan showing the major mine site facilities. (Yellow – Pits, Blue – Dumps/Road Development). Appendix 3-1 includes figures illustrating the LOM sequencing.

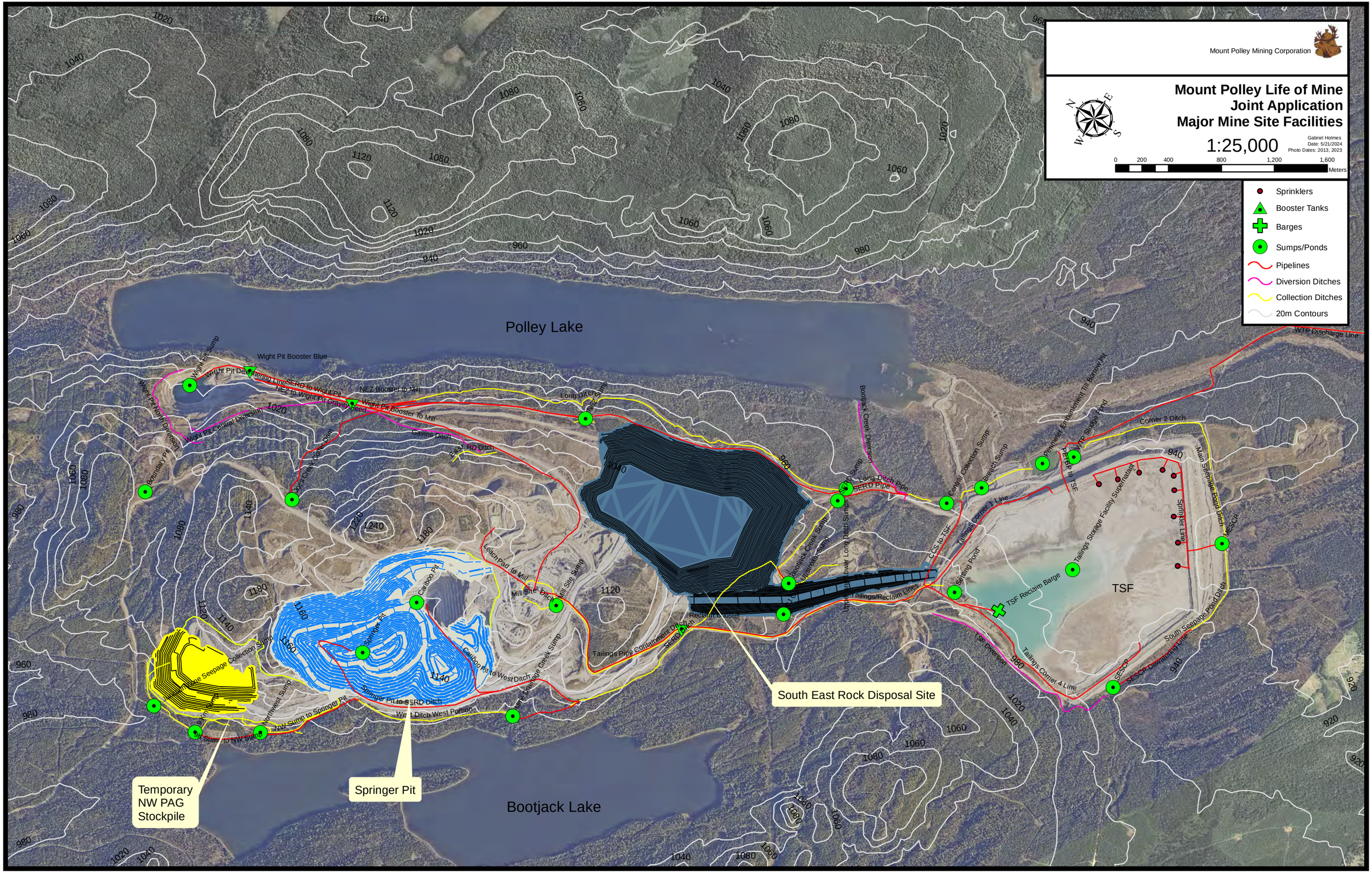

Mount Polley Mining Corporation
Mount Polley Life of Mine
Joint Application
Major Mine Site Facilities
1:25,000
Gabriel Holmes
Date: 5/21/2024
Photo Dates: 2013, 2023
0 200 400 800 1,200 1,600
Meters
Sprinklers
Booster Tanks
Barges
Sumps/Ponds
Pipelines
Diversion Ditches
Collection Ditches
20m Contours
Polley Lake
Bootjack Lake
TSF
South East Rock Disposal Site
Temporary NW PAG Stockpile
Springer Pit
Wight Pit Booster Blue
Wight Pit Sump
Wight Pit Dewatering Line
SERD to Wight Pit
NEZ to Wight Pit Gravity Feed
NEZ Booster to Mill
Wight Pit Booster To Mill
Wight Pit Central Diversion
Wight Pit North Diversion
Boundary Pit
Joes Creek Corner Dam
Gavins Ditch
East RD Ditch
Long Ditch
NEZ Sump
Bootjack Creek Diversion
Bootjack Creek Sump
Upstream Sump
Upper Long Ditch Sumps
Long Ditch Pipe
SERD Pipe
Central Collection Sump
Breach Sump
Pentmeter Embankment Till Borrow Pit
WTP Sludge Pond
Corner 2 Ditch
WTP Discharge Line
PETBP to TSF
Tailings Storage Facility Supernatant
Main Seepage Pond Ditch
Sprinkler Line
MESCP
CCS to TSF
Tailings Corner 1 Line
Settling Pond
TSF Reclaim Barge
Tailings/Reclaim Lines
Reclaim Booster
Leach Pad to Mill
Mill Site Ditch
Mill Site Sump
Tailings Pipe Containment Ditch
SERD Ditch
Cariboo Pit
Springer Pit
Cariboo Pit to West Ditch
Mine Drainage Creek Sump
Springer Pit to SERD Ditch
West Ditch West Portion
Northwest Sump
NW Sump to Springer Pit
9K Sump to NW Sump
Tailings Corner 4 Line
TSF Diversion
SESCP
SESCP Dewatering Line
South Seepage Pond Ditch

3.3.1 Production Schedule and Profiles

The production schedules and profiles are presented in Table 3.3-1 to Table 3.3-3 and Figure 3.3-2 to Figure 3.3-4. A Life of Mine total material moved is shown in Figure 3.3-5.

Table 3.3-1: LoM Waste Mined (t)

	Total Waste Mining by Pit Phase (NAG)							Total Waste Mining by Pit Phase (PAG)					
	C2-B/Car RR-NAG	WX-NAG	Springer 4 - NAG	Springer 5 - NAG	Springer 6 - NAG	Un-Prod Waste RH	Spr Tails/ Dump Fill	C2-B/Car RR-PAG	WX-PAG	Springer 4 - PAG	Springer 5 - PAG	Springer 6 - PAG	PAG ReHandle
2024			1,090,714	17,263,779		735,262	1,671,460			233,148	921,548		
2025	2,223,438		278,717	21,627,577		843,869	375,554	340,301		35,350	803,264		
2026				22,028,147		725,000	11,627				386,955		
2027				14,094,795	2,385,013	689,769	18,825				398,216	407,957	
2028				1,476,896	11,813,839	827,026	41,801				732	13,015,868	
2029	840,294	1,999,546			8,114,673	756,210	1,912,244	38,380	12,173			11,060,273	
2030		5,817,474			7,383,626	700,000	9,326		2,869,174			6,503,661	
2031		2,391,839			101,651	841,868	4,110		2,346,898			38,282	22,500,000
2032													30,000,000
2033													21,429,209

PAG = potentially-acid generating; NAG = non-acid-generating.

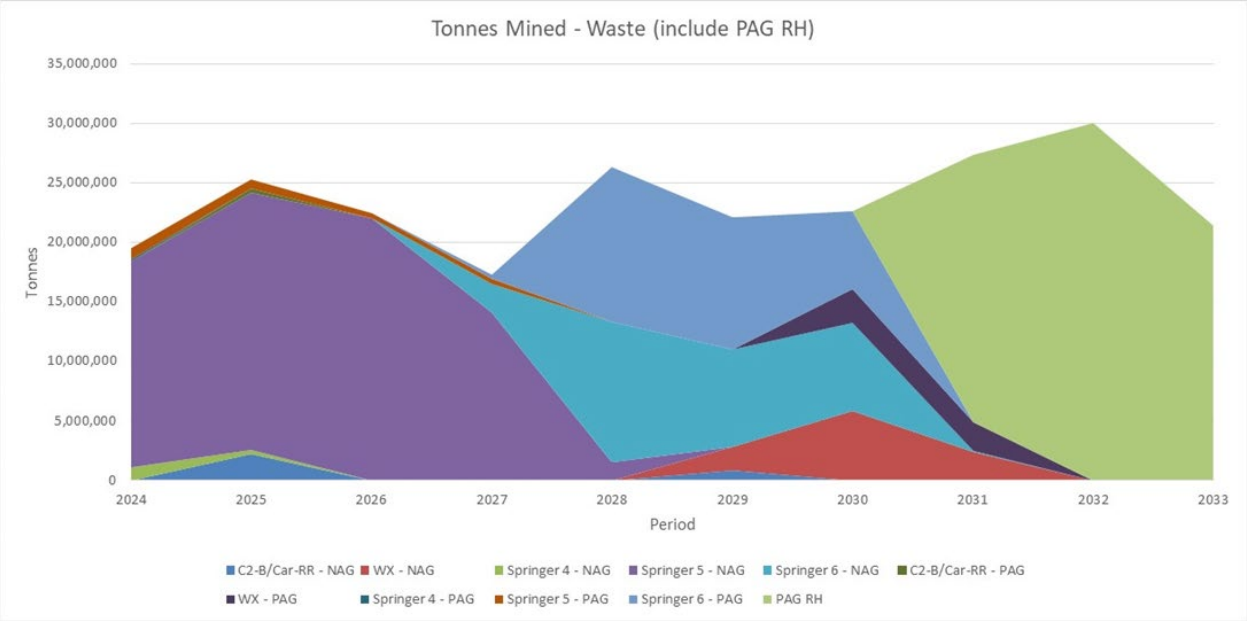

Figure 3.3-2: LoM Waste Mined (t)

Table 3.3-2: LoM Ore Mined (t)

	ORE Above C/O by Pit Phase				
	C2-B/Car-RR	**WX**	**Springer 4**	**Springer 5**	**Springer 6**
2024			5,733,351	1,326,649	
2025	1,626,030		3,883,659	1,550,312	
2026				5,795,978	
2027				8,131,599	72,751
2028				4,013,289	1,258,489
2029	1,908,094	48,935			550,232
2030		802,009			6,083,558
2031		495,484			1,802,980
2032					
2033					

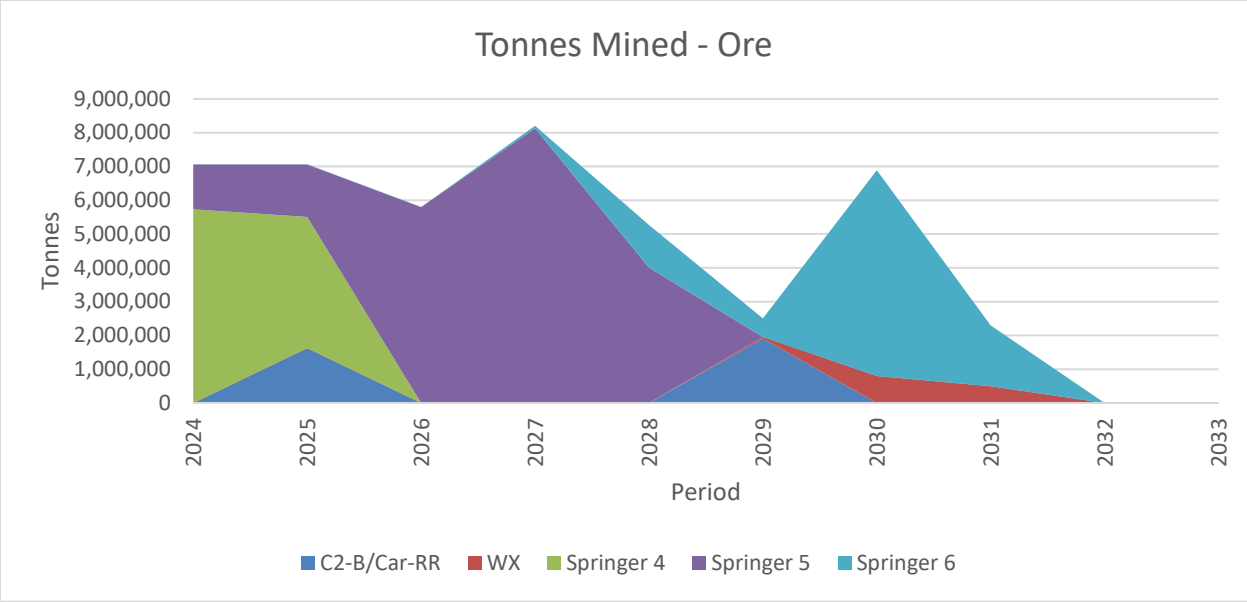

Figure 3.3-3: LoM Ore Mined (t)

Table 3.3-3: LoM Mill Feed by Source (t)

	Plant Feed By Source								
	C2-B/Car-RR	WX	Springer 4	Springer 5	Springer 6	UG/PAG RH	Tailings/ BZ OP	STKPL	Total
2024			5,733,351	1,326,649				240,000	7,300,000
2025	1,626,030		3,883,659	1,550,312				240,000	7,300,000
2026				5,795,978				1,504,022	7,300,000
2027				7,018,688	41,312			240,000	7,300,000
2028				4,013,289	1,258,489			2,028,222	7,300,000
2029	1,908,094	48,935			550,232			4,792,738	7,300,000
2030		802,009			6,083,558			414,434	7,300,000
2031		149,267			1,419,100			38,911	1,607,278
2032									
2033									

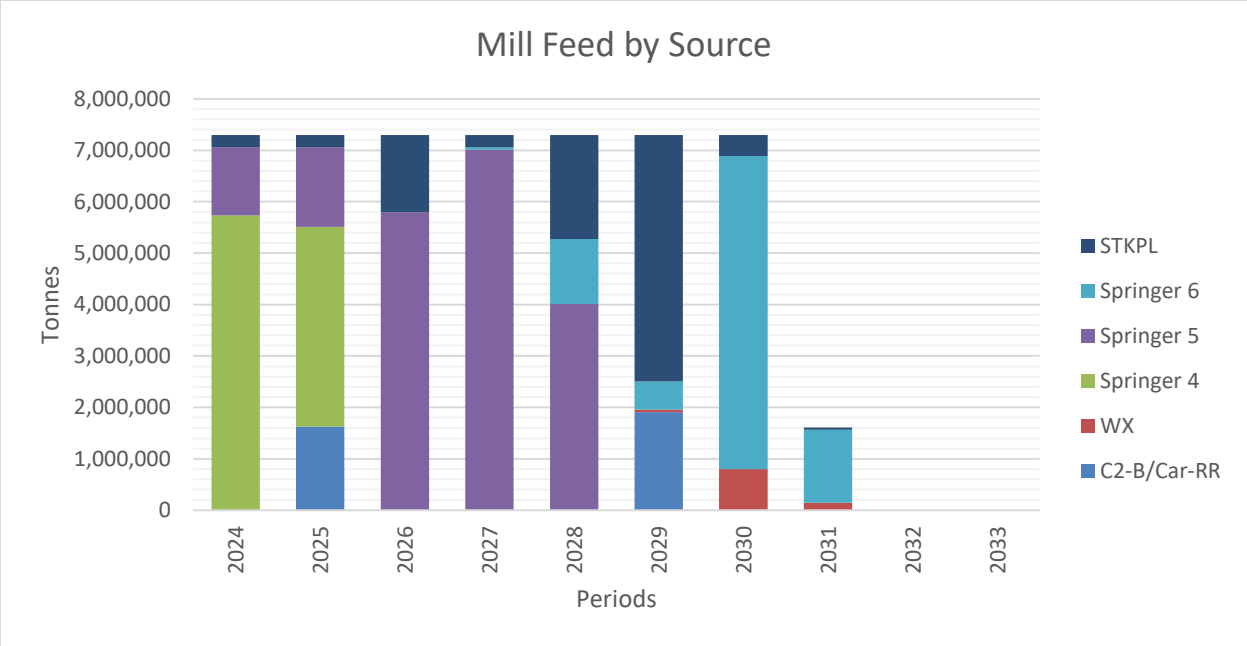

Figure 3.3-4: LoM Mill Feed by Source

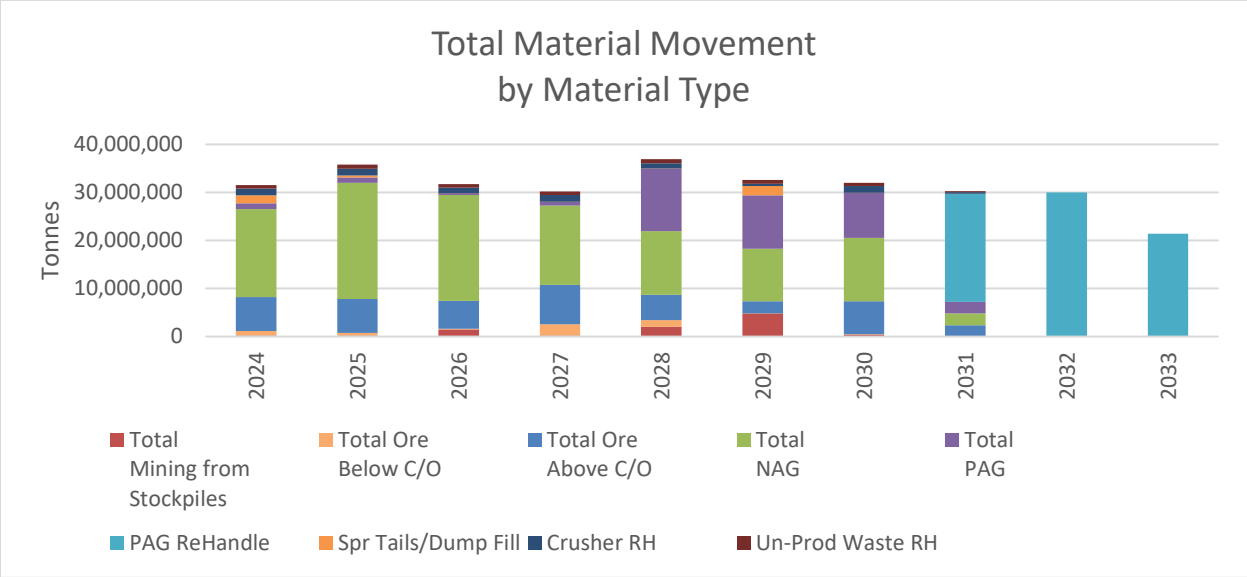

Figure 3.3-5: LoM Total Material Moved (t)

Below is a table of the development dates for each phase of the LoM (Table 3.3-4).

Table 3.3-4: Mine Development Schedule

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Springer 4										
Springer 5										
C2-B/Car-RR										
Springer 6										
WX										
PAH RH										

3.3.2 Surface Disturbances

The development of Springer Expansion pit will require little stripping or preparation as the area has been previously disturbed mining the Bell, C2 and Cariboo pits. Table 3.3-5 provides an inventory of areas disturbed to date, and projection of the land to be disturbed up to the projected end of mine life.

Table 3.3-5: Area Disturbance

Area	Existing Area (ha)	Closure Area (if changed) (ha)	Reclaimed Area (ha)	Lake Area (ha)	Reclamation Area (ha)
Dumps					
Bell Dump	59.12	-	30.58	-	28.54
Boundary Dump	4.84	-	4.7	-	0.14
East RDS	50.95	-	6.37	-	44.58
Highway to Heaven	16.24	-	9.47	-	6.77
NEZ Dump	22.9	-	5.13	-	17.77
North Bell Dump	62.08	-	26.97	-	34.73
SERDS	108.5	***117.69***	-	-	117.69
Temporary NW PAG Stockpile	81.13	***82.55***	-	-	82.55
Total	**405.76**	**200.24**	**83.22**	**0**	**332.77**
Pits					
Boundary Pit	12.1	***19.21***	-	2.74	16.47
~~C2 Pit (Buried)~~	-	-	-	-	-
~~Cariboo Pit (Buried)~~	-	-	-	-	-
~~Pond Zone Pit Buried)~~	-	-	-	-	-
TSF Quarry	11.04	-	-	-	11.04
~~SEZ Pit (Buried)~~	-	-	-	-	-
Cariboo-Springer Pit	133.84	***162.14***	-	49.7	112.44
Wight Pit	38.7		-	14.61	24.09
Total	**195.68**	**181.35**	**0**	**67.05**	**164.04**
Stockpiles					
#1 Stockpile	10.91	***10.58***	-	-	10.58
Biosolids	2.84	-	-	-	2.84
High Ox Stockpile	10.23	-	-	-	10.23
Mount Polley Soil	4.06	-	-	-	4.06
NEZ Soil	9.41	-	-	-	9.41
Cariboo Ore Stockpile	8.83	-	-	-	8.83
Pond Zone	2.83	-	-	-	2.83
SERDS Soil Stockpile	11.66	***10.97***	-	-	10.97
Tailings Soil	2.95	-	-	-	2.95
Total	**63.72**	**21.55**	**0**	**0**	**62.7**
Roads					
Boundary/Wight Pit Connector Road	1.67	-	-	-	1.67
Crusher Road	2.29	-	-	-	2.29
Mill/TSF Connector Road	17.27	-	-	-	17.27
New Access Road	26.9	-	-	-	26.9
Old Tailings Haul Road	12.35	-	-	-	12.35
Old Wraparound Road	11	-	-	-	11
Ore Switchback Road	12.12	-	-	-	12.12
Polley Lake Access Road	0.72	-	-	-	0.72
West Haul Road	60.73	***104.81***	1.81	-	103
Wight Pit Haul Road	14.33	-	-	-	14.33
Wight Pit/Tailings Road	17.37	-	-	-	17.37
Total	**176.75**	**104.81**	**1.81**	**0**	**219.02**
TSF					
Corner 4 to Corner 5	11.34	-	-	-	11.34
Corner 4 to Corner 5 Light Duty Access Road	6.31	-	-	-	6.31
East Till Borrow	12.81	-	-	-	12.81
Hazeltine Discharge Pipe Grade	2.92	-	-	-	2.92
Main Embankment	30.36	-	-	-	30.36
Perimeter Embankment	46.93	-	-	-	44.61
South Embankment	9.17	-	-	-	9.17
Southeast Till Borrow	26.27	-	23.95	-	2–32
TSF - South and Main Ponds	9.4	-	-	-	–.4
TSF - Southwest Pond	3.83	-	-	-	3.83
Tailings Access Road Till Borrow	3.891	3.981	-	-	-
TSF Surface	214.28	-	-	32.14	182.14
Total	**377.511**	**3.981**	**23.95**	**32.14**	**315.21**
Miscellaneous					
Geology Area	2.75	-	-	-	2.75
Helipad	3.13	-	1.53	-	1.6
Hydro Line	3.21	-	-	-	3.21
Long Ditch	7.94	-	-	-	7.94
Mill Area	20.19	-	-	-	20.19
Old Orica Sites	1.79	***0.81***	-	-	0.81
South SERDS Ditch	2.65	***2.21***	-	-	2.21
Warehouse Area	13.64	-	-	-	13.64
Constructed Wetland Treatment System	1.05	***0.55***	-	-	0.55
West Ditch	11.52	-	-	-	11.52
Total	**67.87**	**3.57**	**1.53**	**0**	**64.42**
Total Disturbed Area:	**1,287.29**	**515.50**	**110.51**	**99.19**	**1,158.16**

All water flow interacting with mine activities will utilize existing water management infrastructure. Currently, all mine water is collected in existing ditch systems, and so new construction will require catchment of only additional water as created by the proposed work (Figure 3.3-6).

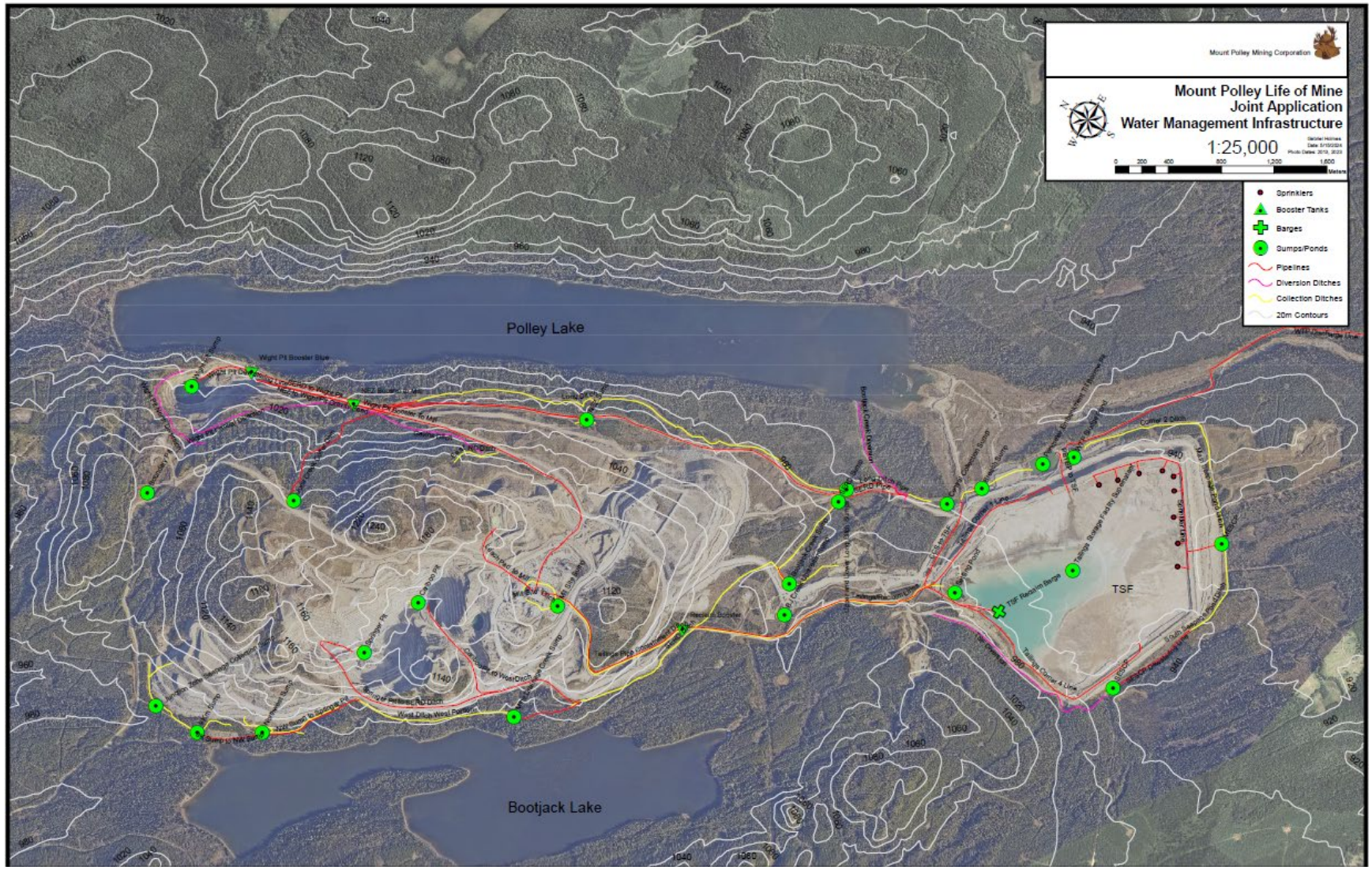

Figure 3.3-6: Water Management Infrastructure

The Springer Pit is currently mined to Phase 4 at a depth of 928m from surface. Dewatering from the Springer Pit will require establishing temporary sumps in the mine working usually at the lowest working bench. Electric or diesel pumps will convey water to a large sump located in the Cariboo pit. The Cariboo Pit will be pumped to the West collection ditch and then to the Perimeter Embankment Till Borrow Pond which acts as an influent pond for the WTP.

All roads are designed, constructed and maintained in accordance with the *Mines Act*. Haulage roads are designed with a 33-meter width plus 3 meters for berm width to provide for two-way traffic, and both internal pit roads and haul roads have a maximum grade of 10%. All existing traffic control plans satisfy EMLI requirements, and construction and operation of all new roads will adhere to existing policy.

Haul road construction is designed to avoid (or minimize where possible) the potential mobilization and erosion of sediment with potential to enter into water bodies. Where avoidance is not possible, mitigation measures are adopted to reduce and prevent impacts to fish and fish habitat. The projected timing of construction projects will be reviewed to reduce potential downstream effects. For further detail, see Section 9.2: Erosion Prevention and Sediment Control Plan.

3.3.2.1 Springer Expansion (LoM)

The Springer Expansion pushes back the extents of the Phase 4 Springer Pit and deepens it. Additionally, two starter pits (WX and C2) will also be deepened in the later years of the LoM. The WX and C2 pits will follow many of the same design principles as already existing in operating pits at Mount Polley Mine. Modeling was done using the Lerch-Grossman pit optimization method, with Table 3.3-6 describing parameters used in design of the pits.

Table 3.3-6: Open Pit Design Parameters

Design Parameter	Value
Bench Operating Height	10 or 12 metres
Interberm Height	24 metres
Bench Face Angle	65 degrees
Safety Berm	8.5 metres
Inter-ramp Wall Angle	42-46 degrees
Haul Road Internal Max. Grade	10%
Haul Road External Grade	7%
Haul Road Double Lane Width	27 metres
Swell Factor	33%
RDS Angle of Repose	37 degrees
RDS Angle of Reslope	2:1 (H:V)

Ten metre (Boundary zone) and 12-metre (C2 zone) bench heights were chosen after considering ore grade control requirements, blast energy distribution using 9 7/8” blast holes, and muck pile height using P&H 2100 shovels and Caterpillar 992 loaders.

The Springer Expansion pit which includes Phase 5, Phase 6, C2, WX will supplement ore production into the year 2031.

Phase 5 involves a pushback of the east wall near the backfilled Bell pit. The pit is roughly 1446m long, 898m wide, a maximum of 396m deep. Access to the pit will be via temporary Northwest Potentially Acid Generating (NW PAG) Stockpile and off the Bootjack Forest Service Road. The pit contains approximately 98,700,000t of material, 19.7 million of which is projected to be ore. Majority of the waste material is expected to be NAG, and similar in nature to material mined from the Springer Pit. Phase 5 will be completed in 2028.

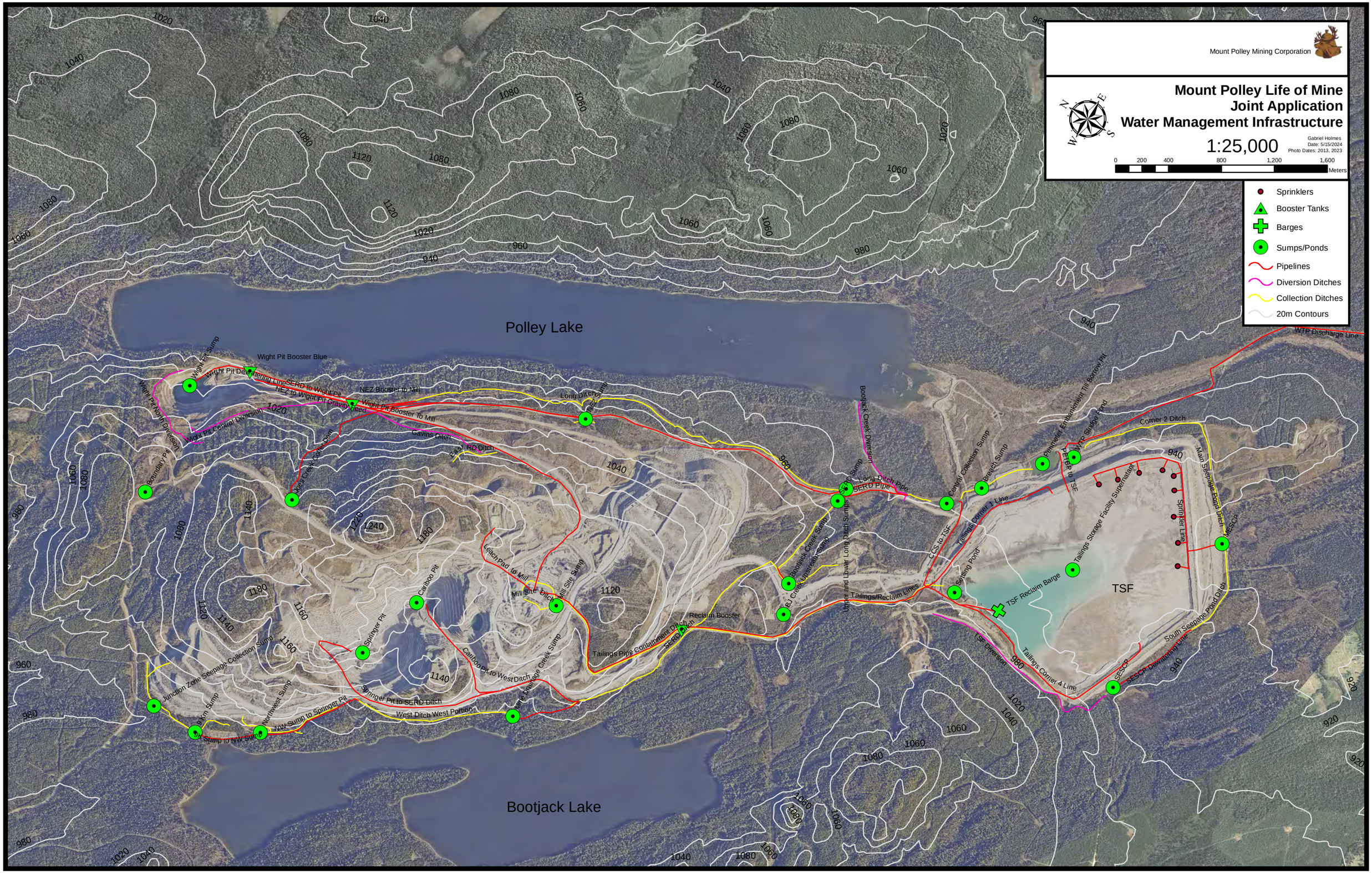

Mount Polley Mining Corporation
Mount Polley Life of Mine
Joint Application
Water Management Infrastructure
1:25,000
Gabriel Holmes
Date: 5/15/2024
Photo Dates: 2013, 2023
0 200 400 800 1,200 1,600
Meters
Sprinklers
Booster Tanks
Barges
Sumps/Ponds
Pipelines
Diversion Ditches
Collection Ditches
20m Contours
Polley Lake
Bootjack Lake
TSF
Wight Pit Sump
Wight Pit Booster Blue
Wight Pit Dewatering Line
SERD to Wight Pit
NEZ to Wight Pit Gravity Feed
NEZ Booster to Mill
Wight Pit Booster To Mill
Wight Pit North Diversion
Wight Pit Central Diversion
Boundary Pit
Joes Creek Coffer Dam
Gavins Ditch
East RD Ditch
Long Ditch
NEZ Sump
Bootjack Creek Diversion
SERD Sump
Long Ditch Pipe
SERD Pipe
Central Collection Sump
Breach Sump
Perimeter Embankment Till Borrow Pit
WTP Sludge Pond
PETBP to TSF
Corner 2 Ditch
WTP Discharge Line
Main Seepage Pond Ditch
MESCP
Sprinkler Line
Tailings Storage Facility Supernatant
Tailings Corner 1 Line
CCS to TSF
Settling Pond
TSF Reclaim Barge
Tailings/Reclaim Lines
Upper and Lower Long Ditch Sumps
Bootjack Creek Sump
BJ Creek Upstream Sump
Reclaim Booster
Tailings Pipe Containment Ditch
SERD Ditch
Leach Pad to Mill
Mill Site Ditch
Mill Site Sump
Cariboo Pit
Springer Pit
Cariboo Pit to West Ditch
Mine Drainage Creek Sump
Springer Pit to SERD Ditch
West Ditch West Portion
NW Sump to Springer Pit
Northwest Sump
9 Km Sump
9K Sump to NW Sump
Junction Zone Seepage Collection Sump
TSF Diversion
Tailings Corner 4 Line
SESCP
SESCP Dewatering Line
South Seepage Pond Ditch

Phase 6 involves deepening the existing Springer Pit. The pit is roughly 842m long, 648m wide, a maximum of 348m deep. Access to the pit will be via the main haul road. The pit contains approximately 70,200,000t of material, 9.3 million of which is projected to be ore. The majority of the waste material is expected to be NAG, and similar in nature to material mined from the Springer Pit. Phase 6 will be completed in 2031.

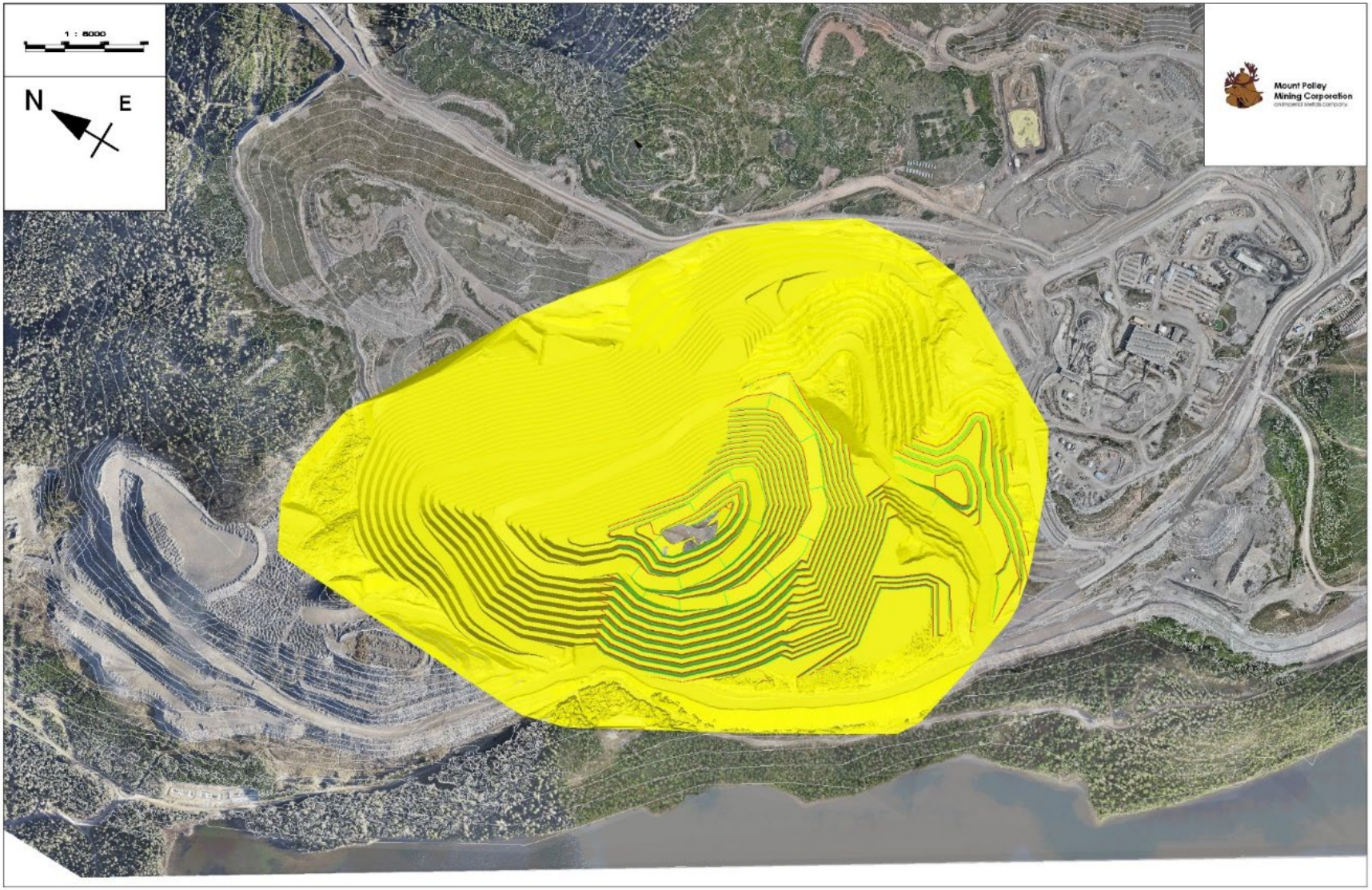

Figure 3.3-8: Plan View of Phase 6

C2 is an existing satellite pit located between the current Springer Pit and the crusher building, adjacent to the former Cariboo pit and will commence mining in 2025 and 2029. Total material movement will be 9,200,000t. The pit is roughly 516m long, 216m wide, a maximum of 120m deep. Access to the pit will be via benches which daylight and connect directly to the Springer/Cariboo haul road. The pit contains approximately 9,200,000t of material, 3.5 million of which is projected to be ore. The majority of the waste material is expected to be NAG, and similar in nature to material mined from the Cariboo pit. Run-off will be within the watershed of the west-ditch.



Figure 3.3-9: Plan View of C2

WX is the final phase in the Springer Expansion and commences in 2029. WX is a satellite pit adjacent to the former Cariboo pit and contains 16,400,000t, 1.0 million of which is projected to be ore. The phase will deepen the existing WX pit and will be completed in 2031. The majority of the waste material is expected to be NAG, and similar in nature to material mined from the Cariboo pit.

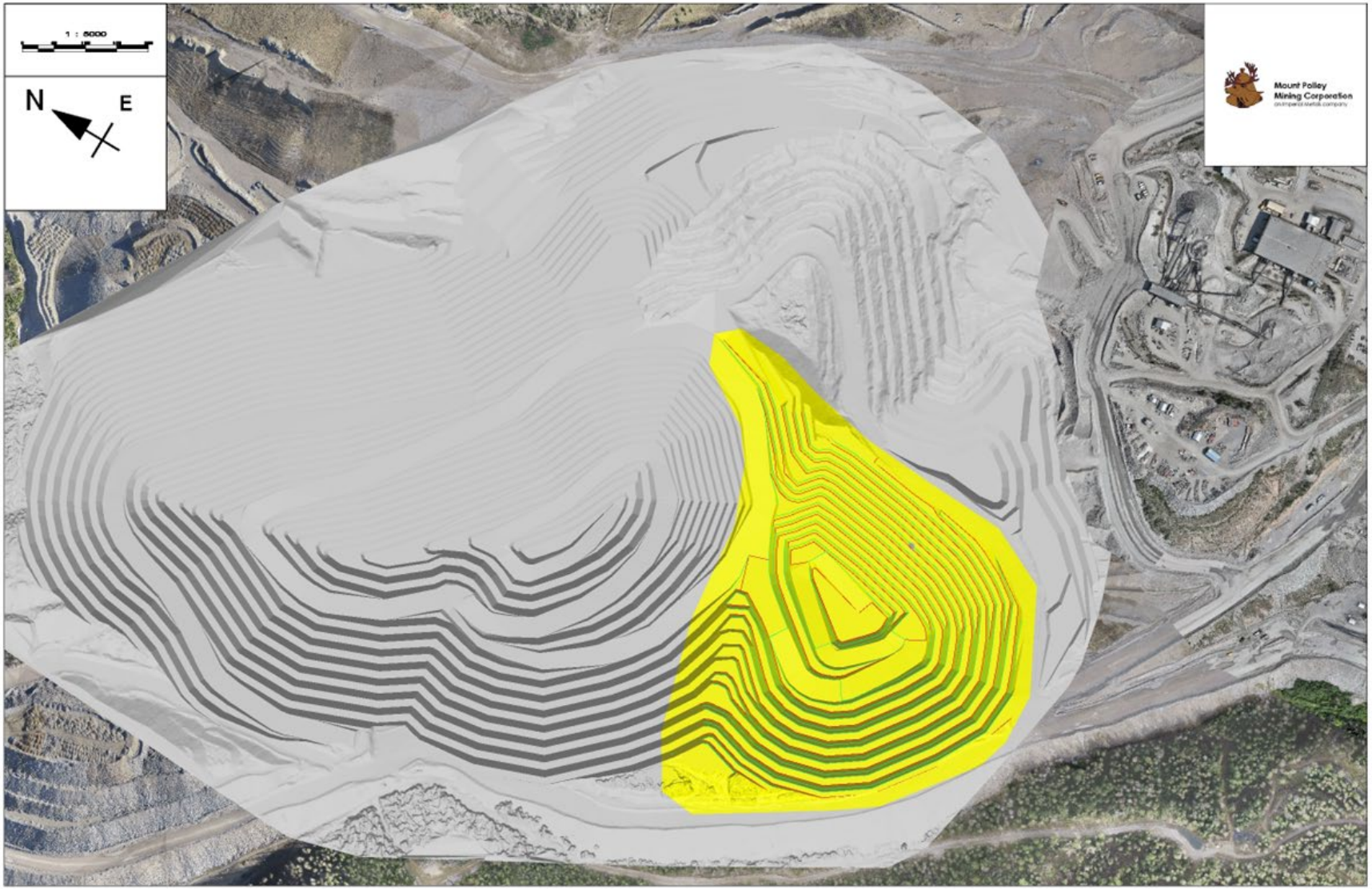

Figure 3.3-10: Plan View of WX

3.3.3 Waste Rock

Additional PAG and NAG material mined as a result of the development of the Springer Expansion will be placed in two locations:

- Temporary NW PAG Stockpile
- Southeast Rock Disposal Site

Dumps will be constructed by end-dumping in 20m lifts from the haulage road at an overall slope of 2:1 (to minimize the need for re-sloping and assist in reclamation work). Quantities of NAG and PAG waste are included in Table 3.3-7.

Table 3.3-7: Storage Capacity of Facilities

Phase	Material (Tonnes)	
	NAG	PAG
C2-B/Car-RR	3,063,732	378,681
WX	10,208,858	5,228,244
Springer 5	76,491,195	2,510,716
Springer 6	29,798,801	31,026,041
Totals	119,562,586	39,143,682

Storage and material capacities of each of the project components is as outlined in Table 3.3-8.

Table 3.3-8: Storage Capacity of Facilities

Component	Material (t)		
	NAG	PAG	Total
SERDS	152,169,152	-	152,169,152
Nag Pad for West Pag	17,612	-	17,612
Pag for West Pag	-	12,442,468	12,442,468

3.3.4 Southeast Rock Disposal Site Construction

Development of the Springer Expansion pits will require additional rock disposal capacity of approximately 121,000,000t of NAG waste rock including 1,300,000t which is authorized in the M-200 permit as Phase 4 mining. NAG material will be stored within the SERDS or existing pits.

A foundation analysis was conducted in 2022 encompassing 28 test pits and drill holes to ensure adequate information to used to design and update a stability analysis of the proposed rock disposal site.

Dumps will be constructed by end-dumping in 20m lifts from the haulage road at an overall slope of 2:1 to minimize the need for re-sloping and assist in reclamation work. Further design description is as included in Section 3.3.3: Waste Rock.

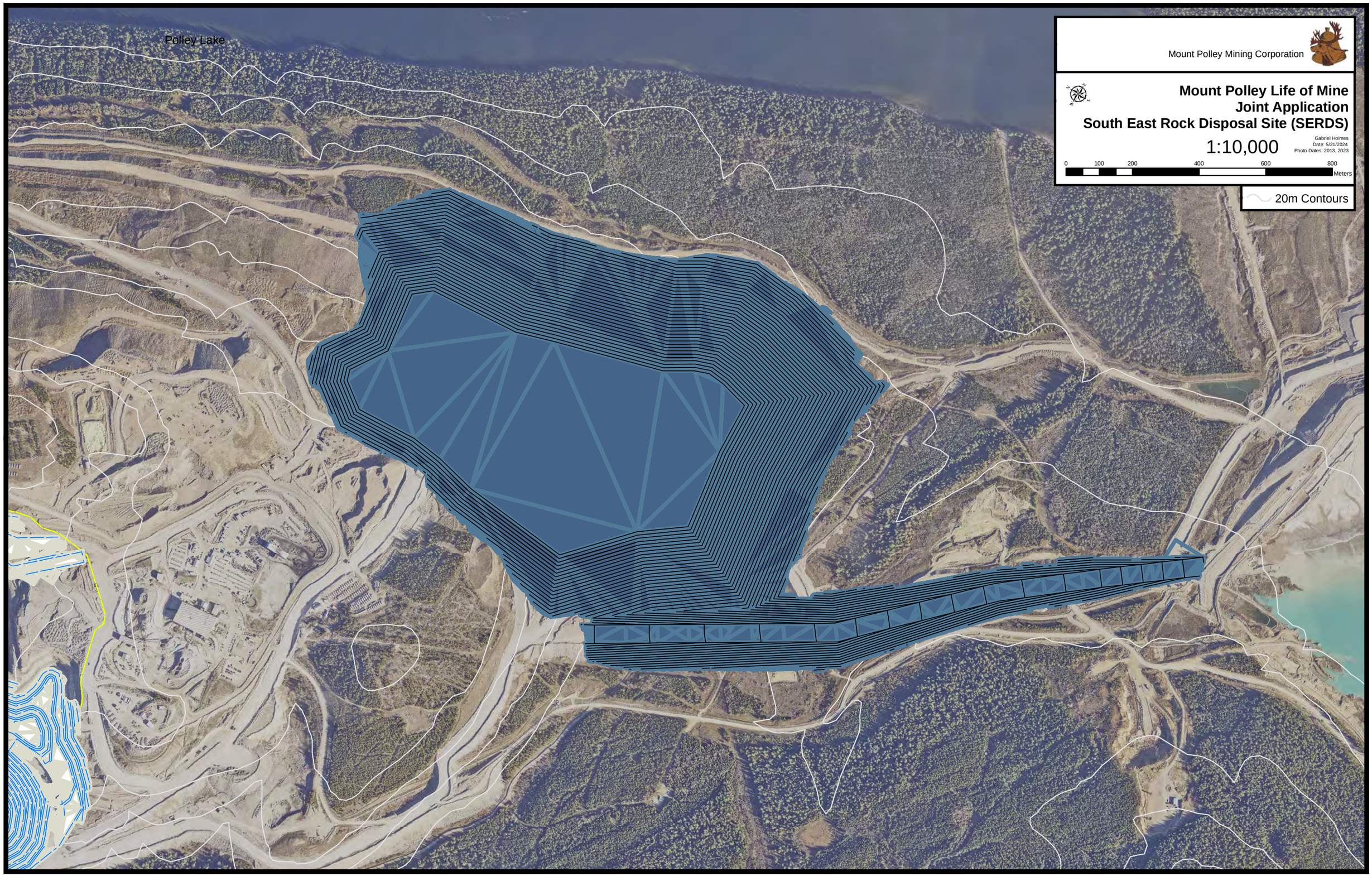
Polley Lake
Mount Polley Mining Corporation
Mount Polley Life of Mine
Joint Application
South East Rock Disposal Site (SERDS)
1:10,000
Gabriel Holmes
Date: 5/21/2024
Photo Dates: 2013, 2023
0
100
200
400
600
800
Meters
20m Contours

Northwest PAG Stockpile (NW PAG)

The PAG will be hauled to the temporary Northwest PAG Stockpile for short term storage before it is permanently stored in the Springer Pit under subaqueous conditions at the end of mine life. The total amount of PAG material from the Springer Expansion will be 74,000,00t.

Polley Lake

Bootjack Lake

Mount Polley Mining Corporation

Mount Polley Life of Mine
Joint Application
Temporary NW PAG Stockpile

1:5,000

Gabriel Holmes
Date: 5/21/2024
Photo Dates: 2013, 2023

0 50 100 200 300 400
Meters

20m Contours

3.4 Detailed Five Year Mine Plan

This section is not required as part of the joint application per the information requirements table.

3.5 Mine Facility Designs and Development

3.5.1 Open Pits

A detailed open pit design report is being completed by WSP and will be submitted as available. The open pit design report will include a review of the proposed ultimate pit (SP-6-RR) detailing previous geotechnical information collected from site to formulate a geotechnical model, a slope stability review, and design recommendations for the open pit slopes.

3.5.2 Underground Workings

This section is not required as part of the joint application per the information requirements table.

3.5.3 Processing Plant (Mill) and Associated Facilities

This section is not required as part of the joint application per the information requirements table.

3.5.4 Tailings Storage Facilities and Associated Infrastructure

3.5.4.1 SERDS

The SERDS is permitted as a tailings storage facility. The amendment proposes to revise the classification from a tailings storage facility to a rock disposal facility.

Rationale for the change include:

1) The SERDS tailings co-disposal facility and SERDS LOM do not store water. Tailings are encapsulated and buttressed by waste rock, to limit the potential for loss in the event of a slope instability failure. This relates to condition in permit M-200 B. 5. (c) (iii) is “The Permittee must submit an assessment report by March 31, 2025, to the Chief Permitting Officer. The Permittee must ensure the report includes an assessment report of the potential of the SERDS Co-disposal Facility contents to flow and the reliance on a barrier structure to prevent an uncontrolled release of contents post-closure.”

2) Failure modes assessments for the SERDS (permitted as a tailings facility) do not indicate the release of tailings. Instead, run-out failures involving waste rock are the potential main failure mode. Slip surfaces that reach the tailings generally had higher values of factors of safety than failure modes with slip surfaces that do not reach the tailings. Analyses consider post earthquake conditions of tailings with the lowest value of undrained shear strength ratio from literature back-analysis of tailings failures. Placement of additional waste rock as part of the SERDS LOM will buttress and ultimately encapsulate the portion containing tailings.

A detailed design report for the SERDS Life of Mine design is provided. Because the SERDS does not store a water pond, slips surfaces for critical slope instability failure modes do not reach the tailings, and will not result in the loss of tailings, the SERDS LOM is designed to be operated and closed as a waste rock storage facility.

Future construction of the TAR will impact surface water conveyance channels and culverts in the area of the TAR. The SERDS ditch (downstream continuation from West Ditch) and the Orica Ditch both cross the existing road between the SERDS and the TSF. Currently culverts exist beneath the existing road that allow the ditches to cross the road. When the TAR is constructed, it will be constructed overtop of this existing road and the ditch crossings will require modification to allow the ditches to cross the future TAR, either through culvert design appropriate for the TAR conditions, or re-routing of ditches as required. Design for these ditch crossing modifications are not included in this current application but will be included within the water management infrastructure design to support the upcoming application of the TSF crest raise to 987 m.

3.5.4.2 TSF Interim Raise to 974 m

The TSF is located approximately 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length (Drawing 02, Appendix A of the design report in Appendix 1-3. The embankment is subdivided into three sections: the Main Embankment, Perimeter Embankment, and South Embankment (Drawing 03, Appendix A of the design report in Appendix 1-3). The embankment has incorporated a staged expansion design utilizing modified centreline and centreline construction methods. The general zoning of the TSF embankment consists of the following:

- upstream fill comprising tailings sand and select fill (e.g., rockfill)
- low-permeability till core
- filter zone
- transition zone
- rockfill

Rockfill forms the downstream wedge of the embankments and the downstream buttress along the Perimeter and Main embankments.

A detailed design report for the TSF interim raise to elevation 974 m is included in Appendix 1-3.

3.5.5 Waste Rock Dumps

A detailed geotechnical assessment is included in Appendix 3-2. A test pit program was completed in September 2023 along the toe of the NW PAG Dump and a drilling program is proposed to be executed. Once the drilling program is complete, laboratory testing will be conducted and a geotechnical assessment including (but not limited to) slope stability analyses demonstrating compliance with target factors of safety and run out analyses will be completed.

NAG waste rock will be stored in the SERDS LoM and associated tailings access road (TAR). The foundations of the SERDS LoM and TAR have been characterized by geotechnical investigation. The design considers run-out failure modes that involve the foundation. The SERDS LoM design and assessments are presented in a detailed design report.

3.5.6 Water Management Structures

For a description of the water management infrastructure please refer to the 2023 WMP provided in Appendix 9-4.

3.5.7 Ore, Overburden, Soil and Construction Stockpiles

A detailed open pit design and waste dump report is included in Appendix 3-3.

3.5.8 Mine Access and Mine Haulage Roads

Existing road access from Williams Lake is 15km southeast on Highway 97 to 150 Mile House, 76km north on the Likely Highway to Morehead Lake, and 12km east on the unpaved Bootjack Forest Service Road to the mine site. Williams Lake is approximately 75 minutes from the mine.

Proposed work as included in the Application will not affect existing access and transportation for mine personnel or mine supplies and products. Road access restrictions, radio frequency use, and land tenure are all currently approved by EMLI, and will remain so as new work will in no way affect them.

All roads are designed, constructed and maintained in accordance with the Mines Act. Haulage roads are designed with a 33-meter width plus 3 meters for berm width to provide for two-way traffic, and both internal pit roads and haul roads have a maximum grade of 10%. All existing traffic control plans satisfy EMLI requirements, and construction and operation of all new roads will adhere to existing policy.

Haul road construction is designed to avoid (or minimize where possible) the potential mobilization and erosion of sediment with potential to enter into water bodies. Where avoidance is not possible, mitigation measures are adopted to reduce and prevent impacts to fish and fish habitat. The projected timing of construction projects will be reviewed to reduce potential downstream effects.

3.5.9 Power Supply and Distribution Infrastructure

The Mount Polley Mine owns a main electrical substation (MTP) located outside the site concentrator and administration building. The substation connects to the BC Hydro 66 kV transmission network and is located 74 km away from BC Hydro's 230 kV/66 kV Soda Creek substation. The peak power demand remains at 30 MW (0.95 power factor lagging) at the MTP 66 kV bus.

The site loads are served by step-down transformers within the MTP for distribution to mine operations at 13.8 kV via site powerlines to in-pit mobile substations and to the concentrator Motor Control Units at 4.16 kV. The voltage is stepped down further to power support equipment and administration facilities. The mill programmable logic controller was modernized in 2022 prior to restart of operations after a 3-year Care and Maintenance period.

3.5.10 Explosives Storage Facilities

A licensed explosives contractor, presently Orica Canada Inc. (Orica), has been retained to supply explosive products. Two licensed storage magazines, an 8'x16' powder magazine and an 8'x12' detonator magazine provide storage for blasting accessories. Both magazines have sufficient storage capacity for future blasting activities. Bulk explosives products are stored in on-site facilities located in the Old NAG Quarry under the supervision of Orica. The emulsion is delivered from a manufacturing plant located in the region.

Orica delivers bulk products to the blasthole in Mobile Manufacturing Units (MMU) trucks. The blastholes are charged with Orica products by MPMC employed Blasters. Electronic detonators are used for blasthole initiation under the supervision of MPMC Blasters and Shiftbosses.

3.5.11 Ancillary Facilities and Support Infrastructure

The existing ancillary facilities and support infrastructure will service the proposed extension to the life-of-mine. The mining and milling rates are planned not to exceed existing permit authorizations. The shops, warehouse, laboratories, fueling stations, offices, lunchrooms, and sanitary conveniences will remain as currently located on the Mine Site.

3.6 References

BC Hydro, 2023, Mount Polley (MTP) Load Increase SIS (Part 1) Load Interconnection System Impact Study 2023 Jan 05

4 RECLAMATION AND CLOSURE PLAN

The Mount Polley Mine contains two main pits, Cariboo Pit and Springer Pit, which abut one another. A small saddle is the sole boundary between the two pits which are collectively referred to as the Cariboo-Springer Pit. MPMC proposes to extend their life of mine until approximately 2031 and are applying for an expansion of the Cariboo-Springer Pit's footprint, referred to as the Springer Expansion. In 2022, MPMC updated their 5-Year MPRP (MPMC 2022a), as required by (EMLI).

This reclamation and closure plan (RCP) is specific to the proposed Springer Expansion. It is designed to align with the existing 5-Year (Appendix 4-1A; MPMC 2022a) and is tailored to specifically address the extent of the proposed Springer Expansion. Major components, such as targeted end land use (ELU) objectives and reclamation approaches have generally not changed from what was presented in the existing MPRP (Appendix 4-1A). The addition of the expanded Springer Pit will result in an extended LoM, which is now expected to mine until 2031 and operate until 2033 to rehandle PAG material back into the expanded Springer Pit. Figure 1.3-6 provides an overview of the Mount Polley Mine in its current configuration. The proposed Springer Expansion includes changes to the following components:

- Expansion of the Springer Pit footprint (Figure 3.3-8)
- Raising of the TSF on an interim basis to 974 and then ultimately to 987 metres above sea level (masl);
- Expansion of the Southeast Rock Disposal (Figure 3.3-11) to accommodate co-disposal of waste rock from the Springer Expansion and additional tailings associated with the milling of the ore

No changes to post-closure pit lake elevations are predicted due to the porous nature of rock above 1050 masl (current pit lake elevation design) and the invert of the Springer Expansion spillway (1050.5 masl).

The RCP presented within this section is conceptual and designed to be integrated into future site wide 5-Year MPRPs. Further, the RCP is designed to evolve over time and to be informed by updates to reclamation research, changes in mine plans, advances in technology, and input from parties of interest (e.g., First Nations, communities of interest, and regulators).

4.1 Definitions

To have a clear understanding of MPMC's closure vision, key definitions are provided below:

- **Life of Mine (LoM)**: The operating period of a mine, where ore is mined and milled, and waste rock and tailings are generated. This period is determined by the mine plan.
- **Active Closure:** The timeframe immediately following operations. During this stage, activities to construct the post-closure landscape and associated ecosystems are underway. Infrastructure is removed, contaminated areas remediated, major landscape features are established (via recontouring), coversoil is placed, and prescribed species are planted. This period is currently expected to last 10 years.
- **Post-Closure:** The timeframe immediately after active closure. During this stage, desired post-closure landscape and plant communities have been established, and the previously disturbed areas of the mine are beginning to recover. Efforts to encourage recovery (e.g., monitoring and maintenance) are conducted with decreasing intensity as time progresses and ecosystem trajectory becomes more certain.
- **Closure Vison:** the amalgamation of several closure objectives into one comprehensive vision. A mission statement that guides all closure activity. An example closure vision statement would be: "*The Cariboo-Springer Pit is geotechnically and geochemically stable, and supports wildlife habitat and traditional land uses"*.
- **Closure Objective:** an objective that must be met to realize the target ELU for the landscape. These are generally broad statements that algin with the overall closure vision of the landscape. Currently, MPMC's closure vision is: "…*to return all areas that have been disturbed by mining operations (except pit walls) to equivalent or greater land capability than existed prior to mining on an average property basis"* (MPMC 2022a).
- **End Land Use:** The desired post-closure use of the reclaimed landscape. A landscape, or portion of a landscape can support multiple ELUs, depending on what they are, and ELUs are expected to change over time. ELUs can include social (e.g., traditional use), economic (e.g., forestry, commercial, power) or biodiversity (e.g., wildlife habitat) orientated land uses. To achieve these ELUs, ELU objectives must be met.

4.2 Closure Objectives

To achieve successful closure, a mine must meet its closure objectives. MPMC's closure objectives are outlined in Table 4.2-1 and derived from MPMC (2022a) in Appendix 4-1A.

Table 4.2-1: Mount Polley Closure Objectives

Closure Objectives	
Landforms have geotechnical stability	Terrestrial and aquatic vegetation common to the surrounding area is established
Landscape enhancements are appropriate to the ecosystem and increase the diversity	The reclaimed landscape provides commercial forest (where designated as an ELU)
The Mine Site's water balance meets the needs of the post-closure landscape	The reclaimed landscape provides for biodiversity
Reclamation materials are placed appropriate to the landform	Traditional ecological values are realized

ELU = End Land Use.

To attain these closure objectives (Table 4.2-1), components of the Mine Site will be broken into master areas (e.g., reclamation polygons). Each master area will receive its own reclamation prescription and encompass its own unique challenges during closure. A comprehensive breakdown of MPMC's closure strategy is available in Appendix 4-1A (MPMC 2022a), while, Section 4.3 of this document provides reclamation approaches intended to meet MPMC's ELUs and ecosystem targets for the Springer Expansion, which are outlined in Section 4.2.1.

4.2.1 Projected End Land Uses and Ecosystems

Prior to the development of the Mine Site, the key land uses were commercial forestry and wildlife habitat (MPMC 2022a). Portions of the Mine Site footprint were also used for cattle grazing, recreational activities, hunting, and trapping. Appendix C of MPMC (2022a; Appendix 4-1A) provides and overview of the valued ecosystem components identified through out the environmental assessment process.

The targeted post-closure ecosystems for Springer Expansion are tied directly to existing target ELUs and post-closure ecosystems (Figure 4.2-1; derived from MPMC 2022a), and align closely with pre-mining land uses and ecosystems (Table 4.2-3). Target post-closure ecosystems for SERDs are provided in Figure 4.2-2. Most of the ELU targets envisioned for the Springer Expansion consist of wildlife habitat, but traditional and recreational uses are also considered. The ELU Plan for the Springer Expansion (Table 4.2-2) considers ELUs across a range of structural stages and ties each ELU to a natural ecosystem equivalent. Each ecosystem can support a variety of ELUs at any given time, and these ELUs are expected to evolve as reclaimed ecosystems mature. the target post-closure ecosystems and associated ELUs aim to support MPMC's closure vision of returning the post-closure landscape to an equivalent or greater capability compared to pre-development conditions.

Table 4.2-2: End Land Uses by Site Series and Structural Stage for the Springer Expansion Area

Ecosystem	TEM/BEC Site Series	Structural Stage 1 to 3 (Sparse – Shrub/Herb)	Structural Stage 4 to 5 (Young Forest)	Structural Stage 6 (Mature Forest)	Structural Stage 7 (Old Growth Forest)
Dry Forest	ICHmk3_02 ICHmk3_03	Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Black Bear) Livestock Grazing	Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Lynx)	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent)	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat
Mesic Forest	ICHmk3_01 ICHmk3_04 ICHmk3_05	Recreation First Nation Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Black Bear) Livestock Grazing	Recreation First Nation Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Lynx)	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent)	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat
Wet Forest	ICHmk3_06	Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) High Biodiversity Value Rare and Listed Plant Habitat	Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Lynx) High Biodiversity Value Rare and Listed Plant Habitat	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat	Commercial Forestry Recreation First Nation Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat

Table 4.2-2: End Land Uses by Site Series and Structural Stage for the Springer Expansion Area

Ecosystem	TEM/BEC Site Series	Structural Stage 1 to 3 (Sparse – Shrub/Herb)	Structural Stage 4 to 5 (Young Forest)	Structural Stage 6 (Mature Forest)	Structural Stage 7 (Old Growth Forest)
Rocky Talus Cliffs	Rocky Outcrop	Recreation First Nation Cultural Use Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Escape Terrain) Rare and Listed Plant Habitat	n/a	n/a	n/a
Pond/Pit Lake	n/a	n/a	n/a	n/a	n/a

TEM = Terrestrial Ecosystem Mapping; BEC = Biogeoclimatic Ecosystem Classification; FN = First Nations; n/a = not applicable.

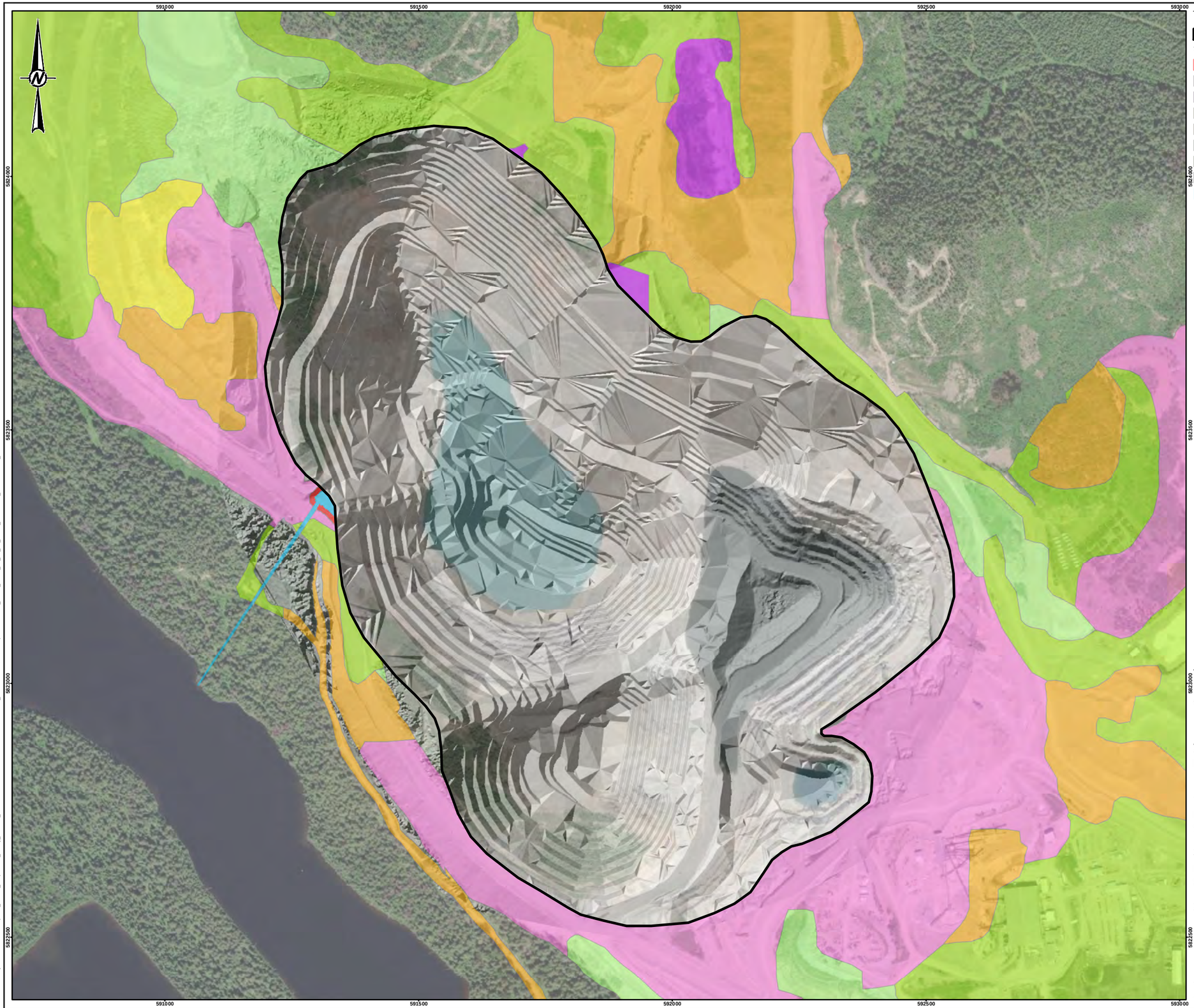

LEGEND

SPRINGER PIT EXPANSION

VEGETATION TYPE

- SNOWBERRY - RED-OSIER DOGWOOD FLOODPLAIN (ICHMK3_00)
- CWSXW - FALSEBOX - KNIGHT'S PLUME (ICHMK3_01)
- FDCW - WAVY-LEAVED MOSS (CHMK3_02)
- CWSXW - SOOPOLALLIE (ICHMK3_03)
- CWSXW - OAK FERN - CAT'S-TAIL MOSS (ICHMK3_04)
- SXWCW - OAK FERN (ICHMK3_05)
- CWHW - DEVIL'S CLUB - LADY FERN (ICHMK3_06)
- ROCKY OUTCROP
- POND / PIT LAKE

0 150 300

1:7,500 METRES

REFERENCE(S)

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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
POST-CLOSURE VEGETATION
SPRINGER PIT EXPANSION

CONSULTANT

YYYY-MM-DD	2023-11-29
DESIGNED	JL
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	CONTROL	REV.	FIGURE
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LEGEND

SERDS EXTENSION

VEGETATION TYPE

- SNOWBERRY - RED-OSIER DOGWOOD FLOODPLAIN (ICHMK3_00)
- CWSXW - FALSEBOX - KNIGHT'S PLUME (ICHMK3_01)
- FDCW - WAVY-LEAVED MOSS (CHMK3_02)
- CWSXW - SOOPOLALLIE (ICHMK3_03)
- CWSXW - OAK FERN - CAT'S-TAIL MOSS (ICHMK3_04)
- SXWCW - OAK FERN (ICHMK3_05)
- CWHW - DEVIL'S CLUB - LADY FERN (ICHMK3_06)
- CWSXW - DEVIL'S CLUB - HORSETAIL (ICHMK3_07)
- NON-FORESTED
- ROCKY OUTCROP
- POND / PIT LAKE

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1:12,000 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
POST-CLOSURE VEGETATION
SERDS EXTENSION

CONSULTANT

wsp

YYYY-MM-DD	2023-11-29
DESIGNED	JL
PREPARED	CDB
REVIEWED	DK
APPROVED	DK

PROJECT NO.	CONTROL	REV.	FIGURE
23590671	81100/81112	0	4.2-2

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Table 4.2-3 provides a breakdown of predicted changes from pre-disturbance to target post-closure ecosystems. Due the disturbance associated with surface mining, operators, such as MPMC, often face numerous challenges in re-establishing planned ELUs. Some of these challenges are presented in Table 4.2-4

Table 4.2-3: Predicted Change in Vegetation Site Series from Pre-disturbance to Post-Closure*

Site Series	Description Area [ha]	Pre-disturbance		Post-closure		Difference	
		Area [ha]	%	Area [ha]	%	Area [ha]	%
ICHmk3_00	Non-forested wetland	27	2	5	1	-22	-82
ICHmk3_01	*CwSxw - Falsebox - Knight's plume*	505	44	286	28	-260	-60
ICHmk3_02	FdCw - Wavy-leaved moss	1	0	30	3	29	2,900
ICHmk3_03	CwSxw - Soopolallie	51	4	4	0	-2	84
ICHmk3_04	CwSxw - Oak fern - Cat's-tail moss	116	10	96	9	-20	-17
ICHmk3_05	SxwCw - Oak fern	45	4	85	8	39	87
ICHmk3_06	CwHw - Devil's club - Lady fern	92	8	339	30	247	279
ICHmk3_07	CwSxw - Devil's club - Horsetail	31	3	11	1	-20	-65
Non-Forested	Grassland / Shrubland	4	0	106	9	102	2,550
Rocky Outcrop	Exposed Rocky Slopes	0	0	15	3	15	1,500
Water	Lakes and Rivers	<1	<1	50	9	50	5,000
Disturbed	Clearcuts / Burns / Development	284	25	0	0	-284	-100
	TOTAL	**1,156**	**100**	**1,026****	**100**	**-**	**-**

*= considers both the existing Mine Site and the Springer Expansion extents; ** = some portions of the Mine Site footprint will remain undisturbed, and therefore are not covered by post-closure ecosystem mapping. See 79 and Figure 4.2-2 for more information.

Table 4.2-4: Potential Challenges Associated with Post-Closure Landscape Establishment

Discipline	Issue	Impact on Successful Closure	Potential Contingencies
Geotechnical	▪ RDSs, Pit, TSF, or other components are physically unstable	▪ Negative impact on public safety ▪ Prevention of reclamation activities	▪ Erosion management ▪ Geomorphic design ▪ Bioengineering ▪ Buttressing with borrow material
Geochemical	▪ RDSs, Pits, or the TSF create ML/ARD issues	▪ Negative impact on public and environmental safety ▪ Risks to wildlife though metals uptake ▪ Risks to water quality	▪ Burial or submersion of ML/ARD material ▪ Water treatment
Soils	▪ Compacted soils ▪ Poor fertility profiles ▪ Shortage of coversoil ▪ Shortages of subsoil/till	▪ Poor plant establishment and survival ▪ Inadequate nutrient profile alters recovery trajectory, and ultimately ecosystem outcome ▪ Inadequate rooting depth leads to high mortality, tree throws	▪ Decompaction ▪ Application of soil amendments ▪ Borrowing from existing borrow areas for additional subsoil ▪ Mixing tailings with till

Table 4.2-4: Potential Challenges Associated with Post-Closure Landscape Establishment

Discipline	Issue	Impact on Successful Closure	Potential Contingencies
Vegetation	▪ Ecosystem trajectory does not match post-closure targets due to weeds ▪ High mortality of planted species	▪ Negative impact on land uses and habitat establishment ▪ Continued erosion risk	▪ Weed management (pulling, mowing, spraying) ▪ Infill planting ▪ Assessment and mitigation of growth limiting factors (e.g., soil chemistry)
Water	▪ Positive water balance ▪ Water quality does not meet Guidelines	▪ Risk of failure of water treatment or water management facilities ▪ Realized post-closure water discharge and quality do not meet projected models, yielding increased risk to humans and wildlife	▪ Activation of the Trigger Response Plan (see (MPMC 2018) ▪ Storage of excess contact water ▪ Enhanced water treatment

ML/ARD = metal leaching/acid rock drainage; RDS = rock disposal site; TSF = tailings storage facility; WQ = water quality.

The challenges outlined in Table 4.2-4 can result in failure to meet closure objectives and establish self-sustaining vegetation communities. To maximize the likelihood of successful reclamation, MPMC uses progressive reclamation, reclamation research, and reclamation monitoring to determine the real-time trajectory of the recovering landscape and ecosystems and the efficacy of proposed reclamation strategies. Deviation from the desired reclamation trajectories may trigger the contingencies outlined in Section 5.10 of Appendix 4-1A (MPMC 2022a) and associated adaptive management strategies. Contingency plans are found in the existing 5-Year MPRP, Appendix 4-1A (MPMC 2022a).

Plans for reclamation research and progressive reclamation can be found in Appendix 4-1A (MPMC 2022a), and will ultimately be used to test reclamation approaches (Section 4.3) and revegetation strategies, to maximize the likelihood of achieving the target ELUs and closure vison for the Mine Site.

4.2.2 Landform Design and Erosion Control

Landform design and erosion control is described in the Mine Plan and Reclamation Program, provided Appendix 4-1A additional information regarding erosion control is included in the Surface Erosion Prevention and Sediment Control Plan, provided in Appendix 9-1.

4.2.3 Revegetation Strategy

The revegetation is described in the Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.2.4 Progressive Reclamation/Sequencing

Information regarding progressive reclamation is described in the M Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.2.5 Reclamation Research

This section is not required as part of the joint application per the information requirements table.

4.2.6 Reclamation Monitoring

Reclamation monitoring criteria is described in the Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.2.7 Habitat Compensation Works

The Fish Habitat Compensation Agreement from 1996 is described in the Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.3 Reclamation Approaches

To achieve the closure and ELU objectives outlined Section 4.2, MPMC has developed strategies to promote physical stability, water quality protection, watercourse protection, sediment retention and erosion control, appropriate soil handling, suitable revegetation, and invasive species management. However, some components of these strategies are still partially in the conceptual phase, as reclamation and closure strategies are designed to be adaptable and evolve based on findings from progressive reclamation, site monitoring and research, and advancements in engineering and science. The following sections outline progressive reclamation and research activities MPMC is currently undertaking, the results of which will continue to influence progressive reclamation, active closure, and post-closure. Reclamation plans and protocols for the topics provided in Table 4.3-1 are provided in Appendix 4-1A (MPMC 2022a).

Table 4.3-1: Reclamation Prescriptions Discussed in the MPMC's 5-Year MPRP

Section in MPRP	Reclamation Prescription	Subtopics
5.1	Physical Stability	▪ Waste Dump Stability ▪ Pit Wall Stability ▪ Road Stability ▪ TSF Reclamation Stability ▪ Underground Stability
5.2	Water Quality and Watercourse Protection	▪ Erosion control ▪ Material Characterization ▪ Water Quantity and Quality Modeling ▪ Closure Water Management ▪ Closure Water Management Planning
5.3	End Land Use Plan	▪ n/a
5.4	Soil Management	▪ Soil Use in Reclamation ▪ Estimated Soil Balances
5.5	Revegetation	▪ Species Selection ▪ Planting Strategies ▪ Alignment with ELUs

Table 4.3-1: Reclamation Prescriptions Discussed in the MPMC's 5-Year MPRP

Section in MPRP	Reclamation Prescription	Subtopics
5.6.	Environmental Risk Assessment	▪ n/a
5.7	Invasive Plant Management	▪ n/a
5.8	Fugitive Particle Management	▪ n/a
5.9	Waste Management	▪ n/a

4.3.1 Soil Resources

MPMC has developed a Soil Management Plan (SMP), which includes protocols for soil salvage, stockpiling, and soil use in reclamation [Appendix M of Appendix 4-1A (MPMC 2022a)]. The SMP recommends the salvage of topsoil, subsoil, organic soil, and woody debris. In general, accessible soils within the Springer Expansion area will be salvaged, unless soil quality concerns are noted during preliminary sampling, or observed in the field (e.g., excessively high coarse fragment content). The SMP describes the procedure for salvaging materials, along with best management practices to maximize soil quality, and maintain the integrity of soil stockpiles. Previously collected soil quality data are also presented in the SMP.

4.3.1.1 Estimated Soil Balance

Currently, there's an estimated 1,694,010 m^3 of coversoil (e.g., suitable growth media that can support higher plants) (adjusted from MPMC 2022a; Appendix 4-1A) available to complete reclamation activities within the Mine Site; a surplus of approximately 220,081 m^3 (Table 4.3-2. However, the Mine Site is short approximately 1,032,028 m^3 of till (subsoil; adjusted from MPMC 2022a; Appendix 4-1A) material. To address this shortage, MPMC will likely borrow additional till material from areas surrounding the TSF, or by mixing tailings with till (as the Mine Site's tailings are relatively inert), provided future reclamation research indicates that this is suitable as a subsoil horizon in reclamation profiles (MPMC 2022a). The geochemistry of the tailings at the Mine Site is included in Appendix 4-1B. Figure 4.3-1 provides the location of existing stockpiles at the Mine Site, which will ultimately be used for reclamation.

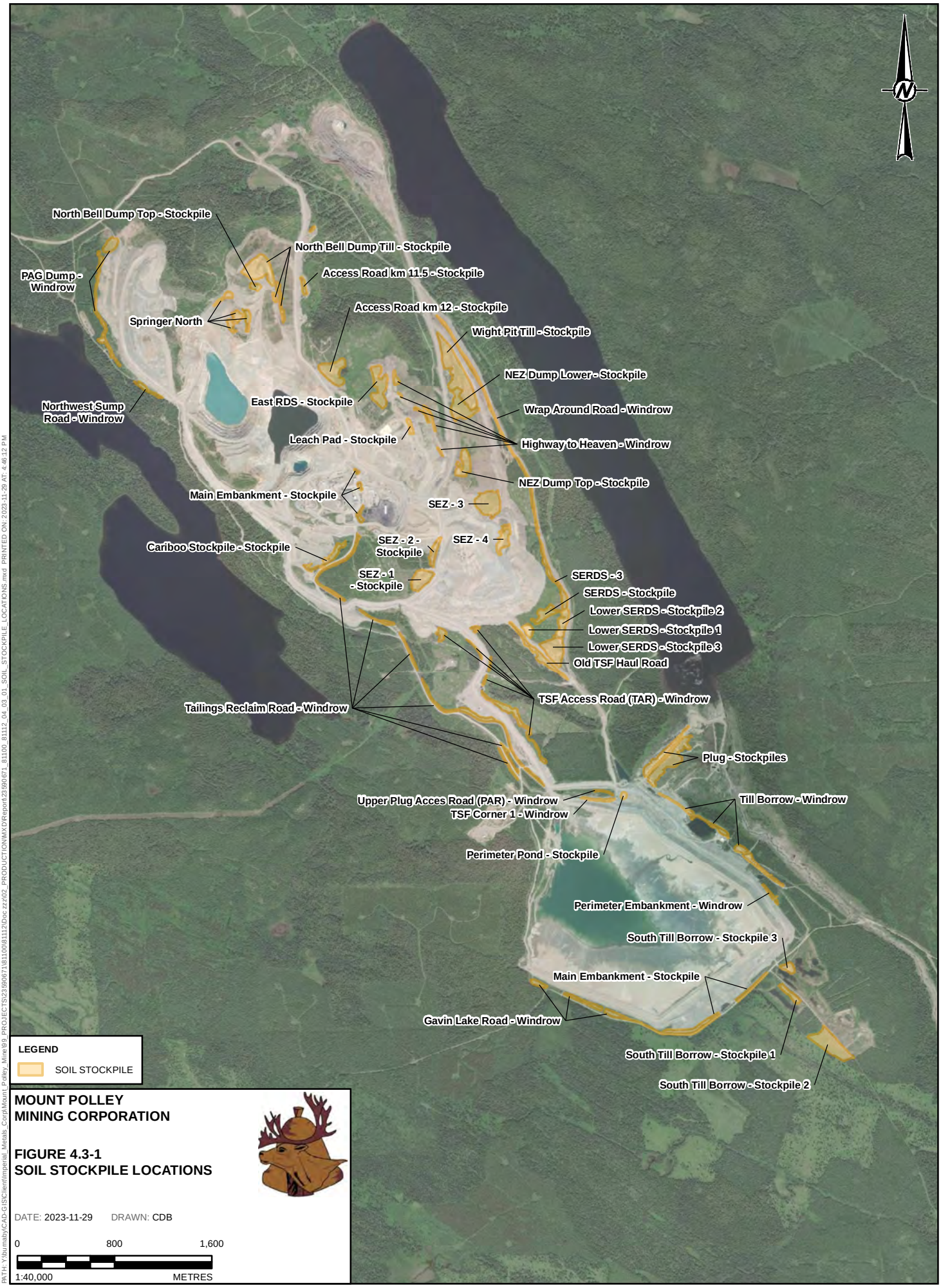

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Table 4.3-2: Mine Site Coversoil Balance as of November 2023

Vegetation Type	Area Requiring Coversoil[(1)] [ha]	Average Coversoil Placement Depth [cm]	Required Coversoil Volume [m^3]	Average Till Placement Depth [cm]	Required Till Volume [m^3]	Available Biosolids Volume[(2)] [m^3]	Available Coversoil [m^3]	Available Till [m^3]
ICHmk3_00	8.36	5	2,437	10	4,873	0	**1695,595**	**160,551**
ICHmk3_01	278.47	20	556,937	10	278,468	0		
ICHmk3_02	33.66	15	50,490	10	33,660	0		
ICHmk3_03	7.81	15	73,501	10	49,001	0		
ICHmk3_04	98.93	15	148,390	15	148,390	0		
ICHmk3_05	94.91	15	142,365	15	142,365	0		
ICHmk3_06	355.11	15	532,662	15	532,662	0		
ICHmk3_07	10.81	15	16,215	15	16,215	0		
Non-Forested / TSF	105.53	5	52,764	5	52,764	164,000		
TOTAL	**1,011.86**	**-**	**1,573,324**	**-**	**1,253,525**	**164,000**		

Note:

ICHmk3 = Interior Cedar Hemlock Zone; Horsefly variant.

The sum of each column may not add exactly due to rounding.

Volumes are estimated and may vary based on-site conditions and handling. Excess material will be spread on site, shortages will be handled as detailed in Section 5.4.2 of Appendix 4-1A (MPMC 2022a)

1) Excludes areas that have already had coversoil placed or do not require coversoil placement (e.g., watercourses, rocky outcrops).

2) Biosolids may be used on other areas of the Mine and will be acquired in volumes sufficient to meet reclamation targets.

4.3.1.2 Soil Application

The SMP describes coversoil application methods in detail, including strategies for reducing compaction Table 4.3-2 details placement depths for the Springer Expansion based on desired post-closure ecosystems and ELUs, while Figure 4.3-2 provides visual representations of these placement depths. The SMP provides information on soil handling methods and best management practices, while Section 4.8.7 of this document provides details on the scheduling of soil placement.

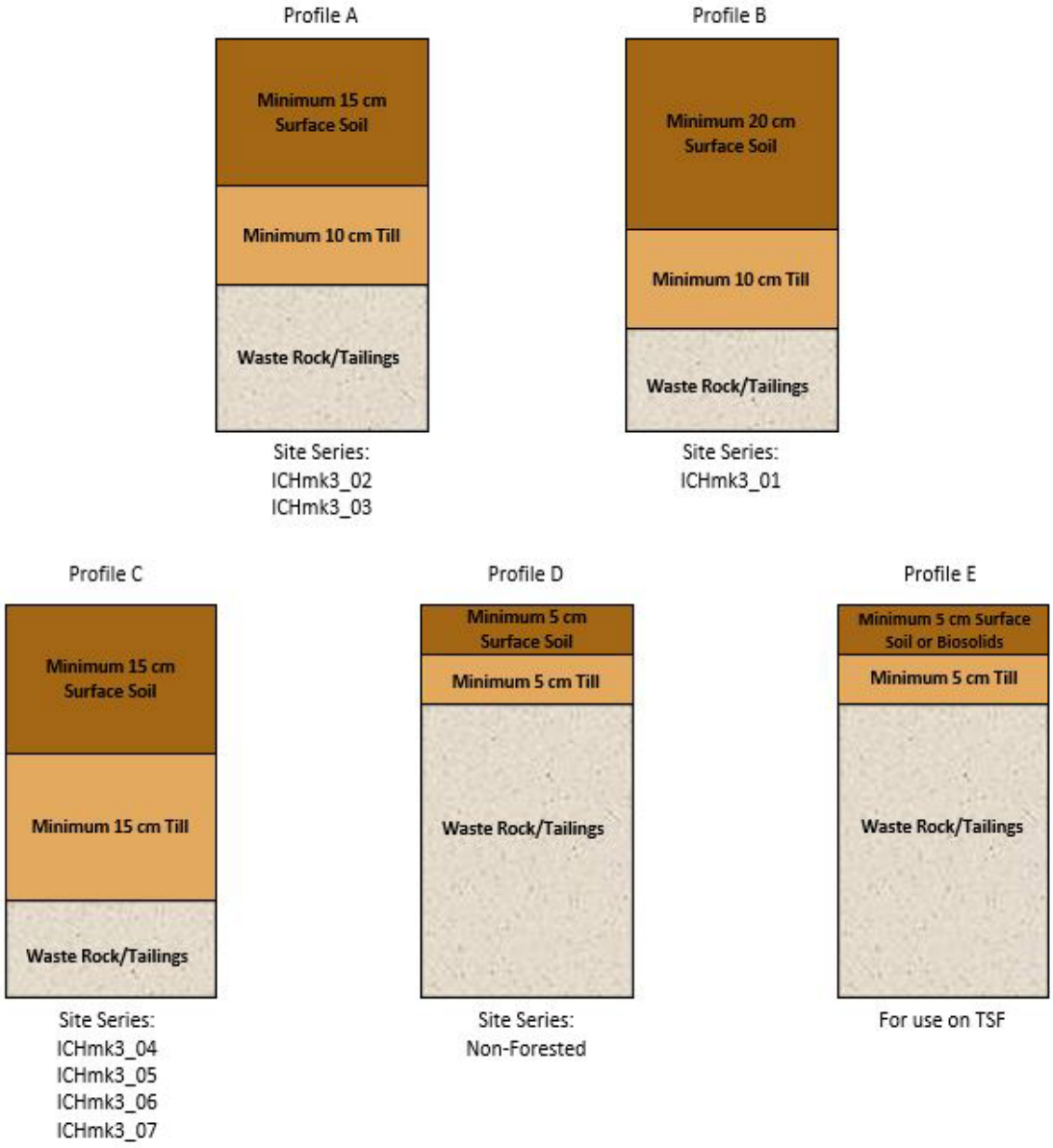

Figure 4.3-2: Proposed Coversoil Profiles Based on Desired Ecosystem and End Land Use

While a shortage of coversoil is not expected, and creation of growth media using amendments is not anticipated, soil amendments may be required to bolster soil quality of previously stockpiled soils. Soil amendments can be any additional materials that are added to reclamation sites to increase soil fertility, improve soil structure, provide better growing conditions for vegetation, or provide enhanced habitat features for target wildlife species. Where possible, on-site soil amendments will be used to reduce costs, make use of waste, and prevent potential ingress of non-native species through importing soil from off-site. Researched soil amendments are detailed comprehensively in the 2017 MPRP Update (MPMC 2017) and summarized below.
Results from ongoing site-specific research will continue to provide guidance on when soil amendments are necessary, and what types and quantities to use. Research will include long-term considerations, as soil amendments are typically only a short-term nutrient source.

Biosolids

Biosolids have been studied on research plots since 1998. Biosolids are available in large quantities for use on the Mine Site. The overall findings are that biosolids can be effective in encouraging initial tree establishment and root development. Biosolids can even act as a replacement for standard growth mediums in some cases. Overall, biosolids have been shown to be an effective soil amendment, at least with regards to establishing desirable vegetation.

Tailings

Initial trials have been conducted into seeding grasses directly into tailings and mixing tailings with till as a growth medium. Seeding grasses into tailings has generally been successful, and initial trials to combine tailings with till and biosolids have been successful (McMahen and Simard 2018). However, evidence from the TSF embankment breach terrestrial ecosystem assessment has indicated that in some cases tailings can be too fine, resulting in poor drainage, excess water retention, and decreased oxygen in the rooting zone, resulting in die off of vegetation.

Fertilizer

Contrasting with biosolids, fertilizer has not been found to be an effective soil amendment. “Tea bag” packages planted with trees were found to reduce long-term growth, and broadcast fertilizer can result in heavy ground cover (grass) development, which provides competition for target tree and shrub species. Results from ongoing site-specific research will continue to provide guidance on when soil amendments are necessary, and what types and quantities to use. This will include long-term considerations, as soil amendments are typically only a short-term nutrient source.

Woody Debris

Following soil application, woody debris (if not already incorporated into soil) should be placed, if available, to enhance microsite diversity and habitats, retain moisture, contribute to long-term soil organic matter, and improve catch of native seeds. If woody debris is not available, boulders or rock fragments can be placed in piles and individually. Although rocks are not a source of nutrients, over time, like woody debris, they can increase moisture retention, promote plant microsite diversity, provide habitat, and reduce soil erosion. Application of boulders or small rock piles will also continue to be carried out as a method of creating varied habitats on reclamation sites.

4.3.2 Landform Design and Erosion Control

Development of an open pit mine and associated works creates surface disturbances that may result in erosion and alteration to watersheds. As such, erosion prevention strategies for construction activities and active closure are outlined in MPMC's Sediment and Erosion Control Management Plan [Appendix K of Appendix 4-1A (MPMC 2022a)].

Erosion control is key to preventing sediment transport and negative impacts on the environment and promoting geotechnical stability of structures. Revegetation is a highly effective and permanent erosion control measure; thus, disturbed areas are seeded and planted at the earliest opportunity. Re-sloping and surface preparation are other erosion control measures used by MPMC. Typically, these methods entail site preparation and creation of microtopography and the direction of surface flow away from slope faces to minimize surface water erosion, where possible. In addition to the measures described in the Sediment and Erosion Control Management Plan, a geomorphic approach is incorporated, where practicable, as an overall strategy for active closure design. Guidance documents for this geomorphic approach have been created (e.g., Golder 2017; Golder 2019) to minimize the erosion of the post-closure landscape to that of natural analogues. Figure 4.3-3 shows expected watersheds at closure.

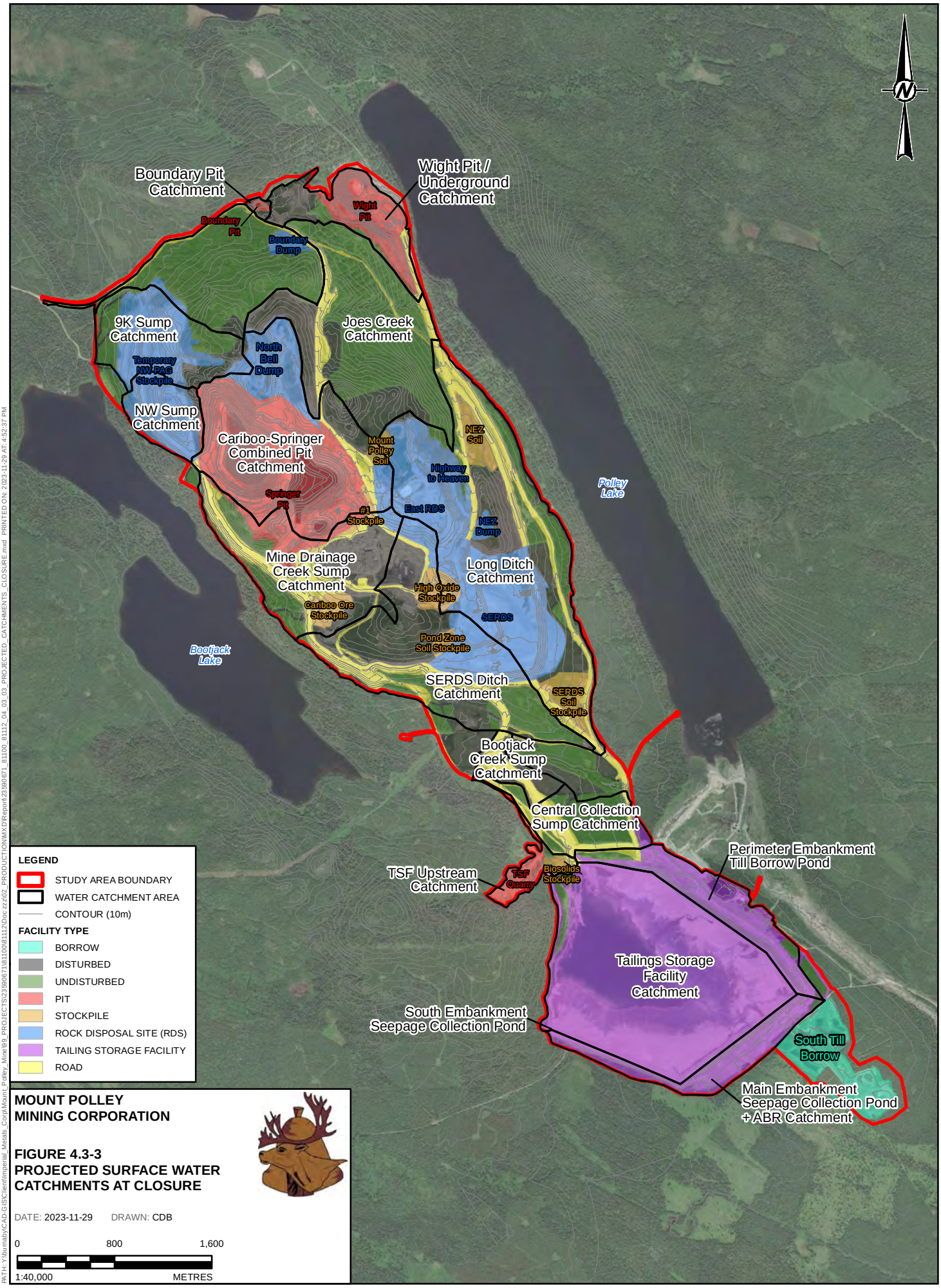
Boundary Pit Catchment
Wight Pit / Underground Catchment
Wight Pit
Boundary Pit
Boundary Dump
9K Sump Catchment
Joes Creek Catchment
North Bell Dump
Temporary NW PAG Stockpile
NW Sump Catchment
Cariboo-Springer Combined Pit Catchment
Mount Polley Soil
NEZ Soil
Highway to Heaven
Polley Lake
Springer Pit
#1 Stockpile
East RDS
NEZ Dump
Mine Drainage Creek Sump Catchment
Long Ditch Catchment
High Oxide Stockpile
Cariboo Ore Stockpile
SERDS
Pond Zone Soil Stockpile
Bootjack Lake
SERDS Ditch Catchment
SERDS Soil Stockpile
Bootjack Creek Sump Catchment
Central Collection Sump Catchment
Perimeter Embankment Till Borrow Pond
TSF Upstream Catchment
TSF Quarry
Biosolids Stockpile
Tailings Storage Facility Catchment
South Embankment Seepage Collection Pond
South Till Borrow
Main Embankment Seepage Collection Pond + ABR Catchment
LEGEND
STUDY AREA BOUNDARY
WATER CATCHMENT AREA
CONTOUR (10m)
FACILITY TYPE
BORROW
DISTURBED
UNDISTURBED
PIT
STOCKPILE
ROCK DISPOSAL SITE (RDS)
TAILING STORAGE FACILITY
ROAD
MOUNT POLLEY MINING CORPORATION
FIGURE 4.3-3
PROJECTED SURFACE WATER CATCHMENTS AT CLOSURE
DATE: 2023-11-29
DRAWN: CDB
0
800
1,600
1:40,000
METRES
PATH: Y:\Burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\09_PROJECTS\2350671811\00\81112\Doc zz\r02_PRODUCTION\MXD\Report\2350671_81100_81112_04_03_03_PROJECTED_CATCHMENTS_CLOSURE.mxd PRINTED ON: 2023-11-29 AT: 4:52:37 PM

4.3.3 Revegetation Strategy

Ingress of native species has been observed at the Mine Site (e.g., South Till Borrow), and is expected to continue. To support natural colonization, active planting and seeding of native vegetation associated with target post-closure ecosystems (Appendix C of Appendix 4-1A; MPMC 2022a) is conducted to promote development of desirable post-closure ecosystems. Planting vegetation prevents erosion, limits establishment of invasive species, and initiates the process of natural succession. Vegetative growth increases soil organic matter, provides native seed sources, and begins to create microsites that will, in time, be appropriate for growth of secondary successional species. For instance, early seral stage conifers used in the logging industry (e.g., lodgepole pine and Douglas-fir) are planted at the Mine Site in areas ready for revegetation, with climax woody species such as Western red cedar, subalpine fir, and hybrid spruce expected to ingress naturally when microsite conditions are appropriate. Ultimately, revegetation efforts promote ELU and closure objectives, such as wildlife values and biodiversity.

To achieve desired ecosystems on the post-closure landscape, conifer species are planted at a roughly uniform density, while targeting ideal, moist, protected microsites. Deciduous tree and shrub species are planted in a similar manner. Variable land surfaces with diverse macro- and microtopography are important to improve vegetation establishment and biodiversity. Land features, such as depressions, on recontoured landscapes, may be supported through targeted plantings, such as densely planted biodiversity islands of deciduous trees and shrubs, or possibly collection and spreading of seeds of more diverse species. Additionally, timing of planting has been shown to affect overall revegetation success. Fall seeding of grass species has been successful on the Mine Site, while tree and shrub planting in the spring is more favourable than during other seasons. The seeding method used also influences revegetation success, with hand seeding being more cost-effective compared to hydroseeding with equally successful results. Finally, rationale for selection of species is provide in Table 4.3-3 and planting strategies are provided in Section 4.3.3.1.

Table 4.3-3: Mine Site Revegetation Prescriptions (MPMC 2022a)

Site Series		Moisture	Gradient (%)	Slope Position	Aspect	Soil Profile Type[7]	Grasses/Forbs[1,2]	Deciduous Trees[3]	Coniferous Trees[4]	Shrubs[5] 200 – 500 sph
Zonal	ICHmk3/01	Mesic/submesic	0 to 20	Middle	Variable	B	native grasses/forbs (30 kg/ha)	black cottonwood – 200 sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph hybrid spruce[e] Western redcedar[e] alpine fir[e]	Sitka alder, saskatoon, prickly rose, willow, huckleberry, blueberry, common juniper [8], soopolallie
Xeric to Subxeric	ICHmk3/02	Xeric, subxeric	0 to 10	Crest	South or west facing	A		trembling aspen – 200 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph hybrid spruce	
	ICHmk3/03		50 to 70	Upper	Variable	A		trembling aspen – 200 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph Western redcedar[e] hybrid spruce[e]	
Mesic to Moist Nutrient Rich	ICHmk3/04	Subhygric, mesic	10 to 35	Lower, middle	Variable	C		black cottonwood – 200 sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph hybrid spruce – 600 sph alpine fir[e] Western redcedar[e] lodgepole pine[e]	
	ICHmk3/05	Subhygric		Middle, lower	Variable			black cottonwood – 200 sph trembling aspen – 50 sph	hybrid spruce – 1400 sph lodgepole pine – 600 sph Western redcedar[e] alpine fir[e]	
Moist, Very Rich	ICHmk3/06	Subhygric, mesic	0 to 25	Lower, middle	Variable	C		black cottonwood – 200 sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph hybrid spruce – 600 sph Western redcedar[e] alpine fir[e] lodgepole pine[e]	
	ICHmk3/07	Hygric	0	Toe of long slopes or depression	Level			black cottonwood – 200 sph	hybrid spruce – 1400 sph western redcedar – 600 sph alpine fir[e] lodgepole pine[e]	
Organic non-Forested	Non-forested	Subhygric	0	Depression	Level	D		n/a	n/a	
TSF		Hygric	0	Lower	Level	E		black cottonwood – 500 sph	n/s	

Note:

1) Grass and forb seeding rate should be reduced (5 to 10 kg/ha) if amendments such as biosolids or fertilizer are used.
2) Grass and forb mixture shown in Table 5-8 of MPMC (2022a).
3) Species chosen based on BC Forest Development Stocking Standards (ICHmk3 biogeoclimatic subzone).
4) Species chosen based on BC Forest Development Stocking Standards (ICHmk3 biogeoclimatic subzone).
5) Later successional species to be considered for underplanting after primary canopy is established.
6) Shrub species to be selected appropriate for each site based on research and availability.
7) Refer to Figure 4.3-2 for profile descriptions.
8) Juniper will be targeted for drier sites.

sph = stems per hectare; n/a = not applicable.

4.3.3.1 Species Selection

MPMC's overarching goal is to re-establish pre-disturbance vegetation communities that support multiple ELUs. Because of this, MPMC uses an approach for revegetative species selection that is based on the BEC system. Appendix C of Appendix 4-1A (MPMC 2022a) describes the BEC zone and site series that were present on the Mine Site prior to development, and these zones and series have been considered in species selection. MPMC's approach for selecting a revegetation prescription for a given area considers slope, elevation, and aspect through Geographic Information System **(**GIS) modelling. This is further informed by site-specific substrate characteristics that suggest soil moisture and nutrient conditions. A generalized GIS matrix is then used to aid in identifying the most appropriate treatment for an area. This approach is not designed to be rigid, and flexibility is maintained to allow for alternative treatments or trials on designated sites, and input of professional discretion in localized areas.

The general steps for species selection are:

1) determine which species are locally common to each site series and those that existed on the landscape prior to development
2) review government regulations for reforestation guidelines and dominant overstory and understorey species for each post-closure site series
3) determine which species are commercially available, or easily harvested on the Mine Site
4) work with First Nations and local communities to determine species that are important for traditional use and support target wildlife species
5) add selected species to the newly reclaimed sites (e.g., immediately after coversoil placement)
6) monitor the progress of reclamation sites to determine which species (or combination of species) are performing well and at which locations (site series)
7) adapt reclamation prescriptions to incorporate learnings from monitoring results
8) incorporate refined prescriptions into progressive reclamation and reclamation research activities to further develop best practices for establishment of high priority target species
9) continue to adapt prescriptions and research trials as new information is gathered and additional target species are identified

Table 4.3-3 shows general prescriptions by site series for reclamation because of this process. Candidate species are then further evaluated for social and economic considerations.

4.3.4 Progressive Reclamation/Sequencing

Currently, progressive reclamation sites at the Mine Site are treated as large-scale research projects, with outcomes influencing future reclamation plans and prescriptions. MPMC intends to take the same approach with progressive reclamation of the Springer Expansion; however, given that this feature is tied directly to operations, it is unlikely to undergo progressive reclamation until much later in the Mine Site's life cycle.

Much of the progressive reclamation to date at the Mine Site occurred in the 2010's. Results from this work can be found in Appendix 4-1A (MPMC 2022a). Additional detailed information on historical results of these trials can be found in the 2017 MRP (MPMC 2017), and Annual Reclamation Reports (e.g., MPMC 2022b). Most monitoring programs associated with progressive reclamation have been executed as planned or have been put on hold due to the Mine Site's recent care and maintenance status.

More recent progressive reclamation programs included salvage of approximately 7,838 m^3 of soil from Cariboo Pit Access and subsequent placement of the salvaged soil at SEZ-1 and Mill Site 1 in 2017. In 2018, approximately 3,691 m^3 of till was placed in the Breach Zone (Lower SERDS-1 to Corner 1 Buttress), the NEZ Dump, and the 9 km Wetland. Tree planting also occurred in 2018 on the North Bell Dump. Table 4.3-4 lists the areas that have been re-contoured, received fertilizer or biosolids, and have been seeded and/or planted as of 2021 (MPMC 2022b). Detailed reclamation prescriptions for all reclamation and research sites within the Mine Site are also provided in MPMC (2022b).

Table 4.3-4: Summary of Completed Progressive Reclamation at the Mine Site (MPMC 2022b)

Area	Parcel	Re-contoured (ha)	Coversoil Applied (ha)	Seeded (ha)	Fertilizer/Biosolids (ha)	Tree Planted (ha)
		Total	Total	Total	Total	Total
NEZ Dump	2a, 2b1, 2b2	5.13	5.13	5.13	5.13	5.13
	Beside 2a/2b	2.47	0.00	0.00	0.00	0.00
NBD	Parcels 1-10	9.45	11.59	11.59	11.59	11.59
	South Triangle	1.30	1.30	1.30	1.30	1.30
	Phase 1	2.21	2.21	2.21	2.21	2.21
	Phase 2	2.87	2.87	2.87	2.87	2.87
	Metro Van Research 1	2.81	2.81	1.87	2.34	2.34
	Wrap Around Toe	0.00	2.20	2.20	0.00	0.00
	Beside Research 1	4.76	1.99	0.00	0.00	0.00
	Metro Van Research 2	2.00	2.00	1.33	1.66	2.00
	Beside Research 2	2.73	0.00	0.00	0.00	0.00
	Beside BJ FSR	0.90	0.00	0.00	0.00	0.00
Boundary Zone	Dump	4.70	4.70	0.00	0.00	4.70
East RDS	Above Access Road	3.42	4.06	4.06	0.00	2.75
	Highway to Heaven	11.53	9.47	6.58	0.00	9.47
	Tree Plots	2.31	2.31	2.31	1.20	2.31
Waste Haul Road	Above WHR	1.81	1.81	1.81	0.00	0.00
	Below Helipad	1.53	1.53	1.53	1.53	1.53
South Till Borrow		23.25	0.00	14.75	12.00	0.00
TOTAL		**85.18**	**55.98**	**59.54**	**41.83**	**48.20**

BJ FSR = Bootjack Forest Service Road; ha = hectares; NBD = North Bell Dump; NEZ = Northeast Zone; RDS = rock disposal stockpile.; WHR = West Haul Road

4.3.5 Reclamation Research

This section is not required as part of the joint application per the information requirements table. However, a summary of terrestrial reclamation research to date can be found in MPMC (2017) and MPMC (2022b). Terrestrial reclamation research has paused temporarily (along with progressive reclamation) due to the care and maintenance status of the Mine Site. Most of the reclamation research since the previous 5-Year MPRP (MPMC [2017]) has been related to water treatment. Appendix G of Appendix 4-1A (MPMC 2022a) provides a comprehensive overview of the research trials into water treatment technologies considered for the Mine Site. Please see the appropriate supporting documentation for further information.

4.3.6 Reclamation Monitoring

MPMC has numerous monitoring plans (appendices of Appendix 4-1A MPMC [2022a]). These monitoring plans will be used throughout the closure lifecycle to minimize environmental risk, and to provide quality control during closure activities. A general schedule for reclamation assessments is as follows:

- post-application inspections (e.g., soil test pits) after placement of coversoil to assess placement depth and to verify if recommended reclamation methods described in Section 4.3.1 and the SMP (Appendix M of Appendix 4-1A [MPMC 2022a]) were appropriately implemented
- assessment of revegetated areas following the first growing season to determine species composition (including presence of invasive species) and cover, as well as documentation of areas of erosion
- observations of wildlife or grazing occurrences and usage
- survival surveys of planted trees and shrubs (for quality control purposes) following their first growing season
- periodic assessments of tree survival/growth and ground cover vegetation, decreasing in frequency over time (e.g., years two, five, and ten)

Table 4.3-5 provides an overview of MPMC's closure objectives, indicators, and measures for the overall Mount Polley Mine Site and proposed Springer Expansion, which directly relate to the ELUs listed in Table 4.2-2. Monitoring will continue with additional reclamation activities occurring in an adaptive management process until objectives have been met. Trends and data associated with monitoring events will be captured in MPMC's annual reclamation reports issued to EMLI. Once closure objectives (and therefore ELU objectives) have been met, the landscape is considered successfully reclaimed. Post-closure monitoring (Section 4.11) is conducted to monitor the status of the reclaimed landscape, so that maintenance, if required, can be conducted.

Table 4.3-5: Mine Site Reclamation Closure Objective

Closure Objective	Indicator	Measure
Landform Function		
Landforms have geotechnical stability	Geotechnical stability	Visual inspection for the presence/absence of subsidence, erosion, deposition of sediment in low lying areas, ponding, gullying, rilling or slumping, including bank stability round watercourses and waterbodies
Landscape enhancements are appropriate to the ecosystem and increase the diversity of the landscape	Landscape enhancements	Presence of rocks, coarse woody debris, standing woody debris, brush piles, snags, bird/bat boxes
Water		
The Mine Site's water balance meets the needs of the post-closure landscape	Successful function of the TSF and Expanded Springer Pit spillways	Assessment of water levels in the TSF and expanded Springer Pit No signs of instability of the TSF, or the TSF and expanded Springer Pit spillways
	Water quality parameters	Water quality parameters support discharge of water to the receiving environment
	Pit lake elevation	Pit lake elevations align with projected modeling. Pit lake elevations successfully cover PAG material
Soil		
Reclamation materials are placed appropriate to the landform	Soil depth	Average placement depth (m)
	Soil pH	Soil pH
	Soil moisture regime	Soil texture/particle size analysis (percent sand, percent silt, percent clay), placement depth, topography
Vegetation		
Terrestrial and aquatic vegetation common to the surrounding area is established	Plant community composition (terrestrial, riparian and, marsh/aquatic)	Presence, percent cover, distribution of noxious and prohibited noxious weeds
		Species inventory and percent cover by layer and species. Include damage codes (e.g., insect, browse)
The reclaimed landscape provides commercial forest (where designated as an ELU within the reclamation plan)	Regeneration of trees (commercial stocking)	Stocking (the percentage of a polygon that contains acceptable tree regeneration) (Information gathered to support this includes height, diameter at breast height (DBH) and age for potentially commercial tree species)
	Mortality of trees	Percent mortality between planting and ten years after planting
	Insects and disease	Percent of trees with signs of chewing, spots, eggs, nests, or galls
	Browsing pressure	Percent of trees with signs of browsing on new shoots, bark damage
	Limitations to vegetation growth	Percent of trees with signs of chlorosis, stunting, unusual formations

Table 4.3-5: Mine Site Reclamation Closure Objective

Closure Objective	Indicator	Measure
Emergent Properties		
The reclaimed landscape provides for biodiversity	Patch size and shape	Patch sizes (ha)
	Food vegetation species	Food species for target wildlife species are present
	Plant community composition – diversity, richness, evenness, and abundance	Species inventory, percent cover and density (stems/ha)
Traditional Ecological Value	Wildlife habitat that supports traditional use	Derived from Plant Community Composition
	Biodiversity that supports traditional use	Derived from Plant Community Composition and incidental wildlife observations
	Vegetation that supports traditional use	Derived from Plant Community Composition

ELU = End Land Use; PAG = Potentially Acid Generating.

4.3.7 Habitat Compensation Works

This section is not required as part of the joint application per the information requirements table.

4.4 Trace Element Uptake in Soils and Vegetation

This section is not required as part of the joint application per the information requirements table.

4.5 Contaminated Sites, Human Health, and Ecological Risk Assessment

Appendix Q of Appendix 4-1A (MPMC 2022a) provides detail on MPMC's conceptual Contaminated Site Assessment. The conceptual plan focuses on areas that store or dispense hydrocarbons, chemicals, blasting products, and stockpiled materials (e.g., ore or PAG waste rock).

At closure, an environmental site assessment will be conducted by a professional approved by the Contaminated Sites Approved Professionals Society of BC. Contaminated areas identified through the environmental site assessment will be remediated. Where possible, contaminated soils will be treated or disposed of on-site. Contaminated soil or overburden that cannot be disposed of or treated on-site will be removed from site and hauled to an appropriate disposal facility. After remediation, site conditions will be compared to the Contaminated Sites Regulation (CSR; BC Government 1997) standards that are most appropriate to the target ELUs.

Appendix N of Appendix 4-1A (MPMC 2022a) provides a preliminary Environmental Risk Assessment (ERA) for the Mine Site. A conceptual site model (CSM) was created for this work. The CSM will be used to assist in mitigation planning. At or before the onset of closure, a human health and environmental risk assessment will be conducted, and the CSM will be updated. The existing CSM will also be used to help plan other sampling programs, if possible.

4.6 Disposal of Chemicals, Reagents, Hazardous Materials and Contaminated Materials

At closure, MPMC will remove chemicals, reagents, explosives, and hazardous materials and return them to suppliers or dispose of them in a designated facility. Modular buildings, small structures, and mobile equipment will be removed for reuse, sale, or salvage. All tanks and fuel storage facilities will be emptied of their contents before they are removed from their foundations. Tank residues will be transferred by a proven and reputable waste oil reprocessing company or waste recycling company, as appropriate. This will follow similar procedures that have been in place throughout the operating period of the Mine. Unused reagents and laboratory chemicals will be repackaged and shipped to other authorized users, or to an appropriate waste disposal facility. Contaminated soils will be collected and stockpiled for treatment or disposed of in an approved manner.

Wastes associated with decommissioning activities (Table 4.6-1) will be disposed of near the date of mine closure, when detailed estimates of waste stream volumes and corresponding landfill capacity and design have been advanced. Wastes associated with decommissioning generally will fall into the categories provided below and will be managed accordingly:

- **Non-salvageable, non-combustible, and non-recyclable materials:** these materials will be buried within the on-site landfill, covered with waste rock, and reclaimed to match the target ecosystem of the surrounding area(s). Any materials that would require the landfill to have an engineered cover will be disposed of off-site.
- **Combustible, non-salvageable materials**: these materials will be burned pending receipt of a refuse permit, and the burned residues will be buried in the onsite landfill.
- **Structural steel, heavy gauge, shred, ferrous, and non-ferrous metals:** these will all be segregated and sheared to scrap metal industry sizing.
- **Concrete rubble:** this material may be used for filling in basements and regrading surfaces in the mill area. For the entire Mine Site, it is assumed that concrete rubble will be pulverized using a heavy excavator equipped with a pulverizing jaw attachment. The pulverized concrete rubble collected from each area will be stockpiled until the end of the demolition phase of the active closure work. Once the demolition phase is complete, the pulverized concrete rubble can be placed in an RDS or other suitable location. Alternatively, it may be preferable to process the concrete rubble through a crushing plant to obtain a 2-inch (50 mm) minus crushed material. This material can be used as cover material for other aspects of demolition (e.g., cover material for foundations) during active closure.

Table 4.6-1: Typical Waste Classifications

Item	Name	Description
1	Total metal (recyclable)	Structural steel (heavy, light, shred), non-ferrous (copper, aluminum).
2	Wood/plywood/mixed wood	Interior wall partitions, wood structures and sheds, exterior wood cladding, shelving, core boxes, interior finishes.
3	Painted/laminated/wood	Counters, wooden and laminate office furniture and lab installations, cabinets, etc.
4	Plastic	Anything plastic within contents of buildings. A significant portion of the contents were observed to have plastics as the primary material.
5	Particle board/tile	Interior finishes and bathrooms.
6	Concrete	Steel reinforced cast in place concrete structures, foundations, footings, interior and exterior slabs, core slabs, cast in place structure elements.
7	Concrete Masonry Units	Concrete masonry units – block walls, etc.
8	Brick (clay based)	Terracotta block, speed block, clay-based exterior brick veneers.
9	Mixed debris/demolition waste	Mixed waste generated from the demolition of the structures, and is combination of small pieces of recyclables, concrete, wood, insulation, and other demolition debris.
10	Interior contents	Interior contents of buildings which are removed prior to structural demolition and segregated from demolition waste and building debris. Recyclables will be removed from this waste stream as practical.
11	Sulphur stockpiles	Excess elemental sulphur stockpiled before use as sulphuric acid in copper ore leaching process

4.7 Groundwater Well Decommissioning

4.7.1 Structures and Equipment

This section is not required as part of the joint application per the information requirements table.

4.7.2 Waste Rock Dump Reclamation

This section is not required as part of the joint application per the information requirements table.

4.7.3 Tailings Storage Facility Reclamation

TSF reclamation stability is described in the Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.7.4 Open Pit Reclamation Prescriptions

This section is not required as part of the joint application per the information requirements table.

4.7.5 Watercourse Reclamation Prescriptions

Watercourse reclamation is included in the Mine Plan and Reclamation Program, provided in Appendix 4-1A.

4.7.6 Road Reclamation

This section is not required as part of the joint application per the information requirements table.

4.7.7 Schedule

Refer to Section 10.1 in Appendix 1-3 for the construction schedule.

4.8 Reclamation and Closure Prescriptions

4.8.1 Structures and Equipment

No structures or equipment will be affected by the Springer Expansion, nor will any additional structures or equipment be needed to support Springer Expansion related operations.

4.8.2 Waste Rock Dump Reclamation

With the expansion of the Springer Expansion, additional waste rock will need to report to SERDS. At closure, the Mine Site is projected to have 434.21 ha of waste rock dumps including areas that are currently undergoing progressive reclamation. The SERDs will expand to accommodate the extra waste rock associated with the Springer Expansion, pushing its total footprint to 181.05 ha (from 103.71 ha pre-Springer Expansion development). Figure 3.3-11 provides the life of mine SERDs footprint. The SERDs will not receive any PAG during its extended lifespan, and any PAG associated with the expansion will be managed separately. At the onset of closure, if necessary, recontouring will occur to achieve a 2H:1V slope. Landform design and aesthetics will be considered to promote natural integration of reclamation sites into the surrounding landscapes and pre-mining drainage pathways. As with other rock disposal stockpiles (RDSs), the SERDs will be designed using a geomorphic approach to minimize water infiltration and to integrate surface water flow into the closure water management design (Figure 4.3-3; Figure 13 of the WMP [Appendix 9-4]). Expected drainage patterns of the Mine Site at closure are provided in Figure 4.3-3.

Following recontouring of RDSs, coversoil will be placed as indicated Figure 4.3-2, with a total reclaimed soil profile ranging between 25 cm and 30 cm in thickness. Actual coversoil placement depths will vary based on material availability, landscape, site preparation techniques used, and equipment used for application. Soil amendments may be added to the profiles, should soil quality parameters indicate organic material deficiencies. Best management practices outlined in the SMP [Appendix M of Appendix 4-1A (MPMC 2022a)] will be followed during reclamation to maximize the likelihood of successful revegetation with early successional species.

Following soil application, woody debris (if not already incorporated into soil) will be placed, if available. Revegetation prescriptions will follow those shown in Table 4.3-3, and where possible, important traditional use species (Table 4.2-2) will be incorporated. During revegetation efforts, wildlife habitat enhancements will also be established to encourage wildlife

usage in alignment with the ELUs associated with the desired post-closure ecosystems (Figure 4.2-1; Figure 4.2-2: ; Table 4.2-2). Once the vegetation community is stable enough, agroforestry practices will be implemented in select areas to allow for livestock forage in young forests and open canopy forests. Other ELUs may also be supported, such as recreation.

4.8.3 Tailings Storage Facility Reclamation

This section is not required as part of the joint application per the information requirements table.

4.8.4 Open Pit Reclamation Prescriptions

The Springer Expansion footprint is approximately 135 ha. At closure, the expansion area will fill to 1050 masl, creating a pit lake. At the onset of active closure, PAG material will be placed in the Springer Pit, to an elevation of 1,004 masl. Following this, the pit will accumulate water, and the water level is expected to reach 1050.5 masl (Springer-Pit Expansion [SPE] spillway inlet) by approximately 2063. Above 1050.5 masl (SPE spillway inlet), the pit will overflow and discharge down the SPE spillway, with water ultimately reporting to Bootjack Lake (Figure 13 of the WMP; Appendix 9-4). Water quality modelling indicates that the water in pit lakes (including the Springer Expansion) will be suitable for wildlife and livestock. Predicted concentrations are below the screening level for livestock and wildlife of 10 mg/L for molybdenum, and selenium will be managed in the pit lake in response to measured water quality, through measures such as carbon addition to reduce selenate and precipitate selenite, if necessary. The need for this mitigation will be confirmed by monitoring the actual water quality observed in the active closure and post-closure periods. Detailed information on water quality modeling is available in Appendix I of Appendix 4-1A (MPMC 2022a).

Public safety is paramount during the reclamation of the open pits. When mining of the Springer Expansion is complete, berms and signage will be installed around the pit perimeter. Remaining exposed pit walls will have a slope ranging between 40° and 50° and are exempt from reclamation pursuant to Section 10.7.13 of the Health, Safety and Reclamation Code for Mines in British Columbia (BC EMLI 2022). The unvegetated pit walls have potential to add to the post-closure landscape's biodiversity by providing microhabitats that did not exist prior to the Mine Site development. Cliff faces, particularly those with ledges, boulder piles, crevices, and overhangs, may provide nest sites for a variety of cliff nesting birds, such as the common raven (*Corvus corax*), birds of prey, cliff swallows (*Petrochelideon pyrrhonota*), barn swallows (*Hirundo rustica*), and Say's phoebe (*Sayornis saya*). Cavities in boulder piles can provide nesting and denning habitat for bats (*Chiroptera* spp.), the bushy-tailed woodrat (*Neotoma cinerea*), deer mice (*Peromyscus* spp.), the northwestern chipmunk (*Tamias minimus*), and other small mammals.

Ramps down to the level of flooding will be decompacted with heavy equipment and reclamation will occur as outlined for ICHmk3_02 BEC series. Flooded pits will have little potential as fish habitat. However, the surface waters of the ponds have potential to support aquatic invertebrates

and may provide useable spawning habitat for western toad and spotted frog. To promote aquatic habitat, species including duckweed (*Lemna* spp.), pond weed (*Potamogeton* spp.), yellow pond lily (*Nuphar variegata*), water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), common cattail (*Typha latifolia*), and river horsetail (*Equisetum fluviatile*) will be considered in revegetation. Floating species help build up organic matter, creating potential habitats for riparian species to be introduced over time. Such plants may also help remediate pit water quality through microbial activity, while the pit lakes may have the potential to act as a drinking water source for wildlife, depending on water quality and access.

4.8.5 Watercourse Reclamation Prescriptions

Section 5.2.4, Appendix H, and Appendix I of Appendix 4-1A (MPMC 2022a) provide information on projections related to post-closure water balance, water management, and water quality and the assumptions for these models. Additionally, Appendix N of Appendix 4-1A (MPMC 2022a) provides detail on the research towards the development of a site-specific passive water treatment technology as presented in the post-closure water management model, which details how water will be routed and managed following reclamation and closure efforts.

In general, contact water will be collected and treated prior to discharge to the receiving environment, as required to avoid adverse effects on the receiving aquatic environments. Collection system ditches that remain in perpetuity (e.g., the SERDS Ditch and Long Ditch as per the conceptual long-term plan) will be further armoured as required, with the banks and adjacent areas revegetated with riparian species, such as black cottonwood, willow (plugs or wattles and live stakes), and Sitka alder, as outlined in Figure 4.2-1; Figure 4.2-2: ; and Table 4.3-3. At closure, habitats for riparian species and aquatic life will be established that will also provide forage for wildlife in wetland and riparian areas.

4.8.6 Road Reclamation

Two types of roads exist at the Mine Site: light vehicle roads (often old forestry roads that pre-date mine operations) and large haul roads made from NAG waste rock (often built up and are essentially linear RDSs). In general, both types of roads will be reclaimed to align with the adjacent ELUs (generally wildlife habitat and forestry), as shown in Figure 4.2-1; and Table 4.3-1, with roads not required post-closure, reclaimed during active closure.
Some additional haul roads may be required to access the Springer Expansion; however, they will be reclaimed as outlined in Section 6.8 of Appendix 4-1A (MPMC 2022a), and will follow monitoring and maintenance activities as outlined in Section 7 of Appendix 4-1A (MPMC 2022a).

4.8.7 Schedule

A conceptual schedule for the Mine Site active closure and post-closure periods are presented in Table 4.8-1.

This schedule can be expected to evolve based on findings of reclamation research and progressive reclamation projects. It is also subject to change in accordance with changes to the mine plan.

Table 4.8-1: Closure Schedule

Component	Phase	Phase Start Date	Phase End Date
SPE	Operation	01-Jul-2024	31-Dec-2031
	PAG disposal	01-Jan-2031	01-Dec-2033
	Pit Flooding	02-Jan-2036	31-Dec-2054
SERDS	Operation	01-Jan-2024	31-Dec-2033
	Reclamation and Closure	01-Jan-2034	19-Feb-2036

SPE = Springer-Pit Expansion; SERDS = Southeast Rock Disposal Stockpile.

4.9 Detailed Five-Year Mine Reclamation Plan

Appendix 4-1A (MPMC 2022a) provides a comprehensive reclamation plan for the next five years of the Mine Site operation. As the Mine Site is currently in care and maintenance, progressive reclamation activities have been postponed. It is expected that reclamation activities will resume with the approval of the Springer Expansion and will only occur in areas of the Mine Site that are no longer required for operation.

4.10 Temporary Shutdown

There are two scenarios where operations are suspended due to unplanned events; these are temporary Care and Maintenance and unexpected Care and Maintenance. The definitions of these two scenarios are provided below:

- **Temporary Care and Maintenance:** An unplanned halt in production and operations due to changes in economic conditions.
- **Unexpected Care and Maintenance:** an unplanned halt in productions and operations due to a more rapid development of unfavourable conditions. This definition includes cases such as an engineering failure or a shutdown due to environmental conditions.

In both cases, a Care and Maintenance Plan will be developed and submitted to the EMLI for review, as resumption of activities is anticipated in the foreseeable future. This plan will include infrastructure preservation and health, safety and environmental maintenance, and surveillance programs. During Care and Maintenance, MPMC employees will conduct ongoing inspections of the site. Reasonable measures will be taken by MPMC to maintain both the safety of the public and the security of infrastructure and equipment, including:

- Locking access road gates.
- Posting signs prohibiting access by unauthorized personnel.
- Restricting site access, via foot or recreational vehicle traffic, to authorized persons only through use of fencing, where required, or by using existing topography and vegetation (i.e., dense forest) as barriers.
- Conducting regular security walk arounds and inspections (e.g., signs of erosion).
- Securing buildings and equipment against vandalism using a combination of fencing, video surveillance, and security personnel.
- Maintaining roads within the Mine Site to allow safe access for monitoring and maintenance.
- Conducting routine monitoring programs (e.g., water quality and water balance)
- Continued operation of site contact water management systems, including the water treatment plant.

As the size of the Mine Site does not allow for exclusion fencing of the entire area, priority will be placed on preventing public access to high-risk areas in the Mine Site. A contact person(s) will be designated for authorized access to the site and the name and telephone number of the contact person(s) will be kept clearly posted on access gates.

Section 10.6 of the Health, Safety and Reclamation Code in BC, requires that proponents notify the EMLI prior to entering Care and Maintenance. Table 4.10-1 provides an overview of these notification requirements.

Table 4.10-1: Temporary Care and Maintenance Notification Requirements

Length of Mine Closure	Notice Required	Type of Closure
<1 year	▪ Continue to carry out the conditions of the Permit ▪ Carry out a program of site monitoring and maintenance	Care and Maintenance
>1 year	▪ Apply for an amendment to the Permit setting out a revised program for approval by the Chief Inspector ▪ Identify the hazards and provide detailed engineering drawings respecting such hazards to local emergency agencies, and update the drawings as required ▪ If practicable, make such plans available on-site at a conspicuous location	Unexpected Closure*

* Unexpected Closure = unplanned closure of the mine; care and maintenance activities are not conducted, and the RCP is executed.

In some scenarios, the conditions that triggered Care and Maintenance do not relent, and a mine progresses to a state of unexpected closure. In the event of unexpected closure, the procedures detailed in Appendix 4-1A (MPMC 2022a) will be implemented, as appropriate, given the mine plan status and the degree of permanence of the closure.

Site water management requirements within the EMA permit continue during Mine operation suspensions, including capture, conveyance, storage, treatment, and discharge of contact water on the Mine.

4.11 Post-Closure Monitoring and Maintenance

Post-closure monitoring and maintenance differs from reclamation monitoring and maintenance with respect to their objectives. Reclamation monitoring and maintenance is geared towards ensuring ecosystem recovery is on the correct trajectory to meet the desired ecosystems and ELUs. Meanwhile, post-closure monitoring and maintenance focuses on ensuring that the newly reclaimed landscape continues to achieve a relatively steady-state configuration that permits the uses outlined by ELU objectives. The Mine Site Post-Closure Monitoring Requirements are presented in Table 4.11-1.

Table 4.11-1: Requirements in the Event of Mine Closure Period

Monitoring Activity	Frequency	Location	Parameter	Success Criteria
Geotechnical Stability	Annually After extreme rainfall events[1]	TSF	Visual inspection of the Mine Site Component by a qualified geotechnical Engineer	No signs of erosion or forms of geotechnical instability to the Mine Site Component
		RDSs		
Surface Water Quality[2]	▪ Quarterly during Active Closure. ▪ Monthly to Annually (location dependent) during the first 5 years of Post-Closure ▪ Quarterly to annually for the remainder of Post-Closure	BC ENV permit Locations	Parameters outlined in BC Water Quality Guidelines	Water quality meets BC Water Quality Guidelines for Freshwater Aquatic Life.
		Water Management Infrastructure	Visual inspection of water management infrastructure by qualified personnel	Water Management Infrastructure supports its intended use
	As outlined in CEMP until distributed discharge is obtained	Quesnel Lake Discharge	Parameters outlined in BC Water Quality Guidelines	Water quality meets BC Water Quality Guidelines for Freshwater Aquatic Life
	Weekly, decreasing to monthly sampling over time	▪ Distributed discharge locations ▪ Quesnel Lake and other receiving environment locations		
Aquatic Effects	▪ Every 3 Years as per MDMER 2022 ▪ Decreasing to every 6 Years as results stabilize	Receiving environments with aquatic invertebrates or fish populations	Field and laboratory testing by a qualified professional.	Sediment chemistry, fish populations, fish tissue, and aquatic invertebrate populations align with observations from natural reference sites

Table 4.11-1: Requirements in the Event of Mine Closure Period

Monitoring Activity	Frequency	Location	Parameter	Success Criteria
Ground Water Quality and Levels	Daily until water levels are stable, followed by annual sampling for approximately 5 years.	▪ Cariboo-Springer Pit wells ▪ Nested monitoring wells near the Cariboo-Springer Pit ▪ Wells adjacent to Wight Pit	Parameters outlined in BC Water Quality Guidelines	▪ Long-term monitoring trends are stable and water quality meets BC Water Quality Guidelines ▪ Water levels follow those modeled for Post-Closure
	Biannually (every 6 months) until trends are stable, and the water chemistry and flow patterns have been adequately characterized.	Water Management Infrastructure is deemed		
Soil Replacement	Immediately after placement	All areas undergoing terrestrial reclamation	Field and laboratory testing by a qualified professional.	▪ Soil depth is within 80% of desired placement depth ▪ Soil pH is not rated as 'unsuitable[3]'
Revegetation and Invasive Plants	▪ Immediately after planting ▪ 1, 2, 5, and 10 years after planting	All revegetated areas via PSPs	▪ Ecosystem composition ▪ Plant mortality ▪ Percent cover ▪ Abundance of invasive plants ▪ Grazing/browsing signs ▪ Disease and infestation signs	▪ The reclaimed plant community supports its intended ELU ▪ The reclaimed plant community dynamics are similar to natural reference sites
Metal Uptake in Vegetation	1, 2, 5, and 10 years after planting	Revegetation PSPs	▪ Trace elements in soil ▪ Trace elements in plant tissue for each primary type of lifeform (e.g., grass, tree, shrub)	Metal uptake into vegetation on reclaimed sites is not significantly different than natural analogues

Table 4.11-1: Requirements in the Event of Mine Closure Period

Monitoring Activity	Frequency	Location	Parameter	Success Criteria
Wildlife	In conjunction with revegetation monitoring	Transects	▪ Population dynamics ▪ Species richness and diversity	▪ Mine Site population dynamics are similar to those in undisturbed areas ▪ Ecosystem dynamics (e.g., species richness) matches that of natural analogues

1) Rainfall exceeds design return period.

2) See Table 7-1 of Appendix 4-1A (MPMC 2022a) for further details

3) As defined by AAFRD (1987).

CEMP = Comprehensive Environmental Monitoring Plan; ELU = End Land Use; PSP = permanent sampling plot; RDS = Rock Disposal Stockpile; TSF; Tailings Storage Facility

4.11.1 Contingencies

It is possible that during post-closure monitoring, maintenance is required. Risks to successful closure will be partially mitigated through adaptive planning and decision-making.
The underlying strategy for reclamation and closure is that it is founded on a management approach that is based on iterative inputs from reclamation monitoring results, research findings, and changes to best practice and regulations. To this end, progressive reclamation activities provide opportunities to test, monitor, and adapt reclamation strategies, where required.
MPMC will use a ground-based sampling program as an effective method to measure success of reclamation and to help support the adaptive management approach to reclamation by identifying areas for mitigation and improvement in reclamation design.

Maintenance is planned for, and is included in, MPMC's long-term reclamation planning. Long-term monitoring and maintenance will be conducted until the Project is ready for certification. If, during monitoring, sites are found that are not performing as expected, mitigations may be applied including, but not limited to:

- Infill planting
- Fertilization
- Mulching, weed control and pest control
- Irrigation
- Further investigations into soil and foliar chemistry

If required, MPMC will work with the EMLI to determine appropriate mitigations based on best practices, experience at other mine sites, and results of academic and on-site research. Where uncertainty remains about the performance of reclamation activities, adaptive management strategies will be used to formulate an appropriate response.

4.12 Reclamation Cost Estimate

Reclamation cost estimates are provided under separate cover.

4.13 References

Alberta Agriculture, Food and Rural Development (AAFRD). 1987. SOIL QUALITY CRITERIA RELATIVE TO DISTURBANCE AND RECLAMATION. Edmonton, Alberta.

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5 WATER MANAGEMENT (MODELLING, MITIGATION, AND DISCHARGES)

5.1 Summary

5.1.1 Springer Pit

MPMC has a permit to discharge treated effluent from the Mine under the *Environmental Management Act* (EMA;) as Permit 11678. The permit was issued on May 30, 1997, and most recently amended through a Consent Order on 18 September 2020. An interim extension to Section 1.2.3 of PE-11678 was granted by Ministry of Environment and Climate Change Strategy (BC ENV) in 2022, allowing the existing discharge to Quesnel Lake to continue until 30 June 2025. The (2022) TAR provided an update on, among other things, receiving environment data and, in aggregate, provided scientific rationale to support the view that the discharge is not causing pollution. Under Section 1.2.3 of Permit 11678, the "authorized discharge period" for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley mine with the development of the Springer Expansion, which will add approximately 8 years of operational mining life. Approval of this project will be sought through a Joint Application through the EMLI and the BC ENV, with the request to BC ENV being an extension of the discharge period beyond 2025.

The 2024s WMP provided in Appendix 9-4, addresses permit requirements for assumed future operations of the site, which at the time of writing are expected to run through 31 March 2031. This WMP also summarizes and discusses predicted water quantity, quality, and treatment during closure (1 April 2031 through 31 March 2041) and post-closure (1 April 2041 through 31 March 2131) phases. It should be noted that these dates are expected dates for mining operations; however, as with all mines, such schedules are subject to changes that result from commodity pricing and other factors.

5.1.2 Interim Raise to 974 m

During construction for the TSF interim raise to 974 m, a portion of the existing diversion and collection channels and ponds that are currently in place around the TSF will be partially or fully covered by the new TSF embankment. Water management infrastructure around the TSF will be impacted, including the following modifications:

- Relocation of the south embankment pond and main embankment pond, as well as the relocation of collection channels that feed these ponds.
- Expansion of the PETBP and relocation of channels that feed this pond.

The TSF water management infrastructure will be designed in alignment with the ultimate embankment raise for 987 m. Some structures will extend beyond the M-200 boundary, and an extension of the M-200 boundary is required to cover the planned disturbance areas, as shown on the TSF water management infrastructure drawings. Additional information including a detailed description of water management structures associated with the TSF interim raise to 974 m is included in the Water Infrastructure Design Report included in Appendix 5-2.

5.2 Conceptual Site Model

This section is not required as part of the joint application per the information requirements table.

5.3 Site-Wide Water Balance Model

A site-wide water balance model (SWWBM) was developed as part of the WMP which describes proposed water management quantities for operations, closure, and post-closure phases of the Mine. A discussion of water treatment during operations and closure/post-closure is also provided, including treatment design bases for these LOM phases. Refer to Appendix 5-3 or Appendix A of the WMP (Appendix 9-4) for a detailed description and results of the SWWBM or to Appendix 5-4 for the operational efficiency and reliability of the WTP.

Note that the surface model already includes assumptions regarding lift of the TSF to 974m and ultimately to 987m. Stage-storage curves and seepage quantity estimates in the model already account for these lifts to ultimate 987m.

5.4 Surface Water Quality Model

A site-wide water quality model (SWWQM) was developed as part of the WMP which describes proposed water management quality for operations, closure, and post-closure phases of the Mine. A discussion of water treatment during operations and closure/post-closure is also provided, including treatment design bases for these LOM phases. Refer to Appendix B of the WMP (Appendix 9-4) for a detailed description and results of the SWWQM.

An additional objective of the WMP is to provide updates on treatment technology development and alternative water treatment strategies that are being assessed by MPMC for implementation both in operations and upon closure of the site.

5.5 Groundwater Model

5.5.1 Conceptual Hydrogeologic Model

5.5.1.1 Site Wide

Situated on a topographic high and centred on Polley Mountain is the main mine site, which reaches an elevation of approximately 1250 metres above sea level (masl). Bootjack Lake is located to the southwest of the mine site, and Polley Lake is located to the northeast of the mine site. Infrastructure of note at the mine site consists of the mill, in the approximate centre of the mine site, the TSF, located about 3 km southeast of the mill in a topographically low area, several pits (Springer, Cariboo, Wight, and Boundary) and Hazeltine Creek (Figure 5.5-1). Hazeltine Creek flows southeast and then east from Polley Lake to Quesnel Lake; Quesnel Lake is located approximately 5 km to the east of the TSF. Numerous groundwater monitoring wells are located throughout the site (see Table 5.5-1)

The climate is described as a humid, continental climate with the driest season in spring and the wettest season in summer. Groundwater recharge occurs through the infiltration of precipitation in the topographic high area of Polley Mountain and the surrounding slopes, excluding the existing mine pits. The open pits act as sinks for groundwater flow when they are dewatered, and as both sinks and sources of groundwater seepage when flooded to the spillover elevation. The primary groundwater discharge areas next to the mine site are: Polley Lake to the east, Bootjack Lake to the west, and an area near the TSF and Hazeltine Creek (located to the southeast of the TSF). Bootjack Lake, Polley Lake, and Quesnel Lake, the largest lake in the area located about 5 km to the east of the mine site, strongly control regional groundwater flow and act as significant hydrogeological boundaries.

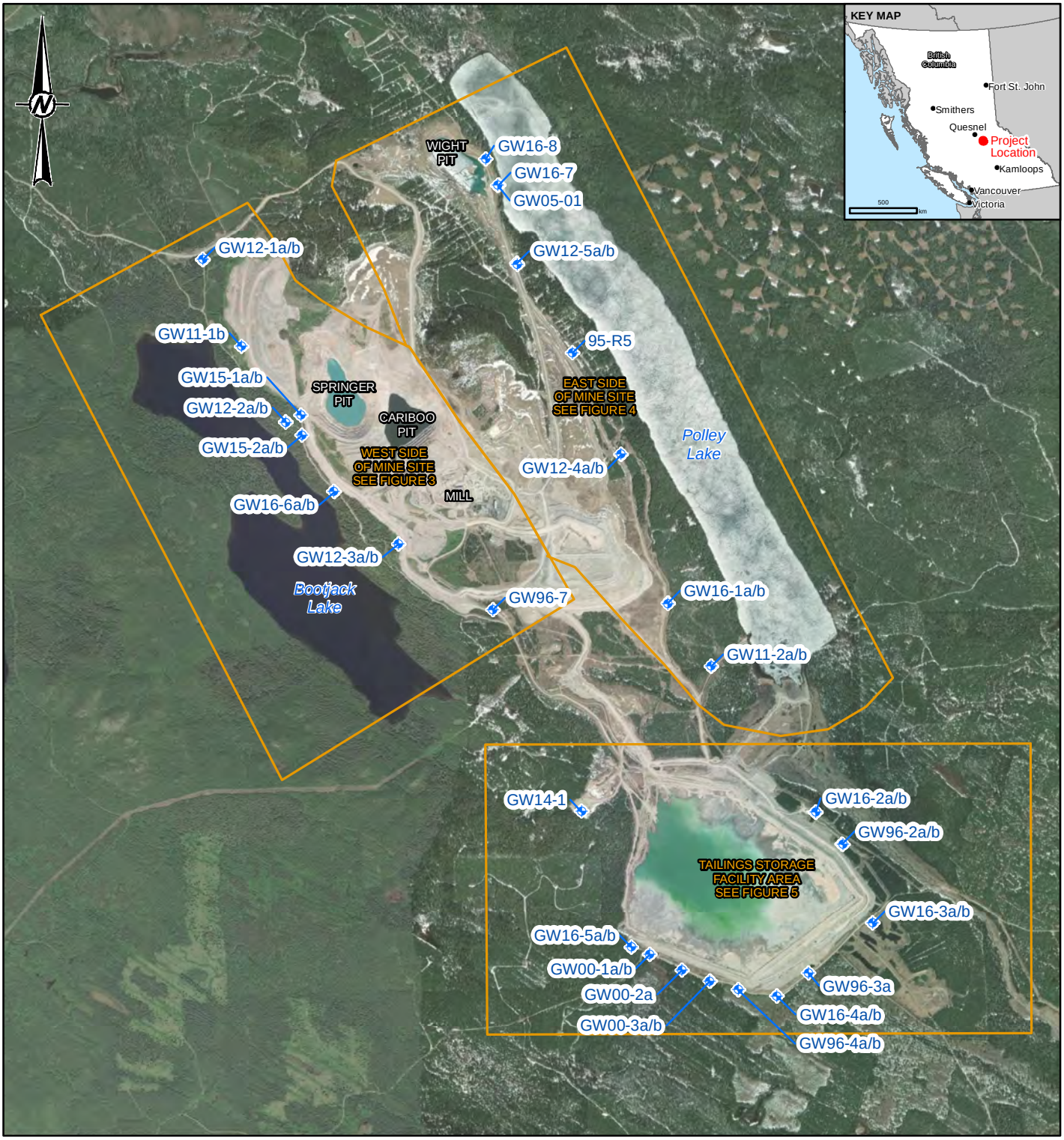

LEGEND

GROUNDWATER MONITORING WELL

MAP EXTENT - REFER TO FIGURES 3, 4 AND 5

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1:50,000 KILOMETRES

REFERENCE(S)

1. IMAGERY COPYRIGHT © 20210621 ESRI AND ITS LICENSORS. SOURCE: MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.
2. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
SITE PLAN

CONSULTANT

YYYY-MM-DD	2024-07-04
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

PROJECT NO.	PHASE	REV.	FIGURE
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The mine site is underlain by monzonite bedrock that has been intruded by hydrothermal breccias and intersected by northwest–southeast striking faults. The bedrock in the area of the Springer and Cariboo pits is overlain by a discontinuous and relatively thin (i.e., a few metres) layer of overburden of glacio-lacustrine and glacio-fluvial origin, primarily silt/clay. Near the Wight Pit, a thicker zone of overburden is identified between the southeast crest of the pit and Polley Lake, with coarser and more permeable sand/gravel sediments present at depth directly above bedrock.

Prior to mining of the site, the direction of groundwater flow was inferred to be from areas of topographic high (i.e., the top of the ridge between Polley Lake and Bootjack Lake) to areas of topographic low (i.e., the lakes). However, after mining commenced, and as a result of mine dewatering, the groundwater flow direction at the mine site has changed. Mine dewatering has lowered the groundwater elevation and created localized radial flow towards the various pits.

Table 5.5-1: Monitoring Well Network

Year	Well Series	Well Numbers	Comments
1995	95	R5	Several wells were drilled in 1995; however, only 95-R5 still exists.
1996	GW96	1b[(a)]; 2a, b; 3a, b[(b)]; 4a, b; and 7	Initially nine wells were drilled with eight installed as multi-level wells. Currently only six monitoring wells[(c)] are monitored (two multi-level wells and two single well locations).
2000	GW00	1a, b; 2a, and 3a, b	Installed along southeast embankment of TSF.
2005	GW05	1	GW05-1 was installed as a pumping well to capture groundwater moving from Polley Lake towards the Wight Pit, pumping it back into Polley Lake.
2011	GW11	1a, b; and 2a, b	Two pairs of multi-level wells were installed to monitor potential impacts from newly disturbed areas.
2012	GW12	1a, b; 2a, b; 3a, b; 4a, b; and 5a, b	Five pairs of multi-level wells were installed to collect additional groundwater information.
2014	GW14	1	Domestic well at Orica site.
2015	GW15[(d)]	1a, b; and 2a, b	Two pairs of multi-level wells installed to monitor seepage conditions associated with Springer Pit Lake.
2016	GW16	1a, b; 2a, b; 3a, b; 4a, b; 5a, b; 6a, b; 7; and 8	Additional monitoring wells installed at various locations to monitor current groundwater quality, and eventually at closure.

Note:

In multi-level well installations, “a” represents deep well, and “b” represents shallow well.

Only wells identified in the most recent CEMP have been identified in the table.

(a) Groundwater monitoring at GW96-1a, and GW96-1b was ceased in 2018 based on Golder’s recommendation, and has been removed from the CEMP sampling requirements; however historical data is included in the chemistry plots.

(b) Groundwater monitoring well is decommissioned.

(c) Currently monitored wells consist of GW96-2a, GW96-2b, GW96-3a, GW96-4a, GW96-4b, and GW96-7.

(d) Only groundwater level was monitored at GW15-1a and GW15-1b.

5.5.1.2 Springer-Cariboo Pit

Hydrogeological conditions around the Springer-Cariboo Pit are described in Golder (2016a), Golder (2017) and WSP (2024). A key hydrogeological feature that affects groundwater movement out of the pit is a groundwater "mound" to the west of the pit. The elevation of the mound rises and falls in response to changes in surrounding water levels, including those in Springer Pit. When water levels in Springer Pit rise above approximately 1,020 masl, a small flux (~20 m^3/day) of groundwater toward Bootjack Lake is anticipated. This volume has been estimated to increase to 90 m^3/day at an elevation of 1,030 masl and 360 m^3/day at 1,050 masl (WSP, 2024).

Water levels in Springer Pit in 2023 were reported to range from 974.89 masl (January) to 975.25 masl (March). Surface water elevations for Springer Pit were not provided beyond April 2023. In 2023, surface water elevations at Springer Pit were generally lower than the groundwater elevations within monitoring wells associated with the west side of the mine site (Figure 5.5-2).

Water levels in Cariboo Pit in 2023 were reported to peak in January (974.31 masl), after which they stabilized at an elevation of 950.23 masl (August). Water levels in Cariboo Pit have been decreasing since May 2022.

Based on a review of groundwater elevations on the west side of the mine site, it can be inferred that a groundwater divide between the Springer Pit and Bootjack Lake remains in the area of GW12-2(a,b) and GW15-2(a,b), as groundwater elevations at these wells remained higher than the surface water elevation in Springer Pit; there continues to be no leakage from Springer Pit to Bootjack Lake. This groundwater divide results in groundwater flow both towards the east and west from the groundwater divide (Figure 5.5-2).

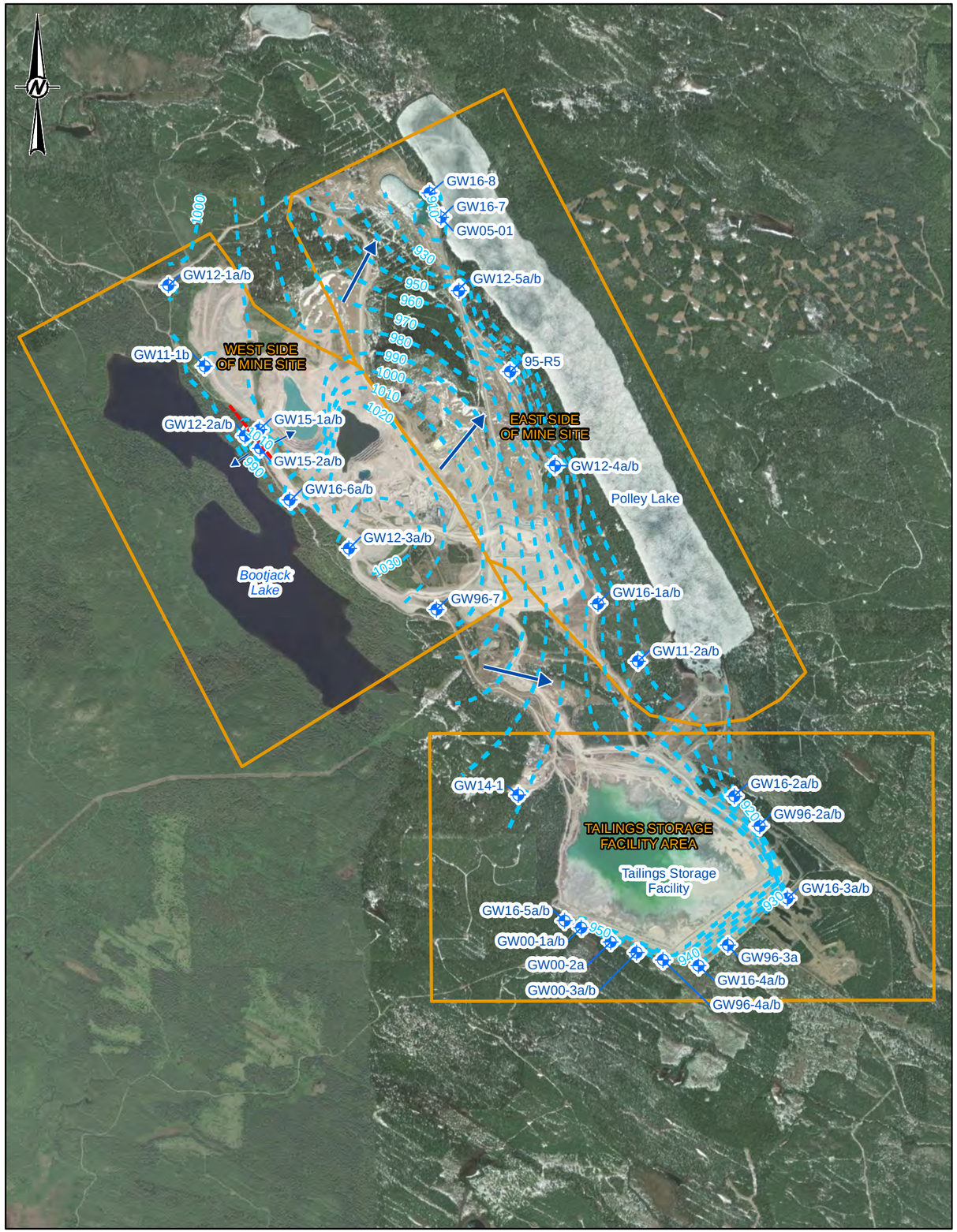

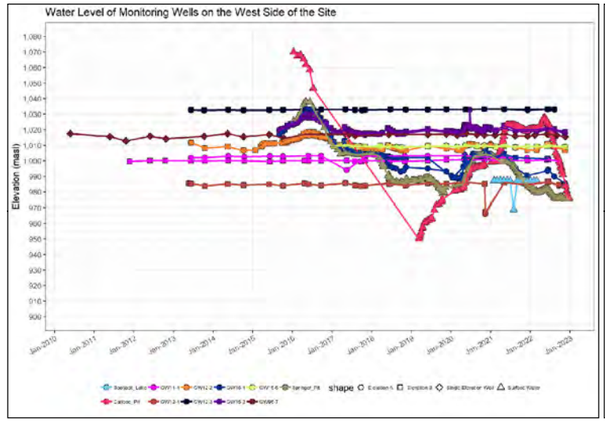

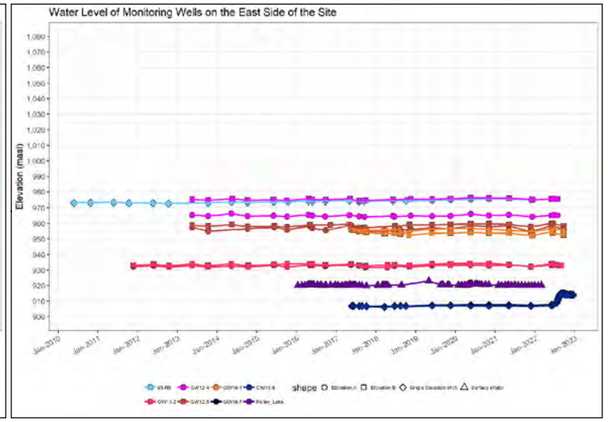

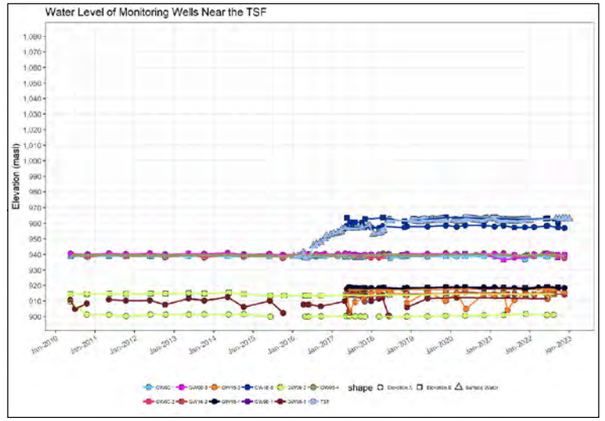

LEGEND

- GROUNDWATER MONITORING WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW
- INFERRED GROUNDWATER DIVIDE
- GROUNDWATER ELEVATION CONTOUR
- MAP EXTENT (SEE FIGURES 3, 4 AND 5)

NOTE(S)
1. TAILINGS STORAGE FACILITY, POLLEY LAKE, BOOTJACK LAKE ELEVATIONS FROM FEBRUARY 2022.

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REFERENCE(S)
1. IMAGERY COPYRIGHT © 20210621 ESRI AND ITS LICENSORS. SOURCE: MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.
2. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-07-04
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

PROJECT
MOUNT POLLEY MINE
SPRINGER PIT JOINT APPLICATION

TITLE
GROUNDWATER FLOW DIRECTION PLAN (JUNE 2022)

PROJECT NO.	PHASE	REV.	FIGURE
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5.5.2 Numerical Hydrogeological Model

In 2016, Golder assessed groundwater flow for the following three open pits at the mine: Springer and Cariboo pits, Wight Pit and Boundary Pit. The analysis for each pit was described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a). Hydrogeological assessments for the pits were conducted as part of the TAR to provide estimates of seepage into and out of the pits. A provision to update the WMP and provide an updated seepage assessment is included as part of the revision trigger and frequency table under the implementation plan and schedule in Section 5.0 of the WMP. The Springer Pit three-dimensional model was updated and recalibrated in 2023/2024 based on more recent data since 2016 and on an updated mine plan. The changes to the model hydrogeological parameters resulting from model recalibration are summarized in Table 5.5-2 below.

Table 5.5-2: Hydrogeological Model Parameter Value Comparison and 2024 Modifications

Item	2016 Model Value	2024 Model Value
K value - Shallow bedrock between the pit crest and GW15-01A/B	3×10^{-6} m/s	5×10^{-6} m/s
K value - Zone of the brecciated bedrock extending along the southwest portion of the Springer Pit and south of the Cariboo Pit	2×10^{-6} m/s	5×10^{-6} m/s
K value - Bedrock at depth between 40 m and 100 m	2×10^{-7} m/s	1×10^{-7} m/s
Anisotropy - Zone characterized with lower hydraulic conductivity around monitoring well GW12-2	Anisotropy – 1	Anisotropy – 5
Recharge from precipitation was increased by approximately 20% from average value based on climate data	October to April	April to June

The recalibrated model was used to estimate updated seepage into and out of the ultimate Springer/Cariboo Pit during closure. The results of this assessment are presented in WSP, 2024 and are summarized in the section below. Similarly, estimates of seepage into and out of the TSF was also assessed using a three-dimensional model (Golder 2016b). The three-dimensional model for the TSF is currently being updated and recalibrated.

Springer/Cariboo Pit

The combined Springer/Cariboo Pit will be mined to the ultimate depth of approximately 763 masl based on the ultimate pit shape provided by MPMC. During closure, the combined Springer/Cariboo Pit will be allowed to flood. The spillway elevation for this pit lake will be approximately 1,050 m elevation. PAG materials will be placed in the combined Cariboo-Springer Pit at closure and stored sub-aqueously to mitigate acid generation and metal leaching, in accordance with standard mine waste handling practices (MEND 2015).

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from the combined Springer/Cariboo pit towards Bootjack Lake for the Phase 4 Cariboo-Springer Pit mine plan (WSP, 2024). Similarly to the previous assessment, in these model simulations, it was assumed that the PAG materials that will be placed in the Springer/Cariboo Pit will have a hydraulic conductivity significantly higher than the surrounding rock mass, and thus offer no resistance to seepage entering or exiting the pit lake. Results showed that, as the pit lake level increases to between 1,020 and 1,030 m elevation, seepage in the range of 20 to 90 m^3/d from the Springer/Cariboo Pit Lake into the subsurface was predicted to occur (Table 5.5-3). Seepage was found to gradually increase to approximately 360 m^3/d when the pit lake reaches the spillway elevation of 1,050 m.

At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from both pits and recharge to groundwater occurring towards the southwest.

Table 5.5-3: Predicted Seepage Quantities for the Ultimate Configuration of the Springer/Cariboo Pit Lake

Springer-Cariboo Pit Lake Elevation (m)	Base Case		Upperbound		Lowerbound	
	Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake
760	640	-	1120	-	420	-
800	640	-	1120	-	420	-
850	640	-	1110	-	420	-
900	630	-	1090	-	410	-
940	620	-	1080	-	410	-
960	610	-	1040	-	400	-

Table 5.5-3: Predicted Seepage Quantities for the Ultimate Configuration of the Springer/Cariboo Pit Lake

Springer-Cariboo Pit Lake Elevation (m)	Base Case		Upperbound		Lowerbound	
	Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake
980	580	-	980	-	390	-
1000	520	-	850	-	360	-
1020	430	20	690	60	320	<10
1030	390	90	620	200	300	30
1040	360	200	560	440	280	80
1050	330	360	510	780	270	150

Source: WSP, 2024.
masl = metres above sea level.

Wight Pit

Hydrogeological modelling was carried out for the Wight Pit (Golder 2016a), and is considered to be generally representative of current conditions. The results from the hydrogeological model indicate that under steady-state conditions Table 5.5-4, groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at an elevation of 880 m to 600 m^3/d at an elevation of 926 m (Golder 2016a).

Table 5.5-4: Predicted Groundwater Flows for the Wight Pit

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Lake	Out of the Lake
Base Case		
880	2,600	0
900	2,500	0
910	2,100	0
920	800	0
926	600	500
Lower Bound		
926	400	300
Upper Bound		
926	700	800

Source: Golder 2016a.

masl = metres above sea level.

Boundary Pit

At present, hydrogeological data specific to the Boundary Pit are not available. However, MPMC indicated that during mining seepage was not observed along the pit walls. This is considered reasonable due to the relatively shallow depth of this pit and depth to water table measured at monitoring wells that were installed near other mine facilities. It is thus considered likely that the water table was located near or below the floor of the Boundary Pit before mining at this location commenced.

Although seepage to the Boundary Pit from the surrounding rock mass is not expected, seepage out of this pit could occur due to water entering the pit via surface water runoff and direct precipitation. An estimate of these potential seepage rates out of the pit was made to provide input to the pit water balance and to characterize a potential seepage pathway originating from this pit (Golder 2016a).

Seepage rates out of the Boundary Pit have been estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake level is 5 m above its base (1,073 m) is approximately 59 m^3/d, with a potential range between 35 and 177 m^3/d due to uncertainty in bedrock permeability (Table 5.5-5).

Table 5.5-5: Estimated Seepage Outflows from the Boundary Pit

Water Level (masl)	Estimated Groundwater Outflow (m^3/d)		
	Lower Bound	Base Case	Upper Bound
1,068	2	3	10
1,069	6	10	29
1,070	12	20	61
1,071	16	26	79
1,072	32	53	159
1,073	35	59	177

Source: Golder 2016a.

masl = metres above sea level.

Seepage from the Tailings Storage Facility

WSP is currently designing a new upstream drainage system to accommodate the increase in the TSF pond elevation (WSP 2023b). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width). Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipated seepage rates through the embankment and foundation. A three-dimensional numerical groundwater flow model will be updated in 2024 to aid in further seepage assessment and refinement.

Using the two-dimensional model, seepage analyses were conducted for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 5.5-6 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 5.5-6: Seepage Flow Rates

Beach (m)	Seepage Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note: includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF pond volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different pond sizes. The estimates are provided in Table 5.5-7, which outline a conservative scenario, in terms of seepage flow quantities.

Table 5.5-7: Tailings Beach Width

TSF Pond Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 5.5-6 and Table 5.5-7 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (1 August 2031), the TSF pond reduces its volume to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 5.5-8 will be in effect 6 months after the end of the operation phase and throughout the closure and post-closure phases.

Table 5.5-8: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	**S2**	**S4**	**S5**
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF pond is limited to 250,000 m³.

5.6 Mitigation Methods

5.6.1 Best Available Technology

This section is not required as part of the joint application per the information requirements table.

5.6.2 Volume and Quantity Control Methods

During normal operations, the TSF will be managed by maintaining the pond volume within the operating range for reclaim water and make-up water. The SWWBM developed as part of the WMP shows that the maximum TSF pond volume during the operational phase remains within the normal operating range during average conditions (50th percentile) and increases to approximately 3.5 million m3, which represents the 99.5th percentile volume.

The inflows that directly contribute to the TSF volume are from precipitation on the direct footprint of the TSF and runoff from the catchment directly above the TSF. The major contribution to TSF supernatant volume is site contact water pumped from facilities including the Central Collection Sump and Perimeter Embankment Till Borrow Pond.

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on site year over year within the TSF by treating and discharging water.

A freeboard and water level assessment (WSP 2024) was completed for the TSF interim raise to 974 m to assess a minimum freeboard that needs to be maintained to prevent overtopping of the TSF by wave action. The freeboard and water level assessment included wave run-up calculations, hydrology and hydraulic modelling, and spillway sizing as an emergency control measure to maintain the minimum freeboard. The freeboard and water lever assessment is summarized below and more details can be found in WSP 2024 in Appendix 5-5.

The design criteria for the spillway are described in the technical basis memorandum document for the TSF Raise to Elevation 974 m (WSP 2023) and inputs to the TSF freeboard and water level assessment are found in WSP 2024.

5.6.2.1 TSF Freeboard

The freeboard for a water-retaining structure can be defined as the minimum vertical distance between the still pool reservoir level and the crest of the retaining structure (CDA 2013, 2019). This distance needs to be maintained at all times to prevent overtopping of the containing structure by waves resulting from wind and wave set-up and run-up. The Canadian Dam Association provides the following definitions to calculate the freeboard (CDA 2013):

- Normal freeboard is the difference in elevation between the dam crest and the maximum operating water level of the facility. The normal freeboard is required to protect the structure from overtopping by 95% of waves caused by wind with an annual exceedance probability of 1:1,000-year event with the reservoir at maximum normal elevation.
- Minimum freeboard is the difference in elevation between the dam crest and the maximum water level that would result from the peak design inflow. The minimum freeboard is required to protect the structure from overtopping by 95% of waves caused by the most critical wind when the reservoir is at its maximum level during the inflow design flood (IDF). The wind for the significant consequence dam has an annual exceedance probability of a 1:10 year event.

The freeboard calculations follow the procedures and equations discussed in CDA (2013, 2019). Wind speeds, pond depth, and dam slope geometry were considered to determine the greatest wave uprush value for the normal and minimum freeboard scenarios.

Hourly wind speed and direction data for the study site are only available from 1997 to 2003, and daily wind speed data are available from 2019 to 2021. Thus, hourly data from the Environment and Climate Change Canada Williams Lake A climate station from 1961 through 2023 (ECCC 2023) were used as the basis for the frequency analysis to estimate extreme hourly wind speed for a range of annual exceedance probabilities. The results are provided in Table 5.6-1.

Table 5.6-1: Hourly Maximum Wind Speed at the Williams Lake A Station

Annual Exceedance Probability (years)	Maximum Hourly Wind Speed (m/s)
10	26.3
1000	32.1

m/s = metre per second

Wave run-up was calculated using the random wave run-up height on gentle slope method by Mase (1989). A contingency of 0.3 m was applied to account for uncertainty due to settlement, crest irregularities, and construction tolerances for crest and spillway invert elevation (ANCOLD 2012). Table 5.6-2 provides the results of the normal and minimum freeboard calculations and 0.7 m is recommended for the minimum freeboard when passing the IDF through the spillway.

Table 5.6-2: Tailings Storage Facility Required Freeboard Results

Description	Unit	Minimum	Normal
Design wind speed	m/s	26 (1:10-year)	32 (1:1,000-year)
TSF Dam crest elevation	m	974	974
Wave height	m	0.76	0.97
Wind setup	m	0.08	0.11
Wave run-up [(a)]	m	0.31	0.39
Wave uprush (setup and run-up)	m	0.4	0.5
Contingency	m	0.3	0.3
Freeboard (wave uprush plus contingency)	m	0.7	0.8

(a) Calculated using the method by Masse (1989).

m/s = metre per second; m = metre

5.6.2.2 Tailings Storage Facility Hydrologic and Hydraulic Modelling

The IDF for the TSF was selected as the probable maximum flood (PMF). The PMF was estimated using the 72-hour probable maximum precipitation (PMP) event plus snowmelt (snowmelt calculated using the mean Aril temperature and the PMP rainfall). Rainfall and snowmelt depths used to estimate the inflows to the TSF for the IDF event are presented in .

Duration	Mean April Temperature[(a)] (°C)	Depth[(b)] (mm)		
		PMP Rainfall	Total Snowmelt	Total Rainfall Plus Snowmelt
24-hour	3.7	224[(a)]	23	247
48-hour		278	38	316
72-hour		339[(a)]	54	393

(a) Source: WSP 2022

(b) Values rounded to the nearest millimetre

PMP = probable maximum precipitation; °C = degree Celsius; mm = millimetre

5.6.3 Geochemical Attenuation Processes

This section is not required as part of the joint application per the information requirements table.

5.6.4 Water Treatment

Information and discussion on the anticipated changes to water quantity and quality as informed by the SWWBM and SWWQM, and how these predictions relate to the water treatment effectiveness and capacities are provided in Sections 4.3 (SWWBM), 4.4 (SWWQM), 4.7.1 (Treatment Design Bases), and 4.7.2 (Treatment Technology Update) of the WMP (Appendix 9-4).

5.6.4.1 Description

A description of the existing water treatment system is provided in Section 4.1 and 4.7.1 of the WMP (Appendix 9-4).

The interim TSF raise to 974 m will use the existing water treatment structures.

5.6.4.2 Location

The location of the existing water treatment system is provided in Figure 3 – Mine Site Layout of the WMP (Appendix 9-4).

The interim TSF raise to 974 m will use the existing water treatment structures.

5.6.4.3 Detailed Design

A detailed design report for the TSF interim raise to elevation 974 m is included in Appendix 1-3.

5.6.4.4 Treatment Effectiveness

Information and discussions on the anticipated changes to water quantity and quality as informed by the Surface Water Balance and Surface Water Quality Models, and how these predictions relate to the water treatment effectiveness and capacities are provided Sections 4.3 (SWWBM), 4.4 (SWWQM), 4.7.1 (Treatment Design Bases), and 4.7.2 (Treatment Technology Update) of the WMP (Appendix 9-4).

5.6.4.5 Performance Risks

Refer to Section 7.12 in Appendix 1-3 for the geotechnical risk associated with the TSF interim raise to 974 m.

5.6.4.6 Influent and Effluent Water Quality

Predictions for changes to WTP influent and effluent volume and quality resulting from the Springer Expansion are provided in Section 4.7.1 and 4.7.2 of the WMP (Appendix 9-4).

5.6.4.7 Waste and By-Products

Only one existing treatment plant provides contact water treatment for the Mine site and this plant is expected to continue operating for the remainder of the proposed life-of-mine period and potentially into closure. One waste stream is produced from the treatment plant: settled solids sludge removed from the contact water during the ballasted settling within the plant. This waste stream is currently pumped from the plant to the TSF (under current permit), and this is proposed to continue for the remaining Mine operating period.

5.6.4.8 Maintenance

The TSF interim raise to 974 m will not impact maintenance at the TSF.

5.6.4.9 Emergency Response Plans

The TSF interim raise to 974 m will not impact emergency response procedures at the TSF.

5.6.4.10 Monitoring Plans

The CEMP (Appendix 7-1) is a unique and integrated monitoring plan that has been developed to capture a number of independent and interdependent monitoring programs, including site monitoring, water discharge, MDMER requirements, and TSF embankment breach response and remediation. Monitoring programs are normally developed by requirements of sector-specific regulations (e.g., MDMER of the federal *Fisheries Act*) or by conditions in a permit with a specific monitoring plan that ties together permit-required and MDMER-required monitoring. As there is no BC ENV Technical Guidance document for this type of plan, the CEMP has been developed through an extensive consultative process that encompasses a number of permitting and other regulatory processes. Through these efforts, it has been suggested by various parties that all of the monitoring programs (e.g., water discharge monitoring, MDMER, TSF embankment breach response, etc.) be combined into one overarching program that takes advantage of the broader data set.

5.6.4.11 Schedule

This section provides a description of the forecasted future mining phases associated with the Springer Expansion LOM Plan:

- **Future operational phase:** The Mine has resumed operation since June 2022 under the current EMA Permit 11678. The future operational phase is assumed for the period from 2 May 2023 through 31 March 2031, in line with the Springer Expansion LOM Plan. Future operations are anticipated to include the following:
  - Full mining and milling activities will resume, including deepening of the Cariboo and Springer pits (Phases 5, 6, C2, WX).
  - Tailings will be deposited into the TSF until March 2031 (subject to approvals for dam raises in the interim to 974 m and ultimately to 987 m).
- **Closure phase:** will begin when mining is finished and will include closure and reclamation activities as identified in the RCP (Appendix 4-1A; MPMC 2022) over the period of 1 April 2031 through 31 March 2041.

- **Post-Closure phase:** will begin when the closure period is finished and will continue indefinitely. For the purposes of modelling and this WMP, post-closure has been assumed over the period of 1 April 2041 through 31 March 2131 (100 years including the closure phase). Pit lakes will develop in the combined Springer-Cariboo Pit and Wight Pit.

It should again be noted that these mine phase dates are assumed for the general purpose of modelling and that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations.

As the closure phase ends and the post-closure phase begins, it is assumed that some catchments will produce non-contact water as areas are successfully remediated, and some sump pumping systems are assumed to be decommissioned to allow overflow from sumps and or pits directly into the environment rather than being pumped into the contact-water system for treatment. More details regarding the closure and post-closure assumptions regarding operating or decommissioned water management components within the mine facilities may be found in the Water Balance Model Report (Appendix A of the WMP [Appendix 9-4]).

5.6.4.12 Cost Estimate

The annual contract water capacity within the water treatment plan is not expected to change with the TSF interim raise to 974 m; therefore, a cost estimate is not applicable.

5.7 Domestic Water/Sewage Treatment

This section is not required as part of the joint application per the information requirements table.

5.8 Effluent Discharge

The mine discharges two types of contact water/effluent, namely point source and non-point source discharges. Point source discharges consist of effluent discharged from the water treatment plan via pipeline to Quesnel Lake. Details on proposed mitigation, including WTP capacity, performance, and adequacy in mitigating the effluent discharge are provided in Section 4.71 and 4.7.2 of the WMP (Appendix 9-4).

The non-point source effluent consists of discharge to ground from the various mine facilities, including pits, waste rock dumps and the TSF. The non-point source discharge to ground is further divided into 1) recoverable seepage (i.e., seepage ponds, collection ditches and sumps) and 2) non-recoverable seepage, which is any seepage that bypasses the collection systems and migrates to the downstream environment. Recoverable seepage is seepage that makes it into the mine contact water system, is captured within the Mine's water management components and is treated at the WTP and discharged to Quesnel Lake. Non-recoverable seepage is evaluated through numerous monitoring wells completed throughout the Site. These monitoring wells

allow for the collection of groundwater quality throughout the year and an evaluation of the groundwater quality against applicable provincial standards. Information regarding groundwater quality is reported on annually within the CEMP report. WSP/Golder (2023) provides detailed information regarding groundwater quality around the Site, with sections divided into monitoring wells in the east portion of the mine, the west portion of the mine and the TSF.

5.9 Initial Dilution Zone

A plume dispersion model was developed by Golder for the near-field (i.e., in the vicinity of the IDZ), and a hydrodynamic model of Quesnel Lake has been developed and calibrated by Tetra Tech EBA to predict effluent transfer throughout the West Basin of Quesnel Lake and to evaluate the potential for build up (Golder 2016a). Monitoring at the near-field station, along with monitoring at other Quesnel Lake receiving environment stations, are used to verify the near-field and lake-wide hydrodynamic models. The near-field and the hydrodynamic models, as described in the LTWMP, serve as the basis for the Trigger Response Plan incorporated in the ADP (MPMC 2018).

Since the discharge to Quesnel Lake was originally authorized, BC ENV published guidance on use of initial dilution zones (BC ENV 2019). The guidance provides considerations for IDZs and the siting of a discharge. Table 5.9-1 provides an evaluation of the existing IDZ under Permit 11678 against those considerations. The analysis provided, together with the absence of change in discharge volume or quality limits, shows that the previously established IDZ remains appropriate for discharge.

Table 5.9-1: Evaluation of Quesnel Lake IDZ against Technical Guidance 11

Considerations for Use of an IDZ	Evaluation of Quesnel Lake IDZ
An IDZ should be as small as possible to minimize the extent of the receiving environment potentially exposed to chronic toxicity levels[1]	The size of the IDZ is based on the common dimensions of an IDZ (a radius of 100 m from the outfall terminus) as is commonly used and represents a very small portion of the surface area of the West Arm of Quesnel Lake. BC ENV guidance (2019) states that the IDZ should be less than 5% of the surface area of a lake. The surface area of the West Arm of Quesnel Lake is approximately 90 km^2. An IDZ with a radius of 100 m has a surface area of approximately 31,000 m^2, which is 0.03% of 90 km^2
An IDZ should not adversely affect sensitive aquatic habitats. These include, but are not limited to: ▪ Spawning, hatching, or rearing areas for fish, overwintering habitats for fish or migratory waterfowl, ecosystems ranked as at risk as per the BC Conservation Data Centre and ecosystems of regional, provincial or national importance (e.g., unique to the region, province); and, ▪ Aquaculture and marine protected areas;	The discharge location is at depth, on the order of minus 50 m depth (the diffusers are at staggered depths). There is spawning habitat available in lower Hazeltine Creek and Sockeye Salmon were observed spawning there during fall of 2022. There may also be some shore spawning by Kokanee in the vicinity of Hazeltine Creek. However, as noted, the diffusers are located at depth to optimize dispersion and separation from sensitive habitats.

Table 5.9-1: Evaluation of Quesnel Lake IDZ against Technical Guidance 11

Considerations for Use of an IDZ	Evaluation of Quesnel Lake IDZ
An IDZ should maintain adequate zones of passage for migrating fish that do not deter the fish from passing through, do not affect their sense of orientation, and do not pose health risks to migrating species	There are adequate zones of passage and spawning salmon are arriving in spawning streams unimpeded by the IDZ.
▪ An IDZ should not result in an adverse effect at the edge of the IDZ on designated water uses in the area: ▪ Designated uses include aquatic life, wildlife, agriculture (e.g., livestock watering and irrigation), and drinking water and recreation. ▪ An IDZ should not be sited near drinking water intakes or food harvesting areas (e.g., shellfish beds or Indigenous Peoples traditional harvesting locations);	Water quality guidelines for designated uses are met at the edge of the IDZ (see Section 2.7.1).
An IDZ should consider setbacks from sensitive areas	There are no identified sensitive areas such as Wildlife Management Areas near the IDZ. The outfall terminus and IDZ is removed from spawning or migration pathways.
An IDZ should avoid highly-frequented recreational water use areas (e.g., public beach)	The IDZ does not overlap with recreational use areas. The nearest recreation area is the Raft Creek campsite, which is located approximately 1 km away.
At the edge of the IDZ, water quality should not result in short-term or long-term effects to aquatic life	The water quality at the edge of the IDZ meets WQG (short term and 30-d average) which are protective against short-term or long-term effects to aquatic life.
IDZs for adjacent authorized effluent discharges should not overlap with each other	There are no nearby authorized effluent discharges.
The effluent plume within the IDZ should not contact the shoreline of a water body in any manner that would prevent effective mixing and/or result in accumulation of Constituents of Potential Concern in the sediments	The plume does not contact the shoreline.
Diffusers used to discharge effluent into an IDZ should be designed to maximize mixing effectiveness	The 4-port diffuser configuration is the result of plume dispersion and dilution modeling including both nearfield and far-field modeling with 10 year forecasting (Golder 2016a). The diffuser depth also considers the presence of a thermocline, when it exists.

1) The surface area of the West Arm of Quesnel Lake is approximately 90 square kilometers. An IDZ with a radius of 100m has a surface area of approximately 31,000 m2, which is 0.03% of 90 square kilometers.

Quesnel Lake Near-Field Model

To predict near field behaviour of the discharge plume from the WTP, concentrations at the edge of the 100 m IDZ were estimated using Cornell Mixing Zone Expert System (CORMIX; Doneker 2007). This model was used to develop an outfall design that maximizes dispersion at the IDZ under a variety of seasonal and wind-driven current conditions. CORMIX provides predictions within the near-field (i.e., at the scale of metres to hundreds of metres, including the edge of the IDZ). A number of individual scenarios were simulated within CORMIX to estimate the dilution factor under a range of expected conditions. Conditions that were varied include discharge rate, ambient water current, temperature, and thermocline depth.

Basin-wide increases in constituent concentrations, and corresponding decreases in dilution beyond the IDZ, as a well as “re-dosing” with the IDZ, are not represented by the CORMIX model. Therefore, a far field model was also used to simulate these processes.

The objective of water quality modelling in Quesnel at the boundary of the IDZ is to verify that the discharge of treated effluent is not causing exceedances of the applicable ambient BC WQGs at the edge of the IDZ, as required by the permit, and to verify the discharge model described in the ADP.

The above assessment did not identify any Constituents of Potential Concern and showed that pollution (as per the EMA definition) is unlikely to occur as a result of the proposed Quesnel Lake discharge. Specifically, adverse effects on aquatic life and impairment of other receiving environment uses identified for the West Basin of Quesnel Lake are not expected based on predicted concentrations at the edge of the IDZ in Quesnel Lake. The treated whole effluent at the point of discharge is not expected to be acutely lethal to aquatic life. Following dilution and mixing, conditions within the IDZ would likewise not be expected to be toxic to aquatic life. Chronic toxicity is not expected beyond the IDZ boundary. Based on this assessment, no additional parameters are identified for assessment or regulation in the proposed permit amendment. Instead monitoring presented in the CEMP is followed to verify predictions at the end-of-pipe and at the IDZ in Quesnel Lake.

Verification of this model has occurred in 2018, 2019, 2020, 2021, and 2022 (Appendix 5-6). This is done by calculating near-field dilution using measured water chemistry data at “end-of-pipe”, in Quesnel Lake background, and at the IDZ. While this method can lead to large variations in calculated dilution factor on a parameter-by-parameter basis, it is the only validation method available that does not entail adding a chemical tracer to the effluent. Adding a tracer, especially one that might introduce colour to the lake, was not considered for these studies because local stakeholders have expressed a strong desire to avoid adding chemicals to Quesnel Lake.

The 2016 near-field model predicted that the minimum dilution factor at the boundary of the IDZ would range from approximately 40 to well above 100. The calculated dilution factors for those years where verification data are consistent with these predictions. Further, the data presented show that the effluent mixing in Quesnel Lake tends to be higher than predicted, indicating that the results of the 2016 model may be conservative.

Based on the results of this verification process of the 2016 near-field modelling that predicted a dilution rate at the edge of the IDZ of approximately 40 to well above 100, no changes to the model are required to support the extension of the discharge to March 2031. Annual verification will continue to occur to support this determination.

Quesnel Lake Far-Field Model

Far-field transport within Quesnel Lake was modeled using H3D, a proprietary three-dimensional hydrodynamic model maintained by Tetra Tech. The model was derived from GF8 (Doneker 2007) developed for Fisheries and Oceans Canada. It simulated temporally and spatially varying conditions throughout the lake based on external drivers such that inflows and atmospheric processes. The model has been calibrated and verified based on historical and recent conditions in Quesnel Lake (BC MoE 2013). Tetra Tech used the United States Environmental Protection Agency Visual Plumes UM3 model, embedded in H3D, to evaluate the behaviours of the outfall plume in Quesnel Lake. UM3 is a near-field numerical model for outfall discharge into the marine and freshwater environments. Its near-field results were consistent with those produced by CORMIX near-field modelling. The salient difference between the long-term three-dimensional approach (H3D-UM3) and the near-field approach (CORMIX) is the possibility of building up a background concentration of effluent in the three-dimensional model of the lake, which accounts for periods of reduced diffuser effectiveness regardless of near-field hydraulic performance.

The H3D model was used to simulate far-field transport over 10 years of varying meteorological conditions to evaluate potential accumulation of effluent in the West Basin of Quesnel Lake and transport to the Quesnel River. This model dynamically simulates circulation and vertical stratification over the modelled time frame. The spatial discretization of the model setup (grid cells approximately 100 m in width near discharge location) limits the model's ability to simulate near-filed conditions, which was instead modelled using CORMIX. However, it has been shown to accurately reproduce Quesnel Lake hydrodynamic conditions at the far-field points of interest (BC MoE 2013). The model setup, assumptions and results of the discharge modelling are detailed in Appendix 5-7.

The dilution ratio at any point in time in the far-field is predicted to remain above the level predicted at the IDZ (40:1). Therefore, the concentrations due to discharge to Quesnel Lake are expected to remain below the predicted concentrations at the IDZ and below levels assessed throughout Quesnel Lake and throughout the operations phase. As shown in Appendix 5-7, concentrations in the far-field of Quesnel Lake approach a quasi-steady state condition after approximately two years, so an extension of the period of discharge (i.e., if the mine life is extended beyond the approved four years) would not significantly change the results of this assessment, provided quantity and quality limits are not increased.

To verify the far-field modelling, monitoring to confirm the attainment of BC WQGs at the IDZ occurs. This monitoring has occurred since discharge began in 2015, and has validated the models applied in 2015, insofar as 1) BC WQGs have been consistently met, and 2) dilution has consistently exceeded the predicted dilution factor.

The monitoring routine includes routine (e.g., monthly) monitoring of limnological profiles and water chemistry at the edge of the IDZ in Quesnel Lake to confirm that BC WQGs are met at the edge of the IDZ. Far-field monitoring is conducted at locations eastward and westward of the diffuser outfall to monitor for potential detection of effluent. Continued monitoring of water quality parameters used in the derivation of effluent treatment targets is recommended to support the potential refinement of targets for the receiving environment.

Monitoring of the far-field receiving environment in Quesnel Lake in the West Basin will be carried out downstream and upstream (for reference) of the mouth of Hazeltine Creek for the verification of the discharge model as described in the ADP.

5.10 References

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6 ENVIRONMENTAL EFFECTS PREDICTIONS AND ASSESSMENT

6.1 Aquatic Resources

As discussed elsewhere in this document, the purpose of the application is to support the approval of the continued discharge of existing treated effluent from the mine until June 2025. No changes to the permitted water quality, quantity, or monitoring requirements are being requested and thus an assessment of effects is not required. Rather, the following section provides an overview of surface water quantity and quality that has been provided in previous permitting documents.

6.1.1 Surface Water Quantity

As discussed in Section 5.3 and Section 5.4, respectively, the SWWBM and SWWQM were developed as part of the WMP (Appendix 9-4) and describe proposed water management quantities and qualities for operations, closure, and post-closure Mine Phases. The SWWBM has been calibrated on an annual basis (refer to Golder [2021] for 2020 annual calibration).

The SWWBM update is intended to reflect the site internal water transfer capacities and mine plan. The mine has a positive water balance, with discharge required during mine operations to prevent year-to-year accumulation of water. Currently, the only permitted discharge of treated water occurs through the existing WTP and the Quesnel Lake pipe and diffusers discharging up to 0.31 m^3/s (for an authorized annual volume of discharge of 10.59 M-m^3) per Section 1.2.1 of PE-11678. The existing WTP, which is considered Best Achievable Technology (BC ENV 2015), has a design capacity of 0.6 m^3/s, equivalent to the permitted maximum daily instantaneous rate.

It is noted that temporary water storage may be required during freshet or during large storm events throughout the course of permitted operations. This is consistent with the water management strategy outlined in the TAR (WSP 2022) and the quantitative performance objective requirements for the TSF (Golder 2020).

6.1.2 Surface Water Quality

To predict the potential influence of treated mine influenced water on the water quality of Quesnel Lake near field and far field dilution characteristics of the discharge were developed as part of the LTWMP (Golder 2016). Effluent quality was not predicted for the Project phases; however, there are no proposed changes to discharge volumes or permit limits for water quality parameters. As a result, existing modelling and field verification of effluent quality remain valid (WSP 2023). Existing effluent quality from 2015 to 2023 is summarized below.

Effluent Quality

Existing effluent chemistry data were screened against permit limits (Table 6.1-1, Appendix 6-1), and exceedances are discussed in below. Boxplots and monthly average dot plots were created for parameters of interest (copper and selenium) to visualize temporal and spatial trends in the data.

The monthly average total and dissolved copper concentrations in effluent at HAD-3 for 2015 to 2021 were plotted to display temporal trends in copper concentration (Figure 6.1-1). A notably higher average copper concentration was observed in May for both total and dissolved copper. In 2018, an investigation of this trend determined that the cause was two seeps from the North East Zone (NEZ) waste rock pile. To mitigate this source, the seep water is now collected in a sump and pumped to the mill. Following this change MPMC has not seen elevated copper concentrations in May (as noted in Table 6.1-1, the May 2021 exceedance was attributed to a laboratory error). Further to this, continued assessment and optimization of the WTP (as per Section 2.9 of PE-11678 and summarized in the Annual Environmental Report), have resulted a further reduction in copper loading to Hazeltine Creek during freshet. Per the boxplot (Figure 6.1-2), lower variability in copper concentrations in the effluent suggests the WTP can effectively stabilize copper concentrations within the effluent.

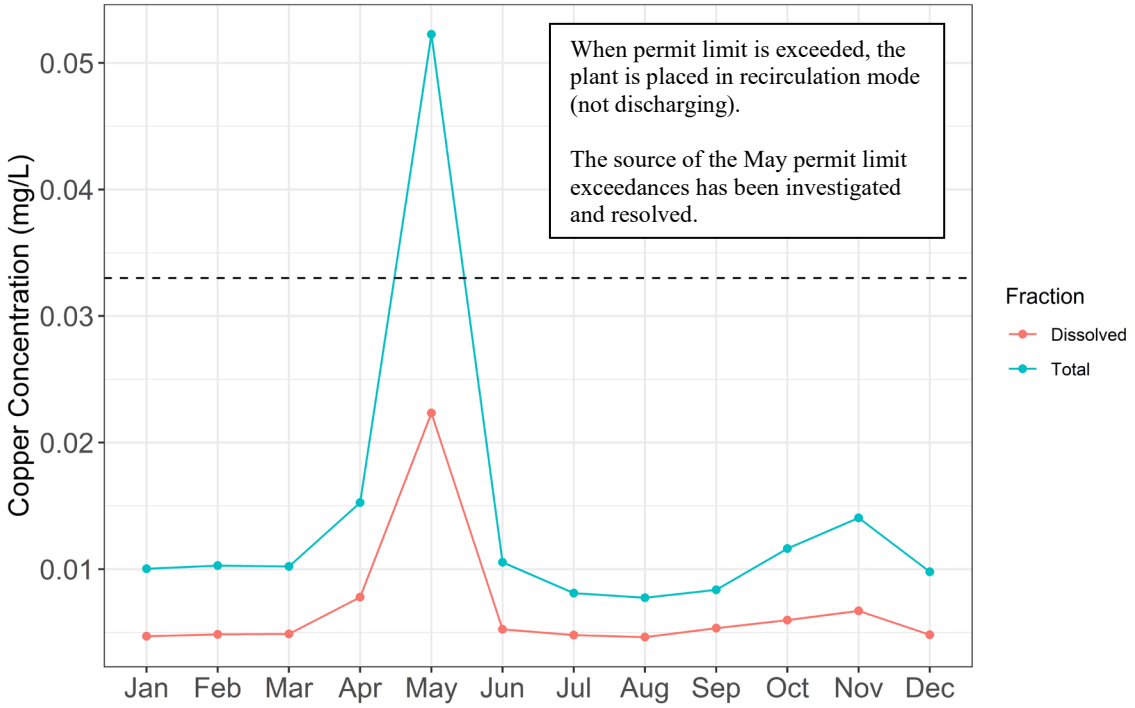

Note: The horizontal dished line represents the permit limit for copper (0.033 mg/L). mg/L = milligrams per litre.

Figure 6.1-1: Monthly Average Copper Concentration from 2015 to 2023 at Stations Representing Water Treatment Plant Effluent Quality (HAD-3)

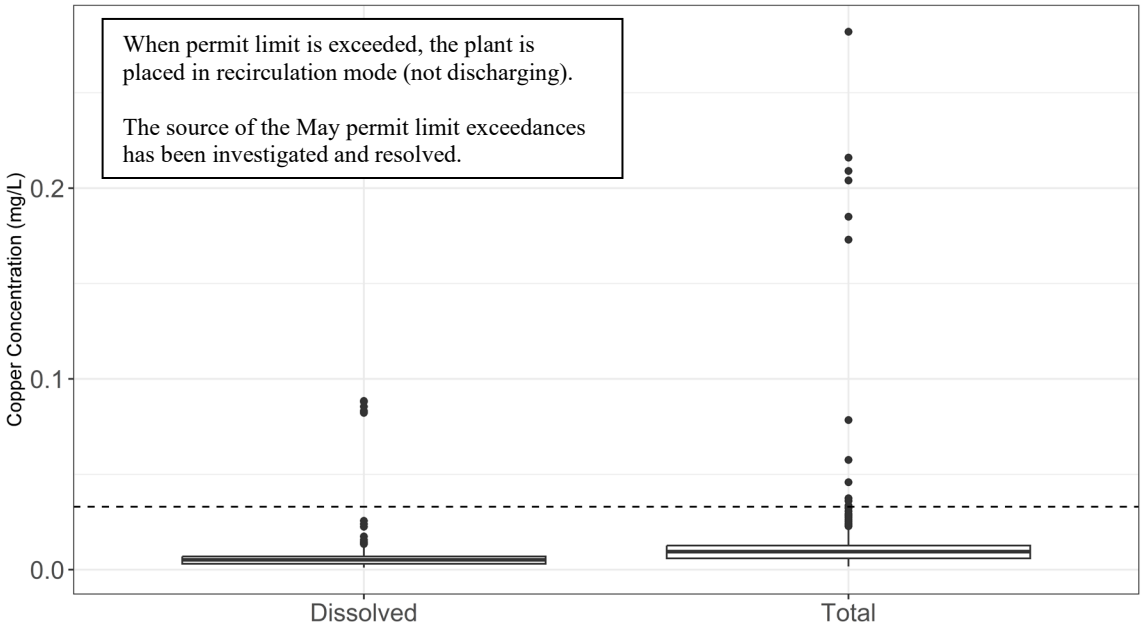

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution. The horizontal dashed line represents the permit limit for copper (0.033 mg/L).

mg/L = milligrams per litre.

Figure 6.1-2: Boxplot of Copper Concentrations from 2015 to 2023 at Stations Representing the Water Treatment Plant Effluent Quality (HAD-3)

The monthly average total and dissolved selenium concentrations were plotted for the WTP effluent (HAD-3) for samples collected from 2015 to 2021 to display temporal trends in selenium concentrations (Figure 6.1-3). Fluctuations of selenium concentrations are seen in the effluent, with an increase in average selenium concentration in May. There is little variation between the interquartile ranges for total and dissolved selenium concentrations in the WTP effluent (Figure 6.1-4).

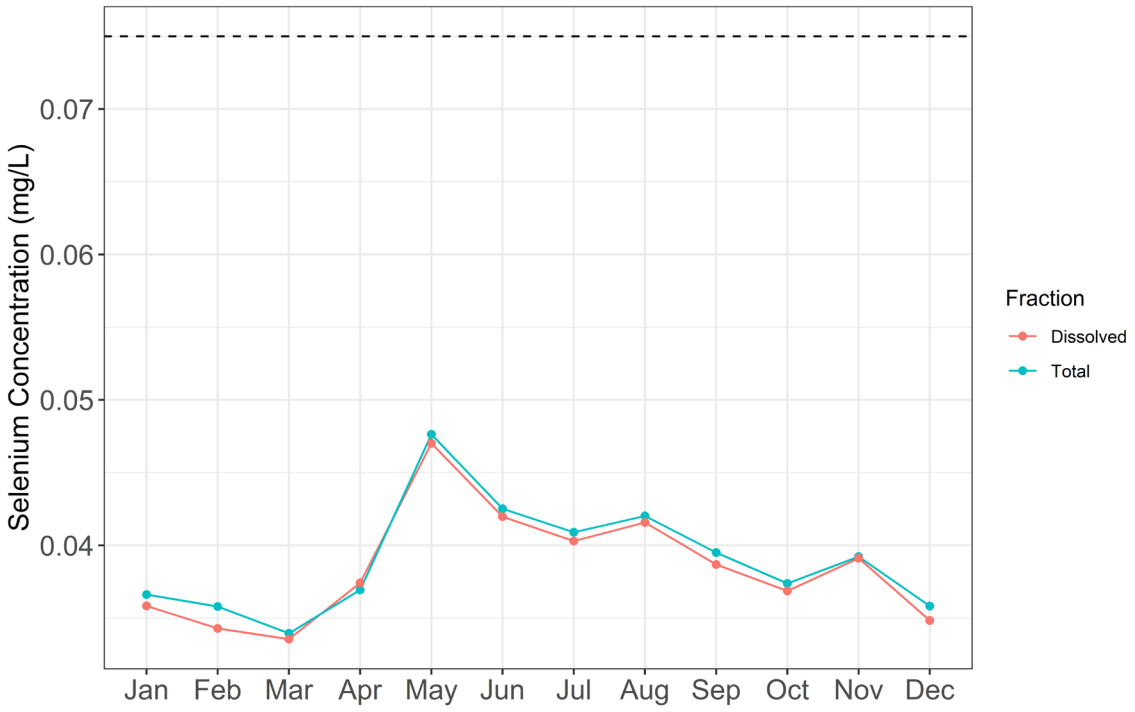

Note: The horizontal dashed line represents the permit limit for selenium (0.075 mg/L). mg/L = milligrams per litre.

Figure 6.1-3*:* Monthly Average Selenium Concentration from 2015 to 2023 at Stations Representing Water Treatment Plant Effluent Quality (HAD-3)

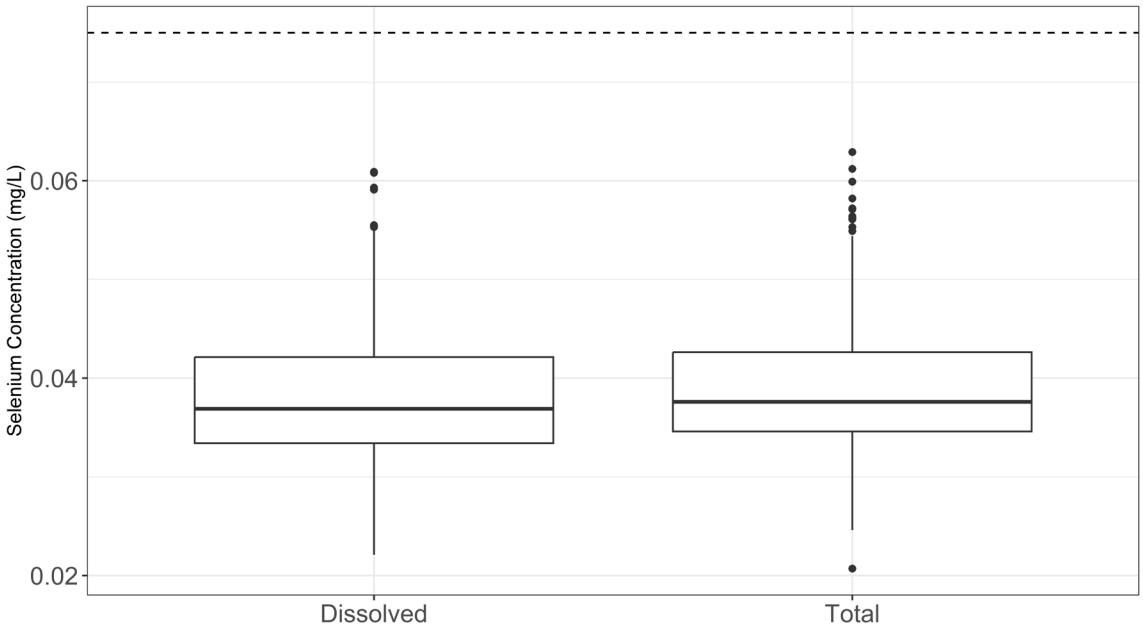

Note: Boxes enclose the interquartile range (Q1 to Q3) of the data, the horizontal line within the box indicates the median value, and the vertical lines show the range of values outside the interquartile range but fall within normal distribution. The horizontal dashed line represents the permit limit for selenium (0.075 mg/L).

mg/L = milligrams per litre.

Figure 6.1-4*:* Boxplot of Selenium Concentrations from 2015 to 2023 at Stations Representing the Water Treatment Plant Effluent Quality (HAD-3)

Effluent Permit Limit Exceedances

From 2015 to 2023, samples from HAD-3 occasionally had concentrations that were above the permit limits. Each time, MPMC notified the required parties, undertook an investigation, and implemented actions as specified in the Trigger Response Plan. For example, when copper exceeds the limit set in PE-11678, the WTP is set to recirculation mode and discharge is suspended. Each event in which a permit limit was exceeded was also investigated, and a summary report was provided to BC ENV. Table 6.1-1 outlines each exceedance and the outcome of the investigations.

As a result of the investigations, actions have been taken to improve the effectiveness of the WTP, including projects such as redirecting the NEZ seeps discussed in Table 6.1-1. This is supported by continued efforts to assess and optimize the performance of the WTP (as per Section 2.9 of PE-11678 and summarized in the Annual Environmental Report), such as:

- adjusting site works to reduce TSS, and associated metals, in the WTP influent
- automation and recording capabilities upgrades
- testing with trimercaptotriazine to enhance copper removal

This work has resulted in a reduced frequency of permit exceedances and resulting Trigger-Response Plan actions at HAD-3, notably during freshet.

Table 6.1-1*:* Summary of Permit Limit Exceedances at HAD-3

Date	Parameter	Expected Cause and Actions Taken
January 16, 2016	TSS	Each time, effluent discharge was ceased upon identification of the TSS exceedances and the Director was notified. These permit limit exceedances were related to WTP commissioning and low suspended solids in the influent, which hindered floc formation in the WTP. Discharge then resumed after subsequent samples confirmed that effluent quality met the permit requirements. The permit limit was amended on 19 September 2016 to reflect the MMER limits allowing a maximum discharge of 30 mg/L TSS, and a 15 mg/L monthly average limit for TSS was introduced.
February 9, 2016	TSS	
May 24, 2016	TSS	
January 12, 2016	Total zinc	This exceedance was an isolated incident and occurred prior to the approval of a temporary permit limit for total zinc.
April 4, 11, 13, and 1 9, 2016	Total copper	The observed increase in the effluent copper concentration was likely related to spring runoff flows that conveyed higher TSS loads and associated copper to the WTP. Effluent discharge was ceased upon identification of the copper exceedances, and the Director was notified. Discharge was only resumed after subsequent samples confirmed that effluent quality met the requirements outlined in the permit.

Table 6.1-1*:* Summary of Permit Limit Exceedances at HAD-3

Date	Parameter	Expected Cause and Actions Taken
June 27, 2016	Total copper	Was not attributed to any environmental conditions or remedial works, and samples taken on previous and subsequent sampling events (23 and 29 June 2016) were below the permit limit. Effluent discharge was ceased upon identification of the copper exceedances, and the Director was notified. Discharge was only resumed after subsequent samples confirmed that effluent quality met the requirements outlined in the permit.
January 3, 2017	Total zinc	Expected to be due to sample bottle contamination Proper handling procedures reviewed by MPMC field crews to avoid contamination of sampling equipment in the future.
February 20, 2018	Dissolved aluminum	MPMC requested emergency turnaround for the subsequent samples, a recheck of the result, and the WTP was put into recirculation mode. Attributed to sampling error, as other locations sampled the same day also had relatively elevated dissolved aluminum and subsequent samples were below the permit limit.
April 17, 2018	Dissolved aluminum	MPMC notified all required parties and requested emergency turnaround for the subsequent samples and a recheck. All additional samples were below the permit limit and therefore the WTP was not shut down. Due to possible sporadic problems with the WTP system or the mixing reagents and testing and sampling of various dosages were scrutinized.
May 10, 2018	Total copper Dissolved cadmium	MPMC notified all required parties and the WTP was put into recirculation mode. Investigation into the cause indicated that two seeps from the NEZ waste rock pile were elevated in copper and other metals (but the pH remained relatively neutral). Measures were taken to mitigate the influence of the seeps into the WTP feed by constructing a sump at the base of the seeps and pumping the water to the mill.
August 16, 2018	Dissolved aluminum	MPMC notified all required parties and requested emergency turnaround for the subsequent samples and a recheck. The WTP was put into recirculation mode. Expected analysis error and reanalysis of the sample returned a dissolved aluminum concentration below the limit. WTP resumed discharge.
December 27, 2018	Total phosphorus	The WTP was shut down, required parties notified, and a recheck and reanalysis requested. Expected sample mix-up, the actual result was below the permit limit. MPMC notified BC ENV, retracted the total phosphorus exceedance, and the WTP resumed discharging.
June 17, 2019	Total chromium	The WTP was promptly shut down, required parties notified, and recheck and reanalysis requested. Expected laboratory error, confirmed by ALS as a sample mix-up, and the actual result was below the permit limit. MPMC emailed BC ENV, retracting the total chromium exceedance, and the WTP resumed discharging.

Table 6.1-1*:* Summary of Permit Limit Exceedances at HAD-3

Date	Parameter	Expected Cause and Actions Taken
January 21, 2020	Total copper	Sample on 15 January 2020 was within 80% of the permit limit, which initiated a Level 1 Trigger: End-of-Pipe (HAD-3) 80% Early Warning Threshold – Monitoring and Response as per MPMC 2019 ADP. WTP throughput reduced by 20%. Results from the 21 January 2020 sample exceeded permit limit. WTP shut down and the BC ENV notified. On 23 January 2020 water was pumped from the TSF to the Perimeter Embankment Till Borrow Pond to raise the pond level and to create influent water that would be amenable to discharge. The NEZ pipeline was thawed, and the NEZ Sump resumed normal operation pumping water to the Wight Pit. On 27 January 2020 the WTP was run in recirculation mode for ~2.5 hours and samples were taken at E19 (WTP influent) and WTP-RC (equivalent to HAD-3 when in recirculation mode but the sample is taken from the outflow trough in the clarifying tank and not the sample port in the discharge pipe). Sample results below the permit limit and the 80% threshold that would trigger additional sampling. WTP resumed normal operation on 30 January 2020 in accordance with the ADP.
March 3 and 10, 2020	Total copper	On 3 and 10 March 2020, HAD-3 total copper concentrations were within 80% of the EMA Permit 11678 limit; however, concentrations decreased below the 80% threshold and did not exceed the permit limit. This incident was also investigated, and an investigation report submitted to BC ENV.

Table 6.1-1*:* Summary of Permit Limit Exceedances at HAD-3

Date	Parameter	Expected Cause and Actions Taken
April 14, 2020	Total copper	Sample on 7 April 2020 was within 80% of the permit limit, which initiated a Level 1 Trigger: End-of- Pipe (HAD-3) 80% Early Warning Threshold – Monitoring and Response as per the MPMC 2020 ADP. WTP throughput was reduced by 20%. Results from the sample collected on 14 April 2020 yielded a concentration exceeding the permit limit. Site management and the Director were notified of the Level 2 Trigger immediately and the Level 2 Trigger: End-of-Pipe (HAD-3) Permit Exceedance – Monitoring and Response procedure was initiated as per the MPMC 2020 ADP. WTP remained in recirculation mode and an additional sample was collected from WTP-RC and E19 on 20 April 2020 and priority service was requested from the lab. The results from the sample indicated a total copper concentration above the permit limit and the WTP was promptly shut down. The WTP was put into recirculation mode from 25 April 2020 to 9 May 2020 for Golder to complete a field trial of trimercaptotriazine usage to reduce copper concentrations within the discharged water. After the trial, the WTP was shut down for the remainder of freshet. The WTP was started in recirculation mode on 27 May 2020 and samples were collected from WTP-RC and E19 and priority service was requested from the lab. The WTP was shut down again following sample collection on 27 May 2020. The results from the sample taken on 27 May 2020 was below the permit limit and as a result, the WTP was restarted and resumed normal operation on 1 June 2020. MPMC Environmental staff collected samples from HAD-3, E19 and QUL-58 (the Quesnel Lake IDZ) on 2 June 2020 and requested priority service from the lab. The results from the samples collected on 2 June 2020 indicated a total copper concentration below the permit limit at HAD-3 and QUL-58 and the WTP continued normal operation.
November 11, 2020	Total copper	Total copper from a 11 November 2020 sample was above the permit limit. This initiated a Level 2 Trigger: End-of- Pipe (HAD-3) Permit Exceedance – Monitoring and Response as per the MPMC 2020 ADP. Site management and the Director were notified immediately and WTP was shut down. The results from the sample collected on 17 November 2020 was within 80% of the permit limit. Site management was notified of the Level 1 Trigger immediately and the Level 1 Trigger: End-of-Pipe (HAD-3) 80% Early Warning Threshold – Monitoring and Response procedure was initiated as per the MPMC 2020 ADP. The WTP was restarted with a 20% reduction in throughput on 24 November, and samples were collected from HAD-3 and E19 later that day with priority service requested from the lab. The results from the sample taken on 24 November 2020 were below the permit limit and 80% early warning threshold. WTP resumed normal operation on 27 November 2020.
May 19, 2021	TSS	This exceedance was attributed to a laboratory error.

Table 6.1-1*:* Summary of Permit Limit Exceedances at HAD-3

Date	Parameter	Expected Cause and Actions Taken
October 27 and November 2, 2021	Total copper	The exceedance event is not believed to have a singular cause, but is likely the result of three known corresponding phenomena, any of which in isolation would not be sufficient to result in an exceedance. These causes are change in water chemistry in the Springer Pit during dewatering, overflow from the TSF booster station, and treatment plant optimization that relied on outdated site water storage chemistry.
May 31 and June 6, 2022	Total copper	NR
June 6, 2022	TSS	NR

Note: NR = not reported at time of submission.

Source: Mount Polley Mining Corporation.

6.2 Terrestrial Resources

6.2.1 Vegetation

Characterization of existing conditions of vegetation resources in the Mine site combined with an understanding of the Springer Pit and TSF interim raise to 974 m activities, and potential changes to the biophysical environment from the proposed expansion, were used to classify and assess the potential effects.

Project-related interactions with vegetation include the following potential effects:

- Loss or alteration of vegetation during Project expansion
- Introduction and proliferation of invasive plants species
- Effects to vegetation communities from fugitive dust
- Effects to vegetation communities from spills of deleterious substances
- Change in area of suitable habitat for at-risk plant species during the Springer Expansion and TSF interim raise to 974 m
- Loss of at-risk plant species during Project expansion

6.2.1.1 Loss or Alterations of Vegetation Communities

The proposed expansion will require the removal of vegetation within the SERDS expansion area. Minimal loss of existing vegetation is expected as a result of the TSF interim raise to 974 m as the TSF area has been previously disturbed.

Introduction and Proliferation of Invasive Plant Species

The Springer Expansion and TSF interim raise to 974 m also have the potential to result in the accidental introduction and/or proliferation of invasive or non-native plant species, particularly those species observed in the area such as bull thistle and yellow salsify. The introduction and proliferation of invasive species can lower the quality of remaining native vegetation by outcompeting native species and reducing plant diversity.

Transportation of equipment and material to the Mine Site from off-site during vegetation clearing, demobilization of equipment post-construction, and disturbance of new areas may result in the introduction of new invasive plant species, or the proliferation of invasive species existing in the area. Plant seeds and parts can be transported in various ways, including via the tracks of machinery, treads of boots, or on clothing. Invasive plants can proliferate from seeds and remanent parts of plants, such as roots stems, on work truck tire treads.

Vehicles, equipment, and clothing can also carry parts and seeds of invasive plants from infested areas of the Mine Site, especially during muddy conditions, depositing them in new locations (BC MFLNRO and ISCBC 2013). Invasive plants may also be introduced to an area through gravels and soils contaminated with seeds and parts of plants (BC MFLNRO and ISCBC 2013). Activities that disturb soil and vegetation, such as clearing/grubbing and road building/widening, can contribute to proliferation of invasive plants as freshly disturbed soils are especially susceptible to the establishment of invasive species (BC MFLNRO and ISCBC 2013).

An Invasive Plant Management Plan (Section 9.9) including a monitoring program will be implemented to reduce the potential for ingress of invasive plants.

Effects to Vegetation Communities from Fugitive Dust

Various construction activities, such as site preparation, vegetation clearing, construction and widening of roads, and transportation of materials could produce dust. Dust may affect the health, growth, and development of affected vegetation, and may shift plant community structure (Prusty et al. 2005). The primary effects of dust are generally confined to the immediate area next to access roads or other disturbance areas (Bignal et al 2004; Everett 1980). Mount Polley Mine controls dust emissions and monitors air quality.

6.2.1.2 Effects to Vegetation Communities from Spills of Deleterious Substances

Accidental spills of deleterious substances, such as hydrocarbons, during the Springer Expansion and TSF interim raise to 974 m may potentially adversely affect vegetation resources through loss of extent. Spills of deleterious substances may require the removal of plants during clean up resulting in loss of vegetation extent. Further, spills may result in effects to vegetation communities via soil contamination. A spill management plan is in place to address avoidance of spills, responses, notification and remediation (Section 9.14).

6.2.1.3 Change in Area of Suitable Habitat for At-Risk Plant Species

Clearing of vegetation for the proposed expansions will result in a decrease in potential habitat for at-risk plant species. In addition, increased sediment input through erosion and sedimentation and fugitive dust as well as releases of deleterious substances into wetland habitat adjacent to the Project Area may decrease the suitability for at-risk plant species. As a rare plant survey was not conducted as part of the field reconnaissance the current abundance and distribution of at-risk plant species in the expansion areas are unknown.

6.2.1.4 Loss of At-Risk Plant Species

Clearing of vegetation in the expansion areas could result in the direct removal of at-risk plant species. While the majority of the Mine Site has been previously disturbed and the reconnaissance-level surveys to date have not identified the presence of at-risk plants, their absence cannot be confirmed. The current abundance and distribution of at-risk plant species in vegetated areas proposed to be cleared during the expansions are unknown.

6.2.2 Wildlife

Effects on wildlife resources are expected to be primarily limited to the immediate expansion area, mainly where vegetation and habitat loss occurs. Potential Project-related interactions with wildlife resources include the following general effects:

- Direct loss of potential breeding, foraging, and living habitat due to clearing and grubbing
- Indirect loss of potential breeding, foraging, and living habitat due to:
  - Changes in habitat quality
  - Sensory disturbance (i.e., noise, dust)
- Creation of barriers to movement and habitat fragmentation
- Change in mortality rates due to:
  - Direct mortality from clearing, rock disposal and construction activities
  - Direct loss of egg masses or nests
  - Indirect mortality due to interactions with SERDS extension construction activities

6.2.2.1 Habitat Loss

Direct habitat loss will result from vegetation clearing during the Springer Expansion. Removal of vegetation will result in the loss of habitat, specifically breeding and foraging habitat for some wildlife species. The removal of wildlife trees, understory, slash, and general woody debris present within the proposed expansion area may result in a loss or alteration of:

- Upland habitat for adult western toad

- Living habitat for garter snake
- Nesting and living habitat for some songbirds
- Foraging habitat for various bird and mammals species

Habitat alteration in support of industrial activities (e.g., oil and gas drilling, mining, renewable energy, logging) is one of the main threats to southern mountain caribou populations (COSEWIC 2014). Changes in habitat composition can lead to increased predation rates on caribou because of facilitated predator movement. The Springer Expansion and TSF interim raise to 974 m are expected to result in the direct loss of some southern mountain caribou critical habitat (unmapped range) and habitat restoration and management will likely be required.

6.2.2.2 Disruption to Movement

Disruption to movement patterns may occur during all phases of the Springer Expansion and TSF interim raise to 974 m that may impact terrestrial wildlife, such as amphibians, reptiles, ungulates and medium to large carnivores. While the proposed expansion areas are located within highly fragmented and previously disturbed areas within the Mine Site, expansion activities have the potential to create barriers to movement and impact wildlife movement among habitats that provide different resources needed to satisfy life history requirements (Government of Canada 2014). Western toads are more vulnerable in fragmented habitats when they are required to travel extensively in terrestrial habitats and long distances between breeding, hibernation, and foraging areas (Government of Canada 2020). The proposed expansion areas are enlargements of existing mine footprints into areas that have been previously disturbed and are therefore not expected to create additional habitat fragmentation based on the current proposed design.

6.2.2.3 Sensory Disturbance

Noise and other sensory disturbances to wildlife are anticipated throughout the Mine Site. The proposed expansion areas are within the existing Mine Site footprint, and as such, wildlife using the expansion area are expected to be habituated to an existing level of noise and disturbance. Increased traffic along Beaver Lake Rd associated with the TSF interim raise to 974 m has the potential to deter wildlife from the mineral lick located adjacent to the road.

6.2.2.4 Mortality

Mortality to wildlife has the potential to occur during clearing activities, rock disposal and as a result of increased traffic in and adjacent to the proposed expansion areas. Less mobile wildlife, such as amphibians and garter snakes, are susceptible to vehicle-wildlife collisions, especially when moving to seek mates and breeding habitat, during migration to and from breeding sites and hibernacula, and dispersal of young. Existing access roads to the proposed expansion areas are adjacent to suitable amphibian habitat. Mine Site activities that require ground disturbance

(e.g., clearing and grubbing) during winter months may result in mortality of hibernating amphibians while disturbance to natal ponds during the breeding season could adversely affect amphibian egg masses and tadpoles. Garter snakes have the potential to be harmed through the removal of coarse woody debris, rock piles, and other structures that provide shelter sites.

It is anticipated that the majority of potential adverse effects to terrestrial wildlife can be avoided, reduced, or mitigated through the Best Management Practices described in the Wildlife Management Plan (DWB Consulting Services Ltd. 2021) provided in Section 9.10 of this application.

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7 ENVIRONMENTAL MONITORING

7.1 Environmental Monitoring Program Design

The environmental monitoring program designs for Mount Polley Mine are described in the CEMP and summarized in the following sections. The CEMP is provided in Appendix 7-1. The linkages between the CEMP monitoring programs are illustrated in Figure 7.1-1.

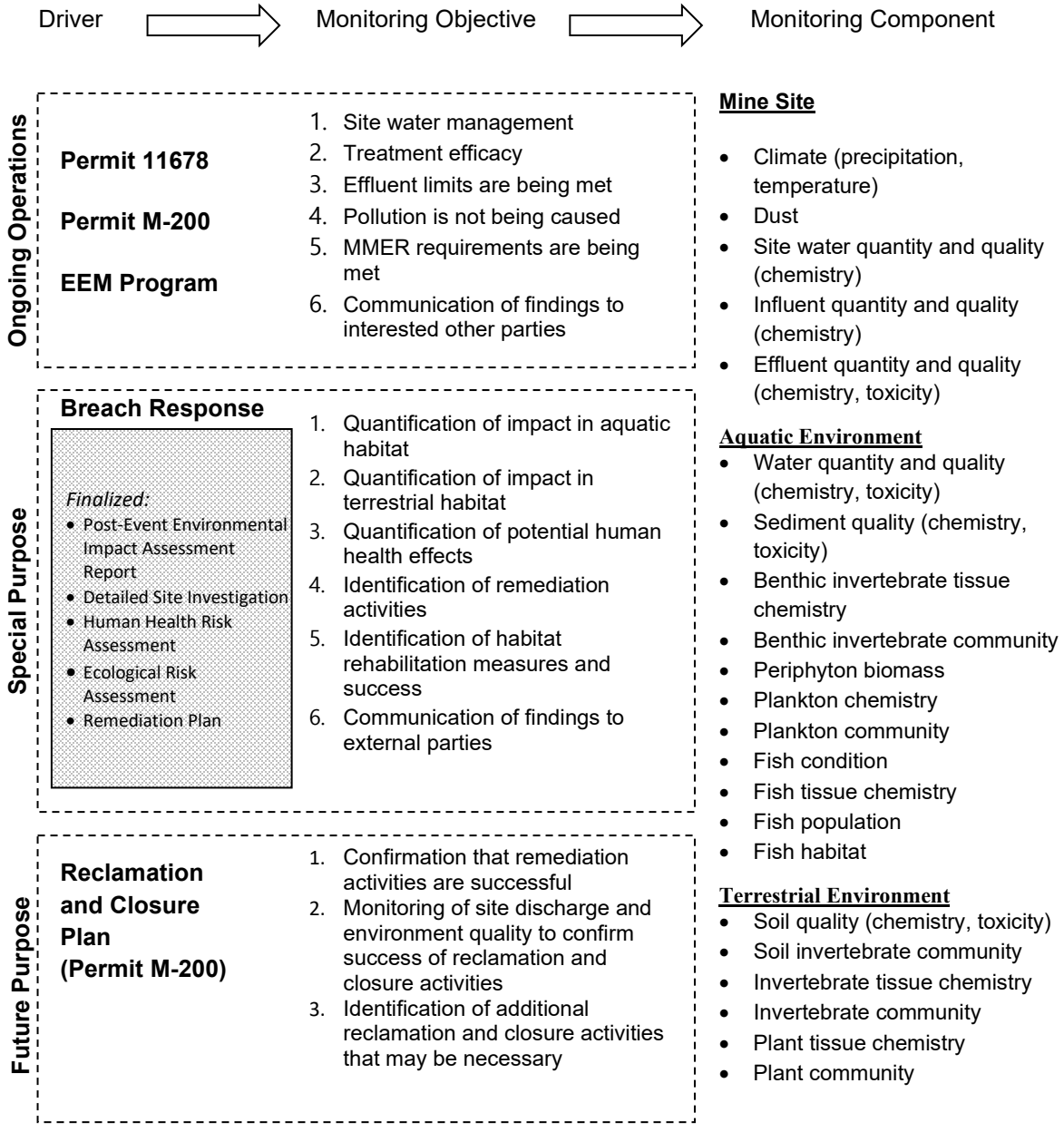

Figure 7.1-1: CEMP (2019) Integration Framework

Monitoring procedures carried out at the Mine Site are consistent with guidance from the BC Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (2013 or most recent version, herein referred to as the "BC Field Sampling Manual"; BC MoE 2013). As appropriate, monitoring procedures will also be consistent with the Metal Mining Technical Guidance for Environmental Effects Monitoring (EEM) (Environment Canada 2012) and the Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BC MoE 2012). Mount Polley Mine's procedures are also consistent with applicable sections of the British Columbia Environmental Laboratory Manual (BC MoE 2015), such as sample collection and preservation requirements.

7.2 Mine Site Water Monitoring Program

Surface Water

Table 7.2-1 summarizes the parameters analysed for surface water quality. The lake field parameters are measured at each sampling depth and for each limnological profile (excluding Secchi depth, which is taken from the surface of each lake sampling point). Table 7.2-2 provides an overview of the surface water monitoring. The location "Mine Site" refers to the streams and creeks adjacent to the mine site. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D of the CEMP (Appendix 7-1). Figure 7.2-1 shows monitoring locations of the surface water sampling locations.

Table 7.2-1: Surface Water Chemistry Parameters

Parameter	LOR	Unit	Parameter	LOR	Unit
Field Parameters - Lake			**Total and Dissolved Metals**		
pH	-	pH	Aluminum (Al)	0.003	mg/L
Specific conductance	-	µS/cm	Antimony (Sb)	0.0001	mg/L
Temperature	-	°C	Arsenic (As)	0.0001	mg/L
Turbidity	-	NTU	Barium (Ba)	0.0001	mg/L
Dissolved oxygen	-	%, mg/L	Beryllium (Be)	0.0001	mg/L
Secchi depth	-	m	Bismuth (Bi)	0.00005	mg/L
Field Parameters - General			Boron (B)	0.01	mg/L
pH	-	pH	Cadmium (Cd)	0.000005	mg/L
Conductivity	-	µS/cm	Calcium (Ca)	0.05	mg/L
Temperature	-	°C	Chromium (Cr)	0.0005	mg/L
Turbidity	-	NTU	Cobalt (Co)	0.0001	mg/L
Physical Tests			Copper (Cu)	0.0005	mg/L
Conductivity	2	µS/cm	Iron (Fe)	0.03	mg/L
Hardness (as $CaCO_3$)	0.5	mg/L	Lead (Pb)	0.00005	mg/L
pH	0.1	pH	Lithium (Li)	0.001	mg/L
Total Suspended Solids	1	mg/L	Magnesium (Mg)	0.1	mg/L
Total Dissolved Solids	10	mg/L	Manganese (Mn)	0.0001	mg/L
Turbidity	0.1	NTU	Molybdenum (Mo)	0.00005	mg/L
Anions and Nutrients			Nickel (Ni)	0.0005	mg/L
Alkalinity, Total (as $CaCO_3$)	1	mg/L	Potassium (K)	0.05	mg/L
Ammonia, Total (as N)	0.005	mg/L	Selenium (Se)	0.00005	mg/L
Chloride (Cl)	0.5	mg/L	Silicon (Si)	0.1	mg/L
Fluoride (F)	0.02	mg/L	Silver (Ag)	0.00001	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L	Sodium (Na)	0.05	mg/L
Nitrate (as N)	0.001	mg/L	Strontium (Sr)	0.0002	mg/L
Nitrite (as N)	0.005	mg/L	Thallium (Tl)	0.00001	mg/L
Total Nitrogen	0.03	mg/L	Tin (Sn)	0.0001	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L	Titanium (Ti)	0.01	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L	Uranium (U)	0.00001	mg/L
Phosphorus (P)-Total	0.002	mg/L	Vanadium (V)	0.0005	mg/L
Sulfate (SO_4)	0.3	mg/L	Zinc (Zn)	0.003	mg/L
Organic / Inorganic Carbon			**EEM Parameters**		
Dissolved Organic Carbon	0.5	mg/L	Mercury (Hg)-Total	0.000005	mg/L

LOR = Limit of Reporting; EEM = Environmental Effects Monitoring.

Table 7.2-2*:* Surface Water Monitoring Overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Mine Site	W1	E225084	Morehead Creek	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W4a	E298551	North Dump Creek below Wight Pit Road	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W5	E208039	Bootjack Creek Above Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8	E216743	NE Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8Z	E223292	SW Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W10	E291209	Lower Edney Creek (upstream of breach impact)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W12	E216744	6 km Creek at Road	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W20	E297070	W20 Creek Tributary to Bootjack Lake	Semi-annually	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Table 7.2-2*:* Surface Water Monitoring Overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Edney Creek	EDC-01	E303014	Lower Edney Creek (remediated reach)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-10	E303010	Upper Hazeltine Creek at Polley Lake outlet	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-13	E304810	End of Reach 1 in Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-14	pending	Middle Hazeltine Creek upstream of the canyon	Monthly[2]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-05a	E304510	Upper Hazeltine Creek at Gavin Lake FSR Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-08	E303013	Lower Hazeltine Creek at Ditch Road Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-01c	E303953	Lower Hazeltine Creek outflow to Quesnel Lake	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Table 7.2-2*:* Surface Water Monitoring Overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Bootjack Lake	B1	E207975	Bootjack Lake deepest area at north end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]Limnological profile	Field parameters - lake	BC WQG - AL	
Bootjack Lake	B2	E215897	Bootjack Lake deepest area at south end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]Limnological profile	Field parameters - lake	BC WQG - AL	
Bootjack Lake	B4	E216744	Bootjack Lake (potential zone of influence from seepage from Springer Pit)	For closure only[5]	For closure only[5]	For closure only[5]	-
Polley Lake	P1	E207974	Polley Lake deepest area at north end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
Polley Lake	P2	E207975	Polley Lake deepest area at south end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL

Table 7.2-2*:* Surface Water Monitoring Overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Quesnel Lake	QUL-58	E304876	Quesnel Lake discharge IDZ	Four times annually[7, 11, 12]	Limnological profile, If plume detected: middle of plume (MP), 5 m above (AP), 5 m below plume (BP) If plume not detected: surface (S), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL
Quesnel Lake	QUL-57	E304874	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-59	E304875	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-18	E303019	Quesnel Lake far-field, downstream of Hazeltine Creek	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 50 m, 100 m[9]	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-2a	E303020	Quesnel Lake far-field, upstream of Hazeltine Creek (reference)	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 40 m, 60 m	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL
Quesnel Lake	QUL-120a	E303022	Quesnel Lake station east of Cariboo Island for model verification	Semi-annually[7, 11]	Limnological profile, If lake is stratified: 0 m, 40 m, 80 m, 120 m, 140 m If lake is well-mixed: 0 m, 80 m, 190 m	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Table 7.2-2*:* Surface Water Monitoring Overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Quesnel Lake	QUL-ZOO-1	E306455	Quesnel Lake in centre of West Basin (zooplankton station)	Semi-annually[10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-ZOO-7	E306456	Quesnel Lake near Cariboo Island (reference zooplankton station)	Semi-annually[10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-ZOO-8	E306457	Quesnel Lake at Junction (reference zooplankton station)	Semi-annually[10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

1) In June and October due to access.
2) May to November only due to restricted access in winter.
3) At spring overturn and late summer.
4) Between spring and fall overturn.
5) Monitoring will depend on closure conditions.
6) If ice and weather conditions meet safety requirements.
7) Taken at evenly spaced time series plus or minus one month.
8) Total mercury will be collected at MID or BT for QUL-58 and at 40 m for QUL-2a as part of EEM four times per year (no less than 1 month apart). Parameter only reported to MDMER.
9) QUL-18 is approximately 110 m deep. 100 m sample depth is collected for historical consistency.
10) Taken in conjunction with plankton sampling (see Section 7.6).
11) When sampling is less frequent than monthly, sampling at Quesnel Lake operational surface water monitoring stations (as identified in Table 7.2-2) will be undertaken when effluent discharge to Quesnel Lake is discharging. In the event of an unexpected shutdown of the water treatment plant, reasonable efforts will be made to re-sample within the timeframe of the quarterly or other specified time period sampling upon restart of effluent discharge to Quesnel Lake.
12) Samples will be taken at HAD-3 on the same day as samples collected from QUL-57, -58, and -59.

DOC = dissolved organic carbon; BC WQG = British Columbia Water Quality Guidelines; AL = aquatic life; FSR = Forest Service Road; EEM = Environmental Effects Monitoring; IDZ = initial dilution zone.

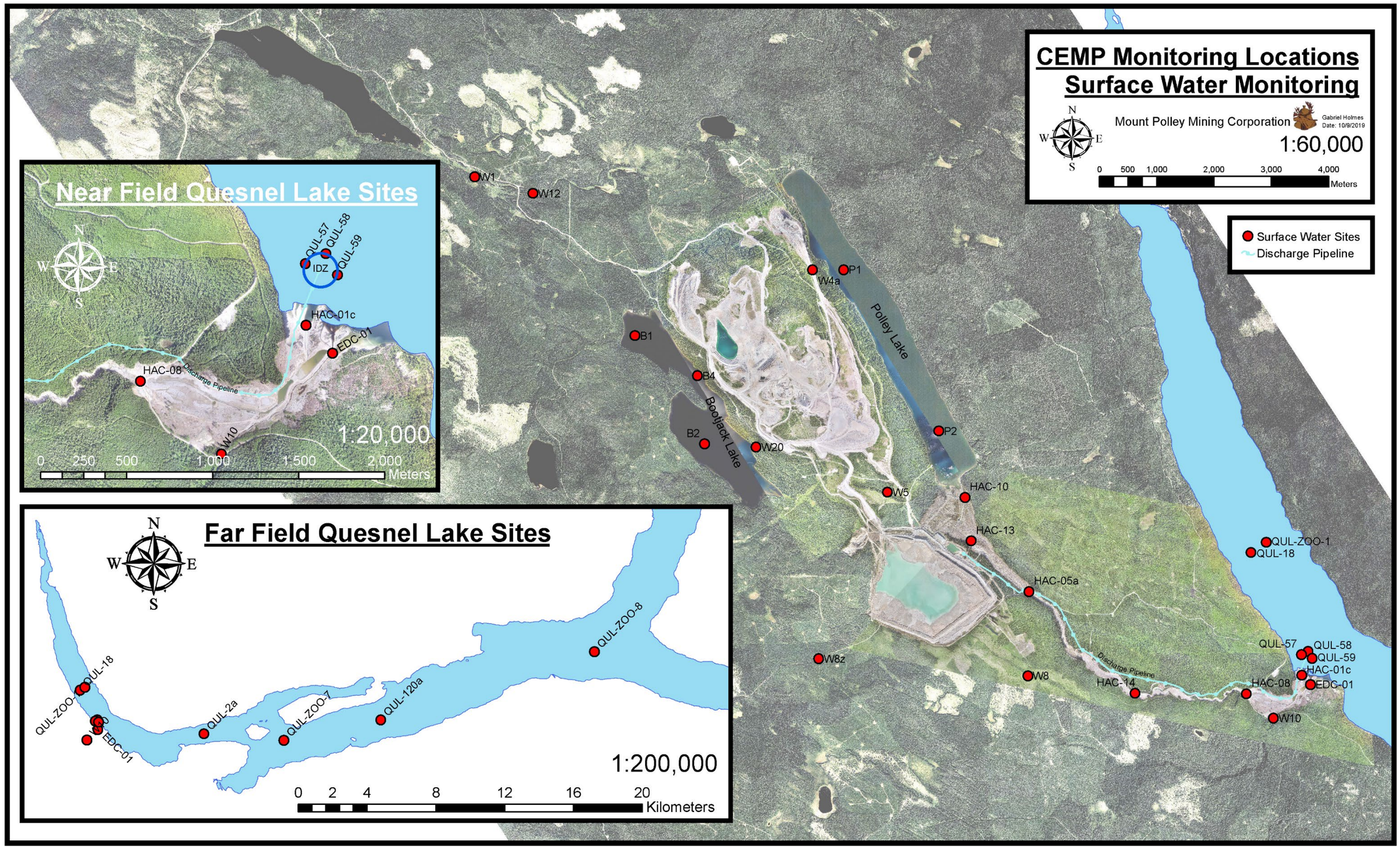

Figure 7.2-1: CEMP Monitoring Locations – Surface Water Monitoring

Groundwater

Groundwater monitoring wells around the mine site are installed in the area around the TSF, the Springer Pit, downstream of waste rock dumps and haul roads, and in other areas on or surrounding the mine. Sampling events at times of maximum and minimum hydrologic conditions to account for seasonal variability will be conducted when appropriate (i.e., spring and late summer/fall). Static water level (SWL) of all wells will be monitored on the same day at minimum once annually to allow for comparison across the Mine Site.

Groundwater monitoring wells were also installed along the Hazeltine Creek in 2015 and 2016. Monitoring of surface water in Hazeltine Creek captures the potential effects of groundwater discharged to the Hazeltine Channel system (Golder 2017). No further monitoring is planned at these groundwater wells. Table 7.2-3 summarizes the parameters analysed for groundwater quality. Table 7.2-4 provides an overview of the groundwater monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D of the CEMP (Appendix 7-1). Figure 7.2-2 shows monitoring locations of the groundwater sampling locations.

Table 7.2-3: Groundwater Chemistry Parameters

Parameter	LOR	Unit
Field Parameters		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L

Parameter	LOR	Unit
Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

LOR = Limit of Reporting.

Table 7.2-4: Groundwater Monitoring Overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW96-2a	E229681	Tailings Impoundment East Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-2b	E229682	Tailings Impoundment East Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-3a	E229683	Tailings Impoundment SE Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4a	E229685	Tailings Impoundment SW Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4b	E229686	Tailings Impoundment SW Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-7	E229690	SE Sed Pond Well	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1a	E242385	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1b	E242384	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW00-2a	E242387	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3a	E242389	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3b	E242388	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
95-R-5	E229695	Lower SERDS Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW05-01	E258923	Wight Pit/Polley Lake Interface Well	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1a	E291210	Below Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1b	E291211	Below Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2a	E291212	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2b	E291213	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1a	E291969	NW of Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1b	E291970	NW of Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-2a	E291971	Springer Pit Well (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-2b	E291972	Springer Pit Well (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-3a	E291973	Below Waste Haul Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-3b	E291974	Below Waste Haul Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4a	E291976	Below NEZ Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4b	E291977	Below NEZ Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5a	E291978	Below Wight Pit Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5b	E291979	Below Wight Pit Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW14-1	E301973	Groundwater well at New Orica Site	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW15-1a	E303210	Springer Pit Well North (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-1b	E303211	Springer Pit Well North (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-2a	E303212	Springer Pit Well South (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A

Table 7.2-4: Groundwater Monitoring Overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW15-2b	E303213	Springer Pit Well South (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A
GW16-1a	E308529	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-1b	E308530	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-2a	E308531	Tailings Impoundment North Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-2b	E308532	Tailing Impoundment North Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-3a	E308533	Tailings Impoundment SE Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-3b	E308534	Tailings Impoundment SE Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-4a	E308535	Tailings Impoundment S Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-4b	E308536	Tailings Impoundment S Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-5a	E308537	Tailings Impoundment W Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-5b	E308538	Tailings Impoundment W Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6a	E308539	West of Cariboo Pit (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6b	E308540	West of Cariboo Pit (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-7	E308541	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-8	E308542	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG

1) Wells show stable chemistry. If an unexpected change in SWL is observed, well water will be sampled.
2) Wells provide domestic water for personnel
3) Leveloggers have been removed from GW15-1a and 1b as wells are dry. Leveloggers will be reinstalled once water is above well screen.

BC WQG = British Columbia water quality guideline; SWL = static water level; CSR = Contaminated Sites Regulations; AL = aquatic life.

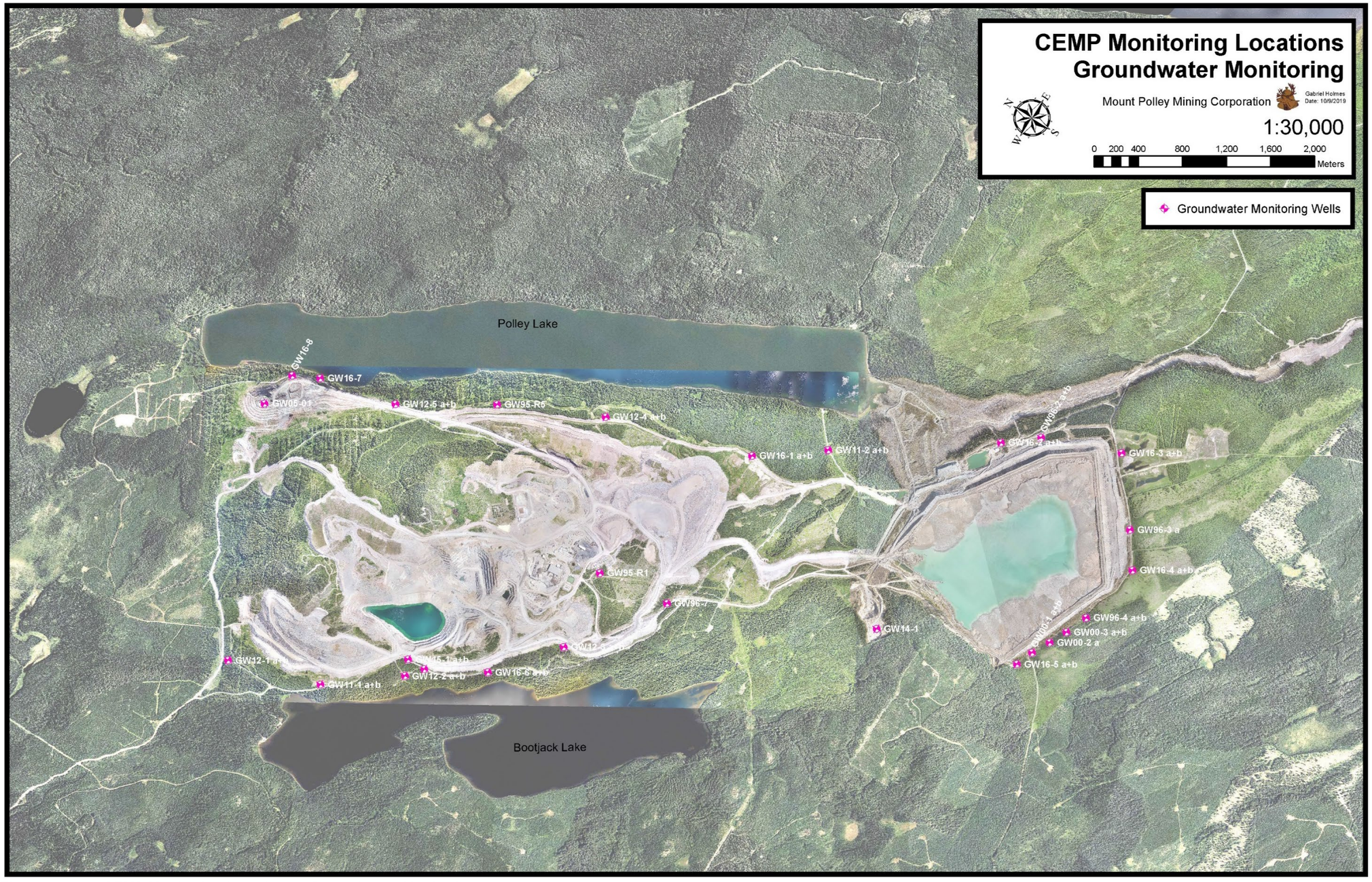

Figure 7.2-2: CEMP Monitoring Locations – Groundwater Monitoring

Seepage Water

Monitoring included in this subsection fall under BC *Mines Act* Permit M-200 and is only described here for completeness. Monitoring is summarized and changes will be presented in the CEMP, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A of Appendix 7-1).

Under the BC *Mines Act* Permit M-200 seepage monitoring program, monitoring of waste rock dump seepages is conducted under a bi-annual seep survey program of all waste rock dumps on site, with representative seeps being monitored more frequently when possible (numerous seeps stop flowing during dry periods). Table 7.2-5 summarizes the parameters analysed for seepage water quality. A list of dumps and pits that are sampled, along with the representative sample locations, is provided in Table 7.2-6 and Table 7.2-7, respectively. Figure 7.2-3 shows monitoring locations of the seepage sampling locations.

Table 7.2-5: Seepage Water Chemistry Parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

LOR = Limit of Reporting.

Table 7.2-6: Seep Monitoring Overview

Waste Rock Dump	Representative Sample	Representative Sample Frequency	Parameters Measured	Guidelines
North Bell Dump	Joe's Creek Pipe	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Dump	Boundary Seep 2	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
East RDS	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
NEZ Dump	NEZ Seep 1	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Waste Haul Road	Mine Drainage Creek Culvert	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Temporary NW PAG Dump	PAG Seep 15	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
TSF Haul Road	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
SERDS	SERD Seep 13	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

Table 7.2-7: Pit Seepage Monitoring Overview

Pit	Station Name	Sample Frequency	Parameters Measured	Guidelines
Cariboo Pit	E8	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Wight Pit	E10	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Springer Pit	E11	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Pit	Boundary Pit	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

1) When pit is not storing water from other sources on site.

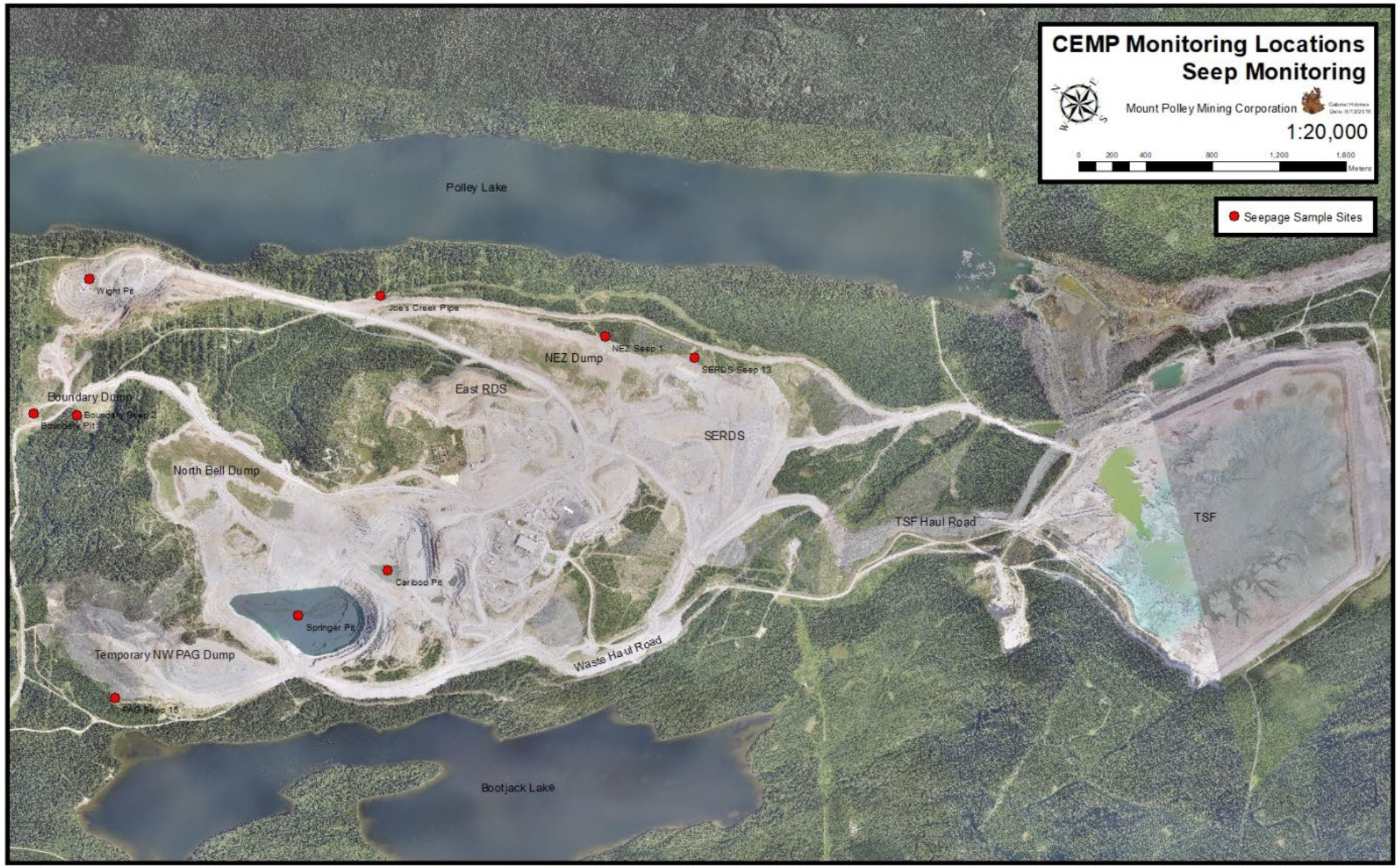

Figure 7.2-3: CEMP Monitoring Locations – Seep Monitoring

7.3 Discharge Monitoring Program

Effluent Monitoring

The objective of the effluent monitoring program is to verify the water chemistry complies with the applicable regulatory limits at the point of discharge (MDMER Schedule 4 and the Permit limits in Table 7.3-1; see Section 1.2.3 in the Permit), and that the discharge flow rate does not exceed the permitted rates of a maximum of 52,000 m^3/day and an annual average of 29,000 m^3/day (see Section 1.2.1 in the Permit). The influent is also sampled to allow for analysis of treatment efficacy.

The flow rate, temperature, and TSS of the effluent will be continuously monitored and recorded in the Veolia WTP HMI. Mount Polley Mine may consider less frequent sampling (MDMER minimum is quarterly) if the monthly mean concentrations of parameters are <10% of the MDMER guidelines for 12 months, as described Section 13 (1) of the MDMER. To make this change if these conditions are met, MPMC will follow the process outlined in Section 7 of CEMP (Appendix 7-1). Table 7.3-2 summarizes the parameters analysed for effluent quality and Table 7.3-3 provides an overview of the effluent monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D of the CEMP (Appendix 7-1). Figure 7.3-1 shows monitoring locations of the effluent sampling locations. Reporting of the monitoring data is outlined in Section 9 of the CEMP (Appendix 7-1).

Table 7.3-1: Permit 11678 and MDMER Schedule 4 Treated Effluent Compliance Limits for Direct Discharge to Quesnel Lake

Constituent	Units	Permit Limit		MDMER Schedule 4: Authorized Limits	
		Interim [1]	Final [2]	MAX Monthly Mean	MAX Grab Sample
Non-Metal Constituents					
pH	pH	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5
Total Suspended Solids	mg/L	15 (mean)/30 (max)		15	30
Total Sulphate	mg/L	720	1,100	-	-
Total Ammonia	mg/L (as N)	0.41	1.21	-	-
Total Nitrate	mg/L (as N)	9.7	34	-	-
Total Nitrite	mg/L (as N)	0.78		-	-
Total Phosphorus	mg/L	0.09		-	-
Fluoride	mg/L	17			
Cyanide [3]	mg/L	-		1	2
Radium 226 [4]	Bq/L	-		0.37	1.11
Total Metals					
Arsenic	mg/L	0.0034	0.028	0.5	1
Chromium	mg/L	0.0011	0.004	-	-
Copper	mg/L	0.012	0.033	0.3	0.6
Iron	mg/L	1		-	-
Lead	mg/L	-		0.2	0.4
Manganese	mg/L	3.4		-	-
Molybdenum	mg/L	0.36		-	-
Selenium	mg/L	0.06	0.075	-	-
Silver	mg/L	0.00024		-	-
Zinc	mg/L	0.059		-	-
Dissolved Metals					
Aluminum	mg/L	0.75		-	-
Cadmium	mg/L	0.00034		-	-
Iron	mg/L	0.35		-	-
Acute Toxicity Testing Results					
96h LC50 Rainbow Trout	Mortality in 100% effluent	50%		-	LC50 >100%
48h LC50 *D. magna*		50%		-	LC50 >100%

1) Maximum discharge limits until toxicity testing on final effluent concentrations is conducted.
2) Maximum discharge limits applicable after BC ENV is satisfied that toxicity testing demonstrates that the final effluent will not cause mixture toxicity. This requirement has been met.
3) MDMER requirement only; if cyanide is not used in the mining/milling process, then it does not have to be analysed. Since cyanide is not used in the mining/milling process at Mount Polley, the effluent is not analysed for cyanide.
4) MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied, and radium 226 analysis is currently conducted quarterly.

Table 7.3-2: Effluent Chemistry Parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

LOR = Limit of Reporting.

Table 7.3-3: Effluent Monitoring Overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
E19	E305050	WTP influent	Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
HAD-3	E304230	WTP treated effluent	Continuous[1]	TSS (calculated), temperature, flow rate	Permit 11678
			Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals, radium 226[2], total mercury[3]	Permit 11678; MDMER; EEM
			Monthly	Acute toxicity tests: ▪ - Rainbow trout: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout* (Reference Method EPS1/RM/13) ▪ - Daphnia Magna: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna* (Reference Method EPS1/RM/14) ▪ - or most recent methods, as per MDMER	Permit 11678; MDMER[4]
			Semi-annually[5]	Chronic toxicity tests: ▪ - Biological Test Method: *Toxicity Tests Using Early Life Stages of Salmonid Fish* (Rainbow Trout) (Reference Method EPS 1/RM/28) ▪ - Invertebrate species: *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia* (Report EPS 1/RM/21) ▪ - Plant species: *Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, Lemna minor* (Reference Method EPS 1/RM/37) ▪ - Algal species: *Biological Test Method: Growth Inhibition Test Using Freshwater Alga Selenastrum capricornutum* (Report Method EPS 1/RM/25)	MDMER

1) Only when discharging.

2) MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied and radium 226 analysis is currently conducted quarterly.

3) EEM requirement only; can be discontinued if concentration is less than 0.10 µg/L in 12 consecutive samples. This has been satisfied and mercury analysis has been discontinued.

4) MDMER June 2018 Part 2 Division 2 16 (1): frequency may be reduced to quarterly if discharge is determined not to be acutely lethal for 12 consecutive months.

5) Chronic/sub-lethal toxicity tests are conducted semi-annually for 3 years. MDMER June 2018 Schedule 5, 6 (1-3): after 3 years, frequency will be increased to once per calendar quarter on the sub lethal species whose results of sub lethal tests produce the lowest geometric mean, taking into account the inhibition concentration that produces a 25% effect or effective concentration of 25%.

N/A = not applicable; TSS = total suspended solids; DOC = dissolved organic carbon; MDMER = Metal and Diamond Mining Effluent Regulations; EEM = Environmental Effects Monitoring.



Figure 7.3-1: CEMP Monitoring Locations – Effluent Monitoring

7.4 Environment Monitoring Program

The CEMP includes surface water, groundwater, sediment, soil, and various environmental receptors (e.g., benthic invertebrates, soil invertebrates, plankton and chlorophyll a, periphyton, fish, wildlife, amphibians and reptiles, and vegetation). The surface water and groundwater monitoring are outlined in Section 7.2 of the CEMP (Appendix 7-1). sediment, benthic invertebrates, plankton and chlorophyll a, periphyton, and fish are outlined in Section 7.6 of the CEMP (Appendix 7-1). Full descriptions of the monitoring programs are provided in Section 6 of the CEMP (Appendix 7-1).

The objective of water chemistry monitoring in Quesnel Lake at the boundary of the IDZ is to verify that the discharge of treated effluent is not causing an exceedance of the applicable ambient BC Water Quality Guidelines at the edge of the IDZ, as required by the Permit, and to verify the discharge model, as described in the ADP.

For the edge of the IDZ sampling, limnological profiles of field parameters (specific conductance, temperature, and turbidity) will be carried out in an attempt to identify the location of the plume from the outfall (i.e., direction of flow). MPMC is committed to spending a reasonable level of effort and time to detect the plume and direction of flow. The reasonable level of effort and time will vary depending on the health and safety risks associated with the weather conditions and season. Vertical profiles of field measurements and water chemistry samples will be taken at the inferred centerline of the plume at the edge of the IDZ (station QUL-58).

A plume dispersion model was developed by WSP, for the nearfield (i.e., in the vicinity of the IDZ), and a hydrodynamic model of Quesnel Lake has been developed and calibrated by Tetra Tech EBA to predict effluent transfer throughout the West Basin of Quesnel Lake and potential for buildup (Golder 2015). Monitoring at the near-field station, along with monitoring of other Quesnel Lake receiving environment stations, will be used to verify the near-field and lake-wide hydrodynamic models. It should be noted that the nearfield and the hydrodynamic models, as described in the LTWMP, serve as the basis for the Trigger Response Plan incorporated into the 2018 ADP.

7.5 Post-Closure Environmental Monitoring Program

MPMC has developed a criterion-indicator framework (Reclamation Monitoring Criteria) that will be used to determine post-closure success, once the Mount Polley Mine Site enters the post-closure. The framework aligns carefully with MPMC's End Land Use Plan. MPMC's post-closure environmental monitoring program components include:

- monitoring of geotechnical structures
- monitoring of water quantity, quality and aquatic effects
- soils and vegetation monitoring

The Reclamation Monitoring Criteria can be found in Table 7.5-1.

Table 7.5-1: Reclamation Monitoring Criteria Framework

Criteria	Indicator	Measure
Landform Function		
Landforms have geotechnical stability	Geotechnical stability	Visual inspection for the presence/absence of subsidence, erosion, deposition of sediment in low lying areas, ponding, gullying, rilling or slumping, including bank stability round watercourses and waterbodies
Landscape enhancements are appropriate to the ecosystem and increase the diversity of the landscape	Landscape enhancements	Presence of rocks, coarse woody debris, brush piles, snags, bird/bat boxes, etc.
Water		
The Mine Site's water balance meets the needs of the post-closure landscape	Successful function of the TSF and Cariboo-Springer Pit Spillways	▪ Assessment of water levels in the TSF and Cariboo-Springer Pit ▪ No signs of instability of the TSF, or the TSF and Cariboo-Springer Spillways
	Water quality parameters	Water quality parameters support discharge of water to the receiving environment
	Pit lake elevation	▪ Pit lake elevations align with projected modelling. ▪ Pit lake elevations successfully cover PAG material
Soil		
Reclamation materials are placed appropriate to the landform	Soil depth Average placement depth (m)	Soil depth Average placement depth (m)
	Soil pH	Soil pH
	Soil moisture regime	Soil texture/particle size analysis (percent sand, percent silt, percent clay), placement depth, topography

Table 7.5-1: Reclamation Monitoring Criteria Framework

Criteria	Indicator	Measure
Vegetation		
Terrestrial and aquatic vegetation common to the surrounding area is established	Plant community composition (terrestrial, riparian and, marsh/aquatic)	Presence, percent cover, distribution of noxious and prohibited noxious weeds
		Species inventory and percent cover by layer and species. Include damage codes (e.g., insect, browse)
The reclaimed landscape provides commercial forest (where designated as an end land use within the reclamation plan)	Mortality of trees	Percent mortality between planting and ten years after planting
	Insects and disease	Percent of trees with signs of chewing, spots, eggs, nests or galls
	Browsing pressure	Percent of trees with signs of browsing on new shoots, bark damage
	Limitations on vegetation growth	Percent of trees with signs of chlorosis, stunting, unusual formations
Emergent Properties		
The reclaimed landscape provides for biodiversity	Patch size and shape	Patch sizes (ha)
	Food vegetation species	Food vegetation species Food species for target wildlife species are present
	composition – diversity, richness, evenness and abundance	Species inventory, percent cover and density (stems/ha)
Traditional Ecological Value	Wildlife habitat that supports traditional use	Derived from Plant Community Composition
	Biodiversity that supports traditional use	Derived from Plant Community Composition and incidental wildlife observations
	Vegetation that supports traditional use	Derived from Plant Community Composition

7.5.1 Monitoring of Geotechnical Structures

The post-closure monitoring program for the inspection and monitoring of the TSF will be aligned with the recommendations of the Canadian Dam Association for tailings facilities that cannot be decommissioned (CDA 2014). During early post-closure the TSF will undergo a dam safety inspection, carried out annually by a qualified geotechnical engineer, with additional extra inspections possible after extreme events (such as rainfall exceeding a selected design return period). The inspections will focus on any conditions that could adversely impact the long-term function and stability of the structure. Annual inspection reports will be submitted to EMLI for review. It is anticipated that the monitoring frequency may be reduced, potentially supplemented by remote monitoring of site instrumentation, as post-closure advances. Major features, such as waste rock dumps and pits will be visually inspected annually, and after major rainfall events, for signs of erosion, rilling, slumping or other forms of instability. As the reclaimed landform revegetates, it is expected that the need for inspections will decrease, as the vegetation cover helps limit issues associated with erosion and gullying.

7.5.2 Monitoring of Water Quantity, Quality and Aquatic Effects

The existing hydrometric stations on receiving water creeks will continue operations during active closure and post-closure. Continuous water level monitoring equipment (pressure transducer and data logger) will continue to be operated at each site during non-freezing periods, and the rating curves will be updated and maintained, as required. While hydrometric stations are only currently present at receiving locations, water levels will be measured quarterly in the TSF pond, and the expanded Springer, Wight, and Boundary pits during post-closure.

Until MPMC's passive/semi-passive water treatment system has been demonstrated to be able to be scaled up and implemented (and permitted), mine contact water will continue to be managed through the centralized system (e.g., WTP) with a single discharge to Quesnel Lake. Monitoring of this discharge will occur according to a monitoring plan that will require BC ENV approval and will likely be similar to the monitoring plan for operational water discharge.

Surface water quality monitoring will continue during active closure for the same parameters monitored during operations (total and dissolved metals, nutrients, physical parameters, ions, and dissolved organic carbon), with quality assurance and quality control quality assurance and quality control sampling procedures to continue. Monitoring locations are available in MPMC (2022). During active closure, mine contact water will continue to be produced, and thus BC ENV permit locations will continue to be monitored, and will follow the CEMP (MPMC 2019). In post-closure, sampling intensity is expected to reduce, as areas that once generated contact water have been revegetated, and post-closure water management infrastructure is in its final configuration. In general, post-closure water quality monitoring will consist of quarterly to annual monitoring frequencies.

Groundwater monitoring well locations are available in MPMC (2022). During active closure and post-closure groundwater monitoring will likely consist of:

- sampling of the Springer Pit wells quarterly and measurements of water levels daily until conditions are stable and appropriately characterized, and then reducing monitoring frequency to annual monitoring for approximately five years
- sampling of a nested pair of monitoring wells near the Cariboo Pit
- sampling of reconditioned wells adjacent to the Wight Pit
- continued bi-annual (i.e., every six months) monitoring of wells adjacent to other facilities until trends are stable and the water chemistry and flow patterns are appropriately characterized, at which point the monitoring frequency will be reduced.

During post-closure, monitoring of point of discharge required under EMA Permit 11678 will continue. In general, routine (likely monthly) sampling in the receiving environment is also anticipated, along with biological monitoring (fish population and fish tissues, sediment chemistry, and benthic invertebrate monitoring). Biological monitoring will continue every three years as per the MDMER (Canada 2022), with the frequency of all monitoring decreasing as results stabilize, until such time when treatment of Mine Site runoff is not required, or passive systems are deemed to be sufficiently effective and not requiring long-term monitoring. Following this, Mount Polley Mine will apply to become a closed mine under the MDMER (Canada 2022), which includes conducting a final biological monitoring study.

7.5.3 Soils and Vegetation Monitoring

Soil and vegetation monitoring will typically be completed in the summer when plants are most easily identifiable. A general schedule for reclamation assessments is as follows:

- post-application visual inspections (e.g., soil test pits) after placement of cover soil to assess placement depth and to verify if reclamation methods outlined in (MPMC 2022) were appropriately implemented
- assessment of revegetated areas following the first growing season to determine species composition (including presence of invasive species) and cover, as well as documentation of any areas of erosion
- observations of wildlife or grazing occurrences and usage
- survival surveys of planted trees and shrubs immediately after planting (for quality control purposes)
- survival surveys of planted trees and shrubs following their first growing season
- periodic assessments of tree survival/growth and ground cover vegetation, decreasing in frequency over time (e.g., years two, five, and ten)

The 2022 Environmental Risk Assessment (ERA) (WSP 2022) discusses methods for evaluating potential pathways for uptake of metals by ecological receptors at the Mine Site. Preliminary results indicate that there is minimal risk of metal uptake from reclaimed soil into vegetation and wildlife. Methods described in (WSP 2022) will coincide with the vegetation monitoring schedule.

7.6 Aquatic Effect Monitoring Program

As part of the annual CEMP, a sediment and aquatic life assessment is conducted. The objectives and overview of monitoring programs for sediment, benthic invertebrates, fish, periphyton, and plankton and chlorophyll a are described below. The detailed monitoring programs are provided in the CEMP (Appendix 7-1).

Sediment

As outlined in Appendix B.1 of the CEMP (Appendix 7-1), the objectives of sediment quality monitoring are to:

- "Evaluate the influence of mine activities on the receiving environments (e.g., Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life by applying a variety of interpretive tools";
- "Provide data to support exposure assessment as part of the ERA and human health risk assessment (HHRA)";
- "Provide supporting information for benthic invertebrate community monitoring"; and,
- "Advance technical understanding of the stability or mobility and potential bioavailability of metals and metalloids in lake sediments affected by the TSF Breach".

Sediment quality monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 perimeter embankment failure; and
3) Monitoring of response to reclamation activity following the perimeter embankment failure.

An overview of the proposed sediment quality monitoring program is provided in Table 2 and Figures 5 and 6 of Appendix B.1 of the CEMP (Appendix 7-1). Sediment quality monitoring is focused on Polley Lake, Hazeltine Creek, and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake). Table 3 in Appendix B.1 of the CEMP (Appendix 7-1) summarizes the analytes and laboratory reporting limits for the sediment quality monitoring program.

The monitoring program is divided into lake monitoring and creek monitoring and will include physical and chemical characterisation of deposited sediments. Sediment quality sampling will be supported by measurements of temperature, dissolved oxygen, pH, and specific conductance near the sediment-water interface at all sampling stations. Some additional monitoring of the stability and potential bioavailability of metals associated with sediments impacted by the TSF Breach may be undertaken (e.g., deployment of Diffusive Gradients in Thin Films devices to

monitor labile metal concentrations; toxicity testing using *Hyalella azteca*). More detail is provided in Appendix B.1 of the CEMP (Appendix 7-1).

Benthic Invertebrates

As outlined in Appendix B.2 of the CEMP (Appendix 7-1), the objectives of benthic invertebrate monitoring are to:

- "Evaluate the influence of Mount Polley Mine activities on benthic invertebrate communities, productivity, and tissue quality in receiving environments (e.g., Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines; BC MoE 2014) and to aquatic ecosystem health by providing supporting information for the assessment of potential effects to higher trophic levels (e.g., fish and fish habitat quality)"; and,
- "Provide data to support exposure assessment as part of the ERA and HHRA."

Benthic invertebrate community monitoring is also required as part of EEM under the MDMER. The objective of the MDMER EEM benthic invertebrate monitoring identified in Appendix B.2 of the CEMP (Appendix 7-1); is to "evaluate whether there are effects to benthic invertebrate community characteristics between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)."

Benthic invertebrate monitoring under the CEMP (Appendix 7-1) is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to reclamation activity following the TSF embankment breach.

An overview of the proposed benthic invertebrate monitoring program is provided in Table 3 of Appendix B.2 of the CEMP (Appendix 7-1), and includes benthic invertebrate community, productivity, and tissue quality. Benthic invertebrate monitoring is focused on Polley Lake, Hazeltine Creek, lower Edney Creek, Quesnel Lake, and associated reference areas (Figures 6 and 7 of Appendix B.2 of the CEMP [Appendix 7-1]). Table 4 in Appendix B.2 of the CEMP (Appendix 7-1); summarizes the analytes and laboratory reporting limits for the benthic invertebrate monitoring program. The sampling frequency at this time is once every three years.

Fish

The objectives of fish monitoring, as outlined in Appendix B.4 of the CEMP (Appendix 7-1), are to;

- "Evaluate the influence of Mount Polley Mine activities on fish communities, populations, and tissue quality in receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines [BC MoE 2014; CFIA 2015])";
- "Provide data to support exposure assessment as part of the ERA and HHRA"; and,
- "Document fish habitat utilization in creek and lake areas that were physically impacted by the TSF breach (most notably Hazeltine Creek and the lower segment of Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts".

From Appendix B.4 of the CEMP (Appendix 7-1), the objective of the MDMER EEM fish monitoring is to "evaluate whether there are differences in population endpoints (survival, growth, and reproduction) of sentinel fish species between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)." Evaluation of selenium in fish tissues is also triggered under the MDMER on the basis of current selenium concentrations in effluent.

Fish monitoring under the CEMP is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to remediation following the TSF embankment breach.

As previously indicated, fish monitoring includes fish tissue quality monitoring, sentinel fish population monitoring, fish habitat characterization and fish usage monitoring, and fish community monitoring. An overview of the proposed fish monitoring program is provided in Table 8 and Figures 5 and 6 of Appendix B.4 of the CEMP (Appendix 7-1). Table 9 in Appendix B.4 of the CEMP (Appendix 7-1) summarizes the fish tissue analytes and laboratory reporting limits for the fish monitoring program.

Periphyton

As outlined in Appendix B.3 of the CEMP (Appendix 7-1), the objectives of periphyton monitoring are to:

- "Evaluate the influence of mine activities (related to mine operations, the TSF breach, and/or rehabilitation activities) on Hazeltine Creek (the creek receiving environment directly influenced by mine activity) and lower Edney Creek (a creek environment directly influenced by the TSF breach)";
- "Serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish)";
- "Provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity"; and,
- "Provide data to support exposure assessment as part of the and HHRA".

Periphyton monitoring will include assessment of productivity, community composition, and tissue quality, with comparison to previous and/or reference conditions, to applicable guidelines (i.e., chlorophyll *a*; BC MoE 2018), and to literature-based criteria (or classification ranges) for productivity.

Periphyton monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the previous discharge of treated effluent to Hazeltine Creek);
2) Monitoring of the impact of the 2014 TSF breach; and
3) Monitoring of the response to reclamation activity following the TSF breach.

An overview of the proposed periphyton monitoring program is provided in Table 1 and Figure 4 of Appendix B.3 of the CEMP (Appendix 7-1). Periphyton monitoring is focused on Hazeltine Creek and lower Edney Creek with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek and lower Hazeltine Creek). Table 2 in Appendix B.3 of the CEMP (Appendix 7-1) summarizes the analytes and laboratory reporting limits or the periphyton monitoring program.

Plankton and Chlorophyll a

Table 7.6-1 summarizes the parameters analysed for plankton and chlorophyll *a* monitoring. Chlorophyll *a*, phytoplankton taxonomy and biomass, and zooplankton taxonomy and metal tissue samples will continue to be collected concurrently with water chemistry samples (including field parameters) three times per year to capture early and late growing seasons as outlined in Table 7.6-2. Growing seasons were determined after monthly sampling was conducted in 2015; data analysis of zooplankton community is presented in Golder (2016). Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D of the CEMP (Appendix 7-1). Figure 7.6-1 shows monitoring locations of the plankton and chlorophyll *a* sampling locations.

Table 7.6-1: Plankton and Chlorophyll *a* Parameters

Parameter	LOR	Unit
Taxonomy		
Phytoplankton	-	-
Zooplankton	-	-
Total Metals in Tissue		
Aluminum (Al)	2	mg/kg
Antimony (Sb)	0.01	mg/kg
Arsenic (As)	0.02	mg/kg
Barium (Ba)	0.05	mg/kg
Beryllium (Be)	0.01	mg/kg
Bismuth (Bi)	0.01	mg/kg
Boron (B)	1	mg/kg
Cadmium (Cd)	0.005	mg/kg
Calcium (Ca)	20	mg/kg
Chromium (Cr)	0.005	mg/kg
Cobalt (Co)	0.05	mg/kg
Copper (Cu)	0.02	mg/kg
Iron (Fe)	0.1	mg/kg
Lead (Pb)	3	mg/kg
Lithium (Li)	0.02	mg/kg
Magnesium (Mg)	0.5	mg/kg
Manganese (Mn)	2	mg/kg
Molybdenum (Mo)	0.05	mg/kg
Nickel (Ni)	0.02	mg/kg
Potassium (K)	0.2	mg/kg
Selenium (Se)	10	mg/kg
Silicon (Si)	20	mg/kg
Silver (Ag)	0.05	mg/kg
Sodium (Na)	0.05	mg/kg
Strontium (Sr)	20	mg/kg
Thallium (Tl)	0.05	mg/kg
Tin (Sn)	0.02	mg/kg
Titanium (Ti)	0.002	mg/kg
Uranium (U)	0.1	mg/kg
Vanadium (V)	0.002	mg/kg
Zinc (Zn)	0.1	mg/kg
Plant Pigments (Water)		
Chlorophyll *a*	0.01	µg

LOR = Limit of Reporting.

Table 7.6-2: Plankton and Chlorophyll *a* Monitoring Overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
P2	E307975	Polley Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
B2	E215897	Bootjack Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-1	E306455	Quesnel Lake zooplankton station at Hazeltine	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-7	E306456	Quesnel Lake zooplankton station at Horsefly	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A

N/A = not applicable; IDZ = initial dilution zone.

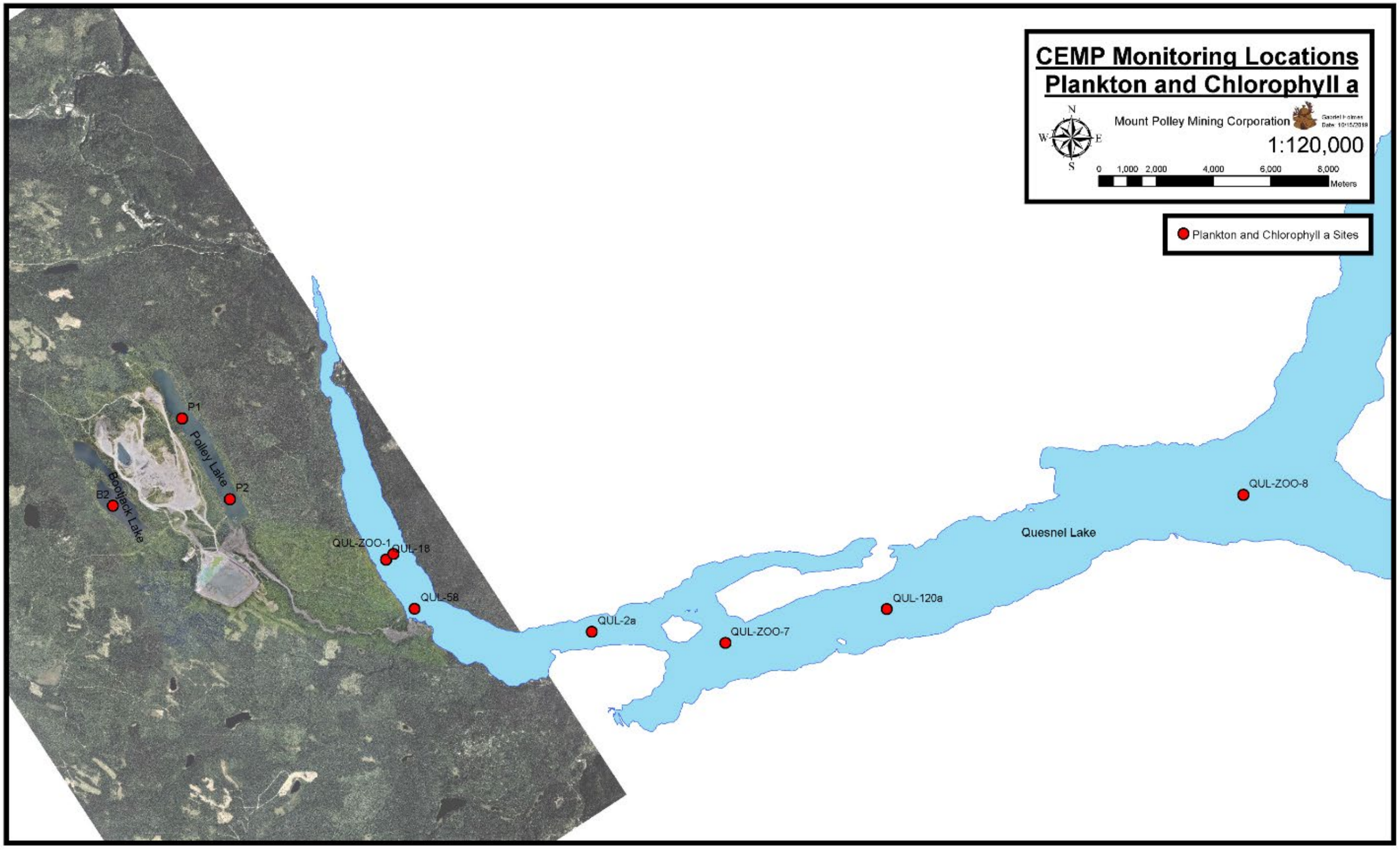

Figure 7.6-1: CEMP Monitoring Locations – Plankton and Chlorophyll *a* Monitoring

7.7 References

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8 HEALTH AND SAFETY

8.1 Occupational Health Risk Assessment

8.1.1 Occupational Health Risk Assessment

This information is not required in the permit application for the Project.

8.1.2 Ergonomics

This information is not required in the permit application for the Project.

8.1.3 Emergency Wash Facilities

This information is not required in the permit application for the Project.

8.1.4 Hazardous Dust

This information is not required in the permit application for the Project.

8.1.5 Lunchrooms, Mine Dry, and Sanitary Conveniences

This information is not required in the permit application for the Project.

8.2 Post Permitting Requirements

This information is not required in the permit application for the Project.

8.2.1 Issued for Construction Plans

Issued for constructions plans are included in the detailed design report for the TSF interim raise to elevation 974 m is included in Appendix 1-3.

8.2.2 Letters of Assurance

This information is not required in the permit application for the Project.

8.2.3 Occupational Health Programs

This information is not required in the permit application for the Project.

8.2.4 Workplace Hazardous Materials Information System (WHMIS)

This information is not required in the permit application for the Project.

8.2.5 Additional Information and Certifications

This information is not required in the permit application for the Project.

9 MANAGEMENT PLANS

9.1 Environmental Management System

MPMC’s Environmental Management System (EMS) is a structured framework that helps identify, monitor, manage, and continuously improve environmental performance. The primary goal of the EMS is to integrate environmental considerations into MPMC's overall business strategy and operations. Here is a summary of key components and principles of the EMS:

4) **Policy and Procedure Development:** Establishing an environmental policy that reflects MPMC's commitment to compliance with applicable environmental laws and regulations, pollution prevention, and continual improvement.

5) **Planning:** Conducting an initial environmental review to identify significant environmental aspects and impacts, legal requirements, and stakeholder expectations. This information is used to set environmental objectives and targets.

6) **Implementation and Operation**: Allocating responsibilities, providing training, and establishing communication processes to ensure that the environmental policy is implemented effectively. This includes developing procedures and documentation to support environmental management.

7) **Monitoring and Measurement:** Regularly monitoring and measuring key environmental performance indicators to track progress toward objectives and targets. This involves routine inspections, data collection, analysis and interpretation.

8) **Evaluation of Compliance:** Ensuring that MPMC is aware of and compliant with relevant environmental legislation and regulations. This involves continuous compliance tracking and assessment.

9) **Review and Improvement:** Conducting periodic management reviews to evaluate the effectiveness of the EMS and management plans, assess progress toward objectives, and identify opportunities for improvement. This includes updating the environmental policy and objectives as needed.

10) **Documentation and Record Keeping:** Maintaining accurate and up-to-date documentation of the EMS, including quality assurance and quality control strategies, policies, procedures, and records of environmental performance.

11) **Emergency Preparedness and Response:** Establishing procedures to identify and respond to potential environmental emergencies or accidents.

Environmental Policy

At Imperial Metals, the pursuit of sustainability guides our approach to business. Our objective is to manage and protect the air, water, land, vegetation, wildlife, and heritage resources of the land, on which our mines are active, to support returning land use objectives following closure of the mine. Through this policy we commit to:

- Comply with applicable legal, regulatory, and other requirements which relate to our operations identified environmental aspects.
- Annually update our Comprehensive Environmental Monitoring Plan (CEMP) to evaluate the effects of mining related activities on surface and groundwater quality, sediments, soils, aquatic ecosystems, fish, vegetation, and wildlife.
- Maintain a positive water balance by minimizing site contact water, recycling on-site water, using enhanced evaporation techniques, and sending excess contact water to an on-site water treatment plant.
- Share information about mine activities and results of monitoring programs with the Mount Polley Public Liaison Committee (PLC) members, and for the members to ask questions regularly with the T'exelc First Nation and the Xatśūll First Nation as a component of the Partnerships Agreement.
- Prevention of pollution.
- Making this policy available to our employees, contractors, visitors, and the public.
- Raising the environmental awareness of our employees, contractors, and visitors.

Environmental management roles and responsibilities are distributed as follows:

General Manager

- General oversight regarding environmental department activities as reported by the Environmental Superintendent. Responsible for budgetary oversight.

Environmental Superintendent

- Oversight regarding all Environmental Department activities including budgetary oversight, permit compliance, resource management, stakeholder engagement, EMS implementation, environmental research and development and regulatory reporting.

Environmental Coordinator

- Oversight regarding all Environmental Department activities including day to day environmental operations and supports activities regarding permit compliance, resource management, stakeholder engagement, EMS implementation, environmental research and development and regulatory reporting.

MPMC is an operating mine that is subject to extensive environmental regulatory oversight. The following is a list of relevant acts, and regulation MPMC is subject to:

Provincial Acts and Regulations

- *BC Drinking Water Protection Act*
- *BC Environmental Assessment Act*
- *BC Environmental Management Act* (EMA)
  - EMA Permit 11678
  - EMA Permit 14590
  - EMA Permit15968
  - EMA Permit 15087
- *BC Forest Act*
- *BC Greenhouse Gas Industrial Reporting and Control Act*
- *BC Heritage Conservation Act*
- *BC Land Act*
- *BC Mineral Land Tax Act*
- *BC Mineral Tax Act*
- *BC Mineral Tenure Act*
- *BC Mines Act*
  - *Mines Act* Permit M-200
- *BC Range Act*
- *Riparian Areas Protection Act*
- *BC Trasport of Dangerous Goods Act*
- *BC Water Protection Act*
- *BC Water Sustainability Act*
  - Conditional Water License 132360
  - Conditional Water License 500331
- *BC Weed Control Act*
- *BC Wildfire Act*
- BC Contaminated Sites Regulation

- BC Greenhous Gas Emission Reporting Regulation
- BC Hazardous Waste Regulation
- BC Municipal Wastewater Regulation
- BC Spill Reporting Regulation
- BC Spill Contingency Planning Regulation

Federal Acts and Regulations

- *Canadian Environmental Protection Act*
- *Canadian Fisheries Act*
- *Canadian Species at Risk Act*
- *Canadian Migratory Birds Convention Act*
- *Canadian Wildlife Act*
- *Canadian Environmental Assessment Act*
- *Canadian Environmental Enforcement Act*
- *Canadian Environmental Violations Administrative Monetary Penalties Act*
- *Canadian Navigable Waters Protection Act*
- Metal and Diamond Mine Effluent Regulation
- Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulation

In addition, MPMC's management practices align with provincial and federal best management practices. The following is a list of relevant best management practices applied at Mount Polley Mine:

- BC Field Sampling Manual
- BC Laboratory Manual
- Requirements and Best Management Practices for Making Changes In and About a Stream
- Timing Windows and Measures to Adequately Manage and Conserve Aquatic Resources in the Cariboo Region
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in BC
- Best Management Practices for Bats in BC – 2016
- Best Management Practices for Amphibian and Reptile Salvages in BC

Organizational Structure

Mount Polley Mining Corporation is a hybrid centralized and decentralized organizational structure with static and dynamic elements. Organizational function is distributed departmentally with a hierarchy of responsibility built into respective departments and overall company structure. Static elements include operational processes infrastructure connected by operational objectives. Dynamic elements include implementation of mining technologies and mining workflow systems.

Training

Relevant environmental management training in all applicable departments is ongoing at Mount Polley Mine. Management and frontline supervisors are trained on MPMC's EMS components on an ongoing basis because they are "live" documents and are modified periodically. Management and frontline supervisors are expected to disseminate management plans and expectations when applicable. The following plans are examples of training materials provided to staff at the mine:

- MPMC Annual Discharge Plan
- MPMC Biosolids Management Plan
- MPMC Environmental Communications Plan
- MPMC Fugitive Dust Management Plan
- MPMC Environmental Emergency Response Plan
- MPMC Flocculant Management Plan
- MPMC Ground Control Plan
- MPMC Invasive Plant Management Plan
- MPMC Nitrogen Management Plan
- MPMC ML/ARD Management Procedure Manual
- MPMC Sediment and Erosion Control Management Plan
- MPMC Soil Management Plan
- MPMC Wildlife Management Plan

In addition, site wide training programs for waste management, spill response and bear awareness have also been developed.

9.2 Surface Erosion Prevention and Sediment Control Plan

The Surface Erosion Prevention and Sediment Control Plan is provided in Appendix 9-1 along with the declaration of competency and conflict of interest for the signing professional engineer. In 2010, MPMC prepared an Erosion and Sediment Control Plan (ESCP) in compliance with their EMA Permit 11678. The Plan addresses existing and potential surface erosion and sediment mobilization impacts associated with mine expansion, operation, and decommissioning activities, and applies to all MPMC employees and contractors. The main objective of the Plan is to prevent erosion and intercept potential sediments as close to the source as possible. Erosion and sediment control measures and best management practices are incorporated in the Plan as approaches to prevent erosion and the introduction of sediment into natural watercourses and water bodies adjacent to the Mine site. The Plan is designed to be updated to incorporate advancements in erosion and sediment control science and Best Management Practices technology.

The MPMC discharge Permit 11678 was amended in December 2022 with some new and additional requirements, one of which is that a QP review the current ESCP. QPs in WSP with experience in erosion and sediment control reviewed the ESCP as per this requirement.
A technical memo summarizing the findings of the review was submitted to MPMC for inclusion with their 2023 annual report to regulators. The 2023 update of the Plan is based on recommendations of the review.

9.2.1 Methods of Erosion Prevention and Sediment Control

Surface erosion prevention and sediment control at the Mine site involves planning, implementation, operation, and monitoring of Best Management Practices in order to limit the mobilization and transport of sediment from the site to the receiving environment. The ESCP consists of three components:

- Site control: upstream diversion channels are used to reduce water contact with disturbed areas.
- Source Control: Active and passive control methods are used to minimize erosion.
- Conveyance and sediment control: This is used to control mobilization of sediment.

Activities during construction, operation and decommissioning during which erosion and sediment control measures are used include:

- Vegetation clearing
- Topsoil stripping
- Topsoil stockpiling
- Road and infrastructure construction
- Tailings and water management structures construction.

The ESCP has been developed for the Mine site for activities during the three phases of construction, operation and decommissioning. Short-term and long-term methods of erosion and sediment control include structural and non-structural measures.

Non-structural methods include:

- Inspection
- Contact Water Monitoring
- Receiving Environment Monitoring
- Management of Emergency Release of Water
- Conducting work during regulated in-stream work windows
- Complying with permitting, notification and reporting requirements of projects
- Provision of appropriate training and awareness to supervisors, employees, and contractors regarding their responsibilities to comply with water quality legislation.

Structural methods are used to stabilize areas to prevent movement of sediment into watercourses and waterbodies. These include:

- Gravel and straw cover
- Rip-rap
- Slope flattening or benching
- Surface ripping and roughening to promote infiltration
- Diversion berms and drains
- Sandbags
- Erosion blankets
- Geosynthetic membranes
- Concrete canvass.

Treatment methods to manage sediment delivery to watercourses and waterbodies include:

- Check dams
- Sediment ponds
- Silt fences/straws
- Runoff collection ditches

During decommissioning and reclamation, the following steps would be implemented to reduce erosion and meet land use and land capability objectives:

- Grade and contour any disturbed areas to promote drainage and conform to adjacent topography.
- Apply soil in a rough manner to create microtopography.
- Apply coarse woody debris, as available, to the reclamation site if it is not already incorporated into the soil.
- Seed and/or plant disturbed areas with a suitable mixture of grass, legume and woody species to establish ground cover and provide stabilization in a timely manner.
- On disturbed areas with potential to impact natural water bodies or watercourses, maintain temporary stabilization measures, such as geotextile or mulch until a vegetative cover is established.

Site monitoring and inspections of sediment and erosion control systems are based on associated risk to the environment. Table 9.2-1 relates potential sediment sources to these sensitive areas and assigns a level of risk based on sensitivity of the receiving environment (receiver size, fish bearing status, etc.) adjacent to Mount Polley Mine site and erosion potential.

Table 9.2-1: Risk Assessment of Receiving Waterbodies and Watercourses Adjacent to Mount Polley Mine Site (Appendix 9-1)

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
6 km Creek	▪ Not fish bearing in upper reaches. ▪ Variable forest buffer.	▪ Access road. ▪ Junction Zone Ditch or 9 km Sump.	▪ NW PAG Stockpile soil stockpiles ▪ NW PAG Stockpile/Junction Zone Ditch access roads. ▪ NW Sump.	▪ Established gravel ditch bottom. ▪ Upstream area mostly covered with waste rock. ▪ Soil stockpiles revegetation. ▪ Two high traffic road crossings.	Medium.
Mine Drainage Creek	▪ Not fish bearing. ▪ Connected to Bootjack Lake.	▪ Mine Drainage Creek Sump. ▪ West Ditch.	▪ Waste Haul Road. ▪ Helipad reclamation parcel. ▪ Crusher Access Road. ▪ Ore Switchback Road. ▪ Cariboo. Stockpile and soil stockpiles. ▪ Pipeline from Springer Pit to water treatment plant.	▪ Some unarmoured ditch sections. ▪ Some till placed on outer slope of Waste Haul Road. ▪ Active haul traffic on roads (can develop sediment-laden puddles). ▪ Caribou Stockpile soil stockpiles new. ▪ Helipad reclamation parcel revegetating. ▪ Majority of runoff into ditch (including from reclamation and soil stockpile areas) filters through rock haul road. ▪ Water in pipeline to treatment plant contains low total suspended solids.	Medium.
W20 Creek	▪ Fish bearing (very low productivity). ▪ Variable forest buffer.	▪ West Ditch. ▪ West Ditch Access Road.	▪ Light Vehicle Tailings Road. ▪ Waste Haul Road. ▪ Above Waste Haul Road reclamation parcel. ▪ Pipeline from Springer Pit to water treatment plant.	▪ Ditch armoured. ▪ Reclamation parcel revegetating; upstream of Waste Haul Road. ▪ Active haul traffic on roads (can develop sediment-laden puddles). ▪ Water in pipeline to treatment plant contains low suspended solids. ▪ Majority of runoff into ditch filters though rock haul road.	Medium.

Table 9.2-1: Risk Assessment of Receiving Waterbodies and Watercourses Adjacent to Mount Polley Mine Site (Appendix 9-1)

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Bootjack Lake	▪ Fish bearing. ▪ Medium sized receiver. ▪ Variable forest buffer.	▪ NW Sump. ▪ NW Ditch. ▪ Mine Drainage Creek Sump. ▪ West Ditch. ▪ West Ditch Access Road. ▪ Mine Drainage Creek. ▪ W20 Creek.	▪ Waste Haul Road. ▪ Helipad reclamation parcel. ▪ Crusher Access Road. ▪ Ore Switchback Road. ▪ Caribou Stockpile and soil stockpiles. ▪ Light Vehicle Tailings Road. ▪ Waste Haul Road. ▪ Above Waste Haul Road reclamation parcel. ▪ Pipeline from Springer Pit to water treatment plant.	▪ Some unarmoured ditch sections. ▪ Some till placed on outer slope of Waste Haul Road. ▪ Active haul traffic on roads (can develop sediment-laden puddles). ▪ Caribou Stockpile soil stockpiles new. ▪ Reclamation parcels revegetating. ▪ Water in pipeline to treatment plant contains low total suspended solids. ▪ Majority of runoff into ditch filters through rock dumps and rock haul roads.	Medium.
North Dump Creek	▪ Not fish bearing in upper reaches. ▪ Variable forest buffer.	▪ Joe's Creek Coffer Dam. ▪ Joe's Creek Pipeline. ▪ Gavin's Ditch (clean water diversion). ▪ Wight Pit Ditch (clean water diversion). ▪ Wight Pit Haul Road.	▪ North Bell Dump reclamation areas and soil stockpiles. ▪ Access Road. ▪ East Dump reclamation areas and soil stockpiles.	▪ Joe's Creek Coffer Dam/Pipeline water very low turbidity/suspended solids. ▪ Ditches armoured or have established of have low-erodibility substrates except some potentially erodible sections in Wight Pit Ditch. ▪ East Dump reclamation area in early stages of revegetation. ▪ Varying levels of soil stockpile revegetation (some new). ▪ Two moderate use road crossings.	Medium.

Table 9.2-1: Risk Assessment of Receiving Waterbodies and Watercourses Adjacent to Mount Polley Mine Site (Appendix 9-1)

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Bootjack Creek	▪ Not fish bearing ▪ Connected to Polley Lake.	▪ Bootjack Creek Sump. ▪ Tailings Access Road Ditch. ▪ SERDS Ditch.	▪ Tailings Access Road. ▪ Tailings Access Road soil stockpiles. ▪ SERDS access roads. ▪ Southeast Zone soil stockpiles.	▪ Some erodible ditch sections. ▪ Portion of runoff into ditches filters through waste rock roads/dumps. ▪ Three high use road crossings.	Medium.
Polley Lake	▪ Fish bearing. ▪ Undergoing rehabilitation. ▪ Sedimentation ponds constructed at outflow.	▪ Wight Pit Ditch (clean water diversion). ▪ Long Ditch. ▪ North Dump Creek.	▪ North Bell Dump reclamation areas and soil stockpiles. ▪ Access Road. ▪ NEZ Dump reclamation area and soil stockpile. ▪ East Dump reclamation areas and soil stockpiles. ▪ Tailings Access Road. ▪ Tailings Access Road soil stockpiles. ▪ SERDS access roads. ▪ Southeast Zone/SERDS soils stockpiles.	▪ Varying levels of revegetation of upstream reclamation areas and soil stockpiles. ▪ Ditches armoured or have established low-erodibility substrates except some potentially erodible sections of Wight Pit Ditch.	Low.

Table 9.2-1: Risk Assessment of Receiving Waterbodies and Watercourses Adjacent to Mount Polley Mine Site (Appendix 9-1)

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Hazeltine Creek[d]	▪ Fish bearing. ▪ Undergoing rehabilitation. ▪ Sedimentation ponds constructed at outflow.	▪ Polley Lake. ▪ Long/SERDS Ditch (combined). ▪ Central Collection Sump. ▪ Perimeter Till Borrow Pit and ditch from Central Collection Sump. ▪ Pipeline from Springer Pit to water treatment plant. ▪ Edney Creek.	▪ TSF and associated infrastructure. ▪ TSF Perimeter Embankment and PAR soil stockpiles. ▪ TSF Ditch (clean water diversion). ▪ TSF South Toe Drain Ditch. ▪ TSF Main Seepage Pond. ▪ ABR/Main Seepage Pond Ditch.	▪ High volume water transfers. ▪ Water has time to settle in the TSF and Perimeter Embankment Till Borrow Pit. ▪ Water in pipeline to treatment plant contains low total suspended solids. ▪ Soil stockpiles varying levels of revegetation. ▪ South Till Borrow area revegetation is advanced. ▪ Active TSF construction upstream.	Medium (Risk will increase when the creek returns to fish-bearing status).
Edney Creek	▪ Fish bearing. ▪ Forest/wetland buffer.	▪ TSF Ditch (clean water diversion). ▪ TSF South Seepage Pond. ▪ TSF South Toe Drain Ditch. ▪ TSF Main Seepage Pond. ▪ ABR/Main Seepage Pond Ditch. ▪ South Till Borrow reclamation area.	▪ TSF and associated infrastructure. ▪ South and Main Embankment soil stockpiles.	▪ Few erodible ditch sections. ▪ Low water volumes managed. ▪ Water seepage ponds contain low turbidity/suspended solids. ▪ New soil stockpiles (early stages of revegetation). ▪ Active TSF construction upstream. ▪ South Till Borrow area revegetation is progressing.	Low.

a) Secondary sources are potential sources of sediment that are upstream of (i.e., potentially contribute to) primary erosion.

b) Historic turbidity and total suspended data in relevant water collection infrastructure were considered when assessing erosion potential; water management contingency measures in place across water management system.

c) Based on combination of area sensitivity and erosion potential.

d) Sediment and erosion control in Hazeltine Creek beyond the mine footprint related to the Tailings Storage Facility embankment breach is managed under a separate program.

9.2.2 Roles, Responsibilities and Training Requirements

Mine Manager: The Mine Manager will be aware of the ESCP and how the proposed mining activities could affect soil erosion potential and sediment delivery to adjacent watercourses and water bodies. The Mine Manager is accountable for allocating resources for implementing the erosion prevention and sediment control measures outlined in the ESCP to comply with relevant water quality guidelines and applicable water quality objectives.

Environmental Manager: The Environmental Manager will be primarily accountable for implementing the requirements of the ESCP, including monitoring and reporting activities. The Environmental Manager will be aware of the relevant legislation and permit requirements listed in Section 2.2 of Appendix 9-1 for the purpose of ensuring compliance with the regulatory requirements. Responsibilities of the Environmental Manager will include:

- Implementation and ongoing maintenance and update of the ESCP.
- Tracking compliance with provincial and federal legislation and applicable permit conditions.
- Communicating environmental requirements to the Mine Manager.
- Investigating and reporting environmental incidents.
- Developing and implementing adaptive management strategies to address environmental risks, incidents, and non-compliance situations.

The Environmental Manager will use an external QP who has specific expertise in erosion protection and sediment control as may be necessary for appropriate implementation of the ESCP. This may require retaining a QP to provide topic-specific training to the Environmental Manager and any other employees and contractors of MPMC for implementation of specific tasks needed to implement the ESCP.

Employees: All employees and contractors involved in the planning, design, and carrying out of earth disturbance works at the Mine site will be required to undergo a basic orientation and to become familiar with the contents of the ESCP. Training will be provided to all such employees and contractors.

9.2.3 Monitoring

Daily inspections of site water containment infrastructure are carried out as per the Water Management Inspection Manual to verify the collection system is working as designed. As per this document, inspections are done at least once on day shift and night shift during high-risk periods (i.e., freshet). The inspection form template is included as Appendix C of Appendix 9-1. Completed forms are provided to the Environmental Department for review and filing at the end of each seven (7) day set. Note that protocols and triggers are in place for immediate notifications to occur if deficiencies are observed. Daily inspections are the responsibility of Mill Maintenance, and the Environmental and Engineering Departments are responsible for updating the Water Management Inspection Manual, which is a component of the site Operation Maintenance and Surveillance Manual.

Inspections of all site water management infrastructure (sumps, ditches, culverts, etc.) are carried out in spring after freshet and in fall prior to freeze up, as per EMA Permit 11678. This is the responsibility of the Environmental Department. Results are documented in the inspection form (refer to the template provided as Appendix D of Appendix 9-1) and filed internally. Inspection results are used to inform upgrades of water management infrastructure components. Noted deficiencies, including areas of sedimentation or erosion, are compiled and prioritized in a project list which is provided to the Engineering Department to address, based on the identified levels of urgency.

9.2.3.1 Contact Water Monitoring

Routine monitoring of mine site contact water conveyed through various infrastructure components is conducted as per Mines Act Permit M-200. This sampling program, including sample locations, frequencies, and quality assurance and quality control quality procedures, is detailed in the site Operation Maintenance and Surveillance Manual, which is regularly updated to account for operational changes at the mine site. All routine samples collected on site are analysed for physical parameters (including total suspended solids and turbidity), anions, nutrients, and total and dissolved metals. Monitoring locations and frequencies (at the time of this update) are shown in Figure 3 of the Surface Erosion Prevention and Sediment Control Plan in Appendix 9-1.

These sample results are included in the Annual Environmental and Reclamation Report to BC ENV and the EMLI, which is written and submitted by the Environmental Department.

9.2.3.2 Receiving Environment Monitoring

The Environmental Department conducts water quality monitoring in receiving environment water bodies and watercourses as per MPMC's CEMP, which is required under EMA Permit 11678. Note that chemistry and flow monitoring at a few contact water sites is included under this program, as opposed to the EMLI program, including monitoring related to the permitted effluent discharge. In addition to regular sampling (e.g., monthly, quarterly), a five (5) week intensive turbidity and total suspended solids monitoring program is conducted in spring and fall in receiving environment streams that could potentially be impacted by erosion from the mine. This includes the following creeks downstream of inflows from runoff diversion ditches:

- North Dump Creek;
- Bootjack Creek;
- Edney Creek; and
- Hazeltine Creek (temporarily suspended due to the TSF breach).

9.2.4 Erosion and Sediment Control during Construction

Construction should comply with the plans developed in the pre-construction phase so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment or other deleterious substances (as defined in the *Fisheries Act*) into a watercourse, thereby preventing "pollution" (as defined in the EMA). Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control plans to be revised accordingly.

Monitoring is to be carried out throughout the construction phase. Actions and maintenance that may be required based on monitoring observations include:

- Correcting deficiencies of the erosion and sediment control measures as soon as they are observed.
- Removal of any sediment and debris accumulation that compromises the effectiveness of the erosion and sediment control measures.
- Implementation of additional stabilization and treatment measures.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.
- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.

- Follow the project CEMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

9.2.5 Stabilization and Treatment Methods

Sediment control measures are to be planned and, if required, installed prior to clearing or earthwork activities. Stabilization measures are put in place to prevent or reduce the mobilization of sediment by stabilizing the source (e.g., exposed soils). Typical interim measures that may be used to stabilize areas that have the potential to be sources of sediment to water bodies or watercourses include:

- Non-vegetative cover (e.g., gravel and straw);
- Rip-rap placement;
- Slope modification to reduce erosive energy (e.g., flattening or benching);
- Surface ripping and roughening to promote infiltration;
- Diversion berms and drains (in particular to intercept upstream runoff);
- Chute construction;
- Sandbags;
- Buffer zones; and
- Erosion blankets.

While pro-active stabilization measures are used to avoid the presence of sediment laden water, treatment measures may be necessary when it is not possible to completely prevent the mobilization of sediment. Typical treatment measures that may be used to manage sediment in contact water include the following:

- Check dams or weir drop structures;
- Outlet protection;
- Sediment retention ponds, sediment traps and sediment basins;
- Silt fence or similar barrier, such as straw; and
- Swales.

9.2.6 Runoff Collection Ditches

Runoff collection ditches may be either temporary or permanent structures. Permanent surface runoff control works should be sized to convey runoff from a 1 in 10 year 24-hour flood flow and to withstand a 1 in 200-year 24-hour event without significant damage as per BC ENV Permit 11678.

The design of sections of ditch may depend on topography, excavation material (till or bedrock) and design discharge. Different material gradations or design approaches may be used for armouring depending on site-specific conditions and material availability. Any convergences with other ditches or streams should be armoured.

Some initial flushing, erosion and self-armouring are expected following construction, and appropriate measures should be taken for non-contact water ditches discharging into the receiving environment. For example, small ponds with rock overflow weirs can be constructed or this water can temporarily be collected in mine contact water systems until it is of appropriate quality to discharge. With aging, erosion and sediment runoff will be controlled to be comparable to natural conditions; however, inspections and monitoring (refer to Section 7 of Appendix 9-1) are required to confirm appropriate sediment control.

9.2.7 Sediment Control Ponds

A sediment control pond is used to detain runoff from a disturbed area so that sediment can settle out of the water column. Sediment control ponds should be designed according to the "Guidelines for the Design, Size, and Operation of Sedimentation Ponds used in Mining" (BC MoE, 2002), where applicable.

9.2.8 Severe Weather Shutdown

In the event that an emergency release of water from the site collection system occurs, the protocol in the Water Management Inspection Manual outlining responsibilities, notification requirements, documentation (refer to the form in Appendix E of Appendix 9-1), and actions to carry out would apply. One key action is the installation of sediment and erosion control materials and/or structures.

Monitoring associated with an emergency release of water is the responsibility of the Environmental Department, and should include the following:

- Assessment of the spatial extent of the release and if the release reached receiving environment waterways or water bodies;
- Monitoring of water released (visual observations, flow measurements/estimates, field parameters including turbidity, and/or sampling, based on the observed location, conditions and size of the release); and

- Monitoring (visual observations, field parameters including turbidity, and sampling) of downstream waterways or waterbodies into which water was released.

Reporting to Emergency Management BC and follow up reporting to provincial regulatory agencies will likely require this information, in addition to the information required to be collected as per the Water Management Inspection Manual.

9.2.9 Emergency Release of Water

If emergency release of water from the site water collection system should occur, sediment and erosion control materials are to be installed, as required, to avoid the displacement of sediment as water moves over land. These materials are stored in the Environmental C-Can located beside the Leach Pad, and the Environmental Department staff is available to guide proper installation. The Mount Polley Emergency Response Plan and Water Management Inspection Manual outline in more detail response protocol for such events, and Section 7.2 of Appendix 9-1 outlines event-based monitoring procedures.

9.2.10 Collection and Analysis of Relevant Data and Risk Assessment

Site monitoring and inspections of sediment and erosion control systems are based on associated risk to the environment. Figure 9.2-1 identifies environmentally sensitive areas (i.e., receiving environment waterways) adjacent to the Mount Polley Mine footprint that could potentially be impacted by sedimentation (). It also shows the location of contact water conveyance structures, areas undergoing progressive reclamation and soil stockpile locations, which are potential sources of sediment. Table 2 of Appendix 9-1 relates potential sediment sources to these sensitive areas and assigns a level of risk based on sensitivity of the receiving environment (receiver size, fish bearing status, etc.) and erosion potential. Note that Hazeltine Creek and adjacent areas impacted by the August 4, 2014, TSF breach are outside of the scope of this document.

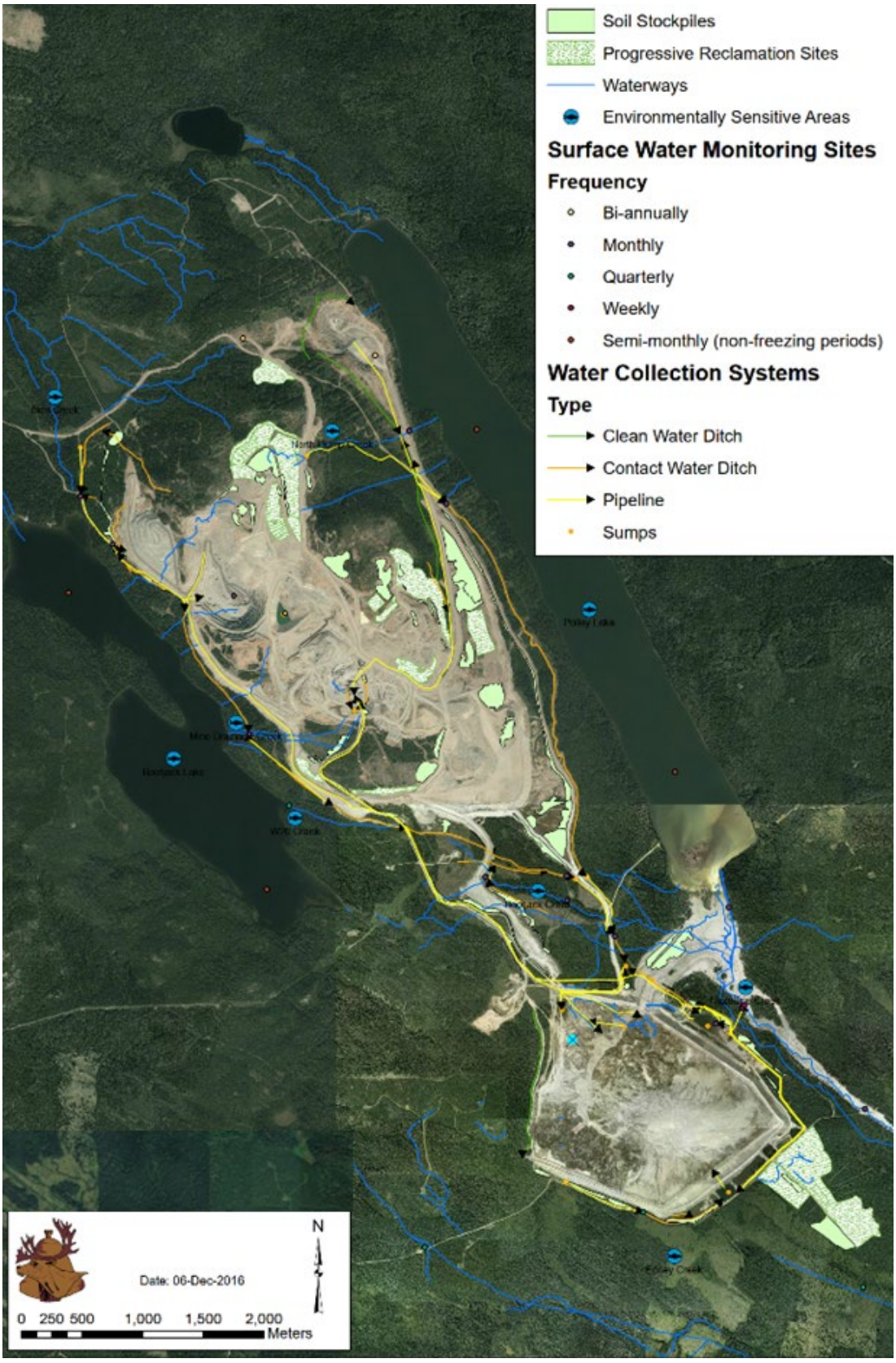

Figure 9.2-1: Surface Water Monitoring Sites

9.2.11 Erosion and Sediment Control during Mine Operation

9.2.11.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Thus, runoff from disturbed areas that potentially contains sediments is not directly released to the environment. Water from these collection systems is stored on site and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels, necessitating removal of suspended sediments through active or passive treatment prior to discharge.

To minimize the volume of contact water collected and stored at the site, upstream ditches to divert non-site contact water may be constructed. As water from these works enters the receiving environment, for construction of new diversion ditches, an environmental management plan will be developed and followed for construction and commissioning.

9.2.11.2 Emergency Release of Water

If emergency release of water from the site water collection system should occur, sediment and erosion control materials are to be installed, as required, to avoid the displacement of sediment as water moves over land. These materials are stored in the Environmental C-Can located beside the Leach Pad, and the Environmental Department staff is available to guide proper installation. The Mount Polley Emergency Response Plan and Water Management Inspection Manual outline in more detail response protocol for such events.

9.2.12 Implementation of the Plan

9.2.12.1 Closure

At closure, MPMC is responsible for leaving the mine site in compliant with all regulations, including site runoff water quality and revegetation to meet end land use and land capability objectives. The following steps should be implemented during reclamation works to reduce erosion:

- Grade and contour any disturbed areas to promote drainage and conform to adjacent topography.
- Apply soil in a rough manner to create microtopography.
- Apply coarse woody debris, as available, to the reclamation site if it is not already incorporated into the soil.
- Seed and/or plant disturbed areas with a suitable mixture of grass, legume and woody species to establish ground cover and provide stabilization in a timely manner.

- On disturbed areas with potential to impact natural water bodies or watercourses, maintain temporary stabilization measures, such as geotextile or mulch until a vegetative cover is established.

Detailed soil application and revegetation plans that include methods for reducing erosion are included in the site Reclamation and Closure Plan.

9.2.12.2 Soil Salvage

Under MPMC's Mines Act Permit M-200, surficial soils are required to be stripped from the areas to be disturbed in advance of construction of works including waste rock dumps, waste or ore stockpiles, and roads. Stockpiles are often required to store salvaged soils for later use in reclamation, and further erosion control considerations apply, in addition to the earthworks project considerations discussed above. Stockpile locations should have minimal exposure to wind, southwest sun, and runoff pathways. Stockpiles should be promptly seeded with a native seed mixture containing grasses and/or forbs. If stockpiles have the potential to impact natural watercourses or water bodies, temporary erosion and control measures should be installed and maintained until a vegetative cover is established. Refer to the MPMC SMP for additional details on the site protocol for soil salvage.

9.2.12.3 Post-Construction

When a project is completed, long-term sediment retention and erosion control measures should be implemented. These measures may include elements of the stabilization and treatment options as well as:

- Restricting access to areas being rehabilitated.
- Establishing a vegetative cover.
- Armouring areas receiving surface runoff.
- Slope modification to reduce erosive energy, such as flattening or benching.
- Surface ripping and roughening to promote infiltration.
- Diversion berms and drains (in particular to intercept upstream runoff).

Any interim measures should remain in place until long-term controls are established. When monitoring and inspections find long-term measures are sufficient, interim or temporary erosion and sediment control features may be reclaimed.

9.2.13 Reporting and Record Keeping

9.2.13.1 Annual Reporting

Site inspections and monitoring activities associated with surface erosion prevention and sediment control during the three phases of construction, operations, and closure will be documented and reported in accordance with the requirements of MPMC's EMA Permit 11678 and *Mines Act* Permit M-200.

9.2.13.2 Incident Reporting

Significant releases of sediment-laden water from onsite disturbed areas will be appropriately characterized concerning extent and loading and reported to Emergency Management BC and follow up reporting to provincial regulatory agencies as required by regulations and permits. The Environmental Manager will review the reports internally to identify necessary improvements in water management procedures.

9.3 Soil Management Plan

The SMP is provided in Appendix 9-2. The purpose of this Plan is to outline the procedures to characterize, salvage, store, and apply suitable growth material in accordance with regulatory requirements and to support reclamation of the Mine site to the desired land capability and end land uses. All surficial soil at the Mount Polley Mine identified through soil surveys as being appropriate for plant growth are salvaged and either used immediately in the reclamation program or stored in a suitable manner for future use. For convenience, the following subsections outline procedures for soil handling and management through the different stages of the mine life at the Mount Polley Mine. However, the reader is referred to the SMP in Appendix 9-2 for more detail.

9.3.1 Soil Characterization

Site-specific soil surveys must be completed for areas scheduled for disturbance by a qualified individual and submitted to the EMLI Chief Inspector for approval. The following survey procedure is recommended and is consistent with soil surveys previously conducted at Mount Polley Mine; however, this methodology may be modified by a qualified individual based on site conditions, existing information, and their experience.

1) Pre-stratify the area according to terrain using aerial photographs. Confirm the stratification is appropriate with a site inspection.
2) Select soil pit locations at representative sites or using a predetermined systematic grid or transect. Soil pit density may range from one pit per half hectare to one pit per two hectares, depending on site variability.

3) Expose the soil profile by machine excavation or hand-dug holes. Existing road cuts and excavations can also be cleaned for use.

4) Describe the soil and site characteristics at each soil profile location as per the BC Ministry of Environment standards and guidance in the "Field Manual for Describing Terrestrial Ecosystems" (BC MoE, 2010).

5) Sample soils at select, representative sites to provide local soil quality data. Sampling intensity may be adapted based on the level of preexisting soil quality data for the area.

6) Present and interpret the soil survey data in a report and recommend salvage depths for (1) soil appropriate for reclamation, and (2) subsoil which could be used in reclamation with soil amendments or as a subsoil.

9.3.2 Soil Salvage

9.3.2.1 Salvage Materials and Depths

Material to be salvaged is grouped into four types as described below, which should be stripped and stockpiled separately. Delineation of these materials in the field is to be supported by a qualified individual; however, some general field guidance is as follows.

1) Non-merchantable woody debris is to be salvaged prior to removing soil and stockpiled for use in reclamation (or immediately used in reclamation, if possible). Small woody debris may be stripped with soil and incorporated into soil stockpiles.

2) Soil appropriate for reclamation should be salvaged to the depth pre-determined in the site specific survey described in Section 2.1 of Appendix 9-2; however, as a general guide, soils are to be salvaged to the effective rooting depth.

3) Underlying subsoil is classified as the material between the soil horizons appropriate for reclamation and the soil parent material.

4) Organic soils from wetlands are recognizable by their black colour and "mucky" texture.

9.3.2.2 Procedure

A qualified individual representing the Environmental Department should train and oversee equipment operators to ensure salvage operations are completed to the specifications described in this Plan. Non-merchantable coarse woody debris is to be salvaged first and stockpiled (small woody debris can be mixed in with topsoil piles). Organic matter (grass, plants, chipped woody material, etc.) is to be incorporated into the topsoil piles by salvaging plant materials on the surface with the topsoil. Soil inventory and strata delineation information collected prior to salvaging will guide the stripping depths and are to be verified in the field by the Environmental Department representative overseeing salvage operations. Desired volumes of subsoil material are to be stripped in a second lift and stored in separate stockpiles from the topsoil.

9.3.3 Soil Stockpiling

When possible, it is preferable for soil to be directly applied for reclamation, allowing microbes and viable seeds to remain in the soil. If this is not possible:

1) Carefully select the storage location because once stockpiled, the soil should not be disturbed again until it is used in final reclamation. Minimize exposure to wind, southwest sun, and water/flooding. To minimize risk of sedimentation of natural water courses, stockpiles should, where possible, be located upstream of site water collection ditches.
2) Stockpile the soil in a manner that maximizes surface area and minimizes soil depth. When possible, the maximum depth should be the height of a pile dumped from a haul truck (~2.5m).
3) Promptly seed stockpiles with the custom MPMC native grasses and forbs blend or, in areas where invasive plant establishment is a concern (i.e., seed sources are present nearby), the custom MPMC aggressive seed mix. Both seed mixes are certified weed free. Revegetation will help to mitigate wind and water erosion, reduce risk of weedy species ingress, and maintain microbial activity.
4) Take a representative sample of the stockpile to assess soil quality, as per the procedure in Appendix A of Appendix 9-2.
5) Place signage on the stockpiles to avoid accidental disturbance.
6) Enter stockpile construction date, soil type, location, and soil volume into the Soil Stockpile Inventory spreadsheet and associated GIS map file. Document seeding in the Environmental Department Reclamation Field Book.
7) Add stockpile locations to site maps and plans for Mine Operations to avoid disturbance or loss of stockpiles.

9.3.4 Soil Stockpile Inspections

Inspection of soil stockpiles is to be completed annually. For each soil stockpile, the following information should be documented: date; photo number (if a photo is taken); percent vegetation coverage; percent invasive plant coverage; species present; signs of erosion and/or sedimentation; any erosion prevention works; and any additional comments or observations. Where possible, inspections should be completed in the summer months when vegetation is actively growing and easiest to identify. Results are to be reviewed and any stockpiles exhibiting erosion and/or poor vegetation coverage are to be added to MPMC's bi-annual seeding list for re-seeding in spring or fall when weather conditions are most appropriate for seeding. Alternative options for more significant erosion may be implemented, as per the MPMC Sediment and Erosion Control Plan (Section 9.2), such as berms or silt fences. Occurrences of invasive species are to be managed as per MPMC's Invasive Plant Management Plan

(Section 9.9). If a stockpile has been seeded twice, and still exhibits low vegetation cover, alternative vegetation options can be investigated, including:

- Amending the soil with compost tea or compost;
- Hydroseeding with a mulch/tackifier mixture designed for poor soil and/or steep slopes;
- Installation of horizontally placed logs to act as catch berms and retain moisture;
- Development of a seed mixture specifically designed for poor quality soils;
- Planting with primary successional shrubs. Willow and cottonwood can be planted using bioengineering techniques, such as live stakes and wattles, for additional erosion control.

9.3.5 Soil Amendment

Recommendations for amendment of soils to be used in reclamation are based on results from a site soil stockpile quality assessment conducted in September 2013, as well as results from ongoing reclamation research and progressive reclamation, provided in Appendix B of Appendix 9-2. Soil amendments may include biosolids and fertilizer, and recommendations for use are detailed in the site Reclamation and Closure Plan. If biosolids are used as a soil amendment, they can be mixed with the soil prior to application to ensure thorough mixing and to reduce compaction caused by the dual application of soil followed by biosolids.

9.3.6 Soil Application

Soil should be replaced to the depths specified for that Mine site unit in the site Reclamation and Closure Plan (Section 4.0) or research trial design. Following soil application, the site should be inspected and test pits dug to verify that the target soil depth was achieved across the site (accounting for the variability associated with site preparation).

9.3.7 Reporting

The following information will be submitted to the MEM, as well as the BC Ministry of Environment, each year in the MPMC Annual Environmental and Reclamation Report:

- An update of soil management and handling activities, including erosion and sediment control measures, and soil replacement depths on reclamation sites;
- An updated soil stockpile inventory, including stockpile volumes and locations;

MPMC also is required to submit an updated Reclamation and Closure Plan to MEM every five years (a minimum), as well as with all major permit amendment applications for changes to the mine plan. The Reclamation and Closure Plan is to include an updated material balance to verify that sufficient quantities of suitable soil are present to reclaim existing and planned disturbed areas to the recommended prescriptions (i.e., soil depths) for meeting land capability objectives.

Contingency options are to be assessed if sufficient volumes of suitable soil may not be available.

9.3.8 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Coordinator):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan.
- Be aware of high level mine planning, to ensure that soil characterization and stripping supervision are incorporated into plans.
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including soil baseline characterizations, overseeing stripping operations, annual inspections, seeding, and reporting.
- Ensure that individuals conducting soil characterization surveys, overseeing soil stripping, and inspecting soil stockpiles have appropriate training.
- Ensure that this Plan is routinely updated to reflect changes in site conditions and procedures, and that the revised plan is submitted to MEM in the Annual Environmental and Reclamation Report and/or a Reclamation and Closure Plan update.

Qualified individual overseeing salvage operations (likely an Environmental Technician/Technologist):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Coordinate with and supervise Mine Operations to ensure soil handling and management.
- procedures are followed during stripping operations.
- Maintain an up-to-date soil stockpile inventory and provide a soil management update in the Annual Environmental and Reclamation Report, as directed by the Environmental Superintendent.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances that will require soil salvaging. Work with that individual to ensure that the soil is characterized prior to stripping and a qualified individual is present to oversee salvage operations.
- Assign appropriate equipment for handling soil.
- Work with the Environmental Superintendent or designate to assign areas for soil to be stockpiled or directly placed.
- Ensure that all material suitable for reclamation is stripped prior to expansion of mine works.

Mine Operations Supervisors:

- Coordinate with the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist).
- Only allow operations to proceed when weather and soil moisture conditions are appropriate.
- Notify the General Foreman and qualified individual overseeing the salvage operation of any concerns that arise and address these concerns prior to proceeding with the work.

Mine Operations Operators:

- Follow instructions from the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist) and Mine Operations Supervisors.
- Clarify uncertainties or address any concerns that arise with the Mine Operations Supervisor and/or qualified individual overseeing the salvage operation prior to proceeding with work.

9.4 Construction Environmental Management Plan

This section is not required as part of the joint application per the information requirements table. However, as part of the normal course of events, it is available to government on request.

9.5 ML/ARD Management Plan

The Metal Leaching/Acid Rock Drainage Management Plan is provided in Appendix 9-3.
The objective of these ML/ARD management procedures is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). These management procedures summarize the various methods, procedures and considerations related to ML/ARD potential through mine life processes.

9.5.1 Background

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulphur (e.g., sulphide and elemental sulphur) are exposed to the weathering effects of oxygen and water. In iron sulphide minerals (e.g., pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid.
ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at Mount Polley Mine is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due to the potential consequences of acid generation for long term management of the site, MPMC actively manages waste rock based on its ARD potential as described in the ML/ARD Management Plan (Appendix 9-3) and as summarized below from that plan.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for metal leaching. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals, but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at Mount Polley Mine).

9.5.2 Determination of ML/ARD Potential

Waste rock on site is separated into two categories, NAG and PAG, using NPR defined as:

$$NPR = NP/AP.$$

Acid Potential (AP) (in kg CaCO3/t) is measured from:

- Total sulphur (%) x 31.25

Neutralizing Potential (in kg CaCO3/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate (SRK 2023a).

9.5.2.1 NPR Criterion

A site-specific criterion (NPR) of 1.6 was developed by SRK for Springer Deep and WX Zones (SRK 2023b). To derive the NPR*, the stable rate of sulphate release was compared to the relative rate of acid neutralization by calcium and magnesium carbonate minerals, as well as potassium and sodium to account for cation exchange. The data showed a tendency toward consumption of approximately 1.6 moles of calcium, magnesium, sodium, and potassium per mole of sulphate released.

Rock sourced from other zones is defined as PAG when NPR ≤ 2.

9.5.2.2 Blast Fractionation

SRK was retained by MPMC to refine ABA procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has led to the development of site-specific ABA procedures for these particular geological zones. An excerpt from the summary report provided by SRK (2023b) is included below.

> "Mineral partitioning during blasting can have an effect on the classification of waste rock ARD potential since fines tend to be more reactive. If carbonate minerals preferentially partition into the blast fines, the use of a bulk TIC-NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially partition to the fines."

Review of SRK's results of blast fractionation for the Springer Deep and WX Zones showed:

- No difference in levels of total sulfur in the fine and bulk fraction.
- NP (calculated from TIC) was enriched in the fine fraction compared to the bulk fraction.

SRK (2023b) derived a regression for the NP/AP relationship between the fines and the bulk fraction.

An NPR* of 0.7 in the blast hole cuttings is used to determine dig limits for PAG rock because this is equivalent to an NPR* of 1.6 in the blast fines, which is the reactive component in the rock. For all other rock types, an NPR of 2 in the blast hole cuttings will be used to determine dig limits until a relationship is confirmed.

9.5.3 Material Characterization Overview

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument, allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be ML/ARD Management Procedure Manual 5/12 submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Mill feed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

Water treatment wastes are quantified monthly and sampled quarterly, with material characterization performed to assess ML/ARD potential and contribute to a material inventory.

As a confirmatory sampling measure, the Environmental Department takes random weekly grab samples from the NAG waste dump when NAG is being dumped and/or used for construction, to verify that material is being appropriately characterized and handled.

In the event that a confirmatory sample or other activities result in the discovery of PAG material in a NAG designated area, a QP is to be informed without delay, who will dictate the response actions in coordination with site contacts. Mount Polley is permitted to blend pockets of less than 1,000 t of PAG materials with non-PAG materials at a ratio of 20:1, as described in Mines Act Permit M-200 Section D.3.(c)(i)(d). If these conditions cannot be met; it may be necessary to remove PAG material from NAG areas.

Water chemistry monitoring of seepage from rock dumps, water treatment plant wastes, and contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third-party laboratory for metals analysis as an additional source of data for site geochemical models.

9.5.3.1 In-Pit Segregation

Blast Hole Sampling:

1) After the production drill has completed and moved away from the hole, the sample may be taken.
2) Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3) Samples are to be collected in a clean plastic sample bag.
4) The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5) The sample bag is to be tied off using ribbon.
6) In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7) Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1) Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2) The sample is to be dried at 105°C.
3) The sample is then to be crushed in the Primary Crusher.
4) The sample is then to be crushed in the Fine Crusher.
5) The sample is to be split until the sample size is approximately 200 g.
    a) Reject from the sample is to be wasted.
6) The sample is then to be pulverized for 75 seconds.
7) The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.

8) If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1) The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the Laboratory Information Management System (LIMS) database.
2) The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3) The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1) Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.
2) Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is displayed in Figure 1 of the ML/ARD Management Plan in Appendix 9-3.
3) The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1) If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2) The Assay Lab will run the sample through the LECO CS230 Carbon Sulphur Analyzer.
3) Once analyzed, the machine transfers the carbon percentage (C%) and the sulphur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4) The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5) The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1) Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2) Modeling the blast
    a) The software used is MineSight.
    b) The model is based on a 5 metre (m) x 5 m x 12 m block system.
    c) The block closest to the ABA sample will closely match the sample.
    d) The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.
    e) Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
    f) Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.
3) The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor.

An example of a sample layout is displayed in Figure 2 of the ML/ARD Management Plan in Appendix 9-3.

Surveyor:

1) The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.
2) Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.
    a) Red Placard = High Grade Ore
    b) White Placard = Super High Grade Ore
    c) Green Placard = Low Grade Ore
    d) Yellow Placard = PAG
    e) Blue Placard = NAG
    f) Pink Ribbon = High Grade Mill Feed Ore
3) Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

9.5.4 Tailings Monitoring

Mill Metallurgy

1) The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    a) Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    b) The shift composite is then to be added to a monthly composite.
    c) At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for ABA total sulfur and carbon analysis.
2) The Environmental Department is to send the monthly tailings composite sample to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by inductively coupled plasma mass spectrometry following aqua regia digestion to provide data for site geochemical modelling.

9.5.5 NAG Material Monitoring

Environment Department:

1) As a confirmatory sampling measure, the Environmental Department is to take ABA grab samples from the NAG Dump and any area where NAG rock is used for construction on a weekly basis, while NAG dumping and/or NAG rock construction is occurring. Sampling will conform with MPMC-SOP-016: ABA and Soil Sampling.
2) To assure data quality, as recommended in the BC Field Sampling Manual, a minimum of one in ten samples will be a duplicate sample, as written in MPMC-SOP-016.
3) Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site are summarized in the Comprehensive Environmental Management Plan.

Ore Control:

1) As a blast fractionation confirmatory sampling measure, ten samples of blast muck will be collected each year. Blast to sample will be selected based on mining activities and by targeting a range of sulfur contents.

9.5.6 Response to Finding PAG in NAG Areas

Environmental Department

1) Upon reviewing data indicating PAG material has been found in a NAG area, without delay contact one or more QPs listed in this document, and the Pit Supervisor or designate to pass along the relevant data and sampling location.
2) Return to the location where PAG material was discovered and stake the sampling location. Note that material may have been dozed, buried or pushed down the dump face, in which case personnel are to mark as close as possible.
3) At the discretion of QPs, undertake additional ABA sampling to assess the prevalence of PAG material.

Pit Supervisor:

1) Discuss NAG/PAG separation with shovel and haul truck operators and investigate the possibility of a loading or dumping mix-up. This is not a punitive activity but meant to identify potential causes and estimate material volume.
2) At the discretion of QPs, organize the removal of PAG material from the non-PAG area.

ML/ARD Qualified Professional

1) Work with site contacts to develop an appropriate plan of action to address the situation.
2) If it is not possible to demonstrate that PAG material meets conditions outlined in M-200 Section D.3.(c)(i)(d), it may be necessary to remove recoverable PAG material.

9.5.7 In-Pit Monitoring

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate, and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC analyzed for total sulfur and total carbon at the Assay Lab to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by inductively coupled plasma mass spectrometry following aqua regia digestion as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are summarized in the Comprehensive Environmental Management Plan.

9.5.8 Management of PAG Rock

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored sub-aqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit
- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

9.6 **Mine Site Water Management Plan**

The Springer Expansion LOM Plan – Water Management Plan is provided in Appendix 9-4, and the executive summary of the plan is provided.

9.6.1 Background

In 2016, MPMC submitted a TAR to the British Columbia Ministry of Environment and Climate Change Strategy. The TAR provided details of the proposed LTWMP for the Mine, including the discharge quantity and quality for the operations, closure, and post-closure phases of mine life. It included a technical assessment of the effluent discharge during operations to identify whether or not receiving water uses would be impaired, and recommended a preferred discharge approach using an active treatment system and a pipeline discharging treated mine water at depth in Quesnel Lake.

Under Section 1.2.3 of Permit 11678, the "authorized discharge period" for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley Mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life. If market conditions remain favourable and operations occur continuously, the mine would operate beyond June 30, 2025.

The WMP addresses permit requirements for assumed future operations of the site, which at the time of writing are expected to run through March 31, 2031. The WMP also summarizes and discusses predicted water quantity, quality, and treatment during closure (April 1, 2031, through March 31, 2041) and post-closure (April 1, 2041, through March 31, 2131) phases. It should be noted that these dates are expected dates for mining operations; however, as with all mines, such schedules are subject to changes that result from commodity pricing and other factors.

9.6.2 Approach

The timeline for operations and closure has been assumed based on mine planning information available at the time of writing and is subject to change over time. The current Reclamation and Closure Plan (MPMC 2022a) describes the plan for closing the site.

This WMP describes the water management approach for the Site during both operations and closure. The regulatory framework for the Site is described in detail, including a table of concordance outlining how the WMP addresses the Joint Application information requirements. The proposed mine plan is described, including the assumed dates for operation, closure, and post-closure phases for modelling purposes.

Baseline information is summarized for the Site, including geology, climate, hydrology, and the receiving environment water quality (Quesnel Lake discharge via submerged diffuser). A major component of this WMP is a summary of the water balance and water quality models developed for the Mine, including a summary of inputs into these models and a summary of the results. These two models are described in detail in the appended reports (Appendix A and Appendix B of Appendix 9.4). The results of the water balance and quality models provides critical information to define the design basis for water treatment for the site (summarized in this WMP), during operations and during closure/post-closure. An update of treatment technology development for closure/post-closure is also provided.

The WMP also provides discussion regarding remediation of landforms on mine sites during closure and post-closure activities.

9.6.3 Final Design and Technology Development

For the purposes of the revised WMP, the “final design” of the site is defined as the water management infrastructure design in place at closure of the site. During operations, the water management infrastructure (i.e., collection ditches, pipes, sumps, pumps, etc.) will remain in its current configuration. During the remainder of operations, plans will be put in place to develop the final design for water management and treatment into closure and post-closure.

A key component of developing the final design during operations is developing alternative treatment technologies that could be considered for closure of the site. The WMP provides an update on progress on a number of possible treatment technologies included in the water treatment technology inventory.

9.7 Discharge Management Plan

The discharge management plan is a component of the CEMP, the 2021 Annual Discharge Plan is provided in Appendix 9-5. The overall water management at the mine is described in detail in the WMP submitted in 2023 (WSP 2023).

The Annual Discharge Plan includes the expected volume, timing, and quality of effluent released to Quesnel Lake, and plan the discharge in such a manner that avoids "pollution", as defined in EMA and as determined by the simple evaluation of parameter concentrations at the edge of the IDZ in Quesnel Lake. Parameter concentrations at the edge of the IDZ will be monitored using a model-based approach as part of a Trigger Response Plan (TRP) designed such that three key priorities (in order) will be met:

Protection of human safety (specifically, the safety of MPMC Environmental Department monitors)

1) Protection of the environment and compliance with environmental laws
2) Related to item 2, the TRP has been designed to reflect the importance for MPMC to be able to effectively manage its site water balance so that it does not accumulate impounded water. The management of site water while minimizing water impoundment has been identified as an important priority not only by MPMC but also by First Nations, Ministry of Energy and Mines, BC ENV and our Independent Expert Review Panel (IERP).

These key priorities helped form the premises for the TRP and subsequent actions. Two major premises have formed the basis of the development of the TRP:

1) The TRP and the actions it contains must be implementable.
2) Modelling of dilution in the Quesnel Lake IDZ can reasonably rely on the near-field dispersion model (CORMIX – Golder) and far-field hydrodynamic model (Tetra Tech EBA) developed for Quesnel Lake.

This model-based TRP approach is in keeping with input from BC ENV and will help alleviate some of the safety concerns associated with sampling in inclement weather while providing reliable estimates of water quality at the edge of the IDZ. The Mine's effluent discharge is also regulated by the Metal and Diamond Mining Effluent Regulations (MDMER) under the Federal Fisheries Act. This Plan has been developed for submission to BC ENV and

Environment and Climate Change Canada to satisfy the applicable requirements of both EMA Permit 11678 and the MDMER.

9.7.1 Trigger Response Plan

As detailed in the TAR (Golder 2016a), derivation of the effluent permit limits was based on attainment of Best Achievable Technology, attainment of the BC WQGs at the edge of the IDZ in Quesnel Lake and absence of acute lethality at the end-of-pipe. As such, compliance will be determined as follows:

- End-of-pipe (HAD-3): compliance with the effluent limits in EMA Permit 11678
- Quesnel Lake IDZ: execution of the Trigger and Response Plan

The model-based TRP approach helps to address several of the safety concerns associated with sampling in inclement weather while providing reliable but cautionary estimates of water quality at the edge of the IDZ. An updated model validation shows that modelled dilution factors previously determined for EMA Permit 11678 amendment continue to provide reasonable, though conservative predictions of water quality at the IDZ and that the overall dilution factor achieved by the effluent infrastructure is protective of Quesnel Lake (Golder 2018c). Sampling in Quesnel Lake may be impeded if safety is considered to be a concern.

9.7.2 Effluent Limits (end-of-pipe)

MPMC maintains an end-of-pipe sampling point at the outlet of the WTP referenced as HAD-3 (EMS code E304230). This sample location is monitored at a 5-sample 30-day frequency as outlined in the CEMP (Appendix 7-1; MPMC 2016a). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, and required by Section 3.8 of EMA Permit 11678. It should be noted that under Levels 1 and 2, samples collected on the weekend (Friday to Sunday) cannot be shipped to the lab until the following Monday.

9.7.2.1 Level 1 Trigger: End-of-Pipe (HAD-3) 80% Early Warning Threshold– Monitoring and Response

Level 1 monitoring and response is undertaken should any parameter listed in Section 1.2.3 of EMA Permit 11678 exceed 80% of the discharge limit in the permit (with the exception of pH). Level 1 monitoring and response is triggered when a database alert (automatically issued) indicates an exceedance of the 80% discharge limit. When this alert is received, the following response plan is initiated:

- Step 1: Collect effluent sample at HAD-3 and send for analysis.
- Step 2: Compare HAD-3 sample results to permit limits.
  - If sampling indicates levels less than 80%, proceed to Step 7.
  - If sampling indicates levels remain at or above 80%, proceed to Step 3.

- Step 3: Reduce discharge flows by 20% of the discharge at the time of the increased parameter values.
- Step 4: Review influent (E19) water quality data and compare to historic values.
- Step 5: Notify BC ENV Director of the Level 1 Alert.
- Step 6: Investigate cause and short term trends of rise in parameter values. Return to Step 1.
- Step 7: Once sampling indicates levels less than 80%, resume normal operations.
- Step 8: Document exceedance of the 80% target and investigation results in monthly report.

Sample(s) at HAD-3 will be collected as soon as reasonably possible. A "Priority" request will be made to the lab on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two (2) or three (3) business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped to the lab until the following Monday.

9.7.2.2 Level 2: End-of-Pipe (HAD-3) Permit Exceedance – Monitoring and Response

Level 2 monitoring and response is undertaken should any parameter, listed in Section 1.2.3 of EMA Permit 11678, exceed the compliance limit (the "Final" concentrations specified in Section 1.2.3 of EMA Permit 11678). The Level 2 trigger is initiated by a database alert (automatically issued), or when review of the data indicates an exceedance of a permit limit. When this alert is received, the following response plan is initiated:

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify BC ENV Director of exceedance
- Step 3: Collect samples of influent (E19) and effluent (HAD-3) and send for analysis. If weather conditions allow, collect sample at Quesnel Lake IDZ (QUL-58) and send for analysis.
  - Step 3a: If exceedance at QUL-58, proceed to Level 3 Alert. If no exceedance, take no further action.
  - Step 3b: Compare HAD-3 sample results to permit limits.
    - If sampling indicates levels less than 80%, proceed to Step 5.
    - If sampling indicates levels at or above 80%, proceed to Step 3 of the Level 1 Alert.
    - If sampling indicates levels exceeding the permit limits, proceed to Step 4.
- Step 4: Investigate influent water quality and water treatment plant operations to determine cause of exceedance.

- Step 5: Notify BC ENV Director, and communicate progress and findings of investigation throughout the process.
- Step 6: Resume normal operation
- Step 7: Submit exceedance investigation report to BC ENV Director

Sample(s) at HAD-3 will be collected as soon as reasonably possible. Sample(s) at QUL-58 will be collected as soon as reasonably possible, weather and safety permitting. A "Priority" request will be made to the lab on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two (2) or three (3) business days. Since sampling at QUL-58 may not be possible for safety reasons, resumption of the discharge during a Level 2 Alert will be dependent on the effluent (HAD-3) meeting the permit limits in Section 1.2.3 of EMA Permit 11678. Concurrently, an investigation will be implemented to determine the cause of the exceedance of the permit limit. Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in EMA Permit 11678 Section 3.11. This report will include:

a) All relevant test results related to the exceedance event(s)

b) An explanation of the most probable cause(s) of the exceedance(s), and

c) A plan to prevent similar exceedance(s)

9.7.3 Edge of Quesnel Lake Initial Dilution Zone

MPMC maintains a sampling point at the edge of the IDZ referenced as QUL-58 (EMS code E304876). This sample location is monitored four times per year, as outlined in the CEMP (Appendix 7-1; MPMC 2016a). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, which is required by Section 3.8 of EMA Permit 11678. Ongoing sampling at QUL-58 will serve as a model verification for the near-field dispersion model (CORMIX – Golder).

9.7.3.1 Level 3: Exceedance of Receiving Environment Trigger Levels – Monitoring and Response

Level 3 monitoring and response is undertaken if any parameter listed in Section 1.2.3 of EMA Permit 11678 exceeds the receiving environment trigger levels set out in the right-most column of Table 4. Monitoring and response is triggered when a sample taken at QUL-58, either as part of routine sampling or following a Level 2 Alert, indicates an exceedance of these trigger levels. When this alert is received, the following response plan is initiated:

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify BC ENV Director of exceedance

- Step 3: Determine if weather conditions allow samples to be taken on Quesnel Lake safely.
  - If yes, sample QUL-58 and QUL-2a and send for analysis.
  - If no, use HAD-3 sample and most recent QUL-2a sample to model water quality at QUL-58.
- Step 4: Compare modelled and measured (if available) QUL-58 results to receiving environment trigger levels.
  - If exceedance, proceed to Step 5.
  - If no exceedance, proceed to Step 8.
- Step 5: Continue investigation of Quesnel Lake water quality by comparing current water quality data to historic data and modelled (TAR) data and dilution modelling.
- Step 6: Use water quality data and dilution modelling to determine discharge rate based on assimilative capacity.
- Step 7: Based on data, and subject to any directions the Director may give:
  - If data does not support resuming operations, return to Step 5.
  - Resume operation. If discharge rate is less than permitted discharge rate, return to Step 3 and repeat the analysis. Otherwise, proceed to Step 10.
- Step 8: Notify BC ENV Director.
- Step 9: Resume normal operation.
- Step 10: Submit exceedance investigation report to BC ENV Director

Sample(s) at QUL-58 and at QUL-2a will be collected as soon as reasonably possible, weather permitting. A “Priority” request will be made to the lab so that turn around time to receive analytical results for the sample is reduced to two (2) or three (3) business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped to the lab until the following Monday.

A review and comparison of the re-sample data with parameter concentrations at the reference station QUL-2a (located in the West Arm of Quesnel Lake), which will serve as a reference comparison, shall be made, and the Relative Percent Difference (RPD) shall be calculated.

- If the RPD is ≤ 20%, the sampling results are considered to be analytically indistinguishable from the reference concentrations. The dilution capacity of Quesnel Lake will be assumed to be diminished and discharge will only be resumed as described below.
- If the RPD is >20%, then a review of the existing monitoring data for the effluent discharge, the edge of the IDZ, and other monitoring points outside the IDZ in the receiving environment (e.g., QUL-2a, Edney Creek, Hazeltine Creek) shall be undertaken. This review

shall include an evaluation of the estimated dilution at the edge of the IDZ. The estimated dilution shall be compared with the dilution factors predicted in the TAR.

- If the dilution is less than the minimum dilution predicted in the TAR:
  - An evaluation of the effluent and ambient conditions shall be undertaken to resolve the discrepancy. Depending on the outcome, the evaluation may include an inspection of the outfall pipes and diffuser ports to confirm that they are intact.
  - MPMC shall investigate and present the findings to the BC ENV Environmental Protection Director identifying the likely cause of the low dilution and its remedy.
  - MPMC shall provide an Interim Discharge Plan to the BC ENV Environmental Protection Director that outlines interim measures to be undertaken by MPMC to manage the water balance in accordance with EMA Permit 11678 and any requirements under Mines Act Permit M-200.
- If the dilution is greater than the minimum dilution predicted in the TAR, it is assumed that background concentrations are elevated and the dilution capacity of Quesnel Lake is diminished. Discharge will be resumed when resampling the effluent discharge (while in recirculation mode) and resampling at QUL-58 indicate that the receiving environment trigger levels can be met using the minimum dilution predicted in the TAR (i.e., the dilution capacity of Quesnel Lake is no longer predicted to be diminished). The flow rate of the effluent discharge can be managed accordingly depending on the sampling results.

When monitoring and analysis has determined the WTP is effectively treating water to meet the end-of pipe permit limit, and the dilution model indicates that the IDZ does not exceed the Edge of the IDZ trigger levels in Table 4, the Director will be notified and the WTP effluent will be redirected to the discharge pipeline.

Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in EMA Permit 11678 Section 3.11. This report will include:

- All relevant test results related to the exceedance event(s)
- An explanation of the most probable cause(s) of the exceedance(s), and
- A plan to prevent similar exceedance(s)

9.7.4 Reporting

Reporting procedures to the Ministry of Environment, Environment Canada, and Local Communities are outlined in the Discharge Plan (Appendix 9-5).

9.8 Vegetation Management Plan

This section is not required as part of the joint application per the information requirements table. However, the Vegetation Management Plan, like all environmental management plans is available to government on request.

9.9 Invasive Plant Management Plan

The Invasive Plant Management Plan is summarized below and provided in Appendix 9-6 and summarized here.

9.9.1 Identification of Potential Sources of Invasive Plant Ingress

Mining activities can facilitate the introduction or spread of invasive plants by removing native vegetation, which decreases competition for weedy plants, and creating exposed soil in disturbed areas. Exposed areas create a soil bed which may allow invasive plants to establish. These areas include:

- Soil stockpiles and areas from which the soil was salvaged
- Soil applied to reclamation areas
- Road and powerline construction and maintenance activities
- Exposed areas around the Mill site, maintenance areas and other associated infrastructure

Table 9.9-1 provides an overview of potential sources of invasive plant ingress to the site. Each potential source is classified into if control is possible or not. If control is not possible, for example the movement of wildlife or wind transport of seed, only prevention methods (and, if necessary, mitigation measures) are applicable to management.

Table 9.9-1: Potential Sources of Invasive Plant Ingress and/or Spread at the Mount Polley Mine Site

Category	Source	Control Method Possible
Animals	Livestock	x
	Wildlife	x
Natural spread	Wind (long-distance)	x
	Rhizome spread or seed drop (short-distance)	✓ (within Mine site only)
Human-mediated spread	People – on-site (e.g., employees, and contractors)	✓
	People – off-site (e.g., tourists and recreationists; spread to areas immediately adjacent to site)	x
	Vehicles and equipment – on-site	✓
	Vehicles and equipment – off-site (spread to areas immediately adjacent to site)	x
Reclamation Activities	Application of soil from contaminated soil stockpiles	✓
	Use of contaminated seed or soil amendments	✓
	Use of contaminated soil amendments	✓

9.9.2 Best Management Practices

9.9.2.1 Prevention Measures

The primary goal involved in managing invasive plant infestations in the project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants and supports the ability to establish desired species during site reclamation activities.

MPMC is to implement the following best management practices for preventing invasive plant establishment on disturbed areas at the Mine, which are to minimize disturbance during all phases of the mining operation in order to limit the availability of exposed, un-vegetated ground to invasive plant seed deposition; and establish a vegetative cover as soon as possible after ground disturbance. Specifics for establishing ground cover vegetation are as follows:

- Seed ground disturbed due to construction or mining activity with a rapidly establishing seed mix for erosion protection and invasive plant control if reclamation of the area is not imminent. Active areas (e.g., open pits or areas without appropriate substrates for vegetation growth) at the Mine do not require invasive plant control as vegetation does not have a chance to become established;
- Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of mill site areas, storage and equipment yards; and generally any disturbed ground where invasive plant establishment is possible;

- Use only high-quality grade seed in the reclamation and interim invasive plant control seed mixtures. Low quality grade seed may contain a higher portion of weed seed in the seed lot. At minimum, ensure that the seed used for revegetation is of the grade Common #1 Forage Mixture or Canada No. 1 Ground Cover Mixture.
- Assess soil amendments that may contain invasive plant seeds or propagules. This is currently only applicable to biosolids, and MPMC's supplier (Metro Vancouver) tests the material to verify that invasive plant seeds are not present.

MPMC typically conducts a seeding program annually in the spring and/or fall, and any disturbed areas (as described above) or areas that were previously seeded but lack appropriate native vegetative cover, should be added to the list of areas to be seeded.

9.9.2.2 Control Measures

If monitoring results (Section 5 of Appendix 9-6) show areas of invasive species infestation that are not consistent with the objectives of this Plan (Section 2 of Appendix 9-6), available control or mitigation options for managing established invasive plants include mechanical, biological, and chemical methods. Mechanical methods include:

- Hand weeding or pulling (if plants are hand-pulled, propagules are to be removed from the site and disposed of in a way that does not allow the spread of seeds. i.e., burned, not composted);
- Mowing or cutting; and
- Burning

Biological control agents are natural organisms that are another option for reducing invasive species populations. Typically, they are insects, nematodes, fungi or viruses that infect or invade the invasive plants and weaken the target species by decreasing seed production and reducing density. Biological control is only an option for select invasive species.

Chemical control through application of herbicides will be the method of last resort because applications are limited by proximity to watercourses and can potentially have detrimental effects on native vegetation.

In addition to these mitigation methods, contingency control programs that could be reviewed for feasibility and implemented are:

- Inspection and/or cleaning of vehicles or equipment coming from offsite or moving from an infested area to an uninfested area within the site;
- Refraining from driving through areas infested with invasive plants;
- Limiting road maintenance to the road surface to retain vegetation along the roadsides;

- Keeping equipment yards and vehicle storage facilities free of invasive plants; and
- Training personnel on preventing invasive plant spread by checking and removing seeds from clothing and equipment.

It is important to note that majority of the invasive plants observed at the Mine are designated in the Cariboo Chilcotin Coast Invasive Plant Committee Regional Strategic Plans as "established" or are designated as non-native species (not invasive species), and management options are not implemented regionally because control of these species is not currently feasible. As such, MPMC does not actively manage these species, unless they are directly impeding reclamation efforts. These aforementioned control measures are listed as options for future use, as required, and are currently not a routine component of MPMC's invasive plant management activities, as the Plan objectives are being met without their use.

Mitigation measures will focus on the "new invaders" and "containment" categories, as well as any "established" species if they are directly impeding reclamation efforts. Consistent with the Regional Strategic Plan, the treatment goal for "new invaders" is eradication (elimination of all individuals and their propagules), while the treatment objective for species listed for "containment" is prevention of invasive plants from spreading to uninfested areas. For species that are impeding reclamation revegetation, but are regionally listed under "containment" or "established" categories, the primary option will be suppression (reduction in plant population size and abundance). These control measures generally follow the following process, based on the level of infestation:

1) Prevent new infestations from becoming established;
2) Eradicate small or isolated "satellite" infestations;
3) Contain the perimeter of large "core" infestations; and
4) Suppress the interior of large "core" infestations.

If control measures area applied in the future, any sites that have treatments applied will be monitored through the established methods (described in Section 5 of Appendix 9-6) in subsequent years to assess if treatment measures have been successful.

9.9.3 Monitoring Program

The MPMC invasive plant monitoring program includes visual surveys conducted in combination with routine assessments of progressive reclamation sites and annual soil stockpiles inspections; invasive plant species present and their percent cover are documented and compiled with revegetation results.

In addition, more formal invasive plant inventories are to be conducted routinely at the Mine site. These inventories should encompass disturbed areas, including any that are undergoing reclamation, as well as adjacent undisturbed areas from which invasive plants could ingress. Inventories may be conducted by MPMC Environmental Department staff with sufficient expertise or an external consultant. Each inventory should include the following items, with the results presented in a report:

- Surveying and mapping of infestation locations, with a focus on reclamation areas and soil stockpiles;
- Identification of invasive plant species present;
- Assessment of the degree of invasive plant growth, distribution, and density present at infestation sites;
- Assessment of success of any prevention and control measures that were previously implemented;
- Recommendations for any prevention and control measures that should be implemented; and
- Recommendations for when the next inventory should be conducted.

Where possible, all assessments and inventories should take place in the late spring/early summer so that eradication measures can be undertaken prior to seed dispersal in late summer/early fall. Alternatively, assessments and inventories can be conducted in mid to late summer, when plants are readily identifiable, with interpretation of results to take place over winter and management applications to be implemented early the following growing season.

9.9.4 Program Review and Continuous Improvement

Each year, the results of invasive species monitoring should be reviewed with respect to the objectives outlined in Section 2 of Appendix 9-6, and the Plan and associated site invasive plant management activities should be updated accordingly. Specific items that should be reviewed and associated actions are listed in Table 9.9-2. When the Plan is updated, it is to be submitted to the Ministry of Energy and Mine with the Annual Environmental and Reclamation Report. In addition, an update on invasive plant monitoring, prevention and control activities at the Mine (including any pertinent results from progressive reclamation and soil stockpile inspections, and site invasive plant inventory reports) is to be included in the Annual Environmental and Reclamation Report each year.

Table 9.9-2: Invasive Plant Management Program Review Process

Item to Review	Associated Actions
Verify that all seed mixes used were certified weed-free (i.e., comply with Canadian Food Inspection Agency standards).	If seed utilized is not certified weed-free (or invasive plants were suspected to be present in the seed mixtures used): ▪ Change seed suppliers and/or seed mixtures.
Verify that all soil amendments (where appropriate) were tested to confirm they did not contain invasive plant propagules or seeds.	If soil amendments were not tested: ▪ Conduct post-application assessments for any soil amendments not tested; ▪ Discontinue use of any soil amendments not tested until appropriate testing has been completed; and ▪ Plan appropriately to test all amendments prior to use in the future.
Verify that no invasive plants identified in monitoring are on provincial noxious weed lists.	If any noxious weeds are identified: ▪ Implement appropriate control measures, with the objective of eradication; and ▪ Ensure that measures taken are monitored as per the program in Section 5 of Appendix 9-6.
Verify that all invasive plants identified in monitoring are being managed according to the most recent Cariboo Chilcotin Coast Invasive Plant Committee Annual Strategic Plan.	If invasive plant management is inconsistent with the Regional Strategic Plan: ▪ Implement prevention and/or control actions until management actions are consistent with the Regional Strategic Plan; and ▪ Ensure that measures taken are monitored as per the program in Section 5 of Appendix 9-6.
Verify that results from reclamation revegetation assessments are consistent with closure objectives (with respect to species composition and/or functional groups). If results are not consistent, verify that invasive plants are not a constraining factor. The prioritization matrix in Figure 1 of the Invasive Plant Management Plan in Appendix 9-6, can be used to aid in separating innocuous from disruptive species in reclamation areas and prioritize management actions accordingly.	If invasive plants are identified as a constraint to meeting revegetation objectives: ▪ Delineate the specific species and areas of concern; ▪ Implement prevention and/or control actions (Section 4 of Appendix 9-6) appropriate for the level of infestation, the life history of the identified invasive plants, and available control options; and ▪ Ensure that measures taken and target native reclamation species are monitored in the identified reclamation areas as per the program in Section 5 of Appendix 9-6.

9.9.5 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or Designate (e.g., Environmental Supervisor):

- Be knowledgeable of, adhere to, and coordinate implementation of all aspects of this Plan;
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan;
- Ensure this Plan and monitoring data are reviewed annually and updated accordingly, with updates submitted in the Annual Environmental and Reclamation Report and appropriate management actions implemented;
- Be aware of high level mine planning to ensure that seeding of disturbed areas can be done in a timely manner and transport of soil is appropriately managed;
- Review updates to the MPMC Mines Act Permit 11678, BC Mines Act, Cariboo Chilcotin Coast Invasive Plant Committee Regional Strategic Plan and provincial noxious weed lists and regulations;
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including monitoring programs and reporting;
- Plan and budget for necessary invasive plant control measures;
- Obtain and permits or authorizations required for control measures that are implemented; and
- Ensure that individuals conducting monitoring, data interpretation, reporting, and planning and implantation of prevention and control measures have appropriate training.

Qualified Individual Conducting Monitoring and Reporting (e.g., Environmental Technician, contractor):

- Be knowledgeable of and adhere to all aspects of this Plan;
- Conduct assigned activities, such that all requirements of this Plan (at minimum) are met; and
- Have appropriate training and expertise for assigned components of this Plan.

Staff or Contractors Conducting Control Measures

- Have appropriate training and expertise for prevention and control actions they are implementing.

Mine Planning Engineer and General Foreman

- Notify the Environmental Superintendent or designate of planned disturbances and any transport of soil materials;
- Where possible, minimize the disturbance of vegetated areas; and
- Transmit relevant information related to the aforementioned points to the Mine Operations Supervisors.

Mine Operations Supervisors:

- Supervise operators such that new disturbances and soil handling are conducted as planned.

9.10 Wildlife Management Plan

The Wildlife Management Plan is provided in Appendix 9-7 and is outlined here.

9.10.1 Permit Requirements

The Wildlife Management Plan is a component of the CEMP (Appendix 4-1A) which is a requirement of Permit 11678 issued under the provision of the EMA by the BC Ministry of Environment and Climate Change Strategy. The implementation of wildlife monitoring programs that track the progress of wildlife and wildlife habitat impacted by mine-related activities is one of the objectives of the CEMP and is addressed in Section 6.17 of the CEMP in Appendix 7-1.

The Wildlife Management Plan also addresses conditions outlined in the M-200 Permit issued under the provision of the *Mines Act* (RSBC 1996, c. 293) by the BC EMLI, formerly known as the Ministry of Energy, Mines and Petroleum Resources (MEMPR, 2020). Conditions under the M-200 Permit include restrictions and requirements that protect wildlife and personnel and ensure wildlife habitat is incorporated into long-term land use goals during reclamation and closure planning.

9.10.2 Timing Windows

Reduced Risk Timing Windows for fish and wildlife are intended to provide specific timing windows to target during operational planning to lower the potential for adverse effects to fish and wildlife. Reduced risk timing windows vary based on geography, and regional differences in fish and wildlife species. Reduced risk timing windows typically coincide with the breeding period for a given species, although they may also encompass other life history activities, such as juvenile dispersal and migration events. These timing windows do not guarantee that there will be zero risk to fish and wildlife during these periods, and do not authorize activities or participating in activities that may contravene applicable legislation (e.g., provincial *Wildlife Act*, federal *Migratory Birds Convention Act*).

9.10.2.1 Fisheries Timing Window

To reduce the risk of contravening the *Water Sustainability Act*, all work activities that occur instream should utilize the appropriate fisheries timing window for the region. Fisheries timing windows (also referred to as in-stream work windows) apply to all fish-bearing streams and watercourses that have direct connectivity to fish-bearing waters downstream. Within the Central Cariboo District, tributary streams located at elevations of less than 1,325 m to the Quesnel River have a reduced risk timing window of July 22– August 15 to account for the presence of both spring and fall spawning fish species occupying the system (Province of BC, 2004). However, this timing window does not necessarily protect anadromous salmonids in freshwater systems; therefore, the regional Department of Fisheries and Oceans should be consulted prior to working in any streams where salmon may be present to determine whether adjustments to the reduced risk timing window are required.

If instream works must occur outside of the reduced risk fisheries timing window, a Change Approval may be required under the *Water Sustainability Act* through the Ministry of Water, Land and Resource Stewardship (WLRS) or a *Fisheries Act* Authorization may be required through Department of Fisheries and Oceans. In addition, the implementation of risk-management strategies under the direction of a qualified environmental professional (QEP) may be a condition of authorization.

9.10.2.2 Bird Nesting Window

To reduce the potential risk of contravening the BC *Wildlife Act* and the federal *Migratory Birds Convention Act*, any activity that may impact breeding birds, including their eggs and nests, should be conducted outside of the peak breeding period for birds in the region; for example, vegetation clearing or removal of buildings that birds are actively nesting on. The least-risk period for nesting birds in the region is from August 12 – April 14, which is the period when less than 5% of the majority of actively breeding birds in forest and wetland habitat are expected to be present within the region (ECCCS, 2018). In addition, any nest belonging to an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl is protected year-round regardless of whether the nest is active (*Wildlife Act*, RSBC 1996, c. 488., s. 34). Should an inactive nest belonging to one of these species require removal, authorization through WLRS would be required. In addition, updates to the Migratory Birds Regulations under the *Migratory Birds Convention Act* in 2022 have afforded year-round protection to 18 species, including pileated woodpecker (*Dryocopus pileatus*). Prior to removing a tree that has a pileated woodpecker nest cavity, a 36-month waiting period is required, and permitting may be required.

If the peak nesting period cannot be avoided, additional risk-management strategies may be required under the direction of a QEP (see Section 9.10.3.1).

9.10.2.3 Amphibian and Reptile Window

An amphibian and reptile timing window has not been formally developed for the Cariboo Region. However, to avoid contravention of the BC *Wildlife Act*, operational activities should avoid areas where amphibian and reptile species have been confirmed hibernating, breeding or migrating. Amphibian species native to the Cariboo region require different habitat types (both aquatic and terrestrial) at different times of the year. Adult aquatic breeding obligate amphibians breed and lay eggs in freshwater, where they hatch into aquatic larvae, that grow and metamorphose into semiterrestrial juveniles. Highest risk periods for amphibians are typically related to movement of individuals between different habitat types, including migration of adults between aquatic breeding habitat and upland foraging or overwinter sites, or dispersal of juvenile amphibians from aquatic breeding sites to nearby terrestrial habitats. Although reptiles in the region, such as the painted turtle (Chrysemys picta *pop. 2*), common garter snake (*Thamnophis sirtalis*), and terrestrial garter snake (*Thamnophis elegans*), do not breed aquatically, their life history is also characterized by seasonal movements between different habitats. Due to both groups' heavy reliance on, and association with, freshwater habitats, any work in and around wetlands, streams, or small water bodies (including water-filled ditches), may also pose a risk of harm to individuals or damage to habitat. The highest risk period for amphibians and reptiles occurs between April 1 and September 30, when individuals of these species are expected to be active on the landscape (i.e., not hibernating) (BC MoE, 2017). Therefore, the reduced risk timing window for amphibians and reptiles is estimated to be October 1 – March 31 for the Cariboo Region.

If amphibians or reptiles have the potential to be impacted by an activity, such as a clearing and grubbing, the completion of a pre-disturbance survey under the direction of a QEP may be required to determine if amphibians, reptiles, or their habitats, are present, and/or at risk. If amphibians or reptiles cannot be avoided, a salvage that has been authorized by WLRS through a General Wildlife Permit may be required so that amphibians or reptiles can be safely translocated from the site to nearby suitable habitat.

9.10.3 Wildlife Encounters

To avoid contravention of the relevant wildlife legislation, wildlife-specific strategies may be required during human-wildlife encounters at the Mine Site, or within the surrounding areas. In most circumstances, allowing the animal to leave the area and reporting the incident to the Operations Supervisor or Accountable Facility Representative, will be the best course of action. In certain situations, further mitigation may be required based on the time of year, status of the species, and nature of the anticipated work activity. Individuals should consult with the Operations Supervisor or Accountable Facility Representative if they have any questions regarding protocols for a particular situation that involves a wildlife encounter. Additional in-house training may be required to ensure personnel have the skills to safely handle human-wildlife conflicts, such as bear encounters, and identify sensitive wildlife features.

9.10.3.1 Birds

The majority of birds in BC are collectively protected under the BC *Wildlife Act*, Canada *Migratory Birds Convention Act*, and/or Canada's SARA, which generally acknowledge that birds are most vulnerable during the breeding period when adults are caring for nests, eggs, and young. The following mitigation measures will be implemented if actively breeding birds are encountered at the Facility or in the Surrounding Areas:

- The destruction or disruption of migratory birds, nests, and eggs, is prohibited, including during travel to and from work sites. If destruction or disruption occurs in the form of incidental harm (i.e., unintentional), the incident will be immediately reported to the Operations Supervisor or Accountable Facility Representative.
- To reduce the risk of encountering and disturbing breeding birds, any activity (e.g., vegetation clearing) that has the potential to disturb and harm birds, nests, eggs, or young, should be completed outside of the peak avian breeding period for the region (see Section 9.10.2.2).
- Report any active bird nests, or repeat observations of breeding pairs, to the Operations Supervisor or Accountable Facility Representative. Birds that are observed at the same location on consecutive days, hover in close proximity to humans, or display agitated behaviour such as persistent alarm-calling or dive-bombing (i.e., swooping down close, before veering away) are evidence that a breeding pair and nest may be present.
- If an active nest or established breeding pair continue to occupy an area of the Facility where the presence of personnel is only periodic and work activity is not constantly occurring (e.g., water sampling), the Accountable Facility Representative may recommend the installation of a buffer around the nest site to signal to other crew members to avoid the area to reduce disturbance. Only the periphery of the buffer should be marked and never the nest or nest tree, itself. Common buffer sizes used according to different avian groups, include (MFLNRO, 2013; MFLNRO, 2014):
  - Songbirds – 30 m radius,
  - Waterfowl – 100 m radius,
  - Swallow colonies – 50 m radius, and
  - Raptors: 100 – 500 m radius (species dependent)
- If an active nest or established breeding pair continue to occupy an area of the Facility where personnel will be regularly present for mine activities that occur for an extended period of time (e.g., geotechnical drilling), or the species is determined to be a designated SAR from Table 1 in Appendix 9-7, the Accountable Facility Representative may consult with a QEP to determine the most suitable mitigation measures appropriate for the species, habitat, and magnitude of the anticipated disturbance.

- Report the presence of any stick nests or cavity nests (e.g., pileated woodpecker) to the Operations Supervisor or Accountable Facility Representative since some stick nests and nesting cavities are protected year-round regardless of occupancy. Should removal of a wildlife tree containing a pileated woodpecker nesting cavity be required to be removed, ECCC must be notified, and monitored for 36 months to ensure the nest is abandoned (Government of Canada, 2023a). Prior to vegetation clearing, a thorough assessment for pileated woodpecker cavities of trees to be felled should be completed.
- Any birds nesting on anthropogenic structures (e.g., barn swallows and cliff swallows) must be allowed to finish nesting once nesting has commenced. If a building with intact barn swallow nests has been scheduled for demolition or removal outside the peak breeding period, consultation with WLRS will be required since barn swallows (and their nests) are protected under Schedule 1 of SARA.

9.10.3.2 Mammals

Small and large mammals are regularly documented at the Facility, including black bears, coyotes, lynx, moose, and mule deer. Signs of caribou presence (scat and tracks) were noted within the proposed SERDS expansion area during the field reconnaissance on August 8 and 9, 2023. Additional mitigation measures are recommended as the southern mountain population of caribou is considered Endangered by COSEWIC, Threatened under Schedule 1 of SARA and is provincially red-listed and ranked S1 (critically imperilled). Harvesting of timber, for example in southern mountain caribou critical habitat is not compatible with the province of BC's commitment to incrementally increasing southern mountain caribou habitat over the course of five years (Government of Canada, 2023b); however, there are currently no federal prohibitions that legally prevent such activities on provincial Crown land. The following general mitigation measures are proposed to avoid and minimize project-related effects to southern mountain caribou and associated critical habitat:

- As per the Joint Application Information Requirements for *Mines Act* and EMA Permits, Section 9.10, specific management plans may be required to address individual wildlife species, particularly those designated as SAR. As such, a Caribou Mitigation and Monitoring Plan may be required for the Expansion Areas. Mitigation measures should conform to the mitigation hierarchy guidance outlined in the provincial Procedures for Mitigating Impacts on Environmental Values (BC MoE, 2014) which is, in order of priority: avoid, minimize, restore on-site, and offset or compensate (off-site or on-site).
- Although the SERDS and TSF expansion footprints do not overlap with the mineral lick located approximately 315 m south of the existing south embankment, it is recommended that a conservative disturbance buffer be established. A 100 m buffer of intact forest should be maintained around significant licks (MECCS 2018). This buffer should include at least two primary trails leading to the lick and connect adjacent forest to provide a windfirm travel corridor. In addition, construction activities should be avoided within 100 m of a significant

lick during the sensitive period (April 1 to October 1). A field reconnaissance and monitoring of the mineral lick to determine ungulate use (e.g., through the installation of wildlife cameras) is recommended prior to the TSF final raise to 987 m.

- Review the federal Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada (Government of Canada 2014).
- All project personnel should receive site orientation and training which will address specific education on mountain caribou and identify specific procedures for managing effects to caribou, including no harassment of caribou, immediate reporting of encounters with caribou, and vehicle operations and methods that can minimize caribou vehicle collisions.

Although the presence of some mammal species on the mine is to be expected due to the remote location of the Facility, the objective is to minimize interactions and, thereby, risks to personnel and animals. The following measures should be implemented if mammals are encountered at the Facility or in the Surrounding Areas:

- Reduce driving speeds to avoid a potential collision with mammal species, especially during hours at dawn and dusk when wildlife activity is heightened, and along known wildlife migration corridors; refer to Section 9.10.4.2 for further guidelines to prevent wildlife-vehicle collisions.
- Avoid approaching or feeding wildlife. Food and waste should be securely stored in buildings, approved waste receptacles, or vehicles at all times; Refer to Section 9.10.4.3 for further guidelines on how to manage for wildlife attractants.
- If wildlife is a designated SAR (e.g., caribou), as listed in Table 1 in Section 4.0 of Appendix 9-7, disturbance should be reduced to a minimum until the animal has left the area. If driving, temporarily stop the vehicle or pull over if it is safe to do so. If the animal has occupied a work area where mine activities are occurring, temporarily suspend works until the animal has moved out of the work area. All sightings of SAR at the Facility should be reported to the Operations Supervisor or Accountable Facility Representative as soon as possible. If repeated observations of a SAR occur at a specific location at the Facility, or in the Surrounding Areas, consultation with a QEP may be required to determine the appropriate course of action for that species.
- If a suspected residence (e.g., den or borrow) of a mammal species is encountered, a GPS coordinate will be collected (if possible) and the location will be immediately reported to the Operations Supervisor or Accountable Facility Representative. If there is evidence the suspected residence of a large mammal species is active due to the presence of recent scat, hair, and/or tracks, the crew will immediately leave the area of the residence until further instructions can be provided by the Accountable Facility Representative.

- If a kill site (e.g., carcass locations that will attract wildlife) or mineral lick (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) is discovered, immediately report the location to the Operations Supervisor or Accountable Facility Representative.
- If conflict wildlife, such as habituated bears or cougars, are observed at the Facility or in the Surrounding Areas, the observation should be reported to the Operations Supervisor or Accountable Facility Representative so that the regional Conservation Officer Service can be notified. Personnel should never attempt to engage with conflict wildlife.
- Mine personnel and visitors whose job responsibilities may place them in a situation where a bear encounter is possible must have bear safety awareness training and be trained on how to safely carry and deploy bear deterrents, such as bear spray.

9.10.3.3 Amphibians and Reptiles

Amphibians and reptiles rely on aquatic and terrestrial habitat to carry out their necessary biological functions. However, western toad and painted turtles are particularly vulnerable to road mortality due to the distance the two species will travel between breeding and overwintering grounds in the spring and fall (PWTWG, 2014; BC MoE, 2017); both are a designated SAR in Table 1 in Section 4.0 of Appendix 9-7. Two western toad were observed during the field reconnaissance conducted on August 8 and 9, 2023; therefore, the species is confirmed to be present within the Expansion Areas. Large congregations of western toad adults or juveniles crossing roadways can be a common phenomenon where roads bisect crucial aquatic (breeding) habitat and suitable upland (overwintering) habitat (PWTWG, 2014). In contrast, painted turtle rely on suitable aquatic habitat for overwintering and move to terrestrial habitats in the spring to breed (BC MoE, 2017). Painted turtles exist in significantly lower numbers in the Cariboo Region compared to other amphibian and reptile species and should be reported if observed (BC MoE, 2017). The common and terrestrial garter snake have the potential to occur at the Facility and in the Surrounding Areas, and both species den communally in hibernacula.

Aquatic habitat, particularly riparian and wetland habitat, are present in the Surrounding Areas around the Facility and, therefore, personnel should be aware that amphibians and reptiles have the potential to be present on commute roads. The following measures will be implemented to reduce the risk to amphibians and reptiles:

- The federal Management Plan for the western toad (*Anaxyrus boreas*) in Canada will be reviewed and applicable management measures will be implemented.
- Mine activities will consider the reduced-risk window for amphibians and reptiles during project planning, as outlined in Section 9.10.2.3. Activities that occur outside the reduced-risk window should determine the level of risk to amphibians and reptiles at the project location prior to commencing.

- If mine activities are occurring outside the reduced-risk window in an area that has been determined to be high-risk for the presence of amphibians and reptiles, the Accountable Facility Representative may request that additional mitigation is implemented at the site, such as temporary installation of exclusion fencing to keep amphibians and reptiles out of the area of disturbance.
- If amphibians and reptiles are occurring inside the boundaries of the work site, an amphibian and reptile salvage may be required by a QEP under the authorization of a Wildlife Permit through WLRS. Handling of amphibians and reptiles by unauthorized personnel is prohibited due to the potential to transfer disease between individuals and incidentally cause harm.
- Observations of large aggregations of amphibians, including migrations across roadways, will be immediately reported to the Operations Supervisor or Accountable Facility Representative so that further mitigation can be implemented, as necessary. Mitigation may include ensuring all personnel are aware to avoid that location, posting signage, installing temporary exclusion fencing, or having a QEP conduct an authorized salvage. The same procedures apply for a single observation of a painted turtle, which occur in lower numbers. Aggregations of snakes may indicate the presence of a hibernacula, which should also be similarly reported.
- Mine activities must not disturb any wetlands, streams or water features, including small, ephemeral (temporary) pools and water-filled ditches, as such habitats can provide important breeding, foraging, and hydration sites for amphibians.
- Any activities near aquatic habitats should avoid impact to shallow water areas and associated riparian vegetation; these areas serve as breeding habitat and cover for many amphibians.

9.10.4 General Best Management Practices

9.10.4.1 General Restrictions

To ensure compliance with Section D-12 of the M-200 permit, the following provisions and restrictions apply:

- No hunting or shooting shall occur within any area encompassed by the mine permit,
- No fishing or hunting shall occur while on company business, or while commuting to and from the mine for all MPMC personnel and contractors,
- Any exclusion fencing (e.g., electric fencing) that is installed shall be regularly maintained to ensure it is effectively functioning at all times while staff are present on site.

To provide compliance with relevant wildlife regulations, the following general provisions and restrictions apply:

- Feeding wildlife is prohibited and is inconsistent with the provisions of the BC *Wildlife Act*. Feeding wildlife may result in wildlife becoming attracted to human foods and habituated to human presence, which can result in the creation of 'conflict wildlife' and have serious consequences for the animal and other people.
- Cooking outside and using outdoor cooking appliances is prohibited.
- Littering is prohibited. All garbage, including organic wastes (e.g., banana peels, pear cores, etc.), should be stored in wildlife-proof temporary containers and removed and appropriately disposed of off-site (see Section 9.10.4.3).
- Harassment of wildlife is prohibited and is inconsistent with the provisions of the BC *Wildlife Act*. Harassment of wildlife can lead to the abandonment of habitat or the disruption of critical activities (e.g., nesting), and may result in injury to wildlife and/or humans.
- Potentially sensitive wildlife features, including bird nests, dens, roosts, hibernacula, kill sites (e.g., carcass locations that will attract wildlife), and mineral licks (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) will be reported to the Operations Supervisor or Accountable Facility Representative. The Accountable Facility Representative may implement measures to avoid or reduce adverse effects to known wildlife features from mine-related activities, which could include restricting the knowledge of the feature location to reduce traffic at the site and prevent vandalism.

9.10.4.2 Equipment and Vehicles

To reduce incidents of wildlife-vehicle collisions and near-misses at the Facility, the following general provisions and restrictions apply:

- The Accountable Facility Representative will be familiar with the BC Wildlife Collision Prevention Program (http://www.wildlifecollisions.ca) and will be responsible for ensuring all mine personnel and visitors are orientated on best management practices for preventing wildlife collisions.
- When travelling to and from the mine, Facility personnel and visitors are required to report incidental wildlife observations. This information will be valuable in identifying areas where potential wildlife-vehicle collisions have a higher chance of occurring.
- Road signage that informs mine personnel (and other road users) to be attentive for wildlife will be established, as necessary. Signage will be placed where potential collisions are predicted (e.g., at known wildlife crossings, blind hills, blind corners, etc.) or have already occurred. All Facility personnel and visitors must obey traffics signs.

- On public gravel or forest service roads, the maximum speed limit is 60 km/hour or per posted signage. During poor road conditions when visibility and traction are reduced, personnel are encouraged to slow down and drive safely to the conditions.
- The maximum speed limit on the mine property is 40 km/hour in ideal driving conditions.
- Wildlife has the right-of-way, except in select circumstances when it is unsafe to apply the brake or come to a complete stop. When wildlife is present on a road, slow down or stop and allow the animal(s) to depart the roadway.
- Limit access to deactivated trails, seasonally or permanently, using signage and high visibility barricades.
- Report wildlife remains observed along access roads at the Facility, and in the Surrounding Areas, to the Operations Supervisor or Accountable Facility Representative. Wildlife carcasses have the potential to lure other wildlife onto the roadway, which may result in an increased likelihood of wildlife-vehicle collisions. MPMC will relay reports of wildlife remains along highways to the regional Conservation Officer Service.
- Wildlife-vehicle collisions that cause injury or death to wildlife must be reported immediately. If an animal is killed as a result of a vehicle collision, the Accountable Facility Representative will notify the regional Conservation Officer Service so the remains can be removed from the road in a timely fashion, suitably disposed of, and documented in an Incident Report. The Royal Canadian Mounted Police must be notified if damage is greater than $1,000 or if there are human injuries. If an animal is injured as a result of a vehicle collision, the Accountable Facility Representative will contact the regional Conservation Officer Service to determine the best course of action (e.g., animal destruction).
  Some injured animals may present a safety hazard (e.g., bears, moose, deer, etc.); consequently, personnel should not approach injured animals.
- A near-miss animal-vehicle collision will be reported as an “incident” as this information will be important for determining high-risk collision areas that may require warning signage.

9.10.4.3 Waste Management

Garbage and food waste are wildlife attractants which may lure and create conflict wildlife, such as bears, foxes, and coyotes. In addition, wildlife attractants may include vegetation growing along the roadside (e.g., grasses), chemicals (e.g., gasoline), waste containers (e.g., empty fuel cannisters), and wildlife remains. Conflict wildlife can create unsafe working conditions for personnel and result in damage to facility structures and equipment.

The following waste management measures will be followed to reduce wildlife conflicts related to food waste and garbage:

- Adhere to the guidelines outlined in the General Restrictions (Section 9.10.4.1).

- Food waste, sewage, and mechanical maintenance waste (e.g., motor oil) will be handled and disposed of appropriately under the direction of the Accountable Facility Representative.
- Temporary recycling and garbage containers shall not be placed or stored outside.
- Wildlife incidents related to garbage or human food attractants will be promptly reported to the Accountable Facility Representative.
- Waste disposed of incorrectly will be reported promptly to the Accountable Facility Representative. The Accountable Facility Representative will affirm that any inappropriately disposed of waste, within and around the Facility, is correctly disposed of.
- Regular site inspections will be conducted of waste transfer areas to ensure site cleanliness, adequate bear-proofing features, and to document improper garbage storage.
- When seeding along road corridors is required at the Facility, the Accountable Facility Representative will select seed mixes that do not contain wildlife attractants (e.g., clover), as these can result in an increase in animal-vehicle collisions.

9.10.4.4 Reporting Wildlife Observations and Incidents

Observations of wildlife or wildlife incidents by mine personnel and visitors must be documented and reported to the Accountable Facility Representative. An observation is defined as physical observations of wildlife or identification of signs that wildlife may be present in the area (e.g., nests, scat, tracks, dens, etc.). An incident may include animal-vehicle collisions, strange behavior (e.g., the animal behaving aggressively or losing its fear of humans), close encounters on foot or within a vehicle, or witnessing deceased or wounded animals.

Reports of wildlife observations and incidents provide information that can help determine:

- Hazardous circumstances requiring intervention (e.g., conflict wildlife).
- Whether notification to the regional Conservation Officer Service is required (e.g., roadkill).
- If there are deficiencies in the conflict wildlife mitigation and waste management measures.
- Areas along roadways that are potential hotspots for animal-vehicle collisions and, thus, require warning signs.

9.10.4.4.1 Wildlife Observations

Observations of wildlife and wildlife habitat features (e.g., nests, dens, wildlife trees, cavities, etc.), provide important data on wildlife habitat usage and behavior patterns at the Facility and in the Surrounding Areas. Wildlife observations will be collected and documented by the Operations Supervisor who will forward the information to the Accountable Facility Representative. All observations will be reviewed to assess the potential for conflict wildlife and

to ensure current guidelines are sufficient in protecting personnel and wildlife. Wildlife observations will be included in MPMC's annual reporting.

Most wildlife and wildlife habitat observations will be discussed at health and safety meetings. However, the location of sensitive wildlife habitat features (e.g., mineral licks) may be disclosed to a restricted number of mine personnel at the discretion of the Accountable Facility Representative.

9.10.4.4.2 Wildlife Incidents

Mine personnel and visitors are required to promptly notify wildlife incidents to the Operations Supervisor or Accountable Facility Representative, who may request the completion of an Incident Report. Incident Reports regarding wildlife will be reviewed for any evidence of conflict wildlife development, to ensure current guidelines are sufficient in protecting personnel and wildlife, and for annual reporting purposes.

9.10.5 Wildlife Monitoring

In accordance with the permit requirements, monitoring programs will be developed to evaluate the effects of mining-related activities on wildlife and wildlife habitat at the Facility and in the Surrounding Areas. Wildlife monitoring will also help determine the success of remediation works completed at Polley Flats and the Hazeltine Creek Corridor, as well as the success of any future remediation that is implemented to achieve long-term reclamation and closure objectives. All monitoring programs will incorporate adaptive management to optimize procedures and outcomes as new information becomes available. The design and development of specialized projects may be done in consultation with QEPs, as required.

An Ecological Risk Assessment was conducted for Polley Flats and the Hazeltine Creek Corridor in 2017 to determine the potential impact of heavy metals on biological receptors and to determine the direction of future remediation and monitoring efforts (Golder 2016).
The assessment determined that the risk of metal uptake was low in aquatic and terrestrial systems and was less likely to cause adverse impacts to wildlife than the effects of the physical disruption to functional habitat (Golder 2016). For further details regarding wildlife monitoring requirements, refer to the CEMP (Appendix 7-1) (MPMC 2019).

9.10.5.1 Reporting

A summary of the effectiveness of the Plan will be included in the annual reclamation report.
In addition, summary reports of wildlife-related mitigation measures, incidents, and observations will be generated annually and will form the basis of adaptive management strategies to address compliance issues and conflict wildlife. These summary reports will be provided to WLRS and First Nations upon request.

9.10.5.2 Adaptive Management

The Plan will be adapted based on the results of ongoing wildlife monitoring programs, reclamation planning, incident and summary reports, and employee education programs. The adaptive management framework recognizes that new information obtained from those sources of information should be used to inform future planning, decision-making, mitigation, and program design to help MPMC maintain compliance. An annual review of the Plan to determine the potential need for revisions will also be required to ensure adaptive management strategies can be successfully identified and integrated.

9.10.6 Reclamation Requirements

MPMC has identified wildlife habitat as one of the primary land-use objectives during reclamation and closure planning, which will fulfill the requirements outlined in Section E-2 of the M-200 permit. Reclamation initiatives will utilize a variety of different strategies to achieve self-sustaining ecosystems that will create long-term habitat for wildlife, including soil amendments to improve soil conditions, revegetation of native species, enhanced landscape features that attract wildlife, and construction of habitat systems that provide ecosystem functions for many species. For further details on how wildlife habitat will be incorporated into long-term reclamation and closure planning, refer to the Reclamation and Closure Plan Update by MPMC (2017).

9.10.7 Stakeholder Consultation

In accordance with the MPMC Communication Plan as a condition of Permit 11678, environmental data will be shared with the Xatśūll First Nation, Williams Lake First Nation, Cariboo Regional District, and the Community of Likely. First Nation and community stakeholders will be provided avenues for discussing and communicating concerns regarding the Plan, including the implementation and results of the wildlife monitoring programs. For further details regarding First Nation and community stakeholder participation, refer to the Communication Plan by MPMC (2016b).

9.11 Archaeological Management and Impact Mitigation Plan

Archaeological sites are protected under the HCA, whether in an intact or disturbed context and impacts to an archaeological site can only be conducted under an HCA Section 12.4 Alteration permit. In order to acquire an Alteration permit, additional site inspection under an HCA Section 12.2 Inspection or Investigation permit may first be required.

On behalf of Mount Polley Mine, WSP is in the process of applying for an Inspection permit to both conduct AIA in the vicinity of Bootjack Creek (see Section 2.12) and to respond to any chance (incidental) finds that might be encountered. Should chance finds occur prior to issuance of the Inspection permit, an archaeologist could still be engaged to determine if the chance find

is archaeological in nature; however, they would be unable to carry out subsurface testing to aid in that determination. A stand-alone Chance Find Management Plan (CFMP) has been provided in Appendix 9-8. The CFMP outlines the process to follow should chance finds occur and will be made available to mine employees and contractors prior to construction activities occurring. The CFMP further provides relevant contact names and details and examples of archaeological materials or features that might be encountered (i.e., what to look for). As no registered (i.e., known) archaeological sites are located within the Springer Expansion area, specific impact mitigation plans have not been provided. Should archaeological sites be identified during the AIA or through the chance find process, these mitigation plans will be developed should site avoidance not be possible. Should archaeological sites need to be impacted under an Alteration permit, the CFMP will be presented by a WSP archaeologist to the construction crew, in addition to reviewing the methods under which the construction can proceed under the Alteration permit (i.e., monitoring or post-impact assessment using methods outlined in the Inspection permit).

9.12 Mine Emergency Response Plan

The Emergency Response Plan is provided in Appendix 9-9, and an overview of the plan is provided herein.

9.12.1 Scope

Being prepared for a mine site emergency is critical in order to effectively respond and control any unexpected occurrence.

The following Mine Emergency Response Plan has been designed and developed for Mount Polley mine to coordinate and effectively respond to any and all mine emergencies.

This is a requirement of the Health, Safety and Reclamation Code for Mines in British Columbia health, safety and reclamation code 3.7.1

9.12.2 Definition of an Emergency

A current or imminent situation that requires prompt coordination of actions of trained personnel to protect health, safety, or welfare of people and to limit damage to property and to the environment.

9.12.3 Goals

- To identify and ensure adequate resources are available on site and off site in order to facilitate effective emergency response.
- To introduce and train management in the roles of the “Control Group” To introduce and train workers in the relevance of the Mine Emergency Response Plan.

- To ensure and maintain a high standard of emergency response training for mine personnel.

9.12.4 Training

For the ERP Training Program to be successful, with adequate revision of this Plan, it is necessary to establish a Drill Program. The Health and Safety, Environmental and any other operational areas will take part in the drills.

All personnel assigned specific duties within this plan shall review pertinent sections of the plan.

All personnel in positions of leadership shall be trained in the Incident Command System.

Emergency Response Drill Schedule

- LEVEL 1 Once every 6 months - Area specific evacuation practice
- LEVEL 2 Once every year / Mine Site wide Involving the Mine Rescue Team
- LEVEL 3 Once every two years / Involving the Mine Rescue Team and Activating the Emergency Operation Centre

9.13 Mine Site Traffic Control Plan

The Traffic Management Plan is provided in Figure 9.13-1.

Mount Polley
Mining Corporation
an Imperial Metals company

TRAFFIC
MANAGEMENT PLAN
MOUNT POLLEY MINE
DATE: 2022/11/12

N
E

LEGEND
- Pickup Access
- 0 - 1% Grade
- 1 - 5 % Grade
- 5 - 10% Grade
- Cross Over
- Single Lane Traffic
- Public Access
- Run Away Lane
- Gates
- Spill Kits
- Yield Sign
- Stop Sign

Radio Channels / Frequencies (MHz)
1 - Tailings - 170.670
2 - Mill T/A - 170.790
3 - RR-25 - 151.310
4 - Old Bootjack - 153.635
5 - Pit Ops 1 - 167R910 & 170T430
~~6 - Pit Ops 2 - 162R075 & 167T055~~ Not Active
7 - Pit T/A - 167.910
8 - Maintenance - 166.020
9 - Supervisor - 164.425

*Designated as CH# on Map
*All vehicles to be on 5/6 when in pit
*All vehicles to be on 1 when at TSF
*Warehouse is on 8
*Surface Crew is on 2/5/6

Priority of Right of Way for vehicles on the minesite
1. All Emergency Vehicles
2. Crew Buses
3. Loaded Haul Trucks
4. Empty Haul Trucks
5. Explosive Trucks
6. Ancillary Equipment
7. Personal Vehicles

Refer to Mine Operations Procedure MO-6 for:
-Maximum Speeds
-Rules for Passing
-Rules of Priority

Date Updated: April 26, 2022

CH5
Wight Pit PAG Dump
Bootjack Road (CH3)
Boundary Dump
Polley Lake Road
Run Away Lane
North Bell Dump
Bootjack Road
Run Away Lane
9K Sump Road
Wight Pit Haul Road
Wight Pit Till Dump
Wrap Around Dump Road
Springer Pit
Cariboo Pit FLOODED
Leach Pad
Limestone Stockpile
Ore Stockpiile
Primary Crusher
Wight Pit Rock Dump
Till Stock Pile
Mine Rescue
Parking Lot
First Aid
High Grade Leach Stock Pile
Wrap Around Expansion Dump
Tailings Dam Road (Polley Lake Road)
Mine Drainage Sump
In-Pit Washrooms
CH5
Core Palace
Landfill
LSW Dump
Till Stock Pile
SERD Dump
CH5
Booster Station
CH5
Tailings Access Road TAR
CH1
Till Stock Pile
Old Orica Site
Tailings Dam Road
Tailings Dam Road
Tailings Hot Line

TSF

MILL AREA

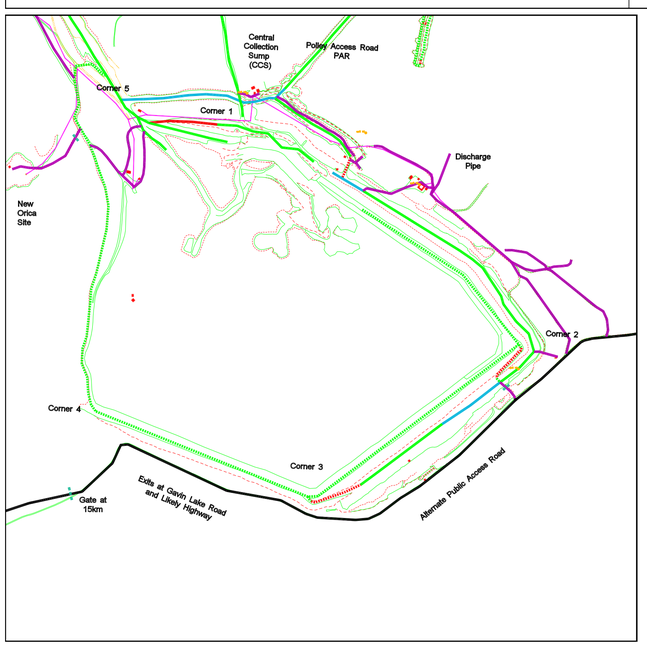

9.14 Fuel Management and Spill Control Plan

The Emergency Spill Response Contingency Plan is provided in Appendix D of the Emergency Response Plan (Appendix 9-9) and is summarized herein.

9.14.1 Potential Spill Materials:

1) Gasoline
2) Diesel Fuel
3) Waste Oil
4) Coolant
5) Hydraulic Fluid
6) Mill Tailings
7) Propane
8) Lime
9) Mill Reagent NaHS
10) Acids
11) Methyl Isobutyl Carbinol (W22)
12) Concentrate
13) Mine Influenced Water
14) Till/mud/soil/rock
15) IPAC

9.14.2 Potential Spill Types:

1) Minor spills from equipment due to leaks.
2) Minor spills from containers being damaged or knocked over.
3) Minor/Major spills from fueling stations.
4) Major spills from storage tanks outside the Mill.
5) Major spills from storage tanks inside the Mill.
6) Major spills form transportation and delivery vehicles.
7) Spills from slurry tailings line.
8) Releases of mine influenced water from water collection or transportation facilities.

9.14.3 Potential Spill Locations:

1) General Mine-site grounds.
2) Mill Building and surrounding areas.
3) Fueling station.
4) Access road to mine site.
5) Access road around mine site.
6) Open Pits.
7) Ditches and pipeline routes.
8) Water storage sumps and ponds.
9) Creeks, lakes and surface water bodies in and around the mine site, including the Hazeltine Creek effluent discharge site.

9.14.4 Spill Response Materials Locations:

1) Light vehicle fuel island (Warehouse).
2) Fuel Island (beside the Crusher).
3) Maintenance areas (Pit Shop, Finning/Shovel Crew Laydown)
4) Springer Pit (MDG)
5) Warehouse (Entrance and in yard, with spare materials in stock).
6) Lower Hazeltine
7) Reach 3 Creek Construction
8) Cold-Water Pump location (Weir)
9) 9K Sump
10) Mine Drainage Sump
11) Central Collection Sump
12) South Seepage Sump

9.14.5 Spill Assessment Potential

Transportation:

The area of greatest vulnerability for spills is transport related incidents resulting from road conditions, and mechanical failures. Contingency plans are filed by the Shipper of the transport company with Transport Canada and drivers are required to be in possession of these files in order to address these types of incidents. Ensure that Shipping Paper is carried in the cabin of the transport vehicle.

The Company:

Undertakes to provide information to the Shipper on avoidance of poor road conditions and rescheduling of deliveries, if necessary. Ensures to maintain the mine road conditions in as favourable condition as possible. Provides the manpower and equipment required to control and minimize the effects on the environment.

Fuels:

Standard procedures are in effect for the safe unloading of fuels to storage tanks and safety berms are provided to contain spills at the storage facilities. Emergency Contingency Plans for effective response to spills are addressed in this document.

Lime:

Unloading of granular quicklime from bulk tank trucks can result in spillage. These spillages, if any, will be cleaned up with a front-end loader and disposed of.

Explosives:

Transport, handling and transfer of explosives are addressed within the Emergency Contingency plan of this document. Explosive materials storage is in separate containers and conform to the Ministry of Mines and Transport Canada standards.

Tailings:

The tailings lines are protected by against vehicle collision. The pipeline is also contained in a ditch along the access road to the tailings pond.

Mine Influenced Water:

Site water collection sumps, ponds, and ditches, water transport pipes, and the Hazeltine Creek Discharge System, all have the potential to release water into the environment, possibly entering surface water bodies. Breaches may occur due extreme runoff events, physical damage to pipes or other facilities, or pump failure.

Other Consumables:

All consumables are contained within their original shipment containers prior to transfer to end user containers. End user spillage Emergency Contingency Plans are addressed in this document.

9.14.6 Response

9.14.7 Contact Group

Spills of chemicals, fuels and other substances may occur as isolated events or they may occur with other emergencies such as fire, explosion, natural causes or accident.

A number of response personnel may be involved to protect mine property and the health and safety of mine personnel and the public.

The key persons involved during a spill occurrence would be as follows:

- The person discovering the spill, and his/her Supervisor.
- The General Manager or his designate (who may be the On-Call Supervisor if the General Manger cannot be reached outside of regular hours).
- The Area Superintendent.
- The Safety Department.
- Mine Rescue trained personnel.
- The clean-up crews.

The responsibilities of key personnel are outlined in the Personnel Responsibilities section.

Applicable telephone numbers are kept current and posted at the mine-site.

9.14.8 First on Scene Personnel Responsibilities

9.14.8.1 Person Discovering the Spill:

- Assess the hazard to one's own health and safety and to others in the vicinity.
- If the risk of gas poisoning exists ensure to conduct atmospheric testing with the appropriate equipment prior to entry.
- If fire or explosion hazards are perceived immediately retreat to safe distance.

9.14.8.2 In both these situations:

- Barricade/Flag the area.
- Place physical guards at a safe distance.
- Warn others in the immediate vicinity of the situation.
- Notify the Area Supervisor IMMEDIATELY following initial response action.
- Arrange for appropriate operating equipment to be shut down, if applicable, to minimize the extent of the spill.
- If warranted, notify designated First Aid Attendant for first aid.
- Firefighting response will be trained site personnel backed up by Mine Rescue trained personnel.
- The Supervisor or the person discovering the spill with the following information must contact the General Manager or his designate IMMEDIATELY following initial response action:
  - Name of person discovering the spill.
  - The time of the spill.
  - The location of the spill.
  - The type of substance spilled.
  - The quantity of material been spilled.
  - The cause of the spill.
  - The weather conditions.
  - Perceived potential for hazard, and any injury to aquatic systems, wildlife or people.
  - Actions already taken.
  - Whether a fire or explosion hazard is deemed to exist.
  - Personnel already notified.
  - If the spill is contained.
  - Any environmental effects that have or could occur.
  - Any injuries.

9.14.9 Level of Emergency

- **Level 1-** A spill that is **below the external reportable quantity** or an emergency where the **potential health and safety risks are low** (no employees are injured). Incidents that can be cleaned up or resolved with little impact on the mine and or environment. No command post is necessary in such an incident.
- **Level 2**- A spill that is **above the external reportable quantity** or an emergency whereby the **health and safety of staff member(s) may be jeopardized**. It is a spill that requires the initiation of the emergency measures. No external help is needed in this situation, but a command post may need to be established.
- **Level 3**- A spill that is **above the external reportable quantity** or an emergency where there is **great potential health and safety risks**. There may be casualties. This type of emergency requires internal and (may require) external intervention. A command post may be set up both onsite and offsite.

	Is the spill above external report quantity?	Potential Health and Safety Risk	Emergency Operations Center	External Support
Level 1	No	Low	No	No
Level 2	Yes	Maybe	Maybe	No
Level 3	Yes	Yes	Yes	Maybe/yes

9.14.10Main Response Elements

Find and Identify

- Mitigate the Source of the Spill
- Establish Communication
- System Collect Information
- Isolate the Emergency Scene

Notify

- Site supervisors, managers, and employees (according to procedures outlined in this document).
- Regulatory bodies and agencies as required (Ministry of Environment, Environment Canada, Provincial Emergency Program), if required.
- Soda Creek Indian Band and Williams Lake Indian Band, if required.
- Notification to public and media, if required.

Ensure Public Health and Safety Protection

- Work with appropriate first responders:
  - Mine Rescue Team and site First Aid attendants
  - Ambulance
  - Fire Department
  - Police
  - Search and Rescue

Environmental Protection

- Establish spill plan
- Manage spill response equipment and resources
- Conduct spill material clean up

Terminate the Incident

- Complete an incident report

9.14.11Personnel Responsibilities

General Manager/Designate:

Deploy response crews and equipment operators to undertake the actual clean-up and supervise their work. Notifies Corporate, Emergency Management BC, First Nations groups, and Media. Maintain responsibility for the activities at the site of the spill.

Maintain contact with and co-ordinate work with the Environmental Superintendent, Terminates the Incident, conducts brief.

- Notifies Government Agencies.
- Monitors Environmental Impact.
- Establishes decontamination measures with safety coordinator.
- Update the Spill Contingency Plan as required, for all potentially hazardous materials, accurate names of personnel and phone numbers.
- Plan and co-ordinate required skills.
- Be responsible for assessing new spill hazards as they develop and take preventative actions, whether covered in the manual or not.

- Check and maintain the operating status of required response equipment, which may be required at a spill.
- Train emergency response personnel with respect to their duties, or work with the Safety Department to do so.

Superintendent of Affected Area:

- Has authority to direct response operations.
- Needs to clear incident action plan with the General Manager (or designate).
- Determines level of Incident.
- Assigns Command Post if necessary.
- Executes the incident action plan.
- Enforces worker safety and environmental protection.
- Briefs team on specific assignment.

Communications:

- Responsible for the communication and emergency assistance
- Notifies emergency response personnel by telephone or radio in the event of an emergency
  - Assigns scribe
  - Records incident details and subsequent developments as they occur.
  - Responsible for establishing communication and emergency assistance.
  - Establishes external support system (if required)
  - Assisting Safety Supervisor.
  - Maintains communication contact with the work parties via walkie-talkies, signal horns, or other means

Health and Safety:

- Advises the incident commander on all aspects of health and safety on the site.
- Recommends stopping the work if any of the work operations threaten worker or public safety.
- Ensure proper personal protective equipment is used and maintained.
- Controls entry and exit at the access control points.
- Monitors onsite hazards and conditions.

- Enforces the Buddy system.
- Control the decontamination of all equipment, personnel and samples from the contaminated areas.
- Assist In the disposal of contaminated clothing and materials.
- Advise medical personnel of potential exposures and consequences.

9.14.12Emergency Response Team Members:

- Consult the Mine Emergency Response Plan to review the site plan relative to building location of the spilled material and specific location of the material within the building/site.
- Consult the appropriate ACTION PLAN contained in this document, to review the properties of the spilled material and recommended response actions.
- If further information is required, contact one of the resource services listed in Heading 2 of this document.
- Assess the spill requirements for manpower, equipment, materials, tools and protective gear to contain the spill, in consideration of the resources available.
- Mobilize these resources and take responsibility for implementation of the response actions in the spill site.
- If the spill is too large or complex to be handled entirely by the Company's resources, call an appropriate group or agency listed on page 3 of this document.
- Contact the Area Superintendent to determine what, if any, sampling should be done and to discuss the spill and any environmental implications.
- Once the initial response action is underway, contact the General Manager or designate to review the situation and strategy.

9.15 Combustible Dust Management Plan

This section is not required as part of the joint application per the information requirements table.

9.16 Chemicals and Materials Storage, Transfer, and Handling Plan

This section is not required as part of the joint application per the information requirements table.

9.17 Waste (Refuse and Emissions) Management Plan

This section is not required as part of the joint application per the information requirements table.

9.18 References

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APPENDIX 1-1: Information Requirements Table – Springer Expansion

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
1. INTRODUCTION AND PROJECT OVERVIEW			
1.1. Application Background	Required ☒ Methods ☐	The scope of this application includes the following activities: • SERDS extension • Springer Pit expansion • Quesnel Lake Discharge [Operational] • Northwest PAG Stockpile Disposal Date • Alternative discharge concepts (Upstream Drain) (possibly; to be determined) • Reducing the NPR from 2 to 1.6 for Springer Deep and WX zones • Updating ML/ARD management procedures to account for the effects of mineral partitioning during blast fractionation for Springer Deep and WX zones. The effects assessment for this application will include: • surface water quantity – Include surface water quality in this section as well. • The methodology by which a reduction in NPR from 2 to 1.6 is developed. • Information on potential changes to material handling procedures for placing material from Springer Deep and WX zones with an NPR between 1.6 and 2 in Not Potentially Acid Generating (NAG) storage facilities. • Information on potential changes to material handling procedures to account for the effects of mineral partitioning during blast fractionation for material from Springer Deep and WX zones.	1.1 Application Background
1.2. Proponent Information	Required ☒ Methods ☐		1.2 Proponent Information
1.3. Project Overview			
1.3.1. Project History	Required ☒ Methods ☐		1.3.1 Project History
1.3.2. Overview of Products and Markets, and Projected Project Benefits	Required ☒ Methods ☐	Project benefits will be discussed	1.3.2 Overview of Products and Markets, and Projected Project Benefits
1.3.3. Location, Access, and Land Use	Required ☒ Methods ☐	A summary description of the Project location and access, including a figure, will be included in the Application. Coordinates for the location of the Project will be provided in the Application. Figures will be developed to illustrate the following: • The location of Mount Polley Mine • Mount Polley Mine layout • Project Footprint • Relevant infrastructure	1.3.3 Location, Access, and Land Use
1.3.4. Mine Components and Off-Site Infrastructure	Required ☒ Methods ☐	The components of the Project will be described in the Application. A figure will be provided for context.	1.3.4 Mine Components and Off-Site Infrastructure
1.3.5. Mine Development and Operations	Required ☒ Methods ☐	Details regarding how the Project fits into permitted mine plan will be provided in the Application.	1.3.5 Mine Development and Operations
1.3.6. Mine Design and Assessment Team	Required ☒ Methods ☐		1.3.6 Mine Design and Assessment Team
1.3.7. Spatial Data	Required ☒ Methods ☐	Relevant spatial data will be provided as maps, including maps of Project and Project component locations. Maps of environmental monitoring and sampling stations will be provided in relevant baseline and monitoring sections.	1.3.7 Spatial Data
1.3.8. Concordance with Environmental Assessment Conditions	Required ☒ Methods ☐	For context discussion of conditions and commitments in the existing EAC will be included in the Application. If there are no relevant commitments, then a statement will be included in the Application indicating that there are no applicable commitments.	1.3.8 Concordance with Environmental Assessment Conditions
1.4. Regulatory Framework	Required ☒ Methods ☐	A summary of authorizations / approvals required for the Project will be provided. Existing authorizations that govern aspects of the Project will be identified.	1.4 Regulatory Framework
1.5. Indigenous Engagement			
1.5.1. Background	Required ☒ Methods ☐	MPMC operates in the territory of the William's Lake First Nation and the Xatśūll First Nation. Summary of previous and planned engagement activities with these First Nations will be provided.	1.5.1 Background
1.5.2. Asserted and Established Rights and Interests	Required ☒ Methods ☐	See 1.5.1	1.5.2 Asserted and Established Rights and Interests

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
1.5.3. Engagement Efforts	Required ☒ Methods ☐	See 1.5.1.	1.5.3 Engagement Efforts
2. BASELINE INFORMATION			
2.1. Summary	Required ☒ Methods ☐	Baseline conditions will be described and will focus on parts of the environment that may be affected by the Project. The scope of the baseline information will be to support assessment consistent with the scope of this Application. Baseline information will be summarized from existing monitoring programs.	2.1 Summary
2.2. Meteorology and Climate	Required ☒ Methods ☐	A summary of relevant meteorological and climate information will be provided, based on existing monitoring data. The baseline information will include parameters relevant for the design and construction of the Project, such as precipitation, snowpack, temperature, and evapotranspiration. The Application must include an assessment of historic climatic conditions at the Project and include general short- and long-term predictions or assumptions related to precipitation, snowpack, temperature, and evapotranspiration that may impact water quantity and quality modelling results.	2.2 Meteorology and Climate
2.3. Geology			
2.3.1. Regional Geology	Required ☒ Methods ☐		2.3.1 Regional Geology
2.3.2. Deposit (Ore) Geology	Required ☒ Methods ☐	A summary of the geological setting will be provided. .	2.3.2 Deposit (Ore) Geology
2.3.3. Surficial Geology, Terrain, and Geohazard Mapping	Required ☒ Methods ☐	A geotechnical evaluation, including assessment of terrain stability and description of natural hazards relevant to the Project activities will be provided.	2.3.3 Surficial Geology, Terrain, and Geohazard Mapping
2.3.4. Natural and Seismic Hazards Assessments	Required ☒ Methods ☐	See 2.3.3	2.3.4 Natural and Seismic Hazards Assessments
2.3.5. Soil Survey and Soil Characterization for Reclamation	Required ☒ Methods ☐	The Project will occur within the M-200 permit boundary. Soil disturbance is anticipated for a small portion of natural ground. Soil survey and soil characterization will be provided for natural areas that may be disturbed.	2.3.5 Soil Survey and Soil Characterization for Reclamation
2.4. Geochemical Characterization and Source Terms	Required ☒ Methods ☐	A QP assessment outlining the estimated time to onset of acid rock drainage and how it relates to the proposed timeline of the Project and the rehandling of PAG material to the existing pit will be provided. The Application will include available static and kinetic laboratory analytical results for PAG material encountered to date and anticipated to be excavated from Phase 4 of the Cariboo-Springer Pit mining operations.	2.4 Geochemical Characterization and Source Terms
2.4.1. Geochemical Characterization	Required ☒ Methods ☐	A QP discussion regarding geochemical characterization of PAG material will be provided. The Application must include a breakdown of geochemical characteristics of previously mined zones as well as zones that may be mined as part of the Springer Pit Expansion.	2.4.1 Geochemical Characterization
2.4.2. Geochemical Source Terms	Required ☒ Methods ☐	Source terms have been updated based on the Springer Pit Expansion (considers more recent data and zones that will be mined as part of the expansion). Source terms for the NAG waste rock dumps will be reviewed by SRK based on the modified NPR.	2.4.2 Geochemical Source Terms
2.5. Topography and Surface Drainage Features	Required ☒ Methods ☐	Existing topography and surface drainage features relevant to the Project components addressed in this Application will be described. A figure showing an overview of surface drainage will be provided.	2.5 Topography and Surface Drainage Features
2.6. Water Quantity			

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	**Requirements**	**Comments**	**Location in Final Application**
2.6.1.Surface Water Quantity	Required ☒ Methods ☐	The hydrology baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place. The Application will include historic and current surface water quantity for the PAG Stockpile. The Application will include information on surface water quantity of NAG storage facilities that are intended to receive material with an NPR between 2 and 1.6.	2.7.1 Surface Water Quantity
2.6.2.Groundwater Quantity	Required ☒ Methods ☐	The groundwater baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published groundwater datasets. The baseline information will be summarized from data collection programs already in place.	2.6.2 Groundwater Quantity
2.7. Water Quality			
2.7.1.Surface Water Quality	Required ☒ Methods ☐	A summary of relevant surface water quality baseline information will be provided. This section will be prepared by summarizing available data and from reports associated with the sites water quality monitoring programs. This section will include receiving environment, Quesnel Lake, data from 2015 to present, and compare it with reference, baseline data. Additionally: - parameters used to calculate guidelines will be provided in table foot notes - presenting graphs will indicate applicable water quality guidelines on the graph itself - where chronic water quality guideline is not applicable to any sampling locations due to monthly sampling, the results will still be compared with chronic guideline - raw data will be provided in an additional appendix For additional reference, this section will provide a summary of data described above for Hazeltine Creek or note where this information has been presented/addressed for reference. The Application will include historic and current surface water quality for the PAG Stockpile. The Application will include an assessment of current surface water quality as it compares to established water quality predictions and timeframes of ML/ARD onset and characteristics. The Application must include information on surface water quality of NAG storage facilities that are intended to receive material with an NPR between 2 and 1.6.	2.7.1 Surface Water Quality
2.7.2.Groundwater Quality	Required ☒ Methods ☐	A summary of relevant groundwater quality baseline information will be provided. This section will be prepared by summarizing available data from reports associated with the site's existing monitoring program.	2.7.2 Groundwater Quality
2.8. Sediment Quality	Required ☒ Methods ☐	In support of the Quesnel Lake Operational Discharge Extension, a summary of relevant sediment quality data from the receiving environment, Quesnel Lake, will be provided. This section will include data from 2015 to present, and compare it with reference, baseline data. Additionally, all sediment toxicity data available to present will be provided along with a comparison to reference conditions. For additional reference, this section will provide a summary of data described above for Hazeltine Creek or note where this information has been presented/addressed for reference.	2.7.3 Sediment Quality
2.9. Fisheries and Aquatic Resources			

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
2.9.1. Periphyton and Benthic Invertebrate Community Measures	Required ☒ Methods ☐	A summary of relevant biological monitoring data from the receiving environment, Quesnel Lake, monitoring locations will be provided. This will include a summary of all relevant periphyton and benthic invertebrate, plankton community measurements from the receiving environment from 2015 to present, along with a comparison to reference, pre-breach/baseline data will be provided. This section will also include all available tissue quality data to present from the applicable receiving environment locations. For additional reference, this section will provide a summary of data described above for Hazeltine Creek or note where this information has been presented/addressed for reference.	2.9.1 Periphyton and Benthic Invertebrate Community Measures
2.9.2. Fish and Fish Habitat	Required ☒ Methods ☐	A summary of the receiving environment, Quesnel Lake, fish habitat condition and use of this habitat by fish populations will be provided.	2.9.2 Fish and Fish Habitat
2.9.3. Tissue Residues	Required ☒ Methods ☐	A summary of all available tissue residue data to present from the applicable sampling location from the relevant receiving environment will be provided.	2.9.3 Tissue Residues
2.10. Ecosystems and Wildlife	Required ☒ Methods ☐	The Project will occur within the M-200 permit boundary. A summary of terrestrial biodiversity will be provided to characterize the baseline conditions, with cross-references to existing reports.	2.10 Ecosystems and Wildlife
2.11. Land Status and Use	Required ☒ Methods ☐	A summary of land status and use will be provided.	2.11 Land Status and Use
2.12. Archaeology	Required ☒ Methods ☐	The Project will occur within the M-200 permit boundary. A summary of relevant archaeological resources will be provided, with cross-references to existing reports.	2.12 Archaeology
2.13. Cultural Use	Required ☒ Methods ☐	The application will contain a brief statement that there is no current cultural resource use of the area, based on existing studies.	2.13 Cultural Use
3. MINE PLAN		This section will include a detailed discussion on the mine plan for the Project. It will include figures outlining development, estimated material volumes, and a discussion on the potential implications of an extended temporary shutdown. No change to the permitted mine boundary is anticipated as part of the Project.	3. MINE PLAN
3.1. Mine Plan Overview	Required ☒	A high-level overview of current mining in the area will be provided in the Application. A description of how the Project will interact with mining will be provided. A description of the Project will be presented to provide context for the assessment of potential effects of the Project and support regulatory review of the Application. Figures will be included.	3.1 Mine Plan Overview
3.2. Existing Development	Required ☒	The existing site conditions described in the Application. The existing environment will be described in Section 2 in the context of the Project. Integration of the Project with the mine site will be described in other sections.	3.2 Existing Development
3.3. Life of Mine Plan	Required ☒		3.3 Life of Mine Plan
3.4. Detailed Five Year Mine Plan	Required ☐		3.4 Detailed Five Year Mine Plan
3.5. Mine Facility Designs and Development	Required ☒		
3.5.1. Open Pits	Required ☒	A QP assessment outlining the estimated time to onset of acid rock drainage and how it relates to the proposed timeline of the Project and the rehandling of PAG material to the existing pit will be provided.	3.5.1 Open Pits
3.5.2. Underground Workings	Required ☐		3.5.2 Underground Workings
3.5.3. Processing Plant (Mill) and Associated Facilities	Required ☐	Existing mill and associated facilities will be used to support the Project. No changes.	3.5.3 Processing Plant (Mill) and Associated Facilities
3.5.4. Tailings Storage Facility and Associated Infrastructure	Required ☐	Modifications needed to support the expansion of the TSF needed to support the Project will be covered under a separate application. A description of this project linkage will be provided in the application.	3.5.4 Tailings Storage Facility and Associated Infrastructure

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
3.5.5. Waste Rock Dumps	Required ☒	This will include discussion from a QP assessment outlining the estimated time to onset of acid rock drainage and how it relates to the proposed timeline of the Project and the rehandling of PAG material to the existing pit will be provided. A description of the permitted Temporary NW PAG Stockpile will be provided.	3.5.5 Waste Rock Dumps
3.5.6. Water Management Structures	Required ☒	A description of existing water management structure relevant to the Project will be provided.	3.5.6 Water Management Structures
3.5.7. Ore, Overburden, Soil and Construction Stockpiles	Required ☒	A description of material stockpiles associated with the Project will be provided in the Application.	3.5.7 Ore, Overburden, Soil and Construction Stockpiles
3.5.8. Mine Access and Mine Haulage Roads	Required ☒	An overview of the access roads and the mine haulage roads relevant to the Project will be provided. The majority of activity will occur using existing infrastructure.	3.5.8 Mine Access and Mine Haulage Roads
3.5.9. Power Supply and Distribution Infrastructure	Required ☒	A summary of the existing facilities to be used will be described.	3.5.9 Power Supply and Distribution Infrastructure
3.5.10. Explosives Storage Facilities	Required ☒	A summary of the existing facilities to be used will be described.	3.5.10 Explosives Storage Facilities
3.5.11. Ancillary Facilities and Support Infrastructure	Required ☒	A summary of the existing facilities to be used will be described.	3.5.11 Ancillary Facilities and Support Infrastructure
4. RECLAMATION AND CLOSURE PLAN			
4.1. End Land Use and Capability Objectives	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project. The footprint and capacity of the Temporary NW PAG Stockpile is not being modified as part of this Project. No change to the reclamation and closure plan presented in the 2017 Mine Reclamation and Closure Plan is required. Disposal of PAG will still occur in pit.	4.2 End Land Use and Capability Objectives
4.2. Reclamation Approaches			
4.2.1. Soil Resources	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.3.1 Soil Resources
4.2.2. Landform Design and Erosion Control	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.3.2 Landform Design and Erosion Control
4.2.3. Revegetation Strategy	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.3.3 Revegetation Strategy
4.2.4. Progressive Reclamation/Sequencing	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.3.4 Progressive Reclamation/Sequencing
4.2.5. Reclamation Research	Required ☐	Reclamation research will not be possible, as these areas will be continuously disturbed during the 8 years of operation.	4.3.5 Reclamation Research
4.2.6. Reclamation Monitoring	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.3.6 Reclamation Monitoring
4.2.7. Habitat Compensation Works	Required ☐	All work will be within the M-200 permit boundary. Habitat offsets, if needed to offset impacts on Bootjack Creek habitat will be handled directly by DFO.	4.3.7 Habitat Compensation Works
4.3. Trace Element Uptake in Soils and Vegetation	Required ☐ Methods ☐		4.4 Trace Element Uptake in Soils and Vegetation
4.4. Contaminated Sites, Human Health and Ecological Risk Assessment	Required ☒ Methods ☐	Human Health and Ecological Risk Assessments that have been done on performed on site will be summarized.	4.5 Contaminated Sites, Human Health and Ecological Risk Assessment
4.5. Disposal of Chemicals, Reagents, Hazardous Materials and Contaminated Materials	Required ☒ Methods ☐	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.6 Disposal of Chemicals, Reagents, Hazardous Materials and Contaminated Materials
4.6. Groundwater Well Decommissioning	Required ☐ Methods ☐	No additional groundwater wells are currently expected as part of the Project.	4.7 Groundwater Well Decommissioning
4.7. Reclamation and Closure Prescriptions-			
4.7.1. Structures and Equipment	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.8.1 Structures and Equipment
4.7.2. Waste Rock Dump Reclamation	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.8.2 Waste Rock Dump Reclamation
4.7.3. Tailings Storage Facility Reclamation	Required ☐		4.8.3 Tailings Storage Facility Reclamation
4.7.4. Open Pit Reclamation Prescriptions	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.8.4 Open Pit Reclamation Prescriptions

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
4.7.5. Watercourse Reclamation Prescriptions	Required ☒	A description for reclamation of Bootjack Creek will be provided in the Application if it will be impacted the SERDS expansion. However, if Bootjack Creek habitat cannot be avoided then it will be buried by the SERDS. It would be addressed through habitat offsets rather than reclamation.	4.8.5 Watercourse Reclamation Prescriptions
4.7.6. Road Reclamation	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.8.6 Road Reclamation
4.7.7. Schedule	Required ☒	An updated schedule for reclamation and closure will be provided based on Project schedule. No change to the reclamation and closure plan presented in the 2017 Mine Reclamation and Closure Plan is required.	4.8.7 Schedule
4.8. Detailed Five-Year Mine Reclamation Plan	Required ☒		4.9 Detailed Five-Year Mine Reclamation Plan
4.9. Temporary Shutdown	Required ☒	A discussion on the potential implications of an extended temporary shutdown or care and maintenance of the mine as it relates to management of surface water quality, quantity and the estimated onset of acid rock drainage in the temporary NW PAG stockpile will be provided. Additionally, this section will also include a contingency management plan for PAG material stored on site that cannot be backfilled into existing pits during extended temporary shutdowns. If additional mitigation measures are required during a temporary shutdown, details and associated cost estimates will also be provided.	4.10 Temporary Shutdown
4.10. Post-Closure Monitoring and Maintenance	Required ☒	Will be included in the Conceptual Reclamation and Closure Plan for the Project.	4.11 Post-Closure Monitoring and Maintenance
4.11. Reclamation Cost Estimate			
4.11.1. Conventional Reclamation and Closure	Required ☒	Reclamation cost estimates for closure scenario will be provided under separate cover.	4.12 Reclamation Cost Estimate
4.11.2. Post-Closure Monitoring	Required ☒	Reclamation cost estimates for closure scenario will be provided under separate cover.	4.12 Reclamation Cost Estimate
4.11.3. Post-Closure Maintenance (excluding Water Treatment)	Required ☒	Reclamation cost estimates for closure scenario will be provided under separate cover.	4.12 Reclamation Cost Estimate
4.11.4. Life of Mine Water Treatment	Required ☒	Reclamation cost estimates for closure scenario will be provided under separate cover.	4.12 Reclamation Cost Estimate
5. MODELLING, MITIGATION, AND DISCHARGES			
5.1. Summary	Required ☒	Qualitative hydrology and water quality assessments of the potential effects of the Project will be provided.	5.1 Summary
5.2. Conceptual Site Model	Required ☐ Methods ☐		5.2 Conceptual Site Model
5.3. Site-Wide Water Balance Model	Required ☒ Methods ☐	Quantitative model will be updated to reflect new LOM schedule. Updates include revisions to catchment boundaries, storage, and runoff impacted by mine development. Results will include facility level water volume and level projections and estimated discharge quantities from the site. Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided. No change to the site-wide water balance is associated with result of the Project. The capacity and surface area of the Temporary NW PAG Stockpile will not change. Water quantity will be discussed to provide context (Section 2.6.1).	5.3 Site-Wide Water Balance Model

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
5.4. Surface Water Quality Model	Required ☒ Methods ☐	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided. Updating the Surface Water Quality Model is not currently anticipated. However, the need for a site-specific excel based water quality model will be determined based on an evaluation of source terms by a QP. The Application must include an assessment on the potential changes of contaminant loading from the PAG Stockpile by lowering the cut-off for PAG classification from an NPR of 2 to 1.6. The Application must include an assessment on the potential changes of contaminant inputs originating from NAG storage facilities caused by the storage of material with an NPR between 2 and 1.6.	5.4 Surface Water Quality Model
5.5. Groundwater Model			
5.5.1.Conceptual Hydrogeologic Model	Required ☒ Methods ☐	As a component of the site-wide conceptual groundwater model, the application will confirm the understanding regarding the groundwater divide between Bootjack Lake and Springer Pit.	5.5.1 Conceptual Hydrogeologic Model
5.5.2.Numeric Hydrogeologic Model	Required ☒ Methods ☐	The application will include an update to the site-wide numerical hydrogeological model and a summary report which describes the model and its ability to simulate the current and future (both operational and closure) groundwater flow conditions that are relevant to this application. Model simulations must be used in the application to support a groundwater impact assessment and inform the groundwater monitoring, management, and mitigation efforts at the mine. If no update to the existing model is needed, supporting rationale from a QP will be provided.	5.5.2 Numeric Hydrogeologic Model
5.6. Mitigation Methods	Required ☐		
5.6.1.Best Available Technology Evaluation	Required ☐ Methods ☐		5.6.1 Best Available Technology Evaluation
5.6.2.Volume and Quantity Control Methods	Required ☐ Methods ☐		5.6.2 Volume and Quantity Control Methods
5.6.3.Geochemical Attenuation Processes	Required ☐ Methods ☐		5.6.3 Geochemical Attenuation Processes
5.6.4.Water Treatment		Information/discussions on the anticipated changes to water quantity and quality as informed by the Surface Water Balance and Surface Water Quality Models, and how it these predictions relate to the water treatment effectiveness and capacities will be provided. An update on water treatment technology and research development will be provided in the updated Water Management Plan submitted with the Application. This will include an implementation plan and schedule for water treatment technology development. current surface water monitoring program intended and that there are no proposed changes in the trigger values arising from the amendment application.	5.6.4 Water Treatment
5.6.4.1. Description	Required ☒	A description of the existing water treatment system will be provided in the Application. A discussion developed by a QP noting the existing WTPs ability to manage the potential impact of the Project will be included in the Application.	5.6.4.1 Description
5.6.4.2. Location	Required ☒	The location of the existing water treatment system will be provided in the Application.	5.6.4.2 Location
5.6.4.3. Detailed Design	Required ☐		5.6.4.3 Detailed Design
5.6.4.4. Treatment Effectiveness	Required ☒	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	5.6.4.4 Treatment Effectiveness
5.6.4.5. Performance Risks	Required ☐		5.6.4.5 Performance Risks

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
5.6.4.6. Influent and Effluent Water Quality	Required ☒	Predictions for changes to WTP influent volume and quality resulting from the Project will be provided. Additionally, this section will provide details on proposed mitigation, including WTP capacity, performance, and adequacy in mitigating the discharge.	5.6.4.6 Influent and Effluent Water Quality
5.6.4.7. Waste and By-Products	Required ☒		5.6.4.7 Waste and By-Products
5.6.4.8. Maintenance	Required ☐		5.6.4.8 Maintenance
5.6.4.9. Emergency Response Plans	Required ☐		5.6.4.9 Emergency Response Plans
5.6.4.10. Monitoring Plans	Required ☒	Existing monitoring plans and their relevance to the Project will be discussed in the Application. The Application will include: • Information on potential changes to material handling procedures for placing material from Springer Deep and WX zones with an NPR between 1.6 and 2 in Not Potentially Acid Generating (NAG) storage facilities. • Information on potential changes to material handling procedures to account for the effects of mineral partitioning during blast fractionation for material from Springer Deep and WX zones.	5.6.4.10 Monitoring Plans
5.6.4.11. Schedule	Required ☒		5.6.4.11 Schedule
5.6.4.12. Cost Estimate	Required ☐		5.6.4.12 Cost Estimate
5.7. Domestic Water/Sewage Treatment	Required ☐ Methods ☐		5.7 Domestic Water/Sewage Treatment
5.8. Effluent Discharge	Required ☒ Methods ☐	A description of effluent discharge will be included in the Application. This will be informed by updates to the Surface Water Balance, Surface Water Quality Models, and Water Management Plan. The potential for non-point discharge seepages to occur will be assessed, if identified a focused monitoring/mitigation program would be reviewed if required.	5.8 Effluent Discharge
5.9. Initial Dilution Zone	Required ☒ Methods ☐		5.9 Initial Dilution Zone
6. ENVRIONMENTAL ASSESSMENT PREDICTIONS			
6.1. Aquatic Resources	Required ☒ Methods ☐		6.1 Aquatic Resources
6.2. Terrestrial Resources	Required ☒ Methods ☐		6.2 Terrestrial Resources

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
7. ENVIRONMENTAL MONITORING		A list of the required changes to the existing Comprehensive Environmental Monitoring Plan based on the proposed Project and associated changes to water management on site will be provided. A summary of any new information and science available including but not limited to publications from QRCC will be provided and considered in the context of the proposed expansion project and the review of the CEMP. An interim update to the Water Management Progress Report required by condition 2.12 of PE-11678 will be provided with the Application. Updates will be provided for: - Site-wide water quality model; - Site-wide water balance model; - Water Management Plan (Mine Operations); - Annual Discharge Plan; - Any other plans that will require updates to reflect the proposed Springer Expansion. Revisions to the Flocculant Management Plan will be completed if necessary. Additional monitoring requirements will be noted, including those related to Bootjack Lake.	7. ENVIRONMENTAL MONITORING
7.1. Environmental Monitoring Program Design	Required ☒ Methods ☐	The existing Comprehensive Environmental Monitoring Plan will be discussed in the Application.	7.1 Environmental Monitoring Program Design
7.2. Mine Site Water Monitoring Program	Required ☒ Methods ☐	The existing Comprehensive Environmental Monitoring Plan will be discussed in the Application.	7.2 Mine Site Water Monitoring Program
7.3. Discharge Monitoring Program	Required ☒ Methods ☐	The existing Comprehensive Environmental Monitoring Plan will be discussed in the Application.	7.3 Discharge Monitoring Program
7.4. Environment Monitoring Program	Required ☒ Methods ☐	The existing Comprehensive Environmental Monitoring Plan will be discussed in the Application.	7.4 Environment Monitoring Program
7.5. Post-Closure Environmental Monitoring Program	Required ☒ Methods ☐	As informed by the 2022 Mine Plan and Reclamation Program.	7.5 Post-Closure Environmental Monitoring Program
7.6. Aquatic Effect Monitoring Program	Required ☒ Methods ☐	The existing Comprehensive Environmental Monitoring Plan will be discussed in the Application.	7.6 Aquatic Effect Monitoring Program
8. HEALTH AND SAFETY			
8.1. Occupational Health and Safety Program			
8.1.1. Occupational Health Risk Assessment	Required ☐		-
8.1.2. Ergonomics	Required ☐		-
8.1.3. Emergency Wash Facilities	Required ☐		-
8.1.4. Hazardous Dust	Required ☐		-
8.1.5. Lunchrooms, Mine Dry, and Sanitary Conveniences	Required ☐		-
8.2. Post Permitting Requirements			
8.2.1. Issued for Construction Plans	Required ☐		-
8.2.2. Letters of Assurance	Required ☐		-
8.2.3. Occupational Health Programs	Required ☐		-
8.2.4. Workplace Hazardous Materials Information System (WHMIS)	Required ☐		-
8.2.5. Additional Information and Certifications	Required ☐		-
9. MANAGEMENT PLANS			

Information (refer to "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
9.1. Environmental Management System	Required ☒		9.1 Environmental Management System
9.2. Surface Erosion Prevention and Sediment Control Plan	Required ☒	Relevant information for surface erosion prevention and sediment control will be included in the Application.	9.2 Surface Erosion Prevention and Sediment Control Plan
9.3. Soil Management Plan	Required ☒	The existing Soil Management Plan will be used to inform the soil salvage and stockpile management.	9.3 Soil Management Plan
9.4. Construction Environmental Management Plan	Required ☐		9.4 Construction Environmental Management Plan
9.5. ML/ARD Management Plan	Required ☒	The ML/ARD Management Procedure Manual will be updated to reflect the reduced NPR. This update will be approved by QP.	9.5 ML/ARD Management Plan
9.6. Mine Site Water Management Plan	Required ☒	Information related to construction water management and the existing Mine Site Water Management Plan will be included in the Application.	9.6 Mine Site Water Management Plan
9.7. Discharge Management Plan	Required ☒		9.7 Discharge Management Plan
9.8. Vegetation Management Plan	Required ☐		9.8 Vegetation Management Plan
9.9. Invasive Plant Management Plan	Required ☒		9.9 Invasive Plant Management Plan
9.10. Wildlife Management Plan	Required ☒		9.10 Wildlife Management Plan
9.11. Archaeological Management and Impact Mitigation Plan	Required ☒		9.11 Archaeological Management and Impact Mitigation Plan
9.12. Mine Emergency Response Plan	Required ☒		9.12 Mine Emergency Response Plan
9.13. Mine Site Traffic Control Plan	Required ☒		9.13 Mine Site Traffic Control Plan
9.14. Fuel Management and Spill Control Plan	Required ☒		9.14 Fuel Management and Spill Control Plan
9.15. Combustible Dust Management Plan	Required ☐		9.15 Combustible Dust Management Plan
9.16. Chemicals and Materials Storage, Transfer, and Handling Plan	Required ☐		9.16 Chemicals and Materials Storage, Transfer, and Handling Plan
9.17. Waste (Refuse and Emissions) Management Plan	Required ☐		9.17Waste (Refuse and Emissions) Management Plan

APPENDIX 1-2: Information Requirements Table – TSF Interim Raise to 974 m

Joint Information Requirements Table

for

Mines Act and *Environmental Management Act* Permits

Prepared by:

British Columbia Ministry of Energy, Mines and Petroleum Resources

&

British Columbia Ministry of Environment and Climate Change Strategy

January 2024

Introduction

The Information Requirements Table (IRT) serves as the single list of information requirements for a *Mines Act* (MA) permit application, issued by the Ministry of Energy, Mines and Low Carbon Innovation (EMLI), and an effluent discharge permit application under the *Environmental Management Act* (EMA), by the Ministry of Environment and Climate Change Strategy (ENV). The IRT is intended to:

- Be used in conjunction with the document entitled, "Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits"[1] and is intended for use in the development of both new and/or permit amendment applications. The information contained within the IRT will be developed to meet the unique nature of each project.
- It is also to be used in conjunction with all other guidance provided by either ENV or EMLI.
- Inform clients of the detailed information required to support MA and EMA permit applications and ensure all the information necessary to support the MA and EMA applications is provided; and
- Aid ENV and EMLI technical staff during the screening phase.

Overview

The IRT is intended to aid proponents and reviewers through the coordinated authorizations review process: during the pre-application stage to determine the information requirements, prior to submitting an application, and in screening, to ensure the required information has been included in the application submission.



It is recommended that proponents carefully review the entire Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits and consider any possible information requirements that may apply to their project proposal. If a specific methodology from the Joint Application Information Requirements guidance document is being proposed, this should be identified in the IRT and initially be described at a high level by proponents during the pre-application stage. More detail or specific Information Requirements can be added by adding in new lines into the IRT in the appropriate section.

After proponents have created a first draft of the IRT, reviewers will carefully review the project proposal and draft IRT prior to meeting with proponents to identify any missing information requirements or areas that require further discussion. The pre-application phase is most often an iterative set of discussions between the proponent and technical reviewers, regarding the information requirements and any specifics and/or methodologies that may be required in a joint

MA/EMA permit application.

Once complete, the province will send the final IRT to proponents for their use in preparing their application. A copy of the IRT must accompany the application submission by proponents and must indicate the locations of each information requirement within the application (far right-hand column).

It is important to note that changes in a project proposal may occur during the pre-application, screening, and/or review phases of the process. These changes may require a reassessment of the information required for an application. Proponents and reviewers will work together to discuss these changes and identify any revisions or additional information requirements.

Abbreviations

CEMP	Construction Environmental Management Plan
CSM	Conceptual Site Model
EMA	*Environmental Management Act*
EMPR	Ministry of Energy, Mines and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy
IFC	Issued for Construction
IRT	Information Requirements Table
MA	*Mines Act*
ML/ARD	Metal Leaching and Acid Rock Drainage
WHMIS	Workplace Hazardous Materials Information System

Application Sign-Off

Project: TSF Interim Raise to elevation 974 m

Applicant Representative:

Name: Mathieu O'Leary

Title: Water and TSF Superintendent, Mount Polley Mining Corporation

Applicant Signature to indicate Agreement with Requirements

_____ Date signed: _____

Ministry of Environment and Climate Change Strategy, Environmental Protection Division

Application (AMS Tracking #: _____), Tentative Authorization #: _____

Ministry Representative:

Name: _____

Title: _____

Ministry Representative Signature to indicate Agreement with Requirements

_____Date signed: _____

Ministry of Energy, Mines, and Petroleum Resources, Major Mines Office

Ministry Representative:

Name: _____

Title: _____

Ministry Representative Signature to indicate Agreement with Requirements

_____Date signed: _____

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
1. INTRODUCTION AND PROJECT OVERVIEW			
1.1. Application Background	Required ☒ Methods ☐	The scope of this application includes the following construction activities: • Extension of portions of the existing buttresses along the Main and Perimeter embankments • Resloping of the South, Main and Perimter embankments to 2H:1V. • Extension of the embankments at the south and north abutments • Construction of an upstream drain upstream of the till core along portions of the Main and Perimeter embankments.	
1.2. Proponent Information	Required ☒ Methods ☐		
1.3. Project Overview			
1.3.1. Project History	Required ☒ Methods ☐		
1.3.2. Overview of Products and Markets, and Projected Project Benefits	Required ☒ Methods ☐	Project benefits will be discussed.	
1.3.3. Location, Access, and Land Use	Required ☒ Methods ☐	A summary description of the Project location and access relative to MPMC, including a figure, will be included in the Application. Coordinates for the location of the Project will be provided in the Application. Figures will be developed to illustrate the following: • The location of MPMC • MPMC layout • Project Footprint • Relevant infrastructure	
1.3.4. Mine Components and Off-Site Infrastructure	Required ☒ Methods ☐	The components of the Project will be described in the Application. Stamped and signed (Issued for Permitting) engineering drawings will be provided at a suitable level of detailed design.	
1.3.5. Mine Development and Operations	Required ☒ Methods ☐	Details regarding how the Project fits into the permitted and future mine plan will be provided in the Application.	
1.3.6. Mine Design and Assessment Team	Required ☒ Methods ☐		
1.3.7. Spatial Data	Required ☒ Methods ☐	Relevant spatial data will be provided as maps, including maps of Project and Project component's locations.	
1.3.8. Concordance with Environmental Assessment Conditions	Required ☒ Methods ☐	Information relevant to the proposed Project will be provided in the Application. If no relevant commitments, then a statement will be included in the Application indicating that there are no applicable commitments.	
1.4. Regulatory Framework	Required ☒ Methods ☐	A summary of authorizations / approvals required for the Project will be provided. Existing authorizations that govern aspects of the Project will be identified.	
1.5. Indigenous Engagement			
1.5.1. Background	Required ☒ Methods ☐	MPMC operates in the territory of the William's Lake First Nation and the Xatśūll First Nation. Summary of previous and planned engagement activities with these First Nation's will be provided.	
1.5.2. Asserted and Established Rights and Interests	Required ☒ Methods ☐	See 1.5.1	
1.5.3. Engagement Efforts	Required ☒ Methods ☐	See 1.5.1.	
2. BASELINE INFORMATION			

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
2.1. Summary	Required ☒ Methods ☐	Baseline conditions will be described and will focus on parts of the environment that may be affected by the Project. The scope of the baseline information will be to provide information to support assessment consistent with the scope of this Application. Baseline information will be summarized from existing monitoring programs.	
2.2. Meteorology and Climate	Required ☒ Methods ☐	A summary of relevant meteorological and climate information will be provided, based on existing monitoring data. The baseline information will include parameters relevant for the design and construction of the Project, such as precipitation, snowpack, temperature, and evapotranspiration.	
2.3. Geology			
2.3.1. Regional Geology	Required ☒ Methods ☐	A foundation characterization report that meets the intent of the EGBC site characterization for dam foundation guidelines will be provided.	
2.3.2. Deposit (Ore) Geology	Required ☐ Methods ☐		
2.3.3. Surficial Geology, Terrain, and Geohazard Mapping	Required ☒ Methods ☐	See 2.3.1	
2.3.4. Natural and Seismic Hazards Assessments	Required ☒ Methods ☐	See 2.3.1	
2.3.5. Soil Survey and Soil Characterization for Reclamation	Required ☒ Methods ☐	The TSF expansion is expected to occur in a largely disturbed area within the M-200 permit boundary; however, the associated water management infrastructure will extend beyond the M-200 permit boundary requiring a boundary extension. Soil survey and soil characterization will be provided for all natural areas that may be disturbed.	
2.4. Geochemical Characterization and Source Terms	Required ☐ Methods ☐		
2.4.1. Geochemical Characterization	Required ☒ Methods ☐	The existing geochemical characterization results used for the tailings will be provided.	
2.4.2. Geochemical Source Terms	Required ☒ Methods ☐	The existing geochemical source terms used for the tailings will be provided.	
2.5. Topography and Surface Drainage Features	Required ☒ Methods ☐	Existing topography and surface drainage features relevant to the Project components addressed in this application will be described. A figure showing an overview of surface drainage will be provided.	
2.6. Water Quantity			
2.6.1. Surface Water Quantity	Required ☒ Methods ☐	The hydrology baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place. Project-related effects on the surface water environment and site water management will be developed based on the results of existing modelling analyses. Relevant maps will be provided.	
2.6.2. Groundwater Quantity	Required ☒ Methods ☐	Existing groundwater conditions relevant to the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place.	

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
2.7. Water Quality			
2.7.1. Surface Water Quality	Required ☒ Methods ☐	A summary of relevant surface water quality baseline information will be provided. This section will be prepared by summarizing available data and from reports associated with the sites water quality monitoring programs.	
2.7.2. Groundwater Quality	Required ☐ Methods ☐	Existing groundwater conditions relevant to the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place.	
2.8. Sediment Quality	Required ☐ Methods ☐		
2.9. Fisheries and Aquatic Resources			
2.9.1. Periphyton and Benthic Invertebrate Community Measures	Required ☐ Methods ☐		
2.9.2. Fish and Fish Habitat	Required ☐ Methods ☐		
2.9.3. Tissue Residues	Required ☐ Methods ☐		
2.10. Ecosystems and Wildlife	Required ☒ Methods ☐	The Project TSF expansion is expected to occur in a largely disturbed area within the M-200 permit boundary; however, the associated water management infrastructure will extend beyond the M-200 permit boundary.	
2.11. Land Status and Use	Required ☒ Methods ☐	A summary of land status and use will be provided.	
2.12. Archaeology	Required ☒ Methods ☒	The Project TSF expansion is expected to occur in a largely disturbed area within the M-200 permit boundary; however, the associated water management infrastructure will extend beyond the M-200 permit boundary.. Archaeological resources for the site have previously been identified and will be summarized based on that report.	
2.13. Cultural Use	Required ☒ Methods ☐	The application will contain a brief statement that there is no current cultural resource use of the tailings storage area.	
3. MINE PLAN			
3.1. Mine Plan Overview	Required ☒	A high-level overview of current mining will be provided in the Application. A description of how the Project will interact with mining will be provided. The following figures are planned: • Site General Arrangement Plan • Project Overall Plot Plan	
3.2. Existing Development	Required ☒	The existing environment will be described in Section 2 in the context of the Project. Integration of the Project with the mine site will be described in other sections.	
3.3. Life of Mine Plan	Required ☒	An overview of the permitted life of mine plan will be provided,.	
3.4. Detailed Five Year Mine Plan	Required ☒		
3.5. Mine Facility Designs and Development	Required ☐		
3.5.1. Open Pits	Required ☐		
3.5.2. Underground Workings	Required ☐		
3.5.3. Processing Plant (Mill) and Associated Facilities	Required ☒	A high-level description of the processing plant, as it relates to the production of tailings, will be provided in the Application.	
3.5.4. Tailings Storage Facility and Associated Infrastructure	Required ☒	A detailed design report for the TSF interim raise to elevation 974 m will be provided in the Application.	
3.5.5. Waste Rock Dumps	Required ☐		

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
3.5.6. Water Management Structures	Required ☒	A description of how the Project will interact with existing water management structures will be provided. Designs for modifications to these structures will be included in the Application.	
3.5.7. Ore, Overburden, Soil and Construction Stockpiles	Required ☒	Descriptions of the soil and construction materials associated with the Project will be provided in the Application.	
3.5.8. Mine Access and Mine Haulage Roads	Required ☒	An overview of the access to the Project will be provided.	
3.5.9. Power Supply and Distribution Infrastructure	Required ☐		
3.5.10. Explosives Storage Facilities	Required ☐		
3.5.11. Ancillary Facilities and Support Infrastructure	Required ☐		
4. RECLAMATION AND CLOSURE PLAN			
4.1. End Land Use and Capability Objectives	Required ☒	The Application will include reclamation and closure information for the Project based on the latest update to the Mine Reclamation and Closure Plan	
4.2. Reclamation Approaches			
4.2.1. Soil Resources	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.2.2. Landform Design and Erosion Control	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.2.3. Revegetation Strategy	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.2.4. Progressive Reclamation/Sequencing	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.2.5. Reclamation Research	Required ☐		
4.2.6. Reclamation Monitoring	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.2.7. Habitat Compensation Works	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.3. Trace Element Uptake in Soils and Vegetation	Required ☐ Methods ☐		
4.4. Contaminated Sites, Human Health and Ecological Risk Assessment	Required ☐ Methods ☐		
4.5. Disposal of Chemicals, Reagents, Hazardous Materials and Contaminated Materials	Required ☐ Methods ☐		
4.6. Groundwater Well Decommissioning	Required ☐ Methods ☐		
4.7. Reclamation and Closure Prescriptions			
4.7.1. Structures and Equipment	Required ☐		
4.7.2. Waste Rock Dump Reclamation	Required ☐		
4.7.3. Tailings Storage Facility Reclamation	Required ☒	The Application will include reclamation and closure information for the Project and based on the latest update to the Mine Reclamation and Closure Plan	
4.7.4. Open Pit Reclamation Prescriptions	Required ☐		
4.7.5. Watercourse Reclamation Prescriptions	Required ☒		

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
4.7.6.Road Reclamation	Required ☐		
4.7.7.Schedule	Required ☒		
4.8. Detailed Five-Year Mine Reclamation Plan	Required ☒	The Application will include reclamation and closure information for the Project.	
4.9. Temporary Shutdown	Required ☒		
4.10. Post-Closure Monitoring and Maintenance	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.11. Reclamation Cost Estimate			
4.11.1. Conventional Reclamation and Closure	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.11.2. Post-Closure Monitoring	Required ☒	As informed by the Mine Reclamation and Closure Plan	
4.11.3. Post-Closure Maintenance (excluding Water Treatment)	Required ☒		
4.11.4. Life of Mine Water Treatment	Required ☒		
5. MODELLING, MITIGATION, AND DISCHARGES			
5.1. Summary	Required ☒		
5.2. Conceptual Site Model	Required ☐ Methods ☐		
5.3. Site-Wide Water Balance Model	Required ☒ Methods ☐	An updated water balance will be provided with the Application.	
5.4. Surface Water Quality Model	Required ☒ Methods ☐	An updated water quality model will be provided with the Application.	
5.5. Groundwater Model			
5.5.1.Conceptual Hydrogeologic Model	Required ☐ Methods ☐		
5.5.2.Numeric Hydrogeologic Model	Required ☒ Methods ☐	Existing numerical model for the TSF will be updated	
5.6. Mitigation Methods	Required ☐		
5.6.1.Best Available Technology Evaluation	Required ☐ Methods ☐		
5.6.2.Volume and Quantity Control Methods	Required ☒ Methods ☒		
5.6.3.Geochemical Attenuation Processes	Required ☐ Methods ☐		
5.6.4.Water Treatment			
5.6.4.1. Description	Required ☒	A brief description of the existing water treatment system will be provided in the Application. A high-level description of the proposed modifications will be provided as part of the Application.	
5.6.4.2. Location	Required ☒	A brief description of the existing water treatment system will be provided in the Application. A high-level description of the proposed modifications will be provided as part of the Application.	
5.6.4.3. Detailed Design	Required ☒		
5.6.4.4. Treatment Effectiveness	Required ☒		
5.6.4.5. Performance Risks	Required ☒		
5.6.4.6. Influent and Effluent Water Quality	Required ☒		

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
5.6.4.7. Waste and By-Products	Required ☒		
5.6.4.8. Maintenance	Required ☒		
5.6.4.9. Emergency Response Plans	Required ☒		
5.6.4.10. Monitoring Plans	Required ☒	Existing monitoring plans and their relevance to the Project will be discussed in the Application.	
5.6.4.11. Schedule	Required ☒		
5.6.4.12. Cost Estimate	Required ☒		
5.7. Domestic Water/Sewage Treatment	Required ☐ Methods ☐		
5.8. Effluent Discharge	Required ☐ Methods ☐		
5.9. Initial Dilution Zone	Required ☐ Methods ☐		
6. ENVRIONMENTAL ASSESSMENT PREDICTIONS			
6.1. Aquatic Resources	Required ☐ Methods ☐		
6.2. Terrestrial Resources	Required ☒ Methods ☐	The Project TSF expansion is expected to occur in a largely disturbed area within the M-200 permit boundary; however, the associated water management infrastructure will extend beyond the M-200 permit boundary..	
7. ENVIRONMENTAL MONITORING			
7.1. Environmental Monitoring Program Design	Required ☐ Methods ☐		
7.2. Mine Site Water Monitoring Program	Required ☒ Methods ☐	The existing Mine Site Water Monitoring Program will be discussed in the Application.	
7.3. Discharge Monitoring Program	Required ☐ Methods ☐		
7.4. Environment Monitoring Program	Required ☐ Methods ☐		
7.5. Post-Closure Environmental Monitoring Program	Required ☒ Methods ☐	As informed by the Mine Reclamation and Closure Plan	
7.6. Aquatic Effect Monitoring Program	Required ☐ Methods ☐		
8. HEALTH AND SAFETY			
8.1. Occupational Health and Safety Program			
8.1.1. Occupational Health Risk Assessment	Required ☒	The existing site wide Construction Environmental Management Plan will be used to support the Project.	
8.1.2. Ergonomics	Required ☐		
8.1.3. Emergency Wash Facilities	Required ☐		
8.1.4. Hazardous Dust	Required ☐		
8.1.5. Lunchrooms, Mine Dry, and Sanitary Conveniences	Required ☐		

Information (refer to "Joint Application Information Requirements for Mines Act and Environmental Management Act Permits" for additional info on each section)	Requirements	Comments	Location in Final Application
8.2. Post Permitting Requirements			
8.2.1. Issued for Construction Plans	Required ☒		
8.2.2. Letters of Assurance	Required ☐		
8.2.3. Occupational Health Programs	Required ☐		
8.2.4. Workplace Hazardous Materials Information System (WHMIS)	Required ☐		
8.2.5. Additional Information and Certifications	Required ☐		
9. MANAGEMENT PLANS			
9.1. Environmental Management System	Required ☐		
9.2. Surface Erosion Prevention and Sediment Control Plan	Required ☒	Relevant information for surface erosion prevention and sediment control will be included in the Application.	
9.3. Soil Management Plan	Required ☒	The existing Soil Management Plan will be used to inform the soil salvage and stockpile management	
9.4. Construction Environmental Management Plan	Required ☒	Management of materials to be used on site during construction will be addressed through the Construction Environmental Management Plan.	
9.5. ML/ARD Management Plan	Required ☒		
9.6. Mine Site Water Management Plan	Required ☒	Information related to construction water management will be included in the Application.	
9.7. Discharge Management Plan	Required ☐		
9.8. Vegetation Management Plan	Required ☒		
9.9. Invasive Plant Management Plan	Required ☒		
9.10. Wildlife Management Plan	Required ☒		
9.11. Archaeological Management and Impact Mitigation Plan	Required ☒		
9.12. Mine Emergency Response Plan	Required ☒		
9.13. Mine Site Traffic Control Plan	Required ☒		
9.14. Fuel Management and Spill Control Plan	Required ☒		
9.15. Combustible Dust Management Plan	Required ☐		
9.16. Chemicals and Materials Storage, Transfer, and Handling Plan	Required ☐		
9.17. Waste (Refuse and Emissions) Management Plan	Required ☐		

APPENDIX 1-3: Tailings Storage Facility - Detailed Design to Elevation 974 m

REPORT

Tailings Storage Facility - Detailed Design to Elevation 974 m

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

Submitted by:

WSP Canada Inc.

840 Howe Street, Suite #1000, Vancouver, BC, V6Z 2M1 Canada

+1 604 685-9381

Reference No. CA0020527.4505-014-R-Rev0-51394

April 19, 2024

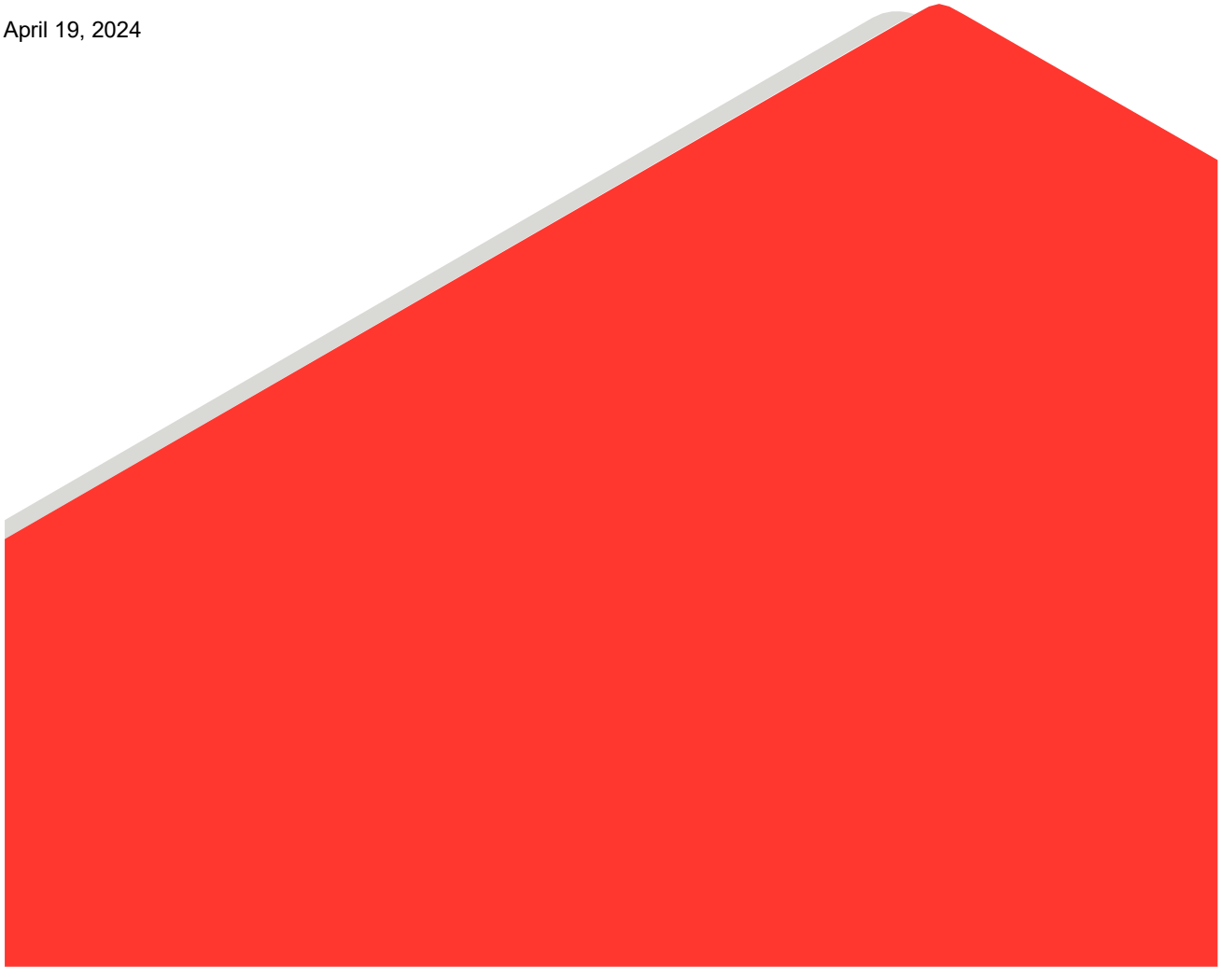

Distribution List

Electronic Copy: Mount Polley Mining Corporation

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1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has retained WSP Canada Inc. (WSP) to complete a detailed design to raise the tailings storage facility (TSF) at Mount Polley Mine. This report presents the detailed design to support raising the TSF from its currently permitted elevation of 970 m to a crest elevation of 974 m. The design crest elevation 974 m is an interim design to enable the TSF to be raised while design efforts for a potential raise of the TSF to contain the life of mine (LoM) tailings is advanced. The following are included in this report:

- design of the TSF raise to elevation 974 m, including the following design assessments:
  - site and deposition technology
  - storage capacity
  - seepage through the embankment and foundation
  - filter compatibility
  - upstream drain capacity
  - slope stability and deformation
  - water balance
  - risk review and design controls
- review and update of the TSF pond management, spillway design, and freeboard requirements
- construction drawings and technical specifications
- material quantities
- closure considerations

This report should be read in conjunction with the most recent TSF site characterization report (WSP 2023).

This design supports regulatory permit application, and hence satisfies the BC Ministry of Energy, Mines and Low Carbon Innovation requirements outlined in the Health, Safety and Reclamation Code for Mines in British Columbia (EMLI 2022). Design drawings of the TSF raise are provided in Appendix A, and the construction technical specification is provided in Appendix B.

MPMC defined and uses the coordinate system tailings grid for the TSF. All coordinates and elevations are presented in tailings grid.

2.0 BACKGROUND

Mount Polley Mine is a copper and gold mine near Williams Lake, British Columbia (BC), operated by MPMC, a subsidiary of Imperial Metals Corporation. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length (Drawing 02, Appendix A). The embankment is subdivided into three sections: the Main Embankment, Perimeter Embankment, and South Embankment (Drawing 03, Appendix A). The embankment has incorporated a staged expansion design utilizing modified centreline and centreline construction methods. The general zoning of the TSF embankment consists of the following:

- upstream fill comprising tailings sand and select fill (e.g., rockfill)
- low-permeability till core
- filter zone
- transition zone
- rockfill

Rockfill forms the downstream wedge of the embankments and the downstream buttress along the Perimeter and Main embankments.

Mount Polley Mine began production in 1997 and operated until October 2001 when operations were suspended for economic reasons. In March 2005, the mine restarted, and was in operation up to the time of the TSF breach in August 2014. The embankment crest was near elevation 968 m at the time.

In 2015, the Freshet Embankment was constructed to elevation 950 m through the breach area to allow the capture and temporary storage of the 2015 and 2016 freshet flows. The construction of buttresses along the Perimeter and Main embankments was completed in October 2016 (Golder 2015a, 2017a).

The June 23, 2016, amendment of *Mines Act* Permit M-200 authorized the return to full operations at the mine, including construction of the TSF to elevation 970 m (Golder 2015b) and deposition of tailings. Construction to raise the Freshet Embankment at Corner 1 to elevation 970 m started in June 2016. By September 2018, construction had been completed to elevation 968 m (Golder 2019b).

Mining operations at Mount Polley Mine were halted between May 2019 and Q4 2021 for economic reasons. In June 2022, the mill restarted operations and tailings deposition into the TSF resumed. Construction to raise the South, Main, and Perimeter embankments to elevation 970 m was restarted in July 2022 and was completed in 2023.

A feasibility design for raising the embankment of the TSF to an elevation of 984 m was completed in 2014 (Golder 2015c). The aim of the feasibility assessment was to identify potential considerations, constraints, or conflicts that may limit the elevation to which the TSF could be raised. The results of the study indicated that a raise of the facility is feasible. In 2021, MPMC updated the LoM plan, and a crest elevation of approximately 987 m was determined to be required to store the LoM tailings. An additional geotechnical investigation and laboratory testing is ongoing to assess potential strength gains from reconsolidation of the upper glaciolacustrine unit (UGLU) that sheared during the breach in 2014. This interim design to elevation 974 m was developed assuming no strength gains of the UGLU that sheared in 2014. A remoulded undrained shear strength equal to the average minus one standard deviation of the measured values as part of the forensic investigation in 2014 was adopted as in previous analyses and designs (Golder 2015b,e). An interim design elevation of 974 m was selected to enable short-term operations of the TSF.

3.0 BASIS OF DESIGN

The design basis for the raise of the TSF is summarized in this section, including the design and operation philosophy and key design criteria. The design of the TSF raise is consistent with applicable regulatory documents and guidelines from MPMC, WSP, and national and international organizations, where applicable (e.g., Canadian Dam Association [CDA], International Commission on Large Dams). The following regulations apply to this study:

- *Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia* (EMLI 2022).
- Guidance Document for Revisions to Part 10 of the HSRC for Mines in BC (BC MEM 2016).

The design of the TSF is also consistent with the following guidelines, where applicable:

- CDA *Dam Safety Guidelines* (CDA 2013).
- *Technical Bulletin: Application of CDA Dam Safety Guidelines to Mining Dams* (CDA 2019).
- *Global Industry Standard for Tailings Management* (Global Tailings Review 2020).
- Mining Association of Canada *Guide to the Management of Tailings Facilities* (MAC 2021).

The complete design basis and design criteria are included in Appendix C.

3.1 Design and Operation Philosophy

The design of the TSF follows the principles set out by the Mining Association of Canada in its Towards Sustainable Mining program and the recommendations made by the Independent Expert Engineering Investigation and Review Panel (IEEIRP 2015). The following approaches have been used for the design of the TSF:

- **Limit the amount of surface water to that required for operation**—This will be achieved through maintaining storage capacity within the external water management ponds and ongoing discharge of water from the mine site.
- **Promote unsaturated conditions in the tailings**—Wide sub-aerial beaches will be maintained upstream of the embankments, and upstream drains will be constructed to create a zone of unsaturated tailings adjacent to the embankments.
- **Promote consolidation of tailings upstream of the TSF embankment**—Upstream drains will be constructed to create a zone of unsaturated tailings adjacent to the embankments.
- **Reduce the hydraulic gradient across the till core**—This will be achieved through maintaining wide sub-aerial beaches along the embankments and the construction of upstream drains.

Operation of the TSF is to follow the above philosophy. Quantitative performance objectives (QPOs) have been defined to confirm that operation of the TSF follows the operation philosophy.

3.2 Design Basis and Criteria

Key design basis and criteria are summarized in Table 1. The complete design basis and criteria are included in Appendix C. Specific design criteria for each design component are provided within those sections in the report.

Table 1: Design Basis and Criteria

Criteria	Unit	Value	Source/Comment
General			
Nominal Tailings Production Rate	t/day	20,000	MPMC (2021)
TSF storage capacity	-	minimum to allow continuity of operation until 2026	Includes the remaining storage capacity of the permitted 970 m raise based on the 2019/2020 survey of the tailings surface 8.0 Mt deposited between June 2022 and December 2023
Dam classification	-	Significant	Refer to Appendix C
Design earthquake event	AEP	1:2,475	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) Other criteria include: ▪ Between 1:100 and 1:1,000 AEP (CDA 2019) ▪ 1:1,000 AEP recommended by GISTM (Global Tailings Review 2020) Consistent with WSP's best practice, an earthquake event of 1:10,000 AEP will be used to assess sensitivity of the analyses
Static (long term)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) CDA (2019) Table 3-4
Static (during or at end of construction)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) Other criteria include: >1.3 recommended by CDA (2019) Table 3-4
Pseudo-static	FoS	1.0	Informed by Table 3-5 of CDA (2019)
Post-earthquake	FoS	1.2	Informed by Table 3-5 of CDA (2019)
Overall downstream slope no steeper than	-	2H:1V	HSRC Guidance Document Section 3.3.1 (BC MEM 2016)

Table 1: Design Basis and Criteria

Criteria		Unit	Value	Source/Comment
Tailings Characteristics				
Solids content of tailings slurry discharged to TSF		%wt	Nominally ~35	Provided by MPMC
Tailings average dry density after deposition		t/m^3	1.35	Assumed by WSP 1.36 t/m^3 by KP (2005)
Tailings beach slope		%	Sub-aerial – 0.5% Sub-aqueous – 2%	Based on available topographic and bathymetric surveys since 2016
Water Management				
IDF	Operations	-	72-hour PMF	PMF runoff volume will be estimated considering the annual 72-hour PMP rainfall plus snowmelt, which was selected consistent with WSP's best practice. Other criteria include: ▪ 1/3 between 1-in-975-year and PMF for a minimum duration of 72 hours required by HSRC Guidance Document Section 3.3.1 (BC MEM 2016). ▪ Between 1-in-100 and 1-in-1,000-year return period recommended by CDA (2019). ▪ 1-in-1,000-year return period recommended by GISTM (2020).
EDF	Operations	years	24-hour 1:200 year precipitation and snowmelt	Typical EDF return periods range from 1-in-50 years to 1-in-200 years (CDA 2019).

Table 1: Design Basis and Criteria

Criteria		Unit	Value	Source/Comment
Freeboard	Normal	-	No overtopping by 95% of waves caused by the most critical wind with a frequency of 1:1,000 year with reservoir at maximum normal elevation	CDA (2013)
	Minimum	-	No overtopping by 95% of waves caused by the most critical wind when the reservoir is at its maximum level during the IDF	CDA (2013)
Water Management				
Operating pond volume range		million m^3	1.5 to 1.7	Minimum provided by MPMC for operation of the mill Maximum adopted to maintain wide sub-aerial beaches
Beach width		m	100	Minimum during normal operating conditions Portion of beach above operating pond level

TSF = tailings storage facility; Mt = million tonnes; HSRC = Health, Safety and Reclamation Code; AEP = annual exceedance probability; GISTM = Global Industry Standard for Tailings Management; FoS = factor of safety; %wt = weight percent; IDF = inflow design flood; EDF = environmental design flood; PMF = probable maximum flood; PMP = probable maximum precipitation.

4.0 SITE CONDITIONS

The Mount Polley TSF site characterization report (WSP 2023) presents the TSF site conditions with respect to climate, geology, seismicity, geotechnical, hydrogeology, and geochemistry.

The Engineers and Geoscientists British Columbia (formerly The Association of Professional Engineers and Geoscientists of British Columbia, APEGBC) site characterization for dam foundation guidelines (APEGBC 2016) were followed during the preparation of the Mount Polley TSF site characterization report. It is intended that the TSF site characterization report be updated with data from future site investigations, and with observations and data from construction and operation of the TSF. Should the understanding and interpretation of site conditions change with time, then the TSF design will be reassessed incorporating the site condition changes.

A summary of the TSF site conditions is presented in this section to provide context for the design and to define conditions and design parameters for analyses including climate and earthquake events. Foundation material properties adopted for seepage and stability modelling are presented in Sections 7.5 and 7.7.

4.1 Site Location and Geomorphology

Mount Polley Mine is located approximately 56 km northeast of Williams Lake, BC, between Polley Lake and Bootjack Lake.

The region is located on the eastern edge of the Interior Plateau, at the boundary between the Quesnel Highlands and the Fraser Plateau. Terrain and geomorphology of the region comprises flat and gently rolling topography with hummock bedrock exposures, dissected by a network of streams and lakes. Surface drainage patterns are influenced by bedrock topography; most of the stream valleys in the region have a northwest orientation and drain southward toward the lowland area north of the western arm of Quesnel Lake (Bichler and Bobrowsky 2003).

In the TSF area, the gentle topography and surface expression of the lowland area at the head of the west arm of Quesnel Lake is the result of glacial advance followed by glacial retreat and inundation by meltwater. The regional surficial geology is dominantly the result of erosion and deposition associated with the most recent glaciation (WSP 2023).

4.2 Climate

The site experiences high summer precipitation due to summer storms, and the lowest monthly precipitation occurs in February. Precipitation typically occurs as snowfall starting in November, which accumulates until March. Average annual precipitation at the site is estimated to be 612 mm, with a standard deviation of 118 mm based on precipitation records for the site from 1974 to 2021. Typically, the increase of temperatures over 0°C starts in March, leading to freshet until June.

A summary of the baseline climate parameters is provided in Table 2. An evaluation of future climate change projections indicates future climate at the site will likely be warmer and wetter, with larger variations throughout the months.

Table 2: Summary of Key Climate Parameters for Mount Polley Mine

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:10-year 24-hour rainfall (mm)	47
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050s (%)	+5

Table 2: Summary of Key Climate Parameters for Mount Polley Mine

Parameter	Value
Projected annual total precipitation anomaly from baseline for 2080s (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Mean snow water equivalent for the month of March (mm)	185
Projected annual air temperature anomaly from baseline for 2050s (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080s (°C)	+2.7
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).

The five-year update of the climate baseline for the site is presented in WSP Golder (2022a) and includes precipitation, air temperature, relative humidity, solar radiation, evaporation, snow depths, wind speed and direction, and updated climate change projections.

4.3 Hydrology

The mine site is drained by three main watersheds: Hazeltine Creek, Edney Creek, and Morehead Lake. The Hazeltine Creek watershed includes Polley Lake and conveys all water from Polley Lake, the east side of Mount Polley, and the area surrounding the TSF. In general, the hydrology of Hazeltine Creek (and by extension, the mine area and TSF) can be described as snowmelt driven, with the majority of annual runoff occurring during the spring snowmelt in April and May freshet (KP 2014).

4.4 Geology

The regional surficial geology is predominantly the result of erosion and deposition associated with the late Pleistocene (Wisconsinan) glacial episode referred to as the Fraser Glaciation (Clague 1987, 1988). The stratigraphic sequence identified in the area of the TSF can be generalized in order of increasing depth as follows:

- fill and anthropogenic materials
- ablation till, including glaciolacustrine and glaciofluvial sub-units
- basal till, including glaciolacustrine and glaciofluvial sub-units
- bedrock

This stratigraphic sequence is generally applicable to the mine area and TSF, with local variations associated with the depositional and erosional history of a particular area. The surficial geological units of the TSF area are interpreted to represent two main stages of the Fraser Glaciation: the advance stage and the recessional stage (Bichler and Bobrowsky 2003). Basal till is punctuated by glaciofluvial and glaciolacustrine deposits that typify the early stages of deposition (the advance stage), represented in the TSF area by basal till and associated sub-units. The ablation till and some layers of the glaciofluvial and glaciolacustrine sub-units were likely deposited during the recession stage of glaciation.

Available mapping indicates the TSF area is underlain by altered, deformed, and brecciated volcanic and intrusive igneous rocks of the Late Triassic Nicola Group, with local sandstone and conglomerate of the Kamloops Group, Dragon Mountain Formation and some unnamed sediment groups (Logan et al. 2007).

4.5 Seismicity

The site is located in an area of relatively low seismicity for BC. WSP developed a site-specific seismic hazard model for the Mount Polley Mine site based on source models developed for the 6th Generation Canadian National Seismic Hazard Model (Canada SHM6) and a review of geological and paleoseismological features (WSP 2023a). Both near-field, moderate-magnitude crustal earthquakes and far-field subduction interface earthquakes contribute to the site seismic hazard. The shallow crustal earthquake sources are dominated by moderate-magnitude earthquakes (**M**6.0 to **M**6.5) close to the site (i.e., less than 60 km) at all annual exceedance probabilities (AEPs). The contribution to hazard at the site from the Cascadia subduction zone is from large earthquakes (**M**8+) at 450 to 550 km from the site at all AEPs and spectral periods of interest.

Probabilistic analysis results from site-specific hazard model are listed in Table 3.

Table 3: Peak Ground Accelerations (5%-damped) for Selected Annual Exceedance Probabilities at the Mount Polley Tailings Storage Facility Site (V_{S30} = 849 m/s)

Annual Exceedance Probability (AEP)	Mean Acceleration (g)
1:1,000	0.026
1:2,475	0.048
1:5,000	0.076
1:10,000	0.116

V_{S30} = time-averaged shear-wave velocity (VS) to a depth of 30 m.

For dams impounding tailings with a Significant consequence classification, the HSRC Guidance Document (BC MEM 2016) defines a minimum earthquake design ground motion with a 1:2,475 AEP.

4.6 Geotechnical Conditions

A detailed description of geotechnical conditions in the area of the TSF embankment is provided in WSP (2023a). Typically, the stratigraphic units in the foundations of the TSF can be characterized as follows:

- **Till**—The till is generally a mixture of gravel, sand, and low plastic fines ranging from silt to silty clay. The material is generally cohesive with a consistency from firm to hard.
- **Glaciofluvial units**—The glaciofluvial units are generally gravelly sandy silt to silty sand with trace gravel. The fines content ranges from about 4% to 100% and are generally non-plastic. The material is generally non-cohesive with a compactness ranging from compact to very dense.
- **Glaciolacustrine units (GLUs)**—The GLUs are generally silty clay to clay with trace to some sand. The fines are generally low to high plasticity. The material is generally cohesive with a consistency ranging from firm to very stiff. The sensitivity of the glaciolacustrine soil interpreted from the cone penetration testing (CPT) data generally ranges between 2 and 3.
  - **Main Embankment**—A semi-continuous layer of glaciolacustrine soil is present at an elevation of approximately 900 to 910 m and extends along the length of the Main Embankment. A shallower layer of glaciolacustrine soil near elevation 920 m was identified near Stn. 2+455 and 2+695. The Main Embankment glaciolacustrine soil generally has a low to intermediate plasticity (silt to silty clay). The average water content is approximately 26%.

Consolidation tests indicate a range of preconsolidation pressures from 1,100 kPa to 4,000 kPa and CPT data generally indicates a minimum preconsolidation pressure of about 1,200 kPa at the elevation of the semi-continuous layer of glaciolacustrine soil. CPT data at the higher elevation glaciolacustrine soil layer shows an interpreted minimum preconsolidation pressure of about 850 kPa. The maximum excess pore pressures generated when rockfill was stockpiled on the Main Embankment in 2022 was equivalent to a B-bar of 0.13.

- **Perimeter Embankment**—The glaciolacustrine soil deposits along the Perimeter Embankment are not continuous, and their elevations generally range from about 885 to 935 m. The Perimeter Embankment glaciolacustrine soil generally has a low to intermediate plasticity (silt to silty clay). The average water content is approximately 21%. Consolidation tests indicate a range of preconsolidation pressures from 900 to 3,800 kPa.
- **Perimeter Embankment at Corner 1**—Upper and lower glaciolacustrine soil deposits are present at Corner 1.
  - The upper glaciolacustrine (UGLU) deposit is a semi-continuous layer between approximate elevation 918 and 925 m from approximately Stn. 4+000 to 4+285. The UGLU generally consists of silty clay to high plasticity clay, with trace to some sand, and is firm to stiff. The fines are generally an intermediate to high plastic material and range from silty clay to clay. The average water content of the UGLU is approximately 31% and is generally greater compared to the glaciolacustrine material encountered in the foundation of the other embankments. Consolidation tests indicate a range of preconsolidation pressures from about 300 kPa to 590 kPa. The maximum excess pore pressures generated during the construction of the 2015 Freshet Management Embankment were equivalent to a B-bar of 0.46. Excess pore water pressures take approximately one year to dissipate based on the rate of consolidation measured in the laboratory and the field.
  - The lower glaciolacustrine (LGLU) deposit is also a semi-continuous layer between approximate elevation 900 and 918 m. The LGLU fines generally consist of a low to intermediate plastic material and range from silty clay-clayey silt to silty clay. The average water content of the LGLU is approximately 22%. Consolidation tests indicate a range of preconsolidation pressures in the order of 700 to 1,200 kPa.
- **South Embankment**—A layer of low plasticity silty clay interpreted to have deposited in a glaciolacustrine environment was encountered directly above bedrock near Stn. 1+095 at the South Embankment; however, the geotechnical testing completed on the material is not representative of the intermediate or high plasticity GLUs found within the footprint of the Perimeter Embankment at Corner 1.

- **Highly weathered bedrock**—Generally weathered volcaniclastic conglomerate, volcanic debris or completely weathered bedrock.

Material properties for limit equilibrium stability analysis are presented in WSP (2023a) and included in Section 7.7.2.

4.7 Hydrogeology

The groundwater flow direction prior to the development of the TSF was inferred to be from the west and northwest towards the east and southeast. The water table was observed to be near ground surface, with artesian pressures measured within the TSF basin upstream of Corner 4 and upward groundwater flow gradients measured along the Main Embankment and Perimeter Embankment at Corner 1.

The current groundwater flow direction in the area of the TSF is inferred to be partly dependent on the existing TSF Pond level. Provided that surface water level elevations within the TSF are above the surrounding shallow groundwater level, groundwater flow will be radial from the TSF towards the southwest, southeast, and northeast. However, when the TSF pond level falls below the shallow groundwater levels on the west side of the TSF, then the TSF area becomes a flow-through environment, similar to pre-development conditions, with groundwater flow directed across the TSF from the west and northwest towards the east and southeast.

Based on in situ and laboratory testing, the hydraulic conductivity of the foundation till (ablation till and basal till) is variable, ranging from 1×10^{-5} m/s to 2×10^{-8} m/s. The range in hydraulic conductivity for the glaciofluvial units, 8×10^{-4} m/s to 2×10^{-6} m/s, confirms that these units are more permeable and may act as preferential pathways for seepage from the TSF. Conversely, the range in hydraulic conductivity for the glaciolacustrine deposits, 7×10^{-8} m/s to 2×10^{-10} m/s, confirms that these units have a low permeability and may act as barriers for seepage migration and/or as confining units where they occur directly above glaciofluvial units, and could potentially cause artesian pressures in the underlying glaciofluvial units.

Material properties for seepage analysis are included in Section 7.5.

4.8 Groundwater Geochemical Conditions

Baseline groundwater quality conditions are generally characterized by low concentrations of dissolved metals, sulphate, and nitrate and low to moderate hardness.

Over the last decade or so, although there were increasing parameter of interest concentration trends at some locations, significant changes to groundwater quality at the perimeter of the TSF has not been identified except with respect to sulphate. The concentration of sulphate in groundwater downgradient of the TSF at the Perimeter Embankment between Corner 1 and Corner 2 and at the South Embankment near Corner 3 approached or reached levels observed in the TSF pond water. The concentration of sulphate does not exceed the BC Ministry of Environment and Climate Change Strategy Contaminated Sites Regulation (BC ENV 1997) standards for protection of freshwater aquatic life and is monitored quarterly or semi-annually depending on location.

5.0 TAILINGS CHARACTERIZATION

5.1 Geotechnical Characterization

Typical characteristics of the tailings that have been deposited in the TSF are included in Table 4.

Table 4: Characteristics of Existing Tailings

Parameter		Value	Source/Comment
Gradation	Sand	31%–38%	Available particle size distributions are shown in Figure 1 In 2014, three particle size tests were undertaken on tailings samples collected from within the TSF near the Perimeter Embankment. The data indicate the tailings deposited near the embankment are generally silty sand/sandy silt (fines content 20% to 58%), likely due to varying degrees of segregation during deposition as conventional slurry
	Fines	62%–69%	
Plasticity		Non-plastic	Based on visual classification
Specific gravity of solids		2.7–2.8	Estimated based on KP (1990) and Golder (2015d)
Hydraulic conductivity		1×10^{-6} to 1×10^{-5} m/s	Considered to be representative of tailings deposited near the embankment Based on falling head laboratory testing (Golder 2015e) and estimated from available particle size distribution curves
Sub-aerial beach slope		0.5%–1%	Based on available topographic and bathymetric surveys since 2016
Sub-aqueous beach slope		2%–3%	Based on available topographic and bathymetric surveys since 2016
Average dry density after deposition		1.35 t/m^3	Assumed by WSP Assumed as 1.36 t/m^3 by KP (2005)

Three CPTs (CPT16-20, -21, and -22) were undertaken on the tailings beach in 2016 to maximum depths of up to 35 m below the tailings surface (Golder 2017b). The three tests were undertaken within 100 m of the upstream crest of the embankment. Using the Robertson (1990) soil behaviour type classification, the tailings materials were predominantly classified as interlayered silty sand, sandy silt, clayey silt, and silty clay. This classification is generally consistent with the findings of particle size tests undertaken on the tailings. The state parameter estimated for all CPTs was between about -0.2 and -0.1 for the first upper 5 to 10 m, and between about -0.1 and 0 below that depth, with the exception of a few thin layers with positive state parameter (Golder 2017b).

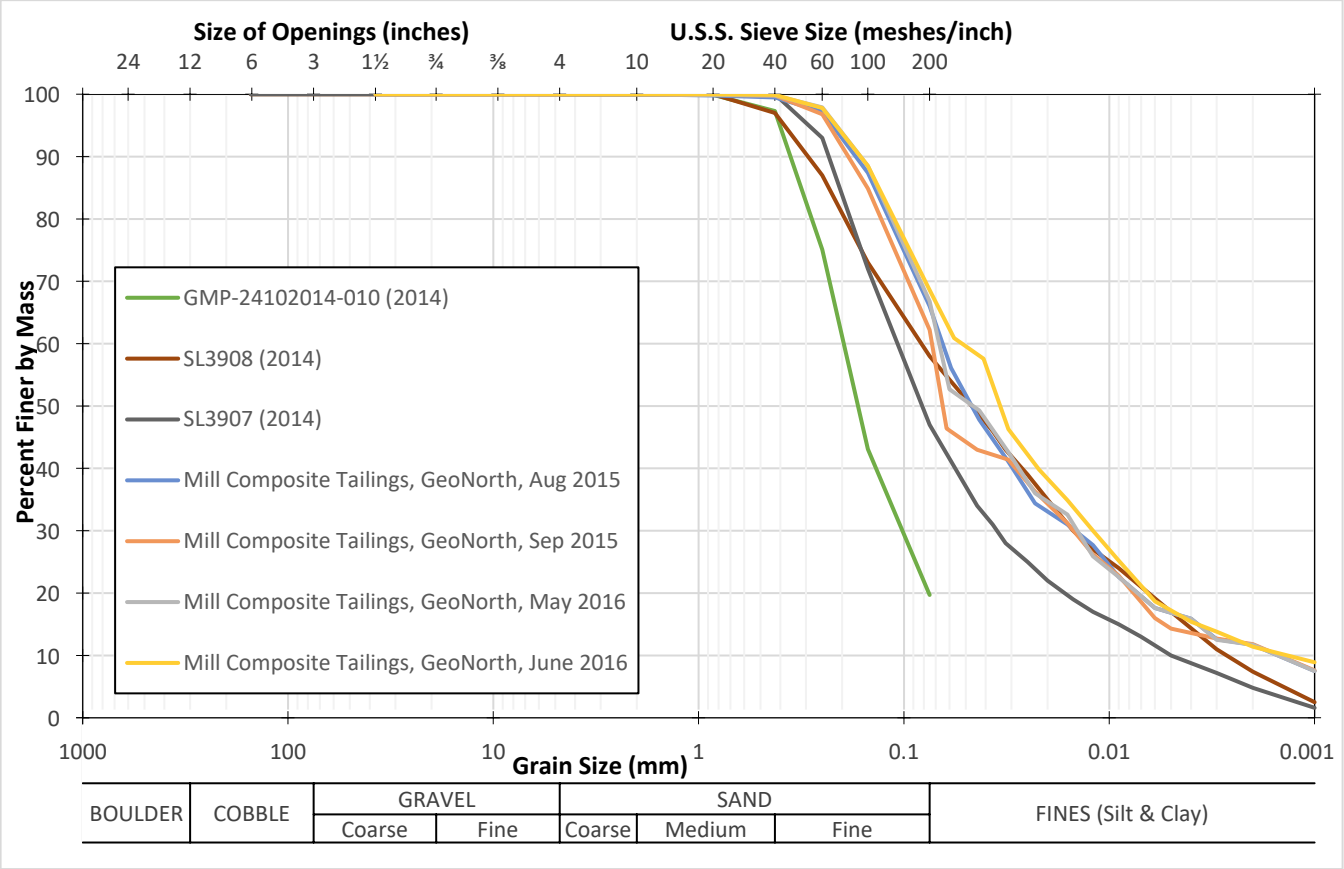

Figure 1: Gradation of Existing Tailings

5.2 Tailings Chemistry

The Mount Polley copper-gold porphyry deposit is classified as an alkalic porphyry copper gold deposit. The mined mineralized zones are enriched in copper and selenium relative to global norms. The tailings are lower in sulphide mineral content compared to the ore because most of the copper sulphides are removed through ore processing. In addition, mill process reagents, with the exception of lime, are not expected to be present within the tailings. Processing changes over time have been minimal and are not expected to affect the geochemical reactivity of the tailings; therefore, tailings geochemistry can be considered generally consistent over time (Kennedy et al. 2016; SRK 2022).

Mount Polley tailings are classified as non-acid generating based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014.

The leachate quality from humidity cell tests and column tests is described below:

- pH typically between 8.0 and 8.2
- sulphate concentrations initially on the order of 1,000 mg/L, with decreasing concentrations over time that reached lower stabilized values
- highest copper concentration of 0.15 mg/L in one test, but with typical maximum concentrations of 0.02 mg/L in humidity cell test leachates and 0.05 mg/L in column test leachates

- highest selenium concentrations were 0.01 mg/L in humidity cell test leachates and 0.06 mg/L in column test leachates
- molybdenum concentrations initially between 2 and 3 mg/L in column leachates

The measured concentrations at the TSF supernatant pond are generally below Permit limits, with the exceptions for total copper, total phosphorous, total arsenic, total zinc, and dissolved aluminium (WSP 2023d). The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility in 2018 (Golder 2022), which has since been decommissioned. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process.

6.0 DESIGN DESCRIPTION

This section includes a description of the design, materials and zoning, surface and foundation preparation, abutment details, water management, and details of the upstream drains and tailings management.

6.1 Overview of Embankment Raise

The TSF embankment (Main, Perimeter, and South embankments) is constructed to a maximum elevation of 970 m. The design of the TSF to elevation 974 m provides storage capacity for tailings production of approximately 24 million tonnes (Mt; based on current beach slopes and includes the remaining storage capacity of the permitted 970 m raise based on the 2019/2020 survey of the tailings surface).

The embankment raise to elevation 974 m includes:

- extension of portions of the buttresses along the Main and Perimeter embankments
- resloping of the South, Main, and Perimeter embankments to 2H:1V
- extension of the embankments at the south and north abutments
- construction of a drain upstream of the till core along the embankments

The facility will require a rate of rise of about 2 m per year (i.e., to about elevation 972 m in 2024 and to 974 m in 2025) to accommodate the planned tailings production.

6.2 Embankment Materials and Zoning

The embankment raises will consist of the components detailed in Table 5. A typical section is shown in Figure 2. Technical specifications detailing placement and compaction and quality assurance and quality control requirements for the materials listed in Table 5 are included in Appendix B.

Table 5: Embankment Zoning

Name	Zone	Description and Purpose
Upstream fill	U	Minimum 20 m wide fill zone to provide upstream support to Zone S (till core)
Till core	S	Minimum of 5 m wide low hydraulic conductivity element, placed upstream of Zone F (filter)
Filter	F	Minimum of 1.5 m wide, placed upstream of Zone T (transition) and downstream of Zone S (till core). Zone F is designed to be filter compatible with Zone S and the foundation till and prevent erosion of Zone S and foundation till into the voids of Zone T
Transition	T	Minimum of 1.5 m wide, placed upstream of Zone C (compacted embankment rockfill) and downstream of Zone F (filter). Zone T is designed to be filter compatible with Zone F and prevent erosion of Zone F into the voids of Zone C
Compacted embankment rockfill	C	Minimum 10 m wide, placed downstream of Zone T (transition) and compacted in 1 m layers
Embankment rockfill	-	13 m wide at elevation 974 m, placed downstream of Zone C (compacted embankment rockfill). The downstream face of the embankment rockfill will be 2 horizontal to 1 vertical (2H:1V)
Buttress rockfill	-	3H:1V downstream face, which will impose a low shear stress on the foundation soils due to the flatter downstream slope and increase the length of potential slip surfaces passing through the foundation soils, thereby resisting force and improving stability

Note: Materials are listed in order from upstream to downstream of the embankment. Materials for construction of the upstream drain are included in Section 6.6.

- = not applicable.

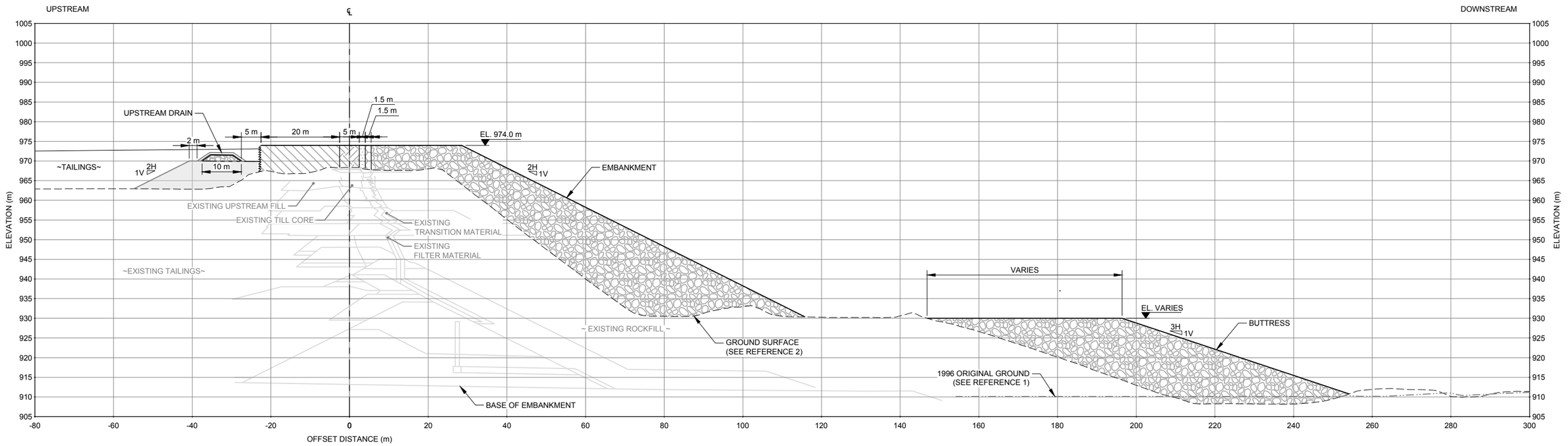

TYPICAL CROSS-SECTION

SCALE 1:500 m

0 20 40

1:500 METRES

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LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- NON-WOVEN GEOTEXTILE
- ROCKFILL (ZONE C)
- TRANSITION MATERIAL (ZONE T)
- FILTER MATERIAL (ZONE F)
- TILL CORE (ZONE S)
- UPSTREAM FILL (ZONE U)
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, REFER TO DESIGN DRAWINGS.
4. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
5. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
6. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: WSP

YYYY-MM-DD	2024-04-18
DESIGNED	S. BAINBRIDGE
PREPARED	T. KLASSEN
REVIEWED	S. BAINBRIDGE
APPROVED	G. PIZARRO

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
TYPICAL CROSS-SECTION

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	51300/51395/014	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds.golder.com\le-vdata\office\Vancouver\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\CA0020527_4505\51300\51395\Doc 014_974 Design\02_PRODUCTION\DWG\Figures\ | File Name: CA0020527_4505-51300-51395-014-02.dwg | Last Edited By: lyklassen Date: 2024-03-22 Time:3:25:12 PM | Printed By: TYKlassen Date: 2024-04-17 Time:9:47:30 PM

The gradation envelops of embankment construction materials are presented in Figure 3. All fill materials will be non-acid generating.

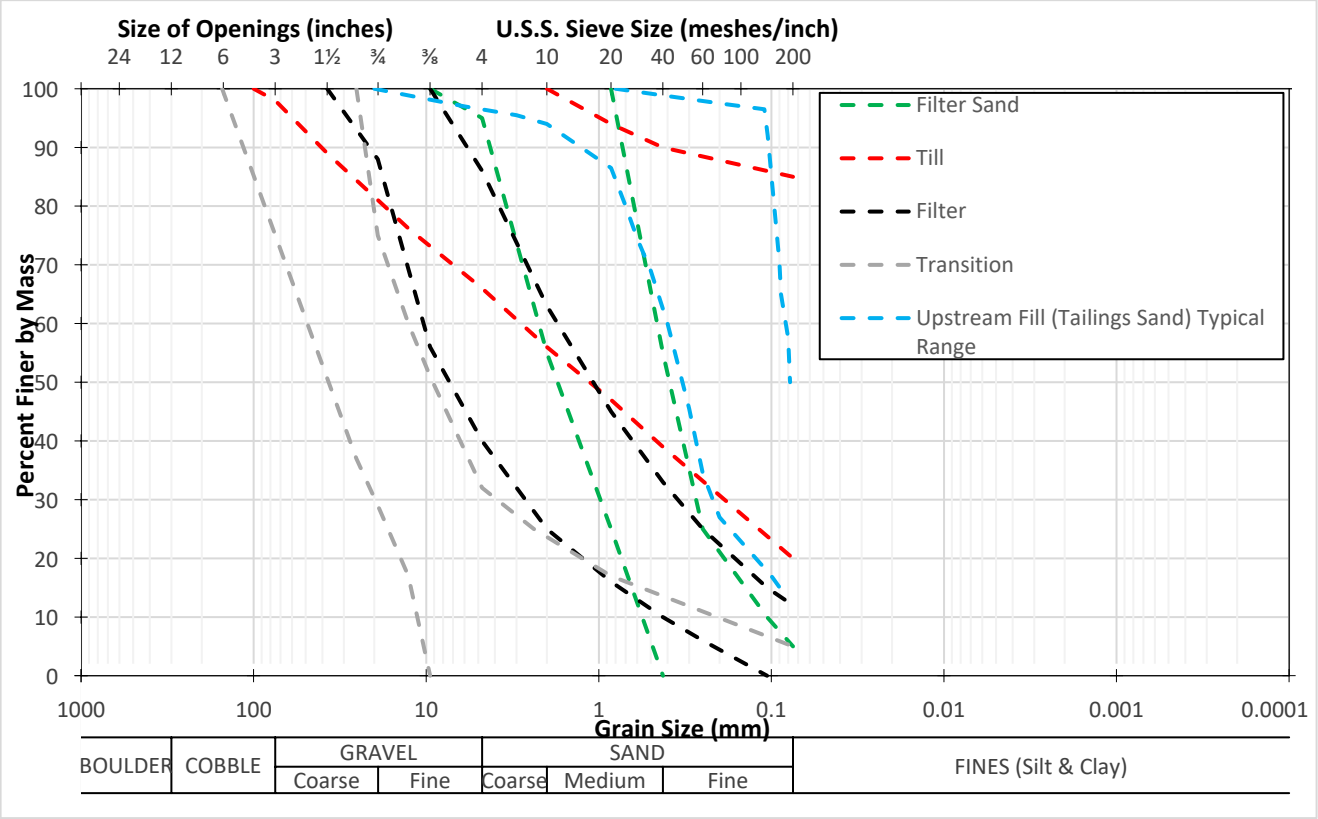

Figure 3: Embankment Construction Material Particle Size Distribution Envelopes

The filter, filter sand, and transition materials have been designed to meet modern filter criteria (USBR 2011; FEMA 2011; Fell et. al 2015; USDA 2017) with a modification on the maximum sand content (i.e., 40%) in the filter band based on laboratory testing (Eldridge and Gilmer 2002). The laboratory testing was carried out on crushed aggregates with a similar gradation under hydraulic gradients much greater than those expected in the Mount Polley TSF.

The filter, filter sand, and transition gradation envelope requirements for construction of the embankment to elevation 974 m remain unchanged from the filter, filter sand, and transition gradation envelopes specified for construction of the embankment to elevation 970 m (Golder 2015b). Fill materials will be produced, stockpiled, hauled, and spread in a manner to minimize segregation. Materials not complying with the specification will not be used in the construction.

6.3 Foundation Preparation

Foundation preparation is required at the following locations prior to any fill placement:

- at the north and south abutments
- along the foundation of the South Embankment reslope
- along the foundation of the Main and Perimeter embankments buttress extension

Stockpiled material, vegetation, and topsoil is to be stripped along the footprint of the abutments, South Embankment reslope, and buttress extensions. Stripped material will be managed in accordance with MPMC soil management programs. The extent of the foundation preparation is shown in Drawings 05, 09, 15, and 20 (Appendix A), and details are provided in the technical specification (Appendix B).

6.3.1 North and South Abutments

The embankment will extend onto natural ground at the north and south abutments (i.e., Corner 4 and Corner 5). The abutment details will consist of the till core tied into competent till or onto bedrock. A filter blanket is to be placed downstream of the till core, along the till foundation. The embankment design at the abutments is shown in Drawing 25, Appendix A. Foundation preparation will consist of removal of topsoil, organics, and soft or loose soil to expose competent till. Where the till foundation is greater than 2 m thick, the till core will be keyed into the till. Where the till is less than 2 m, the till core is to extend down to competent bedrock. The depth of the till foundation will be confirmed by the excavation of test pits.

Where excavation is required to bedrock, highly fractured and weathered bedrock overlying sound bedrock is to be removed. The surface of the exposed bedrock is to be cleaned of all soil and loose bedrock. Depending on the condition of the bedrock and the opinion of the geotechnical engineer, additional treatment may be required, which may consist of the placement of bentonite, shotcrete, or slush grout.

The biosolids stockpile at the north abutment is to be excavated to the extents necessary for foundation preparation. The final limits of foundation preparation at the abutments will be confirmed by the geotechnical engineer during construction.

Placement of a till blanket may be required at the south abutment after foundation preparation is completed to grade the surface so it drains downstream from the till core.

6.4 Water Management

The Mount Polley Mine site has an annual net water surplus, and discharge from the mine site is necessary to manage the mine site water and to prevent accumulation of water on the mine site year over year.

Water management will be consistent with practice to date. Temporary detention of water is necessary in the TSF to manage runoff volumes generated during the freshet; however, the fundamental basis of the water management plan is to not accumulate water on site (including the TSF) by treating and discharging water and to not carry over water from year to year even under extreme wet conditions.

The majority of water inflows into the TSF are pumped and are therefore in the direct control of the operator. The inflows into the TSF are as follows:

- water discharged with the tailings slurry, at approximately 35% solids by weight
- water pumped from the site water management structures for temporary detention in the TSF during freshet or high precipitation events

The water inflows to the TSF that are not pumped, and therefore not in the direct control of the operator, are as follows:

- precipitation on the direct footprint of the TSF (approx. 2.38 km^2)
- runoff from the catchment directly above the TSF (approx. 1.19 km^2)

Outflows from the TSF consist of the following:

- reclaim water pumped to the mill or Perimeter Embankment Till Borrow Pond by means of a floating barge within the TSF pond
- seepage through the embankment, upstream drains and foundation to the seepage collection ponds
- evaporation losses from the TSF pond and wet tailings beaches
- water retained in the newly placed tailings

The TSF will be managed by maintaining the pond volume within the normal operating range (i.e., 1.5 to 1.7 million m^3) for reclaim water and make-up water.

6.5 Tailings Management and Deposition

Tailings management and deposition will be consistent with practice to date. Tailings will be deposited as a slurry with approximately 35% solids by weight. The tailings will be discharged along the embankment crest and will form an average beach slope of approximately 0.5% to 1%. The sub-aqueous tailings will form a steeper slope of approximately 2% to 3%. It is assumed that the maximum pond depth during normal operation is about 4 m at the location of the reclaim barge.

Deposition of the tailings will be planned to maintain the pond near the centre of the facility and against the natural topography on the western perimeter. A minimum beach length of 100 m will be maintained between the TSF pond and the embankment during normal operations. To enable management of the pond against the natural ground and to maintain a minimum beach length of 100 m, the barge will need to be relocated to a central location between Corner 4 and Corner 5.

The location of the pond over the period of operations up to elevation 974 m for the TSF is shown in the tailings deposition figures in Appendix F.

6.6 Upstream Drain

The hydraulic head imposed on the embankments will be controlled by the construction of an upstream drain along the upstream side of the embankments. The upstream drain will be constructed at about elevation 970 m along the Main Embankment and from Corner 1 to Corner 2 at the Perimeter Embankment. Along the South Embankment and at the Perimeter Embankment at Corner 1, the upstream drain may be constructed higher up to elevation 972 m.

The upstream drain will collect water from the tailings in the TSF and will discharge the water outside of the TSF into the downstream water management infrastructure. The upstream drain will also promote drainage and consolidation of newly placed tailings.

The upstream drain has been sized to convey flows for a crest elevation of 987 m. Details for the upstream drain are included in Section 7.6.

7.0 DESIGN ANALYSES AND ASSESSMENTS

The design of the Mount Polley TSF raise to elevation 974 m was informed by the studies and assessments presented in this section:

- site and deposition technology selection
- water balance
- storage capacity analysis
- filter compatibility assessment
- seepage analysis
- upstream drain design
- slope stability analysis
- stress-deformation analysis
- freeboard and spillway design
- closure considerations
- risk review and design controls

7.1 Siting and Deposition Technology

Typically, a single consolidated TSF is preferred over multiple smaller TSFs; however, there are cases where multiple TSFs may be a preferred option. This section provides a summary on the selection of a site for tailings management at the Mount Polley Mine site and on best available technology and best applicable practices for tailings deposition as it relates to Mount Polley Mine. The study is provided in Appendix D.

7.1.1 Objectives

In selecting potential locations and technologies for the storage of tailings, the following objectives are to be met (BC MEM 2016):

- Provide secure and permanent storage facility.
  - physical stability
  - chemically and biologically stable, or be designed to mitigate transport of contaminants into the receiving environment
- Minimize additional land disturbance (i.e., additional footprint of the facility).
- Maximize in-pit or underground backfill.
- Minimize impacts to receiving environment.
- Minimize social impact (e.g., negative public perceptions, disruption of traditional land use).
- Minimize cost, including the costs for investigation, design, procurement, construction, operation, and closure.

- Incorporate post-closure land use objectives.
- Limit the amount of free water within the impoundment.

7.1.2 Site Alternatives and Available Deposition Technologies

A siting and deposition technology assessment was completed as part of the Mount Polley TSF elevation 984 m LoM feasibility design (Golder 2015c). The study included a review of available tailings deposition technologies; a review of potential sites to deposit tailings; and an assessment of the alternatives based on environmental, social, technical, and economic indicators. Deposition of the remaining LoM tailings (i.e., about 70 Mt at the time) as a slurry within the existing TSF was identified as the best available option in 2015 (Golder 2015c).

The site and deposition technology assessment was revisited in 2022 to incorporate updated conditions, including tailings deposition since the restart of operation in 2016 (i.e., about 20 Mt), and remaining LoM production (i.e., 62.8 Mt) and to assess the alternative of co-disposal of hydro-cyclone underflow in the southeast rock disposal site. This is included in Appendix D.

The potential sites identified for the TSF included:

- existing TSF
- new TSF location (four potential locations were identified)
- lake deposition (e.g., Polley Lake, Bootjack Lake, Quesnel Lake)
- open pit deposition (e.g., Springer Pit, Cariboo Pit, Wight Pit, Bullion Pit)
- underground deposition
- co-disposal with waste rock (e.g., southeast rock disposal site)

The existing Mount Polley open pits and underground working were eliminated from further consideration as these are either active mining areas or used for site water management.

The available tailings management technologies are differentiated primarily by the water content of the tailings, which determines the transportation method and the deposition method. The following technologies are available and were included in the 2022 assessment:

- low solids content tailings slurry (i.e., conventional tailings or unthickened tailings)
- thickened (non-segregating) tailings
- paste tailings
- filter tailings
- hydro-cyclone classified tailings

7.1.3 Findings and Recommended Site and Deposition Technology

The findings from the 2022 siting and deposition assessment regarding the range of options considered were as follows:

- The best available option is to store the tailings produced in the remaining LoM within the existing TSF as conventional slurry. This is because:
  - The existing TSF has the best-studied foundation conditions of any of the potential TSF locations. A new land-based TSF footprint is unlikely to offer advantages over the existing TSF footprint. Using a different land-based site would require significant investigation, add to the disturbed area of the mine, and require more closure work at the completion of mining.
  - Conventional tailings can be operated in a manner that reduces both the likelihood (conservative assessment of soil strength and adoption of conservative design criteria resulting in wide buttresses along the embankments) and consequence of failure (wide beaches, relatively dense tailings, and a small pond volume) provided accumulation of water does not occur.
- Separating the tailings into fine (overflow) and coarse (underflow) fractions with hydro-cyclones could reduce the amount of tailings to be stored in the TSF by 10% to 30% if the coarse fraction is placed in the southeast rock disposal site; however, a separate water management pond with a storage capacity of about 4 million m^3 to manage the 1:200-year freshet volume would be required. A separate water management pond would require significant investigation (foundation conditions would be required to be characterized to a sufficient level to enable appropriate design), add to the disturbed area of the mine, and require more closure work at the completion of mining.
- Thickened tailings offer limited advantages over conventional tailings as the mine site has an overall positive water balance and the TSF or a new dam would be required to manage freshet water.
- The high capital cost of a filter plant may not be economic given the relatively short remaining LoM. A separate water management pond with a storage capacity of about 4 million m^3 to manage the 1:200-year freshet volume would also be required.
- Deposition of tailings in deep lakes provides numerous advantages in terms of the physical and chemical stability of tailings; however, the permitting of such facilities is difficult, particularly when the lakes provide habitat for fish.
- The only advantage to using the Bullion Pit is that an area with significant historical mining disturbance could be restored to a landscape similar to the pre-mining condition. The delay to the mine operation related to the investigation and design of the containment structures and the seepage control system to minimize water loss to the Quesnel River, coupled with the increased costs for transporting the tailings to the Bullion Pit and water from the Bullion Pit to the mine and the need for an environmental impact assessment, make this alternative unattractive, and, likely would prevent continuation of operations.

The study recommends that the tailings produced in the remaining LoM be transported as conventional (slurry) tailings to the existing TSF and be managed using best applicable practices, including:

- routine and sustained discharge of mine water such that the volume of water stored in the TSF is maintained low

- managing the pond in the TSF such that beaches are maintained upstream of the embankments throughout the operational life of the TSF
- providing drainage to promote the desaturation and densification of the tailings

7.2 Tailings Storage Facility Water Balance

The SWWBM (site-wide water balance model) supports water management planning and the assessment of water quality and associated water treatment and discharge options. The last SWWBM was updated to reflect the Springer Expansion LoM plan during the operational phase and incorporates closure and post-closure phases for Mount Polley Mine (WSP 2023c), which include a hypothetical raise of the TSF to elevation 987 m.

The stage-storage curves projected up to a crest elevation of 987 m constitute a snapshot that changes with time as tailings are deposited.

The SWWBM was run with probabilistic monthly climate inputs for this assessment. To develop probabilistic inputs, monthly precipitation data in the *Mount Polley Mine Climate Baseline Update* (Golder 2022) were fitted to a log-normal probability distribution.

The minimum and maximum operational water volumes set in the SWWBM for the TSF under normal conditions are 1.5 million m^3 and 1.7 million m^3, respectively. The TSF pond volume in the SWWBM is set at 1.5 million m^3 prior to freshet. When the maximum normal operating volume of 1.7 million m^3 is exceeded the model starts pumping water out of the TSF to return the pond volume to the specified normal operating range after freshet.

During closure and post-closure, the TSF pond is modelled to discharge annually via a spillway, and the TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 million m^3.

Results of the SWWBM presented in Figure 4 show the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF volume pattern shown for the 2041 to 2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131).

It is important to point out that the SWWBM was run for the Springer Expansion LoM plan, which includes raising the TSF to 987 m. The TSF raise to elevation 974 m is expected to be reached by 2026. If the TSF were to initiate closure at elevation 974 m, the closure scenario, with the pond reduced to 0.25 m^3, is applicable and the results presented for closure and post-closure are expected to be similar.

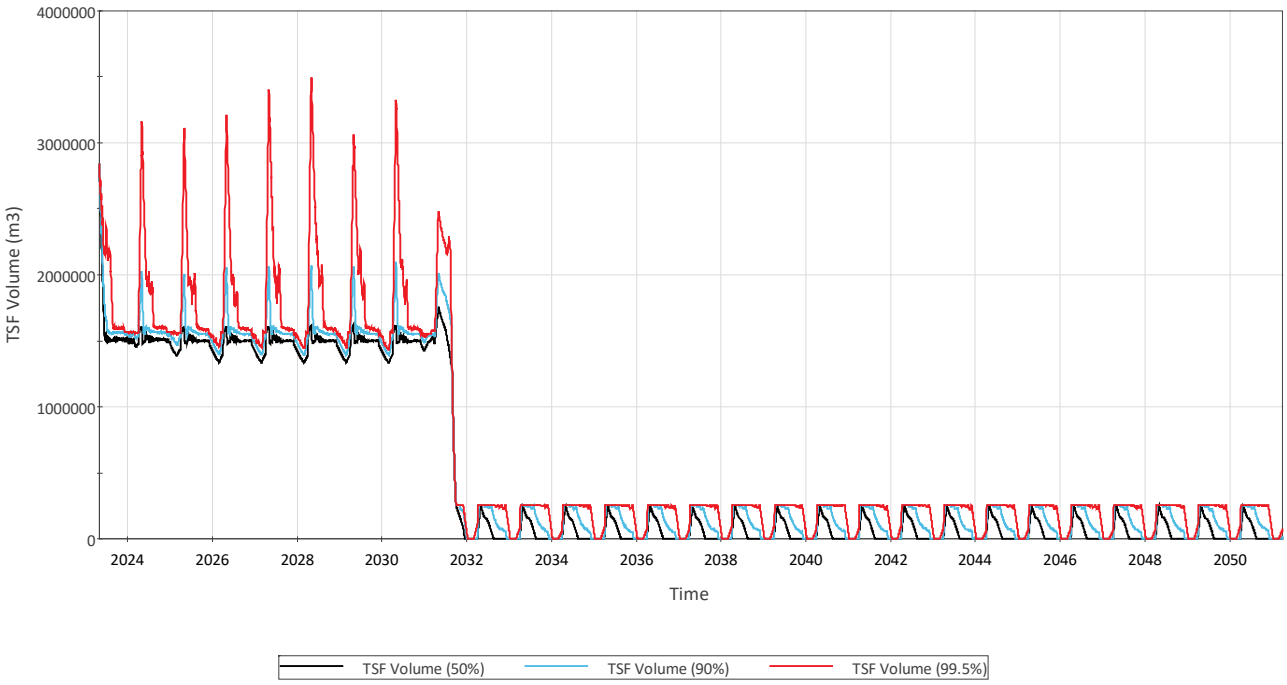

TSF = tailings storage facility.

Figure 4: Tailings Storage Facility Water Volume from Operations to 10 Years after Post-closure – Springer Expansion Life of Mine Plan

Table 6 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 4. The bounds presented represent the minimum, average, and maximum values for each percentile during the operational period: TSF operation to crest elevation 987 m (2023–2031), closure period (2031–2041), and post-closure period (from 2041).

Table 6: Tailings Storage Facility Water Volume (m^3) – Springer Expansion Life of Mine Plan

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,331,000	1,392,000	1,434,000
	Average	1,478,529	1,562,418	1,796,559
	Maximum	1,624,000	2,097,000	3,504,000
Closure	Minimum	0	0	0
	Average	119,426	188,747	266,028
	Maximum	1,762,000	2,030,000	2,507,000
Post-closure	Minimum	0	0	0
	Average	50,748	115,988	182,703
	Maximum	252,571	252,571	252,571

7.3 Tailings Storage Capacity

Tailings storage capacity analysis was undertaken for the TSF to determine the volume of tailings that can be stored in the TSF with a crest elevation of 974 m and provide input to the embankment raise construction schedule. The tailings deposition was modelled using Muk3D v2022.1.1 developed by MineBridge Software Inc. The base surface used for the deposition modelling was generated by combining a topographic survey completed on October 18, 2019, and a bathymetric survey completed on June 17, 2020. Deposition of tailings into the TSF was halted prior to the topographic survey in October 2019 and resumed in June 2022.

The parameters adopted for the deposition model are presented in Table 7.

Table 7: Parameters Adopted for Tailings Storage Facility Deposition Modelling

Parameter	Value	Notes
Tailings slope	0.5% sub-aerial 2% sub-aqueous	Range based on available topographic and bathymetric surveys since 2016
	1% sub-aerial 3% sub-aqueous	
Operational pond volume	1.5 million m^3	Pond volume to be maintained during normal operating conditions
Pond depth	4 m (beneath the reclaim barge)	Estimated for normal operation conditions based on available bathymetric surveys since 2016

Modelling of the deposition was conducted such that the pond is maintained away from the embankments and against the natural topography on the western perimeter of the TSF. To enable management of the pond against the natural ground and to maintain a minimum beach length of 100 m, the reclaim barge will need to be relocated to a central area between Corner 4 and Corner 5. It is important to note that maintaining a minimum beach length of 100 m, as required by the quantitative performance objectives, becomes more challenging with shallow tailings slopes and it is not a desired condition.

The tailings storage capacity (tonnage) versus tailings discharge elevation for the adopted range of tailings slopes is presented in Table 8. Selected stages of the deposition modelling are presented in Appendix E. Deposition timelines and construction scheduling based on these tonnages are discussed in Section 10.0.

As discussed in Section 7.10, a tailings freeboard (i.e., elevation difference between the top of tailings and the crest of the embankment) of 0.9 m is required to maintain adequate water storage capacity for temporary retention of site water generated from large freshet or precipitation events. This tailings freeboard is based on a 0.5% sub-aerial beach slope, which is what has been achieved with recent operations. Tailings freeboard may be increased or reduced during operations based on actual tailings deposition slopes; the tailings freeboard will be included as part of the quantitative performance objectives and changes must be agreed upon with the Engineer of Record.

Table 8: Tailings Capacity vs Tailings Discharge Elevation for Tailings Storage Facility Crest Elevation 974 m

Tailings Elevation (m)	Tailings Slope: 0.5% Sub-aerial, 2% Sub-aqueous		Tailings Slope: 1% Sub-aerial, 3% Sub-aqueous	
	Volume (million m^3)	Tonnage (Mt)	Volume (million m^3)	Tonnage (Mt)
970.0	12.06	16.28	9.33	12.59
972.0	16.02	21.63	13.14	17.74
973.1	17.78	24.01	14.90	20.11

Mt = million tonnes.

It is important to note that shallow tailings slopes are not a desired condition as meeting the quantitative performance objectives will be increasingly challenging. Introduction of a tailings freeboard is a result of the approximate 0.5% sub-aerial beach slopes achieved during recent operations. The tailings freeboard could be reduced, and larger tailings storage capacity made available, if steeper beach slopes were achieved.

7.4 Internal Erosion

The purpose of the filter, filter sand, and transition zones is to prevent erosion of the till core and till foundation into the voids of the rockfill shell.

The specified gradations of filter, filter sand, and transition materials have been designed to meet modern filter criteria (USBR 2011; FEMA 2011; Fell et al. 2015; USDA 2017) with a modification to the maximum sand content (i.e., 40%) in the filter band based on laboratory testing (Eldridge and Gilmer 2002). The filter, filter sand, and transition gradation envelope requirements for construction of the embankment to elevation 974 m remain unchanged from the filter, filter sand and transition gradation envelopes specified for construction of the embankment to elevation 970 m (Golder 2015b).

A detailed assessment of the adequacy of the embankment filter and transition constructed prior to August 2014 is presented in Golder (2016b). A summary of the assessment is included in Sections 7.4.1 to 7.4.3.

7.4.1 Till Core – Filter Compatibility

The filter compatibility assessment between the till core and filter materials was carried out following the criteria presented in Fell et al. (2015) and representative envelope of grain size distribution curves for all stages of construction. Figure 5 shows the filter compatibility criteria and the grain size distribution envelopes for the till core and filter material. The results show a portion of the till core and filter grain size distributions as constructed do not meet filter compatibility criteria.

To assess filters on existing dams, Foster and Fell (2001) developed a method based on laboratory tests and analysis of dams that have experienced piping incidents, defining erosion boundaries:

- “No erosion – practically no erosion; i.e., <10 g of base material for cohesionless soils and no visible erosion of the preformed hole in cohesive soils.”
- “Some erosion and excessive erosion – filter seals after ‘some’ erosion of the base material.”
- “Continuing erosion – for the cases where the filter was too coarse to allow the eroded base materials to seal the filter, resulting in unrestricted erosion of the base soil.”

The no erosion, excessive erosion, and continuing erosion boundaries for the compatibility of the till core–filter materials are presented in Figure 5. In this case, the no erosion criteria coincide with the filter criteria. The results show that a portion of the filter grain size distributions as constructed is in between the no erosion and some erosion boundaries, and therefore the filter would seal after “some” erosion of the till core.

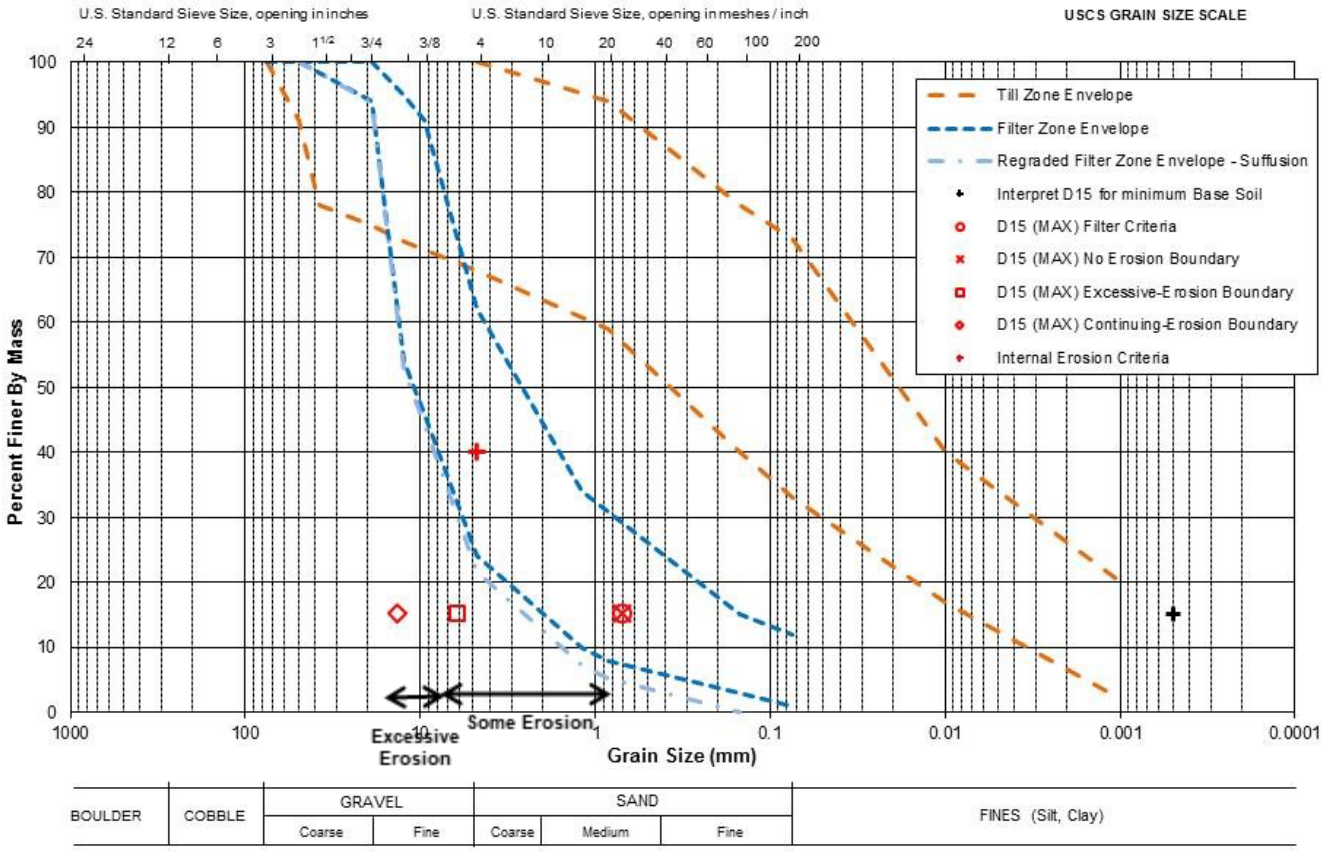

Figure 5: Filter Compatibility between Till Core and Filter Materials Constructed Prior to August 2014

Prior to the breach of the Perimeter Embankment, no signs of erosion or sinkholes were reported and the maximum hydraulic gradient imposed on the till core of the embankment was in the order of 5. As noted in International Commission on Large Dams (ICOLD) Bulletin 164, “The available evidence on the occurrence of global backward erosion (see Figure 2.7 in Section 2.3.2.2) in central core dams is that this internal erosion mode will only occur at relatively high gradients except when the core consists of cohesionless, internally unstable soil subject to suffusion.” The till core is considered not to be susceptible to suffusion due to its plasticity. As noted in Bulletin 164, “for practical purposes Fell et al. (2008) have concluded that based on the data described available soils with Plasticity Index > 7 should be considered not subject to suffusion at the gradients usually experienced in dams and their foundations” (ICOLD 2013).

Based on the filter criteria results and observations prior to the breach, if the hydraulic gradients were to raise to a level sufficient to initiate backward erosion of the till core, some erosion of the till core could be expected before the filter seals it.

To reduce the hydraulic gradient through the till core, minimum 100 m beaches are maintained upstream of the embankments and the size and depth of the pond are limited to the minimum required to operate the process plant. These operational requirements are part of the design and operational philosophy and are included in the QPOs of the TSF.

The TSF raise from elevation 970 to 974 m will result in a small increase of the hydraulic gradient imposed on the till core (i.e., less than 1); however, in consideration of potential future raises, the design includes upstream drains between elevation 970 and 972 m to control the hydraulic head upstream of the embankment and therefore the hydraulic gradient across the till core. The design of the upstream drains is presented in Drawings 25 to 28 in Appendix A.

7.4.2 Filter – Transition Compatibility

The filter and transition grain size distributions as constructed meet filter compatibility criteria. Figure 6 presents the filter compatibility criteria and the grain size distribution envelopes for the filter and transition materials. The no erosion boundary is also included in Figure 6.

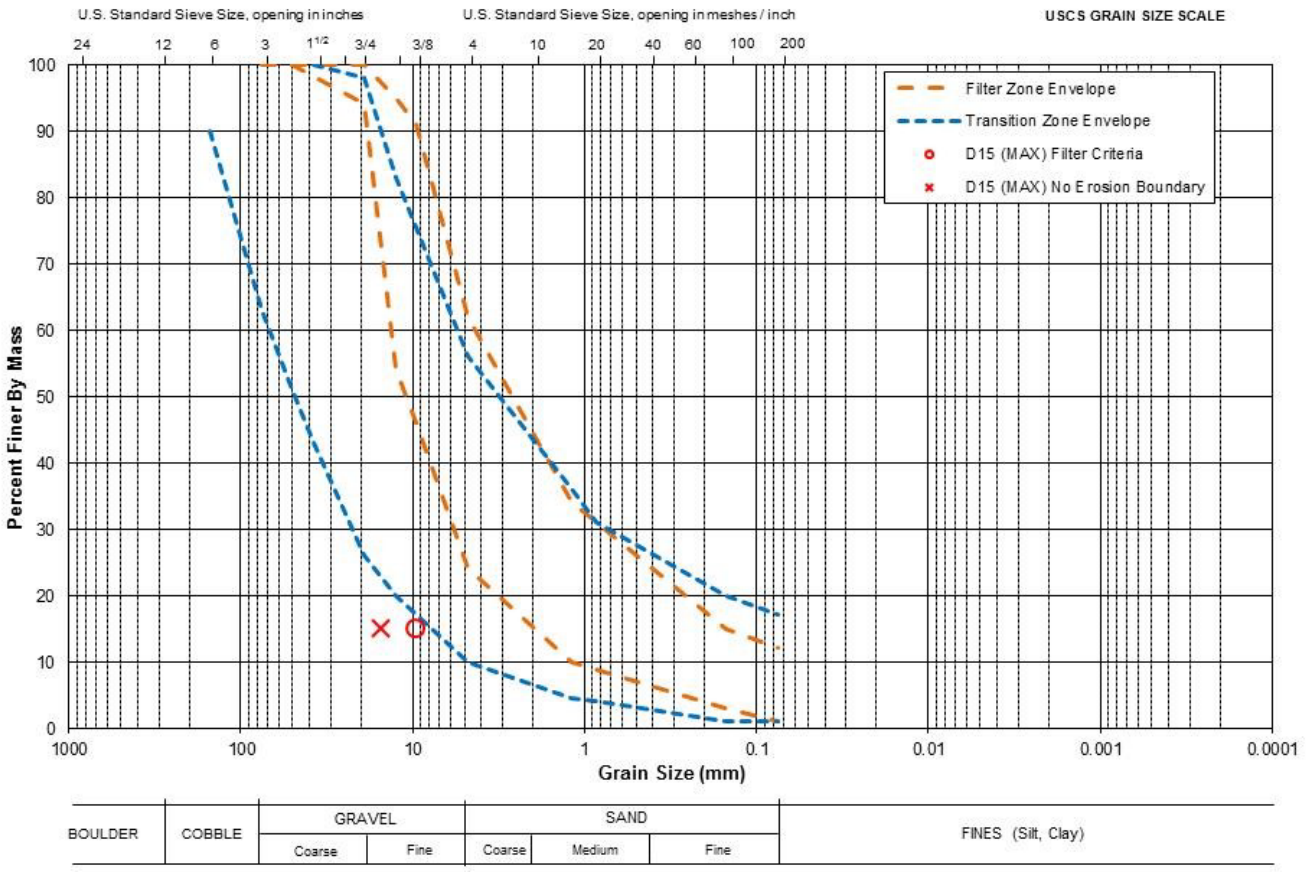

Figure 6: Filter Compatibility between Filter and Transition Materials Constructed Prior to August 2014

7.4.3 Transition – Rockfill Compatibility

The transition and rockfill grain size distributions as constructed meet filter compatibility criteria. Figure 7 presents the filter compatibility criteria and the grain size distribution envelopes for the transition and rockfill materials.

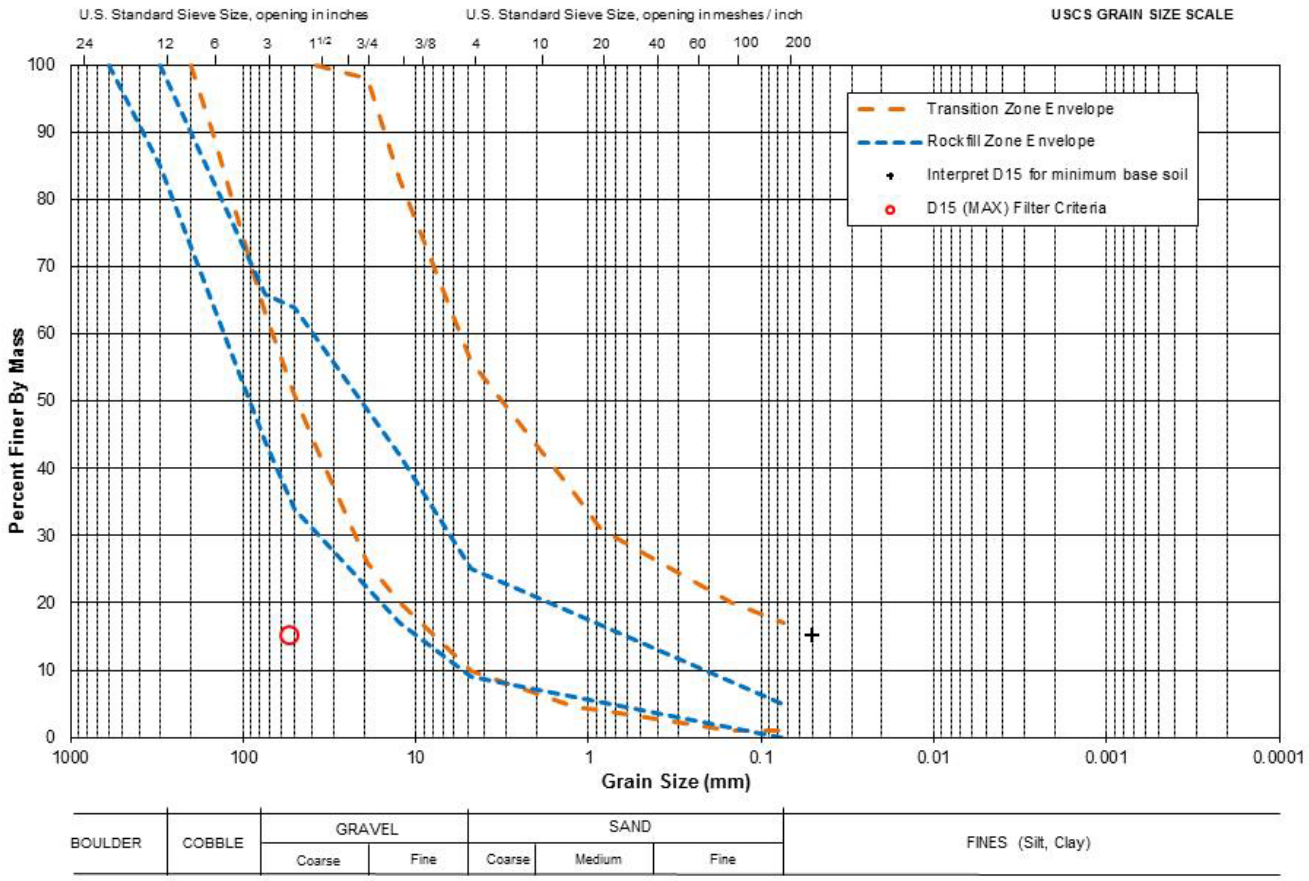

Figure 7: Filter Compatibility between Transition and Rockfill Materials Constructed Prior to August 2014

7.5 Seepage Analysis

Seepage analyses were carried out for typical sections of the elevation 974 m configuration of the South Embankment (Stn. 0+725), Main Embankment (Stn. 2+055), Perimeter Embankment (Stn. 3+765), and Perimeter Embankment at Corner 1 (Stn. 4+255) under steady-state conditions. The section at Corner 1 was analyzed to represent the portion of the embankment that includes a cut-off wall below elevation 950 m (from Stn. 3+996 to 4+464).

The analyses were conducted using GeoStudio 2023.1 from GEOSLOPE International Ltd. The objectives of the seepage analyses were as follows:

- to quantify anticipated seepage rates through the foundation, embankment, and proposed upstream drains
  - to assess sensitivity of the seepage rate through the embankment and foundation and the flow rate through the upstream drain for a range of beach widths (i.e., distance from the embankment to the pond: 0, 50, 100, 200 and 300 m)
- to determine phreatic surface geometries for use in stability analyses

Sensitivity analyses were undertaken to assess the flow rate through the upstream drain for the anticipated range of tailings hydraulic conductivity.

7.5.1 Material Properties Calibration

The tailings and foundation material properties were calibrated using available monitoring data at Corner 1 of the Perimeter Embankment (Stn. 4+255) and near the middle section of the Main Embankment (Stn. 2+055).

Section 4+255 (old Stn. 20+265; Golder 2015a) was selected for calibration of the hydraulic conductivity of the tailings using the estimated upstream drain flows and associated beach width and piezometric data. The hydraulic conductivity of the tailings was calibrated within a range of 1.0×10^{-4} m/s to 1.0×10^{-6} m/s, estimated from laboratory hydraulic conductivity tests and estimations based on particle size distribution (Section 5.1). Tailings anisotropy was estimated to have a horizontal to vertical permeability ratio of kh/kv = 0.1 based on interlayering typical of slurry-deposited tailings.

Section 2+055 (old Stn. 2+060) was selected for the calibration of the hydraulic conductivity of foundation materials and tailings using available vibrating wire piezometer (VWP) data and associated beach width. Material properties for both tailings and foundation materials were calibrated using various combinations to obtain a reasonable comparison between the available VWP data and the calculated phreatic surface in the model.

A distinction is made in the calibration model between tailings materials above and below elevation 960 m to reflect tailings that drained and consolidated following the 2014 embankment breach and tailings deposited since 2016.

The hydraulic conductivities assigned to foundation materials were calibrated within the ranges reported in the site characterization report (WSP 2023a).

The recorded seepage reporting to the Main Embankment Seepage Collection Pond was only used as reference in the calibration as reported flows include a combination of seepage through the embankment, flow through an upstream drain, flow from depressurization wells, and runoff.

The results of the calibration modelling are illustrated in Figures F-2 and F-3 in Appendix F. Calibrated material properties for the seepage analyses are presented in Table 9.

Table 9: Material Properties Used for Seepage Modelling

Name	Material Model	Saturated Hydraulic Conductivity K (m/s)	Anisotropy Ratio K_x'/K_y'	Notes
Foundation – glaciofluvial and till	Saturated only	1×10^{-6}	0.1	Adopted based on foundation characterization (WSP 2023a) and model calibration Glaciofluvial: 8×10^{-6} to 2×10^{-4} m/s Ablation till: 6.4×10^{-8} to 2×10^{-6} (mean 2×10^{-7}) Basal till: 4×10^{-8} to 2×10^{-6} (mean 3×10^{-7})
Foundation – glaciolacustrine	Saturated only	5×10^{-10}	1	Adopted based on foundation characterization (WSP 2023a) and model calibration HydrogeoSieveXL: 2×10^{-10} to 7×10^{-8} (mean 7×10^{-9}) From CPT: 3×10^{-9} to 6×10^{-8} (mean 2×10^{-8})
Rockfill	Saturated only	1×10^{-2}	1	Assumed by WSP

Table 9: Material Properties Used for Seepage Modelling

Name	Material Model	Saturated Hydraulic Conductivity K (m/s)	Anisotropy Ratio K_x'/K_y'	Notes
Tailings deposited since 2016	Saturated / unsaturated	1×10^{-5}	0.1	Estimated based on model calibration
Tailings deposited prior to August 2014	Saturated / unsaturated	1×10^{-6}	0.1	Estimated based on model calibration Available permeability test on tailings sample collected upstream of Corner 1 in 2014 = 2×10^{-6} m/s Estimated hydraulic conductivity using Hazen and Kozeny-Carman for a range of tailings gradations near the embankment = 4×10^{-5} to 8×10^{-6} m/s
Till core	Saturated / unsaturated	1×10^{-8}	1	Based on forensic investigation data and characterization of foundation till (WSP 2023a)
Filter, transition and upstream drain rock	Saturated / unsaturated	1×10^{-2}	1	Assumed by WSP
Upstream fill	Saturated / unsaturated	1×10^{-5}	1	Estimated based on model calibration of tailings
Cut-off wall	Saturated only	1×10^{-8}	1	Upper bound based on the hydraulic conductivity testing of samples taken from the cut-off wall (Golder 2015a)

Kx'/Ky' = horizontal hydraulic conductivity over vertical hydraulic conductivity

7.5.2 Boundary Conditions

The following boundary conditions were used:

- total head boundaries within the facility to define pond elevations for various beach length configurations
- zero-pressure boundaries along the ground surfaces beyond the buttress toe
- zero-flow boundaries within the upstream drain
  - A zero-flow boundary within the upstream drain acts as a sink, pulling water out of the model. This assumes the drain has enough capacity to maintain the phreatic surface at the elevation of the drain.
  - The flow rate at the point of zero-flow within the upstream drain does not report to the embankment buttress toe.
  - The upstream drain at elevation 950 m at Corner 1 was assumed to not be operating.

7.5.3 Seepage Analysis Results

The results of the seepage analyses are presented in Appendix F and summarized in Sections 7.5.3.1 to 7.5.3.3. The analyses were undertaken using the calibrated material properties in Table 9 and considering a range of beach widths (i.e., 0, 50 and 100, 200, and 300 m) to reflect variations in operational and upset conditions. The maximum beach width of 300 m represents a scenario where the operational (1.5 to 1.7 million m^3) pond is against the natural ground to the west of the TSF and there is even beach distributed across each of the embankments.

7.5.3.1 Phreatic Level and Hydraulic Gradient

Table 10 presents the phreatic level of the pond against the till core and the hydraulic gradient through the till core. The results presented are for a scenario where no upstream drain is constructed and with an upstream drain at elevation 970 m.

Table 10: Phreatic Level against the Till Core and Hydraulic Gradient across the Till Core

Embankment	Configuration	Phreatic Level and Hydraulic Gradient (K) at Till Core									
		No Beach		50 m Beach		100 m Beach		200 m Beach		300 m Beach	
		Phreatic Level (elev., m)	K	Phreatic Level (elev., m)	K	Phreatic Level (elev., m)	K	Phreatic Level (elev., m)	K	Phreatic Level (elev., m)	K
South Embankment	Without drains	973.6	4.5	972.0	4.2	970.4	3.9	967.1	3.2	963.6	2.5
	With drain at elev. 970 m	971.2	4.0	970.0	3.8	970.0	3.8	-	-	-	-
Main Embankment	Without drains	973.4	7.3	971.4	6.9	969.4	6.5	964.7	5.5	957.6	4.1
	With drain at elev. 970 m	970.7	6.7	970.0	6.6	970.0	6.6	-	-	-	-
Perimeter Embankment	Without drains	972.7	6.3	969.4	5.7	965.8	5.0	956.1	3.0	946.3	1.1
	With drain at elev. 970 m	970.2	5.8	-	-	-	-	-	-	-	-
Perimeter Embankment at Corner 1	Without drains	972.4	3.9	970.3	3.5	968.6	3.1	964.3	2.3	959.1	1.2
	With drain at elev. 970 m	971.0	3.6	970.0	3.4	-	-	-	-	-	-

Note: Till core elevation corresponds to 5 m till core width at elevation 951 m for the South Embankment, elevation 937 m for the Main Embankment and elevation 941 m for the Perimeter Embankment. The Perimeter Embankment at Corner 1 elevation 953 m is used where cut-off wall transitions to a 5 m wide till core.

Grey shaded cells indicate where phreatic level and hydraulic gradient are not reported for cases with drain at elevation 970 m where the phreatic level is lower than the drain.

The results show that the phreatic level and hydraulic gradient can be managed by maintaining wide tailings beaches upstream of the embankments and that the hydraulic gradient remains relatively low for normal operating and upset conditions.

The analyses also show that the upstream drains will start capturing water when the pond encroaches the embankment (i.e., 100 m beach or less). As discussed in Section 7.4, the upstream drains have been included in the design in consideration of potential future raises above elevation 974 m that would increase the hydraulic gradient imposed on the till core of the embankment. Changes to the hydraulic gradient through the till core will be relatively small (< 1) for the TSF raise from elevation 970 to 974 m. The intent of the upstream drains is to limit increases to hydraulic head upstream of the embankment, and hydraulic gradient through the till core, for crest elevations above 974 m and up to elevation 987 m.

7.5.3.2 Flow Rates through Upstream Drain

Seepage analyses were undertaken to quantify anticipated flows through the upstream drain at elevation 974 m to inform the design of downstream water management infrastructure. The results of the seepage analyses for flow through the upstream drain per embankment are summarized in Table 11.

The upstream drain has been designed to consider potential future raises of the TSF, up to elevation 987 m. Flows used to size the upstream drain are presented in Section 7.6.

Table 11: Flow through Upstream Drains at Tailings Storage Facility Elevation 974 m

Embankment	Total Flow through Upstream Drain per Embankment									
	No Beach		50 m Beach		100 m Beach		200 m Beach		300 m Beach	
	m^3/s	L/s	m^3/s	L/s	m^3/s	L/s	m^3/s	L/s	m^3/s	L/s
South Embankment	3.7×10^{-2}	36.9	5.7×10^{-3}	5.7	1.3×10^{-3}	1.3	-	-	-	-
Main Embankment	3.8×10^{-2}	38.3	5.1×10^{-3}	5.1	2.3×10^{-4}	0.2	-	-	-	-
Perimeter Embankment	5.1×10^{-2}	51.0	2.6×10^{-3}	2.6	-	-	-	-	-	-
Perimeter Embankment at Corner 1	1.3×10^{-2}	13.2	1.1×10^{-3}	1.1	-	-	-	-	-	-

Total flow through upstream drain per embankment calculated based on total length of upstream drains at each embankment:
South Embankment drain length of 1,050 m used to calculate flows.
Main Embankment drain length of 1,200 m used to calculate flows.
Perimeter Embankment drain length of 1,600 m used to calculate flows (includes section west of Corner 1 to Corner 5).
Perimeter Embankment at Corner 1 drain length of 400 m used to calculate flows.
Grey shaded cells indicate that the phreatic level is lower than the drain and negligible flows are observed through the upstream drains.

The existing upstream drain at elevation 950 m at Corner 1 was assumed to not be operational in the analyses to assess the potential flows that the upstream drain at elevation 970 m could experience.

The analysis shows that little to no flow is expected through the upstream drains for beach widths greater than 50 m. The upstream drain has been incorporated to account for future raises above 974 m and is not a critical control for managing hydraulic gradient at TSF elevation 974 m.

7.5.3.3 Seepage Rates through Embankment and Foundation

Seepage analyses were undertaken to quantify seepage rates through the embankment and foundation and to inform the design of downstream water management infrastructure. The results of the seepage analyses for seepage through the embankment and foundation are summarized in Table 12 and shown for the Main Embankment in Figure 8. The seepage values reported do not include flows through upstream drains.

Table 12: Flow through the Embankment and Foundation

Embankment		Total Seepage through Embankment and Foundation per Embankment									
		No Beach		50 m Beach		100 m Beach		200 m Beach		300 m Beach	
		m^3/s	L/s	m^3/s	L/s	m^3/s	L/s	m^3/s	L/s	m^3/s	L/s
South Embankment	Without drain	4.6×10^{-3}	4.6	4.3×10^{-3}	4.3	4.1×10^{-3}	4.1	3.6×10^{-3}	3.6	3.1×10^{-3}	3.1
	With drain	4.3×10^{-3}	4.3	4.1×10^{-3}	4.1	4.0×10^{-3}	4.0	3.6×10^{-3}	3.6	3.1×10^{-3}	3.1
Main Embankment	Without drain	8.4×10^{-3}	8.4	8.1×10^{-3}	8.1	7.8×10^{-3}	7.8	7.1×10^{-3}	7.1	6.1×10^{-3}	6.1
	With drain	8.1×10^{-3}	8.1	7.9×10^{-3}	7.9	7.8×10^{-3}	7.8	7.1×10^{-3}	7.1	6.1×10^{-3}	6.1
Perimeter Embankment	Without drain	1.5×10^{-2}	15.5	1.5×10^{-2}	14.6	1.4×10^{-2}	13.5	1.1×10^{-2}	10.9	8.4×10^{-3}	8.4
	With drain	1.5×10^{-2}	14.8	1.4×10^{-2}	14.4	1.4×10^{-2}	13.5	1.1×10^{-2}	10.9	8.4×10^{-3}	8.4
Perimeter Embankment at Corner 1	Without drain	9.4×10^{-3}	9.4	9.0×10^{-3}	9.0	8.6×10^{-3}	8.6	7.6×10^{-3}	7.6	6.3×10^{-3}	6.3
	With drain	9.1×10^{-3}	9.1	8.9×10^{-3}	8.9	8.6×10^{-3}	8.6	7.6×10^{-3}	7.6	6.3×10^{-3}	6.3

South Embankment length of 1,050 m used to calculate total toe seepage in L/s.

Main Embankment length of 1,200 m used to calculate total toe seepage in L/s.

Perimeter Embankment length of 1,300 m used to calculate flows (section west of Corner 1 to Corner 2). The Perimeter Embankment section modelled includes the Perimeter Embankment Till Borrow Pond and is considered an upper bound for seepage and not representative of the full length of the embankment.

Perimeter Embankment at Corner 1 length of 450 m used to calculate flows (one drainage panel).

The upstream drain has been modelled at elevation 970 m.

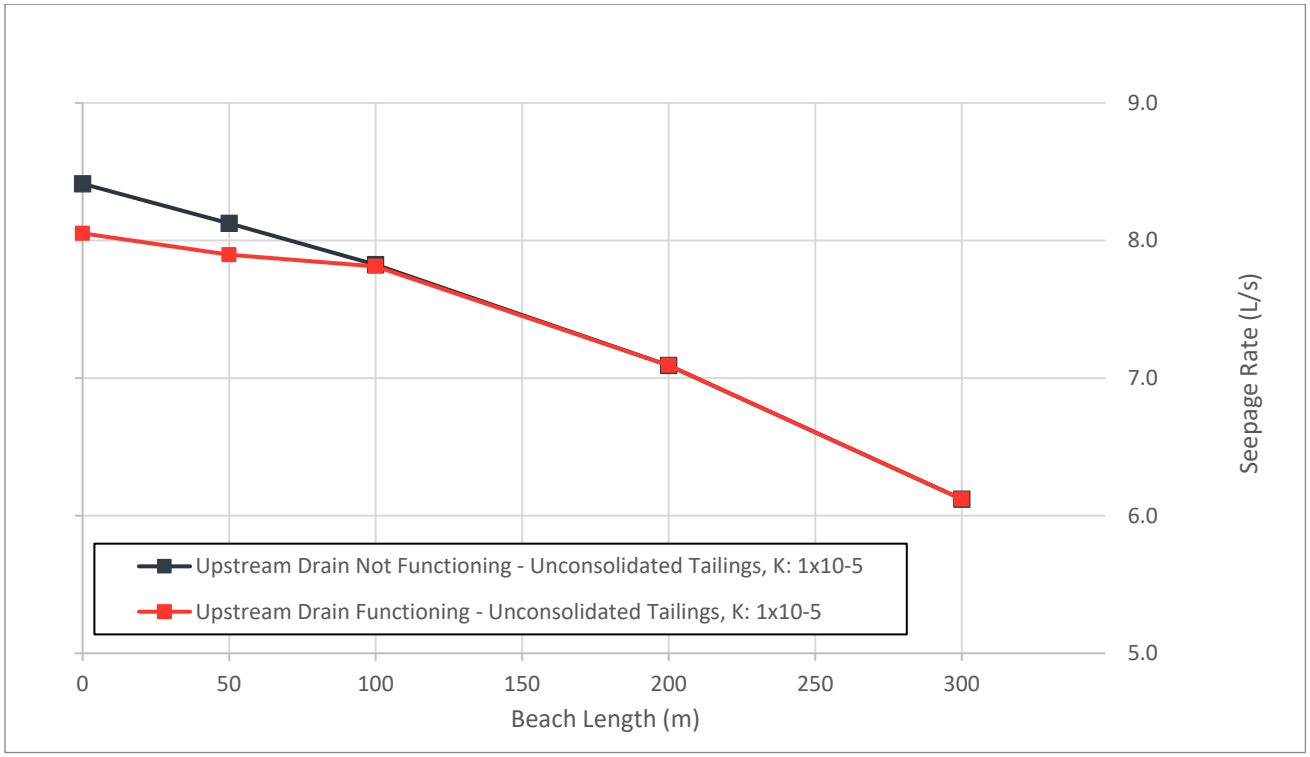

Figure 8: Main Embankment (Stn. 2+055) Total Seepage through Toe/Foundation

The seepage analyses carried out on typical sections of the embankment show that seepage from the TSF will not significantly increase by raising the TSF from elevation 970 to 974 m (WSP 2023b). The seepage rate will be dependent on the length of the tailings beach.

7.6 Upstream Drain Design

This section presents the upstream drain design capacity and layout. Design objectives for the upstream drain system are primarily for potential future raises above elevation 974 m and are to:

- control the hydraulic gradient across the till core by limiting the hydraulic head upstream of the embankment
- promote unsaturated conditions in the tailings above the drain
- promote consolidation of tailings above the drain and upstream of the TSF embankment

These objectives will be met by providing passive drainage of water from the tailings deposited upstream of the till core to the downstream water management infrastructure.

The upstream drainage system design is based on the configuration of the existing Perimeter Embankment upstream drain at Corner 1 and will consist of the following:

- A minimum of 1 m thick and 10 m wide layer of drain rock wrapped on a non-woven geotextile and placed on general fill. Bedding material will be placed under the geotextile at the base and over the drain rock.

- A series of pipe “panels” installed within the drain rock. Each panel consists of six to eight perforated high-density polyethylene (HDPE) drainpipes that connect to a solid HDPE connector pipe, which then conveys flow in one central solid HDPE pipe through the till core and to the downstream water management structures.
  - Each perforated drainpipe (sized as 6-inch DR9 HDPE) will be 10 m long and will be placed 50 m apart and perpendicular to the embankment. The drainpipes will be installed at a grade of 0.5% to 1%.
  - The solid HDPE connector pipe (sized as 12-inch DR17 HDPE) will be installed within the drain rock, parallel to the embankment and at a grade of 0.5% to 1%.
  - The solid HDPE collector pipe (also sized as 12-inch DR17 HDPE) will be installed at a minimum grade of 1% and maximum of 12%.

The upstream drain will be offset 25 m from the till core.

Filter sand will be placed around the HDPE collector pipe on the upstream and downstream side of the till core.

Tailings deposition above the upstream drains must occur in a way to prevent erosion of the constructed upstream drains, either through pipeline discharge location, erosion control measures, spigots, or some combination.

Details of the upstream drain panel are shown in Drawings 25 to 28 in Appendix A and included in the technical specifications in Appendix B.

7.6.1 Pipe Sizing

The drain, connector, and collector pipes were sized to accommodate the estimated flow for an elevation 987 m TSF configuration. Pipe flow capacities were calculated using Manning’s equation with a Manning’s coefficient equal to 0.01 for the HDPE pipes.

The design flow for each pipe was estimated from 2D seepage modelling for the TSF at elevation 987 m. The results of the analyses are presented in Table 13. The criteria adopted to estimate the design flow were a tailings hydraulic conductivity of 1×10^{-5} m/s and a 50 m beach width. A factor of safety (FoS) of 3 was applied to the estimated design flow.

Table 13: Flow through Upstream Drains at Tailings Storage Facility Elevation 987 m with a 50 m Beach

Embankment	Flow per Drain Pipe[(a)] (m^3/s)	Flow per Drain Pipe[(a)] (L/s)
South Embankment Stn. 0+725	1.6×10^{-3}	1.63
Main Embankment Stn. 2+055	1.6×10^{-3}	1.57
Perimeter Embankment Stn. 3+765	1.4×10^{-3}	1.42
Perimeter Embankment at Corner 1 Stn. 4+255	2.0×10^{-3}	2.02

(a) Reported flows consider a lateral catchment area of 50 m per drain pipe.

As shown in Table 13, the results of the 2D seepage model ranged between 1.42 and 2.02 L/s. Considering an applied FoS of 3, the upstream drain pipes require a capacity up to 6.1 L/s. The adopted design flow for sizing of drain pipes installed with 50 spacing was 6.8 L/s.

A typical drainage panel comprises eight upstream drain pipes, which are routed through a singular discharge pipe. The adopted design flow for sizing of the discharge pipe was 54 L/s.

7.7 Stability Analysis

Two-dimensional limit equilibrium slope stability analyses were conducted using GeoStudio 2023.1. The objective of the stability analyses was to confirm that the FoS for short-term and long-term stability meet the design criteria presented in Section 7.7.1.

7.7.1 Design Criteria for Slope Stability

The minimum FoS criteria are summarized in Table 14.

Table 14: Slope Stability Analysis Design Criteria

Criteria	Unit	Value	Source
Static (long term)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016), CDA (2019) Table 3-4
Static (during or at end of construction)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) Other criteria include: >1.3 recommended by CDA (2019) Table 3-4
Pseudo-static	FoS	1.0	Informed by Table 3-5 of CDA (2019)
Post-earthquake	FoS	1.2	Informed by Table 3-5 of CDA (2019)
Design earthquake event	-	1:2,475 AEP	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) Other criteria include: ▪ Between 1:100 and 1:1,000 (CDA 2019) ▪ 1:1,000 AEP recommended by GISTM (Global Tailings Review 2020) Consistent with WSP's best practice, an earthquake event of 1:10,000 AEP is used to assess sensitivity of the analyses
Design earthquake peak ground acceleration	g	0.048	For earthquake event of 1:2,475 AEP 0.116 g for earthquake event of 1:10,000 AEP
Seismic coefficient for limit equilibrium pseudo-static analysis	-	0.5	Hynes-Griffin and Franklin (1984) 20% strength reduction applied to GLUs as recommended by Hynes-Griffin and Franklin (1984) for clays

FoS = factor of safety; HSRC = Health, Safety and Reclamation Code; AEP = annual exceedance probability; GISTM = Global Industry Standard for Tailings Management; GLU = glaciolacustrine unit.

7.7.2 Material Properties

7.7.2.1 Embankment Fill Materials

Strength parameters to be used in the stability analyses for embankment fill materials have been selected based on interpretation of the available field and laboratory test data and are consistent with strength parameters adopted for previous design analyses (i.e., Golder 2015b,c, 2017c).

Table 15: Embankment Material Properties for Stability Analysis

Material	Unit Weight (kN/m^3)	Shear Strength	Notes
Rockfill	21.5	$T = 1.726\ \sigma'_n{}^{0.899}$	Based on Leps (1970) average rockfill (Golder 2016a)
Transition	20		
Tailings	17	Drained: $\phi' = 25°$ $c = 0$ kPa Undrained: $T/\sigma_v' = 0.1$	Assumed by Golder (2015b, 2017c) Undrained shear strength adopted for post-earthquake analysis. Assumes liquefied tailings.
Upstream fill	20	$\phi' = 32°$ $c = 0$ kPa	Assumed by Golder (2015b, 2016a) based on Campaña (2011)
Till core	20.5	$\phi' = 33°$ $c = 0$ kPa	Based on triaxial testing of two recompacted samples of till (KP 1995) and triaxial testing (KCB 2015a, 2015b)
Filter and cut-off wall aggregate	20	$\phi' = 30°$ $c = 0$ kPa	Based on triaxial testing (Golder 2015e)

T = shear strength; σ_v' = effective vertical stress; ϕ' = friction angle; σ'_n = effective normal stress; c = cohesion.

Post-earthquake analyses use an undrained strength ratio for the tailings, which is representative of a liquefied strength. The relatively small magnitude of ground acceleration anticipated during the design earthquake event is unlikely to trigger widespread liquefaction in the tailings. Thus, using a post-liquefied undrained strength for the tailings represents a worst-case scenario for post-earthquake tailings strength.

7.7.2.2 Foundation Soils

Strength parameters used to represent foundation soils in the stability analyses are presented in Table 16.

Till and glaciofluvial materials vary in gradation depending on location, elevation, and depositional history; however, the results of the laboratory testing show a relatively consistent high strength. The shear strength parameters selected for the foundation till and glaciofluvial layers represent an average for the materials. The strength parameters are consistent with the parameters used in previous design analyses, testing results and analyses of the Perimeter Embankment breach at Corner 1 carried out by the IEEIRP (2015), and the results of laboratory testing completed by KCB (2015b).

Glaciolacustrine soils were analyzed using total stress (undrained) strength parameters. The total stress approach uses the SHANSEP (Stress History and Normalized Soil Engineering Properties) model that accounts for the stress history of the soil. The preconsolidation pressure that was selected for modelling the strength of each of the glaciolacustrine soil layers is based on data collected for the specific layer and soils in the immediate area. The data used include the results of laboratory strength testing, CPT profiles, the response of the soils during in situ testing and sampling (e.g., not being able to push a shear vane into the soil layer and bending of Shelby tubes during sampling), and correlation with index testing. Along the Perimeter and Main embankments, the preconsolidation pressure values selected for the analyses were at or below the lower bound of the values obtained from the laboratory consolidation tests and estimated from the CPT profiles. The undrained shear strength ratio function used to characterize glaciolacustrine materials was refined from $\tau = 0.22\ \sigma'_v\ OCR^{0.8}$ (where τ = shear strength, σ'_v = effective vertical stress, and OCR = overconsolidation ratio) to $\tau = 0.22\ \sigma'_v\ OCR^{0.71}$ based on laboratory testing completed as part of the 2021/2022 investigation. The undrained shear strength ratio functions are presented in Figure G-2, Appendix G.

A remoulded undrained shear strength continues to be adopted to characterize the UGLU at Corner 1 in these analyses. The remoulded undrained shear strength was selected as the average minus one standard deviation of the measured values from field vanes and CPTs as part of the forensic investigation in 2014. Since then, the embankment was repaired and constructed to elevation 970 m (approx. 40 m high) over the area of UGLU that sheared. Potential strength gains from reconsolidation of the UGLU have not been included in the characterization and stability analyses.

The sensitivity (strain weakening) of the GLU was not incorporated into the limit equilibrium analyses. Stress- deformation analyses were completed to assess potential redistribution of stresses due to strain weakening of glaciolacustrine units. The results are presented in Section 7.9.

A layer of low plasticity silty clay interpreted to have deposited in a glaciolacustrine environment was identified directly above bedrock near Stn. 1+095 at the South Embankment; however, the geotechnical testing completed on the material showed that it is not representative of the intermediate or high plasticity GLUs found at the Main and Perimeter embankments, including Corner 1. For the purposes of stability modelling, this layer was assigned the same shear strength and preconsolidation pressure (1,200 kPa) as the GLU at the Main Embankment.

B-bar values (i.e., change in pore pressure over the change in confining stress [Skempton 1954]) were assigned to the till and the glaciofluvial and glaciolacustrine soils to account for the excess pore pressures that may be generated during construction (WSP 2023a). The B-bar values determined for each material are based on the maximum pore pressure response measured during construction since 2014.

A detailed summary of available geotechnical data and characterization of the TSF foundation is presented in the TSF dam site characterization report (WSP 2023a). The TSF dam site characterization report will be updated with data from future site investigations, and with observations and data from construction and operation of the facility over the life of the TSF. Should the understanding and characterization of foundation soils change with time, then required changes will be documented in future revisions of the TSF dam site characterization report and incorporated into this design report.

Table 16: Foundation Material Parameters for Stability Analysis

Material	Unit Weight (kN/m^3)	Shear Strength	Pore Pressure Coefficient B-bar	Notes
Foundation till	22	$\phi' = 34°$ $c = 0$ kPa	0.2	Triaxial testing of samples of till by IEEIRP (2015) and KCB (2015b)
Glaciofluvial	22	$\phi' = 34°$ $c = 0$ kPa	0.2	Triaxial testing of undisturbed glaciofluvial samples by Golder (2015d)
UGLU (Perimeter Embankment at Corner 1)	18	Peak: $T = 0.22\ \sigma_v' OCR^{0.71}$ Where $\sigma_p' = 400$ kPa Remoulded: $S_{ur} = 22$ kPa	0.46	Field and laboratory test programs by IEEIRP (2015) and KCB (2015a,b) including vane shear tests, CPT, direct simple shear, direct shear, and triaxial testing Remoulded undrained shear strength selected as the average minus one standard deviation of the measured undrained shear strength values
LGLU (Perimeter Embankment at Corner 1)	20	$T = 0.22\ \sigma_v' OCR^{0.71}$ Where $\sigma_p' = 700$ kPa	0.2	Field and laboratory test programs by IEEIRP (2015), KCB (2015a.b), and Golder (2017b, 2019a) including vane shear tests, CPT, direct simple shear, direct shear, and triaxial testing
GLU (Perimeter Embankment)	20	$T = 0.22\ \sigma_v' OCR^{0.71}$ Where $\sigma_p' = 900$ kPa	0.2	Consolidation testing by Golder on samples from boreholes GA15-06, GA21-03 and GA21-11 at Perimeter Embankment indicate preconsolidation stress from 900 to 3,600 kPa (excluding the samples assessed to be of very poor quality)
GLU (Main Embankment)	20	$T = 0.22\ \sigma_v' OCR^{0.71}$ Where $\sigma_p' = 1{,}200$ kPa	0.2	Field and laboratory test programs by KP (2007), AMEC (2012), Golder (2015d), and WSP Golder (2022b) including vane shear tests, CPT, direct simple shear, direct shear, and triaxial testing Consolidation tests indicate a range of preconsolidation pressure from 2,500 kPa to 4,000 kPa (excluding the samples assessed to be of very poor quality) and CPT data indicate a minimum preconsolidation pressure of about 1,200 kPa
		$T = 0.22\ \sigma_v' OCR^{0.71}$ Where $\sigma_p' = 850$ kPa (GLU at approx. elev. 922 Stn. 2+400 and 2+750)		Field and laboratory test programs by AMEC (2012), Golder (2015d), and WSP Golder (2022b) CPT21-07 data indicate a minimum preconsolidation pressure of about 850 kPa

Table 16: Foundation Material Parameters for Stability Analysis

Material	Unit Weight (kN/m^3)	Shear Strength	Pore Pressure Coefficient B-bar	Notes
Low plasticity silty clay (Stn. 1+095 South Embankment)	20	T = 0.22 σ_v' OCR$^{0.71}$ Where σ_p' = 1,200 kPa	0.2	Index laboratory testing by Golder (2017b)

Source: WSP 2023a.
T = Shear strength; σ_v' = Effective vertical stress; ϕ' = Peak friction angle; OCR = overconsolidation ratio; σ_p' = Preconsolidation stress; c = cohesion; UGLU = upper glaciolacustrine unit; GLU = glaciolacustrine unit; LGLU = lower glaciolacustrine unit; CPT = cone penetration test; S_{ur} = Remolded Undrained shear strength.

7.7.3 Liquefaction Potential of Foundation Soils

Till and glaciofluvial materials vary in gradation, with the majority being a mixture of gravel, sand, and low plastic fines. A portion of glaciofluvial materials have a larger portion of sand (up to 85%) with some fines. While localized portions of the glaciofluvial units could be susceptible to seismic induced strength loss, these materials are typically laterally non-continuous and in a dense state and are not considered to be susceptible to liquefaction or cyclic softening.

7.7.4 Method and Scenarios Assessed

Nineteen sections, identified to represent the variability of the foundation and embankment conditions over the length of the TSF embankment, were chosen for stability analysis (Figure 9). Eighteen of these sections were used for previous stability modelling for the 970 m detailed design (Golder 2015b), design update (Golder 2017c) and Stn. 20+458 stability assessment (Golder 2018), and one section has been added at Stn. 0+725 in this assessment.

All sections were modelled for an embankment with a crest elevation of 974 m and a downstream slope of 2H:1V extending onto natural ground, or buttress. All sections were run for both normal operating conditions (i.e., minimum 100 m beach width and upstream drain functioning) and upset conditions (i.e., 0 m beach width and upstream drain not functioning). The upstream drain is included in the design for future raises of the TSF (Section 7.6) and has little effect for the raise of the TSF to elevation 974 m unless the pond encroaches to the embankment.

Where the design criteria presented in Table 7.7.1 were not met without modifications to the buttresses, iterative analyses were conducted to design a buttress that would meet the minimum FoS criteria. Where required, stability analyses were then re-run for the design configuration of the embankments and buttress.

The following scenarios were analyzed:

- static (end of construction)
  - In this case, the foundation soils are partially consolidated due to the applied load of the rockfill used for raising and resloping the embankment to elevation 974 m and buttress extension. B-bar values were assigned to the till and the glaciofluvial and glaciolacustrine units to account for the excess pore water pressures that may be generated during construction. The B-bar values used are based on measured pore pressure response during construction since 2014.

- Tailings were modelled to an elevation of 969 m.

- static (long term)
  - In this case, any excess pore water pressures generated during construction are considered to have dissipated and no B-bar values were assigned to the model.
  - Tailings were modelled to an elevation of 973 m.
- pseudo-static
  - A peak ground acceleration of 0.048 g corresponding to a 1:2,475 AEP was used for pseudo-static analyses. A seismic coefficient of 0.5 was selected for the pseudo-static analyses as recommended by Hynes-Griffin and Franklin (1984).
  - A 20% strength reduction factor was applied to glaciolacustrine deposits as recommended by Hynes-Griffin and Franklin (1984) for clays to account for strength loss during cyclic loading.
  - Tailings were modelled to an elevation of 973 m.
- post-earthquake
  - The post-earthquake case used an undrained strength for the tailings, which is representative of a liquefied strength.
  - A 20% strength reduction factor was applied to glaciolacustrine deposits to account for strength loss during cyclic loading.
  - Tailings were modelled to an elevation of 973 m.



LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 5)
- GA22-01 — SONIC DRILLING, PIEZOMETER INSTALLATION - CORNER 1 (WSP GOLDER, 2022)
- GA21-10 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1, PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- CPT21-09 — CPT - PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- GA18-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 (GOLDER, 2018)
- GA16-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- CPT16-04 — CPT - TAILINGS, CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- GW16-2A — SONIC DRILLING, MONITORING WELL INSTALLATION (GOLDER, 2016)
- GA15-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION (GOLDER, 2015)
- BGC-TP-2014 — TEST PIT (BGC / GOLDER, 2014)
- SI12-01 — ODEX, SI INSTALLATION - PERIMETER EMBANKMENT (AMEC, 2012)
- VW11-01 — SONIC DRILLING, PIEZOMETER INSTALLATION (AMEC, 2011)
- SI11-01 — SONIC DRILLING, SI INSTALLATION (AMEC, 2011)
- KP08-01 — SONIC DRILLING, SPT, BORROW PROGRAM (KP, 2008)
- SI06-01 — ODEX, SPT, SI INSTALLATION - MAIN EMBANKMENT (KP, 2006)
- SI01-01 — ODEX, SPT - MAIN EMBANKMENT (KP, 2001)
- DH01-01 — DRILLING, BORROW PROGRAM (KP, 2001)
- GW00-01 — ODEX, SPT, MONITORING WELL INSTALLATION - SOUTH EMBANKMENT (KP, 2000)
- CPT 96-1 — CPT - MAIN EMBANKMENT (KP / CONETEC, 1996)
- 96-A1 — SOLID/HOLLOW STEM AUGER, SPT, PIEZOMETER INSTALLATION - MAIN EMBANKMENT (KP / R.E. GRAHAM ENG., 1996)
- PRW96-01 — SOLID STEM AUGER, PRESSURE RELIEF WELL - MAIN EMBANKMENT (KP, 1996)
- GW96-1 — AIR ROTARY, SPT, MONITORING WELL INSTALLATION (KP, 1996)
- MP89-230 — CONDEMNATION BOREHOLES, PIEZOMETER INSTALLATION (KP, 1989)
- STA. 0+725 — STABILITY CROSS-SECTION LOCATION

0 200 400
1:6,000 METRES

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NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
2. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
3. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
4. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
5. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 5 SEPTEMBER 2014.

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MOUNT POLLEY MINING CORPORATION

CONSULTANT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY MODEL CROSS-SECTION LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	51300/51395/014	0	9

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7.7.5 South Embankment Stability Analysis Results

One section, at Stn. 1+095 (old Stn. 1+100), was used in previous stability analyses (Golder 2015a, 2017c) to represent the South Embankment in terms of geometry and foundation conditions (i.e., layer of low plasticity silty clay). No additional geotechnical investigations have been required at the South Embankment and the foundation characterization remains as per the design update in 2017 (Golder 2017c).

An additional section was analyzed at the tallest section of the South Embankment at Stn. 0+725. No GLUs were identified in the foundation along the South Embankment.

The results of the analyses are summarized in Table 17 and Figures G-3 to G-10 in Appendix G.

The results of the slope stability analyses show that the design criteria FoS are achieved for both normal operating conditions (i.e., 100 m beach width and upstream drain functioning) and upset conditions (i.e., 0 m beach width and upstream drain not functioning) for elevation 974 m with a 2H:1V downstream slope for the South Embankment.

Table 17: Stability Analysis Results – South Embankment

Section	Static (end of construction)		Static (long term)		Pseudo-static		Post-earthquake	
	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach
0+725	2.0	2.0	2.1	2.1	2.0	2.0	2.1	2.1
1+095	1.8	1.8	1.8	1.8	1.4	1.5	1.5	1.6

7.7.6 Main Embankment Stability Analysis Results

Five sections, identified to represent the variability of the foundation and embankment conditions over the length of the Main Embankment, were previously chosen for stability analysis. The foundation characterization has been updated for the section at Stn. 2+455 based on results of the 2021/2022 geotechnical investigation. No revisions to the foundation characterization in other areas of the Main Embankment were required, and the other four analyzed sections remain as per the elevation 970 m TSF detailed design (Golder 2015b). The sections and details of the foundation characterization adjustments are as follows:

- Stn. 1+845 (old Stn. 1+850).
- Stn. 2+055 (old Stn. 2+060).
- Stn. 2+235 (old Stn. 2+240).
- Stn. 2+455 (old Stn. 2+460): A glaciolacustrine layer, about 0.5 to 1.6 m thick at about elevation 922 m was included in this section. The GLU was modelled with an 850 kPa preconsolidation value based on CPT data (WSP 2023b).
- Stn. 2+695 (old Stn. 2+700).

The results of the analyses are summarized in Table 18 and Figures G-11 to G-33 in Appendix G.

Table 18: Stability Analysis Results – Main Embankment

Section	Static (end of construction)		Static (long term)		Pseudo-static		Post-earthquake	
	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach
1+845	1.5	1.5	1.5	1.5	1.1	1.1	1.2	1.2
2+055	1.5	1.6	1.5	1.5	1.2	1.2	1.3	1.3
2+235	1.5	1.5	1.5	1.5	1.1	1.1	1.1	1.2
2+455	1.5	1.6	1.5	1.6	1.1	1.2	1.3	1.3
2+695	2.6	2.6	2.5	2.6	2.3	2.4	2.5	2.5

The slope stability analyses required extending the buttress along the majority of the Main Embankment to meet the minimum FoS criteria described in Section 7.7.1. The FoS results presented in Table 18 are for the design buttress. The buttress design was controlled by the stability requirements of Stn. 1+845 through Stn. 2+455. The buttress geometry was maintained from Stn. 2+455 to Corner 2 and resulted in FoS values that largely exceed the minimum design criteria.

The sensitivity (strain weakening) of the GLU was not incorporated into the limit equilibrium analyses; however, as discussed in Section 7.9, the stress deformation model shows that strain-weakening of GLU is not predicted to occur at the Main Embankment.

In addition to the analyzed scenarios presented in Table 18, the following sensitivity analyses were performed on Main Embankment design sections:

- The undrained strength of the GLU layer at elevation 922 m between about Stn. 2+455 and 2+695 was characterized with an 850 kPa preconsolidation value based on CPT data. Sensitivity analyses were carried out for the section at Stn. 2+455, reducing the preconsolidation value to 700 kPa and 400 kPa. A preconsolidation of 700 kPa is representative of the LGLU at Corner 1 and 400 kPa is representative of the UGLU at Corner 1.
  - With a preconsolidation value of 700 kPa, the FoS remained at 1.5.
  - With a preconsolidation value of 400 kPa, the FoS reduced from 1.5 to 1.4. Even with the lowest preconsolidation stress identified in the area of the TSF (400 kPa), the FoS reduced slightly and the section was stable (FoS > 1.0).
- Artesian conditions were applied to the glaciofluvial foundation material at Stn. 2+055 (5 m artesian pressure elevation), Stn. 2+235 (8 m artesian pressure elevation), and Stn. 2+455 (11 m artesian pressure elevation) to represent a scenario where the existing Main Embankment vertical drain wells fail and artesian pressures are generated in the foundation. The FoS slightly decreased but remained at 1.5 at the three sections.
- A peak ground acceleration of 0.116 g, corresponding to an earthquake event of 1:10,000 AEP, was applied to Stn. 2+235 for the pseudo-static long-term, 100 m beach scenario. The FoS reduced from 1.2 to 1.0 and still met the minimum design criteria with a significantly larger seismic load.

7.7.7 Perimeter Embankment Stability Analysis Results

Eleven sections, identified to represent the variability of the foundation and embankment conditions over the length of the Perimeter Embankment, including Corner 1 (approx. Stn. 3+920 to 4+650), were previously chosen for stability analysis.

The foundation characterization was updated for five sections at Stn. 2+850, 3+270, 3+395, 3+765, and 4+255 based on results of the 2021/2022 geotechnical investigation (WSP Golder 2022b).

The foundation characterization was also updated on the west side of Corner 1 based on results of the 2018 geotechnical investigation, and an additional section at Stn. 4+410 was analyzed (Golder 2018). The section at Stn. 4+540 was modified based on the changes at Stn. 4+410 for the current analysis.

No revisions to the foundation characterization in other areas of the Perimeter Embankment were required, and the sections at Stn. 3+185, 3+530, 4+000, 4+175, and 4+285 remain as per the elevation 970 m TSF detailed design (Golder 2015a, 2017c).

The sections and details of the foundation characterization adjustments are as follows:

- Stn. 2+850 (old Stn. 2+850): The GLU, approximately 3 m thick, at about elevation 913 to 916 m, was truncated downstream of the toe of the existing buttress based on borehole GA21-06 completed as part of the 2021/2022 geotechnical investigation.
- Stn. 3+185 (old Stn. 3+190).
- Stn. 3+270 (old Stn. 3+275): The thickness of the GLU was increased to 4 m based on boreholes GA21-03 and GA21-11 completed downstream of the existing buttress.
- Stn. 3+395 (old Stn. 3+400): The two closely spaced GLUs were combined into a single unit between approximate elevation 903 and 909.5 m based on borehole GA21-02.
- Stn. 3+530 (old Stn. 3+535).
- Stn. 3+765 (old Stn. 3+770): A 0.3 m thick GLU was included under the buttress and downstream at elevation 912.5 m based on borehole GA21-01.
- Stn. 4+000 (old Stn. 20+005).
- Stn. 4+175 (old Stn. 20+180).
- Stn. 4+255 (old Stn. 20+265): The UGLU near elevation 920 m at Stn. 4+230 (old Stn. 20+240 in Golder 2015a) was added to the section at Stn. 4+255 (Golder 2017c) to combine both sections.
- Stn. 4+285 (old Stn. 20+295).
- Stn. 4+410 (old Stn. 20+458).
- Stn. 4+540 (old Stn. 4+525): The GLU near elevation 930 m at Stn. 4+410 was added to the section at Stn. 4+540.

The results of the analyses are summarized in Table 19 and Figure G-34 to G-82 in Appendix G.

Table 19: Stability Analysis Results – Perimeter Embankment

Section	Static (end of construction)		Static (long term)		Pseudo-static		Post-earthquake	
	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach	0 m beach	100 m beach
Perimeter Embankment								
2+850	1.7	1.7	1.7	1.7	1.3	1.3	1.5	1.5
3+185	1.8	1.8	1.9	1.9	1.7	1.7	1.9	1.9
3+270	1.6	1.6	1.5	1.6	1.1	1.2	1.2	1.2
3+395	1.5	1.5	1.5	1.5	1.2	1.2	1.3	1.3
3+530	1.5	1.5	1.5	1.5	1.2	1.2	1.3	1.3
3+765	1.6	1.6	1.6	1.7	1.4	1.4	1.5	1.5
Perimeter Embankment at Corner 1								
4+000	2.4	2.4	2.5	2.5	1.9	1.9	2.3	2.3
4+175[(a)]	1.6	1.7	1.6	1.9	1.1	1.3	1.3	1.6
4+255[(a)]	1.9	2.2	1.9	2.1	1.5	1.8	1.6	2.0
4+285[(a)]	2.0	2.2	2.0	2.3	1.5	1.6	1.7	1.9
4+410	1.9	1.9	2.1	2.1	1.7	1.7	1.8	1.9
4+540	1.8	1.8	1.8	1.9	1.4	1.4	1.5	1.6

(a) Corner 1 upstream drain at elevation 950 m operational for 100 m beach normal operational case. The 0 m beach case assumes an upset condition where upstream drain is not functional.

The slope stability analyses required extending the buttress from about Stn. 3+200 to 3+450 and within the Perimeter Embankment Till Borrow Pond from about Stn. 3+580 to 3+920 to meet the minimum FoS criteria described in Section 7.7.1. The FoS results presented in Table 19 are for the design buttress.

The buttress design at Corner 1, from about Stn. 3+920 to 4+650 is controlled by the results of the stress-deformation modelling (Section 7.9). The stress-deformation analyses undertaken at Stn. 4+175 showed that strain weakening in the UGLU propagates under the embankment and buttress if the buttress is designed to meet the FoS criteria using limit equilibrium analyses assuming peak undrained shear strength. As such, the buttress configuration at Corner 1 was designed using the stress-deformation model and result on higher FoS using limit equilibrium analyses assuming peak undrained shear strength.

In addition to the analyzed scenarios presented in Section 7.7.3, the following sensitivity analyses were performed on Perimeter Embankment design sections:

- Additional analyses were carried out to determine the sensitivity of the FoS to the peak undrained shear strength of the GLU. Analysis was undertaken for the Perimeter Embankment section at Stn. 3+395, with lower preconsolidation pressures only identified at Corner 1 (i.e., 400 and 700 kPa). An FoS of 1.4 was achieved when the preconsolidation pressure was reduced from 900 kPa to 700 kPa, for the long-term, 0 m beach scenario and 1.3 when the FoS was reduced to 400 kPa. Even with the lowest preconsolidation stress identified in the area of the TSF (400 kPa), the FoS reduced to 1.3 and the section was stable (FoS > 1.0).
- A peak ground acceleration of 0.116 g, corresponding to an earthquake event of 1:10,000 AEP was applied to Stn. 3+395 and 4+175 for the pseudo-static long term, 100 m beach scenario. The FoS reduced from 1.2 to 1.1, and from 1.3 to 1.1, for the two sections respectively, and still met the minimum design criteria with a significantly larger seismic load.

7.7.8 Upstream Stability Analysis Results

A post-earthquake analysis was performed for upstream embankment stability, which assumes the tailings (excluding the upstream fill) has liquefied. The tailings were modelled with an undrained shear strength of $T/\sigma_v' = 0.1$. The analysis was conducted considering a 3 m elevation difference between the crest of the embankment and the tailings beach. The pond was modelled to be against the embankment (0 m beach) to represent an upset operations case. The result of the analysis is presented in Figure G-32 in Appendix G and shows an FoS of 1.2, which meets the minimum post-earthquake design criteria.

Potential seismic deformations of the upstream fill are discussed in 7.9.2.

7.8 Static Deformations

Vertical deformations resulting from consolidation/settlement of embankment fill materials under static conditions were monitored with a survey monument during construction of the Perimeter Embankment raise from elevation 966 to 970 m at Corner 1 (from 2017 to 2023). The recorded settlement at the crest of the rockfill shell has been in the order of 10 cm, which is within the expected range for a 40 m high rockfill structure. Future raises are anticipated to be consistent with previous annual raise rates (i.e., 2 to 3 m per year), and it is anticipated that settlements will remain low within the previously recorded range. Considering the freeboard allowance (Section 7.10), overtopping of the TSF due to settlement is considered to be a non-credible hazard. It is also noted that any settlements are corrected as part of yearly embankment raises.

Horizontal deformations are anticipated to be minor and distributed along the embankment crest broadly proportionally to the height of the embankment (i.e., would not occur as horizontal shear at a single location). Anticipated deformations would not compromise the integrity of the 5 m wide till core or continuity of the 1.5 m filter and transition zones.

7.9 Stress Deformation Modelling

A stress-deformation analysis was carried out on section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 using the commercially available computer code FLAC Version 8.1 (Cundall 2012). The section at the Main Embankment represents the tallest section of the facility and includes the semi-continuous layer of glaciolacustrine soil in the foundation. The section at the Perimeter Embankment includes the portion of the foundation that failed in 2014 and that has the GLU with lower preconsolidation stress.

These sections also correspond to those controlling the design of the buttress at each embankment based on limit equilibrium analyses.

The analyses were performed to assess the stability and potential deformations of the embankments at elevation 974 m (static analysis) and under the 2,475-year earthquake load (seismic analysis), including the potential for strain-weakening of GLUs. One crustal motion and one subduction interface motion were used as input ground motions in the seismic analysis.

The analysis procedure, characterization of the foundation and embankment materials for modelling purposes, and the static and seismic deformation analyses results are included in Appendix H. A summary of the findings of the analyses is presented in Sections 7.9.1 and 7.9.2.

7.9.1 Static Analysis

Section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 are predicted to be stable at the end of construction up to elevation 974 m under the analyzed conditions. The FoS computed at the end of construction is 1.6 for section 2+055 and 1.7 for section 4+175.

Strain-weakening is not predicted to be initiated in the GLU at section 2+055 of the Main Embankment during construction up to elevation 974 m.

Assuming a constant 22 kPa remoulded undrained shear strength for the UGLU that sheared during the failure in 2014 (i.e., no inclusion of potential strength gains from reconsolidation), a shear band about 3 m long with a maximum plastic shear strain of about 10% is predicted to develop below the downstream slope of the Perimeter Embankment at Corner 1 at section 4+175. However, the predicted degree of strain-weakening is relatively low (about 6% strength reduction in a 3 m long shear band) and does not have a significant impact on the stability of the elevation 974 m embankment.

7.9.2 Seismic Analysis

Section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 are predicted to be stable under the action of the 2,475-year earthquake ground motion.

The maximum permanent horizontal displacement in the downstream direction is less than 5 cm in the embankments and buttresses of both analysed sections.

Strain-weakening is not predicted to be initiated in the GLU at section 2+055 of the Main Embankment under the action of the 2,475-year earthquake ground motion.

Assuming a constant 22 kPa remoulded undrained shear strength for the UGLU that sheared during the failure in 2014 (i.e., no inclusion of potential strength gains from reconsolidation), a relatively low level of strain-weakening (less than 1.5% strength reduction) is predicted in the UGLU under the downstream slope of the Perimeter Embankment at section 4+175 during the 2,475-year earthquake ground motion. This degree of weakening is relatively low (less than 1.5% strength reduction) and does not have a significant impact on the seismic stability of the embankment.

Settlement of the upstream fill (up to 0.5 m) may occur if the phreatic surface upstream of the till core is relatively shallow (e.g., 100 m beach width and phreatic surface at the elevation of the drain) and the seismic loading is enough to trigger liquefaction in the tailings and upstream fill. This deformation mechanism was predicted under the action of the subduction interface motion; the crustal motion was not sufficient to trigger liquefaction. The maximum permanent horizontal and vertical displacements predicted at the centreline of the embankment in both analyzed sections are less than 4 cm at the end of the 2,475-year earthquake ground motion. The serviceability of the till core is not expected to be affected by this level of displacement; however, the displacements associated with this deformation mechanism could potentially affect the serviceability of the upstream drain at elevation 970 m. As indicated in Section 7.5, the seepage analyses show that little to no flow is expected through the upstream drains during normal operations (i.e., beach widths greater than 100 m) to elevation 974 m. The upstream drains have been incorporated to account for future raises above 974 m and are not a critical control for managing hydraulic gradient at TSF elevation 974 m.

7.10 Water Management Infrastructure

7.10.1 Tailings Storage Facility Freeboard and Emergency Spillway

The inflows that directly contribute to the TSF are from precipitation on the footprint of the TSF and runoff from the catchment directly upstream of the TSF. The major contribution to TSF supernatant volume is pumped from the site contact water facilities including the Central Collection Sump and Perimeter Embankment Till Borrow Pond.

A freeboard is required to prevent overtopping of the TSF embankment. The freeboard calculations follow the procedures and equations discussed in the CDA (2013, 2019) guidelines. Wind speeds, pond depth, and embankment slope geometry were considered to determine the greatest wave uprush value for the normal and minimum freeboard scenarios. The calculated minimum freeboard is 0.7 m and controls the freeboard requirement. Freeboard calculations are included in Appendix I.

The TSF emergency spillway will be constructed on the north side of the TSF to protect the embankment during the inflow design flood (IDF) event, which considers the probable maximum flood (PMF). The emergency spillway invert elevation has been calculated to prevent exceedance of the required minimum freeboard during passage of the design IDF event. Hydrologic calculations are included in Appendix I.

Inflow volumes to the TSF were estimated using the United States Department of Agriculture Soil Conservation Service method. Rainfall-runoff models were developed using the Conservation Service method implemented with Hydrologic Engineering Center – Hydrologic Engineering Center (HEC-HMS) software (version 4.11) (USACE 2023).

The PMF for the TSF was estimated using the annual 72-hour probable maximum precipitation (PMP) rainfall plus snowmelt. The runoff volume generated by the IDF was 1.3 million m^3. The peak IDF discharge conveyed by the emergency spillway assumed that the TSF has no storage capacity at the beginning of the event, therefore will discharge all of the IDF runoff volume.

The design of the emergency spillway has a broad-crested weir geometry, with a cross-section that includes a base width of 6 m and 7H:1V side slopes to allow a trafficable surface, and a slope of 0.3% across the embankment crest. The spillway invert is required to be 1.1 m below the embankment crest for conveyance of the peak IDF discharge plus minimum freeboard. Table 20 summarizes the spillway invert, resulting water levels, and peak discharge during the passage of the IDF at an embankment crest elevation of 974 m.

Table 20: Summary of the Emergency Spillway Arrangement and Flood Routing Results for Inflow Design Flood

Embankment Crest Elevation (m)	Spillway Invert Elevation (m)	Spillway Base Width (m)	TSF Peak Discharge (m^3/s)	Peak Water Level Elevation (m)	Minimum Freeboard (m)
974.0	972.9	6.0	2.8	973.3	0.7

The emergency spillway location and alignment was selected considering potential future embankment raises above elevation 974 m and closure.

The emergency spillway is to be constructed for each interim embankment raise between elevation 970 m and 974 m. The emergency spillway entrance and chute will need to be raised as the embankment is raised.

The general layout, plan, profile, and typical sections of the emergency spillway are included in Appendix A. The emergency spillway technical specifications are included in Appendix B.

Emergency Spillway Channel Sizing

The spillway channel was sized using the Manning's equation assuming uniform flow conditions and accounting for superelevation in the curves. The channel conveys the peak flow with 0.3 m of freeboard. Flow velocities were estimated using the Manning's equation to size erosion protection.

The spillway channel material was selected based on the normal flow velocity for the stability scenario and maximum permissible velocity of the lining material. The Manning's roughness coefficients, channel dimensions, normal flow depth, and normal flow velocity for each segment are summarized in Table 21.

Superelevation for each curve of the spillway channel alignment was estimated using the US Army Corps of Engineers (USACE 1972) method and results from the Manning's equation.

Table 21: Summary of the Emergency Spillway Channel Design

Spillway Channel Segment (Approximate Station PVI [m])	Design Consideration	Max Slope (%)	Channel Bed Material	Manning's Roughness Coefficient ($s/m^{1/3}$)		Side Slopes (XH:1V)	Bottom Width (m)	Channel Depth (m)	Normal Flow Depth[a] Including Superelevation (m)	Normal Flow Velocity[b] (m/s)	Freeboard (m)
				Capacity	Stability						
Entrance/crest (10+031–10+122)	Trafficable side slopes	0.3	Granular Road Gravel	0.030	0.022	7H:1V	6.00	1.1–1.4	0.4	1.00	0.7–1.0
Chute (10+122–10+142)	Maximum slope	16.7	100 kg Class Riprap[c]	0.044	0.039	2H:1V	6.00	0.6	0.3	2.9	0.3
Stilling basin (10+142–10+145)	Contain hydraulic jump	0	100 kg Class Riprap[c]	0.044	0.039	2H:1V	6.00	1.0	0.5[d]	n/a	0.5
Stilling basin to road crossing (10+145–10+174)	Channel capacity	0.5	10 kg Class Riprap[c]	0.038	0.034	2H:1V	6.00	1.0	0.4	1.0	0.6
Road crossing (10+174–10+240)	Trafficable side slopes	0.5	Granular Road Gravel	0.030	0.022	10H:1V	6.00	0.7	0.3	1.1	0.4
Outlet Channel (10+242–10+800)	Topographic slope	4.0	10 kg Class Riprap[c]	0.038	0.034	2H:1V	2.00	1.0	0.5	2.6	0.5
		10.0	50 kg Class Riprap[c]	0.042	0.037				0.4	3.3	0.6
Discharge apron (10+800-10+817)	Topographic slope	2.0	10 kg Class Riprap[c]	0.038	0.034	2H:1V	2.00-20.0	0.3-1.0	0.14-0.50[e]	1.00-1.85	0.2-0.5[e]

(a) Normal flow depth for capacity scenario.
(b) Normal flow velocity for stability scenario.
(c) BC MOTI 2020.
(d) Flow depth is representative of the hydraulic jump estimated to be developed within the stilling basin structure.
(e) Flow depth at station 10+817 is calculated using Manning's equation assuming normal flow conditions. However, the flow depth will be less and the freeboard will be greater due to the steep natural slope (33%) beginning at station 10+817.
PVI = Point of Vertical Intersection; n/a = not applicable.

The spillway chute was designed to convey flow from the embankment crest to existing ground with a maximum slope of 6H:1V. A precast concrete weir with a 6.0 m base width and 2H:1V side slopes will be installed at the chute entrance. The spillway chute has a base width of 6.0 m and will be lined with 900 mm of 100 kg class riprap.

The stilling basin structure was sized using the results from the Manning's equation and three hydraulic design methods: Department of the Interior Bureau of Reclamation (USBR 1984), USACE (1977), and Prairie Farm Rehabilitation Administration (PFRA 1979). The length of the stilling basin and the depth of the channel were designed to contain the hydraulic jump (conjugate depth) expected to occur at the outlet of the spillway chute. The conjugate depth was calculated using the Manning's equation and is estimated to be 0.45 m. The resulting length of the stilling basin for each method is provided in Table 22.

Table 22: Spillway Stilling Basin Length

Hydraulic Design Method	Stilling Basin Length (m)
USBR (1984)	2.16
USACE (1977)	2.20
PFRA (1979)	2.52

The stilling basin length was selected as 3.0 m for increased energy dissipation prior to discharge into the spillway channel downstream and improve constructability of the structure. The stilling basin base width will be 6.0 m with 2H:1V side slopes and it will be lined with 900 mm of 100 kg class riprap.

The segment of the spillway from the stilling basin to the road crossing was designed with a 6.0 m base width for continuation between the stilling basin and the road crossing and will be lined with 400 mm of 10 kg class riprap.

The road crossing was designed to convey flow across the haul road as a shallow ford. The road crossing has a base width of 6.0 m, with 10H:1V side slopes to provide adequate crossing geometry for haul trucks. The road crossing will be lined with 200 mm of angular road gravel (75 mm minus) above 400 mm of 10 kg class riprap.

The spillway outlet channel base width, from the road crossing to the discharge apron, will be 2.0 m with 2H:1V side slopes. The spillway outlet channel will be lined with 400 mm of 10 kg class or 680 mm of 50 kg class riprap based on the slope as presented in Table 21.

The discharge apron was designed to disperse flow and reduce energy prior to discharge into Bootjack Creek. The discharge apron channel depth will transition from 1.0 m to 0.3 m and the base width will widen from 2.0 m to 20.0 m at the crest of the natural steep slope. The discharge apron will be lined with 400 mm of 10 kg class riprap. The discharge apron will convey flow onto riprap placed at grade down Bootjack Creek's left downstream bank. The riprap placed at grade shall be field fit and will continue to widen down the bank and terminate prior to Bootjack Creek's main channel.

7.10.2 Tailings Storage Facility Seepage Collection Channels and Ponds

Diversion and collection channels and ponds are currently in place around the TSF. The elevation 974 m TSF raise design will affect portions of the existing surface collection and diversion channels and structures around the TSF. These channels and structures will be partially or fully covered by the TSF embankment or buttress. The following modifications to existing water management infrastructure around the TSF will be required:

- relocation of the South Embankment Seepage Collection Pond and Main Embankment Seepage Collection Pond, as well as relocation of portions of the collection channels that feed these ponds
- expansion of the Perimeter Embankment Till Borrow Pond and relocation of portions of the channels that feed this pond

The inflow to the ponds includes seepage, runoff and flow from the upstream drains that will be collected by the collection channels and direct precipitation to the ponds. New ponds are designed to store the peak flow generated from the 1:10-year 24-hour rain plus snowmelt event and will include 0.5 m of dead storage and 0.5 m of freeboard above the storm event water surface elevation.

The collection channels are proposed to convey the peak flow generated from 1:200-year 24-hour storm event plus seepage and upstream drain flow rates. The channels include a minimum of 0.3 m freeboard.

A diversion channel is required at Corner 4 to capture surface runoff from a relatively small catchment upstream of the TSF. The diversion channel is to be sized to convey the peak flow generated from 1:200-year 24-hour storm event, while maintaining a minimum 0.3 m freeboard.

The design report for the TSF diversion channel, collection channels and ponds will be provided in a separate document.

7.11 Tailings Storage Facility Closure and Reclamation

The closure philosophy will be consistent with the most recent Mine Reclamation and Closure Plan (MPMC 2022). The TSF will remain a permanent structure, which will be reclaimed and given productive land use.

Prior to cover soil placement on the 2H:1V embankment slopes, an assessment will be conducted to determine which species can successfully revegetate the TSF embankments. This assessment will also investigate which species and revegetation/reclamation techniques will maximize overall cover soil stability and minimize erosion and future maintenance requirements.

Following cover soil placement, the TSF will be revegetated. A spillway, sized with capacity for the probable maximum flood, will also be constructed during active closure, so that a desirable long-term pond level will be maintained.

7.12 Geotechnical Risk Review and Design Controls

Potential failure mechanisms that must be addressed in the design of a tailings storage facility are summarized in Table 23 with the designer's assessment of each mechanism. The designer's assessment was made against typical dam failure modes presented in the ICOLD tailings dam safety bulletin (ICOLD 2022).

The design and operational philosophy and controls incorporate the findings and recommendation of the IEEIRP (2015) *Report on Mount Polley Tailings Storage Facility Breach*. These are to limit the amount of surface water to only that required for operation, promote unsaturated conditions in the tailings with drainage provisions, and promote consolidation of tailings upstream of the embankments.

Mount Polley Mine has an active failure modes and effects analysis for the TSF that is updated annually with the Engineer of Record. The failure modes and effects analysis includes a likelihood and risk review for failure modes and effects related to dam safety, environment, health and safety, and mine operations. Table 23 incorporates failure modes that could result in a potential breach of the TSF.

Failure modes presented in Table 23 have been assessed as credible or non-credible. A credible failure mode has been defined as a feasible failure mode that could result in a potential breach of the TSF with controls in place. A non-credible failure mode is a failure mode that cannot be triggered by the design criteria external loading conditions and/or operational upset conditions.

Table 23: Summary of Tailings Storage Facility Failure Modes Assessment

Failure Modes (adapted from ICOLD 2022)		Designer's Assessment		
Mechanism	**Typical Failure Mode**	**Discussion**	**Identified Controls**	**Assessment (if constructed as designed with operational mitigative controls)**
Instability due to foundation failure	Undetected weak foundation materials	Multiple field investigations have been completed along the foundation of the embankments and buttresses to delineate the extent and characterize the foundation materials. Golder/WSP has carried out four geotechnical investigations since 2014 along the South, Main, and Perimeter embankments (Golder 2015d, 2017b, 2018; WSP Golder 2022b). Two site investigations were undertaken by others following the breach in 2014 (KCB 2015; IEEIRP 2015). Prior investigations include KP (1990, 1995, 1997) and AMEC (2012). Foundation characterization has been completed per EGBC guidelines (WSP 2023a). The design criteria factors of safety for limit-equilibrium stability are met for all embankments.	Design of the elevation 974 m TSF raise has been undertaken incorporating a 2H:1V minimum overall downstream slope and wide buttresses are constructed along the Perimeter and Main embankments. Buttress width and height has been maintained along portions of the embankment irrespective of limit equilibrium analyses (i.e., FoS greater than minimum criteria along portions of the embankment). Instrumentation has been installed to monitor foundation response (SI, IPI, SAA and VWPs). Quantitative performance objectives (QPOs) including trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m.	Credible
	Incorrect strength characterization	Multiple field investigations have been completed along the foundation of the embankments and buttresses to characterize the foundation materials. Golder/WSP has carried out four geotechnical investigations since 2014 along the South, Main, and Perimeter embankments (Golder 2015d, 2017b, 2018; Golder WSP 2022). Two site investigations were undertaken by others following the breach in 2014 (KCB 2015; IEEIRP 2015). Prior investigations include KP (1990, 1995, 1997) and AMEC (2012). Foundation material properties have been assigned based on in situ and laboratory testing. Shear strength parameters selected for the foundation till and glaciofluvial layers represent an average for the materials. Glaciolacustrine soils have been analyzed using total stress (undrained) strength parameters. The preconsolidation pressure values selected for the analyses are at or below the lower bound of the values calculated from the laboratory consolidation tests and estimated from the CPT profiles. Foundation characterization has been completed per EGBC guidelines (WSP 2023a). The design criteria FoS for limit-equilibrium stability are met for all embankments. Limit equilibrium analyses completed for a range of GLU strengths to assess sensitivity to potential variability. Stress-deformation analyses completed to assess potential redistribution of stresses due to strain weakening of GLU.	Design of the elevation 974 m TSF raise has been undertaken incorporating a 2H:1V minimum overall downstream slope and wide buttresses are constructed along the Perimeter and Main embankments. Buttress width and height has been maintained along portions of the embankment irrespective of limit equilibrium analyses (i.e., FoS greater than minimum criteria along portions of the embankment). Instrumentation has been installed to monitor foundation response (SI, IPI, SAA and VWPs). QPOs, including trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m.	Credible
	Unexpected pore pressure generation	Excess pore water pressures may develop in the foundation under the buttress and embankment reslope during construction. However, extensive field and laboratory investigations have been completed to characterize the foundation, and the pore pressure response has been monitored during construction of the embankment and buttresses since 2014. The measured maximum pore pressures responses were used in the short-term stability analyses (e.g., during or at the end of construction). The design criteria FoS for limit-equilibrium stability are met for all embankments. The annual embankment crest raise is small, in the order of 2 to 3 m per year.	Construction sequence (buttress extension and embankment reslope prior to raising the embankment) Instrumentation (VWPs) has been installed to monitor foundation response. QPOs, including trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m.	Not credible

Table 23: Summary of Tailings Storage Facility Failure Modes Assessment

Failure Modes (adapted from ICOLD 2022)		Designer's Assessment		
Mechanism	**Typical Failure Mode**	**Discussion**	**Identified Controls**	**Assessment (if constructed as designed with operational mitigative controls)**
Instability due to foundation failure continued	Artesian pore pressure generation	Upward gradients and artesian pressures are present at glaciofluvial units in the Main Embankment foundation. Four vertical drain wells installed under the Main Embankment help relief some of the artesian pressure. Limit equilibrium analyses completed with artesian pressures show little sensitivity to artesian pressures (if vertical drain wells were to fail and pore pressures increase).	Vertical drain wells have been installed in the foundation of the Main Embankment. Instrumentation (VWPs) has been installed to monitor pore pressure in the foundation. QPOs, including trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m.	Not credible
	Liquefaction of cohesionless soils and cyclic softening of cohesive soils	The site is in an area of relatively low seismicity (peak ground acceleration equal to 0.048g for design earthquake event with a 1:2,475 AEP). Laboratory testing has been completed on glaciolacustrine samples to characterize the cyclic response (WSP 2023a). A 20% strength reduction factor has been applied in the pseudo-static and post-seismic limit equilibrium analyses to glaciolacustrine deposits to account for potential strength loss during cyclic loading. The dense till foundation materials are considered to not be susceptible to liquefaction or cyclic softening. The glaciofluvial foundation materials are typically not continuous layers.	Design of the elevation 974 m TSF raise has been undertaken incorporating a 2H:1V minimum overall downstream slope and wide buttresses are constructed along the Perimeter and Main embankments. Buttress width and height has been maintained along portions of the embankment irrespective of limit equilibrium analyses (i.e., FoS greater than minimum criteria along portions of the embankment).	Not credible
	Incorrect seismic hazard/response analysis	The site is in an area of relatively low seismicity. A site-specific probabilistic seismic hazard assessment undertaken for the TSF in 2022 (WSP 2023a). Limit equilibrium analyses were completed for an earthquake event with a 1:10,000 AEP to assess sensitivity to potential variability. Results show FoS equal to or greater than 1. Stress-deformation analyses were completed to confirm stability of the facility due to seismic loading.	Design of the elevation 974 m TSF raise incorporates sensitivity analysis to extreme earthquake event (1:10,000 AEP).	Not credible
	Erosion at the toe due to nearby water courses	Hazeltine Creek is over 200 m away from the toe of the embankment; its flow can be regulated by a weir. Hazeltine Creek is not considered an erosion risk to the buttress and embankment. The elevation 974 m South Embankment will extend across an unnamed creek at Corner 4. The catchment of the creek is small (approx. 0.15 km^2) and its flow is not considered an erosion risk to the embankment. Foundation preparation and potential till blanket placement will be completed so water drains away from the till core. The design includes diversion of water away from the embankment (refer to water management design).	Design of the elevation 974 m TSF raise has been undertaken incorporating Corner 4 creek catchment and diversion. Construction quality assurance / quality control (QA/QC) will be performed to confirm foundation preparation and potential till blanket placement is completed so water drains away from the till core and water is diverted away from the south abutment.	Not credible
	Excavation at the toe for seepage collection ditches or sumps	Water management infrastructure will be relocated in some areas to near the toe of the embankment and buttress; however, seepage collection ditches are shallow (approximately 1 m deep) and ponds are offset from the toe of the embankment and buttress.	Construction QA/QC will be performed. Inspections will be carried out by MPMC and the EoR.	Not credible
	Landslide at an abutment	Foundation at abutments comprises competent till and bedrock. Glaciolacustrine deposits have not be encountered at the abutments. Additional test pits are excavated as part of foundation preparation to confirm foundation conditions. Surficial organic or weak soils are removed as part of foundation preparation. Natural slope grades at the abutments and upstream are gentle (less than 30%). No evidence of historical landslides has been observed.	Construction QA/QC will be performed.	Not credible

Table 23: Summary of Tailings Storage Facility Failure Modes Assessment

Failure Modes (adapted from ICOLD 2022)		Designer's Assessment		
Mechanism	**Typical Failure Mode**	**Discussion**	**Identified Controls**	**Assessment (if constructed as designed with operational mitigative controls)**
Instability of the TSF slope	Inclusion of weak materials in the structural portion of the TSF, possibly due to lack of compaction and/or poor drainage	Design of the TSF raise is consistent with previous raises. Rockfill forms the downstream wedge of the embankments and the downstream buttress along the Perimeter and Main embankments. Rockfill is mainly fresh, intrusive rock with a relatively high internal friction angle (Golder 2016a). Construction of safety berms at different stages of construction may have resulted in localized slivers of loose rockfill or finer rockfill. Some ravelling has been observed on the angle of repose slope; however, the slope will be resloped to 2H:1V as part of the raise using a bottom-up construction method.	Design of the elevation 974 m TSF raise has been undertaken incorporating a 2H:1V minimum overall downstream slope, and wide buttresses are constructed along the Perimeter and Main embankments. Construction QA/QC will be performed.	Not credible
	Liquefaction of non-cohesive soils and cyclic softening of cohesive soils	Tailings upstream of the embankment are susceptible to liquefaction. The upstream fill consists of compacted tailings sand. The upstream fill below approx. elev. 968 m includes layers of rockfill and has undergone consolidation due to dewatering of the TSF in 2014. Post-earthquake limit equilibrium analyses indicate an FoS equal to 1.2 for the upstream slope. Stress-deformation analyses indicate that the till core would experience minor deformations (< 4 cm) if the tailings and upstream fill liquefy. No loss of containment is expected. The till core, filter, transition, and rockfill are mechanically placed and compacted and are not susceptible to liquefaction or cyclic softening.	The amount of surface water is limited to only that required for operation (i.e., lower phreatic surface upstream of the embankment). Construction QA/QC will be performed.	Not credible
Overtopping	Large flood that exceeds capacity of spillway	The spillway is designed to pass the 72-hour annual PMP plus snowmelt. The catchment reporting to the TSF is small and well defined. The majority of water inflows into the TSF are pumped and are therefore in the direct control of the operator.	QPOs, including freeboard trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m. Design includes a freeboard contingency of 0.3 m.	Not credible
	Large flood with blocked spillway (by debris, ice or pipelines)	The spillway invert is wide; the design includes a 6 m invert width and 7:1 side slopes. Freeboard contingency of 0.3 m	Inspection of the facility by owner and EoR team is planned. Design includes a freeboard contingency of 0.3 m. QPOs are in place for the existing TSF and will be updated for the TSF above elevation 970 m. Inspections will include assessment of spillway conditions.	Not credible
	Wave action	Deposition of the tailings is planned to maintain the pond near the centre of the facility and against the natural topography on the western perimeter. The TSF is managed by maintaining the pond volume within the operating range for reclaim water and make-up water. During large freshet events, the pond could encroach onto the upstream fill of the embankment. A minimum of 20 m of upstream fill is compacted upstream of the embankments. Progression of erosion has been slow and can be addressed before it reaches the core.	The pond is maintained away from the embankments, near the centre of the facility against the natural topography. There is 20 m wide compacted fill upstream of the till core. Design includes a freeboard contingency of 0.3 m. QPOs, including minimum beach width trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elev. 970 m.	Not credible

Table 23: Summary of Tailings Storage Facility Failure Modes Assessment

Failure Modes (adapted from ICOLD 2022)		Designer's Assessment		
Mechanism	**Typical Failure Mode**	**Discussion**	**Identified Controls**	**Assessment (if constructed as designed with operational mitigative controls)**
Overtopping continued	Operational upset (improper water management)	The majority of water inflows into the TSF are pumped and are therefore in the direct control of the operator. The catchment reporting to the TSF is small and well defined. Water can be temporarily stored in open pits if required.	Design of the elev. 974 m TSF raise incorporates a spillway and upstream drains to draw down phreatic surface as pond approaches the embankment. Inspections of the facility and water management infrastructure by the owner are planned. QPOs, including minimum beach width, freeboard and pond volume trigger levels and monitoring frequency, are in place for the existing TSF and will be updated for the TSF above elevation 970 m.	Not Credible
	Uncontrolled rupture of a tailings slurry delivery or water reclaim pipeline	The tailings pipeline is located in ditches and along upstream crest of embankments in the TSF.	Inspections of the facility and water management infrastructure by owner are planned.	Not credible
	Landslide into reservoir (rock, snow, or soil)	The slope above the TSF is less than 30 degrees and heavily vegetated. No rock outcrop is present. There is no evidence of historical landslides.	-	Not credible
	Settlement of crest (due to static and/or seismic deformations)	Minor settlement will mainly occur after TSF raises as a result of consolidation of the embankment and foundation. Construction to raise the embankment to elev. 974 m is expected to occur in 2 to 3 consecutive years. Any settlements are corrected as part of construction. Stress-deformation analyses completed to assess deformation due to static and seismic loading show relatively small deformations due to earthquake loading (< 4 cm).	Freeboard contingency is included. Topographic surveys of the facility are completed twice per year.	Not credible
Internal erosion (piping)	Material incompatibility between low and high hydraulic conductivity zones of the embankment	A portion of the filter constructed before 2014 does not meet modern filter criteria. The till core is not expected to initiate backward erosion for the gradients that will be imposed on the core, and that if backward erosion were initiated, the filter as constructed prior to 2014 would prevent ongoing erosion. Pond elevation prior to 2014 reached a maximum elevation of 966.45 m and the pond was in contact with the embankments in some areas. No signs of erosion or sinkholes were reported prior to the breach. The filter and transition zones designed and constructed since 2014 follow modern filtering criteria. Filter extends 25 m downstream in area of breach where foundation cracking/disruption is known to have occurred. Deposition of the tailings is planned to maintain the pond near the centre of the facility and against the natural topography on the western perimeter. The TSF is managed by maintaining the pond volume within the operating range for reclaim water and make-up water. The existing upstream drain at elev. 950 m limits the hydraulic head against the Perimeter Embankment at Corner 1.	Construction of an upstream drain at an elevation of 970 m along the Main and Perimeter embankments and 972 m along the South Embankment and at Corner 1. QPOs (trigger levels, monitoring frequency and actions): - minimum beach width - pond volume - toe drain flow - toe drain turbidity - piezometric levels	Credible

Table 23: Summary of Tailings Storage Facility Failure Modes Assessment

Failure Modes (adapted from ICOLD 2022)		Designer's Assessment		
Mechanism	**Typical Failure Mode**	**Discussion**	**Identified Controls**	**Assessment (if constructed as designed with operational mitigative controls)**
Internal erosion (piping) continued	Elevated pore water pressures and increased hydraulic gradient	Pond elevation prior to 2014 reached a maximum elevation of 966.45 m, and the pond was in contact with the embankments in some areas. During normal operation, the pond will reach a maximum elevation of 971.4 m and will be a minimum 100 m from the embankments.	The existing upstream drain is at elevation 950 m at Corner 1. An upstream drain will be constructed at an elevation of 970 m along the Main and Perimeter embankments and 972 m along the South Embankment and at Corner 1. QPOs (trigger levels, monitoring frequency and actions): - minimum beach width - pond volume - toe drain flow - toe drain turbidity - piezometric levels	Credible
	Hydraulic fracturing due to stress distribution within the TSF, differential settlement, or resulting from deformations due to seismic events	Foundation conditions do not rapidly vary along the embankment. GLUs are typically thin (<1 to 2 m) or overconsolidated (>1,200 kPa at the Main Embankment) Stress-deformation analyses completed to assess deformation due to seismic loading show relatively small deformations due to earthquake loading (< 4 cm). The cut-off wall is designed to allow deformation. Plastic concrete is resistant to erosion. Cutoff aggregate upstream of the wall has fines that will migrate into a crack and plug it.	QPOs (trigger levels, monitoring frequency and actions): - minimum beach width - pond volume - toe drain flow - toe drain turbidity - piezometric levels	Not credible
	Pipes through the TSF, including decant towers and pipes (seepage along the pipe, collapse of the pipe)	Design of upstream drains at elevation 970 and 972 m incorporate uniformly graded filter sand around conduits upstream and downstream of the till core. Upstream drain at Corner 1 at elevation 950 m incorporates uniformly graded filter sand around conduits downstream of the till core. Older upstream drains between about elevation 936 and 950 m incorporate filters around the conduits downstream of the till core. Pond elevation prior to 2014 reached a maximum elevation of 966.45 m, and the pond was in contact with the embankments in some areas. During normal operation, the pond will be a minimum 100 m from the embankments and the phreatic level against the embankment is expected to be at or below the elevation of the new upstream drains and pipe crossings at elevation 970 to 972 m. The new drains will limit the hydraulic head upstream of the pipe crossings. Monitoring data at the upstream drain at Corner 1 at elevation 950 m show that the drain is effective maintaining the pore pressures upstream of the till core at the elevation of the drain. HDPE pipes can accommodate the extra load of the facility raise to elevation 974 m.	Construction of upstream drains at an elevation of 970 m along the Main and Perimeter embankments and 972 m along the South Embankment. Uniformly graded filter sand around conduits upstream and downstream of the till core. QPOs (trigger levels, monitoring frequency and actions): - minimum beach width - pond volume - toe drain and upstream drain flow - toe drain and upstream drain turbidity - piezometric levels	Credible
	Underground features that could cause internal erosion	Development of preferential flow pathways in the foundation soils (e.g., glaciofluvial layers) or bedrock lead to increased seepage through the foundation. Foundation layers are typically non-continuous, with a wide range of hydraulic conductivity. Foundation check (test pits/trenches) are completed during foundation preparation at the Corner 4 and 5 abutments. Filter blanket is installed over the foundation along the embankment downstream of the till core.	QPOs (trigger levels, monitoring frequency and actions): - minimum beach width - pond volume - toe drain flow - toe drain turbidity - piezometric levels	Not credible

EGBC = Engineers and Geoscientists British Columbia; TSF = tailings storage facility; SI = slope inclinometer; IPI = in-place inclinometer; SAA = shape acceleration array; VWP = vibrating wire piezometer; QPOs = Quantitative Performance Objectives; CPT = cone penetration test; FoS = factor of safety; GLU = glaciolacustrine unit; AEP = annual exceedance probability; QA/QC = quality assurance / quality control; MPMC = Mount Polley Mining Corporation; EoR = Engineer of Record; PMP = probable maximum precipitation.

BC MEM (2016) requires assessment of failure modes by specific analyses, which are listed in Table 24 with references to report sections and the designer's assessment.

Table 24: Failure Modes Required to Be Assessed

Failure Modes	Report Section	Assessment
Geotechnical		
Slope stability	7.7 and 7.9	Design meets criteria
Seepage	7.5	Seepage is not a credible failure mode; design raise is 4 m and seepage rates are expected to be slightly higher than for the existing TSF
Internal erosion and piping	7.4	Design includes mitigation of internal erosion and piping by limiting the hydraulic gradient across the till core with operational controls and the use of upstream drains
Static and dynamic liquefaction	7.7 and 7.9	Design meets criteria for stability assuming tailings liquefy under seismic loading
Characterization of the footprint area as well as upstream areas	4.0	Included
Site-specific seismic hazards	4.5 and 7.7	Design meets criteria for stability considering the site-specific seismic hazard
Minimum acceptable factors of safety	7.7.1 and 7.9	Design meets criteria for stability
Long-term consolidation settlements	7.7.8	Consolidation is not a credible failure mode
Short-term and long-term deformations	7.9	Deformation of the embankment is not a credible failure mode
Hydrotechnical		
Flow capacity	7.10	Spillway designed to pass the 72-hour PMF
Surface erosion	-	Not a credible failure mode during operation if OMS controls are implemented. Closure design to consider erosion.
Water balance	6.4 and 7.10	Included
Hydrogeological		
Hydraulic fracturing	-	Not a credible failure mode; design includes management of the hydraulic gradient across the foundation and till core
Seepage through the foundation and abutments	7.5	The 4 m embankment raise is not expected to significantly increase the current seepage rates at the TSF
Geochemical		
Acid generation from tailings or dam construction materials	5.2	Assessment of geochemistry is excluded from the scope of this report. Refer to Kennedy et al. (2016) and SRK (2022).

Table 24: Failure Modes Required to Be Assessed

Failure Modes	Report Section	Assessment
Metal leaching from tailings or dam construction materials	5.2	Assessment of geochemistry is excluded from the scope of this report. Refer to Kennedy et al. (2016) and SRK (2022).
Water treatment effectiveness and capacity	-	Not a credible failure mode because the design does not rely on water treatment to prevent failure and is not anticipated to influence the effectiveness or capacity of the treatment plant
Mechanical		
Tailings transport pressure and flow capacity	-	Assessment of tailings transport is undertaken by MPMC and excluded from the scope of this report.
Water conveyance pressure and flow capacity	6.6	Upstream drain pipes have been sized for expected flows for a TSF crest at elevation 987 m. Flow is by gravity only. Assessment of other water conveyance in pipelines is excluded from the scope of this report (e.g., reclaim barge; conveyance from Perimeter Embankment Till Borrow Pond to TSF
Loading conditions that should be considered in stability analyses include		
Initial and interim and long-term construction stages	7.7	The design meets stability criteria for short- and long-term construction stages
Impounding of water	7.7	The design meets stability criteria assuming an upset condition with no tailings beach (i.e., the pond against the embankment)
Impoundment of tailings	7.7	The design considers impounded tailings to elev. 973 m
Rapid drawdown (if possible, for the facility)	-	Not a credible failure mode; no mechanism to rapidly draw down the pond
Earthquake impact on dam	7.7	Design meets stability criteria considering the site seismic hazard
Earthquake induced liquefaction of retained tailings	7.7	Design meets stability criteria assuming tailings liquefy
Extreme climatic events (precipitation, temperature, and wind)	3.2 and 7.10	IDF design criteria is the 72-hour annual PMP plus snowmelt

Source: BC MEM 2016.

TSF = tailings storage facility; IDF = inflow design flood; PMP = probable maximum precipitation; - = not applicable.

The Engineers and Geoscientists British Columbia (EGBC) guide to the standard for documented independent review of high-risk professional activities or work (EGBC 2023) were followed and a Type I independent review was completed. The independent review checklist and signoff is included in Appendix J.

8.0 INSTRUMENTATION

A geotechnical instrumentation and monitoring system is in place for the Mount Polley TSF in conjunction with established QPOs to monitor performance of the facility.

The monitoring system has been established, and is reviewed on a regular basis, based on failure modes and critical controls identified as part of risk reviews and the design and operational philosophy. The intention of the monitoring system is to provide early warning indications of changing conditions that may affect the safe and effective management of the TSF.

The TSF instrumentation is monitored and assessed against the QPOs by MPMC staff. The Engineer of Record team reviews and interprets the instrumentation data provided by MPMC periodically. MPMC personnel is responsible for implementation of specific actions and responses in the event of anomalous data or QPO exceedances, including informing the Engineer of Record when the QPO thresholds are triggered.

As part of the design for the raise of the TSF to elevation 974 m, the existing TSF instrumentation monitoring system will be retained. Instrumentation, where required, will be relocated or extended during construction.

Geotechnical instrumentation and monitoring will follow the requirements set out in the existing Operation, Maintenance and Surveillance Manual for the TSF. The Operation, Maintenance and Surveillance Manual is reviewed annually and updated as required to reflect changing conditions for the TSF.

Slope inclinometer casing and VWP and shape acceleration array cables will be extended and raised as part of the construction to reslope and raise the embankment. Raising inclinometer casings and standpipe wells through the rockfill buttress can be challenging, and some of the existing inclinometers and standpipes may be damaged during construction. Instrumentation coverage will be reviewed if existing instrumentation is damaged. The need to replace instrumentation will be assessed in a case-by-case basis.

The survey monument installed at the crest of the Perimeter Embankment at Corner 1 was decommissioned during construction of the embankment in 2023. Readings of the remaining survey monument (SM17-02) installed on the Perimeter Embankment buttress at Corner 1 have been unreliable, and the survey monument should be decommissioned prior to raising the embankment above elevation 970 m.

Existing and proposed new instrumentation for the TSF is presented in Table 25. Specifications for the instrumentation are included in Appendix B, and coordinates and typical details are presented in Drawings 29 and 30 in Appendix A.

Table 25: Existing and Proposed Instrumentation for Monitoring of Tailings Storage Facility Failure Modes

Failure Mode	Existing Instrumentation to be Retained	New Instrumentation	Comment
Instability due to foundation failure	■ Twenty-two SIs are to be extended vertically and protected from damage (SI16-15, SI15-10, SI15-14, SI15-17, SI15-18, SI16-01, SI16-03, SI16-06, SI18-01, SI18-03, SI18-04, SI23-01, SI23-02, SI15-01, SI15-02, SI21-01, SI21-02, SI21-03, SI12-02, SI15-07, SI15-08, and SI21-06). ■ Four SAA cables (SAA15-01, SAA15-02, SAA16-01, and SAA16-02) are to be extended and protected from damage. ■ One hundred and twenty-three VWPs installed in the foundation are to be extended and protected from damage.	■ Five SAAs are to be installed in new boreholes in the foundation under the South and Main embankments. ■ VWPs are to be installed in boreholes drilled to install new SAAs. Elevations will be confirmed by the EoR. ■ Seven SAAs are to be retrofitted within existing SI casing on the Main and Perimeter embankments (SI15-12, SI15-15, SI23-03, SI15-04, SI15-06 and SI21-05). SAAs may not be able to be retrofitted in all proposed SIs due to consolidation of the existing casing. Drilling an adjacent borehole may be required in some cases.	■ Installation of SAAs in new boreholes is to be planned so the embankment can be adequately monitored during construction. SIs to be retrofitted with SAAs prior to the bulk of rockfill placement for embankment resloping. New SAAs to be installed within 2 months of completion of resloping of each embankment, or within 3 months of decommissioning of SIs. ■ The following SIs will need to decommissioned as they will be inaccessible to safely read following resloping of the embankments: SI15-19, SI15-20, SI16-16, SI15-03, SI15-05, and SI15-09. ■ SIs within footprint of ramp (SI15-10 and SI15-18) may be decommissioned, if required.
Overtopping	■ Freeboard and pond volume are monitored by survey of the pond level and tailings surface. ■ Minimum beach width and general location of the pond are monitored by visual inspection and satellite images.		
Internal erosion (piping)	■ Thirty-two VWPs installed in the embankment and upstream tailings are to be extended and protected from damage.	■ Forty-six VWPs are to be installed upstream of the till core to monitor the phreatic surface upstream of the till core and the performance of the upstream drains. ■ Manual flow rate and turbidity readings are to be taken on upstream drain discharge points.	■ VWPs to be installed during construction of the upstream drains. ■ Manual flow rate and turbidity readings are to continue for the Perimeter Embankment at Corner 1 upstream drain, South Embankment toe drain, and east and west Main Embankment toe drains. Turbidity readings are to continue at the Freshet Embankment seepage collection ditch and the north and south diversion ditches.

TSF = tailings storage facility; VWP = vibrating wire piezometer; SI = slope inclinometer; SAA = shape acceleration array; EoR = Engineer of Record.

9.0 MATERIAL QUANTITIES

The estimated material quantities required for construction of the embankments and emergency spillway to a crest elevation of 974 m are summarized in Table 26. Quantities include construction of the upstream drain. The estimated fill volumes are based on the August 25, 2023, survey. All fill quantities are estimated after spreading and compaction. No allowances for constructability or bulking factors have been included in the material quantity estimates. All geotextile and pipe quantities are for after installation only and do not include any allowances. Actual quantities may vary based on conditions encountered in the field.

Table 26: Material Quantities for Tailings Storage Facility Raise to Elevation 974 m

Task	Unit	Quantity
Embankment		
Foundation preparation	m^2	140,000
Till core	m^3	104,000
Filter[(a)]	m^3	32,000
Transition[(a)]	m^3	30,000
Raise and reslope rockfill	m^3	3,576,000
Buttress rockfill	m^3	1,609,000
Upstream fill	m^3	378,000
General fill for upstream drain and upstream fill below 970 m[(b)]	m^3	421,000
Drain rock	m^3	50,000
Drain rock transition	m^3	15,000
Filter sand	m^3	100
Geotextile 800 g/m^2	m^2	60,000
Geotextile 340 g/m^2	m^2	68,000
6-inch diameter perforated, SDR 9 HDPE pipe, PE4710	m	850
12-inch diameter solid, SDR 17 HDPE pipe, PE4710[(c)]	m	4,900
12-inch by 12-inch by 12-inch tee, SDR 17 HDPE, PE4710	ea	11
12-inch by 12-inch by 6-inch reducing tee, HDPE, PE4710	ea	85
12-inch end cap, SDR 17 HDPE, PE4710	ea	22
6-inch end cap, SDR 9 HDPE, PE4710	ea	85
Spillway[(d)]		
Riprap (10 kg class)	m^3	1,400
Riprap (50 kg class)	m^3	2,400
Riprap (100 kg class)	m^3	200
Geotextile 340 g/m^2	m^2	300
Granular Road Gravel	m^3	600
Till Liner	m^3	1,200
Fine Bedding	m^3	2,200
Coarse Bedding	m^3	100

Table 26: Material Quantities for Tailings Storage Facility Raise to Elevation 974 m

Task	Unit	Quantity
Native Fill	m^3	1,700
Rockfill	m^3	5,600
Excavation	m^3	13,600

(a) Filter and transition quantities around drainpipes downstream of till core and within the upstream drain are not included.

(b) Based on topographic survey completed in August 2023. Ongoing tailings deposition has filled some of this volume.

(c) The length of pipe required from the downstream crest of the embankment to the downstream water management infrastructure is not included in the quantities in the table.

(d) Rounded up to the nearest 100.

SDR = standard dimension ratio; HDPE = high-density polyethylene.

10.0 CONSTRUCTION

10.1 Construction Schedule

Construction of the till core should be limited to when temperatures are above freezing. Generally, that is from April to October. Construction of the rockfill buttresses and rockfill shell can occur year round provided measures are taken to manage snow, ice, and surface water. A minimum tailings freeboard of 0.9 m (top of tailings surface to crest of embankment) is to be maintained.

The base surface used for the deposition modelling was generated by combining a topographic and bathymetry survey completed on August 25, 2023. Tailings deposition from August 2023 was modelled using actual production values from August to December 2023 and MPMC mine plan tonnages reported in the Design Basis from January 2024 onwards (Appendix C).

Figure 10 shows the embankment construction sequence to 974 m crest elevation from the current crest elevation of 970 m, along with the planned tailings deposition schedule considering a 0.5% and a 1% sub-aerial tailings beach slope. The construction sequence assumes that the construction season is limited to the period between May and October each year due to weather conditions. Note that this figure is based on actual production and the time frame differs from the mine plan presented in Appendix C.

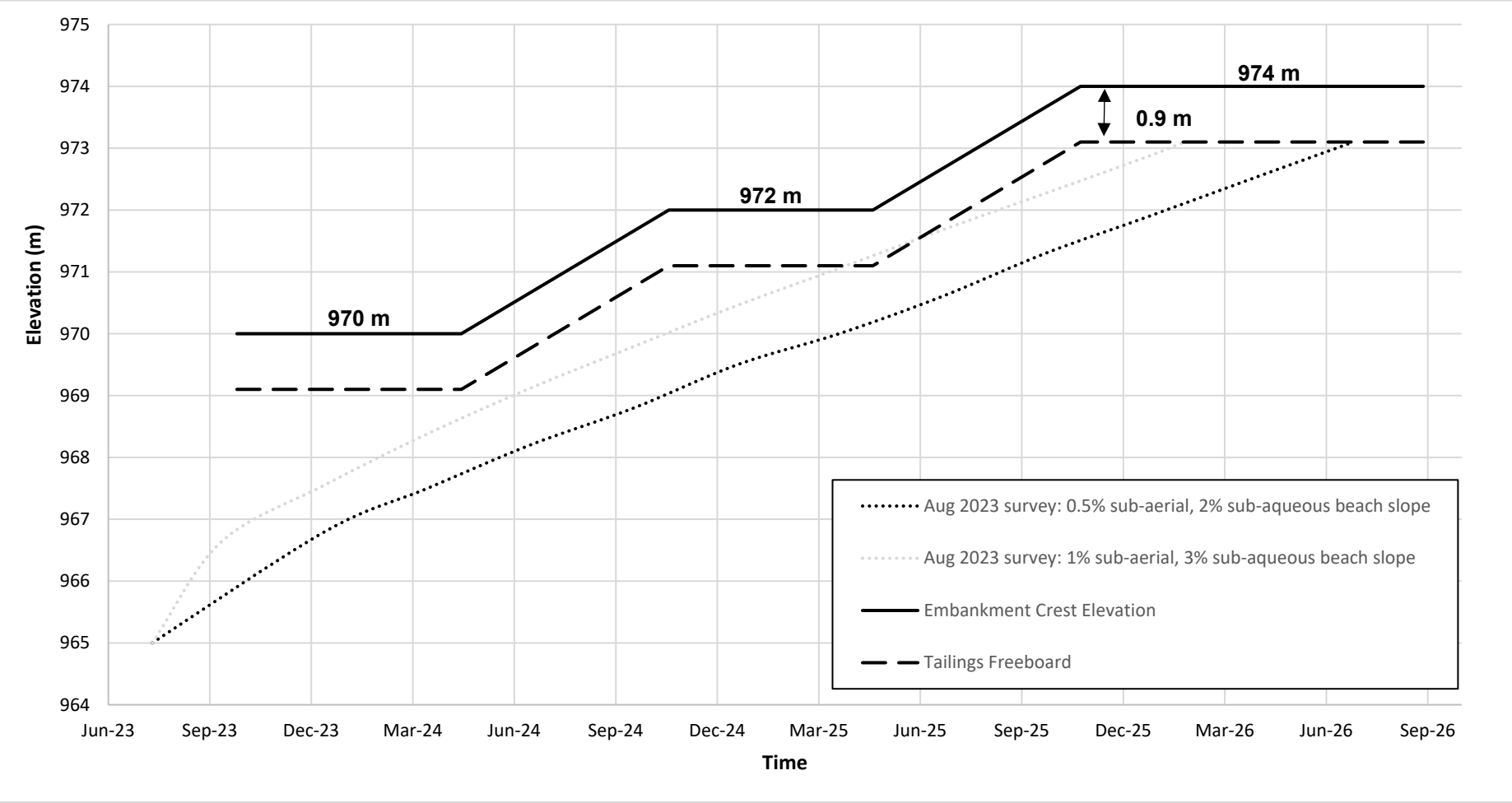

Tailings freeboard is based on a 0.5% sub-aerial beach slope, which is what has been achieved with recent operations. Tailings freeboard may be increased or reduced during operations based on actual tailings deposition slopes; the tailings freeboard will be included as part of the quantitative performance objectives and changes must be agreed upon with the Engineer of Record.

Figure 10: Tailings Storage Facility Embankment Tailings Deposition and Construction Schedule

10.2 Construction Sequence

The following construction sequence is proposed for construction of the TSF to elevation 974 m, although some activities will be performed simultaneously:

- **Instrumentation**—relocation and/or protection of all existing geotechnical instrumentation that may be affected during construction.
- **Foundation preparation**—removal of any unsuitable material.
- **Toe buttress extension**—buttress construction must be completed prior to raising the embankment.
- **Embankment reslope and crest widening at elevation 970 m**—rockfill placement to reslope the embankment to 2H:1V. Buttress extension construction must be completed prior to resloping of the embankment.
- **Abutment foundation preparation**—removal of unsuitable materials and excavation to the underlying competent native till or bedrock to provide suitable tie-in for the till core.
- **Upstream drain construction**—till core crossing must occur at the elevations indicated in the drawings and specifications.
- **Raise of embankment**—till core construction from elevation 970 m, including surrounding upstream fill, filter transition, and rockfill.
- **Spillway construction**—spillway invert to be constructed 1.1 m below embankment crest elevation. Spillway to be constructed after each embankment raise and before freshet.

Sufficient construction material must be stockpiled or available during the construction to allow the sequential raising of the embankment with upstream fill, till, filter, transition, and rockfill.

The quality assurance and quality control requirements are described in detail in the *Embankment Construction to Elevation 974 m Technical Specification* (Appendix B). The Quality Assurance Manager will be present full time on site during construction activities and will be responsible for the quality assurance activities.

11.0 CLOSURE

The reader is referred to the Study Limitations, which precedes the text and forms an integral part of this report. We trust the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate to contact the undersigned.

Signature Page

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APPENDIX A

Design Drawings

MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

DRAWING LIST				
DRAWING NUMBER	DRAWING TITLE	REVISION NUMBER	PURPOSE OF ISSUE	DATE OF ISSUE
01	DRAWING LIST AND PROJECT LOCATION PLAN	0	ISSUED FOR CONSTRUCTION	2024-04-18
02	SITE PLAN	0	ISSUED FOR CONSTRUCTION	2024-04-18
03	PRE-CONSTRUCTION CONDITIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
04	GENERAL ARRANGEMENT - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
05	SOUTH EMBANKMENT - FOUNDATION PREPARATION	0	ISSUED FOR CONSTRUCTION	2024-04-18
06	SOUTH EMBANKMENT - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
07	SOUTH EMBANKMENT - TYPICAL CROSS-SECTION AND DETAIL	0	ISSUED FOR CONSTRUCTION	2024-04-18
08	SOUTH EMBANKMENT - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
09	MAIN EMBANKMENT BUTTRESS - FOUNDATION PREPARATION	0	ISSUED FOR CONSTRUCTION	2024-04-18
10	MAIN EMBANKMENT AND BUTTRESS - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
11	MAIN EMBANKMENT AND BUTTRESS - TYPICAL CROSS-SECTION AND DETAIL	0	ISSUED FOR CONSTRUCTION	2024-04-18
12	MAIN EMBANKMENT - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
13	MAIN EMBANKMENT BUTTRESS - CROSS-SECTIONS (SHEET 1 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18
14	MAIN EMBANKMENT BUTTRESS - CROSS-SECTIONS (SHEET 2 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18
15	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - FOUNDATION PREPARATION	0	ISSUED FOR CONSTRUCTION	2024-04-18
16	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
17	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - TYPICAL CROSS-SECTION AND DETAIL	0	ISSUED FOR CONSTRUCTION	2024-04-18
18	PERIMETER EMBANKMENT (CORNER 2-CORNER 1) - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
19	PERIMETER EMBANKMENT BUTTRESS (CORNER 2-CORNER 1) - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
20	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - FOUNDATION PREPARATION	0	ISSUED FOR CONSTRUCTION	2024-04-18
21	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
22	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - TYPICAL CROSS-SECTION AND DETAIL	0	ISSUED FOR CONSTRUCTION	2024-04-18
23	PERIMETER EMBANKMENT (CORNER 1-CORNER 5) - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
24	PERIMETER EMBANKMENT BUTTRESS (CORNER 1-CORNER 5) - CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
25	SOUTH AND PERIMETER EMBANKMENT ABUTMENTS - PLAN VIEW AND TYPICAL CROSS-SECTIONS	0	ISSUED FOR CONSTRUCTION	2024-04-18
26	UPSTREAM DRAIN - SOUTH AND MAIN EMBANKMENT - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
27	UPSTREAM DRAIN - PERIMETER EMBANKMENT - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
28	UPSTREAM DRAIN - TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 1 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18
29	UPSTREAM DRAIN - TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 2 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18
30	INSTRUMENTATION - PIEZOMETERS - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
31	INSTRUMENTATION - SLOPE INCLINOMETERS AND SAAS - PLAN VIEW	0	ISSUED FOR CONSTRUCTION	2024-04-18
32	TSF SPILLWAY - PLAN AND PROFILE	0	ISSUED FOR CONSTRUCTION	2024-04-18
33	TSF SPILLWAY - TYPICAL DETAILS	0	ISSUED FOR CONSTRUCTION	2024-04-18
34	TSF SPILLWAY - TYPICAL CROSS-SECTIONS (SHEET 1 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18
35	TSF SPILLWAY - TYPICAL CROSS-SECTIONS (SHEET 2 OF 2)	0	ISSUED FOR CONSTRUCTION	2024-04-18

SPECIFICATIONS			
SPECIFICATION NUMBER	SPECIFICATION TITLE	REVISION NUMBER	DATE OF ISSUE
CA0020527.4505-014-R-Rev0-51312	MOUNT POLLEY MINE TAILINGS STORAGE FACILITY EMBANKMENT CONSTRUCTION TO ELEVATION 974 m TECHNICAL SPECIFICATIONS	0	2024-04-18



PROJECT LOCATION PLAN
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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
DRAWING LIST AND PROJECT LOCATION PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	01 of 35	01

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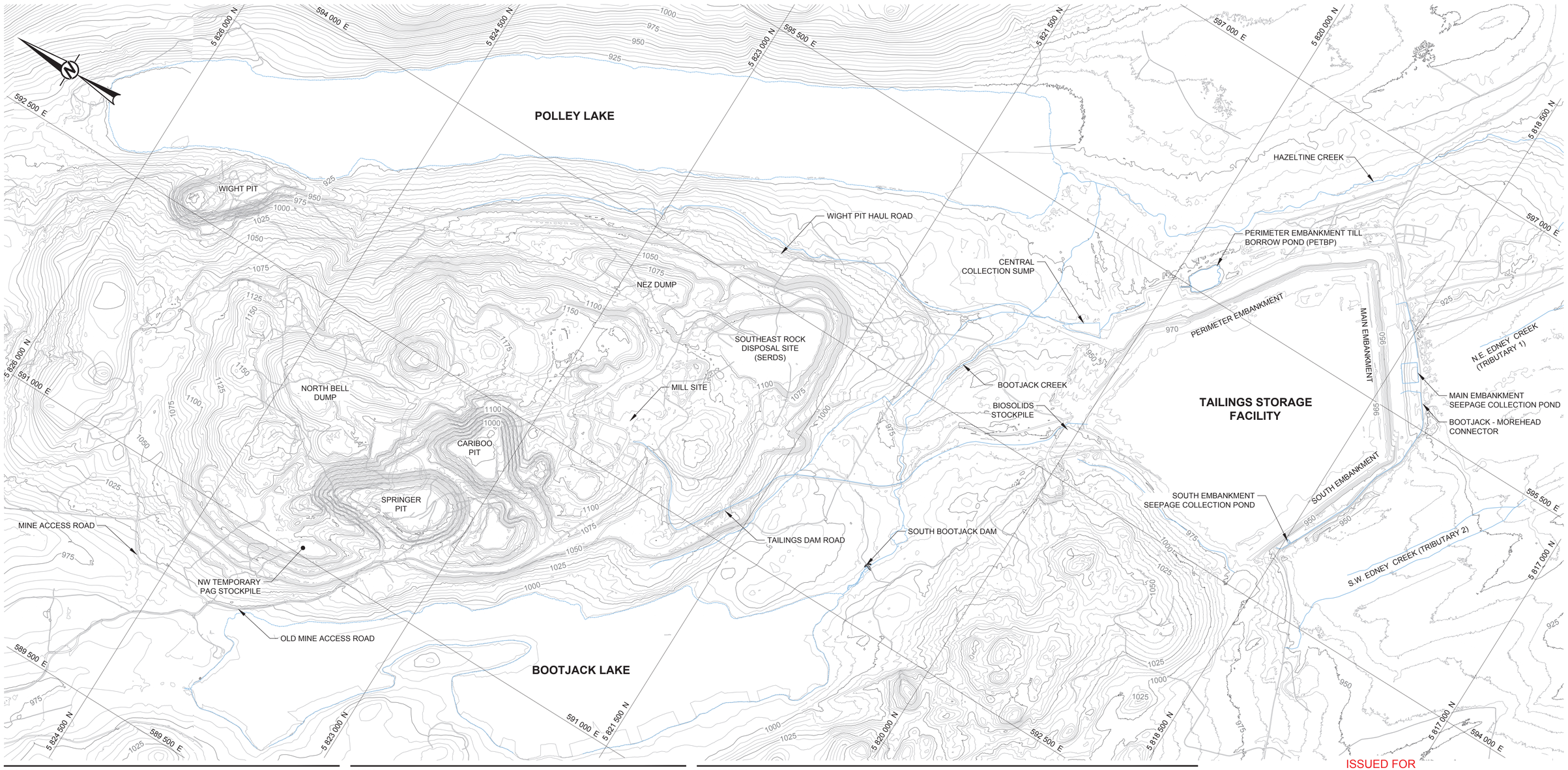

LEGEND

- GROUND CONTOURS (SEE NOTE 4)
- SHORELINE (SEE REFERENCE 6)
- WATERCOURSE (SEE REFERENCE 6)
- SITE ACCESS ROADS (SEE REFERENCE 6)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 25 m MAJOR AND 5 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2013-2023 (SEE REFERENCES 1-5).

REFERENCES

1. 2013 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MTPOLLEY2013-DTM.dwg", SURVEYED: 2013, RECEIVED: 1 OCTOBER 2014.
2. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: SEPTEMBER 3, 2014.
3. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
4. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
5. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
6. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", SURVEYED: 2013, RECEIVED: 5 SEPTEMBER 2014.

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SITE PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	02 of 35	DRAWING
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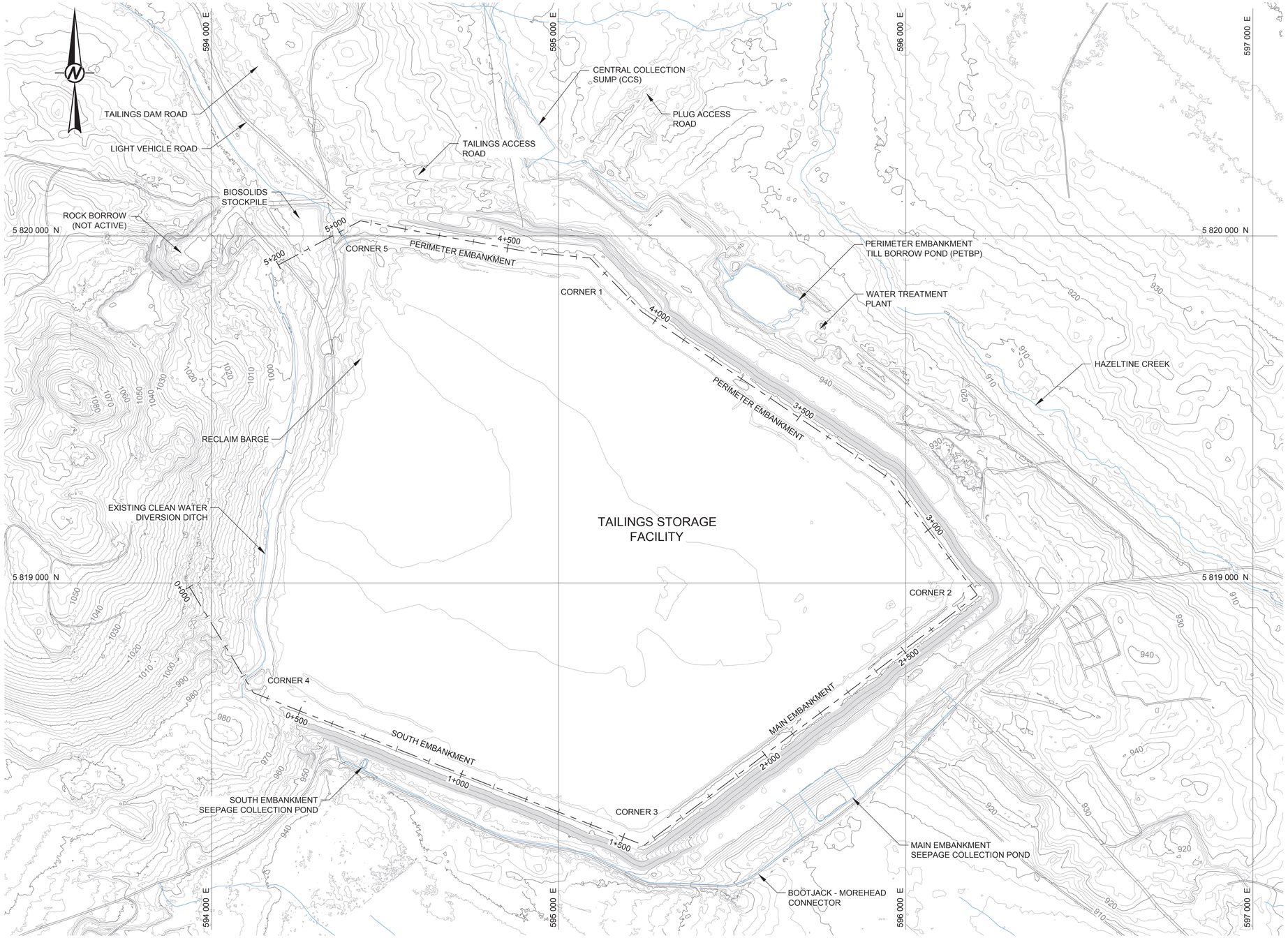

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- SITE ACCESS ROADS (SEE REFERENCE 5)
- WATERCOURSE (SEE REFERENCE 5)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
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5. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 5 SEPTEMBER 2014.

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PRE-CONSTRUCTION CONDITIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	03 of 35	03

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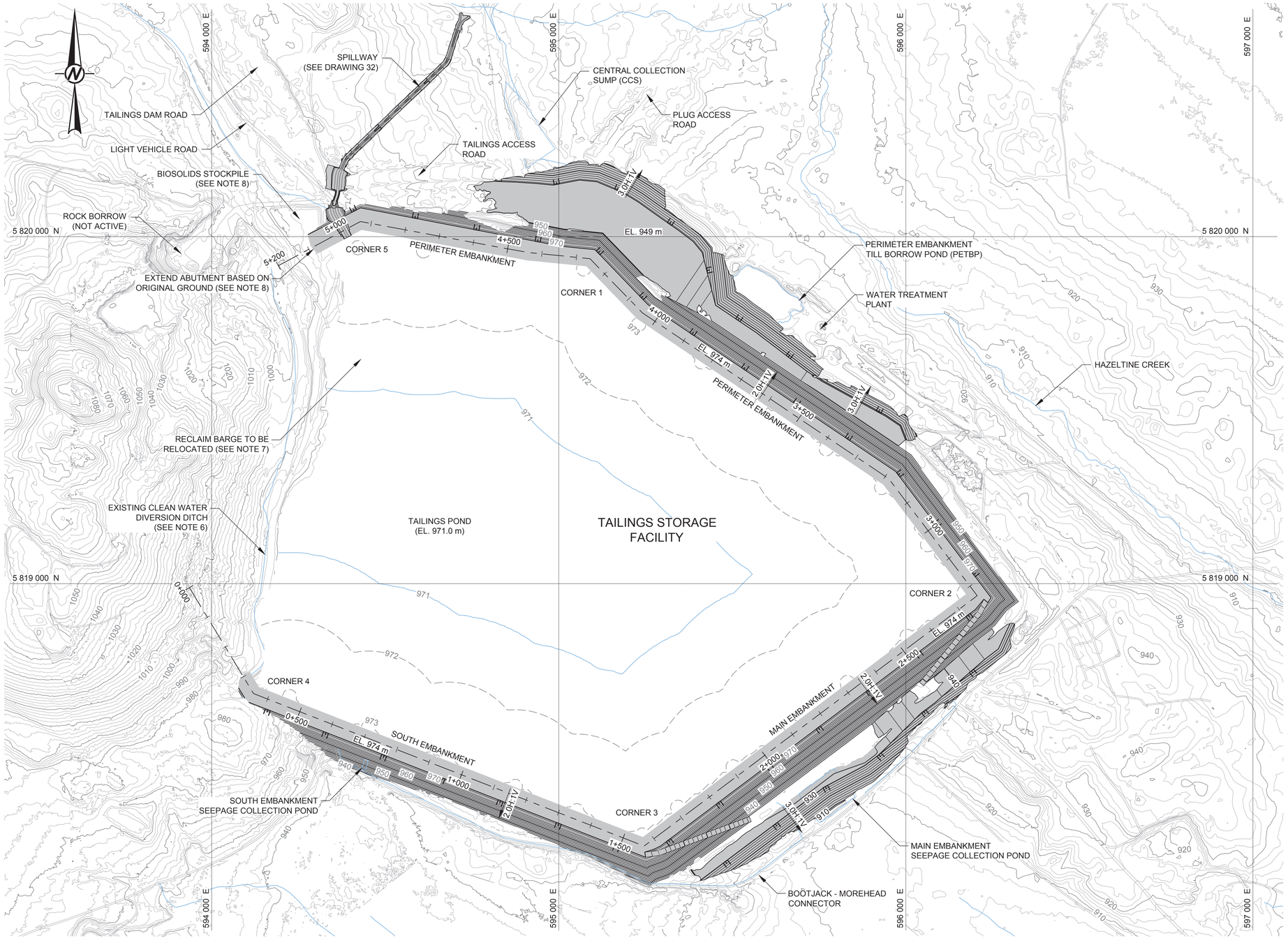

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- TAILINGS SURFACE CONTOURS (SEE NOTE 10)
- TAILINGS POND (EL. 971.0 m)
- SITE ACCESS ROADS (SEE REFERENCE 5)
- WATERCOURSE (SEE REFERENCE 5)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR, TAILINGS DEPOSITION CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
6. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
7. RECLAIM BARGE TO BE RELOCATED TO A CENTRAL LOCATION BETWEEN CORNER 4 AND 5.
8. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
9. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.
10. TAILINGS SURFACE SHOWN FOR REFERENCE ONLY, AND IS EXTRACTED FROM DEPOSITION MODEL AND ADJUSTED TO A MAXIMUM TAILINGS ELEVATION OF 973.1 m.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
2. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
3. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
4. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
5. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

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0 200 400

1:6,000 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
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[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

GENERAL ARRANGEMENT
PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	04 of 35	04

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\complexdata\toffice\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505\51300\51395\Doc 014_974 Design\02_PRODUCTION\DWG\Drawings\ | File Name: CA0020527_4505-51300-51395-014-004.dwg | Last Edited By: tyklassen Date: 2024-04-15 Time:12:19:02 PM | Printed By: TYKlassen Date: 2024-04-17 Time:8:58:57 PM

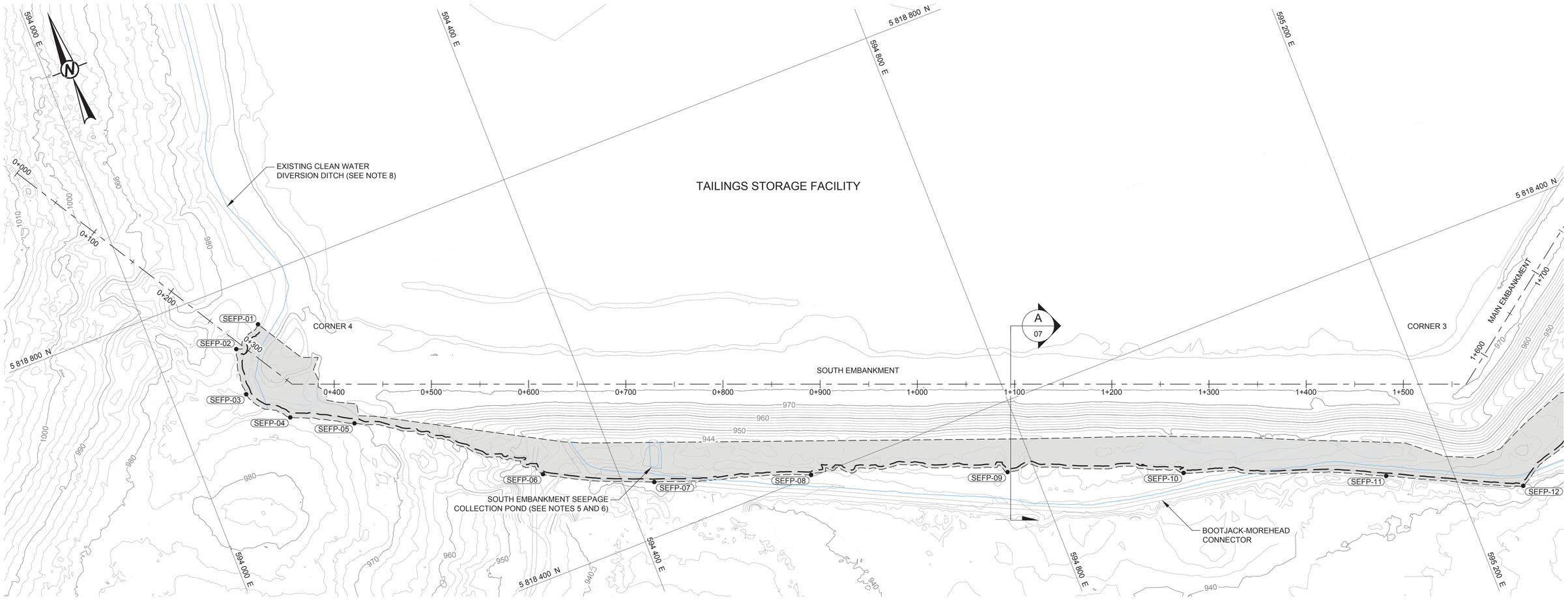

SOUTH EMBANKMENT - FOUNDATION PREPARATION

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE DESIGN TOE
- FOUNDATION PREPARATION FOOTPRINT (SEE NOTES 5 AND 6)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- WATERCOURSE (SEE REFERENCE 4)
- SEFP-12 — SOUTH EMBANKMENT FOUNDATION PREPARATION SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-3).
5. EXTENT AND DEPTH OF FOUNDATION PREPARATION TO BE CONFIRMED BY QA MANAGER.
6. NO FOUNDATION PREPARATION IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH CLEAN WATER DIVERSION DITCH, SOUTH EMBANKMENT SEEPAGE POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
9. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
3. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
4. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

SOUTH EMBANKMENT FOUNDATION PREPARATION SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
SEFP-01	594110.20	5818753.44	977.52
SEFP-02	594080.05	5818737.76	974.58
SEFP-03	594072.68	5818690.81	973.00
SEFP-04	594106.25	5818652.08	974.92
SEFP-05	594165.54	5818622.42	970.35
SEFP-06	594327.19	5818503.10	943.35
SEFP-07	594430.90	5818453.87	939.47
SEFP-08	594583.88	5818402.09	943.32
SEFP-09	594773.21	5818331.18	944.59
SEFP-10	594941.58	5818264.49	944.29
SEFP-11	595134.56	5818185.74	942.54
SEFP-12	595262.17	5818124.96	940.92

ISSUED FOR

CONSTRUCTION

0 100 200

1:2,000 METRES

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SEAL

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2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SOUTH EMBANKMENT FOUNDATION PREPARATION

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	05 of 35	05

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0 25 mm

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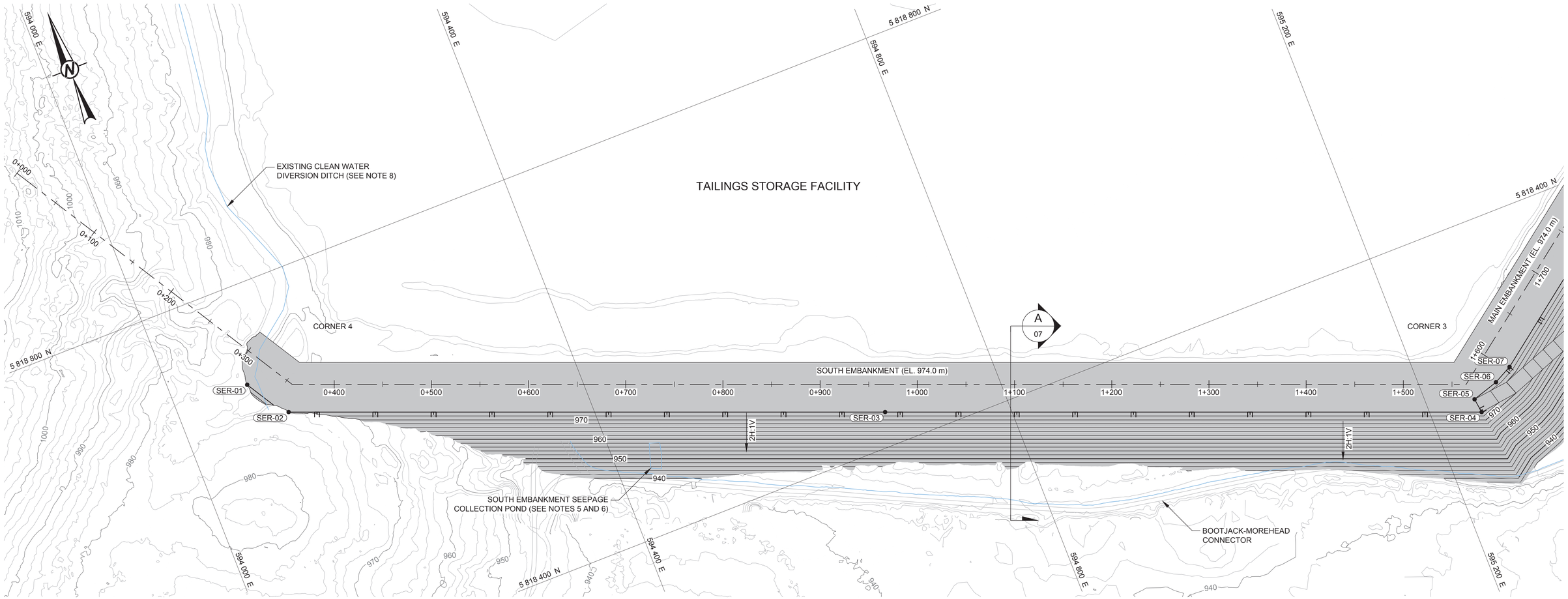

SOUTH EMBANKMENT - PLAN VIEW

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 4)
- WATERCOURSE (SEE REFERENCE 4)
- SER-07 — SOUTH EMBANKMENT RAISE SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-3).
5. EXTENT OF ROCKFILL PLACEMENT TO BE CONFIRMED BY QA MANAGER.
6. NO ROCKFILL PLACEMENT IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH THE CLEAN WATER DIVERSION DITCH, SOUTH EMBANKMENT SEEPAGE COLLECTION POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
9. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
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4. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

SOUTH EMBANKMENT RAISE SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
SER-01	594077.27	5818699.68	974.00
SER-02	594106.78	5818658.03	974.00
SER-03	594678.40	5818434.75	974.00
SER-04	595250.03	5818211.47	974.00
SER-05	595248.07	5818226.34	974.00
SER-06	595274.96	5818234.72	974.00
SER-07	595293.70	5818244.30	974.00

ISSUED FOR

CONSTRUCTION

0 100 200

1:2,000 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SOUTH EMBANKMENT PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.	06 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		06

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\Imperial _metals_corp\mount_polley_mine\99_projects\ca0020527_4505\51300\51395\Doc 014_974 Design\02_PRODUCTION\DWG\Drawings\ | File Name: CA0020527_4505-51300-51395-014-006.dwg | Last Edited By: tyklassen Date: 2024-04-17 Time:9:02:11 PM | Printed By: TYKlassen Date: 2024-04-18 Time:12:28:25 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

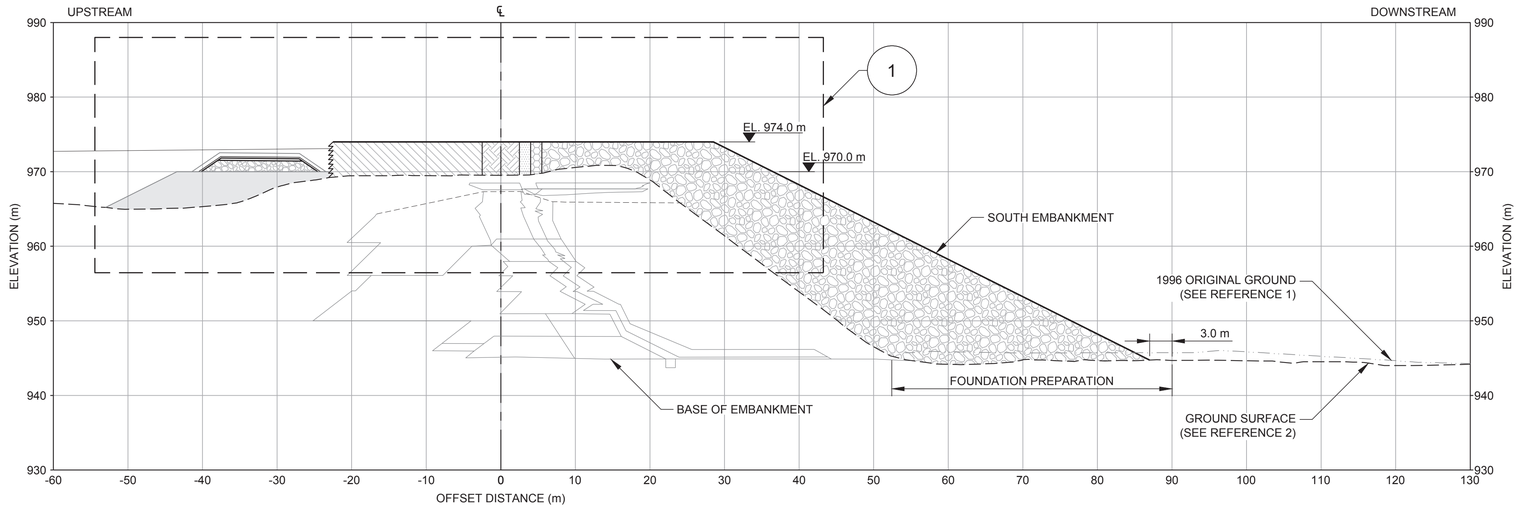

SCALE 1:400 m — A 05 06 — SOUTH EMBANKMENT - TYPICAL CROSS-SECTION (STA. 0+298 TO 1+566)

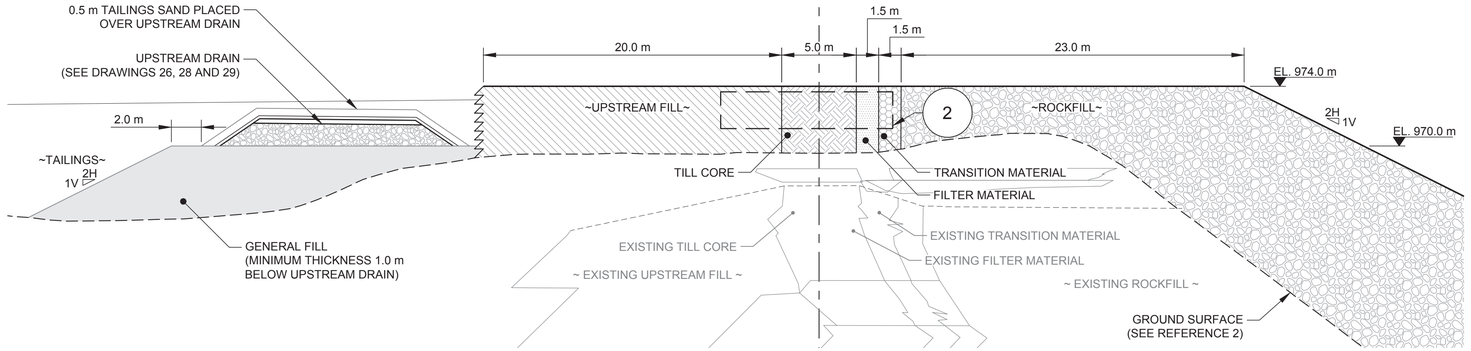

SCALE 1:200 m — 1 — SOUTH EMBANKMENT - TYPICAL DETAIL

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE SOUTH EMBANKMENT UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE CAN VARY BETWEEN ELEVATION 970 - 972 m, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT,
   FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf",
   DATED: 12 MARCH 2014.
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

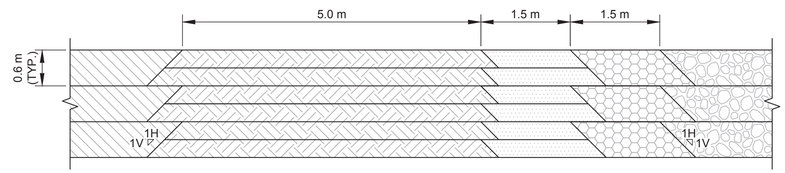

SCALE 1:50 m — 2 — TILL CORE - TYPICAL DETAIL

ISSUED FOR

CONSTRUCTION

0 2 4
1:50 METRES

0 10 20
1:200 METRES

0 20 40
1:400 METRES

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SOUTH EMBANKMENT
TYPICAL CROSS-SECTION AND DETAIL

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	07 of 35	07

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 — 25 mm

Path: \\global\dfs\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505-51300-51395-014-007.dwg | Last Edited By: tyklassen Date: 2024-04-17 Time:9:01:39 PM | Printed By: TYKlassen Date: 2024-04-18 Time:12:26:40 PM

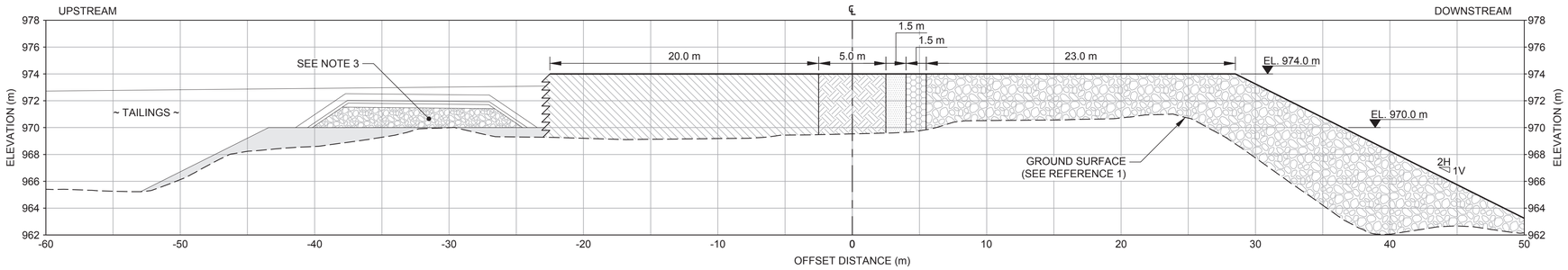

SOUTH EMBANKMENT CROSS-SECTION (STA. 0+500)

SCALE 1:200 m

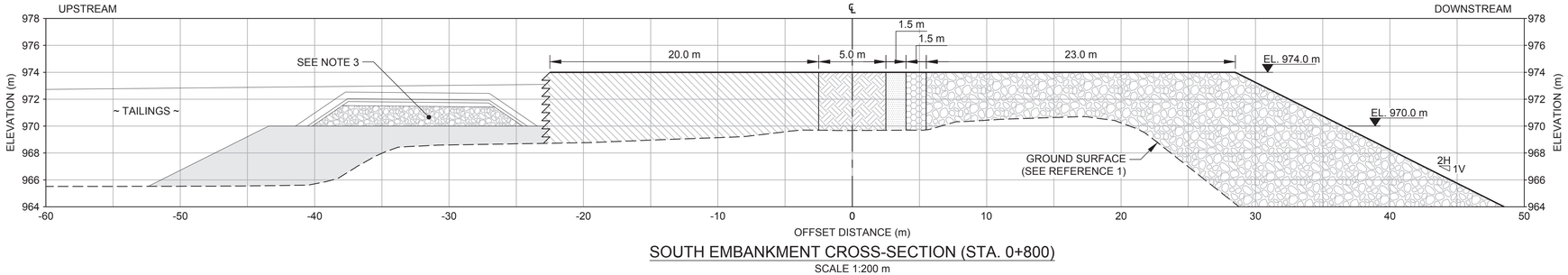

SOUTH EMBANKMENT CROSS-SECTION (STA. 0+800)

SCALE 1:200 m

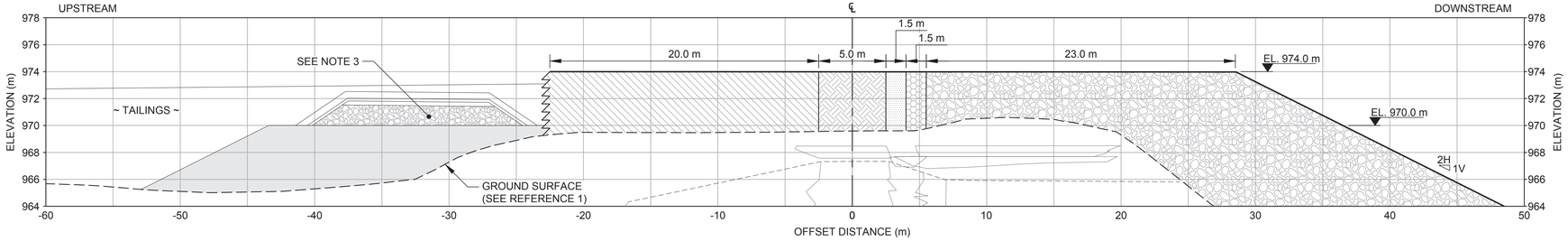

SOUTH EMBANKMENT CROSS-SECTION (STA. 1+100)

SCALE 1:200 m

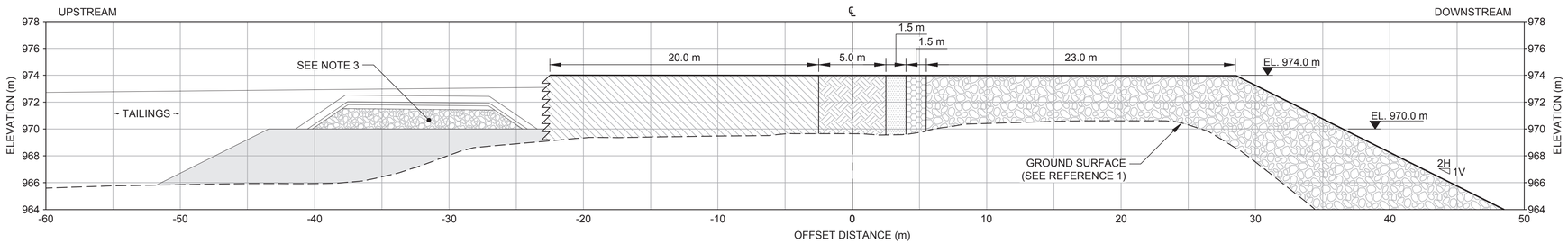

SOUTH EMBANKMENT CROSS-SECTION (STA. 1+400)

SCALE 1:200 m

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE SOUTH EMBANKMENT UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE CAN VARY BETWEEN ELEVATION 970 - 972 m, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCE

1. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

ISSUED FOR

CONSTRUCTION

0 10 20

1:200 METRES

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ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SOUTH EMBANKMENT CROSS-SECTIONS

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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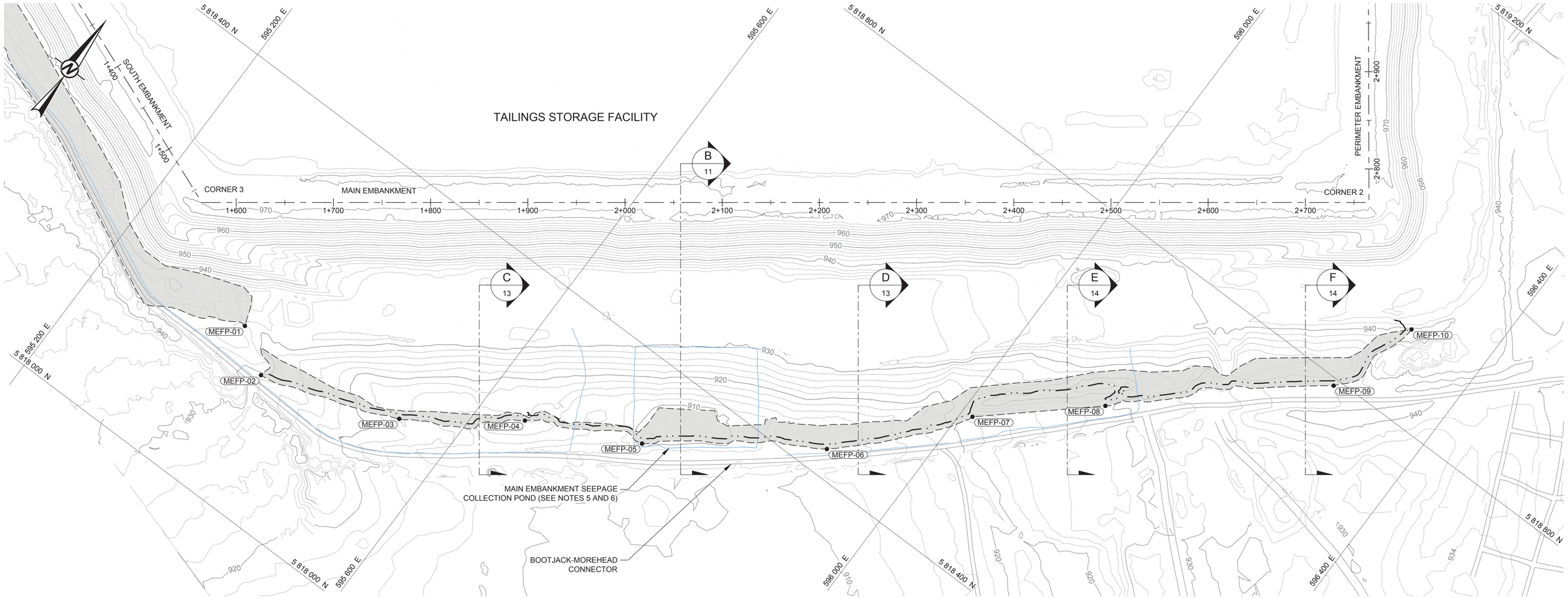

MAIN EMBANKMENT - FOUNDATION PREPARATION

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE DESIGN TOE
- TSF EL. 974 m BUTTRESS DESIGN TOE
- FOUNDATION PREPARATION FOOTPRINT (SEE NOTES 5 AND 6)
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- MEFP-10 — MAIN EMBANKMENT FOUNDATION PREPARATION SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT AND DEPTH OF FOUNDATION PREPARATION TO BE CONFIRMED BY QA MANAGER.
6. NO FOUNDATION PREPARATION IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH MAIN EMBANKMENT SEEPAGE POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

MAIN EMANKMENT FOUNDATION PREPARATION SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
MEFP-01	595357.37	5818168.95	932.26
MEFP-02	595400.93	5818138.37	929.11
MEFP-03	595541.61	5818187.93	916.01
MEFP-04	595646.09	5818264.17	916.05
MEFP-05	595756.62	5818317.71	909.12
MEFP-06	595912.09	5818427.43	912.51
MEFP-07	596011.89	5818543.96	922.97
MEFP-08	596114.46	5818635.08	928.74
MEFP-09	596289.68	5818792.73	937.10
MEFP-010	596318.99	5818887.12	939.54

ISSUED FOR

CONSTRUCTION

0 100 200

1:2,000 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
VANCOUVER, BC
V6Z 2M1
[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

MAIN EMBANKMENT BUTTRESS FOUNDATION PREPARATION

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	09 of 35	09

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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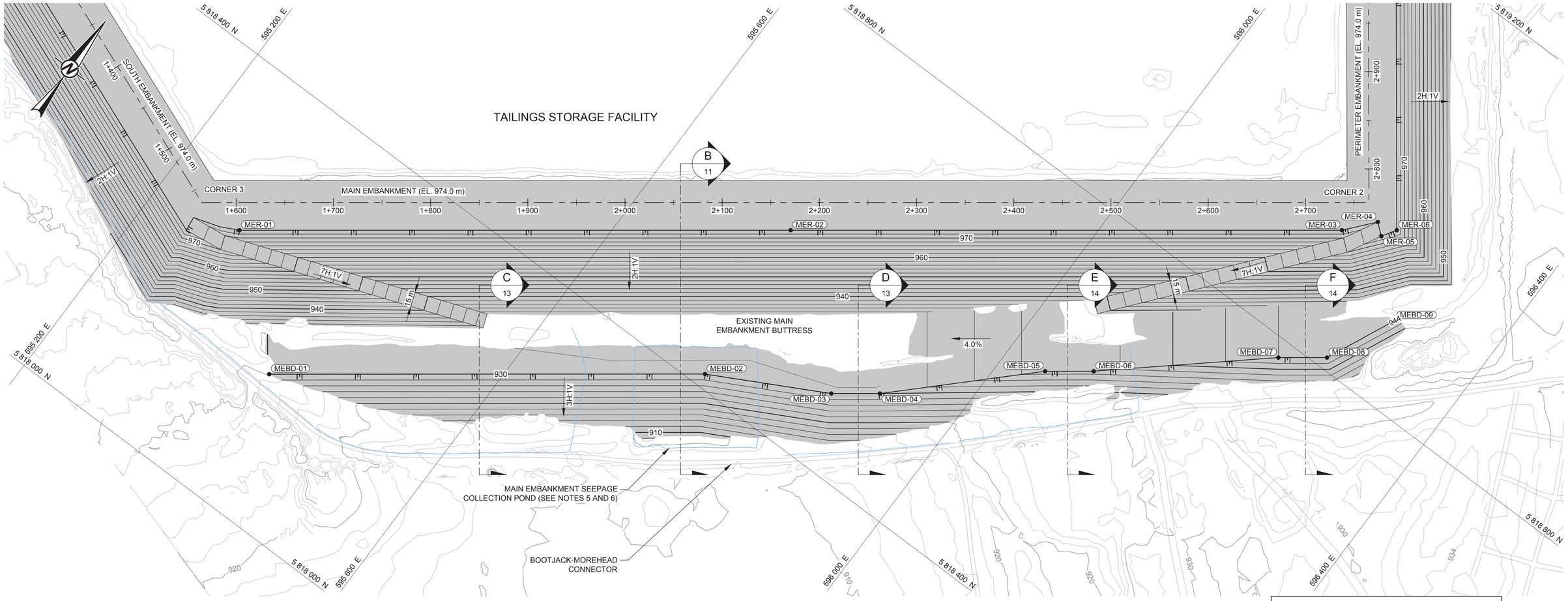

MAIN EMBANKMENT - PLAN VIEW

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- (MER-06) MAIN EMBANKMENT RAISE SETOUT POINT
- (MEBD-09) MAIN EMBANKMENT BUTTRESS DESIGN SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT OF ROCKFILL PLACEMENT TO BE CONFIRMED BY QA MANAGER.
6. NO ROCKFILL PLACEMENT IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH THE MAIN EMBANKMENT SEEPAGE COLLECTION POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

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3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

MAIN EMBANKMENT BUTTRESS DESIGN SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
MEBD-01	595407.09	5818144.29	930.00
MEBD-02	595765.41	5818413.79	930.00
MEBD-03	595881.37	5818475.81	930.00
MEBD-04	595921.33	5818505.86	930.00
MEBD-05	596043.39	5818626.36	937.00
MEBD-06	596083.36	5818656.40	937.00
MEBD-07	596226.84	5818781.75	944.00
MEBD-08	596266.81	5818811.79	944.00
MEBD-09	596299.83	5818884.25	944.00

MAIN EMBANKMENT EL. 974 m RAISE SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
MER-01	595293.71	5818244.30	974.00
MER-02	595747.04	5818585.01	974.00
MER-03	596200.37	5818925.72	974.00
MER-04	596224.82	5818954.73	974.00
MER-05	596236.44	5818945.25	974.00
MER-06	596245.50	5818959.66	974.00

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0 100 200

1:2,000 METRES

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SEAL

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2024-04-18

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[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

MAIN EMBANKMENT AND BUTTRESS PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	10 of 35	10

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0 25 mm

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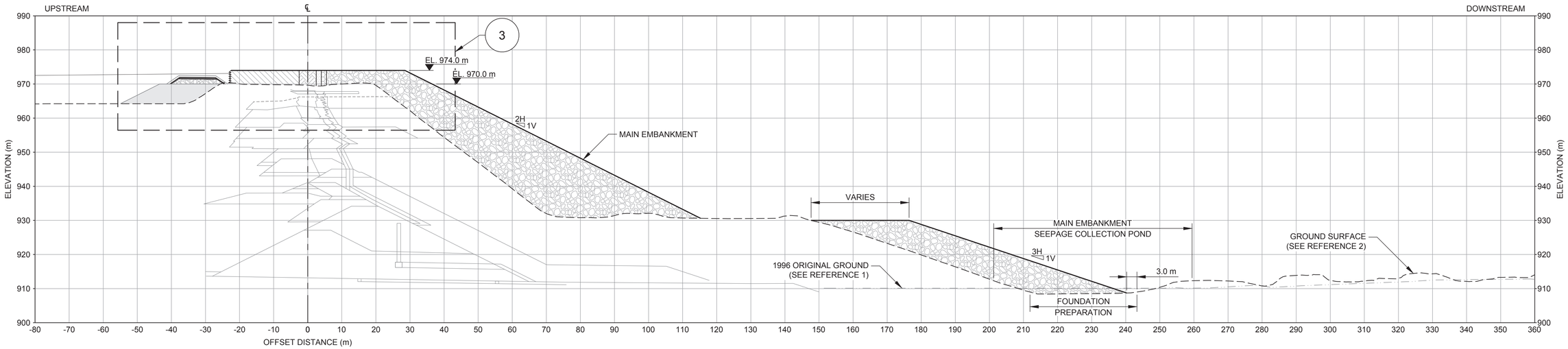

SCALE 1:600 m — B / 09 / 10 — MAIN EMBANKMENT - TYPICAL CROSS-SECTION (STA. 1+566 TO 2+756)

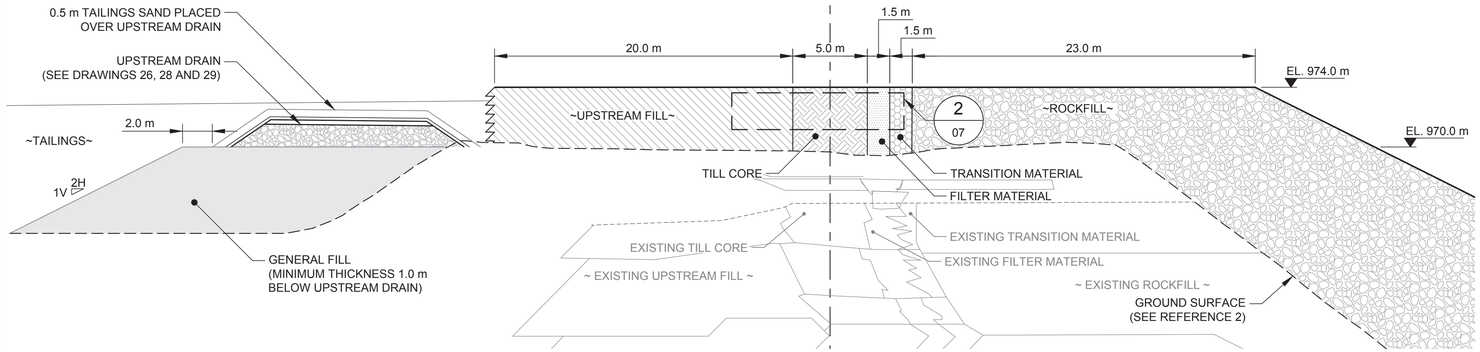

SCALE 1:200 m — 3 — MAIN EMBANKMENT - TYPICAL DETAIL

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE MAIN EMBANKMENT UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE TO BE AT ELEVATION 970 m, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT,
   FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf",
   DATED: 12 MARCH 2014.
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC,
   FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES,
   SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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0 10 20
1:200 METRES

0 20 40
1:600 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

Engineers & Geoscientists BC Permit #1000200

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
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VANCOUVER, BC
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[+1] (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

MAIN EMBANKMENT AND BUTTRESS TYPICAL CROSS-SECTION AND DETAIL

PROJECT NO.	PHASE/TASK/DOC.	REV.	11 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		11

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0 25 mm

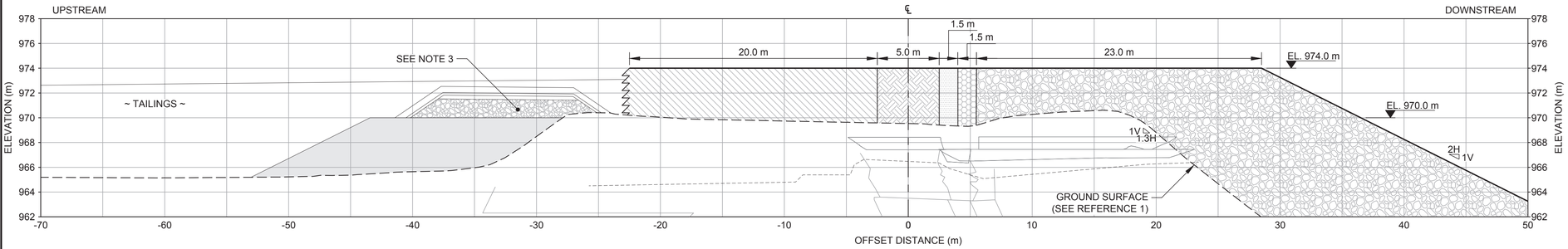

MAIN EMBANKMENT CROSS-SECTION (STA. 1+700)

SCALE 1:200 m

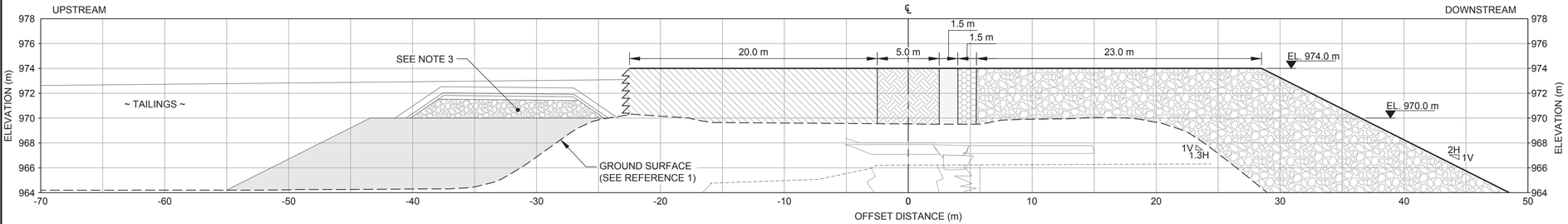

MAIN EMBANKMENT CROSS-SECTION (STA. 2+000)

SCALE 1:200 m

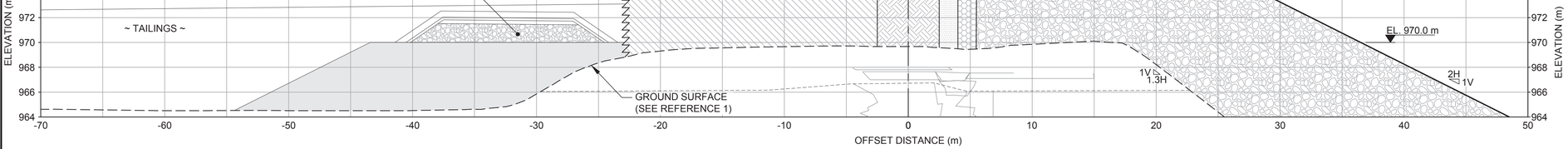

MAIN EMBANKMENT CROSS-SECTION (STA. 2+300)

SCALE 1:200 m

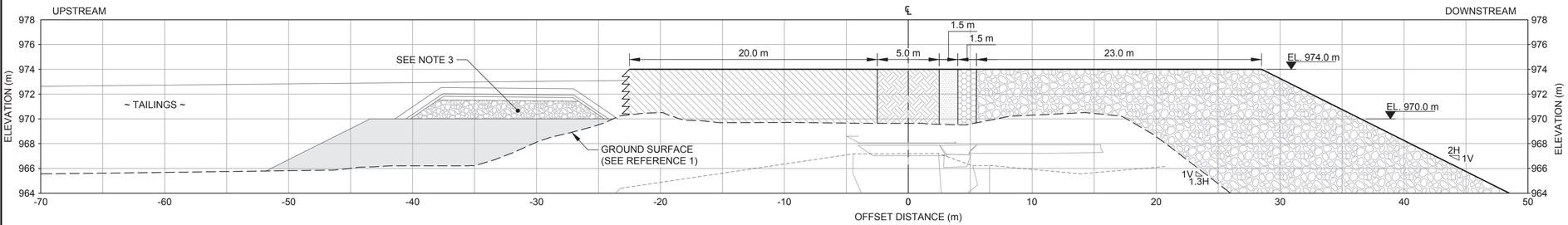

MAIN EMBANKMENT CROSS-SECTION (STA. 2+600)

SCALE 1:200 m

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 4)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE MAIN EMBANKMENT UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE TO BE AT ELEVATION 970 m, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT,
   FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf",
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6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCE

1. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

ISSUED FOR

CONSTRUCTION

0 10 20

1:200 METRES

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

MAIN EMBANKMENT CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	12 of 35	12

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4595\51300\51395\Doc 014_974 Design\02_PRODUCTION\DWG\Drawings\ | File Name: CA0020527_4505-51300-51395-014-012.dwg | Last Edited By: tyklassen Date: 2024-04-11 Time:8:53:37 PM | Printed By: TYKlassen Date: 2024-04-17 Time:9:05:07 PM

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0 25 mm

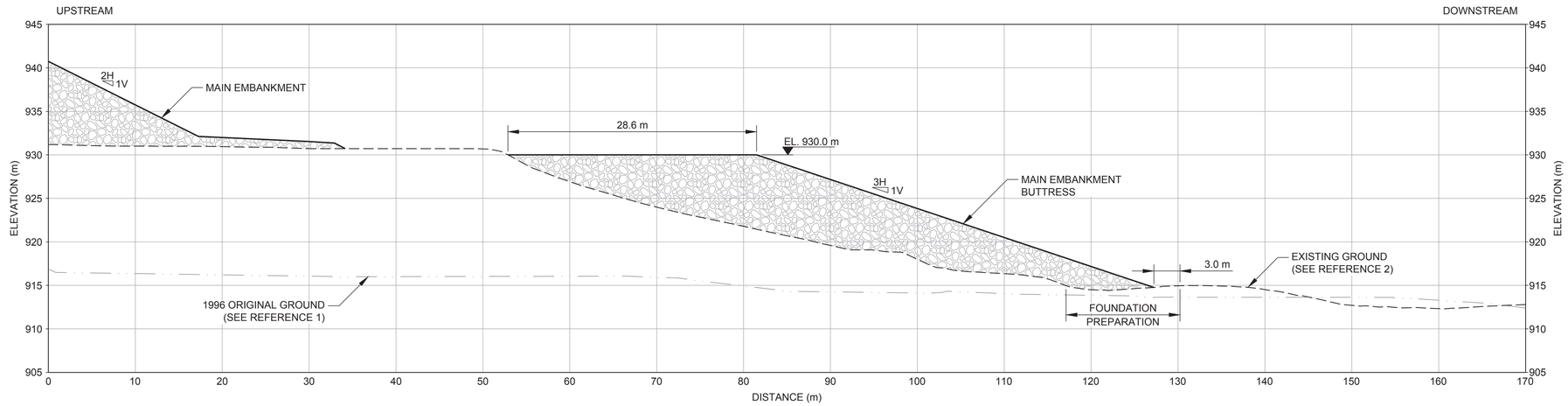

SCALE 1:300 m — C / 09 / 10 — MAIN EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 1+850)

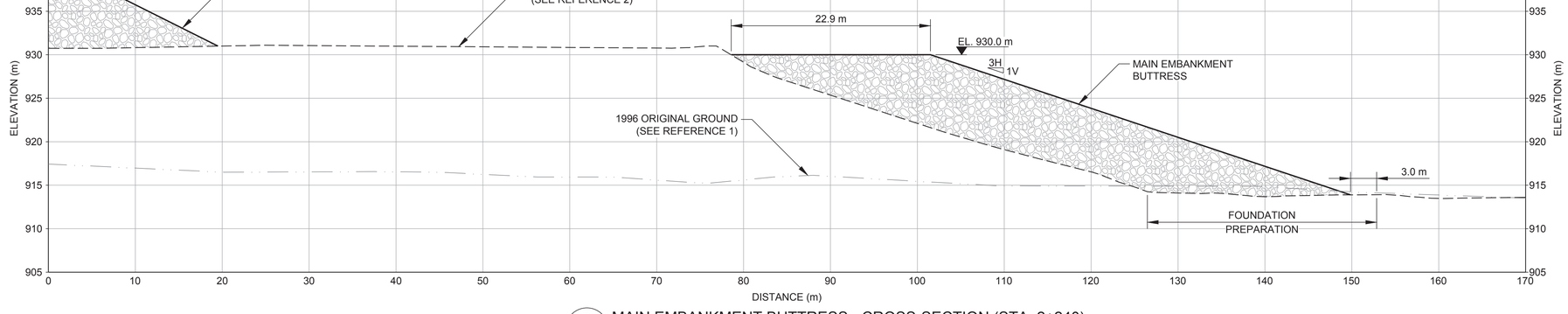

SCALE 1:300 m — D / 09 / 10 — MAIN EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 2+240)

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- EXISTING GROUND (SEE REFERENCE 2)
- ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.

REFERENCE

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

ISSUED FOR

CONSTRUCTION

0 10 20

1:300 METRES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
VANCOUVER, BC
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Engineers & Geoscientists BC Permit #1000200

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
MAIN EMBANKMENT BUTTRESS CROSS-SECTIONS (SHEET 1 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	13 of 35	13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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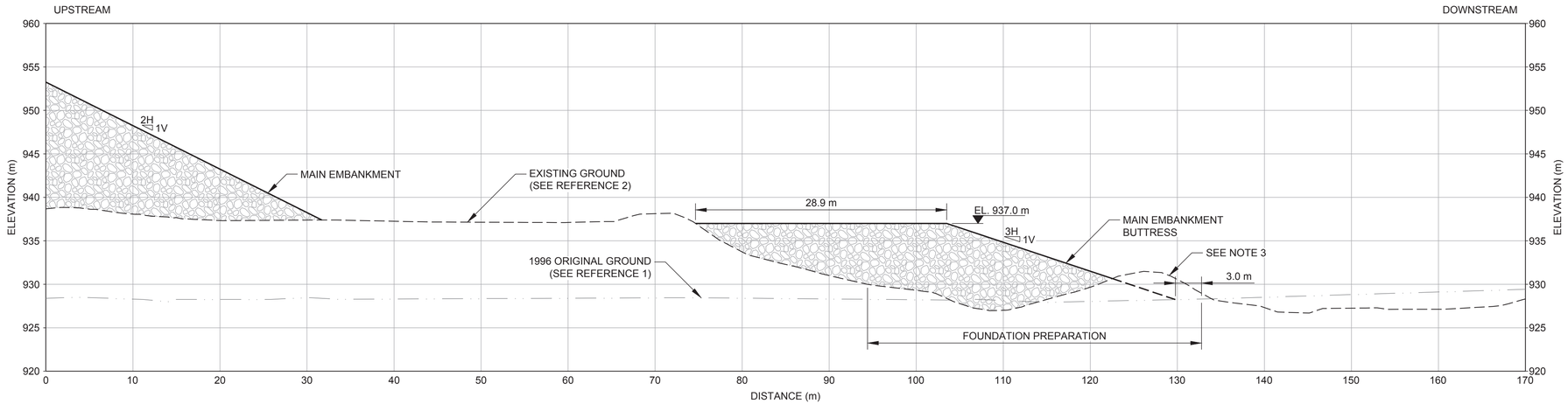

SCALE 1:300 m

E | 09 | 10

MAIN EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 2+450)

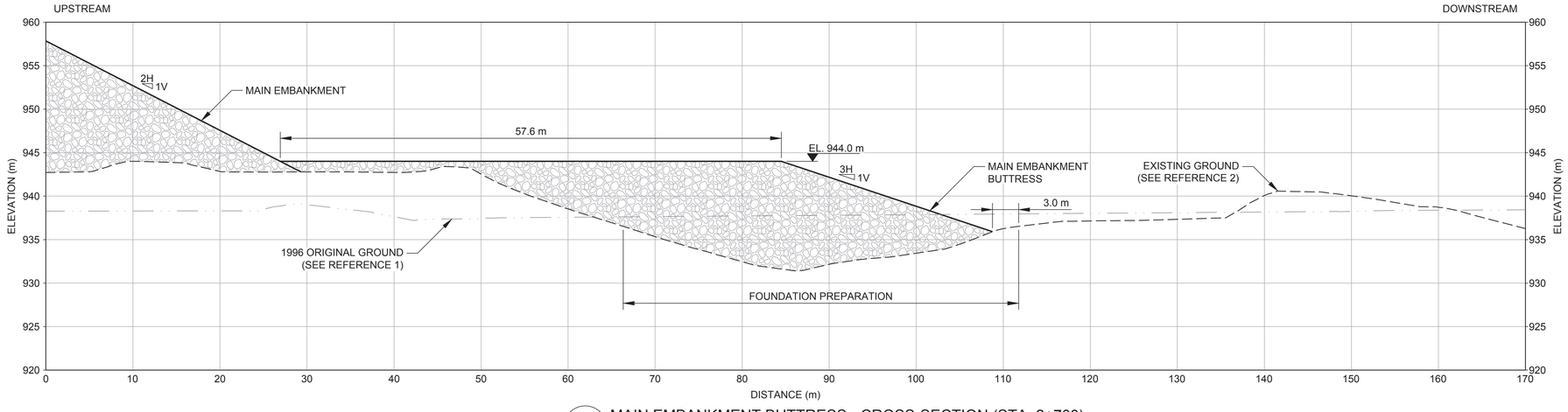

SCALE 1:300 m

F | 09 | 10

MAIN EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 2+700)

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- EXISTING GROUND (SEE REFERENCE 2)
- ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. STOCKPILE MATERIAL TO BE REMOVED AS PART OF FOUNDATION PREPARATION. BUTTRESS TO EXTEND TO NATURAL GROUND. EXTENT AND DEPTH OF FOUNDATION PREPARATION TO BE CONFIRMED BY QA MANAGER.

REFERENCE

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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1:300 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

MAIN EMBANKMENT BUTTRESS CROSS-SECTIONS (SHEET 2 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	14 of 35	14

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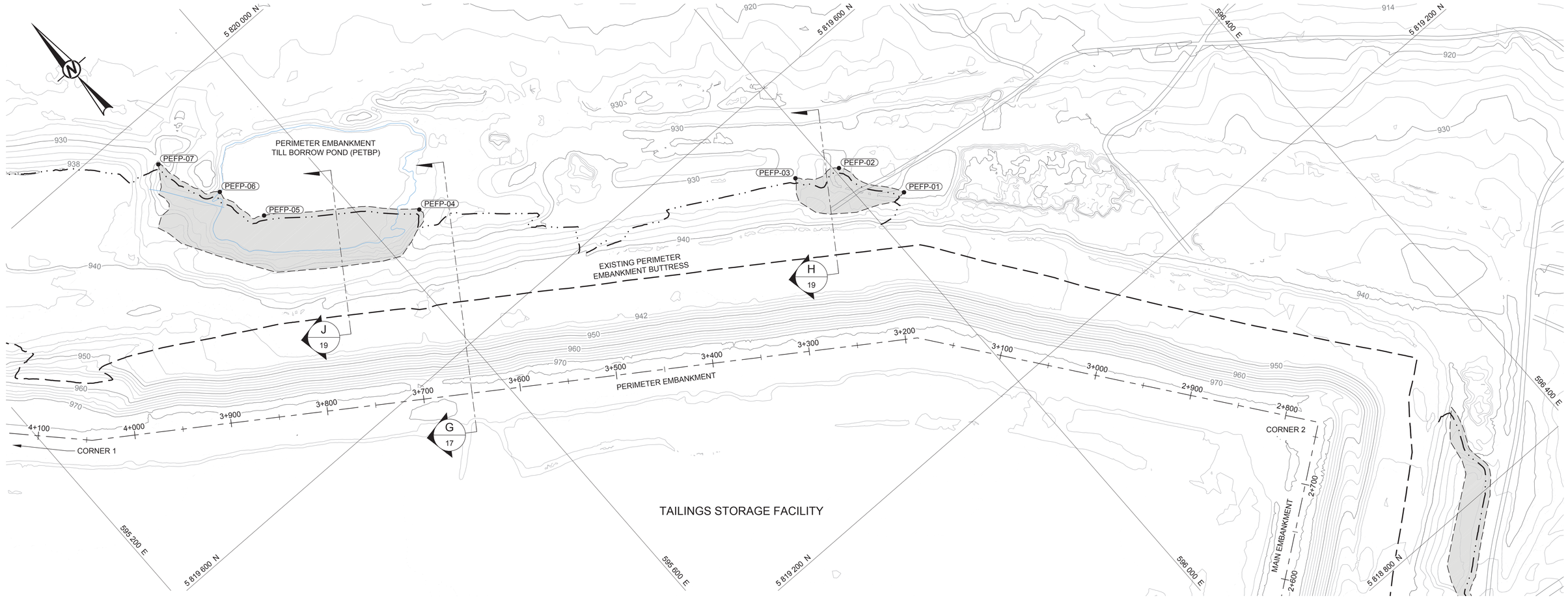

TAILINGS STORAGE FACILITY

PERIMETER EMBANKMENT (CORNER 2-CORNER 1) - FOUNDATION PREPARATION

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE DESIGN TOE
- TSF EL. 974 m BUTTRESS DESIGN TOE
- FOUNDATION PREPARATION FOOTPRINT (SEE NOTES 5 AND 6)
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- PEFP-07 — PERIMETER EMBANKMENT FOUNDATION PREPARATION SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT AND DEPTH OF FOUNDATION PREPARATION TO BE CONFIRMED BY QA MANAGER.
6. NO FOUNDATION PREPARATION IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH PERIMETER EMBANKMENT TILL BORROW POND UNTIL RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

PERIMETER EMBANKMENT FOUNDATION PREPARATION SETOUT TABLE (1 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PEFP-01	596039.02	5819424.35	929.25
PEFP-02	596004.84	5819487.13	929.48
PEFP-03	595964.12	5819508.68	931.77
PEFP-04	595650.73	5819738.76	922.85
PEFP-05	595526.13	5819839.12	920.88
PEFP-06	595507.70	5819887.39	922.39
PEFP-07	595478.52	5819950.38	929.38

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0 100 200

1:2,000 METRES

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - FOUNDATION PREPARATION

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	15 of 35	15

0 25 mm — IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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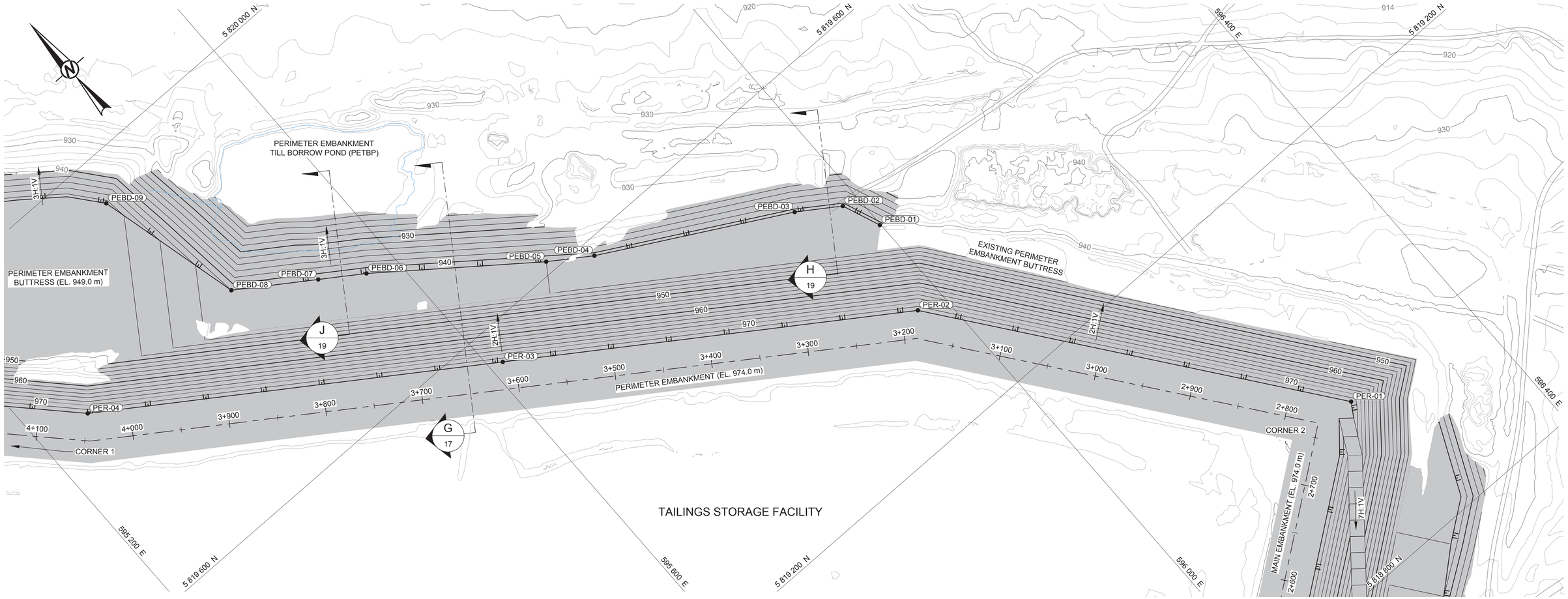

PERIMETER EMBANKMENT (CORNER 2-CORNER 1) - PLAN VIEW

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- (PER-04) PERIMETER EMBANKMENT RAISE SETOUT POINT
- (PEBD-09) PERIMETER EMBANKMENT BUTTRESS DESIGN SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT OF ROCKFILL PLACEMENT TO BE CONFIRMED BY QA MANAGER.
6. NO ROCKFILL PLACEMENT IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH THE MAIN EMBANKMENT SEEPAGE COLLECTION POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
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3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

PERIMETER EMBANKMENT BUTTRESS DESIGN SETOUT TABLE (1 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PEBD-01	595999.02	5819414.94	941.00
PEBD-02	595983.19	5819454.66	941.00
PEBD-03	595941.72	5819482.59	941.00
PEBD-04	595756.80	5819583.96	941.00
PEBD-05	595715.33	5819611.89	942.00
PEBD-06	595567.92	5819724.19	942.00
PEBD-07	595526.45	5819752.12	942.00
PEBD-08	595451.75	5819802.44	942.00
PEBD-09	595413.37	5819954.30	949.00

PERIMETER EMBANKMENT EL. 974 m RAISE SETOUT TABLE (1 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PER-01	596245.50	5818959.65	974.00
PER-02	595970.85	5819323.11	974.00
PER-03	595613.99	5819563.48	974.00
PER-04	595257.14	5819803.85	974.00

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.	16 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		16

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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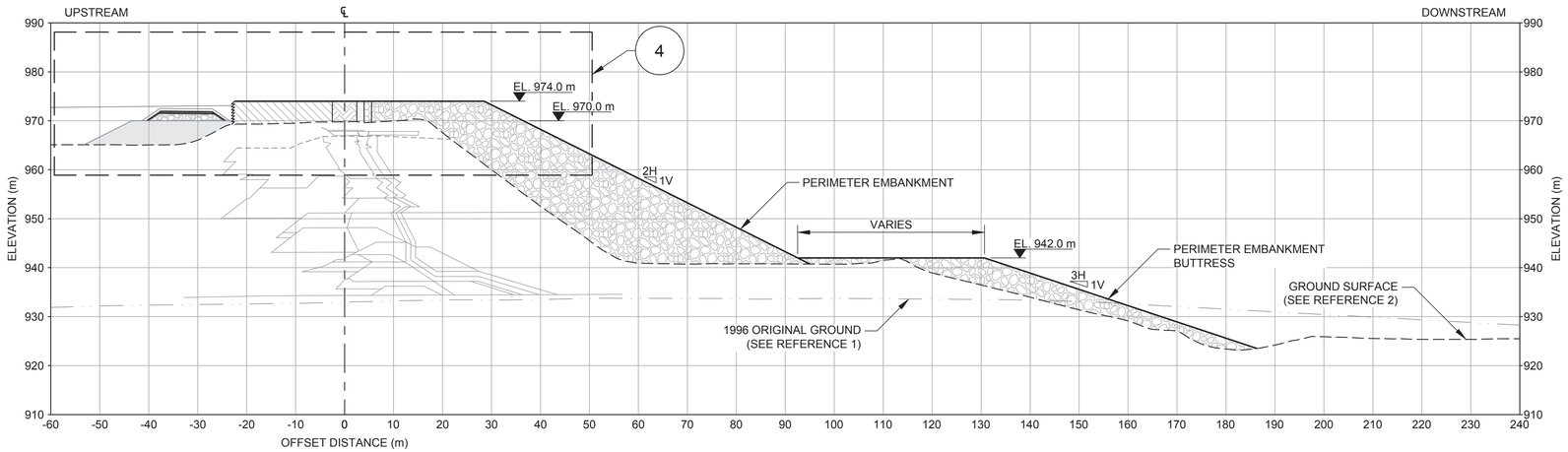

SCALE 1:600 m — G 15 16 — PERIMETER EMBANKMENT - TYPICAL CROSS-SECTION (STA. 2+756 TO 4+000)

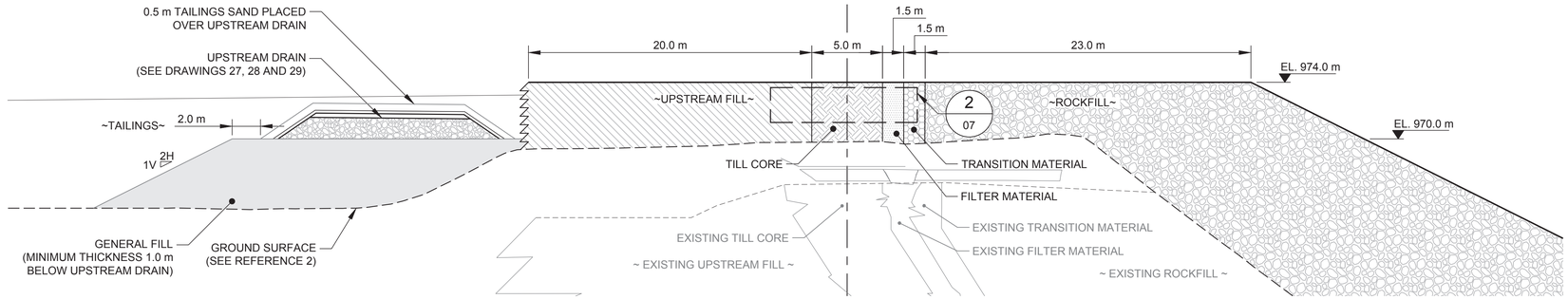

SCALE 1:200 m — 4 — PERIMETER EMBANKMENT - TYPICAL DETAIL

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE PERIMETER EMBANKMENT (CORNER 2 TO CORNER 1) UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE TO BE AT ELEVATION 970 m, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT,
   FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf",
   DATED: 12 MARCH 2014.
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC,
   FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES,
   SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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0 20 40
1:600 METRES

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2-CORNER 1) - TYPICAL CROSS-SECTION AND DETAIL

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	17 of 35	17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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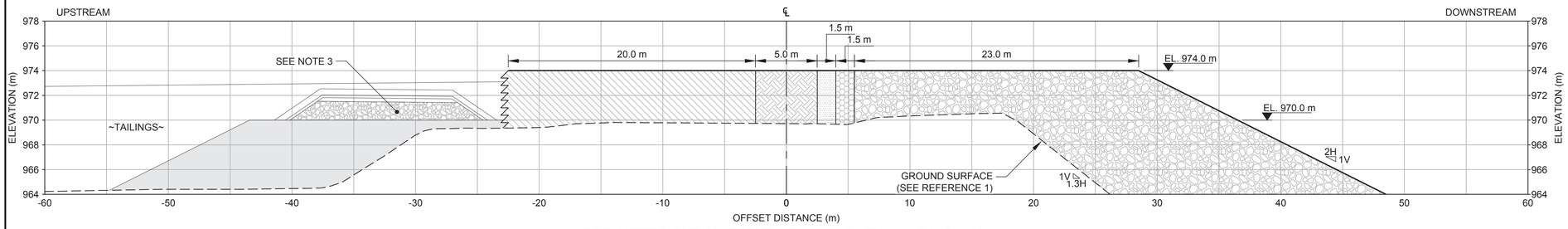

PERIMETER EMBANKMENT CROSS-SECTION (STA. 2+900)

SCALE 1:200 m

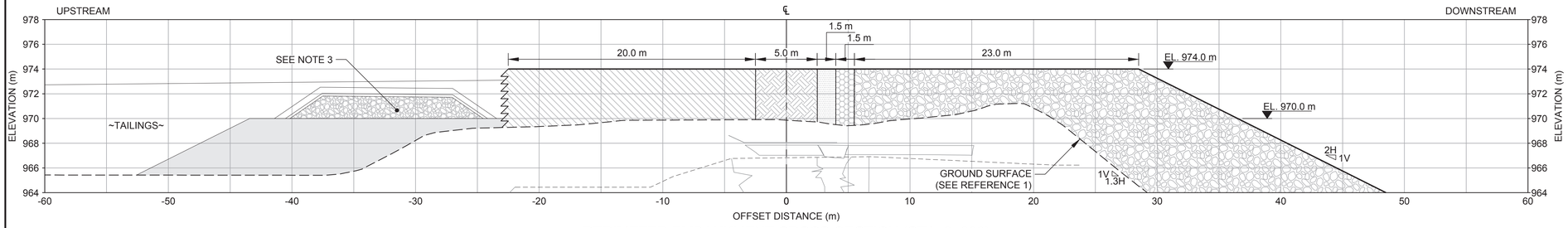

PERIMETER EMBANKMENT CROSS-SECTION (STA. 3+200)

SCALE 1:200 m

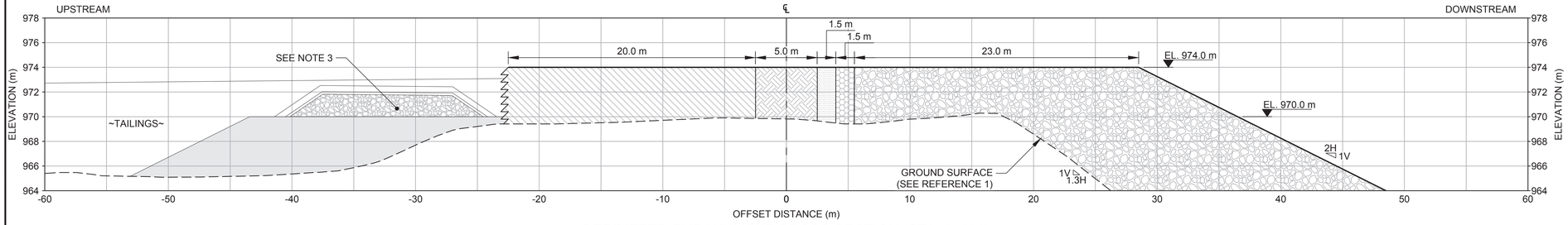

PERIMETER EMBANKMENT CROSS-SECTION (STA. 3+500)

SCALE 1:200 m

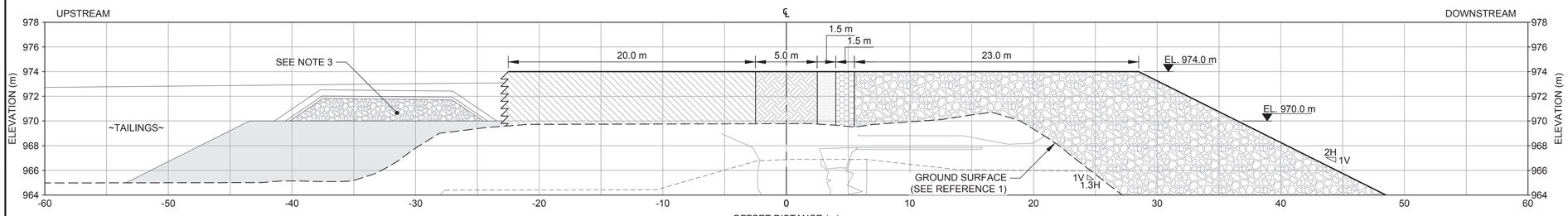

PERIMETER EMBANKMENT CROSS-SECTION (STA. 3+800)

SCALE 1:200 m

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 26, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE PERIMETER EMBANKMENT (CORNER 2 TO CORNER 1) UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE TO BE AT ELEVATION 970 m, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT,
   FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf",
   DATED: 12 MARCH 2014.
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCE

1. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
VANCOUVER, BC
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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT (CORNER 2-CORNER 1) CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	18 of 35	18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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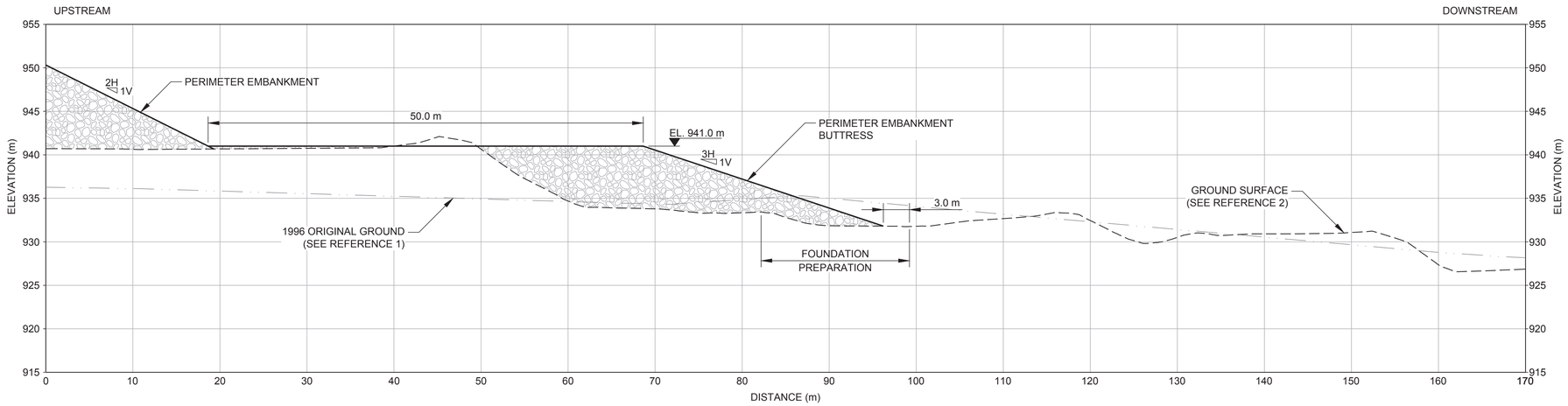

SCALE 1:300 m

PERIMETER EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 3+260)

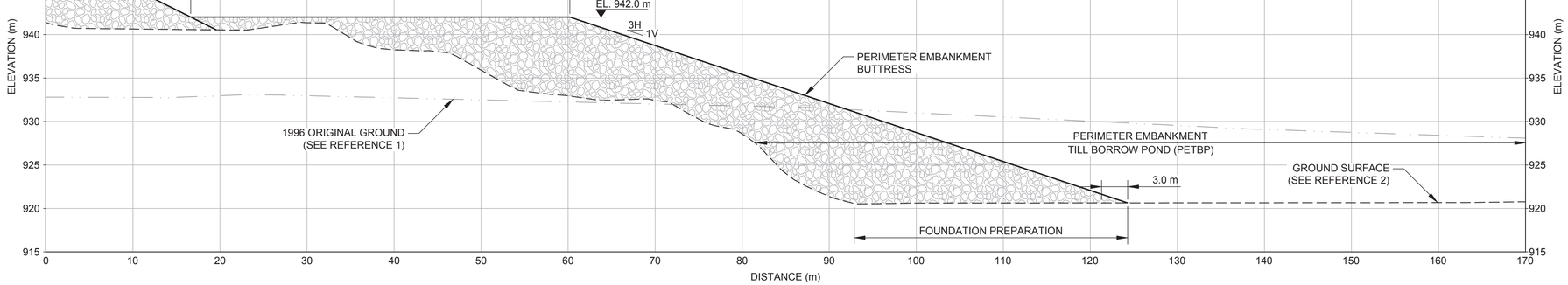

SCALE 1:300 m

PERIMETER EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 3+766)

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.

REFERENCE

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT BUTTRESS (CORNER 2-CORNER 1) CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	19 of 35	19

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 5 10 15 20 25 mm

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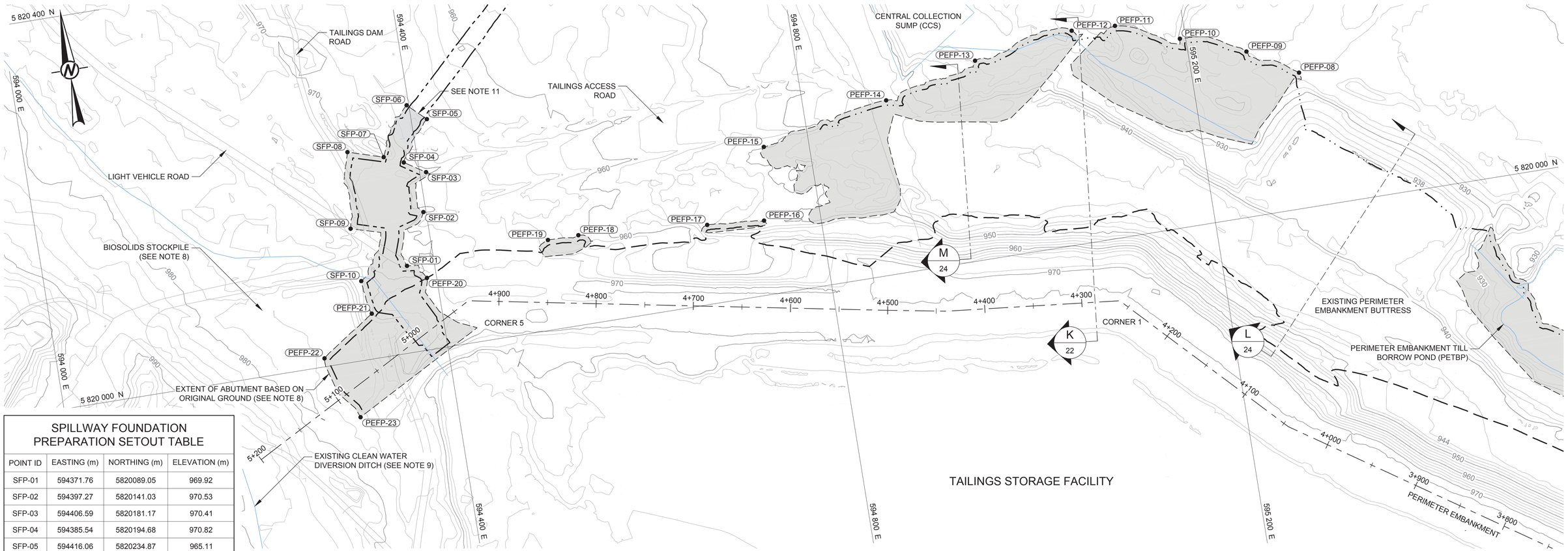

PERIMETER EMBANKMENT (CORNER 1-CORNER 5) - FOUNDATION PREPARATION

SCALE 1:2 000 m

SPILLWAY FOUNDATION PREPARATION SETOUT TABLE

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
SFP-01	594371.76	5820089.05	969.92
SFP-02	594397.27	5820141.03	970.53
SFP-03	594406.59	5820181.17	970.41
SFP-04	594385.54	5820194.68	970.82
SFP-05	594416.06	5820234.87	965.11
SFP-06	594397.83	5820252.29	965.17
SFP-07	594365.96	5820203.38	970.00
SFP-08	594329.98	5820214.42	972.56
SFP-09	594320.58	5820136.06	973.81
SFP-10	594322.82	5820081.11	972.11

LEGEND

- 4+400 — TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE DESIGN TOE
- TSF EL. 974 m BUTTRESS DESIGN TOE
- TSF EL. 974 m SPILLWAY DESIGN FOOTPRINT
- FOUNDATION PREPARATION FOOTPRINT (SEE NOTES 5 AND 6)
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- PEFP-22 — PERIMETER EMBANKMENT FOUNDATION PREPARATION SETOUT POINT
- SFP-10 — SPILLWAY FOUNDATION PREPARATION SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT AND DEPTH OF FOUNDATION PREPARATION TO BE CONFIRMED BY QA MANAGER.
6. NO FOUNDATION PREPARATION IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH CLEAN WATER DIVERSION DITCH, SEEPAGE COLLECTION DITCHES AND PERIMETER EMBANKMENT TILL BORROW POND UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
9. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
10. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.
11. SPILLWAY LOCATION DOWNSTREAM OF ROAD CROSSING TO BE FIELD FIT AND CONFIRMED BY QA MANAGER.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

PERIMETER EMBANKMENT FOUNDATION PREPARATION SETOUT TABLE (2 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PEFP-08	595309.54	5820138.69	924.28
PEFP-09	595259.57	5820168.81	925.60
PEFP-10	595194.08	5820192.75	929.31
PEFP-11	595130.25	5820216.53	930.23
PEFP-12	595085.48	5820218.73	932.17
PEFP-13	594982.43	5820204.11	933.04
PEFP-14	594885.62	5820178.46	943.09
PEFP-15	594753.71	5820151.22	950.43
PEFP-16	594741.82	5820076.35	951.14
PEFP-17	594683.39	5820081.30	954.73
PEFP-18	594550.84	5820092.05	960.46

PERIMETER EMBANKMENT FOUNDATION PREPARATION SETOUT TABLE (2 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PEFP-19	594519.18	5820092.18	963.81
PEFP-20	594390.08	5820073.51	969.44
PEFP-21	594328.12	5820046.28	970.55
PEFP-22	594272.74	5820008.64	977.91
PEFP-23	594299.72	5819942.96	976.51

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - FOUNDATION PREPARATION

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	20 of 35	20

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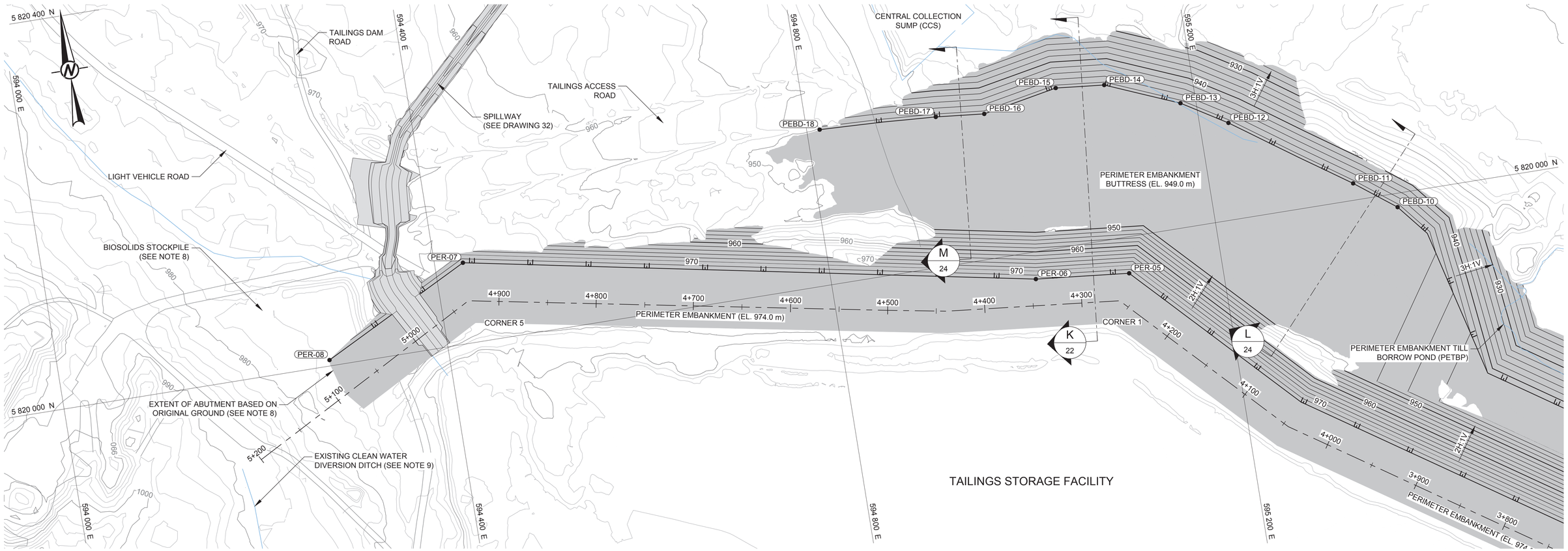

PERIMETER EMBANKMENT (CORNER 1-CORNER 5) - PLAN VIEW

SCALE 1:2 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- TSF EL. 974 m SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- (PER-08) PERIMETER EMBANKMENT RAISE SETOUT POINT
- (PEBD-18) PERIMETER EMBANKMENT BUTTRESS DESIGN SETOUT POINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. EXTENT OF ROCKFILL PLACEMENT TO BE CONFIRMED BY QA MANAGER.
6. NO ROCKFILL PLACEMENT IS TO BE CARRIED OUT IN AREAS THAT OVERLAP WITH THE MAIN EMBANKMENT SEEPAGE COLLECTION POND, AND SEEPAGE COLLECTION DITCHES UNTIL THEY ARE RELOCATED.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
8. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
9. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
10. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

PERIMETER EMBANKMENT BUTTRESS DESIGN SETOUT TABLE (2 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PEBD-10	595387.51	5819985.83	949.00
PEBD-11	595346.24	5820017.27	949.00
PEBD-12	595229.56	5820099.26	949.00
PEBD-13	595184.09	5820127.15	949.00
PEBD-14	595109.61	5820158.16	949.00
PEBD-15	595059.85	5820163.07	949.00
PEBD-16	594983.06	5820148.53	949.00
PEBD-17	594933.30	5820153.44	949.00
PEBD-18	594813.26	5820159.62	949.00

PERIMETER EMBANKMENT EL. 974 m RAISE SETOUT TABLE (2 OF 2)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
PER-05	595104.00	5819962.77	974.00
PER-06	595008.29	5819972.21	974.00
PER-07	594429.05	5820083.02	974.00
PER-08	594277.57	5820006.11	974.00

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	21 of 35	21

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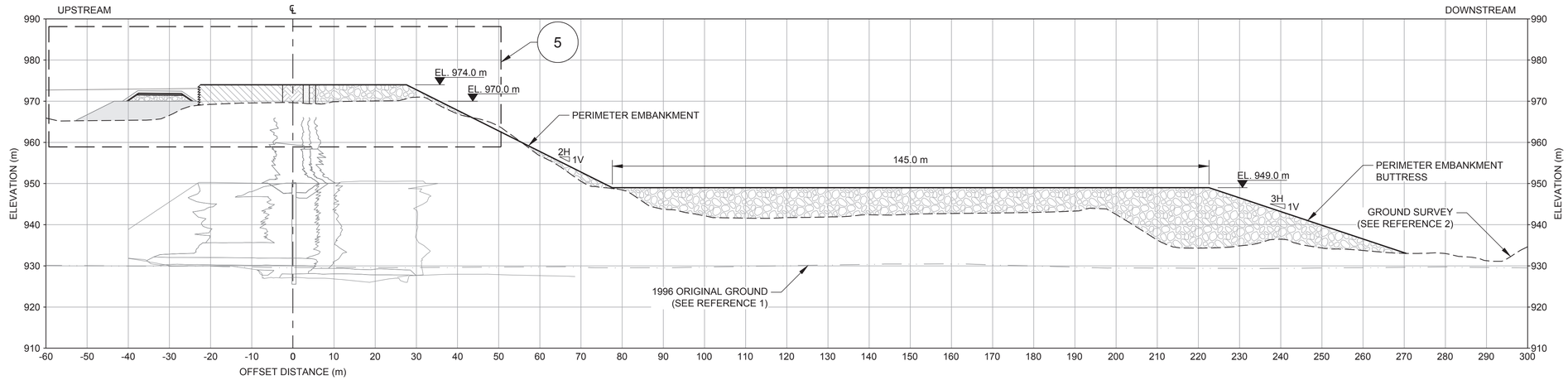

SCALE 1:600 m — K 20/21 — PERIMETER EMBANKMENT - TYPICAL CROSS-SECTION (STA. 4+000 TO 5+200)

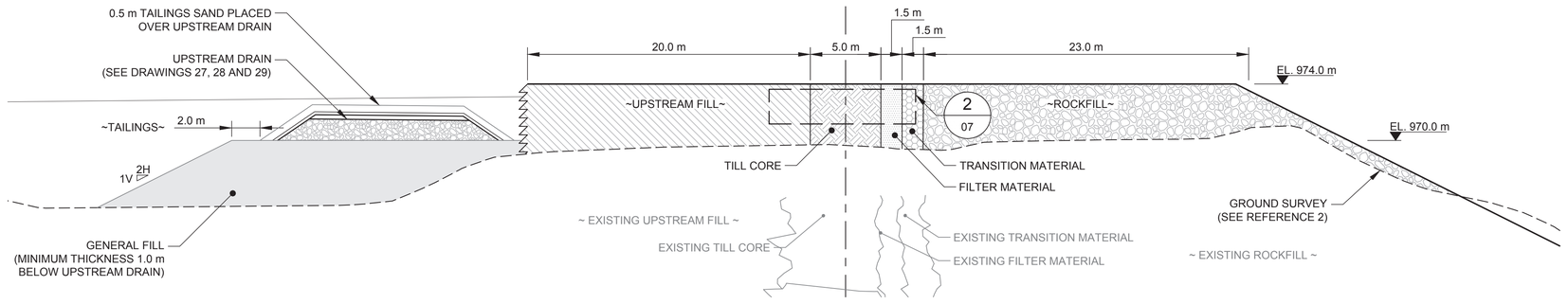

SCALE 1:200 m — 5 — PERIMETER EMBANKMENT - TYPICAL DETAIL

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE PERIMETER EMBANKMENT (CORNER 1 TO CORNER 5) UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE CAN VARY BETWEEN ELEVATION 970 - 972 m, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
5. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
6. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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0 20 40
1:600 METRES

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ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1-CORNER 5) - TYPICAL CROSS-SECTION AND DETAIL

PROJECT NO.	PHASE/TASK/DOC.	REV.	22 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		22

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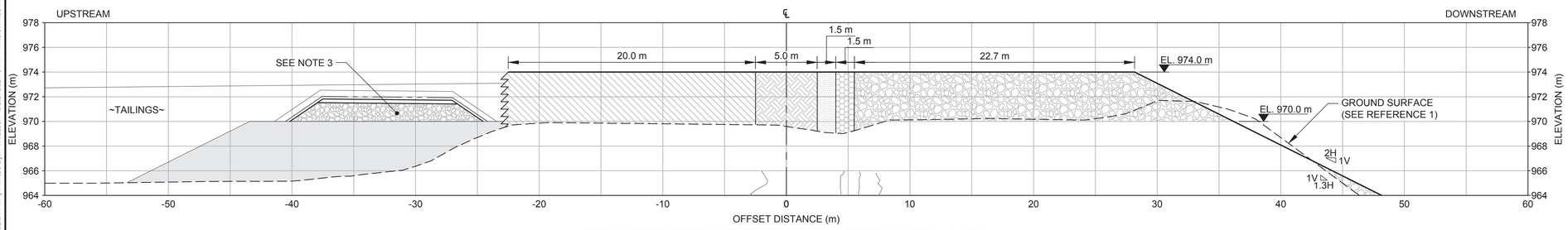

PERIMETER EMBANKMENT CROSS-SECTION (STA. 4+100)

SCALE 1:200 m

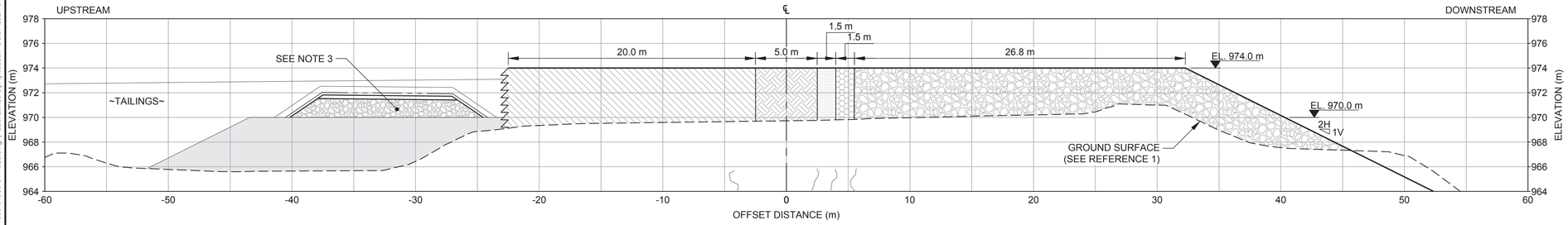

PERIMETER EMBANKMENT CROSS-SECTION (STA. 4+400)

SCALE 1:200 m

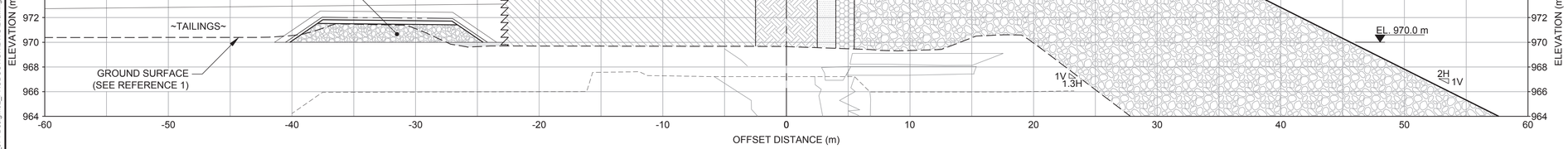

PERIMETER EMBANKMENT CROSS-SECTION (STA. 4+700)

SCALE 1:200 m

LEGEND

- EXISTING GROUND (SEE REFERENCE 1)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- 2013 CONSTRUCTION (SEE NOTE 5)
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- UPSTREAM FILL
- DRAIN ROCK
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE NOT SHOWN, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
4. THE ELEVATION OF THE PERIMETER EMBANKMENT (CORNER 1 TO CORNER 5) UPSTREAM DRAIN PIPE CROSSING THROUGH THE TILL CORE CAN VARY BETWEEN ELEVATION 970 - 972 m, SEE DRAWINGS 27, 28 AND 29 FOR DETAILS.
5. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 RECORD SURVEY AND ANNUAL REVIEW REPORT, FILE NAME: “2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf”, DATED: 12 MARCH 2014,
6. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
7. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCE

1. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

ISSUED FOR

CONSTRUCTION

0 10 20

1:200 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT (CORNER 1-CORNER 5) CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	23 of 35	23

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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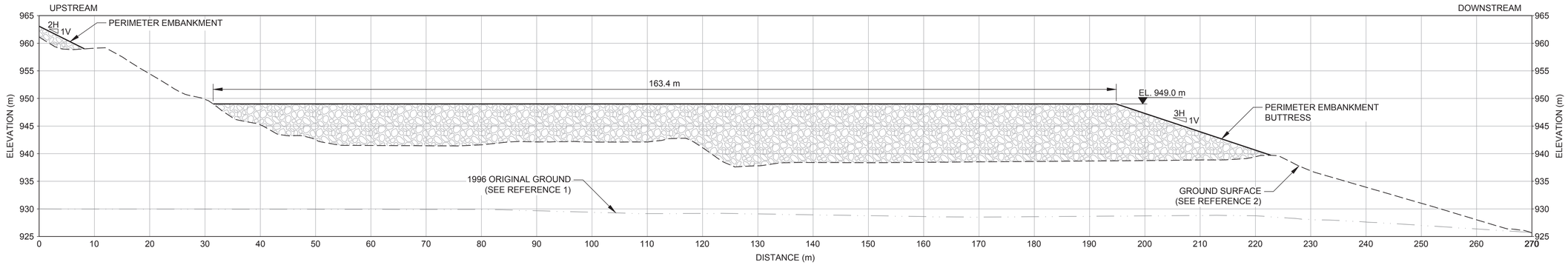

SCALE 1:400 m — L (20/21) — PERIMETER EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 4+100)

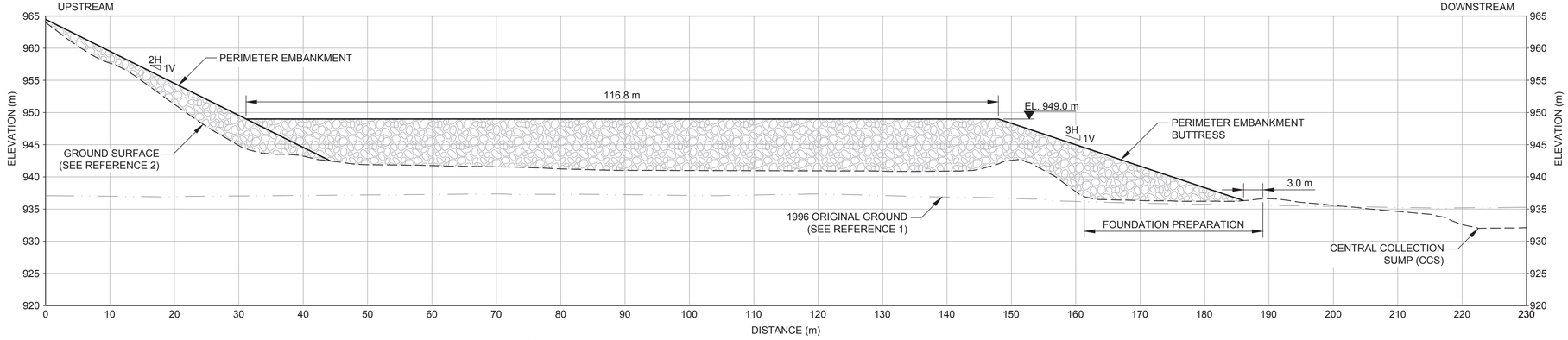

SCALE 1:400 m — M (20/21) — PERIMETER EMBANKMENT BUTTRESS - CROSS-SECTION (STA. 4+410)

LEGEND

- 1996 ORIGINAL GROUND (SEE REFERENCE 1)
- GROUND SURFACE (SEE REFERENCE 2)
- ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.

REFERENCES

1. 1996 ORIGINAL GROUND PROVIDED BY MPMC, FILE NAME: "1996 TSF Topo.dxf", RECEIVED: 11 MARCH 2015.
2. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

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CONSTRUCTION

0 20 40

1:400 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

PERIMETER EMBANKMENT BUTTRESS (CORNER 1-CORNER 5) CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	24 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		24

0 25 mm — IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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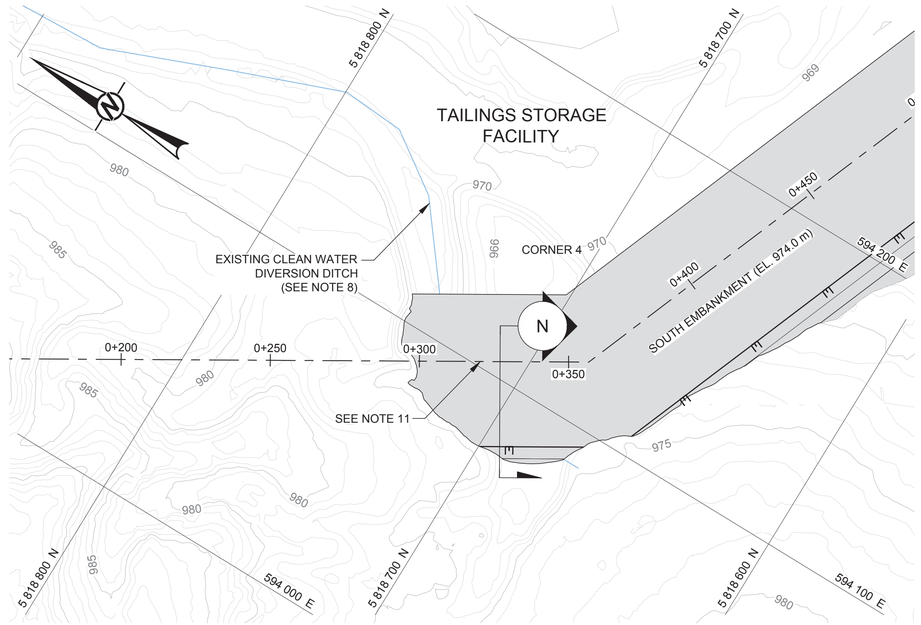

SOUTH EMBANKMENT ABUTMENT DETAIL

SCALE 1:1 000 m

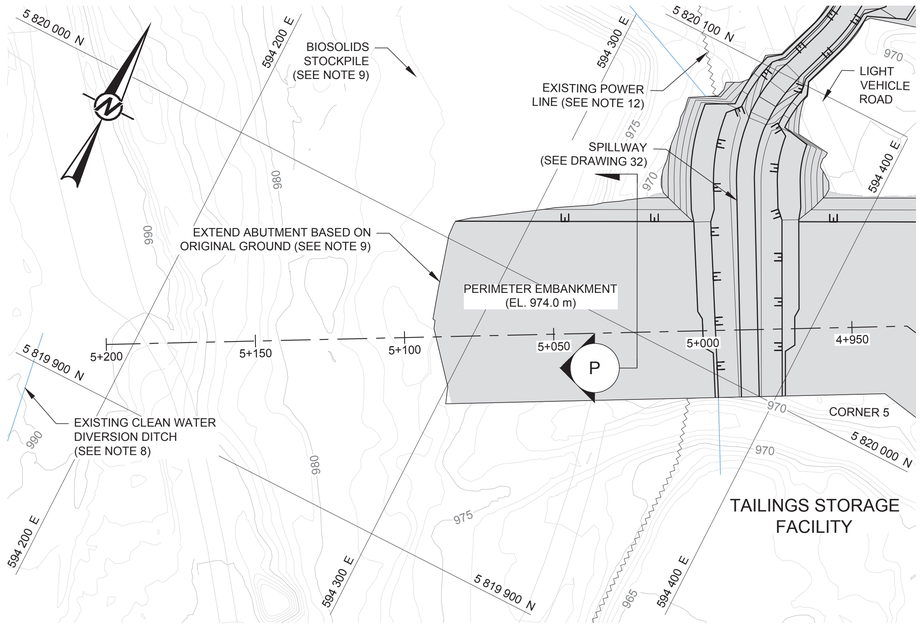

PERIMETER EMBANKMENT ABUTMENT DETAIL

SCALE 1:1 000 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- EXISTING POWERLINE (SEE NOTE 12)
- UPSTREAM FILL
- ROCKFILL
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- BEDROCK

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. MAJOR CONTOUR INTERVAL 5 m, MINOR CONTOUR INTERVAL 1 m.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2023 (SEE REFERENCES 1-2).
5. DEPTH TO BEDROCK TO BE CONFIRMED BY THE QA MANAGER.
6. EXTENT OF EXCAVATION AND FOUNDATION PREPARATION TO BE CONFIRMED BY THE QA MANAGER.
7. EXTEND TILL CORE TO BEDROCK IF FOUNDATION TILL THICKNESS IS LESS THAN 2.0 m.
8. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
9. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
10. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
11. TILL BLANKET TO BE PLACED OVER FOUNDATION TILL BETWEEN APPROXIMATELY STATION 0+300 TO CORNER 4 TO RE-GRADE AREA TO DRAIN AWAY FROM EMBANKMENT.
12. EXISTING POWER LINE TO BE RELOCATED PRIOR TO FOUNDATION PREPARATION (SEE REFERENCE 4).

REFERENCES

1. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

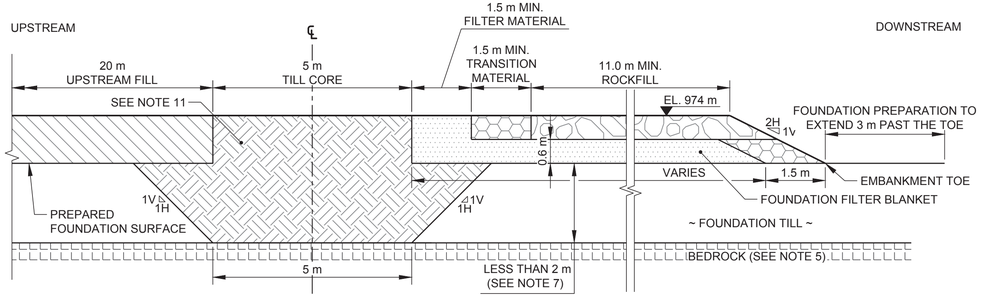

SCALE 1:75 m (N) TYPICAL TILL CORE TIE-IN TO FOUNDATION BEDROCK CROSS-SECTION

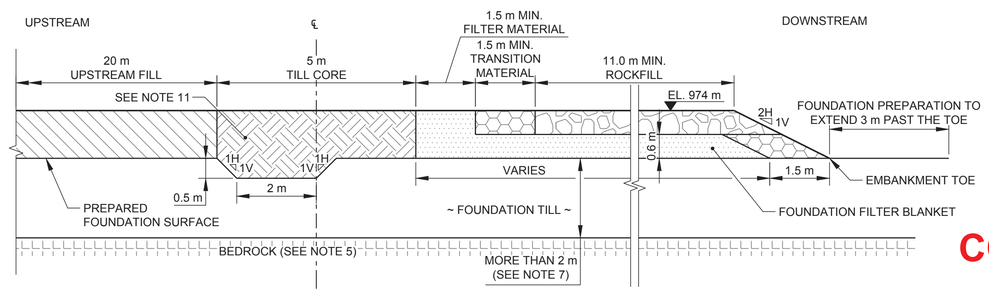

SCALE 1:75 m (P) TYPICAL TILL CORE TIE-IN TO FOUNDATION TILL CROSS-SECTION

ISSUED FOR

CONSTRUCTION

0 2.5 5
1:75 METRES

0 50 100
1:1,000 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

Engineers & Geoscientists BC Permit #1000200

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CONSULTANT

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[+1] (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

SOUTH AND PERIMETER EMBANKMENT ABUTMENTS PLAN VIEW AND TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	25 of 35	25

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

0

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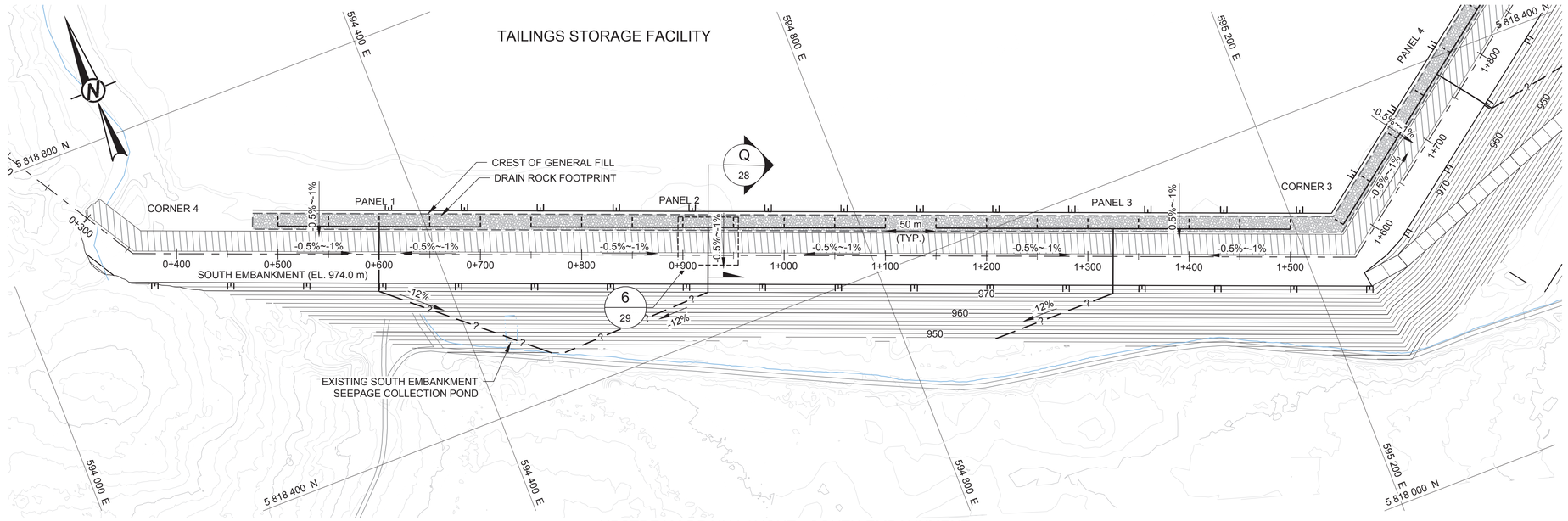

UPSTREAM DRAIN LAYOUT - SOUTH EMBANKMENT

SCALE 1:2 500 m

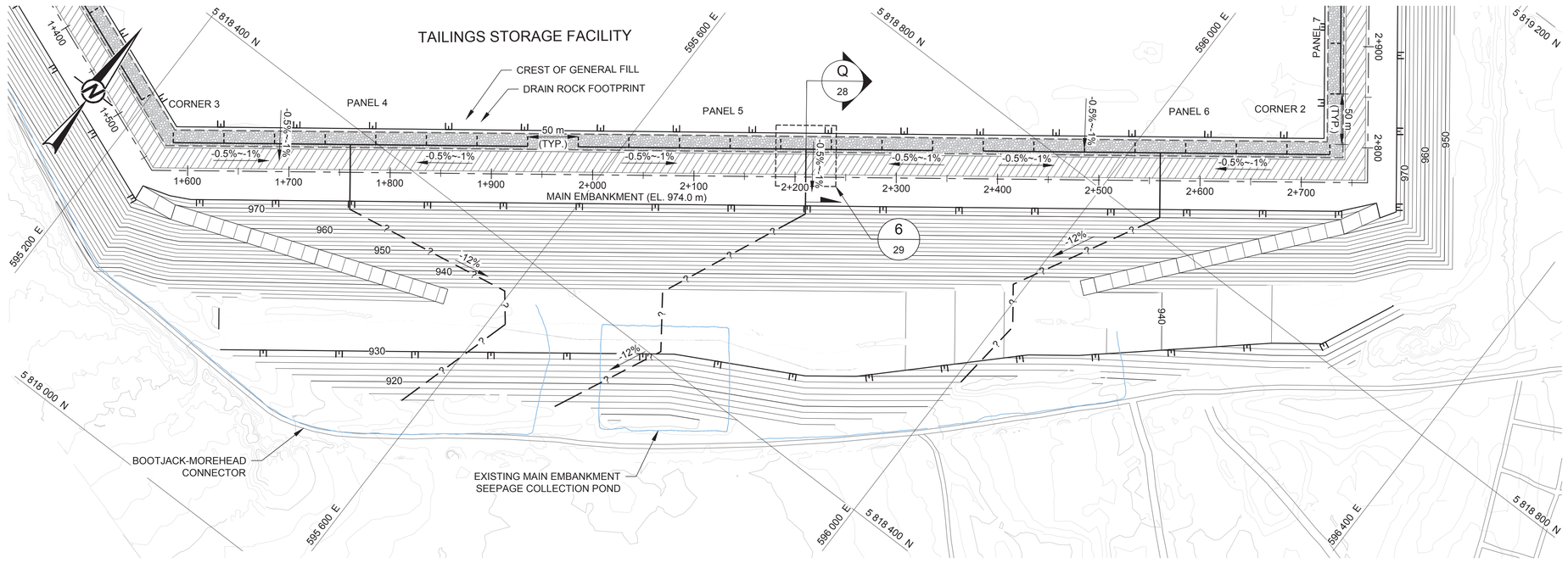

UPSTREAM DRAIN LAYOUT - MAIN EMBANKMENT

SCALE 1:2 500 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- 300 mm Ø SOLID HDPE DRAIN PIPE
- 300 mm Ø SOLID INFERRED DISCHARGE PIPE (SEE NOTE 5)
- 150 mm Ø PERFORATED HDPE DRAIN PIPE
- UPSTREAM FILL
- DRAIN ROCK FOOTPRINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. REPORT TO DOWNSTREAM WATER MANAGEMENT INFRASTRUCTURE CONSIDERATION WILL NEED TO BE MADE TO EXTENDING DISCHARGE PIPE AS THE TSF IS RAISED.
6. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
7. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

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CONSTRUCTION

0 100 200

1:2,500 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

UPSTREAM DRAIN - SOUTH AND MAIN EMBANKMENT PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	26 of 35	26

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
0 25 mm

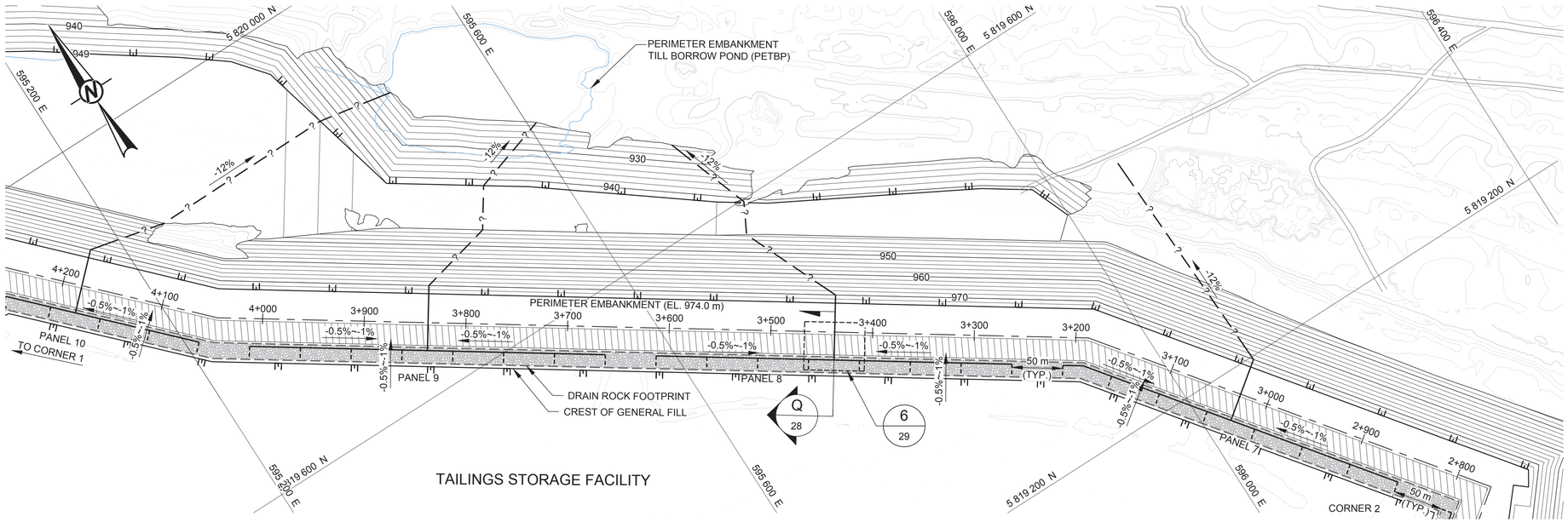

UPSTREAM DRAIN LAYOUT - PERIMETER EMBANKMENT (CORNER 2 - CORNER 1)

SCALE 1:2 500 m

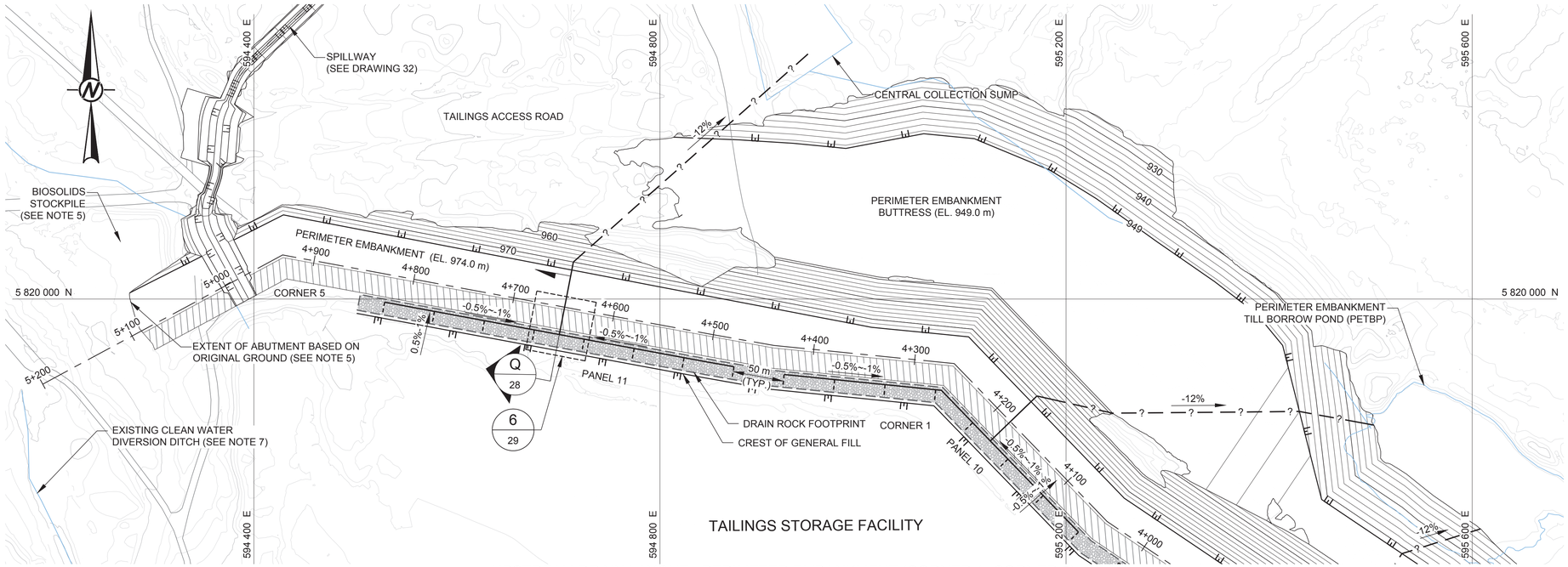

UPSTREAM DRAIN LAYOUT - PERIMETER EMBANKMENT (CORNER 1- CORNER 5)

SCALE 1:2 500 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 3)
- WATERCOURSE (SEE REFERENCE 3)
- 300 mm Ø SOLID HDPE DRAIN PIPE
- 300 mm Ø SOLID INFERRED DISCHARGE PIPE (SEE NOTE 6)
- 150 mm Ø PERFORATED HDPE DRAIN PIPE
- UPSTREAM FILL
- DRAIN ROCK FOOTPRINT

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2019-2023 (SEE REFERENCES 1-2).
5. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
6. REPORT TO DOWNSTREAM WATER MANAGEMENT INFRASTRUCTURE CONSIDERATION WILL NEED TO BE MADE TO EXTENDING DISCHARGE PIPE AS THE TSF IS RAISED.
7. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
8. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
9. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
2. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
3. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

ISSUED FOR

CONSTRUCTION

0 100 200

1:2,500 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

UPSTREAM DRAIN - PERIMETER EMBANKMENT PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.	27 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		27

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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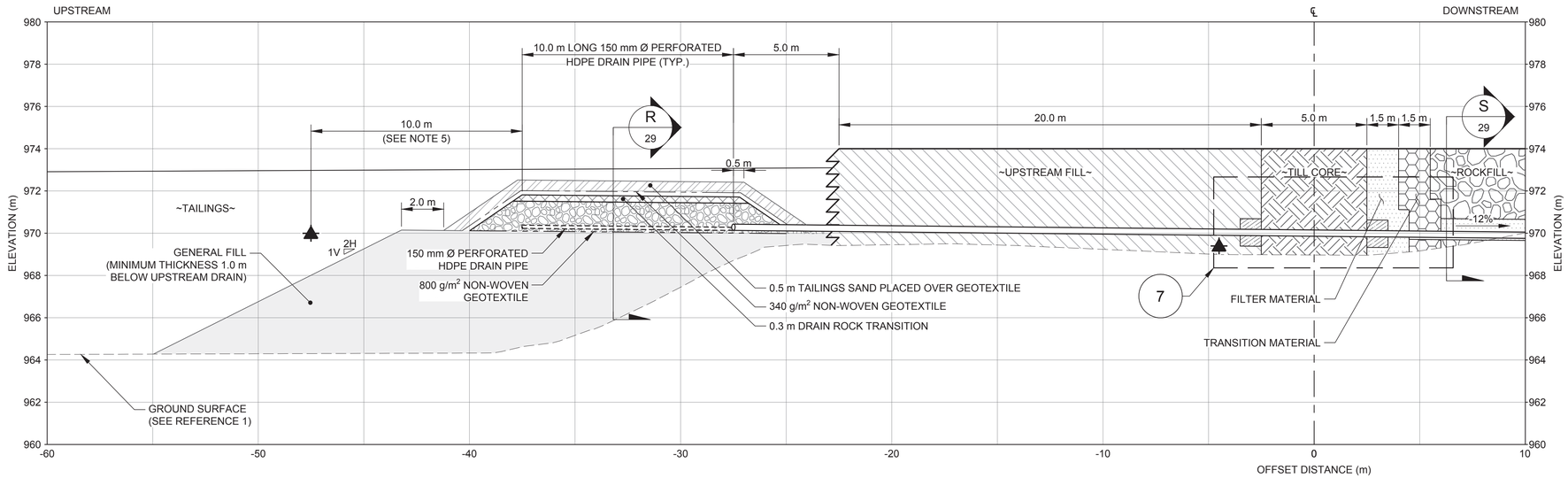

SCALE 1:125 m Q 26 27 UPSTREAM DRAIN TYPICAL CROSS-SECTION

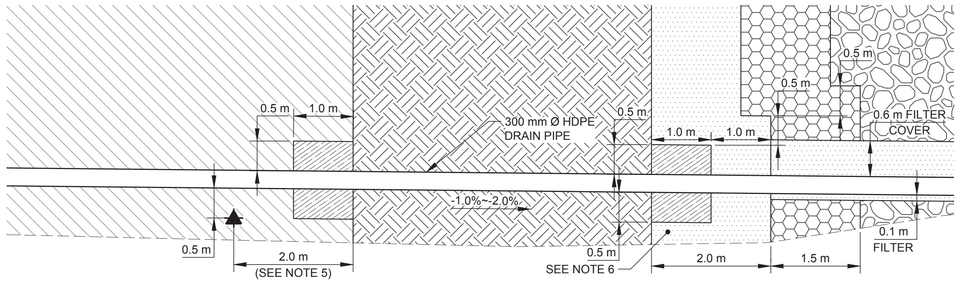

SCALE 1:50 m 7 PIPE THROUGH EMBANKMENT TYPICAL DETAIL

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- 340 g/m^2 NON-WOVEN GEOTEXTILE
- 800 g/m^2 NON-WOVEN GEOTEXTILE
- 300 mm Ø SOLID HDPE DRAIN PIPE
- 150 mm Ø PERFORATED HDPE DRAIN PIPE
- UPSTREAM FILL
- ROCKFILL
- DRAIN ROCK
- DRAIN ROCK TRANSITION
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- TAILINGS SAND
- FILTER SAND
- GENERAL FILL
- 2024 VIBRATING WIRE PIEZOMETER INSTALLED IN UPSTREAM FILL AND TAILINGS BEACH (SEE NOTE 5)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. REFER TO TILL CORE CROSSING CONTROL POINTS IN DRAWING 26 AND 27.
4. A MAXIMUM TILL CORE CROSSING ELEVATION AT 972 m IS ALLOWED FOR PANEL 1 TO 3 AND 10 TO 11.
5. SEE DRAWING 30 FOR VIBRATING WIRE PIEZOMETER PLACEMENT.
6. RECORD DRAWINGS FOR TSF CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS. ZONE F AND ZONE T CONNECTION TO EXISTING FILTER AND TRANSITION TO BE CONFIRMED BY QA MANAGER DURING CONSTRUCTION. A MINIMUM 2.0 m WIDE ZONE F IS REQUIRED TO AT LEAST 0.5 m BELOW THE ELEVATION OF THE BOTTOM OF THE FILTER SAND. A MINIMUM 2.0 m WIDE ZONE T IS REQUIRED TO AT LEAST 0.5 m BELOW THE ELEVATION OF THE BOTTOM OF THE 2.0 m WIDE ZONE F.

REFERENCE

1. 2023 TSF TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.

ISSUED FOR

CONSTRUCTION

0 2 4
1:50 METRES

0 5 10
1:125 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

MOUNT POLLEY MINING CORPORATION

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

UPSTREAM DRAIN
TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 1 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	28 of 35	28

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0 25 mm

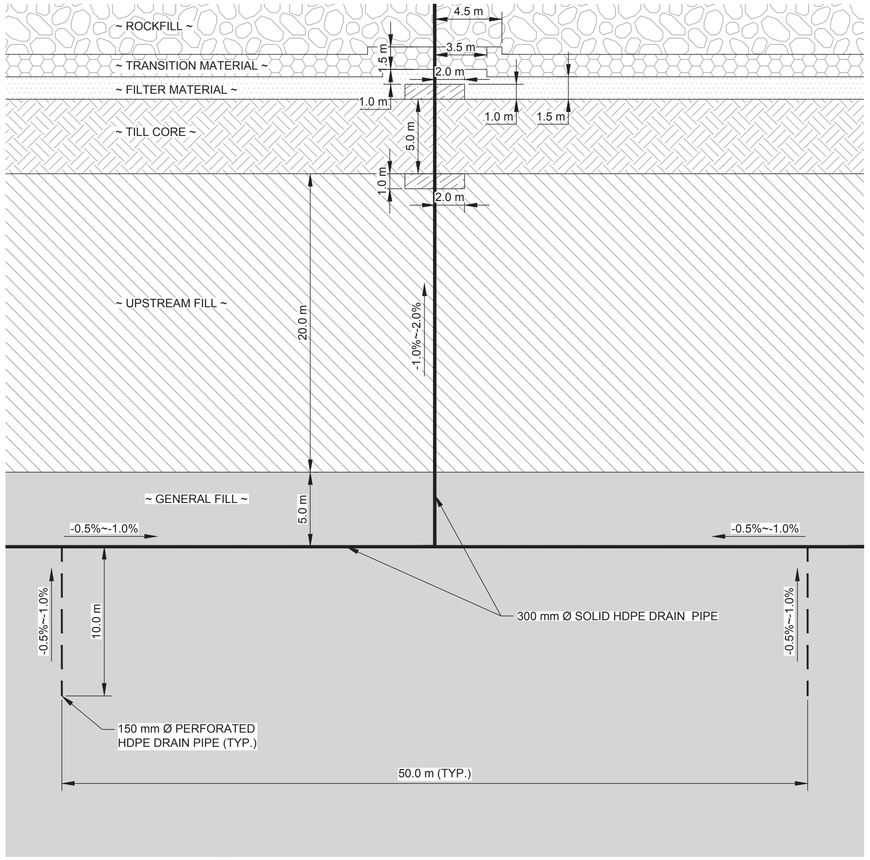

SCALE 1:200 m — 6 / 26 27 — PIPE THROUGH EMBANKMENT MATERIALS TYPICAL DETAIL

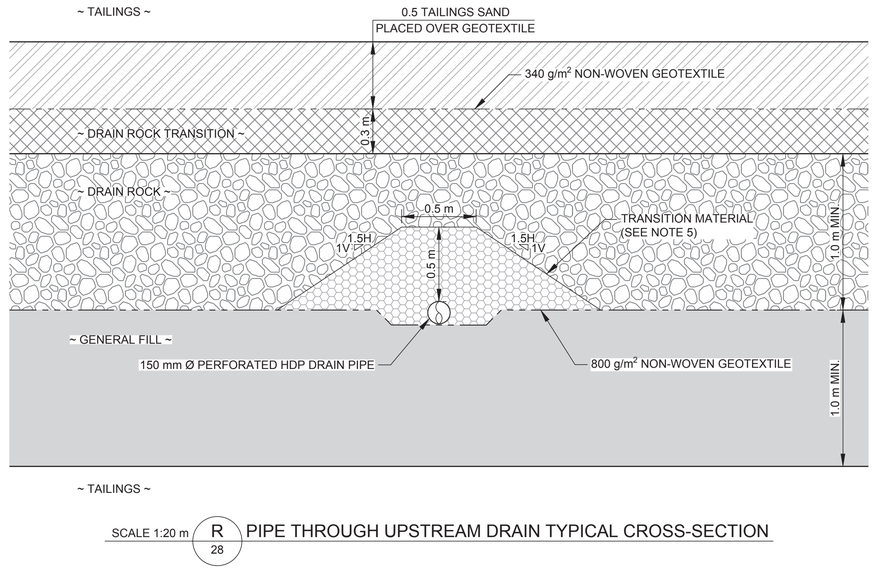

SCALE 1:20 m — R / 28 — PIPE THROUGH UPSTREAM DRAIN TYPICAL CROSS-SECTION

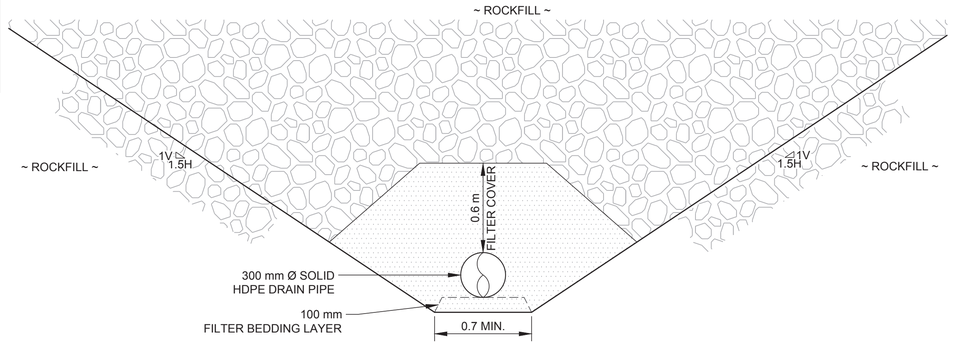

SCALE 1:20 m — S / 28 — PIPE THROUGH ROCKFILL TYPICAL CROSS-SECTION

LEGEND

- 300 mm Ø SOLID HDPE DRAIN PIPE
- 150 mm Ø PERFORATED HDPE DRAIN PIPE
- 340 g/m^2 NON-WOVEN GEOTEXTILE
- 800 g/m^2 NON-WOVEN GEOTEXTILE
- UPSTREAM FILL
- ROCKFILL
- DRAIN ROCK
- DRAIN ROCK TRANSITION
- TRANSITION MATERIAL
- FILTER MATERIAL
- TILL CORE
- TAILINGS SAND
- FILTER SAND
- GENERAL FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. REFER TO TILL CORE CROSSING CONTROL POINTS IN DRAWING 26 AND 27.
4. A MAXIMUM TILL CORE CROSSING ELEVATION AT 972 m IS ALLOWED FOR PANEL 1 TO 3 AND 10 TO 11.
5. TRANSITION MATERIAL TO BE PLACED ALONG THE PERFORATED DRAIN PIPES AND FILTER MATERIAL IS TO BE PLACED AROUND THE SOLID DRAIN PIPES WITHIN THE UPSTREAM DRAIN.

ISSUED FOR

CONSTRUCTION

0 1 2
1:20 METRES

0 10 20
1:200 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

UPSTREAM DRAIN
TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 2 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	29 of 35	29

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0 25 mm

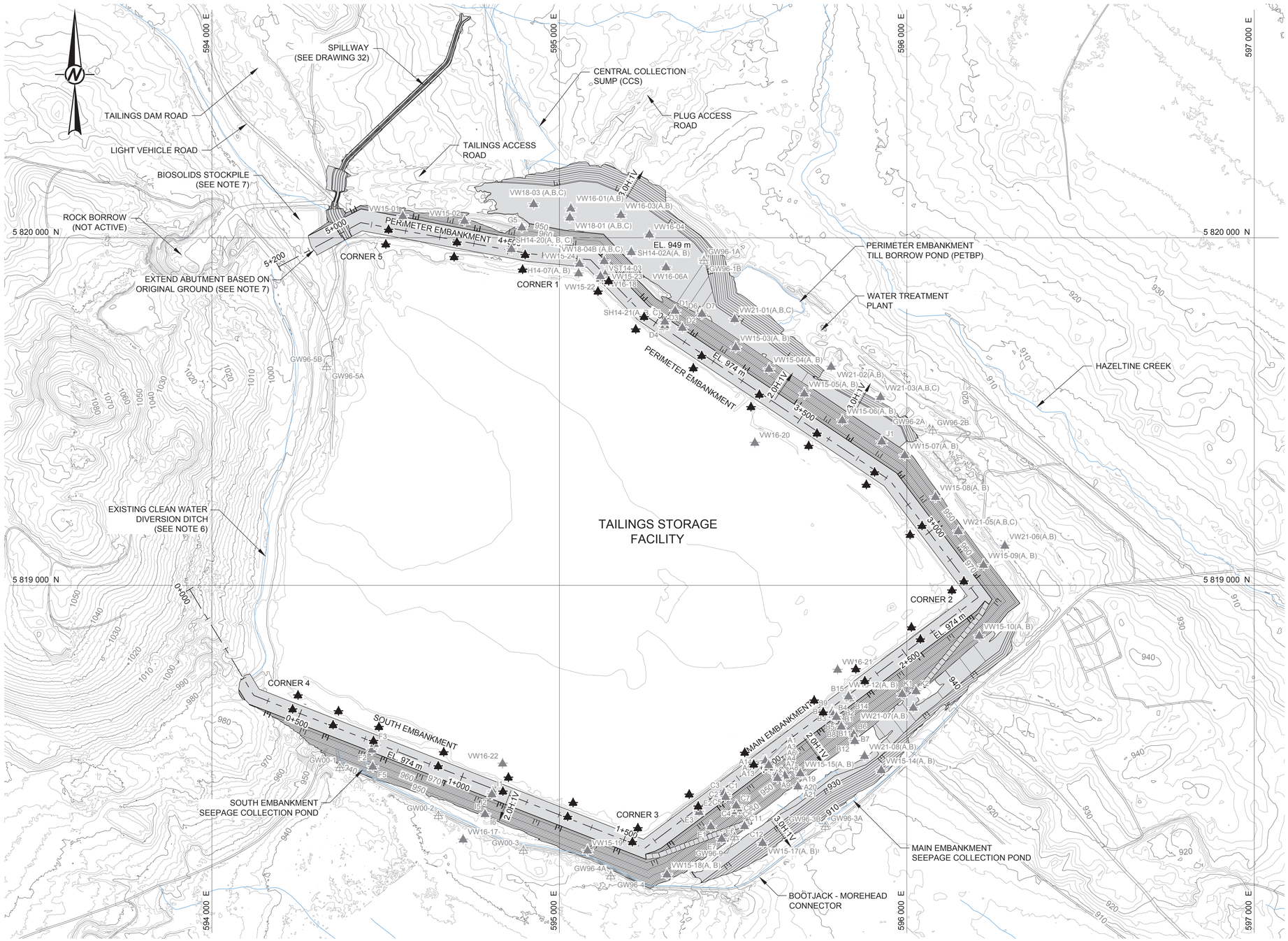

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 5)
- WATERCOURSE (SEE REFERENCE 5)
- 2024 VIBRATING WIRE PIEZOMETER INSTALLED IN UPSTREAM FILL AND TAILINGS BEACH (SEE NOTE 9)
- EXISTING VIBRATING WIRE PIEZOMETER
- EXISTING MONITORING WELL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
6. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
7. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.
9. 2024 VIBRATING WIRE PIEZOMETERS TO BE INSTALLED IN PAIRS AS SHOWN IN CROSS-SECTIONS ON DRAWING 28. TWO PAIRS OF VIBRATING WIRE PIEZOMETERS TO BE INSTALLED AT EACH UPSTREAM DRAIN PANEL. LOCATIONS TO BE CONFIRMED BY QA MANAGER.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
2. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
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4. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .dxf FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
5. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

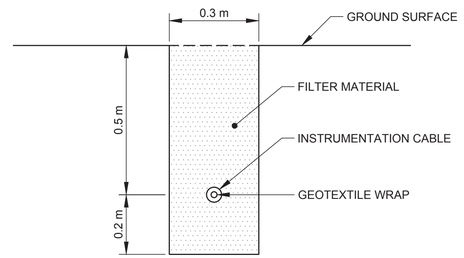

NOT TO SCALE

8

INSTRUMENTATION CABLE EXTENSION TYPICAL DETAIL

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0 200 400

1:6,000 METRES

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0	2024-04-18	ISSUED FOR CONSTRUCTION	Y.J.	T.A.K.	S.B.	G.P.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

Engineers & Geoscientists BC Permit #1000200

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

INSTRUMENTATION - PIEZOMETERS PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.	30 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		30

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0 25 mm

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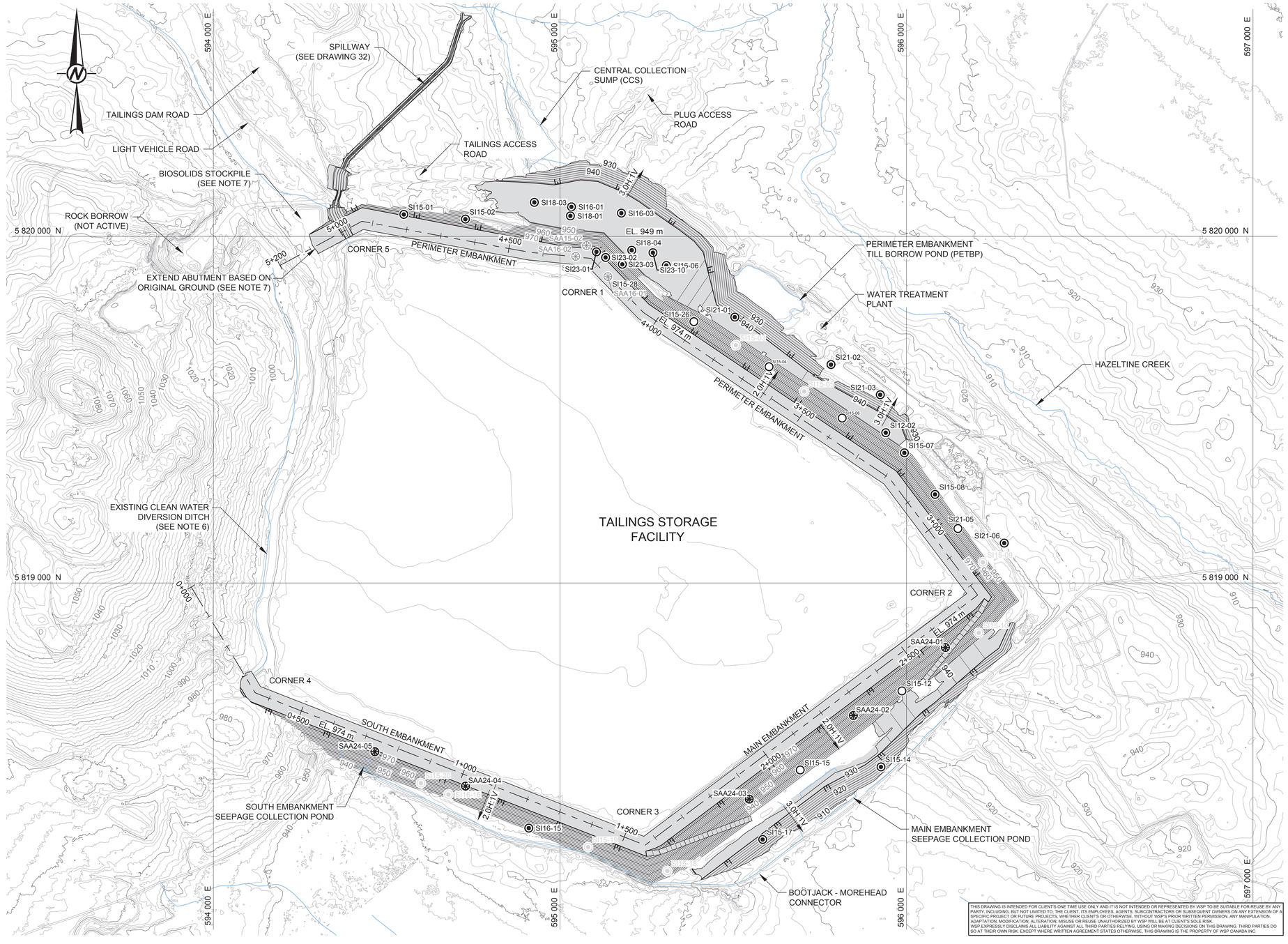

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 5)
- WATERCOURSE (SEE REFERENCE 5)
- PROPOSED SHAPE ACCEL ARRAY (SAA)
- EXISTING SHAPE ACCEL ARRAY (SAA)
- SLOPE INCLINOMETER (SI) TO BE RETROFITTED WITH SHAPE ACCEL ARRAY (SAA)
- SLOPE INCLINOMETER (SI) TO BE EXTENDED/MAINTAINED
- SLOPE INCLINOMETER (SI) TO BE DECOMMISSIONED

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
6. EXISTING CLEAN WATER DIVERSION DITCH TO BE DECOMMISSIONED PRIOR TO CONSTRUCTION.
7. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
8. WATER MANAGEMENT INFRASTRUCTURE SHOWN FOR REFERENCE ONLY.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
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5. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.

2024 PROPOSED SHAPE ACCEL ARRAY (SAA)

POINT ID	EASTING (m)	NORTHING (m)	ELEVATION (m)
SAA24-01	596112.3	5818813.9	955.8
SAA24-02	595846.7	5818617.8	957.2
SAA24-03	595546.1	5818376.6	951.1
SAA24-04	594727.4	5818414.0	970.0
SAA24-05	594465.7	5818513.6	970.0

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1:6,000 METRES

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

INSTRUMENTATION - SLOPE INCLINOMETERS AND SAAS PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	31 of 35	31

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0 25 mm

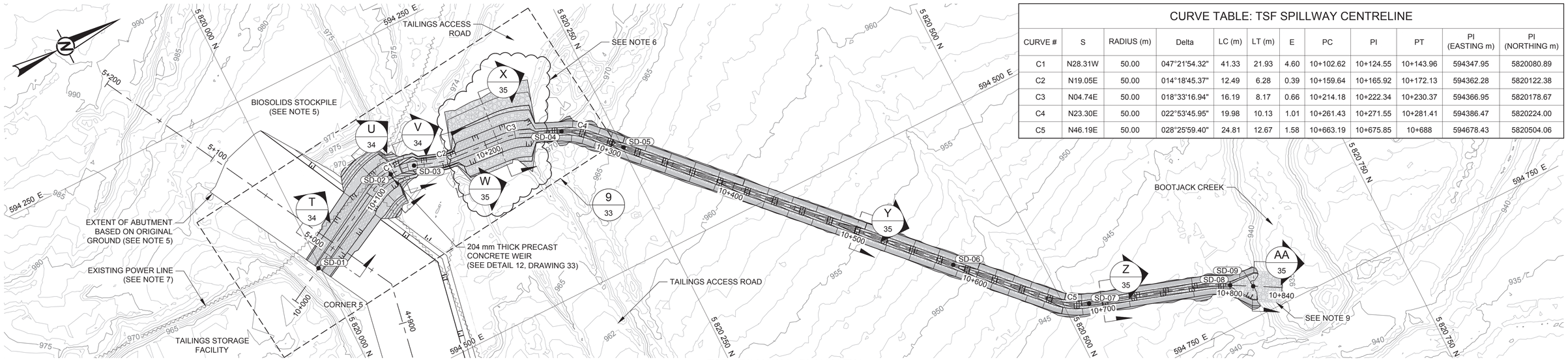

TSF SPILLWAY - PLAN VIEW

SCALE 1:1 500 m

CURVE TABLE: TSF SPILLWAY CENTRELINE											
CURVE #	S	RADIUS (m)	Delta	LC (m)	LT (m)	E	PC	PI	PT	PI (EASTING m)	PI (NORTHING m)
C1	N28.31W	50.00	047°21'54.32"	41.33	21.93	4.60	10+102.62	10+124.55	10+143.96	594347.95	5820080.89
C2	N19.05E	50.00	014°18'45.37"	12.49	6.28	0.39	10+159.64	10+165.92	10+172.13	594362.28	5820122.38
C3	N04.74E	50.00	018°33'16.94"	16.19	8.17	0.66	10+214.18	10+222.34	10+230.37	594366.95	5820178.67
C4	N23.30E	50.00	022°53'45.95"	19.98	10.13	1.01	10+261.43	10+271.55	10+281.41	594386.47	5820224.00
C5	N46.19E	50.00	028°25'59.40"	24.81	12.67	1.58	10+663.19	10+675.85	10+688	594678.43	5820504.06

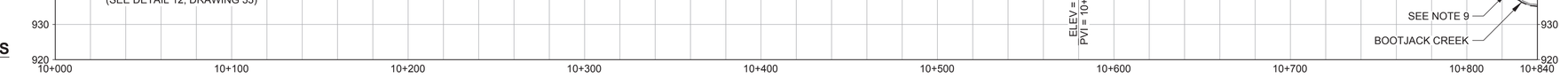

TSF SPILLWAY - PROFILE

HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

N: *PI AND CONTROL POINT NUMBER*
S: *DIRECTION (BEARING)*
R: *RADIUS*
D: *DEFLECTION ANGLE*
LC: *LENGTH OF CURVE*
LT: *LENGTH OF TANGENT*
E: *EXTERNAL SECANT*
PC: *POINT OF CURVATURE*
PI: *POINT OF INTERSECTION OF TANGENTS*
PT: *POINT OF TANGENCY*

HORIZONTAL CURVE PARAMETERS

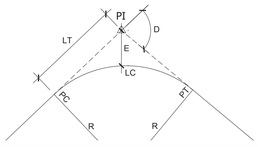

LEGEND

- SPILLWAY DESIGN CENTRELINE (10+100)
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SPILLWAY DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 7 (SEE REFERENCE 2)
- SD-09 SPILLWAY DESIGN SETOUT POINT
- TILL LINER
- FINE BEDDING
- COARSE BEDDING
- ROCKFILL
- RIPRAP
- GRANULAR ROAD GRAVEL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GROUND CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR, SPILLWAY DESIGN CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
5. BIOSOLIDS STOCKPILE TO BE REMOVED AS PART OF ABUTMENT FOUNDATION PREPARATION.
6. ROAD CROSSING DESIGN TO BE CONFIRMED PENDING CONFIRMATION OF FOUNDATION CONDITION AND ACTIVE ROADS BY MPMC.
7. POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
8. INTERIM EMBANKMENT CREST RAISES BETWEEN ELEVATION 970 AND 974, THE ELEVATION OF SPILLWAY DESIGN SETOUT POINTS SD-01 AND SD-02 IS TO BE ADJUSTED BASED ON EMBANKMENT CREST ELEVATION.
9. RIPRAP APRON (400 mm THICK) UNDERLAIN BY FINE BEDDING (200 mm THICK) TO BE FIELD FIT AT NATURAL GRADE ON PREPARED SURFACE (SEE TECHNICAL SPECIFICATIONS FOR REQUIREMENTS).

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

TSF SPILLWAY DESIGN SETOUT TABLE				
POINT ID	EASTING (m)	NORTHING (m)	FINISHED GROUND ELEVATION (m)	STATION
SD-01	594392.32	5819998.53	972.90	10+031.00
SD-02	594352.58	5820080.76	972.62	10+122.79
SD-03	594354.54	5820099.85	968.21	10+142.10
SD-04	594381.90	5820213.39	968.81	10+260.00
SD-05	594414.41	5820250.80	963.82	10+310.00
SD-06	594609.26	5820437.71	950.32	10+580.00
SD-07	594682.90	5820518.03	942.62	10+690.00
SD-08	594718.98	5820621.72	940.42	10+800.00
SD-09	594727.58	5820637.25	940.07	10+817.75

ISSUED FOR

CONSTRUCTION

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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2024-04-18

Engineers & Geoscientists BC Permit #1000200

CLIENT

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CONSULTANT

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840 HOWE STREET, SUITE 1000
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[+1] (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

TSF SPILLWAY
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	32 of 35	32

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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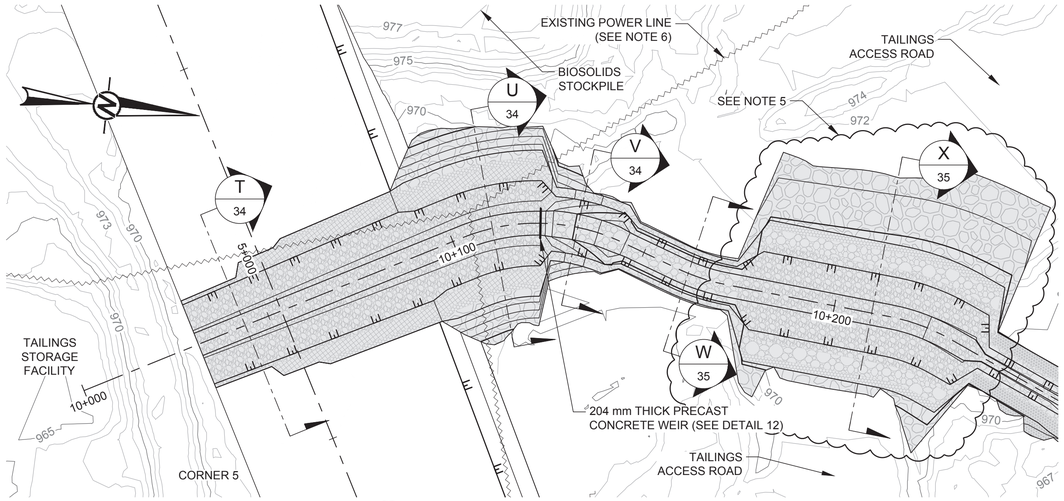

SCALE 1:750 m — 9/32 — SPILLWAY, CHUTE AND ROAD CROSSING - DETAIL

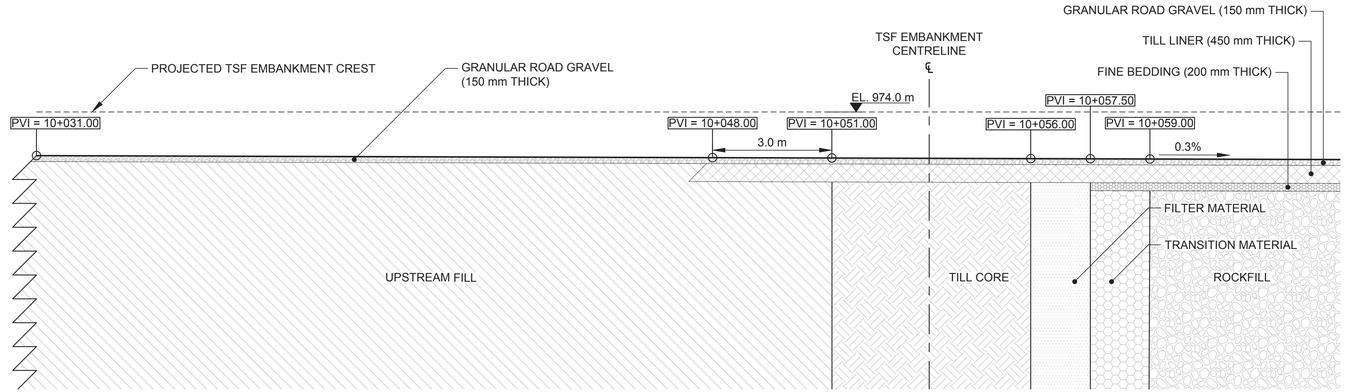

SCALE 1:75 m — 10/32 — SPILLWAY PROFILE - TYPICAL DETAIL

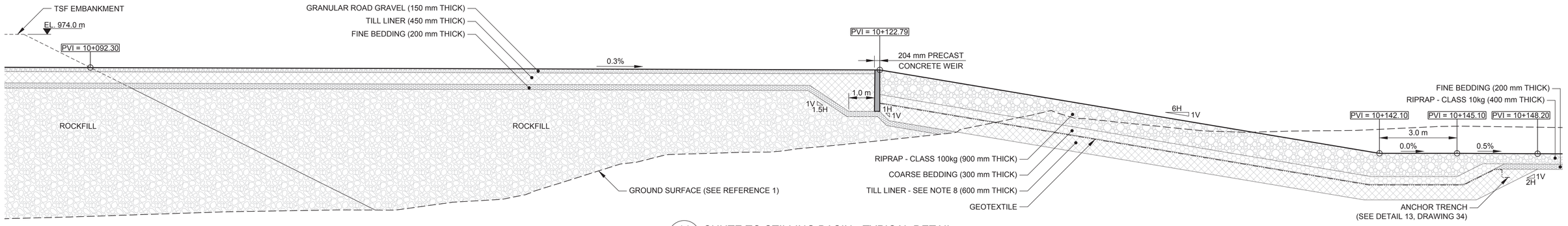

SCALE 1:75 m — 11/32 — CHUTE TO STILLING BASIN - TYPICAL DETAIL

LEGEND

- SPILLWAY DESIGN CENTRELINE (10+100)
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SPILLWAY DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 6 (SEE REFERENCE 2)
- GEOTEXTILE
- PRECAST CONCRETE WEIR
- UPSTREAM FILL
- FILTER MATERIAL
- TILL CORE
- TILL LINER
- FINE BEDDING
- COARSE BEDDING
- ROCKFILL
- RIPRAP
- GRANULAR ROAD GRAVEL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GROUND CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR, SPILLWAY DESIGN CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.
5. ROAD CROSSING DESIGN TO BE CONFIRMED PENDING CONFIRMATION OF FOUNDATION CONDITION AND ACTIVE ROADS BY MPMC.
6. POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
7. PRECAST CONCRETE WEIR TO BE PRECON'S PRECAST PANEL WALL OR EQUIVALENT WEIR TO BE APPROVED BY QA MANAGER.
8. TILL LINER MAY NOT BE REQUIRED IF GROUND SURFACE IS TILL MATERIAL. GROUND SURFACE CONDITIONS TO BE INSPECTED AND APPROVED BY QA MANAGER.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
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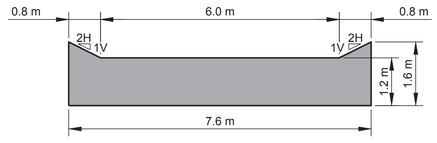

SCALE 1:75 m — 12/32 — PRECAST CONCRETE WEIR - TYPICAL DETAIL (SEE NOTE 7)

ISSUED FOR
CONSTRUCTION

0 2.5 5
1:75 METRES

0 25 50
1:750 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

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Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

TSF SPILLWAY
TYPICAL DETAILS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	33 of 35	33

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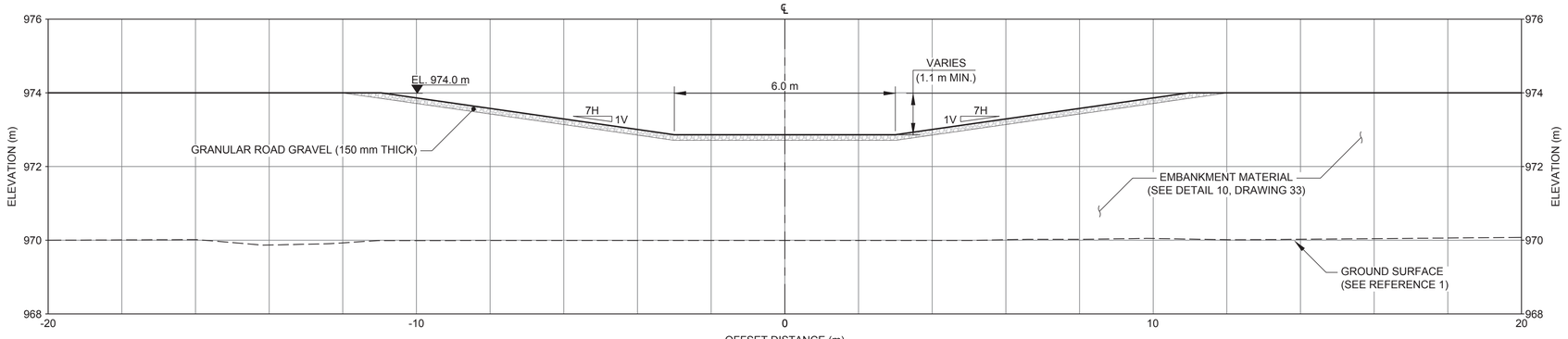

SCALE 1:75 m — T (32 / 33) — SPILLWAY - TYPICAL CROSS-SECTION (STA. 10+031 TO 10+048)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- SPILLWAY FINISHED GRADE
- GEOTEXTILE
- TILL LINER
- FINE BEDDING
- COARSE BEDDING
- ROCKFILL
- RIPRAP
- GRANULAR ROAD GRAVEL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. TILL LINER MAY NOT BE REQUIRED IF GROUND SURFACE IS TILL MATERIAL. GROUND SURFACE CONDITIONS TO BE INSPECTED AND APPROVED BY QA MANAGER.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

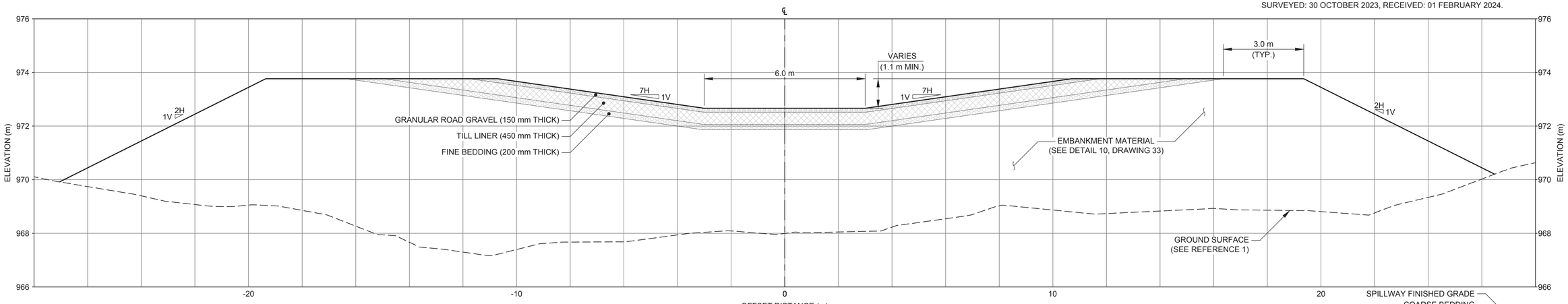

SCALE 1:75 m — U (32 / 33) — SPILLWAY - TYPICAL CROSS-SECTION (STA. 10+048 TO 10+122.79)

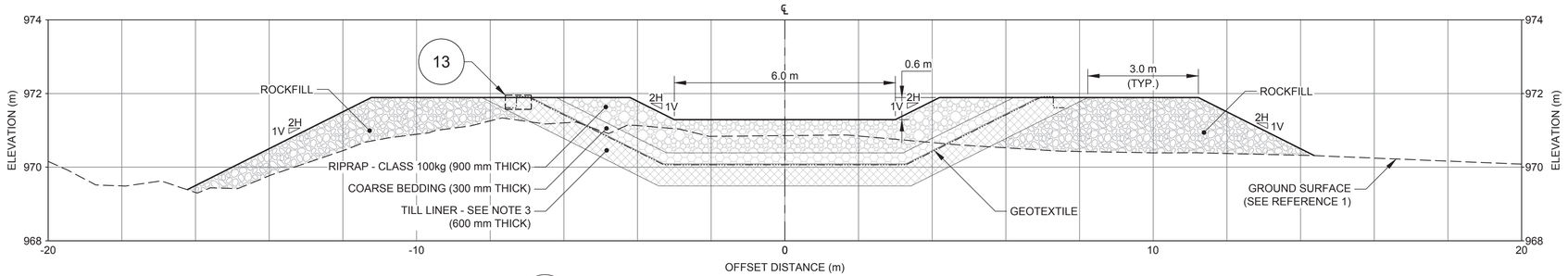

SCALE 1:75 m — V (32 / 33) — CHUTE - TYPICAL CROSS-SECTION (STA. 10+122.79 TO 10+142.10)

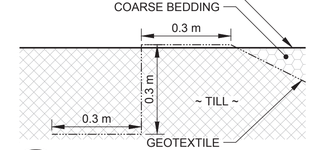

SCALE 1:10 m — 13 — ANCHOR TRENCH - TYPICAL DETAIL

ISSUED FOR

CONSTRUCTION

0 0.5 1
1:10 METRES

0 2.5 5
1:75 METRES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

CLIENT

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[+1] (604) 685 9381

Engineers & Geoscientists BC Permit #1000200

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE

TSF SPILLWAY
TYPICAL CROSS-SECTIONS (SHEET 1 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
CA0020527.4505	51300/51395/014	0	34 of 35	34

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0 25 mm

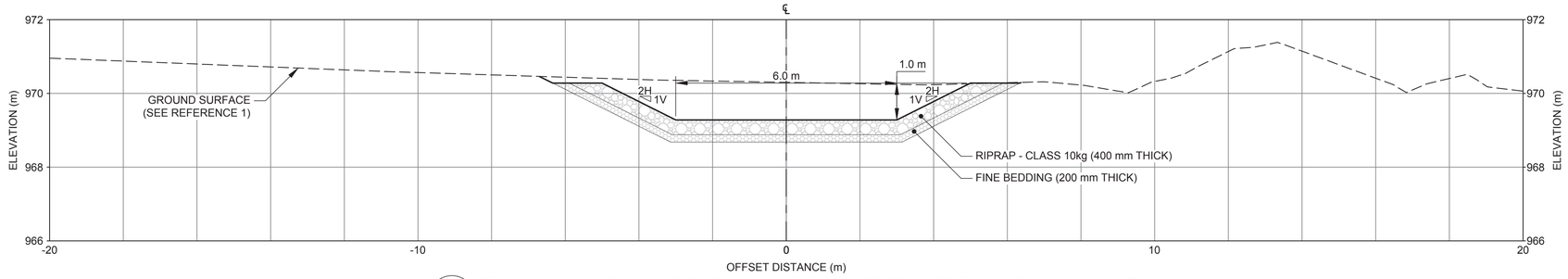

SCALE 1:75 m (W 32 / 33) STILLING BASIN TO ROAD CROSSING - TYPICAL CROSS-SECTION (STA. 10+142.10 TO 10+174)

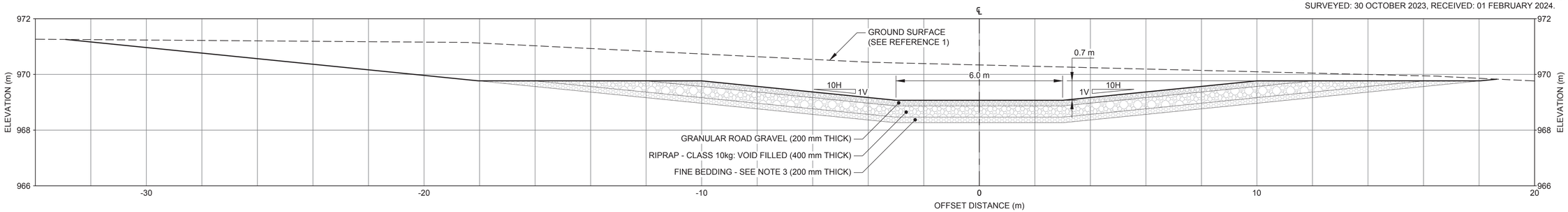

SCALE 1:75 m (X 32 / 33) ROAD CROSSING - TYPICAL CROSS-SECTION (STA. 10+174 TO 10+240) (SEE NOTE 4)

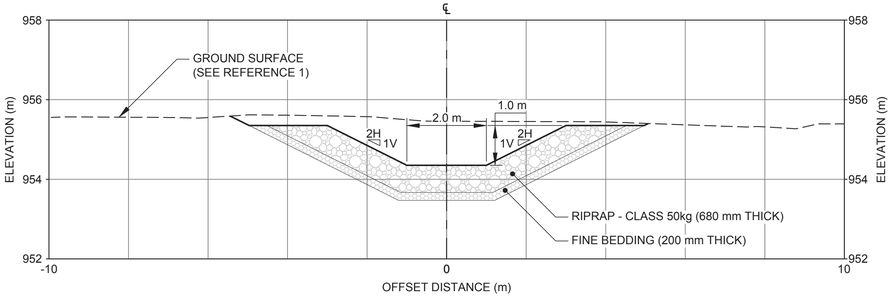

SCALE 1:75 m (Y 32) OUTLET CHANNEL - TYPICAL CROSS-SECTION (STA. 10+260 TO 10+690)

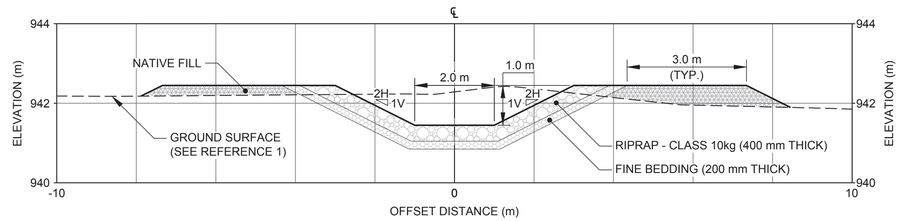

SCALE 1:75 m (Z 32) OUTLET CHANNEL - TYPICAL CROSS-SECTION (STA. 10+240 TO 10+260 AND 10+690 TO 10+800)

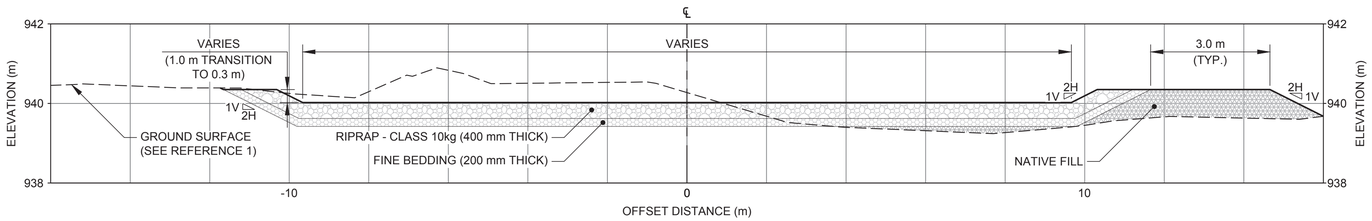

SCALE 1:75 m (AA 32) DISCHARGE APRON - TYPICAL CROSS-SECTION (STA. 10+800 TO 10+817.75)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- SPILLWAY FINISHED GRADE
- FINE BEDDING
- RIPRAP
- GRANULAR ROAD GRAVEL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. SUBGRADE MATERIAL TO BE INSPECTED BY QA MANAGER. OVER EXCAVATION AND GREATER DEPTH OF FINE BEDDING MAY BE REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ROAD CROSSING DESIGN TO BE CONFIRMED PENDING CONFIRMATION OF FOUNDATION CONDITION AND ACTIVE ROADS BY MPMC.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

CONSTRUCTION

0 2.5 5
1:75 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — G. E. PIZARRO SALA # 40077

2024-04-18

Engineers & Geoscientists BC Permit #1000200

CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT

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840 HOWE STREET, SUITE 1000
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[+1] (604) 685 9381

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
TSF SPILLWAY
TYPICAL CROSS-SECTIONS (SHEET 2 OF 2)

PROJECT NO.	PHASE/TASK/DOC.	REV.	35 of 35	DRAWING
CA0020527.4505	51300/51395/014	0		35

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File Name: CA0020527_4505-51300-51395-014-034_035.dwg | Client\Imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505\51300\51395\Doc 014_974 Design\02_PRODUCTION\DWG\Drawings\
AM

APPENDIX B

Technical Specifications

PREPARED FOR:

MOUNT POLLEY MINING CORPORATION

PREPARED BY:

REV.	DATE	REASON FOR REVISION	CHK	APP
0	18 APRIL 2024	ISSUED FOR CONSTRUCTION	SB	GP
A	23 FEBRUARY 2024	ISSUED FOR REVIEW	SB	GP

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1.0 SCOPE

These Specifications provide the technical information for construction of the TSF embankments from elevation 970 m to 974 m, at the Mount Polley Mine near Likely, British Columbia. The scope of this Work includes but is not limited to the following:

- Foundation preparation
- South, Main and Perimeter embankments re-slope
- South, Main and Perimeter embankments raise
- Extension of the rockfill buttress along the Main and Perimeter embankments
- Sourcing and placement of fills for the upstream drain
- Sourcing and placement of fills for the spillway
- Supply and installation of pipe materials
- Supply and installation of instrumentation
- Control of water during construction.

These Specifications shall be read in combination with the latest revision of the Drawings. The work is to be constructed in accordance with and to the lines and grades shown on the Drawings, and as directed by the MPMC Construction Manager and the Geotechnical Engineer's QA Manager.

2.0 GENERAL

2.1 Definitions

The definitions used in this Specification are given in Table 2-1.

Table 2-1:List of Definitions

Term	Definition
Approval	A written engineering or geotechnical opinion, concerning the progress and completion of the work.
ASTM	ASTM International
Drain Rock	Screened rockfill used within the upstream drain and meeting the requirements of these Specifications.
Drawings	The most recent revision of the Issued for Construction (IFC) Tailings Storage Facility Drawings prepared by the Geotechnical Engineer.
General Fill	Fill consisting of mainly tailings and meeting the Specifications.

Table 2-1:List of Definitions

Term	Definition
Geotechnical Engineer	WSP Canada Inc.
Fill	A general terminology to describe soil or rockfill materials placed during the construction.
Filter (Zone F)	Material produced from crushing or screening NPAG rockfill to be placed in contact with the till core, filter sand and transition, and meeting the requirements of these Specifications.
Filter Sand	Granular material to be placed upstream in contact with the upstream fill and till core and downstream in contact with the till core and filter where the upstream drain pipes pass through the till core, and meeting the requirements of these Specifications.
NPAG	Non-Potentially Acid Generating.
Owner	Mount Polley Mining Corporation (MPMC).
PAG	Potentially Acid Generating.
Quality Assurance	Planned and systematic activities that provide confidence to the Owner (MPMC) and various stakeholders that quality control is being implemented effectively.
Quality Control	A planned system of inspection and testing carried out according to accepted standard specifications to ensure the quality of the work meets the design requirements.
Riprap	Armour rock used for erosion protection within water infrastructure
Rockfill or Zone C	Run-of-Mine NPAG rock material meeting the Specifications.
Specifications	The most recent revision of the Tailings Storage Facility technical specifications prepared by the Geotechnical Engineer.
TSF	Tailings Storage Facility.
Till (Zone S)	Soil consisting of sizes ranging from clay to cobbles that will be placed and compacted to form a low hydraulic conductivity layer, and meeting the requirements of these Specifications.
Till Foundation	Natural soil layer consisting of sizes ranging from clay to cobbles that form the foundation of the facility.
Transition (Zone T)	Material produced from crushing or screening NPAG rockfill to be placed in contact with the filter and rockfill, and meeting the requirements of these Specifications.
Upstream Fill (Zone U)	Fill consisting of mainly tailings and meeting the Specifications.
Work	The construction works, or additional work, required to complete construction of the Tailings Storage Facility as defined in the Drawings and Specifications.

2.2 Drawings

Table 2-2 presents a list of the Drawings.

Where a discrepancy exists between these Specifications and the Drawings, the Geotechnical Engineer shall be notified upon discovery of the discrepancy, and a formal written Request for Information (RFI) shall be issued to the Geotechnical Engineer to clarify the design intent.

The user is responsible to confirm that they are using the most recent version of the Specifications and Drawings.

Table 2-2: List of Drawings

Drawing No.	Drawing Title	Revision
01	DRAWING LIST AND PROJECT LOCATION PLAN	0
02	SITE PLAN	0
03	PRE-CONSTRUCTION CONDITIONS	0
04	GENERAL ARRANGEMENT - PLAN VIEW	0
05	SOUTH EMBANKMENT - FOUNDATION PREPERATION	0
06	SOUTH EMBANKMENT - PLAN VIEW	0
07	SOUTH EMBANKMENT - TYPICAL CROSS-SECTION AND DETAIL	0
08	SOUTH EMBANKMENT - CROSS-SECTIONS	0
09	MAIN EMBANKMENT - FOUNDATION PREPARATION	0
10	MAIN EMBANKMENT AND BUTTRESS - PLAN VIEW	0
11	MAIN EMBANKMENT AND BUTTRESS - TYPICAL CROSS-SECTION AND DETAIL	0
12	MAIN EMBANKMENT - CROSS-SECTIONS	0
13	MAIN EMBANKMENT BUTTRESS - CROSS-SECTIONS (1 OF 2)	0
14	MAIN EMBANKMENT BUTTRESS - CROSS-SECTIONS (2 OF 2)	0
15	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2 – CORNER 1) - FOUNDATION PREPARATION	0
16	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2 – CORNER 1) - PLAN VIEW	0
17	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 2 – CORNER 1) - TYPICAL CROSS-SECTION AND DETAIL	0
18	PERIMETER EMBANKMENT (CORNER 2 – CORNER 1) - CROSS-SECTIONS	0
19	PERIMETER EMBANKMENT BUTTRESS (CORNER 2 – CORNER 1) - CROSS-SECTIONS	0
20	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1 – CORNER 5) - FOUNDATION PREPARATION	0

Table 2-2: List of Drawings

Drawing No.	Drawing Title	Revision
21	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1 – CORNER 5) - PLAN VIEW	0
22	PERIMETER EMBANKMENT AND BUTTRESS (CORNER 1 – CORNER 5) - TYPICAL CROSS-SECTION AND DETAIL	0
23	PERIMETER EMBANKMENT (CORNER 1 – CORNER 5) - CROSS-SECTIONS	0
24	PERIMETER EMBANKMENT BUTTRESS (CORNER 1 – CORNER 5) - CROSS-SECTIONS	0
25	SOUTH AND PERIMETER EMBANKMENT ABUTMENTS – PLAN VIEW AND TYPICAL CROSS-SECTIONS	0
26	UPSTREAM DRAIN – SOUTH AND MAIN EMBANKMENT – PLAN VIEW	0
27	UPSTREAM DRAIN – PERIMETER EMBANKMENT – PLAN VIEW	0
28	UPSTREAM DRAIN – TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 1 OF 2)	0
29	UPSTREAM DRAIN – TYPICAL CROSS-SECTIONS AND DETAILS (SHEET 2 OF 2)	0
30	INSTRUMENTATION – PIEZOMETERS – PLAN VIEW	0
31	INSTRUMENTATION – SLOPE INCONOMETERS AND SAAS – PLAN VIEW	0
32	TSF SPILLWAY – PLAN AND PROFILE	0
33	TSF SPILLWAY – TYPICAL DETAILS	0
34	TSF SPILLWAY – TYPICAL CROSS-SECTIONS (SHEET 1 OF 2)	0
35	TSF SPILLWAY – TYPICAL CROSS-SECTIONS (SHEET 2 OF 2)	0

2.3 Standards

Work shall conform to, but not be limited to, the requirements of the latest edition of the standards listed in Table 2-. Work included in this Specification shall conform to the applicable provisions in these publications, except as modified by the requirements specified herein or as indicated in the Drawings. Each publication shall be the most recent revision in effect at the time of issue of the bid package for this work.

Table 2-3: List of Standards

Standard	Description
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
ASTM D2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
ASTM D5240	Standard Test Method for Evaluation of the Durability of Rock for Erosion Control Using Magnesium Sulfate.
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
ASTM D6241	Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50 mm Probe.
ASTM D6473	Standard Test Method for Specific Gravity and absorption of rock for erosion control.
ASTM D6913	Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6928	Standard Test Methods for resistance of coarse aggregate to degradation by abrasion in the micro-deval apparatus

If materials are offered which conform to a standard other than that specified then the standard offered shall be equal to or superior, when tested, to the specified standard and full details of the difference between the standard offered and the standard specified shall be given.

2.4 Roles and Responsibilities

Table 3 presents a summary of the key roles and associated responsibilities and authorities. The roles and responsibilities of each position shall be reviewed, documented, and agreed upon prior to the start of work for each stage of the project.

Table 2-4: Table of Responsibilities

Role	Responsibility	Authority
MPMC TSF Construction Team		
MPMC TSF Qualified Person	▪ Coordinates the design, construction and overall management of the TSF with the EoR and MPMC construction manager, as well as internal and external resources.	▪ Designated by mine manager for safe management of the TSF.
MPMC Construction Manager	▪ Defines the scope of the project. ▪ Provides all materials, including water, and site access. ▪ Obtains all relevant permits. ▪ Provides reasonable access to the general open areas around the work site. ▪ Provision of survey for set-out and for construction record. ▪ Coordinates all project communications. ▪ Arranges coordination and progress meetings, as required. ▪ Leads problem resolution meetings for all QA and QC issues.	▪ Retains the Contractor to complete the project. ▪ Directs the scope of work to complete the project. ▪ Has the authority to stop work due to non-compliance (which shall resume only after a plan for corrective action has been approved by the MPMC Construction Manager and QA Manager).
Contractor	▪ Retained by the MPMC Construction Manager. ▪ Assigned tasks by the MPMC Construction Manager to bring the Work, or additional work, to final completion. ▪ Ensure that the Work is done in accordance with the Drawings and Specifications. ▪ Follows the QC Plan. ▪ Reports to the MPMC Construction Manager. ▪ Request information, as necessary, to clarify the design intent.	▪ Directs work.

Table 2-4: Table of Responsibilities

Role	Responsibility	Authority
Quality Control Laboratory	▪ Reports to the MPMC Construction Manager. ▪ Responsible for performing the QC laboratory and in-situ tests outlined in Section 5.0.	▪ Reports test results to the MPMC Construction Manager and the QA Manager.
Engineering Team		
Engineer of Record (Engineer)	▪ Ensures that the works are constructed in accordance with the design intent. ▪ Conducts site visits at key points to check on progress of work and support the QA team. ▪ Responsible to oversee the QA program to confirm that the works are constructed in accordance with the design intent. ▪ Responsible for the design and preparation of the Drawings and Specifications. ▪ Responsible for all design changes through updates to the Drawings and Specifications, including modifications or clarifications required during construction. ▪ Responsible for review of the construction record report. ▪ Prepares deviance accountability report. ▪ Fulfils the requirements of the Engineer of Record as defined in 10.1.5 of the Code.	▪ Overall supervision and coordination of QA team. ▪ Evaluates the adequacy of the as-built facility relative to the design as well as applicable standards, criteria and guidelines. ▪ Signs construction record.
Quality Assurance (QA) Manager	▪ Reports to the Engineer and represents the Engineer on site. ▪ Responsible for performing the QA tasks outlined in Section 5.0.Responsible for monitoring the Quality Control program to confirm that the works are constructed in accordance with the design intent. ▪ Review of QC data and sign-offs provided for compliance with the design intent, Drawings and Specifications. ▪ Attends site meetings and conducts site inspections. ▪ Assesses site design and construction issues or non-compliances and prepares recommendations for review by the Engineer. ▪ Prepares draft site documentation for review by the Engineer.	▪ Approves work as meeting the design intent, as set out in the Drawings and Specifications. ▪ Rejects work which fails to meet the design intent as set out in the Drawings and Specifications. ▪ Signs as the QA Manager on the construction checklists. ▪ Reports non-conformance of Work to the MPMC Construction Manager and the Engineer.

3.0 CARE OF WATER

3.1 Scope

This Section describes Care of Water during the construction, which consists of all work required to control water from any sources, including groundwater, surface water, snowmelt and precipitation, in order to complete the Work in accordance with the Drawings and Specifications, and in accordance with all environmental and safety controls established by MPMC. Care of water shall include the following:

- Managing water before, during and after excavating, preparing, placing, and compacting embankment fill material. Water management is also to be conducted in designated waste areas, access roads, stockpiles, and when undertaking any other part of the Work.
- Dewatering foundations and associated working areas. Providing, operating and maintaining any channels, flumes, drains, sumps, pumps and other drainage facilities and equipment necessary to divert or to remove water from construction areas.
- Constructing and maintaining any embankments and other protective works required to divert water away from areas required for the Work, and where applicable, removing such structures upon completion of the Work.

3.2 General

Surface water shall be temporarily diverted and managed during construction of the Work. Appropriate channel, ditch, dike and other facilities required to divert surface water from any area required to complete the Work shall be constructed.

Pumps, hoses, culverts and any other equipment required to dewater and maintain all parts of the construction site free from water shall be furnished, installed, maintained, and operated.

Temporary diversion and protective works and pumping stations shall be adequately operated and maintained. These shall also be readily accessible at all times.

Temporary dikes and other temporary works shall be removed promptly when they are no longer required at the direction of the Owner's Construction Manager. Materials from such removal shall be hauled to disposal areas designated by the Owner's Construction Manager.

Excavations shall be dewatered prior to performing work in the excavations, to the extent determined acceptable by the QA Manager. This includes the Perimeter Embankment Till Borrow Pond, Main Embankment till borrow area, Main Embankment Seepage Collection Pond, South Embankment Seepage Collection Pond and seepage collection ditches.

4.0 SURFACE AND FOUNDATION PREPARATION

4.1 Scope

This Section provides the requirements for surface and foundation preparation for raising the TSF embankments. The surface and foundation preparation for the South, Main and Perimeter embankments includes:

- expose and prepare the surface of the Till Core, Filter, and Transition materials along the crest of the embankments
- expose and prepare the surface of the buttress within the embankment re-slope footprint
- clearing, stripping and preparing the foundation within the embankment re-slope and buttress extension footprint
- clearing, stripping and preparing the foundation at the embankment abutments
- loading, hauling, dumping, and disposing of excavated materials.

4.2 General

Excavation shall be carried out in accordance with the Drawings and Specifications using ground support and water control measures required for safe and effective operation. Excavation procedures shall be such that the stability of adjacent fill or cut slopes or of completed Work shall not be at risk.

The excavation shall be laid out, subject to inspection by the QA Manager, prior to commencing any excavation. Excavation shall not start on any part of the Work until the proposed methodology and construction sequence has been approved by the Owner's Construction Manager.

Survey shall be performed to confirm the elevations and coordinates shown on the Drawings.

Excavation work may begin only after the necessary infiltration and runoff control measures have been completed in accordance with Section 3.0, and the necessary equipment, elements and materials for protection of surface excavations are available at the site. Temporary drainage and pumping systems shall be provided, operated and maintained, as required, to direct water away from the excavation areas, as specified in Section 3.0.

The location of the exposed material boundaries and exposed surface shall be surveyed.

4.3 Clearing and Stripping

Any area to be cleared and stripped shall require prior approval by the Owner's Construction Manager and the MPMC Environmental Department.

Clearing and stripping shall consist of removing stockpile material, topsoil, vegetation and other deleterious materials, including trees, brush, stumps, roots, and debris, and loading, hauling and dumping such materials into stockpiles within designated waste areas.

Competent foundation material, as determined by the QA Manager, shall be exposed. Foundation material considered unsuitable by the QA Manager shall be excavated and removed.

Vegetation shall not be disturbed beyond the boundaries shown on the Drawings unless so directed by the Owner's Construction Manager. Waste materials shall not be deposited into any riverbed or other water channel.

The QA Manager will determine if the fill material, containing organics, along the toe of the South Embankment needs to be progressively excavated in 20 m wide panels perpendicular to the embankment. In this case, the fill in each panel is to be removed down to competent foundation material, and Embankment Rockfill (Zone C) placed to replace the excavated material, prior to the excavation of the adjacent panel.

4.4 Foundation Preparation

Following clearing and stripping, the surface of the foundation shall be proof-rolled, as directed by the QA Manager. Where movements are observed which are deemed unacceptable by the QA Manager, the area shall be excavated, as directed by the QA Manager.

The foundation preparation and proof-rolling may be adjusted in the field to suit actual conditions, as defined by the QA Manager.

Fill placement shall not commence until preparation works have been completed, and written approval to proceed has been provided by the QA Manager.

4.5 Surface Preparation Along the Crest of the Embankments

The existing Till Core, Filter and Transition material along the crest of the embankments are to be exposed, as directed by the QA Manager. All deleterious materials are to be removed and hauled to a designated waste area.

Frost affected material along the crest of the Till Core shall be removed as directed by the QA Manager. After removal of frost affected material, the exposed surface of the till core shall be re-compacted with a sheep’s foot roller. The exposed till core may need to be moisture conditioned, as directed by the QA Manager.

Loose upstream fill material along the crest of the embankment shall be moisture conditioned and re-compacted as directed by the QA Manager.

4.6 Perimeter and South Embankments Abutments

Stockpiled material, topsoil, vegetation, and other deleterious materials, including trees, brush, stumps, roots, and debris is to be removed at the South Embankment abutment and Perimeter Embankment abutment. The material is to be loaded, hauled and dumped into stockpiles within designated waste areas.

The thickness of competent till is to be confirmed by the excavation of test pits, as directed by the QA Manager. The test pits are to be excavated along the Till Core and Upstream Fill footprint.

Where a minimum of 2 m of competent till exists above bedrock, the Till Core will be keyed into the foundation till by the excavation of a 0.5 m deep and 2.0 m wide trench.

Where the depth of foundation till to bedrock is less than 2 m, the Till Core shall be placed directly onto bedrock. The bedrock surface will be prepared to receive Till by the removal of all residual soil to fully expose the bedrock. Relatively loose, diggable bedrock is to be excavated and the surface cleaned by high pressure jets. Depending

on the condition of the bedrock surface, the QA Manager may request additional preparation which could include placement of bentonite, shotcrete or slush grout.

Foundation preparation at the abutment shall be completed in such a way that water drains away from the Till Core. This may require placement of a till blanket downstream of the Till Core.

4.7 Designated Waste Areas

Surplus and unsuitable materials shall be disposed of at waste areas designated by the Owner's Construction Manager. Such materials shall be loaded, hauled and placed into such waste areas, and shaped into waste piles. Waste piles shall be constructed such that drainage of surface water and groundwater is not impeded, and such that the piles are stable as defined by the Owner's Construction Manager.

Vegetation, topsoil and other materials resulting from clearing and stripping operations shall be stockpiled separately from other soil or rock materials at designated waste areas, avoiding obstruction of any natural or man- made water flows. All vegetation beyond the limits of such storage areas shall be preserved.

Upon completion of the work, the designated waste area shall be shaped in accordance with the requirements of the Owner's Construction Manager.

5.0 FILL PLACEMENT

5.1 Scope

This section comprises the requirements for placement of fills in the Works to the lines and grades shown on the Drawings, or as directed by the Owner's Construction Manager and QA Manager.

5.2 General

Fill placement shall be to the lines, grades and cross-sections shown on the Drawings and in accordance with the Specifications.

Dam embankment materials shall not encroach upon adjacent zones any further than allowed by the tolerances shown on the Drawings.

Water control measures such as temporary drainage and pumping systems shall be operated and maintained as required to direct water away from the fill placement areas as specified in Section 3.0.

Access to the Work will be provided and coordinated by the Owner's Construction Manager.

No fill shall be placed on any portion of the Works until excavation and surface and foundation preparation, as specified in Section 4.0, has been completed and such portions have been approved in writing by the QA Manager.

Fill shall not be placed on a surface where ice, snow or excessive moisture has accumulated. A previously approved foundation or fill surface, which in the opinion of the QA Manager, has deteriorated shall be repaired prior to any fill placement.

Fill shall consist of unfrozen material that is free of organic or other deleterious material, as approved by the QA Manager.

Fill which, while acceptable at the time of selection has, in the opinion of the QA Manager, deteriorated for any reason such that it no longer meets the Specifications for that material shall not be incorporated in the Works.

Construction traffic shall be routed such that no ruts are formed on the surface of excavated or placed fill areas. If ruts are formed, the ruts shall be graded level and re-compacted to the relevant degree of compaction for the particular fill type as required by the Specification.

5.3 Fill Materials

The material zones of the embankment are shown on the Drawings and described in this Specification.

Materials used in the construction are to be non-potentially acid generating (NPAG). Acceptance of all fill materials based on geochemical properties shall be the responsibility of the Owner's Construction Manager.

The particle size envelopes shown in these Specifications shall apply to the as-placed materials and in the stockpile.

Fill materials shall be well-graded within the specified gradation limits; i.e., they shall contain an even distribution of all sizes of particles within the designated envelope, without significant deficiency in any sizes. Fill material gradations shall meet the specification gradation within the envelope drawn between the specified points and not just at the specified points. Any unsuitable material from the fill shall be excavated and removed.

5.3.1 Till (Zone S)

The Till (Zone S) shall be a well graded Till with a minimum fines content of approximately 20% by weight (particles finer than 0.075 mm). The Till will be sourced from designated borrow areas. The Till shall have a minimum plasticity index (PI) of 7.

The Till shall meet the gradation in Table 5-1.

Table 5-1: Gradation Limits for the Till (Zone S)

Size (mm)	Sieve Size (USS)	Percent Passing (%)
100	4”	100
75	3”	98–100
37.5	1.5”	89–100
19	0.75”	81–100
12.5	0.5”	76–100
4.75	#4	66–100
2	#10	56–100
0.85	#20	47–94
0.425	#40	39–90
0.075	#200	20–85

Particles larger than 150 mm shall be removed from the material prior to compaction.

USS = United States Standard Sieve Size.

5.3.2 Filter Material (Zone F)

The Filter (Zone F) material is to be placed downstream of the till core. The material shall consist of hard, durable mineral particles, without organic matter, clay, soft particles, snow, ice, or any other unsuitable material.

The Filter shall meet the gradation in Table 5-2.

Table 5-2: Gradation Limits for the Filter Material (Zone F)

Size (mm)	Sieve Size (USS)	Percent Passing (%)
37.5	1.5”	100
19.1	0.75”	88-100
9.5	3/8”	56-100
4.75	#4	40-86
2	#10	25-63
0.85	#20	16-45
0.425	#40	10-33
0.25	#60	6-25
0.106	#140	0-15
0.075	#200	0-12

USS = United States Standard Sieve Size.

5.3.3 Transition Material (Zone T)

The Transition (Zone T) material shall be used as a transition zone between the Filter and Rockfill. The material shall consist of a mix of processed boulders, cobbles, gravel and sand produced by crushing or screening rockfill. The material shall consist of hard, durable mineral particles, without organic matter, clay, soft particles, snow, ice, or any other unsuitable material.

The Transition material shall meet the gradation in Table 5-3.

Table 5-3: Gradation Limits for the Transition Material (Zone T)

Size (mm)	Sieve Size (USS)	Percent Passing (%)
152.4	6”	100
25.4	1”	37-100
19.1	0.75”	29-75
12.7	0.5”	17-60
9.5	3/8”	0-51
4.75	#4	0-32
2.38	#8	0-25
0.85	#20	0-17
0.075	#200	0-5

USS = United States Standard Sieve Size.

5.3.4 Upstream Fill (Zone U)

The Upstream Fill (Zone U) shall consist of sandy tailings material or other granular material approved by the Engineer. The upstream fill is to be excavated from within the TSF and placed mechanically in lifts or by depositing the tailings into cells.

Till may be used if conditions allow compaction, and subject to the approval of the QA Manager. Filter material, Transition material or Rockfill may be used in select locations subject to the approval of the QA Manager.

5.3.5 Embankment Rockfill (Zone C) and Buttress Rockfill

Rockfill used in construction of the Embankment (Zone C) and Embankment Buttresses are to be non-potentially acid generating (NPAG). Acceptance of all fill materials based on geochemical properties shall be the responsibility of the Owner's Construction Manager.

The rockfill shall consist of well graded material with a maximum diameter of 1 m, obtained from run-of-mine NPAG rockfill. The material shall consist of hard, durable mineral particles, without organic matter, clay, soft particles, or any other unsuitable material. Any unsuitable materials from the rockfill shall be excavated and removed.

Select coarser rockfill, to be placed within the Main Embankment Seepage Collection Pond and Perimeter Embankment Till Borrow Pond, shall be uniformly graded with only a small proportion of gravel, sand and silt size particles, as approved by the QA Manager.

5.3.6 Drain Rock

The Drain Rock shall consist of screened rockfill with uniform particle sizes between 300 mm and 150 mm.

The material shall consist of hard, durable mineral particles, without organic matter, clay, soft particles, or any other unsuitable material.

5.3.7 Filter Sand

The Filter Sand shall be placed between the Till Core (Zone S) and Filter (Zone F) and between the Upstream Fill (Zone U) and Till Core (Zone S) where the upstream drain pipe crosses through the till core.

The material shall consist of hard, durable mineral particles, without organic matter, clay, soft articles, snow, ice, or any other unsuitable material.

The Filter Sand shall meet the gradation in Table 5-4.

Table 5-4: Gradation Limits for the Filter Sand

Size (mm)	Sieve Size (USS)	Percent Passing (%)
9.5	3/8”	100
4.75	#4	95-100
2	#10	55-100
0.85	#20	25-100
0.425	#40	0-55
0.25	#60	0-25
0.106	#140	0-10
0.075	#200	0-5

5.3.8 General Fill

General Fill material can be used to backfill the TSF tailings beach where the upstream drain will be constructed. If required by construction sequence, the General Fill can also be used to laterally support the 20 m wide Zone U Upstream Fill. General Fill shall consist of sandy tailings material or other granular material approved by the Engineer. General fill is to be placed mechanically in lifts.

5.4 Placement and Compaction

Fill materials shall be placed to the lines and elevations shown on the Drawings.

The placement of fill materials for the various zones of the embankment shall be scheduled as directed by the Owner's Construction Manager. To achieve this, the various fill materials shall be stockpiled so that they are available at the location of the fill placement when required.

The Owner's Construction Manager may require modifications to the fill construction program, depending upon conditions encountered during construction.

The embankments shall be constructed such that lenses, pockets, streaks and layers of materials differing substantially in gradation from the surrounding material within each zone are avoided.

Filter and Transition shall be hauled, placed and spread in such a manner as to prevent segregation. Any material placed which, in the opinion of the QA Manager, does not meet the specified requirements shall be removed or remixed, blended or otherwise reworked to produce a material which meets the specified requirements, whether or not such material has been covered by other fill material.

The fill shall be leveled prior to compaction by means of a tracked dozer, excavator or other suitable approved equipment to obtain an even surface with no depressions.

5.4.1 Till (Zone S)

The Till material shall be spread parallel to the axis of the embankment in horizontal lifts of uniform thickness not exceeding 0.3 m prior to compaction. Thinner lifts may be required if till compaction is carried out in freezing conditions.

Till shall only be placed in contact with the existing Till Core, Upstream Fill, Filter and Filter Sand. Till shall not be placed in direct contact with Transition material or Rockfill.

Precautions shall be taken to avoid any presence of particles greater than 150 mm. Oversize material shall be removed to the satisfaction of the QA Manager. Affected zones of Till material shall be removed at the direction of the QA Manager.

The Till shall be compacted with a sheep's foot drum roller to achieve a dry density of at least 95% of the Standard Proctor maximum dry density, as determined by ASTM D698 and within plus or minus 2% of the optimum moisture content.

Where the moisture content is outside these limits, the lift must be either dried or wetted as directed by the QA Manager. The compacted till surface shall be graded to prevent ponding water.

When placing Till adjacent to a slope of existing Till, the slope of the existing fill shall be benched, the bench height being equal to the fill lift thickness, to achieve a suitable contact surface between the ground and the new fill.

5.4.2 Filter Zone (Zone F)

The Filter (Zone F) material shall be placed in loose lift thicknesses of 0.3 m or less (prior to compaction).

Precautions shall be taken to prevent any contamination of the material. Any contaminated materials shall be removed and replaced. Contaminated material shall be removed to the satisfaction of the QA Manager prior to additional material being placed. Precautions shall be taken to prevent segregation of the Filter material during placement and spreading. Visibly segregated zones of Filter material shall be removed at the direction of the QA Manager.

Filter material shall only be placed in contact with compacted Till Core, Transition material, Filter Sand and existing Filter. Filter material shall not be placed in direct contact with Rockfill.

The Filter material shall be compacted with a smooth-drum roller to achieve a dry density of 95% of the Standard Proctor maximum dry density, as determined by ASTM D698. Over-compaction of the Filter is to be avoided to minimize particle breakage and production of fine particles.

The Filter (Zone F) material shall be raised simultaneously with the Till (Zone S), with no more than 0.6 m elevation difference between both zones. When the elevation difference is larger than 0.3 m, the downstream slope of the till is to be cut after compaction of the lifts. The Till (Zone S) layer shall be raised ahead of the Filter (Zone F) layer.

5.4.3 Transition Zone (Zone T)

The Transition (Zone T) material shall be placed in loose lift thicknesses of 0.6 m or less (prior to compaction).

The Transition material shall be compacted with six (6) passes of a smooth drum vibratory compactor having a static weight of at least twelve (12) tonnes.

The Transition (Zone T) and Filter (Zone F) material shall be raised with no more than one (1) Transition lift thickness between the elevations of both zones. The Zone F is to be placed ahead of the Zone T.

Transition material shall only be placed in contact with Filter and Rockfill. Transition shall not be placed in direct contact with the Till Core.

5.4.4 Upstream Fill (Zone U)

The Upstream Fill (Zone U) shall be placed within the 20 m wide zone adjacent to the Till Core.

The Zone U upstream fill shall be placed in nominal 0.6 m thick layers or less and compacted with a smooth-drum roller. The sandy tailings shall be compacted with a smooth drum vibratory compactor having a static weight of at least twelve (12) tonnes to achieve a dry density of at least 95% of the Standard Proctor maximum dry density, as determined by ASTM D 698.

Alternatively, Upstream Fill (Zone U) shall be tailings deposited in cells. A confining berm shall be constructed on the outside edges of the cells. A culvert is to be constructed through the berm at the end farthest from the tailings discharge point. The culvert will drain the water and finer tailings material into the TSF. Constant reworking of the tailings by a dozer shall be required to provide uniform distribution of the tailings within the cells.

5.4.5 Compacted Embankment Rockfill (Zone C)

The Rockfill (Zone C) next to the Transition (Zone T) shall be placed in a loose lift thickness of 1 m or less. The Zone C shall extend a minimum of 10 m downstream of the Zone T. Oversize boulders (greater than 1 m) shall not be incorporated in the fill. Such oversize materials shall be broken to size or moved to the downstream edge of the embankment.

The Rockfill shall be raised ahead of the Transition with no more than 1 m lift thickness between the elevation of both zones.

The Rockfill (Zone C) shall be compacted with six (6) passes of a smooth drum vibratory compactor having a static weight of at least twelve (12) tonnes.

5.4.6 Embankment Rockfill

The Rockfill shall be placed downstream of the compacted rockfill in a loose lift thickness of 3 m or less (prior to compaction). Routing of the loaded haul truck traffic on the rockfill shall be carried out such that compaction is obtained across the entire width of the fill.

Oversize boulders (greater than 1 m) shall not be incorporated in the fill. Such oversize materials shall be broken to size or moved to the downstream edge of the embankment.

All ramps constructed in rockfill shall be submitted to the Owner's Construction Manager for review. Ramp slopes for haul trucks shall not exceed 10%.

5.4.7 Buttress Rockfill

The rockfill shall be placed in a single lift, and dumped/pushed from the crest to toe, resulting in segregation of the rockfill. Coarser rockfill should collect along the base of the buttress. Select coarse rockfill is to be placed in a single lift within the Main Embankment Seepage Collection Pond and Perimeter Embankment Till Borrow Pond.

The rockfill placement for the buttress is to advance parallel to the existing buttress or where there is no existing buttress, to the downstream toe of the embankment, with the downstream crest overbuilt to allow re-slope of the downstream face of the buttress. A tracked dozer is to grade the downstream face of the placed rockfill to the required 3 horizontal: 1 vertical (3H:1V) grade as placement advances. The distance from the advancing rockfill face and the completed downstream reslope shall not exceed 100 m.

The completed rockfill surface shall be leveled by means of a tracked dozer or other suitable approved equipment to obtain an even surface with no depressions. All necessary steps shall be taken to avoid ponding of water on the fill.

All ramps constructed in rockfill shall be submitted to the Owner's Construction Manager for review. Ramp slopes shall not exceed 10%.

The existing instrumentation is to be raised and/or protected from damage during construction, as specified in Section 7.1 of this Specification.

The upstream toe drains are to be protected from damage.

The Main Embankment Toe Drain Collection Sump is to be relocated or extended.

The piping and pumping infrastructure at the Main Embankment Seepage Collection Pond is to be relocated or protected from damage during the construction.

5.4.8 Drain Rock

The Drain Rock shall be used for the construction of the upstream drain and within the breach pond channel.

The Drain Rock shall be placed in a single lift of 1.0 m (minimum). Traffic of construction equipment over the Drain Rock shall be limited to only what is required for placement of the material.

5.4.9 Filter Sand

The Filter Sand material shall be placed in loose lift thicknesses of 0.3 m or less (prior to compaction).

Precautions shall be taken to prevent any contamination of the material. Any contaminated materials shall be removed and replaced. Contaminated material shall be removed to the satisfaction of the QA Manager prior to additional material being placed. Precautions shall be taken to prevent segregation of the Filter Sand material during placement and spreading. Visibly segregated zones of Filter Sand material shall be removed at the direction of the QA Manager.

Filter Sand will only be placed in contact with Upstream Fill, Till Core and Filter material.

The Filter Sand material shall be compacted with a smooth-drum roller to achieve a dry density of 95% of the Standard Proctor maximum dry density, as determined by ASTM D 698. Over-compaction of the Filter Sand is to be avoided to minimize particle breakage and production of fine particles.

5.4.10 Pipe Bedding and Backfill Material

Till (Zone S), Filter (Zone F), Filter Sand, or Upstream Fill (Zone U) shall be used as pipe bedding and backfill material for the solid HDPE pipe. The bedding and backfill material to be used is as shown on the Drawings.

Where Till (Zone S) is used as pipe bedding and backfill:

- Particles greater than 20 mm shall be removed and the Till shall be wet of optimum (i.e., plus 2% of the optimum moisture content).
- The trench through the Till Core shall be sufficient width to allow proper placement and compaction of the bedding and backfill material.
- The pipe bedding shall be placed in a single minimum 0.1 m thick loose lift. The pipe haunch backfill shall be placed in a 75 mm loose lift. The embedment material shall be worked and tamped within the haunches of the pipe.
- The Till backfill shall be placed in 0.15 m minimum loose lifts. The 0.15 m loose lift shall be carried out after the backfill material has reached the pipe crown. The backfill material shall extend to a minimum of 0.6 m above the crest of the pipe.

- Compact Till bedding and backfill to achieve a dry density of at least 95% of the Standard Proctor maximum dry density, as determined by ASTM D 698 and at plus 2% of the optimum moisture content.

Where Filter Material (Zone F), Filter Sand, and Upstream Fill (Zone U) is used as pipe bedding and Backfill:

- The pipe bedding shall be placed in a single minimum 0.15 m thick loose lift and nominally compacted.
- The pipe haunch backfill shall be placed in a 75 mm loose lift and shall be nominally compacted. The embedment material shall be worked and tamped within the haunches of the pipe.
- Pipe backfill material shall be placed in 0.3 m loose lifts and compacted with a minimum of four (4) passes using hand-held compaction equipment. The 0.3 m loose lift shall be carried out after the backfill material has reached the pipe crown. The backfill material shall extend to a minimum of 0.6 m above the crest of the pipe.

A minimum 0.15 m thick layer of backfill material is to be placed over any pipe before hand-held equipment is operated above the pipe. A minimum 1.0 m thick layer of fill material is to be placed over any pipe before ride-on equipment or construction vehicles are operated above the pipe.

Transition Material (Zone T) shall be placed around the perforated corrugated polyethylene pipe (PCPE), unless directed otherwise.

- The pipe haunch backfill shall be placed in a 0.15 m loose lift and shall be nominally compacted. The embedment material shall be worked and tamped within the haunches of the pipe.
- Pipe backfill material shall be placed in 0.3 m loose lifts and compacted with a minimum of four (4) passes using hand-held compaction equipment. The 0.3 m loose lift shall be carried out after the backfill material has reached the pipe crown. The backfill material shall extend to a minimum of 0.5 m above the crest of the pipe.

5.5 Compaction Requirements

Each layer of spread fill material shall be compacted in a systematic, orderly and continuous manner to ensure that the entire fill is properly compacted. Layer thickness is defined as the thickness of the loose fill before compaction.

Compaction equipment shall generally travel parallel to the axis of the embankment being constructed, except where such routing is not practical, such as at turning areas or adjacent to instrumentation. In such areas, the compaction equipment shall be routed such that the best compaction can be attained.

Materials that cannot be adequately compacted by the specified compaction equipment because of location or space limitations shall be compacted with specified special compactors. Where such special compactors are required, fill layer thickness shall be modified, as required by the QA Manager.

One (1) pass shall mean a single traverse of a compactor across the surface of a layer in one direction. An overlap of at least 0.5 m shall be maintained between adjacent passes.

Vibratory rollers shall travel at an operating speed of no more than 70 m per minute. The operating speed of the compaction equipment is subject to review by the QA Manager, and will depend on the type of fill.

The compaction traffic pattern at fill zone boundaries or construction ramp joints shall be carried out such that the full number of roller passes extends completely across such boundaries.

5.5.1 Compaction Equipment

Sufficient compaction equipment of the types and sizes specified, as necessary for compaction of the various fill materials, shall be provided. This equipment shall be available and shall be maintained in good condition at all times.

Alternative compaction equipment may be used only if it can be demonstrated to the satisfaction of the QA Manager that such alternative equipment will compact the fill materials as effectively as the specified equipment, and also that the material after compaction meets the requirements of the Specifications.

5.5.2 Special Compactors

Special compactors shall include loaded dump trucks, hand-operated mechanical tampers and vibratory rollers, and any other compaction equipment not specified, subject to the approval of the QA Manager.

Special compactors shall be capable of producing the required compaction within a reasonable number of passes.

Hand-operated heavy-duty mechanical tampers shall be used under restricted space and access conditions. The operating frequency shall be such that previously compacted material is not disturbed. Operation shall proceed continuously until the specified level of compaction has been achieved.

A sufficient number of special compactors shall be available to compact inaccessible areas.

5.6 Protection and Maintenance

Any fill placed shall be maintained in a condition satisfactory to the QA Manager until completion of the Work. All necessary steps shall be taken to avoid ponding of water on the fill, or contamination of the fill by traffic or other causes. The surface and slopes shall at all times be kept free from rejected or unsuitable fill, or waste materials.

Should slides or erosion occur within or onto any placed fill, such materials and all other materials affected shall be removed, and the portion rebuilt as required.

5.7 Quality Control and Quality Assurance

Quality Control (QC) will be performed to ensure that the Work is constructed in accordance with the Drawings and Specifications.

Quality Assurance (QA) monitoring and testing will be carried out by the Engineer through their QA Manager, to satisfy themselves and MPMC that the Work is being carried out in accordance with the Drawings and Specifications.

The QC and QA testing requirements and frequency are listed in Table 5-5. At a minimum, all the required testing shall be performed to document the construction quality. The material testing listed in Table 5-5 shall be completed on record samples taken from placed material on the embankment to evaluate suitability of material and segregation during placement.

All necessary inspections, sampling and testing shall be performed to ensure that only materials of the specified composition, gradation and moisture content are supplied to the construction area. A sufficient number of control samples from the stockpile are to be tested prior to use to confirm the suitability of the material used.

The Owner's Construction Manager shall identify material stockpiles available for use in the construction.

Table 5-5: QA/QC Testing of Fill Placement

Material	Testing[a]		
	Test	QC Frequency	QA Frequency
Perimeter and South Embankment Abutment Foundation[b]	Water Content (ASTM D2216)	1 every 250 m^2 [c]	1 every 5 QC Tests
	Atterberg Limits (ASTM D4318)	1 every 250 m^2 [c]	1 every 5 QC Tests
	Gradation and Hydrometer (ASTM D422 & D6913)	1 every 250 m^2 [c]	1 every 5 QC Tests
Zone S Till Core Material	Water Content (ASTM D2216)	1 every 1,000 m^3	1 every 10 QC Tests
	Atterberg Limits (ASTM D4318)	1 every 2,000 m^3	1 every 10 QC Tests
	Gradation (ASTM D6913)	1 every 4,000 m^3	1 every 10 QC Tests
	Hydrometer (ASTM D422)	1 every 12,000 m^3	1 every 10 QC Tests
	Standard Proctor Maximum Dry Density (ASTM D698)	1 every 8,000 m^3	1 every 10 QC Tests
	In Situ Density by Portable Nuclear Gauge (D6938)	1 per each lift completed in a day and 1 every 300 m^3	1 every 10 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
Zone F Filter Material	Water Content	1 every 1,000 m^3	1 every 10 QC Tests
	Wash Sieve Gradation (ASTM C136 & C117)	1 every 1,000 m^3	1 every 10 QC Tests
	Standard Proctor Maximum Dry Density (ASTM D698)	1 every 5,000 m^3	1 every 10 QC Tests
	In Situ Density by Portable Nuclear Gauge (D6938)	1 per each lift completed in a day and 1 every 100 m^3	1 every 10 QC Tests
	Lift Thickness	Measured continuously	Measured periodically

Table 5-5: QA/QC Testing of Fill Placement

Material	Testing[a]		
	Test	QC Frequency	QA Frequency
Zone T Transition Material	Wash Sieve Gradation (ASTM C136 & C117)	1 every 3,000 m^3	1 every 2 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
	Number of Passes of Compactor	Measured continuously	Measured periodically
Zone C Rockfill	Lift Thickness	Measured continuously	Measured periodically
	Visual Gradation	Measured continuously	Periodical visual inspection
Zone U Upstream Fill (Tailings Sand)	Wash Sieve Gradation (ASTM C136 & C117)	1 every 10,000 m^3	1 every 10 QC Tests
	Standard Proctor Maximum Dry Density (ASTM D698)	1 every 20,000 m^3	1 every 10 QC Tests
	In Situ Density by Portable Nuclear Gauge (D6938) [d]	1 per each lift completed in a day and 1 every 2,500 m^3	1 every 10 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
Filter Sand	Water Content	1 test per pipe installation	1 test
	Wash Sieve Gradation (ASTM C136 & C117)	2 tests per provider	1 test
	Standard Proctor Maximum Dry Density (ASTM D698)	2 tests per provider	None required
	In Situ Density by Portable Nuclear Gauge (D6938)	1 per lift	1 every 10 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
Drain Rock	Visual Gradation	Continuously	Continuously

a) Frequencies based on in-place compacted volumes.
b) Samples for testing shall be collected from the foundation within the Till Core and Upstream Fill footprint. Frequency based on area defined by the Till Core and Upstream Fill footprint.
c) Minimum of two tests per abutment per construction year.
d) Small excavations may be required to test the in situ density of the bottom portion of the 0.6 m lifts as required by the QA Manager.

6.0 UPSTREAM DRAIN

6.1 Scope

This Section comprises all requirements for construction of the upstream drains, which includes the placement of Drain Rock and drain rock transition materials, and installation of geotextile and pipeline, according to the lines and grades shown on the Drawings or as directed by the Owner's Construction Manager and QA Manager.

6.2 General

6.2.1 Tolerances

Excavation limits are defined by the lines and elevations shown on the Drawings. Uniform gradients shall be maintained between adjacent spot elevations shown on the Drawings. The excavation shall be in a manner so that piping can be laid straight at a uniform grade, without sags or humps. The tolerances for the pipeline, unless otherwise approved by the QA Manager, shall be as follows:

- Line ± 150 mm; and
- Grade ± 30 mm.

6.2.2 Handling and Storage

Pipe and pipe fittings shall be stored on clean level ground, free of sharp objects which could damage these materials. Stacking shall be limited to a height that shall not cause excessive deformation of the bottom layers of pipe under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

During delivery to site, the geotextile shall be wrapped to protect it from ultraviolet (UV) light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions. Upon delivery at the job site, the geotextile rolls shall be handled and stored in accordance with the manufacturer's instructions to prevent damage, and in particular is to be protected from UV light exposure.

The QA Manager shall inspect the pipe, pipe fittings and geotextile prior to use, to verify that the proper material has been received. The material shall also be inspected to ensure they are free of flaws or damage occurring during manufacturing, shipping, or handling.

6.3 Materials

6.3.1 Polyethylene Pipe and Fittings

Pipes and fittings shall be homogenous throughout and free of visible cracks, holes (other than intentional manufactured perforations), foreign inclusions, or other deleterious effects, and shall be uniform in color, density, melt index, and other physical properties.

Fittings at the ends of pipes shall consist of polyethylene end cap.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Fittings supplied by manufacturers other than the manufacturer of the pipe shall not be permitted without the approval of the QA Manager.

The polyethylene pipe is to be perforated, where perforated pipe is shown on the Drawings. The perforations shall be drilled into the pipe after manufacture at the manufacturing plant.

The following pipe will be required for the works:

- 150 mm diameter perforated SDR 9 high-density polyethylene pipe (HDPE), PE4710 or equivalent approved, with smooth interior wall. The HDPE pipe shall be joined with split corrugated couplings.
- 300 mm diameter solid, SDR 17 HDPE pipe, PE4710.

6.3.2 Pipe Bedding and Backfill Material

Pipe bedding and backfill material shall meet the requirements of Section 5.4.10 of these Specifications.

6.3.3 Drain Rock Transition Material

Drain rock transition material shall meet the requirements of Section 5.4.10 of these Specifications.

6.3.4 Geotextile

An 800 g/m^2 non-woven needle punched geotextile shall be placed along the base of the Drain Rockfill and a 340 g/m^2 non-woven needle punched geotextile shall be placed over the Drain Rock transition. The geotextile shall be manufactured from prime quality virgin polymer. The geotextile shall meet or exceed all material properties listed in Table 6-1 and Table 6-2.

Table 6-1: Properties of 800 g/m^2 non-woven Geotextile

Property	Standard	Unit	Value
Mass per Unit Area	ASTM D 5261	g/m^2	812
Grab Tensile Strength	ASTM D 4632	N	2,000
Grab Elongation	ASTM D 4632	%	50
CBR Puncture Strength	ASTM D 6241	N	1,100
Trapezoidal Tear Strength	ASTM D 4533	N	890
UV Resistance	ASTM D 4355	% retained after 500 hours	70

Table 6-2: Properties of 340 g/m^2 non-woven Geotextile

Property	Standard	Unit	Value
Mass per Unit Area	ASTM D 5261	g/m^2	340
Grab Tensile Strength	ASTM D 4632	N	1,020
Grab Elongation	ASTM D 4632	%	50
CBR Puncture Strength	ASTM D 6241	N	530
Trapezoidal Tear Strength	ASTM D 4533	N	420
UV Resistance	ASTM D 4355	% retained after 500 hours	70

All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number and roll dimensions.

6.4 Execution

6.4.1 Trench Excavation

The trench excavations shall be performed to the lines and grades shown on the Drawings or as directed by the QA Manager. Trench excavations shall not begin until the Surveyor has provided construction staking for the proposed work. The exposed subgrade along the trench shall be inspected by the QA Manager and approved prior to any fill being placed. Final surface shall be free of loose materials, clods, and other debris including grade stakes and hubs.

The trench excavations shall be graded and properly maintained to provide adequate drainage at all times. Work shall be suspended when, in the opinion of the QA Manager, the site is overly wet, muddy, or otherwise unsuitable for proper maintenance, until directed otherwise by QA Manager.

6.4.2 Fill Placement

All fill placement, including Drain Rockfill, drain rock transition, pipe bedding and backfill, shall be in accordance with Section 5.0 of these Specifications.

6.4.3 Piping

6.4.4 Handling and Placement

Care shall be exercised when transporting, handling and placing pipe and fittings, such that they are not cut, kinked, twisted, or otherwise damaged.

The pipe manufacturer's recommendations for handling, storage, and installation of all polyethylene pipe fittings shall be complied with.

Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Slings and straps shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no circumstances shall pipe or fittings be dropped into trenches, or dragged over sharp objects.

The maximum allowable depth of cuts, gouges or scratches on the exterior surface of pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. All pipe and fittings shall be carefully examined for cracks, damage or defects before installation. The QA Manager shall inspect all pipes. Sections of pipe with excessive cuts, gouges or scratches shall be rejected and the rejected pipe shall be removed and replaced.

Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

6.4.5 Pipe Installation

All pipe and fittings shall be installed in accordance with this Specification, the pipe manufacturer's instructions, and ASTM D2321. All pipe and fittings shall be laid or placed to the grades and elevations shown in the Drawings with bedding and backfill as shown in the Drawings.

The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

Field-cutting of pipes, where required, shall be made with a machine specifically designed for cutting pipe. Cuts shall be carefully made, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cutter ends shall be tapered and sharp edges filed off smooth. Flame cutting shall not be allowed.

No pipe shall be laid until the QA Manager has observed the condition of the pipe.

No pipe shall be brought into position until the preceding length has been bedded and secured in its final position. Blocking under piping shall not be permitted unless specifically accepted by the QA Manager for special conditions.

Placement of overlying pipe backfill shall be carried out such that pipe is not damaged. The QA Manager may periodically request to prove that covered pipe has not been crushed.

The location and final elevation of the invert of the pipes shall be surveyed. The pipes shall be surveyed at ends and at approximately 20 m intervals between the ends.

6.4.6 Joints and Connections

All HDPE pipe shall be joined with thermal butt-fusion joints. All joints shall be made in strict compliance with ASTM D2657 and the pipe manufacturer's recommendations.

6.4.7 Geotextile Installation

The geotextile shall be installed in accordance with this Specification and the manufacturer's instructions. The geotextile shall be laid to the lines shown in the Drawings. The geotextile shall be placed after the drain rock transition has been placed, compacted and approved by the QA Manager.

The geotextile shall be handled in such a manner as to minimize damage during installation.

The geotextile panels are to overlap a minimum of 450 mm. No direct equipment trafficking over geotextile is permitted. The geotextile shall not be exposed to rain or snow precipitation prior to being installed and shall not be left exposed for more than 15 days after installation.

Damaged areas in the geotextile shall be repaired to the satisfaction of the QA Manager. Prior to repair, any soil or other materials that has penetrated the damaged geotextile shall be removed. The geotextile shall be repaired by placing a patch of the same type of geotextile that extends a minimum of 300 mm beyond any edge of the area to be repaired. Geotextile that cannot be repaired shall be replaced with new geotextile that complies with the project requirements.

6.5 Quality Assurance

QA monitoring will be carried out by the Geotechnical Engineer through their QA Manager, to satisfy themself and MPMC that the Work is being carried out in accordance with the Drawings and Specifications.

7.0 SPILLWAY

7.1 Scope

The emergency spillway during operations will be constructed on the north side of the TSF and will discharge to Bootjack Creek. Access to the Work will be provided and coordinated by the Owner's Representative.

This section comprises the requirements for construction of the emergency spillway during operations, which includes the placement and compaction of construction materials described in Section 7.3, according to the lines and grades shown on the Drawings or as directed by the Owner’s Construction Manager and QA Manager.

Surveys shall be performed to confirm the elevations and coordinates shown on the Drawings.

The locations of the exposed material boundaries and exposed surfaces shall be surveyed.

7.2 Materials

The materials to be used for spillway construction are shown on the Drawings and described in Sections 7.2.1 to 7.2.9.

7.2.1 Rockfill

Rockfill shall meet the requirements of Section 5.3.5 of these Specifications.

7.2.2 Native Fill

Native excavated material from the emergency spillway excavation can be used, as needed, for the construction of the emergency spillway channel between the Tailings Access Road and Bootjack Creek. Native Fill shall be free of organics, high plasticity clay, frozen or otherwise deleterious materials. Native Fill material shall be visually assessed by the QA Manager prior to placement to ensure it is suitable for placement. Soils with high moisture contents (i.e., saturated) shall not be placed without prior aeration and drying.

7.2.3 Till Liner

The Till Liner shall be a well graded till with a maximum particle size of 150 mm and a fines content between 20% and 70% by weight (particles finer than 0.075 mm). The Till Liner shall be sourced from designated borrow areas. Till Liner material shall be free of organics, high plasticity clay, frozen or otherwise deleterious materials.

7.2.4 Riprap

Riprap material shall be placed for the construction of the emergency spillway and meet the following standards. Riprap shall consist of well-graded, hard, durable, and angular rock which meets the gradation requirements set out in Table 7-1 and Table 7-2. Riprap material properties shall conform with requirements set out in Table 7-3). Riprap material is to be non-potentially acid generating (NPAG). Acceptance of all fill materials based on geochemical properties shall be the responsibility of the Owner's Construction Manager. Riprap is subject to the approval of the QA Manager prior to placement. Riprap QC and QA requirements are provided in Section 7.4.

Table 7-1: Mass Gradation for Riprap

Class of Riprap (kg)	Rock Gradation Percentage Smaller Than Given Rock Mass (kg)			
	15%	50%	85%	100%
10	1	10	1	10
50	5	50	5	50
100	10	100	10	100

Table 7-2: Dimension Gradation for Riprap

Class of Riprap (kg)	Approximate Average Dimension (Sg = 2.5) Equivalent Diameter (mm)			
	15%	50%	85%	100%
10	90	200	285	350
50	155	340	485	600
100	200	425	610	750

Table 7-3: Rip Rap Material Properties

Property	ASTM Test Designation	Allowable Value
Specific Gravity	D6473	≥2.50
Absorption	D6473	≤2%
Soundness By Use Of Magnesium Sulphate	D5240	≤10 % (Following 5 Cycles)
Micro-Deval Abrasion Loss Factor	D6928	≤20%

7.2.5 Fine Bedding

Fine Bedding shall be placed between the Ground Surface and Riprap with D_{50} less than or equal to 400 mm (10 kg Class Riprap, and 50 kg Class Riprap), as shown on the Drawings. Fine Bedding shall be well graded sand and gravel with maximum particle size of 100 mm and less than 12% passing 0.075 mm.

Fine Bedding used in construction of the emergency spillway is to be non-potentially acid generating (NPAG). Acceptance of all fill materials based on geochemical properties shall be the responsibility of the Owner's Construction Manager. The material shall consist of hard, durable mineral particles, without organic matter, clay, soft particles, or any other unsuitable material.

Fine Bedding QC and QA requirements are provided in Section 7.4.

7.2.6 Coarse Bedding

Coarse Bedding shall be placed below Riprap with D_{50} greater than 400 mm (100 kg class Riprap), as shown on the Drawings. The Coarse Bedding shall consist of well graded material with a maximum diameter of 0.2 m , less than 30% sand and less than 5% fines. Granular Bedding material is to be non-potentially acid generating (NPAG). Acceptance of all fill materials based on geochemical properties shall be the responsibility of the Owner's Construction Manager.

Coarse Bedding QC and QA requirements are provided in Section 7.4.

7.2.7 Granular Road Gravel

Granular Road Gravel shall consist of granular material approved by the QA Manager and the Owner's Construction Manager.

7.2.8 Geotextile

A 340 g/m^2 non-woven needle punched geotextile shall be placed along the base of the Coarse Bedding. The geotextile shall be manufactured from prime quality virgin polymer. The geotextile shall meet or exceed all material properties listed Table 6-2.

7.2.9 Precast Concrete Weir

Precast Concrete Weir to be Precon’s precast panel wall or equivalent weir to be approved by QA Manager.

7.3 Execution

Construction to raise the TSF embankment to elevation 974 m is expected to occur over 2 or more construction seasons. The emergency spillway shall be constructed before the end of the first construction season and then raised each season in accordance with the embankment raise.

7.3.1 Spillway Surface and Foundation Preparation

The spillway stripping, clearing, excavations, and foundation preparation shall meet the requirements of Section 4.2, 4.3, and 4.4.

7.3.2 Rockfill Placement and Compaction

The Rockfill placement and compaction for the emergency spillway shall be in accordance with Section 5.4.6.

7.3.3 Native Fill Placement and Compaction

Native Fill shall be placed in loose lift thicknesses of 0.3 m or less (prior to compaction).

Precautions shall be taken to prevent any contamination of the material. Any contaminated materials shall be removed and replaced. Contaminated material shall be removed to the satisfaction of the QA Manager prior to additional material being placed.

Native Fill material shall be compacted with a sheep's foot drum roller to achieve a dry density of at least 95% of the Standard Proctor maximum dry density, as determined by ASTM D698. The final surface of the Native Fill shall be compacted with a smooth drum vibratory roller to achieve an even surface.

7.3.4 Fine Bedding Placement and Compaction

The Fine Bedding shall be placed in loose lifts of 0.3 m or less (prior to compaction) to the extents shown in the Drawings.

The Fine Bedding material shall be compacted with six (6) passes of a smooth drum vibratory compactor having a static weight of at least twelve (12) tonnes.

7.3.5 Coarse Bedding Placement and Compaction

The Coarse Bedding shall be placed in loose lift of 0.3 m or less (prior to compaction) to the extents shown in the Drawings.

The Coarse Bedding material shall be compacted with six (6) passes of a smooth drum vibratory compactor having a static weight of at least twelve (12) tonnes.

7.3.6 Till Liner Placement and Compaction

The Till Liner material shall be spread parallel to the axis of the spillway in horizontal lifts of uniform thickness not exceeding 0.3 m prior to compaction.

Precautions shall be taken to avoid any presence of particles greater than 150 mm. Oversize material shall be removed to the satisfaction of the QA Manager. Affected zones of Till Liner material shall be removed at the direction of the QA Manager.

The Till Liner shall be compacted with a sheep's foot drum roller to achieve a dry density of at least 95% of the Standard Proctor maximum dry density, as determined by ASTM D698.

The compacted till surface shall be graded to prevent ponding water.

7.3.7 Riprap Placement

Riprap shall be placed in lifts, with the average thickness of each lift not to exceed the median rock diameter (D_{50}) of the riprap class being placed. Nominal riprap layer thickness at right angles to the slope shall be a minimum of 0.4 m for 10 kg Class riprap and 0.68 m for 50 kg Class riprap and 0.9 m for 100 kg Class riprap.

Riprap shall be placed with care to ensure adequate interlocking of the particles is achieved. Riprap placed adjacent to the pre-cast concrete weir shall be placed carefully to ensure the concrete is not damaged.

Riprap placed for the road crossing shall be void-filled after each lift washing in granular road gravel. Alternatively, void filling may be accomplished by pre-mixing the riprap with the granular road gravel and carefully placing the mix to ensure adequate interlocking of the riprap.

Riprap shall be placed to the extents, grades, and slopes indicated on the Drawings.

Riprap shall not be placed by end dumping, chutes, or being dropped from a height greater than 1.0 m from its final position.

7.3.8 Granular Road Gravel Placement

Granular Road Gravel shall be washed into the road crossing riprap. Placement and compaction requirements shall be determined by the QA Manager and the Owner's Construction Manager during construction.

7.3.9 Geotextile Installation

The geotextile shall be installed in accordance with this Specification and the manufacturer's instructions. The geotextile shall be laid to the lines shown in the Drawings. The geotextile shall be placed after the Till Liner transition has been placed, compacted and approved by the QA Manager.

The geotextile shall be handled in such a manner as to minimize damage during installation.

The geotextile panels are to overlap a minimum of 450 mm. No direct equipment trafficking over geotextile is permitted. The geotextile shall not be exposed to rain or snow precipitation prior to being installed and shall not be left exposed for more than 15 days after installation.

Damaged areas in the geotextile shall be repaired to the satisfaction of the QA Manager. Prior to repair, any soil or other materials that has penetrated the damaged geotextile shall be removed. The geotextile shall be repaired by placing a patch of the same type of geotextile that extends a minimum of 300 mm beyond any edge of the area to be repaired. Geotextile that cannot be repaired shall be replaced with new geotextile that complies with the project requirements.

7.3.10 Repair and Replacement of Damaged Precast Concrete Weir

For the repair and replacement of damaged concrete the following sequence of steps shall be followed:

- Replace any element that suffers structural damage including cracking or other damage that in the opinion of the QA Manager, compromises its strength, performance, or durability.
- Examine all concrete surfaces and clearly mark out spalled or other areas to be repaired. Obtain the QA Manager's authorization of the delineated repair areas and the proposed method and equipment to be used for the repairs prior to commencing the work.
- Completely remove all damaged concrete down to sound concrete. Remove microfractured surfaces resulting from the initial concrete removal process.
- Sawcut the perimeter perpendicular to the surface to a minimum depth of 25 mm. Do not use any repair method that produces a featheredge.
- Prior to placing repair mortar, clean and dampen the surfaces to obtain a saturated surface dry condition except where the repair technique requires a dry surface.
- Place the polymerized cementitious mortar in accordance with the manufacturer's written instructions. Treat the surface of the concrete to be repaired with a compatible acrylic bonding agent as authorized by the QA Manager prior to mortar filling.
- Construct the repair area slightly proud of the general surface and then grind it to match.
- Following repairs, promptly initiate curing and protection in accordance with CAN / CSA- A23.1.
- Provide completed repair areas that are tightly bonded to the underlying concrete and are free of shrinkage cracks or hollow void areas.

7.4 Spillway Quality Control and Quality Assurance

Quality Control (QC) will be performed to ensure that the Work is constructed in accordance with the Drawings and Specifications.

Quality Assurance (QA) monitoring and testing will be carried out by the Engineer through their QA Manager, to satisfy themselves and MPMC that the Work is being carried out in accordance with the Drawings and Specifications.

The QC and QA testing requirements and frequency for the emergency spillway materials are listed in Table 7-. At a minimum, all the required testing shall be performed to document the construction quality. The material testing listed in Table 7- shall be completed on record samples taken from placed material on emergency spillway to evaluate suitability of material and segregation during placement.

All necessary inspections, sampling and testing shall be performed to ensure that only materials of the specified composition, gradation and moisture content are supplied to the construction area. A sufficient number of control samples from the stockpile are to be tested prior to use to confirm the suitability of the material used.

The Owner's Construction Manager shall identify material stockpiles available for use in the construction.

Table 7-4: Spillway QA/QC Testing

Materials	Testing[a]		
	Test	QC Frequency	QA Frequency
Rockfill	Lift Thickness	Measured continuously	Measured periodically
	Visual Gradation	Measured continuously	Periodical visual inspection
Native Fill	Lift Thickness	Measured continuously	Measured periodically
	Visual Gradation	Measured continuously	Measured periodically
	Standard Proctor Maximum Dry Density (ASTM D698)	1 every 8,000 m^3	-
	In Situ Density by Portable Nuclear Gauge (D6938)	2 per each lift completed in a day	1 every 5 QC Tests
Till Liner Material	Water Content (ASTM D2216)	2 per borrow location and 1 every 1,000 m^3	Periodical visual inspection
	Gradation (ASTM D6913)	2 per borrow location and 1 every 4,000 m^3	1 every 5 QC Tests
	Standard Proctor Maximum Dry Density (ASTM D698)	1 per borrow location and 1 every 8,000 m^3	-
	In Situ Density by Portable Nuclear Gauge (D6938)	2 per each lift completed in a day	1 every 5 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
Riprap	Visual Gradation	Measured continuously	Periodical visual inspection
	Lift Thickness	Measured continuously	Measured periodically
Fine Bedding and Coarse Bedding	Wash Sieve Gradation (ASTM C136 & C117)	1 every 3,000 m^3	1 every 2 QC Tests
	Lift Thickness	Measured continuously	Measured periodically
	Number of Passes of Compactor	Measured continuously	Measured periodically

a) Frequencies based on in-place compacted volumes.

8.0 INSTRUMENTATION

8.1 Scope

This Section describes the requirements for the supply, installation, testing, data acquisition and protection of instrumentation. The requirements include equipment and application software for the data acquisition, transmission and processing system.

The main items include installation of:

- vibrating-wire piezometers (VWPs);
- ShapeAccelArray (SAA) within existing inclinometers and new SAA installation; and
- data acquisition and processing equipment.

Also included is the extension of existing slope inclinometer casing and VWP and SAA cables that will be buried as part of the construction works.

The work shall include all labour, materials and equipment to complete the design as shown on the Drawings.

8.2 General

The locations for the instrumentation are shown in the Drawings, and installation procedures provided in this Specification. The location of all instruments and installation will be subject to approval by the QA Manager.

New instrumentation will be installed as shown in the Drawings. The existing instrumentation integrity shall be kept unless otherwise shown in the drawings.

The instrumentation and all materials required for the installation shall be brought to site at least 15 days in advance of installation, and the QA Manager shall review and approve them.

8.3 Submittals

A list of all instruments, cable, and casing lengths are to be submitted to the Geotechnical Engineer. A method for marking and identifying cables for individual instruments are to be included.

Manufacturer calibration sheets for all instruments to be installed are to be submitted to the Geotechnical Engineer.

Installation data including the installed location, the instrument identification number, the instrument serial number, and the installation date and time is to be provided to the Geotechnical Engineer. The data is to include the SAA azimuth corrections for software, and azimuth direction of X-marks.

8.4 Installation Procedures

Installation of the instruments shall be carried out in accordance with the Drawings, Specification and the instructions of the equipment manufacturer.

Readings of each instrument shall be taken to verify correct functioning. Backfill shall not be placed over the instruments or cable leads until the instruments have been tested and initial readings have been taken. An initial set of readings shall be taken immediately after installation.

Sufficient cable to route to the SAA and VWP data loggers or VWP connector boxes shall be purchased. The cable shall be long enough to provide adequate strain relief. Existing instrumentation shall be extended.

All cables shall be marked with identification tags at intervals of 15 m, or closer if required. In addition, each instrument shall be marked with the identification given to it on the Drawings or as identified by the QA Manager.

All instruments, cables, and connectors shall be protected from damage and displacement during progress of the work, and markers and barricades shall be provided as necessary.

Cables from the instruments to the SAA and VWP data loggers or VWP connector boxes shall be wrapped in geotextile and installed into trenches, as shown on the Drawings or as directed by the QA Manager. The instrumentation cables shall be protected from impact and damage during construction by hand-tamped sand backfill.

No traffic or equipment shall pass over any part of any instrument, cables or connections until at least 600 mm thickness of compacted material cover has been installed.

8.5 Electrical Protection and Safety

New and existing instrumentation shall be connected to the data acquisition system and it shall be confirmed that the system provides the following minimum protection for all electrical equipment:

- over-voltage peak suppressor;
- alternating current filter to eliminate interference; and
- Grounding system for lightning protection.

8.6 Voltage and Electrical Frequency

Facilities requiring permanent electrical power, including battery chargers and space heaters, shall be configured to operate at 110 V, alternating current at 60 Hz.

8.7 Protection

The instrumentation shall be protected with end caps and protective casing.

Cabins, supports and accessories necessary for the installation and protection of the instruments shall be provided.

8.8 Grout Mix

The grout mix in Table 8-1 shall be used for the VWP, inclinometer casing, and SAA installation.

Table 8-1: Grout Mix for Vibrating Wire Piezometer, SAA and Inclinometer Installation

Material	Quantity	Ratio by Weight
Portland Cement	42.5 kg	1
Water	107.5 L	2.5
Bentonite Powder	12.8 kg	0.3

The above quantities shall be adjusted to match the cement weight such that the mix comprises a unit number of bags of cement.

Mixing shall be carried out by first introducing the water into the mixer followed by the cement. The water cement mixture shall be thoroughly mixed before the bentonite is added. Bentonite powder and not pellets shall be used. Mixing shall continue until a stable, uniform slurry is achieved.

Grout shall be continuously agitated during pumping and grouting.

Instrumentation shall be backfilled from the bottom up. Grout shall be delivered into the hole by a threaded tremie PVC pipe.

8.9 Vibrating Wire Piezometers

8.9.1 General

Vibrating wire piezometers shall include the piezometer sensors, leads, the connector box, and all associated equipment and materials, including waterproof junction boxes, universal lead connectors, electrical protection systems and conduits, necessary for installation, testing, and operation. All such equipment shall be provided by the same manufacturer.

Data reading and recording shall be carried out manually during construction of the Work, and automatically thereafter.

Each piezometer shall have a sensor measuring range of up to 1 MPa, with a sensitivity of 0.025% and accuracy of ±0.1% of full-scale pressure (FS).

The following piezometers may to be installed:

- Model VW2100 manufactured by RST Instruments, or approved equivalent; or
- Model 4500S manufactured by Geokon Incorporated, or approved equivalent.

The connector boxes shall have capacity for simultaneous installation of all leads from the piezometers shown on the Drawings.

Additional piezometer cables may be required to connect to the existing piezometers, which will be buried as part of construction, to the connector boxes.

A read-out unit shall be provided to process signals from VWPs and to display the results.

8.9.2 Installation

Piezometers shall be installed according to the manufacturer's instructions, within the embankment fill, general fill (or tailings beach) and foundation at elevations shown on the Drawings or as directed by the QA Manager. Piezometers will be installed at the same time the inclinometer casing is been installed.

Prior to installation, the piezometer shall be immersed in de-aired water in accordance with the manufacturer's instructions.

The VWPs shall be attached, filter facing upward, to the outside of the inclinometer casing using duct or electrical tape.

The vibrating wire piezometer filter shall not be covered with the tape. An initial reading is required right after the readings have stabilized in the hole and before the hole is backfilled with grout.

Following installation, the hole shall be grouted with cement-bentonite from bottom to top using a tremie pipe. The grout mix to be used is defined in Section 8.9.

Installation of the piezometers shall be completed by connecting the leads to the connector boxes within the instrumentation cabin. The leads from the instruments to the connector boxes shall be wrapped in geotextile and installed into trenches, as shown on the Drawings or as directed by the QA Manager.

8.9.3 Extension of Vibrating Wire Piezometer Cables

As part of the embankment raise construction activities it will be necessary to relocate/extend the cable of VWP instrumentation so that they can be accessed from the raised embankment crest or buttress, as shown on the Construction Drawings, and specified in this section.

- Existing excess cable can be used where available and suitable
- All cable shall be inspected for suitability and tested, using a handheld read-out unit, prior to extension
- All extended VWP cables shall be laid horizontally or vertically within the embankment construction material
    - Cable shall be realigned so that it is a minimum of 0.75 m below the existing surface and/or lowest elevation of the till core, as shown in the construction drawings
    - At the initial location of cable realignment (i.e., initial 90-degree turn) the VWP cable shall be backfilled with a cement-bentonite mix to form a minimum 2 m long plug, as shown in the construction drawings
    - VWP cable shall be placed on a minimum bed of 0.1 m of hand placed bedding material (Section 5.4.10) with a maximum particle size of 20 mm and nominally compacted with hand operated equipment
    - VWP cable shall be backfilled to a minimum depth of 0.3 m above the cable with bedding material
    - The remaining 0.45 m above the cable shall be backfill with transition material and nominally compacted with light-duty compactor approved by the QA Manager.
- Where required, new cable shall be spliced in accordance with manufacturers instructions

- Spliced cable sections shall be placed horizontal so that they are located a minimum of 0.5 m from any cable bends, in any direction
- Spliced cable sections shall be backfilled with cement-bentonite mix

All relocated/extended cable shall be tested, using a handheld read-out unit, following relocation/extension to confirm it is operational.

8.10 Shape Acceleration Array Systems

8.10.1 General

This section covers furnishing and installing ShapeAccelArrays (SAAs) systems.

The SAA system shall be an SAAV, as manufactured by Measurand Inc. or approved equivalent. The SAA system shall have segment lengths of 500 mm. The lengths of each SAA system will be confirmed after drilling of the boreholes is completed.

A data acquisition system (DAS) shall be installed to collect data from the SAA instruments. Options include the DAS-1 and DAS-5. Both contain Campbell Scientific Inc. loggers, interface modules, and other components to automate data collection. Refer to the manufacturer for specific and additional components for each DAS. Batteries are not included with the DAS and shall be selected based on the manufacturer's specifications. Maximum cable lengths for SAAV vary; refer to the manufacturer for details. An SAA Surge Protection Device (SAASPD) shall be installed to protect the SAA from electrical surges caused by nearby lightning strikes. Refer to the manufacturer for details.

Twelve SAAs will be installed. Seven SAAs shall be installed on existing inclinometer casing located along the Main and Perimeter embankments. Drilling new boreholes will be required to install five SAAs along the South and Main embankments.

Only SAA splice kits, manufactured by Measurand Inc. shall be used for splicing SAA cables. Other splicing kits can only be used with SAA Manufacturer approval.

8.10.2 Installation

The SAA systems shall be installed in accordance with the manufacturer's handling and installation specifications. The vertical installation shall be done in accordance with the following procedure:

- The installation depth for the SAA shall be confirmed and documented by the QA Manager.
- A 70 mm SAA casing cap shall be placed on the inclinometer casing.
- The SAAV reel shall be set on the reel stand such that it unreels from the top. The reel shall be placed 1.0 m to 1.5 m away from the borehole. For SAAVs longer than 50 m, a sufficiently large reel stand (e.g., jack stands) shall be used to place the reel directly above the borehole.
- The insertion of the SAAV shall be done by at least two people: one person to guide the SAA instrument into the borehole, and the other to control the rate of descent by handling the reel.

- One extension tube shall be detached from the SAAV reel and attached to the springbox assembly. The X-mark on the extension tube should be in line with the X-mark on the SAAV. In cases where the SAAV is shorter than the borehole, several extension tubes may be required. See manufacturer's instructions for more details.
- Once the extension tube has been attached and the SAAV is resting on the bottom of the borehole, the SAAV shall be settled into the inclinometer casing (see manufacturer's instructions for more details):
  - The SAAV installation verification tool included in the Measurand SAA recorder software shall be used by connecting a computer to the SAA.
  - The casing cap shall be removed and set aside with enough slack cable to avoid interference with the settling process.
  - The SAAV shall be lifted until it is hanging in the casing with one segment touching the bottom. The angle reported by the SAAV Installation Verification tool should be 4-6 degrees.
  - Once the SAAV is resting on the bottom of the casing, the SAAV shall be dropped such that it falls straight into the casing. Approximately 5 lbs of downward pressure shall be applied to compress the SAAV within the casing. The compression value shall be recorded in the SAAV installation verification tool and sample data from the SAA recorder shall be collected.
  - The SAAV shall be lifted so only the last segment is resting on the bottom of the casing and dropped repeatedly until three sequential readings of compression do not change by more than 1 mm (10-15 drops).
  - The casing cap shall be replaced over the extension rods onto the top of the casing.
- The azimuth offset shall be determined using the X-mark protractor and methods described in the manufacturer's instructions.
- The SAAV casing cap shall be attached to the inclinometer casing using the method outlined in the manufacturer's instructions.
- The extension tube shall be cut by an amount determined by compressing the SAAV with 11 lbs of mass, and with the use of the extension tube anchor, the cutting location shall be marked.
- After cutting, the extension tube anchor shall be inserted into the top of the tube, and the extension tube shall be compressed until the bolt can be screwed into place.
- The SAAV cable shall be inserted into the cable grommet in the SAAV casing cap. The SAAV casing cap shall be closed and secured. See manufacturer's instructions for more details.

8.11 Inclinometers

8.11.1 General

A 70 mm diameter inclinometer casing manufactured by RST instruments or Durham Geo Slope Indicator (DGSI), or approved equivalent, shall be installed. The corresponding casing coupling manufactured by RST instruments or DGSI, or approved equivalent, shall be used to connect the inclinometer casings.

8.11.2 Installation

The borehole diameter should be large enough to accommodate the inclinometer casing and a tremie pipe so that grout can be pumped into the annulus from the bottom up.

Installation should closely follow the following procedure:

- Once the hole has been drilled to the required depth, the first length of casing shall be inserted, complete with bottom cap, anchor and attached tremie pipe. Additional lengths of casing are added until the desired depth is reached.
- Once the slope inclinometer casing is lowered into the hole to the required depth, a pair of grooves should be aligned in the expected direction of ground movement. This should be done only if it can be accomplished without applying excessive torque to the casing.
- Grout should be pumped through the tremie pipe into the hole, displacing any groundwater within the borehole.
- During casing installation, groundwater, drilling fluid, or fluid grout within the borehole may exert an uplift buoyancy force on the casing, lifting the casing out of the borehole. The following measures shall be used to prevent this uplift:
  - Anchor the casing at the bottom of the borehole prior to grouting by special accessory “casing anchors”.
  - Fill the inclinometer casing with water prior to grouting.
  - Grout the borehole in stages.
  - Blow all water from the inclinometer casing.
- Where there are no special constraints, the casing should stick up about 0.5 to 0.75 m.
- Spiral twisting of the grooves should not exceed 0.75 degrees per metre length of the tubing. Where considered necessary by the QA Manager (e.g., on very deep installations, typically >60 m) a spiral survey of the casing grooves shall be carried out after installation and an appropriate correction applied by the data reduction software.
- Upon completion of the installation, the inside of the casing should be kept clean so that the probe can travel accurately in the grooves all the way in and out of the casing. If the grooves become contaminated by grout, they should be cleaned by flushing with water and gentle brushing, and a dummy probe can be lowered to the bottom to check that the grooves are clear.

- After installation and curing of the grout, two sets of inclinometer readings should be taken to provide a reliable baseline. If the two sets show any apparent movement, additional readings should be taken.

8.11.3 Inclinometer Extensions

Existing inclinometer casings shall be extended. Inclinometer casing extensions shall be protected with fine crushed material before rockfill is placed around them. Inclinometer casing ends shall be capped while material is being placed to avoid clogging. Extension pipes, caps and fittings shall be provided in advance. The inclinometer casings shall be extended above the buttress construction surface.

8.11.4 Inclinometers Decommissioning

Eight inclinometer casings along the embankment will be decommissioned by backfilling the casing with grout. Grout mix is defined in Section 8.9.

The inclinometer casing shall be backfilled from the bottom up. Grout shall be delivered into the hole by a threaded tremie PVC pipe.

SB/RG/GP

APPENDIX C

Design Criteria

TECHNICAL MEMORANDUM

DATE March 21, 2024 **Reference No.** 23590671-067-TM-Rev0-51393

TO Matt O'Leary
Mount Polley Mining Corporation

CC Don Parsons

FROM Sophie Bainbridge, Don Kidd, and Germán Pizarro **EMAIL sophie.bainbridge@wsp.com; don.kidd@wsp.com; german.pizarro@wsp.com**

MOUNT POLLEY MINE, BRITISH COLUMBIA – BASIS OF DESIGN AND DESIGN CRITERIA FOR TAILINGS STORAGE FACILITY RAISE TO ELEVATION 974 M

1.0 INTRODUCTION

WSP Canada Inc. (WSP) has developed this technical memorandum as part of a design to support the permit to raise the Mount Polley Mining Corporation (MPMC) tailings storage facility (TSF). This document presents the basis for design and the associated design criteria to be used by WSP for the issued for permit design for raising the existing TSF from its currently permitted elevation of 970 m to 974 m. This document provides the following:

- **project description**—Section 2.0
- **scope of work**—Section 3.0
- **design basis**—Section 4.0
- **design philosophy**—Section 5.0
- **design criteria**—Section 6.0

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

2.0 PROJECT DESCRIPTION

The Mount Polley Mine is a copper and gold mine operated by MPMC, a subsidiary of Imperial Metals Corporation. The site is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The Mount Polley Mine began production in 1997 and operated until October 2001 when operations were suspended for economic reasons. In March 2005, the mine restarted and was in operation up to the time of the TSF breach in August 2014.

In 2015, the Freshet Embankment was constructed to elevation 950 m through the breach area to allow the capture and temporary storage of the 2015 and 2016 freshet flows. The construction of buttresses along the Perimeter and Main embankments was completed in October 2016 (Golder 2015a, 2017a).

The June 23, 2016 amendment of the *Mines Act* Permit M-200 authorized the return to full operations at the mine, including construction and operation of the TSF design to elevation 970 m (Golder 2015b). Construction to raise the Freshet Embankment at Corner 1 to elevation 970 m started in June 2016. By September 2018, construction of the Corner 1 Embankment had been completed to elevation 968 m (Golder 2019). The raise of the Freshet Embankment was referred to as the Corner 1 Embankment. Construction to raise the embankment to elevation 970 m was started in July 2022 and was completed in 2023.

Mining operations at the Mount Polley mine were halted between May 2019 and Q4 2021 for economic reasons. Deposition of tailings generated at the process plant into the TSF was resumed in June 2022. Dredging of tailings from the Springer Pit and deposition into the TSF started in March 2018 and was halted in October 2019.

The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. The embankment is subdivided into three sections: the Main Embankment, Perimeter Embankment, and South Embankment. The embankment has incorporated a staged expansion design utilizing modified centerline and centerline construction methods. The general zoning of the TSF embankment includes the following:

- upstream fill comprising select fill or tailings sand
- low-permeability till core
- filter zone
- transition zone

Rockfill forms the downstream wedge of the embankment and the downstream buttress along the Perimeter and Main embankments (sandy tailings reclaimed from Hazeltine Creek were also used in the construction of the downstream buttress at Corner 1).

The TSF Clean Water Ditch is located upstream of the TSF between Corner 4 and Corner 5 and diverts runoff into a small wetland downstream of the South Embankment.

In 2014, WSP, formerly Golder Associates Ltd. (Golder), completed a feasibility design for raising the embankment of the TSF to a maximum elevation of 984 m (Golder 2015c). The aim of the feasibility assessment was to identify potential considerations, constraints, or conflicts that may limit the elevation to which the TSF could be raised. The results of the study indicated that a raise of the facility is feasible. The life of mine (LoM) plan was updated in 2021 and a crest elevation of approximately 987 m is estimated to be required to contain the LoM tailings.

3.0 SCOPE OF WORK

The scope of work includes the following:

- update of site selection and technology review
- foundation characterization
- site-specific seismic hazard assessment
- 2D steady-state seepage analysis

- 2D limit equilibrium stability analysis
- 2D stress-deformation modelling
- filter compatibility assessment
- tailings deposition modelling
- review and update of the TSF pond management, spillway design, and freeboard requirements
- detailed design reporting including construction drawings and technical specifications

The battery limits for the study are assumed as:

- discharge of tailings into the TSF
- return water at the existing TSF
- the footprint boundaries of the existing TSF
- tie-in points to infrastructure and utilities (e.g., electrical power, access roads, data and communication, and network)

4.0 DESIGN BASIS

This basis of design is established in accordance with relevant design codes, standards, and guidelines.

4.1 Regulations, Standards, and Guidelines

The assessment of the TSF will be consistent with applicable regulatory documents and guidelines from Mount Polley, WSP, and national and international organizations, where applicable (e.g., Canadian Dam Association, International Commission of Large Dams). Regulations applicable to this study comprise the following:

- Health, Safety and Reclamation Code for Mines in British Columbia (EMLI 2022).
- Guidance Document for Revisions to Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia (BCMEM 2016).

The assessment of the TSF will also be consistent with the following guidelines, where applicable:

- Canadian Dam Association (CDA) Dam Safety Guidelines (2013).
- Technical Bulletin: Application of CDA Dam Safety Guidelines to Mining Dams (2019).
- Global Industry Standard for Tailings Management (GISTM 2020).
- Mining Association of Canada – A Guide to the Management of Tailings Facilities (2021)

Other internationally recognized codes and standards may be used, provided these codes and standards meet or exceed the referenced codes herein.

4.2 Dam Classification

Guidelines for the classification of dams are presented in the Canadian Dam Association (CDA) *Dam Safety Guidelines* (CDA 2013), *Technical Bulletin: Application of CDA Dam Safety Guidelines to Mining Dams* (CDA 2019) and *Technical Bulletin: Revision to Consequences of Failure – Environmental Consequence Classification* (CDA 2023). Tailings dams in British Columbia are regulated under the Health, Safety and Reclamation Code for Mines in British Columbia (BCMEM 2016; EMLI 2022), which references the 2013 CDA guidelines.

Consequence categories are based on the incremental losses that a failure of the dam might inflict on downstream or upstream areas or at the dam location itself. Incremental losses are those over and above losses that might have occurred in the same natural event or condition had the dam not failed. Infrastructure and economic consequences are based on third party losses. The consequences of a dam failure are ranked as Low, Significant, High, Very High, or Extreme for each of the loss categories. The classification assigned to a dam is the highest rank determined among the loss categories.

Table 1 presents the dam classification criteria by the CDA (2013, 2019).

Table 1: Dam Classification in Terms of Consequence of Failure

TS	Population at Risk[a]	Loss of Life[b]	Incremental Losses	
			Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	▪ Minimal short-term loss. ▪ No long-term loss.	Low economic losses; area contains limited infrastructure or service.
Significant	**Temporary Only**	**Unspecified**	▪ **No significant loss or deterioration of fish or wildlife habitat.** ▪ **Loss of marginal habitat only.** ▪ **Restoration or compensation in kind highly possible.**	**Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.**
High	Permanent	10 or fewer	▪ Significant loss or deterioration of important fish or wildlife habitat. ▪ Restoration or compensation in kind highly possible.	High economic losses affecting infrastructure, public transportation and commercial facilities.
Very High	Permanent	100 or fewer	▪ Significant loss or deterioration of critical fish or wildlife habitat. ▪ Restoration or compensation in kind possible but impractical.	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent	More than 100	▪ Major loss of critical fish or wildlife habitat. ▪ Restoration or compensation in kind impossible.	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances).

Source: CDA 2013, 2019.

(a) Definition for population at risk: None – there is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure; Temporary – people are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities); Permanent – the population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents). Three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

(b) Implications for loss of life: Unspecified – the appropriate level of safety required for a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

The TSF is located between the Hazeltine Creek watershed (north of the TSF) and Edney Creek watershed (south of the TSF). Both watersheds flow on an approximate northwest to southeast direction to Quesnel Lake. The topographical features along the South edge of the Edney Creek watershed are up to 40 m higher than Edney Lake, and the topography along the north edge of the Hazeltine Creek watershed are up to about 30 m higher than Hazeltine Creek. The topography to the south and north of the TSF discourage the inundation extending outside of the Hazeltine Creek watershed and the Edney Creek watershed.

A dam breach and inundation study was carried out considering a flood-induced and sunny-day hypothetical failure of the Main Embankment and South Embankment with a crest elevation of 970 m (Golder 2017b).

- In the event of a breach at the Main Embankment, the runoff would flow southeast along Hazeltine Creek and Edney Creek to Quesnel Lake.
- In the event of a breach at the South Embankment, the runoff would flow south to Edney Lake and southeast along Hazeltine Creek and Edney Creek to Quesnel Lake.
- The runoff from a breach of the Perimeter Embankment would flow southeast along Hazeltine Creek or Edney Creek to Quesnel Lake, depending on the location of the breach.

The water treatment plant is the only permanent structure in these areas. The TSF South, Main, and Perimeter embankments have been evaluated according to the loss criteria.

- The loss of life is considered unspecified based on the limited exposure time of the general population and mine staff.
    - The area at risk for the general population is limited to the section of Gavin Lake Road downstream of the TSF, the bridge crossings on Edney Creek, and the area at the confluence of Hazeltine Creek and Edney Creek with Quesnel Lake. There is no permanent population in these areas.
    - The area at risk for mine staff is limited to the TSF (i.e., embankment crest and buttress) and the downstream water management infrastructure (i.e., WTP, SESCP, and MESCP). Mine staff conduct periodic inspections and maintenance activities at these locations but are not permanently in the area.
- Restoration of the fish habitat is possible, as demonstrated by the rehabilitation works that have been completed to date in the Hazeltine Creek channel.
- Third-party economic losses would be low.

The TSF would therefore be ranked as a significant consequence of failure facility.

As the TSF is raised there is an incremental increase in the volume and peak flow of tailings that could runout in the event of an embankment breach; however, the proposed embankment height raise from about 50 to 54 m (from elevation 970 to 974 m) is not expected to significantly impact the run-out zone and therefore the consequence classification.

4.3 Foundation Conditions

The geological setting of the Mount Polley TSF has been extensively investigated and a dam foundation characterization report has been developed for the TSF (WSP 2023). The foundation characterization report interprets all available information for the TSF foundation conditions. The stratigraphic sequence identified in the area of the TSF can be generalized in order of increasing depth as follows:

- fill and anthropogenic materials
- till, interpreted to represent materials deposited by meltwater and ice (ablation till)
- glaciolacustrine sediments
- glaciofluvial sediments
- basal till
- bedrock

4.4 Climate Data

Climate conditions for the site were estimated based on data from several meteorological stations in the region and at the site. MPMC has operated climate stations on site since 1995, although records are not continuous. Climate parameter statistics for the site were prepared using data from the three on-site climate stations (Mill Site Weather Station, Weather Station #1, Weather Station #2) and five regional climate stations operated by Environment and Climate Change Canada (Likely, Williams Lake A, Spokin Lake 4E, Barkerville, Quesnel A, Prince George A). The climate data were processed and analyzed to obtain a baseline climate information (Golder 2022b).

The Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Site is estimated to be 612 mm with a standard deviation of 118 mm based on precipitation records for the Site from 1974 to 2021. Typically, the increase of temperatures over 0°C starts in March, leading to freshet until June.

Table 2, Table 3 and Table 4 summarize the precipitation, evaporation, and temperature at the site, for different weather scenarios. These are results from a monthly frequency analysis considering data from 1974 to 2021.

Table 2: Monthly Precipitation Depths for the Site, 1974 to 2021

Month	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	207	117	17.5	12.4
February	35.8	185	101	8.3	4.7
March	29.7	71	57	9.6	5.0
April	44.7	199	118	8.7	4.3
May	49.9	104	88	17.8	9.4
June	70.8	152	131	18.9	7.7
July	63.6	254	172	7.7	2.4

Table 2: Monthly Precipitation Depths for the Site, 1974 to 2021

Month	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
August	50.6	178	120	11.8	5.7
September	52.3	133	111	9.5	3.1
October	58.1	141	111	19.6	10.7
November	49.8	146	110	11.0	4.7
December	57.6	232	135	20.5	14.3
Annual	**612**	**960**	**836**	**421**	**349**

Table 3: Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site, 1974 to 2001

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**670**	**699**

Table 4: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1

Table 4: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**-**	**-**

Annual maximum series for 24-hour precipitation from the derived historical dataset was used to undertake a frequency analysis to provide rainfall design values (Table 5). The 24-hour, 3-day, and 10-day annual, spring, and summer probable maximum precipitation (PMP) depths (Table 6) were estimated using the Hershfield method (Golder 2022b).

Table 5: 24-hour Precipitation Depths for the Site, 1974 to 2021

Return Period (yr)	Depth (mm)
2	33
10	47
25	54
100	64
200	69
1,000	80

Table 6: Annual, Spring, and Summer Probable Maximum Precipitation Depths for the Site, 1974 to 2021

Period	Annual PMP (mm)	Spring PMP[(a)] (mm)	Summer PMP[(b)] (mm)
24-Hour	224	192	191
3-Day	339	272	294
10-Day	562	295	486

(a) Spring = March, April, and May.

(b) Summer = June, July, and August.

PMP = probable maximum precipitation.

4.5 Site Seismicity

Mount Polley is located in an area of relatively low seismicity for British Columbia. WSP developed a site-specific seismic hazard model for Mount Polley based on historical seismicity and a review of geological and paleoseismological features (WSP 2023). Probabilistic analysis results from site-specific hazard model are listed in Table 7.

Table 7: Site Seismic Hazard Values

Exceedance Probability	Return Period (years)	Peak Ground Acceleration (g)
5% in 50 years	1,000	0.026
2% in 50 years	2,475	0.048
1% in 50 years	5,000	0.076
½% in 50 years	10,000	0.116

Return periods are not exact representations of annual exceedance probabilities; rounding per Canadian Dam Association guidelines (CDA 2013, 2019) is shown.

5.0 DESIGN AND OPERATION PHILOSOPHY

The design and operation of the TSF will follow the principles set out by the Mining Association of Canada in its Towards Sustainable Mining program and the recommendations made by the IEERP (2015). The following approaches have been used for the design and operation of the TSF:

- Limit the amount of surface water to only that required for operation – this will be achieved through maintaining storage capacity within the external water management ponds and ongoing discharge of water from the mine site.
- Promote unsaturated conditions in the tailings – wide sub-aerial beaches will be maintained upstream of the embankments and upstream drains will be constructed to create a zone of unsaturated tailings adjacent to the embankments.
- Promote consolidation of tailings upstream of the TSF embankment –upstream drains will be constructed to create a zone of unsaturated tailings adjacent to the embankments.
- Reduce the hydraulic gradient across the till core – this will be achieved through maintaining sub-aerial beaches along the embankments and the construction of upstream drains.

Operation of the facility is to follow the above philosophy. The existing quantitative performance objectives will be revisited as part of the design to raise the TSF to elevation 974 and will be used to confirm that operation of the facility follows the operation philosophy.

6.0 DESIGN CRITERIA

The project-specific design criteria are detailed in Table 8.

Table 8: Design Criteria

Criteria	Unit	Value	Source/Comment
General			
Nominal Tailings Production Rate	t/day	20,000	MPMC (2021)
TSF Storage Capacity	-	Minimum to allow continuity of operation until 2026	Includes the remaining storage capacity of the permitted 970 m raise based on the 2019/2020 survey of the tailings surface 8.0 Mt deposited between June 2022 and December 2023
Dam classification	-	Significant	Refer to section 4.2
Coordinate system	-	Tailings grid	MPMC
Units	-	Metric	-
Design earthquake event	-	1:2,475 Annual Exceedance Probability (AEP)	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) Other criteria include: ■ Between 1:100 and 1:1,000 (CDA 2019) ■ 1:1,000 AEP recommended by GISTM (2020) Consistent with WSP's best practice, an earthquake event of 1:10,000 AEP will be used to assess sensitivity of the analyses.
Design earthquake peak ground acceleration	g	0.048	for earthquake event of 1:2,475 AEP 0.116 g for earthquake event of 1:10,000 AEP
Seismic coefficient for limit equilibrium pseudo-static analysis	-	0.5	Hynes-Griffin and Franklin (1984) 20% strength reduction applied to glaciolacustrine deposits as recommended by Hynes-Griffin and Franklin (1984) for clays.
Static (long term)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016), CDA (2019) Table 3-4
Static (during or at end of construction)	FoS	1.5	HSRC Guidance Document Section 3.3.1 (BC MEM 2016) >1.3 recommended by CDA (2019) Table 3-4
Pseudo-static	FoS	1.0	Informed by Table 3-5 of CDA (2019)
Post-earthquake	FoS	1.2	Informed by Table 3-5 of CDA (2019)

Table 8: Design Criteria

Criteria	Unit	Value	Source/Comment
Embankment Details			
TSF construction method	-	Centreline	Adopted
Low hydraulic conductivity element	-	Compacted till	Adopted
Overall downstream slope no steeper than	-	2H:1V	HSRC Guidance Document Section 3.3.1 (BC MEM 2016)
Embankment fill material	-	Non-acid generating	MPMC
Tailings Characteristics			
Solids content of tailings slurry discharged to TSF	%wt	Nominally ~ 35	Provided by MPMC
Tailings solids specific gravity	-	2.7	Estimated based on laboratory testing
Tailings average dry density after deposition	t/m^3	1.35	Assumed by WSP 1.36 t/m^3 in Knight Piesold (2005)
Tailings beach slope	%	sub-aerial – 0.5% Sub-aqueous – 2%	Estimated based on available topographic and bathymetric surveys since 2016

TSF = tailings storage facility; FoS = factor of safety.

A tailings deposition plan has been developed by MPMC from the restart of operations in July 2022. Annual tailings deposition into the TSF and cumulative tonnage for restart of operations until Q2 2026 (by which date storage capacity of the elevation 974 m facility will have been achieved, based on the tailings production plan) is included in Table 9.

Table 9: Tailings Production Plan July 2022 to Q2 2026

Period	Tailings Production (tonnes)	Cumulative Total Tonnage
July 2022	470,469	470,469
August 2022	620,000	1,090,469
September 2022	600,000	1,690,469
October 2022	620,000	2,310,469
November 2022	600,000	2,910,469
December 2022	620,000	3,530,469
January 2023	620,000	4,150,469
February 2023	560,000	4,710,469
March 2023	620,000	5,330,469
April 2023	600,000	5,930,469
May 2023	620,000	6,550,469
June 2023	600,000	7,150,469
July 2023	620,000	7,770,469
August 2023	620,000	8,390,469
September 2023	600,000	8,990,469
October 2023	620,000	9,610,469
November 2023	600,000	10,210,469
December 2023	620,000	10,830,469
January 2024	620,000	11,450,469
February 2024	560,000	12,010,469
March 2024	620,000	12,630,469
April 2024	600,000	13,230,469
May 2024	620,000	13,850,469
June 2024	600,000	14,450,469
July 2024	620,000	15,070,469
August 2024	620,000	15,690,469
September 2024	600,000	16,290,469
October 2024	620,000	16,910,469
November 2024	600,000	17,510,469
December 2024	620,000	18,130,469
Q1 2025	1,800,000	19,930,469
Q2 2025	1,820,000	21,750,469
Q3 2025	1,840,000	23,590,469
Q4 2025	1,840,000	25,430,469
Q1 2026	1,800,000	27,230,469
Q2 2026	1,820,000	29,050,469

Note: Some of this material is being deposited within the permitted 970 m TSF configuration. Cumulative total tonnage dates vary based on actual production quantities from July 2022 to date.

Ref. MPMC 2021.

6.1 Water Management Criteria

The Mount Polley Mine site has an annual net water surplus, and discharge from the mine site (after treatment) is necessary to manage the mine site water and to prevent accumulation of water on the mine site on a year over year basis. Temporary detention of water will be necessary to manage the large runoff volumes generated during the freshet; however, the fundamental basis of the water management plan is to not accumulate water on site (including the TSF) by treating and discharging water and to not carry over water from year to year even under extreme wet conditions.

The majority of water inflows into the TSF are pumped and are therefore in the direct control of the operator. These inflows are as follows:

- water discharged with the tailings slurry, at approximately 35% solids by weight
- excess water pumped from the water management structures for temporary detention in the TSF during the freshet and high flow events

Catchment areas directly contributing to the TSF are provided in Figure 1 and Table 10. This catchment delineation is the basis for the TSF spillway design. The water inflows to the TSF that are not pumped, and therefore not in the direct control of the operator, are as follows:

- precipitation on the direct footprint of the TSF
- potential runoff from the catchment directly above the west side of the TSF (catchment B and C in Figure 1) .
- potential runoff from the upstream catchment (catchment A in Figure 1) depending on the updates to the tailings pipeline ditch.

Outflows from the TSF consist of the following:

- reclaim water pumped to the mill by means of a floating barge within the TSF pond
- seepage through the embankment and foundation, including upstream drains, to the seepage collection ponds
- evaporation losses from the TSF pond and TSF wet tailings beaches
- water retained in the newly placed tailings

The TSF will be managed by maintaining the pond volume within the operating range for reclaim water and make-up water.

Deposition of the tailings will be planned in a manner that maintains the pond near the centre of the TSF facility and against the natural topography on the western perimeter.

Relevant parameters used as design criteria are summarized in Table 11.

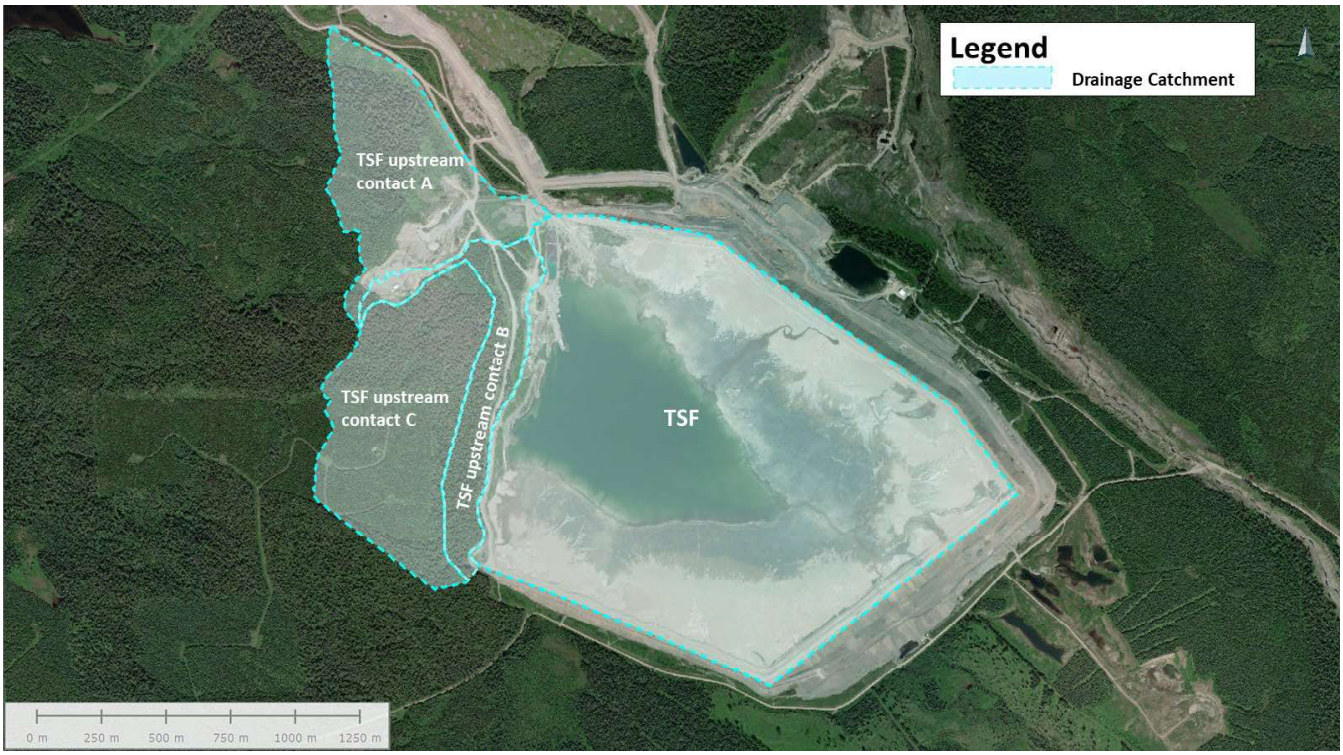

Figure 1: TSF Catchment Areas

Table 10: TSF Catchment Areas

Catchment	Watershed Area (km^2)
TSF upstream contact A[(a)]	0.43
TSF upstream contact B	0.24
TSF upstream contact C	0.52
TSF	2.38

(a) The catchment area is to be refined as per update to the tailings pipeline ditch.

Table 11: Design Criteria for Tailings Storage Facility Water Levels and Emergency Spillway

Design Criteria		Value	Source / Comment
IDF	Operations	72-hour PMF	PMF runoff volume will be estimate considering the annual 72-hour PMP rainfall plus snowmelt, which was selected consistent with WSP's best practice. Other criteria include: • 1/3 between 1-in-975-year and PMF for a minimum duration of 72 hours required by HSRC Guidance Document Section 3.3.1 (BC MEM 2016). • Between 1-in-100 and 1-in-1,000-year return period recommended by CDA (2019). • 1-in-1,000-year return period recommended by GISTM (2020).
EDF	Operations	24-hour 1:200 year precipitation and snowmelt	Typical EDF return periods range from 1-in-50 years to 1-in-200 years (CDA 2019).
Freeboard	Normal	No overtopping by 95% of waves caused by the most critical wind with a frequency of 1:1000 year with reservoir at maximum normal elevation.	CDA (2013)
	Minimum	No overtopping by 95% of waves caused by the most critical wind when the reservoir is at its maximum level during the IDF.	CDA (2013)
Operating pond volume	Normal operating water level range	1.5 to 1.7 million m^3 (Mm^3)	Minimum provided by MPMC for operation of the mill. Maximum adopted to maintain wide sub-aerial beaches.
	Maximum prior to freshet	1.5 Mm^3	Lowest achievable volume provided by MPMC for operation of the mill.

Table 11: Design Criteria for Tailings Storage Facility Water Levels and Emergency Spillway

Design Criteria		Value	Source / Comment
Beach width	Minimum during normal operating conditions	100 m	Portion of beach above operating pond level.
Emergency Spillway during Operations	-	Spillway to pass the IDF; TSF to store the EDF.	CDA 2019
Climate change consideration	-	Not considered due to design life of the emergency spillway during operations.	The potential variation in precipitation under climate change is expected to be within the range of uncertainty in the PMP estimate. Therefore, the PMP will not be modified further to account for potential climate change effects.
Annual 72-hour PMP	-	339 mm	Section 4.4.
72-hour PMP snowmelt depth	-	54 mm	Snowmelts are determined using an energy balance method (Dunne and Leopold 1978) using 72-hour PMP rainfall and mean April temperature and wind speed.
24-hour 1:200-year precipitation and snowmelt	-	69 mm	Golder (2022b)
72-hour snowmelt distribution	-	Evenly distributed over 72-hour duration as baseflow.	Adopted
Erosion protection requirements	Emergency Spillway during operation	Specific erosion protection materials selected using peak velocities along the spillway alignment as calculated in the hydraulic calculations.	BC MOTI 2007
Upstream drain	Flow capacity	To maintain the phreatic level at the elevation of the drain when the pond encroaches 50 to100 m from the elevation 987 m TSF configuration	Adopted
Upstream drain pipelines capacity	FoS	3	Adopted

IDF = inflow design flood; EDF = environmental design flow; PMF = probable maximum flood; TSF = tailings storage facility; MPMC = Mount Polley Mining Corporation; FoS = factor of safety.

7.0 CLOSURE PHILOSOPHY

The closure philosophy will be consistent with the most recent Mine Reclamation and Closure Plan (*Mines Act* Permit M-200). The TSF will remain a permanent structure, which will be reclaimed and given productive land use. The final configuration of the TSF will include a small permanent pond and wetland area on the surface, with maximum 2H:1V embankment slopes and a spillway for pond water level control. The principal activities and areas for reclamation of the TSF will be as follows:

- removal of all infrastructure
- re-sloping and reclamation of embankments
- spillway construction to limit the pond volume to about 0.25 Mm^3
- reclamation of tailings surface (beach and pond)
- reclamation of till borrow pits, as required

Implementation of closure and its philosophy is feasible for the TSF with a 974 m crest elevation; however, the TSF is planned to be raise above elevation 974 m to provide storage capacity for the LoM.

8.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that this technical memorandum provides sufficient information for your present needs. Please do not hesitate to contact us if you require any further elaboration or clarification.

WSP Canada Inc.





2024-03-21

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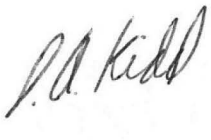

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https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/067-tm-design criteria for tsf 974 m raise/rev 0/23590671-067-tm-rev0-51393-design criteria 21mar_24.docx

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APPENDIX D

Siting and Technology Study

TECHNICAL MEMORANDUM

DATE 27 October 2022 **Reference No.** 22514095-070-TM-Rev0-51343

TO Matt O'Leary
Mount Polley Mining Corporation

FROM Germán Pizarro and Ben Wickland **EMAIL German.Pizarro@wsp.com; Ben.Wickland@wsp.com**

SITE SELECTION AND TECHNOLOGY MEMO – MOUNT POLLEY MINE TAILING STORAGE FACILITY

In 2015, Golder Associates Ltd. (Golder), now a member of WSP (WSP Golder), completed a siting and deposition technology review as part of the Mount Polley tailings storage facility (TSF) elevation 984 m life of mine feasibility design (Golder 2015). The study included a review of available tailings deposition technologies, a review of potential sites to deposit tailings and an assessment of the alternatives based on environmental, social, technical, and economic indicators. Deposition of the remaining life of mine tailings (about 70 million tonnes) as a slurry within the existing TSF was recommended with operation using best applicable practices (BAP) of reduced water storage, maintaining beaches against the dams, and providing drainage to promote desaturation and drainage of the pond (Golder 2015).

Deposition of tailings as a slurry in the TSF re-started in June 2016 and continued until May 2019 when mining operations were halted due to economic reasons. A portion of the tailings in Springer Pit was dredged and deposited in the TSF from March 2018 to October 2019. From the restart of operations in June 2016 to October 2019, a total of about 20 million tonnes of tailings were deposited in the TSF. Construction of the TSF Corner 1 embankment was completed to elevation 968 m in 2018 (Golder 2019). Construction activities to raise the embankment to the permitted elevation of 970 m and deposition of tailings were restarted in July 2022.

As part of the restart of mining operations in 2022, Mount Polley Mining Corporation (MPMC) requested WSP Golder to advance studies to support the co-disposal of tailings excavated from Springer Pit in the Southeast Rock Disposal Site (SERDS) and to advance the design of a raise of the TSF embankment above elevation 970 m. Approximately 63 million tonnes of tailings are planned to be produced till the end of operations at Mount Polley mine (approximately 8.5 years of production at about 20,000 tonnes per day). This represents about 13 million tonnes more (about 18% more) than the life of mine plan considered at the time of preparation of the 2015 siting and deposition technology review.

The Health, Safety and Reclamation Code (HSRC) for mines in British Columbia (EMLI 2021) requires that an alternatives assessment for storage of tailings be submitted as part of the mine permit application. This technical memorandum has been prepared to update the alternatives assessment completed in 2015 and includes co-disposal of hydro-cyclone underflow in the SERDS as an alternative for tailings storage.

1.0 SITE AND TECHNOLOGY SELECTION OBJECTIVES

In selecting potential locations and technologies for the storage of tailings, the following objectives are to be met (BCMEM 2016):

- Provide secure and permanent storage facility
  - Physical stability
  - Chemically and biologically stable, or be designed to mitigate transport of contaminants into the receiving environment
- Minimize additional land disturbance (additional footprint of the facility)
- Maximize in-pit or underground backfill
- Minimize impacts to receiving environment
- Minimize social impact (e.g., negative public perceptions, disruption of traditional land use)
- Minimize cost, including the costs for investigation, design, procurement, construction, operation, and closure
- Incorporate post-closure land use objectives
- Limit the amount of free water within the impoundment

Typically, a single consolidated TSF is preferred over multiple smaller TSFs; however, there are cases where multiple TSFs may be the preferred option. Reasons to consider multiple TSFs include:

- Separation of tailings streams with different geochemical characteristics
- Using tailings as mine backfill (i.e., maximize in-pit or underground backfill)
- Location (e.g., relative to property boundaries, proximity to downstream receptors, ore body)

2.0 POTENTIAL SITES

The potential locations identified for tailings include surface disposal in the existing TSF or in a newly constructed TSF, co-disposal with waste rock (e.g., SERDS or TSF buttress), disposal in the underground mine workings, disposal in an open pit, or lake deposition. The following is a list of potential sites which can be considered for tailings deposition. The potential locations are shown in Figure 1.

- **Existing TSF**—Provide capacity by raising the facility to about elevation 987. The primary advantages of using the existing TSF are:
  - A relatively small additional footprint will be required.
  - The foundation conditions at the TSF have been thoroughly investigated and are well understood.
  - Limited additional infrastructure is needed.

- The primary disadvantages of using the existing TSF are:
  - Negative social perception due to raising the existing TSF.
  - Risk of failure due to internal erosion can be managed by constructing upstream drains, maintaining the pond away from the embankments, and limiting the amount of free water within the facility.
  - Some of the downstream infrastructure (i.e., seepage collection ponds, water treatment plant, powerlines, and access roads) may need to be relocated.
- **New TSF location**—Construct a new TSF at one of the identified potential locations shown in Figure 1. The size and configuration of a new TSF would be dependent on the tailings deposition technology; however, in general, the required area for any technology would be similar. Considering that about 49 million tonnes of tailings will require storage (assumes that about 14 million tonnes are deposited within the permitted elevation 970 m TSF), and that the achieved dry density will be in the range from about 1.35 t/m^3 for slurry deposition to 1.7 t/m^3 for filtered tailings, the volume of tailings to be stored would be in the range of 29 to 36 million m^3. Assuming an average tailings thickness of 20 m for an embankment height of about 30 m, the new TSF would require an area of about 150 to 180 ha. The primary advantages of developing a new TSF are:
  - Positive social perception due to not raising the existing TSF.
- The primary disadvantages of developing a new TSF are:
  - A large footprint would be required for the new TSF, in the order of 65 to 80% the size of the existing TSF.
  - Additional land disturbance will be required for the new borrow areas for dam construction materials, for access roads, for tailings and water conveyance corridors, and for seepage collection and water management ponds.
  - Increased catchment area and volume of water to be managed and treated.
  - A detailed site investigation will be required to characterize the foundation conditions at the new TSF location, which will likely also be partially underlain by glaciolacustrine soils.
  - Costs of construction and closure of a new facility and associated infrastructure (e.g., powerlines, access roads, tailings and water conveyance corridors, seepage collection and water management ponds).

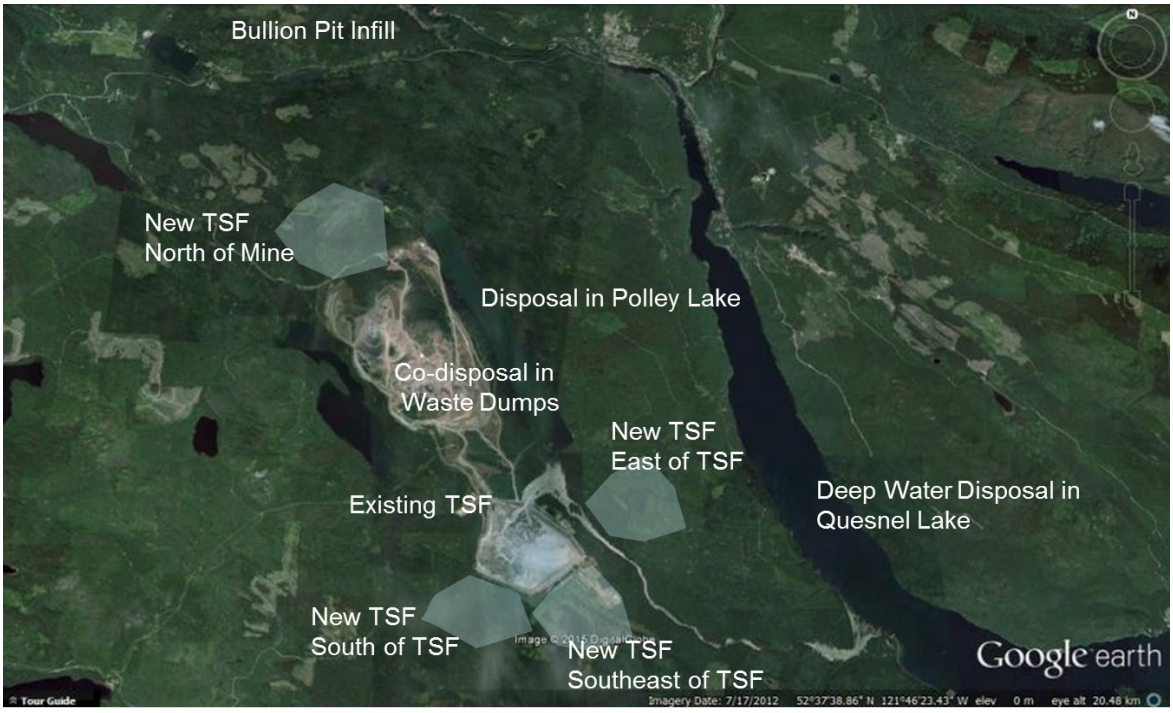

Figure 1: Potential locations for a future tailings storage facility

- **Co-disposal with waste rock**—Disposal of tailings and waste rock in one facility or area. There are many different forms of co-disposal with varying degrees of mixing, physical arrangement, and mixture ratio of tailings to waste rock. Options include the paste rock blended concept, thickened tailings in cells in the waste rock dump, or cyclone underflow (coarse tailings) in the waste rock dump with the cyclone overflow (fine tailings) in a separate TSF.

As part of plans to restart mining operations, MPMC requested WSP Golder to advance studies to support the co-disposal of tailings from Springer Pit in the SERDS (Golder 2022). A similar concept could be considered for placement of the cyclone underflow within the SERDS or TSF buttress; however, the cyclone overflow would still require to be stored within an alternate location (e.g., existing TSF). The cyclone underflow to be co-disposed with waste rock could account for approximately 10% to 30% of the total tailings and will be dependent on the tailings gradation and the underflow gradation requirements. The advantages/disadvantages of co-disposal of tailings and waste rock depend on the tailings technology (e.g., hydro-cycloned tailings, filtered tailings) and are discussed in Sections 4.2 and 4.5.

- **Lake deposition**—Tailings deposition into an existing lake such that the tailings remain below the lake level. Nearby lakes include Polley Lake, Bootjack Lake and Quesnel Lake. This alternative results in a physically stable facility. Acid generation is prevented, which is not a concern for the Mount Polley tailings. The primary advantages of depositing the tailings in a lake are:
  - Minimal additional infrastructure required.

  The primary disadvantages of depositing the tailings in a lake are:
  - Increased footprint and loss of fish habitat.

- Impact on recreational area and negative social perception.
- Increased catchment area and volume of water to be managed and treated.
- a detailed site investigation will be needed to characterize the foundation conditions where retaining embankments will be required, which will likely also be partially underlain by glaciolacustrine soils.

- **Open pit deposition**—Deposition of tailings into an inactive, mined-out pit. The tailings are typically placed sub-aqueously (i.e., deposited under water). After deposition, the solids settle out and the supernatant water can be recycled for use within the mill or treated and discharged from the site. This is a favorable alternative providing a physically stable location without increasing the disturbed footprint.

  Three open pits exist at the Mount Polley mine site; however, Springer and Cariboo pits are part of the active mining operation and Wight Pit is used as part of the site-wide water management. Bullion Pit is a potential site for disposal of tailings from Mount Polley, which would allow to restore the pit to a more natural landform than the present condition. A dam would be required to form a closed perimeter around Bullion Pit. The primary advantages of depositing the tailings in an open pit are:

  - Uses footprint of previously mined area.

  The primary disadvantages of depositing the tailings in an open pit are:

  - Bullion pit is considered a heritage site and tourist attraction in the area.
  - Additional land disturbance will be required for the new borrow areas for dam construction materials, for tailings and water conveyance corridors, and for seepage collection and water management ponds.
  - Increased catchment area and volume of water to be managed and treated.
  - A detailed site investigation will be needed to characterize the foundation conditions where a retaining embankment will be required.
  - Costs of construction and closure of a new facility and associated infrastructure (e.g., powerlines, tailings and water conveyance corridors, seepage collection and water management ponds).

- **Underground disposal—**Tailings may be placed underground in mined-out areas as a means of tailings disposal only, or tailings may be incorporated in the mining process as a backfill material. The required strength of the backfill can vary from negligible (where the only objective is to fill voids) to several megapascals (where the backfill is required to provide structural support to allow for ongoing underground mining). In active mining environments, a maximum of about 50% of the tailings can be placed underground because of the higher porosity of the tailings relative to rock. The current Mount Polley mine plan does not include underground mining and the current underground at Wight Pit could only take a small proportion of the tailings generated. This alternative is not further assessed given the current plans at Mount Polley Mine.

3.0 TAILINGS MANAGEMENT TECHNOLOGIES

The available tailings management technologies are differentiated primarily by the water content of the tailings, which determines the transportation method and the deposition method. Mineral processing commonly results in tailings with solids contents in the range of 30% to 50%. Dewatering of the tailings can be carried out to increase the solids contents of the tailings. This may be done for water management reasons or for tailings management reasons. Similarly, tailings can be sorted into coarse and fines portions to reduce the volume of tailings to be stored in a tailings dam and potentially using the coarse fraction for construction. Examples of dewatering and sorting technologies are shown in Table 1. A summary of the difference between the technologies according to operational criteria is shown in Table 2.

Each technology is explained in more detail in the sub-sections below.

Table 1: Technology, Tailings Consistency, and Conveyance Technology

Dewatering/Sorting Technology	Tailings Consistency	Conveyance Technology
Conventional thickener 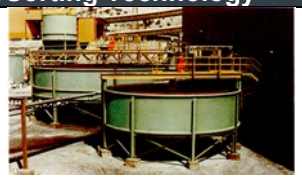	Slurry 30% to 80% solids 	Gravity pipeline or launder, low pressure pipeline, with or without centrifugal pumps 
High-rate thickener 	High density slurry 55% to 65% solids 	Centrifugal pumps or piston diaphragm pumps 
Deep bed thickener, deep cone thickener 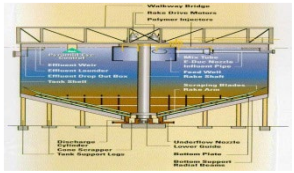	Low density paste 60% to 70% solids 	Piston diaphragm pumps (high pressure) 
Filter 	High density paste 65% to 75% solids 	Dual positive displacement pumps with high-pressure steel pipelines 
Filter 	Filter cake >80% solids 	Truck or conveyor 
Hydro-cyclone 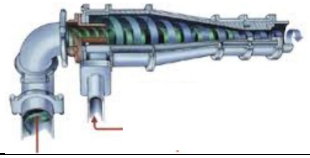	Underflow: low to high density paste Overflow: slurry	Underflow: mechanically placed or positive displacement pumps. Can be diluted and conveyed in low pressure pipeline. Overflow: gravity pipeline, low pressure pipeline, with or without centrifugal pumps

Table 2: Comparison of Tailings Technologies According to Operational Criteria

Criteria	Conventional Slurry	Hydro-cycloned tailings (overflow ~70-90%)	Thickened Tailings	Paste	Filtered Tailings
Pumpability / Conveyance	Gravity flow or centrifugal pumps	Overflow: gravity flow or centrifugal pumps Underflow: mechanically placed or positive displacement pumps. Can be diluted and conveyed in low pressure pipeline.	Gravity flow or centrifugal pumps to piston diaphragm pumps	High pressure positive displacement pumps	Not pumpable, can be transported on trucks or conveyors
In-situ density after deposition	Tailings segregate during deposition resulting in areas with fine tailings and low density	Overflow: Deposition of slurry with low solids content and fine tailings results in low density Underflow: Can be mechanically compacted to achieve highest density	Possible to deposit tailings without segregation and achieve a more uniform deposit with higher density	Tailings can be deposited without segregation and achieve a uniform deposit with higher density	Can be mechanically compacted to achieve highest density
Supernatant water	Low solids content and tailings sedimentation, settlement, and consolidation releases highest volume of water during deposition	Hydro-cyclone does not recover water from the tailings. Highest volume of water remains in the overflow and is released during deposition.	Water recovered from the tailings in the thickener; thickened tailings release less water during deposition	More water recovered from the tailings in the thickener; paste tailings release less water during deposition	Highest amount of water recovered from the tailings in the filter plant; no water released from the tailings during deposition
ARD management	ARD management depends on the specific design of the facility				
Technology and conveyance costs	Lower	Low	Medium	High	Highest
Tailings beach slopes	Flatter 0.3% to 1.5%	Overflow: Flatter < 1% Underflow: can be mechanically placed and compacted at stable angles	Steeper 0.7% to 2%	Steeper 1% to 10%	Tailings mechanically placed and compacted at stable angles

Note: Green cells represent a favorable condition, while red cells represent a less favorable condition. The darker the shade of green or red, the more or less favorable the condition.
ARD = acid rock drainage.

3.1 Low Solids Content (Conventional) Slurry Deposition

Transport and deposition of tailings as a slurry (mixture of water and tailings solids) is commonly used in combination with wet ore mineral processing techniques. This method has been used at the Mount Polley Mine to deposit tailings into the TSF and Springer Pit.

The tailings are transported from the mill to the TSF in a pipeline or open launder chutes and deposited from a single point discharge or from multiple spigots. The deposition can be subaqueous or subaerial, but typically a subaerial beach is developed during the deposition sequence. The coarser fraction of tailings drops out near the discharge to form a beach and the finer fraction is carried to the supernatant pond. The tailings beach slopes typically range between 0.3% and 1.5%. At the Mount Polley TSF, the tailings beach slope has been surveyed to be in the order of 0.5% to 1.0%.

A supernatant pond is typically present within the facility, from which water is decanted by means of a floating barge or decant tower. The pond is maintained on the tailings and is necessary for sedimentation and settling. The size of the pond can be limited to that needed for operation of the water reclaim system. The process water requirements can be supplemented by an alternative source or by having an independent process water pond. Since the restart of operation at the Mount Polley TSF in 2016, the supernatant pond has been maintained on the northwest side of the facility, towards the natural ground and away from the embankments.

The consolidation process increases the density of the tailings, releasing water to the pond, internal drainage in the facility or to the foundation. The typical achieved settled average dry density is in the range of 1.3 to 1.7 t/m^3, depending on the tailings (e.g., mineralogy, grind, and clay content). At the Mount Polley TSF, the average density of the tailings deposited as a slurry is estimated to be about 1.35 t/m^3.

Containment dams can be constructed of earthfill, rockfill (potentially mine waste rock), or sand separated from the tailings using hydro-cyclones, with the design of the dams carried out to suit the characteristics of the site and the mining operation.

3.2 Hydro-cyclone Classified Tailings

Hydro-cyclones are used to separate the tailings into a fine (overflow) and coarse (underflow) fractions. The hydro-cyclones can be selected to produce a coarse fraction with a specified gradation (e.g., sand). The coarse fraction can be transported in pipelines and deposited from spigots or spreader bars and it can be compacted to achieve a dilative, non-liquefiable material. The sand can also be dewatered on screens and transported by truck or by conveyor belt. The fine fraction is typically transported by pipeline and deposited as a low solids content slurry in an impoundment.

The advantages of separating the coarse and fine fractions of the tailings include reducing the volume of tailings to be stored behind a tailings dam and potentially using the coarse fraction for construction of the dam. The disadvantages include flatter beach slopes, lower hydraulic conductivity and lower strength of the fine tailings deposited on the tailings dam. If hydro-cyclones are used at Mount Polley, the underflow would be disposed in the SERDS or TSF buttress and the overflow is deposited in the existing TSF.

The tailings beach slope in the TSF is expected to be flatter and the capacity to maintain a pond away from the embankments would be reduced and possibly eliminated. Assuming an average 0.5% tailings slope above and below water, it is estimated that:

- A maximum 100 m tailings beach could be maintained around a 1.5 Mm^3 TSF pond with a high level of deposition control.
- A pond with a size on the order of 2 Mm^3 would encroach onto the embankments.

The hydraulic conductivity of the fine tailings deposited in the TSF would be lower; therefore, the effectiveness of the upstream drain to control the water level and limit the hydraulic gradient across the embankments would be reduced and reliance on high-quality site-wide water management and tailings deposition would increase. It is estimated that the hydraulic conductivity of the fine fraction of the tailings could be 2 orders of magnitude lower (10^{-8} m/s) than the hydraulic conductivity of the tailings that have deposited near the embankment during deposition of the combined coarse and fine fractions of the tailings.

The change to hydro-cyclones would likely require a change to site water management practices. Based on challenges to manage site water in recent years, uncertainties on the actual tailings beach slope and capacity to maintain the pond away from the embankments, it is the opinion of the Mount Polley TSF EoR that alternative locations to manage site water outside of the TSF would be required if hydro-cycloning was implemented.

Dams constructed from cycloned sand include: the Gibraltar and Highland Valley Copper LL tailings dams in BC; Cerro Verde in Peru; and El Mauro, Las Tortolas, and Ovejeria dams in Chile. The Caserones Copper project in Chile places cyclone sand in a separate sand stack area and contains the cyclone overflow fines behind a rockfill dam.

3.3 Thickened (Non-Segregating) Tailings

Thickening of tailings involves placing slurry tailings in a tank, allowing the solids to settle to the bottom and be removed while water is removed from the top of the tank. Mechanical rakes and/or chemical additives are often required to increase the settling rate of the solids. The additives may be flocculants, coagulants, or a combination of both.

The tailings are typically deposited down a slope from several discharge points, with the tailings confined by a retaining dyke at the foot of the slope. Thickened tailings are generally non-segregating when deposited and form a homogenous mass.

Thickened tailings will bleed some water when deposited, but much of the process water is retained as part of the thickening process. Although a supernatant pond may not be formed, the TSF will still require surface water runoff and seepage management systems. A secondary facility for re-circulation of water may still be required.

The advantages of thickened tailings over conventional tailings typically include higher water recovery before transport and deposition and lower losses (relevant to sites with negative water balances, not surplus conditions as present at Mount Polley), increased storage capacity due to slightly higher settled density and steeper tailings slopes. The disadvantages include higher operational costs (processing and pumping). In areas with large earthquakes, structures to contain all the tailings may be required if liquefaction of the tailings can occur.

Examples of thickened tailings discharge include Kidd Creek Mine, Timmons, Ontario; Peak Mine, Australia; Century zinc mine, Australia; Osborne Mine, Australia; Falconbridge Strathcona mine, Sudbury, Ontario; Musselwhite mine, northwest Ontario; Essakane, Burkina Faso; and the Porgera Gold Mine, Papua New Guinea.

3.4 Paste

Paste tailings typically have solids contents of between 60% and 70% and are pumpable using high pressure pumps, are non-segregating, and typically do not release water. Paste tailings are achieved by a combination of mechanical devices (such as deep cone thickeners) and chemical additives including flocculants.

Paste tailings are frequently used for backfilling underground mine workings (often combined with cement and/or fly ash), but surface disposal of paste tailings is also possible.

Paste tailings can be transported using pressure pipelines to the storage area. Containment facilities are still required for the management of surface water from precipitation, although due to the increased density and increased slope of deposition of the tailings, the size and/or height of the facilities may be reduced compared to slurry type methods of disposal.

Paste tailings have typically been more considered for surface disposal in arid climates with limited water availability. Careful control of the thickener is required to obtain consistent rheology that will give consistent deposited slopes. Changes in the mineralogy, grind, and temperature can affect the rheology. Steeper deposition slopes can be achieved. These steeper slopes can produce inefficient filling for valley containment systems.

Examples of mines that use the paste technology for tailings deposition include Bulyanhulu, Tanzania; Myra Falls, BC; Esparanza, Chile; and Cobriza mine, Peru.

3.5 Filtered Tailings

Filtered tailings are produced using mechanical devices (e.g., high-capacity vacuum and pressure belt filters), often in combination with chemical additives. The tailings are usually dewatered in a high rate thickener to feed the filters. After filtration the tailings have about 80% to 85% solids and are too thick to pump. Instead, they are transported by truck or conveyor system and then stacked. Filtered tailings that are stacked are not dry, but rather have moisture contents at or near saturation.

Typically, filtered tailings are placed, spread, and compacted to form an unsaturated dense and stable stack. No additional containment structures, such as dams, are required to retain the tailings, though waste rock is typically used on the outer slopes to reduce erosion. These facilities may result in a smaller footprint area due to their increased density. Containment structures may be required to manage runoff and sediment from precipitation. If the stack is placed with bottom-up construction, concurrent reclamation of the tailings can be carried out.

The nature of the tailings produced, both the grain size and mineralogy, can play an important role in determining the effectiveness of filter processing. Tailings with a high percentage of clay-sized particles and with clay mineralogy reduce the efficiency of the filtering process and may result in high energy consumption.

The energy consumption and costs associated with filtration and transportation of filtered tailings are considerably higher than those related to slurry and thickened tailings disposal. Truck transport of the tailings increases the carbon footprint relative to methods using transport in pipelines. This method has mostly been utilized in specific conditions where water conservation is critical or only a small footprint is available.

Liners may be installed under the stack if groundwater contaminant could be a problem. Consolidation and downward drainage of the water in the tailings and climate conditions may result in saturated conditions at the base of the stack. Compaction is used to create a non-liquefiable material that will be stable in earthquakes.

Examples of dry stack tailings facilities are Greens Creek mine, Alaska; Raglan, Quebec; Mineral Hill, Montana; La Coipa, Chile; Pogo mine, Alaska; and Cerro Lindo, Peru. The Cerro Lindo tailings facility has a 30 m high water management dam located downstream of the tailings area.

4.0 ASSESSMENT OF TAILINGS MANAGEMENT ALTERNATIVES

The term BAT (best available technology) does not represent any one specific technology that can be applied to every situation. Rather, the technology must match the specific site conditions and the mining situation. The purpose of evaluating alternative technologies in this instance is to identify the preferred method of providing reliable containment of the tailings that will be produced from the remaining life of the Mount Polley Mine (approximately 8.5 years at about 20,000 tonnes per day). Chemical stability of the tailings is less of a concern due to the nature of the Mount Polley tailings. The conservation of water, which is a benefit of thickened and filtered tailings, is not an advantage at Mount Polley due to the net water surplus on the mine site that requires ongoing discharge of water from the site.

The open pits at the Mount Polley Mine are still being actively mined or used for water management and are, therefore, not available for tailings storage. The underground workings could only take a small proportion of the tailings and are used as part of the site water management.

The potential sites, and the potential technologies that could be applied to each site, are summarized in Table 3.

Table 3: Applicability of Tailings Technology to Potential Locations

Site	Conventional Slurry	Hydro-Cycloned Tailings	Thickened Tailings	Paste	Filtered Tailings
Existing TSF	●	●	●	●	●
New TSF	●	●	●	●	●
SERDS co-disposal		● (only underflow, after dewatering by screening)			●
Polley/Bootjack/Quesnel Lakes	●		●		
Bullion Pit	●	●	●	●	●

The options that could accommodate the required volume of tailings were evaluated against the following criteria:

- Environmental
  - Overall affected land footprint size of facility, including related infrastructure (e.g., borrow areas, access roads, power, tailings and water conveyance corridors, seepage collection and water management ponds)
  - Aquatic habitat
- Technical
  - Understanding of foundation conditions

- Socio-economic
  - Public perception as it relates to TSF failure in 2014
  - Maintenance of traditional lifestyle and land use (e.g., loss of access, loss of fishing area, recreation/tourism)
- Project economics
  - Life of mine cost, including construction, operation, and closure
  - Economic risks (e.g., time to start operation)

The five groups of sites have been evaluated based on the required objectives identified, as shown in Table 4.

Physical stability has not been included as a criterion because all potential alternatives can be designed to have a similarly low likelihood of failure. The consequence of failure is related to downstream receptors and the amount of water and eroded tailings that could be released in the event of a failure.

The advantage of paste or filtered tailings is to reduce the consequence of failure by eliminating the supernatant pond that forms when water is released from the tailings, and to increase the placed density of the tailings which reduces the mobility of the tailings in the event of a failure.

If conventional tailings are deposited within the existing TSF, the risk and consequence of failure can similarly be reduced. This can be achieved by implementing BAP (best applicable practices), and following the principles set out in the Independent Expert Engineering Investigation and Review Panel (IEERP) report of January 2015:

- Limit the amount of surface water to only that required for operation – The supernatant pond volume can be maintained within defined limits by having a water management plan, a secondary water storage facility for excess water if required, and water discharge through a spillway. These measures will reduce the risk of overtopping and limit the consequence if failure occurs.
- Promote unsaturated conditions in the tailings with drainage provisions – A minimum beach width is maintained between the embankment and the pond and an upstream drain can be constructed upstream of the embankment. This will result in a portion of the tailings being in an unsaturated condition. The upstream drain at the Corner 1 embankment has performed as intended allowing seepage and maintaining the tailings above the elevation of the drain in an unsaturated condition.
- Achieve dilatant conditions throughout the tailings deposit – The existing tailings within the TSF drained and consolidated after the TSF breach in 2014. Construct drainage through the embankment raise to allow seepage from the facility and promote consolidation of the tailings.

Based on the above, it is considered that tailings management with the goal to improve stability can be realized with tailings slurry deposition, as with alternative technologies such as thickened tailings, paste or filtered tailings. The tailings breach on 4 August 2014 was due to inadequate characterization of the foundation conditions. The foundation conditions and material strengths are now well understood. Implementation of the BAP and the ability to discharge water will limit the volume of water in the TSF.

Table 4: Evaluation of Tailings Storage and Disposal Alternatives

Location	Technology	Environmental Aspects (Additional Disturbed Footprint)	Technical Aspects (Understanding of Foundation Conditions)	Social Impact (Public perception and maintenance of traditional land use)	Economic Impact (Life of mine cost and time required for implementation)
Existing TSF	Low density slurry tailings	**Small footprint change (<50 ha)** Use of existing footprint	**Foundation conditions well understood** Considerable geological interpretation, investigation, and laboratory testing has been performed	**Negative perception** Use of the same facility and technology as prior to the breach	**Low cost** Limited additional infrastructure required Buttresses needed to achieve target levels of stability
	Thickened tailings			**Better perception** Use of the same facility but reducing surface water	**Increased capital and operating costs; longer time required for implementation** Procurement, construction, and operation of thickener Increased pumping cost Buttresses needed to achieve target levels of stability
	Filtered tailings	**Small footprint change (<100 ha)** Use of existing footprint but new water management pond required outside of TSF		**Better perception** Use of the same facility but reducing surface water	**Highest capital and operating cost; longest time required for implementation** Construction costs of new water management pond Procurement, construction, and operation of filter plants Trucks to haul tailings; dozers and graders to spread tailings Buttresses needed to achieve target levels of stability
Existing TSF and SERDS co-disposal	Hydro-cyclone underflow (SERDS/TSF buttress), overflow (TSF)	**Small footprint change (<100 ha)** Use of existing footprint but new water management pond required outside of TSF	**Foundation conditions well understood** Considerable geological interpretation, investigation, and laboratory testing has been performed at the existing TSF. Additional SERDS foundation investigation in progress.	**Negative perception** Reduction of tailings to be stored but uses the same facility	**Increased capital cost** Construction costs of new water management pond Buttresses needed to achieve target levels of stability Dozers to spread tailings
New TSF	Low density slurry tailings	**Large footprint increase (>200 to 300 ha)** Use of undisturbed area for new TSF, access roads, water management ponds, pipeline corridors, and surface water diversion ditches	**Limited information of foundation conditions** Foundation conditions likely to be geologically similar to those at existing TSF. Detailed investigation required to characterize foundation, in particular location and characteristics of glaciolacustrine soils.	**Positive perception** New facility; failed embankment not part of future TSF	**Increased capital cost** Construction, operation, and closure costs for new facility
	Hydro-cyclone overflow and underflow				
	Thickened tailings			**Positive perception** New facility and reduced surface water stored in the TSF	**Increased capital and operating costs; longer time required for implementation** Construction, operation, and closure costs for new facility Procurement, construction, and operation of thickener Increased pumping cost
	Filtered tailings				**Highest cost; longest time required for implementation** Time and cost for site investigation and design. Construction, operation, and closure costs for new facility Procurement, construction, and operation of filter plants Trucks to haul tailings; dozers and graders to spread tailings Construction costs of new water management pond

Table 4: Evaluation of Tailings Storage and Disposal Alternatives

Location	Technology	Environmental Aspects (Additional Disturbed Footprint)	Technical Aspects (Understanding of Foundation Conditions)	Social Impact (Public perception and maintenance of traditional land use)	Economic Impact (Life of mine cost and time required for implementation)
Bullion Pit	Low density slurry tailings	**Medium to large footprint increase** Use of an existing footprint disturbed by previous mining activities but new borrow areas, access roads, power, tailings and water conveyance corridors, surface water diversion ditches, seepage collection and water management ponds would be required	**Limited information of foundation conditions** Detailed investigation to characterize foundation where retaining embankments will be required; however, geological conditions are expected to be more favorable.	**Negative perception** Bullion pit considered a heritage site and tourist attraction for Likely	**Increased cost** Construction of new infrastructure, including tailings and water pumps and pipelines, high dam, seepage cutoff, and collection system to prevent water loss to Quesnel River
Quesnel, Bootjack or Polley Lake	Low density slurry tailings	**Large footprint increase and loss of aquatic habitat** Use of undisturbed or partially undisturbed aquatic habitat.	**Limited information of foundation conditions** Foundation conditions likely to be geologically similar to those at existing TSF. Detailed investigation to characterize foundation where retaining embankments will be required, in particular location and characteristics of glaciolacustrine soils.	**Negative perception** Loss of fish habitat; loss of recreational area	**Low cost** Minimal additional infrastructure required
SERDS co-disposal	Filtered tailings	**Minimal footprint change** Potential footprint increase of waste dump.	**Foundation conditions reasonably well understood** Additional SERDS foundation investigation and characterization in progress. Investigation of footprint expansion required.	**Positive perception** New facility and technology that reduces surface water.	**Highest cost; longest time required for implementation** Procurement, construction, and operation of filter plants Trucks to haul tailings; dozers and graders to spread tailings

5.0 FINDINGS

The following observations have been made regarding the range of options considered:

- The best available option is to store the tailings to be produced in the remaining life of mine within the existing TSF as conventional slurry.
  - The existing TSF has the best-studied foundation conditions of any of the potential TSF locations.
  - Conventional tailings can be operated in a manner that reduces both the likelihood (conservative assessment of soil strength and adoption of conservative design criteria resulting in wide buttresses along the embankments) and consequence of failure (wide beaches, relatively dense tailings, and a small pond volume) provided that accumulation of water does not occur.
- Separating the tailings into fine (overflow) and coarse (underflow) fractions with hydro-cyclones could reduce the amount of tailings to be stored in the TSF by 10 to 30% (i.e., in the order of 2 to 6 m embankment height) if the coarse fraction is placed in the SERDS or TSF buttress; however, a separate water management pond with a storage capacity of about 4 Mm^3 to manage the 1-in-200-year freshet volume would be required (e.g., facility with a dam height in the range of 20 m). A separate water management pond would require significant investigation (foundation conditions would be required to be characterized to a sufficient level to enable appropriate design), add to the disturbed area of the mine, and require more closure work at the completion of mining.
- Thickened tailings offer limited advantages over conventional tailings. The mine site has an overall positive water balance, and freshet water management would be carried out using the TSF, similar to the conventional tailings option. The maximum pond size is controlled by run-off during freshet and not by the needs of the mine operation (i.e., saving water at the mill by thickening does not offer an advantage).
- The high capital cost of a filter plant may not be economic given the relatively short remaining life of the mine. A separate water management pond with a storage capacity of about 4 Mm^3 to manage the 1-in-200-year freshet volume would also be required (e.g., facility with a dam height in the range of 20 m).
- A new land-based TSF footprint is unlikely to offer advantages over the existing TSF footprint. The failure that occurred in the existing TSF was caused by a combination of inadequate understanding of the foundation conditions, inappropriate analysis of the range of loading conditions, and the construction of steep fill slopes. The foundation conditions of the existing TSF can accommodate additional dam construction, providing that the slopes of the dams are matched to the foundation strengths. Each of these issues can therefore be addressed by appropriate design at the existing TSF site. Using a different land-based site would require significant investigation (foundation conditions would be required to be characterized to a sufficient level to enable appropriate design), add to the disturbed area of the mine, and require more closure work at the completion of mining.
- The only advantage to using the Bullion Pit is that an area with significant historical mining disturbance could be restored to a landscape similar to the pre-mining condition. The delay to the mine operation related to the investigation and design of the containment structures and the seepage control system to minimize water loss to the Quesnel River, coupled with the increased costs for transporting the tailings to the Bullion Pit and water from the Bullion Pit to the mine and the need for an environmental impact assessment, make this alternative unattractive, and, likely would prevent continuation of operations.
- Deposition of tailings in lakes provides numerous advantages in terms of the physical stability of tailings. Deposition of tailings in lakes is an appropriate option for some situations; however, the permitting of such facilities is difficult, particularly when the lakes provide habitat for fish. This is the case for all of the potential

lakes that could be considered. Polley Lake is judged to be more likely to be considered for tailings deposition than other lakes in the area but given the trout population in Polley Lake it is considered to be a less favorable site than an on-land site.

6.0 RECOMMENDATIONS

It is recommended that the tailings produced in the remaining life of the Mount Polley mine be transported as conventional (slurry) tailings to the existing TSF and be managed using BAPs. These would include the following:

- Routine and sustained discharge of mine water such that the volume of water stored in the TSF is maintained low
- Managing the pond in the TSF such that beaches are maintained against the containing embankments throughout the operational life of the TSF
- Providing drainage to promote the desaturation and densification of the tailings.

7.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this document.

Golder Associates Ltd.

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/070-tm-51343-site selection and technology memo/22514095-070-tm-rev0-51343-site selection and technology 27oct_22.docx

PERMIT TO PRACTICE #1003064
Engineers & Geoscientists BC

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IEERP (Independent Expert Engineering Investigation and Review Panel). 2015. Report on Mount Polley Tailings Storage Facility Breach. Province of British Columbia. 30 January 2015.

STUDY LIMITATIONS

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APPENDIX E

Tailings Deposition Models

Cumulative Tailings – 4.0 Mt (0.7 Years)

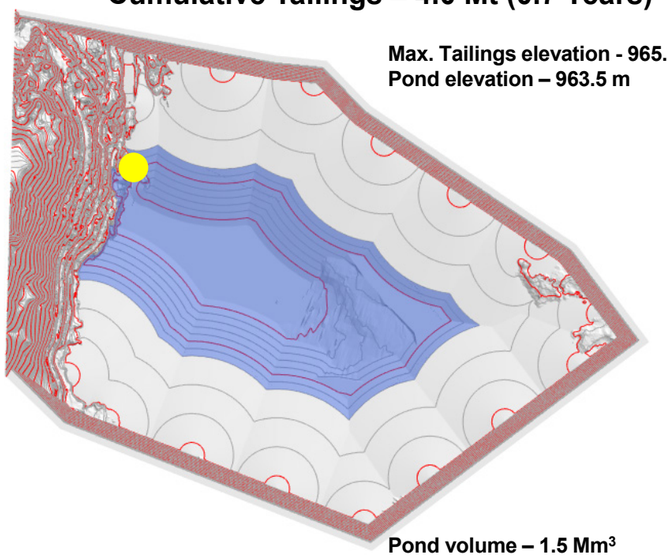

Max. Tailings elevation - 965.2 m
Pond elevation – 963.5 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 7.6 Mt (1.2 Years)

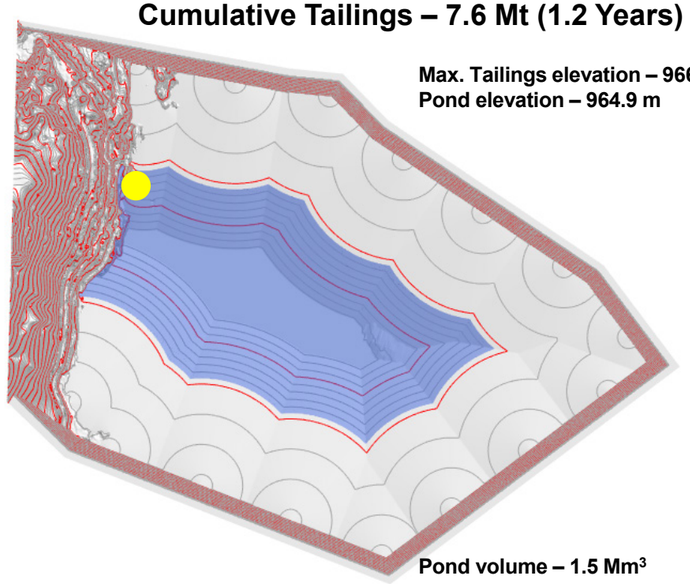

Max. Tailings elevation – 966.7 m
Pond elevation – 964.9 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 11.3 Mt (1.7 Years)

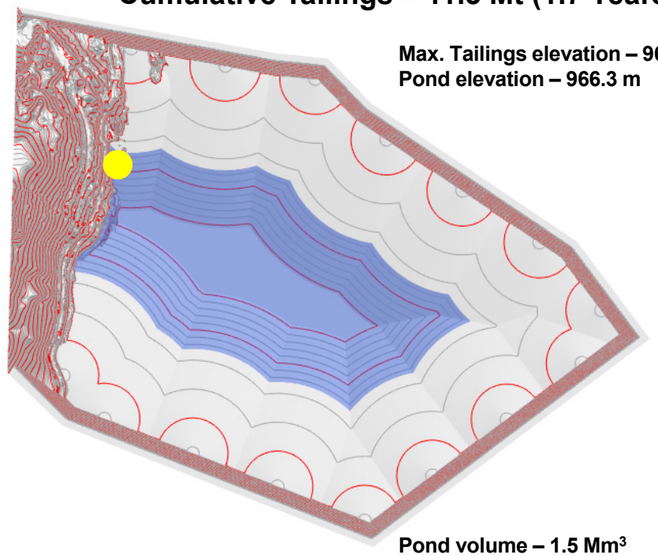

Max. Tailings elevation – 968.1 m
Pond elevation – 966.3 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 15.0 Mt (2.2 Years)

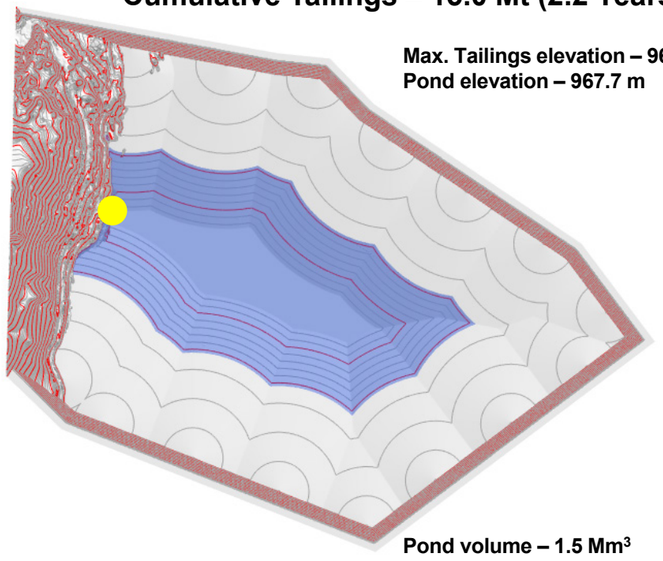

Max. Tailings elevation – 969.5 m
Pond elevation – 967.7 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 18.6 Mt (2.7 Years)

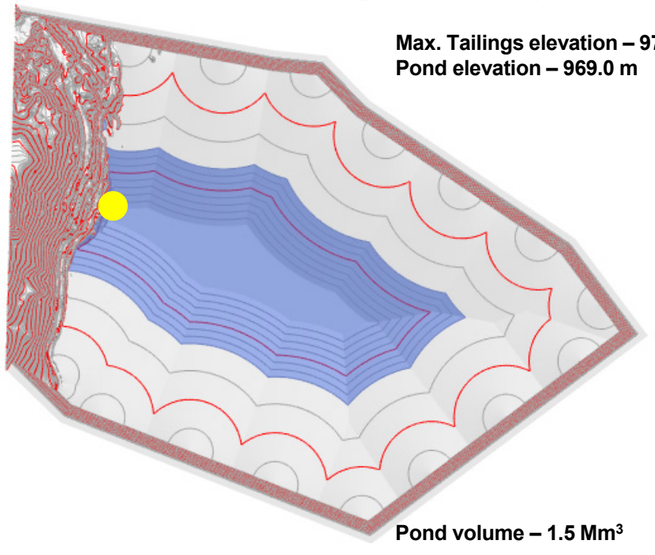

Max. Tailings elevation – 970.9 m
Pond elevation – 969.0 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 26.0 Mt (3.7 Years)

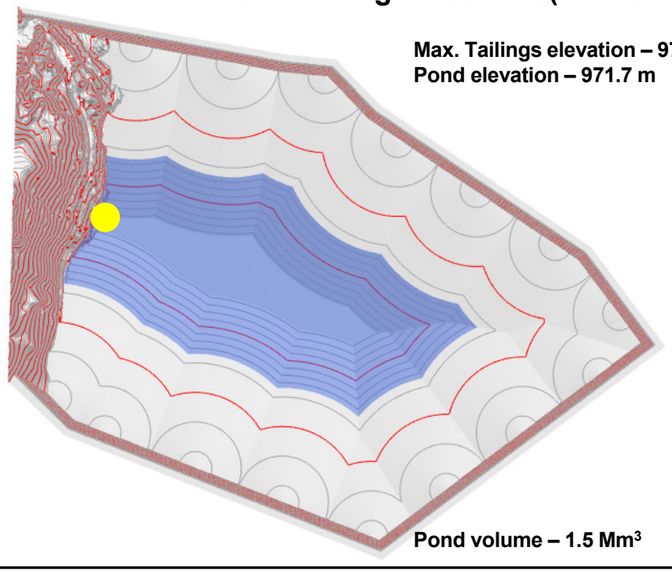

Max. Tailings elevation – 973.6 m
Pond elevation – 971.7 m

Pond volume – 1.5 Mm^3

LEGEND:

Pond

Approximate Barge Location

NOTES:

1. Sub-aerial beach slope = 0.5%; sub-aqueous beach slope = 2%.
2. Maximum pond depth = 4 m.
3. Timeline is based on mine plan as reported in 23590671-067-TM-Rev0-51393
4. In place dry density of 1.35 tonnes/m^3 assumed.
5. Barge to be relocated in 2024.

CLIENT
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wsp

YYYY-MM-DD	2023-04-16
PREPARED	SPC / FG
DESIGN	EW
REVIEW	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
TAILINGS DEPOSITION MODELLING RESULTS (Mine Plan; June 2019 Survey)
0.5% sub-aerial; 2% sub-aqueous

PROJECT No.	Phase/Task	Rev.	Figure No.
CA0020527.4505	51300/51394	0	E-1

Cumulative Tailings – 26.9 Mt (3.8 Years)

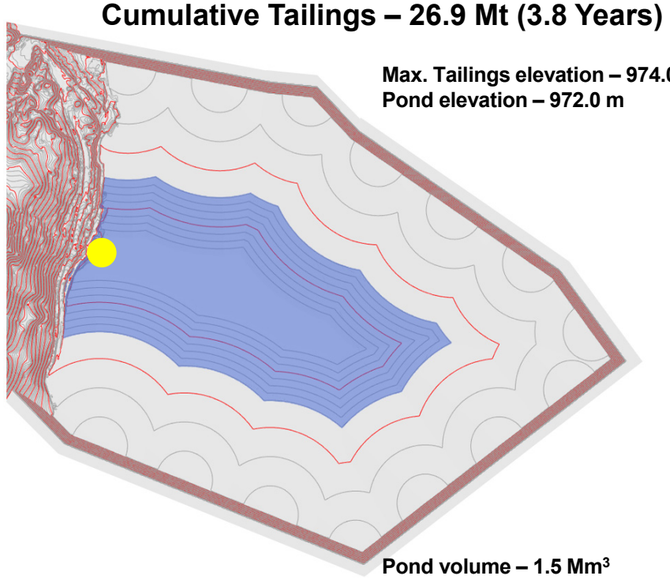

Max. Tailings elevation – 974.0 m
Pond elevation – 972.0 m

Pond volume – 1.5 Mm^3

LEGEND:

Pond

Approximate Barge Location

NOTES:

1. Sub-aerial beach slope = 0.5%; sub-aqueous beach slope = 2%.
2. Maximum pond depth = 4 m.
3. Timeline is based on mine plan as reported in 23590671-067-TM-Rev0-51393
4. In place dry density of 1.35 tonnes/m^3 assumed.
5. Barge to be relocated in 2024.

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DESIGN	EW
REVIEW	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
TAILINGS DEPOSITION MODELLING RESULTS (Mine Plan; June 2019 Survey)
0.5% sub-aerial; 2% sub-aqueous

PROJECT No.	Phase/Task	Rev.	Figure No.
CA0020527.4505	**51300/51394**	**0**	**E-2**

Cumulative Tailings – 4.0 Mt (0.7 Years)

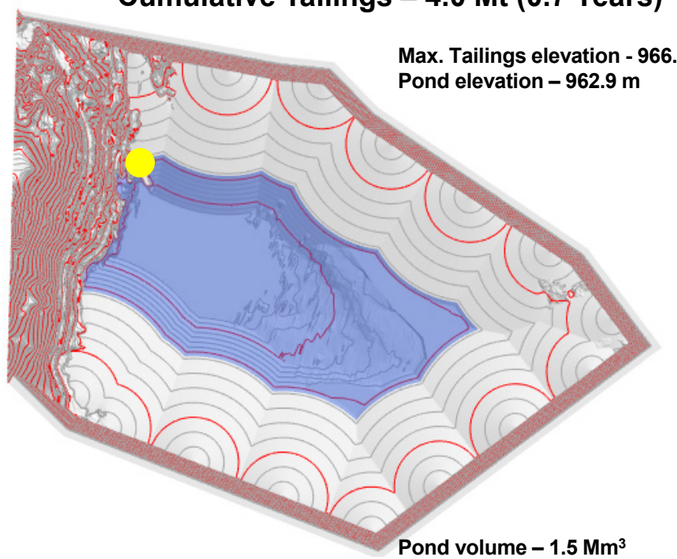

Max. Tailings elevation - 966.5 m
Pond elevation – 962.9 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 7.6 Mt (1.1 Years)

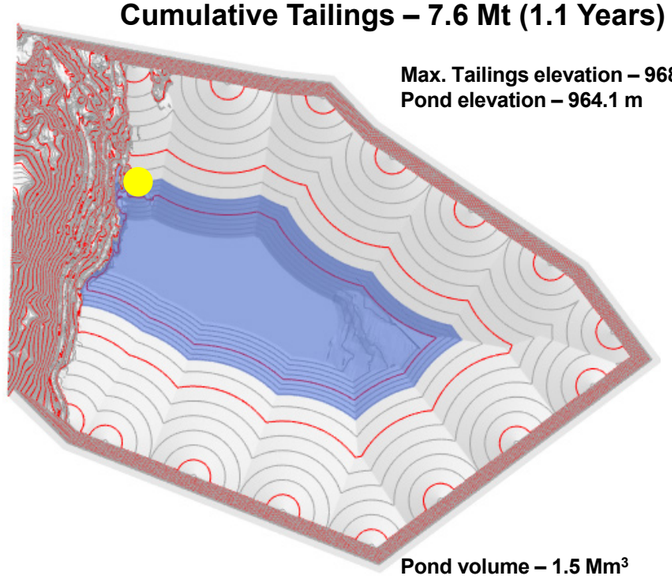

Max. Tailings elevation – 968.1 m
Pond elevation – 964.1 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 11.3 Mt (1.7 Years)

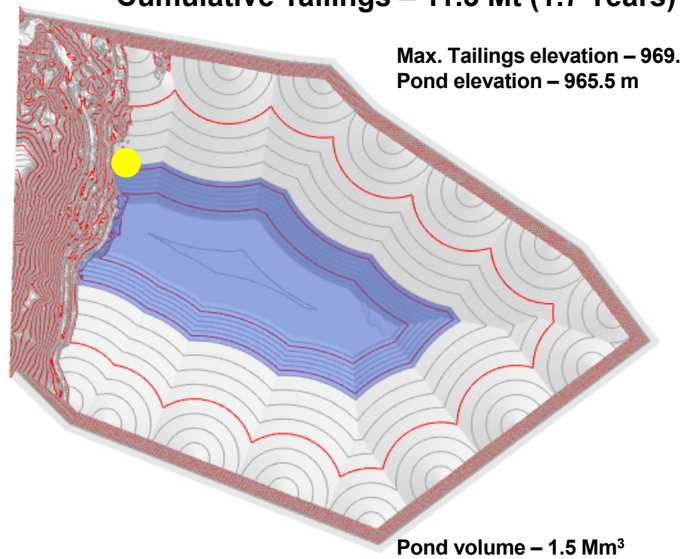

Max. Tailings elevation – 969.5 m
Pond elevation – 965.5 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 14.9 Mt (2.1 Years)

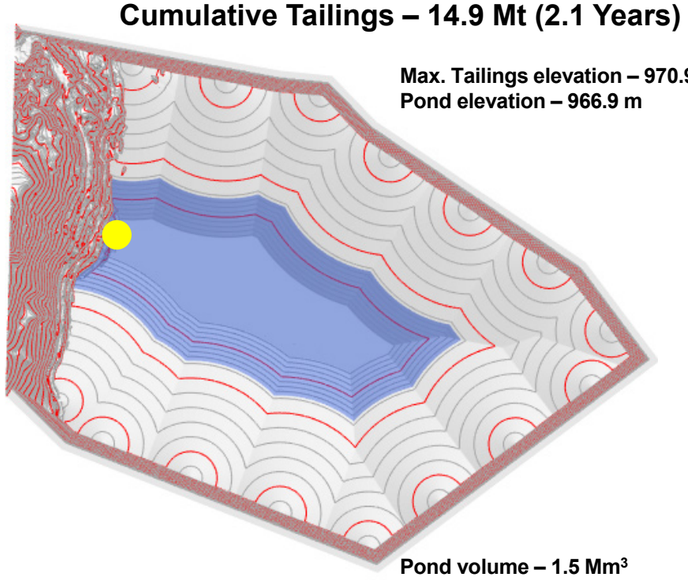

Max. Tailings elevation – 970.9 m
Pond elevation – 966.9 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 18.8 Mt (2.7 Years)

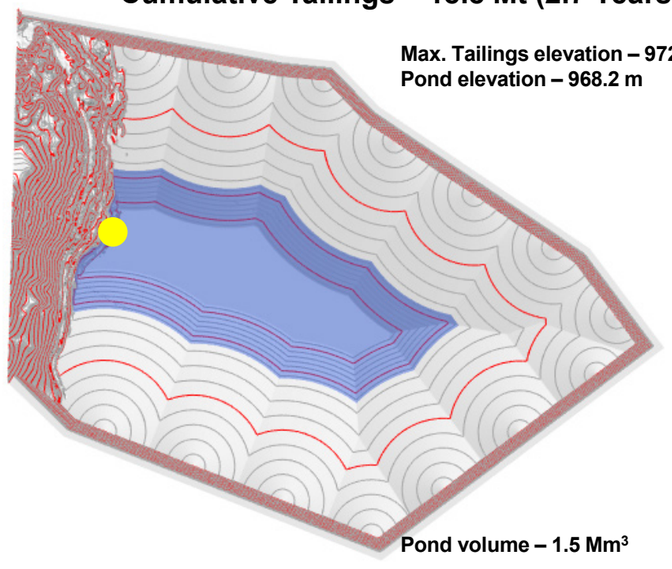

Max. Tailings elevation – 972.4 m
Pond elevation – 968.2 m

Pond volume – 1.5 Mm^3

Cumulative Tailings – 23.0 Mt (3.3 Years)

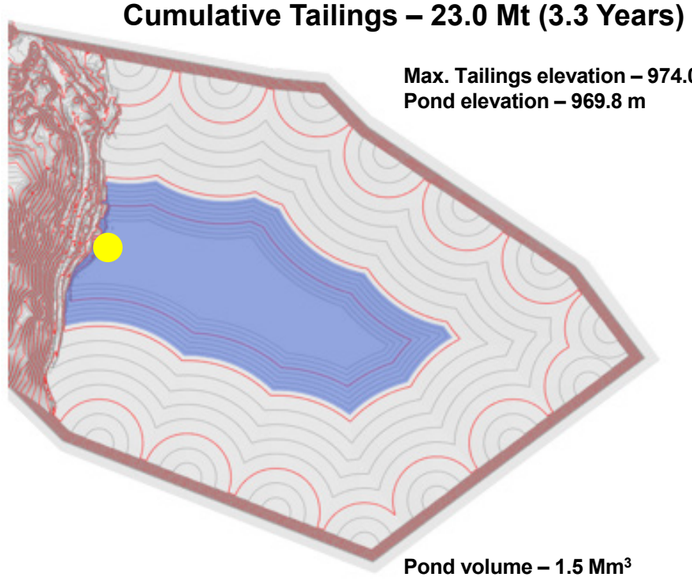

Max. Tailings elevation – 974.0 m
Pond elevation – 969.8 m

Pond volume – 1.5 Mm^3

LEGEND:

Pond

Approximate Barge Location

NOTES:

1. Sub-aerial beach slope = 1%; sub-aqueous beach slope = 3%.
2. Maximum pond depth = 4 m.
3. Timeline is based on mine plan as reported in 23590671-067-TM-Rev0-51393
4. In place dry density of 1.35 tonnes/m^3 assumed.
5. Barge to be relocated in 2024.

CLIENT
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CONSULTANT
wsp

YYYY-MM-DD	2023-04-16
PREPARED	SPC / FG
DESIGN	EW
REVIEW	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
TAILINGS DEPOSITION MODELLING RESULTS (Mine Plan; June 2019 Survey) 1% sub-aerial; 3% sub-aqueous

PROJECT No.	Phase/Task	Rev.	Figure No.
CA0020527.4505	51300/51394	0	E-3

APPENDIX F

Seepage Models

(INPUT LOCATION OF SEEPAGE FILES)

Material Properties				
Materials	**Color**	**Material Model**	**Saturated Hydraulic Conductivity (m/s)**	**Anisotropy**
Foundation Till / Glaciofluvial		Saturated Only	1×10^{-6}	0.1
Glaciolacustrine		Saturated Only	5×10^{-10}	1
Upstream Fill		Saturated / Unsaturated	1×10^{-5}	1
Till Core		Saturated / Unsaturated	1×10^{-8}	1
Filter		Saturated / Unsaturated	1×10^{-2}	1
Transition		Saturated / Unsaturated	1×10^{-2}	1
Rockfill		Saturated Only	1×10^{-2}	1
Tailings deposited since 2016		Saturated / Unsaturated	1×10^{-5}	0.1
Tailings deposited prior to 2014		Saturated / Unsaturated	1×10^{-6}	0.1
Tailings Sand		Saturated / Unsaturated	1×10^{-5}	1
Cutoff Wall		Saturated Only	1×10^{-8}	1
Upstream Drain		Saturated / Unsaturated	1×10^{-2}	1
Bedrock		None	-	-

REFERENCES/NOTES

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS
MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**51300.51395**	**0**	**F-1**

(INPUT LOCATION OF SEEPAGE FILES)

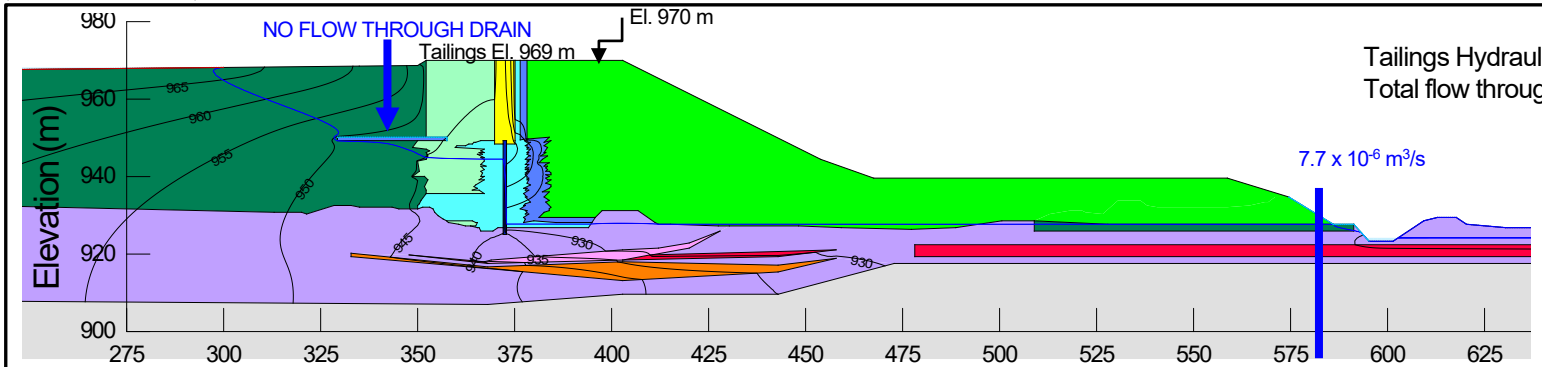

Tailings Hydraulic Conductivity: 1.0 x 10^{-6} m/s
Total flow through upstream drain discharge pipe: 0 L/s

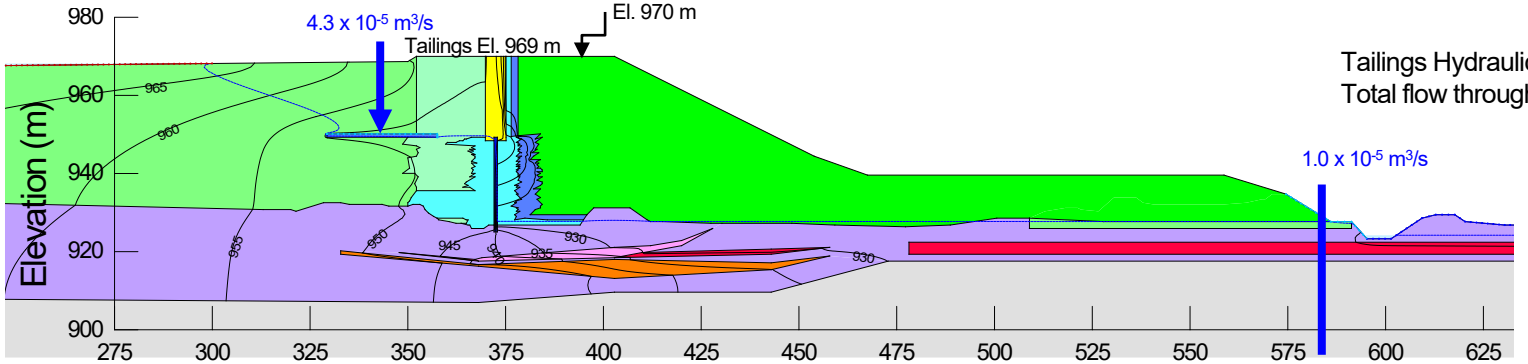

Tailings Hydraulic Conductivity: 1.0 x 10^{-5} m/s
Total flow through upstream drain discharge pipe: 15 L/s

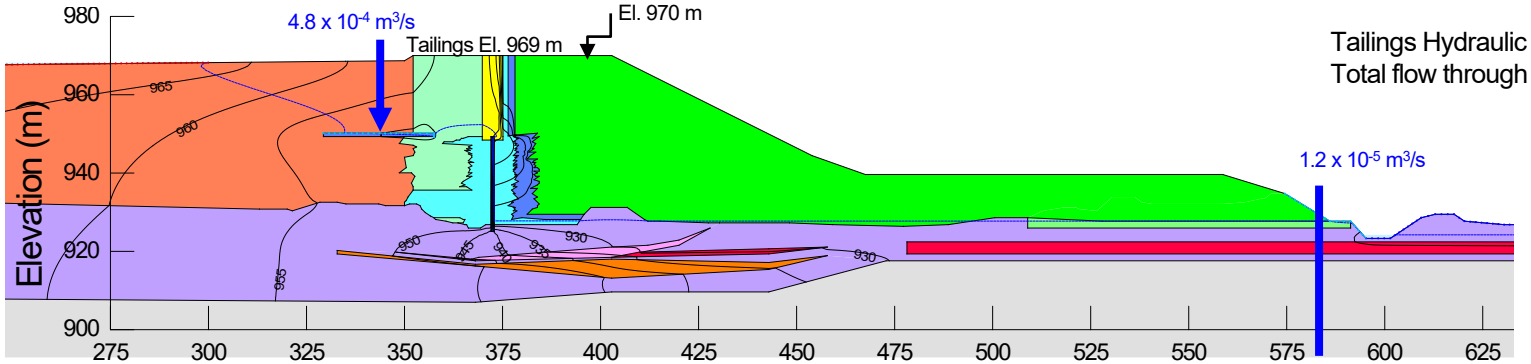

Tailings Hydraulic Conductivity: 1.0 x 10^{-4} m/s
Total flow through upstream drain discharge pipe: 167 L/s

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Beach width: 50 m.
3. Zero flow boundary applied for the drain.
4. Tailings Anisotropy: 0.1
5. Upstream flow rate reported by MPMC has varied between approximately 20 L/s to 45 L/s with beach widths ranging from 0 m to approximately 200 m.

CLIENT
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CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS
CORNER 1 CALIBRATION

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**51300.51395**	**0**	**F-2**

(INPUT LOCATION OF SEEPAGE FILES)

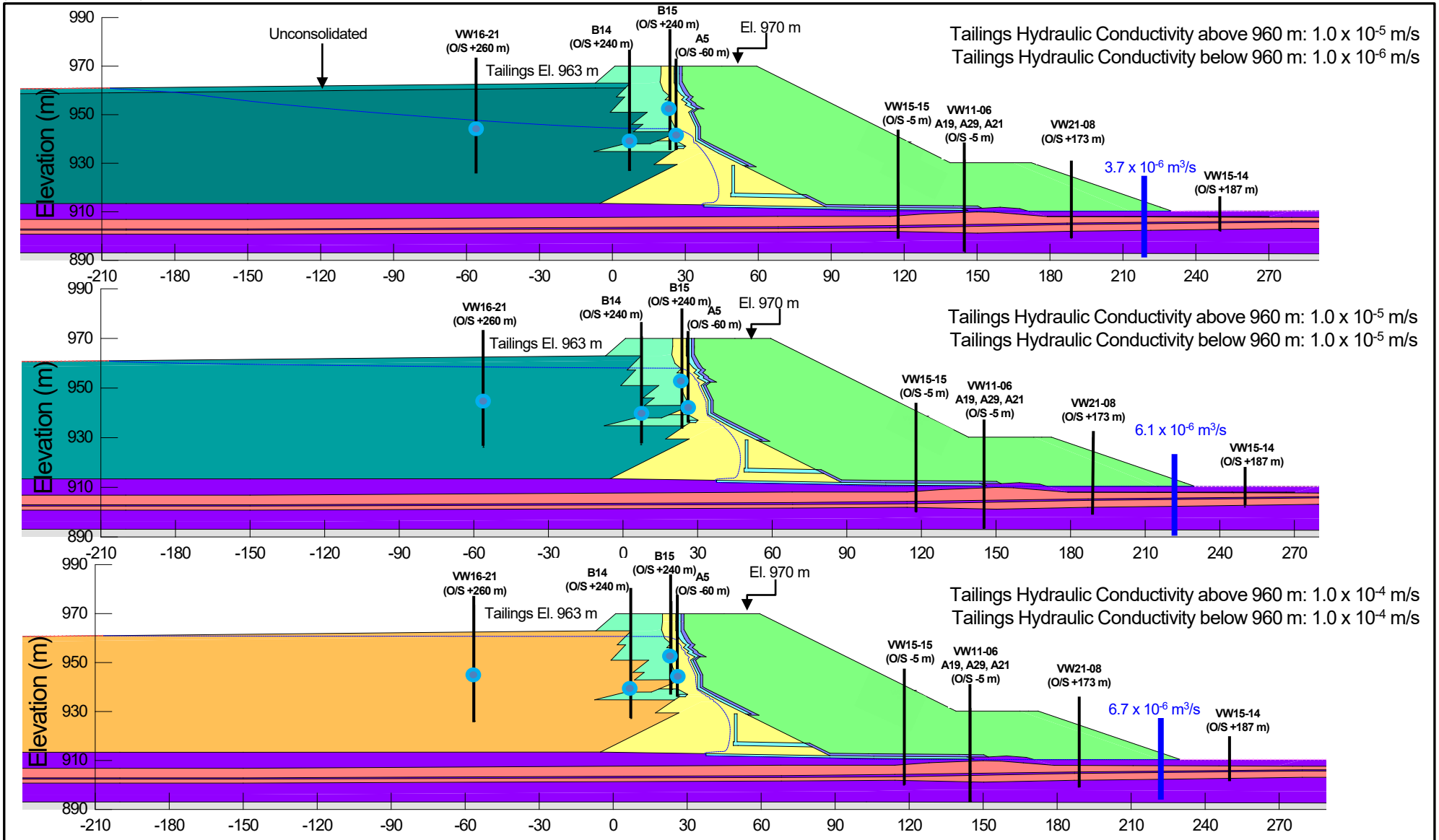

REFERENCES/NOTES

1. Tailings Anisotropy: 0.1
2. Beach width: 200 m.
3. Hydraulic conductivity of Foundation till and Glaciofluvial calibrated to 1x10-6 m/s.

VWP Pressure Reading

Piezometric Line

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS
MAIN EMBANKMENT CALIBRATION

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-3

(INPUT LOCATION OF SEEPAGE FILES)

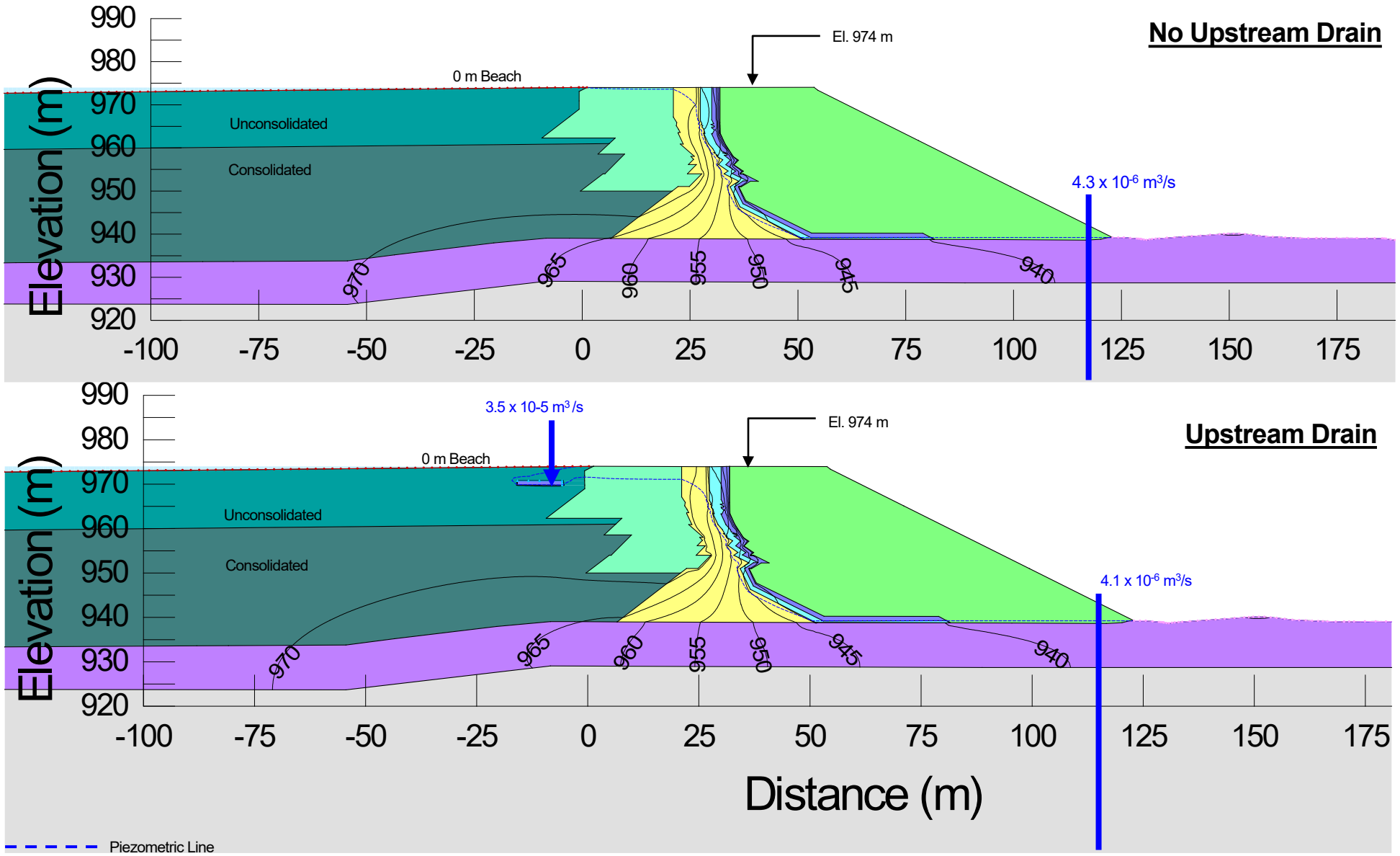

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 27 m from till core.

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DESIGNED	YJ
REVIEWED	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
NO SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-4

(INPUT LOCATION OF SEEPAGE FILES)

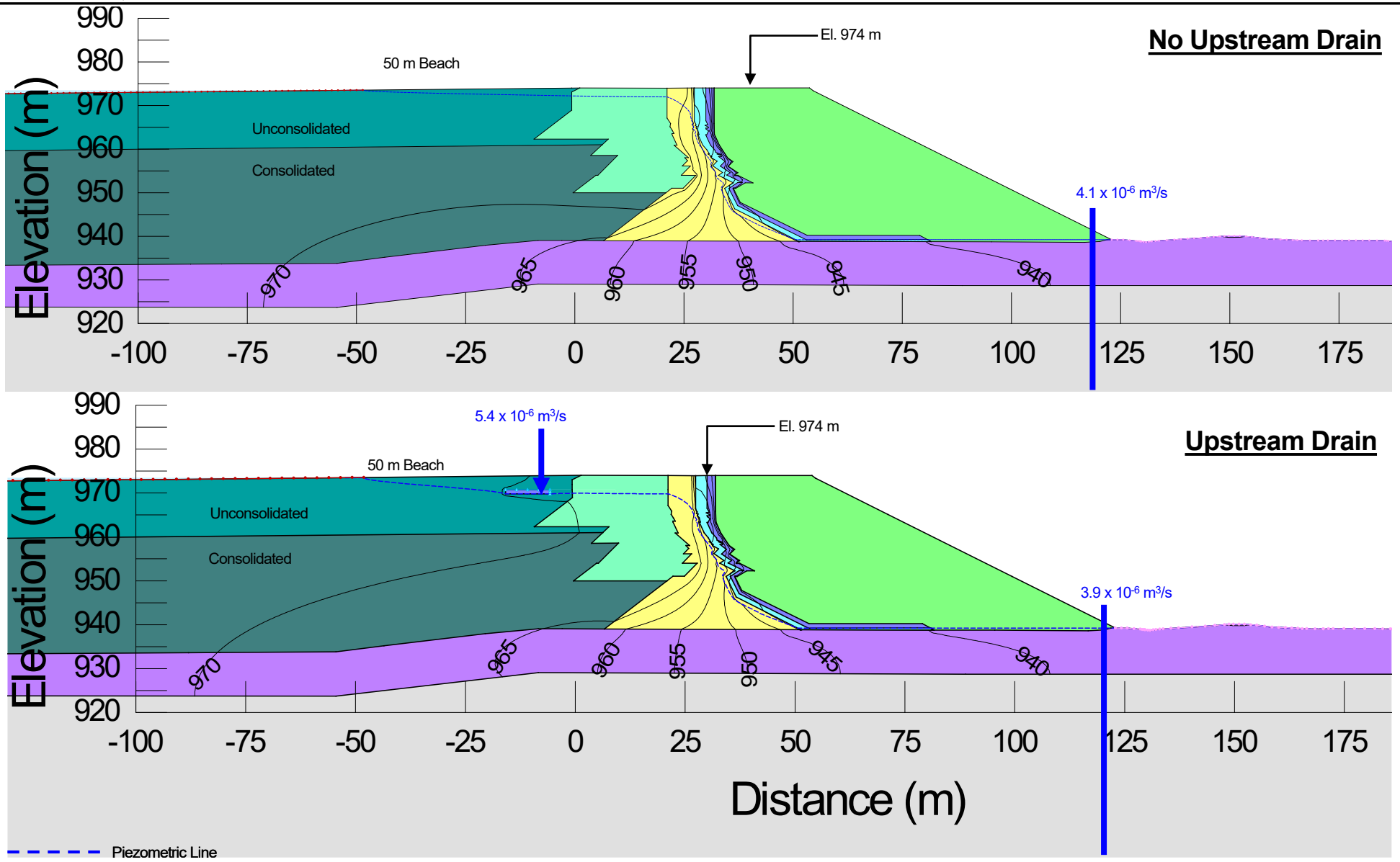

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 27 m from till core.

CLIENT
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DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
50 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-5

(INPUT LOCATION OF SEEPAGE FILES)

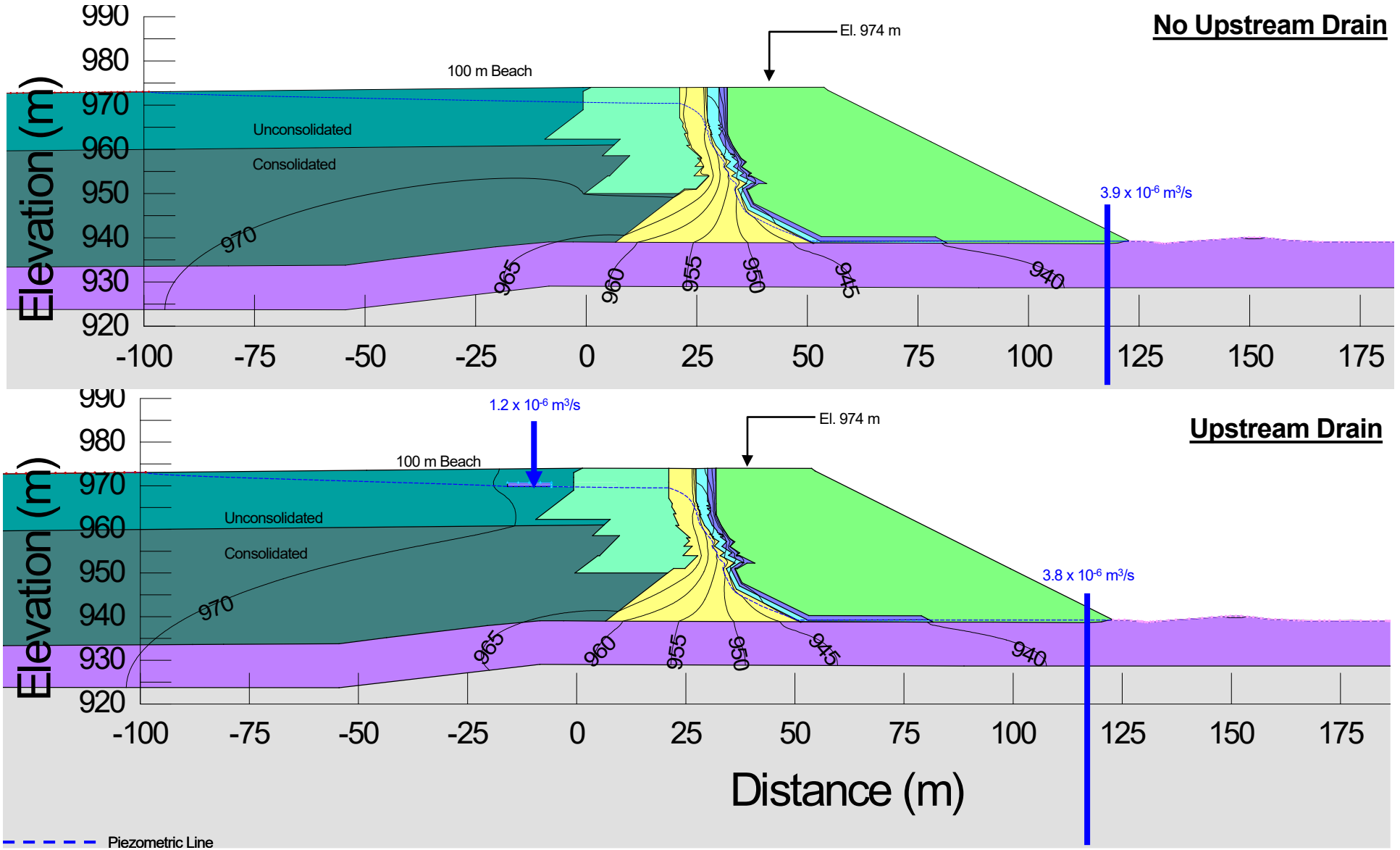

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 27 m from till core.

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DESIGNED	YJ
REVIEWED	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
100 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-6

(INPUT LOCATION OF SEEPAGE FILES)

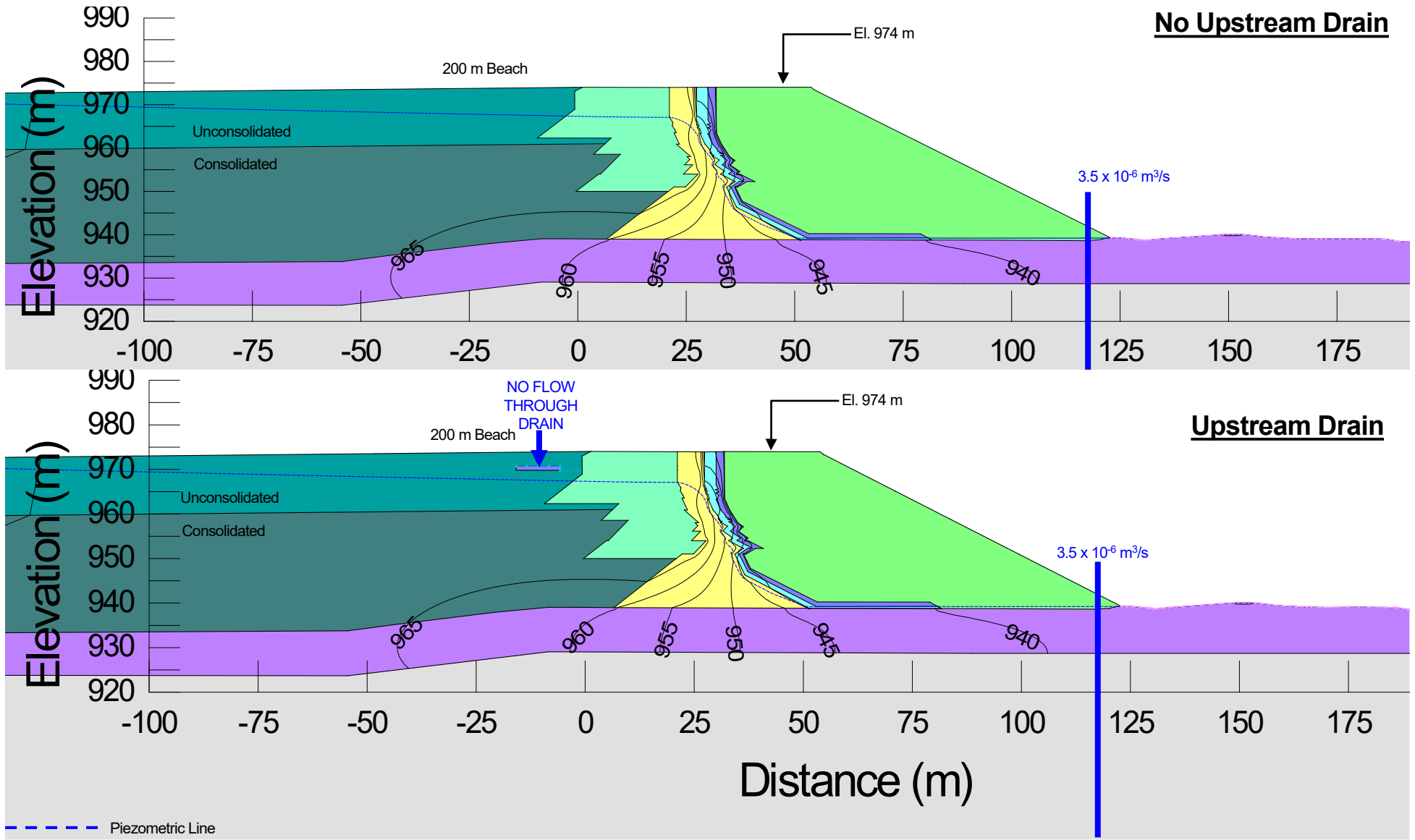

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 27 m from till core.

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PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
200 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-7

(INPUT LOCATION OF SEEPAGE FILES)

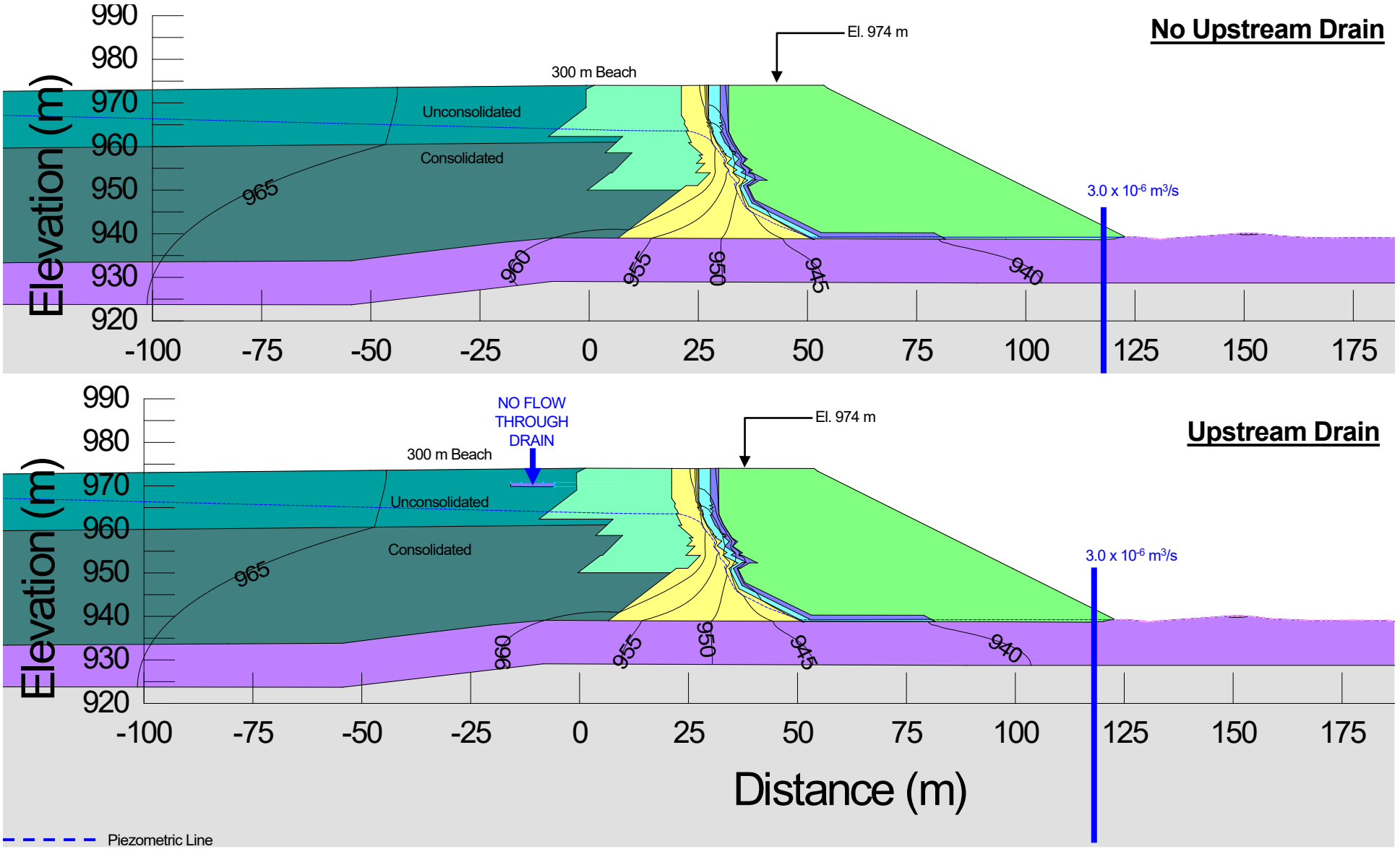

REFERENCES/NOTES

1. Contours show total head, 5 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 27 m from till core.

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DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
300 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-8

(INPUT LOCATION OF SEEPAGE FILES)

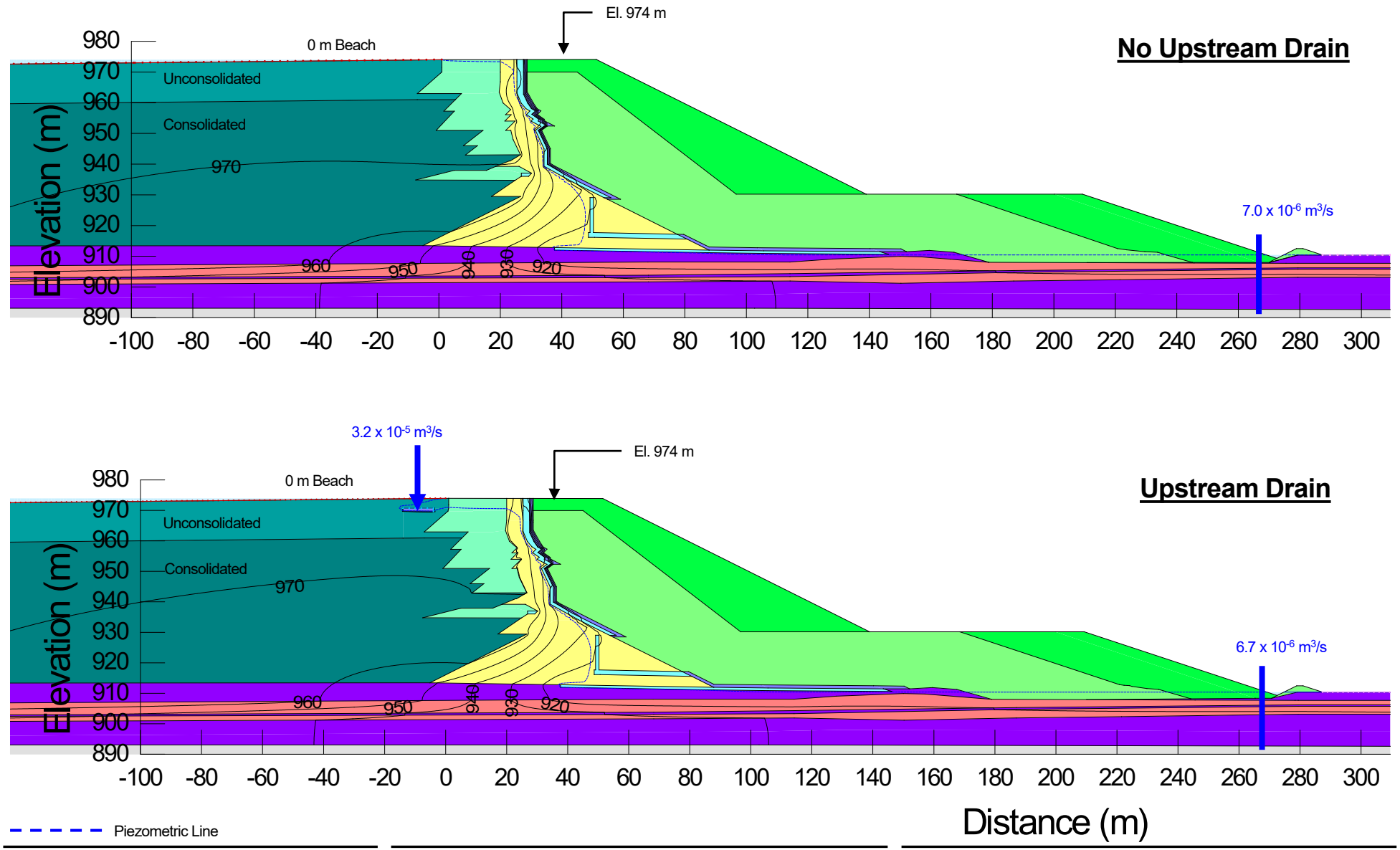

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 24 m from till core

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DESIGNED	YJ
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
NO SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-9

(INPUT LOCATION OF SEEPAGE FILES)

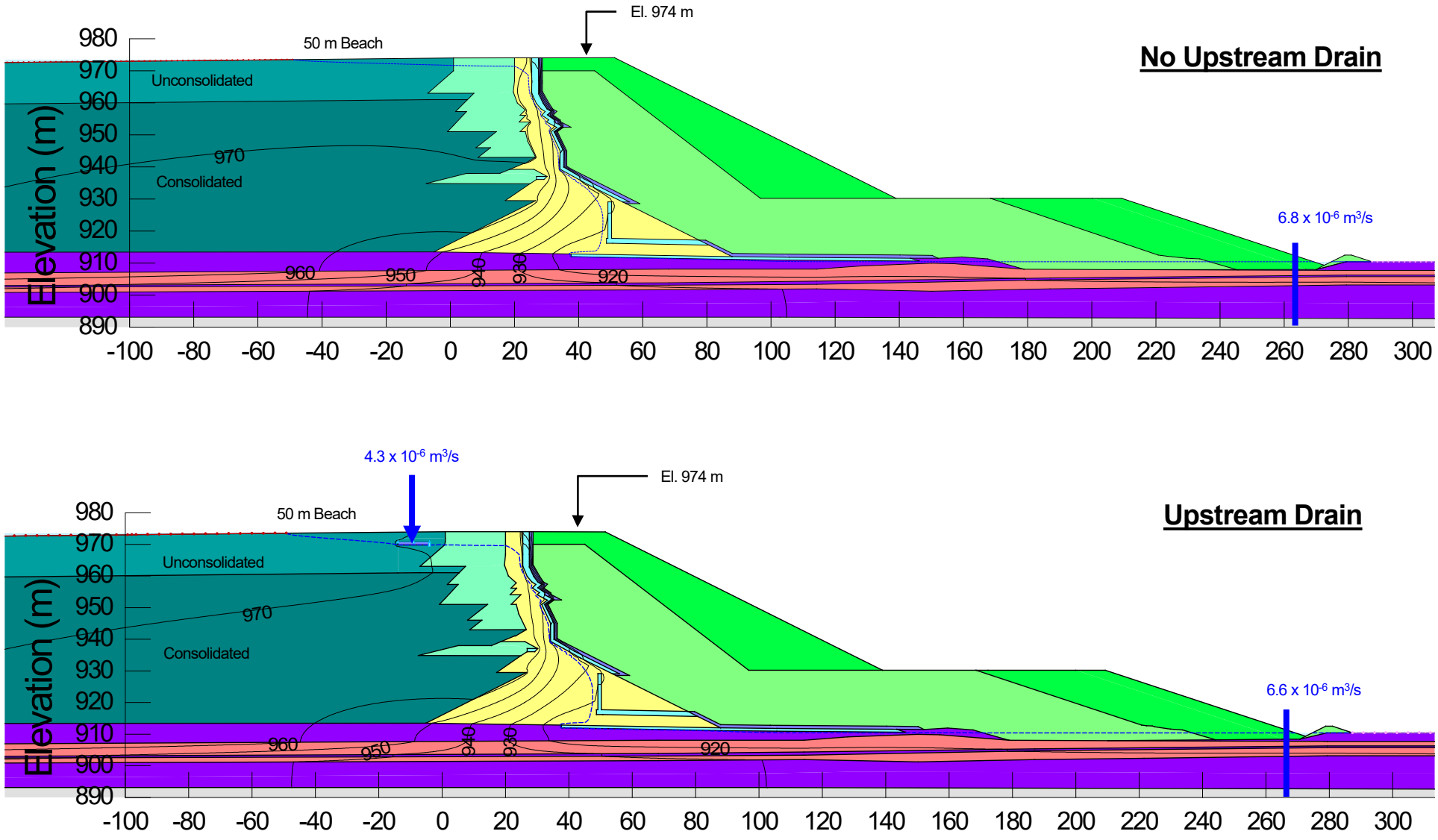

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 24 m from till core

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PREPARED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
50 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-10

(INPUT LOCATION OF SEEPAGE FILES)

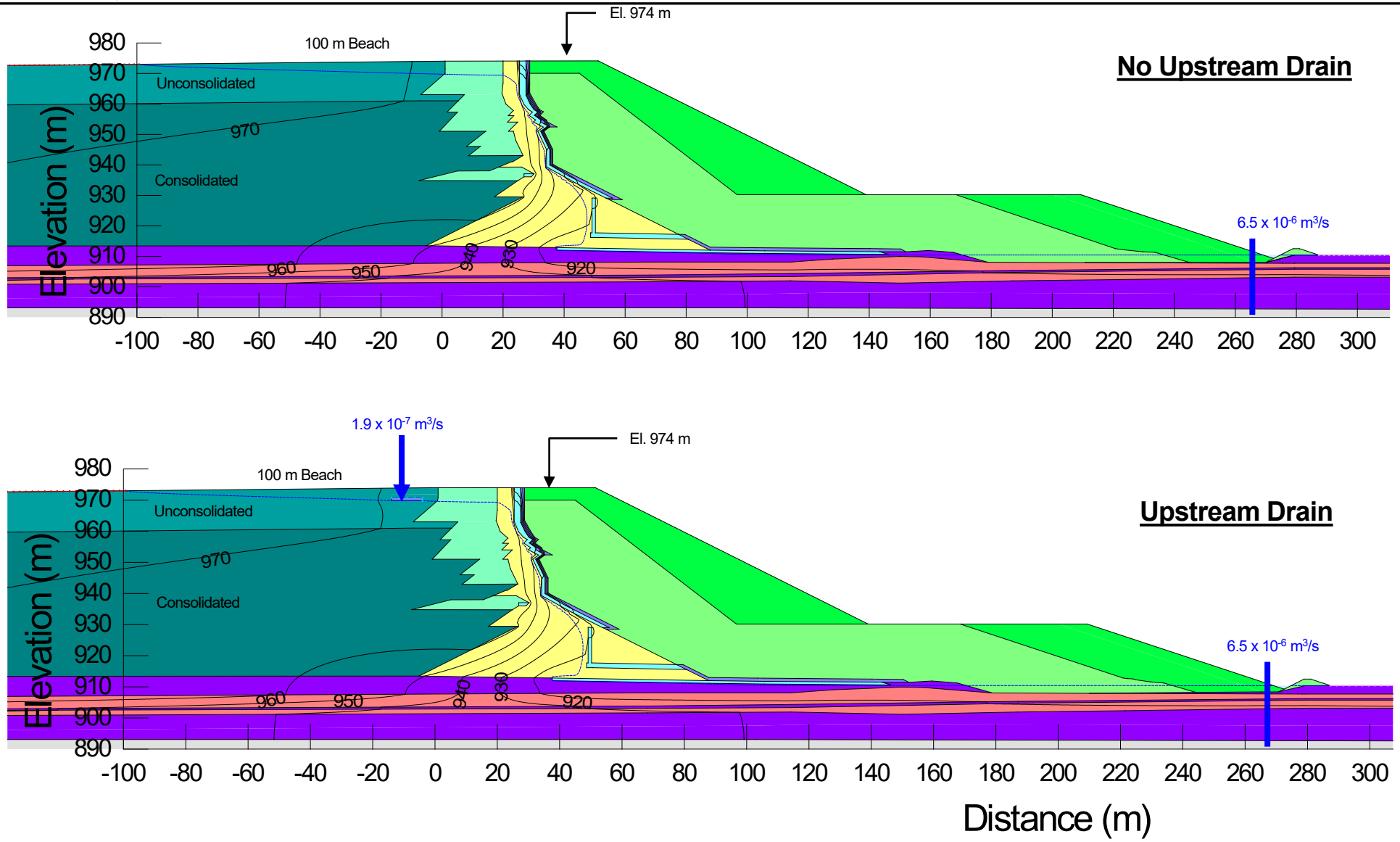

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 24 m from till core

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MOUNT POLLEY MINING CORPORATION

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PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
100 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-11

(INPUT LOCATION OF SEEPAGE FILES)

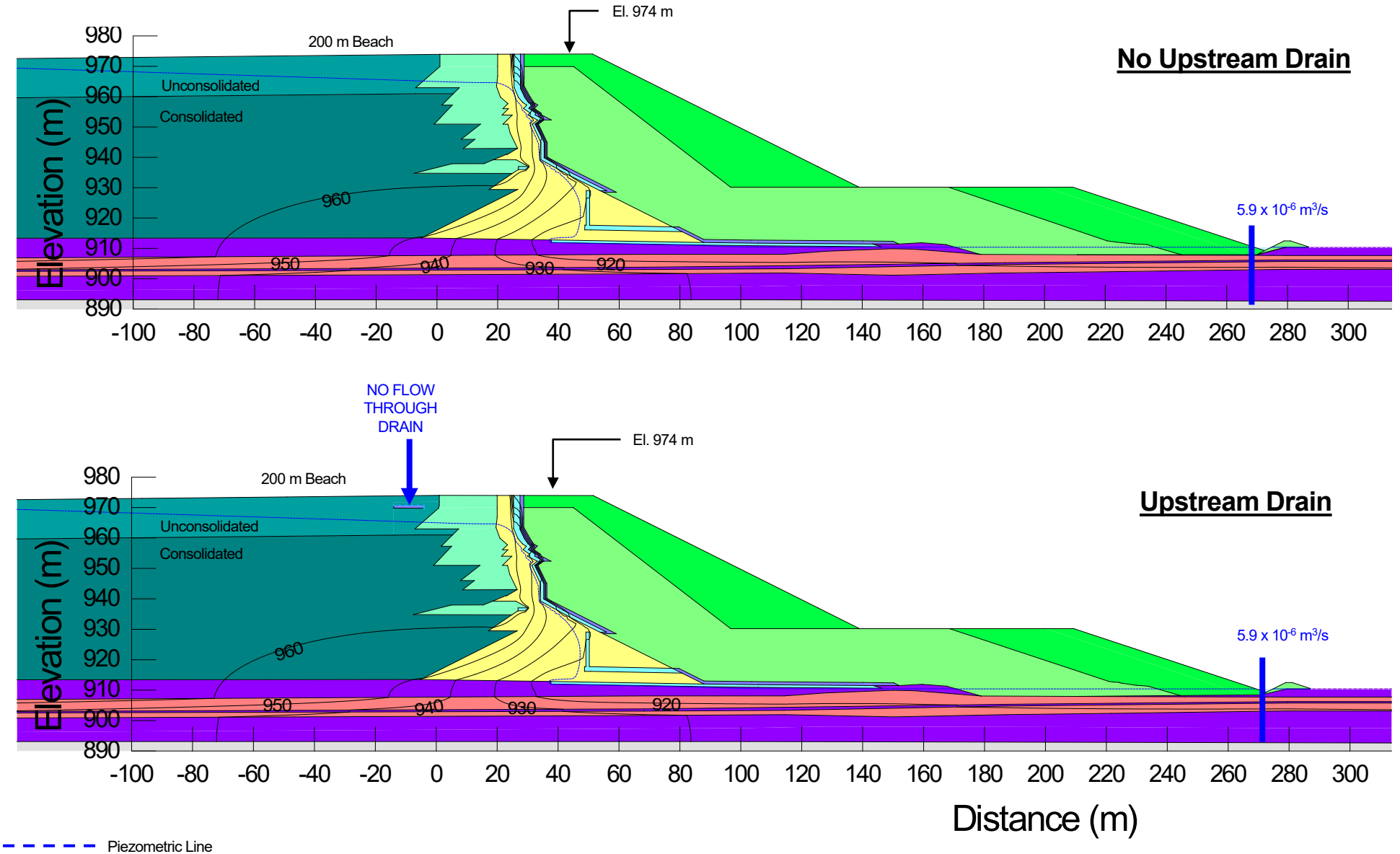

Piezometric Line

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 24 m from till core

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PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
200 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-12

(INPUT LOCATION OF SEEPAGE FILES)

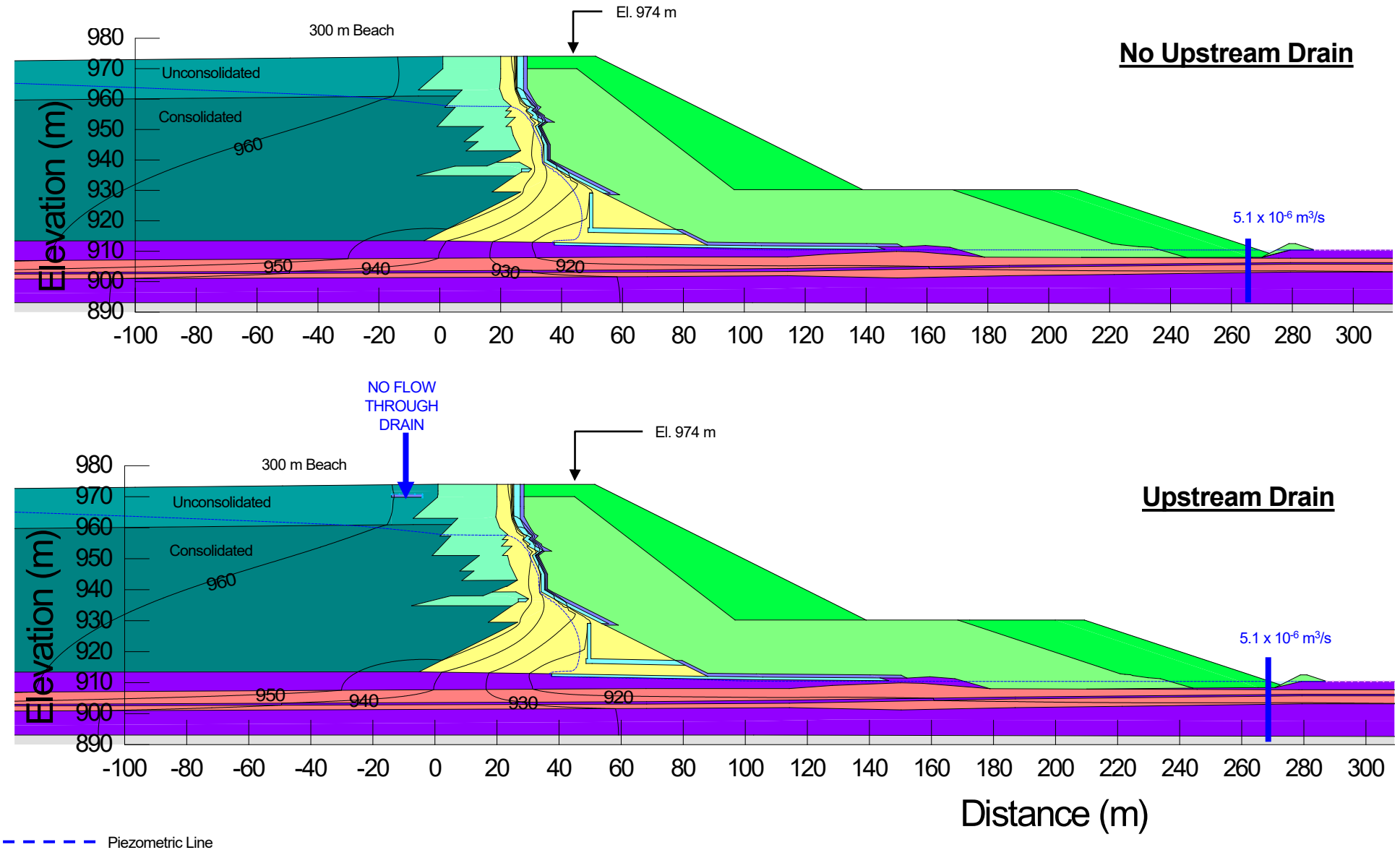

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 24 m from till core

CLIENT
MOUNT POLLEY MINING CORPORATION

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PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
300 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-13

(INPUT LOCATION OF SEEPAGE FILES)

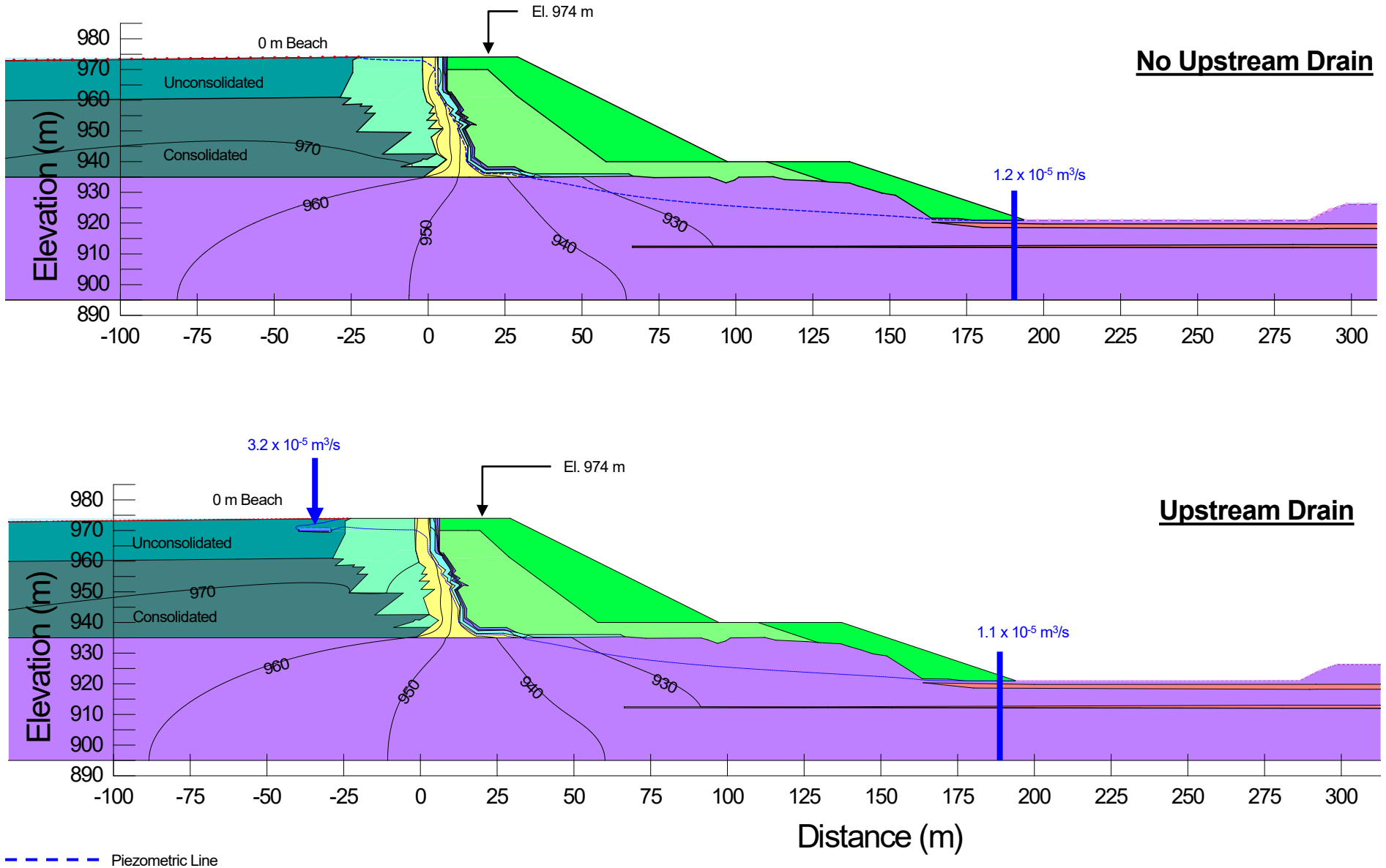

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 28 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
NO SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-14

(INPUT LOCATION OF SEEPAGE FILES)

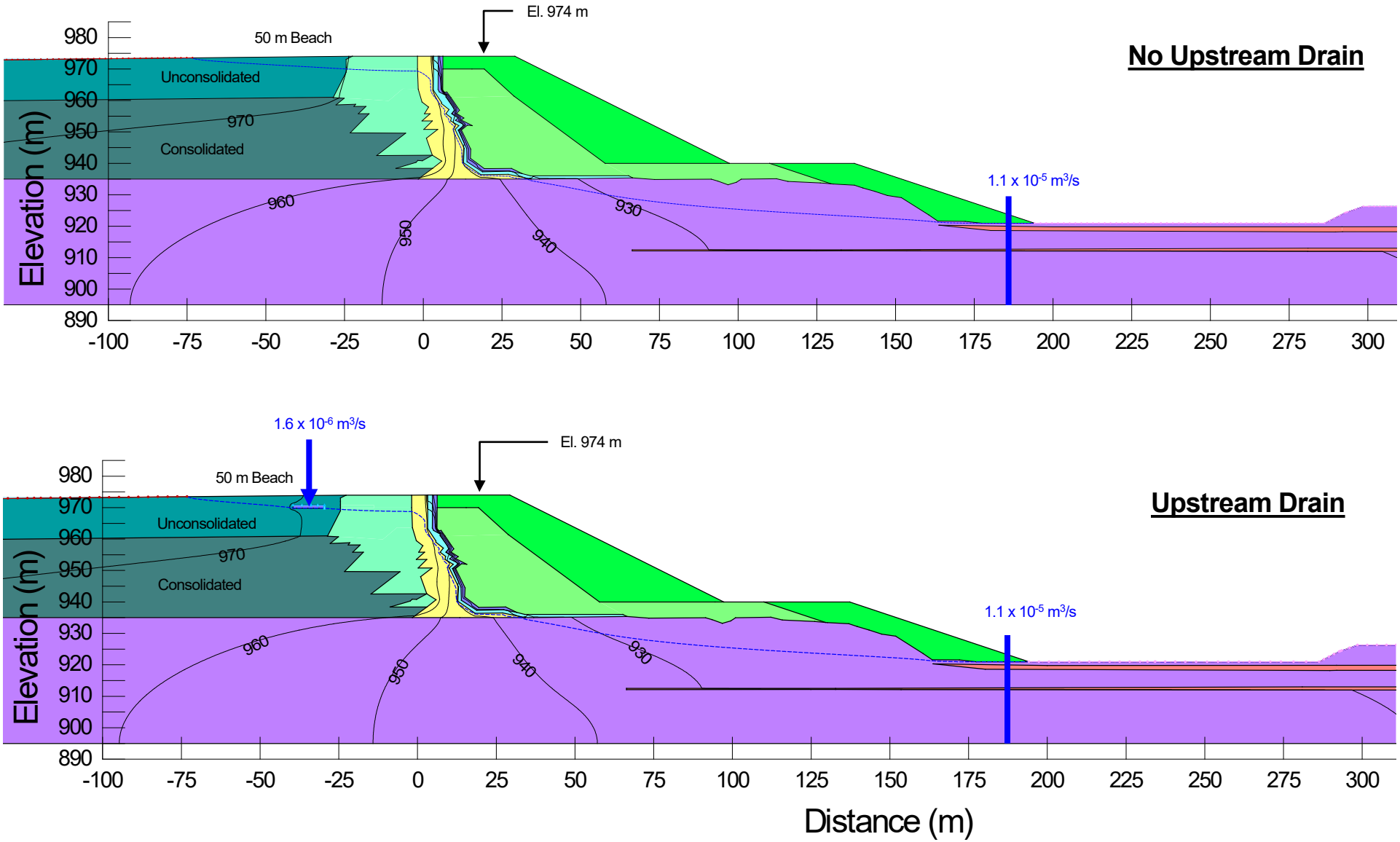

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 28 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
50 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-15

(INPUT LOCATION OF SEEPAGE FILES)

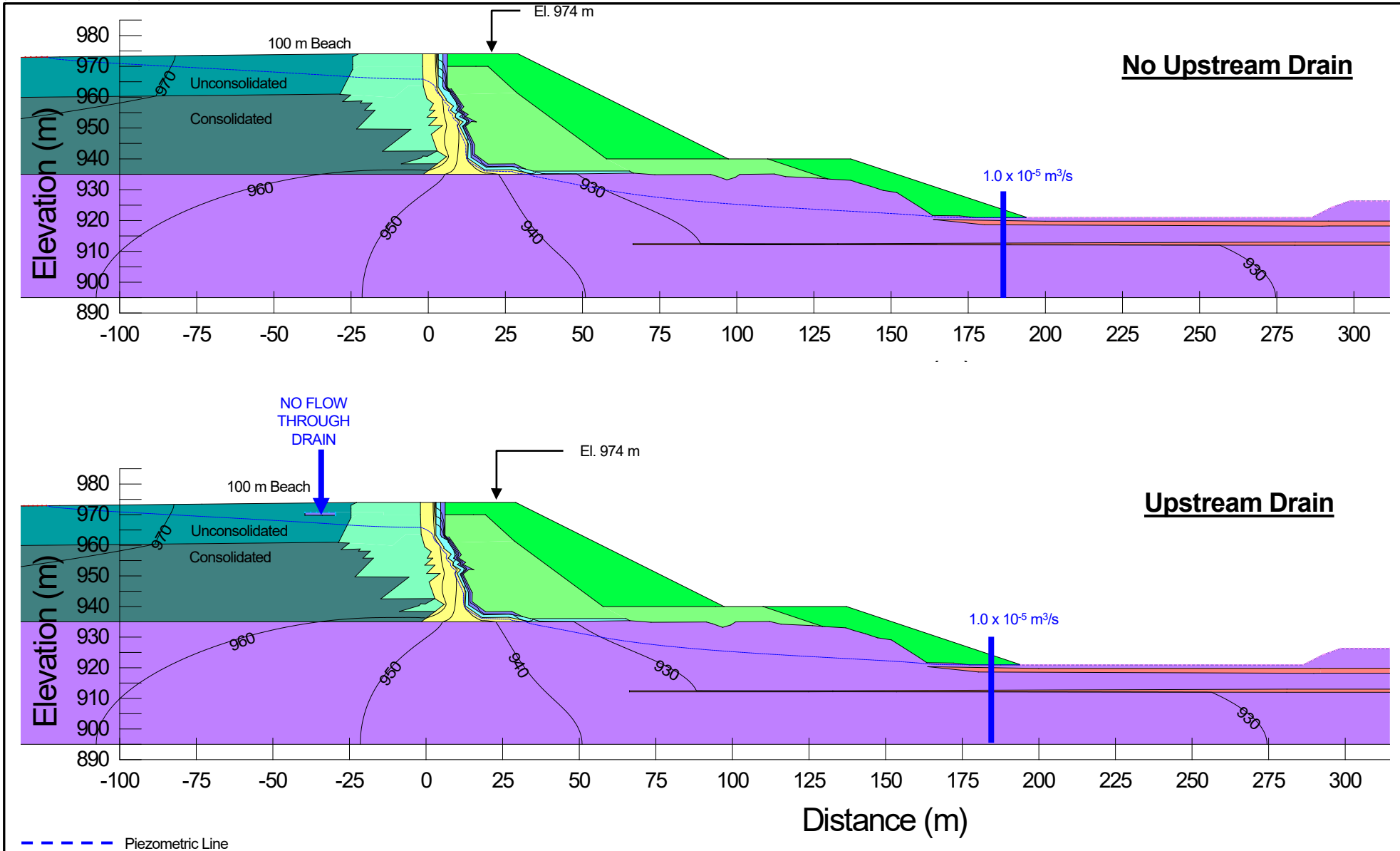

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 28 m from till core.

CLIENT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
100 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-16

(INPUT LOCATION OF SEEPAGE FILES)

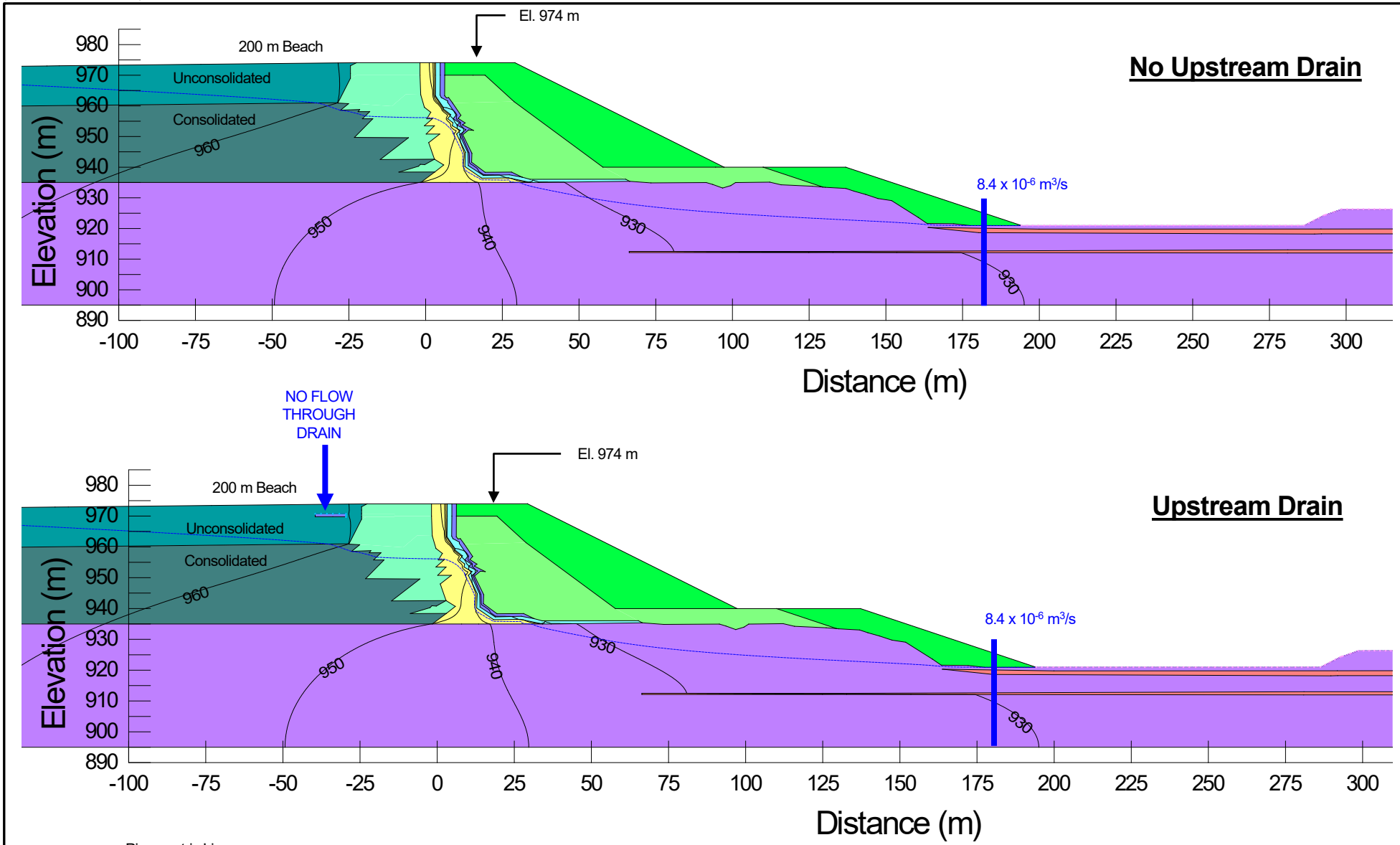

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 28 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
200 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-17

(INPUT LOCATION OF SEEPAGE FILES)

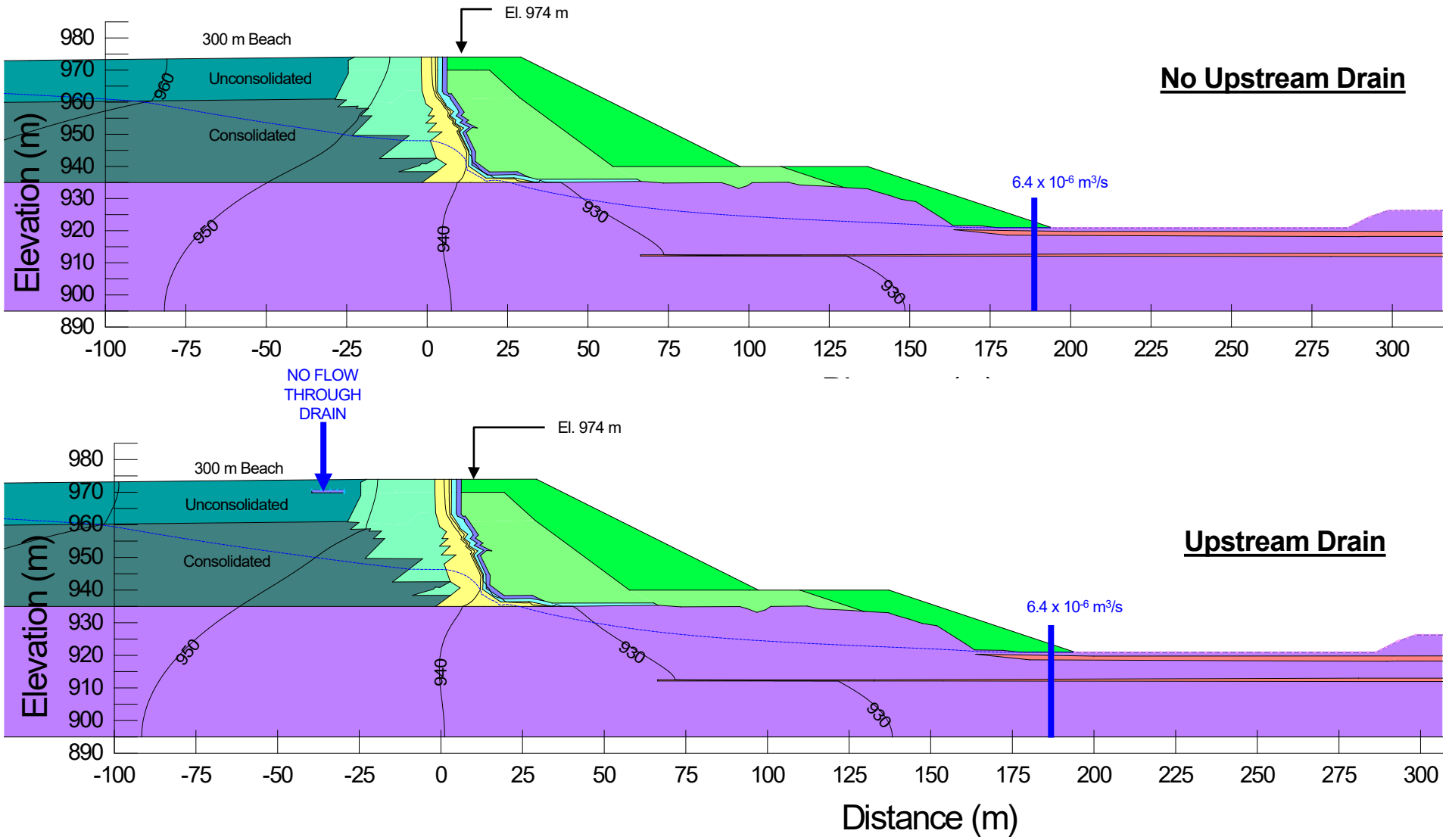

Piezometric Line

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 28 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
300 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-18

(INPUT LOCATION OF SEEPAGE FILES)

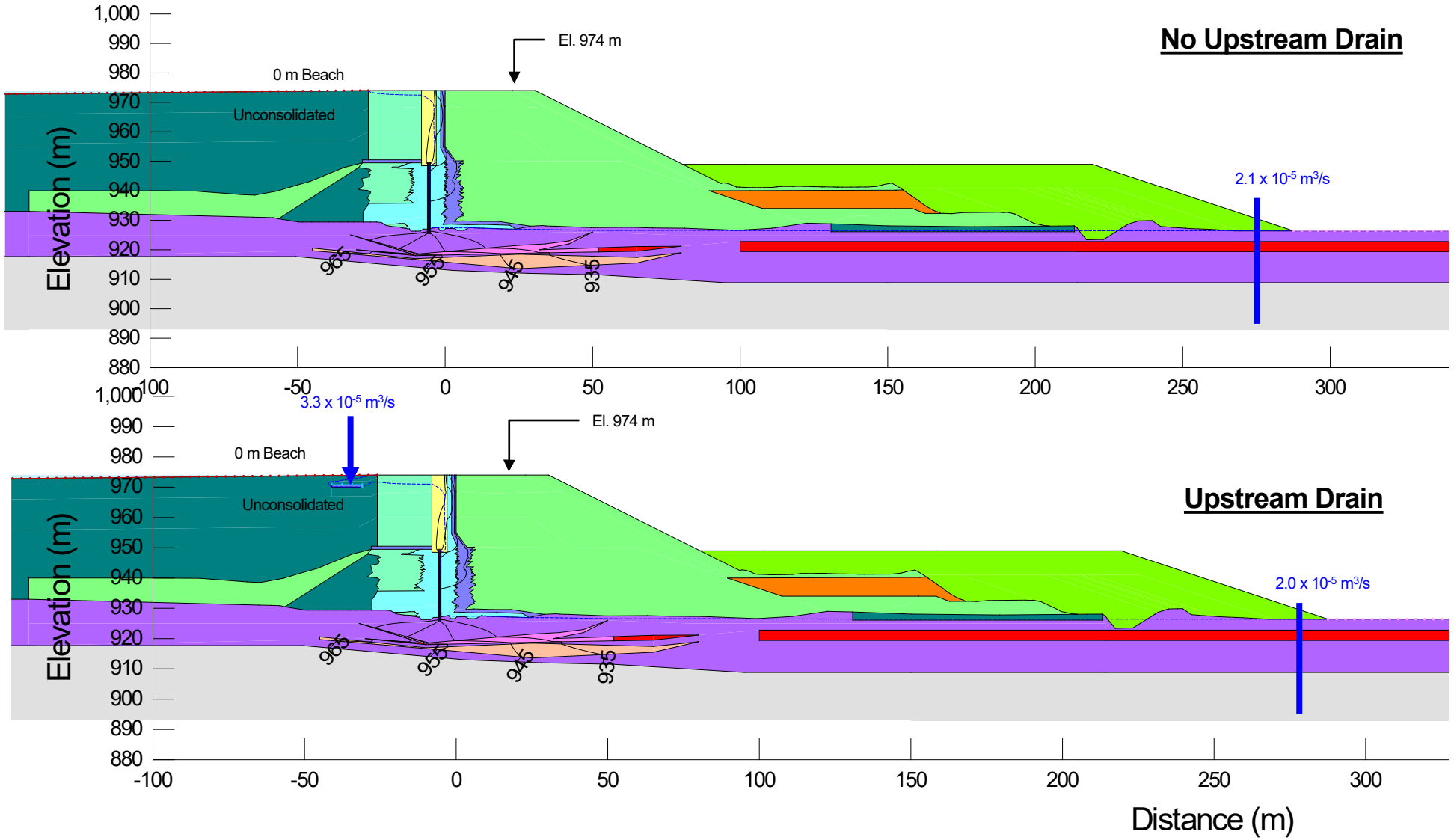

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero flow boundary applied for the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 23 m from till core.

CLIENT
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CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
NO SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-19

(INPUT LOCATION OF SEEPAGE FILES)

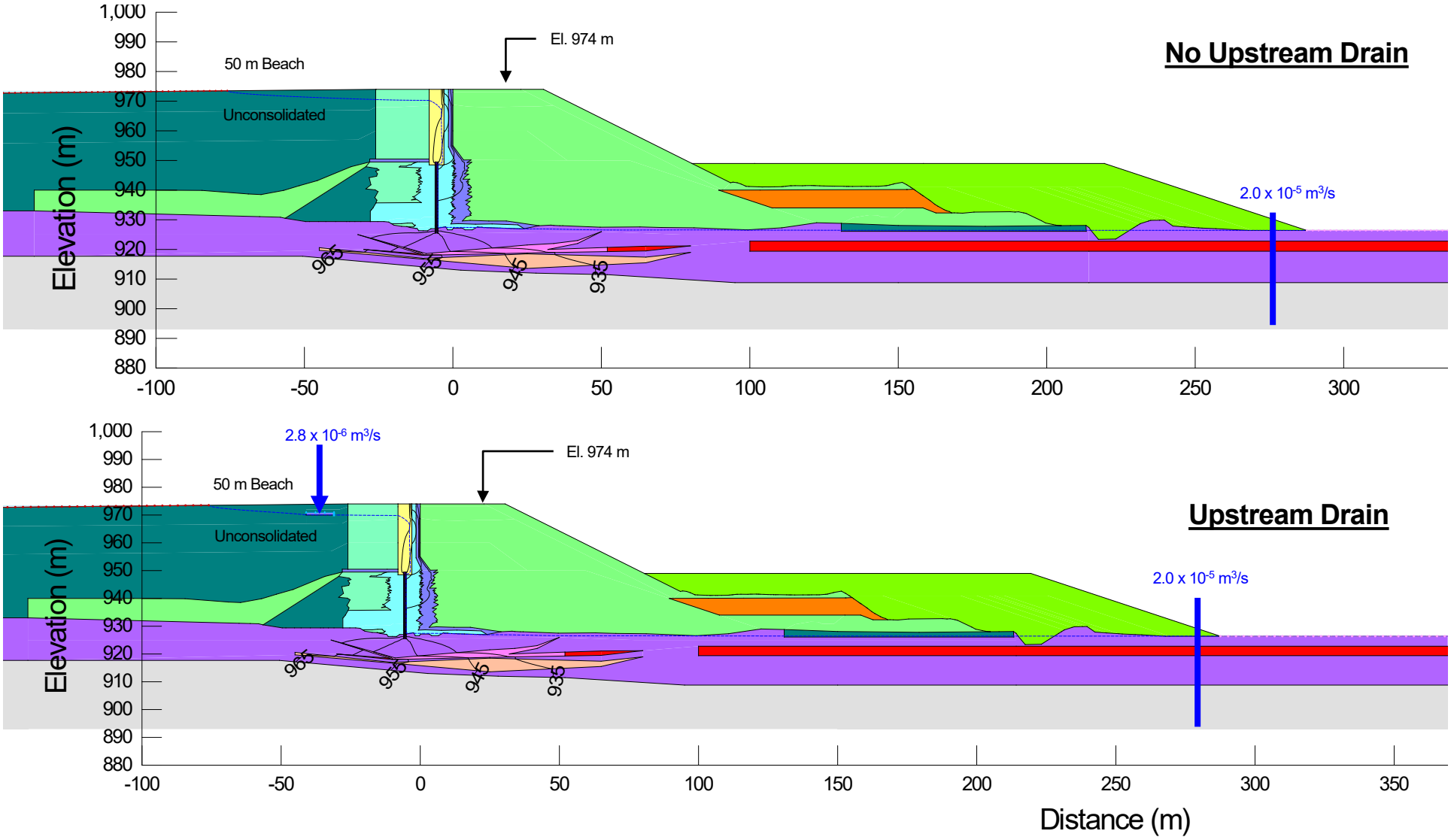

Piezometric Line

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero pressure point boundary applied within the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 23 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
50 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-20

(INPUT LOCATION OF SEEPAGE FILES)

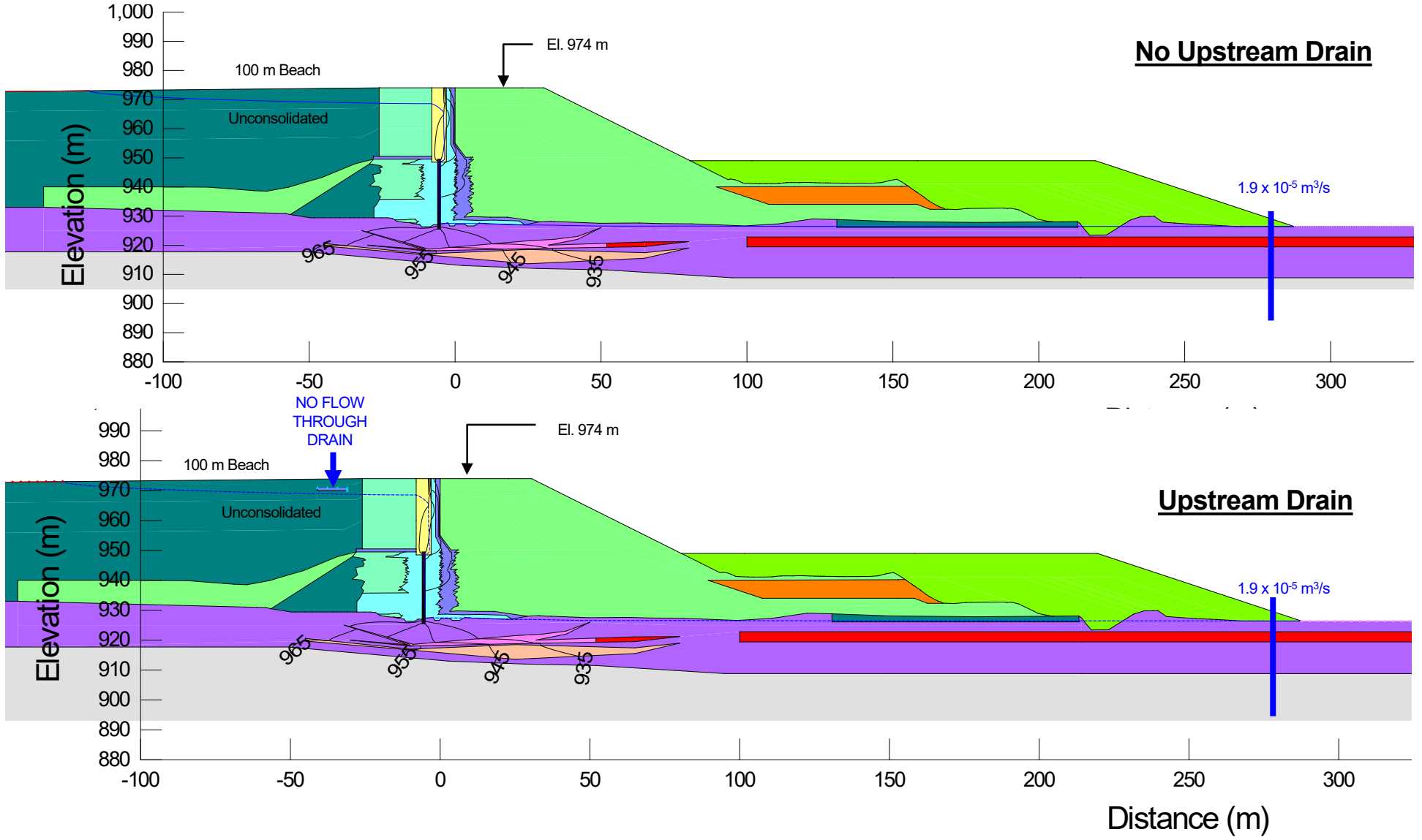

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero pressure point boundary applied within the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 23 m from till core.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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PREPARED	YJ
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REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
100 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-21

(INPUT LOCATION OF SEEPAGE FILES)

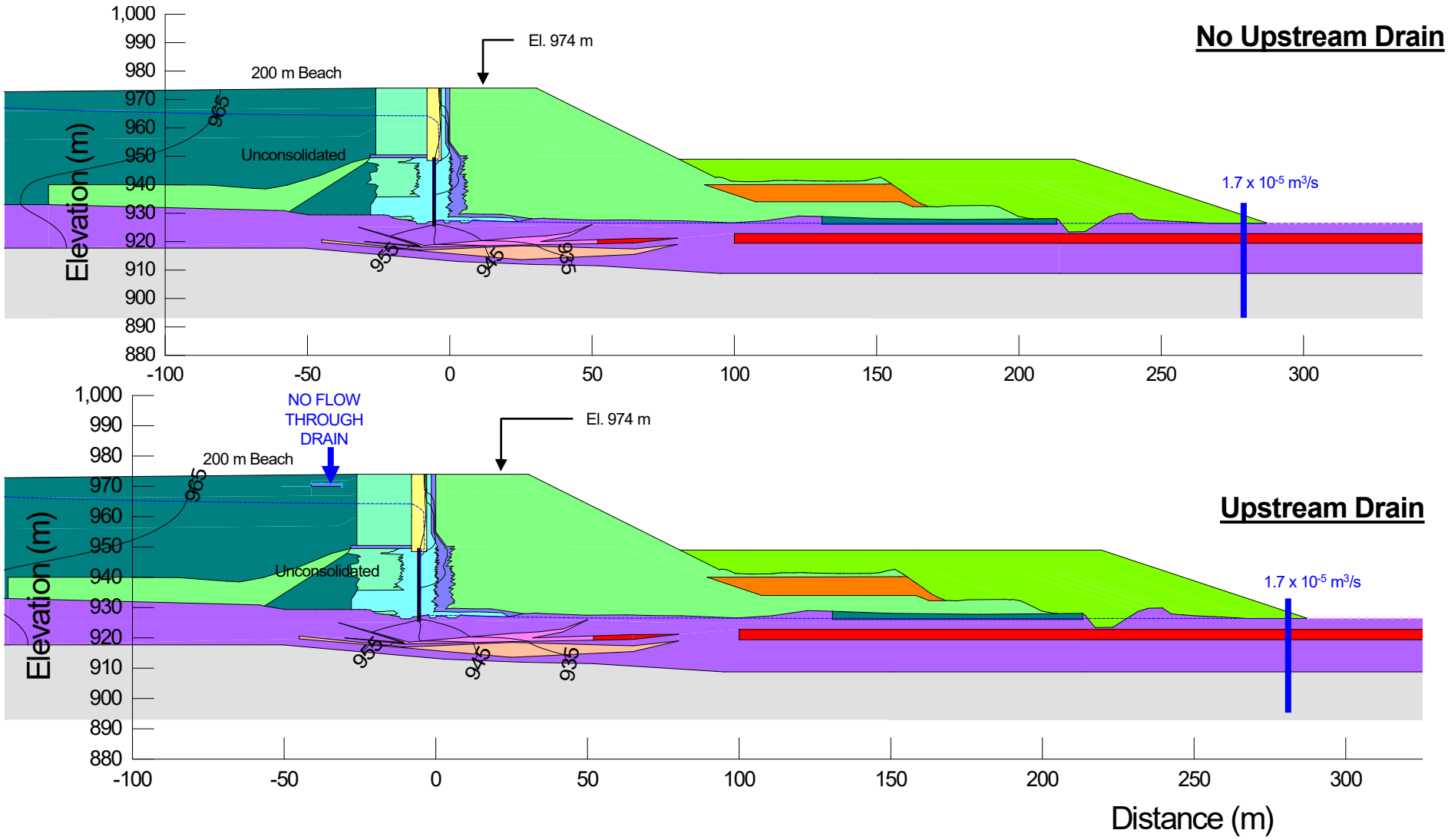

Piezometric Line

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero pressure point boundary applied within the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 23 m from till core.

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PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
200 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-22

(INPUT LOCATION OF SEEPAGE FILES)

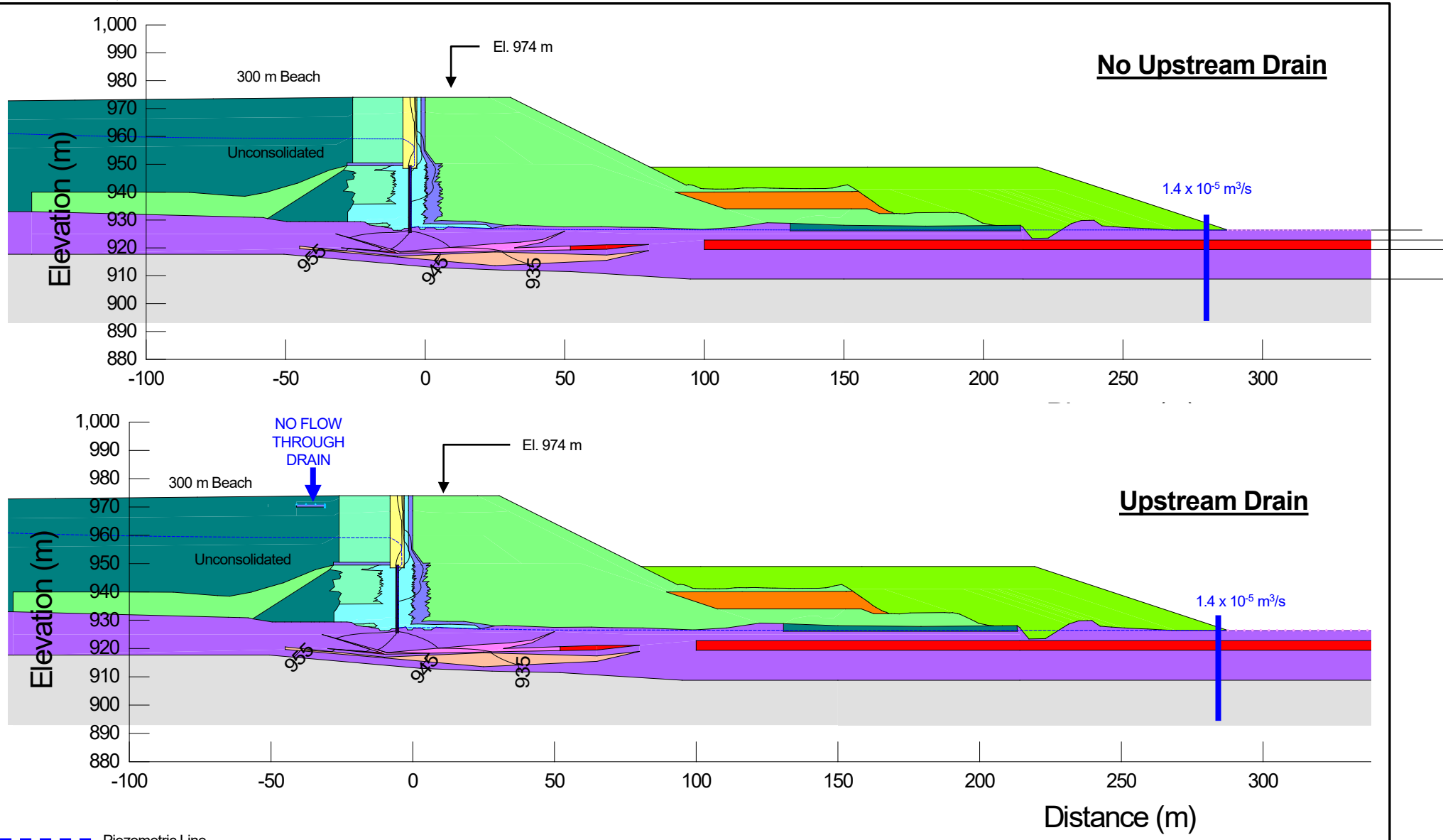

Piezometric Line

REFERENCES/NOTES

1. Contours show total head, 10 m intervals.
2. Zero pressure point boundary applied within the drain.
3. Zero pressure applied to the downstream foundation surface.
4. Upstream Drain offset 23 m from till core.

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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
SEEPAGE ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
300 m SUB-AERIAL BEACH

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	F-23

APPENDIX G

Stability Models

(INPUT LOCATION OF STABILITY FILES)

Material Properties

Glossary: φ = friction angle; *c* = cohesion

Materials	Colour	Unit Weight (kN/m³)	Pore Pressure Coefficient B-bar(1)	Strength Parameters[2]
Foundation Till		22	0.2	Mohr-Coulomb: φ = 34°; *c* = 0 kPa
Glaciofluvial		22	0.2	Mohr-Coulomb: φ = 34°; *c* = 0 kPa
Upper Glaciolacustrine (Perimeter Embankment at Corner 1)		18	0.46	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$, where σ_p' = 400 kPa Remolded: S_{ur} = 22 kPa
Lower Glaciolacustrine (Perimeter Embankment at Corner 1)		20	0.2	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$, where σ_p' = 700 kPa
Glaciolacustrine (Perimeter Embankment)		20	0.2	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$, where σ_p' = 900 kPa
Glaciolacustrine (Main Embankment) and low plasticity silty clay (South Embankment)		20	0.2	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$, where σ_p' = 1,200 kPa
Glaciolacustrine (Main Embankment - approx. El. 922 m Stn. 2+400 and 2+750)		20	0.2	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$, where σ_p' = 850 kPa
Upstream Fill		20	-	Mohr-Coulomb: φ = 32°; *c* = 0 kPa
Till Core		20.5	-	Mohr-Coulomb: φ = 33°; *c* = 0 kPa
Filter		20	-	Mohr-Coulomb: φ = 30°; *c* = 0 kPa
Transition		20	-	Shear-Normal Function: $T = 1.726\ \sigma'^{0.899}_n$
Rockfill		21.5	-	Shear-Normal Function: $T = 1.726\ \sigma'^{0.899}_n$
Tailings		17	-	Mohr-Coulomb: φ = 25°; *c* = 0 kPa Undrained: $\tau / \sigma'_v = 0.1$

REFERENCES/NOTES

1. B-bar values were assigned to the till, glaciofluvial and glaciolacustrine for the short-term static case to account for excess pore water pressures that may be generated during construction.
2. For pseudo-static loading condition, GLU shear strength reduced to 80%.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS
MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-1

(INPUT LOCATION OF STABILITY FILES)

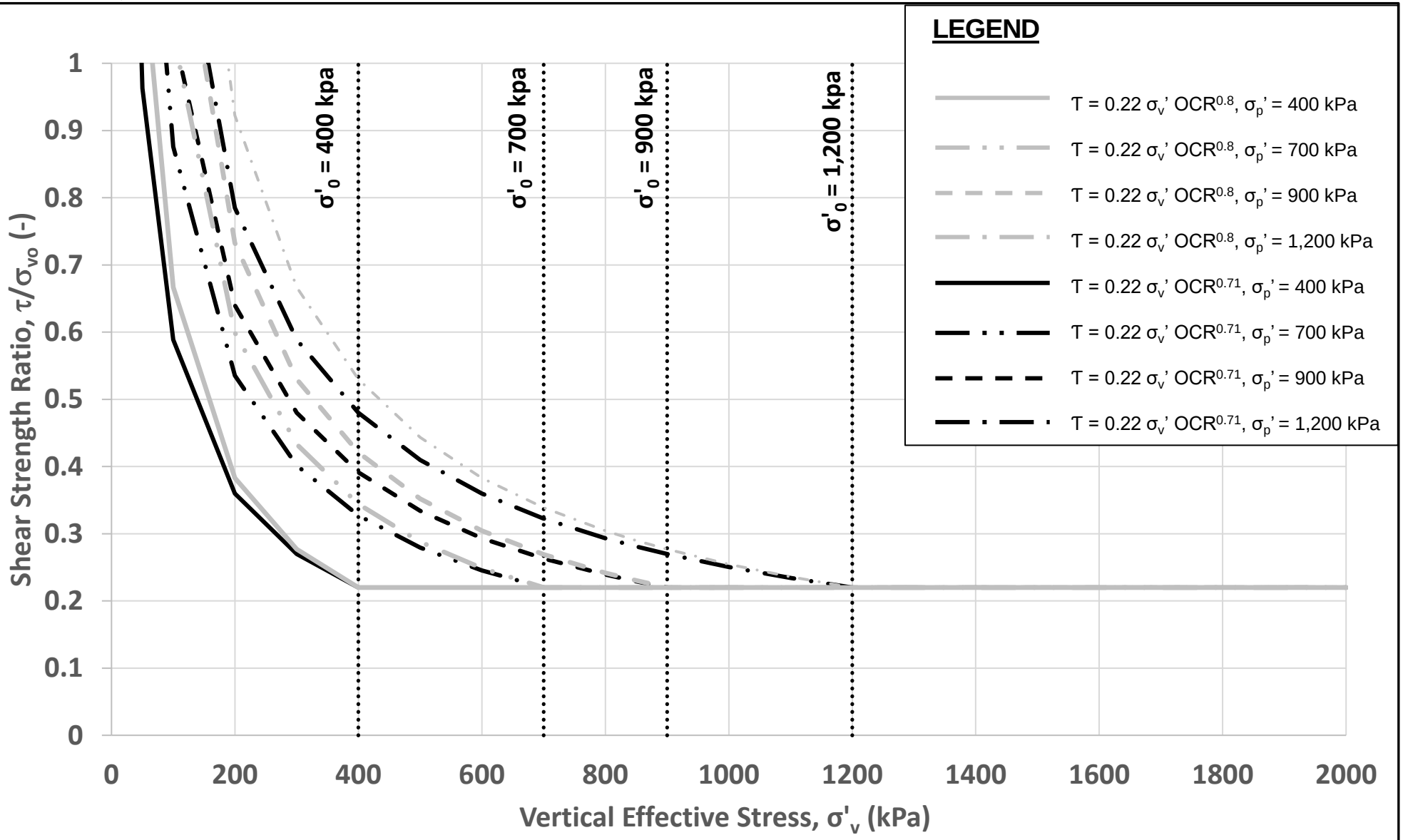

REFERENCES/NOTES

1. Grey curves depict undrained shear strength functions used in El. 970 m detailed design (Golder 2015b).
2. Black curves depict undrained shear strength functions refined for El. 974 m detailed design.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS
UNDRAINED SHEAR STRENGTH FUNCTION
GLACIOLACUSTRINE UNITS

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-2

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.1

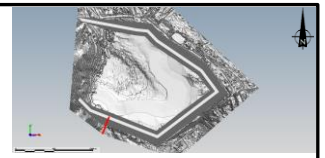

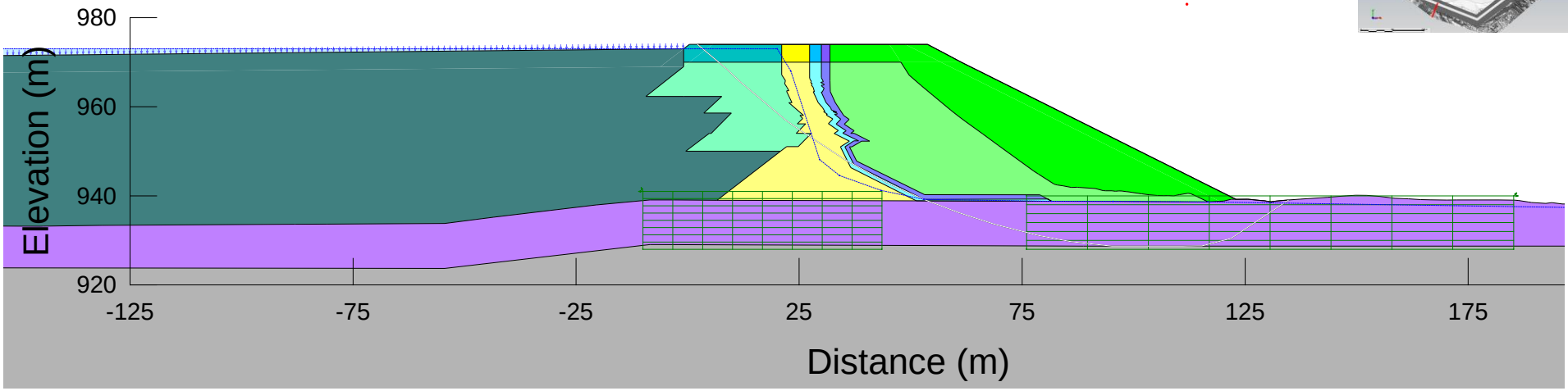

100 m beach

2.1

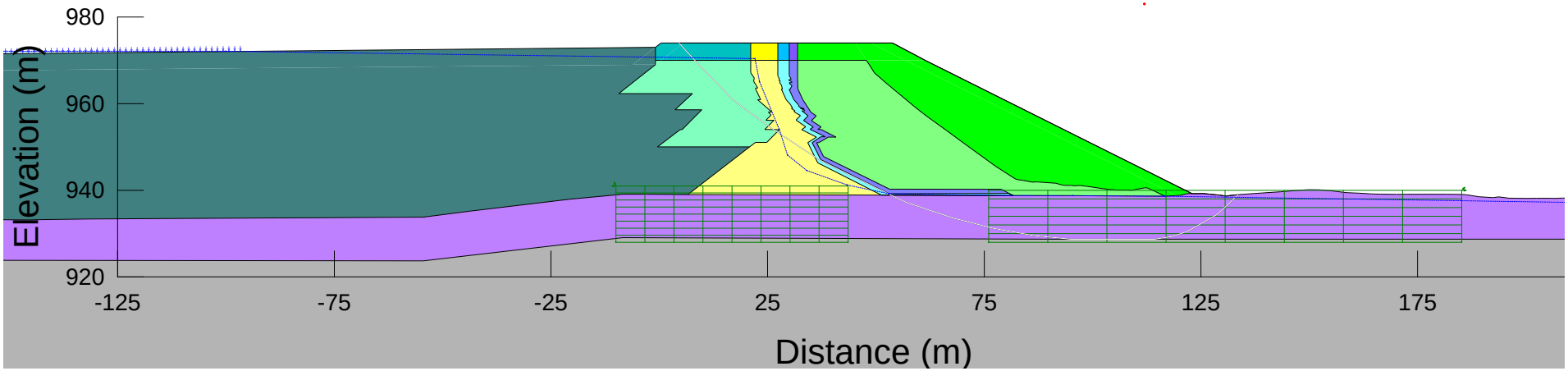

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-3

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.0

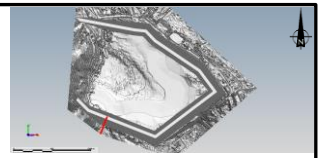

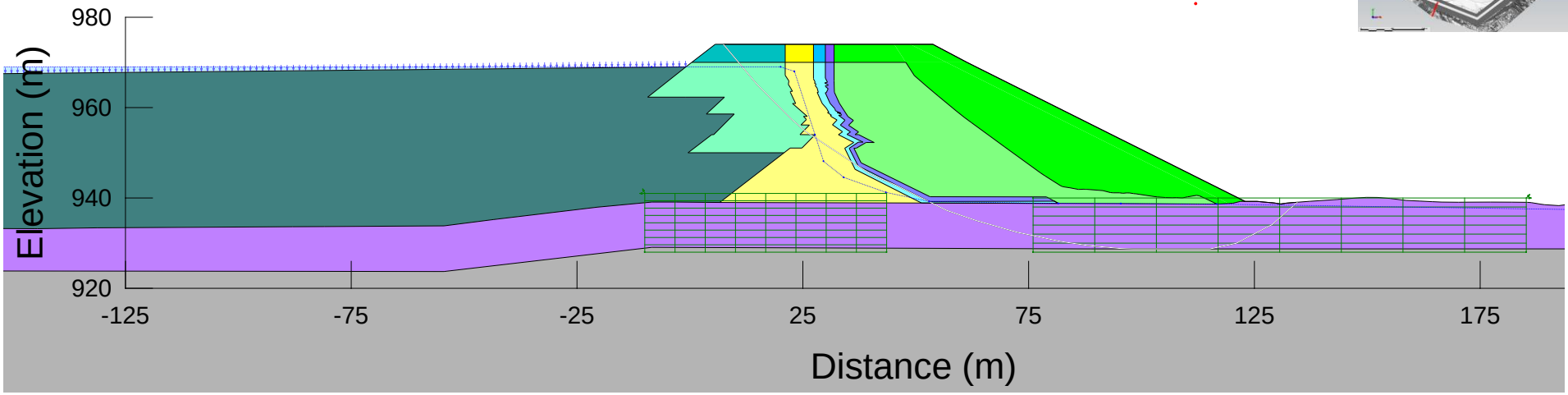

100 m beach

2.0

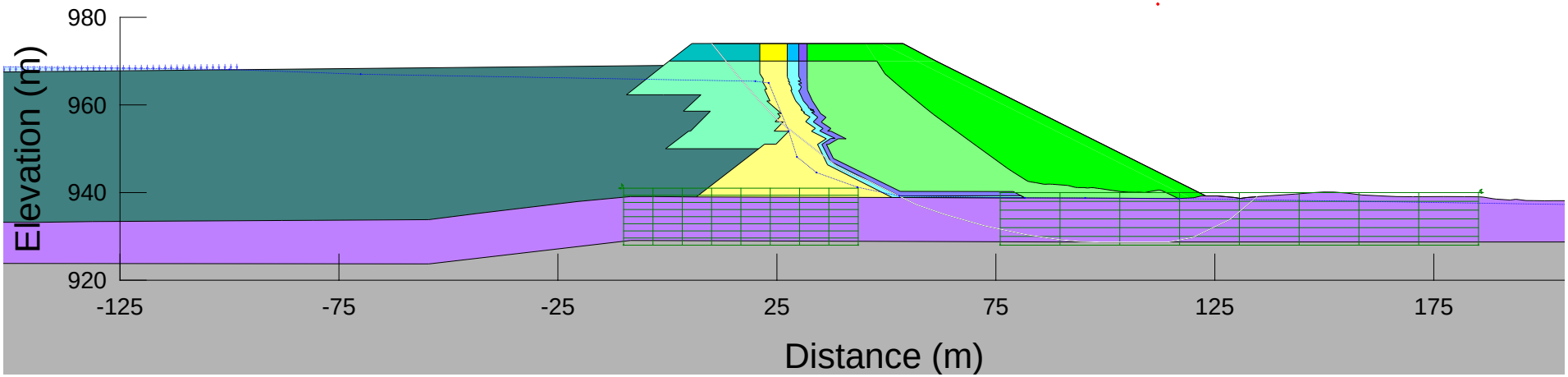

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-4

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.0

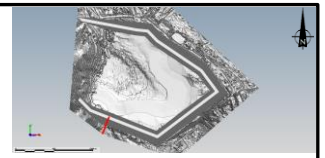

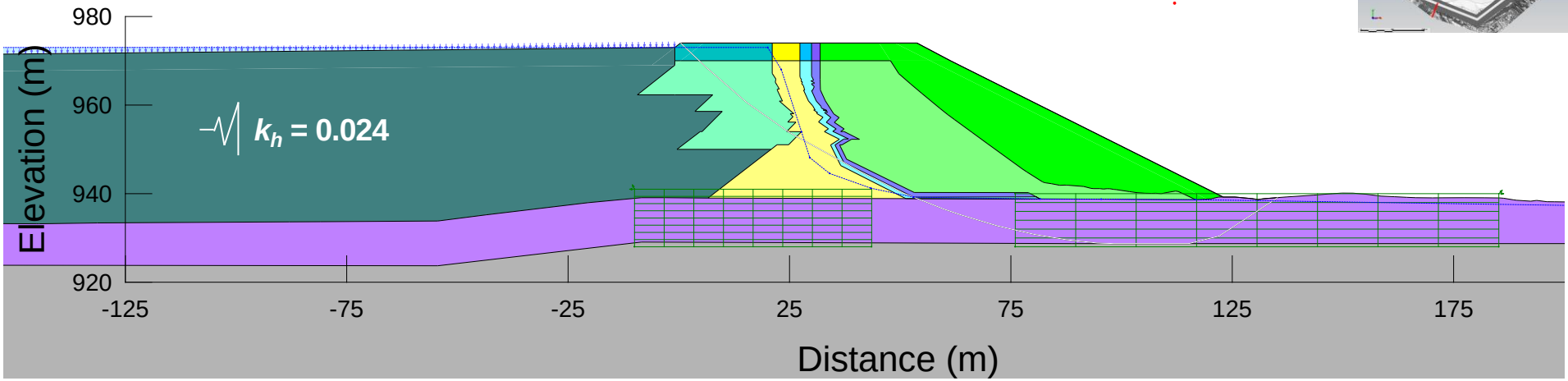

100 m beach

2.0

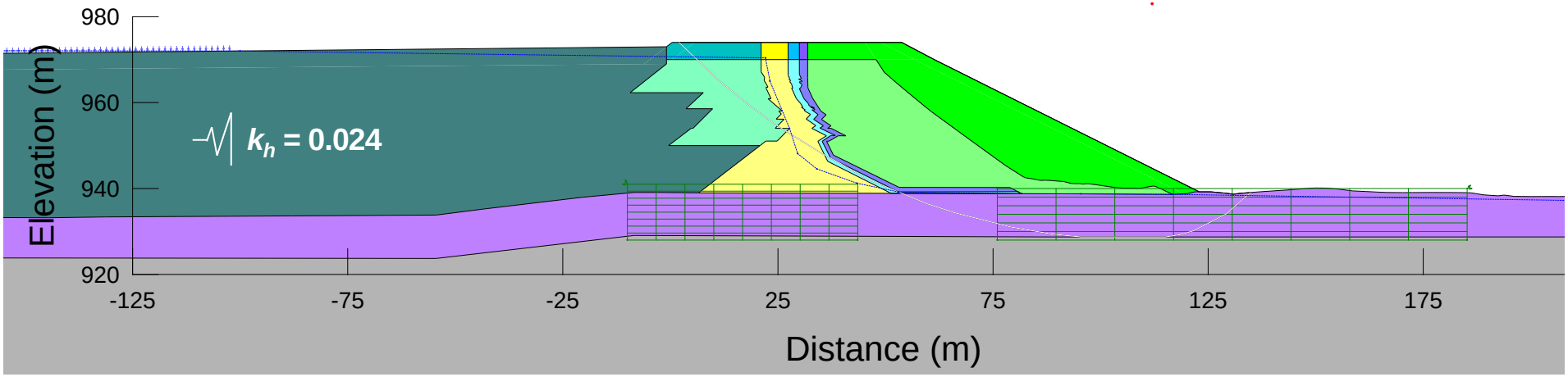

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-5

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.1

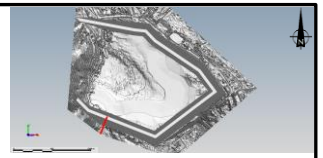

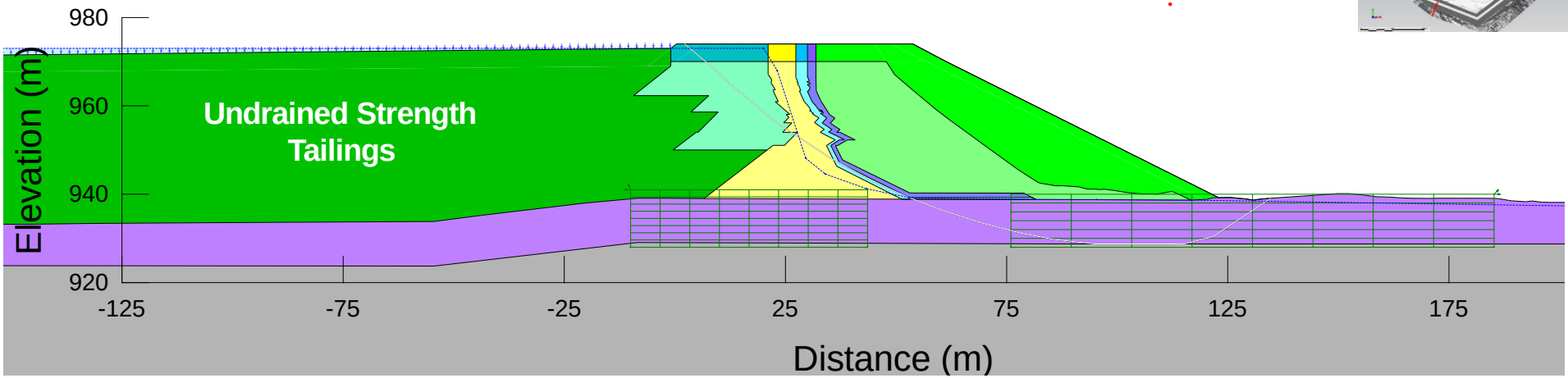

100 m beach

2.1

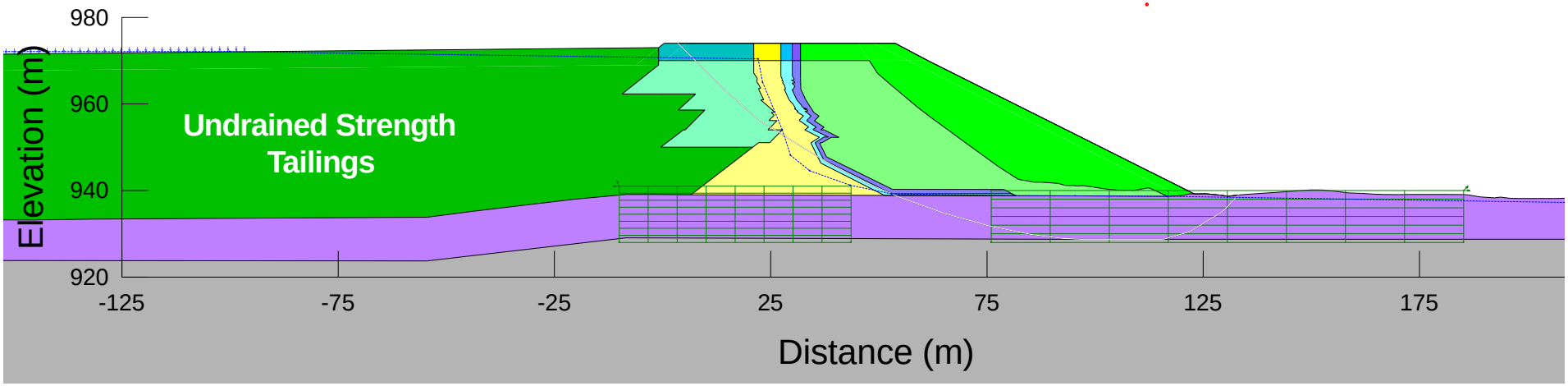

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. No seismic loading applied.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 0+725 *(Old Stn. 0+720)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-6

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.8

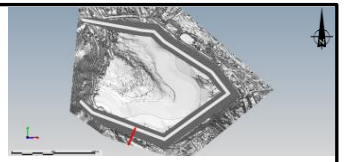

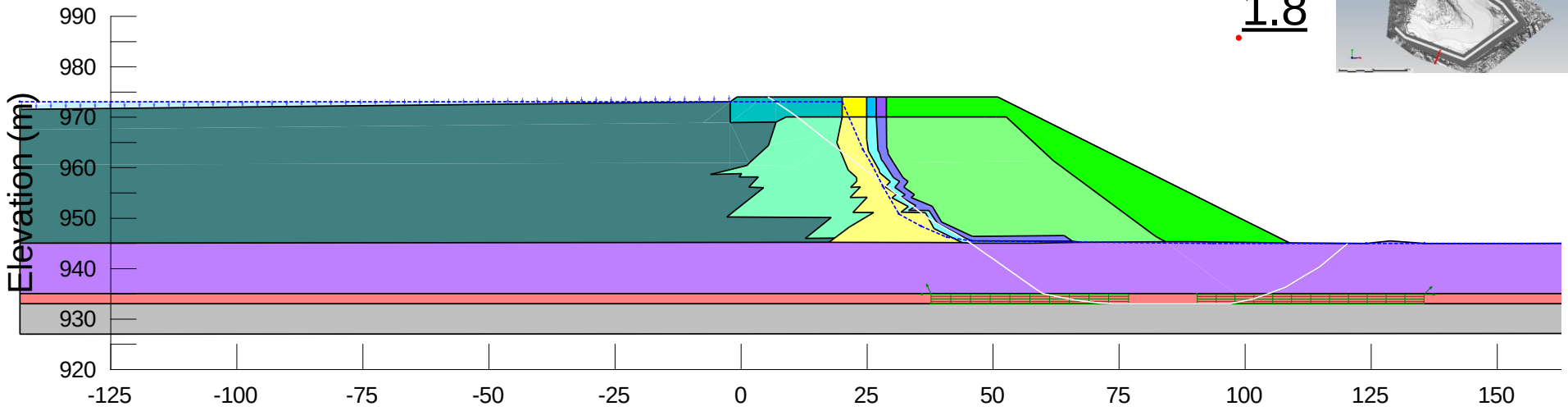

100 m beach

1.8

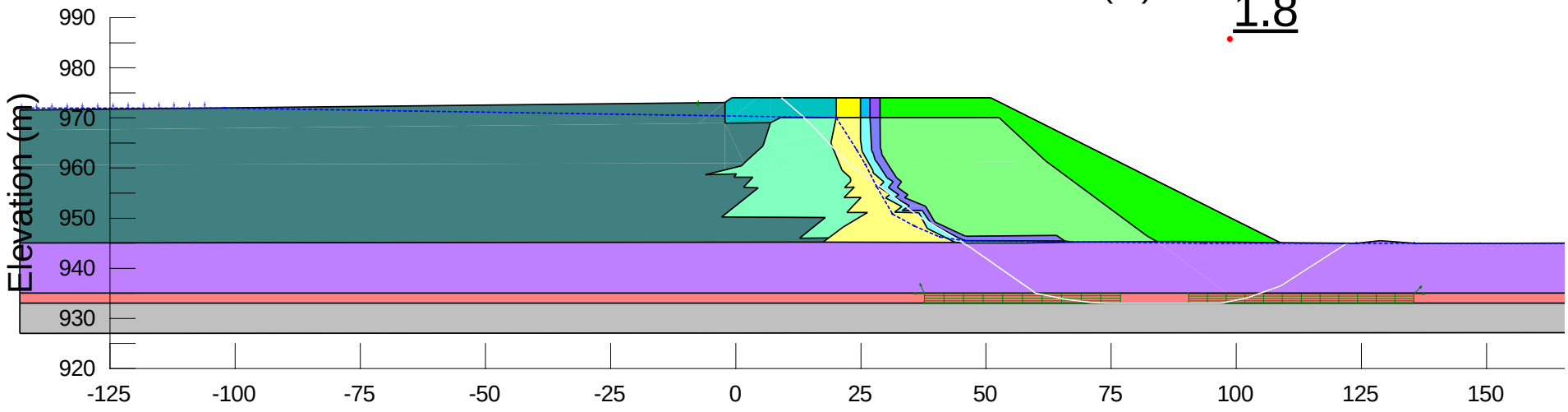

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pre-consolidation pressure low plasticity silty clay: 1,200 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 1+095 *(Old Stn. 1+100)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-7

(INPUT LOCATION OF STABILITY FILES)

0 m beach

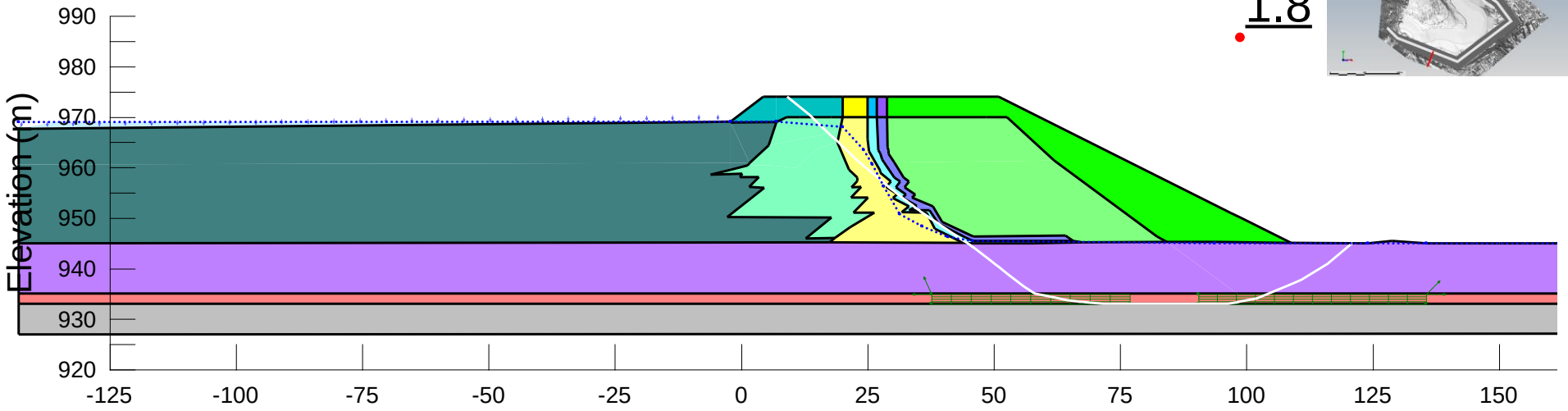

100 m beach

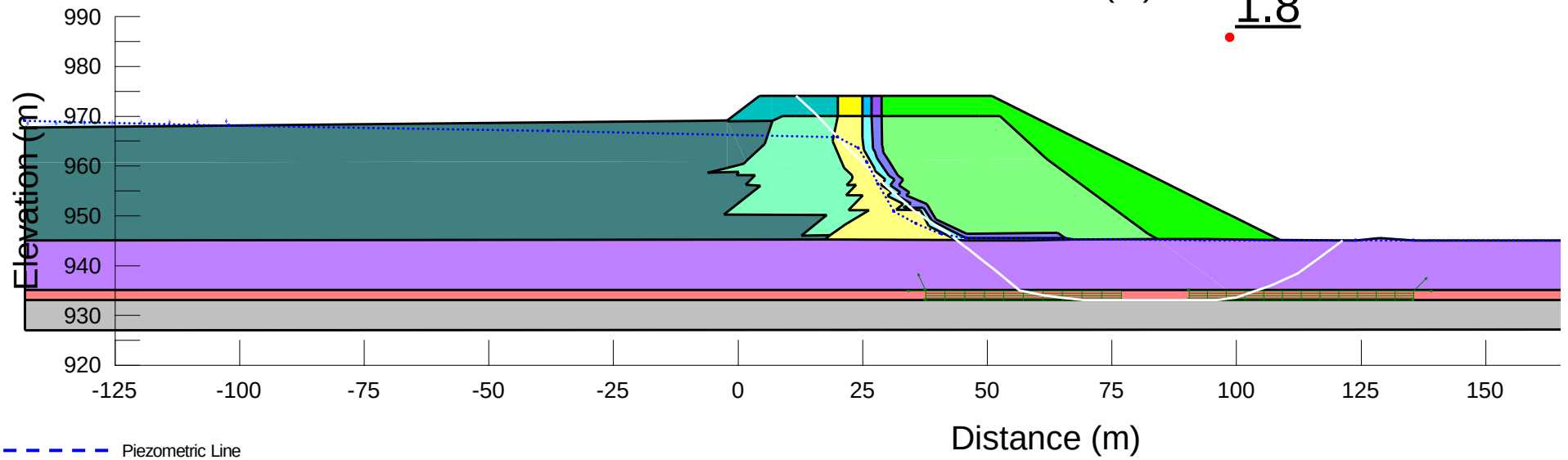

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.
4. Pre-consolidation pressure: Low plasticity silty clay: 1,200 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 1+095 *(Old Stn. 1+100)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-8

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.4

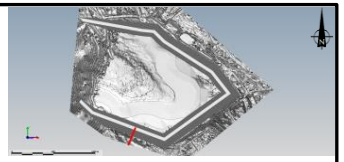

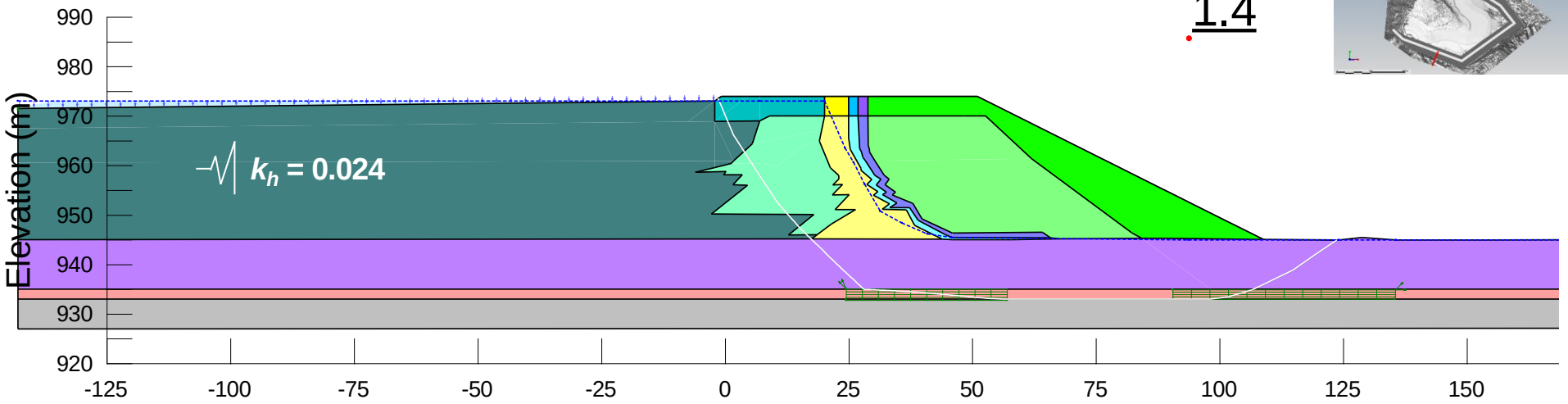

100 m beach

1.5

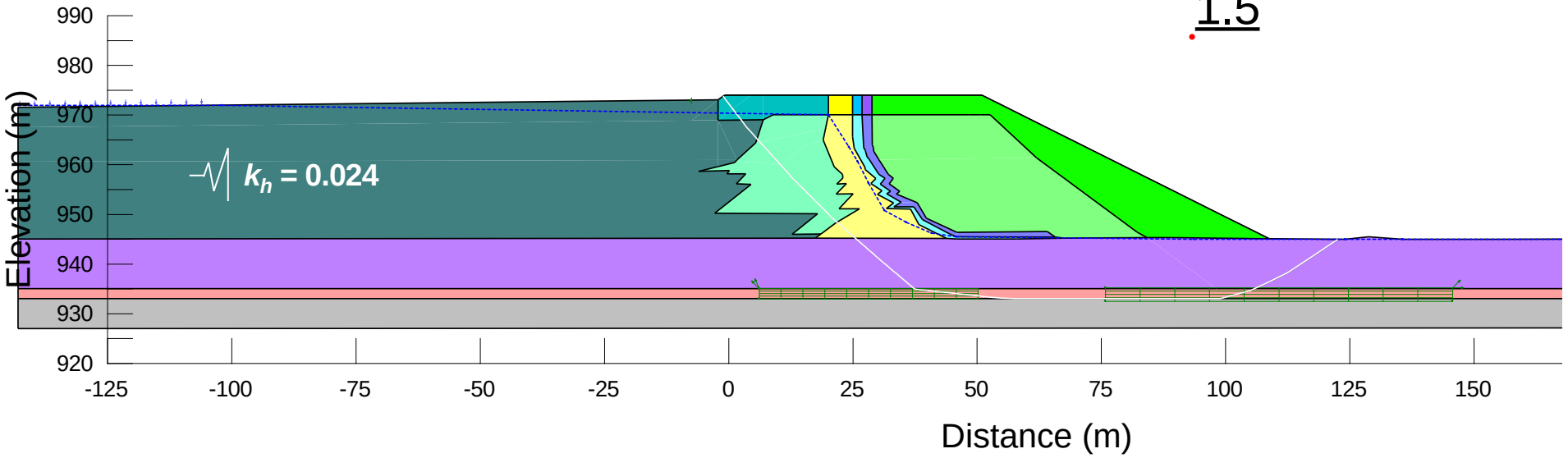

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. Low plasticity silty clay shear strength reduced to 80%.
6. Pre-consolidation pressure: Low plasticity silty clay: 1,200 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 1+095 *(Old Stn. 1+100)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-9

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

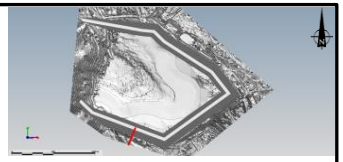

100 m beach

1.6

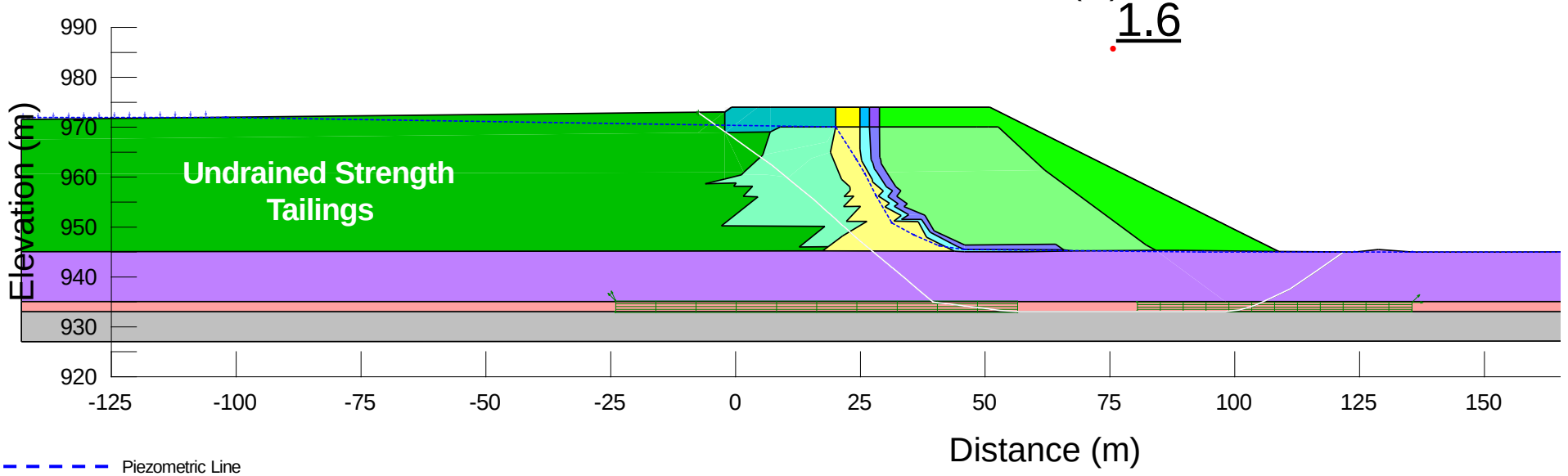

Piezometric Line

REFERENCES/NOTES

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3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Low plasticity silty clay shear strength reduced to 80%.
5. No seismic loading applied.
6. Pre-consolidation pressure: Low plasticity silty clay: 1,200 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (SOUTH EMBANKMENT)
SECTION 1+095 *(Old Stn. 1+100)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-10

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

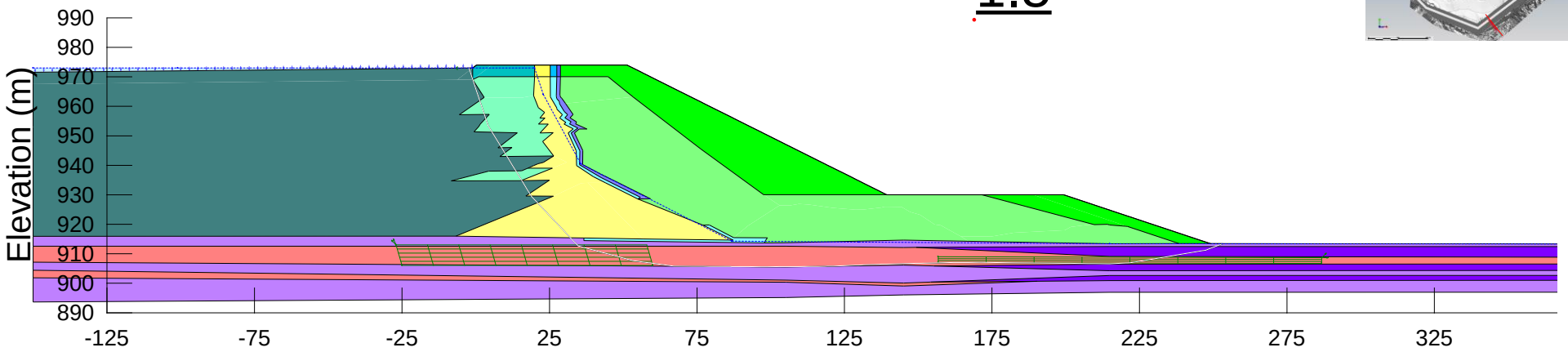

100 m beach

1.5

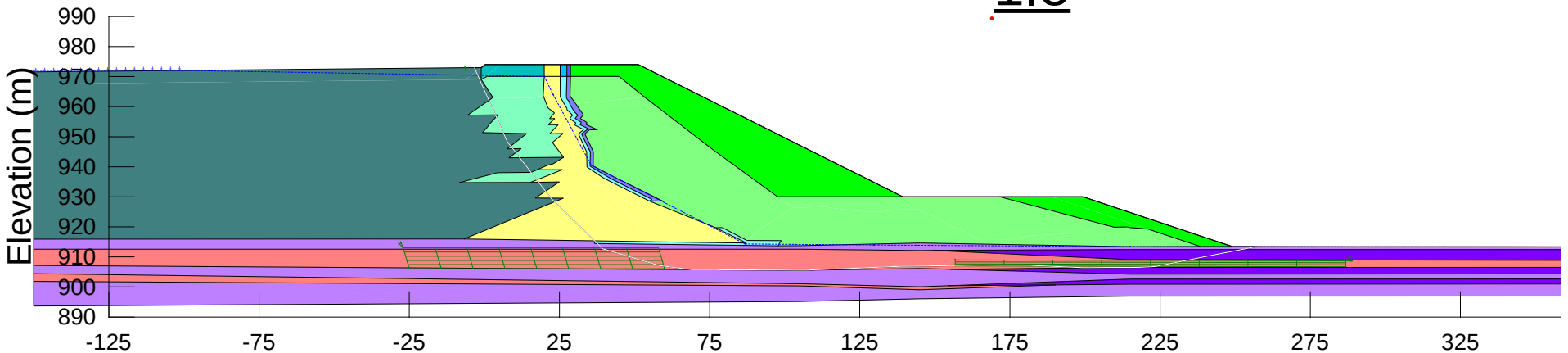

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 1+845 *(Old Stn. 1+850)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-11

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

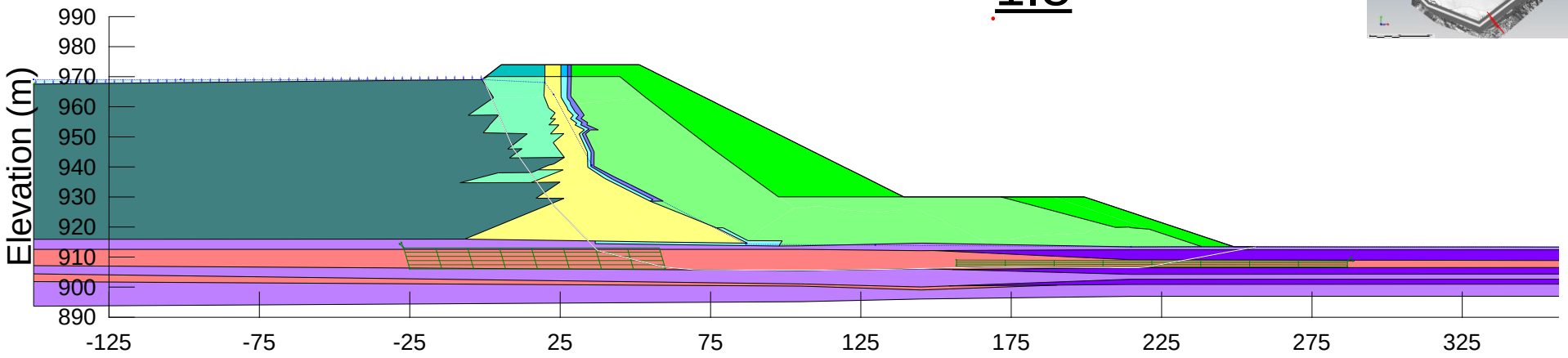

100 m beach

1.5

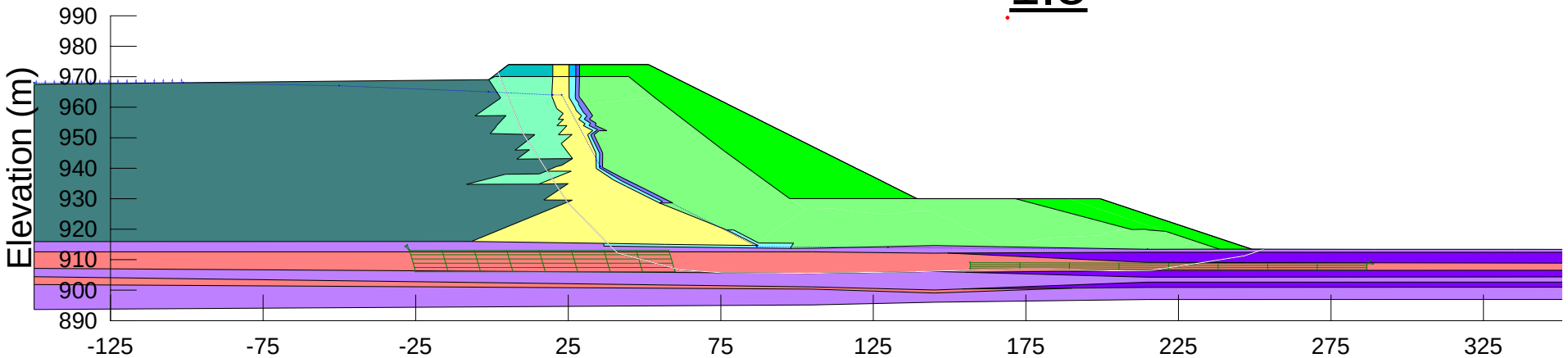

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 1+845 *(Old Stn. 1+850)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-12

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.1

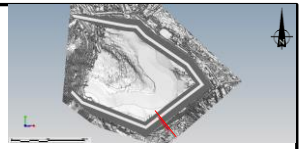

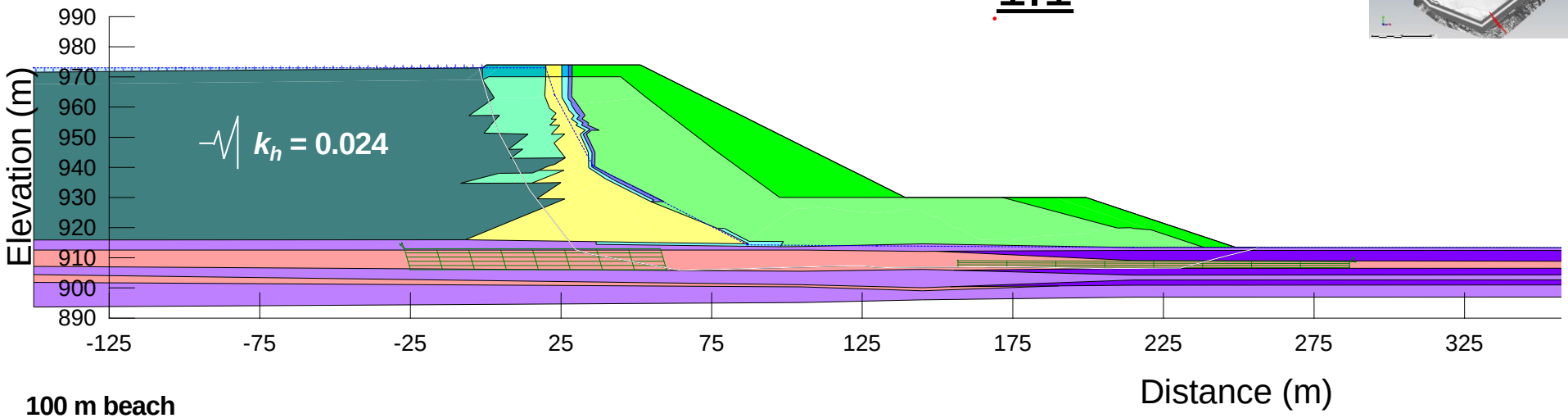

100 m beach

1.1

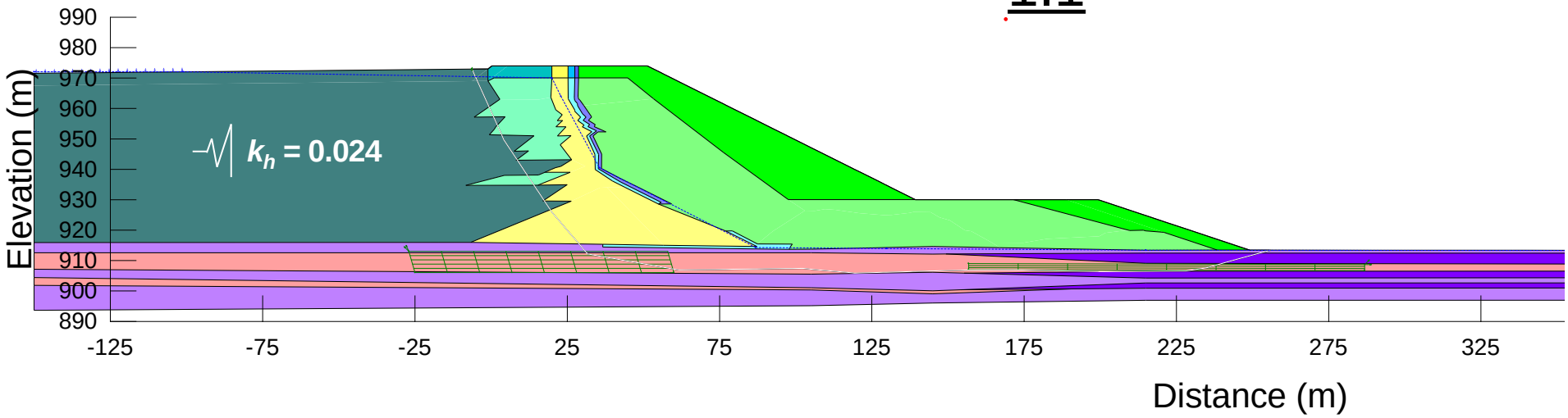

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 1+845 *(Old Stn. 1+850)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-13

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.2

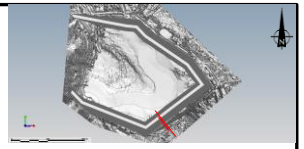

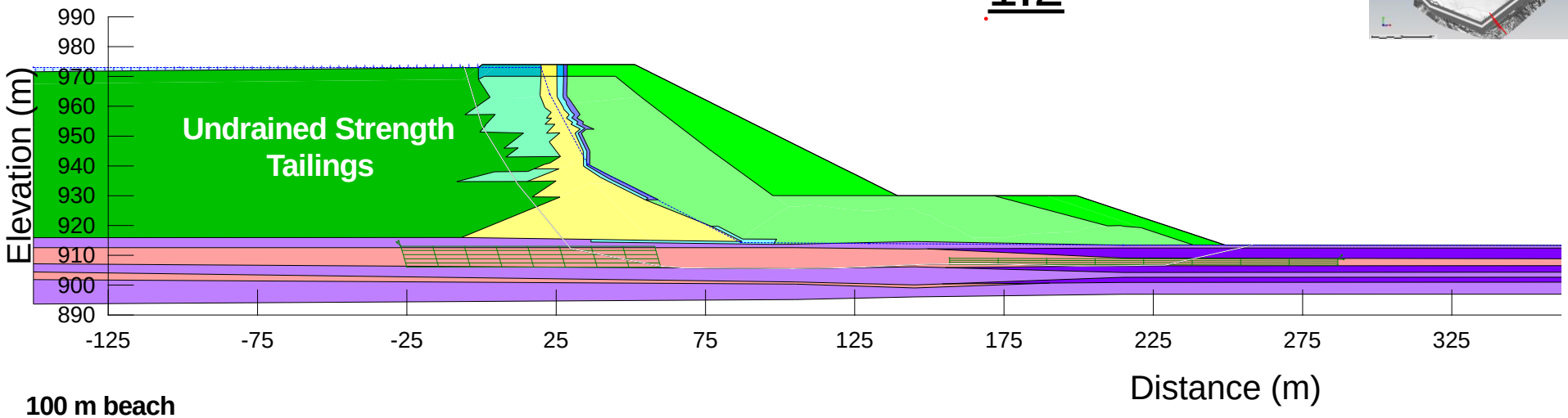

100 m beach

1.2

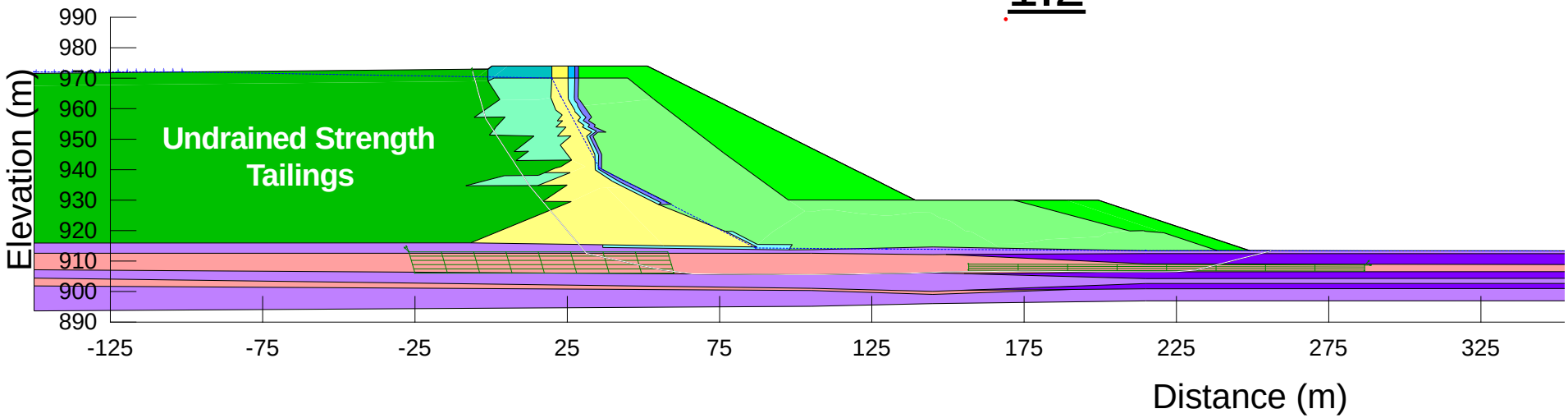

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 1+845 *(Old Stn. 1+850)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-14

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

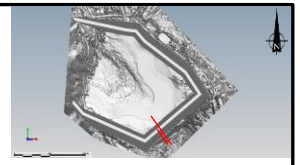

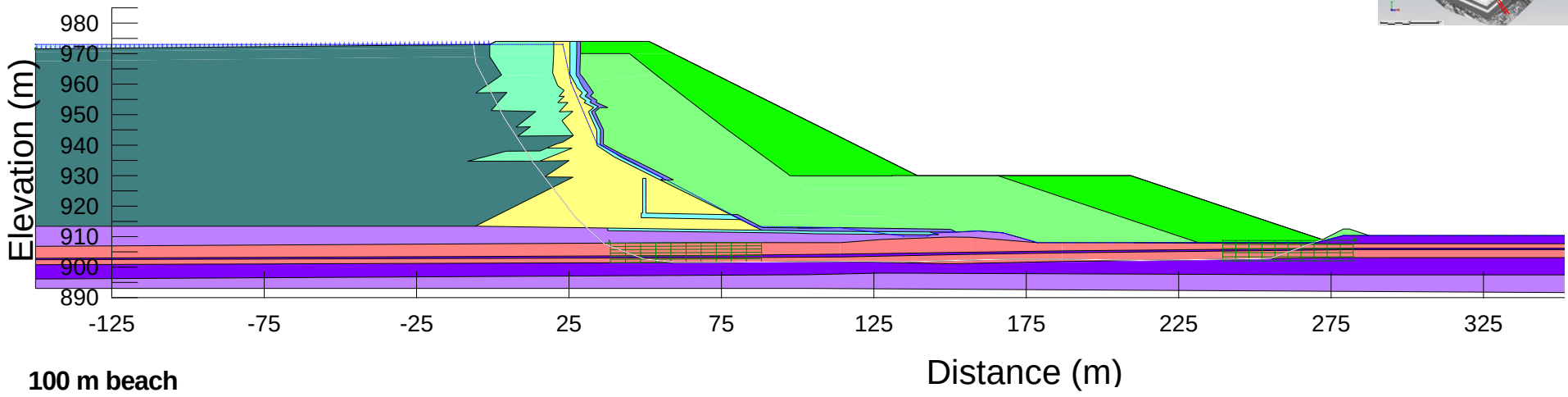

100 m beach

1.5

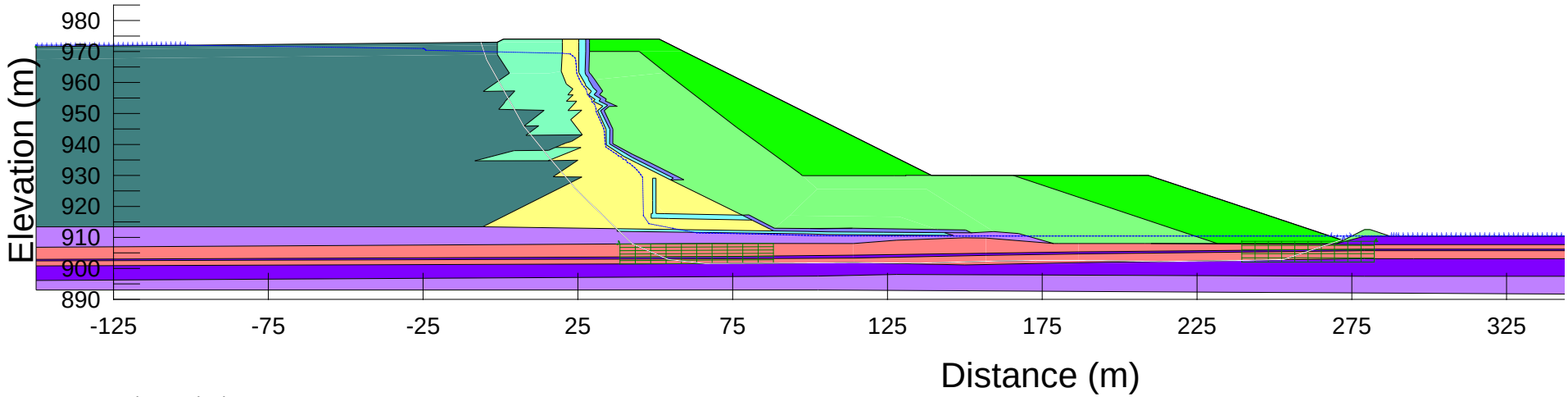

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-15

(INPUT LOCATION OF STABILITY FILES)

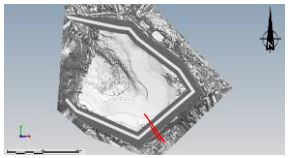

0 m beach

1.5

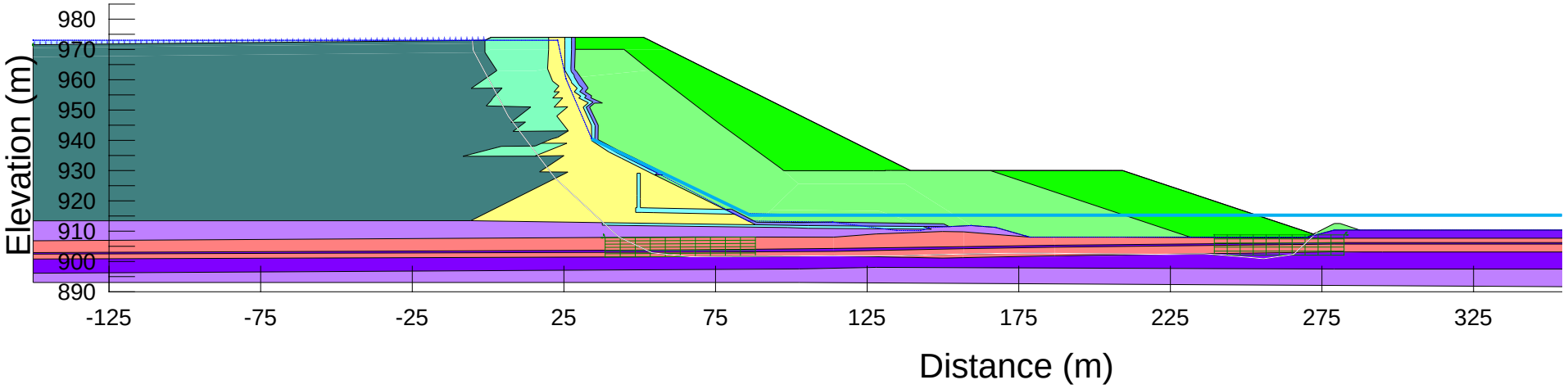

Piezometric Line #1

Piezometric Line #2

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. Sensitivity analysis with artesian conditions (Piezometric Line #1) in the intermediate Glaciofluvial layers at an approx. 3 m pressure elevation (915 m) based on A8 and VW15-15.
5. GLU pre-consolidation pressure: 1200 kPa.
6. Piezometric Lines 1 and 2 superimposed until separation from the elevation of 941 m.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
LONG-TERM (ARTESIAN CONDITIONS)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-16

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

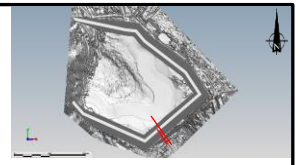

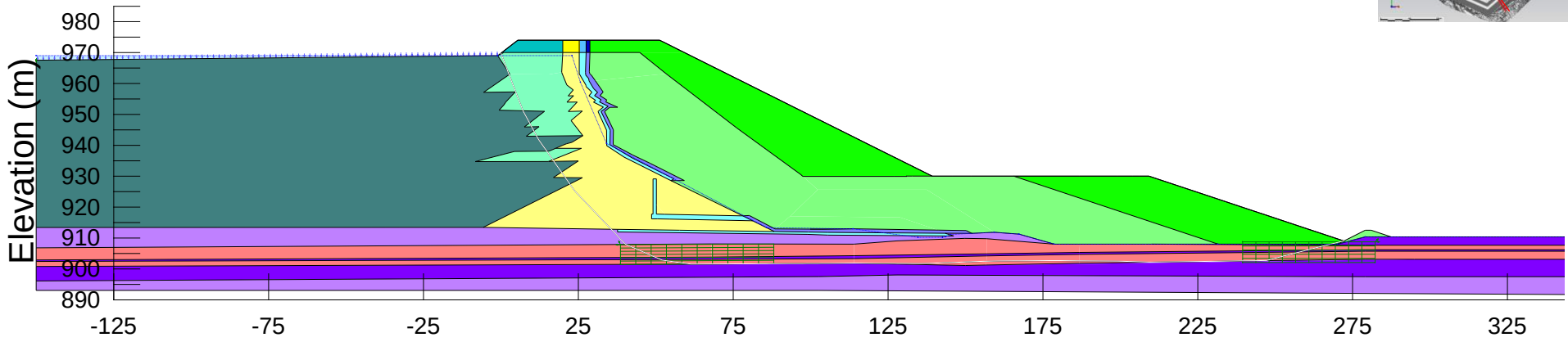

100 m beach

1.6

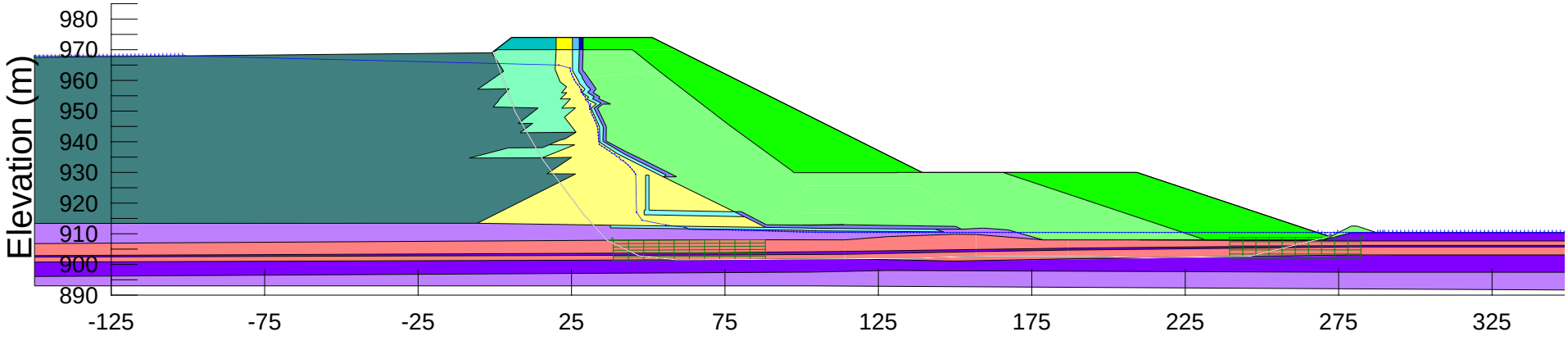

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
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CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-17

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.2

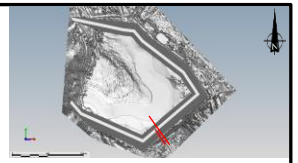

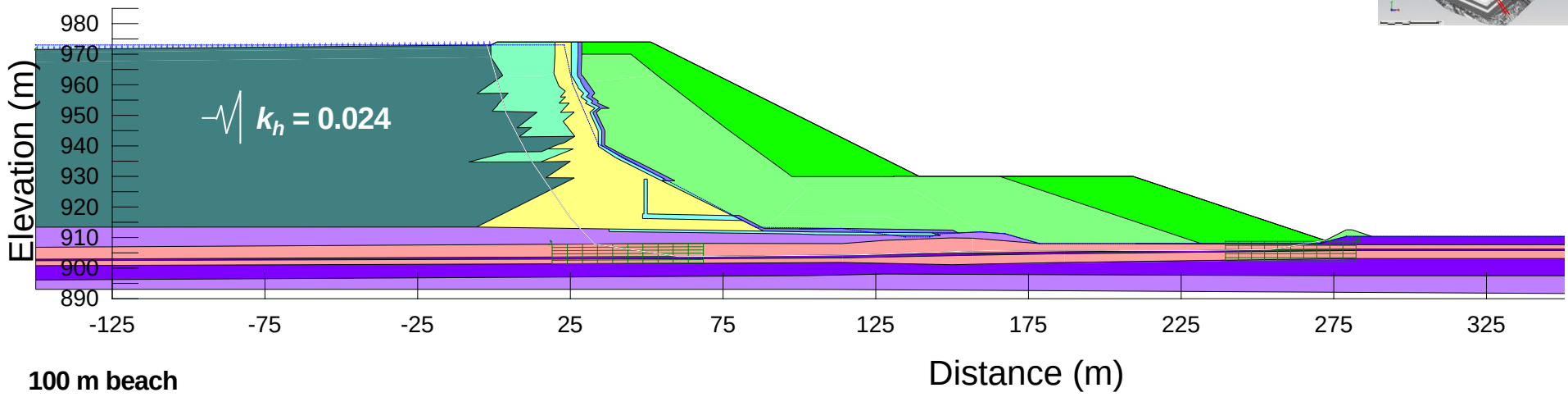

100 m beach

1.2

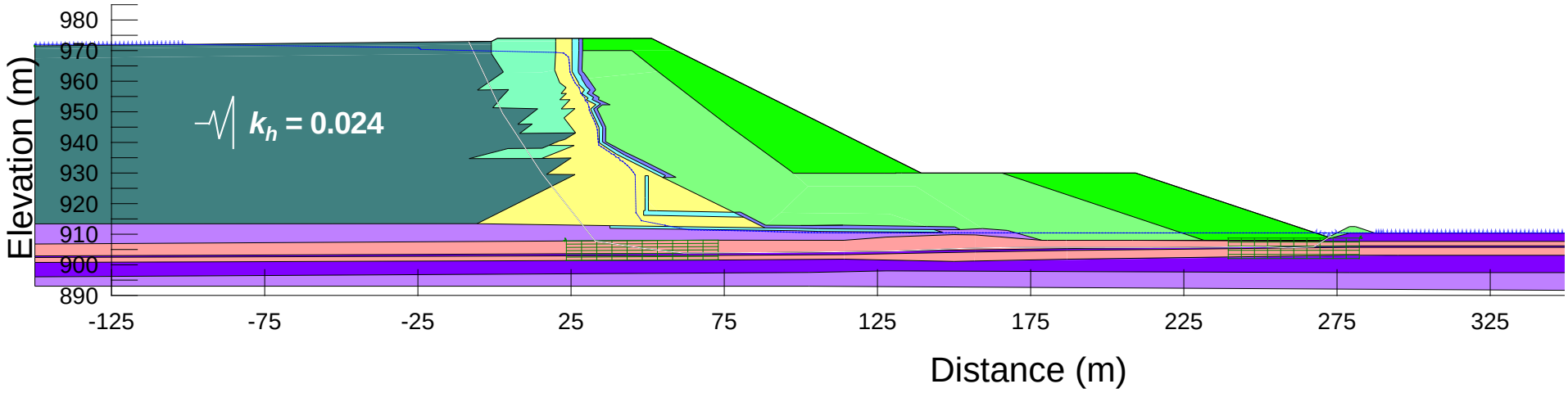

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-18

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.3

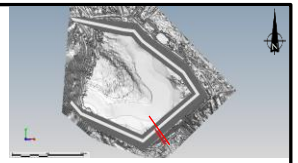

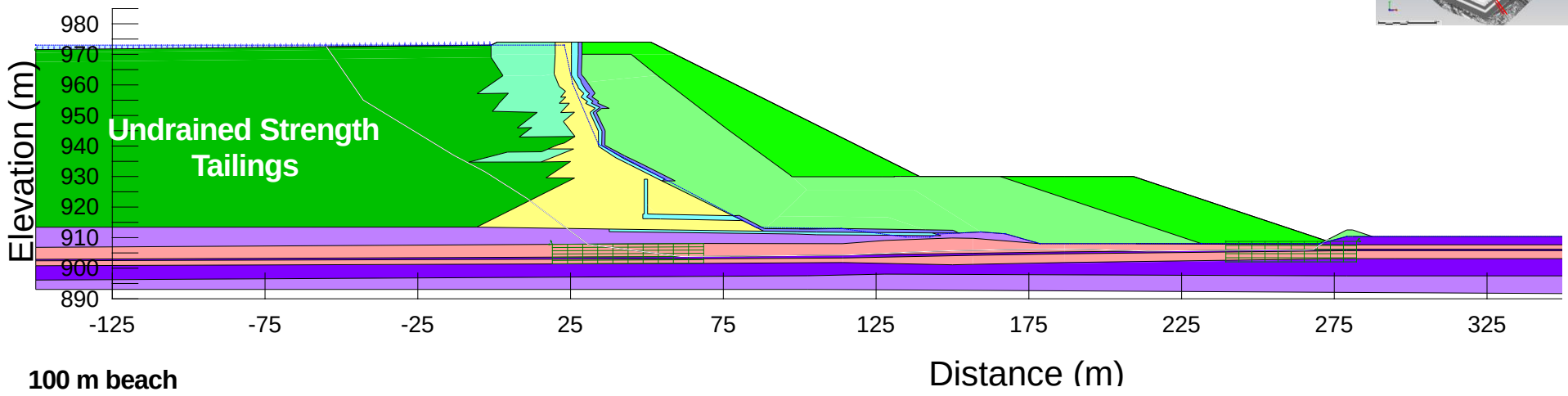

100 m beach

1.3

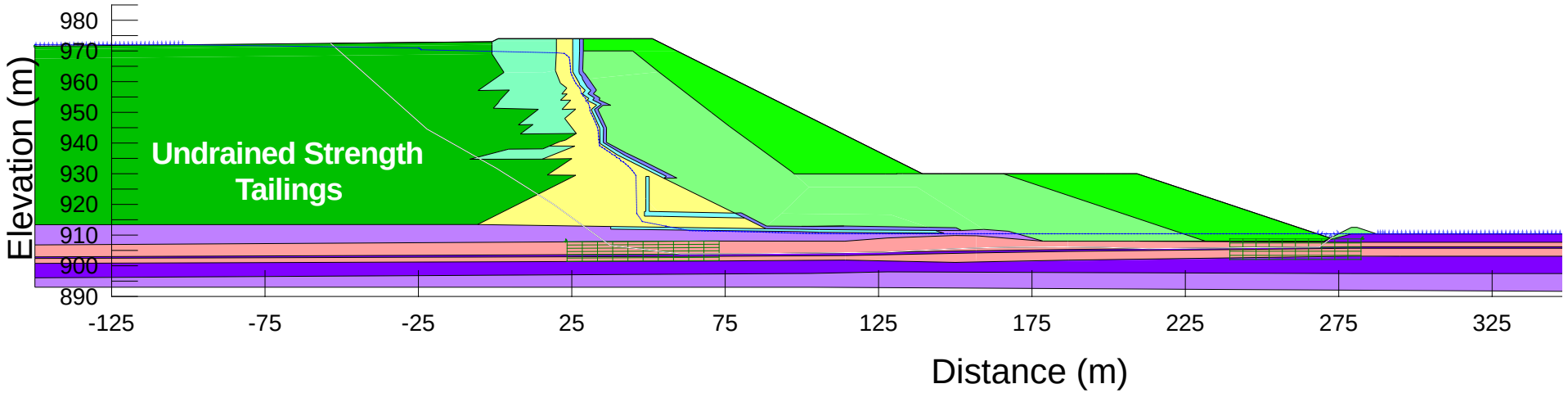

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+055 *(Old Stn. 2+060)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-19

(INPUT LOCATION OF STABILITY FILES)

0 m beach

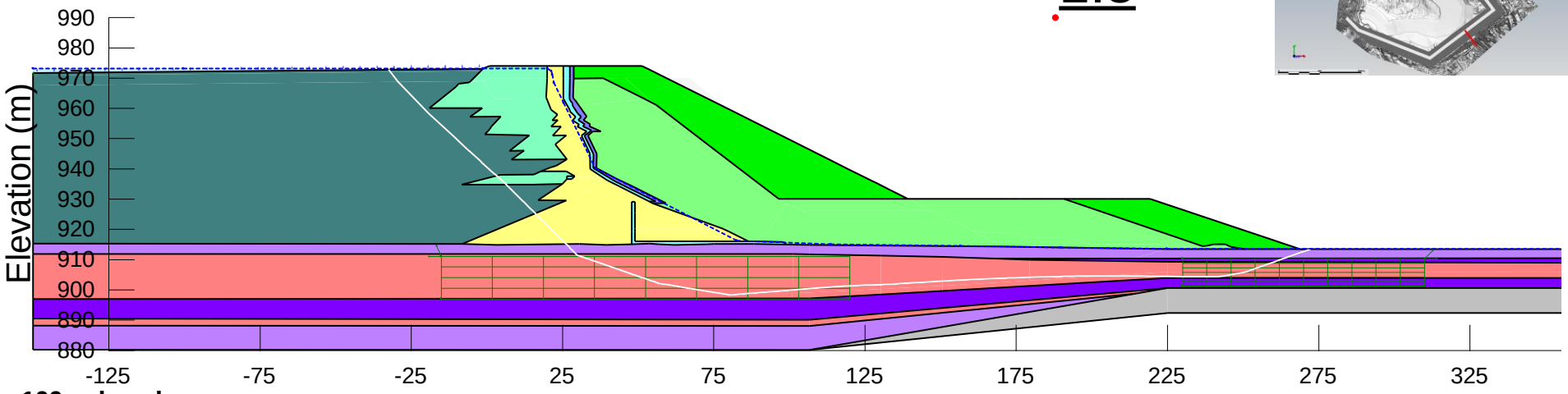

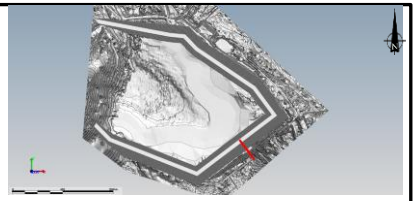

100 m beach

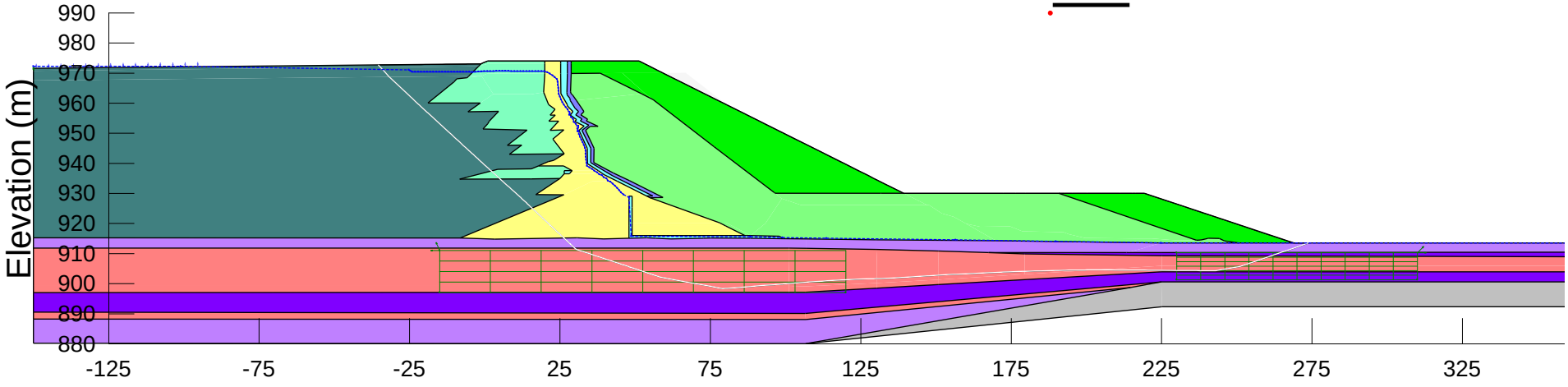

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
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CONSULTANT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-20

(INPUT LOCATION OF STABILITY FILES)

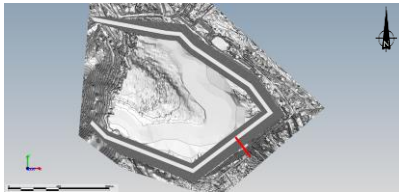

0 m beach

1.5

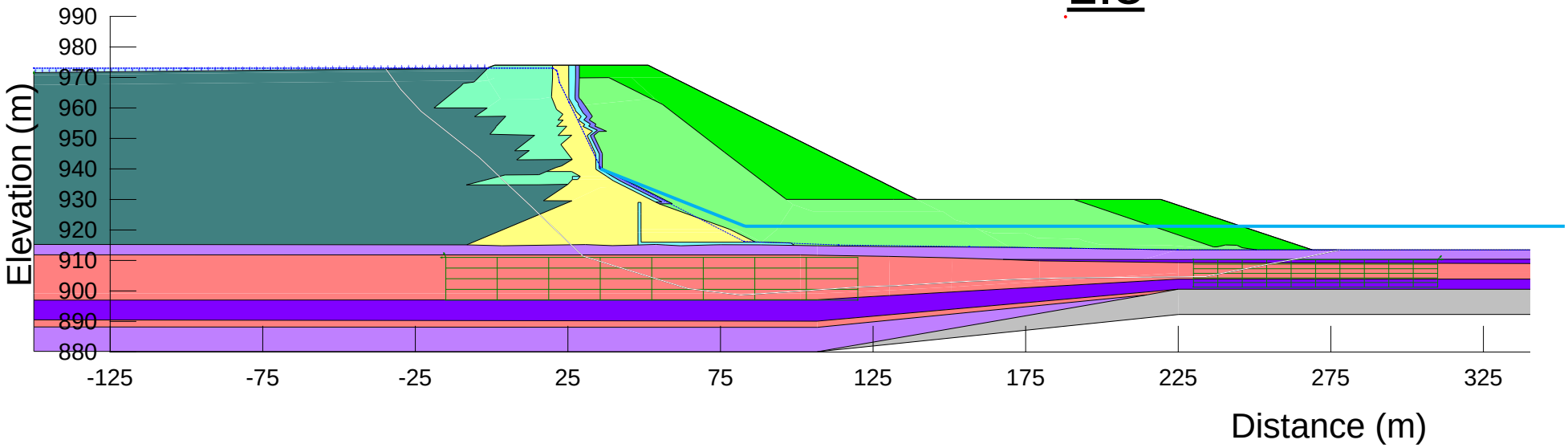

Piezometric Line #1

Piezometric Line #2

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. Sensitivity analysis with artesian conditions (Piezometric Line #1) in the Glaciofluvial layers at an 8 m of pressure elevation (921 m) based on B4 and VW15-14.
5. GLU pre-consolidation pressure: 1200 kPa.
6. Piezometric Lines 1 and 2 superimposed until separation from the elevation of 940 m.

CLIENT
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CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
LONG-TERM (ARTESIAN CONDITIONS)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-21

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

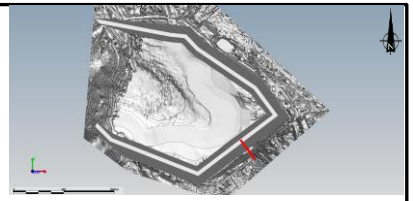

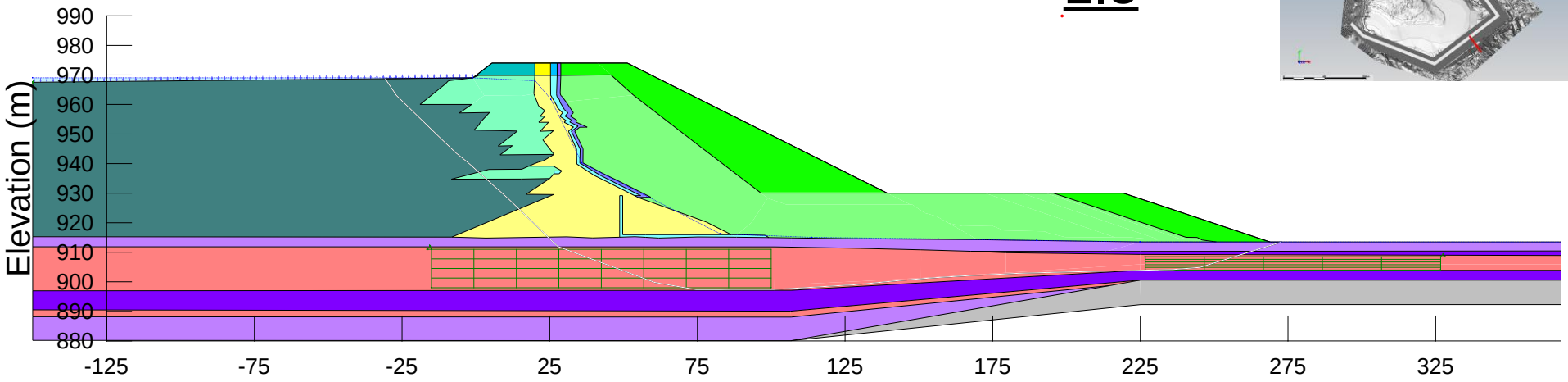

100 m beach

1.5

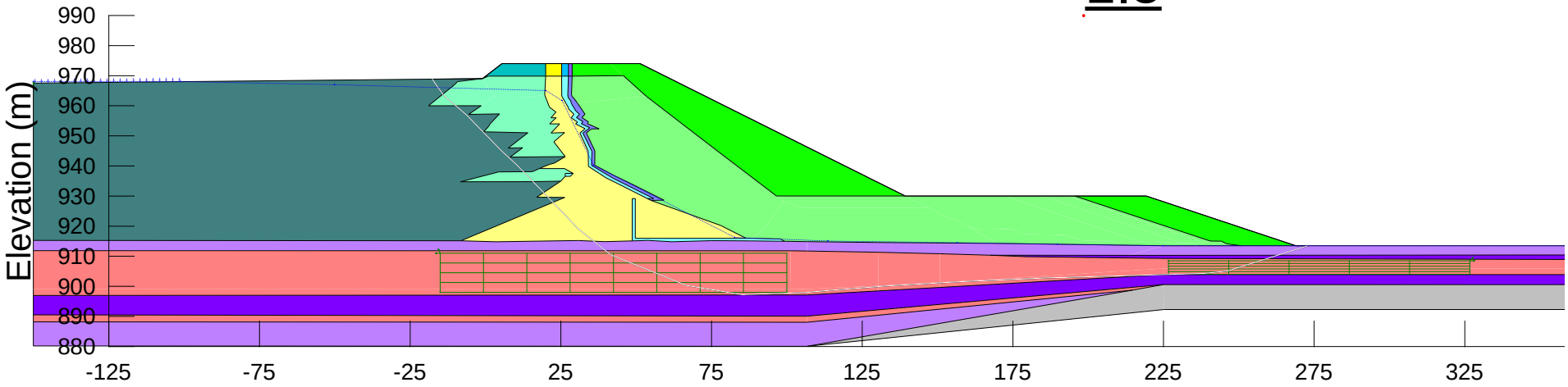

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-22

(INPUT LOCATION OF STABILITY FILES)

0 m beach

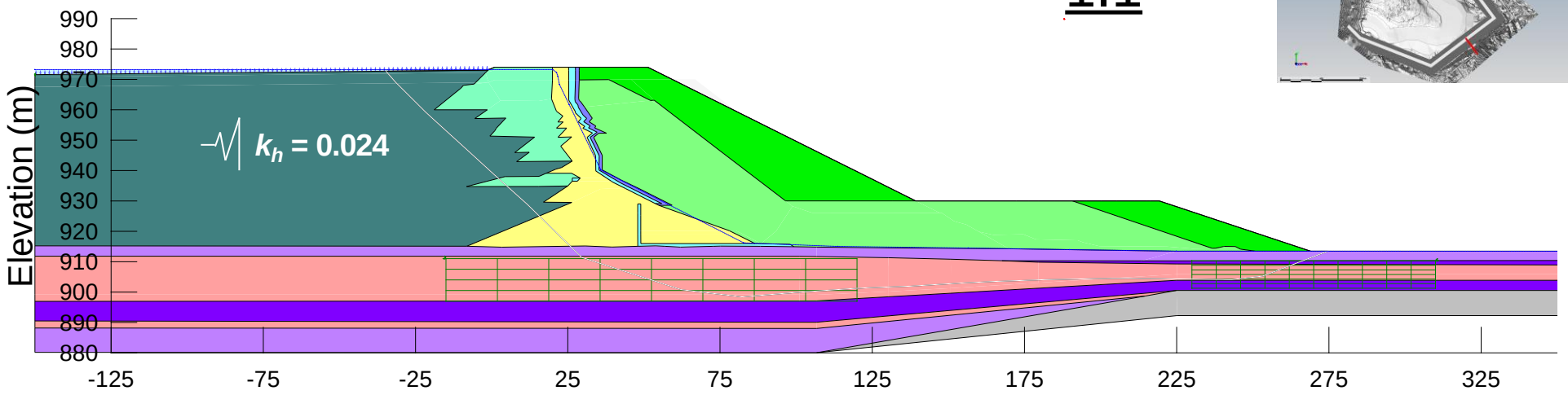

100 m beach

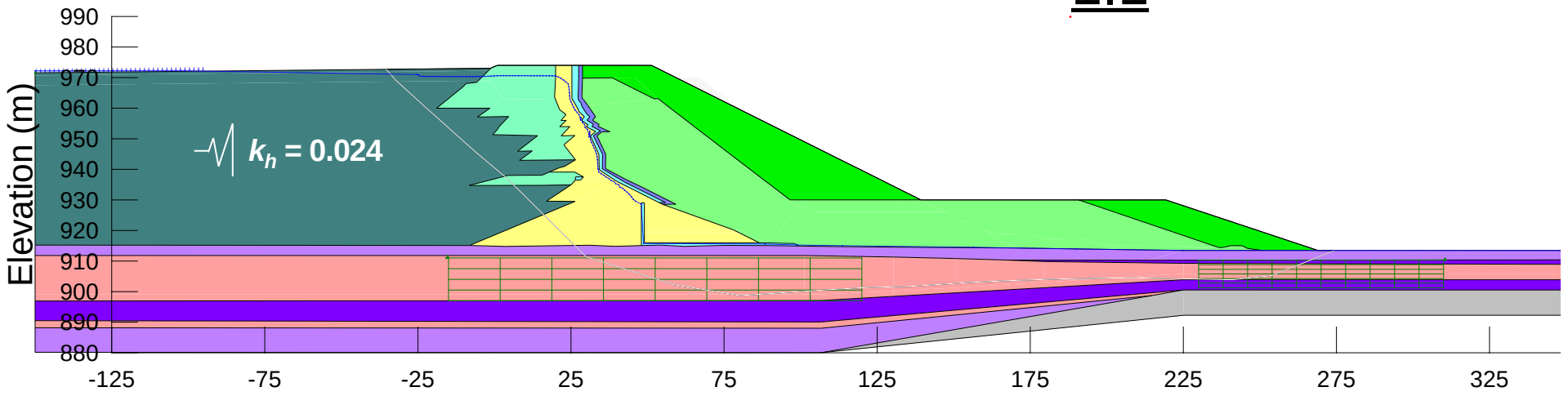

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-23

(INPUT LOCATION OF STABILITY FILES)

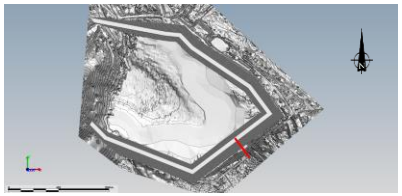

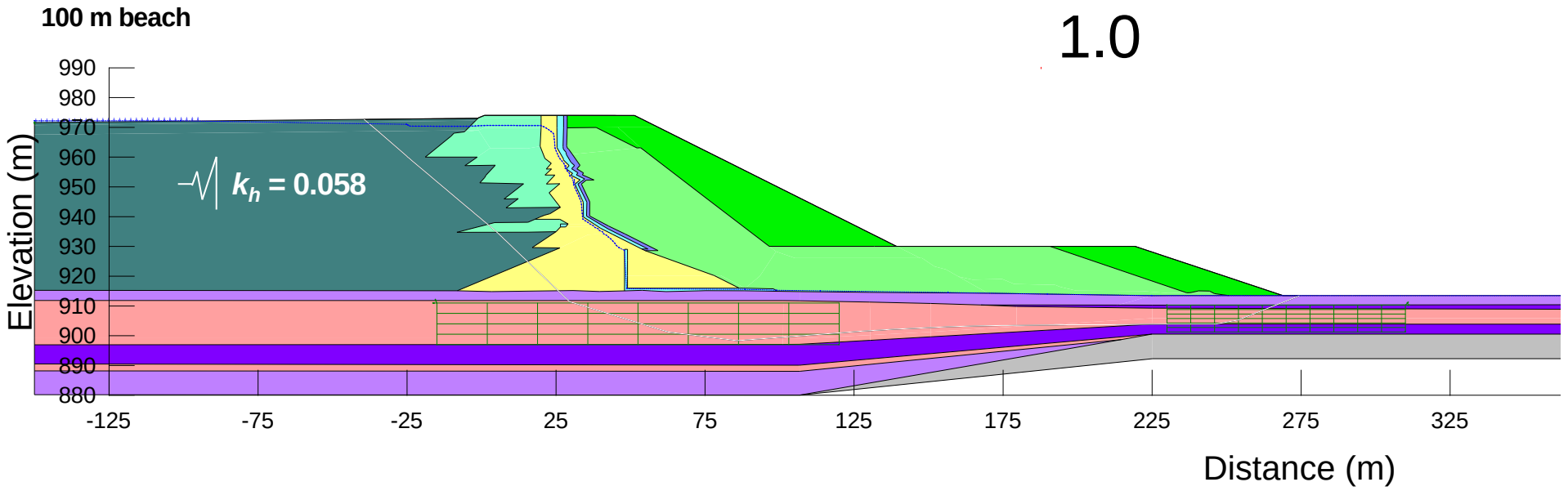

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain functioning.
3. 100 m sub-aerial beaches; pond el. 972 m.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 10,000-year EAP.
5. GLU shear strength reduced to 80%.

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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-24

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.1

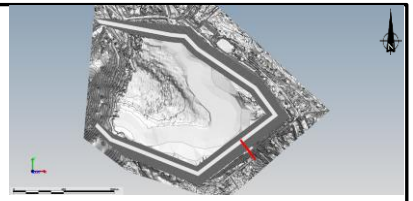

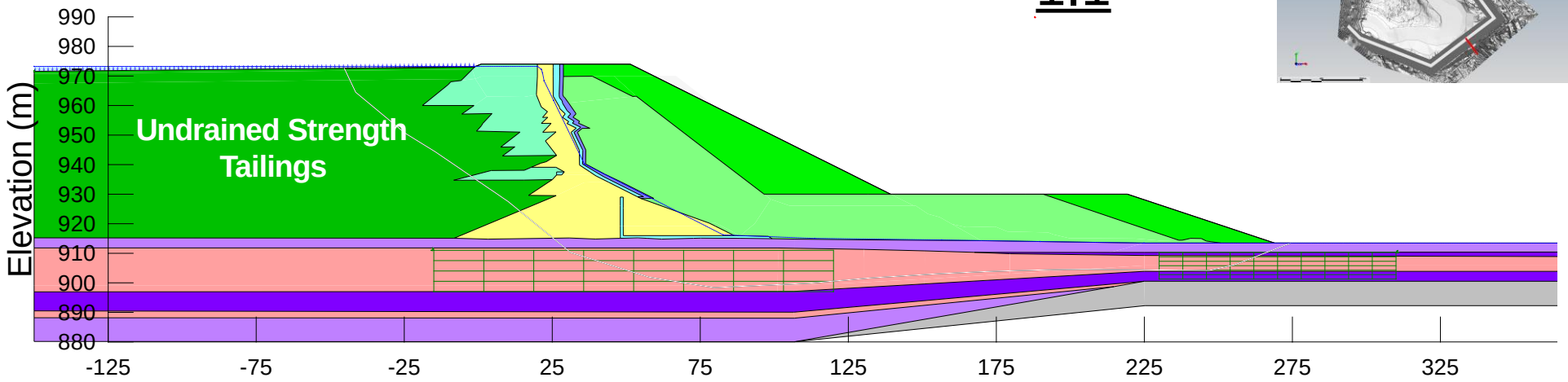

100 m beach

1.2

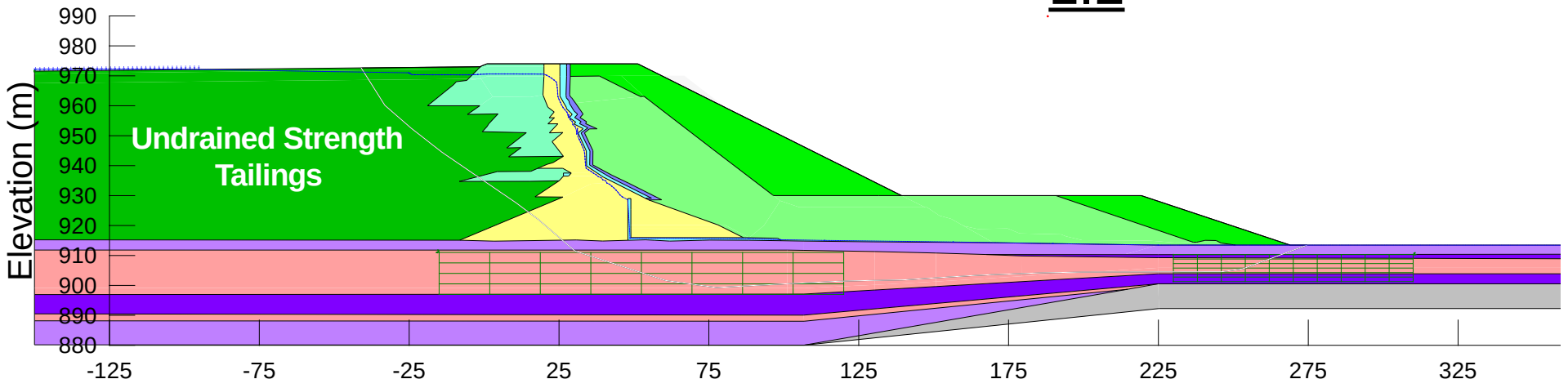

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+235 *(Old Stn. 2+240)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-25

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

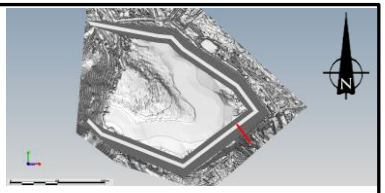

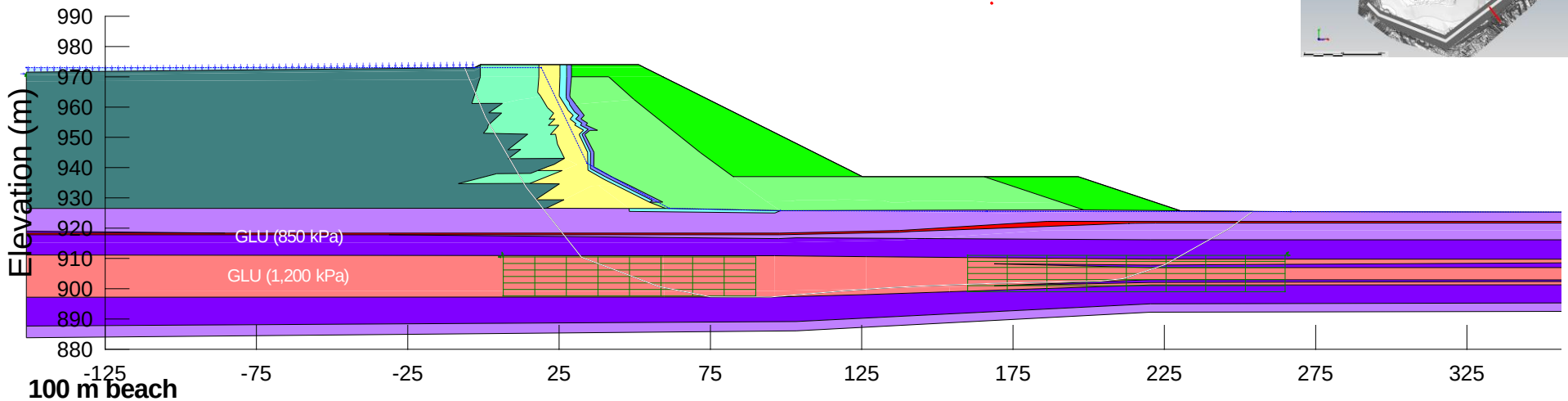

100 m beach

1.6

Distance (m)

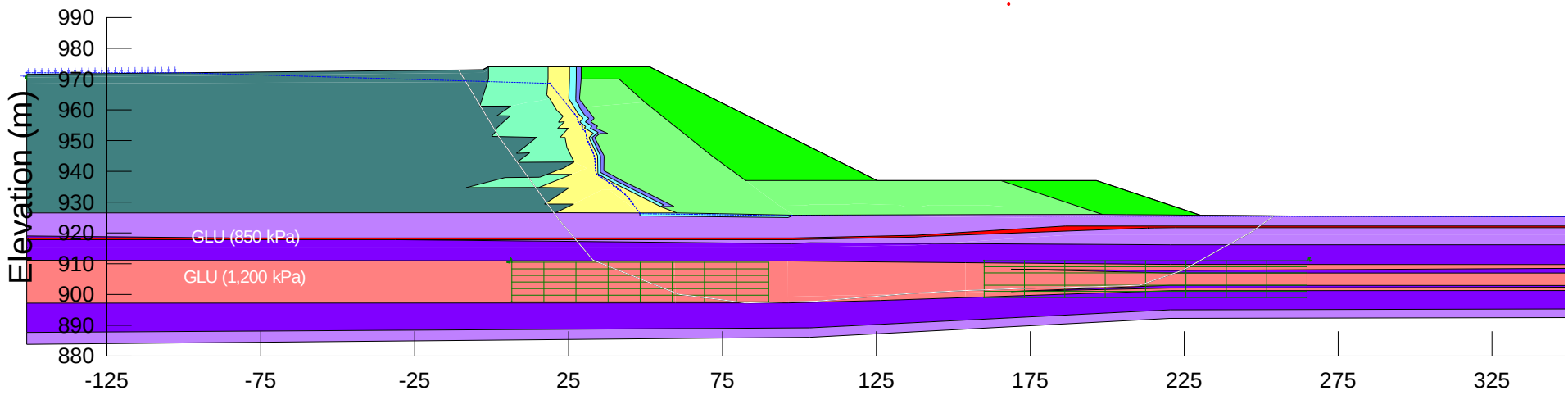

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-26

(INPUT LOCATION OF STABILITY FILES)

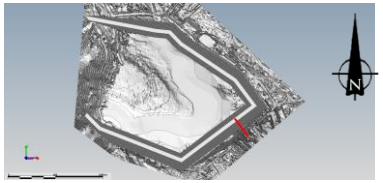

0 m beach

1.5

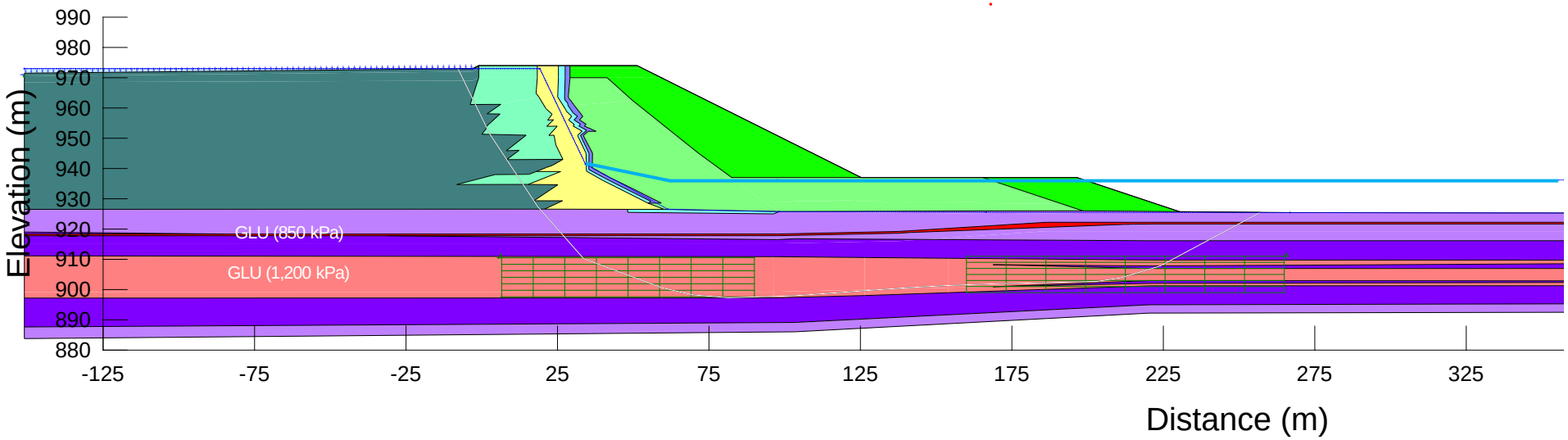

Piezometric Line #1

Piezometric Line #2

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. Sensitivity analysis with artesian conditions (Piezometric Line #1) in the Glaciofluvial layers at an 11 m of pressure elevation (936 m) based on K1 and K2.
5. Piezometric Lines 1 and 2 superimposed until separation from the elevation of 941 m.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
LONG-TERM (ARTESIAN CONDITIONS)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-27

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.4

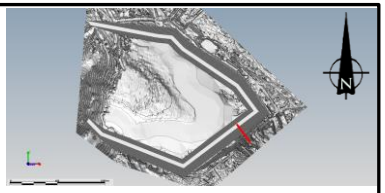

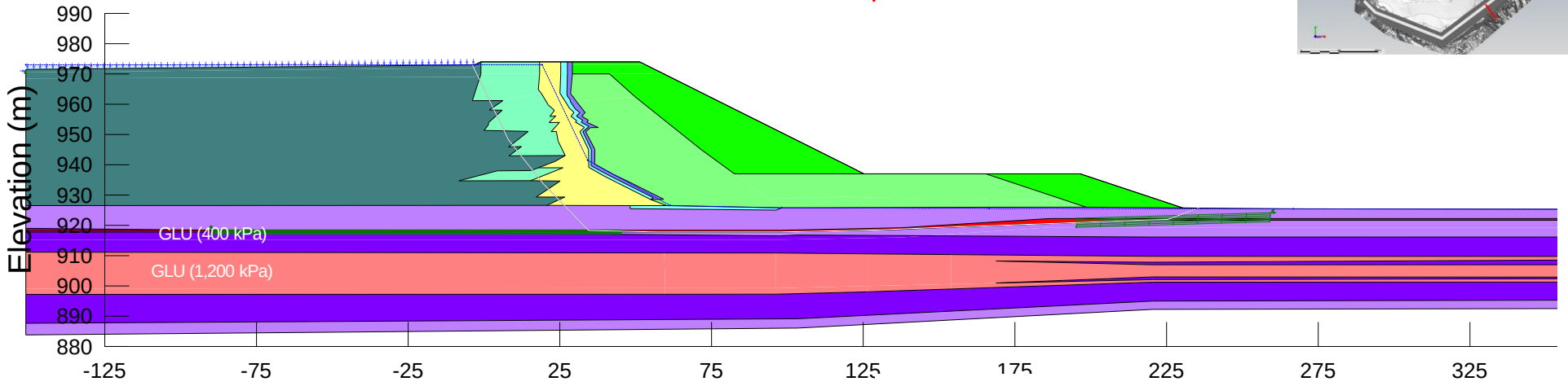

0 m beach

1.6

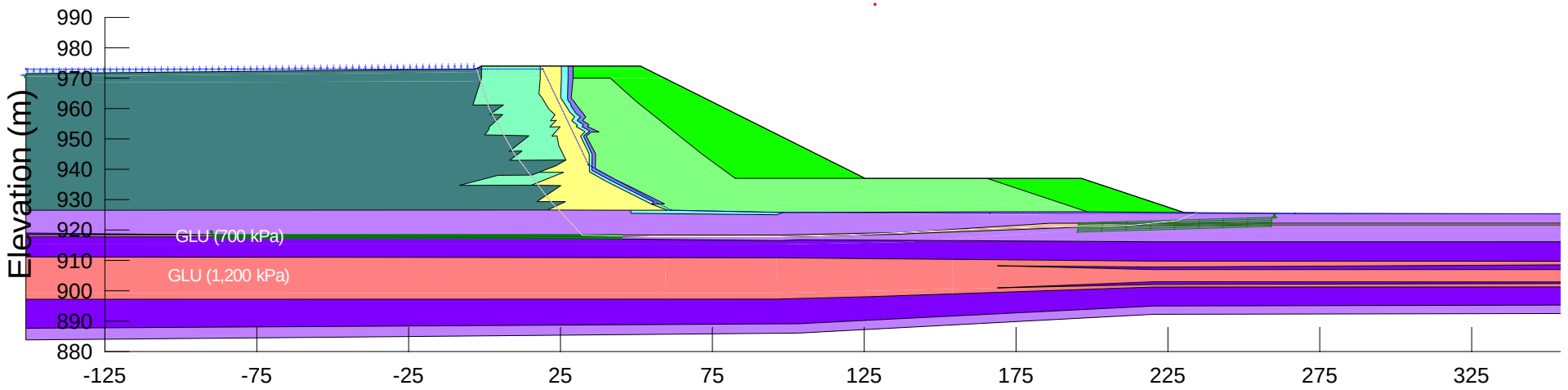

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. For GLU, pre-consolidation pressure reduced to 400 kPa and 700 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
LONG-TERM (GLU SHEAR STRENGTH SENSITIVITY)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-28

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

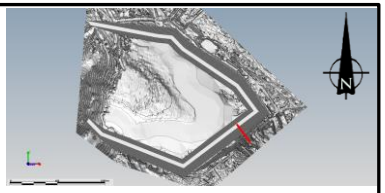

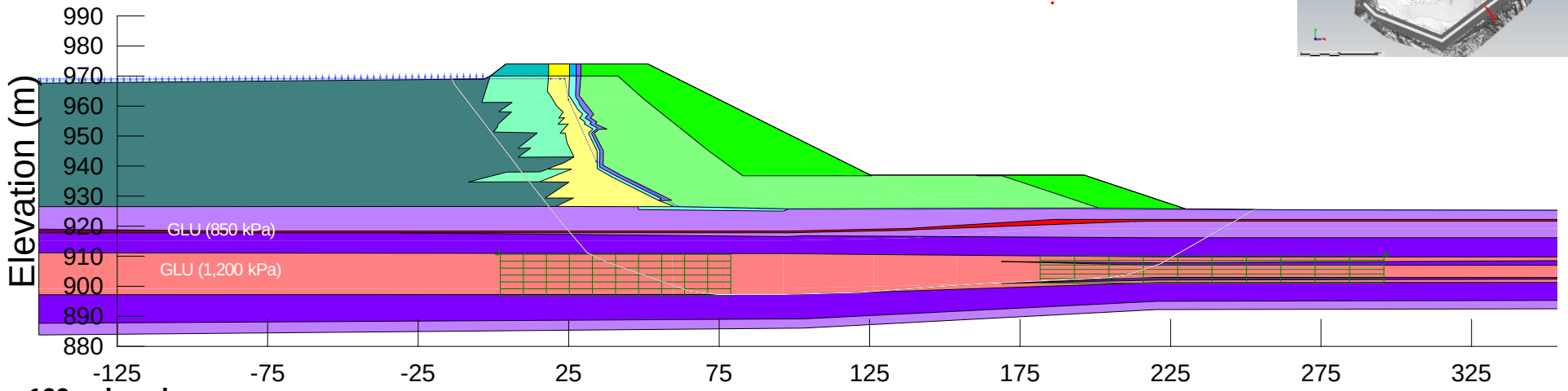

100 m beach

1.6 Distance (m)

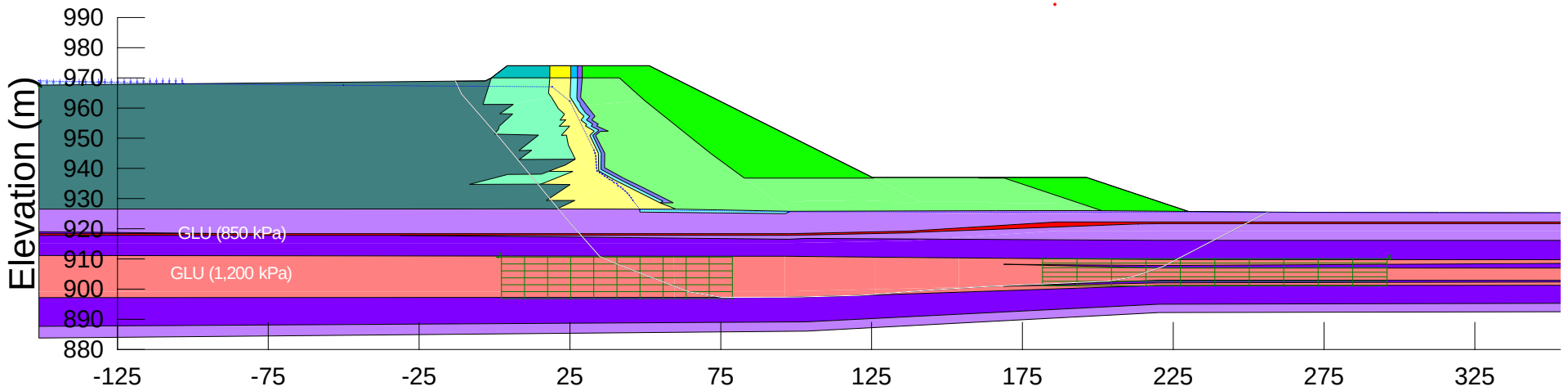

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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YYYY-MM-DD	2024-04-16
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-29

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.1

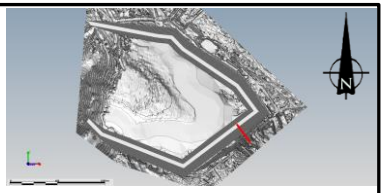

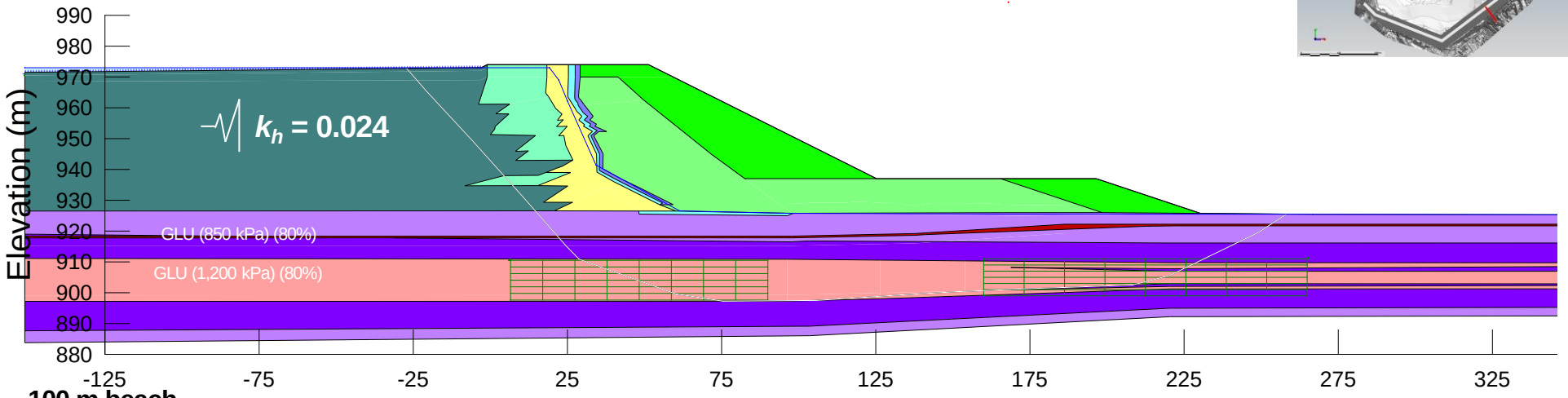

100 m beach

1.2

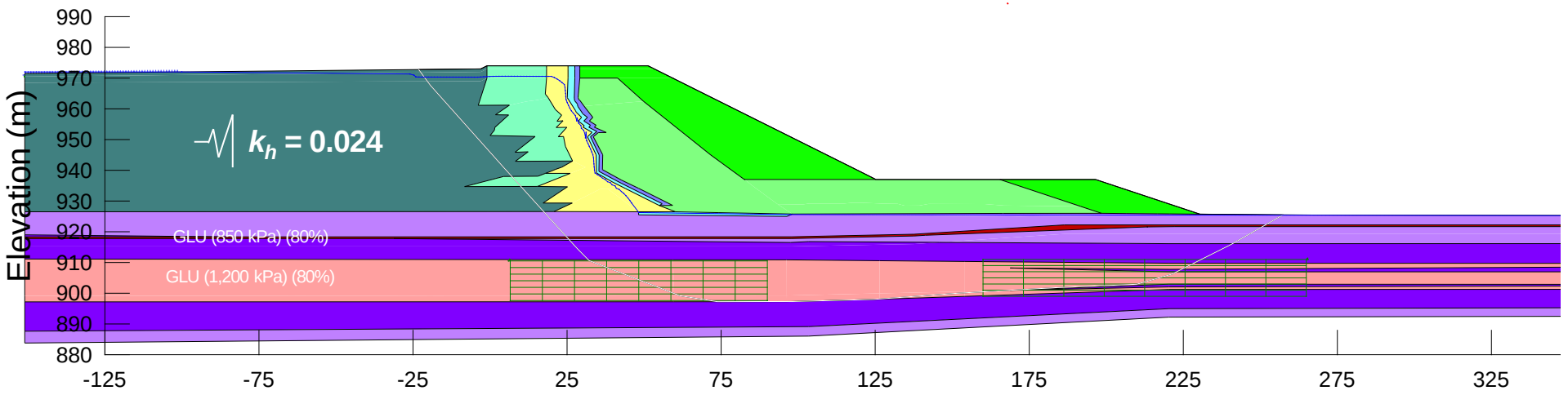

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-30

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.3

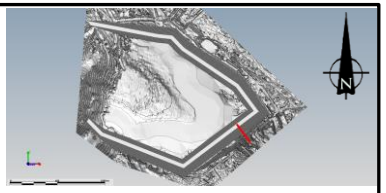

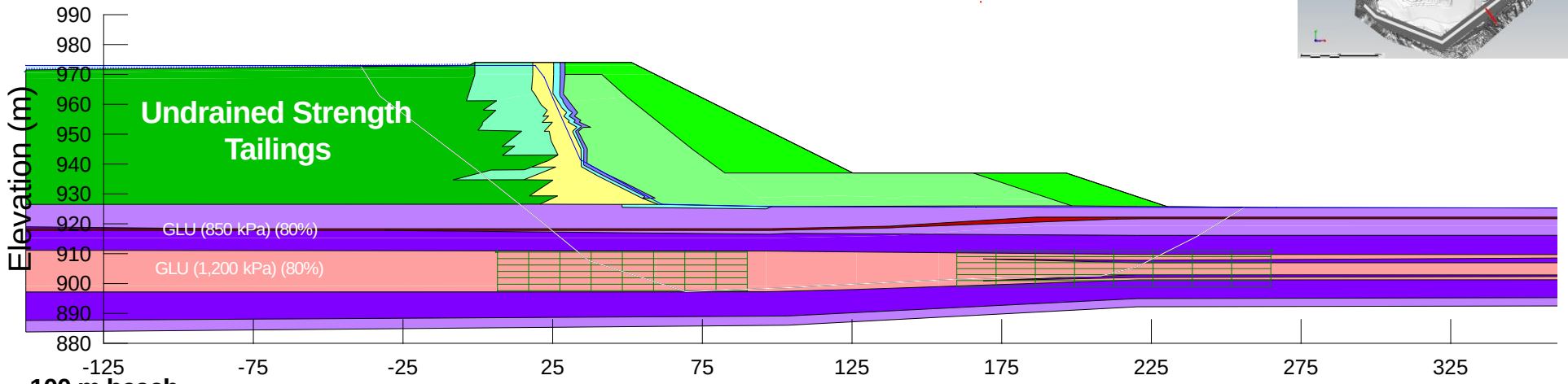

100 m beach

1.3

Distance (m)

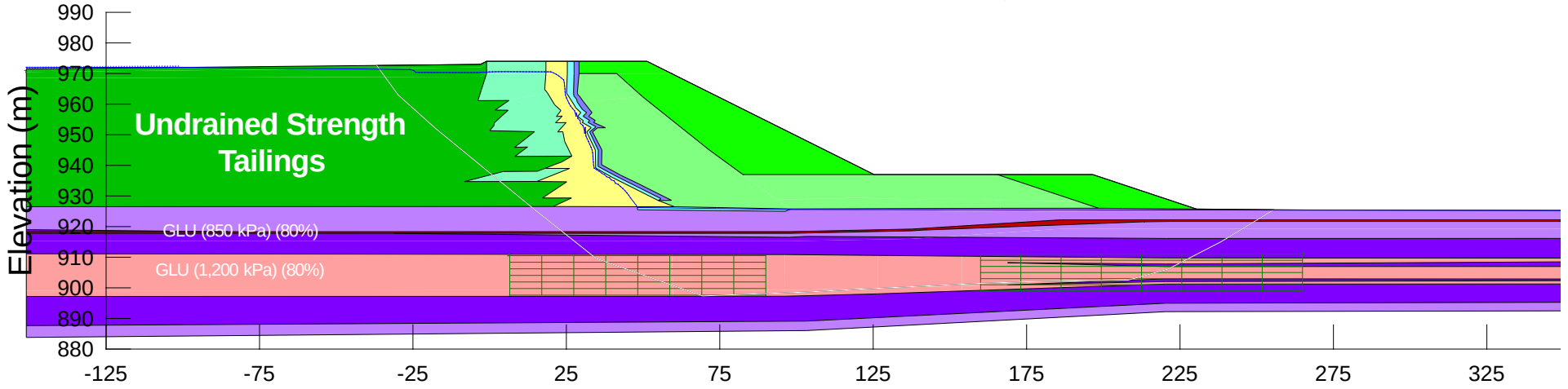

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-31

(INPUT LOCATION OF STABILITY FILES)

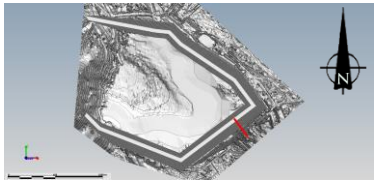

0 m beach

1.2

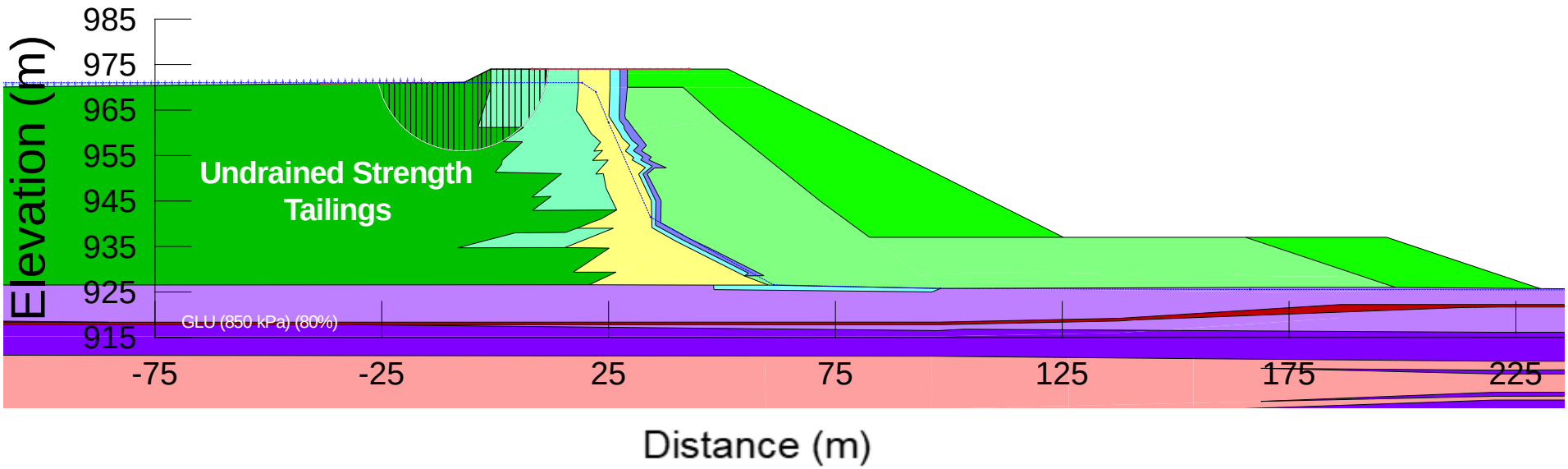

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach.
3. 0 m sub-aerial beach; pond elevation at 971 m.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+455 *(Old Stn. 2+460)*
POST-EARTHQUAKE (UPSTREAM)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-32

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.5

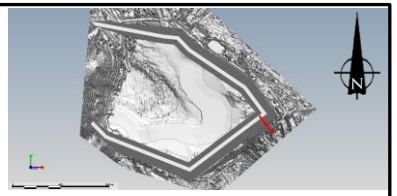

100 m beach

2.6

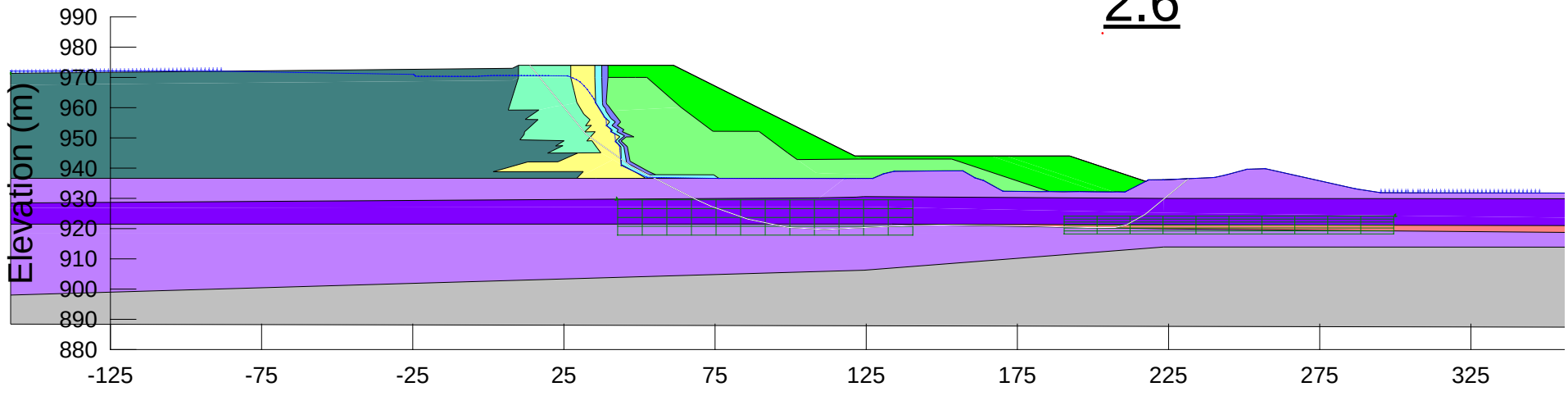

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+695 *(Old Stn. 2+700)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-33

(INPUT LOCATION OF STABILITY FILES)

0 m beach

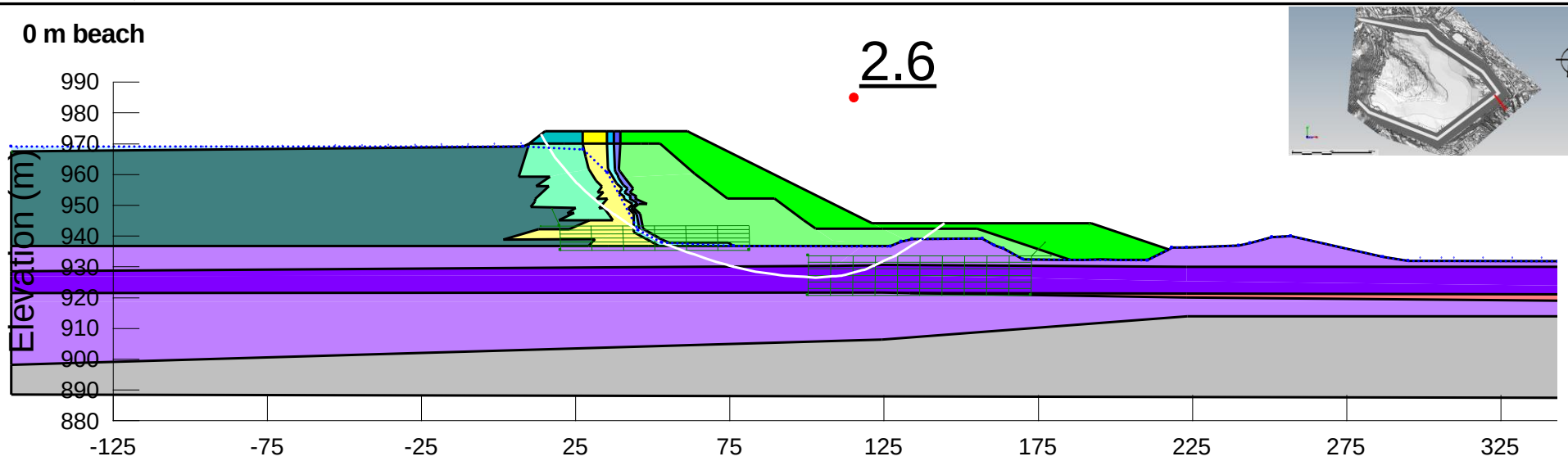

100 m beach

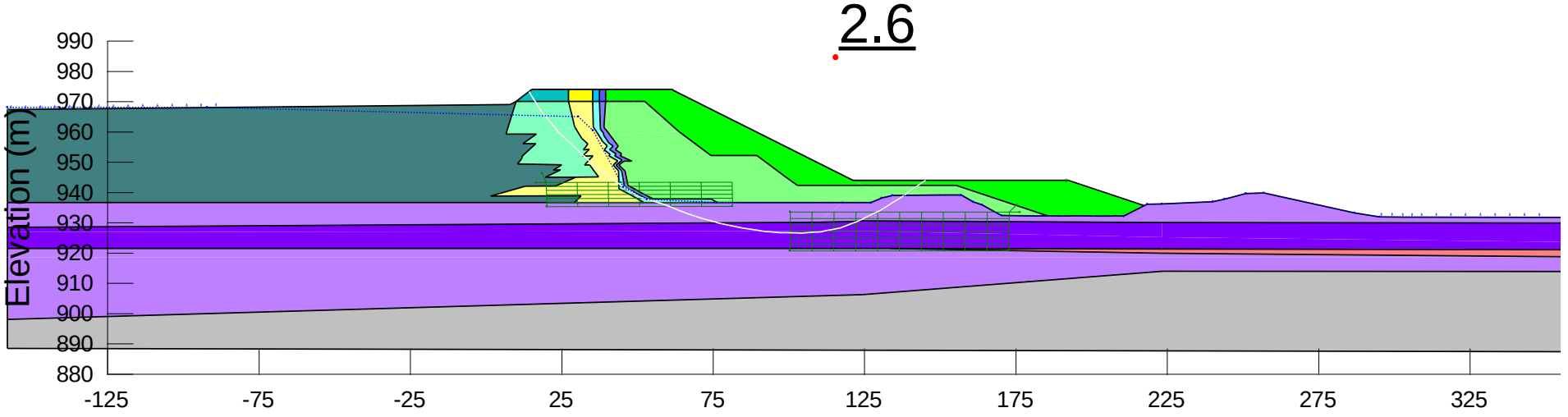

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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MOUNT POLLEY MINING CORPORATION

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+695 *(Old Stn. 2+700)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-34

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.3

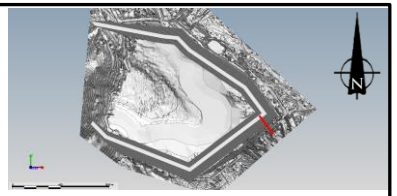

100 m beach

2.4

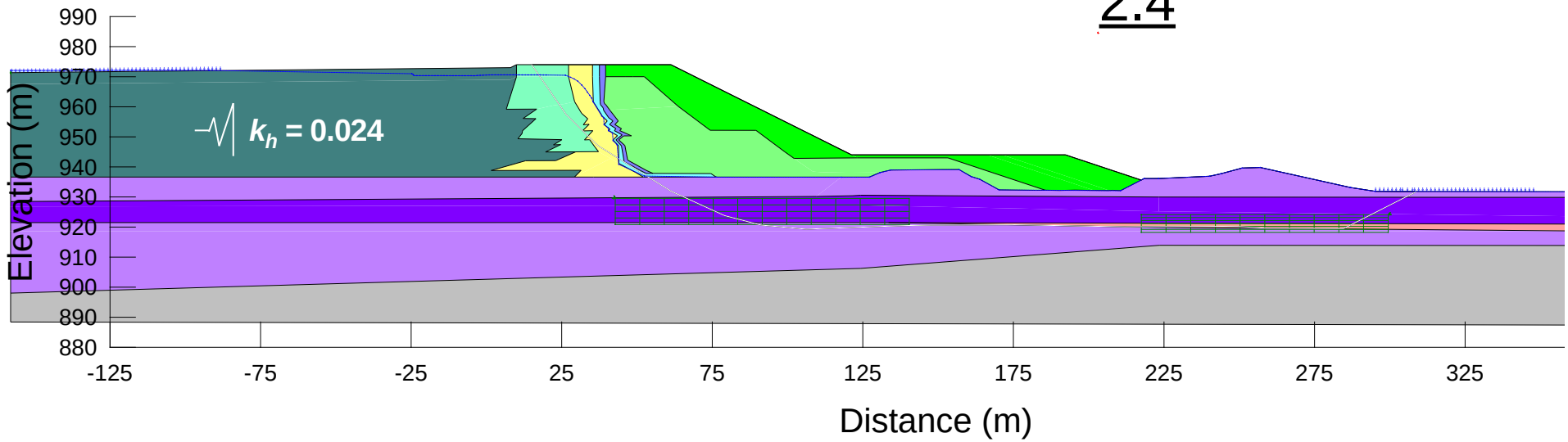

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+695 *(Old Stn. 2+700)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-35

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.5

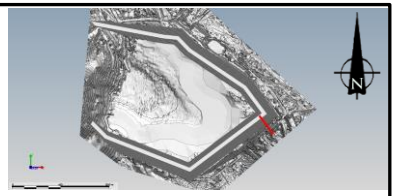

100 m beach

2.5

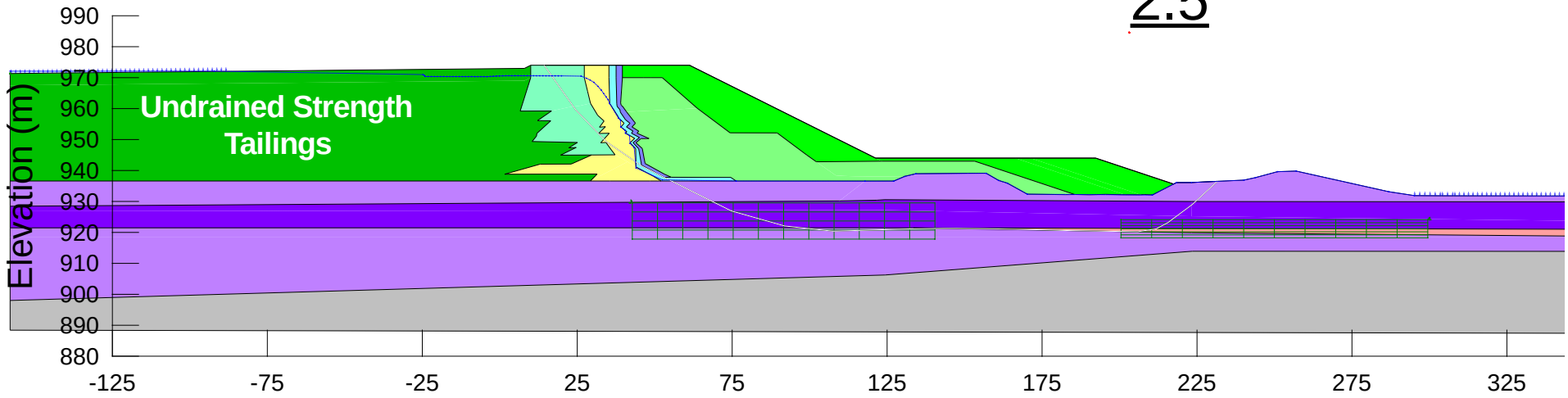

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (MAIN EMBANKMENT)
SECTION 2+695 *(Old Stn. 2+700)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-36

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.7

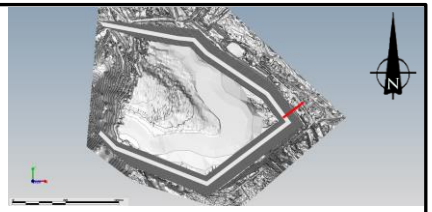

100 m beach

1.7

Distance (m)

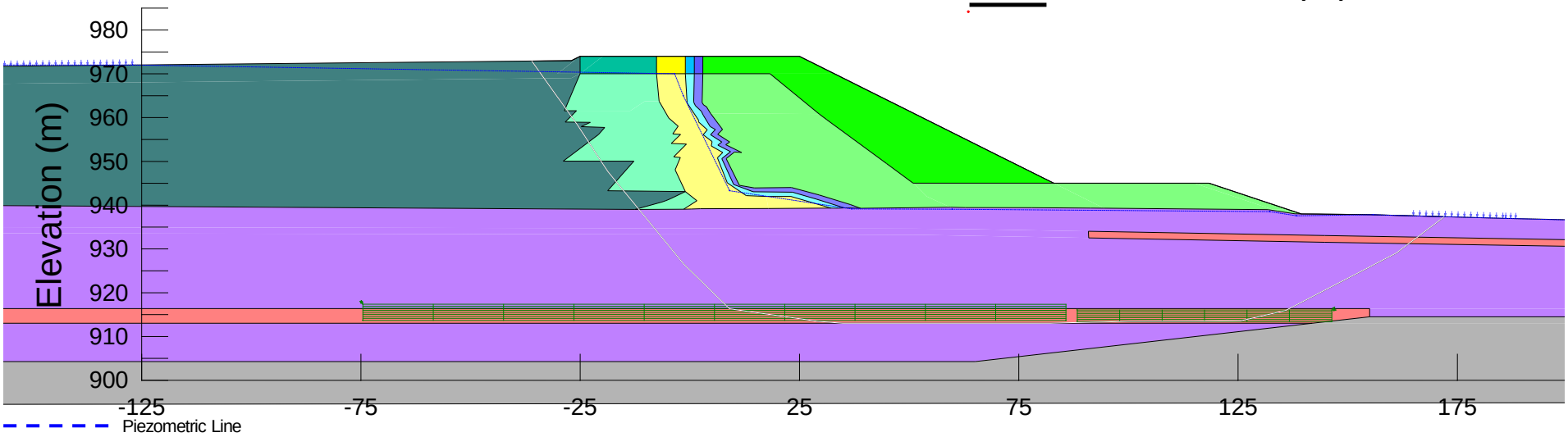

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 2+850 *(Old Stn. 2+850)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-37

(INPUT LOCATION OF STABILITY FILES)

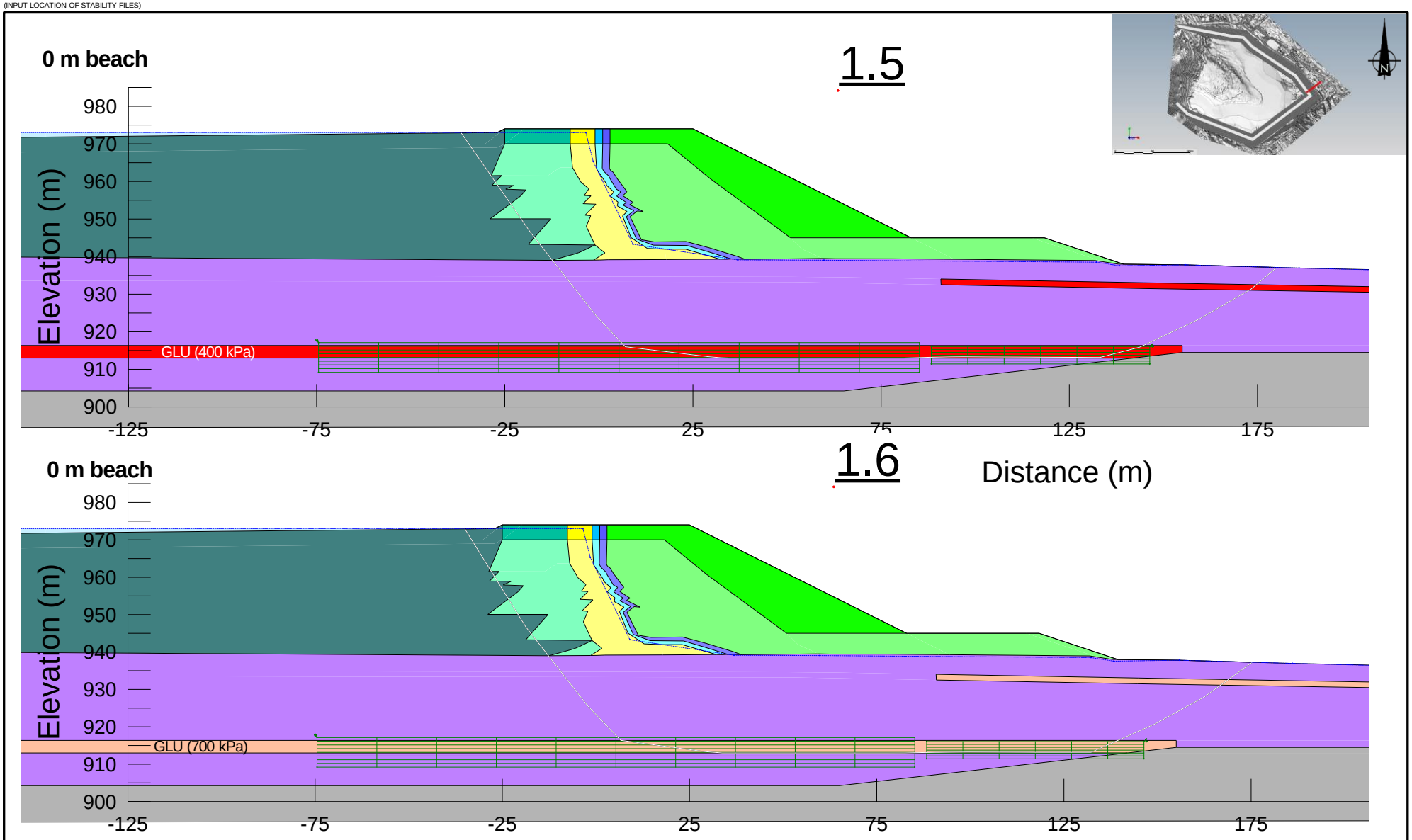

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. Sensitivity GLU undrained shear strength with pre-consolidation pressure reduced to 400 kPa and 700 kPa.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 2+850 *(Old Stn. 2+850)*
LONG-TERM (GLU SHEAR STRENGTH SENSITIVITY)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-38

(INPUT LOCATION OF STABILITY FILES)

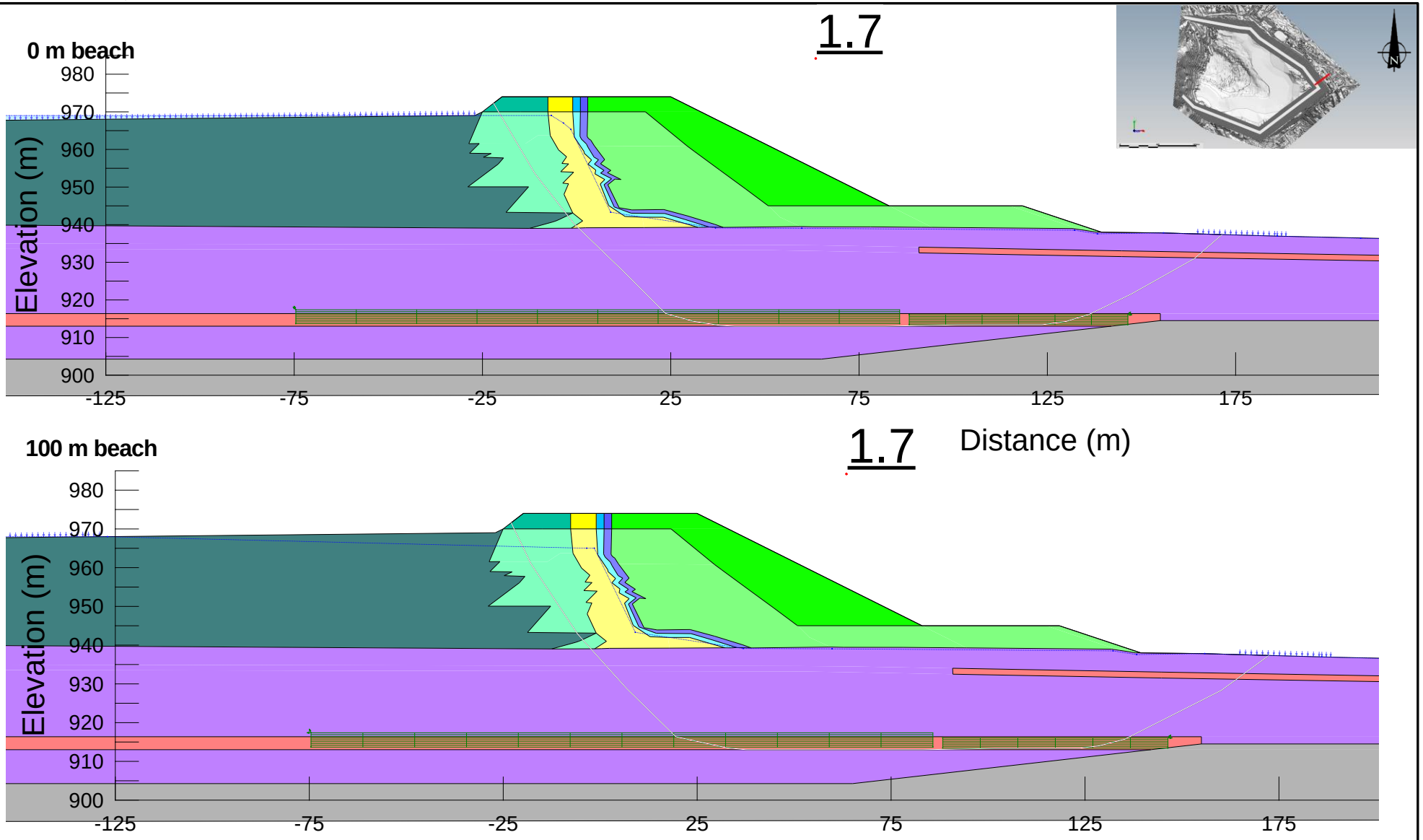

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied..
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 2+850 *(Old Stn. 2+850)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-39

(INPUT LOCATION OF STABILITY FILES)

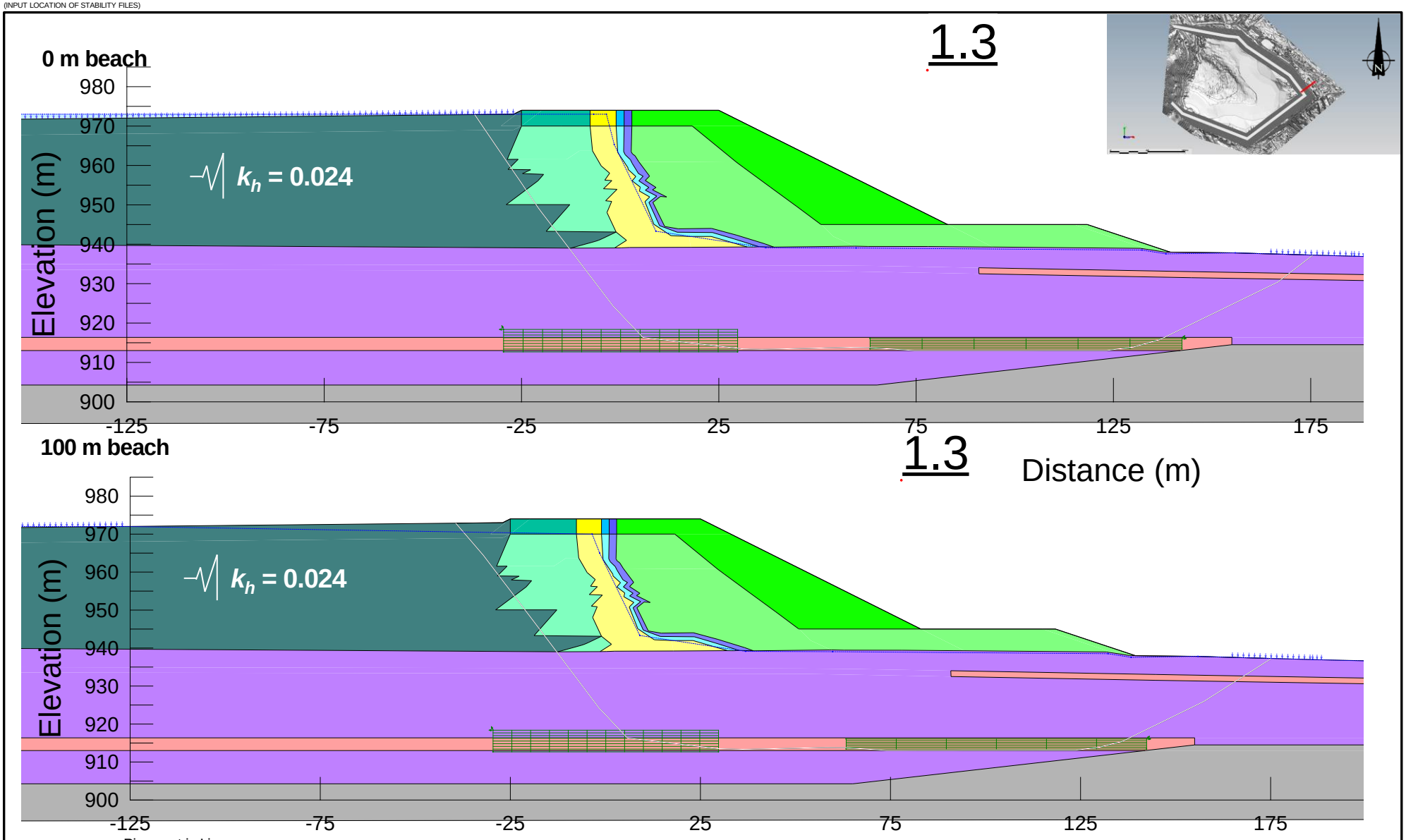

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
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4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 2+850 *(Old Stn. 2+850)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-40

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

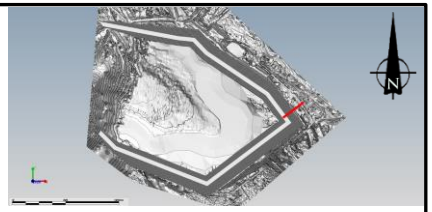

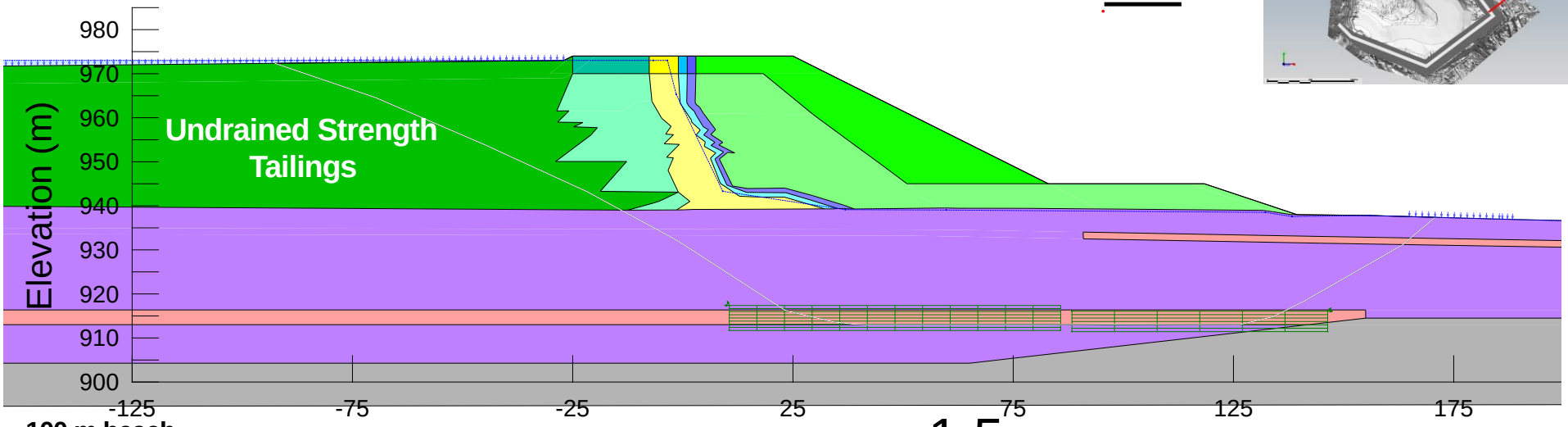

100 m beach

1.5

Distance (m)

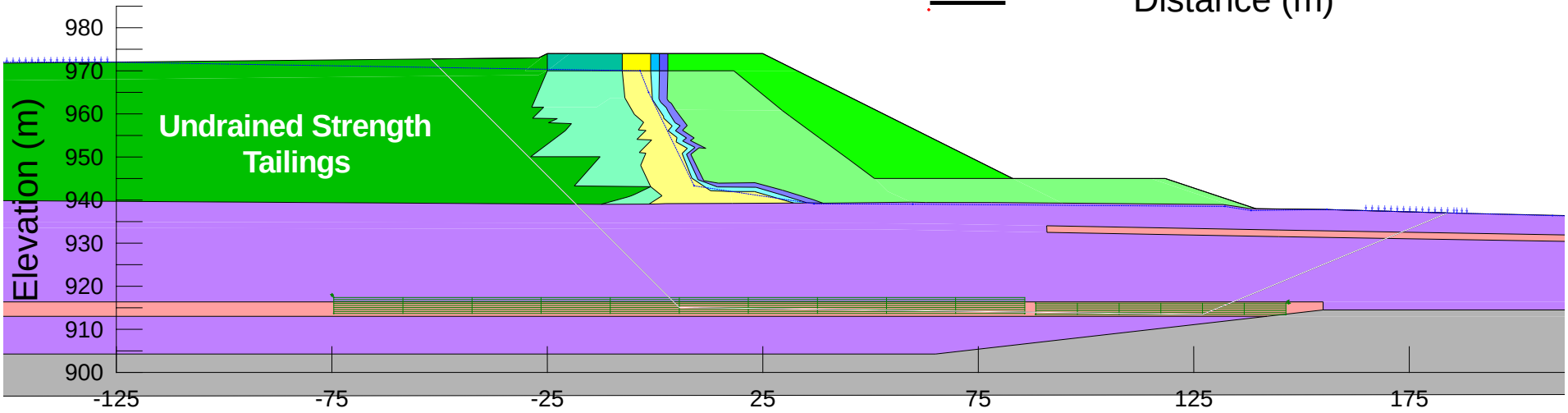

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
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YYYY-MM-DD	2024-04-16
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 2+850 *(Old Stn. 2+850)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-41

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

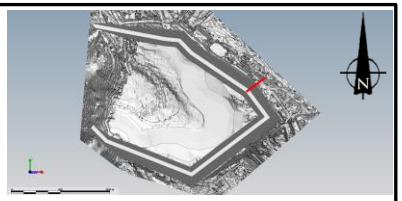

100 m beach

1.9

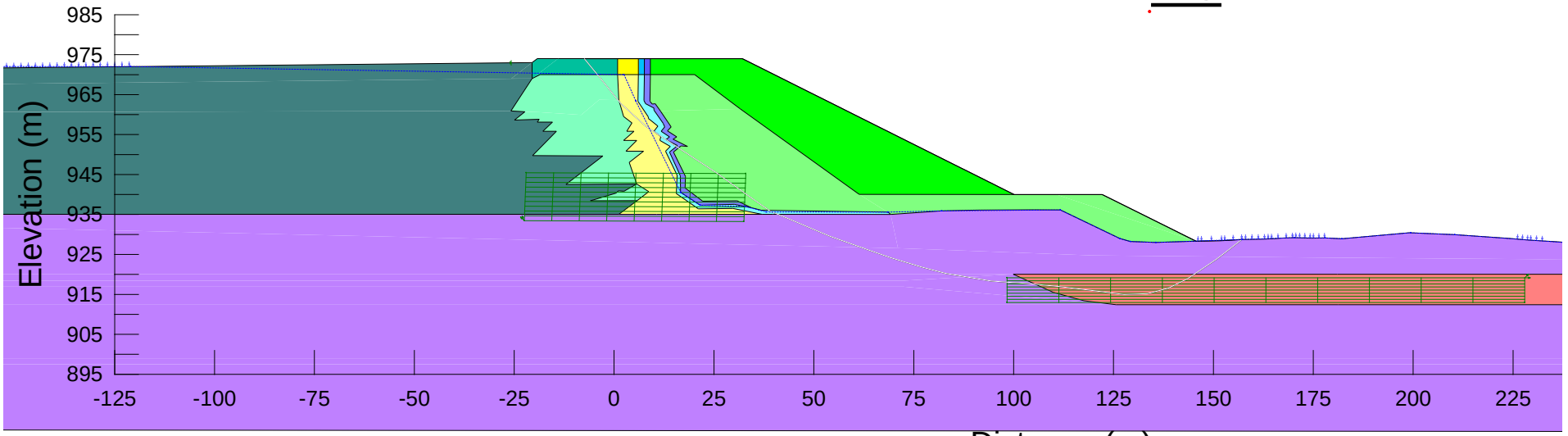

Piezometric Line

REFERENCES/NOTES

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2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+185 *(Old Stn. 3+190)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-42

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.8

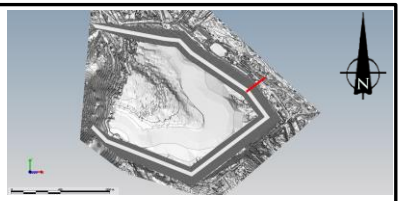

100 m beach

1.8

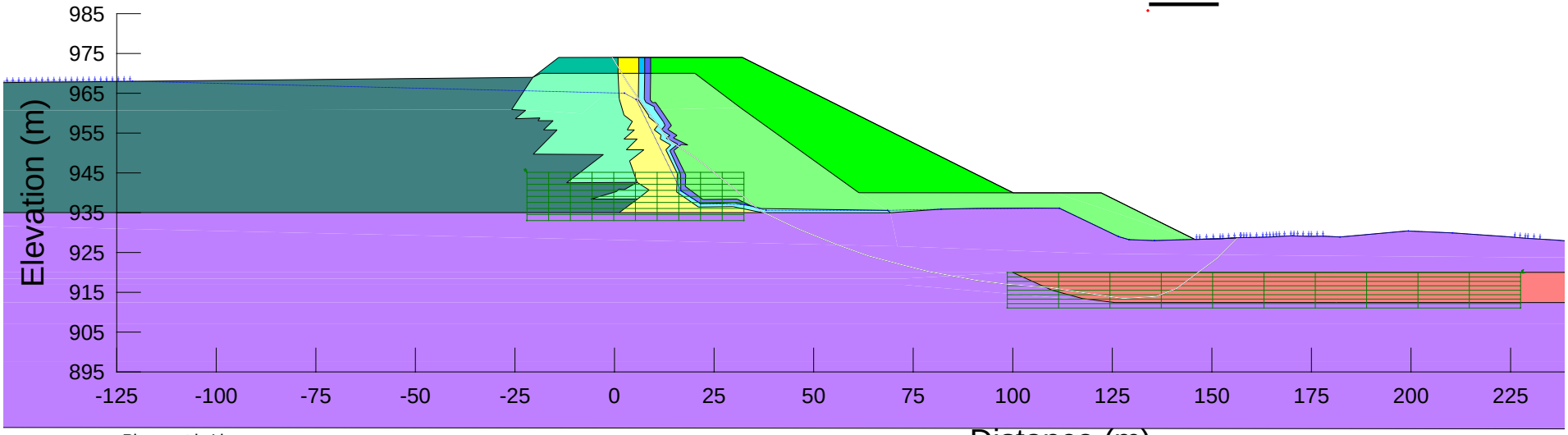

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
PREPARED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+185 *(Old Stn. 3+190)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-43

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.7

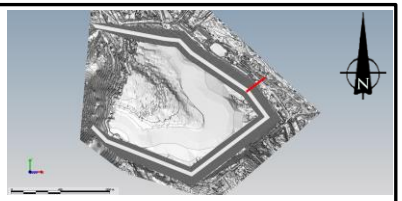

100 m beach

1.7

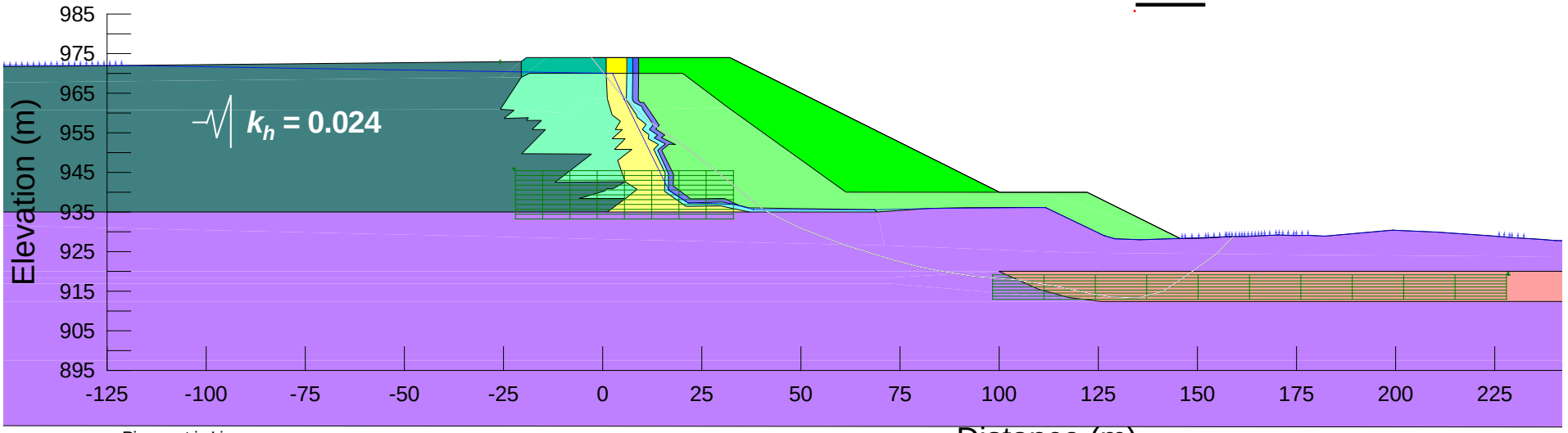

Piezometric Line

REFERENCES/NOTES

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2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+185 *(Old Stn. 3+190)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-44

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

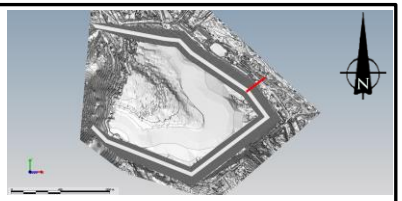

100 m beach

1.9

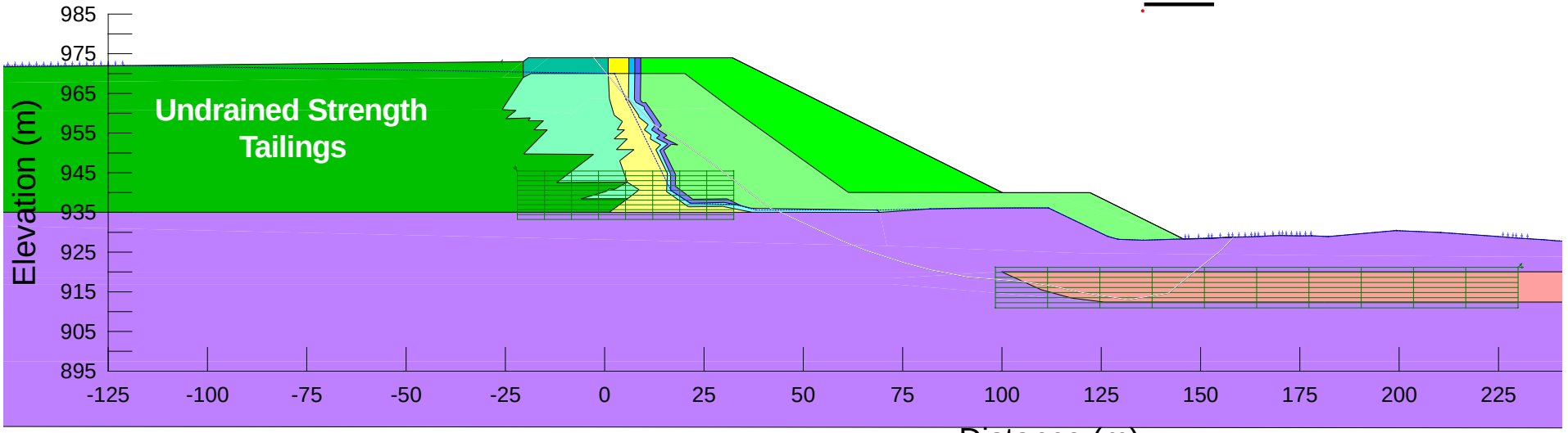

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
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CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+185 *(Old Stn. 3+190)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-45

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

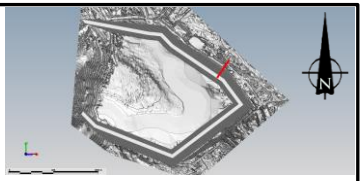

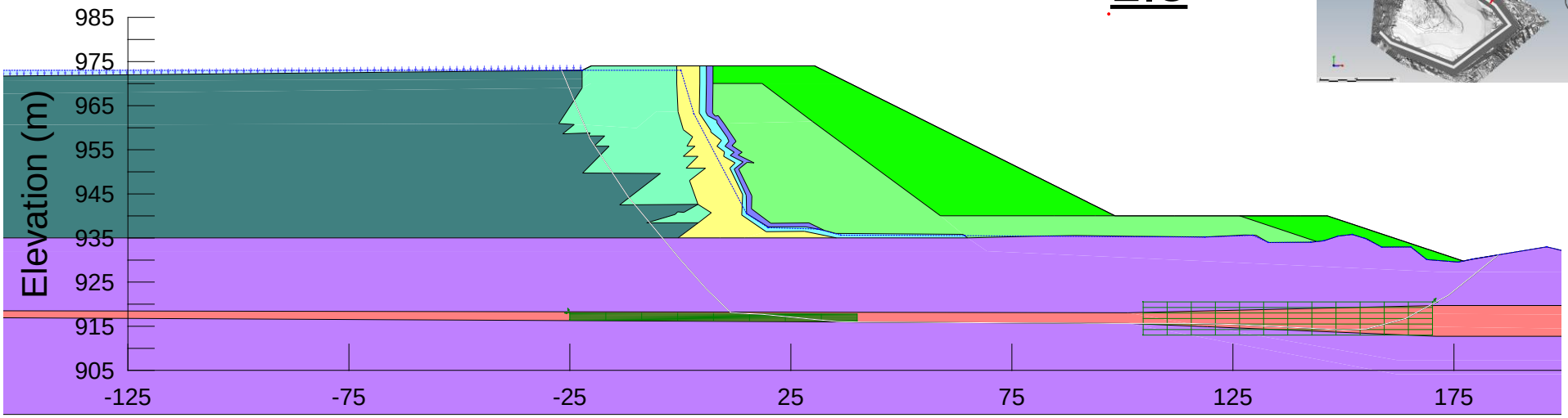

100 m beach

Distance (m)

1.6

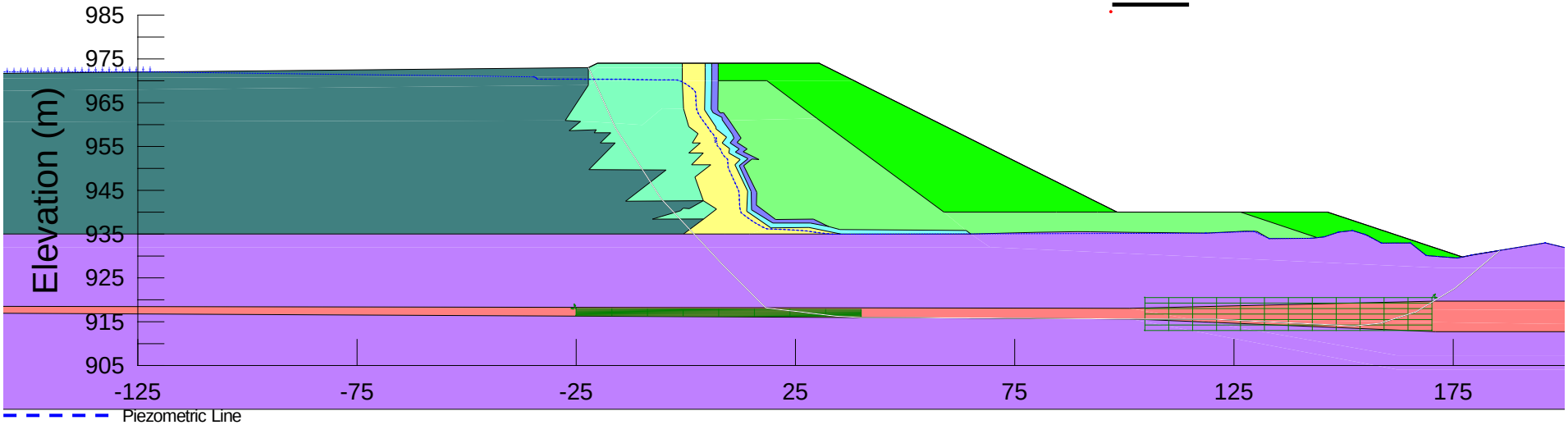

Piezometric Line

REFERENCES/NOTES

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2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
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CONSULTANT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+270 (Old Stn. 3+275)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-46

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

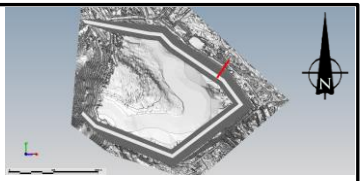

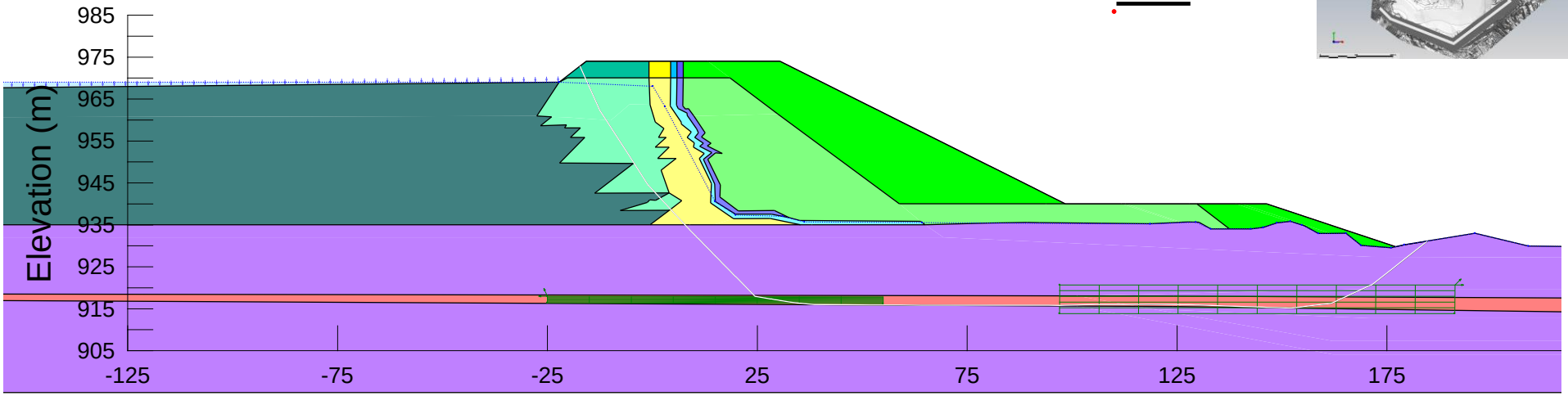

100 m beach

Distance (m)

1.6

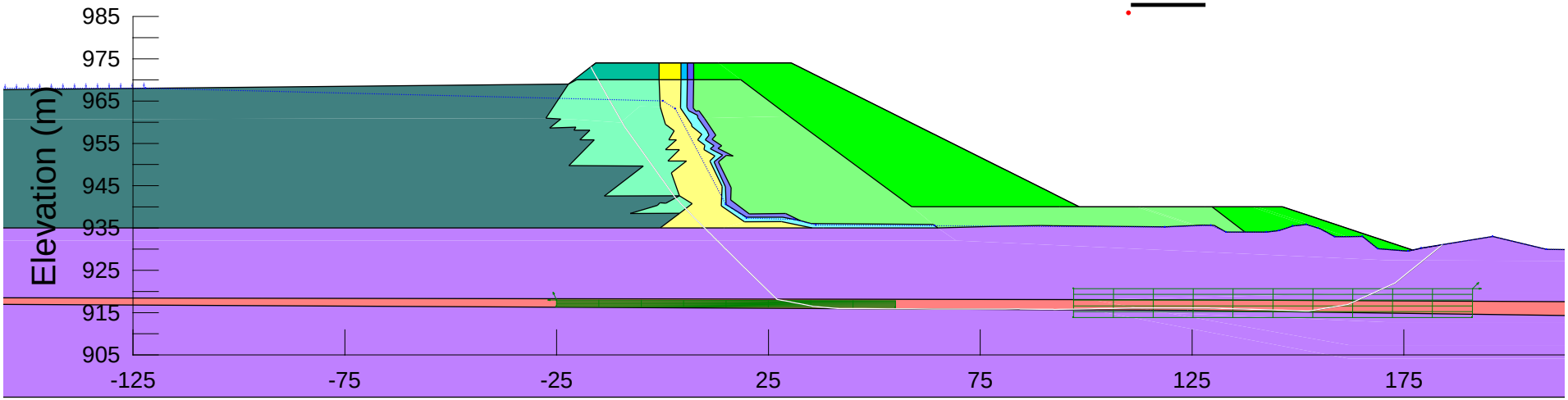

Piezometric Line

REFERENCES/NOTES

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2. Upstream drain not installed yet in short-term scenario.
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+270 *(Old Stn. 3+275)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-47

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.1

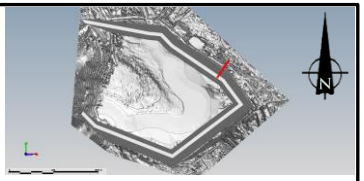

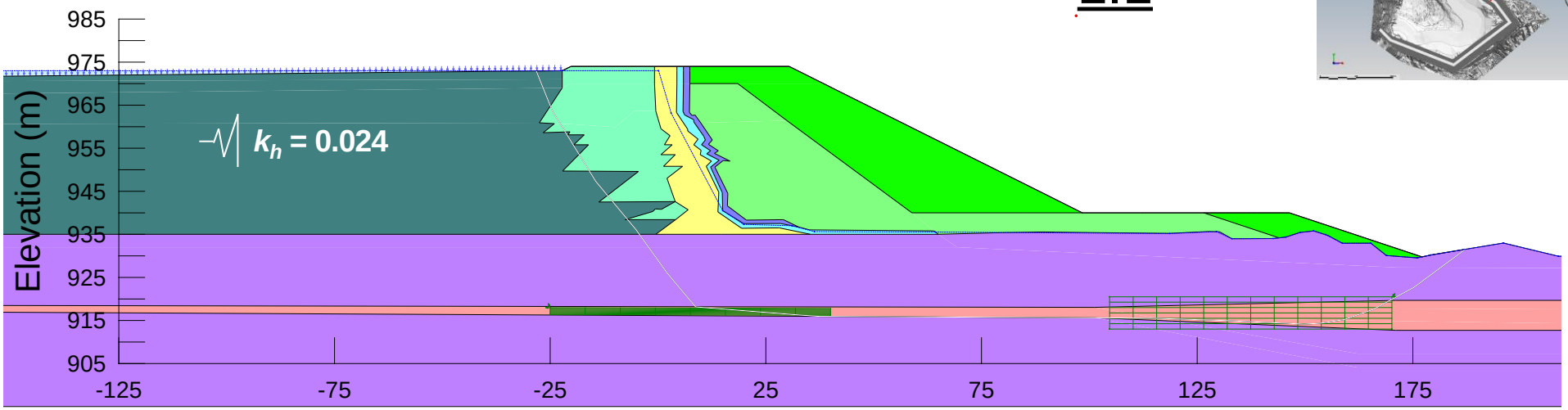

100 m beach

Distance (m)

1.2

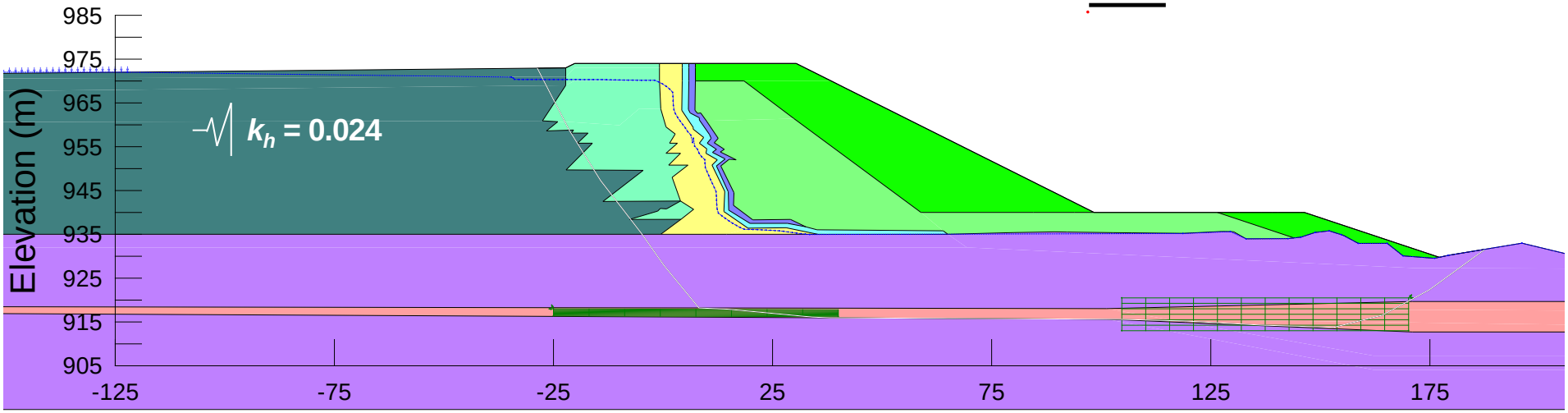

Piezometric Line

REFERENCES/NOTES

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+270 *(Old Stn. 3+275)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-48

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.2

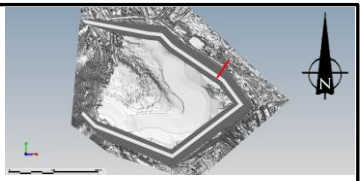

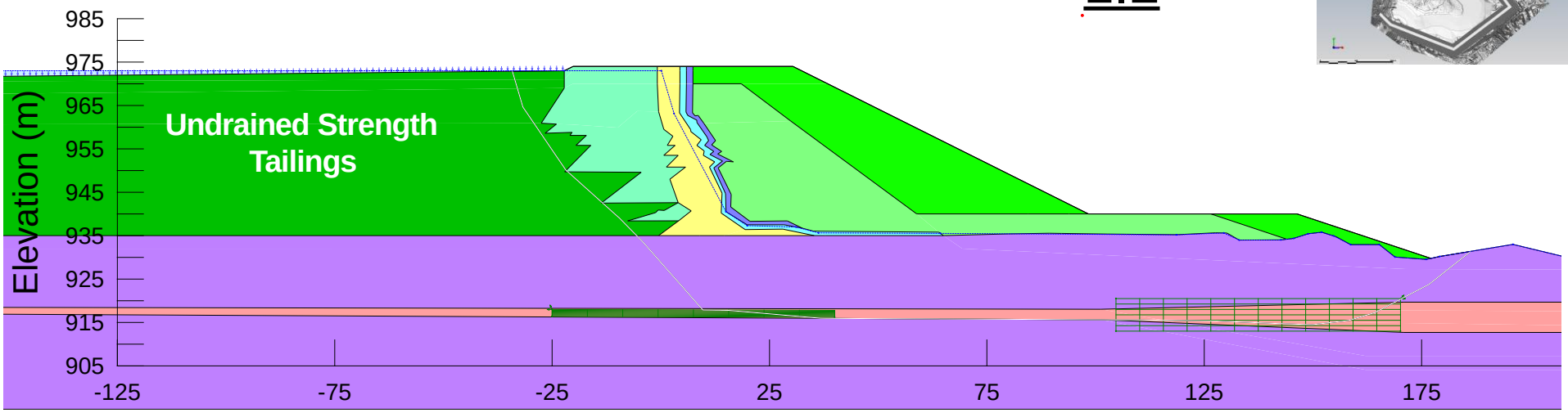

100 m beach

Distance (m)

1.2

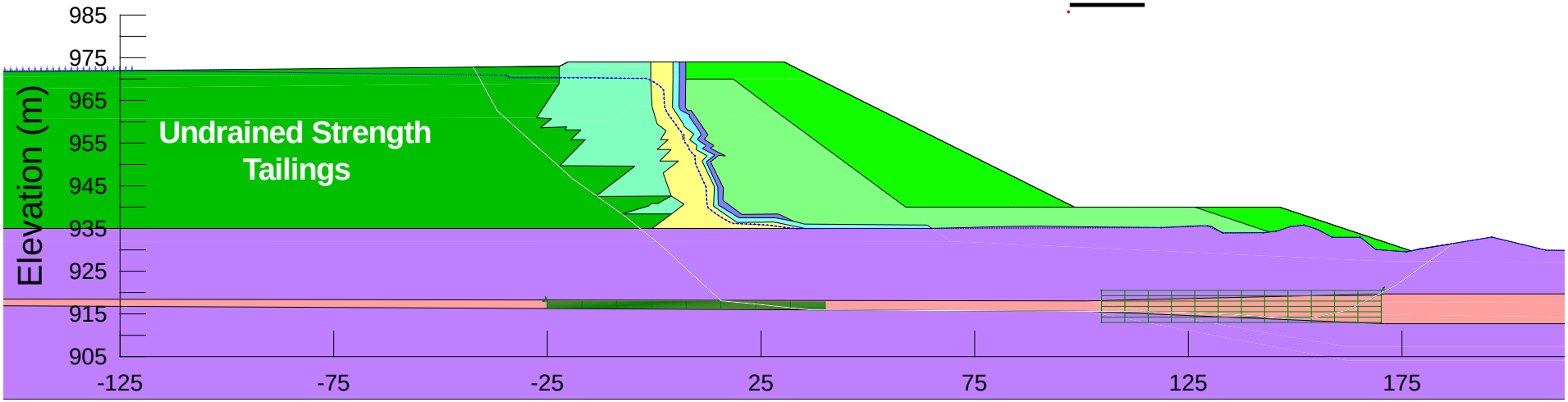

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+270 *(Old Stn. 3+275)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-49

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

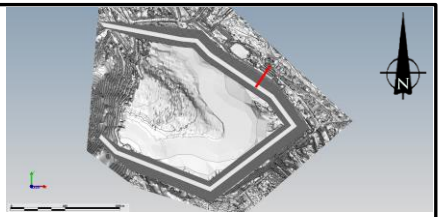

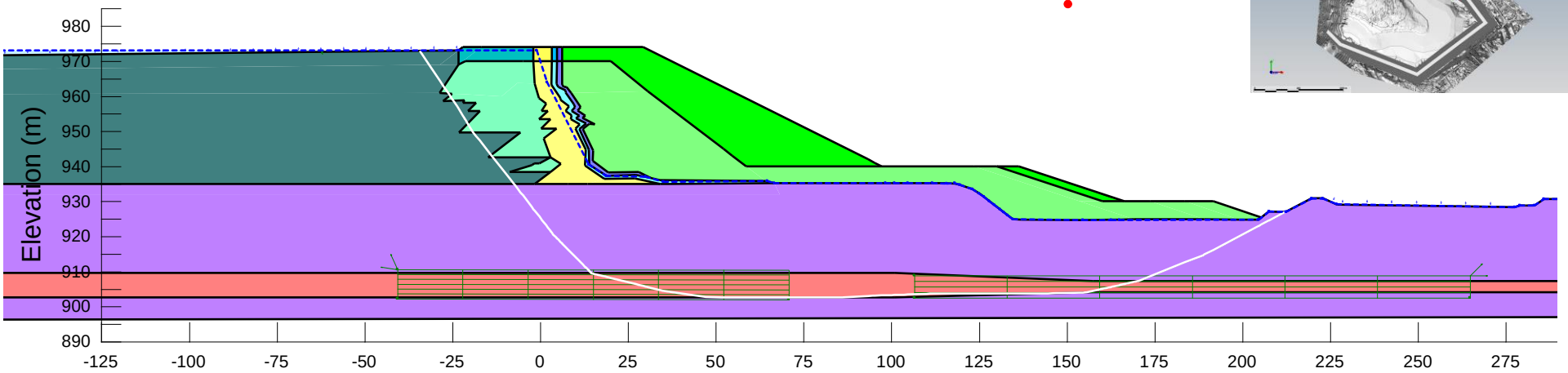

100 m beach

1.5

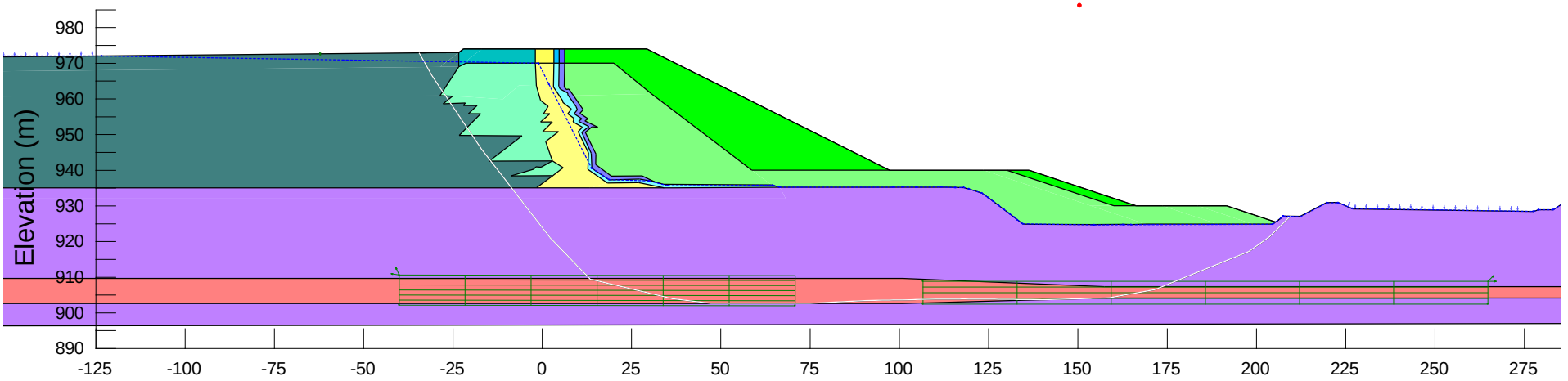

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-50

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.3

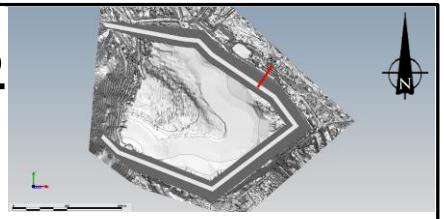

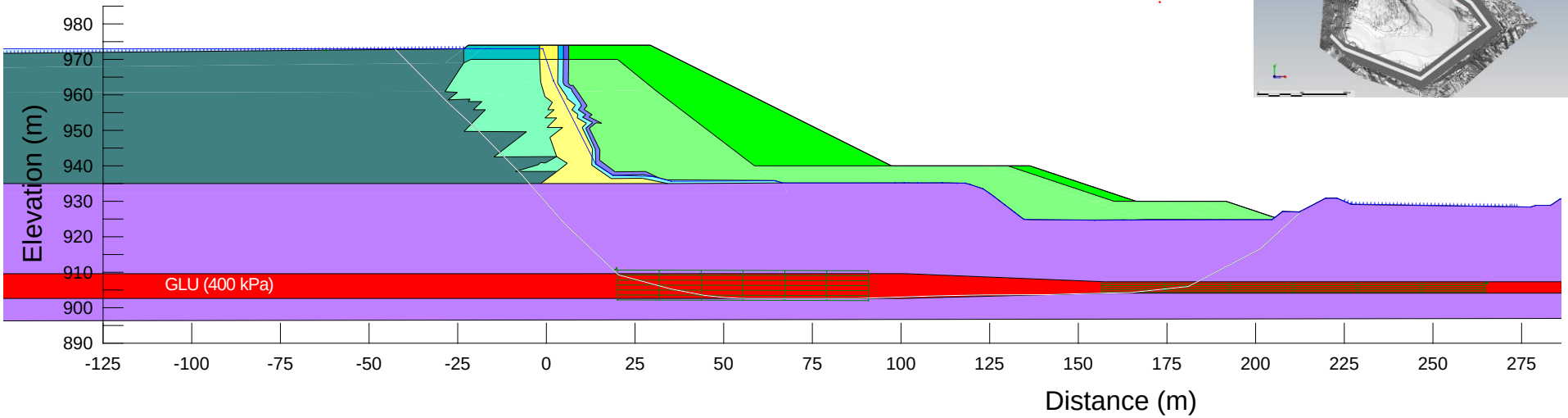

0 m beach

1.4

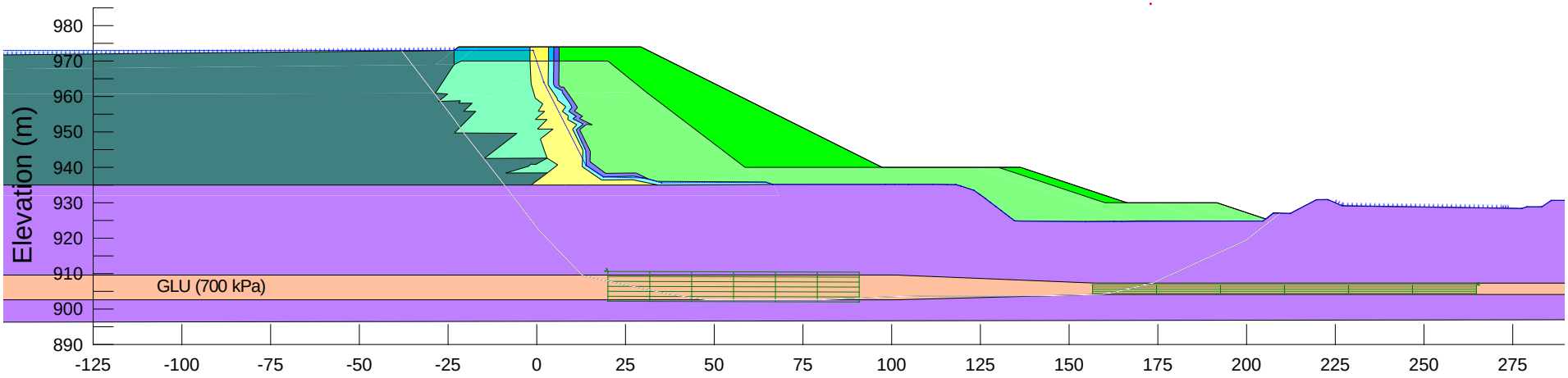

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning.
3. 0 m sub-aerial beach; pond el. 973 m.
4. Sensitivity GLU undrained shear strength with pre-consolidation pressure reduced to 400 kPa and 700 kPa.

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YYYY-MM-DD	2024-04-16
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
LONG-TERM (GLU SHEAR STRENGTH SENSITIVITY)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-51

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

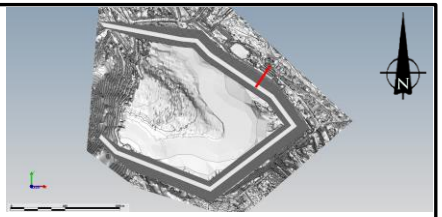

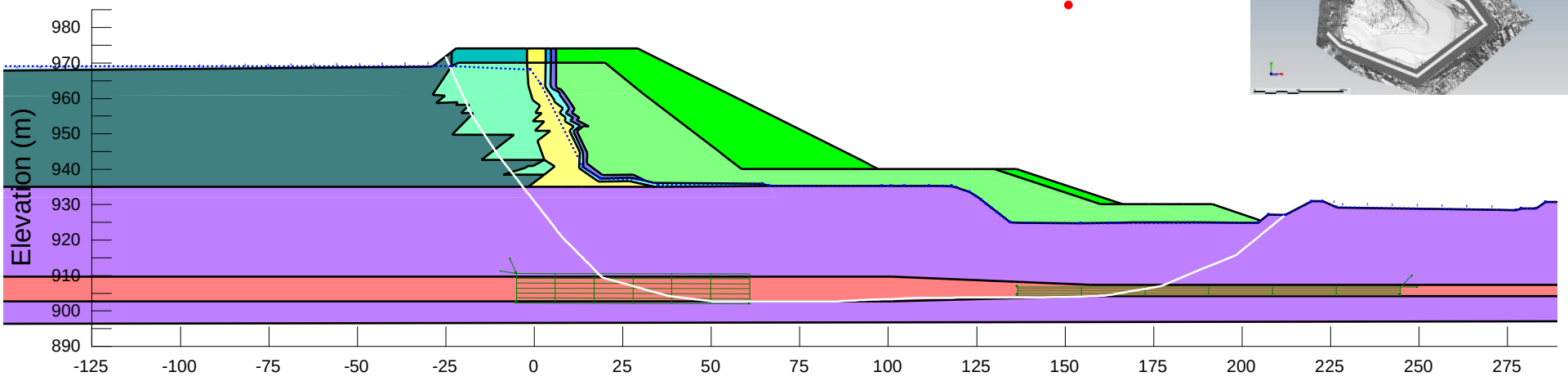

100 m beach

1.5

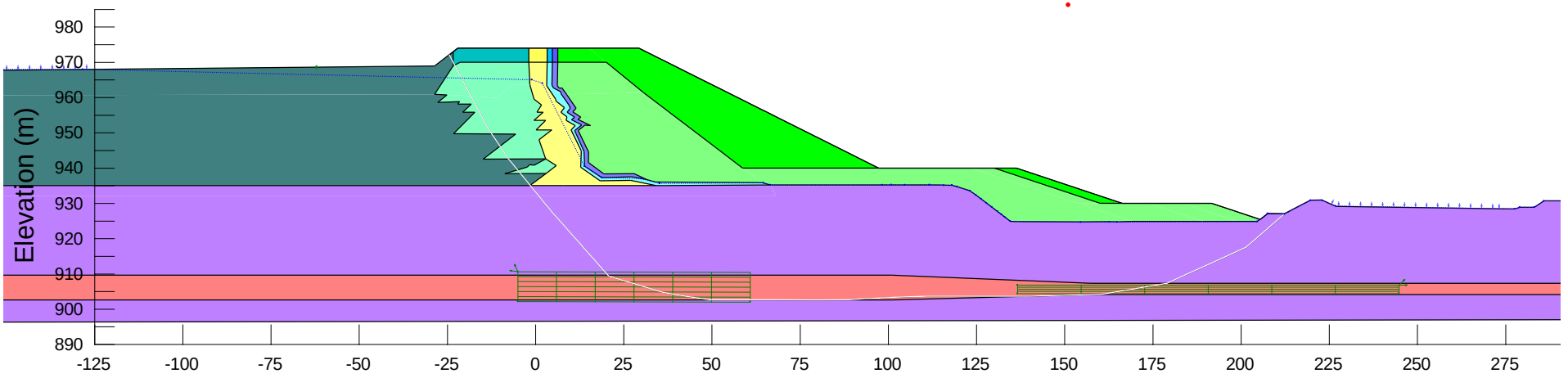

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-52

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.2

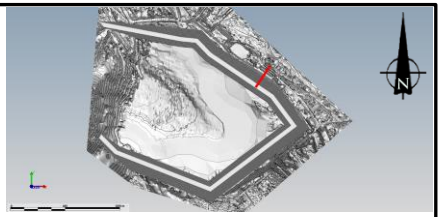

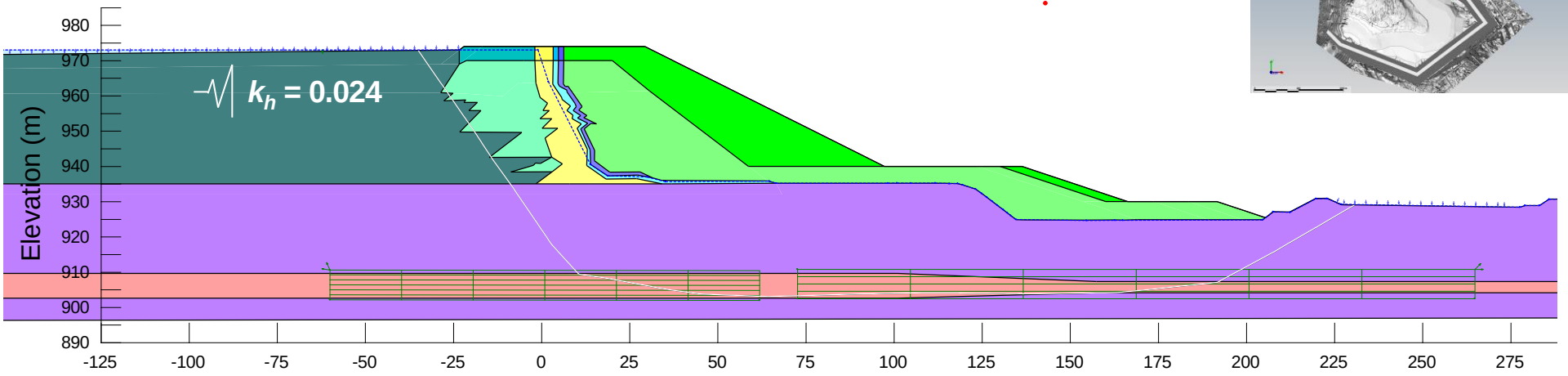

100 m beach

1.2

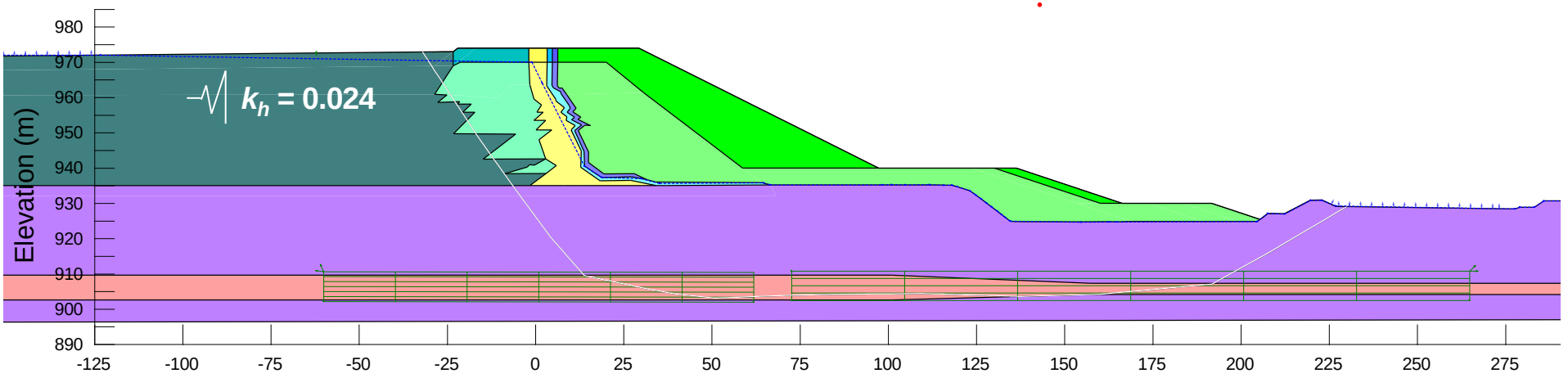

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-53

(INPUT LOCATION OF STABILITY FILES)

100 m beach

1.1

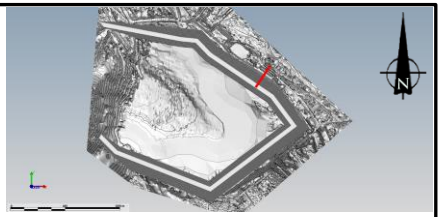

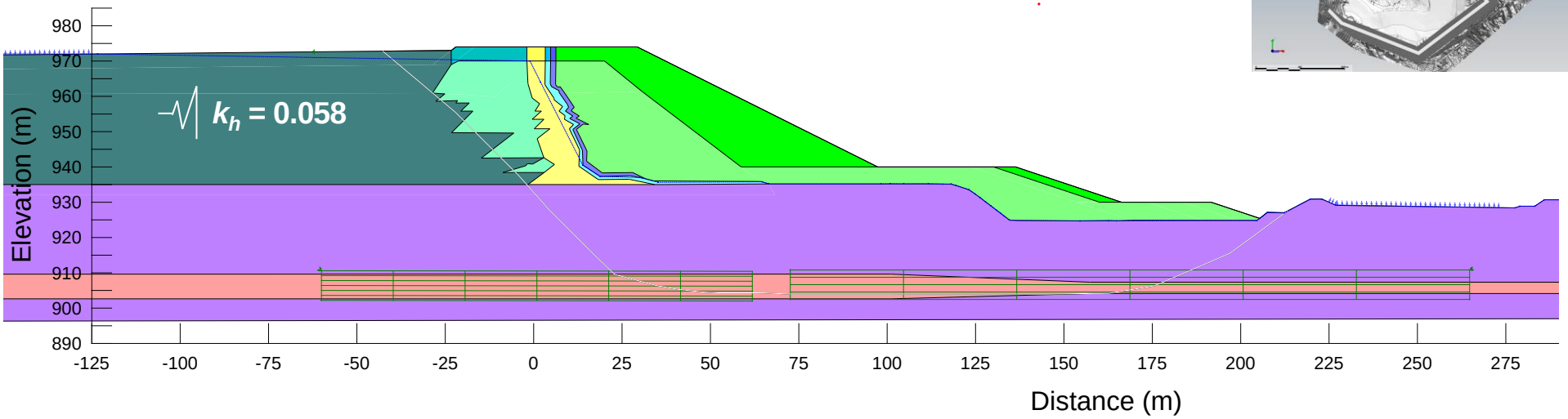

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain functioning.
3. 100 m sub-aerial beach; pond el. 972 m.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 10,000-year EAP.
5. GLU shear strength reduced to 80%.

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YYYY-MM-DD	2024-04-16
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-54

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.3

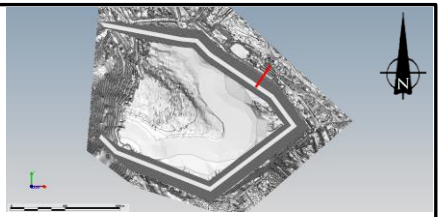

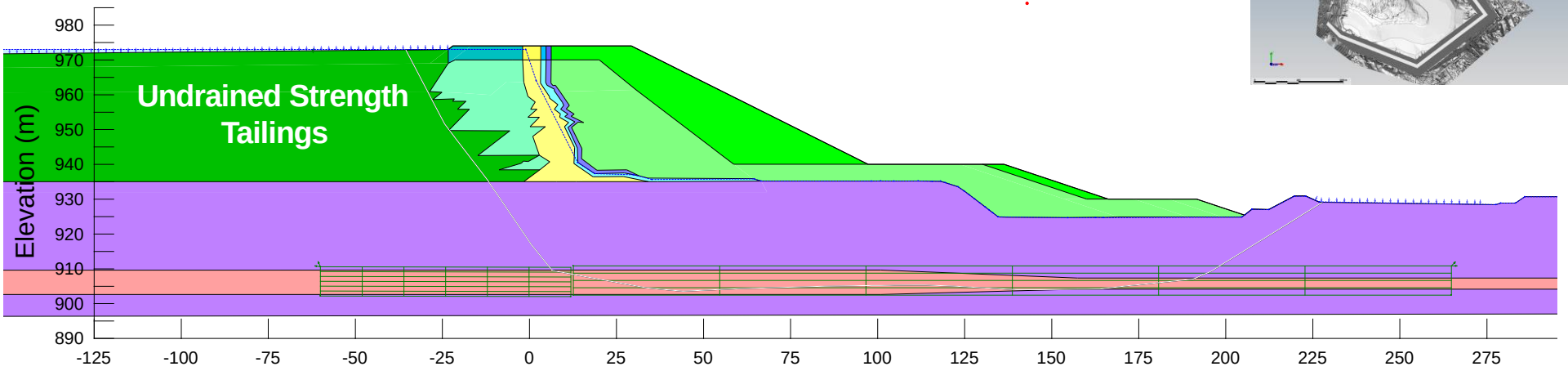

100 m beach

1.3

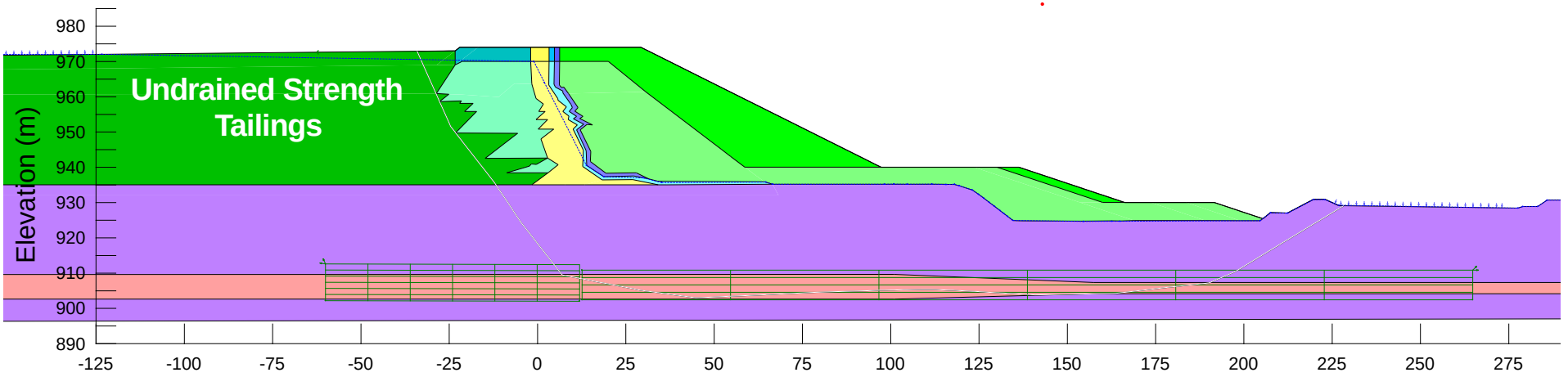

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+395 *(Old Stn. 3+400)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-55

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

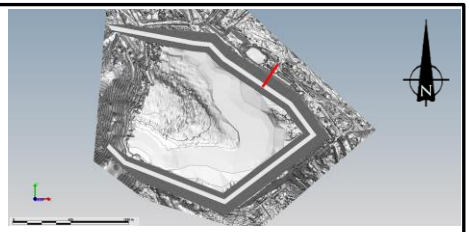

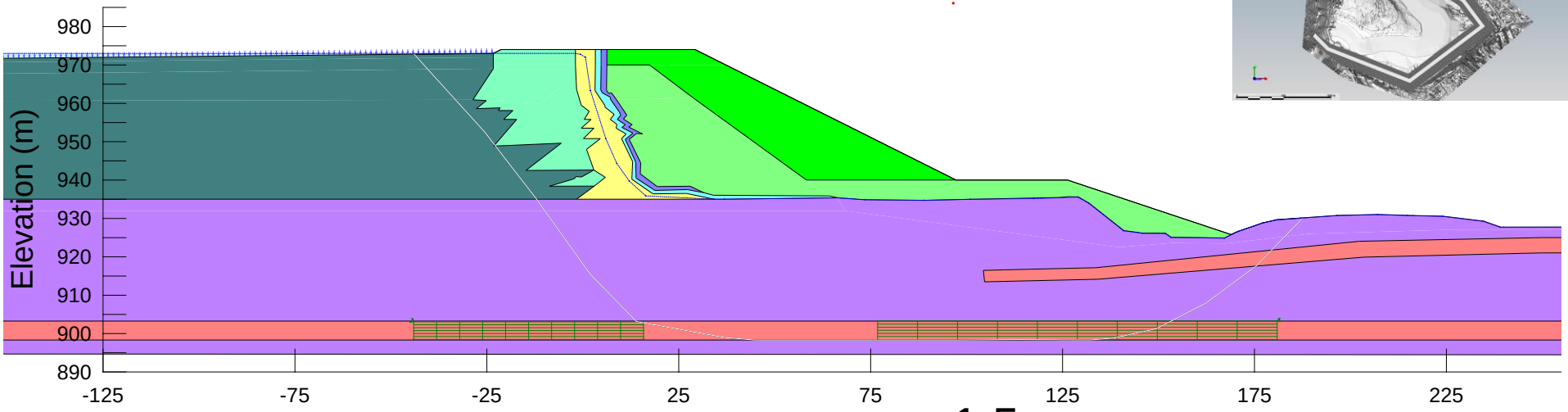

100 m beach

1.5

Distance (m)

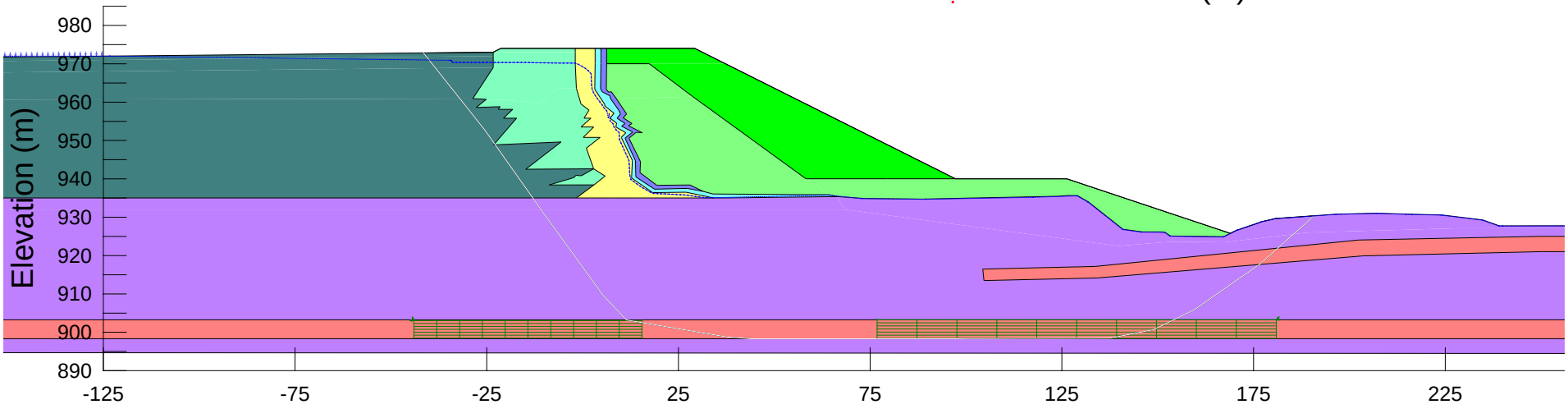

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+530 *(Old Stn. 3+535)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-56

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

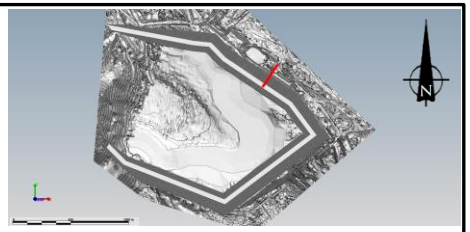

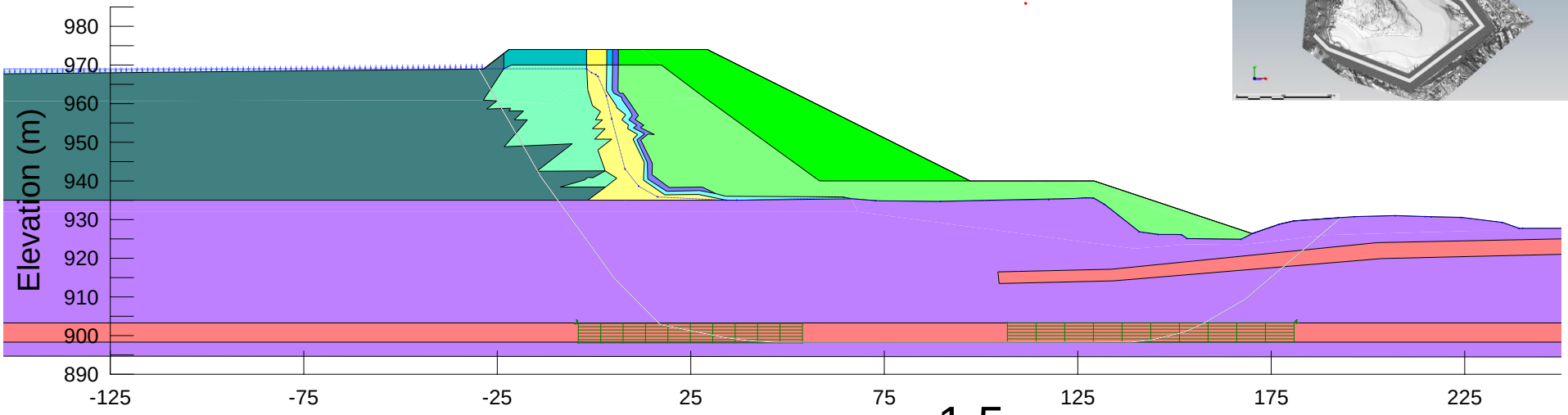

100 m beach

1.5

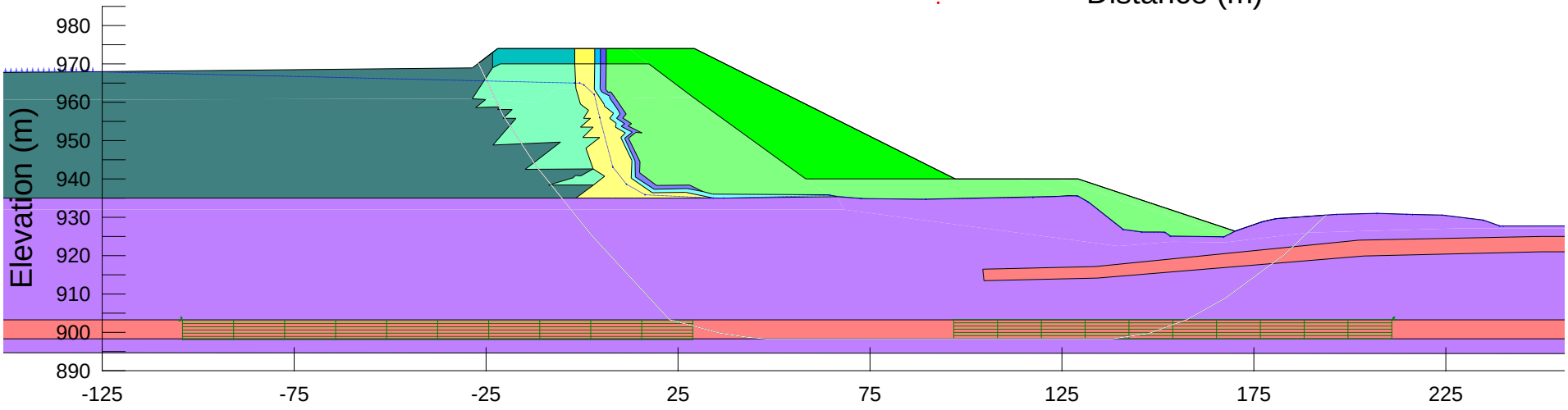

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+530 *(Old Stn. 3+535)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-57

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.2

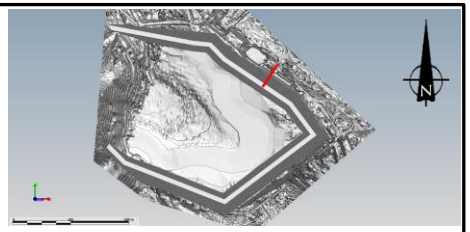

100 m beach

1.2

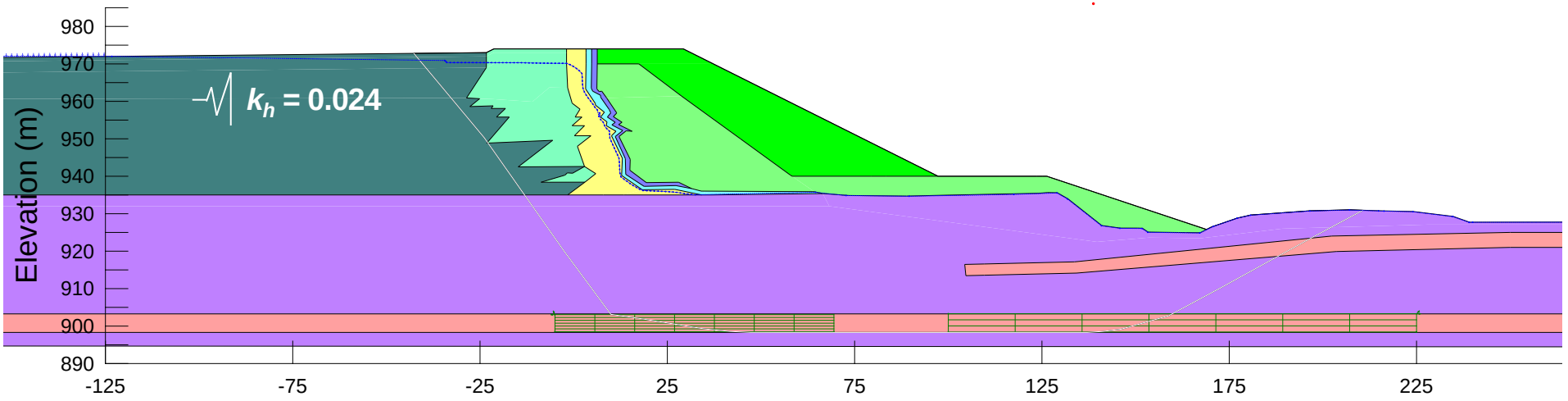

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+530 *(Old Stn. 3+535)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-58

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.3

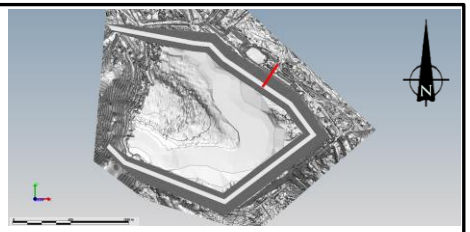

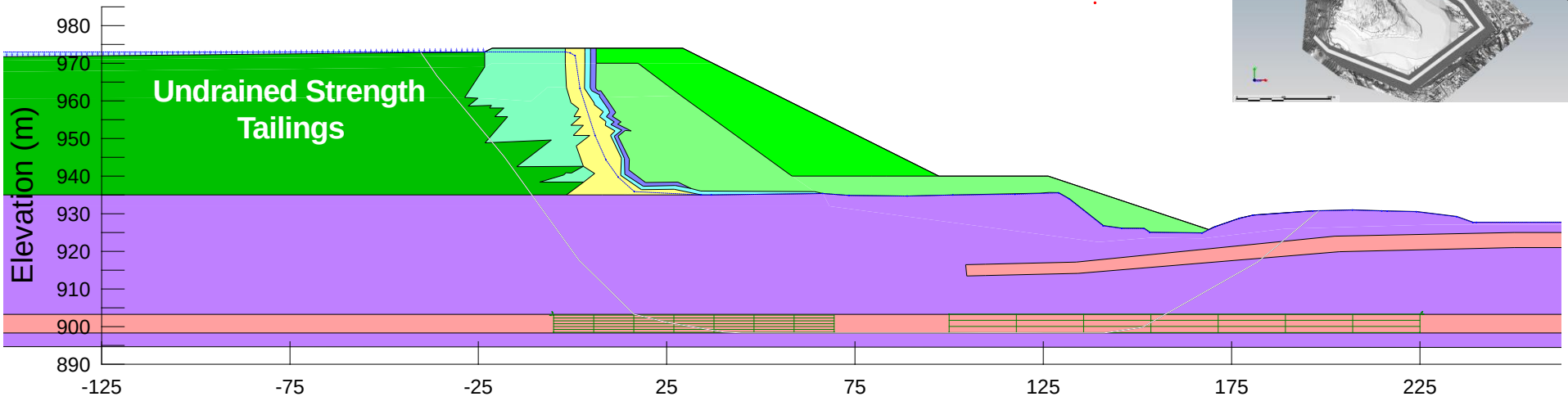

100 m beach

1.3

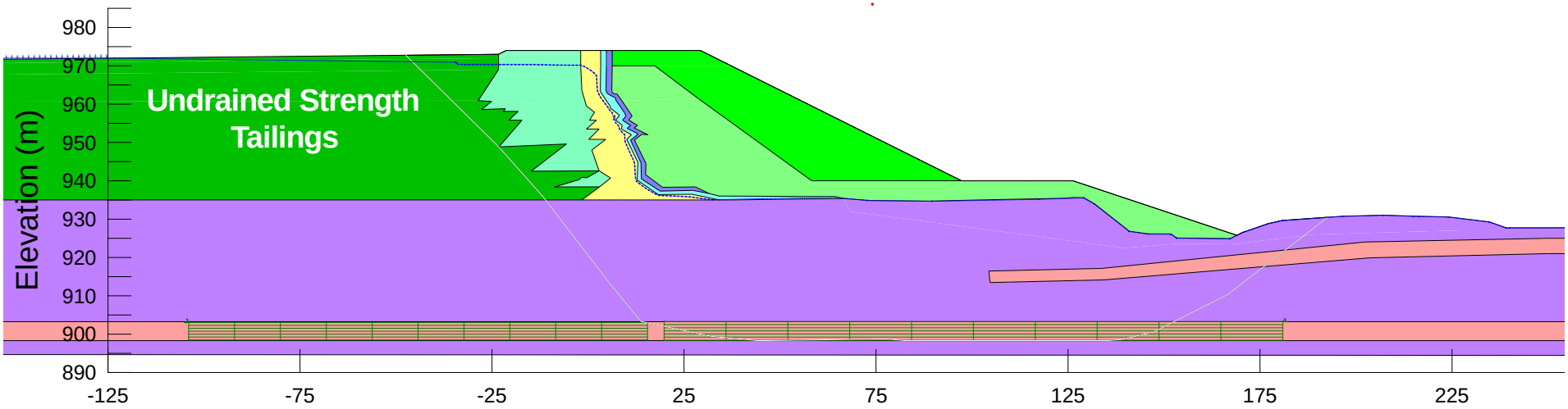

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+530 *(Old Stn. 3+535)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-59

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

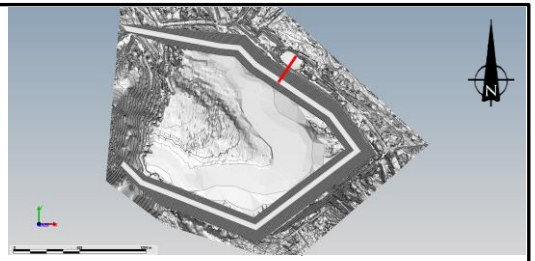

100 m beach

1.7 Distance (m)

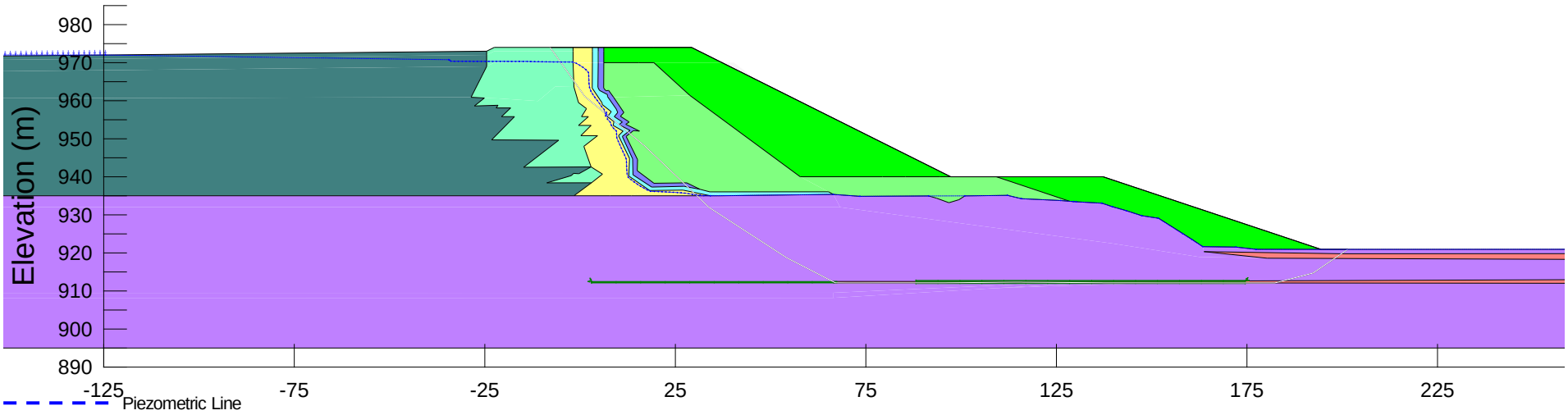

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
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CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-60

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

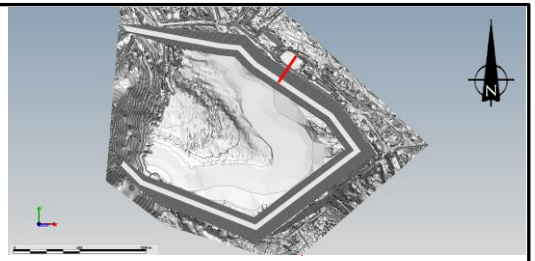

100 m beach

1.6

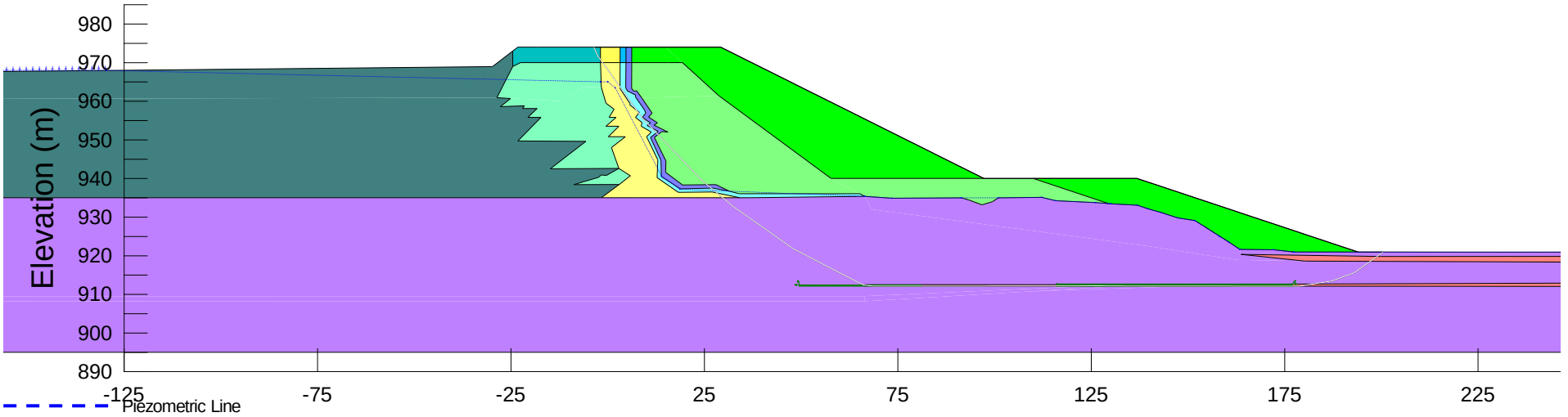

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-61

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.4

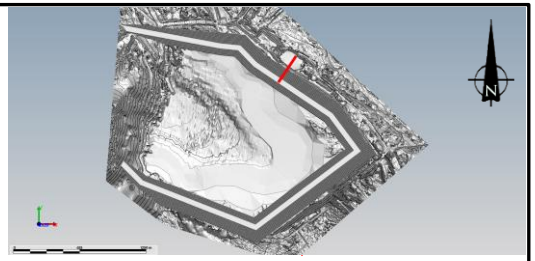

100 m beach

1.4

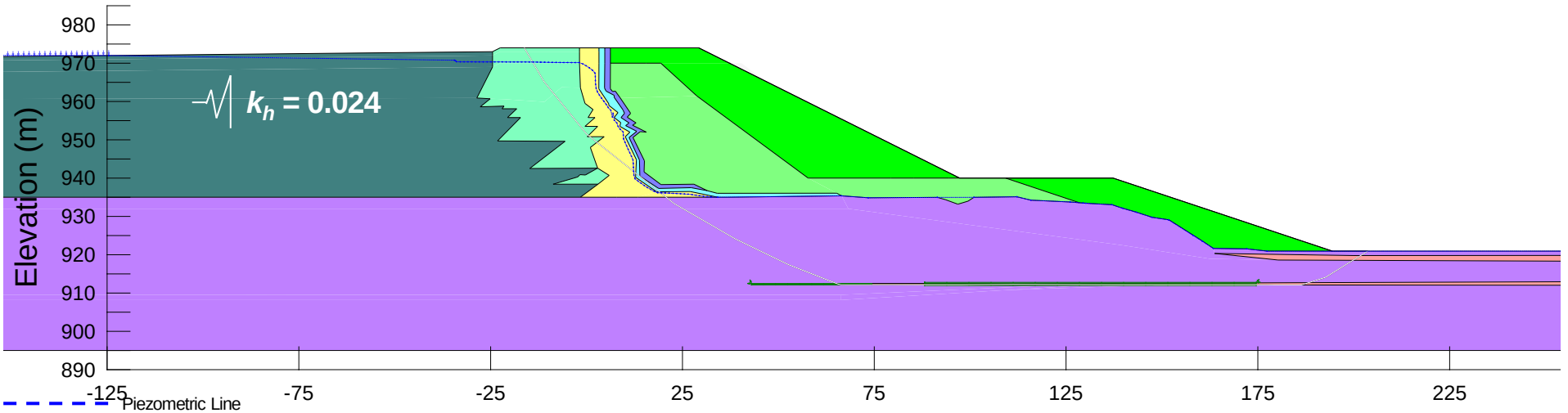

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-62

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

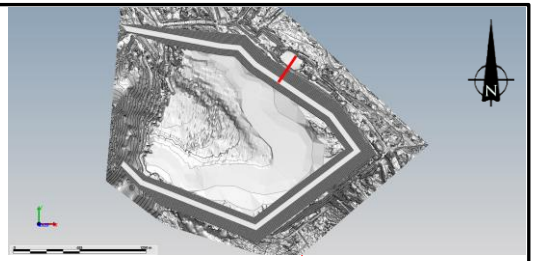

100 m beach

1.5

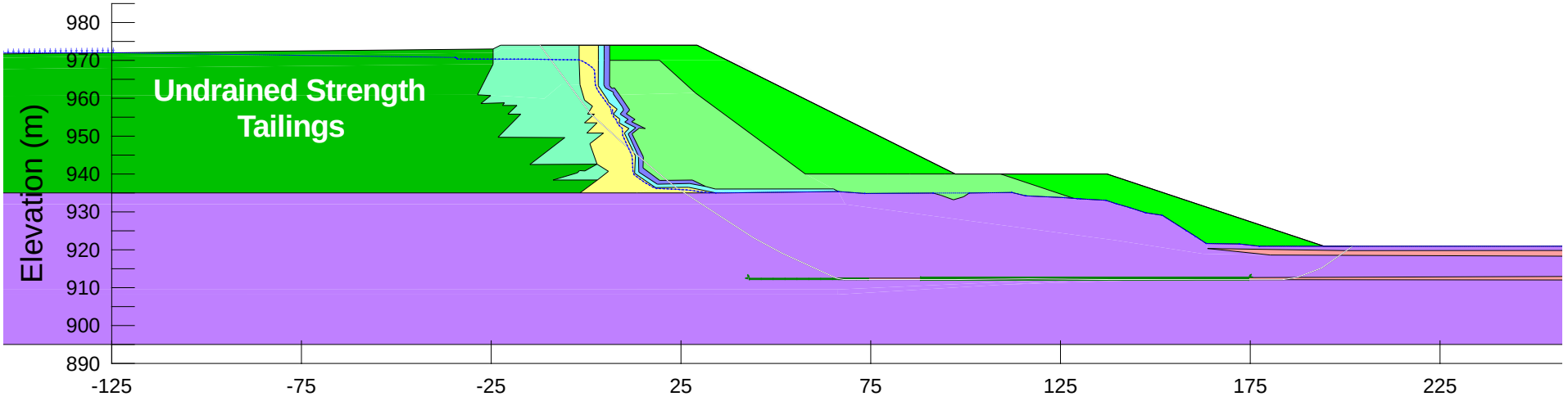

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (PERIMETER EMBANKMENT)
SECTION 3+765 *(Old Stn. 3+770)*
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-63

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.5

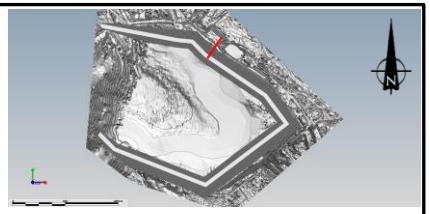

100 m beach

2.5

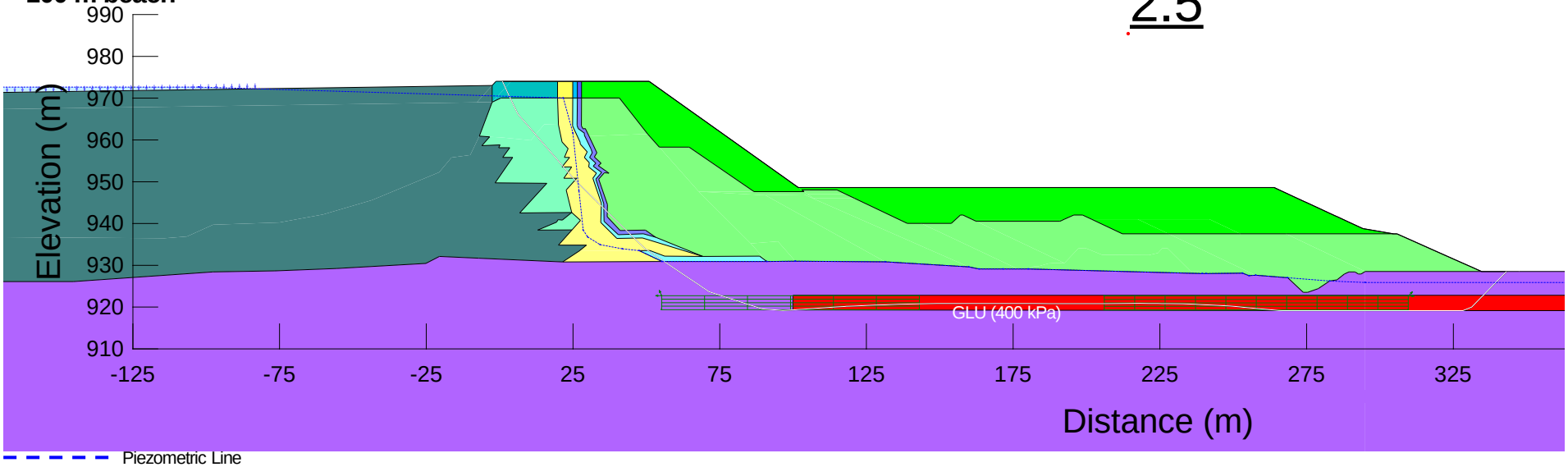

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+000 (Old Stn. 20+005)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-64

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.4

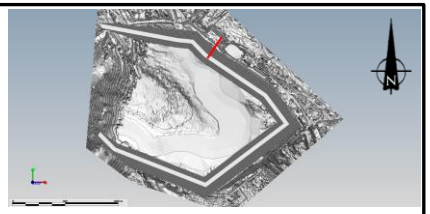

100 m beach

2.4

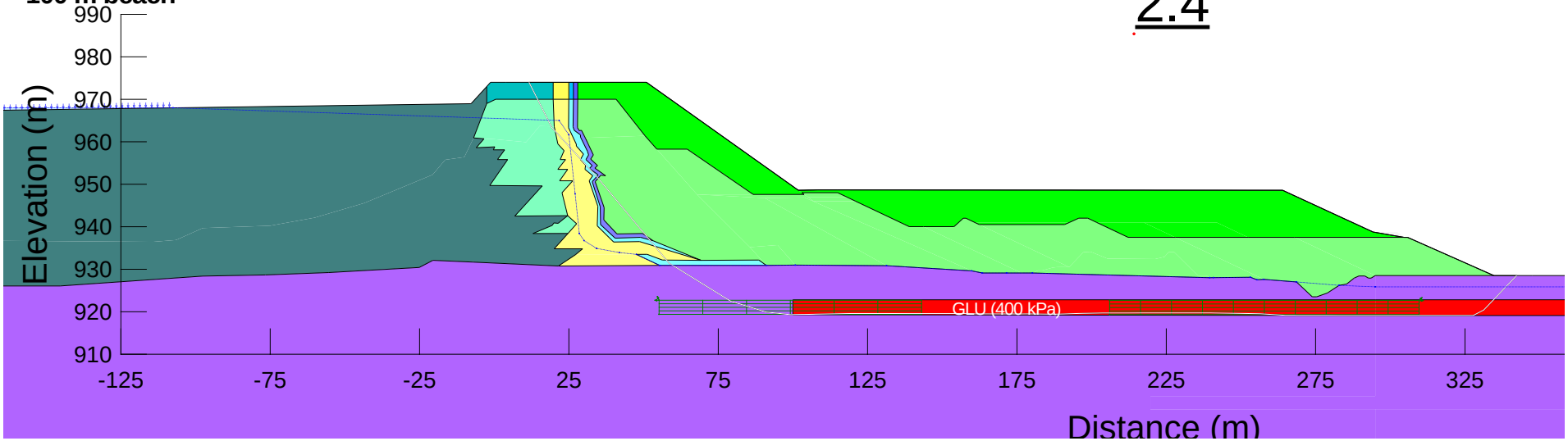

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+000 (Old Stn. 20+005)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-65

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

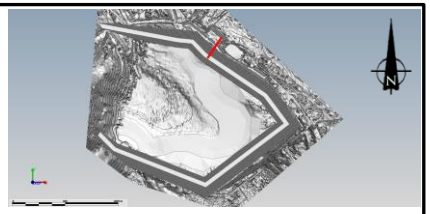

100 m beach

1.9

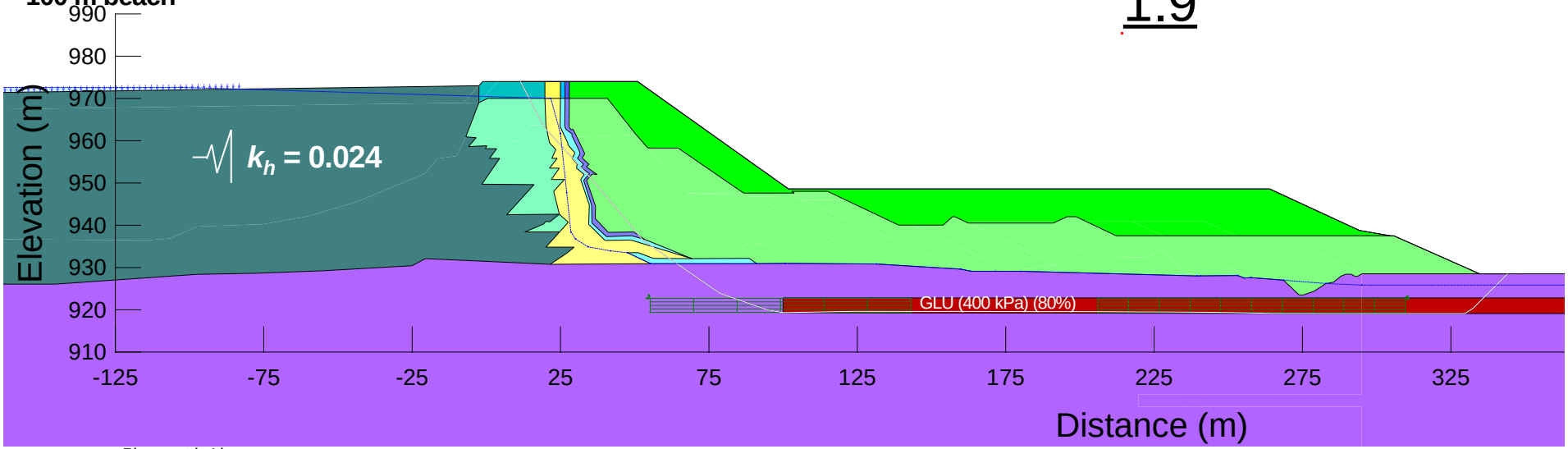

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+000 (Old Stn. 20+005)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-66

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.3

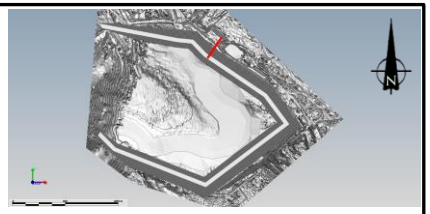

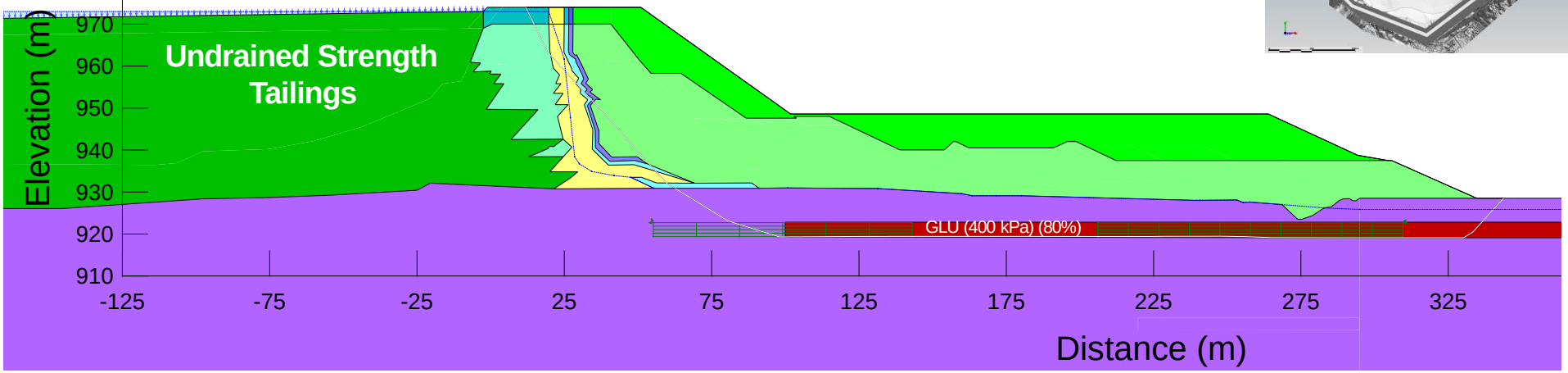

100 m beach

2.3

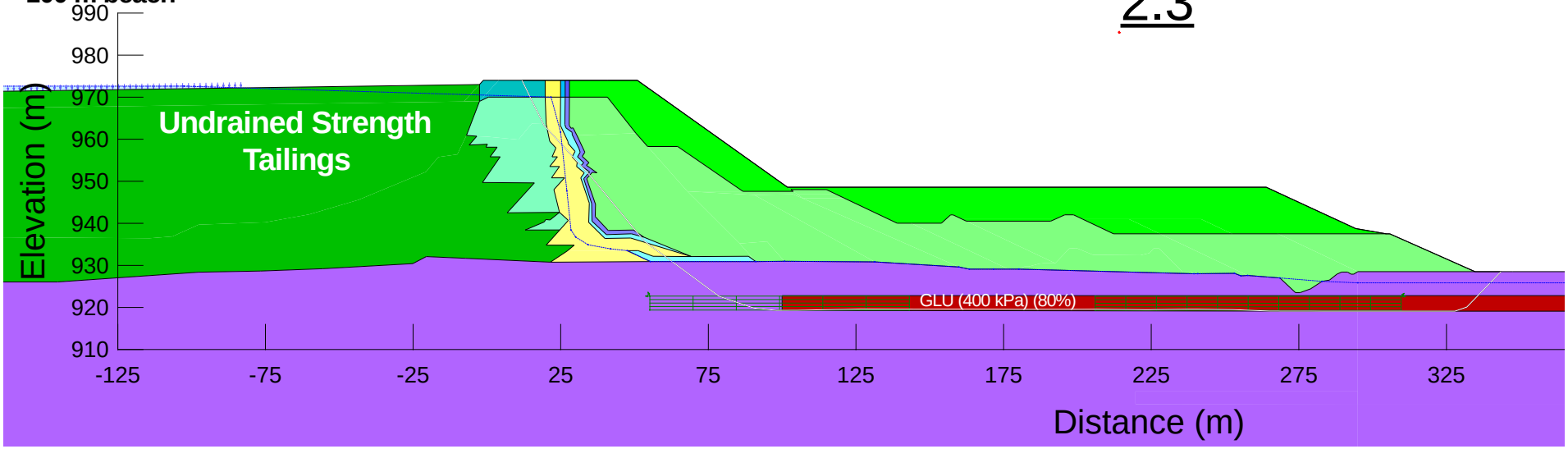

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
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YYYY-MM-DD	2024-04-16
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+000 (Old Stn. 20+005)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-67

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

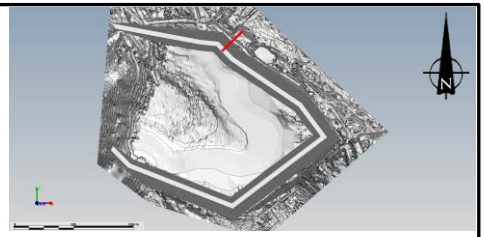

100 m beach

1.9

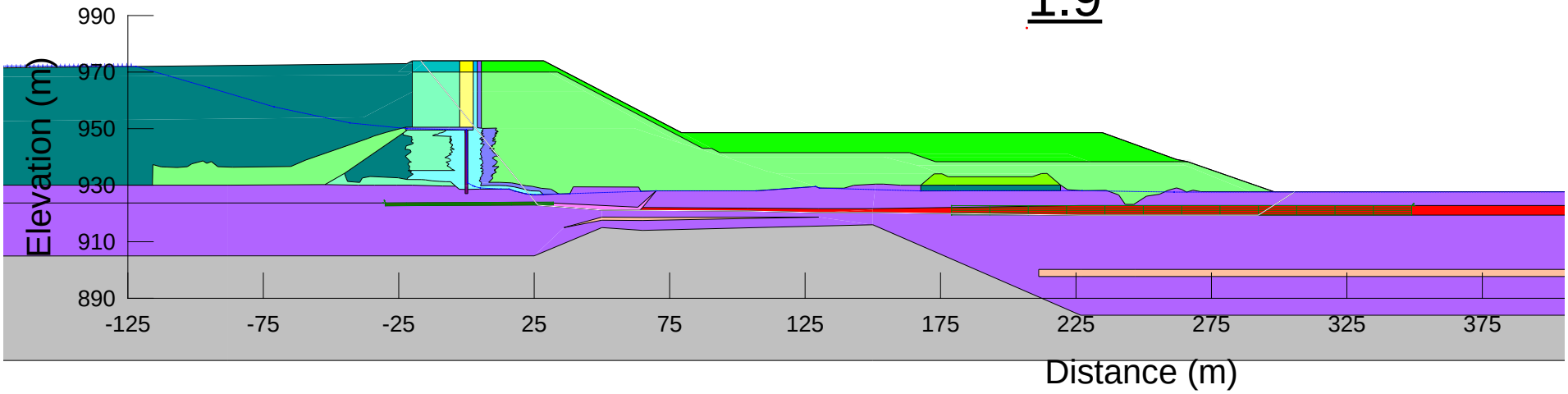

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+175 (Old Stn. 20+180)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-68

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

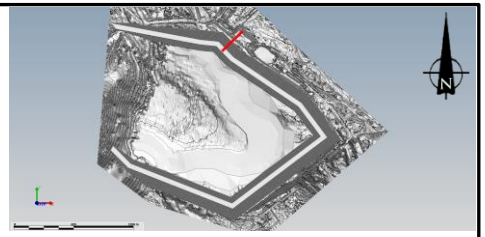

100 m beach

1.7

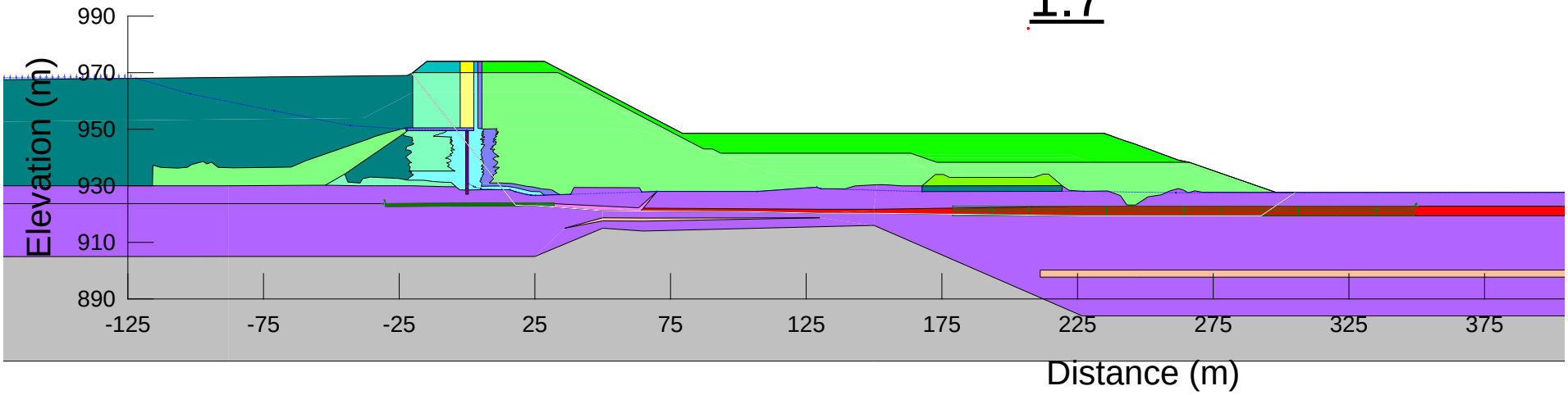

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+175 (Old Stn. 20+180)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-69

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.1

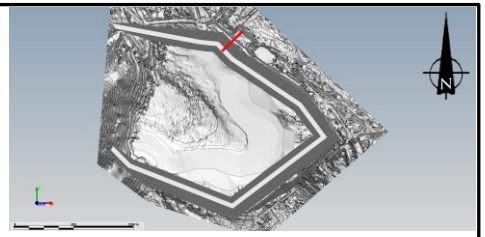

100 m beach

1.3

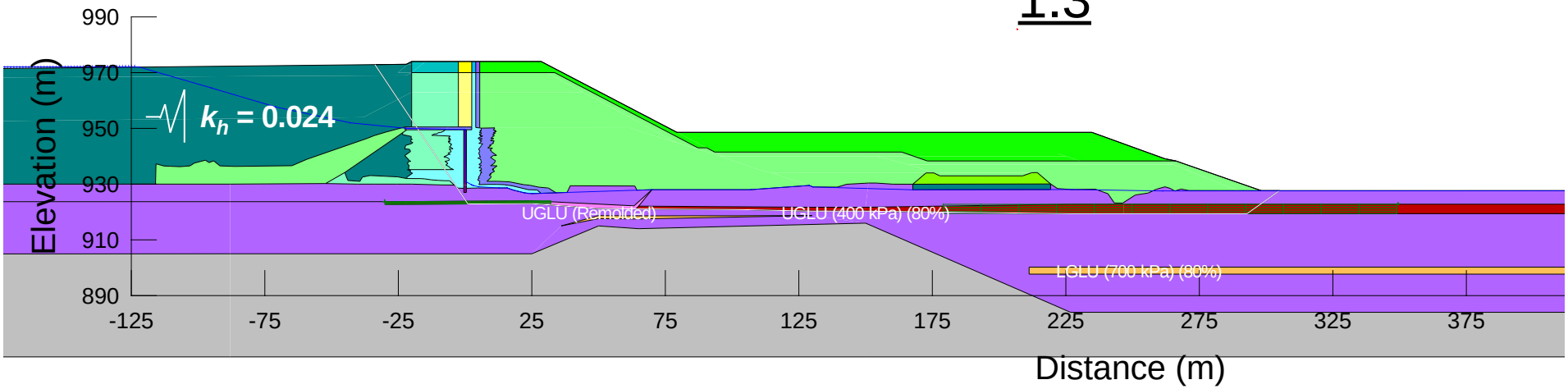

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+175 (Old Stn. 20+180)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-70

(INPUT LOCATION OF STABILITY FILES)

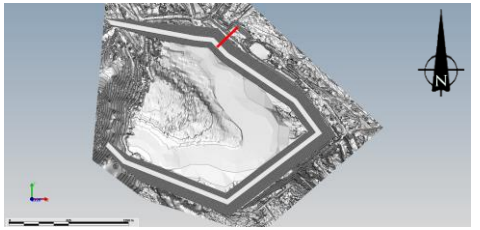

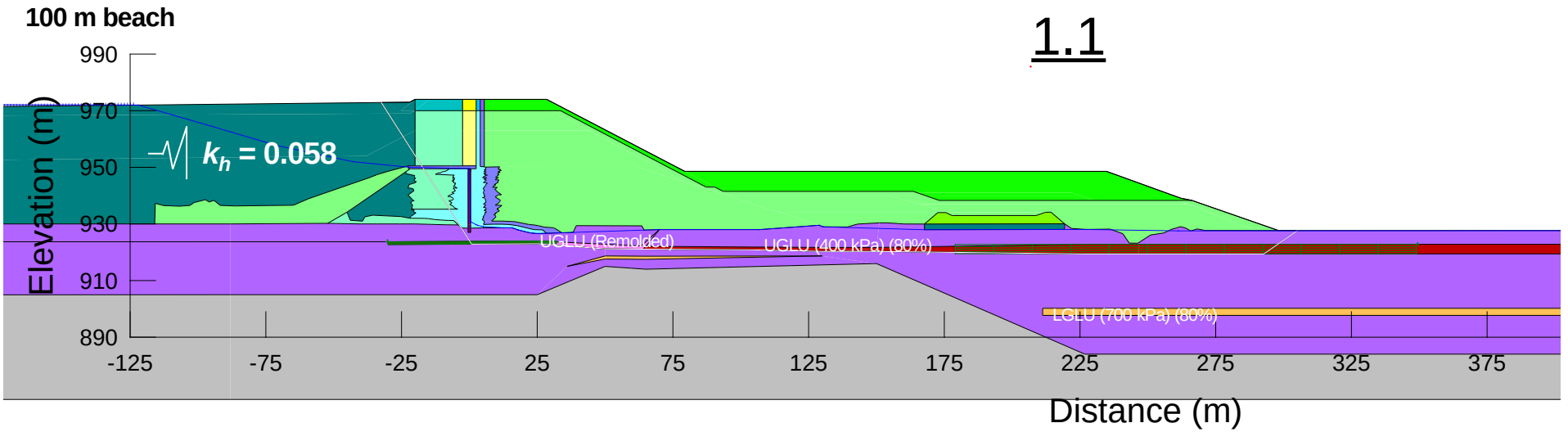

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain at the elevation of 950 m functioning.
3. 100 m sub-aerial beach; pond el. 972 m.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 10,000-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+175 (Old Stn. 20+180)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-71

(INPUT LOCATION OF STABILITY FILES)

0 m beach

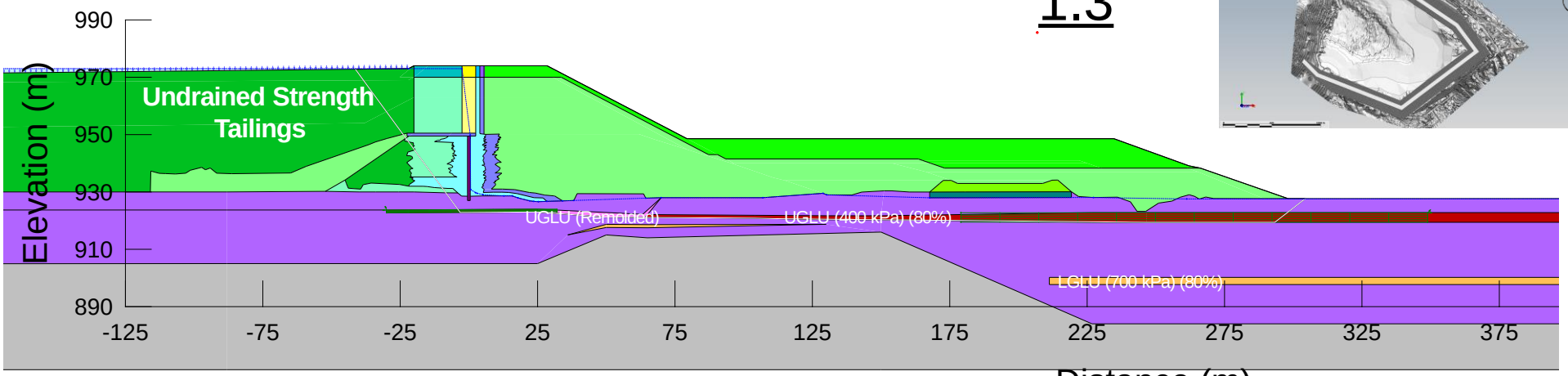

100 m beach

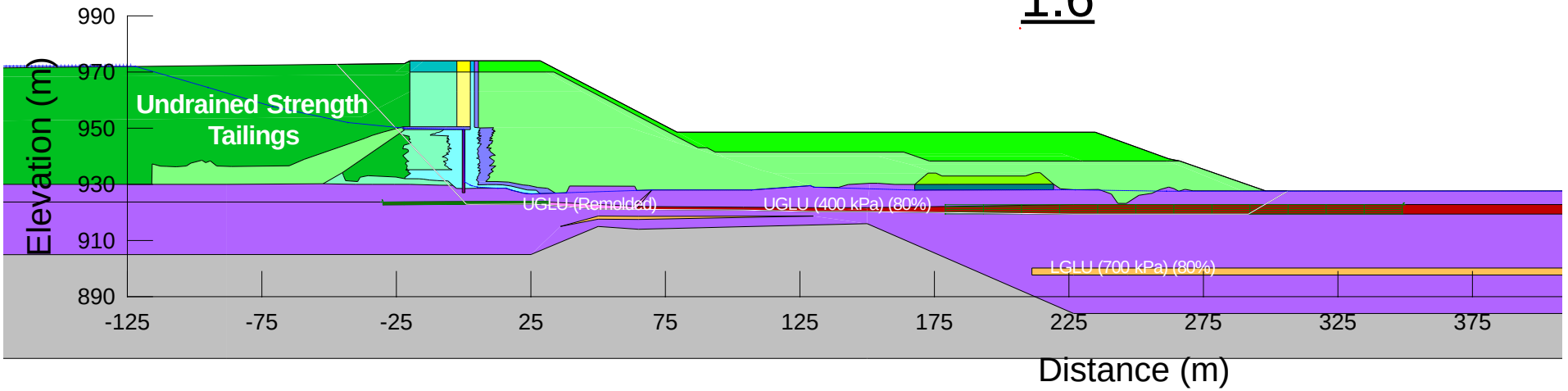

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
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5. No seismic loading applied.

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ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+175 (Old Stn. 20+180)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-72

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

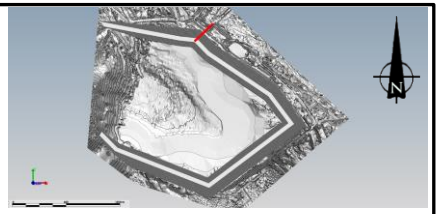

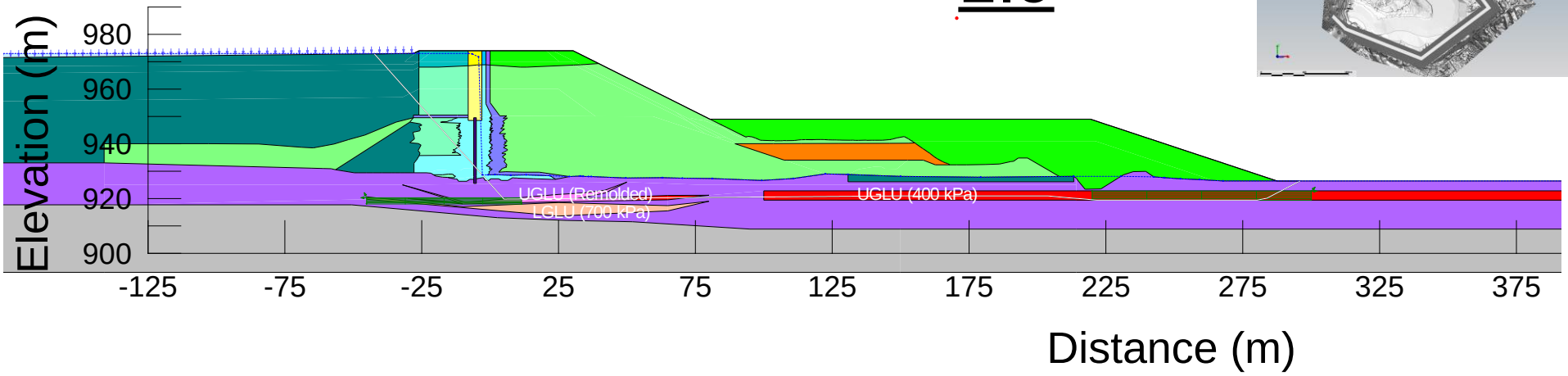

100 m beach

2.1

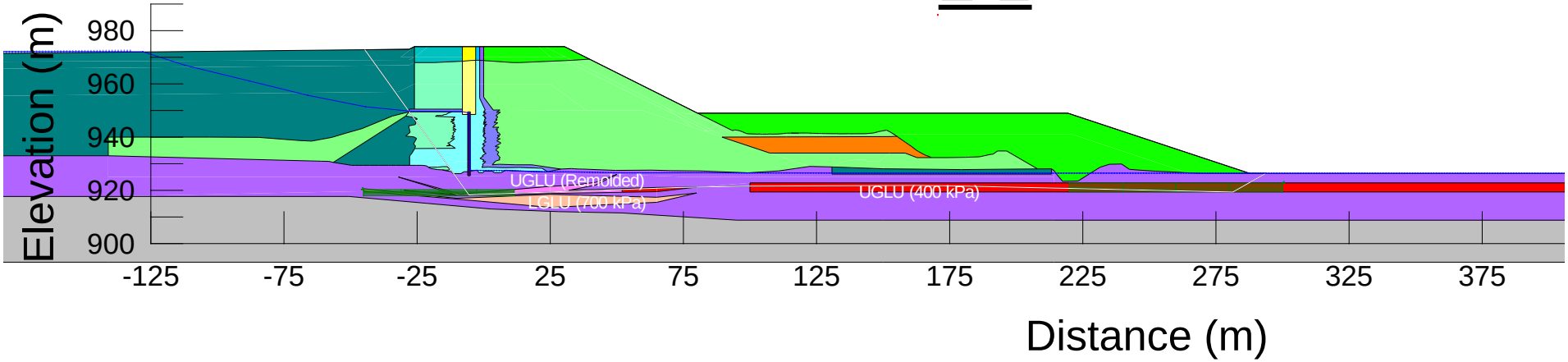

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-73

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

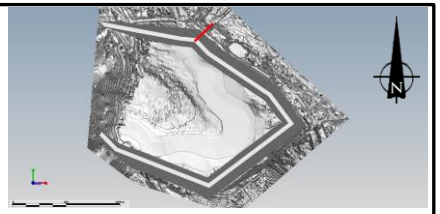

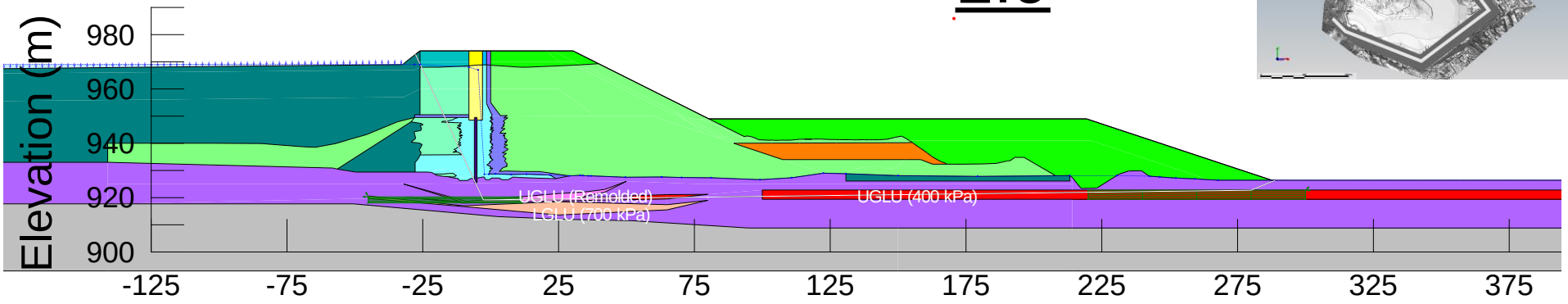

100 m beach

2.2

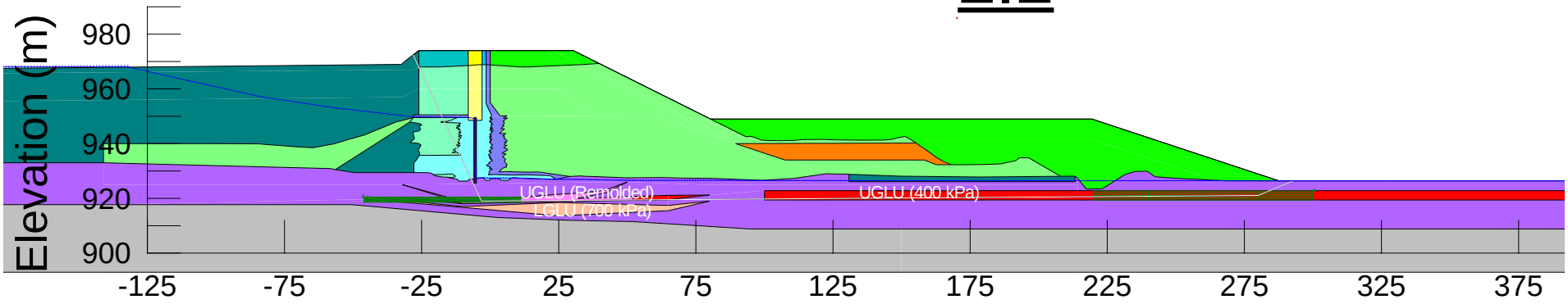

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-74

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

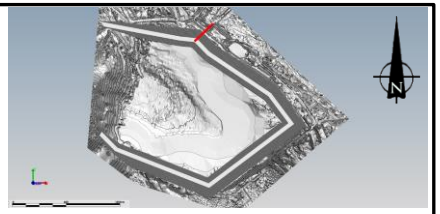

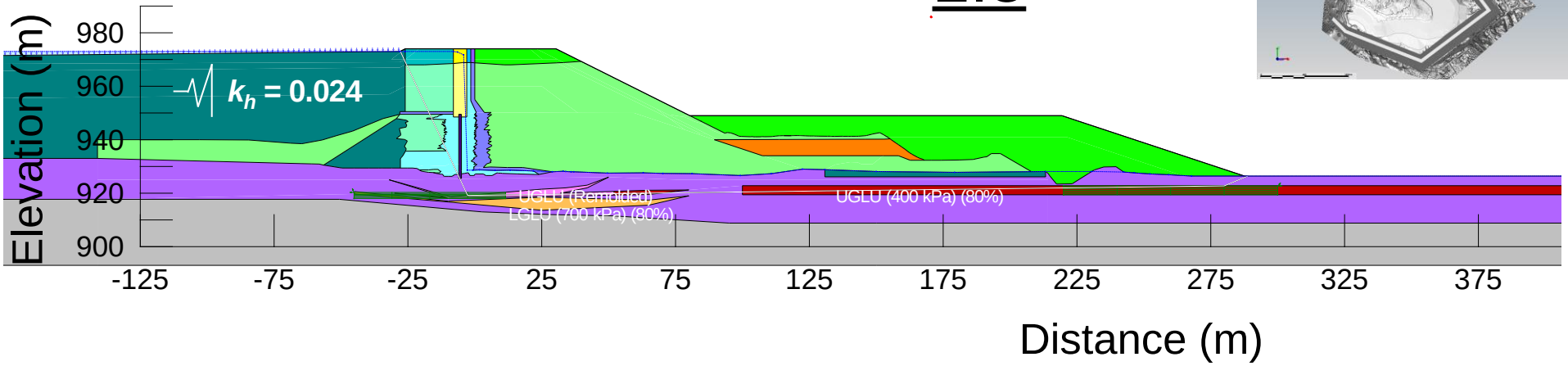

100 m beach

1.8

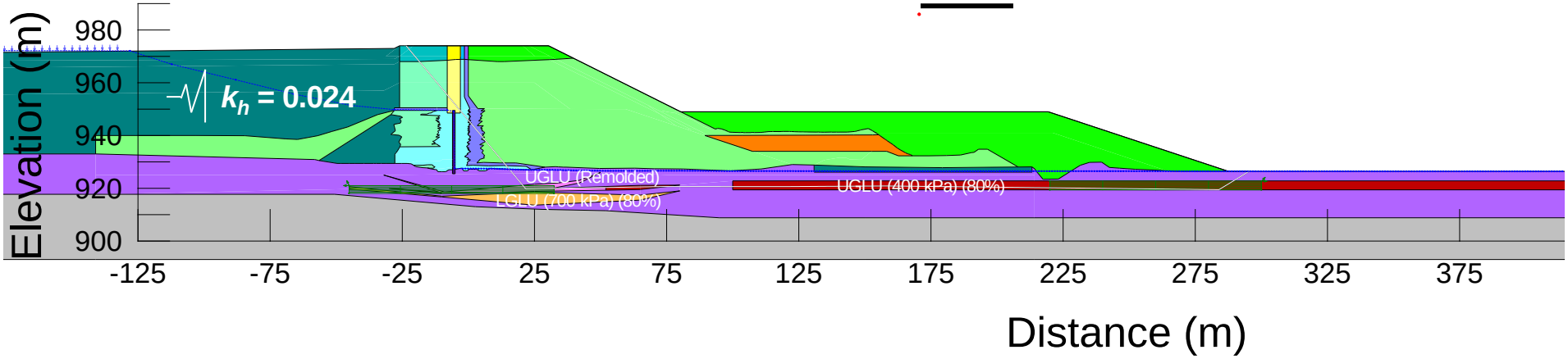

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-75

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.6

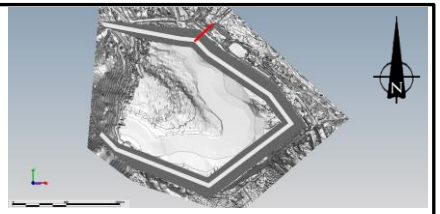

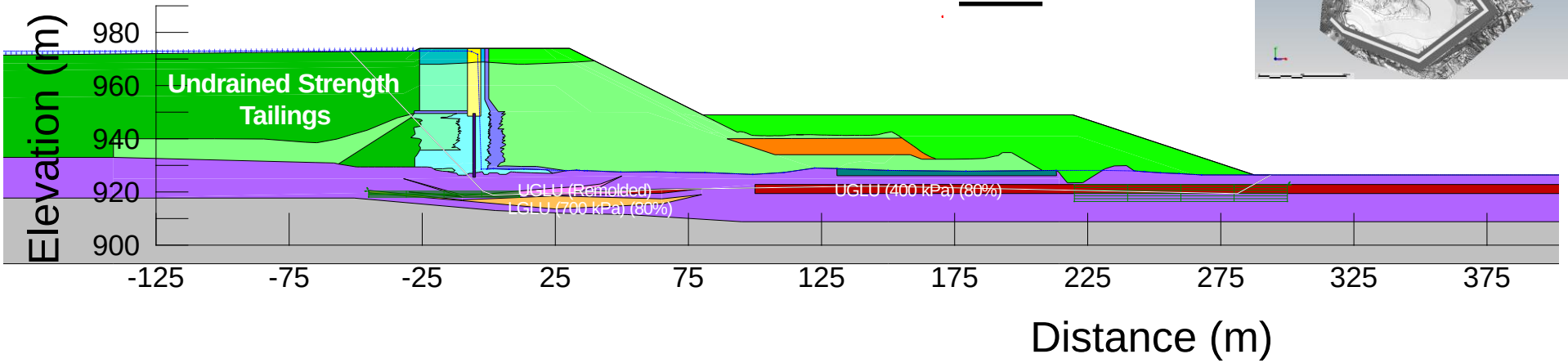

100 m beach

2.0

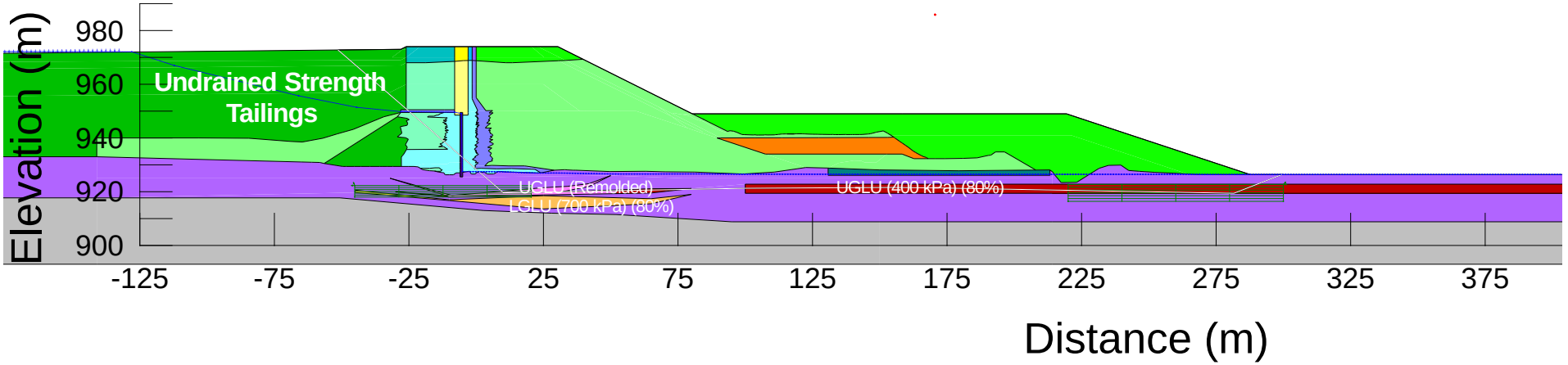

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+255 (Old Stn. 20+265)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-76

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.0

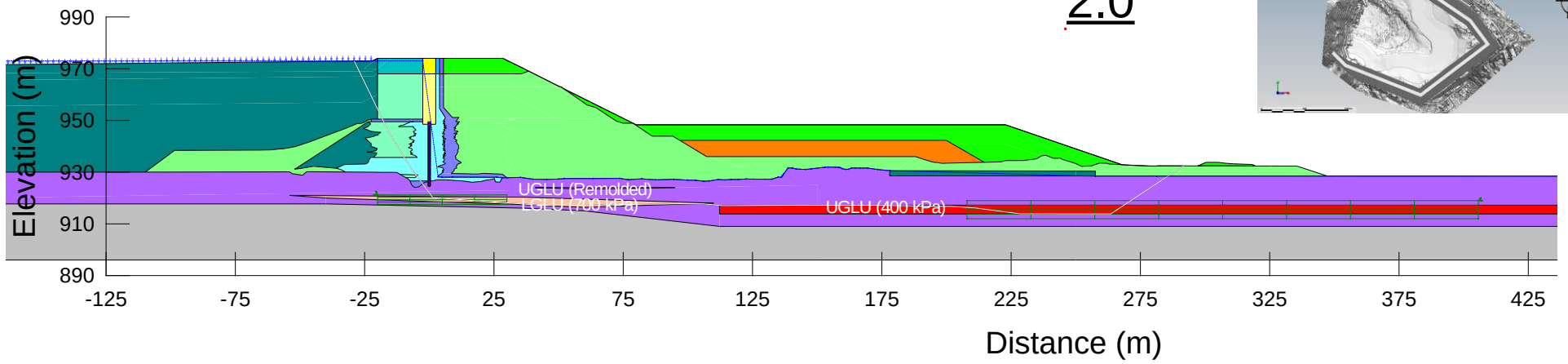

100 m beach

2.3

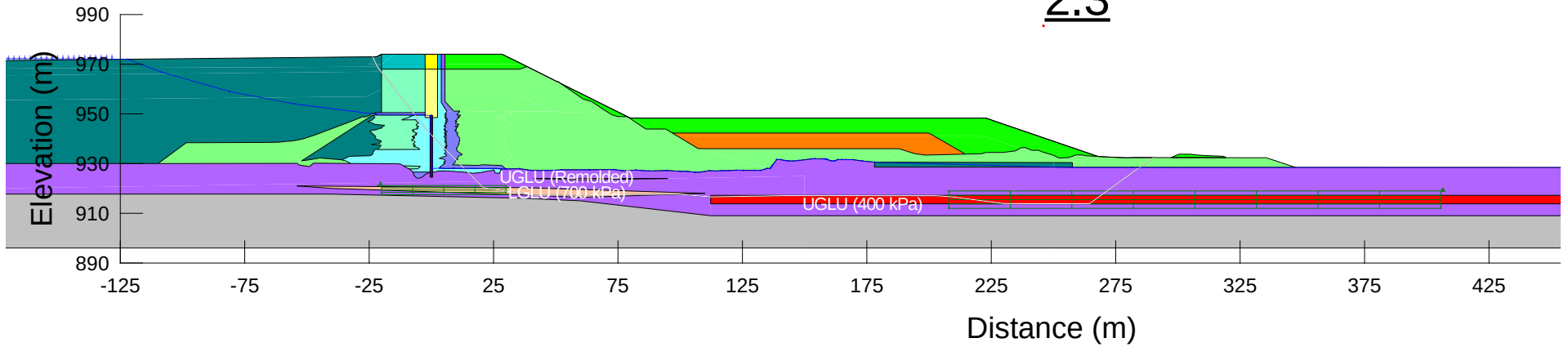

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
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CONSULTANT
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YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+285 (Old Stn. 20+295)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-77

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.0

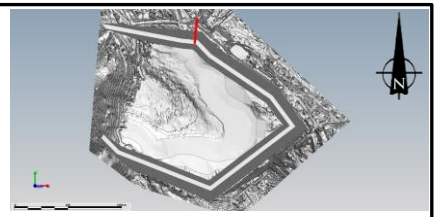

100 m beach

2.2

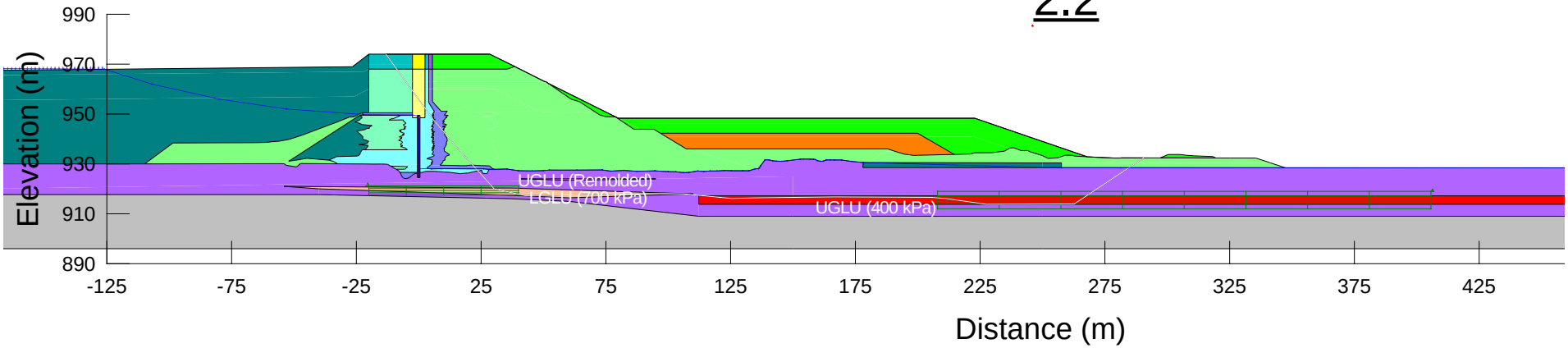

Piezometric Line

REFERENCES/NOTES

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2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+285 (Old Stn. 20+295)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-78

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

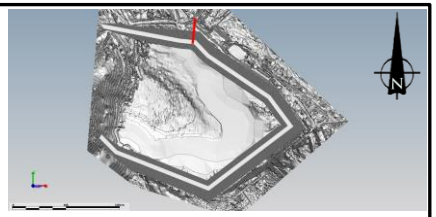

100 m beach

1.6

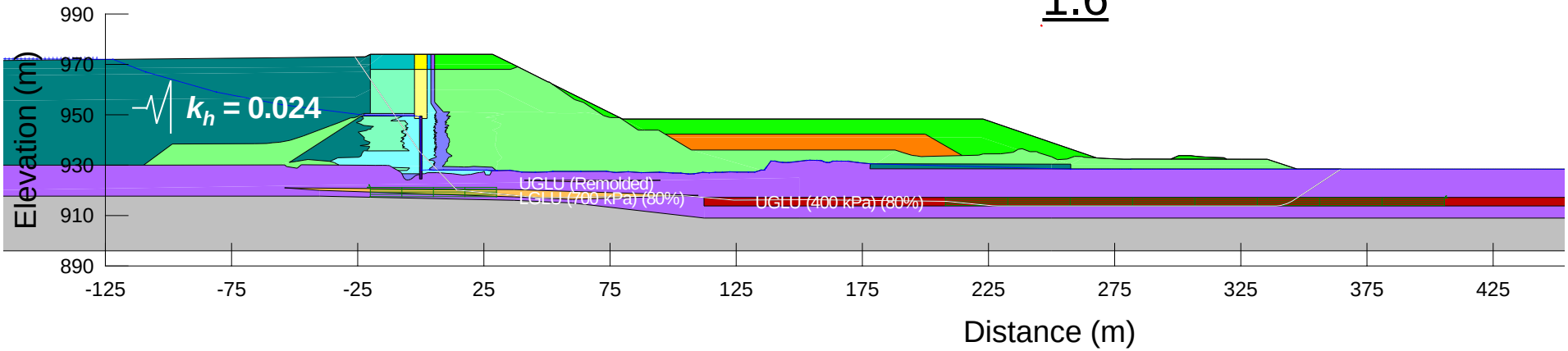

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

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CONSULTANT
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YYYY-MM-DD	2024-04-16
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DESIGNED	YJ
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+285 (Old Stn. 20+295)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-79

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.7

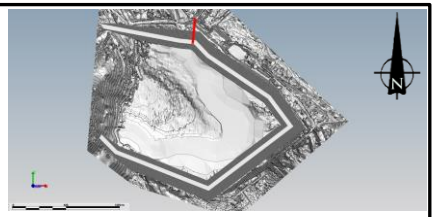

100 m beach

1.9

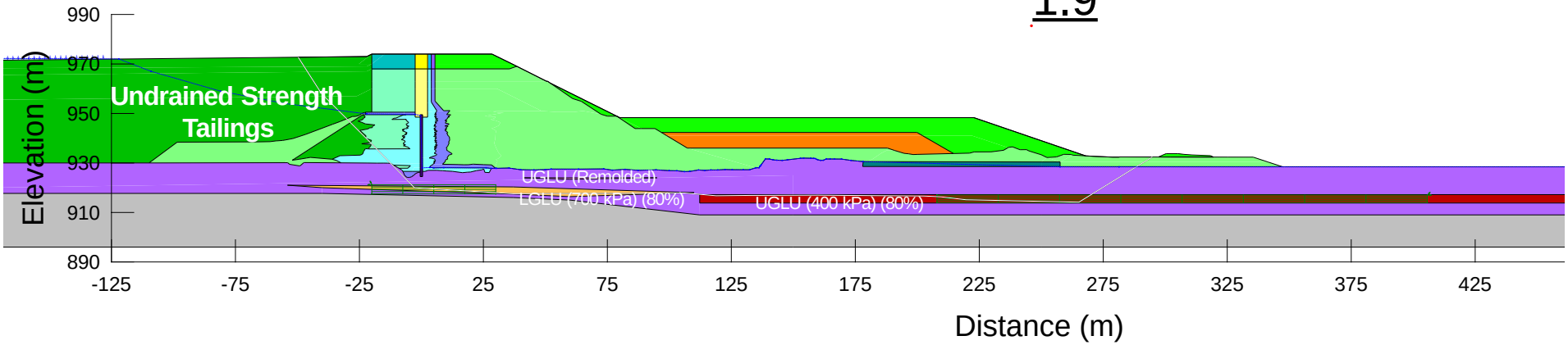

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-04-16
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+285 (Old Stn. 20+295)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-80

(INPUT LOCATION OF STABILITY FILES)

0 m beach

2.1

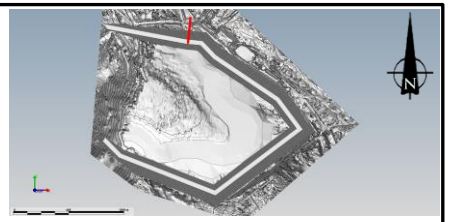

100 m beach

2.1

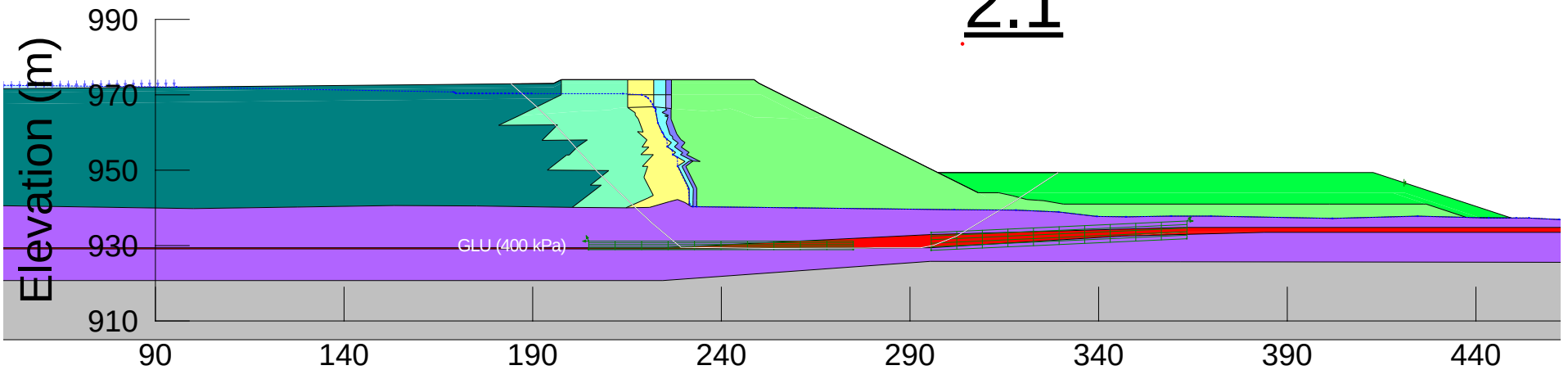

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+410 (Old Stn. 20+420)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-81

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.9

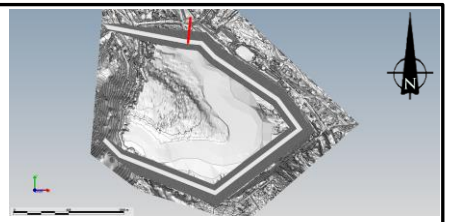

100 m beach

1.9

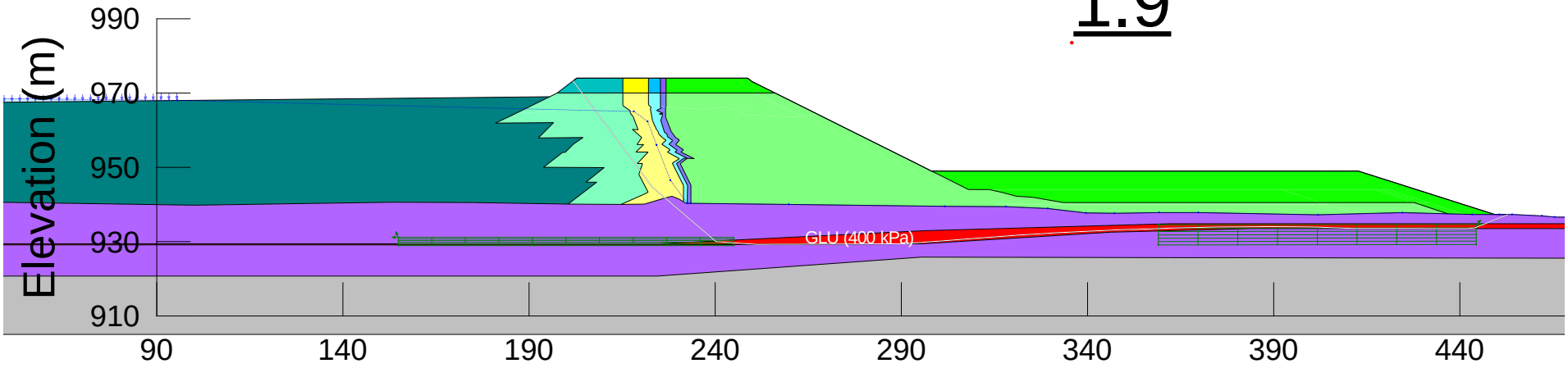

Piezometric Line

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+410 (Old Stn. 20+420)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-82

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.7

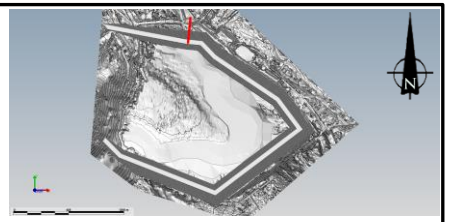

100 m beach

1.7

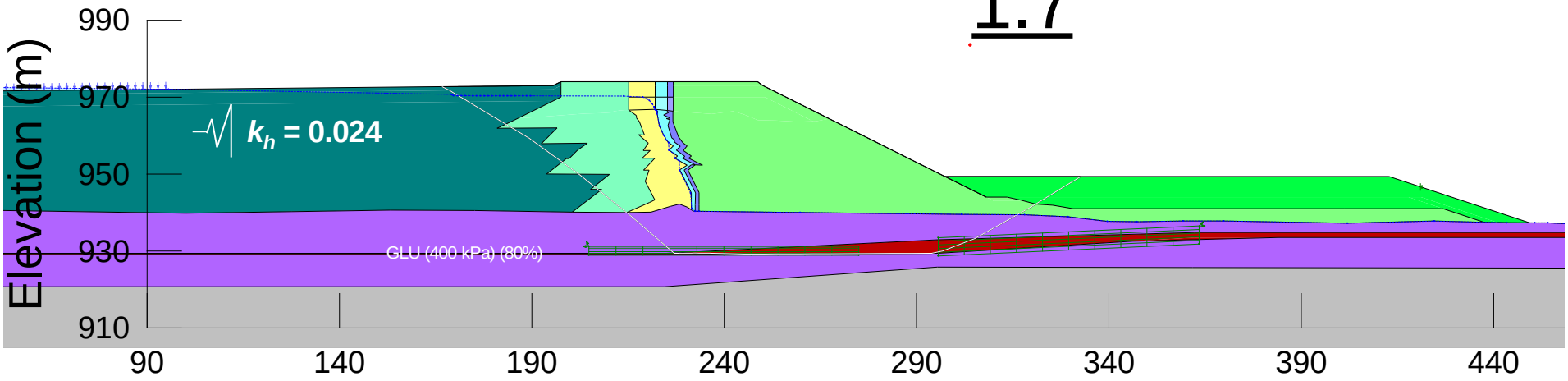

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+410 (Old Stn. 20+420)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-83

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.8

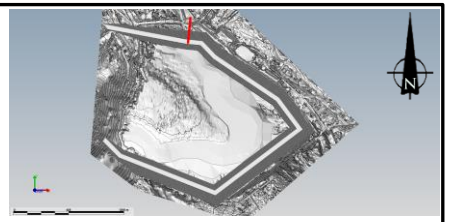

100 m beach

1.9

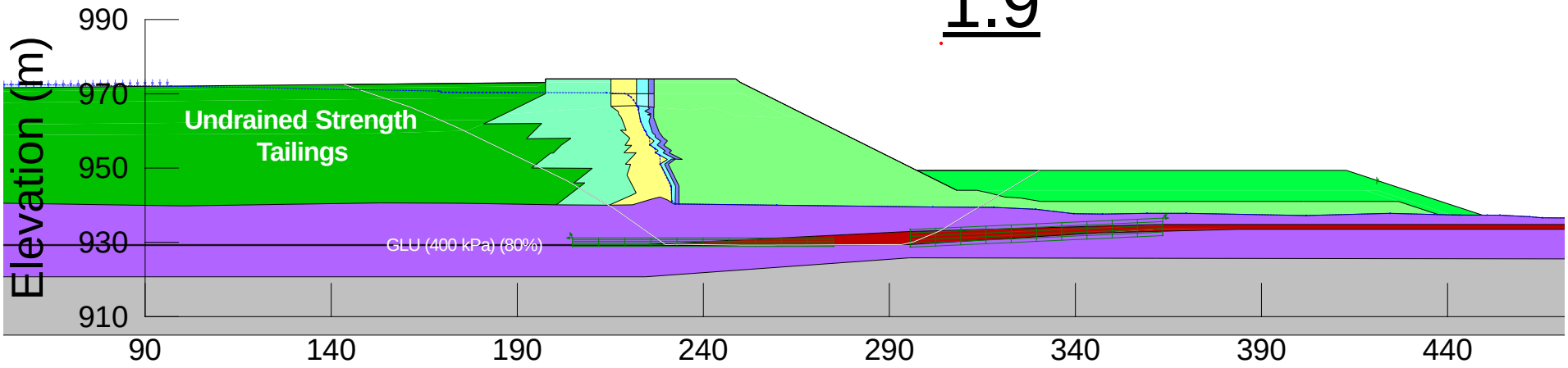

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+410 (Old Stn. 20+420)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-84

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.8

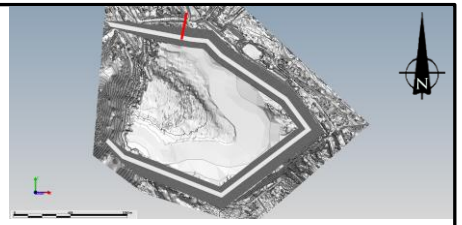

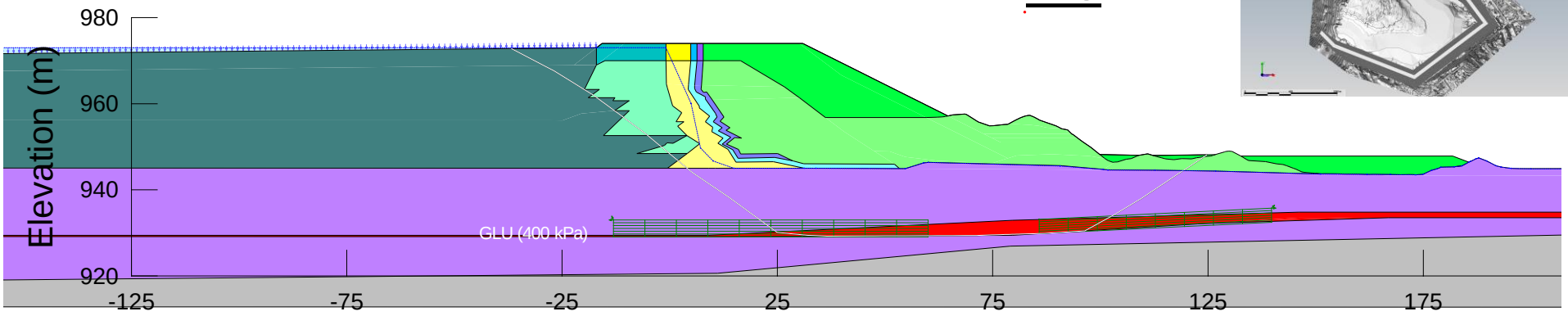

100 m beach

1.9

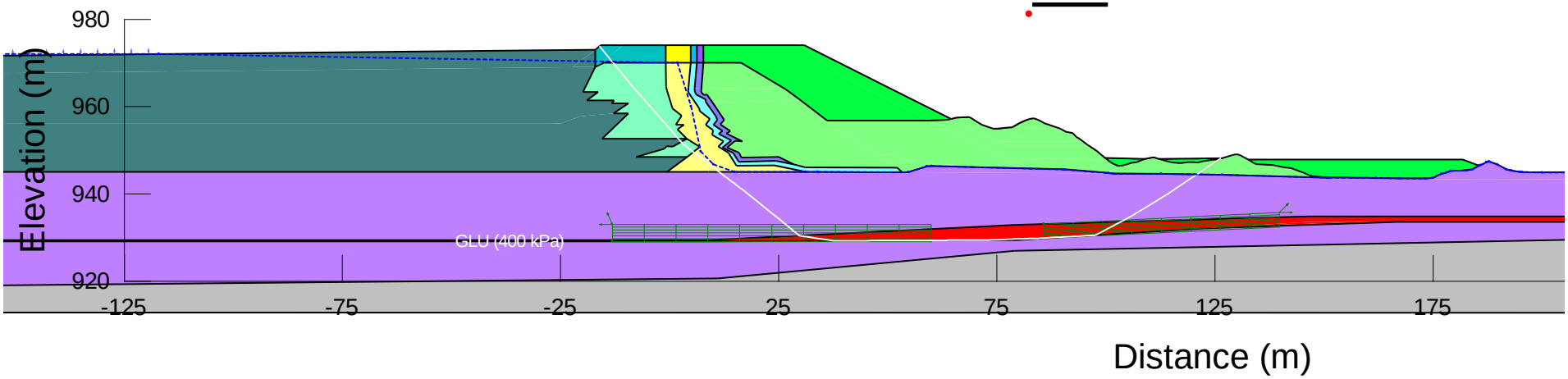

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+540 (Old Stn. 4+525)
LONG-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-85

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.8

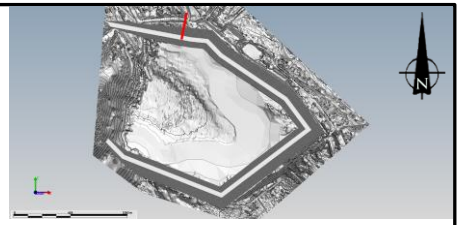

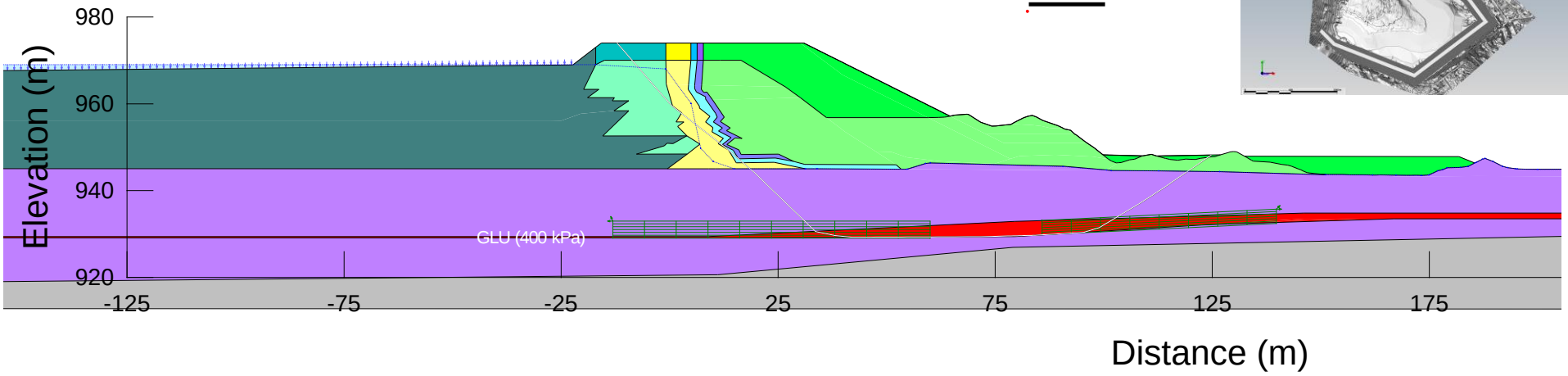

100 m beach

1.8

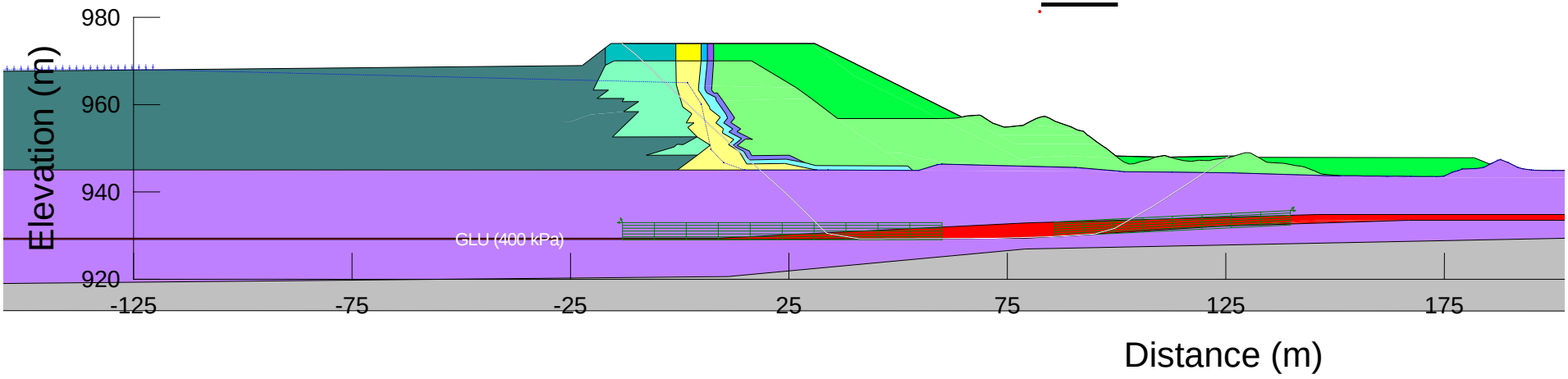

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Partially consolidated foundation soils; B-Bar applied.
2. Upstream drain not installed yet in short-term scenario.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 969 m and 968 m, respectively.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+540 (Old Stn. 4+525)
SHORT-TERM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-86

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.4

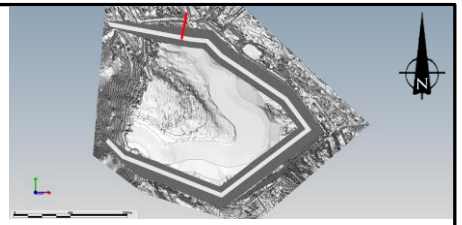

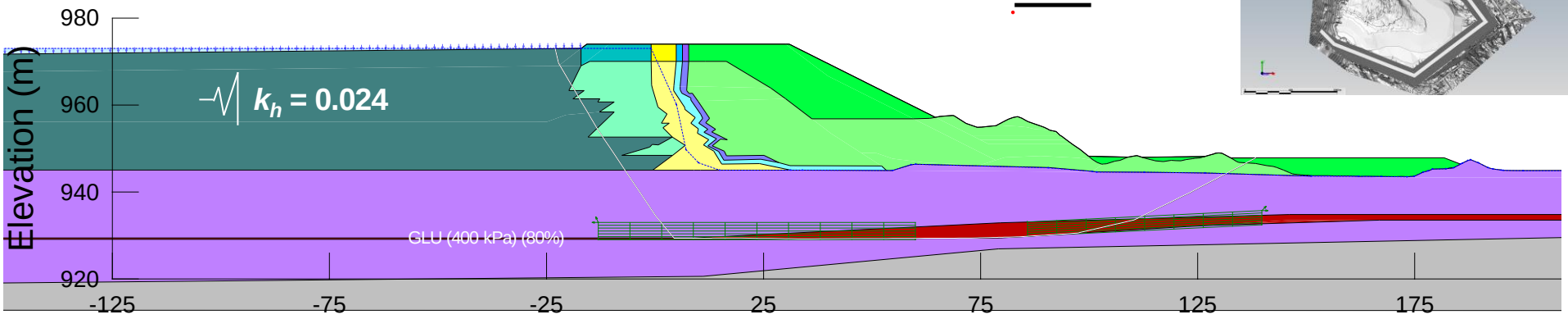

100 m beach

1.4

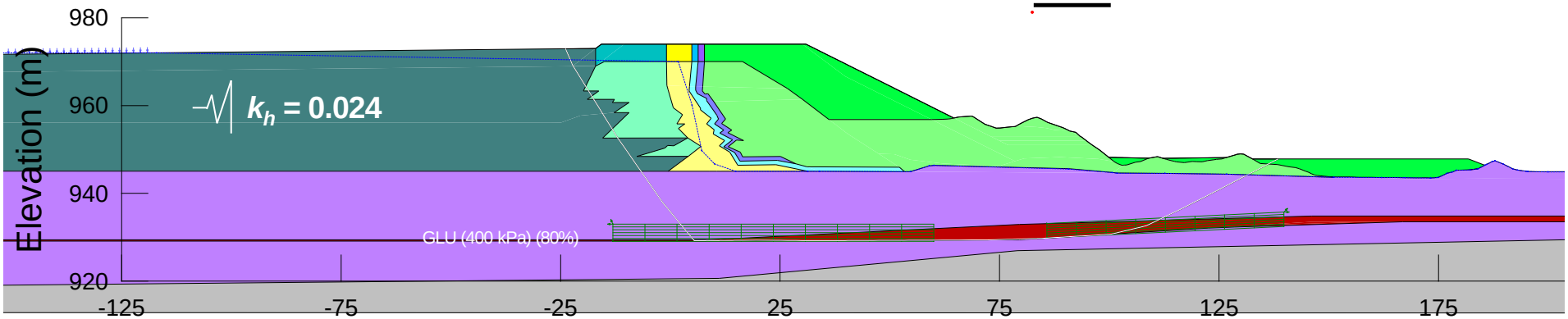

Piezometric Line

Distance (m)

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. Pseudo-static loading equal to 0.5 PGA of earthquake event with a 1 in 2,475-year EAP.
5. GLU shear strength reduced to 80%.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+540 (Old Stn. 4+525)
PSEUDO-STATIC LOADING

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-87

(INPUT LOCATION OF STABILITY FILES)

0 m beach

1.5

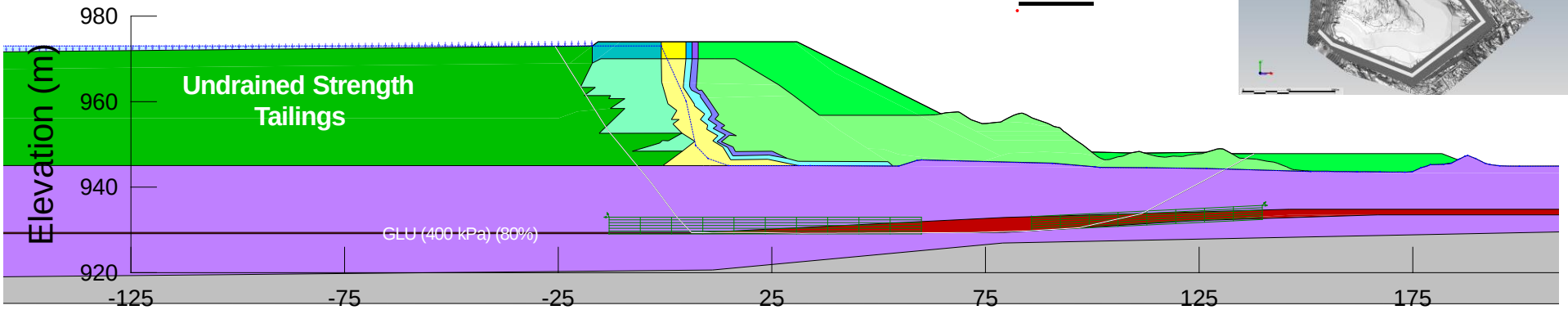

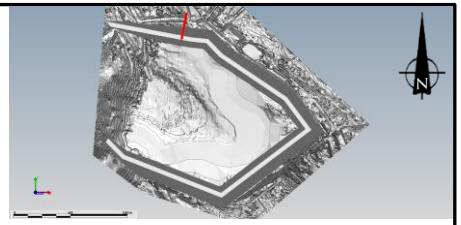

100 m beach

1.6

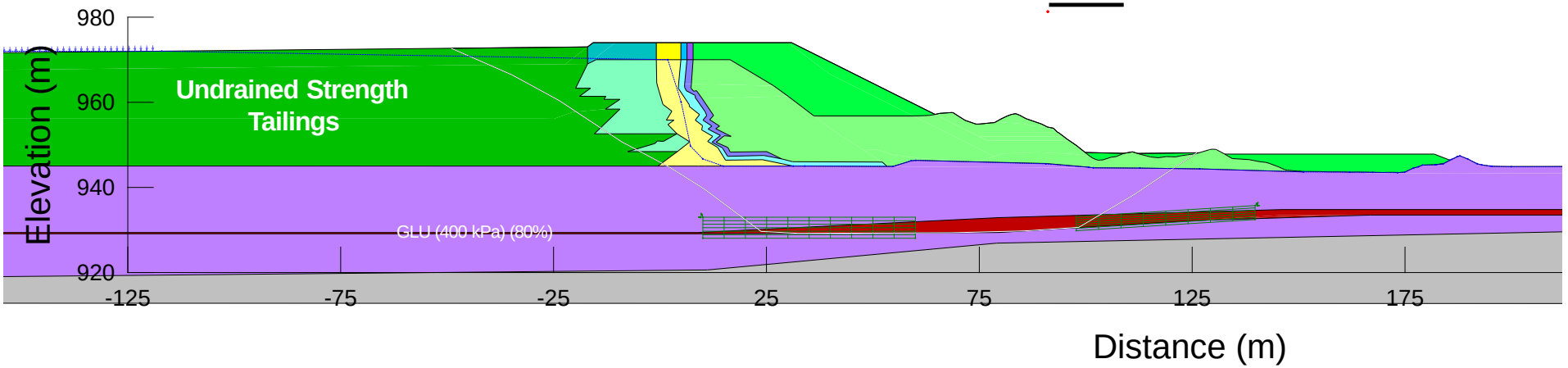

Piezometric Line

REFERENCES/NOTES

1. Consolidated foundation soils; no B-Bar applied.
2. Upstream drain not functioning for 0 m beach and functioning for 100 m beach.
3. 0 m and 100 m sub-aerial beaches; pond elevations at 973 m and 972 m, respectively.
4. GLU shear strength reduced to 80%.
5. No seismic loading applied.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-04-16
PREPARED	YJ
DESIGNED	YJ
REVIEWED	SB
APPROVED	GP

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
ELEVATION 974 m EMBANKMENT RAISE DESIGN

TITLE
STABILITY ANALYSIS (CORNER 1)
SECTION 4+540 (Old Stn. 4+525)
POST-EARTHQUAKE

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	51300.51395	0	G-88

APPENDIX H

Stress Deformation Models

TECHNICAL MEMORANDUM

DATE	March 21, 2024	**Reference No.**	CA0020527.4505-005-TM-Rev0-51346
TO	Matt O'Leary Mount Polley Mining Corporation		
FROM	Andrés E. Torres Guerrero and Germán Pizarro	**EMAIL**	**andres.torres@wsp.com,** **german.pizarro@wsp.com**

STRESS-DEFORMATION ANALYSES OF THE ELEVATION 974 M TAILINGS STORAGE FACILITY AT MOUNT POLLEY MINE

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has retained WSP Canada Inc. (WSP) to complete a detailed design to raise of the tailings storage facility (TSF) at the Mount Polley Mine. The design to support raising the TSF from its currently permitted elevation of 970 m to a crest elevation of 974 m is presented in WSP (2024). The design crest elevation 974 m is an interim design to enable the TSF to be raised whilst design efforts for a potential raise of the TSF to contain the life of mine tailings is advanced.

This report summarizes the results of stress-deformation analyses carried out on two (2) sections of the TSF to support the detailed design for the raise of the TSF to elevation 974 m. The analyses were based on two-dimensional finite difference models developed using the commercially available computer code FLAC Version 8.1 (Cundall 2012). The objectives of the analyses are:

- Assess the stability of the embankments at the end of construction up to elevation 974 m.
- Evaluate the seismic stability, and potential level and pattern of deformation under the 2,475-year earthquake load.

The analyses were carried out for two (2) design earthquake motions selected from eleven (11) acceleration-time histories from crustal and subduction interface earthquake events and matched to the 2,475-year ground motion spectrum. The design earthquake ground motions generated are presented in WSP (2023a).

This document includes the analysis procedure, characterization of the foundation and embankment materials, and the static and seismic deformation analyses results. This report should be read in conjunction with the detailed design report (WSP 2024) and the most recent TSF site characterization report (WSP 2023a).

2.0 BACKGROUND

The Mount Polley Mine is a copper and gold mine operated by MPMC, a subsidiary of Imperial Metals Corporation. The site is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. The embankment is subdivided into three sections:

the Main Embankment, Perimeter Embankment, and South Embankment. The embankment has incorporated a staged expansion design utilizing modified centerline and centerline construction methods. The general zoning of the TSF embankment includes the following:

- upstream fill comprising select fill or tailings sand
- low-permeability till core
- filter zone
- transition zone

Rockfill forms the downstream wedge of the embankments and the downstream buttress along the Perimeter and Main embankments.

The Mount Polley Mine began production in 1997 and operated until October 2001 when operations were suspended for economic reasons. In March 2005, the mine restarted and was in operation up to the time of the TSF breach in August 2014. The embankment crest was near elevation 968 m at the time.

In 2015, the Freshet Embankment was constructed to elevation 950 m through the breach area to allow the capture and temporary storage of the 2015 and 2016 freshet flows. The construction of buttresses along the Perimeter and Main embankments was completed in October 2016 (Golder 2015a, 2017).

The 23 June 2016 amendment of the Mines Act Permit M-200 authorized the return to full operations at the mine, including construction of the TSF design to elevation 970 m (Golder 2015b) and deposition of tailings. Construction to raise the Freshet Embankment at Corner 1 to elevation 970 m started in June 2016. By September 2018, construction of the Perimeter Embankment at Corner 1 had been completed to elevation 968 m (Golder 2019). The raise of the Freshet Embankment is referred to as the Perimeter Embankment at Corner 1.

Mining operations at the Mount Polley mine were halted between May 2019 and Q4 2021 for economic reasons. In June 2022, the mill restarted operations and tailings deposition into the TSF resumed. Construction to raise the South, Main and Perimeter embankments to elevation 970 m was restarted in July 2022 and was completed in 2023. The maximum height of the Main Embankment is about 57 m; the Perimeter Embankment about 42 m and the south embankment about 32 m.

Results of limit equilibrium analyses carried out for the TSF detailed design to elevation 974 m (WSP 2024) indicated that all sections analysed had a factor of safety (FoS) above 1.5 for static conditions and a FoS above 1.0 for pseudo-static conditions and met the design criteria. In this study, stress-deformation analyses were carried out to further confirm the static and seismic stability of the embankments including the potential for strain weakening of glaciolacustrine units.

3.0 PROCEDURE

In general, the stress-deformation analyses included the following:

- Selection of the sections of the TSF to be analyzed.
- Characterization of the materials behaviour under static and seismic conditions.
- Selection of constitutive models to reproduce the characteristic behaviour of the materials.
- Development of finite difference models for the selected sections of the TSF.
- Simulation of the staged construction of the embankments up to elevation 974 m.
- Calculation of the factor of safety at the end of construction at elevation 974 m.
- Simulation of the design earthquake motion.
- Evaluation of the seismic stability of the embankments.

Each aspect of the procedure is described in the following sections of the report.

4.0 EMBANKMENT SECTIONS

Glaciolacustrine deposits have been identified along the Main and Perimeter embankments.

The overconsolidated glaciolacustrine deposits at the Perimeter Embankment at Corner 1 are identified as semi-continuous and have the lowest preconsolidation stress in the area of the TSF (WSP 2023). Along the rest of the Perimeter Embankment foundation, overconsolidated glaciolacustrine deposits are not continuous and have been characterized having a higher preconsolidation stress.

A semi-continuous layer of glaciolacustrine soil is present along the length of the Main Embankment foundation. The glaciolacustrine deposit at the Main Embankment has been characterized having the higher preconsolidation stress in the area of the TSF.

A layer of low plasticity silty clay interpreted to have deposited in a glaciolacustrine environment was identified directly above bedrock near Stn. 1+100 at the South Embankment; however, the geotechnical testing completed on the material showed that it is not representative of the intermediate or high plasticity glaciolacustrine units found at the Main and Perimeter embankments, including at Corner 1.

The stress-deformation analyses were carried out on section 2+055 at the Main Embankment and section 4+175 at the Perimeter Embankment at Corner 1. The section at the Main Embankment represents the tallest section of the facility and includes the semi-continuous layer of glaciolacustrine soil in the foundation. The section at the Perimeter Embankment includes the portion of the foundation that failed in 2014 and that has the glaciolacustrine deposit with lower preconsolidation stress. These sections also correspond to those controlling the design of the buttress at each embankment based on limit equilibrium analyses (LEA). The layout of the TSF and the location of the sections is presented in Figure 1, the geometry of the sections is shown in Figure 2; and the approximate construction sequence and groundwater conditions are presented in Table 1 and Attachment 1. The sections geometry and the construction sequence are based on construction record reports for the Main Embankment

(AMEC 2014, Golder 2017a) and the Perimeter Embankment at Corner 1 (Golder 2015a, 2017b, 2018, 2019); and the detailed design report of the TSF for elevation 974 m (WSP 2024).

The response of piezometers installed within the glaciolacustrine unit at the Perimeter Embankment at Corner 1 indicate that excess pore water pressure generated during construction of the Freshet Embankment dissipated after about one (1) year (WSP 2023a). Based on this, it was assumed in the model that if less than a year passed between construction stages then full dissipation of excess pore water pressure in the glaciolacustrine unit had not occurred (see Table 1).

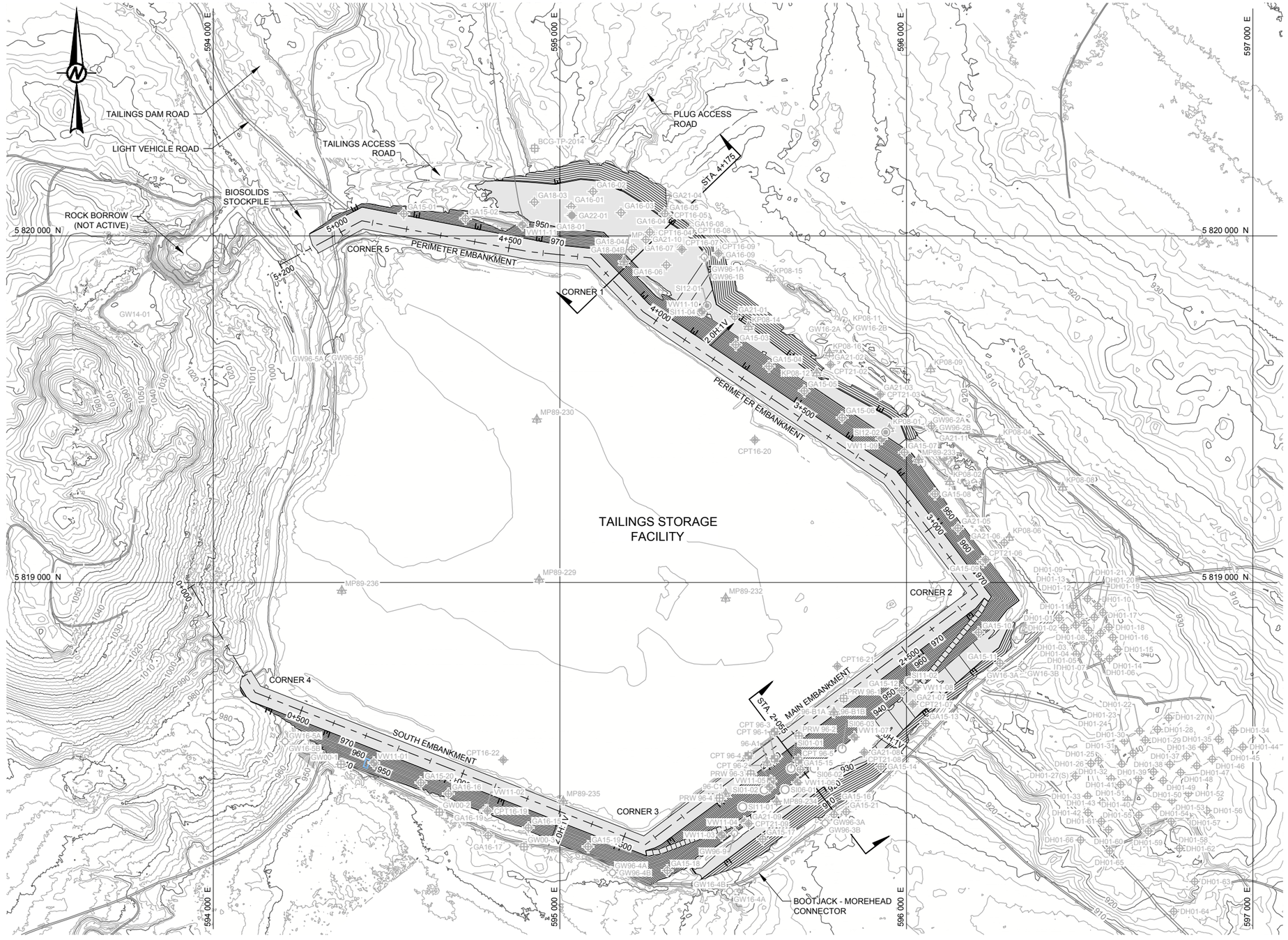

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE NOTE 4)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- SITE ACCESS ROADS (SEE REFERENCE 5)
- GA22-01 — SONIC DRILLING, PIEZOMETER INSTALLATION - CORNER 1 EMBANKMENT (WSP GOLDER, 2022)
- GA21-10 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1, PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- CPT21-09 — CPT - PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- GA18-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 (GOLDER, 2018)
- GA16-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- CPT16-04 — CPT - TAILINGS, CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- GW16-2A — SONIC DRILLING, MONITORING WELL INSTALLATION (GOLDER, 2016)
- GA15-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION (GOLDER, 2015)
- BGC-TP-2014 — TEST PIT (BGC / GOLDER, 2014)
- SI12-01 — ODEX, SI INSTALLATION - PERIMETER EMBANKMENT (AMEC, 2012)
- VW11-01 — SONIC DRILLING, PIEZOMETER INSTALLATION (AMEC, 2011)
- SI11-01 — SONIC DRILLING, SI INSTALLATION (AMEC, 2011)
- KP08-01 — SONIC DRILLING, SPT, BORROW PROGRAM (KP, 2008)
- SI06-01 — ODEX, SPT, SI INSTALLATION - MAIN EMBANKMENT (KP, 2006)
- SI01-01 — ODEX, SPT - MAIN EMBANKMENT (KP, 2001)
- DH01-01 — DRILLING, BORROW PROGRAM (KP, 2001)
- GW00-01 — ODEX, SPT, MONITORING WELL INSTALLATION - SOUTH EMBANKMENT (KP, 2000)
- CPT 96-1 — CPT - MAIN EMBANKMENT (KP / CONETEC, 1996)
- 96-A1 — SOLID/HOLLOW STEM AUGER, SPT, PIEZOMETER INSTALLATION - MAIN EMBANKMENT (KP / R.E. GRAHAM ENG., 1996)
- PRW96-01 — SOLID STEM AUGER, PRESSURE RELIEF WELL - MAIN EMBANKMENT (KP, 1996)
- GW96-1 — AIR ROTARY, SPT, MONITORING WELL INSTALLATION (KP, 1996)
- MP89-230 — CONDEMNATION BOREHOLES, PIEZOMETER INSTALLATION (KP, 1989)
- 2+055 — CROSS-SECTION LOCATION

NOT FOR CONSTRUCTION

0 200 400
1:6,000 METRES

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NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2014-2023 (SEE REFERENCES 1-4).
5. RECORD DRAWINGS FOR TSF CREST ELEVATION CONSTRUCTION TO ELEVATION 970 m ARE IN PROGRESS.

REFERENCES

1. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: 03 SEPTEMBER 2014.
2. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
3. 2023 TSF CORNER 4 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "1m_DEM.xml", SURVEYED: 30 JULY 2023, RECEIVED: 24 AUGUST 2023.
4. 2023 TSF TOPOGRAPHY AND BATHYMETRY PROVIDED BY MPMC AS MULTIPLE .DXF FILES, SURVEYED: 25 AUGUST 2023, RECEIVED: 21 SEPTEMBER 2023.
5. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 5 SEPTEMBER 2014.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-21
DESIGNED	A. TORRES GUERRERO
PREPARED	T. KLASSEN
REVIEWED	G. PIZARRO
APPROVED	A. TORRES GUERRERO

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
STRESS-DEFORMATION ANALYSES OF
ELEVATION 974 m EMBANKMENT RAISE

TITLE
TAILINGS STORAGE FACILITY LAYOUT AND CROSS-SECTION LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	51300/51346/005	0	1

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0 25 mm

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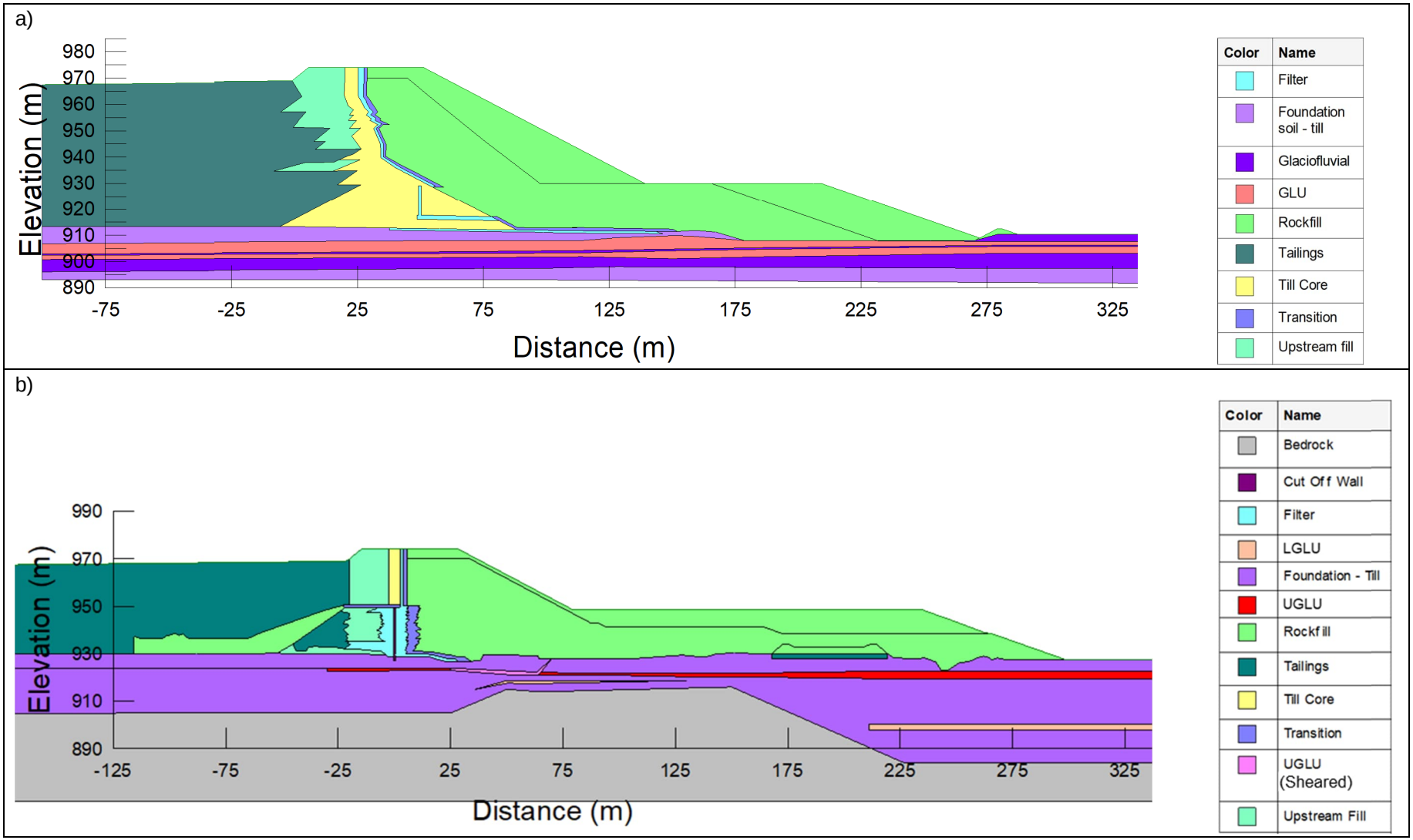

Note: GLU is Glaciolacustrine Unit, UGLU is Upper Glaciolacustrine Unit and LGLU is Lower Glaciolacustrine Unit.

Figure 2: Sections Analysed in Limit Equilibrium Analyses: a) Main Embankment – Section 2+055, and b) Perimeter Embankment at Corner 1 – Section 4+175.

Table 1: Approximate Construction Sequence of the Main Embankment and Perimeter Embankment at Corner 1

Construction Stage	Main Embankment Section 2+055				Perimeter Embankment at Corner 1 Section 4+175			
	Elevation (m)							
	Embankment	Buttress[1]	Tailings	Water Table[2]	Embankment	Buttress[1]	Tailings	Water Table[2]
1	934	-	929	917	950	-	-	928
2	941	-	940	919	960 [3]	937	947	947
3	945	917	943	920	966	942	957	950
4	948	917	946	943	968	942	962	950
5	951	917	951	943	970 [3]	942	969	950
6	958	917	957	943	970	949	969	950
7	962	917	961	943	974	949	973	970
8	964	917	963	943	-	-		-
9	969	926	968	943	-	-		-
10	969	930	968	943	-	-		-
11	974	930	973	970	-	-		-

Note:

(1) Maximum elevation of the buttress.

(2) Water table elevation immediately upstream of the till core. A 100 m long tailings beach was assumed between the embankment and the TSF pond.

(3) Full dissipation of excess pore water pressure not expected before the beginning of the following construction stage.

5.0 MATERIAL CHARACTERIZATION

This section summarizes the geotechnical characterization of the materials for numerical modelling purposes. The TSF site characterization report (WSP 2023a) presents in detail the results of geotechnical testing and interpretation of geotechnical parameters.

The stratigraphic sequence identified in the area of the TSF can be generalized in order of increasing depth as follows:

- embankment materials and tailings
- till
  - glaciolacustrine sub-units
  - glaciofluvial sub-units
- bedrock

At the Perimeter Embankment at Corner 1, two distinct glaciolacustrine units have been identified and characterized separately. The location of the units is shown in Figure 2.

5.1 Foundation Characterization

5.1.1 Bedrock

Generally weathered volcaniclastic conglomerate, volcanic debris or completely weathered bedrock. Results of a downhole seismic test carried out in borehole BH15-10 indicate that the time-averaged shear-wave velocity in the upper 30 m (V_{s30}) of bedrock is about 850 m/s (WSP 2023b). The small strain shear stiffness (G_{max}) of the bedrock was estimated as:

$$G_{max} = \rho_b \cdot (V_s)^2 \qquad \textbf{Equation 1}$$

Where ρ_b is the bulk density and V_s the shear wave velocity, considered equal to the V_{s30}. The static and dynamic shear modulus were calculated as $0.95G_{max}$.

5.1.2 Foundation Till

The foundation till is generally a mixture of gravel, sand and low plasticity fines ranging from silt to silty clay, with consistency ranging from firm to hard. Collected samples showed an average fines content of 50% and an average plasticity index of 11 (WSP 2023a). Effective friction angles were estimated from triaxial tests performed on undisturbed samples at about 34 degrees (BCMEM 2015). Results from pressuremeter testing indicate that the friction angle from the upper till at Corner 1 ranges between 36 and 48 degrees, with an average of about 40 degrees.

The average shear wave velocity measured in downhole seismic tests is about 500 m/s (WSP 2022). The small strain shear stiffness (G_{max}) was calculated using Equation 1 and the static shear modulus was estimated as $0.5G_{max}$.

The shear stress-strain behaviour of the foundation till was characterized using the shear modulus reduction curves presented by Vuccetic and Dobry (1991) for a plasticity index (PI) of 15.

5.1.3 Glaciofluvial Unit

The glaciofluvial unit is generally gravelly sandy silt to silty sand with trace gravel, and an estimated compactness ranging from compact to very dense. Samples tested showed an average fines content of 63% and the fines were generally non-plastic to low plasticity. Shear strength results indicate a peak friction angle of about 35 degrees (WSP 2023a). The shear stress-strain behaviour of the glaciofluvial unit was assumed to be equal to that of the foundation till.

5.1.4 Glaciolacustrine Units

Glaciolacustrine units were identified along the Main and Perimeter embankments. Two distinct glaciolacustrine deposits have been identified at Corner 1 and are referred to as UGLU and LGLU. The UGLU was identified as the soil layer through which the 2014 undrained failure developed and was the focus of subsequent forensic investigations (IEEIRP 2015; KCB 2015a,b). The shear strength of the glaciolacustrine units, except for the UGLU that sheared during the failure in 2014, were characterized based on their preconsolidation stress.

The glaciolacustrine unit at the Main Embankment is generally low to intermediate plasticity clay, with trace to some sand, and consistency ranging from very stiff to hard. GLU samples collected from the Main Embankment showed an average plasticity index of 17.

The UGLU at Corner 1 generally consists of intermediate to high plasticity clay, with trace to some sand, and consistency ranging from firm to stiff. UGLU samples showed an average plasticity index of 27.

The LGLU at Corner 1 generally consists of low to intermediate silty clay to clay, with trace to some sand. LGLU samples showed an average plasticity index of 15.

Results from laboratory and field testing showed different degrees of overconsolidation of the glaciolacustrine units. Table 2 summarizes the vertical effective preconsolidation stress estimated for each unit (WSP 2023a).

Table 2: Vertical Effective Preconsolidation Stress of Glaciolacustrine Units from the Main Embankment and Perimeter Embankment at Corner 1

Location	Unit	Vertical Effective Preconsolidation Stress (kPa)
Main Embankment	Glaciolacustrine Unit (GLU)	1200
Perimeter Embankment at Corner 1	Upper Glaciolacustrine Unit (UGLU)	400
	Lower Glaciolacustrine Unit (LGLU)	700

The overconsolidation ratio (OCR) of the glaciolacustrine units was calculated as follows:

$$OCR = \frac{\sigma'_{vp}}{\sigma'_{vc}}$$ **Equation 2**

Where σ'_{vp} equals the vertical effective preconsolidation stress and σ'_{vc} is the current vertical effective vertical stress.

The peak undrained shear strength ($S_{u\text{-}peak}$) of the glaciolacustrine units was characterized using the SHANSEP (Stress History and Normalized Soil Engineering Properties) method proposed by Ladd and Foot (1974). Results of simple shear tests carried out on undisturbed GLU samples from the Main and Perimeter embankments yielded the following expression for estimating the peak undrained strength ratio ($S_{u\text{-}peak}/\sigma'_{vc}$) (WSP 2023a):

$$\frac{S_{u-peak}}{\sigma'_{vc}} = 0.22 \cdot OCR^{0.71} \qquad \textbf{Equation 3}$$

Undisturbed UGLU specimens from the Corner 1 exhibited a propensity for strain-weakening on shearing during simple shear tests, with an estimated sensitivity of 2 to 3 (KCB 2015a,b). A post-peak reduction in undrained shear strength was observed at shear strains in excess of 5%, and full weakening was attained at shear strains in excess of 60% (Zabolotnii 2020). Figure 3 shows the characteristic strain-weakening function considered for the glaciolacustrine units. Plastic shear strains refer to shear strains accumulated once the peak undrained shear strength is fully mobilized.

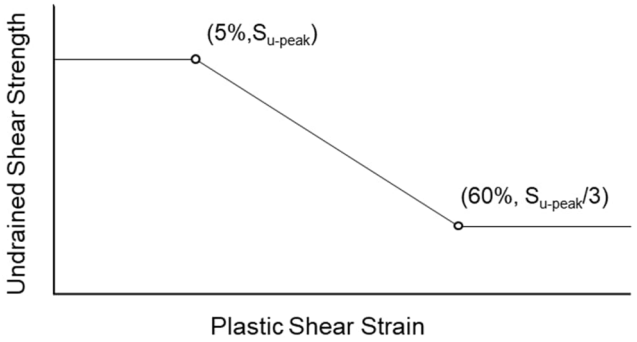

Figure 3: Glaciolacustrine Units Strain-Weakening Function

The UGLU drained peak friction angle was determined as 22 degrees (KCB 2015a,b). Drained shear strength parameters were considered for the portions of the GLU with overconsolidation ratios greater than 3.

The undrained shear strength of the UGLU that sheared during the failure in 2014was modelled constant and equal to 22 kPa, which corresponds to the average minus one standard deviation of the measured remoulded undrained shear strength values from field vane tests and CPTs as part of the forensic investigation in 2014 (WSP 2023a). Since then, the embankment was repaired and constructed to elevation 970 m (approx. 42 m high) over the area of UGLU that sheared. Potential strength gains from reconsolidation of the UGLU that sheared in 2014 have not been included in the characterization.

Shear wave velocity, V_s, of the UGLU and LGLU at Corner 1 was measured during geotechnical investigations with SCPT (BCMEM 2015). Measured V_s ranged between 120 m/s and 350 m/s. A characteristic shear wave velocity of 230 m/s was considered for the glaciolacustrine units. The small strain shear stiffness (G_{max}) was calculated using Equation 1 and the static shear modulus was assumed to be $G_{max}/8$.

Cyclic direct simple shear tests were carried out on undisturbed glaciolacustrine samples from the Main Embankment and Perimeter Embankment at Corner 1 (WSP 2023a). A preliminary assessment indicates factors of safety against cyclic softening generally greater than 1.5 under the 2,475-year earthquake load.

The shear stress-strain behaviour of the glaciolacustrine units was characterized using the shear modulus reduction curves presented by Vuccetic and Dobry (1991) for the average plasticity index (PI) of 15.

5.2 Embankment Materials and Tailings Characterization

Embankment materials were characterized based on the available data from construction monitoring (Golder 2015a; AMEC 2014) and from typical values published in literature.

Shear strength of the rockfill and transition materials was characterized by the average peak friction angle presented by Leps (1970). The peak friction angle, ϕ, of the rockfill and transition is given by:

$$\boldsymbol{\phi = 45.7 - 2.8 \cdot ln\left(\frac{\sigma'_h}{P_a}\right) < 55\ degrees} \qquad \textbf{Equation 4}$$

Where σ'_h is the horizontal effective stress and P_a is the atmospheric pressure.

The shear strength of the till core was measured on the triaxial apparatus on reconstituted specimens of till (KP 1995; BCMEM 2015). The friction angle considered for the till core was 33 degrees.

The friction angles adopted for the filter, upstream fill, and tailings were 30, 32 and 25 degrees, respectively. These values are consistent with the friction angle values used in the limit equilibrium analysis carried out for the elevation 970 and 974 m detailed TSF designs (Golder 2015b, WSP 2024).

The small strain shear stiffness (G_{max}) and static shear modulus (G_{stat}) of the embankment materials and tailings were estimated based on the compaction effort or expected density, from the Mount Polley Mine TSF construction record reports and from typical values obtained from literature (Byrne et al. 1987).

The average elastic modulus (E_0) of the cut-off wall material, estimated from the mix design (Golder 2016), was used to estimate the small strain shear stiffness of the cut-off wall at Corner 1 using:

$$\boldsymbol{G_{max} = \frac{E_0}{(2(1+\nu))}} \qquad \textbf{Equation 5}$$

Where ν is the Poisson ratio, assumed for the cut-off wall equal to 0.25.

6.0 CONSTITUTIVE MODELS

For the simulation of the staged construction of the embankments the elastic-perfectly plastic Mohr-Coulomb model was used to simulate the nonlinear behaviour of the tailings, embankment soils, and the foundation soils non-susceptible to strain-weakening (i.e., GLU with OCR greater than 3, UGLU that sheared in 2014, till and glaciofluvial soils). The strain-softening constitutive model was used to simulate the behaviour of the GLU with overconsolidation ratios less or equal to 3 (OCR≤3). The strain-softening constitutive model is based on the elastic-perfectly plastic Mohr-Coulomb model and allows the definition of the strength parameters (e.g. cohesion) as piecewise-linear functions of a softening parameter measuring the plastic shear strain. The elastic-perfectly plastic Mohr-Coulomb model was used to simulate the nonlinear behaviour of the UGLU that sheared during the failure in 2014 and GLU with overconsolidation ratios greater than 3 (OCR>3). The behaviour of the bedrock and cut-off wall was simulated with the linear elastic model. Table 3 presents the summary of the constitutive models and parameters used for the simulation of the staged construction of the embankments.

The dynamic mechanical response of both the bedrock and the cut-off wall was simulated as linear elastic (see Table 4). The dynamic behaviour of the GLU that sheared during the failure in 2014 and the GLU with overconsolidation ratio greater than 3 was modelled by complementing the linear elastic-perfectly plastic constitutive model with a hysteretic damping model. The seismic response of the GLU with overconsolidation ratios less or equal to 3 was numerically simulated by complementing the strain softening model with a hysteretic damping model. A sigmoidal fitting function was used to represent the characteristic shear stress-strain behaviour of the materials. Table 5 shows a summary of the model parameters used for these materials.

The dynamic response of the foundation till, glaciofluvial and till core was numerically modelled as non-linear, Mohr-Coulomb materials using the constitutive model UBC Hysteretic. In this model, the non-linear response is obtained by modifying the initial tangent shear moduli, that equals the small strain shear modulus ($G_{t\text{-}ini}=G_{max}$), in accordance with a hyperbolic law that depends on the shear strain level. Under cyclic loading, damping is estimated by the hysteretic loops formed by the stress-strain curves. The model input parameters are summarized in Table 6.

The dynamic response of the rockfill, filter, transition, upstream fill, and tailings was numerically modelled using the constitutive model UBCSAND developed to simulate earthquake loading and liquefaction. UBCSAND is an elasto-plastic effective stress model with the mechanical behaviour of the soil skeleton and pore water fully coupled. In UBCSAND, plastic shear induces a change in the soil skeleton volume and, if the pores are filled with water, a change in pore water pressure and effective stress occurs. Details of UBC Hysteretic and UBCSAND models can be found in Naesgaard (2011). The model input parameters are summarized in Table 7.

Table 3: Summary of the Constitutive Models and Parameters Used in the Simulation of the Staged Construction of the Embankments

Description	Constitutive Model	ρ_b (t/m^3)	Shear Strength Parameters		Elastic Parameters (1)			
			c (kPa)	ϕ (°)	$k_{G\text{-}stat}$	n	$k_{B\text{-}stat}$	m
Embankment Materials and Tailings								
Rockfill	Mohr-Coulomb	2.2	0	Equation 4	120	0.4	$8/3k_{G\text{-}stat}$	0.4
Transition		2.0						
Upstream Fill		2.0		32				
Filter		2.0		30				
Till Core		2.1		33	131	0.5		0.5
Tailings		1.7		25	94			
Cut-off Wall	Elastic	2.2	-		$G_{stat}=1.3x10^6$		$B_{stat}=5/3G_{stat}$	
Foundation Materials								
GLU (OCR≤3) (2)	Strain-softening	2.0 (3)	S_u (4)	0	$G_{stat}=1.3x10^4$		$B_{stat}=8/3G_{stat}$	
GLU (OCR>3) (2)	Mohr-Coulomb		0	22				
UGLU that sheared in 2014		1.8	22	0				
Till / Glaciofluvial		2.2	0	34	$G_{stat}=2.8x10^5$		$B_{stat}=8/3G_{stat}$	
Bedrock	Elastic	2.3	-		$G_{stat}=1.6x10^6$		$B_{stat}=8/3G_{stat}$	

Note:

(1) The static elastic shear modulus (G_{stat}) and the static elastic bulk modulus (B_{stat}) were calculated using the corresponding number (k) and exponent (n or m), mean effective stress, p'=(σ'$_1$+σ'$_2$+σ'$_3$)/3; and atmospheric pressure, P_a=100 kPa; for example: $G_{stat} = k_{G-stat} \cdot P_a \cdot \left(\frac{p'}{P_a}\right)^n$.

(2) GLU refers to GLU from the Main Embankment, and UGLU and LGLU from the Perimeter Embankment at Corner 1.

(3) Except for the UGLU from the Perimeter Embankment at Corner 1 where 1.8 t/m^3 was used. (4) S_u was calculated using Equation 2, Equation 3 and the strain-weakening function (see Figure 5).

Nomenclature: bulk density (ρ_b), cohesion (c), angle of internal friction (ϕ), static shear modulus number ($k_{G\text{-}stat}$), static shear modulus exponent (n), static bulk modulus number ($k_{B\text{-}stat}$) and static bulk modulus exponent (m).

Table 4: Parameters of the Linear Elastic Constitutive Model for the Seismic Analysis

Description	G_{dyn} (kPa)	B_{dyn} (kPa)
Bedrock	$1.6x10^6$	G_{dyn}
Cut-off Wall	$1.3x10^6$	G_{dyn}

Nomenclature: dynamic shear modulus (G_{dyn}) and dynamic bulk modulus (B_{dyn}).

Table 5: Parameters of the Mohr-Coulomb and Strain-softening Model for the Seismic Analysis

Description	Constitutive Model	G_{max} (kPa)	B_{max} (kPa)	c (kPa)	ϕ (°)	a	b	x_0
GLU (OCR≤3)	Strain-softening	$1.1x10^5$	G_{max}	S_u (1)	0	1.015	-0.52	-1.2
GLU (OCR>3)	Mohr-Coulomb		(2)	0	22			
UGLU that sheared in 2014				22	0			

Note:

(1) Su calculated using Equation 2, Equation 3 and the strain-weakening function (see Figure 5).

(2) Bmax was calculated as Bmax=2Gmax(1+ν)/(3(1- ν)), where ν is the Poisson ratio equal to 0.49.

Nomenclature: small strain shear stiffness (G_{max}), small strain bulk stiffness (B_{max}), cohesion (c), angle of internal friction (ϕ), and hysteretic parameters (a, b and x_0; Cundall 2012).

Table 6: Parameters of the UBC Hysteretic Model for the Seismic Analysis

Description	hgmax (kPa)	hbulk (kPa)	hfric (°)	hn	hrf	hdfac	hrm	hmodf1
Till / Glaciofluvial	$5.5x10^5$	hgmax	34	2	0.75	1	1.5	0.8
Till Core	(1)	hgmax	33	2	1	1	1	0.8

Note:

(1) hgmax was calculated as $\mathrm{hgmax} = k_g \cdot P_a \cdot \left(\frac{p\prime}{P_a}\right)^{n_g}$, where kg=977, ng=0.5, Pa=100 and p'=(σ'1+σ'2+σ'3)/3.

Nomenclature: maximum shear modulus (hgmax), maximum bulk modulus (hbulk), cohesion (hcoh), angle of internal friction (hfric), and hysteretic parameters (hn, hrf, hdfac, hrm, hmodf1).

Table 7: Parameters of the UBCSAND Model for the Seismic Analysis

Description	K_{ge}	K_b	n_e	m_e	K_{gp}	n_p	ϕ_{pt} (°)	ϕ (°)	R_f
Tailings	867	607	0.5	0.5	267	0.4	33	34	0.81
Filter	979	685	0.5	0.5	488	0.4	33	34	0.76
Transition									
Upstream Fill									
Rockfill	6416	4491	0.4	0	353	0.5	40	Equation 4	0.95

Nomenclature: elastic shear modulus number (K_{ge}), elastic bulk modulus number (K_b), elastic shear modulus exponent (n_e), elastic bulk modulus exponent (m_e), plastic shear modulus number (K_{gp}), plastic shear modulus exponent (n_p), peak friction angle (ϕ), friction angle at phase transformation (ϕ_{cv}) and constant that modifies the hyperbola (R_f).

7.0 STATIC ANALYSIS

The static analysis was carried out to further confirm the stability of the embankments at the end of construction to elevation 974 m. The following sections describe the finite difference models simulation of the staged construction of the embankments and the analysis results.

7.1 Finite Difference Models

Two-dimensional (2D) finite difference models were developed for the selected sections of the TSF using the commercially available computer code FLAC Version 8.1 (Cundall 2012).

The finite difference mesh developed for section 2+055 at the Main Embankment and section 4+175 at the Perimeter Embankment at Corner 1 are shown in Figure 4 and Figure 5, respectively. The meshes extend vertically from about elevation 845 m to the embankments crest design elevation of 974 m. Horizontally, the meshes extend far enough from the embankments to avoid boundary effects. The mesh size is 1 m by 1 m at the centre of the model, increasing to about 4 m by 4 m to the far ends. Numerical models with strongly nonlinear behaviour, such as the strain-weakening behaviour exhibited by the glaciolacustrine units, are particularly sensitive to mesh sizing. Furthermore, results of three-dimensional deformation analyses of the Perimeter Embankment performed by Zabolotnii (2020) suggest that strain localization in a shear band with a thickness not exceeding 12 to 13 cm was requisite for the initiation of the breach at the Mount Polley TSF in 2014. Hence, the mesh size in the GLU at the Main Embankment and the UGLU at the Perimeter Embankment was refined to 0.125 m by 0.125 m.

7.2 Simulation of the Staged Construction of the Embankments

The staged construction of the embankments was simulated by sequentially activating horizontal layers of materials, each 1 m thick, following the construction sequence presented in Table 1. After activating each layer, the model was run to equilibrium and material properties updated according to the new stress state. If a tailings layer was activated, the pond level was raised to maintain a 100 m beach upstream of the embankment, and the pore pressures updated. Hydrostatic conditions were assumed below the water table.

The consolidation-induced hardening of the GLU was modelled by adjusting the undrained strength of the GLU based on the existing stress state. This adjustment was only applied at the end of construction stages where complete dissipation of excess pore water pressure was expected before the beginning of the following stage (see Table 1). Plastic shear strains accumulated in previous construction stages were carried over to the following stages (i.e., GLU was assumed to not heal once the peak undrained shear strength was fully mobilized).

For the simulation of the staged construction of the embankments, the bottom boundary of the 2D numerical models was considered fixed in both vertical and horizontal directions, while the lateral boundaries were considered fixed only in the horizontal directions (i.e., on vertical rollers).

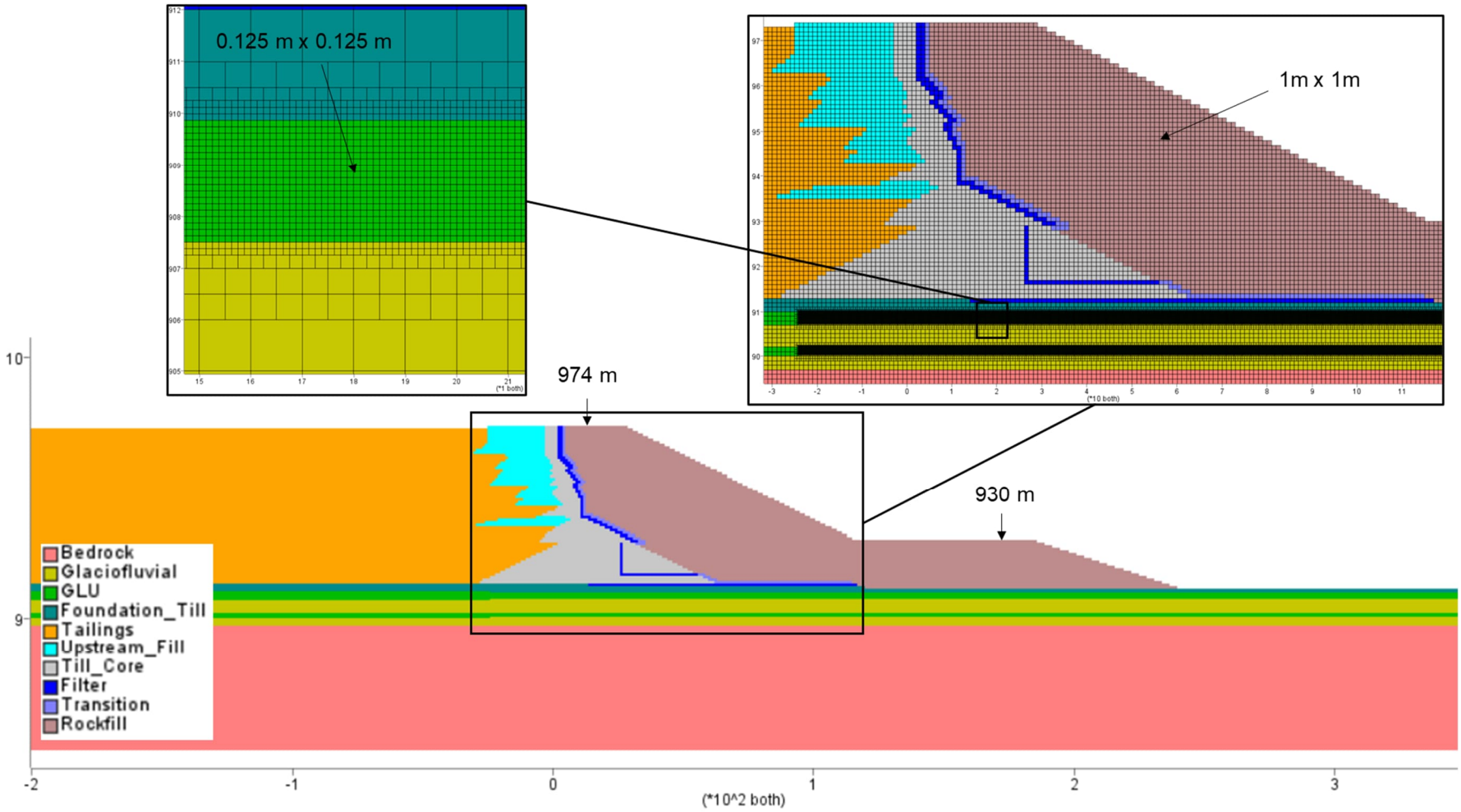

Note: Axes unit is meters.

Figure 4: Finite Difference Mesh of Main Embankment Section at Station 2+055

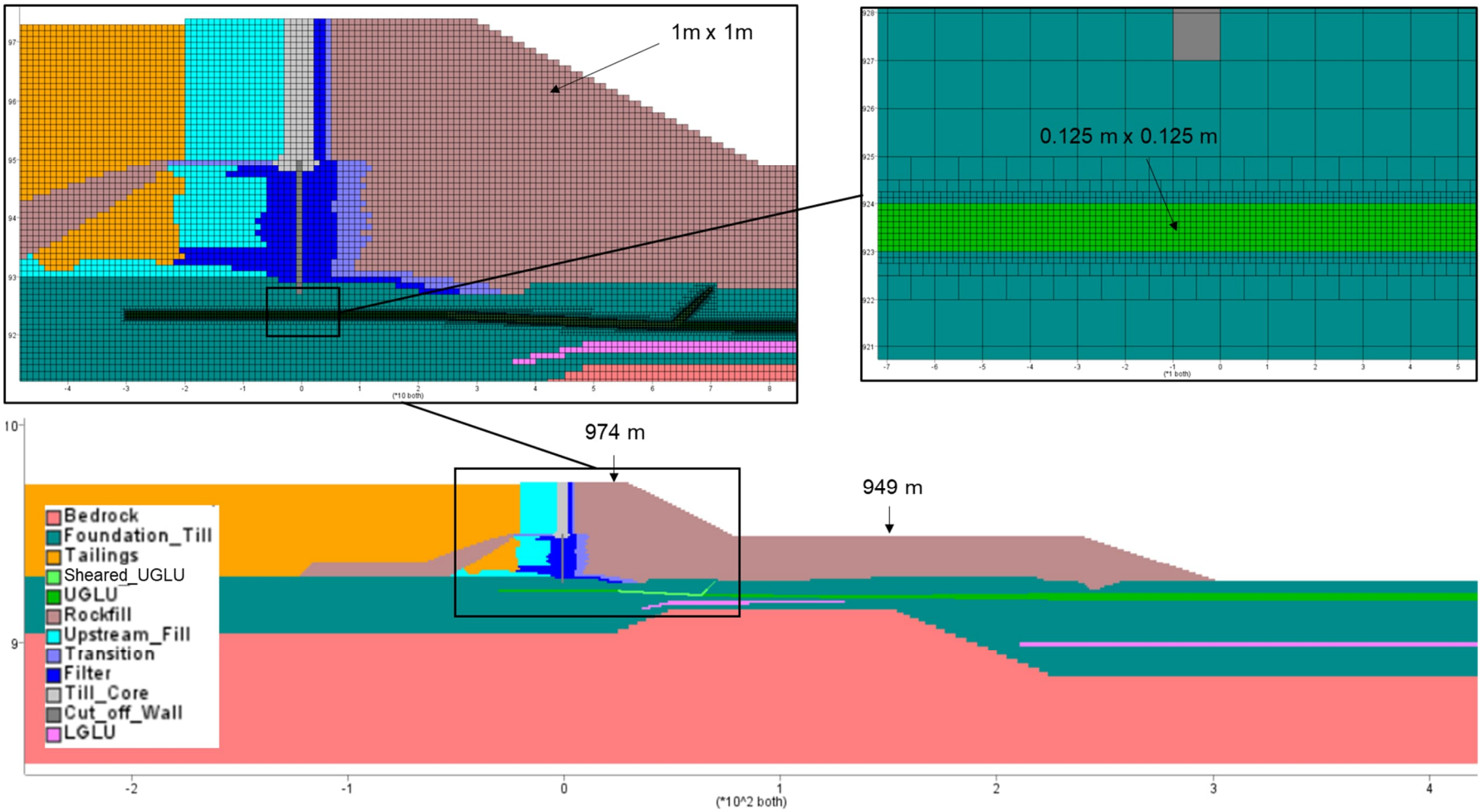

Note: Axes unit is meters.

Figure 5: Finite Difference Mesh of Perimeter Embankment Section at Station 4+175

7.3 Analysis Results

This section presents the results of the static analysis carried out on section 4+175 of the Main Embankment (see Figure 6) and section 2+055 of the Perimeter Embankment (see Figure 7). Contours of horizontal displacements are presented to evaluate potential deformation mechanisms. Contours of accumulated plastic shear strains at the end of construction are presented to evaluate the potential for strain-weakening in the GLU. Plastic shear strains greater than zero but less than 5% indicate that the peak undrained shear strength was fully mobilized. Plastic shear strains greater than 5% indicate post-peak conditions and initiation of weakening. Plastic shear strains greater than 60% indicate that full weakening was attained (see Figure 3). For clarity, plastic shear strains accumulated in the UGLU that sheared in 2014 are not presented in Figure 7. The UGLU that sheared in 2014 was modelled as fully weakened. The factor of safety of the embankments was computed at the end of construction using the strength reduction method.

7.3.1 Main Embankment – Section 2+055

Contours of predicted horizontal displacement in the Main Embankment (see Figure 6a) show a limited, block type downstream movement of the embankment associated with shear strains accumulated in the GLU during construction. Predicted plastic shear strains accumulated in the GLU below the downstream slope of the Main Embankment are less than 1.5% (see Figure 6b), indicating that the peak undrained shear strength is fully mobilized but the weakening process is not initiated. The factor of safety (FoS) computed for section 2+055 of the Main Embankment is about 1.6 and corresponds to a block-type slip surface through the glaciolacustrine unit, as shown in Figure 6c. These results indicate that section 2+055 of the Main Embankment meets the long-term factor of safety design criteria under the analysed conditions.

7.3.2 Perimeter Embankment at Corner 1 – Section 4+175

Contours of predicted horizontal displacement in the Perimeter Embankment at Corner 1 (see Figure 7a) show a limited, block type downstream movement of the embankment associated with shear strains accumulated in the UGLU, including the UGLU that sheared during the failure in 2014, during construction. A relatively small shear band (about 3 m long) with a maximum plastic shear strain of about 10% is predicted to develop immediately downstream of the UGLU zone that sheared in 2014. However, the predicted level of strain-weakening is relatively low (less than 6% strength reduction in a 3 m long shear band). The predicted plastic shear strains in the rest of the UGLU are generally less than 5%. The factor of safety (FoS) computed for section 4+175 is about 1.7 and corresponds to a block-type slip surface through the UGLU, as shown in Figure 7c. The static analysis results indicate that this section of the Perimeter Embankment at Corner 1 meets the long-term factor of safety design criteria under the analysed conditions.

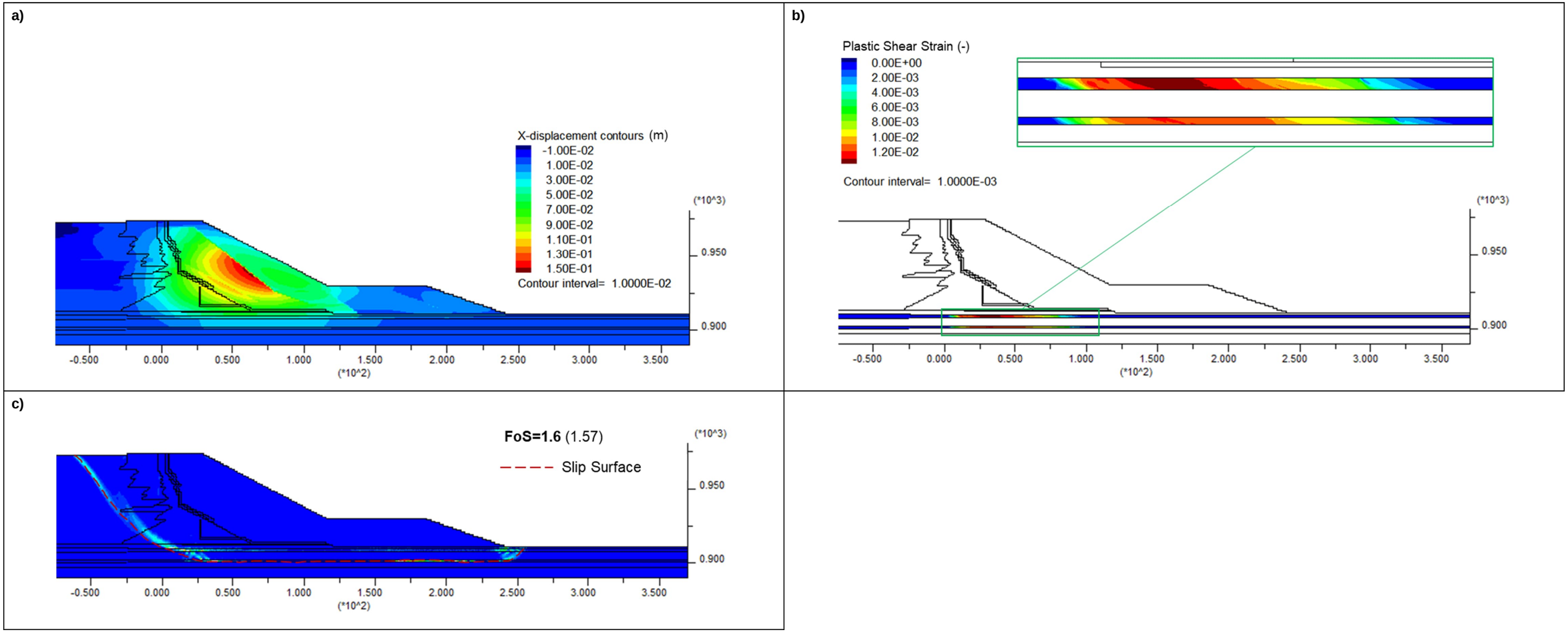

Note: Axes unit is meters.

Figure 6: Static Analysis Results for the Main Embankment – Section 2+055 at the End of the Construction to Elevation 974 m: a) Contours of Predicted Horizontal Displacement, b) Contours of Predicted Plastic Shear Strain in Glaciolacustrine Units, c) Predicted Factor of Safety.

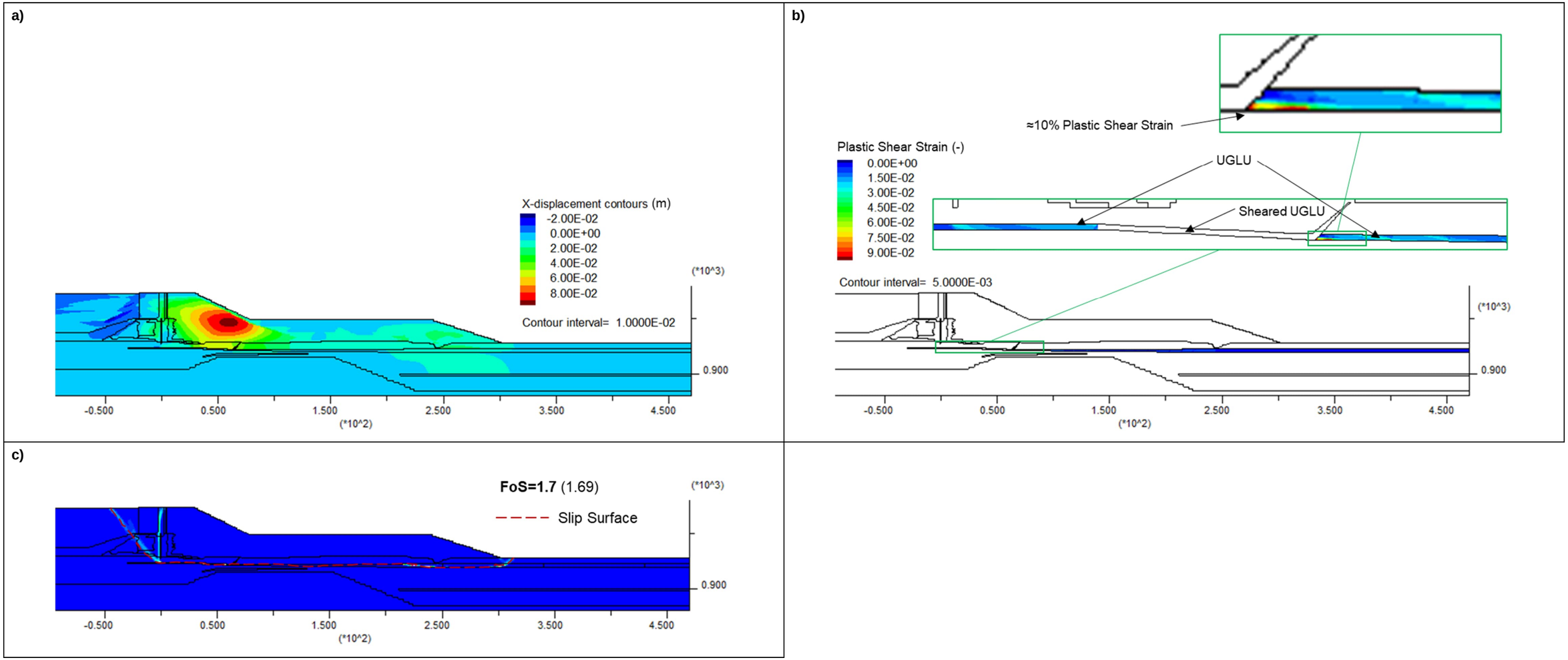

Note: Axes unit is meters.

Figure 7: Static Analysis Results for the Perimeter Embankment at Corner 1 – Section 4+175 at the End of the Construction to Elevation 974 m: a) Contours of Predicted Horizontal Displacement, b) Contours of Predicted Plastic Shear Strain in the Upper Glaciolacustrine Unit, c) Predicted Factor of Safety.

8.0 EARTHQUAKE GROUND MOTIONS

WSP (2023b) carried out a site-specific probabilistic seismic hazard analysis (PSHA) for the Mount Polley TSF site. In this section, only a summary of the results is presented.

Earthquake ground motions were reported as 5%-damped, mean uniform hazard acceleration response spectra at annual exceedance probabilities (AEPs) of 1/1,000, 1/2,475, 1/5,000 and 1/10,000 for the site-specific average shear wave velocity in the 30 m below ground surface (V_{s30}) of 849 m/s. Deaggregations results show that both, near-field, moderate-magnitude earthquakes, and far-field subduction interface earthquakes contribute to the site seismic hazard. The shallow crustal earthquakes sources are dominated by moderate-magnitude earthquakes (**M**6.0 to **M**6.5) close to the site (i.e. <60 km) at all AEPs. The contribution to hazard at the site from Cascadia subduction zone sources is from large earthquakes (**M**8+) at 450 to 550 km from these at all AEPs and spectral periods of interest. Eleven two-horizontal-component earthquake acceleration time histories (EATHs; 22 records) were developed using amplitude scaling to the site-specific 1/2,475 AEP uniform hazard acceleration response spectrum within the period range of interest of 0.5 to 1.5 seconds. These 22 EATHs were developed with eight two-component (16) records from crustal earthquakes and three two-component (6) subduction interface earthquake records. Figure 8 and Figure 9 show the response spectra of one component of the individual scaled EATHs compared with the target spectrum for both crustal and subduction interface motion, respectively.

Following the design criteria (WSP 2024), earthquake ground motions with a return period of 2,475 years were selected for seismic analysis of the Mount Polley Mine TSF site. One crustal motion (RSN4478N) and one subduction interface motion (RSN4000183EW) were selected from the 22 EATHs developed, corresponding to those with the maximum Arias intensity for each seismic source.

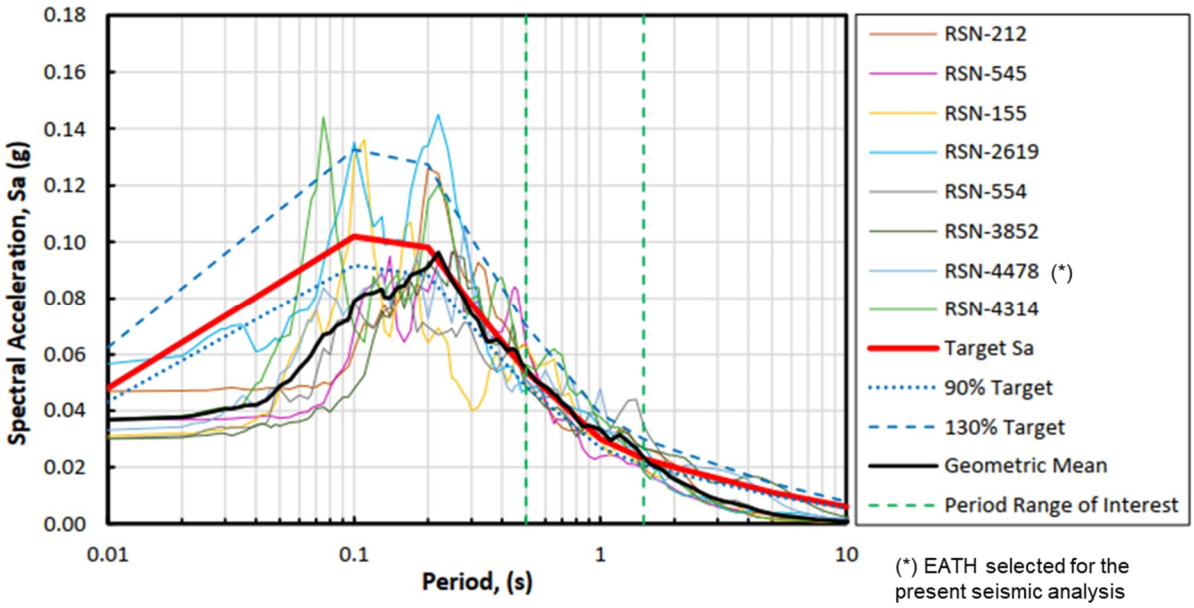

Source: WSP 2023b.

Figure 8: Target Acceleration Response Spectrum and Response Spectra of Individual Crustal Earthquake Acceleration Time histories

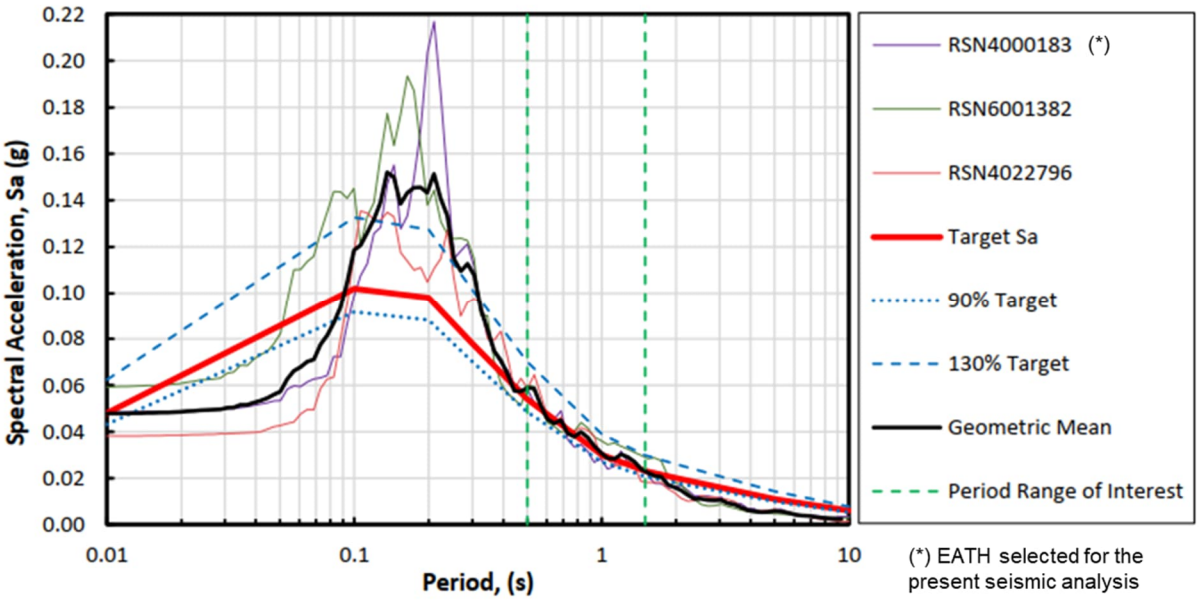

Source: WSP 2023b.

Figure 9: Target Acceleration Response Spectrum and Response Spectra of Individual Subduction Interface Earthquake Acceleration Time Histories

9.0 SEISMIC ANALYSIS

The seismic analysis was carried out to further confirm the stability of the embankments under the 2,475-year earthquake loading. The following sections describe the finite difference models, simulation of the design earthquake and the analysis results.

9.1 Finite Difference Models

The size of the elements used in the finite difference model have an impact on the solution time of the seismic analysis. The smaller the elements, the greater the solution time due to the increased number of elements and the reduced timestep. The finite difference models developed for the static analysis considered 0.125 m by 0.125 m elements for the GLU at the foundation of the Main Embankment and the UGLU at Corner 1. The utilization of such element size for the seismic analysis leads to impractical solution times. Hence, the element size in the GLU was increased to 0.5 m by 0.5 m to perform the seismic analysis. The rationale behind this modification is presented in the following paragraphs.

The selection of the elements size used for the GLU in the static analysis is based on the results of the three-dimensional deformation analyses that suggest that strain localization in a shear band with a thickness not exceeding 12 to 13 cm was requisite for the initiation of the breach at the Mount Polley TSF in 2014 (Zabolotnii 2020). A level of conservatism is introduced in a two-dimensional deformation analysis when adopting the same element size for the GLU since the three-dimensional stability effects in the slope are not included.

The finite difference model developed for the Perimeter Embankment at Corner 1 in Section 7.1 was modified to evaluate the mesh size sensitivity and the degree of conservatism incorporated when using different element sizes for the UGLU. The model was adjusted to represent the geometry, groundwater conditions and construction

sequence of the embankment up to when it failed in 2014 at an approximate crest elevation of 969 m. The staged construction was simulated using different element sizes for the UGLU from 0.125 m to 1 m. Figure 10 shows a summary of the results of the analyses. An element size of 0.5 m still adds a degree of conservatism to the solution while allowing for reasonable solutions times for the seismic analysis.

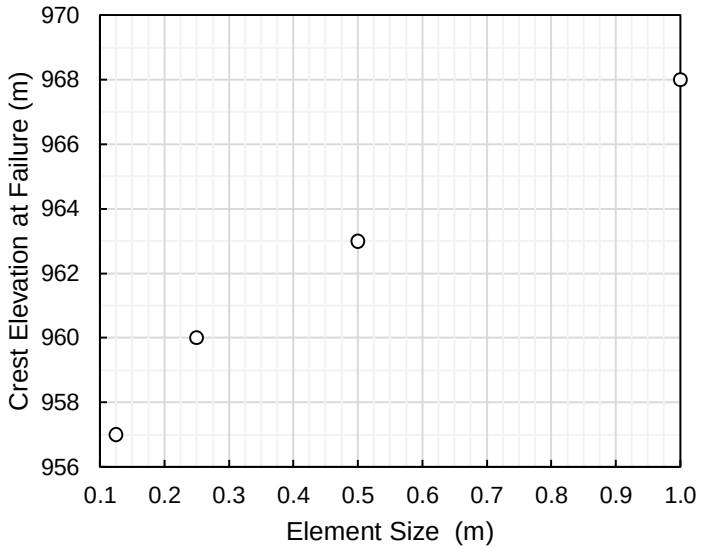

Figure 10: Mesh Sensitivity of the Modified Perimeter Embankment at Corner 1 Finite Difference Model

9.2 Conditions Prior to Application of Seismic Loading

The pre-seismic stress conditions in the embankments and foundation were estimated by simulating the staged construction of the embankments up to elevation 974 m, using 0.5 m by 0.5 m elements in the GLU. The assumed groundwater conditions include a 100 m tailings beach upstream of the embankment, as shown in Figure 11 and Figure 12. Hydrostatic conditions were assumed below the water table.

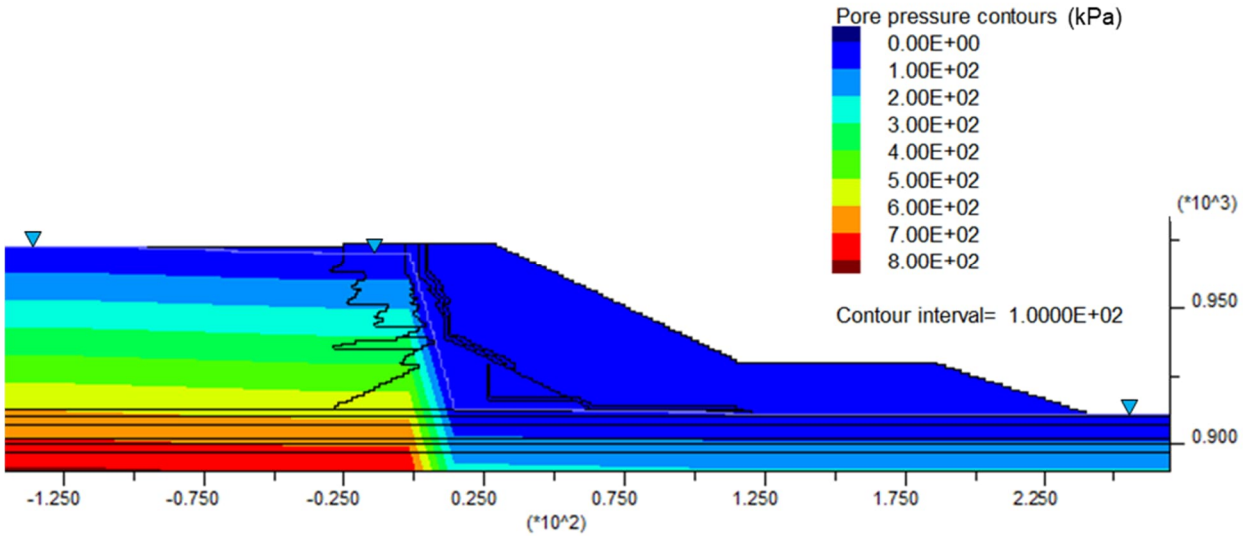

Figure 11: Assumed Pre-Seismic Groundwater Conditions, Section 2+055 – Main Embankment

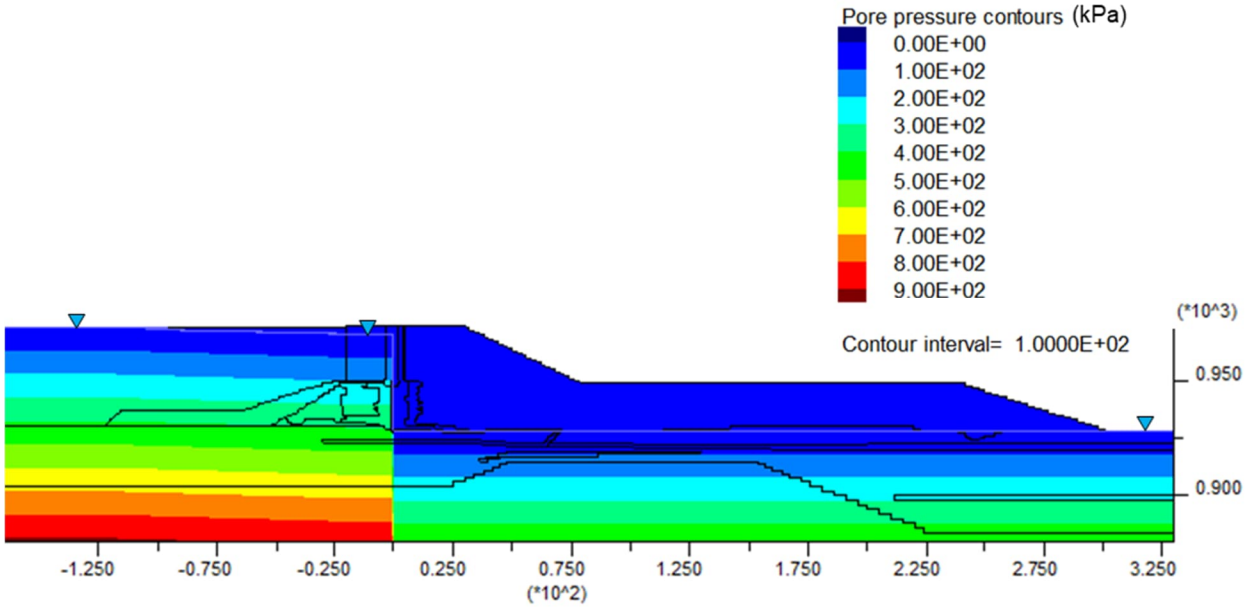

Figure 12: Assumed Pre-Seismic Groundwater Conditions, Section 4+175 – Perimeter Embankment at Corner 1

9.3 Simulation of the Design Earthquake

The response of the embankments to the design earthquake was simulated by using selected earthquake acceleration time histories (EATHs) developed in the seismic hazard assessment as input ground motions at the base of the models. One crustal motion (RSN4478N) and one subduction interface motion (RSN4000183EW) were selected from the 22 EATHs developed, corresponding to those with the maximum Arias intensity for each seismic source (see Section 8.0). The polarity (sign) of each input ground motion was inverted and the analysis repeated to assess the effect of earthquake directionality on the embankments seismic response. Direct polarity (DP) refers to the earthquake acting in one direction and reverse polarity (RP) to the opposite direction.

For the simulation of the design earthquake loading, the bottom boundaries of the model were assigned as quiet (flexible base) and the lateral boundaries as free-field.

9.4 Analysis Results

The following sections present the results of the seismic analysis carried out on section 2+055 of the Main Embankment Figure 13 to Figure 15) and section 4+175 of the Perimeter Embankment at Corner 1 (Figure 16 to Figure 18). For ease of presentation, contours plots are presented only for EATHs applied with direct polarity. Attachment 2 presents the results obtained with the selected EATHs with both polarities.

Contours of predicted horizontal and vertical seismic displacements at the end of earthquake shaking are presented to evaluate potential deformation mechanisms. Predicted displacement-time histories at selected points of the embankment are presented to assess the stability of the embankment at the end of earthquake shaking. Contours of accumulated plastic shear strains during seismic loading are presented to evaluate the potential for strain-weakening in the GLU. Contours of excess pore water pressure ratio are presented to identify where liquefaction was predicted. The excess porewater pressure ratio, $r_u=\Delta u/\sigma'_{v0}$, is defined as the ratio between the excess pore water pressure (Δu) developed during cyclic loading and the initial vertical effective stress (σ'_{v0}).

Full liquefaction occurs when the excess pore water pressure developed during cyclic loading is equal to the initial vertical effective stress (r_u=100%) However, r_u values greater than about 70% are typically high enough to induce significant soil softening and weakening. Zones where r_u exceeds 70% are referred herein as liquefied even though full liquefaction was not reached.

9.4.1 Predicted Main and Perimeter Embankment Deformations

The displacement-time histories show that the movement of both sections analysed stop at the end of earthquake shaking, indicating that the embankment in both analysed sections is stable at the end of the earthquake design ground motions (see Figure 13 and Figure 16). The maximum permanent horizontal displacement in the downstream direction predicted in the embankments and buttresses is less than 5 cm.

Results obtained using the subduction interface motion indicate that a deformation mechanism, with limited upstream movement and settlement of the upstream fill (up to 0.5 m), is initiated upstream of the embankments due to liquefaction of the tailings and upstream fill during earthquake shaking. These displacements could potentially affect the serviceability of the upstream drains at elevation 970 m. This deformation mechanism is not observed during the crustal motion because liquefaction is not triggered in the tailings and upstream fill.

The maximum permanent horizontal and vertical displacements predicted at the centreline of the embankments (i.e., at the crest of the till core) are less than 4 cm. The serviceability of the till core is not expected to be affected by this level of displacements.

9.4.2 GLU Plastic Shear Strains and Potential Strength Weakening

Main Embankment – Section 2+055

Predicted plastic shear strains accumulated during earthquake shaking are less than 0.5% in the GLU at the Main Embankment. Plastic shear strains predicted in the GLU at the end of the construction of the Main Embankment up to elevation 974 m were less than 1.5% (see Figure 6b). The predicted total plastic shear strains (static plus seismic) are still less than 2%. Hence, the weakening process is not expected to be initiated in the GLU at the Main Embankment during the earthquake design ground motions.

Perimeter Embankment at Corner 1 – Section 4+175

Predicted plastic shear strains during earthquake shaking are less than 1% in the UGLU below the downstream slope of the Perimeter Embankment at Corner 1. The static analysis predicted a limited shear band at that location with plastic shear strains of about 10% (see Figure 7b), indicating that the weakening process was initiated during construction of the embankment up to elevation 974 m. The predicted level of strain-weakening is relatively low (less than 1.5% strength reduction) and does not have a significant impact on the seismic stability of the embankment at Corner 1.

Predicted plastic shear strains during earthquake shaking is about 2% in the UGLU below the downstream slope of the buttress at the Perimeter Embankment at Corner 1. The static analysis did not predict development of plastic shear strains at that location during construction of the embankment up to elevation 974 m. Hence, initiation of the weakening process is not expected in the UGLU at that location during the earthquake design ground motions.

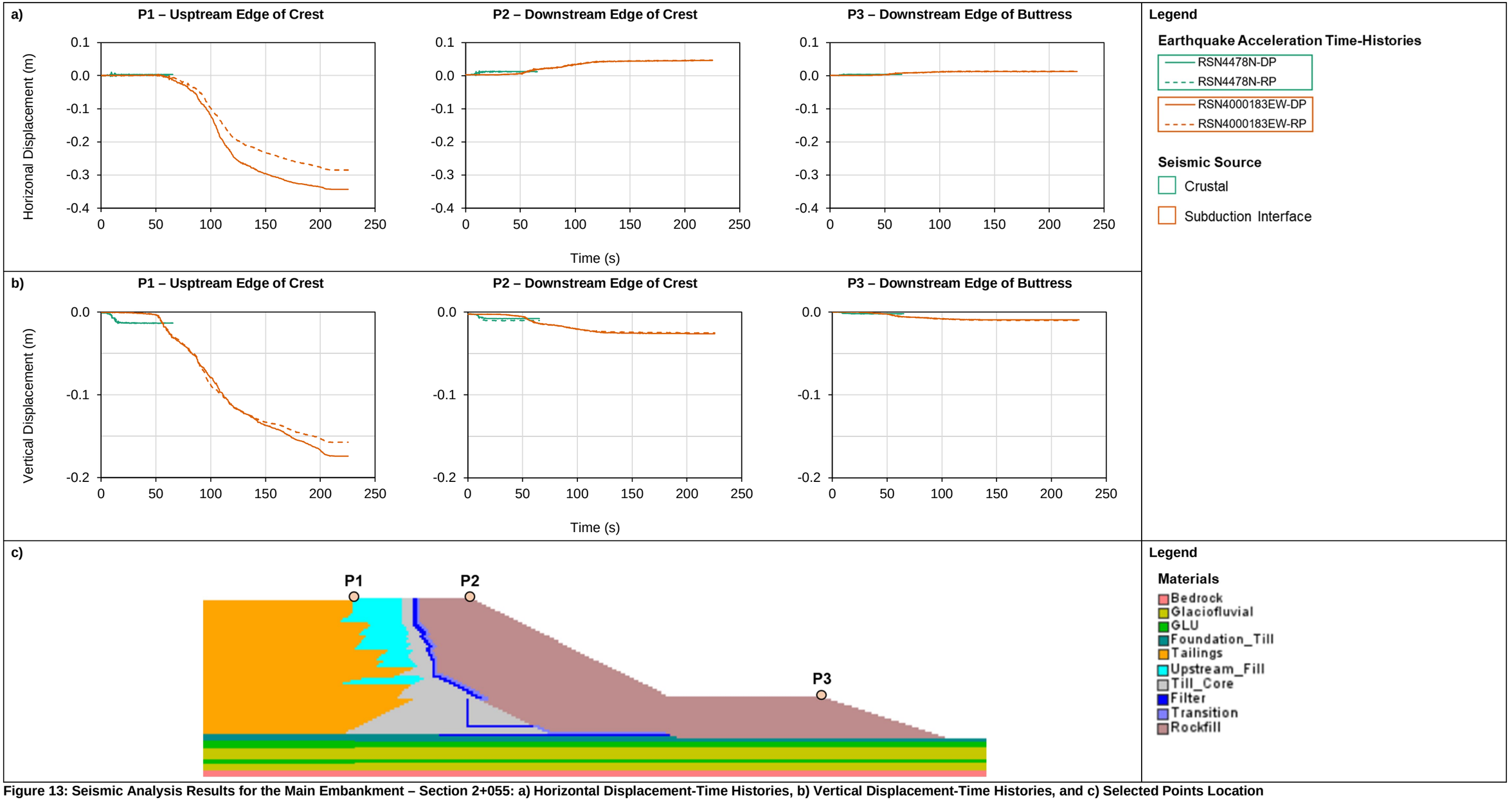

Figure 13: Seismic Analysis Results for the Main Embankment – Section 2+055: a) Horizontal Displacement-Time Histories, b) Vertical Displacement-Time Histories, and c) Selected Points Location

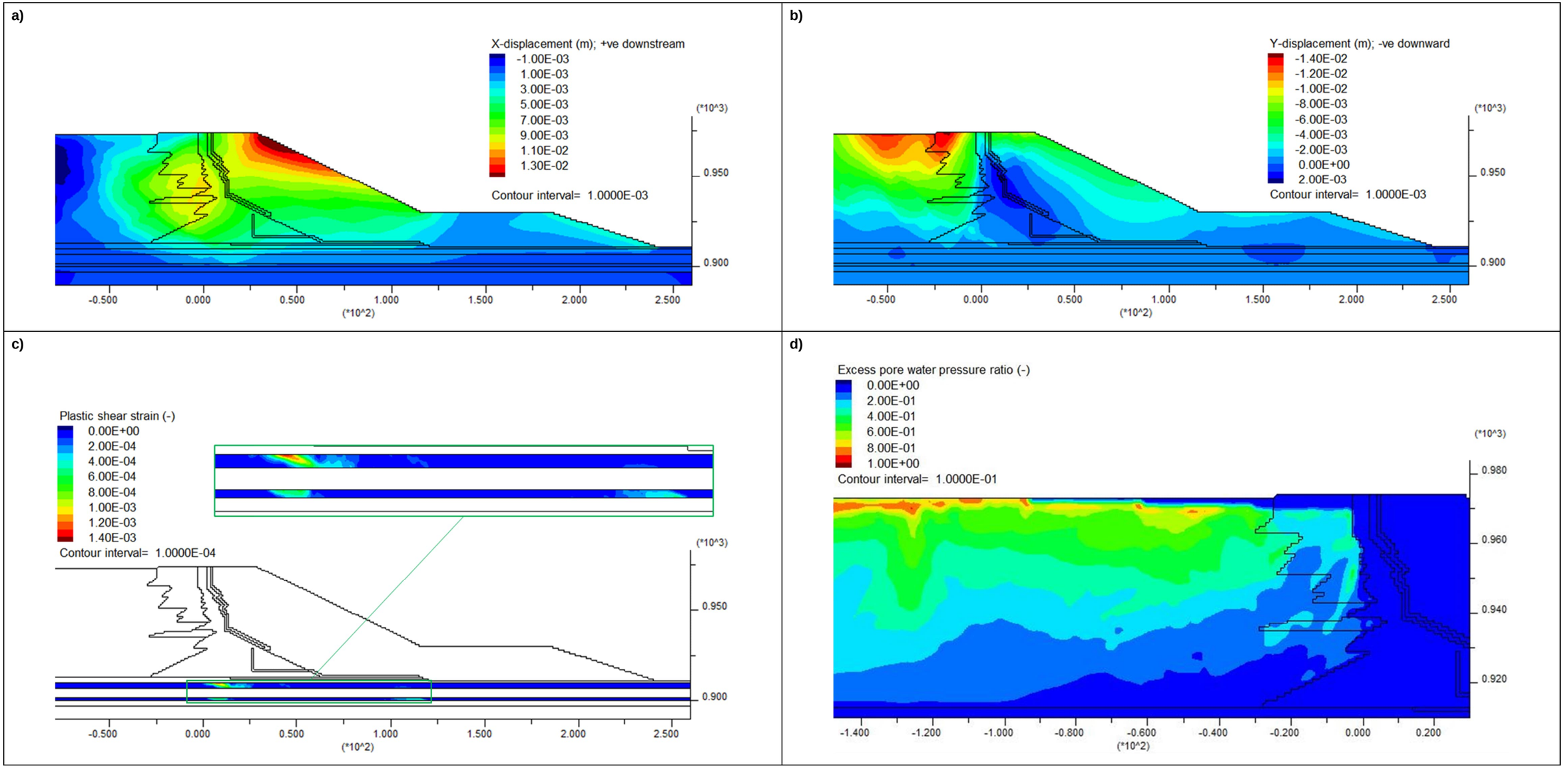

Note: Axes unit is meters.

Figure 14: Seismic Analysis Results for the Main Embankment – Section 2+055 at the End of the Crustal EATH RSN4478N with Direct Polarity (DP): a) Contours of Horizonal Permanent Seismic Displacement, b) Contours of Vertical Permanent Seismic Displacement, c) Contours of Permanent Seismic Plastic Shear Strains and d) Contours of Excess Pore Water Pressure Ratio (r_u).

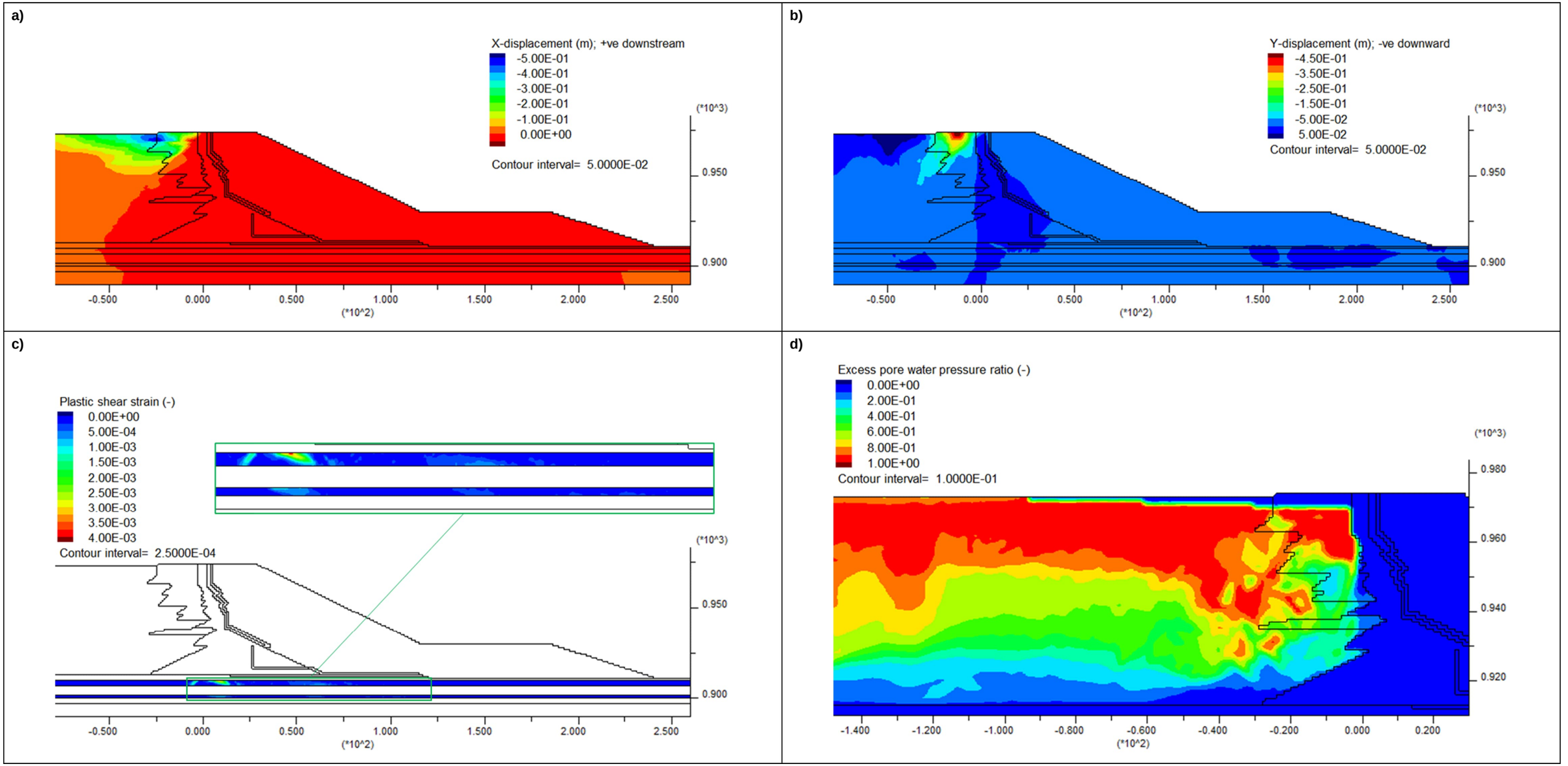

Note: Axes unit is meters.

Figure 15: Seismic Analysis Results for the Main Embankment – Section 2+055 at the End of the Subduction Interface EATH RSN4000183EW with Direct Polarity (DP): a) Contours of Horizonal Permanent Seismic Displacement, b) Contours of Vertical Permanent Seismic Displacement, c) Contours of Permanent Seismic Plastic Shear Strains and d) Contours of Excess Pore Water Pressure Ratio (r_u).

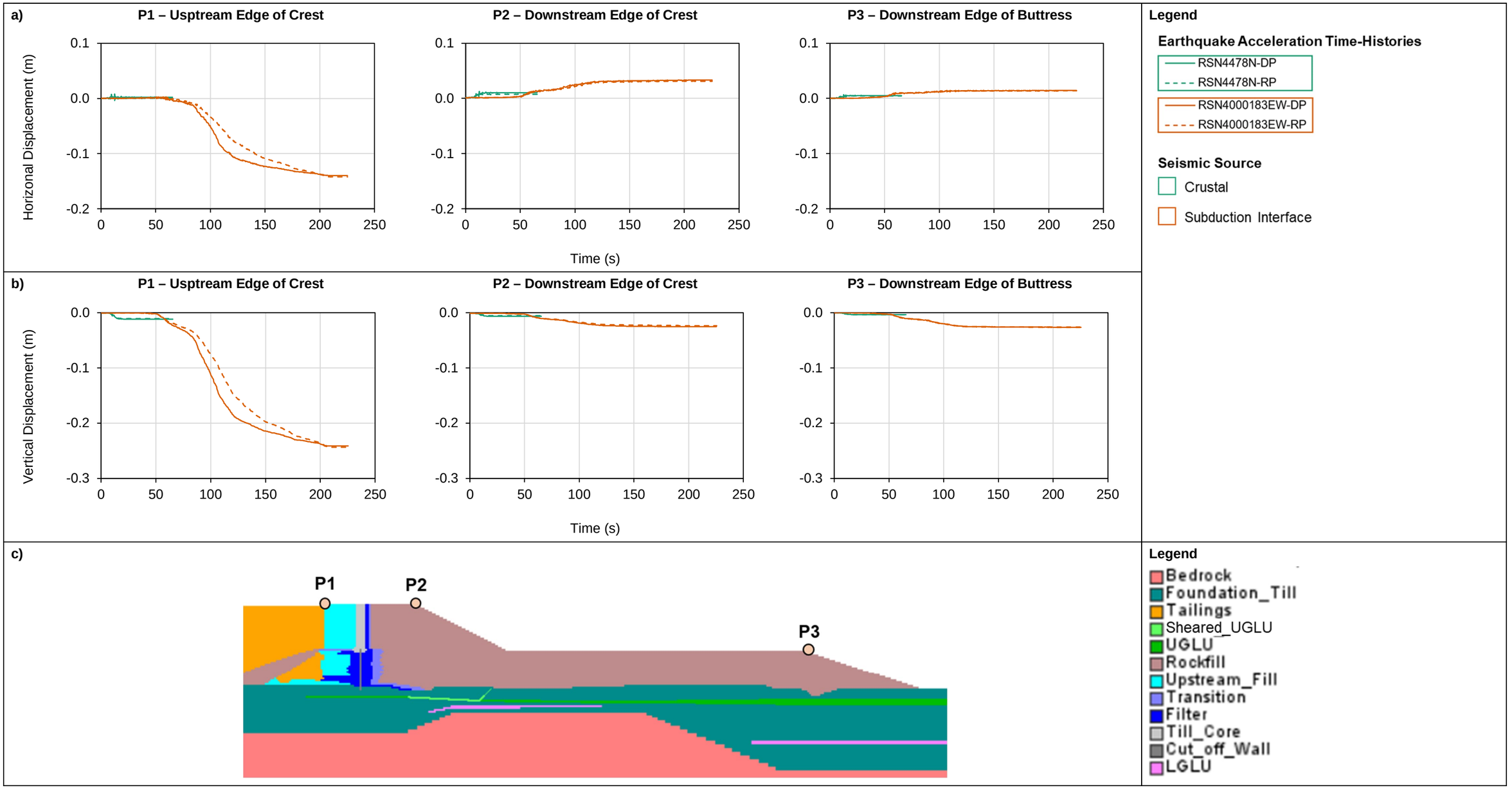

Figure 16: Seismic Analysis Results for the Perimeter Embankment at Corner 1 – Section 4+175: at Selected Points: a) Horizontal Displacement-Time Histories, b) Vertical Displacement-Time Histories, and c) Selected Points Location

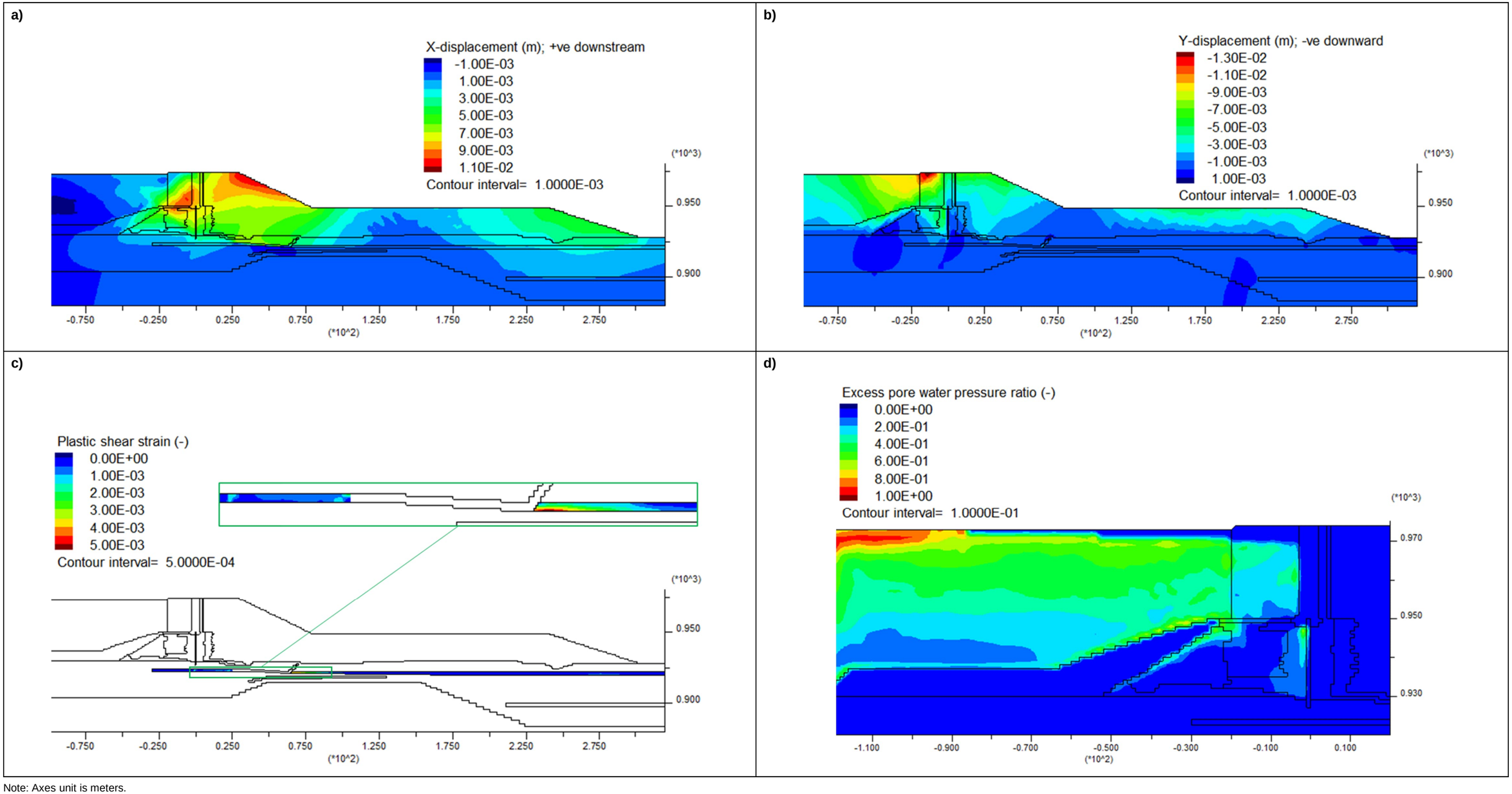

Note: Axes unit is meters.

Figure 17: Seismic Analysis Results for the Perimeter Embankment at Corner 1 – Section 4+175 at the End of the Crustal EATH RSN4478N with Direct Polarity (DP): a) Contours of Horizonal Permanent Seismic Displacement, b) Contours of Vertical Permanent Seismic Displacement, c) Contours of Permanent Seismic Plastic Shear Strains and d) Contours of Excess Pore Water Pressure Ratio (r_u). (Axes Units: m)

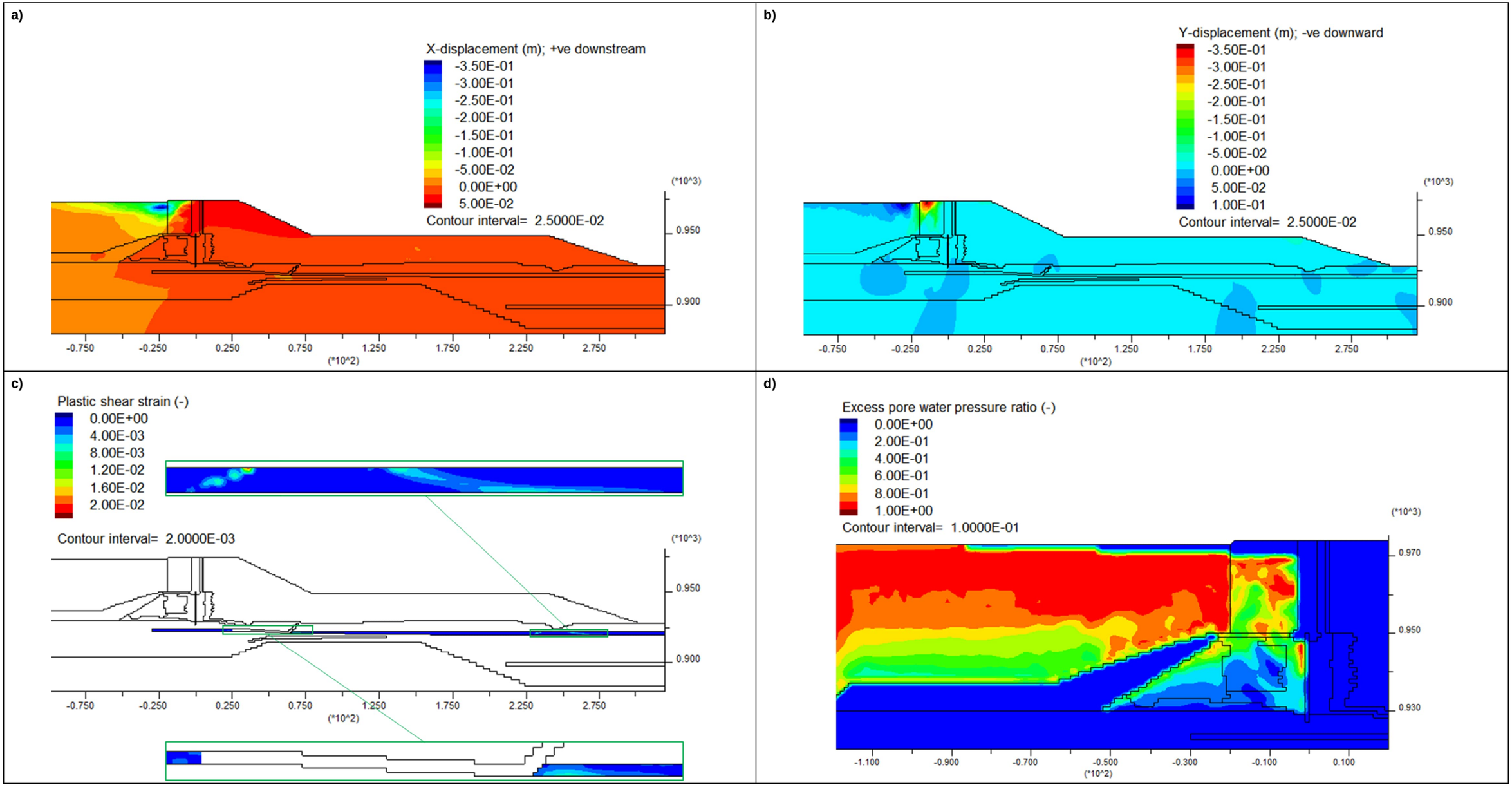

Note: Axes unit is meters.

Figure 18: Seismic Analysis Results for the Perimeter Embankment at Corner 1 – Section 4+175 at the End of the Subduction Interface EATH RSN4000183EW with Direct Polarity (DP): a) Contours of Horizonal Permanent Seismic Displacement, b) Contours of Vertical Permanent Seismic Displacement, c) Contours of Permanent Seismic Plastic Shear Strains and d) Contours of Excess Pore Water Pressure Ratio (ru).

10.0 CONCLUSIONS

Stress-deformation analyses were carried out on section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 to support the detailed design for the raise of the TSF from elevation 970 to 974 m. The analyses were performed to further confirm the stability of the embankments at the end of construction up to elevation 974 m (static analysis) and under the 2,475-year earthquake load (seismic analysis). One crustal motion and one subduction interface motion were used as input ground motions in the seismic analysis. The conclusions of the analyses are presented in the following sections.

10.1 Static Analysis

- Section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 are predicted to be stable at the end of construction up to elevation 974 m under the analysed conditions.
- The factor of safety computed at the end of construction is about 1.6 for section 2+055 of the Main Embankment and about 1.7 for section 4+175 of the Perimeter Embankment at Corner 1.
- Strain-weakening is not predicted in the GLU at section 2+055 of the Main Embankment during construction up to elevation 974 m.
- Assuming a constant 22 kPa undrained shear strength for the UGLU that sheared during the failure in 2014 (i.e., no inclusion of potential strength gains from reconsolidation), a shear band about 3 m long with a maximum plastic shear strain of about 10% is predicted to develop below the downstream slope of the Perimeter Embankment at Corner 1 at section 4+1475. However, the predicted degree of strain-weakening is relatively low (about 6% strength reduction in a 3 m long shear band) and does not have a significant impact on the stability of the elevation 974 m embankment.

10.2 Seismic Analysis

- Section 2+055 of the Main Embankment and section 4+175 of the Perimeter Embankment at Corner 1 are predicted to be stable under the action of the 2,475-year earthquake ground motion.
- The maximum permanent horizontal displacement in the downstream direction is less than 5 cm in the embankments and buttresses of both analysed sections under the action of the 2,475-year earthquake ground motion.
- The maximum permanent horizontal and vertical displacements predicted at the centreline of the embankments in both analysed sections are less than 4 cm at the end of the 2,475-year earthquake ground motion. The serviceability of the till core is not expected to be affected by this level of displacements.
- Strain-weakening is not predicted in the GLU at section 2+055 of the Main Embankment under the action of the 2,475-year earthquake ground motion.
- Assuming a constant 22 kPa undrained shear strength for the UGLU that sheared during the failure in 2014 (i.e., no inclusion of potential strength gains from reconsolidation), a relatively low level of strain-weakening (less than 1.5% strength reduction) is predicted in the UGLU under the downstream slope of the Perimeter Embankment at section 4+175, during the 2,475-year earthquake ground motion. This degree of weakening is relatively low (less than 1.5% strength reduction) and does not have a significant impact on the seismic stability of the embankment.

- A deformation mechanism, with limited upstream movement and settlement of the upstream fill (up to 0.5 m) may develop if the phreatic surface upstream of the till core is relatively shallow and the seismic loading is enough to trigger liquefaction in the tailings and upstream fill. This deformation mechanism was predicted in both analysed sections and only under the action of the subduction interface motion. The displacements associated with this deformation mechanism could potentially affect the serviceability of the upstream drain at elevation 970 m. The seismic loading from the crustal motion was not sufficient to trigger liquefaction in the tailings and upstream fill.

11.0 CLOSING

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

WSP Canada Inc.



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Lead Geotechnical Engineer



Germán Pizarro, P.Eng.
Principal Geotechnical Engineer

ATG/MS/GP/hp

Engineers & Geoscientists BC Permit #1000200

Attachments: Attachment 1 – Model Construction Sequence
Attachment 2 – Seismic Analyses Results

https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/005-tm-51346-numerical model report (tsf 974m stress-deformation analyses)/rev0/ca0020527.4505-005-tm-rev0-51346-numerical model report 21mar_24.docx

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ATTACHMENT 1

Model Construction Sequence

Main Embankment - Section 2+055

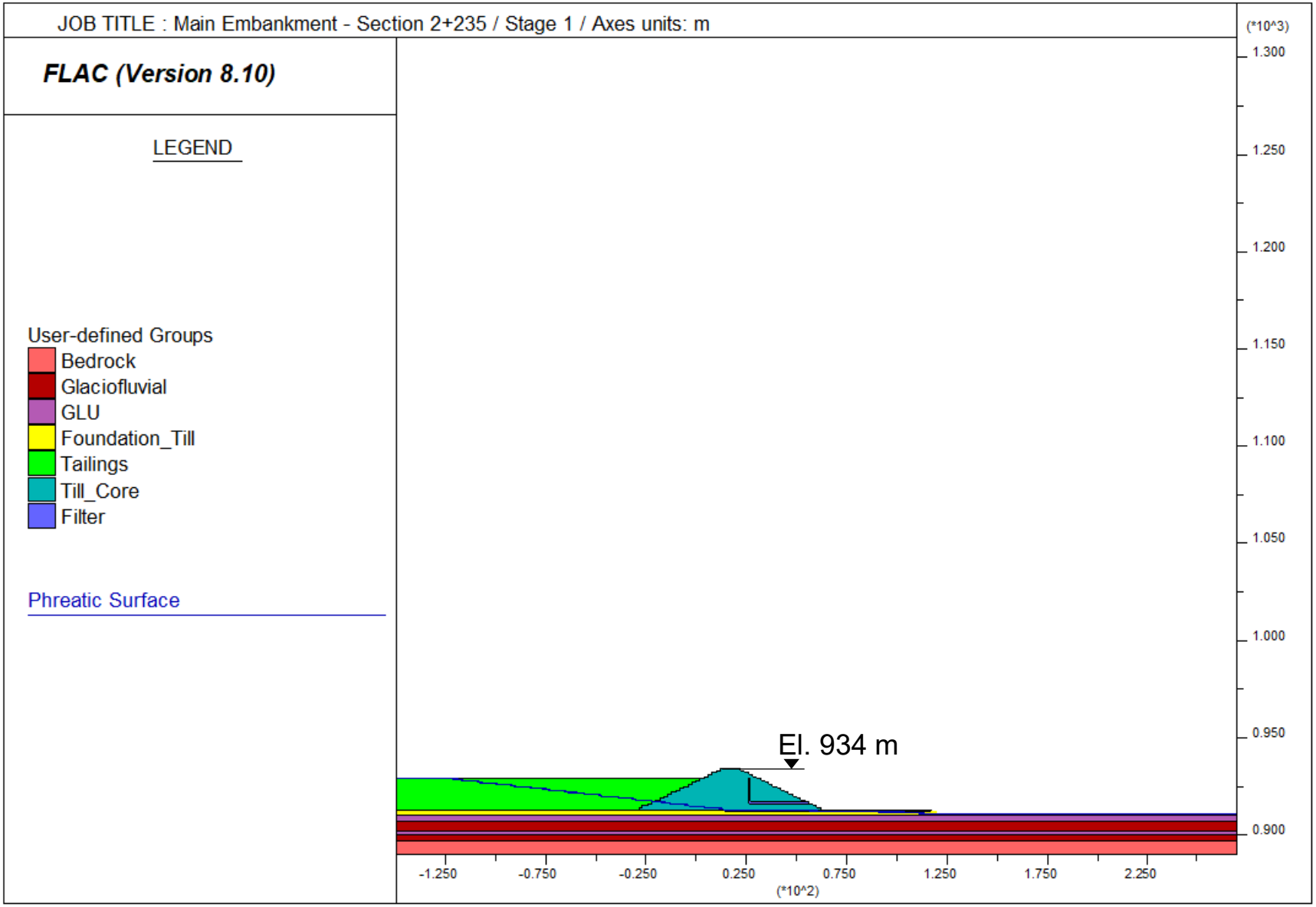
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Till_Core
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1.100
1.050
1.000
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(*10^2)

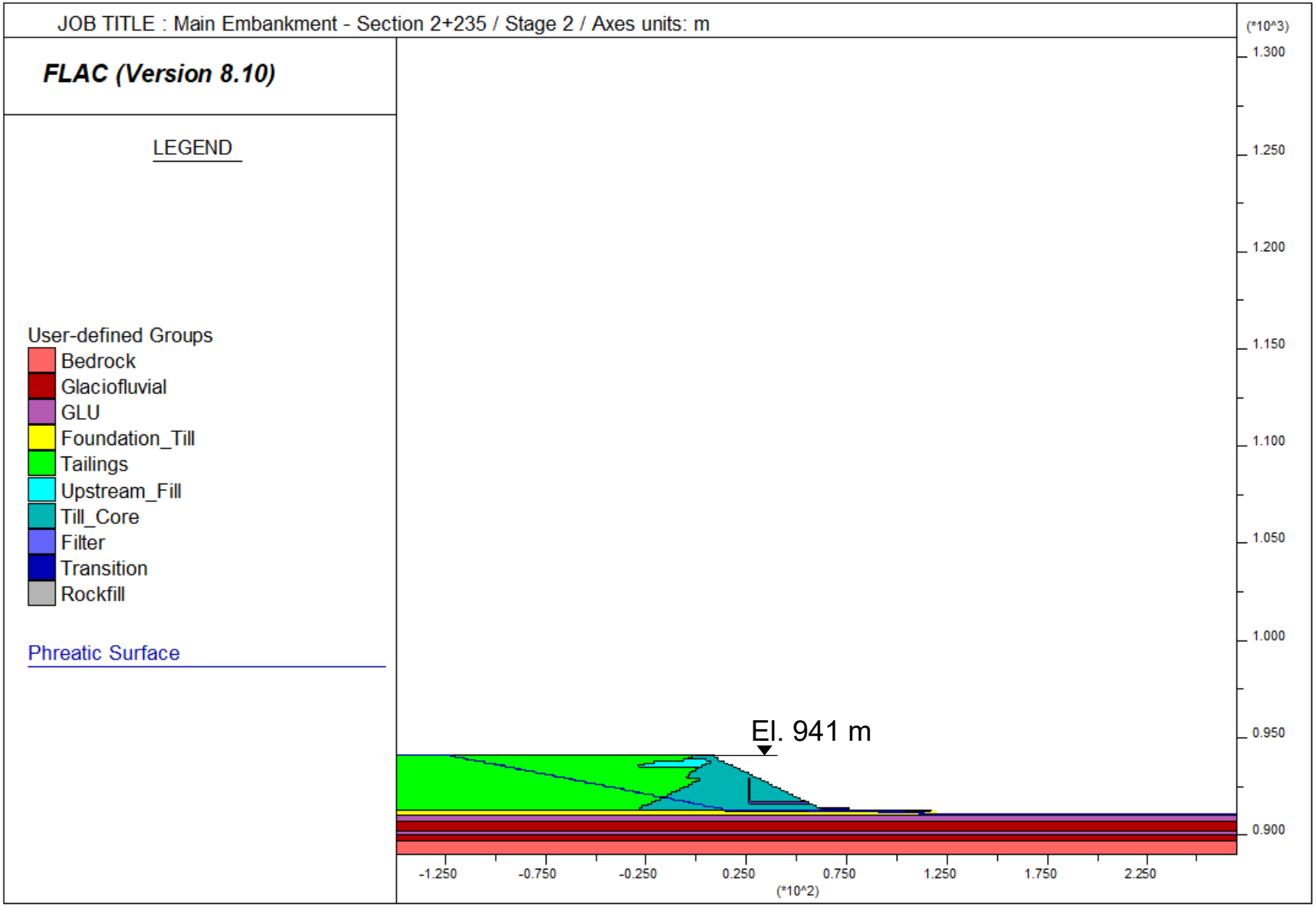
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Till_Core
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Transition
Rockfill
Phreatic Surface
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1.000
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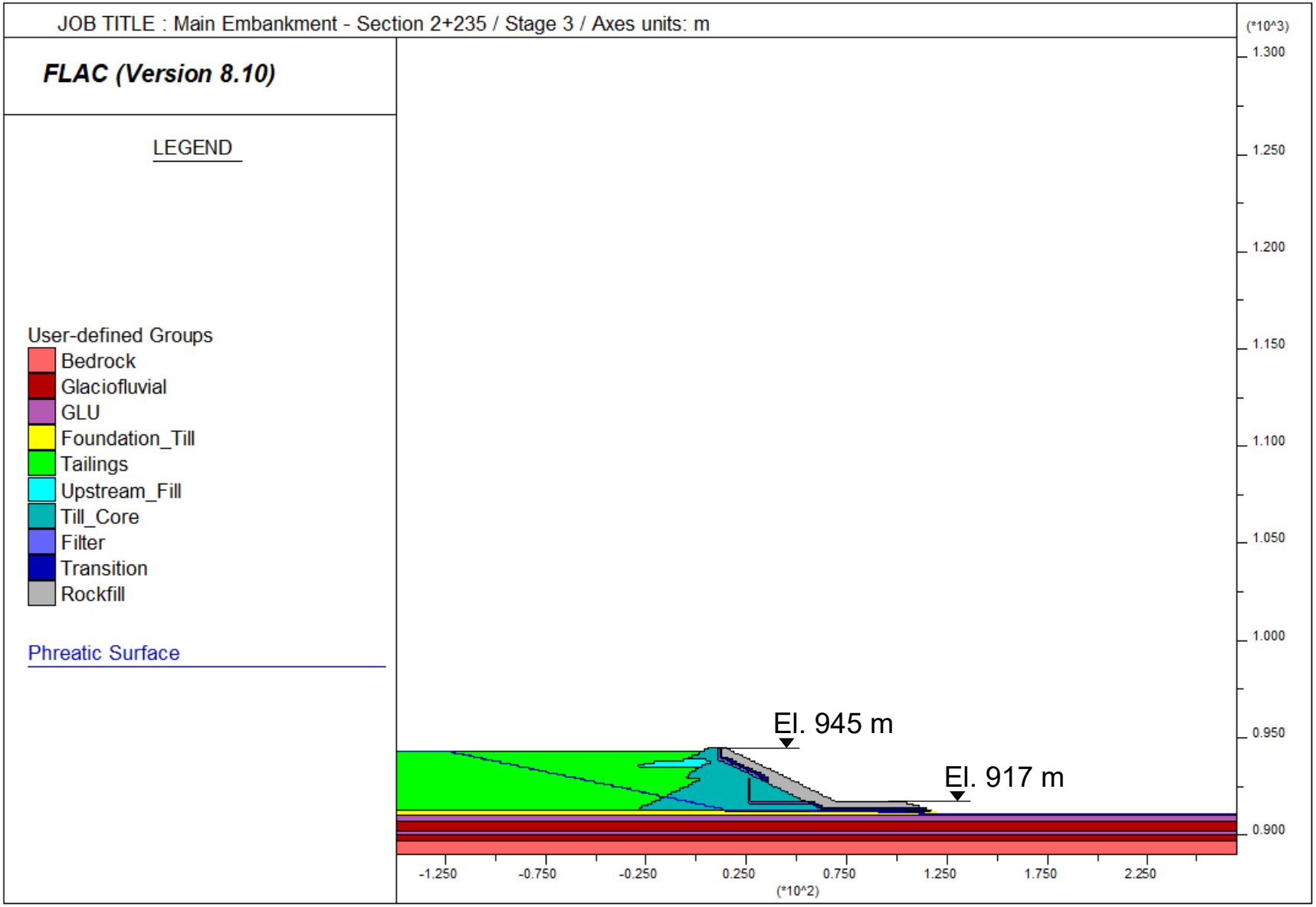
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GLU
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Transition
Rockfill
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1.050
1.000
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0.750
1.250
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(*10^2)

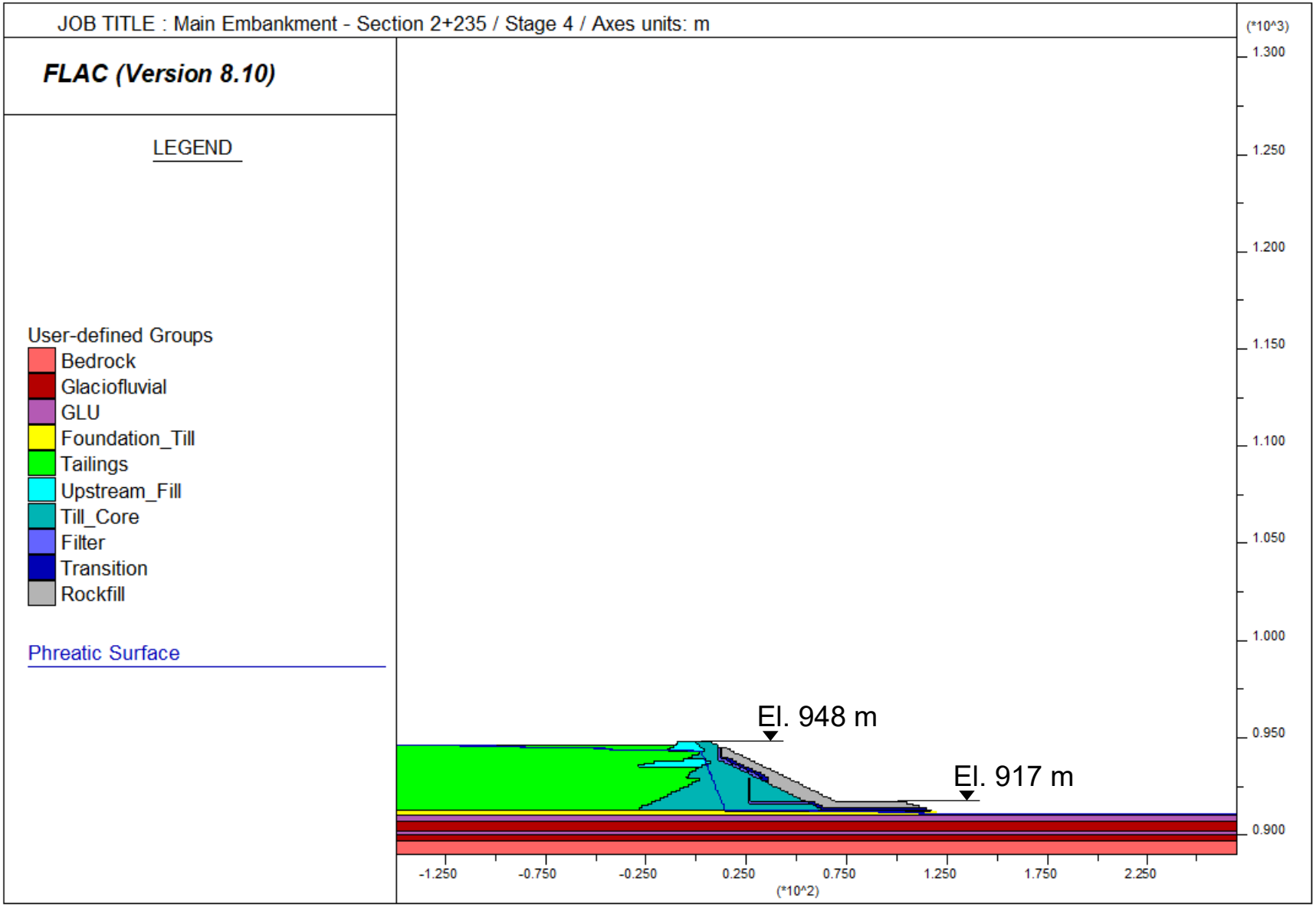
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El. 917 m
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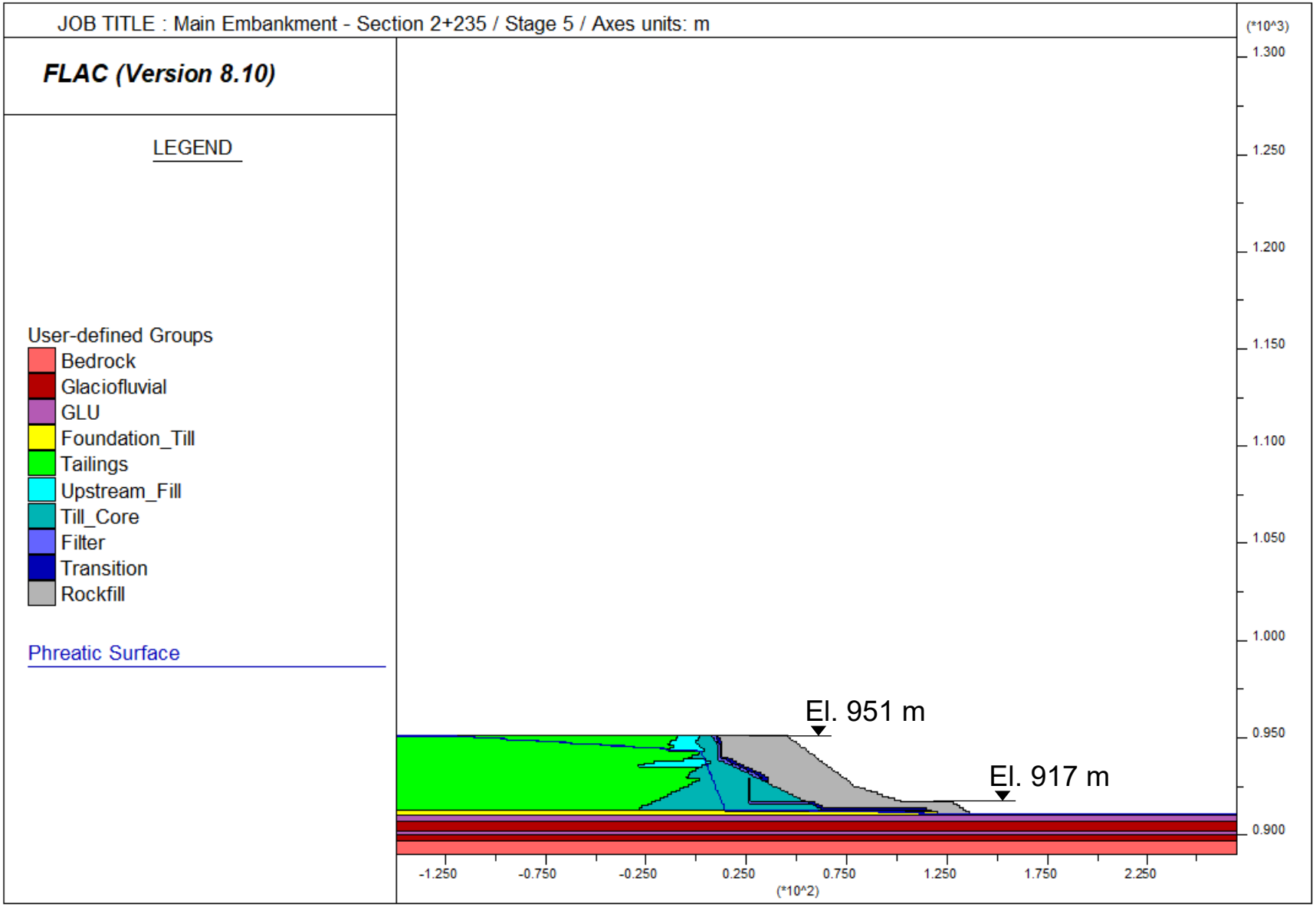
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Transition
Rockfill
Phreatic Surface
El. 951 m
El. 917 m
(*10^3)
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1.100
1.050
1.000
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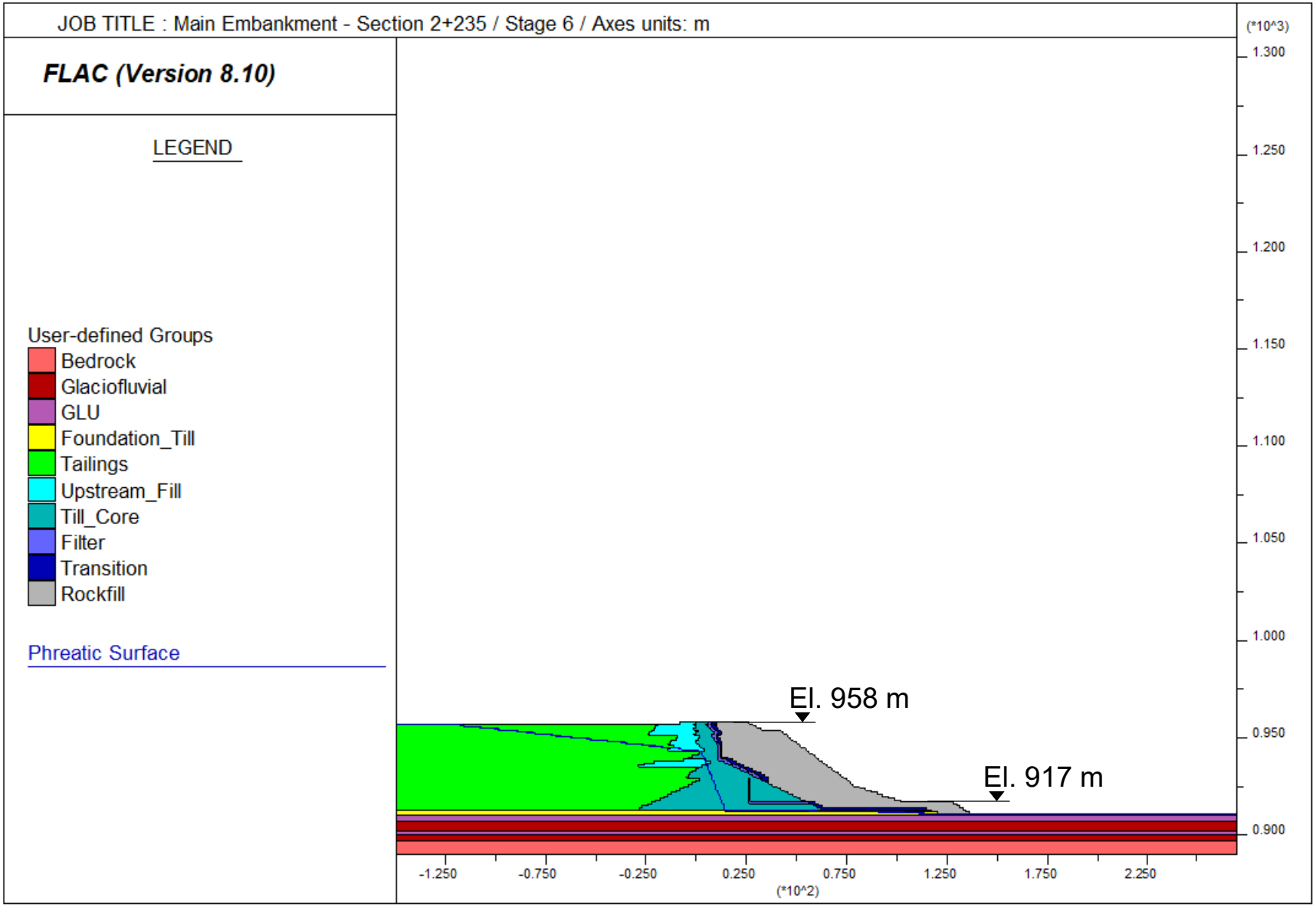
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GLU
Foundation_Till
Tailings
Upstream_Fill
Till_Core
Filter
Transition
Rockfill
Phreatic Surface
El. 958 m
El. 917 m
(*10^3)
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1.250
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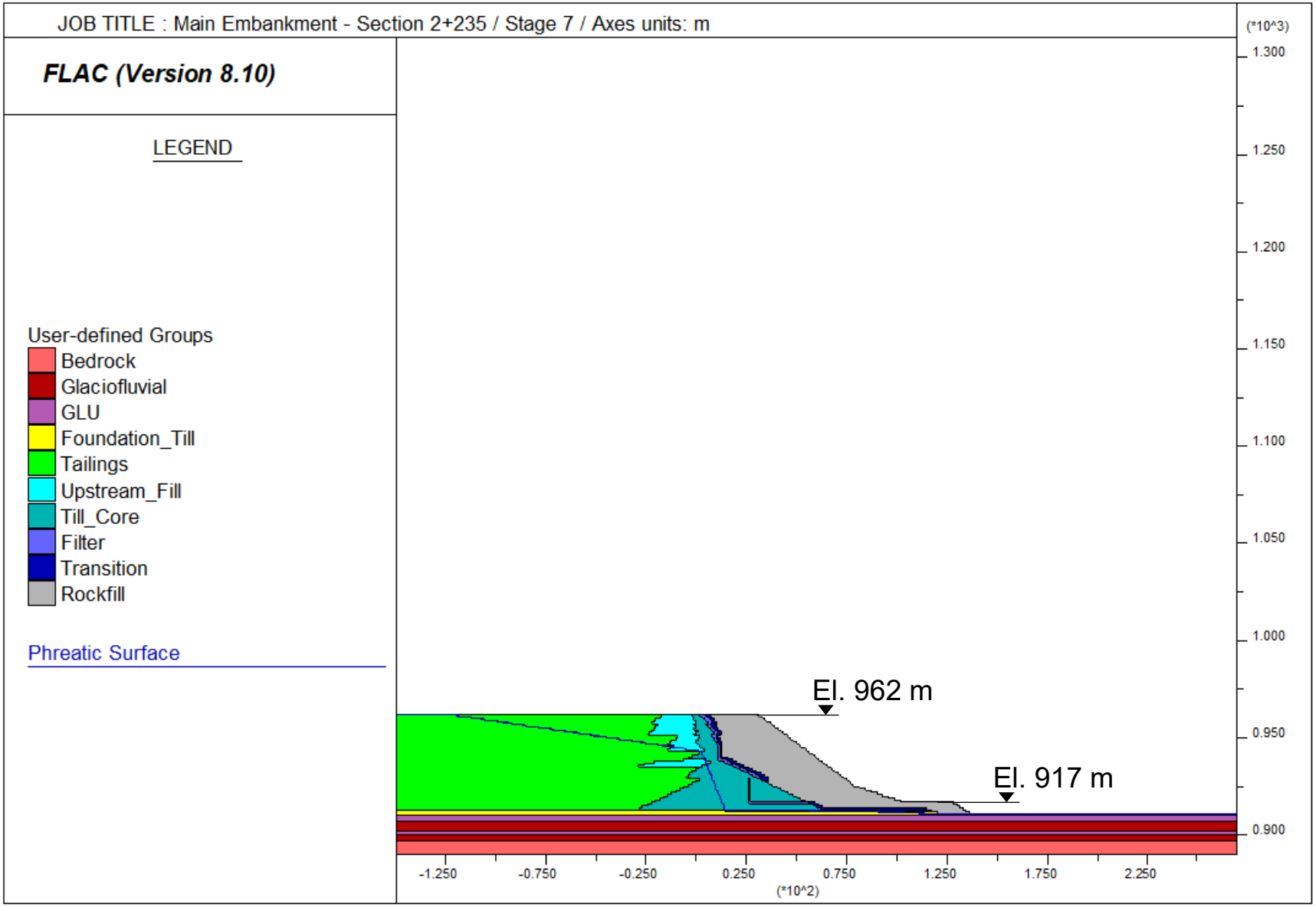
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Upstream_Fill
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Transition
Rockfill
Phreatic Surface
El. 962 m
El. 917 m
(*10^3)
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1.250
1.200
1.150
1.100
1.050
1.000
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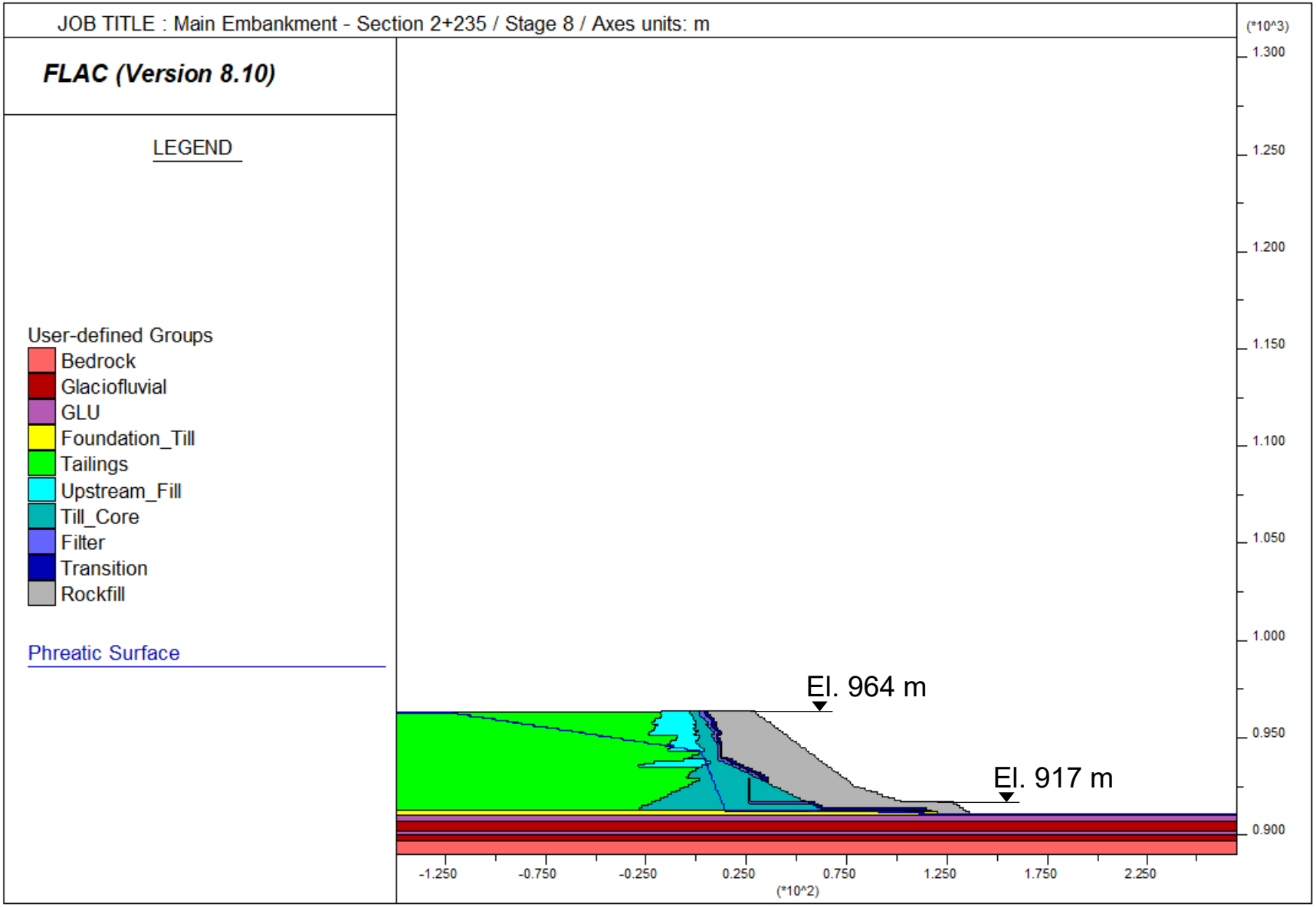
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GLU
Foundation_Till
Tailings
Upstream_Fill
Till_Core
Filter
Transition
Rockfill
Phreatic Surface
El. 964 m
El. 917 m
(*10^3)
1.300
1.250
1.200
1.150
1.100
1.050
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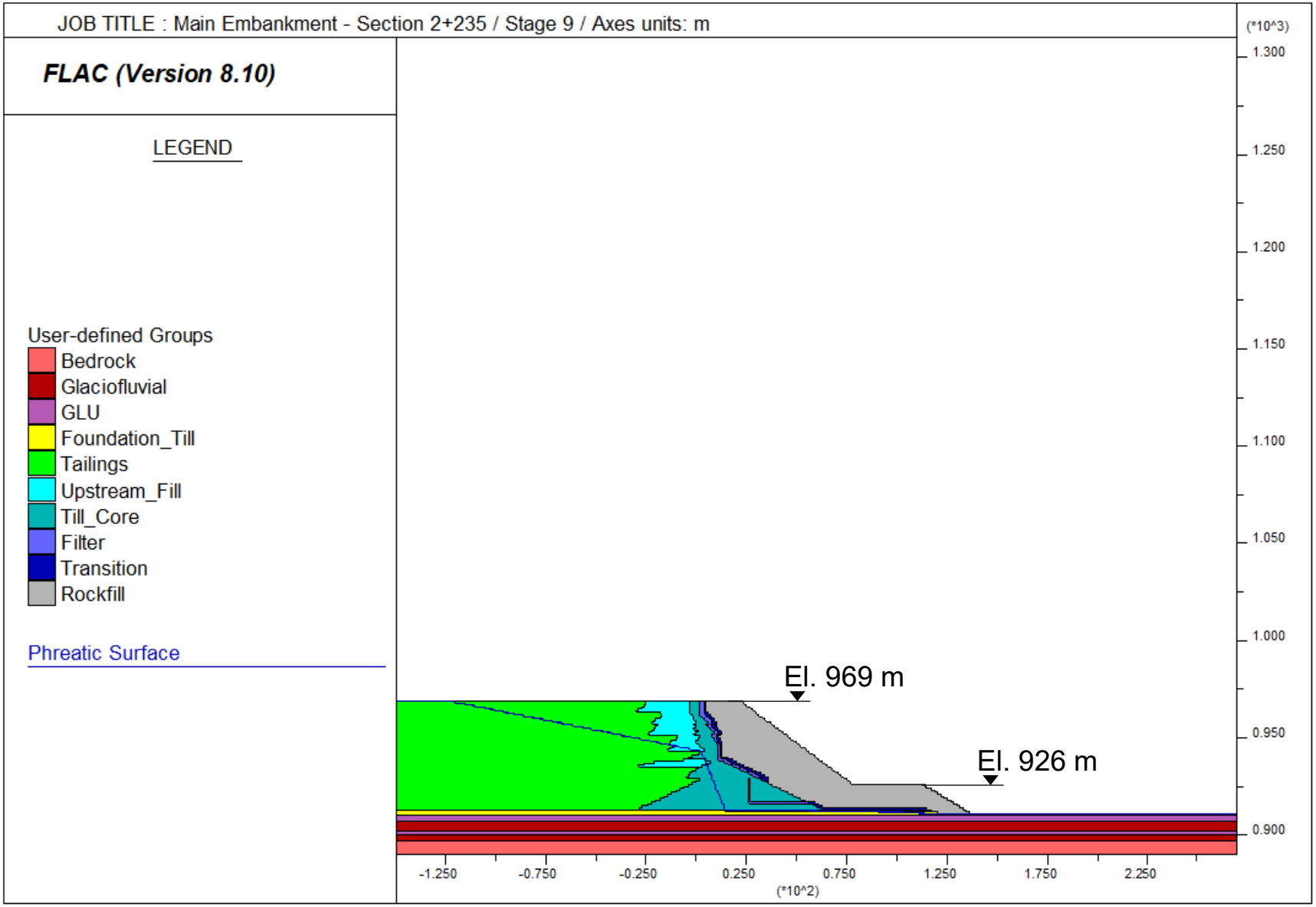
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GLU
Foundation_Till
Tailings
Upstream_Fill
Till_Core
Filter
Transition
Rockfill
Phreatic Surface
El. 969 m
El. 926 m
(*10^3)
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1.250
1.200
1.150
1.100
1.050
1.000
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1.250
1.750
2.250
(*10^2)

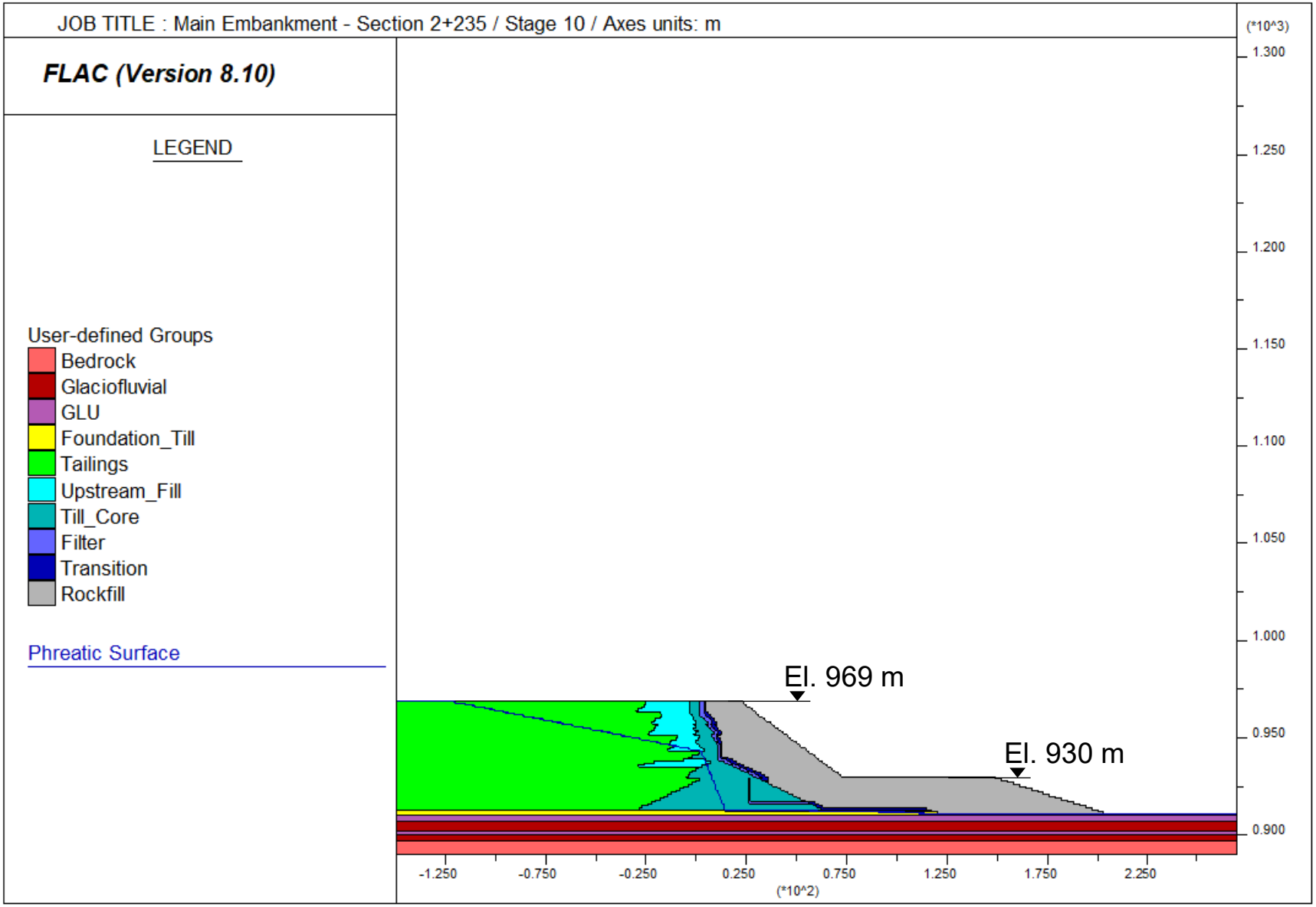
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Glaciofluvial
GLU
Foundation_Till
Tailings
Upstream_Fill
Till_Core
Filter
Transition
Rockfill
Phreatic Surface
El. 969 m
El. 930 m
(*10^3)
1.300
1.250
1.200
1.150
1.100
1.050
1.000
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-0.250
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1.250
1.750
2.250
(*10^2)

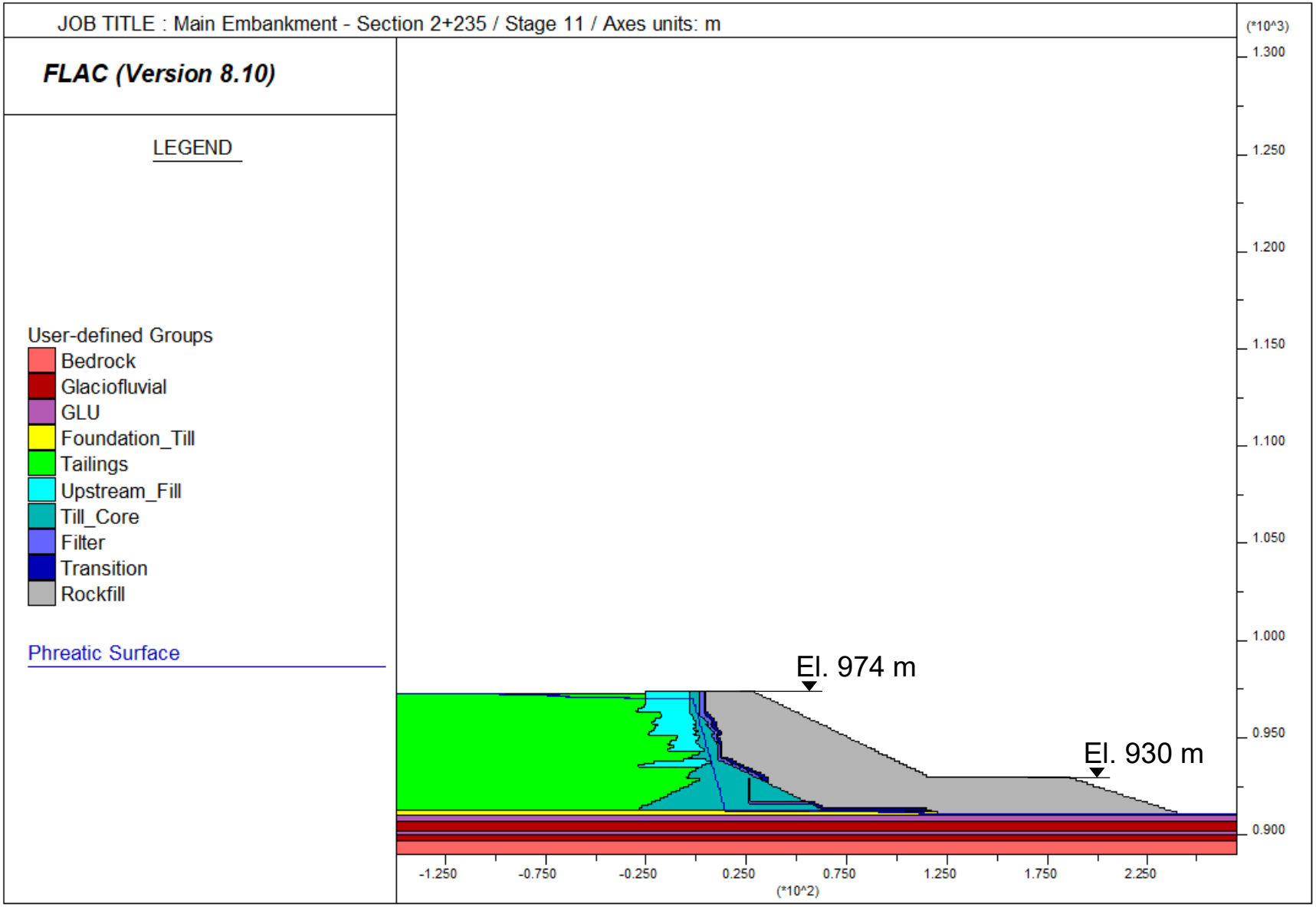
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Glaciofluvial
GLU
Foundation_Till
Tailings
Upstream_Fill
Till_Core
Filter
Transition
Rockfill
Phreatic Surface
El. 974 m
El. 930 m
(*10^3)
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
(*10^2)

Perimeter Embankment at Corner 1 - Section 4+175

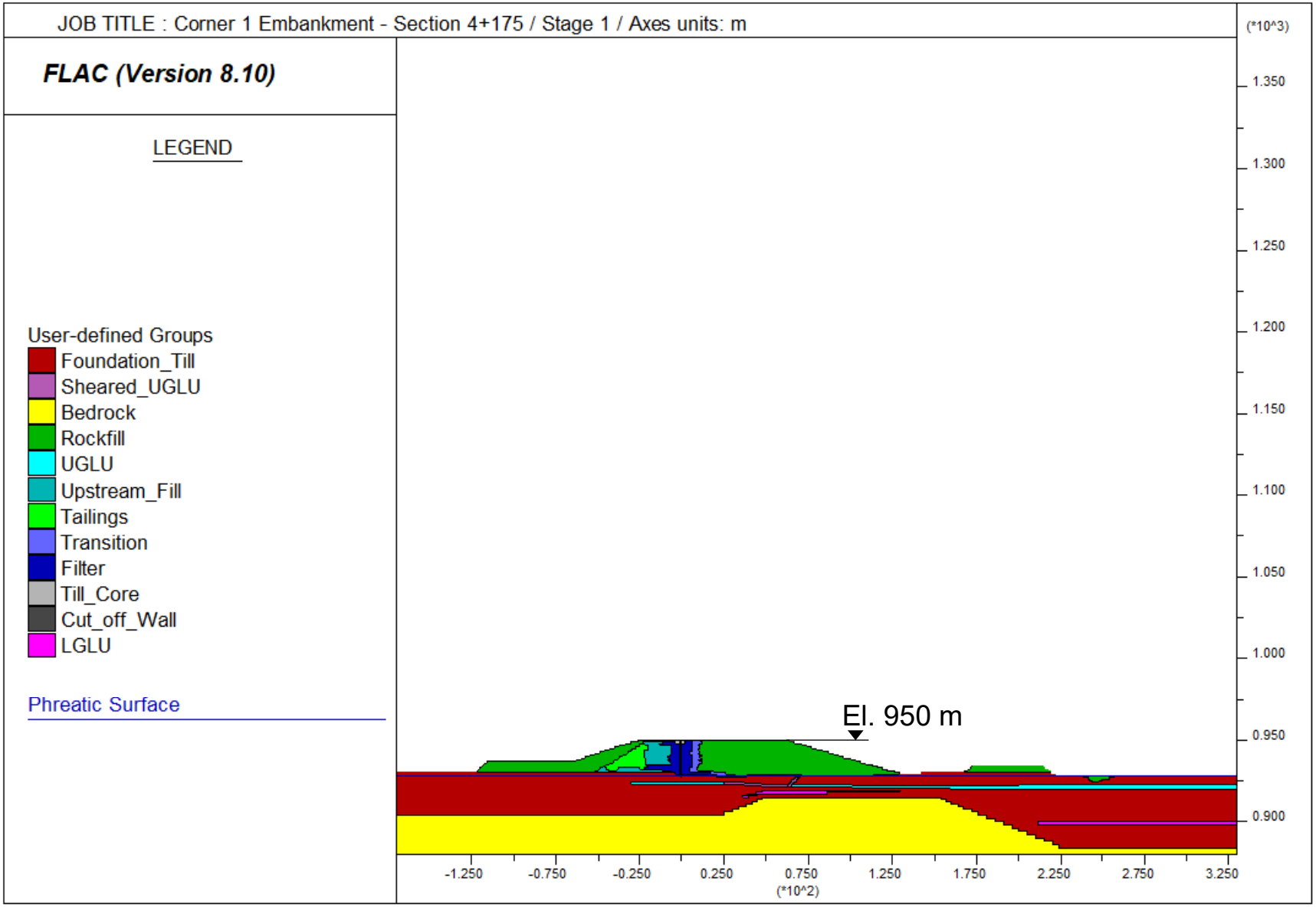
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 1 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Rockfill
UGLU
Upstream_Fill
Tailings
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 950 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

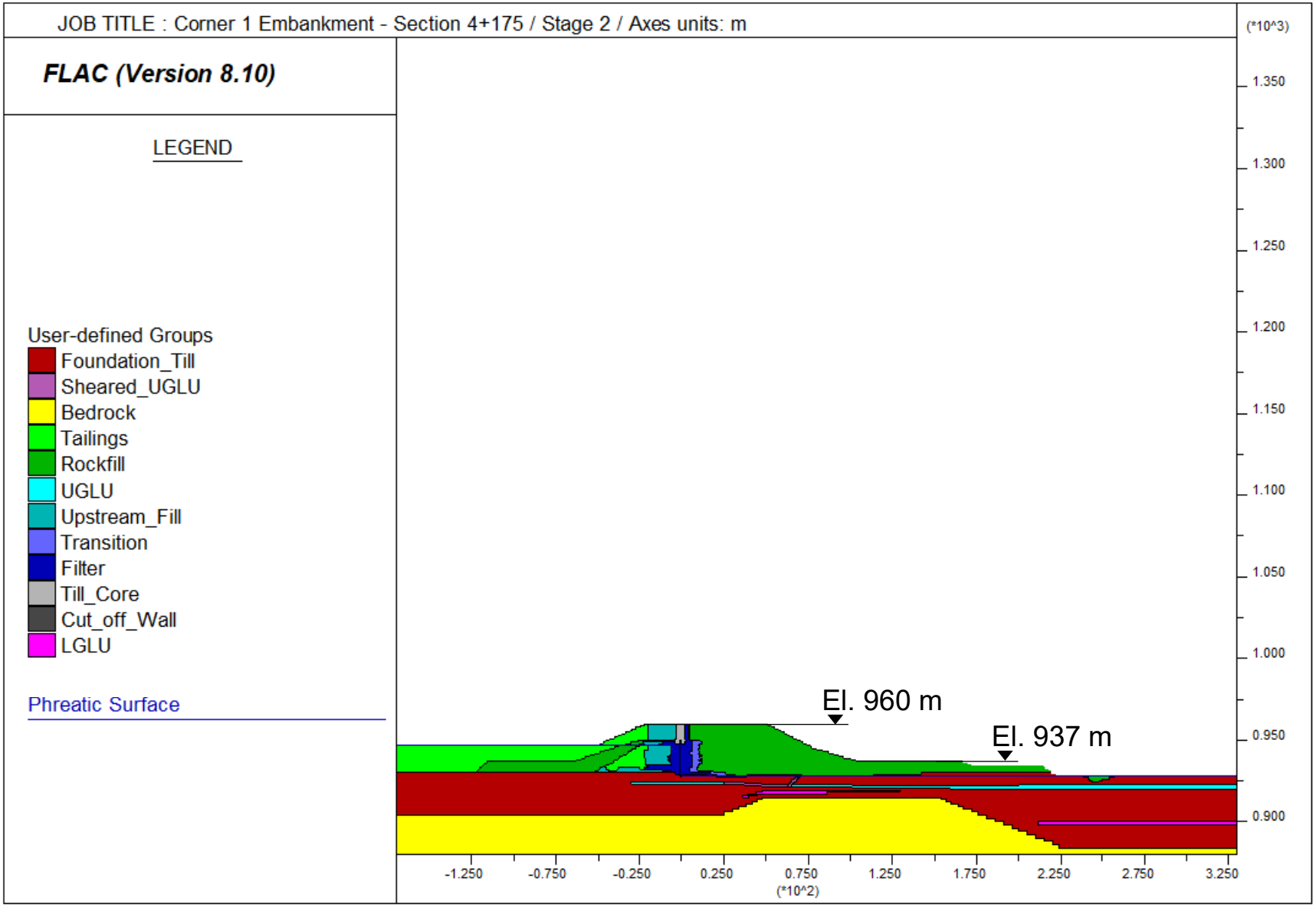
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 2 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 960 m
El. 937 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

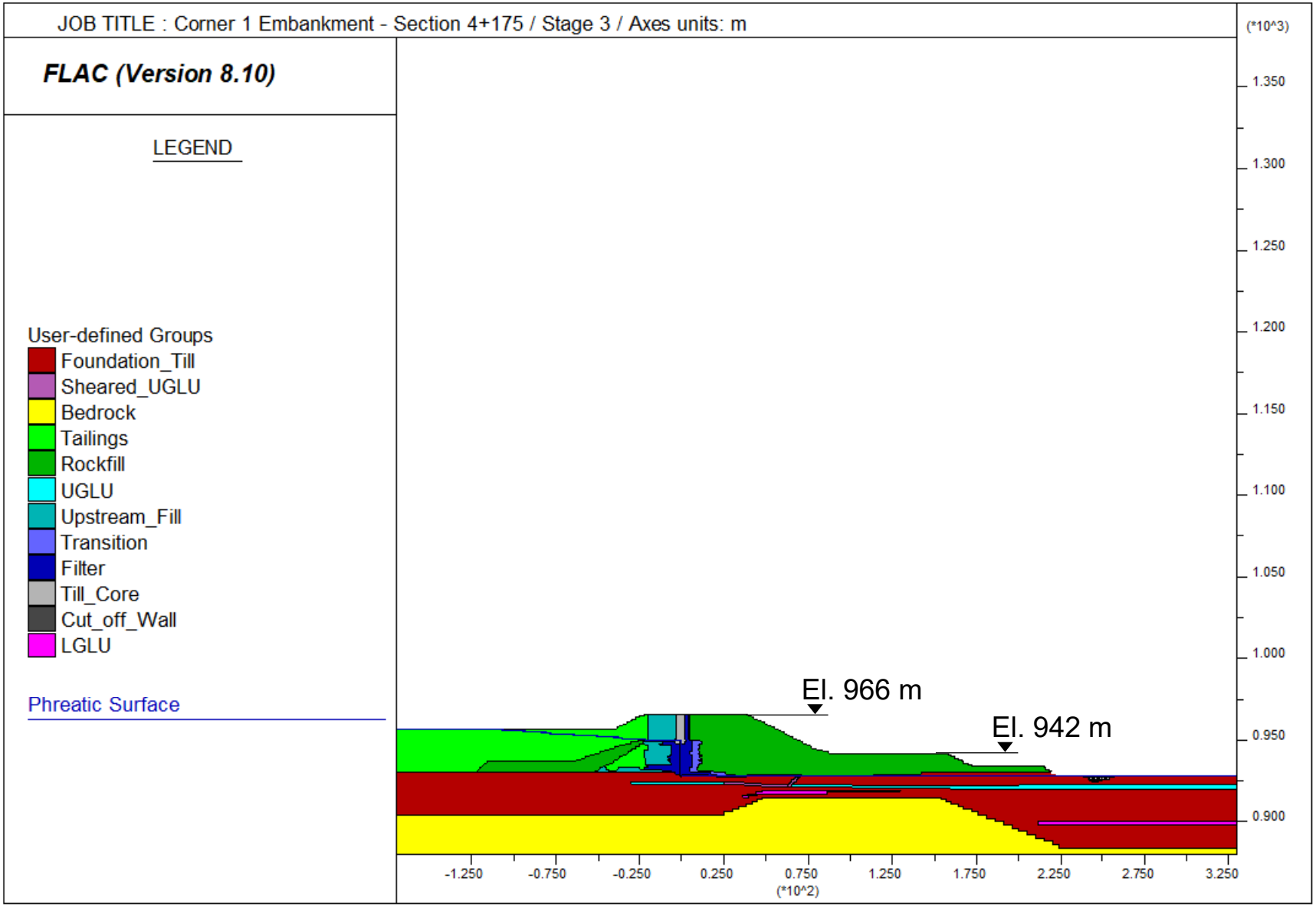
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 3 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 966 m
El. 942 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

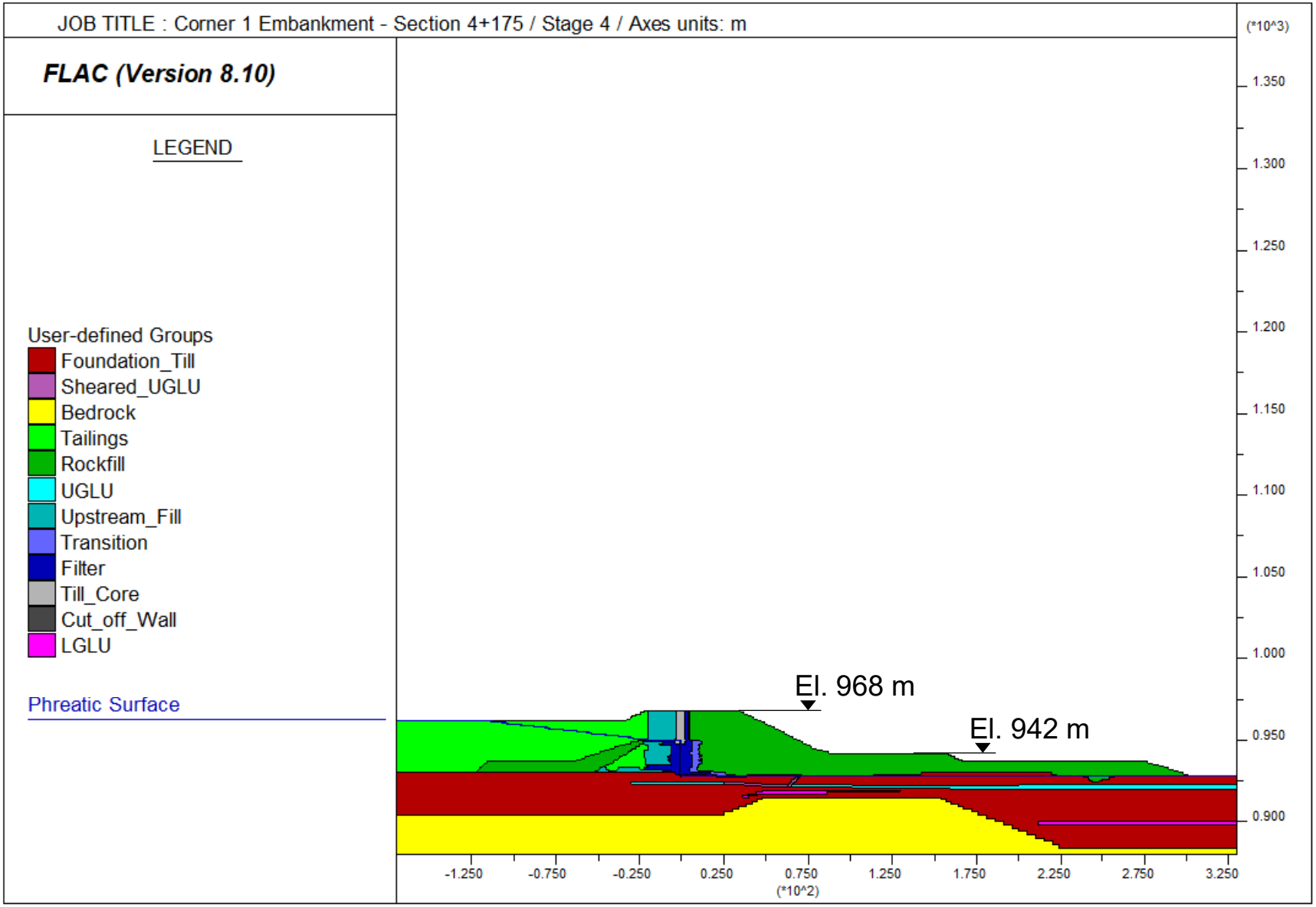
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 4 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 968 m
El. 942 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

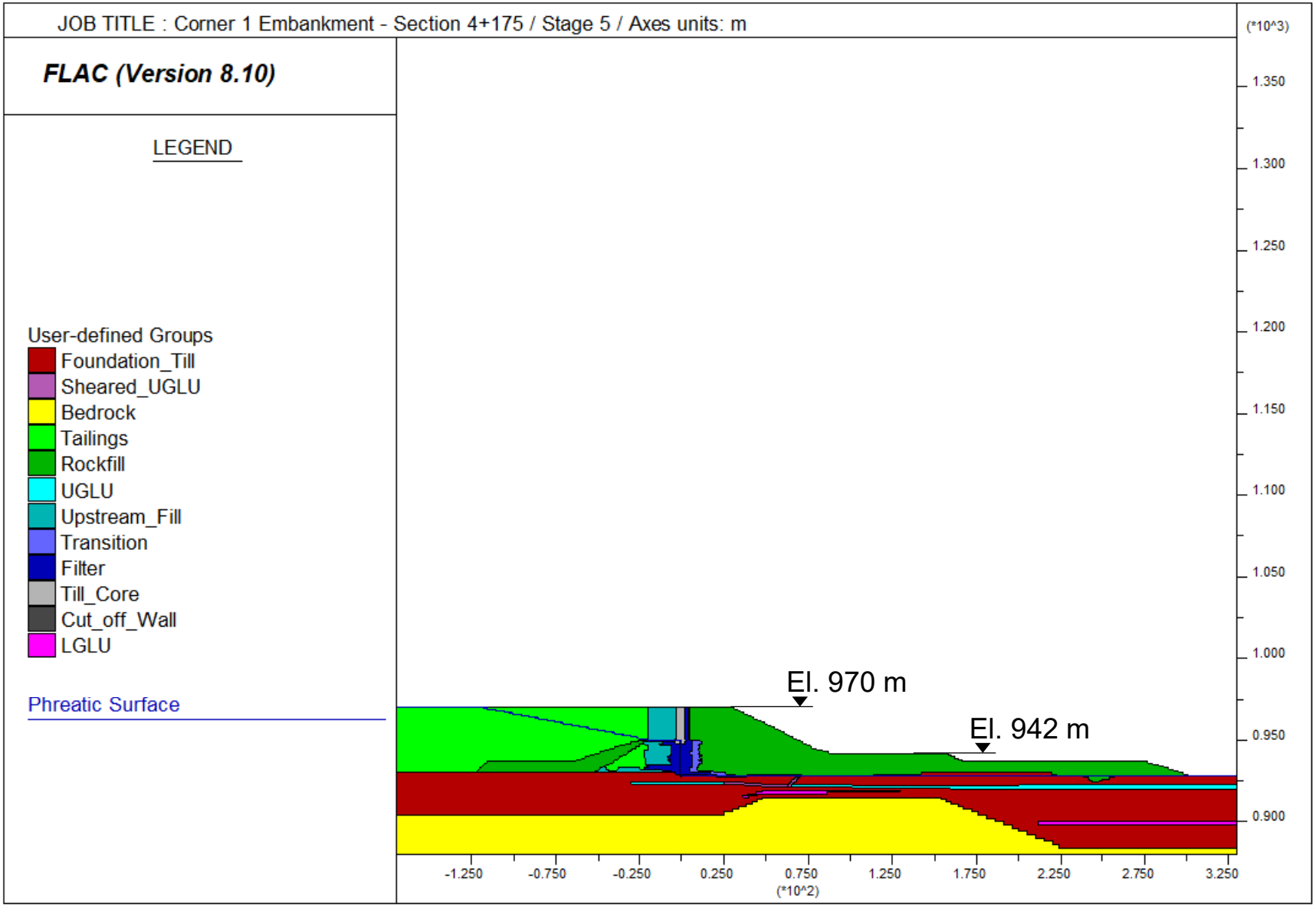
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 5 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 970 m
El. 942 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

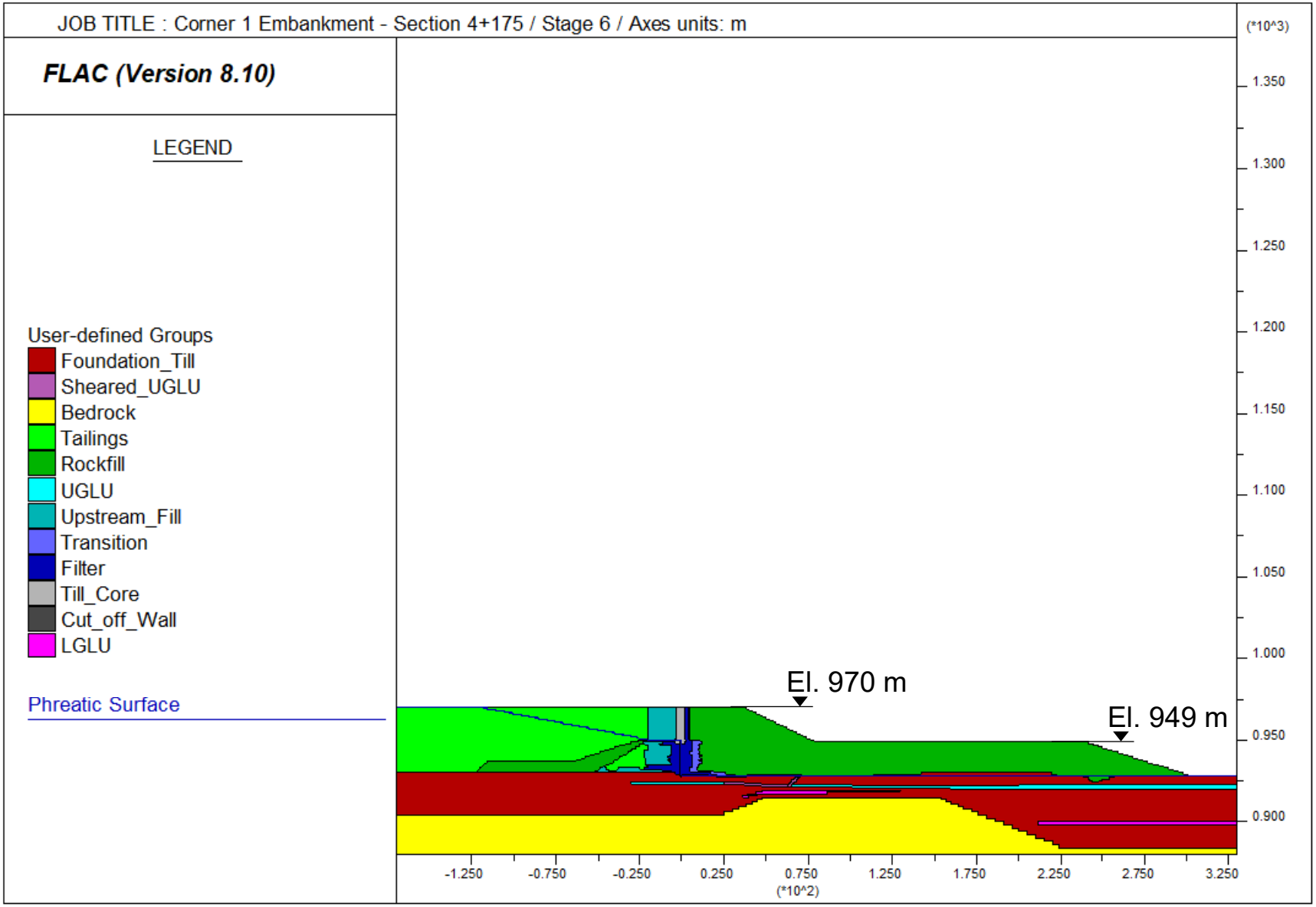
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 6 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 970 m
El. 949 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

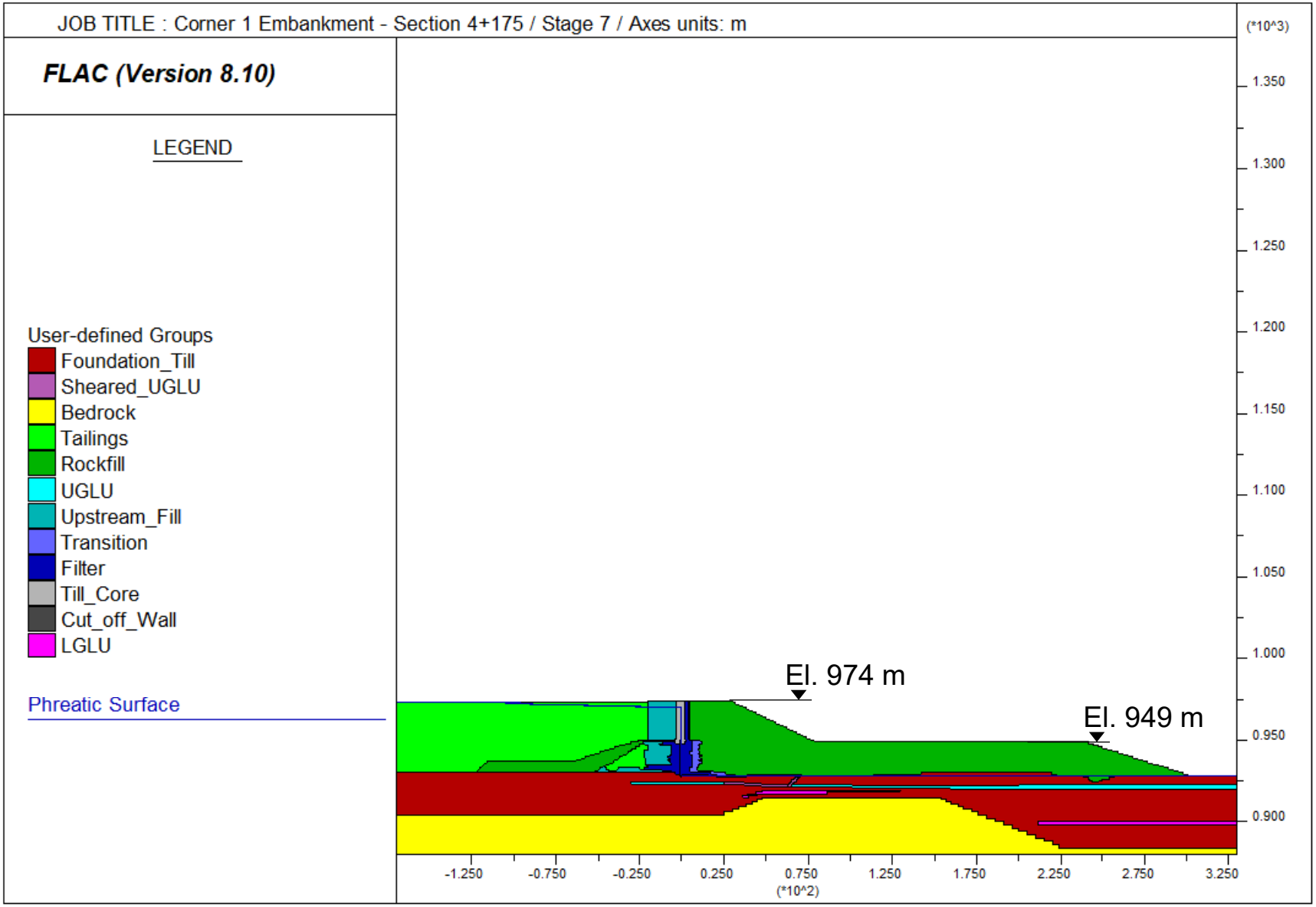
JOB TITLE : Corner 1 Embankment - Section 4+175 / Stage 7 / Axes units: m
FLAC (Version 8.10)
LEGEND
User-defined Groups
Foundation_Till
Sheared_UGLU
Bedrock
Tailings
Rockfill
UGLU
Upstream_Fill
Transition
Filter
Till_Core
Cut_off_Wall
LGLU
Phreatic Surface
El. 974 m
El. 949 m
(*10^3)
1.350
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-1.250
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
3.250
(*10^2)

ATTACHMENT 2

Seismic Analyses Results

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Perimeter Embankment at Corner 1 – Section 4+175	
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• Reverse Polarity (RP)	41

1. Embankment – Section:
   - Main Embankment
   - Perimeter Embankment at Corner 1
2. Record Sequence Number:
   - RSN4478N, Crustal Motion
   - RSN4000183EW, Subduction interface motion
3. Component earthquake motion:
   - North (N)
   - East/West (EW)
4. Polarity:
   - Direct Polarity (DP)
   - Reverse Polarity (RP)
5. Axes units: metres

Example:

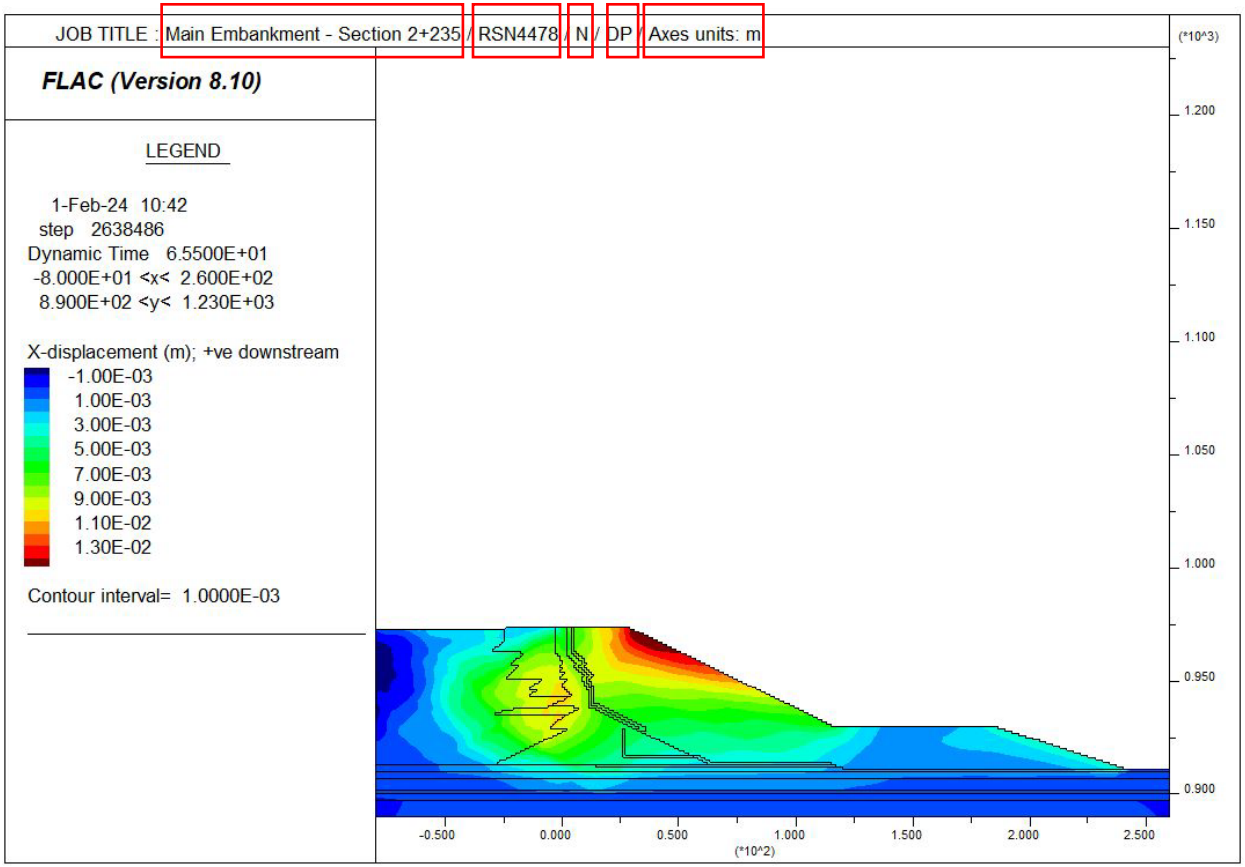

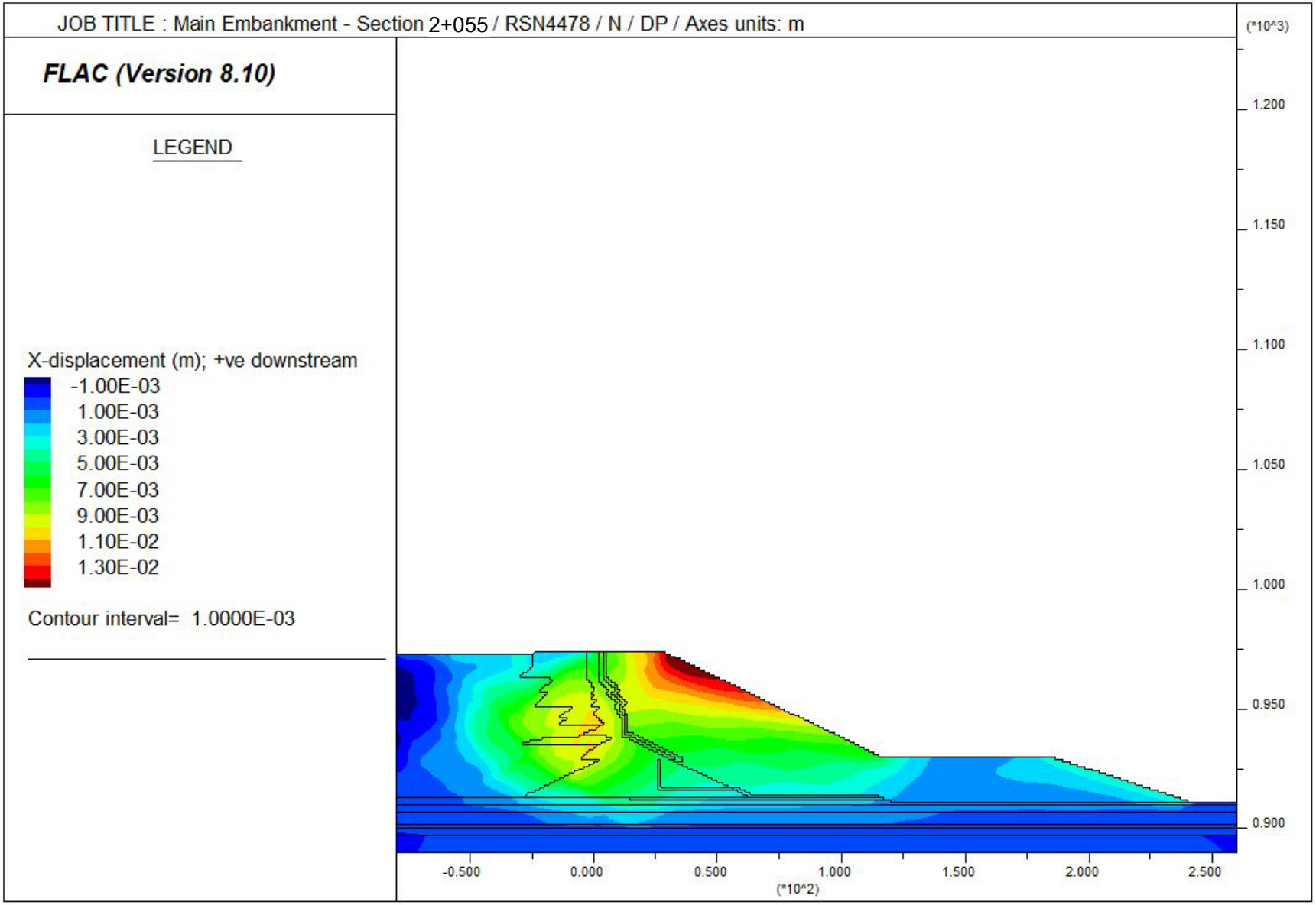
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-1.00E-03
1.00E-03
3.00E-03
5.00E-03
7.00E-03
9.00E-03
1.10E-02
1.30E-02
Contour interval= 1.0000E-03
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

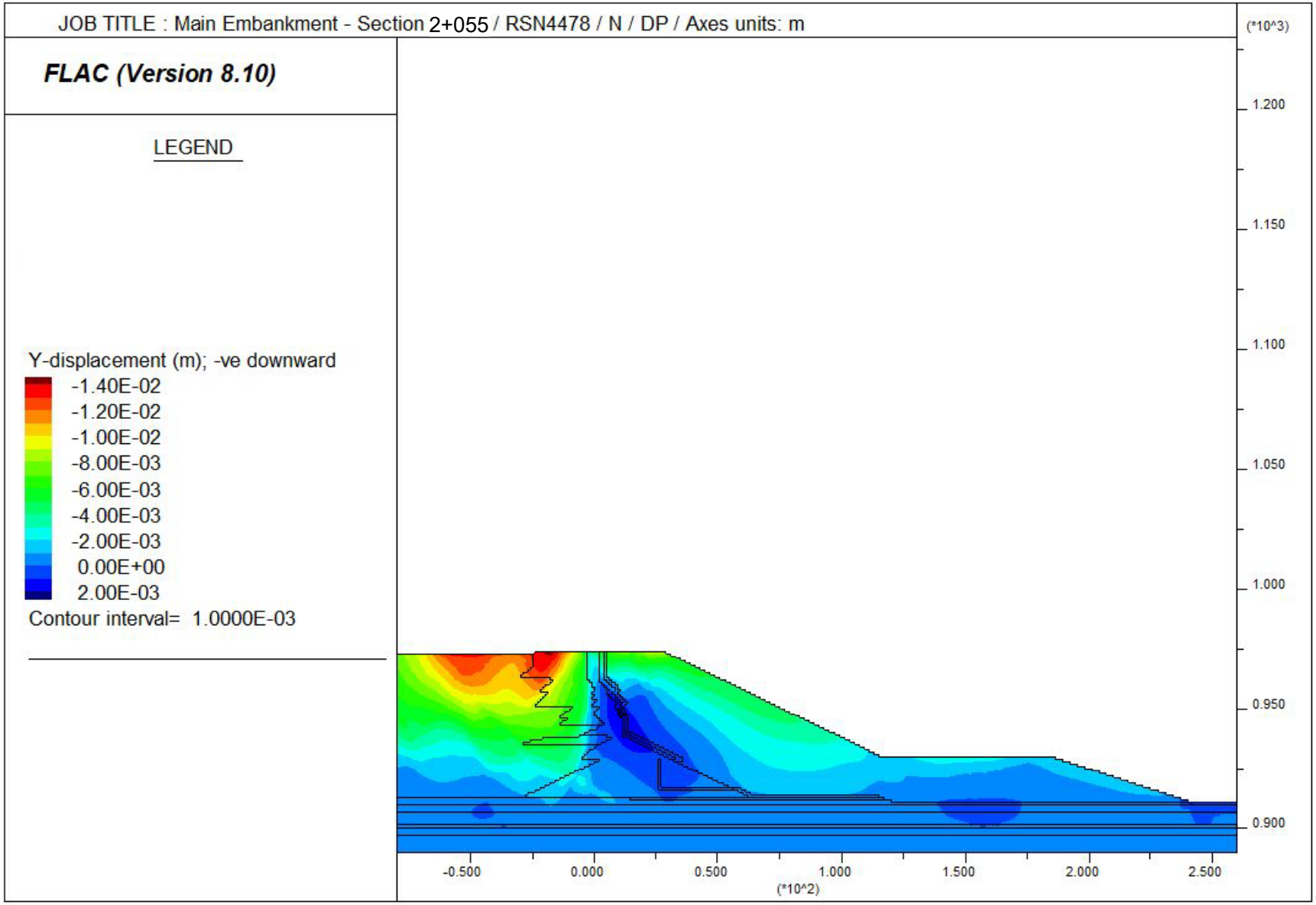
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-1.40E-02
-1.20E-02
-1.00E-02
-8.00E-03
-6.00E-03
-4.00E-03
-2.00E-03
0.00E+00
2.00E-03
Contour interval= 1.0000E-03
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

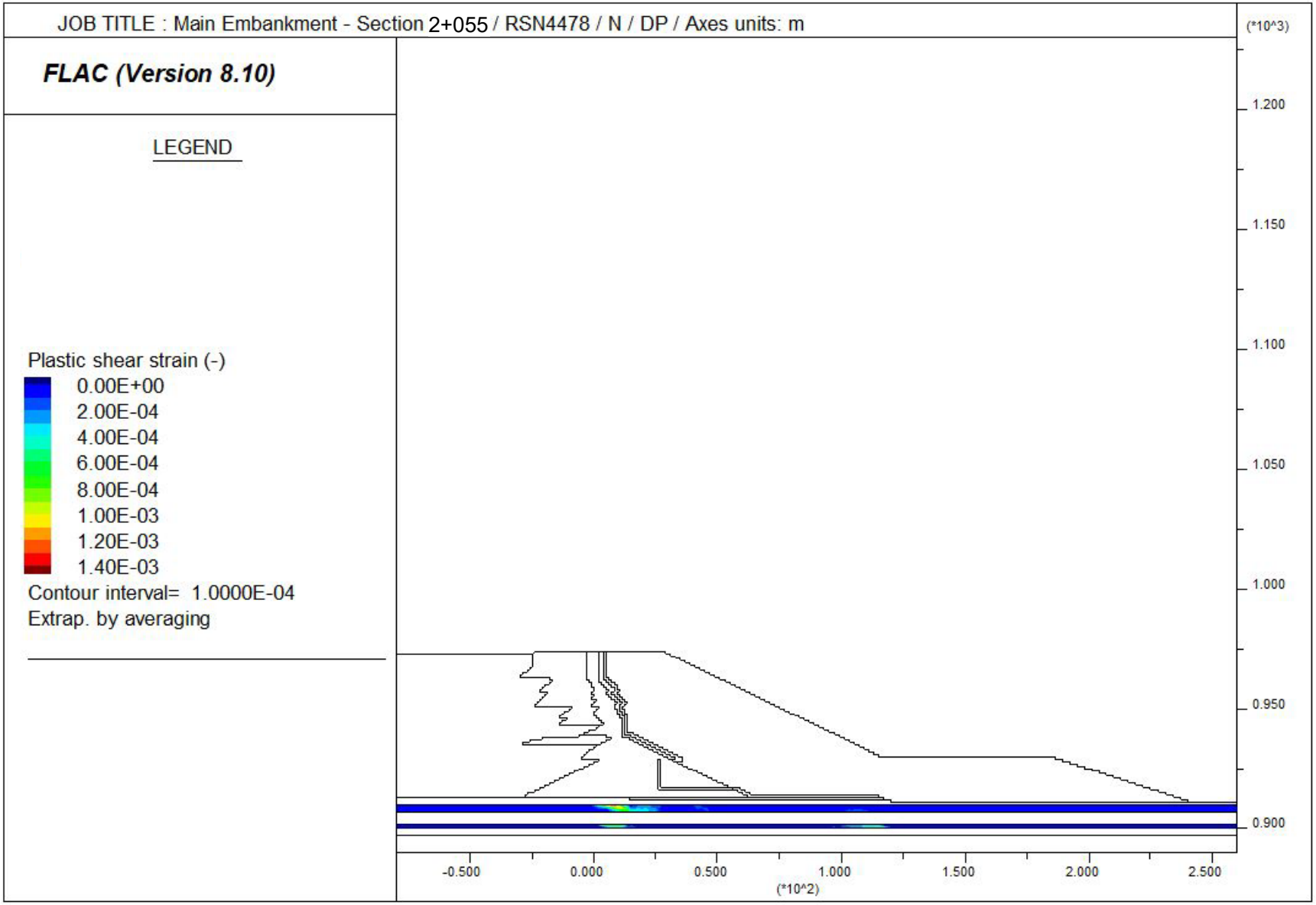
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
2.00E-04
4.00E-04
6.00E-04
8.00E-04
1.00E-03
1.20E-03
1.40E-03
Contour interval= 1.0000E-04
Extrap. by averaging
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

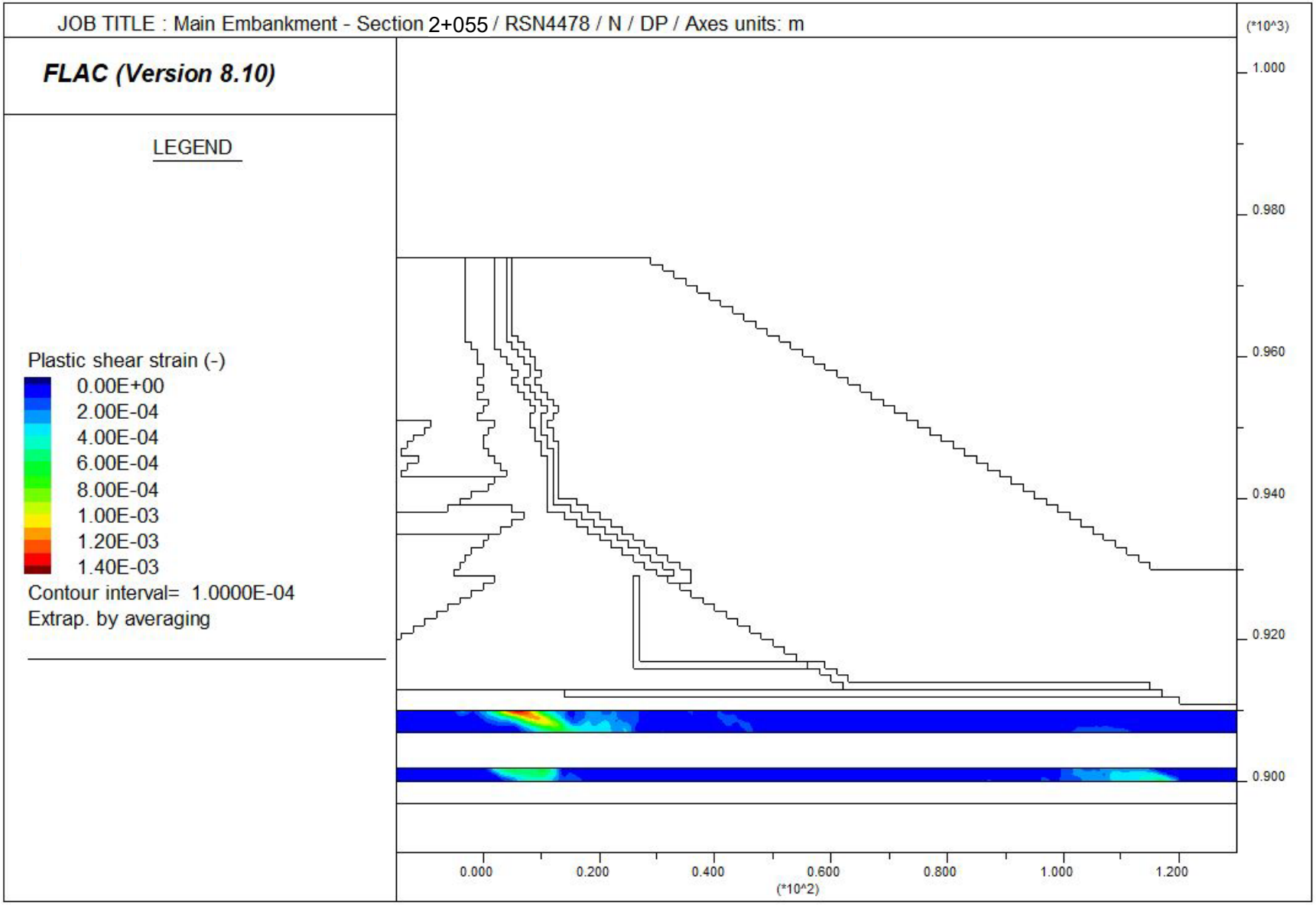
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
2.00E-04
4.00E-04
6.00E-04
8.00E-04
1.00E-03
1.20E-03
1.40E-03
Contour interval= 1.0000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

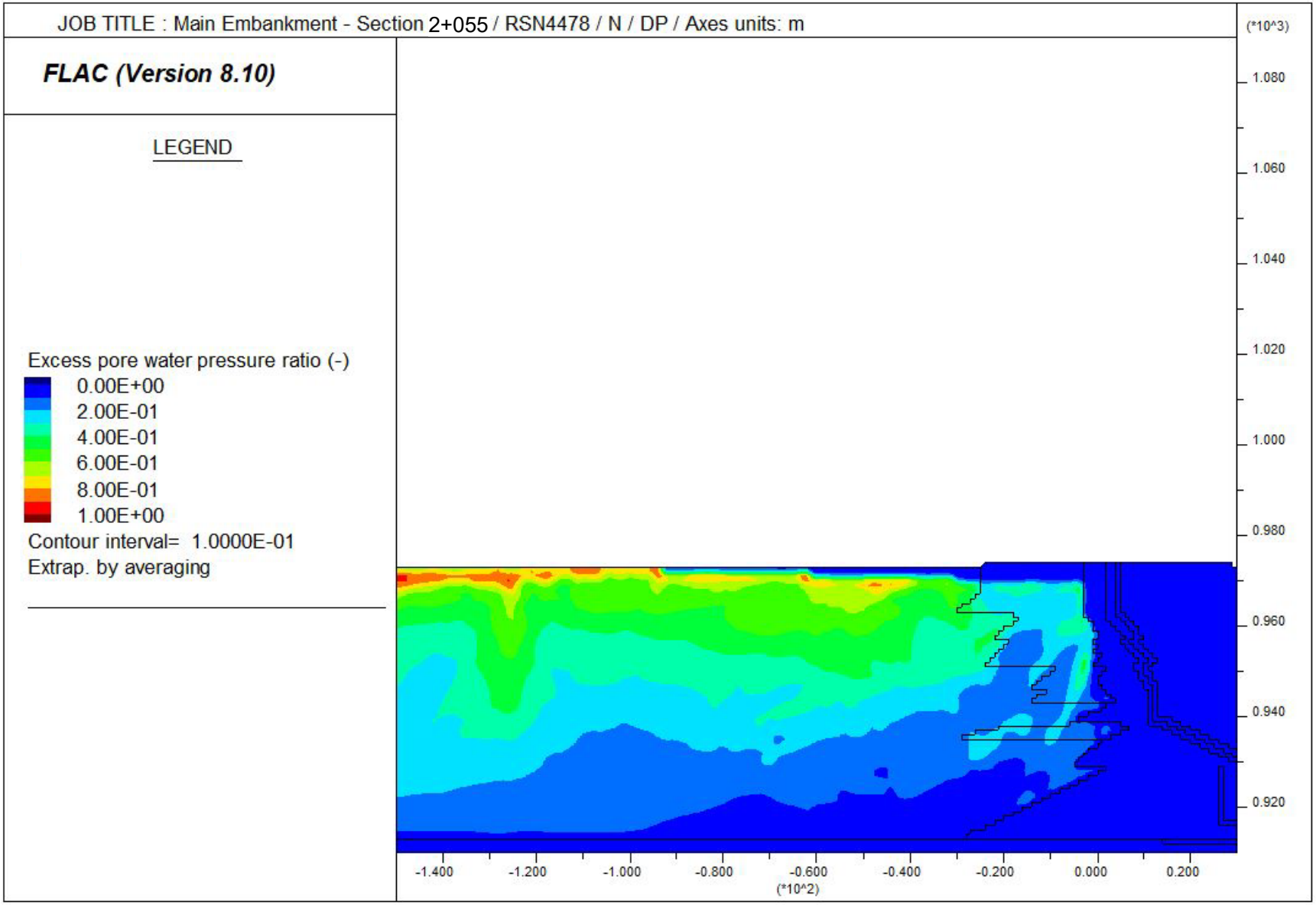
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.080
1.060
1.040
1.020
1.000
0.980
0.960
0.940
0.920
-1.400
-1.200
-1.000
-0.800
-0.600
-0.400
-0.200
0.000
0.200
(*10^2)

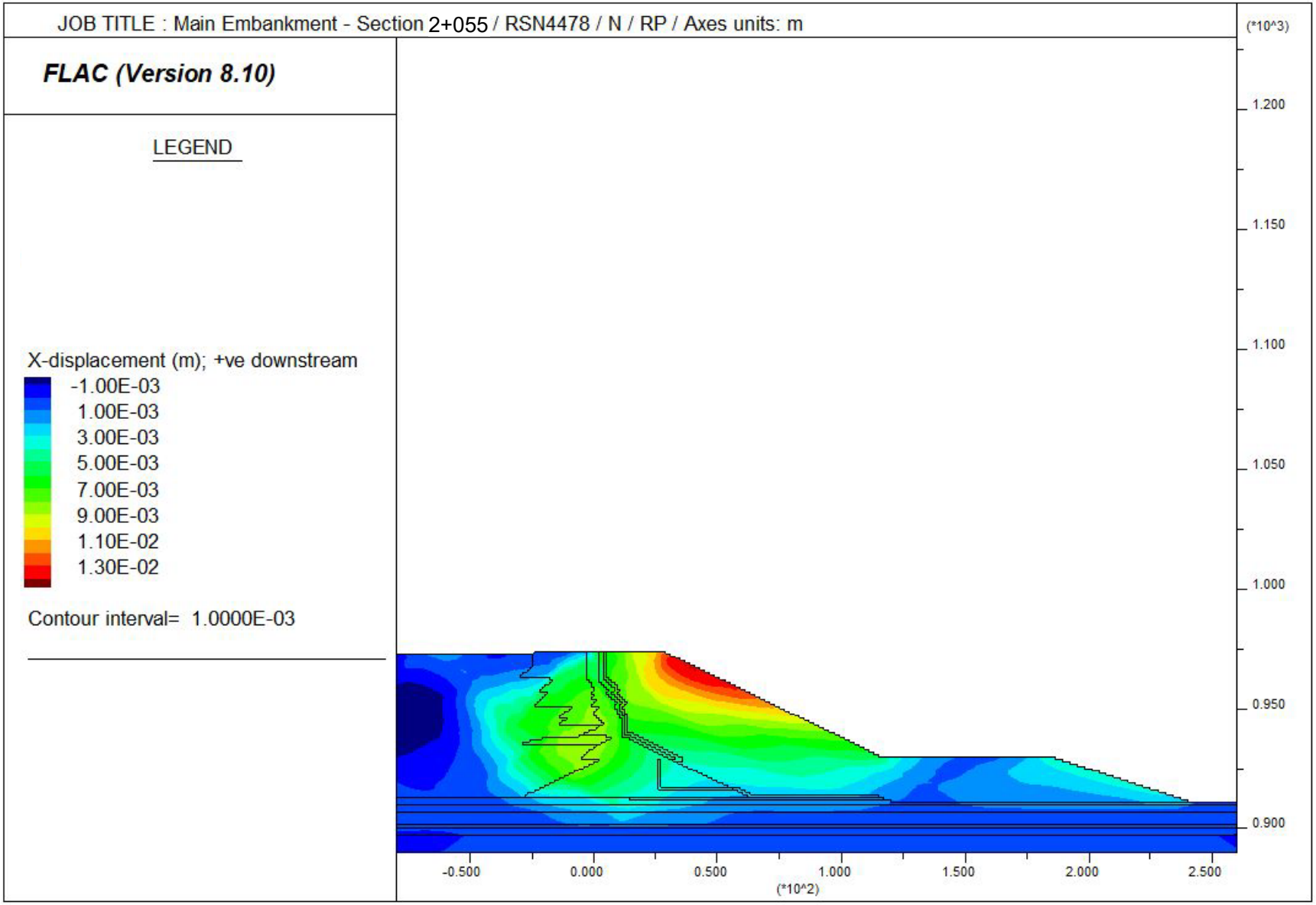
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-1.00E-03
1.00E-03
3.00E-03
5.00E-03
7.00E-03
9.00E-03
1.10E-02
1.30E-02
Contour interval= 1.0000E-03
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

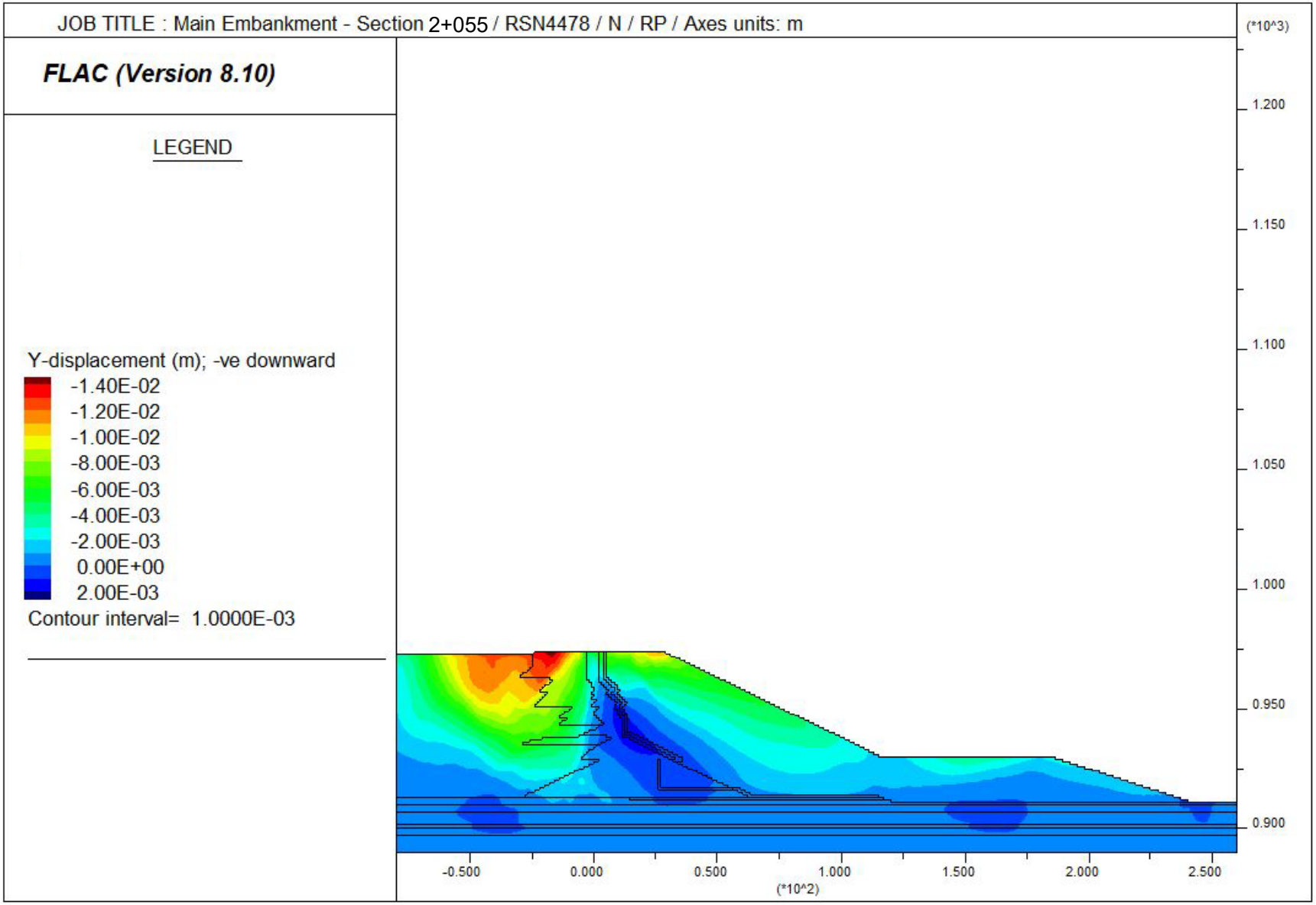
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-1.40E-02
-1.20E-02
-1.00E-02
-8.00E-03
-6.00E-03
-4.00E-03
-2.00E-03
0.00E+00
2.00E-03
Contour interval= 1.0000E-03
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

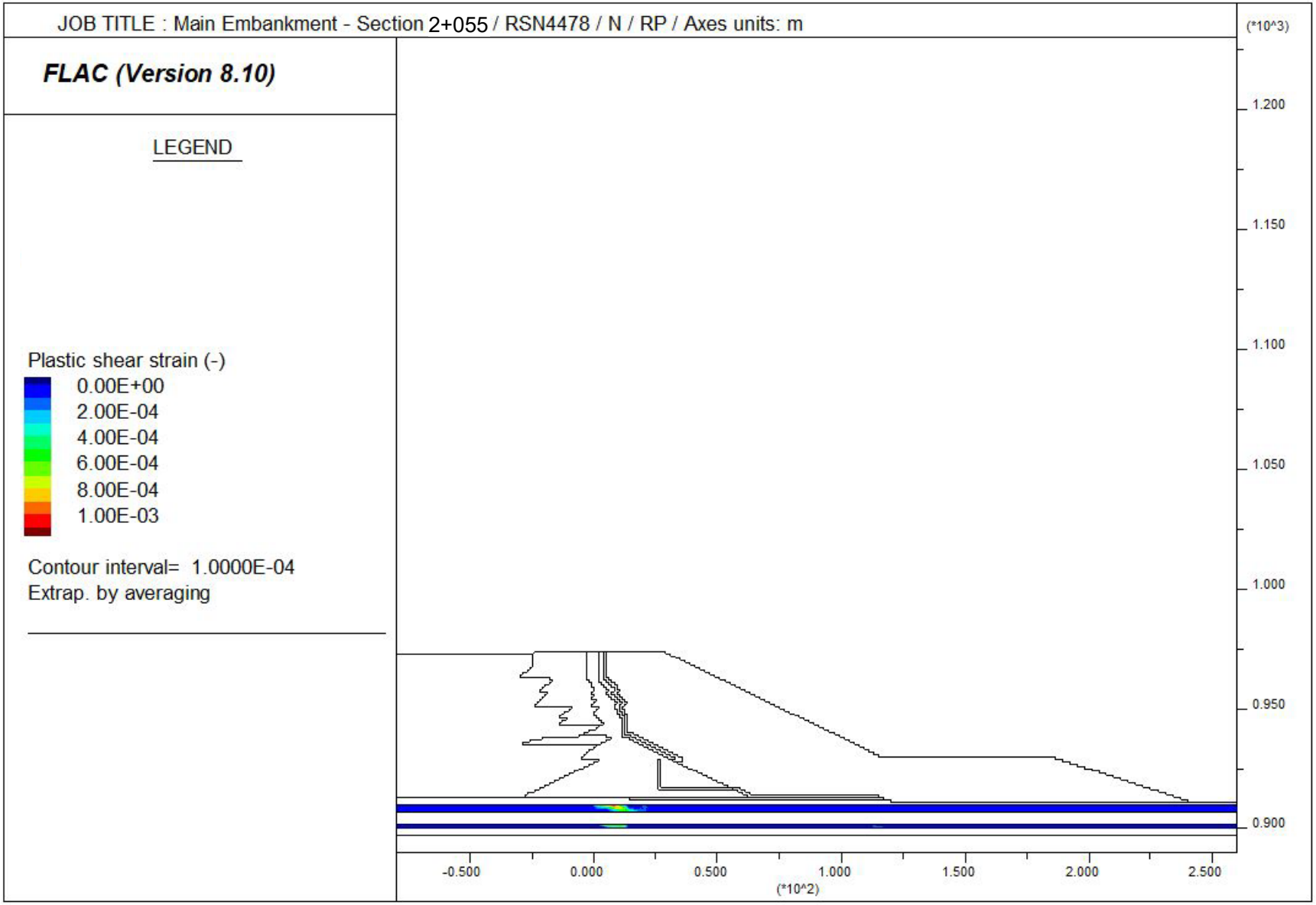
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
2.00E-04
4.00E-04
6.00E-04
8.00E-04
1.00E-03
Contour interval= 1.0000E-04
Extrap. by averaging
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

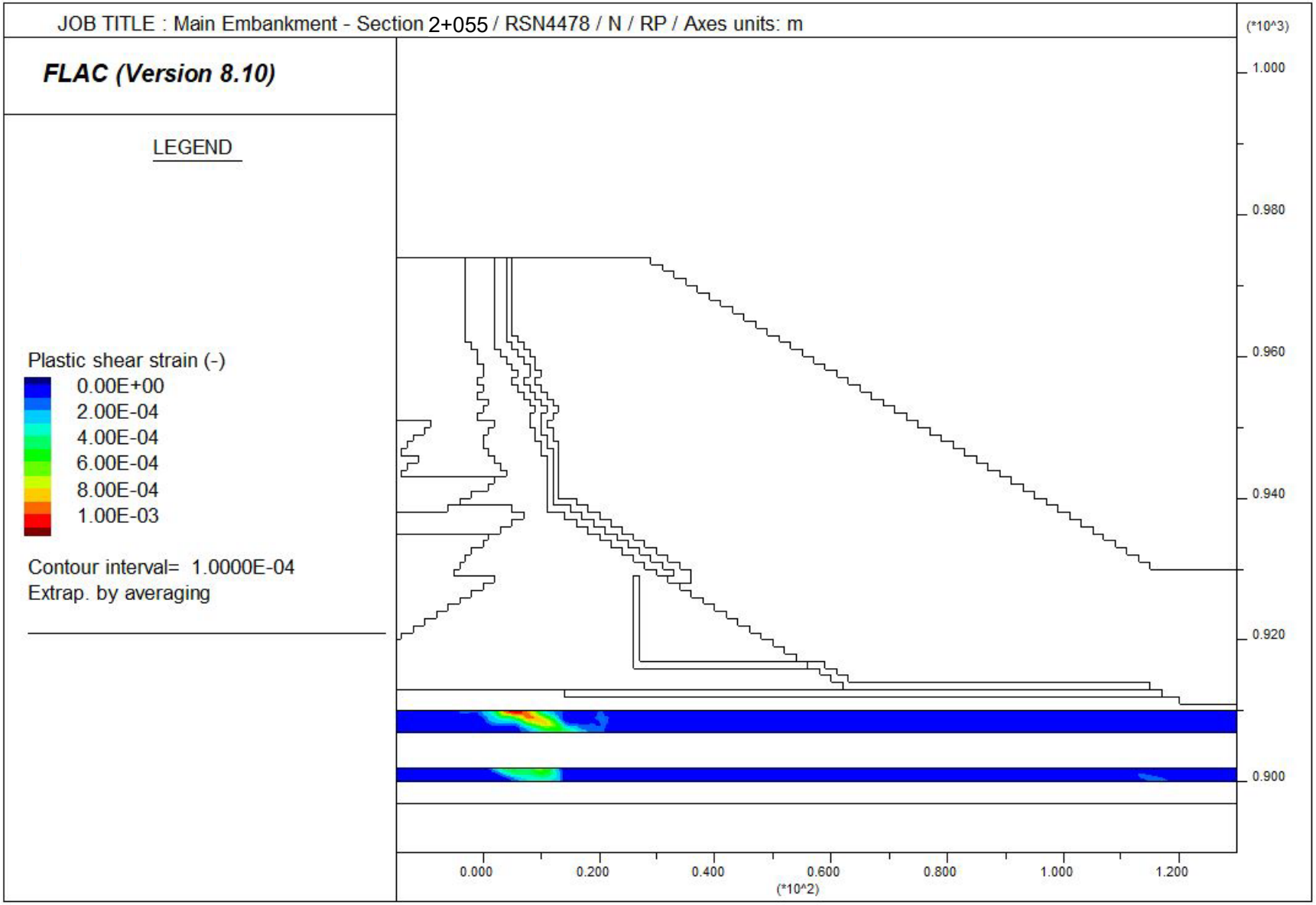
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
2.00E-04
4.00E-04
6.00E-04
8.00E-04
1.00E-03
Contour interval= 1.0000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

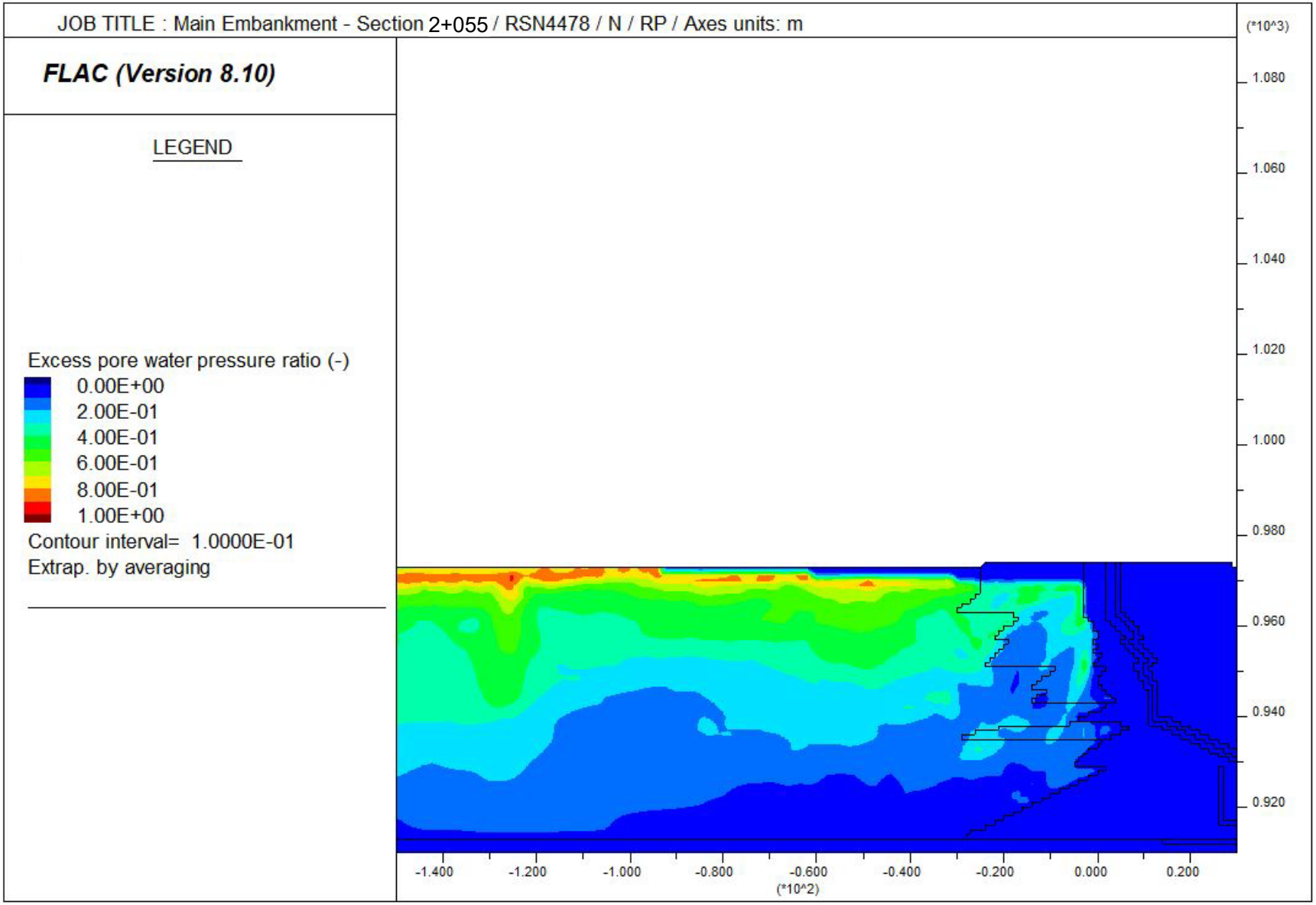
JOB TITLE : Main Embankment - Section 2+055 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.080
1.060
1.040
1.020
1.000
0.980
0.960
0.940
0.920
-1.400
-1.200
-1.000
-0.800
-0.600
-0.400
-0.200
0.000
0.200
(*10^2)

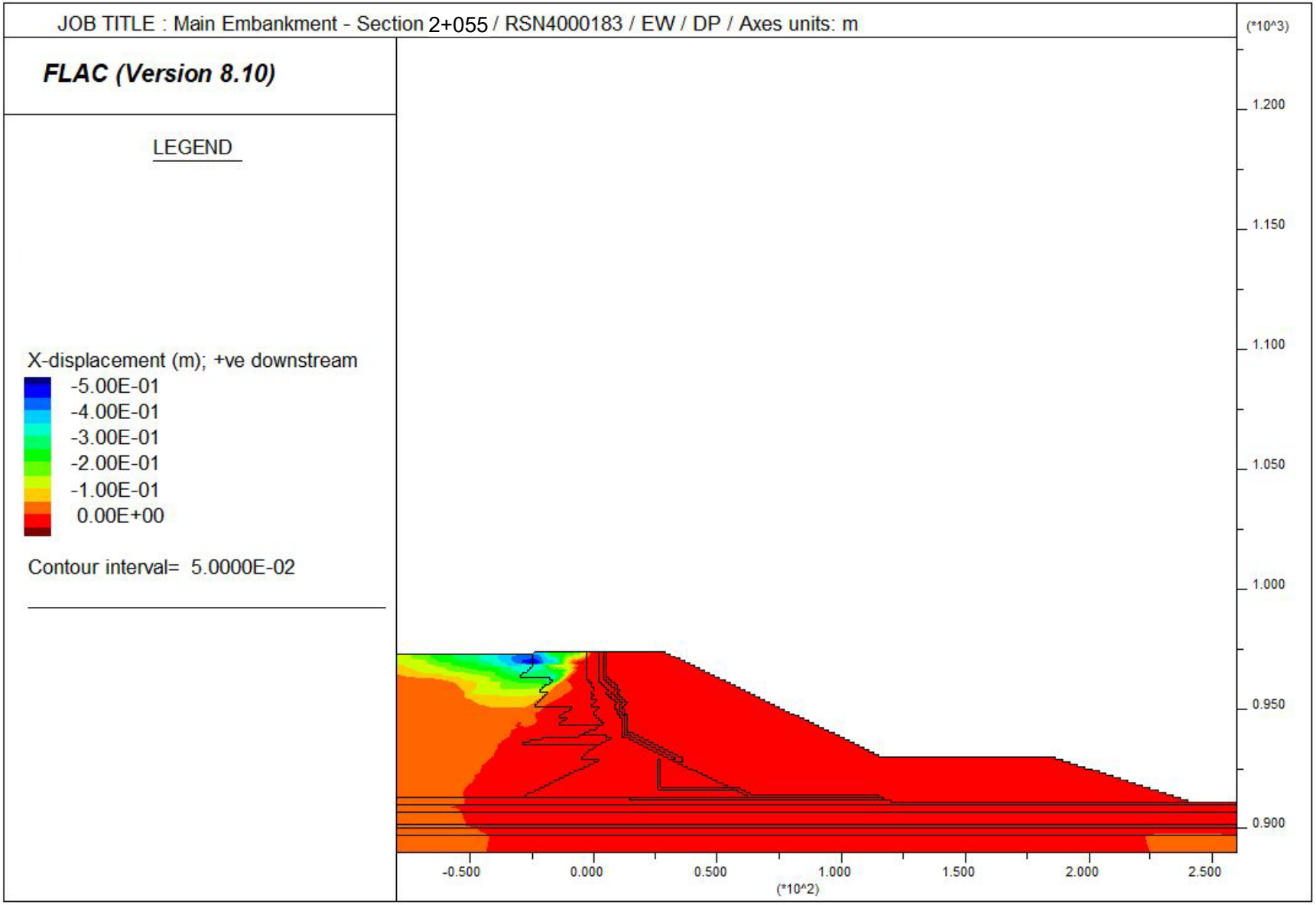
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-5.00E-01
-4.00E-01
-3.00E-01
-2.00E-01
-1.00E-01
0.00E+00
Contour interval= 5.0000E-02
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

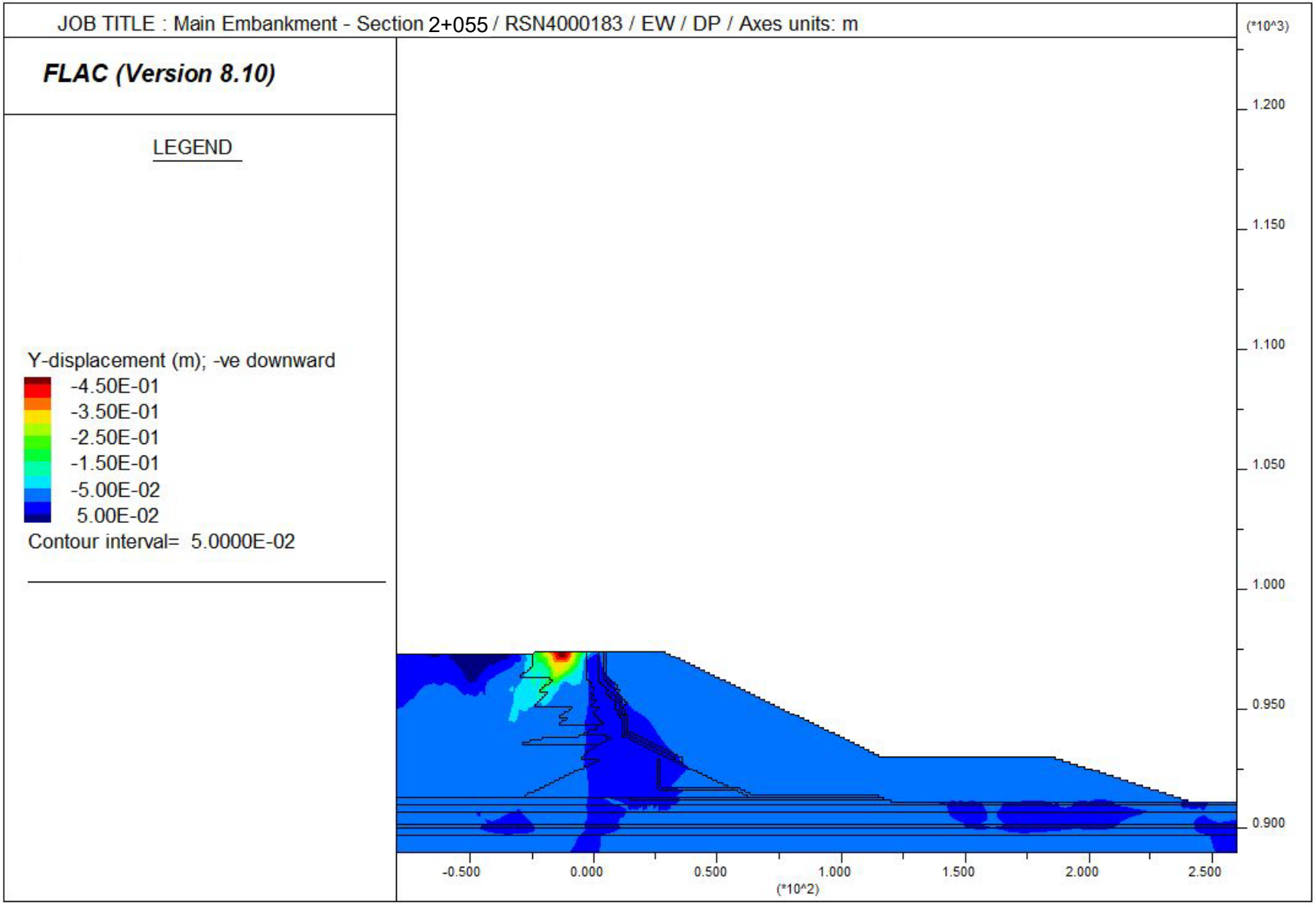
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-4.50E-01
-3.50E-01
-2.50E-01
-1.50E-01
-5.00E-02
5.00E-02
Contour interval= 5.0000E-02
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

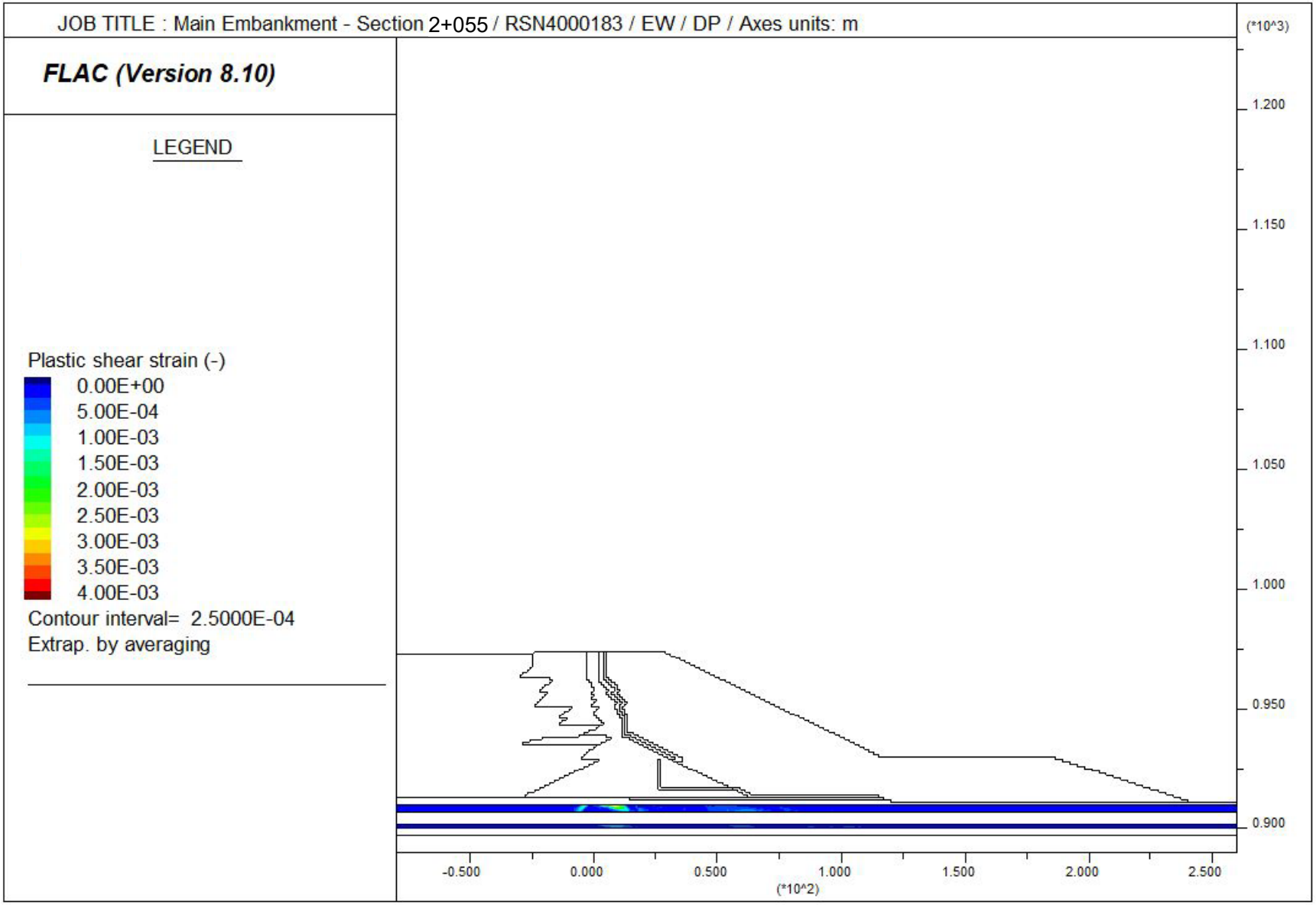
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
5.00E-04
1.00E-03
1.50E-03
2.00E-03
2.50E-03
3.00E-03
3.50E-03
4.00E-03
Contour interval= 2.5000E-04
Extrap. by averaging
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

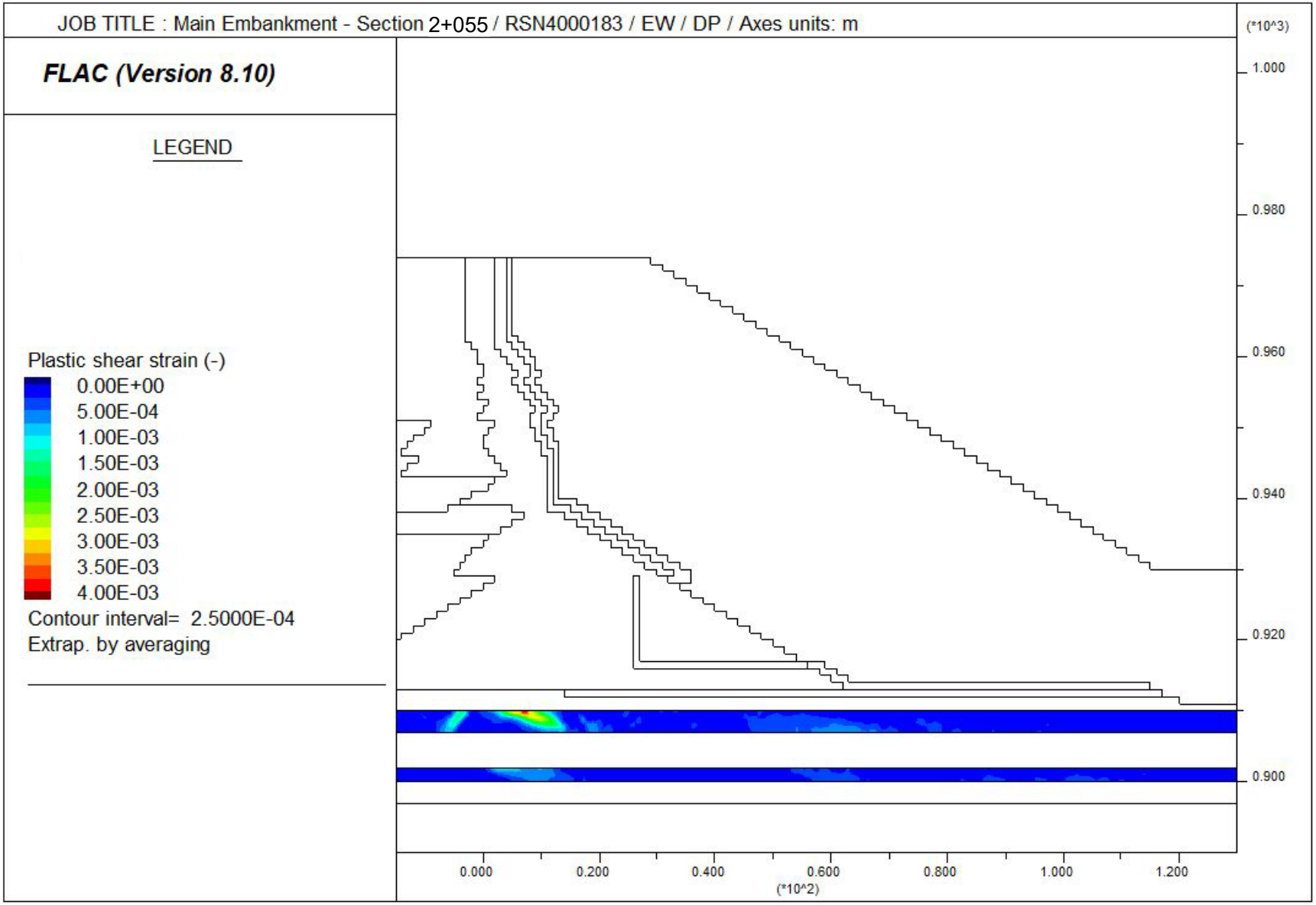
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
5.00E-04
1.00E-03
1.50E-03
2.00E-03
2.50E-03
3.00E-03
3.50E-03
4.00E-03
Contour interval= 2.5000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

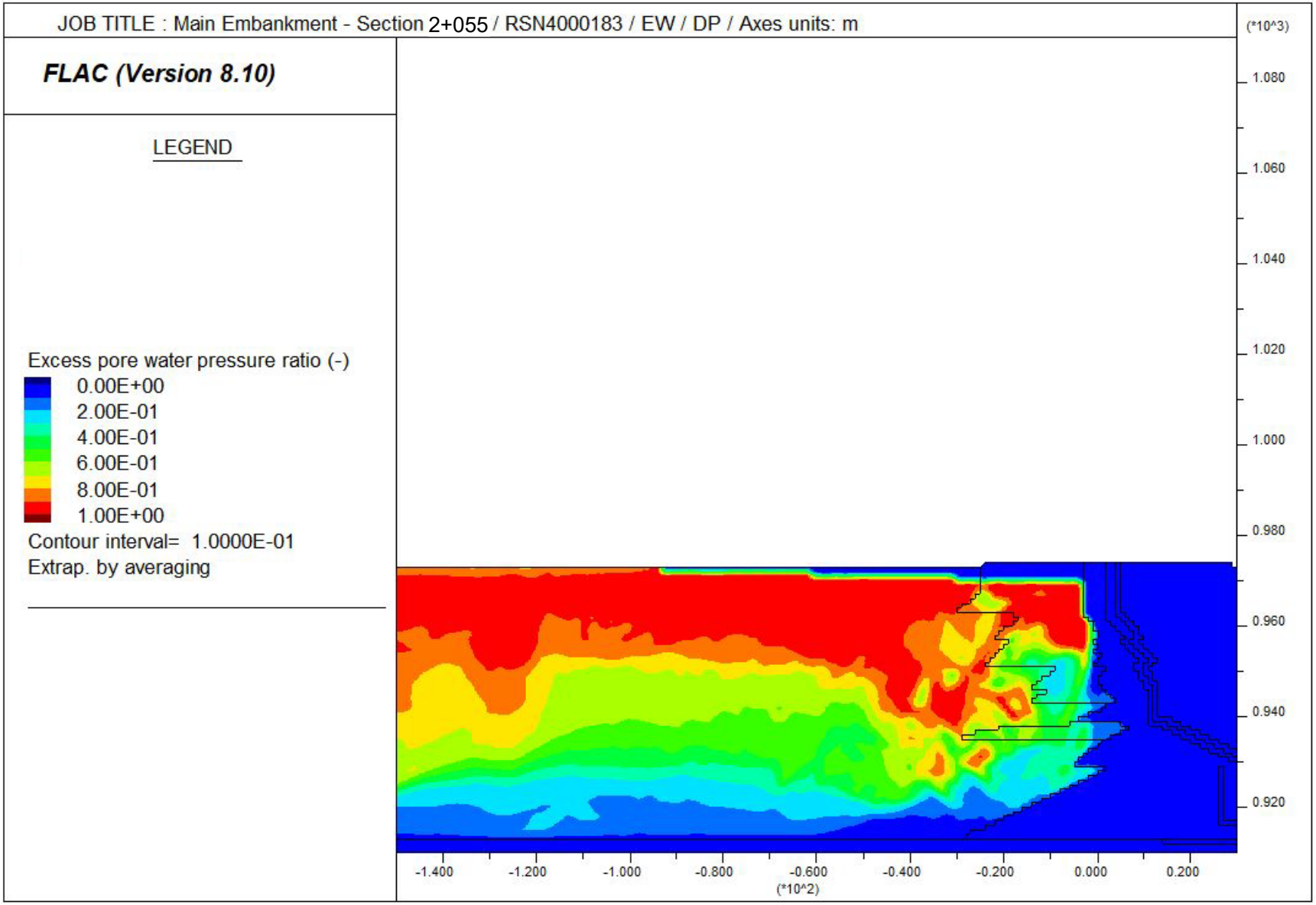
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.080
1.060
1.040
1.020
1.000
0.980
0.960
0.940
0.920
-1.400
-1.200
-1.000
-0.800
-0.600
-0.400
-0.200
0.000
0.200
(*10^2)

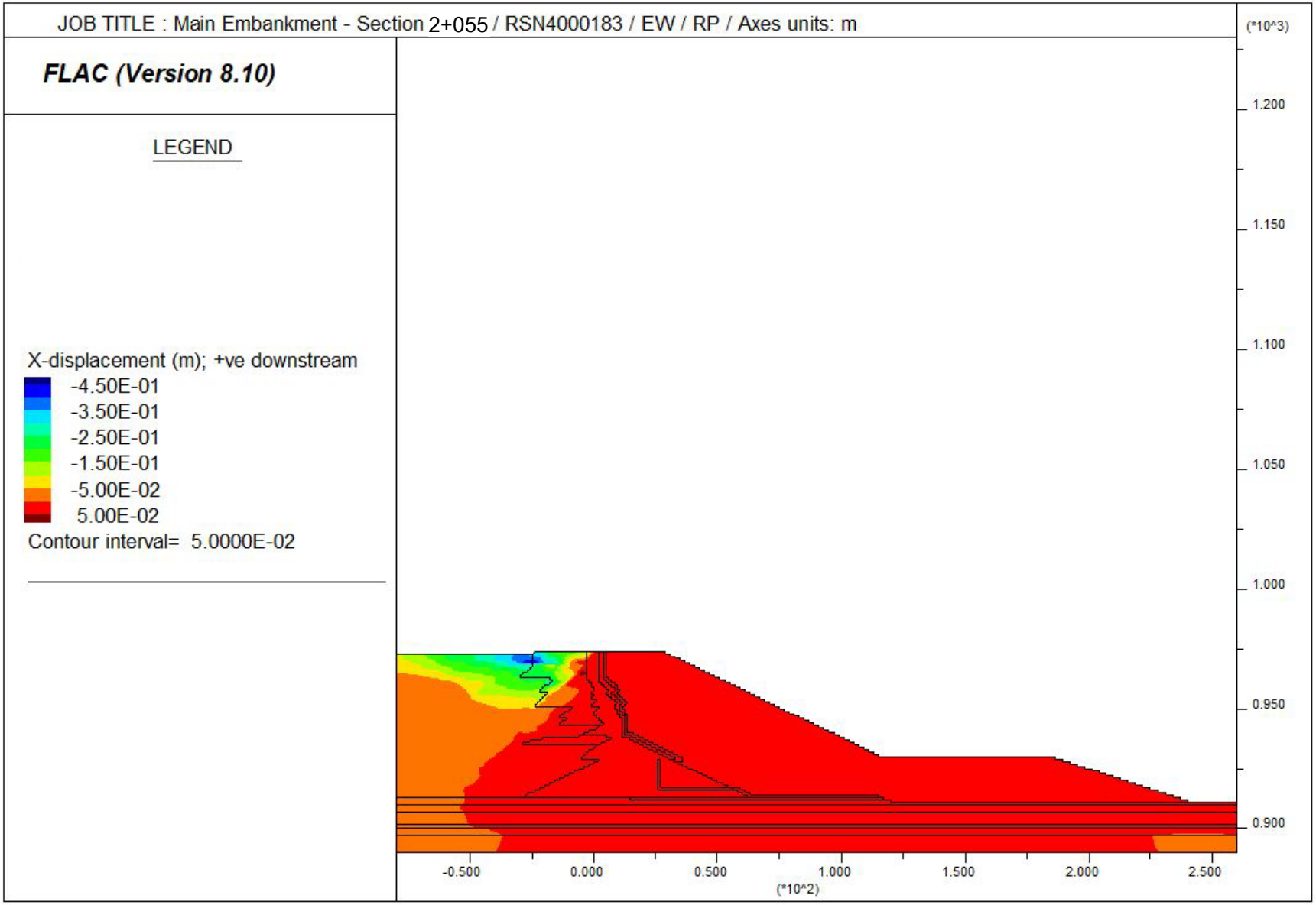
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-4.50E-01
-3.50E-01
-2.50E-01
-1.50E-01
-5.00E-02
5.00E-02
Contour interval= 5.0000E-02
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

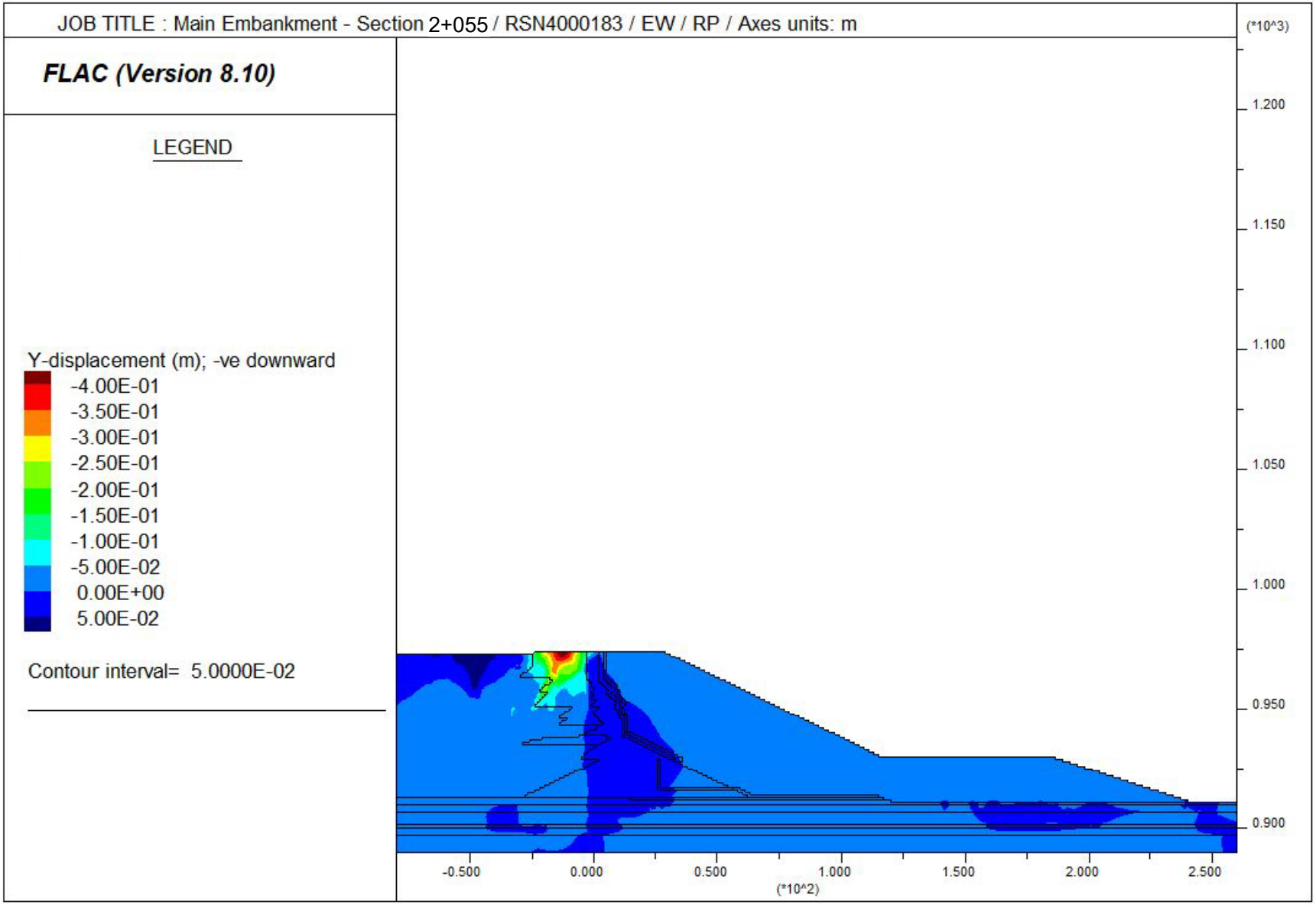
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-4.00E-01
-3.50E-01
-3.00E-01
-2.50E-01
-2.00E-01
-1.50E-01
-1.00E-01
-5.00E-02
0.00E+00
5.00E-02
Contour interval= 5.0000E-02
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

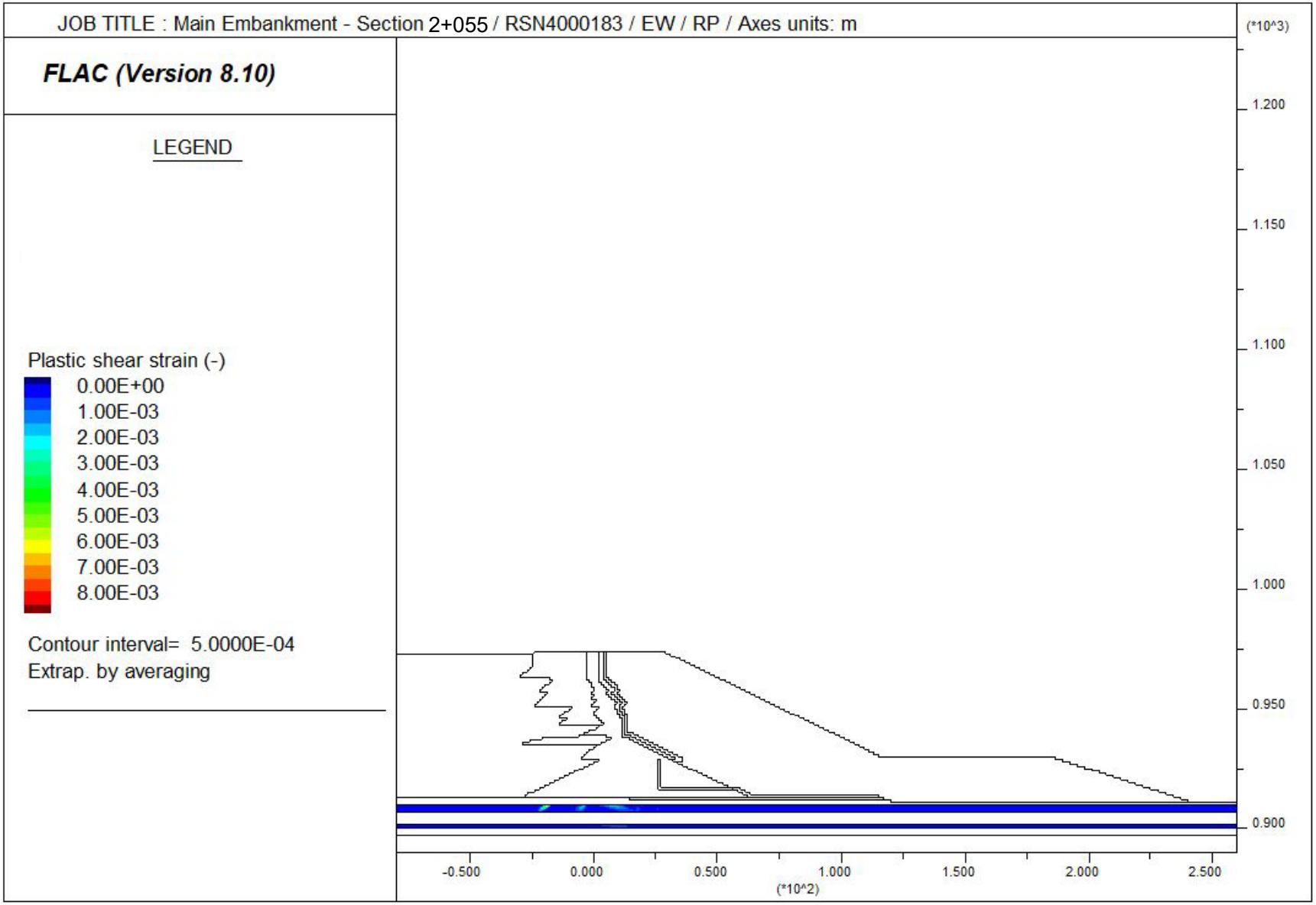
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
6.00E-03
7.00E-03
8.00E-03
Contour interval= 5.0000E-04
Extrap. by averaging
(*10^3)
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
(*10^2)

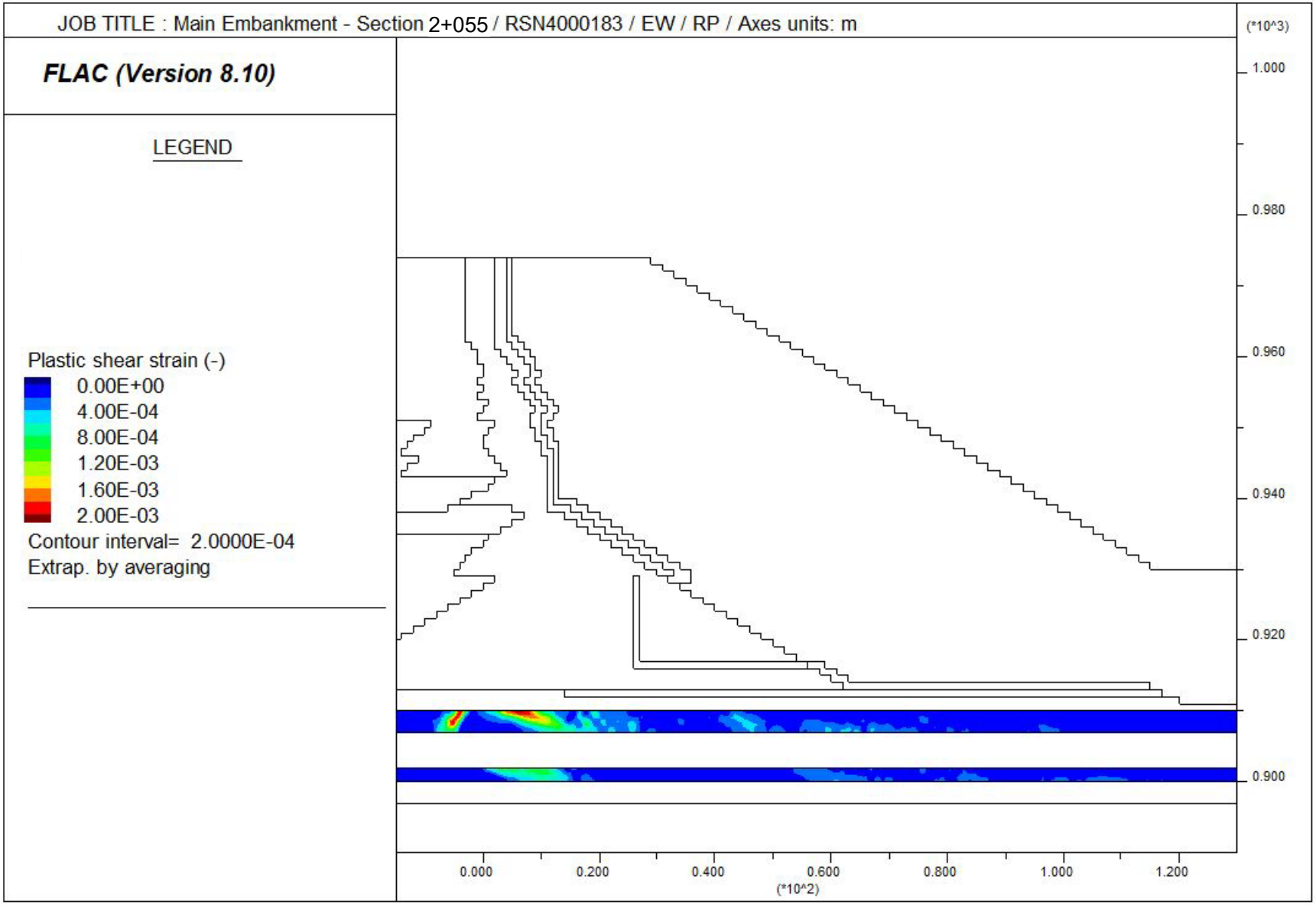
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
4.00E-04
8.00E-04
1.20E-03
1.60E-03
2.00E-03
Contour interval= 2.0000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

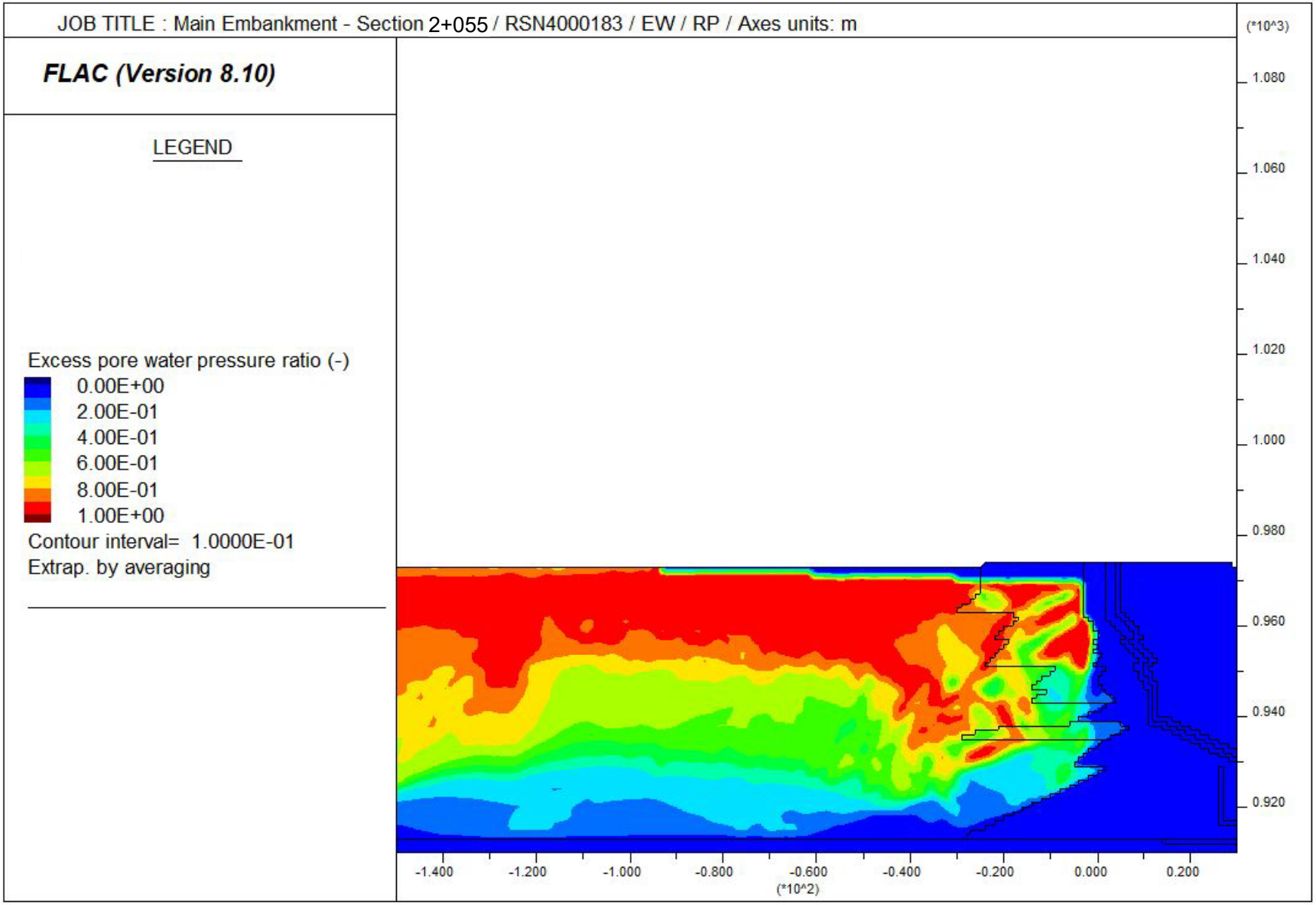
JOB TITLE : Main Embankment - Section 2+055 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.080
1.060
1.040
1.020
1.000
0.980
0.960
0.940
0.920
-1.400
-1.200
-1.000
-0.800
-0.600
-0.400
-0.200
0.000
0.200
(*10^2)

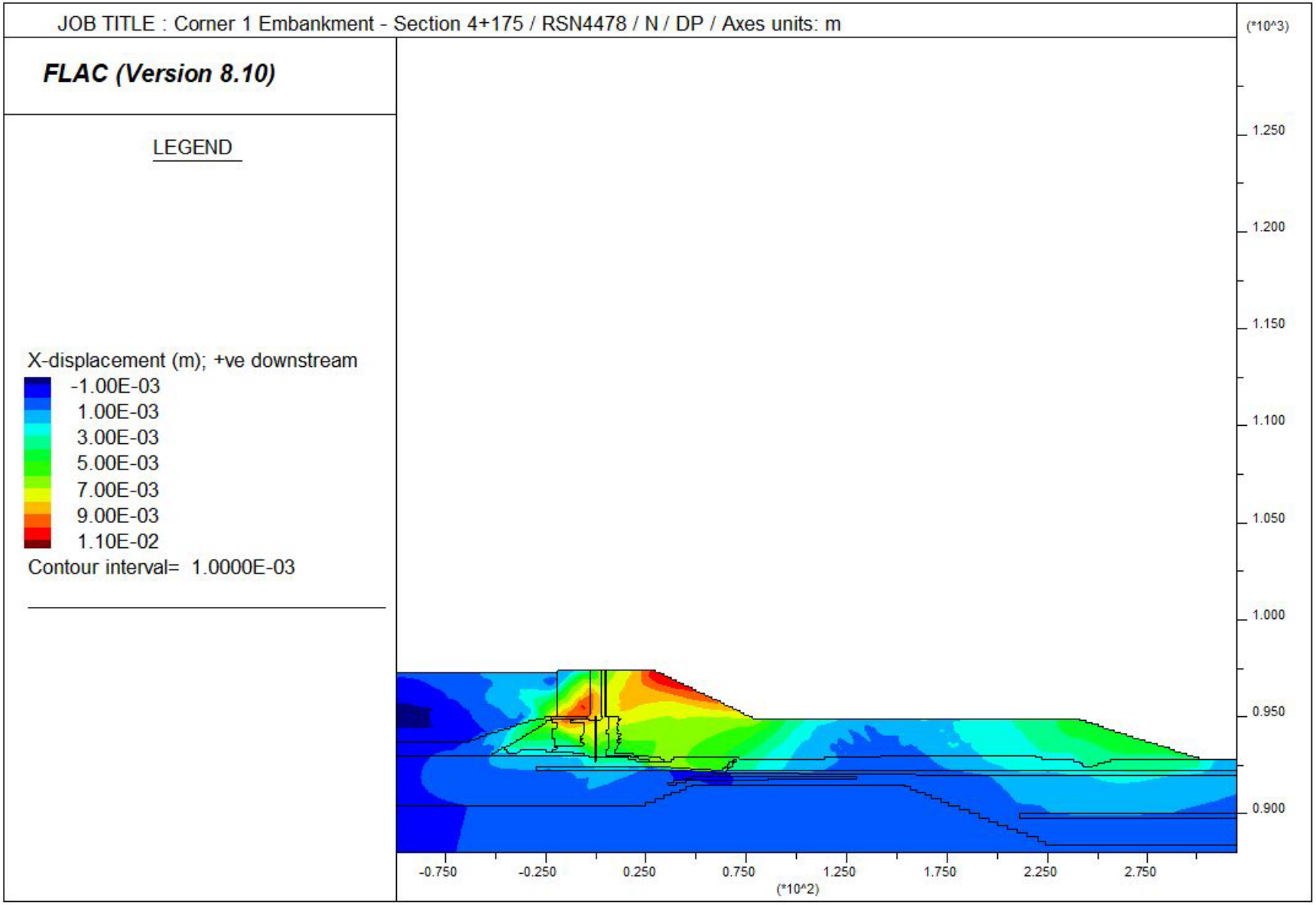
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-1.00E-03
1.00E-03
3.00E-03
5.00E-03
7.00E-03
9.00E-03
1.10E-02
Contour interval= 1.0000E-03
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

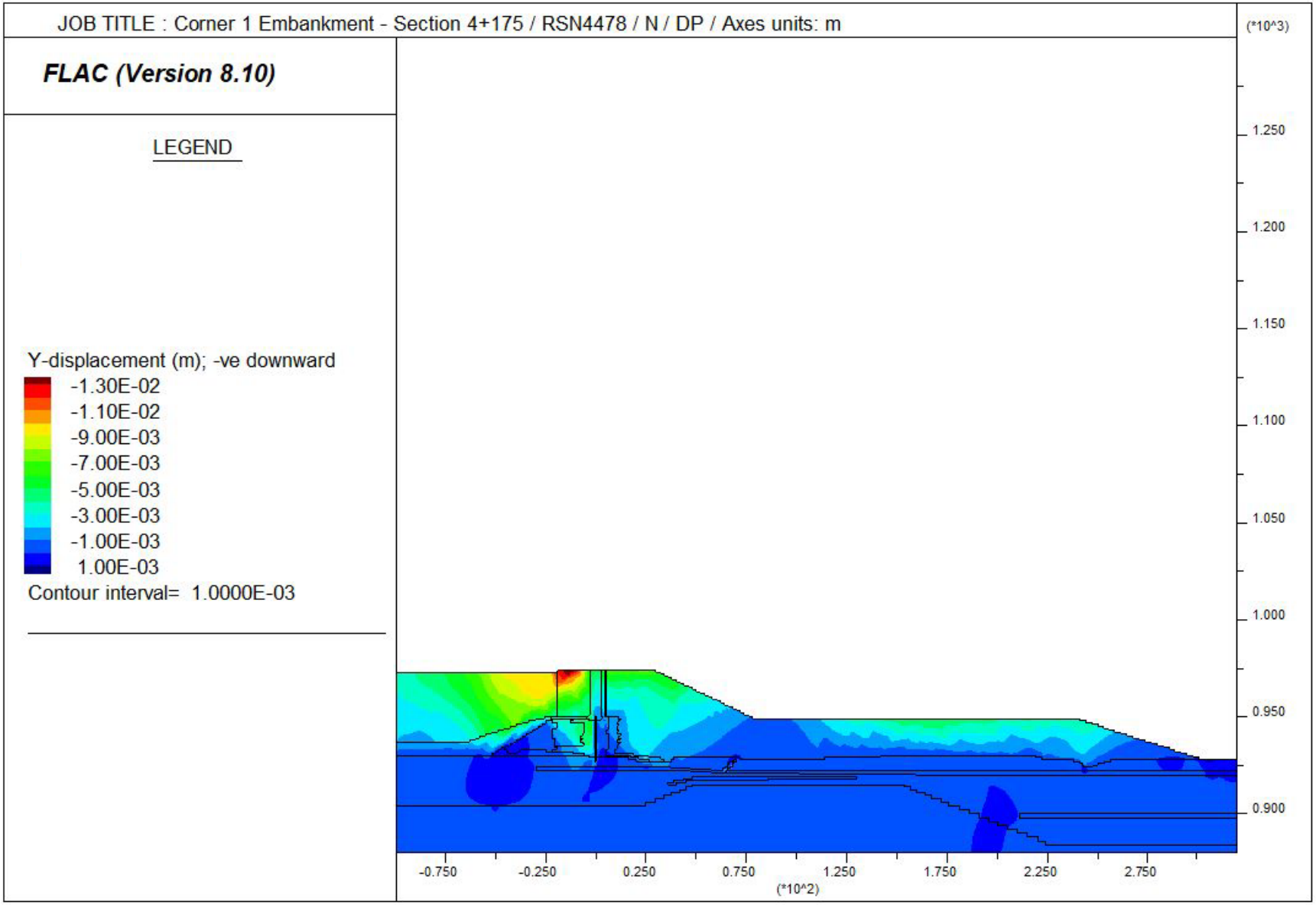
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-1.30E-02
-1.10E-02
-9.00E-03
-7.00E-03
-5.00E-03
-3.00E-03
-1.00E-03
1.00E-03
Contour interval= 1.0000E-03
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

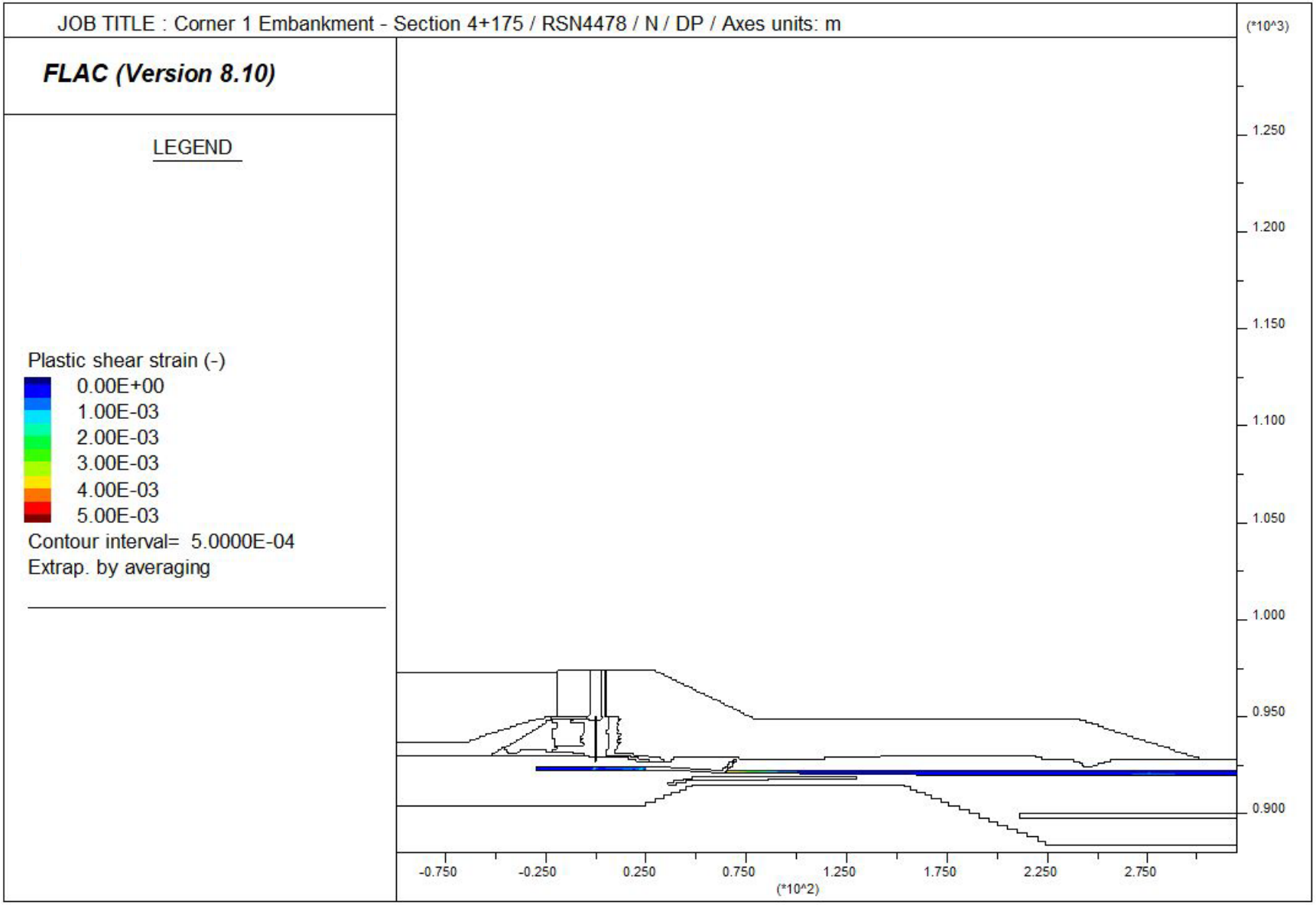
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
Contour interval= 5.0000E-04
Extrap. by averaging
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

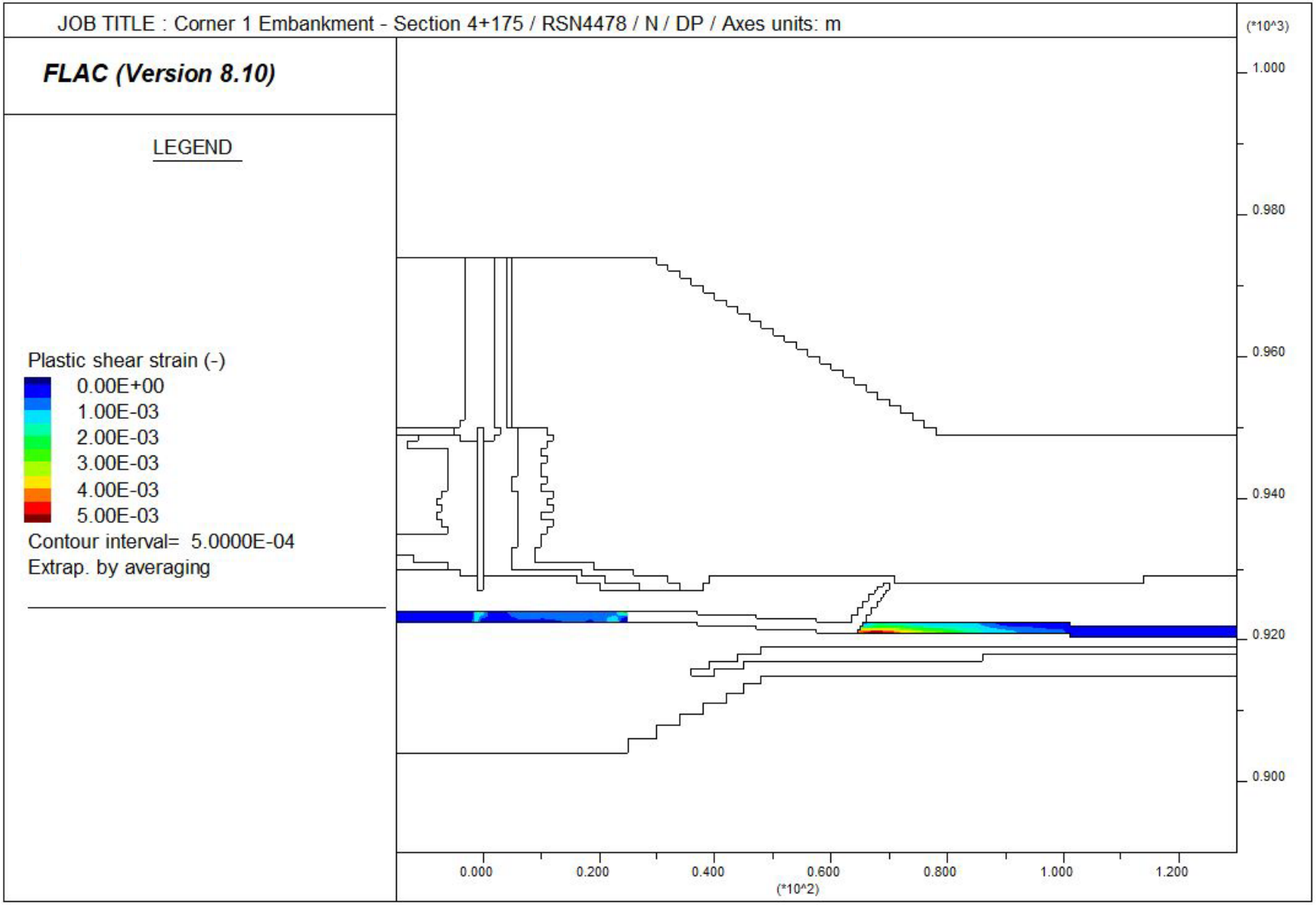
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
Contour interval= 5.0000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

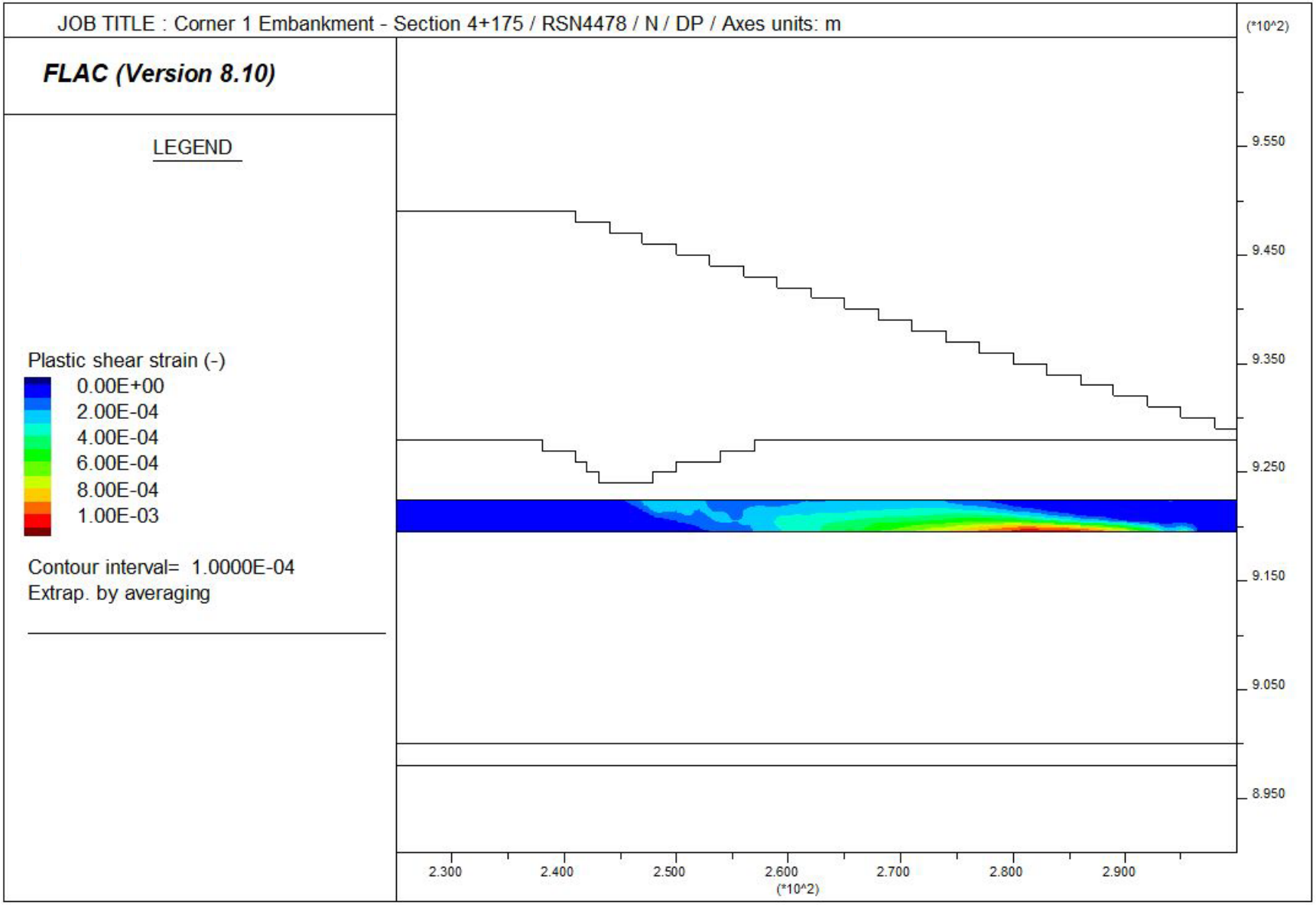
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
2.00E-04
4.00E-04
6.00E-04
8.00E-04
1.00E-03
Contour interval= 1.0000E-04
Extrap. by averaging
(*10^2)
9.550
9.450
9.350
9.250
9.150
9.050
8.950
2.300
2.400
2.500
2.600
2.700
2.800
2.900
(*10^2)

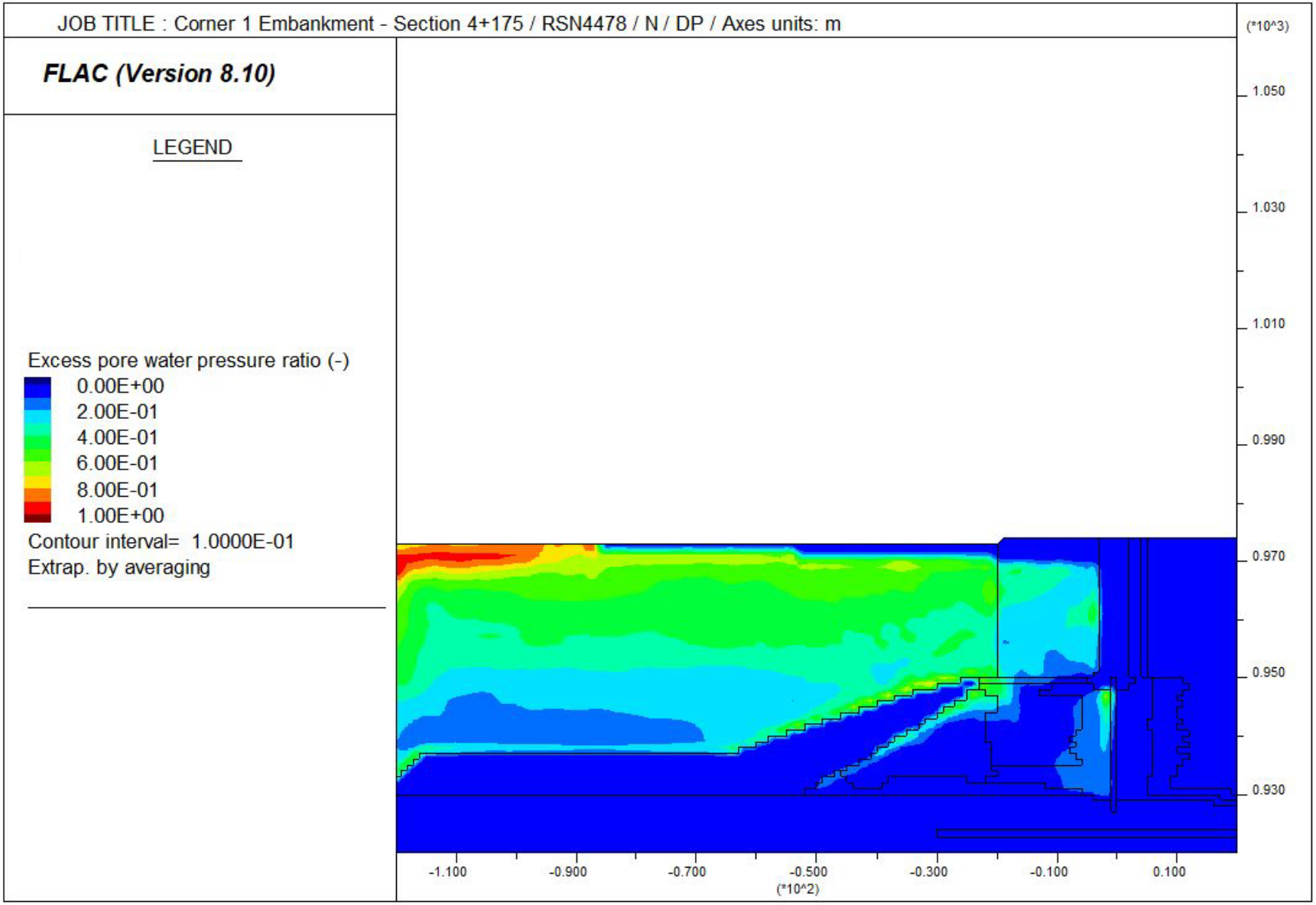
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.050
1.030
1.010
0.990
0.970
0.950
0.930
-1.100
-0.900
-0.700
-0.500
-0.300
-0.100
0.100
(*10^2)

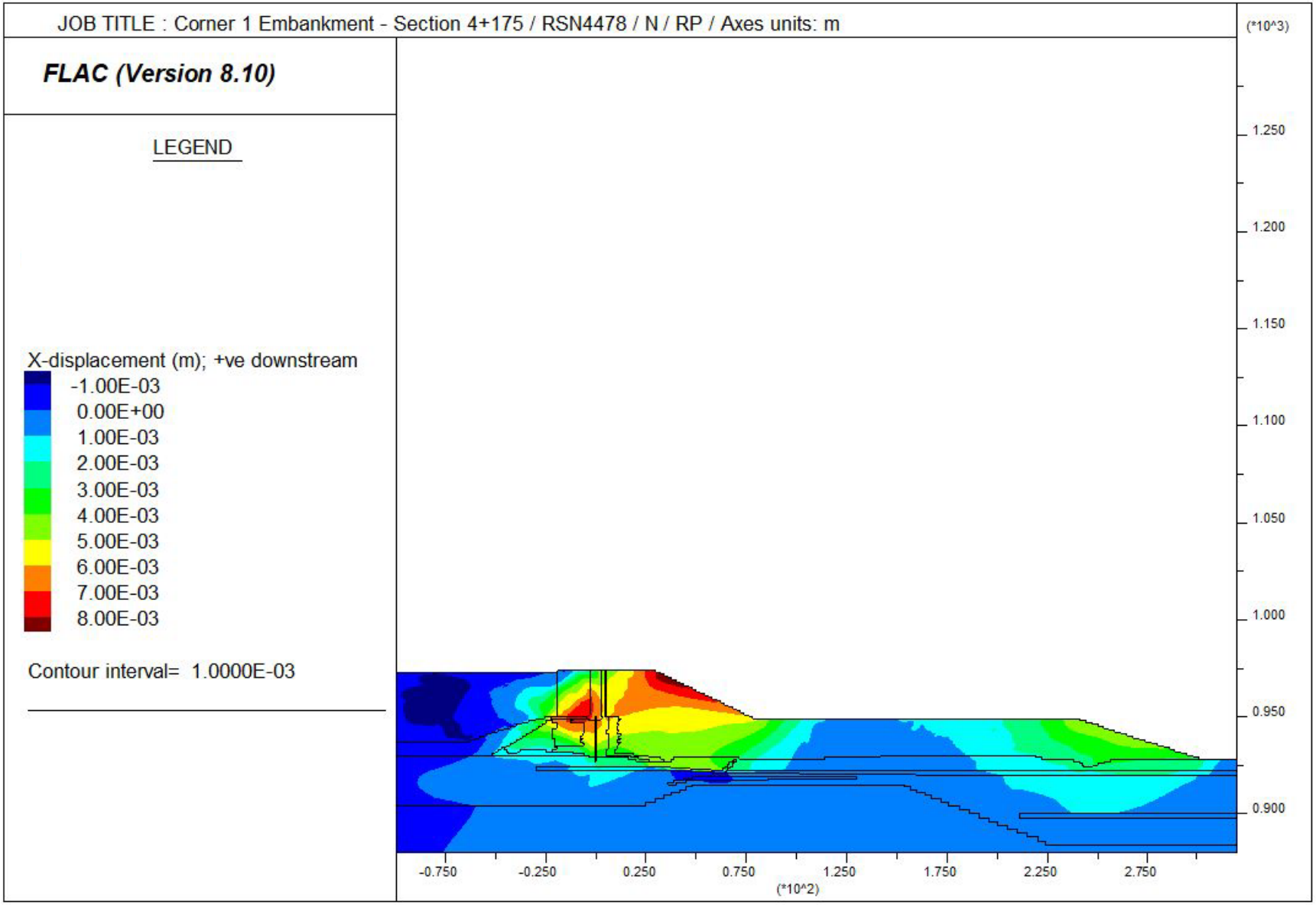
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-1.00E-03
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
6.00E-03
7.00E-03
8.00E-03
Contour interval= 1.0000E-03
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

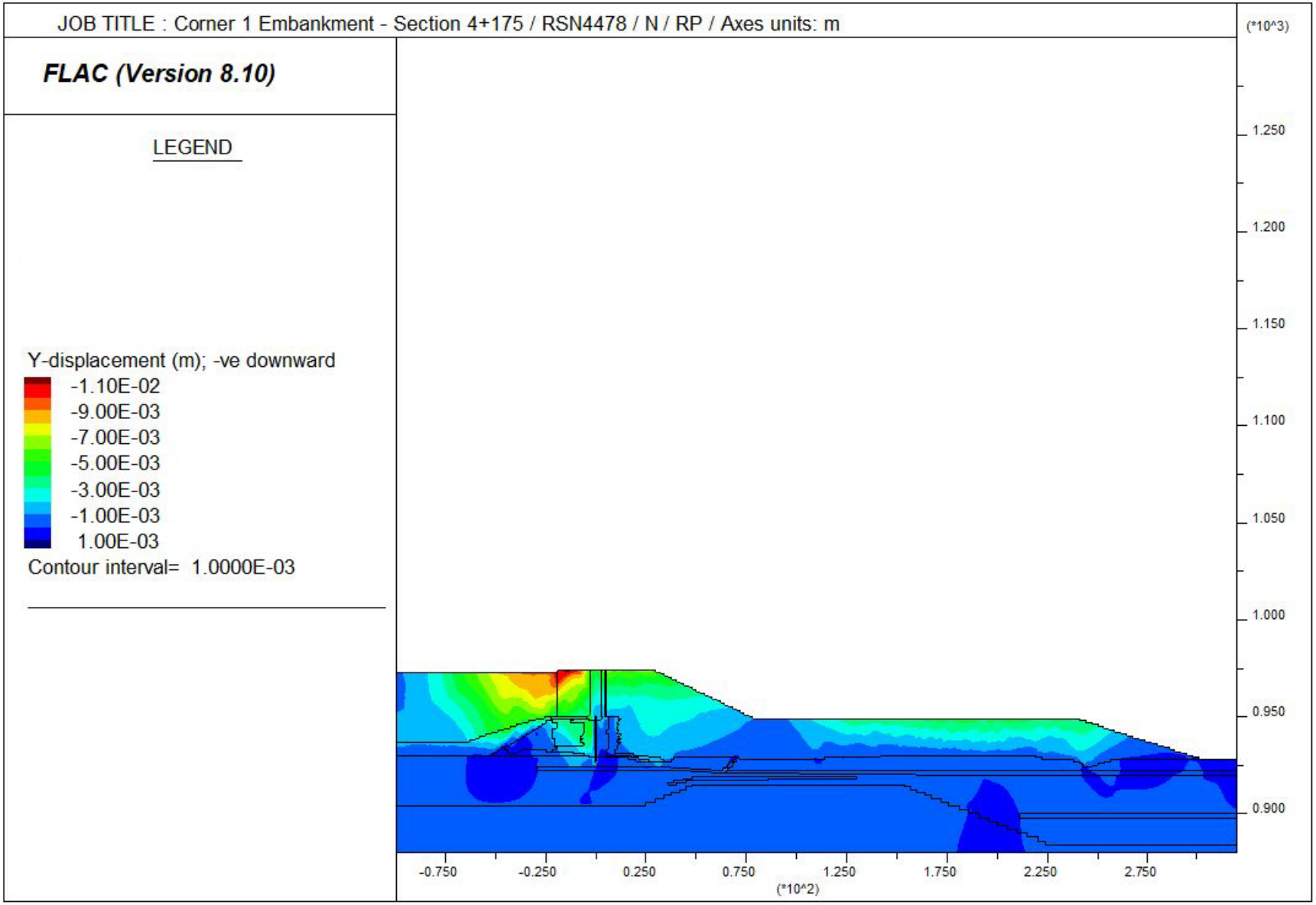
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-1.10E-02
-9.00E-03
-7.00E-03
-5.00E-03
-3.00E-03
-1.00E-03
1.00E-03
Contour interval= 1.0000E-03
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

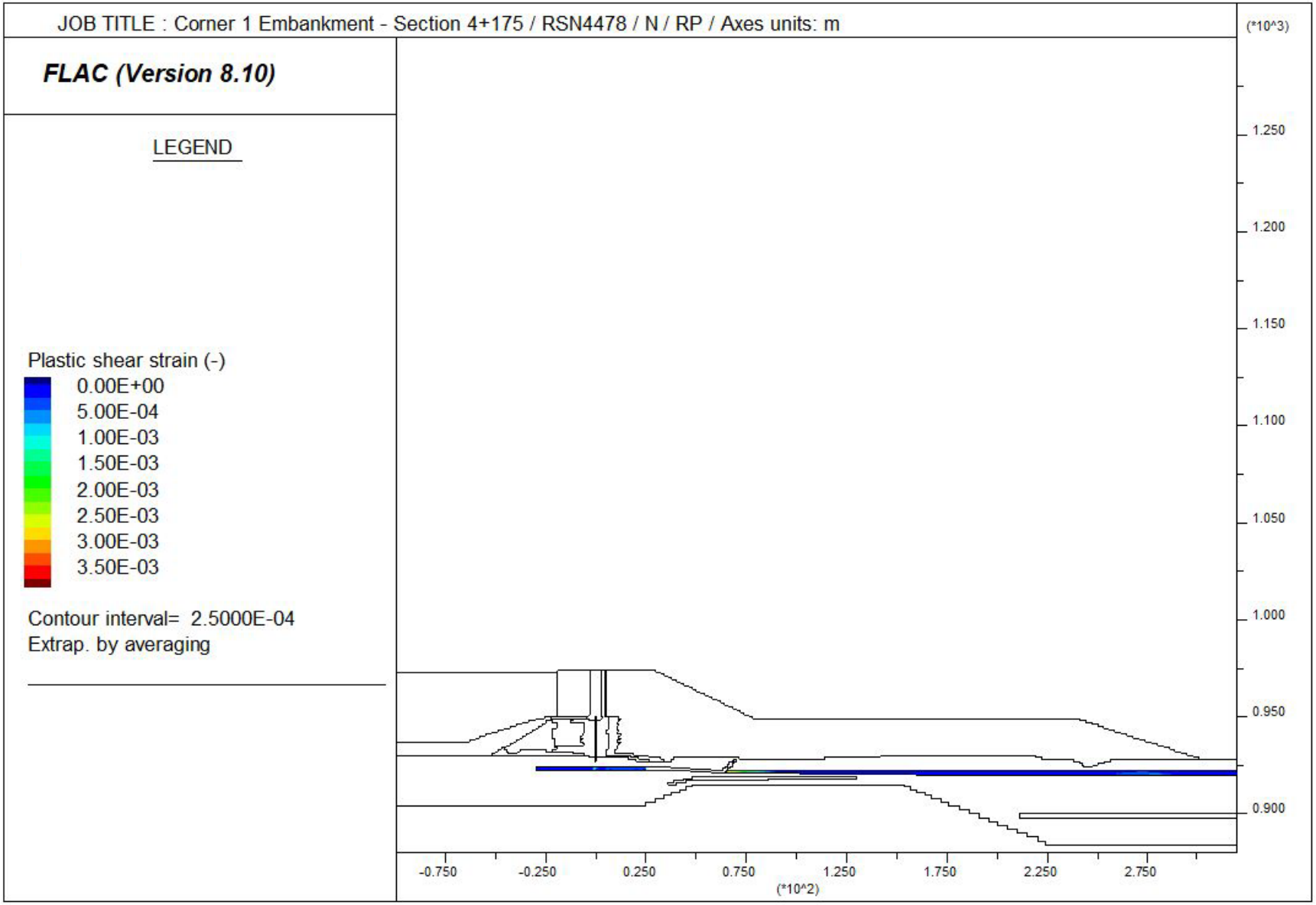
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
5.00E-04
1.00E-03
1.50E-03
2.00E-03
2.50E-03
3.00E-03
3.50E-03
Contour interval= 2.5000E-04
Extrap. by averaging
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

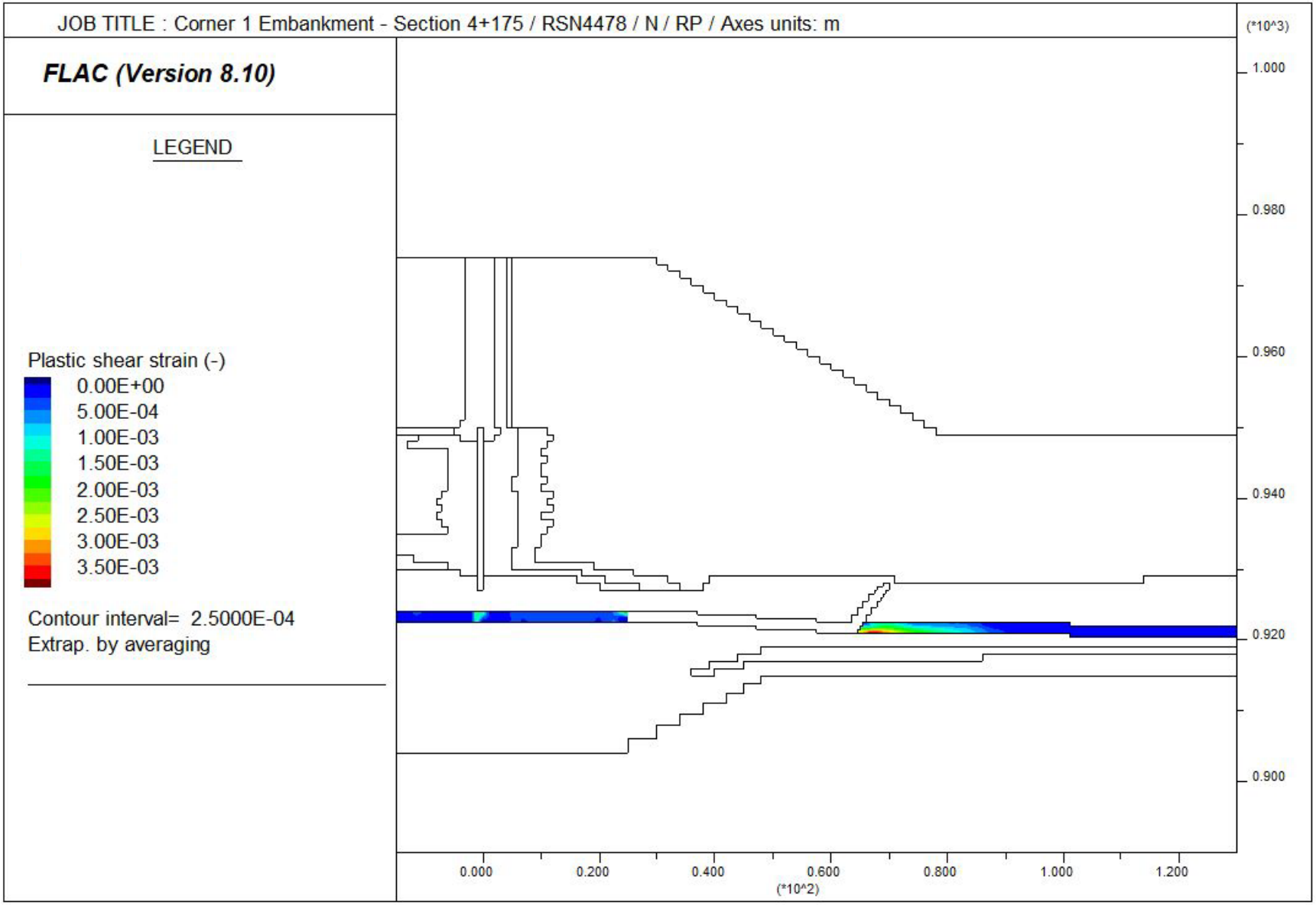
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
5.00E-04
1.00E-03
1.50E-03
2.00E-03
2.50E-03
3.00E-03
3.50E-03
Contour interval= 2.5000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

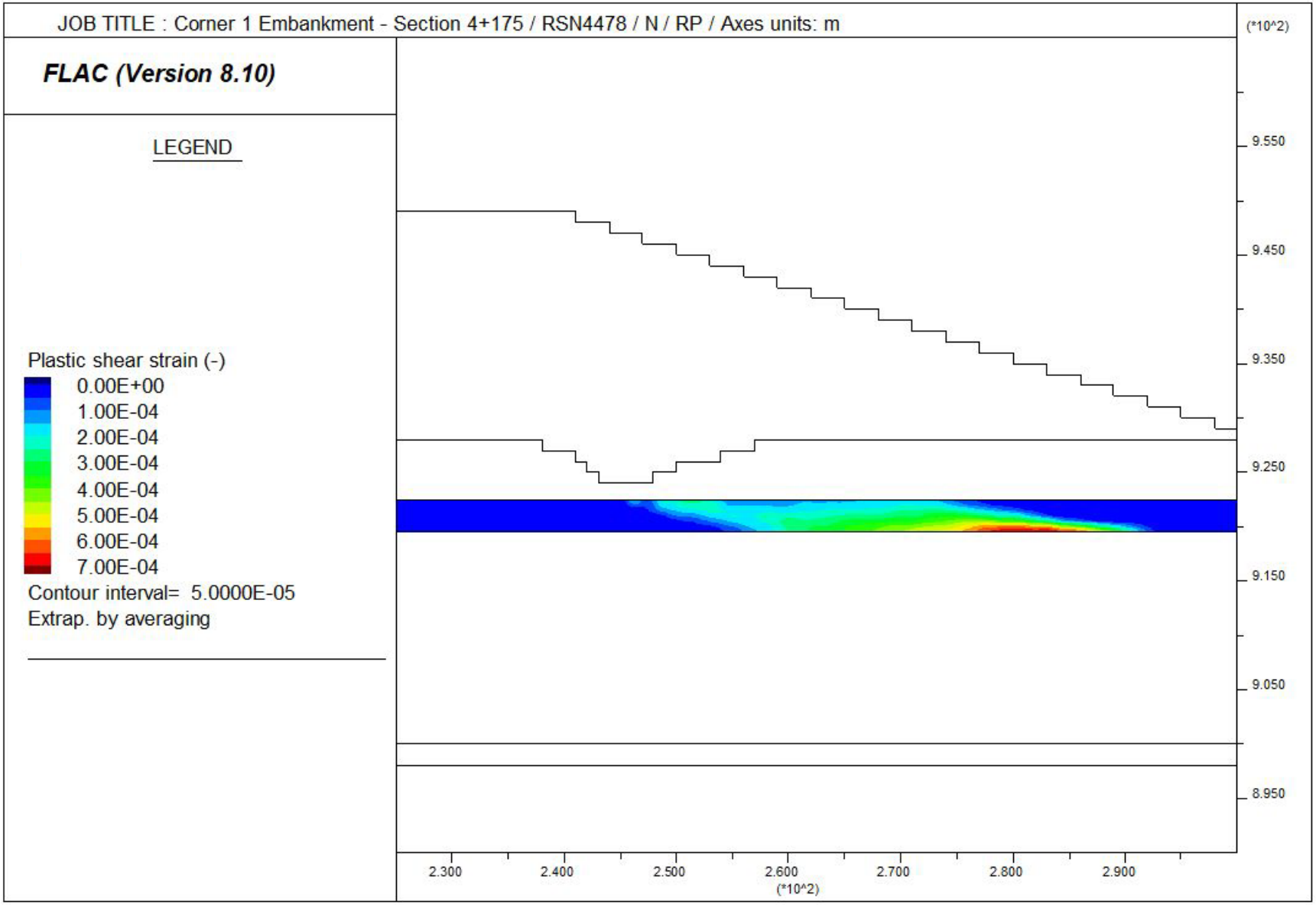
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
1.00E-04
2.00E-04
3.00E-04
4.00E-04
5.00E-04
6.00E-04
7.00E-04
Contour interval= 5.0000E-05
Extrap. by averaging
(*10^2)
9.550
9.450
9.350
9.250
9.150
9.050
8.950
2.300
2.400
2.500
2.600
2.700
2.800
2.900
(*10^2)

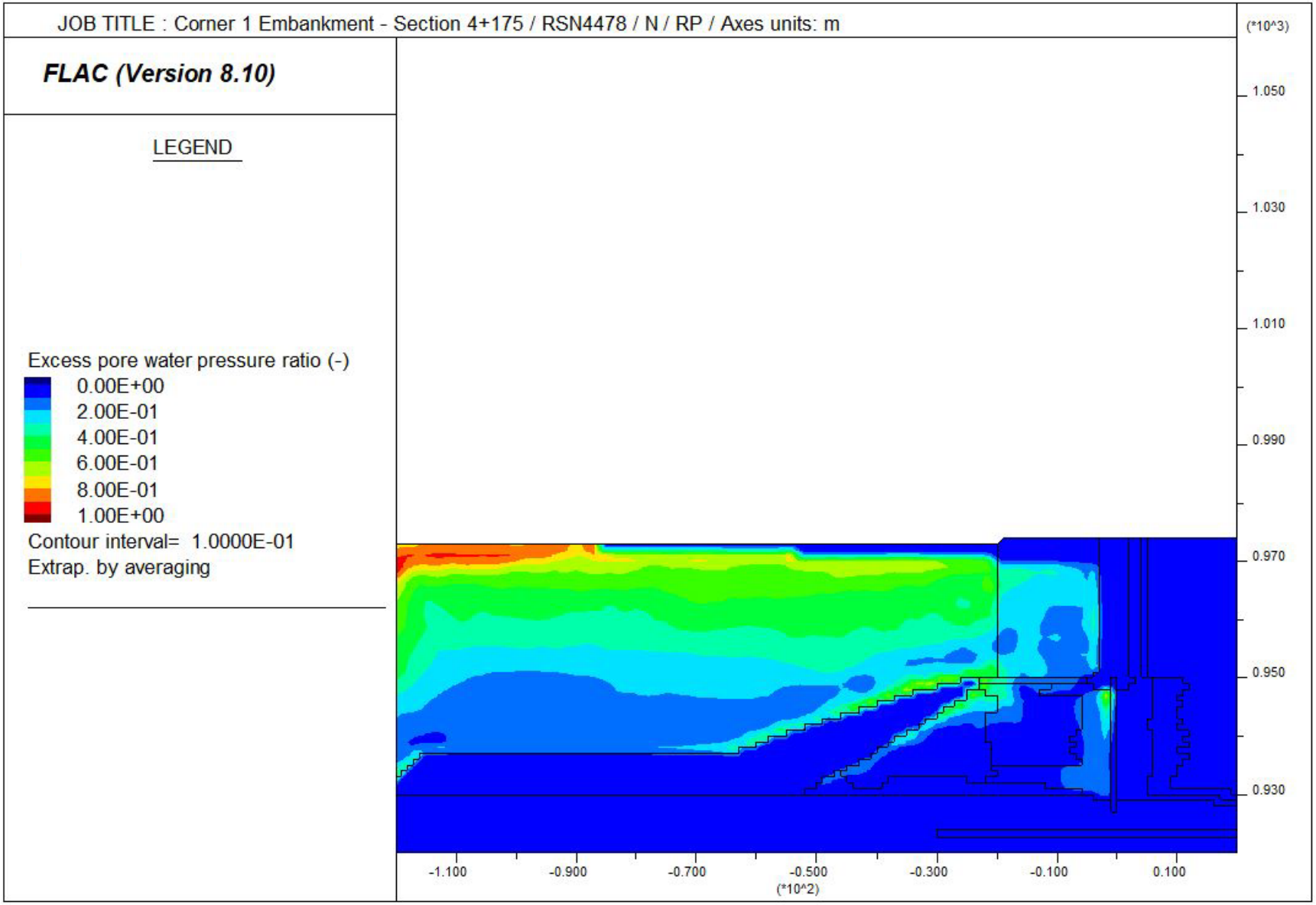
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4478 / N / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.050
1.030
1.010
0.990
0.970
0.950
0.930
-1.100
-0.900
-0.700
-0.500
-0.300
-0.100
0.100
(*10^2)

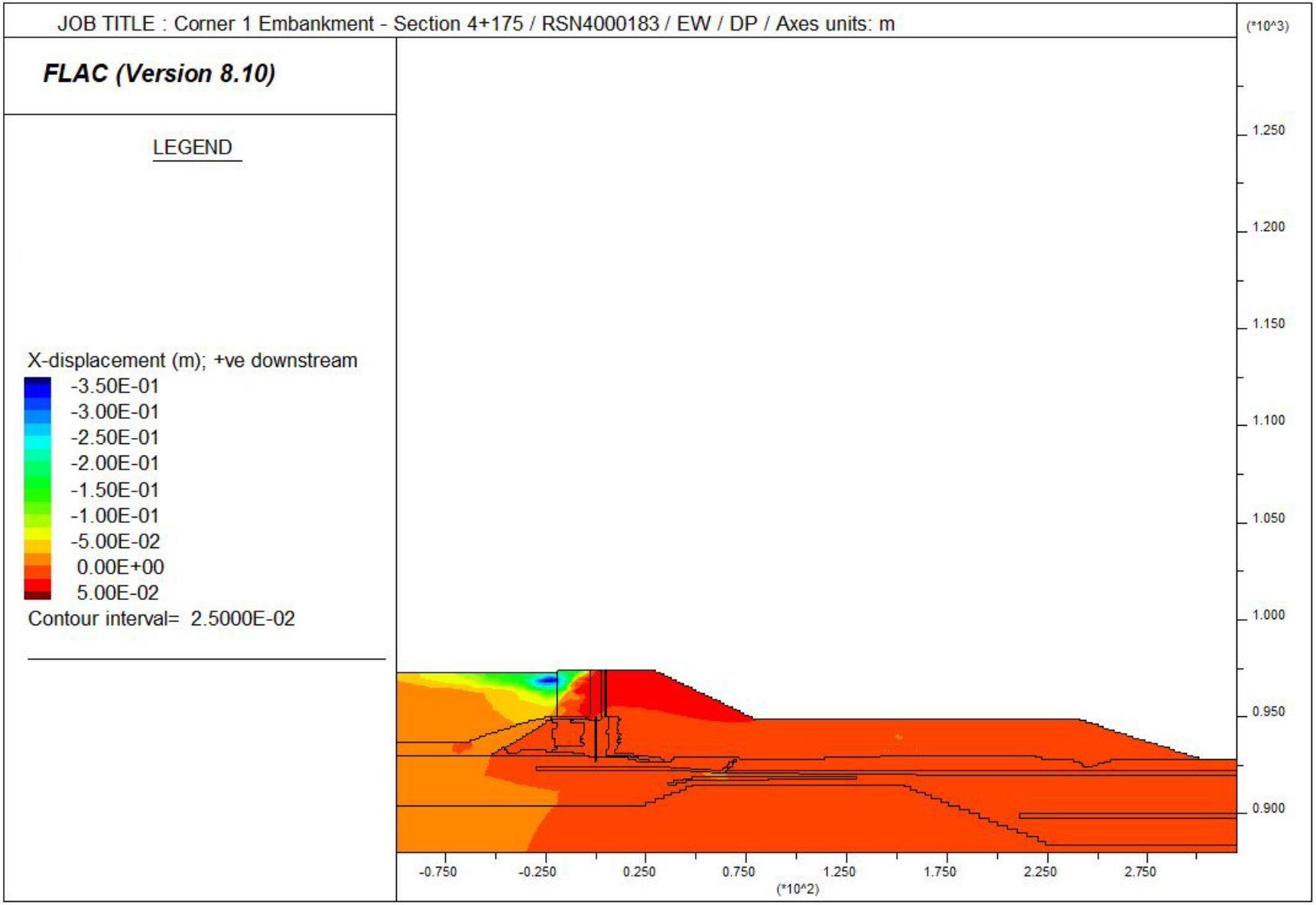
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
X-displacement (m); +ve downstream
-3.50E-01
-3.00E-01
-2.50E-01
-2.00E-01
-1.50E-01
-1.00E-01
-5.00E-02
0.00E+00
5.00E-02
Contour interval= 2.5000E-02
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

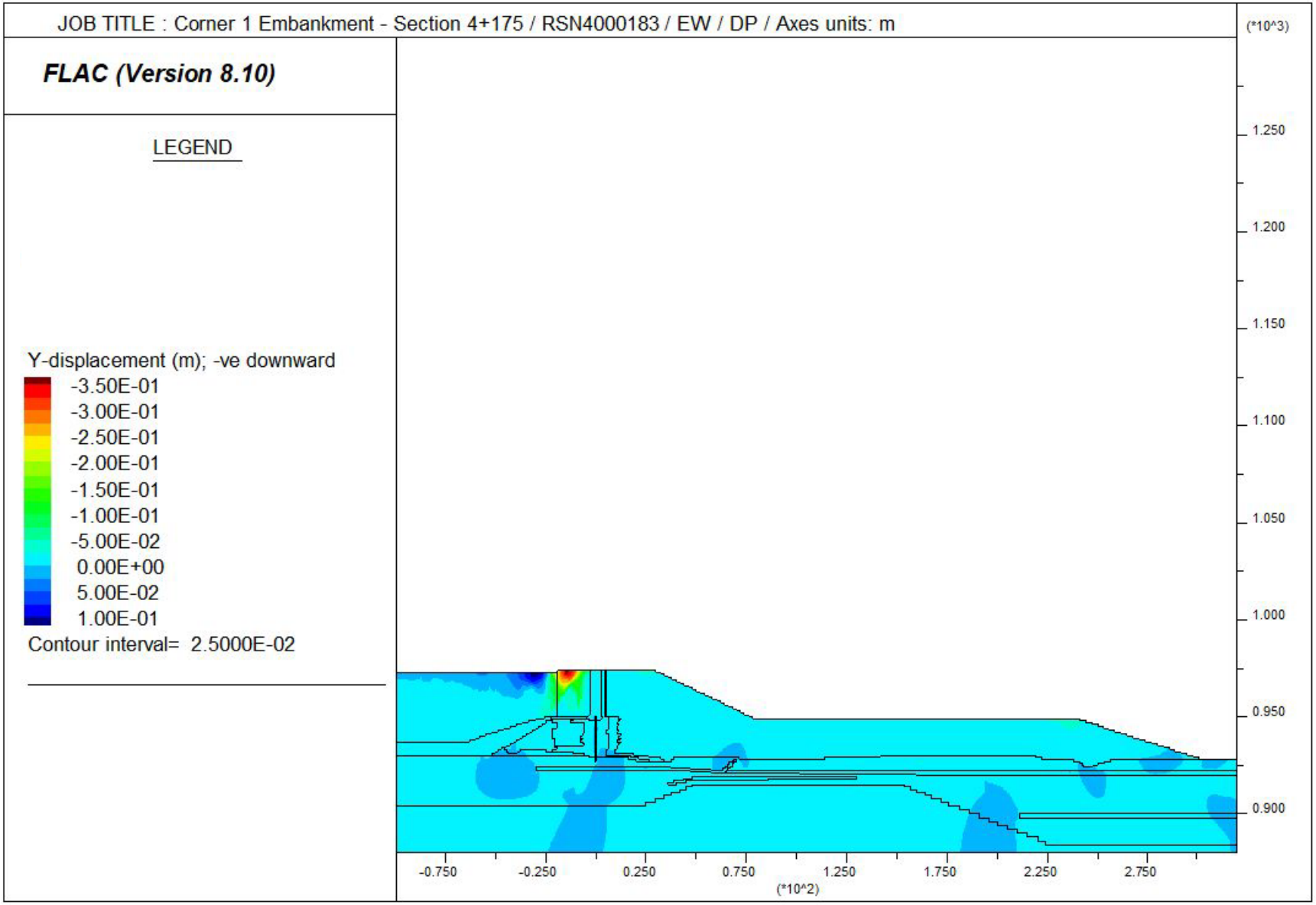
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Y-displacement (m); -ve downward
-3.50E-01
-3.00E-01
-2.50E-01
-2.00E-01
-1.50E-01
-1.00E-01
-5.00E-02
0.00E+00
5.00E-02
1.00E-01
Contour interval= 2.5000E-02
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

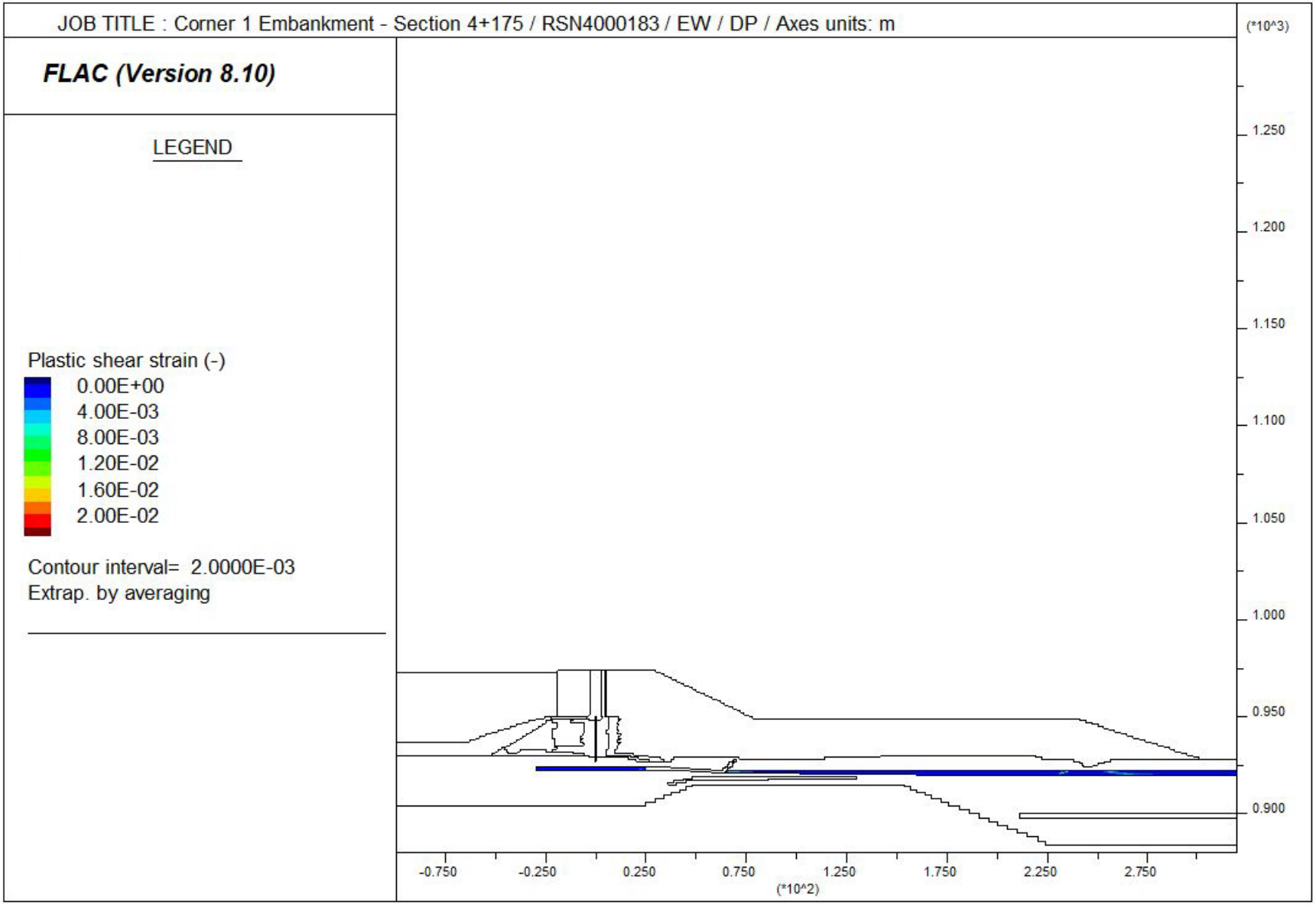
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
4.00E-03
8.00E-03
1.20E-02
1.60E-02
2.00E-02
Contour interval= 2.0000E-03
Extrap. by averaging
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

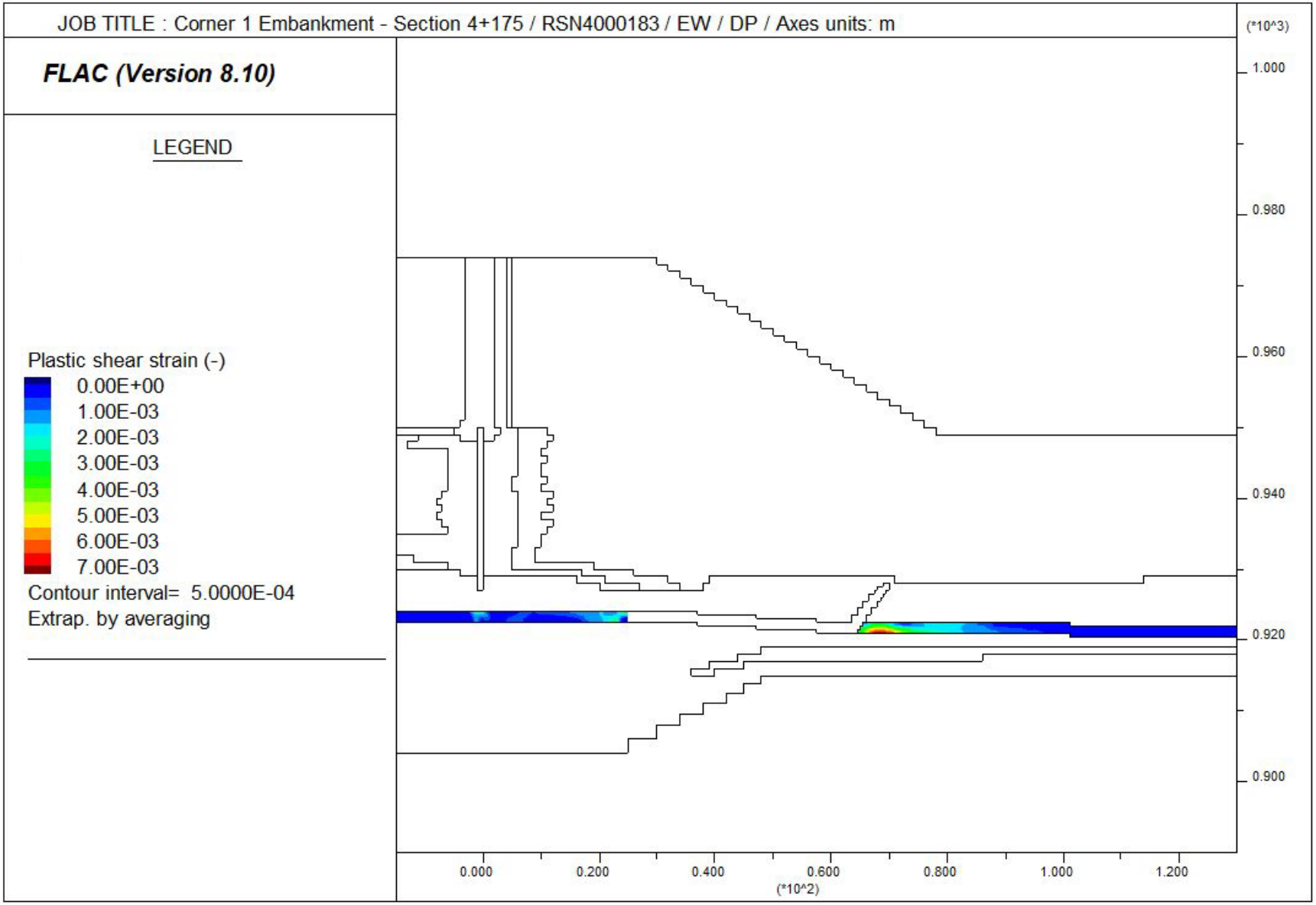
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / DP / Axes units: m
FLAC (Version 8.10)
LEGEND
Plastic shear strain (-)
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
6.00E-03
7.00E-03
Contour interval= 5.0000E-04
Extrap. by averaging
(*10^3)
1.000
0.980
0.960
0.940
0.920
0.900
0.000
0.200
0.400
0.600
0.800
1.000
1.200
(*10^2)

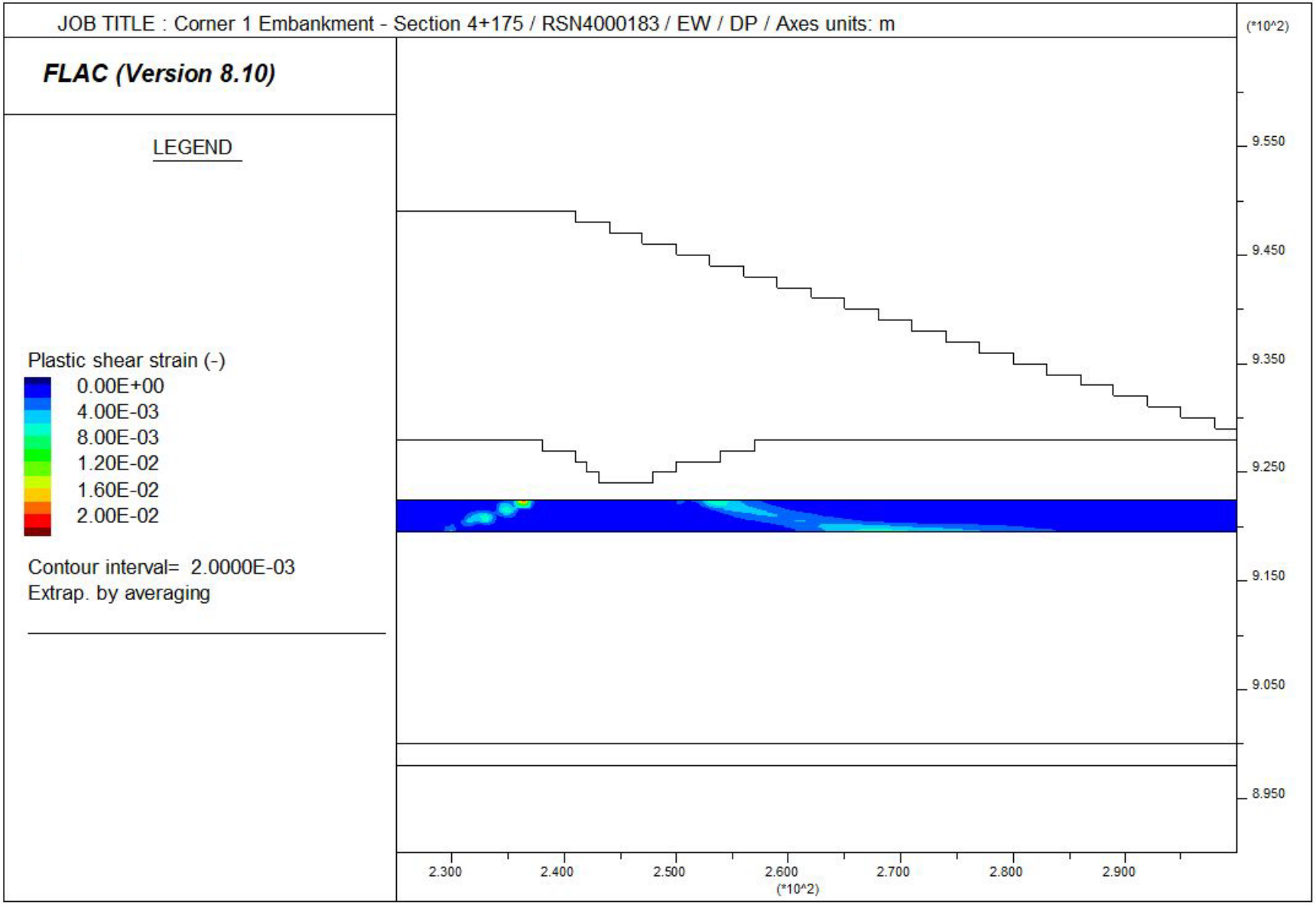
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / DP / Axes units: m
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8.00E-03
1.20E-02
1.60E-02
2.00E-02
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Extrap. by averaging
(*10^2)
9.550
9.450
9.350
9.250
9.150
9.050
8.950
2.300
2.400
2.500
2.600
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2.800
2.900
(*10^2)

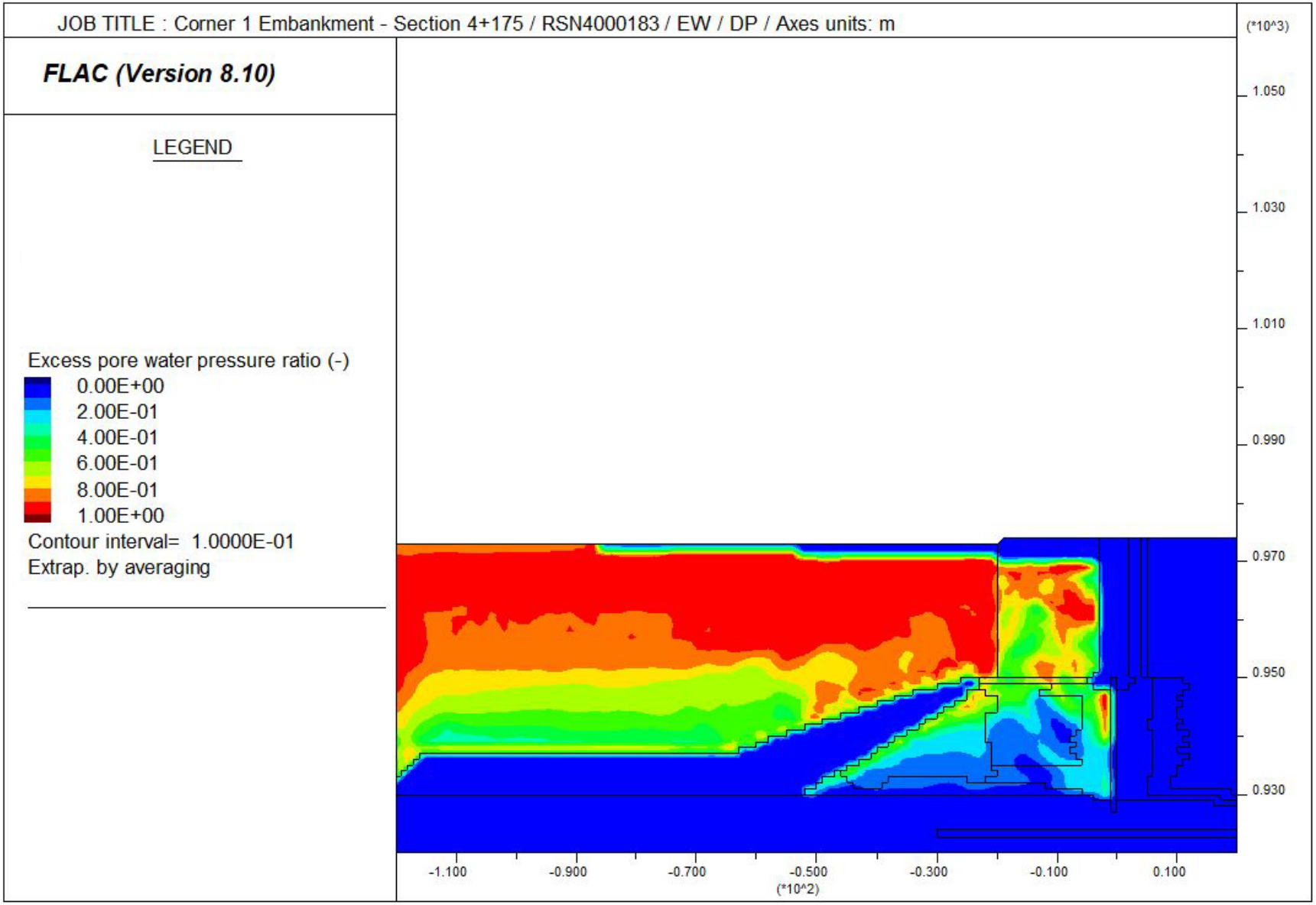
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6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
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1.030
1.010
0.990
0.970
0.950
0.930
-1.100
-0.900
-0.700
-0.500
-0.300
-0.100
0.100
(*10^2)

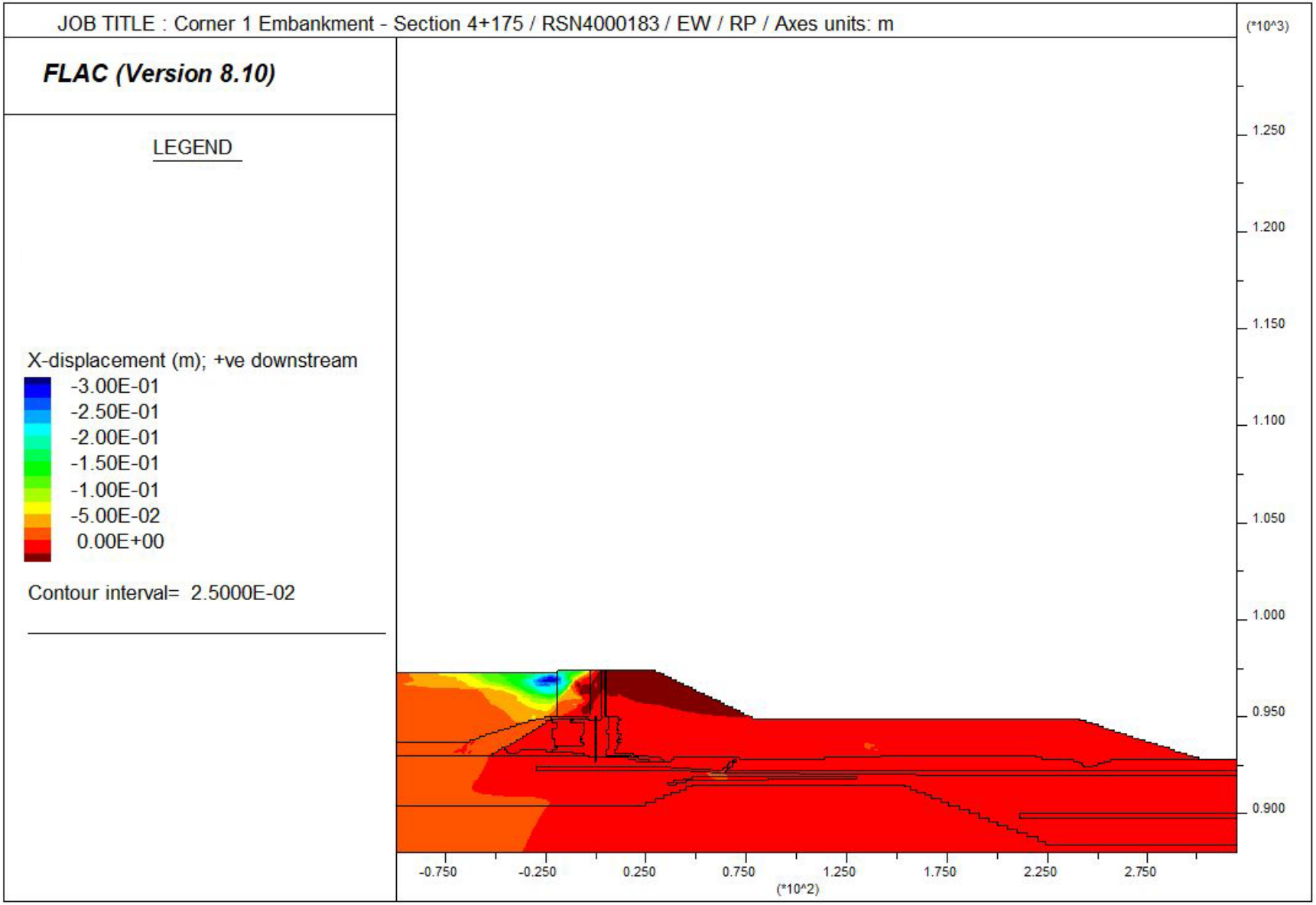
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FLAC (Version 8.10)
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-2.50E-01
-2.00E-01
-1.50E-01
-1.00E-01
-5.00E-02
0.00E+00
Contour interval= 2.5000E-02
(*10^3)
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1.200
1.150
1.100
1.050
1.000
0.950
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-0.250
0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

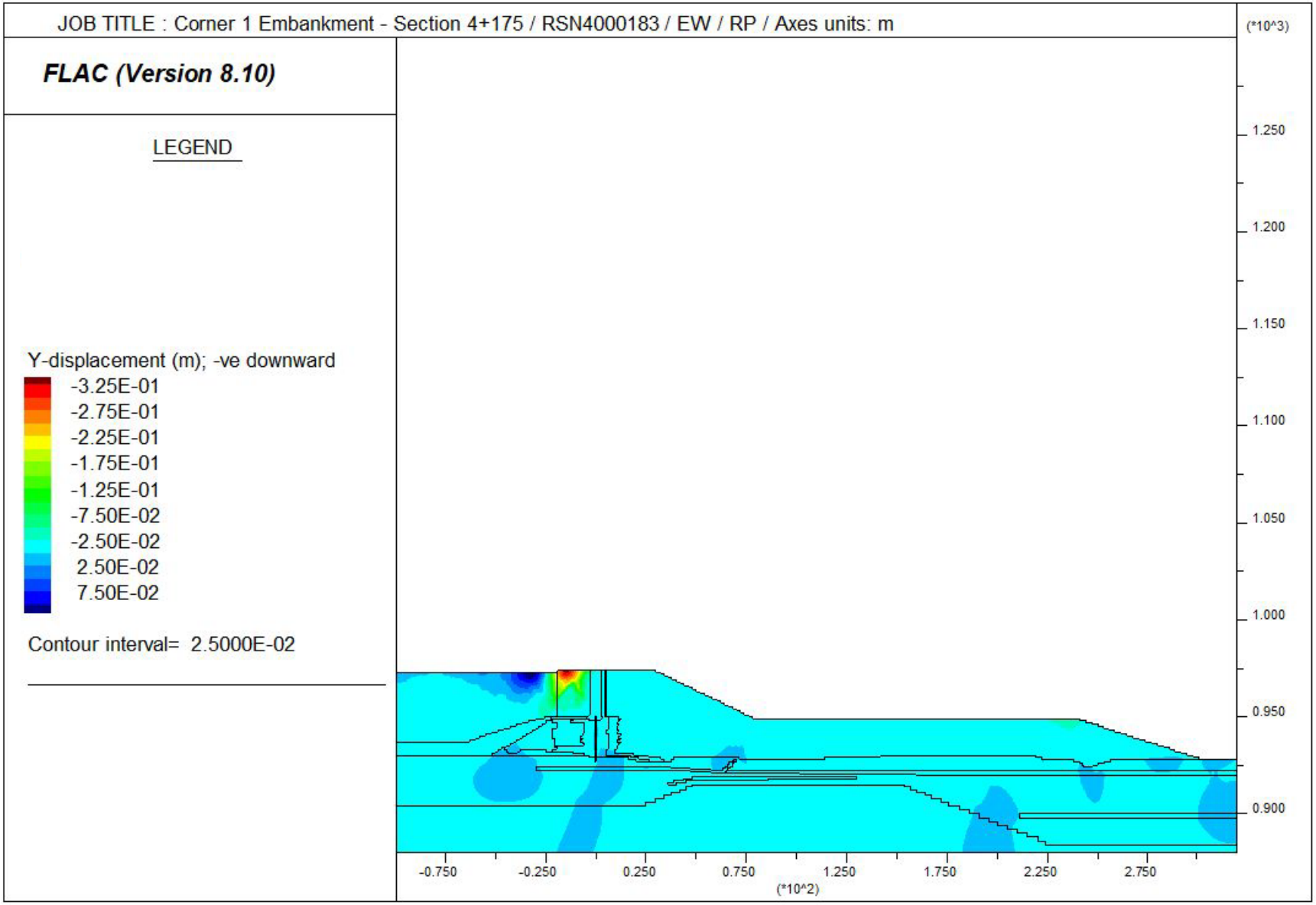
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Y-displacement (m); -ve downward
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-2.25E-01
-1.75E-01
-1.25E-01
-7.50E-02
-2.50E-02
2.50E-02
7.50E-02
Contour interval= 2.5000E-02
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
-0.750
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0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

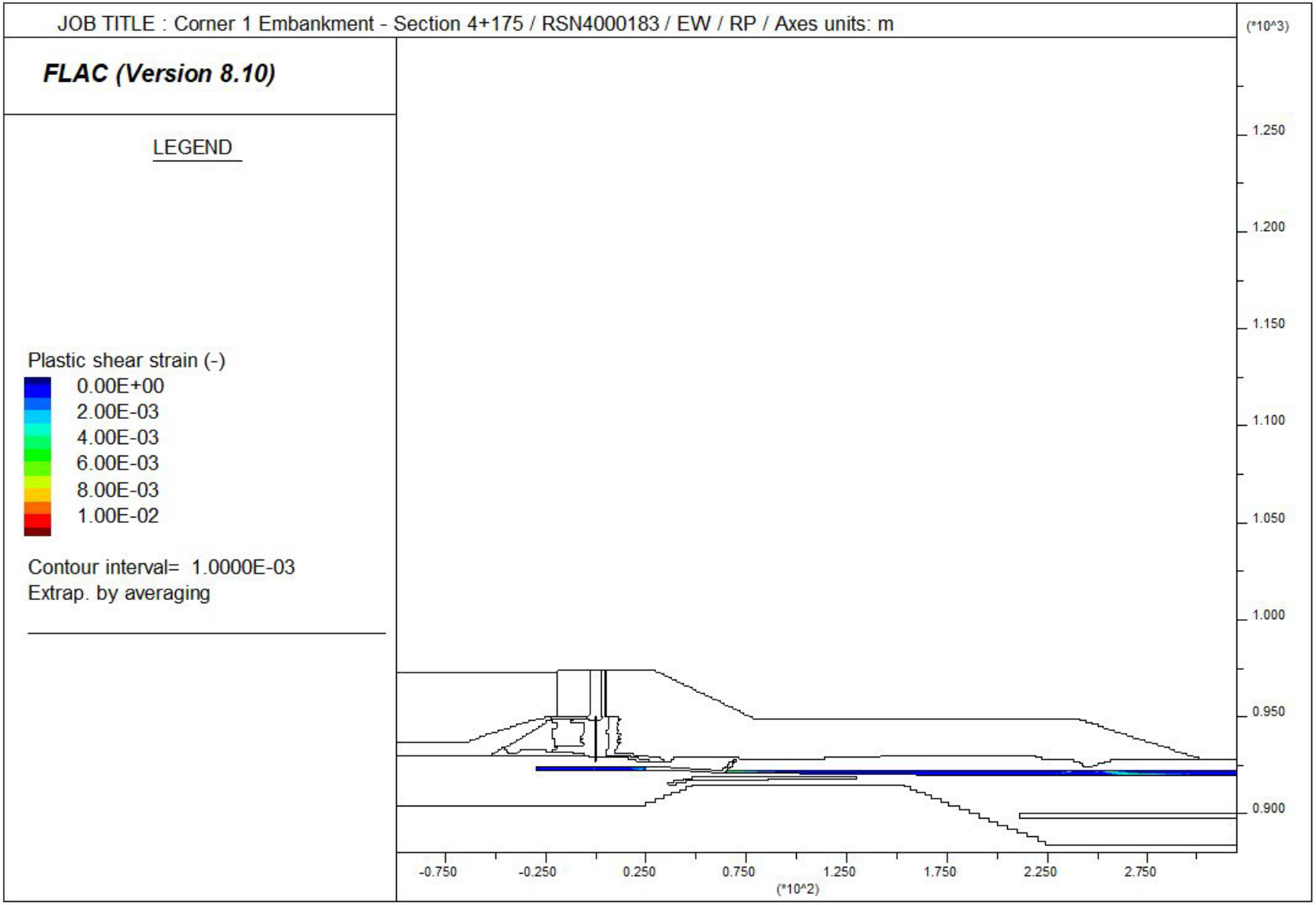
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Plastic shear strain (-)
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2.00E-03
4.00E-03
6.00E-03
8.00E-03
1.00E-02
Contour interval= 1.0000E-03
Extrap. by averaging
(*10^3)
1.250
1.200
1.150
1.100
1.050
1.000
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0.900
-0.750
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0.250
0.750
1.250
1.750
2.250
2.750
(*10^2)

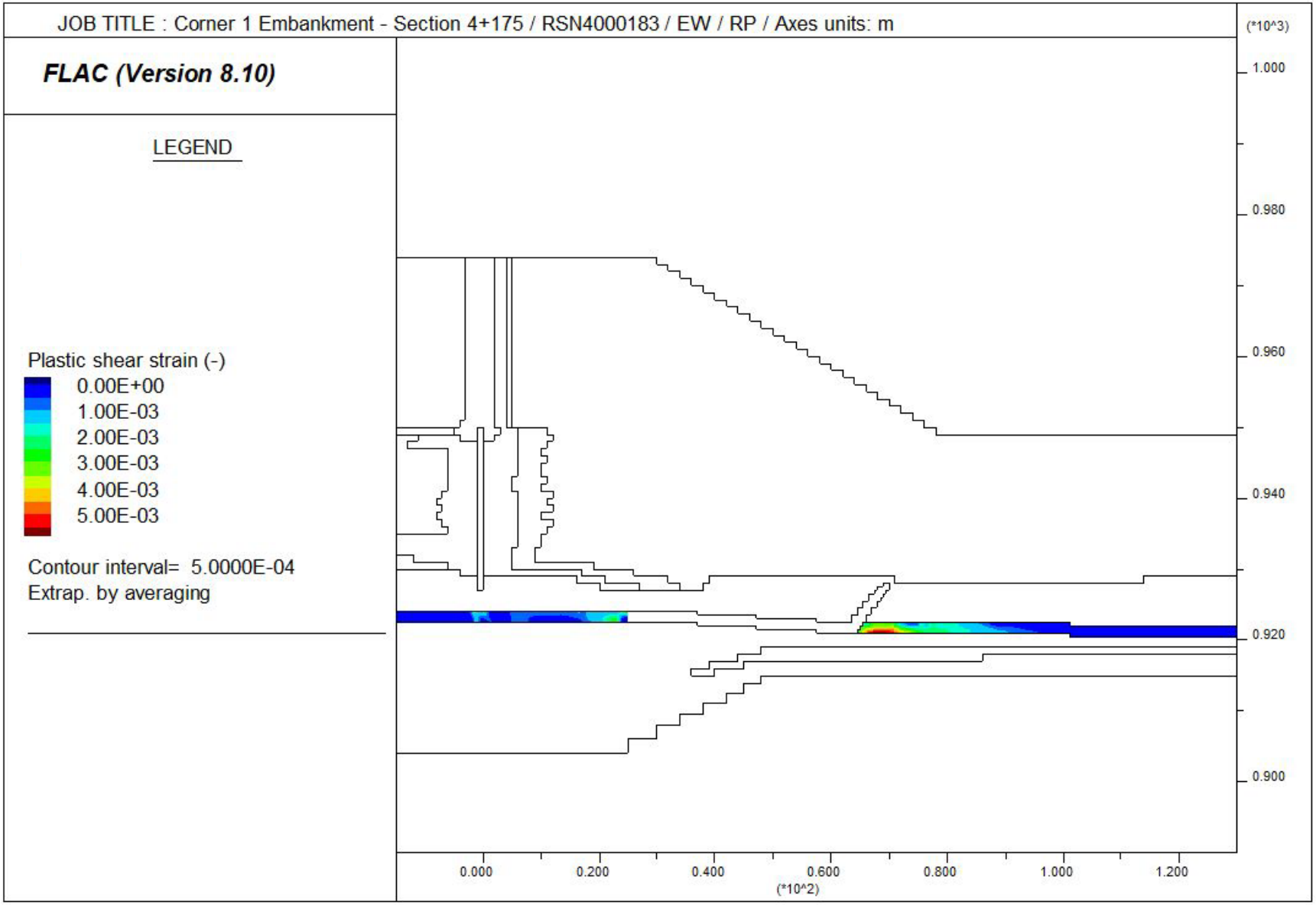
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2.00E-03
3.00E-03
4.00E-03
5.00E-03
Contour interval= 5.0000E-04
Extrap. by averaging
(*10^3)
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0.940
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0.900
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0.400
0.600
0.800
1.000
1.200
(*10^2)

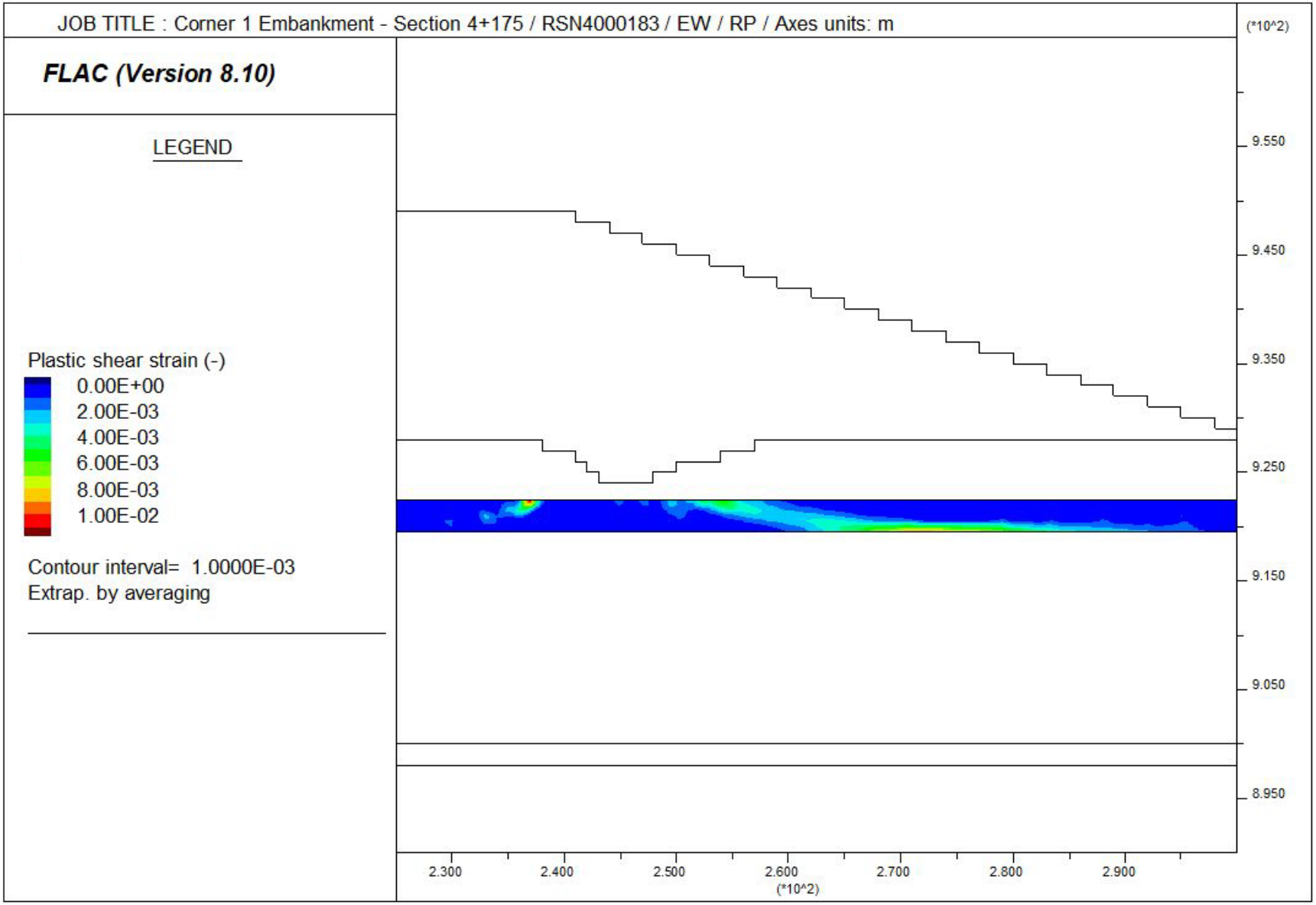
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
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Plastic shear strain (-)
0.00E+00
2.00E-03
4.00E-03
6.00E-03
8.00E-03
1.00E-02
Contour interval= 1.0000E-03
Extrap. by averaging
(*10^2)
9.550
9.450
9.350
9.250
9.150
9.050
8.950
2.300
2.400
2.500
2.600
2.700
2.800
2.900
(*10^2)

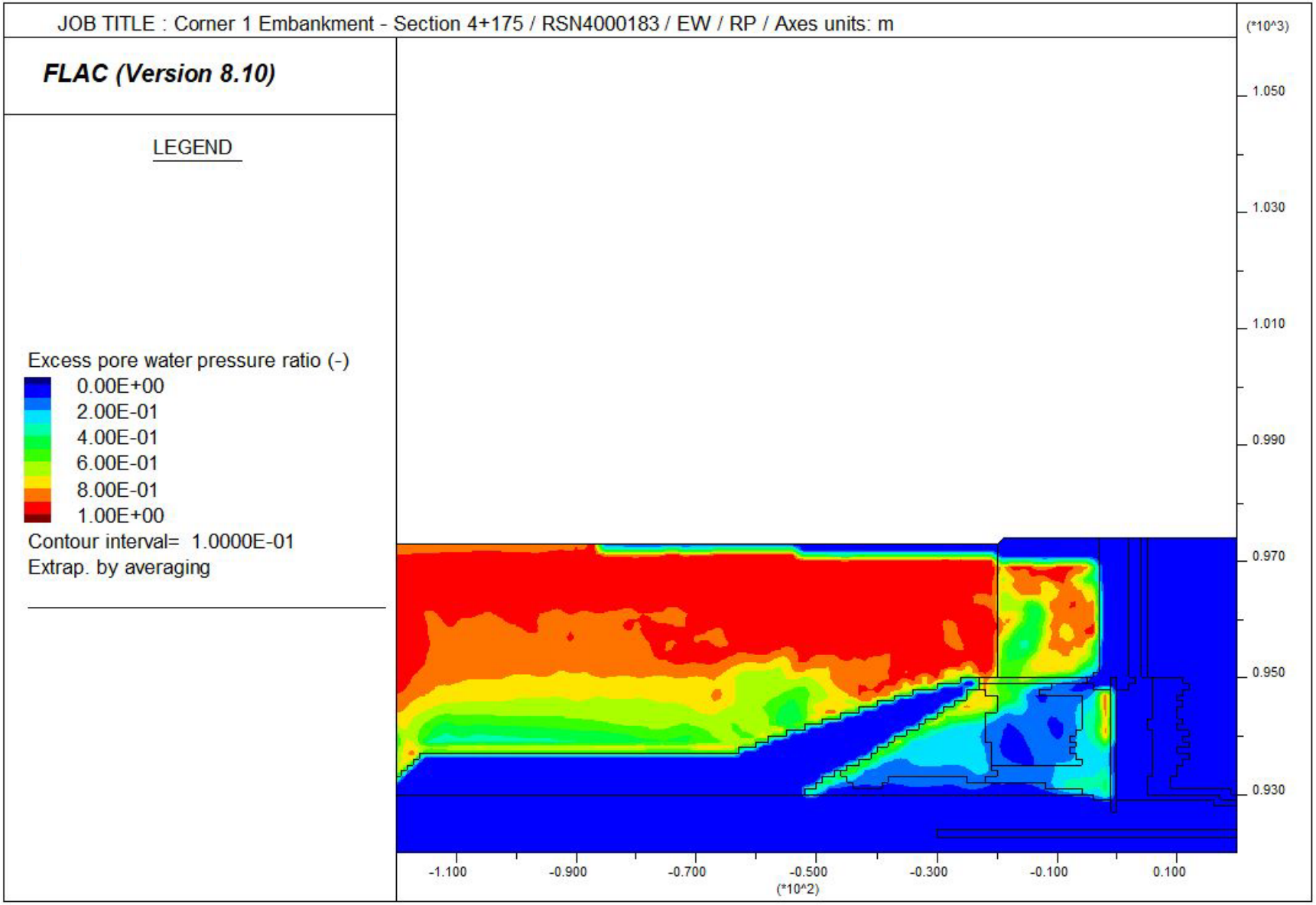
JOB TITLE : Corner 1 Embankment - Section 4+175 / RSN4000183 / EW / RP / Axes units: m
FLAC (Version 8.10)
LEGEND
Excess pore water pressure ratio (-)
0.00E+00
2.00E-01
4.00E-01
6.00E-01
8.00E-01
1.00E+00
Contour interval= 1.0000E-01
Extrap. by averaging
(*10^3)
1.050
1.030
1.010
0.990
0.970
0.950
0.930
-1.100
-0.900
-0.700
-0.500
-0.300
-0.100
0.100
(*10^2)

APPENDIX I

Water Management Design

TECHNICAL MEMORANDUM

DATE April 9, 2024 **Reference No.** CA0020527.4505-015-TM-Rev0-31151

TO Matt O'Leary
Mount Polley Mining Corporation

CC Lee Nikl, Jesse Maddaloni, Germán Pizarro and Andrew McIntosh

FROM Daniel Mullen, Nasim Hossein, and Don Kidd **EMAIL daniel.mullen@wsp.com; nasim.hosseini@wsp.com; donald.kidd@wsp.com**

TAILINGS STORAGE FACILITY RAISE TO ELEVATION 974 M DESIGN – FREEBOARD AND WATER LEVEL ANALYSIS – MOUNT POLLEY MINE

1.0 INTRODUCTION

Mount Polley Mine is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The mine is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The total surface area of the site is 17.8 square kilometres (km^2). The tailings storage facility (TSF) is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length.

This technical memorandum has been prepared by WSP Canada Inc. (WSP) to provide the hydrologic input for the design of the TSF spillway to support raising the existing TSF from its currently permitted elevation of 970 m to 974 m. The purpose of this technical memorandum is as follows:

- Assess a minimum freeboard that needs to be maintained at all times to prevent overtopping of the TSF by wave action.
- An emergency spillway (spillway) design that will maintain the required minimum freeboard during the design event.
- Estimate inflow volumes generated by the design events.
- Determine the water level at which pumping of site water to the TSF must cease.

2.0 BACKGROUND

During normal operations, the TSF will be managed by maintaining the pond volume within the operating range for reclaim water and make-up water. Deposition of tailings will be planned to maintain the pond away from the embankment and against the natural ground on the western perimeter.

The inflows that directly contribute to the TSF are from precipitation on the direct footprint of the TSF and runoff from the catchment directly above the TSF. The major contribution to TSF supernatant volume is site contact water pumped from facilities including the Central Collection Sump and Perimeter Embankment Till Borrow Pond.

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on site year over year within the TSF by treating and discharging water.

A site-wide water balance model has been developed (WSP 2023b) to support water management planning and to predict water volume/level in the TSF throughout future operations. The water balance model shows that the maximum TSF pond volume during the operational phase remains within the normal operating range during average conditions (50th percentile) and increases to approximately 3.5 million m^3, which represents the 99.5th percentile volume.

A spillway will be included in the design of the TSF Raise to Elevation 974 m as an emergency control measure to prevent potential overtopping of the facility.

3.0 DESIGN CRITERIA AND INPUTS

The design criteria for the TSF spillway during operation are described in the technical design basis memorandum document for TSF Raise to Elevation 974 m (WSP 2023a); inputs to the TSF freeboard and water level assessment are summarized in Table 1.

Table 1: Tailings Storage Facility Freeboard and Water Level Assessment Spillway Design Inputs Summary

Item No.	Item Description	Design Basis	Reference/Rationale
Background			
1	Horizontal and vertical datum	Horizontal datum is UTM Zone 10 NAD83 CSRS and vertical datum is relative to local tailings grid.	2023 LiDAR contours with 0.1 m resolution provided by MPMC (Fullerton 2024)
Climate and Hydrology			
2	24-hour 1:200-year precipitation depth	69 mm	Section 3.3
3	72-hour probable maximum precipitation (PMP)	339 mm	Section 3.3
4	24-hour snowmelt depth component of the environmental design flood (EDF)	16 mm	24-hour snowmelt using 24-hour 1:200-year precipitation and mean April temperature Section 3.4
5	72-hour snowmelt depth component of the inflow design flood (IDF)	54 mm	72-hour snowmelt using 72-hour PMP and mean April temperature Section 3.4

Table 1: Tailings Storage Facility Freeboard and Water Level Assessment Spillway Design Inputs Summary

Item No.	Item Description	Design Basis	Reference/Rationale
6	Snowmelt distribution	Evenly distributed over 12 hours centred on the storm peak intensity for each day	Adopted

No. = number; TSF = tailings storage facility; MPMC = Mount Polley Mining Corporation; IDF = inflow design flood; PMP = probable maximum precipitation; EDF = environmental design flood; UTM = Universal Transverse Mercator; NAD83 = North American Datum of 1983; CSRS = Canadian Spatial Reference System.

3.1 Tailings Storage Facility Storage Curve

The TSF storage curve applied in the analysis was generated from a tailings deposition model with a dam crest height of 974 m and tailings freeboard (defined as the height between the crest of the TSF and the maximum elevation of tailings) of 0.9 m and by considering a 0.5% sub-aerial and 2% sub-aqueous tailings beach slope (Figure 1) (WSP 2024).

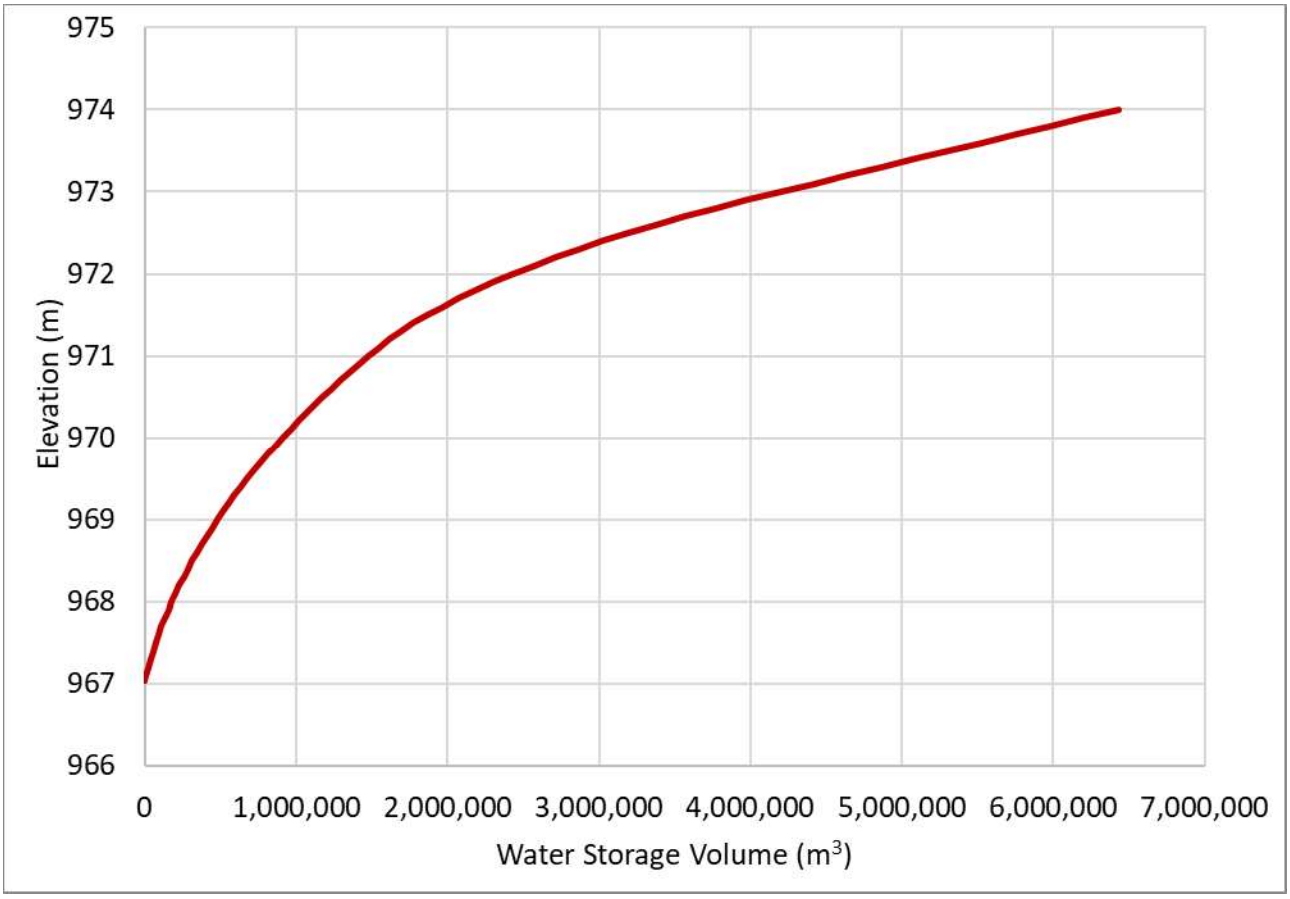

m = metre; m^3 = cubic metre.

Figure 1: Tailings Storage Facility Stage Storage Curve

3.2 Catchment Characteristics

Catchment areas directly contributing to the TSF are provided in Table 2. This catchment delineation is the basis for the TSF spillway design. The water inflows to the TSF that are not pumped and therefore not in the direct control of the operator are as follows:

- precipitation on the direct footprint of the TSF
- runoff from the catchment directly above the TSF (TSF upstream catchment B and C)
- potential runoff from the upstream catchment (catchment A); depending on the updates to the tailings pipeline ditch

Table 2: Tailings Storage Facility Catchment Areas

Catchment	Watershed Area (km^2)
TSF upstream contact A[(a)]	0.43
TSF upstream contact B	0.24
TSF upstream contact C[(b)]	0.52
TSF	2.38

(a) The catchment area is to be refined per update to the tailings pipeline ditch.
(b) Potentially diverted via a diversion channel.
TSF = tailings storage facility; km^2 = square kilometres.

Each catchment was assigned a US Department of Agriculture (USDA) Soil Conservation Service (SCS) curve number (USDA 2009) value (Table 3) based on the land type to predict direct runoff. The wet antecedent moisture condition III was considered in the modelling.

The time of concentration was estimated using the SCS TR-55 method (USDA 2009), which divides the longest flow path into sheet flow, shallow concentrated flow, and open channel flow, and considers a minimum time of concentration of 6 minutes. The lag time was estimated as 60% of the time of concentration. Catchment areas and corresponding lag time values are provided in Table 3.

Table 3: Summary of Catchment Area Parameters

Catchment Area	Lag Time (min)	CN Value (AMC III)	Description
TSF direct	3.6[(a)]	95	TSF area
TSF upstream contact A	14.5	78	undisturbed area and disturbed area with some compacted haul road portions draining directly to TSF
TSF upstream contact B	8.6		
TSF upstream contact C	12	74	undisturbed area with some disturbed portions draining to TSF

(a) A minimum time of concentration of 6 minutes.
TSF = tailings storage facility; CN = curve number; AMC = antecedent moisture condition; min = minute.

3.3 Extreme Precipitation Events

Precipitation depths used to estimate inflows to the TSF for various return periods are presented in Table 4 and the 24-, 48-, and 72-hour probable maximum precipitation (PMP) depths are presented in Table 5.

Table 4: 24-hour Precipitation Depths for Mount Polley Mine, 1974 to 2021

Return Period (year)	24-hour Rainfall Depth (mm)[(a)]
2	33
10	47
25	54
100	64
200	69
1,000	80

(a) Log Pearson III distribution (WSP 2022).

Table 5: Probable Maximum Precipitation Depths

Duration	Depth (mm)[(b)]
24-hour	224[(a)]
48-hour	278
72-hour	339[(a)]

(a) Source: WSP 2022.
(b) Values rounded to the nearest mm.

3.4 Snowmelt

The snowmelt was determined using an energy balance method based on net longwave radiation, net shortwave radiation, and sensible and latent heat fluxes (Dunne and Leopold 1978), noting that the snowmelt is assumed to occur under cloudy skies. Consistent with runoff patterns observed on site during freshet, the snowmelt is expected to occur between March and May with a relatively greater proportion of melting happening in April.

The method is set out in Equation 1:

$$M_{R-t} = 1.42T_a + 2.5 + \frac{R_t T_a C_W}{L} + 0.0059 T_a u_2 \quad \textbf{(Equation 1)}$$

where:

M_{R-t} = snowmelt in mm/day snow water equivalent for return period event duration t
R_t = rainfall depth in mm for return period event duration t, averaged over the duration of the storm
T_a = average air temperature over the return period event duration in °C
C_W = specific heat of water (equal to 1 calorie per gram per Celsius [cal/g/°C])
L = latent heat of fusion of ice equal to 80 cal/g
u_2 = wind speed in km/d

The input parameter values for Equation 1 are summarized in Table 6 and the estimated snowmelt depths are summarized in Table 7.

Table 6: Snowmelt Parameter Input Values

Parameter	Value	Rationale
R_t	See Table 4 and Table 5	Snowmelt generated by rainfall events
T_a	3.7°C	Average April air temperature (assumed snowmelt period); Climate Baseline Update (WSP 2022)
u_2	225 km/day (2.6 m/s)	Average April wind speed; tailings storage facility inflow design flood technical memorandum (Golder 2017)
C_W	1 cal/g/°C	Assumed
L	80 cal/g	Assumed

T_a = average air temperature over the return period event duration in °C; u_2 = wind speed in km/d; C_w = specific heat of water; L = latent heat of fusion of ice; cal/g/°C = calorie per gram per Celsius; cal/g = calorie per gram.

Table 7: Snowmelt Depth

Duration	Depth (mm)
24-hour 1:200-year	16
24-hour PMP	23
48-hour PMP	38
72-hour PMP	54

PMP = probable maximum precipitation; mm = millimetre.

3.5 Freeboard

The freeboard for a water-retaining structure can be defined as the minimum vertical distance between the still pool reservoir level and the crest of the retaining structure (CDA 2013, 2019). This distance needs to be maintained at all times to prevent overtopping of the containing structure by waves resulting from wind and wave set-up and run-up. The Canadian Dam Association provides the following definitions to calculate the freeboard (CDA 2013):

- *Normal freeboard* is the difference in elevation between the dam crest and the maximum operating water level of the facility. The normal freeboard is required to protect the structure from overtopping by 95% of waves caused by wind with an annual exceedance probability of 1:1,000-year event with the reservoir at maximum normal elevation.
- *Minimum freeboard* is the difference in elevation between the dam crest and the maximum water level that would result from the peak design inflow. The minimum freeboard is required to protect the structure from overtopping by 95% of waves caused by the most critical wind when the reservoir is at its maximum level during the inflow design flood (IDF). The wind for the significant consequence dam has an annual exceedance probability of a 1:10-year event.

The freeboard calculations follow the procedures and equations discussed in CDA (2013, 2019). Wind speeds, pond depth, and dam slope geometry were considered to determine the greatest wave uprush value for the normal and minimum freeboard scenarios.

Hourly wind speed and direction data for the study site are only available from 1997 to 2003, and daily wind speed data are available from 2019 to 2021. Thus, hourly data from the Environment and Climate Change Canada Williams Lake A climate station from 1961 through 2023 (ECCC 2023) were used as the basis for the frequency analysis to estimate extreme hourly wind speed for an annual exceedance probability ranging from 1:2 to 1:1,000-year. The results are provided in Table 8. No directional component was considered in this study and the wind was assumed to follow the longest fetch length of the TSF for conservatism.

Table 8: Hourly Maximum Wind Speed at the Williams Lake Station A

Annual Exceedance Probability (years)	Maximum Hourly Wind Speed (m/s)
2	23.0
10	26.3
20	27.3
50	28.6
100	29.5
200	30.3
500	31.4
1,000	32.1

m/s = metre per second.

Wave run-up was calculated using the random wave run-up height on gentle slope method by Mase (1989). A contingency of 0.3 m was selected to account for uncertainty due to settlement, crest irregularities, and construction tolerances for crest and spillway invert elevation (ANCOLD 2012). The freeboard calculation inputs and the corresponding normal and minimum freeboard are shown in Table 9. The minimum freeboard of 0.7 m is recommended when passing the IDF through the spillway.

Table 9: Tailings Storage Facility Required Freeboard Values

Description	Unit	Minimum	Normal
Design wind speed	m/s	26 (1:10-year)	32 (1:1,000-year)
Dam crest elevation	m	974	974
Maximum water elevation at IDF	m	973.3	973.3
Fetch length	km	2.0	2.0
Average water depth	m	2.3-3.8	2.3-3.8
Beach Slope	m/m	0.01[(a)]	0.01[(a)]
Wave height	m	0.76	0.97
Wind setup	m	0.08	0.11
Wave run-up[(b)]	m	0.31	0.39
Wave uprush (setup and run-up)	m	0.4	0.5
Contingency	m	0.3	0.3
Freeboard (wave uprush plus contingency)	m	0.7	0.8

(a) The beach slope is less than the minimum slope recommended by Mase (1989). The lowest recommended slope of 1/30 was used in the wave run-up estimation.

(b) Calculated using the method by Mase (1989).

IDF = inflow design flood; m = metre; m/s = metre per second; m/m = metre per metre; km = kilometre.

4.0 HYDROLOGIC AND HYDRAULIC MODELLING

4.1 Inflow Design Flood

Based on the *Health, Safety and Reclamation Code for Mines in British Columbia* (BCMEM 2022; EMLI 2022), the TSF is ranked as a significant consequence of failure facility (CDA 2013 and WSP 2023a). For a significant consequence dam, BCMEM (2022) recommends an IDF with an annual exceedance probability of one third of the way between the 1:975-year event and the probable maximum flood (PMF). For conservatism and consistency with WSP's best practice, the IDF for the TSF was selected as the PMF. The PMF for the TSF was estimated using the 72-hour PMP event plus snowmelt (snowmelt calculated using mean April temperature and the PMP rainfall). The 72-hour annual PMP of 339 mm was chosen over the spring PMP of 272 mm (WSP 2023a) to be conservative due to the inherent uncertainty in estimating the PMF. Rainfall, snowmelt depths used to estimate inflows to the TSF for the IDF event are presented in Table 10.

The rainfall depth component of the IDF was distributed using the USDA SCS Type II method for a three-day period, with a 24-hour distribution applied for each day.

The 72-hour PMP rainfall was distributed for each day of the event as follows:

a) **Day 1**—The 24-hour PMP was used.

b) **Day 2**—The rainfall depth was calculated as the difference between the 24-hour PMP and 48-hour PMP.

c) **Day 3**—The rainfall depth was calculated as the difference between the 48-hour PMP and 72-hour PMP.

The snowmelt depth component of the IDF was distributed evenly over a 12-hour period each day centred on the peak rainfall intensity of the rainfall events. Similar to the rainfall distribution for day two and day three of the events (i.e., 48-hour and 72-hour events), the snowmelt for each 12-hour period was equal to the incremental snowmelt depth from 24-hour and 48-hour snowmelt, and 48-hour and 72-hour snowmelt.

Table 10: Summary of Inflow Design Flood Parameters

Duration	Mean April Temperature (°C)	Depth[(b)] (mm)		
		PMP Rainfall	Total Snowmelt	Total Rainfall Plus Snowmelt
24-hour	3.7	224[(a)]	23	247
48-hour		278	38	316
72-hour		339[(a)]	54	393

(a) Source: WSP 2022.

(b) Values rounded to the nearest millimetre.

PMP = probable maximum precipitation; °C = degrees Celsius; mm = millimetre.

4.2 Environmental Design Flood

The environmental design flood (EDF) is the most severe flood that is to be managed without release of untreated water to the environment and is necessary in situations where water must be retained with no discharge to the environment or with controlled discharge through a treatment system (CDA 2019). According to CDA (2019), the selection of return period and duration of the EDF depends on factors such as the water quality that is being stored and could be released, regulatory requirements, frequency of overflow events, the rate and duration of the overflows, the environmental sensitivity of the receiving environment, downstream flow in the receiver, downstream mixing characteristics, and public perception on the matter. The following factors have been considered in the selection of EDF:

- The site-wide water balance model demonstrates that the TSF has sufficient capacity to retain the site runoff volumes during the 99.5th percentile storm event (WSP 2023b).
- Under normal conditions, the history of toxicity testing of the TSF supernatant has demonstrated that it is non-toxic.
- The water quality model predictions report (WSP 2023c) demonstrated that the measured concentrations at the TSF supernatant pond are generally below permit limits, with the exceptions for total copper and total phosphorous, total arsenic, total zinc, and dissolved aluminum. The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility (Golder 2022), which has since been decommissioned. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process. Water quality is anticipated to undergo greater dilution during a freshet due to increased flows, which naturally dilute substances in the water. Under non-flood conditions, TSF supernatant is collected and treated.
- Snowpack is regularly monitored on site to predict water flow patterns resulting from snowmelt and to effectively manage reservoir storage.
- The immediate mixing would primarily take place within Bootjack Creek, with expected limitations on dilution. During flood events, it is common for fish to be displaced downstream, reducing their exposure to undiluted runoff.
- MPMC is required to contain and treat up to a 1-in-10-year storm flow (EMA Permit 11678).

Based on these factors, the EDF for the TSF was estimated using the 24-hour 1-in-200-year rainfall plus snowmelt. Rainfall and snowmelt depths used to estimate inflows to the TSF for the EDF event are presented in Table 11.

Table 11: Summary of Environmental Design Flood Estimation

Duration	Mean April Temperature (°C)	Depth[b] (mm)		
		1:200-year Rainfall	Total Snowmelt	Total Rainfall Plus Snowmelt
24-hour	3.7	69[a]	16	85

(a) Source: WSP 2022.

(b) Values rounded to the nearest millimetre.

°C = degrees Celsius; mm = millimetre.

4.3 Methodology

A hydrologic model was developed using United States Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) Model Version 4.11 (USACE 2023) to estimate inflow volumes to the TSF during the EDF and IDF events and peak flows over the proposed spillway channel during the IDF event. Inputs to the HEC-HMS model are discussed in Section 3.0 and the IDF parameters are discussed in Section 4.1.

The spillway inlet was modelled in the HEC-HMS model using the broad-crested weir equation (Brater and King 1976) to define the capacity of the weir. The spillway inlet structure will be trapezoidal with 7H:1V side slopes to allow a trafficable surface. For the trapezoidal channel composed of both triangular and rectangular sections, the discharge coefficient was determined by considering the combined effect of these two geometries on the flow characteristics of the channel. Rectangular weir coefficients of 1.4-1. and triangular weir coefficients of 1.0-1.3 were adopted depending on the hydraulic configuration of the spillway channel and crest (Smith 1995).

Design Storage Volume and Elevations

The TSF will be managed by maintaining the pond volume within the operating range for reclaim water and make-up water. The normal operating water volume of the TSF pond has been set as a range of 1.5 to 1.7 million m^3.

For operation, a trigger level to cease pumping of site water to the TSF is introduced. The trigger water level is set at 0.2 m below the spillway invert to allow time for operations to stop pumping water into the TSF in preparation for potential passage of the IDF through the spillway.

The spillway invert elevation for the TSF was determined through an iterative process using the HEC-HMS model to estimate the required minimum freeboard between the water surface passing through the spillway during the IDF and the dam crest. For modelling purposes, it was conservatively assumed that the water level within the TSF is at the invert elevation of the spillway at the beginning of the IDF event. The invert elevation of the spillway was set at elevation 972.9 m to provide the required minimum freeboard of 0.7 m (Section 3.5). The spillway was designed to convey peak discharge from the TSF during the IDF event while maintaining the required freeboard. The spillway invert was designed with a base width of 6 m with a slope of 0.3% across the dam crest.

As previously discussed, the TSF will temporarily retain site runoff volumes that can be generated during freshet and storm events. The site-wide water balance model demonstrates that the TSF has sufficient capacity to retain the site runoff volumes during the 99.5th percentile storm event (3.5 million m^3; WSP 2023b), with the EDF inflow volumes fitting comfortably within that range.

The water level and inflow volume model results for the TSF are provided in Table 12.

Table 12: Tailings Storage Facility with Spillway Water Level and Inflow Volume Results for Dam Crest Elevation 974 m

Parameters	Values
Dam crest elevation (m)	974.0
IDF inflow volume (million m^3)	1.3
Spillway invert elevation (m)	972.9
Maximum water level over spillway (during passage of IDF) (m)	973.3
Environmental design flood (million m^3)	0.2
Trigger water level to stop pumping site water to the TSF (m)	972.7

Table 12: Tailings Storage Facility with Spillway Water Level and Inflow Volume Results for Dam Crest Elevation 974 m

Parameters	Values
Normal operational pond volume range (million m^3)	1.5-1.7

IDF = inflow design flood; TSF = tailings storage facility; m = metre; m^3 = cubic metre.

The required elevation of the spillway invert will depend on the actual constructed embankment elevation. The emergency spillway design elevations relative to the dam crest elevation are provided in Table 13. The TSF storage curve applied in the analysis was deemed representative of the TSF storage curve for dam crest elevations between 970 and 974 m.

Table 13: Emergency Spillway Design Elevations

Description	Depth Below Dam Crest (m)
Trigger water level to stop pumping site water to the TSF	1.3 m
Spillway invert elevation	1.1 m
Maximum water level over spillway (during passage of IDF)	0.7 m

TSF = tailings storage facility; IDF = inflow design flood; m = metre.

The proposed spillway dimensions and the key results from the HEC-HMS model for the spillway are provided in Table 14, and a schematic of the results is provided in Figure 2 and Figure 3.

Table 14: Summary of the Spillway Arrangement and Flood Routing Results for Inflow Design Flood

Dam Crest Elevation (m)	Spillway Invert Elevation (m)	Spillway Base Width (m)	TSF Peak Discharge During the Passage of IDF (m^3/s)	Maximum Water Level Elevation During the Passage of IDF (m)	Minimum Freeboard (m)	Resulting Normal Freeboard[(a)] (m)
974.0	972.9	6.0	2.8	973.3	0.7	>1.3

(a) The normal freeboard required is 0.8 m and presented in Section 3.5. The resulting normal freeboard is the difference in elevation between the dam crest and the maximum operating water level of the facility from the Trigger water level.

TSF = tailings storage facility; IDF = inflow design flood; m = metre; m^3/s = cubic metres per second.

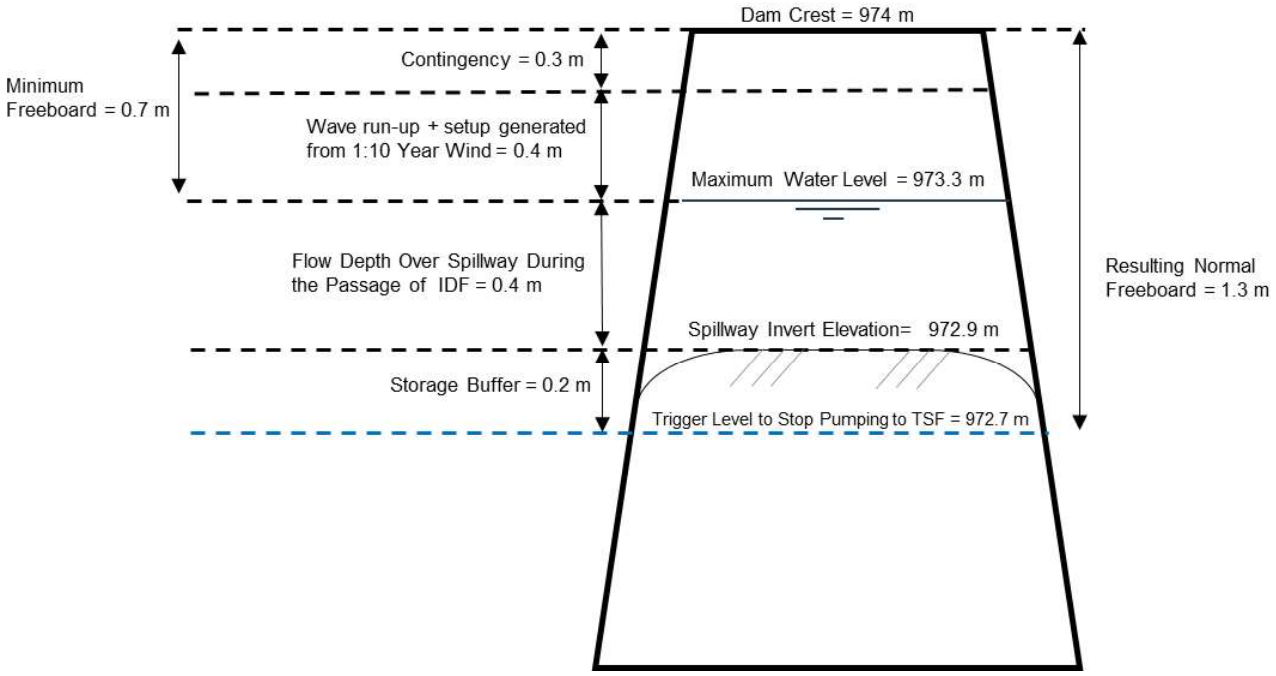

IDF = inflow design flood; TSF = tailings storage facility; m = metre.

Figure 2: Design Events in Relation to Tailings Storage Facility Embankment with Spillway

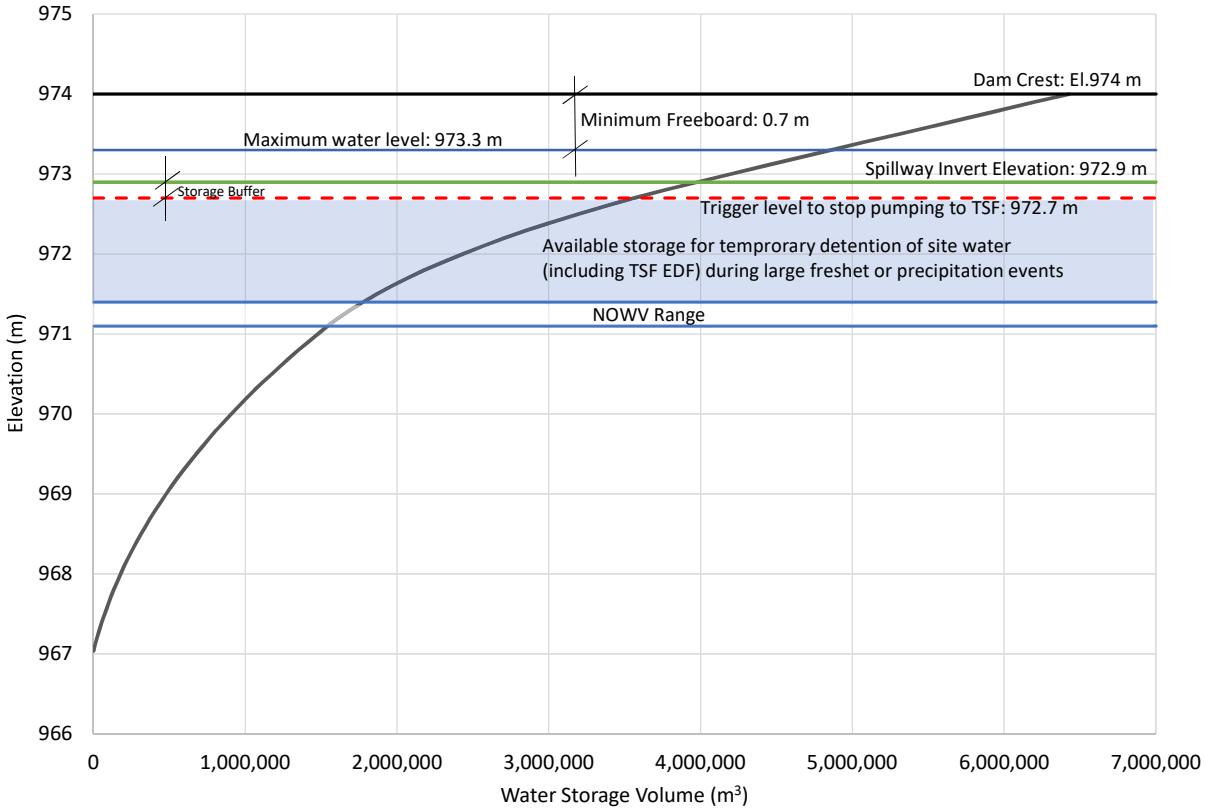

TSF = tailings storage facility; EDF = environmental design flood; NOWV = normal operating water volume; m = metre; m^3 = cubic metre.

Figure 3: Design Events in Relation to the Tailings Storage Facility Storage Curve for Crest Elevation 974 m

5.0 SUMMARY

Inflow volumes to the TSF were estimated using the United States Department of Agriculture Soil Conservation Service (SCS) method. Rainfall-runoff models were developed using the SCS method implemented with HEC-HMS software (version 4.11) (USACE 2023).

The freeboard calculations follow the procedures and equations discussed in CDA (2013, 2019). A minimum freeboard of 0.7 m was recommended while passing the IDF (Section 3.5).

The IDF for the TSF was estimated using the 72-hour PMP of 339 mm plus 54 mm snowmelt. The runoff volume generated by the IDF was 1.3 million m^3.

The spillway inlet elevation was proposed at 1.1 m below the dam crest to convey the peak discharge while providing the minimum freeboard required during the design event. The spillway invert was designed to have a base width of 6 m and 7H:1V side slopes to allow a trafficable surface with a slope of 0.3% across the dam crest.

A trigger water level was set at 0.2 m below the spillway invert to allow time for operations to stop pumping site water to the TSF.

6.0 CLOSURE

We trust that the information presented herein meets the current MPMC requirements. Please do not hesitate to contact the undersigned with any questions or concerns.

WSP Canada Inc.



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https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/015-tm-31151-tsf 974 m raise freeboard/rev0/ca0020527.4505-015-tm-rev0-31151-tsf spillway freeboard for tsf 974 m raise 09apr_24.docx

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APPENDIX J

Type I Independent Review Checklist and Signoff

MEMORANDUM

DATE April 17, 2024 **Reference No.** CA0020527.4505-033-M-Rev0-51397

TO Sophie Bainbridge; Germán Pizarro

FROM Patrick Sean Wells **EMAIL sean.wells@wsp.com**

INDEPENDENT REVIEW OF MOUNT POLLEY MINE TAILINGS STORAGE FACILITY DETAILED DESIGN TO ELEVATION 974 M

This memorandum is in response to your request for undertaking an independent review of the Mount Polley Mine Tailings Storage Facility Detailed Design to Elevation 974 m. The review is complete, with this memo containing list of documents reviewed, review limitations and assumptions, table of reviewer comments and responses, and the EGBC Type 1 Independent Review sheet signed and sealed.

Please contact me directly with any questions or concerns.

Document List for Review or Reference

The following documents were either reviewed or used as reference for the review:

Reviewed Documents

- WSP. 2024. Draft Tailings Storage Facility – Detailed Design to Elevation 974 m, Mount Polley Mine. Prepared for Mount Polley Mining Corporation. WSP Doc. No. CA0020527.4505-014-R-RevA-TSF Detailed Design. February 23, 2024.
- WSP 2024 Spillway CA0020527.4505-014-R-Rev0-51394-974 m TSF Detailed Design.doc – Water Management - Freeboard and Spillway Section 7.10 and Appendix I.

Reference Documents

- WSP. 2023. Draft Mount Polley Mine – Basis of Design and Design Criteria for Tailings Storage Facility Raise to Elevation 974 m. Prepared for Mount Polley Mining Corporation.
  WSP Doc. No. 23590671-067-TM-RevA-51393. November 27, 2023.
- WSP. 2023. Draft Stress-deformation analyses of the elevation 974 m Tailings Storage Facility at Mount Polley Mine. Prepared for Mount Polley Mining Corporation.
  WSP Doc. No. CA0020527.4505-005-TM-RevA-51346. March 1, 2024.
- WSP. 2023. Tailings Storage Facility Site Characterization Report – Mount Polley Mine. Prepared for Mount Polley Mining Corporation.
  WSP Doc. No. 22514095-034-R-Rev0-51392. September 22, 2023.
- Engineers & Geoscientists British Columbia, 2023,Guide to The Standard For Documented Independent Review Of High-Risk Professional Activities Or Work, Version 2.0.

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Limitations of This Review

The primary focus of this review was on Risk and Constructability. Reviews of calculations and models are not included; however, it was confirmed that these reviews were conducted by other qualified professionals.

EGBC Review Document

Checklist And Signoff for An Independent Review of High-Risk Professional Activities or Work

RE: Mount Polley Mine Tailings Storage Facility
Detailed Design to Elevation 974 m

Mount Polley Mine
British Columbia, Canada

PROFESSIONAL OF RECORD

German Pizarro-Sala, P.Eng.

WSP Canada, Inc
840 Howe Street, Vancouver, BC

Item	Reviewed Initials	Remarks
Criteria for carrying out Professional Activities or Work	PSW	Project design basis and design criteria established and documented.
Applicable codes, standards, and other requirements (laws, regulations, design requirements, etc.)	PSW	Applicable regulations and guidelines stated and used to develop criteria and guidance for design.
Geographical and/or environmental conditions and requirements	PSW	Site geotechnical and hydrotechnical conditions are documented. Site visit carried out. Foundation site investigations were carried out, documented and results used in design. Available data on tailings reviewed, an estimated tailings lower bound strength for tailings strength was used in design as stated in the report.
Assumptions for Professional Activities or Work	PSW	Integrated with the Design Criteria, Design Basis sections.
Concept for Professional Activities or Work	PSW	This work is detailed design for construction. Concept was completed as part of previous stages of work. Report includes Siting and Technology review.
Test and analysis procedures and results	PSW	Report includes details on site investigation, material property testing, stability, and seepage analysis.
Quality control and quality analysis procedures	PSW	Quality assurance and control are included as part of the Technical Specifications document. attached as an appendix.

Item	Reviewed Initials	Remarks
Calculations or analysis of representative elements	PSW	Verification of calculation and analysis reviews were completed through 3rd party verifications of the work. Evidence that reviews of the data and modelling were provided as Review Confirmations, Stability: Stability_974 (Static, PS, and post-EQ)_06DEC2023_YJ (1).xlsx; Seepage: Regular Drain Seepage Analyses (QAQC)_16FEB2024_YJ.xlsx; Filter: Gradation Envelope Comparison_29JAN2024_ED.xlsx. This satisfies that these reviews were completed by qualified personal. I did not review the specific modelling or calculation work.
Review of representative details	PSW	Detailed review of the Design Report was completed, comments/questions/recommendations made and presented to the EoR and Deputy EoR, and responses and actions taken were appropriate.
Integration of third-party components and artifacts	PSW	Work by external parties (pipe design, hydrology) are integrated with design basis criteria and final design and analysis.
Representation of output (e.g., drawings, reports, spreadsheets, models)	PSW	Drawings and cross sections were reviewed and were clear and appropriate for use.
Hazards (current and future) identified in the Risk Assessment	PSW	Risk assessment was provided as a Failure Modes and Effects Assessment, together with a Technical Memo dated March 6, 2024, providing additional details to these failure modes. This was adequate for use.
Adequacy and implementation of mitigation measures	PSW	Mitigations within the design were appropriate to the client's risk tolerance and applicable guidance.
Concerns discussed with the Professional of Record	PSW	Concerns were discussed and resolved.
For global, repetitive, or iterative design, recommendation for intervals of Independent Review	PSW	N/A

WSP Canada Inc.

I reviewed
Sean Wells
18 Apr. 2024

INDEPENDENT REVIEWER

Patrick Sean Wells, P.Eng.
Technical Excellence and Innovation Practice Leader – Mine Waste

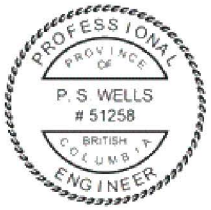

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PSW/na
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APPENDIX 1-4: TSF Site Characterization Report

REPORT

Tailings Storage Facility Site Characterization Report

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Attention: Matt O'Leary

Submitted by:

WSP Canada Inc.
840 Howe Street, Suite 1000, Vancouver, British Columbia, V6Z 2M1 Canada

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Reference No. 22514095-034-R-Rev0-51392

22 September 2023

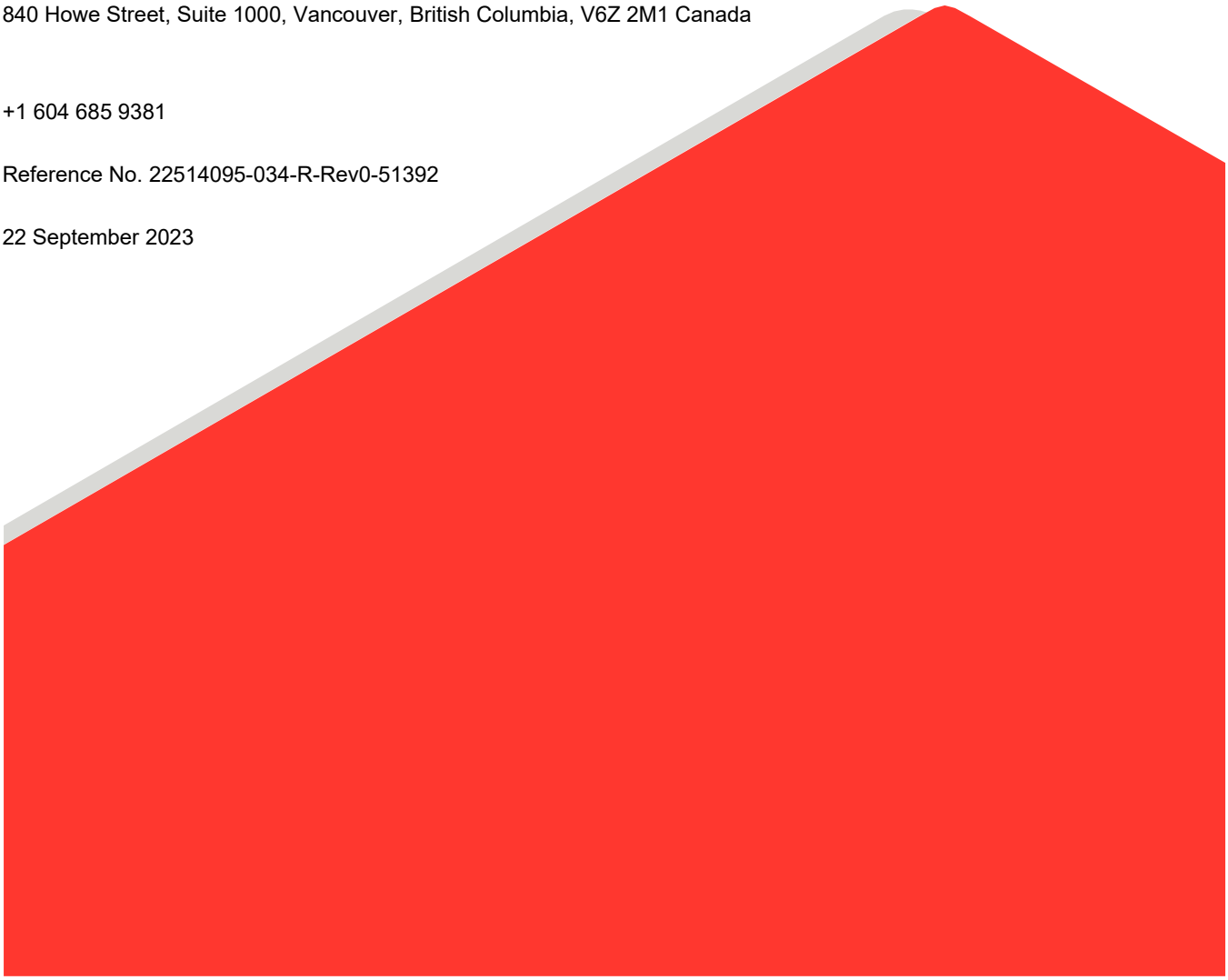

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1.0 INTRODUCTION

The Mount Polley Mine is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The mine site is located approximately 56 km northeast of Williams Lake, British Columbia, near the town of Likely. The mine is situated between Polley Lake and Bootjack Lake, and key components include open pits; waste rock dump sites; crusher, process plant, and administrative buildings; water management systems; and the tailings storage facility (TSF). The mine began production in 1997 and tailings generated at the process plant have been deposited as a low solids content slurry in the TSF located approximately 3 km southeast of the process plant.

The 23 June 2016 amendment of the *Mines Act* Permit M-200 authorized construction and operation of the TSF to elevation 970 m (Golder 2015g); however, mining operations were suspended in May 2019 when the TSF embankment crest elevation was about 968 m.

As part of the restart of mining operations, MPMC requested WSP Canada Inc. (WSP) to advance the design of a raise of the TSF embankment above elevation 970 m. Approximately 63 million tonnes of tailings are planned to be produced and deposited in the TSF until the end of operations at the Mount Polley Mine (approximately 8.5 years of production at about 20,000 tonnes per day). Deposition of tailings generated at the process plant into the TSF resumed in June 2022 and construction to raise the TSF embankment crest to elevation 970 m restarted in July 2022.

This report presents a site characterization for the embankment foundation of the Mount Polley TSF. Site conditions are summarized with respect to climate, geology, seismicity, geotechnical conditions, hydrogeology, and geochemical conditions. Investigations of the TSF foundation site are listed for reference. A discussion of site conditions and features with the potential to impact the TSF is presented with the TSF design approach.

The Engineers and Geoscientists British Columbia (formerly The Association of Professional Engineers and Geoscientists of British Columbia, APEGBC) site characterization for dam foundation guidelines (APEGBC 2016) were followed during the preparation of this report. It is intended that this report be updated with data from future site investigations and with observations and data from construction and operation of the facility over the life of the TSF. Should the understanding and interpretation of site conditions change with time, then required changes will be documented in future revisions of this report.

This report is to be read with the Study Limitations section, which forms an integral part of this document.

MPMC defined and uses the coordinate system tailings grid for the TSF. All coordinates and elevations are presented in tailings grid.

2.0 TAILINGS STORAGE FACILITY DESCRIPTION

The TSF includes one embankment that is approximately 4.6 km in length and has a maximum height of about 55 m as of the end of 2022. The embankment is subdivided into three sections, referred to as the Main Embankment, Perimeter Embankment, and South Embankment. The general layout of the TSF embankment is shown in Figure 1 and Figure 2. The embankment has incorporated a staged expansion design utilizing modified centreline and centreline construction methods. The general zoning of the TSF embankment includes the following:

- upstream fill comprising selected fill or tailings sand
- low permeability till core
- filter zone
- transition zone
- rockfill forming the downstream zone of the embankment and the downstream buttress along the Perimeter and Main Embankments.

The TSF Clean Water Ditch is located upstream of the TSF between Corner 4 and Corner 5 and diverts runoff into a small wetland downstream of the South Embankment.

Refer to the TSF elevation 970 m detailed design and the TSF life of mine feasibility design reports for additional information (Golder 2015g,h).

3.0 FOUNDATION INVESTIGATIONS AND STUDIES

The foundation investigations and studies considered for the TSF foundation characterization are listed below. Details of report contents and scope of investigations are summarized in APPENDIX A.

A layout of the TSF with the locations of the site investigations are shown in Figure 1 and Figure 2.

Geotechnical Investigations

- *Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility* (KP 1990)
- *Report on 1995 Geotechnical Investigations for Mill Site and Tailings Storage Facility* (KP 1995a)
- *Stage 2A Tailings Facility Construction Selected Excerpts from Reference Information* (KP 1997d)
- *Mount Polley Mine Project: Tailings Storage Facility 2011 Geotechnical Site Investigation* (AMEC 2012)
- *Mount Polley Dam Failure – Site Investigation Progress Report No. 2* (KCB 2015c)
- *Report on Mount Polley Tailings Storage Facility Breach* (IEEIRP 2015)
- *Mount Polley Dam Failure – Advanced Laboratory Testing Program Progress Report No. 4* (KCB 2015b)
- *Laboratory Testing Results from Mount Polley Mine* (Golder 2015a)
- *2015 Geotechnical Investigation Factual Report* (Golder 2015d)
- *2016 TSF Geotechnical Investigation Factual Report* (Golder 2017)
- *2018 TSF Geotechnical Investigation Factual Report* (Golder 2018)
- *2021/2022 Tailings Storage Facility Geotechnical Investigation Factual Report* (WSP Golder 2022b)

Hydrogeology Investigations

- *1996 Groundwater Monitoring Well Installation Program* (KP 1997b)
- *Mount Polley Mine Hydrogeology Assessment and Data Review* (AMEC 2013)
- *Installation and Testing of New Monitoring Wells near the TSF, SERDS, Cariboo Pit and Wight Pit – Mount Polley Mine* (Golder 2016d)

Geological Interpretations

- *Surficial Geology and Quaternary Geological Overview of the Mt. Polley Tailings Storage Facility (TSF) Area, British Columbia* (Golder 2015c)

Documents related to TSF Designs

- *Response to Review Comments on Tailings Embankment Design* (KP 1996)
- Mount *Polley Project Tailings Storage Facility Updated Design Report* (KP 1997c)
- *Mount Polley Stage 6 TSF Design* (KP 2007b)

TSF Construction Record Reports

- *Mount Polley Mine Tailings Storage Facility Report on 1998 Construction and Annual Inspection* (KP 1999)
- *Mount Polley Mine Tailings Storage Facility Report on 1999 Construction* (KP 2000)
- *Mount Polley Mine Tailings Storage Facility Report on Stage 3 Construction* (KP 2001)
- *Mount Polley Mine Tailings Storage Facility Report on Stage 4 Construction* (KP 2007a)
- *Mount Polley Mine Tailings Storage Facility Report on Stage 6A Construction* (KP 2009)
- *2015 Freshet Management Embankment As-Built Construction* (Golder 2015f)

4.0 CLIMATE

The five-year update of the climate baseline for the site is presented in WSP Golder (2022a) and includes precipitation, air temperature, relative humidity, solar radiation, evaporation, snow depths, and wind speed and direction. Updated climate change projections for the site are also provided.

The 1974 to 1993 climate records from the nearby Environment and Climate Change Canada Likely climate station and 1995 to 2021 climate records from the local MPMC climate stations served as the basis for developing statistics for describing precipitation and temperature conditions for the site. Records from local, regional, and MPMC climate stations were reviewed to assist in characterizing climate parameters.

The site experiences high summer precipitation due to summer storms, and the lowest monthly precipitation occurs in February. Precipitation typically occurs as snowfall starting in November and accumulating until March. Average annual precipitation at the site is estimated to be 612 mm with a standard deviation of 118 mm based on precipitation records for the site from 1974 to 2021. Typically, the increase of temperatures over 0°C starts in March, leading to freshet until June.

A summary of the updated baseline climate parameters is provided in Table 4-1. An evaluation of future climate change projections indicates future climate at the site will likely be warmer and wetter, with larger variations throughout the months.

Table 4-1: Summary of Key Climate Parameters for the Mount Polley Mine

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:10-year 24-hour rainfall (mm)	47
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050s (%)	+5
Projected annual total precipitation anomaly from baseline for 2080s (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Mean snow water equivalent for the month of March (mm)	185
Projected annual air temperature anomaly from baseline for 2050s (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080s (°C)	+2.7
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).

5.0 QUATERNARY GEOLOGY

This section provides an overview of the Quaternary geology of the TSF embankment area, including geomorphological setting, regional and local geology, stratigraphic interpretation of subsurface investigation data, and interpreted depositional environment and Quaternary history of the area.

5.1 Regional Geomorphological Setting

The region is located on the eastern edge of the Interior Plateau, at the boundary between the Quesnel Highlands and the Fraser Plateau (Holland 1976; Bichler and Bobrowsky 2003). Terrain and geomorphology of the region comprises flat and gently rolling topography with hummocky bedrock exposures, dissected by a network of streams and lakes (Holland 1976; McAndless and Taylor 2006). Surface drainage patterns are influenced by bedrock topography; most of the stream valleys in the region have a northwest orientation and drain southward toward the lowland area north of the western arm of Quesnel Lake (Bichler and Bobrowsky 2003).

During the late Pleistocene, the area of the TSF was covered by the Cordilleran Ice Sheet (Clague 1987, 1988). The gently undulating topography and surface expression of the lowland area at the head of the west arm of Quesnel Lake is the result of glacial erosion and deposition of Quaternary sediments in an environment that evolved initially as a result of glacial advance followed by glacial retreat and inundation by meltwater, creating a glacial lake (glaciolacustrine) environment (Golder 2015c). Glacial landforms within the region include streamlined landforms associated with ground moraine, such as flutings, drumlins, drumlinoid ridges, and craig and tail features (Bichler and Bobrowsky 2003). These landforms indicate a predominantly northwesterly ice flow direction for the Cordilleran Ice Sheet in the Quesnel region (Clague 1988; Bichler and Bobrowsky 2003; Hashmi et al. 2015).

5.2 Regional Surficial Geology

The regional surficial geology is predominantly the result of erosion and deposition associated with the late Pleistocene (Wisconsinan) glacial episode referred to as the Fraser Glaciation (Clague 1987, 1988).

The regional surficial geology is dominated by till, glaciofluvial, and glaciolacustrine sediments of the Fraser Glaciation (Bichler and Bobrowsky 2003; McAndless and Taylor 2006). The glacial stratigraphy locally contains colluvial deposits derived from landslides initiating on valley walls during the late Pleistocene and Holocene (Clague 1988; Bichler and Bobrowsky 2003). Holocene fluvial deposits overlie the glacial deposits in areas local to watercourses and waterbodies throughout the region (Bichler and Bobrowsky 2003).

Bichler and Bobrowsky (2003) identified an “advance glaciolacustrine unit” (Illustration 5-1, Units A and B) that is overlain by a sequence consisting of basal till with intercalated glaciofluvial and glaciolacustrine sediments (Units C and D). This stratigraphic sequence is evident in available subsurface investigation data from the TSF area (Section 5.4). Basal till within the region is typically matrix-supported diamicton massive to weakly stratified, with faceted striated cobbles and boulders (Clague 1988) and is interpreted to be deposited during net glacial advance (Bichler and Bobrowsky 2003).

Glaciolacustrine sediments are present within most of the basal till in the major valleys (Illustration 5-1, Units A and B). These deposits are typically characterized by sub-horizontal, rhythmically bedded sand, silt, and clay in a coarsening upwards sequence. The unit is capped by fine-grained sediment, either rhythmically bedded or massive clay or silt, with local dropstones (Bichler and Bobrowsky 2003).

Glaciofluvial deposits are common within the major valleys, deposited in a succession of well-defined terraces (Clague 1988; Bichler and Bobrowsky 2003). Glaciofluvial sediments typically comprise moderately sorted, weakly to moderately compacted cobble or boulder gravel with a sand matrix (Illustration 5-1, Unit E). Gravel is also present locally in the form of hummocky blankets at higher elevations. Glaciofluvial fan deposits occur within valleys, with a similar composition to that of the glaciofluvial sediments, but typically with a greater sand content (Bichler and Bobrowsky 2003).

Morainal (ablation) till deposits more than 1 m thick are widespread and typically comprise poorly sorted, moderately to well-compacted silty clay diamicton. In the area of the TSF, these deposits are interpreted as ablation till (Illustration 5-1, Units C and D), deposited during net glacial recession (Clague 1988; Bichler and Bobrowsky 2003).

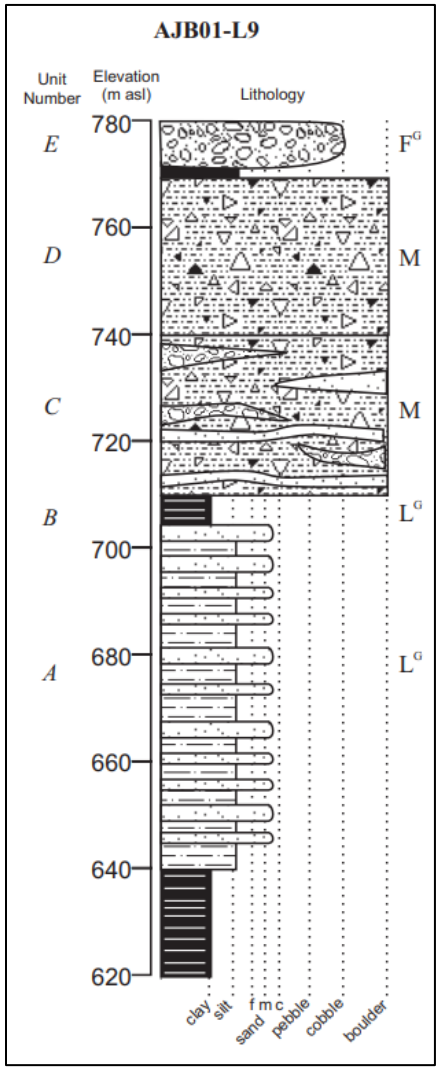

Source: Bichler and Bobrowsky 2003.

asl = above sea level; F^G = glaciofluvial deposits; M = basal till; L^G = glaciolacustrine deposits.

Illustration 5-1: Stratigraphic Column

5.3 Local Surficial Geology

A number of geotechnical subsurface investigations have been carried out in the TSF area (Section 3.0). The local surficial geology comprises Quaternary glacial sediments overlain by fill / anthropogenic deposits. A generalized stratigraphic sequence for the Quaternary sediments in the TSF area is presented in Illustration 5-2. The generalized stratigraphy reflects interpretations of the subsurface geology from geotechnical investigations conducted in the area of the TSF.

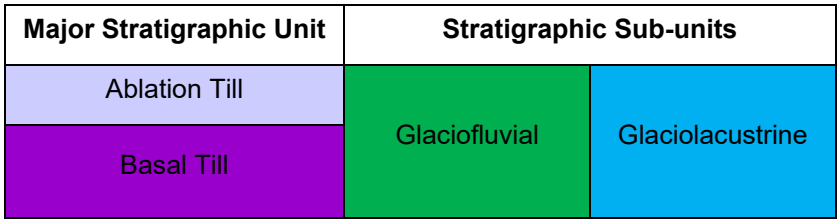

Illustration 5-2: Generalized Stratigraphic Column for Quaternary Sediments of the Tailings Storage Facility Embankment Area

This stratigraphic sequence is generally applicable to the mine area and TSF, with local variations associated with the depositional and erosional history of a particular area. The surficial geological units of the TSF embankment area are interpreted to represent two main stages of the Fraser Glaciation: the advance stage and recessional stage (Bichler and Bobrowsky 2003). Basal till is punctuated by glaciofluvial and glaciolacustrine deposits that typify the early stages of deposition (the advance stage), represented in the TSF area by basal till and associated sub-units. The ablation till and some layers of the glaciofluvial and glaciolacustrine sub-units were likely deposited during the recession stage of glaciation (Section 5.5).

Available mapping indicates the TSF area is underlain by altered, deformed, and brecciated volcanic and intrusive igneous rocks of the Late Triassic Nicola Group, with local sandstone and conglomerate of the Kamloops Group, Dragon Mountain Formation and some unnamed sediment groups (Logan et al. 2007).

5.4 Stratigraphic Interpretation

5.4.1 Methods

Stratigraphic correlations developed from the borehole data from the TSF area are presented as a series of interpretive geological cross-sections (Figure 3 to Figure 9). The stratigraphic interpretation conducted as part of this TSF foundation characterization study expands on the methods and geological interpretation and correlation completed by Golder in 2015, with updates to the previous work based on recent, detailed geological data from boreholes located close to the cross-section profile lines. General procedures used in development of the updated cross-sections and stratigraphic correlations are summarized as follows:

- **Lateral offset, priority and inferred boundaries**—Preference was given to incorporating geological data from boreholes located close to the cross-section lines and to boreholes that had the most detailed geological descriptions of the subsurface conditions encountered. Boreholes that were farther from cross-section lines were reviewed for geological correlation criteria, including information on the specific stratigraphic sequence and elevations of contacts between the different geological units. Boreholes with significant lateral offset from the lines of cross-section were generally omitted given the high degree of uncertainty in projection of the data.

- **Contact type**—Borehole logs with detailed geological descriptive information were used to determine the typical contact type between units (i.e., sharp or gradational).
- **Characteristics**—Geotechnical laboratory testing results were used to assist with distinguishing between geological units where available.

The geological criteria used to develop key stratigraphic correlations between different units are detailed in subsequent sections, with specific criteria for the glaciolacustrine deposits presented in Table 5-1. The criteria were applied to the geological descriptions in each of the boreholes used in the data compilation and review, and stratigraphic correlations identified.

Table 5-1: Stratigraphic Criteria for the Glaciolacustrine Sub-units

Geological Property	Typical Description
Unified Soil Classification System (USCS)[a]	CL, CI, CH, or ML
Structure	Laminated, varved, or massive
Particle size distribution	Less than 5% gravel and 20% sand
Atterberg limits – plasticity index	10 to 25 (typically correlated to intermediate or high plasticity descriptions)
Typical stratigraphic location	Overlying or interbedded with glaciofluvial units

a) From the USCS Group Symbols: CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay, CH = high-plastic clay, ML = inorganic silt with slight or low plasticity.

Interpretation of borehole data is necessarily subjective due to the different terminology used and the consistency with which it is applied. For example, lamination, varving, and bedding were apparently used interchangeably in some of the descriptions of surficial deposits in the different borehole records both among the various consultant data sets, as well as within data obtained from individual consultants.

The scope of each previous investigation determined the level of detail included on the borehole logs in terms of stratigraphic unit descriptions, and whether geotechnical testing was completed. For example, the WSP Golder 2022 geotechnical investigation focused on identifying the glaciolacustrine unit, and therefore the borehole logs segregate units at a detailed scale accompanied by extensive geotechnical testing. In contrast, in the Knight Piésold Ltd. (KP) 1989 report, borehole records provide much less detail in terms of stratigraphic segregation of units and geotechnical testing. Not all borehole logs reviewed had plasticity ratings for stratigraphic units, nor did the associated investigation include Atterberg limits for every layer of the glaciolacustrine unit. In some factual reports, borehole records were not updated to reflect the geotechnical testing results of various surficial units. Therefore, review of both data sets was important to provide accurate stratigraphic interpretation. The Unified Soil Classification System was not used to describe surficial sediment textures in all factual reports, with some instead referring to the Wentworth Scale.

For presentation purposes on the interpretive geological cross-sections (Figure 3 to Figure 9), units of glacial sediment typically less than 0.5 m thick, as described in borehole records, were not shown on the cross-sections due to the scale of the section. This was specifically the case for thinner layers of the glaciofluvial and glaciolacustrine sub-units that were incorporated into adjacent units for cross-section presentation purposes. Similarly, small-scale interbedding, particularly among the glaciofluvial and glaciolacustrine sub-units, has not been shown on some sections.

In some areas of the TSF, the geological contact between glacial sediments and bedrock was difficult to identify accurately given the intensity of bedrock weathering. Therefore, the position of the surficial sediment-bedrock contact should be considered approximate in many parts of the TSF area.

5.4.2 Glacial Environments and Depositional Processes

Depositional environments associated with glacial sediments are inherently complex, particularly in ice-front or ablation zone settings, which are typically associated with glaciofluvial and glaciolacustrine deposits and sedimentation processes.

Glacial lakes disrupt the flow of meltwater and intercept glacial sediment being generated by processes such as ablation (ice removal) (Tweed and Carrivick 2015). Variability in the types of flow processes and meltwater velocities can complicate stratigraphic interpretation of glacial lake deposits. Sediment deposition and distribution in glaciolacustrine environments can be associated with gravity, turbidity, and density flows or currents (Carrivick and Tweed 2013). These flows can lead to structures and stratified deposits that may be interpreted as a mix of glaciofluvial and glaciolacustrine materials, particularly near the edges of a glacial lake where streams enter and exit an otherwise stagnant body of water. Sediment deposition in proximal zones of ice-marginal lakes can also be influenced by proglacial (ice front) activity.

Hillslope processes and valley tributaries entering the ablation zone following glacial retreat can also impact glaciolacustrine depositional environments (Carrivick and Tweed 2013). Ice contact deltas and the up-ice side of grounded fans can have similar characteristics to diamictic-textured till materials (Carrivick and Tweed 2013). Mass movement of valley hillslopes via processes such as slumps, debris slides, and debris flows can cause material to enter the subaqueous or water-free environment (depending on timing) and mix with existing sediments. Valley tributary systems entering the glaciofluvial and glaciolacustrine environments may also result in flow overlap and inter-fingering deposits. These mixing environments can lead to discontinuous and complex textures and structures. These processes and conditions were taken into consideration in the course of carrying out stratigraphic correlations for the TSF area.

5.5 Depositional Environment and Quaternary History of the Tailings Storage Facility Embankment Foundation Area

The stratigraphic interpretation of the TSF area generally correlates with that described by Bichler and Bobrowsky (2003), and the Golder (2015c) interpretation.

Two main stages of glacial activity can be interpreted from the surface and subsurface geological record in the TSF embankment area:

1) advance stage

2) recessional stage

5.5.1 Advance Stage

Depositional environments that developed during the late Pleistocene (Wisconsinan) Fraser Glaciation were dominated in the early stages by glacial advance of the Cordilleran ice sheet over much of central British Columbia (Clague 1987, 1988). Basal till and moraine punctuated by glaciofluvial and glaciolacustrine deposits typify the early stages of deposition, represented in the TSF area by basal till and associated sub-units.

These deposits are present across the TSF area, except in the South Embankment where bedrock is at a relatively high elevation, and the basal till unit is not interpreted to be present. The total maximum thickness of the advance glacial deposits is approximately 40 m (Figure 3 to Figure 9).

The basal till unit typically comprises a mixture of silt/clay with sand and gravel, punctuated by interbedded layers of glaciofluvial and glaciolacustrine sub-units. The relative consistency of the basal till is typically stiff to hard as a result of deposition under or in contact with glacial ice. Sediment comprising the glaciofluvial and glaciolacustrine units was transported from the area of the glacial ice sheet by meltwater streams and accumulated in lakes and stream channels in a pro-glacial (ice marginal) environment in front of the glacier. These sub-units are interpreted to represent hiatuses and/or minor localized glacial retreat, with some glaciofluvial deposits likely representing ice-frontal meltwater channel deposits. The glaciolacustrine and glaciofluvial materials were subsequently overridden and compacted by the glacial ice.

5.5.2 Recessional Stage

Ablation till and some layers of the glaciofluvial and glaciolacustrine sub-units were likely deposited during the recessional stage of glaciation, when ice stagnation, retreat and melting were the dominant processes.

The ablation till unit typically comprises firm to stiff silt and silty clay, with secondary components of gravel and sand. Fines were typically non-plastic or of low plasticity, and locally mottled. Pockets of organic material, mottled fines and iron oxide staining were encountered towards the top of the unit. These characteristics are typical of subaerially exposed sediments, allowing for weathering and development and/or deposition of organic materials.

Glaciofluvial deposits were observed locally at various levels within the ablation till unit. These discontinuous silty sand layers may represent late-stage, short-lived advance during the early-stage net glacial recession, marked by isolated glaciofluvial environments.

The glaciolacustrine sub-unit encountered near the base of the ablation till is interpreted to have formed during early-stage net glacial recession, in areas of localized ponding of glacial meltwater. These glaciolacustrine deposits likely represent the approximate upper boundary of the pro-glacial basal till and associated sub-units.

The Klohn Crippen Berger Ltd. (KCB 2015a) summary report presents an alternative interpretation for the Quaternary history of the TSF area, instead suggesting two separate glaciations: the penultimate glaciation and the Fraser Glaciation. The key difference between the KCB (2015a) interpretation of the Quaternary history of the TSF area and the interpretation presented in this report is that of the ablation till unit, which was interpreted by KCB to represent basal till deposited during advance of a second glaciation rather than ablation till deposited during retreat of the Fraser Glaciation:

- The basal till unit was interpreted by KCB (2015a) to be deposited during net advance of the penultimate glaciation.
- The ablation till unit was interpreted to be basal in origin, deposited during net advance of glaciers in the Fraser Glaciation. Interfingering of the glaciofluvial and glaciolacustrine deposits within the till unit was interpreted to represent multiple periods of glacial advance and retreat during the Fraser Glaciation.
- The diamicton within the ablation till unit was determined to be due to the presence of subglacial landforms mapped in the vicinity of the TSF area.
- Layers of the glaciolacustrine and glaciofluvial sub-units were interpreted to be deposited during glacial retreat of the penultimate glacial period, and during advance of the Fraser Glaciation.

5.5.3 Geological Units of the Tailings Storage Facility Embankment Foundation Area

5.5.3.1 Ablation Till Unit

The ablation till unit in the TSF area is interpreted as till derived from sediment entrained within the glacial ice and deposited directly by melting ice (ablation), typically in the terminus portion of the glacier. It commonly overlies basal till since it is deposited in the latest stages of glaciation. In the TSF area, these deposits are interpreted to be associated with glacial recession.

The main variables used to identify the ablation till unit were elevation, stratigraphic position, and typical unit thickness. The general elevation range of the base of the unit was estimated from borehole data to be between 925 and 940 m but may be as low as 910 m (e.g., Main Embankment).

The ablation till unit typically comprises firm to stiff silt and silty clay, with components of gravel and sand. Pockets of organic material, mottled fines, and iron oxide staining have been described towards the top of the unit. Fines are typically non-plastic or of low plasticity and are occasionally mottled.

Contacts between the ablation till unit and the overlying anthropogenic materials are sharp. The contact between the ablation till unit and underlying basal till unit is typically gradational, except where separated by the glaciolacustrine or glaciofluvial sub-units.

5.5.3.2 Basal Till Unit

Basal till is formed by the subglacial deposition of sediment carried within or below the glacier. In the TSF area, the basal till is interpreted to have been deposited during net glacial advance (Clague 1988).

The basal till unit underlies the ablation till unit and occurs at elevations between approximately 875 and 930 m, with the top contact of the unit typically between 895 and 915 m. The basal till unit is typically stiff to hard, and is composed of a mixture of silt, clay, sand, and gravel with occasional cobbles. The basal till unit differs from the ablation till unit in terms of elevation, sequence of deposition, gradation, and colour. Both the basal and ablation till units are grey to brown; however, mottling associated with oxidation and iron staining, and local pockets of organic material have been observed in the ablation till.

5.5.3.3 Glaciolacustrine Sub-unit

Glaciolacustrine deposits result from settlement of suspended sediment within lakes or sub-glacial meltwater, typically creating layers of silt and clay with laminated or varved (seasonal layering) structures (Tweed and Carrivick 2015).

Stratigraphic criteria for identifying glaciolacustrine deposits are presented in Table 5-1. The key controlling variables were structure, texture, and plasticity, where available. The glaciolacustrine sub-unit typically comprises silt, silty clay, or clay with lesser fine sand, with a varved or laminated structure. Locally, this unit may be more massive and lack a layered structure. Plasticity of this unit is typically medium to high. Trace gravel has been noted locally within the glaciolacustrine sub-unit and may represent dropstones; sand and clay lenses are recorded within some layers of this unit.

The glaciolacustrine sub-unit is interpreted to include all stratigraphic horizons with a layered structure and descriptions indicating deposition in a glacial lake or subglacial setting. This differs slightly from the geotechnical interpretation of the unit, which also applies geotechnical parameters to classify the unit (Table 5-1). As such, there are some locations where the glaciolacustrine sub-unit shown in the geological cross-section has been identified based on geological interpretation only. For example, at approximate Station 0+450 in the South

Embankment, the glaciolacustrine sub-unit has been identified at the base of the ablation till based on descriptions in borehole logs and interpreted depositional setting (Figure 3). At this location (boreholes VW11-02 and GA16-19), a layer of non-plastic to low plasticity silt with some clay and sandy to trace sand was described as bedded with occasional dropstones. This layer is interpreted to have been deposited in a glaciolacustrine environment, but it has geotechnical characteristics that differ from the intermediate and high plasticity glaciolacustrine units identified at the Main and Perimeter embankments (Section 7.3.4).

The glaciolacustrine sub-unit was typically observed near the base of the ablation till unit. It typically overlies or is interbedded with the glaciofluvial sub-unit throughout the basal till at elevations between approximately 900 and 920 m, with some layers locally occurring as low as 887 m (Perimeter Embankment). Reported thicknesses of glaciolacustrine deposits in the TSF area vary from approximately 0.3 to 15 m.

The glaciolacustrine sub-unit encountered near the base of the ablation till is interpreted to have formed during early-stage net glacial recession, in areas of localized ponding of glacial meltwater.

5.5.3.4 Glaciofluvial Sub-unit

Glaciofluvial deposits, sometimes referred to as outwash deposits, comprise sediments and landforms produced by glacial meltwater streams. The outwash sediment typically comprises cobbles, gravel and sand, with minor silt and silty clay. Glaciofluvial deposits may show a lateral decrease in grain size due to relatively rapid downstream movement of sediment. A depositional pattern known as braiding is also typical due to a lack of distinct channelling of sediment and high sediment load.

The key controlling variables for identifying glaciofluvial deposits are texture (sand and gravel dominated), grading, and sorting (where available).

A discontinuous silty and fine to coarse sand unit with trace fine gravel was identified locally within the ablation till unit between approximately 920 and 936 m elevation (Main Embankment). This may represent late-stage, short-lived advance activity during the early-stage net glacial recession, marked by isolated glaciofluvial environments.

The glaciofluvial sub-unit encountered within the basal till is typically interbedded with the glaciolacustrine sub-unit and is sub-divided into sand-dominated and gravel-dominated units. The sand-dominated glaciofluvial sub-unit typically comprises fine- to coarse-grained sand with trace silt, or silty sand with trace gravel noted locally. This sub-unit was recorded extensively throughout the basal till unit from approximately 882 to 924 m (Perimeter Embankment). Recorded thicknesses of the sand-dominated glaciofluvial layers within the TSF area range from approximately 0.15 to 12 m.

The gravel-dominated glaciofluvial sub-unit was identified locally within the Main Embankment and Perimeter Embankment only. The sub-unit typically comprises fine- to coarse-grained gravel with some sand, silt, and cobbles and was typically deposited in sequence with the sand-dominated glaciofluvial sub-unit. The gravel-dominated unit occurs between approximately 886 m (Main Embankment) and 924 m (Perimeter Embankment) elevation, with recorded thicknesses ranging from approximately 0.3 to 3 m.

Glaciofluvial sub-unit layer thicknesses were noted to vary spatially within the same layer, which is typical of stream deposition. Bifurcation (branching) and interfingering with adjacent units are also common stratigraphic characteristics of the glaciofluvial sub-unit. However, as previously noted, such detailed stratigraphic correlations were only possible where boreholes were located close to the line of the cross-section. As such, it is likely that these features are more common within the TSF area than is currently presented on the cross-sections.

Contacts between the glaciofluvial sub-unit and the glaciolacustrine sub-unit are typically sharp, and contacts with the basal till unit are commonly gradational.

The glaciofluvial sub-unit within the basal till is inferred to correlate with sand lenses described in the regional surficial stratigraphy by Bichler and Bobrowsky (2003), interpreted to represent ice-frontal meltwater channel deposits.

5.5.3.5 Bedrock

Weathered bedrock was encountered across the TSF area between approximately 873 and 968 m elevation. Bedrock described in boreholes typically comprised sand and gravel with some fines, recorded as weathered volcaniclastic conglomerate, volcanic debris or completely weathered bedrock. Locating the contact between the bedrock and overlying till was inherently difficult at many borehole locations given the highly weathered nature of the upper part of the bedrock. As such, the weathered bedrock can be difficult to distinguish from the overlying surficial deposits (Panteleyev et al. 1996; Golder 2015c).

6.0 SEISMIC HAZARD

The Mount Polley TSF site is located within the Canadian Cordillera, part of the North American Cordillera that was formed by convergent tectonic processes and the successive accretion of a number of allochthonous terranes to the ancient western margin of the North American plate, likely beginning sometime in the Late Triassic to Early Jurassic (approximately 180 to 200 million years ago) (Monger and Price 1979; Price 1994, 2000; Ricketts 2008; Monger 1989).

The present-day tectonics of western Canada are strongly influenced by the effects of relative motions of the Pacific and North America plates and remnants of the former Farallon plate that was largely subducted. The modern Explorer, Juan de Fuca, and Gorda plates are the remains of the much larger Farallon plate.

The Cascadia subduction zone (CSZ) marks the boundary where the Juan de Fuca, Explorer, and Gorda plates are being subducted beneath western North America. The 1,200 km long CSZ extends from northern California to British Columbia and is approximately 460 km west of the Mount Polley Mine at its closest approach. The present-day convergence (subduction) velocity ranges from about 43 mm/yr for the Juan de Fuca plate that decreases to the northwest to about 20 mm/yr for the Explorer plate (North America fixed). The CSZ has produced repeated great earthquakes (i.e., above moment magnitude (**M**)8) throughout the Holocene Epoch. The most recent CSZ great earthquake was an estimated **M**9.0 in January of 1700. The Cascadia subduction interface is currently locked and accumulating strain toward a future large or great earthquake (e.g., Dragert et al. 1994; Hyndman and Wang 1995; Mazzotti et al. 2003).

The southern Canadian Cordillera, where the Mount Polley Mine is located, has relatively low rates of historical seismicity relative to the CSZ. However, intermediate-to-large magnitude earthquakes have been recorded. For example, a **M**6.0 earthquake in 1918 had an epicentre approximately 220 km east of the site and a **M**5.5 earthquake occurred in 1986 with an epicentre approximately 200 km north of the site. Both earthquakes occurred in the “Rocky Mountain Trench” that marks the boundary between the western Foreland Fold and Thrust Belt and the Quesnel terrane and other terranes. The 1986 earthquake had a thrust fault mechanism, which is consistent with the general structural trends mapped in the area (e.g., Rogers et al. 1990).

WSP developed a site-specific seismic hazard model for the Mount Polley site based on source models developed for the 6th Generation Canadian National Seismic Hazard Model (Canada SHM6) and a review of geological and paleoseismological features (APPENDIX B). Both near-field, moderate-magnitude crustal earthquakes and far-field subduction interface earthquakes contribute to the site seismic hazard. The shallow crustal earthquake sources are dominated by moderate-magnitude earthquakes (**M**6.0 to **M**6.5) close to the site (i.e., less than 60 km away) at all annual exceedance probabilities. The contribution to hazard at the site from CSZ sources is from large earthquakes (**M**8+) at 450 to 550 km from the site at all annual exceedance probabilities and spectral periods of interest.

Probabilistic analysis results from the site-specific hazard model are listed in Table 6-1.

Table 6-1: Site-Specific Accelerations (5%-damped) for Selected Annual Exceedance Probabilities and Spectral Periods at the Mount Polley Tailings Storage Facility Site (V_{S30} = 849 m/s)

Performance Level – Annual Exceedance Probability	Spectral Period (s)	Acceleration[a] (g)					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/1,000	PGA	0.026	0.023	0.023	0.025	0.028	0.028
	0.5	0.033	0.030	0.030	0.033	0.035	0.036
	1.0	0.020	0.017	0.017	0.019	0.021	0.023
	1.5	0.015	0.012	0.012	0.015	0.017	0.018
1/2,475	PGA	0.048	0.042	0.042	0.046	0.053	0.054
	0.5	0.054	0.050	0.050	0.053	0.057	0.058
	1.0	0.030	0.026	0.027	0.030	0.033	0.035
	1.5	0.023	0.018	0.019	0.022	0.026	0.027
1/5,000	PGA	0.076	0.067	0.067	0.073	0.084	0.085
	0.5	0.079	0.073	0.073	0.079	0.083	0.084
	1.0	0.042	0.036	0.038	0.041	0.045	0.048
	1.5	0.031	0.024	0.025	0.029	0.036	0.037
1/10,000	PGA	0.116	0.102	0.102	0.111	0.128	0.128
	0.5	0.114	0.106	0.106	0.115	0.119	0.121
	1.0	0.057	0.050	0.052	0.057	0.060	0.065
	1.5	0.041	0.032	0.034	0.039	0.047	0.048

a) 5%-damped, mean, geometric-mean, peak horizontal acceleration.

PGA = peak ground acceleration.

7.0 GEOTECHNICAL CONDITIONS

This section presents a summary of results of geotechnical testing and interpreted geotechnical parameters.

A summary of available geotechnical data collected during subsurface investigations in the area of the TSF embankment is provided in APPENDIX C (Tables C1 to C5). This includes information related to boreholes, test pits, cone penetration tests (CPTs), monitoring wells and other instrumentation, and laboratory index testing results. The subsurface investigation locations are shown relative to the TSF embankment in Figure 1 and Figure 2. Surficial geological cross-sections were developed for the encountered foundation conditions which are shown in Figure 3 to Figure 9.

A borehole was drilled downstream of the Corner 1 Embankment after completion of the investigation program carried out in 2021 and 2022 (referred to as borehole GA22-01). The record of borehole and other relevant information is provided in APPENDIX D.

The following stratigraphic units were identified in the foundation of the TSF embankment.

- **Till**—The till is generally a mixture of gravel, sand, and low plastic fines ranging from silt to silty clay. The material is generally cohesive with a consistency from firm to hard. The average water content is approximately 12% (ranges from 2% to 33%). Results of geotechnical testing are presented in Section 7.1.
- **Glaciofluvial units**—The glaciofluvial units are generally gravelly sandy silt to silty sand with trace gravel. The fines content ranges from about 4% to 100% and are generally non-plastic. The material is generally non-cohesive with a compactness ranging from compact to very dense. The average water content is approximately 17% (ranges from 2% to 34%). Results of geotechnical testing are presented in Section 7.2.
- **Glaciolacustrine units**—The glaciolacustrine units are generally silty clay to clay with trace to some sand. The fines are generally intermediate to high plasticity. The material is generally cohesive with a consistency ranging from firm to very stiff. The average water contents and clay contents of the glaciolacustrine units vary based on location. Results of geotechnical testing are presented in Section 7.3.
- **Highly weathered bedrock**—Generally weathered volcaniclastic conglomerate, volcanic debris or completely weathered bedrock.

7.1 Till

Till has been encountered during many previous subsurface investigations carried out near the foundation of the TSF. Representative samples were collected throughout the investigations with selected samples chosen for subsequent laboratory testing. The laboratory testing programs generally included a range of index and/or advanced laboratory tests dependent on the specific objective at the time. A summary of the index properties for the samples of till is presented in Table 7-1.

The Atterberg limit results for each embankment are shown graphically in Illustration 7-1. The fines are generally non-plastic or low plasticity and range from silt to silty clay (ML to CL, respectively). Thirteen test results were outside of this general range and had an intermediate plasticity. The samples with an intermediate plasticity were all collected from the Corner 1 Embankment.

The natural water content results were plotted against elevation, which is shown in Illustration 7-2. The average water content of the till was approximately 12% and ranged from 2% to 33%.

Table 7-1: Summary of Index Properties of Till

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	15	0	45	218
	Sand (%)	35	3	61	
	Fines (%)	50	16	97	
Liquid limit[(a)]		25	18	46	169
Plastic limit[(a)]		14	11	22	
Plasticity index[(a)]		11	3	30	
Water content (%)		11.8	2.0	33.1	1,645
Specific gravity of solids		2.76	2.73	2.78	6

a) Atterberg limits exclude six non-plastic results.

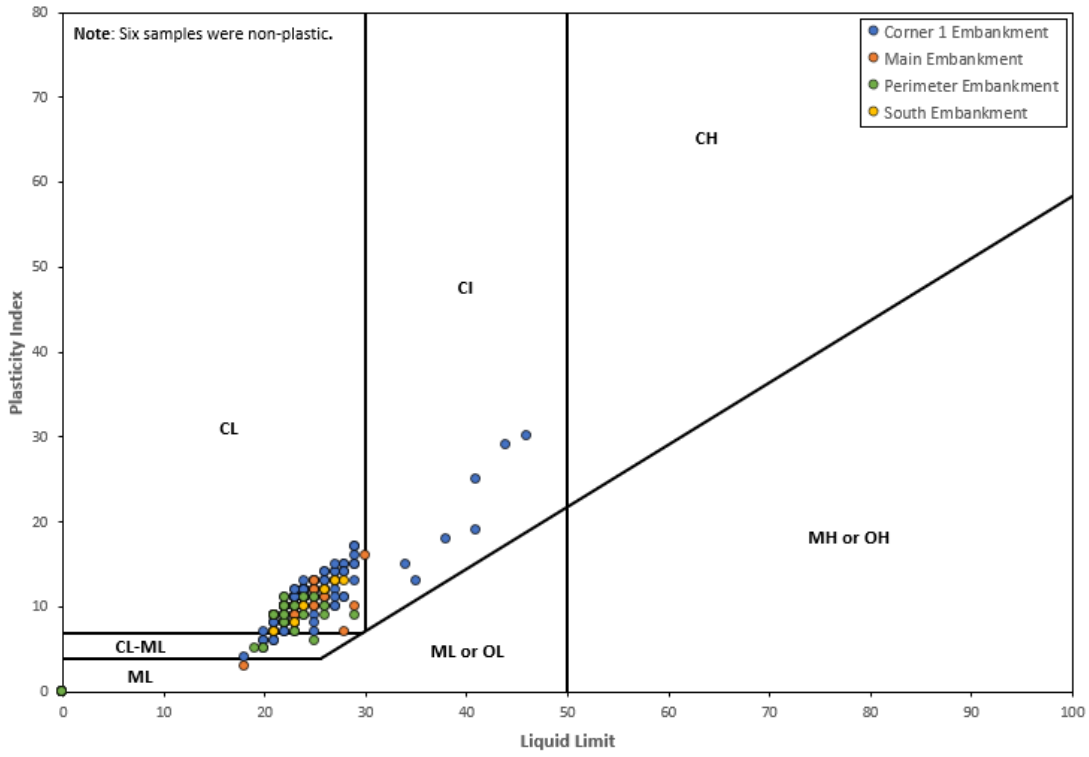

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-1: Plasticity Chart of Till Samples

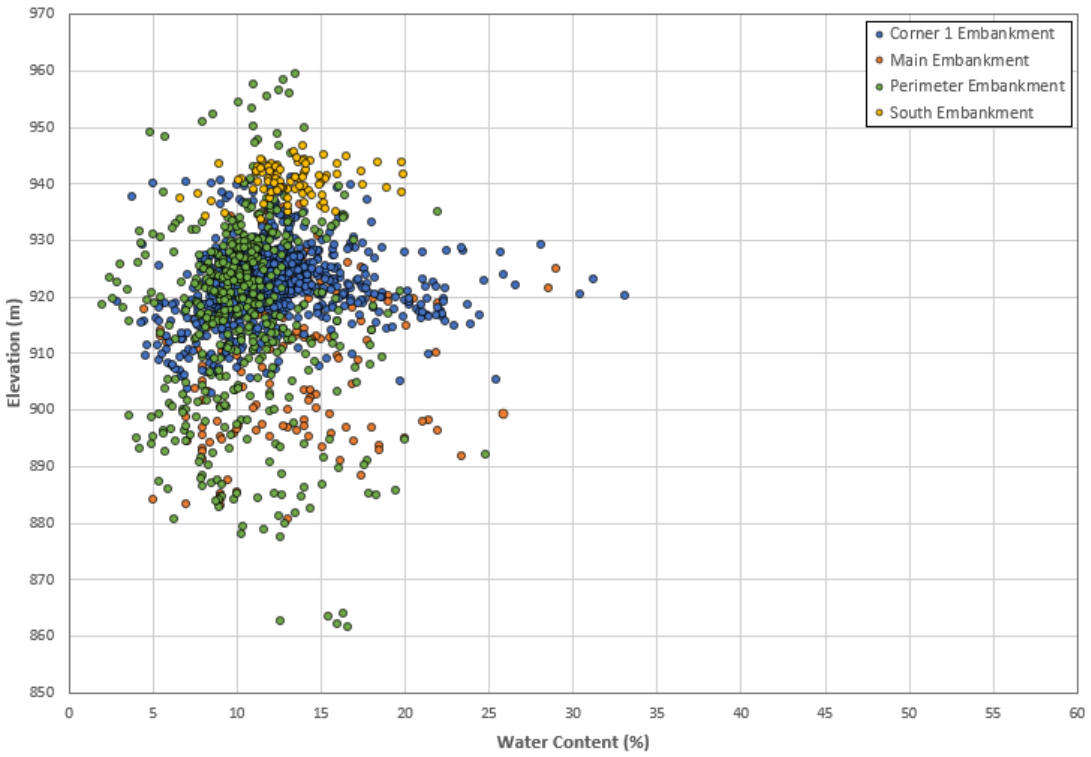

Illustration 7-2: Water Content against Elevation of Till Samples

A summary of the shear strength test results from till samples is presented in Table 7-2. The peak friction angle ranged from 30 to 41 degrees with a cohesion of 0 kPa.

Pressuremeter test results indicate the friction angle of the till at the Corner 1 Embankment ranges between 36 and 48 degrees, with an average of about 40 degrees (IEEIRP 2015).

Table 7-2: Shear Strength Test Results of Till

Borehole / Test Pit No.	Sample No.	Sample Type	Elevation (m)	Peak Shear Strength Parameter		Source
				Friction Angle (degrees)	Cohesion (kPa)	
TP95-27	n/a	Grab	926.2	35	0	KP (1995a)
TP95-37	n/a	Grab	937.0	35	0	
MR14-105	4B	Thin-walled tube	927.8	34	0	IEEIRP (2015)
MR14-106	2	Thin-walled tube	924.6	34	0	
MR14-111	5A	Thin-walled tube	922.9	35	0	
MR14-113	1C	Thin-walled tube	928.0	33	0	
SH14-10A	12	Sonic core	922.4	41	0	KCB (2015b)
	10	Sonic core	921.6	30	0	
	14	Sonic core	918.7	37	0	
TP14-01	BS-01	Block	n/a	34	0	
	BS-01	Block	n/a	33	0	

n/a = not applicable, not available

The median shear wave velocity measured in the till foundation ranged from about 320 to 400 m/s at the Corner 1 Embankment (Golder 2016a).

7.2 Glaciofluvial Unit

A summary of the index properties for the glaciofluvial samples collected from the foundation of the TSF embankment is presented in Table 7-3.

A total of 38 Atterberg limit test results were available for samples of glaciofluvial. Atterberg limit tests were generally only carried out on samples described as exhibiting some plastic behaviour. The fines are generally a non-plastic to low plastic material and range from silt to silty clay (ML to CL, respectively). Twenty-two of the 38 test results were non-plastic. The material is generally non-cohesive with a compactness ranging from compact to very dense. The Atterberg limit results for each embankment are shown graphically in Illustration 7-3.

The natural water content results were plotted against elevation, which is shown in Illustration 7-4. The average water content of the glaciofluvial was approximately 17% and ranged from 2% to 34%.

Table 7-3: Summary of Index Properties of Glaciofluvial Unit

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	6	0	47	43
	Sand (%)	32	0	85	
	Fines (%)	63	4	100	
Liquid limit[(a)]		26	21	30	16
Plastic limit[(a)]		19	13	25	
Plasticity index[(a)]		8	2	14	
Water content (%)		16.9	2.2	33.9	393
Specific gravity of solids		2.78	2.78	2.78	1

a) Atterberg limits exclude 22 non-plastic results.

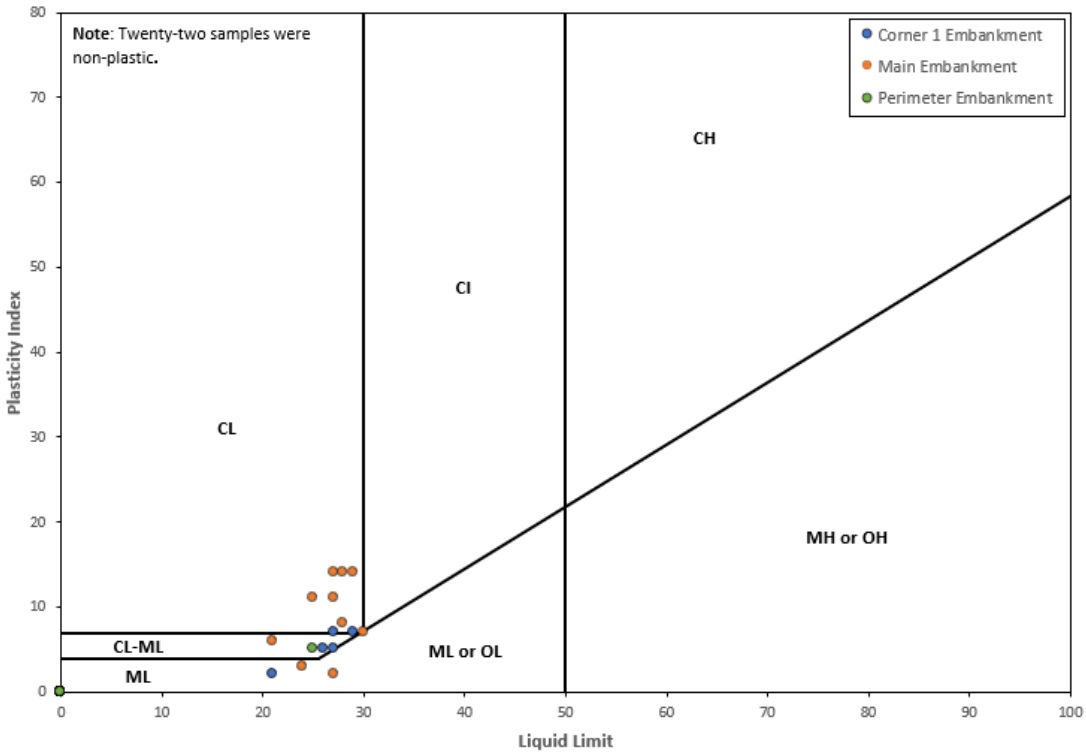

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-3: Plasticity Chart of Glaciofluvial Samples

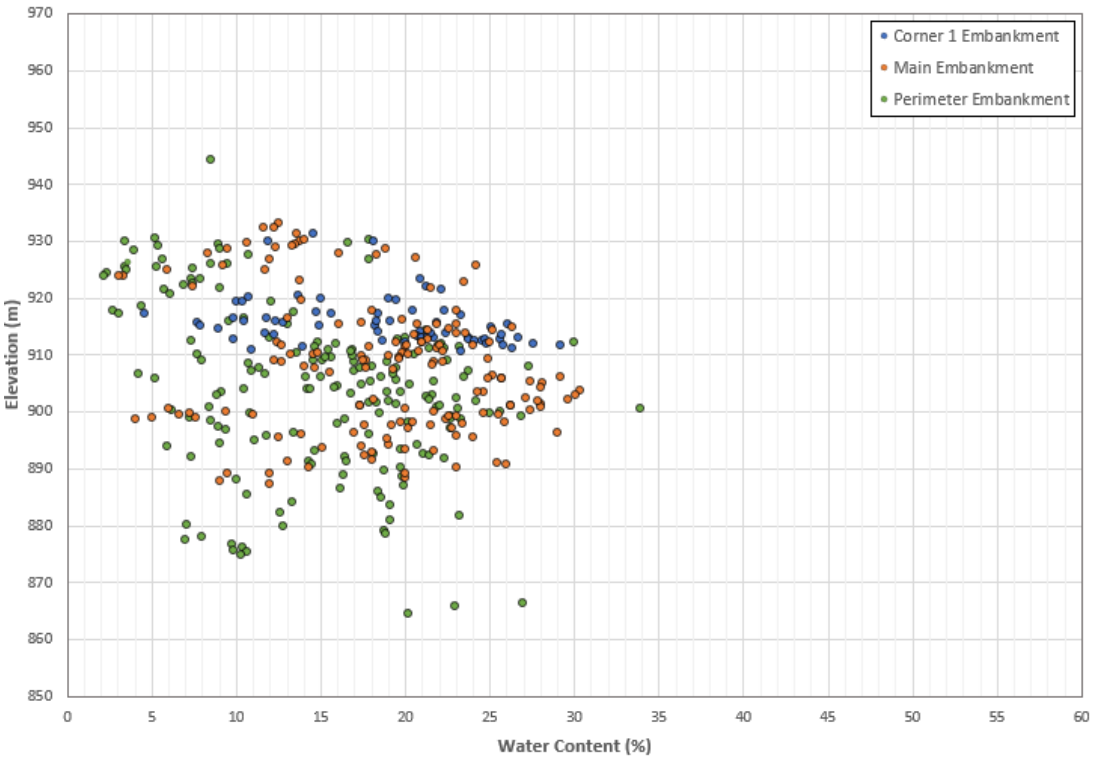

Illustration 7-4: Water Content against Elevation of Glaciofluvial Samples

A summary of the shear strength test results from glaciofluvial samples is presented in Table 7-4. The peak friction angles were 35 and 36 degrees with a cohesion of 0 kPa.

Table 7-4: Shear Strength Test Results of Glaciofluvial Unit

Borehole / Test Pit No.	Sample No.	Sample Type	Elevation (m)	Peak Shear Strength Parameter		Source
				Friction Angle (degrees)	Cohesion (kPa)	
Central Collection Sump	n/a	Thin-walled tube	n/a	36	0	Golder (2015d)
GA15-21	9 (C|U)	Thin-walled tube	902.5	35	0	

n/a = not applicable, not available

7.3 Glaciolacustrine Unit

Glaciolacustrine deposits were identified along the Main, Perimeter, and Corner 1 embankments:

- **Main Embankment**—A semi-continuous layer of glaciolacustrine soil is present at an elevation of approximately 900 to 910 m and extends along the length of the Main Embankment. A shallower layer of glaciolacustrine soil near elevation 920 m was identified near Station 2+400 and 2+750. Results of geotechnical testing completed on samples of glaciolacustrine soils from the Main Embankment are presented in Section 7.3.1.
- **Perimeter Embankment**—The glaciolacustrine soil deposits are not continuous and their elevations generally range between about 885 and 935 m. Results of geotechnical testing completed on samples of glaciolacustrine soils from the Perimeter Embankment are presented in Section 7.3.2.
- **Corner 1 Embankment**—Upper and lower glaciolacustrine soil deposits are present at this location. The upper glaciolacustrine deposit is a semi-continuous layer between approximate elevation 918 and 925 m from approximate Station 20+000 to 20+300. The lower glaciolacustrine deposit is also a semi-continuous layer between approximate elevation 900 and 918 m. Results of geotechnical testing completed on samples of glaciolacustrine soils from the Corner 1 Embankment are presented in Section 7.3.3.

A layer of low plasticity silty clay interpreted to have deposited in a glaciolacustrine environment was encountered directly above bedrock near Station 1+100 at the South Embankment; however, the geotechnical testing completed on the material showed it not to be representative of the intermediate or high plasticity glaciolacustrine units found within the footprint of the Corner 1, Main, and Perimeter embankments (Golder 2017). The results of the geotechnical testing are presented in Section 7.3.4.

7.3.1 Main Embankment

A summary of the index properties for samples of glaciolacustrine material collected from the foundation of the Main Embankment is presented in Table 7-5.

The Atterberg limit results are shown graphically in Illustration 7-5. The fines are generally a low to intermediate plastic material and range from silt to silty clay (ML to CI, respectively). Six results were outside of this general range and were either non-plastic or had a high plasticity.

The natural water content results were plotted against elevation, which is shown in Illustration 7-6. The average water content of the glaciolacustrine samples from the Main Embankment was approximately 26% and ranged from 6% to 42%.

The natural water content results were also plotted against clay content as shown in Illustration 7-7. A total of 44 hydrometer test results were available for glaciolacustrine samples from the Main Embankment foundation. The average clay content (defined as particles smaller than 0.002 mm) of the glaciolacustrine samples was approximately 30% and ranged from 7% to 49%. A general trend of increasing water content with increasing clay content can be seen in the illustration.

All available test results for glaciolacustrine samples collected from the foundation of the other embankments were incorporated into the illustrations for comparison.

Table 7-5: Summary of Index Properties of Glaciolacustrine at the Main Embankment

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	0	0	5	52
	Sand (%)	6	0	40	
	Fines (%)	94	60	100	
	Silt (%)	65	44	92	44
	Clay[a] (%)	30	7	49	
Liquid limit[b]		39	19	61	62
Plastic limit[b]		21	15	28	
Plasticity index[b]		17	1	39	
Water content (%)		26.1	6.3	42.1	179
Specific gravity of solids		2.75	2.65	2.80	8

a) Clay is defined as particles smaller than 0.002 mm.

b) Atterberg limits exclude two non-plastic results from the Main Embankment.

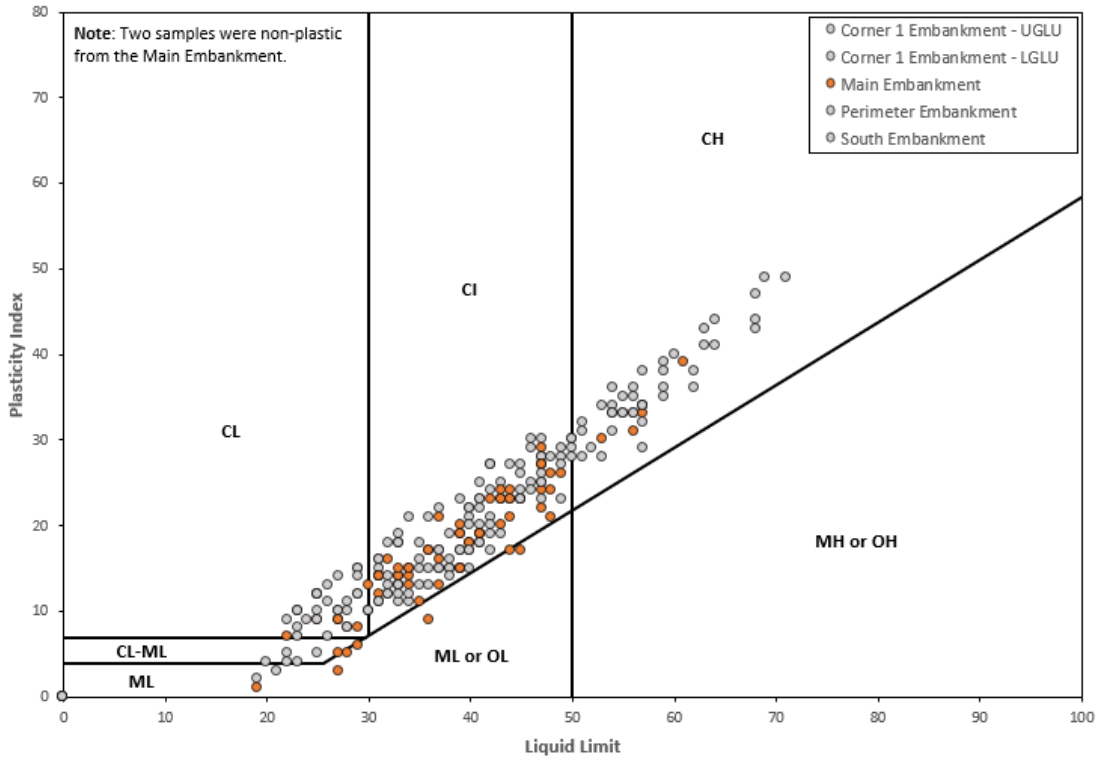

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-5: Plasticity Chart of Glaciolacustrine Samples from the Main Embankment

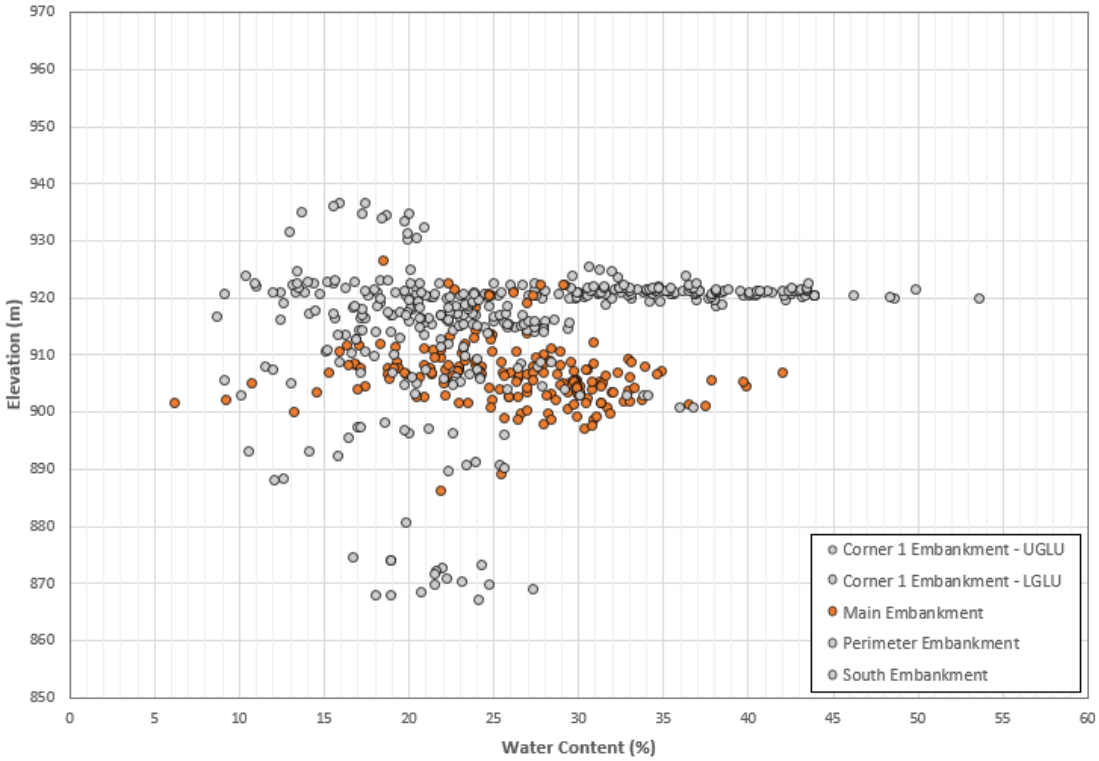

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-6: Water Content against Elevation of Glaciolacustrine Samples from the Main Embankment

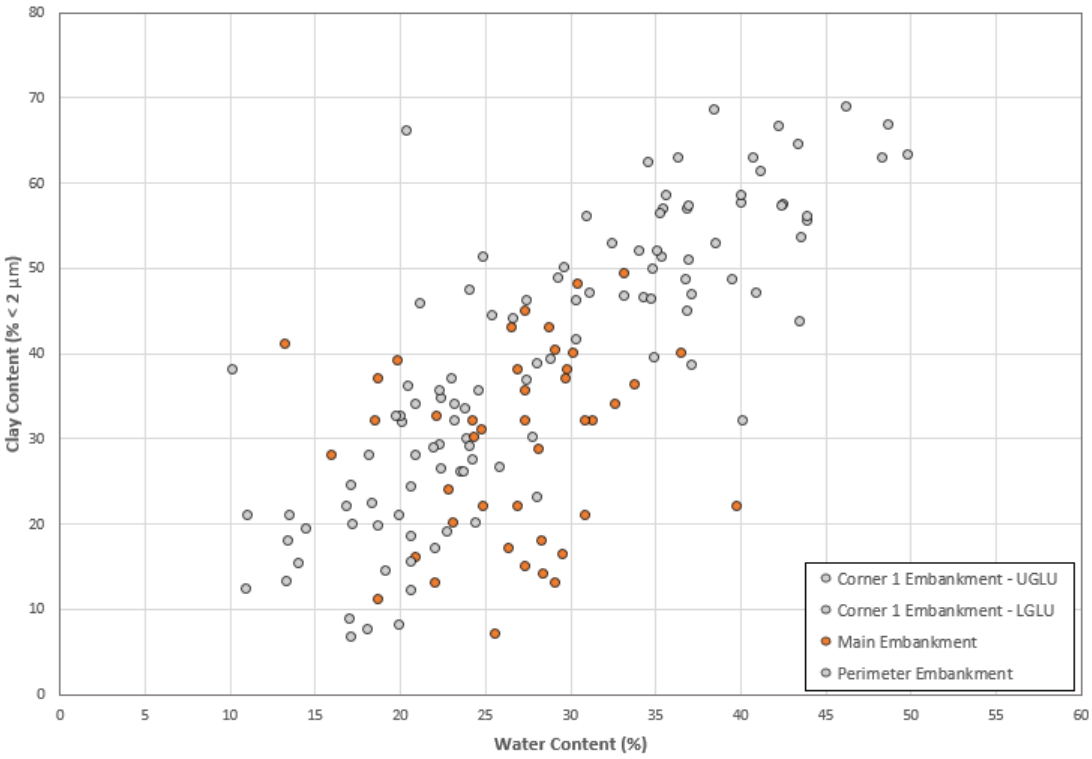

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-7: Water Content against Clay Content of Glaciolacustrine Samples from the Main Embankment

The results of consolidation tests carried out on sonic drilling and thin-walled tube samples of glaciolacustrine material from the Main Embankment are shown in Table 7-6 and Illustration 7-8a. Illustration 7-8b presents the preconsolidation pressures estimated using the Casagrande method.

Table 7-6: Consolidation Test Results of Glaciolacustrine Samples at the Main Embankment

Borehole No.	Sample No.	Sample Type	Elevation (m)	Estimated Preconsolidation Pressure (kPa)		Source
				Casagrande	Strain Energy	
GA15-12B	2	Sonic core	906.3	1,100	1,200	Golder (2015d)
GA15-12B	2	Sonic core	906.3	1,300	1,500	
GA15-12B	3	Sonic core	901.0	1,400	1,200	
GA15-15B	1	Thin-walled tube	907.8	1,200	1,400	
GA15-15B	2	Thin-walled tube	906.3	2,500	2,700	
GA15-21	5	Thin-walled tube	904.9	4,000	4,000	
GA21-07	TO3	Thin-walled tube	902.7	2,900	3,000	WSP Golder (2022b)
GA21-07	TO5	Thin-walled tube	901.5	2,500	2,600	
GA21-08	TO3	Thin-walled tube	906.6	1,100	1,100	
GA21-08	TO3	Thin-walled tube	906.6	3,300	3,400	
GA21-09	TO2	Thin-walled tube	908.6	1,400	1,300	
GA21-09	TO2	Thin-walled tube	908.6	2,900	2,800	

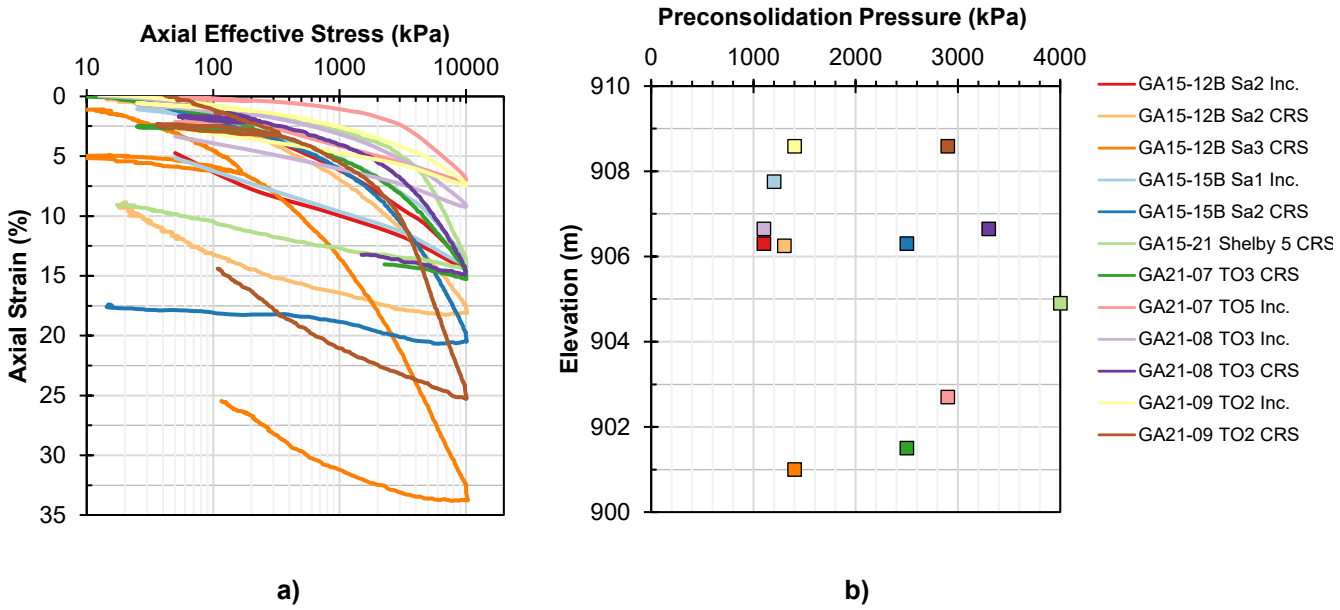

CRS = constant rate of strain; Inc. = incremental load.

Illustration 7-8: a) Consolidation Test Results on Glaciolacustrine Samples at the Main Embankment and b) Inferred Preconsolidation Pressure from Laboratory and Cone Penetration Test Data

The quality of the samples was assessed using two different methods. Lunne et al. (1997) use the $\Delta e/e_0$ value to evaluate the sample quality, where Δe is the change in sample void ratio caused by reapplying the in situ effective stress (σ_{v0}'), and e_0 is the initial void ratio of the soil. Karlsrud and Hernandez-Martinez (2013) use the M_0/M_L value for sample quality evaluation, where M_0 is the maximum constrained modulus in the overconsolidated stress range and M_L is the minimum constrained modulus after the preconsolidation pressure. Table 7-7 shows the sample quality assessment based on values of $\Delta e/e_0$ and M_0/M_L and Table 7-8 presents the results of the assessment.

Table 7-7: Sample Quality Assessment Criteria

Sample Quality	Lunne et al. (1997)		Karlsrud and Hernandez-Martinez (2013)
	$\Delta e/e_0$ for OCR = 1-2	$\Delta e/e_0$ for OCR = 2-4	
1 – Very good to excellent	<0.04	<0.03	>2.0
2 – Good to fair	0.04–0.07	0.03–0.05	1.5–2.0
3 – Poor	0.07–0.14	0.05–0.10	1.0–1.5
4 – Very poor	>0.14	>0.10	<1.0

e_0 = initial void ratio; Δe = change in sample void ratio caused by reapplying σ_{v0}'; σ_{v0}' = in situ effective stress; OCR = overconsolidation ratio.

Table 7-8: Quality Assessment of Glaciolacustrine Samples from the Main Embankment

Borehole No.	Sample No.	Sample Type	Consolidation Test	Lunne et al. (1997)	Karlsrud and Hernandez-Martinez (2013)
GA15-12B	2	Sonic core	Incremental load	Poor	Very poor
GA15-12B	2	Sonic core	CRS	Very poor	Poor
GA15-12B	3	Sonic core	CRS	Very poor	Very poor
GA15-15B	1	Thin-walled tube	Incremental load	Poor	Very poor
GA15-15B	2	Thin-walled tube	CRS	Good to fair	Poor
GA15-21	5	Thin-walled tube	CRS	Very good to excellent	Good to fair
GA21-07	TO3	Thin-walled tube	CRS	Poor	Poor
GA21-07	TO5	Thin-walled tube	Incremental load	Very good to excellent	Poor
GA21-08	TO3	Thin-walled tube	Incremental load	Good to fair	Very poor
GA21-08	TO3	Thin-walled tube	CRS	Poor	Poor
GA21-09	TO2	Thin-walled tube	Incremental load	Good to fair	Very poor
GA21-09	TO2	Thin-walled tube	CRS	Poor	Good to fair

CRS = constant rate of strain.

The results of the laboratory consolidation tests were compared with the interpreted preconsolidation pressure from CPTs carried out along the Main Embankment. The preconsolidation pressure (σ'_p) from the CPT data was estimated as $\sigma'_p = 0.33 (q_t - \sigma_{vo})$ (Mayne 2001). The comparison is shown in Illustration 7-9. Tests corresponding to very poor quality samples, using either of the two methods, are excluded from the comparison. The CPT data are seen to correlate reasonably well with the laboratory consolidation tests and provide a degree of confidence in the CPT interpreted preconsolidation pressure.

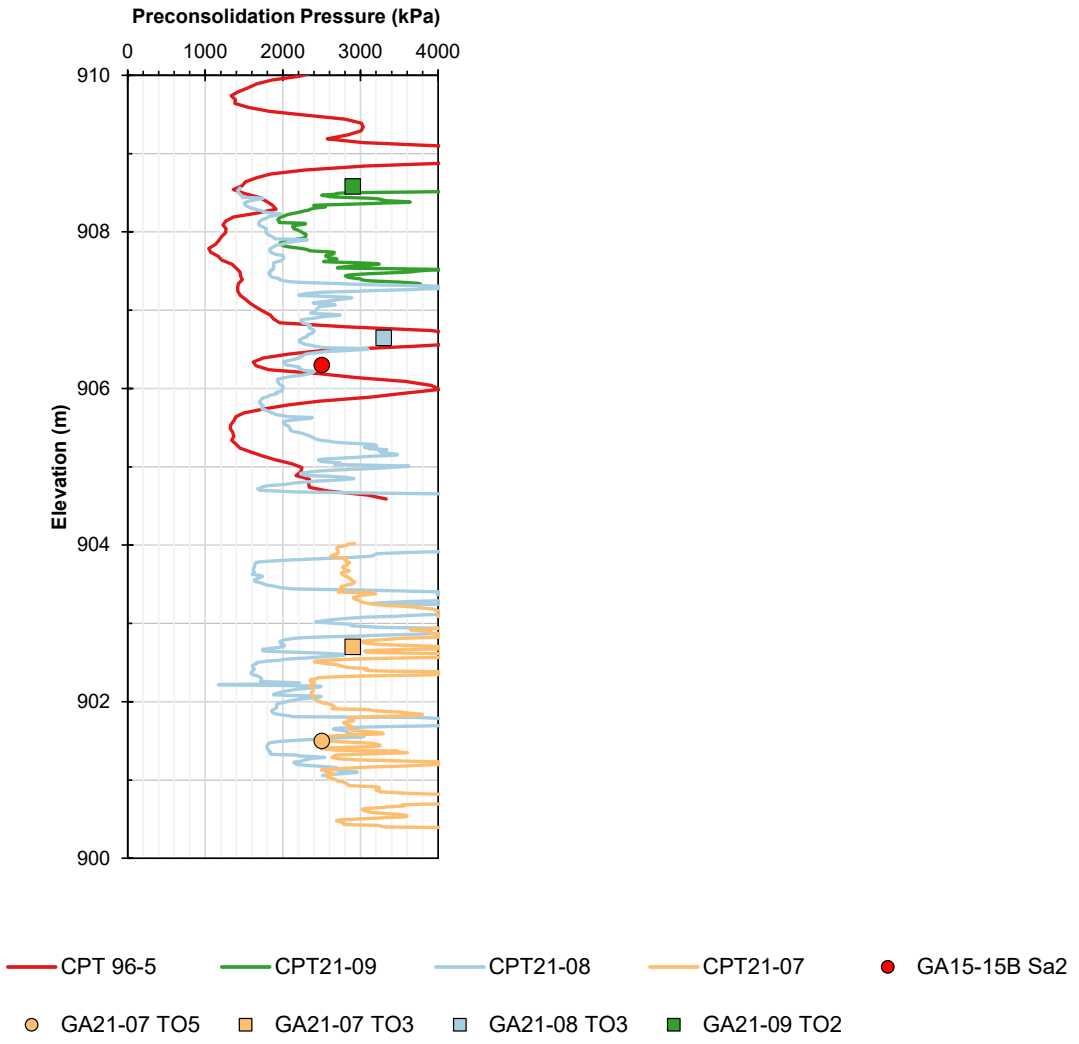

Illustration 7-9: Preconsolidation Pressure Comparison between Laboratory and Cone Penetration Test Data

The interpretations of CPTs from 1996 are presented in Golder (2015e). The interpretations of CPTs from 2021 are presented in APPENDIX E. Illustration 7-10a presents the preconsolidation pressure interpreted from all CPT data obtained at the elevation of the semi-continuous layer of glaciolacustrine soil (typically between approximate elevation 900 and 910 m). The interpreted preconsolidation pressure is generally greater than 1,200 kPa. A few points have a preconsolidation pressure between 1,000 and 1,200 kPa, as can be seen at an elevation of about 917 m for sounding PRW96-1, just below elevation 915 m for CPT96-1, and just below elevation 908 m for CPT96-5.

As shown in Illustration 7-10b, the preconsolidation pressure interpreted from CPT21-07 data near elevation 922 m (higher elevation glaciolacustrine deposit present between approximate Station 2+400 and 2+750) is greater than 850 kPa.

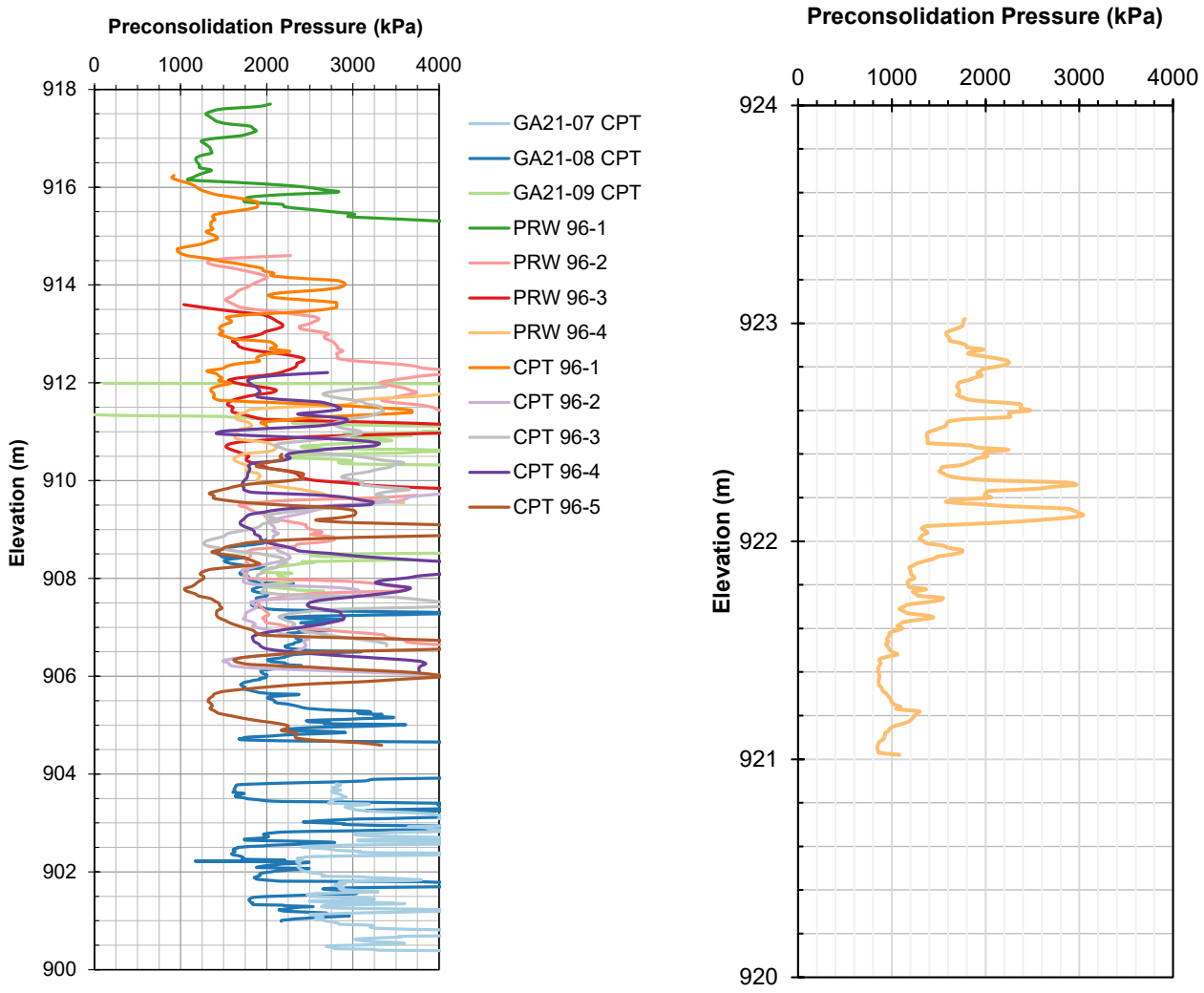

Illustration 7-10: a) Inferred Preconsolidation pressure from Main Embankment Cone Penetration Test Data between Elev. 900 and 918 m and b) Inferred Preconsolidation pressure from Main Embankment CPT21-07 Data between Elev. 921 and 923 m.

The undrained shear strength was measured in the laboratory with simple shear tests on glaciolacustrine soil samples from the Main Embankment (Golder 2015d; WSP Golder 2022b). A summary of the simple shear test results is presented in Table 7-9. The overconsolidation ratio (OCR) is presented for samples consolidated in the laboratory beyond the estimated preconsolidation pressure of the sample prior to shearing.

Table 7-9: Simple Shear Test Results of Glaciolacustrine Samples at the Main Embankment

Borehole No.	Sample No.	Sample Type	Initial Water Content (%)	Plasticity Index	Initial Vertical Effective Stress (kPa)	OCR	Maximum Undrained Shear Strength Ratio	Undrained Shear Strength Ratio at 20% Strain
GA15-12B	2	Sonic core	23.0	17	300	n/a	0.50	0.48
			22.5		900	n/a	0.32	0.30
			18.0		1,200	n/a	0.39	0.39
			18.1		1,200	n/a	0.36	n/a
GA15-12B	3	Sonic core	29.6	22	300	n/a	0.28	0.28
			38.9	n/a	900	n/a	0.26	0.23
			37.5	n/a	1,200	n/a	0.24	0.22
			27.4	n/a	300	4.0	0.71	n/a
GA15-15B	2	Thin-walled tube	30.1	27	300	n/a	0.41	0.40
			29.2	24	600	n/a	0.37	0.33
	1	Thin-walled tube	27.8	19	2,500	n/a	0.27	0.22
			24.8	17	300	8.3	0.99	0.84
GA15-21	5	Thin-walled tube	23.8	19	400	n/a	0.62	n/a
			30.9	22	800	n/a	0.32	n/a
			26.4	19	2,000	n/a	0.23	n/a
GA21-07	TO3	Thin-walled tube	22.5	19	500	4.8	0.68	0.55
			24.8	n/a	1,200	2.0	0.37	0.21
			27.9	n/a	2,400	1.0	0.23	0.17
GA21-08	TO3	Thin-walled tube	25.4	20	500	4.8	0.69	0.66
			26.7	n/a	1,200	2.0	0.40	0.37
			26.1	n/a	2,400	1.0	0.23	0.19
	TO5	Thin-walled tube	26.7	21	300	8.0	0.74	0.63

n/a = not applicable, not available

OCR = overconsolidation ratio.

Illustration 7-11a presents the undrained shear strength ratio function obtained following the SHANSEP (Stress History and Normalized Soil Engineering Properties) method (Ladd and Foot 1974). The results of the tests completed on samples collected from the Perimeter Embankment (Table 7-13 in Section 7.3.2) are also included in the illustration. The samples used to determine the SHANSEP parameters were reconsolidated to a vertical effective stress of 2,400 kPa and then the stresses were reduced to achieve the desired OCR before shearing them. Illustration 7-11b shows the undrained shear strength ratio function corresponding to a preconsolidation pressure of 1,200 kPa and compares it with results of simple shear tests carried out on specimens that were directly reconsolidated to different effective vertical stresses.

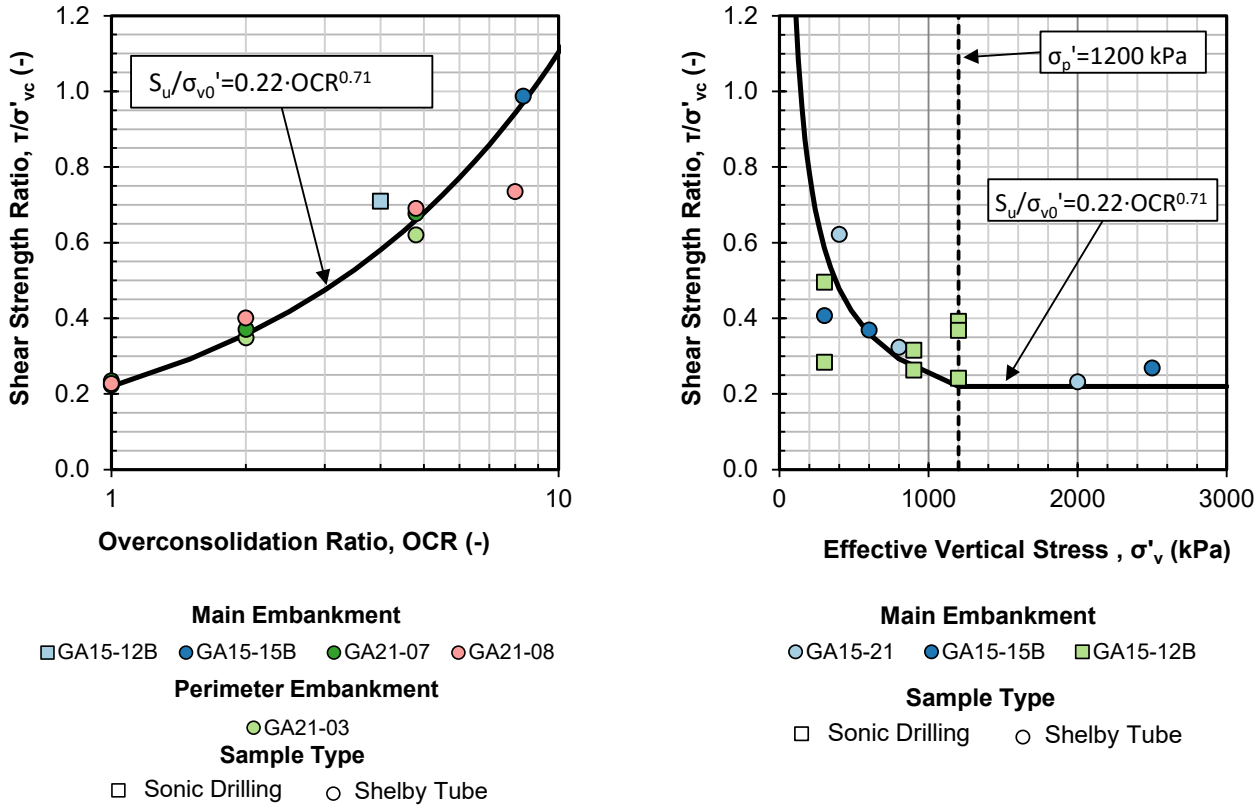

Illustration 7-11: Simple Shear Test Results on Glaciolacustrine Material at the Main Embankment and Perimeter Embankment a) Undrained Shear Strength Ratio Function Estimated Following the SHANSEP Method and b) Undrained Shear Strength Ratio Function for a Preconsolidation Pressure of 1,200 kPa

Undrained shear strength profiles were inferred using the data from CPTs carried out in 1996 and 2021 assuming an average N_{kt} factor of 15. The interpretations of CPTs from 1996 are presented in Golder (2015e). The interpretation of CPTs carried out in 2021 is presented in APPENDIX E. The undrained shear strength profiles show a strength greater than that calculated using the SHANSEP model with a preconsolidation value of 1,200 kPa. The sensitivity interpreted from the CPT data generally ranges between 2 and 3.

The effective friction angle of undisturbed glaciolacustrine samples from the Main Embankment was measured in direct shear tests and triaxial tests.

Direct shear tests were conducted on a sample collected downstream of the Main Embankment, adjacent to the Seepage Collection Pond, at a depth of 2.5 to 3.0 m (KP 2007b). No index properties were available for this sample. The peak friction angle was 26 degrees, and the residual friction angle was 23 degrees (with zero cohesion).

Triaxial tests were conducted on a reconstituted sample from the foundation of the Main Embankment (KP 1995a). The sample had a water content of 28.5% and contained 40% sand and 46% silt size particles. The peak friction angle was 33 degrees, assuming zero cohesion.

The undrained cyclic strength of undisturbed glaciolacustrine samples from the Main Embankment were measured in cyclic direct simple shear tests (WSP Golder 2022b). Illustration 7-12 shows the test results in terms of the cyclic strength ratio (CSR) required to generate single-amplitude shear strains of 3% during uniform cyclic loading.

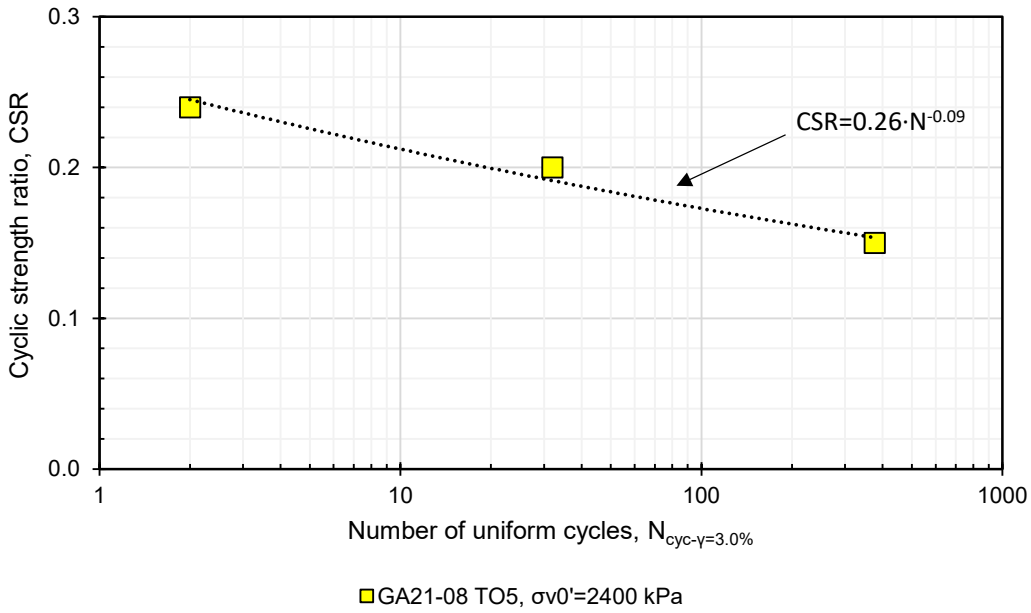

Illustration 7-12: Cyclic Strength Ratio Required to Cause Cyclic Failure (3% Strain) Versus the Number of Uniform Loading Cycles for the Glaciolacustrine at the Main Embankment.

7.3.2 Perimeter Embankment

A summary of the index properties for samples of glaciolacustrine material collected from the foundation of the Perimeter Embankment is presented in Table 7-10.

The Atterberg limit results are shown graphically in Illustration 7-13. The fines are generally a low to intermediate plastic material and range from silt to silty clay (ML to CI, respectively). Six results were outside of this general range and were either a non-plastic silt (ML) or a high plastic clay (CH).

The natural water content results were plotted against elevation, which is shown in Illustration 7-14. The average water content of the glaciolacustrine samples from the Perimeter Embankment was approximately 21% and ranged from 9% to 37%.

The natural water content results were also plotted against clay content as shown in Illustration 7-15. A total of 22 hydrometer test results were available for glaciolacustrine samples from the Perimeter Embankment foundation. The average clay content of the glaciolacustrine samples was approximately 29% and ranged from 7% to 71%. A general trend of increasing water content with increasing clay content can be seen in the illustration.

All available test results for glaciolacustrine samples collected from the foundation of the other embankments were incorporated into the illustrations for a comparison.

Table 7-10: Summary of Index Properties of Glaciolacustrine at the Perimeter Embankment

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	1	0	7	37
	Sand (%)	9	0	36	
	Fines (%)	90	60	100	
	Silt (%)	63	29	81	22
	Clay[a] (%)	29	7	71	
Liquid limit[b]		36	19	68	43
Plastic limit[b]		20	15	26	
Plasticity index[b]		16	2	44	
Water content (%)		21.4	9.2	36.8	113

a) Clay is defined as particles smaller than 0.002 mm.

b) Atterberg limits exclude two non-plastic samples from the Perimeter Embankment.

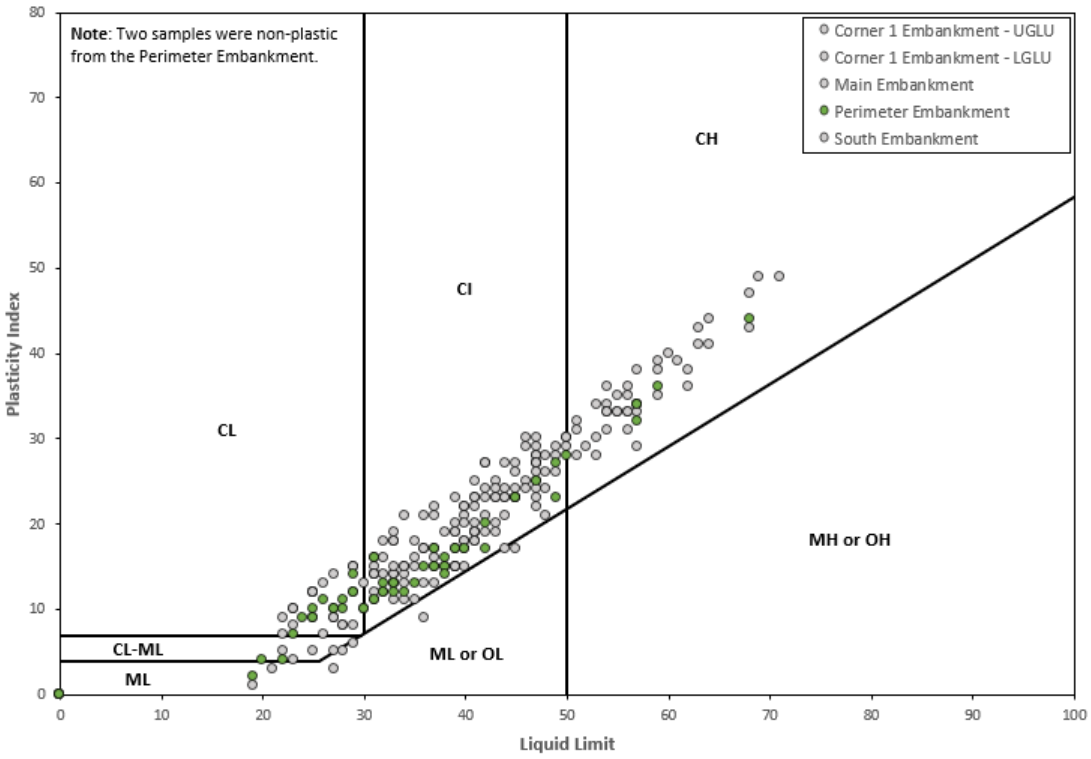

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-13: Plasticity Chart of Glaciolacustrine Samples from the Perimeter Embankment

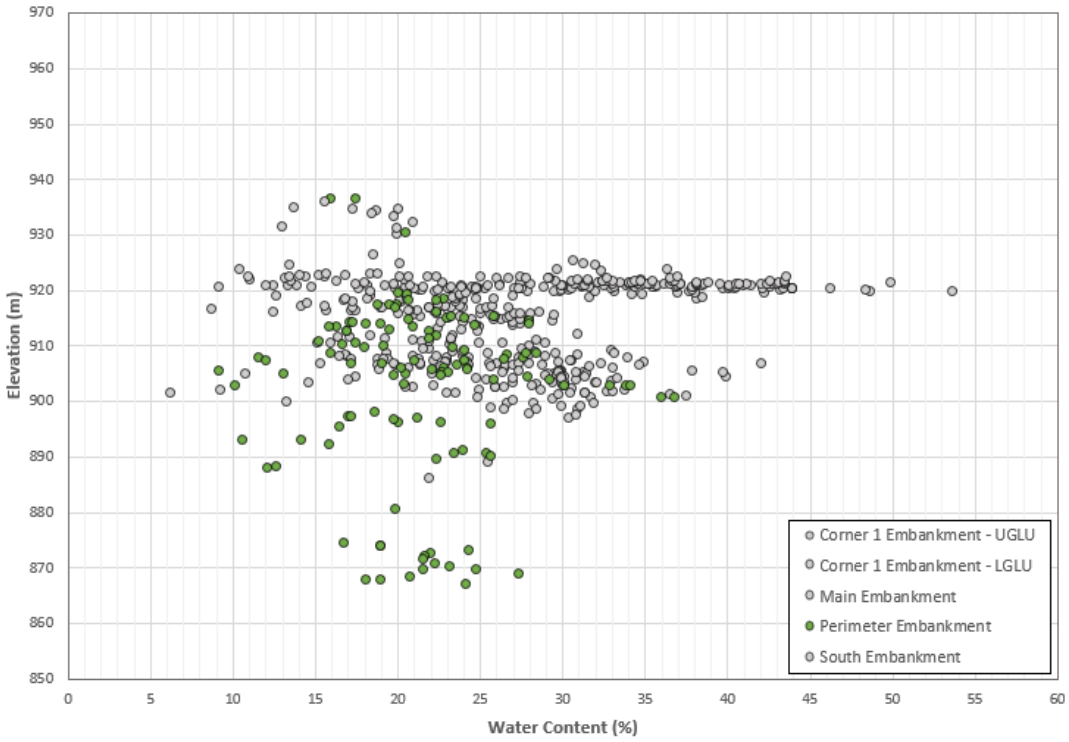

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-14: Water Content against Elevation of Glaciolacustrine Samples from the Perimeter Embankment

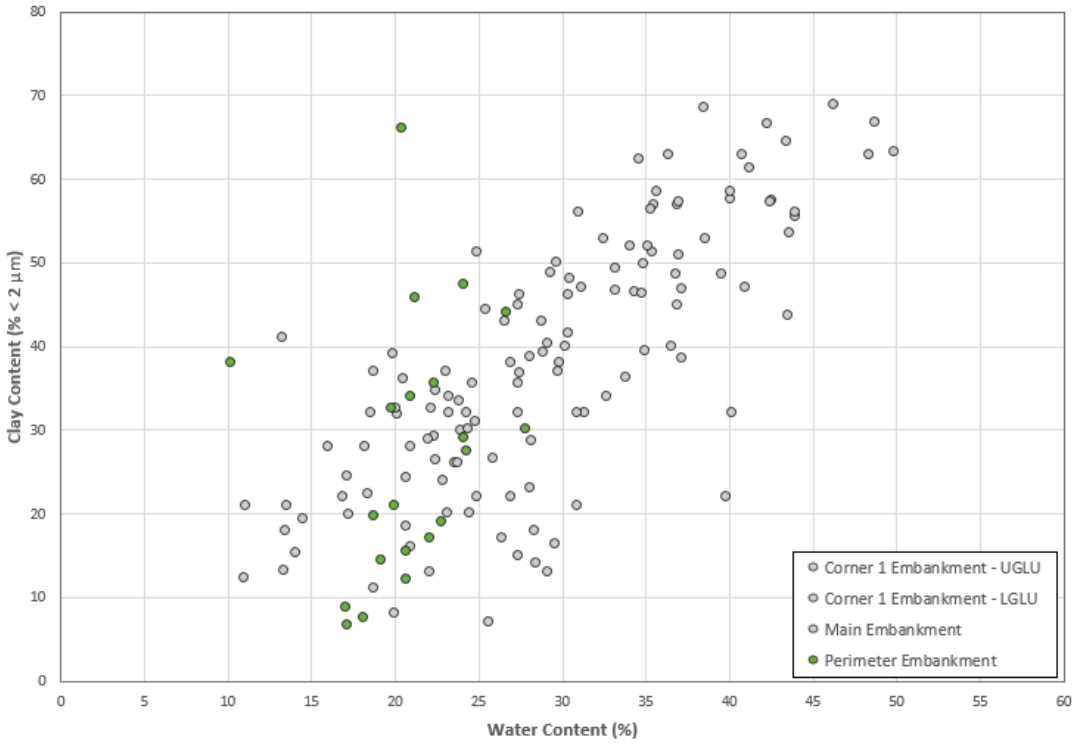

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-15: Water Content against Clay Content of Glaciolacustrine Samples from the Perimeter Embankment

Table 7-11 and Illustration 7-16a show the results of consolidation tests carried out on sonic drilling and thin walled-tube samples of glaciolacustrine soil from the Perimeter Embankment. Illustration 7-16b presents the preconsolidation pressures estimated using the Casagrande method and compares them with the interpreted preconsolidation pressure from CPT21-03 carried out in the Perimeter Embankment. The preconsolidation pressure (σ'_p) from the CPT data was estimated as $\sigma'_p = 0.33 (q_t - \sigma_{vo})$ (Mayne 2001) and is generally greater than 1,500 kPa after the initial push of the cone. The interpretations of CPTs carried out in 2021 are presented in APPENDIX E.

Table 7-11: Consolidation Test Results of Glaciolacustrine Samples at the Perimeter Embankment

Borehole No.	Sample No.	Sample Type	Elevation (m)	Estimated Preconsolidation Pressure (kPa)		Source
				Casagrande	Strain Energy	
GA15-06	Run 11a	Sonic core	908.4	1,500	1,500	Golder (2015d)
GA15-06	Run 11b	Sonic core	908.3	1,500	1,500	
GA15-06	Run 11c	Sonic core	907.5	1,100	1,200	
GA21-03	TO2	Thin-walled tube	905.6	3,600	3,800	WSP Golder (2022b)
GA21-03	TO3	Thin-walled tube	905.2	420	480	
GA21-03	TO4	Thin-walled tube	904.6	2,200	2,500	
GA21-03	TO5	Thin-walled tube	896.9	3,000	3,100	
GA21-03	TO5	Thin-walled tube	896.9	900	900	
GA21-11	TO2	Thin-walled tube	918.1	2,900	2,700	

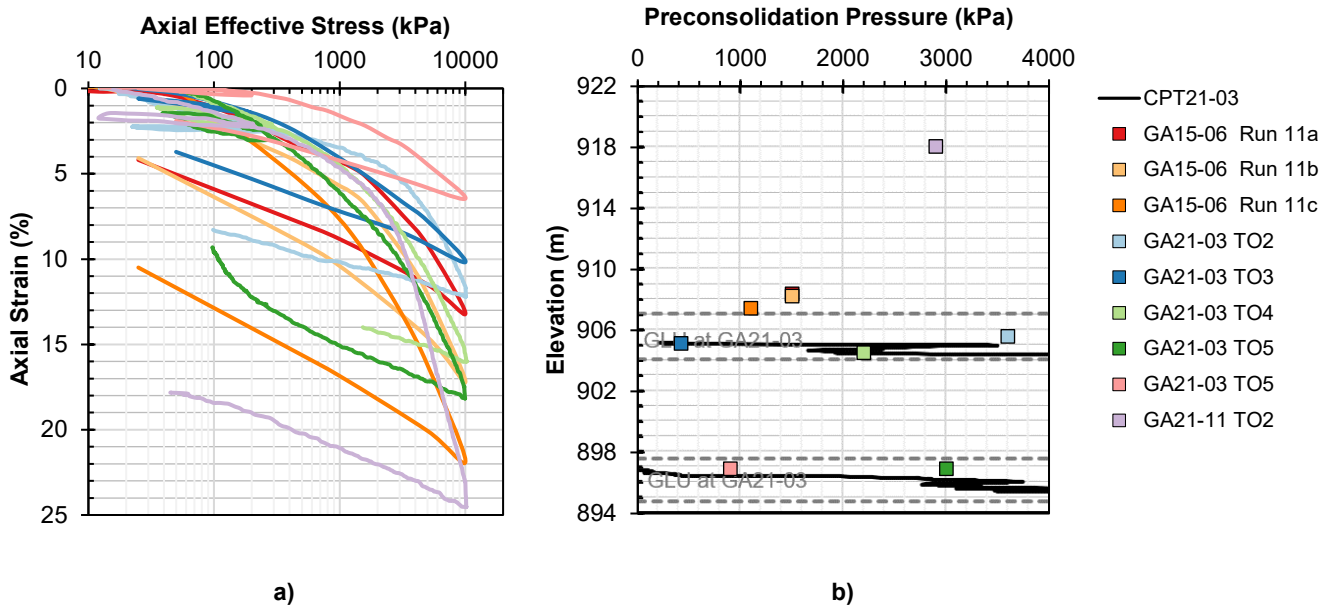

GLU = glaciolacustrine unit.

Illustration 7-16: a) Consolidation Test Results on Glaciolacustrine Samples at the Perimeter Embankment and b) Inferred Preconsolidation Pressure from Laboratory and Cone Penetration Test Data

The quality of the samples was assessed using the methods proposed by Lunne et al. (1997) and Karlsrud and Hernandez-Martinez (2013). A description of both methods is presented in Section 7.3.1. The results of the assessment are summarized in Table 7-12.

Table 7-12: Quality Assessment of Glaciolacustrine Samples from the Perimeter Embankment

Borehole No.	Sample No.	Sample Type	Consolidation Test	Lunne et al. (1997)	Karlsrud and Hernandez-Martinez (2013)
GA15-06	Run 11a	Sonic core	Incremental	Poor	Poor
GA15-06	Run 11b	Sonic core	Incremental	Very poor	Poor
GA15-06	Run 11c	Sonic core	Incremental	Very poor	Very poor
GA21-03	TO2	Thin-walled tube	CRS	Poor	Good to fair
GA21-03	TO3	Thin-walled tube	Incremental	Good to fair	Very poor
GA21-03	TO4	Thin-walled tube	CRS	Very poor	Poor
GA21-03	TO5	Thin-walled tube	CRS	Good to fair	Poor
GA21-03	TO5	Thin-walled tube	Incremental	Very good to excellent	Poor
GA21-11	TO2	Thin-walled tube	CRS	Very good to excellent	Very good to excellent

CRS = constant rate of strain.

The peak undrained shear strength was measured in the laboratory with simple shear tests on glaciolacustrine soil samples from the Main Embankment and Perimeter Embankment (Golder 2015d; WSP Golder 2022b). A single undrained shear strength ratio function was obtained following the SHANSEP method, as shown in Illustration 7-11. A summary of the simple shear test results from the Perimeter Embankment is presented in Table 7-13.

Table 7-13: Simple Shear Test Results of Glaciolacustrine Samples at the Perimeter Embankment

Borehole No.	Sample No.	Sample Type	Initial Water Content (%)	Plasticity Index	Initial Vertical Effective Stress (kPa)	OCR	Maximum Undrained Shear Strength Ratio	Undrained Shear Strength Ratio at 20% Strain
GA21-03	TO4	Thin-walled tube	21.3	15	500	4.8	0.62	0.56
			19.8	n/a	1,200	2.0	0.35	0.34
GA21-03	TO5	Thin-walled tube	23.3	28	2,400	1.0	0.22	0.19

OCR = overconsolidation ratio.

7.3.3 Corner 1 Embankment

Upper and lower glaciolacustrine soil deposits are present at the Corner 1 Embankment. The upper glaciolacustrine unit (UGLU) was identified as the soil layer through which the 2014 undrained failure developed and was the focus of the subsequent forensic investigations (IEEIRP 2015; KCB 2015b,c). As such, the characterization of the UGLU is presented in more detail than for the other soil units.

7.3.3.1 Upper Glaciolacustrine Unit

The UGLU generally consists of intermediate silty clay to high plasticity clay with trace to some sand and is firm to stiff. The UGLU deposit is a semi-continuous layer between about elevation 918 and 925 m from approximately Station 20+000 to 20+300. The maximum thickness of the UGLU within the breach area at Corner 1 is about 3 m as indicated from the forensic investigation carried out by the Independent Expert Engineering Investigation and Review Panel (IEEIRP 2015). The foundation investigation completed in 2016 also confirmed that the UGLU extended downstream of the breach area (Golder 2017). A summary of the index properties for samples of the UGLU collected from the Corner 1 Embankment is presented in Table 7-14.

The Atterberg limit results are shown graphically in Illustration 7-17. The fines are generally an intermediate to high plasticity material and range from silty clay to clay (CI to CH, respectively). Six results were outside of this general range and were either a low plasticity silt (ML) or a low plasticity silty clay (CL).

The natural water content results were plotted against elevation, which is shown in Illustration 7-18. The average water content of the UGLU is approximately 31% and ranges from 9% to 54%. The water content of the UGLU is generally much greater compared to the glaciolacustrine material encountered at the other embankments as shown in the illustration. The illustration also shows a relatively consistent layer of UGLU material from approximate elevation 918 to 925 m.

The natural water content results were also plotted against clay content as shown in Illustration 7-19. A total of 70 hydrometer test results were available for the UGLU sampled from the foundation of the Corner 1 Embankment. The average clay content of the UGLU is approximately 46% and ranges from 8% to 69%.

The clay content of the UGLU is generally much greater compared to the glaciolacustrine material encountered at the other embankments as shown in the illustration. A general trend of increasing water content with increasing clay content can also be seen in the illustration.

All available test results for glaciolacustrine samples collected from the foundation of the other embankments were incorporated into the illustrations for a comparison.

Table 7-14: Summary of Index Properties of Upper Glaciolacustrine Unit

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	3	0	32	72
	Sand (%)	9	0	35	
	Fines (%)	88	43	100	
	Silt (%)	42	20	72	70
	Clay[(a)] (%)	46	8	69	
Liquid limit		46	21	71	96
Plastic limit		19	13	28	
Plasticity index		27	3	49	
Water content (%)		30.5	9.2	53.7	189
Specific gravity of solids		2.80	2.75	2.87	12

a) Clay is defined as particles smaller than 0.002 mm.

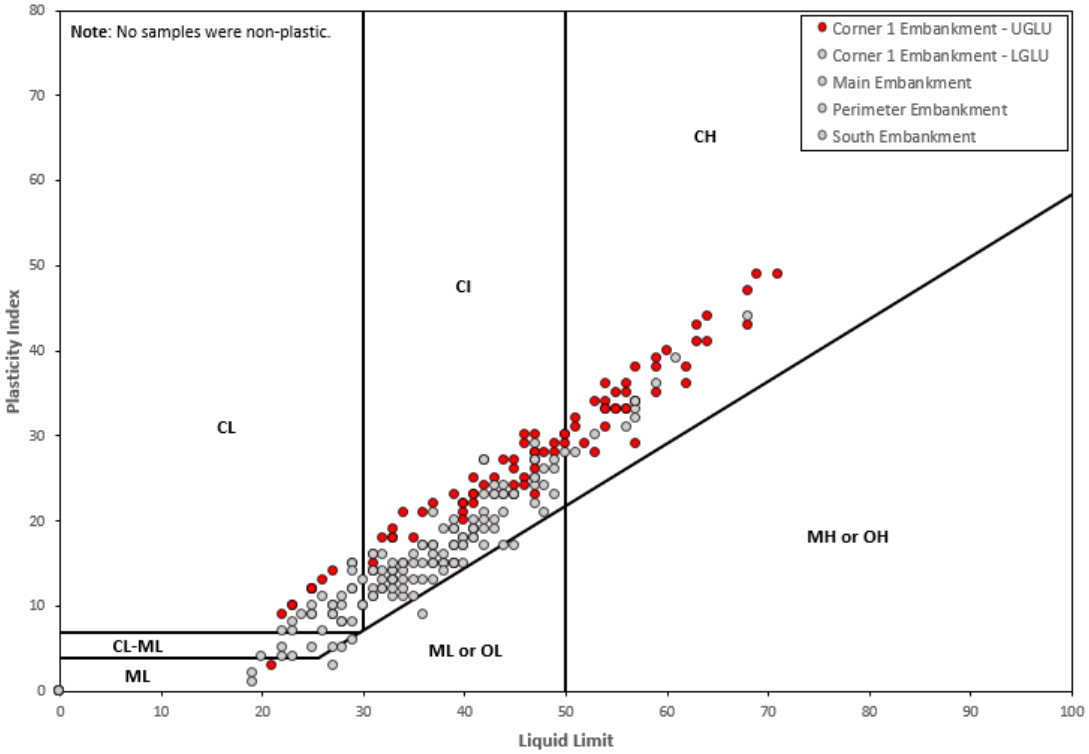

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-17: Plasticity Chart of Upper Glaciolacustrine Unit Samples from the Corner 1 Embankment

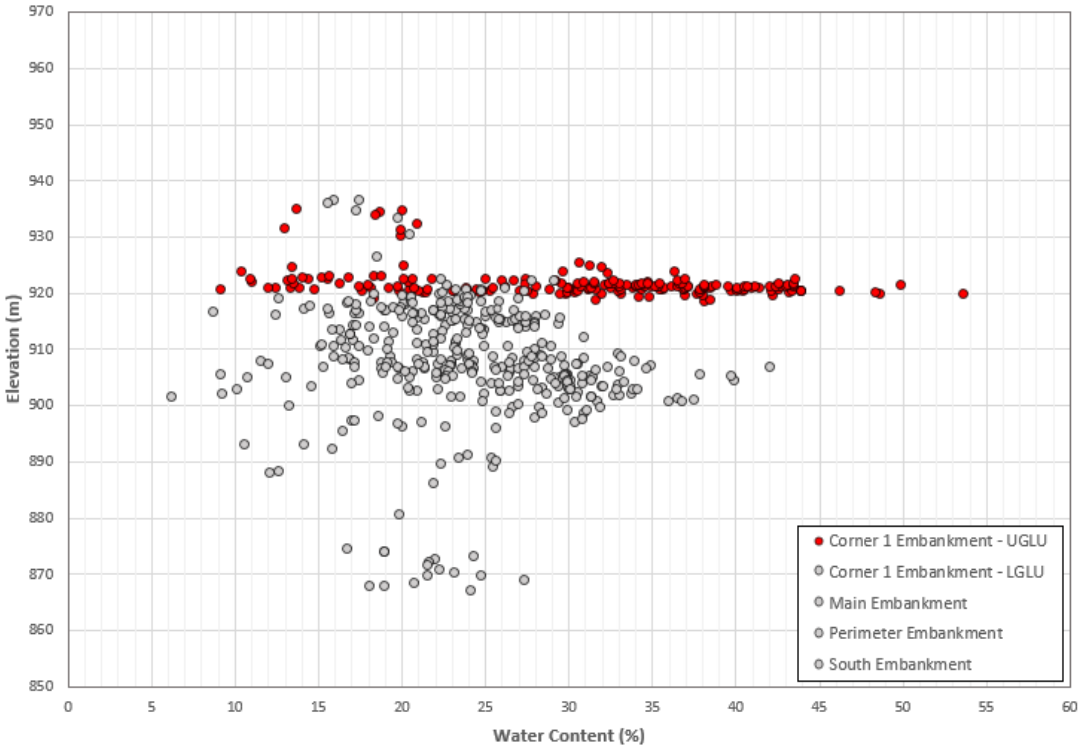

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-18: Water Content against Elevation of Upper Glaciolacustrine Unit Samples from the Corner 1 Embankment

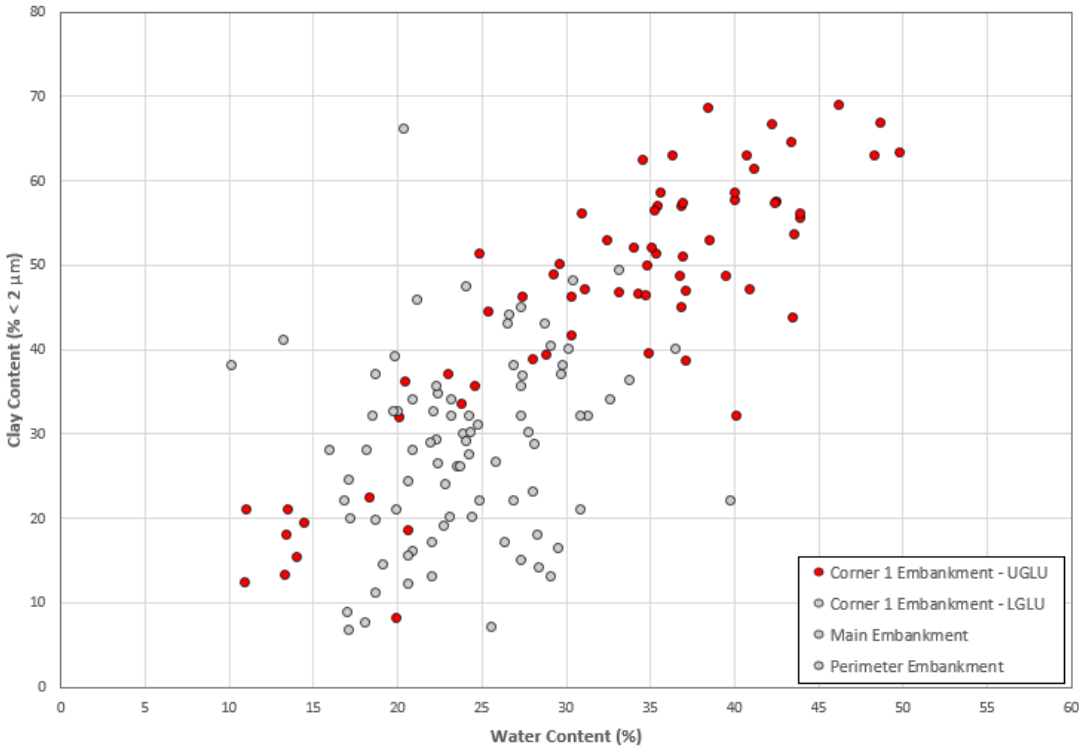

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-19: Water Content against Clay Content of Upper Glaciolacustrine Unit Samples from the Corner 1 Embankment

Table 7-15 and Illustration 7-20 show the results of consolidation tests carried out on the UGLU samples. The results show that the UGLU has a preconsolidation pressure, σ'_p, of about 400 kPa. Estimated hydraulic conductivity from consolidation tests was about 5×10^{-10} m/s for stresses between 100 and 800 kPa, and a coefficient of consolidation (c_v) of about 5×10^{-7} m^2/s. The coefficient of consolidation estimated from pore pressure response in the field following rockfill placement (using piezometer VST14-03) was 6×10^{-7} m^2/s.

Table 7-15: Consolidation Test Results of Upper Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Sample Type	Elevation (m)	Estimated Preconsolidation Pressure (kPa)	Source
MR14-106C	1C	Thin-walled tube	920.9	454	IEEIRP (2015)
MR14-106E	2B	Thin-walled tube	921.1	474	
MR14-106E	2C	Thin-walled tube	920.8	300	
MR14-106E	4B	Thin-walled tube	920.0	535	
MR14-106E	4D	Thin-walled tube	919.8	446	
MR14-106F	3B	Thin-walled tube	920.2	443	
MR14-106G	3A	Thin-walled tube	920.4	510	
MR14-106H	1B	Thin-walled tube	921.1	449	
MR14-107	6C-1	Thin-walled tube	921.6	330	
MR14-107A	1B	Thin-walled tube	921.0	516	
MR14-107B	1B	Thin-walled tube	921.5	312	

Table 7-15: Consolidation Test Results of Upper Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Sample Type	Elevation (m)	Estimated Preconsolidation Pressure (kPa)	Source
RH14-03A	SS-03	Thin-walled tube	920.4	390	KCB (2015b)
RH14-10	SS-01	Thin-walled tube	920.8	380	
RH14-10	SS-02	Thin-walled tube	920.2	380	
RH14-22	SS-02	Thin-walled tube	920.5	400	
RH14-22A	SS-02	Thin-walled tube	920.5	420	
TP14-01	BS-02	Block	n/a	410	
GA16-09	6B	Thin-walled tube	920.2	590	Golder (2017)

n/a = not available.

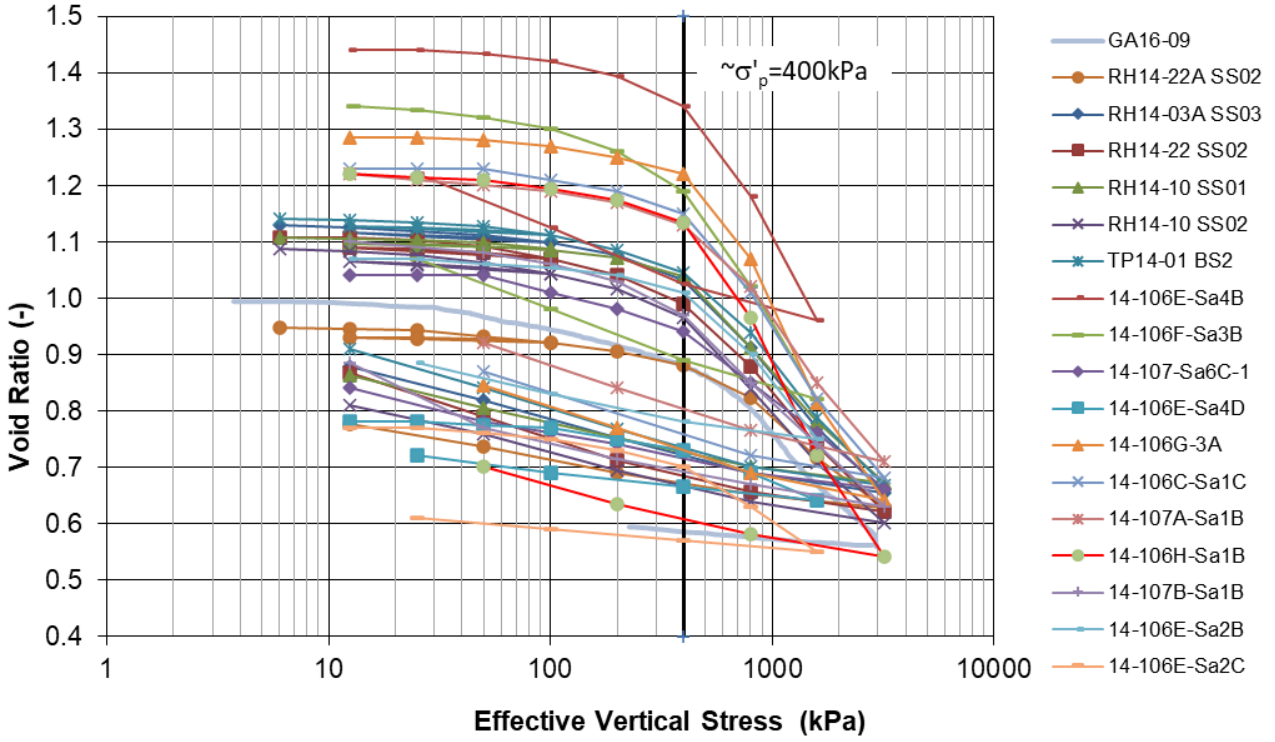

σ'_p = preconsolidation pressure.

Illustration 7-20: Consolidation Test Results on Upper Glaciolacustrine Unit Samples

The quality of the samples was assessed using the methods proposed by Lunne et al. (1997) and Karlsrud and Hernandez-Martinez (2013). A description of both methods is presented in Section 7.3.1. The results of the assessment are summarized in Table 7-16.

Table 7-16: Quality Assessment of Upper Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Sample Type	Consolidation Test	Lunne et al. (1997)	Karlsrud and Hernandez-Martinez (2013)
MR14-106C	1C	Thin-walled tube	Incremental	Very good to excellent	Good to fair
MR14-106E	2B	Thin-walled tube	Incremental	Very good to excellent	Very good to excellent
MR14-106E	2C	Thin-walled tube	Incremental	Good to fair	Very poor
MR14-106E	4B	Thin-walled tube	Incremental	Very good to excellent	Very good to excellent
MR14-106E	4D	Thin-walled tube	Incremental	Good to fair	Poor
MR14-106F	3B	Thin-walled tube	Incremental	Good to fair	Poor
MR14-106G	3A	Thin-walled tube	Incremental	Very good to excellent	Very good to excellent
MR14-106H	1B	Thin-walled tube	Incremental	Very good to excellent	Very good to excellent
MR14-107	6C-1	Thin-walled tube	Incremental	Poor	Very poor
MR14-107A	1B	Thin-walled tube	Incremental	Very good to excellent	Poor
MR14-107B	1B	Thin-walled tube	Incremental	Poor	Poor
RH14-03A	SS-03	Thin-walled tube	Incremental	Good to fair	Poor
RH14-10	SS-01	Thin-walled tube	Incremental	Very good to excellent	Very good to excellent
RH14-10	SS-02	Thin-walled tube	Incremental	Good to fair	Poor
RH14-22	SS-02	Thin-walled tube	Incremental	Poor	Poor
RH14-22A	SS-02	Thin-walled tube	Incremental	Good to fair	Poor
TP14-01	BS-02	Block	Incremental	Very good to excellent	Poor
GA16-09	6B	Thin-walled tube	CRS	Poor	Very good to excellent

CRS = constant rate of strain.

The peak undrained shear strength of UGLU samples were measured in the laboratory with simple shear tests. A summary of the simple shear test results is presented in Table 7-17.

Table 7-17: Simple Shear Test Results of Upper Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Initial Water Content (%)	Plasticity Index	Initial Vertical Effective Stress (kPa)	Static Bias (kPa)	OCR	Maximum Undrained Shear Strength Ratio	Undrained Shear Strength Ratio at 20% Strain
MR14-106A	1C-T1	43.1	31	600	n/a	1.0	0.22	0.18
MR14-106A	1C-T2	36.6	31	600	60	1.0	0.23	n/a
MR14-106A	1C-T3	38.2	31	600	120	1.0	0.26	0.22
MR14-106A	1C-T4	33.1	31	300	60	1.47	0.28	0.25
MR14-106C	1B-T2	43.2	33	600	150	1.0	0.27	0.15
MR14-106C	1B-T3	38.9	33	600	60	1.0	0.21	0.17
MR14-106G	2B-T1	43.5	21	600	60	1.0	0.21	0.17
MR14-106G	B-T2	38.3	21	600	120	1.0	0.26	0.22
MR14-107	6C-T1	43.5	23	300	30	1.1	0.27	0.22

Table 7-17: Simple Shear Test Results of Upper Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Initial Water Content (%)	Plasticity Index	Initial Vertical Effective Stress (kPa)	Static Bias (kPa)	OCR	Maximum Undrained Shear Strength Ratio	Undrained Shear Strength Ratio at 20% Strain
MR14-107	6C-T2	42.6	23	300	30	1.1	0.25	0.20
MR14-107A	1A-T1	42.7	34	600	n/a	1.0	0.21	0.15
MR14-107A	1A-T2	42.1	34	600	n/a	1.0	0.20	0.18
SH14-10A	6	34.9	28	400	n/a	n/a	0.26	0.22
RH14-03A	SS-03	40.2	16	400	n/a	n/a	0.24	0.17
RH14-10	SS-01	37.2	23	400	n/a	n/a	0.23	0.16
RH14-10	SS-01	39.9	23	800	n/a	n/a	0.18	0.17
RH14-10	SS-02	36.1	35	800	n/a	n/a	0.20	0.18
RH14-10	SS-02	28.3	35	400	n/a	n/a	0.26	0.19
RH14-10	SS-02	40.3	35	100	n/a	4.0	0.66	0.53
RH14-22	SS-02	37.7	24	400	n/a	n/a	0.25	0.18
RH14-22	SS-02	40.5	24	100	n/a	4.0	0.63	0.52
RH14-22A	SS-02	36.3	30	800	n/a	n/a	0.18	0.17
RH14-22A	SS-02	39.4	30	400	n/a	n/a	0.26	0.20
RH14-22A	SS-02	35.5	30	100	n/a	4.0	0.60	0.51
TP14-01	BS-02	38.9	22	100	n/a	4.0	0.61	0.60
TP14-01	BS-02	34.5	22	400	n/a	n/a	0.26	0.17
TP14-01	BS-02	36.5	22	800	n/a	n/a	0.20	0.16

n/a = not available, not applicable.

OCR = overconsolidation ratio.

The peak undrained shear strength and remoulded (residual) undrained shear strength were measured with an electronic field vane during the forensic investigations (IEEIRP 2015; KCB 2015c). The peak and remolded undrained shear strengths were also estimated from CPT data collected during the forensic investigations. The sensitivity of the UGLU was inferred to be about 2 to 3 based on average CPT tip resistance within and outside of the breach area (IEEIRP 2015). The undrained shear strength, s_u, was estimated using the cone tip resistance, q_t, total overburden stress, σ'_{v0}, and bearing factor, N_{kt}, as follows:

$$s_u = \frac{q_t - \sigma_{v0}}{N_{kt}}$$

A value N_{kt} of 15 was used. The remoulded shear strength, s_{u_r}, was estimated directly from the sleeve friction resistance, f_s.

Illustration 7-21 and Illustration 7-22 show the average values and standard deviation for the peak and remoulded undrained shear strengths, respectively, estimated for the UGLU. The peak shear strength includes values estimated from the field vane test, CPTs, and simple shear tests. The remoulded undrained shear strength includes values from the field vane tests and CPTs.

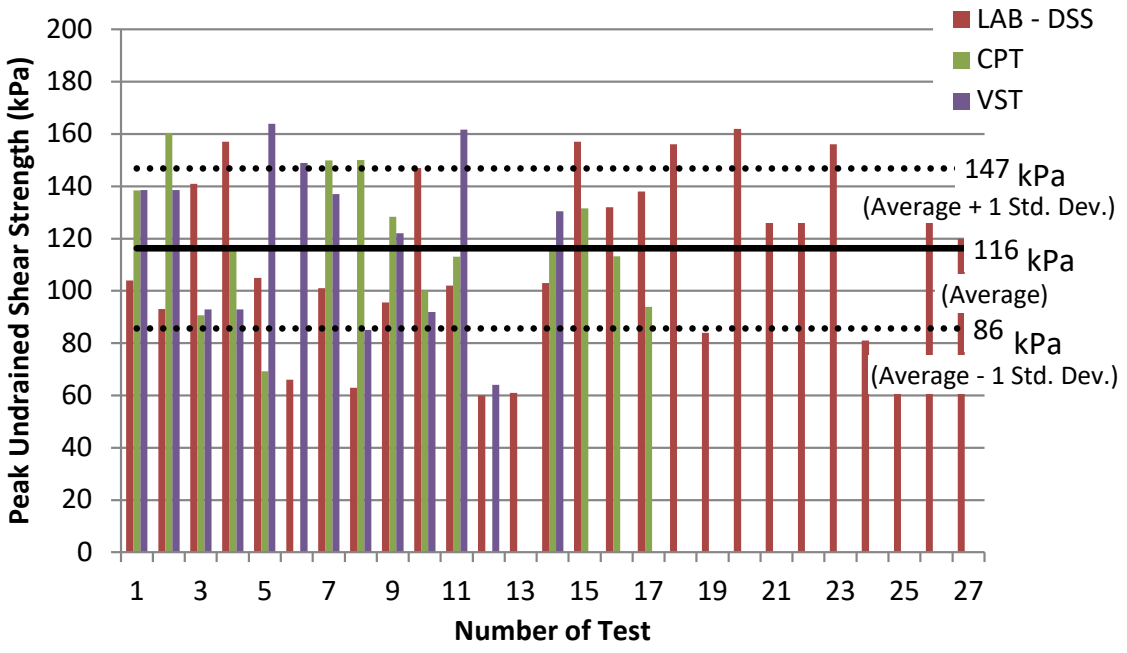

LAB - DSS = direct simple shear; CPT = cone penetration test; VST = vane shear test.

Illustration 7-21: Peak Undrained Shear Strength Estimated for the Upper Glaciolacustrine Unit

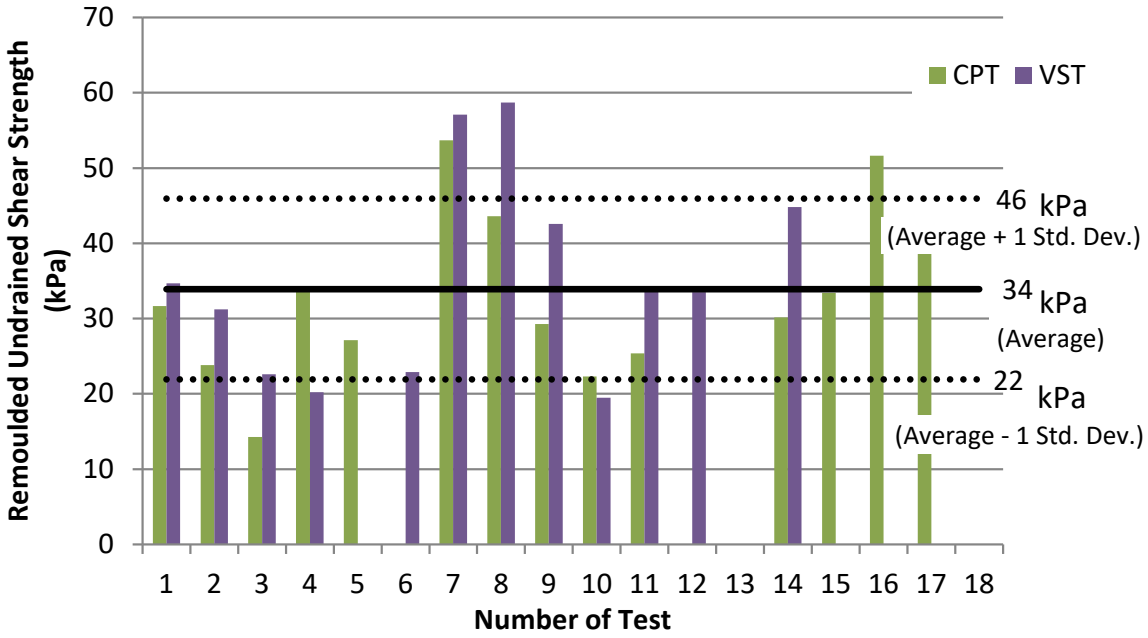

CPT = cone penetration test; VST = vane shear test.

Illustration 7-22: Remoulded Undrained Shear Strength Estimated for the Upper Glaciolacustrine Unit

The peak and remolded undrained shear strengths were also estimated using CPT data collected during the foundation investigation in 2016 downstream of the zone of the breach (Golder 2017). The estimated peak and remolded undrained shear strengths were typically greater than the averages estimated at the zone of the breach.

Illustration 7-23 shows the shear strength ratio estimated from simple shear tests at various effective vertical stress levels. Data obtained from the field vane and CPT is also included in the illustration. The undrained shear strength ratio function based on the SHANSEP method is included in Illustration 7-23. The undrained shear strength ratio (s_u/σ'_v) of the UGLU decreases with increasing effective vertical stress level. For stresses higher than the estimated preconsolidation pressure, the undrained shear strength ratio is constant at s_u/σ'_v = 0.22.

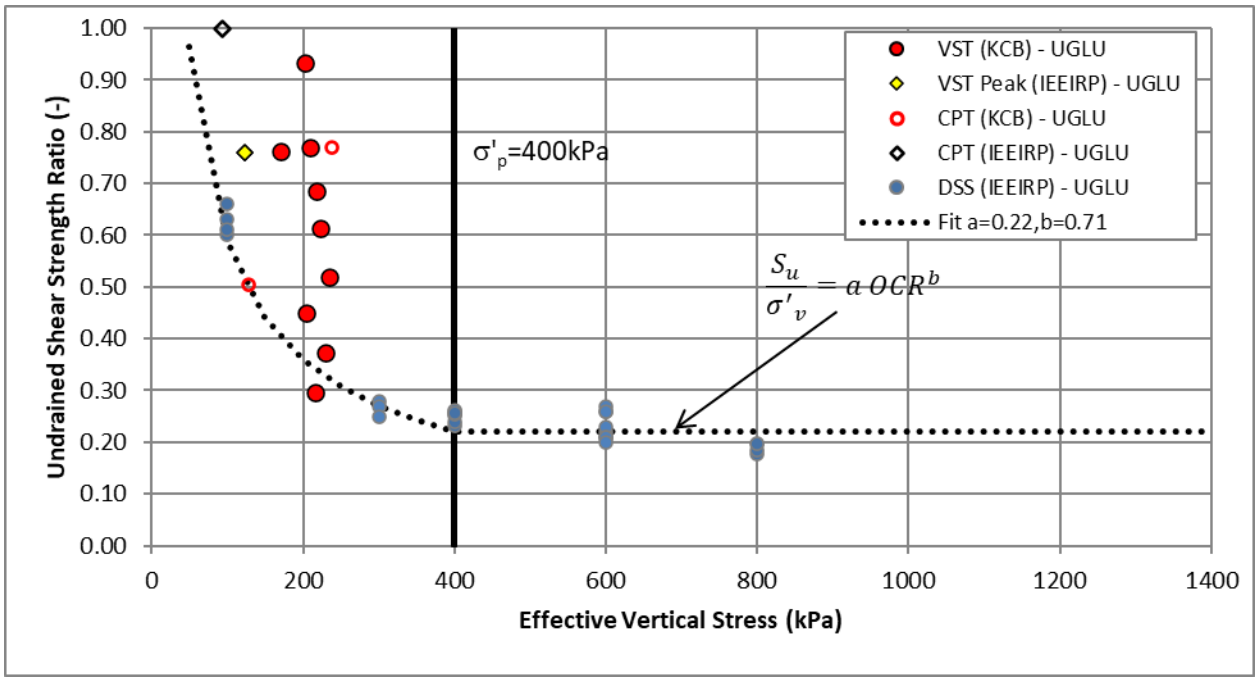

CPT = cone penetration test; OCR = overconsolidation ratio; s_u = undrained shear strength; σ'_p = preconsolidation pressure; σ'_v = effective vertical stress; SS = simple shear; UGLU = upper glaciolacustrine unit; VST = vane shear test.

Illustration 7-23: Peak Undrained Shear Strength Ratio Estimated for the Upper Glaciolacustrine Unit

The IEEIRP report presents stability analyses using a range of strength ratios from 0.22 to 0.27, with the IEEIRP "favouring a result above the average, say 0.25." The deformation analyses carried out by the IEEIRP using PLAXIS indicated collapse occurring at an undrained strength ratio of 0.29.

The peak and residual effective friction angles of the UGLU were measured on undisturbed samples in direct shear tests. The peak effective friction angle was also measured in a triaxial test, with the specimen rotated to allow failure along the GLU. The peak effective friction angle ranged from 19 to 31 degrees, and the residual effective friction angle ranged from 11 to 28 degrees, assuming zero cohesion and for normal stresses up to 800 kPa.

The undrained cyclic strength of the UGLU was measured on a single thin-walled tube sample in a cyclic direct simple shear test. Illustration 7-24 shows the test result in terms of the CSR required to generate peak (single-amplitude) shear strains of 3% during uniform cyclic loading. The test result is compared with other results obtained on glaciolacustrine samples from the Main Embankment.

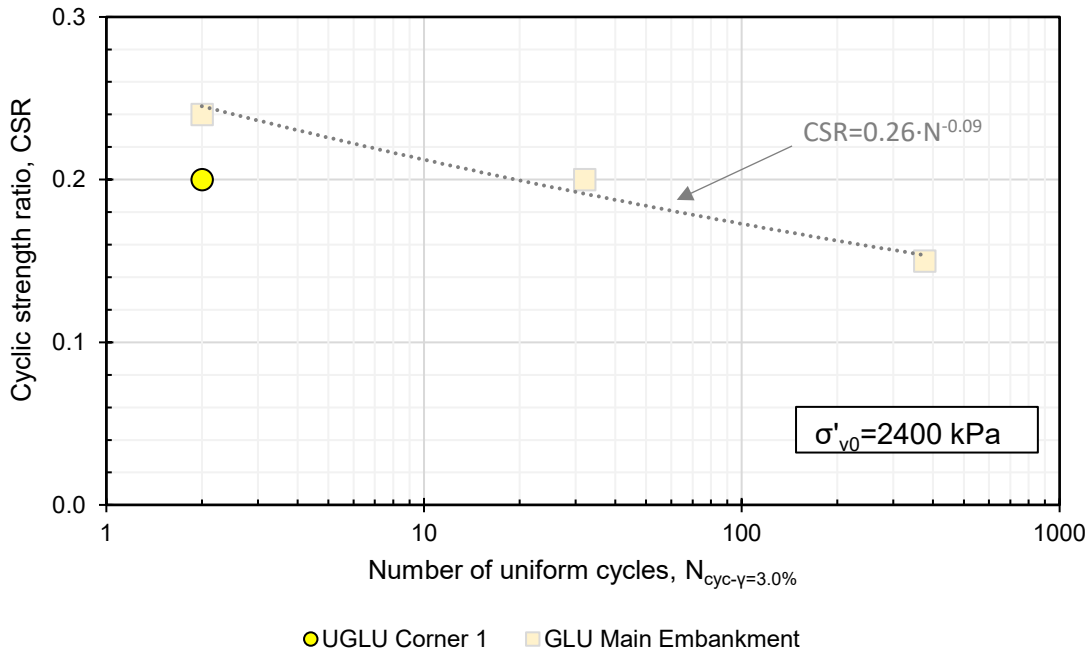

σ_v'= effective vertical stress; GLU = glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-24: Cyclic Strength Ratio Required to Cause Cyclic Failure (3% strain) versus the Number of Uniform Loading Cycles for the Upper Glaciolacustrine Unit

7.3.3.2 Lower Glaciolacustrine Unit

The lower glaciolacustrine unit (LGLU) deposit is a semi-continuous layer between approximate elevation 900 and 918 m. The maximum thickness of the LGLU within the breach area at Corner 1 is approximately 5 m. The foundation investigation completed in 2016 also confirmed that the LGLU extended downstream of the breach area (Golder 2017). A summary of the index properties for samples of the LGLU collected from the Corner 1 Embankment is presented in Table 7-18.

The Atterberg limit results are shown graphically in Illustration 7-25. The fines are generally a low to intermediate plastic material and range from silty clay – clayey silt to silty clay (CL-ML to CI, respectively). One test was outside of this general range, resulting in a high plasticity clay (CH).

The natural water content results were plotted against elevation, which is shown in Illustration 7-26. The average water content of the LGLU is approximately 22% and ranges from 9% to 30%. The water content of the LGLU is generally much lower compared to the UGLU also encountered at the Corner 1 Embankment.

The natural water content results were also plotted against clay content as shown in Illustration 7-27. A total of 20 hydrometer test results were available for the LGLU sampled from the foundation of the Corner 1 Embankment. The average clay content of the LGLU is approximately 28% and ranges from 20% to 37%. The clay content of the LGLU is generally much lower compared to the UGLU.

All available test results for glaciolacustrine samples collected from the foundation of the other embankments were incorporated into the illustrations for comparison.

Table 7-18: Summary of Index Properties of Lower Glaciolacustrine Unit

Index Property		Average	Minimum	Maximum	Number of Tests
Gradation	Gravel (%)	1	0	9	20
	Sand (%)	5	0	18	
	Fines (%)	94	80	100	
	Silt (%)	66	54	74	20
	Clay[a] (%)	28	20	37	
Liquid limit		35	22	51	29
Plastic limit		20	14	25	
Plasticity index		15	4	28	
Water content (%)		22.3	8.8	29.5	79
Specific gravity of solids		2.75	2.75	2.75	1

a) Clay is defined as particles smaller than 0.002 mm.

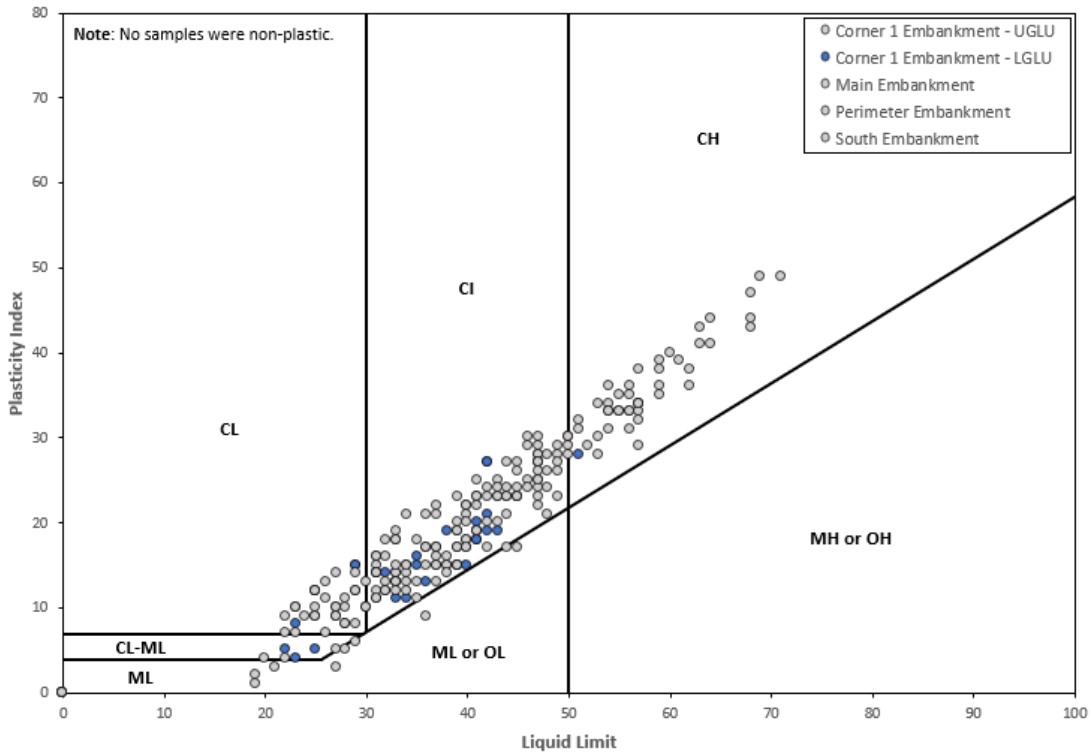

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-25: Plasticity Chart of Lower Glaciolacustrine Unit Samples from the Corner 1 Embankment

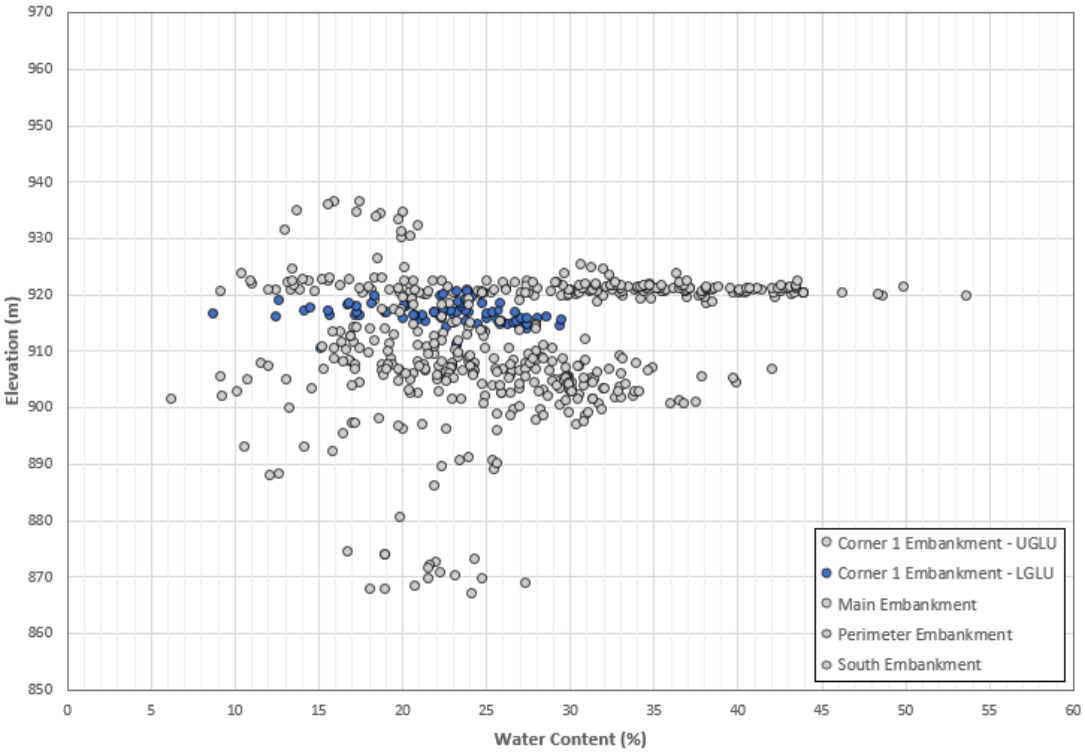

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-26: Water Content against Elevation of Lower Glaciolacustrine Unit Samples from the Corner 1 Embankment

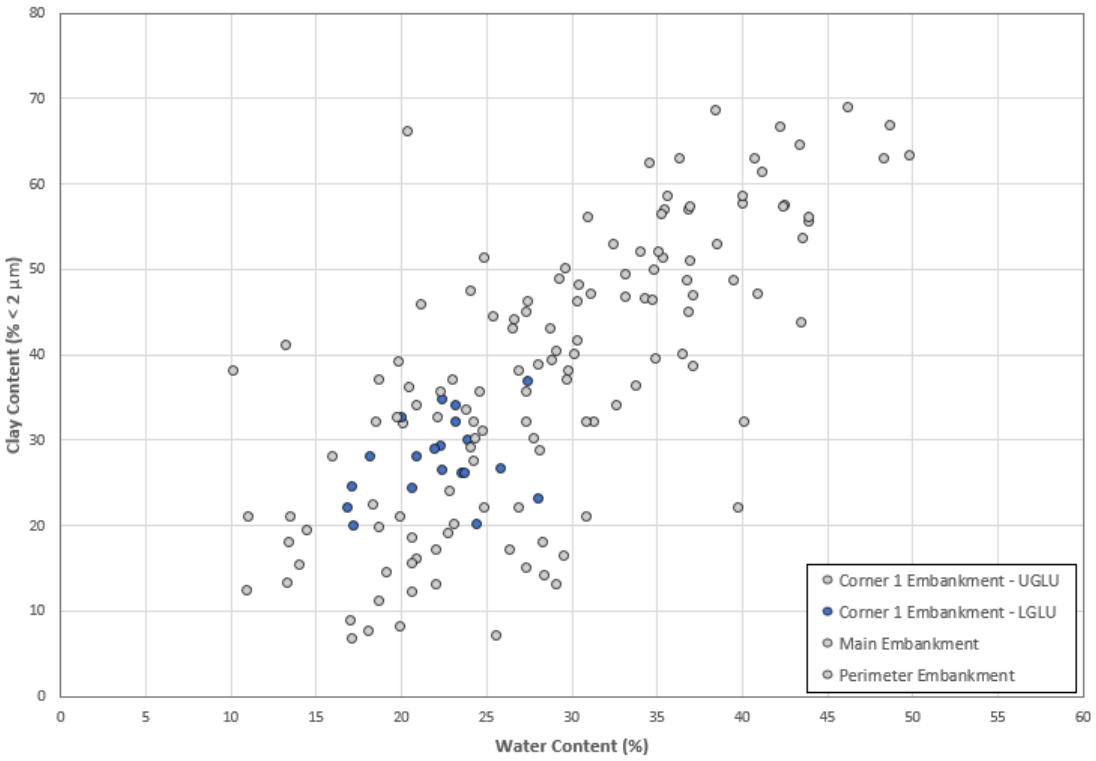

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-27: Water Content against Clay Content of Lower Glaciolacustrine Unit Samples from the Corner 1 Embankment

Table 7-19 and Illustration 7-28 show the results of consolidation tests carried out on the LGLU samples. The results show that the LGLU has a preconsolidation pressure, σ'_p, between about 700 and 1,200 kPa.

Table 7-19: Consolidation Test Results of Lower Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Sample Type	Elevation (m)	Estimated Preconsolidation Pressure (kPa)	Source
MR14-107A	6B	Thin-walled tube	916.7	701	IEEIRP (2015)
MR14-110	6B	Thin-walled tube	916.3	794	
SH14-10A	17	Sonic core	915.3	Preconsolidation pressure appears to exceed applied maximum load	KCB (2015b)
Central Collection Sump	4-bottom	Thin-walled tube	n/a	700–1,000	Golder (2015d)

n/a = not available.

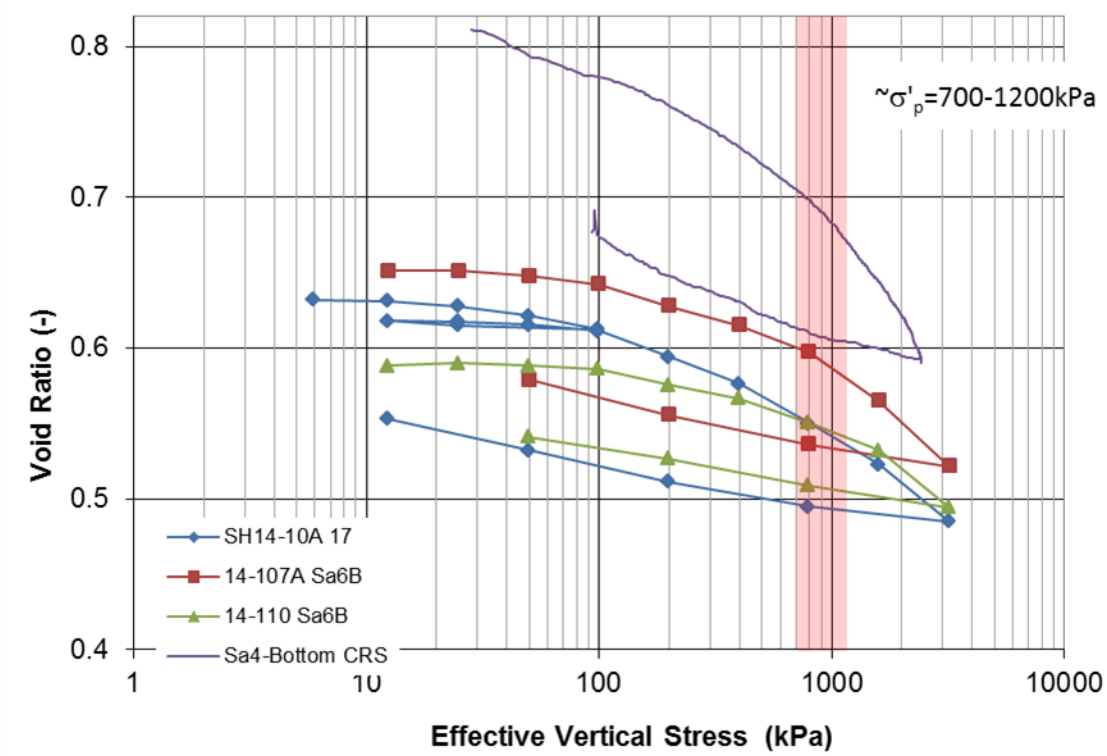

Illustration 7-28: Consolidation Test Results on Lower Glaciolacustrine Unit Samples

The quality of the samples was assessed using the methods proposed by Lunne et al. (1997) and Karlsrud and Hernandez-Martinez (2013). A description of both methods is presented in Section 7.3.1. The results of the assessment are summarized in Table 7-20.

Table 7-20: Quality Assessment of Lower Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Sample Type	Consolidation Test	Lunne et al. (1997)	Karlsrud and Hernandez-Martinez (2013)
MR14-107A	6B	Thin-walled tube	Incremental	Good to fair	Very poor
MR14-110	6B	Thin-walled tube	Incremental	Very good to excellent	Very poor
SH14-10A	17	Sonic core	Incremental	Poor	Very poor

The peak undrained shear strength of LGLU samples was measured in the laboratory with simple shear tests. A summary of the simple shear test results is presented in Table 7-21.

Table 7-21: Simple Shear Test Results of Lower Glaciolacustrine Unit Samples

Borehole No.	Sample No.	Initial Water Content (%)	Plasticity Index	Initial Vertical Effective Stress (kPa)	Static Bias (kPa)	OCR	Maximum Undrained Shear Strength Ratio	Undrained Shear Strength Ratio at 20% Strain
MR14-107A	7	22.2	15	600	n/a	1.2	0.30	0.25
MR14-109	6B	22.2	13	300	30	2.5	0.42	0.35
MR14-110	6C	21.2	15	300	30	2.6	0.27	0.22
Central Collection Sump	1-bottom	17.9	7	400	n/a	n/a	0.28	n/a
	2-bottom	26.0	12	600	n/a	n/a	0.25	n/a
	3-bottom	21.5	-	400	n/a	3.0	0.53	n/a
	4-bottom	25.8	17	1,200	n/a	n/a	0.23	0.17

n/a = not available, not applicable.

OCR = overconsolidation ratio.

Illustration 7-29 presents the undrained shear strength ratio function from the SHANSEP method using a preconsolidation pressure of 700 kPa. For stresses higher than the estimated preconsolidation pressure, the undrained shear strength ratio is constant at s_u/σ'_v = 0.22.

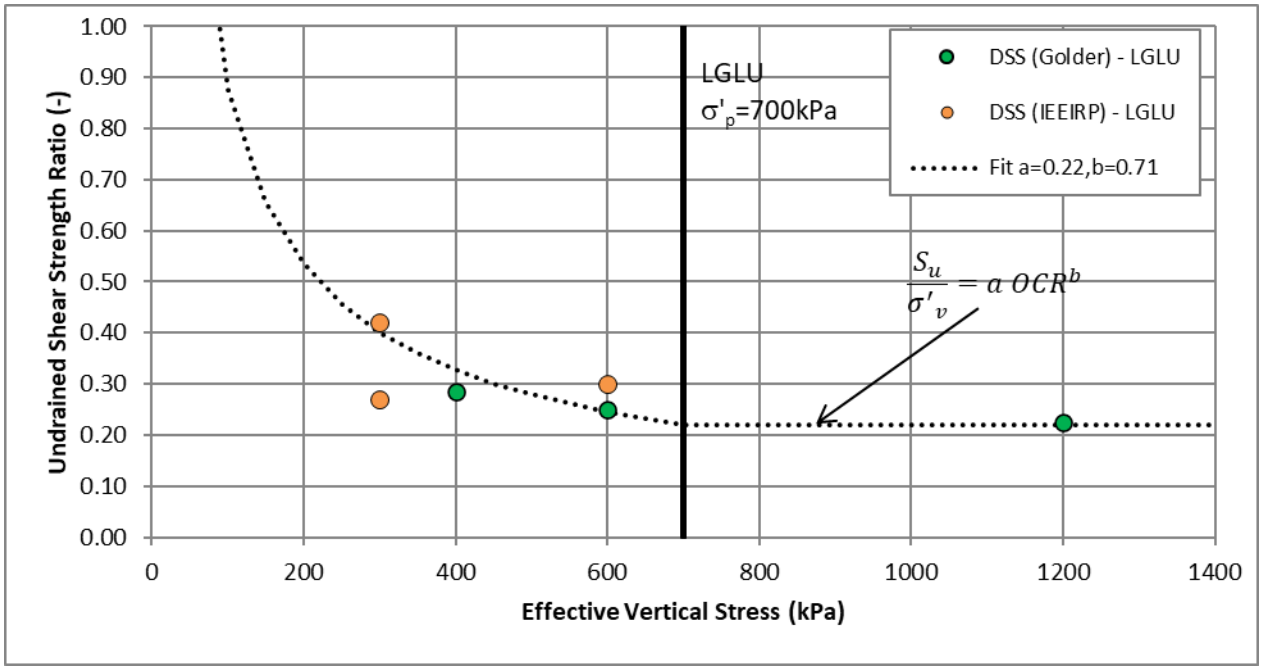

σ'_p = preconsolidation pressure; σ'_v = effective vertical stress; s_u = undrained shear strength; LGLU = lower glaciolacustrine unit; OCR = overconsolidation ratio; SS = simple shear.

Illustration 7-29: Peak Undrained Shear Strength Ratio Estimated for the Lower Glaciolacustrine Unit

A peak effective friction angle of 33 degrees and a residual effective friction angle of 25 degrees were measured on a single undisturbed sample of LGLU in a direct shear test (KCB 2015b).

7.3.4 South Embankment

One of the objectives of the 2016 foundation investigation was to confirm the characteristics of the soil previously identified as of glaciolacustrine origin in borehole VW11-02 (AMEC 2012) and to provide limits on the areal extent of this material along the South Embankment.

The material previously identified as of glaciolacustrine origin was encountered in boreholes DH98-BL-03 and VW11-02, which were drilled near a small tributary of Edney Creek (near Station 1+100). Boreholes GA16-17 and GA16-19 drilled within the area also encountered a bedded, silty soil. The area is estimated to extend about 100 m along the alignment of the South Embankment.

The description of the material intersected in borehole DH98-BL-03 is “Silt, glaciolacustrine, glaciofluvial. Rel. low permeability.” (KP 1999). The description of the material intersected in borehole VW11-02 is “SILT, some clay to clayey, trace sand, low plasticity to non-plastic, hard, […], varved”. The plastic and liquid limits were reported as 20% and 28%, respectively, and the natural water content was reported as 17% (AMEC 2012). Borehole GA16-19 was drilled within 5 m of VW11-02 and intersected material described as “sandy, clayey SILT, trace gravel.” Bedding was observed in the material intersected in GA16-19 but was not described as varved. The plastic and liquid limits were reported as 19% and 26%, respectively, and the natural water content was reported as 16% (Golder 2017). The material intersected in borehole GA16-17 (downstream of GA16-19) is described as “sandy SILT to SILTY SAND, trace gravel; brown; non-cohesive” with a measured water content of 20% (Golder 2017). The thickness of the material encountered in the four boreholes ranges from 0.5 to 1.5 m. In these four boreholes, the silty layer directly overlies bedrock.

A summary of the index properties for the samples of the low plasticity silty clay collected from the foundation of the South Embankment (near Station 1+100) is presented in Table 7-22.

The Atterberg limits and natural water content results against elevation are shown graphically in Illustration 7-30 and Illustration 7-31, respectively. All available test results for glaciolacustrine samples collected from the foundation of the other embankments were incorporated into the illustrations for a comparison. The fines are a low plastic silty clay with a natural water content ranging from 15% to 20%.

The low plasticity and relatively low water content of the silty clay layer encountered at these locations are not representative of the intermediate or high plasticity glaciolacustrine units found within the footprint of the Corner 1 Embankment. Also, CPT16-19 refused at the depth of the low plasticity silty clay layer, with a tip resistance (greater than 20 MPa) and sleeve friction (greater than 500 kPa) greater than the typical values obtained in glaciolacustrine units at the Corner 1 and Main embankments.

Table 7-22: Summary of Index Properties of Low Plasticity Silty Clay at the South Embankment

Index Property	Average	Minimum	Maximum	Number of Tests
Liquid limit	27	26	28	2
Plastic limit	20	19	20	
Plasticity index	8	7	8	
Water content (%)	17.6	15.6	19.8	3

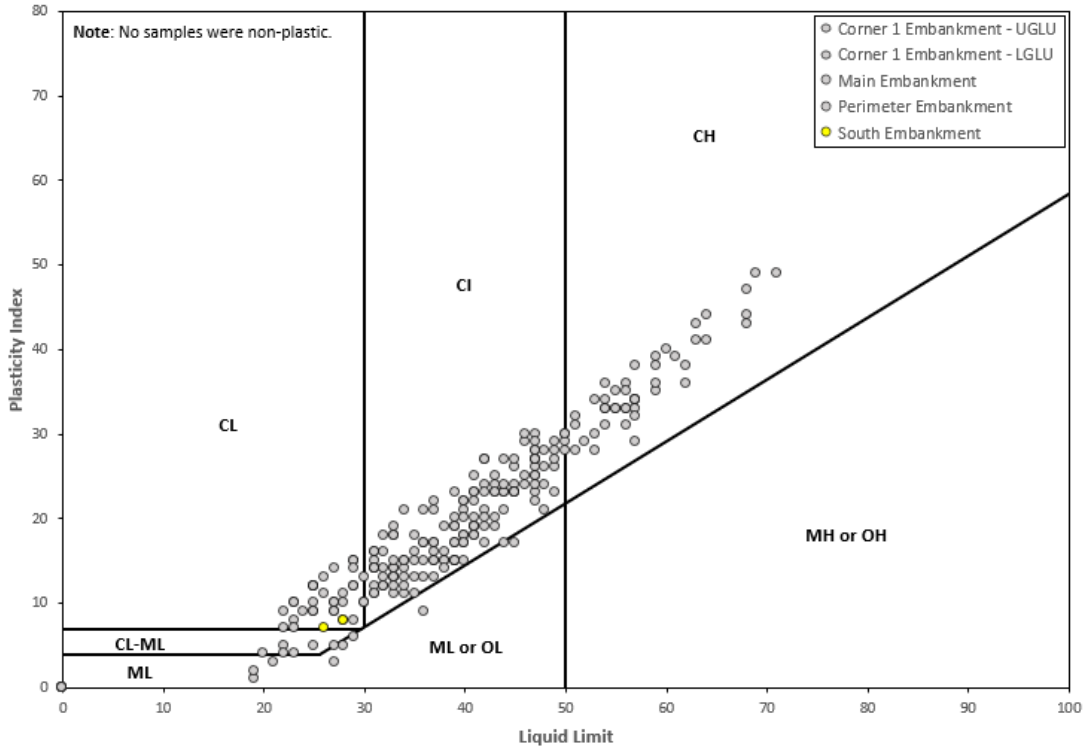

CL = low-plastic clay, generally classified as silty clay; CI = intermediate-plastic clay, generally classified as silty clay; CH = high-plastic clay; CL-ML = low-plastic silty clay to clayey silt; ML = inorganic silt with slight or low plasticity; MH = high-plastic silt, generally classified as clayey silt; OL = low-plastic organic silt; OH = high-plastic organic silt.

Illustration 7-30: Plasticity Chart of Low Plasticity Silty Clay Samples from the South Embankment

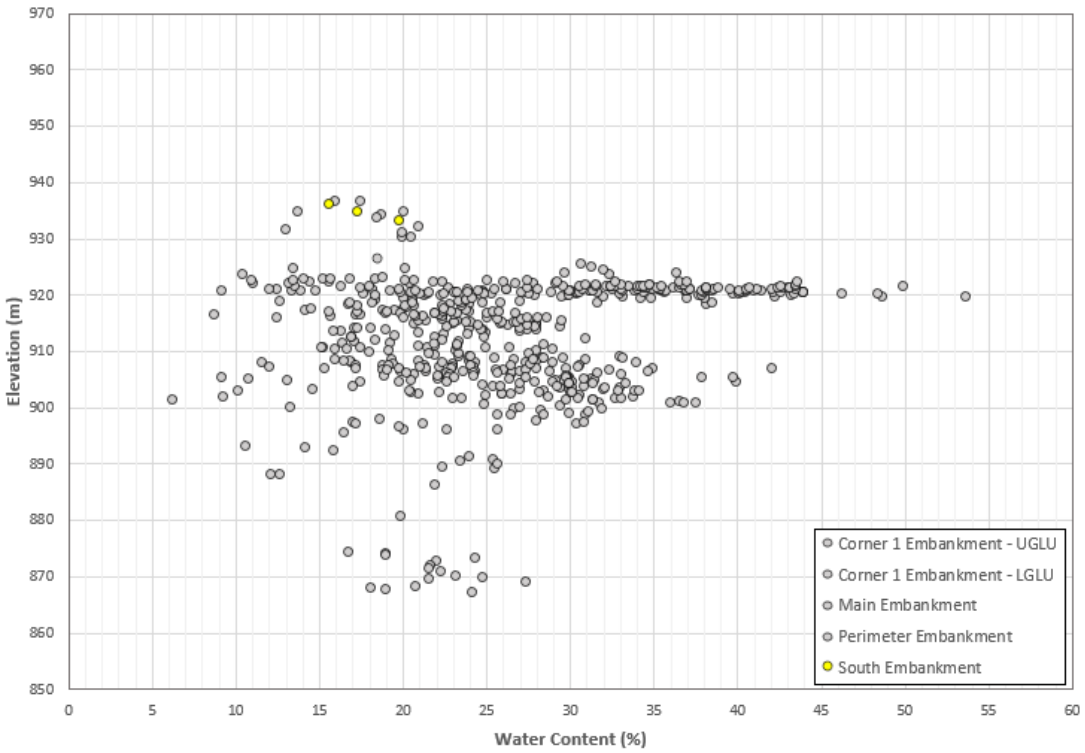

LGLU = lower glaciolacustrine unit; UGLU = upper glaciolacustrine unit.

Illustration 7-31: Water Content against Elevation of Low Plasticity Silty Clay Samples from the South Embankment

7.4 Material Parameters for Stability Analyses

The material parameters for stability analyses are presented in Table 7-23.

Till and glaciofluvial materials vary in gradation depending on location, elevation, and depositional history; however, the results of the laboratory testing show a relatively consistent high strength. The shear strength parameters selected for the foundation till and glaciofluvial layers represent an average for the materials. The strength parameters are consistent with the parameters used in previous design analyses, testing results and analyses of the Corner 1 Perimeter Embankment breach carried out by the IEEIRP (2015), and the results of laboratory testing completed by KCB (2015b,c).

Glaciolacustrine soils have been analyzed using total stress (undrained) strength parameters. The total stress approach uses the SHANSEP model that accounts for preconsolidation of the soil. The preconsolidation pressure that has been selected for modelling the strength of each of the glaciolacustrine soil layers is based on the data collected for the specific layer and soils in the immediate area. The data used include the results of the laboratory strength testing, CPT profiles, the response of the soils during in situ testing and sampling (e.g., not being able to push a shear vane into the soil layer and bending of Shelby tubes during sampling) and correlation with index testing. Along the Perimeter and Main embankments, the preconsolidation pressure values selected for the analyses are at or below the lower bound of the values calculated from the laboratory consolidation tests and estimated from the CPT profiles.

Table 7-23: Foundation Material Parameters for Stability Analyses

Material	Unit Weight (kN/m^3)	Shear Strength	Pore Pressure Coefficient B-bar[(a)]	Notes
Foundation till	22	ϕ' = 34° c = 0 kPa	0.2	Triaxial testing of samples of till by IEEIRP (2015) and KCB (2015b)
Glaciofluvial	22	ϕ' = 34° c = 0 kPa	0.2	Triaxial testing of undisturbed glaciofluvial samples by Golder (2015d)
UGLU (Corner 1 Embankment)	18	Peak: $T = 0.22\ \sigma_v' \ OCR^{0.71}$ Where σ'_p = 400 kPa Remoulded: S_{ur} = 22 kPa	0.46 (peak)	Field and laboratory test programs by IEEIRP (2015) and KCB (2015b,c) including vane shear tests, CPT, and direct simple shear, direct shear, and triaxial testing Remoulded undrained shear strength selected as the average minus one standard deviation of the measured undrained shear strength values
LGLU (Corner 1 Embankment)	20	$T = 0.22\ \sigma_v' \ OCR^{0.71}$ Where σ'_p = 700 kPa	0.2	Field and laboratory test programs by IEEIRP (2015), KCB (2015b,c) and Golder (2017, 2019) including vane shear tests, CPT, and direct simple shear, direct shear, and triaxial testing
GLU (Perimeter Embankment)	20	$T = 0.22\ \sigma_v' \ OCR^{0.71}$ Where σ'_p = 900 kPa	0.2	Consolidation testing by Golder on samples from boreholes GA15-06, GA21-03, and GA21-11 at Perimeter Embankment indicate preconsolidation pressure from 900 to 3,600 kPa (excluding the samples assessed to be of very poor quality). σ'_p = 900 kPa selected as the design basis

Table 7-23: Foundation Material Parameters for Stability Analyses

Material	Unit Weight (kN/m^3)	Shear Strength	Pore Pressure Coefficient B-bar[(a)]	Notes
GLU (Main Embankment)	20	$T = 0.22\ \sigma_v'\ OCR^{0.71}$ Where $\sigma'_p = 1{,}200$ kPa	0.2	Field and laboratory test programs by KP (2007b), AMEC (2012), Golder (2015d), and WSP Golder (2022b) including vane shear tests, CPT, direct simple shear, direct shear, and triaxial testing Consolidation tests indicate a range of preconsolidation pressure from 2,500 kPa to 4,000 kPa (excluding the samples assessed to be of very poor quality) and CPT data indicate a minimum preconsolidation pressure of about 1,200 kPa. $\sigma'_p = 1{,}200$ kPa selected as the design basis
		$T = 0.22\ \sigma_v'\ OCR^{0.71}$ Where $\sigma'_p = 850$ kPa (GLU at approx. elev. 922 Station 2+400 and 2+750)		Field and laboratory test programs by AMEC (2012), Golder (2015d) and WSP Golder (2022b) CPT21-07 data indicate a minimum preconsolidation pressure of about 850 kPa. $\sigma'_p = 850$ kPa selected as the design basis
Low plasticity silty clay (Sta. 1+100 South Embankment)	20	$T = 0.22\ \sigma_v'\ OCR^{0.71}$ Where $\sigma'_p = 1{,}200$ kPa	0.2	Index laboratory testing by Golder (2017)

a) Refer to Section 7.4.1 for explanation of selected B-bar values.

T = shear strength; σ_v'= effective vertical stress; ϕ_p' = peak friction angle; c = cohesion; CPT = cone penetration test; GLU = glaciolacustrine unit; LGLU = lower glaciolacustrine unit; OCR = overconsolidation ratio; σ'_p = preconsolidation pressure; UGLU = upper glaciolacustrine unit.

7.4.1 Pore Pressure Response within the Foundation Soils

Excess pore pressures are generated within soils when a load is applied at a rate faster than water can drain from the pore spaces in the soil. The amount of excess pore pressure depends directly on the magnitude of the applied load, the permeability of the soil, and the rate of application. The pore pressure response within the soil units can be interpreted by means of the pore pressure coefficient B-bar, defined as the change in pore pressure over the change in confining stress (Skempton 1954).

Pore pressure response was measured within the glaciolacustrine, till, and glaciofluvial layers within the Corner 1 area by vibrating wire piezometers (VWPs) monitored during construction of the 2015 Freshet Management Embankment, and at a single location along the Perimeter Embankment during the buttress construction.

Pore pressure response in the UGLU (Corner 1 Embankment) was measured with VWP VST14-03, located beneath the zone of compacted rockfill for the 2015 Freshet Management Embankment construction. The maximum B-bar measured was 0.46 at an intermediate stage of construction, and at the end of fill placement (Golder 2015b). It was determined that the glaciolacustrine soils will take approximately one year to dissipate excess pore water pressures based on the rate of consolidation measured in the laboratory and the field.

Pore pressure responses in the till and glaciofluvial layers were measured with VWP SH14-07, located adjacent to the zone of upstream fill placement. The maximum B-bar measured was 0.23 at the initial piezometer readings following fill placement. The B-bar values decreased to maximums of 0.19 and 0.15 with further fill placement (Golder 2015b). The decrease in the pore pressure and hence B-bar is due to drainage from the soil occurring at a rate faster than the rate of load application.

Only the VWPs installed in borehole GA15-06 at Station 3+400 (Perimeter Embankment) showed a pore pressure response to the approximately 5 m high buttress rockfill constructed along the Perimeter Embankment in 2015. All other VWPs installed along the foundation of the Perimeter Embankment buttress did not record a response to the construction of the buttress. The maximum B-bar measured was 0.16 (Golder 2015e).

VWPs B6, B7, B11, and B12 installed in till and glaciolacustrine layers in the foundation of the Main Embankment buttress recorded excess pore water pressure when rockfill was stockpiled for embankment construction in 2022. The maximum B-bar values measured in till and glaciolacustrine soil were 0.12 and 0.13, respectively.

8.0 HYDROGEOLOGY

Much of the factual and conceptual understanding of groundwater conditions near the TSF was obtained from Golder (2016b,c), Golder (2021), and MPMC (2021).

8.1 Hydrogeological Units and their Properties

The hydrostratigraphy at the TSF includes mine waste materials (tailings), fill materials associated with engineered structures (TSF embankment), soil deposits, bedrock formations, and bedrock structures. The key native hydrogeological units which form the foundation of the TSF are depicted in the cross-sections in Figure 3 to Figure 9 and are listed in Table 8-1, along with a summary of hydraulic conductivity estimates associated with these units.

The locations of the boreholes and monitoring wells listed in Table 8-1 are shown in Figure 1 and Figure 2. Completion details related to the boreholes, test pits, cone penetration tests (CPTs), and the monitoring wells are provided in APPENDIX C (Tables C1 to C5). Single-well response test analyses that were completed in 2022 to obtain in situ hydraulic conductivity estimates are provided in APPENDIX F. Analyses regarding the hydraulic conductivity estimates based on grain size using HydrogeoSieveXL™ (an Excel-based tool to estimate hydraulic conductivity from grain-size analyses) are provided in APPENDIX G. Details on the hydraulic conductivity estimates for the glaciolacustrine unit from the analysis of CPT dissipation tests are provided in APPENDIX E. All other hydraulic conductivity estimates outlined in Table 8-1 are from historical reports referenced in the table.

Table 8-1: Hydrogeological Units and Hydraulic Conductivity (K) Test Results

Hydrostratigraphic Unit	Borehole / Monitoring Well	Source / Consultant	Method	Estimated Hydraulic Conductivity (m/s)	Material Description (as summarized from original log)
Ablation till	MP89-231	IMC (1990)	Packer test	6.4×10^{-8}	Silty till 9–12 m depth
	GA21-01 GA21-02 GA21-03 GA21-05 GA21-06 GA21-07 GA21-08	Appendix G	HydrogeoSieveXL (grain-size analysis for 10 soil samples)	Range: 2×10^{-8} to 2×10^{-6} Geomean: 2×10^{-7}	Variable
Basal till	GW00-1B	Appendix F	Solid slug and bailer	3×10^{-6}	Silt till with sand interbed
	GW00-3B	Appendix F	Solid slug	8×10^{-7}	Silt till with silt / fine sand interbed
	GW16-4B	Golder (2016d)	Solid slug	2×10^{-5}	Silty sand
	GW21-06	Appendix F	Solid slug	1×10^{-5}	Inferred sand and gravel till
	GW21-09	Appendix F	Solid slug	1×10^{-6}	Silty clay / silt and sand
	MP89-232	IMC (1990)	Packer test	7.7×10^{-8}	Clayey silt till 15–18 m depth
	MP89-233	IMC (1990)	Packer test	1.1×10^{-7}	Sandy till 12–18 m depth
	MP89-234	IMC (1990)	Packer test	1.4×10^{-7}	Clayey sand (till) 6–12 m depth
	GA21-01 GA21-02 GA21-03 GA21-05 GA21-06 GA21-08 GA21-09	Appendix F	HydrogeoSieveXL (grain-size analysis for 7 soil samples)	Range: 4×10^{-8} to 2×10^{-6} Geomean: 3×10^{-7}	Variable
Glaciolacustrine	GA21-08 GA21-11	Appendix G	HydrogeoSieveXL (grain-size analysis for 5 soil samples)	Range: 2×10^{-10} to 7×10^{-8} Geomean: 7×10^{-9}	Silty clay or sandy silty clay
	CPT21-03 CPT21-07 CPT21-08 CPT21-09	Appendix E	CPT dissipation tests (6 tests)	Range: 3×10^{-9} to 6×10^{-8} Geomean: 2×10^{-8}	CPT21-03 and CPT21-07: High plasticity clay, trace sand, varved CPT21-08: Silty clay, medium plasticity, trace sand, laminated or varved CPT21-09 (910.9 m): Sandy silty clay, medium plasticity, laminated. CPT21-09 (908.3 m): Silty clay to clay, low to high plasticity, trace sand, laminated.
Glaciofluvial	GW16-2A	Golder (2016d)	Pneumatic test	8×10^{-4}	Sandy silty gravel
	GW16-2B	Golder (2016d)	Pneumatic test	2×10^{-4}	Sand and gravel
	GW96-2B	Appendix F	Solid slug and bailer	4×10^{-4}	Sand and gravel
	GW96-4B	Appendix F	Solid slug	2×10^{-6}	Sand some gravel
	GW16-3B	Golder (2016d)	Solid slug	8×10^{-6}	Silty sand and gravel
	GA21-06	Appendix G	HydrogeoSieveXL (grain-size analysis for 1 soil sample)	3×10^{-5}	Gravelly sand

Table 8-1: Hydrogeological Units and Hydraulic Conductivity (K) Test Results

Hydrostratigraphic Unit	Borehole / Monitoring Well	Source / Consultant	Method	Estimated Hydraulic Conductivity (m/s)	Material Description (as summarized from original log)
Weathered bedrock	GW16-3A	Golder (2016d)	Recovery test	$<10^{-10}$	Weathered bedrock (silty clay)
	GW16-4A	Golder (2016d)	Recovery test	1×10^{-7}	Weathered bedrock (clayey silt and sand)
	GW96-2A	Appendix F	Solid slug	3×10^{-6}	Inferred weathered volcanic conglomerate (gravel with some coarse sand)
	MP89-231	IMC (1990)	Packer test	1.6×10^{-8}	Soft volcanics 30–37 m depth
	MP89-232	IMC (1990)	Packer test	3.2×10^{-8}	Fractured volcanics 32–37 m depth
	MP89-233	IMC (1990)	Packer test	2.2×10^{-7} 1.6×10^{-7} 1.7×10^{-7}	Soft rock 30–37 m depth Broken rock 37–46 m depth Broken rock 49–55 m depth
	MP89-235	IMC (1990)	Packer test	5.1×10^{-6}	Highly fractured bedrock in contact with overburden 6–12 m depth
Competent bedrock	GW16-5A	Golder (2016d)	Solid slug	5×10^{-6}	Inferred competent bedrock
	GW16-5B	Golder (2016d)	Recovery test	2×10^{-7}	Inferred competent bedrock
	MP89-231	IMC (1990)	Packer test	2.9×10^{-9}	Competent bedrock 37–43 m depth
	MP89-232	IMC (1990)	Packer test	1.0×10^{-7}	Competent bedrock 43–46 m depth
	MP89-234	IMC (1990)	Packer tests	3.2×10^{-9} 3.3×10^{-8}	Competent bedrock 30–37 m depth Competent bedrock 46–49 m depth
	MP89-235	IMC (1990)	Packer tests	8.6×10^{-10} 4.0×10^{-9} 1.1×10^{-7}	Very competent bedrock 12–18 m depth; Competent bedrock 18–30 m depth; Slightly fractured bedrock 30–43 m depth
	MP89-236	IMC (1990)	Packer tests	2.7×10^{-7} 2.7×10^{-8} 2.0×10^{-8} 7.7×10^{-9}	Bedrock 8–12 m depth Bedrock 14–24 m depth Bedrock 24–37 m depth Bedrock 35–46 m depth

CPT = cone penetration test.

8.1.1 Surficial Native Deposits

The surficial deposits underlying the TSF consist of glacial deposits, predominantly till (ablation till and basal till) with interbeds of glaciofluvial and glaciolacustrine sediments. The relative distribution of the till, glaciofluvial, and glaciolacustrine sediments varies by location according to the depositional and erosional history of the area as shown on the cross-sections (Figure 3 to Figure 9). The combined thickness of the glacial deposits range from approximately 5 m along a bedrock knoll near the South Embankment to approximately 60 m along portions of the Main Embankment. During foundation preparation at the North Abutment of the TSF in 2022, the thickness of the glacial deposits was observed to be on the order of 2 m. Additional test pits need to be excavated when construction resumes in 2023 to confirm the glacial deposit thickness.

The TSF till core has been keyed into the foundation till. Where the natural surficial till along and upstream of the till core alignment was observed to be less than 2 m thick, and was underlain by glaciofluvial/glaciolacustrine sediments, a low permeability till liner was constructed with a nominal thickness of at least 2 m (KP 1997a, 2011 Section 2.2; Golder 2016b, Section 3.3.1.7).

Based on the information outlined in Table 8-1 above, the hydraulic conductivity of the foundation till (ablation till and basal till) is highly variable, ranging from 1×10^{-5} m/s to 2×10^{-8} m/s. The hydraulic conductivity of the till liner was estimated by KP (2005) to be on the order of 1×10^{-8} m/s. The range in hydraulic conductivity for the glaciofluvial units, 8×10^{-4} m/s to 2×10^{-6} m/s, confirms that these units are more permeable and may act as preferential pathways for seepage from the TSF. Conversely, the range in hydraulic conductivity for the glaciolacustrine deposits, 7×10^{-8} m/s to 2×10^{-10} m/s, confirms that these units have a low permeability and may act as barriers for seepage migration and/or as confining units where they occur directly above glaciofluvial units, and could potentially cause artesian pressures in the underlying glaciofluvial units.

A previous hydrogeological assessment by Golder (2016c), which involved development of a numerical groundwater flow model for the TSF area, estimated the bulk horizontal and vertical hydraulic conductivity of the foundation soils to be on the order of 5×10^{-7} m/s and 5×10^{-8} m/s respectively (i.e., an anisotropy of 10:1), based on the results of model calibration to observed hydraulic heads and seepage flow rates at the facility. Therefore, these calibrated values are considered representative of the composite foundation overall.

8.1.2 Bedrock

The upper portion of the bedrock beneath the TSF is weathered and/or fractured and consists predominantly of volcanic conglomerate based on drilling observations in the TSF footprint prior to mining (IMC 1990).
The thickness of this weathered bedrock zone is highly variable and is inferred to range from 2 to 40 m based on borehole logs for the 1996 series monitoring wells (KP 1997b) and the 2015 series boreholes (Golder 2015d).
The underlying competent bedrock consists of Nicola Group volcanics that, according to the local geology map (Logan et al. 2007), likely consist of undivided mafic volcanic and volcanoclastic rocks and/or intrusive rocks (pseudoleucite syenite).

Based on the information outlined in Table 8-1, the hydraulic conductivity of weathered bedrock is highly variable, ranging from 5×10^{-6} m/s to 1×10^{-10} m/s in the vicinity of the TSF. Competent bedrock had a similar range in hydraulic conductivity as that of weathered bedrock (5×10^{-6} m/s to 9×10^{-10} m/s). The calculated geometric mean of the individual tests for weathered and competent bedrock is approximately 9×10^{-8} m/s and 3×10^{-8} m/s respectively. Based on the results of packer testing at two boreholes, the hydraulic conductivity of competent bedrock is expected to generally decrease with depth (as seen at MP89-236), except where bedrock fractures are encountered (as seen at MP89-235).

8.2 Groundwater Recharge/Discharge and Tailings Storage Facility Seepage

The central area of the mine site is a topographic high consisting of Polley Mountain, which reaches an elevation of approximately 1,255 m. The TSF is located about 3 km southeast of this location in a topographically low area with an original ground surface elevation of approximately 920 to 940 m. Topographic high areas are typically areas where groundwater recharge occurs, whereas topographic low areas are typically areas where groundwater discharge occurs.

8.2.1 Recharge Areas

Groundwater recharge from precipitation near the TSF is expected to occur primarily along topographic highs, such as upgradient of the western boundary of the TSF, between the TSF and Bootjack Lake. The recharge rate in this area was estimated to be approximately 20% of average annual precipitation based on the results of numerical model calibration for a groundwater flow model of the TSF area (Golder 2016c).

Prior to construction of the TSF, groundwater discharge to ground surface was reported to occur within the footprint of the TSF, as indicated by the presence of a small pond and two swampy marsh-like areas within this footprint. This is supported by the observation of a near-surface water table, artesian pressures measured below the west side of the TSF footprint, and upward groundwater flow gradients measured along the Main and Perimeter embankments, as described in Section 8.4.1). However, the construction of the TSF and the presence of the TSF Pond changed the groundwater conditions such that the TSF Pond is now a source of groundwater recharge (i.e., contributes to seepage through the foundation). The TSF Pond level rose from approximately 938 to 962 m between 2016 and 2018 (Section 8.3), and then remained relatively stable thereafter, at an elevation of approximately 962 to 963 m. The TSF Pond elevation is inferred to control the amount of seepage that reports to the TSF seepage collection systems, as described in Section 8.2.2.

8.2.2 Tailings Storage Facility Seepage

Seepage through the TSF embankment is collected at the downstream seepage collection ponds and ditches. The seepage collection ponds and ditches are unlined and are reportedly installed within till. Limited recharge is expected to occur from the seepage collection systems to the groundwater system.

The primary systems that report to the seepage collection ponds and ditches are:

- foundation drains that underlie the downstream shell of the dam
- upstream toe drains within the South, Main, and Perimeter Embankments
- four passive pressure relief wells (PRW96-1 to PRW96-4) and trenches installed below the Main Embankment

Measured flows reporting to the TSF seepage collection systems ranged between about 2,500 and 6,200 m^3/d (29 and 72 L/s) in 2021 (Golder 2022a). Most of the seepage (70% to 80%) is from the upstream drain at Corner 1 (21 to 45 L/s), with the remaining (20% to 30%) being a combination of flow from upstream drains, seepage through the embankments, flow from passive pressure relief wells and runoff (8 to 27 L/s). Golder (2015g) previously reported measured flows from the foundation drains to be on the order of 80 L/s in 2014 prior to the breach. Although not explicitly stated in the Golder (2015g) report, the foundation drains are considered to be connected to the upstream drains, and flow measurements through the embankment and from the pressure relief wells without the contribution from the upstream drains is not available.

Seepage losses through the foundation on the order of 35 to 294 m^3/d (0.4 to 3.4 L/s, about 2.2 L/s on average) were estimated to bypass the downstream seepage collection ditches and ponds based on estimates in previous design reports which considered TSF embankment elevations of 960 m (KP 1995b) and 965 m (KP 2005). More recent estimates of the seepage losses are not available.

8.2.3 Discharge Areas

The primary groundwater discharge areas downgradient of the TSF footprint include Edney Creek, Edney Creek tributaries, and Hazeltine Creek.

Within the TSF embankment foundation, there are four passive pressure relief wells and connecting trenches that were installed within native soils in 1996 (KP 1997c, Section 5.2.2). These wells act to reduce the artesian pressures along the foundation of the Main Embankment and constitute a discharge area for groundwater. The pressure relief wells are situated directly below the Main Embankment between approximately Station 1+800 and 2+300 (see Figure 1) and consist of auger holes drilled to a depth of between 10 and 22 m and backfilled with filter sand. The pressure relief trenches were excavated and backfilled with gravelly sand. Because these wells are buried below the embankment, direct flow measurement from the wells is not possible. As indicated in Section 8.2.2, flows from these wells are routed to the TSF Main Embankment Seepage Collection Pond.

8.3 Hydraulic Heads and Vertical Hydraulic Gradients

The most recent groundwater level data is reported in the *2021 Annual Groundwater Monitoring Report* (Golder 2022b). The following information is based on that report.

Hydraulic Heads

Groundwater monitoring has been ongoing at the mine site since 1995 with the objectives to monitor direction, quantity, and quality of groundwater flow near all mine facilities. As part of this program, eight monitoring well pairs (each with one deeper well and one shallow well, and typically one bedrock and one overburden well per pair) and three single monitoring wells, all situated next to the outer perimeter of the TSF, are monitored monthly to annually, depending on location. The well locations are shown on the plan in Illustration 8-1, and also shown on the cross-sections in Figure 3 to Figure 9. Completion details for the wells are provided in APPENDIX C (Table C4). The monitoring well locations include the following, listed from west to east:

- Northwest Side: GW14-1
- South Embankment: GW16-5A/B, GW00-1A/B, GW00-2A, GW00-3A/B, GW96-4A/B
- Main Embankment: GW16-4A/B, GW96-3A, GW16-3A/B
- Perimeter Embankment: GW96-2A/B, GW16-2A/B



Source: Golder (2021) modified Figure 6.

Illustration 8-1: Shallow Hydraulic Head Contours for November 2020

Hydraulic heads around the TSF ranged from a high of 963 m (at GW16-5B) on the northwest side of the facility to a low of 915 m (at GW96-2B) on the northeast side in 2021. As shown on the time-series water level plot in Illustration 8-2, the hydraulic heads have remained fairly constant over time since approximately 2003, excluding seasonal water level fluctuations of approximately 2 to 3 m at most locations (the small seasonal variation relative to the total head change across the facility suggests that these seasonal variations are unlikely to affect overall interpretation of groundwater flow directions near the TSF). Conversely, the TSF Pond level rose from approximately 938 m to approximately 962 m between 2016 and 2018, and then remained relatively stable thereafter at an elevation between 961 and 963 m. Currently, the monitoring well nest located at the west end of the South Embankment (GW16-5A/B) has hydraulic heads that are relatively close to the TSF Pond level, whereas hydraulic heads along the remaining perimeter of the facility are significantly lower. Although not shown in Illustration 8-1, the surface water level in Bootjack Lake, situated approximately 2 km northwest of the TSF, was approximately 987 m in 2021 (approximately 24 m higher than the current TSF Pond level), and the groundwater level within the bedrock knoll in between the TSF and Bootjack Lake was inferred to be higher relative to the lake level based on measured groundwater levels to the northwest of the TSF and closer to Polley Mountain (GW96-7; approximately 1,017 m). The distribution in hydraulic heads indicates that the groundwater flow direction is radially outward from the TSF towards the southwest, southeast, and northeast, with some groundwater inflow into the facility from the northwest. Groundwater flow direction is discussed in more detail in Section 8.4.

Next to the Perimeter Embankment, the hydraulic head observed in the deep well screen at GW96-2A completed in weathered bedrock (901.61 m on 25 November 2021) is significantly lower than would be expected based on nearby surface water elevations in Edney Creek and Hazeltine Creek, with surface water level elevations being about 10 m higher. The high hydraulic conductivity results for GW96-2A at an elevation of 878 m (3×10^{-6} m/s, see Table 8-1) indicates a possible zone of enhanced permeability at this location. According to Golder (2016c), the low water level measurement in GW96-2A suggests the well could be connected locally, through this enhanced permeability zone, to farther down-gradient and downstream areas of Hazeltine Creek. Based on the groundwater quality results for the TSF described in Section 9.5 and considering the groundwater quality trends for this well from pre-mining to present shown in Figure 10, this well does not appear to be influenced by seepage from the TSF. This suggests that the inferred enhanced permeability zone at GW96-2A is not hydraulically connected to the TSF.

Vertical Hydraulic Gradients

Data from the multi-level wells from 2019 onwards indicated mostly downward (shallow to deep) vertical hydraulic gradients around the TSF perimeter with the following exceptions:

- A consistently upward hydraulic gradient, observed from November 2019 to November 2021 next to the South Embankment close to the southwest corner of the facility (at GW96-4A/B and GW00-3A/B).
- Periodic flowing artesian conditions since approximately 2003 observed or inferred (water levels recorded at the top of the well collar on some occasions; however, the static water level height above the well collar has not been measured) at bedrock well GW96-3A situated southeast of the Main Embankment. This well location is situated downgradient of the four passive pressure relief wells described in Section 8.2.3 and next to the Main Embankment Seepage Collection Pond.

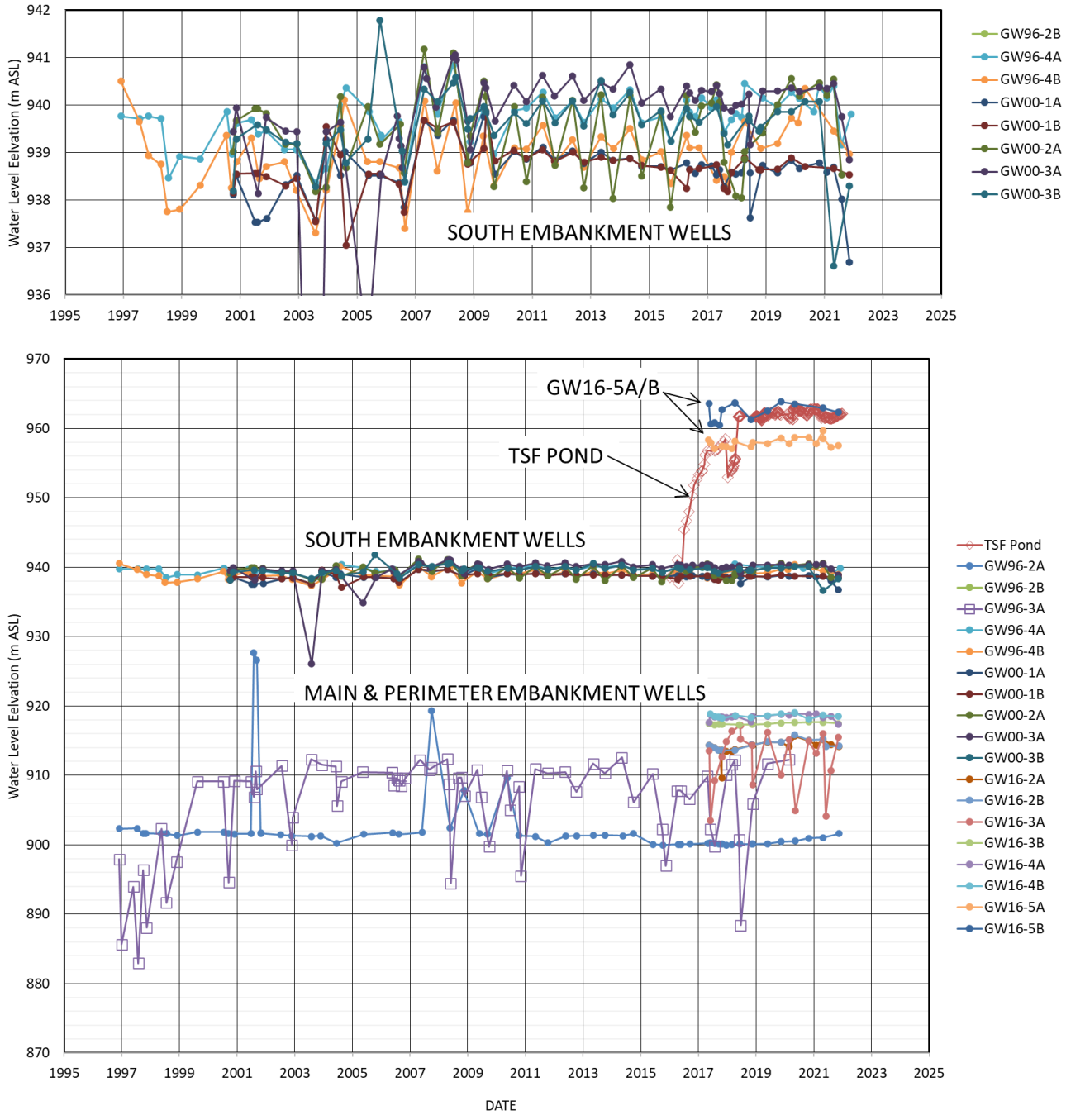

TSF = tailings storage facility.

Illustration 8-2: Tailings Storage Facility Pond Level and Surrounding Groundwater Levels over Time

8.4 Groundwater Flow Direction

8.4.1 Pre-development Groundwater Flow Direction

Prior to the TSF construction, hydraulic head measurements were collected by KP (1990) at 10 monitoring wells and piezometers. The inferred groundwater flow directions based on these data are presented in Illustration 8-3 below.

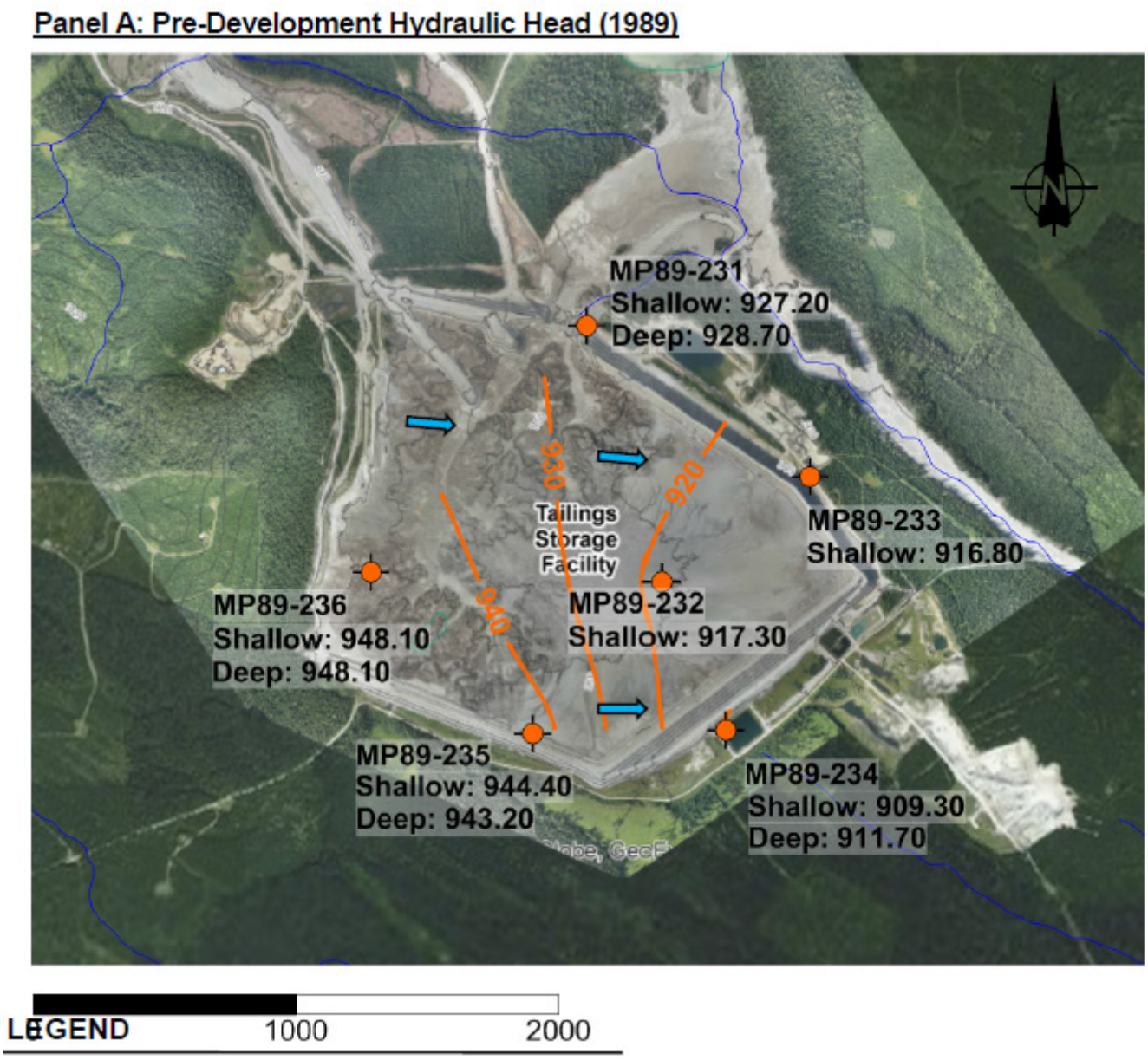

Source: KP 1990; modified from Figure 4 in Golder 2016c.

Illustration 8-3: Pre-development Hydraulic Heads and Groundwater Flow Direction

Based on the measured hydraulic heads, the groundwater flow direction prior to the development of the TSF was inferred to be from the west and northwest towards the east and southeast. The water table was observed to be near ground surface, with artesian pressures measured within the TSF basin at MP89-236 and upward groundwater flow gradients measured along the Main and Corner 1 embankments (MP89-234 and MP89-231). The observed upward gradients and artesian flow conditions are consistent with reported observations of two swampy areas and a small pond within the footprint of the TSF prior to development. A downward hydraulic gradient was observed at MP89-235, which is located near a bedrock ridge (topographic high) adjacent to and beneath the South Embankment.

8.4.2 Current Groundwater Flow Direction

The current groundwater flow direction in the area of the TSF is inferred to be partly dependent on the TSF Pond level. Provided that surface water level elevations within the TSF are above the surrounding shallow groundwater level, groundwater flow will be radial from the TSF towards the southwest, southeast, and northeast. However, when the TSF Pond level falls below the shallow groundwater levels on the west side of the TSF, then the TSF area becomes a flow-through environment, similar to pre-development conditions described above, with groundwater flow directed across the TSF from the west and northwest towards the east and southeast.

The plan in Illustration 8-1 shows the November 2020 hydraulic head contours and groundwater flow directions around the perimeter of the TSF. In 2020 and 2021, groundwater flow towards the TSF was from the upgradient, northwest side of the facility (i.e., area of GW14-1 and GW16-5A/B), originating from the area of Bootjack Lake and Polley Mountain. With the TSF Pond level at approximately 962 m, groundwater within the TSF footprint was inferred to flow radially outward towards the southwest (towards Edney Creek and its tributaries), southeast, and northeast (towards Hazeltine Creek).

8.5 Groundwater Use Downgradient of the Mine

A search in the Ministry of Environment's online database (iMapBC) in December 2022 indicated that there are no mapped aquifers within a radius of 10 km from the mine. The closest mapped aquifer, Fraser Plateau Lave Aquifer No. 124 IIIB (11), is a laterally extensive bedrock unit that was classified as having low demand and moderate vulnerability. The northern limit of this aquifer is situated more than 15 km south of the mine and is not considered to be hydraulically connected to groundwater from the mine area and the Hazeltine Channel corridor. This database search also indicated that water supply wells are not present in the immediate vicinity of the mine. The closest wells are approximately 6 km east, on the opposite (eastern) shore of Quesnel Lake. The database also contains information on water wells that are located northwest from the mine (near Little Lake) and southwest from the mine (near Gavin Lake) at a distance of at least 7 km. Considering these distances and the fact that several surface water features are between these wells and the mine, it is unlikely that seepage from the mine facilities could reach these wells or the closest mapped aquifer. A map showing the results of the water well search and the nearest mapped aquifer is included in APPENDIX F.

9.0 GEOCHEMICAL CONDITIONS

9.1 Monitoring Program

As stated previously, groundwater monitoring by MPMC has been ongoing at the mine site since 1995 with the objectives to monitor direction, quantity, and quality of groundwater flow near all mine facilities. The monitoring wells used to monitor groundwater levels around the perimeter of the TSF (listed in Section 8.3) are also used to monitor groundwater quality. The monitoring well network is shown in Illustration 8-1.

Groundwater samples from the monitoring wells are collected quarterly or semi-annually, depending on location, and are analyzed for field parameters, anions, nutrients, and dissolved metals and are reported annually. The analyses are focused on nine parameters of interest which included hardness, sulphate, nitrate, and the following dissolved metals: aluminum, arsenic, cadmium, molybdenum, and selenium.

The most recent groundwater quality data for the TSF area is reported in the *2021 Annual Groundwater Monitoring Report* (Golder 2022b). Water quality trend plots from this report are provided in Figure 10.

9.2 Baseline Groundwater Quality

The plots in Figure 10 provide information on baseline and early operations groundwater quality conditions, from 1996 to approximately 1999, at a few monitoring wells that were installed prior to or at the start of TSF operations in 1998 and continue to be monitored today. Based on these plots, baseline groundwater quality conditions are generally characterized by low concentrations of dissolved metals, sulphate, and nitrate and low to moderate hardness, with the exception of one monitoring well (GW96-3A) where concentrations of many parameters fluctuated substantially. The erratic results at GW96-3A suggest that non-natural factors (e.g., possible well contamination or well design flaws such as bentonite seal within the screened interval) were affecting the water quality results from this well. It should be noted that periodically flowing artesian conditions have been observed or inferred at this well and that it is situated next to the unlined Main Embankment Seepage Collection Pond (Section 8.3).

9.3 Tailings Storage Facility Tailings

The following information on metal leaching and acid rock drainage geochemistry is from the SRK *Derivation of Geochemical Source Terms, Mount Polley Mine* (Appendix C in Golder 2016b) and from Kennedy and Anglin (2016).

The Mount Polley copper-gold porphyry deposit is classified as an alkalic porphyry copper gold deposit. The mined mineralized zones are enriched in copper and selenium relative to global norms. Processing of the ore yields a copper sulphide concentrate. The tailings are lower in sulphide mineral content compared to the ore because most of the copper sulphides were removed through ore processing. In addition, mill process reagents, with the exception of lime, are not expected to be present within tailings. Furthermore, processing changes over time were minimal and not expected to affect the geochemical reactivity of the tailings; therefore, tailings geochemistry can be considered generally consistent over time.

Mount Polley tailings are classified as non-acid generating based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014. Compared to crustal normal concentrations, copper and selenium were present in the tailings sampled from Hazeltine Creek following the tailings release at order of magnitude higher concentrations, indicating tailings enriched in copper and selenium. However, average selenium concentrations in the operational tailings from within the TSF were lower than the spilled tailings in the creek and were similar to background levels (i.e., similar to average selenium concentrations in stream sediment samples from the region surrounding Mount Polley [Kennedy and Anglin 2016, Section 5.2.2]).

Humidity cell tests and column tests that ran for about 52 weeks and 35 weeks, respectively, using selected samples which had typical characteristics of tailings in the impoundment, were used to assess potential tailings leachate quality. The leachate quality from these tests is described below:

- pH typically between 8.0 and 8.2
- sulphate concentrations initially on the order of 1,000 mg/L, with decreasing concentrations over time that reached lower stabilized values
- highest copper concentration of 0.15 mg/L in one test, but with typical maximum concentrations of 0.02 mg/L in humidity cell test leachates and 0.05 mg/L in column test leachates
- highest selenium concentrations were 0.01 mg/L in humidity cell test leachates and 0.06 mg/L in column test leachates
- molybdenum concentrations initially between 2 and 3 mg/L in column leachates

9.4 Tailings Storage Facility Pond Water Quality

The quality of the TSF Pond water is monitored several times per year at monitoring location E1a as part of the Mount Polley Mine's Comprehensive Environmental Monitoring Plan under the *Environmental Management Act* Permit 11678 and *Mines Act* Permit M-200. The following water quality characteristics with respect to selected parameters of interest for this contact water (i.e., mine-affected water) from E1a were obtained from MPMC (2021, Section 4.10.1). Note that the mine was in care and maintenance in 2020 so values for the period between 2012 and 2014 are also included below.

- Annual mean hardness of 450 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 438 mg/L.
- Annual mean chloride concentration of 8.9 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 24.3 mg/L.
- Annual mean sulphate concentration of 438 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 542 mg/L.
- Annual mean nitrate concentration of 1.9 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 6.4 mg/L.
- Annual mean total iron concentration of 0.188 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 0.272 mg/L.
- Annual mean total copper concentration of 0.357 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 0.010 mg/L.
- Annual mean total selenium concentration of 0.0292 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 0.0260 mg/L.
- Annual mean total molybdenum concentration of 0.158 mg/L in 2020. For comparison, the pre-breach (2012 to 2014) mean was 0.184 mg/L.

MPMC (2021) reports that, of the parameters of interest, total molybdenum and possibly chloride have shown a general increasing trend after post-breach deposition of tailings commenced. Total copper concentrations have increased in recent years due to seepage with high copper concentration from the heap leach trial area in the waste dump.

9.5 Current Groundwater Quality

Based on the inferred groundwater flow direction described in Section 8.4, the upgradient and downgradient wells relative to the TSF are as follows:

- upgradient wells:
  - west: GW14-1 (no water quality data available for this location)
  - southwest (Corner 4): GW16-5A/B (potentially side-gradient)
- downgradient wells:
  - South Embankment: GW00-1A/B, GW00-2A, GW00-3A/B, GW96-4A/B
  - Main Embankment: GW16-4A/B, GW96-3A, GW16-3A/B
  - Perimeter Embankment: GW96-2A/B, GW16-2A/B

The following summary on groundwater quality is based on information from the *2021 Annual Groundwater Monitoring Report* (Golder 2022b). This summary provides an overview of the 2021 groundwater quality results and the groundwater quality trends for monitoring wells located around the TSF (as shown in Figure 10).

Over the last decade or so, although there were increasing parameter of interest concentration trends at some locations, significant changes to groundwater quality at the perimeter of the TSF had not been identified except with respect to sulphate. Sulphate concentrations in the shallow groundwater downgradient of the TSF approached or reached levels observed in the TSF Pond water next to the Perimeter Embankment at GW16-2B and GW96-2B and next to the South Embankment at GW96-4B. The highest sulphate concentrations were observed at GW96-2B in November 2021 (543 mg/L). These wells are known or inferred to be completed in glaciofluvial units based on soil descriptions and the relatively high hydraulic conductivity results (Table 8-1). The remaining wells indicated relatively stable or slightly decreasing sulphate concentration trends.

Groundwater quality results for the upgradient well nest location, GW16-5A/B, indicated no significant trends since the installation of the wells in 2016. Furthermore, the water quality at this location appears to be similar to baseline or pre-development water quality (described in Section 9.2).

The 2021 groundwater quality results were compared to the British Columbia (BC) Ministry of Environment and Climate Change Strategy Contaminated Sites Regulation (BC ENV 1997) standards for protection of freshwater aquatic life and the BC Approved Water Quality Guidelines for protection of aquatic life (BCWQG AW; BC ENV 2021). An analysis of the results indicated no exceedances of the Contaminated Sites Regulation standards for protection of freshwater aquatic life and no exceedances of the BCWQG AW guidelines with the following exceptions concerning the BCWQG AW criteria only:

- pH above the guideline range (6.5 to 9.0) at one downgradient well location (GW00-3A, pH = 11), with two locations only slightly above the guidelines (GW00-1A, GW16-2A)
- sulphate concentrations above the chronic guideline (128 to 429 mg/L, hardness dependent) at several downgradient well locations (GW96-2B in November 2021 [543 mg/L] but not in May 2021: GW96-4B [471 to 507 mg/L]; GW00-1A [226 mg/L]; GW16-2B [475 to 518 µg/L])
- dissolved iron above the acute guideline (350 ug/L) at one downgradient well location (GW96-4B, 785 to 877 µg/L); elevated dissolved iron concentrations were observed at the two upgradient well locations (GW14-1 in February to August 2021 [1,120 to 1,300 µg/L] but non-detectable in November 2021 [<30 µg/L], and GW16-5A [675 to 716 µg/L]).

10.0 DISCUSSION

This section presents a discussion of potential dam safety issues related to site conditions, along with the TSF design approach to mitigate each issue.

A general embankment description is included in Section 2.0. With a 970 m crest elevation, the embankment is approximately 4.8 km in length and has a maximum height of 58 m. The embankment has incorporated a staged expansion design utilizing modified centreline and centreline construction methods. The zoning of the embankment includes a low permeability till core, filter, and transition zones and rockfill zones forming the downstream shell of the embankment and the downstream buttress.

The elevation 970 m TSF design description is presented in Golder (2015g). The design to raise to facility to 987 m follows the same philosophy and is presented in WSP Golder (2022c).

10.1 Stability

Strength of Foundation Materials

Potential stability issues related to the strength of foundation materials include:

- insufficient strength in the foundation (i.e., glaciolacustrine layers) to resist the loads applied by the dam
- strain weakening of glaciolacustrine soils
- unidentified foundation conditions (e.g., unidentified glaciolacustrine deposits)

Multiple field investigations have been completed along the foundation of the embankment and buttress to delineate the extent and characterize the different foundation materials.

The weaker layers in the foundation of the embankment and buttress are the glaciolacustrine deposits. Extensive field and laboratory investigations have been completed to characterize the strength of the glaciolacustrine deposits.

The design approach is to analyze embankment stability and deformation considering the interpreted foundation conditions and includes:

- limit equilibrium analyses of downstream failure modes under static and pseudo-static conditions for the range of foundation conditions along the embankment
- limit equilibrium analyses with a range of glaciolacustrine deposits strength to assess sensitivity to potential variability
- stress-deformation analysis (2D FLAC model) to predict patterns of deformation and potential redistribution of stresses due to strain weakening of glaciolacustrine deposits

The design approach also follows the principles set out in the IEEIRP report of January 2015:

- Limit the amount of surface water to only that required for operation.
- Promote unsaturated conditions in the tailings with drainage provisions (i.e., minimum beach width and upstream drain).
- Achieve dilatant conditions throughout the tailings deposit (i.e., the existing tailings within the TSF drained and consolidated after the TSF breach in 2014 and the upstream drain promotes consolidation of new tailings).

Loading of Foundation Materials

The potential stability issue related to raising the TSF is the development of excess pore water pressure in the foundation materials during construction.

Extensive field and laboratory investigations have been completed to characterize the glaciolacustrine deposits.

The pore pressure response has been monitored within the glaciolacustrine deposits, till, and glaciofluvial layers during construction of the Corner 1 Embankment and Perimeter and Main embankment buttresses.

The design approach is to analyze embankment stability including the generation of excess pore water pressure due to loading of the foundation at key stages of construction.

Groundwater Conditions

The potential stability issue related to groundwater conditions is the failure of the Main Embankment vertical drain wells and the development of artesian pressures in the foundation.

The pore water pressure has been monitored within the glaciofluvial, till, and glaciolacustrine layers in the foundation of the Main Embankment. The readings show that the Main Embankment's vertical passive pressure relief wells continue to work and artesian pressures have not developed.

The design approach is to analyze embankment stability assuming that artesian pressures redevelop to the levels measured prior to the installation of the Main Embankment vertical drain wells.

10.2 Seepage

The potential seepage issue related to site conditions is the development of preferential flow pathways in the foundation soils (e.g., glaciofluvial layers) or bedrock, leading to increased seepage and potential groundwater quality issues.

- The design approach is to include suitable foundation preparation, placement of a filter blanket downstream of the till core and confirmation that a minimum thickness of competent till is present on surface along and upstream of the till core alignment. Where the thickness of competent till is adequate, the till core is keyed into the foundation till. Where the thickness of competent till is less than the minimum required, a till blank is constructed upstream of the till core and the till core is keyed into competent till or bedrock to cut-off through layers of higher hydraulic conductivity soils (e.g., glaciofluvial) or bedrock (e.g., fractured bedrock).
- For raises of the TSF, the thickness of competent till is confirmed during construction of the South and North abutments.

Monitoring data collected since 1996 shows that groundwater quality downgradient of the TSF is being affected by seepage from the TSF. The concentration of sulphate in groundwater downgradient of the TSF approached or reached levels observed in the TSF Pond water; however, it does not exceed the BC ENV (1997) Contaminated Sites Regulation water quality standards for protection of freshwater aquatic life. Additional groundwater monitoring downgradient of the TSF between monitoring wells showing elevated sulphate concentrations and surface water receptors should be planned.

11.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions, please contact the undersigned.

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/034-r-51392-foundation characterization report/rev0/22514095-034-r-rev0-51392-mt polley tsf dam site charact report_22aug_23.docx

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FIGURES

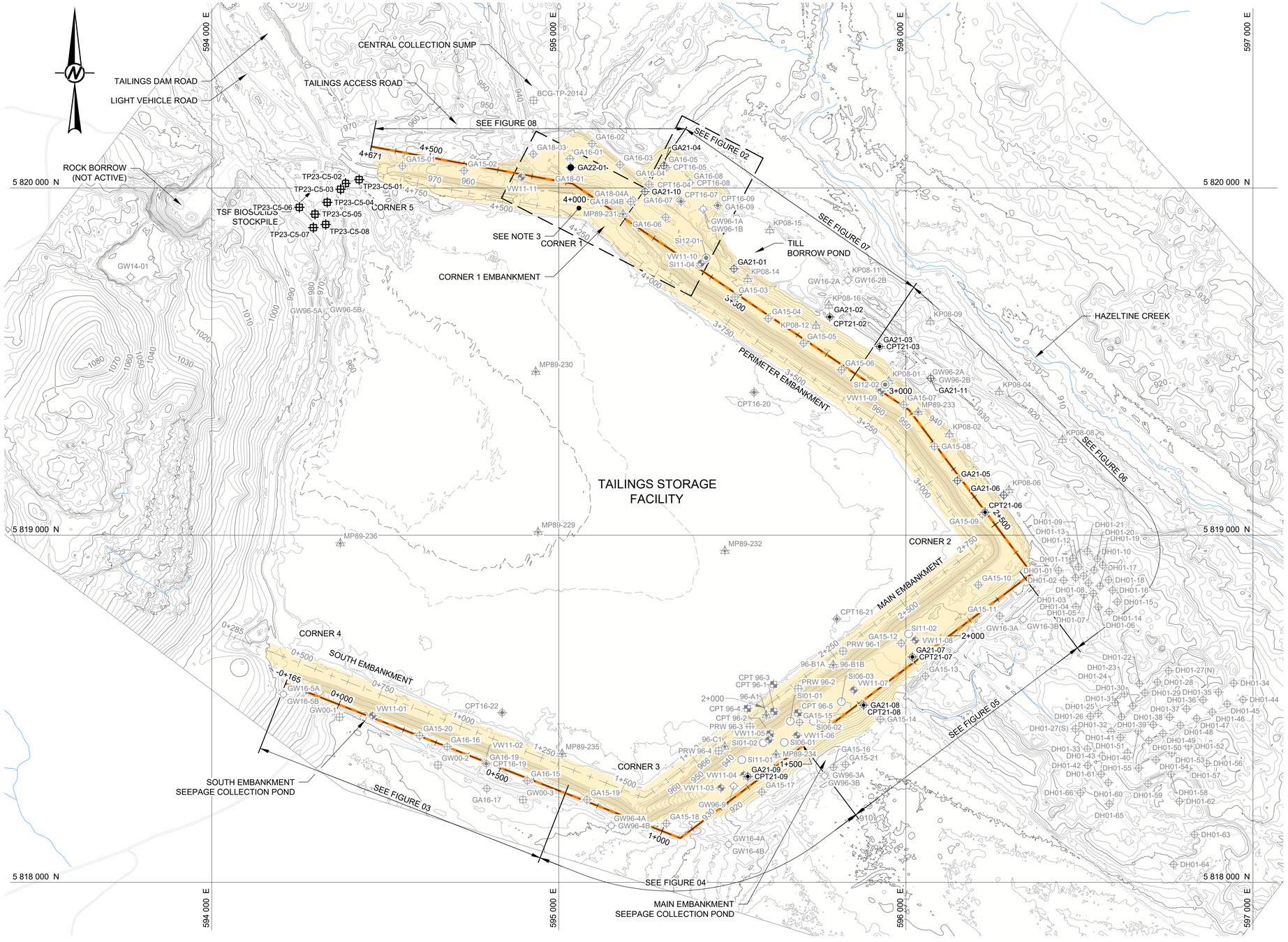

LEGEND

- SETOUT LINE - S.O.L. - ORIGINAL ALIGNMENT (SEE REFERENCE 1)
- GROUND CONTOURS (SEE REFERENCE 2)
- BATHYMETRY CONTOURS (SEE REFERENCE 3)
- STREAM (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- GA22-01 — SONIC DRILLING, PIEZOMETER INSTALLATION - CORNER 1 EMBANKMENT (GOLDER, 2022)
- GA21-10 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1, PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- CPT21-09 — CPT - PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- GA18-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 (GOLDER, 2018)
- GA16-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- CPT16-04 — CPT - TAILINGS, CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- GW16-2A — SONIC DRILLING, MONITORING WELL INSTALLATION (GOLDER, 2016)
- GA15-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION (GOLDER, 2015)
- BGC-TP-2014 — TEST PIT (BGC / GOLDER, 2014)
- SI12-01 — ODEX, SI INSTALLATION - PERIMETER EMBANKMENT (AMEC, 2012)
- VW11-01 — SONIC DRILLING, PIEZOMETER INSTALLATION (AMEC, 2011)
- SI11-01 — SONIC DRILLING, SI INSTALLATION (AMEC, 2011)
- KP08-01 — SONIC DRILLING, SPT, BORROW PROGRAM (KP, 2008)
- SI06-01 — ODEX, SPT, SI INSTALLATION - MAIN EMBANKMENT (KP, 2006)
- SI01-01 — ODEX, SPT - MAIN EMBANKMENT (KP, 2001)
- DH01-01 — DRILLING, BORROW PROGRAM (KP, 2001)
- GW00-01 — ODEX, SPT, MONITORING WELL INSTALLATION - SOUTH EMBANKMENT (KP, 2000)
- CPT 96-1 — CPT - MAIN EMBANKMENT (KP / CONETEC, 1996)
- 96-A1 — SOLID/HOLLOW STEM AUGER, SPT, PIEZOMETER INSTALLATION - MAIN EMBANKMENT (KP / R.E. GRAHAM ENG., 1996)
- PRW96-01 — SOLID STEM AUGER, PRESSURE RELIEF WELL - MAIN EMBANKMENT (KP, 1996)
- GW96-1 — AIR ROTARY, SPT, MONITORING WELL INSTALLATION (KP, 1996)
- MP89-230 — CONDEMNATION BOREHOLES, PIEZOMETER INSTALLATION (KP, 1989)
- EMBANKMENT FOOTPRINT

GEOLOGICAL PROFILE REFERENCE LINE

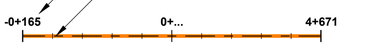

0 200 400
1:6,000 METRES

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NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.
3. THE FORENSIC INVESTIGATION BOREHOLES NEAR CORNER 1 (FROM 2014) ARE NOT SHOWN ON THE FIGURE FOR CLARITY, REFER TO FIGURE 02.
4. THE FOLLOWING DRILLING INVESTIGATIONS ARE NOT SHOWN ON THE FIGURE FOR CLARITY: DH97-BA (KP 1997c), DH97-BA2 (IEERP 2015), DH98-BA2 (IEERP 2015), DH98-BA4 (IEERP 2015), DH98-BL (KP 1999), PRW98 (KP 1999), BH99 (KP 1999), AND DH99 (KP 2000).
5. TEST PIT INVESTIGATIONS ARE NOT SHOWN ON THE FIGURE FOR CLARITY.

REFERENCES

1. S.O.L - ORIGINAL ALIGNMENT PROVIDED BY BGC ENGINEERING INC., DRAWING No. 01, DRAWING TITLE, "SI PLANNING PLAN MAP", PROJECT No. P14178, FILE NAME: "ACAD-01.dwg", DATED: SEPTEMBER 2014.
2. GROUND SURVEY PROVIDED BY MPMC, FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
3. BATHYMETRY CONTOURS PROVIDED BY MPMC, FILE NAME: "200617 sound.csv", SURVEYED: 17 JUNE 2020, RECEIVED: 23 JUNE 2020,
4. EXISTING SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 5 SEPTEMBER 2014, AND FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
OVERVIEW BOREHOLE LOCATION PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	01

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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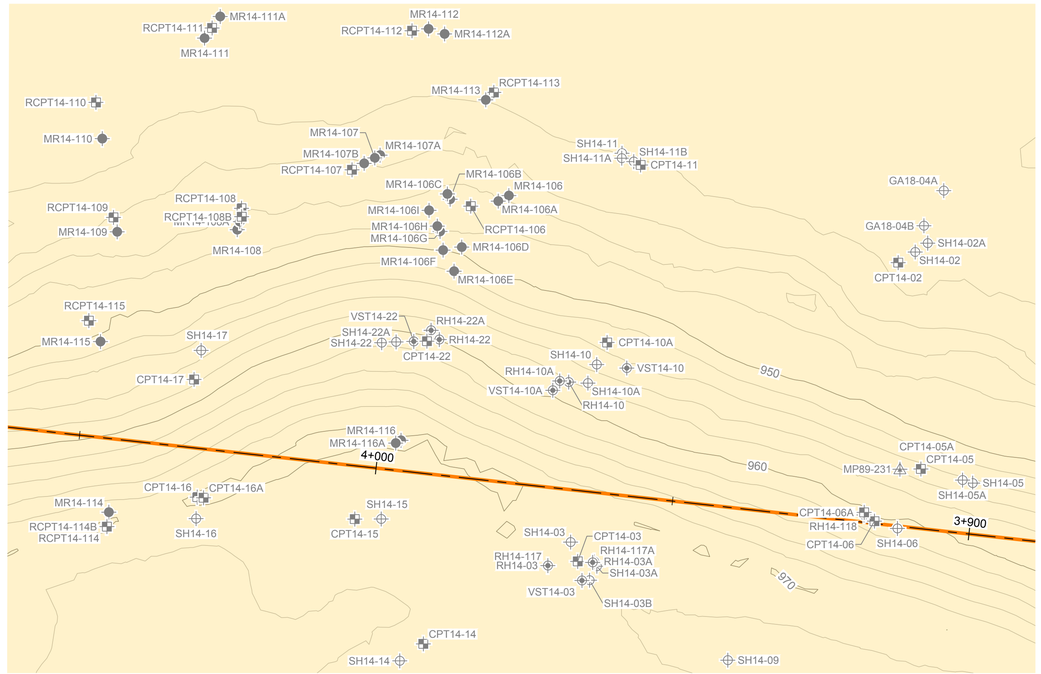

INSET
SCALE 1:500 m

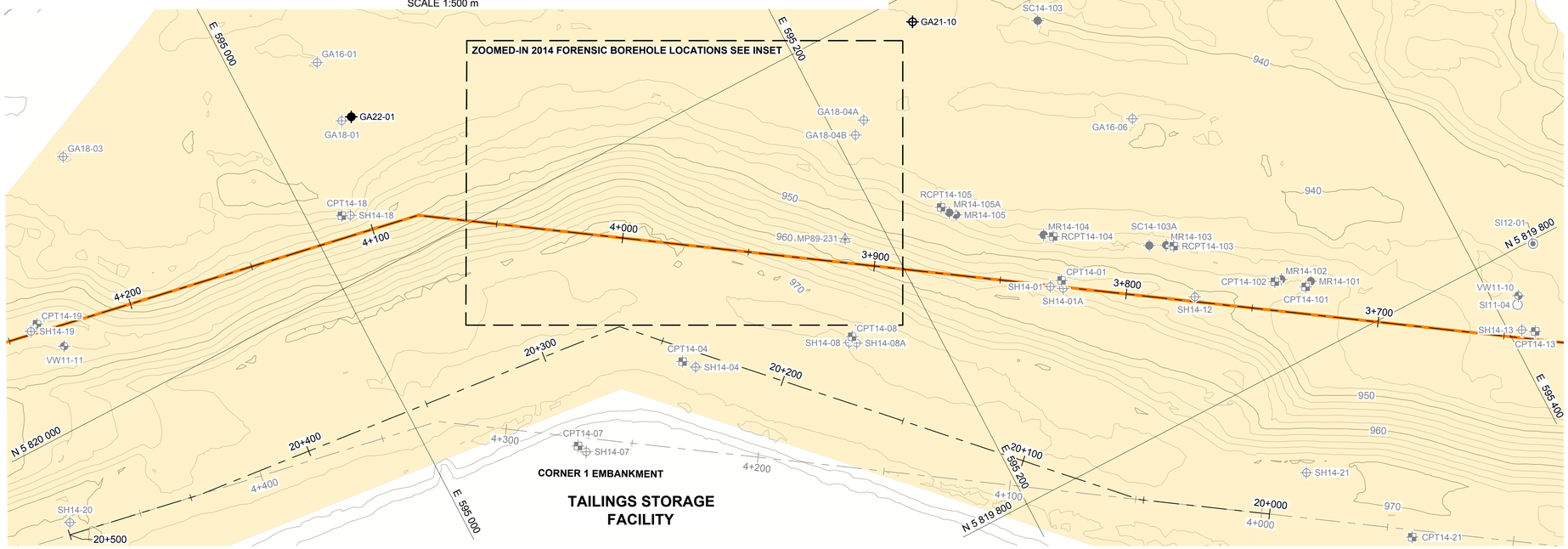

CORNER 1 EMBANKMENT

TAILINGS STORAGE FACILITY

NOTES
1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS SHOWN ARE REFERENCED TO TAILINGS GRID.

REFERENCES
1. S.O.L - ORIGINAL ALIGNMENT PROVIDED BY BGC ENGINEERING INC., DRAWING No. 01, DRAWING TITLE, "SI PLANNING PLAN MAP", PROJECT No. P14178, FILE NAME: "ACAD-01.dwg", DATED: SEPTEMBER 2014.
2. GROUND SURVEY PROVIDED BY MPMC, FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

LEGEND

- 3+800 — GEOLOGICAL PROFILE REFERENCE LINE AND CHAINAGE
- 20+200 — CORNER 1 PERIMETER EMBANKMENT ALIGNMENT
- 4+400 — SETOUT LINE - S.O.L. - ORIGINAL ALIGNMENT (SEE REFERENCE 1)
- GROUND CONTOURS (SEE REFERENCE 2)
- GA22-01 — SONIC DRILLING, PIEZOMETER INSTALLATION - CORNER 1 EMBANKMENT (GOLDER, 2022)
- GA21-10 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1, PERIMETER AND MAIN EMBANKMENT (GOLDER, 2021)
- GA18-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 (GOLDER, 2018)
- GA16-01 — SONIC DRILLING, SI AND PIEZOMETER INSTALLATION - CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- CPT16-04 — CPT - TAILINGS, CORNER 1 AND SOUTH EMBANKMENT (GOLDER, 2016)
- CPT14-101 / RCPT14-103 — CPT - CORNER 1 EMBANKMENT (THE PANEL, 2014)
- CPT14-01 — CPT - CORNER 1 EMBANKMENT (KCB, 2014)
- SH14-10 — SONIC DRILLING, SI, SAA, AND PIEZOMETER INSTALLATION - CORNER 1 EMBANKMENT (KCB, 2014)
- RH14-03 / VST 14-03 — MUD ROTARY, PIEZOMTER INSTALLATION - CORNER 1 EMBANKMENT (KCB, 2014)
- MR14-104 / SC14-103 / RH14-117 — MUD ROTARY - CORNER 1 EMBANKMENMT (THE PANEL, 2014)
- SI12-01 — ODEX, SI INSTALLATION - PERIMETER EMBANKMENT (AMEC, 2012)
- SI11-01 — SONIC DRILLING, SI INSTALLATION (AMEC, 2011)
- VW11-01 — SONIC DRILLING, PIEZOMETER INSTALLATION (AMEC, 2011)
- GW96-1 — AIR ROTARY, SPT, MONITORING WELL INSTALLATION (KP, 1996)
- MP89-230 — CONDEMNATION BOREHOLES, PIEZOMETER INSTALLATION (KP, 1989)
- EMBANKMENT FOOTPRINT

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
CORNER 1 EMBANKMENT BOREHOLE LOCATION PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	02

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

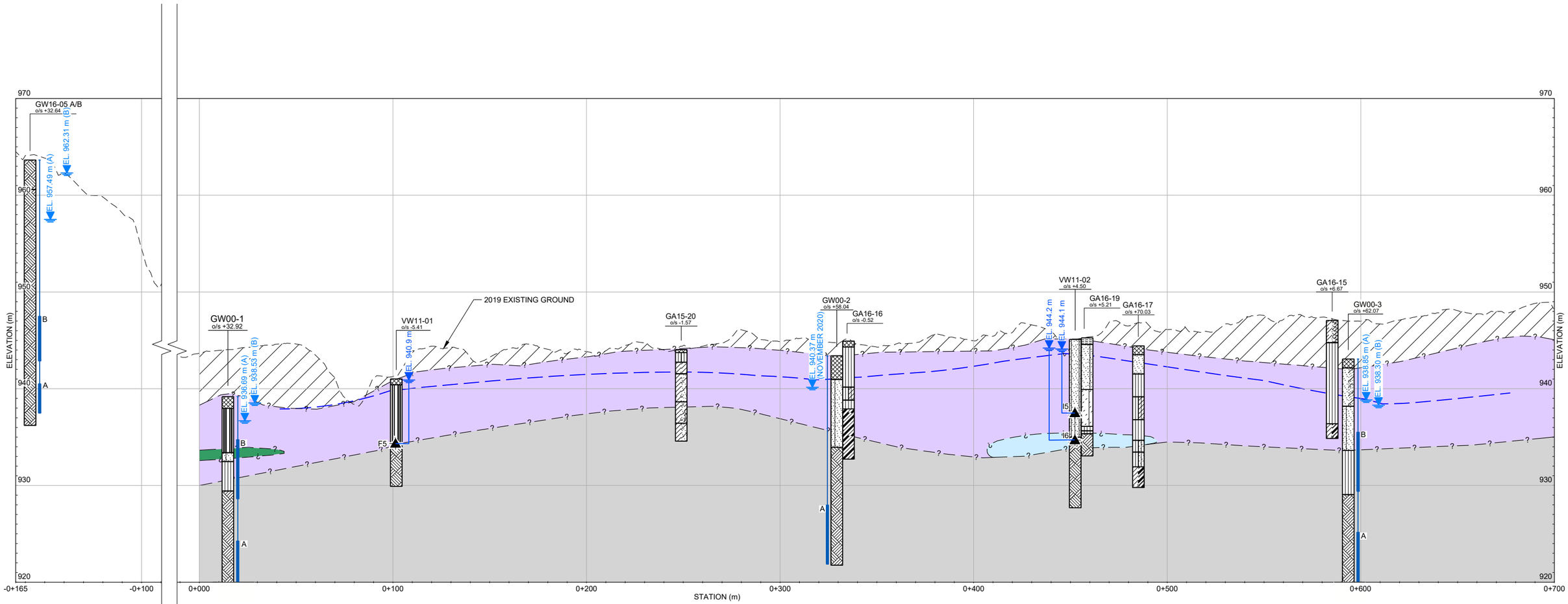

PROFILE - STA. -0+165 m TO 0+700 m

HORIZ. SCALE 1:2,000 m
VERT. SCALE 1:400 m

LEGEND

2019 EXISTING GROUND SURFACE — INFERRED STRATIGRAPHIC CONTACT
INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02
o/s -88.59

DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER
DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES
GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021
EXISTING VIBRATING WIRE PIEZOMETER
MONITORING WELL SCREEN
TEST HOLE RECORD SHOWING SOIL CONDITIONS
(FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

FILL, PT - PEAT, OL - ORGANIC SILT, OH - ORGANIC SILT, CL - SILTY CLAY, TOPSOIL, CI - SILTY CLAY, CH - CLAY, MH - CLAYEY SILT, ML - CLAYEY SILT OR SILT, ASPHALT, SC - CLAYEY SAND, SW - WELL GRADED SAND, SM - SILTY SAND, SP - POORLY GRADED SAND, GC - CLAYEY GRAVEL, GM - SILTY GRAVEL, GP - POORLY GRADED GRAVEL, GW - WELL GRADED GRAVEL, BEDROCK

SOIL STRATIGRAPHY

FILL, ABLATION TILL, GLACIOLACUSTRINE SUB-UNIT, BASAL TILL, GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED), GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

BEDROCK / WEATHERED BEDROCK

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND MAY VARY FROM THAT SHOWN.
3. VARIOUS COMBINATIONS OF THE SYMBOLS HAVE BEEN USED TO REPRESENT TRANSITIONAL MATERIALS OR RANGES OF MATERIALS WITHIN A STRATUM.
4. PREFERENCE WAS GIVEN TO INCORPORATING GEOLOGIC DATA FROM BOREHOLES LOCATED CLOSE TO THE CROSS-SECTION LINES AND TO BOREHOLES THAT HAD THE MOST DETAILED GEOLOGIC DESCRIPTIONS OF THE SUBSURFACE CONDITIONS ENCOUNTERED. BOREHOLES THAT WERE FARTHER FROM CROSS-SECTION LINES WERE REVIEWED FOR GEOLOGICAL CORRELATION CRITERIA, INCLUDING INFORMATION ON THE SPECIFIC STRATIGRAPHIC SEQUENCE AND ELEVATIONS OF CONTACTS BETWEEN THE DIFFERENT GEOLOGIC UNITS. BOREHOLES WITH SIGNIFICANT LATERAL OFFSET FROM THE LINES OF CROSS-SECTION WERE GENERALLY OMITTED GIVEN THE HIGH DEGREE OF UNCERTAINTY IN PROJECTION OF THE DATA.

REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC,
FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

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0 10 20
VERT. SCALE 1:400 METRES

0 50 100
HORIZ. SCALE 1:2,000 METRES

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
SURFICIAL GEOLOGY PROFILE (1 OF 6)
STA. -0+165 TO 0+700

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	03

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

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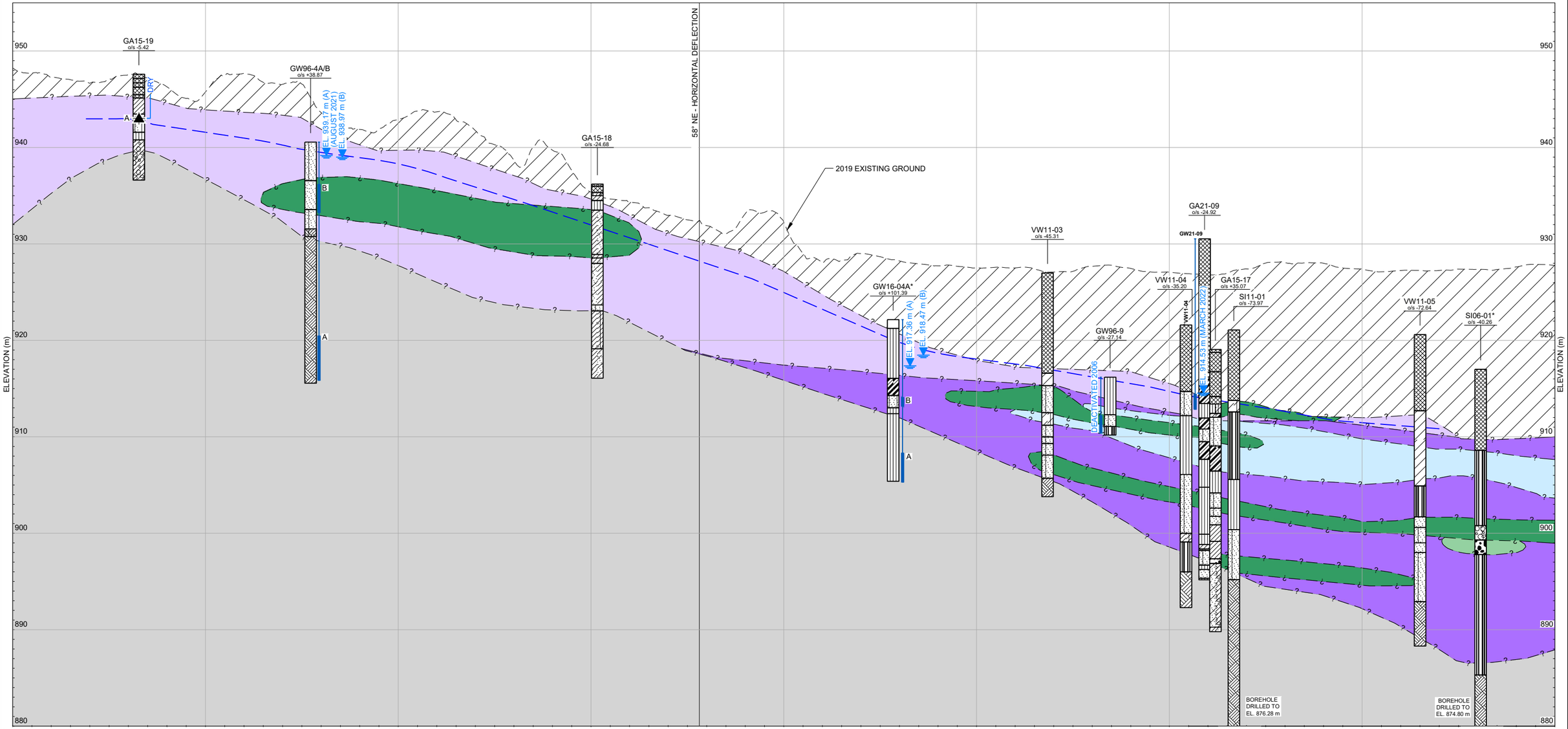

LEGEND

2019 EXISTING GROUND SURFACE — INFERRED STRATIGRAPHIC CONTACT

INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02
o/s -88.59

DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER
DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES
GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021
EXISTING VIBRATING WIRE PIEZOMETER
MONITORING WELL SCREEN
TEST HOLE RECORD SHOWING SOIL CONDITIONS
(FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

- FILL
- PT - PEAT
- OL - ORGANIC SILT
- OH - ORGANIC SILT
- CL - SILTY CLAY
- TOPSOIL
- CI - SILTY CLAY
- CH - CLAY
- MH - CLAYEY SILT
- ML - CLAYEY SILT OR SILT
- ASPHALT
- SC - CLAYEY SAND
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- GC - CLAYEY GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GW - WELL GRADED GRAVEL
- BEDROCK

SOIL STRATIGRAPHY

- FILL
- ABLATION TILL
- GLACIOLACUSTRINE SUB-UNIT
- BASAL TILL
- GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
- GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

- BEDROCK / WEATHERED BEDROCK

NOTES

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2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND MAY VARY FROM THAT SHOWN.
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REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC,
   FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

PROFILE - STA. 0+700 m TO 1+500 m

HORIZ. SCALE 1:2,000 m
VERT. SCALE 1:400 m

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0 10 20
VERT. SCALE 1:400 METRES

0 50 100
HORIZ. SCALE 1:2,000 METRES

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
SURFICIAL GEOLOGY PROFILE (2 OF 6)
STA. 0+700 TO 1+500

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	04

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

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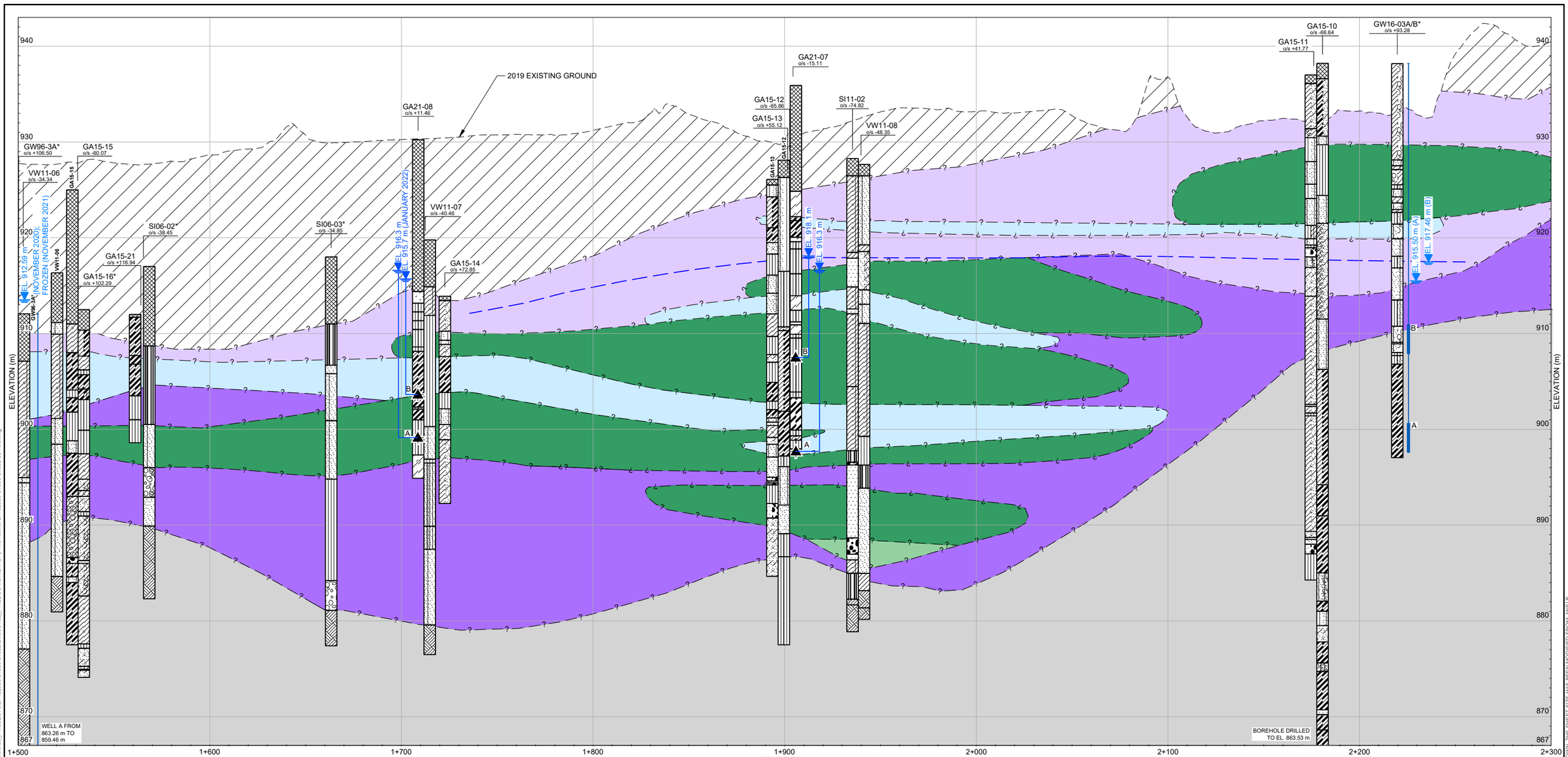

LEGEND

2019 EXISTING GROUND SURFACE — INFERRED STRATIGRAPHIC CONTACT

INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02
o/s -88.59

DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER
DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES
GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021
EXISTING VIBRATING WIRE PIEZOMETER
MONITORING WELL SCREEN
TEST HOLE RECORD SHOWING SOIL CONDITIONS
(FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

- FILL
- PT - PEAT
- OL - ORGANIC SILT
- OH - ORGANIC SILT
- CL - SILTY CLAY
- TOPSOIL
- CI - SILTY CLAY
- CH - CLAY
- MH - CLAYEY SILT
- ML - CLAYEY SILT OR SILT
- ASPHALT
- SC - CLAYEY SAND
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- GC - CLAYEY GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GW - WELL GRADED GRAVEL
- BEDROCK

SOIL STRATIGRAPHY

- FILL
- ABLATION TILL
- GLACIOLACUSTRINE SUB-UNIT
- BASAL TILL
- GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
- GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

- BEDROCK / WEATHERED BEDROCK

NOTES

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REFERENCE

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PROFILE - STA. 1+500 m TO 2+300 m

HORIZ. SCALE 1:2,000 m
VERT. SCALE 1:400 m

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0 10 20
VERT. SCALE 1:400 METRES

0 50 100
HORIZ. SCALE 1:2,000 METRES

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
SURFICIAL GEOLOGY PROFILE (3 OF 6)
STA. 1+500 TO 2+300

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	05

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25 mm

0

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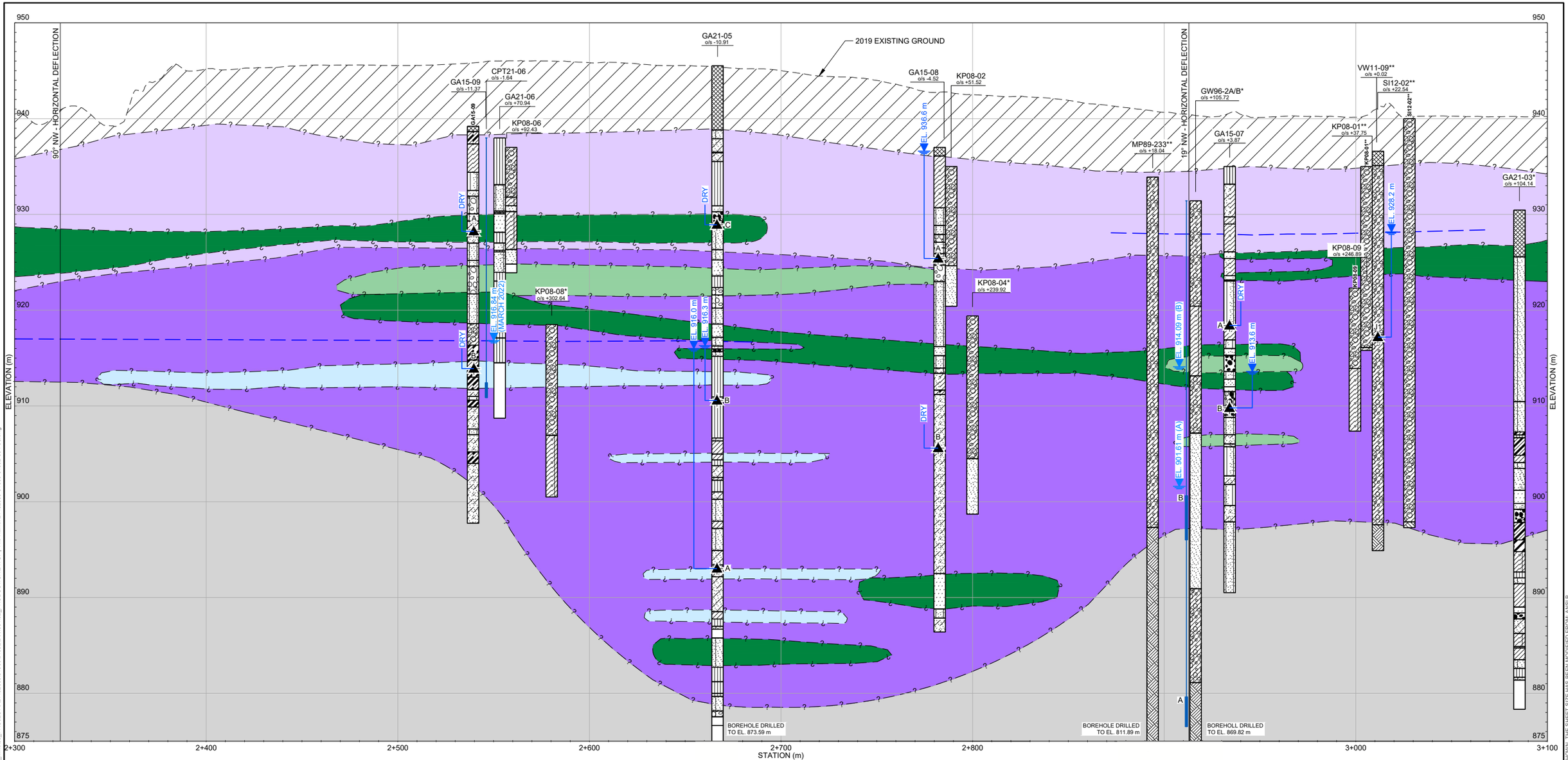

LEGEND

2019 EXISTING GROUND SURFACE — — ? — INFERRED STRATIGRAPHIC CONTACT

INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02 — DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER

o/s -88.59 — DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES

GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021

EXISTING VIBRATING WIRE PIEZOMETER

MONITORING WELL SCREEN

TEST HOLE RECORD SHOWING SOIL CONDITIONS (FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

FILL	TOPSOIL	ASPHALT	GC - CLAYEY GRAVEL
PT - PEAT	CI - SILTY CLAY	SC - CLAYEY SAND	GM - SILTY GRAVEL
OL - ORGANIC SILT	CH - CLAY	SW - WELL GRADED SAND	GP - POORLY GRADED GRAVEL
OH - ORGANIC SILT	MH - CLAYEY SILT	SM - SILTY SAND	GW - WELL GRADED GRAVEL
CL - SILTY CLAY	ML - CLAYEY SILT OR SILT	SP - POORLY GRADED SAND	BEDROCK

SOIL STRATIGRAPHY

FILL	GLACIOLACUSTRINE SUB-UNIT	GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
ABLATION TILL	BASAL TILL	GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

BEDROCK / WEATHERED BEDROCK

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND MAY VARY FROM THAT SHOWN.
3. VARIOUS COMBINATIONS OF THE SYMBOLS HAVE BEEN USED TO REPRESENT TRANSITIONAL MATERIALS OR RANGES OF MATERIALS WITHIN A STRATUM.
4. PREFERENCE WAS GIVEN TO INCORPORATING GEOLOGIC DATA FROM BOREHOLES LOCATED CLOSE TO THE CROSS-SECTION LINES AND TO BOREHOLES THAT HAD THE MOST DETAILED GEOLOGIC DESCRIPTIONS OF THE SUBSURFACE CONDITIONS ENCOUNTERED. BOREHOLES THAT WERE FARTHER FROM CROSS-SECTION LINES WERE REVIEWED FOR GEOLOGICAL CORRELATION CRITERIA, INCLUDING INFORMATION ON THE SPECIFIC STRATIGRAPHIC SEQUENCE AND ELEVATIONS OF CONTACTS BETWEEN THE DIFFERENT GEOLOGIC UNITS. BOREHOLES WITH SIGNIFICANT LATERAL OFFSET FROM THE LINES OF CROSS-SECTION WERE GENERALLY OMITTED GIVEN THE HIGH DEGREE OF UNCERTAINTY IN PROJECTION OF THE DATA.

REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC, FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

PROFILE - STA. 2+300 m TO 3+100 m

HORIZ. SCALE 1:2,000 m

VERT. SCALE 1:400 m

THIS FIGURE IS INTENDED FOR CLIENT'S ONE TIME USE ONLY AND IT IS NOT INTENDED OR REPRESENTED BY WSP TO BE SUITABLE FOR REUSE BY ANY PARTY, INCLUDING, BUT NOT LIMITED TO, THE CLIENT, ITS EMPLOYEES, AGENTS, SUBCONTRACTORS OR SUBSEQUENT OWNERS ON ANY EXTENSION OF A SPECIFIC PROJECT OR FUTURE PROJECTS, WHETHER CLIENT'S OR OTHERWISE, WITHOUT WSP'S PRIOR WRITTEN PERMISSION. ANY MANIPULATION, ADAPTATION, MODIFICATION, ALTERATION, MISUSE OR REUSE UNAUTHORIZED BY WSP WILL BE AT CLIENT'S SOLE RISK. WSP EXPRESSLY DISCLAIMS ALL LIABILITY AGAINST ALL THIRD PARTIES RELYING, USING OR MAKING DECISIONS ON THIS FIGURE. THIRD PARTIES DO SO AT THEIR OWN RISK. EXCEPT WHERE WRITTEN AGREEMENT STATES OTHERWISE, THIS FIGURE IS THE PROPERTY OF WSP.

0 10 20

VERT. SCALE 1:400 METRES

0 50 100

HORIZ. SCALE 1:2,000 METRES

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT

MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE

SURFICIAL GEOLOGY PROFILE (4 OF 6)
STA. 2+300 TO 3+100

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	06

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

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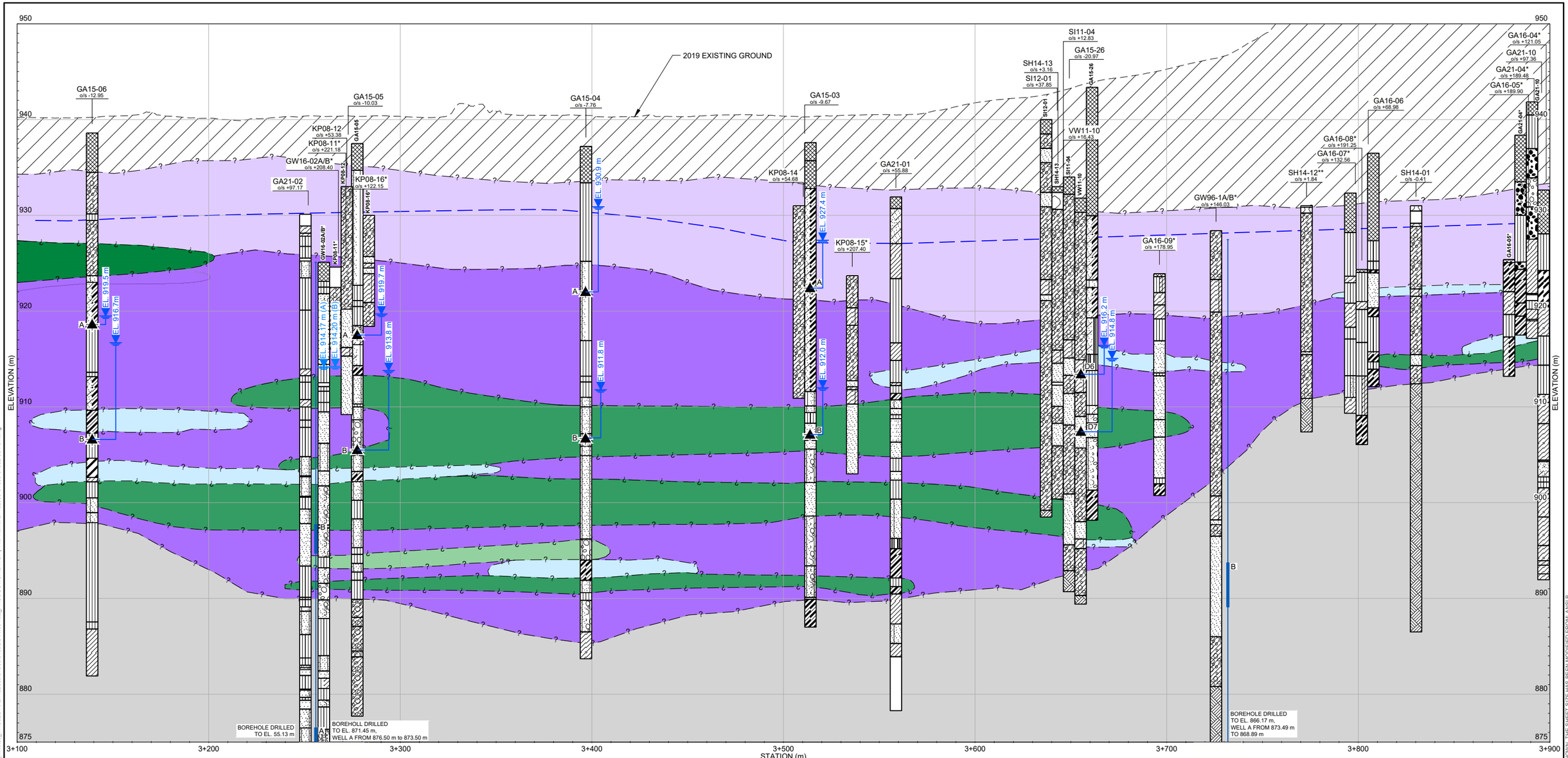

LEGEND

2019 EXISTING GROUND SURFACE — INFERRED STRATIGRAPHIC CONTACT

INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02 / o/s -88.59 — DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER; DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES

GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021

EXISTING VIBRATING WIRE PIEZOMETER

MONITORING WELL SCREEN

TEST HOLE RECORD SHOWING SOIL CONDITIONS (FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

FILL	TOPSOIL	ASPHALT	GC - CLAYEY GRAVEL
PT - PEAT	CI - SILTY CLAY	SC - CLAYEY SAND	GM - SILTY GRAVEL
OL - ORGANIC SILT	CH - CLAY	SW - WELL GRADED SAND	GP - POORLY GRADED GRAVEL
OH - ORGANIC SILT	MH - CLAYEY SILT	SM - SILTY SAND	GW - WELL GRADED GRAVEL
CL - SILTY CLAY	ML - CLAYEY SILT OR SILT	SP - POORLY GRADED SAND	BEDROCK

SOIL STRATIGRAPHY

FILL	GLACIOLACUSTRINE SUB-UNIT	GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
ABLATION TILL	BASAL TILL	GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

BEDROCK / WEATHERED BEDROCK

NOTES

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2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND MAY VARY FROM THAT SHOWN.
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REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC, FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

PROFILE - STA. 3+100 m TO 3+900 m

HORIZ. SCALE 1:2,000 m

VERT. SCALE 1:400 m

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0 10 20
VERT. SCALE 1:400 METRES

0 50 100
HORIZ. SCALE 1:2,000 METRES

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT

MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE

SURFICIAL GEOLOGY PROFILE (5 OF 6)
STA. 3+100 TO 3+900

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	07

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

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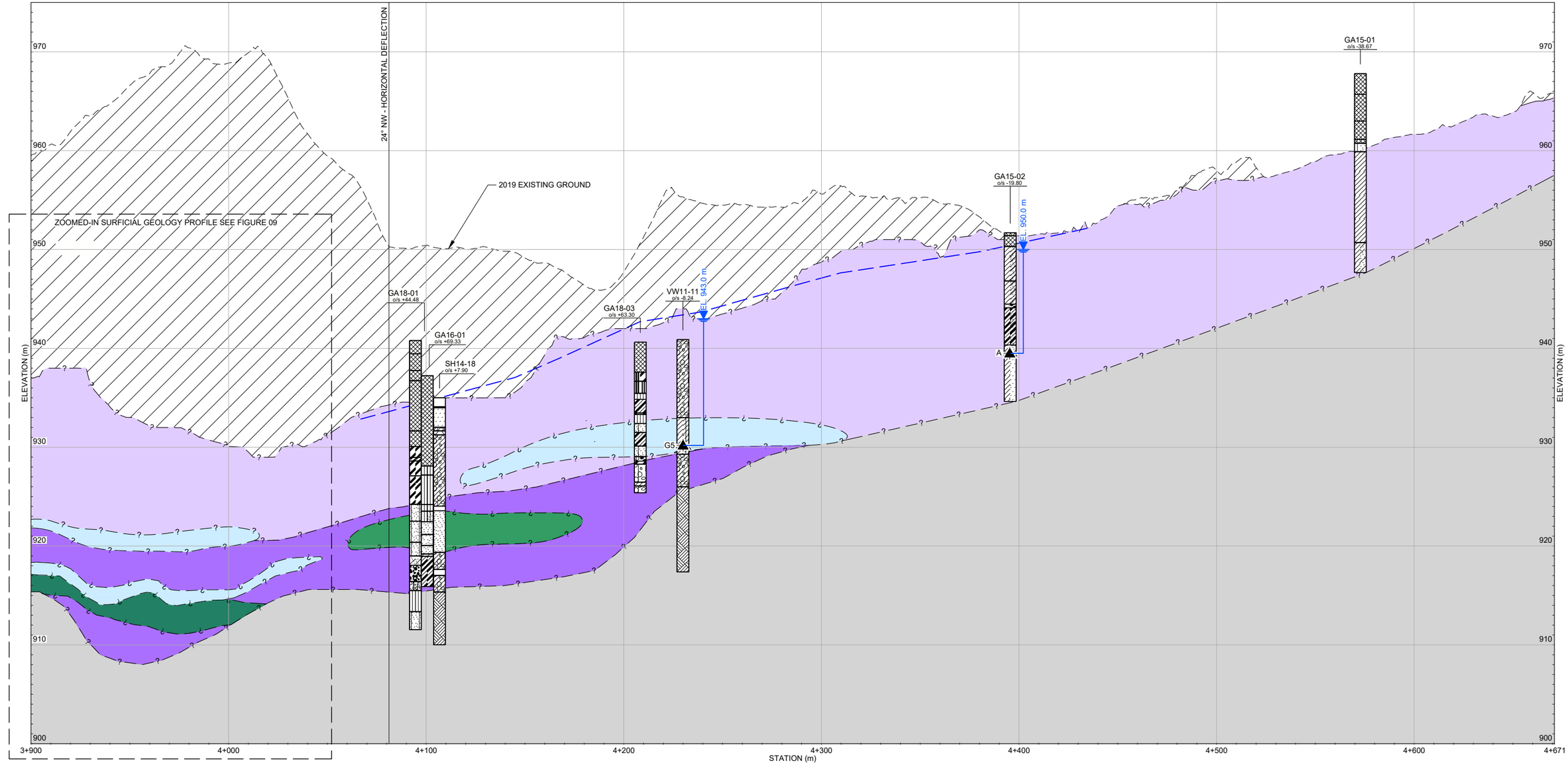

LEGEND

2019 EXISTING GROUND SURFACE — — ? — INFERRED STRATIGRAPHIC CONTACT

INFERRED WATER TABLE (PHREATIC SURFACE)

TEST HOLE LEGEND

BH19-02
o/s -88.59

DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER
DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES
GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021
EXISTING VIBRATING WIRE PIEZOMETER
MONITORING WELL SCREEN
TEST HOLE RECORD SHOWING SOIL CONDITIONS (FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

NOT USED FOR THE GEOLOGICAL PROFILE BOUNDARIES SYMBOLS SUMMARY

*	REVIEWED BOREHOLE LOG DATA ONLY. BOREHOLE LOG NOT USED FOR CREATING STRATIGRAPHIC BOUNDARIES.
**	BOREHOLE LOG DID NOT PROVIDE SUFFICIENT GEOLOGICAL DETAIL FOR INCLUSION IN STRATIGRAPHIC INTERPRETATION.

SOIL LITHOLOGY

- FILL
- PT - PEAT
- OL - ORGANIC SILT
- OH - ORGANIC SILT
- CL - SILTY CLAY
- TOPSOIL
- CI - SILTY CLAY
- CH - CLAY
- MH - CLAYEY SILT
- ML - CLAYEY SILT OR SILT
- ASPHALT
- SC - CLAYEY SAND
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- GC - CLAYEY GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GW - WELL GRADED GRAVEL
- BEDROCK

SOIL STRATIGRAPHY

- FILL
- ABLATION TILL
- GLACIOLACUSTRINE SUB-UNIT
- BASAL TILL
- GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
- GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

- BEDROCK / WEATHERED BEDROCK

NOTES

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REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC,
   FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

PROFILE - STA. 3+900 m TO 4+671 m

HORIZ. SCALE 1:2,000 m
VERT. SCALE 1:400 m

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0 10 20
VERT. SCALE 1:400 METRES

0 50 100
HORIZ. SCALE 1:2,000 METRES

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
SURFICIAL GEOLOGY PROFILE (6 OF 6)
STA. 3+900 TO 4+671

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	08

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
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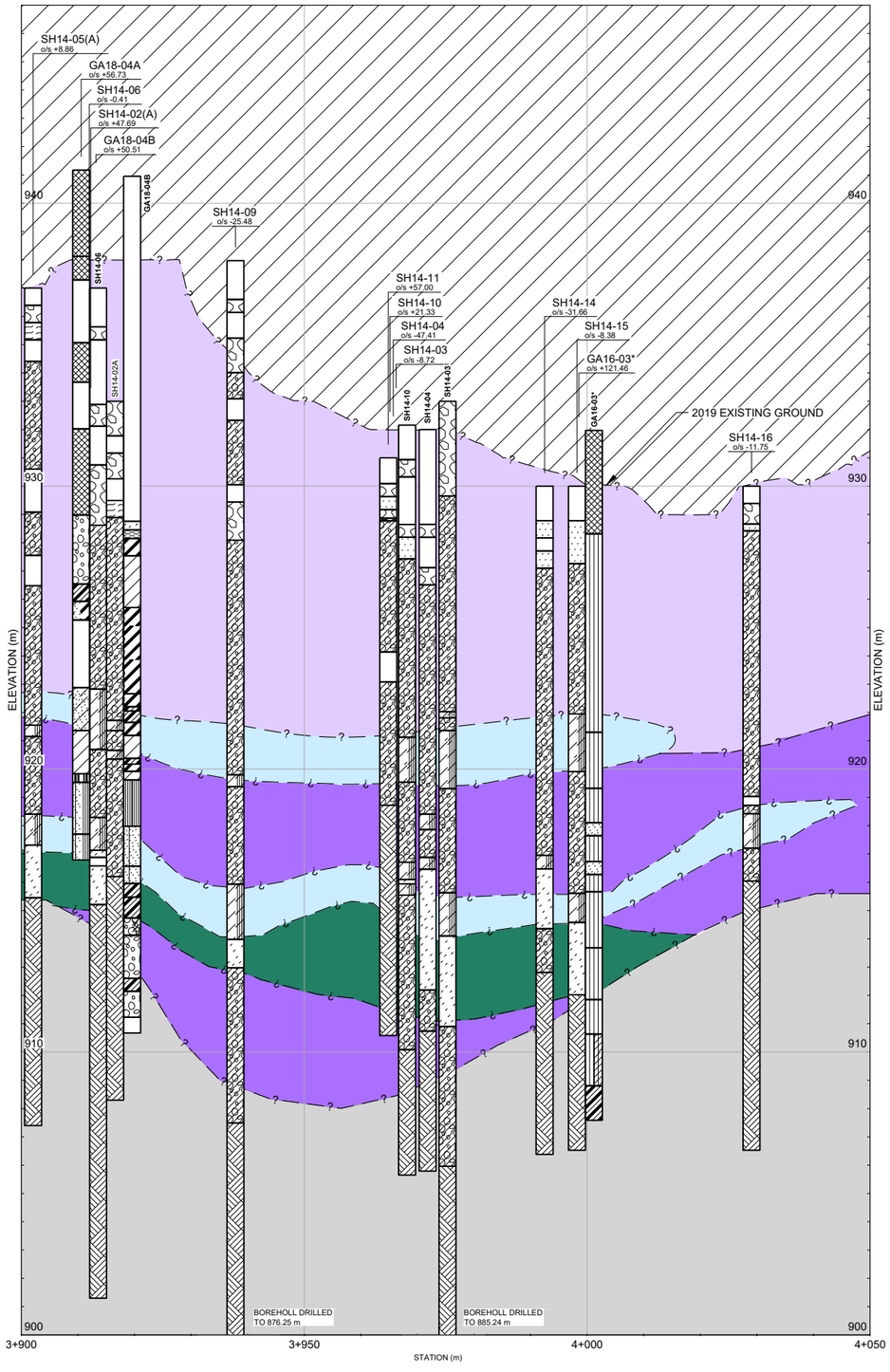

PROFILE - STA. 3+900 m TO 4+050 m
HORIZ. SCALE 1:1,000 m
VERT. SCALE 1:200 m

LEGEND

2019 EXISTING GROUND SURFACE — — ? — INFERRED STRATIGRAPHIC CONTACT

TEST HOLE LEGEND

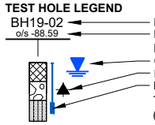

DENOTES TEST HOLE TYPE, INVESTIGATION YEAR AND ID NUMBER
DENOTES PERPENDICULAR DISTANCE FROM TEST HOLE TO SECTION LINE IN METRES
GROUNDWATER LEVEL / PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2021
EXISTING VIBRATING WIRE PIEZOMETER
MONITORING WELL SCREEN
TEST HOLE RECORD SHOWING SOIL CONDITIONS
(FOR DETAILED GEOTECHNICAL INFORMATION REFER TO RECORD OF BOREHOLE)

BOREHOLE LOGS SYMBOLS SUMMARY

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SOIL LITHOLOGY

FILL	TOPSOIL	ASPHALT	GC - CLAYEY GRAVEL
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OH - ORGANIC SILT	MH - CLAYEY SILT	SM - SILTY SAND	GW - WELL GRADED GRAVEL
CL - SILTY CLAY	ML - CLAYEY SILT OR SILT	SP - POORLY GRADED SAND	BEDROCK

SOIL STRATIGRAPHY

FILL	BASAL TILL
ABLATION TILL	GLACIOFLUVIAL SUB-UNIT (SAND DOMINATED)
GLACIOLACUSTRINE SUB-UNIT	GLACIOFLUVIAL SUB-UNIT (GRAVEL DOMINATED)

BEDROCK / WEATHERED BEDROCK

BEDROCK / WEATHERED BEDROCK

NOTES

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REFERENCE

1. EXISTING GROUND SURVEY PROVIDED BY MPMC, FILE NAME: "Tailings_Points_1m_18.10.2019.laz", SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.

0 5 10
VERT. SCALE 1:200 METRES

0 25 50
HORIZ. SCALE 1:1,000 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2023-08-11
DESIGNED	RG/CL
PREPARED	AW
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
ZOOMED-IN SURFICIAL GEOLOGY PROFILE
STA. 3+900 TO 4+050

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
21452039	51300/51392/034	0	09

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

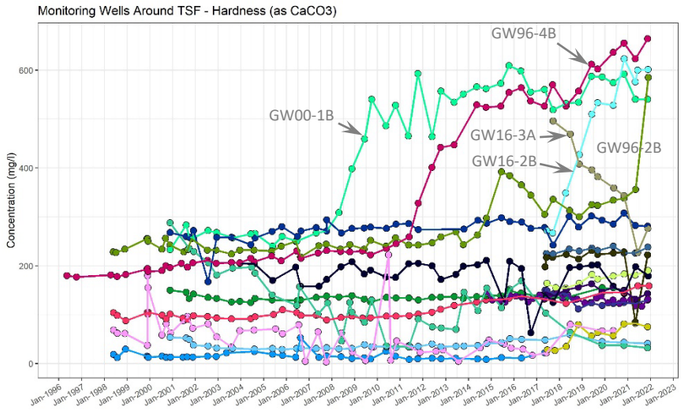

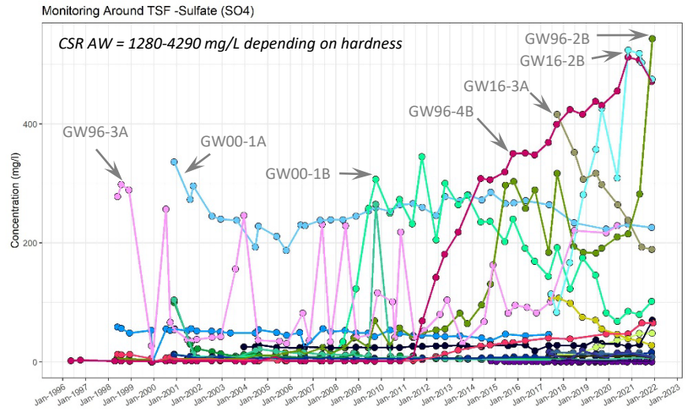

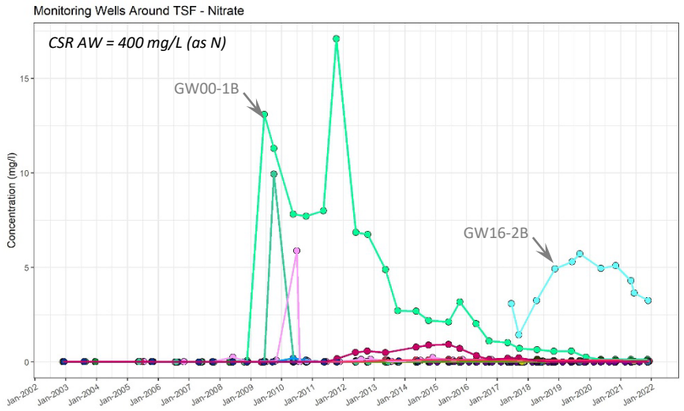

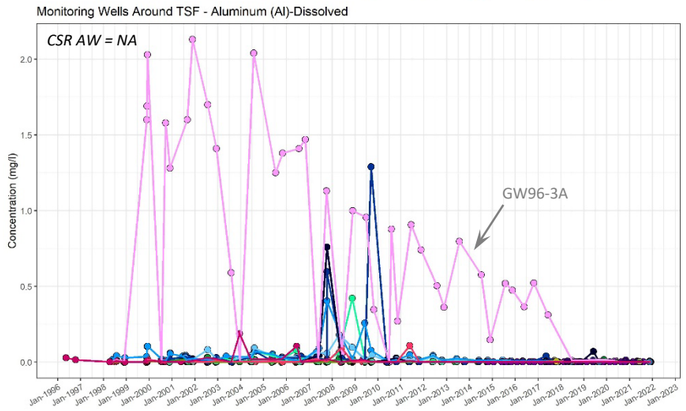

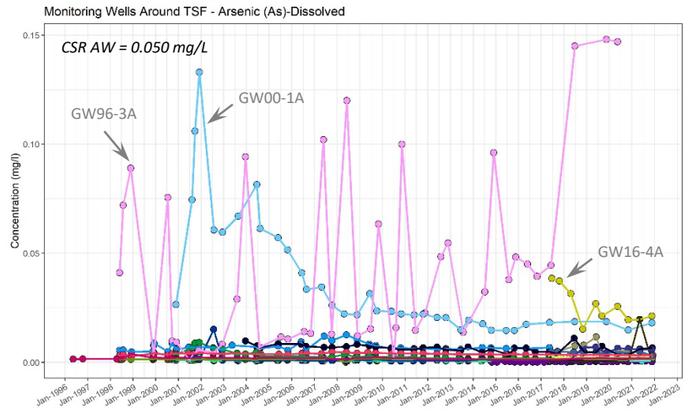

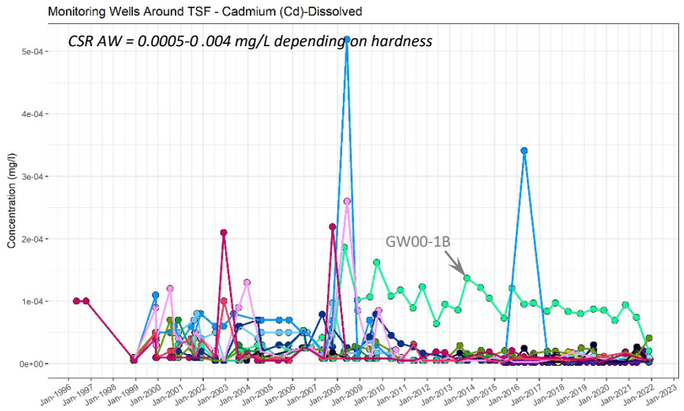

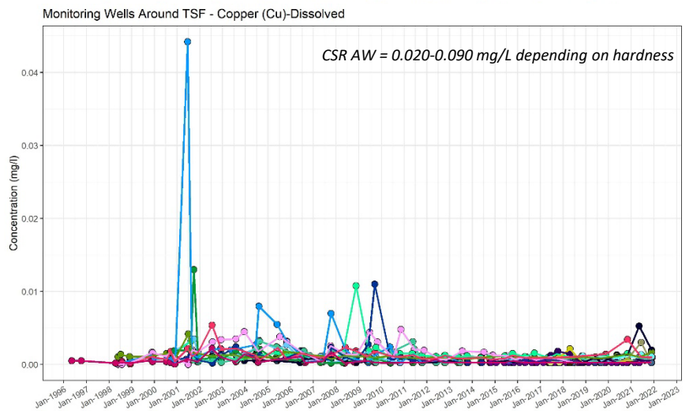

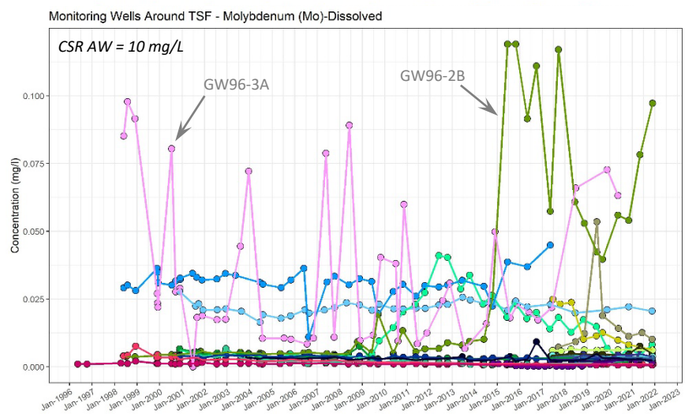

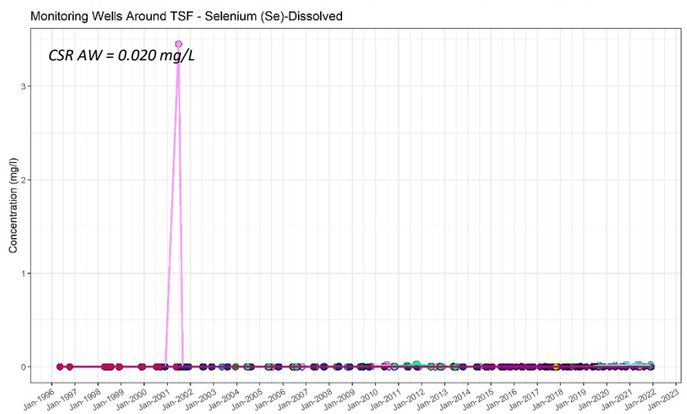

GW00-1A GW00-2A GW00-3B GW16-2A GW16-3A GW16-4A GW16-5A GW96-1A GW96-2B GW96-4A
GW00-1B GW00-3A GW14-1 GW16-2B GW16-3B GW16-4B GW16-5B GW96-2A GW96-3A GW96-4B

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-07-25
PREPARED	CR
DESIGNED	CR
REVIEWED	JF
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION

TITLE
GROUNDWATER QUALITY TRENDS FOR THE TSF – 1996 to 2021 (FROM GOLDER 2022b, FIGURE 5)

PROJECT NO.		REV.	FIGURE
22514095	51300/51392/034	0	10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

APPENDIX A

Summary of Investigations

GEOTECHNICAL INVESTIGATIONS

KP (Knight and Piésold Ltd.). 1990. Report on Geotechnical Investigations and Design of Open Pit, Waste Dumps and Tailings Storage Facility. Prepared for Imperial Metals Corporation. 12 June 1990.

Purpose

The main objectives and considerations of this study were to:

- present the design for the open pit, waste dumps, and tailings storage facility (TSF)
- provide input for the Stage 1 report and permit applications and become part of the overall Mount Polley Mine Feasibility Study

Scope

The scope related to the TSF foundation includes the following:

- site characteristics including hydrometeorology, regional geology, and seismicity
- geotechnical investigations carried out in the proposed TSF location consisting of field mapping, test pits and diamond drilling with permeability testing
  - Eighteen test pits (TPB-01 to TPB-18) were excavated within the proposed TSF footprint on 27/28 August 1989.
  - Eight condemnation boreholes (MP89-229 to MP89-236) were drilled in the proposed TSF footprint from 29 October 1989 to 12 November 1989.
    - Completion depths ranged from 73.2 to 121.9 m below ground surface.
    - Piezometers – 10 piezometers were installed in 6 boreholes (4 pneumatic and 6 standpipe piezometers).
    - Permeability testing consisted of the following:
      - packer tests – 21 tests conducted in 6 boreholes
      - falling head tests – 3 tests conducted in 3 boreholes
  - Laboratory testing of till samples collected from the test pits consisted of the following:
    - water content – 2 tests
    - Atterberg limits – 2 tests
    - sieve analysis – 2 tests
    - hydrometer – 2 tests
    - specific gravity – 1 test
    - modified Proctor – 1 test
    - permeability – 1 test
- identification of construction materials for the TSF

Data

- Appendix A – Climatological Summaries
- Appendix B – Discontinuity Data and Point Load Test Results
- Appendix C – Waste Rock Acid Generation Potential Testwork
- Appendix D – Laboratory Testwork on Tailings
- Appendix E – Geochemical Tests on Tailings
- Appendix F – Tailings Area B. Test Pit Logs, Borehole Logs and Permeability Test Results

KP (Knight Piésold Ltd.). 1995. Report on 1995 Geotechnical Investigations for Mill Site and Tailings Storage Facility. Prepared for Imperial Metals Corporation. Document No. 1623/1. 14 March 1995.

Purpose

The main objectives and considerations for the geotechnical investigation were to evaluate the type and distribution of surficial materials and the near surface foundation conditions at the mill site, along access roads and pipeline routes, potential borrow areas, within the tailings basin, and at the Polley Lake dam site.

Scope

The geotechnical investigation program was undertaken from 11 to 17 January 1995.

- Four test pits (TP95-16 to TP95-19) were excavated north of the proposed TSF and partially along the proposed tailings and reclaim pipeline route.
- Three test pits (TP95-29 to TP95-31) were excavated on the ridge east of the tailings facility to investigate potential borrow sources for future embankment construction.
- Eleven test pits (TP95-26 to TP95-28 and TP95-32 to TP95-39) were excavated within the proposed TSF footprint.
- Laboratory testing of soil samples collected from the test pits consisted of the following:
  - visual description of soils
  - water contents – 7 tests
  - Atterberg limits – 6 tests
  - sieve analysis – 7 tests
  - hydrometer – 7 tests
  - specific gravity – 4 tests
  - consolidated undrained triaxial compression – 3 tests
  - modified Proctor – 3 tests
  - falling head permeameter – 5 tests

Data

- Appendix A – Test Pit Logs
- Appendix B – Detailed Laboratory Test Results

KP (Knight Piésold Ltd.). 1997. Stage 2A Tailings Facility Construction Selected Excerpts from Reference Information. Prepared for Mount Polley Mining Corporation. Document No. 10162/9-2. 6 November 1997.

Purpose

The main objective of this report was to provide further background information on the geotechnical conditions encountered within the TSF footprint for the tender of the Stage 2A construction.

The report presents the geotechnical investigations completed for the Stage 2A construction. The main objectives and considerations for the investigation were to:

- delineate suitable borrow materials within Borrow Area No. 4
- investigate foundation conditions at the Perimeter Embankment for future downstream expansions
- complete laboratory testing of waste dump materials and mill site processed rock

Scope

The geotechnical investigation program was undertaken from 30 September 1997 to 6 October 1997.

- Twenty-one test pits (TP97-BA4-F8 to TP97-BA4-J9) were excavated at Borrow Area No. 4. Completion depths ranged from 5.0 to 6.2 m below ground surface.
- Four test pits were excavated (TP97-PETP-1 to TP97-PETP-4) within the proposed Perimeter Embankment expansion footprint. Completion depths ranged from 5.0 to 5.4 m below ground surface.
- Laboratory testing of soil samples collected from the test pits consisted of the following:
  - visual description of soils
  - water contents – 95 tests

Data

- Appendix A – Stage 2A Investigations – Test Pit Logs
- Appendix B – Borrow Area #4 – Summary of Natural Moisture Content of Test Pit Samples
- Appendix C – Particle Size Analyses of Waste Dump Material and Millsite Processed Material
- Appendix D – Stage 1A/1B Construction Quality Assurance – Record Test Data
- Appendix E – Stage 1A/1B Construction Quality Assurance – Control Test Data and Gradation Plots
- Appendix F – Borrow Area #2 Test Pit Program – Summary of Natural Moisture Content of Test Pit Samples
- Appendix G – Borrow Area #3 Test Pit Program – Summary of Natural Moisture Content of Test Pit Samples

AMEC (AMEC Environment & Infrastructure, a division of AMEC Americas Limited). 2012. Mount Polley Mine Project: Tailings Storage Facility 2011 Geotechnical Site Investigation – Final. Prepared for Mount Polley Mining Corporation. Document No. VM00560.200.3. 28 March 2012.

Purpose

The main objectives and considerations for the geotechnical investigation were to:

- further characterize the glaciolacustrine soils within the TSF foundation
- install new instrumentation and replace non-functioning instrumentation in key locations for dam performance monitoring including pore pressure response and slope movements

Scope

The geotechnical investigation program was undertaken from 29 September 2011 to 11 October 2011.

- Fourteen sonic boreholes (VW11-01 to VW11-11 and SI11-01, SI11-02, and SI11-04) were drilled downstream of the Perimeter Embankment, Main Embankment and South Embankment.
  - Completion depths ranged from 11.1 to 49.4 m below ground surface.
  - Vibrating wire piezometers (VWPs) – 23 VWPs were installed in 11 boreholes.
  - Slope inclinometers (SIs) – Three SIs were installed.
  - Shelby tubes – Three thin-walled tubes were collected.
- Four sonic boreholes were drilled at two locations outside the TSF footprint (i.e., mine site area).
  - Monitoring wells – Four monitoring wells (GW11-1A/B and GW11-2A/B) were installed at two locations.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - water contents – 199 tests
  - Atterberg limits – 20 tests
  - sieve analysis – 19 tests
  - hydrometer – 16 tests

Data

- Appendix A – 2011 Laboratory Testing Data
- Appendix B – 2011 Drill Hole Site Investigation Logs
- Appendix C – Drill Core Photographs
- Appendix D – Vibrating Wire Calibration Reports
- Appendix E – Instrumentation Readings
- Appendix F – Monitoring Well Drill Hole Logs

KCB (Klohn Crippen Berger Ltd.). 2015. Mount Polley Dam Failure – Site Investigation Progress Report No. 2. Prepared for BC Ministry of Energy and Mines. Document No. M09954A02.730. 21 January 2015.

Purpose

The main objectives and considerations for the geotechnical investigation were to:

- collect field data to help determine the August 2014 embankment failure mechanism
- characterize the profile and geotechnical properties of the foundation soils both inside and outside the failed area
- investigate and characterize any construction materials within the dam that may have influenced the failure mechanism
- locate the seat of the dam failure through the foundation materials, if applicable

This report supersedes the Site Investigation Progress Report No. 1 submitted to the BC Ministry of Energy and Mines on 12 December 2014.

Scope

The geotechnical investigation program was conducted between mid-September and late-November 2014.

- Visual reconnaissance and surficial mapping were conducted at the dam breach area to establish the post-failure configuration and provide insights into the nature of the failure mechanism.
- Geophysical surveys were conducted to estimate bedrock depth and approximate material boundaries within the dam failure area (Corner 1).
  - resistivity and induced polarity – 8 survey lines
  - seismic refraction – 6 survey lines
- Phase 1 – A sonic coring program was conducted to delineate the soil profile, obtain samples for geotechnical testing, and install instrumentation.
  - Thirty-two sonic boreholes (SH14-01 to SH14-22, with additional “A” and “B” designations) were drilled at 22 locations near the dam failure area (Corner 1).
    - Completion depths ranged from 1.8 to 72.4 m below ground surface.
    - Vibrating wire piezometers – Twenty-two VWPs were installed in 8 boreholes.
    - Slope inclinometers – Five SIs were installed.
    - Preserved core samples – Thirty-three preserved core samples were collected from three boreholes (SH14-03A, SH14-03B and SH14-10A).
    - Field tests – Pocket penetrometer, pilcon and/or torvane tests were conducted approximately every 0.5 m.

- Phase 2 – Cone penetration test (CPT) soundings and in situ testing were conducted to estimate the strength, hydraulic conductivity, and consolidation characteristics of the soil units.
  - Twenty-three CPTs were conducted at 19 locations within the dam failure area (Soundings CPT14-01 to CPT14-08, CPT14-10, CPT14-11, CPT14-13 to CPT14-19, CPT14-21, and CPT14-22).
    - Continuous resistivity measurements, and several shear wave velocity and porewater pressure tests, were completed.
  - Four vane shear test (VST) locations were completed within the dam failure area.
    - A total of 10 electronic VSTs were attempted in the upper glaciolacustrine unit.
  - Two boreholes contained standard penetration test (SPT) energy measurements.
- Phase 3 – Mud rotary drilling was carried out to conduct SPTs and retrieve high quality piston samples of relevant soils for laboratory test work.
  - Six mud rotary boreholes were drilled at three locations within the dam failure area (two per location).
    - Piston tubes – Seventeen thin-walled samples of the upper glaciolacustrine unit were collected.
    - Standard penetration tests – Thirty SPTs were conducted in the upper glacial till (VST14-22, VST14-10A, RH14-03, and CPT14-05A).
- Test pits and trenches were excavated to observe the conditions in the dam and foundation soils and recover block samples for laboratory testing.
  - One test trench was excavated in the dam till core.
  - One test pit was excavated in the up-thrusted toe bulge for block sampling (TP14-01).
    - A block sample of till and a block sample of upper glaciolacustrine material was collected from the test pit.
  - Bulk samples – Two bulk samples of till core were recovered for laboratory testing.
- Laboratory testing was conducted to determine the index, hydraulic conductivity, and strength properties of the various foundation soils and dam materials.
  - visual description of soils
  - water contents – 991 tests
  - Atterberg limits – 139 tests
  - sieve analysis – 127 tests
  - hydrometer – 125 tests
  - standard Proctor – 2 tests
  - specific gravity – 17 tests
  - organic contents – 3 tests
  - X-Ray diffraction – 12 tests on samples of upper and lower glaciolacustrine units
- The following advanced geotechnical tests were ongoing at the time of report preparation:
  - consolidated drained direct shear tests on samples of upper and lower glaciolacustrine units

- direct simple shear tests on samples of upper glaciolacustrine unit
- one-dimensional consolidation tests on samples of upper and lower glaciolacustrine units
- consolidated undrained monotonic triaxial compression tests on samples of till core, upper glacial till, and upper glaciolacustrine unit
- triaxial extension tests on samples of upper glacial till
- hydraulic permeability using triaxial cell (includes monotonic shear after completion of test)

Data

- Appendix I – Sonic Core Hole Logs
- Appendix II – Core Photographs
- Appendix III – Penetrometer Test Results on Sonic Core
- Appendix IV – Instrumentation Readings
- Appendix V – Standard Penetration Test Results
- Appendix VI – Sonic Core Sample Preservation
- Appendix VII – Thin-Walled Piston Tube Samples
- Appendix VIII – Test Pits and Block Sampling
- Appendix IX – Visual Reconnaissance and Field Mapping
- Appendix X – Observations During Core Excavation
- Appendix XI – Laboratory Index Test Results
- Appendix XII – Vibrating Wire Piezometer Calibration Records
- Appendix XIII – ConeTec In-situ Testing Report
- Appendix XIV – Frontier Geosciences Geophysics Report

IEEIRP (Independent Expert Engineering Investigation and Review Panel). 2015. Report on Mount Polley Tailings Storage Facility Breach. Prepared for BC Ministry of Energy and Mines. 30 January 2015.

Purpose

The main objectives and considerations for the forensic investigation were to:

- investigate and report on the cause of the TSF failure that occurred on 4 August 2014.
  - identify any mechanism(s) of failure of the TSF
  - identify any technical, management, or other practices that may have enabled or contributed to the mechanism(s) of failure; this may include an independent review of the design, construction, operation, maintenance, surveillance, and regulation of the TSF
  - identify any changes that could be considered to reduce the potential for future such occurrences
- make recommendations to government on actions that could be taken to ensure that a similar failure does not occur at other mine sites in BC
- comment on what actions could have been taken to prevent this failure and to identify practices or successes in other jurisdictions that could be considered for implementation in BC

Scope

The forensic investigation consisted of the following:

- Surface investigations were conducted to document geological and geotechnical features exposed in the breach area prior to disturbance by investigation activities or other operations.
- Subsurface investigations were conducted to examine the soil and groundwater conditions within the breach and surrounding area.
  - The sonic boreholes drilled by KCB in 2014 (SH14-01 to SH14-22, with additional “A” and “B” designations) were observed and independently logged.
    - No additional samples were collected for laboratory testing.
  - Rotary drilling was conducted to obtain disturbed and undisturbed samples of the upper glaciolacustrine unit and other soil units for laboratory testing.
    - Thirty-two mud rotary boreholes (MR14-101 to MR14-116) were drilled at 16 locations near the dam breach area (Corner 1).
      - Completion depths ranged from 2.6 to 16.9 m below ground surface.
      - Large penetration tests (LPTs) – Continuous LPTs were completed in boreholes MR14-116 and MR14-116A.
    - Three air rotary (ODEX) boreholes (RH14-117 to RH14-118) were drilled at two locations within the dam breach area.
      - Completion depths ranged from 13.1 to 18.0 m below ground surface.
    - Two soil core boreholes (SC14-103 and SC14-103A) were drilled at one location downstream of the Perimeter Embankment.
      - Completion depths were 9.8 m below ground surface.

- In situ sampling methods consisted of direct push of thin-walled tubes, piston tube sampling and the Pitcher Sampler.
  - Pocket penetrometer and torvane testing was conducted on the soil at the end of the tubes after retrieval of a relatively undisturbed sample.
  - All undisturbed thin-walled tube samples were CT scanned.
- CPTs and VSTs were conducted to characterize the foundation stratigraphy and to identify sampling locations for advanced laboratory testing.
  - Two CPTs and 15 resistivity cone penetration tests (RCPTs) were advanced at 15 locations near the dam breach area (soundings CPT14-101, CPT14-102, and RCPT14-103 to RCPT14-115).
    - Completion depths ranged from 1.3 to 17.1 m below ground surface.
    - Pore pressure dissipation tests were completed at selected locations.
  - Several in situ electronic VSTs were completed at five locations within the dam breach area, referred to as VST14-105 to VST14-107B, VST14-111, and VST14-112.
- Pressuremeter testing (PMT) was conducted in the glacial till to obtain shear strength and shear modulus values.
  - Several PMTs were completed at three locations within the dam breach area, referred to as PMT14-105 to PMT14-106, and PMT14-108.

- Laboratory testing of soil samples collected from the test pits and boreholes.
  - visual description of soils
  - water contents – 261 tests
  - Atterberg limits – 121 tests
  - sieve analysis – 126 tests
  - hydrometer – 106 tests
  - specific gravity – 6 tests
  - consolidated undrained triaxial compression – 13 tests
  - one-dimensional consolidation using incremental loading – 19 tests
  - direct simple shear – 17 tests
  - direct shear – 1 test

Data

- Appendix A – Terms of Reference
- Appendix B – Supporting Information
- Appendix C – Surface Investigation
- Appendix D – Subsurface Investigation
- Appendix E – Laboratory Testing and Results
- Appendix F – Instrumentation and Monitoring
- Appendix G – Water Balance
- Appendix H – Breach Analysis
- Appendix I – B.C. Tailings Dam Failure Frequency and Portfolio Risk
- Appendix J – Cariboo Regional District Video

KCB (Klohn Crippen Berger Ltd.). 2015. Mount Polley Dam Failure – Advanced Laboratory Testing Program Progress Report No. 4. Prepared for BC Ministry of Energy and Mines. Document No. M09954A02.730. 12 February 2015.

Purpose

The main objective of this report was to present the procedures and results of the advanced geotechnical laboratory testing program carried out on soil samples collected during the site investigation program.

This report supersedes the Advanced Laboratory Testing Program Progress Report No. 3 submitted to the BC Ministry of Energy and Mines on 21 January 2015.

Scope

The advanced geotechnical laboratory testing program began in October 2014.

- Advanced geotechnical laboratory testing was conducted on the following samples:
  - preserved (sonic) core samples of upper glacial till, and upper and lower glaciolacustrine units
  - thin-walled piston tube samples of upper glaciolacustrine unit
    - Five thin-walled tubes were selected for advanced testing.
  - block samples of upper glacial till and upper glaciolacustrine unit
    - One of each soil unit was selected for advanced testing.
  - bulk samples of the compacted till core (i.e., glacial till)
- Laboratory testing of soil samples collected from the test pit and boreholes consisted of the following:
  - one-dimensional consolidation using incremental loading – 10 tests
  - direct shear – 15 tests
  - direct simple shear (including cyclic) – 15 tests
  - permeability and consolidated undrained triaxial compression – 8 tests
  - consolidated undrained triaxial compression – 4 tests
  - consolidated undrained triaxial extension – 1 test

Data

- Appendix I – Laboratory Testing Program
- Appendix II – Specimen Preparation
- Appendix III – One-Dimensional Consolidation Results
- Appendix IV – Direct Shear Results
- Appendix V – Direct Simple Shear Results
- Appendix VI – Triaxial Test Results
- Appendix VII – Photographs
- Appendix VIII – Interpretation of Triaxial Tests on Block Samples of UGLU

Golder (Golder Associates Ltd.). 2015. Laboratory Testing Results from Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Document No. 1413803-012-TM-Rev0-2000. 26 March 2015.

Purpose

The main objective of this technical memorandum was to present the results of the laboratory testing program carried out on the soil samples obtained at the Central Collection Sump

Scope

- Laboratory testing of soil samples collected from the Central Collection Sump consisted of the following:
  - visual description of soils
  - water contents – 3 tests
  - Atterberg limits – 3 tests
  - sieve analysis – 6 tests
  - hydrometer – 3 tests
  - specific gravity – 3 tests
  - consolidated undrained triaxial compression – 3 tests
  - one-dimensional consolidation using controlled-strain loading – 1 test
  - direct simple shear – 4 tests

Data

- Attachment 1 – Lab Results
- Attachment 2 – Photographs
- Attachment 3 – Calibration Certificates

Golder (Golder Associates Ltd.). 2015. 2015 Geotechnical Investigation Factual Report. Prepared for Mount Polley Mining Corporation. Document No. 1413803-061-R-RevB-2000. 7 July 2015.

Purpose

The main objectives and considerations for the geotechnical investigation were to:

- better define foundation conditions along the Perimeter, Main, and South embankments to support studies regarding the stability of the embankments
- install instrumentation to monitor the performance of the embankments

Scope

The geotechnical investigation program was conducted from January 2015 to May 2015.

- Twenty sonic boreholes (GA15-01 to GA15-20) were drilled downstream of the TSF embankments.
  - Completion depths ranged from 9.5 to 74.7 m below ground surface.
  - Vibrating wire piezometers – Thirty-three VWPs were installed in 20 boreholes.
  - Slope inclinometers – Twenty-two SIs were installed.
  - Standard penetration tests – Three SPTs were conducted in 2 boreholes.
  - Vane shear tests – Several VSTs were attempted in the initial boreholes with a Nilcon vane. However, the soil was too stiff to penetrate.
  - Grab samples and thin-walled tube samples were collected for laboratory testing.
- Three additional sonic boreholes (GA15-12B, GA15-15B, and GA15-21 [beside GA15-16]) were drilled for thin-walled tube sampling.
- One test pit was excavated downstream of the Perimeter Embankment for thin-walled tube sampling.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - water contents – 795 tests
  - Atterberg limits – 113 tests
  - sieve analysis – 113 tests
  - hydrometer – 50 tests
  - specific gravity – 7 tests
  - vane shear – 73 tests conducted in the laboratory
  - consolidated undrained triaxial compression – 1 test
  - one-dimensional consolidation using incremental loading – 5 tests
  - one-dimensional consolidation using controlled-strain loading – 4 tests
  - direct simple shear – 5 tests

Data

- Appendix A – Records of Boreholes

- Appendix B – Photographs of Sonic Core
- Appendix C – Laboratory Testing Results from Mount Polley Mine Technical Memo (Golder 2014)
  - Attachment 1 – Lab Results
  - Attachment 2 – Photographs
  - Attachment 3 – Calibration Certificates
- Appendix D – Calibration Certificates
- Appendix E – Laboratory Testing Results
  - Appendix E-1 – Routine Laboratory Testing Summary Table
  - Appendix E-2 – Routine Laboratory Test Results
  - Appendix E-3 – Advanced Laboratory Tests Results

Golder (Golder Associates Ltd.). 2017. 2016 TSF Geotechnical Investigation Factual Report. Prepared for Mount Polley Mining Corporation. Document No. 1662612-114-R-Rev0-51121. 10 March 2017.

Purpose

The main objectives and considerations for the geotechnical investigation were to:

- better define foundation conditions downstream of the South Embankment around borehole VW11-02
- confirm the foundation conditions downstream of the buttress for the elevation 963 m Corner 1 Embankment
- assess the condition (i.e., dilative/contractive) of the tailings upstream of the Perimeter, Main, and South embankments
- install VWPs upstream of the embankments

Scope

The geotechnical investigation program was conducted from October 2016 to January 2017.

- Thirteen sonic boreholes (GA16-01 to GA16-09, GA16-15 to GA16-17, and GA16-19) were drilled downstream of the South Embankment and the Corner 1 Embankment. Four additional sonic boreholes were drilled to install vibrating wire piezometers within the TSF.
  - Completion depths ranged from 6.6 to 40.7 m below ground surface.
  - Vibrating wire piezometers – Eleven VWPs were installed in nine boreholes.
  - Slope inclinometers – Five SIs were installed.
  - Grab samples and four thin-walled piston tube samples were collected for laboratory testing.
- Nine CPTs were conducted from 6 to 17 January 2017.
  - Three CPTs were conducted on the tailings beach upstream of the Perimeter Embankment, Main Embankment, and South Embankment.
  - One CPT was conducted downstream of the South Embankment.
  - Five CPTs were conducted downstream of the Corner 1 Embankment.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - water contents – 323 tests
  - Atterberg limits – 12 tests
  - sieve analysis – 3 tests
  - hydrometer – 3 tests
  - one-dimensional consolidation using controlled-strain loading – 1 test

Data

- Appendix A – Records of Boreholes
- Appendix B – Photographs of Sonic Core
- Appendix C – CPT Report
- Appendix D – Calibration Certificates
- Appendix E – Laboratory Testing

Golder (Golder Associates Ltd.). 2019. 2018 TSF Geotechnical Investigation Factual Report. Prepared for Mount Polley Mining Corporation. Document No. 1662612-210-R-Rev0-51121. 8 March 2019.

Purpose

The main objective of the geotechnical investigation was to install additional instrumentation downstream of the Corner 1 Embankment to improve monitoring of embankment performance.

Scope

The geotechnical investigation program was conducted from 16 to 20 January 2018.

- Four sonic boreholes (GA18-01, GA18-03, GA18-04A, and GA18-04B) were drilled downstream of the Corner 1 Embankment.
  - Completion depths ranged from 15.2 to 29.7 m below ground surface.
  - Vibrating wire piezometers – Nine VWPs were installed in three boreholes.
  - Slope inclinometers – Three SIs were installed.
  - Grab samples were collected for laboratory testing.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - water contents – 156 tests
  - Atterberg limits – 5 tests

Data

- Appendix A – Records of Boreholes
- Appendix B – Photographs of Sonic Core
- Appendix C – VWP Calibration Certificates
- Appendix D – Laboratory Testing

WSP Golder (Golder Associates Ltd., a member of WSP). 2022. 2021/2022 Tailings Storage Facility Geotechnical Investigation Factual Report. Prepared for Mount Polley Mining Corporation. Document No. 22514095-011-R-Rev0-51300. 18 October 2022.

Purpose

The main objectives and considerations for the geotechnical investigation were to:

- confirm the foundation conditions downstream of the Perimeter Embankment buttress.
- complete additional in situ and laboratory testing to further refine the characterization of the glaciolacustrine units at the Main and Corner 1 embankments.

Scope

The geotechnical investigation program was conducted from 12 October 2021 to 4 December 2021 and 26 February 2022 to 1 March 2022.

- Eleven sonic boreholes (GA21-01 to GA21-11) were drilled downstream of the Corner 1 Embankment, Perimeter Embankment, and Main Embankment. Five additional sonic boreholes were drilled for thin-walled open tube sampling of encountered glaciolacustrine units.
  - Completion depths ranged from 20.9 to 75.0 m below ground surface.
  - Vibrating wire piezometers – Twenty VWPs were installed in eight boreholes.
  - Slope inclinometers – Five SIs were installed.
  - Monitoring wells – Two monitoring wells were installed.
  - Grab samples and thin-walled open tube samples were collected for laboratory testing. The Pitcher Sampler, Shelby tubes, and Lexan tubes were used to collect the thin-walled open tube samples.
- Six CPTs (soundings CPT21-02, CPT21-03, and CPT21-06 to CPT21-09) were conducted downstream of the Perimeter Embankment and Main Embankment.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - water contents – 649 tests
  - Atterberg limits – 64 tests
  - sieve analysis – 80 tests
  - hydrometer – 45 tests
  - unit weight – 8 tests
  - one-dimensional consolidation using incremental loading – 6 tests
  - one-dimensional consolidation using controlled-strain loading – 8 tests
  - direct simple shear – 5 tests (with several points)
  - cyclic direct simple shear – 2 tests (with several points)

Data

- Appendix A – Records of Boreholes

- Appendix B – Photographs of Sonic Core
- Appendix C – Gregg Cone Penetration Test Summary Report
- Appendix D – Vibrating Wire Piezometer Calibration Certificates
- Appendix E – FP Innovations CT Scan Summary Report
- Appendix F – Laboratory Test Results
  - Appendix F1 – Particle Size Distribution
  - Appendix F2 – Atterberg Limits
  - Appendix F3 – Water Content
  - Appendix F4 – Unit Weight
  - Appendix F5 – Consolidation
  - Appendix F6 – Direct Simple Shear
  - Appendix F7 – Cyclic Direct Simple Shear

HYDROGEOLOGY INVESTIGATIONS

KP (Knight Piésold Ltd.). 1997. 1996 Groundwater Monitoring Well Installation Program. Prepared for Mount Polley Mining Corporation. Document No. 1628/4. 7 February 1997.

Purpose

The main objective was to install monitoring wells around the mine site for future groundwater quality sampling as part of the geotechnical evaluation of the open pits, waste dumps, and TSF.

Scope

The hydrogeological investigation program was conducted from 30 October 1996 to 6 December 1996.

- Eleven air rotary boreholes (GW96-1A/B to GW96-5A/B and GW96-9) were drilled at six locations around the perimeter of the TSF.
  - Completion depths ranged from 6.0 to 61.6 m below ground surface.
    - Monitoring wells – Eleven monitoring wells (GW96-1A/B to GW96-5A/B and GW96-9) were installed at six locations.
  - Standard penetration tests – SPTs were conducted in three boreholes (GW96-1A to GW96-3A).

Data

- Appendix A – Drillhole Logs
- Appendix B – Groundwater Monitoring Well Completion Details

AMEC (AMEC Environment & Infrastructure, a division of AMEC Americas Limited). 2013. Mount Polley Mine Hydrogeology Assessment and Data Review. Prepared for Mount Polley Mining Corporation. Document No. VM00560B. 26 March 2013.

Purpose

The main objectives of the hydrogeological assessment were to:

- provide a data gap analysis and attempt to resolve gaps in the available data
- characterize the local hydrogeological conditions at the mine site and develop a site-specific conceptual model
- identify surface and/or groundwater quality changes related to mining activity, specifically acid rock drainage
- determine infiltration rates into the Springer Pit and identify potential groundwater impacts related to the Springer Pit development
- identify areas of potential environmental concern and potential contaminants of concern

Scope

- A data review and compilation of relevant groundwater information collected from MPMC and the public domain was conducted.
  - Several existing monitoring wells where identified within the TSF area:
    - monitoring wells GW96-1A/B to GW96-5A/B
    - monitoring wells GW00-1A/B to GW00-3A/B
    - monitoring wells GW11-2A/B
- The hydrogeological investigation program was conducted from 14 November 2012 to 18 December 2012.
  - Two air rotary (ODEX) boreholes (SI12-01 and SI12-02) were drilled at two locations downstream of the Perimeter Embankment.
    - Completion depths were 41.5 and 42.7 m below ground surface.
    - Slope inclinometers – Two SIs (SI12-01 and SI12-02) were installed.
- A conceptual site model was developed and wells exhibiting significant changes in either baseline static water levels and/or water quality were identified.
  - Three monitoring wells installed downstream of the TSF began showing evidence of influence by mine operations:
    - GW96-2B – increased level of sulphates
    - GW96-4B – increased level of hardness, sulphates and nitrate
    - GW00-1B – increased level of hardness, sulphates, nitrates, cadmium, molybdenum, and selenium
- Hydrogeological mapping was conducted to define discharge and recharge areas.
- One monitoring well was decommissioned.

Data

- Appendix A – Borehole Logs

Golder (Golder Associates Ltd.). 2016. Installation and Testing of New Monitoring Wells near the TSF, SERDS, Cariboo Pit and Wight Pit – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Document No. 1662612-058-TM-Rev0-53100. 23 December 2016.

Purpose

The main objective of the hydrogeological investigation was to enhance the existing monitoring well network and facilitate monitoring during ongoing operations and closure of the mine.

Scope

- Hydrogeological investigation program was conducted from 24 October 2016 to 4 December 2016.
  - Eight sonic boreholes (GW16-02A/B to GW16-05A/B) were drilled at four locations around the perimeter of the TSF.
    - Completion depths ranged from 9.1 to 53.6 m below ground surface.
    - Monitoring wells – Eight monitoring wells (GW16-02A/B to GW16-05A/B) were installed at four locations. Single-well response tests were conducted following well development at each location.

Data

- Attachment 1 – Borehole Logs
- Attachment 2 – Photographs of Well Completions
- Attachment 3 – Well Development Sheets
- Attachment 4 – Results of Hydraulic Conductivity Testing

GEOLOGICAL INTERPRETATIONS

Golder (Golder Associates Ltd.). 2015. Surficial Geology and Quaternary Geological Overview of the Mt. Polley Tailings Storage Facility (TSF) Area, British Columbia. Prepared for Mount Polley Mining Corporation. Document No. 1413803-058-R-Rev0-2000. 6 July 2015.

Purpose

The main objective of the geological overview was to provide an assessment of the surficial geology using existing geological and geotechnical data to develop an interpretation of the Quaternary deposits and geological history in the area of the TSF.

Scope

The geological overview assessment involved the following steps:

- review, compilation, and interpretation of existing subsurface and surface geological information such as:
  - subsurface geotechnical investigation data from borehole investigations
  - regional geological mapping
  - previous geotechnical reports on the TSF (both pre- and post-dam breach)
  - existing data on surficial geology and subsurface Quaternary geology
- providing local and regional Quaternary geological context for the surficial and bedrock materials present in the TSF area
- development of surficial geological cross-sections of the subsurface conditions in the TSF area

Data

- Figure 3 – Overview of Borehole and Section Locations
- Figures 4 to 9 – Surficial Geology Cross-Sections
- Figure 10 – Uppermost Native Clay Layer Elevation, Thickness
- Figure 11 – Contact Between Advance and Recessional Stage Deposits – Elevation Contour Plan
- Figures 12 to 15 – Composite Geological Cross-Sections Across TSF
- Appendix A – Records of Boreholes

DOCUMENTS RELATED TO TSF DESIGNS

KP (Knight Piésold Ltd.). 1996. Response to Review Comments on Tailings Embankment Design. Prepared for Imperial Metals Corporation. Reference No. 1625/6. 25 January 1996.

Purpose

The main objective of this study was to provide a response to the comments made by Mr. Brawner with respect to his review of the tailings embankment design. This report provides the following:

- modifications and recommendations pertaining to the embankment design
- review comments and concerns

Scope

The scope related to the TSF foundation includes the following:

- Test pit excavations near the Main Embankment to supplement the knowledge and understanding of the glacial materials within the valley.
  - Thirty-four test pits (TP95ME-01 to TP95ME-34) were excavated near the Main Embankment in early October 1995.
    - Completion depths ranged from 2.5 to 7.0 m below ground surface.
  - Six test pits were also excavated near the Seepage Collection Pond (TPS19, TPS20, TPS20.5, TPS21, TPS21.2, and TPS22).
    - Completion depths ranged from 4.0 to 6.5 m below ground surface.

Data

- Appendix A – Test Pit Logs from 1995 Supplementary Investigations

KP (Knight Piésold Ltd.). 1997. Mount Polley Project Tailings Storage Facility Updated Design Report. Prepared for Mount Polley Mining Corporation. Reference No. 1627/2. 6 June 1997.

Purpose

The main objective of this study was to provide an updated version of the original TSF design report. This report was prepared in response to:

- modifications to the embankment design
- review comments and concerns
- the additional detailed geological and geotechnical information gathered during the Stage 1A/1B construction program

Scope

The scope related to the TSF foundation includes the following:

- site characteristics including hydrometeorology, regional geology, and seismicity
  - seismic design parameters for the TSF embankments
- geotechnical investigations carried out during the Stage 1A/1B construction program in 1996 and 1997:
  - test pit excavations to identify suitable embankment fill materials in potential borrow sources including Borrow Areas No. 1, No. 2, and No. 3 (referred to as the Original Borrow Area, Future Borrow Area and Alternative Borrow Area, respectively), which are all within or near the TSF
    - Several test pits (96-43 to 96-55 and 96-84 to 96-108) were excavated in the three potential borrow sources during the 1996 construction program.
      - Completion depths ranged from 1.2 to 8.0 m below ground surface.
      - Laboratory testing of soil samples collected from the test pits consisted of the following:
        - index – water content, Atterberg limits, sieve analysis, hydrometer, and specific gravity
        - compaction – standard Proctor
        - permeability – falling head tests
        - shear strength – triaxial tests
    - Several test pits were also excavated in January 1997 (TP96-BA-E4 to TP96-BA-I9).
      - Completion depths up to 6.7 m below ground surface.
      - Laboratory tests were not specified in the report.
  - borehole investigations to define the maximum borrow depth in Borrow Areas No. 1 and No. 2
    - Twenty-eight boreholes (DH97-BA-F5 to DH97-BA-I8) were drilled with a solid and hollow stem auger in January 1997.
      - Completion depths were up to 17.0 m below ground surface.
      - SPTs were conducted in the boreholes.
    - Laboratory tests were not specified in the report.

- groundwater monitoring well drilling around the perimeter of the TSF for long-term groundwater quality monitoring
  - Eleven air rotary boreholes were drilled at six locations around the perimeter of the TSF from 30 October 1996 to 6 December 1996.
    - Monitoring wells – 11 monitoring wells (GW96-1A/B to GW96-5A/B and GW96-9) were installed at 6 locations.
    - Standard penetration tests – SPTs were conducted in three boreholes (GW96-1A to GW96-3A).
- test pit excavations to delineate the extent of the basin liners
  - Several test pits (96-1 to 96-42) were excavated to delineate the basin liner extents during the 1996 construction program.
    - Completion depths ranged from 1.1 to 7.3 m below ground surface.
    - In situ permeability testing consisted of field air entry permeameter tests of the underlying glaciolacustrine and glaciofluvial units.
  - Upper and lower basin liners were constructed near the Main Embankment.
- test pit excavations to investigate potential sand deposits for use as filter sand in the embankment drains
  - Several test pits (96-56 to 96-69 and 96-111 to 96-115) were excavated during the 1996 construction program.
    - Completion depths ranged from 4.3 to 8.2 m below ground surface.
  - Laboratory testing of soil samples collected from the test pits to evaluate suitability for filter sand consisted of the following:
    - 16 samples for index testing including water content, Atterberg limits, grain size analysis, and specific gravity
    - eight samples for effective strength parameters, compaction, and permeability testing
- borehole investigations to accompany the installation of instrumentation in the foundation soils of the Main Embankment
  - Four boreholes (96-A1, 96-B1a, 96-B1b, and 96-C1) were drilled with a solid and hollow stem auger in the Main Embankment footprint from 21 to 24 July 1996.
    - Completion depths ranged from 9.1 to 16.5 m below ground surface.
    - Vibrating wire piezometers – Six VWPs were installed in four boreholes.
    - Standard penetration tests – Sixty-four SPTs were conducted in three boreholes.
  - Laboratory tests were not specified in the report.
- CPT investigation to further investigate the foundation soils of the Main Embankment
  - Ten CPTs (soundings CPT96-1 to CPT96-5 and PRW96-1 to PRW96-4) were advanced in the Main Embankment footprint from 27 to 28 July 1996. Two soundings were advanced at PRW96-2, referred to as PRW96-2 (4) and PRW96-2 (4A).
    - Completion depths ranged from 7.65 to 15.85 m below ground surface.

    - Shear wave velocity tests were completed at 1 m intervals and several pore pressure dissipation tests.
  - Four boreholes (PRW96-1 to PRW96-4) were drilled with a solid stem auger beside their respective CPT location to serve as pressure relief wells from 27 to 28 July 1996.
    - Completion depths ranged from 9.9 to 22.1 m below ground surface.
    - Field tests – Pocket penetrometer and torvane tests were conducted at selected depths.
  - Four pressure relief trenches were also excavated downstream of the Main Embankment (test trenches PRT-01 to PRT-04).
- a detailed geological summary of the four main soil units encountered in the TSF foundation including ablation till, glaciolacustrine/glaciofluvial, basal till, and bedrock

Data

- Appendix A – Summary of Recent Geological Investigations
- Appendix B – Supplementary Investigation Reports
  - Appendix B1 – R.E. Graham Field Report
  - Appendix B2 – ConeTec Field Report

KP (Knight Piesold Ltd.). 2007. Mount Polley Stage 6 TSF Design. Letter to Mr. Chris Carr, Geotechnical Mines Inspector, Ministry of Energy, Mines and Petroleum Resources. Reference No. VA101-1/18-A.01. 19 December 2007.

Purpose

The main objective of this letter was to provide additional information on three items requested by Mr. Chris Carr:

- results of direct shear testing on lacustrine soils
- cross-sections showing stability analyses for dam raise to elevation 958 m
- slope inclinometer depth vs. cumulative displacement plots showing cumulative displacement from date of installation

Scope

The scope related to the TSF foundation includes the following:

- Two brass tube samples of a lacustrine unit were collected from a test pit (TP-07) excavated next to the Main Embankment Seepage Collection Pond on 13 May 2007.
- Testing consisted of the following:
  - direct shear – 1 test (with 3 points)

Data

- Appendix A – Direct Shear Testing Results

TSF CONSTRUCTION RECORD REPORTS

KP (Knight Piésold Ltd.). 1999. Mount Polley Mine Tailings Storage Facility Report on 1998 Construction and Annual Inspection. Prepared for Mount Polley Mining Corporation. Reference No. 11162/10-1. 16 June 1999.

Purpose

The main objectives of this report were to document the Stage 2A/2B construction program, which involved raising the Main and Perimeter embankments by 3 m to an elevation of 937 m and document the 1998 annual inspection. This report provides the following:

- discussion of the construction methods used during the program
- results of the quality assurance tests
- a review of the new instrumentation and monitoring results
- as-built drawings corresponding to the Stage 2A/2B construction program
- results of the investigations undertaken during the program
- results of the annual inspection

Scope

The scope related to the TSF foundation includes the following:

- Ten VWPs were installed in the foundation soils at the Main Embankment.
- Three pressure relief trenches (PRT98-01 to PRT98-03) and seven pressure relief wells (PRW98-01 to PRW98-07) were installed at the Main Embankment.
- Nineteen boreholes (DH98-BL-01 to DH98-BL-19) were drilled within the tailings basin to investigate the requirements for the basin liner in February 1998.
  - Completion depths ranged from 1.2 to 7.6 m below ground surface.
  - Grab samples were collected for laboratory testing.
- Forty-four boreholes (BH99-01 to BH99-44) were drilled within the tailings basin to investigate the requirements for the basin liner in 1999.
  - Completion depths ranged from 0.6 to 9.1 m below ground surface.
  - Grab samples were collected for laboratory testing.
- Laboratory testing of soil samples collected from the boreholes consisted of the following:
  - visual description of soils
  - ater contents
  - Atterberg limits
  - sieve analysis
  - hydrometer
  - consolidated undrained triaxial compression

Data

- Appendix A – Borrow Area and Basin Liner Investigations
- Appendix B – Construction Quality Assurance Record Test Summary Sheets
- Appendix C – Construction Quality Assurance Control Test Summary Sheets and Gradation Plots
- Appendix D – Consolidated Undrained Triaxial Test Results for R/ZS-12
- Appendix E – 1998 Construction Photos
- Appendix F – 1998 Annual Inspection Photos
- Appendix G – Piezometer Records
  - Appendix G1 – Tailings Piezometers
  - Appendix G2 – Embankment Foundation Piezometers
  - Appendix G3 – Embankment Fill Piezometers
  - Appendix G4 – Drain Piezometers

KP (Knight Piésold Ltd.). 2000. Mount Polley Mine Tailings Storage Facility Report on 1999 Construction. Prepared for Mount Polley Mining Corporation. Reference No. 11162/13-5. 30 August 2000.

Purpose

The main objective of this report was to document the Stage 2C construction program, which involved raising the Main and Perimeter embankments by 4 m to an elevation of 941 m. This report provides the following:

- discussion of the construction methods used during the program
- results of the quality assurance tests
- a review of the new instrumentation and monitoring results
- as-built drawings corresponding to the Stage 2C construction program
- results of the investigations undertaken during the program

Scope

The scope related to the TSF foundation includes the following:

- Ninety-one boreholes (DH99-45 to DH99-135) were drilled around the perimeter of the TSF to evaluate the potential for seepage infiltration into foundation materials during hydraulic placement of cycloned sand.
  - Completion depths ranged from 0.6 to 7.5 m below ground surface.
  - SPTs were conducted in some of the boreholes.
  - Grab samples were collected for laboratory testing.
- Twenty-four boreholes (DH99-136 to DH99-159) were drilled within Borrow Area No. 2 (downstream of the Main Embankment) to determine the availability and suitability of core zone material.
  - Completion depths ranged from 4.6 to 13.9 m below ground surface.

Data

- Appendix A – Investigations
- Appendix B – Construction Quality Assurance Control Test Summary Sheets and Gradation Plots
- Appendix C – Construction Quality Assurance Record Test Summary Sheets
- Appendix D – Stage 2C Construction Photos
- Appendix E – Stage 2C Design Modifications

KP (Knight Piésold Ltd.). 2001. Mount Polley Mine Tailings Storage Facility Report on Stage 3 Construction. Prepared for Mount Polley Mining Corporation. Reference No. 11162/14-3. 19 October 2001.

Purpose

The main objective of this report was to document the Stage 3 construction program which involved raising the TSF embankments to an elevation of 942.5 m. This report provides the following:

- discussion of the construction methods used during the program
- results of the quality assurance tests
- a review of the new instrumentation and monitoring results
- as-built drawings corresponding to the Stage 3 construction program
- results of the investigations undertaken during the program

Scope

The scope related to the TSF foundation includes the following:

- installation of four VWPs in the foundation soils
- geotechnical investigations conducted during the Stage 3 construction program
  - Three air rotary (ODEX) boreholes (GW00-01 to GW00-03) were drilled downstream of the South Embankment in August 2000.
    - Completion depths ranged from 21.0 to 24.3 m below ground surface.
    - Monitoring wells – Six monitoring wells (GW00-01A/B to GW00-03A/B) were installed at three locations.
    - SPTs were conducted in two boreholes.
  - Eighty boreholes (DH01-01 to DH01-80) were drilled to investigate the availability of glacial till within Borrow Areas No. 2, No. 3, and No. 5 in April 2001.
    - Completion depths ranged from 1.2 to 12.2 m below ground surface.
    - Grab samples were collected for laboratory testing.
  - Two air rotary (ODEX) boreholes (SI01-01 and SI01-02) were drilled downstream of the Main Embankment in July 2001.
    - Completion depths were 24.4 and 30.3 m below ground surface.
    - Slope inclinometers – Two SIs were installed.
    - SPTs were conducted in both boreholes.
  - Laboratory testing of soil samples collected from the boreholes consisted of the following:
    - visual description of soils
    - water contents
    - sieve analysis
    - hydrometer

Data

- Appendix A – Investigations
- Appendix B – Construction Quality Assurance Control Test Summary Sheets and Gradation Plots
- Appendix C – Construction Quality Assurance Record Test Summary Sheets
- Appendix D – Stage 3 Construction Photos
- Appendix E – Stage 3 Design Modifications

KP (Knight Piésold Ltd.). 2007. Mount Polley Mine Tailings Storage Facility Report on Stage 4 Construction. Prepared for Mount Polley Mining Corporation. Reference No. VA101-1/10-1. 13 March 2007.

Purpose

The main objective of this report was to document the Stage 4 construction program which involved raising the TSF embankments by 4 m to an elevation of 948 m. This report provides the following:

- discussion of the construction methods used during the program
- results of the quality assurance tests
- a review of the instrumentation monitoring results
- as-built drawings corresponding to the Stage 4 construction program
- results of the investigation undertaken during the program

Scope

The scope related to the TSF foundation includes the following:

- geotechnical investigation program conducted in May 2006
  - Three air rotary boreholes (SI06-01 to SI06-03) were drilled downstream of the Main Embankment.
    - Completion depths ranged from 34.7 to 42.2 m below ground surface.
    - Slope inclinometers – Three SIs were installed.
    - SPTs were conducted in all three boreholes.
- other relevant information:
  - Slope inclinometer SI01-01 was destroyed during Stage 4 construction.
- laboratory testing of soil samples collected from the boreholes:
  - visual description of soils
  - ater contents – 10 tests
  - Atterberg limits – 10 tests
  - sieve analysis – 10 tests
  - hydrometer – 10 tests
  - one-dimensional consolidation using incremental loading – 1 test

Data

- Appendix A – Laboratory Test Results
  - Appendix A1 – Zone S Control Results
  - Appendix A2 – Zone S Record Results
  - Appendix A3 – Zone U Results
- Appendix B – Inclinometer Installations

- Appendix B1 – Drill Logs
- Appendix B2 – Laboratory Test Results

- Appendix C – Nuclear Densometer Results
- Appendix D – Photographs

KP (Knight Piésold Ltd.). 2009. Mount Polley Mine Tailings Storage Facility Report on Stage 6A Construction. Prepared for Mount Polley Mining Corporation. Reference No. VA101-1/23-1. 10 July 2009.

Purpose

The main objective of this report was to document the Stage 6A construction program which involved raising the TSF embankments by 3 m to an elevation of 954 m. This report provides the following:

- discussion of the construction methods used during the program
- results of the quality assurance tests
- a review of the instrumentation monitoring results
- as-built drawings corresponding to the Stage 6A construction program
- results of the investigation undertaken during the program

Scope

The scope related to the TSF foundation includes the following:

- geotechnical investigation program conducted in May 2008
  - Eleven sonic boreholes (KP08-01, KP08-02, KP08-04, KP08-06, KP08-08, KP08-09, KP08-11, KP08-12, and KP08-14 to KP08-16) were drilled in a potential borrow area downstream of the Perimeter Embankment.
    - Completion depths ranged from 8.5 to 23.8 m below ground surface.
    - SPTs were conducted in most of the boreholes.
    - Grab samples were collected for laboratory testing.

Data

- Appendix A – Laboratory Test Results
  - Appendix A1 – Zone S Control
  - Appendix A2 – Zone S Record
  - Appendix A3 – Zone U Record
  - Appendix A4 – Zone F Record
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- Appendix C3 – Fill Piezometers
- Appendix C4 – Drain Piezometers

- Appendix D – Inclinometer Data
- Appendix E – Photographs
- Appendix F – Site Investigation Drill Logs

Golder (Golder Associates Ltd.). 2015. 2015 Freshet Management Embankment As-Built Construction. Prepared for Mount Polley Mining Corporation. Document No. 1413803-065-R-Rev0-2000. 4 September 2015.

Purpose

The main objective of this report was to document the Freshet Management Embankment construction program. This report provides the following:

- summary of design and adjustments to accommodate conditions encountered during construction
- description of the major construction activities including water management
- summary of the construction quality assurance and construction quality control information
- as-built drawings
- as-built instrumentation installation
- construction documentation

Scope

The scope related to the TSF foundation includes the following:

- installation of five slope inclinometers (SI15-26 to SI15-30) during the construction program
  - Four slope inclinometers were installed in the cut-off wall, while the other was installed to replace two damaged slope inclinometers downstream of the Perimeter Embankment.
- installation of two shape accel arrays (SAAs) within existing slope inclinometers downstream of the Freshet Management Embankment
  - SAA15-01 was installed within slope inclinometer SH14-03.
  - SAA15-02 was installed within slope inclinometer SH14-16.

Data

- Appendix A – 2015 Freshet Management Embankment Issued for Construction Drawings and Construction Technical Specifications
- Appendix B – 2015 Freshet Management Embankment As-Built Construction Drawings
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APPENDIX B

Site-Specific Seismic Hazard Assessment

REPORT

Site-Specific Seismic Hazard Assessment

Mount Polley TSF Site, British Columbia

Submitted to:

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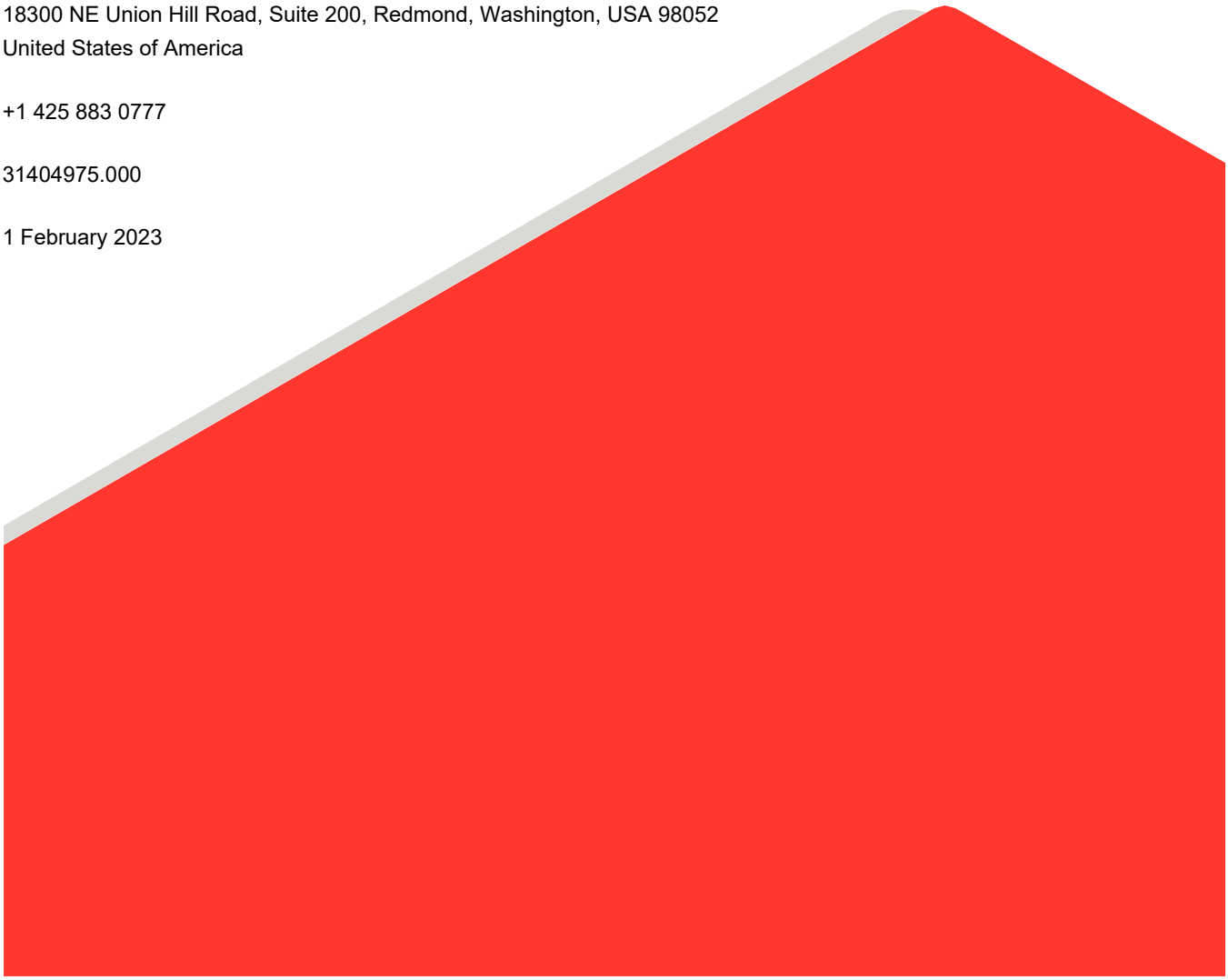

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APPENDICES

APPENDIX A
Earthquake Acceleration Time Histories

Appendix B
Evaluation of the Time-Average Shear-Wave Velocity

DISCLAIMERS AND LIMITATIONS

Seismic hazard analysis and geotechnical earthquake engineering are dynamic and fast-evolving fields of research and engineering practice. The standard of practice in this technical area continues to develop as new information about the sources of earthquakes becomes available. Consequently, the results presented in this report should be reviewed when new data and/or new scientific theory becomes available.

WSP USA Inc (WSP USA). has prepared this report exclusively for the use of WSP Canada Inc (WSP Canada). for the Mount Polley TSF site. If there are significant changes in the nature, design, location, or site ground conditions, then WSP should be notified so that we can review our conclusions and recommendations. A written modification or verification of the changes can be provided, if required.

EXECUTIVE SUMMARY

This report presents the results of a site-specific probabilistic seismic hazard analysis (PSHA) undertaken by WSP USA Inc. (WSP USA) for the Mount Polley Tailings Storage Facility (TSF) site approximately 380 km northeast of Vancouver, British Columbia. The PSHA has been undertaken for a site at 52.509º N latitude and 121.588º W longitude. Appendix A provides details of the development of earthquake acceleration time histories. Appendix B presents the evaluation of the time-average shear-wave velocity in the 30 m below the ground surface (V_{S30}) used in this assessment.

The site-specific PSHA is based on seismic source models developed for the 6th Generation Canadian National Seismic Hazard Model (CanadaSHM6). WSP USA's review of the tectonic setting, historical earthquake activity rates, and earthquake epicenter distribution within about 500 km of Mount Polley found that the CanadaSHM6 seismic source models are appropriate for estimating the seismic hazard of the TSF site.

Source-to-site attenuation ground motion models (GMMs) for active shallow crustal sources were applied as in CanadaSHM6. For sources associated with the Cascadia subduction zone to the southwest of the site, WSP USA applied a weighted suite of the 2020 NGA-Sub GMMs to model the source-to-site attenuation of subduction earthquake strong ground motions.

Earthquake ground motions are reported as 5%-damped, mean uniform hazard acceleration response spectra at annual exceedance probabilities (AEPs) of 1/1,000, 1/2,475, 1/5,000 and 1/10,000 for the site-specific V_{S30} of 849 m/s. Table S-1 below lists the mean uniform hazard spectral ordinates for selected AEPs at horizontal peak ground acceleration (PGA), 0.5 s, 1.0 s, and 1.5 s spectral periods developed from the site-specific PSHA at the Mount Polley TSF site. The results at an AEP of 1/2,475 are slightly lower than CanadaSHM6 at spectral periods below ~2.0 s and slightly higher at spectral periods above 2.0 s. These differences are attributed to the different ground motion model selection and weighting, and site-specific V_{S30} of 847 m/s used in this assessment.

Deaggregations were performed for the total hazard and separately for active shallow crustal and subduction sources at 1/2,475 and 1/10,000 AEPs at selected spectral periods. The results show that both near-field, moderate-magnitude crustal earthquakes and far-field subduction interface earthquakes contribute to the site seismic hazard. The shallow crustal earthquake sources are dominated by moderate-magnitude earthquakes (**M**6.0 to **M**6.5) close to the site (i.e., <60 km) at all AEPs. The contribution to hazard at the site from Cascadia subduction zone sources is from large earthquakes (**M**8+) at 450 to 550 km from these at all AEPs and spectral periods of interest.

Table S-1: Site-specific accelerations (5%-damped) for selected annual exceedance probabilities and spectral periods at the Mount Polley TSF site, British Columbia, Canada (V_{S30} = 849 m/s)

Performance Level - AEP	Spectral Period (s)	Acceleration (g)[1]					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/1,000	PGA	0.026	0.023	0.023	0.025	0.028	0.028
	0.5	0.033	0.030	0.030	0.033	0.035	0.036
	1.0	0.020	0.017	0.017	0.019	0.021	0.023

Performance Level - AEP	Spectral Period (s)	Acceleration (g)[1]					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
	1.5	0.015	0.012	0.012	0.015	0.017	0.018
1/2,475	PGA	0.048	0.042	0.042	0.046	0.053	0.054
	0.5	0.054	0.050	0.050	0.053	0.057	0.058
	1.0	0.030	0.026	0.027	0.030	0.033	0.035
	1.5	0.023	0.018	0.019	0.022	0.026	0.027
1/5,000	PGA	0.076	0.067	0.067	0.073	0.084	0.085
	0.5	0.079	0.073	0.073	0.079	0.083	0.084
	1.0	0.042	0.036	0.038	0.041	0.045	0.048
	1.5	0.031	0.024	0.025	0.029	0.036	0.037
1/10,000	PGA	0.116	0.102	0.102	0.111	0.128	0.128
	0.5	0.114	0.106	0.106	0.115	0.119	0.121
	1.0	0.057	0.050	0.052	0.057	0.060	0.065
	1.5	0.041	0.032	0.034	0.039	0.047	0.048

Note:

1. 5%-damped, mean, geometric-mean, peak horizontal acceleration.

Eleven two-horizontal-component EATHs (22 records) were developed using amplitude scaling to the site-specific 1/2,475 AEP uniform hazard acceleration response spectrum within the period range of interest of 0.5 to 1.5 seconds (Appendix A). These 22 EATHs were developed with eight two-component (16) records from crustal earthquakes and three two-component (6) subduction interface earthquake records. Comparison of the intensity measures of the scaled EATHs to predicted $D_{5\text{-}75}$, $D_{5\text{-}95}$, CAV, and AI intensity measures indicates that the scaled EATHs are generally within the 16th and 84th percentile range of the empirically predicted values.

1.0 INTRODUCTION

This report provides earthquake ground motions estimated from a site-specific probabilistic seismic hazard analysis (PSHA) and deterministic seismic analysis (DSA) undertaken by WSP USA Inc. (WSP USA) for the Tailings Storage Facility (TSF) at the Mount Polley mine TSF site in British Columbia, Canada. Seismic parameters presented in this report can be used to support future engineering analysis at the Mount Polley TSF site.

1.1 Site Location

The Mount Polley TSF site is in British Columbia, about 380 km northeast of Vancouver (Figure 1). The site is at 52.509º N latitude and 121.588º W longitude, and hereinafter referred to as the 'site'.

1.2 Background

Mount Polley Mining Corporation (MPMC) requested WSP Canada Inc. (WSP Canada) to provide a series of work plans for ongoing engineering support of the Mount Polley Mine site development. One key task is to update the feasibility design for raising of the South, Main, and Perimeter embankments for the Mount Polley TSF. The design to be updated is that described in Golder (2015).

Dynamic analysis modelling requires input acceleration time histories that represent realistic earthquake ground motions for the annual exceedance probability (AEP) being considered. In turn, these acceleration time histories should reflect a state-of-practice seismic hazard analysis at the site. Because there have been several major developments in the assessment of seismic hazards in North America in recent years, and importantly the publication of the NGA-Subduction ground motion models, a revised site-specific seismic hazard analysis was included as part of Golder's work plan for stability analysis for the Mount Polley TSF.

This report presents the data, methods, and results of the site-specific PSHA undertaken to support seismic stress deformation modeling for the Mount Polley TSF. The work was undertaken by specialist staff from WSP USA Inc. and WSP New Zealand Limited (formerly Golder Associates New Zealand Ltd.) under an intercompany agreement with WSP Canada Inc. (WSP Canada). The agreed work scope of work for the PSHA and development of earthquake acceleration time histories provided in Appendix A is described in proposal 21452039-078-WP-Rev0-50000-TSF2022_28JAN_22. Further details are provided in Section 1.3 below.

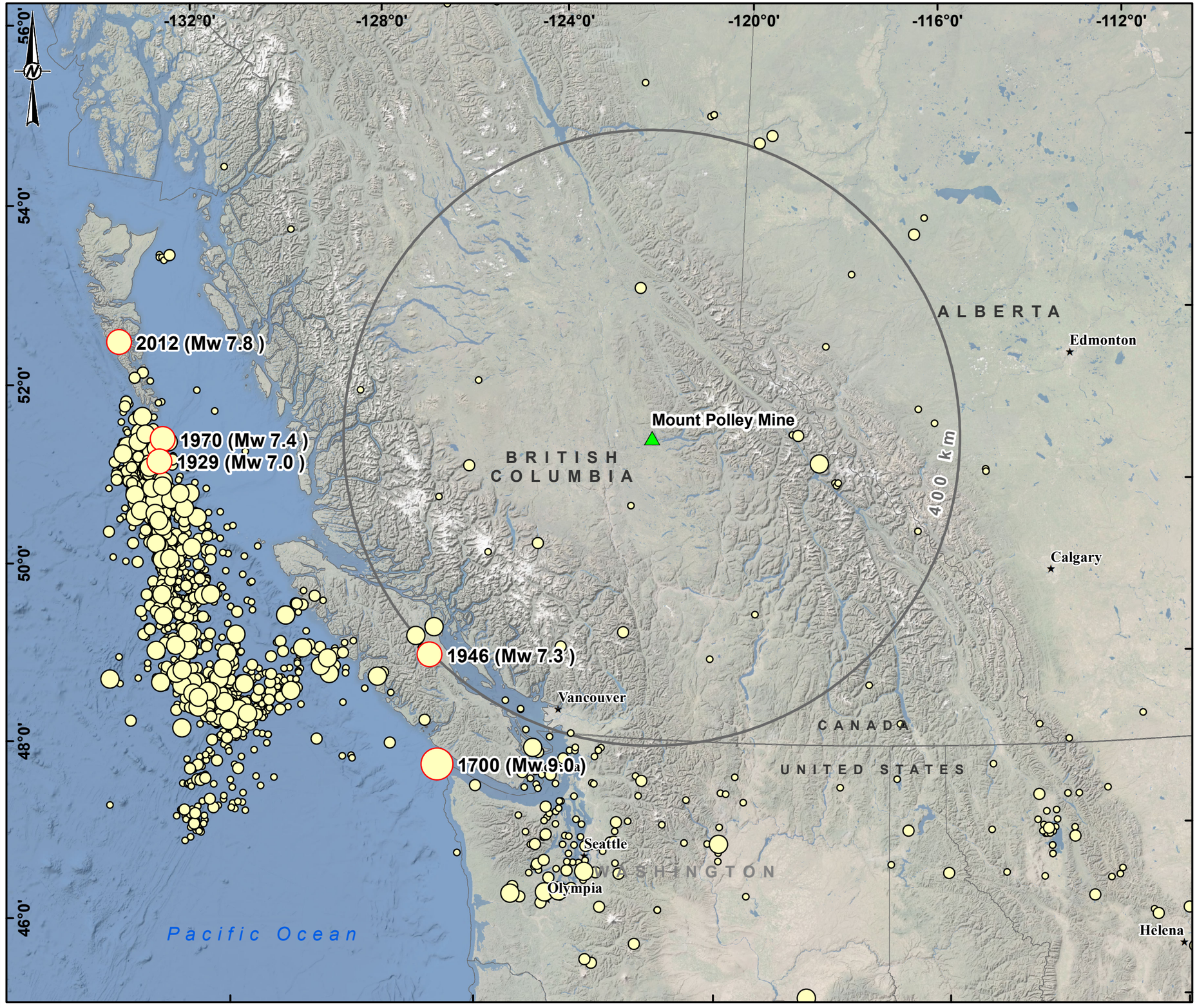

LEGEND

Project Location

Earthquake Epicenter

Moment Magnitude (Mw)

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- ≥ 8

(Year and magnitude labeled)

0 100 200 400

KILOMETERS

REFERENCE(S)

1. COORDINATE SYSTEM: NAD 1983 2011 UTM ZONE 11N
2. SERVICE LAYER CREDITS: USGS,NGA,NASA,CGIAR,GEBCO,N ROBINSON,NCEAS,NLS,OS,NMA,GEODATASTYRELSEN AND THE GIS USER COMMUNITY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT

GOLDER ASSOCIATES LTD.

PROJECT

SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT FOR MOUNT POLLEY MINE, BRITISH COLUMBIA

TITLE

HISTORICAL EARTHQUAKE EPICENTERS IN SOUTHWESTERN CANADA

CONSULTANT

wsp

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PREPARED	HJ
REVIEWED	AK/ET
APPROVED	AH

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1.3 Work Scope

WSP USA has completed the following major tasks to develop earthquake ground motions, acceleration time histories (Appendix A), and evaluation of site time-average shear-wave velocity (Appendix B) for site-specific seismic hazard analysis at the Mount Polley TSF site:

- Reviewed existing reports and readily available published, unpublished, and on-line records of the tectonic, geologic and earthquake history of the region surrounding the site.
- Assessed available information and estimated the time-averaged shear-wave velocity of the site ground conditions beneath the Mount Polley TSF site (Appendix B).
- Developed a seismic source model based on the seismic sources in CanadaSHM6 within about 400 km of the Mount Polley TSF site.
- Evaluated and weighted appropriate site-to-source attenuation ground motion models (GMM) for southwest Canada.
- Developed probabilistic hazard curves for a ground condition with a V_{S30} of 849 m/s (i.e., time-averaged shear-wave velocity in the upper 30 m below a reference depth).
- Prepared site-specific, 5%-damped, spectral acceleration hazard curves for an AEP range from 1/10 to 1/10,000, and for discrete spectral periods at horizontal peak ground acceleration (PGA), 0.2 s, and 1.0 s.
- Developed site-specific, 5%-damped, uniform hazard response spectra (UHRS) horizontal mean values at AEPs of 1/2,475, 1/5,000, and 1/10,000 and spectral periods (T_S) up to 10 s.
- Developed spectral accelerations (S_a) mean values, and median values ± one and two standard deviations (i.e., ±1 sigma and ±2 sigma) for discrete spectral periods at PGA, 0.2 s, and 1.0 s or the selected AEPs.
- Developed probabilistic deaggregation analysis by magnitude, distance, and epsilon for mean values of PGA and S_a of 0.1 s, 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s, and 10.0 s, and at AEPs of 1/2,475, 1/5,000, and 1/10,000.
- Evaluated the PGA and S_a values for the dam performance levels (e.g., OBE and SEE) as specified by CDA (2014) and ICMM (2019) bulletins.
- Assessment and incorporation of model uncertainties used to estimate mean ground motions at the site.
- Earthquake acceleration time histories as presented in Appendix A.
- Prepared this report with the data, methods, and results of the seismic hazard analysis used to develop the recommended seismic parameters at the site.

1.4 Terminology

The terminology used in PSHA is specialised and is often used inappropriately. Use of variable and different terms can result in some confusion. Table 2 lists key terms used in this report as well as alternative, similar terms that relate terms used in this report to other commonly used terms with similar definitions.

Table 2: Terminology Used in this Report

Terms and Units	Alternative Similar Terms (units and definition may very)
Spectral period (seconds, s)	Period, natural-period, period-of-vibration, natural frequency.
Acceleration[1] (percentage of gravitational acceleration, g)	Peak geometric-mean horizontal acceleration, spectral acceleration.
Annual exceedance probability (AEP, likelihood of being exceeded in 1 year)	Return period[2] (years), frequency, annual probability of exceedance (AEP).
Uniform hazard acceleration response spectrum	Uniform hazard curve, acceleration response spectrum, response spectrum, spectral response spectrum, uniform hazard mean acceleration response spectrum.
Ground motion model (GMM)	Ground motion prediction equation (GMPE), attenuation equation.
Deaggregation	Disaggregation, de-aggregation.

Notes:

1. Where we use the term 'acceleration' it refers to the mean (geometric-mean) horizontal peak acceleration response of a 5 %-damped, single degree of freedom pendulum.
2. The inverse of the AEP is approximately equal to the return period for AEP values less than about 1/100 (0.01).

1.5 Report Structure

This report has the following structure:

- **Section 2.0: Site Ground Conditions**
  Describes the near-surface ground conditions used in this assessment
- **Section 3.0: Seismic Source Models**
  Describes the approach adopted in this assessment to model the magnitude, location, and frequency of earthquakes in the region around the site that contribute to the earthquake ground motion hazard.
- **Section 4.0: Ground Motion Model Selection and Weighting**
  Describes the ground motion models selected to undertake the PSHA, including the rationale for their selection and weighting.
- **Section 5.0: Probabilistic Seismic Hazard Analysis**
  Describes the PSHA analytical procedures of this site-specific assessment.
- **Section 6.0: Deterministic Assessment**
  Describes consideration of an MCE scenario for this assessment.
- **Section 7.0: Site-specific Probabilistic Seismic Hazard Analysis Results**
  Describes the results from the PSHA for this site-specific assessment.
- **Section 8.0: Seismic Hazard Analysis Discussion and Recommendations**
  Presents comparison of results with previous studies, and discussion of applying the results to assist in selection of engineering design.
- **Section 9.0: Closing**

- **Appendix A**

  Earthquake Acceleration Time History Development for Mount Polley TSF, British Columbia, Canada

- **Appendix B**

  Evaluation of the Time-Average Shear-Wave Velocity

2.0 SITE GROUND CONDITIONS

Near-surface site ground conditions can have a significant influence on the earthquake ground motion at a site. The effects of near surface ground conditions are spectral period dependent. Softer site ground conditions cause damping of short period waves and amplification of long period waves, and the inverse is observed at stiffer sites. Site ground conditions are incorporated into PSHA using parameters related to the shear-wave velocity profile beneath the site as used in GMMs. The shear-wave velocity related parameters are:

- V_{S30}: The time-averaged shear-wave velocity of the upper 30 m of ground or a reference surface below the site.
- $Z_{1.0}$: The depth to a shear wave velocity of 1,000 m/s.
- $Z_{2.5}$: The depth to a shear wave velocity of 2,500 m/s.

These parameters are typically derived from the ground surface. However, they can also be developed for a reference depth such as engineering bedrock, especially in the case where the outputs of the PSHA are being used as an input for seismic ground response analysis to model the effects of non-linear behavior of near surface materials on the seismic hazard or the base of geotechnical models to assess dynamic stability. In general, there should be a negligible amount of non-linear behavior of earth materials beneath the reference depth.

Earthquake ground motions reported in this seismic hazard assessment are for V_{S30} of 849 m/s for engineering bedrock. This value was estimated through communication with the project engineering team and is based on VSP analysis at three borehole locations along the Mount Polley TSF. Appendix B provides further details for the site V_{S30} analysis used for this assessment.

The Kaklamanos et al. (2011) method based on the ground surface V_{S30} was used to estimate the $Z_{1.0}$ and $Z_{2.5}$ parameter values of 20.5 m and 590 m, respectively.

3.0 SEISMIC SOURCE MODELS

Seismic source models are an input into site-specific PSHA. They describe the spatial distribution, likelihood and magnitude of future earthquakes that may affect the site. Because the location and magnitude of future earthquakes is unknowable, a range of methods is used to predict the location, likelihood, and magnitude of future earthquakes creating a set of weighted alternative seismic source models.

The seismic source model used for this assessment adopts seismic sources and their parameters as developed for the preliminary release of the 2020 National Hazard Model of Canada (Kolaj et al. 2020b). The following sections describe the seismotectonic setting of the Mount Polley TSF site, and the source model adopted from CanadaSHM6 for this site-specific analysis.

3.1 Seismotectonic and Geological Setting

The Mount Polley TSF site is located within the Canadian Cordillera, part of the North American Cordillera that was formed by convergent tectonic processes and the successive accretion of a number of allochthonous terranes[1] to the ancient western margin of the North American plate, likely beginning sometime in the Late Triassic to Early Jurassic (~180 to 200 million years ago (Ma)) (Ricketts 2008; Price, 2000, 1994; Monger 1989; Monger and Price 1979). The accretion of allochthonous terranes was diachronous along the North American plate margin, with numerous complexities related to the amalgamation of terranes prior to accretion (e.g., Monger 1989). The Mount Polley mine site is located within the Quesnel terrane, which consists of an island arc assemblage that developed outboard of the ancient North American continental margin and was accreted to the North American plate sometime in the latest Triassic or earliest Jurassic (~200 Ma) (Beatty et al. 2006). The Quesnel terrane hosts numerous porphyry copper-gold and other important mineral deposits related to various metallogenetic processes (Nelson and Colpron 2007). East of this terrane is the Foreland Fold and Thrust Belt, comprising amalgamated volcanic, island arc and oceanic terranes that were accreted onto the western edge of the North American craton during the Late Jurassic to Paleocene about 150 to 60 Ma, together with highly deformed sedimentary sequences mostly represented by the Canadian Rocky Mountains.

The seismotectonic setting of western Canada is complex and with a diverse range of earthquake sources. The present-day tectonics of western Canada are strongly influenced by the effects of relative motions of the Pacific and North America plates and remnants of the former Farallon plate that was largely subducted. The modern Explorer, Juan de Fuca, and Gorda plates are the remain of the much larger Farallon plate.

The Cascadia subduction zone (CSZ) marks the boundary where the Juan de Fuca, Explorer, and Gorda plates are being subducted beneath western North America. The 1,200-km-long CSZ extends from northern California to British Columbia and is ~460 km west of Mount Polley at its closest approach. The present-day convergence (subduction) velocity ranges from about 43 mm/yr for the Juan de Fuca plate that decreases to the northwest to about 20 mm/yr for the Explorer plate (North America fixed). The CSZ has produced repeated great earthquakes (i.e., greater than moment magnitude (**M**)8.0 throughout the Holocene Epoch (i.e., last 11,700 years). The most recent CSZ great earthquake was an estimated **M**9.0 in January of 1700. The Cascadia subduction interface is currently locked and accumulating strain toward a future large or great earthquake (e.g., Dragert et al. 1994, Hyndman and Wang 1995, Mazzotti et al. 2003). The CSZ has a high rate of historical seismicity relative to the southern Canadian Cordillera where the Mt Polley TSF site is located.

The southern Cordillera has relatively low rates of historical seismicity relative to the northern Cordillera and CSZ to the west. However, intermediate-to-large magnitude earthquakes have been recorded. For example, an **M**6.0 earthquake in 1918 had an epicenter ~ 220 km east of the site (Halchuk et al. 2015). An **M**5.5 earthquake occurred in 1986 with an epicenter ~200 km north of the site (Table 3). Both earthquakes occurred in the “Rocky Mountain Trench” that marks the boundary between the western Foreland Fold and Thrust Belt and the Quesnel terrane and other terranes. The 1986 earthquake had a thrust fault mechanism, which is consistent with the general structural trends mapped in the area (e.g., Rogers et al. 1990).

[1] Allochthonous terranes are assemblages or packages of rocks that are stratigraphically and structurally distinct from their neighbours. Each terrane has a distinct geological history that precedes its amalgamation to other terranes. Terranes are created by crustal- and lithosphere-scale plate tectonic processes. Many allochthonous terranes have been identified throughout western North America, including Alaska.

3.2 Canadian National Seismic Source Model

The preliminary 6th Generation Seismic Hazard Model of Canada (CanadaSHM6) was released in 2020 as the basis for the 2020 National Building Code of Canada (NBCC 2020). The CanadaSHM6source modelling approach is described in more detail by Kolaj et al. (2020b). Information and digital files for the model used in this assessment were gathered from GSC Open File 8630 by Kolaj et al. (2020b; updated 29 November 2021), downloaded directly from the Natural Resources Canada website.

The Kolaj et al. (2020b) model is divided into three main components based on location — western Canada, eastern Arctic Canada, and southeast Canada. This assessment used only the western Canada component of CanadaSHM6. Between CanadaSHM5 and CanadaSHM6 significant updates were made to the western Canada model, including improved characterization of the CSZ and addition of the Leech River Valley Fault – Devil's Mountain Fault system in southern Vancouver Island. This has resulted in an increase in the estimated seismic hazard in southern British Columbia.

The Kolaj et al. (2020a) seismic source model includes sources for the CSZ interface, CSZ in-slab, active crustal, and stable crustal earthquakes. The seismic sources adopted for this assessment are described in Section 3.4 and Section 3.5 below.

3.3 Earthquake Catalog

Development of a site-specific SHA requires a comprehensive understanding of the spatial and temporal distribution of historical earthquakes for the region surrounding the site. The Seismic Hazard Earthquake Epicenter File (SHEEF2010), developed by Halchuk et al. (2015), was used to compute the earthquake occurrence rates for areal sources in CanadaSHM5 and CanadaSHM6.

The SHEEF2010 catalog includes earthquakes with an original catalog earthquake magnitude of 2.5 or higher. The estimated earthquake moment magnitude (**M**) used in the catalog can be less. The SHEEF2010 is estimated by Halchuk et al. (2015) to be complete from 1900 through 2010 for all reported magnitudes.

Although the catalog ends in 2010, updating the catalog and recalculating the activity rates has not been considered for this analysis. The update was not undertaken because there are insufficient recorded earthquakes in the region surrounding the site since 2010 to cause a change in calculated earthquake activity rates. Figure 1 presents **M**4 and larger earthquakes from SHEEF2010 within ~700 km from the site. Table 3 lists the key parameters for historical earthquakes that have occurred within 200 km from the site. Only three of the recorded earthquakes exceeded **M**4, indicating a relatively low rate of historical earthquake activity.

Table 3: Earthquakes with M>3 Magnitude Recorded within 200 km of the Mount Polley TSF Site

Date	Time (UTC)	Latitude (ºN)	Longitude (ºW)	Moment Magnitude (M)	Depth [km]	Distance to TSF site [km]
14/12/1988	04:07	53.183	122.291	3.1	5	89
28/8/1962	19:19	51.7	121.9	4.3	0	92
13/12/1968	08:50	52.4	120.2	3.7	18	95

Date	Time (UTC)	Latitude (ºN)	Longitude (ºW)	Moment Magnitude (M)	Depth [km]	Distance to TSF site [km]
13/12/1968	08:50	52.4	120.2	3.7	18	95
13/11/1968	11:59	52.32	120.12	3.2	18	102
4/6/1967	03:26	52.2	120	3.4	0	114
28/7/1965	18:33	52.3	119.8	3.5	0	124
22/10/1983	22:14	51.62	120.48	3.9	18	125
26/8/1969	01:25	51.9	120	3	18	128
16/11/1981	14:21	51.72	120.22	3.4	18	128
6/3/1988	22:54	51.486	122.604	3	10	133
22/1/1983	13:40	53.06	119.75	3.3	18	138
10/8/1968	21:10	52.88	119.63	3.2	18	139
10/3/1981	10:01	52.85	119.5	3.5	18	146
11/1/1995	23:39	51.688	119.914	3.4	5	147
23/3/1982	19:15	52.9	119.5	3.8	18	148
3/12/1957	13:47	51.6	123.3	3.3	0	155
15/4/1999	13:14	52.329	119.309	3.1	10	156
26/2/2001	21:17	52.25	119.324	3.8	11	157
2/5/2007	20:46	52.932	119.308	3	1	161
27/11/1970	22:17	52.64	119.13	3.8	10	167
10/10/2007	17:50	52.885	124.072	3.9	22.3	173
14/5/1978	22:37	52.61	118.9	4.7	7	183
29/3/1964	10:59	52	119	3.2	0	186
16/5/1996	13:13	54.182	122.036	3.5	0	189
14/5/1978	22:37	52.603	118.791	5	10	190
22/5/1985	01:29	52.42	118.79	3.3	18	190
21/3/1986	23:56	54.24	122	5.5	10	195
27/7/1968	04:52	52.3	118.7	3	18	198
26/7/1968	22:23	52.28	118.68	3.3	18	200
30/12/2003	13:22	52.354	118.661	3.3	6.1	200

3.4 Shallow Crustal Sources

3.4.1 Uniform-area sources

CanadaSHM6 uses uniform-area sources to model the occurrence of crustal seismicity not associated with known mapped seismogenic features such as seismically active faults or other seismogenic structures. There are eight crustal uniform-area sources within the Western CanadaSHM6 model within ~400 km of the site. These sources are described further below and shown in Figure 2.

- **Foothills (FTH):** Foreland Basin rocks located within the interior platform of western Canada immediately adjacent and east of the Canadian Cordillera. Characterized by very low rates of natural historical seismicity. In recent years oil and gas exploration has greatly increased the number of small earthquakes in the region. These “induced” earthquakes are not incorporated into this analysis because they contribute only to the short-term hazard locally and not the longer-term hazard considered here.
- **Rocky Mountain Fold/Thrust Belt North (ROCN):** Foreland fold and thrust belt of the Canadian Cordillera. This zone is characterized by slightly higher rates of historical seismicity compared to NBC and SBC. This source zone hosted an **M**5.5 earthquake in 1986.
- **Rocky Mountain Fold/Thrust Belt South (ROCS):** Foreland fold and thrust belt of the Canadian Cordillera. This zone is characterized by slightly higher rates of seismicity compared to the NBC and SBC sources zones (see below). This source zone hosted an **M**6.0 earthquake in 1918.
- **Northern British Columbia (NBC):** Interior of the Canadian Cordillera. This source zone has very low rates of historical seismicity. The eastern boundary of the NBC is the Rocky Mountain Trench. The northern boundary is marked by elevated seismicity rates interpreted to result from the transfer of strain from the Yakutat collision about 600 to 800 km to the west.
- **Southern British Columbia (SBC):** Interior of the Canadian Cordillera. This source zone has very low rates of historical seismicity. The Mount Polley TSF site is within this source zone. The eastern boundary of the SBC is the Rocky Mountain Trench. The western boundary is the Cascade Fold Belt.
- **Coastal Mountains (CST):** This source zone is underlain by the Middle Jurassic to Eocene Coastal Plutonic Complex with a relatively low rate of historical seismicity. The northern boundary is marked by elevated seismicity associated with the collision of the Yakutat Block with the North American Plate. The Yakutat Block is a composite oceanic-continental allochthonous terrane on the Pacific Plate.
- **Cascade Mountains (CAS):** The Cascade Fold Belt has historical seismicity rates higher than NBC and SBC source zones to the east.
- **Vancouver Island Coast Mountains (VICM):** This source zone is underlain by the Middle Jurassic to Eocene Coastal Plutonic Complex. This VICM has hosted numerous large crustal earthquakes in historical times including the 1949 **M**7.3 Vancouver Island earthquake. This source zone has earthquakes associated with ongoing arc volcanism.

Table 4 lists the parameters for the uniform-area sources adopted from CanadaSHM6.

The truncated Gutenberg-Richter (G-R) distribution is used to model earthquake occurrence rates within each uniform-area source zone. Three separate activity rates and three maximum earthquake magnitude (M_{max}) values are used to represent uncertainty in the estimation of the magnitude-recurrence parameters (Kolaj et al. 2020a).

For computational efficiency, these activity-rate- M_{max} pairs are collapsed down to a single weighted magnitude frequency distribution (MFD) for each area-source zone.

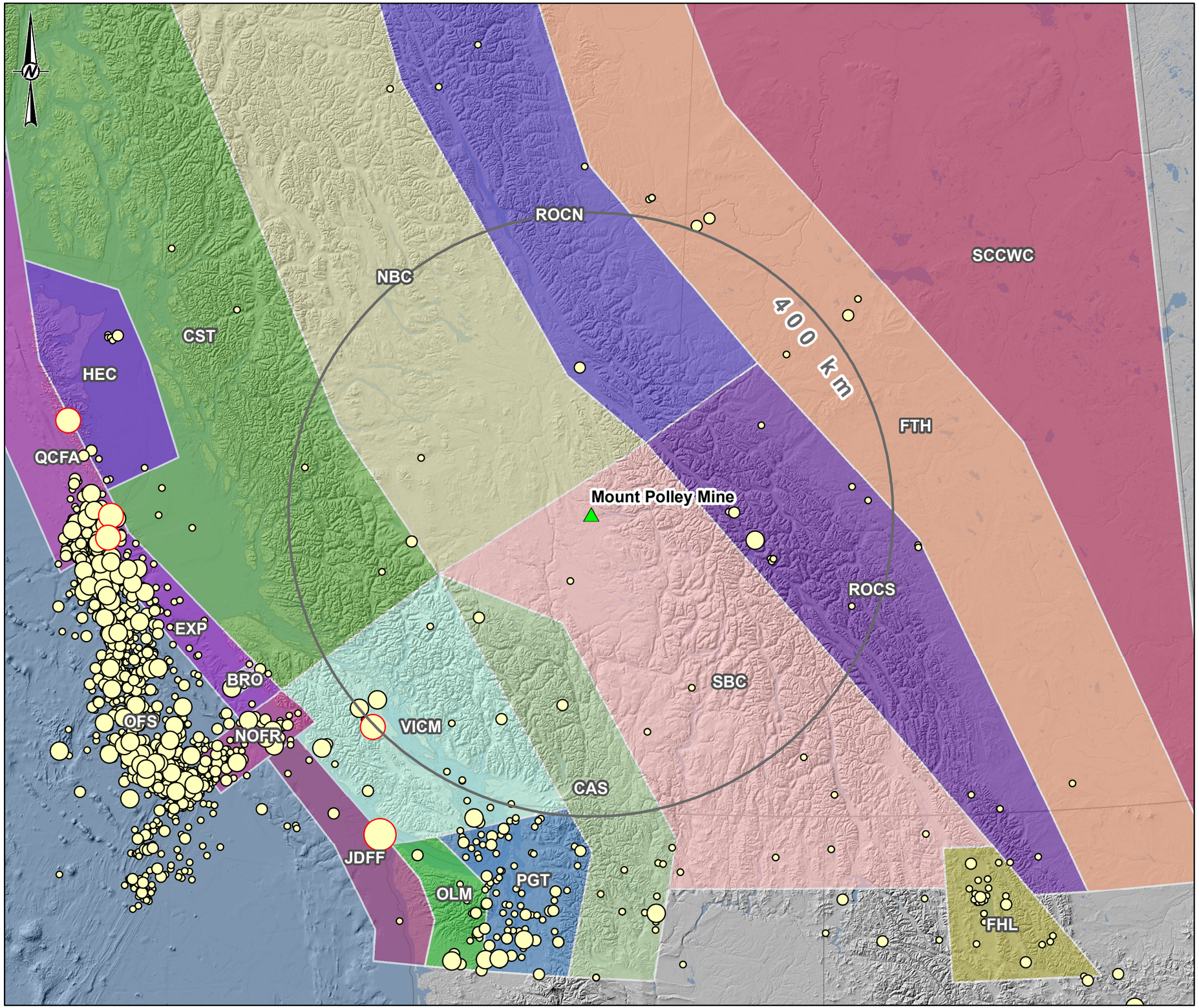

LEGEND

Project Location

Earthquake Epicenter

Moment Magnitude (Mw)

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- ≥ 8

Seismic Source Zone

- BRO - BROOKS PENINSULA
- CAS - CASCADE MOUNTAINS
- CST - COASTAL MOUNTAINS
- EXP - EXPLORER PLATE BENDING
- FHL - FLATHEAD LAKE
- FTH - FOOTHILLS
- FWFA - FAIRWEATHER FAULT AREA
- HEC - HECATE
- JDFF - JUAN DE FUCA PLATE BENDING, OFFSHORE
- NBC - NORTHERN BRITISH COLUMBIA
- NOFR - NOOTKA
- OLM - OLYMPIC
- PGT - PUGET SOUND (shallow)
- QCFA - QUEEN CHARLOTTE FAULT AREA
- ROCN - ROCKY MOUNTAIN FOLD/THRUST BELT NORTH
- ROCS - ROCKY MOUNTAIN FOLD/THRUST BELT SOUTH
- SBC - SOUTHERN BRITISH COLUMBIA
- SCCWC - STABLE CRATONIC CORE WESTERN CANADA
- VICM - VANCOUVER ISLAND COAST MOUNTAINS

0 100 200 400

KILOMETERS

REFERENCE(S)

1. COORDINATE SYSTEM: WGS 1984 UTM ZONE 11N
2. SERVICE LAYER CREDITS: USGS,NGA,NASA,CGIAR,GEBCO,N ROBINSON,NCEAS,NLS,OS,NMA,GEODATASTYRELSEN AND THE GIS USER COMMUNITY

CLIENT

GOLDER ASSOCIATES LTD.

PROJECT

SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT FOR MOUNT POLLEY MINE, BRITISH COLUMBIA

TITLE

EARTHQUAKE EPICENTERS AND CRUSTAL SEISMIC SOURCES FOR SOUTHWESTERN CANADA

CONSULTANT

wsp

YYYY-MM-DD	2022-08-31
DESIGNED	-
PREPARED	HJ
REVIEWED	AK/ET
APPROVED	AH

PROJECT NO.	PHASE	REV.	FIGURE
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Table 4: Uniform-area Active Shallow Crust Source Parameters

Tectonic Region	Source Zone	Closest distance to TSF site (km)	Weighted Mmin[a]	Weighted Mmax[b]	Upper Seimogenic Depth [km]	Lower Seismogenic Depth [km]	Weighted Activity Parameters	
							N(0)[c]	b-value[d]
Active Shallow Crust	SBC	0	4.8	7.14	0	25	1955.607	1.0139
	CAS	142	4.8	7.14	0	25	111.204	0.765
	VICM	212	4.8	7.49	0	25	187.72	0.742
	CST	212	4.8	7.14	0	25	8948.44	1.0419
	NBC	30	4.8	7.14	0	25	234.184	0.869
	ROCN	113	4.8	7.19	0	25	267.36	0.834
	FTH	295	4.8	7.02	0	25	270.933	0.869
	ROCS	110	4.8	7.19	0	25	495.34	0.83

Notes:

a. Mmin is the minimum magnitude included in the source model and defines the lower magnitude truncation of the Gutenberg-Richter distribution.

b. Mmax is the maximum magnitude included in the source model and defines the upper magnitude truncation of the Gutenberg-Richter distribution. The Mmax is the weighted sum of the collapsed MFD.

c. N(0) is the annual number of earthquakes (N) at magnitude zero – this is the same as the a-value, a constant in the Gutenberg-Richter relationship. The N(0) value is the weighted sum of the collapsed MFD.

d. b-value is a constant in the Gutenberg-Richter relationship that describes the proportion of large magnitude earthquakes to small magnitude earthquakes. The b value is the weighted sum of the collapsed MFD.

3.4.2 Crustal Fault Sources

There are no known crustal seismogenic fault sources within 400 km of the Mount Polley TSF site. Accordingly, linear active crustal fault sources are not in the seismic source model. Earthquake occurrence near the site is instead modelled using shallow crustal uniform-area sources (Section 3.4.1) and CSZ sources (Section 3.5).

3.5 Subduction Sources

The CSZ marks the boundary where the Explorer, Juan de Fuca, and Gorda plates (i.e., remnants of the older Farallon plate) subduct beneath the North America plate. The CSZ is about 460 km from the site at its closest approach. CanadaSHM6 has separate subduction source models for the subduction interface fault and the subduction in-slab sources as shown in Figure 3. These models are used for this assessment.

3.5.1 Subduction Interface

The CSZ interface fault is the surface trace of the boundary between the subducting Juan de Fuca plate system, comprised of the Gorda, Juan de Fuca, and Explorer plates, and the overriding North American plate. The CSZ is a “mega-thrust” source known to generate great earthquakes (**M**>8.5) such as in 1700. In CanadaSHM6, the CSZ interface fault has four sections: the Cascadia Interface, the Explorer Interface, the Winona thrust fault, and the Haida Gwaii thrust fault. Compared to CanadaNSHM5, CanadaSHM6 incorporates an improved model for the Juan de Fuca segment of the Cascadia subduction zone by incorporating current understanding of the paleoseismic history rather than a simple deterministic scenario. The more refined approach has reduced the average inter-event period for great earthquakes to increase the estimated seismic hazard for many sites in the coastal regions of Western Canada.

Table 5 lists the parameters for the subduction interface sections adopted from CanadaSHM6.

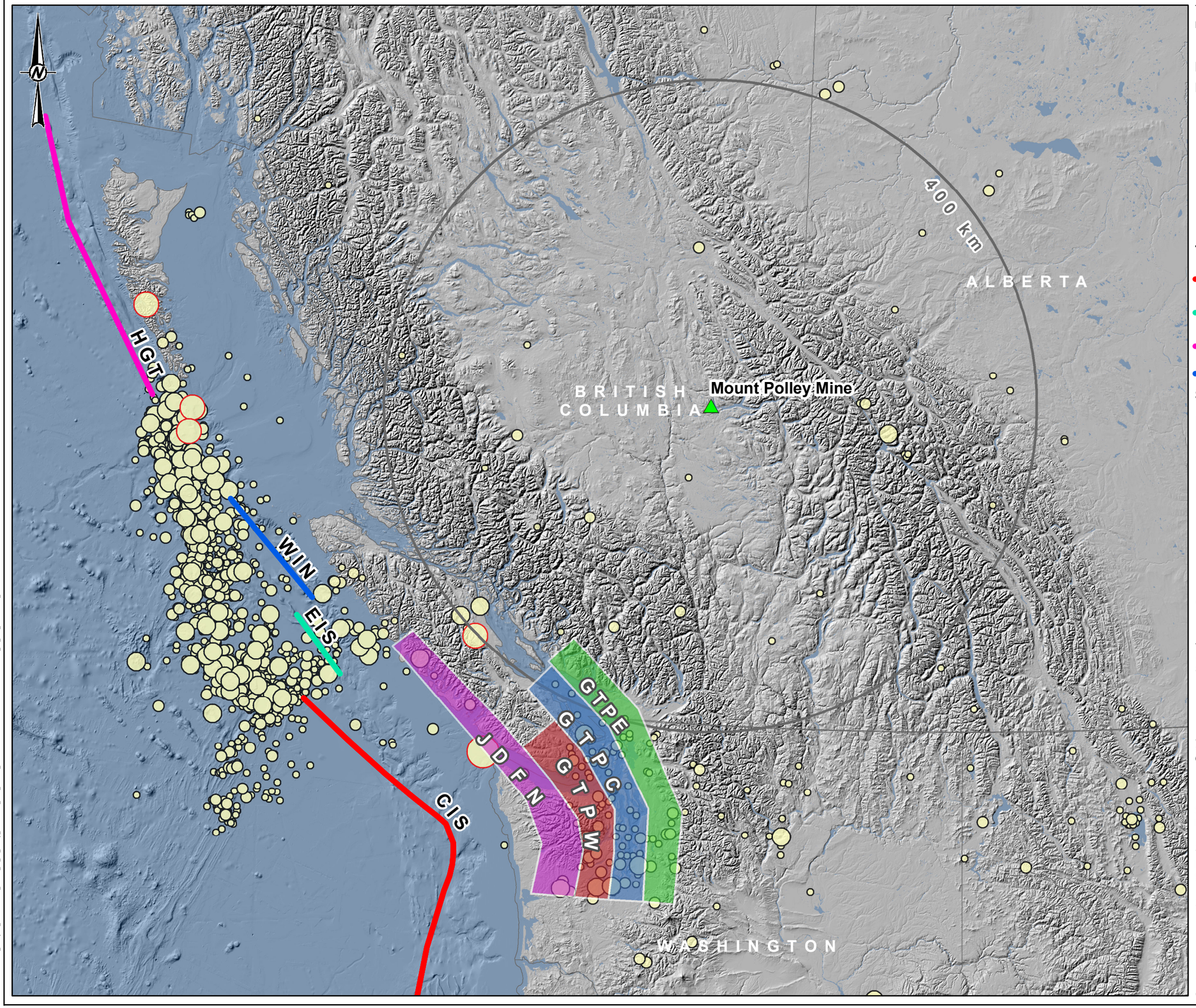

LEGEND

Project Location

Earthquake Epicenter

Moment Magnitude (Mw)

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- ≥ 8

Top of Subduction Interface Sources

- CIS - CASCADIA SUBDUCTION INTERFACE
- EIS - EXPLORER PLATE INTERFACE
- HGT - HAIDA GWAII THRUST FAULT
- WIN - WINONA THRUST FAULT

Subduction In-slab Sources

- GTPC - GEORGIA STRAIT PUGET SOUND CENTRAL
- GTPE - GEORGIA STRAIT PUGET SOUND EAST
- GTPW - GEORGIA STRAIT PUGET SOUND WEST
- JDFN - JUAN DE FUCA PLATE BENDING, ONSHORE (Deep)

0 100 200 400

KILOMETERS

REFERENCE(S)

1. COORDINATE SYSTEM: WGS 1984 UTM ZONE 11N
2. SERVICE LAYER CREDITS: USGS,NGA,NASA,CGIAR,GEBCO,N ROBINSON,NCEAS,NLS,OS,NMA,GEODATASTYRELSEN AND THE GIS USER COMMUNITY

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TITLE

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CONSULTANT

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PROJECT NO.	PHASE	REV.	FIGURE
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Table 5: Cascadia Subduction Zone Interface Seismic Source Parameters

Tectonic Region	Source Zone	Model and *Weight*	Closest distance to site (km)	Mmin	Mmax[1]			Upper Seimogenic Depth [km]	Lower Seismogenic Depth [km]	Weighted Activity Parameters[1]					
					U	P	L			N(0)			b-value		
										U	P	L	U	P	L
Subduction Interface	Cascadia Interface	Landward fault depth 31.0 km *(0.25)*	463	8.4	9.3	-	9.1	5.0	31.0	Not reported			Not reported		
		Landward fault depth 27.0 km *(0.50)*	482	8.4	9.3	-	9.1	5.0	27.0	Not reported			Not reported		
		Landward fault depth 23.0 km *(0.25)*	501	8.4	9.3	-	9.1	5.0	23.0	Not reported			Not reported		
	Explorer Interface	Landward fault depth 28.0 km *(0.25)*	471	7.5	-	8.5 *(1.0)*	-	5.0	28.0	-	0.0009 *(1.0)*	-	-	-2.1715 *(1.0)*	-
		Landward fault depth 22.0 km *(0.50)*	490	7.5	-	8.0 *(1.0)*	-	5.0	22.0	-	0.003 *(1.0)*	-	-	-2.1715 *(1.0)*	-
		Landward fault depth 16.0 km *(0.25)*	509	7.5	-	7.6 *(1.0)*	-	5.0	16.0	-	0.0067 *(1.0)*	-	-	-2.1715 *(1.0)*	-
	Winona Thrust Fault		522	7.0	7.7	7.4	7.1	2.0	5.0	2313.516	4522.26	18375.9	-	0.8 *(1.0)*	-
			522	7.0	7.7	7.4	7.1	2.0	5.0	0.0373	0.102	0.5471	-	0.0001 *(1.0)*	-
	Haida Gwaii Thrust Fault		635	7.0	8.2	8.0	7.8	3.0	22.0	7894.441	10205	16062.53	-	0.8 *(1.0)*	-
			635	7.0	8.2	8.0	7.8	3.0	22.0	0.0612	0.107	0.2483	-	0.0001 *(1.0)*	-

1 Values for Mmax and Weighted Activity parameters are listed as U = Upper, P = Preferred, L = Lower

3.5.2 Subduction In-slab

The CanadaSHM6 defines four in-slab sources within about 500 km of the site. Table 6 lists the parameters from CanadaSHM6 used in this assessment. These sources represent earthquakes occurring in the subducting Juan de Fuca plate that extends beneath most of Vancouver Island, Puget Sound, and northern Washington state in the USA (Figure 3).

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Table 6: Cascadia Subduction Zone In-slab Seismic Source Parameters

Tectonic Region	Seismic Source Zone	Closest distance to site (km)	Mmin	Mmax			Upper Seimogenic Depth [km]	Lower Seismogenic Depth [km]	Weighted Activity Parameters[1]					
				U	P	L			N(0)			b-value		
									U	P	L	U	P	L
Subduction In-slab	Georgia Strait Puget Sound Central	375	4.8	7.5	7.2	7.0	45	65	15.4	20	72.8	0.413	0.478	0.69
	Georgia Strait Puget Sound East	336	4.8	7.5	7.2	7.0	50	70	3.3	4.4	5.8	0.365	0.478	0.59
	Georgia Strait Puget Sound West	416	4.8	7.5	7.2	7.0	40	60	18.4	23.5	130.2	0.413	0.478	0.746
	Juan De Fuca Plate Bending, Onshore (Deep)	455	4.8	7.3	7.0	6.9	25	45	26.3	52.86	107.01	0.5351	0.69	0.8448

1. Values for Mmax and Weighted Activity parameters are listed as U = Upper, P = Preferred, L = Lower

3.6 Source Model Parameters

There are important parameter limits included in PSHA:

- **Source-to-site distance (R)** is the maximum distance from the site considered in the hazard calculation. The maximum r parameter (r_{max}) is selected considering the distribution of historical earthquake epicenters, limitations of the GMMs, and the AEPs and spectral periods of interest to the project. The r_{max} in CanadaSHM6 is defined depending on the tectonic region with the longest distance for the subduction sources (1000 km) and shorter distances for the crustal sources (400 to 600km).
- **Maximum earthquake magnitude (M_{max})** is the maximum earthquake magnitude expected from an earthquake source. Refer to Sections 3.4 and 3.5 for further details.
- **Minimum earthquake magnitude (M_{min})** is the minimum earthquake magnitude expected to result in some damage to the facility or site under study. Refer to Sections 3.4 and 3.5 for further details for M_{min} for the defined seismic sources.
- **Epsilon (ε)** is a standard deviation of the ground motion models above and below the median ground motion calculated from each GMM. Inclusion of excessively unlikely ground motions is computationally demanding with minimal gain in the earthquake ground motion prediction. Epsilon (ε) is truncated at five in CanadaSHM6, and was also applied in this assessment (i.e., the ground motions above and below five standard deviations of the median are not included in the hazard integral).

Epistemic uncertainty is incorporated using a logic-tree approach. GMMs are weighted and propagated through the logic tree to provide a suite of weighted results that are then summed. The CanadaSHM6 model trial version logic tree was collapsed (Kolaj et al. 2020b) to reduce the time required for calculation of the magnitude recurrence branches. The logic tree collapsing does not impact the mean hazard value obtained, only the hazard fractiles.

4.0 GROUND MOTION MODEL SELECTION AND WEIGHTING

Empirical ground motion models (GMM) are used to estimate the earthquake ground motions at a site for an earthquake with a magnitude, a rupture mechanism (e.g., normal, strike-slip, reverse or thrust), and a known source-to-site distance. The GMMs are developed for defined tectonic regions and seismic types (e.g., subduction zones or shallow crust). The GMMs used in this assessment are selected based on the similarity between the tectonic and geologic conditions in the region surrounding the site and the conditions in the regions from which earthquake recordings were selected to derive the GMMs.

4.1 Active Shallow Crustal Ground Motion Models

CanadaSHM6 uses the Pacific Earthquake Engineering Research Center (PEER) Next Generation of Ground Motion Attenuation Phase 2 Project (NGA-West2) GMMs to model source-to-site attenuation for all active shallow crustal sources. The NGA-West2 GMMs were developed for active tectonic regions based mostly on earthquake strong ground motion data recorded at seismically active, present-day tectonic plate boundaries, primarily from western United States, Japan, New Zealand, and other seismically active regions around the world.

The NGA-West2 GMMs were developed in a systematic process using improved strong ground motion recordings and considered the soil conditions at the ground motion recording stations, near-source saturation effects, and sedimentary basin and fault hanging-wall effects. These GMMs have been employed globally to model source-to-site attenuation from shallow crustal sources in PSHA. Spectral accelerations are estimated as a function of

earthquake magnitude, source-to-site distance, fault geometry, and time-averaged shear-wave velocity in the upper 30 m below the site ground reference surface (i.e., V_{S30}).

Table 7 lists the crustal GMMS used, their weights, and key distance measures.

4.2 Subduction Ground Motion Models

Subduction zone earthquake sources include both the subduction interface and subduction in-slab sources. GMMs have been developed for each of the interface and in-slab sources independently, but there is significant overlap in the development of GMMs for these sources because they are typically both used when a site is near a major subduction zone.

The selection and weighting of subduction GMMs for CanadaSHM6 is based on 15 discrete V_{S30} values. The V_{S30} value used in this assessment is not one of the pre-defined values in CanadaNSH6. Consequently, the use of GMMs in this assessment differs from that in CanadaSHM6.

This assessment uses three of the GMMs developed for the NGA-Sub project to model source-to-site attenuation for the subduction interface sources: Abrahamson and Gülerce (2020), Kuehn et al. (2020), and Parker et al. (2020). The Si (2020) GMM was developed specifically for Japanese subduction zones using only Japanese strong motion data. This GMM is not yet recommended for use outside Japan. The NGA-Sub project followed a similar methodology as the NGA-West2 project. The 2020 NGA-Sub GMMs are now considered the more advanced GMMs for subduction zone earthquakes because they have been developed using the similar robust and peer reviewed approach as used for the NGA-West2.

The Abrahamson et al. (2018) pre-NGA-Sub GMM was also used in this analysis because it was specifically developed for the CSZ as part of the BC Hydro assessment in 2012. Abrahamson et al. (2018) is an updated version of the BC Hydro GMM. The Abrahamson et al. (2018) central model was included with a relatively low weight to capture the epistemic uncertainty in CSZ ground motion predictions. The central, low, and high alternatives of Abrahamson et al. (2018) were included to capture the epistemic uncertainty for the in-slab sources.

Table 7: Selected Ground Motion Models and Weights used in this Assessment

Tectonic Region	GMMs	Weight	Primary distance metric[1]	Moment Magnitude (M) range	Source-to-site distance (km)
Active Shallow Crust	Abrahamson et al. (2014)	0.25	Rrup	3.0-8.5	0-300
	Boore et al. (2014)	0.25	Rjb	3.0-7.9	0-400
	Campbell and Bozorgnia (2014)	0.25	Rrup	3.3-8.5	0-300
	Chiou and Youngs (2014)	0.25	Rrup	3.5-8.5	0-300
Subduction Interface	Abrahamson and Gülerce (2020) *Cascadia-specific coefficients	0.35	Rrup	5.0-9.5	0-800
	Abrahamson et al. (2018)	0.15	Rrup	5.0-9.5	0-1000
	Kuehn et al. (2020)	0.35	Rrup	5.0-9.5	10-1000
	Parker et al. (2020)	0.15	Rrup	4.5-9.5	20-1000
Subduction In-slab	Abrahamson et al. (2018)	0.2	Rrup	5.0-9.5	0-1000
	Abrahamson and Gülerce (2020) *Cascadia-specific coefficients	0.4	Rrup	5.0-9.5	0-800
	Kuehn et al. (2020)	0.4	Rrup	5.0-9.5	10-1000

1. Distances metrics are Rrup for rupture plane distance, Rjb for Joyner-Boore distance as closest distance to the surface projection of the fault plane.

5.0 PROBABILISTIC SEISMIC HAZARD ANALYSIS

This section provides a general overview of the PSHA method as applied in the site-specific hazard assessment, including incorporation of uncertainties.

5.1 Methodology

PSHA is based on a method proposed by Cornell (1968) that essentially relates the recurrence of earthquakes in the seismic source models to the probability that an earthquake ground motion exceeds a certain value in a specific time period at a specific location (see following equation). This approach relies on the assumption that earthquakes occur randomly in space and time (i.e., Poisson process).

$$P(IM > s) = 1 - e^{-\varphi(s)t}$$

Where:

- *P* = probability
- *IM* = ground motion (also known as ground motion intensity measure)
- s = a specific value of ground motion
- φ(s) = annual exceedance probability (AEP)
- t = time period

For this assessment, the target annual exceedance probabilities (AEP) are 1/1,000, 1/2,475, 1/5,000 and 1/10,000. The annual probability of exceedance is calculated following equation:

$$(IM > x) = \sum_{i=1}^{n_{sources}} \lambda(M > m_{min}) \int_{m_{min}}^{m_{max}} \int_{0}^{r_{max}} P(IM > x|m,r) f_M(m,r) f_R(r) dr dm$$

Where:

- $n_{sources}$ = number of sources considered
- $\lambda(M>m_{min})$ = the rate of occurrence of earthquakes greater than m_{min} from the i_{th} source
- $P(IM>x \mid m,r)$ = the probability that *IM* exceeds x given magnitude *m* and distance *r*
- $f_M(m)f_R$® = probability density functions for magnitude *m* and distance r

The probabilistic analysis for this site was undertaken using the OpenQauke software (v.3.11.4) developed by the Global Earthquake Model Foundation (GEM, 2022).

5.2 Logic Tree Analysis

Epistemic uncertainty is the uncertainty associated with the simplified and imprecisely known scientific model of a natural process. This uncertainty is typically parameterized by considering alternative model input parameters to the PSHA (e.g., Abrahamson 2006, 2009). The input model parameters include the seismic source models, their recurrence parameters and maximum earthquake magnitudes, hypocentral depth, and ground motion model. Epistemic uncertainty is commonly accommodated through a logic-tree approach.

One of the planned changes for CanadaSHM6 was to implement the model in OpenQuake—an open-source seismic hazard and risk calculation software developed and maintained by the Global Earthquake Model Foundation (GEM 2022). Allen et al. (2020) converted CanadaSHM5 to OpenQuake to ensure the change in calculation software did not result in a change in hazard values.

As part of this implementation of the seismic source models in OpenQuake, the two magnitude-frequency distribution (MFD) branches of the logic tree, the three-alternative a- and b-value branches and three alternative M_{max} branches, were collapsed into a single MFD branch. This approach was used by Allen et al. (2020) to reduce the unreasonably long runtimes in OpenQuake v3.2 with nine weighted source model sub-branches for each earthquake source.

Variations in occurrence rates and M_{max} were collapsed into a combined, weighted average branch for computational efficiency. Allen et al. (2020) outlines in detail the implementation of CanadaSHM5 in OpenQuake and the differences in results between the two calculation software programs. While collapsing these two branches in the logic tree had a negligible impact on median hazard values, it limits the ability to perform a detailed analysis of the fractiles or model input sensitivity test. Improvements in computation runtimes in OpenQuake v.3.11 allow for a sensitivity analysis of a subset of spectral periods and return periods. The input parameters, logic tree, and weighting values used in this assessment are adopted from the Kolaj et al. (2020b) model and presented in Figure 4.

Figure 4 shows the source model logic tree used in this site-specific analysis.

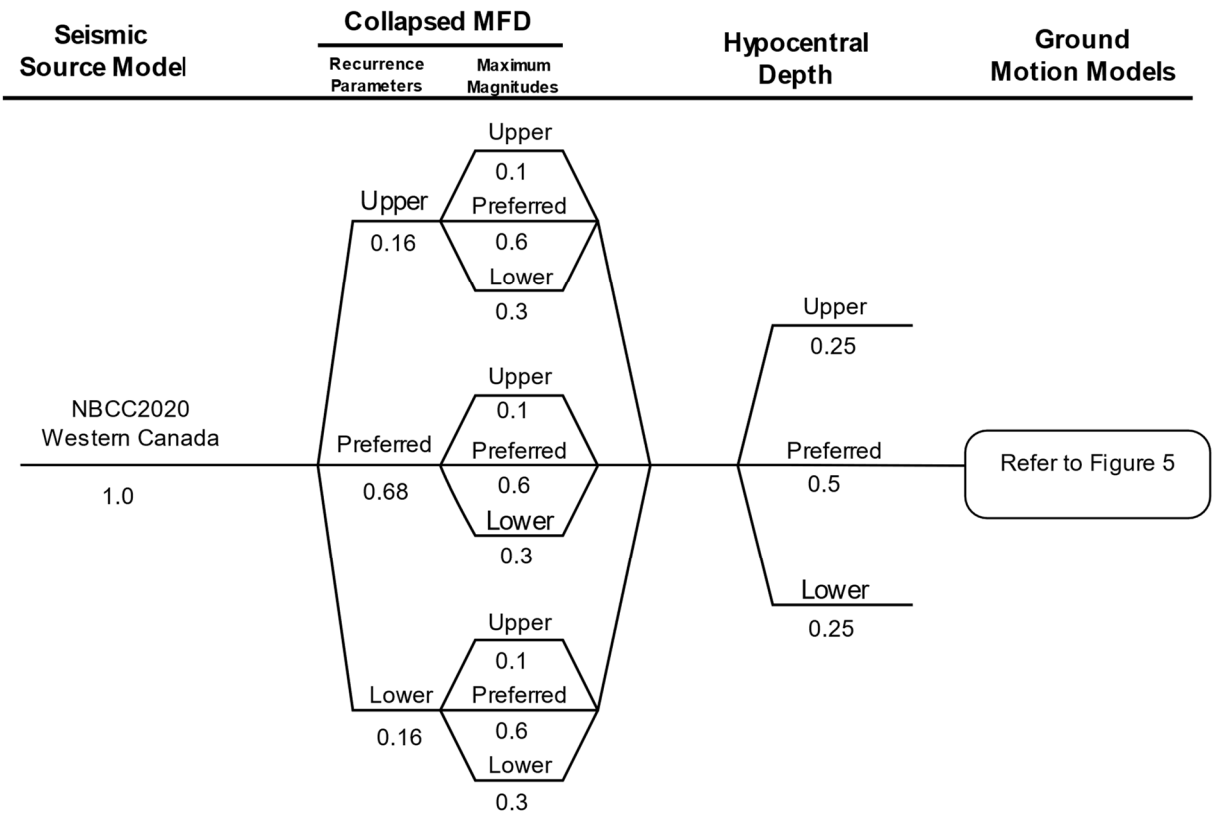

Figure 4 Seismic Source Model Logic Tree used in this assessment

Figure 5 shows the GMM logic and weighting as described in Section 4.0.

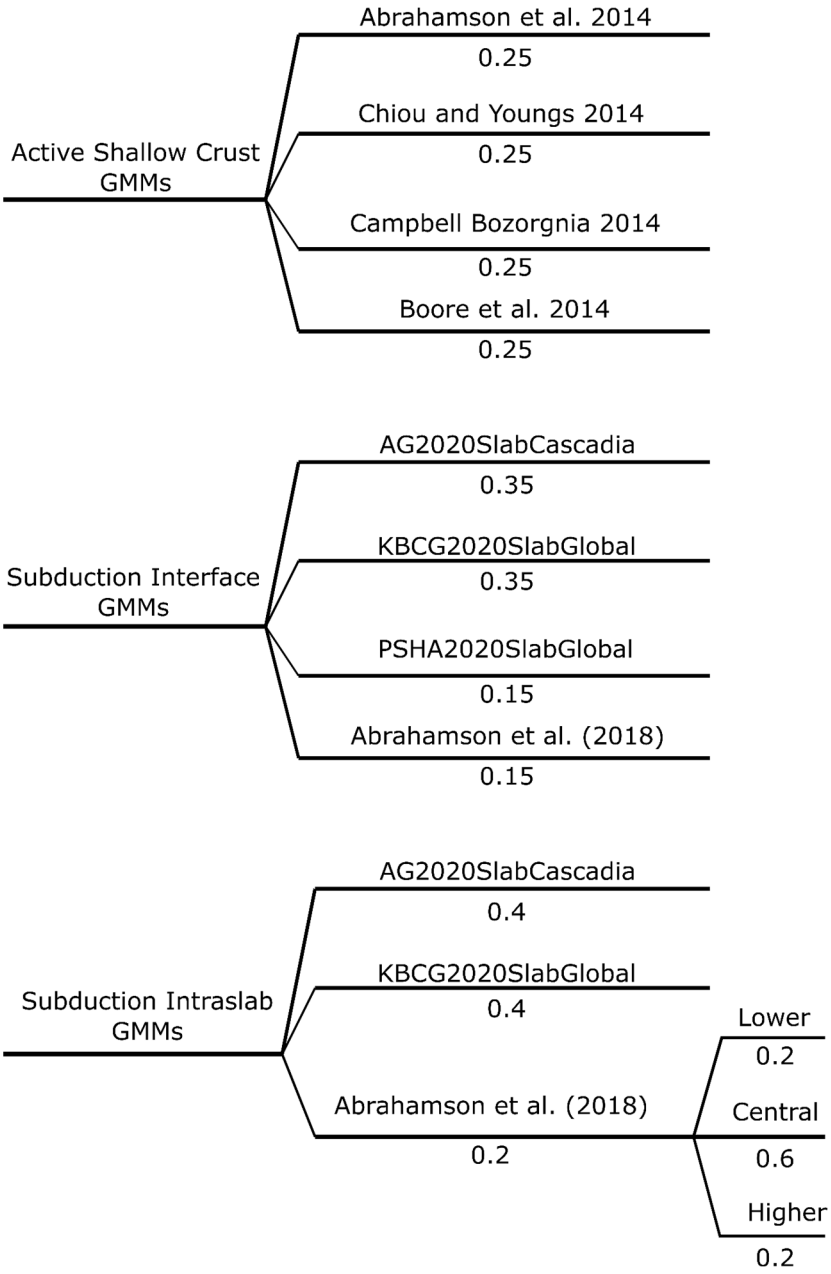

Figure 5 Logic trees for selected ground motion models and their weights for crustal, subduction interface, and subduction in-slab sources

5.3 Validation of Model Implementation

The results of a full CanadaSHM6 model (unmodified) run for the site is compared to results derived from the Seismic Hazard Tool calculator available online (Natural Resources Canada (NRCan) 2020) as the basis to validate our implementation of the CanadaSHM6 source models and GMMs in OpenQuake. Table 8 lists results for the 1/475 and 1/2475 AEPs.

The results from our implementation of CanadaSHM6 in OpenQuake and those available from the seismic hazard tool for the two AEPs are almost identical. The discrepancies in acceleration values in this validation test are negligible and can be attributed to changes in the versions of the OpenQuake software engine. From this validation test, our implementation of CanadaSHM6 is considered valid.

Table 8 also lists the 1/475 AEP and 1/2475 AEP mean hazard results using the site-specific source model developed for the site. The site-specific results are generally lower than CanadaSHM6, although the absolute value of the total hazard and differences in hazard are low. Differences in the results are primarily attributed to the different ground motion model selection and weighting, and the V_{S30} used in this assessment.

Table 8: Accelerations for Validation of Models at 1/475 AEP and 1/2475 AEP

Parameter		Mean acceleration (g)			
AEP	Spectral period (s)	CanadaSHM6 results[1] V_{S30}= 760 m/s	This assessment		
			CanadaSHM6 model[2] V_{S30}= 760 m/s	Site-specific[3] V_{S30}= 760 m/s	Site-specific [4] V_{S30} = 849 m/s
1/475	PGA	0.019	0.018	0.016	0.015
	0.2	0.037	0.036	0.031	0.029
	0.5	0.027	0.027	0.024	0.021
	1.0	0.018	0.018	0.015	0.013
	2.0	0.014	0.013	0.009	0.010
	5.0	0.006	0.006	0.004	0.008
	10.0	0.003	0.003	0.002	0.004
1/2,475	PGA	0.057	0.055	0.051	0.048
	0.2	0.115	0.111	0.107	0.098
	0.5	0.067	0.064	0.061	0.054
	1.0	0.043	0.042	0.043	0.030
	2.0	0.034	0.032	0.035	0.020
	5.0	0.018	0.017	0.011	0.011
	10.0	0.013	0.012	0.006	0.006

Notes:

1. Natural Resources Canada (2020). Obtained using NRCan Seismic Hazard Tool: https://earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php for V_{S30} of 760m/s at site location.
2. Variations between these results and the CanadaSHM6 results are due to minor changes between OpenQuake versions. Results presented in this assessment are from OpenQuake v3.11.4.
3. Variations between these results and the CandaSHM6 published results are due to the source models and weightings developed for this assessment.
4. As per note 3, and the difference in V_{S30}.

6.0 DETERMINISTIC ANALYSIS

The Canadian Dam Association (CDA) guidelines for tailings dams (CDA 2019, Table 3.1) permit the use of a maximum credible earthquake (MCE) for Very High and Extreme consequence facilities. The Mount Polley TSF is located within a relatively tectonically stable continental region in western North America. Major systems or segments of faults with seismogenic potential needed to estimate an MCE within about 400 km of the site are unknown based on our review of readily available information. Consequently, the magnitude-distance pair required to generate discrete, single-valued earthquakes to estimate the site-specific MCE ground motions is not possible for the Mount Polley TSF site. Probabilistically based mean accelerations developed from this assessment, therefore, are recommended for earthquake ground motion analyses at the Mount Polley TSF site.

7.0 SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ANALYSIS RESULTS

Sections below present the site-specific earthquake ground motions for the Mount Polley TSF site. Section 8.0 provides discussion of the results and recommendations. The results presented here are for a V_{s30} of 849 m/s (Appendix B).

The ground motion hazard results from the PSHA are described in three ways:

- Hazard curves that describe the acceleration at a specific spectral period at a range of AEPs. Section 7.1 describes hazard curves for the site.
- Uniform hazard acceleration response spectrum that describes the acceleration for a range of spectral periods at a specific AEP. The response spectrum is “uniform hazard” because each acceleration value has the same AEP. Section 7.2 presents uniform hazard response spectra for the site.
- Magnitude-distance deaggregations that describe the joint probability mass distribution of earthquake-magnitude and source-to-site distance that contribute to the mean hazard at a specific AEP and spectral period. Section 7.3 present magnitude-distance deaggregations for the site.

7.1 Hazard Curves

Hazard curves describe earthquake acceleration values at different AEPs at a given spectral period. Figure 6 shows mean hazard curves for selected spectral periods. The 1/1,000, 1/2,475, 1/5,000, and 1/10,000 AEPs are also shown. The mean hazard curves are the result of summing weighted hazard curves as developed from the logic tree.

Figure 7 shows PGA, 0.5 s, 1.0 s, and 1.5 s spectral period mean hazard curves with 5th, 15th, 50th (median), 85th, and 95th fractiles (median ± 1 and 2 standard deviations). The fractiles reflect the uncertainty in the hazard results as incorporated in the logic trees in this site-specific PSHA. As described in Section 5.2 the b-value and maximum earthquake magnitude uncertainties from the areal source models are not incorporated in the fractile analysis.

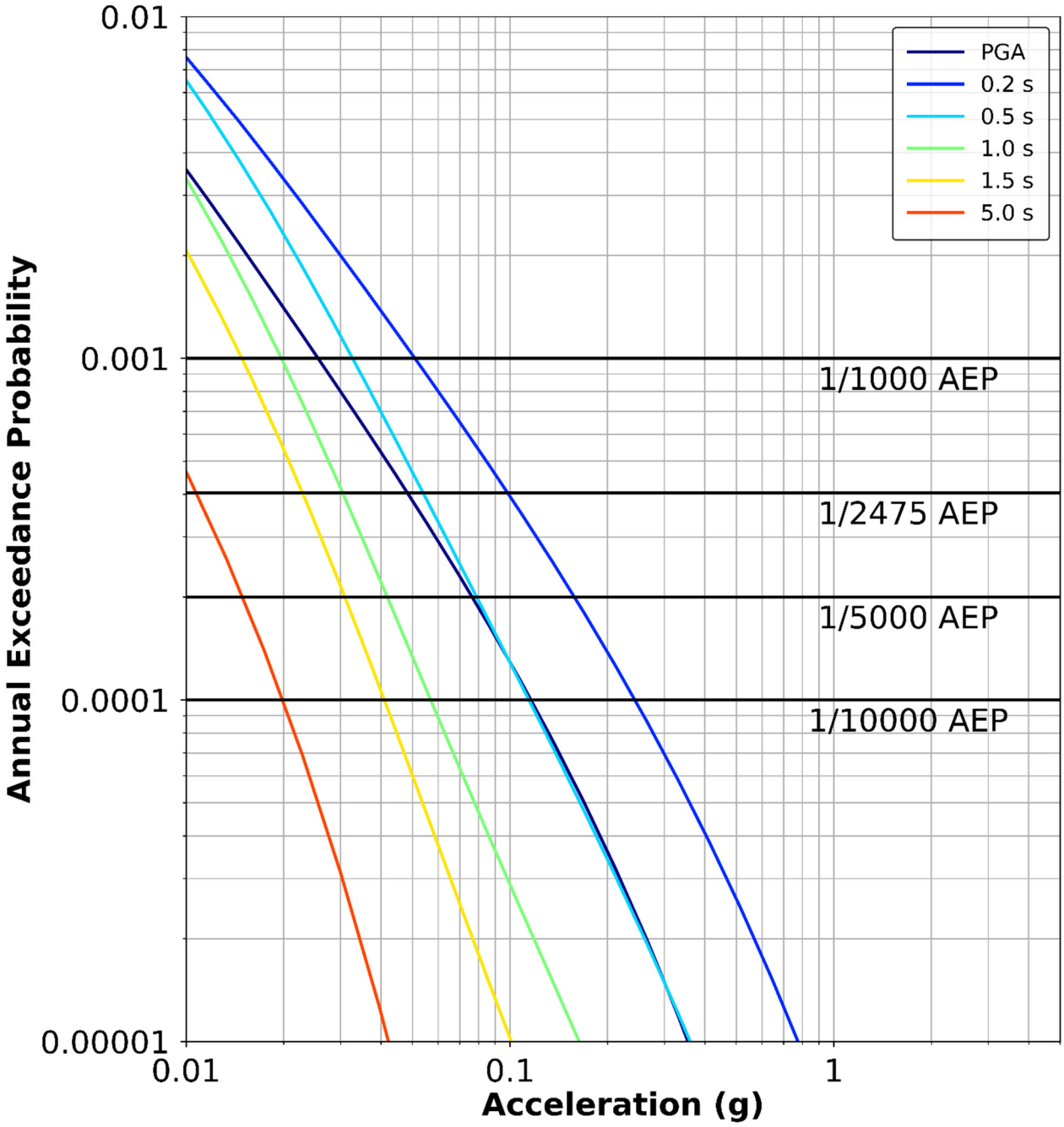

Figure 6: Mean hazard curves for selected spectral periods for top of engineering bedrock ground condition (V_{S30} = 849 m/s)

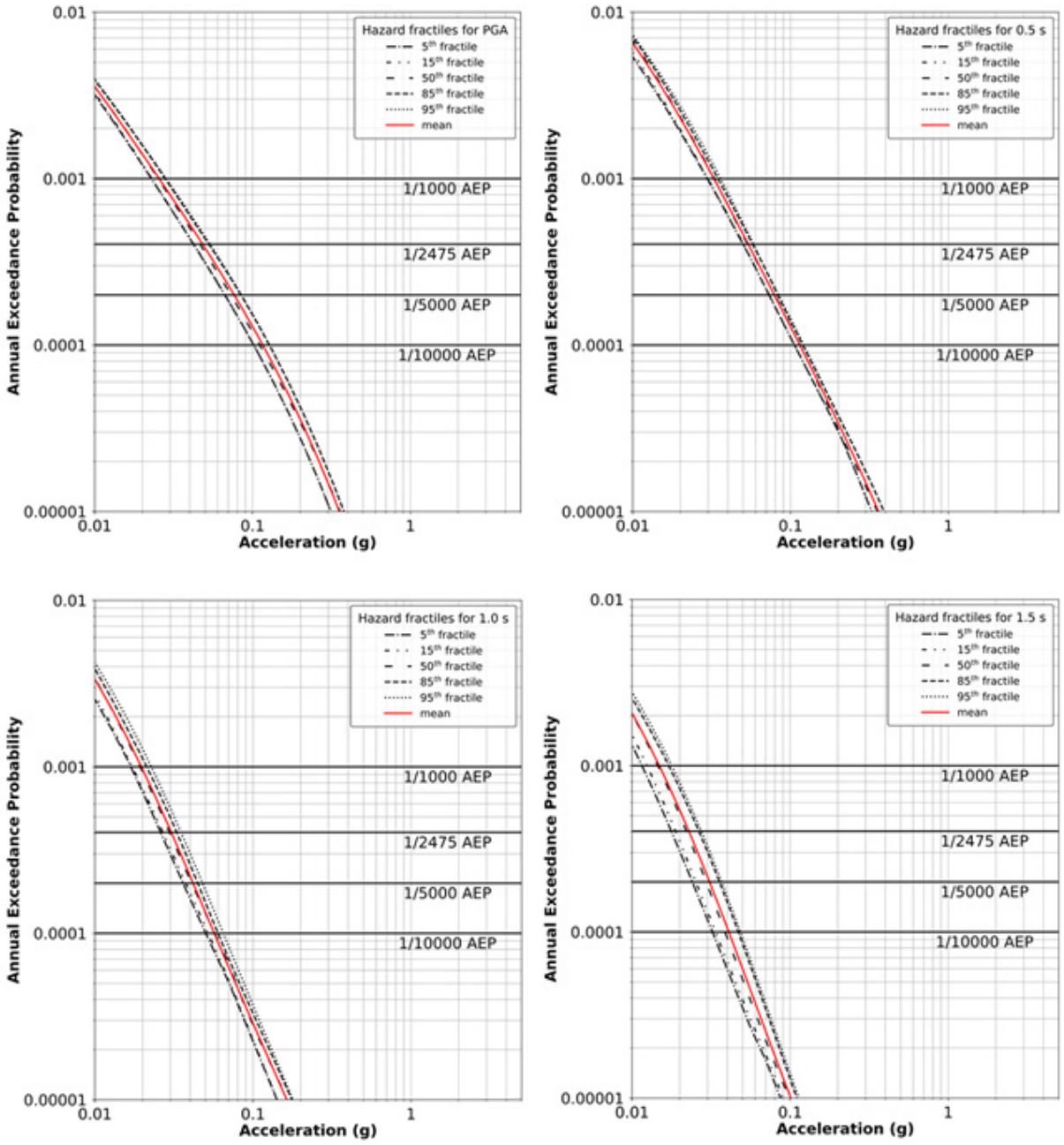

Figure 7: Mean hazard curves, showing 5th, 15th, 50th (median), 85th, and 95th fractiles for PGA (top left), 0.5 s (top right), 1.0 s (bottom left), and 1.5 s (bottom right) spectral periods

7.2 Uniform Hazard Acceleration Response Spectra

Figure 8 shows the mean uniform hazard acceleration response spectra (5%-damped) (UHRS) for the 1/1,000 AEP, 1/2,475 AEP, 1/5,000, and 1/10,000 AEP, respectively. These mean values are for the top of engineering bedrock ground condition (V_{S30} of 849 m/s). Table 9 lists the spectral ordinates for these UHRS.

Figure 9 to Figure 12 show the mean uniform hazard acceleration response spectra (5%-damped) (UHRS) along with the 5th, 15th, 50th (median), 85th, and 95th fractiles for AEPs of 1/1,000, 1/2,475, 1/5,000, and 1/10,000 AEP, respectively. Table 10 to Table 13 list the spectral ordinates for these UHRS for the 1/1,000, 1/2,475, 1/5,000, and 1/10,000 AEP, respectively. These values are for the top of engineering bedrock ground condition with a V_{S30} of 849 m/s.

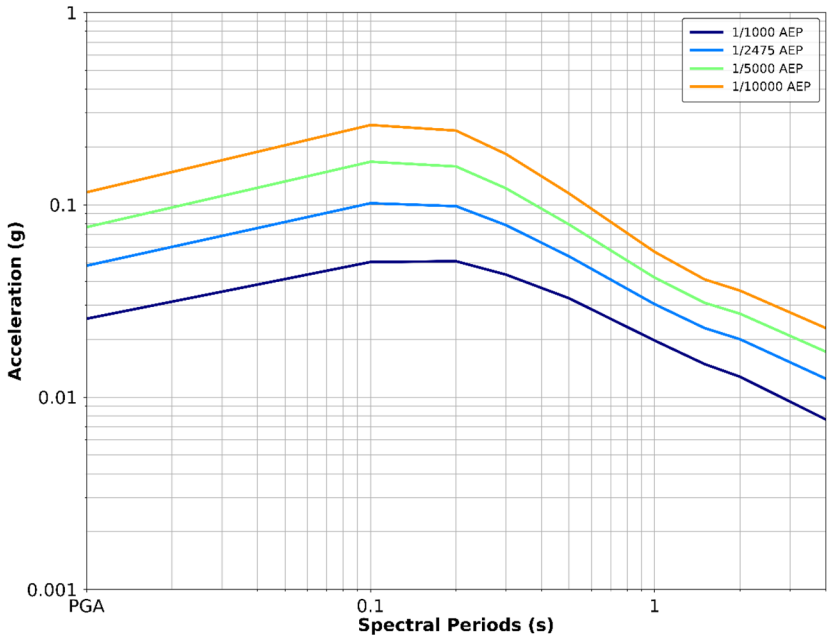

Figure 8: Mean Uniform Hazard Acceleration Response Spectra

Table 9: Uniform Hazard Acceleration Response Spectral Ordinates for Selected AEPs

Special Period (s)	Mean acceleration (g)			
	1/1,000 AEP	1/2,475 AEP	1/5,000 AEP	1/10,000 AEP
PGA	0.026	0.048	0.076	0.116
0.1	0.050	0.102	0.167	0.260
0.2	0.051	0.098	0.158	0.243
0.3	0.043	0.078	0.122	0.183
0.5	0.033	0.054	0.079	0.114
1.0	0.020	0.030	0.042	0.057
1.5	0.015	0.023	0.031	0.041
2.0	0.013	0.020	0.027	0.036
5.0	0.007	0.011	0.015	0.020
10.0	0.003	0.006	0.008	0.011

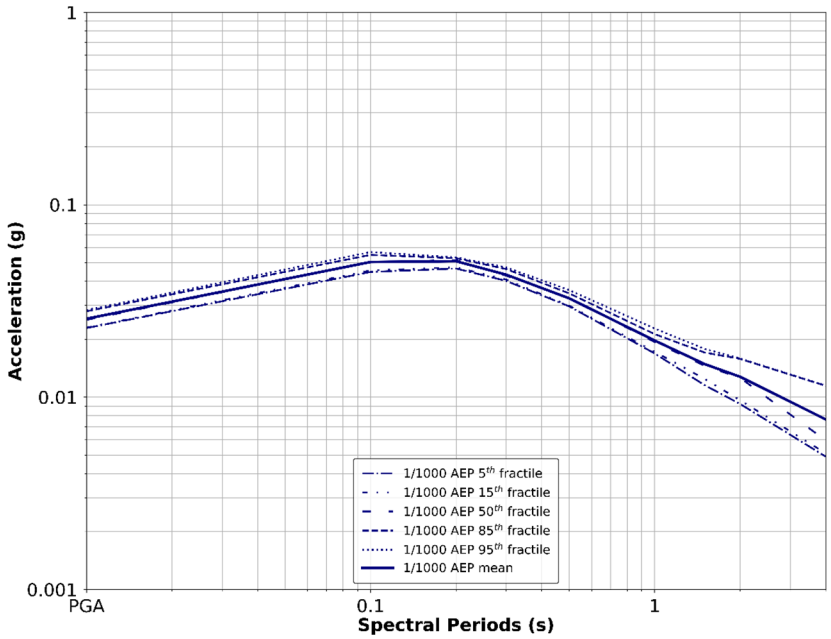

Figure 9: 1/1,000 AEP Mean Uniform Hazard Acceleration Response Spectra and Selected Fractiles

Table 10: Uniform Hazard Acceleration Response Spectral Ordinates for 1/1,000 AEP with Selected Fractiles

Spectral period (s)		Acceleration (g)					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/1,000AEP	PGA	0.026	0.023	0.023	0.025	0.028	0.028
	0.1	0.050	0.045	0.046	0.050	0.055	0.057
	0.2	0.051	0.047	0.047	0.052	0.053	0.053
	0.3	0.043	0.040	0.041	0.043	0.046	0.047
	0.5	0.033	0.030	0.030	0.033	0.035	0.036
	1.0	0.020	0.017	0.017	0.019	0.021	0.023
	1.5	0.015	0.012	0.012	0.015	0.017	0.018
	2.0	0.013	0.009	0.010	0.013	0.016	0.016
	5.0	0.007	0.004	0.004	0.005	0.010	0.010
	10.0	0.003	0.002	0.002	0.002	0.006	0.006

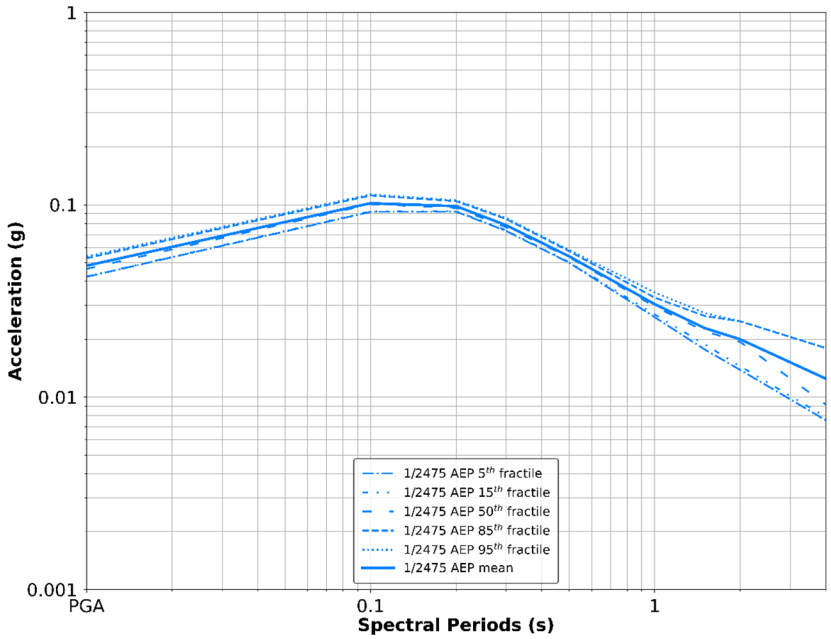

Figure 10: 1/2,475 AEP Mean Uniform Hazard Acceleration Response Spectra and Selected Fractiles

Table 11: Uniform Hazard Acceleration Response Spectral Ordinates for 1/2,475 AEP with Selected Fractiles

Spectral period (s)		Acceleration (g)					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/2,475 AEP	PGA	0.048	0.042	0.042	0.046	0.053	0.054
	0.1	0.102	0.092	0.092	0.101	0.112	0.113
	0.2	0.098	0.092	0.093	0.096	0.104	0.105
	0.3	0.078	0.073	0.074	0.076	0.084	0.085
	0.5	0.054	0.050	0.050	0.053	0.057	0.058
	1.0	0.030	0.026	0.027	0.030	0.033	0.035
	1.5	0.023	0.018	0.019	0.022	0.026	0.027
	2.0	0.020	0.014	0.014	0.019	0.025	0.025
	5.0	0.011	0.006	0.006	0.007	0.016	0.016
	10.0	0.006	0.003	0.003	0.004	0.009	0.009

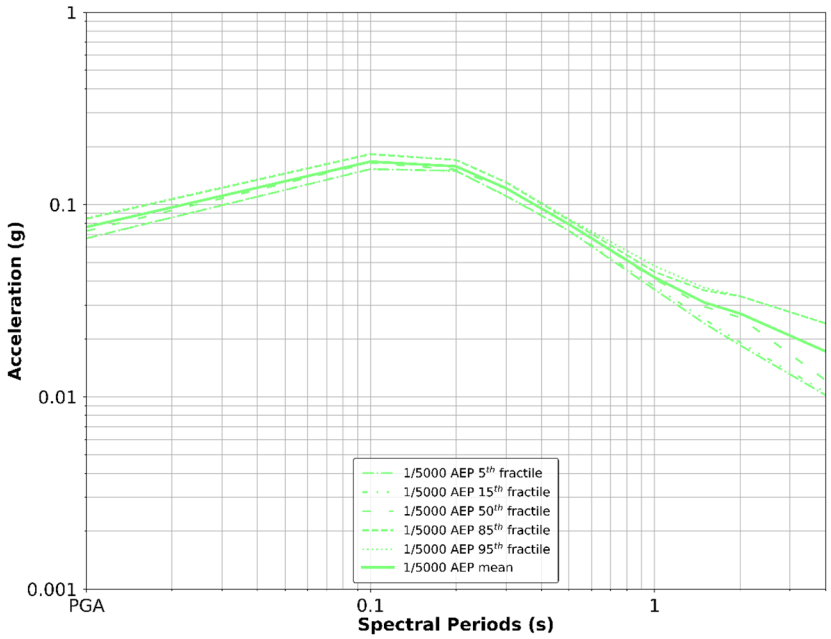

Figure 11: 1/5,000 AEP Mean Uniform Hazard Acceleration Response Spectra and Selected Fractiles

Table 12: Uniform Hazard Acceleration Response Spectral Ordinates for 1/5,000 AEP with Selected Fractiles

Spectral period (s)		Acceleration (g)					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/5,000 AEP	PGA	0.076	0.067	0.067	0.073	0.084	0.085
	0.1	0.167	0.153	0.153	0.165	0.183	0.184
	0.2	0.158	0.150	0.150	0.152	0.170	0.171
	0.3	0.122	0.111	0.111	0.121	0.130	0.131
	0.5	0.079	0.073	0.073	0.079	0.083	0.084
	1.0	0.042	0.036	0.038	0.041	0.045	0.048
	1.5	0.031	0.024	0.025	0.029	0.036	0.037
	2.0	0.027	0.019	0.019	0.026	0.033	0.033
	5.0	0.015	0.008	0.009	0.010	0.022	0.022
	10.0	0.008	0.004	0.004	0.005	0.012	0.012

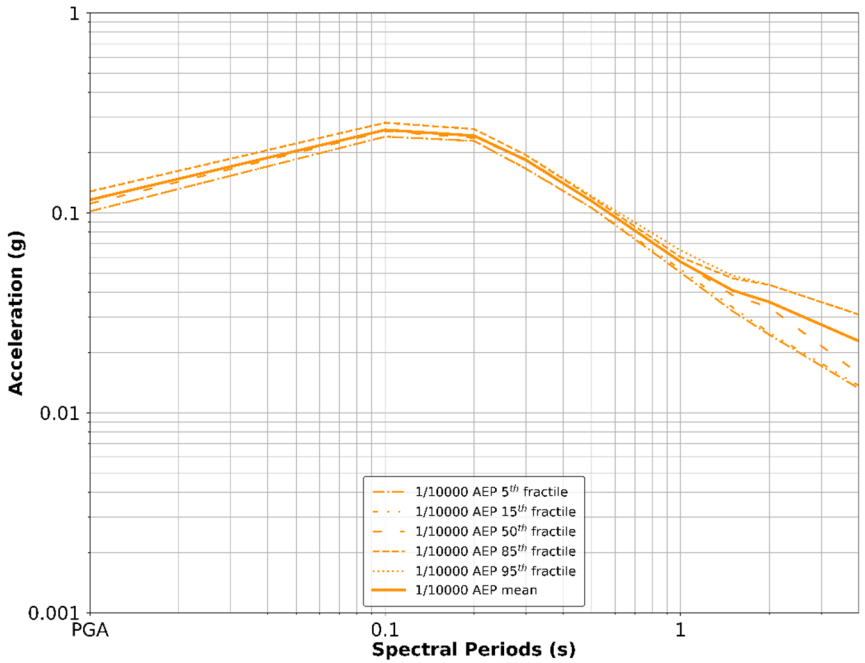

Figure 12: 1/10,000 AEP Mean Uniform Hazard Acceleration Response Spectra and Selected Fractiles

Table 13: Uniform Hazard Acceleration Response Spectral Ordinates for 1/10,000 AEP with selected Fractiles

Spectral period (s)		Acceleration (g)					
		Mean	Fractile				
			5th	15th	50th (median)	85th	95th
1/10,000 AEP	PGA	0.116	0.102	0.102	0.111	0.128	0.128
	0.1	0.260	0.240	0.240	0.256	0.282	0.282
	0.2	0.243	0.229	0.229	0.237	0.262	0.262
	0.3	0.183	0.166	0.166	0.186	0.194	0.194
	0.5	0.114	0.106	0.106	0.115	0.119	0.121
	1.0	0.057	0.050	0.052	0.057	0.060	0.065
	1.5	0.041	0.032	0.034	0.039	0.047	0.048
	2.0	0.036	0.025	0.025	0.034	0.044	0.044
	5.0	0.020	0.011	0.011	0.012	0.028	0.028
	10.0	0.011	0.005	0.005	0.006	0.015	0.015

7.3 Magnitude-distance Deaggregation

Magnitude-distance deaggregation allows identification of earthquake sources that contribute to the total mean hazard at a specified spectral acceleration and AEP. Epsilon (described in Section 3.6) is a parameter of ground-motion uncertainty that further improves the diagnostic capability of magnitude-distance hazard deaggregation. Seismic hazard assessments are concerned with probabilities of exceedance of given ground motions, so the distribution of epsilon greater than zero is important. The magnitude-distance deaggregations are color-coded by epsilon in one-epsilon bins. Selected magnitude-distance deaggregations are plotted in the following figures:

- Figure 13 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/2,475 AEP. This figure represents relative contributions to the total hazard.
- Figure 14 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/10,000 AEP. This figure represents relative contributions to the total hazard.
- Figure 15 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/2,475 AEP. This figure represents relative contribution of the crustal sources located within 400 km of the site.
- Figure 16 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/10,000 AEP. This figure represents relative contribution of the crustal sources located within 400 km of the site.
- Figure 17 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/2,475 AEP. This figure represents relative contribution of the subduction (i.e., interface and in-slab) sources located within 1000 km of the site.
- Figure 18 shows the magnitude-distance deaggregation results of the mean spectral acceleration at PGA, 0.5 s, 1.0 s, and 1.5 s spectral periods for 1/10,000 AEP. This figure represents relative contribution of the subduction (i.e., interface and in-slab) sources located within 1000 km of the site.

The mean and mode of the magnitude-distance joint probability mass distribution is often used for earthquake acceleration time history development. Table 14, Table 15 and Table 16 list the mean, median, and mode of the magnitude, distance, and epsilon values, for the 1/2,475 and 1/10,000 AEPs at PGA, and spectral periods of PGA, 0.5 s, 1.0 s, and 1.5 s, for the total hazard, crustal (within 400 km of the site), and subduction (within 1000 km of the site) sources, respectively.

These results indicate that at AEPs of 1/2,475 and 1/10,000 both crustal earthquakes and subduction interface earthquakes contribute to the total hazard at the Mount Polley TSF site. Subduction earthquakes are the dominant contributor to hazard at periods of about 1 s and longer, while the crustal earthquakes dominate the hazard contributions at the short periods, including at PGA. Appendix A describes how these results were used to develop a representative suite of acceleration time histories suitable for deformation analysis.

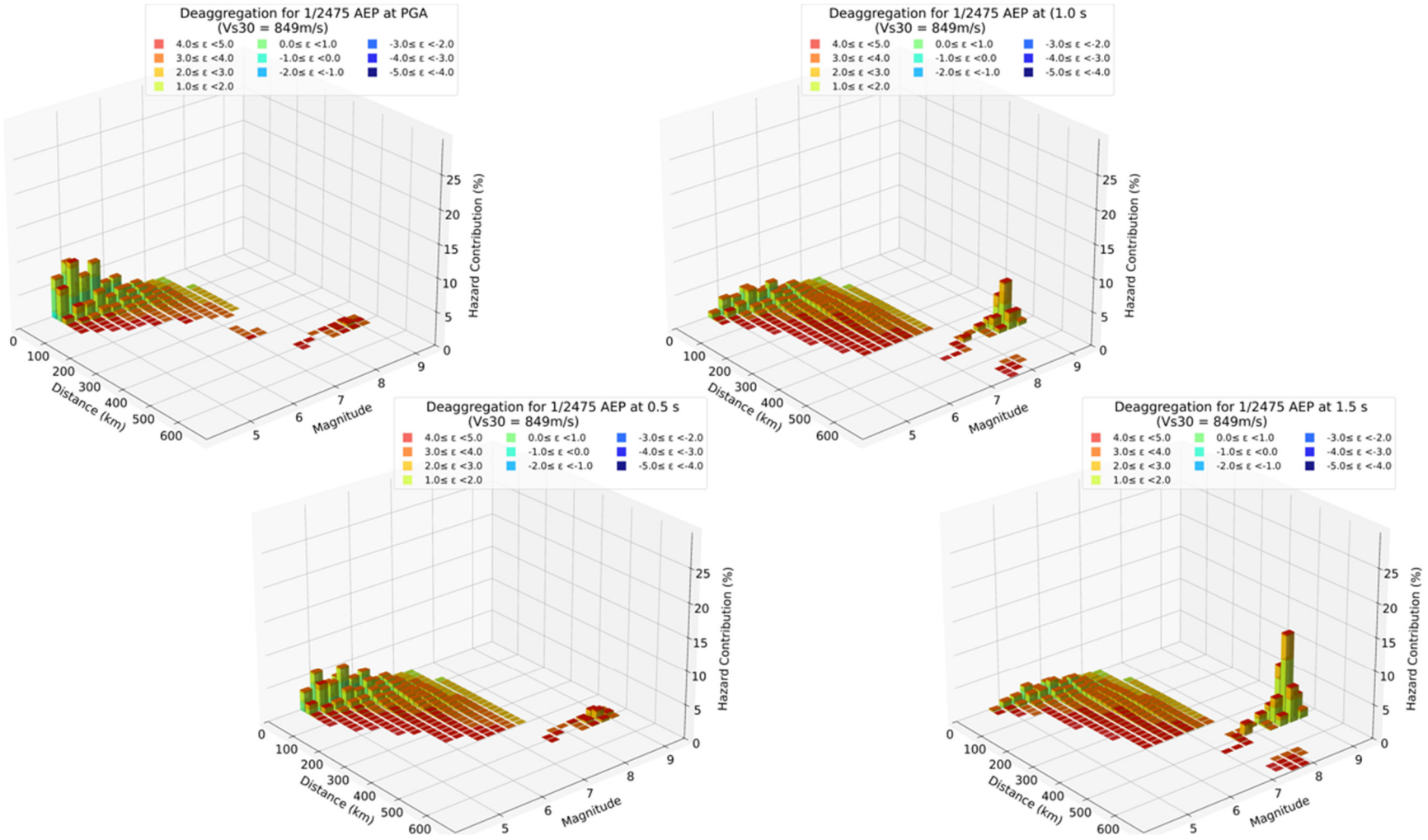

Figure 13: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/2,475 AEP from full source model, color coded by epsilon in one-epsilon intervals

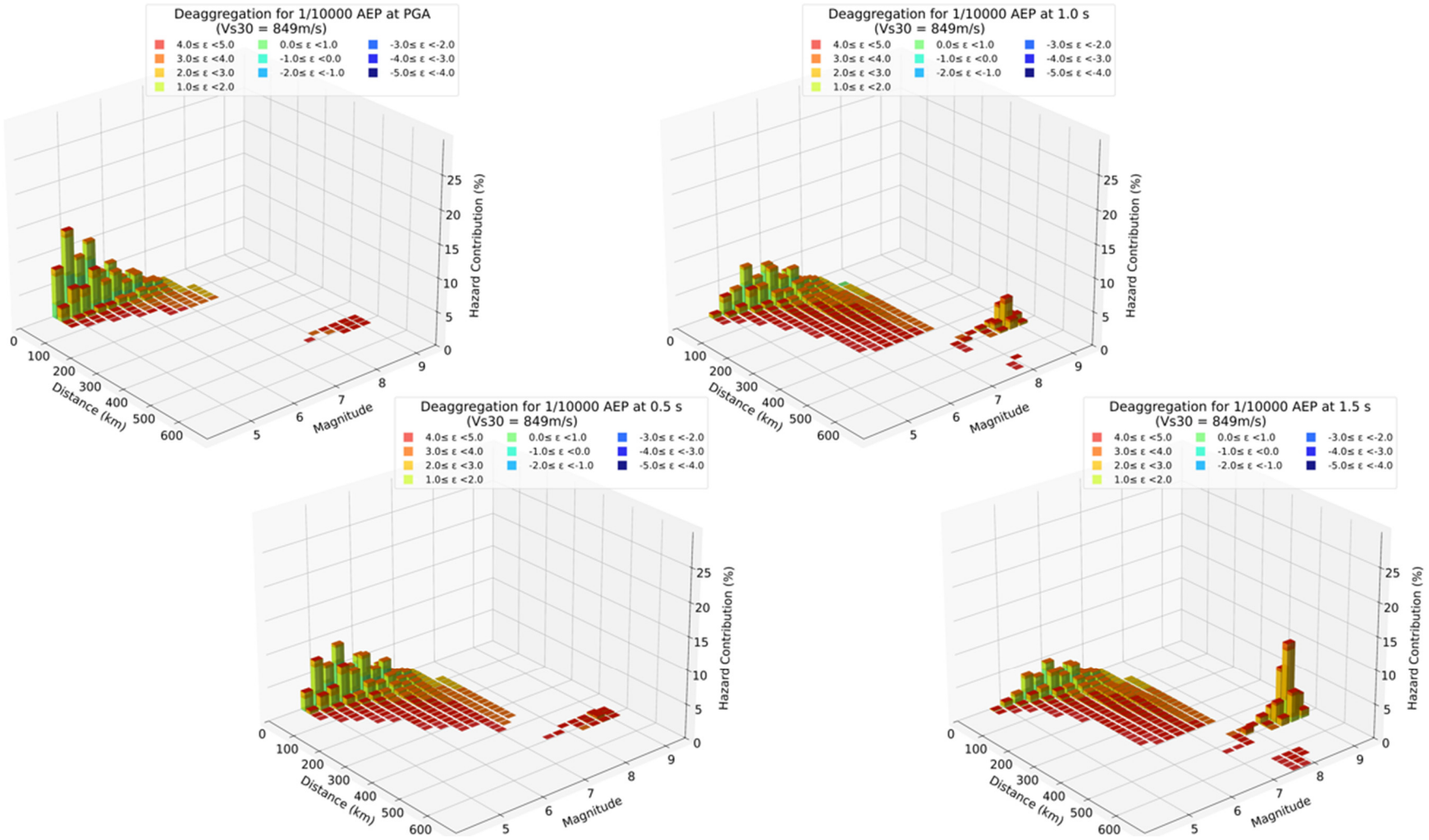

Figure 14: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/10,000 AEP from full source model, color coded by epsilon in one-epsilon intervals

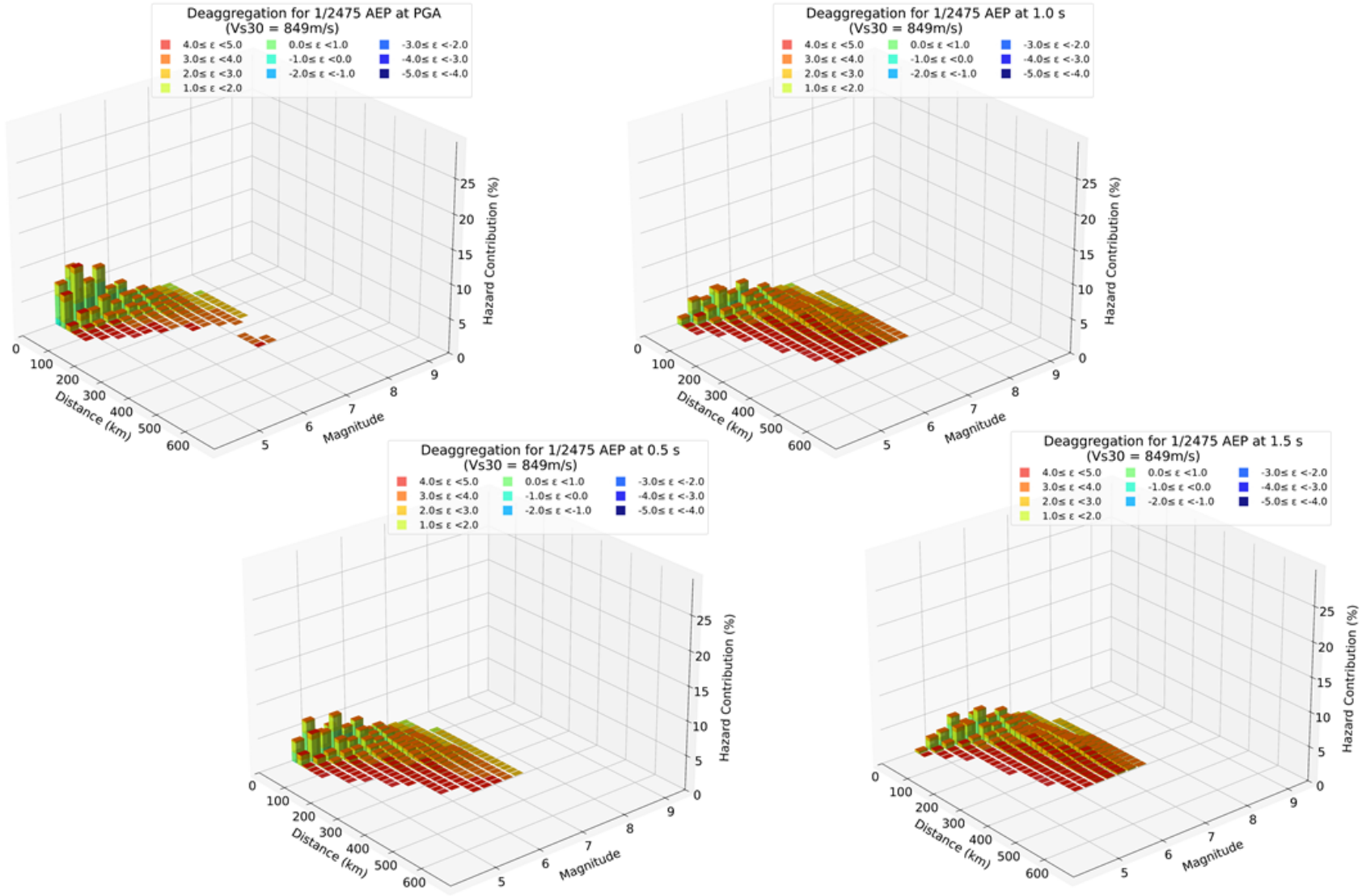

Figure 15: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/2,475 AEP from crustal sources, color coded by epsilon in one-epsilon intervals

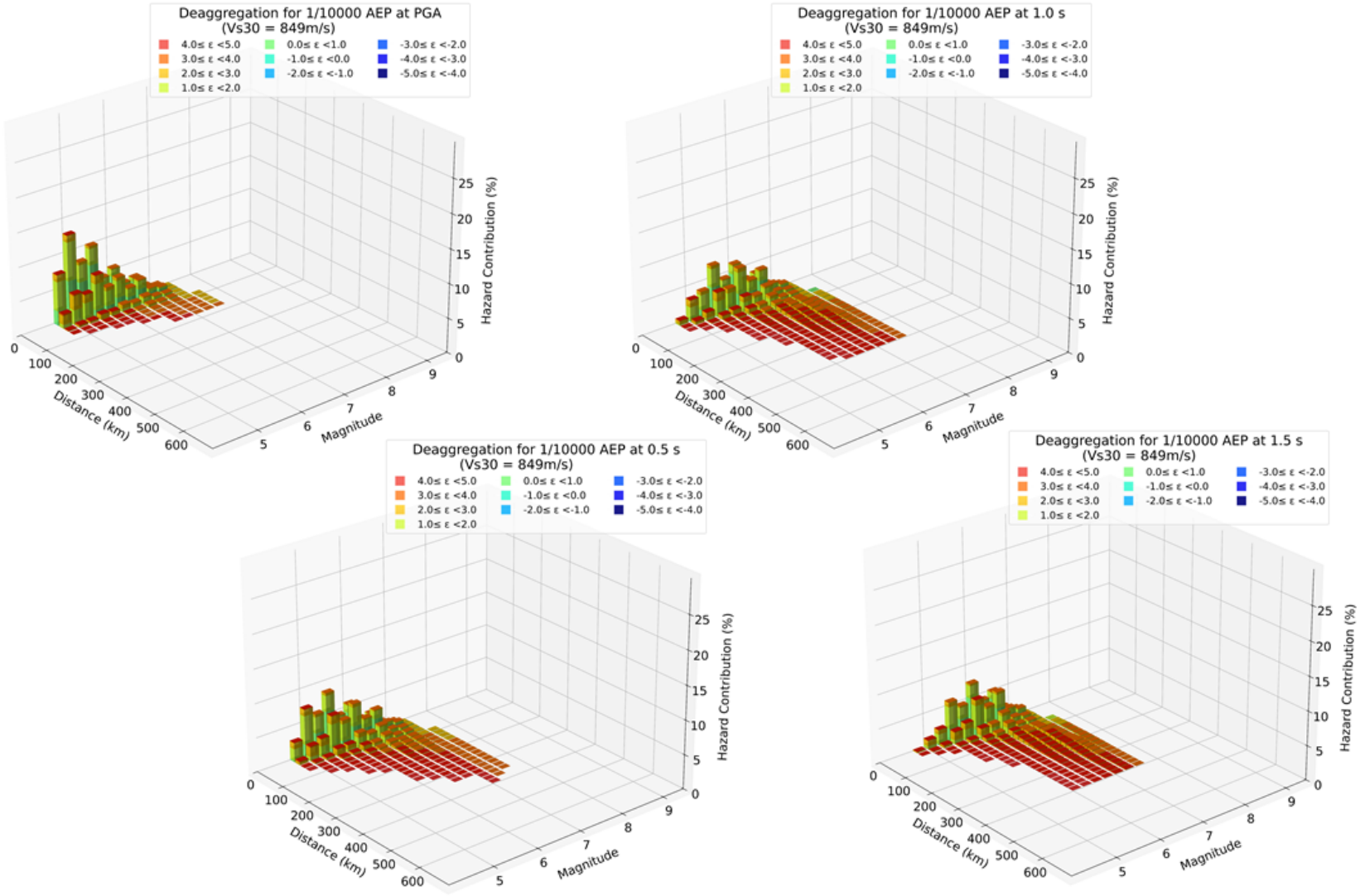

Figure 16: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/10,000 AEP from crustal sources, color coded by epsilon in one-epsilon intervals

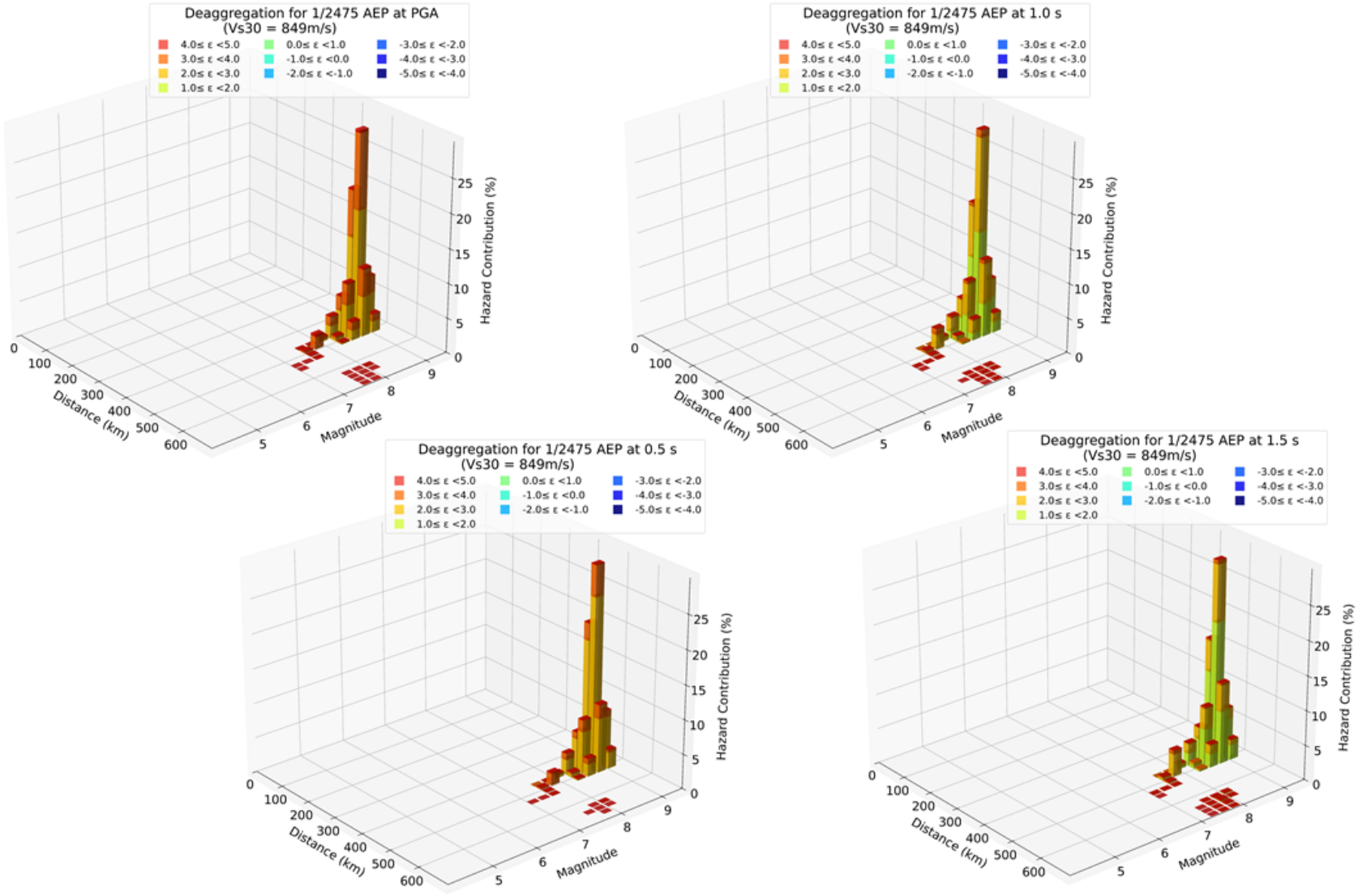

Figure 17: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/2,475 AEP from subduction sources, color coded by epsilon in one-epsilon intervals

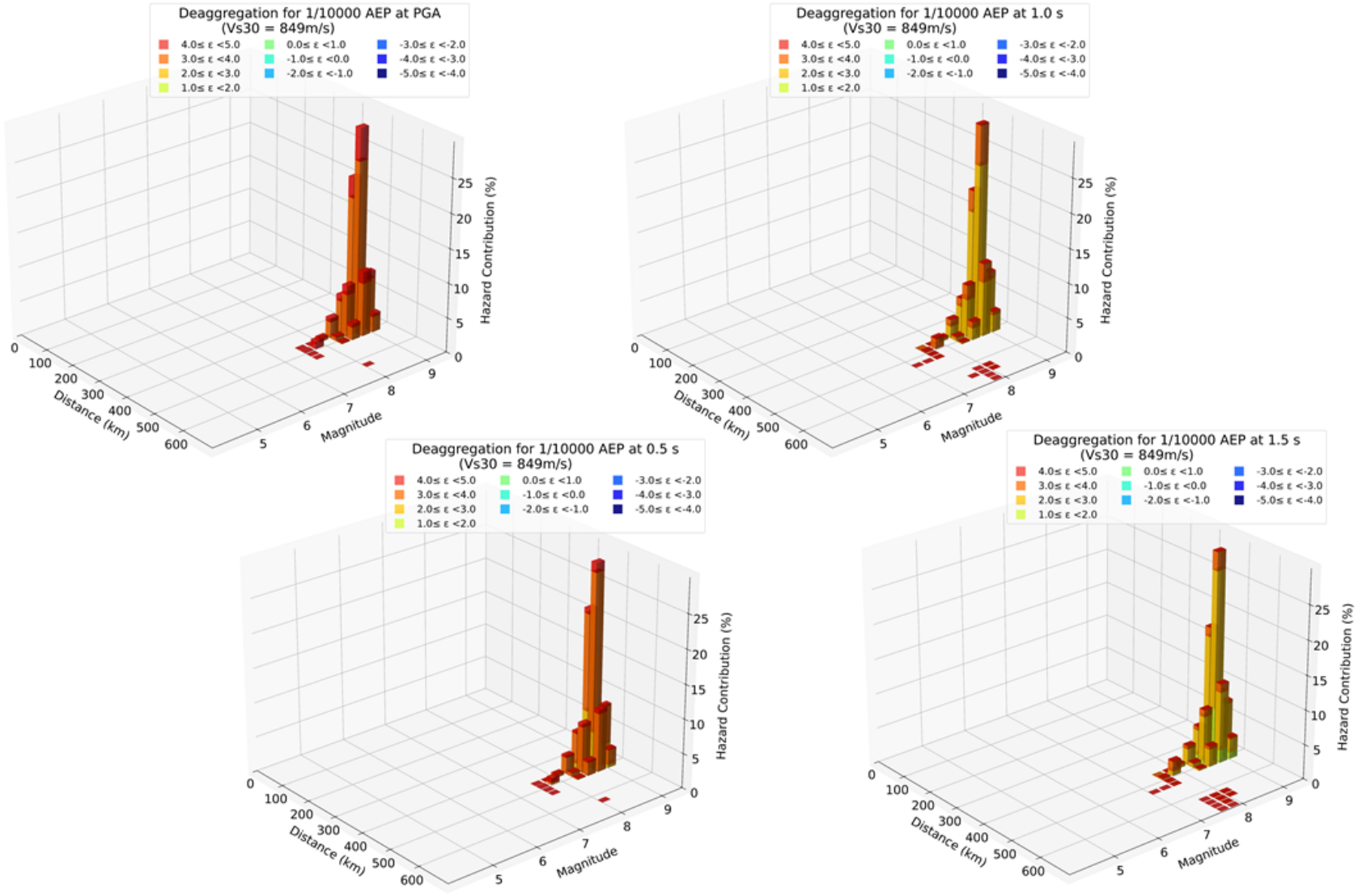

Figure 18: Magnitude-distance deaggregation of the mean PGA (upper left), 0.5 s (lower left), 1.0 s (upper right) and 1.5 s (lower right) spectral periods for the 1/10,000 AEP from subduction sources, color coded by epsilon in one-epsilon intervals

Table 14: Average Distance, Magnitude, and Epsilon for Magnitude-distance Deaggregation for the Total Hazard

AEP	Spectral period (s)	Distance (km)			Magnitude (M_w)			Epsilon[1]		
		Mean	Median	Mode	Mean	Median	Mode	Mean	Median	Mode
1/2,475	PGA	40 - 60	20 - 40	20 - 40	5.5 - 5.75	5.5 - 5.75	5.0 - 5.25	0.7	0.5	0.5
	0.5	80 - 100	40 - 60	0 - 20	6.0 - 6.25	6.0 - 6.25	5.0 - 5.25	1.0	0.5	0.5
	1.0	180 - 200	100 - 120	480 - 500	6.75 - 7.0	6.5 - 6.75	8.75 - 9.0	1.7	1.5	1.5
	1.5	280 - 300	260 - 280	480 - 500	7.5 - 7.75	7.0 - 7.25	8.75 - 9.0	2.4	2.5	2.5
1/10,000	PGA	20 - 40	0 - 20	0 - 20	5.5 - 5.75	5.5 - 5.75	5.0 - 5.25	0.6	0.5	0.5
	0.5	20 – 40	20 – 40	0 – 20	6.0 – 6.25	6.0 – 6.25	5.5 – 5.75	1.1	1.5	1.5
	1.0	100 – 120	20 – 40	480 – 500	6.5 – 6.75	6.25 – 6.5	8.75 – 9.0	1.0	0.5	0.5
	1.5	220 - 240	100 - 120	480 - 500	7.25 - 7.5	6.75 - 7.0	8.75 - 9.0	2.2	2.5	2.5

Notes:

1. Epsilon values are based on the range of values for the median-distance and median-magnitude.

Table 15: Average Distance, Magnitude, and Epsilon for Magnitude-distance Deaggregation of Crustal Seismic Sources

AEP	Spectral period (s)	Distance (km)			Magnitude (M_w)			Epsilon[1]		
		Mean	Median	Mode	Mean	Median	Mode	Mean	Median	Mode
1/2,475	PGA	20 - 40	0 - 20	0 - 20	5.5 - 5.75	5.5 - 5.75	5.0 - 5.25	0.6	0.5	0.5
	0.5	60 – 80	40 – 60	0 – 20	6.0 – 6.25	6.0 – 6.25	5.0 – 5.25	1.0	0.5	0.5
	1.0	80 – 100	60 – 80	20 – 40	6.25 – 6.5	6.25 – 6.5	6.0 – 6.25	1.3	1.5	1.5
	1.5	100 – 120	60 – 80	20 – 40	6.5 – 6.75	6.5 – 6.75	6.0 – 6.25	1.3	1.5	1.5
1/10,000	PGA	40 – 60	20 – 40	0 – 20	6.25 – 6.5	6.25 – 6.5	5.5 – 5.75	1.0	0.5	0.5
	0.5	20 – 40	20 – 40	0 – 20	6.0 – 6.25	6.0 – 6.25	5.5 – 5.75	1.1	1.5	1.5
	1.0	40 – 60	20 – 40	0 – 20	6.25 – 6.5	6.25 – 6.5	5.5 – 5.75	1.0	0.5	0.5
	1.5	60 – 80	20 - 40	0 – 20	6.25 – 6.5	6.5 – 6.75	6.0 – 6.25	1.0	0.5	0.5

Notes:

1. Epsilon values are based on the range of values for the median-distance and median-magnitude.

Table 16: Average Distance, Magnitude, and Epsilon for Magnitude-distance Deaggregation of Subduction Seismic Sources

AEP	Spectral period (s)	Distance (km)			Magnitude (M_w)			Epsilon[1]		
		Mean	Median	Mode	Mean	Median	Mode	Mean	Median	Mode
1/2,475	PGA	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	2.9	2.5	2.5
	0.5	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	2.7	2.5	2.5
	1.0	480 - 500	480 - 500	480 - 500	8.75 - 9.0	8.75 - 9.0	8.75 - 9.0	2.0	1.5	1.5
	1.5	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	1.8	1.5	1.5
1/10,000	PGA	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	3.7	3.5	3.5
	0.5	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	3.4	3.5	3.5
	1.0	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	2.7	2.5	2.5
	1.5	480 – 500	480 – 500	480 – 500	8.75 – 9.0	8.75 – 9.0	8.75 – 9.0	2.3	2.5	2.5

Notes:

1. Epsilon values are based on the range of values for the median-distance and median-magnitude.

8.0 SEISMIC HAZARD ANALYSIS: DISCUSSION AND RECOMMENDATIONS

In this section:

- The results of this site-specific seismic hazard assessment are compared to results from the CanadaSHM6
- Earthquake acceleration time history development.

8.1 Comparison of Seismic Hazard Assessment Results to CanadaSHM6

The CanadaSHM6 seismic hazard assessment is not site-specific because it was developed for a national seismic source model and for a series of fixed V_{S30} values. As part of the validation for this assessment (Section 5.3) the CanadaSHM6 results are compared to the results of this assessment at selected AEPs. The results of this site-specific assessment are slightly lower at spectral periods below 2.0 s and slightly higher at spectral periods above 2.0 s. These changes are attributed to the different ground motion model selection and weighting, and V_{S30} used in this assessment.

8.3 Earthquake Acceleration Time History Development

A principal purpose for the site-specific seismic hazard assessment reported here is to support the development of earthquake acceleration time histories. Appendix A presents the data, methods, and results from the development of a suite of 11 two-horizontal-component earthquake acceleration time histories for the Mount Polley TSF site. The 22 EATHs were developed for the site-specific, mean horizontal acceleration response spectrum with an AEP of 1/2,475 years. Electronic files with the developed EATHs were transmitted separately.

9.0 CLOSING

WSP USA appreciates the opportunity to provide WSP Canada with site-specific earthquake hazard assessment for the Mount Polley TSF site. We have applied the best-available science and our understanding of the generally accepted practice in seismic hazard assessment. If you have any questions about the content or use of this report, please contact the undersigned.

Signature Page

WSP USA Inc.



Alan Hull PhD, CEG (CA)
Senior Technical Director

https://wsponlinenam-my.sharepoint.com/personal/tonya_peeler_wsp_com/documents/31404975.000-gal-rev0- mount polley_01022023.docx

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APPENDIX A

Earthquake Acceleration Time Histories

TECHNICAL MEMORANDUM

DATE February 1, 2023 **Project No.** 31404975.000

TO Andres Torres
WSP Canada Inc.

CC Alan Hull

FROM Mahir Badanagki and Feng Li **EMAIL mahir.badanagki@wsp.com**

EARTHQUAKE ACCELERATION TIME HISTORY DEVELOPMENT FOR MOUNT POLLEY MINE, BRITISH COLUMBIA, CANADA

This technical memorandum (TM) presents a suite of 11 two-horizontal-component earthquake acceleration time histories (EATHs, a.k.a. motions) developed by WSP USA Inc. (WSP USA) for the Mount Polley Mine TSF site in British Columbia, Canada. The 22 EATHs were developed for the target spectrum—the site-specific, mean horizontal acceleration response spectrum with an annual exceedance probability (AEP) of 1/2,475 years as presented in Golder (2022). Electronic files with the developed EATHs were transmitted separately.

1.0 INTRODUCTION

WSP USA developed 11, two-horizontal-component EATHs to support ongoing engineering analyses for the Mount Polley Mine site. WSP USA used the amplitude scaling method to develop the EATHs. The target spectrum is the uniform hazard response spectrum (UHRS) with a 1/2,475 AEP as presented in Golder (2022). The key steps to develop the EATHs were:

- Select seed EATHs that have similar spectral shape to the target spectrum.
- Apply the amplitude scaling method to adjust seed records to match the target spectrum.
- Compare the geometric-mean spectrum of the scaled EATHs to the target spectrum.
- Select a suite of eleven, two-component EATHs suitable for subsequent analyses at the Mount Polley Mine site.
- Prepare this TM to document the approach, procedures, and results.

Figure 1 shows the site-specific mean acceleration response spectrum (i.e., the target spectrum) for an AEP of 1/2,475 as presented in Golder (2022).

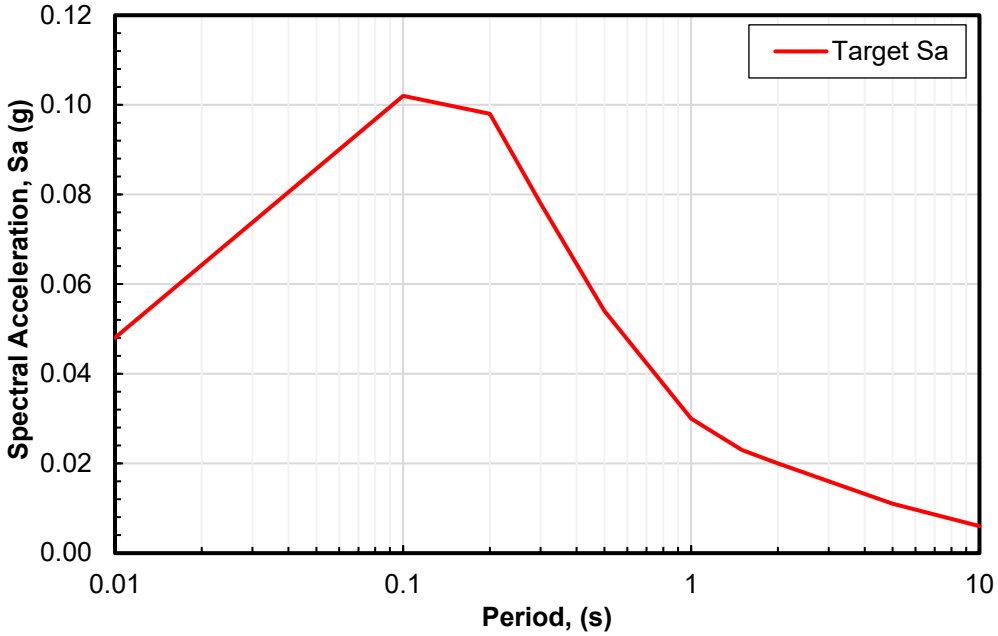

Figure 1: Site-Specific Target Acceleration Response Spectrum for an Annual Exceedance Probability (AEP) of 1/2,475 for Mt Polley TSF Site

2.0 EARTHQUAKE ACCELERATION TIME HISTORY DEVELOPMENT

The following sections describe the EATH selection criteria, process to scale the records, and the resulting EATHs.

2.1 Selection Criteria

WSP USA selected seed EATHs from the Pacific Earthquake Engineering Research Center (PEER) Next Generation Attenuation Phase 2 Project (NGA-West2) strong-motion database. Typical time history selection criteria included earthquake magnitude, source-to-site distance, style of faulting, rupture directivity, and near-surface ground condition at the recording station.

Key EATH selection criteria were:

- Earthquake records should reflect both the near-field moderate-magnitude crustal earthquakes and the far-field subduction interface earthquakes as indicated by the deaggregation analysis. WSP USA judged that eight two-component records from near-field crustal earthquakes and three two-component subduction earthquakes provided a reasonable representation of the 1/2,475 AEP hazard sources.
- Source earthquakes are of moment magnitude (**M**) 5.5 to 6.5 centered at about **M**6.0 that is the preferred modal magnitude in Golder (2022) for crustal motions. The magnitude criterion was relaxed to **M**5.5 to include more seed EATHs. For subduction interface motions, source earthquakes are of **M**8.0 to **M**9.5 centered at **M**9.0.

- Seed EATHs were recorded at stations less than 50 km for the source earthquake for crustal motions and less than 500 km for subduction interface motions.
- Seed EATHs recorded at stations with a V_{S30} (i.e., the time-averaged shear-wave velocity for the top 30 m of earth materials below the ground or reference surface) from 360 to 1500 m/s assuming the site V_{S30} of interest is 849 m/s.
- The shape of the acceleration response spectra of the seed EATHs agrees well with the shape of the target spectrum within the period range of interest of 0.5 to 1.5 seconds, which covers the estimated fundamental period of 1 second for the facility of interest.
- Scaling factors for the seed EATHs are preferred to be between 0.25 and 4.
- No more than two seed EATHs are from the same earthquake.
- No EATHs with velocity pulses were included because the site is more than 10 km away from a known seismically active fault.
- The style-of-faulting criterion was relaxed to include all fault rupture styles.

2.2 Results

The 11 EATHs were selected that meet the selection criteria described above. Figures 2 and 3 show the geometric-mean acceleration response spectrum of the selected and scaled EATHs for crustal and subduction interface motions, respectively, compared with the target response spectrum and 90% and 130% of the target (i.e., -10% and +30% of the target). Typical practice in earthquake geotechnical engineering requires the geometric-mean response spectrum to be within about 90% to 130% of the target response spectrum within the period range of interest (Figure 2).

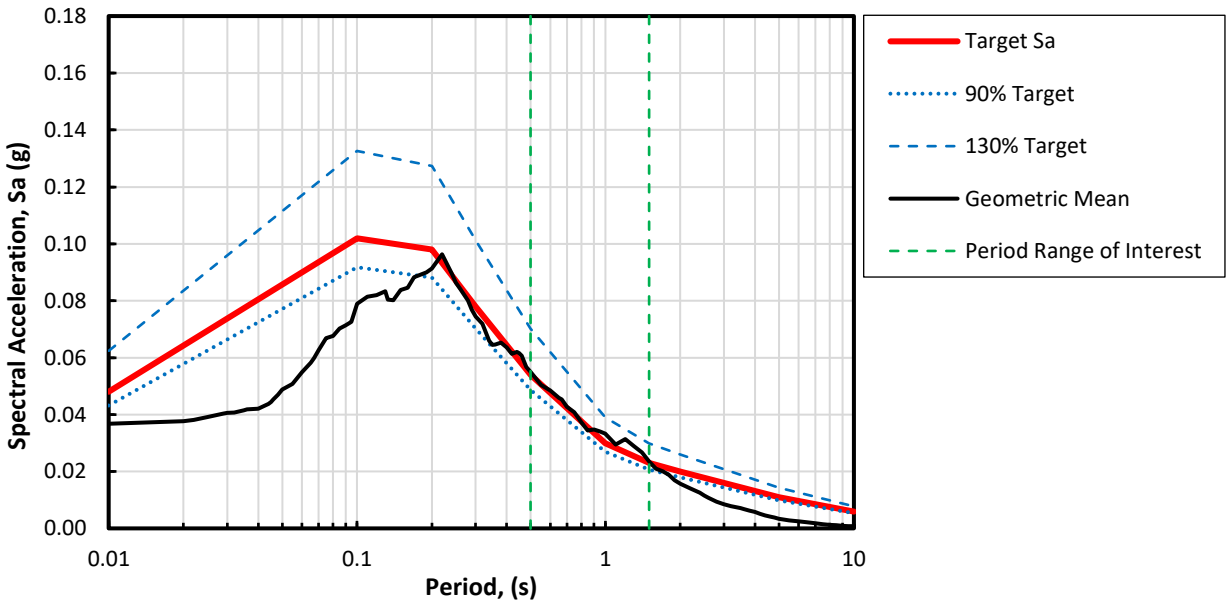

Figure 2: Target Acceleration Response Spectrum and the Geometric-Mean Response Spectrum of Selected and Scaled Crustal Earthquake Acceleration Time Histories

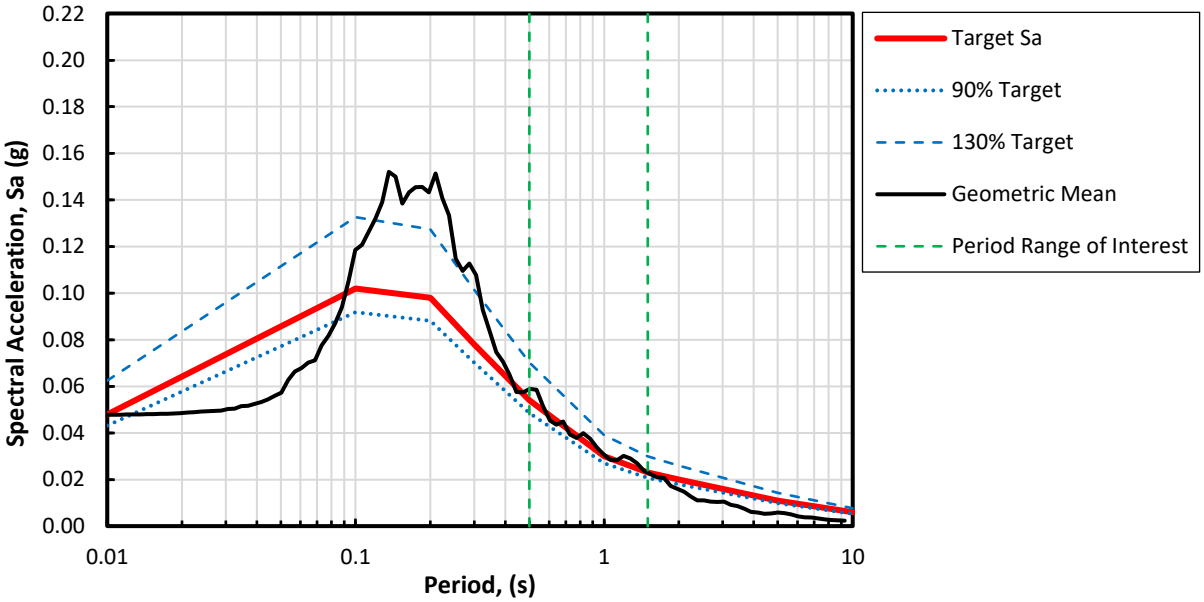

Figure 3: Target Acceleration Response Spectrum and the Geometric-Mean Response Spectrum of Selected and Scaled Interface Earthquake Acceleration Time Histories

Figures 4 and 5 show the response spectra of individual scaled EATHs compared with the target spectrum for both crustal and subduction interface motions. Figures 4 and 5 show that the individual response spectra agree reasonably well with the target. Table 1 lists key parameters of the selected and scaled EATHs.

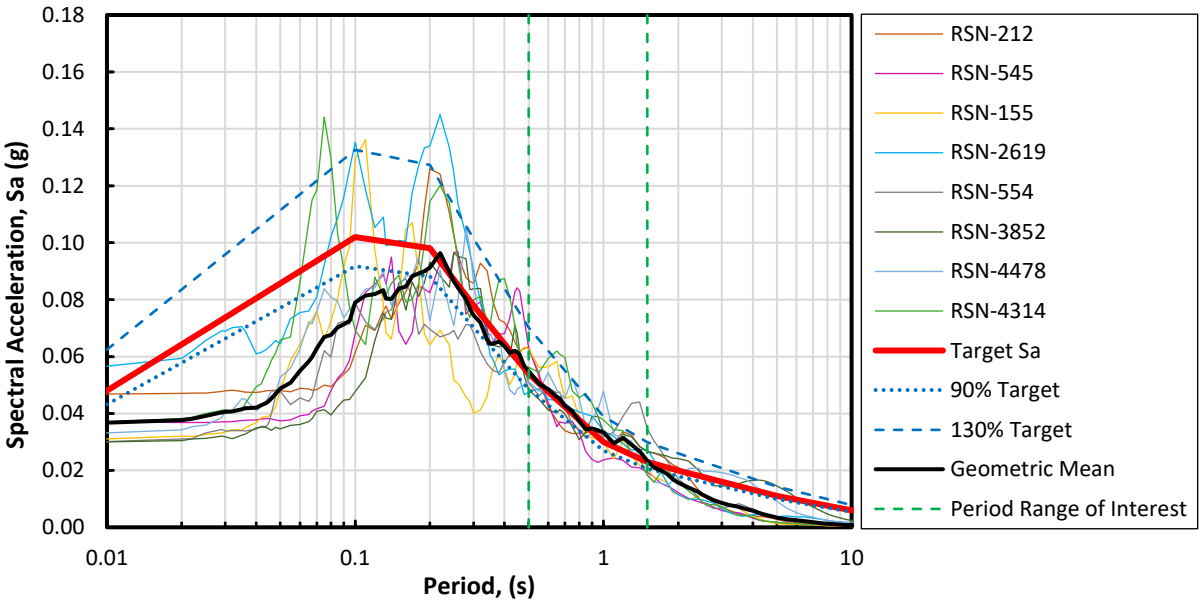

Figure 4: Target Acceleration Response Spectrum and Response Spectra of Individual Crustal Earthquake Acceleration Time Histories

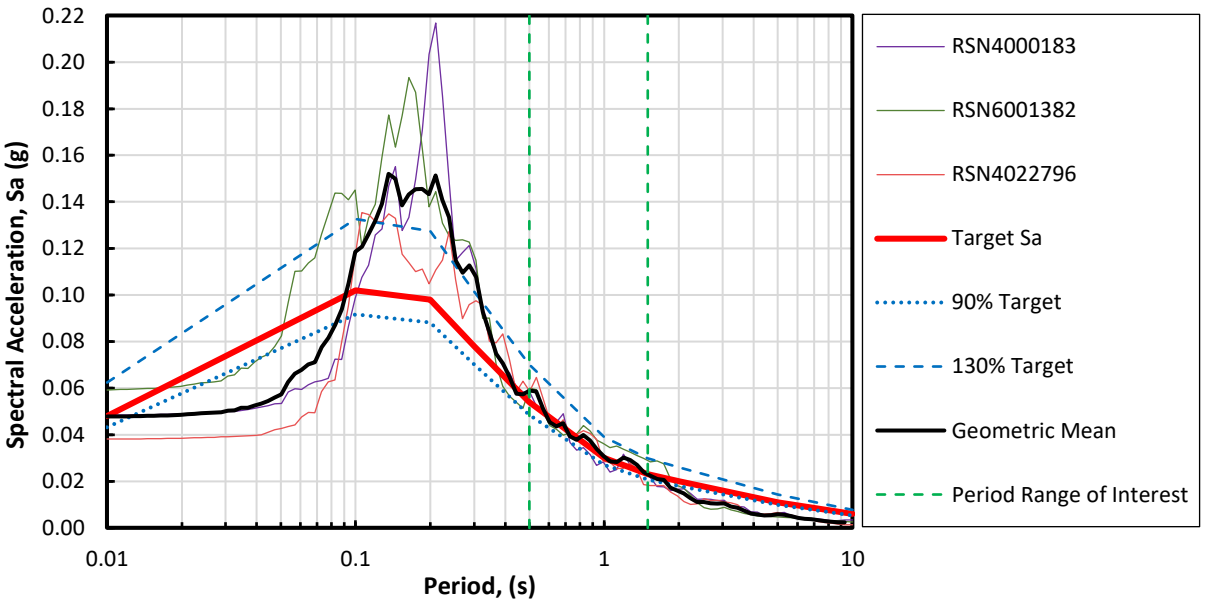

Figure 5: Target Acceleration Response Spectrum and Response Spectra of Individual Subduction Interface Earthquake Acceleration Time Histories

Table 1: Key Parameters of Selected and Scaled Earthquake Acceleration Time Histories

Record Sequence Number (RSN)[a]	Moment Magnitude (M)	Earthquake Name	Year	Station Name	Scale Factor	R_{rup}[b] (km)	R_{jb}[c] (km)	V_{S30}[d] (m/s)	Fault Type	Component	D_{5-75} (s)[e]	D_{5-95} (s)[f]	AI[g] (m/s)	CAV[h] (m/s)
155	5.90	Norcia, Italy	1979	Bevagna	1.10	31	31	401	Normal	NS	10.5	14.6	0.018	1.1
										EW	9.2	14.9	0.013	1.0
212	5.80	Livermore, USA	1980	Del Valle Dam (Toe)	0.25	25	24	403	Strike slip	156	4.8	12.1	0.006	0.6
										246	2.1	7.3	0.013	0.8
357	6.36	Coalinga, USA	1983	Parkfield-Stone Corral	0.30	34	33	565	Reverse	0	4.8	12.2	0.013	1.0
										90	5.4	11.0	0.011	1.0
554	6.19	Chalfant Valley, USA	1986	Long Valley Dam	0.40	21	18	537	Strike slip	0	5.1	11.0	0.010	0.8
										90	7.9	11.9	0.010	0.9
2619	6.20	Chi-Chi, Taiwan	1999	TCU067	0.29	28	28	434	Reverse	N	5.3	6.6	0.009	0.7
										E	5.1	7.1	0.011	0.7
3852	6.20	Chi-Chi, Taiwan	1999	CHY006	0.27	25	25	438	Strike slip	N	5.9	16.7	0.014	1.2
										E	5.7	16.4	0.012	1.1
4314	5.60	Umbria, Italy	1984	Citta Di Castello-Regnano	0.77	41	41	388	Normal	0	7.1	17.7	0.017	1.1
										90	4.9	15.5	0.017	1.1
4478	6.30	L'Aquila, Italy	2009	Lab-Gran Sasso	1.47	11	11	547	Normal	E	7.1	11.5	0.013	1.1
										N	5.6	9.3	0.020	1.2
4000183	9.12	Tohoku	2011	4000183	0.66	104	-	634	Interface	EW	47.3	82.7	0.137	8.6
										NS	47.5	87.5	0.087	6.8
6001382	8.15	Iquique	2014	6000270	0.66	105	-	415	Interface	HLE	28.0	57.4	0.064	4.3
										HLN	21.8	49.5	0.085	4.7
4022796	8.29	Tokachi-oki	2003	4000330	0.70	191	-	386	Interface	EW2	34.7	61.9	0.071	5.3
										NS2	32.9	60.6	0.079	5.4

a. The record sequence number is assigned to individual records in the PEER NGA-West2 database.
b. R_{rup} = closest distance to fault rupture.
c. R_{jb} = closest horizontal distance to the surface projection of the surface fault rupture.
d. V_{s30} = the time-averaged shear-wave velocity for the upper 30 m of earth materials below the ground surface.
e. D_{5-75} = significant duration; the time between 5% and 75% of the cumulative Arias intensity.
f. D_{5-95} = significant duration; the time between 5% and 95% of the cumulative Arias intensity.
g. AI = Arias intensity
h. CAV = cumulative absolute velocity

Earthquake magnitude and source-to-site distance are causal parameters that are indirect measures of the source and travel path characteristics of the selected EATHs. Direct intensity measures, including significant durations (e.g., D_{5-75}), CAV, and AI were compared to predictions from the empirical relations listed in Tables 2 and 3. The predicted intensity measures were calculated for a representative earthquake scenario as listed in Tables 2 and 3. The target scenarios for crustal and subduction interface earthquakes were based on the deaggregation results for the period range of interest from Golder (2022). We used the mode magnitude and mode distance from the deaggregation results.

Table 2: Predicted Intensity Measures from Empirical Relations for a Selected Representative Crustal Earthquake Scenario

Empirical Relation Source	Intensity Measure	Median	16th Percentile	84th Percentile	Closet Distance to Rupture, R_{rup} (km)	Moment Magnitude (M)
Bommer et al. (2009)	D_{5-75}[a] (s)	4	3	7	20	6.0
	D_{5-95}[b] (s)	9	6	15		
Macedo et al. (2021)	CAV[c] (m/s)	1.0	0.7	1.4		
Abrahamson et al. (2016)	AI[d] (m/s)	0.023	0.016	0.034	-	

a. D_{5-75} = significant duration; the time between 5% and 75% of the total energy
b. D_{5-95} = significant duration; the time between 5% and 95% of the total energy
c. CAV = cumulative absolute velocity
d. AI = Arias intensity

Table 3: Predicted Intensity Measures Using Empirical Relations for a Selected Representative Subduction Interface Earthquake Scenario

Empirical Relation	Intensity Measure	Median	16th Percentile	84th Percentile	Closet Distance to Rupture, R_{rup} (km)	Moment Magnitude (M)
Macedo et al. (2019)	CAV[a] (m/s)	6.5	4.9	8.5	450	9
Liu and Macedo (2022)	AI[b] (m/s)	0.12	0.09	0.18		

a. CAV = cumulative absolute velocity
b. AI = Arias intensity

Figures 6 and 7 are comparisons of the intensity measures of the scaled EATHs to the predicted intensity measures. Comparison of the intensity measures of the scaled EATHs to the predicted intensity measures indicates that the D_{5-75}, D_{5-95}, CAV, and AI of the scaled EATHs are generally within the 16th and 84th percentile range of the empirically predicted values. Figures 6 and 7 show that the CAVs of the selected and scaled motions meet the target reasonably well, whereas the AIs are relatively less than the corresponding empirically based targets for both crustal and subduction interface records. It is almost always challenging to meet all four direct measures satisfactorily. For the Mt Polley TSF site, we consider that meeting the CAV criterion is more important than meeting the AI criterion. This is because CAV was observed to correlate better to durations than AI and can potentially be a more efficient intensity measure for predicting ground deformation that depends on the number of shaking cycles above some acceleration threshold (Macedo et al. 2021).

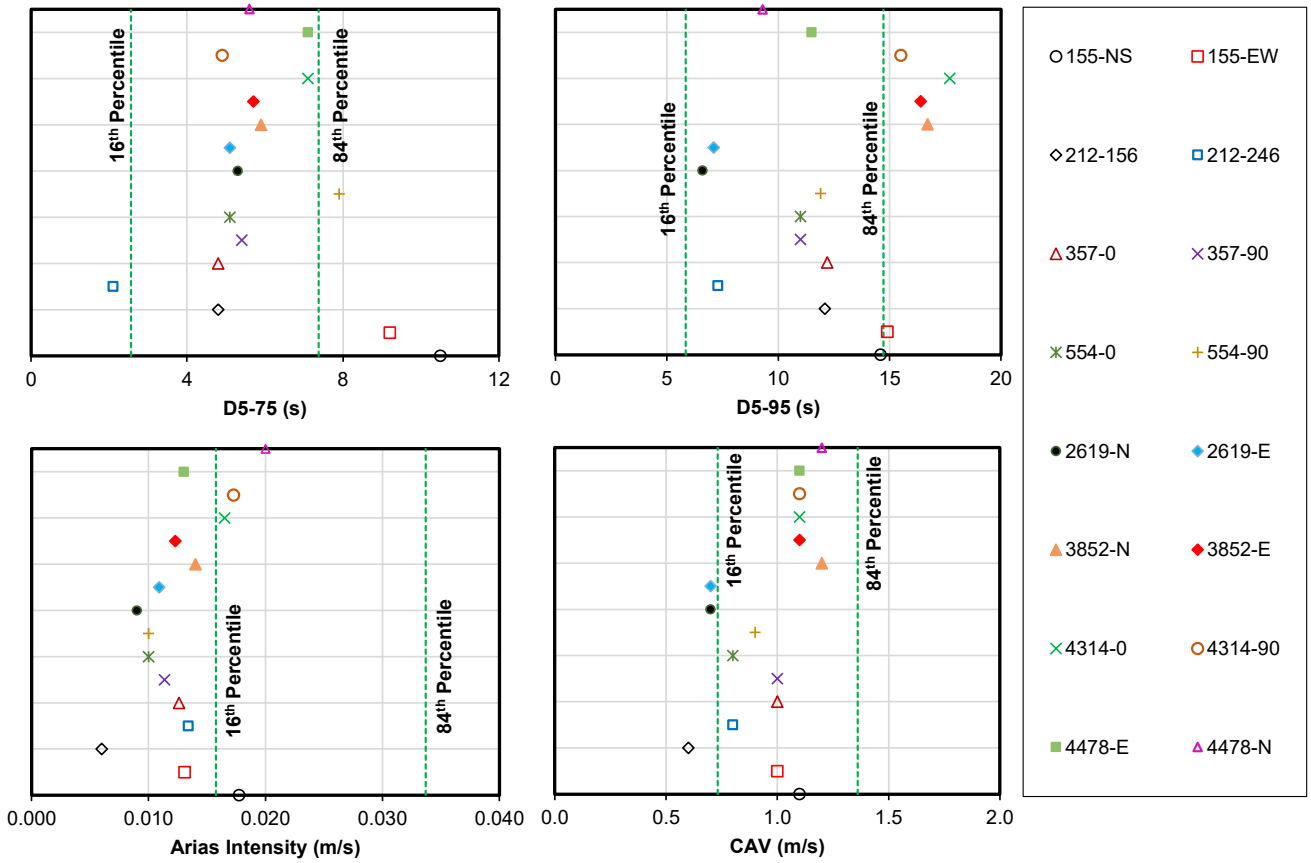

Figure 6: Comparison of Direct Intensity Measures of Selected Scaled Crustal Motions to Predictions Using Empirical Relations for the Mean 1/2,475 AEP Target Spectrum

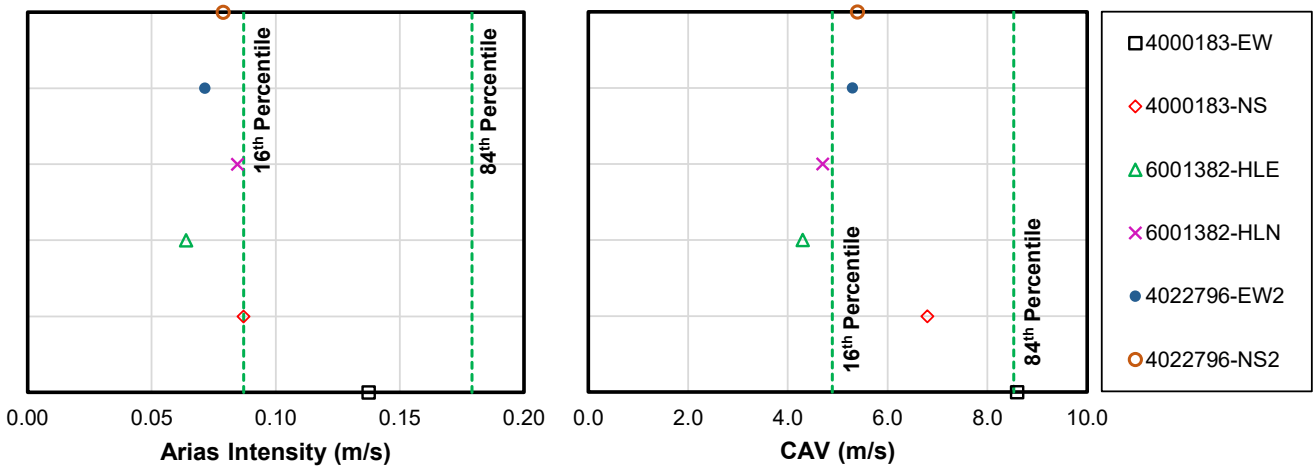

Figure 7: Comparison of Direct Intensity Measures of Selected Scaled Subduction Interface Motions to Predictions Using Empirical Relations for the Mean 1/2,475 AEP Target Spectrum

3.0 LIMITATIONS

Eleven two-horizontal-component EATHs were developed using amplitude scaling to support ongoing engineering analyses for the Mount Polley TSF site in British Columbia, Canada. These EATHs were developed specifically to address the conditions and requirements at the Mount Polley TSF site. They should not be used for other sites or projects without prior review and authorization by WSP USA.

The CAVs of the selected and scaled motions meet the target reasonably well, whereas the AIs are relatively lower than the corresponding target. For this project site, we assumed CAV is better related to the performance of the structure of interest, and hence consider the selected and scaled motions are acceptable. If subsequent analysis shows that this assumption is incorrect, then WSP USA recommends re-evaluation and reselection of the motions, if required.

WSP USA Inc.



Mahir Badanagki, PhD, EI
Associate Consultant, Geotechnical Engineer

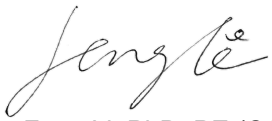

Feng Li, PhD, PE (CA)
Lead Consultant, Geotechnical Engineer

MB/FL

Attachments: Attachment A – Amplitude Scaling Results for the 22 Individual EATHs for Target Acceleration Response Spectrum

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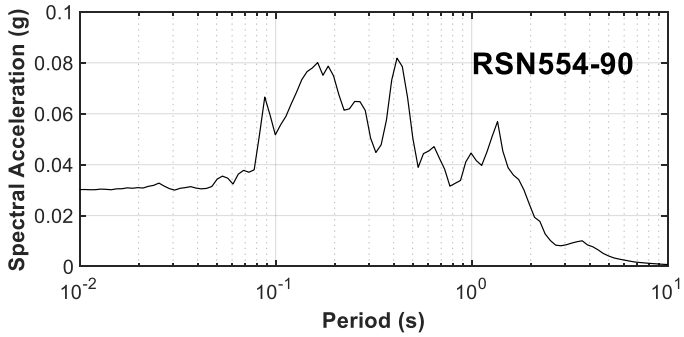

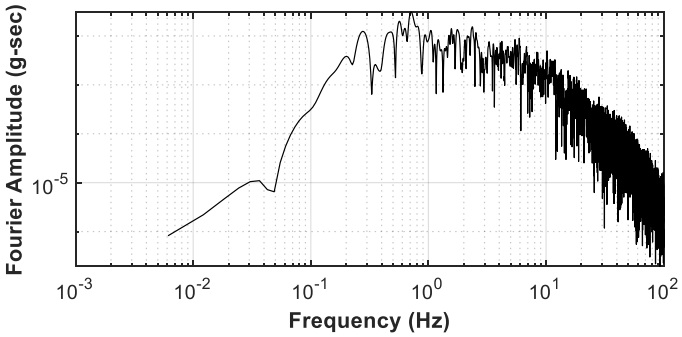

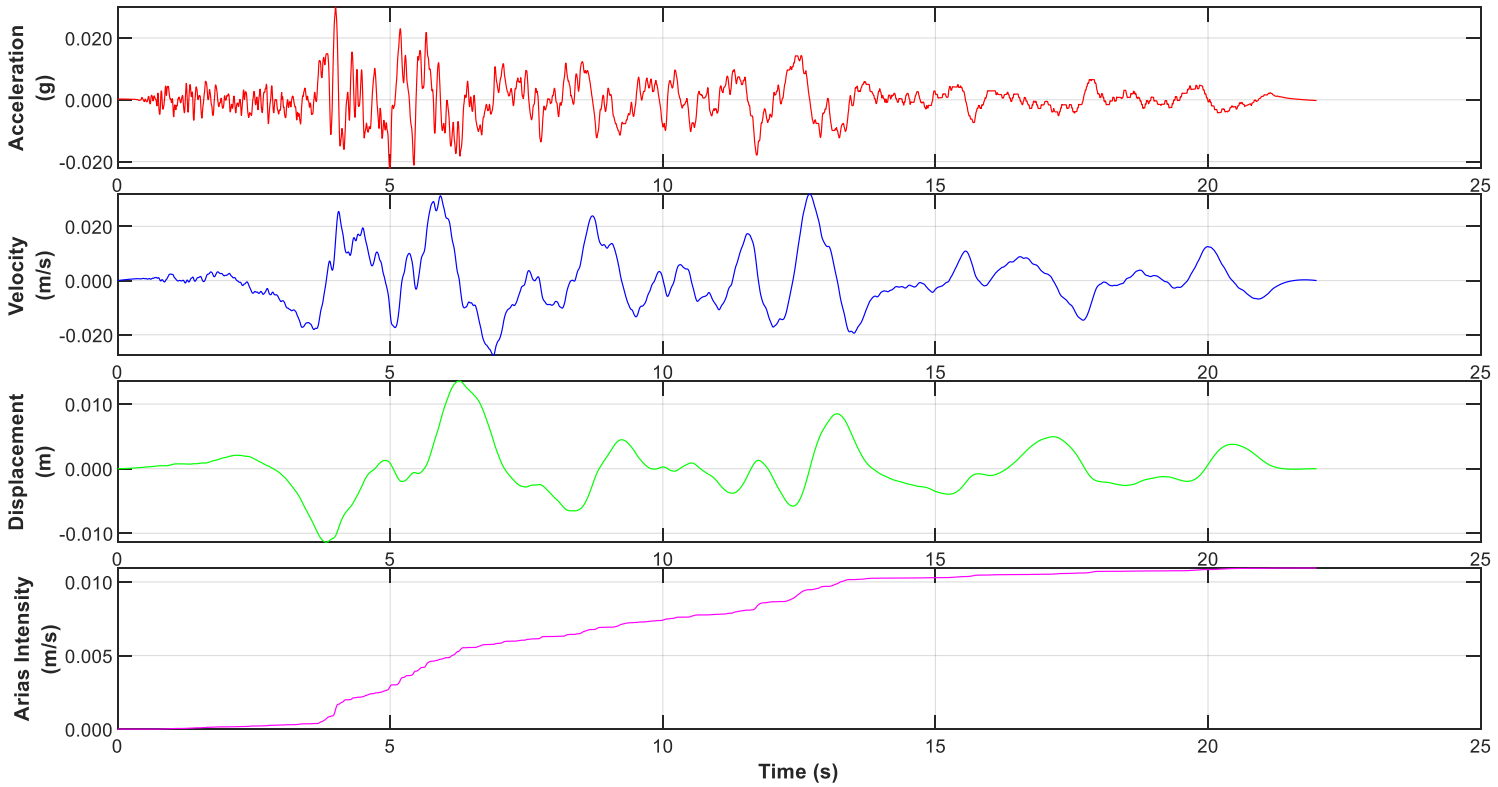

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN554-90

PROJECT No.	PHASE	Rev.	FIGURE
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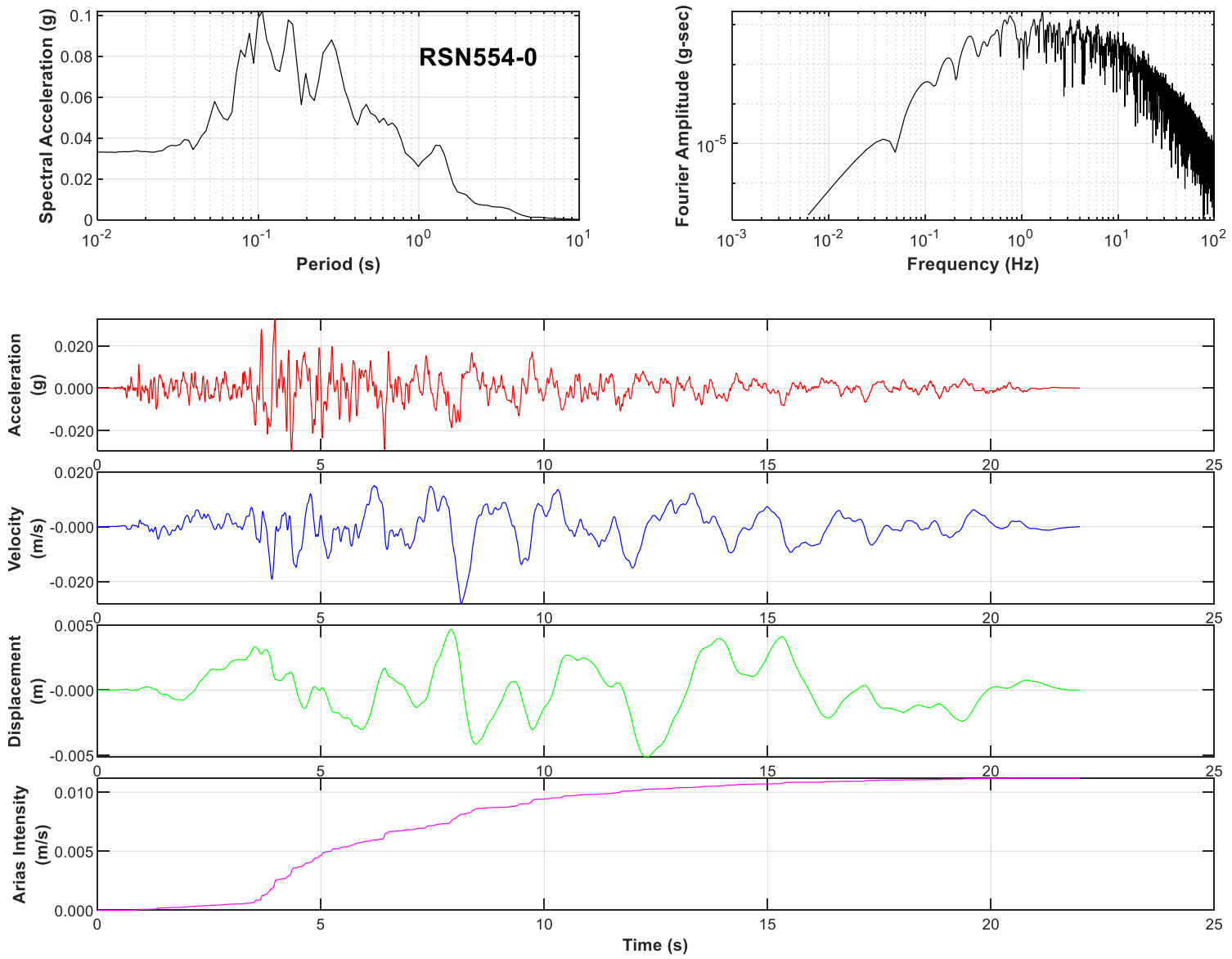

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN554-0

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
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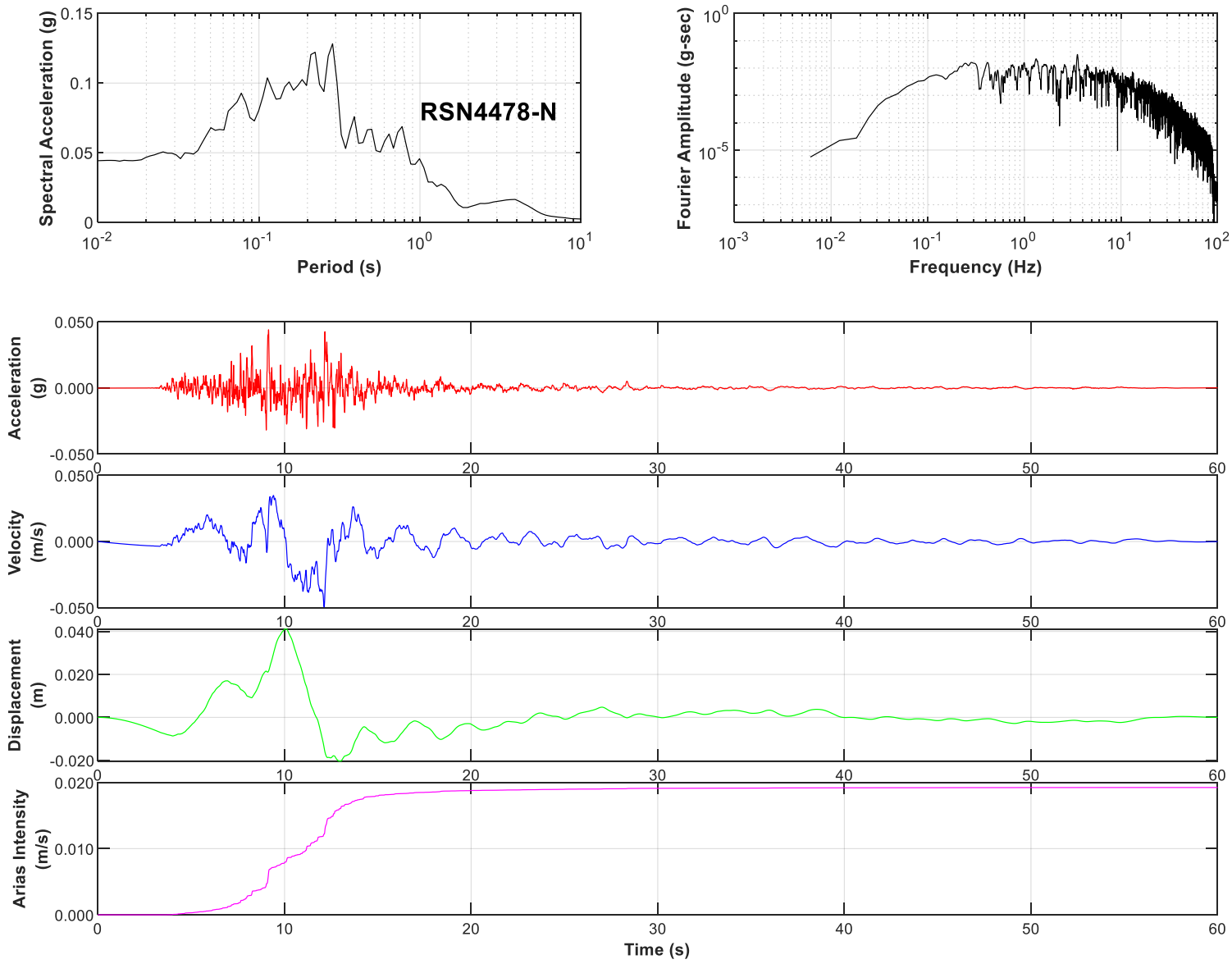

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4478-N

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
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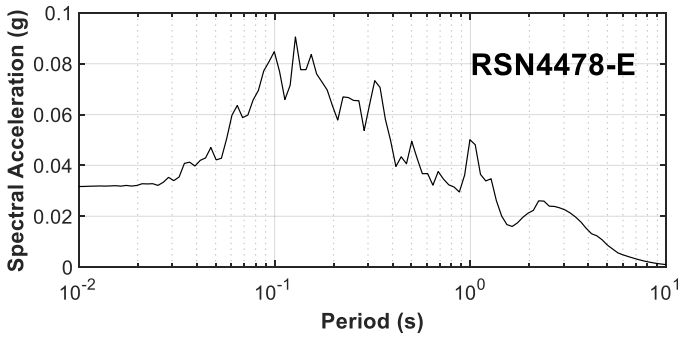

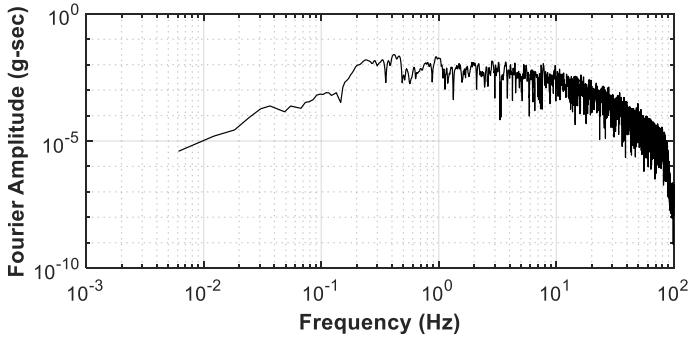

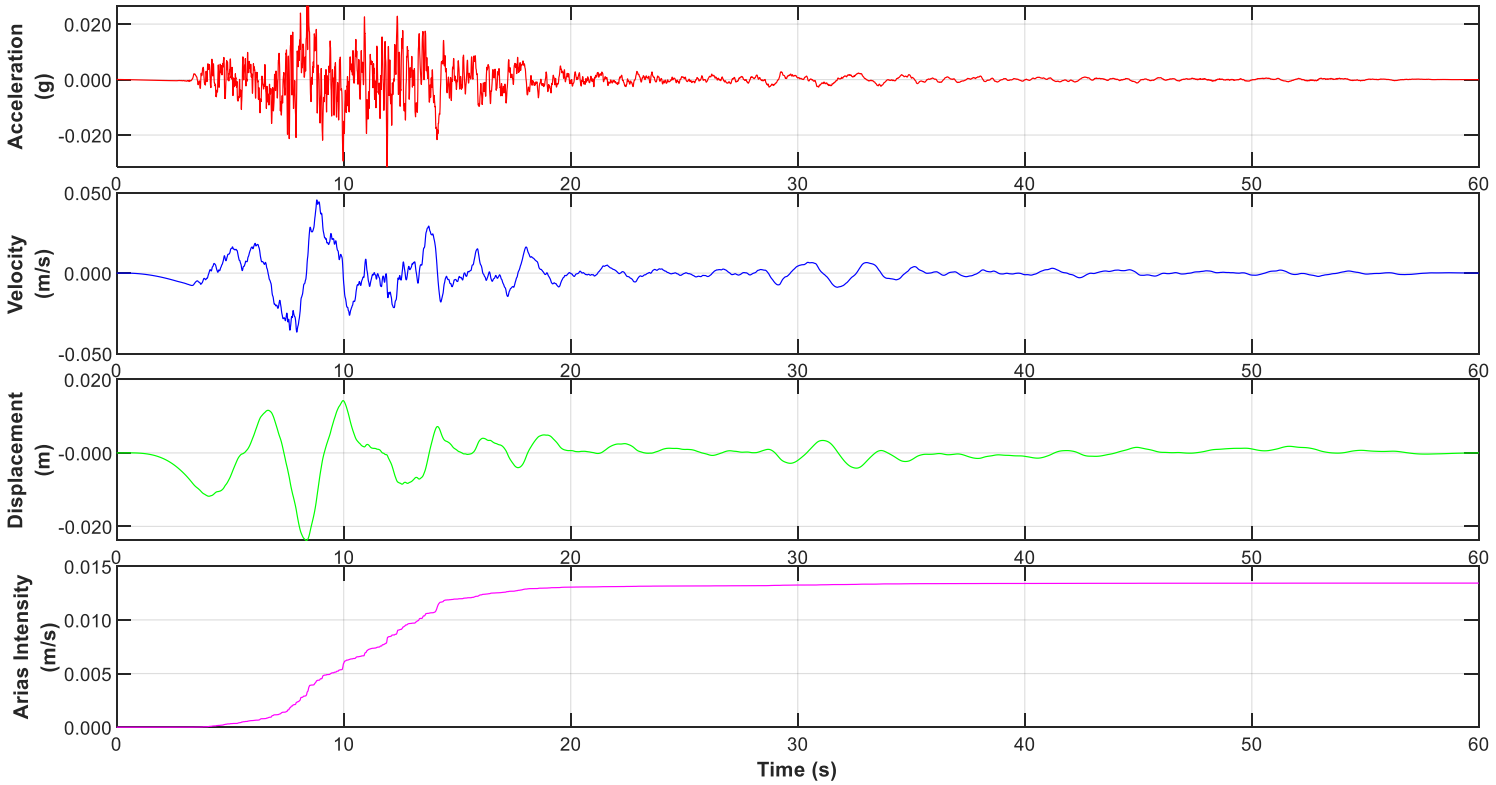

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4478-E

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
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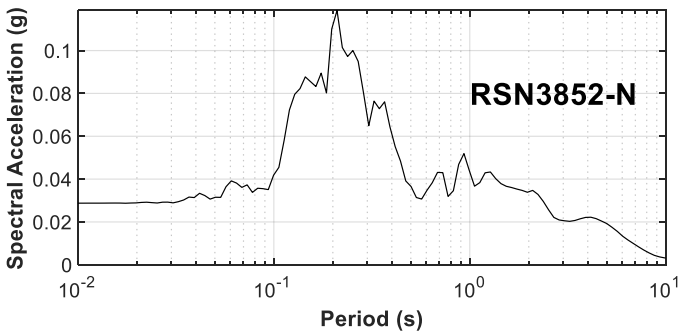

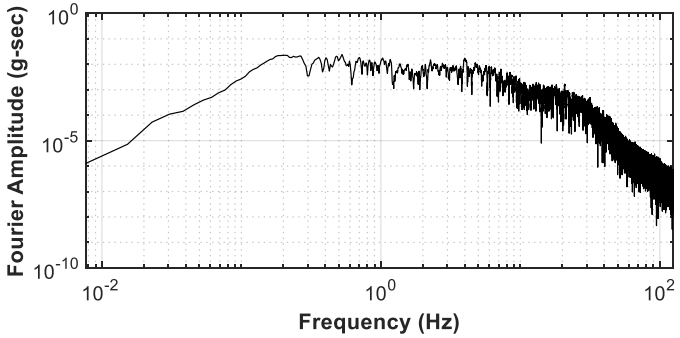

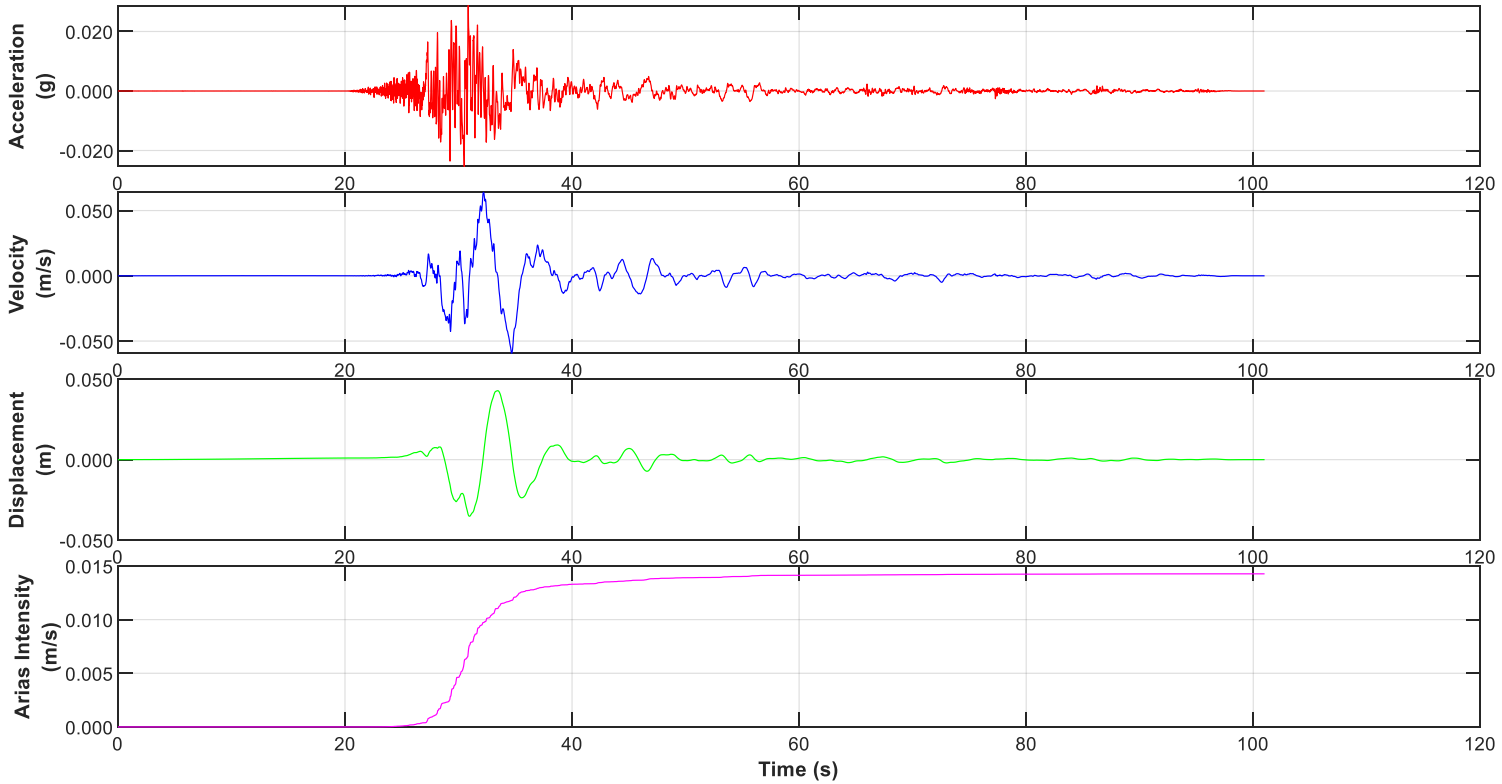

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN3852-N

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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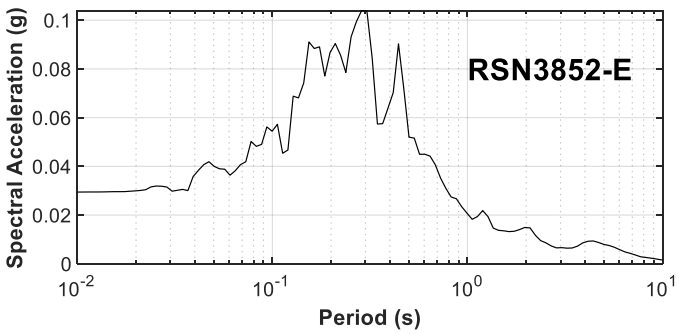

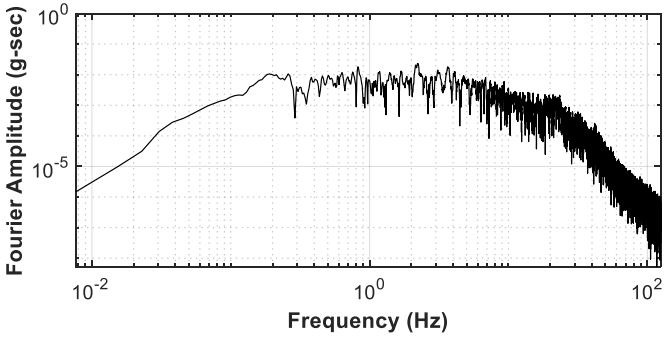

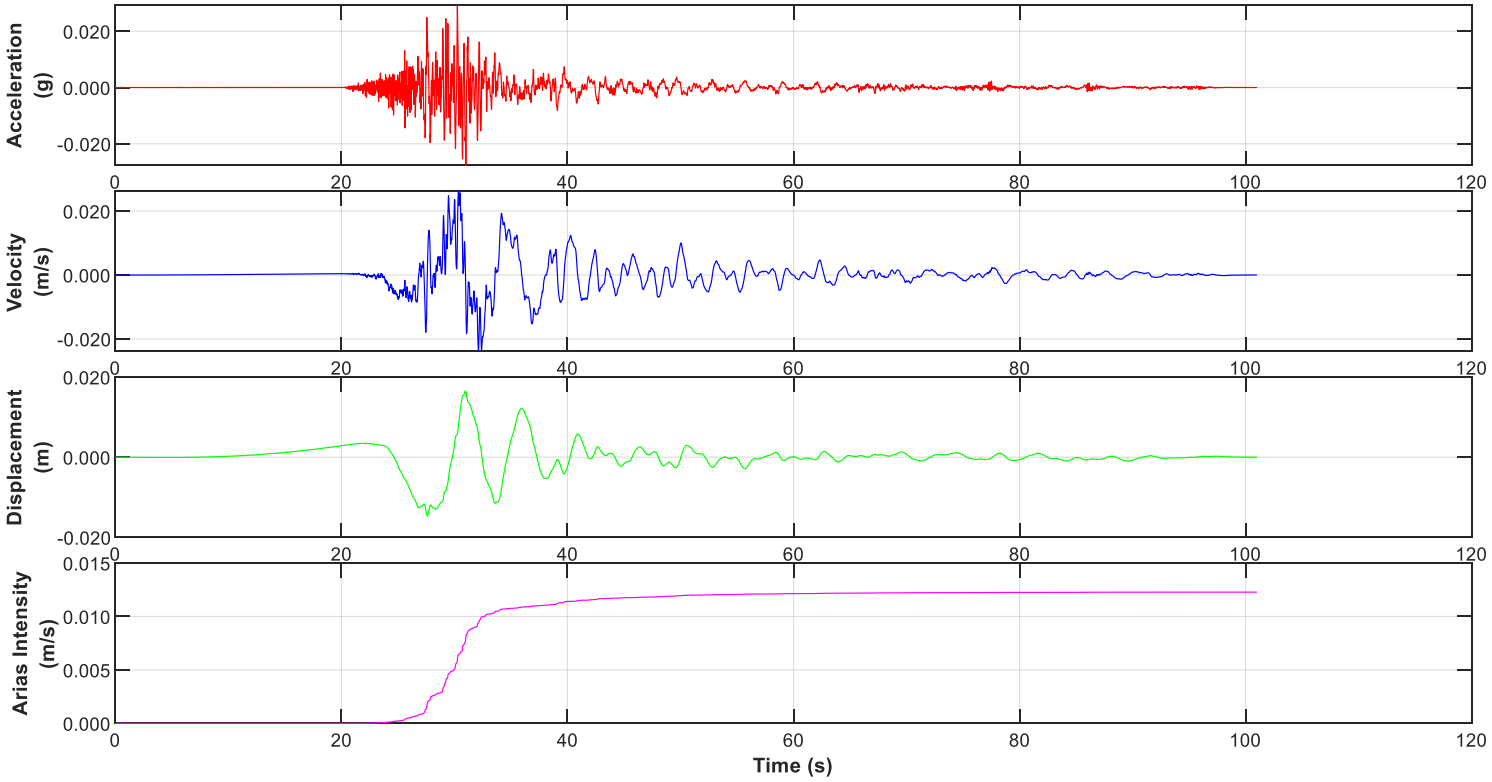

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN3852-E

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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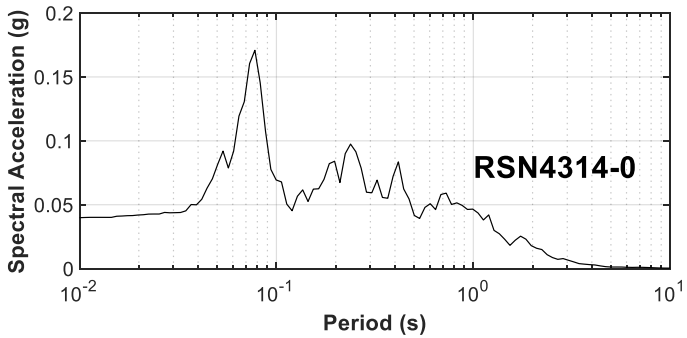

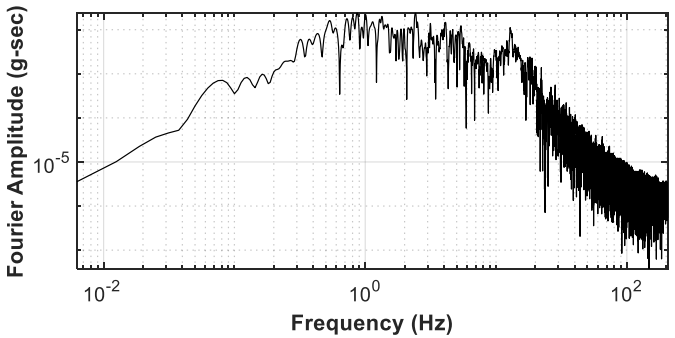

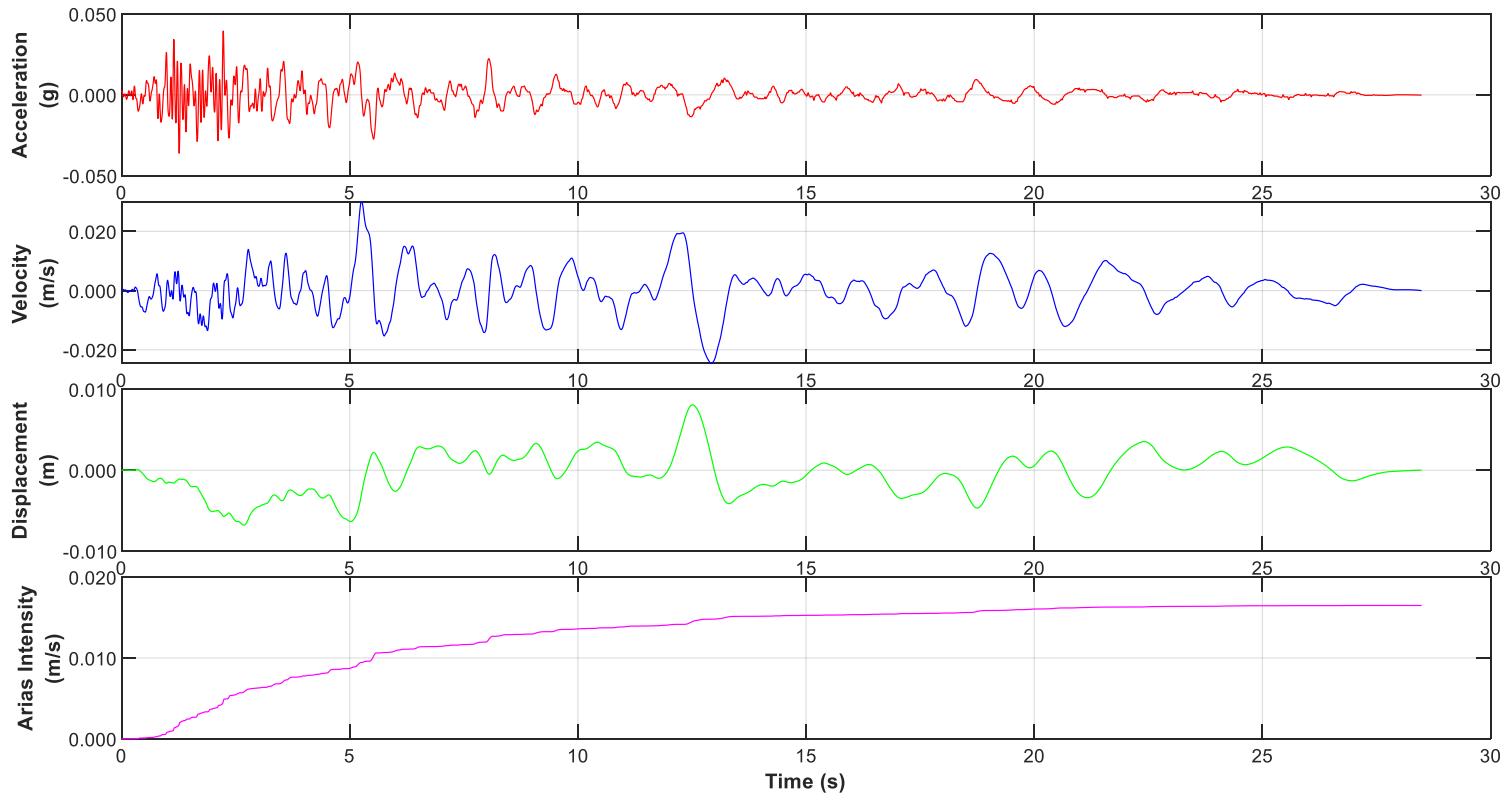

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4314-0

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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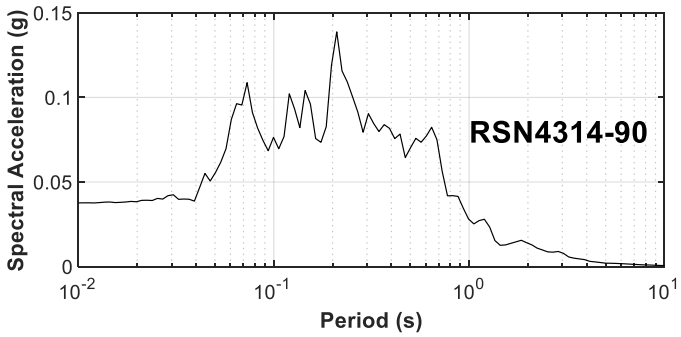

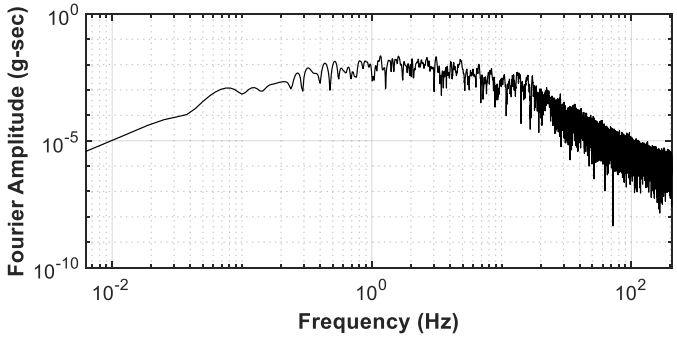

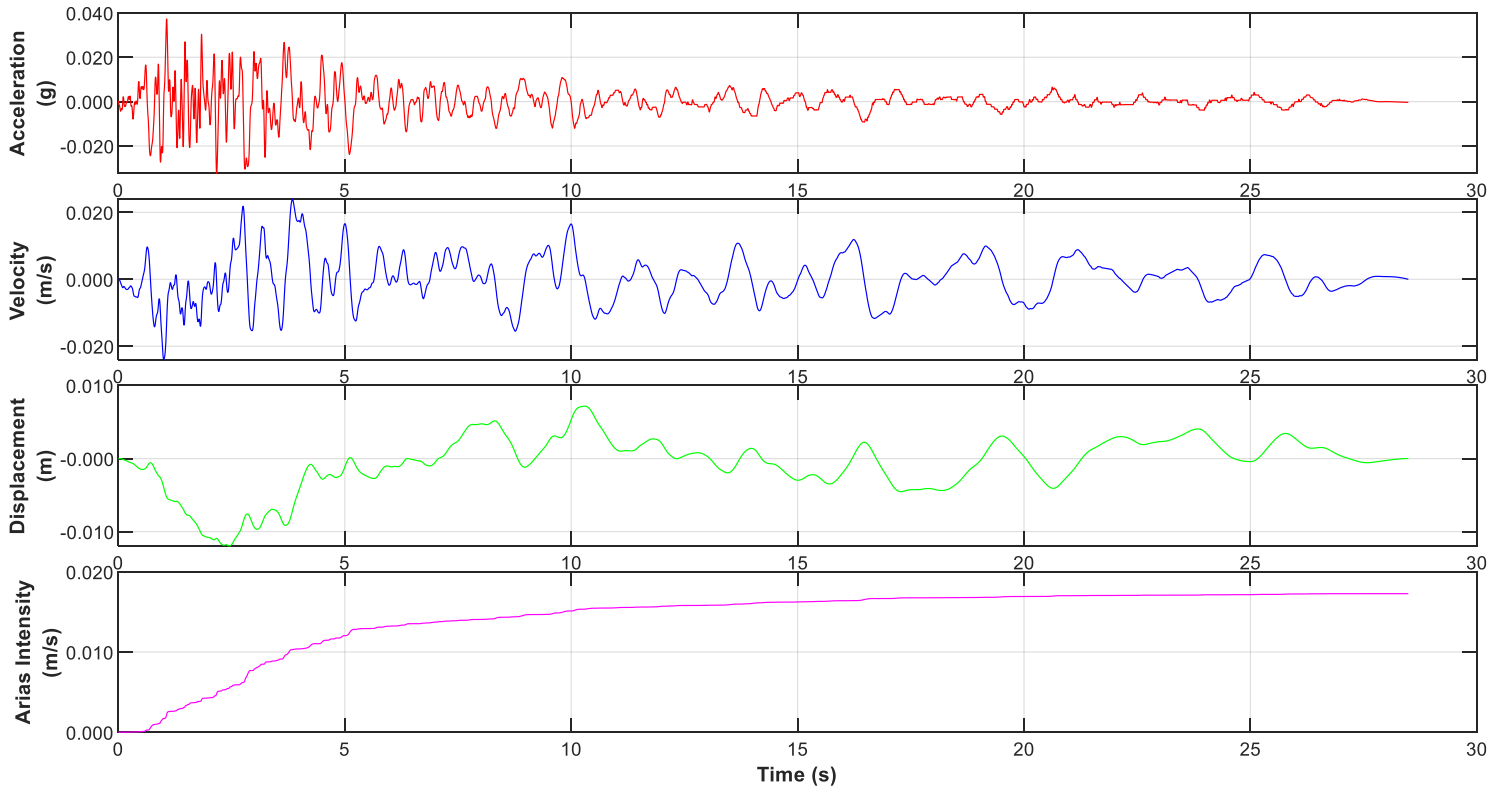

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4314-90

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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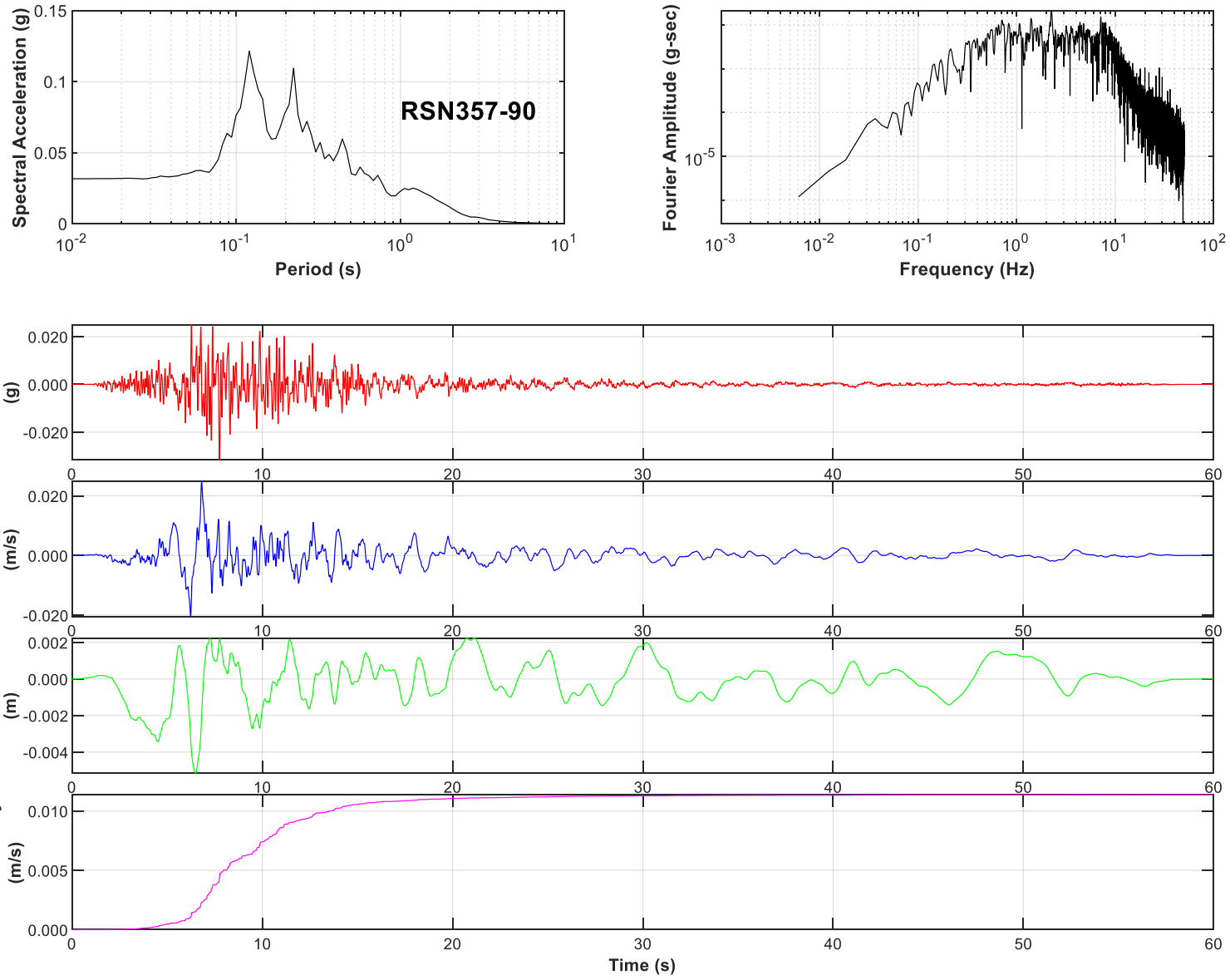

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN357-90

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in

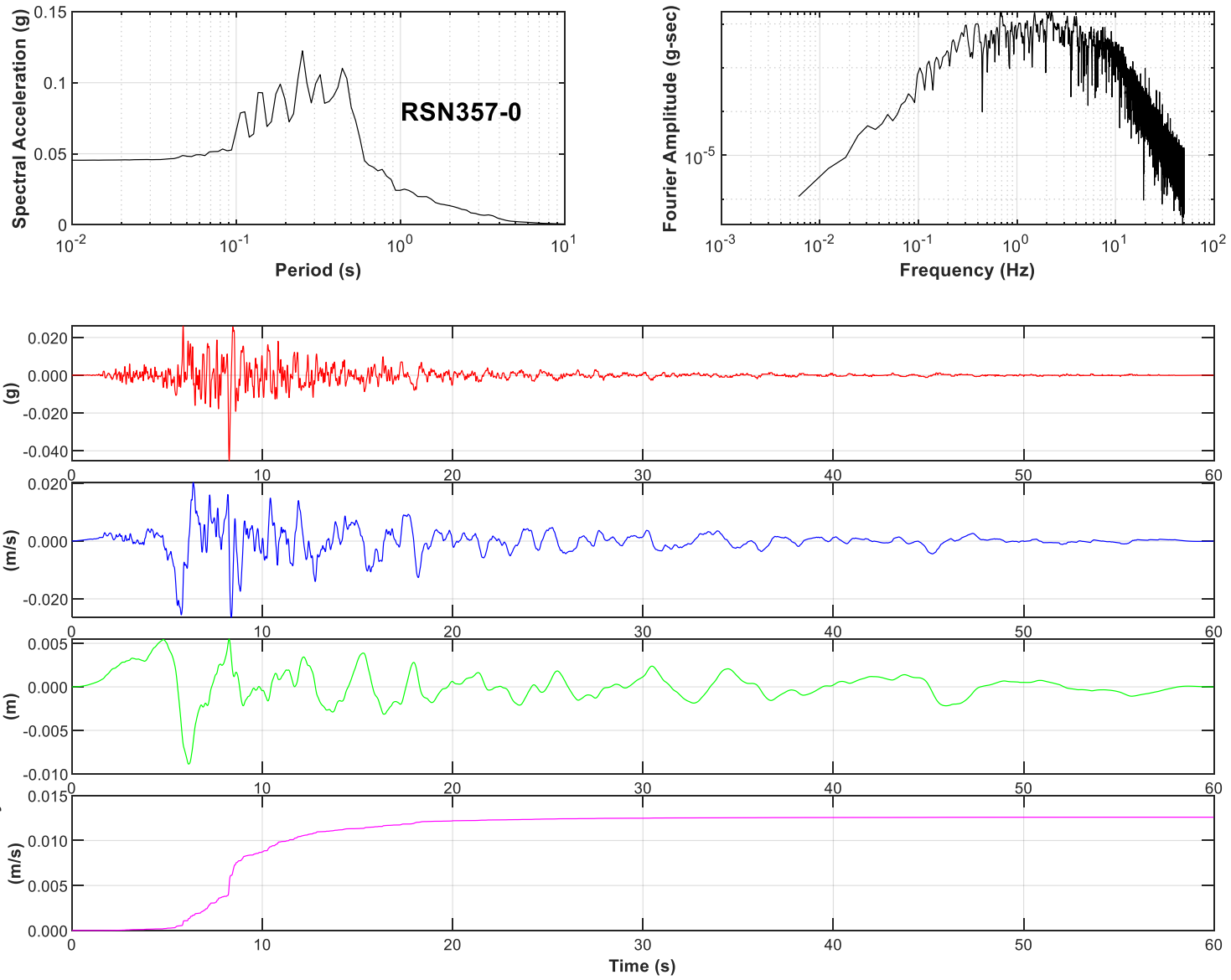

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN357-0

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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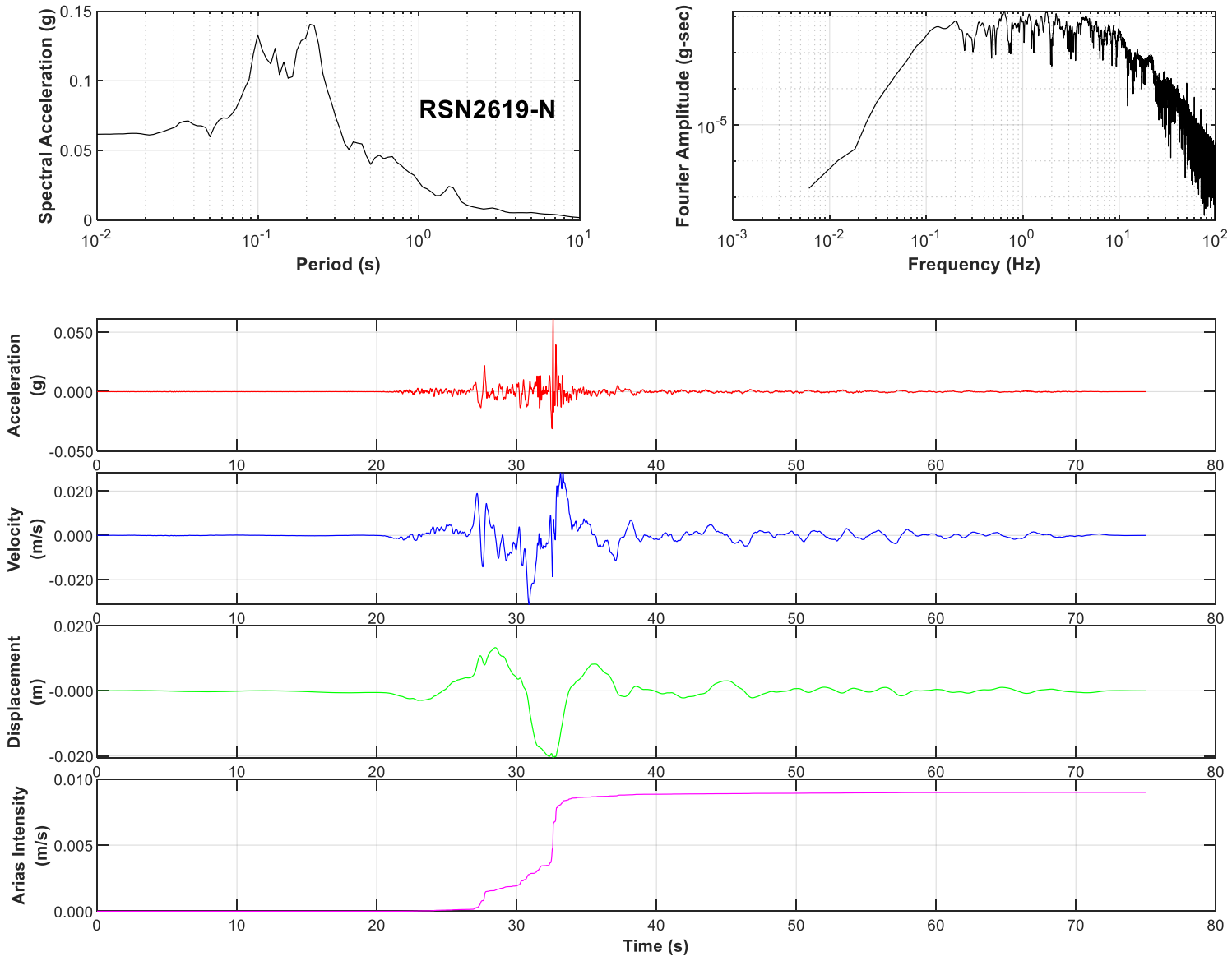

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN2619-N

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**11**

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1 in
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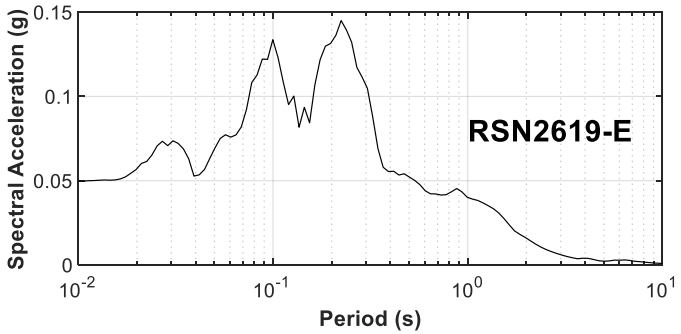

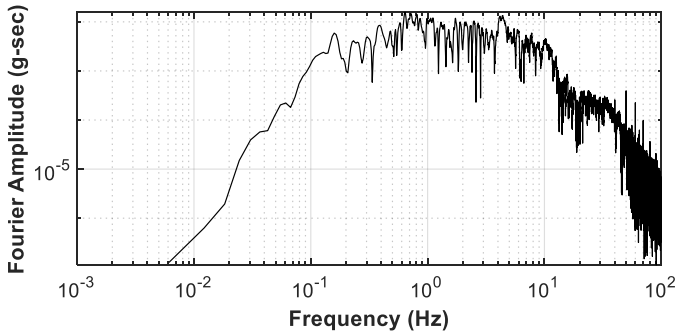

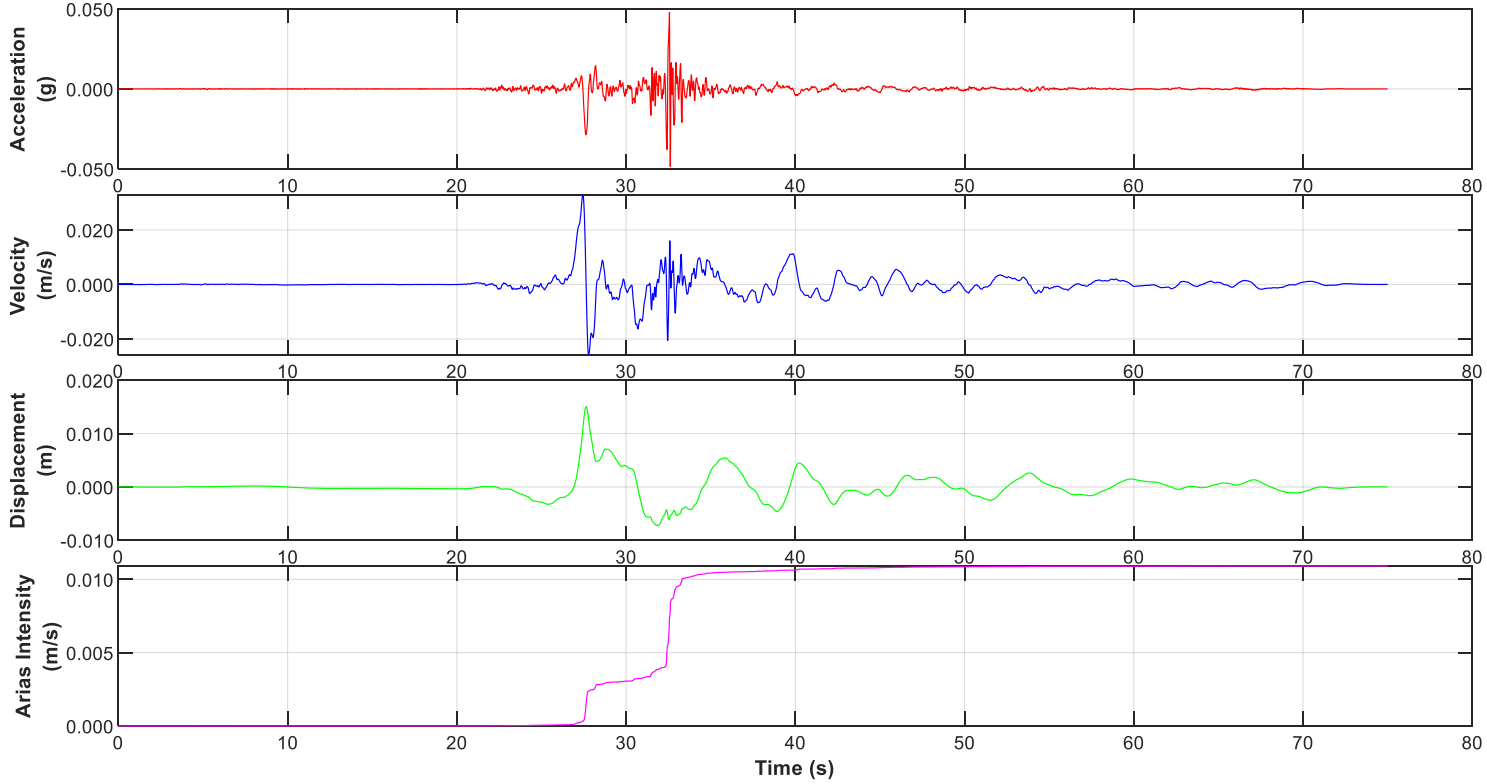

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN2619-E

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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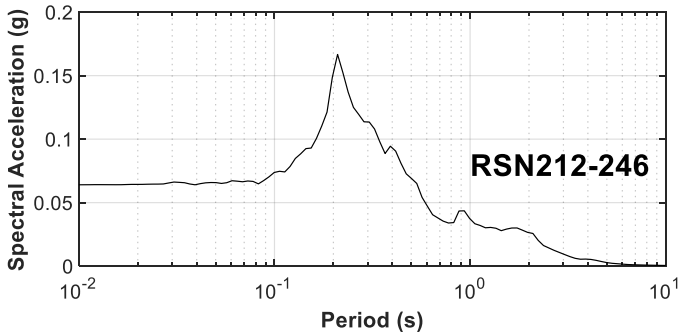

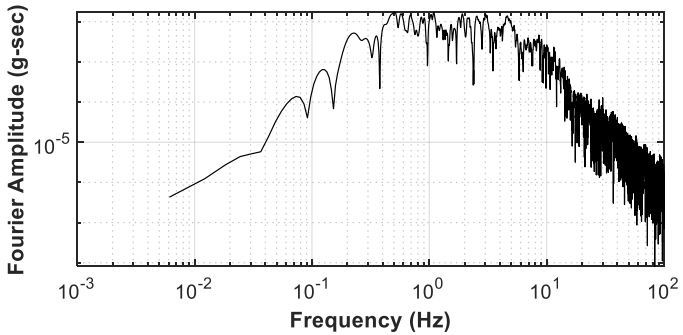

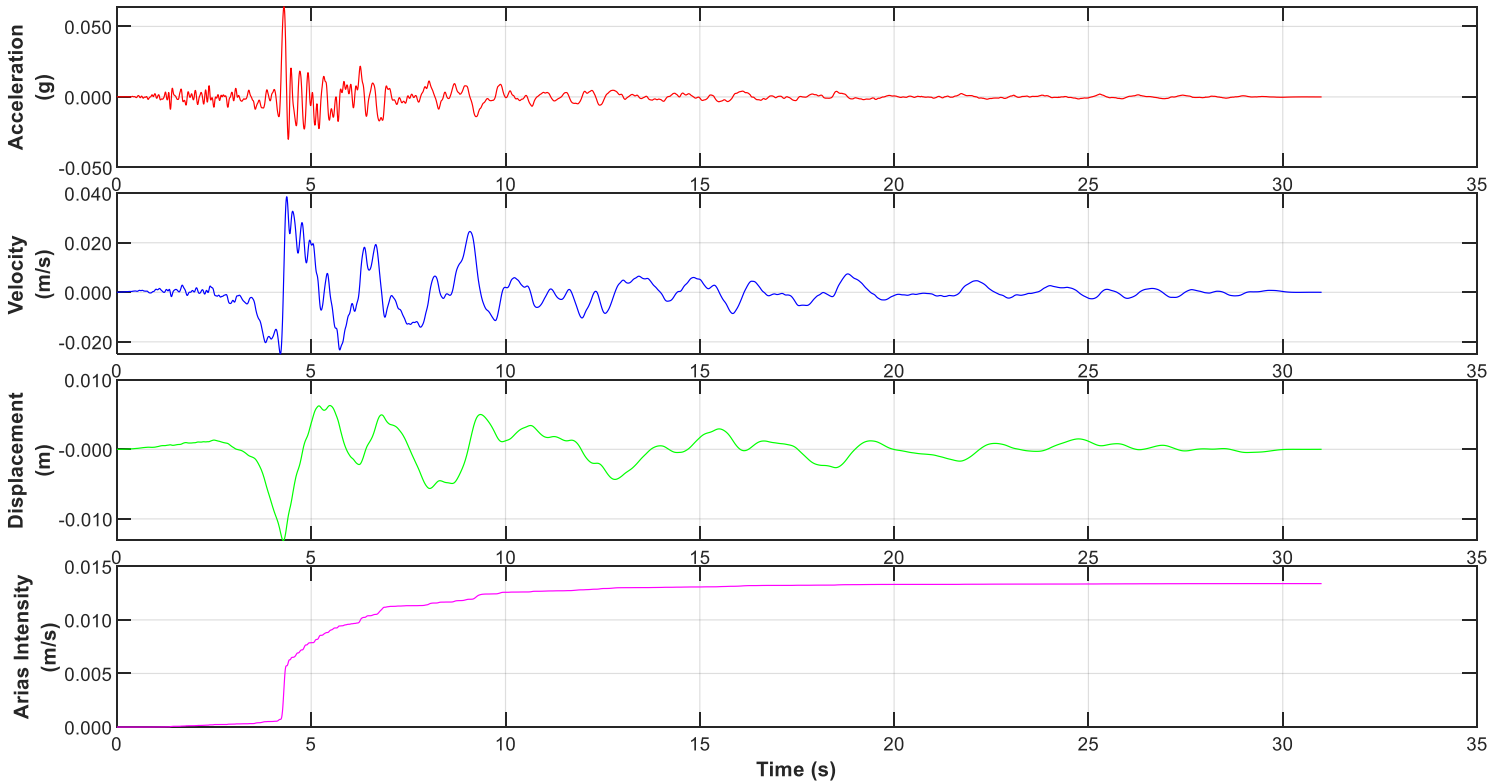

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN212-246

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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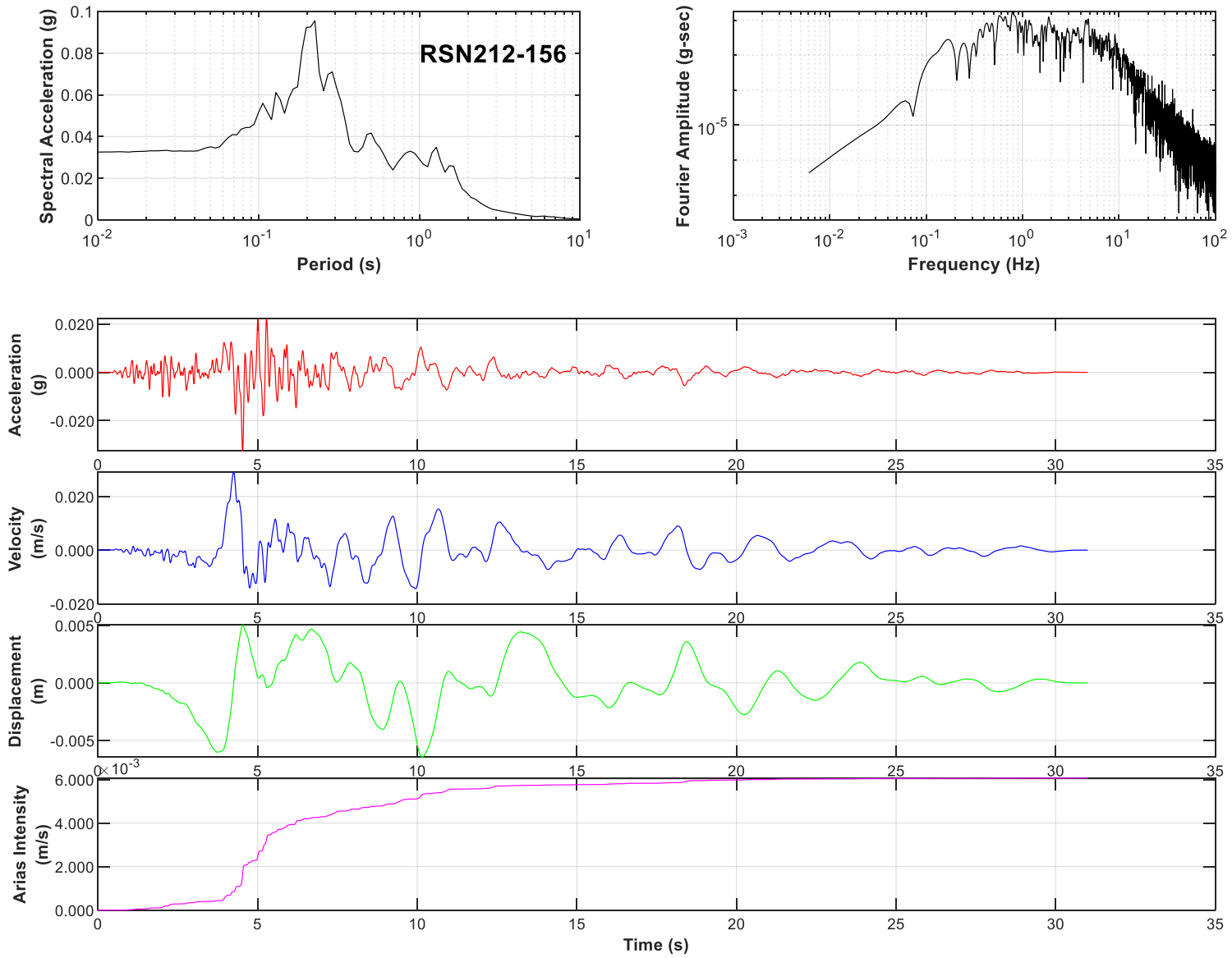

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN212-156

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 in
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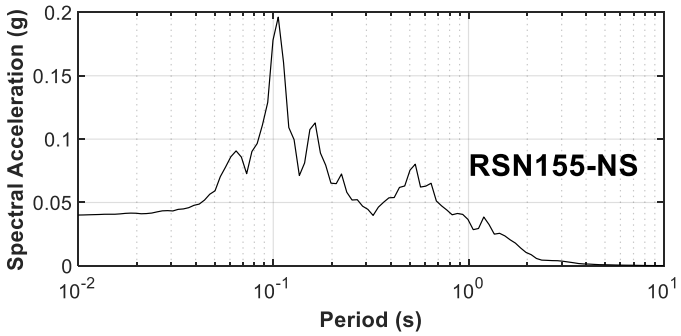

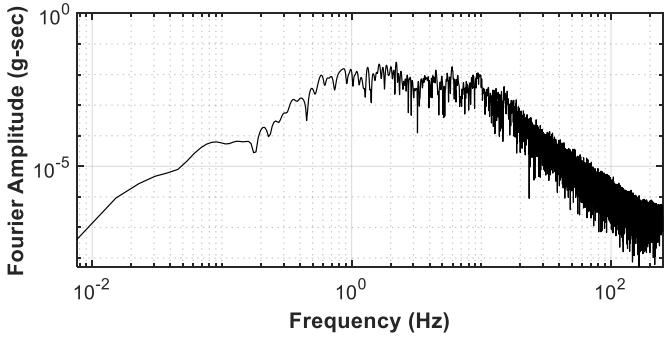

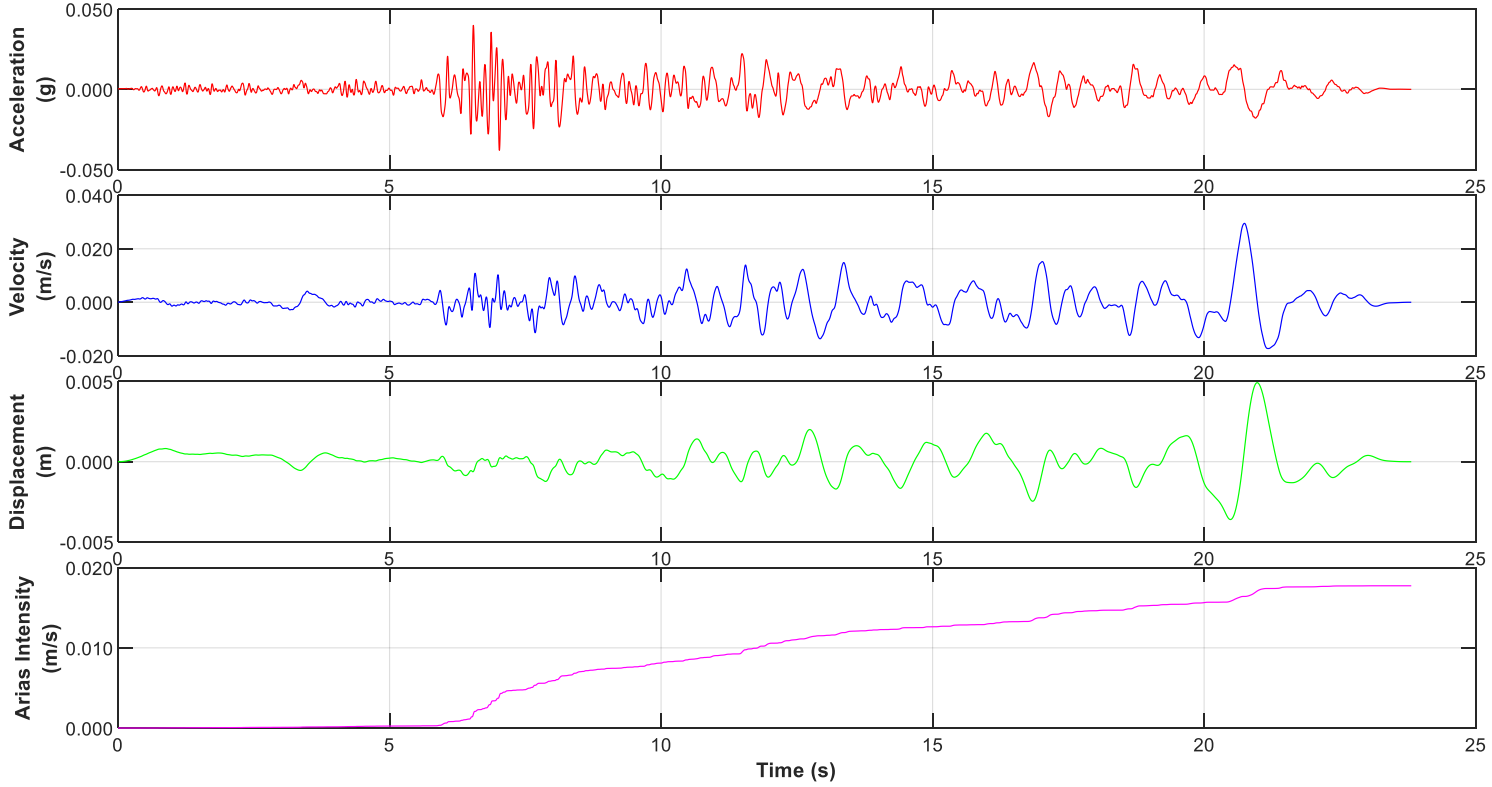

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN155-NS

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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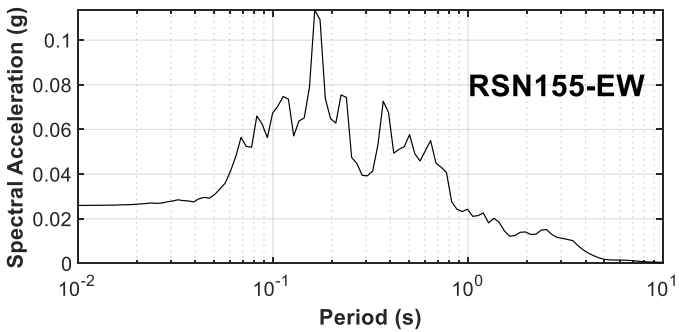

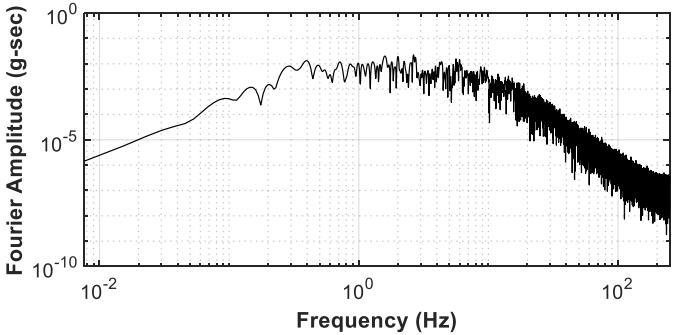

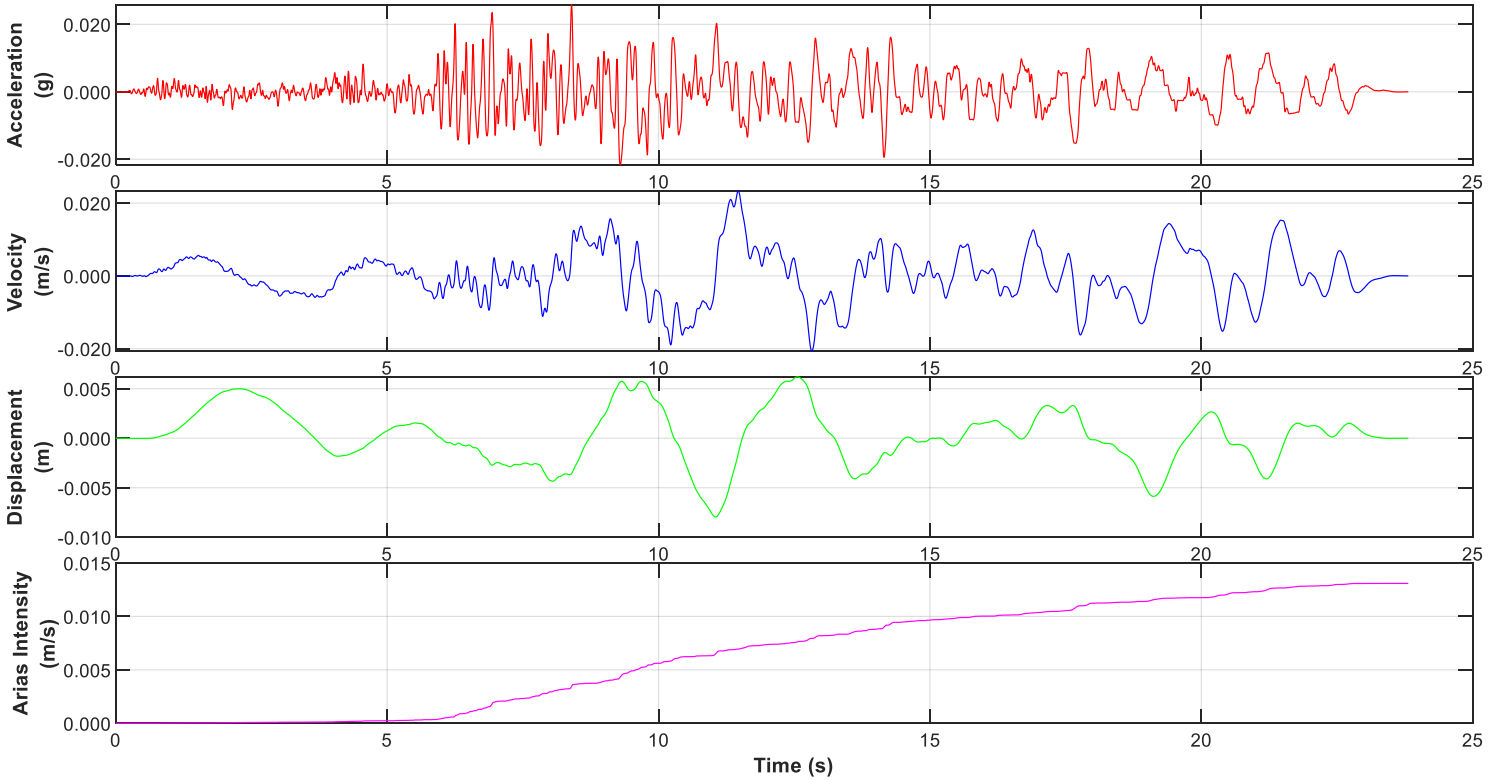

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN155-EW

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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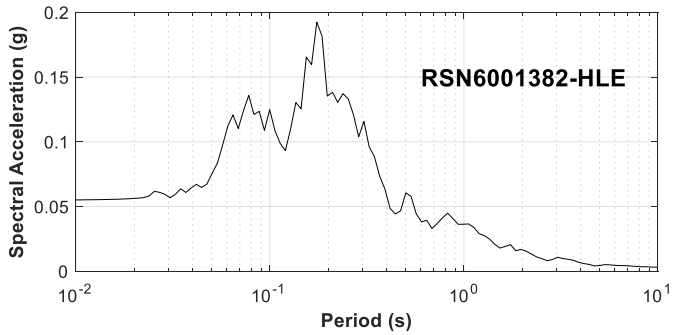

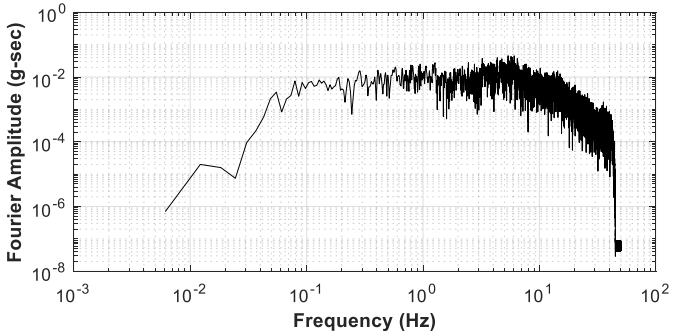

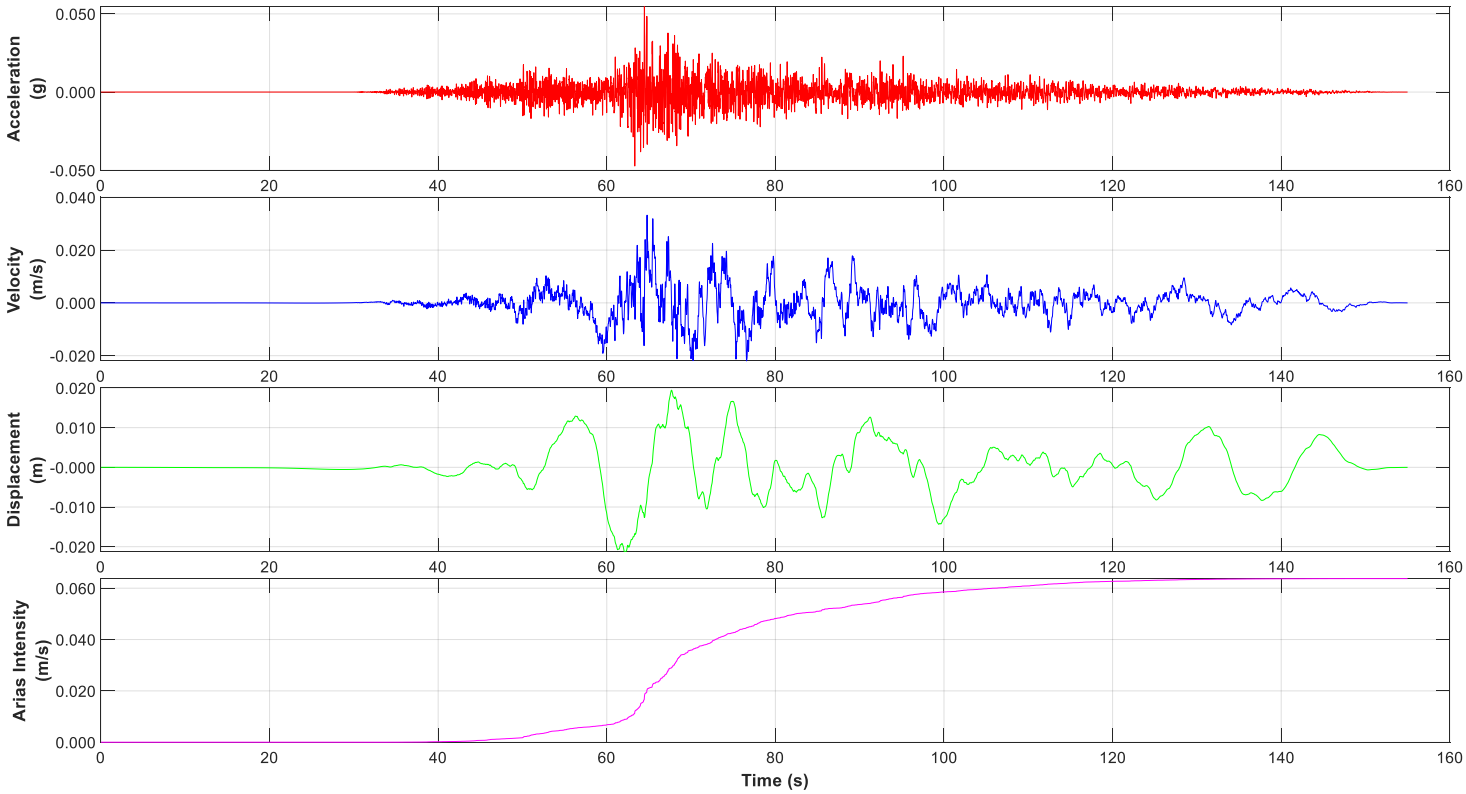

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN6001382-HLE

PROJECT No.	PHASE	Rev.	FIGURE
31404975.000	**300.00**	**01**	**17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
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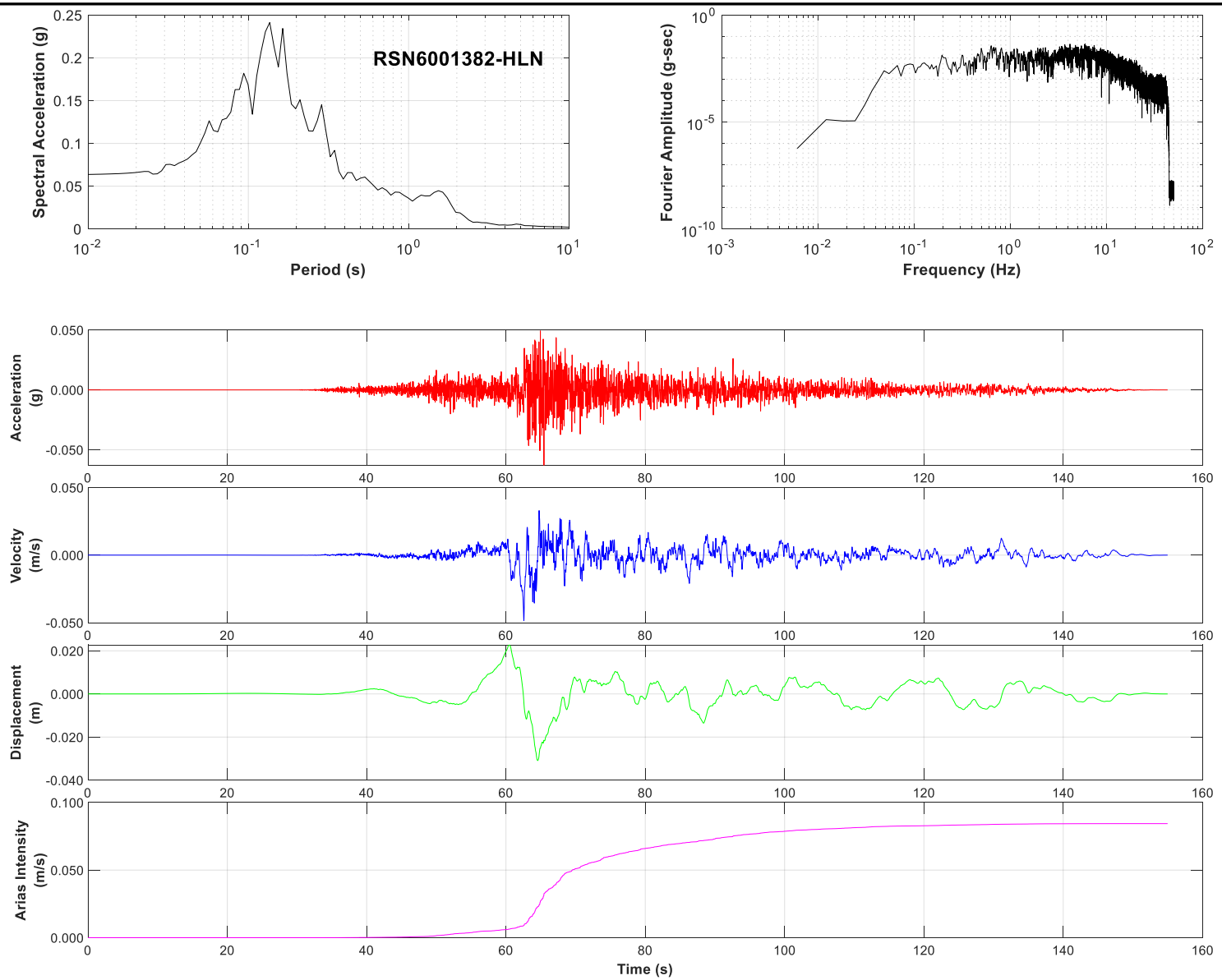

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN6001382-HLN

PROJECT No.	PHASE	Rev.	FIGURE
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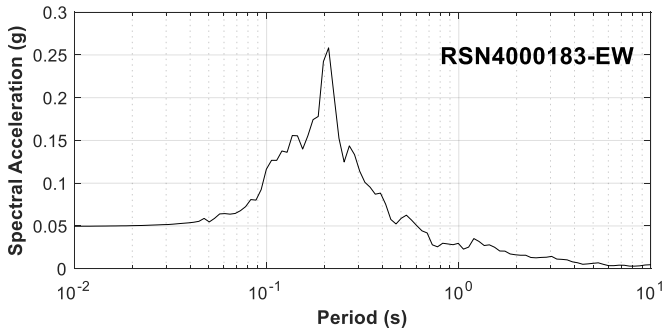

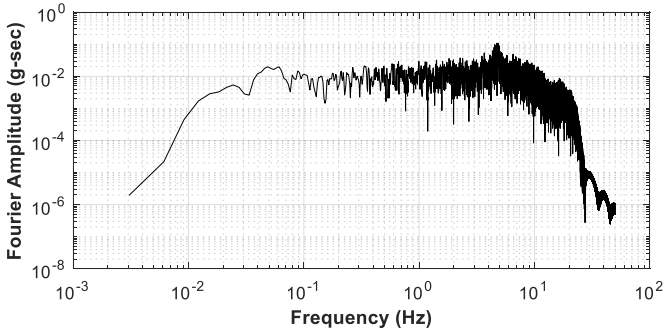

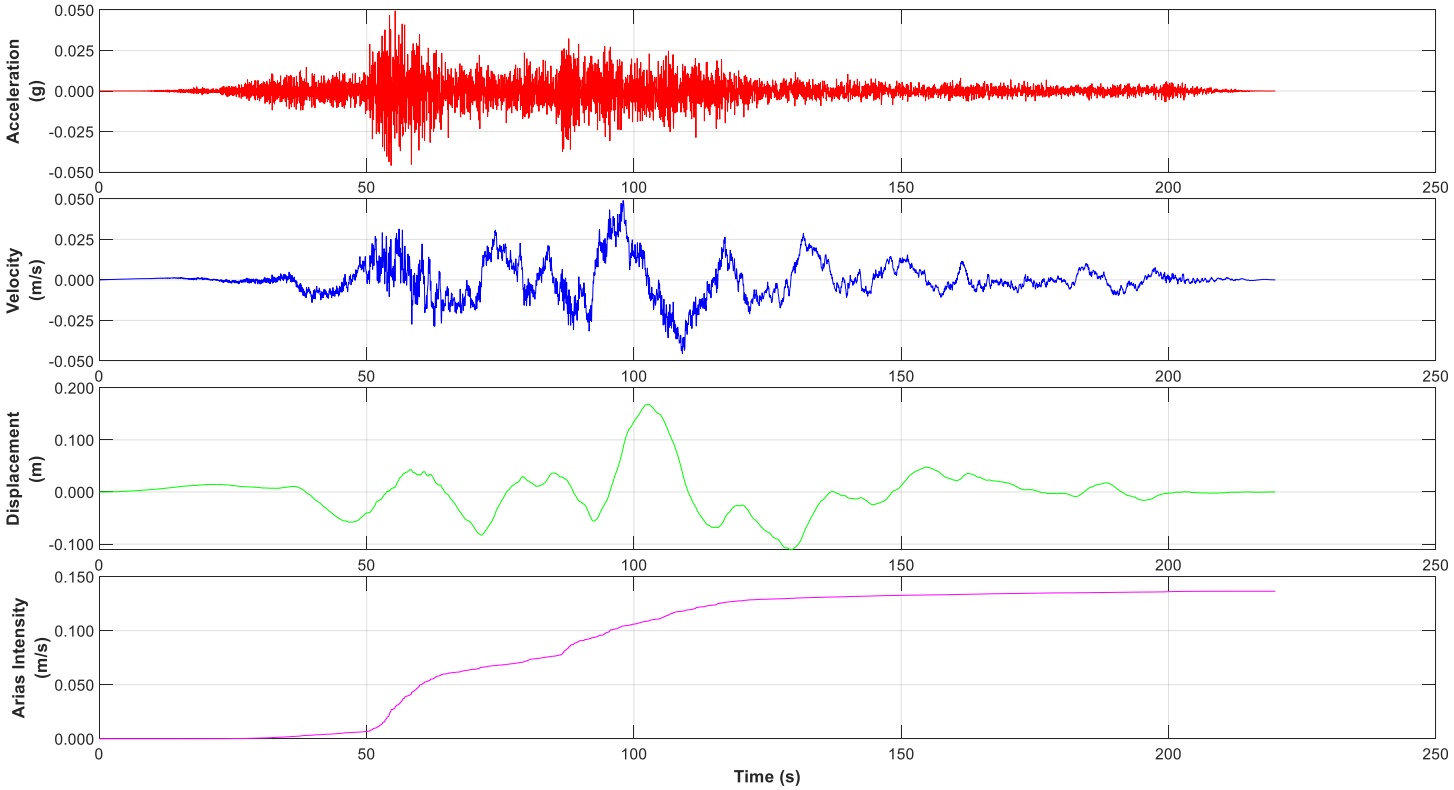

CLIENT
WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4000183-EW

PROJECT No.	PHASE	Rev.	FIGURE
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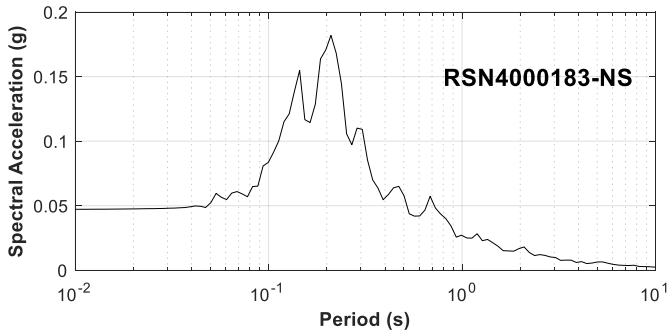

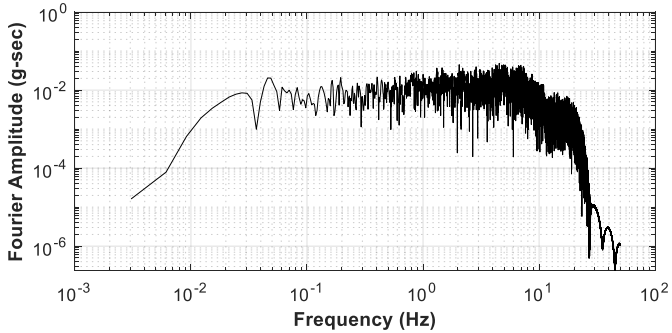

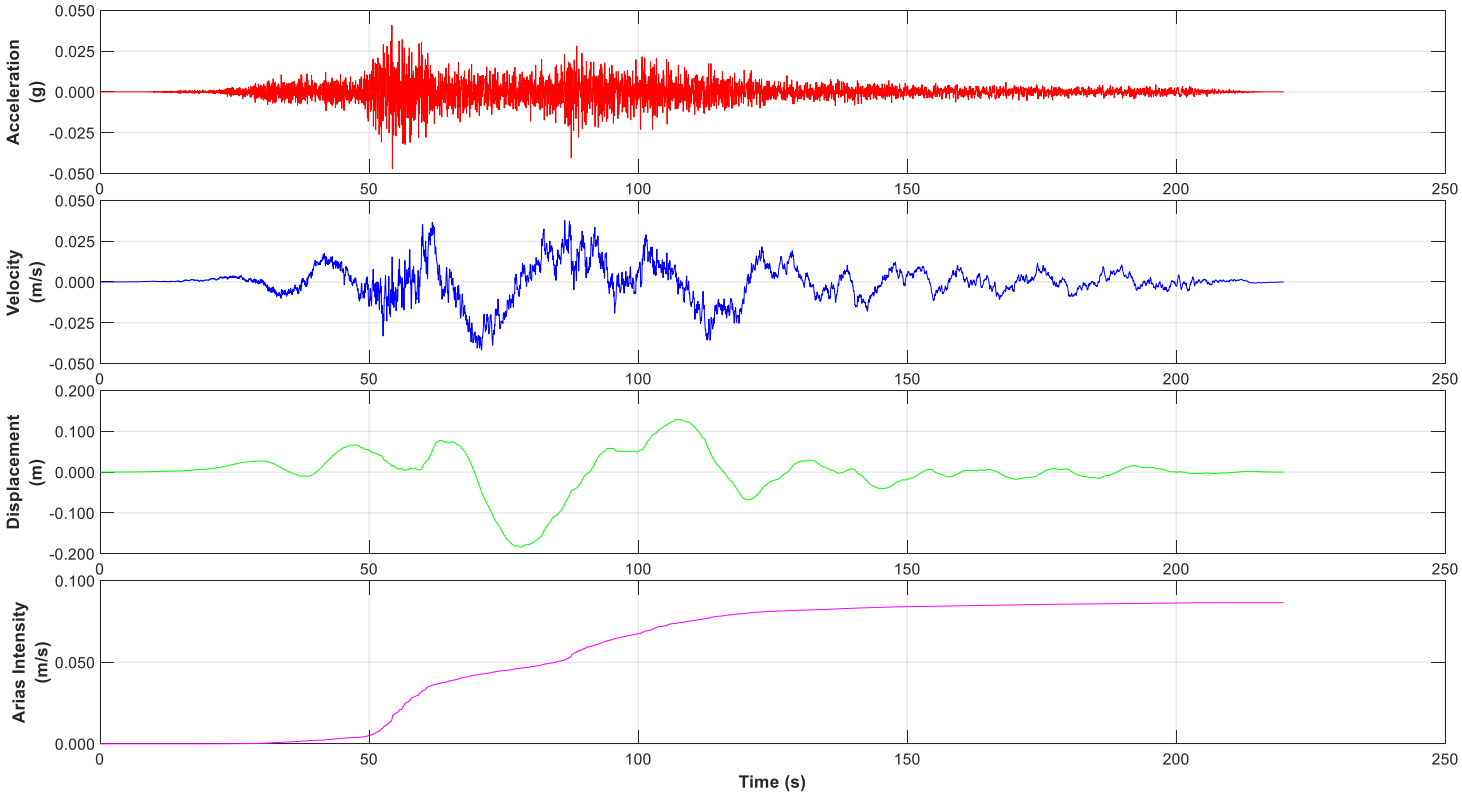

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PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

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YYYY-MM-DD	2022-08-28
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TITLE
AMPLITUDE SCALING RESULTS FOR RSN4000183-NS

PROJECT No.	PHASE	Rev.	FIGURE
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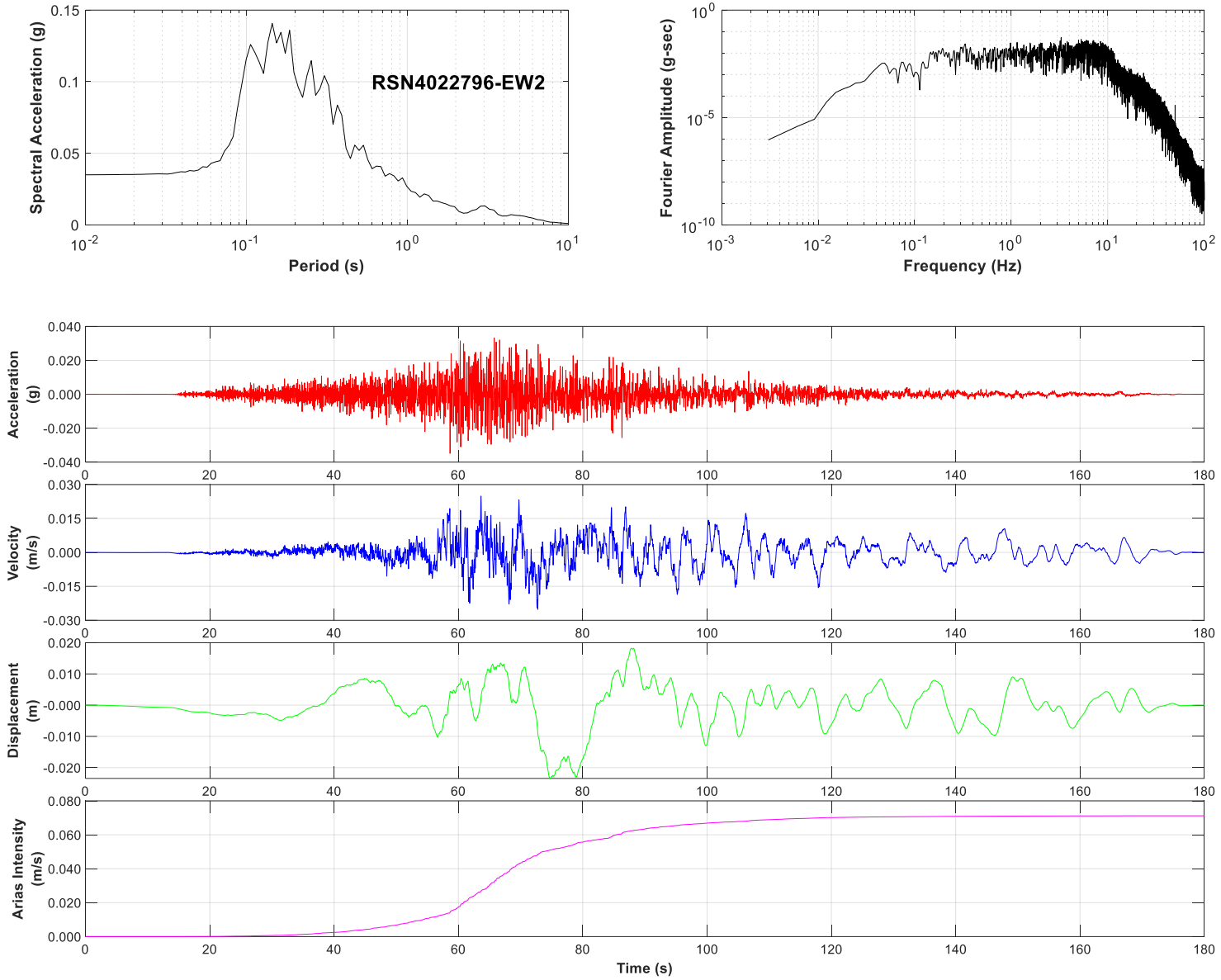

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SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
PREPARED	MAB
DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4022796-EW2

PROJECT No.	PHASE	Rev.	FIGURE
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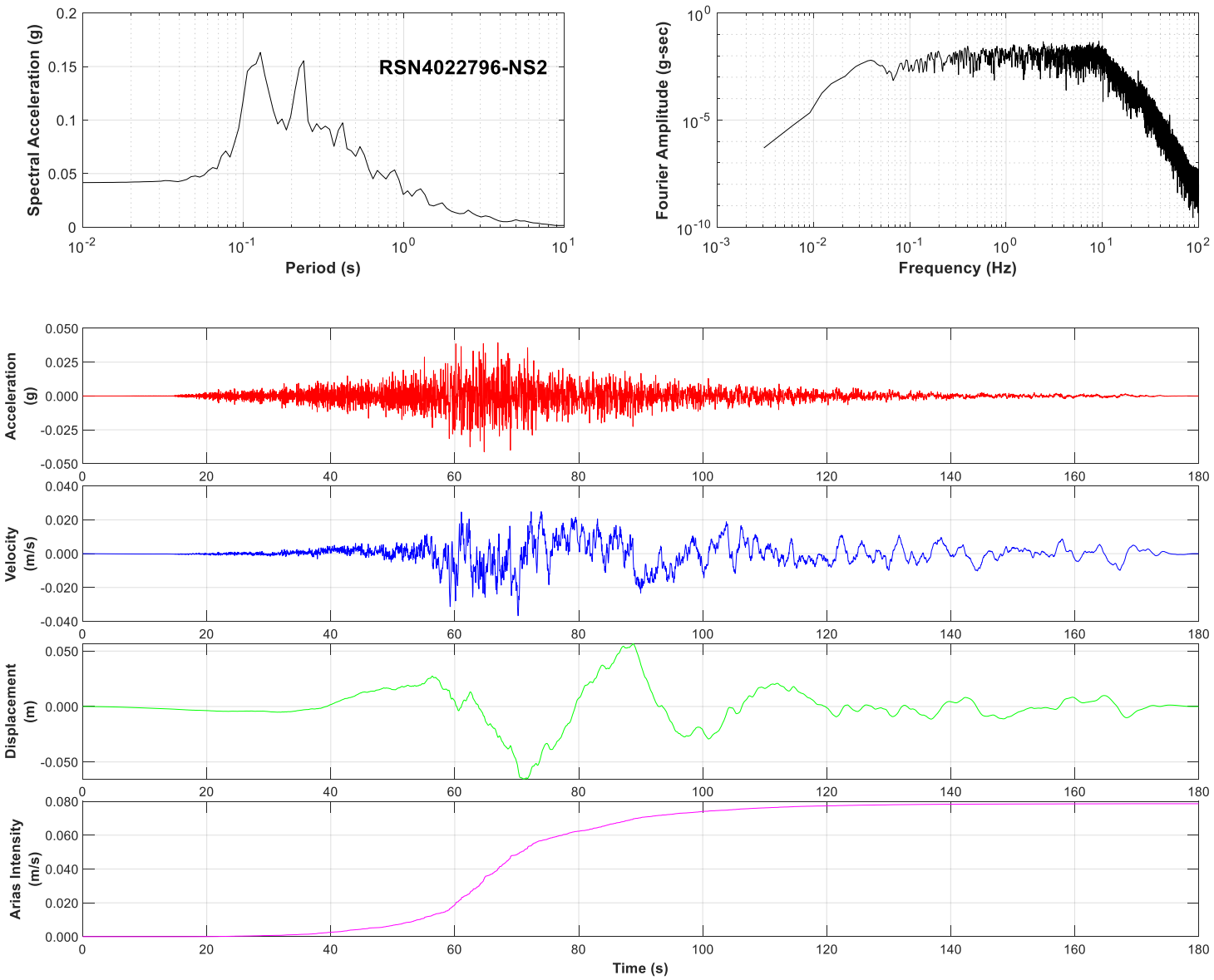

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WSP Canada Inc.

PROJECT
SITE-SPECIFIC PROBABILISTIC SEISMIC HAZARD ASSESSMENT
MT POLLEY MINE, BRITISH COLUMBIA

CONSULTANT

YYYY-MM-DD	2022-08-28
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DESIGN	MAB
REVIEW	FL
APPROVED	FL

TITLE
AMPLITUDE SCALING RESULTS FOR RSN4022796-NS2

PROJECT No.	PHASE	Rev.	FIGURE
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APPENDIX B

Evaluation of the Time-Average Shear-Wave Velocity

Memorandum

To	Alan Hull
Copy	Erin Todd
From	Matt Harris
Office	Auckland
Date	20 June 2022
File/Ref	6-DY039.00
Subject	Mt Polley VSP Reanalysis and V_{S30} Discussion

Introduction

This memo presents the results of reanalysis of VSP data from three boreholes at the tailings storage facility, Mount Polley Mine, BC Canada. The VSP measurements were originally presented in Technical Memorandum 22514095-040-TM-RevA-51344, dated 10 June 2022.

Approach to Reanalysis

Reanalysis focussed on BH15-10, as this had the deepest penetration, and is the only borehole that penetrated 30 m into material classified as bedrock. A number of approaches were taken to determination of V_{S30} for bedrock, using both the original and revised picks of shear-wave arrivals. The results are presented in Table 1 below, listed in order of reducing confidence. Based on a weighted average these velocities, the V_{S30} for bedrock at BH15-10 is considered to be 849 +/- 33 m/s.

Table 1: Summary of V_{S30} of bedrock from reanalysis of BH15-10 VSP data

Approach to Analysis	V_{S30} from Revised picks (m/s)	V_{S30} from Original picks (m/s)
Revised layer model	857	865
Initial layer model	826	877
Single layer method	852	864
1 m Interval Velocities (defined by 3-point regression)	831	850
1 m Interval Velocities (defined by 5-point regression)	864	890
1 m Interval Velocities (defined by successive arrival times)	820	873

The presented velocities were derived as follows:

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- Revised layer model - the velocity of each layer was calculated based on a linear regression of the vertical component of arrival times within that layer. Assignment of layer boundaries revised during reanalysis, based on slope breaks on a plot of arrival time against depth. V_{S30} calculated as the traveltime-weighted average shear wave velocity from 31.8 m to 61.8 m.
- Initial layer model – As above, without reassignment of layer boundaries.
- Single layer method - An estimate of V_{S30} obtained by assuming a single "layer" over 30 metres from top of bedrock. Based on picks at 31.8 m and 62.5 m depth.
- 1 m Interval Velocities (defined by 3-point regression) - traveltime-weighted average shear wave velocity from 31.8 m to 61.8 m, using 1 m layers with layer velocities derived from a 3-point linear regression of the slope of vertical traveltime data.
- 1 m Interval Velocities (defined by 5-point regression) - traveltime-weighted average shear wave velocity from 31.8 m to 61.8 m, using 1 m layers with layer velocities derived from a 5-point linear regression of the slope of vertical traveltime data.
- 1 m Interval Velocities (defined by successive arrival times) - traveltime-weighted average shear wave velocity from 31.8 m to 61.8 m, using 1 m layers with layer velocities derived from successive shear-wave arrival picks.

The shear-wave arrivals at 31.8 m and 62.5 m in BH15-10 are well defined. These are useful for assessing the travel time of the shear wave through the upper 30 m of material defined as bedrock, using the 'single layer' method of Hunter and Crow (2012). To assess the likely minimum and maximum V_{S30} using this method, both arrivals were picked as early and late as considered reasonable, and results compared. Based on this approach, estimated extreme minimum and maximum V_{S30} for bedrock at this borehole location are 706 m/s and 981 m/s, respectively.

Summary of Results

At borehole BH15-10, which penetrated into bedrock, V_{S30} is considered to be 849 +/- 33 m/s based on reanalysis of available VSP data. Extreme minimum and maximum V_{S30} for bedrock at BH15-10 are estimated at 706 m/s and 981 m/s, respectively.

Borehole BH15-18 only penetrated 6 m into bedrock, though showed good data quality; V_S of the upper bedrock here is considered to be 523 +/- 59 m/s. For comparison, V_S of the upper 6 m of bedrock at BH15-10 is considered to be 643 +/- 51 m/s.

At BH15-06, signal quality is poor, though estimated V_S values for the upper 10 m to 15 m of bedrock were made as roughly 350 m/s to 600 m/s.

Considerations/Data Quality

The data quality is rather variable between the three boreholes, which influences the confidence that can be attributed to each. The signal quality is best at BH15-18, though penetration into bedrock here is only around 6 m.

Signal quality at BH15-10 is considered reasonably good, and worthy of thorough analysis as this borehole penetrates over 30 m into material identified as bedrock.

At BH15-06, signal quality is poor and clear shear-wave arrivals are not able to be identified with confidence at most traces. Any velocities determined here should be treated with caution. Detailed reanalysis of this borehole has not been performed. The high V_S (up to 2820 m/s) initially reported for this borehole seems to be influenced by data quality. Single layer estimates within bedrock suggest V_S values for the upper 10 m to 15 m of bedrock here may be roughly 350 m/s to 600 m/s.

The interpretation of bedrock depths has not been changed. It should be appreciated though that the contrast between bedrock and overlying material at the site is subtle and has been noted as "pretty variable and hard to define".

During the reanalysis, discussed the data and data quality with Rob Luzitano, who performed the initial data analysis. He noted that the boreholes that were used for testing were originally installed in 2015, for use with inclinometers. This meant they were cased with PVC of a suitable diameter, though the approach taken to grouting was unknown. There may therefore be some areas where poor bonding between casing and grout has impacted data quality.

Data was not acquired at every ~1 m (3 foot) interval, as the crew on site were under time pressure during acquisition. At BH15-06 there is 3.5 m below the deepest two recorded intervals. The arrival on the lowest record is indistinct, so additional data here would have been useful.

Particularly high velocities are noted at shallow depth at BH15-06. While not repicked, note that these velocities are based on a small number of ambiguous picks and therefore considered unreliable.

Closure

I trust that this memo meets your needs. If you have any questions regarding the material contained within, please contact the undersigned.

Prepared by:



Matt Harris

Senior Geophysicist

Geophysical Services Limitation Statement

WSP geophysical services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions and subject to the time limits, financial and physical constraints applicable to the services.

The inherent uncertainty in geophysical results should be considered during the interpretation process. To help reduce uncertainties in the interpretation, the interpreter will typically make use of prior knowledge and any external complementary datasets, such as existing geologic information, drilling data, the location of underground services, borehole geophysical logs and other geophysical datasets.

References

Golder Associates Ltd. 2022. Bedrock Shear-Wave Velocity Measurements at Three Locations along the Tailings Storage Facility at Mt. Polley Mine, BC. Technical Memorandum (22514095-040-TM-RevA-51344, dated 10 June 2022).

Hunter, J.A. and Crow, H.L. (ed.), 2012. Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock; Geological Survey of Canada, Open File 7078, 227 p. doi:10.4095/291753

APPENDIX C

Geotechnical Data

Table C1: Summary of Boreholes

Year	Consultant	Borehole ID	Drill Method	General Location Description	Coordinates		Ground Elevation (m)	Azimuth (degrees)	Inclination (degrees)	Completion Depth (m)	Bedrock Depth (m)	Geotechnical Instrumentation																Record of Borehole Log in Database?	Location on Figure 01?	Location on Figure 02?
												VWP 1				VWP 2				VWP 3				Slope Inclinometer		Shape Accel Array						
					Northing (m)	Easting (m)						Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Collar Elevation (m)	Base Elevation (m)	Sensor Top Elevation (m)	Sensor Base Elevation (m)	SAA ID	Serial No.			
1989	Knight Piesold	MP89-229	Tricone Rotary	Tailings Basin	5,818,999.58	594,945.89	929.10	0	-90	121.92	22.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-230	Tricone Rotary	Tailings Basin	5,819,465.36	594,932.62	929.10	0	-90	73.15	19.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-231	Tricone Rotary	Corner 1 Embankment	5,819,929.90	595,178.85	927.20	0	-90	121.92	32.00	117.3	809.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
1989	Knight Piesold	MP89-232	Tricone Rotary	Tailings Basin	5,818,944.44	595,471.80	919.40	0	-90	121.9	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-233	Tricone Rotary	Perimeter Embankment	5,819,358.58	596,015.13	933.90	0	-90	121.9	36.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-234	Tricone Rotary	Main Embankment	5,818,369.54	595,625.93	909.30	0	-90	121.9	29.0	82.3	827.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-235	Tricone Rotary	South Embankment	5,818,356.15	595,016.85	946.20	0	-90	121.9	4.6	118.9	827.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1989	Knight Piesold	MP89-236	Tricone Rotary	Tailings Basin	5,818,961.71	594,395.20	949.00	0	-90	115.8	7.6	115.8	833.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	R.E. Graham Engineering	96-A1	Solid / Hollow Stem Auger	Main Embankment	5,818,482.71	595,598.14	912.67	0	-90	15.4	-	8.9	903.77	A2-PE2-01	-	2.8	909.87	A2-PE2-02	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	R.E. Graham Engineering	96-B1a	Solid Stem Auger	Main Embankment	5,818,628.27	595,787.88	916.97	0	-90	16.5	-	15.2	901.77	B2-PE2-01	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	R.E. Graham Engineering	96-B1b	Solid / Hollow Stem Auger	Main Embankment	5,818,627.47	595,790.66	916.99	0	-90	9.1	-	7.4	909.59	B2-PE2-02	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	R.E. Graham Engineering	96-C1	Solid / Hollow Stem Auger	Main Embankment	5,818,392.41	595,478.24	915.71	0	-90	15.4	-	8.1	907.61	C2-PE2-01	-	5.1	910.61	C2-PE2-02	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-1A	Air Rotary	Corner 1 Embankment	5,819,939.06	595,415.82	927.89	0	-90	61.3	47.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
1996	Knight Piesold	GW96-1B	Air Rotary	Corner 1 Embankment	5,819,935.22	595,416.16	927.81	0	-90	42.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
1996	Knight Piesold	GW96-2A	Air Rotary	Perimeter Embankment	5,819,449.92	596,065.40	931.42	0	-90	61.6	52.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-2B	Air Rotary	Perimeter Embankment	5,819,447.08	596,074.73	931.42	0	-90	35.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-3A	Air Rotary	Main Embankment	5,818,308.97	595,768.75	912.06	0	-90	54.9	35.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-3B	Air Rotary	Main Embankment	5,818,306.52	595,765.16	912.06	0	-90	20.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-4A	Air Rotary	South Embankment	5,818,164.58	595,147.94	940.56	0	-90	25.0	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-4B	Air Rotary	South Embankment	5,818,162.87	595,151.26	940.46	0	-90	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-5A	Air Rotary	West side of TSF	5,819,626.68	594,330.34	973.55	0	-90	25.5	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-5B	Air Rotary	West side of TSF	5,819,629.64	594,329.79	973.44	0	-90	7.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	GW96-9	Air Rotary	Main Embankment	5,818,277.14	595,503.89	916.18	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	PRW96-1	Solid Stem Auger	Main Embankment	5,818,643.37	595,825.84	919.50	0	-90	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	PRW96-2	Solid Stem Auger	Main Embankment	5,818,541.21	595,686.74	913.00	0	-90	16.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	PRW96-3	Solid Stem Auger	Main Embankment	5,818,439.06	595,547.63	915.00	0	-90	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1996	Knight Piesold	PRW96-4	Solid Stem Auger	Main Embankment	5,818,356.46	595,443.30	918.00	0	-90	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
1997	Knight Piesold	DH97-BA-F5	-	Borrow Area No. 1	5,818,982.15	595,826.54	-	0	-90	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-F8	-	Borrow Area No. 1	5,819,095.63	595,728.43	-	0	-90	15.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-F10	-	Borrow Area No. 1	5,819,173.84	595,662.79	-	0	-90	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-F13	-	Borrow Area No. 1	5,819,286.97	595,562.93	-	0	-90	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-F16	-	Borrow Area No. 1	5,819,399.40	595,465.86	-	0	-90	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-G5	-	Borrow Area No. 1	5,819,014.63	595,862.51	-	0	-90	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-G6	-	Borrow Area No. 1	5,819,052.34	595,831.08	-	0	-90	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
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1997	Knight Piesold	DH97-BA-H5	-	Borrow Area No. 1	5,819,048.15	595,900.92	-	0	-90	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H7	-	Borrow Area No. 1	5,819,125.66	595,834.57	-	0	-90	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H8	-	Borrow Area No. 1	5,819,164.07	595,801.75	-	0	-90	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H10	-	Borrow Area No. 1	5,819,240.18	595,735.41	-	0	-90	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H12	-	Borrow Area No. 1	5,819,316.30	595,669.77	-	0	-90	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H13	-	Borrow Area No. 1	5,819,354.01	595,636.95	-	0	-90	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H14	-	Borrow Area No. 1	5,819,391.02	595,605.52	-	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H15	-	Borrow Area No. 1	5,819,429.43	595,572.00	-	0	-90	14.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-H16	-	Borrow Area No. 1	5,819,467.14	595,539.18	-	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-I5	-	Borrow Area No. 1	5,819,082.36	595,937.93	-	0	-90	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-I6	-	Borrow Area No. 1	5,819,120.77	595,905.11	-	0	-90	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-I7	-	Borrow Area No. 1	5,819,158.48	595,871.59	-	0	-90	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA-I8	-	Borrow Area No. 1	5,819,195.49	595,838.07	-	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1997	Knight Piesold	DH97-BA2-B1	-	Borrow Area No. 2	5,818,204.66	596,430.29	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-B2	-	Borrow Area No. 2	5,818,282.11	596,369.03	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-B3	-	Borrow Area No. 2	5,818,361.29	596,307.18	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-B4	-	Borrow Area No. 2	5,818,439.32	596,245.34	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-B5	-	Borrow Area No. 2	5,818,516.19	596,184.08	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-C1	-	Borrow Area No. 2	5,818,264.19	596,511.21	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-C2	-	Borrow Area No. 2	5,818,341.64	596,449.36	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-C3	-	Borrow Area No. 2	5,818,420.24	596,388.68	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-C4	-	Borrow Area No. 2	5,818,497.69	596,326.83	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-C5	-	Borrow Area No. 2	5,818,575.72	596,265.57	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-D1	-	Borrow Area No. 2	5,818,323.72	596,592.70	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-D2	-	Borrow Area No. 2	5,818,402.33	596,531.43	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-D3	-	Borrow Area No. 2	5,818,480.35	596,471.33	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-D4	-	Borrow Area No. 2	5,818,557.80	596,408.33	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1997	Knight Piesold	DH97-BA2-D5	-	Borrow Area No. 2	5,818,634.67	596,347.64	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-1	-	Borrow Area No. 4	5,819,831.28	594,714.04	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-2	-	Borrow Area No. 4	5,819,891.34	594,728.01	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-3	-	Borrow Area No. 4	5,819,851.53	594,649.10	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-4	-	Borrow Area No. 4	5,819,908.10	594,667.26	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-5 (N)	-	Borrow Area No. 4	5,819,868.99	594,596.03	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-5 (S)	-	Borrow Area No. 4	5,819,914.38	594,463.34	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-6	-	Borrow Area No. 4	5,819,771.22	594,612.09	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-7	-	Borrow Area No. 4	5,819,762.84	594,508.04	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-8	-	Borrow Area No. 4	5,819,841.06	594,477.31	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-10	-	Borrow Area No. 4	5,819,949.99	594,475.22	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-11	-	Borrow Area No. 4	5,819,932.54	594,544.35	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA4-12	-	Borrow Area No. 4	5,819,921.36	594,605.80	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-1	-	Borrow Area No. 2	5,818,539.20	596,423.03	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-2	-	Borrow Area No. 2	5,818,595.26	596,366.97	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-3	-	Borrow Area No. 2	5,818,651.32	596,281.64	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-4	-	Borrow Area No. 2	5,818,606.18	596,309.92	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-5	-	Borrow Area No. 2	5,818,546.65	596,382.85	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-6	-	Borrow Area No. 2	5,818,476.69	596,523.25	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-7	-	Borrow Area No. 2	5,818,518.86	596,497.45	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-8	-	Borrow Area No. 2	5,818,597.65	596,460.06	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-9	-	Borrow Area No. 2	5,818,646.86	596,398.72	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BA2-16	-	Main Embankment	5,818,689.52	596,103.54	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-NO-NAME	-	Main Embankment	5,818,722.76	596,173.49	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	DH98-BL-01	-	South Embankment	5,818,299.01	595,073.01	944.50	0	-90	1.5	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-02	-	Tailings Basin	5,818,490.51	594,933.26	942.00	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-03	-	South Embankment	5,818,377.20	594,800.76	943.00	0	-90	6.7	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-04	-	South Embankment	5,818,495.46	594,531.42	942.20	0	-90	7.6	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-05	-	South Embankment	5,818,478.74	594,688.69	941.80	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-06	-	South Embankment	5,818,506.61	594,727.70	939.50	0	-90	1.2	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-07	-	Tailings Basin	5,818,705.36	594,410.67	943.00	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-08	-	Tailings Basin	5,818,999.58	594,495.47	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-09	-	Tailings Basin	5,819,142.03	594,400.50	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-10	-	Tailings Basin	5,819,411.59	594,364.88	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-11	-	South Embankment	5,818,284.04	595,144.07	946.00	0	-90	2.1	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-12	-	South Embankment	5,818,375.34	595,031.71	948.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-13	-	South Embankment	5,818,401.97	594,895.49	945.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-14	-	Tailings Basin	5,818,486.39	595,029.77	941.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-15	-	Tailings Basin	5,818,631.68	594,861.44	933.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-16	-	Tailings Basin	5,818,567.29	594,894.87	936.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-17	-	South Embankment	5,818,456.45	594,849.06	942.00	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-18	-	South Embankment	5,818,415.59	594,759.89	942.20	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	DH98-BL-19	-	South Embankment	5,818,477.51	594,599.53	942.20	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1998	Knight Piesold	PRW98-01	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	PRW98-02	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	PRW98-03	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	PRW98-04	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	PRW98-05	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1998	Knight Piesold	PRW98-06	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N

Table C1: Summary of Boreholes

Year	Consultant	Borehole ID	Drill Method	General Location Description	Coordinates		Ground Elevation (m)	Azimuth (degrees)	Inclination (degrees)	Completion Depth (m)	Bedrock Depth (m)	Geotechnical Instrumentation																Record of Borehole Log in Database?	Location on Figure 01?	Location on Figure 02?
												VWP 1				VWP 2				VWP 3				Slope Inclinometer		Shape Accel Array						
					Northing (m)	Easting (m)						Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Collar Elevation (m)	Base Elevation (m)	Sensor Top Elevation (m)	Sensor Base Elevation (m)	SAA ID	Serial No.			
1998	Knight Piesold	PRW98-07	-	Main Embankment	-	-	-	0	-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
1999	Knight Piesold	BH99-01	-	South Embankment	5,818,482.46	594,754.94	934.00	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-02	-	South Embankment	5,818,474.41	594,729.55	936.00	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-03	-	South Embankment	5,818,502.89	594,694.88	935.50	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-04	-	South Embankment	5,818,510.94	594,670.73	935.50	0	-90	0.9	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-05	-	South Embankment	5,818,520.85	594,653.39	940.00	0	-90	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-06	-	South Embankment	5,818,543.76	594,609.43	935.80	0	-90	1.8	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-07	-	South Embankment	5,818,551.81	594,576.00	936.00	0	-90	2.4	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-08	-	South Embankment	5,818,567.29	594,518.41	937.50	0	-90	3.7	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-09	-	South Embankment	5,818,554.90	594,499.22	939.50	0	-90	5.8	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-10	-	South Embankment	5,818,553.67	594,432.97	945.00	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-11	-	South Embankment	5,818,523.94	594,462.07	943.00	0	-90	6.7	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-12	-	South Embankment	5,818,315.28	594,919.02	946.50	0	-90	5.5	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-13	-	South Embankment	5,818,362.34	594,899.83	948.00	0	-90	5.5	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-14	-	South Embankment	5,818,395.16	594,888.06	946.50	0	-90	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-15	-	South Embankment	5,818,470.08	594,759.89	934.50	0	-90	1.8	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-16	-	South Embankment	5,818,440.97	594,885.59	944.00	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-17	-	South Embankment	5,818,479.36	594,871.35	939.50	0	-90	5.8	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-18	-	South Embankment	5,818,505.37	594,851.53	936.50	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-19	-	South Embankment	5,818,488.65	594,822.43	935.00	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-20	-	South Embankment	5,818,464.50	594,802.00	936.00	0	-90	6.1	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-21	-	South Embankment	5,818,442.21	594,769.80	936.00	0	-90	4.3	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-22	-	Tailings Basin	5,818,855.21	594,554.32	935.00	0	-90	6.1	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-23	-	Tailings Basin	5,818,811.86	594,562.37	933.20	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-24	-	Tailings Basin	5,818,776.75	594,531.91	933.00	0	-90	4.3	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-25	-	Tailings Basin	5,818,733.23	594,506.65	933.80	0	-90	3.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-26	-	Tailings Basin	5,818,762.95	594,525.22	934.00	0	-90	4.6	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-27	-	Tailings Basin	5,818,794.53	594,548.13	934.00	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-28	-	Tailings Basin	5,818,746.85	594,467.64	938.00	0	-90	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-29	-	Tailings Basin	5,818,712.79	594,428.63	941.50	0	-90	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-30	-	South Embankment	5,818,652.12	594,419.34	939.50	0	-90	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-31	-	South Embankment	5,818,598.25	594,444.73	938.50	0	-90	5.8	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-32	-	Tailings Basin	5,818,681.22	594,518.41	933.10	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-33	-	South Embankment	5,818,640.35	594,511.60	933.50	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-34	-	South Embankment	5,818,591.44	594,506.03	935.50	0	-90	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-35	-	Tailings Basin	5,818,831.06	594,515.32	393.00	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-36	-	Tailings Basin	5,818,852.73	594,468.26	942.80	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-37	-	Tailings Basin	5,818,804.43	594,504.79	938.50	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-38	-	Tailings Basin	5,818,819.29	594,465.78	942.50	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-39	-	Tailings Basin	5,818,790.81	594,502.93	938.00	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-40	-	Tailings Basin	5,818,795.77	594,457.11	942.40	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-41	-	South Embankment	5,818,263.27	594,902.92	948.50	0	-90	5.8	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-42	-	South Embankment	5,818,326.43	594,963.60	947.20	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-43	-	South Embankment	5,818,357.39	594,950.60	946.80	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	BH99-44	-	South Embankment	5,818,377.82	594,941.93	946.20	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-45	-	South Embankment	5,818,531.74	594,642.13	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-46	-	South Embankment	5,818,545.24	594,659.35	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-47	-	South Embankment	5,818,539.66	594,684.49	-	0	-90	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-48	-	South Embankment	5,818,550.36	594,680.77	-	0	-90	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-49	-	South Embankment	5,818,547.57	594,697.53	-	0	-90	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-50	-	South Embankment	5,818,540.12	594,713.35	-	0	-90	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-51	-	South Embankment	5,818,514.98	594,689.61	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-52	-	South Embankment	5,818,498.69	594,706.37	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-53	-	South Embankment	5,818,517.78	594,715.22	-	0	-90	1.8	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-54	-	South Embankment	5,818,517.42	594,718.89	-	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-55	-	South Embankment	5,818,501.04	594,738.95	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-56	-	South Embankment	5,818,468.79	594,746.65	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-57	-	South Embankment	5,818,468.22	594,733.52	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-58	-	South Embankment	5,818,459.08	594,772.91	-	0	-90	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-59	-	South Embankment	5,818,447.66	594,837.13	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-60	-	South Embankment	-	-	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-61	-	South Embankment	5,818,293.31	595,038.04	-	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-62	-	South Embankment	5,818,314.37	594,988.98	-	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-63	-	South Embankment	5,818,284.69	595,000.00	-	0	-90	1.1	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-64	-	South Embankment	5,818,259.32	595,045.95	-	0	-90	1.3	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-65	-	South Embankment	5,818,253.74	595,081.33	-	0	-90	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-66	-	South Embankment	5,818,262.06	595,125.14	-	0	-90	0.9	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-67	-	South Embankment	5,818,314.58	595,097.05	-	0	-90	2.7	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-68	-	South Embankment	5,818,354.04	595,040.07	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-69	-	South Embankment	5,818,330.92	595,013.24	-	0	-90	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-70	-	South Embankment	5,818,322.65	595,000.00	-	0	-90	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-71	-	South Embankment	5,818,347.19	594,963.58	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-72	-	South Embankment	5,818,311.23	594,972.71	-	0	-90	0.9	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-73	-	South Embankment	5,818,302.38	594,954.73	-	0	-90	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-74	-	Main Embankment	5,818,795.20	596,109.49	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-75	-	Main Embankment	5,818,804.62	596,093.62	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-76	-	Main Embankment	5,818,783.79	596,059.88	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-77	-	Main Embankment	5,818,758.98	596,072.29	-	0	-90	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-78	-	Main Embankment	5,818,720.78	596,040.04	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-79	-	Main Embankment	5,818,733.43	596,005.59	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-80	-	Main Embankment	5,818,710.22	595,975.87	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-81	-	Main Embankment	5,818,689.05	596,005.59	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-82	-	Main Embankment	5,818,671.54	595,946.97	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-83	-	Main Embankment	5,818,653.22	595,971.39	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-84	-	Main Embankment	5,818,643.45	595,906.66	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-85	-	Main Embankment	5,818,609.25	595,909.10	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-86	-	Main Embankment	5,818,569.55	595,880.40	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-87	-	Main Embankment	5,818,577.49	595,844.97	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-88	-	Main Embankment	5,818,511.53	595,823.60	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-89	-	Main Embankment	5,818,519.78	595,790.82	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-90	-	Main Embankment	5,818,481.10	595,782.68	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-91	-	Main Embankment	5,818,483.14	595,734.23	-	0	-90	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-92	-	Main Embankment	5,818,448.53	595,744.00	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-93	-	Main Embankment	5,818,376.06	595,655.65	-	0	-90	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-94	-	Main Embankment	5,818,394.38	595,619.82	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-95	-	Main Embankment	5,818,326.38	595,520.89	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-96	-	Main Embankment	5,818,308.06	595,540.43	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-97	-	Main Embankment	5,818,275.08	595,482.61	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-98	-	Main Embankment	5,818,349.59	595,597.84	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-99	-	Main Embankment	5,818,354.07	595,565.67	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-100	-	Main Embankment	5,818,260.43	595,437.83	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-101	-	Main Embankment	5,818,236.81	595,427.24	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-102	-	Main Embankment	5,818,236.81	595,405.66	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-103	-	Main Embankment	5,818,223.78	595,386.12	-	0	-90	2.9	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-104	-	Main Embankment	5,818,218.69	595,357.82	-	0	-90	2.2	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-105	-	Main Embankment	5,818,222.36	595,321.79	-	0	-90	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-106	-	Main Embankment	5,818,215.03	595,279.04	-	0	-90	3.4	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-107	-	South Embankment	5,818,193.04	595,224.69	-	0	-90	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-108	-	Main Embankment	5,818,175.33	595,307.74	-	0	-90	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-109	-	Main Embankment	5,818,176.55	595,366.98	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-110	-	South Embankment	5,818,226.63	595,172.77	-	0	-90	1.7	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-111	-	Corner 1 Embankment	5,820,012.58	594,936.53	-	0	-90	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N

Table C1: Summary of Boreholes

Year	Consultant	Borehole ID	Drill Method	General Location Description	Coordinates		Ground Elevation (m)	Azimuth (degrees)	Inclination (degrees)	Completion Depth (m)	Bedrock Depth (m)	Geotechnical Instrumentation																Record of Borehole Log in Database?	Location on Figure 01?	Location on Figure 02?
												VWP 1				VWP 2				VWP 3				Slope Inclinometer		Shape Accel Array						
					Northing (m)	Easting (m)						Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Collar Elevation (m)	Base Elevation (m)	Sensor Top Elevation (m)	Sensor Base Elevation (m)	SAA ID	Serial No.			
1999	Knight Piesold	DH99-112	-	Corner 1 Embankment	5,820,005.12	595,000.00	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-113	-	Corner 1 Embankment	5,820,016.31	595,026.41	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-114	-	Corner 1 Embankment	5,819,991.81	595,051.29	-	0	-90	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-115	-	Corner 1 Embankment	5,819,962.02	595,077.36	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-116	-	Corner 1 Embankment	5,819,973.66	595,111.81	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-117	-	Corner 1 Embankment	5,819,941.53	595,117.40	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-118	-	Corner 1 Embankment	5,819,947.59	595,147.66	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-119	-	Corner 1 Embankment	5,819,914.07	595,153.71	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-120	-	Corner 1 Embankment	5,819,920.59	595,197.94	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-121	-	Corner 1 Embankment	5,819,878.69	595,204.92	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-122	-	Corner 1 Embankment	5,819,887.07	595,250.08	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-123	-	Corner 1 Embankment	5,819,825.15	595,279.41	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-124	-	Perimeter Embankment	5,819,750.19	595,391.60	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-125	-	Perimeter Embankment	5,819,751.59	595,422.80	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-126	-	Perimeter Embankment	5,819,696.66	595,465.16	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-127	-	Perimeter Embankment	5,819,643.12	595,536.39	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-128	-	Perimeter Embankment	5,819,632.88	595,592.26	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-129	-	Perimeter Embankment	5,819,588.18	595,618.33	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-130	-	Perimeter Embankment	5,819,575.61	595,663.49	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-131	-	Perimeter Embankment	5,819,540.70	595,691.88	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-132	-	Corner 1 Embankment	5,820,016.10	595,044.43	-	0	-90	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-133	-	Corner 1 Embankment	5,819,972.60	594,879.16	-	0	-90	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-134	-	Borrow Area No. 2	5,818,655.79	596,347.62	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-135	-	Borrow Area No. 2	5,818,649.34	596,372.43	-	0	-90	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-136	-	Borrow Area No. 2	5,818,611.14	596,360.03	930.00	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-137	-	Borrow Area No. 2	5,818,611.14	596,398.72	937.40	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-139	-	Borrow Area No. 2	5,818,701.93	596,364.49	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-140	-	Borrow Area No. 2	5,818,729.21	596,468.18	938.50	0	-90	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-141	-	Borrow Area No. 2	5,818,681.59	596,551.52	938.40	0	-90	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-142	-	Borrow Area No. 2	5,818,663.23	596,494.47	938.60	0	-90	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-143	-	Borrow Area No. 2	5,818,661.25	596,601.14	937.80	0	-90	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-144	-	Borrow Area No. 2	5,818,634.95	596,505.88	939.00	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-145	-	Borrow Area No. 2	5,818,610.15	596,568.39	938.90	0	-90	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-146	-	Borrow Area No. 2	5,818,600.72	596,517.29	939.50	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-147	-	Borrow Area No. 2	5,818,585.84	596,584.76	939.20	0	-90	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-148	-	Borrow Area No. 2	5,818,571.95	596,529.20	939.30	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-149	-	Borrow Area No. 2	5,818,552.60	596,611.06	939.80	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-150	-	Borrow Area No. 2	5,818,530.27	596,546.07	939.20	0	-90	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-151	-	Borrow Area No. 2	5,818,751.54	596,277.67	937.00	0	-90	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-152	-	Borrow Area No. 2	5,818,772.87	596,309.42	937.20	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-153	-	Borrow Area No. 2	5,818,820.50	596,362.01	938.60	0	-90	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-154	-	Borrow Area No. 2	5,818,869.12	596,415.59	939.00	0	-90	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-155	-	Borrow Area No. 2	5,818,837.86	596,450.82	938.40	0	-90	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-156	-	Borrow Area No. 2	5,818,793.71	596,459.75	938.10	0	-90	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-157	-	Borrow Area No. 2	5,818,726.24	596,509.36	938.40	0	-90	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
1999	Knight Piesold	DH99-158	-	Borrow Area No. 2	5,818,727.23	596,434.44	938.00	0	-90	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2000	Knight Piesold	GW00-1	ODEX	South Embankment	5,818,476.00	594,368.00	939.18	0	-90	21.0	9.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2000	Knight Piesold	GW00-2	ODEX	South Embankment	5,818,337.50	594,651.80	943.40	0	-90	21.6	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2000	Knight Piesold	GW00-3	ODEX	South Embankment	5,818,238.10	594,896.40	943.07	0	-90	24.3	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-01	-	Borrow Area No. 2	5,818,909.31	596,436.65	-	0	-90	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-02	-	Borrow Area No. 2	5,818,880.48	596,450.41	-	0	-90	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-03	-	Borrow Area No. 2	5,818,841.85	596,468.93	-	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-04	-	Borrow Area No. 2	5,818,803.62	596,486.13	-	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-05	-	Borrow Area No. 2	5,818,838.14	596,508.62	-	0	-90	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-06	-	Borrow Area No. 2	5,818,802.56	596,548.57	-	0	-90	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-07	-	Borrow Area No. 2	5,818,842.38	596,534.28	-	0	-90	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-08	-	Borrow Area No. 2	5,818,872.80	596,520.00	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-09	-	Borrow Area No. 2	5,818,895.56	596,507.03	-	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-10	-	Borrow Area No. 2	5,818,913.55	596,536.14	-	0	-90	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-11	-	Borrow Area No. 2	5,818,886.83	596,482.96	-	0	-90	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-12	-	Borrow Area No. 2	5,818,920.43	596,491.16	-	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-13	-	Borrow Area No. 2	5,818,944.50	596,475.02	-	0	-90	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-14	-	Borrow Area No. 2	5,818,788.27	596,580.58	-	0	-90	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-15	-	Borrow Area No. 2	5,818,818.04	596,603.60	-	0	-90	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-16	-	Borrow Area No. 2	5,818,850.84	596,590.37	-	0	-90	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-17	-	Borrow Area No. 2	5,818,863.81	596,554.66	-	0	-90	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-18	-	Borrow Area No. 2	5,818,883.39	596,576.88	-	0	-90	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-19	-	Borrow Area No. 2	5,818,925.72	596,559.68	-	0	-90	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-20	-	Borrow Area No. 2	5,818,943.97	596,543.81	-	0	-90	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-21	-	Borrow Area No. 2	5,818,964.08	596,515.76	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-22	-	Borrow Area No. 2	5,818,575.68	596,668.95	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-23	-	Borrow Area No. 2	5,818,547.90	596,628.74	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-24	-	Borrow Area No. 2	5,818,521.45	596,599.90	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-25	-	Borrow Area No. 2	5,818,489.43	596,553.07	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-26	-	Borrow Area No. 2	5,818,479.64	596,531.90	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-27 (N)	-	Borrow Area No. 2	5,818,615.37	596,751.50	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-27 (S)	-	Borrow Area No. 2	5,818,442.69	596,490.26	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-28	-	Borrow Area No. 2	5,818,581.50	596,720.02	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-29	-	Borrow Area No. 2	5,818,548.17	596,684.83	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-30	-	Borrow Area No. 2	5,818,511.66	596,650.96	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-31	-	Borrow Area No. 2	5,818,476.47	596,619.48	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-32	-	Borrow Area No. 2	5,818,433.61	596,588.26	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-33	-	Borrow Area No. 2	5,818,383.39	596,525.66	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-34	-	Borrow Area No. 2	5,818,577.80	596,938.03	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-35	-	Borrow Area No. 2	5,818,552.93	596,893.84	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-36	-	Borrow Area No. 2	5,818,529.65	596,848.60	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-37	-	Borrow Area No. 2	5,818,503.72	596,802.30	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-38	-	Borrow Area No. 2	5,818,477.79	596,755.47	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-39	-	Borrow Area No. 2	5,818,455.57	596,709.17	-	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-40	-	Borrow Area No. 2	5,818,436.25	596,666.57	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-41	-	Borrow Area No. 2	5,818,416.41	596,616.04	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-42	-	Borrow Area No. 2	5,818,338.08	596,526.12	-	0	-90	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-43	-	Borrow Area No. 2	5,818,364.43	596,566.80	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-44	-	Borrow Area No. 2	5,818,529.65	596,963.43	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-45	-	Borrow Area No. 2	5,818,517.74	596,918.18	-	0	-90	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-46	-	Borrow Area No. 2	5,818,495.52	596,876.12	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-47	-	Borrow Area No. 2	5,818,473.56	596,831.67	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-48	-	Borrow Area No. 2	5,818,452.39	596,785.63	-	0	-90	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-49	-	Borrow Area No. 2	5,818,428.84	596,737.74	-	0	-90	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-50	-	Borrow Area No. 2	5,818,409.00	596,696.47	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-51	-	Borrow Area No. 2	5,818,373.21	596,636.61	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-52	-	Borrow Area No. 3	5,818,392.63	596,807.67	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-53	-	Borrow Area No. 3	5,818,372.75	596,761.90	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-54	-	Borrow Area No. 3	5,818,351.49	596,717.52	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-55	-	Borrow Area No. 3	5,818,326.98	596,668.51	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-56	-	Borrow Area No. 3	5,818,341.78	596,860.38	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-57	-	Borrow Area No. 3	5,818,326.06	596,806.75	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-58	-	Borrow Area No. 3	5,818,310.80	596,759.59	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-59	-	Borrow Area No. 3	5,818,280.29	596,694.87	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-60	-	Borrow Area No. 3	5,818,283.06	596,584.37	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-61	-	Borrow Area No. 2	5,818,308.95	596,563.57	-	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-62	-	Borrow Area No. 3	5,818,231.28	596,783.17	-	0	-90	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N

Table C1: Summary of Boreholes

Year	Consultant	Borehole ID	Drill Method	General Location Description	Coordinates		Ground Elevation (m)	Azimuth (degrees)	Inclination (degrees)	Completion Depth (m)	Bedrock Depth (m)	Geotechnical Instrumentation																Record of Borehole Log in Database?	Location on Figure 01?	Location on Figure 02?
												VWP 1				VWP 2				VWP 3				Slope Inclinometer		Shape Accel Array						
					Northing (m)	Easting (m)						Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Collar Elevation (m)	Base Elevation (m)	Sensor Top Elevation (m)	Sensor Base Elevation (m)	SAA ID	Serial No.			
2001	Knight Piesold	DH01-63	-	Borrow Area No. 3	5,818,132.34	596,828.48	-	0	-90	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-64	-	Borrow Area No. 3	5,818,045.43	596,771.15	-	0	-90	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-65	-	Borrow Area No. 3	5,818,221.11	596,588.07	-	0	-90	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-66	-	Borrow Area No. 2	5,818,252.55	596,506.70	-	0	-90	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	DH01-67	-	-	-	-	-	0	-90	5.2	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-68	-	-	-	-	-	0	-90	2.7	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-69	-	-	-	-	-	0	-90	1.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-70	-	-	-	-	-	0	-90	3.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-71	-	-	-	-	-	0	-90	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-72	-	-	-	-	-	0	-90	1.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-73	-	-	-	-	-	0	-90	2.7	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-74	-	-	-	-	-	0	-90	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-75	-	-	-	-	-	0	-90	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-76	-	-	-	-	-	0	-90	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-77	-	-	-	-	-	0	-90	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-78	-	-	-	-	-	0	-90	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-79	-	-	-	-	-	0	-90	1.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	DH01-80	-	-	-	-	-	0	-90	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	N
2001	Knight Piesold	SI01-01	ODEX	Main Embankment	5,818,464.00	595,667.00	915.70	0	-90	24.4	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2001	Knight Piesold	SI01-02	ODEX	Main Embankment	5,818,401.00	595,589.00	917.30	0	-90	30.3	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2006	Knight Piesold	SI06-01	Air Rotary	Main Embankment	5,818,399.60	595,649.50	917.10	0	-90	42.2	31.7	-	-	-	-	-	-	-	-	-	-	-	-	917.40	875.10	-	-	Y	Y	N
2006	Knight Piesold	SI06-02	Air Rotary	Main Embankment	5,818,462.93	595,734.02	917.10	0	-90	34.7	27.2	-	-	-	-	-	-	-	-	-	-	-	-	918.10	886.10	-	-	Y	Y	N
2006	Knight Piesold	SI06-03	Air Rotary	Main Embankment	5,818,520.66	595,815.07	917.70	0	-90	40.6	36.9	-	-	-	-	-	-	-	-	-	-	-	-	918.70	882.60	-	-	Y	Y	N
2008	Knight Piesold	KP08-01	Sonic	Perimeter Embankment	5,819,445.00	595,951.00	935.00	0	-90	19.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-02	Sonic	Perimeter Embankment	5,819,292.00	596,125.00	935.00	0	-90	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-04	Sonic	Perimeter Embankment	5,819,414.00	596,269.00	920.00	0	-90	20.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-06	Sonic	Perimeter Embankment	5,819,131.00	596,297.00	937.00	0	-90	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-08	Sonic	Perimeter Embankment	5,819,276.00	596,451.00	918.00	0	-90	17.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-09	Sonic	Perimeter Embankment	5,819,617.00	596,070.00	921.00	0	-90	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-11	Sonic	Perimeter Embankment	5,819,744.00	595,835.00	924.00	0	-90	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-12	Sonic	Perimeter Embankment	5,819,605.00	595,741.00	933.00	0	-90	23.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-14	Sonic	Perimeter Embankment	5,819,739.00	595,544.00	931.00	0	-90	20.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-15	Sonic	Perimeter Embankment	5,819,880.00	595,608.00	925.00	0	-90	20.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2008	Knight Piesold	KP08-16	Sonic	Perimeter Embankment	5,819,663.00	595,778.00	930.00	0	-90	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-01	Sonic	South Embankment	5,818,480.00	594,463.00	941.01	0	-90	11.1	7.0	7.0	934.01	F5	1119797	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-02	Sonic	South Embankment	5,818,343.00	594,786.00	945.09	0	-90	17.4	10.7	7.6	937.49	I5	1119796	10.4	934.69	I6	1119792	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-03	Sonic	Main Embankment	5,818,272.00	595,467.00	927.00	0	-90	23.2	21.3	15.2	911.80	E6	1119794	18.9	908.10	E7	1119801	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-04	Sonic	Main Embankment	5,818,309.00	595,533.00	921.59	0	-90	29.3	25.6	12.5	909.09	C11	1119798	21.0	900.59	C12	1119795	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-05	Sonic	Main Embankment	5,818,410.00	595,605.00	920.60	0	-90	32.3	27.7	12.2	908.40	A16	1119799	16.8	903.80	A17	09-2810	24.4	896.20	A18	09-2808	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-06	Sonic	Main Embankment	5,818,423.00	595,686.00	916.34	0	-90	35.4	31.7	10.7	905.64	A19	09-2811	15.2	901.14	A20	09-2809	22.9	893.44	A21	1119786	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-07	Sonic	Main Embankment	5,818,554.00	595,850.00	919.78	0	-90	43.3	40.0	13.7	906.08	B11	1119793	25.9	893.88	B12	1119791	31.1	888.68	B13	1119785	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-08	Sonic	Main Embankment	5,818,697.00	596,027.00	927.66	0	-90	47.5	44.5	15.2	912.46	K1	1119788	33.8	893.86	K2	1119784	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-09	Sonic	Perimeter Embankment	5,819,415.00	595,928.00	936.59	0	-90	41.7	39.0	19.4	917.19	J1	1119800	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2011	AMEC	VW11-10	Sonic	Perimeter Embankment	5,819,783.00	595,410.00	931.80	0	-90	42.4	41.5	18.4	913.40	D6	1119790	24.4	907.40	D7	1119802	-	-	-	-	-	-	-	-	-	Y	Y	Y
2011	AMEC	VW11-11	Sonic	Corner 1 Embankment	5,820,031.00	594,892.00	940.89	0	-90	23.5	14.9	6.1	934.79	G4	1119789	10.7	930.19	G5	1119787	-	-	-	-	-	-	-	-	-	Y	Y	Y
2011	AMEC	SI11-01	Sonic	Main Embankment	5,818,353.00	595,527.00	921.08	0	-90	44.8	25.9	-	-	-	-	-	-	-	-	-	-	-	-	921.10	876.30	-	-	Y	Y	N
2011	AMEC	SI11-02	Sonic	Main Embankment	5,818,716.00	595,998.00	928.27	0	-90	49.4	46.0	-	-	-	-	-	-	-	-	-	-	-	-	928.30	878.90	-	-	Y	Y	N
2011	AMEC	SI11-04	Sonic	Perimeter Embankment	5,819,780.00	595,408.00	931.93	0	-90	43.3	41.1	-	-	-	-	-	-	-	-	-	-	-	-	931.90	888.60	-	-	Y	Y	Y
2012	AMEC	SI12-01	ODEX	Perimeter Embankment	5,819,786.00	595,408.00	940.00	0	-90	41.5	40.8	-	-	-	-	-	-	-	-	-	-	-	-	940.00	898.50	-	-	Y	Y	Y
2012	AMEC	SI12-02	ODEX	Perimeter Embankment	5,819,421.00	595,920.00	940.00	0	-90	42.7	42.1	-	-	-	-	-	-	-	-	-	-	-	-	940.00	897.30	-	-	Y	Y	N
2014	Thurber	MR14-101	Mud Rotary	Dam Breach Area	5,819,826.00	595,340.00	933.00	0	-90	16.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-102	Mud Rotary	Dam Breach Area	5,819,832.00	595,330.00	932.50	0	-90	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-103	Mud Rotary	Dam Breach Area	5,819,865.00	595,296.00	930.70	0	-90	9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	SC14-103	Soil Coring	Dam Breach Area	5,819,967.00	595,292.00	930.80	0	-90	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	SC14-103A	Soil Coring	Dam Breach Area	5,819,868.00	595,290.00	930.90	0	-90	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-104	Mud Rotary	Dam Breach Area	5,819,891.00	595,255.00	931.70	0	-90	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-105	Mud Rotary	Dam Breach Area	5,819,914.00	595,228.00	931.70	0	-90	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-105A	Mud Rotary	Dam Breach Area	5,819,916.00	595,226.00	931.70	0	-90	2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106	Mud Rotary	Dam Breach Area	5,819,997.00	595,148.00	929.40	0	-90	12.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106A	Mud Rotary	Dam Breach Area	5,819,997.00	595,146.00	928.70	0	-90	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106B	Mud Rotary	Dam Breach Area	5,820,001.00	595,139.00	928.50	0	-90	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106C	Mud Rotary	Dam Breach Area	5,820,002.00	595,139.00	928.50	0	-90	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106D	Mud Rotary	Dam Breach Area	5,819,993.00	595,137.00	928.70	0	-90	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106E	Mud Rotary	Dam Breach Area	5,819,990.00	595,134.00	929.00	0	-90	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106F	Mud Rotary	Dam Breach Area	5,819,994.00	595,134.00	928.70	0	-90	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106G	Mud Rotary	Dam Breach Area	5,819,997.00	595,135.00	928.70	0	-90	8.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106H	Mud Rotary	Dam Breach Area	5,819,998.00	595,135.00	928.60	0	-90	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-106I	Mud Rotary	Dam Breach Area	5,820,001.00	595,135.00	928.60	0	-90	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-107	Mud Rotary	Dam Breach Area	5,820,013.00	595,131.00	928.70	0	-90	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-107A	Mud Rotary	Dam Breach Area	5,820,013.00	595,132.00	928.30	0	-90	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-107B	Mud Rotary	Dam Breach Area	5,820,013.00	595,129.00	928.40	0	-90	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-108	Mud Rotary	Dam Breach Area	5,820,013.00	595,105.00	928.60	0	-90	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-108A	Mud Rotary	Dam Breach Area	5,820,014.00	595,106.00	928.60	0	-90	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-109	Mud Rotary	Dam Breach Area	5,820,022.00	595,087.00	929.00	0	-90	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-110	Mud Rotary	Dam Breach Area	5,820,037.00	595,092.00	928.70	0	-90	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-111	Mud Rotary	Dam Breach Area	5,820,044.00	595,115.00	928.60	0	-90	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-111A	Mud Rotary	Dam Breach Area	5,820,046.00	595,119.00	928.10	0	-90	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-112	Mud Rotary	Dam Breach Area	5,820,028.00	595,149.00	928.90	0	-90	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-112A	Mud Rotary	Dam Breach Area	5,820,026.00	595,151.00	928.70	0	-90	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-113	Mud Rotary	Dam Breach Area	5,820,013.00	595,152.00	929.40	0	-90	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-114	Mud Rotary	Dam Breach Area	5,819,981.00	595,064.00	930.60	0	-90	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-115	Mud Rotary	Dam Breach Area	5,820,007.00	595,076.00	929.00	0	-90	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-116	Mud Rotary	Dam Breach Area	5,819,969.00	595,113.00	930.60	0	-90	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	MR14-116A	Mud Rotary	Dam Breach Area	5,819,969.00	595,112.00	930.60	0	-90	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	RH14-117	ODEX / Mud Rotary	Dam Breach Area	5,819,939.00	595,125.00	932.40	0	-90	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	RH14-117A	ODEX / Mud Rotary	Dam Breach Area	5,819,936.00	595,132.00	932.60	0	-90	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	Thurber	RH14-118	ODEX / Mud Rotary	Dam Breach Area	5,819,922.00	595,176.00	937.70	0	-90	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-01	Sonic	Dam Breach Area	5,819,871.71	595,247.86	931.35	0	-90	44.5	18.6	43.3	888.05	VWP-A	VW30340	15.8	915.55	VWP-B	VW30342	8.8	922.55	VWP-C	VW30341	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-01A	Sonic	Dam Breach Area	5,819,868.67	595,252.00	931.20	0	-90	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-02	Sonic	Dam Breach Area	5,819,957.08	595,204.00	932.90	0	-90	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-02A	Sonic	Dam Breach Area	5,819,957.44	595,206.55	932.93	0	-90	24.7	16.8	15.2	917.73	VWP-A	VW30347	9.1	923.83	VWP-B	VW30343	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-03	Sonic	Dam Breach Area	5,819,940.73	595,130.30	932.52	0	-90	47.8	22.1	-	-	-	-	-	-	-	-	-	-	-	-	933.30	885.02	930.0	902.6	SAA15-01	62667	Y	N	Y
2014	KCB	SH14-03A	Sonic	Dam Breach Area	5,819,935.11	595,132.33	932.62	0	-90	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	SH14-03B	Sonic	Dam Breach Area	5,819,933.59	595,130.16	932.63	0	-90	20.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	SH14-04	Sonic	Dam Breach Area	5,819,908.34	595,109.12	932.20	0	-90	26.2	24.8	-	-	-	-	-	-	-	-	-	-	-	-	933.10	906.30	-	-	-	-	Y	N	Y
2014	KCB	SH14-05	Sonic	Dam Breach Area	5,819,918.30	595,194.61	937.11	0	-90	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-05A	Sonic	Dam Breach Area	5,819,919.53	595,193.34	937.21	0	-90	29.6	21.5	20.7	916.51	VWP-A	VW30345	15.8	921.41	VWP-B	VW30357	13.7	923.51	VWP-C	VW30356	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-06	Sonic	Dam Breach Area	5,819,917.39	595,179.92	937.46	0	-90	35.7	22.4	-	-	-	-	-	-	-	-	-	-	-	-	938.40	902.06	-	-	-	-	Y	N	Y
2014	KCB	SH14-07	Sonic	Dam Breach Area	5,819,898.72	595,055.32	931.70	0	-90	20.4	14.0	12.2	919.50	VWP-A	VW30355	9.1	922.60	VWP-B	VW30354	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-08	Sonic	Dam Breach Area	5,819,888.90	595,167.20	947.55	0	-90	60.1	42.3	34.7	912.85	VWP-A	VW30350	24.1	923.45	VWP-B	VW30353	22.9	924.65	VWP-C	VW30351	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-08A	Sonic	Dam Breach Area	5,819,887.33	595,169.80	947.61	0	-90	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-09	Sonic	Dam Breach Area	5,819,910.99	595,144.50	937.97	0	-90	61.7	28.0	-	-	-	-	-	-	-	-	-	-	-	-	938.90	906.57	-	-	-	-	Y	N	Y
2014	KCB	SH14-10	Sonic	Dam Breach Area	5,819,965.07	595,147.95	932.15	0	-90	26.5	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-10A	Sonic	Dam Breach Area	5,819,963.00	595,145.20	930.96	0	-90	17.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	SH14-11	Sonic	Dam Breach Area	5,819,994.51	595,168.10	930.97	0	-90	20.4	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-11A	Sonic	Dam Breach Area	5,819,993.79	595,167.68	930.86	0	-90	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-11B	Sonic	Dam Breach Area	5,819,992.35	595,169.20	931.17	0	-90	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-12	Sonic	Dam Breach Area	5,819,841.69	595,296.54	930.77	0	-90	23.6	20.1	15.2	915.57	VWP-A	VW30344	7.6	923.17	VWP-B	VW30348	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-13	Sonic	Perimeter Embankment	5,819,770.42	595,404.93	933.06	0	-90	32.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-14	Sonic	Dam Breach Area	5,819,936.34	595,095.71	930.12	0	-90	23.6	17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-15	Sonic	Dam Breach Area	5,819,958.85	595,103.95	930.19	0	-90	23.5	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-16	Sonic	Dam Breach Area	5,819,973.26	595,076.47	930.23	0	-90	23.5	14.0	-	-	-	-	-	-	-	-	-	-	-	-	931.30	907.03	929.1	908.7	SAA15-02	62550	Y	N	Y

Table C1: Summary of Boreholes

Year	Consultant	Borehole ID	Drill Method	General Location Description	Coordinates		Ground Elevation (m)	Azimuth (degrees)	Inclination (degrees)	Completion Depth (m)	Bedrock Depth (m)	Geotechnical Instrumentation														Record of Borehole Log in Database?	Location on Figure 01?	Location on Figure 02?
												VWP 1				VWP 2				VWP 3				Slope Inclinometer		Shape Accel Array						
					Northing (m)	Easting (m)						Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Installation Depth (m)	Elevation (m)	VWP ID	Serial No.	Collar Elevation (m)	Base Elevation (m)	Sensor Top Elevation (m)	Sensor Base Elevation (m)	SAA ID	Serial No.			
2014	KCB	SH14-17	Sonic	Dam Breach Area	5,819,997.87	595,090.27	929.57	0	-90	20.4	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-18	Sonic	Dam Breach Area	5,820,024.51	595,016.05	934.76	0	-90	25.0	19.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-19	Sonic	Dam Breach Area	5,820,042.20	594,883.10	942.82	0	-90	20.4	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-20	Sonic	Dam Breach Area	5,819,968.30	594,861.83	969.92	0	-90	54.0	49.3	51.8	918.12	VWP-A	VW30368	39.9	930.02	VWP-B	VW30371	35.1	934.82	VWP-C	VW30373	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-21	Sonic	Dam Breach Area	5,819,759.86	595,303.52	968.91	0	-90	72.4	66.1	56.4	912.51	VWP-A	VW30369	43.6	925.31	VWP-B	VW30372	40.8	928.11	VWP-C	VW30370	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-22	Sonic	Dam Breach Area	5,819,985.00	595,117.70	929.89	0	-90	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	SH14-22A	Sonic	Dam Breach Area	5,819,984.00	595,119.90	929.96	0	-90	23.5	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	N	Y
2014	KCB	RH14-03	Mud Rotary	Dam Breach Area	5,819,939.00	595,125.10	932.40	0	-90	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	RH14-03A	Mud Rotary	Dam Breach Area	5,819,936.00	595,132.30	932.59	0	-90	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	RH14-10	Mud Rotary	Dam Breach Area	5,819,964.65	595,142.43	930.91	0	-90	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	RH14-10A	Mud Rotary	Dam Breach Area	5,819,965.51	595,141.18	930.86	0	-90	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	RH14-22	Mud Rotary	Dam Breach Area	5,819,981.00	595,126.50	929.78	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	RH14-22A	Mud Rotary	Dam Breach Area	5,819,983.00	595,126.00	929.79	0	-90	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	VST14-03	Mud Rotary	Dam Breach Area	5,819,934.14	595,129.01	932.77	0	-90	9.8	-	12.2	920.57	VWP-A	VW30346	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	VST14-10	Mud Rotary	Dam Breach Area	5,819,962.22	595,152.14	932.08	0	-90	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	VST14-10A	Mud Rotary	Dam Breach Area	5,819,964.65	595,139.43	930.91	0	-90	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2014	KCB	VST14-22	Mud Rotary	Dam Breach Area	5,819,982.71	595,122.56	929.79	0	-90	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	Y
2015	Golder	GA15-01	Sonic	Perimeter Embankment Buttress	5,820,063.30	594,549.30	967.80	0	-90	20.1	-	10.1	957.74	-	VW31559	-	-	-	-	-	-	-	-	969.30	947.67	-	-	-	-	Y	Y	N
2015	Golder	GA15-02	Sonic	Perimeter Embankment Buttress	5,820,049.70	594,727.00	951.70	0	-90	17.1	12.6	12.2	939.51	-	VW31556	-	-	-	-	-	-	-	-	952.80	934.63	-	-	-	-	Y	Y	N
2015	Golder	GA15-03	Sonic	Perimeter Embankment Buttress	5,819,685.96	595,507.54	937.60	0	-90	50.6	47.7	30.5	907.12	VWP-B	VW30361	15.2	922.36	VWP-A	VW30358	-	-	-	-	938.58	887.00	-	-	-	-	Y	Y	N
2015	Golder	GA15-04	Sonic	Perimeter Embankment Buttress	5,819,623.88	595,603.27	937.20	0	-90	53.5	32.3	30.5	906.72	VWP-B	VW30360	15.2	921.96	VWP-A	VW30359	-	-	-	-	937.97	883.70	-	-	-	-	Y	Y	N
2015	Golder	GA15-05	Sonic	Perimeter Embankment Buttress	5,819,552.77	595,704.96	937.50	0	-90	59.8	45.6	32.0	905.50	VWP-B	VW30366	20.0	917.50	VWP-A	VW30365	-	-	-	-	938.46	877.80	-	-	-	-	Y	Y	N
2015	Golder	GA15-06	Sonic	Perimeter Embankment Buttress	5,819,475.88	595,814.30	938.60	0	-90	56.7	40.7	32.0	906.60	VWP-B	VW30363	20.0	918.60	VWP-A	VW30362	-	-	-	-	939.61	881.91	-	-	-	-	Y	Y	N
2015	Golder	GA15-07	Sonic	Perimeter Embankment Buttress	5,819,375.46	595,993.82	935.00	0	-90	44.5	19.7	25.2	909.85	VWP-B	VW31562	16.6	918.39	VWP-A	VW31565	-	-	-	-	936.16	890.50	-	-	-	-	Y	Y	N
2015	Golder	GA15-08	Sonic	Perimeter Embankment Buttress	5,819,255.51	596,082.35	937.00	0	-90	50.6	25.8	31.4	905.61	VWP-B	VW31561	11.6	925.42	VWP-A	VW31560	-	-	-	-	937.70	886.40	-	-	-	-	Y	Y	N
2015	Golder	GA15-09	Sonic	Perimeter Embankment Buttress	5,819,060.02	596,220.56	939.20	0	-90	41.5	22.9	25.3	913.90	VWP-B	VW31567	11.0	928.23	VWP-A	VW31568	-	-	-	-	940.30	897.75	-	-	-	-	Y	Y	N
2015	Golder	GA15-10	Sonic	Main Embankment Buttress	5,818,856.37	596,208.51	938.21	0	-90	74.7	32.0	25.5	912.76	VWP-B	VW31569	11.9	926.32	VWP-A	VW31566	-	-	-	-	939.21	863.54	-	-	-	-	Y	Y	N
2015	Golder	GA15-11	Sonic	Main Embankment Buttress	5,818,767.00	596,270.00	937.00	0	-90	52.7	23.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2015	Golder	GA15-12	Sonic	Main Embankment Buttress	5,818,688.59	595,986.74	928.10	0	-90	50.6	41.4	29.0	899.10	VWP-B	VW30367	18.3	909.80	VWP-A	VW30349	-	-	-	-	929.11	877.50	-	-	-	-	Y	Y	N
2015	Golder	GA15-13	Sonic	Main Embankment Buttress	5,818,594.00	596,056.00	926.10	0	-90	41.5	33.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2015	Golder	GA15-14	Sonic	Main Embankment Buttress	5,818,469.60	595,926.30	913.90	0	-90	21.6	13.4	11.9	902.01	VWP-B	VW31557	6.7	907.19	VWP-A	VW31558	-	-	-	-	915.14	892.26	-	-	-	-	Y	Y	N
2015	Golder	GA15-15	Sonic	Main Embankment Buttress	5,818,460.56	595,693.19	925.00	0	-90	47.5	32.0	25.0	900.00	VWP-B	VW30364	18.0	907.02	VWP-A	VW30352	-	-	-	-	926.00	877.50	-	-	-	-	Y	Y	N
2015	Golder	GA15-16	Sonic	Main Embankment Buttress	5,818,331.00	595,791.00	912.50	0	-90	38.4	21.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2015	Golder	GA15-17	Sonic	Main Embankment Buttress	5,818,260.10	595,584.90	919.05	0	-90	29.3	22.2	20.7	898.35	VWP-B	VW31563	12.8	906.25	VWP-A	VW31564	-	-	-	-	919.93	889.79	-	-	-	-	Y	Y	N
2015	Golder	GA15-18	Sonic	Main Embankment Buttress	5,818,169.50	595,309.60	936.20	0	-90	20.1	12.5	13.4	922.80	VWP-B	1126314	6.1	930.10	VWP-A	1126315	-	-	-	-	937.06	916.08	-	-	-	-	Y	Y	N
2015	Golder	GA15-19	Sonic	South Embankment	5,818,238.20	595,081.10	947.60	0	-90	11.0	6.0	4.6	943.03	-	1126311	-	-	-	-	-	-	-	-	948.35	936.62	-	-	-	-	Y	Y	N
2015	Golder	GA15-20	Sonic	South Embankment	5,818,422.80	594,988.70	944.04	0	-90	9.5	5.4	-	-	-	-	-	-	-	-	-	-	-	-	944.61	934.58	-	-	-	-	Y	Y	N
2015	Golder	GA15-21	Sonic	Main Embankment Buttress	5,818,480.81	595,720.16	-	0	-90	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2015	Golder	VW15-22	Sonic	Corner 1 Embankment	5,819,884.00	595,118.70	950.53	0	-90	-	-	15.0	935.50	-	VW32659	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2015	Golder	VW15-23	Sonic	Corner 1 Embankment	5,819,895.00	595,131.70	951.16	0	-90	-	-	22.5	928.66	-	VW32660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2015	Golder	VW15-24	Sonic	Corner 1 Embankment	5,819,927.00	595,058.70	950.08	0	-90	-	-	14.9	935.17	-	VW32661	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2015	Golder	VW15-25	Sonic	Corner 1 Embankment	5,819,942.00	595,060.70	951.12	0	-90	-	-	23.3	927.79	-	VW32662	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2015	Golder	SI15-26	Sonic	Perimeter Embankment Buttress	5,819,754.00	595,386.50	943.37	0	-90	45.2	42.1	-	-	-	-	-	-	-	-	-	-	-	-	943.75	898.16	-	-	-	-	Y	N	N
2015	Golder	SI15-27	Sonic	Corner 1 Embankment	5,819,858.00	595,163.30	951.09	0	-90	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	951.49	926.61	-	-	-	-	N	N	N
2015	Golder	SI15-28	Sonic	Corner 1 Embankment	5,819,884.00	595,138.30	951.09	0	-90	26.2	-	-	-	-	-	-	-	-	-	-	-	-	-	952.01	925.55	-	-	-	-	N	N	N
2015	Golder	SI15-29	Sonic	Corner 1 Embankment	5,819,938.00	595,080.00	951.10	0	-90	28.7	-	-	-	-	-	-	-	-	-	-	-	-	-	952.12	923.41	-	-	-	-	N	N	N
2015	Golder	SI15-30	Sonic	Corner 1 Embankment	5,819,942.00	595,045.30	951.02	0	-90	24.7	-	-	-	-	-	-	-	-	-	-	-	-	-	951.28	926.92	-	-	-	-	N	N	N
2016	Golder	GA16-01	Sonic	Corner 1 Embankment Buttress	5,820,084.00	595,032.00	937.20	0	-90	21.3	18.3	15.2	922.00	VWP-B	VW39061	13.4	923.80	VWP-A	VW39064	-	-	-	-	937.80	915.10	-	-	-	-	Y	Y	Y
2016	Golder	GA16-02	Sonic	Corner 1 Embankment Buttress	5,820,128.00	595,095.00	933.00	0	-90	24.4	23.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GA16-03	Sonic	Corner 1 Embankment Buttress	5,820,067.00	595,176.00	932.00	0	-90	24.4	23.2	18.0	914.00	VWP-B	VW39067	12.2	919.80	VWP-A	VW39065	-	-	-	-	932.70	908.00	-	-	-	-	Y	Y	N
2016	Golder	GA16-04	Sonic	Corner 1 Embankment Buttress	5,820,010.00	595,259.00	932.60	0	-90	40.7	40.1	10.2	922.40	-	VW39059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2016	Golder	GA16-05	Sonic	Corner 1 Embankment Buttress	5,820,062.00	595,305.00	925.40	0	-90	12.2	8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2016	Golder	GA16-06	Sonic	Corner 1 Embankment Buttress	5,819,915.00	595,307.00	936.50	0	-90	24.4	22.6	16.8	919.70	-	VW39066	-	-	-	-	-	-	-	-	937.00	912.50	-	-	-	-	Y	Y	Y
2016	Golder	GA16-07	Sonic	Corner 1 Embankment Buttress	5,819,964.00	595,348.00	932.30	0	-90	23.0	21.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2016	Golder	GA16-08	Sonic	Corner 1 Embankment Buttress	5,820,015.00	595,378.00	924.30	0	-90	18.3	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2016	Golder	GA16-09	Sonic	Corner 1 Embankment Buttress	5,819,946.00	595,459.00	923.90	0	-90	23.2	22.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2016	Golder	GA16-15	Sonic	South Embankment	5,818,293.00	594,909.00	947.00	0	-90	12.2	10.7	-	-	-	-	-	-	-	-	-	-	-	-	947.80	935.30	-	-	-	-	Y	Y	N
2016	Golder	GA16-16	Sonic	South Embankment	5,818,391.00	594,678.00	944.80	0	-90	12.2	7.0	-	-	-	-	-	-	-	-	-	-	-	-	945.50	933.00	-	-	-	-	Y	Y	N
2016	Golder	GA16-17	Sonic	South Embankment	5,818,270.00	594,793.00	944.40	0	-90	14.6	12.5	10.6	933.80	-	VW39068	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GA16-18	Sonic	Corner 1 Embankment	5,819,891.00	595,118.00	961.00	0	-90	6.6	-	6.5	954.50	-	VW39063	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2016	Golder	GA16-19	Sonic	South Embankment	5,818,341.00	594,790.00	945.20	0	-90	12.2	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GA16-20	Sonic	Perimeter Embankment	5,819,411.00	595,562.00	961.20	0	-90	31.0	-	30.5	930.70	-	VW39060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2016	Golder	GA16-21	Sonic	Main Embankment	5,818,759.00	595,801.00	964.00	0	-90	37.8	-	37.8	926.20	-	VW39069	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2016	Golder	GA16-22	Sonic	South Embankment	5,818,489.00	594,836.00	962.90	0	-90	24.5	-	24.4	938.50	-	VW39062	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	N	N
2016	Golder	GW16-02A	Sonic	Perimeter Embankment	5,819,731.19	595,831.15	925.10	0	-90	53.6	52.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-02B	Sonic	Perimeter Embankment	5,819,734.31	595,832.84	924.95	0	-90	30.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-03A	Sonic	Main Embankment	5,818,752.04	596,335.81	938.19	0	-90	41.2	31.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-03B	Sonic	Main Embankment	5,818,757.46	596,337.84	938.35	0	-90	30.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-04A	Sonic	Main Embankment	5,818,106.62	595,491.16	922.16	0	-90	16.8	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-04B	Sonic	Main Embankment	5,818,109.50	595,489.47	922.26	0	-90	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-05A	Sonic	South Embankment	5,818,539.05	594,207.62	963.64	0	-90	27.4	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2016	Golder	GW16-05B	Sonic	South Embankment	5,818,541.45	594,206.42	963.91	0	-90	21.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2018	Golder	GA18-01	Sonic	Corner 1 Embankment Buttress	5,820,059.00	595,030.00	940.80	0	-90	29.3	24.4	25.9	914.90	VWP-C	VW48120	18.6	922.20	VWP-B	VW48122	15.8	925.00	VWP-A	VW48121	941.10	913.70	-	-	-	-	Y	Y	Y
2018	Golder	GA18-03	Sonic	Corner 1 Embankment Buttress	5,820,098.00	594,926.00	940.63	0	-90	15.2	9.1	13.1	927.50	VWP-C	VW48117	8.7	931.90	VWP-B	VW48116	7.2	933.40	VWP-A	VW48115	940.90	925.70	-	-	-	-	Y	Y	Y
2018	Golder	GA18-04A	Sonic	Corner 1 Embankment Buttress	5,819,964.00	595,213.00	941.17	0	-90	24.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2018	Golder	GA18-04B	Sonic	Corner 1 Embankment Buttress	5,819,960.00	595,207.00	940.95	0	-90	29.7	25.0	28.6	912.40	VWP-C	VW48123	19.5	921.50	VWP-B	VW48118	18.9	922.10	VWP-A	VW48119	941.30	911.00	-	-	-	-	Y	Y	Y
2021	Golder	GA21-01	Sonic	Perimeter Embankment Buttress	5,819,767.00	595,505.00	931.92	0	-90	53.6	48.0	45.5	886.44	VWP-A	VW139093	26.5	905.44	VWP-B	VW139075	19.5	912.39	VWP-C	VW139057	932.87	878.30	-	-	-	-	Y	Y	N
2021	Golder	GA21-02	Sonic	Perimeter Embankment Buttress	5,819,630.00	595,782.00	930.11	0	-90	75.0	68.9	33.9	896.19	VWP-A	VW139082	27.1	903.04	VWP-B	VW129095	16.4	913.69	VWP-C	VW139086	931.04	855.05	-	-	-	-	Y	Y	N
2021	Golder	GA21-03	Sonic	Perimeter Embankment Buttress	5,819,543.00	595,924.00	930.45	0	-90	52.1	46.9	30.1	900.36	VWP-A	VW139053	25.5	904.93	VWP-B	VW139067	15.8	914.68	VWP-C	VW139097	931.31	879.12	-	-	-	-	Y	Y	N
2021	Golder	GA21-04	Sonic	Corner 1 Embankment Buttress	5,820,064.00	595,303.00	938.38	0	-90	20.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2021	Golder	GA21-05	Sonic	Perimeter Embankment Buttress	5,819,157.00	596,148.00	945.52	0	-90	71.9	68.0	52.5	893.00	VWP-A	VW139088	34.9	910.67	VWP-B	VW139089	16.6	928.96	VWP-C	VW139096	946.52	873.42	-	-	-	-	Y	Y	N
2021	Golder	GA21-06	Sonic	Perimeter Embankment Buttress	5,819,115.00	596,282.00	937.98	0	-90	29.3	23.5	13.1	924.86	VWP-A	VW139081	8.0	929.96	VWP-B	VW139076	-	-	-	-	938.82	908.60	-	-	-	-	Y	Y	N
2021	Golder	GA21-07	Sonic	Main Embankment Buttress	5,818,649.00	596,019.00	935.90	0	-90	38.4	-	38.2	897.72	VWP-A	VW139078	28.4	907.52	VWP-B	VW139085	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2021	Golder	GA21-08	Sonic	Main Embankment Buttress	5,818,510.00	595,878.00	930.24	0	-90	35.4	-	31.1	899.16	VWP-A	VW139059	26.6	903.66	VWP-B	VW139099	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2021	Golder	GA21-09	Sonic	Main Embankment Buttress	5,818,305.00	595,544.00	930.53	0	-90	35.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2021	Golder	GA21-10	Sonic	Corner 1 Embankment Buttress	5,819,989.00	595,248.00	941.84	0	-90	24.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y
2021	Golder	GA21-11	Sonic	Perimeter Embankment Buttress	5,819,452.00	596,072.00	930.81	0	-90	27.9	-	14.3	916.53	VWP-A	VW134469	8.3	922.47	VWP-B	VW139080	-	-	-	-	-	-	-	-	-	-	-	Y	Y	N
2022	Golder	GA22-01	Sonic	Corner 1 Embankment Buttress	5,820,058.76	595,034.32	940.84	0	-90	26.8	22.6	15.1	925.75	-	VW136218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y

Table C2: Summary of Test Pits

Year	Consultant	Test Pit ID	Method	General Location Description	Coordinates		Ground Elevation (m)	Completion Depth (m)	Bedrock Encountered? (Y/N)	Record of Test Pit Log in Database?
					Northing (m)	Easting (m)				
1989	Knight Piesold	TPB-01	CAT 225	Main Embankment	5,818,814.05	595,975.06	-	4.1	N	Y
1989	Knight Piesold	TPB-02	CAT 225	Main Embankment	5,819,012.21	596,081.47	-	4.9	N	Y
1989	Knight Piesold	TPB-03	CAT 225	Perimeter Embankment	5,819,190.28	596,214.15	-	5.5	N	Y
1989	Knight Piesold	TPB-04	CAT 225	Perimeter Embankment	5,819,396.99	596,154.10	-	5.2	N	Y
1989	Knight Piesold	TPB-05	CAT 225	Perimeter Embankment	5,819,451.74	595,919.83	-	4.0	N	Y
1989	Knight Piesold	TPB-06	CAT 225	Perimeter Embankment	5,819,675.71	595,825.50	-	5.2	N	Y
1989	Knight Piesold	TPB-07	CAT 225	Perimeter Embankment	5,819,526.73	595,699.80	-	3.4	N	Y
1989	Knight Piesold	TPB-08	CAT 225	Tailings Basin	5,819,369.37	595,609.71	-	4.9	N	Y
1989	Knight Piesold	TPB-09	CAT 225	Tailings Basin	5,818,924.19	595,540.23	-	5.2	N	Y
1989	Knight Piesold	TPB-10	CAT 225	Main Embankment	5,818,678.26	595,752.76	-	3.7	N	Y
1989	Knight Piesold	TPB-11	CAT 225	Main Embankment	5,818,380.54	595,495.64	-	5.2	N	Y
1989	Knight Piesold	TPB-12	CAT 225	Main Embankment	5,818,263.28	595,343.37	926.20	4.9	N	Y
1989	Knight Piesold	TPB-13	CAT 225	Main Embankment	5,818,465.53	595,629.39	-	4.9	N	Y
1989	Knight Piesold	TPB-14	CAT 225	Main Embankment	5,818,323.13	595,714.69	-	4.9	N	Y
1989	Knight Piesold	TPB-15	CAT 225	Tailings Basin	5,818,523.04	595,466.33	-	4.9	N	Y
1989	Knight Piesold	TPB-16	CAT 225	South Embankment	5,818,549.95	594,423.68	946.00	4.3	N	Y
1989	Knight Piesold	TPB-17	CAT 225	Tailings Basin	5,819,774.82	594,762.80	-	4.9	N	Y
1989	Knight Piesold	TPB-18	CAT 225	Corner 1 Embankment	5,819,954.10	595,051.75	-	4.9	N	Y
1995	Knight Piesold	TP95-16	Hitachi X200	TSF Access Road	5,820,580.00	594,370.00	980.00	6.4	N	Y
1995	Knight Piesold	TP95-17	Hitachi X200	TSF Access Road	5,821,110.00	594,230.00	980.00	5.8	N	Y
1995	Knight Piesold	TP95-18	Hitachi X200	Tailings / Reclaim Pipeline Route	5,821,100.00	593,285.00	992.00	3.5	N	Y
1995	Knight Piesold	TP95-19	Hitachi X200	Tailings / Reclaim Pipeline Route	5,821,600.00	592,980.00	1042.00	6.4	Y	Y
1995	Knight Piesold	TP95-26	Hitachi X200	Tailings Basin	5,819,180.00	594,645.00	938.00	6.1	N	Y
1995	Knight Piesold	TP95-27	Hitachi X200	Perimeter Embankment	5,819,740.00	595,350.00	930.00	6.2	N	Y
1995	Knight Piesold	TP95-28	Hitachi X200	Tailings Basin	5,819,360.00	595,285.00	923.40	6.2	N	Y
1995	Knight Piesold	TP95-29	Hitachi X200	Borrow Area No. 2	5,818,745.00	596,270.00	936.00	5.7	N	Y
1995	Knight Piesold	TP95-30	Hitachi X200	Borrow Area No. 2	5,818,495.00	596,560.00	938.00	5.5	N	Y
1995	Knight Piesold	TP95-31	Hitachi X200	Borrow Area No. 2	5,818,955.00	596,470.00	939.00	5.8	N	Y
1995	Knight Piesold	TP95-32	Hitachi X200	Tailings Basin	5,819,140.00	595,780.00	932.00	6.0	N	Y
1995	Knight Piesold	TP95-33	Hitachi X200	Tailings Basin	5,818,750.00	594,820.00	932.00	7.7	N	Y
1995	Knight Piesold	TP95-34	Hitachi X200	Tailings Basin	5,818,730.00	595,250.00	924.00	6.4	N	Y
1995	Knight Piesold	TP95-35	Hitachi X200	Tailings Basin	5,818,690.00	595,535.00	917.00	6.6	N	Y
1995	Knight Piesold	TP95-36	Hitachi X200	Tailings Basin	5,818,520.00	595,275.00	924.00	6.3	N	Y
1995	Knight Piesold	TP95-37	Hitachi X200	Tailings Basin	5,818,345.00	595,260.00	938.00	3.0	Y	Y
1995	Knight Piesold	TP95-38	Hitachi X200	Main Embankment	5,818,460.00	595,485.00	915.00	6.7	N	Y
1995	Knight Piesold	TP95-39	Hitachi X200	Main Embankment	5,818,405.00	595,405.00	918.00	7.5	N	Y
1995	Knight Piesold	TP95ME-01	Hitachi X200	Main Embankment	5,818,503.74	595,604.67	912.60	2.5	N	Y
1995	Knight Piesold	TP95ME-02	Hitachi X200	Main Embankment	5,818,542.46	595,636.73	913.00	3.0	N	Y
1995	Knight Piesold	TP95ME-03	Hitachi X200	Main Embankment	5,818,614.44	595,735.34	915.60	3.4	N	Y
1995	Knight Piesold	TP95ME-04	Komatsu PC 200 LC	Main Embankment	5,818,505.56	595,641.57	912.40	6.0	N	Y
1995	Knight Piesold	TP95ME-05	Komatsu PC 200 LC	Main Embankment	5,818,519.47	595,657.30	912.50	6.5	N	Y
1995	Knight Piesold	TP95ME-06	Komatsu PC 200 LC	Main Embankment	5,818,537.62	595,680.29	912.90	6.0	N	Y
1995	Knight Piesold	TP95ME-07	Komatsu PC 200 LC	Main Embankment	5,818,550.32	595,696.62	913.20	5.7	N	Y
1995	Knight Piesold	TP95ME-08	Komatsu PC 200 LC	Main Embankment	5,818,566.26	595,717.73	913.80	5.8	N	Y
1995	Knight Piesold	TP95ME-09	Komatsu PC 200 LC	Main Embankment	5,818,583.32	595,739.05	916.50	6.0	N	Y
1995	Knight Piesold	TP95ME-10	Komatsu PC 200 LC	Main Embankment	5,818,459.93	595,584.81	912.40	6.0	N	Y
1995	Knight Piesold	TP95ME-11	Komatsu PC 200 LC	Main Embankment	5,818,442.83	595,563.23	912.50	6.2	N	Y
1995	Knight Piesold	TP95ME-12	Komatsu PC 200 LC	Main Embankment	5,818,428.58	595,541.24	912.80	6.3	N	Y
1995	Knight Piesold	TP95ME-13	Komatsu PC 200 LC	Main Embankment	5,818,409.85	595,520.07	913.40	6.4	N	Y
1995	Knight Piesold	TP95ME-14	Komatsu PC 200 LC	Main Embankment	5,818,393.97	595,498.90	914.80	6.2	N	Y
1995	Knight Piesold	TP95ME-15	Komatsu PC 200 LC	Main Embankment	5,818,378.91	595,478.14	914.40	6.1	N	Y
1995	Knight Piesold	TP95ME-16	Komatsu PC 200 LC	Main Embankment	5,818,359.36	595,457.78	915.40	7.0	N	Y
1995	Knight Piesold	TP95ME-17	Komatsu PC 200 LC	Main Embankment	5,818,346.74	595,432.94	916.40	5.7	N	Y
1995	Knight Piesold	TP95ME-18	Komatsu PC 200 LC	Main Embankment	5,818,334.53	595,408.11	917.00	6.0	N	Y
1995	Knight Piesold	TP95ME-19	Komatsu PC 200 LC	Main Embankment	5,818,325.16	595,387.34	917.80	5.4	N	Y
1995	Knight Piesold	TP95ME-20	Komatsu PC 200 LC	Main Embankment	5,818,313.76	595,365.76	918.60	5.7	N	Y
1995	Knight Piesold	TP95ME-21	Komatsu PC 200 LC	Main Embankment	5,818,298.70	595,345.41	919.80	3.7	N	Y
1995	Knight Piesold	TP95ME-22	Komatsu PC 200 LC	Main Embankment	5,818,376.94	595,417.55	918.00	4.6	N	Y
1995	Knight Piesold	TP95ME-23	Komatsu PC 200 LC	Main Embankment	5,818,435.78	595,474.69	915.70	6.3	N	Y
1995	Knight Piesold	TP95ME-24	Komatsu PC 200 LC	Main Embankment	5,818,465.63	595,513.91	914.00	6.3	N	Y
1995	Knight Piesold	TP95ME-25	Komatsu PC 200 LC	Main Embankment	5,818,394.00	595,573.61	913.70	5.9	N	Y
1995	Knight Piesold	TP95ME-26	Komatsu PC 200 LC	Main Embankment	5,818,322.31	595,491.16	915.40	6.4	N	Y
1995	Knight Piesold	TP95ME-27	Komatsu PC 200 LC	Main Embankment	5,818,285.26	595,448.82	916.90	6.0	N	Y
1995	Knight Piesold	TP95ME-28	Komatsu PC 200 LC	Main Embankment	5,818,257.17	595,413.81	918.00	5.5	N	Y
1995	Knight Piesold	TP95ME-29	Komatsu PC 200 LC	Main Embankment	5,818,281.43	595,466.16	917.20	6.7	N	Y
1995	Knight Piesold	TP95ME-30	Komatsu PC 200 LC	Main Embankment	5,818,207.09	595,420.73	918.00	5.9	N	Y
1995	Knight Piesold	TP95ME-31	Komatsu PC 200 LC	Main Embankment	5,818,257.98	595,493.61	916.20	6.2	N	Y
1995	Knight Piesold	TP95ME-32	Komatsu PC 200 LC	Main Embankment	5,818,288.52	595,525.36	914.80	6.2	N	Y
1995	Knight Piesold	TP95ME-33	Komatsu PC 200 LC	Main Embankment	5,818,314.98	595,566.49	913.30	6.3	N	Y
1995	Knight Piesold	TP95ME-34	Komatsu PC 200 LC	Main Embankment	5,818,345.11	595,612.49	912.20	6.2	N	Y
1995	Knight Piesold	TPS19	JD 690D LC	Main Embankment	5,818,411.89	595,724.46	910.80	4.1	N	Y
1995	Knight Piesold	TPS20	Komatsu PC 200 LC	Main Embankment	5,818,386.15	595,679.09	911.00	6.4	N	Y
1995	Knight Piesold	TPS20.5	Komatsu PC 200 LC	Main Embankment	5,818,329.20	595,685.15	911.20	6.5	N	Y
1995	Knight Piesold	TPS21	JD 690D LC	Main Embankment	5,818,276.28	595,682.32	911.20	4.0	N	Y
1995	Knight Piesold	TPS21.2	Komatsu PC 200 LC	Main Embankment	5,818,290.02	595,717.46	910.00	6.0	N	Y
1995	Knight Piesold	TPS22	JD 690D LC	Main Embankment	5,818,408.36	595,851.97	911.00	4.9	N	Y
1996	Knight Piesold	96-1	-	Tailings Basin	5,818,487.41	595,201.48	-	3.9	N	Y
1996	Knight Piesold	96-2	-	Tailings Basin	5,818,377.48	595,290.03	-	3.0	N	Y
1996	Knight Piesold	96-3	-	Tailings Basin	5,818,422.68	595,245.45	-	2.5	N	Y
1996	Knight Piesold	96-4	-	Tailings Basin	5,818,568.10	595,148.49	-	3.9	N	Y
1996	Knight Piesold	96-5	-	Tailings Basin	5,818,532.48	595,050.02	-	3.9	N	Y

Table C2: Summary of Test Pits

Year	Consultant	Test Pit ID	Method	General Location Description	Coordinates		Ground Elevation (m)	Completion Depth (m)	Bedrock Encountered? (Y/N)	Record of Test Pit Log in Database?
					Northing (m)	Easting (m)				
1996	Knight Piesold	96-6	-	Tailings Basin	5,818,401.30	595,026.20	-	6.0	N	Y
1996	Knight Piesold	96-7	-	South Embankment	5,818,314.58	595,097.05	-	1.1	Y	Y
1996	Knight Piesold	96-8	-	Tailings Basin	5,818,402.52	595,147.12	-	2.5	Y	Y
1996	Knight Piesold	96-9	-	Tailings Basin	5,818,332.90	595,232.63	-	2.0	Y	Y
1996	Knight Piesold	96-10	-	Tailings Basin	5,818,446.90	595,355.18	-	5.3	N	Y
1996	Knight Piesold	96-11	-	Main Embankment	5,818,250.45	595,257.05	-	1.9	Y	Y
1996	Knight Piesold	96-12	-	Tailings Basin	5,818,416.77	595,331.56	-	5.6	N	Y
1996	Knight Piesold	96-13	-	Tailings Basin	5,818,488.02	595,317.72	-	2.3	N	Y
1996	Knight Piesold	96-14	-	Tailings Basin	5,818,519.37	595,350.29	-	4.0	N	Y
1996	Knight Piesold	96-15	-	Tailings Basin	5,818,472.75	595,136.13	-	5.0	N	Y
1996	Knight Piesold	96-16	-	Tailings Basin	5,818,395.19	595,061.62	-	4.8	N	Y
1996	Knight Piesold	96-17	-	Tailings Basin	5,818,506.75	595,254.61	-	6.5	N	Y
1996	Knight Piesold	96-18	-	Tailings Basin	5,818,551.94	595,267.64	-	4.5	N	Y
1996	Knight Piesold	96-19	-	Tailings Basin	5,818,392.75	595,072.01	-	4.7	Y	Y
1996	Knight Piesold	96-20	-	Main Embankment	5,818,586.55	595,307.95	-	7.3	N	Y
1996	Knight Piesold	96-21	-	Tailings Basin	5,818,512.04	595,394.67	-	5.7	N	Y
1996	Knight Piesold	96-22	-	Tailings Basin	5,818,565.79	595,371.87	-	5.2	N	Y
1996	Knight Piesold	96-23	-	Tailings Basin	5,818,586.55	595,407.29	-	2.7	N	Y
1996	Knight Piesold	96-24	-	Tailings Basin	5,818,681.23	595,353.10	-	4.3	N	Y
1996	Knight Piesold	96-25	-	Tailings Basin	5,818,737.09	595,262.31	-	5.7	N	Y
1996	Knight Piesold	96-26	-	Tailings Basin	5,818,709.16	595,307.71	-	3.0	N	Y
1996	Knight Piesold	96-27	-	Tailings Basin	5,818,770.61	595,202.26	-	2.3	N	Y
1996	Knight Piesold	96-28	-	Tailings Basin	5,818,786.67	595,274.88	-	2.4	N	Y
1996	Knight Piesold	96-29	-	Main Embankment	5,818,597.65	595,688.02	-	3.8	N	Y
1996	Knight Piesold	96-30	-	Tailings Basin	5,818,641.01	595,654.43	-	4.8	N	Y
1996	Knight Piesold	96-31	-	Tailings Basin	5,818,614.54	595,613.92	-	4.2	N	Y
1996	Knight Piesold	96-32	-	Main Embankment	5,818,569.76	595,645.27	-	3.1	N	Y
1996	Knight Piesold	96-33	-	Tailings Basin	5,818,589.71	595,571.58	-	2.5	N	Y
1996	Knight Piesold	96-34	-	Tailings Basin	5,818,561.21	595,530.05	-	2.5	N	Y
1996	Knight Piesold	96-35	-	Tailings Basin	5,818,588.08	595,500.73	-	2.5	N	Y
1996	Knight Piesold	96-36	-	Tailings Basin	5,818,617.39	595,541.04	-	2.1	N	Y
1996	Knight Piesold	96-37	-	Main Embankment	5,818,540.44	595,603.74	-	2.3	N	Y
1996	Knight Piesold	96-38	-	Main Embankment	5,818,509.91	595,563.03	-	2.3	N	Y
1996	Knight Piesold	96-39	-	Main Embankment	5,818,478.56	595,523.94	-	1.9	N	Y
1996	Knight Piesold	96-40	-	Tailings Basin	5,818,517.23	595,493.00	-	3.8	N	Y
1996	Knight Piesold	96-41	-	Main Embankment	5,818,453.41	595,487.50	-	3.7	N	Y
1996	Knight Piesold	96-42	-	Tailings Basin	5,818,490.47	595,482.21	-	4.2	N	Y
1996	Knight Piesold	96-43	-	Borrow Area No. 3	5,818,188.95	596,706.31	-	1.2	N	Y
1996	Knight Piesold	96-44	-	Borrow Area No. 3	-	-	-	2.2	N	Y
1996	Knight Piesold	96-45	-	Borrow Area No. 3	-	-	-	4.2	N	Y
1996	Knight Piesold	96-46	-	Borrow Area No. 3	-	-	-	5.3	N	Y
1996	Knight Piesold	96-47	-	Borrow Area No. 3	5,818,339.77	596,714.74	-	4.4	N	Y
1996	Knight Piesold	96-48	-	Borrow Area No. 3	-	-	-	5.0	N	Y
1996	Knight Piesold	96-49	-	Borrow Area No. 3	-	-	-	6.0	N	Y
1996	Knight Piesold	96-50	-	Borrow Area No. 3	-	-	-	5.2	N	Y
1996	Knight Piesold	96-51	-	Borrow Area No. 3	-	-	-	5.0	N	Y
1996	Knight Piesold	96-52	-	Borrow Area No. 3	5,818,268.58	596,786.68	-	4.5	N	Y
1996	Knight Piesold	96-53	-	Borrow Area No. 3	5,818,276.76	596,636.36	-	6.0	N	Y
1996	Knight Piesold	96-54	-	Borrow Area No. 2	5,818,353.16	596,608.58	-	5.8	N	Y
1996	Knight Piesold	96-55	-	Borrow Area No. 2	5,818,432.05	596,562.94	-	5.4	N	Y
1996	Knight Piesold	96-56	-	Perimeter Embankment	5,819,723.19	595,881.83	-	8.2	N	Y
1996	Knight Piesold	96-57	-	Perimeter Embankment	5,819,760.44	595,906.04	-	6.8	N	Y
1996	Knight Piesold	96-58	-	Perimeter Embankment	5,819,659.88	595,839.00	-	7.6	N	Y
1996	Knight Piesold	96-59	-	Perimeter Embankment	5,819,697.59	595,910.69	-	7.9	N	Y
1996	Knight Piesold	96-60	-	Perimeter Embankment	5,819,671.05	595,929.78	-	5.8	N	Y
1996	Knight Piesold	96-61	-	Perimeter Embankment	5,819,749.26	595,856.69	-	7.5	N	Y
1996	Knight Piesold	96-62	-	Perimeter Embankment	5,819,762.76	595,822.70	-	6.2	N	Y
1996	Knight Piesold	96-63	-	Perimeter Embankment	5,819,779.99	595,797.56	-	6.2	N	Y
1996	Knight Piesold	96-64	-	Perimeter Embankment	5,819,818.16	595,765.91	-	6.0	N	Y
1996	Knight Piesold	96-65	-	Perimeter Embankment	5,819,813.04	595,730.99	-	4.3	N	Y
1996	Knight Piesold	96-66	-	Perimeter Embankment	5,819,705.97	595,847.38	-	5.6	N	Y
1996	Knight Piesold	96-67	-	Perimeter Embankment	5,819,694.79	595,874.84	-	6.2	N	Y
1996	Knight Piesold	96-68	-	Perimeter Embankment	5,819,727.85	595,909.76	-	6.2	N	Y
1996	Knight Piesold	96-69	-	Perimeter Embankment	5,819,751.59	595,888.81	-	5.5	N	Y
1996	Knight Piesold	96-70	-	Tailings Basin	5,819,026.81	594,885.13	-	2.7	N	Y
1996	Knight Piesold	96-71	-	Tailings Basin	5,819,048.46	594,776.19	-	3.8	N	Y
1996	Knight Piesold	96-72	-	Tailings Basin	5,819,051.25	594,740.58	-	0.4	N	Y
1996	Knight Piesold	96-73	-	Tailings Basin	5,819,061.03	594,702.87	-	4.2	N	Y
1996	Knight Piesold	96-74	-	Tailings Basin	5,819,014.94	594,772.00	-	1.0	N	Y
1996	Knight Piesold	96-75	-	Tailings Basin	5,818,985.61	594,767.81	-	3.4	N	Y
1996	Knight Piesold	96-76	-	Tailings Basin	5,818,918.36	594,758.04	-	2.9	N	Y
1996	Knight Piesold	96-77	-	Tailings Basin	5,818,823.01	594,743.18	-	2.5	N	Y
1996	Knight Piesold	96-78	-	Tailings Basin	5,819,142.03	594,767.12	-	2.5	N	Y
1996	Knight Piesold	96-79	-	Tailings Basin	5,819,093.85	594,852.31	-	3.5	N	Y
1996	Knight Piesold	96-80	-	Tailings Basin	5,819,157.40	594,711.25	-	3.0	N	Y
1996	Knight Piesold	96-81	-	Tailings Basin	5,818,962.32	594,833.58	-	3.0	N	Y
1996	Knight Piesold	96-82	-	Tailings Basin	5,818,921.46	594,864.53	-	3.0	N	Y
1996	Knight Piesold	96-83	-	Tailings Basin	5,818,998.18	594,810.41	-	4.7	N	Y
1996	Knight Piesold	96-84	-	Borrow Area No. 1	5,819,082.74	596,016.53	-	5.3	N	Y
1996	Knight Piesold	96-85	-	Borrow Area No. 1	5,819,205.27	595,926.75	-	5.3	N	Y
1996	Knight Piesold	96-86	-	Borrow Area No. 1	5,819,325.38	595,827.59	-	6.4	N	Y

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Year	Consultant	Test Pit ID	Method	General Location Description	Coordinates		Ground Elevation (m)	Completion Depth (m)	Bedrock Encountered? (Y/N)	Record of Test Pit Log in Database?
					Northing (m)	Easting (m)				
1996	Knight Piesold	96-87	-	Borrow Area No. 1	5,819,434.32	595,725.64	-	2.5	N	Y
1996	Knight Piesold	96-88	-	Borrow Area No. 1	5,819,479.71	595,534.30	-	6.5	N	Y
1996	Knight Piesold	96-89	-	Borrow Area No. 1	5,819,314.91	595,681.64	-	2.5	N	Y
1996	Knight Piesold	96-90	-	Borrow Area No. 1	5,819,240.49	595,834.96	-	2.8	N	Y
1996	Knight Piesold	96-91	-	Borrow Area No. 1	5,819,109.60	595,919.07	-	2.5	N	Y
1996	Knight Piesold	96-92	-	Borrow Area No. 1	5,819,054.43	595,837.37	-	2.5	N	Y
1996	Knight Piesold	96-93	-	Borrow Area No. 1	5,818,710.63	595,744.21	-	5.7	N	Y
1996	Knight Piesold	96-94	-	Borrow Area No. 1	5,818,866.23	595,647.07	-	7.0	N	Y
1996	Knight Piesold	96-95	-	Borrow Area No. 1	5,818,825.45	595,808.94	-	4.0	N	Y
1996	Knight Piesold	96-96	-	Borrow Area No. 1	5,818,738.11	595,789.40	-	4.0	N	Y
1996	Knight Piesold	96-97	-	Borrow Area No. 1	5,818,784.32	595,895.26	-	3.3	N	Y
1996	Knight Piesold	96-98	-	Borrow Area No. 1	5,818,784.53	595,735.04	-	4.0	N	Y
1996	Knight Piesold	96-99	-	Borrow Area No. 1	5,818,872.09	596,030.12	-	6.0	N	Y
1996	Knight Piesold	96-100	-	Borrow Area No. 1	5,818,816.90	595,938.01	-	3.8	N	Y
1996	Knight Piesold	96-101	-	Borrow Area No. 1	5,819,013.23	595,934.43	-	7.3	N	Y
1996	Knight Piesold	96-102	-	Borrow Area No. 1	5,818,944.44	595,859.37	-	7.6	N	Y
1996	Knight Piesold	96-103	-	Borrow Area No. 1	5,819,062.81	595,755.66	-	7.5	N	Y
1996	Knight Piesold	96-104	-	Borrow Area No. 1	5,819,000.00	595,683.39	-	8.0	N	Y
1996	Knight Piesold	96-105	-	Borrow Area No. 1	5,819,129.85	595,831.08	-	6.5	N	Y
1996	Knight Piesold	96-106	-	Borrow Area No. 1	5,819,249.26	595,734.02	-	7.6	N	Y
1996	Knight Piesold	96-107	-	Borrow Area No. 1	5,819,179.43	595,659.99	-	8.0	N	Y
1996	Knight Piesold	96-108	-	Borrow Area No. 1	5,818,857.20	595,878.56	-	6.5	N	Y
1996	Knight Piesold	96-109	-	Main Embankment	5,818,273.46	595,519.66	-	3.7	N	Y
1996	Knight Piesold	96-110	-	Main Embankment	5,818,246.99	595,463.88	-	4.7	N	Y
1996	Knight Piesold	96-111	-	Perimeter Embankment	5,819,480.09	596,067.50	-	5.4	N	Y
1996	Knight Piesold	96-112	-	Perimeter Embankment	5,819,206.34	596,208.57	-	6.7	N	Y
1996	Knight Piesold	96-113	-	Perimeter Embankment	5,819,659.88	595,977.73	-	5.4	N	Y
1996	Knight Piesold	96-114	-	Perimeter Embankment	5,819,644.05	595,893.93	-	5.4	N	Y
1996	Knight Piesold	96-115	-	Perimeter Embankment	5,819,692.00	595,944.21	-	5.8	N	Y
1996	Knight Piesold	96-116	-	Tailings Basin	5,818,924.89	595,293.02	-	3.0	N	Y
1996	Knight Piesold	96-117	-	Tailings Basin	5,818,876.71	595,411.74	-	5.0	N	Y
1996	Knight Piesold	96-118	-	Tailings Basin	5,818,764.97	595,474.59	-	4.0	N	Y
1996	Knight Piesold	96-119	-	Main Embankment	5,818,482.71	595,598.14	-	5.8	N	Y
1996	Knight Piesold	TP96-BA-E4	-	Borrow Area No. 1	5,818,910.92	595,822.35	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-E5	-	Borrow Area No. 1	5,818,949.33	595,788.83	-	5.8	N	Y
1996	Knight Piesold	TP96-BA-E6	-	Borrow Area No. 1	5,818,986.34	595,757.41	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-E7	-	Borrow Area No. 1	5,819,025.10	595,724.24	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-E8	-	Borrow Area No. 1	5,819,063.51	595,690.72	-	5.5	N	Y
1996	Knight Piesold	TP96-BA-E9	-	Borrow Area No. 1	5,819,101.22	595,657.90	-	6.2	N	Y
1996	Knight Piesold	TP96-BA-F4	-	Borrow Area No. 1	5,818,948.63	595,856.57	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-F5	-	Borrow Area No. 1	5,818,982.15	595,825.85	-	6.1	N	Y
1996	Knight Piesold	TP96-BA-F6	-	Borrow Area No. 1	5,819,020.21	595,794.07	-	6.1	N	Y
1996	Knight Piesold	TP96-BA-F7	-	Borrow Area No. 1	5,819,057.92	595,761.95	-	2.3	N	Y
1996	Knight Piesold	TP96-BA-F8	-	Borrow Area No. 1	5,819,095.63	595,728.43	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-F9	-	Borrow Area No. 1	5,819,134.74	595,695.61	-	-	-	N
1996	Knight Piesold	TP96-BA-G4	-	Borrow Area No. 1	-	-	-	6.2	N	Y
1996	Knight Piesold	TP96-BA-G5	-	Borrow Area No. 1	5,819,014.63	595,862.51	-	6.2	N	Y
1996	Knight Piesold	TP96-BA-G6	-	Borrow Area No. 1	5,819,052.34	595,831.08	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-G7	-	Borrow Area No. 1	5,819,091.44	595,797.56	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-G8	-	Borrow Area No. 1	5,819,129.85	595,765.44	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-G9	-	Borrow Area No. 1	5,819,168.26	595,731.22	-	4.0	N	Y
1996	Knight Piesold	TP96-BA-H4	-	Borrow Area No. 1	5,819,007.64	595,933.04	-	6.7	N	Y
1996	Knight Piesold	TP96-BA-H5	-	Borrow Area No. 1	5,819,048.15	595,900.92	-	5.6	N	Y
1996	Knight Piesold	TP96-BA-H6	-	Borrow Area No. 1	5,819,085.68	595,868.09	-	5.5	N	Y
1996	Knight Piesold	TP96-BA-H7	-	Borrow Area No. 1	5,819,125.66	595,834.57	-	6.2	N	Y
1996	Knight Piesold	TP96-BA-H8	-	Borrow Area No. 1	5,819,164.07	595,801.75	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-H9	-	Borrow Area No. 1	5,819,201.60	595,768.23	-	6.2	N	Y
1996	Knight Piesold	TP96-BA-I4	-	Borrow Area No. 1	5,819,044.48	595,970.75	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-I5	-	Borrow Area No. 1	5,819,082.19	595,937.23	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-I6	-	Borrow Area No. 1	5,819,120.60	595,904.41	-	6.0	N	Y
1996	Knight Piesold	TP96-BA-I7	-	Borrow Area No. 1	5,819,158.31	595,870.89	-	6.1	N	Y
1996	Knight Piesold	TP96-BA-I8	-	Borrow Area No. 1	5,819,197.41	595,838.07	-	6.1	N	Y
1996	Knight Piesold	TP96-BA-I9	-	Borrow Area No. 1	5,819,235.12	595,805.24	-	6.3	N	Y
1996	Knight Piesold	PRT-01	-	Main Embankment	5,818,530.77	595,725.27	-	-	-	N
1996	Knight Piesold	PRT-02	-	Main Embankment	5,818,413.92	595,565.67	-	-	-	N
1996	Knight Piesold	PRT-03	-	Main Embankment	5,818,412.10	595,503.12	-	-	-	N
1996	Knight Piesold	PRT-04	-	Main Embankment	5,818,360.11	595,482.59	-	-	-	N
1997	Knight Piesold	TP97-BA-F11	-	Borrow Area No. 1	5,819,212.25	595,628.57	-	5.7	N	Y
1997	Knight Piesold	TP97-BA-F12	-	Borrow Area No. 1	5,819,249.96	595,596.45	-	5.8	N	Y
1997	Knight Piesold	TP97-BA-F14	-	Borrow Area No. 1	5,819,324.68	595,531.50	-	6.0	N	Y
1997	Knight Piesold	TP97-BA-F15	-	Borrow Area No. 1	5,819,363.09	595,499.38	-	6.1	N	Y
1997	Knight Piesold	TP97-BA-G4	-	Borrow Area No. 1	5,818,977.27	595,894.98	-	5.8	N	Y
1997	Knight Piesold	TP97-BA-G10	-	Borrow Area No. 1	5,819,205.27	595,693.51	-	5.9	N	Y
1997	Knight Piesold	TP97-BA-G11	-	Borrow Area No. 1	5,819,245.07	595,665.58	-	6.1	N	Y
1997	Knight Piesold	TP97-BA-G12	-	Borrow Area No. 1	5,819,283.48	595,632.06	-	5.7	N	Y
1997	Knight Piesold	TP97-BA-G13	-	Borrow Area No. 1	5,819,321.89	595,599.94	-	5.8	N	Y
1997	Knight Piesold	TP97-BA-G14	-	Borrow Area No. 1	5,819,358.20	595,567.81	-	6.1	N	Y
1997	Knight Piesold	TP97-BA-G15	-	Borrow Area No. 1	5,819,395.21	595,535.69	-	6.3	N	Y
1997	Knight Piesold	TP97-BA-G16	-	Borrow Area No. 1	5,819,433.62	595,502.17	-	5.7	N	Y
1997	Knight Piesold	TP97-BA-H3	-	Borrow Area No. 1	5,818,971.68	595,965.51	-	5.8	N	Y
1997	Knight Piesold	TP97-BA-H11	-	Borrow Area No. 1	5,819,277.72	595,703.29	-	5.7	N	Y

Table C2: Summary of Test Pits

Year	Consultant	Test Pit ID	Method	General Location Description	Coordinates		Ground Elevation (m)	Completion Depth (m)	Bedrock Encountered? (Y/N)	Record of Test Pit Log in Database?
					Northing (m)	Easting (m)				
1997	Knight Piesold	TP97-BA-H12	-	Borrow Area No. 1	-	-	-	5.9	N	Y
1997	Knight Piesold	TP97-BA-I10	-	Borrow Area No. 1	5,819,273.53	595,773.12	-	5.9	N	Y
1997	Knight Piesold	TP97-BA-I11	-	Borrow Area No. 1	5,819,311.24	595,739.60	-	5.7	N	Y
1997	Knight Piesold	TP97-BA-I12	-	Borrow Area No. 1	5,819,351.04	595,706.78	-	3.7	N	Y
1997	Knight Piesold	TP97-BA-I13	-	Borrow Area No. 1	5,819,386.66	595,673.96	-	5.5	N	Y
1997	Knight Piesold	TP97-BA-I14	-	Borrow Area No. 1	5,819,422.97	595,641.84	-	5.6	N	Y
1997	Knight Piesold	TP97-BA-I15	-	Borrow Area No. 1	5,819,462.78	595,609.71	-	5.6	N	Y
1997	Knight Piesold	TP97-BA-I16	-	Borrow Area No. 1	5,819,500.48	595,576.89	-	5.7	N	Y
1997	Knight Piesold	TP97-BA4-F8	-	Borrow Area No. 4	5,819,693.71	594,514.32	951.08	5.5	N	Y
1997	Knight Piesold	TP97-BA4-F9	-	Borrow Area No. 4	5,819,793.57	594,512.23	955.30	5.9	N	Y
1997	Knight Piesold	TP97-BA4-G4	-	Borrow Area No. 4	5,819,287.98	594,619.07	939.80	5.3	N	Y
1997	Knight Piesold	TP97-BA4-G5	-	Borrow Area No. 4	5,819,387.84	594,619.77	941.20	5.7	N	Y
1997	Knight Piesold	TP97-BA4-G6	-	Borrow Area No. 4	5,819,490.50	594,614.88	944.60	5.3	N	Y
1997	Knight Piesold	TP97-BA4-G7	-	Borrow Area No. 4	5,819,590.36	594,612.79	945.36	5.6	N	Y
1997	Knight Piesold	TP97-BA4-G8	-	Borrow Area No. 4	5,819,693.71	594,611.39	947.80	5.3	N	Y
1997	Knight Piesold	TP97-BA4-G9	-	Borrow Area No. 4	5,819,794.27	594,609.29	952.30	5.7	N	Y
1997	Knight Piesold	TP97-BA4-H4	-	Borrow Area No. 4	5,819,290.08	594,718.23	937.80	5.3	N	Y
1997	Knight Piesold	TP97-BA4-H5	-	Borrow Area No. 4	5,819,392.03	594,715.44	939.40	5.0	N	Y
1997	Knight Piesold	TP97-BA4-H6	-	Borrow Area No. 4	5,819,491.89	594,714.04	941.30	5.3	N	Y
1997	Knight Piesold	TP97-BA4-H7	-	Borrow Area No. 4	5,819,591.75	594,711.25	942.80	6.2	N	Y
1997	Knight Piesold	TP97-BA4-H8	-	Borrow Area No. 4	5,819,695.11	594,710.55	944.10	5.4	N	Y
1997	Knight Piesold	TP97-BA4-H9	-	Borrow Area No. 4	5,819,795.67	594,707.06	947.80	5.3	N	Y
1997	Knight Piesold	TP97-BA4-I4	-	Borrow Area No. 4	5,819,290.08	594,813.20	936.40	5.1	N	Y
1997	Knight Piesold	TP97-BA4-I6	-	Borrow Area No. 4	5,819,493.29	594,811.11	936.90	6.0	N	Y
1997	Knight Piesold	TP97-BA4-I7	-	Borrow Area No. 4	5,819,594.55	594,808.32	937.20	5.8	N	Y
1997	Knight Piesold	TP97-BA4-I8	-	Borrow Area No. 4	5,819,695.11	594,805.52	939.90	5.3	N	Y
1997	Knight Piesold	TP97-BA4-I9	-	Borrow Area No. 4	5,819,796.36	594,804.13	942.45	5.3	N	Y
1997	Knight Piesold	TP97-BA4-J8	Hitachi EX270	Borrow Area No. 4	5,819,695.80	594,903.99	934.41	5.1	N	Y
1997	Knight Piesold	TP97-BA4-J9	Hitachi EX270	Borrow Area No. 4	5,819,799.86	594,901.19	936.66	5.3	N	Y
1997	Knight Piesold	TP97-PETP-1	-	Perimeter Embankment	5,819,588.32	595,551.16	-	5.4	N	Y
1997	Knight Piesold	TP97-PETP-2	-	Perimeter Embankment	5,819,653.52	595,451.18	-	5.2	N	Y
1997	Knight Piesold	TP97-PETP-3	-	Corner 1 Embankment	5,819,796.98	595,281.64	-	5.1	N	Y
1997	Knight Piesold	TP97-PETP-4	-	Corner 1 Embankment	5,819,962.17	595,014.30	-	5.0	N	Y
1998	Knight Piesold	TP98-BA2-1	-	Borrow Area No. 2	5,818,449.41	596,433.45	-	-	-	N
1998	Knight Piesold	TP98-BA2-2	-	Borrow Area No. 2	5,818,548.63	596,463.71	-	-	-	N
1998	Knight Piesold	TP98-BA2-3	-	Borrow Area No. 2	5,818,541.68	596,361.52	-	-	-	N
1998	Knight Piesold	TP98-BA2-5	-	Borrow Area No. 2	5,818,640.91	596,247.41	-	-	-	N
1998	Knight Piesold	PRT98-01	-	Main Embankment	-	-	-	-	-	N
1998	Knight Piesold	PRT98-02	-	Main Embankment	-	-	-	-	-	N
1998	Knight Piesold	PRT98-03	-	Main Embankment	-	-	-	-	-	N
2014	KCB	TP14-01	Komatsu PC 400 LC	Dam Breach Area	5,819,966.80	595,121.70	931.00	-	N	N
2014	BGC	BGC-TP-2014	-	Corner 1 Embankment	5,820,252.50	594,927.20	932.14	-	-	N

Table C3: Summary of Cone Penetration Tests

Year	Consultant	CPT Sounding	Method(s)	General Location Description	Coordinates		Ground Elevation (m)	Start Depth (m)	Completion Depth (m)	Intermediate Drill Outs? (Y/N)	Record of CPT in Database?	CPT on Figure 01?	CPT on Figure 02?
					Northing (m)	Easting (m)							
1996	Knight Piesold	CPT96-1	SCPTu	Main Embankment	5,818,475.71	595,586.23	-	0.00	9.70	N	Y	Y	N
1996	Knight Piesold	CPT96-2	CPTu	Main Embankment	5,818,405.37	595,581.55	-	0.00	9.60	N	Y	Y	N
1996	Knight Piesold	CPT96-3	CPTu	Main Embankment	5,818,538.81	595,593.97	-	0.00	10.85	N	Y	Y	N
1996	Knight Piesold	CPT96-4	CPTu	Main Embankment	5,818,478.56	595,515.80	-	0.00	11.50	N	Y	Y	N
1996	Knight Piesold	CPT96-5	CPTu	Main Embankment	5,818,464.00	595,664.61	-	0.00	10.00	N	Y	Y	N
1996	Knight Piesold	PRW96-1	CPT	Main Embankment	-	-	-	0.00	7.65	N	Y	N	N
1996	Knight Piesold	PRW96-2 (4)	CPTu	Main Embankment	-	-	-	0.00	11.80	Y	Y	N	N
1996	Knight Piesold	PRW96-2 (4A)	SCPTu	Main Embankment	-	-	-	7.70	15.85	N	Y	N	N
1996	Knight Piesold	PRW96-3	CPTu	Main Embankment	-	-	-	0.00	8.25	N	Y	N	N
1996	Knight Piesold	PRW96-4	CPTu	Main Embankment	-	-	-	0.00	10.25	N	Y	N	N
2014	The Panel	CPT14-101	CPTu	Dam Breach Area	5,819,824.96	595,337.17	933.02	-	17.13	Y	Y	N	Y
2014	The Panel	CPT14-102	CPTu	Dam Breach Area	5,819,832.38	595,327.32	932.48	-	13.05	N	Y	N	Y
2014	The Panel	RCPT14-103	RCPTu	Dam Breach Area	5,819,863.30	595,298.44	930.58	-	9.43	N	Y	N	Y
2014	The Panel	RCPT14-104	RCPTu	Dam Breach Area	5,819,888.67	595,258.02	931.74	-	12.53	N	Y	N	Y
2014	The Panel	RCPT14-105	RCPTu	Dam Breach Area	5,819,919.38	595,224.14	931.61	0.00	12.28	N	Y	N	Y
2014	The Panel	RCPT14-106	RCPTu	Dam Breach Area	5,819,998.38	595,141.52	928.65	0.00	13.15	N	Y	N	Y
2014	The Panel	RCPT14-107	RCPTu	Dam Breach Area	5,820,013.00	595,126.70	928.41	0.00	14.20	N	Y	N	Y
2014	The Panel	RCPT14-108	RCPTu	Dam Breach Area	5,820,015.85	595,107.30	928.26	0.00	12.75	N	Y	N	Y
2014	The Panel	RCPT14-108B	RCPTu	Dam Breach Area	5,820,014.58	595,106.67	928.44	0.00	15.88	N	Y	N	Y
2014	The Panel	RCPT14-109	RCPTu	Dam Breach Area	5,820,024.43	595,087.57	928.63	0.00	16.15	N	Y	N	Y
2014	The Panel	RCPT14-110	RCPTu	Dam Breach Area	5,820,042.87	595,093.88	928.65	0.00	15.98	N	Y	N	Y
2014	The Panel	RCPT14-111	RCPTu	Dam Breach Area	5,820,044.92	595,116.91	928.41	0.00	14.00	N	Y	N	Y
2014	The Panel	RCPT14-112	RCPTu	Dam Breach Area	5,820,029.00	595,146.40	928.63	0.00	11.70	N	Y	N	Y
2014	The Panel	RCPT14-113	RCPTu	Dam Breach Area	5,820,013.48	595,153.78	929.17	0.00	11.93	N	Y	N	Y
2014	The Panel	RCPT14-114	RCPTu	Dam Breach Area	5,819,979.00	595,062.50	930.61	0.00	1.25	N	Y	N	Y
2014	The Panel	RCPT14-114B	RCPTu	Dam Breach Area	5,819,979.00	595,062.60	930.63	-	14.73	N	Y	N	Y
2014	The Panel	RCPT14-115	RCPTu	Dam Breach Area	5,820,011.00	595,075.90	929.11	0.00	13.00	N	Y	N	Y
2014	KCB	CPT14-01	RSCPTu	Dam Breach Area	5,819,871.83	595,252.96	931.29	2.83	14.68	Y	Y	N	Y
2014	KCB	CPT14-02	RSCPTu	Dam Breach Area	5,819,956.83	595,200.65	933.03	9.48	16.60	Y	Y	N	Y
2014	KCB	CPT14-03	RSCPTu	Dam Breach Area	5,819,937.31	595,129.86	932.47	5.38	20.53	N	Y	N	Y
2014	KCB	CPT14-04	RSCPTu	Dam Breach Area	5,819,912.66	595,105.56	932.27	5.43	17.25	N	Y	N	Y
2014	KCB	CPT14-05	RCPTu	Dam Breach Area	5,819,924.42	595,188.02	937.43	-	5.80	-	N	N	Y
2014	KCB	CPT14-05A	RSCPTu	Dam Breach Area	5,819,924.42	595,188.02	937.43	13.45	17.60	N	Y	N	Y
2014	KCB	CPT14-06	RSCPTu	Dam Breach Area	5,819,920.26	595,177.07	937.76	9.68	20.23	Y	Y	N	Y
2014	KCB	CPT14-06A	RCPTu	Dam Breach Area	5,819,922.37	595,176.22	937.71	10.70	18.10	N	Y	N	Y
2014	KCB	CPT14-07	RSCPTu	Dam Breach Area	5,819,902.21	595,053.58	931.58	6.13	14.18	N	Y	N	Y
2014	KCB	CPT14-08	RSCPTu	Dam Breach Area	5,819,890.40	595,169.41	947.50	21.23	28.88	N	Y	N	Y
2014	KCB	CPT14-10	RCPTu	Dam Breach Area	5,819,967.55	595,151.21	932.24	7.63	16.28	Y	Y	N	N
2014	KCB	CPT14-10A	RSCPTu	Dam Breach Area	5,819,967.55	595,151.21	932.24	-	11.00	-	N	N	Y
2014	KCB	CPT14-11	RSCPTu	Dam Breach Area	5,819,991.32	595,169.95	931.06	5.65	10.63	N	Y	N	Y
2014	KCB	CPT14-13	RSCPTu	Perimeter Embankment	5,819,767.45	595,409.35	933.41	6.73	22.95	Y	Y	N	Y
2014	KCB	CPT14-14	RSCPTu	Dam Breach Area	5,819,937.03	595,100.52	930.45	3.05	13.98	N	Y	N	Y
2014	KCB	CPT14-15	RSCPTu	Dam Breach Area	5,819,960.89	595,100.02	930.20	3.53	18.83	N	Y	N	Y
2014	KCB	CPT14-16	RSCPTu	Dam Breach Area	5,819,976.38	595,078.31	930.28	8.03	12.48	N	Y	N	Y
2014	KCB	CPT14-16A	RSCPTu	Dam Breach Area	5,819,975.79	595,079.20	930.44	2.33	8.98	N	Y	N	Y
2014	KCB	CPT14-17	RSCPTu	Dam Breach Area	5,819,994.09	595,086.97	929.99	3.48	13.95	Y	Y	N	Y
2014	KCB	CPT14-18	RSCPTu	Dam Breach Area	5,820,025.89	595,012.98	934.84	3.85	11.85	N	Y	N	Y
2014	KCB	CPT14-19	RSCPTu	Dam Breach Area	5,820,043.69	594,886.51	942.67	3.38	7.08	Y	Y	N	Y
2014	KCB	CPT14-21	RSCPTu	Perimeter Embankment	5,819,718.00	595,328.74	971.00	0.00	25.55	Y	Y	N	Y
2014	KCB	CPT14-22	RSCPTu	Dam Breach Area	5,819,981.72	595,124.54	929.77	3.93	18.40	N	Y	N	Y
2016	Golder	CPT16-04	CPTu	Corner 1 Embankment Buttress	5,820,009.00	595,265.00	932.80	8.50	15.80	Y	Y	Y	Y
2016	Golder	CPT16-05	CPTu	Corner 1 Embankment Buttress	5,820,060.00	595,310.00	925.50	3.10	7.60	Y	Y	Y	Y
2016	Golder	CPT16-07	CPTu	Corner 1 Embankment Buttress	5,819,961.00	595,352.00	932.40	9.00	14.80	N	Y	Y	Y
2016	Golder	CPT16-08	CPTu	Corner 1 Embankment Buttress	5,820,015.00	595,378.00	924.40	4.10	7.10	N	Y	Y	Y
2016	Golder	CPT16-09	CPTu	Corner 1 Embankment Buttress	5,819,949.00	595,458.00	923.90	2.10	6.50	N	Y	Y	Y
2016	Golder	CPT16-19	CPTu	South Embankment	5,818,341.00	594,791.00	945.20	9.10	9.50	N	Y	Y	N
2016	Golder	CPT16-20	CPTu	Perimeter Embankment (Tailings)	5,819,411.00	595,562.00	961.20	0.70	31.00	N	Y	Y	N
2016	Golder	CPT16-21	CPTu	Main Embankment (Tailings)	5,818,759.00	595,801.00	964.00	0.80	38.40	N	Y	Y	N
2016	Golder	CPT16-22	CPTu	South Embankment (Tailings)	5,818,489.00	594,836.00	962.90	0.70	24.40	N	Y	Y	N
2021	Golder	CPT21-02	SCPTu	Perimeter Embankment Buttress	5,819,628.37	595,780.62	930.07	15.24	26.20	Y	Y	Y	N
2021	Golder	CPT21-03	SCPTu	Perimeter Embankment Buttress	5,819,542.99	595,924.23	930.45	25.30	40.10	Y	Y	Y	N
2021	Golder	CPT21-06	SCPTu	Perimeter Embankment Buttress	5,819,066.04	596,228.13	946.12	30.73	30.91	N	Y	Y	N
2021	Golder	CPT21-07	SCPTu	Main Embankment Buttress	5,818,649.11	596,018.63	935.90	12.50	35.54	Y	Y	Y	N
2021	Golder	CPT21-08	SCPTu	Main Embankment Buttress	5,818,510.30	595,878.28	930.24	18.63	29.89	N	Y	Y	N
2021	Golder	CPT21-09	SCPTu	Main Embankment Buttress	5,818,304.68	595,544.37	930.53	18.53	25.42	Y	Y	Y	N

Table C4 (a): Summary of Monitoring Wells

Year	Consultant	Monitoring Well ID	Borehole	General Location Description	Coordinates		Ground Elevation (m)	Collar Elevation (m)	Screen Interval (m)		Screen Interval (mbgs)		Soil Units	Hydraulic Conductivity Tests		Record of MW in Database?	Location on Figure 01?
					Northing (m)	Easting (m)			From	To	From	To		Method	Hydraulic Conductivity (m/s)		
1989	Knight Piesold	MP89-231	MP89-231	Corner 1 Embankment	5,819,929.90	595,178.85	927.20	-	927.20	892.10	0.0	35.1	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1989	Knight Piesold	MP89-232	MP89-232	Tailings Basin	5,818,944.44	595,471.80	919.40	-	919.40	904.20	0.0	15.2	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1989	Knight Piesold	MP89-233	MP89-233	Perimeter Embankment	5,819,358.58	596,015.13	933.90	-	933.90	903.40	0.0	30.5	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1989	Knight Piesold	MP89-234	MP89-234	Main Embankment	5,818,369.54	595,625.93	909.30	-	909.30	869.70	0.0	39.6	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1989	Knight Piesold	MP89-235	MP89-235	South Embankment	5,818,356.15	595,016.85	946.20	-	946.20	914.20	0.0	32.0	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1989	Knight Piesold	MP89-236	MP89-236	Tailings Basin	5,818,961.71	594,395.20	949.00	-	949.00	917.00	0.0	32.0	See Table B4 (b)	Packer Test	See Table C4 (b)	Y	Y
1996	Knight Piesold	GW96-1A	GW96-1A	Corner 1 Embankment	5,819,939.06	595,415.82	927.89	928.49	873.49	868.89	54.4	59.0	Bedrock - Volcanic Conglomerate	-	-	Y	Y
1996	Knight Piesold	GW96-1B	GW96-1B	Corner 1 Embankment	5,819,935.22	595,416.16	927.81	928.41	893.71	889.11	34.1	38.7	gravelly SAND *(Glaciofluvial)*	-	-	Y	Y
1996	Knight Piesold	GW96-2A	GW96-2A	Perimeter Embankment	5,819,449.92	596,065.40	931.42	931.92	879.62	876.52	51.8	54.9	Weathered Bedrock - Conglomerate	2022 Solid Slug	3×10^{-6}	Y	Y
1996	Knight Piesold	GW96-2B	GW96-2B	Perimeter Embankment	5,819,447.08	596,074.73	931.42	932.02	900.62	896.02	30.8	35.4	SAND and GRAVEL *(Glaciofluvial?)*	2022 Solid Slug	4×10^{-4}	Y	Y
1996	Knight Piesold	GW96-3A	GW96-3A	Main Embankment	5,818,308.97	595,768.75	912.06	912.56	863.26	859.46	48.8	52.6	Bedrock - Volcanoclastic Conglomerate	-	-	Y	Y
1996	Knight Piesold	GW96-3B	GW96-3B	Main Embankment	5,818,306.52	595,765.16	912.06	912.56	895.16	892.06	16.9	20.0	SAND *(Glaciofluvial)* overlying SAND and SILT *(Basal Till)*	-	-	Y	Y
1996	Knight Piesold	GW96-4A	GW96-4A	South Embankment	5,818,164.58	595,147.94	940.56	941.26	920.46	915.86	20.1	24.7	Bedrock - Volcanoclastic Conglomerate	-	-	Y	Y
1996	Knight Piesold	GW96-4B	GW96-4B	South Embankment	5,818,162.87	595,151.26	940.46	941.16	936.16	933.26	4.3	7.2	SAND, some gravel *(Glaciofluvial?)*	2022 Solid Slug	2×10^{-6}	Y	Y
1996	Knight Piesold	GW96-5A	GW96-5A	West side of TSF	5,819,626.68	594,330.34	973.55	974.15	958.55	954.15	15.0	19.4	Bedrock - Syenite Intrusive	-	-	Y	Y
1996	Knight Piesold	GW96-5B	GW96-5B	West side of TSF	5,819,629.64	594,329.79	973.44	974.04	969.74	966.74	3.7	6.7	sandy SILT *(Ablation Till)*	-	-	Y	Y
1996	Knight Piesold	GW96-9	GW96-9	Main Embankment	5,818,277.14	595,503.89	916.18	916.78	912.18	910.38	4.0	5.8	SAND *(Glaciofluvial)* overlying SILT *(Glaciolacustrine)*	-	-	Y	Y
2000	Knight Piesold	GW00-1A	GW00-1A	South Embankment	5,818,476.10	594,367.95	939.19	940.02	924.25	918.16	14.9	21.0	Bedrock - Volcanic, fractured	-	-	Y	Y
2000	Knight Piesold	GW00-1B	GW00-1B	South Embankment	5,818,475.85	594,371.11	939.20	940.05	934.72	928.62	4.5	10.6	SILT Till with SAND interbed *(Basal Till)*	2022 Solid Slug	3×10^{-6}	Y	Y
2000	Knight Piesold	GW00-2A	GW00-2A	South Embankment	5,818,337.64	594,651.69	943.42	944.17	927.97	921.87	15.5	21.6	Bedrock - Volcanic	-	-	Y	Y
2000	Knight Piesold	GW00-2B	GW00-2B	South Embankment	5,818,336.36	594,657.64	943.43	944.39	935.84	932.79	7.6	10.6	sandy SILT Till overlying Weathered Bedrock	-	-	Y	Y
2000	Knight Piesold	GW00-3A	GW00-3A	South Embankment	5,818,237.66	594,899.91	943.34	944.04	925.14	919.05	18.2	24.3	Weathered Bedrock	-	-	Y	Y
2000	Knight Piesold	GW00-3B	GW00-3B	South Embankment	5,818,238.09	594,896.22	943.06	943.79	935.50	929.40	7.6	13.7	SILT Till with SILT / fine SAND interbed *(Basal Till)*	2022 Solid Slug	8×10^{-7}	Y	Y
2011	AMEC	GW11-2A	GW11-2A	North of TSF	5,821,031.81	594,939.05	934.40	935.15	908.20	905.10	26.2	29.3	Weathered Bedrock	-	-	Y	N
2011	AMEC	GW11-2B	GW11-2B	North of TSF	5,821,029.90	594,937.74	934.47	935.24	923.37	920.27	11.1	14.2	sandy SILT *(Till)* overlying SILT *(Glaciofluvial)*	-	-	Y	N
2014	-	GW14-01	GW14-01	Northwest side of TSF	5,819,742.90	593,765.90	1036.30	-	-	-	-	-	Bedrock	-	-	N	Y
2016	Golder	GW16-2A	GW16-2A	Perimeter Embankment	5,819,731.19	595,831.15	925.10	925.90	876.50	873.50	48.6	51.6	sandy SILTY GRAVEL *(Glaciofluvial)*	Pneumatic	8×10^{-4}	Y	Y
2016	Golder	GW16-2B	GW16-2B	Perimeter Embankment	5,819,734.31	595,832.84	924.95	925.52	897.72	894.72	27.2	30.2	SAND and GRAVEL *(Glaciofluvial)*	Pneumatic	2×10^{-4}	Y	Y
2016	Golder	GW16-3A	GW16-3A	Main Embankment	5,818,752.04	596,335.81	938.19	938.91	900.61	897.61	37.6	40.6	Weathered Bedrock - gravelly sandy SILTY CLAY	Recovery	$<10^{-10}$	Y	Y
2016	Golder	GW16-3B	GW16-3B	Main Embankment	5,818,757.46	596,337.84	938.35	939.00	910.90	907.90	27.4	30.4	SILTY SAND and GRAVEL	Solid Slug	8×10^{-6}	Y	Y
2016	Golder	GW16-4A	GW16-4A	Main Embankment	5,818,106.62	595,491.16	922.16	922.90	908.30	905.30	13.9	16.9	Weathered Bedrock - CLAYEY SILT and SAND	Recovery	1×10^{-7}	Y	Y
2016	Golder	GW16-4B	GW16-4B	Main Embankment	5,818,109.50	595,489.47	922.26	922.97	914.07	913.17	8.2	9.1	SILTY SAND *(Ablation Till)*	Solid Slug	2×10^{-5}	Y	Y
2016	Golder	GW16-5A	GW16-5A	South Embankment	5,818,539.05	594,207.62	963.64	964.29	940.49	937.49	23.2	26.2	Inferred Competent Bedrock	Solid Slug	5×10^{-6}	Y	Y
2016	Golder	GW16-5B	GW16-5B	South Embankment	5,818,541.45	594,206.42	963.91	964.57	947.47	942.87	16.4	21.0	Inferred Competent Bedrock	Recovery	2×10^{-7}	Y	Y
2021	Golder	GW21-06	CPT21-06	Perimeter Embankment Buttress	5,819,066.00	596,228.05	946.12	947.08	912.42	910.87	33.7	35.3	Inferred SAND and GRAVEL *(Basal Till)*	2022 Solid Slug	1×10^{-5}	Y	Y
2021	Golder	GW21-09	GA21-09	Main Embankment Buttress	5,818,304.61	595,544.33	930.53	931.41	914.42	912.85	16.1	17.7	sandy SILTY CLAY / SILT and SAND *(Basal Till)*	2022 Solid Slug	1×10^{-6}	Y	Y
2022	Golder	GW22-01	GA22-01	Corner 1 Embankment Buttress	5,820,058.76	595,034.32	940.84	941.57	920.72	919.20	20.1	21.6	SILTY SAND / gravelly SAND *(Glaciofluvial)*	-	-	Y	Y

Functioning monitoring wells installed around the TSF.

Table C4 (b): Summary of Wireline Packer Test Results (IMC 1990 - Table 4-14)

TABLE 4-14
IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT

TAILINGS AREA B SITE INVESTIGATION
SUMMARY OF WIRELINE PACKER PERMEABILITY TEST RESULTS

Hole No.	Depth Interval (m)	Permeability (cm/s)	Material Description
MP89-231	9 to 12	6.4×10^{-6}	Overburden
	30 to 37	1.6×10^{-6}	Soft Volcanics
	37 to 43	2.9×10^{-7}	Competent Rock
MP89-232	15 to 18	7.7×10^{-6}	Overburden
	32 to 37	3.2×10^{-6}	Fractured Volcanics
	43 to 46	1.0×10^{-5}	Competent Rock
MP89-233	12 to 18	1.1×10^{-5}	Overburden
	30 to 37	2.2×10^{-5}	Soft Rock
	37 to 46	1.6×10^{-5}	Broken Rock
	49 to 55	1.7×10^{-5}	
MP89-234	6 to 12	1.4×10^{-5}	Overburden
	30 to 37	3.2×10^{-7}	Competent Bedrock
	46 to 49	3.3×10^{-6}	Competent Bedrock
MP89-235	6 to 12	5.1×10^{-4}	Heavily Fractured Bedrock at Contact with Overburden
	12 to 18	8.6×10^{-8}	Very Competent Bedrock
	18 to 30	4.0×10^{-7}	Competent Bedrock
	30 to 43	1.1×10^{-5}	Slightly Fractured Bedrock
MP89-236	8 to 12	2.7×10^{-5}	Bedrock
	14 to 24	2.7×10^{-6}	Bedrock
	24 to 37	2.0×10^{-6}	Bedrock
	35 to 46	7.7×10^{-7}	Bedrock

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
1989	Knight Piesold	TPB-01	Main Embankment	Grab	-	-		-		-	Glacial Till	-	13.7	CL	29	19	10	-0.53	CL	-	-	-	-	-	-	-	3.0	14.0	67.0	16.0	0.002	-
1989	Knight Piesold	TPB-13,14,16	South and Main Embankment	Grab	-	-		-		-	Glacial Till	2.76	25.1	CL/CI	30	16	14	0.65	CL/CI	-	-	-	-	1935	13.3	1.60E-10	1.0	17.0	61.0	21.0	0.002	-
1995	Knight Piesold	TP95-18	Tailings / Reclaim Pipeline Route	Grab	-	1.40		990.60		990.60	Glacial Till	-	13.8	-	27	13	14	0.06	CL	-	-	-	-	2130	10.1	-	38.0	36.0	19.0	7.0	0.002	-
1995	Knight Piesold	TP95-27	Perimeter Embankment	Grab	-	3.80		926.20		926.20	Glacial Till	2.73	11.1	-	22	14	8	-0.36	CL	-	-	-	-	2200	8.0	4.00E-10	19.0	37.0	33.0	11.0	0.002	TX
1995	Knight Piesold	TP95-31	Borrow Area No. 2	Grab	-	2.20		936.80		936.80	Glacial Till	-	11.0	-	22	14	8	-0.38	CL	-	-	-	-	2200	7.6	6.00E-10	41.0	27.0	25.0	7.0	0.002	-
1995	Knight Piesold	TP95-35	Tailings Basin	Grab	-	5.40		911.60		911.60	Glaciolacustrine[1]	2.78	16.5	CL-ML	21	14	7	0.36	CL-ML	-	-	-	-	-	-	7.00E-09	2.0	22.0	65.0	11.0	0.002	-
1995	Knight Piesold	TP95-37	Tailings Basin	Grab	-	1.00		937.00		937.00	Glacial Till	-	18.8	-	27	16	11	0.25	CL	-	-	-	-	-	-	-	14.0	40.0	35.0	11.0	0.002	TX
1995	Knight Piesold	TP95-38	Main Embankment	Grab	-	6.20		908.80		908.80	Glaciolacustrine[1]	2.79	28.4	CI	33	19	14	0.67	CI	-	-	-	-	-	-	3.00E-09	3.0	6.0	73.0	18.0	0.002	-
1995	Knight Piesold	TP95-39	Main Embankment	Grab	-	7.00		911.00		911.00	Glaciolacustrine[1]	2.76	28.5	-	-	-	-	-	-	-	-	-	-	-	-	2.00E-08	0.0	40.0	46.0	14.0	0.002	TX
1996	Knight Piesold	96-45	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-1A	2.40	2.70	-	-	-	Glacial Till	2.74	8.9	-	21	15	6	-1.02	CL-ML	-	-	-	-	-	-	-	46.1	26.6	24.8	2.5	0.002	-
1996	Knight Piesold	96-45	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-1B	3.60	3.90	-	-	-	Glacial Till	2.73	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	32.7	25.4	33.9	8.0	0.002	-
1996	Knight Piesold	96-46	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-2A	0.30	0.60	-	-	-	Glacial Till	2.72	12.8	-	-	-	-	-	-	-	-	2025	10.2	-	-	-	15.7	36.2	39.1	9.0	0.002	-
1996	Knight Piesold	96-46	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-2B	2.00	3.00	-	-	-	Glacial Till	2.73	11.2	-	25	15	10	-0.38	CL	-	-	2083	10.5	-	-	-	21.5	29.0	36.5	13.0	0.002	-
1996	Knight Piesold	96-46	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-2C	2.50	3.10	-	-	-	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-46	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-2D	3.60	4.10	-	-	-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-46	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-2E	5.00	5.30	-	-	-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-47	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-3A	1.00	2.00	-	-	-	Glacial Till	2.74	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	21.7	35.0	35.8	7.5	0.002	-
1996	Knight Piesold	96-48	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-4A	0.00	0.70	-	-	-	Glacial Till	-	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-48	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-4B	1.00	2.00	-	-	-	Glacial Till	-	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-48	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-4C	2.00	3.00	-	-	-	Glacial Till	2.73	10.5	-	-	-	-	-	-	-	-	2070	10.5	-	-	-	14.8	35.1	44.1	6.0	0.002	-
1996	Knight Piesold	96-48	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-4D	4.00	5.00	-	-	-	Glacial Till	-	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-49	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-5A	2.00	3.00	-	-	-	Glacial Till	2.73	11.0	-	24	15	9	-0.44	CL	-	-	2083	9.5	-	-	-	22.7	30.9	38.9	7.5	0.002	-
1996	Knight Piesold	96-49	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-5B	3.30	3.60	-	-	-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-50	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-6A	0.50	1.50	-	-	-	Glacial Till	2.74	11.8	-	-	-	-	-	-	-	-	2000	11.4	-	-	-	11.5	32.1	48.4	8.0	0.002	-
1996	Knight Piesold	96-50	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-6B	2.20	2.70	-	-	-	Glacial Till	-	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-50	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-6C	4.40	4.70	-	-	-	Glacial Till	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-51	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-7A	3.50	4.50	-	-	-	Glacial Till	2.72	9.3	-	-	-	-	-	-	-	-	2168	8.3	-	-	-	18.9	38.8	34.8	7.5	0.002	-
1996	Knight Piesold	96-51	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-7B	4.50	5.00	-	-	-	Glacial Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-52	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-8A	0.30	1.00	-	-	-	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-52	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-8B	1.00	2.00	-	-	-	Glacial Till	-	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-52	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-8C	2.50	3.00	-	-	-	Glacial Till	-	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-53	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-9A	1.00	2.00	-	-	-	Glacial Till	-	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-53	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-9B	3.00	4.00	-	-	-	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-53	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-9C	4.50	4.90	-	-	-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-53	Borrow Area No. 3	Grab	C/ME(AB)/(ZS,ZB)-9D	6.00	6.30	-	-	-	Glacial Till	-	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-54	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-10A	0.20	0.50	-	-	-	Glacial Till	-	14.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-54	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-10B	0.50	1.10	-	-	-	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-54	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-10C	2.00	2.40	-	-	-	Glacial Till	2.75	13.2	-	24	15	9	-0.20	CL	-	-	2025	11.3	-	-	-	15.9	34.4	43.4	6.3	0.002	-
1996	Knight Piesold	96-54	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-10D	3.40	3.60	-	-	-	Glacial Till	-	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11A	0.10	0.40	-	-	-	Glacial Till	-	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11B	0.40	0.85	-	-	-	Glacial Till	-	14.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11C	0.85	2.00	-	-	-	Glacial Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11D	2.00	3.00	-	-	-	Glacial Till	-	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11E	3.50	3.70	-	-	-	Glacial Till	-	9.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11F	4.00	4.20	-	-	-	Glacial Till	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-55	Borrow Area No. 2	Grab	C/ME(AB)/(ZS,ZB)-11G	5.00	5.40	-	-	-	Glacial Till	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-84	Borrow Area No. 1	Grab	C/ME/ZS-34A	0.00	0.25	-	-	-	Glacial Till	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-84	Borrow Area No. 1	Grab	C/ME/ZS-34B	0.25	0.55	-	-	-	Glacial Till	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-84	Borrow Area No. 1	Grab	C/ME/ZS-34C	0.55	2.00	-	-	-	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-84	Borrow Area No. 1	Grab	C/ME/ZS-34E	4.80	5.10	-	-	-	Glacial Till	-	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-84	Borrow Area No. 1	Grab	C/ME/ZS-34F	5.50	5.70	-	-	-	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-85	Borrow Area No. 1	Grab	C/ME/ZS-35A	0.00	0.60	-	-	-	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-85	Borrow Area No. 1	Grab	C/ME/ZS-35B	0.60	2.00	-	-	-	Glacial Till	-	9.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-85	Borrow Area No. 1	Grab	C/ME/ZS-35C	3.00		-		-	Glacial Till	2.72	8.6	-	-	-	-	-	-	-	-	-	-	-	-	-	20.2	33.4	38.9	7.5	0.002	-
1996	Knight Piesold	96-85	Borrow Area No. 1	Grab	C/ME/ZS-35D	4.50		-		-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36A	0.00	0.25	-	-	-	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36B	0.25	0.60	-	-	-	Glacial Till	-	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36C	0.60	2.00	-	-	-	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36D	3.10		-		-	Glacial Till	2.75	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	24.0	29.5	37.5	9.0	0.002	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36E	4.50		-		-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36F	6.00		-		-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-86	Borrow Area No. 1	Grab	C/ME/ZS-36G	6.30		-		-	Glacial Till	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-87	Borrow Area No. 1	Grab	C/ME/ZS-37A	0.00	0.40	-	-	-	Glacial Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-87	Borrow Area No. 1	Grab	C/ME/ZS-37B	0.40	1.00	-	-	-	Glacial Till	-	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-87	Borrow Area No. 1	Grab	C/ME/ZS-37C	1.00	2.50	-	-	-	Glacial Till	2.72	11.7	-	-	-	-	-	-	-	-	-	-	-	-	-	21.6	34.7	32.7	11.0	0.002	-
1996	Knight Piesold	96-88	Borrow Area No. 1	Grab	C/ME/ZS-38A	0.30	1.10	-	-	-	Glacial Till	-	14.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-88	Borrow Area No. 1	Grab	C/ME/ZS-38B	1.10	2.00	-	-	-	Glacial Till	2.75	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	21.5	38.5	33.0	7.0	0.002	-
1996	Knight Piesold	96-88	Borrow Area No. 1	Grab	C/ME/ZS-38C	3.70		-		-	Glacial Till	-	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-88	Borrow Area No. 1	Grab	C/ME/ZS-38D	5.00	5.80	-	-	-	Glacial Till	-	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-88	Borrow Area No. 1	Grab	C/ME/ZS-38E	6.00		-		-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-89	Borrow Area No. 1	Grab	C/ME/ZS-39A	0.25	1.10	-	-	-	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-89	Borrow Area No. 1	Grab	C/ME/ZS-39B	1.10	2.50	-	-	-	Glacial Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-90	Borrow Area No. 1	Grab	C/ME/ZS-40A	0.50	1.20	-	-	-	Glacial Till	-	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-90	Borrow Area No. 1	Grab	C/ME/ZS-40B	1.20	2.50	-	-	-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-91	Borrow Area No. 1	Grab	C/ME/ZS-41A	0.00	0.60	-	-	-	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-91	Borrow Area No. 1	Grab	C/ME/ZS-41B	0.60	2.00	-	-	-	Glacial Till	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-91	Borrow Area No. 1	Grab	C/ME/ZS-41C	2.50		-		-	Glacial Till	-	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-92	Borrow Area No. 1	Grab	C/ME/ZS-42A	0.50	1.20	-	-	-	Glacial Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-92	Borrow Area No. 1	Grab	C/ME/ZS-42B	1.20	2.50	-	-	-	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-93	Borrow Area No. 1	Grab	C/ME/ZS-20	-		-		-	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	28.6	48.2	15.0	0.002	-
1996	Knight Piesold	96-94	Borrow Area No. 1	Grab	C/ME/ZS-21	-		-		-	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-95	Borrow Area No. 1	Grab	C/ME/ZS--22A	0.50	1.50	-	-	-	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-95	Borrow Area No. 1	Grab	C/ME/ZS-22B	2.50	3.00	-	-	-	Glacial Till	-	16.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-96	Borrow Area No. 1	Grab	C/ME/ZS-23A	0.50	1.50	-	-	-	Glacial Till	2.75	13.6	CL	28	15	13	-0.11	CL	-	-	1990	12.3	-	-	-	11.4	29.1	44.5	15.0	0.002	-
1996	Knight Piesold	96-96	Borrow Area No. 1	Grab	C/ME/ZS-23B	2.50	3.50	-	-	-	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	33.5	53.7		-	-
1996	Knight Piesold	96-98	Borrow Area No. 1	Grab	C/ME/ZS-24	0.50	1.50	-	-	-	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-99	Borrow Area No. 1	Grab	C/ME/ZS-25	4.00	6.00	-	-	-	Glacial Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	17.6	28.9	53.5		-	-
1996	Knight Piesold	96-99	Borrow Area No. 1	Grab	C/ME/ZS-26B	5.70	7.30	-	-	-	Glacial Till	-	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	33.9	37.8	28.3		-	-
1996	Knight Piesold	96-101	Borrow Area No. 1	Grab	C/ME/ZS-26A	2.00	3.50	-	-	-	Glacial Till	-	15.5	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8	15.2	81.0		-	-
1996	Knight Piesold	96-102	Borrow Area No. 1	Grab	C/ME/ZS-27A	0.50	2.00	-	-	-	Glacial Till	-	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-102	Borrow Area No. 1	Grab	C/ME/ZS-27B	2.00	3.00	-	-	-	Glacial Till	2.73	12.1	ML			Non-Plastic		ML	-	-	2000	11.2	-	-	-	9.8	37.8	49.4	3.0	0.002	-
1996	Knight Piesold	96-102	Borrow Area No. 1	Grab	C/ME/ZS-27C	3.00	4.00	-	-	-	Glacial Till	-	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	48.7	39.3		-	-
1996	Knight Piesold	96-102	Borrow Area No. 1	Grab	C/ME/ZS-27D	4.00	6.00	-	-	-	Glacial Till	-	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	13.9	47.5	38.6		-	-
1996	Knight Piesold	96-102	Borrow Area No. 1	Grab	C/ME/ZS-27E	6.00	7.00	-	-	-	Glacial Till	-	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-103	Borrow Area No. 1	Grab	C/ME/ZS-28A	1.00	3.00	-	-	-	Glacial Till	2.70	11.8	CL-ML	24	17	7	-0.74	CL-ML	-	-	2030	11.0	-	-	-	9.1	39.4	39.5	12.0	0.002	-
1996	Knight Piesold	96-103	Borrow Area No. 1	Grab	C/ME/ZS-28B	3.00	5.00	-	-	-	Glacial Till	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	10.6	34.2	47.2	8.0	0.002	-
1996	Knight Piesold	96-104	Borrow Area No. 1	Grab	C/ME/ZS-29	0.50	1.20	-	-	-	Glacial Till	-	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-105	Borrow Area No. 1	Grab	C/ME/ZS-30A	1.00	3.00	-	-	-	Glacial Till	2.73	10.2	-	22	16	6	-0.97	CL-ML	-	-	2090	9.5	-	-	-	17.3	42.7	32.0	8.0	0.002	-
1996	Knight Piesold	96-105	Borrow Area No. 1	Grab	C/ME/ZS-30B	4.00	6.00	-	-	-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-106	Borrow Area No. 1	Grab	C/ME/ZS-31A	0.50	2.00	-	-	-	Glacial Till	2.75	12.7	-	20	14	6	-0.22	CL-ML	-	-	2015	11.0	-	-	-	8.4	51.0	32.6	8.0	0.002	-
1996	Knight Piesold	96-106	Borrow Area No. 1	Grab	C/ME/ZS-31B	4.00	6.00	-	-	-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-107	Borrow Area No. 1	Grab	C/ME/ZS-32A	0.10	0.60	-	-	-	Glacial Till	-	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-107	Borrow Area No. 1	Grab	C/ME/ZS-32B	1.50	2.50	-	-	-	Glacial Till	2.71	13.1	CL	24	13	11	0.01	CL	-	-	2005	10.9	-	-	-	13.1	34.0	41.9	11.0	0.002	-
1996	Knight Piesold	96-107	Borrow Area No. 1	Grab	C/ME/ZS-32C	4.00	5.80	-	-	-	Glacial Till	-	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-108	Borrow Area No. 1	Grab	C/ME/ZS-33A	0.60	1.50	-	-	-	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-108	Borrow Area No. 1	Grab	C/ME/ZS-33B	1.50	2.00	-	-	-	Glacial Till	-	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-108	Borrow Area No. 1	Grab	C/ME/ZS-33D	4.50	6.00	-	-	-	Glacial Till	-	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-111	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-1A	0.30	0.50	-	-	-	Glacial Till	-	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-111	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-1B	0.80	1.00	-	-	-	Glacial Till	-	15.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-111	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-1C	2.00	4.00	-	-	-	Glacial Till	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	29.9	32.6	37.5		-	-
1996	Knight Piesold	96-111	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-1D	5.00	5.40	-	-	-	Glacial Till	-	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	23.3	34.5	37.2	5.0	0.002	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
1996	Knight Piesold	96-112	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-2A	0.70	1.00	-	-	-	Glacial Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-112	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-2B	3.00	3.50	-	-	-	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	38.4	55.0	-	-
1996	Knight Piesold	96-113	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-3A	1.00	1.50	-	-	-	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-113	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-3B	2.50	3.00	-	-	-	Glacial Till	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0	36.9	35.1	3.0	0.002	-
1996	Knight Piesold	96-114	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-4A	0.70	1.20	-	-	-	Glacial Till	-	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	Knight Piesold	96-114	Perimeter Embankment	Grab	C/ME(FB)/(ZS,ZB)-4B	2.50	3.00	-	-	-	Glacial Till	-	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F8	Borrow Area No. 4	Grab	-	0.70		950.38		950.38	Glacial Till	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F8	Borrow Area No. 4	Grab	-	1.40		949.68		949.68	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F8	Borrow Area No. 4	Grab	-	2.20		948.88		948.88	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F8	Borrow Area No. 4	Grab	-	3.40		947.68		947.68	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F8	Borrow Area No. 4	Grab	-	4.90		946.18		946.18	Glacial Till	-	29.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	1.00		954.30		954.30	Glacial Till	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	1.85		953.45		953.45	Glacial Till	-	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	2.10		953.20		953.20	Glacial Till	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	3.25		952.05		952.05	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	4.60		950.70		950.70	Glacial Till	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-F9	Borrow Area No. 4	Grab	-	5.00		950.30		950.30	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G4	Borrow Area No. 4	Grab	-	0.70		939.10		939.10	Glacial Till	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G4	Borrow Area No. 4	Grab	-	2.50		937.30		937.30	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G4	Borrow Area No. 4	Grab	-	3.00		936.80		936.80	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G4	Borrow Area No. 4	Grab	-	4.00		935.80		935.80	Glacial Till	-	14.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G5	Borrow Area No. 4	Grab	-	0.50		940.70		940.70	Glacial Till	-	19.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G5	Borrow Area No. 4	Grab	-	1.60		939.60		939.60	Glacial Till	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G5	Borrow Area No. 4	Grab	-	3.00		938.20		938.20	Glacial Till	-	14.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G5	Borrow Area No. 4	Grab	-	5.40		935.80		935.80	Glacial Till	-	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G6	Borrow Area No. 4	Grab	-	1.60		943.00		943.00	Glacial Till	-	16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G6	Borrow Area No. 4	Grab	-	3.00		941.60		941.60	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G6	Borrow Area No. 4	Grab	-	5.00		939.60		939.60	Glacial Till	-	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G7	Borrow Area No. 4	Grab	-	0.70		944.66		944.66	Glacial Till	-	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G7	Borrow Area No. 4	Grab	-	2.05		943.31		943.31	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G7	Borrow Area No. 4	Grab	-	3.25		942.11		942.11	Glacial Till	-	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G7	Borrow Area No. 4	Grab	-	4.00		941.36		941.36	Glacial Till	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G7	Borrow Area No. 4	Grab	-	5.20		940.16		940.16	Glacial Till	-	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G8	Borrow Area No. 4	Grab	-	0.70		947.10		947.10	Glacial Till	-	15.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G8	Borrow Area No. 4	Grab	-	1.20		946.60		946.60	Glacial Till	-	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G8	Borrow Area No. 4	Grab	-	1.80		946.00		946.00	Glacial Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G8	Borrow Area No. 4	Grab	-	3.70		944.10		944.10	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G8	Borrow Area No. 4	Grab	-	5.00		942.80		942.80	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G9	Borrow Area No. 4	Grab	-	0.80		951.50		951.50	Glacial Till	-	20.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G9	Borrow Area No. 4	Grab	-	1.50		950.80		950.80	Glacial Till	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G9	Borrow Area No. 4	Grab	-	2.20		950.10		950.10	Glacial Till	-	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G9	Borrow Area No. 4	Grab	-	3.10		949.20		949.20	Glacial Till	-	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-G9	Borrow Area No. 4	Grab	-	4.30		948.00		948.00	Glacial Till	-	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H4	Borrow Area No. 4	Grab	-	0.50		937.30		937.30	Glacial Till	-	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H4	Borrow Area No. 4	Grab	-	1.40		936.40		936.40	Glacial Till	-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H4	Borrow Area No. 4	Grab	-	2.75		935.05		935.05	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H4	Borrow Area No. 4	Grab	-	5.10		932.70		932.70	Glacial Till	-	12.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H5	Borrow Area No. 4	Grab	-	0.50		938.90		938.90	Glacial Till	-	19.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H5	Borrow Area No. 4	Grab	-	1.50		937.90		937.90	Glacial Till	-	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H5	Borrow Area No. 4	Grab	-	2.30		937.10		937.10	Glacial Till	-	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H5	Borrow Area No. 4	Grab	-	4.00		935.40		935.40	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H6	Borrow Area No. 4	Grab	-	1.60		939.70		939.70	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H6	Borrow Area No. 4	Grab	-	3.40		937.90		937.90	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H6	Borrow Area No. 4	Grab	-	4.20		937.10		937.10	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H6	Borrow Area No. 4	Grab	-	5.30		936.00		936.00	Glacial Till	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H7	Borrow Area No. 4	Grab	-	0.90		941.90		941.90	Glacial Till	-	16.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H7	Borrow Area No. 4	Grab	-	2.05		940.75		940.75	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H7	Borrow Area No. 4	Grab	-	3.00		939.80		939.80	Glacial Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H7	Borrow Area No. 4	Grab	-	4.00		938.80		938.80	Glacial Till	-	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H7	Borrow Area No. 4	Grab	-	5.00		937.80		937.80	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H8	Borrow Area No. 4	Grab	-	1.00		943.10		943.10	Glacial Till	-	18.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H8	Borrow Area No. 4	Grab	-	1.70		942.40		942.40	Glacial Till	-	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H8	Borrow Area No. 4	Grab	-	2.50		941.60		941.60	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H8	Borrow Area No. 4	Grab	-	4.60		939.50		939.50	Glacial Till	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H8	Borrow Area No. 4	Grab	-	5.30		938.80		938.80	Glacial Till	-	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H9	Borrow Area No. 4	Grab	-	0.50		947.30		947.30	Glacial Till	-	18.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H9	Borrow Area No. 4	Grab	-	1.60		946.20		946.20	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H9	Borrow Area No. 4	Grab	-	1.90		945.90		945.90	Glacial Till	-	12.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H9	Borrow Area No. 4	Grab	-	3.70		944.10		944.10	Glacial Till	-	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-H9	Borrow Area No. 4	Grab	-	4.40		943.40		943.40	Glacial Till	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I4	Borrow Area No. 4	Grab	-	1.30		935.10		935.10	Glacial Till	-	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I4	Borrow Area No. 4	Grab	-	2.30		934.10		934.10	Glacial Till	-	13.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I4	Borrow Area No. 4	Grab	-	3.10		933.30		933.30	Glacial Till	-	14.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I4	Borrow Area No. 4	Grab	-	3.70		932.70		932.70	Glacial Till	-	13.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I6	Borrow Area No. 4	Grab	-	1.00		935.90		935.90	Glacial Till	-	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I6	Borrow Area No. 4	Grab	-	2.00		934.90		934.90	Glacial Till	-	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I6	Borrow Area No. 4	Grab	-	4.40		932.50		932.50	Glacial Till	-	12.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I6	Borrow Area No. 4	Grab	-	4.40		932.50		932.50	Glaciolacustrine	-	19.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I6	Borrow Area No. 4	Grab	-	5.00		931.90		931.90	Glaciolacustrine	-	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	0.70		936.50		936.50	Glacial Till	-	22.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	1.30		935.90		935.90	Glacial Till	-	15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	2.30		934.90		934.90	Glacial Till	-	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	3.20		934.00		934.00	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	4.60		932.60		932.60	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I7	Borrow Area No. 4	Grab	-	5.20		932.00		932.00	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I8	Borrow Area No. 4	Grab	-	0.70		939.20		939.20	Glacial Till	-	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I8	Borrow Area No. 4	Grab	-	2.00		937.90		937.90	Glacial Till	-	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I8	Borrow Area No. 4	Grab	-	4.50		935.40		935.40	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I9	Borrow Area No. 4	Grab	-	0.50		941.95		941.95	Glacial Till	-	22.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I9	Borrow Area No. 4	Grab	-	1.70		940.75		940.75	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I9	Borrow Area No. 4	Grab	-	3.00		939.45		939.45	Glacial Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I9	Borrow Area No. 4	Grab	-	4.30		938.15		938.15	Glacial Till	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-I9	Borrow Area No. 4	Grab	-	5.10		937.35		937.35	Glacial Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J8	Borrow Area No. 4	Grab	-	1.00		933.41		933.41	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J8	Borrow Area No. 4	Grab	-	1.50		932.91		932.91	Glacial Till	-	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J8	Borrow Area No. 4	Grab	-	3.40		931.01		931.01	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J8	Borrow Area No. 4	Grab	-	4.50		929.91		929.91	Glacial Till	-	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J9	Borrow Area No. 4	Grab	-	0.75		935.91		935.91	Glacial Till	-	19.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J9	Borrow Area No. 4	Grab	-	2.00		934.66		934.66	Glacial Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J9	Borrow Area No. 4	Grab	-	3.40		933.26		933.26	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	Knight Piesold	TP97-BA4-J9	Borrow Area No. 4	Grab	-	4.80		931.86		931.86	Glacial Till	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	Knight Piesold	DH98-BA2-6	Borrow Area No. 2	Grab	-	2.29		-		-	Glacial Till	-	10.9	-	23	12	11	-0.10	CL	-	-	-	-	-	-	-	8.4	48.6	30.3	12.7	0.002	-
1998	Knight Piesold	DH98-BA2-9	Borrow Area No. 2	Grab	-	4.27	-	-		-	Glacial Till	-	14.5	-	23	12	11	0.23	CL	-	-	-	-	-	-	-	23.1	39.1	24.3	13.5	0.002	-
1998	Knight Piesold	DH98-BA2-11	Borrow Area No. 2	Grab	-	3.81	-	-		-	Glacial Till	-	10.6	-	20	13	7	-0.34	CL-ML	-	-	-	-	-	-	-	13.7	45.9	27.1	13.3	0.002	-
1998	Knight Piesold	DH98-BA2-16	Main Embankment	Grab	-	1.83	-	-		-	Glacial Till	-	11.8	CL	25	12	13	-0.02	CL	-	-	-	-	-	-	-	13.0	34.9	33.2	18.9	0.002	-
1998	Knight Piesold	DH98-BA4-1	Borrow Area No. 4	Grab	-	2.74	-	-		-	Glacial Till	-	11.3	CL	21	12	9	-0.08	CL	-	-	-	-	-	-	-	7.3	37.8	41.7	13.2	0.002	-
1998	Knight Piesold	DH98-BA4-6	Borrow Area No. 4	Grab	-	4.27	-	-		-	Glacial Till	-	11.0	CL	23	12	11	-0.09	CL	-	-	-	-	-	-	-	7.3	36.0	41.6	15.1	0.002	-
1998	Knight Piesold	DH98-BA4-9	Borrow Area No. 4	Grab	-	1.22	-	-		-	Glacial Till	-	12.4	CL	22	11	11	0.13	CL	-	-	-	-	-	-	-	1.0	42.0	38.6	18.4	0.002	-
1998	Knight Piesold	DH98-BL-04	South Embankment	Grab	-	1.22	940.98	940.98		940.98	Glacial Till	-	13.7	CL	24	14	10	-0.03	CL	-	-	-	-	-	-	-	8.5	39.3	33.8	18.4	0.002	-
1998	Knight Piesold	DH98-BL-08	Tailings Basin	Grab	-	3.66	-	-		-	Glaciolacustrine	-	46.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	Knight Piesold	DH98-BL-10	Tailings Basin	Grab	-	1.37	-	-		-	Glacial Till	-	14.0	CL	27	16	11	-0.18	CL	-	-	-	-	-	-	-	0.4	41.7	33.6	24.3	0.002	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
1998	Knight Piesold	DH98-BL-12	South Embankment	Grab	-	1.22		946.78		946.78	Glacial Till	-	13.9	CL	27	14	13	-0.01	CL	-	-	-	-	-	-	-	11.7	35.7	30.8	21.8	0.002	-
1999	Knight Piesold	BH99-12	South Embankment	Grab	BH99-12A	2.59	3.05	943.91	943.45	943.68	Glacial Till	-	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	6.2	32.3	61.5		-	-
1999	Knight Piesold	BH99-13	South Embankment	Grab	BH99-13A	2.59	3.05	945.41	944.95	945.18	Glacial Till	-	15.2	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	30.9	27.6	33.0	0.002	-
1999	Knight Piesold	BH99-14	South Embankment	Grab	BH99-14A	2.59	3.05	943.91	943.45	943.68	Glacial Till	-	19.8	-	-	-	-	-	-	-	-	-	-	-	-	-	11.5	30.9	57.6		-	-
1999	Knight Piesold	BH99-16	South Embankment	Grab	BH99-16A	2.59	3.05	941.41	940.95	941.18	Glacial Till	-	13.5	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	33.7	24.3	33.8	0.002	-
1999	Knight Piesold	BH99-16	South Embankment	Grab	BH99-16B	5.64	6.10	938.36	937.90	938.13	Glacial Till	-	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	18.1	26.2	55.7		-	-
1999	Knight Piesold	BH99-16	South Embankment	Grab	BH99-16C	8.69	9.14	935.31	934.86	935.08	Glacial Till	-	15.9	-	-	-	-	-	-	-	-	-	-	-	-	-	15.3	26.4	58.3		-	-
1999	Knight Piesold	BH99-17	South Embankment	Grab	BH99-17A	2.59	3.05	936.91	936.45	936.68	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	31.3	63.7		-	-
1999	Knight Piesold	BH99-24	Tailings Basin	Grab	BH99-24A	2.44	2.90	930.56	930.10	930.33	Glaciolacustrine	-	20.9	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	15.1	78.3		-	-
1999	Knight Piesold	BH99-27	Tailings Basin	Grab	BH99-27A	5.33	6.10	928.67	927.90	928.29	Glaciolacustrine	-	21.7	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	28.9	69.3		-	-
1999	Knight Piesold	BH99-41	South Embankment	Grab	BH99-41A	2.59	3.05	945.91	945.45	945.68	Glacial Till	-	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	11.1	34.8	54.1		-	-
1999	Knight Piesold	BH99-42	South Embankment	Grab	BH99-42A	2.59	3.05	944.61	944.15	944.38	Glacial Till	-	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	11.1	30.8	25.8	32.3	0.002	-
1999	Knight Piesold	BH99-42	South Embankment	Grab	BH99-42B	5.64	6.10	941.56	941.10	941.33	Glacial Till	-	15.4	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	30.9	60.6		-	-
1999	Knight Piesold	BH99-43	South Embankment	Grab	BH99-43A	2.59	3.05	944.21	943.75	943.98	Glacial Till	-	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	31.6	63.3		-	-
1999	Knight Piesold	BH99-43	South Embankment	Grab	BH99-43B	5.64	6.10	941.16	940.70	940.93	Glacial Till	-	15.3	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	29.8	63.8		-	-
1999	Knight Piesold	BH99-44	South Embankment	Grab	BH99-44A	2.59	3.05	943.61	943.15	943.38	Glacial Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	14.2	31.0	54.8		-	-
1999	Knight Piesold	BH99-44	South Embankment	Grab	BH99-44B	5.64	6.10	940.56	940.10	940.33	Glacial Till	-	13.2	-	-	-	-	-	-	-	-	-	-	-	-	-	22.0	26.6	21.8	29.6	0.002	-
2001	Knight Piesold	DH01-01	Borrow Area No. 2	Grab	DH01-01A	3.05		-		-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	18.9	37.5	43.6		-	-
2001	Knight Piesold	DH01-02	Borrow Area No. 2	Grab	DH01-02A	3.05		-		-	Glacial Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	15.9	39.3	25.9	18.9	0.002	-
2001	Knight Piesold	DH01-02	Borrow Area No. 2	Grab	DH01-02B	6.10		-		-	Glacial Till	-	17.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-02	Borrow Area No. 2	Grab	DH01-02C	9.14		-		-	Glacial Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-03	Borrow Area No. 2	Grab	DH01-03A	3.05		-		-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	16.7	40.6	42.7		-	-
2001	Knight Piesold	DH01-06	Borrow Area No. 2	Grab	DH01-06A	3.05		-		-	Glacial Till	-	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	14.7	36.8	48.5		-	-
2001	Knight Piesold	DH01-07	Borrow Area No. 2	Grab	DH01-07B	6.10		-		-	Glacial Till	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	14.2	40.3	28.9	16.6	0.002	-
2001	Knight Piesold	DH01-08	Borrow Area No. 2	Grab	DH01-08C	9.14		-		-	Glacial Till	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	38.6	48.6		-	-
2001	Knight Piesold	DH01-09	Borrow Area No. 2	Grab	DH01-09A	3.05		-		-	Glacial Till	-	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-10	Borrow Area No. 2	Grab	DH01-10B	6.10		-		-	Glacial Till	-	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-11	Borrow Area No. 2	Grab	DH01-11C	9.14		-		-	Glacial Till	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-12	Borrow Area No. 2	Grab	DH01-12A	3.05		-		-	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	19.1	41.4	26.3	13.2	0.002	-
2001	Knight Piesold	DH01-12	Borrow Area No. 2	Grab	DH01-12B	6.10		-		-	Glacial Till	-	20.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-13	Borrow Area No. 2	Grab	DH01-13A	3.05		-		-	Glacial Till	-	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-14	Borrow Area No. 2	Grab	DH01-14A	3.05		-		-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-15	Borrow Area No. 2	Grab	DH01-15A	3.05		-		-	Glacial Till	-	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-16	Borrow Area No. 2	Grab	DH01-16B	6.10		-		-	Glacial Till	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-17	Borrow Area No. 2	Grab	DH01-17A	3.05		-		-	Glacial Till	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	18.6	36.9	25.0	19.5	0.002	-
2001	Knight Piesold	DH01-18	Borrow Area No. 2	Grab	DH01-18A	3.05		-		-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-19	Borrow Area No. 2	Grab	DH01-19B	6.10		-		-	Glacial Till	-	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	48.8	39.2		-	-
2001	Knight Piesold	DH01-20	Borrow Area No. 2	Grab	DH01-20A	3.05		-		-	Glacial Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	9.7	41.2	49.1		-	-
2001	Knight Piesold	DH01-21	Borrow Area No. 2	Grab	DH01-21B	6.10		-		-	Glacial Till	-	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-23	Borrow Area No. 2	Grab	DH01-23A	3.05		-		-	Glacial Till	-	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3	46.1	50.6		-	-
2001	Knight Piesold	DH01-24	Borrow Area No. 2	Grab	DH01-24A	3.05		-		-	Glacial Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-25	Borrow Area No. 2	Grab	DH01-25A	3.05		-		-	Glacial Till	-	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-26	Borrow Area No. 2	Grab	DH01-26A	3.05		-		-	Glacial Till	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-26	Borrow Area No. 2	Grab	DH01-26B	6.10		-		-	Glacial Till	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	39.4	54.2		-	-
2001	Knight Piesold	DH01-29	Borrow Area No. 2	Grab	DH01-29A	3.05		-		-	Glacial Till	-	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	29.7	42.7	27.6		-	-
2001	Knight Piesold	DH01-30	Borrow Area No. 2	Grab	DH01-30A	3.05		-		-	Glacial Till	-	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-31	Borrow Area No. 2	Grab	DH01-31A	3.05		-		-	Glacial Till	-	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	7.2	39.9	52.9		-	-
2001	Knight Piesold	DH01-32	Borrow Area No. 2	Grab	DH01-32A	3.05		-		-	Glacial Till	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-33	Borrow Area No. 2	Grab	DH01-33B	6.10		-		-	Glacial Till	-	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3	36.3	50.4		-	-
2001	Knight Piesold	DH01-39	Borrow Area No. 2	Grab	DH01-39A	3.05		-		-	Glacial Till	-	8.6	-	-	-	-	-	-	-	-	-	-	-	-	-	26.0	48.5	25.5		-	-
2001	Knight Piesold	DH01-39	Borrow Area No. 2	Grab	DH01-39B	6.10		-		-	Glacial Till	-	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	22.8	46.2	31.0		-	-
2001	Knight Piesold	DH01-40	Borrow Area No. 2	Grab	DH01-40A	3.05		-		-	Glacial Till	-	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-41	Borrow Area No. 2	Grab	DH01-41A	3.05		-		-	Glacial Till	-	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-42	Borrow Area No. 2	Grab	DH01-42A	3.05		-		-	Glacial Till	-	11.5	-	-	-	-	-	-	-	-	-	-	-	-	-	14.8	38.7	30.3	16.2	0.002	-
2001	Knight Piesold	DH01-43	Borrow Area No. 2	Grab	DH01-43A	3.05		-		-	Glacial Till	-	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-51	Borrow Area No. 2	Grab	DH01-51A	3.05		-		-	Glacial Till	-	10.3	-	-	-	-	-	-	-	-	-	-	-	-	-	9.0	39.0	52.0		-	-
2001	Knight Piesold	DH01-59	Borrow Area No. 3	Grab	DH01-59A	3.05		-		-	Glacial Till	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-60	Borrow Area No. 3	Grab	DH01-60B	6.10		-		-	Glacial Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	11.9	34.6	53.5		-	-
2001	Knight Piesold	DH01-61	Borrow Area No. 2	Grab	DH01-61A	3.05		-		-	Glacial Till	-	11.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-62	Borrow Area No. 3	Grab	DH01-62A	3.05		-		-	Glacial Till	-	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	19.6	37.0	43.4		-	-
2001	Knight Piesold	DH01-64	Borrow Area No. 3	Grab	DH01-64A	3.05		-		-	Glacial Till	-	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-65	Borrow Area No. 3	Grab	DH01-65A	3.05		-		-	Glacial Till	-	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	8.9	35.9	35.9	19.3	0.002	-
2001	Knight Piesold	DH01-66	Borrow Area No. 2	Grab	DH01-66A	3.05		-		-	Glacial Till	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	Knight Piesold	DH01-67	-	Grab	DH01-67A	3.05		-		-	Glacial Till	-	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	30.5	44.1	24.9	0.002	-
2001	Knight Piesold	DH01-74	-	Grab	DH01-74A	3.05		-		-	Glacial Till	-	14.2	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	32.8	65.5		-	-
2001	Knight Piesold	DH01-75	-	Grab	DH01-75A	3.05		-		-	Glacial Till	-	14.6	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	30.8	41.4	26.9	0.002	-
2001	Knight Piesold	DH01-77	-	Grab	DH01-77A	3.05		-		-	Glacial Till	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	Knight Piesold	SI06-01	Main Embankment	Split Spoon	SI06-01-02	10.06		907.04		907.04	-	-	16.0	CL-ML	20	16	4	0.00	CL-ML	-	-	-	-	-	-	-	0.9	27.5	54.3	17.3	0.002	-
2006	Knight Piesold	SI06-01	Main Embankment	Thin-walled Open Tube	SI06-01-Shelby 1	13.11		903.99		903.99	-	-	30.7	ML	39	26	13	0.36	ML	-	1861	-	-	-	-	-	0.0	1.2	86.3	12.5	0.002	-
2006	Knight Piesold	SI06-02	Main Embankment	Split Spoon	SI06-02-01	8.53		908.57		908.57	-	-	24.2	CI	44	26	18	-0.10	CI	-	-	-	-	-	-	-	0.0	1.2	61.3	37.5	0.002	-
2006	Knight Piesold	SI06-02	Main Embankment	Thin-walled Open Tube	SI06-02-Shelby 1	11.73		905.37		905.37	-	-	40.3	CH/MH	53	29	24	0.47	CH/MH	-	-	-	-	-	-	-	0.0	2.2	45.3	52.5	0.002	Incremental Consolidation
2006	Knight Piesold	SI06-02	Main Embankment	Thin-walled Open Tube	SI06-02-Shelby 2	16.31	16.92	900.79	900.18	900.49	-	-	27.3	ML		Non-Plastic		-	ML	-	1583	-	-	-	-	-	0.0	1.0	96.0	3.0	0.002	-
2006	Knight Piesold	SI06-03	Main Embankment	Split Spoon	SI06-03-02A	8.53		909.17		909.17	-	-	13.6	CL-ML	24	17	7	-0.49	CL-ML	-	-	-	-	-	-	-	19.0	19.0	48.8	13.2	0.002	-
2006	Knight Piesold	SI06-03	Main Embankment	Split Spoon	SI06-03-02B	8.76		908.94		908.94	-	-	14.4	CL	28	18	10	-0.36	CL	-	-	-	-	-	-	-	4.3	6.0	66.9	22.8	0.002	-
2006	Knight Piesold	SI06-03	Main Embankment	Split Spoon	SI06-03-04	11.58		906.12		906.12	-	-	23.3	CI	37	24	13	-0.05	CI	-	-	-	-	-	-	-	1.3	5.6	66.0	27.1	0.002	-
2006	Knight Piesold	SI06-03	Main Embankment	Split Spoon	SI06-03-06	14.63		903.07		903.07	-	-	25.9	CI	42	24	18	0.11	CI	-	-	-	-	-	-	-	0.0	1.2	68.8	30.0	0.002	-
2006	Knight Piesold	SI06-03	Main Embankment	Split Spoon	SI06-03-08	17.68		900.02		900.02	-	-	23.6	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0.0	1.2	96.3	2.5	0.002	-
2011	AMEC	VW11-01	South Embankment	Grab	G1	1.40		939.61		939.61	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-01	South Embankment	Grab	G2	2.00		939.01		939.01	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	36.0	45.0	14.0	0.002	-
2011	AMEC	VW11-01	South Embankment	Grab	G3	3.50		937.51		937.51	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-01	South Embankment	Grab	G4	5.90		935.11		935.11	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-02	South Embankment	Grab	G1	1.60		943.49		943.49	Glacial Till	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-02	South Embankment	Grab	G2	3.10		941.99		941.99	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-02	South Embankment	Grab	G3	6.20		938.89		938.89	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-02	South Embankment	Grab	G4	8.90		936.19		936.19	Glacial Till	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-02	South Embankment	Grab	G5	10.50		934.59		934.59	Glaciolacustrine	-	17.3	CL	28	20	8	-0.34	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-03	Main Embankment	Grab	G1	13.20		913.80		913.80	Glaciofluvial	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-03	Main Embankment	Grab	G2	15.00		912.00		912.00	Glaciolacustrine	-	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-03	Main Embankment	Grab	G3	16.60		910.40		910.40	Glaciolacustrine	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-03	Main Embankment	Grab	G4	18.10		908.90		908.90	Glaciofluvial	-	22.2	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-03	Main Embankment	Grab	G5	19.30		907.70		907.70	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G1	9.20		912.39		912.39	Glacial Till	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0	43.0	38.0	13.0	0.002	-
2011	AMEC	VW11-04	Main Embankment	Grab	G2	10.00		911.59		911.59	Glaciolacustrine	-	23.4	CI	44	21	23	0.10	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G3	11.70		909.89		909.89	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G4	13.80		907.79		907.79	Glaciolacustrine	-	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G5	15.00		906.59		906.59	Glaciolacustrine	-	32.4	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G6	16.60		904.99		904.99	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G7	18.70		902.89		902.89	-[1]	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	1.0	65.0	34.0	0.002	-
2011	AMEC	VW11-04	Main Embankment	Grab	G8	21.10		900.49		900.49	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G9	22.70		898.89		898.89	Glacial Till	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-04	Main Embankment	Grab	G10	24.80		896.79		896.79	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G1	10.10		910.50		910.50	Glaciolacustrine	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G2	12.60		908.00		908.00	Glaciolacustrine	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G3	13.70		906.90		906.90	Glaciolacustrine	-	29.8	CI	43	20	23	0.43	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G4	15.30		905.30		905.30	Glaciolacustrine	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G5	16.60		904.00		904.00	Glaciolacustrine	-	24.8	ML	27	24	3	0.27	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G6	19.30		901.30		901.30	Glaciofluvial	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G7	20.50		900.10		900.10	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G8	25.10		895.50		895.50	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-05	Main Embankment	Grab	G9	27.50		893.10		893.10	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Grab	G1	7.40		908.94		908.94	Glaciolacustrine	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2011	AMEC	VW11-06	Main Embankment	Core Return	C1	8.20		908.14		908.14	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C1	8.90		907.44		907.44	Glaciolacustrine	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C1	9.40		906.94		906.94	Glaciolacustrine	-	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C2	11.10		905.24		905.24	Glaciolacustrine	-	37.9	CI	48	24	24	0.58	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C2	12.00		904.34		904.34	Glaciolacustrine	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C2	13.10		903.24		903.24	Glaciolacustrine	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C3	13.20		903.14		903.14	Glaciolacustrine	-	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C3	13.90		902.44		902.44	Glaciolacustrine	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C3	14.90		901.44		901.44	Glaciolacustrine	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C4	15.40		900.94		900.94	Glaciofluvial	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C4	16.90		899.44		899.44	Glaciofluvial	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C4	17.30		899.04		899.04	Glaciofluvial	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C5	17.70		898.64		898.64	Glaciofluvial	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C5	18.10		898.24		898.24	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Core Return	C5	19.60		896.74		896.74	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Grab	G2	21.10		895.24		895.24	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Grab	G3	25.10		891.24		891.24	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-06	Main Embankment	Grab	G4	31.20		885.14		885.14	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G1	5.00		914.78		914.78	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G2	8.90		910.88		910.88	Glaciolacustrine	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G3	10.50		909.28		909.28	Glaciolacustrine	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G4	11.70		908.08		908.08	Glaciolacustrine	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G5	13.20		906.58		906.58	Glaciolacustrine	-	26.1	CI	37	24	13	0.16	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G6	16.30		903.48		903.48	Glaciolacustrine	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G7	17.80		901.98		901.98	Glaciolacustrine	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G8	20.20		899.58		899.58	Glaciolacustrine	-	26.7	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G9	23.00		896.78		896.78	Glacial Till	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G10	23.40		896.38		896.38	Glacial Till	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G11	25.40		894.38		894.38	Glacial Till	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G12	27.50		892.28		892.28	[illegible]	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G13	30.80		888.98		888.98	Glaciolacustrine	-	25.5	CL-ML	27	22	5	0.70	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G14	34.20		885.58		885.58	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G15	35.10		884.68		884.68	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G16	36.70		883.08		883.08	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-07	Main Embankment	Grab	G17	39.10		880.68		880.68	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G1	1.60		926.06		926.06	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G2	3.10		924.56		924.56	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	8.0	44.0	34.0	14.0	0.002	-
2011	AMEC	VW11-08	Main Embankment	Grab	G3	5.90		921.76		921.76	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G4	7.40		920.26		920.26	Glacial Till	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G5	7.70		919.96		919.96	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G6	8.50		919.16		919.16	Glaciolacustrine	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Core Return	C1	8.80		918.86		918.86	Glaciolacustrine	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	5.0	73.0	22.0	0.002	-
2011	AMEC	VW11-08	Main Embankment	Grab	G7	9.90		917.76		917.76	Glaciofluvial	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G8	12.30		915.36		915.36	Glaciofluvial	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	68.0	32.0		-	-
2011	AMEC	VW11-08	Main Embankment	Core Return	C2	13.60		914.06		914.06	Glaciolacustrine	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Thin-walled Open Tube	U1	14.00	14.20	913.66	913.46	913.56	Glaciolacustrine	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G9	15.40		912.26		912.26	Glaciofluvial	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	48.0	47.0	5.0	0.002	-
2011	AMEC	VW11-08	Main Embankment	Grab	G10	16.10		911.56		911.56	Glaciofluvial	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G11	16.90		910.76		910.76	Glaciolacustrine	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Thin-walled Open Tube	U2	17.00	17.40	910.66	910.26	910.46	Glaciolacustrine	-	26.4	ML	29	23	6	0.57	ML	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G12	20.00		907.66		907.66	Glaciolacustrine	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Core Return	C3	20.70		906.96		906.96	Glaciolacustrine	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G13	24.50		903.16		903.16	Glaciolacustrine	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Core Return	C4	25.30		902.36		902.36	Glaciolacustrine	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G14	27.60		900.06		900.06	Glaciolacustrine	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G15	28.80		898.86		898.86	Glaciolacustrine	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G16	30.00		897.66		897.66	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G17	31.90		895.76		895.76	Glaciofluvial	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G18	33.40		894.26		894.26	Glaciofluvial	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G19	34.90		892.76		892.76	Glaciofluvial	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G20	36.40		891.26		891.26	Glaciofluvial	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G21	37.30		890.36		890.36	Glaciofluvial	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G22	38.60		889.06		889.06	Glaciofluvial	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G23	39.20		888.46		888.46	Glaciofluvial	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G24	40.40		887.26		887.26	Glaciofluvial	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-08	Main Embankment	Grab	G25	43.40		884.26		884.26	Glacial Till	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G1	1.50		935.09		935.09	Glacial Till	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G2	3.20		933.39		933.39	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G3	6.60		929.99		929.99	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G4	9.40		927.19		927.19	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	9.0	41.0	41.0	9.0	0.002	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G5	12.40		924.19		924.19	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G6	15.40		921.19		921.19	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G7	18.10		918.49		918.49	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G8	19.40		917.19		917.19	Glaciolacustrine	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	11.0	67.0	21.0	0.002	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G9	20.90		915.69		915.69	Glacial Till	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G10	22.40		914.19		914.19	Glacial Till	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G11	24.20		912.39		912.39	Glacial Till	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G12	26.10		910.49		910.49	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G13	27.60		908.99		908.99	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G14	30.60		905.99		905.99	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0	49.0	40.0	5.0	0.002	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G15	33.70		902.89		902.89	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G16	36.70		899.89		899.89	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G17	39.50		897.09		897.09	Weathered Bedrock	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-09	Perimeter Embankment	Grab	G18	40.70		895.89		895.89	Bedrock	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G1	1.70		930.10		930.10	Glacial Till	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G2	2.60		929.20		929.20	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G3	3.10		928.70		928.70	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G4	5.60		926.20		926.20	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G5	9.30		922.50		922.50	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G6	12.30		919.50		919.50	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	8.0	45.0	39.0	8.0	0.002	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G7	15.10		916.70		916.70	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G8	17.00		914.80		914.80	Glaciolacustrine	-	23.0	CI	39	22	17	0.06	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G9	17.40		914.40		914.40	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.5	99.5		-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G10	18.20		913.60		913.60	Glaciolacustrine	-	24.7	CI	38	23	15	0.11	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G11	19.40		912.40		912.40	Glaciolacustrine	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G12	20.00		911.80		911.80	Glaciolacustrine	-	22.4	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G13	21.20		910.60		910.60	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G14	22.40		909.40		909.40	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G15	23.00		908.80		908.80	Glaciofluvial	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G16	23.90		907.90		907.90	Glaciofluvial	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G17	25.80		906.00		906.00	Glaciofluvial	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G18	27.60		904.20		904.20	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G20	31.50		900.30		900.30	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G21	34.00		897.80		897.80	Glaciofluvial	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G22	35.80		896.00		896.00	Glaciolacustrine	-	20.1	CL	28	18	10	0.21	CL	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G23	37.00		894.80		894.80	Glacial Till	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G24	37.90		893.90		893.90	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G25	41.00		890.80		890.80	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-10	Perimeter Embankment	Grab	G26	41.80		890.00		890.00	Bedrock	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G1	0.20		940.69		940.69	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G2	0.50		940.39		940.39	Glacial Till	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G3	0.80		940.09		940.09	Glacial Till	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G4	1.10		939.79		939.79	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G5	1.70		939.19		939.19	Glacial Till	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G6	2.30		938.59		938.59	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G7	4.40		936.49		936.49	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G8	5.90		934.99		934.99	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G9	7.60		933.29		933.29	Glacial Till	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G10	8.80		932.09		932.09	Upper Glaciolacustrine[2]	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G11	9.50		931.39		931.39	Upper Glaciolacustrine[2]	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G12	9.90		930.99		930.99	Upper Glaciolacustrine[2]	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	8.0	72.0	8.0	0.002	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G13	10.80		930.09		930.09	Upper Glaciolacustrine[2]	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G14	11.40		929.49		929.49	-[1]	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G15	12.40		928.49		928.49	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G16	14.50		926.39		926.39	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G17	16.00		924.89		924.89	Weathered Bedrock	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	VW11-11	Corner 1 Embankment	Grab	G20	19.70		921.19		921.19	Bedrock	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G1	8.40		912.68		912.68	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G2	10.70		910.38		910.38	Glaciolacustrine	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	27.0	44.0	28.0	0.002	-
2011	AMEC	SI11-01	Main Embankment	Grab	G3	11.70		909.38		909.38	Glaciolacustrine	-	27.6	CI	34	21	13	0.51	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G4	13.10		907.98		907.98	Glaciolacustrine	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G5	16.50		904.58		904.58	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G6	17.70		903.38		903.38	Glacial Till	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-01	Main Embankment	Grab	G7	19.50		901.58		901.58	Glacial Till	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	13.0	46.0	33.0	8.0	0.002	-
2011	AMEC	SI11-01	Main Embankment	Grab	G8	22.30		898.78		898.78	Glacial Till	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	39.0	35.0	26.0		-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G1	3.20		925.07		925.07	Glacial Till	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G2	5.30		922.97		922.97	Glacial Till	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G3	6.90		921.37		921.37	Glacial Till	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	15.0	38.0	36.0	11.0	0.002	-
2011	AMEC	SI11-02	Main Embankment	Grab	G4	8.40		919.87		919.87	Glacial Till	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G5	9.50		918.77		918.77	Glacial Till	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G6	10.10		918.17		918.17	Glaciolacustrine	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G7	10.60		917.67		917.67	Glaciofluvial	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G8	13.60		914.67		914.67	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G9	15.10		913.17		913.17	Glaciolacustrine	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G10	16.00		912.27		912.27	Glaciofluvial	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G11	16.50		911.77		911.77	Glaciolacustrine	-	18.4	ML	19	18	1	0.40	ML	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G12	20.20		908.07		908.07	Glaciolacustrine	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	14.0	70.0	16.0	0.002	-
2011	AMEC	SI11-02	Main Embankment	Grab	G13	21.50		906.77		906.77	Glaciolacustrine	-	15.4	CL	25	16	9	-0.07	CL	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G14	24.20		904.07		904.07	Glaciolacustrine	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G15	27.60		900.67		900.67	Glaciolacustrine	-	31.8	CH	57	24	33	0.24	CH	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G16	29.70		898.57		898.57	Glaciolacustrine	-	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G17	31.30		896.97		896.97	Glaciolacustrine	-	30.4	CI	37	21	16	0.59	CI	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G18	32.80		895.47		895.47	Glaciofluvial	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G19	34.90		893.37		893.37	Glaciofluvial	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G20	36.70		891.57		891.57	Glaciofluvial	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G21	37.60		890.67		890.67	Glaciofluvial	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G22	39.20		889.07		889.07	Glaciofluvial	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G23	40.40		887.87		887.87	Glaciofluvial	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G24	42.20		886.07		886.07	Glaciolacustrine	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G25	44.10		884.17		884.17	Glacial Till	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-02	Main Embankment	Grab	G26	45.00		883.27		883.27	Glacial Till	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-04	Perimeter Embankment	Core Return	C1	18.10		913.83		913.83	Glaciolacustrine	-	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-04	Perimeter Embankment	Core Return	C1	18.70		913.23		913.23	Glaciolacustrine	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	1.0	65.0	34.0	0.002	-
2011	AMEC	SI11-04	Perimeter Embankment	Core Return	C1	19.80		912.13		912.13	Glaciofluvial	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	AMEC	SI11-04	Perimeter Embankment	Core Return	C2	20.20		911.73		911.73	Glaciofluvial	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-101	Dam Breach Area	Thin-walled Tube	1	5.00		928.00		928.00	Possible Ablation / Moraine Till	-	11.0	SC	23	13	10	-0.20	CL	-	-	-	-	-	-	-	16.0	39.2	44.8		-	-
2014	Thurber	MR14-101	Dam Breach Area	Thin-walled Tube	2	5.70		927.30		927.30	Possible Ablation / Moraine Till	-	9.7	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-101	Dam Breach Area	Thin-walled Tube	3	6.40		926.60		926.60	Possible Ablation / Moraine Till	-	12.2	SC	22	13	9	-0.09	CL	-	-	-	-	-	-	-	16.1	36.8	31.5	15.6	0.002	-
2014	Thurber	MR14-101	Dam Breach Area	Grab	4	7.30		925.70		925.70	Possible Ablation / Moraine Till	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-101	Dam Breach Area	Thin-walled Tube	6	15.30		917.70		917.70	Basal Till	-	8.9	SC	22	14	8	-0.64	CL	-	-	-	-	-	-	-	26.0	35.3	38.7		-	-
2014	Thurber	MR14-101	Dam Breach Area	Thin-walled Tube	7	16.20		916.80		916.80	Basal Till	-	10.9	GC-GM	22	15	7	-0.59	CL-ML	-	-	-	-	-	-	-	34.0	33.4	32.6		-	-
2014	Thurber	MR14-102	Dam Breach Area	Thin-walled Tube	1	3.30		929.20		929.20	Possible Weathered Ablation / Moraine Till	-	13.0	SC	26	15	11	-0.18	CL	-	-	-	-	-	-	-	27.6	32.5	27.9	12.0	0.002	-
2014	Thurber	MR14-102	Dam Breach Area	Thin-walled Tube	2	3.90		928.60		928.60	Possible Weathered Ablation / Moraine Till	-	10.9	SC	24	13	11	-0.19	CL	-	-	-	-	-	-	-	22.6	36.4	29.0	12.0	0.002	-
2014	Thurber	MR14-102	Dam Breach Area	Thin-walled Tube	3	6.70		925.80		925.80	Possible Weathered Ablation / Moraine Till	-	11.9	SC	23	13	10	-0.11	CL	-	-	-	-	-	-	-	24.0	33.3	42.7		-	-
2014	Thurber	MR14-102	Dam Breach Area	Thin-walled Tube	5	9.40		923.10		923.10	Possible Ablation / Moraine Till	-	15.7	CL	23	13	10	0.27	CL	-	-	-	-	-	-	-	7.0	33.6	41.4	18.0	0.002	-
2014	Thurber	MR14-102	Dam Breach Area	Thin-walled Tube	6	10.00		922.50		922.50	Possible Ablation / Moraine Till	-	11.5	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-102	Dam Breach Area	Grab	7	10.60		921.90		921.90	Basal Till	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	1	3.50		927.20		927.20	Possible Ablation / Moraine Till	-	10.2	SC	23	13	10	-0.28	CL	-	-	-	-	-	-	-	12.0	39.7	31.4	16.9	0.002	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	2	4.90		925.80		925.80	Possible Ablation / Moraine Till	-	11.4	SC	25	14	11	-0.24	CL	-	-	-	-	-	-	-	21.6	38.4	27.3	12.7	0.002	-
2014	Thurber	MR14-103	Dam Breach Area	Grab	3	5.50		925.20		925.20	Possible Ablation / Moraine Till	-	16.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5A	7.90		922.80		922.80	Upper Glaciolacustrine[2]	-	15.7	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5B	7.90		922.80		922.80	Upper Glaciolacustrine[2]	-	18.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	3.9	26.4	47.3	22.4	0.002	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5C	8.00		922.70		922.70	Upper Glaciolacustrine[2]	-	16.9	CL	27	13	14	0.28	CL	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5D	8.00		922.70		922.70	Upper Glaciolacustrine[2]	-	15.3	CL	33	15	18	0.02	CL	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5E	8.10		922.60		922.60	Upper Glaciolacustrine[2]	-	14.1	CL	23	13	10	0.11	CL	-	-	-	-	-	-	-	11.0	34.7	38.9	15.3	0.002	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5F	8.30		922.40		922.40	Upper Glaciolacustrine[2]	-	25.1	CL	35	17	18	0.45	CL	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	5G	8.30		922.40		922.40	Upper Glaciolacustrine[2]	-	27.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-103	Dam Breach Area	Thin-walled Tube	6	8.60		922.10		922.10	Basal Till	-	12.7	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	SC14-103	Dam Breach Area	Grab	1	2.70		928.10		928.10	Possible Ablation / Moraine Till	-	14.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	SC14-103	Dam Breach Area	Grab	2	3.70		927.10		927.10	Possible Ablation / Moraine Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	SC14-103	Dam Breach Area	Grab	3	5.30		925.50		925.50	Possible Ablation / Moraine Till	-	5.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	SC14-103	Dam Breach Area	Grab	4	6.80		924.00		924.00	Possible Ablation / Moraine Till	-	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	SC14-103	Dam Breach Area	Grab	5	8.40		922.40		922.40	Possible Ablation / Moraine Till	-	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-104	Dam Breach Area	Thin-walled Tube	1	3.80		927.90		927.90	Possible Ablation / Moraine Till	-	9.9	SC	22	13	9	-0.34	CL	-	-	-	-	-	-	-	16.0	36.0	32.0	16.0	0.002	-
2014	Thurber	MR14-104	Dam Breach Area	Thin-walled Tube	2	4.60		927.10		927.10	Possible Ablation / Moraine Till	-	8.9	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-104	Dam Breach Area	Grab	3	5.30		926.40		926.40	-	-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-104	Dam Breach Area	Thin-walled Tube	4	6.20		925.50		925.50	Possible Ablation / Moraine Till	-	11.9	SC	23	12	11	-0.01	CL	-	-	-	-	-	-	-	26.3	35.9	24.2	13.6	0.002	-
2014	Thurber	MR14-104	Dam Breach Area	Grab	6	9.10		922.60		922.60	Possible Ablation / Moraine Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-104	Dam Breach Area	Thin-walled Tube	8	11.60		920.10		920.10	Possible Ablation / Moraine Till	-	33.1	CL	41	16	25	0.68	CL	-	-	-	-	-	-	-	8.9	31.4	24.0	35.7	0.002	-
2014	Thurber	MR14-104	Dam Breach Area	Thin-walled Tube	9	12.40		919.30		919.30	Possible Ablation / Moraine Till	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.3	35.9	37.8		-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	2	2.50		929.20		929.20	Possible Fill	-	18.7	OL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	3	3.30		928.40		928.40	Possible Fill	-	14.6	SC	28	15	13	-0.03	CL	-	-	-	-	-	-	-	15.0	43.6	26.7	14.7	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	4A	3.80		927.90		927.90	Possible Fill	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	4B	3.90		927.80		927.80	Possible Fill	-	15.5	SC	28	14	14	0.11	CL	-	-	-	-	-	-	-	10.2	41.3	31.3	17.2	0.002	TX
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	4C	4.10		927.60		927.60	Possible Fill	-	11.7	CL	25	14	11	-0.21	CL	-	-	-	-	-	-	-	6.3	38.5	37.2	18.0	0.002	OD
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	5	5.10		926.60		926.60	Possible Ablation / Moraine Till	-	13.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Grab	6	6.40		925.30		925.30	Possible Ablation / Moraine Till	-	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	7	7.10		924.60		924.60	Possible Ablation / Moraine Till	-	12.0	SC	23	12	11	0.00	CL	-	-	-	-	-	-	-	20.7	36.2	29.0	14.1	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	8	8.20		923.50		923.50	Possible Ablation / Moraine Till	-	16.2	SC	22	12	10	0.42	CL	-	-	-	-	-	-	-	16.5	37.6	30.8	15.1	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9A	9.20		922.50		922.50	Possible Ablation / Moraine Till	-	14.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9B	9.20		922.50		922.50	Possible Ablation / Moraine Till	-	21.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	19.0	11.8	45.4	23.8	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9C	9.30		922.40		922.40	Upper Glaciolacustrine[2]	-	11.0	GC	25	13	12	-0.17	CL	-	-	-	-	-	-	-	28.5	28.2	31.0	12.3	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9D	9.40		922.30		922.30	Upper Glaciolacustrine[2]	-	14.5	CL	25	13	12	0.13	CL	-	-	-	-	-	-	-	2.3	26.0	52.5	19.3	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9E	9.50		922.20		922.20	Upper Glaciolacustrine[2]	-	21.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9F	9.50		922.20		922.20	Upper Glaciolacustrine[2]	-	43.6	CH	54	20	34	0.69	CH	-	-	-	-	-	-	-	1.9	9.7	34.8	53.6	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	9G	9.70		922.00		922.00	Possible Ablation / Moraine Till	-	17.4	CL	27	13	14	0.31	CL	-	-	-	-	-	-	-	8.8	30.3	40.8	20.1	0.002	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	10	11.00		920.70		920.70	Possible Ablation / Moraine Till	-	18.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-105	Dam Breach Area	Thin-walled Tube	10	11.20		920.50		920.50	Possible Ablation / Moraine Till	-	12.9	CL	21	13	8	-0.01	CL	-	-	-	-	-	-	-	5.2	42.5	37.7	14.6	0.002	OD
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	1	3.20		926.20		926.20	Possible Ablation / Moraine Till	-	12.0	SC	25	13	12	-0.08	CL	-	-	-	-	-	-	-	21.2	34.3	29.8	14.7	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	2	4.80		924.60		924.60	Possible Ablation / Moraine Till	2.77	12.1	CL	22	12	10	0.01	CL	-	-	-	-	-	-	-	11.2	36.2	34.2	18.4	0.002	TX

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Clay Threshold (< mm)	Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)			
																												Silt (%)	Clay (%)		
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	3	5.30		924.10		924.10	Possible Ablation / Moraine Till	-	13.9	SC	25	13	12	0.08	CL	-	-	-	-	-	-	-	14.4	35.9	34.4	15.4	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	4	6.00		923.40		923.40	Possible Ablation / Moraine Till	-	12.3	GC	23	12	11	0.03	CL	-	-	-	-	-	-	-	32.8	30.7	25.0	11.5	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	5	6.80		922.60		922.60	Possible Ablation / Moraine Till	-	13.2	SC	24	12	12	0.10	CL	-	-	-	-	-	-	-	22.8	40.1	25.3	11.8	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	6A	8.00		921.40		921.40	Upper Glaciolacustrine[2]	-	-	CH	52	23	29	-	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	6B	8.00		921.40		921.40	Upper Glaciolacustrine[2]	-	35.5	CL	45	21	24	0.60	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	7A	8.70		920.70		920.70	Upper Glaciolacustrine[2]	-	13.4	SC	23	13	10	0.04	CL	-	-	-	-	-	-	-	22.0	28.3	36.5	13.2	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	7B	8.90		920.50		920.50	Upper Glaciolacustrine[2]	-	14.8	CL	29	14	15	0.05	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	7C	8.90		920.50		920.50	Basal Till	-	13.3	SC	21	13	8	0.04	CL	-	-	-	-	-	-	-	11.9	39.4	35.7	13.0	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	7D	9.00		920.40		920.40	Basal Till	-	16.4	CL	27	13	14	0.24	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	7E	9.10		920.30		920.30	Basal Till	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	10.8	33.9	41.1	14.2	0.002	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	8A	10.40		919.00		919.00	Basal Till	-	20.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106	Dam Breach Area	Thin-walled Tube	8B	10.50		918.90		918.90	Lower Glaciolacustrine[2]	-	23.8	CL	39	24	15	-0.01	CL	-	-	-	-	-	-	-	0.0	1.7	72.2	26.1	0.002	-
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1A	7.30		921.40		921.40	Possible Ablation / Moraine Till	-	7.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1B	7.50		921.20		921.20	Upper Glaciolacustrine[2]	-	27.5	CL	45	19	26	0.33	CL	-	-	-	-	-	-	-	0.0	1.8	52.1	46.1	0.002	-
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1C-T1	7.60		921.10		921.10	Upper Glaciolacustrine[2]	-	43.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1C-T2	7.60		921.10		921.10	Upper Glaciolacustrine[2]	-	36.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1C-T3	7.60		921.10		921.10	Upper Glaciolacustrine[2]	-	38.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1C	7.70		921.00		921.00	Upper Glaciolacustrine[2]	-	35.3	CH	54	23	31	0.40	CH	-	-	-	-	-	-	-	0.0	0.8	42.8	56.4	0.002	-
2014	Thurber	MR14-106A	Dam Breach Area	Thin-walled Tube	1C-T4	7.70		921.00		921.00	Upper Glaciolacustrine[2]	-	33.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1B-T2	7.30		921.20		921.20	Upper Glaciolacustrine[2]	-	43.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1B-T3	7.30		921.20		921.20	Upper Glaciolacustrine[2]	-	38.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1B	7.40		921.10		921.10	Upper Glaciolacustrine[2]	-	34.6	CH	56	23	33	0.35	CH	-	-	-	-	-	-	-	0.0	1.0	36.6	62.4	0.002	-
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1B	7.50		921.00		921.00	Upper Glaciolacustrine[2]	-	38.6	CH	50	20	30	0.62	CH	-	-	-	-	-	-	-	0.0	0.2	46.9	52.9	0.002	TX
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1C	7.60		920.90		920.90	Upper Glaciolacustrine[2]	2.83	41.2	CH	62	24	38	0.45	CH	-	-	-	-	-	-	-	0.0	0.2	38.6	61.2	0.002	OD
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1C	7.60		920.90		920.90	Upper Glaciolacustrine[2]	-	40.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1D	7.70		920.80		920.80	Upper Glaciolacustrine[2]	-	23.9	CL	31	17	14	0.49	CL	-	-	-	-	-	-	-	0.0	14.3	52.3	33.4	0.002	-
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	1E	7.70		920.80		920.80	Upper Glaciolacustrine[2]	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106C	Dam Breach Area	Thin-walled Tube	2	7.80		920.70		920.70	Upper Glaciolacustrine[2]	-	13.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106D	Dam Breach Area	Thin-walled Tube	2	8.40		920.30		920.30	Upper Glaciolacustrine[2]	-	40.5	CH	54	21	33	0.59	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	2A	7.70		921.30		921.30	Upper Glaciolacustrine[2]	-	33.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	2B	7.90		921.10		921.10	Upper Glaciolacustrine[2]	-	35.2	CL	55	22	33	0.40	CL	-	-	-	-	-	-	-	-	-	-	-	-	OD
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	2C	8.00		921.00		921.00	Upper Glaciolacustrine[2]	-	35.4	CH	50	21	29	0.50	CH	-	-	-	-	-	-	-	0.0	0.5	48.2	51.3	0.002	TX
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	2C	8.20		920.80		920.80	Upper Glaciolacustrine[2]	-	25.5	CL	42	18	24	0.31	CL	-	-	-	-	-	-	-	0.0	2.9	52.7	44.4	0.002	OD
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	3A	8.30		920.70		920.70	Upper Glaciolacustrine[2]	-	30.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	3B	8.40		920.60		920.60	Upper Glaciolacustrine[2]	2.86	40.1	CH	55	20	35	0.57	CH	-	-	-	-	-	-	-	0.0	1.0	40.6	58.4	0.002	TX
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	3B	8.50		920.50		920.50	Upper Glaciolacustrine[2]	-	40.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	3C	8.80		920.20		920.20	Upper Glaciolacustrine[2]	2.87	40.1	CH	55	22	33	0.55	CH	-	-	-	-	-	-	-	0.0	0.0	42.4	57.6	0.002	TX
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	4A	8.90		920.10		920.10	Upper Glaciolacustrine[2]	-	39.8	CH	57	19	38	0.55	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	4B	9.00		920.00		920.00	Upper Glaciolacustrine[2]	-	48.4	CH	63	22	41	0.64	CH	-	-	-	-	-	-	-	0.0	10.4	26.7	62.9	0.002	OD
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	4C	9.00		920.00		920.00	Upper Glaciolacustrine[2]	-	24.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106E	Dam Breach Area	Thin-walled Tube	4D	9.20		919.80		919.80	Upper Glaciolacustrine[2]	-	24.7	CL	41	22	19	0.14	CL	-	-	-	-	-	-	-	0.0	0.0	64.5	35.5	0.002	OD
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	2B	8.00		920.70		920.70	Upper Glaciolacustrine[2]	-	30.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	2B	8.10		920.60		920.60	Upper Glaciolacustrine[2]	-	37.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	49.0	50.9	0.002	-
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	2B	8.10		920.60		920.60	Upper Glaciolacustrine[2]	-	41.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	2B	8.30		920.40		920.40	Upper Glaciolacustrine[2]	-	38.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	3A	8.40		920.30		920.30	Upper Glaciolacustrine[2]	-	27.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	3B	8.50		920.20		920.20	Upper Glaciolacustrine[2]	-	43.4	CH	64	23	41	0.50	CH	-	-	-	-	-	-	-	0.0	6.2	29.3	64.5	0.002	OD
2014	Thurber	MR14-106F	Dam Breach Area	Thin-walled Tube	3C	8.60		920.10		920.10	Upper Glaciolacustrine[2]	-	17.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	15.0	24.1	60.9		-	-
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B	7.80		920.90		920.90	Upper Glaciolacustrine[2]	-	38.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B-T1	7.80		920.90		920.90	Upper Glaciolacustrine[2]	-	43.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B	8.00		920.70		920.70	Upper Glaciolacustrine[2]	-	41.0	CL	40	19	21	1.05	CL	-	-	-	-	-	-	-	0.0	2.5	50.4	47.0	0.002	-
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B	8.00		920.70		920.70	Upper Glaciolacustrine[2]	-	33.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B	8.00		920.70		920.70	Upper Glaciolacustrine[2]	-	38.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TX
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	2B-T2	8.10		920.60		920.60	Upper Glaciolacustrine[2]	-	38.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-106G	Dam Breach Area	Thin-walled Tube	3A	8.30		920.40		920.40	Upper Glaciolacustrine[2]	-	42.6	CH	57	23	34	0.58	CH	-	-	-	-	-	-	-	0.0	0.5	42.1	57.4	0.002	OD
2014	Thurber	MR14-106H	Dam Breach Area	Thin-walled Tube	1A	7.30		921.30		921.30	Upper Glaciolacustrine[2]	-	34.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-106H	Dam Breach Area	Thin-walled Tube	1B	7.40		921.20		921.20	Upper Glaciolacustrine[2]	-	38.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DS
2014	Thurber	MR14-106H	Dam Breach Area	Thin-walled Tube	1B	7.50		921.10		921.10	Upper Glaciolacustrine[2]	-	40.8	CH	56	20	36	0.58	CH	-	-	-	-	-	-	-	0.0	1.1	36.0	62.9	0.002	OD
2014	Thurber	MR14-106I	Dam Breach Area	Thin-walled Tube	1	7.60		921.00		921.00	Upper Glaciolacustrine[2]	-	34.1	CL	47	21	26	0.50	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	1	2.90		925.80		925.80	Possible Ablation / Moraine Till	-	13.9	SC	24	13	11	0.08	CL	-	-	-	-	-	-	-	27.5	30.3	28.7	13.5	0.002	-
2014	Thurber	MR14-107	Dam Breach Area	Grab	3	4.00		924.70		924.70	Possible Ablation / Moraine Till	-	15.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	4	4.90		923.80		923.80	Possible Ablation / Moraine Till	-	13.6	SC	24	12	12	0.13	CL	-	-	-	-	-	-	-	28.5	31.5	27.5	12.5	0.002	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	5	6.30		922.40		922.40	Possible Ablation / Moraine Till	-	12.8	SC	23	12	11	0.07	CL	-	-	-	-	-	-	-	23.3	36.4	28.4	12.0	0.002	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6	7.30		921.40		921.40	Upper Glaciolacustrine[2]	-	32.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C	7.10		921.60		921.60	Upper Glaciolacustrine[2]	-	34.8	CL	47	24	23	0.47	CL	-	-	-	-	-	-	-	0.0	0.4	53.3	46.3	0.002	OD
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C-T1	7.10		921.60		921.60	Upper Glaciolacustrine[2]	-	43.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C-T2	7.20		921.50		921.50	Upper Glaciolacustrine[2]	-	42.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C	7.30		921.40		921.40	Upper Glaciolacustrine[2]	-	32.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C	7.40		921.30		921.30	Upper Glaciolacustrine[2]	-	43.5	CL	45	22	23	0.93	CL	-	-	-	-	-	-	-	0.0	1.9	54.5	43.6	0.002	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C	7.40		921.30		921.30	Upper Glaciolacustrine[2]	-	32.2	CL/CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107	Dam Breach Area	Thin-walled Tube	6C	7.40		921.30		921.30	Upper Glaciolacustrine[2]	-	49.9	CL/CH	-	-	-	-	-	-	-	-	-	-	-	-	0.0	2.7	34.1	63.2	0.002	-
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1A-T1	7.20		921.10		921.10	Upper Glaciolacustrine[2]	-	42.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1A	7.20		921.10		921.10	Upper Glaciolacustrine[2]	-	42.5	CH	57	23	34	0.57	CH	-	-	-	-	-	-	-	0.0	0.3	42.6	57.2	0.002	-
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1A-T2	7.30		921.00		921.00	Upper Glaciolacustrine[2]	-	42.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1B	7.30		921.00		921.00	Upper Glaciolacustrine[2]	-	39.6	CL	46	21	25	0.74	CL	-	-	-	-	-	-	-	0.0	0.0	51.3	48.6	0.002	OD
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1C	7.40		920.90		920.90	Upper Glaciolacustrine[2]	-	28.1	CL	45	18	27	0.37	CL	-	-	-	-	-	-	-	7.7	25.0	28.6	38.7	0.002	-
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	1D	7.60		920.70		920.70	Basal Till	-	13.9	CL	23	15	8	-0.14	CL	-	-	-	-	-	-	-	18.1	30.8	38.2	12.9	0.002	-
2014	Thurber	MR14-107A	Dam Breach Area	Grab	2	8.70		919.60		919.60	Basal Till	-	16.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107A	Dam Breach Area	Grab	5	11.00		917.30		917.30	Basal Till	-	18.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	6A	11.50		916.80		916.80	Lower Glaciolacustrine[2]	-	17.3	CL	33	22	11	-0.43	CL	-	-	-	-	-	-	-	8.8	9.8	61.5	19.9	0.002	-
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	6B	11.60		916.70		916.70	Lower Glaciolacustrine[2]	-	22.0	CL	40	25	15	-0.20	CL	-	-	-	-	-	-	-	0.0	0.7	70.4	28.9	0.002	OD
2014	Thurber	MR14-107A	Dam Breach Area	Thin-walled Tube	7	12.00		916.30		916.30	Lower Glaciolacustrine[2]	-	22.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-107B	Dam Breach Area	Thin-walled Tube	1B	6.90		921.50		921.50	Upper Glaciolacustrine[2]	-	32.5	CL	49	20	29	0.43	CL	-	-	-	-	-	-	-	0.0	3.0	44.2	52.8	0.002	OD
2014	Thurber	MR14-107B	Dam Breach Area	Thin-walled Tube	1C	7.10		921.30		921.30	Upper Glaciolacustrine[2]	-	34.1	CH	53	25	28	0.33	CH	-	-	-	-	-	-	-	0.0	0.1	47.9	52.0	0.002	-
2014	Thurber	MR14-108	Dam Breach Area	Thin-walled Tube	1	1.80		926.80		926.80	Possible Ablation / Moraine Till	-	12.8	CL	24	14	10	-0.12	CL	-	-	-	-	-	-	-	14.7	33.7	51.6		-	-
2014	Thurber	MR14-108	Dam Breach Area	Thin-walled Tube	2	3.00		925.60		925.60	Possible Ablation / Moraine Till	-	12.6	SC	24	12	12	0.05	CL	-	-	-	-	-	-	-	25.2	30.7	30.7	13.3	0.002	-
2014	Thurber	MR14-108	Dam Breach Area	Thin-walled Tube	3	3.70		924.90		924.90	Possible Ablation / Moraine Till	-	17.6	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	14.8	46.4	38.8		-	-
2014	Thurber	MR14-108	Dam Breach Area	Thin-walled Tube	4	5.80		922.80		922.80	Possible Ablation / Moraine Till	-	17.1	SC	27	12	15	0.34	CL	-	-	-	-	-	-	-	29.1	29.5	25.6	15.7	0.002	-
2014	Thurber	MR14-108	Dam Breach Area	Thin-walled Tube	6	8.00		920.60		920.60	Possible Ablation / Moraine Till	-	17.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-108A	Dam Breach Area	Thin-walled Tube	1	8.60		920.00		920.00	Basal Till	-	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-108A	Dam Breach Area	Thin-walled Tube	6	11.60		917.00		917.00	Lower Glaciolacustrine[2]	-	22.5	CL	43	24	19	-0.08	CL	-	-	-	-	-	-	-	0.0	1.0	72.7	26.3	0.002	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	1	1.50		927.50		927.50	Possible Ablation / Moraine Till	-	13.9	CL	26	15	11	-0.10	CL	-	-	-	-	-	-	-	10.4	35.2	54.4		-	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	2	2.70		926.30		926.30	Possible Ablation / Moraine Till	-	13.2	SC	25	14	11	-0.07	CL	-	-	-	-	-	-	-	24.6	31.7	30.2	13.5	0.002	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	3	3.50		925.50		925.50	Possible Ablation / Moraine Till	-	15.3	CL-ML	22	15	7	0.04	CL-ML	-	-	-	-	-	-	-	12.3	35.1	52.6		-	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	4	4.70		924.30		924.30	Possible Ablation / Moraine Till	-	13.0	CL-ML	23	16	7	-0.43	CL-ML	-	-	-	-	-	-	-	13.2	36.0	39.0	11.8	0.002	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	5	6.60		922.40		922.40	Basal Till	-	12.4	GC-GM	25	18	7	-0.80	CL-ML	-	-	-	-	-	-	-	31.5	30.3	30.4	7.9	0.002	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	6A	12.30		916.70		916.70	Basal Till	-	14.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	6B	12.30		916.70		916.70	Basal Till	-	21.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	6B	12.40		916.60		916.60	Basal Till	-	22.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	6B	12.50		916.50		916.50	Basal Till	2.74	13.1	CL/ML	-	-	-	-	-	-	-	-	-	-	-	-	17.6	20.9	48.6	12.9	0.002	-
2014	Thurber	MR14-109	Dam Breach Area	Thin-walled Tube	6B	12.50		916.50		916.50	Basal Till	-	19.9	CL	35	22	13	-0.16	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	1	2.30		926.40		926.40	Possible Ablation / Moraine Till	-	13.7	SC	25	14	11	-0.03	CL	-	-	-	-	-	-	-	22.1	33.3	44.6		-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Clay Threshold (< mm)	Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)			
																												Silt (%)	Clay (%)		
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	2	3.20		925.50		925.50	Possible Ablation / Moraine Till	-	13.1	SC	22	14	8	-0.11	CL	-	-	-	-	-	-	-	19.5	32.5	35.0	13.1	0.002	-
2014	Thurber	MR14-110	Dam Breach Area	Grab	3	4.10		924.60		924.60	Possible Ablation / Moraine Till	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.7	40.6	45.8		-	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	4	4.80		923.90		923.90	Possible Ablation / Moraine Till	-	13.0	CL	22	13	9	0.00	CL	-	-	-	-	-	-	-	12.9	32.5	40.5	14.1	0.002	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	5	5.70		923.00		923.00	Possible Ablation / Moraine Till	-	31.2	CL-ML	21	15	6	2.70	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	6A	12.20		916.50		916.50	Lower Glaciolacustrine[2]	-	8.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	6B	12.40		916.30		916.30	Lower Glaciolacustrine[2]	-	17.2	CL	36	23	13	-0.45	CL	-	-	-	-	-	-	-	0.0	1.1	74.4	24.5	0.002	OD
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	6C	12.50		916.20		916.20	Lower Glaciolacustrine[2]	-	21.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	6C	12.50		916.20		916.20	Lower Glaciolacustrine[2]	-	22.4	CL/ML	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	70.6	29.2	0.002	-
2014	Thurber	MR14-110	Dam Breach Area	Thin-walled Tube	6C	12.50		916.20		916.20	Lower Glaciolacustrine[2]	-	20.8	CL	39	24	15	-0.21	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	1	1.90		926.70		926.70	Possible Ablation / Moraine Till	-	18.2	GC	25	12	13	0.48	CL	-	-	-	-	-	-	-	35.2	29.1	23.3	12.4	0.002	-
2014	Thurber	MR14-111	Dam Breach Area	Grab	2	2.50		926.10		926.10	Possible Ablation / Moraine Till	-	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	3A	3.70		924.90		924.90	Possible Ablation / Moraine Till	-	12.1	SC	22	11	11	0.10	CL	-	-	-	-	-	-	-	19.3	36.9	27.8	16.0	0.002	-
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	3B	3.90		924.70		924.70	Upper Glaciolacustrine[2]	-	20.2	CL	34	13	21	0.34	CL	-	-	-	-	-	-	-	17.3	24.1	26.8	31.8	0.002	-
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	3C	4.10		924.50		924.50	Upper Glaciolacustrine[2]	-	13.5	CL	22	13	9	0.06	CL	-	-	-	-	-	-	-	12.1	33.8	36.1	18.0	0.002	-
2014	Thurber	MR14-111	Dam Breach Area	Grab	7	4.30		924.30		924.30	Possible Ablation / Moraine Till	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	5A	5.70		922.90		922.90	Possible Ablation / Moraine Till	-	12.9	CL	22	14	8	-0.14	CL	-	-	-	-	-	-	-	12.4	34.6	39.8	13.2	0.002	TX
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	5B	5.90		922.70		922.70	Possible Ablation / Moraine Till	-	10.8	CL-ML	21	15	6	-0.70	CL-ML	-	-	-	-	-	-	-	11.4	33.9	43.6	11.0	0.002	OD
2014	Thurber	MR14-111	Dam Breach Area	Thin-walled Tube	5B	5.90		922.70		922.70	Possible Ablation / Moraine Till	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-111	Dam Breach Area	Grab	6	9.90		918.70		918.70	Possible Ablation / Moraine Till	-	15.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-111A	Dam Breach Area	Grab	5	4.30		923.80		923.80	Possible Ablation / Moraine Till	-	12.6	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-112	Dam Breach Area	Thin-walled Tube	1	1.70		927.20		927.20	Possible Ablation / Moraine Till	-	11.0	SC	25	13	12	-0.17	CL	-	-	-	-	-	-	-	26.8	32.1	26.6	14.5	0.002	-
2014	Thurber	MR14-112	Dam Breach Area	Grab	3	3.80		925.10		925.10	Possible Ablation / Moraine Till	-	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-112	Dam Breach Area	Thin-walled Tube	4A	4.40		924.50		924.50	Possible Ablation / Moraine Till	-	14.4	GC	23	13	10	0.14	CL	-	-	-	-	-	-	-	37.6	27.6	23.5	11.3	0.002	-
2014	Thurber	MR14-112	Dam Breach Area	Thin-walled Tube	4B	4.60		924.30		924.30	Upper Glaciolacustrine[2]	-	32.0	CH	59	21	38	0.29	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-112	Dam Breach Area	Thin-walled Tube	4C	4.80		924.10		924.10	Possible Ablation / Moraine Till	-	16.2	CL	29	13	16	0.20	CL	-	-	-	-	-	-	-	9.1	31.7	38.1	21.1	0.002	-
2014	Thurber	MR14-112	Dam Breach Area	Grab	5	5.60		923.30		923.30	Possible Ablation / Moraine Till	-	13.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-112	Dam Breach Area	Grab	6	6.50		922.40		922.40	Possible Ablation / Moraine Till	-	17.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	1A	1.30		928.10		928.10	[1]	-	131.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	1B	1.30		928.10		928.10	Possible Ablation / Moraine Till	-	23.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OD
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	1C	1.40		928.00		928.00	Possible Ablation / Moraine Till	2.78	20.0	CL	27	14	13	0.46	CL	-	-	-	-	-	-	-	6.5	33.0	40.6	19.9	0.002	TX
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	1D	1.60		927.80		927.80	Possible Ablation / Moraine Till	-	17.9	CL	26	13	13	0.38	CL	-	-	-	-	-	-	-	9.8	36.9	36.7	16.6	0.002	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	2	3.90		925.50		925.50	Possible Ablation / Moraine Till	-	12.1	SC	24	13	11	-0.08	CL	-	-	-	-	-	-	-	22.3	30.5	32.7	14.5	0.002	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	3	5.20		924.20		924.20	Possible Ablation / Moraine Till	-	12.8	SC	21	12	9	0.09	CL	-	-	-	-	-	-	-	23.3	29.6	34.1	13.0	0.002	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	4A	6.30		923.10		923.10	Possible Ablation / Moraine Till	-	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	4A	6.30		923.10		923.10	Possible Ablation / Moraine Till	-	10.8	CL-ML	21	14	7	-0.46	CL-ML	-	-	-	-	-	-	-	3.6	35.9	48.2	12.3	0.002	OD
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	4B	6.50		922.90		922.90	Possible Ablation / Moraine Till	-	11.4	CL-ML	21	14	7	-0.37	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	4B	6.60		922.80		922.80	Possible Ablation / Moraine Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	3.6	35.5	48.5	12.3	0.002	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	4B	6.60		922.80		922.80	Possible Ablation / Moraine Till	-	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DSS
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	5	7.40		922.00		922.00	Possible Ablation / Moraine Till	-	13.2	CL-ML	20	13	7	0.03	CL-ML	-	-	-	-	-	-	-	8.7	39.8	36.9	14.6	0.002	-
2014	Thurber	MR14-113	Dam Breach Area	Thin-walled Tube	6C	9.40		920.00		920.00	Possible Ablation / Moraine Till	-	18.7	CL	28	17	11	0.15	CL	-	-	-	-	-	-	-	4.6	27.1	50.0	18.3	0.002	OD
2014	Thurber	MR14-114	Dam Breach Area	Thin-walled Tube	2	3.80		926.80		926.80	Possible Ablation / Moraine Till	-	7.9	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-114	Dam Breach Area	Thin-walled Tube	3	4.80		925.80		925.80	Possible Ablation / Moraine Till	-	11.3	SC	23	12	11	-0.06	CL	-	-	-	-	-	-	-	25.1	32.3	28.4	14.2	0.002	-
2014	Thurber	MR14-114	Dam Breach Area	Thin-walled Tube	5	6.60		924.00		924.00	Possible Ablation / Moraine Till	-	10.8	SC	21	12	9	-0.13	CL	-	-	-	-	-	-	-	26.6	32.0	29.5	11.9	0.002	-
2014	Thurber	MR14-114	Dam Breach Area	Grab	7	9.20		921.40		921.40	Possible Ablation / Moraine Till	-	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-115	Dam Breach Area	Grab	2	2.50		926.50		926.50	Possible Ablation / Moraine Till	-	14.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-115	Dam Breach Area	Thin-walled Tube	3	3.80		925.20		925.20	Possible Ablation / Moraine Till	-	11.6	SC	23	12	11	-0.04	CL	-	-	-	-	-	-	-	25.0	31.6	28.0	15.4	0.002	-
2014	Thurber	MR14-115	Dam Breach Area	Thin-walled Tube	4	4.50		924.50		924.50	Possible Ablation / Moraine Till	-	11.3	SC	23	15	8	-0.46	CL	-	-	-	-	-	-	-	18.7	33.7	36.6	11.0	0.002	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	1	0.30		930.30		930.30	Possible Ablation / Moraine Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	2	1.50		929.10		929.10	Possible Ablation / Moraine Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	3	2.10		928.50		928.50	Possible Ablation / Moraine Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	4	2.60		928.00		928.00	Possible Ablation / Moraine Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	5	3.30		927.30		927.30	Possible Ablation / Moraine Till	-	13.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	6	4.00		926.60		926.60	Possible Ablation / Moraine Till	-	11.8	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	7	4.50		926.10		926.10	Possible Ablation / Moraine Till	-	12.5	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	8	5.10		925.50		925.50	Possible Ablation / Moraine Till	-	12.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	9	5.30		925.30		925.30	Upper Glaciolacustrine[2]	-	30.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	10	5.80		924.80		924.80	Upper Glaciolacustrine[2]	-	31.3	CL	49	21	28	0.37	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	11	6.40		924.20		924.20	Possible Ablation / Moraine Till	-	13.7	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	12	7.00		923.60		923.60	Possible Ablation / Moraine Till	-	15.4	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	13	7.50		923.10		923.10	Possible Ablation / Moraine Till	-	13.0	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	14	8.20		922.40		922.40	Possible Ablation / Moraine Till	-	13.3	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	15	8.60		922.00		922.00	Possible Ablation / Moraine Till	-	13.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	16	10.60		920.00		920.00	Upper Glaciolacustrine[2]	-	21.5	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	17	10.90		919.70		919.70	Upper Glaciolacustrine[2]	-	37.7	CH	51	20	31	0.57	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	18	11.20		919.40		919.40	Upper Glaciolacustrine[2]	-	38.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	19	11.40		919.20		919.20	Basal Till	-	16.8	CL	25	16	9	0.09	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	20	11.90		918.70		918.70	Lower Glaciolacustrine[2]	-	23.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	21	12.50		918.10		918.10	Lower Glaciolacustrine[2]	-	16.8	CL	23	15	8	0.23	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	22	13.10		917.50		917.50	Lower Glaciolacustrine[2]	-	14.6	CL-ML	22	17	5	-0.48	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	23	13.50		917.10		917.10	Lower Glaciolacustrine[2]	-	14.2	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	24	13.80		916.80		916.80	Lower Glaciolacustrine[2]	-	19.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	25	14.30		916.30		916.30	Lower Glaciolacustrine[2]	-	17.5	CL-ML	23	19	4	-0.38	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	26	14.70		915.90		915.90	Lower Glaciolacustrine[2]	-	12.5	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116	Dam Breach Area	Grab	27	15.00		915.60		915.60	Lower Glaciolacustrine[2]	-	27.1	CL	41	23	18	0.23	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116A	Dam Breach Area	Grab	1	0.30		930.30		930.30	Possible Ablation / Moraine Till	-	13.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116A	Dam Breach Area	Grab	2	0.70		929.90		929.90	Possible Ablation / Moraine Till	-	15.1	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116A	Dam Breach Area	Grab	4	2.10		928.50		928.50	Possible Ablation / Moraine Till	-	13.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	MR14-116A	Dam Breach Area	Grab	5	2.70		927.90		927.90	Possible Ablation / Moraine Till	-	11.8	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	RH14-118	Dam Breach Area	Grab	2	15.00		922.70		922.70	Possible Ablation / Moraine Till	-	13.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	RH14-118	Dam Breach Area	Grab	3	15.50		922.20		922.20	Possible Ablation / Moraine Till	-	16.6	GC	23	12	11	0.42	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	1	Slice 4		935.16		935.16	Dam Till Core	-	10.1	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	2	Slice 6		933.84		933.84	Dam Till Core	-	12.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	3	Slice 9		935.29		935.29	Dam Till Core	-	11.8	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	4	Slice 14		940.14		940.14	Dam Filter	-	7.1	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	51.4	37.6	11.0		-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	5	Slice 14		936.73		936.73	Dam Till Core	-	10.8	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	7	Slice 18		940.35		940.35	Dam Filter	-	6.8	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	58.3	32.0	9.7		-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	8	Slice 18		933.93		933.93	Fill - Sand	-	15.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	1.0	77.6	21.4		-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	9	Slice 20		937.33		937.33	Dam Till Core	-	8.1	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	50.6	37.5	12.0		-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	10	Slice 20		941.20		941.20	Dam Filter	-	9.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	12.5	32.6	38.5	16.4	0.002	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	11	Slice 24		930.13		930.13	Fill - Gravel	-	11.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	12	Slice 27		930.99		930.99	Dam Till Core	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	13	Slice 27		930.93		930.93	Dam Till Core	-	10.3	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	14 U/S	Slice 31		931.65		931.65	Dam Till Core	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	7.6	38.4	37.8	16.2	0.002	-
2014	Thurber	Remnant Core Excavation	Dam Breach Area	Grab	15 D/S	Slice 31		931.26		931.26	Dam Till Core	-	10.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	18.4	34.3	34.0	13.3	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	1	-	-	-		-	Dam Till Core	-	7.0	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	9.5	38.2	39.7	12.6	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	2	-	-	-		-	Glacial Till	-	8.8	SM/SC	-	-	-	-	-	-	-	-	-	-	-	-	10.2	37.2	34.6	18.0	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	3	-	-	-		-		-	38.8	ML	42	29	13	0.75	ML	-	-	-	-	-	-	-	0.0	0.5	72.6	26.9	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	4	-	-	-		-	Glacial Till	-	9.2	CL/ML	-	-	-	-	-	-	-	-	-	-	-	-	0.0	30.4	43.7	17.9	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	5	-	-	-		-	-	-	10.7	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	0.0	57.9	42.1		-	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	6	-	-	-		-	-	-	1.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	0.0	78.6	21.4		-	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	7	-	-	-		-	Dam Till Core	-	5.5	SC/SM	-	-	-	-	-	-	-	-	-	-	-	-	6.0	37.1	41.4	15.6	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	8	-	-	-		-	-	-	9.3	GP-GM	-	-	-	-	-	-	-	-	-	-	-	-	60.9	27.5	11.6		-	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	9	-	-	-		-	-	-	35.5	ML	39	29	10	0.65	ML	-	-	-	-	-	-	-	0.0	1.5	75.0	23.5	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	10	-	-	-		-		-	15.9	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	0.0	58.4	41.6		-	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	11	-	-	-		-	Glacial Till	-	6.7	SM/SC	-	-	-	-	-	-	-	-	-	-	-	-	13.6	36.0	34.5	15.9	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	12	-	-	-		-	Glacial Till	-	6.9	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	22.1	32.1	31.6	14.2	0.002	-
2014	Thurber	Site Recon	Dam Breach Area	Grab	13	-	-	-		-	Glacial Till	-	4.7	CL/ML	-	-	-	-	-	-	-	-	-	-	-	-	11.4	34.8	39.1	14.6	0.002	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G1	2.23		929.12		929.12	Upper Glacial Till	-	28.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-01	Dam Breach Area	Grab	G2	2.59		928.76		928.76	Upper Glacial Till	-	18.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G3	2.68		928.67		928.67	Upper Glacial Till	-	16.7	CL	28	13	15	0.25	CL	-	-	-	-	-	-	-	8.9	38.2	34.4	18.6	0.002	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G4	2.96		928.39		928.39	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G5	3.35		928.00		928.00	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G6	3.51		927.84		927.84	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G7	3.57		927.78		927.78	Upper Glacial Till	-	12.8	CL	26	12	14	0.06	CL	-	-	-	-	-	-	-	8.7	39.6	32.3	19.4	0.002	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G8	4.09		927.26		927.26	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G9	4.67		926.68		926.68	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G24	11.46		919.89		919.89	Middle Glacial Till	-	9.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G26	12.07		919.28		919.28	Middle Glacial Till	-	7.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G27	12.50		918.85		918.85	Middle Glacial Till	-	6.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G29	12.71		918.64		918.64	Middle Glacial Till	-	6.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G30	13.11		918.24		918.24	Middle Glacial Till	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G31	13.50		917.85		917.85	Middle Glacial Till	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G32	13.90		917.45		917.45	Middle Glacial Till	-	10.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G34	14.24		917.11		917.11	Middle Glacial Till	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G35	14.66		916.69		916.69	Middle Glacial Till	-	8.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G37	15.12		916.23		916.23	Middle Glacial Till	-	8.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G38	15.55		915.80		915.80	Middle Glacial Till	-	4.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G39	15.67		915.68		915.68	Upper Glaciofluvial	-	7.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G40	16.16		915.19		915.19	Upper Glaciofluvial	-	18.2	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G42	16.64		914.71		914.71	Lower Glaciofluvial	-	8.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G43	17.07		914.28		914.28	Lower Glacial Till	-	18.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G44	17.22		914.13		914.13	Lower Glacial Till	-	8.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G45	17.83		913.52		913.52	Lower Glacial Till	-	11.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G46	18.38		912.97		912.97	Lower Glacial Till	-	5.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G48	18.90		912.45		912.45	Weathered Bedrock (Mafic)	-	12.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G50	19.36		911.99		911.99	Weathered Bedrock (Mafic)	-	9.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G51	19.81		911.54		911.54	Weathered Bedrock (Mafic)	-	6.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G52	20.39		910.96		910.96	Weathered Bedrock (Mafic)	-	8.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G53	20.94		910.41		910.41	Weathered Bedrock (Mafic)	-	8.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G54	21.49		909.86		909.86	Weathered Bedrock (Mafic)	-	6.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G55	21.50		909.85		909.85	Weathered Bedrock (Mafic)	-	14.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G56	21.83		909.52		909.52	Weathered Bedrock (Mafic)	-	14.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G57	22.40		908.95		908.95	Weathered Bedrock (Mafic)	-	9.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G58	22.95		908.40		908.40	Weathered Bedrock (Mafic)	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G60	23.47		907.88		907.88	Weathered Bedrock (Mafic)	-	5.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G61	24.05		907.30		907.30	Weathered Bedrock (Mafic)	-	5.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G62	24.45		906.90		906.90	Weathered Bedrock (Mafic)	-	6.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G63	24.93		906.42		906.42	Weathered Bedrock (Mafic)	-	8.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G65	25.39		905.96		905.96	Weathered Bedrock (Mafic)	-	6.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G66	26.09		905.26		905.26	Weathered Bedrock (Mafic)	-	4.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G67	26.25		905.10		905.10	Weathered Bedrock (Mafic)	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G69	26.98		904.37		904.37	Weathered Bedrock (Mafic)	-	7.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G70	27.53		903.82		903.82	Weathered Bedrock (Mafic)	-	5.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G71	27.95		903.40		903.40	Weathered Bedrock (Mafic)	-	7.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G72	28.59		902.76		902.76	Weathered Bedrock (Mafic)	-	6.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G74	29.05		902.30		902.30	Weathered Bedrock (Mafic)	-	3.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G75	29.66		901.69		901.69	Weathered Bedrock (Mafic)	-	7.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G77	30.21		901.14		901.14	Weathered Bedrock (Mafic)	-	6.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G78	30.66		900.69		900.69	Weathered Bedrock (Mafic)	-	2.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G79	31.00		900.35		900.35	Weathered Bedrock (Mafic)	-	9.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G80	31.67		899.68		899.68	Weathered Bedrock (Mafic)	-	10.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G81	32.10		899.25		899.25	Weathered Bedrock (Mafic)	-	4.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G82	32.68		898.67		898.67	Weathered Bedrock (Mafic)	-	8.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G83	33.26		898.09		898.09	Weathered Bedrock (Mafic)	-	7.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G84	33.47		897.88		897.88	Weathered Bedrock (Mafic)	-	6.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G86	34.38		896.97		896.97	Weathered Bedrock (Mafic)	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G87	35.08		896.27		896.27	Weathered Bedrock (Mafic)	-	5.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G88	35.82		895.53		895.53	Weathered Bedrock (Mafic)	-	7.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G89	36.58		894.77		894.77	Weathered Bedrock (Mafic)	-	5.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G91	37.31		894.04		894.04	Weathered Bedrock (Mafic)	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01	Dam Breach Area	Grab	G92	38.07		893.28		893.28	Weathered Bedrock (Mafic)	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G1	5.12		926.08		926.08	Upper Glacial Till	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G2	5.64		925.56		925.56	Upper Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G3	5.64		925.56		925.56	Upper Glacial Till	-	12.0	SC	25	12	13	0.00	CL	-	-	-	-	-	-	-	11.9	38.8	30.7	18.6	0.002	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G4	6.02		925.18		925.18	Upper Glacial Till	-	11.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G5	6.34		924.86		924.86	Upper Glacial Till	-	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G6	6.61		924.59		924.59	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G8	7.04		924.16		924.16	Upper Glacial Till	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G9	7.50		923.70		923.70	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G10	7.50		923.70		923.70	Upper Glacial Till	-	12.6	CL	22	12	10	0.06	CL	-	-	-	-	-	-	-	9.2	38.4	36.6	15.8	0.002	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G11	7.77		923.43		923.43	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G12	8.02		923.18		923.18	Upper Glacial Till	-	17.2	CL	23	14	9	0.36	CL	-	-	-	-	-	-	-	3.9	28.8	48.7	18.6	0.002	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G13	8.14		923.06		923.06	Upper Glacial Till	-	15.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G14	8.38		922.82		922.82	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G15	8.84		922.36		922.36	Upper Glaciolacustrine	-	13.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G16	8.93		922.27		922.27	Upper Glaciolacustrine	-	37.0	CH	64	20	44	0.39	CH	-	-	-	-	-	-	-	0.1	7.6	35.0	57.3	0.002	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G18	9.05		922.15		922.15	Upper Glaciolacustrine	-	26.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G19	9.69		921.51		921.51	Middle Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G20	10.15		921.05		921.05	Middle Glacial Till	-	15.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G21	10.21		920.99		920.99	Middle Glacial Till	-	10.9	CL	21	13	8	-0.26	CL	-	-	-	-	-	-	-	12.5	36.9	37.0	13.6	0.002	-
2014	KCB	SH14-01A	Dam Breach Area	Grab	G22	10.67		920.53		920.53	Middle Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02	Dam Breach Area	Grab	G1	4.99		927.91		927.91	Upper Glacial Till	-	25.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02	Dam Breach Area	Grab	G2	5.48		927.42		927.42	Upper Glacial Till	-	15.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02	Dam Breach Area	Grab	G3	7.49		925.41		925.41	Upper Glacial Till	-	13.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G1	4.27		928.66		928.66	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G2	4.57		928.36		928.36	Upper Glacial Till	-	16.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G3	5.18		927.75		927.75	Upper Glacial Till	-	11.2	CL	26	12	14	-0.06	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G4	5.49		927.44		927.44	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G5	5.79		927.14		927.14	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G7	6.40		926.53		926.53	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G8	6.61		926.32		926.32	Upper Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G9	7.01		925.92		925.92	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G10	7.01		925.92		925.92	Upper Glacial Till	-	11.7	CL	24	12	12	-0.03	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G11	7.35		925.58		925.58	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G12	7.86		925.07		925.07	Upper Glacial Till	-	10.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G13	8.14		924.79		924.79	Upper Glacial Till	-	11.5	SC	24	11	13	0.04	CL	-	-	-	-	-	-	-	16.5	36.1	29.2	18.3	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G14	8.29		924.64		924.64	Upper Glacial Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G15	8.87		924.06		924.06	Upper Glacial Till	-	11.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G16	9.20		923.73		923.73	Upper Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G17	9.30		923.63		923.63	Upper Glacial Till	-	12.5	SC	23	11	12	0.13	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G18	9.75		923.18		923.18	Upper Glacial Till	-	11.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G19	10.21		922.72		922.72	Upper Glacial Till	-	12.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G20	10.36		922.57		922.57	Upper Glacial Till	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G22	10.82		922.11		922.11	Upper Glacial Till	-	26.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G23	11.13		921.80		921.80	Upper Glacial Till	-	21.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G24	11.31		921.62		921.62	Upper Glaciolacustrine	-	33.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G25	11.31		921.62		921.62	Upper Glaciolacustrine	-	36.8	CH	51	19	32	0.56	CH	-	-	-	-	-	-	-	0.3	4.2	46.9	48.5	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G26	11.77		921.16		921.16	Upper Glacial Till	-	12.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G27	12.25		920.68		920.68	Upper Glacial Till	-	13.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-02A	Dam Breach Area	Grab	G28	12.50		920.43		920.43	Upper Glaciolacustrine	-	31.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G29	12.56		920.37		920.37	Upper Glaciolacustrine	-	28.9	CI	41	18	23	0.47	CI	-	-	-	-	-	-	4.5	14.8	41.5	39.2	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G30	12.65		920.28		920.28	Middle Glacial Till	-	16.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G31	13.11		919.82		919.82	Middle Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G32	13.32		919.61		919.61	Middle Glacial Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G33	13.32		919.61		919.61	Middle Glacial Till	-	8.9	CL	20	14	6	-0.85	CL-ML	-	-	-	-	-	-	6.1	42.6	39.3	12.0	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G34	13.90		919.03		919.03	Middle Glacial Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G35	14.17		918.76		918.76	Middle Glacial Till	-	17.5	CL	29	16	13	0.12	CL	-	-	-	-	-	-	3.7	18.5	54.1	23.7	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G36	14.33		918.60		918.60	Middle Glacial Till	-	15.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G37	14.78		918.15		918.15	Middle Glacial Till	-	18.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G38	15.09		917.84		917.84	Lower Glaciofluvial	-	20.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G39	15.09		917.84		917.84	Lower Glaciofluvial	-	22.3	ML		Non-Plastic		-	ML	-	-	-	-	-	-	2.0	11.9	80.6	5.4	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G40	15.39		917.54		917.54	Lower Glaciofluvial	-	14.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G41	15.54		917.39		917.39	Lower Glaciofluvial	-	15.6	ML	-	-	-	-	-	-	-	-	-	-	-	0.1	52.6	47.4		-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G42	15.70		917.23		917.23	Lower Glaciofluvial	-	18.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G44	15.88		917.05		917.05	Lower Glaciofluvial	-	23.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G45	16.31		916.62		916.62	Lower Glacial Till	-	17.3	SC	24	14	10	0.33	CL	-	-	-	-	-	-	14.0	40.6	30.3	15.0	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G46	16.49		916.44		916.44	Lower Glacial Till	-	15.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G47	16.76		916.17		916.17	Lower Glacial Till	-	15.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G48	19.05		913.88		913.88	Weathered Bedrock (Mafic)	-	16.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G49	19.05		913.88		913.88	Weathered Bedrock (Mafic)	-	17.1	CI	42	23	19	-0.31	CI	-	-	-	-	-	-	0.6	38.1	42.3	19.0	0.002	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G50	19.51		913.42		913.42	Weathered Bedrock (Mafic)	-	17.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G51	19.96		912.97		912.97	Weathered Bedrock (Mafic)	-	17.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G52	20.27		912.66		912.66	Weathered Bedrock (Mafic)	-	26.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G54	23.47		909.46		909.46	Weathered Bedrock (Mafic)	-	8.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-02A	Dam Breach Area	Grab	G55	24.38		908.55		908.55	Weathered Bedrock (Mafic)	-	7.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G1	5.18		927.34		927.34	Upper Glacial Till	-	13.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G2	5.79		926.73		926.73	Upper Glacial Till	-	13.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G4	6.25		926.27		926.27	Upper Glacial Till	-	10.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G5	6.65		925.87		925.87	Upper Glacial Till	-	12.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G6	7.17		925.35		925.35	Upper Glacial Till	-	11.8	SC	24	12	12	-0.02	CL	-	-	-	-	-	-	14.7	35.5	31.8	18.0	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G7	7.32		925.20		925.20	Upper Glacial Till	-	12.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G8	7.81		924.71		924.71	Upper Glacial Till	-	10.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G9	8.23		924.29		924.29	Upper Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G11	8.84		923.68		923.68	Upper Glacial Till	-	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G12	9.30		923.22		923.22	Upper Glacial Till	-	12.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G13	9.45		923.07		923.07	Upper Glacial Till	-	11.8	SC	24	12	12	-0.02	CL	-	-	-	-	-	-	14.0	39.0	31.1	16.0	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G14	9.76		922.76		922.76	Upper Glacial Till	-	10.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G16	10.73		921.79		921.79	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G17	11.07		921.45		921.45	Upper Glaciolacustrine	-	31.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G18	11.10		921.42		921.42	Upper Glaciolacustrine	-	30.6	CI	41	16	25	0.58	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G19	11.34		921.18		921.18	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G20	11.71		920.81		920.81	Upper Glaciolacustrine	-	32.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G21	11.89		920.63		920.63	Upper Glaciolacustrine	-	35.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G22	11.95		920.57		920.57	Upper Glaciolacustrine	-	24.5	CI	33	14	19	0.55	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G23	12.19		920.33		920.33	Upper Glaciolacustrine	-	21.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G24	12.44		920.08		920.08	Upper Glaciolacustrine	-	25.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G25	12.68		919.84		919.84	Upper Glaciolacustrine	-	37.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G26	12.84		919.68		919.68	Upper Glaciolacustrine	-	33.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G27	13.20		919.32		919.32	Upper Glaciolacustrine	-	37.0	CI	44	17	27	0.74	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G28	13.57		918.95		918.95	Upper Glaciolacustrine	-	18.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G29	13.72		918.80		918.80	Middle Glacial Till	-	12.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G30	14.24		918.28		918.28	Middle Glacial Till	-	10.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G31	14.63		917.89		917.89	Middle Glacial Till	-	20.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G32	15.09		917.43		917.43	Middle Glacial Till	-	22.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G33	15.30		917.22		917.22	Middle Glacial Till	-	20.9	CI	41	22	19	-0.06	CI	-	-	-	-	-	-	0.0	2.7	64.1	33.2	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G34	15.49		917.03		917.03	Middle Glacial Till	-	22.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G35	15.70		916.82		916.82	Middle Glacial Till	-	21.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G36	16.00		916.52		916.52	Middle Glacial Till	-	21.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G38	16.40		916.12		916.12	Middle Glacial Till	-	21.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G39	16.86		915.66		915.66	Middle Glacial Till	-	22.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G40	17.38		915.14		915.14	Lower Glaciolacustrine	-	26.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G41	17.44		915.08		915.08	Lower Glaciolacustrine	-	26.9	CI	42	21	21	0.28	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G42	17.99		914.53		914.53	Lower Glaciolacustrine	-	26.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G43	18.29		914.23		914.23	Lower Glaciolacustrine	-	27.9	CI	31	20	11	0.72	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G44	18.44		914.08		914.08	Lower Glaciolacustrine	-	27.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G45	18.75		913.77		913.77	Lower Glaciolacustrine	-	27.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G47	19.74		912.78		912.78	Upper Glaciofluvial	-	25.6	ML	27	22	5	0.72	ML	-	-	-	-	-	-	0.0	5.2	80.3	14.5	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G48	19.60		912.92		912.92	Upper Glaciofluvial	-	26.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G49	20.88		911.64		911.64	Upper Glaciofluvial	-	25.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G50	21.34		911.18		911.18	Upper Glaciofluvial	-	26.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G51	22.53		909.99		909.99	Weathered Bedrock (Sedimentary)	-	43.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G52	22.56		909.96		909.96	Weathered Bedrock (Sedimentary)	-	40.5	CH	111	34	77	0.08	CH	-	-	-	-	-	-	0.0	4.8	22.7	72.5	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G53	22.86		909.66		909.66	Weathered Bedrock (Sedimentary)	-	43.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G54	23.47		909.05		909.05	Weathered Bedrock (Sedimentary)	-	47.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G55	23.78		908.74		908.74	Weathered Bedrock (Sedimentary)	-	50.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G56	23.87		908.65		908.65	Weathered Bedrock (Sedimentary)	-	48.0	CH	88	39	49	0.18	CH	-	-	-	-	-	-	0.8	22.3	31.3	45.6	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G57	24.39		908.13		908.13	Weathered Bedrock (Sedimentary)	-	45.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G58	25.00		907.52		907.52	Weathered Bedrock (Sedimentary)	-	25.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G59	25.61		906.91		906.91	Weathered Bedrock (Sedimentary)	-	23.4	CH	71	24	47	-0.01	CH	-	-	-	-	-	-	0.9	30.2	27.5	41.4	0.002	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G60	27.43		905.09		905.09	Weathered Bedrock (Sedimentary)	-	47.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03	Dam Breach Area	Grab	G61	28.96		903.56		903.56	Weathered Bedrock (Sedimentary)	-	42.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-03B	Dam Breach Area	Grab	G4	12.14		920.49		920.49	Upper Glaciolacustrine	2.78	31.2	CI	47	20	27	0.41	CI	-	-	-	-	-	-	0.0	1.7	51.3	47.0	0.002	DS
2014	KCB	SH14-03B	Dam Breach Area	Grab	G5	12.45		920.18		920.18	Upper Glaciolacustrine	2.80	46.3	CH	68	25	43	0.50	CH	-	-	-	-	-	-	0.0	4.6	26.5	68.9	0.002	DS
2014	KCB	SH14-04	Dam Breach Area	Grab	G1	0.61		931.59		931.59	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G2	1.06		931.14		931.14	Upper Glacial Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G3	1.52		930.68		930.68	Upper Glacial Till	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G4	6.55		925.65		925.65	Upper Glacial Till	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G5	7.01		925.19		925.19	Upper Glacial Till	-	13.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G6	7.16		925.04		925.04	Upper Glacial Till	-	12.5	CL	23	13	10	-0.05	CL	-	-	-	-	-	-	4.4	37.4	40.1	18.1	0.002	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G7	7.46		924.74		924.74	Upper Glacial Till	-	13.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G8	7.62		924.58		924.58	Upper Glacial Till	-	14.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G9	8.04		924.16		924.16	Upper Glacial Till	-	14.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G10	8.56		923.64		923.64	Upper Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G12	9.29		922.91		922.91	Upper Glacial Till	-	9.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G13	9.66		922.54		922.54	Upper Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G14	10.12		922.08		922.08	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G16	10.82		921.38		921.38	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G17	11.21		920.99		920.99	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G18	11.82		920.38		920.38	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G19	12.01		920.19		920.19	Upper Glacial Till	-	12.1	CL	23	14	9	-0.21	CL	-	-	-	-	-	-	12.8	35.7	38.0	13.5	0.002	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G20	12.46		919.74		919.74	Upper Glacial Till	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G21	13.04		919.16		919.16	Upper Glacial Till	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G22	13.59		918.61		918.61	Upper Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G23	13.65		918.55		918.55	Upper Glaciolacustrine	-	31.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G24	13.65		918.55		918.55	Upper Glaciolacustrine	2.80	38.5	CH	71	22	49	0.34	CH	-	-	-	-	-	-	2.8	8.9	19.8	68.5	0.002	DS
2014	KCB	SH14-04	Dam Breach Area	Grab	G25	13.96		918.24		918.24	Upper Glaciolacustrine	-	38.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G26	14.14		918.06		918.06	Middle Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G27	14.23		917.97		917.97	Middle Glacial Till	-	14.9	CL	27	16	11	-0.10	CL	-	-	-	-	-	-	18.2	22.1	45.9	13.8	0.002	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G28	14.60		917.60		917.60	Middle Glacial Till	-	14.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G30	15.27		916.93		916.93	Lower Glaciolacustrine	-	25.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-04	Dam Breach Area	Grab	G31	16.30		915.90		915.90	Upper Glaciofluvial	-	18.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G32	16.46		915.74		915.74	Upper Glaciofluvial	-	21.9	ML	21	19	2	1.45	ML	-	-	-	-	-	-	-	0.0	32.6	58.1	9.3	0.002	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G33	16.91		915.29		915.29	Upper Glaciofluvial	-	26.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G34	17.37		914.83		914.83	Upper Glaciofluvial	-	25.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G35	18.13		914.07		914.07	Lower Glaciofluvial	-	20.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G36	18.13		914.07		914.07	Lower Glaciofluvial	-	18.4	SM	-	Non-Plastic	-	-	ML	-	-	-	-	-	-	-	2.4	49.4	43.2	5.1	0.002	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G37	18.74		913.46		913.46	Lower Glaciofluvial	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G38	19.20		913.00		913.00	Lower Glaciofluvial	-	21.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-04	Dam Breach Area	Grab	G39	19.66		912.54		912.54	Lower Glaciofluvial	-	24.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G1	3.35		933.86		933.86	Upper Glacial Till	-	16.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G2	3.81		933.40		933.40	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G3	4.12		933.09		933.09	Upper Glacial Till	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G5	5.70		931.51		931.51	Upper Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G6	6.16		931.05		931.05	Upper Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G7	8.48		928.73		928.73	Upper Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G8	8.78		928.43		928.43	Upper Glacial Till	-	12.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G10	11.19		926.02		926.02	Upper Glacial Till	-	14.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G11	11.68		925.53		925.53	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G13	12.35		924.86		924.86	Upper Glacial Till	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G14	12.86		924.35		924.35	Upper Glacial Till	-	7.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G16	13.57		923.64		923.64	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G18	14.14		923.07		923.07	Upper Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G20	14.85		922.36		922.36	Upper Glacial Till	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G21	15.18		922.03		922.03	Upper Glacial Till	-	14.5	CL	22	12	10	0.25	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G22	15.70		921.51		921.51	Upper Glaciolacustrine	-	29.6	CI	42	15	27	0.54	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G23	15.70		921.51		921.51	Upper Glaciolacustrine	-	34.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G24	16.16		921.05		921.05	Upper Glacial Till	-	13.1	CL	23	12	11	0.10	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G25	16.77		920.44		920.44	Middle Glacial Till	-	11.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G26	17.07		920.14		920.14	Middle Glacial Till	-	7.7	SC	21	14	7	-0.90	CL-ML	-	-	-	-	-	-	-	10.9	43.1	34.1	12.0	0.002	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G27	17.38		919.83		919.83	Middle Glacial Till	-	8.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G28	17.83		919.38		919.38	Middle Glacial Till	-	7.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G30	18.75		918.46		918.46	Lower Glaciolacustrine	-	20.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G31	18.84		918.37		918.37	Lower Glaciolacustrine	-	18.2	CL	29	17	12	0.10	CL	-	-	-	-	-	-	-	0.3	17.7	54.0	28.0	0.002	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G32	19.20		918.01		918.01	Lower Glaciolacustrine	-	20.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G34	19.51		917.70		917.70	Lower Glaciolacustrine	-	20.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G35	19.81		917.40		917.40	Lower Glaciofluvial	-	4.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G36	20.61		916.60		916.60	Lower Glaciofluvial	-	9.8	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G37	21.28		915.93		915.93	Lower Glaciofluvial	-	12.3	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-05A	Dam Breach Area	Grab	G38	21.49		915.72		915.72	Lower Glaciofluvial	-	12.8	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G1	8.48		928.98		928.98	Upper Glacial Till	-	12.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G3	8.91		928.55		928.55	Upper Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G4	10.03		927.43		927.43	Upper Glacial Till	-	10.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G5	10.25		927.21		927.21	Upper Glacial Till	-	10.4	SC	24	13	11	-0.24	CL	-	-	-	-	-	-	-	20.8	35.1	29.1	15.0	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G6	10.40		927.06		927.06	Upper Glacial Till	-	8.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G7	10.73		926.73		926.73	Upper Glacial Till	-	9.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G8	11.34		926.12		926.12	Upper Glacial Till	-	10.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G10	11.95		925.51		925.51	Upper Glacial Till	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G11	12.32		925.14		925.14	Upper Glacial Till	-	10.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G12	12.56		924.90		924.90	Upper Glacial Till	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G13	12.99		924.47		924.47	Upper Glacial Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G15	13.36		924.10		924.10	Upper Glacial Till	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G16	13.84		923.62		923.62	Upper Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G17	14.42		923.04		923.04	Upper Glacial Till	-	21.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G18	14.67		922.79		922.79	Upper Glacial Till	-	24.7	CL	24	13	11	1.06	CL	-	-	-	-	-	-	-	0.0	21.2	51.3	27.5	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G19	15.03		922.43		922.43	Upper Glaciolacustrine	-	20.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G20	15.09		922.37		922.37	Upper Glaciolacustrine	-	20.7	CH	21	18	3	0.90	CH	-	-	-	-	-	-	-	0.3	27.0	54.3	18.5	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G21	15.43		922.03		922.03	Upper Glaciolacustrine	-	26.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G21A	15.79		921.67		921.67	Upper Glaciolacustrine	-	31.0	CH	54	21	33	0.30	CH	-	-	-	-	-	-	-	0.4	1.7	41.9	56.0	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G22	16.19		921.27		921.27	Upper Glaciolacustrine	-	34.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G24	16.71		920.75		920.75	Middle Glacial Till	-	16.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G25	17.47		919.99		919.99	Middle Glacial Till	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G26	17.68		919.78		919.78	Middle Glacial Till	-	9.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G27	17.74		919.72		919.72	Middle Glacial Till	-	9.0	CL	22	14	8	-0.63	CL	-	-	-	-	-	-	-	19.0	35.3	33.8	12.0	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G28	18.08		919.38		919.38	Middle Glacial Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G29	18.35		919.11		919.11	Middle Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G30	18.72		918.74		918.74	Lower Glaciolacustrine	-	12.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G31	19.09		918.37		918.37	Lower Glaciolacustrine	-	16.9	CL	29	14	15	0.19	CL	-	-	-	-	-	-	-	4.8	15.4	57.7	22.0	0.002	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G32	19.60		917.86		917.86	Lower Glaciolacustrine	-	17.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G33	20.88		916.58		916.58	Lower Glaciofluvial	-	11.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-06	Dam Breach Area	Grab	G34	21.49		915.97		915.97	Lower Glaciofluvial	-	10.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G1	2.14		929.56		929.56	Tailings	-	20.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G2	2.44		929.26		929.26	Upper Glacial Till	-	14.2	CL	28	13	15	0.08	CL	-	-	-	-	-	-	-	8.7	35.9	36.3	19.2	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G3	2.75		928.95		928.95	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G4	3.20		928.50		928.50	Upper Glacial Till	-	10.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G5	3.66		928.04		928.04	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G7	4.42		927.28		927.28	Upper Glacial Till	-	9.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G8	5.03		926.67		926.67	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G9	5.28		926.42		926.42	Upper Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G10	5.43		926.27		926.27	Upper Glacial Till	-	9.5	CL	21	12	9	-0.28	CL	-	-	-	-	-	-	-	22.5	34.8	29.6	13.1	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G11	5.73		925.97		925.97	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G12	6.04		925.66		925.66	Upper Glacial Till	-	9.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G14	6.53		925.17		925.17	Upper Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G15	6.92		924.78		924.78	Upper Glacial Till	-	14.0	CL	29	12	17	0.12	CL	-	-	-	-	-	-	-	10.4	28.3	35.8	25.5	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G16	7.17		924.53		924.53	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G17	7.81		923.89		923.89	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G18	8.33		923.37		923.37	Upper Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G19A	8.54		923.16		923.16	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G19	8.65		923.05		923.05	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G21	9.15		922.55		922.55	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G21A	9.36		922.34		922.34	Upper Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G22	9.70		922.00		922.00	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G23	10.21		921.49		921.49	Upper Glacial Till	-	11.3	CL	22	12	10	-0.07	CL	-	-	-	-	-	-	-	13.7	37.5	33.7	15.1	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G24	10.46		921.24		921.24	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G25	10.85		920.85		920.85	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G26	11.22		920.48		920.48	Lower Glaciolacustrine	-	23.3	CI	38	19	19	0.23	CI	-	-	-	-	-	-	-	0.0	5.5	60.5	34.0	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G27	11.37		920.33		920.33	Lower Glaciolacustrine	-	23.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G28	11.74		919.96		919.96	Lower Glaciolacustrine	-	22.5	CI	37	20	17	0.15	CI	-	-	-	-	-	-	-	0.0	3.3	62.0	34.7	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G29	11.95		919.75		919.75	Lower Glaciolacustrine	-	22.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G30	12.26		919.44		919.44	Lower Glaciofluvial	-	10.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G31	12.90		918.80		918.80	Lower Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G32	13.14		918.56		918.56	Lower Glacial Till	-	8.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G33	13.51		918.19		918.19	Lower Glacial Till	-	8.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G33A	13.66		918.04		918.04	Lower Glacial Till	-	9.5	SC	24	13	11	-0.32	CL	-	-	-	-	-	-	-	11.9	48.0	27.6	12.5	0.002	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G34	14.48		917.22		917.22	Weathered Bedrock (Volcanic)	-	16.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-07	Dam Breach Area	Grab	G35	16.77		914.93		914.93	Weathered Bedrock (Volcanic)	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G1	20.22		927.33		927.33	Upper Glacial Till	-	13.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G2	20.37		927.18		927.18	-	-	17.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G2A	21.21		926.34		926.34	-	-	23.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G3	20.90		926.65		926.65	-	-	23.2	CI	34	18	16	0.33	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G4	21.29		926.26		926.26	Upper Glacial Till	-	10.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G5	21.90		925.65		925.65	Upper Glacial Till	-	11.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-08	Dam Breach Area	Grab	G6	22.20		925.35		925.35	Upper Glacial Till	-	10.7	SC	25	12	13	-0.10	CL	-	-	-	-	-	-	-	15.3	36.6	31.6	16.5	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G6A	22.35		925.20		925.20	Upper Glacial Till	-	11.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G7	22.81		924.74		924.74	Upper Glacial Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G8	23.42		924.13		924.13	Upper Glacial Till	-	13.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G9	23.88		923.67		923.67	Upper Glacial Till	-	14.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G10	23.88		923.67		923.67	Upper Glaciolacustrine	-	36.4	CH	63	20	43	0.38	CH	-	-	-	-	-	-	-	5.7	10.6	20.9	62.8	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G11	24.18		923.37		923.37	Upper Glacial Till	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G13	24.79		922.76		922.76	Upper Glacial Till	-	13.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G14	25.25		922.30		922.30	Upper Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G15	25.40		922.15		922.15	Upper Glacial Till	-	9.2	CL	24	15	9	-0.64	CL	-	-	-	-	-	-	-	8.2	33.4	42.6	15.8	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G16	27.99		919.56		919.56	Middle Glacial Till	-	9.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G17	28.14		919.41		919.41	Middle Glacial Till	-	9.5	CL	23	14	9	-0.50	CL	-	-	-	-	-	-	-	10.8	35.0	39.7	14.5	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G18	28.91		918.64		918.64	Middle Glacial Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G19	28.45		919.10		919.10	Middle Glacial Till	-	10.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G20	29.76		917.79		917.79	Middle Glacial Till	-	9.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G22	30.35		917.20		917.20	Middle Glacial Till	-	6.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G23	30.89		916.66		916.66	Middle Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G24	31.44		916.11		916.11	Middle Glacial Till	-	7.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G25	31.55		916.00		916.00	Middle Glacial Till	-	7.5	SM	18	14	4	-1.63	ML	-	-	-	-	-	-	-	18.6	55.8	18.6	7.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G26	32.16		915.39		915.39	Middle Glacial Till	-	4.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G27	32.65		914.90		914.90	Middle Glacial Till	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G28	32.92		914.63		914.63	Middle Glacial Till	-	10.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G30	33.68		913.87		913.87	Upper Glaciofluvial	-	11.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G31	34.17		913.38		913.38	Upper Glaciofluvial	-	20.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G32	34.39		913.16		913.16	Upper Glaciofluvial	-	21.0	SP	27	20	7	0.14	CL-ML	-	-	-	-	-	-	-	0.0	6.7	76.3	17.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G33	34.81		912.74		912.74	Upper Glaciofluvial	-	24.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G34	35.15		912.40		912.40	Upper Glaciofluvial	-	18.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G35	36.73		910.82		910.82	Lower Glacial Till	-	13.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G36	37.19		910.36		910.36	Lower Glacial Till	-	7.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G37	37.65		909.90		909.90	Lower Glacial Till	-	8.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G38	38.10		909.45		909.45	Lower Glacial Till	-	6.6	SM	20	14	6	-1.23	CL-ML	-	-	-	-	-	-	-	21.7	49.6	19.7	9.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G39	38.41		909.14		909.14	Lower Glacial Till	-	9.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G41	39.35		908.20		908.20	Lower Glacial Till	-	8.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G42	39.69		907.86		907.86	Lower Glacial Till	-	8.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G43	40.02		907.53		907.53	Lower Glacial Till	-	10.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G44	40.36		907.19		907.19	Lower Glacial Till	-	6.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G45	40.79		906.76		906.76	Lower Glacial Till	-	8.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G46	41.00		906.55		906.55	Lower Glacial Till	-	8.8	CL	29	14	15	-0.35	CL	-	-	-	-	-	-	-	9.0	37.2	36.8	17.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G47	41.21		906.34		906.34	Lower Glacial Till	-	8.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G48	41.55		906.00		906.00	Lower Glacial Till	-	6.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G49	42.10		905.45		905.45	Lower Glacial Till	-	25.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G51	42.55		905.00		905.00	Weathered Bedrock (Sedimentary)	-	27.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G52	43.10		904.45		904.45	Weathered Bedrock (Sedimentary)	-	25.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G53	43.56		903.99		903.99	Weathered Bedrock (Sedimentary)	-	27.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G54	43.80		903.75		903.75	Weathered Bedrock (Sedimentary)	-	31.6	CH	77	28	49	0.07	CH	-	-	-	-	-	-	-	0.0	10.6	62.3	27.1	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G55	44.23		903.32		903.32	Weathered Bedrock (Sedimentary)	-	29.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G56	44.93		902.62		902.62	Weathered Bedrock (Sedimentary)	-	37.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G57	45.14		902.41		902.41	Weathered Bedrock (Sedimentary)	-	32.5	CH	69	34	35	-0.04	CH	-	-	-	-	-	-	-	0.0	14.6	62.4	23.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G58	45.60		901.95		901.95	Weathered Bedrock (Sedimentary)	-	43.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G59	46.27		901.28		901.28	Weathered Bedrock (Sedimentary)	-	41.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G60	46.73		900.82		900.82	Weathered Bedrock (Sedimentary)	-	46.8	CH	150	56	94	-0.10	CH	-	-	-	-	-	-	-	0.0	2.4	37.1	60.5	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G61	46.94		900.61		900.61	Weathered Bedrock (Sedimentary)	-	43.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G62	47.10		900.45		900.45	Weathered Bedrock (Sedimentary)	-	37.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G63	47.40		900.15		900.15	Weathered Bedrock (Sedimentary)	-	46.7	CH	137	37	100	0.10	CH	-	-	-	-	-	-	-	0.0	3.4	40.6	56.0	0.002	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G64	47.96		899.59		899.59	Weathered Bedrock (Sedimentary)	-	44.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G65	48.41		899.14		899.14	Weathered Bedrock (Sedimentary)	-	28.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G66	49.18		898.37		898.37	Weathered Bedrock (Sedimentary)	-	37.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G67	49.63		897.92		897.92	Weathered Bedrock (Sedimentary)	-	38.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G70	51.16		896.39		896.39	Weathered Bedrock (Sedimentary)	-	23.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G71	51.77		895.78		895.78	Weathered Bedrock (Sedimentary)	-	34.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G72	52.28		895.27		895.27	Weathered Bedrock (Sedimentary)	-	44.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G73	52.89		894.66		894.66	Weathered Bedrock (Sedimentary)	-	41.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G74	53.50		894.05		894.05	Weathered Bedrock (Sedimentary)	-	25.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G75	54.11		893.44		893.44	Weathered Bedrock (Sedimentary)	-	35.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08	Dam Breach Area	Grab	G76	54.72		892.83		892.83	Weathered Bedrock (Sedimentary)	-	52.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G1	25.06		922.55		922.55	Upper Glacial Till	-	15.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G2	25.40		922.21		922.21	Upper Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G3	25.77		921.84		921.84	Upper Glacial Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G4	26.10		921.51		921.51	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G5	26.47		921.14		921.14	Upper Glacial Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G5A	26.62		920.99		920.99	Upper Glacial Till	-	11.9	CL	22	12	10	-0.01	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G6	26.71		920.90		920.90	Upper Glaciolacustrine	-	26.2	CH	68	21	47	0.11	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G6A	26.80		920.81		920.81	Upper Glacial Till	-	14.4	CL	29	12	17	0.14	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G7	27.29		920.32		920.32	Upper Glacial Till	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G8	27.62		919.99		919.99	Middle Glacial Till	-	9.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G9	27.99		919.62		919.62	Middle Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G10	28.33		919.28		919.28	Middle Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G11	28.69		918.92		918.92	Middle Glacial Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-08A	Dam Breach Area	Grab	G12	29.03		918.58		918.58	Middle Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G2	10.21		927.76		927.76	Upper Glacial Till	-	21.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G3	10.67		927.30		927.30	Upper Glacial Till	-	15.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G4	11.37		926.60		926.60	Upper Glacial Till	-	13.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G6	11.98		925.99		925.99	Upper Glacial Till	-	11.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G7	12.37		925.60		925.60	Upper Glacial Till	-	12.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G8	12.74		925.23		925.23	Upper Glacial Till	-	8.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G9	13.14		924.83		924.83	Upper Glacial Till	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G10	13.26		924.71		924.71	Upper Glacial Till	-	10.4	SC	23	11	12	-0.05	CL	-	-	-	-	-	-	-	17.4	40.9	28.6	13.1	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G11	13.66		924.31		924.31	Upper Glacial Till	-	8.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G12	14.39		923.58		923.58	Upper Glacial Till	-	9.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G13	14.72		923.25		923.25	Upper Glacial Till	-	11.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G15	15.30		922.67		922.67	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G16	15.88		922.09		922.09	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G17	16.25		921.72		921.72	Upper Glacial Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G18	16.64		921.33		921.33	Upper Glacial Till	-	12.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G19	16.82		921.15		921.15	Upper Glacial Till	-	13.7	CL	21	12	9	0.19	CL	-	-	-	-	-	-	-	5.0	40.2	39.6	15.2	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G20	17.45		920.52		920.52	Upper Glacial Till	-	16.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G21	17.83		920.14		920.14	Upper Glacial Till	-	15.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G22B	18.20		919.77		919.77	Upper Glaciolacustrine	-	27.9	CI	46	17	29	0.38	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G22	18.23		919.74		919.74	Upper Glaciolacustrine	-	29.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G22A	18.35		919.62		919.62	Upper Glaciolacustrine	-	32.0	CI	53	19	34	0.38	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G23	18.84		919.13		919.13	Middle Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G24	19.23		918.74		918.74	Middle Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G24A	19.35		918.62		918.62	Middle Glacial Till	-	12.9	CL	25	15	10	-0.21	CL	-	-	-	-	-	-	-	5.4	33.0	45.9	15.7	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G25	19.60		918.37		918.37	Middle Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G26	20.48		917.49		917.49	Middle Glacial Till	-	9.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G27	20.82		917.15		917.15	Middle Glacial Till	-	9.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G28	21.18		916.79		916.79	Middle Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G29	21.52		916.45		916.45	Middle Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G30	21.88		916.09		916.09	Middle Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G31	22.22		915.75		915.75	Lower Glaciolacustrine	-	20.1	CI	42	23	19	-0.15	CI	-	-	-	-	-	-	-	0.7	4.9	61.9	32.6	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G32	22.71		915.26		915.26	Lower Glaciolacustrine	-	21.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-09	Dam Breach Area	Grab	G34	23.32		914.65		914.65	Lower Glaciolacustrine	-	25.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G35	23.44		914.53		914.53	Lower Glaciolacustrine	-	24.5	CI	33	20	13	0.35	CI	-	-	-	-	-	-	-	0.0	6.5	73.4	20.1	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G36	23.77		914.20		914.20	Lower Glaciolacustrine	-	22.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G37	24.96		913.01		913.01	Upper Glaciofluvial	-	23.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G38	25.24		912.73		912.73	Upper Glaciofluvial	-	23.7	ML	26	21	5	0.54	CL-ML	-	-	-	-	-	-	-	0.0	9.9	78.7	11.4	0.002	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G39	25.51		912.46		912.46	Upper Glaciofluvial	-	24.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G40	27.40		910.57		910.57	Upper Glaciofluvial	-	23.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G41	28.44		909.53		909.53	Weathered Bedrock (Sedimentary)	-	22.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G42	29.05		908.92		908.92	Weathered Bedrock (Sedimentary)	-	29.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G43	29.29		908.68		908.68	Weathered Bedrock (Sedimentary)	-	41.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G44	29.96		908.01		908.01	Weathered Bedrock (Sedimentary)	-	41.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G45	30.78		907.19		907.19	Weathered Bedrock (Sedimentary)	-	31.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G46	31.61		906.36		906.36	Weathered Bedrock (Sedimentary)	-	53.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G47	32.22		905.75		905.75	Weathered Bedrock (Sedimentary)	-	49.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G48	32.83		905.14		905.14	Weathered Bedrock (Sedimentary)	-	54.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G49	33.44		904.53		904.53	Weathered Bedrock (Sedimentary)	-	41.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G50	34.05		903.92		903.92	Weathered Bedrock (Sedimentary)	-	54.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G51	54.25		883.72		883.72	Weathered Bedrock (Sedimentary)	-	50.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G52	55.93		882.04		882.04	Weathered Bedrock (Sedimentary)	-	46.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-09	Dam Breach Area	Grab	G53	57.39		880.58		880.58	Weathered Bedrock (Sedimentary)	-	29.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G1	5.03		927.12		927.12	Upper Glacial Till	-	13.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G2	5.58		926.57		926.57	Upper Glacial Till	-	11.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G4	6.34		925.81		925.81	Upper Glacial Till	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G5	6.95		925.20		925.20	Upper Glacial Till	-	12.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G6	7.22		924.93		924.93	Upper Glacial Till	-	11.4	SC	24	12	12	-0.05	CI	-	-	-	-	-	-	-	19.6	33.6	29.8	17.0	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G7	7.59		924.56		924.56	Upper Glacial Till	-	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G8	8.32		923.83		923.83	Upper Glacial Till	-	12.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G10	9.08		923.07		923.07	Upper Glacial Till	-	12.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G11	9.84		922.31		922.31	Upper Glacial Till	-	10.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G12	10.21		921.94		921.94	Upper Glacial Till	-	11.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G13	10.66		921.49		921.49	Upper Glacial Till	-	10.8	SC	23	14	9	-0.36	CL	-	-	-	-	-	-	-	20.5	42.2	22.3	15.0	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G14	11.16		920.99		920.99	Upper Glaciolacustrine	-	19.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G15	11.28		920.87		920.87	Upper Glaciolacustrine	-	35.0	CH	39	16	23	0.83	CH	-	-	-	-	-	-	-	0.0	1.0	59.6	39.4	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G16	11.43		920.72		920.72	Upper Glaciolacustrine	-	31.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G17	11.73		920.42		920.42	Upper Glaciolacustrine	-	35.7	CH	60	20	40	0.39	CH	-	-	-	-	-	-	-	0.0	0.9	40.6	58.5	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G18	11.89		920.26		920.26	Upper Glaciolacustrine	-	42.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G19	12.19		919.96		919.96	Upper Glaciolacustrine	-	30.4	CH	46	16	30	0.48	CH	-	-	-	-	-	-	-	0.0	9.5	44.3	46.2	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G20	12.34		919.81		919.81	Upper Glaciolacustrine	-	43.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G21	12.50		919.65		919.65	Upper Glaciolacustrine	-	48.7	CH	69	20	49	0.59	CH	-	-	-	-	-	-	-	0.0	1.8	31.5	66.7	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G22	12.59		919.56		919.56	Upper Glaciolacustrine	-	53.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G23	13.41		918.74		918.74	Middle Glacial Till	-	11.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G24	15.09		917.06		917.06	Lower Glaciolacustrine	-	22.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G25	15.24		916.91		916.91	Lower Glaciolacustrine	-	15.6	CI	42	15	27	0.02	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G26	15.54		916.61		916.61	Lower Glaciolacustrine	-	19.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G27	15.85		916.30		916.30	Lower Glaciolacustrine	-	20.7	CI	31	17	14	0.26	CI	-	-	-	-	-	-	-	0.0	3.4	72.3	24.3	0.002	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G28	16.00		916.15		916.15	Lower Glaciolacustrine	-	15.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G29	16.76		915.39		915.39	Lower Glacial Till	-	18.3	SC	46	16	30	0.08	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G30	17.07		915.08		915.08	Lower Glacial Till	-	23.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G31	17.22		914.93		914.93	Lower Glacial Till	-	22.9	SC	44	15	29	0.27	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G32	17.53		914.62		914.62	Lower Glacial Till	-	19.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G33	18.14		914.01		914.01	Lower Glacial Till	-	15.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10	Dam Breach Area	Grab	G35	18.93		913.22		913.22	Lower Glacial Till	-	14.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-10A	Dam Breach Area	Grab	G12	9.73		921.23		921.23	Upper Glacial Till	-	11.5	CL	24	13	11	-0.14	CL	-	-	-	-	-	-	-	17.7	36.1	29.1	17.1	0.002	TXP, TXCU
2014	KCB	SH14-10A	Dam Breach Area	Grab	G10 (Clay Portion)	10.59		920.37		920.37	Upper Glaciolacustrine	-	30.4	CI	40	18	22	0.56	CI	-	-	-	-	-	-	-	2.4	7.8	48.3	41.6	0.002	-
2014	KCB	SH14-10A	Dam Breach Area	Grab	G10 (Silt Portion)	10.59		920.37		920.37	Upper Glacial Till	-	30.4	CL	28	14	14	1.17	CL	-	-	-	-	-	-	-	13.9	25.9	35.1	25.1	0.002	TXP, TXCU
2014	KCB	SH14-10A	Dam Breach Area	Grab	G6	11.74		919.22		919.22	Upper Glaciolacustrine	-	34.9	CI	48	20	28	0.53	CI	-	-	-	-	-	-	-	0.0	2.7	47.4	49.9	0.002	DS, DSS
2014	KCB	SH14-10A	Dam Breach Area	Grab	G14	13.20		917.76		917.76	Middle Glacial Till	2.76	11.3	SC	20	15	5	-0.74	CL-ML	-	-	-	-	-	-	-	10.3	47.0	31.2	11.5	0.002	TXP, TXCU
2014	KCB	SH14-10A	Dam Breach Area	Grab	G17	15.64		915.32		915.32	Lower Glaciolacustrine	2.75	21.0	CI	35	19	16	0.13	CI	-	-	-	-	-	-	-	0.0	3.5	68.5	28.0	0.002	OD, DS
2014	KCB	SH14-11	Dam Breach Area	Grab	GI	2.26		928.71		928.71	Upper Glacial Till	-	23.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G2	3.63		927.34		927.34	Upper Glacial Till	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G3	3.93		927.04		927.04	Upper Glacial Till	-	11.4	CL	26	16	10	-0.46	CL	-	-	-	-	-	-	-	8.9	37.2	38.2	15.7	0.002	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G4	4.39		926.58		926.58	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G5	5.15		925.82		925.82	Upper Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G6	5.76		925.21		925.21	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G7	6.43		924.54		924.54	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G9	8.66		922.31		922.31	Upper Glacial Till	-	13.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G10	8.81		922.16		922.16	Upper Glacial Till	-	12.9	CL-ML	21	14	7	-0.16	CL-ML	-	-	-	-	-	-	-	10.8	33.9	42.3	13.0	0.002	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G11	9.11		921.86		921.86	Upper Glacial Till	-	9.9	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G12	9.42		921.55		921.55	Upper Glacial Till	-	11.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G14	10.94		920.03		920.03	Middle Glacial Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G15	11.34		919.63		919.63	Middle Glacial Till	-	10.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G17	12.13		918.84		918.84	Lower Glacial Till	-	10.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G18	12.80		918.17		918.17	Lower Glacial Till	-	14.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11	Dam Breach Area	Grab	G19	13.59		917.38		917.38	Lower Glacial Till	-	11.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	14.1	51.5	23.8	10.5	0.002	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G1	1.68		929.49		929.49	Tailings	-	22.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G3	2.72		928.45		928.45	Upper Glacial Till	-	15.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G4	3.20		927.97		927.97	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G6	3.97		927.20		927.20	Upper Glacial Till	-	10.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G7	4.61		926.56		926.56	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G8	5.25		925.92		925.92	Upper Glacial Till	-	10.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G9	5.58		925.59		925.59	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G10	6.04		925.13		925.13	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G12	6.77		924.40		924.40	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G14	7.23		923.94		923.94	Upper Glacial Till	-	7.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G15	8.33		922.84		922.84	Upper Glacial Till	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G16	8.69		922.48		922.48	Upper Glacial Till	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G17	9.21		921.96		921.96	Upper Glacial Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G18	9.70		921.47		921.47	Middle Glacial Till	-	16.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G18A	9.76		921.41		921.41	Middle Glacial Till	-	15.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	8.6	43.7	47.7		-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G19	10.21		920.96		920.96	Middle Glacial Till	-	13.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G20	10.73		920.44		920.44	Middle Glacial Till	-	11.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G20A	11.25		919.92		919.92	Middle Glacial Till	-	12.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G21	11.40		919.77		919.77	Middle Glacial Till	-	21.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G22	11.65		919.52		919.52	Upper Glaciofluvial	-	10.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G23	12.35		918.82		918.82	Lower Glacial Till	-	11.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G24	12.93		918.24		918.24	Lower Glacial Till	-	12.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G25	13.48		917.69		917.69	Lower Glacial Till	-	11.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-11B	Dam Breach Area	Grab	G26	13.96		917.21		917.21	Lower Glacial Till	-	-	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G1	1.25		929.52		929.52	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G3	2.59		928.18		928.18	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G5	3.05		927.72		927.72	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G6	3.51		927.26		927.26	Upper Glacial Till	-	8.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G7	3.66		927.11		927.11	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G9	4.57		926.20		926.20	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G9A	5.27		925.50		925.50	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G10	5.64		925.13		925.13	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G12	6.28		924.49		924.49	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G13	6.80		923.97		923.97	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G14	7.16		923.61		923.61	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G16	8.32		922.45		922.45	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G17	8.69		922.08		922.08	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-12	Dam Breach Area	Grab	G19	9.85		920.92		920.92	Middle Glacial Till	-	8.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G21	10.73		920.04		920.04	Middle Glacial Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G22	11.37		919.40		919.40	Middle Glacial Till	-	9.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G24	12.13		918.64		918.64	Middle Glacial Till	-	8.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G25	12.74		918.03		918.03	Middle Glacial Till	-	7.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G27	13.50		917.27		917.27	Middle Glacial Till	-	7.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G28	14.39		916.38		916.38	Middle Glacial Till	-	8.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G30	15.18		915.59		915.59	Middle Glacial Till	-	5.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G31	15.54		915.23		915.23	Middle Glacial Till	-	16.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G32	15.91		914.86		914.86	Middle Glacial Till	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G34	16.95		913.82		913.82	Middle Glacial Till	-	9.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G35	17.71		913.06		913.06	Middle Glacial Till	-	10.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G37	18.68		912.09		912.09	Middle Glacial Till	-	10.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G38	19.23		911.54		911.54	Lower Glacial Till	-	4.7	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-12	Dam Breach Area	Grab	G40	20.09		910.68		910.68	Lower Glacial Till	-	11.3	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G1	2.80		930.26		930.26	Upper Glacial Till	-	13.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G3	3.23		929.83		929.83	Upper Glacial Till	-	13.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G4	3.78		929.28		929.28	Upper Glacial Till	-	10.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G6	4.36		928.70		928.70	Upper Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G7	4.85		928.21		928.21	Upper Glacial Till	-	12.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G8	5.27		927.79		927.79	Upper Glacial Till	-	8.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	GI0	6.16		926.90		926.90	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G11	7.04		926.02		926.02	Upper Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G13	7.68		925.38		925.38	Upper Glacial Till	-	9.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G14	8.32		924.74		924.74	Upper Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G16	9.20		923.86		923.86	Upper Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G17	9.85		923.21		923.21	Upper Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G19	10.85		922.21		922.21	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G20	11.31		921.75		921.75	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G22	12.34		920.72		920.72	Upper Glacial Till	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G23	12.50		920.56		920.56	Upper Glacial Till	-	9.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G25	13.87		919.19		919.19	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G26	14.45		918.61		918.61	Upper Glacial Till	-	2.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G27	14.78		918.28		918.28	Upper Glacial Till	-	18.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G29	16.03		917.03		917.03	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G30	16.79		916.27		916.27	Upper Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G31	17.07		915.99		915.99	Glaciolacustrine[1]	-	22.4	CI	42	22	20	0.02	CI	-	-	-	-	-	-	-	0.0	8.3	56.1	35.6	0.002	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G32	17.83		915.23		915.23	Glaciolacustrine[1]	-	23.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G33	18.04		915.02		915.02	Glaciolacustrine[1]	-	25.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G34	18.14		914.92		914.92	Glaciolacustrine[1]	-	24.1	CI	49	22	27	0.08	CI	-	-	-	-	-	-	-	0.0	1.1	51.6	47.3	0.002	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G35	18.59		914.47		914.47	Upper Glaciofluvial	-	21.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G37	19.96		913.10		913.10	Upper Glaciofluvial	-	20.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G40	21.18		911.88		911.88	Lower Glaciofluvial	-	22.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G41	21.64		911.42		911.42	Lower Glaciofluvial	-	23.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G43	22.25		910.81		910.81	Lower Glaciofluvial	-	16.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G44	23.01		910.05		910.05	Lower Glaciofluvial	-	7.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G45	23.90		909.16		909.16	Lower Glaciofluvial	-	8.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G46	25.24		907.82		907.82	Lower Glaciofluvial	-	19.5	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G48	26.88		906.18		906.18	Lower Glaciofluvial	-	14.1	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G50	27.80		905.26		905.26	Lower Glacial Till	-	6.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G51	28.29		904.77		904.77	Lower Glacial Till	-	7.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G53	29.32		903.74		903.74	Lower Glacial Till	-	5.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G54	29.90		903.16		903.16	Lower Glacial Till	-	16.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G56	30.54		902.52		902.52	Lower Glacial Till	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G57	30.97		902.09		902.09	Lower Glacial Till	-	13.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G58	31.42		901.64		901.64	Lower Glacial Till	-	8.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-13	Perimeter Embankment	Grab	G60	32.40		900.66		900.66	Lower Glacial Till	-	9.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G3	3.20		926.92		926.92	Upper Glacial Till	-	10.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G4	3.66		926.46		926.46	Upper Glacial Till	-	10.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G5	4.51		925.61		925.61	Upper Glacial Till	-	10.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G6	4.57		925.55		925.55	Upper Glacial Till	-	11.5	SC	25	17	8	-0.69	CL	-	-	-	-	-	-	-	17.6	35.5	33.9	13.0	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G7	5.30		924.82		924.82	Upper Glacial Till	-	14.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G9	6.13		923.99		923.99	Upper Glacial Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	GI0	6.83		923.29		923.29	Upper Glacial Till	-	9.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	GII	7.77		922.35		922.35	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G12	8.32		921.80		921.80	Upper Glacial Till	-	21.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G13	8.69		921.43		921.43	Upper Glacial Till	-	12.6	CL	23	14	9	-0.16	CL	-	-	-	-	-	-	-	6.7	40.5	36.7	16.1	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G14	9.02		921.10		921.10	Upper Glacial Till	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G15	9.91		920.21		920.21	Upper Glaciolacustrine	-	27.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G16	10.00		920.12		920.12	Upper Glaciolacustrine	-	24.9	CI	47	19	28	0.21	CI	-	-	-	-	-	-	-	2.3	17.8	28.7	51.2	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G18	10.27		919.85		919.85	Upper Glaciolacustrine	-	21.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G19	10.55		919.57		919.57	Middle Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G20	11.37		918.75		918.75	Middle Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G21	11.73		918.39		918.39	Middle Glacial Till	-	13.2	CL	27	17	10	-0.38	CL	-	-	-	-	-	-	-	8.2	31.9	43.9	16.0	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G22	12.07		918.05		918.05	Middle Glacial Till	-	12.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G23	12.89		917.23		917.23	Middle Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G24	13.32		916.80		916.80	Lower Glaciolacustrine	-	25.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G25	13.35		916.77		916.77	Lower Glaciolacustrine	-	24.0	CI	33	20	13	0.31	CI	-	-	-	-	-	-	-	0.1	6.9	63.1	29.9	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G26	14.94		915.18		915.18	Upper Glaciofluvial	-	14.9	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G27	15.09		915.03		915.03	Lower Glaciofluvial	-	7.9	GP	-	-	-	-	-	-	-	-	-	-	-	-	46.8	43.5	9.7	0.0	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G28	16.15		913.97		913.97	Lower Glacial Till	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G29	17.07		913.05		913.05	Weathered Bedrock (Sedimentary)	-	38.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G30	17.71		912.41		912.41	Weathered Bedrock (Sedimentary)	-	54.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G31	17.98		912.14		912.14	Weathered Bedrock (Sedimentary)	-	41.0	CH	103	41	62	0.00	CH	-	-	-	-	-	-	-	3.5	30.7	21.4	44.3	0.002	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G32	18.44		911.68		911.68	Weathered Bedrock (Sedimentary)	-	56.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G33	18.68		911.44		911.44	Weathered Bedrock (Sedimentary)	-	54.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G34	19.32		910.80		910.80	Weathered Bedrock (Sedimentary)	-	50.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G35	20.09		910.03		910.03	Weathered Bedrock (Sedimentary)	-	53.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G36	20.94		909.18		909.18	Weathered Bedrock (Sedimentary)	-	47.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G37	21.52		908.60		908.60	Weathered Bedrock (Sedimentary)	-	42.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G38	22.04		908.08		908.08	Weathered Bedrock (Sedimentary)	-	41.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G39	23.32		906.80		906.80	Weathered Bedrock (Sedimentary)	-	36.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-14	Dam Breach Area	Grab	G40	23.32		906.80		906.80	Weathered Bedrock (Sedimentary)	-	38.8	CH	116	36	80	0.04	CH	-	-	-	-	-	-	-	0.8	13.0	38.7	47.5	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G1	2.99		927.20		927.20	Upper Glacial Till	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G3	3.63		926.56		926.56	Upper Glacial Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G5	4.45		925.74		925.74	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G6	5.27		924.92		924.92	Upper Glacial Till	-	8.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G7	5.88		924.31		924.31	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G8	5.91		924.28		924.28	Upper Glacial Till	-	11.7	CL	24	12	12	-0.03	CL	-	-	-	-	-	-	-	12.0	38.1	33.7	16.2	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G9	6.92		923.27		923.27	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G10	7.56		922.63		922.63	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G12A	8.08		922.11		922.11	Upper Glaciolacustrine	-	29.3	CI	47	20	27	0.34	CI	-	-	-	-	-	-	-	0.5	2.0	48.8	48.7	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G12	8.35		921.84		921.84	Upper Glaciolacustrine	-	20.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G13	8.63		921.56		921.56	Upper Glacial Till	-	17.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G14	8.99		921.20		921.20	Upper Glacial Till	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G15	9.17		921.02		921.02	Upper Glacial Till	-	20.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G16	9.45		920.74		920.74	Upper Glaciolacustrine	-	31.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G17A	9.71		920.48		920.48	Upper Glaciolacustrine	-	33.2	CI	40	20	20	0.66	CI	-	-	-	-	-	-	-	0.2	19.0	34.2	46.6	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G17	9.75		920.44		920.44	Upper Glacial Till	-	15.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G18	10.09		920.10		920.10	Upper Glaciolacustrine	-	33.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G19	10.30		919.89		919.89	Middle Glacial Till	-	18.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-15	Dam Breach Area	Grab	G20	10.58		919.61		919.61	Middle Glacial Till	-	16.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G21	10.85		919.34		919.34	Lower Glaciolacustrine	-	24.2	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G22	11.13		919.06		919.06	Lower Glaciolacustrine	-	23.8	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G23	11.73		918.46		918.46	Lower Glaciolacustrine	-	24.8	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G24	11.80		918.39		918.39	Lower Glaciolacustrine	-	25.9	Cl	35	20	15	0.39	Cl	-	-	-	-	-	-	-	1.4	10.5	61.6	26.5	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G27	13.14		917.05		917.05	Lower Glaciolacustrine	-	23.8	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G28	13.56		916.63		916.63	Lower Glaciolacustrine	-	22.0	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G29	14.42		915.77		915.77	Lower Glaciolacustrine	-	25.1	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G30	14.48		915.71		915.71	Lower Glaciolacustrine	-	27.5	Cl	41	23	18	0.25	Cl	-	-	-	-	-	-	-	0.0	3.7	59.5	36.8	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G30A	14.78		915.41		915.41	Lower Glaciolacustrine	-	29.5	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G31	15.18		915.01		915.01	Lower Glaciolacustrine	-	26.7	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G33	16.46		913.73		913.73	Upper Glaciofluvial	-	22.4	CL	29	22	7	0.06	CL	-	-	-	-	-	-	-	2.6	9.9	75.0	12.5	0.002	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G34	16.82		913.37		913.37	Upper Glaciofluvial	-	21.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G35	18.44		911.75		911.75	Weathered Bedrock (Sedimentary)	-	25.5	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G36	19.96		910.23		910.23	Weathered Bedrock (Sedimentary)	-	27.3	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G37	21.58		908.61		908.61	Weathered Bedrock (Sedimentary)	-	15.1	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-15	Dam Breach Area	Grab	G38	23.10		907.09		907.09	Weathered Bedrock (Sedimentary)	-	14.8	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G1	1.77		928.46		928.46	Upper Glacial Till	-	14.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G2	2.23		928.00		928.00	Upper Glacial Till	-	11.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G4	2.96		927.27		927.27	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G5	3.35		926.88		926.88	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G6	3.60		926.63		926.63	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G7	4.08		926.15		926.15	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G8	4.11		926.12		926.12	Upper Glacial Till	-	11.5	CL	25	13	12	-0.13	CL	-	-	-	-	-	-	-	17.8	32.4	34.1	15.8	0.002	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G9	4.75		925.48		925.48	Upper Glacial Till	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G10	5.27		924.96		924.96	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G12	5.97		924.26		924.26	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G12A	6.40		923.83		923.83	Upper Glacial Till	-	17.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G13	6.64		923.59		923.59	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G14	7.16		923.07		923.07	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G16	7.68		922.55		922.55	Middle Glacial Till	-	15.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G17	8.32		921.91		921.91	Middle Glacial Till	-	12.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G18	8.69		921.54		921.54	Middle Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G19	8.75		921.48		921.48	Middle Glacial Till	-	14.7	CL	27	17	10	-0.23	CL	-	-	-	-	-	-	-	5.0	32.7	43.2	19.0	0.002	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G20	9.33		920.90		920.90	Middle Glacial Till	-	12.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G21	9.85		920.38		920.38	Middle Glacial Till	-	18.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G22	10.45		919.78		919.78	Lower Glaciolacustrine	-	18.4	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G25	11.77		918.46		918.46	Lower Glaciolacustrine	-	23.6	Cl	32	18	14	0.40	Cl	-	-	-	-	-	-	-	0.4	6.3	67.3	26.0	0.002	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G26	12.34		917.89		917.89	Lower Glaciolacustrine	-	23.6	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G27	13.26		916.97		916.97	Lower Glacial Till	-	14.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G28	15.00		915.23		915.23	Weathered Bedrock (Sedimentary)	-	36.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G29	16.25		913.98		913.98	Weathered Bedrock (Sedimentary)	-	26.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G30	18.14		912.09		912.09	Weathered Bedrock (Sedimentary)	-	15.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G31	21.34		908.89		908.89	Weathered Bedrock (Sedimentary)	-	25.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-16	Dam Breach Area	Grab	G32	22.56		907.67		907.67	Weathered Bedrock (Volcanic)	-	31.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G1	2.23		927.34		927.34	Tailings	-	21.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G2	2.62		926.95		926.95	Upper Glacial Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G3	2.68		926.89		926.89	Upper Glacial Till	-	10.7	SC	26	14	12	-0.28	CL	-	-	-	-	-	-	-	16.5	36.4	31.1	16.0	0.002	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G4	3.14		926.43		926.43	Upper Glacial Till	-	11.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G5	3.69		925.88		925.88	Upper Glacial Till	-	10.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G6	4.33		925.24		925.24	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G8	4.60		924.97		924.97	Upper Glacial Till	-	15.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G9	5.30		924.27		924.27	Upper Glacial Till	-	14.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G10	5.45		924.12		924.12	Upper Glacial Till	-	14.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G11	5.88		923.69		923.69	Upper Glaciolacustrine	-	29.7	CH	56	21	35	0.25	CH	-	-	-	-	-	-	-	2.9	12.8	34.3	50.0	0.002	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G12	6.19		923.38		923.38	Middle Glacial Till	-	18.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G13	6.64		922.93		922.93	Middle Glacial Till	-	14.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G14	7.16		922.41		922.41	Middle Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G15	7.59		921.98		921.98	Middle Glacial Till	-	16.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G16	7.77		921.80		921.80	Middle Glacial Till	-	16.0	Cl	34	19	15	-0.20	Cl	-	-	-	-	-	-	-	2.9	10.9	62.2	24.0	0.002	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G17	8.32		921.25		921.25	Middle Glacial Till	-	15.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G18	8.69		920.88		920.88	Middle Glacial Till	-	14.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G19	9.24		920.33		920.33	Middle Glacial Till	-	14.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G21	9.85		919.72		919.72	Middle Glacial Till	-	20.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G22	10.21		919.36		919.36	Middle Glacial Till	-	17.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G23	10.70		918.87		918.87	Middle Glacial Till	-	17.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G25	11.40		918.17		918.17	Middle Glacial Till	-	15.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G26	11.80		917.77		917.77	Middle Glacial Till	-	19.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G27	12.22		917.35		917.35	Lower Glaciolacustrine	-	22.5	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G28	12.83		916.74		916.74	Lower Glaciolacustrine	-	23.3	Cl	41	21	20	0.12	Cl	-	-	-	-	-	-	-	0.0	1.3	66.7	32.0	0.002	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G29	13.01		916.56		916.56	Lower Glaciolacustrine	-	25.1	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G31	13.75		915.82		915.82	Upper Glaciofluvial	-	19.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G32	15.70		913.87		913.87	Weathered Bedrock (Mafic)	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-17	Dam Breach Area	Grab	G33	17.07		912.50		912.50	Weathered Bedrock (Mafic)	-	11.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G1	3.16		931.60		931.60	Dam Till Core	-	11.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G2	4.27		930.49		930.49	Upper Glacial Till	-	17.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G4	5.27		929.49		929.49	Upper Glacial Till	-	14.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G5	5.64		929.12		929.12	Upper Glacial Till	-	15.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G6	5.97		928.79		928.79	Upper Glacial Till	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G8	6.80		927.96		927.96	Upper Glacial Till	-	10.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G9	7.16		927.60		927.60	Upper Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G10	7.41		927.35		927.35	Upper Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G12	8.32		926.44		926.44	Upper Glacial Till	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G13	8.69		926.07		926.07	Upper Glacial Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G14	9.20		925.56		925.56	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G16	9.60		925.16		925.16	Upper Glacial Till	-	15.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G18	10.45		924.31		924.31	Upper Glacial Till	-	9.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G19	10.73		924.03		924.03	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G20	11.43		923.33		923.33	Upper Glaciofluvial	-	20.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G22	12.65		922.11		922.11	Lower Glaciofluvial	-	21.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G23	13.26		921.50		921.50	Lower Glaciofluvial	-	22.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G25	14.36		920.40		920.40	Lower Glaciofluvial	-	13.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G26	14.69		920.07		920.07	Lower Glaciofluvial	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G27	15.03		919.73		919.73	Lower Glaciofluvial	-	19.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G29	15.94		918.82		918.82	Lower Glacial Till	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G30	16.28		918.48		918.48	Lower Glacial Till	-	5.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G31	16.61		918.15		918.15	Lower Glacial Till	-	7.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G33	18.14		916.62		916.62	Lower Glacial Till	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G35	19.05		915.71		915.71	Lower Glacial Till	-	6.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G36	19.81		914.95		914.95	Weathered Bedrock (Sedimentary)	-	30.9	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G38	21.12		913.64		913.64	Weathered Bedrock (Sedimentary)	-	15.1	Cl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-18	Dam Breach Area	Grab	G39	24.17		910.59		910.59	Weathered Bedrock (Volcanic)	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G1	2.93		939.89		939.89	Glacial Till	-	16.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G3	3.66		939.16		939.16	Glacial Till	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G4	4.27		938.55		938.55	Glacial Till	-	12.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G5	5.27		937.55		937.55	Glacial Till	-	9.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G6	5.64		937.18		937.18	Glacial Till	-	10.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G7	6.13		936.69		936.69	Glacial Till	-	10.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G9	6.80		936.02		936.02	Glacial Till	-	11.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G10	7.41		935.41		935.41	Glacial Till	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G12	8.32		934.50		934.50	Glacial Till	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-19	Dam Breach Area	Grab	G13	8.69		934.13		934.13	Glacial Till	-	13.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G14	8.93		933.89		933.89	Glacial Till	-	13.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G16	9.85		932.97		932.97	Glacial Till	-	13.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G17	10.45		932.37		932.37	Glacial Till	-	15.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G18	10.45		932.37		932.37	Glacial Till	-	14.0	CL	28	17	11	-0.27	CL	-	-	-	-	-	-	-	11.9	27.2	47.1	13.7	0.002	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G19	11.40		931.42		931.42	Upper Glaciofluvial	-	14.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G21	12.92		929.90		929.90	Upper Glaciofluvial	-	11.9	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G22	13.47		929.35		929.35	Glacial Till	-	11.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G26	14.36		928.46		928.46	Glacial Till	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G27	14.90		927.92		927.92	Glacial Till	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G29	15.36		927.46		927.46	Glacial Till	-	8.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G30	16.15		926.67		926.67	Weathered Bedrock (Volcanic)	-	17.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G31	16.82		926.00		926.00	Weathered Bedrock (Volcanic)	-	18.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G32	18.01		924.81		924.81	Weathered Bedrock (Volcanic)	-	18.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-19	Dam Breach Area	Grab	G33	19.78		923.04		923.04	Weathered Bedrock (Volcanic)	-	22.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G1	10.22		959.70		959.70	Dam Till Core	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G3	11.32		958.60		958.60	Dam Till Core	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G4	12.02		957.90		957.90	Dam Till Core	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G6	12.72		957.20		957.20	Dam Till Core	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G7	13.22		956.70		956.70	Dam Till Core	-	11.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G8	13.52		956.40		956.40	Dam Till Core	-	9.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G9	13.82		956.10		956.10	Dam Till Core	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G10	14.42		955.50		955.50	Dam Till Core	-	8.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G11	15.02		954.90		954.90	Dam Till Core	-	8.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G13	15.92		954.00		954.00	Dam Till Core	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G14	16.52		953.40		953.40	Dam Till Core	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G16	17.52		952.40		952.40	Dam Till Core	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G17	18.12		951.80		951.80	Dam Till Core	-	14.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G19	19.02		950.90		950.90	Dam Till Core	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G20	19.42		950.50		950.50	Dam Till Core	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G21	20.02		949.90		949.90	Dam Till Core	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G22	20.52		949.40		949.40	Dam Till Core	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G23	20.92		949.00		949.00	Dam Till Core	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G24	21.42		948.50		948.50	Dam Till Core	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G25	22.12		947.80		947.80	Dam Till Core	-	7.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G26	22.82		947.10		947.10	Dam Till Core	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G27	23.42		946.50		946.50	Dam Till Core	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G28	23.82		946.10		946.10	Dam Till Core	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G29	24.32		945.60		945.60	Dam Till Core	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G30	25.12		944.80		944.80	Dam Till Core	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G31	25.82		944.10		944.10	Dam Till Core	-	10.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G33	28.02		941.90		941.90	Dam Till Core	-	8.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G35	28.80		941.12		941.12	Glacial Till	-	13.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G37	29.41		940.51		940.51	Glacial Till	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G38	29.96		939.96		939.96	Glacial Till	-	8.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G39	30.33		939.59		939.59	Glacial Till	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G41	31.49		938.43		938.43	Glacial Till	-	9.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G42	32.10		937.82		937.82	Glacial Till	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G44	32.92		937.00		937.00	Glacial Till	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G45	33.22		936.70		936.70	Glacial Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G46	33.62		936.30		936.30	Glacial Till	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G48	34.44		935.48		935.48	Glacial Till	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G49	34.75		935.17		935.17	Glacial Till	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G51	35.27		934.65		934.65	Glacial Till	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G52	35.45		934.47		934.47	Glacial Till	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G53	36.00		933.92		933.92	Glacial Till	-	13.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G54	36.30		933.62		933.62	Glacial Till	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G55	36.73		933.19		933.19	Glacial Till	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G57	37.49		932.43		932.43	Glacial Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G58	37.80		932.12		932.12	Glacial Till	-	13.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G59	38.25		931.67		931.67	Glacial Till	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G61	39.04		930.88		930.88	Glacial Till	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G63	39.84		930.08		930.08	Upper Glaciofluvial	-	18.1	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G64	40.78		929.14		929.14	Glacial Till	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G66	41.42		928.50		928.50	Glacial Till	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G67	42.18		927.74		927.74	Glacial Till	-	11.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G68	42.64		927.28		927.28	Glacial Till	-	8.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G70	43.07		926.85		926.85	Glacial Till	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G71	43.49		926.43		926.43	Glacial Till	-	13.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G72	44.14		925.78		925.78	Glacial Till	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G73	44.17		925.75		925.75	Glacial Till	-	11.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G75	45.14		924.78		924.78	Glacial Till	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G76	45.45		924.47		924.47	Glacial Till	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G77	45.72		924.20		924.20	Glacial Till	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G79	46.54		923.38		923.38	Glacial Till	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G80	47.21		922.71		922.71	Glacial Till	-	8.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G82	48.25		921.67		921.67	Glacial Till	-	14.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G84	48.77		921.15		921.15	Glacial Till	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G85	50.02		919.90		919.90	Weathered Bedrock (Volcanic)	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G86	51.88		918.04		918.04	Weathered Bedrock (Volcanic)	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-20	Dam Breach Area	Grab	G87	53.40		916.52		916.52	Weathered Bedrock (Volcanic)	-	16.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G3	32.71		936.20		936.20	Dam Filter	-	13.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G5	33.61		935.30		935.30	Dam Till Core	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G6	34.21		934.70		934.70	Dam Till Core	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G7	34.61		934.30		934.30	Dam Till Core	-	11.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G8	35.11		933.80		933.80	Dam Till Core	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G9	35.71		933.20		933.20	Dam Till Core	-	14.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G10	36.31		932.60		932.60	Dam Till Core	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G11	37.01		931.90		931.90	Dam Till Core	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G12	38.21		930.70		930.70	Dam Till Core	-	11.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G13	38.81		930.10		930.10	Dam Till Core	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G18	39.41		929.50		929.50	Dam Till Core	-	14.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G14	39.41		929.50		929.50	Dam Till Core	-	18.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G15	40.18		928.73		928.73	Upper Glacial Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G16	40.85		928.06		928.06	Upper Glacial Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G17	41.18		927.73		927.73	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G19	41.76		927.15		927.15	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G20	42.07		926.84		926.84	Upper Glacial Till	-	-	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G21	42.46		926.45		926.45	Upper Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G22	42.92		925.99		925.99	Upper Glacial Till	-	9.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G23	43.74		925.17		925.17	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G24	44.20		924.71		924.71	Upper Glacial Till	-	14.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G25	44.69		924.22		924.22	Upper Glacial Till	-	9.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G26	45.15		923.76		923.76	Upper Glacial Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G27	45.48		923.43		923.43	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G28	46.15		922.76		922.76	Upper Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G29	46.73		922.18		922.18	Upper Glacial Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G30	47.07		921.84		921.84	Upper Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G31	47.65		921.26		921.26	Middle Glacial Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G32	48.25		920.66		920.66	Middle Glacial Till	-	10.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G33	48.65		920.26		920.26	Middle Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	SH14-21	Dam Breach Area	Grab	G34	49.47		919.44		919.44	Middle Glacial Till	-	10.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G35	49.72		919.19		919.19	Middle Glacial Till	-	2.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G36	50.14		918.77		918.77	Middle Glacial Till	-	8.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G37	50.78		918.13		918.13	Middle Glacial Till	-	5.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G38	51.33		917.58		917.58	Middle Glacial Till	-	6.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G39	51.73		917.18		917.18	Middle Glacial Till	-	10.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G40	52.58		916.33		916.33	Middle Glacial Till	-	8.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G42	53.44		915.47		915.47	Middle Glacial Till	-	8.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G43	53.80		915.11		915.11	Middle Glacial Till	-	7.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G44	54.49		914.42		914.42	Middle Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G45	54.59		914.32		914.32	Middle Glacial Till	-	9.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G46	55.36		913.55		913.55	Middle Glacial Till	-	6.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G47	55.81		913.10		913.10	Middle Glacial Till	-	9.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G48	56.12		912.79		912.79	Upper Glaciofluvial	-	9.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G49	56.79		912.12		912.12	Upper Glaciofluvial	-	20.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G50A	57.15		911.76		911.76	Upper Glaciofluvial	-	29.2	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G50	57.43		911.48		911.48	Upper Glaciofluvial	-	13.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G51	57.89		911.02		911.02	Upper Glaciofluvial	-	10.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G52	58.37		910.54		910.54	Lower Glacial Till	-	5.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G53	58.95		909.96		909.96	Lower Glacial Till	-	5.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G54	59.90		909.01		909.01	Lower Glacial Till	-	7.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G55	60.45		908.46		908.46	Lower Glacial Till	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G56	60.84		908.07		908.07	Lower Glacial Till	-	6.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G57	61.36		907.55		907.55	Lower Glacial Till	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G58	61.91		907.00		907.00	Lower Glacial Till	-	8.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G59	62.31		906.60		906.60	Lower Glacial Till	-	8.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G60	62.82		906.09		906.09	Lower Glacial Till	-	6.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G61	65.14		903.77		903.77	Lower Glacial Till	-	7.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G62	65.90		903.01		903.01	Lower Glacial Till	-	8.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G64	66.70		902.21		902.21	Weathered Bedrock (Volcanic)	-	11.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G65	67.34		901.57		901.57	Weathered Bedrock (Volcanic)	-	14.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G66	68.22		900.69		900.69	Weathered Bedrock (Volcanic)	-	13.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G67	68.77		900.14		900.14	Weathered Bedrock (Volcanic)	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G68	69.71		899.20		899.20	Weathered Bedrock (Volcanic)	-	17.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G69	70.20		898.71		898.71	Weathered Bedrock (Volcanic)	-	15.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G70	71.11		897.80		897.80	Weathered Bedrock (Volcanic)	-	13.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-21	Dam Breach Area	Grab	G71	71.72		897.19		897.19	Weathered Bedrock (Volcanic)	-	14.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G1	2.40		927.49		927.49	Tailings	-	22.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G2	2.75		927.14		927.14	Upper Glacial Till	-	13.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G4	3.36		926.53		926.53	Upper Glacial Till	-	8.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G5	4.12		925.77		925.77	Upper Glacial Till	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G7	5.25		924.64		924.64	Upper Glacial Till	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G8	5.58		924.31		924.31	Upper Glacial Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G10	6.77		923.12		923.12	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22	Dam Breach Area	Grab	G11	7.11		922.78		922.78	Upper Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G1	5.25		924.71		924.71	Upper Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G2	5.58		924.38		924.38	Upper Glacial Till	-	12.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G3	6.04		923.92		923.92	Upper Glacial Till	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G4	6.16		923.80		923.80	Upper Glacial Till	-	14.2	CL	26	13	13	0.09	CL	-	-	-	-	-	-	-	-	12.7	36.6	33.9	16.7	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G5	6.77		923.19		923.19	Upper Glacial Till	-	11.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G6	7.11		922.85		922.85	Upper Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G8	8.02		921.94		921.94	Upper Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G9	8.45		921.51		921.51	Upper Glacial Till	-	22.4	CL	29	14	15	0.56	CL	-	-	-	-	-	-	-	-	1.8	15.1	57.0	26.1	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G10	9.09		920.87		920.87	Upper Glaciolacustrine	-	30.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G11	9.45		920.51		920.51	Upper Glaciolacustrine	-	37.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G12	9.48		920.48		920.48	Upper Glaciolacustrine	-	34.4	CI	46	22	24	0.52	CI	-	-	-	-	-	-	-	-	0.0	1.0	52.5	46.5	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G13	10.09		919.87		919.87	Upper Glaciolacustrine	-	30.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G14	10.46		919.50		919.50	Upper Glaciolacustrine	-	42.3	CH	62	26	36	0.45	CH	-	-	-	-	-	-	-	-	0.4	2.4	30.7	66.5	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G15	10.86		919.10		919.10	Middle Glacial Till	-	22.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G16	11.37		918.59		918.59	Middle Glacial Till	-	21.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G17	11.40		918.56		918.56	Middle Glacial Till	-	23.7	CI	38	20	18	0.21	CI	-	-	-	-	-	-	-	-	0.4	2.9	66.7	30.0	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G18	11.98		917.98		917.98	Middle Glacial Till	-	22.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G19	12.75		917.21		917.21	Middle Glacial Till	-	21.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G20	13.26		916.70		916.70	Lower Glaciolacustrine	-	26.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G22	14.03		915.93		915.93	Lower Glaciolacustrine	-	28.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G23	14.45		915.51		915.51	Lower Glaciolacustrine	-	25.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G23A	14.18		915.78		915.78	Lower Glaciolacustrine	-	28.1	CI	34	23	11	0.46	CI	-	-	-	-	-	-	-	-	0.0	4.2	72.8	23.0	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G24	14.85		915.11		915.11	Lower Glaciolacustrine	-	23.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G25	15.40		914.56		914.56	Lower Glaciolacustrine	-	27.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G27	16.37		913.59		913.59	Upper Glaciofluvial	-	25.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G27A	16.25		913.71		913.71	Upper Glaciofluvial	-	21.5	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	0.1	27.5	66.4	6.0	0.002	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G28	17.93		912.03		912.03	Upper Glaciofluvial	-	27.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	SH14-22A	Dam Breach Area	Grab	G29	17.96		912.00		912.00	Upper Glaciofluvial	-	24.8	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	0.6	9.4	80.0	10.0	0.002	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-01	4.22		933.21		933.21	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-02	5.18		932.25		932.25	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-03	6.10		931.33		931.33	Upper Glacial Till	-	15.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-04	6.93		930.50		930.50	Upper Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-05	7.77		929.66		929.66	Upper Glacial Till	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-06	8.79		928.64		928.64	Upper Glacial Till	-	12.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-07	9.63		927.80		927.80	Upper Glacial Till	-	14.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-08	10.52		926.91		926.91	Upper Glacial Till	-	12.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-09	11.43		926.00		926.00	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-10	12.32		925.11		925.11	Upper Glacial Till	-	14.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	CPT14-05A	Dam Breach Area	Split Spoon	SPT-11	13.23		924.20		924.20	Upper Glacial Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-01	3.76		927.15		927.15	Upper Glacial Till	-	11.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-02	4.42		926.49		926.49	Upper Glacial Till	-	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-03	5.22		925.69		925.69	Upper Glacial Till	-	12.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-04	6.21		924.70		924.70	Upper Glacial Till	-	13.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-05	7.12		923.79		923.79	Upper Glacial Till	-	14.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-06	7.99		922.92		922.92	Upper Glacial Till	-	15.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-10A	Dam Breach Area	Split Spoon	SPT-07	8.90		922.01		922.01	Upper Glacial Till	-	14.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-01	3.10		926.69		926.69	-[1]	-	311.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-02	3.96		925.83		925.83	Upper Glacial Till	-	13.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-03	4.88		924.91		924.91	Upper Glacial Till	-	14.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-04	5.92		923.87		923.87	Upper Glacial Till	-	11.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-05	6.63		923.16		923.16	Upper Glacial Till	-	15.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	VST14-22	Dam Breach Area	Split Spoon	SPT-06	7.49		922.30		922.30	Upper Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	RH14-03A	Dam Breach Area	Thin-walled Piston Tube	SS-03	12.19		920.40		920.40	Upper Glaciolacustrine	-	40.2	CI	31	16	15	1.61	CI	-	-	-	-	-	-	-	-	0.0	16.4	51.6	32.0	0.002	OD, DSS
2014	KCB	RH14-10	Dam Breach Area	Thin-walled Piston Tube	SS-01	10.06		920.85		920.85	Upper Glaciolacustrine	2.79	37.2	CI	44	21	23	0.70	CI	-	-	-	-	-	-	-	-	0.0	0.7	52.5	46.8	0.002	TXCU, OD, DS, DSS
2014	KCB	RH14-10	Dam Breach Area	Thin-walled Piston Tube	SS-01	10.06		920.85		920.85	Upper Glaciolacustrine	-	37.2	CI	33	15	18	1.23	CI	-	-	-	-	-	-	-	-	0.0	5.5	55.9	38.6	0.002	-
2014	KCB	RH14-10	Dam Breach Area	Thin-walled Piston Tube	SS-02	10.67		920.24		920.24	Upper Glaciolacustrine	2.75	44.0	CH	59	24	35	0.57	CH	-	-	-	-	-	-	-	-	0.0	0.4	44.1	55.5	0.002	OD, DSS
2014	KCB	RH14-10	Dam Breach Area	Thin-walled Piston Tube	SS-02	10.67		920.24		920.24	Upper Glaciolacustrine	-	44.0	CH	59	20	39	0.62	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	RH14-10	Dam Breach Area	Thin-walled Piston Tube	SS-02	10.67		920.24		920.24	Upper Glaciolacustrine	-	44.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	RH14-22	Dam Breach Area	Thin-walled Piston Tube	SS-02	9.29		920.49		920.49	Upper Glaciolacustrine	-	36.9	CI	43	18	25	0.76	CI	-	-	-	-	-	-	-	-	0.0	1.6	53.5	44.9	0.002	OD, DS, DSS
2014	KCB	RH14-22	Dam Breach Area	Thin-walled Piston Tube	SS-02	9.29		920.49		920.49	Upper Glaciolacustrine	-	36.9	CH	56	23	33	0.42	CH	-	-	-	-	-	-	-	-	0.0	0.2	43.0	56.8	0.002	TXCU
2014	KCB	RH14-22A	Dam Breach Area	Thin-walled Piston Tube	SS-02	9.30		920.49		920.49	Upper Glaciolacustrine	2.78	35.5	CI	50	20	30	0.52	CI	-	-	-	-	-	-	-	-	0.0	2.3	40.9	56.8	0.002	OD, DSS
2014	KCB	TP14-01	Dam Breach Area	Block	BS-01	-	-	-	-	-	Upper Glacial Till	2.76	10.3	SC	26	14	12	-0.31	CL	-	-	-	-	-	-	-	-	21.4	34.1	30.0	14.5	0.002	TXP, TXCU, TXE
2014	KCB	TP14-01	Dam Breach Area	Block	BS-02	-	-	-	-	-	Upper Glaciolacustrine	2.78	-	CI	32	20	12	-	CI	-	-	-	-	-	-	-	-	0.0	7.1	55.4	37.5	0.002	TXCU
2014	KCB	TP14-01	Dam Breach Area	Block	BS-02	-	-	-	-	-	Upper Glaciolacustrine	2.79	-	CI	40	18	22	-	CI	-	-	-	-	-	-	-	-	0.0	2.2	52.0	45.8	0.002	OD, DS, DSS
2014	KCB	TP14-01	Dam Breach Area	Block	BS-02	-	-	-	-	-	Upper Glaciolacustrine	-	35.2	CH	54	18	36	0.48	CH	-	-	-	-	-	-	-	-	0.0	3.1	44.9	52.0	0.002	-
2014	KCB	Perimeter Embankment Core	Dam Breach Area	Bulk	TC-01	-	-	-	-	-	Dam Till Core	2.76	10.7	SC	23	13	10	-0.23	CL	-	-	2006	10.6	-	-	-	-	17.7	36.7	35.2	10.5	0.002	TXP, TXCU

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2014	KCB	Perimeter Embankment Core	Dam Breach Area	Bulk	TC-01	-		-		-	Dam Till Core	2.76	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	KCB	Perimeter Embankment Core	Dam Breach Area	Bulk	TC-02	-		-		-	Dam Till Core	2.76	10.8	CL	26	15	11	-0.38	CL	-	-	1977	12.5	-	-	-	11.1	34.1	37.7	17.0	0.002	TXP, TXCU
2014	KCB	Toe Bulge	Dam Breach Area	Bulk	-	-		-		-	Upper Glacial Till	-	-	CL	28	14	14	-	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	Golder	-	-	Thin-walled Tube	1-Top	4.00		-		-	Glaciofluvial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7	80.8	16.5		-	TXCU
2014	Golder	-	-	Thin-walled Tube	1-Bottom	4.00		-		-	Glaciolacustrine	-	15.9	CL-ML	25	18	7	-0.30	CL-ML	-	-	-	-	-	-	-	3.2	16.0	62.8	18.0	0.002	DSS
2014	Golder	-	-	Thin-walled Tube	2-Top	4.00		-		-	Glaciofluvial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	82.1	16.3		-	TXCU
2014	Golder	-	-	Thin-walled Tube	2-Bottom	4.00		-		-	Glaciolacustrine	2.70	21.5	CI	32	20	12	0.13	CI	-	-	-	-	-	-	-	0.0	8.1	64.9	27.0	0.002	DSS
2014	Golder	-	-	Thin-walled Tube	3-Top	4.00		-		-	Glaciofluvial	2.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	79.3	18.1		-	TXCU
2014	Golder	-	-	Thin-walled Tube	4-Bottom	4.00		-		-	Glaciolacustrine	2.77	25.8	CI	35	18	17	0.46	CI	-	-	-	-	-	-	-	0.3	11.5	48.2	40.0	0.002	DSS, CRS
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	1	7.20	7.50	960.60	960.30	960.45	Topsoil	-	15.1	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	2	7.80	8.00	960.00	959.80	959.90	Topsoil / Glacial Till	-	146.4	ML/SM/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	3	8.20	8.50	959.60	959.30	959.45	Glacial Till	-	13.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	4	9.20	9.50	958.60	958.30	958.45	Glacial Till	-	12.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	5	10.20	10.50	957.60	957.30	957.45	Glacial Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	6	11.20	11.50	956.60	956.30	956.45	Glacial Till	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	6B	11.70	12.00	956.10	955.80	955.95	Glacial Till	-	13.1	CL	21	12	9	0.12	CL	-	-	-	-	-	-	-	13	37	50		-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	7	12.20	12.50	955.60	955.30	955.45	Glacial Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	8	13.20	13.50	954.60	954.30	954.45	Glacial Till	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	9	14.20	14.50	953.60	953.30	953.45	Glacial Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	10	15.50	15.70	952.30	952.10	952.20	Glacial Till	-	8.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	11	16.70	17.00	951.10	950.80	950.95	Glacial Till	-	8.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	12	17.50	17.80	950.30	950.00	950.15	Glacial Till	-	11.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	13	18.50	18.80	949.30	949.00	949.15	Glacial Till	-	4.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-01	Perimeter Embankment Buttress	Grab	14	19.30	19.60	948.50	948.20	948.35	Glacial Till	-	5.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	1	1.80	2.10	949.90	949.60	949.75	Glacial Till	-	14.0	CL-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	2	2.80	3.10	948.90	948.60	948.75	Glacial Till	-	12.4	CL-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	3	3.70	4.10	948.00	947.60	947.80	Glacial Till	-	11.3	CL-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	3B	4.20	4.50	947.50	947.20	947.35	Glacial Till	-	11.1	CL-SC	25	14	11	-0.26	CL	-	-	-	-	-	-	-	18	37	45		-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	4	4.90	5.20	946.80	946.50	946.65	Glacial Till	-	12.5	CL-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	5	6.30	6.60	945.40	945.10	945.25	Glacial Till	-	13.2	CL-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	6	7.20	7.50	944.50	944.20	944.35	Glaciofluvial	-	8.5	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	7	8.60	8.90	943.10	942.80	942.95	Glacial Till	-	11.0	CI-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	8	10.60	10.90	941.10	940.80	940.95	Glacial Till	-	10.8	CI-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	9	11.60	11.90	940.10	939.80	939.95	Glacial Till	-	10.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	9B	12.00	12.30	939.70	939.40	939.55	Glacial Till	-	16.1	CL/SC	29	20	9	-0.43	CL	-	-	-	-	-	-	-	14	33	53		-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	10	12.60	12.90	939.10	938.80	938.95	Weathered Bedrock	-	9.0	CL/SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	11	13.60	13.90	938.10	937.80	937.95	Weathered Bedrock	-	4.8	CL/SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	12	14.60	14.90	937.10	936.80	936.95	Weathered Bedrock	-	16.0	CL/SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	13	15.60	15.90	936.10	935.80	935.95	Weathered Bedrock	-	16.0	CL/SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-02	Perimeter Embankment Buttress	Grab	14	16.60	16.90	935.10	934.80	934.95	Weathered Bedrock	-	16.5	CL/SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	1	2.10	2.40	935.50	935.20	935.35	Fill	-	6.5	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	2	3.00	3.30	934.60	934.30	934.45	Fill	-	8.7	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	3	3.90	4.20	933.70	933.40	933.55	Fill	-	12.8	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	4	4.50	4.80	933.10	932.80	932.95	Fill	-	9.1	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	5	5.40	5.70	932.20	931.90	932.05	Glacial Till	-	9.6	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	6	6.30	6.60	931.30	931.00	931.15	Glacial Till	-	10.4	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	7	7.20	7.50	930.40	930.10	930.25	Glacial Till	-	11.3	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	8	8.10	8.40	929.50	929.20	929.35	Glacial Till	-	9.9	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	9	9.30	9.60	928.30	928.00	928.15	Glacial Till	-	10.1	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	10	10.20	10.50	927.40	927.10	927.25	Glacial Till	-	8.9	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	50	11.30	11.60	926.30	926.00	926.15	Glacial Till	-	11.6	SC/CI	22	14	8	-0.30	CL	-	-	-	-	-	-	-	20	34	46		-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	11	11.60	11.80	926.00	925.80	925.90	Glacial Till	-	10.8	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	12	12.30	12.60	925.30	925.00	925.15	Glacial Till	-	9.8	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	13	13.20	13.50	924.40	924.10	924.25	Glacial Till	-	10.2	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	14	14.40	14.70	923.20	922.90	923.05	Glacial Till	-	9.1	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	15	15.60	15.90	922.00	921.70	921.85	Glacial Till	-	9.5	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	16	16.50	16.80	921.10	920.80	920.95	Glacial Till	-	10.3	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	17	17.40	17.70	920.20	919.90	920.05	Glacial Till	-	12.2	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	18	18.30	18.60	919.30	919.00	919.15	Glacial Till	-	10.7	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	19	19.50	19.80	918.10	917.80	917.95	Glacial Till	-	10.2	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	20	20.40	20.70	917.20	916.90	917.05	Glacial Till	-	9.0	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	21	21.60	21.90	916.00	915.70	915.85	Glacial Till	-	8.6	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	22	22.50	22.80	915.10	914.80	914.95	Glacial Till	-	8.2	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	23	23.70	24.00	913.90	913.60	913.75	Glacial Till	-	10.7	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	24	24.60	24.90	913.00	912.70	912.85	Glacial Till	-	10.3	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	25	25.50	25.80	912.10	911.80	911.95	Glacial Till	-	12.3	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	26	26.02	27.00	911.58	910.60	911.09	Glaciofluvial	-	21.4	ML/SM	-	Non-Plastic		-	ML	-	-	-	-	-	-	-	0	36	64		-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	26	26.02	27.00	911.58	910.60	911.09	Glaciofluvial	-	22.3	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	27	27.30	27.60	910.30	910.00	910.15	Glaciofluvial	-	20.5	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	28	28.20	29.00	909.40	908.60	909.00	Glaciofluvial	-	22.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	28	28.50	28.80	909.10	908.80	908.95	Glaciofluvial	-	15.1	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	1	3	96		-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	29	29.40	29.70	908.20	907.90	908.05	Glaciofluvial	-	27.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	30	30.30	30.60	907.30	907.00	907.15	Glaciofluvial	-	17.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	31	31.50	31.80	906.10	905.80	905.95	Glaciofluvial	-	5.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	32	32.70	33.00	904.90	904.60	904.75	Glacial Till	-	17.1	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	33	33.90	34.20	903.70	903.40	903.55	Glacial Till	-	9.9	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	34	34.80	35.10	902.80	902.50	902.65	Glacial Till	-	6.8	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	35	35.70	36.00	901.90	901.60	901.75	Glaciofluvial	-	17.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	36	36.60	36.90	901.00	900.70	900.85	Glaciofluvial	-	8.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	37	37.80	38.10	899.80	899.50	899.65	Glaciofluvial	-	18.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	38	38.70	39.00	898.90	898.60	898.75	Glaciofluvial	-	16.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	39	39.60	39.90	898.00	897.70	897.85	Glacial Till	-	8.1	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	40	40.80	41.20	896.80	896.40	896.60	Glacial Till	-	6.1	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	41	41.80	42.10	895.80	895.50	895.65	Glacial Till	-	9.7	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	42	43.00	43.30	894.60	894.30	894.45	Glacial Till	-	6.4	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	43	44.20	44.50	893.40	893.10	893.25	Glacial Till	-	9.6	SM-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	44	45.10	45.40	892.50	892.20	892.35	Glacial Till	-	8.6	SM-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	45	46.00	46.30	891.60	891.30	891.45	Glacial Till	-	7.9	SM-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	46	47.20	47.50	890.40	890.10	890.25	Glacial Till	-	8.3	SM-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	47	48.10	48.40	889.50	889.20	889.35	Weathered Bedrock	-	15.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	48	49.00	49.30	888.60	888.30	888.45	Weathered Bedrock	-	14.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-03	Perimeter Embankment Buttress	Grab	49	50.20	50.50	887.40	887.10	887.25	Weathered Bedrock	-	6.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	1	0.30	0.60	936.90	936.60	936.75	Fill	-	6.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	2	1.20	1.50	936.00	935.70	935.85	Fill	-	5.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	3	2.10	2.40	935.10	934.80	934.95	Fill	-	4.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	4	3.00	3.30	934.20	933.90	934.05	Fill	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	5	3.90	4.20	933.30	933.00	933.15	Glacial Till	-	15.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	6	5.40	5.70	931.80	931.50	931.65	Glacial Till	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	7	6.30	6.60	930.90	930.60	930.75	Glacial Till	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	8	7.20	7.50	930.00	929.70	929.85	Glacial Till	-	9.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	9	8.40	8.70	928.80	928.50	928.65	Glacial Till	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	10	9.30	9.60	927.90	927.60	927.75	Glacial Till	-	8.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	11	10.50	10.80	926.70	926.40	926.55	Glacial Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	12	11.40	11.70	925.80	925.50	925.65	Glacial Till	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	13	12.60	12.90	924.60	924.30	924.45	Glacial Till	-	12.4	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	14	13.50	13.80	923.70	923.40	923.55	Glacial Till	-	12.1	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	55B	14.00	14.40	923.20	922.80	923.00	Glacial Till	-	10.2	SM/ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	13	39	48		-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	15	14.40	14.70	922.80	922.50	922.65	Glacial Till	-	10.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	16	15.30	15.60	921.90	921.60	921.75	Glacial Till	-	11.0	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	17	16.50	16.80	920.70	920.40	920.55	Glacial Till	-	9.7	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	18	17.40	17.70	919.80	919.50	919.65	Glacial Till	-	6.9	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	19	18.30	18.60	918.90	918.60	918.75	Glacial Till	-	11.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	20	19.20	19.50	918.00	917.70	917.85	Glacial Till	-	9.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	21	20.40	20.70	916.80	916.50	916.65	Glacial Till	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	22	21.30	21.60	915.90	915.60	915.75	Glacial Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	23	22.20	22.50	915.00	914.70	914.85	Glacial Till	-	6.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	24	23.70	24.00	913.50	913.20	913.35	Glacial Till	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	25	24.60	24.90	912.60	912.30	912.45	Glacial Till	-	7.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	26	25.50	25.80	911.70	911.40	911.55	Glacial Till	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	27	26.40	26.70	910.80	910.50	910.65	Glacial Till	-	12.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	56B	26.70	27.20	910.50	910.00	910.25	Glacial Till	-	10.0	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	22	61	17		-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	28	27.30	27.60	909.90	909.60	909.75	Glaciofluvial	-	16.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	29	28.20	28.50	909.00	908.70	908.85	Glaciofluvial	-	18.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	30	29.40	29.70	907.80	907.50	907.65	Glaciofluvial	-	17.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	31	30.30	30.60	906.90	906.60	906.75	Glaciofluvial	-	4.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	32	31.50	31.80	905.70	905.40	905.55	Glaciofluvial	-	19.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	33	32.40	32.70	904.80	904.50	904.65	Bedrock	-	14.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	34	33.30	33.60	903.90	903.60	903.75	Bedrock	-	6.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	35	34.20	34.50	903.00	902.70	902.85	Bedrock	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	36	35.10	35.40	902.10	901.80	901.95	Bedrock	-	6.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	37	36.00	36.30	901.20	900.90	901.05	Bedrock	-	5.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	38	36.60	36.90	900.60	900.30	900.45	Bedrock	-	5.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	39	37.50	37.80	899.70	899.40	899.55	Bedrock	-	9.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	40	38.70	39.00	898.50	898.20	898.35	Bedrock	-	5.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	41	39.90	40.20	897.30	897.00	897.15	Bedrock	-	7.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	42	40.80	41.10	896.40	896.10	896.25	Bedrock	-	5.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	57B	41.50	41.80	895.70	895.40	895.55	Bedrock	-	7.3	GM		Non-Plastic		-	ML	-	-	-	-	-	-	-	49	34	17		-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	43	42.00	42.30	895.20	894.90	895.05	Bedrock	-	8.3	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	44	42.90	43.20	894.30	894.00	894.15	Bedrock	-	6.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	45	43.80	44.10	893.40	893.10	893.25	Bedrock	-	14.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	46	44.70	45.00	892.50	892.20	892.35	Bedrock	-	11.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	47	45.90	46.20	891.30	891.00	891.15	Bedrock	-	16.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	48	46.80	47.10	890.40	890.10	890.25	Bedrock	-	21.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	49	48.00	48.30	889.20	888.90	889.05	Bedrock	-	5.7	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	50	49.20	49.50	888.00	887.70	887.85	Bedrock	-	5.5	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	51	50.10	50.40	887.10	886.80	886.95	Bedrock	-	8.9	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	52	51.00	51.30	886.20	885.90	886.05	Bedrock	-	7.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	53	51.90	52.20	885.30	885.00	885.15	Bedrock	-	6.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-04	Perimeter Embankment Buttress	Grab	54	52.80	53.10	884.40	884.10	884.25	Bedrock	-	7.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	1	0.90	1.20	936.60	936.30	936.45	Fill	-	6.9	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	2	2.70	3.00	934.80	934.50	934.65	Glacial Till	-	13.9	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	3	3.90	4.20	933.60	933.30	933.45	Glacial Till	-	13.1	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	50B	4.20	4.70	933.30	932.80	933.05	Glacial Till	-	8.0	SM/ML	22	14	8	-0.75	CL	-	-	-	-	-	-	-	9	50	41		-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	4	5.10	5.40	932.40	932.10	932.25	Glacial Till	-	10.0	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	5	6.30	6.60	931.20	930.90	931.05	Glacial Till	-	9.4	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	6	7.30	7.60	930.20	929.90	930.05	Glacial Till	-	10.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	7	8.40	8.70	929.10	928.80	928.95	Glacial Till	-	10.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	8	9.50	9.80	928.00	927.70	927.85	Glacial Till	-	9.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	9	10.20	10.50	927.30	927.00	927.15	Glacial Till	-	9.8	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	10	11.00	11.30	926.50	926.20	926.35	Glacial Till	-	9.9	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	11	12.30	12.60	925.20	924.90	925.05	Glacial Till	-	10.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	12	13.70	14.00	923.80	923.50	923.65	Glacial Till	-	10.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	13	14.80	15.10	922.70	922.40	922.55	Glacial Till	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	14	16.40	16.70	921.10	920.80	920.95	Glacial Till	-	9.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	15	16.70	17.00	920.80	920.50	920.65	Glacial Till	-	8.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	16	17.60	17.90	919.90	919.60	919.75	Glacial Till	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	17	18.20	18.50	919.30	919.00	919.15	Glacial Till	-	7.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	18	18.80	19.10	918.70	918.40	918.55	Glacial Till	-	7.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	19	20.30	20.60	917.20	916.90	917.05	Glacial Till	-	10.1	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	57	20.40	20.70	917.10	916.80	916.95	Glacial Till	-	19.0	CL-ML	25	19	6	0.00	CL-ML	-	-	-	-	-	-	-	4	29	67		-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	20	21.20	21.50	916.30	916.00	916.15	Glacial Till	-	8.9	SC/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	51B	22.10	22.40	915.40	915.10	915.25	Glacial Till	-	8.3	SC/ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	18	35	47		-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	21	22.40	22.70	915.10	914.80	914.95	Glacial Till	-	10.8	SC/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	58	23.20	23.50	914.30	914.00	914.15	-[1]	-	19.3	CI	39	20	19	-0.04	CI	-	-	-	-	-	-	-	5	34	61		-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	22	24.20	24.50	913.30	913.00	913.15	Glaciofluvial	-	12.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	23	24.80	25.10	912.70	912.40	912.55	Glaciofluvial	-	7.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	24	25.40	25.70	912.10	911.80	911.95	Glaciofluvial	-	15.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	25	26.60	26.90	910.90	910.60	910.75	Glaciofluvial	-	16.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	52B	27.20	27.50	910.30	910.00	910.15	-	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	8	29	58	5	0.002	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	26	27.50	27.80	910.00	909.70	909.85	Glacial Till	-	8.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	27	28.40	28.70	909.10	908.80	908.95	Glacial Till	-	8.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	28	31.10	31.40	906.40	906.10	906.25	Glacial Till	-	8.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	29	32.00	32.30	905.50	905.20	905.35	Glacial Till	-	5.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	30	32.90	33.20	904.60	904.30	904.45	Glaciofluvial	-	16.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	53B	33.20	33.90	904.30	903.60	903.95	Glaciofluvial	-	14.2	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	6	55	36	3	0.002	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	31	33.90	34.20	903.60	903.30	903.45	Glaciofluvial	-	18.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	100	34.60	34.90	902.90	902.60	902.75	Glaciolacustrine	-	10.2	CI	42	25	17	-0.87	CI	-	-	-	-	-	-	-	0	4	58	38	0.002	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	32	34.70	35.00	902.80	902.50	902.65	Glaciolacustrine	-	30.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	33	35.60	35.90	901.90	901.60	901.75	Glaciofluvial	-	18.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	34	36.70	37.00	900.80	900.50	900.65	Glaciofluvial	-	23.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	35	37.70	38.00	899.80	899.50	899.65	Glaciofluvial	-	25.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	54B	38.00	38.70	899.50	898.80	899.15	Glaciofluvial	-	26.9	ML	25	20	5	1.38	CL-ML	-	-	-	-	-	-	-	0	19	81		-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	36	38.70	39.00	898.80	898.50	898.65	Glaciofluvial	-	23.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	37	40.30	40.60	897.20	896.90	897.05	Glaciofluvial	-	22.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	38	41.30	41.60	896.20	895.90	896.05	Glaciofluvial	-	17.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	39	42.50	42.80	895.00	894.70	894.85	Glacial Till	-	15.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	40	43.20	43.50	894.30	894.00	894.15	Glaciofluvial	-	20.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	41	44.00	44.30	893.50	893.20	893.35	Glaciofluvial	-	19.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	42	45.20	45.50	892.30	892.00	892.15	Glacial Till	-	24.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	43	46.30	46.60	891.20	890.90	891.05	Weathered Bedrock	-	22.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	44	47.60	47.90	889.90	889.60	889.75	Weathered Bedrock	-	7.8	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	45	48.50	48.80	889.00	888.70	888.85	Weathered Bedrock	-	4.4	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	46	49.70	50.00	887.80	887.50	887.65	Weathered Bedrock	-	5.6	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	47	50.30	50.60	887.20	886.90	887.05	Weathered Bedrock	-	6.6	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	48	50.90	51.20	886.60	886.30	886.45	Weathered Bedrock	-	11.4	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	49	51.80	52.10	885.70	885.40	885.55	Weathered Bedrock	-	12.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	50	53.00	53.30	884.50	884.20	884.35	Weathered Bedrock	-	16.2	GC/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	51	53.90	54.20	883.60	883.30	883.45	Weathered Bedrock	-	13.0	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	52	55.10	55.40	882.40	882.10	882.25	Weathered Bedrock	-	11.9	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	53	56.00	56.30	881.50	881.20	881.35	Weathered Bedrock	-	14.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	54	56.90	57.20	880.60	880.30	880.45	Weathered Bedrock	-	15.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	55	58.40	58.70	879.10	878.80	878.95	Weathered Bedrock	-	14.8	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-05	Perimeter Embankment Buttress	Grab	56	59.30	59.60	878.20	877.90	878.05	Weathered Bedrock	-	3.9	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	1	1.37	1.68	937.23	936.92	937.08	Fill	-	5.4	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	2	4.42	4.72	934.18	933.88	934.03	Glacial Till	-	9.5	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	3	5.18	5.49	933.42	933.11	933.27	Glacial Till	-	13.0	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	4	6.25	6.55	932.35	932.05	932.20	Glacial Till	-	11.9	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	50	6.40	7.30	932.20	931.30	931.75	Glacial Till	-	7.3	GC	24	13	11	-0.52	CL	-	-	-	-	-	-	-	45	28	27		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	5	7.32	7.62	931.28	930.98	931.13	Glacial Till	-	12.4	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	6	8.23	8.53	930.37	930.07	930.22	Glacial Till	-	11.5	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	7	9.45	9.75	929.15	928.85	929.00	Glacial Till	-	9.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	8	10.52	10.82	928.08	927.78	927.93	Glacial Till	-	8.5	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Clay Threshold (< mm)	Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)			
																												Silt (%)	Clay (%)		
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	51	10.70	11.60	927.90	927.00	927.45	Glacial Till	-	7.8	GC	22	13	9	-0.58	CL	-	-	-	-	-	-	-	43	25	32		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	9	11.58	11.89	927.02	926.71	926.87	Glacial Till	-	10.4	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	10	12.50	12.80	926.10	925.80	925.95	Glacial Till	-	8.3	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	11	13.41	13.72	925.19	924.88	925.04	Glacial Till	-	8.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	12	14.63	14.94	923.97	923.66	923.82	Glacial Till	-	8.5	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	52	14.90	15.80	923.70	922.80	923.25	Glaciofluvial	-	7.3	SM		Non-Plastic			ML	-	-	-	-	-	-	-	26	37	37		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	13	15.85	16.15	922.75	922.45	922.60	Glacial Till	-	6.7	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	14	16.46	16.76	922.14	921.84	921.99	Glacial Till	-	7.8	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	15	17.68	17.98	920.92	920.62	920.77	Glacial Till	-	9.7	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	16	18.59	18.90	920.01	919.70	919.86	Glacial Till	-	10.4	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	53	18.60	19.50	920.00	919.10	919.55	Glacial Till	-	9.5	SC/CI	20	15	5	-1.10	CL-ML	-	-	-	-	-	-	-	21	34	45		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	17	19.51	19.81	919.09	918.79	918.94	Glacial Till	-	9.6	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	18	20.73	21.03	917.87	917.57	917.72	Glacial Till	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	19	21.64	21.95	916.96	916.65	916.81	Glacial Till	-	7.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	20	22.56	22.86	916.04	915.74	915.89	Glacial Till	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	21	23.47	23.77	915.13	914.83	914.98	Glacial Till	-	13.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	22	24.99	25.30	913.61	913.30	913.46	Glacial Till	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	23	25.91	26.21	912.69	912.39	912.54	Glacial Till	-	13.3	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	54	26.20	26.80	912.40	911.80	912.10	Glacial Till	-	-	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	14	38	48		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	24	26.82	27.13	911.78	911.47	911.63	Glacial Till	-	11.9	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	25	27.74	28.04	910.86	910.56	910.71	Glacial Till	-	9.7	SC/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	26	28.96	29.26	909.64	909.34	909.49	Glaciolacustrine	-	23.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	27	29.87	30.18	908.73	908.42	908.58	Glaciolacustrine	-	28.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	28	30.78	31.09	907.82	907.51	907.67	Glaciolacustrine	-	27.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	Run 11	29.60	30.80	909.00	907.80	908.40	Glaciolacustrine	-	27.8	CI	36	21	15	0.45	CI	-	-	-	-	-	-	-	0	0	70	30	0.002	Incremental Consolidation
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	Run 11	30.30	30.30	908.30	908.30	908.30	Glaciolacustrine	-	26.7	CI	47	22	25	0.19	CI	-	-	-	-	-	-	-	0	0	56	44	0.002	Incremental Consolidation
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	Run 11	31.10	31.20	907.50	907.40	907.45	Glaciolacustrine	-	26.5	CI	49	26	23	0.02	CI	-	-	-	-	-	-	-	-	-	-	-	-	Incremental Consolidation
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	Run 11	31.30	31.30	907.30	907.30	907.30	Glaciolacustrine	-	24.1	CI	38	24	14	0.01	CI	-	-	-	-	-	-	-	0	2	69	29	0.002	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	29	31.70	32.00	906.90	906.60	906.75	Glacial Till	-	8.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	30	32.61	32.92	905.99	905.68	905.84	Glacial Till	-	9.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	31	34.14	34.44	904.46	904.16	904.31	Glaciolacustrine	-	27.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	55	34.44	35.36	904.16	903.24	903.70	Glaciolacustrine	-	25.9	CH	59	23	36	0.08	CH	-	-	-	-	-	-	-	0	9	91		-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	32	34.75	35.05	903.85	903.55	903.70	Glaciolacustrine	-	29.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	100	34.90	35.20	903.70	903.40	903.55	Glaciolacustrine	-	2.4	CH	57	25	32	-0.71	CH	-	-	-	-	-	-	-	0	0	29	71	0.002	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	101	35.60	35.90	903.00	902.70	902.85	Glaciolacustrine	-	20.4	CH	57	23	34	-0.08	CH	-	-	-	-	-	-	-	0	1	33	66	0.002	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	33	35.66	35.97	902.94	902.63	902.79	Glaciolacustrine	-	32.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	34	36.58	36.88	902.02	901.72	901.87	Glaciofluvial	-	19.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	35	37.49	37.80	901.11	900.80	900.96	Glaciofluvial	-	21.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	36	38.40	38.71	900.20	899.89	900.05	Glacial Till	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	37	39.78	40.08	898.82	898.52	898.67	Glacial Till	-	7.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	38	40.84	41.15	897.76	897.45	897.61	Weathered Bedrock	-	13.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	39	41.45	41.76	897.15	896.84	897.00	Weathered Bedrock	-	14.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	40	42.37	42.67	896.23	895.93	896.08	Weathered Bedrock	-	13.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	41	43.59	43.89	895.01	894.71	894.86	Weathered Bedrock	-	13.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	42	44.81	45.11	893.79	893.49	893.64	Weathered Bedrock	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	43	46.02	46.33	892.58	892.27	892.43	Weathered Bedrock	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	44	51.21	51.51	887.39	887.09	887.24	Weathered Bedrock	-	11.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	45	52.12	52.43	886.48	886.17	886.33	Weathered Bedrock	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	46	53.04	53.34	885.56	885.26	885.41	Weathered Bedrock	-	15.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	47	54.25	54.56	884.35	884.04	884.20	Weathered Bedrock	-	13.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	48	55.32	55.63	883.28	882.97	883.13	Weathered Bedrock	-	20.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-06	Perimeter Embankment Buttress	Grab	49	56.24	56.54	882.36	882.06	882.21	Weathered Bedrock	-	18.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	1	0.30	0.60	934.70	934.40	934.55	Glacial Till	-	16.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	2	1.20	1.50	933.80	933.50	933.65	Glacial Till	-	6.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	3	2.10	2.40	932.90	932.60	932.75	Glacial Till	-	10.3	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	4	3.00	3.30	932.00	931.70	931.85	Glacial Till	-	7.6	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	12	3.30	3.90	931.70	931.10	931.40	Glacial Till	-	12.1	SC/CL	22	12	10	0.01	CL	-	-	-	-	-	-	-	26	34	40		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	5	4.20	4.50	930.80	930.50	930.65	Glacial Till	-	10.9	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	6	5.10	5.40	929.90	929.60	929.75	Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	6B	5.70	5.80	929.30	929.20	929.25	Glacial Till	-	-	CL	22	12	10	-	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	7	6.30	6.60	928.70	928.40	928.55	Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	8	7.50	7.80	927.50	927.20	927.35	Glacial Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	9	8.70	9.00	926.30	926.00	926.15	Glaciofluvial	-	8.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	10	9.60	9.90	925.40	925.10	925.25	Glacial Till	-	11.5	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	10B	9.90	10.20	925.10	924.80	924.95	Glacial Till	-	8.0	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	10C	10.20	10.50	924.80	924.50	924.65	Glacial Till	-	8.4	SC/CL	23	15	8	-0.83	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	10C	10.20	10.50	924.80	924.50	924.65	Glacial Till	-	-	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	15	36	49		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	11	10.50	10.80	924.50	924.20	924.35	Glacial Till	-	9.4	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	11B	11.60	11.90	923.40	923.10	923.25	Glaciofluvial	-	7.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	12B	12.10	12.40	922.90	922.60	922.75	Glacial Till	-	11.0	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	13	13.10	13.40	921.90	921.60	921.75	Glacial Till	-	12.0	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	16	45	39		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	13B	13.40	13.70	921.60	921.30	921.45	Glacial Till	-	8.1	ML/SM	19	14	5	-1.18	CL-ML	-	-	-	-	-	-	-	12	31	57		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	14	14.10	14.40	920.90	920.60	920.75	Glacial Till	-	14.8	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	15	15.10	15.40	919.90	919.60	919.75	Glacial Till	-	15.9	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	16	16.10	16.40	918.90	918.60	918.75	Glacial Till	-	11.9	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	17B	17.40	17.70	917.60	917.30	917.45	Glacial Till	-	16.1	CL	26	17	9	-0.10	CL	-	-	-	-	-	-	-	2	19	79		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	17	17.10	17.40	917.90	917.60	917.75	Glacial Till	-	13.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	18	18.10	18.40	916.90	916.60	916.75	Glacial Till	-	9.3	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	19	19.10	19.40	915.90	915.60	915.75	Glacial Till	-	3.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	20	19.80	20.10	915.20	914.90	915.05	Bedrock	-	4.2	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	20B	20.40	20.70	914.60	914.30	914.45	Bedrock	-	-	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	57	37	6		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	21	21.10	21.40	913.90	913.60	913.75	Bedrock	-	6.4	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	22	22.10	22.40	912.90	912.60	912.75	Bedrock	-	10.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	23	23.10	23.40	911.90	911.60	911.75	Bedrock	-	9.9	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	24	24.15	24.45	910.85	910.55	910.70	Bedrock	-	6.3	GM-GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	25	25.10	25.40	909.90	909.60	909.75	Bedrock	-	7.0	GM-GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	26	25.90	26.21	909.10	908.79	908.95	Bedrock	-	15.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	27	26.21	26.50	908.79	908.50	908.65	Bedrock	-	14.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	27B	26.50	26.80	908.50	908.20	908.35	Bedrock	-	15.2	SM		Non-Plastic			ML	-	-	-	-	-	-	-	12	60	28		-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	28	27.10	27.40	907.90	907.60	907.75	Bedrock	-	16.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	29	28.00	28.30	907.00	906.70	906.85	Bedrock	-	6.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	30	29.10	29.40	905.90	905.60	905.75	Bedrock	-	5.8	SP/GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	31	30.15	30.45	904.85	904.55	904.70	Bedrock	-	10.0	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	32	31.10	31.40	903.90	903.60	903.75	Bedrock	-	6.6	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	33	32.10	32.40	902.90	902.60	902.75	Bedrock	-	10.8	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	34	33.10	33.30	901.90	901.70	901.80	Bedrock	-	13.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	35	34.05	34.35	900.95	900.65	900.80	Bedrock	-	6.5	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	36	35.00	35.30	900.00	899.70	899.85	Bedrock	-	8.4	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	37	36.15	36.45	898.85	898.55	898.70	Bedrock	-	9.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	38	37.15	37.35	897.85	897.65	897.75	Weathered Bedrock	-	4.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	39	38.10	38.40	896.90	896.60	896.75	Weathered Bedrock	-	4.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	40	38.90	39.15	896.10	895.85	895.98	Weathered Bedrock	-	8.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	41	40.35	40.60	894.65	894.40	894.53	Weathered Bedrock	-	2.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	42	41.85	42.10	893.15	892.90	893.03	Weathered Bedrock	-	4.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-07	Perimeter Embankment Buttress	Grab	43	44.10	44.40	890.90	890.60	890.75	Weathered Bedrock	-	2.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	1	1.50	1.80	935.50	935.20	935.35	Glacial Till	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	2B	2.40	2.70	934.60	934.30	934.45	Glacial Till	-	11.3	CL	23	13	10	-0.17	CL	-	-	-	-	-	-	-	9	38	53		-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	2	2.70	3.00	934.30	934.00	934.15	Glacial Till	-	12.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	3	3.60	3.90	933.40	933.10	933.25	Glacial Till	-	14.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	4	4.50	4.80	932.50	932.20	932.35	Glacial Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	5	5.40	5.70	931.60	931.30	931.45	Glacial Till	-	14.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Clay Threshold (< mm)	Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)			
																												Silt (%)	Clay (%)		
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	6	6.30	6.60	930.70	930.40	930.55	Glacial Till	-	5.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	6B	6.60	6.90	930.40	930.10	930.25	Glacial Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	28	56	16	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	7	7.50	7.80	929.50	929.20	929.35	Glacial Till	-	4.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	8B	8.40	8.70	928.60	928.30	928.45	-	-	7.3	SM	18	14	4	-1.68	CL-ML	-	-	-	-	-	-	-	6	63	31	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	8	8.70	9.00	928.30	928.00	928.15	-	-	8.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	9	9.90	10.20	927.10	926.80	926.95	-	-	3.8	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	10	11.10	11.40	925.90	925.60	925.75	-	-	11.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	11	12.30	12.60	924.70	924.40	924.55	-	-	6.8	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	12	13.50	13.80	923.50	923.20	923.35	-	-	2.3	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	13	14.40	14.70	922.60	922.30	922.45	Glaciofluvial	-	7.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	14	15.30	15.60	921.70	921.40	921.55	Glaciofluvial	-	5.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	15	16.20	16.50	920.80	920.50	920.65	Glaciofluvial	-	6.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	16	17.40	17.70	919.60	919.30	919.45	Glaciofluvial	-	12.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	17	18.30	18.60	918.70	918.40	918.55	Glaciofluvial	-	4.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	18	19.20	19.50	917.80	917.50	917.65	Glaciofluvial	-	13.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	19	20.40	20.70	916.60	916.30	916.45	Glaciofluvial	-	10.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	20	21.30	21.60	915.70	915.40	915.55	-	-	2.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	21	22.20	22.50	914.80	914.50	914.65	-	-	15.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	22	23.40	23.70	913.60	913.30	913.45	Glacial Till	-	5.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	23B	24.00	24.30	913.00	912.70	912.85	Glacial Till	-	7.6	SC/CL	24	15	9	-0.82	CL	-	-	-	-	-	-	-	16	41	43	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	23	24.30	24.60	912.70	912.40	912.55	Glacial Till	-	6.4	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	24	25.20	25.50	911.80	911.50	911.65	Glacial Till	-	15.7	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	24B	25.50	25.80	911.50	911.20	911.35	-	-	-	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	12	40	48	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	25	26.40	26.70	910.60	910.30	910.45	Bedrock	-	10.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	26	27.30	27.60	909.70	909.40	909.55	Bedrock	-	5.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	27	28.20	28.50	908.80	908.50	908.65	Bedrock	-	6.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	28	29.40	29.70	907.60	907.30	907.45	Bedrock	-	11.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	29	30.30	30.60	906.70	906.40	906.55	Bedrock	-	16.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	30	31.20	31.50	905.80	905.50	905.65	Bedrock	-	11.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	31	32.40	32.70	904.60	904.30	904.45	Bedrock	-	12.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	32	33.30	33.60	903.70	903.40	903.55	Bedrock	-	11.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	33	34.20	34.50	902.80	902.50	902.65	Bedrock	-	9.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	34	35.10	35.40	901.90	901.60	901.75	Bedrock	-	9.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	35	36.10	36.40	900.90	900.60	900.75	Bedrock	-	12.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	36	37.20	37.50	899.80	899.50	899.65	Bedrock	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	37	38.10	38.40	898.90	898.60	898.75	Bedrock	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	38	38.70	39.00	898.30	898.00	898.15	Bedrock	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	39	39.60	39.90	897.40	897.10	897.25	Bedrock	-	9.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	40	40.50	40.80	896.50	896.20	896.35	Bedrock	-	7.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	41	41.40	41.70	895.60	895.30	895.45	Bedrock	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	42	42.60	42.90	894.40	894.10	894.25	Bedrock	-	9.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	43	43.50	43.80	893.50	893.20	893.35	Bedrock	-	8.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	44	44.40	44.70	892.60	892.30	892.45	Bedrock	-	5.9	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	45	45.30	45.60	891.70	891.40	891.55	Bedrock	-	10.1	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	46	46.20	46.50	890.80	890.50	890.65	Bedrock	-	10.2	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	47	47.10	47.40	889.90	889.60	889.75	Bedrock	-	11.2	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	48	48.30	48.60	888.70	888.40	888.55	Bedrock	-	14.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	49	49.20	49.50	887.80	887.50	887.65	Bedrock	-	10.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-08	Perimeter Embankment Buttress	Grab	50	50.30	50.60	886.70	886.40	886.55	Bedrock	-	9.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	1	0.90	1.20	938.30	938.00	938.15	-	-	17.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	2	2.10	2.40	937.10	936.80	936.95	-	-	9.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	3	3.00	3.30	936.20	935.90	936.05	-	-	9.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	4B	3.90	4.20	935.30	935.00	935.15	-	-	10.2	CL	23	14	9	-0.42	CL	-	-	-	-	-	-	-	7	35	58	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	4	4.20	4.50	935.00	934.70	934.85	-	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	5	5.40	5.70	933.80	933.50	933.65	-	-	14.8	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	5B	5.70	6.00	933.50	933.20	933.35	-	-	15.9	ML/SM	21	15	6	0.15	CL-ML	-	-	-	-	-	-	-	5	35	60	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	6	6.30	6.60	932.90	932.60	932.75	-	-	13.0	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	7	7.20	7.50	932.00	931.70	931.85	-	-	8.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	8	8.40	8.70	930.80	930.50	930.65	-	-	9.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	9	9.30	9.60	929.90	929.60	929.75	-	-	11.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	10	10.20	10.50	929.00	928.70	928.85	-	-	5.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	11	11.10	11.40	928.10	927.80	927.95	-	-	17.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	12	12.30	12.60	926.90	926.60	926.75	-	-	5.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	13	13.20	13.50	926.00	925.70	925.85	-	-	3.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	14	14.40	14.70	924.80	924.50	924.65	-	-	10.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	15	15.30	15.60	923.90	923.60	923.75	-	-	4.6	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	16	16.20	16.50	923.00	922.70	922.85	-	-	4.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	17	17.40	17.70	921.80	921.50	921.65	-	-	8.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	18	18.60	18.90	920.60	920.30	920.45	-	-	7.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	19	19.50	19.80	919.70	919.40	919.55	-	-	4.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	20	20.40	20.70	918.80	918.50	918.65	-	-	4.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	21	21.30	21.60	917.90	917.60	917.75	-	-	5.8	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	22	22.50	22.80	916.70	916.40	916.55	-	-	5.2	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	23	23.40	23.70	915.80	915.50	915.65	Bedrock	-	20.2	CI/CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	100	24.00	24.30	915.20	914.90	915.05	Bedrock	-	18.0	CI/CH	38	16	22	0.09	CI	-	-	-	-	-	-	-	0	22	46	32	0.002	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	24	24.30	24.60	914.90	914.60	914.75	Bedrock	-	22.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	25	25.50	25.80	913.70	913.40	913.55	Bedrock	-	15.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	26	26.40	26.70	912.80	912.50	912.65	Bedrock	-	16.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	27	27.30	27.60	911.90	911.60	911.75	Bedrock	-	7.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	28	28.50	28.80	910.70	910.40	910.55	Bedrock	-	13.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	29	29.40	29.70	909.80	909.50	909.65	Bedrock	-	14.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	30	30.30	30.60	908.90	908.60	908.75	Bedrock	-	9.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	31	31.50	31.80	907.70	907.40	907.55	Bedrock	-	7.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	32	32.40	32.70	906.80	906.50	906.65	Bedrock	-	12.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	33	33.30	33.60	905.90	905.60	905.75	Bedrock	-	11.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	34	34.50	34.80	904.70	904.40	904.55	Bedrock	-	18.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	35	35.40	35.70	903.80	903.50	903.65	Weathered Bedrock	-	13.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	36	36.30	36.60	902.90	902.60	902.75	Weathered Bedrock	-	11.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	37	37.50	37.80	901.70	901.40	901.55	Weathered Bedrock	-	4.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	38	38.70	39.00	900.50	900.20	900.35	Weathered Bedrock	-	23.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	39	39.60	39.90	899.60	899.30	899.45	Weathered Bedrock	-	17.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-09	Perimeter Embankment Buttress	Grab	40	40.50	40.80	898.70	898.40	898.55	Weathered Bedrock	-	6.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	1	1.80	2.10	936.41	936.11	936.26	Glacial Till	-	13.8	CI/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	2	2.70	3.00	935.51	935.21	935.36	Glacial Till	-	13.0	CI/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	3	3.00	3.30	935.21	934.91	935.06	Glacial Till	-	11.9	CI/SC	26	15	11	-0.28	CL	-	-	-	-	-	-	-	14	38	48	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	4	3.90	4.20	934.31	934.01	934.16	Glacial Till	-	9.7	CI/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	6	6.30	6.60	931.91	931.61	931.76	Glacial Till	-	9.5	CI/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	8	8.10	8.40	930.11	929.81	929.96	Glaciofluvial	-	13.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	9	9.30	9.60	928.91	928.61	928.76	Glaciofluvial	-	18.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	10	10.20	10.50	928.01	927.71	927.86	Glaciofluvial	-	16.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	10B	10.50	10.80	927.71	927.41	927.56	Glaciofluvial	-	18.3	ML	-	Non-Plastic	-	-	ML	-	-	-	-	-	-	-	0	11	85	4	0.002	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	11	11.10	11.40	927.11	926.81	926.96	Glaciofluvial	-	20.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	100	11.90	12.20	926.31	926.01	926.16	Glaciolacustrine[1]	-	18.6	ML	38	23	15	-0.29	CI	-	-	-	-	-	-	-	0	4	64	32	0.002	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	12	12.30	12.60	925.91	925.61	925.76	Glaciofluvial	-	24.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	13	13.20	13.50	925.01	924.71	924.86	Glaciofluvial	-	5.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	14	14.10	14.40	924.11	923.81	923.96	Glaciofluvial	-	3.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	15	15.00	15.30	923.21	922.91	923.06	Glaciofluvial	-	13.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	16	15.90	16.20	922.31	922.01	922.16	Glaciofluvial	-	7.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	17	17.10	17.40	921.11	920.81	920.96	Glacial Till	-	15.9	GC/SC	25	15	10	0.09	CL	-	-	-	-	-	-	-	39	35	26	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	18	18.60	18.90	919.61	919.31	919.46	Glacial Till	-	10.1	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	19	19.50	19.80	918.71	918.41	918.56	Glacial Till	-	8.2	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2015	Golder	GA15-10	Main Embankment Buttress	Grab	20	20.10	20.40	918.11	917.81	917.96	Glacial Till	-	16.9	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	21	21.00	21.30	917.21	916.91	917.06	Glacial Till	-	10.2	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	22	22.20	22.50	916.01	915.71	915.86	Glacial Till	-	11.9	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	23	23.10	23.40	915.11	914.81	914.96	Glacial Till	-	20.1	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	24	24.00	24.30	914.21	913.91	914.06	Glacial Till	-	18.0	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	25	24.90	25.20	913.31	913.01	913.16	Glacial Till	-	13.5	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	26	26.10	26.40	912.11	911.81	911.96	Glacial Till	-	9.6	GC/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	27	27.30	27.60	910.91	910.61	910.76	Glacial Till	-	7.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	27B	27.60	27.90	910.61	910.31	910.46	Glacial Till	-	9.1	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	13	61	26		-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	28	28.50	28.80	909.71	909.41	909.56	Glacial Till	-	10.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	29	29.40	29.70	908.81	908.51	908.66	Glacial Till	-	17.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	30	30.60	30.90	907.61	907.31	907.46	Glacial Till	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	31	31.50	31.80	906.71	906.41	906.56	Glacial Till	-	10.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	32	32.40	32.70	905.81	905.51	905.66	Weathered Bedrock	-	22.2	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	32B	33.30	33.60	904.91	904.61	904.76	Weathered Bedrock	-	14.6	CL-CI	26	15	11	-0.04	CL	-	-	-	-	-	-	-	16	34	50		-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	33	33.60	33.90	904.61	904.31	904.46	Weathered Bedrock	-	12.1	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	34	34.50	34.80	903.71	903.41	903.56	Weathered Bedrock	-	15.5	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	42B	42.60	42.90	895.61	895.31	895.46	Weathered Bedrock	-	11.3	CL-CI	31	16	15	-0.31	CI	-	-	-	-	-	-	-	19	25	56		-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	54B	54.90	55.20	883.31	883.01	883.16	Weathered Bedrock	-	10.9	SM/GM		Non-Plastic		-	ML	-	-	-	-	-	-	-	39	48	13		-	-
2015	Golder	GA15-10	Main Embankment Buttress	Grab	56B	57.30	57.60	880.91	880.61	880.76	Weathered Bedrock	-	10.1	ML/SM	23	16	7	-0.84	CL	-	-	-	-	-	-	-	28	35	37		-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	1	1.00	1.30	936.00	935.70	935.85	Glacial Till	-	12.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	2	2.00	2.30	935.00	934.70	934.85	Glacial Till	-	13.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	3	3.00	3.30	934.00	933.70	933.85	Glacial Till	-	13.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	3B	3.60	3.90	933.40	933.10	933.25	Glacial Till	-	11.6	CL/SC	25	13	12	-0.12	CL	-	-	-	-	-	-	-	25	30	45		-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	4	4.05	4.35	932.95	932.65	932.80	Glacial Till	-	11.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	5	5.00	5.30	932.00	931.70	931.85	Glacial Till	-	12.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	5B	5.70	6.00	931.30	931.00	931.15	Glacial Till	-	11.8	GC/CL	25	15	10	-0.32	CL	-	-	-	-	-	-	-	31	21	33	15	0.002	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	6	6.00	6.30	931.00	930.70	930.85	Glacial Till	-	14.8	GC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	7	7.00	7.30	930.00	929.70	929.85	Glaciofluvial	-	10.6	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	8	8.00	8.30	929.00	928.70	928.85	Glaciofluvial	-	12.3	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	9	9.00	9.30	928.00	927.70	927.85	Glaciofluvial	-	8.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	10	10.00	10.30	927.00	926.70	926.85	Glaciofluvial	-	12.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	11	11.10	11.40	925.90	925.60	925.75	Glaciofluvial	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	12	12.00	12.30	925.00	924.70	924.85	Glaciofluvial	-	11.7	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	13	13.00	13.30	924.00	923.70	923.85	Glaciofluvial	-	3.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	13B	13.30	13.60	923.70	923.40	923.55	Glaciofluvial	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	-	0	85	15		-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	14	14.10	14.40	922.90	922.60	922.75	Glaciofluvial	-	23.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	15	15.00	15.30	922.00	921.70	921.85	Glaciofluvial	-	21.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	16	15.60	15.90	921.40	921.10	921.25	Glaciolacustrine	-	22.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	17	16.30	16.60	920.70	920.40	920.55	Glaciolacustrine	-	24.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	17B	16.60	16.85	920.40	920.15	920.28	Glaciolacustrine	-	27.4	CL-ML	36	27	9	0.04	ML-OL	-	-	-	-	-	-	-	0	1	84	15	0.002	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	18	17.10	17.40	919.90	919.60	919.75	Glacial Till	-	18.1	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	19	17.80	18.10	919.20	918.90	919.05	Glacial Till	-	19.0	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	20	19.10	19.40	917.90	917.60	917.75	Glacial Till	-	4.5	SM/GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	21	20.20	20.50	916.80	916.50	916.65	Glacial Till	-	11.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	22	21.00	21.30	916.00	915.70	915.85	Glacial Till	-	7.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	23	22.10	22.40	914.90	914.60	914.75	Glacial Till	-	8.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	24	22.80	23.10	914.20	913.90	914.05	Glacial Till	-	5.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	25	23.20	23.50	913.80	913.50	913.65	Weathered Bedrock	-	12.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	26	24.20	24.50	912.80	912.50	912.65	Weathered Bedrock	-	12.1	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	27	25.20	25.50	911.80	911.50	911.65	Weathered Bedrock	-	13.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	27B	25.50	25.80	911.50	911.20	911.35	Weathered Bedrock	-	13.3	CL/SC	30	16	14	-0.19	CL/CI	-	-	-	-	-	-	-	14	27	59		-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	28	26.20	26.50	910.80	910.50	910.65	Weathered Bedrock	-	16.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	29	27.10	27.40	909.90	909.60	909.75	Weathered Bedrock	-	16.1	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	30	28.20	28.50	908.80	908.50	908.65	Weathered Bedrock	-	16.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	31	29.10	29.50	907.90	907.50	907.70	Weathered Bedrock	-	14.6	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	32	30.20	30.50	906.80	906.50	906.65	Weathered Bedrock	-	6.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	33	31.20	31.50	905.80	905.50	905.65	Weathered Bedrock	-	6.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	34	32.10	32.40	904.90	904.60	904.75	Weathered Bedrock	-	12.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	35	33.00	33.30	904.00	903.70	903.85	Weathered Bedrock	-	12.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	36	34.20	34.50	902.80	902.50	902.65	Weathered Bedrock	-	5.8	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	37	35.20	35.50	901.80	901.50	901.65	Weathered Bedrock	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	38	36.20	36.50	900.80	900.50	900.65	Weathered Bedrock	-	8.9	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	39	37.20	37.50	899.80	899.50	899.65	Weathered Bedrock	-	9.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	40	38.10	38.40	898.90	898.60	898.75	Weathered Bedrock	-	10.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	41	38.80	39.10	898.20	897.90	898.05	Weathered Bedrock	-	14.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	42	39.80	40.10	897.20	896.90	897.05	Weathered Bedrock	-	7.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	43	40.80	41.10	896.20	895.90	896.05	Weathered Bedrock	-	6.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	44	41.80	42.10	895.20	894.90	895.05	Weathered Bedrock	-	10.9	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	45	42.70	43.00	894.30	894.00	894.15	Weathered Bedrock	-	5.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	46	43.80	44.10	893.20	892.90	893.05	Weathered Bedrock	-	5.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	47	45.80	46.10	891.20	890.90	891.05	Weathered Bedrock	-	11.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	48	48.00	48.30	889.00	888.70	888.85	Weathered Bedrock	-	9.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	49	48.90	49.20	888.10	887.80	887.95	Weathered Bedrock	-	12.8	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	50	49.20	49.50	887.80	887.50	887.65	Weathered Bedrock	-	9.5	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	51	50.00	50.30	887.00	886.70	886.85	Weathered Bedrock	-	7.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	52	51.00	51.30	886.00	885.70	885.85	Weathered Bedrock	-	6.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-11	Main Embankment Buttress	Grab	53	52.10	52.40	884.90	884.60	884.75	Weathered Bedrock	-	7.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	1	1.80	2.10	926.30	926.00	926.15	Glacial Till	-	16.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	2	3.00	3.30	925.10	924.80	924.95	Glacial Till	-	11.5	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	3	4.20	4.50	923.90	923.60	923.75	Glacial Till	-	12.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	4	5.40	5.70	922.70	922.40	922.55	[1]	-	357.4	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	5	6.30	6.60	921.80	921.50	921.65	Glacial Till	-	15.0	SM/ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	26	27	47		-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	6	6.60	6.90	921.50	921.20	921.35	Glacial Till	-	11.9	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	7	7.20	7.50	920.90	920.60	920.75	Glacial Till	-	11.3	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	8	8.40	8.70	919.70	919.40	919.55	Glacial Till	-	14.3	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	9	9.30	9.60	918.80	918.50	918.65	Glacial Till	-	11.6	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	10	10.20	10.50	917.90	917.60	917.75	Glacial Till	-	11.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	11	11.40	11.70	916.70	916.40	916.55	Glaciofluvial	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	12	12.60	12.90	915.50	915.20	915.35	Glaciofluvial	-	20.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	13	13.50	13.80	914.60	914.30	914.45	Glaciofluvial	-	21.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	14	14.40	14.70	913.70	913.40	913.55	Glaciofluvial	-	20.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	15	15.30	15.60	912.80	912.50	912.65	Glaciofluvial	-	21.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	15B	15.60	15.90	912.50	912.20	912.35	Glaciofluvial	-	21.0	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	27	73		-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	16	16.20	16.50	911.90	911.60	911.75	Glaciofluvial	-	24.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	17	17.40	17.70	910.70	910.40	910.55	Glaciolacustrine	-	21.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	18	18.60	18.90	909.50	909.20	909.35	Glaciolacustrine	-	21.6	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	19	19.05	19.35	909.05	908.75	908.90	Glaciolacustrine	-	23.4	CL-CI	29	21	8	0.30	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	20	19.50	19.80	908.60	908.30	908.45	Glaciolacustrine	-	19.4	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	21	20.40	20.70	907.70	907.40	907.55	Glaciolacustrine	-	19.5	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	Run 8	20.60	20.85	907.50	907.25	907.38	Glaciolacustrine	-	18.8	CL-CI	31	17	14	0.13	CI	-	-	-	-	-	-	-	0	11	52	37	0.002	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	22	21.60	21.90	906.50	906.20	906.35	Glaciolacustrine	-	21.4	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	23	22.50	22.80	905.60	905.30	905.45	Glaciolacustrine	-	22.7	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	24	25.50	25.80	902.60	902.30	902.45	Glaciolacustrine	-	26.5	CL-CI	31	19	12	0.63	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	Run 10	26.50	26.60	901.60	901.50	901.55	Glaciolacustrine	-	32.7	CI	45	28	17	0.28	ML-OL	-	-	-	-	-	-	-	0	0	66	34	0.002	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	Run 10	26.60	28.70	901.50	899.40	900.45	Glaciolacustrine	-	24.9	CI	39	24	15	0.06	CI	-	-	-	-	-	-	-	0	2	76	22	0.002	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	25	26.70	27.00	901.40	901.10	901.25	Glaciolacustrine	-	31.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	27	28.50	28.80	899.60	899.30	899.45	Glaciolacustrine	-	28.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	28	29.40	29.70	898.70	898.40	898.55	Glaciolacustrine	-	28.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	29	30.60	30.90	897.50	897.20	897.35	Glaciolacustrine	-	30.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	100	30.90	31.10	897.20	897.00	897.10	Glaciofluvial	-	22.8	ML	30	23	7	-0.03	ML	-	-	-	-	-	-	-	0	11	71	18	0.002	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2015	Golder	GA15-12	Main Embankment Buttress	Grab	30	31.50	31.80	896.60	896.30	896.45	Glaciofluvial	-	29.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	31	32.70	33.00	895.40	895.10	895.25	Glaciofluvial	-	18.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	32	33.90	34.20	894.20	893.90	894.05	Glaciofluvial	-	17.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	32B	34.20	34.50	893.90	893.60	893.75	Glaciofluvial	-	15.1	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	33	34.80	35.10	893.30	893.00	893.15	Glaciofluvial	-	21.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	34	35.70	36.00	892.40	892.10	892.25	Glaciofluvial	-	17.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	35	36.90	37.20	891.20	890.90	891.05	Glaciofluvial	-	25.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	36	37.80	38.10	890.30	890.00	890.15	Glaciofluvial	-	14.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	37	38.70	39.00	889.40	889.10	889.25	Glaciofluvial	-	9.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	38	39.60	39.90	888.50	888.20	888.35	Glacial Till	-	17.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	39	40.50	40.80	887.60	887.30	887.45	Glacial Till	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	40	41.70	42.00	886.40	886.10	886.25	Weathered Bedrock	-	14.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	41	42.90	43.20	885.20	884.90	885.05	Weathered Bedrock	-	2.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	42	43.80	44.10	884.30	884.00	884.15	Weathered Bedrock	-	2.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	43	44.70	45.00	883.40	883.10	883.25	Weathered Bedrock	-	6.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	44	45.60	45.90	882.50	882.20	882.35	Weathered Bedrock	-	6.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	45	46.50	46.80	881.60	881.30	881.45	Weathered Bedrock	-	7.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	46	47.70	48.00	880.40	880.10	880.25	Weathered Bedrock	-	20.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	47	48.90	49.20	879.20	878.90	879.05	Weathered Bedrock	-	18.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12	Main Embankment Buttress	Grab	48	49.80	50.10	878.30	878.00	878.15	Weathered Bedrock	-	6.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-12B	Main Embankment Buttress	Grab	1	18.00	18.10	910.10	910.00	910.05	Glaciolacustrine	-	23.2	CL	27	18	9	0.58	CL	-	-	-	-	-	-	-	0	7	73	20	0.002	-
2015	Golder	GA15-12B	Main Embankment Buttress	Grab	2	21.50	22.10	906.60	906.00	906.30	Glaciolacustrine	2.71	19.9	CI	36	19	17	0.05	CI	-	-	-	-	-	-	-	0	7	54	39	0.002	DSS, CRS, Incremental Consolidation
2015	Golder	GA15-12B	Main Embankment Buttress	Grab	3	26.80	27.40	901.30	900.70	901.00	Glaciolacustrine	2.77	36.6	CI	47	25	22	0.53	CI	-	-	-	-	-	-	-	0	3	57	40	0.002	DSS, CRS
2015	Golder	GA15-13	Main Embankment Buttress	Grab	1	0.70	1.00	925.40	925.10	925.25	Glacial Till	-	17.4	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	2	1.70	2.00	924.40	924.10	924.25	Glacial Till	-	11.8	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	3	2.70	3.00	923.40	923.10	923.25	Glacial Till	-	14.0	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	3B	3.00	3.30	923.10	922.80	922.95	Glacial Till	-	14.3	CL-CI	30	14	16	0.02	CL/CI	-	-	-	-	-	-	-	15	31	54		-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	4	3.80	4.10	922.30	922.00	922.15	Glacial Till	-	14.0	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	5	5.20	5.50	920.90	920.60	920.75	Glaciolacustrine[1]	-	26.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	5B	5.70	6.00	920.40	920.10	920.25	Glaciolacustrine[1]	-	24.8	CI	37	16	21	0.42	CI	-	-	-	-	-	-	-	0	19	50	31	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	6	6.30	6.60	919.80	919.50	919.65	Glacial Till	-	20.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	7	7.20	7.50	918.90	918.60	918.75	Glacial Till	-	12.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	8	8.20	8.50	917.90	917.60	917.75	Glacial Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	9	9.20	9.50	916.90	916.60	916.75	Glacial Till	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	10	10.20	10.50	915.90	915.60	915.75	Glaciofluvial	-	17.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	10B	10.50	10.80	915.60	915.30	915.45	Glaciofluvial	-	16.1	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	60	40		-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	11	11.20	11.50	914.90	914.60	914.75	Glaciofluvial	-	22.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	12	12.20	12.50	913.90	913.60	913.75	Glaciofluvial	-	23.6	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	13	13.60	13.90	912.50	912.20	912.35	Glaciofluvial	-	19.5	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	100	14.60	14.90	911.50	911.20	911.35	Glaciofluvial	-	17.9	CL	28	20	8	-0.26	CL	-	-	-	-	-	-	-	0	5	76	19	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	14	14.80	15.10	911.30	911.00	911.15	Glaciofluvial	-	21.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	15	15.70	16.00	910.40	910.10	910.25	Glaciofluvial	-	19.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	15B	16.10	16.40	910.00	909.70	909.85	Glaciofluvial	-	17.4	CL	27	16	11	0.13	CL	-	-	-	-	-	-	-	0	6	82	12	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	16	16.80	17.10	909.30	909.00	909.15	Glaciofluvial	-	17.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	101	17.10	17.30	909.00	908.80	908.90	Glaciofluvial	-	12.7	ML	21	15	6	-0.38	CL-ML	-	-	-	-	-	-	-	0	21	60	19	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	17	18.20	18.50	907.90	907.60	907.75	Glaciofluvial	-	17.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	18	19.20	19.50	906.90	906.60	906.75	Glaciolacustrine	-	19.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	18B	19.50	19.80	906.60	906.30	906.45	Glaciolacustrine	-	18.8	ML	22	15	7	0.54	CL	-	-	-	-	-	-	-	0	19	70	11	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	19	20.20	20.50	905.90	905.60	905.75	Glaciolacustrine	-	20.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	20	21.20	21.50	904.90	904.60	904.75	Glaciolacustrine	-	29.5	CI-CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	20b	21.60	21.90	904.50	904.20	904.35	Glaciolacustrine	-	30.2	CI-CH	49	23	26	0.28	CI	-	-	-	-	-	-	-	0	0	60	40	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	21	22.30	22.60	903.80	903.50	903.65	Glaciolacustrine	-	25.4	CI-CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	22	23.30	23.60	902.80	902.50	902.65	-[1]	-	34.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	23	24.30	24.60	901.80	901.50	901.65	Glaciolacustrine	-	33.1	CI-CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	23b	24.60	24.90	901.50	901.20	901.35	Glaciolacustrine	-	31.4	CI-CH	48	22	26	0.36	CI	-	-	-	-	-	-	-	0	9	59	32	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	24	25.30	25.60	900.80	900.50	900.65	Glaciofluvial	-	20.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	102	26.20	26.40	899.90	899.70	899.80	Glaciolacustrine	-	13.3	CL	44	20	24	-0.28	CI	-	-	-	-	-	-	-	0	6	53	41	0.002	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	25	26.40	26.70	899.70	899.40	899.55	Glaciolacustrine	-	31.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	26	27.70	28.00	898.40	898.10	898.25	Glaciofluvial	-	19.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	26B	28.20	28.50	897.90	897.60	897.75	Glaciofluvial	-	19.2	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	70	30		-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	27	28.70	29.00	897.40	897.10	897.25	Glaciofluvial	-	20.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	28	29.70	30.00	896.40	896.10	896.25	Glaciofluvial	-	17.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	29	31.20	31.50	894.90	894.60	894.75	Glacial Till	-	9.1	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	30	32.20	32.50	893.90	893.60	893.75	Glacial Till	-	18.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	31	33.00	33.30	893.10	892.80	892.95	Glacial Till	-	18.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	32	34.00	34.30	892.10	891.80	891.95	Weathered Bedrock	-	6.2	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	33	35.00	35.30	891.10	890.80	890.95	Weathered Bedrock	-	6.8	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	34	35.70	36.00	890.40	890.10	890.25	Weathered Bedrock	-	12.7	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	35	36.70	37.00	889.40	889.10	889.25	Weathered Bedrock	-	12.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	36	37.70	38.00	888.40	888.10	888.25	Weathered Bedrock	-	11.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	37	38.70	39.00	887.40	887.10	887.25	Weathered Bedrock	-	16.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	38	39.70	40.00	886.40	886.10	886.25	Weathered Bedrock	-	11.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-13	Main Embankment Buttress	Grab	39	40.70	41.00	885.40	885.10	885.25	Weathered Bedrock	-	4.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	1	0.60	0.90	913.30	913.00	913.15	Glacial Till	-	14.7	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	2	1.60	1.90	912.30	912.00	912.15	Glacial Till	-	13.1	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	3	2.60	2.90	911.30	911.00	911.15	Glacial Till	-	12.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	3B	3.00	3.30	910.90	910.60	910.75	Glacial Till	-	12.0	CL/SC	23	14	9	-0.22	CL	-	-	-	-	-	-	-	12	37	51		-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	4	3.60	3.90	910.30	910.00	910.15	Glaciofluvial	-	13.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	5	4.60	4.90	909.30	909.00	909.15	Glaciofluvial	-	17.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	6	5.60	5.90	908.30	908.00	908.15	Glaciolacustrine	-	16.9	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	7	6.60	6.90	907.30	907.00	907.15	Glaciolacustrine	-	22.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	7B	6.90	7.20	907.00	906.70	906.85	Glaciolacustrine	-	22.9	CI	34	20	14	0.21	CI	-	-	-	-	-	-	-	0	1	75	24	0.002	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	8	7.90	8.20	906.00	905.70	905.85	Glaciolacustrine	-	33.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	9	8.70	9.00	905.20	904.90	905.05	Glaciolacustrine	-	31.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	9B	9.00	9.30	904.90	904.60	904.75	Glaciolacustrine	-	29.2	CI	39	20	19	0.48	CI	-	-	-	-	-	-	-	0	3	84	13	0.002	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	10	9.90	10.20	904.00	903.70	903.85	Glaciofluvial	-	30.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	10B	10.20	10.50	903.70	903.40	903.55	Glaciofluvial	-	24.6	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	0	99	1	0.002	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	11	10.90	11.20	903.00	902.70	902.85	Glaciofluvial	-	30.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	12	12.60	12.90	901.30	901.00	901.15	Glaciofluvial	-	17.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	13	14.00	14.30	899.90	899.60	899.75	Weathered Bedrock	-	8.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	14	15.00	15.30	898.90	898.60	898.75	Weathered Bedrock	-	8.4	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	15	16.10	16.40	897.80	897.50	897.65	Weathered Bedrock	-	2.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	16	17.10	17.40	896.80	896.50	896.65	Weathered Bedrock	-	14.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	17	18.10	18.40	895.80	895.50	895.65	Weathered Bedrock	-	8.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	18	19.10	19.40	894.80	894.50	894.65	Weathered Bedrock	-	8.9	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	19	20.10	20.40	893.80	893.50	893.65	Weathered Bedrock	-	11.6	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-14	Main Embankment Buttress	Grab	20	21.10	21.40	892.80	892.50	892.65	Weathered Bedrock	-	1.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	1	0.90	1.20	924.10	923.80	923.95	Fill	-	2.8	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	2	5.40	5.70	919.60	919.30	919.45	Fill	-	9.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	3	6.60	6.90	918.40	918.10	918.25	Fill	-	6.0	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	4	7.50	7.80	917.50	917.20	917.35	Fill	-	6.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	5	9.30	9.60	915.70	915.40	915.55	Fill	-	3.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	6	10.20	10.50	914.80	914.50	914.65	Fill	-	6.8	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	7	11.40	11.70	913.60	913.30	913.45	Fill	-	3.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	8	12.60	12.90	912.40	912.10	912.25	Fill	-	5.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	9	14.70	15.00	910.30	910.00	910.15	Glacial Till	-	21.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	9B	15.30	15.60	909.70	909.40	909.55	Glacial Till	-	16.0	CL	23	13	10	0.30	CL	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	10	15.90	16.20	909.10	908.80	908.95	Glacial Till	-	16.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	11	16.80	17.10	908.20	907.90	908.05	Glaciolacustrine	-	16.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	12	19.20	19.50	905.80	905.50	905.65	Glaciolacustrine	-	26.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	Run 7	19.70	19.80	905.30	905.20	905.25	Glaciolacustrine	-	29.9	CI	44	27	17	0.17	ML-OL	-	-	-	-	-	-	-	0	1	61	38	0.002	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2015	Golder	GA15-15	Main Embankment Buttress	Grab	13	20.40	20.70	904.60	904.30	904.45	Glaciolacustrine	-	29.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	Run 8	21.50	21.60	903.50	903.40	903.45	Glaciofluvial	-	24.3	ML	27	25	2	-0.35	ML	-	-	-	-	-	-	-	2	0	90	8	0.002	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	14	21.60	21.90	903.40	903.10	903.25	Glaciolacustrine	-	30.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	14B	21.90	22.20	903.10	902.80	902.95	Glaciolacustrine	-	28.5	CI	42	19	23	0.41	CI	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	15	22.50	22.80	902.50	902.20	902.35	Glaciolacustrine	-	26.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	16	23.70	24.00	901.30	901.00	901.15	Glaciofluvial	-	26.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	17	24.60	24.90	900.40	900.10	900.25	Glaciofluvial	-	27.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	17B	24.90	25.20	900.10	899.80	899.95	Glaciofluvial	-	21.7	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	18	25.50	25.80	899.50	899.20	899.35	Glaciofluvial	-	23.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	19	26.70	27.00	898.30	898.00	898.15	Glaciofluvial	-	20.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	20	27.60	27.90	897.40	897.10	897.25	Glacial Till	-	10.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	21	28.50	28.80	896.50	896.20	896.35	Glacial Till	-	13.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	22	29.70	30.00	895.30	895.00	895.15	Glacial Till	-	12.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	23	30.60	30.90	894.40	894.10	894.25	Glacial Till	-	8.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	24	39.00	39.30	886.00	885.70	885.85	Weathered Bedrock	-	12.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	25	41.10	41.40	883.90	883.60	883.75	Weathered Bedrock	-	3.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	26	42.00	42.30	883.00	882.70	882.85	Weathered Bedrock	-	10.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	27	43.50	43.80	881.50	881.20	881.35	Weathered Bedrock	-	12.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	28	44.70	45.00	880.30	880.00	880.15	Weathered Bedrock	-	13.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	29	45.60	45.90	879.40	879.10	879.25	Weathered Bedrock	-	16.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15	Main Embankment Buttress	Grab	30	46.80	47.10	878.20	877.90	878.05	Weathered Bedrock	-	16.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-15B	Main Embankment Buttress	Thin-walled Piston Tube	1	17.02	17.45	907.98	907.55	907.77	Glaciolacustrine	-	24.4	CI	39	20	19	0.23	CI	-	-	-	-	-	-	-	0	1	69	30	0.002	DSS
2015	Golder	GA15-15B	Main Embankment Buttress	Thin-walled Piston Tube	1	17.02	17.45	907.98	907.55	907.77	Glaciolacustrine	-	27.4	CI	40	23	17	0.26	CI	-	-	-	-	-	-	-	1	0	67	32	0.002	Incremental Consolidation
2015	Golder	GA15-15B	Main Embankment Buttress	Thin-walled Piston Tube	2 (300 DSS)	18.54	18.92	906.46	906.08	906.27	Glaciolacustrine	-	28.8	CI	47	20	27	0.33	CI	-	-	-	-	-	-	-	0	1	56	43	0.002	DSS
2015	Golder	GA15-15B	Main Embankment Buttress	Thin-walled Piston Tube	2 (600 DSS)	18.54	18.92	906.46	906.08	906.27	Glaciolacustrine	-	26.6	CI	43	19	24	0.32	CI	-	-	-	-	-	-	-	0	1	56	43	0.002	DSS
2015	Golder	GA15-15B	Main Embankment Buttress	Thin-walled Piston Tube	2 (CRS)	18.54	18.92	906.46	906.08	906.27	Glaciolacustrine	-	27.0	CI	40	22	18	0.28	CI	-	-	-	-	-	-	-	0	2	60	38	0.002	CRS
2015	Golder	GA15-16	Main Embankment Buttress	Grab	1	0.90	1.20	911.60	911.30	911.45	Fill	-	11.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	2	2.30	2.60	910.20	909.90	910.05	Glaciofluvial	-	20.2	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	2B	2.70	3.00	909.80	909.50	909.65	[1]	-	17.0	CL-CI	30	17	13	0.00	CL/CI	-	-	-	-	-	-	-	7	21	72		-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	3	3.30	3.60	909.20	908.90	909.05	Glaciofluvial	-	12.2	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	4	4.30	4.60	908.20	907.90	908.05	Glaciofluvial	-	14.0	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	5	5.00	5.30	907.50	907.20	907.35	Glaciolacustrine	-	19.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	5B	5.30	5.70	907.20	906.80	907.00	Glaciolacustrine	-	24.3	CL	30	17	13	0.56	CL	-	-	-	-	-	-	-	0	10	58	32	0.002	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	6	6.00	6.30	906.50	906.20	906.35	Glaciolacustrine	-	24.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	7	6.90	7.20	905.60	905.30	905.45	Glaciolacustrine	-	29.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	7B	7.20	7.50	905.30	905.00	905.15	Glaciolacustrine	-	29.8	CI	40	22	18	0.43	CI	-	-	-	-	-	-	-	0	2	61	37	0.002	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	8	7.65	7.95	904.85	904.55	904.70	Glaciolacustrine	-	31.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	9	8.25	8.60	904.25	903.90	904.08	Glaciolacustrine	-	33.4	CI-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	9B	8.70	9.00	903.80	903.50	903.65	Glaciolacustrine	-	30.9	CI-ML	35	24	11	0.63	CI	-	-	-	-	-	-	-	0	0	79	21	0.002	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	10	9.00	9.30	903.50	903.20	903.35	Glaciolacustrine	-	29.4	CI-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	11	10.10	10.35	902.40	902.15	902.28	Glaciofluvial	-	29.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	11B	10.50	10.80	902.00	901.70	901.85	Glaciofluvial	-	27.8	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	0	95	5	0.002	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	12	11.30	11.60	901.20	900.90	901.05	Glaciofluvial	-	26.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	13	12.60	12.90	899.90	899.60	899.75	Glaciofluvial	-	24.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	14	13.60	13.90	898.90	898.60	898.75	Glaciofluvial	-	22.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	15	14.60	14.90	897.90	897.60	897.75	Glaciofluvial	-	21.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	16	15.60	15.90	896.90	896.60	896.75	Glacial Till	-	16.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	17	16.60	16.95	895.90	895.55	895.73	Glacial Till	-	15.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	18	17.30	17.60	895.20	894.90	895.05	Glacial Till	-	20.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	19	17.80	18.00	894.70	894.50	894.60	Glacial Till	-	7.1	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	20	19.10	19.30	893.40	893.20	893.30	Glacial Till	-	15.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	21	19.80	20.10	892.70	892.40	892.55	Glacial Till	-	8.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	22	20.40	20.70	892.10	891.80	891.95	Glacial Till	-	23.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	23	21.30	21.60	891.20	890.90	891.05	Glacial Till	-	16.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	24	21.90	22.20	890.60	890.30	890.45	Weathered Bedrock	-	8.9	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	25	23.15	23.45	889.35	889.05	889.20	Weathered Bedrock	-	8.3	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	26	24.20	24.50	888.30	888.00	888.15	Weathered Bedrock	-	8.6	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	27	25.25	25.60	887.25	886.90	887.08	Weathered Bedrock	-	8.6	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	28	26.20	26.50	886.30	886.00	886.15	Weathered Bedrock	-	9.3	SW/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	29	27.30	27.60	885.20	884.90	885.05	Weathered Bedrock	-	11.4	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	31	29.30	29.55	883.20	882.95	883.08	Weathered Bedrock	-	8.5	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	33	31.10	31.40	881.40	881.10	881.25	Weathered Bedrock	-	13.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	34	32.00	32.30	880.50	880.20	880.35	Weathered Bedrock	-	12.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	35	32.70	33.00	879.80	879.50	879.65	Weathered Bedrock	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	36	33.70	34.00	878.80	878.50	878.65	Weathered Bedrock	-	17.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	37	35.00	35.30	877.50	877.20	877.35	Weathered Bedrock	-	23.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	38	35.50	35.80	877.00	876.70	876.85	Weathered Bedrock	-	24.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	39	36.50	36.80	876.00	875.70	875.85	Weathered Bedrock	-	12.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-16	Main Embankment Buttress	Grab	40	38.10	38.40	874.40	874.10	874.25	Weathered Bedrock	-	16.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	1	6.30	6.60	912.75	912.45	912.60	Glacial Till	-	14.5	ML-SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	1B	6.60	6.90	912.45	912.15	912.30	Glaciofluvial	-	12.4	CL-CI	29	15	14	-0.19	CL	-	-	-	-	-	-	-	4	31	65		-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	2	7.30	7.60	911.75	911.45	911.60	Glaciofluvial	-	20.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	3	8.30	8.60	910.75	910.45	910.60	Glaciofluvial	-	20.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	3B	8.80	9.10	910.25	909.95	910.10	Glaciofluvial	-	14.6	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	71	29		-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	4	9.30	9.60	909.75	909.45	909.60	Glaciofluvial	-	19.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	5	10.60	10.90	908.45	908.15	908.30	Glaciolacustrine	-	31.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	6	11.60	11.90	907.45	907.15	907.30	Glaciolacustrine	-	30.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	100	12.40	12.60	906.65	906.45	906.55	Glaciolacustrine	-	25.6	CI	28	23	5	0.52	ML	-	-	-	-	-	-	-	0	1	92	7	0.002	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	7	12.70	13.00	906.35	906.05	906.20	Glaciofluvial	-	29.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	7B	13.00	13.30	906.05	905.75	905.90	Glaciofluvial	-	25.7	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	0	98	2	0.002	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	8	13.70	14.00	905.35	905.05	905.20	Glaciofluvial	-	28.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	9	14.70	15.00	904.35	904.05	904.20	Glaciofluvial / Till	-	28.0	ML/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	9B	15.15	15.45	903.90	903.60	903.75	Glacial Till	-	7.5	SM	18	15	3	-2.50	ML	-	-	-	-	-	-	-	27	42	31		-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	10	15.70	16.00	903.35	903.05	903.20	Glacial Till	-	8.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	11	16.70	17.00	902.35	902.05	902.20	Glaciofluvial	-	18.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	12	17.70	18.00	901.35	901.05	901.20	Glaciofluvial	-	17.3	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	13	18.70	19.00	900.35	900.05	900.20	Glacial Till	-	14.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	14	19.70	20.00	899.35	899.05	899.20	Glacial Till	-	15.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	15	20.70	21.00	898.35	898.05	898.20	Glacial Till	-	21.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	15B	21.00	21.30	898.05	897.75	897.90	Glacial Till	-	21.1	CL	28	21	7	0.01	CL	-	-	-	-	-	-	-	2	5	93		-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	16	21.70	22.00	897.35	897.05	897.20	Glacial Till	-	14.0	SW-GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	17	22.70	23.00	896.35	896.05	896.20	Weathered Bedrock	-	8.9	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	18	23.70	24.00	895.35	895.05	895.20	Weathered Bedrock	-	9.4	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	19	24.70	25.00	894.35	894.05	894.20	Weathered Bedrock	-	8.7	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	20	25.50	25.80	893.55	893.25	893.40	Weathered Bedrock	-	7.2	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-17	Main Embankment Buttress	Grab	21	26.60	26.90	892.45	892.15	892.30	Weathered Bedrock	-	16.8	SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	1	1.80	2.10	934.40	934.10	934.25	Glacial Till	-	16.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	2	2.80	3.10	933.40	933.10	933.25	Glaciofluvial	-	12.5	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	3B	3.60	3.80	932.60	932.40	932.50	Glaciofluvial	-	11.6	CL/SC	27	13	14	-0.10	CL	-	-	-	-	-	-	-	0	37	63		-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	3	3.80	4.10	932.40	932.10	932.25	Glaciofluvial	-	12.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	4	4.80	5.10	931.40	931.10	931.25	Glaciofluvial	-	13.6	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	5	5.80	6.10	930.40	930.10	930.25	Glaciofluvial	-	14.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	6B	6.50	6.80	929.70	929.40	929.55	Glaciofluvial	-	13.5	CL/SC	28	14	14	-0.04	CL	-	-	-	-	-	-	-	4	35	61		-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	6	6.80	7.10	929.40	929.10	929.25	Glaciofluvial	-	13.3	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	100	7.30	7.50	928.90	928.70	928.80	Glaciofluvial	-	9.5	CL	25	14	11	-0.41	CL	-	-	-	-	-	-	-	0	30	49	21	0.002	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	7	7.90	8.20	928.30	928.00	928.15	Glacial Till	-	14.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	8	8.80	9.10	927.40	927.10	927.25	Glacial Till	-	11.4	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	8b	9.10	9.40	927.10	926.80	926.95	Glacial Till	-	10.7	SC/CL	21	12	9	-0.14	CL	-	-	-	-	-	-	-	5	47	48		-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	9	9.80	10.10	926.40	926.10	926.25	Glacial Till	-	11.0	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	10	10.80	11.10	925.40	925.10	925.25	Glacial Till	-	10.5	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	11	11.80	12.10	924.40	924.10	924.25	Glacial Till	-	9.4	SC/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2015	Golder	GA15-18	Main Embankment Buttress	Grab	12	12.90	13.20	923.30	923.00	923.15	Weathered Bedrock	-	18.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	13	13.80	13.90	922.40	922.30	922.35	Weathered Bedrock	-	14.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	14	14.40	14.70	921.80	921.50	921.65	Weathered Bedrock	-	14.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	15	15.50	15.80	920.70	920.40	920.55	Weathered Bedrock	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	16	16.40	16.70	919.80	919.50	919.65	Weathered Bedrock	-	13.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-18	Main Embankment Buttress	Grab	17	17.40	17.70	918.80	918.50	918.65	Weathered Bedrock	-	6.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	1	2.50	2.80	945.10	944.80	944.95	Glacial Till	-	16.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	1B	3.00	3.30	944.60	944.30	944.45	Glacial Till	-	13.6	CL	26	14	12	-0.03	CL	-	-	-	-	-	-	-	3	35	62		-	-
2015	Golder	GA15-19	South Embankment	Grab	2	3.50	3.80	944.10	943.80	943.95	Glacial Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	3	4.50	4.80	943.10	942.80	942.95	Glacial Till	-	11.3	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	3B	5.10	5.40	942.50	942.20	942.35	Glacial Till	-	12.3	SM/ML	21	14	7	-0.24	CL-ML	-	-	-	-	-	-	-	8	43	49		-	-
2015	Golder	GA15-19	South Embankment	Grab	4	5.50	5.80	942.10	941.80	941.95	Glacial Till	-	11.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	5	6.80	7.10	940.80	940.50	940.65	Weathered Bedrock	-	8.0	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-19	South Embankment	Grab	6	7.80	8.10	939.80	939.50	939.65	Weathered Bedrock	-	6.6	GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-20	South Embankment	Grab	1	1.50	1.80	942.54	942.24	942.39	Glacial Till	-	14.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-20	South Embankment	Grab	1B	1.80	2.10	942.24	941.94	942.09	Glacial Till	-	17.4	CL	28	15	13	0.18	CL	-	-	-	-	-	-	-	1	19	80		-	-
2015	Golder	GA15-20	South Embankment	Grab	2	2.50	2.80	941.54	941.24	941.39	Glacial Till	-	12.2	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-20	South Embankment	Grab	2b	3.00	3.30	941.04	940.74	940.89	Glacial Till	-	11.9	CL/SC	26	14	12	-0.18	CL	-	-	-	-	-	-	-	12	39	49		-	-
2015	Golder	GA15-20	South Embankment	Grab	3	3.70	4.00	940.34	940.04	940.19	Glacial Till	-	15.0	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-20	South Embankment	Grab	4	4.60	4.90	939.44	939.14	939.29	Glacial Till	-	12.8	CL/SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-20	South Embankment	Grab	4b	4.90	4.95	939.14	939.09	939.12	Glacial Till	-	13.5	CL/SC	27	14	13	-0.04	CL	-	-	-	-	-	-	-	11	44	45		-	-
2015	Golder	GA15-20	South Embankment	Grab	5	6.10	6.40	937.94	937.64	937.79	Weathered Bedrock	-	4.6	CL/SC/GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	1	5.18	5.48	907.32	907.02	907.17	Glaciolacustrine	-	30.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	2	5.48	6.10	907.02	906.40	906.71	Glaciolacustrine	-	28.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	2	5.48	6.10	907.02	906.40	906.71	Glaciolacustrine	-	42.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	3	6.10	6.70	906.40	905.80	906.10	Glaciolacustrine	-	31.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	3	6.10	6.70	906.40	905.80	906.10	Glaciolacustrine	-	25.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	5 (CRS)	7.39		905.11		905.11	Glaciolacustrine	2.76	39.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	0	1	77	22	0.002	CRS
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	5 (2000 kPa)	7.48		905.02		905.02	Glaciolacustrine	2.72	26.4	CI	34	19	15	0.49	CI	-	-	-	-	-	-	-	0	0	83	17	0.002	DSS
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	5 (800 kPa)	7.53		904.97		904.97	Glaciolacustrine	2.65	30.9	CI	47	22	25	0.36	CI	-	-	-	-	-	-	-	0	0	68	32	0.002	DSS
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	5 (400 kPa)	7.62		904.88		904.88	Glaciolacustrine	2.80	22.1	CI	39	19	20	0.16	CI	-	-	-	-	-	-	-	0	1	86	13	0.002	DSS
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	6	7.90	8.50	904.60	904.00	904.30	Glaciolacustrine	-	31.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	6	7.90	8.50	904.60	904.00	904.30	Glaciolacustrine	-	30.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	Golder	GA15-21	Main Embankment Buttress	Thin-walled Piston Tube	9 (CIU)	9.75	10.36	902.75	902.14	902.45	Glaciofluvial	2.78	27.1	ML	24	21	3	2.03	ML	-	-	-	-	-	-	-	0	27	64	9	0.002	TXCU
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	1	9.14	9.30	928.06	927.90	927.98	Till Like	-	13.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	2	9.75	9.91	927.45	927.29	927.37	Till Like	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	3	10.52	10.67	926.68	926.53	926.61	Till Like	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	4	11.20	11.35	926.00	925.85	925.93	Till Like	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	5	11.89	12.04	925.31	925.16	925.24	Till Like	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	6	12.57	12.73	924.63	924.47	924.55	Till Like	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	7	13.26	13.41	923.94	923.79	923.87	Till Like	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	8	13.94	14.10	923.26	923.10	923.18	Till Like	-	13.0	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	9	14.78	14.94	922.42	922.26	922.34	-	-	13.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	10	15.47	15.62	921.73	921.58	921.66	-	-	18.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	11	16.15	16.31	921.05	920.89	920.97	Till Like	-	12.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	12	16.84	16.99	920.36	920.21	920.29	Till Like	-	12.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	13	17.53	17.68	919.67	919.52	919.60	Till Like	-	22.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	14	18.14	18.29	919.06	918.91	918.99	Till Like	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	15	18.90	19.05	918.30	918.15	918.23	Weathered Bedrock	-	13.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	16	19.58	19.74	917.62	917.46	917.54	Weathered Bedrock	-	10.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	17	20.27	20.42	916.93	916.78	916.86	Weathered Bedrock	-	15.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-01	Corner 1 Embankment Buttress	Grab	18	20.96	21.11	916.24	916.09	916.17	Weathered Bedrock	-	7.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	1	3.05	3.20	929.95	929.80	929.88	-	-	40.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	2	3.73	3.89	929.27	929.11	929.19	-	-	19.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	3	4.27	4.42	928.73	928.58	928.66	-	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	4	4.95	5.11	928.05	927.89	927.97	Till Like	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	5	5.64	5.79	927.36	927.21	927.29	Till Like	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	6	6.32	6.48	926.68	926.52	926.60	-	-	11.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	7	7.01	7.16	925.99	925.84	925.92	Till Like	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	8	7.70	7.85	925.30	925.15	925.23	Till Like	-	13.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	9	8.46	8.61	924.54	924.39	924.47	Till Like	-	9.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	10	9.07	9.14	923.93	923.86	923.90	-	-	8.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	11	9.69	9.83	923.31	923.17	923.24	-	-	10.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	12	10.36	10.52	922.64	922.48	922.56	-	-	8.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	13	11.05	11.20	921.95	921.80	921.88	-	-	9.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	14	11.73	11.89	921.27	921.11	921.19	-	-	9.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	15	12.42	12.57	920.58	920.43	920.51	-	-	10.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	16	13.11	13.26	919.89	919.74	919.82	-	-	15.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	17	13.79	13.94	919.21	919.06	919.14	-	-	21.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	18	14.48	14.63	918.52	918.37	918.45	-	-	12.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	19	15.24	15.39	917.76	917.61	917.69	Till Like	-	15.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	20	15.93	16.08	917.07	916.92	917.00	Lower Glaciolacustrine[2]	-	22.9	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	21	16.61	16.76	916.39	916.24	916.32	Lower Glaciolacustrine[2]	-	23.1	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	22	17.30	17.45	915.70	915.55	915.63	Lower Glaciolacustrine[2]	-	22.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	23	17.98	18.14	915.02	914.86	914.94	Lower Glaciolacustrine[2]	-	23.1	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	24	18.67	18.82	914.33	914.18	914.26	Lower Glaciolacustrine[2]	-	29.4	CL-ML	25	20	5	1.88	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	25	19.35	19.51	913.65	913.49	913.57	-	-	18.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	26	20.27	20.42	912.73	912.58	912.66	-	-	21.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	27	21.11	21.26	911.89	911.74	911.82	-	-	16.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	28	21.49	21.64	911.51	911.36	911.44	-	-	24.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	29	22.17	22.33	910.83	910.67	910.75	-	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	30	22.86	23.01	910.14	909.99	910.07	-	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-02	Corner 1 Embankment Buttress	Grab	31	23.55	23.70	909.45	909.30	909.38	Weathered Bedrock	-	6.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	1	3.66	3.81	928.34	928.19	928.27	Till Like	-	22.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	2	4.27	4.42	927.73	927.58	927.66	Till Like	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	3	4.88	5.03	927.12	926.97	927.05	Till Like	-	9.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	4	5.49	5.64	926.51	926.36	926.44	Till Like	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	5	6.10	6.25	925.90	925.75	925.83	Till Like	-	13.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	6	6.71	6.86	925.29	925.14	925.22	Till Like	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	7	7.32	7.47	924.68	924.53	924.61	Till Like	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	8	7.92	8.08	924.08	923.92	924.00	Till Like	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	9	8.53	8.69	923.47	923.31	923.39	Till Like	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	10	9.14	9.30	922.86	922.70	922.78	Till Like	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	11	9.75	9.91	922.25	922.09	922.17	Till Like	-	11.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	12	10.36	10.52	921.64	921.48	921.56	Till Like	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	13	10.97	11.13	921.03	920.87	920.95	Till Like	-	8.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	14	11.58	11.73	920.42	920.27	920.35	Till Like	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	15	12.19	12.34	919.81	919.66	919.74	Till Like	-	11.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	16	12.80	12.95	919.20	919.05	919.13	Till Like	-	17.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	17	13.41	13.56	918.59	918.44	918.52	Till Like	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	18	14.02	14.17	917.98	917.83	917.91	-	-	16.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	19	14.63	14.78	917.37	917.22	917.30	Till Like	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	20	15.85	16.00	916.15	916.00	916.08	Till Like	-	11.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	21	16.46	16.61	915.54	915.39	915.47	Till Like	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	22	17.07	17.22	914.93	914.78	914.86	Till Like	-	9.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	23	17.68	17.83	914.32	914.17	914.25	Till Like	-	8.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	24	18.29	18.44	913.71	913.56	913.64	Till Like	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	25	18.90	19.05	913.10	912.95	913.03	Till Like	-	8.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	26	19.51	19.66	912.49	912.34	912.42	Till Like	-	6.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	27	20.12	20.27	911.88	911.73	911.81	Till Like	-	7.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	28	20.73	20.88	911.27	911.12	911.20	Till Like	-	10.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	29	21.34	21.49	910.66	910.51	910.59	Till Like	-	10.3	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	30	21.95	22.10	910.05	909.90	909.98	Till Like	-	21.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	31	22.56	22.71	909.44	909.29	909.37	Till Like	-	8.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-03	Corner 1 Embankment Buttress	Grab	32	23.16	23.32	908.84	908.68	908.76	Weathered Bedrock	-	8.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	1	0.61	0.76	931.99	931.84	931.92	Fill	-	4.2	SP-GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	2	2.13	2.29	930.47	930.31	930.39	Fill	-	4.8	SP-GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	3	4.88	5.03	927.72	927.57	927.65	Till Like	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	4	5.64	5.79	926.96	926.81	926.89	Till Like	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	5	6.55	6.71	926.05	925.89	925.97	Till Like	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	6	7.16	7.32	925.44	925.28	925.36	Till Like	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	7	7.77	7.92	924.83	924.68	924.76	Till Like	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	8	8.38	8.53	924.22	924.07	924.15	-[1]	-	3.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	9	8.99	9.14	923.61	923.46	923.54	Upper Glaciolacustrine[2]	-	10.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	10	9.60	9.75	923.00	922.85	922.93	Upper Glaciolacustrine[2]	-	18.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	11	10.21	10.36	922.39	922.24	922.32	Upper Glaciolacustrine[2]	-	15.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Thin-walled Piston Tube	12B	10.62	10.92	921.98	921.68	921.83	Upper Glaciolacustrine[2]	-	11.1	CH	25	13	12	-0.16	CL	-	-	-	-	-	-	-	17.4	32.6	29.0	21.0	0.002	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Thin-walled Piston Tube	12	10.70	11.00	921.90	921.60	921.75	Upper Glaciolacustrine[2]	-	31.6	CH	57	28	29	0.12	CH	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	13	11.43	11.58	921.17	921.02	921.10	Upper Glaciolacustrine[2]	-	17.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	14	12.04	12.19	920.56	920.41	920.49	Upper Glaciolacustrine[2]	-	9.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	15	12.80	12.95	919.80	919.65	919.73	-	-	13.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	16	13.49	13.64	919.11	918.96	919.04	-	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	17	14.17	14.33	918.43	918.27	918.35	-	-	12.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	18	14.86	15.01	917.74	917.59	917.67	-	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	19	15.54	15.70	917.06	916.90	916.98	-	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	20	16.23	16.38	916.37	916.22	916.30	-	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	21	16.92	17.07	915.68	915.53	915.61	-	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	22	18.44	18.59	914.16	914.01	914.09	Till Like	-	9.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	23	19.13	19.28	913.47	913.32	913.40	Till Like	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	24	19.81	19.96	912.79	912.64	912.72	Till Like	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	25	20.50	20.65	912.10	911.95	912.03	Till Like	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	26	21.34	21.49	911.26	911.11	911.19	Lower Glaciolacustrine[2]	-	23.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	26B	21.49	22.02	911.11	910.58	910.85	Lower Glaciolacustrine[2]	-	23.3	CL	51	23	28	0.01	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	27	22.02	22.17	910.58	910.43	910.51	Lower Glaciolacustrine[2]	-	15.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	28	22.71	22.86	909.89	909.74	909.82	Till Like	-	16.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	29	23.39	23.55	909.21	909.05	909.13	Till Like	-	15.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	30	24.08	24.23	908.52	908.37	908.45	Till Like	-	12.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	31	24.77	24.92	907.83	907.68	907.76	Till Like	-	14.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	32	25.45	25.60	907.15	907.00	907.08	Till Like	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	33	26.14	26.29	906.46	906.31	906.39	Till Like	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	34	26.82	26.97	905.78	905.63	905.71	Till Like	-	10.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	35	27.51	27.66	905.09	904.94	905.02	Till Like	-	19.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	36	28.19	28.35	904.41	904.25	904.33	-	-	8.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	37	28.88	29.03	903.72	903.57	903.65	-	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	38	29.57	29.72	903.03	902.88	902.96	-	-	11.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	39	30.25	30.40	902.35	902.20	902.28	-	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	40	31.09	31.24	901.51	901.36	901.44	-	-	14.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	41	31.78	31.93	900.82	900.67	900.75	-	-	6.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	42	32.46	32.61	900.14	899.99	900.07	-	-	6.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	43	33.15	33.30	899.45	899.30	899.38	-	-	9.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	44	33.83	33.99	898.77	898.61	898.69	-	-	16.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	45	34.52	34.67	898.08	897.93	898.01	-	-	5.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	46	35.20	35.36	897.40	897.24	897.32	-	-	12.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	47	35.89	36.04	896.71	896.56	896.64	-	-	5.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	48	36.58	36.73	896.02	895.87	895.95	-	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	49	37.26	37.41	895.34	895.19	895.27	-	-	9.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	50	37.95	38.10	894.65	894.50	894.58	-	-	11.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	51	38.63	38.79	893.97	893.81	893.89	-	-	5.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	52	39.32	39.47	893.28	893.13	893.21	-	-	7.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	53	40.01	40.16	892.59	892.44	892.52	Weathered Bedrock	-	15.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-04	Corner 1 Embankment Buttress	Grab	54	40.54	40.69	892.06	891.91	891.99	Weathered Bedrock	-	2.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	1	0.30	0.46	925.10	924.94	925.02	Till Like	-	11.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	2	0.91	1.07	924.49	924.33	924.41	Till Like	-	9.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	3	1.52	1.68	923.88	923.72	923.80	Till Like	-	10.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	4	2.13	2.29	923.27	923.11	923.19	Till Like	-	10.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	5	2.74	2.90	922.66	922.50	922.58	Till Like	-	11.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	6	3.35	3.51	922.05	921.89	921.97	Upper Glaciolacustrine[2]	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Thin-walled Piston Tube	7	3.80	4.10	921.60	921.30	921.45	Upper Glaciolacustrine[2]	-	16.3	CL	37	15	22	0.06	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Thin-walled Piston Tube	7B	3.80	4.10	921.60	921.30	921.45	Upper Glaciolacustrine[2]	-	13.6	CL	26	13	13	0.05	CL	-	-	-	-	-	-	-	23.0	28.9	27.1	21.0	0.002	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	8	4.57	4.72	920.83	920.68	920.76	Upper Glaciolacustrine[2]	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	9	5.18	5.33	920.22	920.07	920.15	Upper Glaciolacustrine[2]	-	21.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	10	5.79	5.94	919.61	919.46	919.54	Till Like	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	11	6.40	6.55	919.00	918.85	918.93	Till Like	-	5.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	12	7.01	7.16	918.39	918.24	918.32	Till Like	-	10.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	13	7.62	7.77	917.78	917.63	917.71	Till Like	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-05	Corner 1 Embankment Buttress	Grab	14	8.23	8.38	917.17	917.02	917.10	Weathered Bedrock	-	8.5	CL-CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	1	9.14	9.30	927.36	927.20	927.28	-	-	8.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	2	9.75	9.91	926.75	926.59	926.67	-	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	3	10.36	10.52	926.14	925.98	926.06	-	-	13.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	4	10.97	11.13	925.53	925.37	925.45	-	-	11.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	5	11.58	11.73	924.92	924.77	924.85	-	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	6	12.19	12.34	924.31	924.16	924.24	-	-	10.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	7	12.80	12.95	923.70	923.55	923.63	Till Like	-	9.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	8	13.41	13.56	923.09	922.94	923.02	Till Like	-	9.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	9	14.02	14.17	922.48	922.33	922.41	Till Like	-	12.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	10	14.63	14.78	921.87	921.72	921.80	Till Like	-	12.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	11	15.24	15.39	921.26	921.11	921.19	Till Like	-	13.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	12	15.85	16.00	920.65	920.50	920.58	Till Like	-	9.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	13	16.46	16.61	920.04	919.89	919.97	-	-	16.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	14	17.07	17.22	919.43	919.28	919.36	Till Like	-	20.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	15	17.68	17.83	918.82	918.67	918.75	Till Like	-	11.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	16	18.29	18.44	918.21	918.06	918.14	Till Like	-	8.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	17	18.90	19.05	917.60	917.45	917.53	Till Like	-	10.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	18	19.51	19.66	916.99	916.84	916.92	Till Like	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	19	20.12	20.27	916.38	916.23	916.31	Till Like	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	20	20.73	20.88	915.77	915.62	915.70	-	-	19.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	21	21.34	21.49	915.16	915.01	915.09	-	-	11.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	22	21.95	22.10	914.55	914.40	914.48	Till Like	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-06	Corner 1 Embankment Buttress	Grab	23	22.56	22.71	913.94	913.79	913.87	Weathered Bedrock	-	8.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	1	4.11	4.27	928.19	928.03	928.11	Till Like	-	14.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	2	4.80	4.95	927.50	927.35	927.43	Till Like	-	13.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	3	5.49	5.64	926.81	926.66	926.74	Till Like	-	14.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	4	6.17	6.32	926.13	925.98	926.06	Till Like	-	13.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	5	6.86	7.01	925.44	925.29	925.37	Till Like	-	14.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	6	7.54	7.70	924.76	924.60	924.68	Till Like	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Thin-walled Piston Tube	8	8.70	9.00	923.60	923.30	923.45	Upper Glaciolacustrine[2]	-	32.4	CL	39	22	17	0.61	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	9	9.60	9.75	922.70	922.55	922.63	-	-	13.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	10	10.29	10.44	922.01	921.86	921.94	-	-	17.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	11	10.97	11.13	921.33	921.17	921.25	-	-	13.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	12	11.66	11.81	920.64	920.49	920.57	-	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	13	12.34	12.50	919.96	919.80	919.88	-	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	14	13.03	13.18	919.27	919.12	919.20	-	-	12.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	15	13.72	13.87	918.58	918.43	918.51	-	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	16	14.40	14.55	917.90	917.75	917.83	-	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	17	15.09	15.24	917.21	917.06	917.14	-	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	18	15.77	15.93	916.53	916.37	916.45	-	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	19	16.46	16.61	915.84	915.69	915.77	-	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	20	17.15	17.30	915.15	915.00	915.08	-	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	21	17.83	17.98	914.47	914.32	914.40	-	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	22	18.52	18.67	913.78	913.63	913.71	-	-	15.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	23	19.20	19.35	913.10	912.95	913.03	-	-	8.2	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	24	19.89	20.04	912.41	912.26	912.34	-	-	8.0	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	25	20.57	20.73	911.73	911.57	911.65	-	-	8.6	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	26	21.26	21.34	911.04	910.96	911.00	-	-	7.3	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-07	Corner 1 Embankment Buttress	Grab	27	21.49	21.64	910.81	910.66	910.74	Weathered Bedrock	-	18.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	1	0.30	0.46	924.00	923.84	923.92	Till Like	-	15.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	2	0.91	1.07	923.39	923.23	923.31	Till Like	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	3	1.52	1.68	922.78	922.62	922.70	Till Like	-	13.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	4	2.13	2.29	922.17	922.01	922.09	Till Like	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	5	2.74	2.90	921.56	921.40	921.48	Till Like	-	11.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	6	3.35	3.96	920.95	920.34	920.65	Upper Glaciolacustrine[2]	-	19.3	CL	41	18	23	0.06	CI	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	7	3.96	4.11	920.34	920.19	920.27	Upper Glaciolacustrine[2]	-	23.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	8	4.57	4.72	919.73	919.58	919.66	Till Like	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	9	5.18	5.33	919.12	918.97	919.05	Till Like	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	10	5.79	5.94	918.51	918.36	918.44	Till Like	-	11.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	11	6.40	6.55	917.90	917.75	917.83	Till Like	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	12	7.01	7.16	917.29	917.14	917.22	Till Like	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	13	7.62	7.77	916.68	916.53	916.61	Till Like	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	14	8.23	8.38	916.07	915.92	916.00	Till Like	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	15	8.84	8.99	915.46	915.31	915.39	Till Like	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	16	9.45	9.60	914.85	914.70	914.78	Till Like	-	9.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	17	10.06	10.21	914.24	914.09	914.17	Till Like	-	9.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	18	10.67	10.82	913.63	913.48	913.56	Till Like	-	7.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	19	11.28	11.43	913.02	912.87	912.95	Till Like	-	8.2	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	20	11.89	12.04	912.41	912.26	912.34	Till Like	-	9.7	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	21	12.50	12.65	911.80	911.65	911.73	Till Like	-	11.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	22	13.11	13.26	911.19	911.04	911.12	Till Like	-	9.3	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	23	13.72	13.87	910.58	910.43	910.51	Till Like	-	9.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	24	14.33	14.48	909.97	909.82	909.90	Till Like	-	6.9	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	25	14.94	15.09	909.36	909.21	909.29	Till Like	-	9.1	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	26	15.54	15.70	908.76	908.60	908.68	Weathered Bedrock	-	6.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	27	16.15	16.31	908.15	907.99	908.07	Weathered Bedrock	-	6.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	28	16.76	16.92	907.54	907.38	907.46	Weathered Bedrock	-	6.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	29	17.37	17.53	906.93	906.77	906.85	Weathered Bedrock	-	8.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-08	Corner 1 Embankment Buttress	Grab	30	17.98	18.14	906.32	906.16	906.24	Weathered Bedrock	-	6.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	1	0.30	0.46	923.60	923.44	923.52	Till Like	-	14.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	2	0.91	1.07	922.99	922.83	922.91	Till Like	-	11.3	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	3	1.52	1.68	922.38	922.22	922.30	Till Like	-	12.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	4	2.13	2.29	921.77	921.61	921.69	Till Like	-	13.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	5	2.74	2.90	921.16	921.00	921.08	-[1]	-	25.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Thin-walled Piston Tube	6	3.35	4.00	920.55	919.90	920.23	Upper Glaciolacustrine[2]	-	30.6	CL	33	19	14	0.83	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Thin-walled Piston Tube	6B	3.35	4.00	920.55	919.90	920.23	Upper Glaciolacustrine[2]	2.75	23.1	CL	36	15	21	0.39	CI	-	-	-	-	-	-	-	5.0	22.5	35.5	37.0	0.002	CRS
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	7	4.10	4.40	919.80	919.50	919.65	Upper Glaciolacustrine[2]	-	29.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	8	4.57	4.72	919.33	919.18	919.26	Upper Glaciolacustrine[2]	-	34.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	9	5.18	5.33	918.72	918.57	918.65	Till Like	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	10	5.79	5.94	918.11	917.96	918.04	Till Like	-	9.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	11	6.40	6.55	917.50	917.35	917.43	Till Like	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	12	7.01	7.16	916.89	916.74	916.82	Till Like	-	8.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	13	7.62	7.77	916.28	916.13	916.21	Till Like	-	5.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	14	8.23	8.38	915.67	915.52	915.60	Till Like	-	8.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	15	8.84	8.99	915.06	914.91	914.99	Till Like	-	7.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	16	9.45	9.60	914.45	914.30	914.38	Till Like	-	12.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	17	10.06	10.21	913.84	913.69	913.77	Till Like	-	11.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	18	10.67	10.82	913.23	913.08	913.16	Till Like	-	9.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	19	11.28	11.43	912.62	912.47	912.55	Till Like	-	6.7	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	20	11.89	12.04	912.01	911.86	911.94	Till Like	-	6.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	21	12.50	12.65	911.40	911.25	911.33	Till Like	-	5.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	22	13.11	13.26	910.79	910.64	910.72	Till Like	-	7.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	23	13.72	13.87	910.18	910.03	910.11	Till Like	-	9.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	24	14.33	14.48	909.57	909.42	909.50	Till Like	-	4.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	25	14.94	15.09	908.96	908.81	908.89	Till Like	-	5.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	26	15.54	15.70	908.36	908.20	908.28	Till Like	-	5.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	27	16.15	16.31	907.75	907.59	907.67	Till Like	-	6.2	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	28	16.76	16.92	907.14	906.98	907.06	Till Like	-	6.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	29	17.37	17.53	906.53	906.37	906.45	-	-	9.3	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	30	17.98	18.14	905.92	905.76	905.84	-	-	8.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	31	18.59	18.75	905.31	905.15	905.23	-	-	10.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	32	19.20	19.35	904.70	904.55	904.63	-	-	9.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	33	19.81	19.96	904.09	903.94	904.02	-	-	6.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	34	20.42	20.57	903.48	903.33	903.41	-	-	6.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	35	21.03	21.18	902.87	902.72	902.80	-	-	7.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-09	Corner 1 Embankment Buttress	Grab	36	21.64	21.79	902.26	902.11	902.19	-	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	1	3.05	3.20	943.95	943.80	943.88	Till Like	-	18.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	2	3.66	3.81	943.34	943.19	943.27	Till Like	-	12.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	3	4.27	4.42	942.73	942.58	942.66	Till Like	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	4	4.88	5.03	942.12	941.97	942.05	Till Like	-	11.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	5	5.49	5.64	941.51	941.36	941.44	Till Like	-	14.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	6	6.10	6.25	940.90	940.75	940.83	Till Like	-	10.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	7	6.71	6.86	940.29	940.14	940.22	Till Like	-	11.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	8	7.32	7.47	939.68	939.53	939.61	Till Like	-	13.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	9	7.92	8.08	939.08	938.92	939.00	Till Like	-	11.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-15	South Embankment	Grab	10	8.53	8.69	938.47	938.31	938.39	Till Like	-	19.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	1	0.61	0.76	944.19	944.04	944.12	Till Like	-	14.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	2	1.22	1.37	943.58	943.43	943.51	Till Like	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	3	1.83	1.98	942.97	942.82	942.90	Till Like	-	11.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	4	2.44	2.59	942.36	942.21	942.29	Till Like	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	5	3.05	3.20	941.75	941.60	941.68	Till Like	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	6	3.66	3.81	941.14	940.99	941.07	Till Like	-	13.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	7	4.27	4.42	940.53	940.38	940.46	Till Like	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	8	4.88	5.03	939.92	939.77	939.85	Till Like	-	17.5	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	9	5.49	5.64	939.31	939.16	939.24	Till Like	-	18.9	CL-ML	23	15	8	0.49	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	10	6.10	6.25	938.70	938.55	938.63	Till Like	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-16	South Embankment	Grab	11	6.71	6.86	938.09	937.94	938.02	Till Like	-	15.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	1	0.91	1.07	943.49	943.33	943.41	Till Like	-	8.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	2	1.52	1.68	942.88	942.72	942.80	Till Like	-	11.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	3	2.13	2.29	942.27	942.11	942.19	Till Like	-	12.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	4	2.74	2.90	941.66	941.50	941.58	Till Like	-	16.0	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	5	3.35	3.51	941.05	940.89	940.97	Till Like	-	12.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	6	3.96	4.11	940.44	940.29	940.37	Till Like	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	7	4.57	4.72	939.83	939.68	939.76	Till Like	-	14.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2016	Golder	GA16-17	South Embankment	Grab	8	5.18	5.33	939.22	939.07	939.15	Till Like	-	12.7	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	9	5.79	5.94	938.61	938.46	938.54	Till Like	-	12.1	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	10	6.40	6.55	938.00	937.85	937.93	Till Like	-	14.5	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	11	7.01	7.16	937.39	937.24	937.32	Till Like	-	13.0	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	12	7.62	7.77	936.78	936.63	936.71	Till Like	-	15.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	13	8.23	8.38	936.17	936.02	936.10	Till Like	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	14	8.84	8.99	935.56	935.41	935.49	Till Like	-	15.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	15	9.45	9.60	934.95	934.80	934.88	Till Like	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	16	10.06	10.21	934.34	934.19	934.27	Till Like	-	8.1	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	17	10.67	10.82	933.73	933.58	933.66	Till Like	-	11.4	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-17	South Embankment	Grab	18	11.28	11.43	933.12	932.97	933.05	Glaciolacustrine[2]	-	19.8	ML-SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	1	0.30	0.46	944.90	944.74	944.82	-	-	21.0	OH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	2	0.91	1.07	944.29	944.13	944.21	Till Like	-	11.4	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	3	1.52	1.68	943.68	943.52	943.60	Till Like	-	14.1	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	4	2.13	2.29	943.07	942.91	942.99	Till Like	-	12.3	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	5	2.74	2.90	942.46	942.30	942.38	Till Like	-	12.6	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	6	3.35	3.51	941.85	941.69	941.77	Till Like	-	19.9	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	7	3.96	4.11	941.24	941.09	941.17	Till Like	-	13.5	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	8	4.57	4.72	940.63	940.48	940.56	Till Like	-	10.1	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	9	5.18	5.33	940.02	939.87	939.95	Till Like	-	12.2	SP-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	10	5.79	5.94	939.41	939.26	939.34	Till Like	-	12.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	11	6.40	6.55	938.80	938.65	938.73	Till Like	-	12.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	12	7.01	7.16	938.19	938.04	938.12	Till Like	-	7.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	13	7.62	7.77	937.58	937.43	937.51	Till Like	-	6.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	14	8.23	8.38	936.97	936.82	936.90	Till Like	-	8.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	15	8.84	8.99	936.36	936.21	936.29	Till Like	-	11.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	Golder	GA16-19	South Embankment	Grab	16	9.14	9.45	936.06	935.75	935.91	Glaciolacustrine[2]	-	15.6	ML	26	19	7	-0.49	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	1	0.39		940.41		940.41	Fill	-	12.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	2	0.82		939.98		939.98	Fill	-	16.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	3	1.26		939.54		939.54	Fill	-	10.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	4	1.69		939.11		939.11	Fill	-	13.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	5	2.13		938.67		938.67	Fill	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	6	2.56		938.24		938.24	Fill	-	15.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	7	3.00		937.80		937.80	Fill	-	15.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	8	3.44		937.36		937.36	Fill	-	18.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	9	3.87		936.93		936.93	Fill	-	9.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	10	4.31		936.49		936.49	Fill	-	6.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	11	4.74		936.06		936.06	Fill	-	9.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	12	5.18		935.62		935.62	Fill	-	8.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	13	5.61		935.19		935.19	Fill	-	10.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	14	6.05		934.75		934.75	Fill	-	7.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	15	6.56		934.24		934.24	Fill	-	9.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	16	7.07		933.73		933.73	Fill	-	7.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	17	7.58		933.23		933.23	Fill	-	4.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	18	8.08		932.72		932.72	Fill	-	7.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	19	8.59		932.21		932.21	Fill	-	6.7	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	20	9.10		931.70		931.70	Fill	-	7.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	21	9.61		931.19		931.19	Fill	-	7.2	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	22	10.12		930.68		930.68	Fill	-	9.1	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	23	10.63		930.18		930.18	Fill	-	11.1	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	24	11.13		929.67		929.67	-	-	16.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	25	11.64		929.16		929.16	-	-	15.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	26	12.15		928.65		928.65	-	-	14.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	27	12.91		927.89		927.89	-	-	11.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	28	13.68		927.13		927.13	-	-	9.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	29	14.44		926.36		926.36	-	-	11.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	30	15.00		925.80		925.80	-	-	11.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	31	15.50		925.30		925.30	-	-	13.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	32	16.00		924.80		924.80	-	-	12.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	33	16.50		924.30		924.30	-	-	10.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	34	17.00		923.80		923.80	-	-	20.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	35	17.50		923.30		923.30	-	-	22.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	36	18.00		922.80		922.80	-	-	19.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	37	18.50		922.30		922.30	-	-	14.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	38	19.00		921.80		921.80	-	-	16.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	39	19.50		921.30		921.30	-	-	16.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	40	20.00		920.80		920.80	-	-	11.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	41	20.50		920.30		920.30	-	-	11.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	42	21.00		919.80		919.80	-	-	10.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	43	21.50		919.30		919.30	-	-	12.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	44	22.00		918.80		918.80	-	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	45	22.50		918.30		918.30	-	-	17.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	46	23.00		917.80		917.80	Weathered Bedrock	-	12.3	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	47	23.50		917.30		917.30	Weathered Bedrock	-	15.4	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	48	24.00		916.80		916.80	Weathered Bedrock	-	11.9	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	49	24.50		916.30		916.30	Weathered Bedrock	-	13.6	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	50	25.00		915.80		915.80	Weathered Bedrock	-	16.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	51	25.50		915.30		915.30	Inferred Bedrock	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	52	26.00		914.80		914.80	Inferred Bedrock	-	15.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	53	26.50		914.30		914.30	Inferred Bedrock	-	13.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	54	27.00		913.80		913.80	Inferred Bedrock	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	55	27.50		913.30		913.30	Inferred Bedrock	-	12.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	56	28.00		912.80		912.80	Inferred Bedrock	-	8.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-01	Corner 1 Embankment Buttress	Grab	57	28.50		912.30		912.30	Inferred Bedrock	-	16.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	1	0.50		940.13		940.13	Fill	-	9.6	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	2	1.00		939.63		939.63	Fill	-	10.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	3	1.50		939.13		939.13	Fill	-	8.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	4	2.00		938.63		938.63	Fill	-	9.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	5	2.50		938.13		938.13	Fill	-	5.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	6	3.00		937.63		937.63	Till Like	-	3.8	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	7	3.50		937.13		937.13	Till Like	-	17.7	MH/CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	8	4.00		936.63		936.63	Till Like	-	12.3	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	9	4.50		936.13		936.13	-	-	11.6	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	10	5.00		935.63		935.63	-	-	11.8	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	11	5.50		935.13		935.13	-	-	13.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	12	5.90		934.73		934.73	Upper Glaciolacustrine[1]	-	13.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	31	6.10		934.53		934.53	Upper Glaciolacustrine[1]	-	20.1	CI	34	19	15	0.07	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	13	6.50		934.13		934.13	Upper Glaciolacustrine[1]	-	18.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	14	7.00		933.63		933.63	Upper Glaciolacustrine[1]	-	18.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	15	7.50		933.13		933.13	-	-	17.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	16	8.00		932.63		932.63	-	-	24.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	17	8.50		932.13		932.13	-	-	15.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	18	9.00		931.63		931.63	-	-	11.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	19	9.50		931.13		931.13	Till Like	-	13.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	20	10.00		930.63		930.63	Till Like	-	11.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	21	10.50		930.13		930.13	Till Like	-	8.8	CI/SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	22	11.00		929.63		929.63	Till Like	-	9.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	23	11.50		929.13		929.13	Till Like	-	4.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	24	11.94		928.69		928.69	Weathered Bedrock	-	5.7	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	25	12.19		928.44		928.44	-	-	10.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	26	13.00		927.63		927.63	Weathered Bedrock	-	2.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	27	13.50		927.13		927.13	Weathered Bedrock	-	2.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	28	14.27		926.36		926.36	-	-	17.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	29	14.65		925.98		925.98	Weathered Bedrock	-	3.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-03	Corner 1 Embankment Buttress	Grab	30	15.00		925.63		925.63	Weathered Bedrock	-	3.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	1	0.49		940.68		940.68	Fill	-	19.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	2	1.01		940.16		940.16	Fill	-	20.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	3	1.49		939.68		939.68	Fill	-	17.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	4	1.98		939.19		939.19	Fill	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	5	2.50		938.67		938.67	Fill	-	7.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	6	2.99		938.18		938.18	Fill	-	15.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	7	3.51		937.66		937.66	Fill	-	14.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	8	3.99		937.18		937.18	Fill	-	8.8	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	9	6.49		934.68		934.68	Fill	-	6.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	10	7.01		934.16		934.16	Fill	-	6.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	11	7.50		933.67		933.67	Fill	-	3.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	12	9.69		931.48		931.48	Fill	-	7.8	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	13	10.00		931.17		931.17	Fill	-	5.1	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	14	10.49		930.68		930.68	Fill	-	5.4	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	15	11.00		930.17		930.17	Fill	-	6.8	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	16	11.49		929.68		929.68	Fill	-	6.2	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	17	12.01		929.16		929.16	Fill	-	6.7	GM/GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	18	12.50		928.67		928.67	-	-	6.9	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	19	14.63		926.54		926.54	-	-	14.4	GP/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	20	15.00		926.17		926.17	-	-	-	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	21	15.37		925.80		925.80	-	-	16.6	SC/CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	22	18.50		922.67		922.67	-	-	11.2	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	23	18.99		922.18		922.18	-	-	11.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	24	20.48		920.69		920.69	-	-	15.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	25	21.00		920.17		920.17	-	-	20.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	26	21.01		920.16		920.16	-	-	19.3	CL	24	14	10	0.53	CL	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	27	21.49		919.68		919.68	-	-	17.1	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	28	22.01		919.16		919.16	-	-	13.4	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	29	22.49		918.68		918.68	Till Like	-	20.2	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	30	22.98		918.19		918.19	Till Like	-	9.5	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	31	23.50		917.67		917.67	-	-	23.5	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04A	Corner 1 Embankment Buttress	Grab	32	23.99		917.18		917.18	-	-	26.5	SM/ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	1	12.68		928.27		928.27	Topsoil	-	207.1	OL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	2	13.20		927.75		927.75	-	-	44.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	3	13.69		927.26		927.26	Till Like	-	11.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	4	14.20		926.75		926.75	Till Like	-	10.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	5	14.69		926.26		926.26	Till Like	-	9.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	6	15.18		925.77		925.77	Till Like	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	7	15.70		925.25		925.25	-	-	10.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	8	16.18		924.77		924.77	-	-	10.0	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	9	16.70		924.25		924.25	-	-	11.3	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	10	17.19		923.76		923.76	-	-	10.8	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	11	17.68		923.27		923.27	-	-	11.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	12	18.20		922.75		922.75	-	-	11.9	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	13	18.79		922.16		922.16	Upper Glaciolacustrine[2]	-	32.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	20	18.87		922.09		922.09	Upper Glaciolacustrine[2]	-	36.6	CI	47	17	30	0.65	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	14	19.25		921.70		921.70	Upper Glaciolacustrine[1]	-	34.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	19	19.40		921.55		921.55	Upper Glaciolacustrine[2]	-	36.7	CH	41	19	22	0.80	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	15	19.66		921.29		921.29	Upper Glaciolacustrine[2]	-	18.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	16	19.91		921.04		921.04	Upper Glaciolacustrine[1]	-	36.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	17	20.47		920.48		920.48	-	-	14.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	21	20.68		920.28		920.28	Upper Glaciolacustrine[2]	-	19.9	CI	31	15	16	0.31	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	18	20.87		920.08		920.08	-	-	20.2	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	22	21.82		919.13		919.13	Till Like	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	23	22.34		918.61		918.61	Till Like	-	8.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	24	22.83		918.12		918.12	Till Like	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	25	23.35		917.60		917.60	-	-	11.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	26	23.84		917.11		917.11	-	-	20.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	27	24.32		916.63		916.63	Till Like	-	24.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	28	24.84		916.11		916.11	Till Like	-	13.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	29	25.33		915.62		915.62	Till Like	-	16.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	30	25.85		915.10		915.10	Weathered Bedrock	-	14.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	31	26.33		914.62		914.62	Weathered Bedrock	-	10.0	GP-GC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	32	26.82		914.13		914.13	Weathered Bedrock	-	13.4	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	33	27.34		913.61		913.61	Weathered Bedrock	-	7.0	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	34	27.83		913.12		913.12	Weathered Bedrock	-	4.9	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	35	28.32		912.63		912.63	Weathered Bedrock	-	5.7	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	36	28.83		912.12		912.12	Weathered Bedrock	-	9.7	CI/GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	37	29.32		911.63		911.63	Weathered Bedrock	-	8.0	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	Golder	GA18-04B	Corner 1 Embankment Buttress	Grab	38	29.72		911.23		911.23	Weathered Bedrock	-	4.5	GP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	1	1.22		930.70		930.70	Basal Till	-	12.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	1	1.52	1.83	930.40	930.09	930.25	Basal Till	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	14.1	40.3	31.8	13.8	0.002	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	2	1.83		930.09		930.09	Basal Till	-	11.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	3	2.13		929.79		929.79	Basal Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	4	2.74		929.18		929.18	Basal Till	-	9.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	5	3.35		928.57		928.57	Basal Till	-	10.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	6	3.96		927.96		927.96	Basal Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	2	3.96	4.27	927.96	927.65	927.81	Basal Till	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	15.1	40.2	31.0	13.7	0.002	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	7	4.57		927.35		927.35	Basal Till	-	12.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	8	5.18		926.74		926.74	Basal Till	-	10.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	9	5.79		926.13		926.13	Basal Till	-	9.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	10	6.40		925.52		925.52	Basal Till	-	7.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	11	7.01		924.91		924.91	Basal Till	-	8.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	12	7.62		924.30		924.30	Basal Till	-	8.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	13	8.23		923.69		923.69	Basal Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	14	8.84		923.08		923.08	Basal Till	-	8.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	15	9.45		922.47		922.47	Basal Till	-	8.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	16	10.06		921.86		921.86	Basal Till	-	7.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	17	10.67		921.25		921.25	Basal Till	-	8.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	18	11.28		920.64		920.64	Basal Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	19	11.89		920.03		920.03	Basal Till	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	20	12.50		919.42		919.42	Basal Till	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	21	13.11		918.81		918.81	Basal Till	-	7.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	22	13.72		918.20		918.20	Basal Till	-	7.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	23	14.33		917.59		917.59	Basal Till	-	7.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	24	14.94		916.98		916.98	Basal Till	-	8.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	25	15.54		916.38		916.38	Basal Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	6	15.85	16.15	916.07	915.77	915.92	Basal Till	-	8.9	CL	22	11	11	-0.19	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	26	16.15		915.77		915.77	Basal Till	-	8.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	27	16.76		915.16		915.16	Basal Till	-	8.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	28	17.37		914.55		914.55	Basal Till	-	8.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	29	17.98		913.94		913.94	Basal Till	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	30	18.59		913.33		913.33	Basal Till	-	7.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	31	19.20		912.72		912.72	Basal Till	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	8	19.39	19.69	912.53	912.23	912.38	Glaciolacustrine	-	17.0	CL	27	17	10	0.00	CL	-	-	-	-	-	-	-	-	-	0.3	8.1	91.6		-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	32	19.51		912.41		912.41	Glaciolacustrine	-	17.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	33	19.81		912.11		912.11	Basal Till	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	34	20.42		911.50		911.50	Basal Till	-	17.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	10	20.51	21.18	911.41	910.74	911.08	Glaciolacustrine[2]	-	22.0	CI	33	21	12	0.08	CI	-	-	-	-	-	-	-	0	2.8	97.2		-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	35	21.03		910.89		910.89	-	-	21.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	36	21.64		910.28		910.28	Glaciofluvial	-	13.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	37	22.25		909.67		909.67	Glaciofluvial	-	15.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	38	22.86		909.06		909.06	Basal Till	-	10.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	39	23.47		908.45		908.45	Glaciofluvial	-	10.8	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	13	23.77	24.08	908.15	907.84	908.00	Glaciofluvial	-	-	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	40.0	49.0	11.0		-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	40	24.08		907.84		907.84	Glaciofluvial	-	11.3	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	41	24.69		907.23		907.23	Glaciofluvial	-	10.9	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	42	25.30		906.62		906.62	Glaciofluvial	-	11.7	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	43	25.91		906.01		906.01	Glaciofluvial	-	18.6	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	44	26.52		905.40		905.40	Glaciofluvial	-	17.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	45	27.13		904.79		904.79	Glaciofluvial	-	17.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	46	27.74		904.18		904.18	Basal Till	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	47	28.35		903.57		903.57	Basal Till	-	9.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	48	28.96		902.96		902.96	-	-	17.2	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	49	29.57		902.35		902.35	-	-	12.5	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	50	30.18		901.74		901.74	Basal Till	-	7.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	51	30.78		901.14		901.14	Basal Till	-	6.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	52	31.39		900.53		900.53	Basal Till	-	6.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	53	32.00		899.92		899.92	Basal Till	-	6.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	54	32.61		899.31		899.31	Basal Till	-	5.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	55	33.22		898.70		898.70	Basal Till	-	4.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	56	33.83		898.09		898.09	Basal Till	-	10.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	57	34.44		897.48		897.48	Basal Till	-	10.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	18	34.75	35.36	897.17	896.56	896.87	Basal Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	-	8.6	50.9	32.8	7.7	0.002	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	58	35.05		896.87		896.87	Basal Till	-	9.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	59	35.66		896.26		896.26	Basal Till	-	6.9	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	60	36.27		895.65		895.65	Basal Till	-	7.2	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	61	36.88		895.04		895.04	Basal Till	-	4.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	62	37.49		894.43		894.43	Basal Till	-	7.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	63	38.10		893.82		893.82	Basal Till	-	4.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	64	38.71		893.21		893.21	Basal Till	-	4.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	65	39.32		892.60		892.60	Basal Till	-	5.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	66	39.93		891.99		891.99	Glaciofluvial	-	7.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	67	40.54		891.38		891.38	Glaciofluvial	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	68	41.15		890.77		890.77	Basal Till	-	7.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	69	41.76		890.16		890.16	-	-	13.4	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	70	42.37		889.55		889.55	-	-	16.7	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	22	42.37	42.67	889.55	889.25	889.40	-	-	16.9	CL/CI	30	17	13	-0.01	CL/CI	-	-	-	-	-	-	-	1.2	7.7	91.1		-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	71	42.98		888.94		888.94	-	-	10.9	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	72	43.59		888.33		888.33	-	-	15.3	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	73	44.20		887.72		887.72	-	-	16.4	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	74	44.81		887.11		887.11	Glaciofluvial	-	19.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	75	45.42		886.50		886.50	Glaciofluvial	-	16.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	76	46.02		885.90		885.90	Glaciofluvial	-	18.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	77	46.63		885.29		885.29	Basal Till	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Grab	25	46.94	47.24	884.98	884.68	884.83	Basal Till	-	12.7	CL	26	16	10	-0.33	CL	-	-	-	-	-	-	-	0.6	14.1	85.3		-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	78	47.24		884.68		884.68	Basal Till	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	79	47.85		884.07		884.07	Basal Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	80	48.46		883.46		883.46	Bedrock	-	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	81	49.07		882.85		882.85	Bedrock	-	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	82	49.68		882.24		882.24	Bedrock	-	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-01	Perimeter Embankment Buttress	Chunk	83	50.29		881.63		881.63	Bedrock	-	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	1	1.22		928.89		928.89	Basal Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	2	1.83		928.28		928.28	Basal Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	1	1.98	2.29	928.13	927.82	927.98	-	-	16.4	CL	26	14	12	0.20	CL	-	-	-	-	-	-	-	6.0	30.1	63.9		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	3	2.13		927.98		927.98	-	-	15.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Thin-walled Open Tube	TO5	2.13	3.66	927.98	926.45	927.22	Basal Till	-	-	SC	-	-	-	-	-	2151	2365	-	-	-	-	-	11.6	39.3	35.7	13.4	0.002	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	4	2.74		927.37		927.37	Basal Till	-	11.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	5	3.35		926.76		926.76	Basal Till	-	10.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	6	3.96		926.15		926.15	Glaciofluvial	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	7	4.57		925.54		925.54	Glaciofluvial	-	5.3	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	8	5.18		924.93		924.93	-	-	3.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	3	5.49	5.79	924.62	924.32	924.47	-	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	-	22.7	43.2	27.7	6.4	0.002	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	9	5.79		924.32		924.32	-	-	3.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	10	6.40		923.71		923.71	-	-	5.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	11	7.01		923.10		923.10	-	-	5.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	4	7.32	7.62	922.79	922.49	922.64	-	-	5.5	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	30.6	69.4		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	12	7.62		922.49		922.49	-	-	5.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	13	8.23		921.88		921.88	-	-	25.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	14	8.84		921.27		921.27	-	-	5.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	15	9.45		920.66		920.66	-	-	5.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	16	10.06		920.05		920.05	-	-	4.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	17	10.67		919.44		919.44	-	-	9.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	18	11.28		918.83		918.83	-	-	21.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	19	11.89		918.22		918.22	-	-	6.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	20	12.50		917.61		917.61	-	-	4.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	21	13.11		917.00		917.00	-	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	22	13.72		916.39		916.39	-	-	15.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	23	14.33		915.78		915.78	-	-	19.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	24	14.94		915.17		915.17	-	-	22.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	25	15.54		914.57		914.57	-	-	17.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	26	16.15		913.96		913.96	-	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	9	16.15	16.46	913.96	913.65	913.81	Glaciolacustrine	-	19.0	CL	27	17	10	0.20	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	27	16.76		913.35		913.35	Glaciolacustrine	-	16.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	28	17.37		912.74		912.74	Glaciofluvial	-	19.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	29	17.98		912.13		912.13	Glaciofluvial	-	14.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	30	18.59		911.52		911.52	Glaciofluvial	-	14.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	31	19.20		910.91		910.91	Glaciofluvial	-	15.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	11	19.51	19.81	910.60	910.30	910.45	-	-	17.7	CL	27	18	9	-0.03	CL	-	-	-	-	-	-	-	0	5.6	94.4		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	32	19.81		910.30		910.30	-	-	18.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	33	20.42		909.69		909.69	Glaciofluvial	-	15.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	34	21.03		909.08		909.08	Glaciofluvial	-	14.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	35	21.64		908.47		908.47	-	-	16.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	36	22.25		907.86		907.86	-	-	13.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	37	22.86		907.25		907.25	Glaciofluvial	-	23.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	38	23.47		906.64		906.64	Glaciofluvial	-	19.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	39	24.08		906.03		906.03	Glaciofluvial	-	23.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	40	24.69		905.42		905.42	Glaciofluvial	-	21.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	41	25.30		904.81		904.81	Glaciofluvial	-	20.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	42	25.91		904.20		904.20	Glaciofluvial	-	15.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Thin-walled Open Tube	TO3	26.21	27.13	903.90	902.98	903.44	Glaciofluvial	-	-	ML	-	-	-	-	-	1826	2262	-	-	-	-	-	0.2	35.3	58.4	6.1	0.002	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	43	26.52		903.59		903.59	Glaciofluvial	-	19.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	44	27.13		902.98		902.98	Glaciofluvial	-	21.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	15	27.31	27.40	902.80	902.71	902.76	Glaciolacustrine	-	33.9	CI	40	23	17	0.64	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	45	27.37		902.74		902.74	Glaciolacustrine	-	34.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	46	27.74		902.37		902.37	Glaciofluvial	-	23.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	47	28.35		901.76		901.76	Glaciofluvial	-	24.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	48	28.96		901.15		901.15	Glaciofluvial	-	22.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	17	29.44	29.54	900.67	900.57	900.62	Glaciolacustrine	-	36.8	CI	34	22	12	1.23	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	49	29.50		900.61		900.61	Glaciolacustrine	-	36.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	50	29.57		900.54		900.54	Glaciofluvial	-	33.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	51	30.18		899.93		899.93	Glaciofluvial	-	25.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	52	30.78		899.33		899.33	Glaciofluvial	-	22.6	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	53	31.39		898.72		898.72	Glaciofluvial	-	22.7	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	54	32.00		898.11		898.11	Glaciofluvial	-	20.2	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	55	32.61		897.50		897.50	Glaciofluvial	-	8.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	56	33.22		896.89		896.89	Glaciofluvial	-	9.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	19	33.22	33.53	896.89	896.58	896.74	Glaciofluvial	-	-	SP	-	-	-	-	-	-	-	-	-	-	-	34.3	61.6	4.1		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	57	33.83		896.28		896.28	Glaciofluvial	-	13.4	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	58	34.44		895.67		895.67	Glaciofluvial	-	11.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	59	35.05		895.06		895.06	Glaciofluvial	-	11.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	60	35.66		894.45		894.45	Glaciofluvial	-	9.1	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	61	36.27		893.84		893.84	Glaciofluvial	-	5.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	62	36.88		893.23		893.23	Glaciofluvial	-	14.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	63	37.49		892.62		892.62	Glaciofluvial	-	18.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	64	38.10		892.01		892.01	Glaciofluvial	-	16.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	65	38.71		891.40		891.40	Glaciofluvial	-	16.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	66	39.32		890.79		890.79	Glaciofluvial	-	14.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	67	39.93		890.18		890.18	Glaciofluvial	-	19.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	68	40.54		889.57		889.57	Glaciofluvial	-	18.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	69	41.15		888.96		888.96	Glaciofluvial	-	16.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	70	41.76		888.35		888.35	Basal Till	-	8.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	71	42.37		887.74		887.74	Basal Till	-	7.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	72	42.98		887.13		887.13	Basal Till	-	8.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	73	43.59		886.52		886.52	Basal Till	-	8.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	74	44.20		885.91		885.91	Basal Till	-	5.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	75	44.81		885.30		885.30	Basal Till	-	10.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	76	45.42		884.69		884.69	Basal Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	77	46.02		884.09		884.09	Basal Till	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	78	46.63		883.48		883.48	Glaciofluvial	-	19.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	24	47.09	47.34	883.02	882.77	882.90	Basal Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	23.3	35.5	25.3	15.9	0.002	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	79	47.24		882.87		882.87	Basal Till	-	8.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	80	47.85		882.26		882.26	Glaciofluvial	-	12.6	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	81	48.46		881.65		881.65	Glaciofluvial	-	23.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	82	49.07		881.04		881.04	Glaciofluvial	-	19.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	83	49.65		880.46		880.46	Glaciolacustrine	-	19.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	84	49.83		880.28		880.28	Glaciofluvial	-	7.1	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	85	50.29		879.82		879.82	Glaciofluvial	-	12.8	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	86	50.90		879.21		879.21	Glaciofluvial	-	18.8	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	87	51.51		878.60		878.60	Glaciofluvial	-	18.8	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	88	52.12		877.99		877.99	Glaciofluvial	-	8.0	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	89	52.73		877.38		877.38	Glaciofluvial	-	7.0	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	90	53.34		876.77		876.77	Glaciofluvial	-	9.8	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	91	53.95		876.16		876.16	Glaciofluvial	-	10.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	92	54.56		875.55		875.55	Glaciofluvial	-	9.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	27	54.56	54.86	875.55	875.25	875.40	Glaciofluvial	-	10.6	SM		Non-Plastic		-	ML	-	-	-	-	-	-	-	36.6	46.2	17.2		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	93	55.17		874.94		874.94	Glaciofluvial	-	10.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	94	55.78		874.33		874.33	Glaciolacustrine	-	16.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	29	56.08	56.39	874.03	873.72	873.88	Glaciolacustrine	-	19.0	CI	35	22	13	-0.23	CI	-	-	-	-	-	-	-	0	1.7	98.3		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	95	56.39		873.72		873.72	Glaciolacustrine	-	19.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	96	57.00		873.11		873.11	Glaciolacustrine	-	24.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	97	57.61		872.50		872.50	Glaciolacustrine	-	22.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	98	58.22		871.89		871.89	Glaciolacustrine	-	21.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	99	58.83		871.28		871.28	Glaciolacustrine	-	21.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	100	59.44		870.67		870.67	Glaciolacustrine	-	22.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	101	60.05		870.06		870.06	Glaciolacustrine	-	23.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	32	60.35	60.66	869.76	869.45	869.61	Glaciolacustrine	-	24.8	CI	38	22	16	0.18	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	102	60.66		869.45		869.45	Glaciolacustrine	-	21.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	103	61.26		868.85		868.85	Glaciolacustrine	-	27.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	104	61.87		868.24		868.24	Glaciolacustrine	-	20.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Grab	33	62.18	62.48	867.93	867.63	867.78	Glaciolacustrine	-	18.1	CI	31	20	11	-0.17	CI	-	-	-	-	-	-	-	0	2.2	97.8		-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	105	62.48		867.63		867.63	Glaciolacustrine	-	19.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	106	63.09		867.02		867.02	Glaciolacustrine	-	24.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	107	63.70		866.41		866.41	Glaciofluvial	-	27.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	108	64.31		865.80		865.80	Glaciofluvial	-	22.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	109	64.92		865.19		865.19	-	-	15.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	110	65.53		864.58		864.58	Glaciofluvial	-	20.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	111	66.14		863.97		863.97	Basal Till	-	16.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	112	66.75		863.36		863.36	Basal Till	-	15.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	113	67.36		862.75		862.75	Basal Till	-	12.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	114	67.97		862.14		862.14	Basal Till	-	15.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	115	68.58		861.53		861.53	Basal Till	-	16.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	116	69.19		860.92		860.92	-	-	15.5	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	117	69.80		860.31		860.31	-	-	15.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	118	70.41		859.70		859.70	Bedrock	-	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	119	71.02		859.09		859.09	Bedrock	-	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-02	Perimeter Embankment Buttress	Chunk	120	71.63		858.48		858.48	Bedrock	-	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	1	5.18		925.27		925.27	Ablation Till	-	12.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	2	5.79		924.66		924.66	Ablation Till	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	3	6.40		924.05		924.05	Ablation Till	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	4	7.01		923.44		923.44	Ablation Till	-	9.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	2	7.01	7.32	923.44	923.13	923.29	Ablation Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	16.7	43.6	31.5	8.2	0.002	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	5	7.62		922.83		922.83	Ablation Till	-	9.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	6	8.23		922.22		922.22	Ablation Till	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	7	8.84		921.61		921.61	Ablation Till	-	12.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	8	9.45		921.00		921.00	Ablation Till	-	8.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	9	10.06		920.39		920.39	Ablation Till	-	11.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	4	10.36	10.67	920.09	919.78	919.94	Ablation Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	25.0	34.8	30.3	9.9	0.002	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	10	10.67		919.78		919.78	Ablation Till	-	10.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	11	11.28		919.17		919.17	Ablation Till	-	12.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	12	11.89		918.56		918.56	Ablation Till	-	11.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	13	12.50		917.95		917.95	Ablation Till	-	10.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	14	13.11		917.34		917.34	Ablation Till	-	10.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	15	13.72		916.73		916.73	Ablation Till	-	11.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	16	14.33		916.12		916.12	Ablation Till	-	11.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	17	14.94		915.51		915.51	Ablation Till	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	18	15.54		914.91		914.91	Ablation Till	-	12.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	19	16.15		914.30		914.30	Ablation Till	-	12.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	20	16.76		913.69		913.69	Ablation Till	-	12.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	21	17.37		913.08		913.08	Ablation Till	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	22	17.98		912.47		912.47	Ablation Till	-	11.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	23	18.59		911.86		911.86	Ablation Till	-	12.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	24	19.20		911.25		911.25	Ablation Till	-	11.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	25	19.81		910.64		910.64	Ablation Till	-	11.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	26	20.42		910.03		910.03	Ablation Till	-	12.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	27	21.03		909.42		909.42	Ablation Till	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	28	21.64		908.81		908.81	Ablation Till	-	11.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	29	22.25		908.20		908.20	Ablation Till	-	10.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	30	22.86		907.59		907.59	Ablation Till	-	12.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	12	23.17	23.47	907.28	906.98	907.13	Glaciolacustrine	-	21.1	CI	45	22	23	-0.04	CI	-	-	-	-	-	-	-	5.6	7.9	86.5		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	31	23.47		906.98		906.98	Basal Till	-	9.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	32	24.08		906.37		906.37	Glaciolacustrine	-	23.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	13	24.38	24.69	906.07	905.76	905.92	Glaciolacustrine	-	24.3	CI	37	22	15	0.15	CI	-	-	-	-	-	-	-	0	2.3	97.7		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	33	24.69		905.76		905.76	Glaciolacustrine	-	22.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Thin-walled Open Tube	TO2	24.69	24.99	905.76	905.46	905.61	Glaciolacustrine	-	22.1	CI		Non-Plastic		-	ML	-	-	-	-	-	-	-	0	17.4	65.6	17.0	0.002	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Thin-walled Open Tube	TO2-CRS	24.69	24.99	905.76	905.46	905.61	Glaciolacustrine	-	24.3	CI	33	20	13	0.33	CI	-	-	-	-	-	-	-	0	1.3	71.3	27.4	0.002	CRS
2021	Golder	GA21-03	Perimeter Embankment Buttress	Thin-walled Open Tube	TO3	24.99	25.60	905.46	904.85	905.16	Glaciolacustrine	-	22.8	CI	32	19	13	0.29	CI	-	-	-	-	-	-	-	0	3.7	77.3	19.0	0.002	Incremental Consolidation
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	34	25.30		905.15		905.15	Glaciolacustrine	-	23.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	14	25.60	25.91	904.85	904.54	904.70	Glaciolacustrine	-	20.5	CL/CI	30	20	10	0.05	CL/CI	-	-	-	-	-	-	-	0	10.5	89.5		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Thin-walled Open Tube	TO4-CRS	25.60	26.21	904.85	904.24	904.55	Glaciolacustrine	-	19.8	CL/CI	37	22	15	-0.15	CI	1682	2014	-	-	-	-	-	0	1.8	65.6	32.6	0.002	DSS, CRS
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	35	25.91		904.54		904.54	Glaciolacustrine	-	22.7	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	36	26.52		903.93		903.93	Glaciofluvial	-	10.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	37	27.13		903.32		903.32	Glaciofluvial	-	16.8	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	38	27.74		902.71		902.71	Glaciofluvial	-	21.3	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	39	28.35		902.10		902.10	Glaciofluvial	-	21.4	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	40	28.96		901.49		901.49	Glaciofluvial	-	19.5	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	41	30.18		900.27		900.27	Glaciofluvial	-	6.1	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	42	30.78		899.67		899.67	Glaciofluvial	-	10.8	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	43	31.39		899.06		899.06	Glaciofluvial	-	7.2	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	44	32.00		898.45		898.45	Glaciofluvial	-	8.5	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	45	32.61		897.84		897.84	Glaciolacustrine	-	18.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	46	33.22		897.23		897.23	Glaciolacustrine	-	17.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	19	33.22	33.53	897.23	896.92	897.08	Glaciolacustrine	-	17.2	CI	37	20	17	-0.16	CI	-	-	-	-	-	-	-	0	2.0	98.0		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Thin-walled Open Tube	TO5-DSS	33.22	33.83	897.23	896.62	896.93	Glaciolacustrine	-	21.2	CI	50	22	28	-0.03	CI/CH	-	-	-	-	-	-	-	2.5	8.0	43.7	45.8	0.002	DSS, CRS, Incremental Consolidation
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	47	33.83		896.62		896.62	Glaciolacustrine	-	19.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	48	34.44		896.01		896.01	Glaciolacustrine	-	22.7	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	20	34.44	34.75	896.01	895.70	895.86	Glaciolacustrine	-	25.7	CH	68	24	44	0.04	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	49	35.05		895.40		895.40	Glaciolacustrine	-	16.5	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	50	35.66		894.79		894.79	-	-	10.8	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	51	36.27		894.18		894.18	-	-	10.5	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	21	36.58	36.88	893.87	893.57	893.72	-	-	16.8	CL-ML	20	15	5	0.36	CL-ML	-	-	-	-	-	-	-	1.7	25.6	72.7		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	52	36.88		893.57		893.57	-	-	17.7	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	53	37.49		892.96		892.96	-	-	25.4	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	22	37.80	38.10	892.65	892.35	892.50	Glaciofluvial	-	21.1	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	54	38.10		892.35		892.35	Glaciofluvial	-	21.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	55	38.71		891.74		891.74	Glaciofluvial	-	22.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	56	39.32		891.13		891.13	Glaciolacustrine	-	24.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	57	39.93		890.52		890.52	Glaciolacustrine	-	25.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	23	39.93	40.23	890.52	890.22	890.37	Glaciolacustrine	-	23.5	CL	29	15	14	0.61	CL	-	-	-	-	-	-	-	0	3.8	96.2		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	58	40.54		889.91		889.91	Glaciolacustrine	-	25.7	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	59	41.15		889.30		889.30	Glaciolacustrine	-	22.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	60	41.76		888.69		888.69	Glaciofluvial	-	19.9	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	61	42.37		888.08		888.08	Glaciofluvial	-	10.0	GW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	62	42.98		887.47		887.47	Basal Till	-	8.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	63	43.59		886.86		886.86	Basal Till	-	9.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	25	43.59	43.89	886.86	886.56	886.71	Basal Till	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	20.6	35.4	34.6	9.4	0.002	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	64	44.20		886.25		886.25	Basal Till	-	14.0	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	65	44.81		885.64		885.64	Basal Till	-	19.5	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Grab	26	45.11	45.42	885.34	885.03	885.19	Basal Till	-	17.9	CL-ML	23	16	7	0.27	CL-ML	-	-	-	-	-	-	-	1.4	26.7	71.9		-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	66	45.42		885.03		885.03	Basal Till	-	18.3	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	67	46.02		884.43		884.43	Basal Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	68	46.63		883.82		883.82	Basal Till	-	8.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-03	Perimeter Embankment Buttress	Chunk	69	47.24		883.21		883.21	Weathered Bedrock	-	18.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	1	14.33		924.05		924.05	Ablation Till	-	13.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	2	14.94		923.44		923.44	Ablation Till	-	12.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	3	15.54		922.84		922.84	Ablation Till	-	12.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	4	16.15		922.23		922.23	Ablation Till	-	12.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	5	16.76		921.62		921.62	Ablation Till	-	10.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	6	17.37		921.01		921.01	Ablation Till	-	14.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Grab	4	17.53	17.68	920.85	920.70	920.78	Upper Glaciolacustrine[2]	-	18.2	CI	32	14	18	0.23	CI	-	-	-	-	-	-	-	2.0	20.1	77.9		-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	7	17.68		920.70		920.70	Upper Glaciolacustrine[2]	-	20.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Thin-walled Open Tube	TO1	17.68	18.29	920.70	920.09	920.40	Upper Glaciolacustrine[2]	-	20.5	CI	47	19	28	0.05	CI	-	-	-	-	-	-	-	32.3	9.5	22.1	36.1	0.002	Cyclic DSS
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Chunk	8	19.05		919.33		919.33	Basal Till	-	17.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Thin-walled Open Tube	TO3	19.20	20.12	919.13	918.26	918.72	Basal Till	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	14.8	39.7	33.2	12.3	0.002	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Thin-walled Open Tube	TO4	20.12	20.73	918.26	917.65	917.96	Basal Till	-	-	SC	-	-	-	-	-	2063	2320	-	-	-	-	-	21.1	34.5	31.0	13.4	0.002	-
2021	Golder	GA21-04	Corner 1 Embankment Buttress	Thin-walled Open Tube	TO5	20.73	20.88	917.65	917.50	917.58	Basal Till	-	-	SC	-	-	-	-	-	1982	2250	-	-	-	-	-	14.9	39.2	32.7	13.2	0.002	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	1	7.01		938.51		938.51	Ablation Till	-	5.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	2	7.62		937.90		937.90	Ablation Till	-	16.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	3	8.23		937.29		937.29	Ablation Till	-	11.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	1	8.23	8.53	937.29	936.99	937.14	Ablation Till	-	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	17.4	41.7	28.7	12.2	0.002	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	4	8.84		936.68		936.68	Ablation Till	-	10.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	2	9.02	9.08	936.50	936.44	936.47	Glaciolacustrine	-	17.5	CI	31	15	16	0.16	CI	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	5	9.05		936.47		936.47	Glaciolacustrine	-	16.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	6	9.45		936.07		936.07	Ablation Till	-	11.9	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	7	10.06		935.46		935.46	Ablation Till	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	8	10.67		934.85		934.85	Ablation Till	-	11.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	9	11.28		934.24		934.24	Ablation Till	-	16.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	10	11.58		933.94		933.94	Ablation Till	-	16.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	11	12.50		933.02		933.02	Ablation Till	-	15.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	12	13.11		932.41		932.41	Ablation Till	-	15.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	13	13.72		931.80		931.80	Ablation Till	-	14.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	14	14.33		931.19		931.19	Ablation Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	15	14.94		930.58		930.58	Glaciofluvial	-	5.2	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	16	15.54		929.98		929.98	Glaciofluvial	-	3.4	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	17	16.15		929.37		929.37	Glaciofluvial	-	9.0	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	18	16.76		928.76		928.76	Glaciofluvial	-	9.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	19	17.98		927.54		927.54	Glaciofluvial	-	10.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	20	18.59		926.93		926.93	Glaciofluvial	-	5.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	21	19.20		926.32		926.32	Glaciofluvial	-	3.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	22	19.81		925.71		925.71	Basal Till	-	3.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	23	20.42		925.10		925.10	Glaciofluvial	-	7.4	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	24	21.03		924.49		924.49	Glaciofluvial	-	2.4	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	25	21.64		923.88		923.88	Glaciofluvial	-	2.2	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	26	22.25		923.27		923.27	Basal Till	-	2.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	27	22.86		922.66		922.66	Basal Till	-	2.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	28	23.47		922.05		922.05	-	-	6.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	29	24.08		921.44		921.44	-	-	3.3	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	30	24.69		920.83		920.83	-	-	3.0	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	31	25.30		920.22		920.22	-	-	3.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	32	25.91		919.61		919.61	Basal Till	-	2.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	33	26.82		918.70		918.70	Basal Till	-	11.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	34	27.74		917.78		917.78	Glaciofluvial	-	2.7	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	35	28.35		917.17		917.17	Glaciofluvial	-	3.1	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	11	28.65	28.96	916.87	916.56	916.72	Basal Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	-	7.5	44.7	41.8	6.0	0.002	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	36	28.96		916.56		916.56	Basal Till	-	12.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	37	29.57		915.95		915.95	Glaciofluvial	-	9.6	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	38	30.18		915.34		915.34	Glaciofluvial	-	13.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	39	30.78		914.74		914.74	Basal Till	-	10.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	40	31.39		914.13		914.13	Basal Till	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	41	32.00		913.52		913.52	Basal Till	-	12.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	42	32.61		912.91		912.91	Basal Till	-	15.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	43	33.22		912.30		912.30	Basal Till	-	14.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	44	33.83		911.69		911.69	Basal Till	-	14.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	45	34.44		911.08		911.08	Basal Till	-	16.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	16	34.75	35.05	910.77	910.47	910.62	Glaciolacustrine	-	15.3	CL	29	17	12	-0.14	CL	-	-	-	-	-	-	-	1.2	24.8	74.0		-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	46	35.05		910.47		910.47	Glaciolacustrine	-	17.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	47	35.66		909.86		909.86	Basal Till	-	14.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	48	36.27		909.25		909.25	Basal Till	-	18.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	49	36.88		908.64		908.64	Basal Till	-	14.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	50	37.49		908.03		908.03	Basal Till	-	18.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	51	38.10		907.42		907.42	Basal Till	-	17.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	52	38.71		906.81		906.81	Basal Till	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	53	39.32		906.20		906.20	Basal Till	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	54	39.93		905.59		905.59	Basal Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	55	40.54		904.98		904.98	Basal Till	-	13.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	19	40.54	40.84	904.98	904.68	904.83	-	-	15.0	CL	29	15	14	0.00	CL	-	-	-	-	-	-	-	2.0	16.5	81.5		-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	56	41.15		904.37		904.37	-	-	14.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	57	41.76		903.76		903.76	Basal Till	-	10.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	58	42.37		903.15		903.15	Basal Till	-	8.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	59	42.98		902.54		902.54	Basal Till	-	12.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	20	42.98	43.28	902.54	902.24	902.39	Basal Till	-	9.3	CL	27	14	13	-0.36	CL	-	-	-	-	-	-	-	0	39.0	61.0		-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	60	43.59		901.93		901.93	Basal Till	-	8.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	61	44.20		901.32		901.32	Basal Till	-	7.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	62	44.81		900.71		900.71	Basal Till	-	9.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	63	45.42		900.10		900.10	Basal Till	-	7.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	64	46.02		899.50		899.50	Basal Till	-	6.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	65	46.63		898.89		898.89	Basal Till	-	3.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	66	47.24		898.28		898.28	Basal Till	-	10.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	67	47.85		897.67		897.67	Basal Till	-	13.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	68	48.46		897.06		897.06	Basal Till	-	7.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	69	49.07		896.45		896.45	Basal Till	-	5.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	70	49.68		895.84		895.84	Basal Till	-	5.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	71	50.29		895.23		895.23	Basal Till	-	5.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	72	50.90		894.62		894.62	Basal Till	-	10.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	73	51.51		894.01		894.01	Basal Till	-	12.3	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	74	52.12		893.40		893.40	Basal Till	-	12.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	27	52.43	52.73	893.09	892.79	892.94	Glaciolacustrine	-	10.6	CL	26	15	11	-0.40	CL	-	-	-	-	-	-	-	4.4	35.6	60.0		-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	75	52.73		892.79		892.79	Glaciolacustrine	-	14.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	76	53.34		892.18		892.18	Glaciolacustrine	-	15.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	77	53.95		891.57		891.57	Basal Till	-	15.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	78	54.56		890.96		890.96	Basal Till	-	17.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	79	55.17		890.35		890.35	Basal Till	-	17.6	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	80	55.78		889.74		889.74	Basal Till	-	16.0	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	81	57.00		888.52		888.52	Basal Till	-	12.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Grab	30	57.30	57.61	888.22	887.91	888.07	Glaciolacustrine	-	12.7	CL	25	15	10	-0.23	CL	-	-	-	-	-	-	-	7.2	27.1	65.7		-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	82	57.61		887.91		887.91	Glaciolacustrine	-	12.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	83	58.22		887.30		887.30	Basal Till	-	5.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	84	58.83		886.69		886.69	Basal Till	-	15.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	85	60.05		885.47		885.47	Glaciofluvial	-	10.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	86	60.66		884.86		884.86	Glaciofluvial	-	18.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	87	61.26		884.26		884.26	Glaciofluvial	-	13.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	88	63.09		882.43		882.43	Basal Till	-	14.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	89	63.70		881.82		881.82	Basal Till	-	13.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	90	64.31		881.21		881.21	Basal Till	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	91	64.92		880.60		880.60	Basal Till	-	6.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	92	65.68		879.84		879.84	Basal Till	-	12.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	93	66.14		879.38		879.38	Basal Till	-	10.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	94	66.75		878.77		878.77	Basal Till	-	11.7	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	95	67.36		878.16		878.16	Basal Till	-	10.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	96	67.97		877.55		877.55	Basal Till	-	12.6	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-05	Perimeter Embankment Buttress	Chunk	97	68.58		876.94		876.94	Bedrock	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	1	0.30		937.68		937.68	Basal Till	-	12.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	2	0.91		937.07		937.07	Basal Till	-	12.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	3	1.52		936.46		936.46	Basal Till	-	10.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	4	2.13		935.85		935.85	Basal Till	-	10.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Grab	1	2.44	2.74	935.54	935.24	935.39	Basal Till	-	-	ML	-	-	-	-	-	-	-	-	-	-	-	5.3	36.4	42.8	15.5	0.002	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	5	2.74		935.24		935.24	Basal Till	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	6	3.35		934.63		934.63	Basal Till	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	7	3.96		934.02		934.02	Basal Till	-	10.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	8	4.57		933.41		933.41	Basal Till	-	9.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	9	5.18		932.80		932.80	Basal Till	-	6.4	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	10	5.79		932.19		932.19	Basal Till	-	6.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	11	6.40		931.58		931.58	Basal Till	-	4.3	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Grab	2	6.40	6.71	931.58	931.27	931.43	Basal Till	-	-	SM	-	-	-	-	-	-	-	-	-	-	-	32.4	43.9	18.4	5.3	0.002	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	12	7.01		930.97		930.97	Basal Till	-	5.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	13	7.62		930.36		930.36	Glaciofluvial	-	17.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Grab	3	7.77	7.93	930.21	930.05	930.13	Glaciolacustrine	-	20.5	CI	32	20	12	0.04	CI	-	-	-	-	-	-	-	0.8	14.7	84.5		-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	14	8.23		929.75		929.75	Glaciofluvial	-	16.6	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	15	8.84		929.14		929.14	Glaciofluvial	-	5.4	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	16	9.45		928.53		928.53	Glaciofluvial	-	4.0	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	17	10.06		927.92		927.92	Basal Till	-	6.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	18	10.67		927.31		927.31	Basal Till	-	4.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	19	11.28		926.70		926.70	Glaciofluvial	-	17.8	SW-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	20	11.89		926.09		926.09	Basal Till	-	4.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	21	12.50		925.48		925.48	Glaciofluvial	-	3.4	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Grab	6	12.80	13.11	925.18	924.87	925.03	Glaciofluvial	-	-	SP-SM	-	-	-	-	-	-	-	-	-	-	-	44.3	44.8	8.6	2.3	0.002	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	22	13.11		924.87		924.87	Glaciofluvial	-	3.5	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	23	14.33		923.65		923.65	Basal Till	-	9.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	24	14.94		923.04		923.04	Basal Till	-	7.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	25	15.54		922.44		922.44	Basal Till	-	7.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	26	16.15		921.83		921.83	Glaciofluvial	-	9.0	SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	27	16.76		921.22		921.22	Basal Till	-	3.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Grab	8	16.76	17.07	921.22	920.91	921.07	Basal Till	-	-	GM	-	-	-	-	-	-	-	-	-	-	-	38.1	35.5	20.4	6.0	0.002	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	28	17.37		920.61		920.61	Basal Till	-	5.0	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	29	17.98		920.00		920.00	Basal Till	-	5.5	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	30	18.59		919.39		919.39	Basal Till	-	4.6	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	31	19.20		918.78		918.78	Basal Till	-	5.1	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	32	19.81		918.17		918.17	Basal Till	-	3.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	33	20.42		917.56		917.56	Basal Till	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	34	21.03		916.95		916.95	Basal Till	-	7.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	35	21.64		916.34		916.34	Basal Till	-	8.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	36	22.25		915.73		915.73	Basal Till	-	9.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-06	Perimeter Embankment Buttress	Chunk	37	22.86		915.12		915.12	Basal Till	-	11.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	1	11.28		924.62		924.62	Basal Till	-	14.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	2	11.89		924.01		924.01	Basal Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Grab	1	11.89	12.19	924.01	923.71	923.86	Basal Till	-	-	CL	-	-	-	-	-	-	-	-	-	-	-	12.1	33.8	36.8	17.3	0.002	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	3	12.50		923.40		923.40	Basal Till	-	13.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	4	13.11		922.79		922.79	Basal Till	-	15.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	5	13.72		922.18		922.18	Glaciolacustrine	-	22.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Grab	2	13.72	14.02	922.18	921.88	922.03	Glaciolacustrine	-	27.8	CI	47	18	29	0.34	CI	-	-	-	-	-	-	-	4.9	16.6	78.5		-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-07	Main Embankment Buttress	Thin-walled Open Tube	TO1	13.72	14.17	922.18	921.73	921.96	Glaciolacustrine	-	29.2	CI	45	22	23	0.31	CI	-	-	-	-	-	-	-	1.5	12.1	46.1	40.3	0.002	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	6	14.33		921.57		921.57	Basal Till	-	28.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	7	14.94		920.96		920.96	Basal Till	-	11.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	8	15.54		920.36		920.36	Basal Till	-	13.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	9	16.15		919.75		919.75	Glaciofluvial	-	13.8	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	10	16.76		919.14		919.14	Basal Till	-	11.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	11	17.37		918.53		918.53	Basal Till	-	12.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	12	17.98		917.92		917.92	Basal Till	-	12.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	13	18.59		917.31		917.31	Basal Till	-	12.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	14	19.20		916.70		916.70	Basal Till	-	9.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	15	19.81		916.09		916.09	Glaciofluvial	-	19.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	16	20.42		915.48		915.48	Glaciofluvial	-	21.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	17	21.03		914.87		914.87	Glaciofluvial	-	26.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	18	21.64		914.26		914.26	Glaciofluvial	-	25.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	19	22.25		913.65		913.65	Glaciolacustrine	-	24.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	20	22.86		913.04		913.04	Glaciolacustrine	-	22.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Grab	9	22.86	23.17	913.04	912.73	912.89	Glaciolacustrine	-	23.9	CL	27	18	9	0.66	CL	-	-	-	-	-	-	-	0	15.6	84.4		-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	21	23.47		912.43		912.43	Glaciolacustrine	-	24.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	22	24.08		911.82		911.82	Glaciofluvial	-	22.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	23	24.69		911.21		911.21	Glaciolacustrine	-	19.3	MH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	24	25.30		910.60		910.60	-	-	19.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Grab	11	25.30	25.60	910.60	910.30	910.45	-	-	19.3	CL	28	18	10	0.13	CL	-	-	-	-	-	-	-	0	5.2	94.8		-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	25	25.91		909.99		909.99	-	-	22.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	26	26.52		909.38		909.38	Glaciofluvial	-	19.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	27	27.13		908.77		908.77	Glaciofluvial	-	21.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	28	27.74		908.16		908.16	Glaciofluvial	-	21.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	29	28.35		907.55		907.55	Glaciofluvial	-	19.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	30	28.96		906.94		906.94	-	-	18.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	31	29.57		906.33		906.33	-	-	21.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	32	30.18		905.72		905.72	-	-	28.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	33	30.78		905.12		905.12	-	-	30.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	34	31.39		904.51		904.51	-	-	33.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	35	32.00		903.90		903.90	-	-	34.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	36	32.61		903.29		903.29	Glaciolacustrine	-	32.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Thin-walled Open Tube	TO3	32.92	33.53	902.98	902.37	902.68	Glaciolacustrine	-	22.2	CH	41	22	19	0.01	CI	1353	1587	-	-	-	-	-	0	0.6	66.8	32.6	0.002	-
2021	Golder	GA21-07	Main Embankment Buttress	Thin-walled Open Tube	TO3-DSS	32.92	33.53	902.98	902.37	902.68	Glaciolacustrine	-	28.2	CH	33	18	15	0.68	CI	-	-	-	-	-	-	-	0	1.1	70.3	28.6	0.002	DSS, CRS
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	37	33.22		902.68		902.68	Glaciolacustrine	-	30.1	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	38	33.83		902.07		902.07	Glaciolacustrine	-	30.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Grab	15	33.83	34.14	902.07	901.76	901.92	Glaciolacustrine	-	28.7	CH	61	22	39	0.17	CH	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Thin-walled Open Tube	TO4	33.83	34.14	902.07	901.76	901.92	Glaciolacustrine	-	33.8	CH	43	20	23	0.60	CI	-	-	-	-	-	-	-	0	2.0	61.7	36.3	0.002	CRS, Incremental Consolidation
2021	Golder	GA21-07	Main Embankment Buttress	Thin-walled Open Tube	TO5	34.14	34.75	901.76	901.15	901.46	Glaciolacustrine	-	30.5	CH	53	23	30	0.25	CH	1559	2014	-	-	-	-	-	0	1.7	50.3	48.0	0.002	Incremental Consolidation
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	39	34.44		901.46		901.46	Glaciolacustrine	-	23.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	40	35.05		900.85		900.85	Glaciolacustrine	-	37.6	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	41	35.66		900.24		900.24	Glaciolacustrine	-	29.4	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	42	36.27		899.63		899.63	Glaciofluvial	-	25.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	43	36.88		899.02		899.02	Glaciolacustrine	-	31.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	44	37.49		898.41		898.41	-	-	29.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-07	Main Embankment Buttress	Chunk	45	38.10		897.80		897.80	Glaciofluvial	-	23.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	1	17.37		912.87		912.87	Ablation Till	-	15.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	1	17.37	17.68	912.87	912.56	912.72	Ablation Till	-	-	ML	-	-	-	-	-	-	-	-	-	-	-	-	13.4	35.4	38.9	12.3	0.002	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	2	17.98		912.26		912.26	Ablation Till	-	17.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	3	18.59		911.65		911.65	Glaciofluvial	-	12.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	4	19.20		911.04		911.04	-	-	8.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	5	19.81		910.43		910.43	-	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	6	20.42		909.82		909.82	Glaciofluvial	-	19.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	7	21.03		909.21		909.21	Glaciofluvial	-	24.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	8	21.64		908.60		908.60	Glaciolacustrine	-	25.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	9	22.25		907.99		907.99	Glaciolacustrine	-	22.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	4	22.71	22.86	907.53	907.38	907.46	Glaciolacustrine	-	21.3	CI	36	19	17	0.14	CI	-	-	-	-	-	-	-	0	5.5	94.5		-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	10	22.86		907.38		907.38	Glaciolacustrine	-	17.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	11	23.47		906.77		906.77	Glaciolacustrine	-	21.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Thin-walled Open Tube	TO3	23.53	23.68	906.71	906.56	906.64	Glaciolacustrine	-	27.4	CI	43	23	20	0.22	CI	-	-	-	-	-	-	-	0	5.0	59.4	35.6	0.002	DSS, CRS, Incremental Consolidation
2021	Golder	GA21-08	Main Embankment Buttress	Grab	5	23.77	23.93	906.47	906.31	906.39	Glaciolacustrine	-	34.7	CI	48	27	21	0.37	CI	-	-	-	-	-	-	-	0	0.5	99.5		-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	12	24.08		906.16		906.16	Glaciolacustrine	-	22.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	13	24.69		905.55		905.55	Glaciolacustrine	-	18.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Thin-walled Open Tube	TO5-DSS	24.69	25.30	905.55	904.94	905.25	Glaciolacustrine	-	27.4	CI	44	23	21	0.21	CI	1599	2027	-	-	-	-	-	0	0.3	54.8	44.9	0.002	DSS, Cyclic DSS
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	14	25.30		904.94		904.94	Glaciolacustrine	-	10.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	15	25.91		904.33		904.33	Glaciolacustrine	-	17.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	6	26.06	26.21	904.18	904.03	904.11	Glaciolacustrine	-	30.0	CI	47	23	24	0.29	CI	-	-	-	-	-	-	-	0	3.1	96.9		-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	16	26.52		903.72		903.72	Glaciolacustrine	-	17.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	17	27.13		903.11		903.11	Glaciolacustrine	-	14.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	7	27.43	27.74	902.81	902.50	902.66	Glaciolacustrine	-	-	CI	-	-	-	-	-	-	-	-	-	-	-	-	0	0.2	55.6	44.2	0.002	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	18	27.74		902.50		902.50	Glaciolacustrine	-	20.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	19	28.35		901.89		901.89	Glaciolacustrine	-	9.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	20	28.96		901.28		901.28	Glaciolacustrine	-	6.3	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	8	28.96	29.26	901.28	900.98	901.13	Glaciolacustrine	-	29.8	CI	41	22	19	0.41	CI	-	-	-	-	-	-	-	0	0.2	99.8		-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	21	29.57		900.67		900.67	Glaciofluvial	-	6.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	22	30.18		900.06		900.06	Glaciofluvial	-	9.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	23	30.78		899.46		899.46	Glaciofluvial	-	6.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	24	31.39		898.85		898.85	Glaciofluvial	-	7.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	25	32.00		898.24		898.24	Glaciofluvial	-	25.9	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	26	32.61		897.63		897.63	Glaciofluvial	-	17.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	27	33.22		897.02		897.02	Basal Till	-	12.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	28	33.83		896.41		896.41	Basal Till	-	11.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	29	34.44		895.80		895.80	Basal Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-08	Main Embankment Buttress	Grab	10	34.75	35.05	895.49	895.19	895.34	Basal Till	-	-	CL	-	-	-	-	-	-	-	-	-	-	-	-	6.0	41.9	33.2	18.9	0.002	-
2021	Golder	GA21-08	Main Embankment Buttress	Chunk	30	35.05		895.19		895.19	Basal Till	-	14.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	1	14.33		916.20		916.20	Basal Till	-	12.8	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	2	14.94		915.59		915.59	Basal Till	-	17.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	3	15.54		914.99		914.99	Basal Till	-	9.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	4	16.15		914.38		914.38	Basal Till	-	14.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	5	16.76		913.77		913.77	Basal Till	-	13.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	6	17.37		913.16		913.16	Basal Till	-	5.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	7	17.98		912.55		912.55	Basal Till	-	6.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Grab	3	18.90	19.05	911.63	911.48	911.56	Glaciolacustrine	-	17.1	CI	32	16	16	0.07	CI	-	-	-	-	-	-	-	0	25.4	74.6		-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	8	18.59		911.94		911.94	Basal Till	-	5.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	9	19.20		911.33		911.33	Glaciolacustrine	-	16.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	10	19.81		910.72		910.72	Glaciofluvial	-	22.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	11	20.12		910.41		910.41	Glaciofluvial	-	14.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	12	21.64		908.89		908.89	Glaciolacustrine	-	24.0	CL/CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Thin-walled Open Tube	TO2	21.64	22.25	908.89	908.28	908.59	Glaciolacustrine	-	29.6	CL/CH	28	20	8	1.20	CL	-	-	-	-	-	-	-	0	0.8	82.8	16.4	0.002	-
2021	Golder	GA21-09	Main Embankment Buttress	Thin-walled Open Tube	TO2-CRS	21.64	22.25	908.89	908.28	908.59	Glaciolacustrine	-	33.2	CL/CH	56	25	31	0.26	CH	-	-	-	-	-	-	-	0	0.2	50.5	49.3	0.002	CRS, Incremental Consolidation
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	13	22.86		907.67		907.67	Glaciofluvial	-	14.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	14	23.47		907.06		907.06	Glaciofluvial	-	15.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	15	24.08		906.45		906.45	Glaciofluvial	-	25.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Grab	7	24.38	24.69	906.15	905.84	906.00	Glaciofluvial	-	24.9	ML		Non-Plastic		-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	16	24.69		905.84		905.84	Glaciofluvial	-	25.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	17	25.30		905.23		905.23	Glaciofluvial	-	27.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	18	25.91		904.62		904.62	Basal Till	-	16.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	19	26.52		904.01		904.01	Basal Till	-	10.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	20	27.13		903.40		903.40	Basal Till	-	14.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m³)	Wet Density (kg/m³)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution				Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m³)	Optimum Water Content (%)	Maximum Dry Density (kg/m³)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2021	Golder	GA21-09	Main Embankment Buttress	Grab	8	27.43	27.74	903.10	902.79	902.95	Basal Till	-	-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	11.3	25.9	54.0	8.8	0.002	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	21	27.74		902.79		902.79	Basal Till	-	14.7	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	22	28.35		902.18		902.18	Basal Till	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	23	28.96		901.57		901.57	Basal Till	-	14.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	24	29.57		900.96		900.96	Basal Till	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	25	30.18		900.35		900.35	Basal Till	-	11.0	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	26	30.78		899.75		899.75	Glaciofluvial	-	7.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	27	31.39		899.14		899.14	Glaciofluvial	-	22.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Grab	9	31.70	32.00	898.83	898.53	898.68	Glaciolacustrine	-	25.7	CL/CI	30	20	10	0.57	CL/CI	-	-	-	-	-	-	-	-	0	5.1	94.9		-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	28	32.00		898.53		898.53	Glaciolacustrine	-	26.5	CL/CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	29	32.61		897.92		897.92	Basal Till	-	8.8	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	30	33.22		897.31		897.31	Basal Till	-	11.5	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	31	33.83		896.70		896.70	Basal Till	-	10.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	32	34.44		896.09		896.09	Glaciofluvial	-	13.8	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-09	Main Embankment Buttress	Chunk	33	35.05		895.48		895.48	Glaciofluvial	-	12.5	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	1	3.35		938.49		938.49	Fill	-	18.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	2	3.96		937.88		937.88	Fill	-	15.5	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	3	4.57		937.27		937.27	Fill	-	15.6	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	4	14.33		927.51		927.51	Ablation Till	-	10.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	5	14.94		926.90		926.90	Ablation Till	-	9.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	6	15.54		926.30		926.30	Ablation Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	7	16.15		925.69		925.69	Ablation Till	-	10.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	8	16.76		925.08		925.08	Ablation Till	-	11.0	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	9	17.37		924.47		924.47	Ablation Till	-	13.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	10	17.98		923.86		923.86	Ablation Till	-	11.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	11	18.59		923.25		923.25	Ablation Till	-	11.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	12	19.20		922.64		922.64	Ablation Till	-	12.6	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	13	19.81		922.03		922.03	Ablation Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	14	21.03		920.81		920.81	Ablation Till	-	13.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	15	21.64		920.20		920.20	Ablation Till	-	12.3	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	16	22.25		919.59		919.59	Ablation Till	-	12.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	17	23.01		918.83		918.83	Ablation Till	-	12.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	18	23.47		918.37		918.37	Ablation Till	-	13.9	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	19	24.08		917.76		917.76	Ablation Till	-	11.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-10	Corner 1 Embankment Buttress	Chunk	20	24.69		917.15		917.15	Ablation Till	-	10.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	1	0.61		930.20		930.20	Ablation Till	-	15.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	2	1.22		929.59		929.59	Ablation Till	-	12.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	3	1.83		928.98		928.98	Ablation Till	-	13.1	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	4	2.44		928.37		928.37	Ablation Till	-	11.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	5	3.05		927.76		927.76	Ablation Till	-	10.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	6	3.66		927.15		927.15	Ablation Till	-	10.2	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	7	4.27		926.54		926.54	Ablation Till	-	10.9	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	8	4.72		926.09		926.09	Ablation Till	-	11.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	9	5.49		925.32		925.32	Ablation Till	-	10.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	10	6.10		924.71		924.71	Ablation Till	-	11.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	11	6.71		924.10		924.10	Ablation Till	-	9.6	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	12	7.32		923.49		923.49	Ablation Till	-	10.7	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	13	7.92		922.89		922.89	Ablation Till	-	11.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	14	8.38		922.43		922.43	Glaciofluvial	-	6.9	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	15	9.14		921.67		921.67	Ablation Till	-	10.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	16	9.75		921.06		921.06	Ablation Till	-	19.8	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	17	10.21		920.60		920.60	Ablation Till	-	15.1	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	18	10.97		919.84		919.84	Ablation Till	-	11.4	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	19	11.43		919.38		919.38	Glaciolacustrine	-	20.1	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	20	11.73		919.08		919.08	Glaciolacustrine	-	20.6	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	21	12.50		918.31		918.31	Glaciolacustrine	-	22.9	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Thin-walled Open Tube	TO2-CRS	12.65	12.83	918.16	917.98	918.07	Glaciolacustrine	-	20.7	ML/CL	25	16	9	0.52	CL	-	-	-	-	-	-	-	-	0	10.8	73.7	15.5	0.002	CRS
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	22	12.83		917.98		917.98	Glaciolacustrine	-	22.4	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Grab	15	13.41	13.65	917.40	917.16	917.28	Glaciolacustrine	-	18.8	ML/CL	28	17	11	0.16	CL	-	-	-	-	-	-	-	-	3.1	11.6	65.6	19.7	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	23	13.56		917.25		917.25	Glaciolacustrine	-	19.5	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	24	14.17		916.64		916.64	Glaciolacustrine	-	19.9	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Thin-walled Open Tube	TO9-CRS	16.00	16.23	914.81	914.58	914.70	Glaciolacustrine	-	20.7	ML/CL	20	16	4	1.18	CL-ML	-	-	-	-	-	-	-	-	0.8	16.4	70.6	12.2	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Grab	16	16.64	16.76	914.17	914.05	914.11	Glaciolacustrine	-	17.1	ML/CL	22	18	4	-0.23	CL-ML	-	-	-	-	-	-	-	-	0.9	12.9	77.5	8.7	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	25	16.73		914.08		914.08	Glaciolacustrine	-	17.3	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Thin-walled Open Tube	TO11-CRS	16.76	17.14	914.05	913.67	913.86	Glaciolacustrine	-	18.1	ML/CL	23	16	7	0.30	CL-ML	-	-	-	-	-	-	-	-	0.5	11.5	80.5	7.5	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	26	17.47		913.34		913.34	Glaciolacustrine	-	15.9	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	27	18.07		912.74		912.74	Glaciolacustrine	-	19.5	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	28	18.75		912.06		912.06	Ablation Till	-	11.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	29	19.35		911.46		911.46	Ablation Till	-	9.0	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	30	19.96		910.85		910.85	Ablation Till	-	9.5	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	31	20.57		910.24		910.24	Glaciolacustrine	-	16.7	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Grab	20	20.73	21.03	910.08	909.78	909.93	Glaciolacustrine	-	19.2	ML/CL	24	15	9	0.47	CL	-	-	-	-	-	-	-	-	4.3	18.4	62.9	14.4	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	32	21.18		909.63		909.63	Glaciolacustrine	-	18.1	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	33	21.79		909.02		909.02	Glaciolacustrine	-	24.1	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	34	22.40		908.41		908.41	Glaciolacustrine	-	16.0	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	35	23.01		907.80		907.80	Glaciolacustrine	-	11.6	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	36	23.62		907.19		907.19	Glaciolacustrine	-	12.1	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Grab	24	23.93	24.23	906.88	906.58	906.73	Glaciolacustrine	-	17.2	ML/CL	19	17	2	0.10	ML	-	-	-	-	-	-	-	-	4.0	20.7	68.7	6.6	0.002	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	37	24.23		906.58		906.58	Glaciolacustrine	-	19.1	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	38	24.84		905.97		905.97	Glaciolacustrine	-	20.2	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	39	25.45		905.36		905.36	Glaciolacustrine	-	9.2	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	40	26.06		904.75		904.75	Glaciolacustrine	-	13.2	ML/CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	41	26.67		904.14		904.14	Glaciofluvial	-	14.4	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	42	27.28		903.53		903.53	Glaciofluvial	-	9.2	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	Golder	GA21-11	Perimeter Embankment Buttress	Chunk	43	27.89		902.92		902.92	Glaciofluvial	-	8.9	GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	1	0.46		940.38		940.38	Tailings	-	7.8	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	2	2.29		938.55		938.55	Tailings	-	18.1	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	3	3.51		937.33		937.33	Tailings	-	18.6	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	4	5.03		935.81		935.81	Rockfill	-	8.6	GW-GM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Grab	6	11.28	11.58	929.56	929.26	929.41	Glacial Till	-	16.8	CL	27	15	12	0.15	CL	-	-	-	-	-	-	-	-	8.6	37.1	34.3	20.0	0.002	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	5	11.43		929.41		929.41	Glacial Till	-	17.5	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	6	12.04		928.80		928.80	Glacial Till	-	17.1	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	7	12.65		928.19		928.19	Glacial Till	-	13.2	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	8	13.11		927.73		927.73	Glacial Till	-	9.8	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	9	13.87		926.97		926.97	Glacial Till	-	9.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	10	14.33		926.51		926.51	Glacial Till	-	9.7	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Grab	10	14.93	15.24	925.91	925.60	925.76	Glacial Till	-	9.3	SC	22	13	9	-0.41	CL	-	-	-	-	-	-	-	-	14.0	37.2	29.7	19.1	0.002	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	11	15.09		925.75		925.75	Glacial Till	-	9.1	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	12	15.54		925.30		925.30	Glacial Till	-	10.4	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	13	16.31		924.53		924.53	Glacial Till	-	10.8	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Grab	12	17.07	17.37	923.77	923.47	923.62	-	-	17.9	CL-ML	20	16	4	0.48	CL-ML	-	-	-	-	-	-	-	-	0.1	12.7	16.2	71.0	0.002	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	14	17.22		923.62		923.62	-	-	18.3	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Grab	13	17.98	18.29	922.86	922.55	922.71	-	-	24.3	CL-ML	26	20	6	0.72	CL-ML	-	-	-	-	-	-	-	-	0.2	3.0	89.2	7.6	0.002	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	15	18.14		922.70		922.70	-	-	24.9	CL-ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	16	18.59		922.25		922.25	-	-	24.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	17	19.32		921.52		921.52	-	-	18.3	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	18	19.66		921.18		921.18	-	-	13.9	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	19	20.27		920.57		920.57	-	-	16.2	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Grab	17	20.73	21.03	920.11	919.81	919.96	Glaciofluvial	-	15.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	71.4	24.3	2.5	0.002	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	20	20.88		919.96		919.96	Glaciofluvial	-	19.0	SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	21	21.22		919.62		919.62	-	-	11.0	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C5: Summary of Index Test Results

Year	Consultant	Borehole / Test Pit ID	General Location Description	Sample Type	Sample No.	Depth (m)		Elevation (m)			Soil Unit	Specific Gravity	Water Content (%)	Unified Soil Classification System (USCS)	Atterberg Limits				Atterberg Classification	Dry Density (kg/m^3)	Wet Density (kg/m^3)	Standard Proctor		Modified Proctor		Hydraulic Conductivity (m/s)	Particle Size Distribution					Advanced Testing Completed
						From	To	From	To	Mid-Point					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)				Maximum Dry Density (kg/m^3)	Optimum Water Content (%)	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)		Gravel (%)	Sand (%)	Fines (%)		Clay Threshold (< mm)	
																												Silt (%)	Clay (%)		
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	22	22.10		918.74		918.74	-	-	13.7	SP-SM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	23	22.40		918.44		918.44	Glacial Till	-	16.4	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	24	23.32		917.52		917.52	Weathered Bedrock	-	11.2	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022	Golder	GA22-01	Corner 1 Embankment Buttress	Chunk	25	23.93		916.91		916.91	Weathered Bedrock	-	6.4	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Soil unit was redefined from original description based on further assessment.
2. Soil unit was redefined from glaciolacustrine to either upper glaciolacustrine or lower glaciolacustrine.

APPENDIX D

Borehole GA22-01

Appendix D1
Record of Borehole

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT

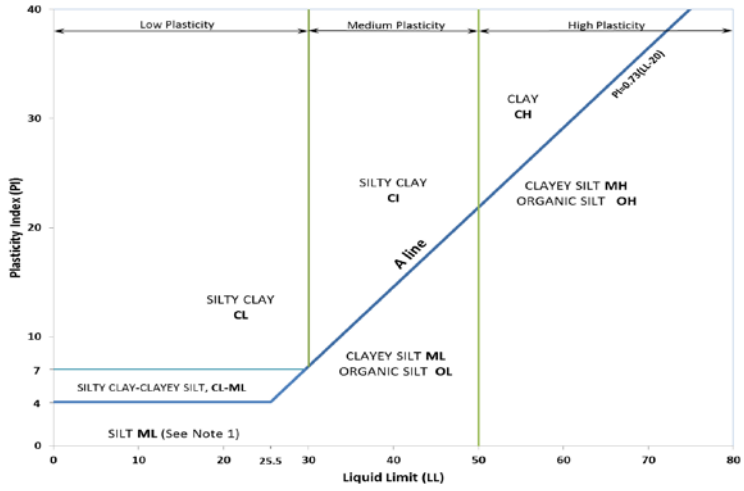

Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

RECORD OF BOREHOLE: GA22-01

CLIENT:	Mount Polley Mining Corporation	START DATE:	July 19, 2022	ELEVATION:	940.84 m (Ground)
PROJECT:	2021 TSF Site Investigation	END DATE:	July 20, 2022	COORDINATES:	N: 5820058.8 m E: 595034.3 m
PROJECT NO:	21452039 / 51300 / 51331	INCLINATION:	90.0°	COORD SYS:	CA Tailings Grid - Mount Polley
LOCATION:	Mount Polley Mine, Likely, B.C.	CONTRACTOR:	Geotech Drilling Services Ltd.	HORZ DATUM:	NAD83
				HOLE LOC:	Corner 1 Embankment Buttress

DRILL RIG: TSI 150CC Sonic Rig

DRILL METHOD: Sonic Drilling - 178-mm Hole Dia.

DEPTH (m)	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)
0	TAILINGS - (SP-SM) SAND, fine, poorly graded, some gravel, some fines; brown; non-cohesive, moist, compact.	SP-SM		0.00 / 940.08
1	TAILINGS - (SM) SILTY SAND, fine, trace gravel; grey; non-cohesive, wet, compact.	SM		0.76 / 936.88
4	ROCK FILL - (GW-GM) sandy GRAVEL, fine to coarse, well graded, subangular to angular, some fines; brown; 15% by volume cobbles/boulders; non-cohesive, moist, compact.	GW-GM		3.96
6	- 6.10 m: becomes increased gravel and cobbles/ boulders content.			

SAMPLES (Hammer: N/A; ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop)

NUMBER	TYPE	REC %	N-VALUE
1	GS		
2	GS		
3	GS		
4	GS		
5	GS		

SOIL CORE: RUN NO. 1, 2, 3; REC % (20 40 60 80)

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

GRADATION %: GRAVEL | SAND | FINES

GROUNDWATER OBSERVATIONS: 21-Jul-22 13:00

CONSTRUCTION AND INSTALLATION DETAILS: GW22-01, Stickup = 0.69 m

- 0.00 - 0.30 m bgs: Concrete
- 0.30 - 6.10 m bgs: Bentonite Chips
- 6.10 - 10.77 m bgs: Cement-Bentonite Grout and Slough

Continued on Next Page

DEPTH SCALE: 1:50

HAMMER TYPE: N/A

REV: 0

LOGGED: Jonathan Simonson DATE: Jul 19, 2022

CHECKED: Germán Pizarro DATE: Jan 19, 2023

Draft

RECORD OF BOREHOLE: GA22-01

CLIENT:	Mount Polley Mining Corporation	START DATE:	July 19, 2022	ELEVATION:	940.84 m (Ground)
PROJECT:	2021 TSF Site Investigation	END DATE:	July 20, 2022	COORDINATES:	N: 5820058.8 m E: 595034.3 m
PROJECT NO:	21452039 / 51300 / 51331	INCLINATION:	90.0°	COORD SYS:	CA Tailings Grid - Mount Polley
LOCATION:	Mount Polley Mine, Likely, B.C.	CONTRACTOR:	Geotech Drilling Services Ltd.	HORZ DATUM:	NAD83
				HOLE LOC:	Corner 1 Embankment Buttress

DRILL RIG: TSI 150CC Sonic Rig

DRILL METHOD: Sonic Drilling - 178-mm Hole Dia.

DEPTH (m)	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	N-VALUE (Hammer: N/A; ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop)	SOIL CORE: RUN NO.	REC %	WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic	GRADATION %: GRAVEL	SAND	FINES	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
11	ROCK FILL - (GW-GM) sandy GRAVEL, fine to coarse, well graded, subangular to angular, some fines; brown; 15% by volume cobbles/boulders; non-cohesive, moist, compact.	GW-GM		930.07					4							
	(CL) SILTY CLAY and SAND, low plasticity, fine to coarse sand, some fine gravel; brown mottled, iron oxide staining, (TILL), grey veins with small rootlets; cohesive, w > PL, firm.			10.77	6	GS						9	37	54		
12	- 12.04 m: small inclusion of organics.	CL		928.65	7	GS										
	(CL) sandy SILTY CLAY, low plasticity, some gravel; brown, (TILL); cohesive, w < PL, very stiff.			12.19	8	GS										
13	- 12.95 to 13.41 m: becomes gravelly.			927.43												
	(SC) gravelly CLAYEY SAND, fine to coarse sand, low plasticity fines, fine to coarse gravel, grey, (TILL), presence of cobbles/boulders; cohesive, w < PL, hard.			13.41	9	GS			5							10.77 - 16.61 m bgs: Cement-Bentonite Grout
14																
15	- 15.24 m: becomes very stiff.	SC			10	GS						14	37	49		VW136218 (15.09 m)
16	- 16.15 m: becomes stiff.				11	GS										
				924.08					6							
17	(CL-ML) sandy SILTY CLAY to CLAYEY SILT, low plasticity, fine sand, trace gravel; dark grey, slight laminations; non-cohesive, moist to wet, compact to dense.			16.76	12	GS						0	13	87		
18	- 17.68 m: becomes trace sand, brown, wet, loose to compact	CL-ML			13	GS						0	3	97		16.61 - 18.44 m bgs: Bentonite Chips
				922.40												
19	(ML) sandy SILT, non plastic, trace gravel; brown; non-cohesive, wet, compact.	ML		18.44	14	GS										18.44 - 19.76 m bgs: Bentonite Pellets
				921.41					7							
20	(SM) gravelly SILTY SAND; brown, iron oxide staining; non-cohesive, wet, compact.	SM		19.43	15	GS										

Continued on Next Page

DEPTH SCALE: 1:50

HAMMER TYPE: N/A

REV: 0

WSP GOLDER

LOGGED: Jonathan Simonson DATE: Jul 19, 2022

CHECKED: Germán Pizarro DATE: Jan 19, 2023

Document / Soil-Sonic 1 Gradation / Golder - 1 Metric Global / Golder CA Auto (common in Canada) / 2022-11-10

Draft

RECORD OF BOREHOLE: GA22-01

CLIENT:	Mount Polley Mining Corporation	START DATE:	July 19, 2022	ELEVATION:	940.84 m (Ground)
PROJECT:	2021 TSF Site Investigation	END DATE:	July 20, 2022	COORDINATES:	N: 5820058.8 m E: 595034.3 m
PROJECT NO:	21452039 / 51300 / 51331	INCLINATION:	90.0°	COORD SYS:	CA Tailings Grid - Mount Polley
LOCATION:	Mount Polley Mine, Likely, B.C.	CONTRACTOR:	Geotech Drilling Services Ltd.	HORZ DATUM:	NAD83
				HOLE LOC:	Corner 1 Embankment Buttress

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	N-VALUE	SOIL CORE: RUN NO.	REC % (20 40 60 80)	WATER CONTENT: Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic (0 20 40 60 80 100)	GRADATION %: GRAVEL	SAND	FINES	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
			(SM) gravelly SILTY SAND; brown, iron oxide staining; non-cohesive, wet, compact.			920.42	16	GS										
			(SM) SILTY SAND, fine to coarse, non-plastic fines, trace gravel; brown, (GLACIOFLUVIAL); non-cohesive, wet, compact.	SM		20.42												
21						919.73	17	GS						2	71	27		
			- 21.11 to 21.16 m: silt lens			21.11	18	GS										
			(SP-SM) gravelly SAND, medium to coarse, poorly graded, some fines; brown; non-cohesive, wet, compact. - 21.56 m: becomes fine to coarse sand, some gravel	SP-SM														
22						918.59	19	GS										
			(CL) sandy SILTY CLAY, low plasticity, some gravel; brown, iron oxide staining, (TILL); cohesive, w < PL, stiff.	CL		22.25	20	GS										
						918.28												
			BEDROCK, slightly weathered, grey, fine to coarse grained, strong to very strong.			22.56					8							
23	TSI 150CC Sonic Rig	Sonic Drilling - 178-mm Hole Dia.					21	GS										
							22	GS										
24											9							19.76 - 21.79 m bgs: Silica Sand 10/20
																		21.79 - 26.82 m bgs: Bentonite Chips
25																		
											10							
26							23	GS										
						914.02												
27			End of hole at 26.82 m.															
			Notes: - Chunk samples were collected approximately every 0.6 m and tested on-site for water content. - The compactness of non-cohesive soils was inferred based on resistance to drilling penetration.															
28																		
29																		
30																		

Hammer: N/A
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

DEPTH SCALE: 1:50
HAMMER TYPE: N/A

REV: 0

WSP GOLDER

LOGGED: Jonathan Simonson DATE: Jul 19, 2022
CHECKED: Germán Pizarro DATE: Jan 19, 2023

Document / Soil-Sonic 1 Gradation / Golder - 1 Metric Global / Golder CA Auto (common in Canada) / 2022-11-10

Draft

MONITORING WELL COMPLETION AND BOREHOLE ABANDONMENT DETAILS

1) Well ID: GW22-01

2) Date: 20 July 2022

3) Borehole Diameter: 177.8 mm above 21.34 mbgs and 152.4 mm below 21.34 mbgs ☐ in ☐ m

4) Standpipe Diameter: 50.8 mm ☐ in ☐ m

5) Screen Length: 1.52 m

6) Approx. Water Level: 8.67 ☒ mbgs ☐ mbtop

7) Approx. Well Depth: 21.64 ☒ mbgs ☐ mbtop

8) Stick-up Height: 0.69 ☒ mags
(Top of pipe)

BOREHOLE ABANDONMENT

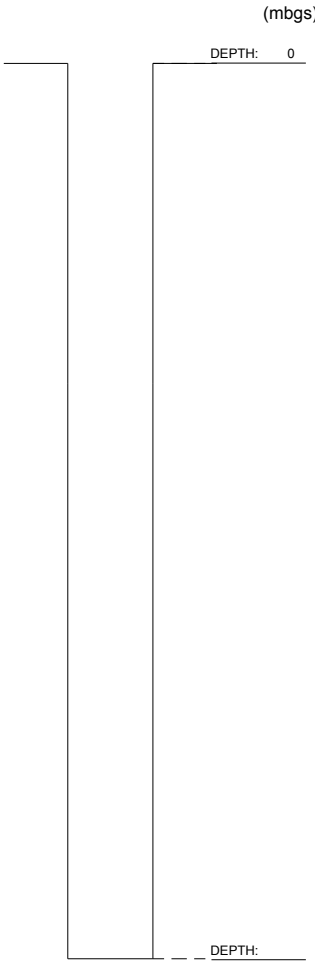

FLUSHMOUNT WELL INSTALLATION

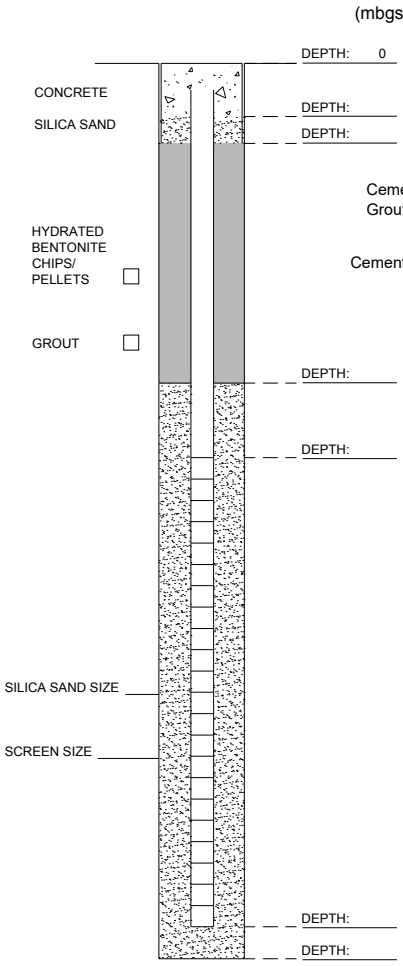

STICK-UP WELL INSTALLATION

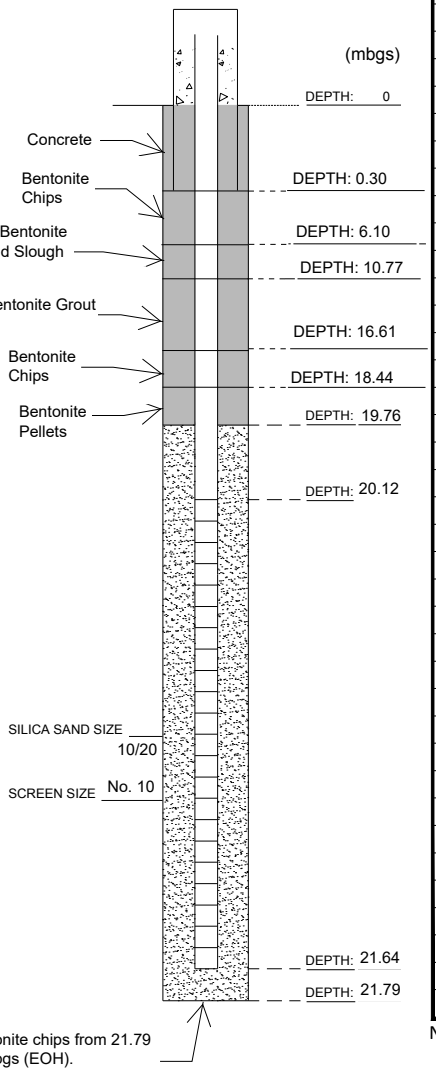

ft	m	ft	m
1	0.3	41	12.5
2	0.6	42	12.8
3	0.9	43	13.1
4	1.2	44	13.4
5	1.5	45	13.7
6	1.8	46	14.0
7	2.1	47	14.3
8	2.4	48	14.6
9	2.7	49	14.9
10	3.0	50	15.2
11	3.4	51	15.5
12	3.7	52	15.8
13	4.0	53	16.2
14	4.3	54	16.5
15	4.6	55	16.8
16	4.9	56	17.1
17	5.2	57	17.4
18	5.5	58	17.7
19	5.8	59	18.0
20	6.1	60	18.3
21	6.4	61	18.6
22	6.7	62	18.9
23	7.0	63	19.2
24	7.3	64	19.5
25	7.6	65	19.8
26	7.9	66	20.1
27	8.2	67	20.4
28	8.5	68	20.7
29	8.8	69	21.0
30	9.1	70	21.3
31	9.4	71	21.6
32	9.8	72	21.9
33	10.1	73	22.3
34	10.4	74	22.6
35	10.7	75	22.9
36	11.0	76	23.2
37	11.3	77	23.5
38	11.6	78	23.8
39	11.9	79	24.1
40	12.2	80	24.4

Note: 0.15 meters=6 inches

MONITORING WELL INSTALLATION GUIDELINES

BENTONITE SILICA SAND CONCRETE SLOUGH

mbgs = meters below ground surface; mags = meters above ground surface; mbtop = meters below top of pipe

Appendix D2
Photographs of Sonic Core





CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 19 JULY 2022
DEPTH RANGE: 0.0 to 20.0 ft / 0.0 to 6.1 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-1**



CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 19 JULY 2022
DEPTH RANGE: 20.0 to 40.0 ft / 6.1 to 12.2 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-2**

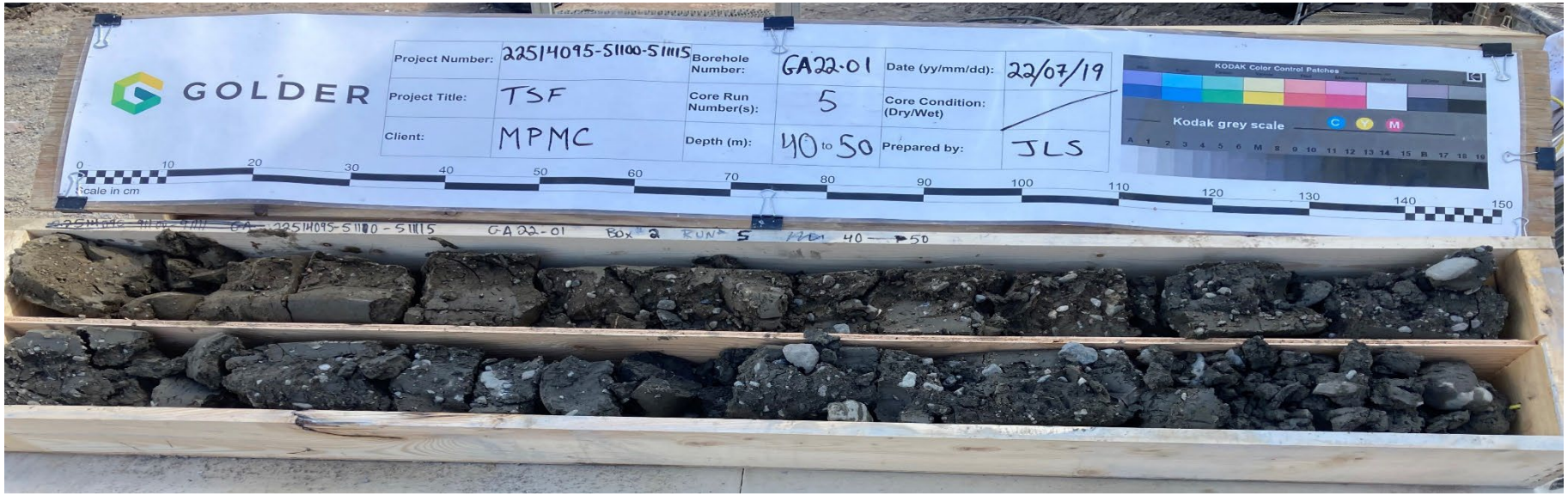



CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 19 JULY 2022
DEPTH RANGE: 40.0 to 58.7 ft / 12.2 to 17.9 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-3**



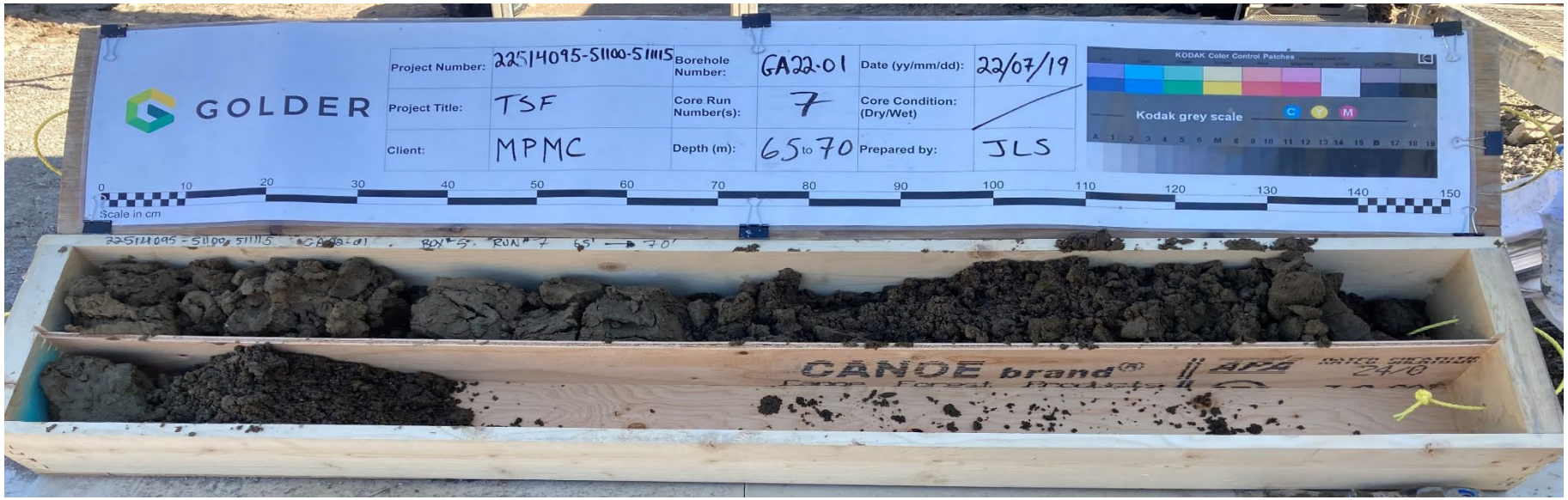

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 19 JULY 2022
DEPTH RANGE: 58.7 to 70.0 ft / 17.9 to 21.3 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-4**





CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 19 / 20 JULY 2022
DEPTH RANGE: 70.0 to 80.0 ft / 21.3 to 24.4 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-5**



CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2022-11-04
PREPARED	RG
DESIGN	RG
REVIEW	GP
APPROVED	GP

PROJECT
MOUNT POLLEY MINE
2022 TAILINGS STORAGE FACILITY GEOTECHNICAL INVESTIGATION

TITLE
BOREHOLE: GA22-01
DATE DRILLED: 20 JULY 2022
DEPTH RANGE: 80.0 to 88.0 ft / 24.4 to 26.8 m

PROJECT No.	Phase/Task	Rev.	Figure No.
22514095	**51100 / 51115**	**0**	**D-6**

Appendix D3
VWP Calibration Certificate

Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Monitor with Confidence

Vibrating Wire Piezometer

Customer: HUCKLEBERRY MINES LTD.
Sales Order: 228638
Customer ID:
Model: VW2100-0.35
Serial Number: VW136218
Mfg Number: P136218
Range: 350 kPa
Cable Length: 20 meters
Cable Marking: 551052 m to 551073 m
Cable Type: EL380004
Cable Colour Code: Red/Black (Coil) Green/White (Thermistor)
Thermistor Type: 3K

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (%FS)	Calculated Polynomial (kPa)	Polynomial Error (%FS)
0.0	9010	9010	9010	0.1	0.02	0.1	0.03
70.0	8328	8329	8329	69.8	-0.04	69.8	-0.05
140.0	7644	7644	7644	140.0	0.01	140.0	0.00
210.0	6960	6960	6960	210.1	0.02	210.1	0.01
280.0	6277	6277	6277	280.1	0.02	280.1	0.02
350.0	5596	5595	5595	349.9	-0.03	349.9	-0.02
Max Error (%)					0.04		0.05

Linear Calibration Factor: CF = 1.0246e-01 kPa/B unit
Temperature Correction Factor: Tk = -7.3641e-02 kPa/°C rise

Polynomial Gauge Factor:
A = 2.2220e-08 kPa/(B unit)² B = -1.0278e-01 kPa/B unit C = calculate (see below) kPa

Users must establish site zero readings for calculation purposes
Polynomial C = $-[A(L_0^2) + B(L_0)]$

Pressure is calculated with the following equations:
Linear: $P = CF(L_0 - L) - Tk(T_0 - T) + (S_0 - S)$
Polynomial: $P = A(L^2) + B(L) + C - Tk(T_0 - T) + (S_0 - S)$

L_0, L = initial (installation) and current readings, in B units
T_0, T = initial (installation) and current temperature, in °C
S_0, S = initial (installation) and current barometric pressure readings, in kPa
B units = Hz²/1000 ie: 1700 Hz = 2890 B units

	Date	VW Reading (B Units)	Temperature (°C)	Baro (mbar)
Shipped Zero Readings:	15 Jul 2021	8986	21.6	1016.0

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

Technician: Ora Nygren **Date:** 15/07/2021
Approved: Samantha Shaw **Date:** 15/07/2021

Appendix D4
Laboratory Test Results

Water Content Summary
ASTM D2216

Test Request #	B23-001	Project Number:	22514095-51100-51115
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation		

Sample Location	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
GA22-01	CS1	0.46		CS		7.8	B	
GA22-01	CS2	2.29		CS		18.1	B	
GA22-01	CS3	3.51		CS		18.6	B	
GA22-01	CS4	5.03		CS		8.6	B	
GA22-01	CS5	11.43		CS		17.5	B	
GA22-01	CS6	12.04		CS		17.1	B	
GA22-01	CS7	12.65		CS		13.2	B	
GA22-01	CS8	13.11		CS		9.8	B	
GA22-01	CS9	13.87		CS		9.8	B	
GA22-01	CS10	14.33		CS		9.7	B	
GA22-01	CS11	15.09		CS		9.1	B	
GA22-01	CS12	15.54		CS		10.4	B	
GA22-01	CS13	16.31		CS		10.8	B	
GA22-01	CS14	17.22		CS		18.3	B	
GA22-01	CS15	18.14		CS		24.9	B	
GA22-01	CS16	18.59		CS		24.3	B	
GA22-01	CS17	19.32		CS		18.3	B	
GA22-01	CS18	19.66		CS		13.9	B	
GA22-01	CS19	20.27		CS		16.2	B	
GA22-01	CS20	20.88		CS		19.0	B	
GA22-01	CS21	21.22		CS		11.0	B	
GA22-01	CS22	22.10		CS		13.7	B	

Notes:

Disclaimer:

The laboratory testing services reported herein have been performed in accordance with the terms of a contract with WSP's client, and with the recognized standards indicated in this report, or local industry practice. This laboratory testing services report is for the sole use of WSP's client, relates only to the sample(s) tested and does not represent any (actual or implied) interpretation or opinion regarding specification compliance or materials suitability for any specific purpose.

Tested by: TBach **Date:** 25 Jul 2022

Checked by: SJohn **Date:** 10 Jan 2023

Reviewed by: RGarritsen **Date:** 10 Jan 2023

WSP Canada Inc.
Unit 300 - 3811 North Fraser Way, Burnaby, British Columbia, V5J 5J2,
Canada
[+1] 604 412 6899

Water Content Summary
ASTM D2216

Test Request #	B23-001	Project Number:	22514095-51100-51115
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation		

Sample Location	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
GA22-01	CS23	22.40		CS		16.4	B	
GA22-01	CS24	23.32		CS		11.2	B	
GA22-01	CS25	23.93		CS		6.4	B	

Notes:

Disclaimer:

The laboratory testing services reported herein have been performed in accordance with the terms of a contract with WSP's client, and with the recognized standards indicated in this report, or local industry practice. This laboratory testing services report is for the sole use of WSP's client, relates only to the sample(s) tested and does not represent any (actual or implied) interpretation or opinion regarding specification compliance or materials suitability for any specific purpose.

Tested by: TBach **Date:** 25 Jul 2022

Checked by: SJohn **Date:** 10 Jan 2023

Reviewed by: RGarritsen **Date:** 10 Jan 2023

WSP Canada Inc.
Unit 300 - 3811 North Fraser Way, Burnaby, British Columbia, V5J 5J2,
Canada
[+1] 604 412 6899

GOLDER
MEMBER OF WSP

Water Content Summary
ASTM D2216

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation		

Sample Location	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
GA22-01	6	11.28	11.58	GS		16.8	B	
GA22-01	10	14.94	15.24	GS		9.3	B	
GA22-01	12	17.07	17.37	GS		17.9	B	
GA22-01	13	17.98	18.29	GS		24.3	B	
GA22-01	17	20.73	21.03	GS		15.0	B	

Notes:

Disclaimer:

The laboratory testing services reported herein have been performed in accordance with the terms of a contract with Golder's client, and with the recognized standards indicated in this report, or local industry practice. This laboratory testing services report is for the sole use of Golder's client, relates only to the sample(s) tested and does not represent any (actual or implied) interpretation or opinion regarding specification compliance or materials suitability for any specific purpose.

Tested by: JPandez **Date:** 30 Aug 2022

Checked by: VNogra **Date:** 01 Sep 2022

Reviewed by: SJohn **Date:** 07 Sep 2022

Golder Associates
Unit 300 - 3811 North Fraser Way, Burnaby, British Columbia, V5J 5J2, Canada
[+1] 604 412 6899

GOLDER
MEMBER OF WSP

PARTICLE SIZE DISTRIBUTION

ASTM D6913 and ASTM D422

Method B

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	6
Soil Description:		Type:	GS
		Depth (m):	11.28 - 11.58

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	8/31/2022
Specimen Description	NA				

Grain Size Distribution (%) 8.6 37.1 54.3

BOULDER | COBBLE | GRAVEL (Coarse, Fine) | SAND (Coarse, Medium, Fine) | FINES (Silt, Clay)

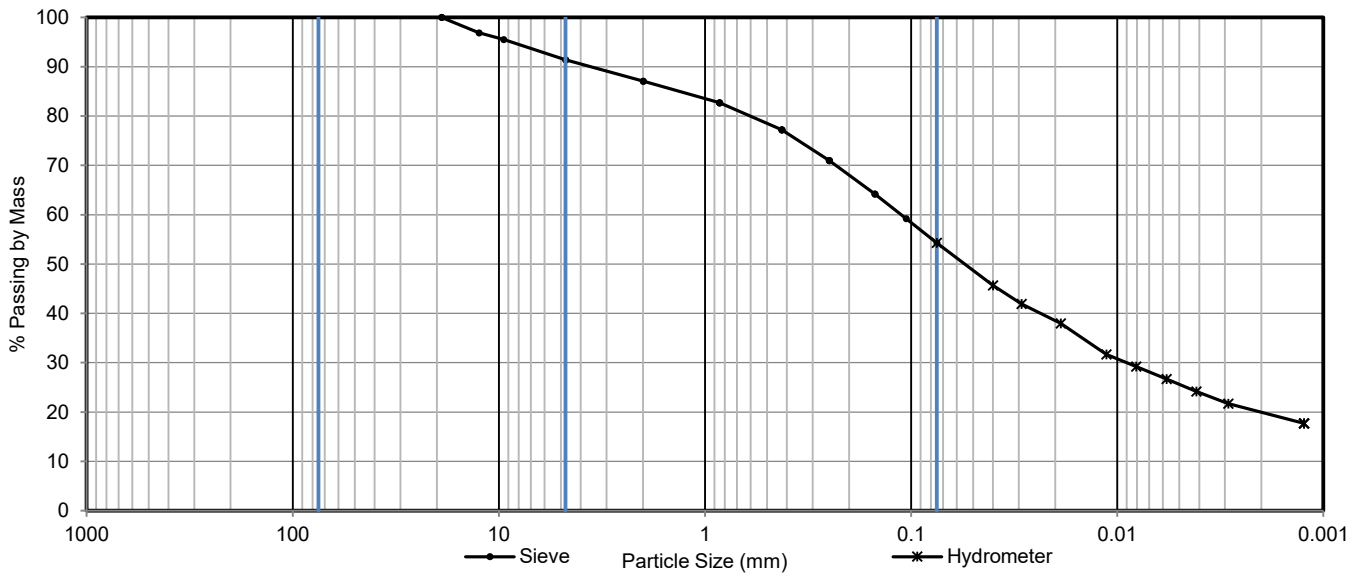

Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/4"	19	100.0	0.0401	45.7
1/2"	12.5	96.9	0.0291	41.9
3/8"	9.5	95.5	0.0188	38.0
#4	4.75	91.4	0.0113	31.7
#10	2	87.1	0.0081	29.2
#20	0.85	82.7	0.0058	26.7
#40	0.425	77.2	0.0041	24.2
#60	0.25	71.0	0.0029	21.7
#100	0.15	64.2	0.0012	17.7
#140	0.106	59.2		
#200	0.075	54.3		
			0.005 mm	25.60
			0.002 mm	20.00
			D60	0.11
			D30	0.01
			D10	
			Cu	
			Cc	

Notes:

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Tested by: VNogra **Date:** 31-Aug-22 **Checked by:** VNogra **Date:** 1-Sep-22 **Reviewed by:** SJohn **Date:** 7-Sep-22

Golder Associates
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[+1] 604 412 6899

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PARTICLE SIZE DISTRIBUTION

ASTM D6913 and ASTM D422

Method B

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	10
Soil Description:		Type:	GS
		Depth (m):	14.94 - 15.24

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	8/31/2022
Specimen Description	NA				

Grain Size Distribution (%) 14.0 37.2 48.8

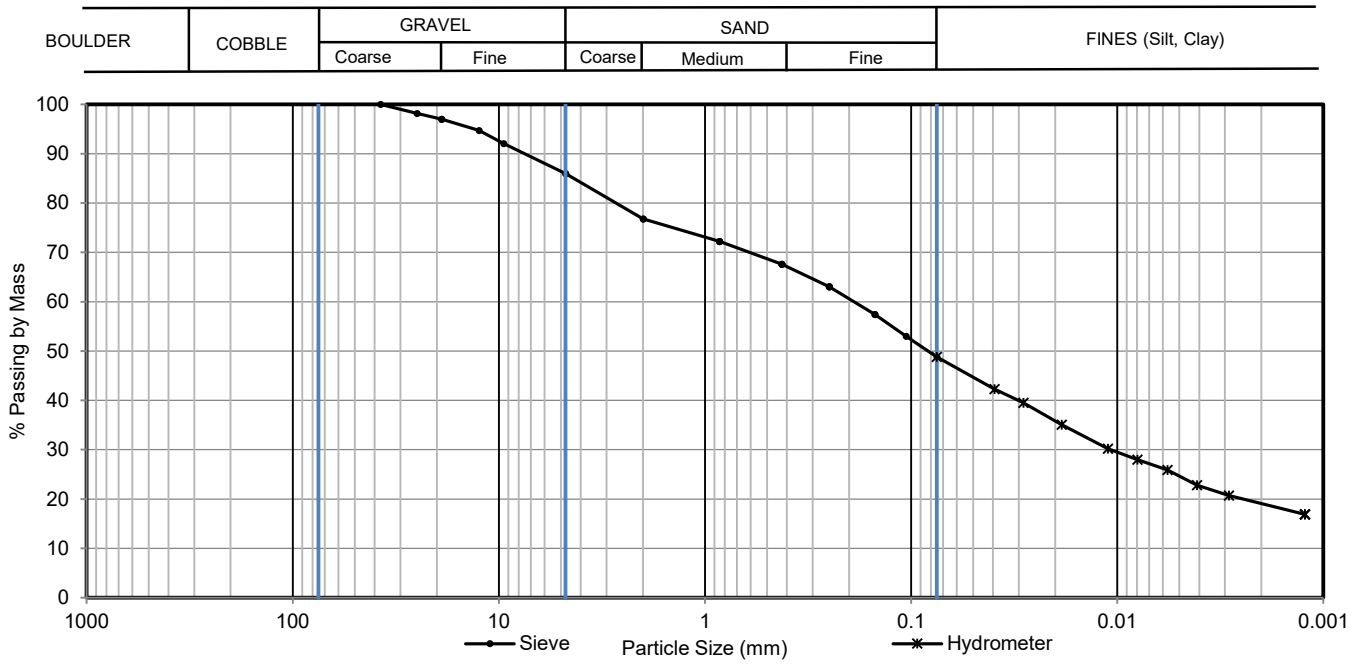

Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
1 1/2"	37.5	100.0	0.0394	42.3
1"	25	98.2	0.0285	39.5
3/4"	19	97.0	0.0186	35.1
1/2"	12.5	94.7	0.0111	30.2
3/8"	9.5	92.1	0.0080	28.0
#4	4.75	86.0	0.0057	25.9
#10	2	76.8	0.0041	22.8
#20	0.85	72.2	0.0029	20.7
#40	0.425	67.6	0.0012	16.9
#60	0.25	63.1		
#100	0.15	57.5		
#140	0.106	53.0		
#200	0.075	48.8		
			0.005 mm	24.60
			0.002 mm	19.10
			D60	0.19
			D30	0.01
			D10	
			Cu	
			Cc	

Notes:

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Tested by: VNogra **Date:** 31-Aug-22 **Checked by:** VNogra **Date:** 1-Sep-22 **Reviewed by:** SJohn **Date:** 7-Sep-22

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PARTICLE SIZE DISTRIBUTION

ASTM D6913 and ASTM D422

Method B

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	12
Soil Description:		Type:	GS
		Depth (m):	17.07 - 17.37

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	8/31/2022
Specimen Description	NA				

Grain Size Distribution (%) 0.1 12.7 87.2

BOULDER | COBBLE | GRAVEL (Coarse, Fine) | SAND (Coarse, Medium, Fine) | FINES (Silt, Clay)

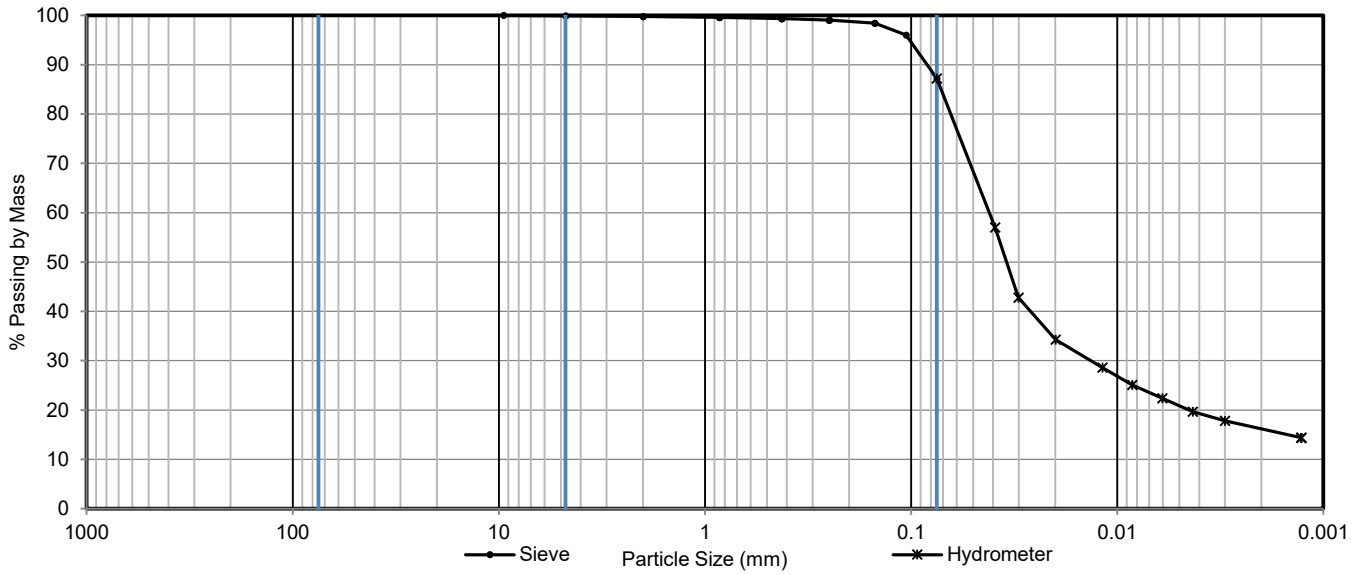

Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/8"	9.5	100.0	0.0391	57.0
#4	4.75	99.9	0.0301	42.8
#10	2	99.8	0.0199	34.3
#20	0.85	99.6	0.0118	28.6
#40	0.425	99.3	0.0085	25.1
#60	0.25	99.0	0.0060	22.4
#100	0.15	98.4	0.0043	19.7
#140	0.106	96.1	0.0030	17.8
#200	0.075	87.2	0.0013	14.4
			0.005 mm	20.90
			0.002 mm	16.20
			D60	0.04
			D30	0.01
			D10	
			Cu	
			Cc	

Notes:

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Tested by: VNogra **Date:** 31-Aug-22 **Checked by:** VNogra **Date:** 1-Sep-22 **Reviewed by:** SJohn **Date:** 7-Sep-22

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PARTICLE SIZE DISTRIBUTION

ASTM D6913 and ASTM D422

Method B

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	13
Soil Description:		Type:	GS
		Depth (m):	17.98 - 18.29

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	8/31/2022
Specimen Description	NA				

Grain Size Distribution (%) 0.2 3.0 96.8

BOULDER | COBBLE | GRAVEL (Coarse, Fine) | SAND (Coarse, Medium, Fine) | FINES (Silt, Clay)

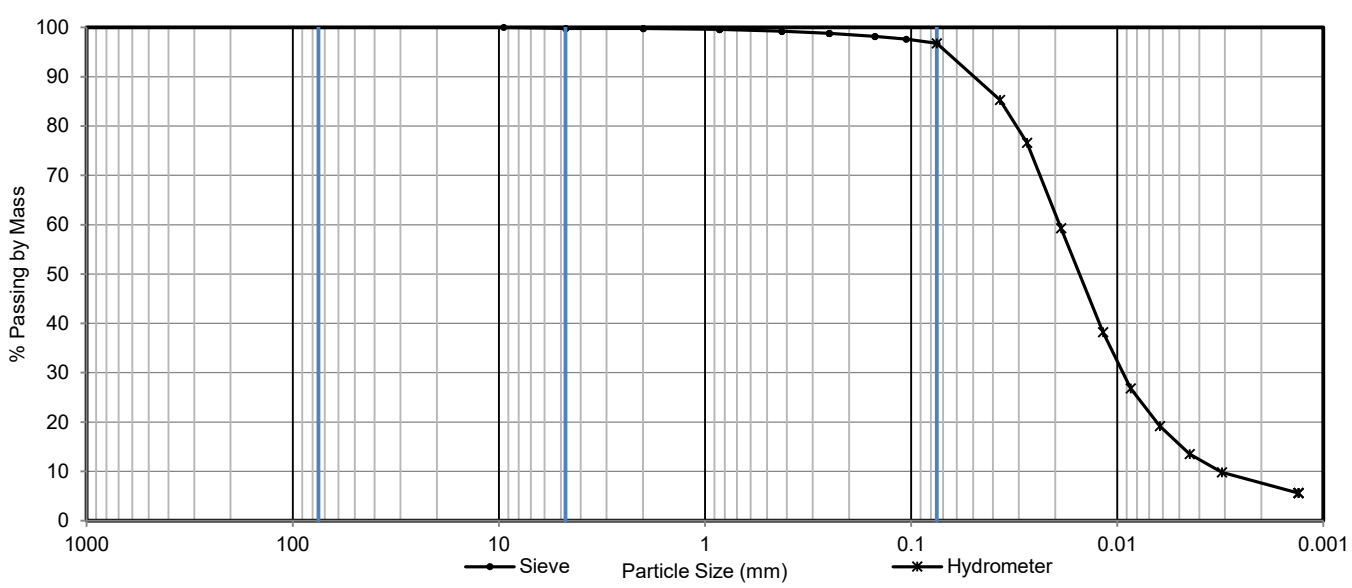

Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/8"	9.5	100.0	0.0371	85.3
#4	4.75	99.8	0.0274	76.6
#10	2	99.8	0.0187	59.3
#20	0.85	99.6	0.0117	38.2
#40	0.425	99.2	0.0086	26.8
#60	0.25	98.8	0.0062	19.2
#100	0.15	98.2	0.0045	13.5
#140	0.106	97.6	0.0031	9.8
#200	0.075	96.8	0.0013	5.6
			0.005 mm	15.50
			0.002 mm	7.60
			D60	0.02
			D30	0.01
			D10	0.00
			Cu	6.00
			Cc	1.50

Notes:

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Tested by: VNogra **Date:** 31-Aug-22 **Checked by:** VNogra **Date:** 1-Sep-22 **Reviewed by:** SJohn **Date:** 7-Sep-22

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PARTICLE SIZE DISTRIBUTION

ASTM D6913 and ASTM D422

Method B

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	17
Soil Description:		Type:	GS
		Depth (m):	20.73 - 21.03

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	8/31/2022
Specimen Description	NA				

Grain Size Distribution (%) 1.8 71.4 26.8

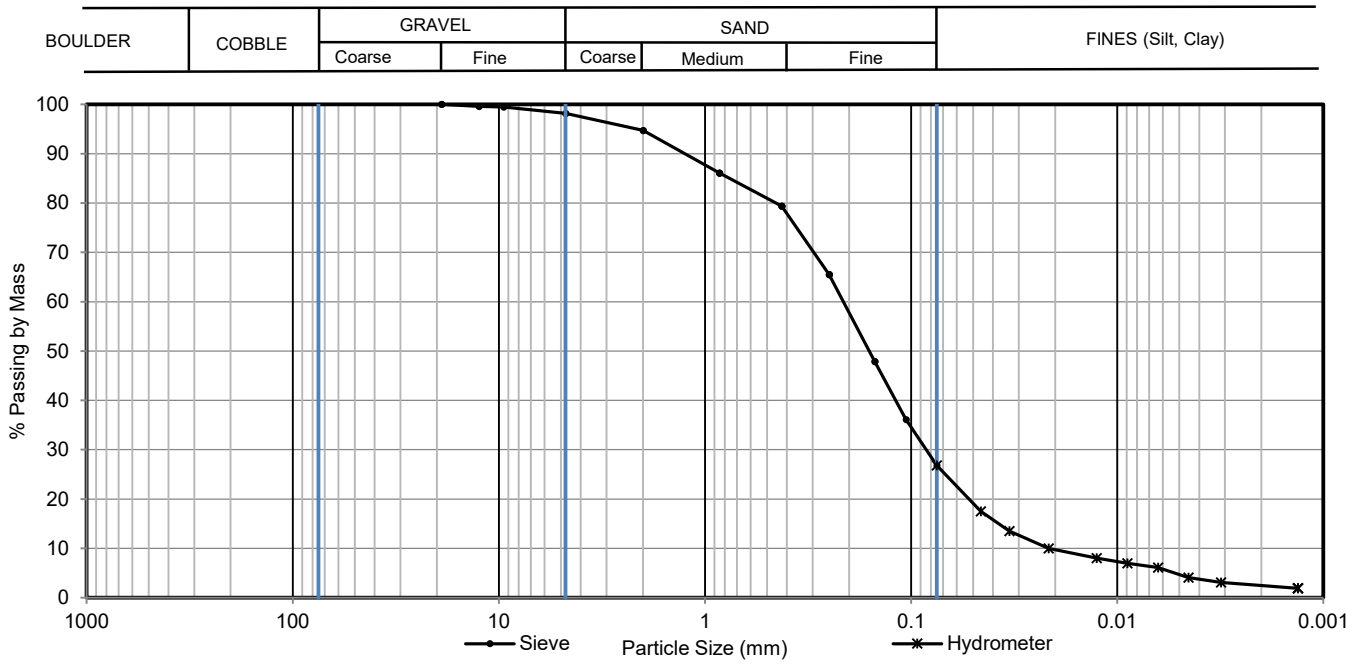

Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/4"	19	100.0	0.0459	17.5
1/2"	12.5	99.6	0.0333	13.5
3/8"	9.5	99.5	0.0215	10.0
#4	4.75	98.2	0.0126	8.0
#10	2	94.7	0.0089	7.0
#20	0.85	86.1	0.0063	6.1
#40	0.425	79.4	0.0045	4.1
#60	0.25	65.5	0.0031	3.1
#100	0.15	47.9	0.0013	1.9
#140	0.106	36.1		
#200	0.075	26.8		
			0.005 mm	4.70
			0.002 mm	2.50
			D60	0.21
			D30	0.08
			D10	0.02
			Cu	9.90
			Cc	1.60

Notes:

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Tested by: VNogra **Date:** 31-Aug-22 **Checked by:** VNogra **Date:** 1-Sep-22 **Reviewed by:** SJohn **Date:** 7-Sep-22

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Method A - Multipoint Test

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	6
Soil Description:		Type:	GS
		Depth (m):	11.28 - 11.58

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	01 Sep 2022
Specimen Description	NA				

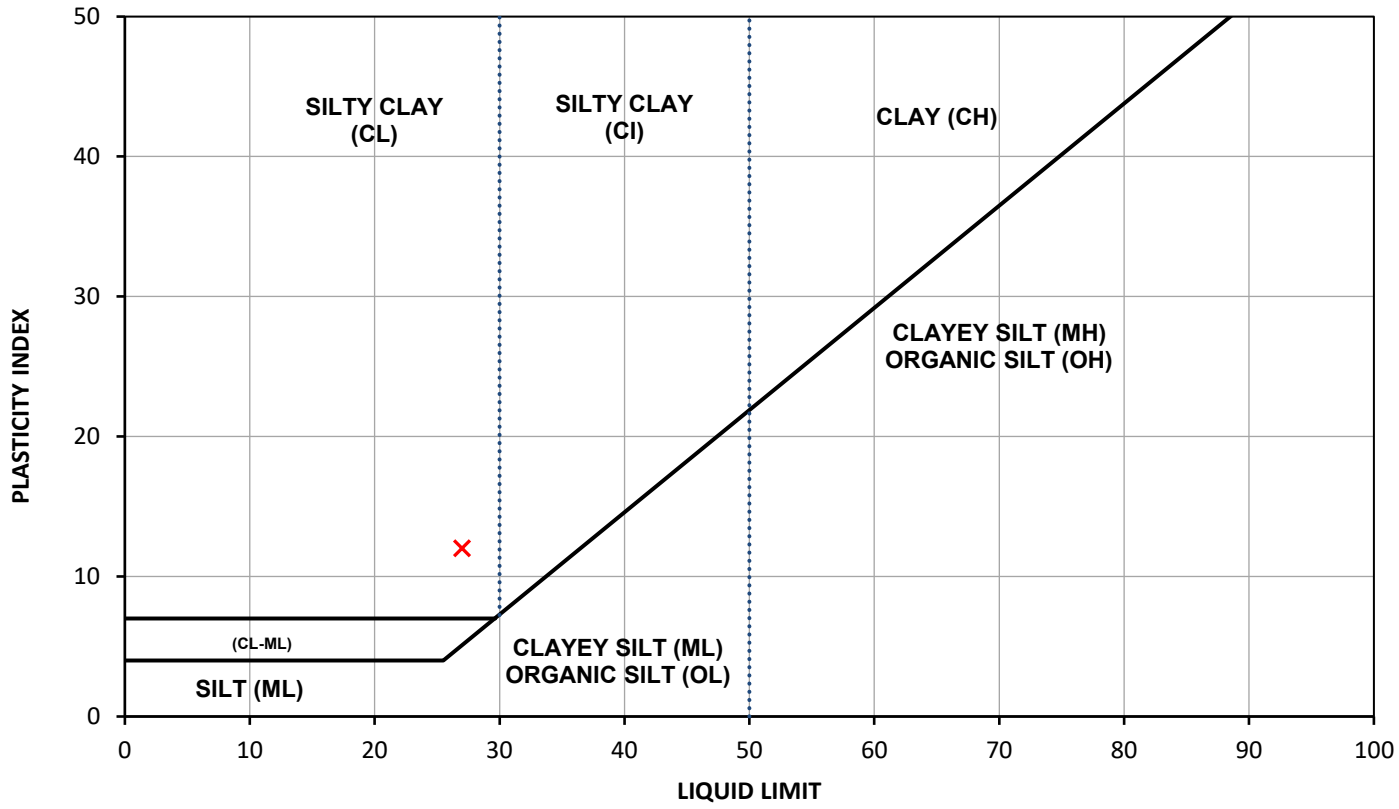

Legend
A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
GA22-01	6	11.28	11.58	77	16.8	27	15	12	0.15

NP = Non-Plastic
ND = Not Determined

Test Preparation
Dry Preparation Tested after >425um removed

Notes:

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Tested by: JPandez **Date:** 01 Sep 2022
Checked by: VNogra **Date:** 06 Sep 2022
Reviewed by: SJohn **Date:** 07 Sep 2022

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Method A - Multipoint Test

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	10
Soil Description:		Type:	GS
		Depth (m):	14.94 - 15.24

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	01 Sep 2022
Specimen Description	NA				

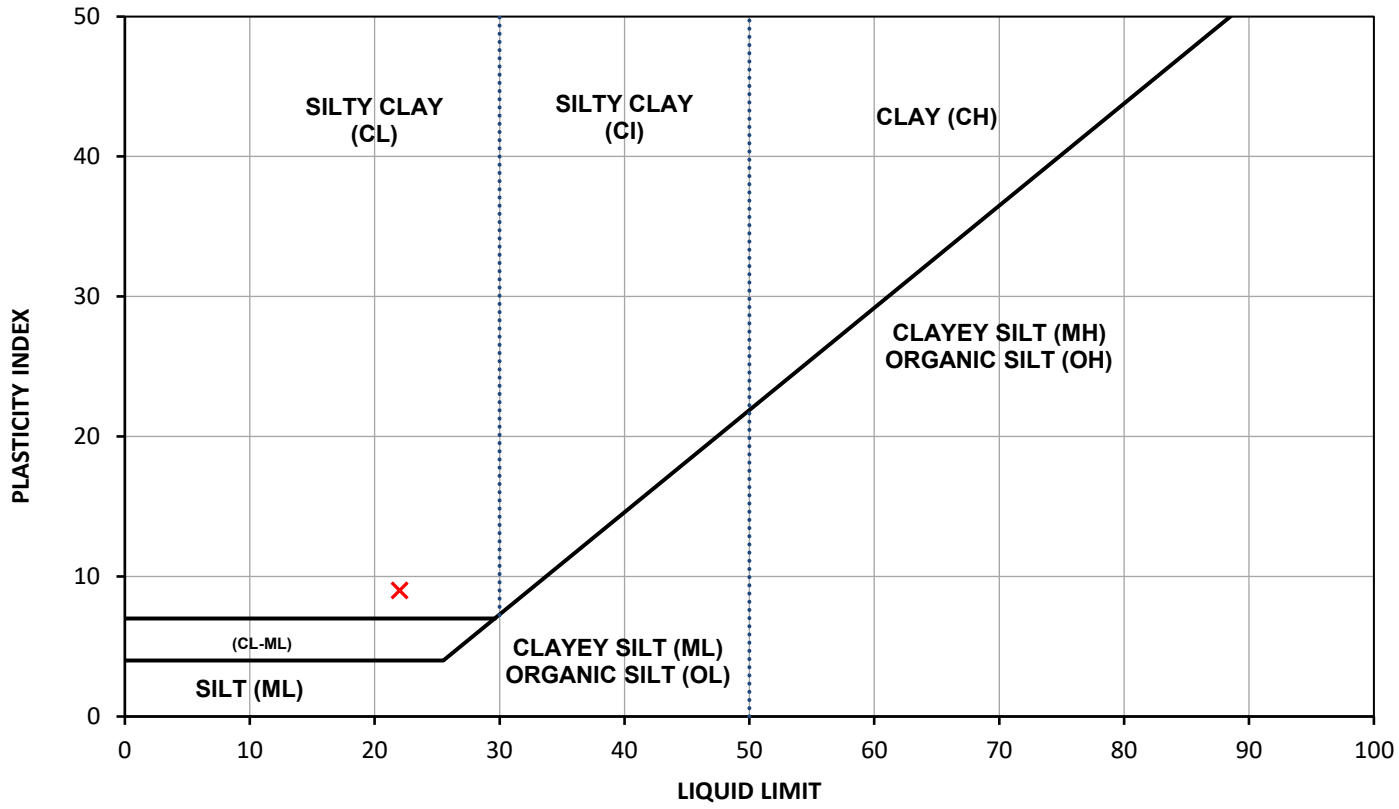

Legend
A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
GA22-01	10	14.94	15.24	68	9.3	22	13	9	-0.41

NP = Non-Plastic
ND = Not Determined

Test Preparation
Dry Preparation Tested after >425um removed

Notes:

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Tested by: JPandez **Date:** 01 Sep 2022
Checked by: VNogra **Date:** 06 Sep 2022
Reviewed by: SJohn **Date:** 07 Sep 2022

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Method A - Multipoint Test

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	12
Soil Description:		Type:	GS
		Depth (m):	17.07 - 17.37

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	06 Sep 2022
Specimen Description	NA				

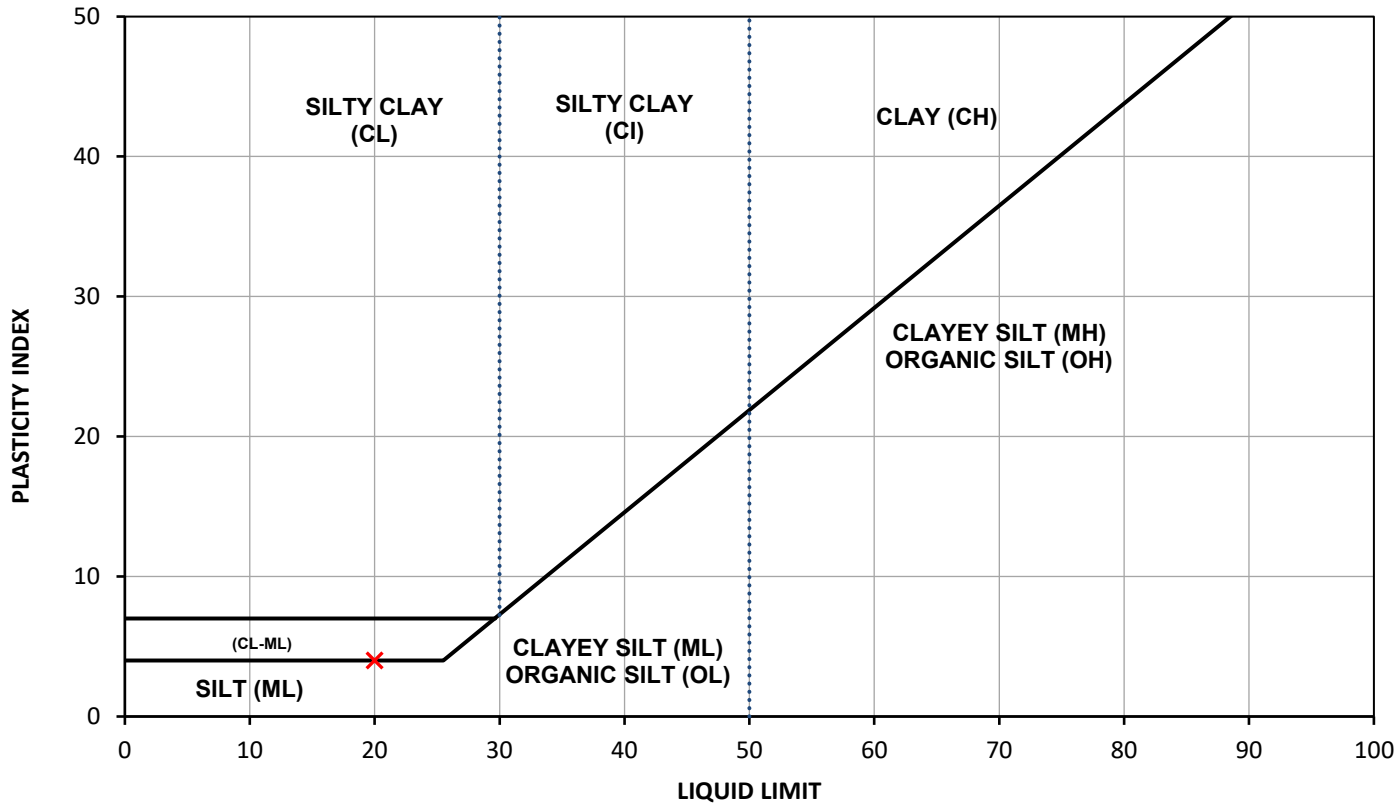

Legend
A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
GA22-01	12	17.07	17.37	99	17.9	20	16	4	0.48

NP = Non-Plastic
ND = Not Determined

Test Preparation
Wet Preparation Tested in natural condition

Notes:

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Tested by: JPandez **Date:** 06 Sep 2022
Checked by: VNogra **Date:** 07 Sep 2022
Reviewed by: SJohn **Date:** 07 Sep 2022

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Method A - Multipoint Test

Test Request #	B22-274	Project Number:	22514095-51300-51331
Client:	Mount Polley Mining Corporation	Project Location:	Mount Polley Mine, Likely, BC
Project Name:	2022 TSF Geotechnical Investigation	Sample Location:	GA22-01
Source:		Sample No.:	13
Soil Description:		Type:	GS
		Depth (m):	17.98 - 18.29

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	06 Sep 2022
Specimen Description	NA				

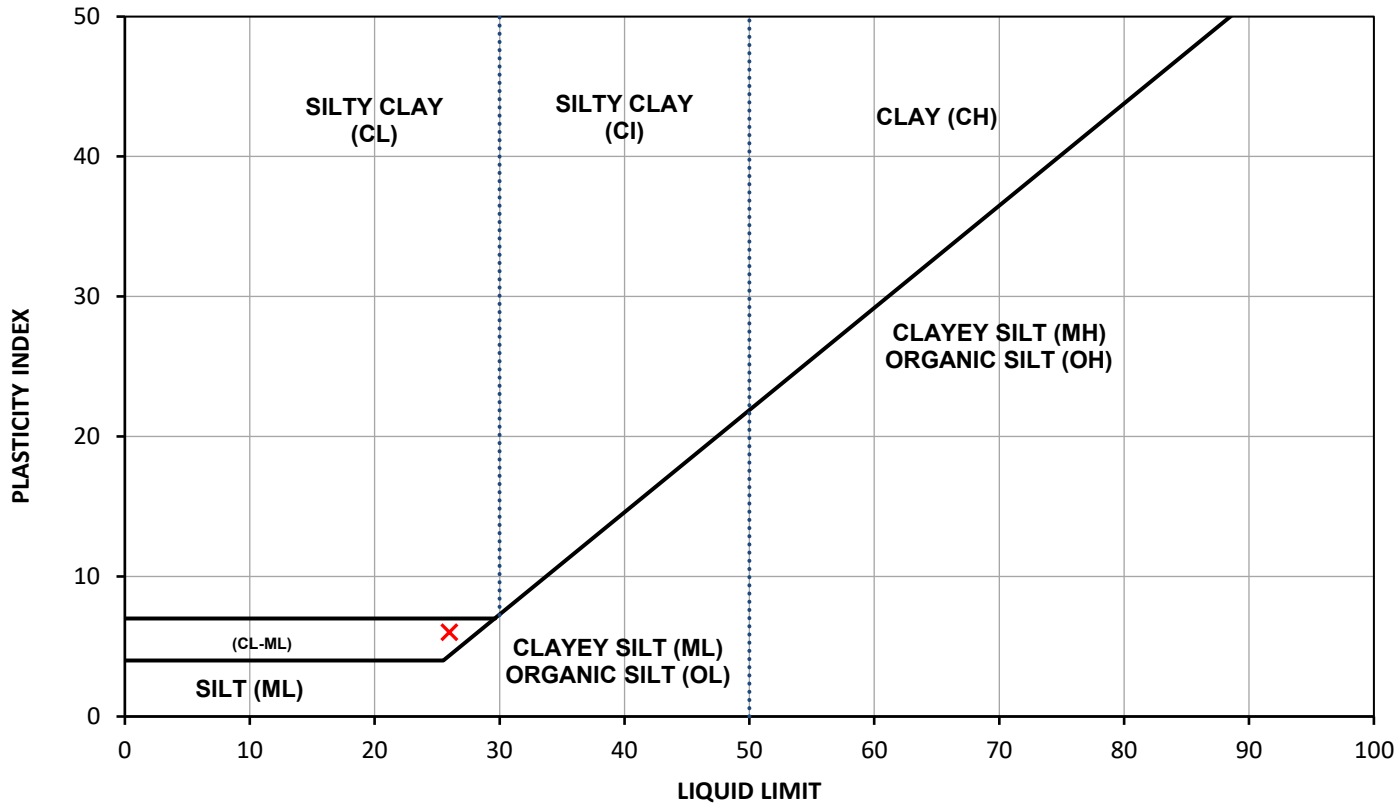

Legend
A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
GA22-01	13	17.98	18.29	99	24.3	26	20	6	0.72

NP = Non-Plastic
ND = Not Determined

Test Preparation
Wet Preparation Tested in natural condition

Notes:

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Tested by: JPandez **Date:** 06 Sep 2022
Checked by: VNogra **Date:** 07 Sep 2022 **Reviewed by:** SJohn **Date:** 07 Sep 2022

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APPENDIX E

2021 CPT Data and Interpretation

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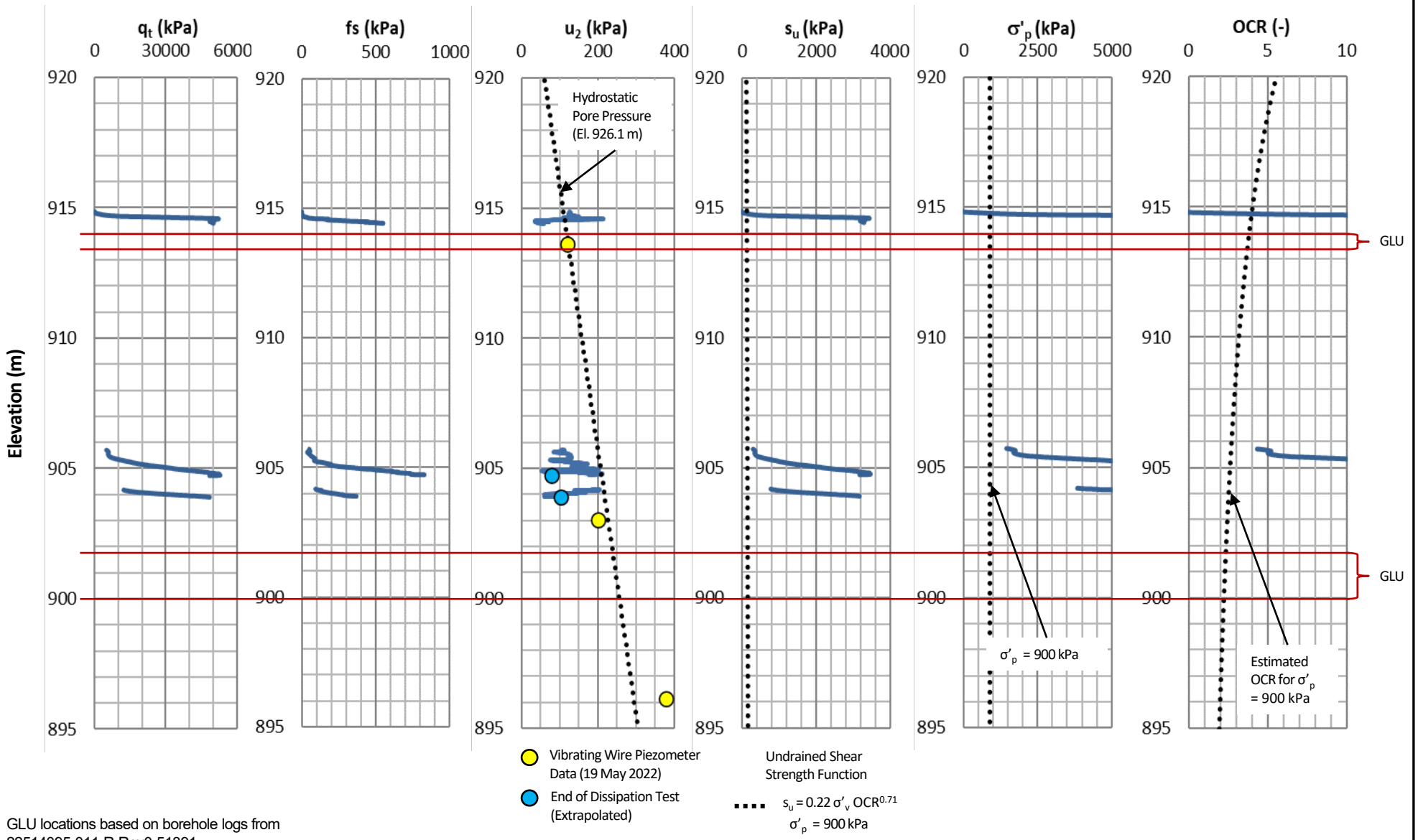

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
5. σ'_p = Preconsolidation Stress
6. OCR = Overconsolidation Ratio
7. σ'_v = Vertical Effective Stress
8. σ_v = Total Vertical Stress
9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-02

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	51300	51392	0	E-1

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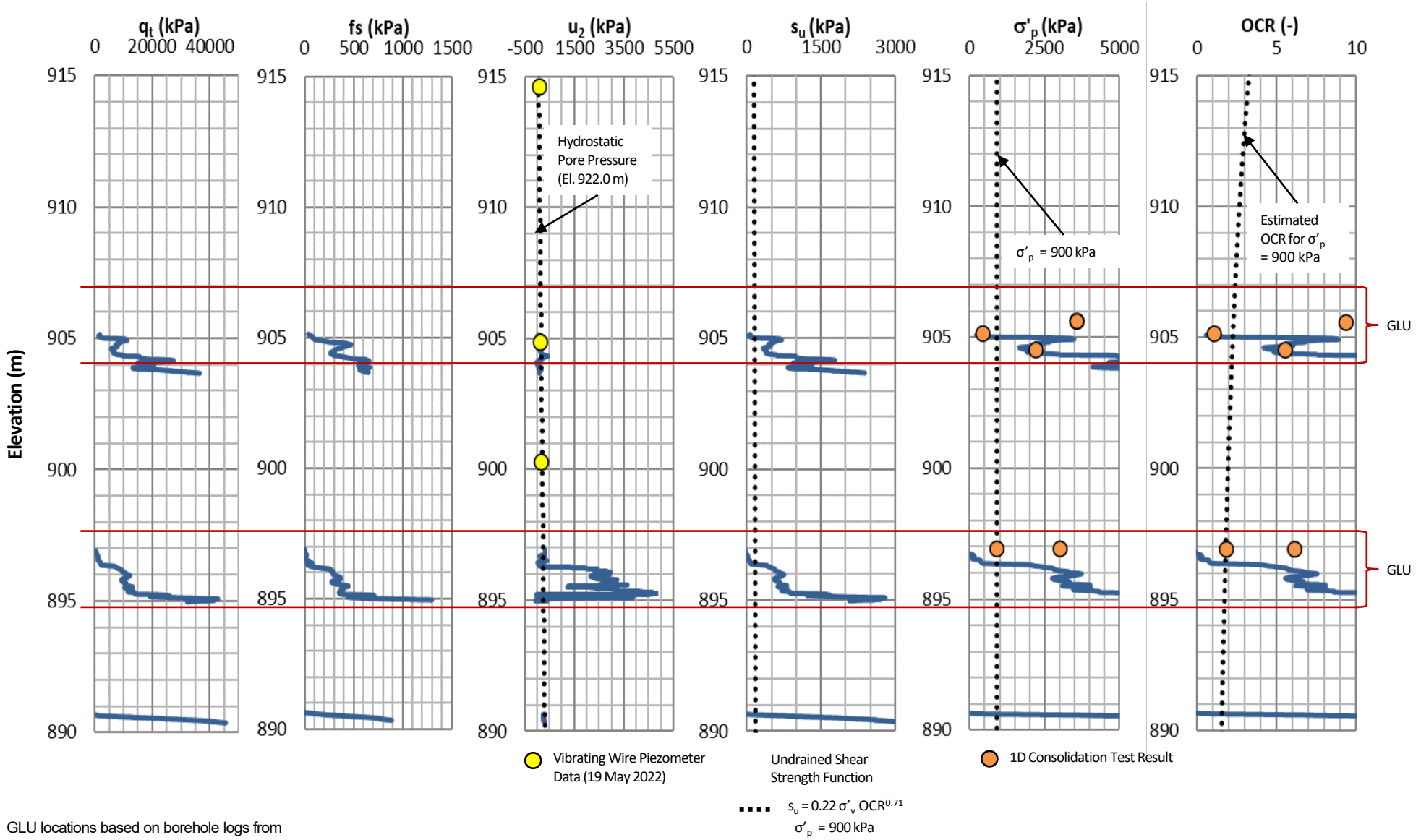

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
5. σ'_p = Preconsolidation Stress
6. OCR = Overconsolidation Ratio
7. σ'_v = Vertical Effective Stress
8. σ_v = Total Vertical Stress
9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-03

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	**51300**	**51392**	**0**	**E-2**

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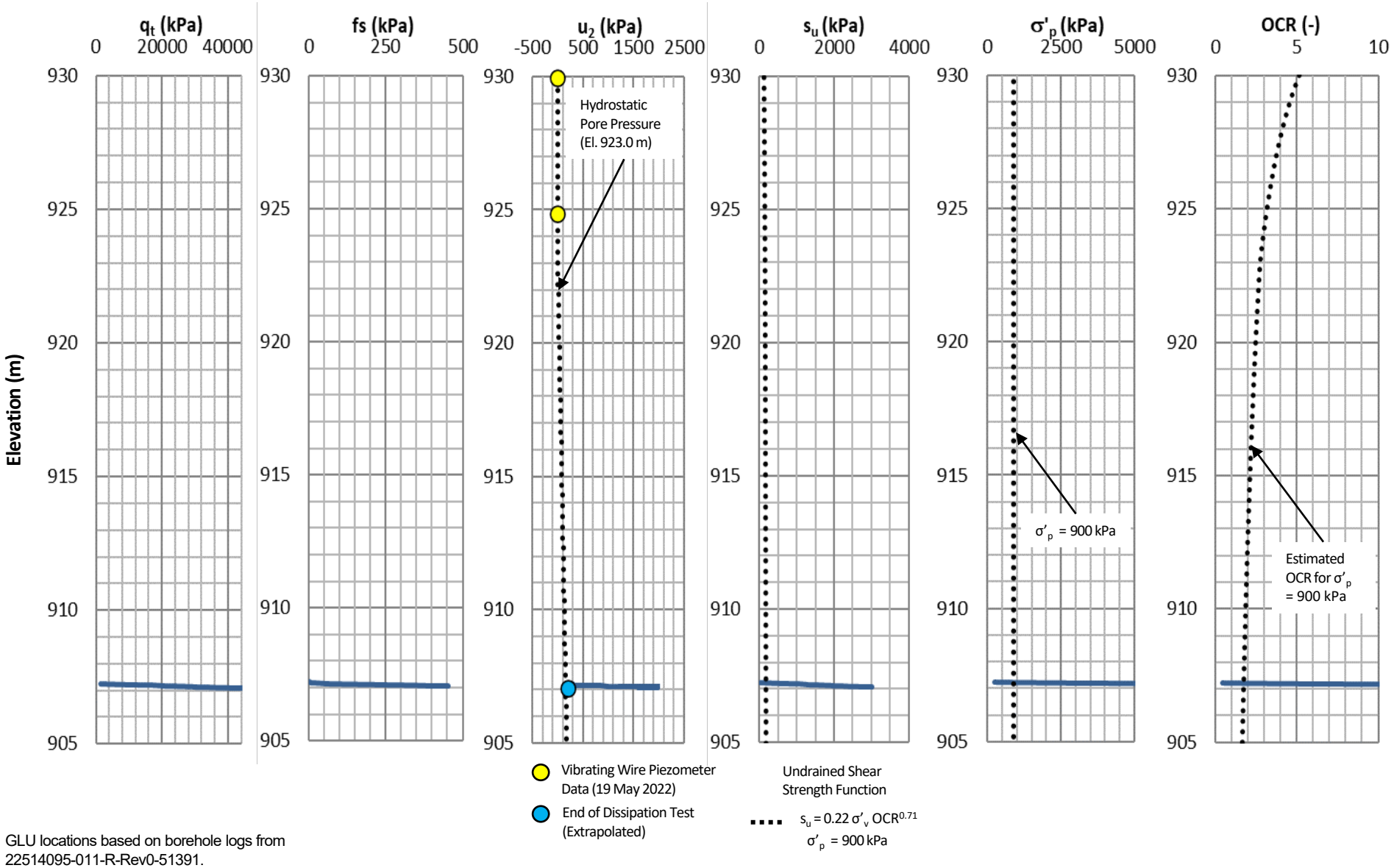

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
5. σ'_p = Preconsolidation Stress
6. OCR = Overconsolidation Ratio
7. σ'_v = Vertical Effective Stress
8. σ_v = Total Vertical Stress
9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-06

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	**51300**	**51392**	**0**	**E-3**

https://golderassociates.sharepoint.com/sites/10023g/50000_TSF_ENGINEERING/Forms/AllItems.aspx?csf=1&web=1&e=nYBCs9&ovuser=3d234255%2De20f%2D4205%2D88a5%2D9658a402999b%2Cscott%2Ecoombs%40wsp%2Ecom&OR=Teams%2DHL&CT=1661378880663&clickparams=eyJBcHBOYW1lIjoiVGVhbXMtRGVza3RvcCIsIkFwcFZlcnNpb24iOiIyNy8yMjA3MzEwMTAwNSIsIkhhc0ZlZGVyYXRlZFVzZXIiOnRydWV9&cid=9dc739fa%2De3f1%2D4631%2Dabbf%2Dce95a81677b4&RootFolder=%2Fsites%2F10023g%2F50000%5FTSF%5FENGINEERING%2F51300%5FUltimate%5FDesign%2F51331%5F2021%20Site%20Investigation%2FCPT%2FCPTu%20Interpretation&FolderCTID=0x012000ECCF7810C0D4C94D91E590ED93C22946

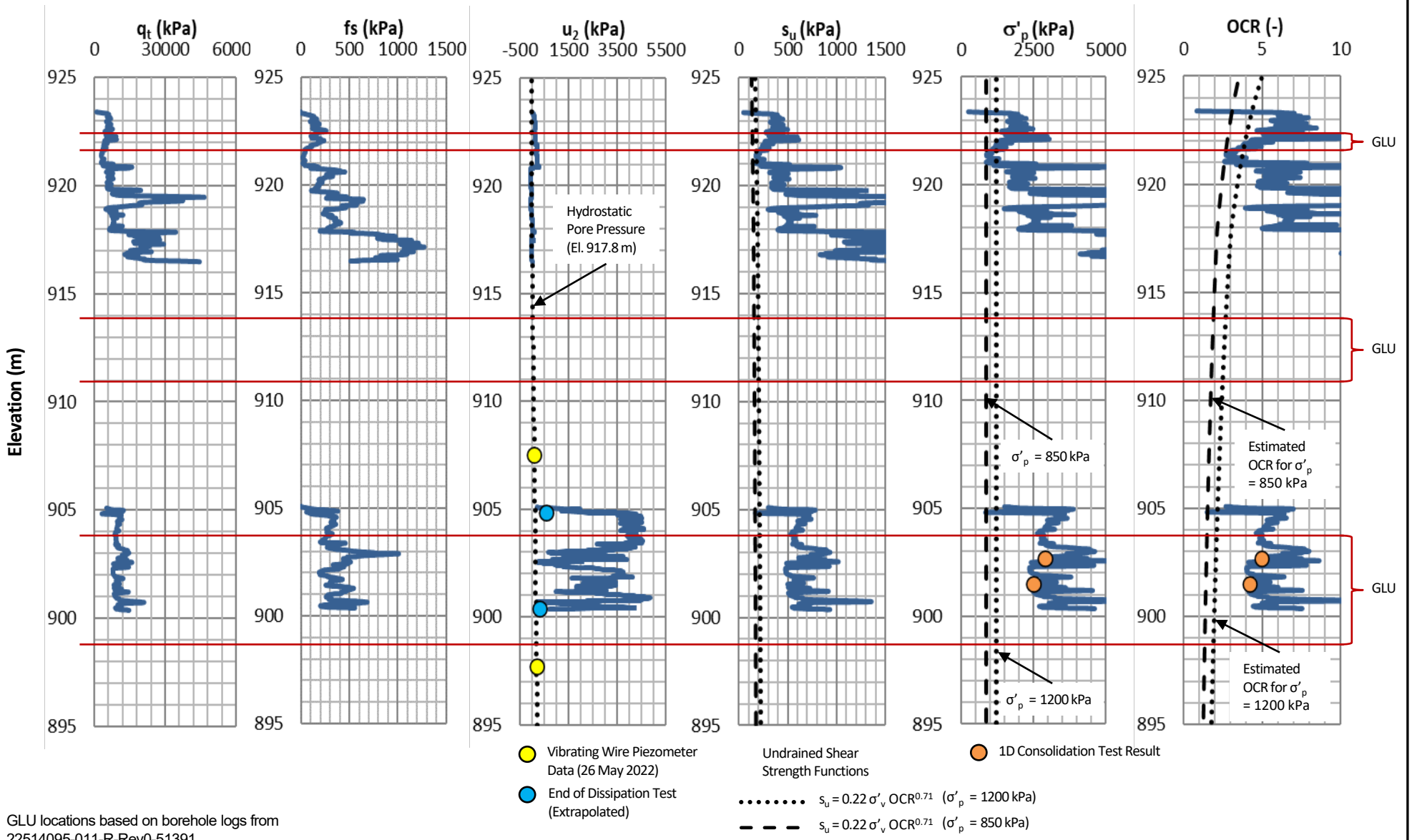

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
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6. OCR = Overconsolidation Ratio
7. σ'$_v$ = Vertical Effective Stress
8. σ_v = Total Vertical Stress
9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-07

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	**51300**	**51392**	**0**	**E-4**

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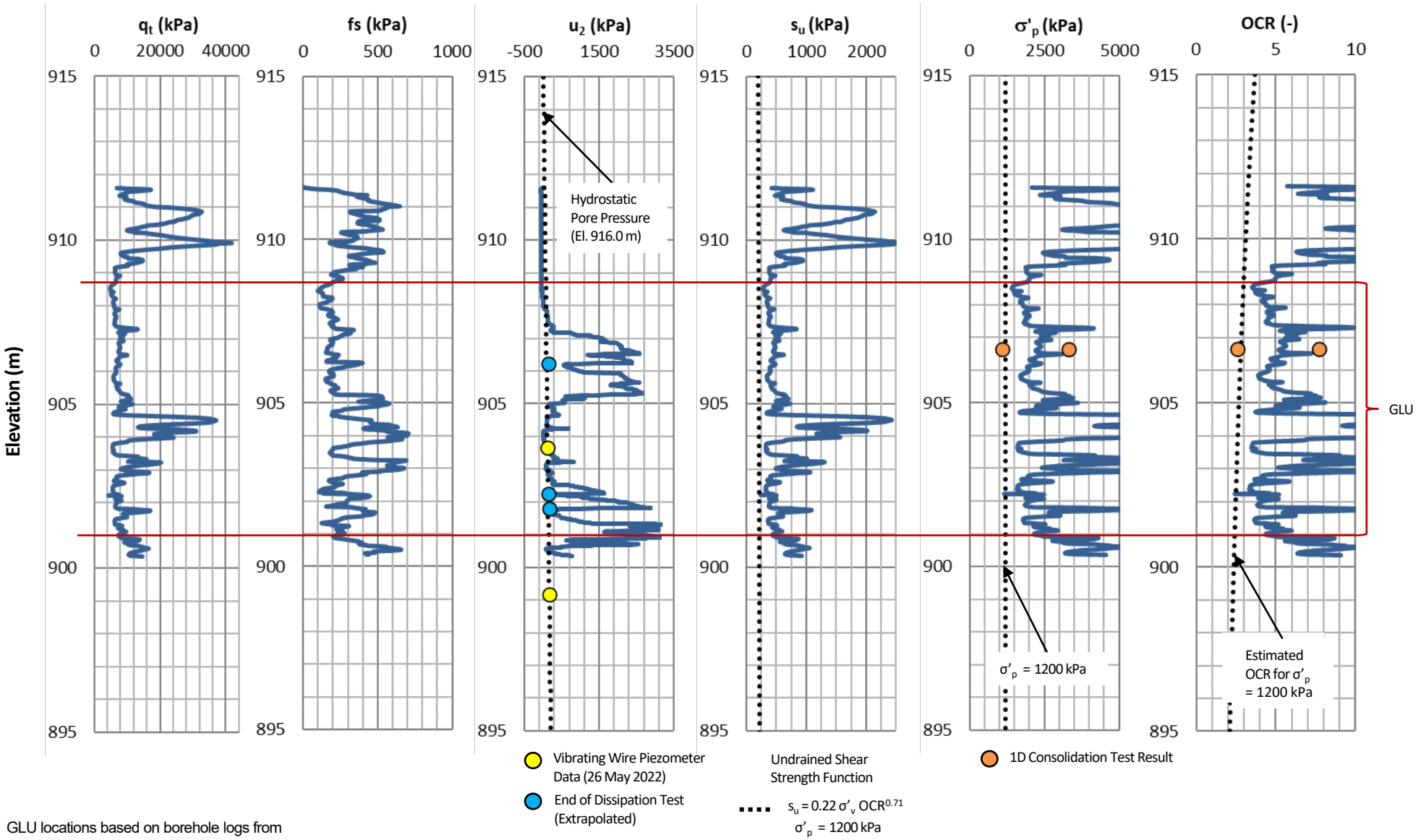

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
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6. OCR = Overconsolidation Ratio
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8. σ_v = Total Vertical Stress
9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-08

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	51300	51392	0	E-5

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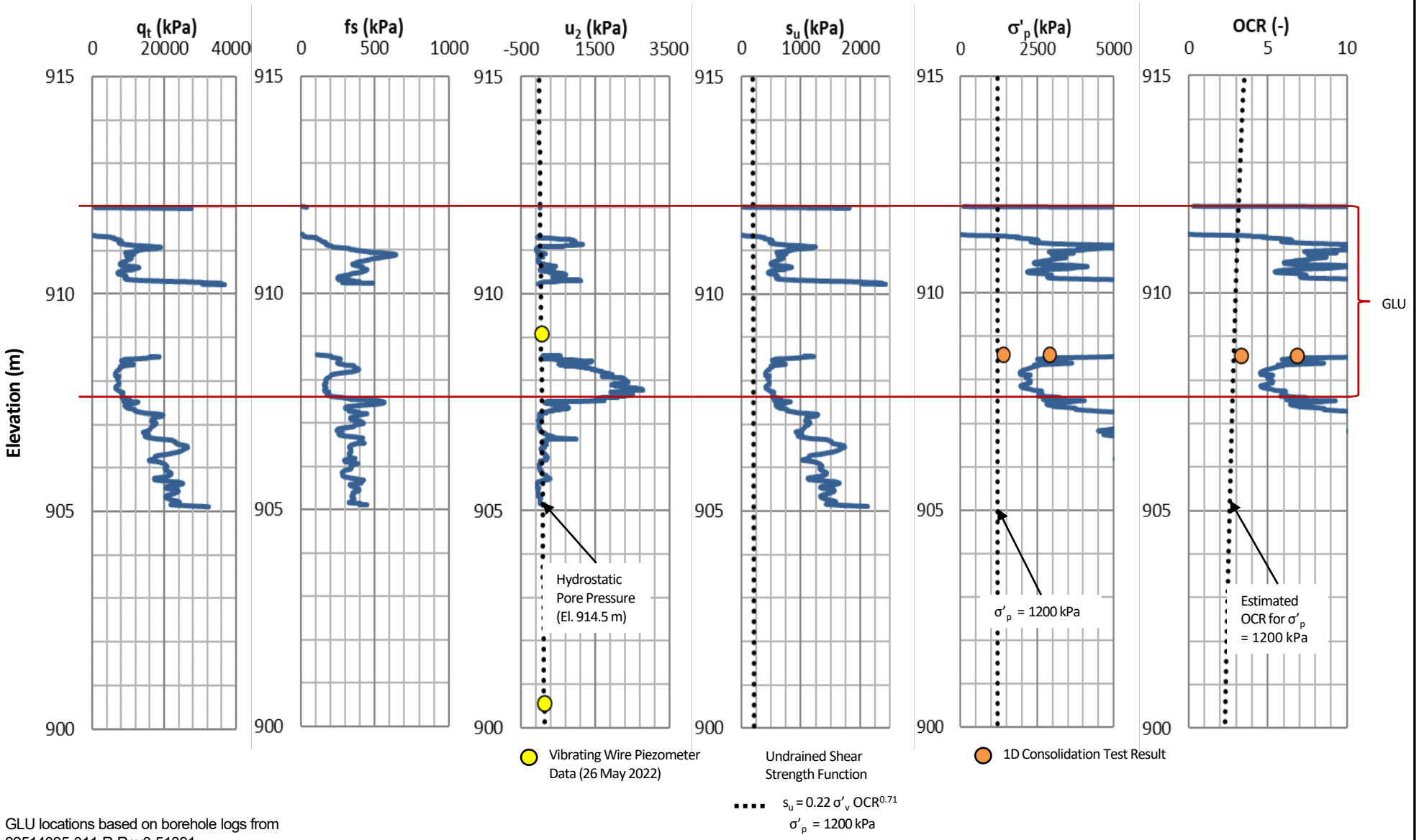

GLU locations based on borehole logs from 22514095-011-R-Rev0-51391.

REFERENCES/NOTES

1. q_t = Tip Resistance
2. fs = Sleeve Friction
3. u_2 = Pore Pressure
4. s_u = Undrained Shear Strength
5. σ'_p = Preconsolidation Stress
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7. σ'_v = Vertical Effective Stress
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9. GLU = Glaciolacustrine Unit
10. $s_u = (q_t-\sigma_v)/15$
11. $\sigma'_p = 0.33(q_t-\sigma_v)$
12. $OCR = \sigma'_p/\sigma'_v$

CLIENT
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CONSULTANT
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YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
CPT21-09

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	**51300**	**51392**	**0**	**E-6**

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CPT	Elevation (m)	t_{50} (s)	Estimated Hydraulic Conductivity (m/s)	Lithology
CPT21-02	904.7	27	1.6×10^{-7}	Silt and sand, non plastic fines (glaciofluvial)
CPT21-02	903.9	18	2.7×10^{-7}	Silt and sand, non plastic fines (glaciofluvial)
CPT21-03	895.1	655	3.0×10^{-9}	High plasticity clay, trace sand, varved (glaciolacustrine)
CPT21-07	920.9	726	2.7×10^{-9}	Gravelly sandy silty clay, medium plasticity (basal till)
CPT21-07	904.8	81	4.1×10^{-8}	Clayey silt, medium plasticity
CPT21-07	900.4	73	4.7×10^{-8}	High plasticity clay, trace sand, varved (glaciolacustrine)
CPT21-08	906.2	127	2.3×10^{-8}	Silty clay, medium plasticity, trace sand, laminated (glaciolacustrine)
CPT21-08	902.3	301	8.0×10^{-9}	Silt, non-plastic, laminated (glaciofluvial)
CPT21-08	901.8	62	5.8×10^{-8}	Silty clay, medium plasticity, varved (glaciolacustrine)
CPT21-09	910.9	158	1.8×10^{-8}	Sandy silty clay, medium plasticity, laminated (glaciolacustrine)
CPT21-09	908.3	198	1.3×10^{-8}	Silty clay to clay, low to high plasticity, trace sand, laminated (glaciolacustrine)

REFERENCES/NOTES

1. Hydraulic conductivity estimates based on Parez & Fauriel (1988).

$$k_h\,(cm/s) \approx \left(\frac{1}{251 * t_{50}(sec)}\right)^{1.25}$$

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-13
PREPARED	S. Coombs
DESIGNED	A., Torres
REVIEWED	A. Torres
APPROVED	G. Pizarro

PROJECT
MOUNT POLLEY MINE
TAILINGS STORAGE FACILITY
FOUNDATION CHARACTERIZATION REPORT

TITLE
CPT DATA AND INTERPRETATION
ESTIMATED HYDRAULIC CONDUCTIVITY FROM DISSIPATION TESTS

PROJECT NO.	PHASE	TASK	REV.	FIGURE
22514095	51300	51392	0	E-7

APPENDIX F

Well Test Results and Nearest Registered Water Wells and Mapped Aquifers

Well Location Data					GW Levels			Screened Interval					Single Well Response Test Results		
Easting	Northing	Well No.	Ground Surface Elevation (m)	TOC Elevation (m)	Date	Water Level (mbtoc)	Water Level (m)	Top (mbgs)	Bottom (mbgs)	Top (m)	Bottom (m)	HS unit	Method	Number of Tests Analyzed	K (m/s)
594371.11	5818475.85	GW00-1B	939.20	940.05	02-Jun-22	1.34	938.71	4.5	10.6	934.7	928.6	SILT Till with SAND interbed (Basal Till)	Solid Slug and Bailer	5	3E-06
594896.22	5818238.09	GW00-3B	943.06	943.79	02-Jun-22	3.80	939.98	7.6	13.7	935.5	929.4	SILT Till with SILT/f.SAND interbed (Basal Till)	Solid Slug	2	8E-07
596065.40	5819449.92	GW96-2A	931.42	931.92	01-Jun-22	30.80	901.13	51.8	54.9	879.6	876.5	Weathered Bedrock - conglomerate	Solid Slug	2	3E-06
596074.73	5819447.08	GW96-2B	931.42	932.02	01-Jun-22	17.21	914.81	30.8	35.4	900.6	896.0	SAND and GRAVEL *(Glaciofluvial?)*	Solid Slug and Bailer	8	4E-04
595151.26	5818162.87	GW96-4B	940.46	941.16	01-Jun-22	1.91	939.25	4.3	7.2	936.2	933.3	SAND and GRAVEL *(Glaciofluvial?)*	Solid Slug	6	2E-06
596228.05	5819066.00	GW21-06	946.12	947.08	31-Mar-22	30.24	916.84	33.7	35.3	912.4	910.9	Unknown Overburden	Solid Slug	2	1E-05
595544.37	5818304.68	GW21-09	930.53	931.44	31-Mar-22	16.91	914.53	16.1	17.7	914.4	912.9	Silty CLAY / SILT and SAND (Basal Till)	Solid Slug	2	1E-06

* indicates this elevation was calculated from stickup, not directly surveyed

[1] this is the reccommended method to start with, but ideally tests should be conducted with both the small and large slu

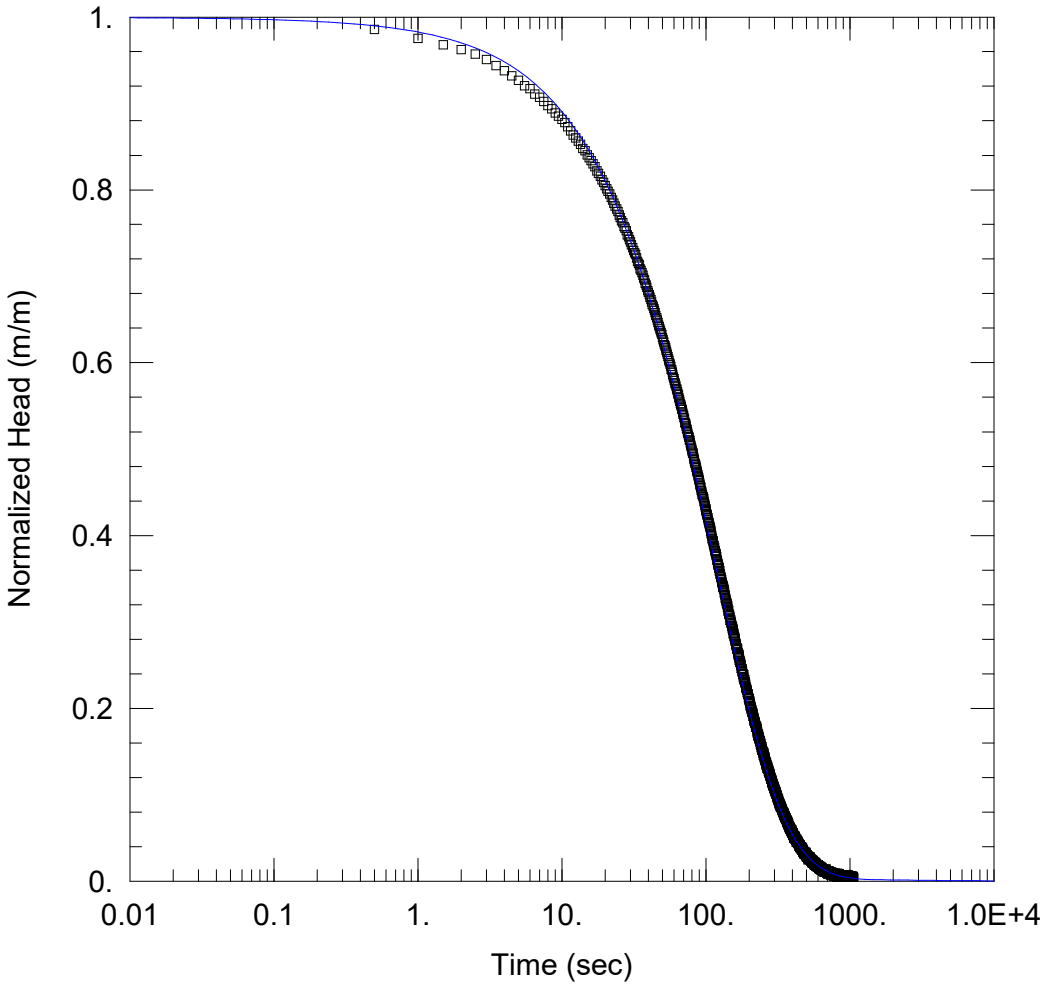

WELL TEST ANALYSIS

Data Set: C:\...\GW96-2A_1b_GH.aqt
Date: 06/16/22 Time: 15:41:04

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 24.96 m

WELL DATA (GW96-2A)

Initial Displacement: 0.4507 m
Total Well Penetration Depth: 24.96 m
Casing Radius: 0.026 m
Static Water Column Height: 24.96 m
Screen Length: 4.3 m
Well Radius: 0.075 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 2.7E-6 m/sec
Kz/Kr = 1.
Ss = 9.6E-6 m^{-1}

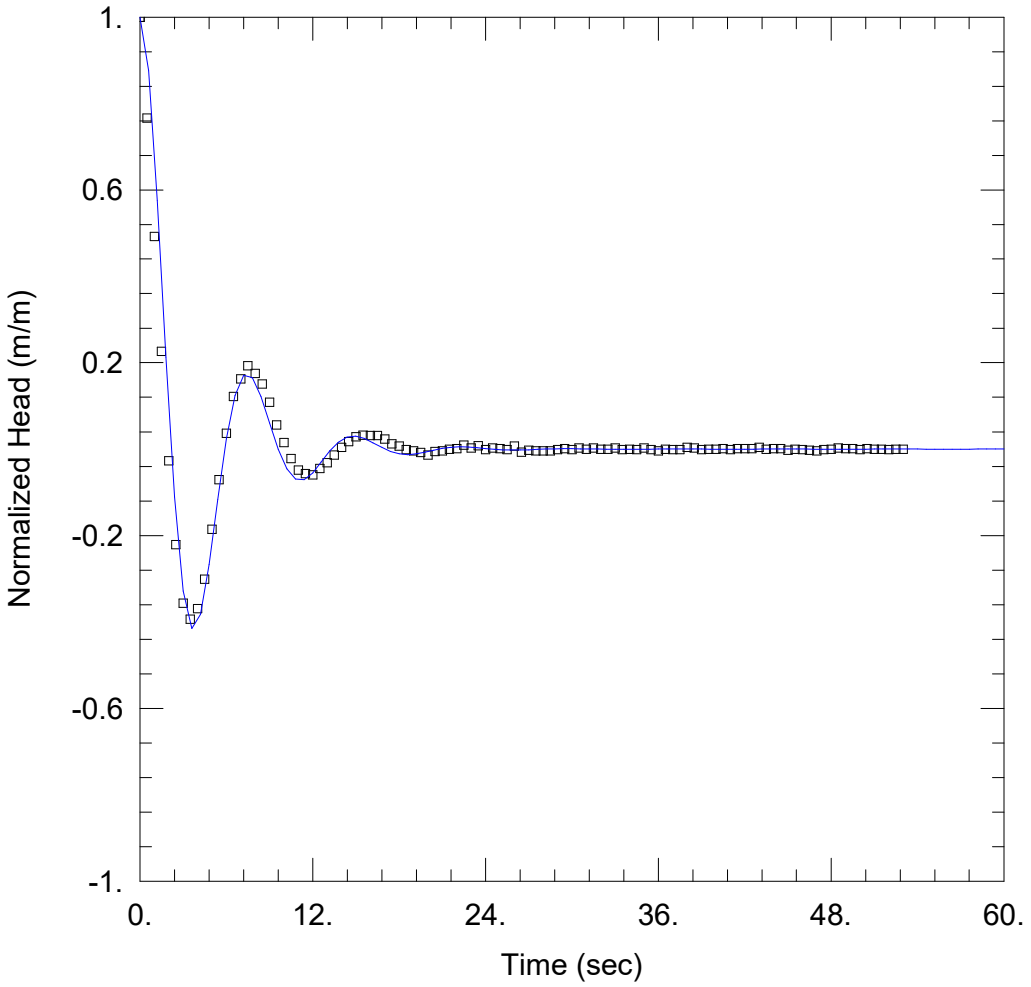

WELL TEST ANALYSIS

Data Set: C:\...\GW96-2B_1b_GH.aqt
Date: 06/16/22 Time: 15:50:31

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 19.15 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW96-2B)

Initial Displacement: 0.0737 m
Total Well Penetration Depth: 19.15 m
Casing Radius: 0.026 m
Static Water Column Height: 19.15 m
Screen Length: 6. m
Well Radius: 0.075 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar
K = 0.00039 m/sec
Le = 12.71 m

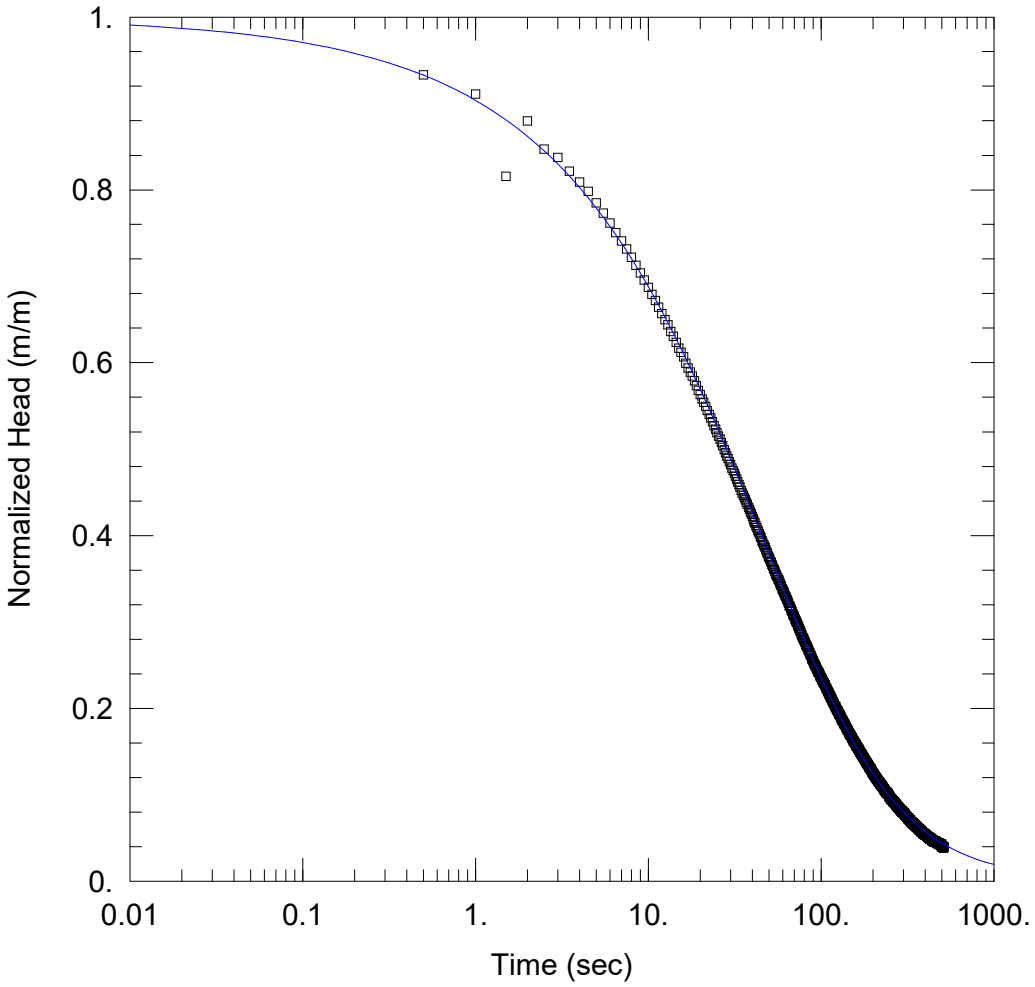

WELL TEST ANALYSIS

Data Set: C:\...\GW96-4B_2a_GH.aqt
Date: 06/16/22 Time: 16:36:10

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 6.27 m

WELL DATA (GW96-4B)

Initial Displacement: 0.4043 m
Total Well Penetration Depth: 6.27 m
Casing Radius: 0.026 m
Static Water Column Height: 6.27 m
Screen Length: 4.6 m
Well Radius: 0.075 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.0E-6 m/sec
Kz/Kr = 1.
Ss = 0.0031 m^{-1}

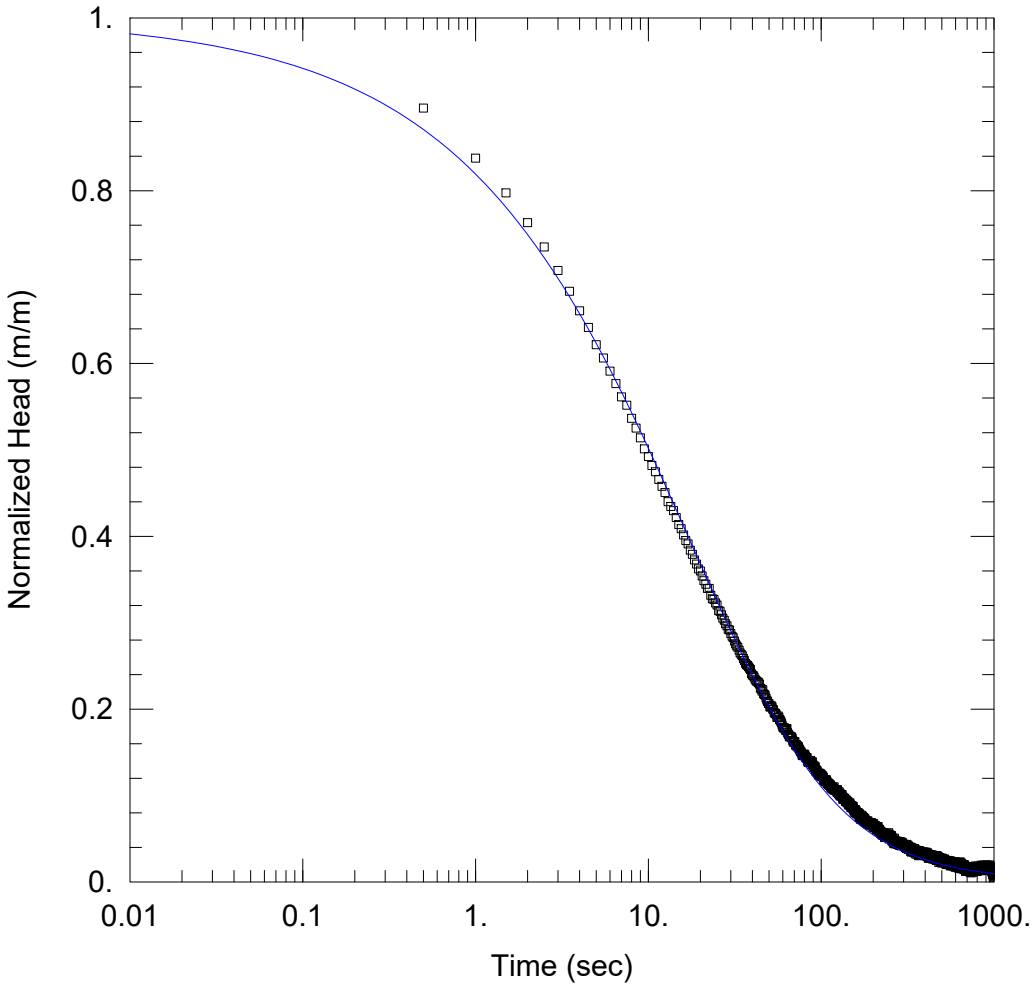

WELL TEST ANALYSIS

Data Set: C:\...\GW00-1B_1b_GH.aqt
Date: 06/15/22 Time: 11:00:00

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 9.39 m

WELL DATA (GW00-1b)

Initial Displacement: 0.1245 m
Total Well Penetration Depth: 9.39 m
Casing Radius: 0.025 m
Static Water Column Height: 9.39 m
Screen Length: 6.1 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.7E-6 m/sec
Kz/Kr = 1.
Ss = 0.01 m^{-1}

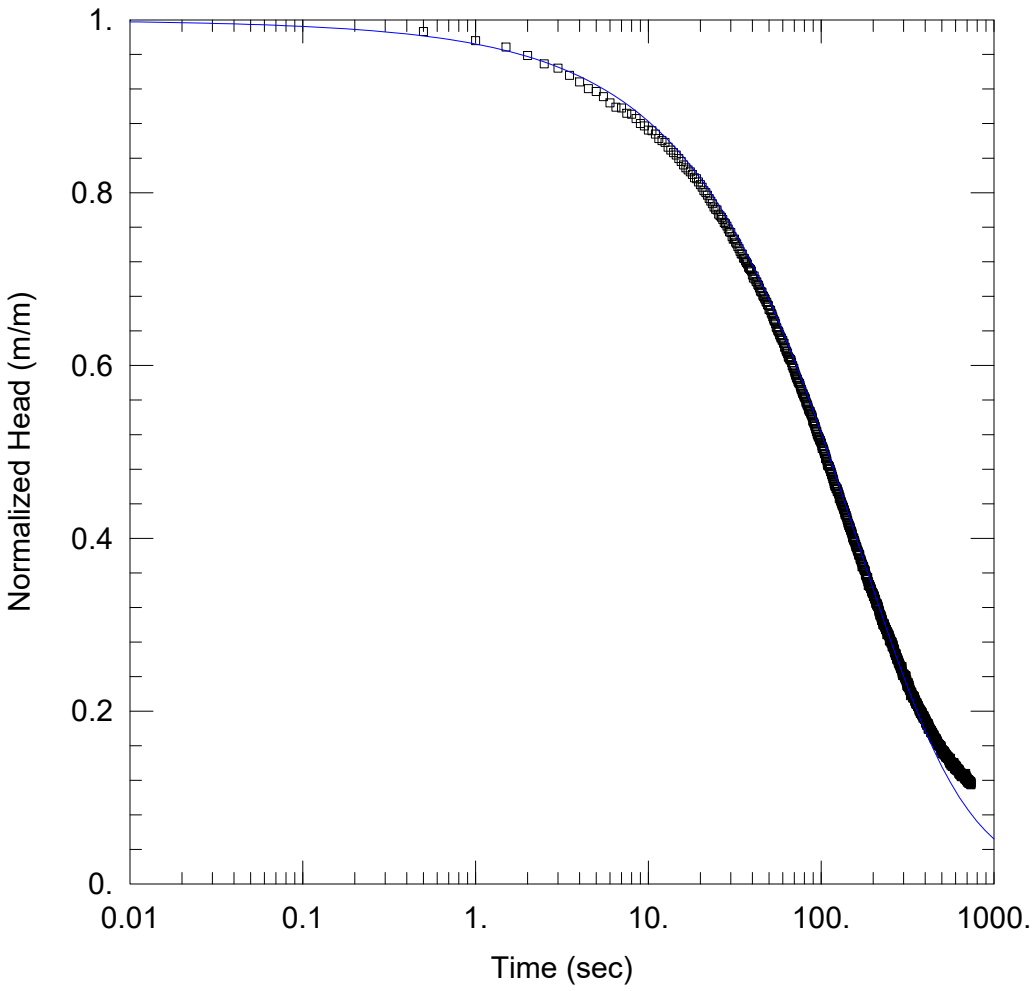

WELL TEST ANALYSIS

Data Set: C:\...\GW00-3B_1b_GH.aqt
Date: 06/15/22 Time: 11:33:34

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 9.92 m

WELL DATA (GW00-3b)

Initial Displacement: 0.4201 m
Total Well Penetration Depth: 9.92 m
Casing Radius: 0.025 m
Static Water Column Height: 9.92 m
Screen Length: 6.1 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 7.5E-7 m/sec
Kz/Kr = 1.
Ss = 0.0005 m^{-1}

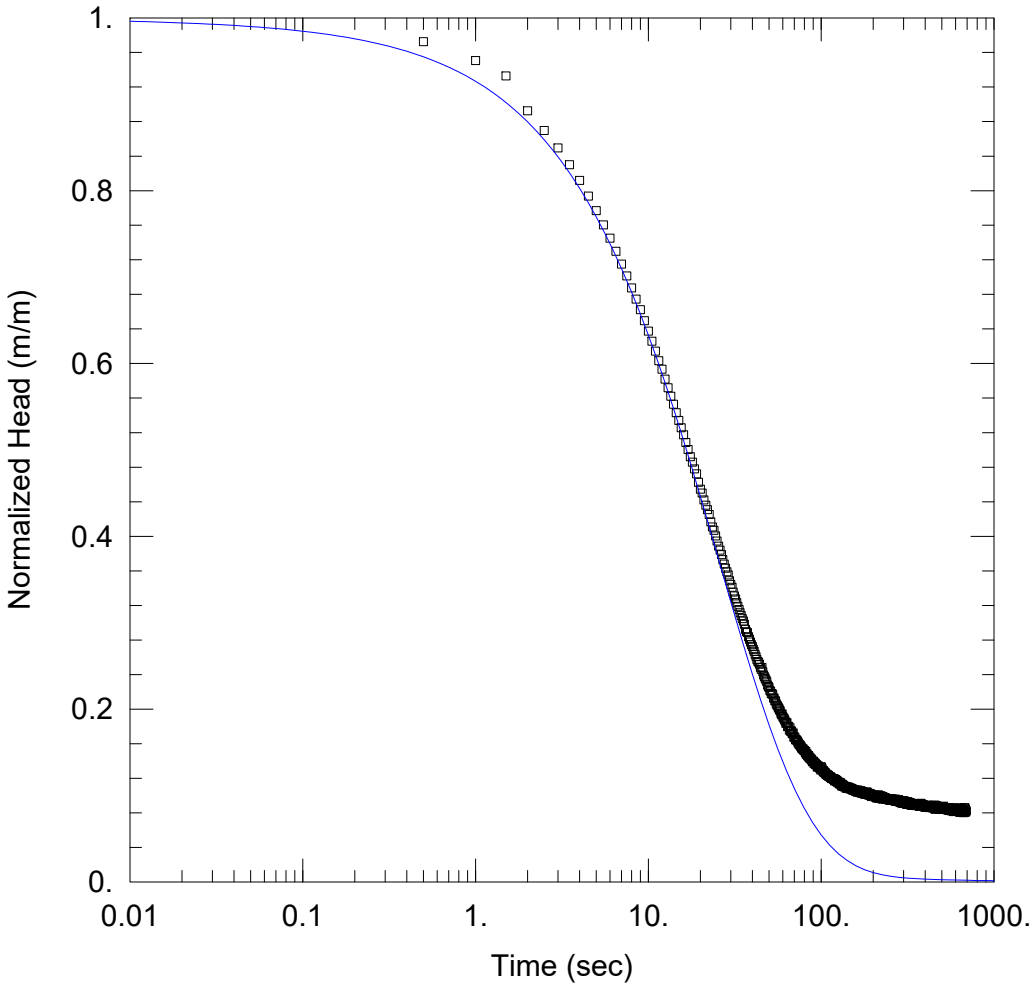

WELL TEST ANALYSIS

Data Set: C:\...\MW21-06_1b_GH.aqt
Date: 06/16/22 Time: 14:59:29

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 6. m

WELL DATA (MW21-06)

Initial Displacement: 0.4292 m
Total Well Penetration Depth: 6.05 m
Casing Radius: 0.025 m
Static Water Column Height: 6. m
Screen Length: 1.6 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 2.2E-5 m/sec
Kz/Kr = 1.
Ss = 0.0003 m^{-1}

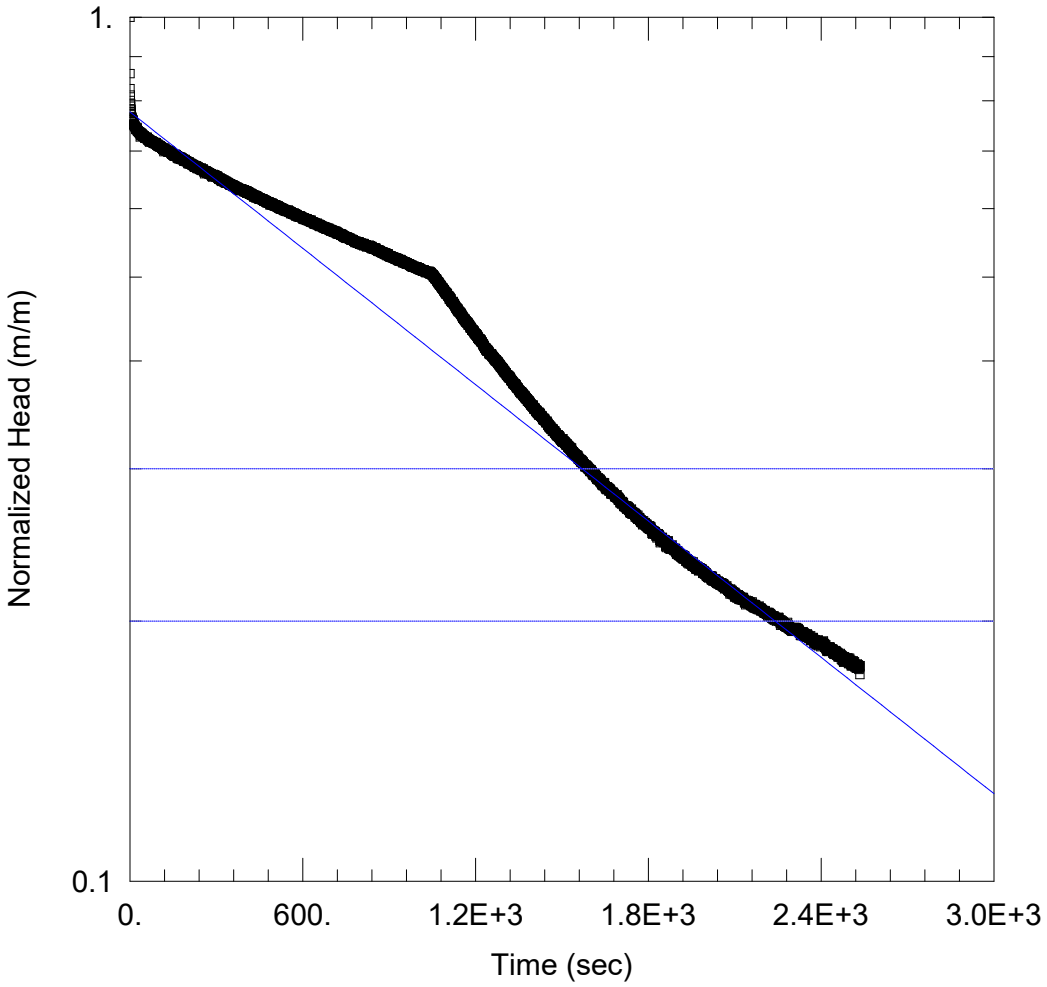

WELL TEST ANALYSIS

Data Set: C:\...\MW21-09_1_GH.aqt
Date: 07/06/22 Time: 09:55:25

PROJECT INFORMATION

Company: Golder
Client: Mount Polley Mine
Project: 22514095
Test Well: GW00-1B
Test Date: June 4, 2022

AQUIFER DATA

Saturated Thickness: 1.7 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW21-09)

Initial Displacement: 0.353 m
Total Well Penetration Depth: 1.73 m
Casing Radius: 0.025 m
Static Water Column Height: 1.7 m
Screen Length: 1.6 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 9.5E-7 m/sec y0 = 0.2742 m

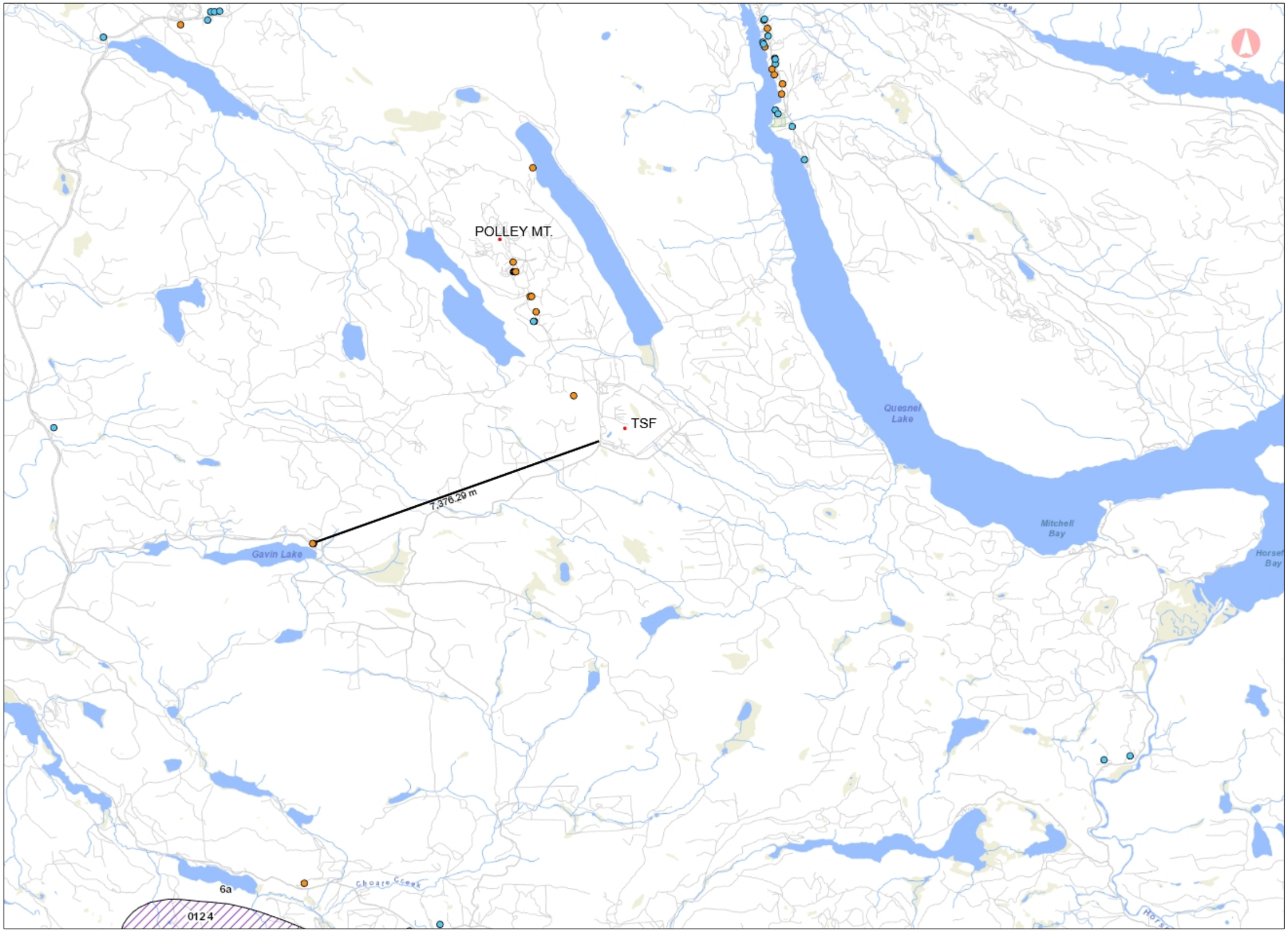

BRITISH COLUMBIA

iMapBC Mapping

Legend

- Water Wells - Private Dome:
- Water Wells - Licensed/Unli
  - WELL_LICENCE_GENERAL_S
  - Licensed
  - Unlicensed
- Aquifers - Subtype - BC - Cc
  - AQUIFER_SUBTYPE_CODE
  - 1a
  - 1b
  - 1c
  - 2
  - 3
  - 4a
  - 4b
  - 4c
  - 5a
  - 5b
  - 6a
  - 6b
  - UNK
- Aquifers - Vulnerability - BC
  - VULNERABILITY_CODE
  - Bedrock High Vulnerability
  - Bedrock Moderate Vulnerability
  - Bedrock Low Vulnerability
  - Unconsolidated High Vulnerabili
  - Unconsolidated Moderate Vulne

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CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum:	NAD83
Projection:	NAD_1983_BC_Environment_Albers

Key Map of British Columbia



APPENDIX G

Soil Grain Size Analyses for K

Sample Location	Sample No.	Depth (m)	Lithology	Soil Descripton	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Other (%)	Bulk Density	K (m/s) Estimate from HydrogeoSieve	
											K (m/s)	K Estimation Method Details
GA21-01	GS1	1.52 - 1.83	Ablation Till	gravelly CLAYEY SAND and SILTY CLAY	13.8	31.8	40.3	14.1	0.0	NA	1E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-01	GS2	3.96 - 4.27	Ablation Till	gravelly CLAYEY SAND and SILTY CLAY	13.7	31.0	40.2	15.1	0.0	NA	1E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-01	GS18	34.75 - 35.36	Basal Till	gravelly sandy SILT	7.7	32.8	50.9	8.6	0.0	NA	2E-06	Estimation from Krumbein and Monk. The geometric mean seems too low
GA21-02	GS3	5.49 - 5.79	Ablation Till	gravelly sandy SILT	6.4	27.7	43.2	22.7	0.0	NA	1E-06	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-02	GS24	47.09 - 47.34	Basal Till	sandy CLAYEY SILT	15.9	25.3	35.5	23.3	0.0	NA	1E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-03	GS2	7.01 - 7.32	Ablation Till	sandy gravelly SILT	8.2	31.5	43.6	16.7	0.0	NA	4E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-03	GS4	10.36 - 10.67	Ablation Till	sandy gravelly SILT	9.9	30.3	34.8	25.0	0.0	NA	2E-06	Estimation from Krumbein and Monk. The geometric mean seems too low
GA21-03	GS25	43.59 - 43.89	Basal Till	sandy gravelly SILTY CLAY	9.4	34.6	35.4	20.6	0.0	NA	1E-06	Estimation from Krumbein and Monk. The geometric mean seems too low
GA21-05	GS1	8.23 - 8.53	Ablation Till	sandy SILTY CLAY	12.2	28.7	41.7	17.4	0.0	NA	2E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-05	GS11	28.65 - 28.96	Basal Till	SILT	6.0	41.8	44.7	7.5	0.0	NA	3E-07	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-06	GS1	2.44 - 2.74	Ablation Till	gravelly sandy SILT	15.5	42.8	36.4	5.3	0.0	NA	2E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-06	GS2	6.40 - 6.71	Ablation Till	gravelly SILTY SAND	5.3	18.4	43.9	32.4	0.0	NA	1E-06	Geometric mean of applicable methods (Terzaghi, Sauerbrei, Kozeny-Carmen, Zamarin, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-06	GS6	12.80 - 13.11	Glaciofluvial	gravelly SAND	2.3	8.6	44.8	44.3	0.0	NA	3E-05	Geometric mean of applicable methods (Terzaghi, Sauerbrei, Zamarin, Barr, Alyamani and Sen) too low, use 10 times higher (i.e., use 3E-4 m/s)
GA21-06	GS8	16.76 - 17.07	Basal Till	gravelly sandy SILT	6.0	20.4	35.5	38.1	0.0	NA	1E-06	Geometric mean of applicable methods (Terzaghi, Sauerbrei, Kozeny-Carmen, Zamarin, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-07	GS1	11.89 - 12.19	Ablation Till	sandy SILTY CLAY	17.3	36.8	33.8	12.1	0.0	NA	2E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-08	GS1	17.37 - 17.68	Ablation Till	sandy SILT	12.3	38.9	35.4	13.4	0.0	NA	9E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-08	GS7	27.43 - 27.74	Glaciolacustrine	SILTY CLAY	44.2	55.6	0.2	0.0	0.0	NA	3E-10	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-08	GS10	34.75 - 35.05	Basal Till	sandy SILTY CLAY	18.9	33.2	41.9	6.0	0.0	NA	4E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk)
GA21-09	GS8	27.43 - 27.74	Basal Till	sandy SILT	8.8	54.0	25.9	11.3	0.0	NA	6E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-11	GS15	13.41 - 13.65	Glaciolacustrine	SILTY CLAY	19.7	65.6	11.6	3.1	0.0	NA	4E-09	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-11	GS16	16.64 - 16.76	Glaciolacustrine	SILTY CLAY	8.7	77.5	12.9	0.9	0.0	NA	2E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-11	GS20	20.73 - 21.03	Glaciolacustrine	sandy SILTY CLAY	14.4	62.9	18.4	4.3	0.0	NA	9E-09	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)
GA21-11	GS24	23.93 - 24.23	Glaciolacustrine	sandy SILTY CLAY	6.6	68.7	20.7	4.0	0.0	NA	7E-08	Geometric mean of applicable methods (Sauerbrei, Barr, Alyamani and Sen)

APPENDIX H

Assurance Statements

APPENDIX A-1: DESIGN ENGINEER'S SITE CHARACTERIZATION ASSURANCE STATEMENT

To: The Owner(s) Date: 18 September 2023

Name: Mount Polley Mining Corporation

Address: PO Box 12, Likely, BC, V0L 1N0

For the dam:

UTM (Location): Zone IOU; Easting 595,768; Northing 5,818,548

Located at (Description): near Likely, BC

Name of dam or description: Mount Polley Tailings Storage Facility

Provincial dam number: Permit M-200

Dam function: Tailings Storage

Current *project stage* is:

Check one

☐ Feasibility design
☐ Detailed design
▪ Construction/operations

The undersigned hereby gives assurance that he/she is a qualified APEGBC-registered professional and is a professional engineer and is the **Design Engineer** for the dam project identified above.

I have signed, sealed, and dated the attached dam site characterization report in accordance with the *APEGBC Professional Practice Guidelines – Site Characterization for Dam Foundations in BC*. The report must be read in conjunction with this Assurance Statement.

In preparing the dam site characterization report, I have completed the following activities:

(Check the applicable items)

Completed by the Design Engineer	Activity
X	Collected and reviewed available and relevant background information, documentation, and data
X	Visited the site and reviewed the conditions in the field that may be relevant for site characterization
X	Developed and executed a site characterization program that provides information to support the design of the dam, subject to the qualifications noted
X	Reviewed previous site characterization studies and data and updated the dam site characterization assessment report to include all data and, where appropriate, revised interpretations of data
X	Assessed potential areas of risk identified during site characterization programs to date and, as far as is practical, addressed the risks
X	Evaluated the level of complexity of the site and documented how it was assessed and supported by the site characterization program(s)
X	Reviewed and accepted all assurance statements submitted by the supporting registered professionals (SRPs)
X	Prepared a data record report
X	Prepared the dam site characterization report, which interprets the site conditions

In preparing the dam site characterization report, I have completed the following activities or reviewed and accepted such activities completed by a supporting registered professional (SRP):

(Check the applicable items)

Completed by the Design Engineer	Completed by the SRP, and reviewed and accepted by the Design Engineer	Activity
	X	Assessed the surficial and bedrock geological models to confirm that they adequately support the understanding of the spatial variability of the geotechnical properties of the foundation materials
X		Carried out sufficient in situ and laboratory testing to quantify the geotechnical properties of the foundation materials
X		Assessed the strength properties of the foundation materials with consideration of stress state and response to loadings
	X	Assessed the hydrogeological properties of the foundation materials with consideration of potential hydraulic gradients, artesian pressures, and seepage flow paths
	X	Assessed the seismotectonic conditions to provide a basis for the seismic hazard analysis of the dam
X	X	Evaluated the level of complexity of the site and documented how it was assessed and supported by the site characterization program(s)
X		Reviewed and accepted all assurance statements submitted by the supporting registered professionals (SRPs)
X	X	Prepared a data record report
X	X	Prepared the dam site characterization report, which interprets the site conditions

I hereby give my assurance that based on the attached dam site characterization report, at this point in time:

Check one

- [x] The dam site characterization report is reasonably comprehensive and supports the design of the dam.
- [ ] The dam site characterization report is not sufficiently comprehensive to support the design of the dam, in that the dam site characterization report identifies areas of potential concern that require additional investigation as set out in section(s) _____ of the attached dam site characterization report

Name: (print) Germán Pizarro

Signature: _____ Date: 18 September 2023

Address: 840 Howe Street, #1000, Vancouver, BC, V6Z 2M1

(Affix professional seal here)

Telephone: 604 787 2166

Email: german.pizarro@wsp.com



2023-09-22

(If the APEGBC professional is a member of a firm, complete the following)

I am a member of the firm WSP Canada Inc.

(Print name of firm)

and I sign this letter on behalf of the firm.

APPENDIX A-2: SUPPORTING REGISTERED PROFESSIONAL'S ASSURANCE STATEMENT OF PROFESSIONAL SERVICES

To: The Design Engineer Date: 5 September 2023

Name: Germán Pizarro-Sala

Address: WSP Canada Inc

840 Howe Street, #1000, Vancouver BC, V6Z 2M1, Canada

For the dam:

UTM (Location): Zone: IOU; Easting 595768.72 m; Northing 5818548.36 m

Located at (Description): near Likely, British Columbia

Name of dam or description: TSF Embankment

Dam function: tailings storage

Owned by: Mount Polley Mining Corporation (MPMC)

Current project stage is:

Check one

☐ Feasibility design
☐ Detailed design
☒ Construction/operations

This is to advise that the undersigned is a **supporting registered professional** (SRP) retained by MPMC to carry out supporting professional services for the dam.

I undertook supporting professional services in the following:

(Check applicable sections)

☐ Bedrock/structural geology
☐ Surficial geology
☐ Geotechnical investigations
☒ Hydrogeology
☐ Seismotectonic investigations
☐ Other

The undersigned hereby gives assurance that the

hydrogeological and geochemical assessment

and the documents prepared by this supporting registered professional for the project have been carried out in a manner that meets the intent of the applicable APEGBC guidelines and good professional practice.

These professional services are described, and the results of them reported on in the documents prepared by me, or under my direct supervision, which bear my professional seal.

(With respect to field reviews, initial the following statements, as applicable. Leave blank those that are not applicable.)

_____ Field review(s) are not applicable

CR Field review(s) are applicable:

CR I have performed field review(s) for the services identified above. (field review: 30 May 2022 to 1 June 2022)

_____ Field review(s) have been performed by _____.

I confirm that I have communicated and liaised as required with the appropriate APEGBC professionals for the purposes of my services.

I hereby give my assurance that I am an APEGBC-registered professional.

Name: (print) Connie Romano

Signature: CRomano Date: 5 September 2023

Address: WSP Canada Inc.

840 Howe St. #1000, Vancouver BC, V6Z 2M1

Telephone:

Email: connie.romano@wsp.com



2023-09-05

(If the APEGBC professional is a member of a firm, complete the following)

I am a member of the firm WSP Canada Inc.

(Print name of firm)

and I sign this letter on behalf of the firm.

APPENDIX A-2: SUPPORTING REGISTERED PROFESSIONAL'S ASSURANCE STATEMENT OF PROFESSIONAL SERVICES

To: The Design Engineer Date: 9 September 2023

Name: (print) Germán Pizarro, PEng

Address: (print) WSP Global Inc. 840 Howe Street, Suite 1000

Vancouver, British Columbia V6Z 2M1 Canada

For the dam:

UTM (Location): Zone: lOU; Easting 595768.72 m; Northing 5818548.36 m

Located at (Description): near Likely, British Columbia

Name of dam or description: TSF embankment

Dam function: tailings storage

Owned by: Mount Polley Mining Corporation (MPMC)

Current project stage is:

Check one

- ☐ Feasibility design
- ☐ Detailed design
- ☑ Construction/operations

This is to advise that the undersigned is a **supporting registered professional** (SRP) retained by MPMC to carry out supporting professional services for the dam.

I undertook supporting professional services in the following:

(Check applicable sections)

- ☑ Bedrock/structural geology
- ☑ Surficial geology
- ☐ Geotechnical investigations
- ☐ Hydrogeology
- ☑ Seismotectonic investigations
- ☐ Other

The undersigned hereby gives assurance that the surficial geology, bedrock geology, seismotectonics

(Insert here the specific professional services carried out) and the documents prepared by this supporting registered professional for the project have been carried out in a manner that meets the intent of the applicable APEGBC guidelines and good professional practice.

These professional services are described, and the results of them reported on in the documents prepared by me, or under my direct supervision, which bear my professional seal.

(With respect to field reviews, initial the following statements, as applicable. Leave blank those that are not applicable.)

_____ Field review(s) are not applicable

X Field review(s) are applicable:

X I have performed field review(s) for the services identified above.

_____ Field review(s) have been performed by _____.

I confirm that I have communicated and liaised as required with the appropriate APEGBC professionals for the purposes of my services.

I hereby give my assurance that I am an APEGBC-registered professional.

Name: (print) Jeffrey Fillipone

Signature: 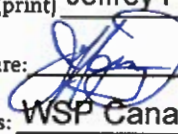 Date: 9 September 2023

Address: WSP Canada Inc.

301-3600 Uptown Blvd.

Victoria, BC V8Z 0B9

Telephone: 250-360-3572

Email: jeff.fillipone@wsp.com

(Affix professional seal here)



(If the APEGBC professional is a member of a firm, complete the following)

I am a member of the firm WSP Canada Inc
(Print name of firm)

and I sign this letter on behalf of the firm.



wsp.com

APPENDIX 1-5: Author Statements

BRITISH COLUMBIA

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Chris Dodd

   Title Registered Professional Consulting Archaeologist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: BC Association of Professional Archaeologists Registration # n/a

3. Brief description of professional services:

   Archaeological input for Section 2.12-Archaeology and Section 9.11-Archaeological Management and Impact Mitigation for the Springer Pit Expansion Joint Application

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X

Print Name: Chris Dodd

Witnessed by:

X

Print Name: Konain Sajid

Date signed: Nov 28, 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act*, the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Chris Dodd, as a member of BC Association of Professional Archaeologists declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Springer Pit Expansion Joint Application
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc LaChance, erring on the side of caution.

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

_____

_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Signature:

X _____

Print name: Chris Dodd

Date: Nov 29, 2023

Witnessed by:

X _____

Print name: Konain Sajid

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Jacqueline Foley

   Title Senior Principal Hydrogeologist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: Engineers and Geoscientists BC Registration # 130626

3. Brief description of professional services:

   Provided hydrogeological support and technical oversite in support of the permit application.

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X Jacqueline Foley

Witnessed by:

X

Print Name: Jacqueline Foley

Print Name: Konain Sajid

Date signed: 23 November 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act,* the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Jacqueline Foley (Print First and Last Name), as a member of Engineers and Geoscientists of BC (Print Name of Professional Association) declare

Select one of the following:

☑ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this application/assessment (application/project/work/etc.).
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Ministry of Environment and Climate Change Strategy (Ministry/Regulated Person), erring on the side of caution.

Ministry of Environment and Climate Change Strategy

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Signature:

X Jacqueline Foley

Witnessed by:

X

Print name: Jacqueline Foley

Print name: Konain Sajid

Date: 23 November 2023

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Alannah Gray Hubbard

   Title Lead Senior Geological Engineer

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: EGBC Registration # 48028

3. Brief description of professional services:

   Geotechnical assessment of open pits and waste rock dumps

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x [signature]

Print Name: Alannah Gray Hubbard

Witnessed by:

x [signature]

Print Name: Bryan Chiu

Date signed: Nov 28, 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act,* the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

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e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Alannah Gray Hubbard (Print First and Last Name), as a member of EGBC (Print Name of Professional Association) declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this permit application (application/project/work/etc.).
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Morgan Dyas (Insert Ministry Contact Name), erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

_____

_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X _____

Print name: Hannah Gray Hubbard

Date: Nov 28, 2023

Witnessed by:

X _____

Print name: Bryan China

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional DREW KAISER

   Title Biologist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 2332

3. Brief description of professional services:

   PEER REVIEW OF SECTIONS 2.10, 6.2, 9.10 IN THE JOINT APPLICATION FOR MINE PERMIT (M-200) FOR MOUNT Polley MINE

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X _____

Print Name: DREW KAISER

Witnessed by:

X _____

Print Name: Kristine Novakowski

Date signed: 24 November 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

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e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I DREW KAISER (Print First and Last Name), as a member of COLLEGE OF APPLIED BIOLOGISTS (Print Name of Professional Association) declare

Select one of the following:

☐ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this PROJECT - MOUNT POLLEY MINE - SPRINGER PIT EXPANSION (application/project/work/etc.). I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to LUC LACHANCE (Insert Ministry Contact Name), erring on the side of caution.

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

N/A

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

N/A

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X

Print name: DREW KAISER

Date: 24 NOVEMBER 2023

Witnessed by:

X

Print name: Kristine Novakowski

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Jorden Laskosky

Title Senior, Mine Closure and Reclamation Specialist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

Name of Association: BC Institute of Agrologists Registration # 4447

3. Brief description of professional services:

Acted as a qualified professional for Section 2.3.5., Section 4.0 and Section 7.5. of the MPMC Springer Pit Expansion Application

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x Jorden Laskosky

Print Name: Jorden Laskosky

Witnessed by:

x

Print Name: Konain Sajid

Date signed: 23 November 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I **Jorden Laskosky**, as a member of **British Columbia Institute of Agrologists** declare

Select one of the following:

☐ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Springer Pit Expansion Permit Application

I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Insert Ministry Contact Name, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

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Signature:

X Jorden Laskosky

Print name: Jorden Laskosky

Date: 23 November 2023

Witnessed by:

X Konain

Print name: Konain Sajid

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional: Shauna Litke

   Title: Senior Consultant (Geochemistry)

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: Engineers and Geoscientists BC Registration #: 49392

3. Brief description of professional services:

   Assessment of ML/ARD potential, development of geochemical source terms, and review of ML/ARD Procedure Manual

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: **X** _____

Print Name: Shauna Litke

Witnessed by: **X** _____

This signature has been scanned. The author has given permission for its use in this particular document. The original signature is held on file.

Print Name: Lara Sirotic

Date signed: November 28, 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I Shauna Litke, as a member of EGBC declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this **application**.

I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to **Luc LaChance**, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

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Signature:

X _____

Print name: Shauna Litke

Witnessed by:

This signature has been scanned. The author has given permission for its use in this particular document. The original signature is held on file.

X _____

Print name: Lara Sirotic

Date: November 28, 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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1. Name of Qualified Professional: Jesse Maddaloni

   Title: Senior Mechanical Engineer

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: EGBC Registration # P.Eng #36620

3. Brief description of professional services:

   Mine site water management planning

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X 

Print Name: Jesse Maddaloni

Witnessed by:

X 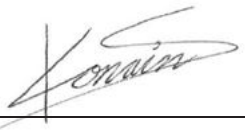

Print Name: Konain Sajid

Date signed: November 27, 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I Jesse Maddaloni, as a member of EGBC

declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this application.
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc LaChance, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

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_____

_____

_____

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Signature:

X _____

Print name: Jesse Maddaloni

Date: November 27, 2023

Witnessed by:

X _____

Print name: Konain Sajid

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Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional: Andrew McIntosh

   Title: Certified Erosion and Sediment Control Lead

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: ESCA-BC Registration # 210306

3. Brief description of professional services:

   Review and update of site Erosion and Sediment Control Management Plan

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X Andrew McIntosh

Print Name: Andrew McIntosh

Witnessed by:

X L. Nikl

Print Name: Lee Nikl

Date signed: November 22, 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I Andrew McIntosh (Insert First and Last Name), as a member of ESCA-BC (Insert Professional Association) declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Application (application/project/work/etc.).
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to EMLI (Insert Ministry Contact Name), erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

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_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X Andrew McIntosh

Print name: Andrew McIntosh

Witnessed by:

X L. Nikl

Print name: Lee Nikl

Date: November 22, 2023

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Lee Nikl

   Title Senior Environmental Scientist, Fellow.

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 601

3. Brief description of professional services:
   Project Director for Joint Application for a Permit Amendment at Mount Polley Mine

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x L. Nikl

Print Name: Lee Nikl

Witnessed by:

x Ryan Johnson

Print Name: Ryan Johnson

Date signed: Nov. 23, 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Lee Nikl, as a member of College of Applied Biologists declare

Select one of the following:

☑ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Joint Application for a Permit Amendment. I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc LaChance, erring on the side of caution.

Ministry of Environment and Climate Change Strategy

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

N/A.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X L. Nikl

Print name: Lee Nikl.

Date: Nov. 23, 2023.

Witnessed by:

X Ryan Johnson

Print name: Ryan Johnson

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Tanya Seebacher

   Title Terrestrial Biologist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 2191

3. Brief description of professional services:

   Peer review of sections 2.10, 6.2, 9.10 in Springer Pit Expansion Application (Mt. Polley Mine)

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x [signature]

Print Name: Tanya Seebacher

Witnessed by:

x [signature]

Print Name: DAVID FEGHALI

Date signed: 23 Nov 2023

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a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Tanya Seebacher (Print First and Last Name), as a member of the College of Applied Biologists. (Print Name of Professional Association)
declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Project - Mount Polley Springer Pit Expansion (application for authorization/work/etc.).
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc LaChance (Ministry Contact Name), erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):
N/A

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:
N/A

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X _____

Print name: Tanya Seebacher

Date: 23 November 2023

Witnessed by:

X _____

Print name: DAVID FEGHALI

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1. Name of Qualified Professional Rachelle Smith

Title Intermediate Biologist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

Name of Association: College of Applied Biology Registration # 3960

3. Brief description of professional services:

Provided support for the wildlife biology components of Sections 2.10, 6.2 and 9.10 of the MPMC Springer Pit Expansion permit application.

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: Witnessed by:

X R Smith **X** Konain

Print Name: Rachelle Smith Print Name: Konain Sajid

Date signed: 23 November 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I Rachelle Smith, as a member of College of Applied Biology declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this application/assessment.
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Ministry of Environment and Climate Change Strategy, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

_____

_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

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Signature:

X R.Smith _____

Print name: Rachelle Smith

Date: 23 November 2023

Witnessed by: Konain

X _____

Print name: Konain Sajid

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1. Name of Qualified Professional: Barbara Wernick

   Title: Senior Principal Environmental Scientist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 1171

3. Brief description of professional services:

   Senior oversight for Sections 2.7 - Water Quality, 2.8 - Sediment Quality, 2.9 - Fisheries and Aquatic Resources, and 6.1 - Aquatic Resources of the Springer Pit Expansion Permit Application Technical Assessment Report.

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: BWernick

X _____

Print Name: Barbara Wernick

Witnessed by: Konain

X _____

Print Name: Konain Sajid

Date signed: November 24, 2023

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Ministry of Environment and Climate Change Strategy

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Declaration

I Barbara Wernick, as a member of College of Applied Biologists declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this application.

I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Ministry of Environment, erring on the side of caution.

Ministry of Environment and Climate Change Strategy

☐ Real or perceived conflict of interest

Description and nature of conflict(s):
n/a

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

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Signature: 

X _____

Print name: Barbara Wernick

Witnessed by: 

X _____

Print name: Konain Sajid

Date: November 24, 2023

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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1. Name of Qualified Professional: Peter Morgan

   Title: Fellow, Engineering Manager-Mine Water

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: Engineers and Geoscientists BC Registration # 15896

3. Brief description of professional services:

   Reviewing and updating the Sediment and Erosion Control Management Plan for the Mount Polley Mine site.

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: **X** Peter Morgan

Witnessed by: **X** Andrew McIntosh

Print Name: Peter Morgan

Print Name: Andrew McIntosh

Date signed: February 16, 2024

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BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

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Declaration

I Peter Morgan (Print First and Last Name), as a member of EGBC (Name of Professional Association) declare

Select one of the following:

☑ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this Sediment and Erosion Control Management Plan (Applicable Project Name).
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Ministry of Environment and Climate Change Strategy (Ministry Name), erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

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Signature: Peter Morgan

X _____

Witnessed by: Andrew McIntosh

X _____

Print name: Peter Morgan

Print name: Andrew McIntosh

Date: February 16, 2024

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APPENDIX 2-1: Climate Baseline

REPORT

Climate Baseline Update

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely, BC V0L 1N0

Submitted by:

Golder Associates Ltd.
Suite 200 - 2920 Virtual Way, Vancouver, British Columbia, V5M 0C4, Canada

+1 604 296 4200

Reference No. 22514095-066-R-Rev0-31547

30 August 2022

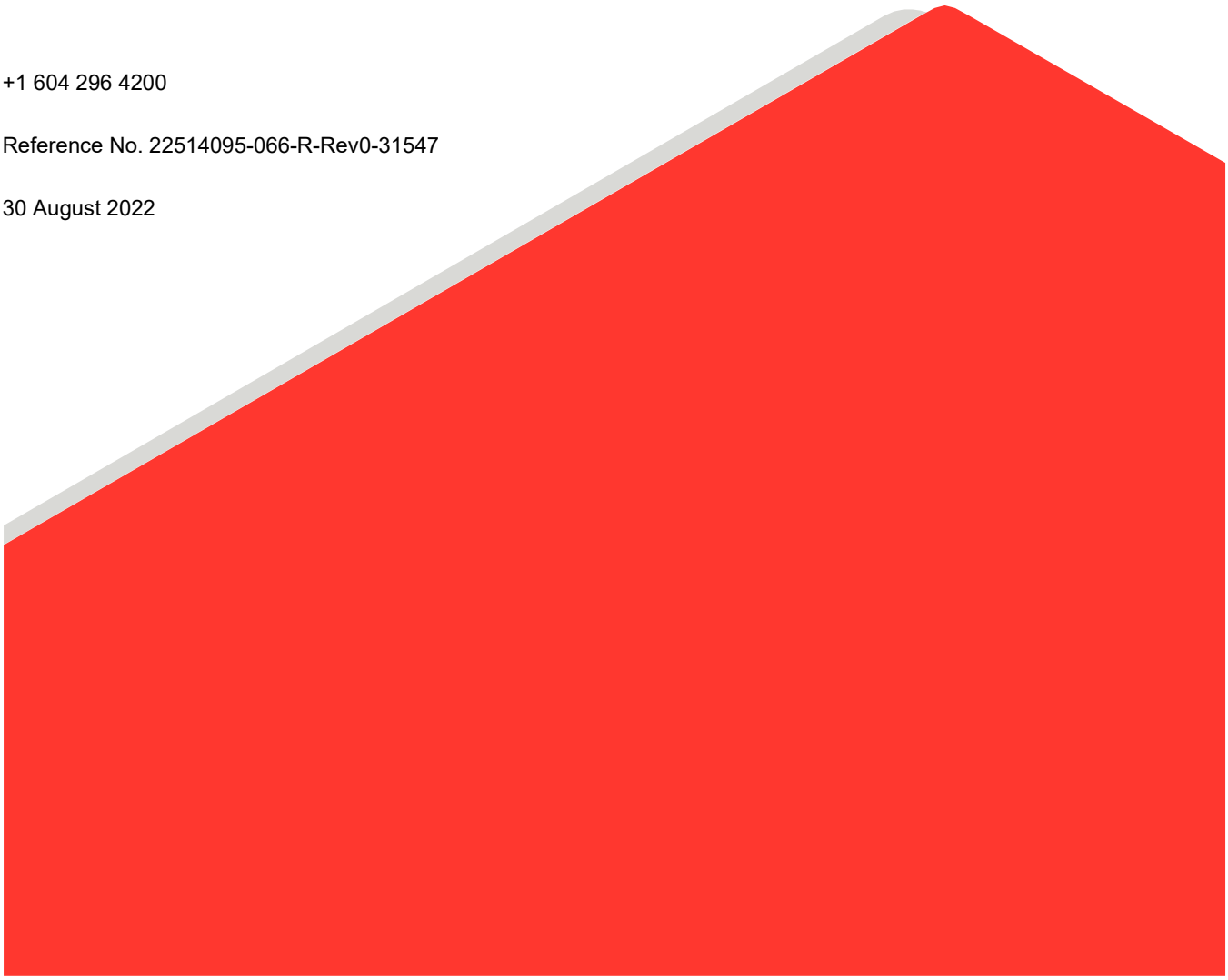

Distribution List

Electronic Copy - Mount Polley Mining Corporation

Electronic Copy - Golder Associates Ltd.

Executive Summary

This report provides a five-year update of climate baseline at Mount Polley Mine site (the Site) owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. Updated baseline statistics are presented for precipitation (total precipitation, rainfall), air temperature, relative humidity, solar radiation, evaporation, snow depths, wind speed and directions. Updated climate change projections for the Site are also provided.

The 1974 to 1993 climate records from the nearby Environment and Climate Change Canada (ECCC) Likely climate station and 1995 to 2021 climate records from the local MPMC climate stations served as the basis for developing statistics for describing precipitation and temperature conditions for the Site. Records from regional and MPMC climate stations were reviewed to assist in characterizing climate parameters, such as relative humidity and solar radiation, and to support the identification of spatial trends. Local and regional climate station data were interrogated for inconsistencies or gaps, and then infilled using regional data and translation factors.

A summary of the updated baseline climate parameters developed in this study is provided in Table 1. The trends in climate parameters at the Site are similar to those at the ECCC regional stations considered in the study. An evaluation of future climate change projections indicates future climate at the Site will likely be warmer and wetter, with larger variations throughout the months.

Table 1: Summary of Key Mount Polley Climate Parameters

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050's (%)	+5
Projected annual total precipitation anomaly from baseline for 2080's (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Projected annual air temperature anomaly from baseline for 2050's (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080's (°C)	+2.7
Mean annual relative humidity (%)	68.1
Mean annual solar radiation (W/m^2)	135
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863
Mean snow water equivalent for the month of March (mm)	185

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).
mm = millimetre; ˚C = degrees Celsius; W/m^2 = watts per square metre.

Study Limitations

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1.0 INTRODUCTION

1.1 Overview

Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation, owns and operates the Mount Polley Mine (the Mine). The Mine is a copper-gold mine located 56 km northeast of Williams Lake, British Columbia (BC).

1.2 Purpose

Guidance from the Global Industry Standard on Tailings Management (GISTM) published by the International Council on Mining & Metals (ICMM) (2020) stipulates under Requirement 2.1 that the environmental knowledge base including climate parameters should be updated every five years to capture uncertainties due to climate change.

The last climate baseline for the Mine site (the Site) was carried out by Golder Associates Ltd., a member of WSP (WSP Golder) in 2016, and MPMC has retained WSP Golder to prepare an update. The purpose of the update is to extend the existing long-term climate dataset for the Site using local and regional data collected in the last 5 years in support of design activities.

This report provides a climate baseline update for precipitation, air temperature, relative humidity, solar radiation, evaporation, wind speed and direction, and snow depths, and includes updated climate change projections for the Site.

1.3 Scope

The scope of work for this climate study included:

- Literature review of previous descriptions of climate conditions near the Site study area.
- Statistical analysis of historical climate records at different locations near the Site study area to develop statistics for climate variables, including precipitation (total precipitation, rainfall), air temperature, relative humidity, solar radiation, wind speed and direction, and snow cover properties.
- Mathematical modelling to calculate evaporation and potential evapotranspiration statistics for the Site study area.
- Statistical analysis of point climate data from downscaled circulation models using Shared Socioeconomic Pathways scenarios (ECCC 2022c) for future climate projections for the Site study area.

2.0 STUDY AREAS

The Site is located 56 km northwest of Williams Lake, British Columbia (BC) near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976).

2.1 Local Study Area

Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

The Site is located on the divide of two sub-watersheds within the Quesnel Lake watershed. The western watershed, which includes drainage from Bootjack Lake, discharges to the Quesnel River via Morehead Creek and drained approximately 60% of the Mount Polley area prior to Mine construction. The eastern watershed includes Polley Lake, which discharges to the east via Hazeltine Creek, Edney Creek, and the West Arm of Quesnel Lake. The Hazeltine Creek and Edney Creek watershed areas at Quesnel Lake are approximately 30.2 km^2 and 87.4 km^2, respectively. Approximately 10.5 km^2 that historically reported to this watershed is now within the Site contact water runoff collection system catchment.

Bootjack Creek is a small tributary of Hazeltine Creek downstream of Polley Lake. Historically, Bootjack Lake discharged into Hazeltine Creek via Bootjack Creek, but in 1913 a dam was constructed at the south end of Bootjack Lake and the flow direction was reversed in order to direct water into Morehead Lake for hydropower production. This resulted in 14 km^2 being diverted from the Hazeltine Creek catchment. The old Bootjack Lake Dam was upgraded by MPMC in 1997 as fulfillment of a Fish Habitat Compensation Agreement signed between MPMC and the regulating federal and provincial agencies. The Bootjack Lake watershed area is 11.2 km^2; approximately 2.3 km^2 that historically reported to this watershed is now within the Site contact water runoff collection system catchment. Currently, Bootjack Creek reports to Polley Lake.

The regional topography, water bodies, and pre-mining watersheds are shown in Figure 1. Mine Site water collection systems and catchment areas are not included in the scope of this report.

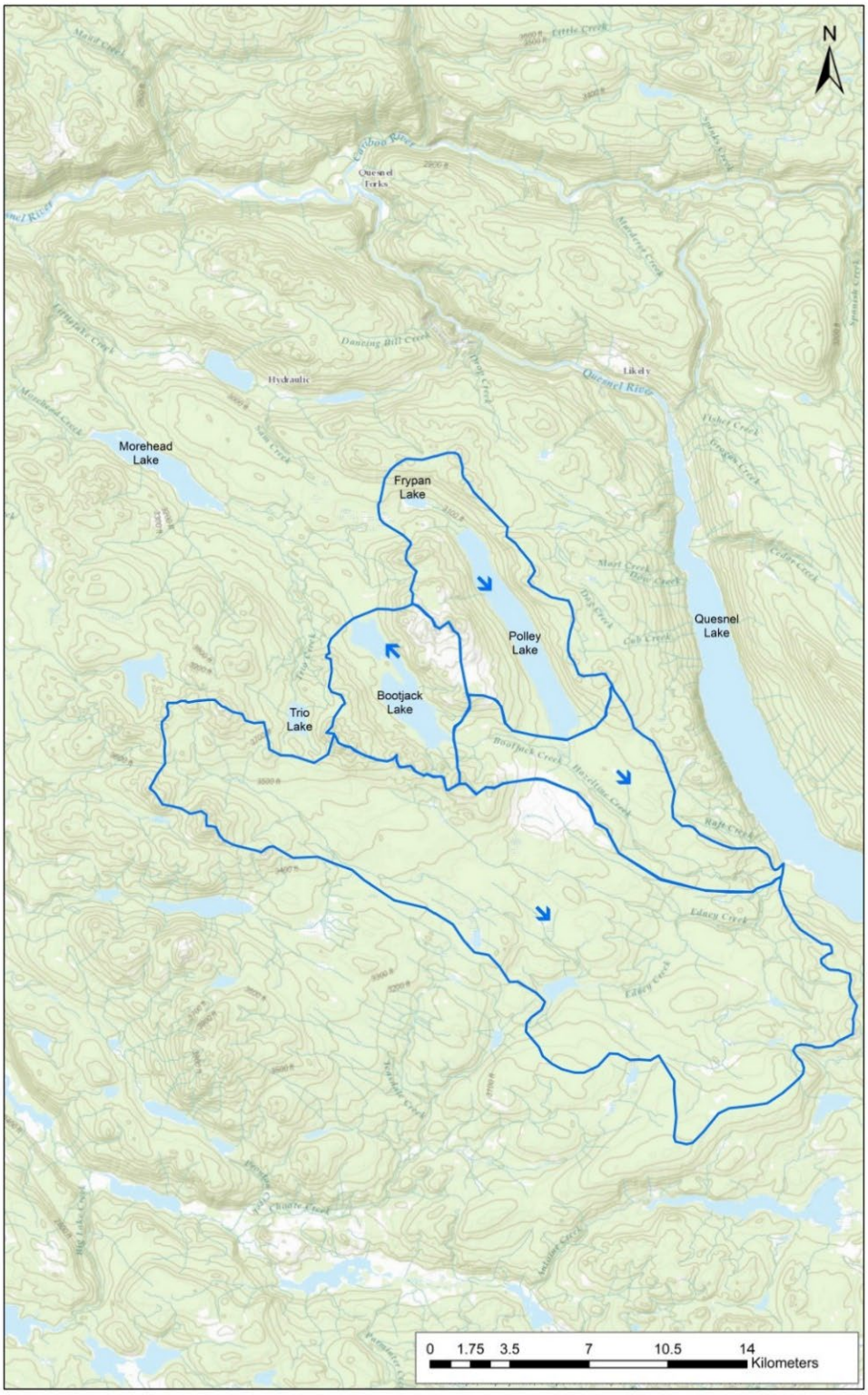

Figure 1: Mount Polley Mine Site and Surrounding Area Water Bodies and Topography Pre-Mining Activities

The Site study area is presented in Figure 2 The Site study area comprises the footprint of the physical infrastructure of the Mine and the tailings storage facility (TSF).

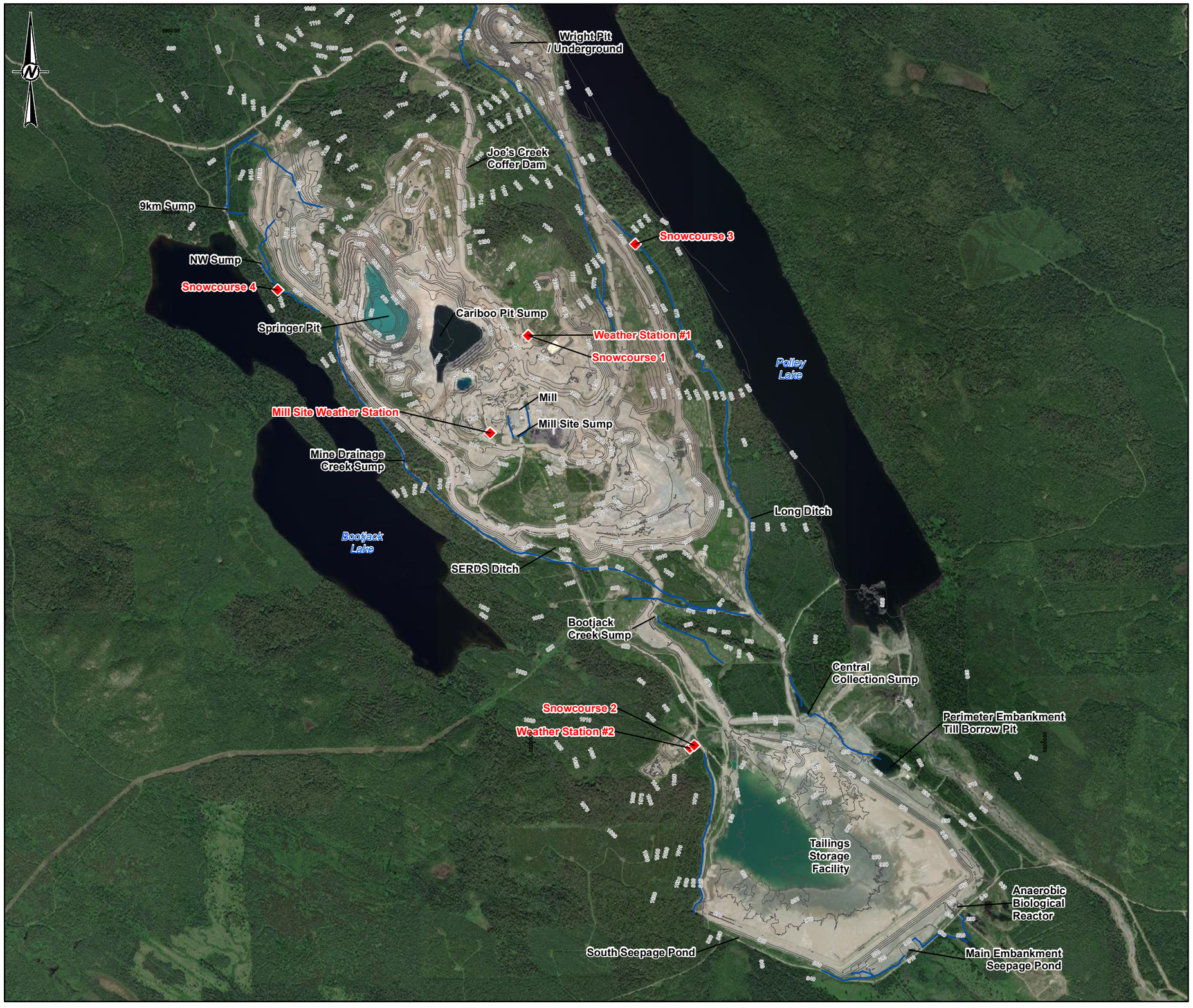

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- CLIMATE STATION
- WATER COLLECTION DITCH
- CONTOUR (10m)

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REFERENCE(S)

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM SNC LAVALIN (2014)
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD.
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
WATER MANAGMENT PLAN - BASELINE CLIMATE UPDATE

TITLE
MOUNT POLLEY SITE STUDY AREA CLIMATE STATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-08-29
DESIGNED	DM
PREPARED	CDB
REVIEWED	DRW
APPROVED	JD

PROJECT NO.	CONTROL	REV.	FIGURE
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2.2 Regional Study Area

The regional study area (RSA) is comprised of the nearest Environment and Climate Change Canada (ECCC) climate stations (Figure 3). The RSA ECCC climate stations have elevations ranging from 1,283 m to 545 m with a mean elevation of 908 m, 130 m below the mean elevation of the Site study area.

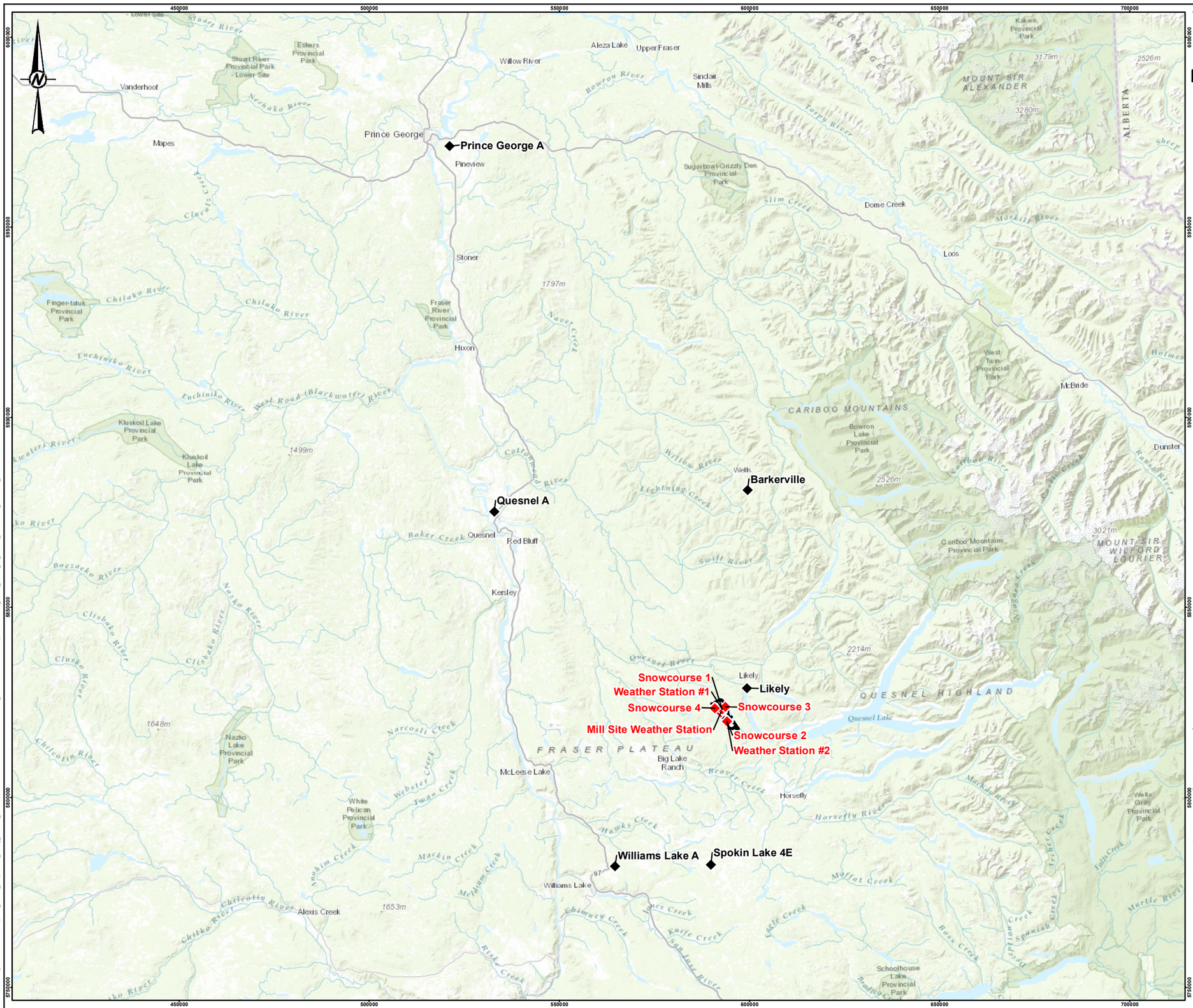

REFERENCE(S)

1. BASE IMAGERY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
WATER MANAGMENT PLAN - BASELINE CLIMATE UPDATE

TITLE
LOCAL AND REGIONAL CLIMATE STATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-08-29
DESIGNED	DM
PREPARED	CDB
REVIEWED	DRW
APPROVED	JD

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3.0 METHODS

3.1 Study Design

Climate parameters (e.g., precipitation, temperature, and evaporation) vary both spatially and temporally. They vary spatially in response to changes in elevation and/or overall circulation patterns, and temporally, across the seasons, and from year to year. Describing the climate conditions for a certain area means presenting the climate statistics that capture the variation, including both the average expected values and the extent of the variation around the average.

The summary statistics for precipitation, temperature, evaporation, relative humidity, solar radiation, wind speed and directions, and snow depths presented herein were prepared from historical measurements recorded at local climate stations, supported by data collected from nearby regional climate stations. Raw station data were interrogated for inconsistencies or gaps then infilled using regional data and translation factors to generate short duration (daily and sub-daily) and long-duration (Annual) estimates for a range of return periods (precipitation only) or percentiles (temperature, evaporation, relative humidity, and solar radiation only). Except for wind and snow cover, the datasets were extended using historical regional data and translation factors to include a range of possible weather events and climatic trends.

Future climate projections come from publicly available statistical downscaled future climate projections on a daily scale. Recognizing the inherent uncertainty with projections, multiple projections from multiple models and scenarios were included in the analysis. Therefore, the future projections are provided in terms of percentiles or exceedance probabilities. The following sections provide a summary of the climate stations used in this report.

3.2 Review of Existing Information

Climate conditions for the Site were estimated based on data from several meteorological stations in the region and at the Site (Figure 3). The meteorological stations are listed in Table 2 and Table 4.

3.2.1 Local Climate Stations

MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and directions (1997 to 2003). In 2012, this station was replaced with two stations: one near the mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall.

Rainfall was measured using a manual rain gauge from 1997 to present at each climate station, and in 2019 automated tipping rain gauges were added at WS1 and WS2. For this study, rainfall for the Site was averaged across all instruments that recorded rainfall on a given day. Relative humidity and solar radiation were recorded at WS1 and WS2 from 2019 to 2021, although records are not continuous. In addition, solar radiation was recorded at the Mill Site station from 2001 to 2003.

Details of these stations are provided in Table 2 and their locations are shown in Figure 2.

Table 2: Local Climate Stations for the Mount Polley Mine

Station Name	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)[2]	Data Type	Period of Record
Mill Site Weather Station	5822420	592495	1,118	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	R, T, RH, SR, E, WS	2012-2021[3]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	R, T, RH, SR, E, WS	2012-2021[3]

1) UTM Coordinate system – Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

3) Station still in operation.

TSF = tailings storage facility; masl = metres above sea level.

R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation; E = Evaporation; WS = Wind Speed; WD = Wind Direction.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically taken during the melt phase. The details of these snow course stations are provided in Table 3 and their locations are shown in Figure 2.

Table 3: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[1]	Easting (m E)[1]	Approximate Elevation (masl)[2]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

1) UTM Coordinate system - Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

3.2.2 Regional Climate Stations

Five Environment and Climate Change Canada (ECCC) climate stations: Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, were selected for the update due to their proximity to the Site, length of record, elevation range, and concurrent period of record with the local climate stations at the Site. In addition, the ECCC Prince George climate station was added to include an additional station with solar radiation data. Historical records were retrieved from ECCC's Historical Climate Data web server (ECCC 2022a). More recent records were compiled through e-mail correspondence with ECCC staff (ECCC 2022b). The regional climate station details are provided in Table 4, and their respective locations are shown in Figure 3.

Table 4: Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[2]
Likely (1094616)	5828785	599332	724	9	P, R, S, T	1974-1993
Williams Lake A (1098940)	5781820	564666	940	50	P, R, S, T, RH, SR	1961-2021[4]
Spokin Lake 4E (1097646)	5782274	589827	1,033	40	P, R, S, T	1983-2021[4]
Barkerville (1090660)	5880996	599515	1,283	59	P, R, S, T	1888-2021[3, 4]
Quesnel A[5] (1096630)	5873987	546720	545	80	P, R, S, T, RH	1946-2021[4]
Prince George A (1096450)	5971423	521103	691	163	P, R, S, T, RH, SR	1973-1995

1) UTM Coordinate system – Zone 10U.
2) Length of record from start year to end year may not reflect the number of complete years of data.
3) Provisional data for the period January 2016 to December 2021 were provided by ECCC.
4) Station still in operation.
5) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

ID = Identification; masl = metres above sea level; km = kilometre.
P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation.

3.3 Data Processing

Climate parameter statistics for the Site were prepared using data from the three on-site climate stations operated by MPMC, and the five regional climate stations operated by ECCC (Sections 3.2.1 and 3.2.2). Data were interrogated for gaps and errors, and where appropriate, extended and filled with data from regional stations using translation factors derived from the available periods of record as described in Section 3.4. Local data were screened for outliers in the time series that may be indicative of errors or equipment malfunction. Potential high outliers were identified in the Mount Polley rainfall record in April 2009 but were not removed from the time series as there was insufficient evidence to support removal. In addition, climate parameter records were checked using the World Meteorological Organization (WMO) guidelines (WMO 2018) as reference. Monthly records were removed if there were more than five days missing, or more than 3 consecutive days missing. Annual records were only calculated using years with a complete dataset (twelve months).

3.4 Data Analysis

3.4.1 Precipitation

The MPMC precipitation dataset was extended and infilled using the available data record from the five regional stations as described below to derive a daily and 24-hour long-term synthetic precipitation dataset for the Site.

Extended MPMC Precipitation Data Record

The Likely ECCC Station data were considered to extend the precipitation record for the Site given the station's length of record and proximity to the Site. As the Likely ECCC station and MPMC climate stations do not have concurrent data sets, the mean monthly April-to-November rainfall distribution for the available data records were compared to evaluate the suitability of using the Likely station data to represent precipitation conditions at the Site. As shown in Figure 4, the Likely and Site station monthly precipitation distributions show a similar trend overall, with MPMC recording notably greater rainfall in April, and notably less rainfall in June and August relative to Likely. The notable differences in monthly rainfall between the MPMC and Likely datasets for the months of April, June, and August were investigated with the following observations:

- April: the length of record for MPMC is relatively short and is not continuous, and outliers have potential to bias mean monthly rainfall. As previously mentioned, potential high outliers were identified in the Mount Polley rainfall record in April 2009 but were not removed from the time series as there was insufficient evidence to support removal. However, if the potential high outlier data were to be removed, the mean monthly April values would be more aligned between the data sets (48.8 mm for MPMC versus of 33.1 mm for Likely).
- June: review of the MPMC and concurrent regional June monthly rainfall records for Barkerville, Spokin Lake, and Williams Lake indicate that relatively low June rainfall totals (compared to average values for the complete available data set from the regional stations) were recorded in several years during the 1997 to 2021 period of record (2002, 2003, 2006, 2009, 2014, 2019, and 2021). These years represent approximately 40% of the available June records for MPMC, suggesting the MPMC mean June rainfall may be biased low (i.e., due to shorter period of record used in computing the mean) compared to Likely.
- August: review of regional rainfall records for Barkerville, Spokin Lake, and Williams Lake from 1997 to 2021 (i.e., concurrent with the MPMC precipitation data set), indicate that regional mean August monthly rainfall records were 84%, 87%, and 85% of the mean of the full period of record, respectively, indicating that there has been reduction (compared to the longer-term mean) in August rainfall regionally in more recent years. In other words, the differences between MPMC and Likely mean August rainfall values may be attributed to differing precipitation trends in the respective reporting periods.

Based on above, the historical Likely ECCC Station record was considered acceptable for extending the historical precipitation record for the Site. Owing to the elevation difference between the Site and Likely ECCC Station, a precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the Likely ECCC climate station to the Site. The adjustment was based on the April-to-November rainfall ranking factor of the raw Likely ECCC climate station and Site rainfall records.

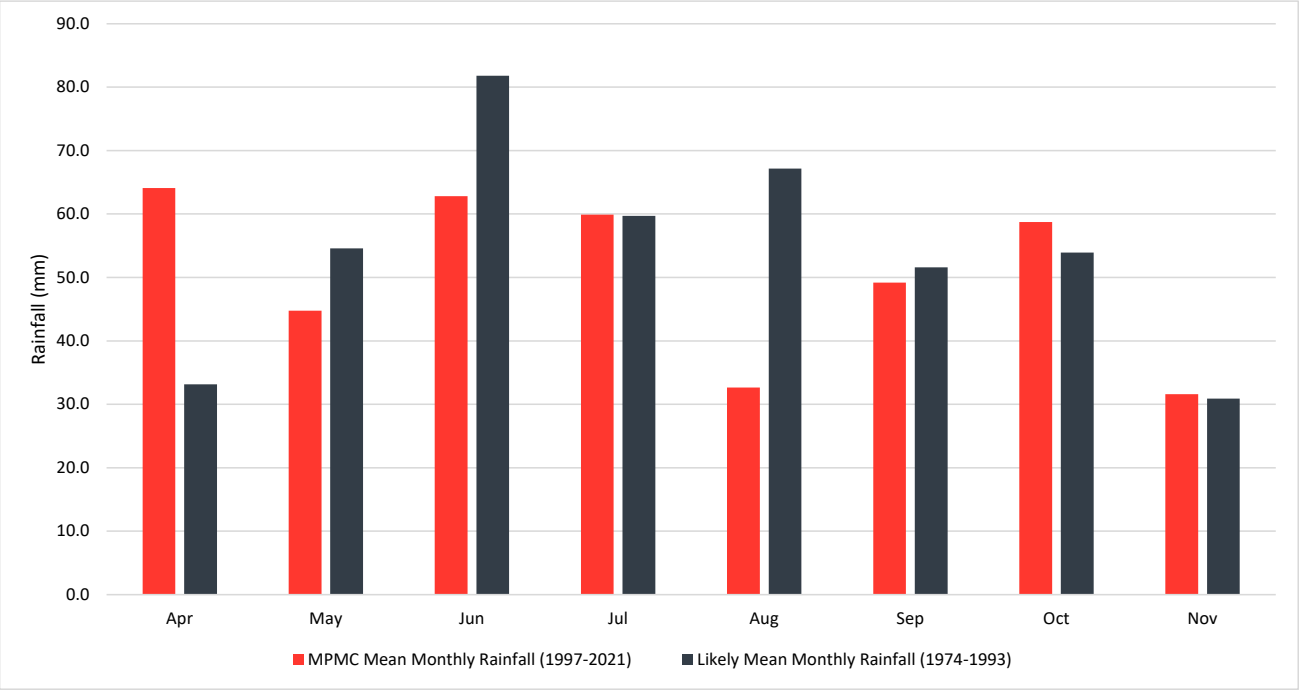

Figure 4: April-to-November Rainfall Distributions at Mount Polley Mine and ECCC Likely Climate Stations

MPMC Precipitation Data Gap Infilling

The priority sequence of concurrent regional climate station data used to infill gaps in the extended Site precipitation record was determined by analyzing measured daily rainfall from April to November for all climate stations; it was assumed that precipitation occurring between December and March occurred as snowfall. The regional climate station priority sequence considered the best-fit measured concurrent daily rainfall correlation (Rainfall Correlation), rainfall ranking correlation (Rainfall Rank), and percentage of time rain was recorded on the same day (Concurrent Daily Rain) between the raw data collected at the MPMC climate stations and each ECCC climate station (Table 5). Regional climate station precipitation data replaced missing rainfall data in the extended Site data record following the priority sequence, and all precipitation data from December to March as it was assumed precipitation during this period occurs as snowfall and daily snowfall is not recorded at the Site.

Table 5: Regional Climate Stations Priority Sequence for Precipitation Data Gap Infilling in Extended Record for MPMC

Priority	Station	Rainfall Correlation (R^2)	Rainfall Rank (R^2)	Concurrent Daily Rain (%)	Period of Record	Currently Active	Distance from site (km)
1	Williams Lake A	0.1950	0.9872	61.8	1960-2021	Yes	50
2	Spokin Lake 4E	0.1829	0.9747	65.8	1983-2021	Yes	40
3	Barkerville	0.1579	0.9216	66.4	1888-2021	Yes	59
4	Quesnel A	0.0502	0.9556	23.3	1946-2021	Yes	80

A precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the ECCC climate stations used to infill gaps. The adjustment was based on the April-to-November rainfall ranking factor of the raw ECCC climate station and Site rainfall records.

Daily to 24-Hour, 3-day, and 10-day Precipitation

The daily long-term synthetic precipitation dataset was converted to 24-hour, 3-day, and 10-day precipitation by applying a factor of 1.13 (WMO 2009), 1.03, and 1.01 (Miller 1964), respectively.

3.4.2 Temperature

Similar to precipitation analysis above, the MPMC temperature dataset was extended and infilled using the available data record from the five regional stations to derive a long-term synthetic temperature dataset for the Site.

Extended MPMC Temperature Data Record

The Likely ECCC Station data were considered to extend the temperature record for the Site given the station's length of record and proximity to the Site. As the Likely ECCC station and MPMC climate stations do not have concurrent data sets, the mean monthly air temperature distributions for the Site and Likely climate stations were compared to evaluate the suitability of using the Likely station data to represent temperature conditions at the Site. As shown in Figure 5, the monthly distributions show similar trend with MPMC and the historical Likely ECCC Station record was considered acceptable for extending the historical temperature record for the Site. Owing to the elevation difference between the Site and Likely ECCC Station, a temperature-elevation orographic factor was applied to adjust the raw precipitation data from the Likely ECCC climate station used to extend the historical record. The adjustment was based on monthly regional lapse-rates as discussed below.

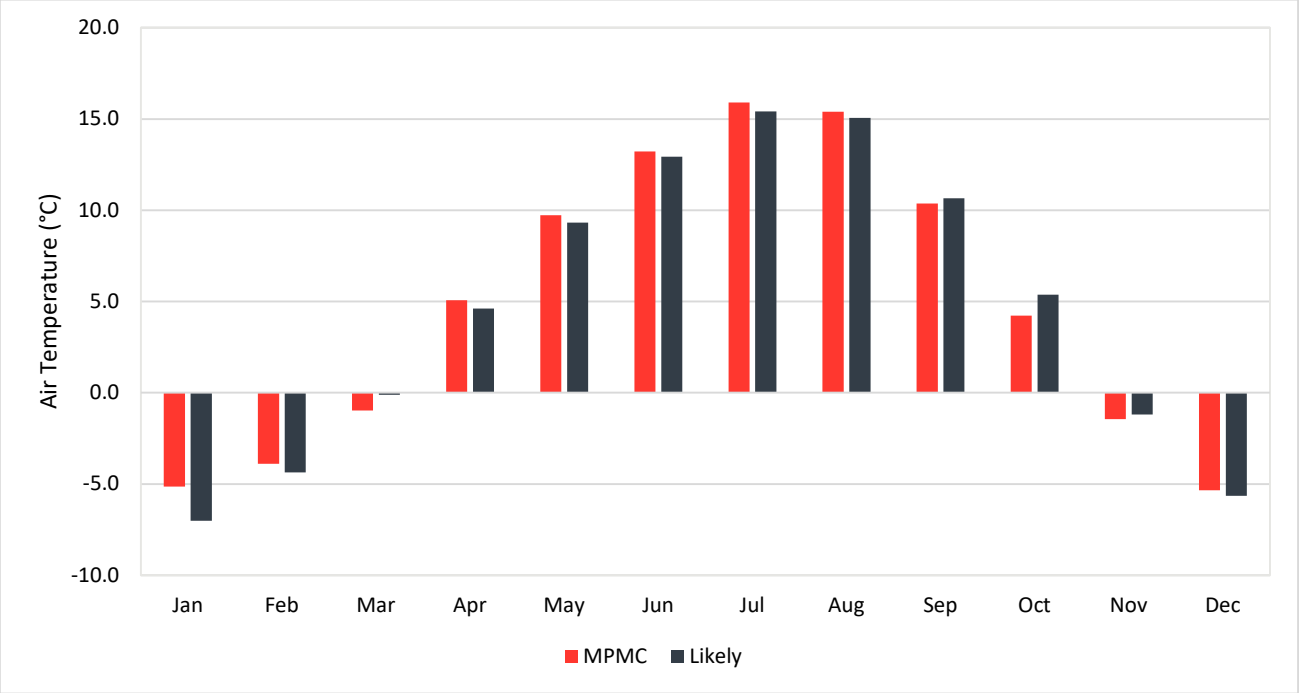

Figure 5: Mean Monthly Air Temperature Distributions for the Site and Likely ECCC Climate Station

ECCC Climate Normals for the regional climate stations were reviewed and are summarized in Table 6 and mean monthly air temperatures are presented in Figure 6. Comparing the Normals for the five regional ECCC Climate stations, there is an evident trend (the temperature lapse rate) of decreasing mean annual temperature with increasing elevation. The annual temperature lapse rate for the region is -0.47 °C / 100 m elevation increase. The lapse rate is larger for warmer months (April to October -0.55 °C / 100 m) and smaller for colder months (November to March -0.33 °C / 100 m). When analysed at a monthly level, the lapse rate is lowest for January (-0.09°C / 100 m) and highest for April, May, June, and July (-0.61°C / 100 m, -0.61°C / 100 m, -0.60°C / 100 m, and -0.59°C / 100 m, respectively). The R^2 of the linear trend is markedly lower for January (0.43) than for all the other months of the year (0.79 to 0.92), which suggests that temperature inversion may occur in the region in January. Lapse rates are presented in Table 7 and Figure 7.

Table 6: Monthly and Annual Air Temperature Climate Normals for Regional ECCC Climate Stations

Station Name	Quesnel A (545 masl)	Williams Lake A (940 masl)	Spokin Lake 4E (1,033 masl)	Barkerville (1,283 masl)	Likely (740 masl)
Time period for EC Climate Normals	1981-2010	1981-2010	1981-2010	1981-2010	1971-2000
Month	**Temperature (°C)**				
January	-6.9	-6.7	-7.6	-7.5	-7.0
February	-3.6	-4.1	-5.4	-5.9	-4.4
March	1.3	0.3	-1.2	-2.8	-0.1
April	6.4	4.9	3.7	1.4	4.6
May	11.1	9.6	8.0	6.2	9.3
June	14.7	13.3	11.4	10.0	12.9
July	16.8	16.0	13.4	12.3	15.4
August	16.4	15.3	12.8	12.8	15.1
September	11.5	10.6	8.5	8.0	10.7
October	5.5	4.6	3.4	2.4	5.4
November	-1.4	-2.3	-3.2	-4.3	-1.2
December	-5.9	-7.3	-7.7	-7.8	-5.7
Annual	**5.5**	**4.5**	**3.0**	**2.0**	**4.6**

masl = metres above sea level.

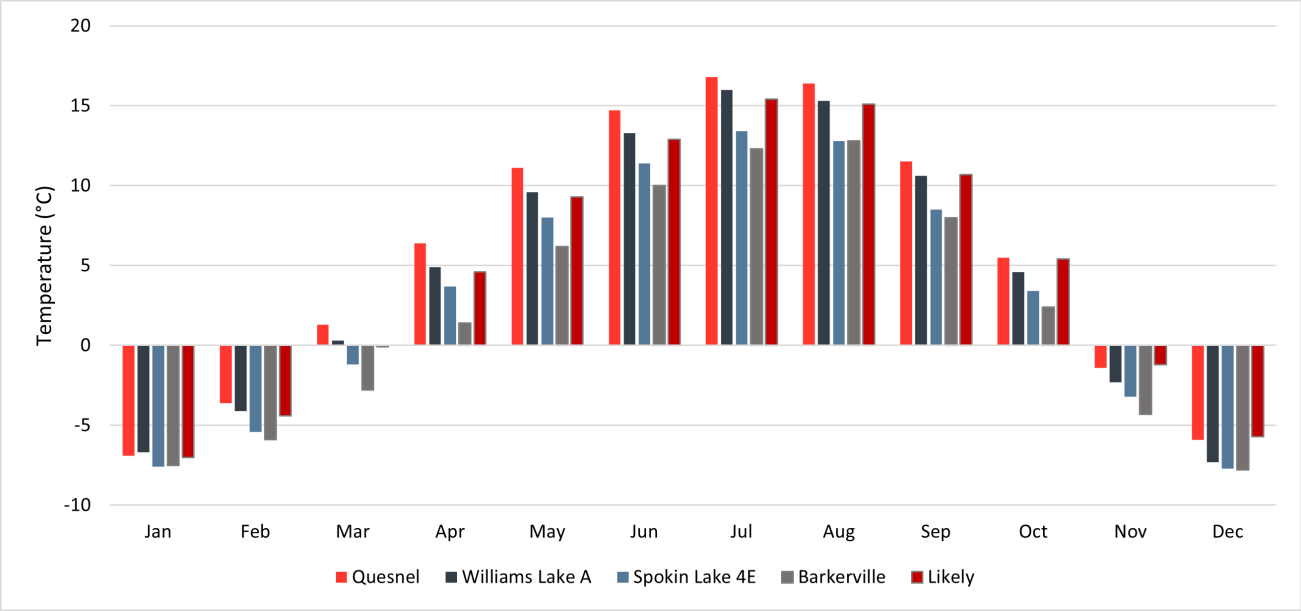

Figure 6: Mean Monthly Air Temperature for Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

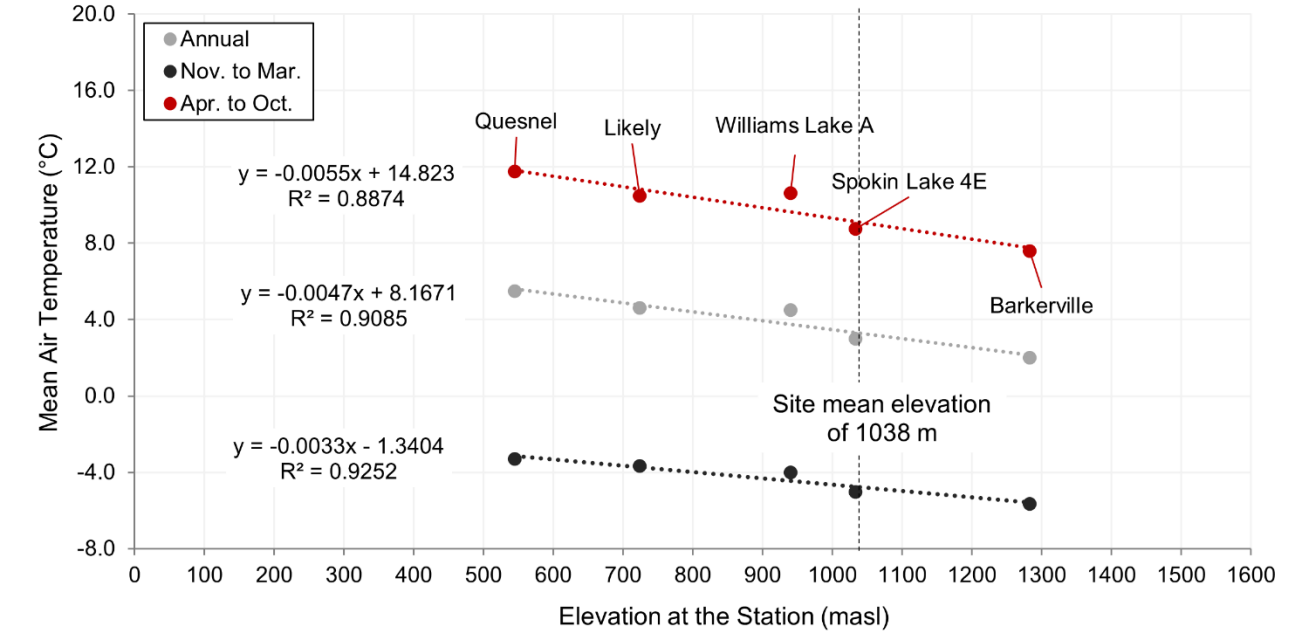

Figure 7 : Annual, April-to-October, and November-to-March Air Temperature Lapse Rates for Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

Table 7: Monthly Air Temperature Lapse Rate Variation Among Five Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

Month	Lapse Rate = °C Difference / 100 m Elevation Increase	R^2 of the Linear Trend
January	-0.09	0.43
February	-0.30	0.82
March	-0.51	0.86
April	-0.61	0.88
May	-0.61	0.89
June	-0.60	0.87
July	-0.59	0.81
August	-0.50	0.79
September	-0.49	0.85
October	-0.45	0.92
November	-0.43	0.90
December	-0.32	0.82
Annual	-0.47	0.91

MPMC Temperature Data Gap Infilling

The priority sequence of regional climate station data used to infill gaps in the extended Site air temperature record was based on the best-fit daily air temperature correlation (Temperature Correlation), air temperature ranking (Temperature Ranking), and concurrent daily temperature recordings between the MPMC climate stations and each ECCC climate station (Table 8).

Table 8: Regional Climate Stations Priority Sequence for Temperature Data Gap Infilling in Extended Record for MPMC

Priority	Station	Temperature Correlation (R^2)	Temperature Rank (R^2)	Concurrent Daily Temperature (%)	Period of Record	Currently Active	Distance from site (km)
1	Williams Lake A	0.8917	0.9942	93.5	1960-2021	Yes	50
2	Barkerville	0.8834	0.9951	99.0	1888-2021	Yes	59
3	Quesnel A	0.8628	0.9861	97.5	1946-2021	Yes	80
4	Spokin Lake 4E	0.8525	0.9810	99.5	1983-2021	Yes	40

Regional ECCC climate station daily air temperature data were adjusted using the monthly air temperature lapse-rate presented in Table 7 to derive representative air temperature at the Site.

3.4.3 Relative Humidity

Relative humidity data are available for the Site from 2019 to 2021 and for ECCC climate stations Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). The MPMC WS1 relative humidity record is more complete than WS2's record; therefore, WS1 data were used for the analysis and infilled with WS2 data where necessary and if available. However, relative humidity data for the Site are insufficient for characterizing long-term climatic conditions of the Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative relative humidity estimate for the Site. Comparisons between the Site data and each ECCC climate station data were made to determine which station best represents the potential relative humidity at the Site.

Figure 8 and Figure 9 present the comparison between concurrent daily relative humidity values at the ECCC Quesnel and MPMC climate stations (January 2019 to December 2021). The 15-day moving average indicates that the relative humidity is generally higher at the Site than at the ECCC Quesnel climate station. The two datasets are well correlated (R^2=0.96).

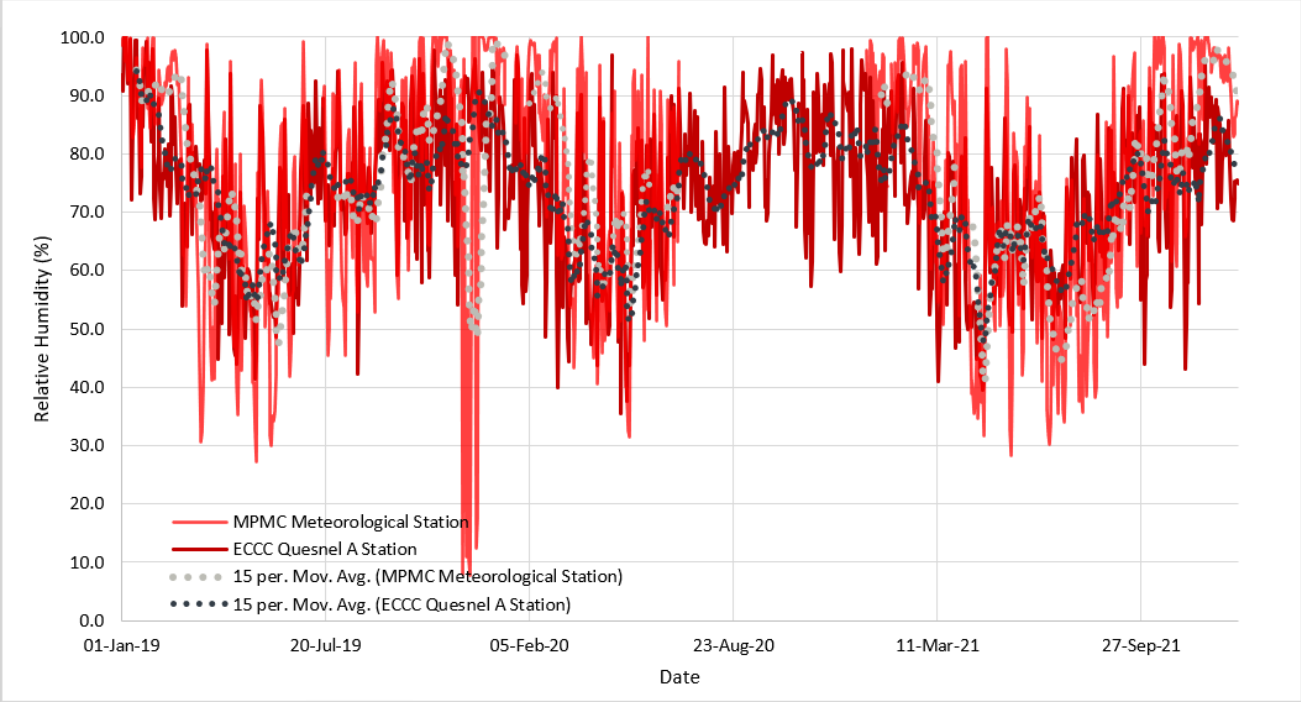

Figure 8: Concurrent Daily Relative Humidity Values at the MPMC and ECCC Quesnel Climate Stations (2019-2021)

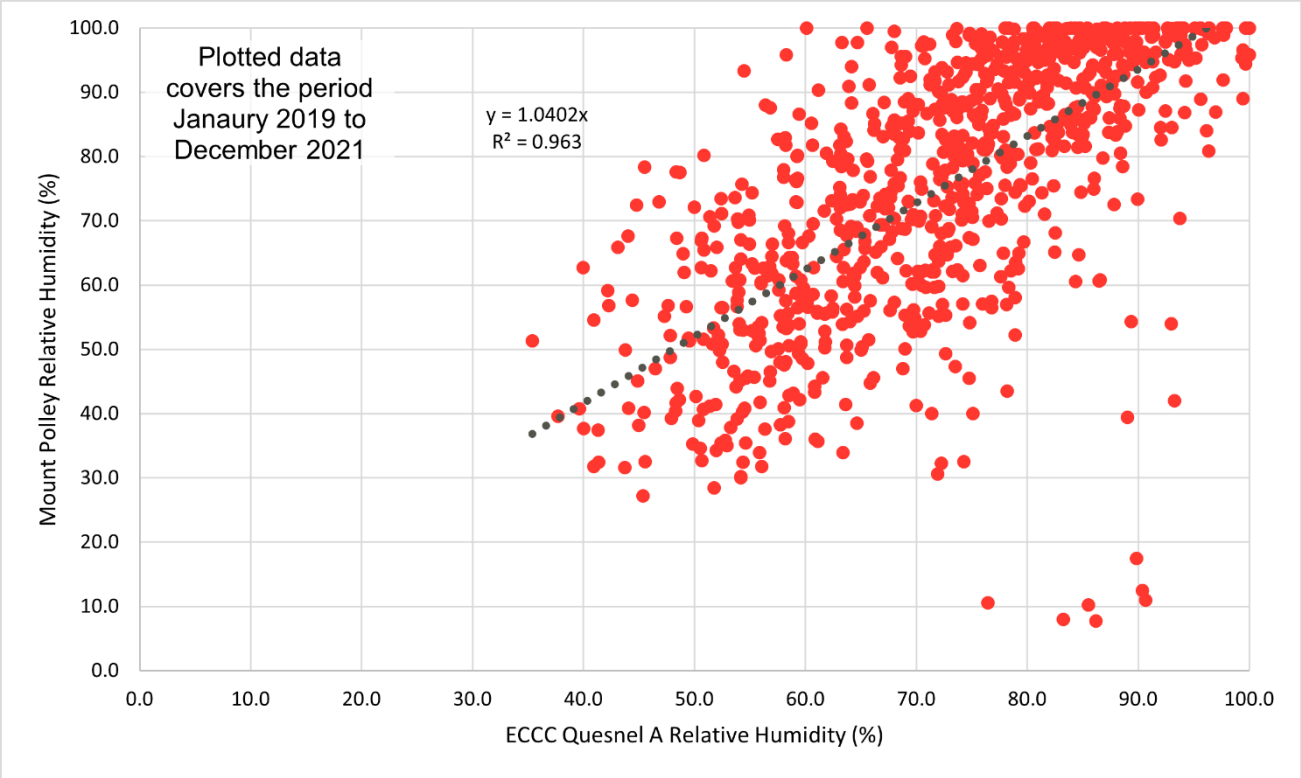

Figure 9: Correlation Relationship of Daily Relative Humidity Values at MPMC and ECCC Quesnel Climate Stations (2019-2021)

Figure 10 and Figure 11 present the comparison between concurrent daily relative humidity values at the ECCC Williams Lake and MPMC climate stations (January 2019 to December 2021). The 15-day moving average indicates that the relative humidity is generally higher at the Site than at ECCC Williams Lake climate station. The two datasets are very well correlated (R^2=0.98).

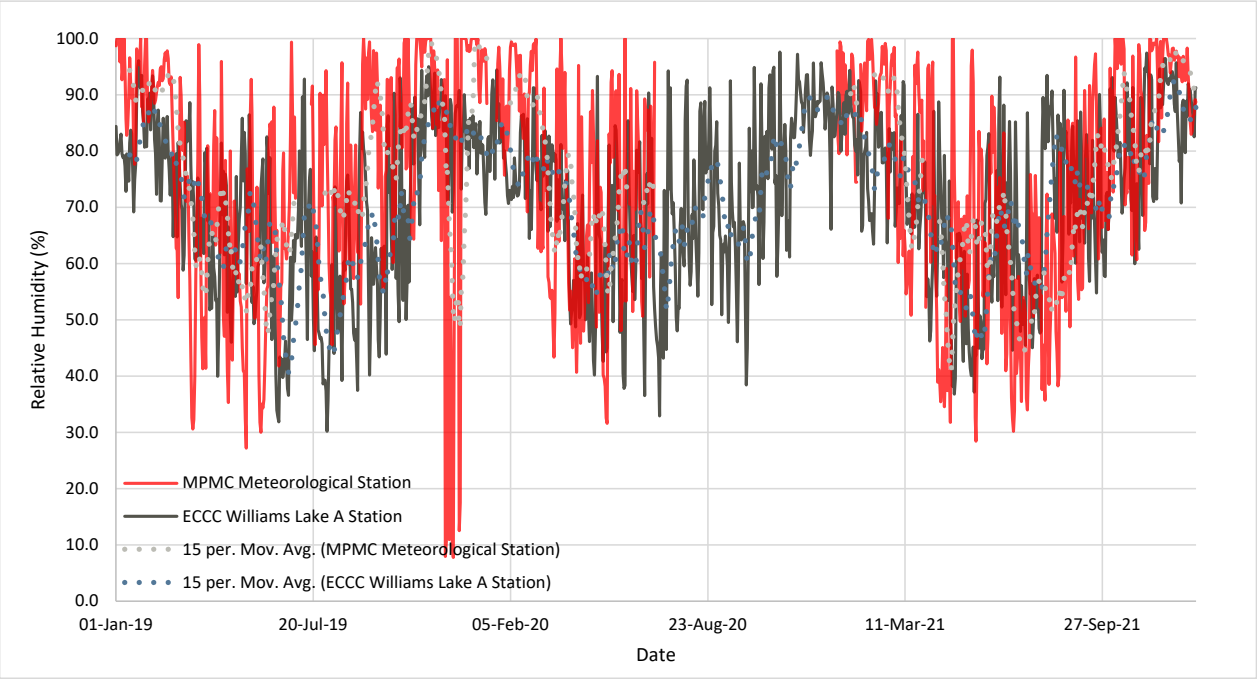

Figure 10 : Concurrent Daily Relative Humidity Values at MPMC and ECCC Williams Lake Climate Stations (2019-2021)

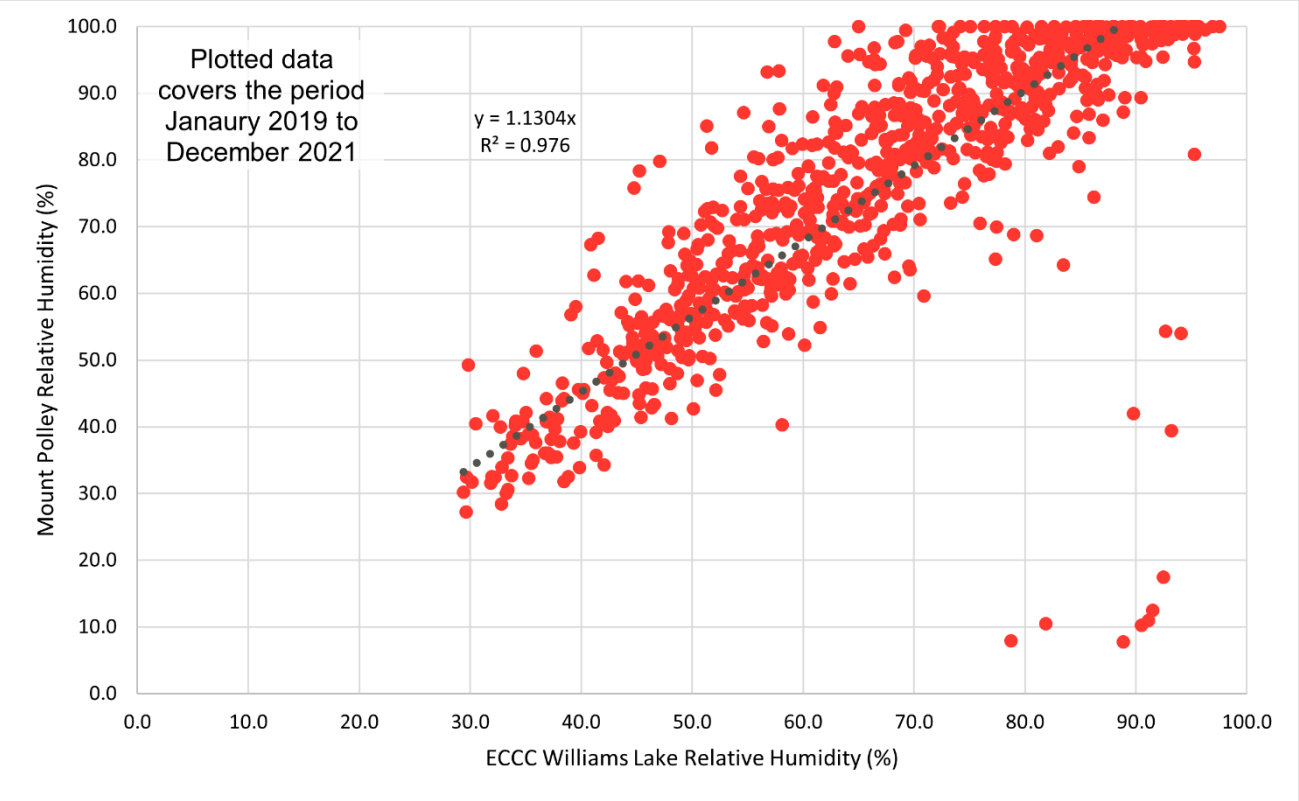

Figure 11 : Correlation Relationship of Daily Relative Humidity Values at MPMC and ECCC Williams Lake Climate Stations (2019-2021)

A long-term relative humidity time series for the Site was developed using ECCC Williams Lake A data infilled with ECCC Quesnel A data with an adjustment factor of 1.13 and 1.04 based on the relationships presented in Figure 11 and Figure 9, respectively.

3.4.4 Solar Radiation

Solar radiation data are available for the Site from 2001 to 2003 and 2019 to 2021, and for ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data for the Site are insufficient for characterizing climatic conditions of the Site due to the short period of record, and as the data recorded in 2001 is incomplete and not concurrent with either ECCC climate station. However, as presented in Figure 12, a discernible trend in mean monthly solar radiation is apparent for MPMC solar radiation (2019 to 2021) and in data from the ECCC Williams Lake and Prince George climate stations. Figure 13 presents ECCC Williams Lake and Prince George mean monthly solar radiation correlation (R^2 = 0.98) from 1973 to 1995.

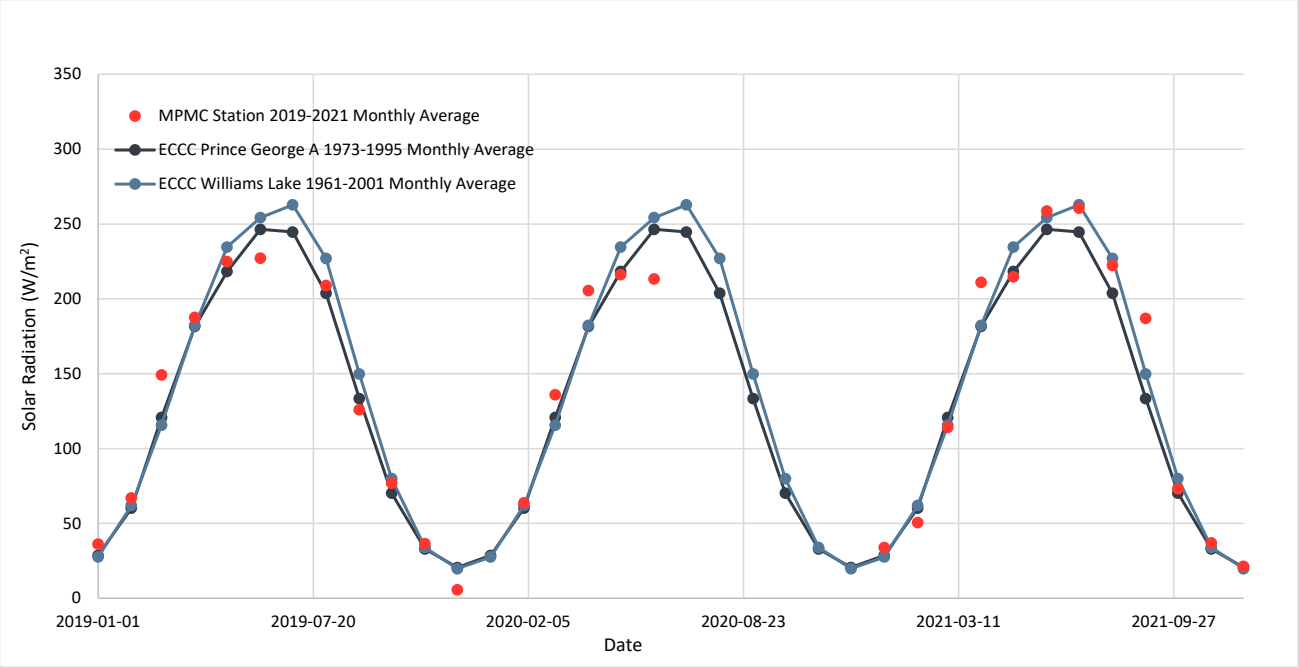

Figure 12 : Mean Monthly Solar Radiation for MPMC and ECCC Regional Climate Stations

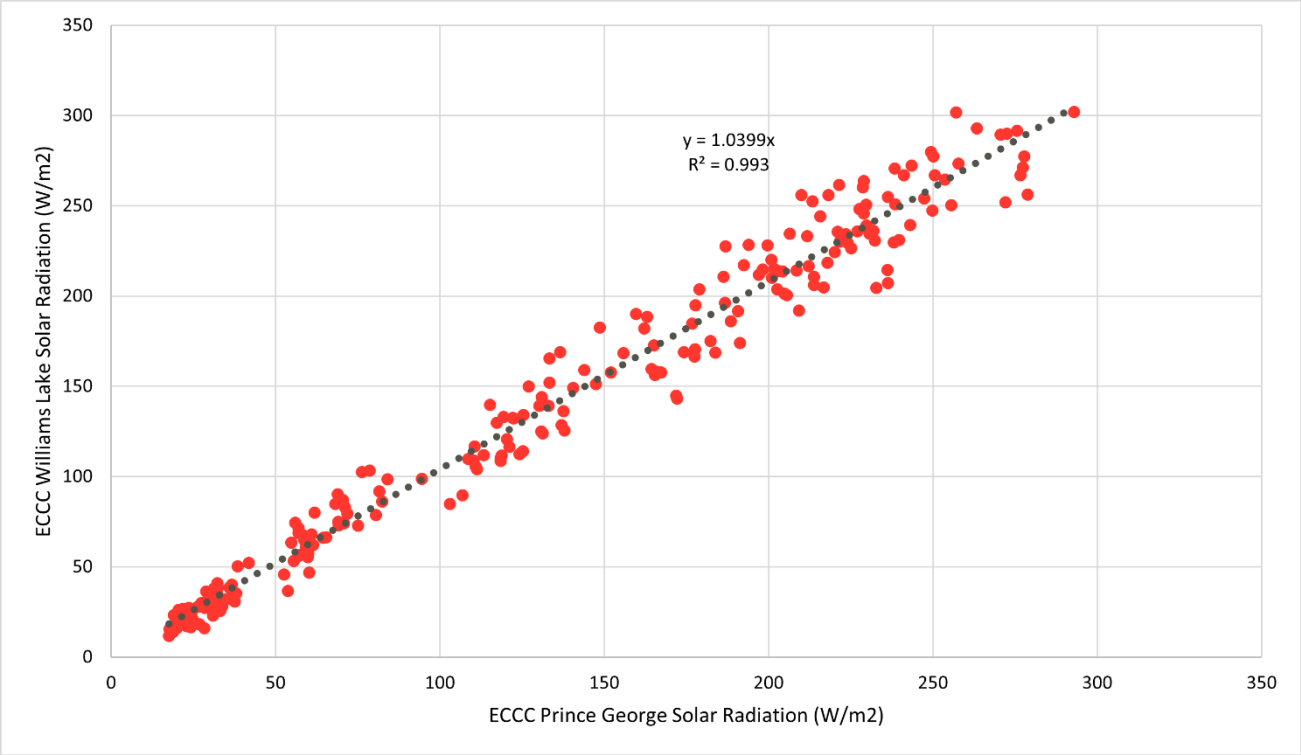

Figure 13 : Daily Solar Radiation Correlation Between ECCC Williams Lake and Prince George Climate Stations (1973-1995)

The strong correlation between ECCC Williams Lake and Prince George climate stations suggest there is little variation in solar radiation across the region. Based on the comparison of mean monthly solar radiation records and the proximity in distance to the Site, solar radiation statistics for the Site were determined from the ECCC Williams Lake data. Missing values were infilled by adjusting the Prince George records by a factor of 1.04 based on the relationship presented in Figure 13.

3.4.5 Evaporation and Evapotranspiration

Evaporation monitoring data are available for the Site from 2019 to 2021; however, the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Site. Therefore, a mathematical model (Morton 1983) was used to calculate evaporation and evapotranspiration (actual and potential) for the Site based on the long-term synthetic records for air temperature, relative humidity, and solar radiation. Evaporation in this study is defined as free water evaporation, or the amount of evaporation from open/free water surfaces (i.e., the water is returned to the atmosphere from lakes, ponds, and watercourses). Potential evapotranspiration is the water loss that occurs from a vegetated natural surface if there is no deficiency of water in the soil for use by vegetation (Thornthwaite 1948).

3.4.6 Wind Speed and Direction

Hourly wind speed and direction data are available for the Site from 1997 to 2003, and daily wind speed data are available from 2019 to 2021; however, the data are not continuous. The hourly wind speed and direction data available from 1997 to 2003 were used to develop wind rose plots. A wind rose depicts the relative frequency of wind from a given direction on a 16-point compass. Each ring on the wind rose represents a frequency of 2% of the data period. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a defined wind speed range. A wind rose is provided for the period of August 1997 to November 2003, and seasonal wind roses are presented to display seasonal variability in wind patterns, where the seasons have been defined as follows:

- Winter – December to February
- Spring – March to May
- Summer – June to August
- Autumn – September to November

Daily wind data recorded from 2019 to 2021 from WS1 and WS2 were wind speed only, no direction. The period of record for WS2 and 2020 are incomplete and are not included in the analysis. The relative frequency (%) of the magnitude of the daily wind speed data recorded at WS1 for 2019 and 2021 were compared in this study to the relative frequency (%) of wind speed magnitude of the data from 1997 to 2003.

3.4.7 Snow Cover Properties

Snow cover is an important climatic variable as it influences the spring freshet flow volume and distribution. Snow cover data at the Site are available monthly from manual measurements from 1997 to 2022, recorded as snow-water-equivalent (SWE). Measurements, although not continuous, are typically recorded at the beginning and end of a month, with the latter being representative of the monthly SWE.

4.0 RESULTS

The following section summarizes the precipitation, air temperature, relative humidity, solar radiation, evaporation and evapotranspiration, wind speed and direction, and snow cover baseline conditions at the Site.

4.1 Annual Precipitation

The Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Site is estimated to be 612 mm with a standard deviation of 118 mm. Frequency analyses of the derived long-term precipitation time series for the Site were undertaken to generate the variability in monthly and annual precipitation of the Site. Estimated annual wet and dry precipitation depths for a range of return periods are shown in Table 9, Figure 14, and Figure 15.

Table 9: Annual Precipitation Depths for the Site (1974-2021)

Return Period (yr)	Wet (mm)[1]	Dry (mm)[1]
5	714	508
10	768	459
25	825	412
50	861	386
100	893	366
200	922	349
Average	612	

1) Weibull distribution was selected based on the statistical distribution goodness-of-fit-test.

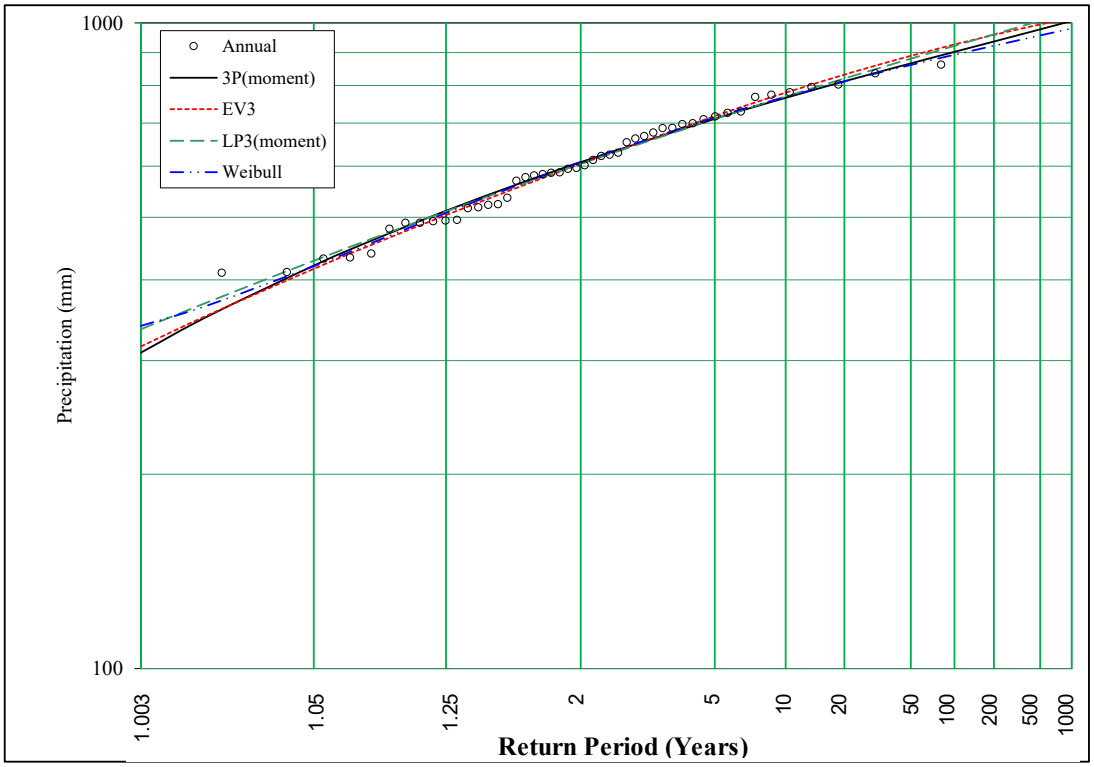

Figure 14 : Annual Precipitation Frequency Analysis – Wet Results

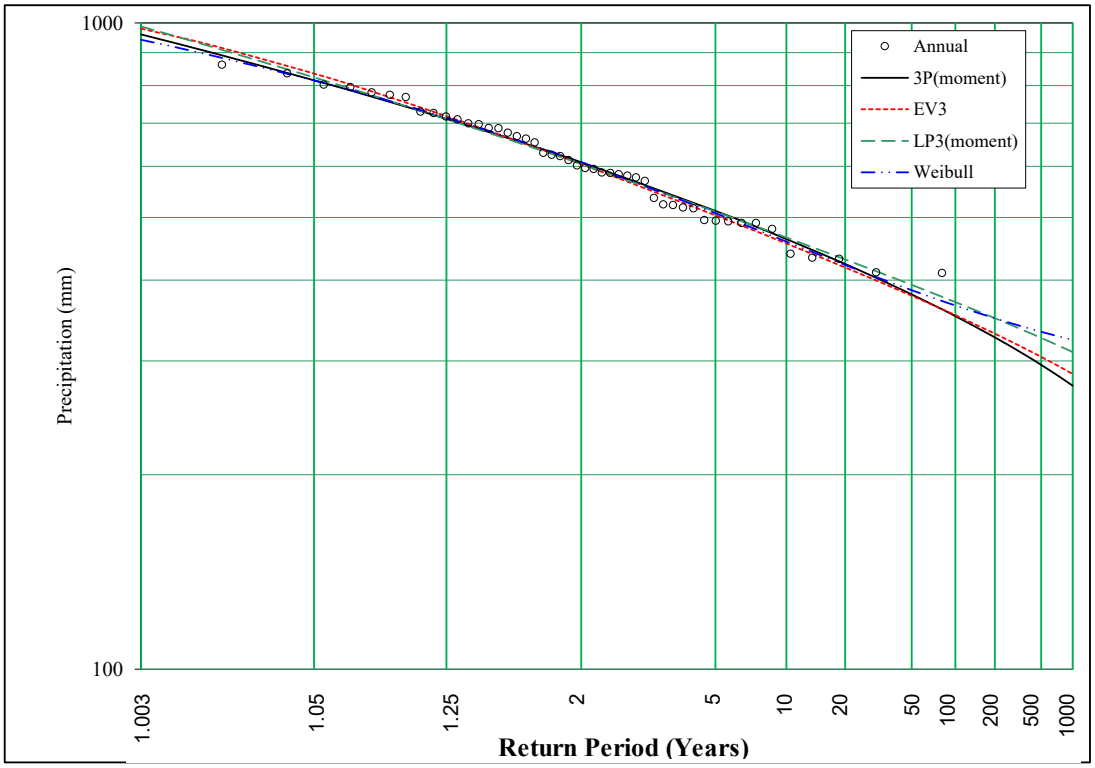

Figure 15 : Annual Precipitation Frequency Analysis - Dry Results

Monthly values for the 25- and 200-year return periods for wet and dry precipitation depths are presented in Table 10. Monthly values for the 1:25 year dry and wet precipitation for the 1:200 year dry and wet precipitation were assumed to follow the same monthly distribution as the average precipitation.

Table 10: Monthly Precipitation Depths for the Site (1974-2021)

Month[1]	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	74.3	66.5	33.2	28.2
February	35.8	54.0	48.3	24.1	20.5
March	29.7	44.7	40.0	20.0	16.9
April	44.7	67.3	60.2	30.1	25.5
May	49.9	75.2	67.2	33.6	28.5
June	70.8	107	95.4	47.7	40.4
July	63.6	95.8	85.7	42.9	36.3
August	50.6	76.2	68.1	34.1	28.8
September	52.3	78.8	70.5	35.2	29.9
October	58.1	87.5	78.2	39.1	33.1
November	49.8	75.0	67.1	33.5	28.4
December	57.6	86.8	77.7	38.8	32.9
Annual Total[2]	**612**	**922**	**825**	**412**	**349**

1) Wet and Dry Monthly values assumed to follow the same monthly distribution as the Average.

2) Annual total precipitation depths were rounded to the nearest mm for presentation purposes; therefore, it may appear the sum of the monthly values do not equal the annual total.

4.2 Rainfall

Annual maximum series for 24-hour precipitation from the derived historical data set was used to undertake a frequency analysis to provide rainfall design values. Results are shown in Table 10. The 24-hour, 3-day, and 10-day annual, spring, and summer probable maximum precipitation (PMP) depths were estimated using the Hershfield method (WMO 2009).

Table 11: 24-hour Precipitation Depths for the Site (1974-2021)

Return Period (yr)	Depth (mm) [1, 2]
2	**33**
10	**47**
25	**54**
100	**64**
200	**69**
1000	**80**

1) Log Pearson III distribution was selected based on the statistical distribution goodness-of-fit test.

2) Values rounded up to the nearest mm.

Table 12: Annual, Spring, and Summer PMP Depths for the Site (1974-2021)

Period	Annual PMP[1] (mm)	Spring PMP[1, 2] (mm)	Summer PMP[1, 3] (mm)
24-Hour	224	192	191
3-Day[4]	339	272	294
10-Day[5]	562	295	486

1) The PMP does not have a return period.
2) Spring = March, April, May.
3) Summer = June, July, August.
4) Adjusted from fixed-time interval by a factor of 1.03 (Miller 1964).
5) Adjusted from fixed time interval by a factor of 1.01 (Miller 1964).

4.3 Air Temperature

Air temperature statistics for the Site were developed using historical data from the nearby ECCC climate station in Likely approximately 9 km northeast of the Site. The historical Likely data set was adjusted to the average elevation of the Mount Polley mine by applying the regional monthly lapse rate presented in Table 7. Data gaps were infilled using data from the four regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

Monthly and annual air temperature statistics for the Site (1974-2021) are presented in Table 13 and Figure 16. The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between –6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively. Mean monthly air temperatures generally turn positive in April and negative in November. The percentiles presented in Table 13 indicate the probability of the air temperature to be less than the calculated value for each period, i.e. the 25th percentile for the month of March indicates the monthly air temperature for March is 25% probable to be less than -2.2°C, or 75% probable to exceed -2.2°C. Larger variation between the 25th and 75th percentiles indicate greater variation in air temperature from the median during the month with the largest variations occurring in the winter months (December, January, and February).

Table 13: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**38.1**	**-39.8**

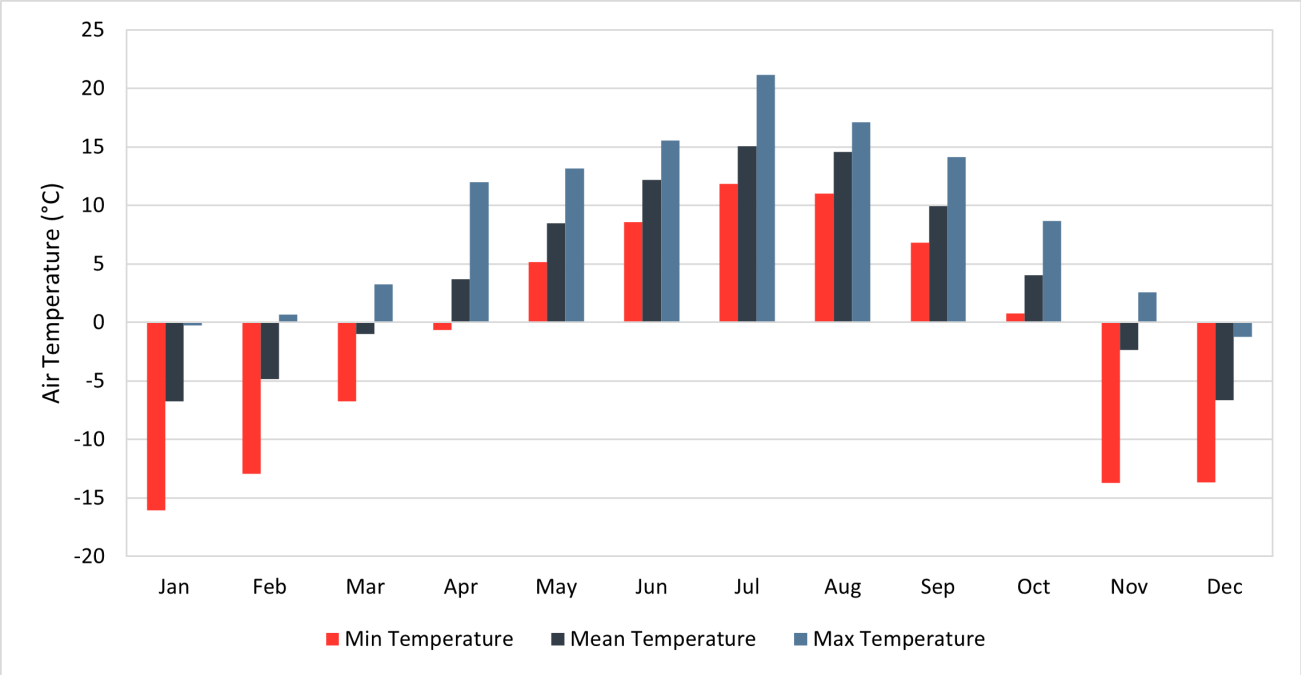

Figure 16 : Derived Monthly Air Temperature Statistics for Mount Polley Mine (1974-2021)

4.4 Relative Humidity

Statistics for relative humidity are presented in Table 14 and Figure 17. Mean annual relative humidity is 68.1%. Monthly mean values vary between 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity show little variation from the median indicating the Site experiences relatively constant relative humidity on a monthly basis from year to year.

Table 14: Derived Monthly and Annual Relative Humidity Statistics for the Site (1974-2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

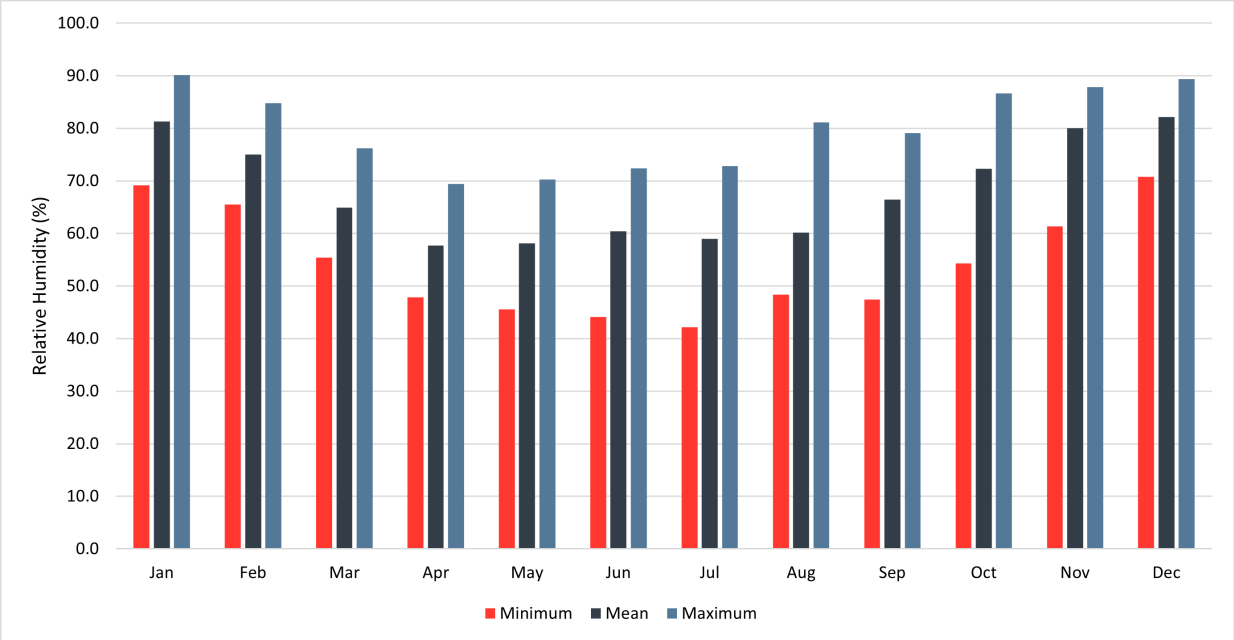

Figure 17 : Derived Monthly Relative Humidity for the Site (1974-2021)

4.5 Solar Radiation

Table 15 and Figure 16 present solar radiation statistics for the Site. Mean annual solar radiation is 135 W/m^2, with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July following the same seasonal pattern for monthly air temperature. The 25th and 75th percentiles show greatest variation in solar radiation occurs in the summer months when solar radiation is greatest during the year, and less variation in winter months when solar radiation is lowest.

Table 15: Estimated Solar Radiation Statistics for the Site (1974-2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

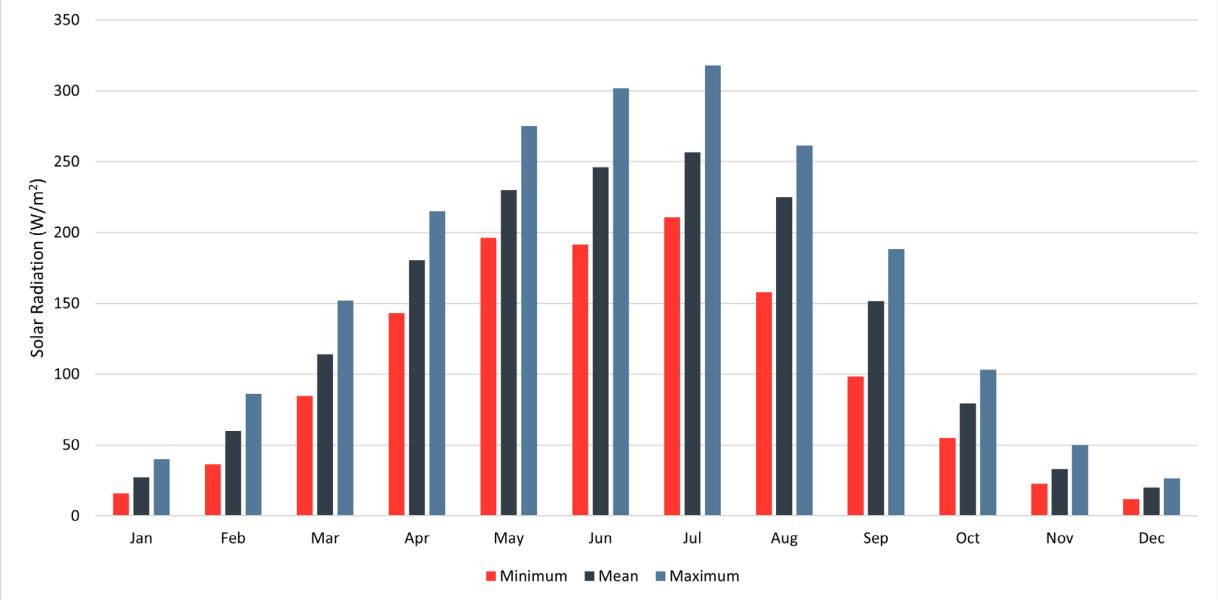

Figure 18 : Estimated Monthly Solar Radiation for the Site (1974-2001)

4.6 Evaporation and Evapotranspiration

The Morton model (Morton 1983) was applied to calculate monthly evaporation, potential evapotranspiration (PET), and actual evapotranspiration (AET) for the Site based on the air temperature, relative humidity, and solar radiation data presented in Sections 4.3, 4.4, and 4.5, respectively. The calculated evaporation rates are considered reflective of potential shallow lake evaporation rates; that is, there is no thermal impact of deeper water levels.

4.6.1 Shallow Lake Evaporation

Table 16 and Figure 19 present monthly statistics for shallow lake evaporation using the Morton Model. The mean annual evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates vary between 0 mm in December to 138 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly evaporation occurs in July when evaporation is greatest, and lowest variation occurs in January and December when evaporation is lowest.

Table 16 : Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**670**	**699**

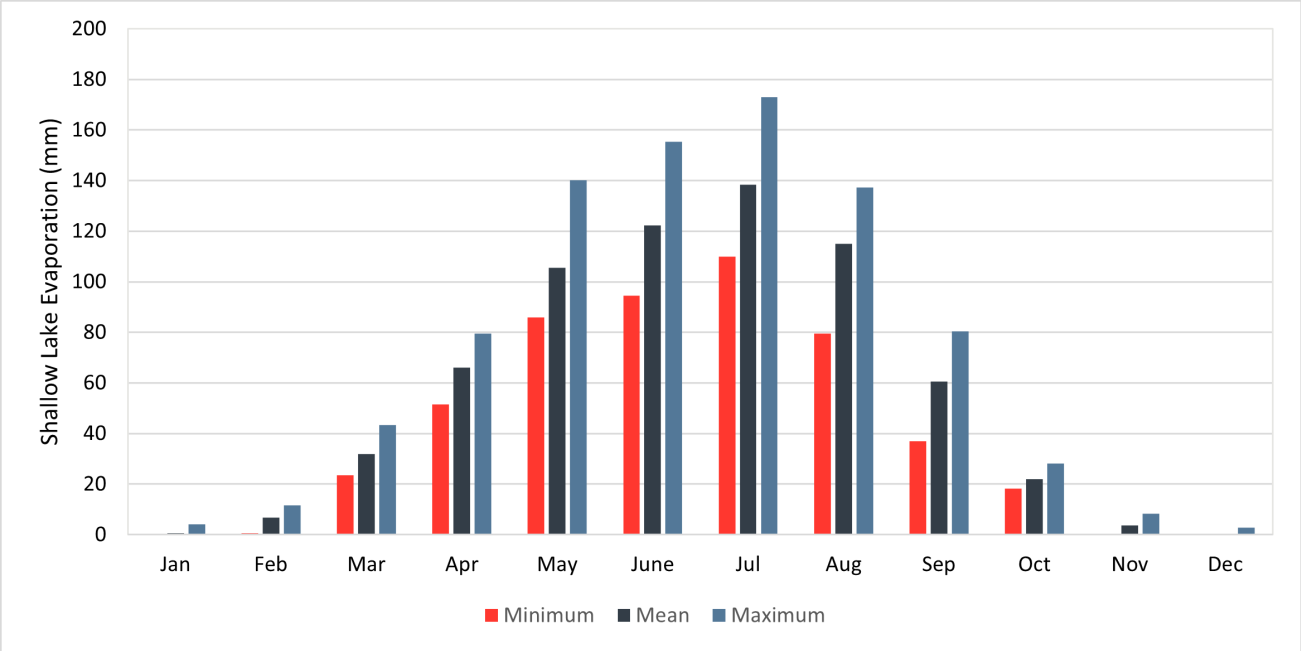

Figure 19 : Estimated Shallow Lake Evaporation Statistics for the Site (1974-2001)

4.6.2 Potential Evapotranspiration

Table 17 and Figure 20 present monthly statistics for PET using the Morton Model. The mean annual PET rate is estimated to be 863 mm, varying between 744 mm and 1022 mm. Mean monthly PET rates vary between 1 mm in December and January to 171 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly PET occurs in July when PET is greatest, and lowest variation occurs in January and December when PET is lowest. On an annual basis, PET rates are greater than shallow lake evaporation and AET since PET is not limited by the availability of water.

Table 17 : Estimated Monthly and Annual Potential Evapotranspiration Statistics for the Site (1974-2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

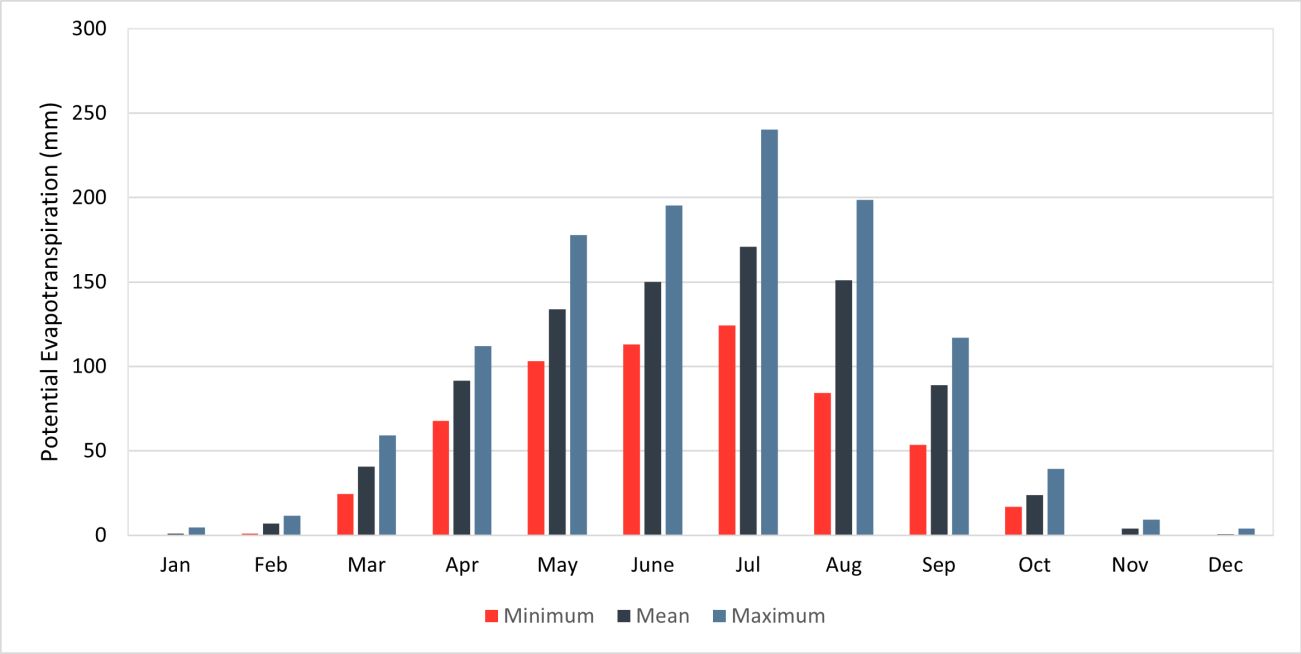

Figure 20 : Estimated Potential Evapotranspiration Statistics for the Site (1974-2001)

4.6.3 Actual Evapotranspiration

Table 18 and Figure 21 present monthly statistics for AET as calculated using the Morton Model. The mean annual AET rate is estimated to be 399 mm, varying between 319 mm and 449 mm. Mean monthly AET rates vary between 1 mm in December and January to 89 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly AET occurs in July when AET is greatest, and lowest variation occurs in January and December when AET is lowest. On an annual basis, AET at the Site is less than shallow lake evaporation and PET rates because AET is limited by the availability of water, particularly during the summer months when the air temperature is highest.

Table 18 : Estimated Monthly and Annual Actual Evapotranspiration Statistics for the Site (1974-2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

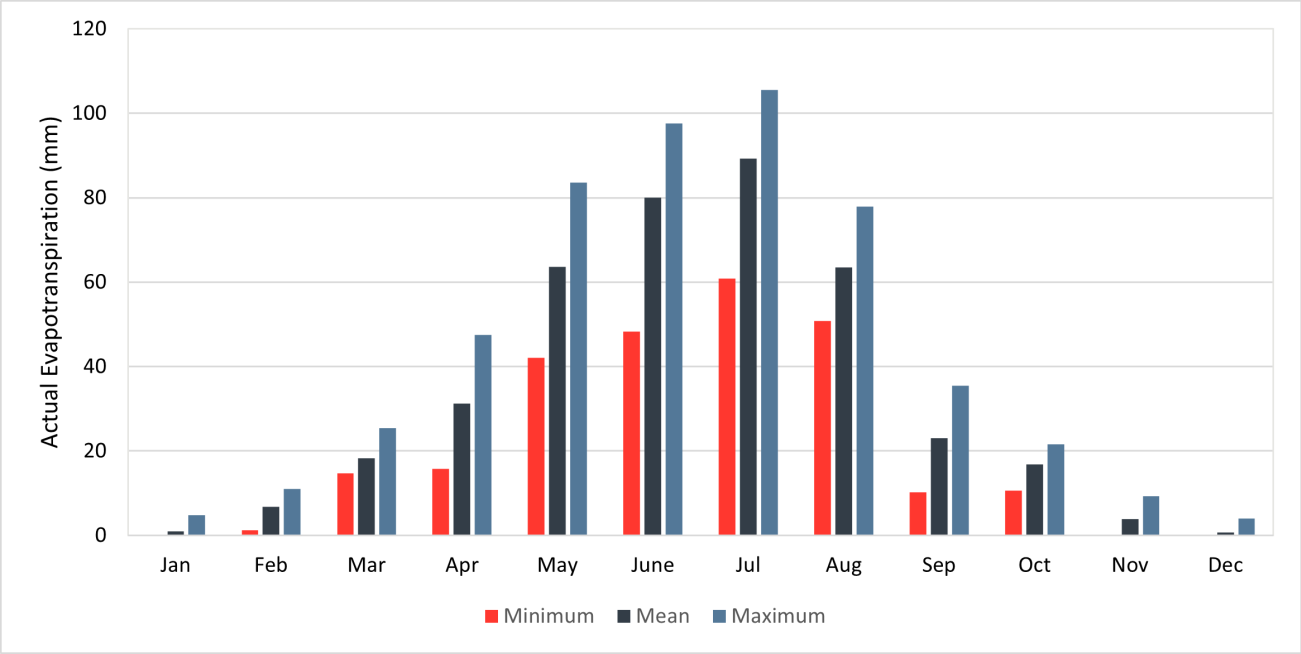

Figure 21 : Estimated Actual Evapotranspiration Statistics for the Site (1974-2001)

4.7 Wind Speed and Direction

A wind rose plot for the Site depicting the relative frequency of mean hourly wind speed and direction, and the seasonal distribution, between 29 August 1997 and 27 November 2003 is shown in Figure 22.

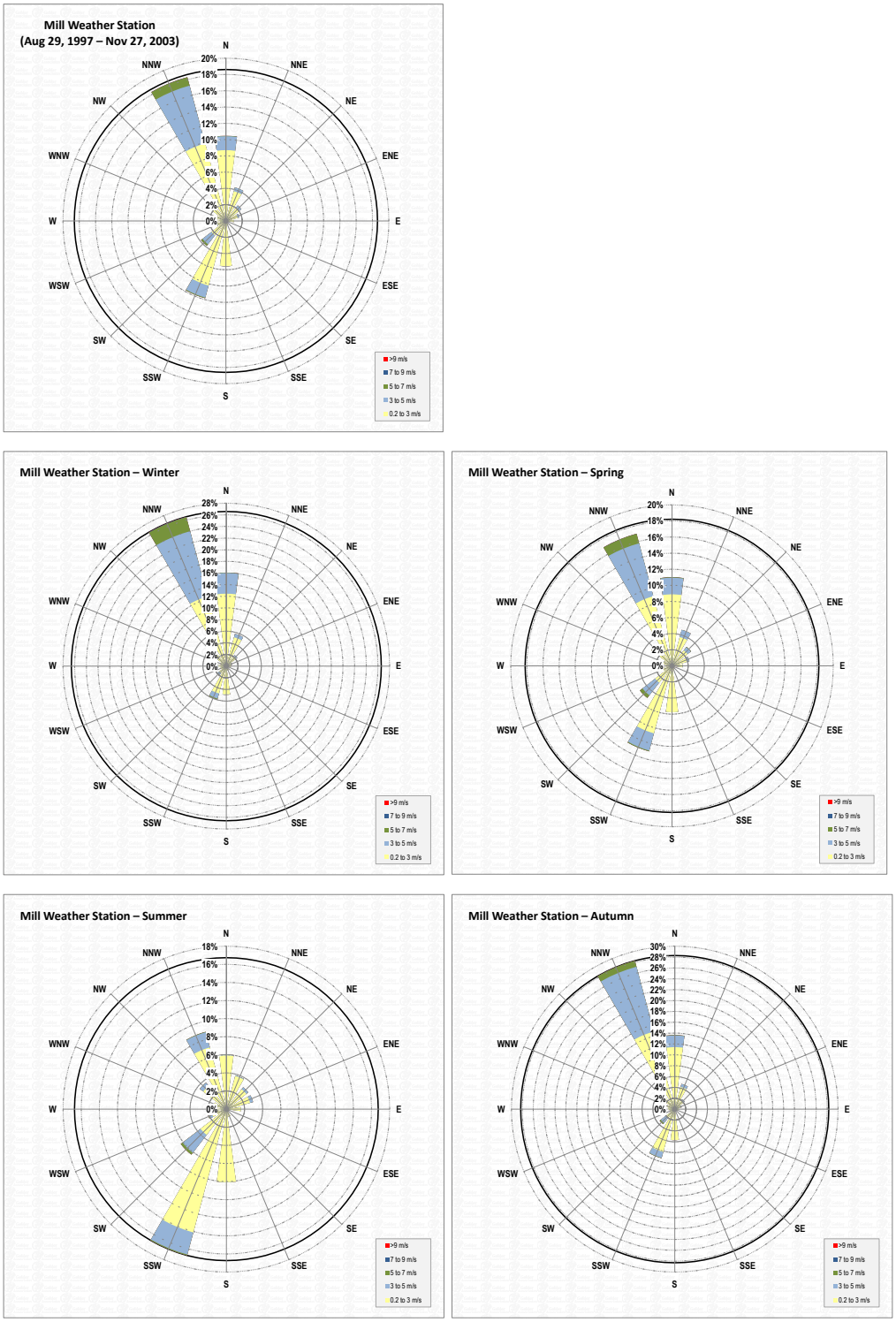

Figure 22: MPMC Station Monitoring Period and Seasonal Wind Roses - 29 August 1997 to 27 November 2003

Spring = March, April, May; Summer = June, July, August; Autumn = September, October, November; Winter = December, January, February.

Winds measured at the Site typically blew from the north-northwest, north, and south-southwest directions, with minimal winds from the east and the west. The spring, autumn, and winter seasonal wind roses were consistent with the wind rose pattern for the entire monitoring period; however, during the summer months, the majority of winds were from the south-southwest. Similarly, wind speeds in spring, autumn, and winter were generally consistent with the wind rose for the entire monitoring period, while wind speeds in summer were generally lower.

Wind speed measured and seasonal distributions at the Site from 2019 to 2021 were consistent with the relative frequency of wind speed magnitudes and the seasonal distributions recorded between 29 August 1997 and 27 November 2003 (Table 19 and Figure 23). A similar seasonal pattern in wind speed is identifiable with lower wind speeds in the summer months and higher wind speeds in the spring, autumn, and winter months (Table 20 and Figure 24). It is noted that the data from 2019 and 2021 are daily wind speed rather than hourly wind speed and only the relative frequency (%) of wind speed magnitude was compared.

Table 19: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station 29 August 1997 to 27 November 2003[1]	Weather Station 1 1 January 2019 to 31 December 2021[2]
calm	35%	28%
0.2 to 3 m/s	50%	56%
3 to 5 m/s	14%	13%
5 to 7 m/s	2%	3%
7 to 9 m/s	0%	0%
>9 m/s	0%	0%

1) Recorded as hourly wind speed.

2) Recorded as daily wind speed.

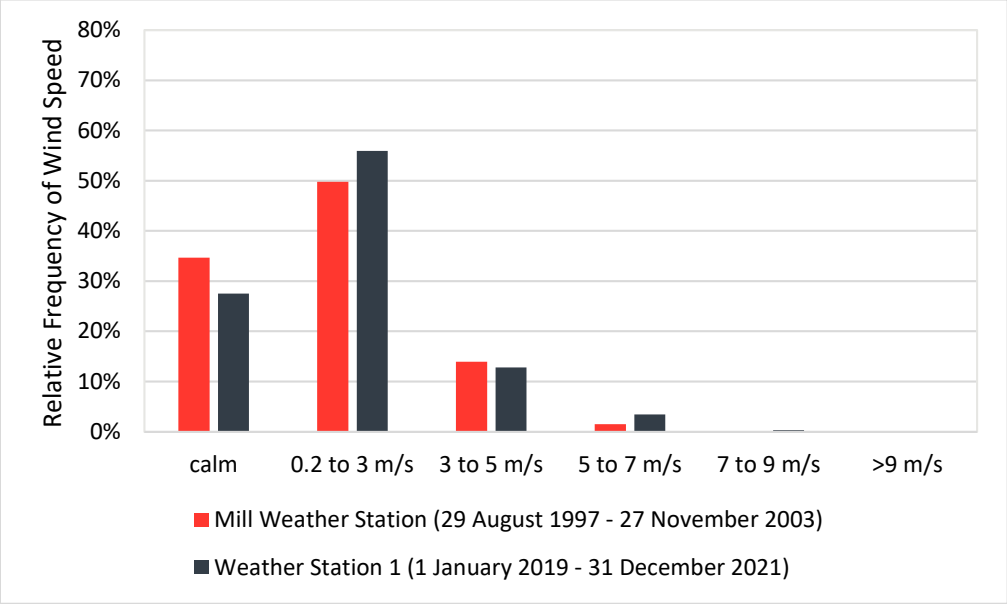

Figure 23: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Table 20: Comparison of Relative Frequency of Wind Speed Seasonal Distributions from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station 29 August 1997 to 27 November 2003[1]				Weather Station 1 1 January 2019 to 31 December 2021[2]			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
calm	31%	32%	22%	27%	23%	18%	31%	37%
0.2 to 3 m/s	51%	59%	57%	52%	58%	75%	46%	44%
3 to 5 m/s	16%	9%	19%	19%	13%	7%	17%	15%
5 to 7 m/s	2%	0%	2%	3%	5%	0%	6%	3%
7 to 9 m/s	0%	0%	0%	0%	1%	0%	0%	1%

1) Recorded as hourly wind speed.

2) Recorded as daily wind speed.

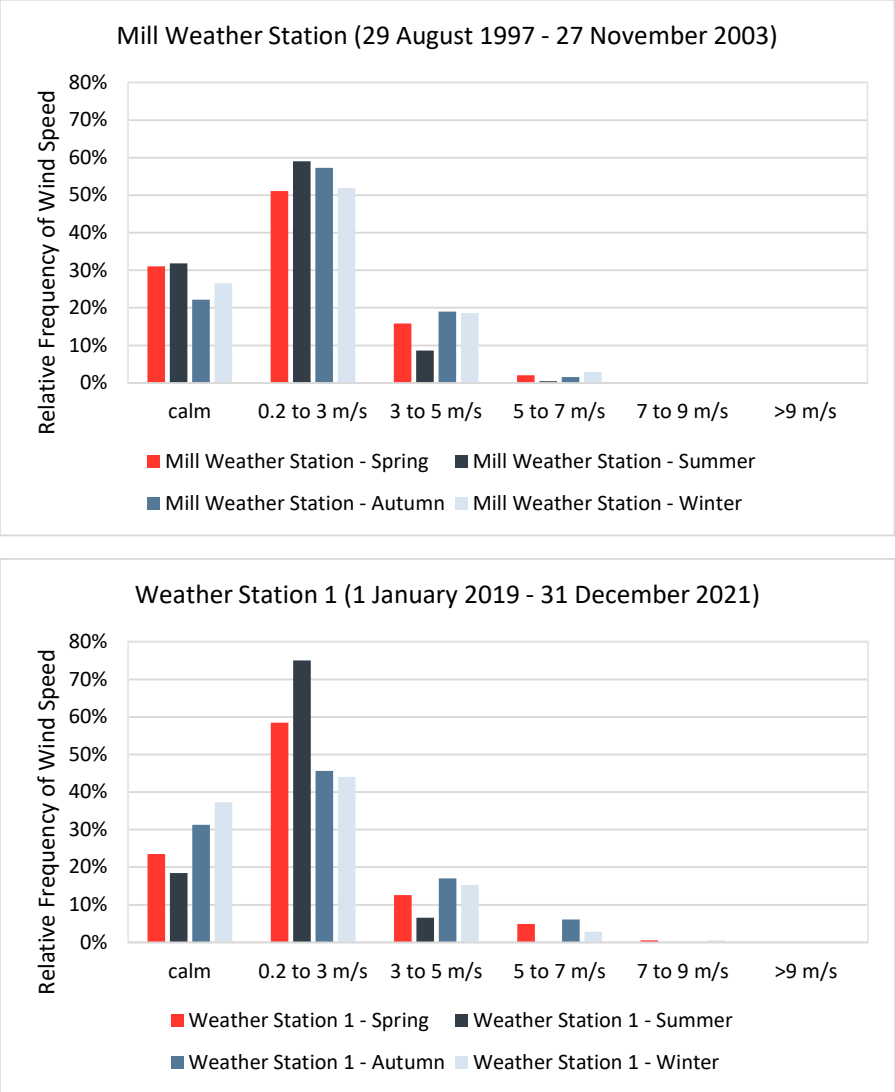

Figure 24: Comparison of Relative Frequency of Wind Speed Seasonal Distribution from Mill Weather Station and Weather Station 1 for the Site

4.8 Snow Cover Properties

Snow cover monthly statistics, reported as SWE, are presented in Table 21. At 50% exceedance, snow begins accumulating in November and achieves its maximum in March, reducing to 0 mm in April. The 5th and 95th percentiles and standard deviation values demonstrate the variability in the amount of SWE at the Site, with March having the greatest variability from year to year.

Table 21: Snow Water Equivalent for the Site (1997-2021)

Month	Number of Measurements	Mean (mm)	Minimum (mm)	Percentile					Maximum (mm)	Standard Deviation (mm)
				5%	25%	50%	75%	95%		
January	22	147	76	88	120	139	164	327	339	56
February	22	182	99	104	131	193	222	338	344	61
March	22	185	0	6	97	198	257	403	411	108
April	21	33	0	0	0	0	81	177	177	58
November	22	17	0	0	0	9	37	72	72	25
December	22	102	32	50	77	101	122	193	196	44

5.0 CLIMATE CHANGE PROJECTIONS

Future climate projections are important for understanding how climate is projected to change at the Site from the climate baseline. Future climate projections come from publicly available statistical downscaled future climate projections on a daily scale. Recognizing the inherent uncertainty with projections, multiple projections from multiple models and scenarios were included in the analysis presented herein, and the future projections are presented in terms of percentiles or exceedance probabilities. Changes to climate may influence how representative the statistics estimated based on historical data are for future time periods.

5.1 Data Sources for Future Climate

The Intergovernmental Panel on Climate Change (IPCC) is generally considered to be the definitive source of information related to past and future climate change as well as climate science. As an international body, the IPCC provides a common source of information relating to emission scenarios, provides third party reviews of models, and recommends approaches to document future climate projections. Periodically, the IPCC issues assessment reports summarizing the current state of climate science. The Sixth Assessment Report (AR6) (IPCC 2021) represents the most currently available complete synthesis of information regarding climate change.

5.2 Global Climate Change Projections

Future climate is typically projected using global circulation models (GCMs) that involve the mathematical representation of global land, sea, and atmosphere interactions over a long period of time. These GCMs have been developed by various government agencies, but they share a number of common elements as described by the IPCC (2021). The IPCC does not run the models but acts as a clearinghouse for the distribution and sharing of the model forecasts.

Global climate models require extensive inputs to characterize the physical processes and social development paths that could alter climate in the future. To represent the wide range of the possible inputs to global climate models, the IPCC has established a series of Shared Socioeconomic Pathways (SSPs) that help define the future levels of radiative forcing terms. Future climate projection data are available from approximately 30 GCMs and four main SSPs (SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5) in AR6 (ECCC 2022c).

The primary differentiating aspect of each model are the SSPs developed by the IPCC and presented in AR6 to quantify potential emission output scenarios (ECCC 2022c). The SSPs were created with varying assumptions about human developments and are designed to work in combination with an updated version of the Representative Concentration Pathways (RCPs) from the previous IPCC Fifth Assessment Report (AR5) (ECCC 2022c). The SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5 scenarios are the four common greenhouse gas concentration profiles that are widely used; SSP5-8.5 represents the most extreme scenario with the highest volume of greenhouse gases emitted (ECCC 2022c).

5.3 Regional Climate Change Projections

The climate change projection data available from ClimateData.ca portal provided by ECCC uses GCMs with RCP pathways from IPCC AR5 rather than the latest SSPs from AR6. Therefore, the data used in this study will be obtained from ClimateBC.ca provided by the University of British Columbia (UBC). This tool downscales PRISM (Daly et al. 2008) 1971-2000 gridded monthly climate normal data (800 x 800 m) to scale-free point locations and uses the scale-free data as a baseline to downscale more than 200 future climate variables for individual years and periods between 1901 and 2100 (Wang et al. 2016).

The ClimateBC (UBC 2022) tool that is currently managed by UBC uses the same data management framework as Coupled Model Intercomparison Project Number 6 (CMIP6) where the SSP emission profiles are coupled with GCMs. ClimateBC selected a subset of eight GCMs from the models contributing to the CMIP6 ScenarioMIP project based on the following criteria (UBC 2022):

- Minimum of three historical runs available.
- Minimum temperature and maximum temperature available for all runs.
- At least one run for each of the four main SSP marker scenarios.
- One model per institution.
- No closely related models based on Figure 5 in *Reduced global warming from CMIP6 projections when weighting models by performance and independence* (Brunner et al. 2020).
- No large biases over BC.
- Are within IPCCs transient climate response "likely[1]" range and Earth's equilibrium climate sensitivity "very likely[2]" range.

The eight GCMs presented in this report are ACCESS-ESM1-5, BC-CSM2-MR, CNRM-ESM2-1, GFDL-ESM4, GISS-E2-1-G, MIROC6, MPI-ESM1-2-HR, and MRI-ESM2-0.

Table 22: Inventory of Global Climate Models Referenced in this Study

Model	Source / Institution
ACCESS-ESM1-5	Commonwealth Scientific and Industrial Research Organisation
BC-CSM2-MR	Beijing Climate Center
CNRM-ESM2-1	CNRM (Centre National de Recherches Meteorologiques) and CERFACS (Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique)
GFDL-ESM4	National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory
GISS-E2-1-G	Goddard Institute for Space Studies
MIROC6	JAMSTEC (Japan Agency for Marine-Earth Science and Technology), AORI (Atmosphere and Ocean Research Institute), NIES (National Institute for Environmental Studies), and R-CCS (RIKEN Center for Computational Science)
MPI-ESM1-2-HR	Max Planck Institute for Meteorology
MRI-ESM2-0	Meteorological Research Institute

The Site coordinates and elevation were entered into ClimateBC to extract site-specific model outputs (i.e., projections) for precipitation, air temperature, solar radiation, relative humidity, and precipitation as snowfall.

[1] Transient climate response metric in the range 1.4 to 2.2°C (66% likelihood) deemed as "likely" in AR6 (Hausfather et al. 2022).

[2] Equilibrium climate sensitivity metric in the range 2 to 5°C deemed as "very likely" in AR6 (Hausfather et al. 2022).

5.4 Climate Change Projections Results

The following sections build on the current climate baseline by providing the projected changes under future climate conditions for two future time horizons (2041-2070; 2050s, and 2071-2100; 2080s). Time horizons used for the available projections are by periods. Section 5.4.1 provides a description of future projected conditions for temperature and precipitation. Sections 5.4.2 through 5.4.5 provide the projected changes in relative humidity, solar radiation, evaporation, and snow cover. In all sections, projections are provided in terms of exceedance probability measured over the 32-member multi-model ensemble (i.e., 8 models and 4 SSPs). The focus of the results discussion is on the 50th percentile (median), while additional exceedance probabilities are available in the tables presented, including the maximum and minimum. Using the median, or 50th percentile, provides an indication of the middle of the projected changes from the multi-model ensemble.

5.4.1 Future Temperature and Precipitation Projections

This section provides the projected future mean temperature and total precipitation for the Site. The future climate projections are benchmarked against a modelled baseline (e.g., ClimateBC output of the baseline information available for the 32-member multi-model ensemble for the normal period of 1991-2020) and are described in terms of “anomaly” or change from the baseline.

Annual Temperature and Precipitation Projections

Comparisons of the future climate projections of temperature and precipitation for the Site for the 2050s (2041-2070) and 2080s (2071-2100) projection periods are shown as a scatter plot in Figure 25. The plots illustrate the projected change in temperature (vertical axis) and precipitation (horizontal axis) from the current climate baseline (1991 through 2020 normal period) for each of the models and the four SSPs considered in the IPCC’s AR6 (IPCC 2021). For reference, the current climate is shown as a solid circle where the axes intersect. The model projections are generally in the upper right quadrant of the plots, suggesting a future climate that will likely be warmer and wetter. There is a larger spread of future projected precipitation, with a majority of model runs projecting a wetter future climate. Precipitation projections typically have larger uncertainty than temperature projections due to the challenge of capturing precipitation in the climate models (temperature is better understood) (Araya-Osses et al. 2020).

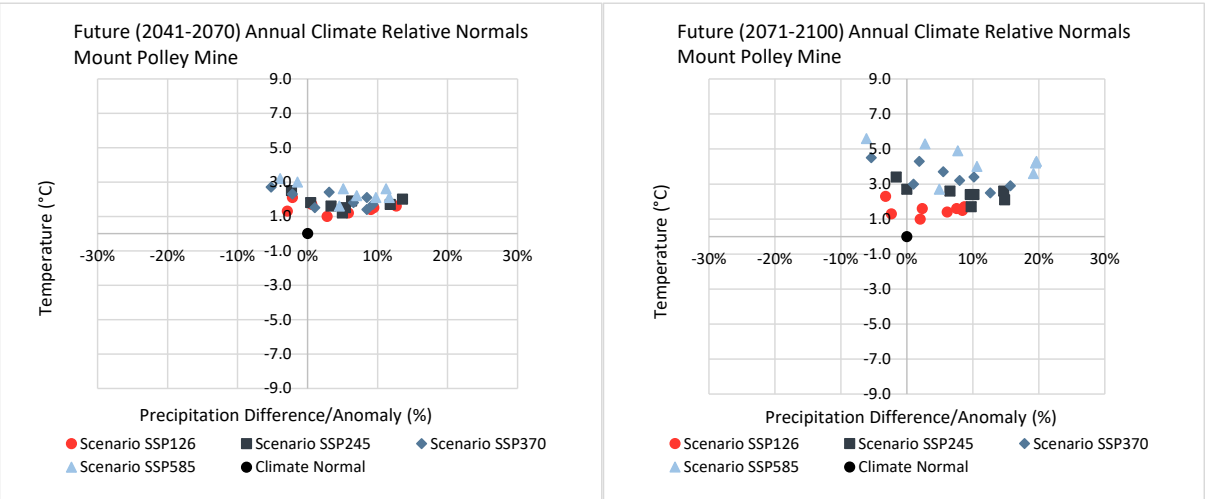

Figure 25: Scatter Plots Presenting Annual Temperature and Precipitation Projections for the 2050s and the 2080s for the Mount Polley Mine Area

Monthly Temperature and Precipitation Projections

Figure 26 and Figure 27 depict the projected anomalies in monthly temperatures for the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represents the spread between the 5th percentile and the 95th percentile of the ensemble. The figures show projected increases in temperature for all months for the 2050s and the 2080s. For the 2050s (Figure 26) the projected increase in the median temperature (dashed line) is less in winter months and greater in the summer months, with an annual average increase of 1.8ºC. The 5th and 95th percentiles of the 2050s ensembles range from an increase of 1.2ºC to around 2.9ºC. The 95th percentile shows a larger variation throughout the months of the year compared to the 5th percentile, and a seasonal pattern arises for the summer months, with larger projected increases of 4.3°C.

The projected increase in the median temperature for the 2080s (Figure 27) is less in winter months and greater in the summer months, with an annual average increase of 2.7ºC. The 5th and 95th percentiles of the 2080s ensemble range from an increase of approximately 1.4ºC to 5.1ºC on average. The 95th percentile shows a larger variation throughout the months of the year and greatest variation in the summer months, with projected increases of 7ºC.

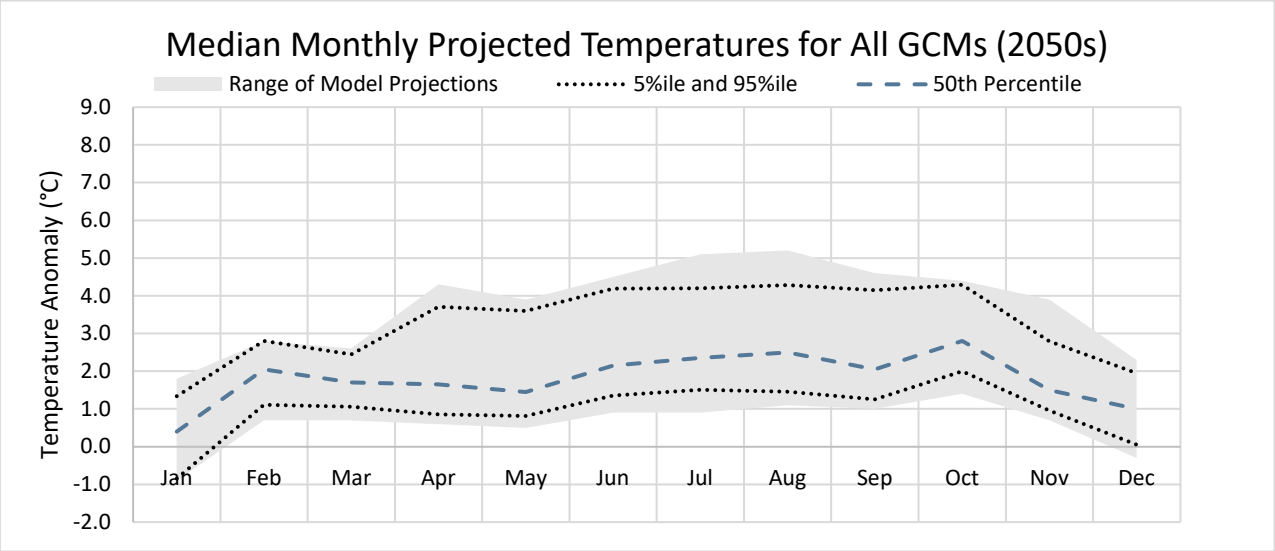

Figure 26: Monthly Projected Temperature Anomalies for the Mount Polley Mine Area (2050s)

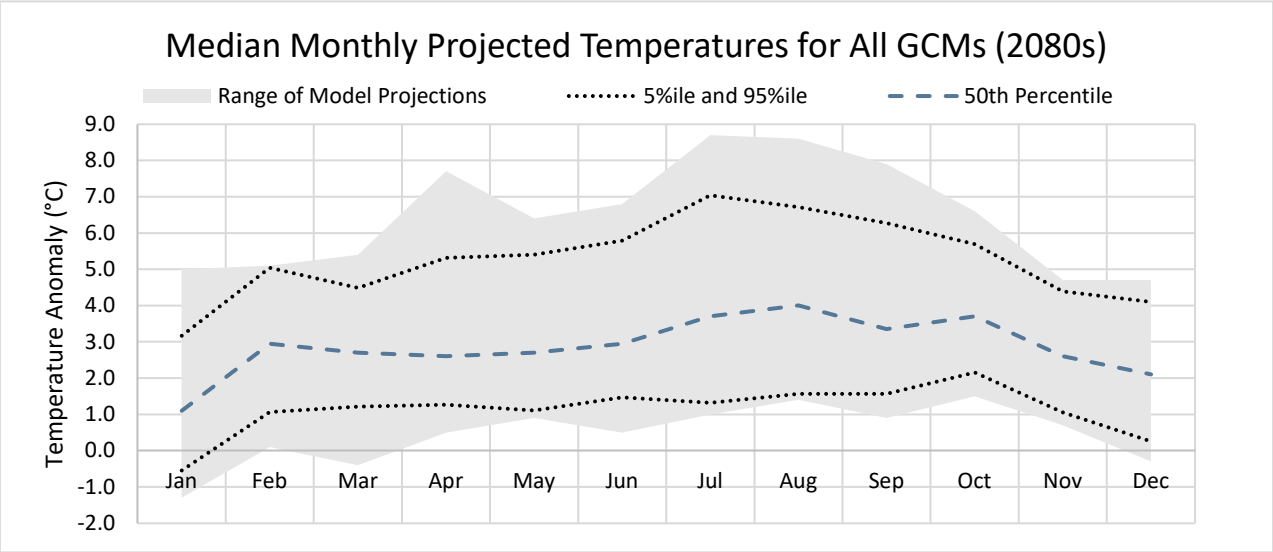

Figure 27: Monthly Projected Temperature Anomalies for the Mount Polley Mine Area (2080s)

Figure 28 and Figure 29 present the monthly projected precipitation anomalies for the Site for the 2050s and 2080s, respectively. For the 2050s (Figure 28) the projected median anomaly (dashed line) indicates changes in the seasonal distribution throughout the year, with an annual average increase of 5%, except for the summer where a slight decrease is projected for the months of June and July. The summer and fall months also present a larger spread in projections from the ensemble (shaded area on the graph), indicating less agreement between the projections. The 2080s (Figure 29) present similar behaviour to the 2050s except for an overall higher projected increase (around 8%), except for the months of June and July, where a decrease in precipitation is projected.

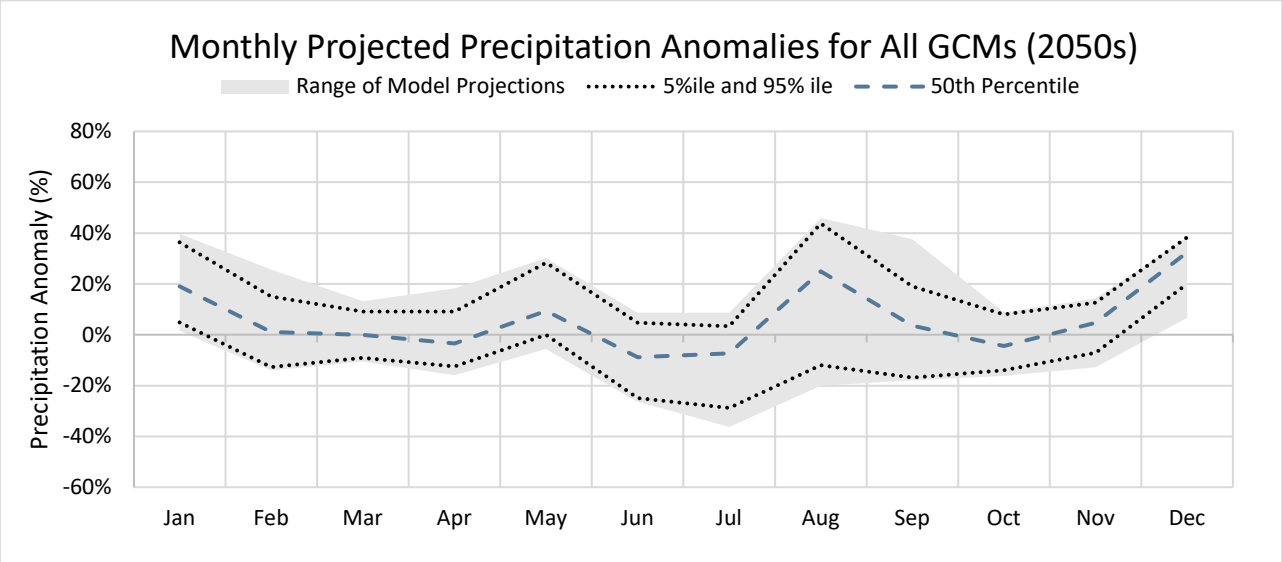

Figure 28: Monthly Projected Precipitation Anomalies for the Mount Polley Mine Area (2050s)

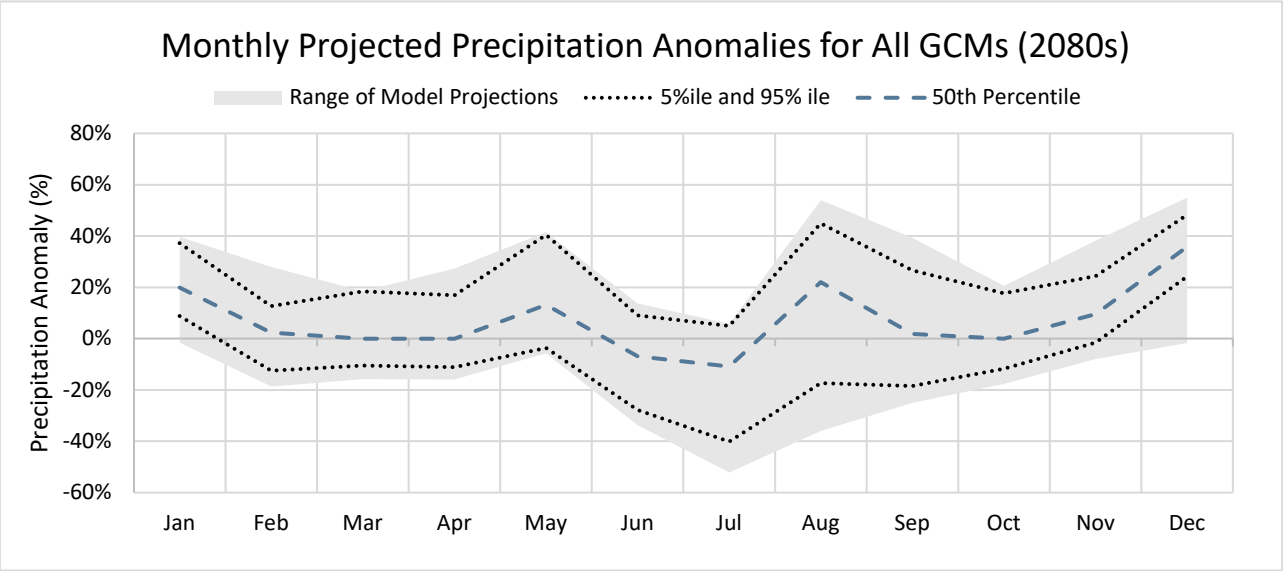

Figure 29: Monthly Projected Precipitation Anomalies for the Mount Polley Mine Area (2080s)

Overall, there is less variability and uncertainty (measured as the agreement within the ensemble or range of projected anomalies) during the 2050s. However, variability increases for both the precipitation and temperature anomalies during the 2080s.

Annual and Monthly Temperature and Precipitation Projections Summary

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual temperatures are summarized in Table 23 and Table 24. In the 2050s, at 50% exceedance probability, the annual temperature is projected to increase by 1.8°C, with the biggest monthly increase of 2.8°C in October, and smallest monthly increase of 0.4°C in January. In the 2080s, at 50% exceedance probability, the annual temperature is projected to increase by 2.7°C, with the biggest monthly increase of 4.0°C in August, and smallest monthly increase of 1.1°C in January.

Table 23: Projected Anomalies in Monthly and Annual Temperature in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-0.9	-0.8	-0.4	0.1	0.4	0.6	1.1	1.3	1.7	1.8	0.3	0.6
February	0.7	1.1	1.2	1.6	2.1	2.4	2.8	2.8	2.8	2.8	2.0	0.6
March	0.7	1.1	1.1	1.4	1.7	2.1	2.2	2.4	2.6	2.6	1.7	0.5
April	0.6	0.9	0.9	1.3	1.7	2.1	3.1	3.7	4.3	4.3	1.9	0.9
May	0.5	0.8	0.9	1.2	1.5	2.7	3.5	3.6	3.8	3.9	1.9	1.0
June	0.9	1.4	1.4	1.7	2.2	2.5	3.2	4.2	4.4	4.5	2.2	0.9
July	0.9	1.5	1.6	1.8	2.4	3.1	4.1	4.2	4.8	5.1	2.6	1.0
August	1.1	1.5	1.7	2.2	2.5	3.2	3.9	4.3	5.0	5.2	2.7	0.9
September	1.0	1.3	1.5	1.7	2.1	2.8	4.0	4.1	4.5	4.6	2.4	0.9
October	1.4	2.0	2.2	2.4	2.8	3.6	4.0	4.3	4.4	4.4	2.9	0.8
November	0.7	1.0	1.1	1.2	1.5	2.1	2.6	2.8	3.6	3.9	1.7	0.7
December	-0.3	0.1	0.2	0.7	1.0	1.3	1.8	1.9	2.2	2.3	1.0	0.6
Annual	1.0	1.2	1.3	1.5	1.8	2.3	2.6	2.9	3.2	3.2	1.9	0.8

Table 24: Projected Anomalies in Monthly and Annual Temperature in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-1.3	-0.5	-0.2	0.4	1.1	1.8	2.7	3.2	4.5	5.0	1.2	1.3
February	0.1	1.1	1.4	2.1	3.0	3.6	5.0	5.0	5.1	5.1	3.0	1.3
March	-0.4	1.2	1.3	1.8	2.7	3.3	4.2	4.5	5.2	5.4	2.6	1.2
April	0.5	1.3	1.5	1.9	2.6	3.7	4.5	5.3	7.1	7.7	2.9	1.5
May	0.9	1.1	1.3	1.8	2.7	3.7	4.8	5.4	6.1	6.4	2.9	1.4
June	0.5	1.5	1.7	2.3	3.0	3.9	4.9	5.8	6.5	6.8	3.2	1.4
July	1.0	1.3	1.9	2.6	3.7	4.8	6.1	7.0	8.2	8.7	3.9	1.8
August	1.4	1.6	2.1	2.9	4.0	5.1	6.4	6.7	8.1	8.6	4.1	1.7
September	0.9	1.6	1.8	2.3	3.4	4.2	5.6	6.3	7.5	7.9	3.5	1.6
October	1.5	2.2	2.3	2.9	3.7	4.7	5.1	5.7	6.4	6.6	3.8	1.2
November	0.7	1.1	1.1	1.6	2.6	3.4	4.2	4.4	4.6	4.7	2.6	1.1
December	-0.3	0.3	0.6	1.2	2.1	2.9	3.5	4.1	4.5	4.7	2.1	1.2
Annual	1.0	1.4	1.5	2.0	2.7	3.8	4.5	5.1	5.5	5.6	3.0	1.4

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual precipitation are summarized in Table 25 and Table 26. The annual precipitation in the 2050s is projected to increase by 5% from the baseline at the 50% exceedance probability. The projected highest monthly increases in the 2050s occur in the winter and August while small and negative changes are expected in June and July. The 2080s annual precipitation is projected to increase by 8% from the baseline, with the largest increases occurring in winter and August, and a small decrease in the summer months of June and July.

Table 25: Projected Anomalies in Monthly and Annual Precipitation in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	2%	5%	8%	13%	19%	23%	35%	36%	39%	40%	19%	9%
February	-14%	-13%	-9%	-7%	1%	7%	14%	15%	23%	26%	1%	10%
March	-11%	-9%	-8%	-5%	0%	5%	8%	9%	12%	13%	0%	6%
April	-16%	-12%	-11%	-7%	-3%	2%	7%	9%	15%	18%	-2%	7%
May	-6%	0%	4%	8%	9%	15%	21%	28%	30%	30%	11%	8%
June	-26%	-25%	-21%	-18%	-9%	-3%	1%	5%	8%	9%	-9%	9%
July	-36%	-29%	-23%	-13%	-7%	-3%	0%	3%	8%	9%	-9%	10%
August	-20%	-12%	-2%	8%	25%	32%	34%	44%	46%	46%	20%	17%
September	-18%	-17%	-16%	-11%	4%	8%	14%	19%	34%	38%	1%	13%
October	-16%	-14%	-10%	-8%	-4%	-1%	4%	8%	9%	9%	-4%	6%
November	-13%	-7%	-5%	0%	5%	8%	11%	13%	14%	14%	4%	6%
December	7%	20%	22%	28%	33%	35%	38%	38%	38%	38%	31%	7%
Annual	-5%	-3%	-2%	1%	5%	9%	12%	12%	13%	14%	5%	5%

Table 26: Projected Anomalies in Monthly and Annual Precipitation in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-2%	9%	11%	14%	20%	27%	30%	37%	39%	40%	21%	9%
February	-19%	-12%	-7%	-2%	2%	7%	12%	13%	24%	28%	2%	9%
March	-16%	-11%	-8%	-5%	0%	8%	13%	18%	18%	18%	1%	9%
April	-16%	-11%	-9%	-7%	0%	12%	16%	17%	24%	27%	2%	11%
May	-6%	-4%	2%	8%	13%	19%	35%	40%	42%	42%	15%	12%
June	-34%	-28%	-24%	-18%	-7%	0%	5%	9%	13%	14%	-9%	12%
July	-52%	-40%	-30%	-19%	-11%	-3%	4%	5%	6%	6%	-13%	15%
August	-36%	-17%	-8%	8%	22%	29%	41%	45%	52%	54%	18%	20%
September	-25%	-18%	-15%	-4%	2%	15%	21%	27%	36%	39%	4%	15%
October	-18%	-12%	-10%	-6%	0%	9%	15%	18%	20%	21%	1%	10%
November	-8%	-2%	0%	4%	10%	16%	22%	24%	35%	38%	11%	9%
December	-2%	24%	25%	33%	36%	42%	47%	48%	53%	55%	36%	10%
Annual	-6%	-4%	-2%	2%	8%	10%	16%	19%	20%	20%	7%	7%

Comparison to Regional Projections

Within Canada there are two major sources of regional projections available: the ClimateData.ca portal (ClimateData 2022) and Canada's Changing Climate Report (Bush and Lemmen 2019). The ClimataData.ca portal provides summarized information about selected locations within Canada using a multi-model ensemble across multiple emission scenarios following IPCC AR5 RCPs (IPCC 2013). Canada's Changing Climate Report (Bush and Lemmen 2019) looks at changing climate trends across Canada and how regional changes fit within the national and global context of climate change. Both resources are used to provide context for the analysis of projections presented in Section 5.4.1 above.

Under a high emissions scenario (RCP 8.5), the ClimateData.ca portal projects a mean annual average temperature increase of 1.6ºC for the 2021 to 2050 period at the Site, 3.6ºC for the 2051 to 2080 period, and 5.1ºC for the end of the century relative to the climate normal period from 1981 to 2010 (ClimateData.ca 2022). This is consistent with the ensemble projections presented above that show increases of 1.8ºC for the 2050s (2041-2070) and 2.7ºC for the 2080s (2071-2100) relative to the modelled climate normal period from 1991 to 2020. Similarly, average annual precipitation is projected by ClimateData.ca to increase by 5% for the 2021 to 2050 period, 12% for the 2051 to 2080 period, and by 15% for the end of the century relative to climate normal period from 1951 to 1980 (ClimateData.ca 2022). These projected changes are consistent with the projections presented above considering the difference in the projection and normal periods (i.e., projection of 5% increase for the 2041 to 2070 period above compared to the 7% increase for the 2051 to 2080 period relative to normal period from 1991 to 2020).

Bush and Lemmen (2019) (Canada's Change Climate Report) does not include trends specifically for the Mine area; however, projections indicate an increase in both mean annual temperature and precipitation, with northern Canada expected to experience larger increases. Under a low emissions scenario (RCP 2.6) temperature is projected to increase by 1.8°C and by more than 6°C under a high emissions scenario (RCP 8.5) by the end of the century. Annual mean precipitation is projected to increase by 7% under a low emissions scenario (RCP 2.6) and by 24% under a high emissions scenario (RCP 8.5) by the end of the century (Bush and Lemmen 2019).

5.4.2 Future Relative Humidity Projections

Annual Projections

Comparison of the future mean annual relative humidity projections from all GCMs for the Mine area and 2050s and 2080s projection periods are shown in Table 27 and Figure 30, and Table 28 and Figure 31, respectively. Projections for the 2050s period shows little variation compared to the baseline period (1991 to 2020) for all climate models and all SSPs with an anomaly range of -2% to 2%. Projections for the 2080s period shows similar pattern to the 2050s period (-1% to 2% anomaly range) for SSP1-2.6 and SSP2-4.5, and greater variation for higher emissions scenarios SSP3-7.0 and SSP5-8.5 (-2% to 5% anomaly range).

Table 27: Projected Mean Annual Relative Humidity for all GCMs (2050s)

Climate Model	Relative Humidity Anomaly (%)			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	1.0	2.0	2.0	2.0
BCC-CSM2-MR	0.0	0.0	0.0	1.0
CNRM-ESM2-1	0.0	0.0	0.0	0.0
GFDL-ESM4	0.0	-1.0	-2.0	-1.0
GISS-E2-1-G	1.0	0.0	1.0	1.0
MIROC6	1.0	1.0	1.0	1.0
MPI-ESM1-2-HR	-1.0	-1.0	-1.0	1.0
MRI-ESM2-0	0.0	0.0	-1.0	-1.0
Baseline	0.0	0.0	0.0	0.0
Anomaly Range	-1 to 1	-1 to 2	-2 to 2	-1 to 2

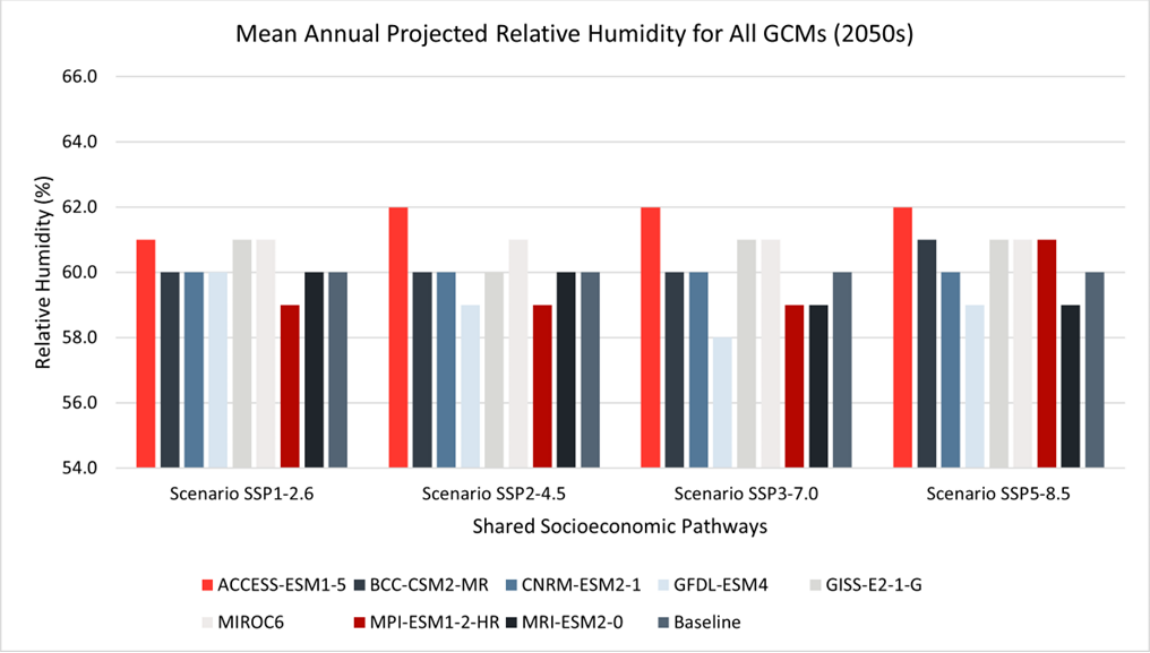

Figure 30: Projected Mean Annual Relative Humidity for all GCMs (2050s)

Table 28: Projected Mean Annual Relative Humidity for all GCMs (2080s)

Climate Model	Relative Humidity Anomaly (%)			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	2.0	2.0	4.0	4.0
BCC-CSM2-MR	1.0	1.0	0.0	2.0
CNRM-ESM2-1	0.0	1.0	1.0	1.0
GFDL-ESM4	0.0	-1.0	-2.0	-1.0
GISS-E2-1-G	1.0	1.0	2.0	1.0
MIROC6	1.0	1.0	1.0	2.0
MPI-ESM1-2-HR	-1.0	-1.0	-1.0	5.0
MRI-ESM2-0	0.0	-1.0	-1.0	-1.0
Baseline	0.0	0.0	0.0	0.0
Anomaly Range	-1 to 2	-1 to 2	-2 to 4	-1 to 5

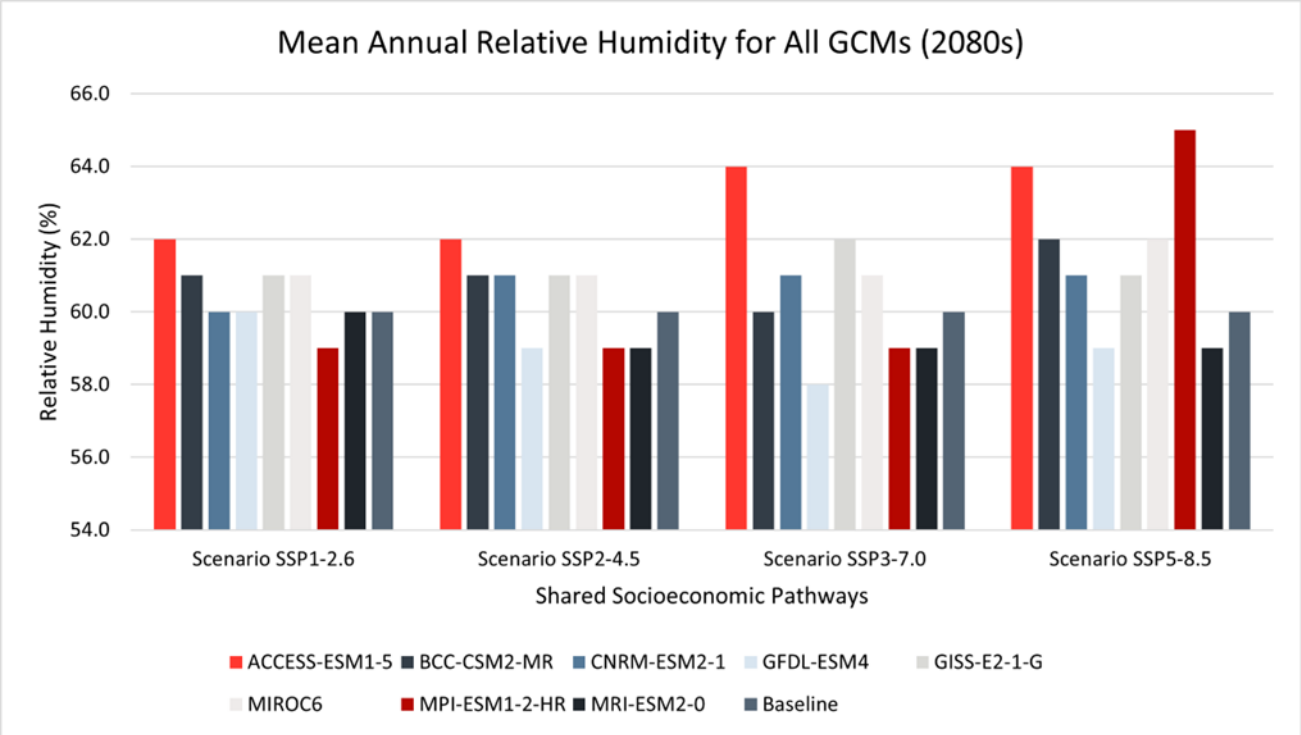

Figure 31: Projected Mean Annual Relative Humidity for all GCMs (2080s)

Monthly Projections

Figure 32 and Figure 33 depict the projected anomalies in monthly median relative humidity at the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represent the spread between the 5th percentile and the 95th percentile of the ensemble. The figures show the projected seasonal pattern with increases in relative humidity for spring and summer months and decreases in relative humidity for winter months, with no change to the annual average. The 5th and 95th percentiles of the 2050s ensembles range from a decrease of -1.0% to an increase of 2.2% on average. The 5th and 95th percentile variations follow the projected median throughout the months of the year, with no discernible seasonal pattern. The 5th and 95th percentiles of the 2080s ensemble, range from a decrease of -1.0% to an increase of 4.0% on average. The 5th and 95th percentile variations are similar throughout the winter months of the year with larger projected uncertainty in the spring and summer months.

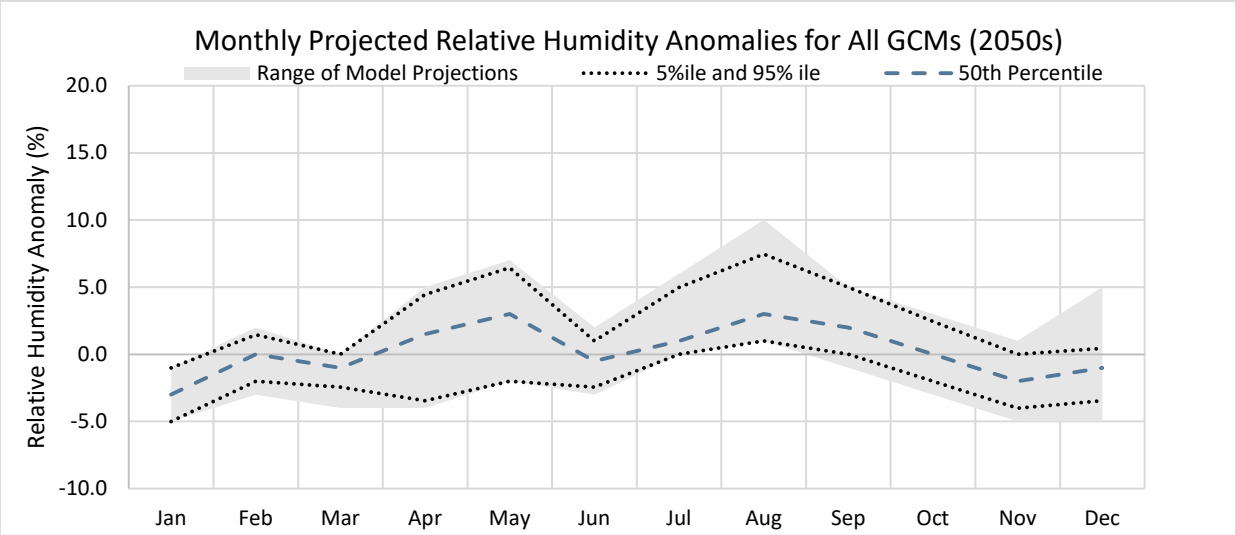

Figure 32: Monthly Projected Relative Humidity Anomalies for Mount Polley Mine Area (2050s)

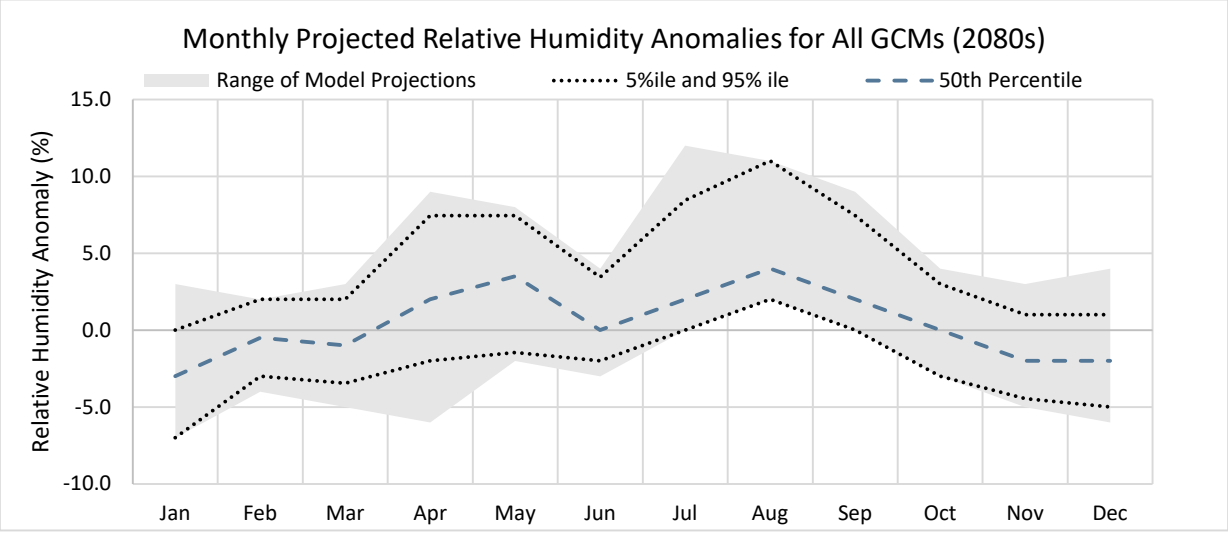

Figure 33: Monthly Projected Relative Humidity Anomalies for Mount Polley Mine Area (2080s)

Summary of Annual and Monthly Projections

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual relative humidity are summarized in Table 29 and Table 30. In the 2050s, at 50% exceedance probability, the annual relative humidity is projected to remain the same as baseline conditions with monthly relative humidity increasing in spring and summer months (up to 3% absolute increase in May and August) and decreasing in fall and winter months (up to -3% absolute decrease in January). In the 2080s, at 50% exceedance probability, the annual relative humidity is projected to remain the same as baseline conditions with monthly relative humidity increasing in spring and summer months (up to 4% absolute increase in August) and decreasing in fall and winter months (up to -3% in January). There is greater variability in the range of relative humidity in the summer months (Figure 33).

Table 29: Projected Anomalies in Monthly and Annual Relative Humidity in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-5%	-5%	-5%	-4%	-3%	-1%	-1%	-1%	-1%	-1%	-3%	1%
February	-3%	-2%	-2%	-1%	0%	1%	1%	1%	2%	2%	0%	1%
March	-4%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	-1%	1%
April	-4%	-3%	-2%	0%	2%	3%	4%	4%	5%	5%	1%	2%
May	-2%	-2%	-1%	2%	3%	4%	6%	6%	7%	7%	3%	2%
June	-3%	-2%	-2%	-1%	-1%	1%	1%	1%	2%	2%	0%	1%
July	0%	0%	0%	1%	1%	2%	4%	5%	6%	6%	2%	2%
August	1%	1%	1%	2%	3%	5%	7%	7%	9%	10%	4%	2%
September	-1%	0%	1%	1%	2%	3%	4%	5%	5%	5%	2%	2%
October	-3%	-2%	-2%	-1%	0%	1%	2%	2%	3%	3%	0%	1%
November	-5%	-4%	-4%	-3%	-2%	-1%	0%	0%	1%	1%	-2%	2%
December	-5%	-3%	-3%	-3%	-1%	0%	0%	0%	4%	5%	-1%	2%
Annual	-2%	-1%	-1%	0%	0%	1%	1%	2%	2%	2%	0%	1%

Table 30: Projected Anomalies in Monthly and Annual Relative Humidity in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-7%	-7%	-6%	-5%	-3%	-1%	0%	0%	2%	3%	-3%	2%
February	-4%	-3%	-3%	-1%	-1%	1%	1%	2%	2%	2%	0%	2%
March	-5%	-3%	-2%	-2%	-1%	0%	1%	2%	3%	3%	-1%	2%
April	-6%	-2%	-2%	1%	2%	3%	5%	7%	9%	9%	2%	3%
May	-2%	-1%	0%	2%	4%	5%	7%	7%	8%	8%	3%	3%
June	-3%	-2%	-2%	-1%	0%	2%	3%	3%	4%	4%	0%	2%
July	0%	0%	0%	1%	2%	4%	7%	8%	11%	12%	3%	3%
August	2%	2%	2%	2%	4%	6%	9%	11%	11%	11%	5%	3%
September	0%	0%	1%	1%	2%	3%	7%	7%	9%	9%	3%	2%
October	-3%	-3%	-2%	-1%	0%	1%	3%	3%	4%	4%	0%	2%
November	-5%	-4%	-4%	-3%	-2%	0%	0%	1%	2%	3%	-2%	2%
December	-6%	-5%	-5%	-4%	-2%	0%	1%	1%	3%	4%	-2%	2%
Annual	-2%	-1%	-1%	-1%	1%	1%	2%	4%	5%	5%	1%	2%

5.4.3 Future Solar Radiation Projections

Annual Projections

Comparison of the future mean annual solar radiation projections for the Mine area for the 2050s and 2080s projection periods are shown in Table 31 and Figure 34, and Table 32 and Figure 35, respectively. Baseline solar radiation for the Site is from ECCC Williams Lake climate station for the period from 1961 through 2001 as modelled baseline solar radiation for the Site is not available. Projections for the 2050s period shows a mean annual solar radiation increase of 4.3% from baseline, with a range of 2.1% to 11.3% increase from baseline across all climate models and SSPs. Projections for the 2080s period shows a mean annual solar radiation increase of 5% from baseline, with a range of 1.2% to 12.2% increase from baseline across all climate models and SSPs.

Table 31: Projected Mean Annual Solar Radiation for all GCMs (2050s)

Climate Model	Solar Radiation Anomaly			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	7.1%	6.3%	7.1%	7.1%
BCC-CSM2-MR	7.1%	7.1%	9.7%	11.3%
CNRM-ESM2-1	3.7%	3.7%	2.9%	2.9%
GFDL-ESM4	4.6%	4.6%	2.9%	2.9%
GISS-E2-1-G	4.6%	2.1%	2.1%	2.1%
MIROC6	4.6%	2.1%	2.1%	2.1%
MPI-ESM1-2-HR	2.1%	2.1%	2.9%	2.1%
MRI-ESM2-0	4.6%	4.6%	2.9%	4.6%
Baseline[a]	0%	0%	0%	0%
Anomaly Range	2.1% to 7.1%	2.1% to 7.1%	2.1% to 9.7%	2.1% to 11.3%

a) Baseline solar radiation for the Site is from ECCC Williams Lake climate station for a period from 1961 through 2001.

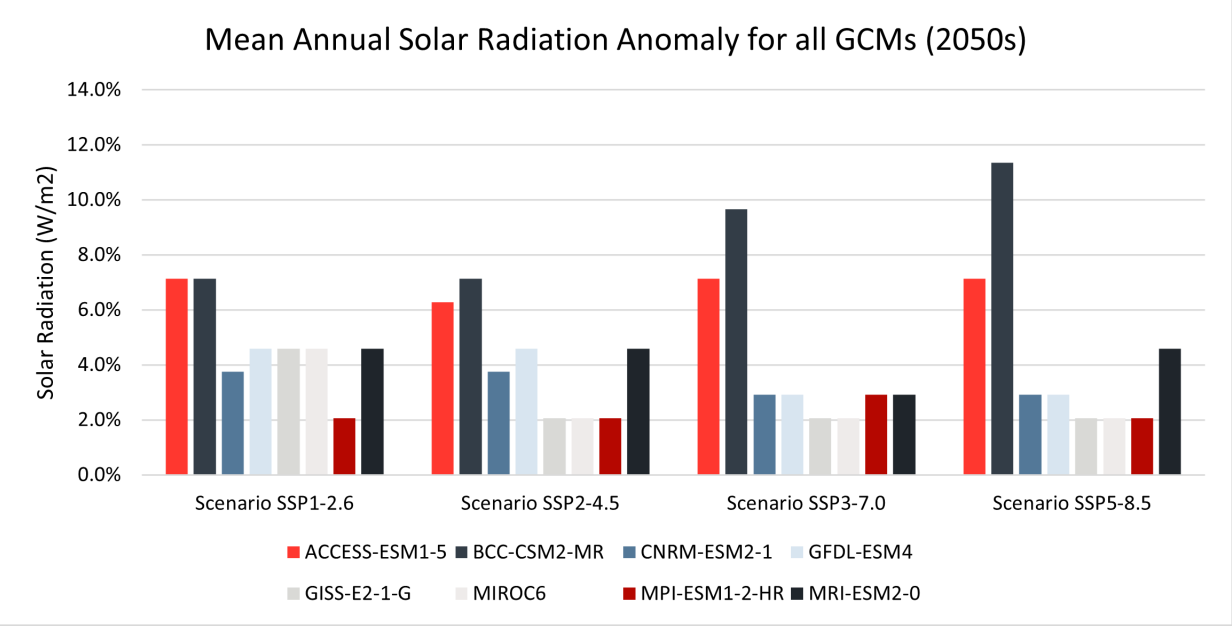

Figure 34: Projected Mean Annual Solar Radiation Anomaly for all GCMs (2050s)

Table 32: Projected Mean Annual Solar Radiation for all GCMs (2080s)

Climate Model	Solar Radiation Anomaly			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	7.1%	7.1%	8.0%	8.0%
BCC-CSM2-MR	9.7%	10.5%	13.9%	12.2%
CNRM-ESM2-1	3.7%	2.1%	2.9%	0.4%
GFDL-ESM4	5.4%	4.6%	6.3%	2.1%
GISS-E2-1-G	5.4%	2.9%	2.9%	0.4%
MIROC6	4.6%	2.9%	2.1%	1.2%
MPI-ESM1-2-HR	2.9%	1.2%	2.9%	1.2%
MRI-ESM2-0	7.1%	4.6%	3.7%	2.9%
Baseline[a]	0%	0%	0%	0%
Anomaly Range	2.9% to 9.7	1.2% to 10.5%	2.1% to 13.9%	0.4% to 12.2%

a) Baseline solar radiation for the Site is from ECCC Williams Lake climate station for a period from 1961 through 2001.

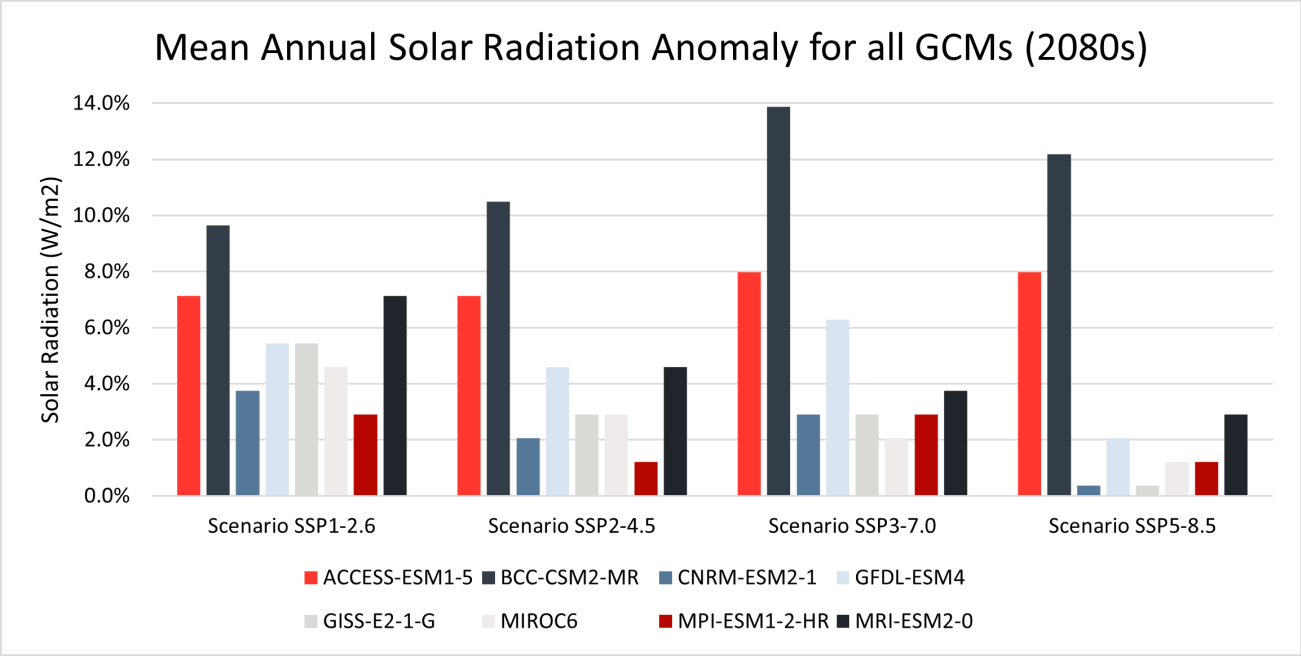

Figure 35: Projected Mean Annual Solar Radiation Anomaly for all GCMs (2080s)

Monthly Projections

Figure 36 and Figure 37 depict the projected anomalies in monthly solar radiation at the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represents the spread between the 5th percentile and 95th percentile of the ensemble. The figures show projected increases in solar radiation for all months for the 2050s and the 2080s except for April, May, and October. For the 2050s (Figure 36) the projected increase in the solar radiation (dashed line) is greater in winter months and less in the summer months, with an annual average increase of 5.1 W/m^2. The 5th and 95th percentiles of the 2050s ensembles range from 2.8 W/m^2 to 11.3 W/m^2 on average with the largest variation occurring in the summer months. The 95th percentile shows a larger variation during the summer months, with projected increases of nearly 21.7 W/m^2.

The projected increase in the mean solar radiation for the 2080s (Figure 37) show a similar pattern to the 2050s period. The projected increase (dotted line) is greater in winter months and less in summer months, with an average annual increase of 5.1 W/m^2. The 5th and 95th percentiles of the 2080s ensemble range from 1.2 W/m^2 to 15.4 W/m2 on average. The 95th percentile shows a larger variation throughout the summer months, with projected increases of nearly 41.2 W/m^2. There is greater uncertainty in the projected solar radiation in July and August.

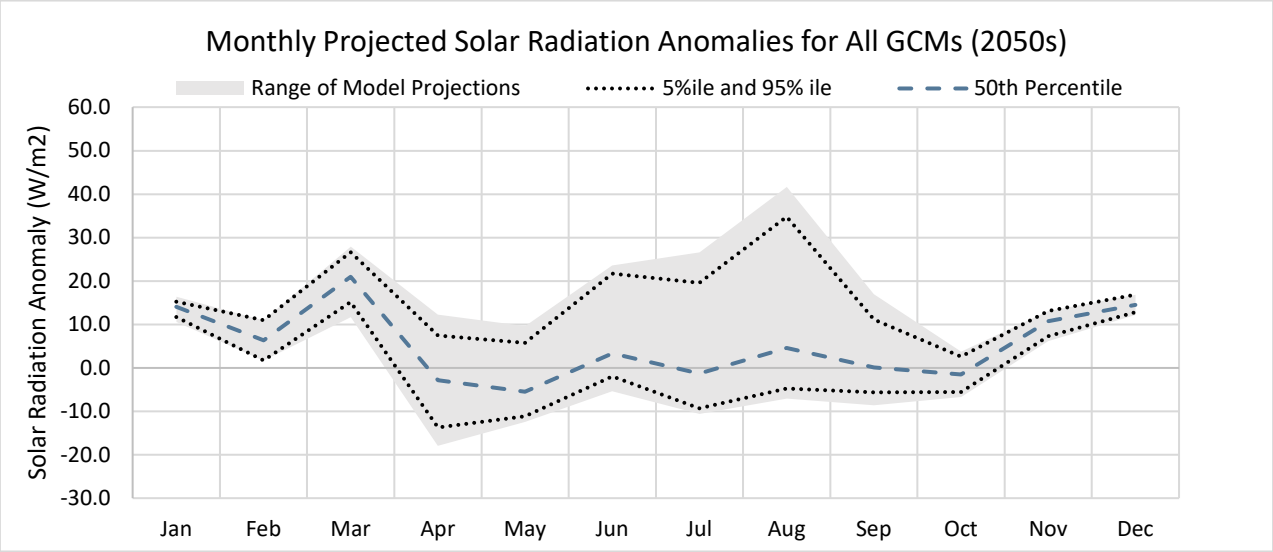

Figure 36: Projected Monthly Solar Radiation Anomalies for Mount Polley Mine Area (2050s)

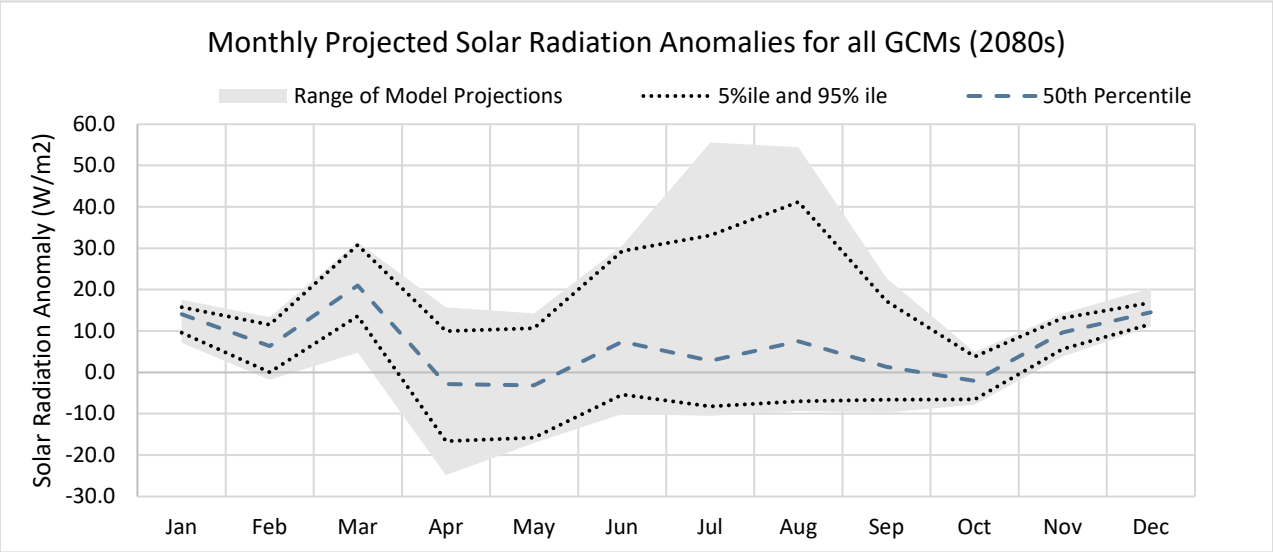

Figure 37: Projected Monthly Solar Radiation Anomalies for Mount Polley Mine Area (2080s)

Summary of Annual and Monthly Projections

The projected future changes in the 2050s and 2080s from the baseline period (Williams Lake 1961 through 2001) in monthly and annual solar radiation are summarized in Table 33 and Table 34. In the 2050s and 2080s, at 50% exceedance probability, the median annual solar radiation is projected to increase by 5.1 W/m^2. Monthly solar radiation is projected to increase for all months except April, May, and October.

Table 33: Projected Anomalies in Monthly and Annual Solar Radiation in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	10.6	11.8	12.9	13.8	14.1	15.2	15.2	15.2	16.0	16.4	14.0	1.2
February	1.7	1.7	2.9	5.2	6.3	8.7	10.9	11.0	11.0	11.0	6.7	2.8
March	11.7	15.2	16.5	18.4	21.0	23.3	25.5	26.7	27.9	27.9	21.0	3.7
April	-17.9	-13.7	-8.6	-4.0	-2.8	1.2	4.0	7.5	11.2	12.2	-2.0	6.3
May	-12.4	-11.2	-10.1	-7.8	-5.5	-0.8	1.3	5.8	9.6	9.6	-4.4	5.3
June	-5.4	-1.9	-1.9	0.4	3.3	9.7	17.8	21.7	23.6	23.6	6.1	7.6
July	-10.5	-9.3	-8.2	-4.2	-1.3	4.2	11.3	19.6	26.6	26.6	1.2	9.1
August	-7.0	-4.7	-4.7	-0.1	4.6	10.4	27.3	34.8	41.3	41.7	7.7	12.1
September	-8.6	-5.6	-3.9	-2.8	0.1	4.5	8.7	11.1	15.1	16.9	1.1	5.8
October	-6.7	-5.5	-4.4	-2.0	-1.5	0.6	2.5	2.6	3.4	3.8	-1.0	2.6
November	6.2	7.3	7.4	9.6	10.8	10.8	12.0	13.1	13.1	13.1	10.2	1.7
December	12.2	12.8	13.4	14.5	14.5	15.7	16.7	16.8	16.8	16.8	14.8	1.2
Annual	2.8	2.8	2.8	2.8	5.1	6.9	9.8	11.3	14.8	15.6	5.9	3.3

Table 34: Projected Anomalies in Monthly and Annual Solar Radiation in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	7.1	9.5	10.6	12.6	14.1	14.4	15.2	15.8	17.2	17.6	13.3	2.2
February	-1.8	0.0	1.7	2.9	6.3	8.7	11.0	11.5	12.9	13.3	6.1	3.7
March	4.7	13.6	15.2	17.5	21.0	24.5	27.7	30.8	31.4	31.4	20.5	5.7
April	-24.9	-16.6	-15.4	-6.9	-2.8	3.3	8.7	9.9	13.9	15.7	-2.8	9.1
May	-17.1	-15.8	-14.5	-10.7	-3.1	-0.8	4.9	10.7	13.5	14.3	-4.0	8.0
June	-10.0	-5.4	-1.9	0.4	7.4	15.5	23.5	29.3	30.6	30.6	8.2	10.6
July	-10.5	-8.2	-5.9	-3.6	2.8	11.5	18.3	33.1	52.0	55.6	6.2	14.3
August	-9.4	-7.0	-0.1	2.2	7.5	12.7	32.8	41.2	51.9	54.4	10.3	14.2
September	-9.7	-6.7	-5.1	-3.9	1.3	5.6	9.8	17.2	22.0	22.7	2.0	7.5
October	-7.8	-6.6	-5.5	-4.4	-2.0	0.6	2.6	3.8	4.6	4.9	-1.6	3.3
November	3.8	5.6	7.3	8.5	9.6	10.8	12.0	13.1	13.9	14.3	9.4	2.3
December	11.0	11.7	12.2	13.4	14.5	15.7	15.7	16.8	19.3	20.3	14.3	1.9
Annual	0.5	1.2	1.7	3.7	5.1	9.8	13.0	15.4	18.3	19.0	6.6	4.7

5.4.4 Future Evaporation Projections

Evaporation and evapotranspiration projections are not available from ClimateBC or ClimateData.ca. However, evaporation and evapotranspiration are likely to change as dependent variables change, in particular air temperature. The extent of the change will depend on the climate change scenario.

5.4.5 Snow Cover Properties Projections

Potential changes in winter air temperature will likely lead to changes in snow cover properties and the annual SWE available for freshet. ClimateBC does not project snow cover and instead projects precipitation-as-snow (PAS) for future climate periods. PAS projections are indicative of the trends in total snow cover and SWE available to contribute to freshet flows, with less PAS resulting in less SWE. Table 35 summarizes ClimateBC projected PAS for future normal periods relative to the modelled baseline period (1991 through 2020) and indicates an overall decrease in PAS in the future. At 50% exceedance probability, the annual PAS is projected to decrease by 30 mm and 59 mm on average for the 2050s and 2080s, respectively.

Climate change model data published for the province of BC by ECCC (2019) project snow depth reduction relative to the 1986 to 2005 reference normal period using CMIP5 RCP (Table 36). At 50% exceedance, the snow cover depth is projected to decrease by 83 mm and 117 mm on average for the 2046-2065 and 2081-2100 normal periods, respectively.

Table 35: Projected Annual Precipitation-As-Snow Anomaly for the Mount Polley Mine Area

Shared Socioeconomic Pathway	Normal Period	Precipitation-as-Snow Anomaly Percentiles (mm)		
		25%	50%	75%
SSP1-2.6	2011-2040	-7	-4	2
	2041-2070	-23	-17	-13
	2071-2100	-25	-21	-18
SSP2-4.5	2011-2040	-11	-5	2
	2041-2070	-32	-27	-18
	2071-2100	-50	-47	-38
SSP3-7.0	2011-2040	-5	-2	2
	2041-2070	-41	-33	-16
	2071-2100	-78	-72	-55
SSP5-8.5	2011-2040	-6	-1	3
	2041-2070	-50	-43	-29
	2071-2100	-110	-95	-80
Average	2011-2040	-7	-3	2
	2041-2070	-36	-30	-19
	2071-2100	-66	-59	-48

Table 36: Snow Depth Change Relative to 1986 to 2005 Predictions for British Columbia (ECCC 2019)

Representative concentration Pathway	Normal Period	Snow Depth Change (mm)		
		25%	50%	75%
RCP2.6	2016-2035	-46.5	-41.4	-12.7
	2046-2065	-67.5	-61.3	-17.4
	2081-2100	-72.6	-68.4	-21.3
RCP4.5	2016-2035	-43.8	-39	-10
	2046-2065	-80.4	-80.5	-33.4
	2081-2100	-109.1	-105.4	-37
RCP8.5	2016-2035	-52.8	-50.1	-14.1
	2046-2065	-101	-105.7	-35.4
	2081-2100	-159.4	-176.4	-58.9

6.0 CONCLUSION AND RECOMMENDATIONS

This report provides the five-year update of climate baseline at Mount Polley Mine Site as per Requirement 2.1 of the Global Industry Standards on Tailings Management (GISTM). The purpose of the update is to extend the existing long-term climate data for the Site using local and regional data collected in the last five years. The last climate baseline update was carried out by WSP Golder in 2016.

This report provides an updated climate baseline for precipitation, air temperature, relative humidity, solar radiation, evaporation, wind speed and direction, and snow depths, and includes updated climate change projections for the Site. Overall, trends in these climate parameters at Mount Polley are similar to those at Environment and Climate Change Canada (ECCC) regional stations. Future climate projections for Mount Polley show that the future climate at the Site would likely be warmer and wetter, with larger variations throughout the months. The greatest variation would likely be in summer months with a projected summer temperature increase of 7°C and less summer precipitation by the year 2100. Annual temperature is projected to increase by 2.7°C and annual precipitation is projected to increase by 8% from the baseline by 2100.

The updated climate parameters and extended long-term climate dataset are deemed to be representative of the climate at the Site and are suitable for support of design and modelling activities. It is recommended that MPMC continue to monitor and record climate data, and that the climate parameters be updated a minimum of every five years to encompass local and regional data collected, and to reflect uncertainties due to climate change.

Signature Page

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APPENDIX 2-2: Geochemical Source Terms

FINAL

Mount Polley Mine Geochemical Source Terms – 2023 Update

Mount Polley Mine, BC, Canada

Mount Polley Mining Corporation



SRK Consulting (Canada) Inc. ▪ CAPR002434 ▪ October 2023

srk consulting

FINAL

Mount Polley Mine Geochemical Source Terms – 2023 Update

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Appendices

Appendix A ML/ARD Management Procedure Manual
Appendix B Waste Rock Source Terms
Appendix C Pit Wall Source Terms
Appendix D Ore Processing Source Terms
Appendix E Tailings Source Terms

Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid-base accounting
AP	Acid Potential
$CaSO_4 \cdot 2H_2O$	gypsum
CGM	conceptual geochemical model
$(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$	chrysocolla
$Cu_2CO_3(OH)_2$	malachite
Cu_5FeS_4	bornite
Cu_9S_5	digenite
$CuFeS_2$	chalcopyrite
CuO	tenorite
CuS	covellite
FeS_2	pyrite
HCT	Humidity Cell Test
LSW	Low Sulphur Waste
ML/ARD	metal leaching and acid rock drainage
MPIC	Mount Polley Intrusive Complex
MPM	Mount Polley Mine
MPMC	Mount Polley Mining Corporation
NAG	Non-Acid Generating
NEZ	Northeast Zone
NP	Neutralization Potential
NW	Northwest
PAG	Potentially Acid Generating
SERDS	South East Rock Disposal Site
SFE	Shake Flask Extraction
TC	Total Carbon
TIC	Total Inorganic Carbon
TSF	Tailings Storage Facility

Executive Summary

Mount Polley Mining Corporation is preparing a Joint Mines Act and Environmental Management Act Permit Amendment Application to support the Springer Pit Expansion Project. The scope of the application includes an extension of the South East Rock Disposal Site (SERDS), an expansion of the Springer Pit, an extension to the duration of treated water discharge to Quesnel Lake to be throughout mining operations, and an extension of the Northwest Potentially Acid Generating (PAG) Stockpile disposal date. This application involves modelling of water quality at the site and in the receiving environment. Inputs to this model are geochemical source terms which are estimations of the chemistry of water in contact with materials and surfaces exposed by mining activity. Source terms mainly consider the potential for metal leaching and acid rock drainage (ML/ARD).

The purpose of this report is to characterize the materials that will be mined as part of the Project, including an assessment outlining the estimated time to onset of acid rock drainage and how it relates to the proposed timeline of the Project, and to describe the derivation and use of the source terms.

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit. The deposit has been mined from several mineralized zones (Springer, Cariboo, Bell, Southeast, Northeast, Boundary). The proposed extension of the existing Springer and Cariboo pits includes mining in three new zones: Springer Deep Zone, WX Zone, and C2 Zone). With the exception of the distinctive small Pond Zone skarn deposit, all other zones have common geological features including mainly a monzonitic plutonic host rock, association with breccia bodies in the intrusion, dominantly potassic hydrothermal alteration, lack of pronounced pyrite haloes, enrichment in copper and selenium relative to global norms, pervasive calcite, and natural oxide alteration. As a result, geochemical characteristics are consistent between zones, allowing a site-wide approach to geochemical characterization.

PAG and non-PAG waste rock materials occur locally as pyrite zones but non-PAG dominates. ARD potential was used to segregate waste rock, with non-PAG waste rock being placed in several waste rock dumps and PAG waste rock either deposited in completed pits that are projected to flood at the closure of the mine (in accordance with the management practice of subaqueous disposal) or placed in a temporary stockpile for final disposal in the Springer-Cariboo Pit. Based on review of operational processes and data, non-PAG waste rock is expected to be non-acidic in perpetuity.

Tailings are classified as non-PAG based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014.

Major geochemical sources were identified as waste rock stockpiles and the tailings. Other sources include backfilled waste rock, ore processing, pit walls, ore stockpiles, and magnetite stockpiles. Source terms were mainly developed from conceptual geochemical models then interpretation of rock geochemical characteristics and seepage data rather than scale-up of laboratory kinetic test data. Pit wall source terms (including PAG walls) were obtained by scaling of kinetic test data. Source terms were not specifically developed for the magnetite stockpiles because they are small sources.

1 Introduction

Mount Polley Mining Corporation (MPMC), a wholly owned subsidiary of Imperial Metals Corporation, has been operating the Mount Polley Mine (MPM), located approximately 56 km northeast of Williams Lake and approximately 15 km southwest of the community of Likely in British Columbia, Canada, since 1996. MPMC recovers copper and gold from porphyry-style mineralization by open pit and underground mining. The plant is capable of processing 22,000 t/d of ore using standard mineral flotation technology.

MPMC is preparing a Joint Mines Act and Environmental Management Act Permit Amendment Application to support the Springer Pit Expansion Project (the Project). The scope of the application includes an extension of the South East Rock Disposal Site (SERDS), an expansion of the Springer Pit, an extension to the duration of treated water discharge to Quesnel Lake to be throughout mining operations, and an extension of the Northwest Potentially Acid Generating (PAG) Stockpile disposal date. This application involves modelling of water quality at the site and in the receiving environment. Inputs to this model are geochemical source terms which are estimations of the chemistry of water in contact with materials and surfaces exposed by mining activity. Source terms mainly consider the potential for metal leaching and acid rock drainage (ML/ARD).

The purpose of this report is to characterize the materials that will be mined as part of the Project, including an assessment outlining the estimated time to onset of acid rock drainage and how it relates to the proposed timeline of the Project, and to describe the derivation and use of the source terms.

2 Background

2.1 Site Overview and Closure

Figure 1 shows the locations of the open pits at MPM. Full scale mining began in the Cariboo Pit by mining high oxide and high gold parts of the ore body then transitioning to the Bell Pit in 1999. Mining was suspended in 2001 due to unfavorable market conditions. The mine re-opened in 2005 after a three-and-a-half-year care-and-maintenance period. The following zones have been mined since 2005:

- Completed mining and backfilling of the Bell Pit.
- Completed mining and backfilling of the small Southeast Zone and Pond Zone Pits.
- Completed mining and flooding of the Wight Pit (Northeast Zone).
- Completed mining of the Boundary Pit.
- Completed permitted mining and flooding of Northeast Zone underground (access from the Wight Pit).

In August 2014, mining was suspended due to the breach of the tailings dam. Mining restarted in 2015 with tailings being deposited in the Springer Pit. In 2016, tailings were deposited in the Tailings Storage Facility (TSF) following reconstruction of the dam.

In May 2019, mining was again suspended due to unfavourable market conditions, but mining operations restarted in November 2021 and milling operations resumed in June 2022. Active mining is currently focussed on the Cariboo and Springer Pits (which will merge to a single pit).

Upon completion of mining, the Springer-Cariboo Pit will be backfilled by rock from the Temporary Northwest (NW) PAG Stockpile (the NAG/PAG Pad) and allowed to flood. The TSF will be decommissioned with a minimal water cover.

Figure 1: Pits and Waste Rock Dumps

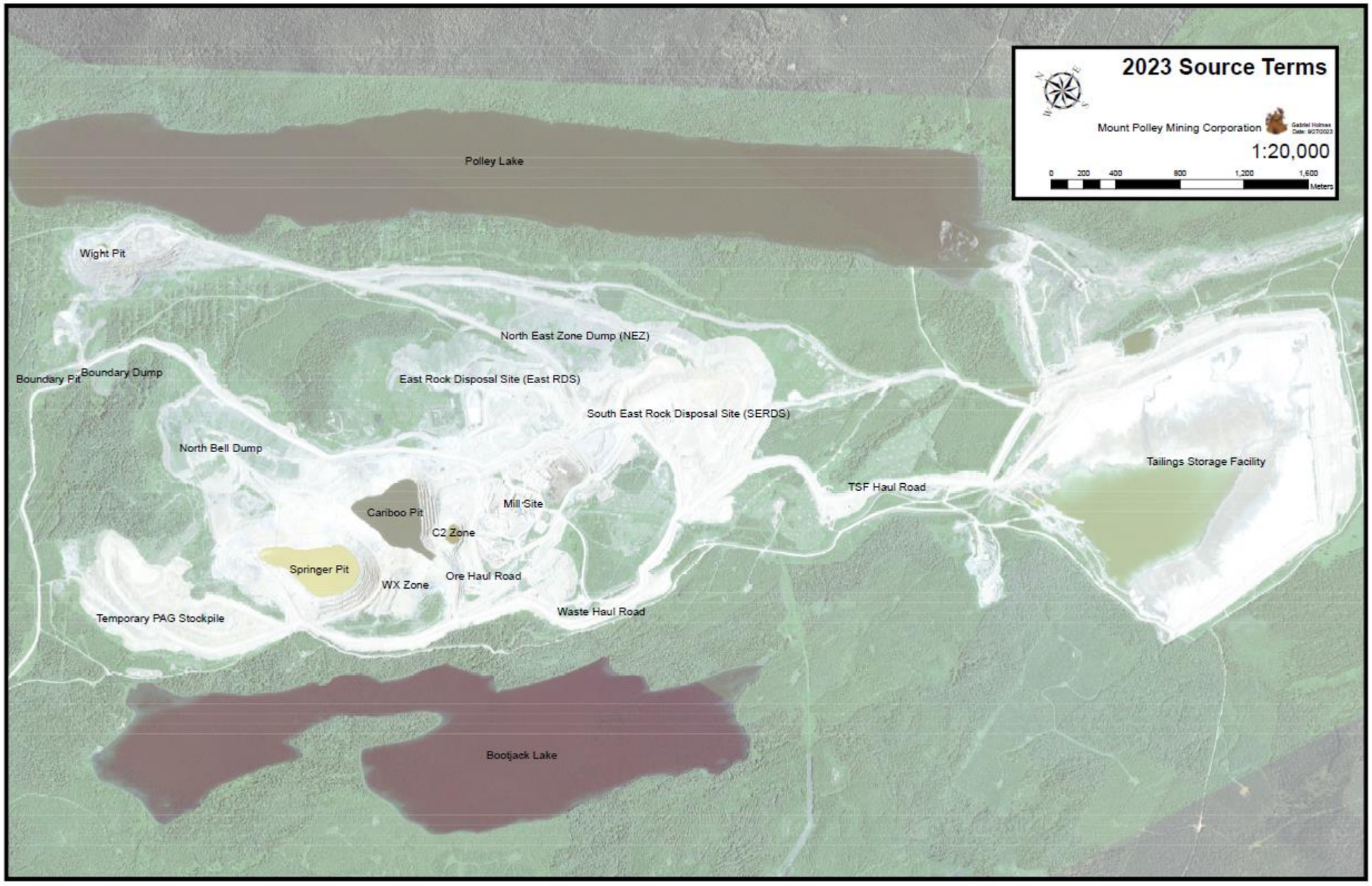

Sources: Provided by MPMC

2.2 Geological Setting

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008). With the exception of the distinctive small Pond Zone, it has been mined from several mineralized zones which have the following common features:

- The host rock for porphyry mineralization is the Mount Polley Intrusive Complex (MPIC) which intruded into Nicola Group Volcanics (Figure 2). The intrusion is primarily monzonite to monzo-diorite in composition. Smaller phases vary in composition from diorite to syenite.
- Mineralization is associated with magmatic-hydrothermal breccias. Alteration and mineralization occurs in the matrix of the breccias, and in veins and swarms distributed around the breccias. BX1 is the main host for the bulk of the mineralization at MPM which is mined in the Cariboo and Springer Pits (Figure 2). BX1 is characterized by alteration which resulted in the strongest destruction of both primary and breccia textures. Breccia bodies BX2 host satellite mineralization in the Southeast Zone, Wight Pit, and Boundary Zone. BX2 is less intensively altered and original textures are more apparent. BX3 is unmineralized and has not been mined.
- Alteration at MPM is classified as potassic (sodic and calcic) with salmon-pink potassium feldspar as the main alteration mineral. Biotite is less common. Sodic alteration is defined by albite and calcic alteration (actinolite, diopside, epidote, clinozoisite, and sporadic andraditic garnet). Calcite is pervasive. Alteration is zoned with the strongest calcic-potassic alteration in the core associated with BX1. Nicola Group rocks and fringing MPIC rocks are propylitically-altered and characterized by stronger epidote and pyrite.
- Like other alkalic porphyry deposits (e.g., Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g., Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPM geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit. Samples from Bell Pit blast holes collected in the early years of operations were identified as being from a Pyrite Zone but the location of this feature is not known.
- Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5). Bornite is relatively more abundant in the Northeast and Boundary Zones.
- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$) formed as a natural weathering product. Iron carbonates have not been reported.
- A significant portion of the copper at the MPM is not associated with sulphides (upwards of 50% in the upper portions of each pit). This fraction has been termed ‘copper oxide’ by MPM personnel and is associated primarily with chrysocolla ($(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$) and malachite ($Cu_2CO_3(OH)_2$) in equal proportions (Henry 2009). SRK (2015b) has shown that chlorite is a significant host for copper. It is assumed that chlorite formed hydrothermally and incorporated

copper as part of the mineralizing event rather than due to weathering. Suarez et al. (2009) found that the form of copper in chlorite at the Aguablanca Ni-Cu-PGE Sulfide Deposit was native copper between silicate layers rather than as a substitution in the crystal lattice. The mineral is suspected to have formed during hydrothermal alteration rather than by natural weathering processes. It is not known whether this same form of copper is also present at MPM.

The small Pond Zone is andradite-clinopyroxene-magnetite skarn mineralization occurring at the contact between a diorite to monzodiorite intrusion and Nicola Group volcanic rocks of andesite to basalt composition. It appears to be linked to the presence of a limestone unit in the Nicola Group.

From an ML/ARD perspective, a significant feature of the Mount Polley mineralization is the lack of reported arsenic, lead, and zinc minerals which are commonly associated with porphyry deposits elsewhere in British Columbia and globally. Since arsenic, zinc, and associated cadmium are relatively mobile under non-acidic conditions, the lack of the minerals hosting these elements indicates that potential for leaching concerns is lower than other porphyries. Based on the copper sulphide and copper oxide dominated mineralogy, the primary metal leaching concern is expected to be for copper.

In addition, the lack of a distinctive pyrite halo means that pyrite abundance is lower than other porphyry deposits and ARD potential is expected to be lower.

Figure 2: Geological Map of the Mount Polley Mine

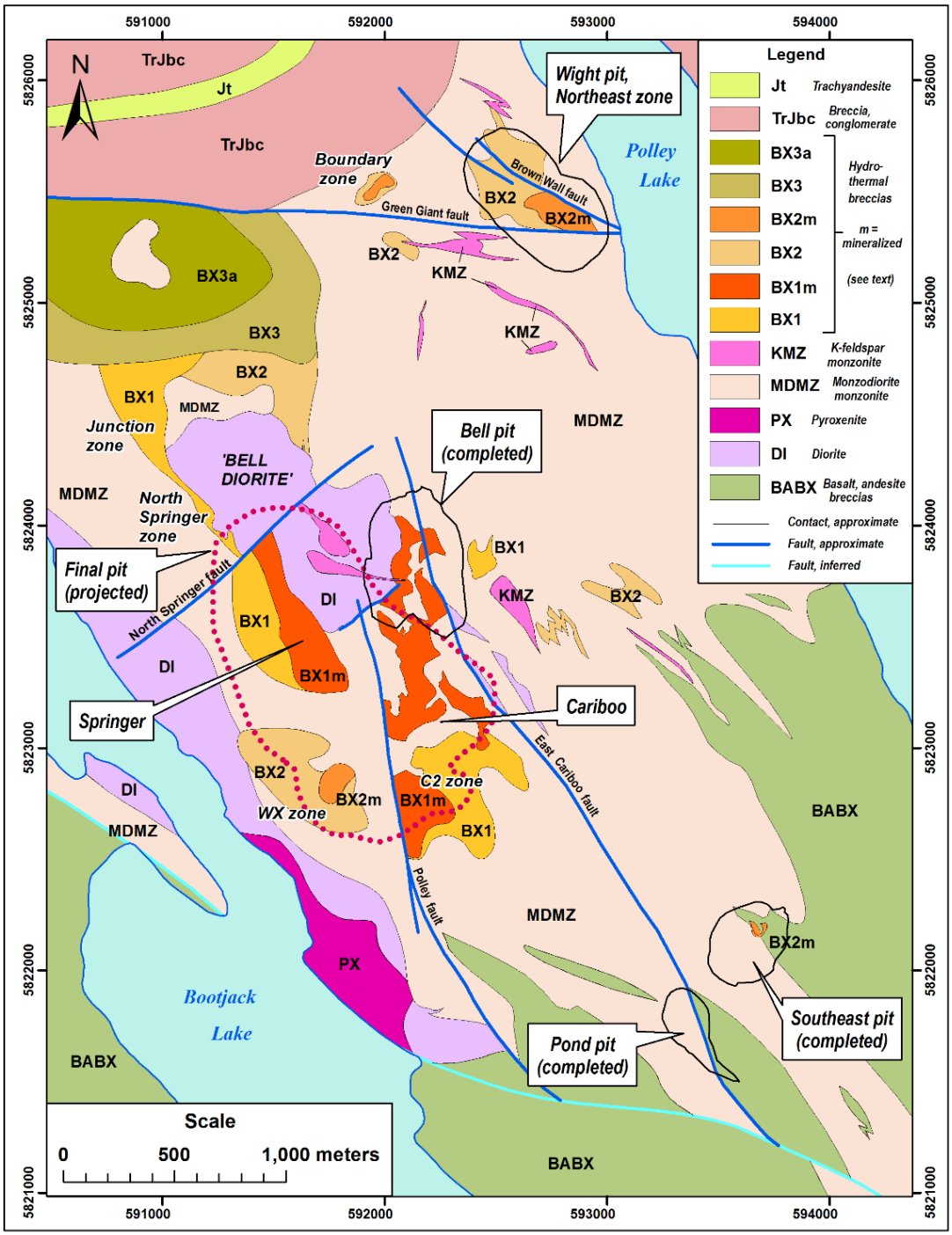

Sources: Rees (2013)

2.3 ML/ARD Management

2.3.1 Classification of Mine Waste

According to the *Mines Act* Permit M-200 (referred to as the M-200 Permit in this document), potentially acid generating (PAG) and ML materials are defined as:

- Neutralization potential (NP) is calculated using total inorganic carbon (TIC).
- Acid potential (AP) is calculated using total sulphur.
- All waste rock, quarry rock, borrow materials, and tailings are classified as PAG if they have an NP/AP ratio of less than 2.0.
- Borrow material or waste rock containing soluble metal levels (as determined by the shake flask test) higher than the receiving water objectives are defined as having potential for metal leaching.

2.3.2 Mine Waste Rock and Tailings Management

The M-200 Permit specifies the following requirements for waste management:

- Waste Rock
  - PAG waste rock can only be disposed in the Cariboo, combined Cariboo/Springer, Wight, and Southeast Zone pits, where it is submerged permanently beneath a water cover.
  - A maximum of 62 million tonnes of PAG waste rock can be stored in the Temporary NW PAG Stockpile.
  - Isolated pockets of PAG materials (less than 1,000 tonnes) may be blended with non-PAG materials within the waste rock dumps, at a minimum non-PAG:PAG ratio of 20:1.
- Quarry Rock
  - Quarry rock can be used as construction material in the TSF if the NP/AP is greater than 2.0 and the total copper solid concentration is less than 180 mg/kg.
- Tailings
  - PAG tailings may not be cycloned for use in dam construction.
  - Cyclone tailings must have an NP/AP ratio greater than 2.0.
  - Cycloned tailings may be used for construction of the following TSF components:
    - The upstream and downstream faces of the Perimeter Embankment.
    - The upstream side of the Main Embankment.
    - The maintenance of a till core in the Perimeter and Main Embankments.

The procedure used by MPMC to identify and segregate PAG waste rock is attached in Appendix A.

2.3.3 Waste Rock Inventory

Table 1 summarizes major waste rock disposal locations as of September 30, 2023, which are shown in Figure 1. The primary NAG rock disposal locations are the North Bell Dump, which includes backfill in the Bell Pit, the South East Rock Disposal Site (SERDS), which also includes the backfilled Southeast Zone and Pond Zone Pits, and the Northeast Zone (NEZ) Dump. NAG rock has been used for construction purposes (Waste Haul Road and the TSF). NAG rock from the open pits has been disposed at a variety of different locations resulting in waste rock dumps containing non-unique source materials. The exception is that the NEZ Dump received waste primarily from the Wight Pit.

As described in SRK (2016), prior to 2005 (i.e., before operations were re-started), limited PAG waste rock was mined and was dumped into the bottom of the Bell Pit. A small amount was dumped over the north end of the Cariboo Pit, but it was re-handled to the bottom of the Cariboo Pit. Acid-base accounting (ABA) analyses were performed by an external lab.

Since 2005, PAG waste rock has primarily been disposed in the Temporary NW PAG Stockpile (which includes the NAG/PAG Pad and called Ex-pit PAG in this report) which is planned to be backhauled to the Springer-Cariboo Pit at closure for subaqueous disposal. PAG rock has also been disposed sub-aqueously in the Cariboo Pit backfill and Southeast Zone Pit. PAG rock mainly originates from the Cariboo Pit and Springer Pit. The PAG waste rock in the North Bell Dump originated from the Southeast Zone Pit which was dominated by PAG waste rock.

An amendment to Mines Act Permit M-200 on July 8, 2009 allowed the placement of low sulphur (less than 0.3%) waste (LSW) as 2 m layers with Springer Zone NAG waste rock to create a NAG waste rock blend. The quantity of PAG rock mined from the Pond Zone was 6,615 t, which was disposed in a portion of the Northeast Zone Dump referred to as the Sandwich Dump.

2.3.4 Stockpiled Ore

Stockpiled ore is not classified by ARD potential, but the quantities are insignificant relative to waste rock. The current quantity of stockpiled ore is summarized in Table 2.

Table 1: Waste Rock Disposal Locations as of September 30, 2023

Placement Location	NAG		PAG	
	Mass (kt)	Percent of NAG	Mass (kt)	Percent of PAG
Bell Pit Rock Disposal	74,891	30%	530[1]	1%
Boundary Pit Rock Disposal	821	0.3%	-	0%
Temporary NW PAG Stockpile	7,461	3.0%	34,560	78%
East Rock Disposal Site	28,502	11%	-	0%
South East Rock Disposal Site	66,617	26%	-	0%
SERDS Co-Disposal	3,146	1.2%	-	0%
Northeast Zone Dump	34,590	14%	-	0%
Sandwich Dump	275[2]	0.1%	-	0%
Southeast Pit Backfill	36	0.01%	1,017[1]	2%
Wight Pit Backfill	363	0.1%	8,089	18%
Crusher Haul Road	4,116	1.6%	-	0%
SERD Lower Haul Road	6,953	2.8%	-	0%
TSF Access and Haul Roads	6,624	2.6%	-	0%
TSF Dam	15,230	6.0%	-	0%
Other (Minor Road Construction and Maintenance)	2,999	1.2%	-	0%
Total Tonnes	**252,625**		**44,197**	

Sources: MPMC, https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsx

Notes:

[1] Submerged.

[2] Includes 6,615 t of low sulphur waste from the Pond Zone.

Table 2: Stockpiled Ore Inventory

Stockpile	Mass (kt)
#1 Stockpile	70
Upper Super High Grade & High Oxide	12
Low Grade Stockpiles[1]	800
Springer Ore Muck (in pit)	162
#3 Stockpile	1,538
High Oxide	2,564
Total	**5,147**

Sources: MPMC, https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsx

Notes:

[3] Total of two low grade stockpiles.

2.4 Springer Pit Expansion

MPM is proposing to extend the LOM to 2032 by mining approximately 65 million tonnes of additional ore from an extension of MPM Site's existing pit infrastructure. The project will include the following modifications:

- **Pit and waste rock dump extensions:** extension of the existing Springer and Cariboo pits (i.e., into Springer Deep Zone, WX Zone, and C2 Zone) and associated waste rock dumps (SERDS and Temporary NW PAG Stockpile).
- **PAG waste rock disposal date:** To allow for mining to continue in the Springer Pit for the proposed LOM, the date in which the Springer-Cariboo Pit will be backfilled by PAG rock from the Temporary NW PAG Stockpile will need to be extended to December 31, 2034. This accounts for three years of rehandling PAG material (2032 to 2034).
- **Tailings storage expansion:** incremental expansion of the existing TSF to accommodate additional tailings form the extended mine life.

3 Geochemical Characteristics

3.1 Rock

3.1.1 Overview

Understanding of waste rock geochemical characteristics has been accumulated from a variety of sources including diamond drill core tested prior to mining, blast hole cuttings to inform waste rock management operations in the pit during operations, and post-depositional monitoring (Table 3). The database is dominated by the data gathered to operationally characterize waste rock in the Springer Pit, including the Springer Deep Zone. However, the database is incomplete because some of the earlier data were lost, and blast hole data are lacking for Cariboo Pit and Bell Pit. For Cariboo Pit and Wight Pit, confirmatory post-depositional data partly address this gap. For Cariboo Pit, data gathered to operationally characterize waste rock during more recent mining operations in the pit from 2016 – 2019 also addresses this gap.

Table 3: Static Test Inventory for Rock Samples with Known Source as of the End of 2022

Source	Drill Core	Blast Hole	Confirmatory[1]	Total
Boundary Zone	16	123	0	139
Bell Pit	0	78	25	103
Wight Zone	102	0	0	102
SE Zone	52	132	0	184
Pond Zone	27	174	0	201
Springer Pit	131	4,929	9	5,069
Cariboo Pit	1,004	2,877	60	3,941
C2 Pit	604	0	0	604
Springer Deep	16,391	0	0	16,391
WX Zone	5,267	0	0	5,267
Total	23,594	8,313	94	32,001

Source: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/[Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsm]

Notes:

[1] Includes blast muck and post-depositional samples where source of rock is known.

The inventory primarily contains static ARD potential data, though trace element scans are also available for all zones except the Boundary Pit. Drill core analyses were primarily performed by off-site laboratories and included total sulphur, sulphate, sulphide by difference, total carbonate, neutralization potential (NP by Sobek method), and paste pH. For some samples, a trace element scan was performed. On-site tests were total sulphur and total carbon. The former is assumed to be a proxy for sulphide sulphur because other forms of sulphur (including sulphate) are not common at MPM. The

latter is assumed to be a proxy for reactive carbonate minerals. The assumption is supported by the observed dominance of calcite, the lack of reported iron carbonate and the strong correlation and equivalence of total carbon and total inorganic carbon (TIC) (Figure 3). The dominant plutonic geological setting supports the lack of non-carbonate carbon. As TC equals TIC, NP is represented by carbonate content as represented by TC (NP*).

Figure 3: Comparison of Total Carbon and Total Inorganic Carbon

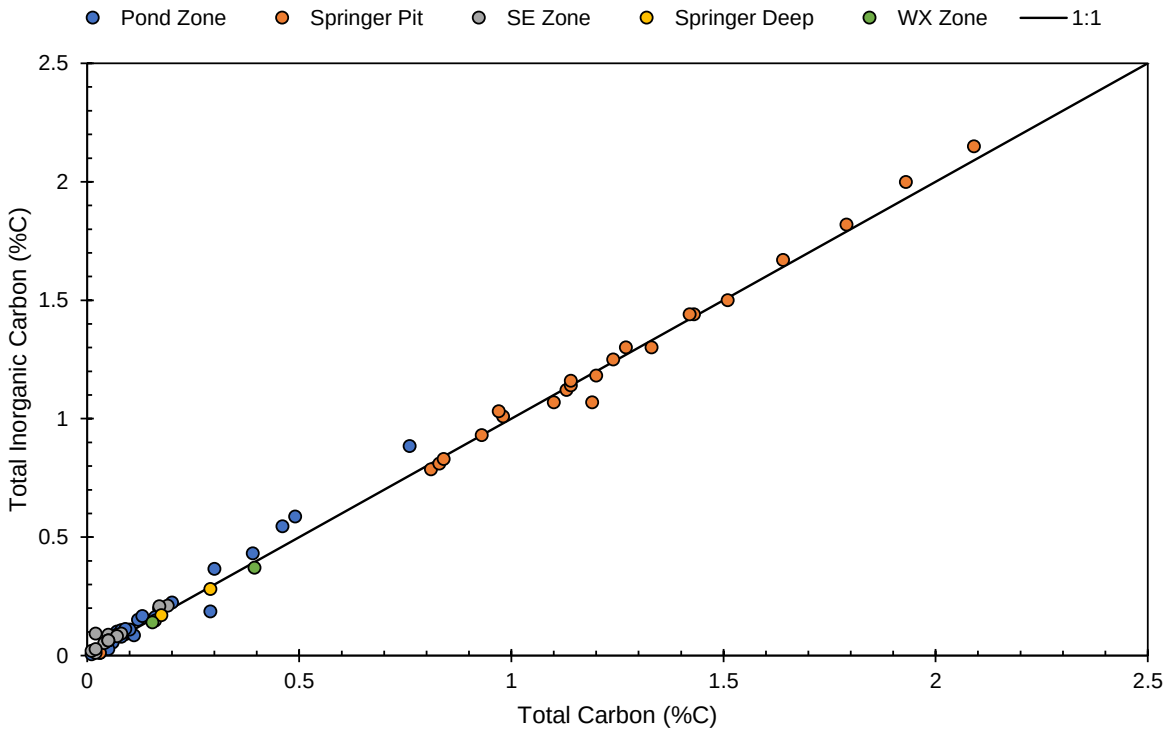

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3.1.2 ARD Potential

Figure 4 shows the distribution of total sulphur and sulphate by zone. Sulphate concentrations are uniformly low (averages near the detection limit of 0.01%) with no substantial differences between zones. Total sulphur, which therefore provides an approximation of sulphide content, shows some differences by zone as there is variability in higher end concentration values (95th percentiles range from 0.08% to 2.5%). The Southeast Zone and Wight Zone have the highest mean total sulphur concentrations at 0.79% and 0.77%, respectively, whereas C2 Pit and Cariboo Pit have the lowest at 0.029% and 0.098%. No sulphate data were available for the Boundary Zone, C2, Springer Deep, and WX Zone.

Figure 4: Total Sulphur (Top) and Sulphate (Bottom) Distributions by Zone

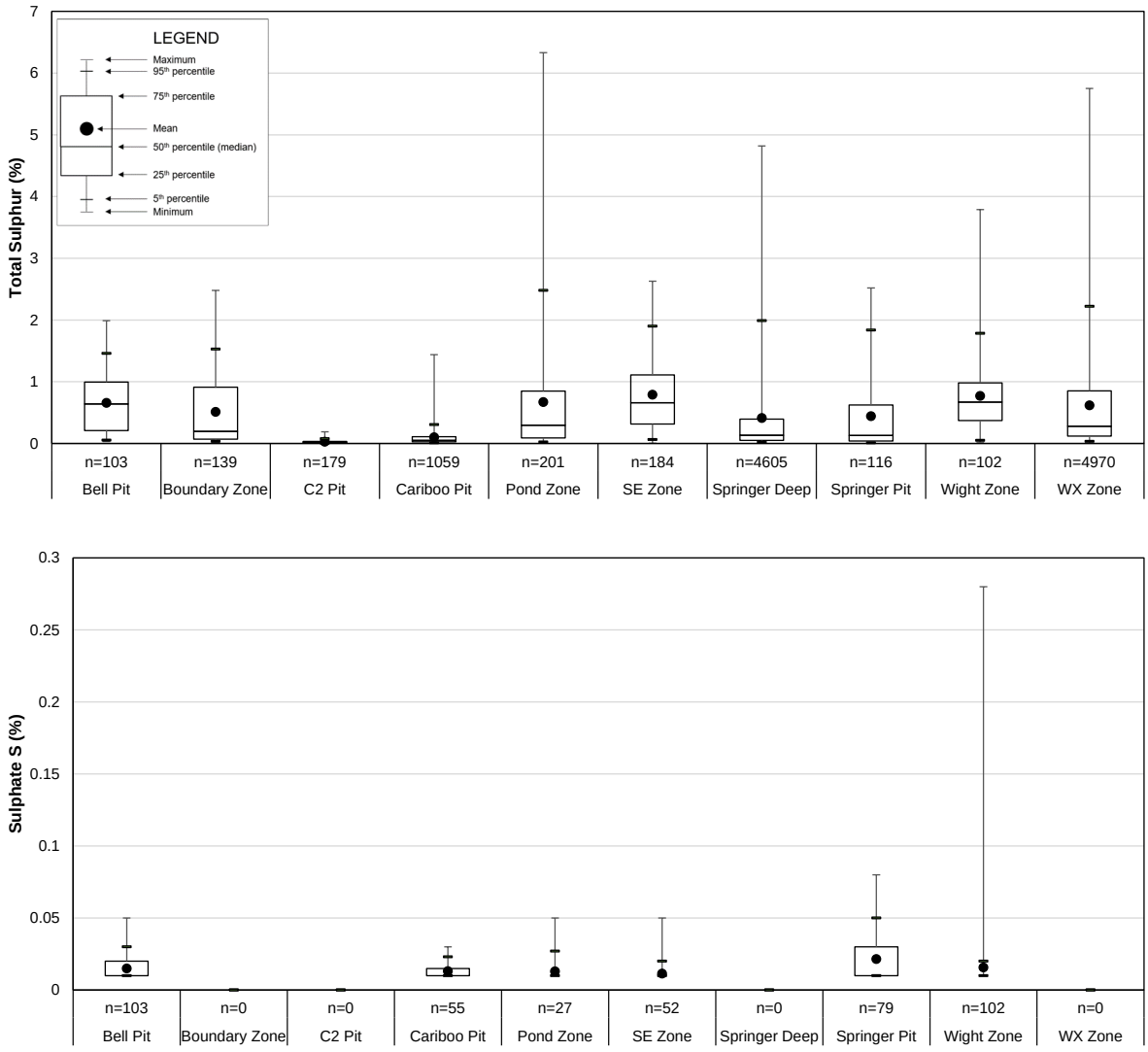

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/[Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsm]

Comparison of carbonate content with NP shows that, except for few samples, Sobek NP exceeds TIC (Figure 5). This reflects the digestion of silicates during the NP determination. The difference between NP and TIC varies by zone. The skarn mineralization of the Pond Zone shows the greatest NP relative to TIC reflecting the presence of epidote that digests more readily in acid than feldspars which dominate in the other rock types. The Springer Pit (including Cariboo Pit backfill samples), the Southeast Zone and the Cariboo Pit show the next greatest difference followed by the Wight Zone, and the Bell Pit.

The difference between NP and TIC at MPM led to the adoption of total carbon as a proxy for TIC content rather than relying on NP (see Figure 6). Comparison of AP and TIC for drill core samples

shows that the Southeast Zone is dominantly PAG whereas the Wight Zone, the Cariboo Pit, and the C2 Pit are dominantly NAG (Figure 6). Other zones show characteristics overlapping the NAG and PAG, including the Springer Deep and WX zones, which were plotted individually due to a large number of data points for these localities (Figure 6).

Figure 7 shows results of blast hole sampling for comparison. Bell Pit blast hole data are presented as part of the above descriptions because pre-mining ABA data were not available. The presence of PAG rock in all zones is apparent and resulted in segregation. This figure illustrates that for the most part, PAG rock has higher sulphide content than NAG rock because TIC-NP is relatively consistent regardless of sulphide content.

Figure 5: Sobek Neutralization Potential Versus Total Inorganic Carbon by Zone

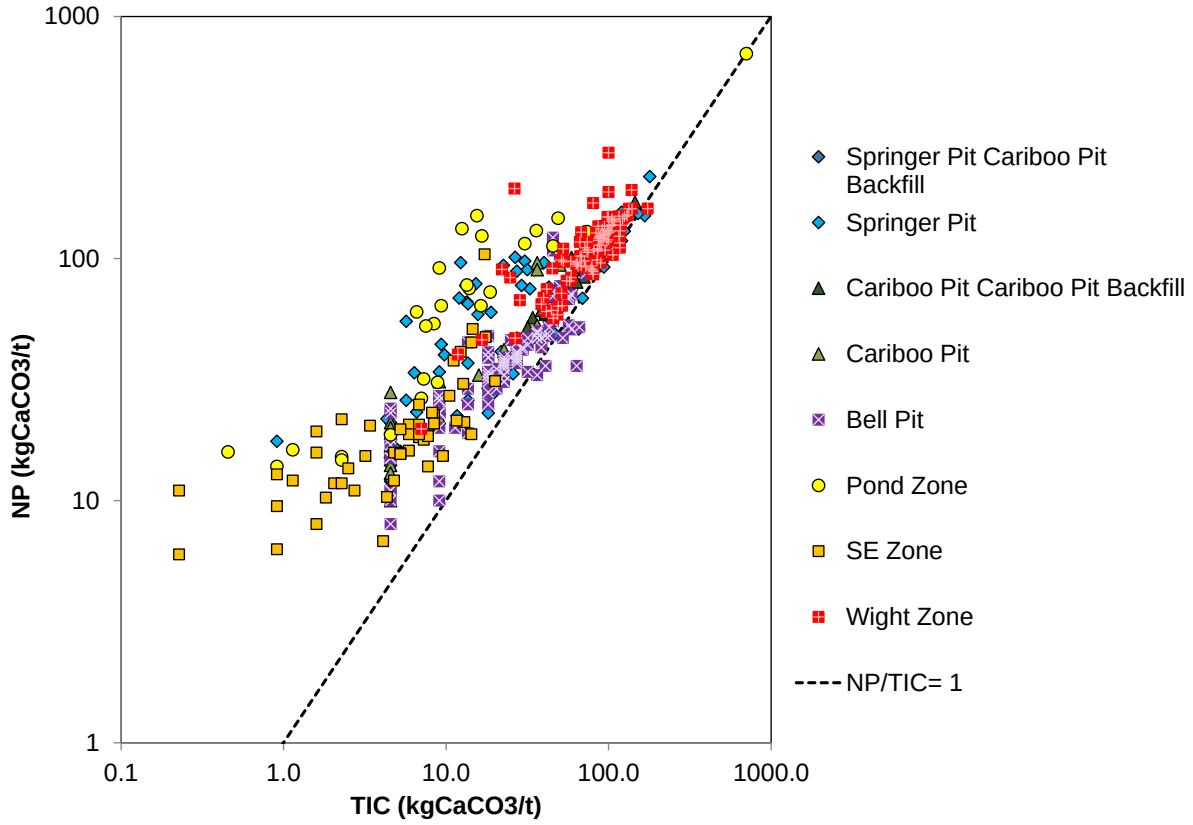

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/[Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsm]

Figure 6: Total Inorganic Carbon versus Acid Potential of Drill Core Samples from Springer Deep (top left), WX Zone (top right), and All Other Zones (bottom)

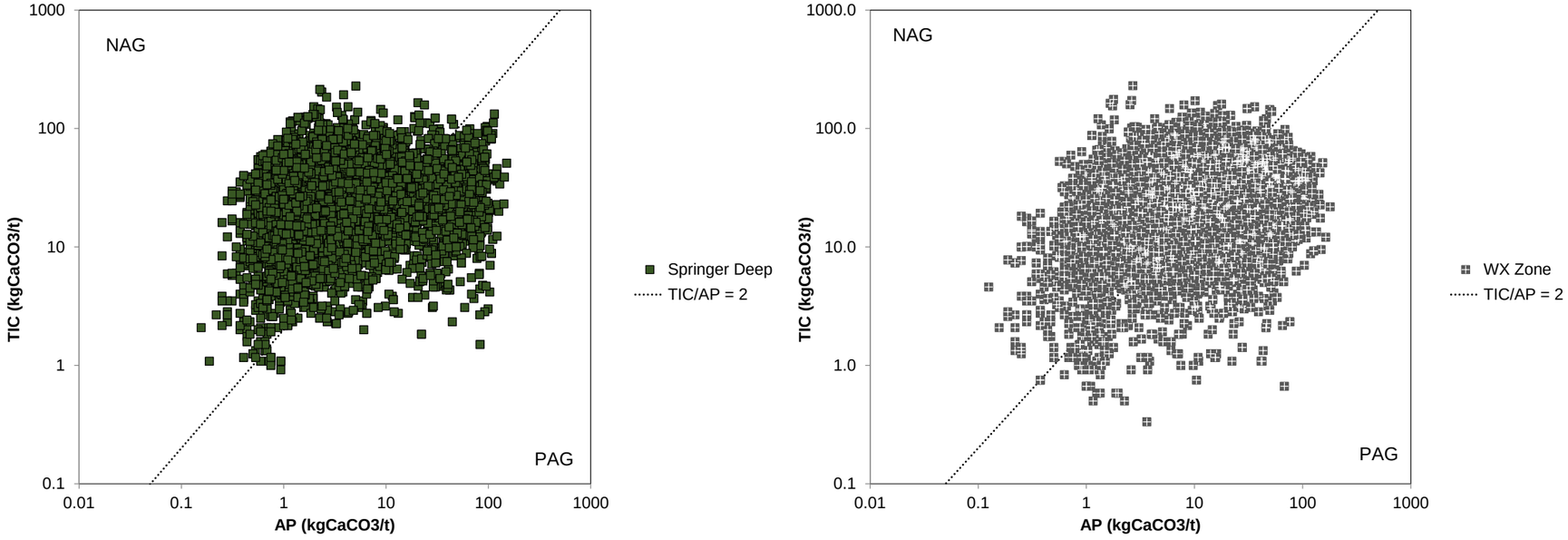

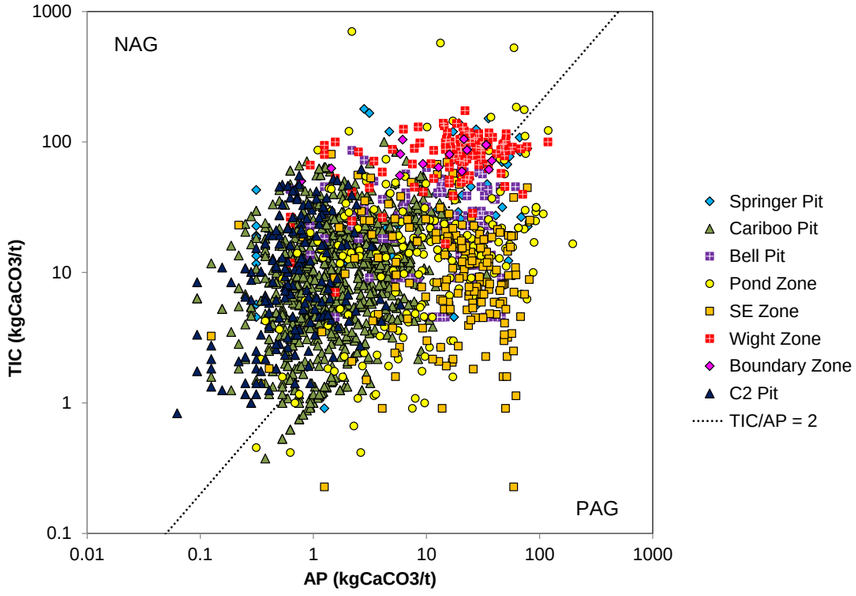

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Figure 7: Total Inorganic Carbon versus Acid Potential of Blast Hole Samples from Springer Pit (top right), Cariboo Pit (top left), Boundary Zone (bottom left), Southeast Zone (bottom middle), and Pond Zone (bottom right)

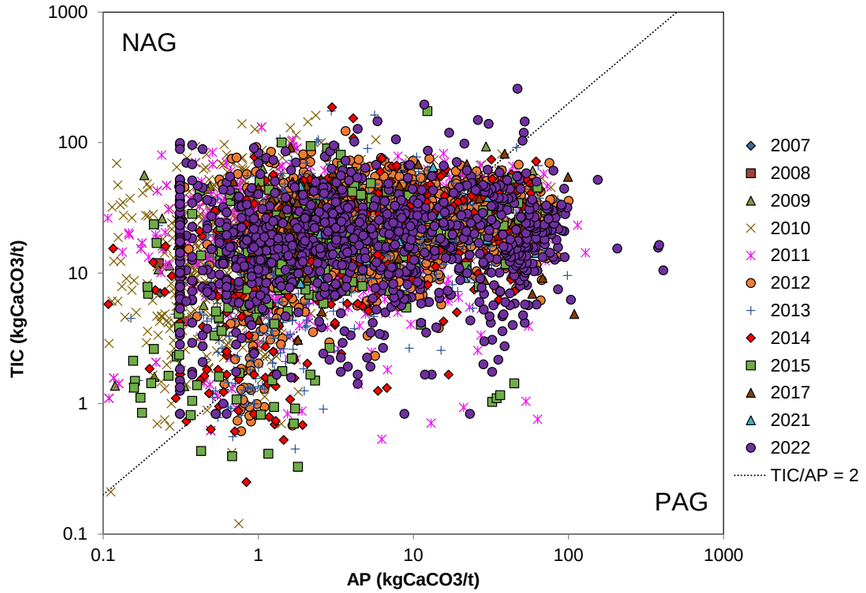

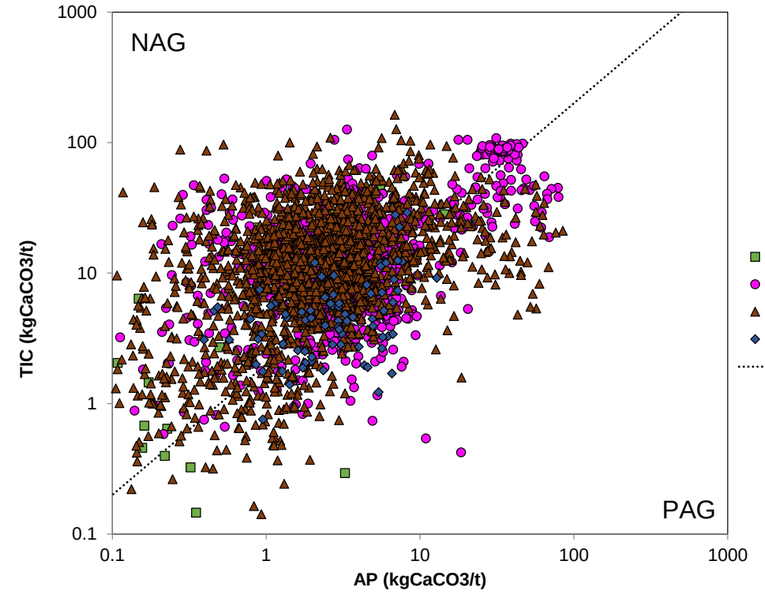

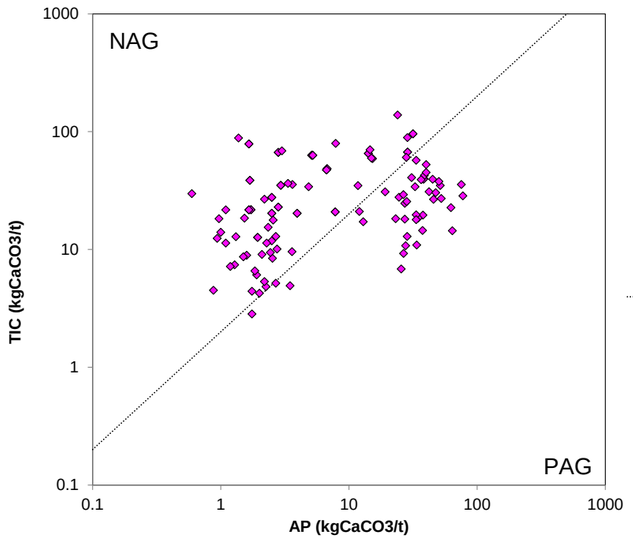

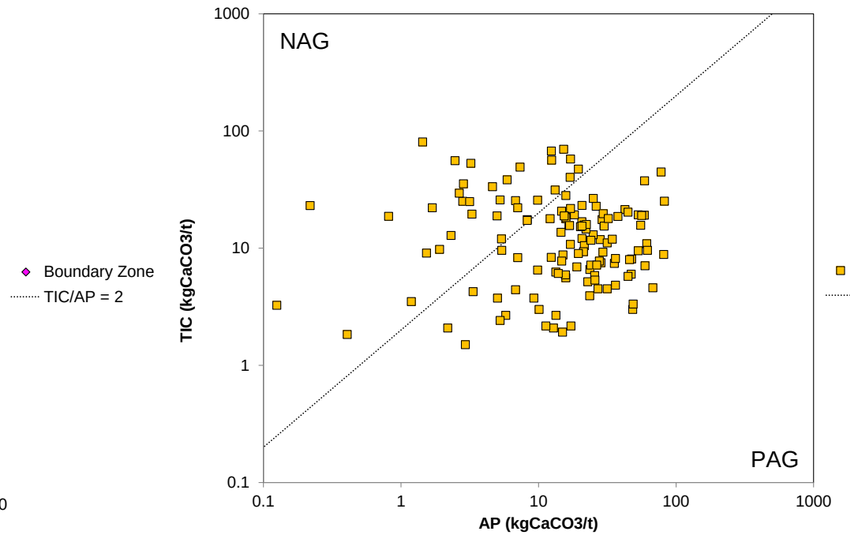

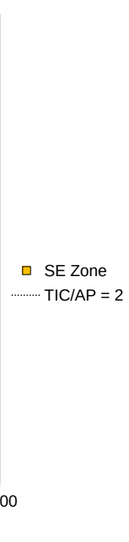

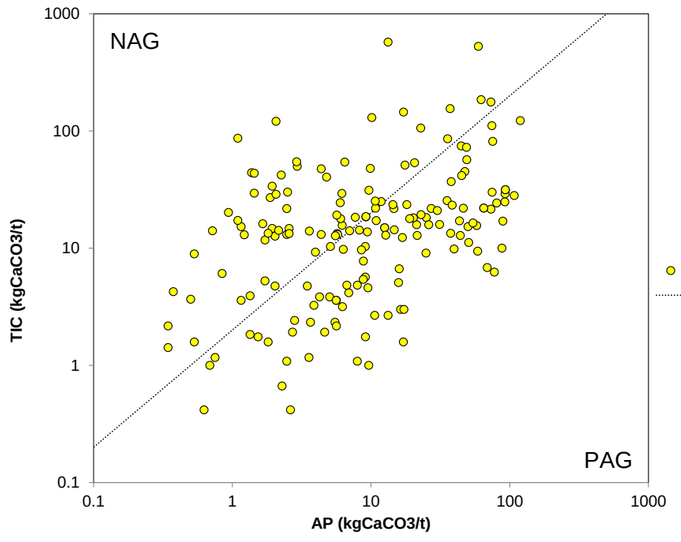

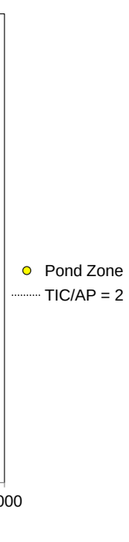

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3.1.3 Trace Element Content

When compared to the global average for igneous rocks (Price 1997), some of the rocks (greater than 75% of samples) at MPM have concentrations an order of magnitude higher for antimony, arsenic, copper, molybdenum, selenium, and silver. Median copper concentrations exceed this threshold in the Bell Pit, Cariboo Pit, Pond Zone, Springer Pit, and Wight Zone. Median selenium concentrations exceeded this threshold in the Bell Pit, Cariboo Pit, Pond Zone, and Southeast Zone. Trace element data were not collected for the Boundary Zone and C2 Pit, and copper and selenium concentrations were not available for Springer Deep or WX Zone. Copper concentrations correlate with selenium concentrations (Figure 8).

Within the site, selenium concentrations were elevated in the Cariboo Pit and Springer Pit rocks and lowest at the Wight Pit (Figure 9). Selenium-to-sulphur ratios were examined because selenium is typically released by oxidation of sulphide and the ratios can be indicative of differences in selenium release. The ratio is notably higher for the Cariboo Pit and Springer Pit, intermediate for the Bell Pit and Pond Zone and lowest for the Southeast Zone and Wight Zone (Figure 10). The distributions imply spatial zoning of selenium relative to sulphide. Selenium data were not collected for Boundary Zone, C2 Pit, Springer Deep, and WX Zone.

Figure 8: Copper Concentrations Versus Selenium Concentrations (All Zones)

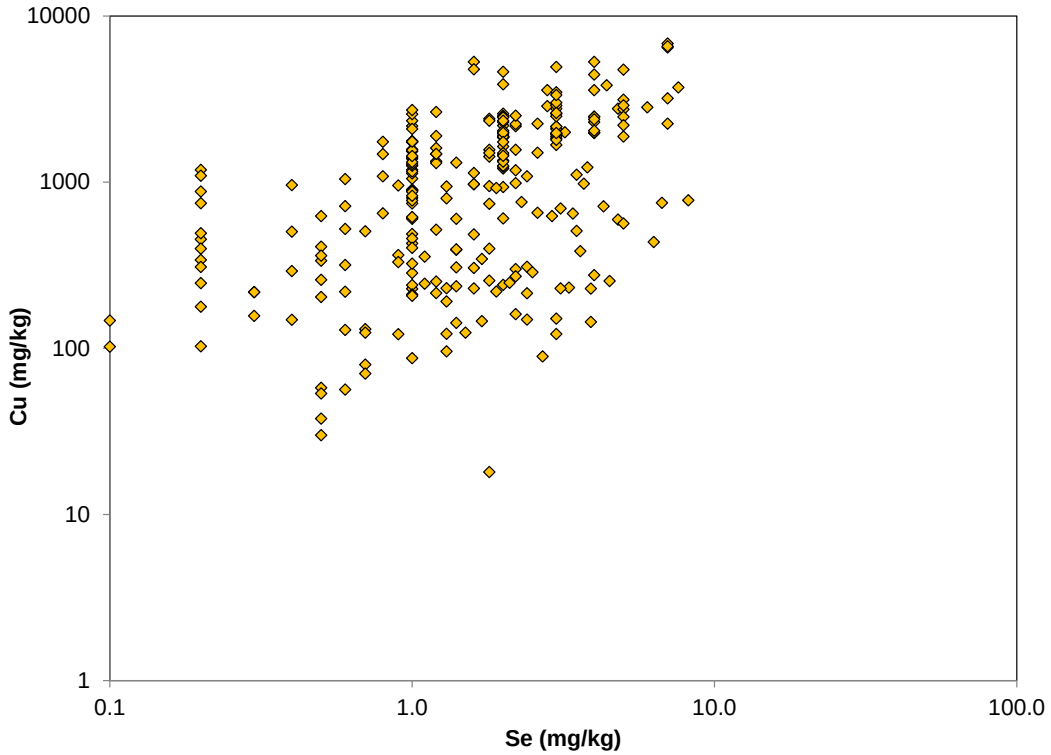

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/[Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsx]

Figure 9: Box and Whisker Distribution for Selenium Content

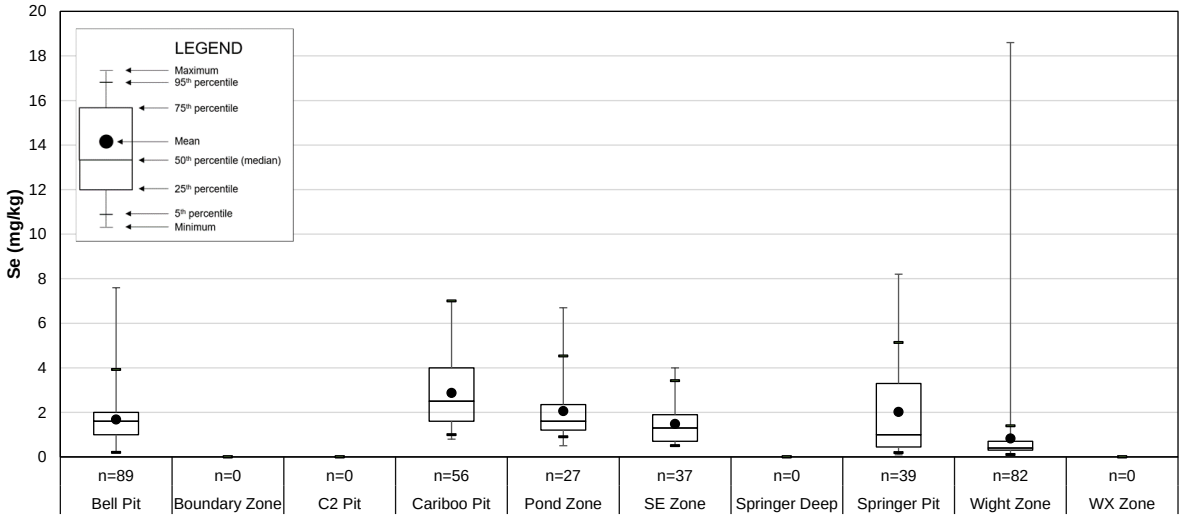

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Figure 10: Box and Whisker Distribution for Selenium-to-Sulphur Ratios

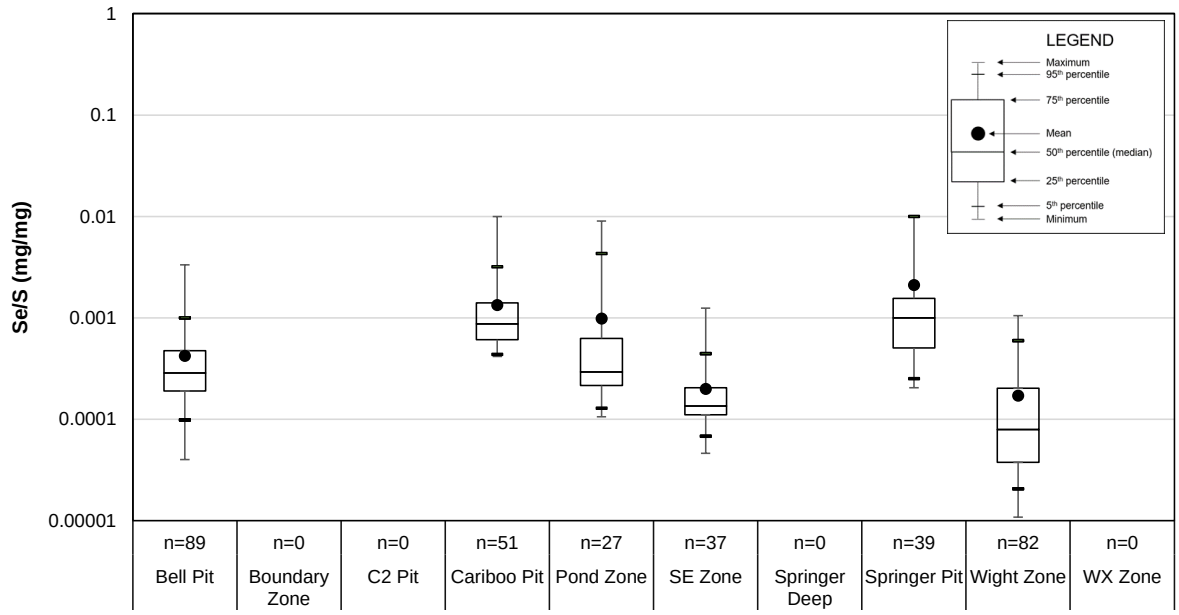

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3.1.4 Extraction Tests

The Mines Act Permit M-200 amended on August 2, 2000 required that “oxidized” samples be tested for solubility using the Shake Flask Extraction (SFE) method of Price (2009). The definition of oxidized was not provided in the permit. Nine samples of the -2 mm fraction of blasted rock were submitted for the procedure in 2001. Eight samples of ore stockpile rock were also tested in 2015 as part of a Mines Act Permit M-200 requirement to evaluate closure requirements for the stockpiles (SRK 2015b).

Leachates from all extraction tests were non-acidic with leachate chemistry dominated by sulphate, alkalinity, and calcium. The 2015 tests were more useful than the 2001 tests for understanding trace element leachability due to the use of lower detection limits and testing of stockpiled waste rock. Average arsenic, copper, molybdenum and selenium concentrations were 4, 5, 29 and 15 µg/L, respectively. A number of trace elements were not detected or yielded concentrations close to detection limits including cadmium (0.05 µg/L), chromium (0.5 µg/L), cobalt (0.1 µg/L), lead (0.1 µg/L), mercury (0.05 µg/L), nickel (0.5 µg/L) and zinc (10 µg/L).

3.1.5 Kinetic Testing

Laboratory kinetic (humidity cell) tests were performed on nineteen samples in support of geochemical characterization for permitting of mining of the Wight Pit (Northeast Zone), Southeast Zone, Boundary Zone, Pond Zone, an earlier expansion of the Springer Pit, Springer Deep, and WX Zone (Table 4). Results have been reported annually as part of Mines Act Permit M-200 requirements. The samples were generally selected to evaluate oxidation rates for typical and elevated sulphide concentrations.

Samples from the Pond Zone were submitted for an acid-leaching procedure to remove carbonate and evaluate the reactivity of silicate minerals.

Table 4: Characteristics of Samples in Waste Rock Humidity Cells

HCT	Sample ID	Zone	Rock Type[1]	Date Started	Date Stopped	Paste pH	TIC	Total S	SO4-S	AP	NP	NP/AP	TIC/AP	Ag	As	Ca	Cd	Co	Cu	Hg	Mg	Mn	Mo	Ni	Pb	Sb	Se	V	Zn
							%C	%	%S	kg $CaCO_3$/t	kg $CaCO_3$/t			ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
HC2	31576	NE	PPp	7/21/2004	1/7/2013	8	0.79	1.4	<0.01	44	83	1.9	1.5	0.4	19	3.0	1.1	8.7	330	0.57	0.6	1400	13	1.2	38	0.3	0.7	85	170
HC3	32491	NE	Bx	7/21/2004	8/11/2008	8.3	1.1	0.45	<0.01	14	140	10	6.4	1.1	12	4.4	0.6	19	1700	0.39	1.3	1900	5.8	3.3	17	0.2	1	260	150
HC4	31943	NE	Bx	7/21/2004	8/11/2008	8.4	1.1	0.99	<0.01	31	130	4.1	2.9	1.2	10	4.2	0.9	20	1300	0.25	0.7	2000	7.6	4.2	21	0.3	1.4	210	170
HC5	32519	NE	PPp	7/21/2004	8/11/2008	8.6	0.62	0.54	<0.01	17	88	5.2	3.1	0.7	18	3.4	0.1	14	1700	0.19	1.2	1400	1.9	4.1	13	0.5	1.3	200	100
HC6	SE-05-17 Comp #1	SE	MZ	9/26/2005	1/7/2013	8.4	0.12	0.72	<0.01	23	21	0.91	0.43	0.3	17	0.87	<0.1	8.1	710	0.1	0.6	420	170	1.7	7.6	0.7	0.9	88	34
HC7	SE-05-30 Comp #1	SE	MZ	9/26/2005	1/7/2013	8.7	0.12	0.37	<0.01	12	40	3.5	0.85	<0.1	15	1.7	0.1	11	180	0.02	0.9	480	6.1	12	10	0.4	0.5	110	30
HC8	SE-07-66-72.5-75.13	SE	-	8/11/2008	1/7/2013	9.2	0.082	1	0.01	32	19	0.59	0.21	0.12	10	1.3	0.1	7.9	160	0.02	0.9	460	6	2.7	7.5	0.92	1.5	100	40
HC9	476111	Springer	-	8/11/2008	10/6/2009	7.9	0.011	0.04	0.01	0.94	18	19	0.97	0.34	11	1.7	0.42	21	710	0.08	1.3	1100	1.1	9.3	7.8	0.21	0.5	160	89
HC10	146677	Boundary	-	8/11/2008	10/6/2009	8.4	2	0.1	0.01	2.8	150	53	59	0.13	14	6.3	0.21	30	510	0.04	1.5	2800	1.4	12	7.8	0.64	0.7	160	110
HC11	146794	Boundary	-	8/11/2008	10/6/2009	8.4	1.4	0.15	0.01	4.4	160	35	27	0.17	17	4.7	0.37	23	250	0.12	1.2	2300	3	9.2	10	0.54	1.3	150	110
HC12	50033-1; Composite-4	Pond	MZ	4/20/2009	6/8/2009	6.6	<0.01	0.51	<0.01	16	8.4	0.53	<0.03	0.48	14	1.2	0.15	10	340	0.02	0.7	610	4.9	4.7	5.7	0.37	1.9	66	47
HC13	50033-1; Composite-5	Pond	DI	4/20/2009	Ongoing	7.7	<0.01	0.19	<0.01	5.9	7.9	1.3	<0.08	0.25	12	0.89	0.11	8.8	250	0.01	0.6	520	3.5	4.1	6	0.4	1.2	65	49
HC14	465240; SD-07-23	Springer	BX	10/12/2009	1/7/2013	8.1	0.48	0.39	-	12	96	7.9	3.3	0.62	34	2.6	0.98	14	720	0.4	1	1500	6	2.8	10	0.28	4.3	130	86
HC15	475695; SD-07-48	Springer	DI	10/12/2009	1/7/2013	8.1	0.27	2.5	-	79	94	1.2	0.29	0.88	18	2.3	0.09	20	780	0.02	1	500	18	5	11	0.07	8.2	150	41
HC16	480684; SD-07-57	Springer	MZ	10/12/2009	1/7/2013	8.9	0.14	0.06	-	1.9	69	37	6.4	0.52	13	2.2	0.43	14	360	0.14	0.7	730	3.5	2.4	10	0.16	0.5	130	92
HC17	HC-17 SD MZ	Springer Deep	MZ	8/5/2022	Ongoing	8.8	0.28	1.4	0.03	43	32	0.75	0.55	0.41	18	3.2	0.28	17	519	0.1	0.86	556	39	4.0	15	0.3	6.0	146	53
HC18	HC-18 SD FBXm	Springer Deep	FBXm	8/5/2022	Ongoing	8.8	0.17	2.0	0.02	61	36	0.59	0.23	0.61	20	1.5	0.19	28	1368	0.1	1.6	626	47	5.0	5.9	0.5	8.0	205	49
HC19	HC-19 WX MZ	WX	MZ	8/5/2022	Ongoing	8.6	0.14	2.0	0.03	63	23	0.36	0.19	0.36	11	2.3	0.3	12	577	0	0.82	430	36	1.0	14	0.1	5.0	152	53
HC20	HC-20 WX FBXm	WX	FBXm	8/5/2022	Ongoing	8.5	0.37	2.5	0.02	78	40	0.51	0.39	0.43	15	2.7	0.17	14	830	0.2	0.89	611	44	2.0	11	0.4	7.0	144	45

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Report_Tables_CAPR002434_Rev01_KWJ.xlsm

Notes:

[1] Rock types for some humidity cells were not recorded. PPp = Plagioclase porphyry, Bx = Breccia, DI = Diorite, Monz = Monzonite, FBXm = Monzonite breccia.

One Pond Zone test is continuing. Two Springer Deep tests and two WX Zone tests were initiated in August 2022 and are continuing. The other tests ran for 1 to 9 years. General findings were as follows:

- Except for the Pond Zone tests which were artificially depleted of carbonate to induce acidification, no other tests generated acid. Six samples were classified as PAG from ABA but carbonate content prevented acid generation for the duration of the test. Preliminary tests of Springer Deep and WX Zone rock classified as PAG have not generated acid as of 44 weeks.
- Sulphate release was strongly correlated with sulphur content regardless of zone (Figure 11).
- There was a lack of correlation between trace element content and trace element release rates, and sulphide content and trace element content.
- Comparison of relative utilization of carbonate minerals to oxidation rates indicated that an NP/AP ratio of 2 or lower is appropriate for classification of ARD potential.

Figure 11: Correlation of Sulphur Content with Oxidation Rate for Waste Rock Humidity Cells

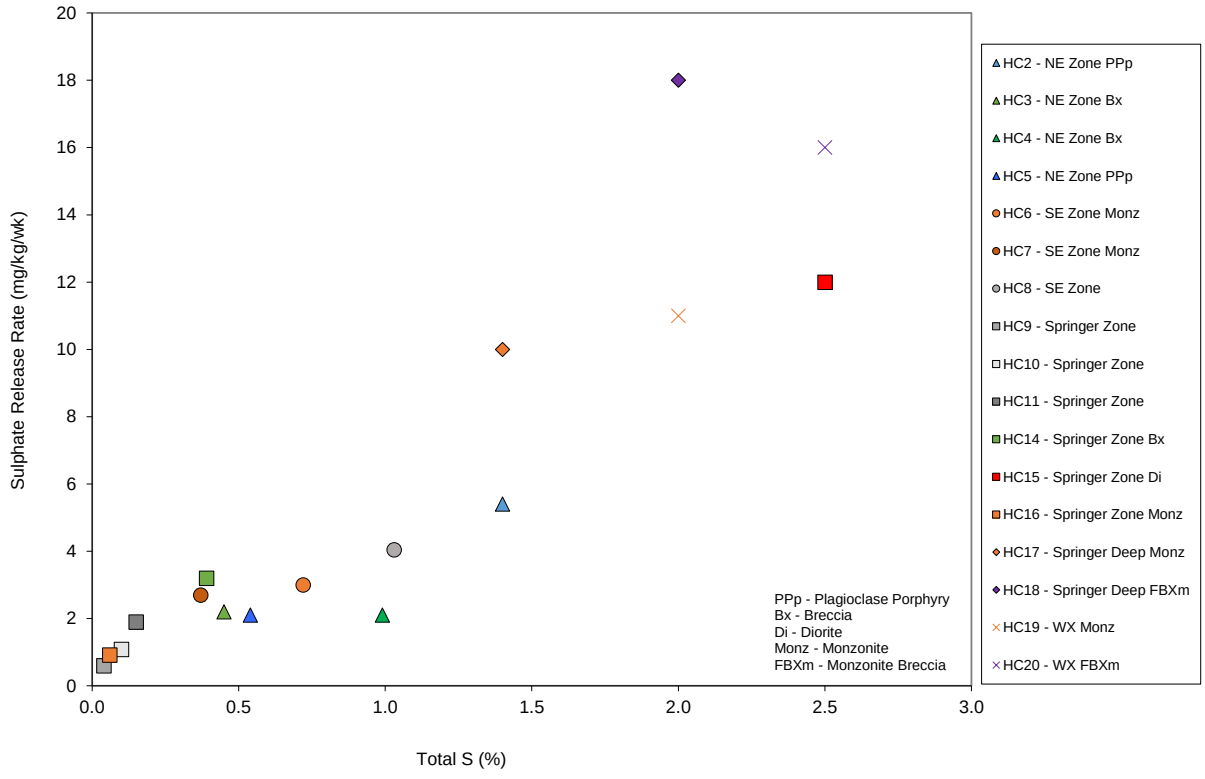

Sources: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/!020_Project_Data/030_Lab Data/Kinetic Data/Calculations/[Mt_Polley_HCT_WR_Outcomes_1CM017.011_rtc_rev00.xlsx]

Determination of Critical NP/AP

The current operational NP*/AP for classifying waste rock as NAG (or non-PAG) is specified in the Permit as 2. However, the critical NP/AP ratio (NP/AP_{crit}) can be developed using data from humidity cell tests. NP/AP_{crit} was derived from the comparison of cation release ratios and sulphate release rates (Figure 12).

Cation release ratios reflect carbonate dissolution, while sulphate release rates reflect sulphide oxidation. The trend of these data approaches a cation release ratio value between 1 and 2 and none of these cells have generated acid thus far. Relative rates expressed as the molar ratio of the stable release rates of the four cations to sulphate [$(Ca+Mg+0.5Na+0.5K)/SO_4$] mol/mol were used directly to estimate the NP/AP_{crit} for the waste rock. These ratios were compared to sulphate release rates from the HCTs to differentiate between dissolution of carbonates by sulphuric acid (from pyrite oxidation) and by carbonic acid (formed by carbon dioxide dissolved in the deionized water). The consideration of Na and K reflects the potential for Ca and Mg liberated by carbonate dissolution to exchange with Na and K in phyllosilicates. The release rate for Na and K are halved to account for their lower charge. Inclusion of Na and K also limits the possibility of under-stating carbonate mineral utilization thereby resulting in a lower NP/AP_{crit}.

At low oxidation rates (lower sulphate release), the dominant process in the test is assumed to be dissolution of carbonates by carbonic acid and the $(Ca+Mg+0.5Na+0.5K)/SO_4$ ratio is high. As the influence of sulphide oxidation increases (shown by increase in sulphate release), the $(Ca+Mg+0.5Na+0.5K)/SO_4$ ratio greater reflects the interaction of sulphuric acid with carbonates which is the expected dominant process at full scale in waste rock dumps.

A lack of testing on samples with high oxidation rates hampered previous estimations of NP/AP_{crit} (SRK 2016). The initiation of the four HCTs in 2022, which have run for 48 weeks thus far, all have higher oxidation rates than previous HCTs and were used to define $NP/AP_{crit.}$ SRK recommends defining NP/AP_{crit} of 1.6 based on the new HCTs.

Figure 12: Cation Release Ratio versus Oxidation Rate

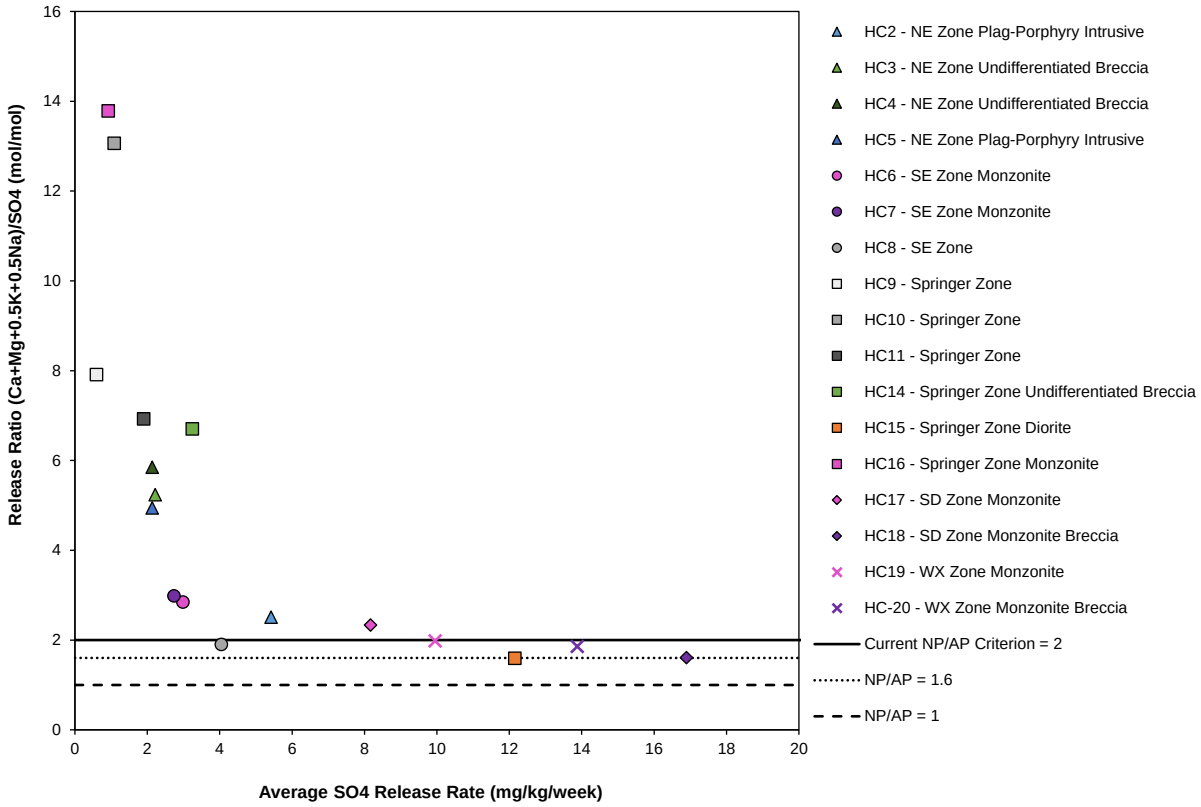

Sources: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/!020_Project_Data/030_Lab Data/Kinetic Data/Calculations/[Mt_Polley_HCT_WR_Outcomes_1CM017.011_rtc_rev00.xlsx]

Delay to Onset of Acid Generation

Following the same method used in SRK (2016) and SRK (2010), the straight-line average of the correlation between initial NP/AP (i.e., at time = 0, NP/AP_0) and calculated time for the onset of acidification (t_{onset}, in years) for all humidity cells from MPM was updated using NP/AP_{crit} of 1.6:

$$t_{onset} = 63 \times \left(\frac{NP}{AP}\right)_0$$

The equation indicates that a sample with NP/AP of 1 might be expected to generate acid in 63 years. The calculated lower 95% confidence on the 63 years coefficient was 55 years.

To estimate the exposure time PAG waste rock can be stored sub-aerially before the onset of acidification, t_{onset} (average and lower 95% confidence limit) was calculated for samples classified as PAG from the MPM blast hole database. A temperature correction of 0.3 to reflect slower reaction rates under cooler site conditions was included in the calculation.

Figure 13: Distribution of t_{onset} for PAG Waste Rock at Mount Polley Mine

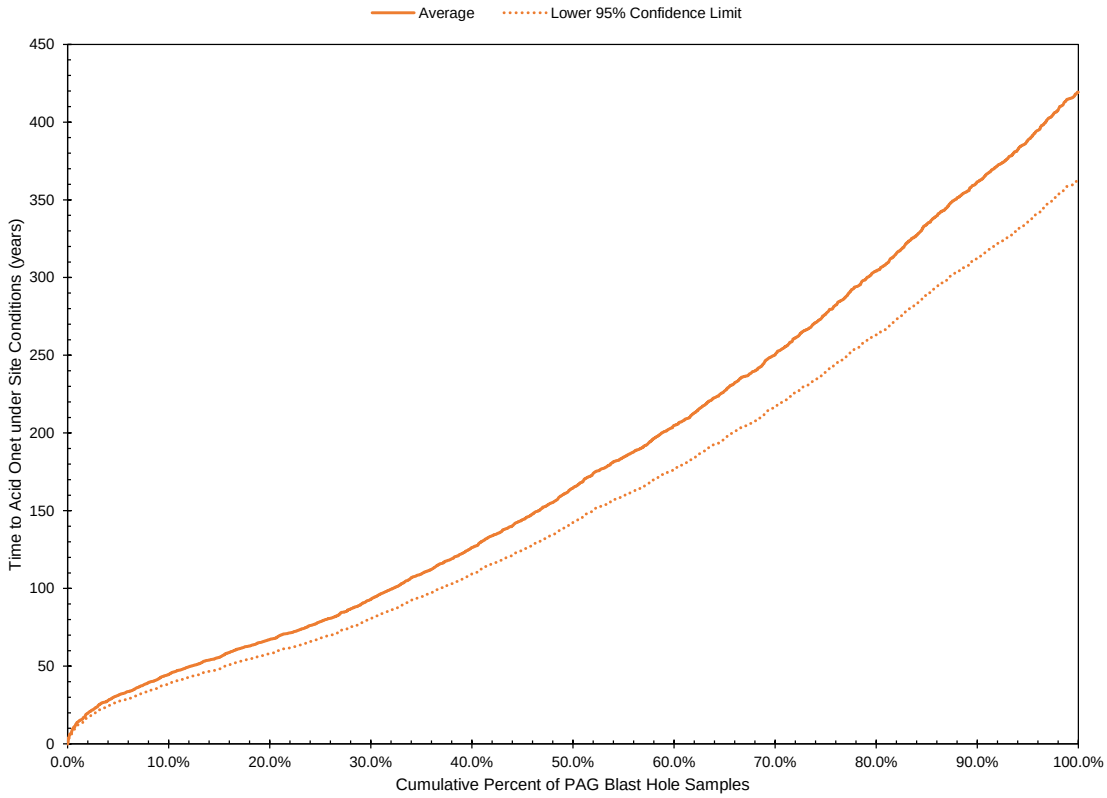

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/TimeOnset_CAPR002434_Rev00_SJL.xlsx

The distribution for faster-reacting components represented by the lower dashed line indicates that about 2% of the rock might become acidic in 20 years, and 10% after 40 years. The majority of the rock with higher NP/AP might take over 100 years to become acidic A number of factors complicate the actual estimate for higher NP/AP materials. Increasing acidification along with heating would result in accelerated oxidation and NP depletion though decreasing oxidation rates due to sulphide depletion and formation of secondary mineral coatings would result in lower oxidation rates and greater time to onset of acidic conditions.

The general finding from the kinetic testing is that acidification of PAG materials at MPM will take on the order of decades to centuries to develop. This is consistent with the widespread pH neutral weathering conditions at MPM in both natural and mined materials. Initial mining at Mount Polley was 25 years ago but waste rock has not acidified.

The Temporary NW PAG Stockpile contains less than 0.1% of rehandled PAG waste rock that was mined between 2001 – 2007 and initial construction of the NAG/PAG Pad began in 2011 (12 years ago). The Springer Pit Expansion Project proposes to rehandle PAG waste rock stored in the Temporary NW PAG Stockpile starting in 2032 and finishing by the end of 2034. Based on the assessment above, the risk of developing widespread acidic conditions within this timeframe is low (24 years after initial construction of the Temporary NW PAG Stockpile).

3.2 Tailings

3.2.1 Overview

A summary of available data is presented in Table 5. Monthly composite samples of tailings have been collected in the mill when processing since 1997. Tailings samples were also collected from the banks of Hazeltine Creek in 2014 after the TSF breach ("spilled tailings") along eighteen parallel transects oriented perpendicular to the course of Hazeltine Creek, as described in SRK (2015a). Two types of tailings-bearing samples were observed along Hazeltine Creek. They were classified in the field as 'grey tailings' and 'magnetite sands'. This classification was based on physical and mineralogical characteristics as follows:

- Grey tailings were dominantly grey in colour and had a finer texture (silty sand) than the magnetite sands. They had a strong reaction (referred to as "fizz") with 10% HCl and did not contain sulphide minerals that were visible by examination with a hand lens. Mineral identification was difficult due to small grain size, but the dominant minerals included potassium feldspar and plagioclase, with minor biotite mica and quartz.
- Magnetite sands were speckled pinkish-orange and black. They were strongly magnetic and coarser (sand) than the grey tailings. They had weak fizz and trace (less than 1%) sulphide minerals were infrequently noted. The dominant minerals identified included plagioclase feldspar and magnetite. Biotite mica and quartz appeared more abundant than in the grey tailings.

Similar to waste rock, total sulphur is assumed to be a proxy for sulphide sulphur because other forms of sulphur are not common in Mount Polley tailings (SRK 2015a).

Table 5: Static Test Inventory for Tailings

Tailings Type	Number of Samples
Monthly Composite – Final Tailings	166
Grey Tailings	40
Magnetite Sand	20
Grey Tailings/Magnetite Sand Mix	8

Source: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsm

3.2.2 ARD Potential

ARD potential of tailings is assessed based on sulphide content (approximated from total sulphur) and NP derived from TIC. The resulting TIC/AP is used to classify Mount Polley tailings as PAG (TIC/AP ≤ 2) or NAG (TIC/AP< 2).

Sulphur concentrations in Mount Polley tailings are uniformly low, with total sulphur ranging from 0.01% to 1.1% (median concentration of 0.10%). The majority of tailings samples (99%) were found to be NAG based on their TIC/AP values (Figure 14).

Figure 14: Total Inorganic Carbon versus Acid Potential of Mount Polley Mine Tailings

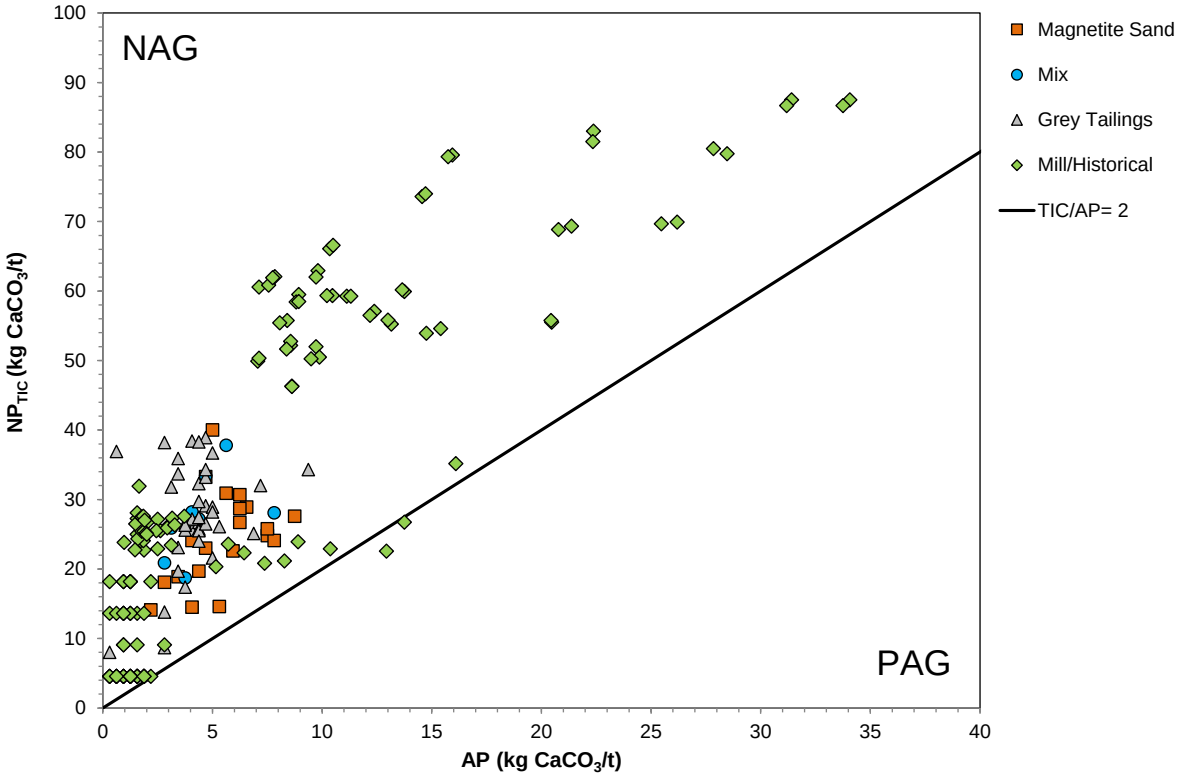

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Compiled_Geochem_Data_CAPR002434_Rev02_SJL_KWJ.xlsm

3.2.3 Trace Element Content

Median concentrations of copper and selenium were present in the tailings at an order of magnitude higher concentrations compared to average crustal concentrations for igneous rocks. Copper is partially deported as silicate minerals. Selenium is associated with the sulphide component of the tailings and is also correlated with copper content. Kinetic testing on tailings samples has to-date confirmed they are non-acid generating.

3.2.4 Kinetic Testing

Six samples of tailings collected from Hazeltine Creek following the dam failure were tested in humidity cells starting in 2015. Currently, two of these tests (HC-3 and HC-4) are continuing, while the rest were terminated after 64 weeks (Figure 15). HC-3 has relatively high sulphide content (0.33% pyrite) and elevated copper and selenium concentrations. HC-4 has lower copper and selenium concentrations, but copper is leaching at higher concentrations than in HC-3, which is thought to be attributed to higher dissolved organic carbon (DOC) leaching from HC-4 (2 mg/L) compared to HC-3 (1 mg/L) which may

form humic complexes with copper increasing it solubility. The tests are continuing with the purpose of evaluating the role of breakdown of organic matter on metal mobility (SRK 2023).

Three of the samples are also being tested in columns using a trickle leach applied at less than 0.1 L/kg/week (compared to flood leach of 0.5 L/kg/week for humidity cells). The samples were selected to represent visually distinctive tailings materials (magnetite sand and grey tailings). The samples are dominated by tailings solids but also contained native materials (mineral and organic soils, and glacial sediments entrained in the debris flow). The samples characterize weathering behaviour for a range of sulphur concentrations which align with typical characteristics of tailings in the impoundment. The columns have operated for over 400 weeks and SRK have requested them be terminated as copper release rates, which were initially unstable, have now stabilized at low levels (Figure 15).

All tests have yielded leachate pHs typically between 7.7 and 8.3. Sulphate concentrations were initially near 1000 mg/L for humidity cells and above 1000 mg/L for columns. Both types of tests showed decreasing sulphate concentrations which have stabilized at lower concentrations. They have also showed decreasing metals concentrations, including those originally enriched (copper and selenium), which have stabilized at low concentrations. Maximum copper and selenium concentrations in both tests were as follows:

- The highest copper concentration in one HCT was 0.15 mg/L, but typical maximum copper concentrations were 0.02 mg/L in HCT leachates and 0.05 mg/L in column test leachates.
- The highest selenium concentrations were 0.01 mg/L in HCT leachates and 0.06 mg/L in column test leachates.

For other parameters, notable results were initial molybdenum concentrations between 2 and 3 mg/L in column leachates. These have since stabilized to concentrations between 0.01 and 0.02 mg/L.

Figure 15: Selected Leachate Chemistry for Tailings Humidity Cells

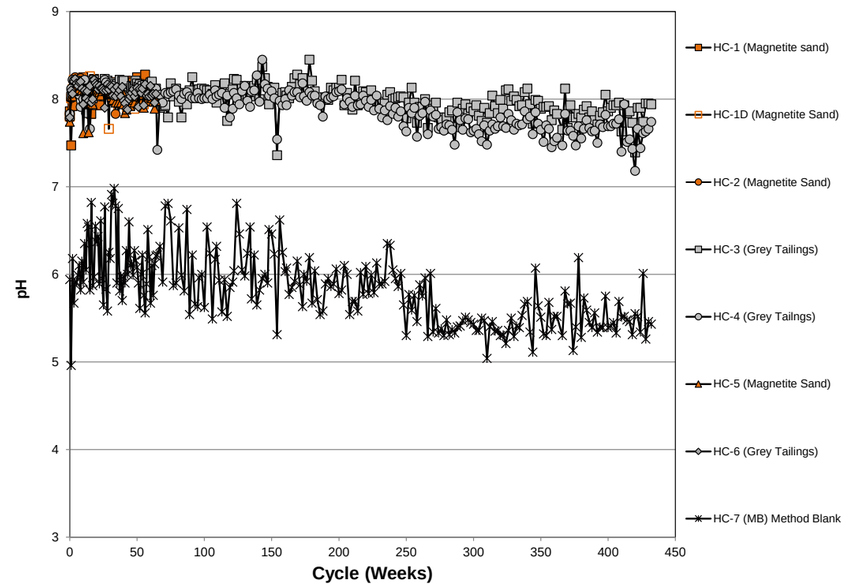

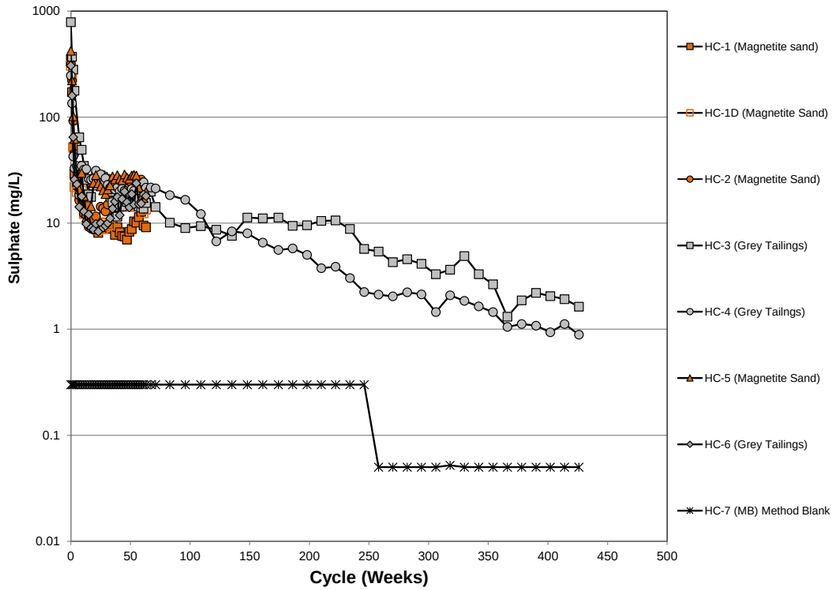

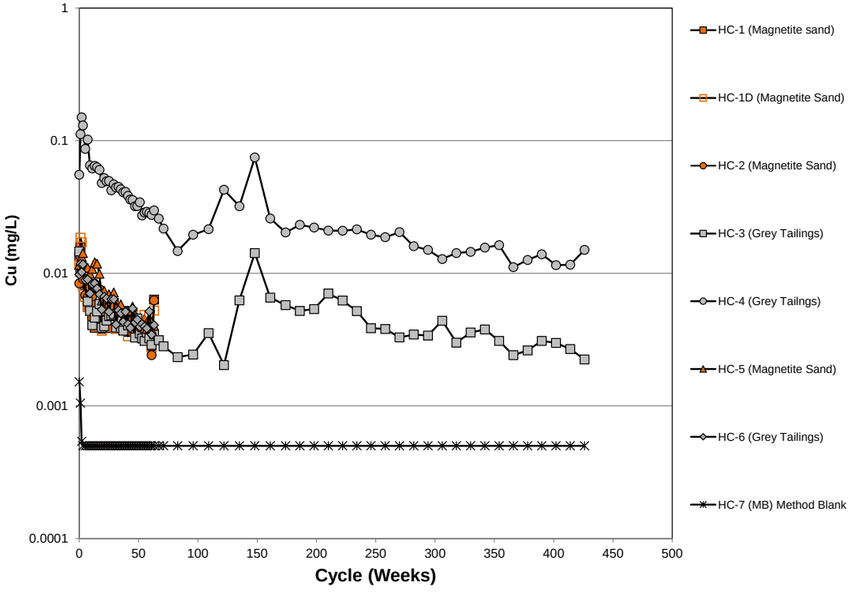

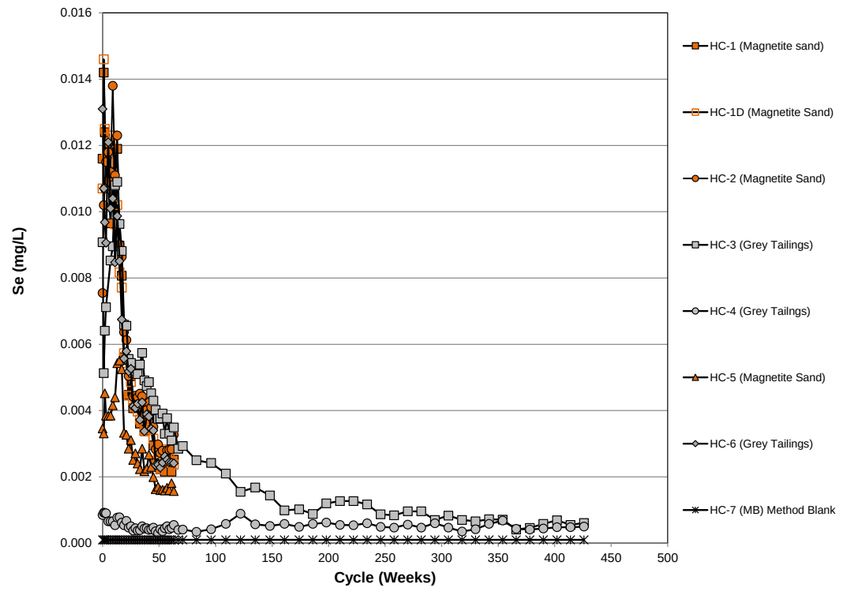

Sources: https://srk.sharepoint.com/sites/NA1CI008.003/Internal/410_Kinetic_Tests/Calculations+Charts/HCTs/Mt.%20Polley_HCT_Conc%20Charts%20_1CI008-003_rtc_rev02.xlsx

Figure 16: Selected Leachate Chemistry for Tailings Columns

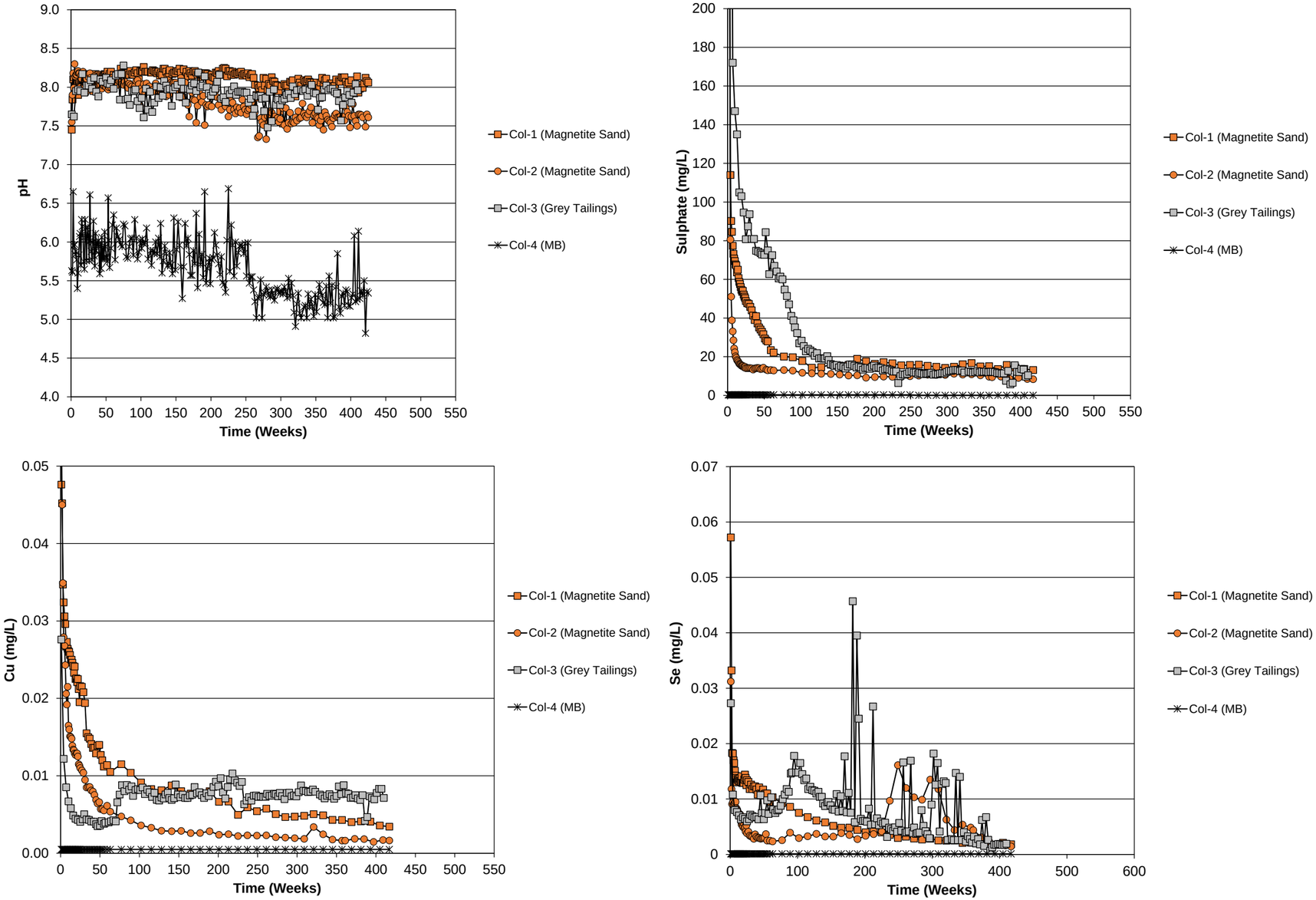

Sources: https://srk.sharepoint.com/sites/NA1CI008.003/Internal/410_Kinetic_Tests/Calculations+Charts/COLs/Mt.%20Polley_Col_Conc%20Charts_1CI008-003_rtc_rev02.xlsx

3.3 Other Sources

Two other sources were identified as potentially requiring geochemical source terms.

Magnetite is recovered from MPM tailings to generate a concentrate for use as a dense medium in coal processing. The magnetite stockpiles are located adjacent to the ore processing plant. No geochemical data are available for the magnetite.

Sulphur was imported in 2004 as part of evaluations of recovery of copper present as oxide. Excess sulphur was stored in a nearby stockpile, first in the Cariboo Pit (2006-2009) and then moved to a crushed rock pad beside the heap leach pad (2009-2018) when mining resumed in the Cariboo Pit. SRK (2022) found the elemental sulphur was composed of about 90% sulphur, and assumed the material had no neutralization potential. Oxidation of the sulphur generated sulphuric acid, which markedly increased the solubility of metals in the surrounding materials that would not otherwise be leachable at neutral pH. In 2018, the excess sulphur was relocated on top of the lined leach pad after evidence showed that water quality on the mine may be affected by contaminated drainage from below the sulphur stockpile (Litke et al. 2019). The affected drainage is seepage from the NEZ Dump, located east of the Test Heap Leach Facility.

4 Conceptual Geochemical Models

4.1 Purpose

The purpose of conceptual geochemical models (CGMs) is to describe the anticipated geochemical performance of each source at MPM which is then implemented as a numerical model to generate source terms. CGMs consider the current understanding of geochemical characteristics (as described in Sections 3.1 and 3.2).

The following sources were evaluated and CGMs for each are described below:

- NAG waste rock and construction fills.
- NAG waste rock influenced by the sulphur stockpile.
- PAG waste rock.
- Ore stockpiles.
- Pit backfills.
- Pit walls.
- Ore processing.
- Tailings.

4.2 Ex-Pit NAG Waste Rock and Construction Fills

Processes in NAG waste rock under non-acidic conditions include:

- Oxidation of sulphides (pyrite, chalcopyrite, and bornite) to release iron, acidity, sulphate, and trace elements contained in the sulphides. Copper is expected to be primarily released by oxidation of chalcopyrite and bornite. Iron released by oxidation of sulphides replaces pyrite and other sulphides as solid iron (III) oxyhydroxides. Iron concentrations in the drainage are expected to be at or near detection limits.
- The oxidation reaction is exothermic (releases heat) and is expected to result in average internal temperatures that are higher than ambient average temperatures. During winter, internal temperatures will be higher than ambient temperatures.
- Due to the temperature difference in winter, air will move by advection through the waste rock by convection. Cold air will be drawn in through coarser materials at the base formed by end-dumping. The heated air will exit the dump at a higher elevation. This process is expected to result in deep penetration of oxygen and generally an over-supply of oxygen for oxidation of sulphides.
- Neutralization of acidity produced by the oxidation reaction will be by reaction with calcium carbonate minerals or mixing with alkaline waters resulting in neutral to basic pHs. The pH of contact waters will be determined by the partial pressure of carbon dioxide in pore gases (lower pH with higher CO_2).

- For non-PAG waste rock the neutral pH weathering environment will result in precipitation of metals as various secondary minerals, including gypsum ($CaSO_4 \cdot 2H_2O$), metal oxides (tenorite - CuO), metal carbonates (malachite – $Cu_2CO_3(OH)_2$), and metal silicates (e.g., chrysocolla). Adsorption to secondary oxides will also occur. The resulting concentrations of metals (principally copper) in contact waters will be controlled by the relatively low solubility of the secondary minerals and the tendency to be adsorbed at these pHs.
- Selenium and molybdenum originate from oxidation of pyrite, but form oxyanions that are mobile at the expected pH. The concentrations of these trace elements are expected to increase.
- There is a hydraulic lag between when waste is placed, and its signature appears at monitoring locations.

Due to the solubility control exerted by secondary minerals, contact water chemistry is expected to be constrained so that chemical loadings are directly proportional to infiltrating water volume. Sulphate is expected to increase as new waste is added but will be constrained by gypsum solubility.

4.3 NAG Waste Rock Influenced by the Sulphur Stockpile

Elevated sulphate and metal concentrations at NEZ Seep 1 and NEZ Seep 2 since 2014 are believed to be influenced by elemental sulphur stockpile oxidation and leaching. The stockpile was stored on the East RDS near the leach pad until its removal in 2018. For context, monitoring of the drainage from the leach pad containing ore, waste rock, and elemental sulphur showed average pH, sulphate, and copper of 3.3, 15 g/L, and 750 mg/L, respectively. There was a risk that depletion of acid neutralizing minerals from the waste rock could have triggered acidification of the waste rock on the infiltrating water flowpath but this does not seem to have occurred based on sampling of the foundation materials (Litke et al. 2019). It is expected that the seeps influenced by the sulphur stockpile will show a downward trend in parameters such as sulphate and copper now that the elemental sulphur was removed.

The seeps from the NEZ Dump that are influenced by the sulphur stockpile leachate (NEZ Seep 1 and NEZ Seep 2) are collected and managed separately from the other waste rock seepages.

4.4 Ex-Pit PAG Waste Rock

Segregated and exposed ex-pit PAG waste rock is present in the Temporary NW PAG Stockpile located adjacent to the Springer Pit. PAG rock at MPM is not defined by a particular rock type but is associated with pyrite halos formed by hydrothermal alteration. Sulphide content is higher than NAG waste rock.

Due to the higher sulphide content of PAG waste rock, the overall oxidation rate of PAG waste rock is expected to be greater than NAG waste rock. However, before acidification occurs, PAG and NAG weathering conditions are expected to be similar with secondary minerals exerting solubility controls. For example, the solubility of sulphate is expected to be controlled by gypsum which will be similar regardless of the sulphide oxidation rate.

Acidification is expected to take decades to progress with early contact waters remaining basic and having metal concentrations controlled by the solubility of secondary minerals. The timeframe for acidification effects is expected to be on the order of decades.

4.5 Ore Stockpiles

Ore stockpiles will perform the same as NAG and PAG waste rock depending on composition. The presence of more copper sulphides than waste rock will result in more leachable copper being generated but similar solubility controls are expected for the elements of interest.

4.6 Pit Backfill

Existing backfilled pits are the Bell Pit (completely full), the Southeast Zone Pit (completely full), the Pond Zone Pit (completely full), the Wight Pit (partially full), and Cariboo Pit (partially full). PAG rock from Temporary NW PAG Stockpile will be backfilled into the Springer-Cariboo Pit at completion of mining. Backfilling of currently filled pits occurred during operation so that run-of mine waste rock was directed immediately to a backfill location. The water level has risen in most of these pits resulting in complete submergence of PAG rock and partial submergence of NAG rock. PAG rock in the Cariboo Pit remains unsubmerged due to drawdown of the water table as operations continue in these pits.

4.7 Pit Walls

Exposed pit walls will remain in the Springer-Cariboo Pit, Wight Pit and Boundary Pit. All other pits have been backfilled resulting in pit wall reactive surfaces becoming part of the backfill.

Pit walls are composed of fractured walls and rubble resulting from over-blast and physical weathering. Localized wall failures will contribute additional talus. Reactive surface area for pit walls is contained primarily in the broken rock rather than fractured walls.

For source terms, pit walls are assumed to perform the same as waste rock dumps composed of PAG and NAG waste but flow paths are much shorter.

During flooding of pit walls, accumulated soluble weathering products will be flushed into pit walls. Following submergence, oxidation of walls will effectively be stopped due to reduction in availability of oxygen. Highwalls above final flood levels will continue to weather.

4.8 Ore Processing

Ore processing results in crushing and grinding of ore in contact water. Soluble components of the ore are dissolved and become part of the process water. Modification of process water chemistry may occur in the cleaner circuit where lime is added to increase pH. The change in pH may cause copper to precipitate.

The ore source term is expressed as mass leached per mass of ore. Except for the possible effects of pH adjustment described above, process water concentrations are expected to be too low to be controlled by secondary minerals.

The ore processing terms will depend on the degree of oxidation of the ore. Freshly blasted ore will contribute less load than ore re-handled from stockpiles, and deep fresh ore will contribute less load than near surface ore that has been naturally oxidized.

4.9 Tailings Solids

During operations, tailings are deposited by spigotting from the TSF embankments, resulting in tailings beaches and slimes migrating to the centre of TSF. Cycloned tailings were also used for dam construction.

Under normal operational conditions, slimes in the centre would be fully saturated and below the process pond. Due to the finger drains in the dam, the water table drops from surface at the edge of the pond in the centre of the facility to the finger drains. As a result, tailings near the embankments are partially saturated. Oxygen enters the unsaturated tailings in the beaches and embankments by diffusion resulting in near surface tailings oxidizing most rapidly and consuming oxygen. An oxygen concentration profile will be present in the tailings which decreases most rapidly near surface and eventually results in negligible oxygen concentrations at depth. For tailings containing sulphur concentrations near 0.1%, the expectation is that oxidation of tailings will occur to tens of metres in depth.

Due to the acid-consuming characteristics of the tailings, the weathering environment is pH-basic and overall processes are comparable to NAG waste rock (Section 4.2). Pore water chemistry during operations is dominated by process water with less effect from weathering processes because tailings are continually deposited, resulting in re-setting of the oxidation profile.

Process water contains low levels of dissolved organic carbon from flotation process reagents (e.g., methyl isobutyl carbinol). These compounds may act as a source of reduced carbon to facilitate reductive dissolution processes in the saturated components of the tailings such as dissolution of iron oxides and release of contained trace elements. SRK (2015a) assessed this susceptibility and concluded the tailings were stable under chemically-reducing conditions.

Following the tailings dam failure in August 2014, the water table dropped, allowing more of the tailings to become unsaturated than under operational conditions. Draindown of pore waters will have occurred allowing oxidation processes to influence pore water chemistry. Reactivation of the tailings pond resulted in the water table rising again into the tailings. As the water table rose, oxidation products formed following partial draindown were dissolved by process waters. Pore waters were therefore expected to reflect a mixture of process water effects and flushing of oxidation products in the years following the reactivation of the pond. However, with the return to operational conditions in 2022, process water will be dominate.

After operations cease, the process pond will decrease and the water table will again drop resulting in more tailings becoming unsaturated. Draindown of the tailings will result in a transition from process

water dominated chemistry to oxidation effects becoming dominant. Eventual pore water chemistry will be controlled by equilibration of water chemistry with tailings weathering products which will include oxides and sulphates.

4.10 Nitrogen Leaching

Nitrogen leaching is covered separately from the foregoing conceptual models because it originates from explosives residuals rather than mineral weathering. Since the rock does not generate leachable nitrogen, the leaching of residuals provides a flush of nitrogen which occurs with water contact. It is expected that the load of nitrogen flushed is greatest initially then decaying in proportion to the remaining soluble nitrogen. In terms of cumulative leaching, a newly constructed waste rock dump would be expected to show increasing loads for several years then stable loads as the volume of rock added each year becomes small relative to the total volume. “Tailing off” at closure will occur. Delays and lag effects may be expected due to hydrological factors.

For a mature site such as MPM, active and long closed waste rock dumps indicate nitrogen release under operational and closed conditions. Sump waters from open pits indicate leaching from pit walls.

Leaching of explosive residual from ore will occur due to flushing in the milling process. Tailings solids themselves will not leach nitrogen because flushing during processing is very efficient. Nitrogen leaching from the TSF will reflect the influence of process water.

5 Source Terms

5.1 General Approach

MPM operations started in 1997, resulting in generation of waste rock and tailings. These full-scale waste facilities provide a more appropriate basis for predicting current and future water chemistry than scaling laboratory tests to full-scale conditions, provided that near source monitoring locations are available and appropriate allowance for local dilution effects at monitoring locations are included. The general approach for MPM has been to use interpreted full scale monitoring data to develop source terms supplemented by laboratory data where needed. This approach removes most of the uncertainty related to predicting source term chemistry.

The approach for each term described below follow the same methods outlined in SRK (2016). The update incorporates recent monitoring and testing data.

5.2 Incorporating Uncertainty

The CGMs described in Section 4 indicate that geochemical processes reflected in source terms consist of weathering of primary minerals, which is determined by rates of mineral conversions, and dissolution processes which combine rates and solubility constraints. The latter consists of the rate at which minerals dissolve and the eventual concentrations achieved when equilibrium with the contact water is reached. For example, chalcopyrite oxidizes at some rate to produce copper sulphate. The copper sulphate then dissolves at a rate adding copper and sulphate to the water until copper and sulphate concentrations in the water are in equilibrium with the solid copper sulphate.

As described in Section 5.1, the general methodology used to develop the source terms relies mainly on-site monitoring data which reflects the end product of weathering and dissolution of weathering products. The assumption is that the monitoring data contain indications of the endpoint solubility of the weathering products with the proviso that dilution needs to be considered. Higher end concentrations in the dataset are used as the starting point to develop source terms because these are most likely to be closest to a solubility limit. To represent uncertainty in the underlying solubility limits, the statistics from water chemistry databases used are the 95th and 99th percentile concentrations. Maximum concentrations are not used to eliminate the bias caused by spurious concentrations resulting from sampling and analytical errors. The two high end percentiles are used because concentrations constrained by the solubility of minerals are not fixed but dependent on total solution chemistry including, particularly, pH.

Other approaches to incorporating uncertainty are described in the following sections.

5.3 NAG Waste Rock and Construction Fills

5.3.1 Method

The method for the NAG waste rock source terms is similar to the method in SRK (2016) and is as follows:

- Evaluate partitioning of reactive minerals during blasting.
- Evaluate potential for acidification due to included PAG rock.
- Evaluate seepage chemistry for geochemical controls.
- Prepare statistical summaries for seeps from major rock dumps.
- Scale-up maximum concentrations to account for dilution effects to yield source terms.

The basis for the latter step is that seepage chemistry may be diluted from true contact water and therefore needs to be scaled to remove dilution effects. Scaling was approached by assuming that gypsum is likely to exert a strong solubility control on major ion chemistry due to the interaction between oxidizing sulphides (yielding sulphate) and dissolving carbonates (yielding calcium). It also has well-defined behaviour in which chemistry matches thermodynamic models and is expected to be one of the most soluble secondary minerals in this setting. The high solubility indicates that it will likely be the last to reach equilibrium with contact water compared to other major primary minerals.

Scaling is therefore achieved using the following equation:

$$[M]_{corrected} = \left(\frac{[SO_4]_{theoretical}}{[SO_4]_{observed}}\right) \cdot [M]_{observed}$$

Where $[M]_{corrected}$ is the scaled element concentration, $[SO_{4,\ theoretical}]$ is the maximum sulphate concentration indicated by the solubility of gypsum, $[SO_{4,\ observed}]$ is the observed sulphate concentration, and $[M]_{observed}$ is the observed element concentration. The $[SO_{4,\ observed}]$ values are the 95th and 99th percentile seep concentrations selected to be at the upper end of the distribution so that the need for correction is minimized.

$[SO_{4,\ theoretical}]$ depends on bulk chemistry being lowest for waters containing only calcium as the balancing cation. As other major ions (K, Mg, and Na) increase in significance, $[SO_{4,\ theoretical}]$ increases. The ratio (Mg+K+Na)/Ca shows variation within MPM (Figure 17), with the lowest ratio for the Boundary Dump and highest for seeps from the two haul roads. For the purpose of determining a range of $[SO_{4,\ theoretical}]$, the 50th and 95th percentiles for each dump group were used. The 50th percentile indicates median predicted sulphate whereas the 95th percentile is a conservative limit. The actual range of the ratio is fairly narrow. For the Boundary Dump, the resulting range is 1510 mg/L to 1550 mg/L whereas for the Waste Haul Road, the range is 1670 mg/L to 1750 mg/L.

Figure 17: Box and Whisker Distributions for the Cation Ratio

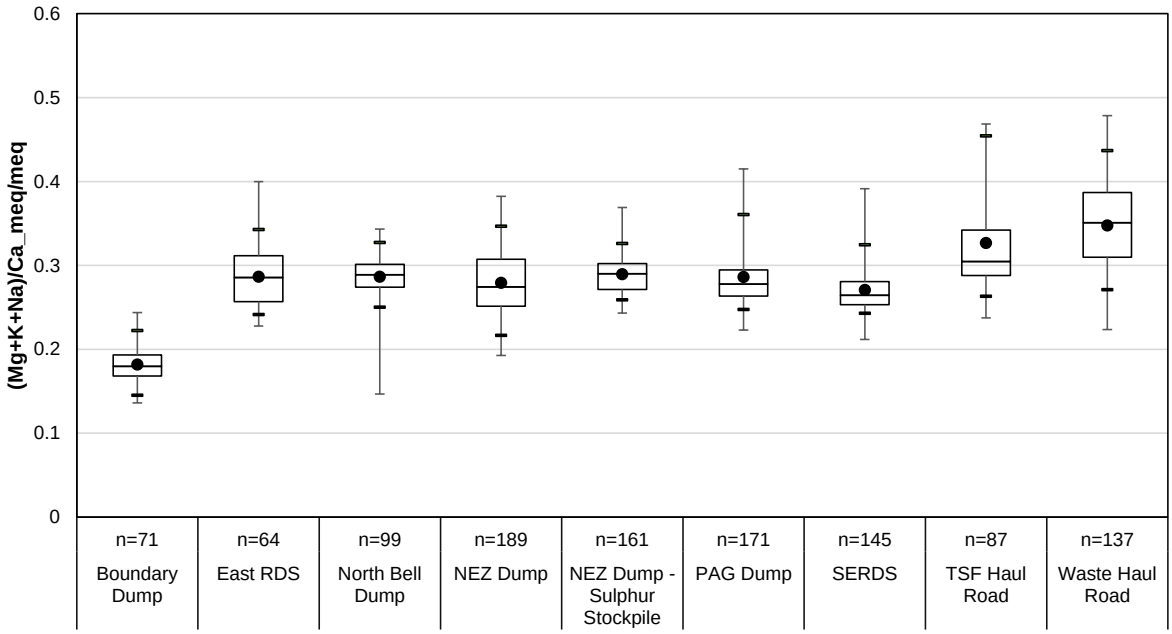

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5.3.2 Inputs

Mineral Partitioning During Blasting

Mineral partitioning during blasting was evaluated using blast hole cuttings because this can have an effect on the classification of waste for ARD potential (Day et al. 2015). If carbonate minerals preferentially partition into the blast fines, the use of a bulk NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially classify into the fines.

In 2001, blast muck samples from the Bell and Cariboo Pits were collected and the +2 mm and -2 mm fractions were tested separately for acid-base accounts. SRK (2016) describes the interpretation for mineral partitioning for these samples. Both sulphur and carbonate preferentially partitioned into the -2 mm fraction but the effect was much stronger for carbonate. For the Cariboo Pit, there was no correlation between the fractions so the observed partitioning was qualitative only, but for the Bell Pit, a regression was derived. The finding from this assessment was that the classification of PAG using TIC/AP of 2 in blast hole cuttings has probably led to misclassification of some NAG rock as PAG. This finding was not used directly but primarily to confirm that under-classification of PAG rock (i.e., increased likelihood of PAG rock in NAG rock) is not a concern for MPM.

Potential for Acidification

The potential for acidification of NAG rock is described in SRK (2016) and considered:

- The likelihood that misclassified PAG waste rock occurs as large, segregated volumes (resulting in hotspots).
- The mass balance ABA resulting from misclassified PAG rock.

SRK (2016) concluded acidification of NAG waste rock at more than a very local scale is not expected because the percentage of PAG rock that could have been inadvertently included in the NAG waste risk is likely no more than a few percent. As there is a good understanding of the occurrence of PAG rock based on geological controls, it is expected that unaccounted for PAG rock is probably not more than a few percent. Therefore, NAG rock can be expected to remain permanently non-acidic and that long term changes in the NAG rock source term do not need to be considered.

Waste Rock Seepage Database

The seepage database was interpreted to understand what mineralogical controls may be constraining water chemistry, determine if seasonal variations are apparent, and derive statistics for the input into source term derivation.

As a general interpretation effort, relationships between rock composition and seepage chemistry were evaluated. However, except for the Wight Pit (Northeast Zone Dump) and Boundary Pit waste rock dumps, waste rock from all pits has been placed in several different locations limiting the opportunity to link rock composition to seepage chemistry.

Description of the Database

The current database as of the end of 2022 contains 1124 water analyses for seeps located as shown in Figure 18. Seeps have been sampled biannually since 2013. Filtering of samples has occurred in the field since 2014. Samples are analyzed for a full range of major and trace ions.

Figure 18: Seep Sampling Locations



Sources: MPMC

General Description of Water Chemistry

Water chemistry statistics are grouped according to the areas indicated in Table 6.

All seeps are non-acidic with medians above 7 and more typically nearer 8. The major anion is sulphate followed by bicarbonate (indicated by alkalinity) which is balanced mainly by calcium and magnesium. As discussed with reference to Figure 17, some differences in major ion chemistry were reflected in the cation ratio but differences in seepage chemistry were generally absent, except for NEZ Dump seeps influenced by the sulphur stockpile, reflecting consistencies with the geological setting and placement of waste rock from the pits at multiple locations for all other waste rock dumps.

Selenium to sulphate ratios were examined for comparison with ratios in the rocks. Rock chemistry showed some distinctive variations in the ratio with typical ratios between 0.0001 and 0.001 mg Se/mg S. Likewise, the ratio was in the same range for seeps (Figure 19). Wight Pit extended to lower ratios in both rock and seeps. SRK concluded that selenium leaching is due to oxidation of sulphides and that leaching effects are similar throughout the site.

Nitrate concentrations varied considerably by source area (Figure 20). Distinctively higher concentrations were found for the Southeast Dump, the Temporary NW PAG Stockpile, TSF Haul Road, and the North Bell Dump. The differences are linked to placement activity with lowest concentrations for dumps less recently active. Notably, nitrate concentrations in the North Bell Dump have decreased in recent years (Figure 20).

Figure 19: Se/SO_4 Ratios in Waste Rock Seepage

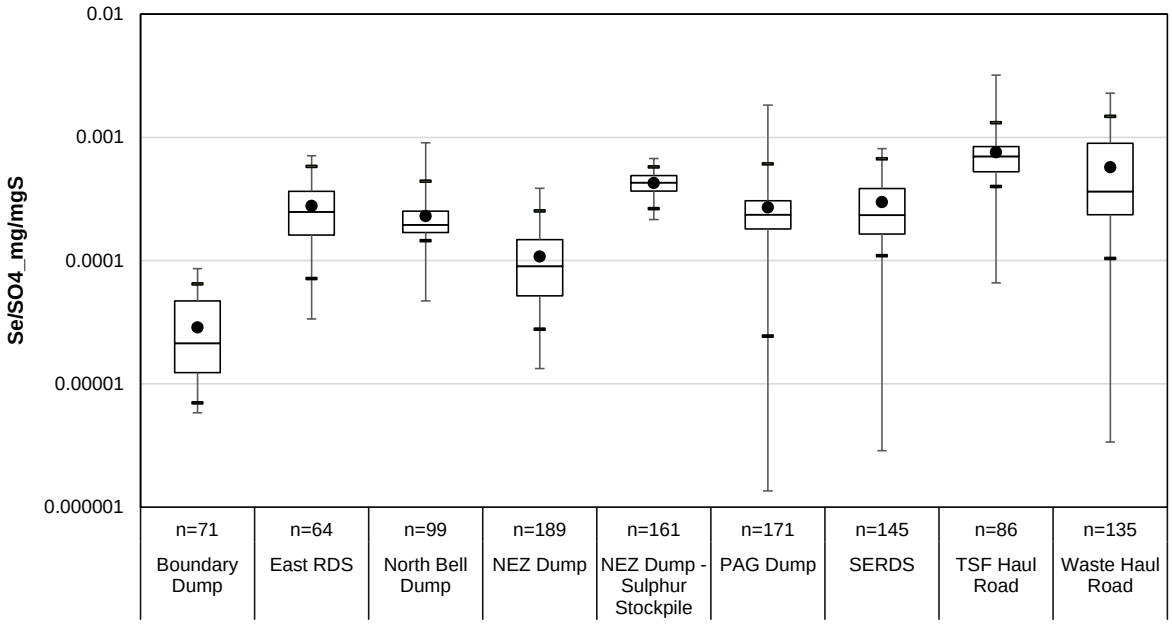

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Figure 20: Nitrate Concentrations in Waste Rock Seepage

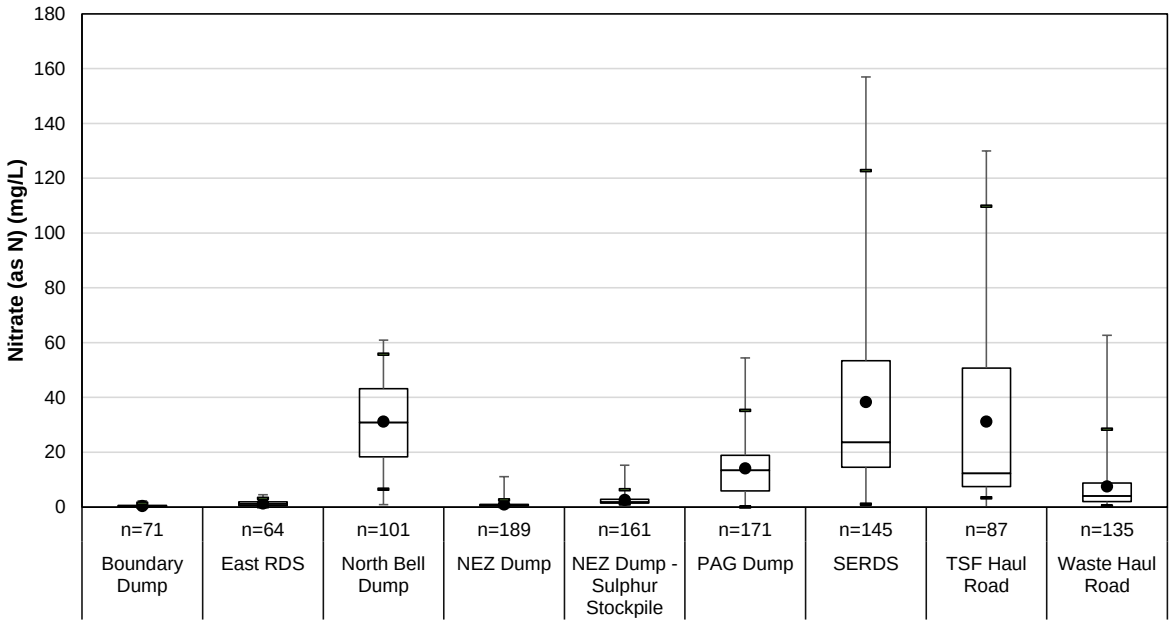

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Figure 21: Timeseries of Nitrate Concentrations from the North Bell Dump

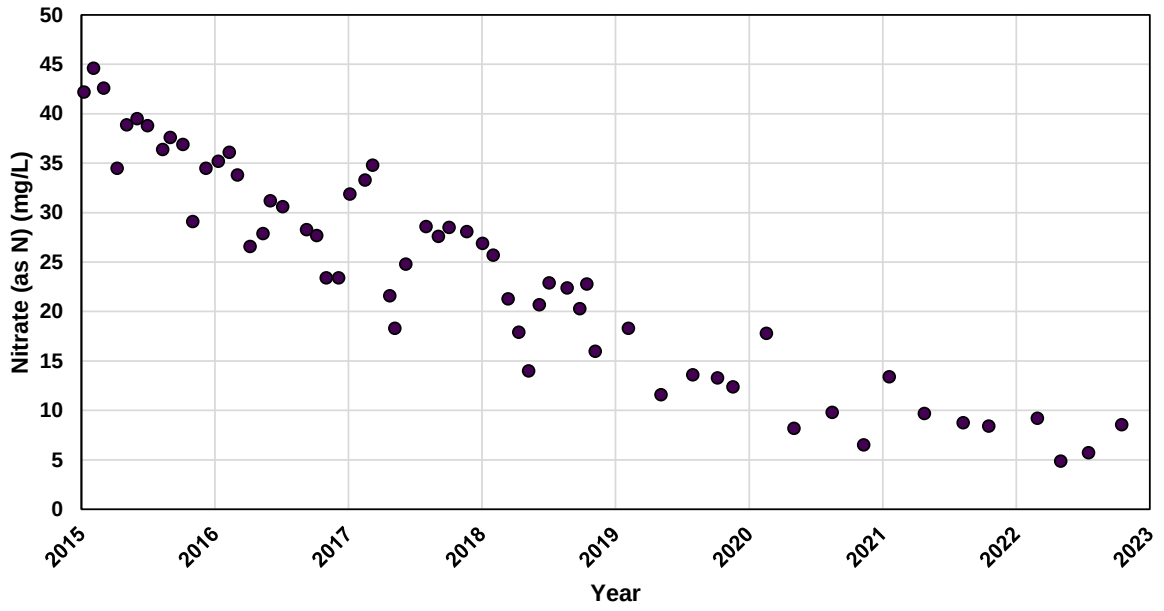

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Annual_Reporting/Contact_Water/2022_ContactWQ_CAPR002434_rev0_SJL.xlsb

Table 6: Waste Rock Seepage Statistics

Statistic	Zone	n	pH[1]	Alkalinity[1]	Cl	F	NO_3	NO_2	SO_4	Al-D	As-D	Cd-D	Ca-D	Co-D	Cu-D	Fe-D	Mg-D	Mn-D	Mo-D	Ni-D	Se-D	Zn-D
				mg/L	mg/L	mg/L	mg-N/L	mg-N/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
P95	Boundary	92	7.0	110	5.0	0.29	1.5	0.012	640	0.0077	0.0018	0.000071	260	0.00077	0.0087	0.26	40	0.41	0.053	0.0005	0.010	0.0035
	Wight	215	6.9	63	10	0.40	2.7	0.02	1200	0.014	0.00061	0.00020	370	0.00051	0.021	0.09	88	0.44	0.18	0.0015	0.050	0.0081
	NEZ Dump - Sulphur Stockpile	176	6.7	25	10	0.80	6.4	0.02	1200	0.069	0.00031	0.0011	380	0.014	1.8	0.06	78	1.1	0.25	0.017	0.21	0.11
	All Non-PAG	886	7.0	43	10	0.59	89	0.086	1300	0.018	0.0028	0.00067	490	0.0014	0.022	0.06	94	0.85	0.37	0.0012	0.32	0.068
	All PAG - Pre-Acid	202	7.0	81	10	0.40	35	0.93	1300	0.017	0.0018	0.00033	450	0.0059	0.012	0.37	71	3.3	0.58	0.0011	0.15	0.0063
P99	Boundary	92	7.0	78	6.2	0.38	2.2	0.022	730	0.02	0.0023	0.000082	260	0.0013	0.0095	0.33	43	0.51	0.074	0.00055	0.013	0.0045
	Wight	215	6.8	58	10	0.42	5.7	0.02	1300	0.02	0.00079	0.00036	400	0.0010	0.039	0.87	92	2.3	0.25	0.0022	0.062	0.019
	NEZ Dump - Sulphur Stockpile	176	6.1	9.7	17	1.4	10	0.02	1300	0.75	0.00061	0.0020	410	0.031	16	0.076	79	1.8	0.31	0.031	0.24	0.23
	All Non-PAG	886	6.7	33	17	0.69	130	0.82	1500	0.032	0.0034	0.0015	590	0.0073	0.043	0.49	110	3.2	0.55	0.0027	0.52	0.18
	All PAG - Pre-Acid	202	6.7	52	15	0.40	51	3.6	1300	0.16	0.0025	0.00052	470	0.018	0.024	1.8	76	8.1	0.66	0.0018	0.24	0.023

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Notes:

[1] Statistics reported for pH and alkalinity are 5th percentile (for P95) and 1st percentile (for P99).

Interpretation of Water Chemistry

Water chemistry was interpreted by using PHREEQC and the minteq.v4 database to calculate mineral saturation indices thereby providing an indication of possible constraining minerals.

Saturation indices for sulphate were consistent with gypsum as a strong solubility control (Figure 22). At higher sulphate concentrations, gypsum saturation indices approached 0. Most seeps had sulphate concentrations well below those required to be at gypsum saturation indicating possible dilution effects, lack of gypsum, or incomplete equilibration. Regardless, the general observation is gypsum likely controls major ion (calcium and sulphate) chemistry with pH control by carbonate. Saturation indices greater than 0 for calcite were consistent with its dissolution and partial pressures for CO_2 were above -3.4 (Figure 23).

Saturation indices for malachite were well above 0 showing that copper concentrations were higher than would be predicted if malachite is controlling copper (Figure 24). Tenorite saturations indices were between 0 and 1 at higher copper concentrations indicating that it is more likely that a copper oxide is controlling copper concentrations. The finding that malachite does not appear to be controlling copper concentration is not consistent with the observed presence of malachite which formed by natural oxidation of the orebody. The likely controls on copper concentrations are secondary minerals resulting from oxidation of the waste rock following mining.

Other indications that higher end concentrations indicate mineral saturation included molybdenum which may be controlled by calcium molybdate (Figure 25). Trace elements occurring at concentrations well below saturation in indices of 0 for their discrete minerals are probably adsorbed or co-precipitated with major secondary minerals (for example, iron oxyhydroxides).

Like the majority of trace elements, saturation indices for selenium minerals were well below 0, reflecting that discrete selenium minerals are not likely to be forming. Relationships between selenium concentrations and saturation indices for major ions that do appear to be controlling solution chemistry were examined (Figure 26). The relationship with tenorite saturation indices showed that selenium concentrations appear to be constrained as copper concentrations were constrained. This may indicate that selenium is co-precipitating or adsorbing with an oxide or that the conditions resulting in copper oxide precipitation also result in selenium removal from solution. These interpretations do not provide a conclusive mechanism for constraining selenium concentrations but suggest that higher selenium concentrations in the dataset may be constrained. On this basis, seepage concentrations were used as the basis to calculate source terms.

Figure 22: Gypsum Saturation Indices Compared to Sulphate Concentrations

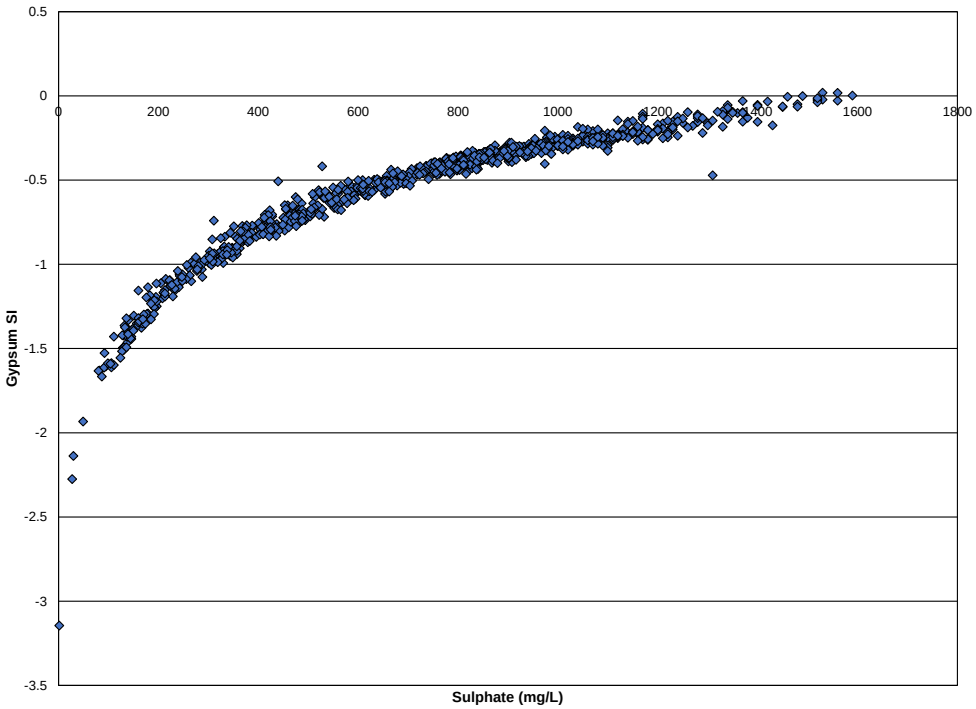

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Figure 23: Partial Pressure of CO_2 in Waste Rock Seepages

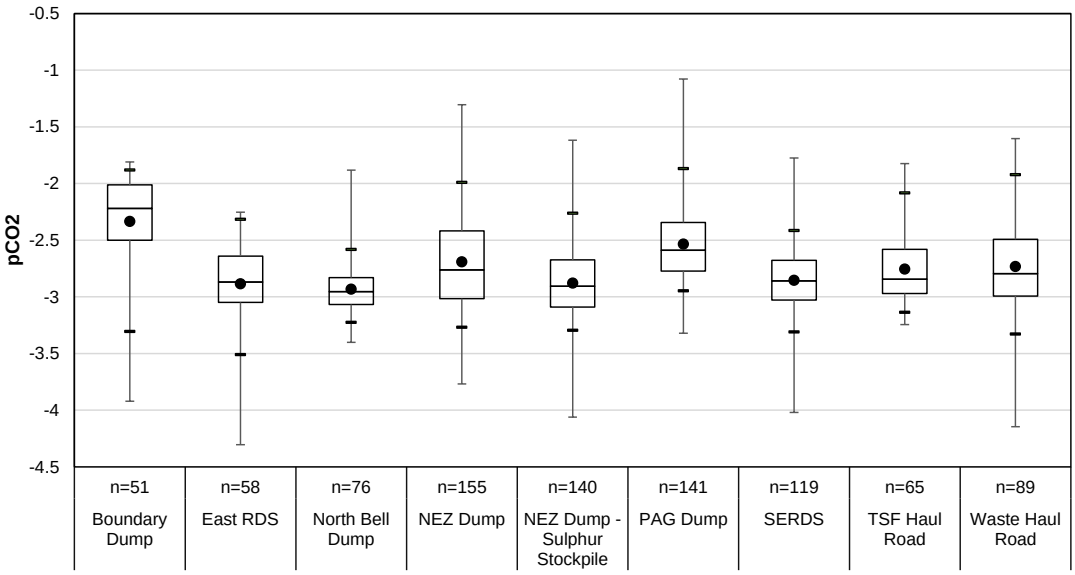

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Figure 24: Copper Mineral Saturation Indices Compared to Copper Concentrations

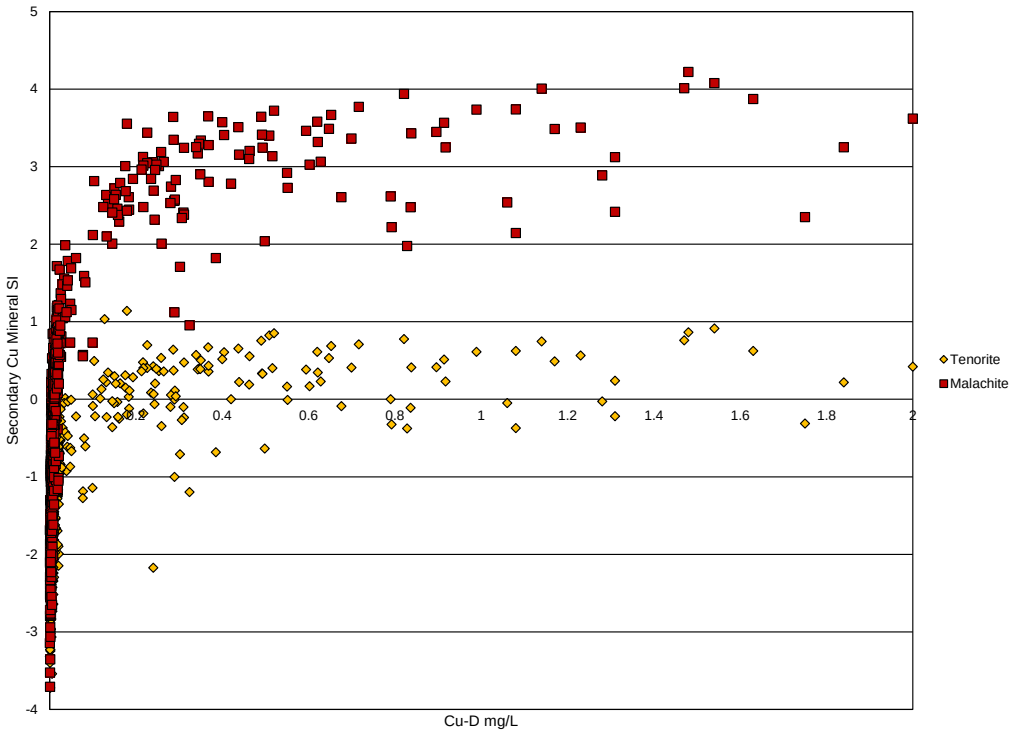

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Figure 25: $CaMoO_4$ Saturation Indices Compared to Molybdenum Concentrations

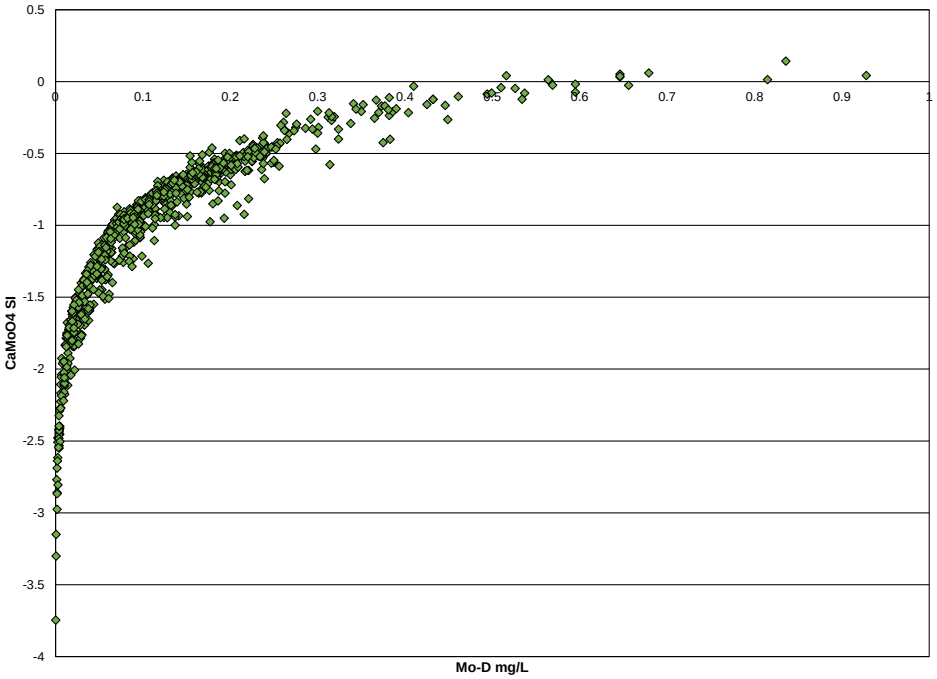

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/[Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx]

Figure 26: Relationships between Selenium Concentrations and Saturation Indices for Gypsum (top left), $CaMoO_4$ (top right), and Tenorite (bottom)

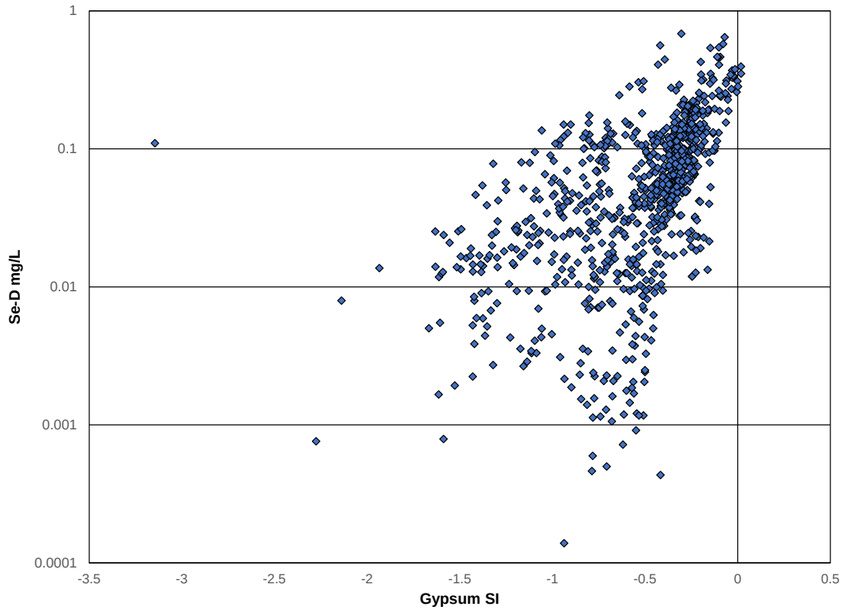

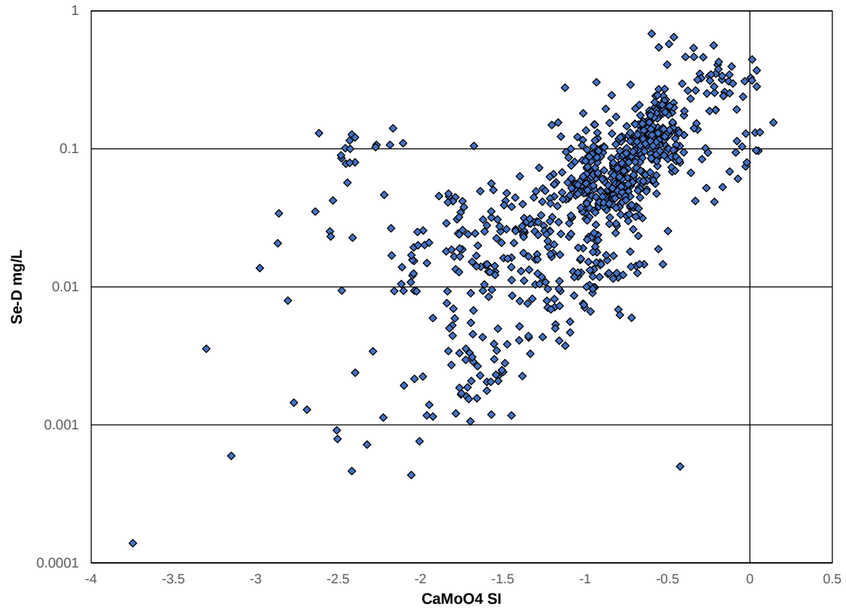

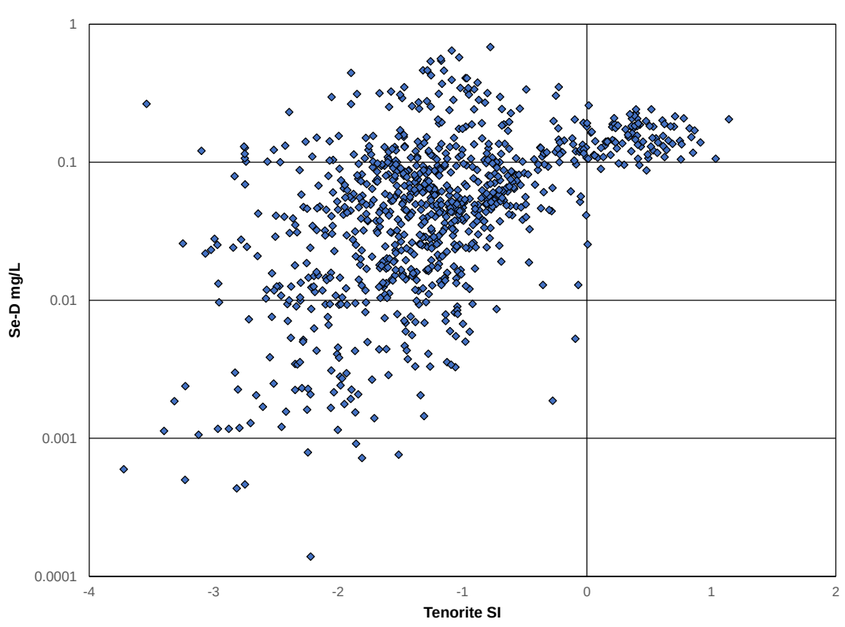

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5.3.3 Results

Source terms for NAG waste rock are provided in Appendix B.

5.4 NAG Waste Rock Influenced by the Sulphur Stockpile

Because acidification of the waste rock on the infiltrating water flowpath from the sulphur stockpile does not seem to have occurred based on sampling of the foundation materials and the sulphur stockpile has been relocated, no separate waste rock term was derived. Because the stockpile has been removed, the influence from the sulphur stockpile on these seeps may dimmish with time. The waste rock term for the seeps influenced by the sulphur stockpile is that shown as “NEZ Dump - Sulphur Stockpile” in Appendix B.

5.5 PAG Waste Rock

Since ex-pit PAG waste rock will be re-handled to the Springer-Cariboo Pit at closure before acidification is predicted to occur, and the same solubility controls are expected as NAG, no separate PAG waste rock term was generated. The PAG waste rock term is that shown as “All-PAG Pre-acid” in Appendix B.

Acidification of PAG walls is discussed subsequently in Section 5.8.

5.6 Ore Stockpiles

Ore stockpiles are composed of rock with similar composition to waste rock with the exception of higher copper concentrations. Overall controls on water chemistry are expected to be similar to NAG waste rock and no separate term was developed. The effects of processing oxidized ore are considered separately in Section 5.9.

5.7 Pit Backfill

Exposed components of pit backfill are assigned the same source term as NAG waste rock. Following submergence, the same source term is assigned to the pore water chemistry assuming that pore waters equilibrate with the same previously formed secondary minerals. Over time, leaching of these minerals will result in decreasing concentrations; however, this process has not been quantified and it is conservatively assumed that constant pore water chemistry will be maintained in perpetuity.

5.8 Pit Walls

5.8.1 Method

Similar to the approach outlined in SRK (2016), pit wall source terms prior to flooding consider the loading from weathering of rubble in exposed walls. Walls covered by waste rock backfill are not assigned a loading because the reactive surface area in waste rock far exceeds that in the rubble on pit walls.

The process of flushing walls by rising water levels was not considered because the relative volume water involved and flushing of pit walls weathering under non-acidic conditions will be small relative to ongoing flushing of exposed walls and flushing of backfilled waste rock.

Pit walls covered by water are also assumed to yield negligible loading because oxidation processes are effectively altered by a water cover. Ongoing leaching may occur (as described for waste rock backfill) but the volume involved is relatively small.

The load of parameter *i* released by weathering of rubble on pit benches (W_i) is calculated from:

$$W_i = M \cdot R_i \cdot k_O \cdot k_T \cdot k_p$$

Where R_i is the rate of release indicated by HCTs scaled to allow for oxygen availability (k_O), differences in temperature (k_T), and differences in reactive surface area (k_p), and applied to as mass M. Mass is calculated on a per m^2 planar wall basis, using a rock density (ρ) and an assumed reacting thickness (h):

$$M = 1 \cdot h \cdot \rho$$

The load leached (L_i) is calculated from:

$$L_i = W_i \cdot k_c$$

k_c is a factor to account for incomplete leaching of weathering products.

The resulting concentration [M_i] in wall area runoff over infiltration area, I, is obtained:

$$[M_i] = \frac{L_i}{I}$$

Concentrations obtained for non-acidic walls are constrained to the NAG waste rock if concentrations greater than for NAG waste rock are obtained. For PAG walls, concentrations were not constrained assuming that low pHs will result in high solubility of secondary minerals.

5.8.2 Inputs

R_is for non-acidic conditions were estimated from three humidity cells (HC14, HC15, and HC16) performed on Springer Pit rock and two humidity cells (HC (3) and HC (4)) performed on WX Zone rock (Table 4). The average of the five tests was used to estimate R. Scaling factors used for k_O, k_T, k_p, and

k_C were 1, 0.3, 0.1, and 1, respectively, and assume that oxygen is not limited, temperatures are lower under site conditions, rock is coarser than humidity cells, and weathering products are completely leached.

No naturally progressing humidity cells have yielded acidic leachate for MPM but rates obtained from HCTs on Pond Zone rock forced to generate acid by stripping of carbonate (HC12 and HC13 in Table 4) were used to estimate an acidic source term. Since these samples were selected to evaluate oxidation rates following carbonate depletion for samples containing lower sulphide in the Pond Zone, the HCT weathering rates $R_{i,HCT}$ were scaled to sulphide concentrations in the acidic Springer Pit walls ($S_{i,Wall}$) using:

$$R_{i,acid}=R_{i,HCT}\left(\frac{S_{acid,wall}}{S_{HCT}}\right)$$

$S_{acid,wall}$ was estimated from the blast hole cuttings database from the Springer Pit. For each PAG sample in the database, the sulphur remaining following depletion of all NP was calculated from the measured sulphide content (S_0) and carbonate content ($NP_{TIC,0}$) and the rate ratio for depletion of carbonate (R_{ratio}):

$$S_{acid,wall}=S_0-\left(\frac{NP_{TIC,0}}{R_{ratio}\cdot 31.25}\right)$$

R_{ratio} is equivalent to the PAG/NAG segregation criterion of 2. The 95th percentile of the resulting distribution of $S_{acid,wall}$ was calculated to be 2.3% compared to the 95th percentile of measured values of 2.8%. The resulting rates are shown in Table 7.

The weathering thickness (h) was set to 2 m to be equivalent to typical over-blast thickness. The bulk density, ρ, was used as 2.65 t/m^3.

Total annual precipitation of 620 mm/year (MPMC 2022) was used to estimate infiltration of 560 mm/year assuming that 90% of precipitation contacts wall rocks.

Table 7: Humidity Cell Rates (mg/kg/wk) Used for Pit Wall Terms

HCT	Zone	Alkalinity	SO_4	Al	As	Cd	Ca	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	U	Zn
HC-12	Pond	0	14	0.063	0.0014	0.000078	2.6	0.0037	0.068	0.037	0.00010	0.52	0.19	0.00038	0.0013	0.0030	0.000050	0.056
HC-13	Pond	0	4.6	0.025	0.000058	0.000035	1.2	0.0051	0.088	0.0054	0.000043	0.22	0.12	0.00013	0.0011	0.00014	0.0000044	0.011
HC-14	Springer	18	3.2	0.022	0.00068	0.000029	7.2	0.000031	0.0024	0.018	0.000037	1.0	0.0020	0.0067	0.000052	0.0064	0.000068	0.0014
HC-15	Springer	6.3	12	0.17	0.00013	0.0000048	7.2	0.00013	0.0061	0.063	0.00014	0.12	0.0028	0.0042	0.000054	0.00017	0.000035	0.0013
HC-16	Springer	13	0.92	0.068	0.00063	0.0000051	4.0	0.000013	0.00089	0.0039	0.000028	0.38	0.00034	0.0022	0.000046	0.00019	0.000032	0.0010
HC-17	Springer	8.2	9.9	0.039	0.00036	0.0000194	7.2	0.000015	0.0010	0.0038	0.000045	0.33	0.00124	0.0427	0.000093	0.00082	0.000095	0.0010
HC-18	Springer	7.5	18	0.021	0.00044	0.0000162	9.1	0.000020	0.0013	0.0038	0.000141	0.29	0.00138	0.0333	0.000103	0.00124	0.000188	0.0014
HC-19	WX	7.0	10.5	0.030	0.00041	0.000012	5.8	0.000011	0.0007	0.0037	0.000060	0.21	0.0015	0.018	0.000091	0.00067	0.000164	0.0010
HC-20	WX	7.9	15	0.022	0.00055	0.000025	9.0	0.000004	0.0011	0.0055	0.00005	0.31	0.0003	0.060	0.00012	0.0006	0.00018	0.0014

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

5.8.3 Results

Pit wall source terms of non-acidic and acidic walls are shown in Appendix C.

5.9 Ore Processing

5.9.1 Method

The method and resulting source terms are the same as presented in SRK (2016). The mass leached from ore as it is processed was calculated from shake flask extraction test data. Concentrations in the shake flask tests (in mg/L) were converted to mass leached as (mg/t) by multiplying by factors of 3 L/kg which is the leach ratio in the test, and 1000 kg/t. The mass leached is used to determine the load added to the process water from each tonne of rock processed.

5.9.2 Inputs

Shake flask data from characterization of eight samples from four ore stockpiles were used (SRK 2015b). The data were used to calculate 5th, 50th and 95th percentile of the loads leached. Since the rock in the stockpiles varied in age from one to nine years, they were not representative of freshly blasted ore. To account for this, the 5th percentile was used to indicate leaching of freshly blasted ore and the 95th percentile was used for processing of the stockpiles.

5.9.3 Results

The resulting source terms are provided in Appendix D.

5.10 Tailings

5.10.1 Method

Tailings source terms were developed for operating conditions (i.e., when tailings are being discharged) and closure conditions when contact waters are assumed to represent oxidation of tailings following draindown of process waters. Re-flooding resulting from reactivation of the impoundment would result in seepage chemistry intermediate between these conditions.

For operational conditions, observed seepage chemistry from tailings dam drains was assumed to be representative of future tailings contact water. Seepage chemistry is assumed to reflect mainly the influence of entrained process water with less influence from oxidation of tailings. Since localized influence from groundwater and non-contact surface can be expected, the range of concentrations assumed was the 95th and 99th percentiles.

For closure conditions, the preferred approach was to obtain direct chemistry from contact waters in the current unsaturated zone because these would likely represent the conditions when the tailings are

fully drained down. No suitable monitoring locations were identified with likely contact water chemistry, so data from the tailings columns were used, similar to the approach outlined in SRK (2016).

Interpretation of leach column data (see below) indicated that early chemistry provided a good indication of contact water chemistry reflecting the influence of oxidation processes. The following method was used to estimate contact water chemistry for drained down tailings:

- The 95th and 99th percentile concentrations of column data were calculated (for alkalinity, the 5th and 1st percentile, respectively, were used).
- For the majority of parameters, drain down chemistry was characterized by the column data percentiles.
- For selenium, interpretation of the column data resulted in the conclusion that attenuation of selenium may be occurring in the early stages of testing as a result of reductive process converting selenate to selenite. To address this possible effect, selenium concentrations were calculated using the sulphate statistics and the range of Se/SO_4 ratios indicated by later data:

$$[Se] = \left(\frac{Se}{SO_4}\right)_{ratio} \times [SO_4]$$

- The equivalent dam drain percentile was used for ammonia because it was not measured in column leachates.
- Manganese concentrations were markedly lower in column leachates compared to seepage. This difference may reflect that conditions in desaturated tailings favour lower mobility of manganese, but the seepage data were selected.

5.10.2 Inputs

Seepage data statistics were calculated for all seepage collection points collected between 1998 and 2022 (Table 8).

Seepage and column data were evaluated for solubility controls using the same approach as waste rock (Section 5.3). Sulphate concentrations in the early column data were close to 2000 mg/L and found to yield gypsum saturation indices near 0, and therefore consistent with solubility control by gypsum (Figure 27). Seepage saturation indices tended to be well below 0. Other parameters showing possible secondary mineral controls were copper (tenorite) and molybdenum (calcium molybdate). Based on similar reasoning as waste rock, the early column data appear to indicate secondary mineral solubility controls for these elements and provide a good indication of the solubility of other elements.

Table 8: Tailings Seepage Statistics

Statistic	Type	n	pH[1]	Alkalinity[1]	Cl	F	NO_3	NO_2	SO_4	Al-D	As-D	Cd-D	Ca-D	Co-D	Cu-D	Fe-D	Mg-D	Mn-D	Mo-D	Ni-D	Se-D	Zn-D
				mg/L	mg/L	mg/L	mg-N/L	mg-N/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
P95	Toe Drain	802	7.2	62	29	1.0	4.6	0.29	680	0.007	0.0024	0.00030	210	0.0016	0.013	0.40	29	1.2	0.29	0.0012	0.019	0.018
	Seepage Pond	417	7.3	65	26	0.80	9.4	0.18	650	0.036	0.0027	0.00019	220	0.00063	0.013	0.14	35	0.49	0.25	0.0016	0.037	0.014
P99	Toe Drain	802	6.9	52	31	1.1	6.4	0.39	780	0.044	0.0033	0.00033	240	0.0022	0.025	0.47	33	1.6	0.39	0.0017	0.032	0.026
	Seepage Pond	417	7.0	48	30	0.84	16	0.26	760	0.10	0.0031	0.00027	240	0.00085	0.025	0.25	42	0.83	0.30	0.0042	0.062	0.038

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Notes:

[1] Statistics reported for pH and alkalinity are 5th percentile (for P95) and 1st percentile (for P99).

Figure 27: Gypsum Saturation Indices for Tailings Seepage and Column Data

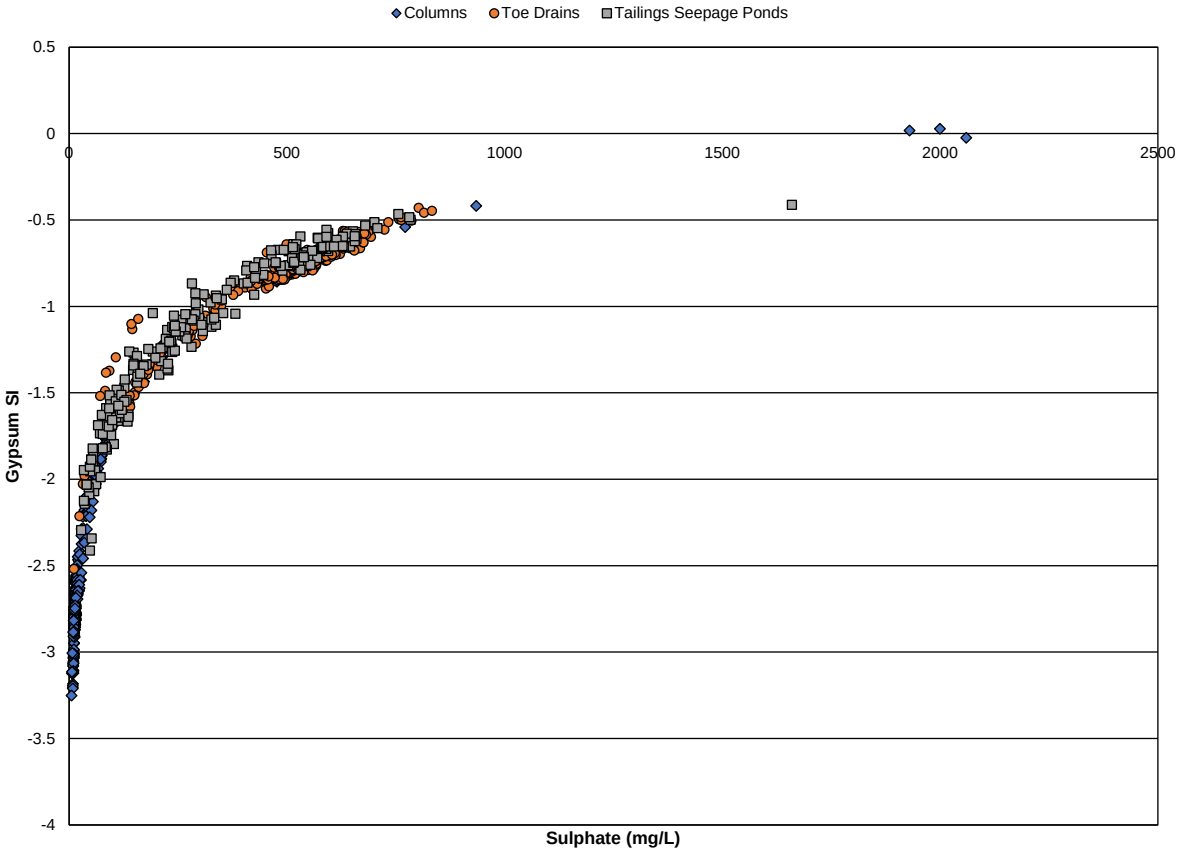

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Figure 28 shows the ratio of Column to Seepage for the two statistics. The columns showed higher concentrations than seepage for some elements (Al, As, Sb, V), but were within an order of magnitude for all except arsenic. The high concentrations of arsenic (> 0.01 mg/L) in the column leachates were not associated with an initial flush and may be evidence of some desorption during testing. Concentrations have been < 0.01 mg/L since cycle 233.

Most parameters linked to acid generation and neutralization processes (SO_4, Ca, Mg) and related elements (Cu, Mo, Se) are now similar to or lower in the columns compared to what was reported in SRK (2016), reflecting depletion as the tests proceeded. Those lower in column data also include nitrogen forms (which would be introduced by leaching in the process plant), and manganese and iron. Manganese and iron may be higher in seepage due to reducing conditions in drains.

Figure 28: Comparison of P95 and P99 Statistics for Ratio of Column/Seepage

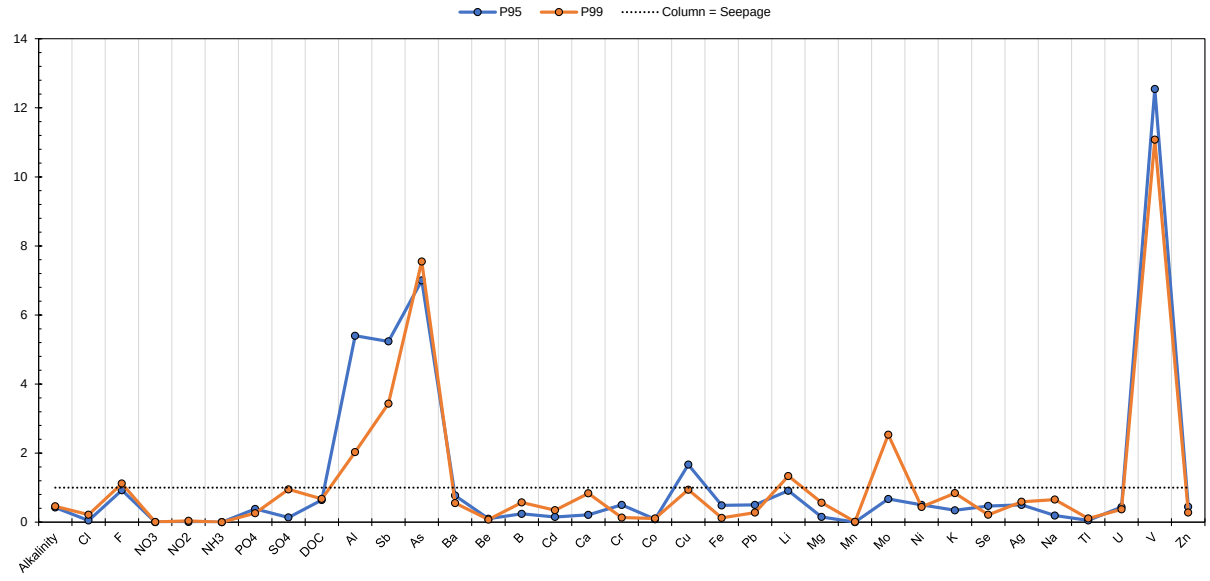

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

5.10.3 Results

Tailings source terms are provided in Appendix E.

5.11 Magnetite Stockpiles

No separate source term was developed for the magnetite stockpiles. Relative to other sources, these stockpiles are not expected to be significant sources.

5.12 Nitrogen Leaching

Nitrogen leaching was included for each source term as follows:

- **Waste Rock:** Nitrogen sources terms were developed from existing seepage by grouping waste rock dumps into active (PAG Ex-Pit and SERDS), and inactive (Boundary Dump and NEZ Dump). For each group, mean concentrations and 95% confidence limits on the means were calculated to consider uncertainty (Table 9).
- **Pit Walls:** Pit walls were assumed to have zero contribution due to the small mass involved and expected results of meteoric leaching which is expected to result in any leaching effects having short duration and being insignificant relative to waste rock reporting to pit water sumps.
- **Backfill:** Backfill source terms are the same as those for waste rock (Table 9).

- **Ore Processing:** Leaching of nitrogen forms by processing were based on the shake flask extraction data (Appendix D).
- **Tailings:** Tailings source terms are based on the observed seepage for operational conditions and column data for draindown conditions (Appendix E).

Table 9: Waste Rock Nitrogen Source Terms

Phase	Statistic	Ammonia	Nitrate	Nitrite
		mg-N/L	mg-N/L	mg-N/L
Inactive	Low 95% Confidence Limit	0.013	0.84	0.0065
	Mean	0.027	1.6	0.0078
	Upper 95% Confidence Limit	0.04	2.4	0.0092
Active	Low 95% Confidence Limit	0.017	19	0
	Mean	0.057	26	0.38
	Upper 95% Confidence Limit	0.098	33	1.0

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

6 Conclusions

This report presents source term geochemical predictions that are inputs into the site wide water quality model. The main conclusions that provided input into the source terms are:

- While several ore zones at MPM have been mined since 1997, all except the relatively small Pond Zone are alkalic porphyry mineralization centred on magmatic-hydrothermal breccia bodies with similar geological characteristics. The host rock for the mineralization is the MPIC which is mainly monzonite. The similarities of the mineralized zones, including their host rocks, indicate that source terms can appropriately be developed on a site-wide basis rather than considering significant differences between the zones.
- As a result of geochemical segregation of waste rock based on ARD potential through the mine life, PAG waste rock has been or will be placed in open pits where it will be permanently flooded thereby preventing ARD from developing.
- It is expected that operational inefficiencies will have resulted in PAG waste being incorporated into the NAG waste rock but the segregation approach was conservative and mass balance excess of acid neutralizing minerals over acid generating minerals means that future development of ARD is unlikely. Weathering conditions are predicted to be pH-basic in perpetuity.
- Tailings are non-PAG.
- As a result of the pH-basic weathering conditions, chemistry of seepage from the existing full-scale facilities reflects solubility limits for weathering minerals. Chemistry is affected by dilution which was corrected using the solubility limit of gypsum.

Closure

This report, Mount Polley Mine Geochemical Source Terms – 2023 Update, was prepared by



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EGBC Permit to Practice: 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A ML/ARD Management Procedure Manual

Prepared by Mount Polley Mining Corporation

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

ML/ARD MANAGEMENT PROCEDURE MANUAL

OBJECTIVE

The objective of this Metal Leaching/Acid Rock Drainage (ML/ARD) Management Procedure Manual is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). This document summarizes all the various procedures and considerations related to ML/ARD potential through mine life processes.

DOCUMENT REVISION HISTORY

This document replaces earlier versions of similar documents that directed ML/ARD Management at MPM in response to *Mines Act* Permit M-200 issued on August 3, 1995. The procedures as described have been in the place since that date.

Document Update Summary

Revision Date	Author	Comment
June 30, 2016	Chad Cameron Ben Harding Katie McMahen Luke Moger Ryan Brown Stephen Day (SRK)	Original Document
August 04, 2022	Mathieu O'Leary Gabriel Holmes Aaron Zwiebel (DWB) Shauna Litke (SRK)	Added contacts, water treatment plant waste ML/ARD characterization, QA/QC sampling, and PAG misplacement action plan.

KEY CONTACTS AND QUALIFIED PROFESSIONALS

Numerous personnel at Mount Polley are responsible for carrying out the procedures written in this plan. Key mine personnel and their contact information are as follows.

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Any update to this document is reviewed by a Qualified Professional (QP) in the area of practice of ML/ARD management, as required by *Mines Act* Permit M-200 Condition A.5. Qualified professionals reviewing this document are as follows:

Version	Qualified Professional	Phone	Email
June 30, 2016	Stephen Day, PGeo (SRK)	604-862-4097	sday@srk.com
August 04, 2022	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com

BACKGROUND

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of: weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulphur (e.g. sulphide and elemental sulphur) are exposed to the weathering effects of oxygen and water. In iron sulphide minerals (e.g. pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid. ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at MPM is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due

to the potential consequences of acid generation for long term management of the site, Mount Polley Mining Corporation (MPMC) actively manages waste rock based on its ARD potential as described in the following sections.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for ML. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at MPM).

UNDERSTANDING OF THE DISTRIBUTION OF ARD POTENTIAL

Like other alkalic porphyry deposits (e.g. Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g. Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPMC geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit.

This ML/ARD Management Procedure Manual applies to waste rock and ore stockpiles. Tailings are consistently NAG due to removal of copper sulphides by ore processing.

MANAGEMENT OF PAG ROCK

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored subaqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit
- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo-Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

DETERMINATION OF ML/ARD POTENTIAL

Waste rock on site is separated into two categories, NAG and PAG, using Neutralizing Potential Ratio (NPR) defined as:

NPR = NP/AP.

Acid Potential (AP) (in kg $CaCO_3$/t) is measured from:

- Total sulphur (%) x 31.25

Neutralizing Potential (NP) (in kg $CaCO_3$/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate.

As required by *Mines Act* Permit M-200, PAG is defined as:

- NPR≤2 and total S>0.1%.

This *Mines Act* Permit M-200 requirement was specified in terms of NP determined by a whole-rock acid extraction and titration method; however, MPMC chose to use total carbonate which yields lower NP than the titration methods.

MATERIAL CHARACTERIZATION OVERVIEW

This section provides an overview of characterization procedures.

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument , allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be

submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries, and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Millfeed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

Water treatment wastes are quantified monthly and sampled quarterly, with material characterization performed to assess ML/ARD potential and contribute to a material inventory.

As a confirmatory sampling measure, the Environmental Department takes random weekly grab samples from the NAG waste dump when NAG is being dumped and/or used for construction, to verify that material is being appropriately characterized and handled.

In the event that a confirmatory sample or other activities result in the discovery of PAG material in a NAG-designated area, a QP is to be informed without delay, who will dictate the response actions in coordination with site contacts. Mount Polley is permitted to blend pockets of less than 1,000 t of PAG materials with non-PAG materials at a ratio of 20:1, as described in *Mines Act* Permit M-200 Section D.3.(c)(i)(d). If these conditions cannot be met, it may be necessary to remove PAG material from NAG areas.

Water chemistry monitoring of seepage from rock dumps, water treatment plant wastes, and contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third-party laboratory for metals analysis as an additional source of data for site geochemical models.

IN-PIT SEGREGATION

Blasthole Samples:

1. After the production drill has completed and moved away from the hole, the sample may be taken.
2. Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3. Samples are to be collected in a clean plastic sample bag.
4. The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5. The sample bag is to be tied off using ribbon.

6. In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7. Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1. Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2. The sample is to be dried at 105°C.
3. The sample is then to be crushed in the Primary Crusher.
4. The sample is then to be crushed in the Fine Crusher.
5. The sample is to be split until the sample size is approximately 200 g.
    a. Reject from the sample is to be wasted.
6. The sample is then to be pulverized for 75 seconds.
7. The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.
8. If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1. The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the LIMS database.
2. The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3. The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1. Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.
2. Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is included as Figure 1.

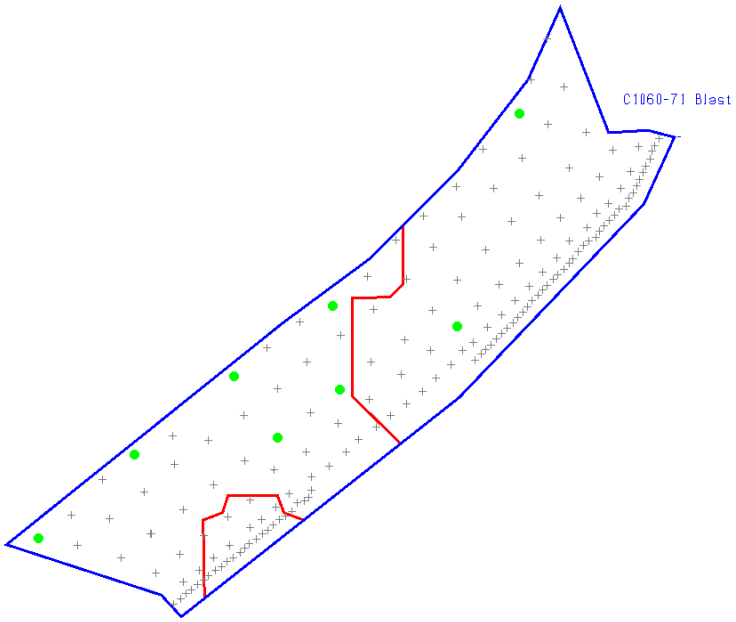

Figure 1: Location of ABA samples (green dots) within a blast. Red polygons denote mill feed ore, remainder is waste. The Ore Control Technician focuses sampling on areas which are designated waste and/or stockpile ore by the blasthole model. Reference blast = 149,173 t.

3. The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1. If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2. The Assay Lab will run the sample through the LECO CS230 Carbon Sulphur Analyzer.
3. Once analyzed, the machine transfers the carbon percentage (C%) and the sulphur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4. The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5. The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1. Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2. Modeling the blast
    a. The software used is MineSight.
    b. The model is based on a 5 metre (m) x 5 m x 12 m block system.
    c. The block closest to the ABA sample will closely match the sample.
    d. The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.

e. Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
f. Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.

3. The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor. An example of a sample layout is included as Figure 2.

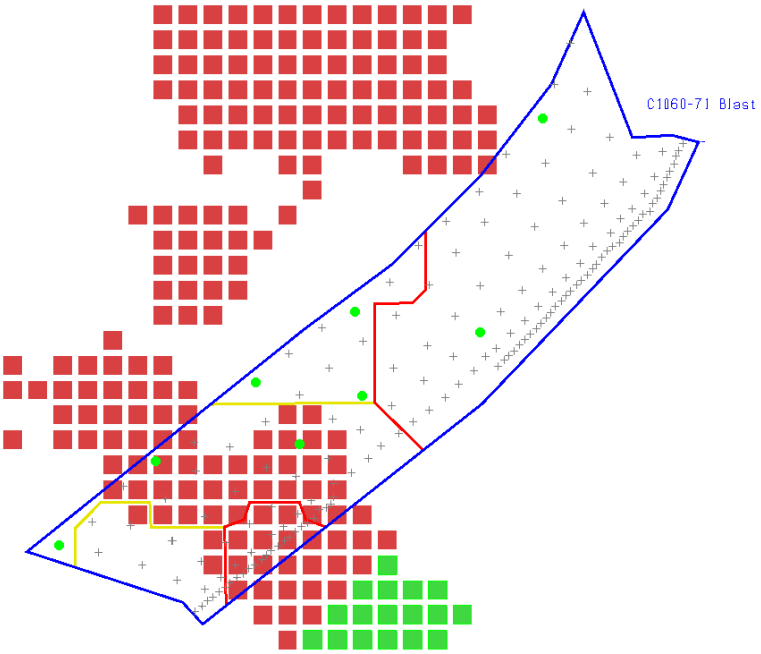

Figure 2. ABA results from samples shown in Figure 1 are used to update the blasthole PAG model item which identifies blocks which meet PAG criteria (red). The Ore Control Technician then marks up the PAG waste (yellow polygon) and the complete ore/waste markup is released to the Surveyor.

Surveyor:

1. The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.

2. Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.
   a. Red Placard = High Grade Ore
   b. White Placard = Super High Grade Ore
   c. Green Placard = Low Grade Ore
   d. Yellow Placard = PAG
   e. Blue Placard = NAG
   f. Pink Ribbon = High Grade Mill Feed Ore
3. Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

MATERIAL HANDLING

Shovel/Haul Truck Operators:

1. The Shovel Operator will mine the rock, following the contacts laid out by the Surveyor.
2. The Shovel Operator will ensure that all material contained within the contact stakes is routed as described by the markup and that any uncertainty in material classification is resolved by seeking the assistance of either the Pit Supervisor or the Engineering Department.
3. Upon loading a haul truck, the Shovel Operator shall direct the Haul Truck Driver as to the material type being hauled, and destination, using a horn sequence. The Haul Truck Driver will then take the material to the designated area.

IN-PIT MONITORING

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC analyzed for total sulfur and total carbon at the Assay Lab to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are summarized in the Comprehensive Environmental Management Plan.

TAILINGS MONITORING

Mill Metallurgy

1. The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    - Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    - The shift composite is then to be added to a monthly composite.
    - At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for ABA total sulfur and carbon analysis.
2. The Environmental Department is to send the monthly tailings composite sample to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion to provide data for site geochemical modelling.

WATER TREATMENT PLANT WASTE

Environmental Department:

1. Record the value on the waste line totalizer monthly when Water Treatment Plant (WTP) data are downloaded.
2. Collect samples of waste which has exited the WTP quarterly to characterize WTP wastes. Samples shall be taken of material that has exited the sludge line, to the West of the WTP and down-flow from where microsand is cycloned for re-use.
3. Sampling Method for liquid wastes (adapted from MPMC-WORK-002):
    - Record in-situ measures: pH, temperature, conductivity, and turbidity.
    - Take a water sample from the pipe outflow and send for lab analysis corresponding with other contact water samples as described in the Comprehensive Environmental Monitoring Plan, including but not limited to: physical parameters, pH, total and dissolved metals.
4. Sampling method for solid wastes (adapted from MPMC-WORK-016):
    - Take a composite sample of solids from the sludge pile adjacent to the WTP, with samples from at least 5 locations on the pile.
    - Send to an external laboratory for total sulfur, total inorganic carbon, elemental analysis by ICP-MS following aqua regia digestion and shake flask extraction testing to assess the ML/ARD potential of solids.
5. Review and archive lab data in a timely manner for use by personnel responsible for the Annual Reclamation Report.
6. The TSS concentration in wastewater will be used along with the waste line totalizer values to quantify the solids delivered to the TSF. The relationship between total and dissolved metals in the WTP waste line sample will be used to quantify the suspended (filterable) metals in this sample.

7. This information will be included in the MLARD materials inventory, and reported to EMLI in the Annual Reclamation Report as per Code Section 10.5.7 on water treatment wastes and by-products.

NAG Material Monitoring

Environment Department

1. As a confirmatory sampling measure, the Environmental Department is to take ABA grab samples from the NAG Dump and any area where NAG rock is used for construction on a weekly basis, while NAG dumping and/or NAG rock construction is occurring. Sampling will conform with MPMC-SOP-016: ABA and Soil Sampling.
2. To assure data quality, as recommended in the BC Field Sampling Manual, a minimum of one in ten samples will be a duplicate sample, as written in MPMC-SOP-016.
3. Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site are summarized in the Comprehensive Environmental Management Plan.

Response to Finding PAG in NAG Areas

Environmental Department

1. Upon reviewing data indicating PAG material has been found in a NAG area, without delay contact one or more Qualified Professionals listed in this document, and the Pit Supervisor or designate to pass along the relevant data and sampling location.
2. Return to the location where PAG material was discovered and stake the sampling location. Note that material may have been dozed, buried or pushed down the dump face, in which case personnel are to mark as close as possible.
3. At the discretion of Qualified Professionals, undertake additional ABA sampling to assess the prevalence of PAG material.

Pit Supervisor:

1. Discuss NAG/PAG separation with shovel and haul truck operators and investigate the possibility of a loading or dumping mix-up. This is not a punitive activity but meant to identify potential causes and estimate material volume.
2. At the discretion of Qualified Professionals, organize the removal of PAG material from the non-PAG area.

ML/ARD Qualified Professional

1. Work with site contacts to develop an appropriate plan of action to address the situation.
2. If it is not possible to demonstrate that PAG material meets conditions outlined in M-200 Section D.3.(c)(i)(d), it may be necessary to remove recoverable PAG material.

REVIEW OF RESULTS AND PROGRAM EFFICACY

Data collected and corresponding interpretation regarding the ML/ARD program are included in the Annual Environmental and Reclamation Report (AERR), due annually to the British Columbia Ministry of Environment and Ministry of Energy and Mines on March 31 of each year, reflective of the previous calendar year. Personnel responsible for the AERR may recommend updates to the ML/ARD program based on operational changes or findings of annual reporting. The AERR includes sections on: waste rock characterization and disposal; drainage water quality monitoring; and, updates to long-term predictions (kinetic testing).

Appendix B Waste Rock Source Terms

Table 10: Waste Rock Source Terms

	pH	Alkalinity	Cl	F	P-D	SO4	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D
		mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Median Cation Ratio																		
Boundary	7.0	110	10	0.63	0.37	1400	0.032	0.00046	0.0043	0.098	0.0019	0.00093	0.14	0.00014	490	0.00093	0.0022	0.018
Wight	6.9	63	10	0.41	0.023	1400	0.021	0.00039	0.0008	0.076	0.001	0.001	0.28	0.00036	400	0.00059	0.00096	0.037
NEZ Dump - Sulphur Stockpile	6.7	25	21	1.7	0.015	1600	0.9	0.00095	0.00076	0.079	0.0025	0.0013	0.13	0.0025	510	0.0013	0.034	15
All Non-PAG	7.0	43	13	0.59	0.071	1400	0.025	0.0026	0.0031	0.1	0.0018	0.00091	0.22	0.0012	500	0.00091	0.0042	0.028
All PAG - Pre-Acid	7.0	81	14	0.4	0.055	1400	0.072	0.00057	0.0025	0.15	0.001	0.001	0.37	0.0005	470	0.001	0.017	0.024
High Cation Ratio																		
Boundary	7.0	78	10	0.63	0.38	1400	0.032	0.00046	0.0043	0.099	0.0019	0.00094	0.14	0.00014	490	0.00094	0.0022	0.018
Wight	6.8	58	10	0.42	0.023	1400	0.022	0.00039	0.00081	0.077	0.001	0.001	0.28	0.00036	400	0.0006	0.00097	0.037
NEZ Dump - Sulphur Stockpile	6.1	9.7	40	3.1	0.029	3000	1.7	0.0018	0.0014	0.15	0.0047	0.0024	0.24	0.0047	970	0.0024	0.065	28
All Non-PAG	6.7	33	14	0.59	0.072	1400	0.025	0.0026	0.0031	0.1	0.0018	0.00092	0.22	0.0013	500	0.00092	0.0042	0.028
All PAG - Pre-Acid	6.7	52	14	0.41	0.055	1400	0.073	0.00058	0.0025	0.15	0.001	0.001	0.37	0.0005	470	0.001	0.017	0.024

	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Median Cation Ratio																			
Boundary	0.61	0.00033	0.0056	78	0.94	0.13	0.00097	3.6	0.024	14	0.000019	17	6.7	0.00002	0.0005	0.038	0.0026	0.0026	0.0078
Wight	0.8	0.0001	0.0037	93	2.1	0.23	0.0022	4.0	0.062	7.2	0.00002	28	6.6	0.00002	0.0002	0.021	0.0048	0.002	0.018
NEZ Dump - Sulphur Stockpile	0.088	0.00025	0.028	98	2.1	0.38	0.035	3.5	0.3	7.7	0.00005	33	7.5	0.000064	0.0005	0.029	0.0023	0.0034	0.26
All Non-PAG	0.21	0.000091	0.013	99	1.8	0.44	0.0023	4.9	0.41	11	0.000018	30	7.0	0.00018	0.00018	0.019	0.0068	0.0029	0.15
All PAG - Pre-Acid	1.8	0.00013	0.0072	76	7.9	0.66	0.0017	7.0	0.24	9.5	0.000021	53	1.7	0.00002	0.0002	0.026	0.0027	0.0039	0.021
High Cation Ratio																			
Boundary	0.61	0.00033	0.0056	78	0.94	0.13	0.00097	3.6	0.024	14	0.000019	17	6.7	0.00002	0.0005	0.038	0.0026	0.0026	0.0078
Wight	0.81	0.0001	0.0038	93	2.2	0.24	0.0022	4.1	0.062	7.3	0.00002	28	6.6	0.00002	0.0002	0.021	0.0049	0.002	0.018
NEZ Dump - Sulphur Stockpile	0.17	0.00047	0.052	190	4.0	0.72	0.067	6.6	0.57	15	0.000095	62	14	0.00012	0.00095	0.055	0.0044	0.0065	0.49
All Non-PAG	0.21	0.000092	0.013	100	1.8	0.44	0.0023	5.0	0.42	11	0.000018	30	7.1	0.00018	0.00018	0.019	0.0069	0.003	0.15
All PAG - Pre-Acid	1.8	0.00013	0.0072	76	7.9	0.66	0.0017	7.0	0.24	9.6	0.000021	53	1.7	0.00002	0.0002	0.026	0.0027	0.0039	0.021

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Appendix C Pit Wall Source Terms

Table 11: Pit Wall Source Terms

Case	Alkalinity	Cl	F	P-D	SO_4	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D
	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PAG Low	0	85	4.8	9.3	1300	4.6	0.0063	0.057	2.5	0.013	0.0035	2.3	0.0057	180	0.0083	0.54	11	1.5
PAG High	0	120	7.1	18	1800	5.2	0.011	0.11	3	0.02	0.0066	3.2	0.0066	190	0.0091	0.85	18	2.4
NAG Average	140	10	0.59	0.067	140	0.025	0.0017	0.0028	0.026	0.000078	0.000058	0.15	0.00025	110	0.00071	0.00067	0.022	0.14

Case	Pb-D	Li-D	Mg-D-D	Mn	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PAG Low	0.0069	0.19	32	13	0.018	0.14	21	0.1	380	0.0017	91	0.65	0.00067	0.012	0.038	0.002	0.018	2.7
PAG High	0.0072	0.28	32	15	0.031	0.2	30	0.19	510	0.0017	140	0.74	0.0009	0.017	0.042	0.0033	0.02	3.5
NAG Average	0.000092	0.0066	6.6	0.024	0.23	0.0011	1.8	0.03	11	0.000018	13	0.26	0.000026	0.00018	0.007	0.0014	0.003	0.019

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Notes:

[1] MPMC estimates PAG rock above 1030 masl is 13%. Acidification will be progressive.

[2] Concentrations are "annual". Seasonal variation can be expected but these concentrations are intended to reflect seasonal worst for each case.

[3] Probabilities cannot be attached to the terms. Use the terms to assess proximity to trigger levels but not to assess probability of exceedance.

Appendix D Ore Processing Source Terms

Table 12: Ore Processing Source Terms

Case	Alkalinity	Cl	F	NO_3	NO_2	NH_3	PO_4	SO_4	DOC	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr
	mg $CaCO_3$/t	mg/t	mg/t	mg-N/t	mg-N/t	mg-N/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t
P5	73000	1500	11000	93	20	610	2800	33000	0	280	0.47	6.3	33	1.5	33	0.15	26000	1.5
P50	87000	1500	14000	230	26	810	2800	48000	0	480	1.2	9	42	1.5	39	0.15	30000	1.5
P95	92000	2800	15000	3600	33	1000	2800	96000	0	580	2.3	20	120	1.5	75	0.15	46000	1.5

Case	Co	Cu	Fe	Pb	Li	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	U	V	Zn
	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t
P5	0.3	3	90	0.3	15	2100	2.2	51	1.5	2900	12	0.15	12000	0.3	0.11	12	30
P50	0.3	8.1	90	0.3	15	4100	3.1	69	1.5	5800	49	0.15	14000	0.3	0.22	30	30
P95	0.3	26	90	0.3	15	5500	14	130	1.5	8100	61	0.15	18000	0.3	0.34	53	30

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

Appendix E Tailings Source Terms

Table 13: Tailings Source Terms

Case		Alkalinity	Cl	F	NO_3	NO_2	NH_3	PO_4	SO_4	DOC	Al-D	Sb-D	As-D	Ba-D	Be-D	B-D	Cd-D	Ca-D
		mg $CaCO_3$/L	mg/L	mg/L	mg-N/L	mg-N/L	mg-N/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Seepage	P95	63	29	1.0	9.3	0.27	0.2	0.029	700	6.9	0.017	0.00099	0.0026	0.087	0.001	0.18	0.00041	220
Seepage	P99	51	30	1.1	25	0.31	0.32	0.056	1200	9.3	0.069	0.0017	0.0032	0.15	0.0016	0.25	0.0006	370
Drained Down	P95	27	1.4	0.94	0.014	0.002	0.2	0.011	95	4.4	0.094	0.0052	0.018	0.067	0.0001	0.043	0.000061	47
Drained Down	P99	23	6.6	1.2	0.19	0.012	0.32	0.015	1100	6.3	0.14	0.0059	0.024	0.085	0.00012	0.14	0.00021	310

Case		Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Ag-D	Na-D	Tl-D	U-D	V-D	Zn-D
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Seepage	P95	0.001	0.0012	0.016	0.062	0.0001	0.011	34	1.0	0.3	0.001	19	0.036	0.00002	110	0.0002	0.004	0.002	0.0083
Seepage	P99	0.0038	0.002	0.048	0.24	0.0003	0.021	68	1.5	0.4	0.0022	21	0.16	0.00002	120	0.0002	0.0097	0.0031	0.023
Drained Down	P95	0.0005	0.0001	0.026	0.03	0.00005	0.01	5.1	1.0	0.2	0.0005	6.5	0.047	0.00001	20	0.00001	0.004	0.025	0.0037
Drained Down	P99	0.0005	0.00021	0.045	0.03	0.000082	0.028	38	1.5	1.0	0.00098	18	0.56	0.000012	78	0.000021	0.0097	0.034	0.0063

Sources: https://srk.sharepoint.com/sites/NACAPR002434/Internal/!020_Project_Data/010_SRK/Source_Terms/Source_Terms_CAPR002434_Rev00_SJL.xlsx

APPENDIX 2-3: 2023 Water Balance Calibration Report

TECHNICAL MEMORANDUM

DATE March 21, 2024 **Reference No.** CA0020527.4505-026-TM-Rev0-31141

TO Matt O'Leary
Mount Polley Mining Corporation

FROM Stella Cheng, Gonzalo Donoso, and Peter Morgan **EMAIL stella.cheng@wsp.com; gonzalo.donoso@wsp.com; peter.morgan@wsp.com**

2023 SITE WIDE WATER BALANCE MODEL UPDATE AND CALIBRATION – MOUNT POLLEY MINE

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to provide water balance modelling services to update and calibrate the Site Wide Water Balance Model (SWWBM) in support of MPMC's 2023 Annual Report. This exercise is a requirement of Section 4.2.1 (f) of MPMC's Discharge Permit 11678, issued under the *Environmental Management Act* and most recently amended through a Consent Order on December 31, 2020 (BC ENV 2020).

The SWWBM was developed using GoldSim™, a highly graphical software package for carrying out dynamic, probabilistic simulations to support decision-making (GoldSim 2018). GoldSim™ is frequently used to evaluate water management alternatives, perform sensitivity analyses, and conduct mass balance simulations.

The SWWBM was developed as part of the Mount Polley Mine Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water management across the site (e.g., runoff, water transfers, and storage). The details of the SWWBM were first presented in the Mount Polley Mine Water Balance report (Golder 2016b).

On May 26, 2019, Mount Polley Mine (the Mine) entered a care and maintenance phase. On June 1, 2022, the Mine resumed operations under the current EMA Permit 11678. Mining and tailings deposition occurred throughout 2023.

WSP updated the SWWBM in March 2023 to calibrate water volumes, water levels and discharges in the Tailings Storage Facility (TSF) for the period from January 1, 2022 to December 31, 2022 (WSP 2023a). An updated Water Balance Report was presented in 2023 (WSP 2023b) as part of the Water Management Plan for the Springer Expansion Life-of-Mine update (WSP 2023c).

This technical memorandum describes updates to the SWWBM to reflect site conditions in 2023, and calibration to measured water levels in the TSF for the period from January 1, 2023 to December 31, 2023. A summary of the model updates, the assumptions made in the calibration process, a discussion of the calibration results, and the end-of-year water balance for the Mine, is included in this document.

2.0 MODEL UPDATE

2.1 Data Received

MPMC provided WSP with measured data from site (MPMC 2024a). The following data were received from MPMC (2024a):

- "Snow Pack 2023.xlsx" Periodic snowpack measurements (snow water equivalent [SWE] in cm).
- "TSF Water Balance Jan 24, 2023 v3.xlsx" Periodic Springer Pit, Cariboo Pit and Wight Pit water level measurements in 2023 (m, mine grid).
- "2023 all weather station data.xlsx" Q1 to Q4 2023 climate data from site – including rainfall (mm), daily temperature (ºC) and evaporation (mm).
- "HMI WTP 2023 Total.xlsx" Monthly discharge of treated water (m^3) through the water treatment plant (WTP).
- "Weekly TSF Reports.pdf" TSF reclaim pond water level measurements (m, tailings grid) and Springer Pit remaining tailings (M-m^3) throughout 2023
- "2023 DSI Report Data Request.msg" Tailings deposited in the TSF throughout 2023 (tonnes).

2.2 Summary of Model Updates

Through discussions with MPMC, the SWWBM was updated to reflect site water management operations for the period of January 1, 2023 to December 31, 2023. The model updates were as follows:

- Tailings discharge from the ore processing plant to the TSF throughout 2023.
- Discharge to the environment through the WTP was updated. The volume of WTP discharge saw a significant decline beginning in September 2023. This decrease occurred because the WTP has been offline since September 13, 2023, as water has been redirected from Wight Pit to TSF (MPMC 2024a). Monthly discharge volumes through the WTP are shown on Figure 1.
- Water from Wight Pit was transferred to the WTP via Long Ditch for treatment and discharge in 2023. A time series plot of the modelled total water volume in Wight Pit is shown in Figure 1.
- Water from Springer Pit was transferred to the WTP via West Ditch for treatment and discharge throughout 2023. A time series plot of the modeled total water volume in Springer Pit is shown in Figure 1.
- Water from Cariboo Pit was transferred to the WTP via West Ditch for treatment and discharge throughout 2023. A time series plot of the modeled total water volume in Cariboo Pit is shown in Figure 1.

Additional details related to use of available surveys are provided in the following section.

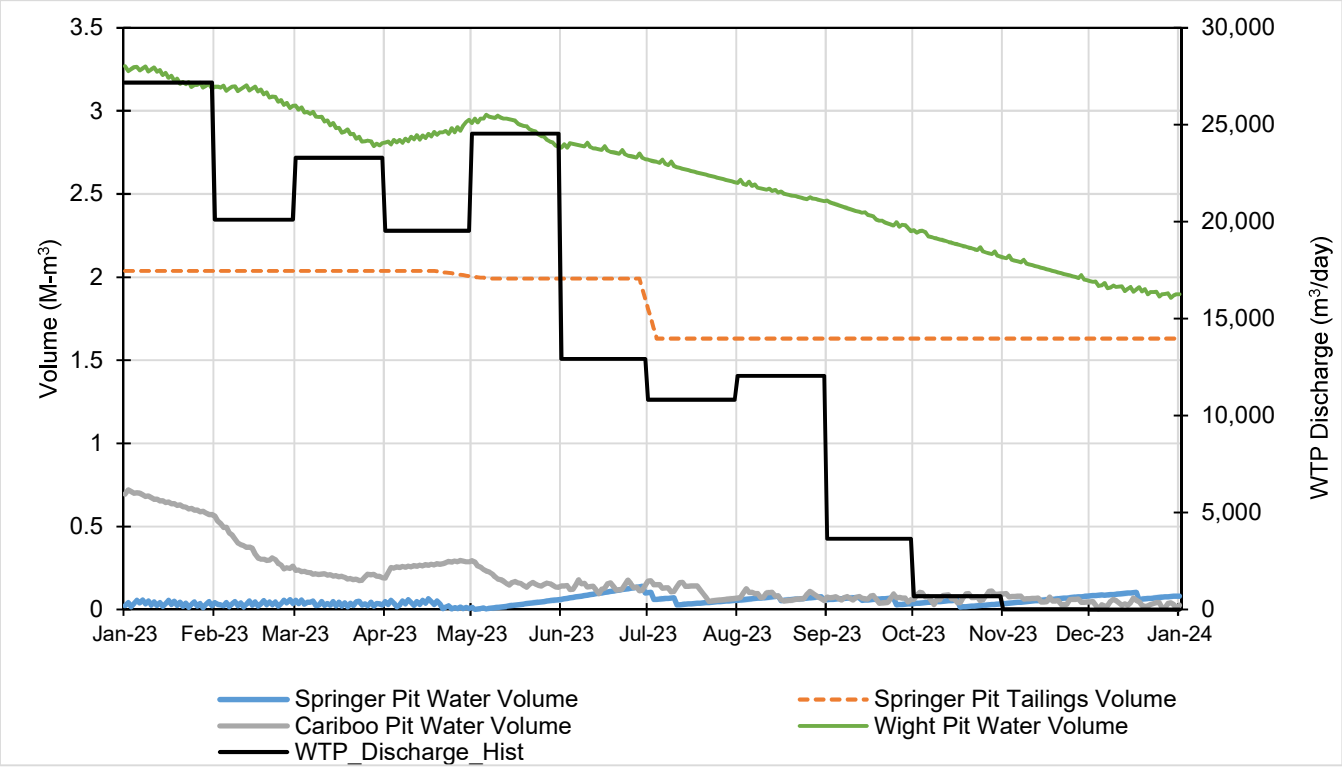

Note: The primary y-axis unit (M-m3) denotes millions of cubic meters.

Stored water volume = surface water volume + voids water volume

Figure 1: Springer, Cariboo, Wight Pits Volumes and WTP Discharge Flow Rate

2.3 Site Surveys

2.3.1 TSF

Topographic surveys of the TSF were conducted by MPMC on October 30, 2023. A bathymetric survey within the TSF was conducted on August 25, 2023. The storage-elevation curve was developed using the combined bathymetry and topography, and it is used in the SWWBM to infer the TSF free water volume from measured water level data, recognizing that the surfaces described are a triangulation of a bathymetry survey (tailings surface under water) and a topographic survey (tailings surface above water). The triangulation of survey points near the transition between water and land, as well as the use of different dates for the Topographic and Bathymetric Surveys, introduce uncertainty into the resulting storage-elevation curves. However, the accuracy is considered acceptable for the required resolution of the model results.

Storage-elevation curves for the TSF up to a dam crest elevation of 974 m developed from the August 25, 2023 TSF survey were used in support of the free water volumes projection affected by tailings deposition after the survey date of October 30, 2023. Storage-elevation curves were used to model the facilities with linear interpolation throughout 2023.

2.3.2 Springer-Cariboo

A bathymetric and topographic survey of Springer-Cariboo Pit was conducted by MPMC on January 25, 2024, indicating that the Springer and Cariboo pits were divided up to the saddle level (approximate elevation of 964 m), and then combined from that level upward. Based on the recorded pit elevation data from MPMC (MPMC 2024a) and the fact that the Springer Pit was completely dewatered as of April 18, 2023 (MPMC 2024b), the Springer Pit and Cariboo Pit should be considered as separate reservoirs for modeling purposes in 2023. Storage-elevation curves for Springer Pit and Cariboo Pit were generated individually to infer the free water volumes within the pits from measured water level data in the SWWBM.

Springer Pit storage-elevation curves based on the bathymetric and topographic survey on November 7, 2019 were utilized in the model until April 18, 2023. These were then projected to the Springer Pit storage-elevation curve based on the January 25, 2024 survey. Projected storage-elevation curves were used to model the facilities with linear interpolation. Tailings were excavated during the calibration period, it is assumed that the excavation is reflected in the survey data. Figure 1 shows a time series plot of Springer Pit tailings volume.

Cariboo Pit storage-elevation curves (dated January 30, 2023, refer to MPMC 2023) were utilized until the end of 2022. These were then projected to the Cariboo Pit storage-elevation curve based on the January 25, 2024 survey. Projected storage-elevation curves were used to model the facilities with a daily linear interpolation between dates, throughout 2023.

2.3.3 Wight Pit

Wight Pit storage-elevation curves (dated March 1, 2022; MPMC 2022) were provided by MPMC. The curves include underground workings and pore space assumptions. Measured water level data from MPMC were used to infer the water volumes in the pit based on the storage-elevation curves provided.

3.0 MODEL CALIBRATION

3.1 Overview

The SWWBM was calibrated by adjusting outflows of the reservoirs and comparing modelled water levels to measured water levels recorded at the TSF. The TSF temporarily retains high runoff inflows experienced during freshet and storm events. The resulting modelled water levels in the TSF are the balance of site-wide inflows and outflows, including pumping to and from the pits and the booster station, which are temporary storage locations for surplus water on site.

An input climate dataset was generated (Section 3.2) and seasonal runoff coefficients were used during freshet (Section 3.3) to better represent measured site runoff conditions (i.e., reduction in measured snowpack depth) in 2023 and to facilitate the calibration.

3.2 Climate Data

A climate dataset at the Mine for 2023 was generated and used to represent site climatic conditions for the calibration.

The dataset consisted of the following:

- January through December rainfall data from MPMC.

- Freshet (March through April) snowmelt as determined from decreases in snowpack SWE depth recorded at the Mine.

3.3 Runoff Coefficients

Runoff coefficients in the SWWMB are adjustable loss parameters that translate measured climate trends and ground conditions into estimates of modelled runoff. Model performance from historical climate data for the year 2023 supported the delineation of runoff coefficients into two distinct seasonal climate periods:

- Freshet (March to June; inclusive) – Highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.
- General (January to February; inclusive and July to December; inclusive) – Mid range coefficients to represent soil moisture contents for intermittent runoff events. A 30% increase to the general coefficients is applied to the subsequent month if the previous month had a cumulative rainfall plus snowmelt depth greater than 50 mm.

The seasonal runoff coefficients defined for the catchment types remained unchanged from those used in the 2022 SWWBM calibration and are listed in Table 1.

Table 1: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020

4.0 CALIBRATION RESULTS

Figure 2 shows the modelled and measured water levels within the TSF for the 2023 calibration period. The modeled water levels were estimated from the modeled volume estimated using the storage-elevation storage curves. The average difference between modelled and measured water levels is approximately 0.14 m, which is considered acceptable for the purposes of the calibration exercise.

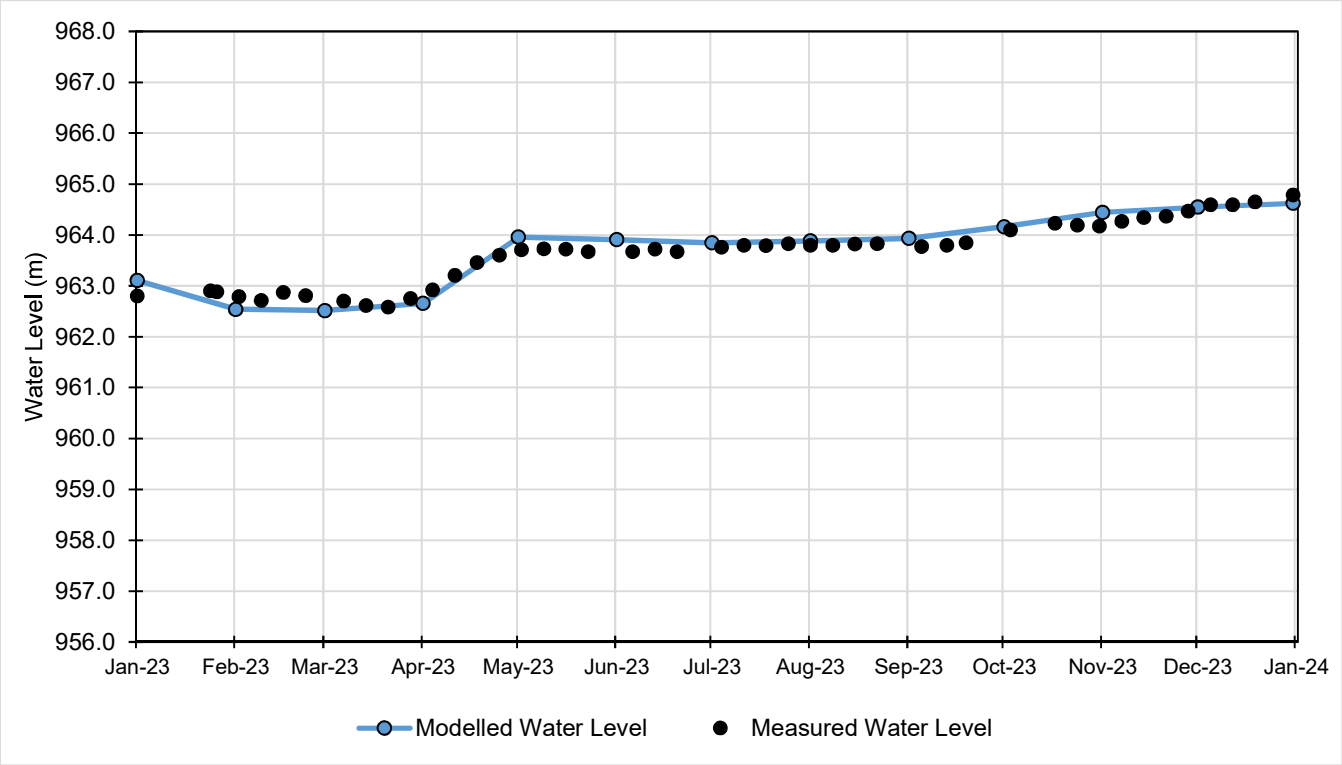

Note: Last measured water level occurred on 31 December 2023.

Figure 2: Water Levels in the TSF

Figure 3 shows the modelled free water volume in the TSF along with the inferred free water volume from measured water levels. The measured water levels were converted to an inferred water volume using the storage-elevation curves described in Section 2.3.

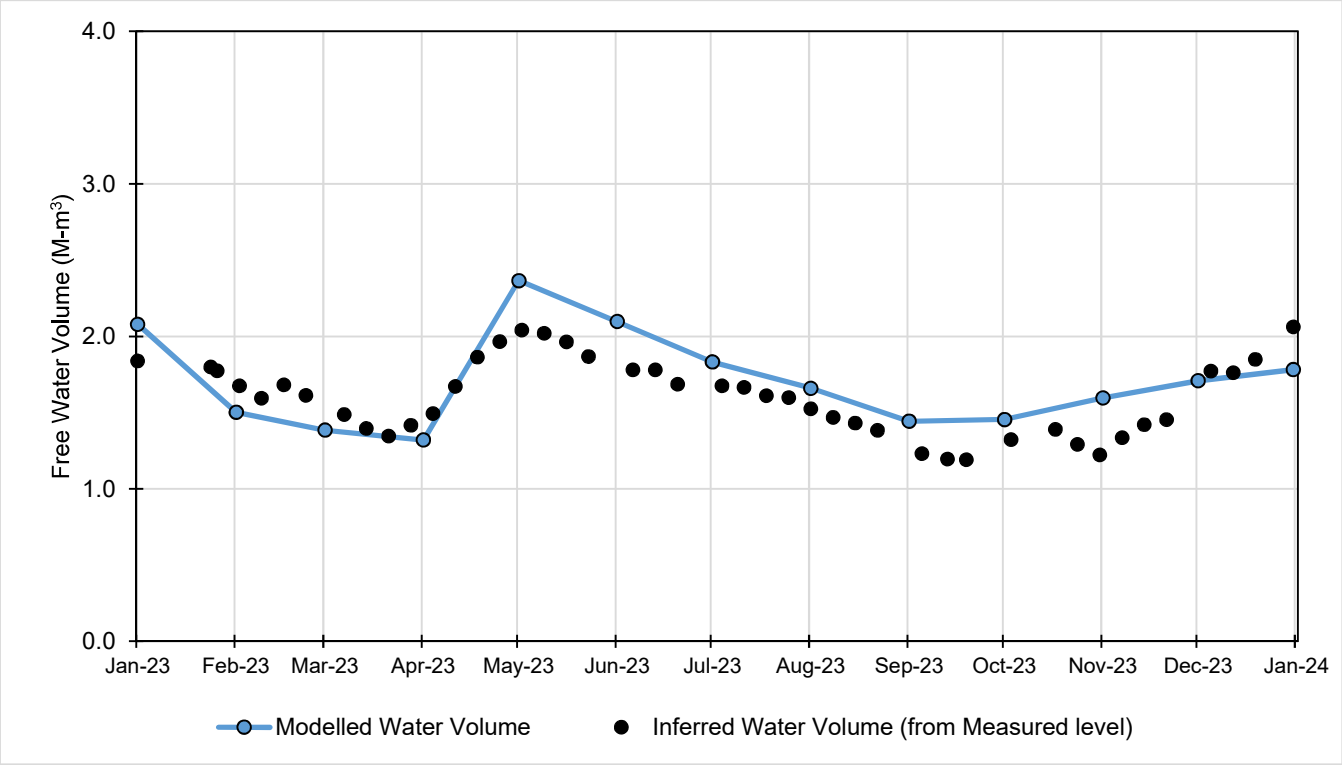

Note: Last measured water level occurred on December 31, 2023. The y-axis unit (M-m^3) denotes million cubic meters.

Figure 3: Free Water Volume in the TSF

Figure 2 and Figure 3 indicate that the model is reasonably calibrated and there is general alignment between measured free water levels and the inferred free water volume in the TSF. Differences between modelled and measured values may have several explanations:

- Variability in runoff coefficient throughout the year.
- Uncertainties in the climate data (e.g., snowpack surveys can miss intermittent snowmelt if conducted infrequently and the use of composite datasets may over or under-estimate actual conditions).
- Uncertainties in the TSF bathymetric survey (e.g., the transition between exposed tailings surface [i.e., beach] and free water can be complex).
- Uncertainties associated with the tie-in of the October 30, 2023 TSF storage curve with those utilized in the 2022 calibration, specifically referring to the projected storage curves from the 2020 TSF survey to the 987 m dam crest elevation.
- Uncertainties related to the projection of the Cariboo Pit storage curve from 2022 Calibration to the January 25, 2024 survey could lead to a situation where less storage capacity is modeled for the Cariboo Pit. Consequently, the volumes for the TSF and other pits may over estimated.
- Potential inaccuracies in water level measurements.

- Potential inaccuracies and/or missing WTP discharge data. The TSF weekly report noted that WTP ceased operations after September 13, 2023. However, there were still low volumes of WTP discharge recorded in October and November 2023. Additionally, the WTP discharge data are available for only 6 days in December 2023 (MPMC 2024a).
- Potential differences between modeled water transfer rates and actual transfers on site.
- There were minor discrepancies in the tailings deposition data between TSF Water Balance Spreadsheet and 2023 DSI Report data request (MPMC 2024a). WSP proceeded with tailings production umbers from the 2023 DSI Report data request to ensure consistency with the data used in the DSI.

The modelled results for the 2023 SWWBM calibration provide a reasonable approximation of site conditions and are considered suitable for water management planning.

5.0 END-OF-YEAR WATER BALANCE

Table 1 presents End of Year (EoY) modelled site water balance from 2017 through 2023. The modelled balance is the net storage of free water volume (total water) on site and net annual inflow. Storage locations include the TSF, pits, sumps, and ponds.

Table 2: EoY Modelled Site Water Balance Volume

Date	Total Water on Site[(a)(b)] (M-m^3)	Annual Water Net Inflow[(c)] (M-m^3)
December 31, 2017	6.0	4.6
December 31, 2018	3.9	5.3
December 31, 2019	3.8	6.4
December 31, 2020	8.2	9.5
December 31, 2021	7.5	6.1
December 31, 2022	6.0	6.4
December 31 ,2023	4.0	5.6

(a) End of year sum of water in TSF, pits, sumps, and ponds.
(b) Includes Wight Pit stored water volume.
(c) Net Inflows = Direct Precipitation + Runoff + Baseflows + Groundwater Inflow - Evaporation - Groundwater Outflow (for calendar year).

6.0 RECOMMENDATIONS

Based on the results of the 2023 SWWBM calibration, the following recommendations are provided to enable more robust water balance modelling:

- Increase the frequency of periodic snowpack measurements in the spring and fall seasons to generate more representative snowmelt data (e.g., in case mid-season snowmelt occurs outside of the freshet period).
- Record both snowfall and rainfall data measurements in the winter to produce more representative climate data (only rainfall and snowpack is recorded currently).

- Conduct both topographic and bathymetric surveys in spring and fall annually to achieve a more precise TSF storage curve progression.
- Review and validate available flow data on site to supplement the calibration of the SWWBM.
- Refine the runoff coefficients as part of future model updates.
- Refine the catchment areas to confirm various land types annually, thereby enhancing the precision of runoff estimations in the model through future updates.

7.0 CLOSURE

This technical memorandum summarizes the SWWBM calibration and end-of-year water balance for the model run period January 1, 2023 to December 31, 2023 (inclusive). The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust that this technical memorandum satisfies your current requirements. Please contact the undersigned should you have any questions.

WSP Canada Inc.



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Water Resources Engineer



2024-03-21

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PERMIT TO PRACTICE #1000200
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Fellow, Mine Water

SC/GD/PWM/ar/ca/anr

https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/026-tm-31141-2023 site wide water balance model update and calibration/rev0/ca0020527.4505-026-tm-rev0-31141-2023 wb calibration 21mar_24.docx

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STUDY LIMITATIONS

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APPENDIX 2-4: Water Quality Screening Tables

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2017-06-21	2015-10-06	2015-11-26	2016-05-16	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19
Parameter																					
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	142.1	143.7	104.1	-	-	-	-	106	-	181.8	129.1	140.3	97.9	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	8.21	7.82	7.87	-	-	-	-	7.25	-	7.47	8.27	7.71	7.58	-
Turbidity	NTU	1	-	-	-	-	1	-	0.19	0.33	0.09	-	-	-	-	0.46	-	0.57	0.43	0.3	0.56	-
Temperature	C	-	-	-	-	-	-	-	12.21	5.58	5.14	-	-	-	-	18.718	-	14.958	11.25	6.704	6.4	-
Dissolved oxygen	%	-	-	-	-	-	-	-	90.5	87	88.7	-	-	-	-	100.8	-	94.1	103.6	88.5	91.4	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	9.7	10.95	11.3	-	-	-	-	9.4	-	9.49	11.4	10.81	11.28	-
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.6	-	-	-	48.5	53.1	48.5	45.1	47.2	48.7	48.9	49.7	49.4	49.2	43.1
Specific conductivity	uS/cm	-	-	-	-	-	-	106	-	-	-	110	111	109	95.1	104	106	108	107	110	110	93
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.95	-	-	-	7.84	7.98	7.98	7.94	7.87	7.98	7.85	7.93	7.85	7.88	7.79
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	-	-	-	11.5	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	1.1
Turbidity	NTU	1	-	-	-	-	1	0.26	-	-	-	0.2	0.31	0.24	0.49	0.23	0.21	0.21	0.22	0.27	0.38	0.75
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	50.1	-	-	-	55.3	51.5	51.8	47.9	52.5	51.4	53.6	53.1	53.4	51	46.5
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	-	-	-	68	65	68	66	63	68	67	61	69	58	63
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.51	-	-	-	1.86	2.11	1.91	2.09	2.22	1.82	1.73	1.67	1.49	1.83	2.56
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.14	-	-	-	0.137	0.136	0.133	0.0818	0.0544	0.0522	0.0514	0.0588	0.0947	0.123	0.0672
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.14	-	-	-	-	0.136	0.133	0.0818	0.0544	0.0522	0.0514	0.0588	0.0947	0.123	0.0672
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0134	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	-	-	-	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	0.0022	0.0086
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.191	-	-	-	0.183	0.177	0.182	0.15	0.121	0.097	0.498	0.128	0.178	0.2	0.198
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	0.134	0.38	0.079	0.508	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	16.7	-	-	-	18.7	17.4	17.6	16.1	17.6	17.4	18.2	18.1	18.1	17.2	15.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.031	-	-	-	0.032	0.029	0.034	0.032	0.031	0.031	0.031	0.03	0.032	0.034	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.06	-	-	-	2.07	1.94	1.93	1.88	2.06	1.93	1.99	1.91	1.97	1.97	1.98
Potassium	mg/L	-	-	-	-	-	-	0.46	-	-	-	0.474	0.455	0.494	0.516	0.493	0.471	0.5	0.475	0.429	0.487	0.618
Sodium	mg/L	-	-	-	-	-	-	0.951	-	-	-	0.922	0.948	0.956	0.945	0.871	0.819	0.869	0.858	0.88	0.93	0.973
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.48	-	-	-	6.26	6.22	6.19	5.69	5.81	6.25	6.51	6.5	6.28	6.07	5.31

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2017-06-21	2015-10-06	2015-11-26	2016-05-16	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.015	-	-	-	0.0126	0.0145	0.0133	0.025	0.0138	0.0106	0.0121	0.0106	0.0119	0.0274	0.0394
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	0.0001	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	-	-	-	0.00011	0.00013	<0.00010	0.00015	0.00016	0.00011	0.00014	<0.00010	0.00011	0.00011	0.00018
Barium	mg/L	-	1W	-	-	-	1	0.00504	-	-	-	0.00506	0.00525	0.00535	0.00554	0.00595	0.00504	0.00513	0.005	0.00519	0.00569	0.00681
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	-	-	-	<0.00050	<0.000050	<0.000050	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	-	-	-	<0.000010	0.0000057	<0.0000050	0.0000055	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.4	-	-	-	18.5	18.1	17.3	16.1	17.1	17.4	18.1	17.5	17.7	17	15.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00075	-	-	-	0.0006	0.00109	0.00074	0.00095	<0.0010	0.00062	0.00058	0.00063	0.0006	0.00075	0.00114
Iron	mg/L	-	-	1	-	-	1	<0.030	-	-	-	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	0.046	0.058
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000115	-	-	-	<0.000050	0.000119	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	-	-	-	0.00077	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.18	-	-	-	2.07	1.99	1.91	1.9	2.05	1.97	2	1.87	1.94	1.96	2.01
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00126	-	-	-	0.000737	0.0011	0.00102	0.00261	0.00204	0.00038	0.001	0.00088	0.00098	0.00207	0.00413
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000311	-	-	-	0.00031	0.000434	0.000312	0.000475	0.000376	0.000343	0.000316	0.000298	0.0003	0.000337	0.000427
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.496	-	-	-	0.486	0.503	0.49	0.516	0.496	0.484	0.512	0.469	0.431	0.491	0.607
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000089	-	-	-	<0.00050	0.000134	0.000101	0.000148	0.000113	0.000088	0.000099	0.000079	0.000087	0.000093	0.000132
Silicon	mg/L	-	-	-	-	-	-	1.86	-	-	-	1.66	1.71	1.67	1.72	1.64	1.5	1.47	1.43	1.55	1.82	2.06
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.02	-	-	-	0.922	1.01	0.973	0.926	0.894	0.865	0.879	0.876	0.908	0.951	0.99
Strontium	mg/L	-	-	-	-	-	-	0.13	-	-	-	0.132	0.137	0.127	0.113	0.117	0.128	0.136	0.137	0.14	0.13	0.102
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000159	-	-	-	0.000154	0.00017	0.000153	0.000138	0.000139	0.000155	0.000151	0.000165	0.000164	0.000157	0.000123
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	-	-	-	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-2a	QUL-2a	QUL-2a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Date								2017-06-21	2015-10-06	2015-11-26	2016-05-16	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0106	-	-	-	0.006	0.0061	0.0072	0.0111	0.0088	0.0089	0.0072	0.0062	0.0058	0.0109	0.0145
Antimony	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	0.00013	0.00011	<0.00010	0.00011	<0.00010	<0.00010	0.0001	0.00013
Barium	mg/L	-	-	-	-	-	-	0.00489	-	-	-	0.00497	0.00497	0.00518	0.00529	0.0058	0.00502	0.00498	0.0049	0.00505	0.00543	0.00632
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	-	-	-	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	-	-	-	<0.0000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00088	-	-	-	<0.00050	0.00054	0.00059	0.00064	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	0.00062	0.00075
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	-	-	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.00011	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	-	-	-	0.00092	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00065	-	-	-	0.000167	0.00033	0.00056	0.0014	0.00027	0.00085	0.00023	0.00013	0.00025	0.00114	0.00194
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000311	-	-	-	0.000268	0.000342	0.000287	0.00035	0.000343	0.000311	0.000315	0.00028	0.000292	0.000337	0.000396
Nickel	mg/L	-	-	-	-	-	-	<0.00050	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000086	-	-	-	<0.00050	0.000103	0.000071	0.000133	0.000115	0.000095	0.000092	0.000076	0.000098	0.000086	0.000152
Silicon	mg/L	-	-	-	-	-	-	1.63	-	-	-	1.62	1.69	1.68	1.71	1.63	1.5	1.45	1.43	1.54	1.79	2.02
Silver	mg/L	-	-	-	-	-	-	<0.000010	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.126	-	-	-	0.132	0.135	0.128	0.111	0.116	0.127	0.134	0.137	0.134	0.126	0.1
Thallium	mg/L	-	-	-	-	-	-	<0.000010	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000156	-	-	-	0.000142	0.000165	0.000145	0.000134	0.000136	0.000151	0.000145	0.000157	0.000158	0.000143	0.000118
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	-	-	-	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date Parameter								2016-06-27	2016-07-20	2016-08-24	2017-04-10	2017-06-21	2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	90.5	93.1	102.7	106.9	104.2	109.4	99.2	92	100.9	107.1	102.2	102.8	110.2	98.6	104.9
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.26	8.16	8.39	7.56	7.88	7.92	8.14	7.66	8.01	6.88	7.43	8.01	7.73	7.94	8.27
Turbidity	NTU	1	-	-	-	-	1	0	0.04	0.94	0.44	0.63	0.36	0.7	0	0.95	0	0.29	0.11	0.4	0	0.11
Temperature	C	-	-	-	-	-	-	18.833	18.714	17.714	2.507	11.577	17.52	11.867	17.35	15.148	9.349	8.874	18.102	10.025	17.212	16.001
Dissolved oxygen	%	-	-	-	-	-	-	87.6	95.8	91.2	88.8	98.7	96.8	84.6	101.6	94.7	91.8	93.5	96	96.9	98	98.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	8.12	8.93	8.64	12.1	10.74	9.26	9.14	9.75	9.52	10.52	10.84	9.07	10.93	9.43	9.71
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	38.6	43.7	47.7	49.9	45.4	46.1	47.4	42.2	47.7	49.1	45.9	45.2	46.8	43.1	46.5
Specific conductivity	uS/cm	-	-	-	-	-	-	95.3	96.2	105	116	99.3	103	102	93.7	104	105	104	100	104	98.6	104
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.78	7.77	7.83	7.94	7.91	7.83	7.91	7.81	7.94	7.94	7.98	7.93	7.8	7.95	7.99
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.27	0.27	0.27	0.22	0.44	0.27	0.6	0.44	0.3	0.37	0.23	0.24	0.37	0.33	0.19
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	47.1	47.3	49.8	52.5	46.4	49.1	43.5	46.3	48.7	52.4	52.2	49.1	50.9	45.3	51.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49	48	53
Total dissolved solids	mg/L	-	-	-	1000	-	1000	78	84	81	73	73	64	68	64	86	74	82	67	64	62	69
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.1	2.21	1.83	2.12	2.1	1.86	2.28	2.21	1.82	1.53	1.81	1.72	2.36	2.83	2.32
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0636	0.0451	0.0587	0.137	0.107	0.0465	0.114	0.0652	0.0413	0.082	0.111	0.0509	0.11	0.03	0.0273
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0636	0.0451	0.0587	0.137	0.107	0.0465	0.114	0.0652	0.0413	0.082	0.111	0.0509	0.11	0.0302	0.0274
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0124	<0.0050	<0.0050	<0.0050	0.0066	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	0.0029	0.0025	<0.0020	<0.0020	<0.0020	0.0057	0.0024
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0024	<0.0020	<0.0020	<0.0020	0.0041	<0.020	0.0047	0.0033	0.0048	0.0062	0.0045	0.0022	0.0086	0.0024	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	0.0014	0.0015	0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.174	0.126	0.115	0.186	0.198	0.136	0.175	0.127	0.135	0.168	0.181	0.145	0.193	0.138	0.102
Chlorophyll a	ug/L	-	-	-	-	-	-	0.355	-	0.381	-	-	0.56	-	0.448	1.06	-	0.703	0.746	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	15.7	15.8	16.8	17.6	15.3	16.5	14.5	15.1	16.5	17.9	17.6	16.5	17.1	14.9	17.3
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.033	0.032	0.034	0.031	0.03	0.03	0.035	0.033	0.032	0.033	0.037	0.032	0.037	0.034	0.034
Magnesium	mg/L	-	-	-	-	-	-	1.91	1.91	1.9	2.1	1.99	1.93	1.77	2.1	1.85	1.86	1.98	1.88	1.98	1.95	2.06
Potassium	mg/L	-	-	-	-	-	-	0.513	0.52	0.489	0.535	0.479	0.476	0.477	0.547	0.49	0.486	0.521	0.447	0.505	0.484	0.495
Sodium	mg/L	-	-	-	-	-	-	0.907	0.887	0.849	0.938	0.906	0.883	0.849	1.02	0.87	0.884	0.985	0.817	0.908	0.919	0.954
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	5.54	5.77	6.27	6.46	5.97	6.49	6	5.78	6.01	6.65	6.44	5.76	6.09	5.43	5.85

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Date								2016-06-27	2016-07-20	2016-08-24	2017-04-10	2017-06-21	2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0198	0.0135	0.0116	0.0095	0.0232	0.0112	0.0287	0.0291	0.0122	0.0396	0.0149	0.0141	0.025	0.0211	0.0136
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	0.00011	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	0.00012	<0.00010	0.00012	0.00015	0.00011	0.00013	0.00017	0.00012	0.00017	0.0001	<0.00010	0.00015	0.00016	0.00015
Barium	mg/L	-	1W	-	-	-	1	0.00541	0.00535	0.00497	0.00533	0.00511	0.00568	0.00564	0.00672	0.00546	0.00602	0.00513	0.00449	0.00538	0.00544	0.00494
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000056	0.0000055	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	15.3	15.6	17.7	17.7	16.3	17.4	16.2	13.2	17	18.9	15.7	15.8	16.4	15.7	17.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.0008	0.00056	0.00054	0.00053	0.00061	0.00056	0.00077	0.00112	0.00077	0.00274	0.00055	0.00062	0.00078	0.00067	0.00058
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032	0.038	<0.030	0.034	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.86	1.9	1.96	2.07	2.04	2.03	1.94	2.01	1.99	2.32	1.85	1.8	1.95	2.13	2
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00198	0.00169	0.00078	0.00088	0.00189	0.00156	0.00208	0.00312	0.00137	0.00235	0.00135	0.00066	0.00163	0.00163	0.00117
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000391	0.000351	0.000279	0.000337	0.000345	0.00033	0.000353	0.000387	0.000332	0.000329	0.000369	0.000264	0.000343	0.000382	0.000301
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.501	0.482	0.476	0.488	0.51	0.498	0.518	0.564	0.503	0.52	0.432	0.436	0.507	0.492	0.425
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00011	0.000099	0.000062	0.000091	0.000113	0.000095	0.000099	0.000156	0.000128	0.000103	0.000108	0.000105	0.000107	0.00013	0.000126
Silicon	mg/L	-	-	-	-	-	-	1.74	1.69	1.49	1.76	1.92	1.6	1.81	1.89	1.62	1.61	1.77	1.37	1.93	1.98	1.66
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.905	0.863	0.879	0.977	1.01	0.958	0.974	1.02	0.942	1.04	0.862	0.778	0.934	0.918	0.846
Strontium	mg/L	-	-	-	-	-	-	0.11	0.11	0.138	0.136	0.12	0.134	0.119	0.0942	0.122	0.142	0.124	0.116	0.125	0.113	0.134
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000133	0.00014	0.000144	0.000164	0.00014	0.000152	0.000158	0.000119	0.000148	0.00018	0.000153	0.000148	0.000153	0.000139	0.000146
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.004	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island
Date								2016-06-27	2016-07-20	2016-08-24	2017-04-10	2017-06-21	2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0137	0.0109	0.0096	0.0044	0.0122	0.0081	0.0115	0.0122	0.008	0.0064	0.0081	0.0101	0.0122	0.0133	0.0116
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00012	<0.00010	<0.00010	0.0001	<0.00010	0.00011	0.00013	<0.00010	<0.00010	0.00011	<0.00010	0.0001	0.00014	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00546	0.00551	0.00493	0.00508	0.00506	0.00541	0.00491	0.00647	0.00544	0.00542	0.00527	0.00478	0.00549	0.00579	0.00578
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00058	<0.00050	<0.00050	<0.00050	0.00059	<0.00050	<0.00050	0.00072	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	0.00053	0.00058
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00131	0.0008	0.00038	0.00021	0.00064	0.00023	0.00112	0.00215	0.00046	0.00034	0.00049	<0.00010	0.0004	0.00012	0.00037
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000362	0.000343	0.000265	0.000313	0.000321	0.000305	0.000306	0.000431	0.000368	0.000295	0.000332	0.000274	0.000316	0.000388	0.000302
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000108	0.000098	0.00005	0.00009	0.000083	0.000101	0.000088	0.000135	0.000083	0.000081	0.000133	0.000068	0.000084	0.000105	0.000084
Silicon	mg/L	-	-	-	-	-	-	1.74	1.7	1.44	1.61	1.66	1.52	1.77	1.83	1.46	1.37	1.68	1.45	1.87	1.8	1.66
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.106	0.109	0.132	0.132	0.106	0.128	0.113	0.108	0.132	0.136	0.126	0.129	0.127	0.109	0.125
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000128	0.000133	0.000134	0.000154	0.000136	0.000141	0.00013	0.00013	0.000153	0.000157	0.00016	0.000143	0.000139	0.000119	0.000152
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0221	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Date								2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	107.5	106	117.9	109.2	106.5	111.7	95.4	97.1	104.6	-	-	-	-	115.1	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.97	8.32	7.99	8.88	7.88	7.74	8.04	7.94	8.06	-	-	-	-	7.5	-
Turbidity	NTU	1	-	-	-	-	1	0.13	0.22	0.05	0.06	0.19	0	0.68	0	0	-	-	-	-	0.31	-
Temperature	C	-	-	-	-	-	-	7.018	7.142	20.347	15.747	8.989	3.314	12.84	20.664	13.362	-	-	-	-	3.863	-
Dissolved oxygen	%	-	-	-	-	-	-	88.3	95.3	100.1	94.8	90.8	90.2	100.1	100	94.6	-	-	-	-	82.6	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.71	11.52	9.03	9.4	10.49	12.03	10.58	8.97	9.89	-	-	-	-	10.86	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	47.5	47.3	45	51.7	47.7	50.5	44.2	41.9	44	48.3	51.3	50	50.9	48.8	52.1
Specific conductivity	uS/cm	-	-	-	-	-	-	108	107	98.5	112	107	112	94.5	99.5	105	110	103	110	106	113	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	7.84	7.95	7.91	7.94	7.9	7.8	7.88	7.86	7.85	7.97	7.94	7.93	7.89	7.91
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	1.2	<1.0	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.16	0.42	0.16	0.13	0.16	0.19	0.75	0.28	0.19	0.2	0.34	0.24	0.23	0.13	0.2
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.8	51.7	47.5	51.7	52.1	52.4	45.7	45.6	53.9	54	52.2	50.7	53.7	55.6	53.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	51.5	47.3	47.9	55	53.2	53.9	48.3	44.4	50.7	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	77	67	76	85	70	78	66	62	79	66	69	68	66	65	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	12.7	2.37	2.23	1.72	1.65	1.96	2.72	2.32	1.67	2.07	2.09	1.81	1.68	1.81	1.74
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.104	0.129	0.0509	0.0439	0.087	0.134	0.0807	0.0207	0.0366	0.145	0.135	0.143	0.143	0.143	0.145
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.104	0.129	0.0509	0.0439	0.087	0.134	0.0807	0.0207	0.0366	-	0.135	0.143	0.143	0.143	0.145
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	0.0052	0.0059	<0.0050	<0.0050	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0047	<0.0020	0.0029	<0.0020	0.0025	0.0021	<0.0020	0.0022	0.0022
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.158	0.184	0.119	0.118	0.141	0.22	0.143	0.088	0.113	0.198	0.181	0.186	0.179	0.182	0.167
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.8	17.3	16.1	17.6	17.7	17.5	15.2	15.1	18.4	18.4	17.6	17.2	18.1	18.8	18.2
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.034	0.037	0.03	0.033	0.035	0.035	0.032	0.029	0.035	0.032	0.033	0.033	0.034	0.033	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.04	2.07	1.78	1.89	1.93	2.12	1.89	1.91	1.94	1.97	2	1.88	2.03	2.09	2.04
Potassium	mg/L	-	-	-	-	-	-	0.496	0.529	0.484	0.467	0.482	0.502	0.483	0.508	0.466	0.484	0.455	0.471	0.515	0.506	0.491
Sodium	mg/L	-	-	-	-	-	-	0.893	1.01	0.82	0.864	0.853	0.986	0.848	0.866	0.846	0.932	0.932	0.937	0.987	0.945	0.915
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.74	6.33	5.85	6.38	6.8	6.4	5.15	5.26	6.48	6.28	6.15	6.31	6.27	6.09	6.39

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Date								2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0128	0.0222	0.0149	0.0119	0.0123	0.0327	0.0358	0.0181	0.0138	0.0147	0.0221	0.0153	0.0138	0.0122	0.0105
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00015	0.00014	0.0001	0.00012	0.00011	0.00011	0.00012	0.0001	0.00011	0.00013	0.00011	0.00012	0.00012	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00482	0.00516	0.00553	0.00456	0.00501	0.00613	0.00548	0.0054	0.00489	0.00514	0.00531	0.00523	0.005	0.00568	0.00506
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.4	15.7	16	18.8	18	18.1	16.3	14.7	17	18.3	17.7	17.4	17.8	18.2	18.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00089	0.00063	0.00053	0.00053	0.00053	0.0011	0.00465	0.00055	0.00051	0.00093	0.00102	0.00064	0.00083	<0.0010	0.00071
Iron	mg/L	-	-	1	-	-	1	<0.030	0.03	<0.030	<0.030	<0.030	0.039	0.04	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000058	<0.000050	0.000068	0.00014	0.000099	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.00078	0.001	<0.0010	<0.0010	0.0012	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.97	1.96	1.94	1.95	2	2.12	1.84	1.88	2	1.98	2.01	1.91	2	2.05	2.06
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00088	0.00188	0.00181	0.00063	0.00112	0.00288	0.00232	0.00147	0.00152	0.00074	0.00148	0.00104	0.00089	0.00074	0.00072
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.0003	0.000383	0.00037	0.000304	0.000349	0.000354	0.00033	0.00035	0.000284	0.000331	0.000409	0.000311	0.000326	0.000333	0.000343
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.458	0.47	0.506	0.481	0.496	0.502	0.476	0.489	0.48	0.488	0.479	0.472	0.499	0.486	0.48
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000095	0.000114	0.000127	0.0001	0.000089	0.000125	0.000084	0.000117	0.00011	<0.00050	0.000101	0.000099	0.000083	0.000081	0.000082
Silicon	mg/L	-	-	-	-	-	-	1.64	2.12	1.8	1.4	1.67	1.86	1.93	1.64	1.36	1.69	1.76	1.64	1.67	1.74	1.7
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.897	0.958	0.901	0.882	0.905	0.995	0.832	0.862	0.849	0.941	0.992	0.953	0.962	0.937	0.898
Strontium	mg/L	-	-	-	-	-	-	0.139	0.12	0.111	0.132	0.141	0.136	0.117	0.117	0.139	0.137	0.136	0.13	0.133	0.136	0.139
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000155	0.000149	0.000136	0.000148	0.000173	0.000167	0.000139	0.000134	0.000157	0.000159	0.000176	0.000154	0.000157	0.000157	0.000169
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-0m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Date								2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0079	0.0128	0.0108	0.0087	0.01	0.0051	0.0203	0.0109	0.0085	0.0062	0.0064	0.0047	0.006	0.0052	0.0053
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.0001	0.00012	<0.00010	<0.00010	<0.00010	0.00013	0.00013	0.00018	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001
Barium	mg/L	-	-	-	-	-	-	0.0046	0.00524	0.00527	0.00498	0.00513	0.00513	0.00531	0.00531	0.00524	0.00505	0.00508	0.00506	0.00508	0.00543	0.00498
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	<0.00050	0.0006	<0.00050	<0.00050	0.00069	0.00061	0.00064	<0.00050	<0.00050	0.0007	0.00103	0.0006	0.00077	0.00086	0.00064
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000118	0.000199	0.000117	0.000082	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00084	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00035	0.00111	0.00075	0.00023	0.00104	0.00029	0.00087	0.00058	0.00023	0.000086	0.00033	0.00025	0.00021	0.00016	0.00016
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000317	0.00035	0.00038	0.00028	0.000339	0.000345	0.000309	0.000331	0.000266	0.000268	0.000356	0.000296	0.000312	0.00032	0.000329
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000078	0.000109	0.000108	0.000117	0.000088	0.000086	0.000106	0.000117	0.000093	<0.00050	0.00009	0.000077	0.000083	0.000081	0.000073
Silicon	mg/L	-	-	-	-	-	-	1.53	1.89	1.62	1.36	1.48	1.74	1.9	1.52	1.3	1.64	1.77	1.64	1.68	1.74	1.68
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.147	0.131	0.12	0.13	0.136	0.139	0.107	0.11	0.142	0.126	0.133	0.131	0.135	0.132	0.136
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000156	0.000142	0.000135	0.000148	0.00016	0.000162	0.000133	0.000134	0.00015	0.000137	0.000167	0.000147	0.000155	0.000154	0.000158
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date Parameter								2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	-	104.7	109.1	108.6	-	115.6	108.3	107.6	110.9	-	118	110.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	-	7.82	7.45	7.85	-	7.72	7.22	7.95	6.69	-	7.64	7.7
Turbidity	NTU	1	-	-	-	-	1	-	0.39	-	-	1.42	0	0.28	-	2.99	0.41	0.55	0	-	0.29	0
Temperature	C	-	-	-	-	-	-	-	-	-	-	4.881	3.856	8.67	-	6.631	3.765	6.508	3.815	-	3.886	3.829
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	89.2	80.9	97.3	-	94.8	88.2	93.1	86.4	-	92.9	90
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	-	-	11.43	10.64	11.21	-	11.48	11.63	11.42	11.38	-	12.22	11.85
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.8	51	50.6	50.4	50.4	48.3	50.7	50.5	49	50.1	50.1	50.4	48.5	50.5	47.5
Specific conductivity	uS/cm	-	-	-	-	-	-	109	109	113	113	109	108	108	110	105	111	109	111	111	110	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.75	7.83	7.81	7.9	7.77	7.86	7.79	7.96	7.8	7.89	7.88	7.97	7.98	7.82	7.9
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1
Turbidity	NTU	1	-	-	-	-	1	0.28	0.12	0.12	0.27	0.38	0.26	0.16	0.27	0.13	0.22	0.19	0.2	<0.10	0.28	0.16
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.2	55.1	55.4	53.4	54.2	53.3	52.9	50.1	51.5	54.2	51.3	54.5	50.1	54	52.5
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52.6	53.9
Total dissolved solids	mg/L	-	-	-	1000	-	1000	67	64	75	61	66	80	81	70	57	72	77	68	71	73	75
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.75	1.53	1.31	1.48	1.56	1.46	1.61	1.66	1.53	1.85	1.6	1.38	1.68	1.89	1.72
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.148	0.147	0.146	0.132	0.136	0.141	0.144	0.142	0.147	0.143	0.146	0.148	0.14	0.138	0.143
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.148	0.147	0.146	0.132	0.136	0.141	0.144	0.142	0.147	0.143	0.146	0.148	0.14	0.138	0.143
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0032	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	<0.0020	<0.0020	0.0048	<0.0020	<0.0020	<0.0020	<0.020	0.0022	0.0436	0.0022	0.0053	0.0057	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013
Total nitrogen	mg/L	-	-	-	-	-	-	0.189	0.2	0.201	0.193	0.182	0.175	0.178	0.184	0.219	0.143	0.186	0.187	0.204	0.2	0.199
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	19	18.7	18.8	18	18.3	18	17.8	16.6	17.3	18.1	17.3	18.6	16.6	18.2	17.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.032	0.032	0.033	0.034	0.033	0.034	0.036	0.031	0.032	0.034	0.033	0.034	0.035	0.036	0.034
Magnesium	mg/L	-	-	-	-	-	-	2.13	2.02	2.04	2.04	2.07	2.04	2.06	2.06	2.04	2.22	1.96	1.95	2.08	2.09	2.05
Potassium	mg/L	-	-	-	-	-	-	0.511	0.478	0.453	0.484	0.508	0.5	0.514	0.478	0.473	0.512	0.494	0.479	0.502	0.506	0.506
Sodium	mg/L	-	-	-	-	-	-	0.954	0.933	0.929	0.948	1.01	0.938	0.968	0.955	0.966	1.02	0.921	0.944	0.973	0.936	1
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.4	6.33	6.13	6.28	6.19	6.28	6.24	6.54	6.67	6.5	6.21	6.55	6.21	6.61	6.55

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0184	0.0093	0.0085	0.0166	0.0364	0.0114	0.0103	0.0132	0.0078	0.0137	0.0107	0.0069	0.0102	0.0134	0.011
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	<0.00010	0.00012	0.00012	0.00012	0.0001	<0.00010	0.00012	0.00011	0.00011	0.0001	<0.00010	<0.00010	0.00011	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00527	0.0051	0.005	0.00553	0.00596	0.00496	0.00517	0.00476	0.00522	0.00543	0.00518	0.00517	0.0047	0.00514	0.00502
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.000005	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.1	17.6	18.2	18	18.1	17.4	18.7	17.7	17.8	17.8	18.1	17.7	15.5	17.7	17.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00094	0.00054	0.00055	0.00092	0.0014	0.00078	0.00085	0.00065	0.00083	0.00065	0.00123	0.00054	0.00067	0.00057	0.00067
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	0.000092	0.000077	0.000076	0.000122	0.000089	0.00006	0.000205	0.000411	0.000847	0.000319	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.001
Magnesium	mg/L	-	-	-	-	-	-	2.03	1.93	1.99	2.07	2.08	2.01	2.07	2.22	2.1	2.14	2.09	1.98	1.84	2.05	2.22
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00082	0.00046	0.00056	0.00148	0.00148	0.00083	0.00069	0.00106	0.00066	0.0012	0.00072	0.00056	0.00076	0.00114	0.00079
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000335	0.000332	0.000305	0.000351	0.0003	0.000319	0.000312	0.000326	0.000347	0.000318	0.000302	0.000318	0.000305	0.000342	0.000311
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.527	0.501	0.451	0.49	0.582	0.488	0.509	0.533	0.477	0.506	0.504	0.468	0.445	0.502	0.507
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000071	0.000101	0.000086	0.000081	0.000084	0.000075	0.000064	0.000069	0.000106	0.000122	0.000068	0.000102	0.000084	0.000094	0.000071
Silicon	mg/L	-	-	-	-	-	-	1.67	1.65	1.69	1.8	1.76	1.68	1.73	1.83	1.83	1.86	1.69	1.63	1.57	1.85	1.8
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.973	0.97	0.954	0.988	0.926	0.941	0.987	1.04	0.984	0.952	0.995	0.908	0.856	0.934	0.997
Strontium	mg/L	-	-	-	-	-	-	0.139	0.143	0.142	0.139	0.131	0.127	0.143	0.134	0.142	0.139	0.133	0.145	0.124	0.136	0.142
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000156	0.000168	0.000164	0.000167	0.000156	0.000154	0.000152	0.000158	0.000157	0.000172	0.000167	0.000169	0.000151	0.000161	0.000164
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island
Date								2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0051	0.0082	0.006	0.0059	0.0065	0.0052	0.0047	0.0055	0.0054	0.0056	0.0052	0.0054	0.0042	0.006	0.0046
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00516	0.00519	0.00514	0.00529	0.00531	0.00507	0.005	0.00479	0.00521	0.00538	0.005	0.00495	0.0049	0.00526	0.00522
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00062	0.00054	0.00069	0.00073	0.00079	0.00066	0.00072	0.00054	0.00078	0.00055	0.00078	0.00094	<0.00050	<0.00050	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000063	<0.000050	0.000178	0.00014	0.000095	0.000274	0.00011	0.000062	0.000263	0.000307	0.000357	0.000252	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00016	0.00012	0.00016	0.00038	0.00028	0.00013	0.00016	0.00018	0.00019	0.00017	0.00018	0.00019	0.00011	0.00012	<0.00010
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000322	0.000305	0.000305	0.000309	0.000283	0.000322	0.000305	0.000303	0.000299	0.000328	0.000326	0.000302	0.000377	0.000336	0.000328
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00007	0.000102	0.00008	0.000087	0.000089	0.000073	0.00006	0.000082	0.000087	0.000081	0.000078	0.00007	0.000094	0.0001	0.000106
Silicon	mg/L	-	-	-	-	-	-	1.74	1.72	1.7	1.75	1.71	1.7	1.7	1.62	1.71	1.67	1.6	1.57	1.72	1.8	1.75
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.139	0.137	0.139	0.133	0.132	0.129	0.136	0.125	0.136	0.144	0.144	0.141	0.141	0.144	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000153	0.000155	0.00016	0.000152	0.000146	0.000148	0.000141	0.000154	0.00016	0.000165	0.000171	0.000153	0.000147	0.000151	0.000161
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0044	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21
Parameter																					
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	111.9	111.5	110.4	131.4	114.4	110.6	111.7	111.1	108.5	110.1	-	104.7	109.2	107.1	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.97	8.36	7.31	8.65	7.63	7.68	7.7	7.54	7.5	-	7.81	7.44	7.96	-
Turbidity	NTU	1	-	-	-	-	1	0.01	0.16	0.08	0.03	0.03	0.05	0	0.33	0	0	-	1.84	0	0	-
Temperature	C	-	-	-	-	-	-	3.818	3.891	3.885	3.921	3.812	3.886	3.278	3.915	3.829	3.87	-	5.438	3.811	6.502	-
Dissolved oxygen	%	-	-	-	-	-	-	89.7	87.1	90	89.7	88.5	88.2	90.5	90.8	89.1	88.8	-	90.6	80	92.2	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.81	11.45	11.83	11.78	11.65	11.6	12.08	11.92	11.72	11.68	-	11.44	10.53	11.09	-
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.7	48.4	49	50.3	53.5	48.6	50.9	50.8	48	46.8	50.5	48.9	48.6	50.5	49.9
Specific conductivity	uS/cm	-	-	-	-	-	-	111	111	112	109	118	110	113	109	112	111	113	108	108	108	109
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.95	7.83	7.86	7.91	7.86	7.91	7.9	7.87	7.85	7.88	7.9	7.77	7.85	7.79	7.95
Total suspended solids	mg/L	-	-	-	-	-	-	<1.1	<1.0	<1.0	<1.0	<1.1	<1.0	3.9	1.2	<1.1	<1.0	<1.0	1.3	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	<0.10	<0.10	0.19	<0.10	<0.10	<0.10	0.24	0.18	0.14	<0.10	0.3	0.53	0.22	0.14	0.2
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	55.1	54	53.1	53	52	53.8	53.4	54.4	51.8	54.9	53.3	53.7	53.3	52.9	50.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	58	50.1	52.5	54.7	57.4	53.8	53.2	55.3	52.8	52	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	73	71	72	84	71	71	76	70	66	92	60	68	81	81	68
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.74	12.5	2.06	1.86	1.77	1.64	2.15	2.21	1.95	1.89	1.43	1.67	1.39	1.55	1.45
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.139	0.154	0.137	0.143	0.145	0.148	0.131	0.137	0.143	0.147	0.135	0.138	0.142	0.146	0.145
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.14	0.154	0.137	0.143	0.145	0.148	0.131	0.137	0.143	0.147	0.135	0.138	0.142	0.146	0.145
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	0.0029	<0.0020	0.0022	<0.0020	0.0043	0.004	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.18	0.205	0.176	0.218	0.191	0.186	0.215	0.16	0.176	0.19	0.194	0.177	0.192	0.178	0.184
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	18.5	18.2	17.8	18.1	17.4	18.3	17.8	18.3	17.3	18.6	18	18.1	18	17.9	17
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.03	0.039	0.038	0.032	0.032	0.036	0.037	0.034	0.032	0.038	0.035	0.034	0.033	0.036	0.031
Magnesium	mg/L	-	-	-	-	-	-	2.17	2.08	2.1	1.9	2.09	1.98	2.18	2.11	2.1	2.06	2.02	2.06	2.05	2	2.04
Potassium	mg/L	-	-	-	-	-	-	0.514	0.502	0.522	0.466	0.506	0.484	0.52	0.488	0.527	0.498	0.482	0.571	0.499	0.487	0.486
Sodium	mg/L	-	-	-	-	-	-	1.04	0.96	0.993	0.892	1.01	0.909	1.02	0.95	0.987	0.985	0.924	0.974	0.948	0.937	0.949
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.25	6.79	6.71	6.61	6.54	6.82	6.32	6.28	6.14	6.69	6.32	6.19	6.26	6.25	6.54

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0102	0.008	0.0192	0.0097	0.0099	0.0094	0.0268	0.0106	0.0096	0.007	0.0126	0.046	0.0138	0.01	0.0118
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.0001	0.00012	0.0001	<0.00010	0.00012	0.00011	<0.00010	0.00011	0.00013	0.00011	0.00014	0.00011	<0.00010	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00484	0.00509	0.00527	0.00521	0.0049	0.00497	0.00565	0.0052	0.0052	0.00504	0.00523	0.00602	0.0051	0.00505	0.00472
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	19.8	16.6	17.5	18.4	19.5	18.2	17.7	18.7	17.7	17.4	17.7	18.1	17.3	17.9	17.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00071	0.00097	0.0006	0.00051	0.00057	0.00056	0.00074	<0.00050	<0.00050	<0.00050	0.00089	0.00167	0.00089	0.00093	0.00054
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.03	<0.030	<0.030	<0.030	<0.030	0.039	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000083	0.000076	0.000115	0.000146	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	0.001	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.1	2.07	2.14	2.13	2.11	2.04	2.2	2.09	2.09	2.08	2	2.1	2	2.09	2.22
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00064	0.0006	0.00189	0.00076	0.00064	0.00063	0.00216	0.00105	0.00075	0.00056	0.00096	0.00171	0.00084	0.00071	0.00094
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000315	0.00032	0.000356	0.000352	0.000316	0.000346	0.000368	0.000348	0.000351	0.000314	0.000327	0.000317	0.000329	0.000297	0.000322
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.444	0.483	0.507	0.503	0.511	0.497	0.522	0.488	0.505	0.498	0.471	0.561	0.494	0.521	0.521
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000088	0.000084	0.000092	0.000082	0.000057	0.000089	0.000123	0.00008	0.000093	0.000082	0.000082	0.000078	0.000085	0.000064	0.000076
Silicon	mg/L	-	-	-	-	-	-	1.79	1.75	1.99	1.97	1.78	1.86	1.83	1.9	1.85	1.78	1.71	1.81	1.69	1.71	1.81
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.92	0.981	1.03	0.982	1.01	1.03	1.03	0.948	0.983	0.946	0.94	0.915	0.947	0.984	1.03
Strontium	mg/L	-	-	-	-	-	-	0.15	0.146	0.135	0.14	0.143	0.14	0.141	0.136	0.144	0.147	0.137	0.131	0.13	0.14	0.134
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00015	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000154	0.000162	0.00017	0.000162	0.000159	0.000177	0.000164	0.000162	0.000166	0.000166	0.000163	0.000156	0.000155	0.000145	0.000157
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-120m - Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0052	0.0041	0.0081	0.0055	0.0053	0.0056	0.0064	0.0077	0.0051	0.0053	0.0054	0.0081	0.0049	0.0046	0.0054
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	0.00014	<0.00010	0.00011	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00526	0.00497	0.00521	0.00461	0.0052	0.00468	0.00527	0.00528	0.00505	0.00531	0.00521	0.00541	0.00508	0.00501	0.00495
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00076	0.00091	0.00057	<0.00050	0.00053	<0.00050	0.00065	<0.00050	0.00052	<0.00050	0.0007	0.00083	0.00068	0.00072	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000152	0.000186	0.00016	0.000111	0.00006
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00028	0.00011	<0.00010	0.00013	0.00042	0.00016	0.00018	0.00013	0.00027	0.00042	0.00011	0.00016	0.00015
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000316	0.00032	0.000341	0.00039	0.000294	0.000328	0.000357	0.000312	0.000329	0.000329	0.00031	0.000294	0.000299	0.000292	0.000297
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00115	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00013	0.000095	0.000081	0.000136	0.000079	0.000074	0.000088	0.000077	0.00008	0.000098	0.000082	0.000067	0.000088	0.000069	0.000076
Silicon	mg/L	-	-	-	-	-	-	1.89	1.58	1.82	1.72	1.62	1.6	1.8	1.92	1.76	1.75	1.68	1.72	1.7	1.68	1.69
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.14	0.154	0.135	0.15	0.131	0.142	0.142	0.132	0.131	0.144	0.133	0.128	0.13	0.137	0.134
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000163	0.000162	0.000157	0.000165	0.000151	0.000164	0.000164	0.000153	0.000153	0.000152	0.000152	0.00015	0.000153	0.000144	0.000163
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	115.3	108.3	107.1	111.2	-	118.1	110.7	112	111.7	110.8	131.6	114.3	110.6	112.4	111.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.67	7.21	7.85	6.7	-	7.65	7.68	7.79	7.95	8.39	7.31	8.73	7.62	7.67	7.67
Turbidity	NTU	1	-	-	-	-	1	1.14	0.44	0.48	0	-	0.24	0	0.05	0.13	0.06	0	0.06	0.05	0	0.44
Temperature	C	-	-	-	-	-	-	6.684	3.745	5.264	3.735	-	3.857	3.825	3.791	3.842	3.852	3.867	3.751	3.886	3.286	3.868
Dissolved oxygen	%	-	-	-	-	-	-	91.7	88.3	91.1	86.3	-	92.9	90	89.4	87	89.9	89.3	87.8	88.2	90.4	90.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.22	11.65	11.54	11.39	-	12.22	11.85	11.78	11.45	11.82	11.75	11.58	11.6	12.07	11.94
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.9	50.3	51.9	49.9	48.5	51.2	47.5	49.4	49	48.7	47.9	52.7	49.2	50.9	50.7
Specific conductivity	uS/cm	-	-	-	-	-	-	107	110	110	109	110	111	111	111	111	112	110	118	111	112	109
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.8	7.88	7.75	7.96	7.97	7.81	7.82	7.94	7.84	7.87	7.87	7.86	7.93	7.9	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0	<1.0	<1.1	<1.0	<1.0	<1.0	3.8	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.13	0.25	0.1	0.26	<0.10	0.22	0.11	<0.10	<0.10	0.26	<0.10	<0.10	<0.10	0.24	0.26
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.6	54.3	51.5	54.7	53.4	54.4	53.4	55.8	54.4	53.2	54.6	55.3	54.7	53	54.8
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	52.4	54	53	52.6	49.8	52.6	57.6	53.2	51.9	54.5
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	69	77	68	74	69	70	76	72	73	88	82	69	80	72
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.46	0.67	1.81	1.24	1.61	2	1.96	1.79	12.8	2.05	2.21	1.86	1.73	2.27	2.18
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.149	0.143	0.144	0.146	0.14	0.139	0.142	0.136	0.154	0.135	0.143	0.148	0.15	0.131	0.138
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.149	0.143	0.144	0.146	0.14	0.14	0.142	0.136	0.154	0.135	0.143	0.148	0.15	0.131	0.138
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0103	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0027	0.003	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.020	0.0023	0.077	<0.0020	0.0063	0.0061	<0.0020	<0.0020	<0.0020	0.0022	0.0023	<0.0020	<0.0020	0.0025	0.003
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.001	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.178	0.15	0.184	0.188	0.211	0.204	0.205	0.209	0.209	0.177	0.179	0.194	0.179	0.215	0.184
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.7	18.1	17.4	18.6	17.9	18.3	18	18.7	18.4	17.8	18.6	18.8	18.6	17.6	18.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.032	0.034	0.033	0.034	0.035	0.036	0.034	0.036	0.039	0.038	0.038	0.038	0.038	0.037	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.02	2.22	1.93	1.97	2.13	2.13	2.06	2.23	2.06	2.13	1.97	2.02	2.01	2.19	2.14
Potassium	mg/L	-	-	-	-	-	-	0.467	0.517	0.477	0.487	0.508	0.51	0.513	0.516	0.509	0.522	0.476	0.495	0.493	0.53	0.499
Sodium	mg/L	-	-	-	-	-	-	0.953	1.02	0.905	0.957	0.982	0.945	0.997	1.06	0.959	1.01	0.909	0.966	0.919	1.02	0.961
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.66	6.5	6.2	6.56	6.19	6.6	6.53	6.43	6.79	6.69	6.46	6.61	6.82	6.35	6.31

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.007	0.0156	0.0105	0.0063	0.0073	0.0144	0.0112	0.0077	0.0088	0.0162	0.0099	0.0084	0.0081	0.018	0.0114
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.0001	0.00011	<0.00010	<0.00010	0.00011	0.0001	<0.00010	<0.00010	0.00012	0.00014	0.00011	0.00012	0.00011	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00504	0.0053	0.0052	0.00531	0.00446	0.00506	0.00496	0.00513	0.00504	0.00503	0.0055	0.00471	0.00518	0.00548	0.00549
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000071	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.7	17.3	18.1	18	17	17.6	18	17.8	17.6	16.6	17.8	19.6	18	17.2	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00082	0.0011	0.00184	0.00061	<0.00050	0.0008	0.00066	0.00054	0.00057	0.00056	0.00052	0.0006	0.00059	0.00068	<0.00050
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.00014	0.000327	0.000353	0.000305	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.11	2.04	2	1.94	1.95	2.03	2.21	2.1	2.08	2.03	1.99	2.1	2.01	2.18	2.15
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00064	0.00138	0.00076	0.00056	0.00074	0.00118	0.00074	0.00064	0.00066	0.00161	0.001	0.00069	0.00065	0.00192	0.00124
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000322	0.000328	0.000303	0.000319	0.000306	0.000337	0.000341	0.000321	0.000316	0.000351	0.000344	0.000356	0.00034	0.00034	0.000324
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00068	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.48	0.485	0.507	0.463	0.473	0.498	0.505	0.475	0.481	0.472	0.515	0.498	0.503	0.51	0.491
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000099	0.000093	0.000078	0.000097	0.00007	0.000108	0.000105	0.000117	0.000125	0.000114	0.000109	0.000078	0.000092	0.000106	0.000092
Silicon	mg/L	-	-	-	-	-	-	1.8	1.79	1.74	1.7	1.67	1.83	1.83	1.68	1.73	2.02	1.85	1.78	1.8	1.88	1.95
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.985	0.917	0.989	0.916	0.922	0.929	0.986	0.932	0.961	0.978	0.984	0.987	0.941	1.02	0.963
Strontium	mg/L	-	-	-	-	-	-	0.142	0.135	0.132	0.145	0.131	0.135	0.14	0.134	0.135	0.128	0.138	0.147	0.141	0.138	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00023	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000161	0.000167	0.000172	0.000183	0.000164	0.00016	0.000165	0.000162	0.000159	0.00017	0.000167	0.000162	0.000175	0.000169	0.000161
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-06-19	2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0053	0.006	0.0051	0.0046	0.0043	0.0063	0.0045	0.0047	0.0042	0.008	0.005	0.0072	0.0057	0.006	0.0063
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	0.0001	<0.00010	<0.00010	0.0001	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.005	0.00548	0.00531	0.00524	0.00539	0.00538	0.00516	0.0056	0.00491	0.00512	0.0048	0.00502	0.00464	0.0053	0.00524
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.0008	0.00059	<0.00050	0.00078	<0.00050	<0.00050	<0.00050	0.00056	0.00124	0.00061	<0.00050	<0.00050	0.00051	0.00063	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000207	0.000279	0.000215	0.000255	<0.000050	<0.000050	<0.000050	<0.000050	0.000138	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00013	<0.00010	0.00013	0.0003	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	0.00026	0.0001	0.00016	<0.00010	0.00042	0.00012
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000311	0.000328	0.000315	0.000288	0.000338	0.000336	0.000337	0.000357	0.000312	0.000344	0.000349	0.000298	0.000334	0.000361	0.000326
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000081	0.000087	0.00007	0.000082	0.000082	0.000128	0.00011	0.000107	0.000088	0.000113	0.000092	0.000098	0.000072	0.000118	0.000091
Silicon	mg/L	-	-	-	-	-	-	1.72	1.68	1.58	1.58	1.77	1.82	1.76	1.89	1.62	1.83	1.76	1.76	1.6	1.87	1.9
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.139	0.144	0.146	0.146	0.144	0.139	0.139	0.141	0.138	0.151	0.138	0.147	0.134	0.142	0.139	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000152	0.000171	0.000165	0.000153	0.000156	0.000151	0.000159	0.000166	0.000162	0.000153	0.000164	0.000162	0.000163	0.000153	0.000156
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2017-04-10	2018-05-23	2019-06-19	2015-03-16
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	108.7	110.3	-	-	-	-	116.9	-	-	-	-	108.6	109.1	113.7	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.53	7.42	-	-	-	-	7.29	-	-	-	-	7.59	7.27	7.73	-
Turbidity	NTU	1	-	-	-	-	1	0	0	-	-	-	-	0.29	-	-	-	-	0.38	0.35	0.97	-
Temperature	C	-	-	-	-	-	-	3.799	3.841	-	-	-	-	3.645	-	-	-	-	4.881	3.64	4.712	-
Dissolved oxygen	%	-	-	-	-	-	-	88.9	88.8	-	-	-	-	80.7	-	-	-	-	-	89.7	88.1	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.72	11.68	-	-	-	-	10.67	-	-	-	-	-	11.87	11.34	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.1	46.9	48.7	52.1	50.5	51	49	52.3	50.7	51.7	50.7	49.6	50.1	49.2	50.1
Specific conductivity	uS/cm	-	-	-	-	-	-	112	112	111	111	110	106	112	113	111	109	114	114	113	111	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	7.87	7.86	7.99	7.93	7.9	7.88	7.89	7.79	7.86	7.82	7.92	7.88	8	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<1.1	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	1.1	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.14	<0.10	0.36	0.49	0.29	0.24	0.13	0.18	0.28	0.15	0.12	0.29	0.28	<0.10	0.22
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.5	53.2	53.4	52.3	50.6	54.2	56.5	54.8	55.4	55.3	55.4	51.9	47	55.4	55.6
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	50.5	51.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	76	89	65	66	68	65	64	74	74	69	76	69	71	80	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.87	1.87	2.09	2.28	2.1	1.71	1.75	1.6	1.65	1.51	1.45	1.45	1.81	1.59	2.08
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.142	0.147	0.148	0.131	0.141	0.143	0.144	0.151	0.15	0.148	0.152	0.143	0.14	0.143	0.138
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.142	0.147	-	0.131	0.141	0.143	0.144	0.151	0.15	0.148	0.152	0.143	0.14	0.143	-
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0024	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0042	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	<0.0020	0.0027	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.010	0.003	0.0075	0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.0031	0.0011	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.178	0.191	0.195	0.176	0.188	0.182	0.185	0.166	0.193	0.195	0.194	0.175	0.18	0.206	0.186
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.5	17.8	18.2	17.4	17.1	18.3	19.1	18.5	18.8	18.8	18.9	17.4	15.7	18.7	18.8
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.033	0.038	0.032	0.033	0.033	0.034	0.033	0.034	0.033	0.032	0.033	0.031	0.035	0.045	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.14	2.12	1.97	2.13	1.9	2.06	2.12	2.06	2.06	2.02	2.02	2.06	1.88	2.13	2.11
Potassium	mg/L	-	-	-	-	-	-	0.528	0.506	0.494	0.473	0.472	0.506	0.507	0.482	0.518	0.481	0.442	0.502	0.45	0.516	0.483
Sodium	mg/L	-	-	-	-	-	-	1	1	0.948	0.97	0.963	0.971	0.954	0.886	0.964	0.955	0.905	0.941	0.883	1.02	0.921
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.14	6.68	6.33	6.09	6.27	6.24	6.09	6.46	6.43	6.34	6.18	6.41	6.49	6.76	6.26

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2017-04-10	2018-05-23	2019-06-19	2015-03-16
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0097	0.0074	0.0215	0.0267	0.0181	0.0188	0.0119	0.0098	0.0196	0.0103	0.0093	0.0151	0.0176	0.0091	0.0165
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.00011	0.00012	0.00014	0.00011	0.00011	0.00011	0.00011	0.00013	<0.00010	0.00012	0.00012	0.00011	0.0001	0.0001
Barium	mg/L	-	1W	-	-	-	1	0.00508	0.00521	0.00526	0.00558	0.0054	0.00521	0.00562	0.00518	0.00518	0.00502	0.00501	0.00526	0.00555	0.00483	0.00511
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010
Calcium	mg/L	-	-	-	1000	-	1000	16.8	17.2	18.2	17.8	17.2	18.2	18.6	18.6	18.3	17.8	18.4	17.8	17.8	16.6	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	<0.00050	<0.00050	0.00084	0.00089	0.00072	0.00076	<0.0010	0.00069	0.00091	0.00062	0.00067	0.00075	0.00078	0.00061	0.00065
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	0.037	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	0.000084	0.000137	0.000177	0.000078	<0.000050	0.000055	<0.000050	0.000071	0.000091	0.000319	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	0.0007	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	0.00081
Magnesium	mg/L	-	-	-	-	-	-	2.07	2.13	1.97	2.09	1.93	2.05	2.11	2.07	2.03	1.92	2.01	2.06	2.1	1.86	2.05
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.0008	0.00068	0.0014	0.0027	0.00138	0.00121	0.00074	0.0009	0.0009	0.00054	0.00058	0.00133	0.00164	0.00093	0.00178
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000344	0.000325	0.000315	0.000402	0.000319	0.00034	0.000317	0.000324	0.000309	0.000334	0.000303	0.000329	0.000328	0.000361	0.000321
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.501	0.511	0.496	0.486	0.493	0.516	0.486	0.483	0.513	0.477	0.475	0.485	0.511	0.432	0.484
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000136	0.000071	<0.00050	0.00012	0.000095	0.000069	0.0001	0.000085	0.000074	0.000085	0.000093	0.000096	0.000082	0.000105	<0.00050
Silicon	mg/L	-	-	-	-	-	-	1.93	1.84	1.73	1.87	1.72	1.76	1.79	1.71	1.68	1.67	1.71	1.76	1.79	1.79	1.65
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.974	0.97	0.949	1.03	0.988	0.986	0.91	0.902	0.978	0.939	0.964	0.965	1.01	0.873	0.936
Strontium	mg/L	-	-	-	-	-	-	0.138	0.146	0.13	0.136	0.129	0.135	0.135	0.14	0.141	0.143	0.147	0.139	0.132	0.135	0.131
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000158	0.000161	0.000152	0.00017	0.000155	0.000159	0.000159	0.000176	0.000156	0.000169	0.000165	0.000162	0.000169	0.000157	0.000155
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-140m Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-190m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2022-08-15	2022-10-19	2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2017-04-10	2018-05-23	2019-06-19	2015-03-16
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0052	0.0059	0.0052	0.0072	0.0059	0.0059	0.0053	0.005	0.0057	0.0052	0.0048	0.0047	0.0045	0.005	0.0054
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00014	<0.00010	0.0001	<0.00010	0.00011	0.0001	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00507	0.00538	0.00508	0.00525	0.00527	0.00502	0.00544	0.00492	0.00512	0.00498	0.00503	0.00488	0.0048	0.00511	0.005
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00056	<0.00050	0.0007	0.00067	0.00066	0.0006	0.00203	0.00068	0.00074	0.00067	0.00063	0.00059	0.00061	<0.00050	0.00057
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	0.000069	0.000155	0.000117	0.000103	<0.000050	0.00012	0.000056	0.000111	0.00013	0.000236	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.00087	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00084
Manganese	mg/L	-	-	-	-	-	-	0.00012	0.00014	0.000341	0.00089	0.00021	0.00021	0.00015	0.00017	0.00016	0.00011	0.00013	0.00017	0.00021	<0.00010	0.000171
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00036	0.000338	0.00026	0.000375	0.000293	0.000334	0.000317	0.000294	0.000317	0.000292	0.000288	0.0003	0.000318	0.000351	0.000289
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00007	0.000101	<0.00050	0.000098	0.000063	0.0001	0.00009	0.000081	0.000087	0.000061	0.000063	0.000085	0.000085	0.000127	<0.00050
Silicon	mg/L	-	-	-	-	-	-	1.8	1.8	1.67	1.83	1.69	1.76	1.78	1.71	1.69	1.71	1.7	1.63	1.77	1.76	1.63
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.142	0.127	0.133	0.13	0.132	0.133	0.137	0.139	0.136	0.142	0.135	0.124	0.135	0.13
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000158	0.000156	0.000135	0.000163	0.000145	0.000153	0.000155	0.000161	0.000156	0.000152	0.000159	0.000156	0.000147	0.000169	0.000141
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date Parameter								2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	117.4	147.4	184	138.3	139.5	101.3	-	108.1	104.4	114.2	113.2	107.1
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	7.57	7.8	7.75	7.98	7.7	7.33	-	7.71	7.55	7.82	7.5	7.39
Turbidity	NTU	1	-	-	-	-	1	-	-	-	0.35	0.69	0.51	0.17	0.14	0.12	-	0	0.33	0.57	0.48	0.67
Temperature	C	-	-	-	-	-	-	-	-	-	4.874	4.504	4.565	5.103	6.713	4.124	-	4.738	4.591	4.392	4.605	4.184
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	83.1	82.1	80.9	86.9	86.9	85.2	-	85.9	83.7	87.6	84.7	87.9
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	-	10.64	10.61	10.43	11.05	10.63	11.12	-	11.04	10.8	11.36	10.93	11.46
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	52.2	46.5	50.5	48.6	51.2	51.2	50.9	49	49.9	49.6	42.9	50.3	49.9	48.8	49.6
Specific conductivity	uS/cm	-	-	-	-	-	-	110	106	106	112	110	111	107	110	114	108	107	106	109	107	109
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.99	7.9	7.91	7.88	7.88	7.82	7.95	7.87	7.89	7.8	7.73	7.79	7.95	7.81	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.38	0.21	0.17	0.16	0.18	0.51	0.13	0.27	0.19	2.11	0.31	0.24	0.24	0.18	0.27
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.2	50.9	53.2	55.3	53.7	55.2	54.6	53.8	53	52.5	53.4	53.1	50.2	49.6	54.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	67	66	70	72	72	69	74	61	71	88	82	58	69	67
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.1	1.76	1.58	1.82	1.77	1.77	1.74	1.36	1.42	1.46	1.76	1.56	1.58	1.76	1.68
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.136	0.137	0.14	0.139	0.143	0.144	0.15	0.0924	0.134	0.137	0.137	0.143	0.14	0.146	0.138
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.136	0.137	0.14	0.139	0.143	0.144	0.15	0.0924	0.134	0.137	0.137	0.143	0.14	0.146	0.138
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.003	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0024	0.0036	<0.0020	<0.0020	0.0023	0.0023	0.0031	0.0024	<0.0020	0.0065	0.0028	<0.0020	<0.0020	<0.020	0.0027
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.0012
Total nitrogen	mg/L	-	-	-	-	-	-	0.178	0.18	0.184	0.188	0.171	0.195	0.201	0.158	0.188	0.18	0.194	0.175	0.187	0.187	0.15
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.3	18	18.7	18.1	18.7	18.6	18.3	17.9	17.8	18	17.8	16.7	16.5	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.032	0.033	0.034	0.033	0.033	0.033	0.032	0.032	0.034	0.033	0.034	0.036	0.031	0.032	0.034
Magnesium	mg/L	-	-	-	-	-	-	1.98	1.86	2	2.09	2.04	2.08	1.99	1.97	2	1.99	2.07	2.07	2.08	2	2.21
Potassium	mg/L	-	-	-	-	-	-	0.472	0.464	0.5	0.507	0.497	0.512	0.495	0.437	0.478	0.56	0.513	0.526	0.455	0.475	0.515
Sodium	mg/L	-	-	-	-	-	-	0.977	0.915	0.956	0.942	0.946	0.987	0.937	0.899	0.922	0.954	0.967	1	0.941	0.981	1.03
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.18	6.22	6.25	6.13	6.41	6.43	6.3	6.28	6.32	6.25	6.29	6.33	6.46	6.72	6.45

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0139	0.0127	0.0186	0.0111	0.0131	0.223	0.009	0.0125	0.0158	0.0855	0.0167	0.0161	0.0151	0.0084	0.015
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00012	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	<0.00010	0.0001	0.00013	0.0001	0.00022	0.00011	0.00012	0.00012	0.00015	0.00011	<0.00010	0.00013	0.00011	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00517	0.00522	0.00514	0.00567	0.00522	0.00813	0.00519	0.00514	0.00527	0.00723	0.00524	0.00541	0.0049	0.0056	0.00552
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.9	17.4	18	18.1	18.5	18.2	17.8	17.7	17.7	18.1	17.5	18.4	17.7	17.6	17.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00067	0.00096	0.00069	<0.0010	0.00125	0.00728	0.00063	0.0006	0.00093	0.00251	0.00138	0.001	0.00057	0.00063	0.0007
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	0.173	<0.030	<0.030	<0.030	0.06	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000455	0.000527	0.000182	0.000065	0.000116	0.000189	<0.000050	0.00034	0.000227	0.00012	0.000322	0.000354	0.000055	0.000466	0.000504
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.98	1.89	2.01	2.05	2.12	2.16	1.94	1.94	1.99	2.09	2.03	2.13	2.22	2.07	2.16
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00105	0.00081	0.00093	0.0012	0.00119	0.00889	0.00072	0.00103	0.00103	0.0022	0.00118	0.00141	0.00104	0.00124	0.00125
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000385	0.000271	0.000344	0.000378	0.000398	0.000372	0.000334	0.000307	0.000337	0.000315	0.000365	0.000353	0.000322	0.000386	0.000331
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.461	0.465	0.511	0.5	0.505	0.572	0.491	0.443	0.475	0.612	0.497	0.507	0.52	0.492	0.503
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000129	0.000084	0.0001	0.000082	0.000101	0.000084	0.000066	0.000091	0.000085	0.000065	0.000088	0.000075	0.0001	0.000115	0.000091
Silicon	mg/L	-	-	-	-	-	-	1.7	1.62	1.66	1.75	1.76	2.07	1.69	1.55	1.74	1.84	1.74	1.78	1.84	1.84	1.86
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.966	0.938	0.968	0.949	0.974	0.99	0.97	0.918	0.944	0.968	0.953	1.01	1.02	1	0.968
Strontium	mg/L	-	-	-	-	-	-	0.138	0.131	0.135	0.134	0.14	0.138	0.141	0.139	0.137	0.134	0.128	0.14	0.135	0.139	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000171	0.00016	0.000158	0.000156	0.000176	0.00016	0.000166	0.000165	0.000165	0.000159	0.000154	0.000147	0.000155	0.000157	0.000165
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00075	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0057	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-06-21	2017-08-31	2018-06-19
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0068	0.0062	0.006	0.0052	0.0095	0.0053	0.0048	0.0057	0.005	0.0072	0.0073	0.0059	0.0061	0.0055	0.0063
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.00011	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00494	0.00513	0.00498	0.00561	0.00495	0.00517	0.0051	0.00495	0.00512	0.00571	0.00526	0.00496	0.00497	0.00521	0.00562
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00058	0.00061	0.00073	0.00079	0.00134	0.00081	0.00057	0.00064	0.00065	0.00081	0.00091	0.00079	0.00051	0.00054	0.00068
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000298	0.000712	0.000218	0.000238	0.000065	0.000059	0.000054	0.000426	0.000177	<0.000050	0.000508	0.000193	0.000067	0.000646	0.000495
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00034	0.00024	0.00019	0.00025	0.00027	0.00028	0.00011	0.00025	0.00024	0.00054	0.00024	0.00032	0.00018	0.00036	0.00014
Mercury	mg/L	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000342	0.000286	0.000294	0.000364	0.00037	0.000355	0.000317	0.000301	0.000297	0.000315	0.000357	0.000349	0.000298	0.000343	0.00031
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00009	0.000072	0.000076	0.000106	0.000077	0.00009	0.000077	0.000059	0.000091	0.000081	0.0001	0.000073	0.000083	0.000101	0.000102
Silicon	mg/L	-	-	-	-	-	-	1.72	1.61	1.65	1.75	1.69	1.72	1.7	1.54	1.72	1.64	1.73	1.7	1.66	1.81	1.68
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.136	0.132	0.132	0.132	0.137	0.137	0.139	0.138	0.132	0.135	0.127	0.137	0.122	0.13	0.142
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000167	0.000149	0.000155	0.00015	0.00016	0.000149	0.000156	0.000158	0.000152	0.000158	0.000151	0.000142	0.000152	0.000145	0.00017
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0081	0.0031	<0.0030	<0.0030	0.0078	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date Parameter								2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	107.3	110.2	111	116.4	109.7	111	107.5	109.6	130.4	113.9	108.5	111.1	110.8	107.6	109.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.8	7.01	7.59	7.73	7.81	7.96	8.12	8.35	7.54	8.75	7.75	7.72	7.87	7.83	7.59
Turbidity	NTU	1	-	-	-	-	1	1.07	0	0.11	0.34	0	0.08	0.24	0.28	0	0.08	0.21	0	0.4	0	0
Temperature	C	-	-	-	-	-	-	8.555	5.205	4.774	4.439	4.332	4.444	6.988	4.069	4.857	4.376	7.734	3.22	4.137	4.298	4.719
Dissolved oxygen	%	-	-	-	-	-	-	94.8	83.6	85	92.8	89.5	88.3	88.2	90.6	89.7	88	89.2	90.1	90.3	87.9	86.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.07	10.61	10.92	12.02	11.63	11.44	10.71	11.85	11.49	11.41	10.62	12.05	11.8	11.43	11.12
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50	49.2	47.9	49.5	47.7	49.2	47.3	48.3	50.6	52.6	47.1	50.5	50.3	47.1	46.2
Specific conductivity	uS/cm	-	-	-	-	-	-	108	107	109	109	111	111	106	110	109	117	109	112	110	112	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.86	7.93	7.96	7.8	7.91	7.92	7.85	7.84	7.87	7.84	7.95	7.89	7.86	7.82	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0	<1.1	<1.1	<1.0	<1.1	<1.0	11	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.18	0.27	0.16	0.33	0.14	<0.10	0.15	0.35	<0.10	<0.10	0.13	0.17	0.22	0.18	0.11
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51	53.6	53.3	53.2	52.6	55.1	54.1	54.3	53.8	53.5	54.6	51.5	54.5	53.1	48.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	51.8	52.9	55.8	49.5	50.3	53.4	54.3	53.2	52.8	52.5	51.6	53
Total dissolved solids	mg/L	-	-	-	1000	-	1000	80	69	73	68	72	71	73	76	80	84	70	74	73	75	92
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.6	1.56	1.94	2	1.95	1.86	12.5	2.19	1.96	1.78	1.72	1.98	1.93	2.09	1.95
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.144	0.129	0.138	0.134	0.141	0.142	0.103	0.14	0.144	0.15	0.102	0.134	0.138	0.139	0.146
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.144	0.129	0.138	0.134	0.141	0.143	0.104	0.14	0.144	0.15	0.102	0.134	0.138	0.139	0.146
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	0.005	0.006	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0049	0.0024	0.0069	0.0062	<0.0020	<0.0020	0.0023	<0.0020	0.0024	<0.0020	0.0026	0.007	0.0029	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.0013	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.189	0.184	0.218	0.21	0.204	0.184	0.173	0.182	0.185	0.198	0.147	0.212	0.181	0.178	0.198
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	17.2	18.2	17.9	17.9	17.6	18.4	18.3	18.3	18.4	18.1	18.6	17.1	18.4	17.8	15.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.033	0.034	0.035	0.038	0.036	0.035	0.036	0.036	0.032	0.035	0.036	0.034	0.034	0.033	0.038
Magnesium	mg/L	-	-	-	-	-	-	1.93	1.98	2.11	2.1	2.07	2.2	2.03	2.1	1.91	2.02	1.98	2.14	2.08	2.1	2.1
Potassium	mg/L	-	-	-	-	-	-	0.497	0.499	0.494	0.503	0.513	0.533	0.508	0.537	0.477	0.482	0.498	0.506	0.486	0.529	0.507
Sodium	mg/L	-	-	-	-	-	-	0.927	0.991	0.993	0.935	0.981	1.06	0.91	1.01	0.898	0.981	0.881	0.992	0.933	0.998	1.01
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.31	6.71	6.41	6.5	6.48	6.3	6.72	6.66	6.71	6.67	6.89	6.4	6.26	6.12	6.92

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a	Quesnel Lake QUL-120a
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date								2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0104	0.0082	0.012	0.0194	0.0175	0.0105	0.0143	0.0227	0.0111	0.0095	0.014	0.102	0.0111	0.0135	0.011
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.0001	<0.00010	0.00013	0.00011	0.00013	0.00011	0.00014	0.00011	<0.00010	0.00011	0.00016	<0.00010	0.00011	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00537	0.00576	0.00463	0.0053	0.00494	0.00504	0.00481	0.00507	0.00518	0.00513	0.00509	0.00692	0.0052	0.00535	0.00524
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000053	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.2	17	16.4	17.4	17.5	18.9	16.5	16.8	17.9	18.2	18	17.6	17.6	17.2	17.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00106	0.00063	0.00066	0.00076	0.00065	0.00107	0.00064	0.0006	0.00054	0.00094	0.00056	0.0024	<0.00050	0.00063	0.00052
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	0.044	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	0.088	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000632	0.00086	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.0011	0.001
Magnesium	mg/L	-	-	-	-	-	-	2.21	2.04	1.91	2.05	2.22	2.1	2	2.02	2.12	2.15	2.01	2.15	2.07	2.09	2.09
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00131	0.00109	0.00106	0.00143	0.00118	0.00104	0.0009	0.00186	0.00136	0.00178	0.00123	0.00458	0.00107	0.00113	0.0016
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000391	0.000397	0.000384	0.000359	0.00032	0.000362	0.000303	0.000328	0.000399	0.000389	0.000357	0.000335	0.000321	0.000392	0.00043
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.51	0.488	0.463	0.506	0.509	0.444	0.47	0.475	0.506	0.518	0.502	0.511	0.476	0.509	0.502
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00013	0.000116	0.000104	0.000156	0.000097	0.000149	0.000073	0.000147	0.000101	0.000115	0.000098	0.000087	0.000082	0.000108	0.000097
Silicon	mg/L	-	-	-	-	-	-	1.8	1.7	1.6	1.89	1.83	1.91	1.58	2.02	1.98	1.85	1.73	1.97	1.86	1.87	1.84
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.05	1.01	0.917	0.942	0.997	0.926	0.914	0.972	0.98	1.03	0.925	0.999	0.92	0.993	0.965
Strontium	mg/L	-	-	-	-	-	-	0.133	0.14	0.126	0.135	0.136	0.147	0.14	0.133	0.135	0.142	0.141	0.137	0.137	0.139	0.147
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000169	0.000167	0.000151	0.00016	0.000164	0.000149	0.000153	0.000163	0.000167	0.00016	0.000179	0.000171	0.000164	0.000163	0.000161
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island	QUL-120a-40m - Quesnel Lake Beyond Cariboo Island
Date Parameter								2018-08-27	2018-10-17	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0058	0.0051	0.0053	0.0077	0.0059	0.0058	0.0074	0.0095	0.0064	0.0086	0.0068	0.0055	0.0068	0.0066	0.0063
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.00014
Barium	mg/L	-	-	-	-	-	-	0.0049	0.00521	0.00491	0.00542	0.00535	0.00564	0.00476	0.00518	0.00484	0.00505	0.00502	0.00516	0.0052	0.00516	0.00558
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00056	0.0007	<0.00050	0.00057	<0.00050	0.00074	0.00094	0.00073	0.00053	0.00051	0.00058	0.00063	<0.00050	0.00062	0.00052
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000498	0.000507	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00029	0.00034	0.00016	0.00021	0.00012	0.00024	0.00037	0.00036	0.00021	0.00017	0.00044	0.0003	0.00011	0.00018	0.00039
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000371	0.000359	0.000444	0.000365	0.000327	0.000396	0.000315	0.000353	0.000395	0.000348	0.000371	0.00035	0.000306	0.000359	0.00045
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000074	0.000104	0.000102	0.000102	0.0001	0.000106	0.000084	0.000118	0.000156	0.00009	0.000114	0.000112	0.000073	0.000093	0.000109
Silicon	mg/L	-	-	-	-	-	-	1.61	1.6	1.77	1.83	1.79	1.87	1.54	1.83	1.75	1.69	1.5	1.75	1.92	1.84	1.84
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.143	0.137	0.144	0.14	0.135	0.136	0.146	0.136	0.146	0.128	0.139	0.14	0.134	0.132	0.144
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000162	0.000152	0.000153	0.000147	0.000158	0.000164	0.000162	0.000156	0.000164	0.000155	0.000162	0.000158	0.000155	0.000154	0.00015
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date Parameter								2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-04-10	2017-06-21
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	-	114.9	147.1	183.5	137.5	141.4	101.5	-	108.8	104.5	107.5	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	-	7.53	7.67	7.6	7.78	7.78	7.19	-	7.55	7.39	7.62	-
Turbidity	NTU	1	-	-	-	-	1	-	-	-	-	0.31	0.68	0.45	0.26	0.14	0.19	-	0	0.23	0.29	-
Temperature	C	-	-	-	-	-	-	-	-	-	-	4.1	3.889	3.781	3.839	3.841	3.956	-	3.957	3.951	2.456	-
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	82.6	81	80.3	86	82.3	82.9	-	82.9	83.6	85.8	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	-	-	10.79	10.65	10.59	11.32	10.83	10.87	-	10.88	10.96	11.71	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49	52	41.2	50.1	50	51.1	50.6	51.1	50.6	49.6	49.1	48	50	49.2	49.7
Specific conductivity	uS/cm	-	-	-	-	-	-	111	110	103	107	111	111	111	109	112	112	108	108	107	115	107
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.98	7.93	7.91	7.88	7.91	7.8	7.85	7.8	7.89	7.77	7.84	7.78	7.93	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.27	0.25	0.21	0.15	0.13	0.19	0.81	0.14	0.17	0.2	0.66	0.38	0.15	0.19	0.3
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	55.7	52.1	51.1	53	55.9	53.6	55	54.7	54.9	53.3	53.9	53.2	53.2	53.5	50.1
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	70	66	65	62	67	72	67	76	62	65	84	78	73	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.21	2.24	1.81	1.55	1.75	1.6	1.79	1.5	1.44	1.6	1.48	1.61	1.39	1.54	1.71
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.142	0.134	0.139	0.143	0.144	0.145	0.15	0.149	0.15	0.133	0.136	0.141	0.143	0.136	0.142
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	-	0.134	0.139	0.143	0.144	0.145	0.15	0.149	0.15	0.133	0.136	0.141	0.143	0.136	0.142
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0025	0.0026	<0.0020	<0.0020	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	0.0055	<0.0020	<0.0020	0.0022	0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.191	0.181	0.177	0.181	0.187	0.166	0.198	0.195	0.206	0.191	0.179	0.176	0.181	0.184	0.186
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.9	17.6	17.3	18	18.9	18.1	18.6	18.6	18.6	18	18.2	18	18	17.9	16.5
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.033	0.032	0.033	0.034	0.034	0.033	0.034	0.031	0.033	0.035	0.032	0.034	0.035	0.031	0.031
Magnesium	mg/L	-	-	-	-	-	-	2.1	1.99	1.9	1.98	2.1	2.03	2.08	2	2.03	2.03	2.05	2.02	2	2.12	2.12
Potassium	mg/L	-	-	-	-	-	-	0.486	0.463	0.465	0.499	0.515	0.491	0.527	0.491	0.472	0.478	0.589	0.503	0.489	0.525	0.465
Sodium	mg/L	-	-	-	-	-	-	0.95	0.959	0.944	0.954	0.935	0.912	0.996	0.96	0.981	0.941	0.977	0.941	0.948	0.94	0.942
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.35	6.16	6.28	6.28	6.13	6.4	6.4	6.31	6.11	6.3	6.21	6.28	6.22	6.46	6.48

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date								2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-04-10	2017-06-21
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0158	0.0171	0.0146	0.0129	0.012	0.0101	0.0349	0.0096	0.01	0.0189	0.0401	0.0125	0.0096	0.0082	0.0167
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00014	0.00011	<0.00010	0.00012	0.00011	0.00015	<0.00010	0.00013	0.00011	0.00013	0.00011	<0.00010	0.00011	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00521	0.00522	0.00547	0.00495	0.00542	0.00503	0.00558	0.00526	0.0052	0.00546	0.00632	0.00504	0.00517	0.00519	0.00532
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.3	18	17.2	17.6	17.7	18.2	18.6	18.1	18	18	18.1	17.4	18.2	18	17.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00082	0.00078	0.00067	0.00075	<0.0010	0.00061	0.00172	0.00066	0.00072	0.00113	0.00148	0.0008	0.00099	0.00054	0.00078
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	0.000228	0.000241	0.000074	0.000063	<0.000050	0.000096	<0.000050	0.000136	0.000175	0.00007	0.000165	0.000117	0.00008	0.00008
Lithium	mg/L	-	-	-	-	-	-	0.00072	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.05	2.03	1.89	1.96	1.99	2.06	2.07	1.99	1.98	2.04	2.08	1.99	2.04	2.05	2.24
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.000873	0.0013	0.00103	0.00086	0.00083	0.00065	0.00144	0.00049	0.00067	0.00139	0.00154	0.0009	0.00073	0.00063	0.00128
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000328	0.00038	0.000325	0.000324	0.000327	0.000338	0.000344	0.000334	0.000318	0.000337	0.000289	0.000313	0.000314	0.00034	0.000348
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.493	0.467	0.48	0.495	0.481	0.474	0.536	0.485	0.449	0.482	0.587	0.507	0.516	0.491	0.515
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	<0.00050	0.000103	0.000089	0.00007	0.00011	0.000083	0.000083	0.000068	0.000098	0.000097	0.000099	0.000108	0.000071	0.000099	0.000089
Silicon	mg/L	-	-	-	-	-	-	1.65	1.77	1.64	1.62	1.68	1.7	1.82	1.72	1.69	1.77	1.78	1.66	1.72	1.72	1.85
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.935	1	0.959	0.946	0.914	0.922	0.99	0.954	0.973	0.969	0.957	0.964	0.971	0.965	1.06
Strontium	mg/L	-	-	-	-	-	-	0.129	0.136	0.13	0.131	0.132	0.138	0.139	0.142	0.141	0.137	0.128	0.138	0.144	0.138	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000148	0.000171	0.000161	0.000154	0.000155	0.000171	0.000159	0.000173	0.000168	0.000171	0.000154	0.000175	0.000145	0.000168	0.000162
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00066	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date								2015-03-16	2015-04-29	2015-05-13	2015-06-10	2015-07-22	2015-08-12	2015-09-14	2015-10-15	2015-11-18	2016-04-26	2016-05-19	2016-06-27	2016-08-24	2017-04-10	2017-06-21
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0058	0.0069	0.0063	0.0059	0.0055	0.0054	0.0079	0.0048	0.0093	0.0063	0.0064	0.005	0.0051	0.0045	0.0059
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00511	0.00509	0.00514	0.00497	0.00541	0.00501	0.00528	0.00503	0.00531	0.00522	0.0056	0.00506	0.00501	0.00493	0.00486
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000065	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.0007	0.00095	0.00065	0.00061	0.00162	0.00071	0.00093	0.00064	0.00104	0.00071	0.00087	0.00069	0.00073	0.00051	0.00064
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000052	0.000148	0.000239	0.000137	0.000164	0.000054	0.000111	0.000061	0.000565	0.000141	0.000116	0.000218	0.000114	0.000178	0.00009
Lithium	mg/L	-	-	-	-	-	-	0.00088	0.001	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.000182	0.00036	0.00021	0.00019	0.00015	0.00015	0.00042	0.00011	0.00033	0.00031	0.00023	0.00012	0.00019	0.00016	0.00018
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00029	0.000346	0.000287	0.000309	0.000326	0.000338	0.000375	0.000296	0.000313	0.000315	0.000302	0.000325	0.000313	0.000303	0.000303
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	<0.00050	0.000092	0.000079	0.00009	0.00009	0.000086	0.000093	0.000104	0.000067	0.000108	0.000081	0.000086	0.000057	0.000077	0.000104
Silicon	mg/L	-	-	-	-	-	-	1.66	1.74	1.67	1.66	1.75	1.65	1.7	1.7	1.72	1.74	1.71	1.69	1.69	1.62	1.67
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.127	0.135	0.128	0.132	0.134	0.134	0.138	0.139	0.137	0.133	0.131	0.125	0.138	0.139	0.124
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000138	0.000164	0.000154	0.000153	0.000158	0.000162	0.000157	0.000154	0.000159	0.000153	0.00015	0.000143	0.000143	0.000161	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27
Parameter																					
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	108.2	108.1	107.2	110.5	113.4	-	117.6	110.6	111.7	111	110.8	130.9	113.9	110.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.37	7.24	7.92	6.71	7.75	-	7.7	7.73	7.84	8.04	8.3	7.42	8.76	7.63
Turbidity	NTU	1	-	-	-	-	1	-	0.72	0.68	1.41	0	0.89	-	0.36	0	0.07	0.15	0.06	0	0.05	0.08
Temperature	C	-	-	-	-	-	-	-	3.827	3.831	6.933	3.932	5.324	-	4.03	3.902	3.886	4.388	3.929	4.026	3.933	4.133
Dissolved oxygen	%	-	-	-	-	-	-	-	88.9	87.9	94.4	85.5	90.4	-	92.9	90	89.5	86.4	90.3	89.8	88.8	88.1
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	11.71	11.57	11.48	11.22	11.44	-	12.16	11.82	11.77	11.21	11.86	11.76	11.66	11.5
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.5	51.6	49.7	50.5	49.1	48.8	48.8	50.8	48	49.1	47.9	48.5	51	53.1	48
Specific conductivity	uS/cm	-	-	-	-	-	-	106	109	110	108	109	110	111	110	111	112	110	112	108	118	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.81	7.95	7.86	7.88	7.94	7.99	7.97	7.82	7.9	7.95	7.82	7.84	7.89	7.86	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<1.1	<1.0	<1.1	<1.0	<1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.15	0.26	0.2	0.23	0.28	<0.10	0.15	0.13	<0.10	<0.10	<0.10	0.19	<0.10	<0.10	<0.10
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.6	45.6	52.6	51.2	57.9	55.2	55.4	54.6	53.4	53.6	52.1	52.2	54	54.1	54.6
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	52.7	54	56.7	51.1	52.9	52.7	56.1	54.2
Total dissolved solids	mg/L	-	-	-	1000	-	1000	65	71	67	79	64	84	77	71	73	74	71	74	78	80	69
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.64	1.75	1.55	1.44	1.3	1.51	1.56	2.16	1.73	1.62	12.7	2	1.81	1.73	1.74
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.148	0.14	0.141	0.146	0.148	0.146	0.14	0.141	0.143	0.145	0.147	0.138	0.145	0.146	0.151
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.148	0.14	0.141	0.146	0.148	0.146	0.14	0.141	0.144	0.145	0.148	0.138	0.145	0.146	0.151
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0027	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.020	0.0038	0.0028	0.0043	0.0057	0.0033	0.0059	0.0061	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0014	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.19	0.163	0.148	0.185	0.194	0.207	0.202	0.204	0.201	0.188	0.194	0.176	0.182	0.192	0.183
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.7	15.3	17.5	17.3	19.9	18.8	18.7	18.5	18	18.1	17.5	17.5	18.5	18.4	18.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.032	0.034	0.034	0.033	0.034	0.038	0.035	0.038	0.037	0.033	0.038	0.038	0.032	0.032	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.06	1.81	2.14	1.92	2	1.99	2.12	2.05	2.02	2.03	2.04	2.06	1.89	1.98	1.99
Potassium	mg/L	-	-	-	-	-	-	0.477	0.435	0.494	0.476	0.495	0.497	0.51	0.488	0.504	0.494	0.482	0.51	0.471	0.483	0.496
Sodium	mg/L	-	-	-	-	-	-	0.982	0.846	1	0.897	0.98	0.974	0.984	0.906	0.98	0.985	0.953	0.986	0.88	0.949	0.911
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.64	6.48	6.52	6.23	6.54	6.75	6.19	6.67	6.58	6.28	6.79	6.76	6.59	6.61	6.86

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0084	0.0208	0.0113	0.0092	0.0068	0.0068	0.0077	0.0102	0.01	0.0083	0.0102	0.0207	0.01	0.0088	0.0086
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	0.00011	<0.00010	0.0001	<0.00010	0.00011	<0.00010	0.00012	<0.00010	0.00011	<0.00010	0.00014	<0.00010	<0.00010	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00562	0.00557	0.005	0.00534	0.00541	0.00477	0.00431	0.00508	0.00486	0.00467	0.00506	0.00536	0.0051	0.0047	0.00513
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.6	17.3	18.2	18	16.6	16.3	17.8	18	19.3	17	17.6	17.7	19.1	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.0006	0.00085	0.00061	0.0008	0.00053	0.00061	<0.00050	0.00066	0.00061	0.00056	0.00057	0.00059	0.0005	0.00055	0.00063
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	-	0.000324	0.000277	0.000597	0.000308	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.001
Magnesium	mg/L	-	-	-	-	-	-	2.16	2.09	1.98	2.03	1.98	1.86	1.93	2.04	2.18	2.08	2.1	2.18	2.07	2.05	2.07
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00085	0.00175	0.00097	0.00078	0.00059	0.0007	0.00044	0.0009	0.00075	0.00057	0.00108	0.00189	0.00081	0.00057	0.00085
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000353	0.000352	0.000314	0.000293	0.000317	0.000337	0.000299	0.000332	0.000326	0.000303	0.000342	0.000355	0.000334	0.000342	0.00037
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.525	0.508	0.473	0.504	0.475	0.407	0.476	0.494	0.494	0.434	0.49	0.512	0.497	0.507	0.504
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000081	0.000093	0.000117	0.000061	0.000115	0.000111	0.000091	0.000093	0.000081	0.000118	0.000114	0.000143	0.000096	0.000075	0.000093
Silicon	mg/L	-	-	-	-	-	-	1.76	1.78	1.74	1.69	1.7	1.68	1.61	1.78	1.77	1.79	1.74	2.03	1.93	1.74	1.9
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.998	0.994	0.885	0.983	0.922	0.842	0.903	0.931	0.972	0.922	0.98	1.03	0.962	0.982	0.968
Strontium	mg/L	-	-	-	-	-	-	0.142	0.133	0.135	0.131	0.15	0.138	0.127	0.139	0.15	0.149	0.136	0.141	0.136	0.148	0.145
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000165	0.000168	0.000163	0.000165	0.000169	0.000158	0.000155	0.000162	0.000172	0.000155	0.000158	0.000178	0.000158	0.000159	0.000179
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-120a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island
Date								2017-08-31	2018-05-23	2018-06-19	2018-08-27	2018-10-17	2019-06-19	2019-08-19	2020-06-16	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0066	0.0053	0.0098	0.0041	0.0062	0.0048	0.005	0.0058	0.0053	0.0047	0.0053	0.0069	0.0059	0.004	0.0061
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00503	0.00473	0.00542	0.00496	0.00525	0.00482	0.00513	0.0052	0.00526	0.00511	0.00493	0.00495	0.00462	0.00497	0.00482
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000084	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00063	0.0006	0.00078	<0.00050	0.00069	<0.00050	<0.00050	0.00055	<0.00050	0.00074	<0.00050	0.00054	<0.00050	<0.00050	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.00041	0.000261	0.000348	0.000296	0.000281	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00022	0.00023	0.00029	0.00014	0.00019	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	0.00022	0.00025	0.00011	<0.00010	0.00012
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000336	0.000325	0.000314	0.00031	0.000308	0.00032	0.000338	0.000328	0.000318	0.000321	0.000362	0.000345	0.000365	0.000292	0.000344
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000101	0.000089	0.000061	0.00008	0.000066	0.000102	0.000103	0.000089	0.000084	0.000091	0.000092	0.000079	0.00009	<0.000050	0.000078
Silicon	mg/L	-	-	-	-	-	-	1.75	1.75	1.65	1.58	1.56	1.67	1.75	1.72	1.72	1.68	1.68	1.74	1.72	1.7	1.64
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.137	0.123	0.139	0.145	0.145	0.137	0.145	0.144	0.142	0.136	0.142	0.136	0.151	0.132	0.14
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000155	0.000159	0.000169	0.000161	0.000168	0.000177	0.000149	0.00016	0.000159	0.000162	0.000153	0.000154	0.000166	0.000158	0.000169
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-120a / QUL-120a-80m - Quesnel Lake Beyond Cariboo Island / 2022-05-09	Quesnel Lake QUL-120a / QUL-120a-80m - Quesnel Lake Beyond Cariboo Island / 2022-06-27	Quesnel Lake QUL-120a / QUL-120a-80m - Quesnel Lake Beyond Cariboo Island / 2022-08-15	Quesnel Lake QUL-120a / QUL-120a-80m - Quesnel Lake Beyond Cariboo Island / 2022-10-19	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-03-11	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-03-18	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-03-24	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-04-01	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-04-08	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-04-14	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-05-06	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-06-03	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-07-01	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-08-26	Quesnel Lake QUL-2a / QUL-2a-0m - QUL Between Cariboo Island and HAC / 2015-09-14
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	112	110.7	108.1	109.9	-	-	-	-	-	-	-	-	103.7	141.7	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.69	7.74	7.58	7.54	-	-	-	-	-	-	-	-	7.35	7.84	-
Turbidity	NTU	1	-	-	-	-	1	0	0.37	0	0	-	-	-	-	-	-	-	-	0.76	0.15	-
Temperature	C	-	-	-	-	-	-	3.239	3.911	3.881	3.945	-	-	-	-	-	-	-	-	17.845	17.635	-
Dissolved oxygen	%	-	-	-	-	-	-	90.2	90.5	88.8	88.1	-	-	-	-	-	-	-	-	107.2	99.8	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	12.06	11.89	11.67	11.56	-	-	-	-	-	-	-	-	10.21	9.53	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.6	50.7	47.5	46.7	46.8	51.2	49.9	48.9	46.5	52.2	41.7	35.8	46.8	46.6	49.7
Specific conductivity	uS/cm	-	-	-	-	-	-	113	110	112	111	110	111	111	110	110	111	114	103	102	107	109
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.86	7.84	7.88	7.92	7.9	7.83	7.89	7.98	7.7	8.01	7.98	8	7.98	7.9
Total suspended solids	mg/L	-	-	-	-	-	-	6.1	<1.2	<1.1	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.22	0.35	0.15	<0.10	0.51	0.38	0.64	0.47	0.43	0.41	0.42	0.22	0.23	0.16	0.23
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.6	54.4	51.9	52.4	52.9	54.9	53.3	53.4	55.9	51.6	51.9	49.9	48.8	53.1	53.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	53	54.8	52.6	51.6	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	82	74	70	90	67	64	63	75	64	67	77	65	58	77	71
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.06	1.89	1.8	1.7	2.3	1.63	1.76	2.67	2.02	2.22	2.23	2.32	1.97	1.58	1.72
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.132	0.141	0.142	0.15	0.136	0.136	0.133	0.133	0.135	0.135	0.135	0.0992	0.0717	0.0497	0.052
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.132	0.141	0.142	0.15	0.136	0.136	-	0.133	0.135	0.135	0.135	0.0992	0.0717	0.0497	0.052
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0025	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	0.0034	<0.0020	0.0032	0.0027	0.002	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.216	0.161	0.178	0.194	0.25	0.204	0.185	0.183	0.182	0.211	0.186	0.164	0.123	0.104	0.124
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.26	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.5	18.4	17.3	17.6	17.8	18.6	18	18.1	18.9	17.5	17.5	16.8	16.5	18.1	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.036	0.034	0.032	0.038	0.033	0.034	0.035	0.033	0.033	0.034	0.035	0.033	0.031	0.031	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.15	2.05	2.11	2.06	2.04	2.07	2	2	2.13	1.94	1.97	1.93	1.88	1.93	1.98
Potassium	mg/L	-	-	-	-	-	-	0.512	0.472	0.524	0.501	0.546	0.521	0.494	0.502	0.476	0.461	0.501	0.508	0.444	0.475	0.485
Sodium	mg/L	-	-	-	-	-	-	1	0.913	0.995	0.994	1.05	1.02	1.03	0.972	1	0.942	1.05	0.921	0.833	0.867	0.866
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.36	6.34	6.16	6.72	6.7	6.62	6.56	6.36	6.51	6.42	6.7	5.99	5.92	6.54	6.46

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08	2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.015	0.007	0.0095	0.0078	0.0372	0.0311	0.0243	0.0242	0.0225	0.024	0.0324	0.0278	0.0149	0.01	0.0119
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	<0.00010	0.0001	0.00011	0.00015	0.00015	0.00011	0.00011	0.00014	0.00011	0.00014	0.00014	0.00012	0.00011	0.00015
Barium	mg/L	-	1W	-	-	-	1	0.00537	0.00515	0.00517	0.00525	0.00642	0.00615	0.00586	0.00498	0.00553	0.00545	0.00602	0.00556	0.00508	0.00509	0.00507
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	0.000069	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.7	18.5	17.7	17.2	18.2	18.4	17.8	17.4	19	17.4	18.1	16	16.5	17.5	17.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00057	0.00054	0.00056	0.00065	0.00141	0.00115	0.00109	0.00086	0.001	0.00086	0.00116	0.00079	0.00055	<0.00050	0.00061
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.041	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	0.000061	0.000092	<0.000050	0.000103	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	0.0011	0.001	0.00115	0.00072	0.00087	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.13	2.08	2.05	2.09	2.1	2.07	2.01	1.94	2.15	1.93	2.03	1.9	1.88	1.86	1.98
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00169	0.00012	0.00078	0.00068	0.0015	0.0015	0.00139	0.00126	0.0012	0.00123	0.00164	0.00268	0.0014	0.00057	0.00089
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000337	0.000337	0.000346	0.00031	0.000608	0.000503	0.000531	0.000678	0.00049	0.000424	0.000532	0.000379	0.000316	0.000305	0.000307
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0008	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.502	0.483	0.496	0.511	0.56	0.517	0.511	0.488	0.469	0.472	0.519	0.501	0.452	0.487	0.51
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000085	0.000076	0.000092	0.000068	<0.00050	<0.00050	<0.00050	0.000105	0.00011	0.0001	0.000101	0.00011	0.000117	0.000091	0.000076
Silicon	mg/L	-	-	-	-	-	-	1.84	1.8	1.87	1.76	1.78	1.84	1.73	1.69	1.91	1.7	1.79	1.72	1.58	1.43	1.46
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.998	0.936	0.967	0.961	1.07	1.06	1.05	0.949	0.983	0.976	1.06	0.915	0.845	0.876	0.918
Strontium	mg/L	-	-	-	-	-	-	0.136	0.138	0.141	0.148	0.147	0.136	0.141	0.146	0.135	0.143	0.15	0.119	0.112	0.134	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00019	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000165	0.000158	0.00016	0.000164	0.00019	0.000173	0.000182	0.000183	0.000159	0.000165	0.000175	0.000142	0.000148	0.000168	0.000153
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-120a	QUL-120a	QUL-120a	QUL-120a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-120a-80m - Quesnel Lake Beyond Cariboo Island	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08	2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14
Parameter																					
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0051	0.0061	0.0056	0.0055	0.0064	0.006	0.0078	0.0055	0.0061	0.0056	0.0069	0.0098	0.01	0.0072	0.007
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	0.00015	0.00013	0.00012	0.0001	<0.00010	<0.00010	<0.00010	0.00012	0.0001	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.0052	0.00494	0.00514	0.0054	0.00548	0.00543	0.00544	0.00494	0.0051	0.00519	0.00556	0.00533	0.00498	0.00494	0.005
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.0006	<0.00050	0.0006	<0.00050	0.00108	0.00077	0.00074	0.00064	0.00069	0.00059	0.00082	0.00063	0.00054	<0.00050	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	0.00103	0.00062	0.00082	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00037	0.00012	0.00011	0.00014	0.000514	0.00039	0.000315	0.00028	0.00033	0.00025	0.00049	0.00091	0.00055	0.00017	0.00023
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000342	0.000309	0.000334	0.000332	0.000552	0.000392	0.000443	0.000359	0.000411	0.000381	0.000486	0.000343	0.000295	0.0003	0.000316
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000137	0.00009	0.000085	0.000096	<0.00050	<0.00050	<0.00050	0.000126	0.000095	0.00011	0.000118	0.000117	0.000091	0.000116	0.000066
Silicon	mg/L	-	-	-	-	-	-	1.77	1.88	1.79	1.75	1.71	1.76	1.7	1.68	1.88	1.69	1.73	1.76	1.57	1.44	1.46
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.136	0.134	0.143	0.141	0.126	0.135	0.131	0.133	0.143	0.145	0.117	0.117	0.131	0.133
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000154	0.000158	0.00016	0.000158	0.000173	0.000155	0.000165	0.000151	0.00016	0.000156	0.000167	0.000143	0.000136	0.000154	0.000152
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Parameter																				
Field Parameters																				
Specific conductivity	uS/cm	-	-	-	-	-	-	132.5	148	149.7	106.9	100.9	98.4	95.7	95.1	99	102.3	100.7	107.5	109.1	109.9	100.6
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.94	7.67	7.86	7.38	8.06	7.65	7.82	8.35	8.05	7.67	-	7.19	7.6	7.74	7.54
Turbidity	NTU	1	-	-	-	-	1	0.81	0.17	0.36	5.34	0.15	0.15	0	0.47	0.26	0.17	1.35	0.54	0.76	0.25	0.94
Temperature	C	-	-	-	-	-	-	9.544	7.958	4.859	2.577	8.342	12.616	17.794	18.859	20.324	14.818	9.274	7.524	2.717	4.953	12.509
Dissolved oxygen	%	-	-	-	-	-	-	105.2	87.8	86.5	93.3	98.8	102.8	101.9	96.1	89	92.3	94.8	92.3	86.2	94.7	92.9
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	13.34	10.41	11.08	12.72	11.59	10.9	9.68	8.94	8.03	9.33	10.89	11.06	11.69	12.1	9.9
Conventional Parameters																				
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.9	49.6	48.2	48.8	50.4	47.2	41.1	44.9	48.4	48.8	49.8	48.4	49.6	48.9	45.1
Specific conductivity	uS/cm	-	-	-	-	-	-	110	111	110	112	114	102	95.3	97.1	100	104	108	105	117	112	97.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.89	7.77	7.81	7.93	7.85	7.84	7.74	7.85	7.86	7.77	7.88	7.94	7.86	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.24	0.23	0.25	0.19	0.53	0.68	0.33	0.36	0.21	0.35	0.34	0.26	0.32	0.3	0.44
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	55.8	54.2	55.5	54.7	53.5	51.1	47.1	46.9	50.2	49.6	49.1	51.9	53.8	52.5	47.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	77	69	65	74	61	66	75	76	56	73	78	69	73	73	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.31	1.61	1.84	1.64	2.01	1.87	2.34	2.68	2.31	1.9	1.74	1.99	1.58	1.69	2.04
Nutrients and Biological Indicators																				
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0637	0.0791	0.104	0.124	0.113	0.0904	0.0598	0.0367	0.042	0.0556	0.0792	0.0905	0.141	0.129	0.108
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0637	0.0791	0.104	0.124	0.113	0.0904	0.0598	0.0367	0.042	0.0556	0.0792	0.0905	0.141	0.129	0.108
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	0.0024	0.0051	<0.0020	0.0036	0.0047	0.003	<0.0020	0.0033	<0.0020	<0.0020	0.0031	0.0022	0.003
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.119	0.141	0.164	0.174	0.188	0.168	0.154	0.138	0.111	0.133	0.141	0.156	0.187	0.174	0.208
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	0.553	-	0.342	-	-	-	-	-	0.654
Major Ions																				
Calcium	mg/L	-	-	-	1000	-	1000	19	18.4	18.8	18.5	18	17.2	15.7	15.5	16.8	16.7	16.8	17.5	18	17.7	15.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.031	0.034	0.034	0.034	0.034	0.032	0.033	0.032	0.031	0.035	0.032	0.034	0.032	0.032	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.02	2	2.08	2.04	2.07	2.01	1.91	1.97	2	1.94	1.75	1.99	2.19	2.03	1.97
Potassium	mg/L	-	-	-	-	-	-	0.431	0.457	0.48	0.485	0.482	0.565	0.515	0.486	0.5	0.5	0.439	0.5	0.536	0.509	0.516
Sodium	mg/L	-	-	-	-	-	-	0.8	0.868	0.901	0.921	0.988	0.945	0.922	0.906	0.945	0.953	0.839	0.918	1.08	0.96	0.96
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.38	6.54	6.55	6.53	6.56	5.8	5.74	5.74	6	6.33	6.48	6.8	7.31	6.64	5.99

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0208	0.0107	0.0164	0.0106	0.023	0.0206	0.0204	0.0206	0.0132	0.0134	0.0162	0.0161	0.0195	0.0165	0.0226
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	0.00011	0.00011	<0.00010	0.00011	0.00015	0.00013	0.00015	0.00013	0.00012	0.00012	0.00012	0.00013	0.0001	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00538	0.00482	0.00532	0.00505	0.00567	0.00591	0.00563	0.00587	0.00553	0.00513	0.00518	0.00613	0.0056	0.00528	0.00526
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.8	17.8	18.2	18.1	17.7	17	15.2	15.8	16.9	17.2	17.1	16.8	18.2	17.6	15.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.0007	0.00068	0.00074	0.00064	0.00105	0.00078	0.00067	0.00067	0.00077	0.00062	0.00064	0.00069	0.00097	0.0006	0.00069
Iron	mg/L	-	-	1	-	-	1	0.03	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.038	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.91	1.95	2.05	2.08	2.05	2.02	1.89	2.02	2.01	1.95	1.94	2.3	2.17	2.17	1.85
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00108	0.00098	0.00111	0.0009	0.00161	0.00185	0.00239	0.00238	0.0012	0.00092	0.00108	0.00118	0.00123	0.00114	0.00159
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000311	0.000383	0.000355	0.000352	0.000445	0.000344	0.000374	0.000437	0.000351	0.000324	0.000338	0.000394	0.000613	0.000399	0.000361
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.448	0.451	0.48	0.486	0.487	0.597	0.536	0.493	0.506	0.474	0.491	0.519	0.523	0.513	0.485
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000077	0.000104	0.000091	0.000091	0.000113	0.000107	0.000132	0.000121	0.00009	0.000084	0.000087	0.000114	0.000158	0.000096	0.00009
Silicon	mg/L	-	-	-	-	-	-	1.47	1.53	1.66	1.65	1.76	1.79	1.79	1.88	1.59	1.59	1.62	1.6	1.77	1.76	1.72
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.829	0.875	0.913	0.921	1.03	0.97	0.973	0.93	0.959	0.852	0.911	1.04	1.11	1.02	0.905
Strontium	mg/L	-	-	-	-	-	-	0.129	0.137	0.138	0.136	0.138	0.116	0.113	0.109	0.125	0.131	0.132	0.134	0.14	0.135	0.117
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000164	0.000158	0.000158	0.000162	0.000167	0.00014	0.000139	0.000138	0.00014	0.00016	0.000161	0.000161	0.000167	0.000163	0.000148
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0035	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0053	0.0054	0.0051	0.0058	0.0075	0.0102	0.0127	0.0121	0.01	0.0095	0.0081	0.0072	0.0047	0.0052	0.0097
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00016	<0.00010	<0.00010	<0.00010	0.00011	0.0001	0.00012	0.00012	0.00011	0.0001	<0.00010	0.00011	<0.00010	<0.00010	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00517	0.0049	0.00512	0.00499	0.0053	0.00574	0.00539	0.00567	0.00542	0.00538	0.00476	0.00541	0.0051	0.00508	0.00545
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000054	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	<0.00050	<0.00050	0.00056	0.00051	0.00073	0.00067	0.0006	0.0005	0.00052	0.00052	0.00055	0.00075	0.00057	0.00054	0.00054
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00014	0.00015	0.00026	0.00025	0.00076	0.00087	0.0013	0.00092	0.0005	0.00023	0.00023	<0.00010	0.00029	0.00037	0.00065
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000306	0.000308	0.000352	0.00033	0.000467	0.000356	0.00034	0.000392	0.000338	0.000287	0.00033	0.000417	0.000565	0.000387	0.000348
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000077	0.000085	0.000087	0.000097	0.000105	0.000094	0.000084	0.000121	0.000089	0.000072	0.000077	0.000131	0.00013	0.000079	0.00011
Silicon	mg/L	-	-	-	-	-	-	1.47	1.52	1.64	1.63	1.77	1.78	1.79	1.83	1.65	1.67	1.44	1.55	1.64	1.67	1.71
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.129	0.135	0.136	0.134	0.132	0.12	0.11	0.106	0.122	0.125	0.127	0.133	0.136	0.134	0.118
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000161	0.000155	0.000154	0.000153	0.000152	0.000141	0.000132	0.000132	0.000141	0.000143	0.000146	0.000144	0.000157	0.000142	0.000139
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	0.0077	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-06-19	2019-07-25	2019-08-20
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	113.3	-	94.9	99.7	102	100	106.8	105.2	-	83.6	105	100.9	90.9
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	7.92	-	8.1	8.13	7.9	7.8	7.84	7.82	-	7.85	7.9	7.89	7.8
Turbidity	NTU	1	-	-	-	-	1	-	-	0.13	-	0.74	0.13	0	0	0	0	-	1.2	0.77	0.38	0.12
Temperature	C	-	-	-	-	-	-	-	-	8.618	-	14.136	13.636	16.735	15.576	9.026	4.326	-	14.163	12.348	17.701	17.008
Dissolved oxygen	%	-	-	-	-	-	-	-	-	99.1	-	79	106.6	99	95.7	90.5	90.6	-	105.8	97.1	96	93
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	11.56	-	7.98	10.18	9.61	9.52	10.45	11.78	-	10.86	10.38	9.14	9.04
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	46	49.1	49.5	49.3	42.6	46.3	47	48.7	48.2	49.2	48.4	44.6	45	45	47.9
Specific conductivity	uS/cm	-	-	-	-	-	-	102	103	107	106	88.6	98.5	103	107	106	107	114	100	102	98.7	102
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.95	7.93	7.92	7.7	7.85	7.97	7.99	7.9	7.82	8	8	8.01	7.94	7.95
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	1	<1.0	2.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.26	0.24	0.31	0.17	1.94	0.45	0.28	0.18	0.34	0.22	0.28	0.45	0.31	0.23	0.25
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.5	50.4	49.5	49.2	44.9	48.7	46.1	49.2	51.8	56.7	56.4	49	53.8	48.5	47
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	75	67	76	60	58	91	68	66	72	64	75	74	75	53	67
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.87	1.61	2.03	1.44	4.05	2.07	1.78	1.53	1.77	1.66	1.74	1.94	1.94	2.29	1.96
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0468	0.0491	0.0865	0.112	0.0525	0.0828	0.0885	0.0449	0.0787	0.12	0.126	0.09	0.0887	0.0564	0.0468
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0484	0.0491	0.0865	0.112	0.0525	0.0828	0.0885	0.0449	0.0787	0.12	0.126	0.09	0.0887	0.0564	0.0468
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	0.0085	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0094	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0057	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	0.0036	0.0026	<0.0020	<0.0020	0.0021	<0.0020	0.0031	<0.0020	<0.0020	0.003	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	0.0034	<0.0020	0.0488	0.0022	0.003	0.0044	0.003	0.0024	0.0041	0.0054	0.0068	0.0072	0.003
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0012	<0.0010	<0.0010	0.0011	0.0023	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.142	0.122	0.145	0.176	0.162	0.18	0.166	0.123	0.156	0.172	0.209	0.191	0.161	0.159	0.134
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1.05	0.444	-	-	-	-	0.862	-	1.36
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.5	17	16.6	16.3	14.6	16.1	15.5	16.6	17.6	18.9	19.1	16.5	18.1	16.2	15.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.031	0.028	0.033	0.035	0.037	0.032	0.031	0.032	0.034	0.034	0.034	0.038	0.039	0.036	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.14	1.95	1.92	2.05	2.05	2.06	1.81	1.87	1.9	2.32	2.14	1.93	2.07	1.94	1.99
Potassium	mg/L	-	-	-	-	-	-	0.519	0.485	0.487	0.488	0.615	0.545	0.494	0.444	0.507	0.535	0.522	0.511	0.557	0.491	0.454
Sodium	mg/L	-	-	-	-	-	-	0.93	0.874	0.884	0.955	1.03	0.96	0.884	0.863	0.908	1.06	1.03	0.932	1.03	0.925	0.923
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.39	6.29	6.7	6.61	5.28	5.92	5.93	6.37	6.21	6.77	6.53	5.96	6.32	5.9	5.82

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-06-19	2019-07-25	2019-08-20
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0112	0.0098	0.0107	0.0167	0.0776	0.0144	0.039	0.0176	0.0111	0.013	0.0116	0.0169	0.0154	0.0188	0.015
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.00012	0.0001	0.00013	0.00022	0.00016	<0.0010	0.00013	0.00013	0.00011	0.00012	<0.00010	0.00012	0.00014	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00572	0.0054	0.00559	0.00598	0.00761	0.00598	0.0056	0.00536	0.0053	0.0051	0.00532	0.00511	0.00503	0.00562	0.00499
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000104	<0.0000050	<0.000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	16.8	17.7	16.6	18.7	14	15.8	15.5	16.6	16.8	17	17.5	16.5	15.1	15.9	15.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00055	<0.00050	0.00105	0.00077	0.00124	0.00069	<0.0050	0.00073	0.00063	0.00056	0.0008	0.00061	0.00058	0.00097	0.00072
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	0.115	<0.030	<0.10	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.07	1.93	1.89	2.37	2.07	1.98	1.8	1.9	1.98	2.08	2.05	1.85	1.78	1.9	1.79
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00149	0.00079	0.00133	0.00312	0.00651	0.00131	0.0017	0.00116	0.00102	0.00103	0.00128	0.00179	0.00146	0.00136	0.0009
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	<0.00040	0.000295	0.000342	0.000422	0.000468	0.000346	0.00059	0.00032	0.00034	0.000406	0.000403	0.000365	0.000371	0.000343	0.000294
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	0.00054	<0.00050	<0.00050	<0.00050	0.00064	<0.00050	<0.0050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.488	0.498	0.472	0.471	0.582	0.524	<0.50	0.446	0.463	0.514	0.485	0.471	0.434	0.464	0.442
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000107	0.000077	0.000156	0.000109	0.000203	0.000123	<0.00050	0.000103	0.000077	0.000118	0.000122	0.000114	0.000135	0.000139	0.000074
Silicon	mg/L	-	-	-	-	-	-	1.49	1.48	1.53	1.64	2.45	1.76	1.6	1.54	1.54	1.75	1.7	1.7	1.74	1.68	1.55
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.882	0.894	0.863	1.23	1.08	0.97	1	0.848	0.87	1.04	1.05	0.883	0.85	0.961	0.849
Strontium	mg/L	-	-	-	-	-	-	0.123	0.13	0.134	0.141	0.101	0.116	0.12	0.125	0.134	0.139	0.13	0.123	0.124	0.12	0.111
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000141	0.000161	0.000141	0.000189	0.000121	0.000144	0.00016	0.000164	0.000144	0.000161	0.000165	0.00015	0.000147	0.000141	0.000133
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	0.0043	0.0031	<0.0030	<0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-06-19	2019-07-25	2019-08-20
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0088	0.0077	0.0062	0.0063	0.0162	0.0101	0.0266	0.0103	0.006	0.0063	0.005	0.0108	0.0101	0.0098	0.009
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	<0.00010	<0.00010	<0.00010	0.00018	0.00017	<0.00010	<0.00010	0.0001	0.00011	<0.00010	0.0001	0.00012	<0.00010	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00552	0.00496	0.00558	0.00523	0.00679	0.00568	0.00852	0.00529	0.0049	0.00538	0.00538	0.0056	0.00555	0.00528	0.00495
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000063	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	<0.00050	<0.00050	<0.00050	0.00051	0.00098	<0.00050	0.00148	0.0008	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	0.00051	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00027	0.00019	0.00018	0.00017	0.00291	0.00055	0.00124	0.00064	0.00025	0.00027	0.00021	0.00087	0.00071	0.00018	0.0001
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000283	0.000277	0.000295	0.000325	0.00046	0.00035	0.000455	0.000319	0.000374	0.000444	0.000388	0.000361	0.000335	0.000327	0.000311
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000073	0.000074	0.000093	0.000116	0.000163	0.000133	0.000136	0.000111	0.000094	0.000142	0.000135	0.000103	0.000099	0.000097	0.00011
Silicon	mg/L	-	-	-	-	-	-	1.45	1.4	1.54	1.58	2.14	1.76	1.41	1.47	1.28	1.55	1.65	1.82	1.74	1.71	1.58
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.124	0.127	0.132	0.127	0.0988	0.119	0.117	0.134	0.131	0.14	0.138	0.118	0.124	0.113	0.118
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000137	0.000147	0.000135	0.00014	0.000118	0.000135	0.000139	0.000152	0.000158	0.000166	0.000176	0.000153	0.000171	0.00015	0.000137
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2019-10-30	2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-12-07
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	99.8	104.7	-	89	104.9	108.5	107.6	118.3	109.5	107	111.5	93.4	96.9	104.2	150.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.86	7.77	-	7.94	8.13	8.01	8.08	8	8.45	7.91	7.79	7.94	7.92	8.1	7.77
Turbidity	NTU	1	-	-	-	-	1	0.02	0.37	-	0	0.09	0.19	0.2	0.41	0.04	0.24	0.42	1.08	0	0	0.37
Temperature	C	-	-	-	-	-	-	7.739	11.163	-	16.085	15.88	6.574	8.695	19.674	15.721	9.038	4.143	16.16	21.059	13.505	4.845
Dissolved oxygen	%	-	-	-	-	-	-	93.1	-	-	97.9	99.3	88.1	97.3	101	94.7	90.9	92.5	106.4	99.6	94.6	85.1
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.09	11.04	-	9.64	9.82	10.8	11.31	9.24	9.4	10.49	12.07	10.46	8.87	9.85	10.91
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.8	45.3	42.6	43.3	47.3	48.5	47.8	42.9	51	47.3	50.9	43.4	42.2	43.6	48.3
Specific conductivity	uS/cm	-	-	-	-	-	-	110	99.3	95.4	98.8	104	108	109	97.3	113	107	112	90.7	97.7	106	111
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.89	7.77	7.46	7.93	7.95	7.87	7.87	7.92	7.9	7.95	7.9	7.77	7.86	7.87	7.78
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0	<1.0	<1.0	1.9	1.6	<1.0	<1.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.22	0.92	1.43	0.49	0.29	0.18	0.38	0.25	0.18	0.28	0.3	1.43	0.27	0.2	0.28
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	50.2	48.2	43.6	46.5	49.1	51.1	52.3	46.9	48.6	50.5	52	44.7	45.9	51.5	54.5
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	46.8	49.4	48.2	49.1	53.6	47.8	49	50.9	52.7	53.8	44.8	46.4	49.6	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	65	65	66	66	67	70	72	82	67	88	64	64	83	64
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.93	3.03	4.13	2.93	2.19	12.5	2.46	2.18	1.73	1.71	2.05	3.36	2.32	1.96	1.53
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0882	0.0848	0.016	0.0366	0.0301	0.116	0.116	0.0553	0.0435	0.0854	0.126	0.0508	0.0196	0.0286	0.104
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0882	0.0852	<0.0500	0.0372	0.0304	0.116	0.116	0.0553	0.0435	0.0854	0.126	0.0508	0.0196	0.0286	0.104
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	0.0056	<0.0050	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0026	<0.0020	0.0024	0.0022	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0049	0.0087	0.0114	0.0061	0.0027	0.0022	<0.0020	<0.0020	0.0021	<0.0020	0.0025	0.0064	<0.0020	0.0023	0.0027
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.199	0.2	0.15	0.15	0.13	0.177	0.176	0.139	0.123	0.141	0.184	0.185	0.086	0.113	0.162
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	16.8	15.8	14.1	15.3	16.5	17.2	17.5	15.9	16.4	17.2	17.2	14.7	15.2	17.4	18.5
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.035	0.038	0.039	0.035	0.035	0.037	0.037	0.035	0.031	0.034	0.037	0.031	0.03	0.036	0.032
Magnesium	mg/L	-	-	-	-	-	-	1.99	2.08	2.06	2	1.93	1.98	2.1	1.76	1.87	1.84	2.21	1.94	1.92	1.96	2.03
Potassium	mg/L	-	-	-	-	-	-	0.501	0.535	0.516	0.53	0.49	0.472	0.523	0.479	0.463	0.45	0.523	0.51	0.511	0.487	0.475
Sodium	mg/L	-	-	-	-	-	-	0.897	0.951	0.97	0.948	0.924	0.914	1.02	0.815	0.844	0.818	1.04	0.888	0.869	0.899	0.89
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.97	5.61	4.8	5.43	5.91	6.98	6.51	5.82	6.36	6.82	6.68	4.96	5.25	6.32	6.54

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																					
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2019-10-30	2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-12-07
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.013	0.045	0.0625	0.0214	0.0132	0.0135	0.0181	0.0152	0.0118	0.0122	0.0238	0.0531	0.018	0.0111	0.0235
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00016	0.00023	0.00016	0.00011	0.00011	0.00014	0.00018	0.00011	0.00013	0.00012	0.00016	0.00012	0.00013	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00621	0.00616	0.00751	0.00547	0.00527	0.00489	0.00516	0.00587	0.00448	0.0049	0.00548	0.00642	0.00524	0.00517	0.00529
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000084	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000081	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.2	15.3	16.1	15.8	16.4	18	15.9	16.7	17.3	17.9	18	14.8	15.5	16.6	17.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00064	0.00087	0.00115	0.00072	0.00066	0.00056	0.00074	0.00058	0.00062	0.00052	0.00088	0.00083	0.00055	<0.00050	0.00082
Iron	mg/L	-	-	1	-	-	1	<0.030	0.066	0.103	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.074	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000233
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.93	2.06	2.26	2.11	1.97	2.08	1.97	1.78	1.87	1.94	2.15	1.91	1.88	1.99	2
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00112	0.00375	0.00428	0.00216	0.00119	0.00116	0.00176	0.00188	0.00078	0.00096	0.00187	0.00357	0.00152	0.00108	0.00113
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000385	0.000413	0.000483	0.000392	0.000324	0.000384	0.00039	0.00038	0.000316	0.000342	0.000437	0.000385	0.000341	0.000301	0.000353
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.00054	0.00075	0.00051	<0.00050	<0.00050	0.00057	<0.00050	0.00054	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.447	0.532	0.586	0.51	0.46	0.47	0.468	0.511	0.463	0.49	0.508	0.501	0.485	0.481	0.465
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000122	0.000149	0.00016	0.00015	0.00013	0.000115	0.000139	0.000105	0.000108	0.000102	0.000138	0.00013	0.000111	0.000094	0.000091
Silicon	mg/L	-	-	-	-	-	-	1.59	2.16	2.42	2.01	1.7	1.68	2.08	1.69	1.36	1.59	1.85	2.18	1.54	1.31	1.62
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.919	0.962	1.08	0.928	0.888	0.968	0.985	0.887	0.864	0.879	1.02	0.886	0.851	0.872	0.883
Strontium	mg/L	-	-	-	-	-	-	0.125	0.109	0.0989	0.117	0.124	0.142	0.121	0.119	0.125	0.138	0.143	0.102	0.117	0.136	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000149	0.000132	0.00013	0.000127	0.000147	0.000156	0.000147	0.000151	0.000145	0.000169	0.000165	0.000127	0.000139	0.000148	0.000156
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-0m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2019-10-30	2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-12-07
Parameter																					
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0082	0.0162	0.0195	0.0145	0.0093	0.0094	0.011	0.01	0.0083	0.0067	0.0062	0.0185	0.0113	0.0073	0.0053
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00014	0.00019	0.00016	0.00012	<0.00010	0.00012	0.00012	<0.00010	0.00011	<0.00010	0.00014	0.00011	0.00014	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.0052	0.00616	0.00586	0.00581	0.00545	0.00466	0.00519	0.00512	0.00504	0.00454	0.00523	0.00578	0.00531	0.00532	0.00508
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	<0.00050	0.00073	0.00077	0.00072	0.00069	<0.00050	0.00061	<0.00050	<0.00050	<0.00050	0.00064	0.0007	<0.00050	<0.00050	0.00055
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000374
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00019	0.00078	0.00042	<0.00010	0.00036	0.00045	0.0009	0.00073	0.00025	0.00031	0.00037	0.00114	0.00058	0.00022	0.0003
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000393	0.000409	0.000441	0.000349	0.000346	0.000414	0.000365	0.000355	0.000294	0.00032	0.000444	0.000364	0.000324	0.000339	0.000337
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000137	0.000154	0.000182	0.000128	0.000091	0.000127	0.00014	0.000126	0.00011	0.000097	0.000124	0.000149	0.000072	0.00008	0.00008
Silicon	mg/L	-	-	-	-	-	-	1.59	2.12	2.36	1.91	1.61	1.61	1.91	1.61	1.37	1.44	1.74	2.12	1.55	1.26	1.6
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.129	0.11	0.0914	0.11	0.128	0.142	0.128	0.117	0.138	0.13	0.139	0.099	0.108	0.136	0.135
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000142	0.000122	0.000118	0.000125	0.000151	0.000152	0.000146	0.00014	0.000146	0.000157	0.000159	0.000118	0.000128	0.000144	0.000153
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	107.8	100.5	-	105.9	102.2	-	105.2	101.3	108.2	109.3	110.2	106.1	-	-	113.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.43	7.95	-	7.17	7.89	-	7.86	-	7.34	7.6	7.76	7.54	-	-	7.74
Turbidity	NTU	1	-	-	-	-	1	0.39	0.22	-	0	0.08	-	0.18	0	0.06	0.79	0.34	0.9	-	-	0.21
Temperature	C	-	-	-	-	-	-	3.04	5.076	-	5.315	6.684	-	6.281	9.337	7.576	2.718	4.071	6.134	-	-	8.6
Dissolved oxygen	%	-	-	-	-	-	-	85.4	91.5	-	88.7	86	-	80.7	88.9	86.2	85.5	91.3	89	-	-	94.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.48	11.65	-	11.2	10.5	-	9.91	10.2	10.32	11.59	11.94	11	-	-	11.01
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.7	50.9	49.6	46.1	48.8	51	50.5	50	49	50	50	45.8	46.9	48.3	49.1
Specific conductivity	uS/cm	-	-	-	-	-	-	112	112	106	107	106	106	106	105	106	118	112	100	105	103	102
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.92	7.77	7.81	7.73	7.83	7.85	7.91	7.9	7.93	7.83	7.87	7.87	7.94	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.31	0.33	0.44	0.3	0.36	0.22	0.28	0.35	0.31	0.55	0.31	0.38	0.17	0.33	0.32
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54.9	53	53.3	52.3	51.5	52.9	51.7	49.4	52	53.4	53.1	49.1	54.3	50.3	48.8
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	69	69	69	75	77	66	83	68	64	70	78	68	73	72	75
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.74	1.63	1.81	1.61	1.85	2.19	1.66	1.83	1.94	1.68	1.54	1.79	1.7	1.69	1.8
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.122	0.127	0.126	0.135	0.127	0.13	0.129	0.0806	0.0904	0.146	0.133	0.125	0.131	0.106	0.0869
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.122	0.127	0.126	0.135	0.127	0.13	0.129	0.0806	0.0904	0.146	0.133	0.125	0.131	0.106	0.0869
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	0.117	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0055	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	0.0053	0.0032	0.0037	<0.0020	0.0038	<0.0020	<0.0020	0.0029	0.005	<0.0020	<0.0020	<0.0020	0.0032
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.161	0.198	0.179	0.198	0.178	0.188	0.171	0.139	0.155	0.19	0.177	0.189	0.197	0.171	0.142
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.6	17.9	17.9	17.6	17.3	17.8	17.4	16.8	17.6	17.8	17.8	16.4	18.1	16.8	16.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.035	0.035	0.033	0.035	0.034	0.033	0.036	0.033	0.034	0.032	0.032	0.032	0.032	0.029	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.04	2.03	2.06	2.03	2	2.08	1.98	1.77	1.96	2.2	2.1	1.99	2.2	2	1.93
Potassium	mg/L	-	-	-	-	-	-	0.484	0.479	0.599	0.509	0.476	0.532	0.517	0.459	0.492	0.549	0.52	0.502	0.541	0.496	0.482
Sodium	mg/L	-	-	-	-	-	-	0.941	0.943	0.997	0.979	0.905	1.02	1.02	0.852	0.916	1.08	0.974	0.938	1.03	0.941	0.887
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.79	6.3	6.29	6.65	6.51	6.48	6.57	6.46	6.79	7.78	6.65	6.19	6.61	6.25	6.7

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26
Parameter																				
Total Metals																				
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.022	0.0167	0.0581	0.0178	0.0144	0.0124	0.0137	0.0233	0.0219	0.0247	0.0164	0.0194	0.0111	0.0128	0.0197
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00011	0.00013	0.00013	0.00012	0.00011	0.0001	0.00011	0.00012	0.00013	<0.00010	0.00011	0.0001	0.00011	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00546	0.0053	0.00648	0.00538	0.00529	0.00517	0.00519	0.00522	0.00613	0.00582	0.00521	0.00517	0.00548	0.00553	0.00574
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.4	17.8	18	18.2	17.7	18	17.6	16.8	16.7	17.9	17.9	16.1	17.2	18	16.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00103	0.00128	0.00176	0.00103	0.00063	0.00074	0.00075	0.00094	0.00133	0.00114	0.00059	0.00056	0.00069	0.00054	0.0009
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	0.047	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.00036	0.000093	0.000069	0.000278	0.000137	0.000216	0.000315	0.00056	0.00214	0.000162	<0.000050	0.000122	0.000184	0.000133	0.000552
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.0013	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.11	2.04	2.11	2.1	2.05	2.02	1.93	1.91	2.3	2.15	2.14	1.92	2.12	2	1.92
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.0011	0.00127	0.0019	0.00146	0.00119	0.00106	0.00121	0.00126	0.00139	0.00129	0.0011	0.00136	0.00078	0.0012	0.00126
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000428	0.000358	0.000366	0.000414	0.000392	0.000431	0.000388	0.000335	0.000392	0.000726	0.000374	0.000351	<0.00040	0.000341	0.000306
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.508	0.486	0.577	0.545	0.475	0.516	0.489	0.494	0.528	0.524	0.515	0.495	0.492	0.513	0.474
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000098	0.000103	0.000127	0.000104	0.000105	0.000093	0.000108	0.000101	0.000115	0.00016	0.000088	0.000088	0.000125	0.000079	0.000135
Silicon	mg/L	-	-	-	-	-	-	1.67	1.81	1.84	1.82	1.75	1.64	1.73	1.61	1.62	1.82	1.73	1.7	1.75	1.7	1.61
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.959	0.972	0.964	1.05	0.914	0.999	1.07	0.896	1.04	1.14	1.01	0.905	0.949	0.959	0.885
Strontium	mg/L	-	-	-	-	-	-	0.139	0.138	0.13	0.139	0.133	0.138	0.135	0.132	0.133	0.142	0.135	0.125	0.131	0.133	0.135
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000168	0.000162	0.000157	0.000168	0.000165	0.000153	0.000168	0.000162	0.000164	0.000166	0.00016	0.000156	0.000155	0.000162	0.000137
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26
Parameter																				
Dissolved Metals																				
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.005	0.0061	0.0076	0.0065	0.0072	0.0072	0.006	0.0081	0.0077	0.0065	0.0055	0.0076	0.0069	0.0067	0.006
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001
Barium	mg/L	-	-	-	-	-	-	0.00512	0.00526	0.00566	0.00517	0.00515	0.00533	0.00531	0.00487	0.00542	0.00516	0.00522	0.00518	0.00516	0.00499	0.0055
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00071	0.00109	0.00086	0.00086	0.00055	0.00077	0.00076	0.00075	0.00094	0.0009	0.00101	0.00052	0.00171	<0.00050	0.00079
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000095	0.000115	0.000092	0.000361	0.000259	0.000354	0.000338	0.00063	0.000744	0.000207	0.000073	0.00009	0.00032	0.000129	0.000463
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00026	0.00041	0.00027	0.0003	0.00039	0.00027	0.00026	0.00022	0.00016	0.00033	0.00035	0.00011	0.00046	0.00025	0.00019
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000395	0.000335	0.000354	0.000377	0.000354	0.000399	0.000358	0.000318	0.000397	0.000684	0.000363	0.000334	0.000341	0.000301	0.000283
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000086	0.000095	0.000112	0.000106	0.000084	0.000104	0.000096	0.000081	0.000091	0.000144	0.000089	0.000078	0.000106	0.00009	0.00012
Silicon	mg/L	-	-	-	-	-	-	1.62	1.74	1.72	1.75	1.7	1.69	1.83	1.46	1.58	1.65	1.67	1.68	1.66	1.59	1.52
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.132	0.129	0.131	0.13	0.135	0.132	0.127	0.134	0.136	0.135	0.126	0.134	0.13	0.132
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000155	0.000151	0.000151	0.000156	0.00015	0.000149	0.000151	0.000148	0.000142	0.000167	0.000139	0.000148	0.000149	0.000147	0.000134
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30	2020-06-16	2020-07-21	2020-08-11
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	106.8	112.3	106.3	107.5	102.6	107.8	109.5	-	108	109.5	108.9	107.5	111.1	-	107.9
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.41	7.58	7.81	7.75	7.62	7.8	-	7.7	7.74	7.89	7.86	7.74	-	7.92
Turbidity	NTU	1	-	-	-	-	1	0.05	0.37	0.47	0	0	0	0	-	0.52	0.35	0	0	0.13	-	0
Temperature	C	-	-	-	-	-	-	5.768	4.206	5.525	5.294	6.747	8.06	4.343	-	5.055	5.156	7.057	7.765	7.281	-	5.488
Dissolved oxygen	%	-	-	-	-	-	-	94.9	89	98.1	85.6	85.1	86.6	89.3	-	93.3	84.1	84.8	91	95.9	-	87.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.88	11.59	11.37	10.83	10.35	10.22	11.6	-	11.87	10.67	10.22	10.84	11.56	-	11.01
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.5	51.1	48.5	48.8	49.4	47.8	49	48.7	48.3	48	49.8	49.1	47.9	46.2	46
Specific conductivity	uS/cm	-	-	-	-	-	-	105	108	107	107	109	107	107	114	109	106	105	111	105	107	106
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.92	7.83	7.89	7.96	7.93	7.91	7.82	8	8	7.88	7.97	7.9	7.76	7.34	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	1.2	<1.1	<1.0	<1.1
Turbidity	NTU	1	-	-	-	-	1	0.23	0.35	0.32	0.21	0.18	0.31	0.24	0.22	0.15	0.14	0.23	0.19	0.6	0.69	0.26
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.9	52.7	50.9	49.2	49.8	50.4	55.4	55.7	53.5	49.8	48.8	49.8	50.2	50.2	49.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49.4	52	51.7
Total dissolved solids	mg/L	-	-	-	1000	-	1000	58	66	73	69	68	69	67	72	68	65	66	67	66	73	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.33	4.4	2.09	1.77	1.54	1.66	1.71	1.73	1.69	2.03	1.76	2	2.36	2.22	2.17
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.113	0.137	0.13	0.129	0.108	0.0883	0.12	0.129	0.131	0.128	0.109	0.088	0.112	0.122	0.128
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.113	0.137	0.13	0.129	0.108	0.0883	0.12	0.129	0.131	0.128	0.109	0.088	0.112	0.122	0.128
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	0.0104	<0.0050	<0.0050	<0.0050	0.0066	0.0129	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0021	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	0.0031
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0021	0.0064	0.0031	0.0051	0.0043	0.0037	0.0026	0.0038	0.0072	0.0026	0.0029	0.007	0.0068	0.0072	0.0022
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0014	<0.0010	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.165	0.176	0.181	0.179	0.174	0.168	0.174	0.176	0.22	0.202	0.18	0.2	0.201	0.21	0.206
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.7	17.5	16.9	16.5	16.8	17.1	18.4	18.6	18.1	16.6	16.1	16.7	16.8	16.8	16.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.035	0.039	0.033	0.031	0.032	0.034	0.034	0.036	0.042	0.038	0.034	0.035	0.035	0.036	0.034
Magnesium	mg/L	-	-	-	-	-	-	2.09	2.16	2.08	1.96	1.9	1.88	2.29	2.21	2.04	2.06	2.09	1.95	2.04	2	2.01
Potassium	mg/L	-	-	-	-	-	-	0.475	0.535	0.513	0.477	0.447	0.5	0.525	0.533	0.516	0.497	0.473	0.481	0.514	0.502	0.524
Sodium	mg/L	-	-	-	-	-	-	0.918	1.03	0.951	0.919	0.901	0.915	1.07	1.06	0.979	0.992	0.983	0.88	0.927	0.924	0.983
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.63	6.45	6.23	6.18	6.37	6.24	6.77	6.51	6.48	6.58	6.11	7.11	6.11	6.09	6.32

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Date								2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30	2020-06-16	2020-07-21	2020-08-11
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0114	0.0193	0.0153	0.0136	0.0099	0.0066	0.0125	0.0117	0.012	0.0099	0.0088	0.0133	0.0364	0.0463	0.0198
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.0001	0.00022	0.0001	0.00012	0.00011	0.00013	0.00015	<0.00010	0.0001	<0.00010	0.00011	0.00016	0.00013	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00559	0.00567	0.00563	0.0053	0.00539	0.00526	0.00515	0.00519	0.00488	0.00549	0.00492	0.00534	0.00571	0.00596	0.00529
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000066	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17	15.6	16.7	16.4	16.6	17.2	16.9	17.3	17.4	17.1	16.5	16.7	16.4	17.4	17.2
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00066	0.00057	0.00071	0.00067	0.00054	0.00072	0.00061	0.00056	0.00056	0.00107	<0.00050	0.00062	0.00073	0.00076	0.0007
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.045	0.05	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000157	0.000448	0.000912	0.000512	0.000234	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.89	2.15	2.09	2.01	1.88	2.01	2.08	2.05	1.96	1.99	1.87	1.91	2.01	2.06	2.15
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00105	0.0018	0.00168	0.00099	0.00093	0.0002	0.00109	0.00123	0.00119	0.00106	0.00066	0.00109	0.0021	0.00186	0.00146
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000379	0.000321	0.000349	0.00039	0.000333	0.000354	0.000429	0.000391	0.000369	0.000407	0.000343	0.000372	0.000355	0.000331	0.000353
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.444	0.495	0.521	0.484	0.428	0.471	0.511	0.481	0.475	0.476	0.466	0.436	0.511	0.518	0.499
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00011	0.000099	0.00012	0.000121	0.000086	0.000097	0.000116	0.000138	0.000076	0.000105	0.000118	0.000106	0.000111	0.000122	0.00011
Silicon	mg/L	-	-	-	-	-	-	1.62	1.9	1.84	1.7	1.63	1.52	1.75	1.71	1.64	1.81	1.64	1.58	1.93	1.91	1.86
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.898	1.01	0.998	0.999	0.841	0.896	1.05	1.04	0.939	1	0.909	0.908	0.923	0.978	0.954
Strontium	mg/L	-	-	-	-	-	-	0.141	0.137	0.13	0.137	0.127	0.134	0.134	0.132	0.137	0.132	0.124	0.124	0.126	0.129	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000186	0.000155	0.000158	0.000168	0.000158	0.000152	0.000159	0.000163	0.000166	0.000161	0.000145	0.000144	0.000144	0.000164	0.000149
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	0.005	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30	2020-06-16	2020-07-21	2020-08-11
Parameter																				
Dissolved Metals																				
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0054	0.0069	0.0067	0.0056	0.006	0.0067	0.0062	0.0054	0.0064	0.0057	0.0065	0.0081	0.0115	0.0086	0.0082
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00016	<0.00010	<0.00010	0.00012	0.0001	<0.00010	<0.00010	0.0001	0.00011	0.00013	0.00012	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00502	0.00557	0.00531	0.00555	0.00539	0.0049	0.00532	0.00538	0.00539	0.00518	0.00515	0.00514	0.00548	0.00511	0.00536
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.0006	0.00058	<0.00050	0.00057	0.00057	0.00069	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	<0.00050	0.00051
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.00014	0.000379	0.000495	0.000411	0.000229	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00018	0.00023	0.00024	0.00019	0.00023	0.00098	0.00016	0.0002	0.00015	0.00012	<0.00010	0.0002	0.00023	0.00021	0.00014
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000345	0.000317	0.000336	0.000354	0.000338	0.000359	0.000416	0.000384	0.000374	0.000399	0.00037	0.000368	0.00036	0.000343	0.00035
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000107	0.00007	0.000119	0.000136	0.000111	0.000082	0.000092	0.000099	0.000112	0.000128	0.000127	0.000168	0.000126	0.000118	0.000093
Silicon	mg/L	-	-	-	-	-	-	1.59	1.73	1.73	1.52	1.6	1.33	1.58	1.67	1.83	1.81	1.71	1.57	1.96	1.82	1.79
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.13	0.136	0.128	0.126	0.132	0.132	0.14	0.137	0.133	0.129	0.129	0.126	0.128	0.126	0.133
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.00015	0.000169	0.000147	0.000143	0.00016	0.000153	0.000164	0.00017	0.000165	0.000159	0.000145	0.000145	0.000136	0.000156	0.00015
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	110.6	109.6	110.2	129.8	114.9	107.4	112.3	108.4	105.8	105.7	-	-	-	-	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.05	8.09	8.23	7.63	8.48	7.85	7.78	8.01	8.22	7.8	-	-	-	-	-
Turbidity	NTU	1	-	-	-	-	1	0.04	0.25	0.04	0.47	0.05	0.25	0	0.49	0	0	-	-	-	-	-
Temperature	C	-	-	-	-	-	-	5.272	6.281	4.484	5.748	5.827	9	4.056	5.241	5.726	9.612	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	-	86.7	87.4	92.2	90.4	86	90.5	92.3	89.7	86.6	87.2	-	-	-	-	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.99	10.8	11.92	11.38	10.72	10.46	12.07	11.36	10.85	9.89	-	-	-	-	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.6	47.8	48.7	46.9	51.3	47.7	50.8	49.3	46.2	44	47.2	51.7	55.1	50.6	42.6
Specific conductivity	uS/cm	-	-	-	-	-	-	109	109	111	108	114	107	113	106	107	106	112	113	111	113	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.93	7.87	7.88	7.85	7.87	7.94	7.91	7.86	7.82	7.87	7.98	8	7.84	7.99	7.98
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.1	<1.0	4.1	1.1	<1.0	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.15	0.14	0.15	0.11	<0.10	0.15	0.19	0.53	0.19	0.23	0.51	0.65	0.62	0.59	0.46
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52	53.7	52.8	53	50.3	54	53	52.9	51.1	50.7	53.3	55	53.8	53.8	57.1
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	50.4	52.4	50.1	52.4	53.2	51.9	53.2	53.6	49.9	50.7	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	71	67	80	70	84	68	80	74	74	87	64	71	61	80	65
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.97	12.8	2.01	2.03	1.72	1.7	1.91	2.51	2.16	2.06	2.07	2.1	2.05	2.62	2.14
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.128	0.116	0.137	0.138	0.123	0.0853	0.128	0.121	0.126	0.0458	0.136	0.136	0.132	0.132	0.135
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.128	0.116	0.137	0.138	0.123	0.0853	0.128	0.121	0.126	0.0458	0.136	0.136	-	0.132	0.135
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0026	0.0037	<0.0020	0.0022	0.0024	<0.0020	0.0039	0.0044	0.002	0.0034	0.0022	0.0021	0.0025	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.192	0.188	0.166	0.18	0.191	0.124	0.212	0.18	0.191	0.13	0.21	0.192	0.19	0.182	0.181
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.5	18	17.7	18.2	16.8	18.4	17.7	17.8	17	17.1	18	18.7	18.2	18.2	19.3
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.036	0.037	0.038	0.038	0.032	0.034	0.036	0.034	0.032	0.036	0.035	0.034	0.035	0.033	0.033
Magnesium	mg/L	-	-	-	-	-	-	2	2.12	2.08	1.83	2.02	1.96	2.13	2.06	2.1	1.95	2.05	2.05	2.02	2.02	2.18
Potassium	mg/L	-	-	-	-	-	-	0.5	0.512	0.512	0.463	0.494	0.491	0.503	0.497	0.537	0.482	0.513	0.513	0.507	0.486	0.486
Sodium	mg/L	-	-	-	-	-	-	0.987	0.976	0.993	0.859	0.946	0.867	1	0.936	0.99	0.9	1.05	1.07	1.04	0.937	1
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.42	7.09	6.86	6.51	6.51	6.84	6.66	6.08	5.91	6.5	6.71	6.71	6.59	6.4	6.5

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0131	0.0142	0.0118	0.0153	0.0099	0.0112	0.0184	0.0211	0.0128	0.0121	0.0372	0.0348	0.0325	0.0316	0.0238
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	<0.00010	0.0001	0.00014	<0.00010	0.00011	0.0001	0.00013	0.0001	0.00012	0.00014	0.00014	0.00013	0.00011	0.00015
Barium	mg/L	-	1W	-	-	-	1	0.005	0.0052	0.0048	0.00536	0.00465	0.00485	0.00544	0.00549	0.00531	0.00518	0.00636	0.00624	0.00597	0.00528	0.00556
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	16.9	17.5	16.8	17.8	18.1	17.6	17.8	18	16.6	17	18.2	18.1	17.6	18.5	19.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00073	0.00059	0.00058	0.00053	0.00058	0.00053	0.0007	0.0006	0.00054	0.00055	0.00132	0.00132	0.00111	0.00118	0.00102
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000099	0.000052	0.000083	0.000092
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.00089	0.00066	0.00089	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.1	1.97	1.93	1.95	1.94	2.14	2.1	2.06	2	2.11	2.05	1.99	2.06	2.18
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00125	0.00114	0.00107	0.00117	0.00067	0.00093	0.00167	0.00188	0.00109	0.00122	0.00144	0.00152	0.00143	0.00137	0.00133
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000357	0.000439	0.000366	0.000363	0.000397	0.000329	0.000443	0.000364	0.000396	0.000318	0.000626	0.000567	0.000516	0.000486	0.000423
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.462	0.492	0.455	0.512	0.483	0.49	0.498	0.498	0.507	0.492	0.526	0.522	0.515	0.491	0.481
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000134	0.000136	0.000092	0.000115	0.000112	0.0001	0.000191	0.000102	0.000125	0.000087	<0.00050	<0.00050	<0.00050	0.000112	0.000097
Silicon	mg/L	-	-	-	-	-	-	1.66	1.68	1.89	1.82	1.68	1.55	1.79	2.03	1.9	1.46	1.79	1.81	1.74	1.8	1.9
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.898	0.982	0.95	0.983	0.942	0.883	1.01	0.953	0.975	0.876	1.06	1.07	1.06	0.973	0.997
Strontium	mg/L	-	-	-	-	-	-	0.13	0.139	0.131	0.135	0.134	0.138	0.135	0.131	0.135	0.138	0.147	0.134	0.14	0.138	0.138
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000153	0.00016	0.000163	0.00017	0.000152	0.00017	0.000165	0.000154	0.00015	0.000149	0.00019	0.000179	0.000179	0.000174	0.000163
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-20m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0078	0.0087	0.0064	0.0066	0.0063	0.0073	0.0058	0.0095	0.0078	0.0079	0.0067	0.007	0.0077	0.006	0.0055
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	0.0001	<0.00010	<0.00010	0.0001	<0.00010	0.0001	0.00011	0.00015	0.00011	0.00013	0.00012	0.00011	0.00011
Barium	mg/L	-	-	-	-	-	-	0.0054	0.00504	0.00499	0.00445	0.00528	0.00491	0.00512	0.00522	0.00509	0.00545	0.00557	0.00558	0.0055	0.0048	0.00514
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.000100	<0.000100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.00100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00066	<0.00050	0.0006	<0.00050	0.00052	<0.00050	0.00066	0.00053	0.00077	0.00052	0.00109	0.0009	0.00084	0.00119	0.00072
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000068	0.000073	0.000132	0.000072
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00094	0.00056	0.00074	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00027	0.00044	0.00021	0.0001	0.00017	0.00032	0.00032	0.00021	0.00027	0.00022	0.000435	0.000387	0.000359	0.00029	0.00032
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00038	0.000474	0.000388	0.00039	0.000371	0.000345	0.000431	0.000354	0.000376	0.000328	0.000563	0.000487	0.000451	0.000413	0.000403
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000142	0.000102	0.000109	0.000142	0.000114	0.000116	0.000124	0.000122	0.000099	0.000114	<0.00050	<0.00050	<0.00050	0.000093	0.000091
Silicon	mg/L	-	-	-	-	-	-	1.62	1.58	1.75	1.66	1.74	1.42	1.71	1.94	1.8	1.38	1.72	1.76	1.72	1.73	1.86
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.131	0.15	0.141	0.148	0.142	0.138	0.14	0.128	0.13	0.133	0.142	0.142	0.132	0.136	0.141	0.135
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000151	0.000158	0.000154	0.000165	0.000152	0.000162	0.000155	0.00015	0.000147	0.000152	0.000179	0.000172	0.000162	0.000168	0.00016
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute		QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
								2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14	2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	124.6	150.4	184.4	145.2	151.5	150.3	107.9	101.4	104.1	-	106.1	104.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	7.69	7.59	7.81	7.91	7.77	7.69	7.4	7.95	7.78	-	7.82	7.67
Turbidity	NTU	1	-	-	-	-	1	-	-	-	0.63	0.19	0.5	0.6	0.28	0.39	0.43	0.2	0.03	-	0.13	0.28
Temperature	C	-	-	-	-	-	-	-	-	-	5.092	4.621	4.943	5.005	5.667	4.848	3.051	4.314	4.538	-	4.839	4.815
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	81.4	82	83.1	82.3	81.5	84.1	83.3	88.5	85.9	-	84.7	78.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	-	10.36	10.58	10.61	10.5	10.19	10.78	11.19	11.49	11.1	-	10.86	10.06
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	53.2	51.4	48.7	50.9	48.5	50.8	50.8	50.3	48.5	48.4	50.2	49.3	46.4	51.1	51.9
Specific conductivity	uS/cm	-	-	-	-	-	-	112	113	113	111	111	111	113	112	111	112	113	107	107	112	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.84	8.03	8.01	7.94	7.8	7.83	7.82	7.84	7.8	7.83	7.91	7.77	7.81	7.77	7.82
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.44	0.46	0.22	0.19	0.22	0.25	0.39	0.53	0.31	0.34	0.47	3.48	0.39	0.29	0.24
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.6	51.5	54.5	53.1	53	54.3	57.1	56.1	54.1	54.8	53	53.9	53.2	54.1	53.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	70	72	62	74	69	77	68	66	64	70	66	76	81	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.11	2.03	2.16	1.75	1.7	1.73	1.75	1.66	1.67	1.77	1.48	1.5	1.59	1.77	2.14
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.135	0.135	0.139	0.138	0.145	0.135	0.146	0.13	0.105	0.121	0.128	0.131	0.139	0.152	0.142
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.135	0.135	0.139	0.138	0.145	0.135	0.146	0.13	0.105	0.121	0.128	0.131	0.139	0.152	0.142
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0041	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	0.0072	0.0046	0.0021	0.0046	0.0029	0.0035	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.197	0.182	0.179	0.168	0.182	0.191	0.203	0.193	0.159	0.166	0.191	0.184	0.202	0.196	0.188
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	17.8	17.4	18.5	17.9	18	18.4	19.3	19	18.3	18.6	17.9	18.2	17.9	18.2	18
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.034	0.035	0.035	0.033	0.033	0.033	0.034	0.036	0.033	0.035	0.035	0.032	0.035	0.036	0.033
Magnesium	mg/L	-	-	-	-	-	-	1.98	1.95	2.04	2.02	1.96	2.04	2.13	2.09	2.02	2.03	2.02	2.07	2.05	2.1	2.14
Potassium	mg/L	-	-	-	-	-	-	0.461	0.511	0.518	0.467	0.503	0.514	0.472	0.475	0.471	0.493	0.476	0.551	0.504	0.508	0.541
Sodium	mg/L	-	-	-	-	-	-	0.973	1.03	1.02	0.942	0.999	0.953	0.95	0.981	0.892	0.936	0.947	0.962	0.963	1.03	1.05
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.49	6.69	6.71	6.4	6.56	6.43	6.36	6.53	6.55	6.79	6.41	6.32	6.57	7.48	6.62

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14	2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15
Parameter																					
Total Metals																					
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0265	0.0297	0.0196	0.0124	0.0144	0.0207	0.025	0.0275	0.0178	0.0232	0.0173	0.0515	0.014	0.0171	0.0146
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.00014	0.00012	0.00011	0.00013	0.00014	0.00011	0.00013	0.00011	0.0001	0.00011	0.00015	0.00012	0.00011	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00544	0.00582	0.00559	0.00529	0.00563	0.00541	0.00607	0.00563	0.00531	0.00544	0.00531	0.00663	0.00529	0.00531	0.00538
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000055	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18	18.1	18.2	17.8	17.7	18.5	18.2	18.4	18.1	18.4	17.6	18.1	17.7	18.2	18
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00105	0.00173	0.00102	0.00089	0.0008	0.00111	0.00115	0.00114	0.00091	0.00097	0.00108	0.00166	0.00094	0.00086	0.00089
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.03	<0.030	<0.030	0.043	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000141	0.000914	<0.000050	<0.00015	0.000059	0.000175	0.000051	0.0003	0.000164	0.000072	0.000081	0.000117	0.000169	0.000088	0.000174
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.04	2.05	2.01	1.93	2.08	2.02	2.05	2.04	2.13	2	2.11	2.03	2.11	2.12
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00126	0.00155	0.00118	0.00126	0.00118	0.0013	0.00134	0.00145	0.0013	0.00106	0.00126	0.00203	0.00145	0.00132	0.00128
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000452	0.000521	0.000494	0.000381	0.000451	0.000354	0.000468	0.000454	0.00036	0.000435	0.000372	0.000371	0.000354	0.000637	0.000447
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.475	0.508	0.514	0.478	0.52	0.516	0.479	0.499	0.487	0.499	0.476	0.593	0.517	0.492	0.527
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000109	0.000092	0.000083	0.000095	0.00013	0.000086	0.000107	0.000098	0.000096	0.000096	0.00008	0.000103	0.000107	0.000125	0.000114
Silicon	mg/L	-	-	-	-	-	-	1.75	1.77	1.77	1.7	1.68	1.72	1.78	1.78	1.64	1.68	1.73	1.82	1.77	1.75	1.71
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.987	1.03	1.04	0.956	1.03	0.981	0.945	1.01	0.921	0.946	0.971	0.986	0.992	1.03	1.05
Strontium	mg/L	-	-	-	-	-	-	0.15	0.147	0.139	0.132	0.145	0.138	0.131	0.142	0.138	0.14	0.136	0.137	0.135	0.14	0.14
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000169	0.000172	0.000174	0.000168	0.000173	0.000158	0.000179	0.000171	0.000159	0.000166	0.000163	0.000164	0.00016	0.000165	0.000159
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-04-14	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-05-06	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-06-03	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-07-01	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-08-26	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-09-14	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-10-28	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-11-09	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2015-12-07	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-01-20	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-04-26	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-05-19	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-06-28	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-07-20	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2016-08-15
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0057	0.0069	0.0064	0.0103	0.0053	0.0057	0.0055	0.0057	0.0049	0.0042	0.0058	0.0057	0.0053	0.0091	0.0057
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	0.00011	<0.00010	0.0001	0.00011	0.00023	<0.00010	<0.00010	0.0001	<0.00010	0.00011	<0.00010	<0.00010	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00519	0.00546	0.00538	0.00531	0.00535	0.00505	0.0057	0.00513	0.00512	0.0051	0.00519	0.00558	0.00508	0.00542	0.00533
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00074	0.0011	0.0009	0.00098	0.00072	0.00074	0.00078	0.00077	0.00054	0.00072	0.00082	0.00077	0.00107	0.00071	0.00075
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000106	0.000157	0.00013	0.000121	0.000058	0.000118	0.000097	0.000264	0.000214	0.000085	0.000086	0.000087	0.000341	0.000207	0.000257
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00031	0.00036	0.00015	0.00058	0.00024	0.00029	0.00018	0.00019	0.00017	0.00025	0.00031	0.00023	0.00029	0.00021	0.00025
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000377	0.000475	0.000422	0.000355	0.000381	0.000354	0.000478	0.0004	0.000338	0.000391	0.000334	0.000351	0.000362	0.000606	0.000449
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000103	0.000099	0.000089	0.00008	0.0001	0.000082	0.000097	0.000099	0.000071	0.000089	0.000087	0.0001	0.000082	0.00013	0.000125
Silicon	mg/L	-	-	-	-	-	-	1.7	1.7	1.77	1.7	1.65	1.66	1.77	1.73	1.6	1.61	1.7	1.73	1.72	1.72	1.71
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.145	0.144	0.131	0.129	0.135	0.136	0.131	0.139	0.134	0.135	0.134	0.134	0.134	0.14	0.139
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000154	0.000164	0.000158	0.000155	0.00016	0.000157	0.000178	0.000157	0.000158	0.000157	0.000152	0.000154	0.000157	0.000165	0.000157
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	106.2	109	113.3	111.3	110.1	108.5	-	-	116.5	107.2	112.3	107.7	109.4	106.2	112.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.64	-	7.41	7.59	7.76	7.52	-	-	7.6	-	7.49	7.37	7.64	7.58	7.47
Turbidity	NTU	1	-	-	-	-	1	0.26	0.12	0.26	1.49	0.32	0.89	-	-	0.17	0	0.66	0.64	0	0	0
Temperature	C	-	-	-	-	-	-	5.146	5.787	6.641	3.104	3.976	4.944	-	-	6.081	5.731	4.016	4.352	4.409	4.814	4.966
Dissolved oxygen	%	-	-	-	-	-	-	82.1	82.3	82.5	81.7	89.9	87.5	-	-	90.7	94.8	88.9	96.4	85.3	85.5	82.6
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.44	10.29	10.04	10.69	11.79	11.19	-	-	11.26	11.88	11.65	11.51	11.06	10.97	10.55
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.2	50.3	48.8	49.7	49.3	48.2	47.8	49.6	50.2	49.7	51.4	49.8	50.2	50.8	49.4
Specific conductivity	uS/cm	-	-	-	-	-	-	110	113	105	119	111	108	108	105	104	103	108	108	111	114	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.83	7.65	7.9	7.93	7.83	7.87	7.89	7.95	7.92	7.92	7.83	7.9	7.99	7.98	7.9
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	13.6	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.19	0.54	0.3	1.05	0.32	0.34	0.19	0.18	0.27	0.2	0.35	0.34	0.25	0.21	0.21
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	50.5	51.7	52.5	53.4	53.1	51.1	52.3	52.1	47.9	52.1	54.9	52.9	49.3	51.9	53.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	80	78	68	72	94	77	73	73	72	72	60	73	73	67	79
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.67	1.56	2	1.58	1.63	1.62	1.88	1.75	1.84	1.38	2.02	1.95	1.66	1.64	1.7
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.14	0.167	0.0948	0.153	0.134	0.139	0.145	0.144	0.134	0.115	0.139	0.136	0.142	0.147	0.153
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.14	0.167	0.0948	0.153	0.134	0.139	0.145	0.144	0.134	0.115	0.139	0.136	0.142	0.147	0.153
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0031	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0058	<0.0020	<0.0020	0.0028	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0031	0.0044	0.0031	0.0032	0.0043	0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	0.0011	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.18	0.226	0.153	0.201	0.189	0.196	0.191	0.196	0.181	0.176	0.174	0.192	0.188	0.2	0.214
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	16.9	17.5	17.7	17.8	17.8	17	17.3	17.4	15.8	17.3	18.3	17.5	16.5	17.3	18
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.034	0.034	0.035	0.033	0.032	0.033	0.032	0.03	0.034	0.035	0.036	0.033	0.032	0.034	0.036
Magnesium	mg/L	-	-	-	-	-	-	2	1.92	2.02	2.18	2.07	2.09	2.21	2.09	2.04	2.15	2.24	2.22	1.95	2.11	2.03
Potassium	mg/L	-	-	-	-	-	-	0.525	0.53	0.511	0.589	0.514	0.516	0.522	0.509	0.493	0.494	0.547	0.534	0.476	0.489	0.546
Sodium	mg/L	-	-	-	-	-	-	1.04	1.1	0.945	1.18	0.97	1.03	1.02	1.03	0.995	0.965	1.06	1.01	0.957	1.12	1.13
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.64	8.32	6.88	8.41	6.66	6.74	6.71	6.58	7.04	6.64	6.43	6.27	6.52	7.43	7.2

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.015	0.0283	0.0201	0.0576	0.0165	0.0192	0.0103	0.01	0.0145	0.0133	0.0215	0.017	0.0141	0.0117	0.013
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	0.0001	0.00013	0.00013	<0.00010	0.00011	0.00011	0.00013	0.00012	0.00011	0.00011	0.00013	0.00011	0.00013	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00526	0.00573	0.00599	0.0067	0.00544	0.00533	0.00548	0.00549	0.00561	0.005	0.00555	0.00551	0.00521	0.00565	0.00554
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.9	17.7	16.9	18.4	18.3	16.8	17.8	18.1	17.2	17.2	17.6	16.8	17	17.5	18
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00106	0.00144	0.00115	0.00189	0.00061	0.00081	0.00063	0.00059	0.00122	0.00064	0.00076	0.00076	0.00389	0.00078	0.00074
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000202	0.000272	0.000717	0.000102	0.000205	0.000056	<0.000050	0.000073	0.000637	0.000121	0.00038	0.000523	0.000437	0.000185	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.04	2.02	2.29	2.22	2.17	2.02	2.18	2.05	2.02	1.99	2.11	2.08	2.03	1.94	2.09
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00129	0.00135	0.00137	0.00191	0.00123	0.0013	0.00114	0.00126	0.0011	0.001	0.00198	0.00138	0.00132	0.00103	0.00102
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000408	0.000946	0.000417	0.000974	0.000411	0.000468	<0.00040	0.000423	0.000479	0.000393	0.000352	0.000353	0.000491	0.000678	0.000745
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.502	0.563	0.519	0.567	0.519	0.503	0.499	0.529	0.492	0.433	0.49	0.534	0.48	0.468	0.508
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000112	0.00022	0.000107	0.000209	0.000092	0.000107	0.000121	0.000115	0.000145	0.000095	0.000115	0.000094	0.000127	0.000176	0.000197
Silicon	mg/L	-	-	-	-	-	-	1.74	1.77	1.62	1.87	1.75	1.73	1.81	1.82	1.77	1.59	1.86	1.82	1.74	1.73	1.79
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.914	1.15	1.04	1.24	1.02	0.993	0.965	1.03	0.994	0.994	0.994	1.01	1.03	1.01	1.1
Strontium	mg/L	-	-	-	-	-	-	0.139	0.142	0.133	0.144	0.142	0.13	0.134	0.134	0.136	0.137	0.142	0.129	0.139	0.14	0.143
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000165	0.000165	0.000159	0.000171	0.000165	0.00016	0.000159	0.000169	0.000141	0.000179	0.000171	0.000158	0.000177	0.000165	0.000148
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0039	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date								2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19	2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18
Parameter																				
Dissolved Metals																				
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0057	0.0049	0.0076	0.0063	0.0056	0.0063	0.0057	0.0061	0.0054	0.0053	0.0061	0.0075	0.0057	0.0066	0.0069
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	0.0001
Barium	mg/L	-	-	-	-	-	-	0.00536	0.0052	0.00552	0.00534	0.00524	0.00534	0.00499	0.00498	0.0056	0.0053	0.00569	0.00568	0.00542	0.00553	0.00533
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00106	0.00088	0.00089	0.00087	0.00055	0.00061	0.00063	0.00054	0.00085	0.00056	0.00053	0.00051	0.00058	0.00075	0.00057
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000237	0.000304	0.000483	0.000144	0.000088	0.00007	0.000104	0.000092	0.000154	0.000101	0.000297	0.000396	0.000345	0.000164	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00024	0.00027	<0.00010	0.00022	0.00028	0.00013	0.00032	0.00024	0.00016	0.00015	0.00026	0.0002	0.00029	0.00025	0.0002
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000365	0.000871	0.000427	0.000914	0.000375	0.000444	0.000327	0.000399	0.00044	0.000345	0.000327	0.000334	0.000458	0.000691	0.000702
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.0001	0.000188	0.000148	0.000191	0.000066	0.000128	0.000097	0.000094	0.000117	0.000096	0.000091	0.000092	0.000101	0.000179	0.000158
Silicon	mg/L	-	-	-	-	-	-	1.82	1.59	1.61	1.67	1.67	1.67	1.74	1.72	1.72	1.56	1.72	1.78	1.53	1.69	1.55
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.129	0.136	0.135	0.139	0.136	0.132	0.131	0.133	0.136	0.128	0.142	0.133	0.129	0.14	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.00015	0.000149	0.000148	0.000164	0.000142	0.000152	0.000143	0.000153	0.000132	0.000151	0.000172	0.000155	0.000154	0.000164	0.000166
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30	2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	109.5	-	109.8	111.4	112.4	111.3	118.3	-	110.3	113.2	113.9	112.3	132.2	113.6	114.1
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.78	-	7.62	7.58	7.63	7.77	7.69	-	7.77	7.83	8.02	8.2	7.51	8.48	7.63
Turbidity	NTU	1	-	-	-	-	1	0	-	0.51	0.46	0	0	0	-	0	0.08	0.21	0	0.42	0.06	0.18
Temperature	C	-	-	-	-	-	-	4.347	-	4.258	4.518	4.709	5.478	4.761	-	4.607	4.603	5.212	4.306	4.859	4.816	5.609
Dissolved oxygen	%	-	-	-	-	-	-	88.5	-	91.7	85.2	85.3	87.5	93.5	-	89.5	88.6	85.6	91.8	90	88.4	86.3
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.49	-	11.94	11.01	10.96	11.03	12.01	-	11.55	11.42	10.85	11.93	11.53	11.33	10.85
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.5	48.8	48.6	49.1	51.3	51.7	49.3	47.9	47.3	48.7	48.4	48.2	48	53.1	48.7
Specific conductivity	uS/cm	-	-	-	-	-	-	107	115	111	109	111	114	112	111	110	113	112	112	111	117	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.78	7.99	8	7.88	7.98	7.88	7.82	7.46	7.87	7.95	7.84	7.87	7.85	7.86	7.92
Total suspended solids	mg/L	-	-	-	-	-	-	1.2	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.1	<1.1	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.27	0.25	0.13	<0.10	0.12	0.17	0.34	0.35	0.19	0.16	0.14	0.14	0.19	<0.10	0.1
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	57.4	55.2	52.4	52.4	52.7	51.5	53.9	51.8	52.4	53.5	55.2	52.4	53	51.2	56
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	52.6	57	53.7	52	53.4	45.2	52	57.7	53.8
Total dissolved solids	mg/L	-	-	-	1000	-	1000	64	68	71	69	73	66	72	72	72	71	74	79	84	82	71
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.7	1.77	1.68	1.87	1.73	1.76	2.14	2	2.24	1.87	12.8	1.99	1.93	1.71	1.83
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.121	0.132	0.141	0.139	0.148	0.133	0.13	0.137	0.138	0.143	0.144	0.135	0.144	0.146	0.149
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.121	0.132	0.141	0.139	0.148	0.133	0.131	0.137	0.138	0.143	0.144	0.135	0.144	0.146	0.149
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0075	0.0093	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0039	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0032	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0024	0.0035	0.0054	0.0067	0.0033	0.0034	0.007	0.0052	0.0022	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.242	0.189	0.205	0.214	0.22	0.221	0.213	0.199	0.217	0.202	0.203	0.172	0.198	0.194	0.182
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	19.1	18.5	17.6	17.5	17.3	17.4	18.1	17.3	17.6	18	18.5	17.6	17.9	17	19
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.036	0.037	0.04	0.039	0.035	0.037	0.035	0.041	0.036	0.036	0.038	0.036	0.039	0.033	0.038
Magnesium	mg/L	-	-	-	-	-	-	2.32	2.2	2.07	2.09	2.29	1.98	2.14	2.08	2.07	2.1	2.2	2.06	2.03	2.12	2.07
Potassium	mg/L	-	-	-	-	-	-	0.546	0.533	0.52	0.509	0.488	0.492	0.515	0.508	0.527	0.51	0.523	0.495	0.505	0.528	0.506
Sodium	mg/L	-	-	-	-	-	-	1.07	1.08	1.02	1.06	1.1	0.914	0.979	0.969	1	1.05	1.07	0.993	0.959	1.02	1.01
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.71	6.75	6.85	7.12	7.1	7.2	6.72	6.45	6.59	7.12	7.88	7.07	6.93	6.81	8.35

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC
Date								2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30	2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0125	0.0133	0.0116	0.0118	0.0119	0.0155	0.0211	0.0265	0.015	0.0131	0.0155	0.0104	0.0132	0.0099	0.0125
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00012	0.0001	0.00011	<0.00010	0.00011	0.00014	0.00011	0.0001	0.00012	0.00011	0.00011	0.00011	0.00011	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.0051	0.00519	0.00508	0.00558	0.0053	0.0055	0.0054	0.00578	0.00507	0.0052	0.00532	0.00431	0.00522	0.00482	0.00502
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051
Calcium	mg/L	-	-	-	1000	-	1000	17.1	17.6	18.4	16.8	15.6	18.1	17.6	19.1	17.9	17.3	17.8	15.1	17.3	19.7	18.2
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00063	0.00064	0.0006	0.00071	0.00072	0.00104	0.00068	0.00071	0.00062	0.00066	0.00076	0.00056	0.00063	0.00056	0.00067
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.09	2.05	2.01	2.01	1.97	1.95	2.1	2.24	2.2	2.12	2.16	1.81	2.15	2.06	2.03
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00117	0.00127	0.00102	0.00115	0.00102	0.00124	0.00145	0.00131	0.00121	0.00132	0.00126	0.00078	0.00113	0.00098	0.0008
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	<0.0000050	<0.0000050	<0.0000050	-	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000398	0.000479	0.000466	0.000548	0.000478	0.000431	0.000437	0.000406	0.000388	0.000498	0.000645	0.000412	0.000475	0.000418	0.000831
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.517	0.483	0.478	0.487	0.481	0.449	0.512	0.556	0.504	0.482	0.486	0.407	0.522	0.501	0.504
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000125	0.000135	0.000116	0.000129	0.000169	0.000111	0.000121	0.000082	0.000105	0.000133	0.000185	0.000151	0.000149	0.000129	0.000227
Silicon	mg/L	-	-	-	-	-	-	1.72	1.76	1.67	1.72	1.74	1.69	1.95	1.87	1.79	1.79	1.84	1.89	1.82	1.72	1.81
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.02	1.08	0.987	1.06	1.01	0.938	0.977	1.08	0.981	0.989	1.07	0.89	1.03	0.997	1.03
Strontium	mg/L	-	-	-	-	-	-	0.138	0.132	0.143	0.134	0.122	0.135	0.137	0.14	0.147	0.135	0.139	0.117	0.139	0.141	0.141
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000161	0.000159	0.000171	0.000162	0.00014	0.000154	0.000166	0.000173	0.000157	0.000164	0.000159	0.000157	0.00015	0.000155	0.000168
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2018-12-18	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2019-05-08	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2019-06-18	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2019-07-25	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2019-08-20	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2019-10-30	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2020-06-16	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2020-07-21	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2020-08-11	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2020-09-16	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2020-11-04	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2021-05-19	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2021-07-21	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2021-09-15	Quesnel Lake QUL-2a / QUL-2a-40m - QUL Between Cariboo Island and HAC / 2021-10-27
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0061	0.0054	0.0059	0.006	0.0059	0.0065	0.0076	0.0061	0.0064	0.0066	0.0084	0.007	0.0082	0.0066	0.0082
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	<0.00010	<0.00010	0.0001	0.00011	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00548	0.00525	0.00543	0.0055	0.00501	0.00505	0.00556	0.00501	0.00538	0.00554	0.00552	0.00493	0.00492	0.00525	0.00513
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00057	<0.00050	<0.00050	0.00052	0.00051	<0.00050	0.00059	0.00051	<0.00050	0.00064	0.0006	0.00063	0.00066	0.00055	0.00064
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00019	0.00015	<0.00010	0.00016	0.00015	0.00022	0.00017	0.00016	0.00018	0.00025	0.00028	0.00019	0.0002	0.00016	0.0002
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000387	0.000488	0.000467	0.000519	0.00058	0.000396	0.000416	0.000388	0.000364	0.000532	0.000658	0.000414	0.000495	0.000398	0.000763
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000098	0.000174	0.000129	0.000159	0.000157	0.000079	0.000123	0.000121	0.000104	0.000159	0.00015	0.000158	0.000147	0.000105	0.000196
Silicon	mg/L	-	-	-	-	-	-	1.56	1.67	1.88	1.81	1.75	1.69	1.86	1.87	1.78	1.72	1.7	1.74	1.77	1.86	1.59
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.143	0.144	0.132	0.127	0.136	0.136	0.142	0.133	0.134	0.14	0.154	0.136	0.142	0.143	0.144
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000169	0.000178	0.000161	0.000157	0.000156	0.000153	0.000151	0.000159	0.000153	0.000153	0.000156	0.000153	0.000166	0.000147	0.000167
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station		BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit																				
Date								2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08	2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14
Parameter																					
Field Parameters																					
Specific conductivity	uS/cm	-	-	-	-	-	-	112.5	109.9	107.8	112.1	-	-	-	-	-	-	-	-	126.6	150.9	184.7
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.76	7.86	7.84	7.56	-	-	-	-	-	-	-	-	7.63	7.63	7.67
Turbidity	NTU	1	-	-	-	-	1	0	0.43	0	0	-	-	-	-	-	-	-	-	0.72	0.21	0.64
Temperature	C	-	-	-	-	-	-	4.052	4.538	4.566	4.848	-	-	-	-	-	-	-	-	4.374	4.51	4.478
Dissolved oxygen	%	-	-	-	-	-	-	92.2	91	87.8	85.7	-	-	-	-	-	-	-	-	81.1	81	81.9
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	12.07	11.76	11.34	10.99	-	-	-	-	-	-	-	-	10.52	10.47	10.59
Conventional Parameters																					
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.9	50	47.2	45.6	47.6	52	44.7	50.8	45	51.6	51.5	47	51.2	49.2	50.4
Specific conductivity	uS/cm	-	-	-	-	-	-	112	108	110	112	111	113	111	113	111	114	114	113	113	113	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.91	7.87	7.83	7.89	7.98	8	7.87	8.01	7.98	7.86	8.03	8	7.94	7.8	7.82
Total suspended solids	mg/L	-	-	-	-	-	-	2.1	<1.0	<1.1	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.18	0.26	0.13	<0.10	0.85	0.57	0.64	0.61	0.72	0.59	0.59	0.18	0.26	0.24	0.19
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53.5	51.7	51.4	56.6	53.8	55.2	54.1	53.5	56.9	52.8	52.8	54.5	53.5	55.6	54.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	52.4	49.8	50.3	52.3	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	79	71	70	86	75	69	69	81	71	65	73	68	65	73	68
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.06	2.39	2.11	1.98	1.89	2.34	1.88	2.46	2.12	2.13	2.18	2.04	1.87	1.74	1.76
Nutrients and Biological Indicators																					
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.127	0.132	0.136	0.154	0.141	0.136	0.132	0.133	0.136	0.134	0.137	0.143	0.141	0.149	0.137
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.127	0.132	0.136	0.154	0.141	0.136	-	0.133	0.136	0.134	0.137	0.143	0.141	0.149	0.137
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	0.0225	<0.0050	0.0066	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0021	0.0029	<0.0020	0.002	0.0022	0.0027	0.0028	0.0022	0.0022	0.0022	0.0026	<0.0020	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.215	0.17	0.192	0.209	0.204	0.191	0.192	0.207	0.184	0.183	0.183	0.178	0.171	0.191	0.186
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																					
Calcium	mg/L	-	-	-	1000	-	1000	18	17.2	17.1	19.2	18.1	18.7	18.4	18.1	19.2	17.9	17.8	18.5	18	18.8	18.5
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.036	0.034	0.033	0.038	0.036	0.034	0.036	0.034	0.033	0.034	0.036	0.035	0.034	0.035	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.07	2.12	2.12	2.11	2.08	2.08	2.02	1.99	2.18	1.98	2	2.04	2.05	2.07	2.05
Potassium	mg/L	-	-	-	-	-	-	0.474	0.494	0.531	0.508	0.523	0.5	0.513	0.475	0.485	0.479	0.541	0.521	0.483	0.534	0.519
Sodium	mg/L	-	-	-	-	-	-	0.924	0.954	1.01	1.06	1.12	1.02	1.07	0.928	1.03	1.01	1.11	1.04	1.01	1.11	0.976
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.67	6.24	6.21	7.54	7.05	6.64	6.67	6.44	6.63	6.6	6.95	6.69	6.62	6.76	6.43

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08	2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0298	0.0119	0.0124	0.0106	0.0526	0.0479	0.0417	0.0241	0.0416	0.036	0.049	0.0224	0.0152	0.0191	0.0127
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	<0.00010	0.0001	0.00013	0.00017	0.00015	0.00014	0.00011	0.00017	0.00011	0.00018	0.00014	0.00014	0.00014	0.00014
Barium	mg/L	-	1W	-	-	-	1	0.00531	0.00496	0.0052	0.00529	0.00706	0.00651	0.00621	0.0051	0.00607	0.00577	0.00647	0.00559	0.00553	0.00594	0.00512
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.5	16.7	16.7	17.4	18.4	18.1	17.8	17.9	19.3	17.8	18.2	18.2	17.9	18.7	18.2
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00107	<0.00050	0.00057	0.00057	0.00186	0.00139	0.00137	0.00158	0.00152	0.00122	0.00159	0.00108	0.00109	0.00111	0.00072
Iron	mg/L	-	-	1	-	-	1	0.038	<0.030	<0.030	<0.030	<0.030	0.04	<0.030	<0.030	0.036	<0.030	0.034	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	0.000082	0.000077	<0.000050	0.000059	0.000102	0.000597	0.000134	0.000083	<0.00010	0.000057	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	0.001	<0.0010	0.00085	0.00074	0.00092	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.12	1.97	2.09	2.14	2.13	2.05	2.01	1.99	2.19	1.99	2.05	2.06	2.04	2.08	2.04
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00256	0.00104	0.00123	0.0011	0.00211	0.0029	0.00158	0.00129	0.00196	0.00163	0.00204	0.00127	0.00115	0.00159	0.00108
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	-	-	-	-	-	-	-	<0.0000050	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000435	0.000336	0.000426	0.000664	0.000835	0.000527	0.000577	0.000471	0.000519	0.000518	0.000627	0.000553	0.000501	0.000564	0.000359
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00276	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.481	0.44	0.509	0.51	0.557	0.507	0.518	0.492	0.493	0.48	0.534	0.524	0.497	0.537	0.513
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000152	0.000102	0.000108	0.000182	<0.00050	<0.00050	<0.00050	0.000113	0.000122	0.000104	0.000122	0.000103	0.000128	0.000131	0.000084
Silicon	mg/L	-	-	-	-	-	-	1.83	1.9	1.91	1.85	1.84	1.82	1.78	1.74	2	1.75	1.81	1.8	1.74	1.81	1.68
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1	0.889	0.998	1.01	1.14	1.04	1.08	0.976	1.05	1.03	1.11	1.06	1.04	1.11	0.983
Strontium	mg/L	-	-	-	-	-	-	0.138	0.127	0.139	0.144	0.152	0.133	0.141	0.136	0.141	0.152	0.154	0.14	0.131	0.135	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000163	0.000151	0.000157	0.000163	0.000203	0.000173	0.00018	0.000174	0.000175	0.000176	0.000181	0.000175	0.000179	0.00019	0.000159
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-40m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria														
Date								2022-05-09	2022-06-27	2022-08-15	2022-10-19	2015-03-11	2015-03-18	2015-03-24	2015-04-01	2015-04-08	2015-04-14	2015-05-06	2015-06-03	2015-07-01	2015-08-26	2015-09-14
Parameter																					
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0054	0.0082	0.0064	0.0067	0.0078	0.0062	0.0078	0.0059	0.0063	0.0057	0.0078	0.006	0.007	0.0061	0.0057
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	0.00011	0.00017	0.00015	0.00011	0.00011	0.0001	0.00012	0.00011	0.00013	0.00011	0.00012	0.00011	0.0001
Barium	mg/L	-	-	-	-	-	-	0.0051	0.00529	0.0051	0.00543	0.00597	0.00556	0.0056	0.00481	0.00531	0.00536	0.00601	0.00537	0.00545	0.00574	0.00527
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00053	0.00051	0.00065	0.00055	0.00118	0.00084	0.00095	0.0016	0.00085	0.00081	0.00118	0.00088	0.00099	0.00101	0.00069
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050	<0.000050	0.000085	0.000094	0.000073	0.000134	0.000086	0.000098	0.000069	0.000057
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	0.00077	0.00075	0.00075	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00033	0.00016	0.0003	0.00014	0.000699	0.000408	0.000397	0.00027	0.00027	0.00034	0.0004	0.00014	0.0002	0.00054	0.00025
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000444	0.000314	0.00043	0.000693	0.000747	0.000435	0.000485	0.000386	0.000463	0.00044	0.000619	0.000436	0.000483	0.000522	0.000344
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000095	0.00011	0.000123	0.000206	<0.00050	<0.00050	<0.00050	0.000093	0.000089	0.000104	0.000113	0.000098	0.000103	0.00011	0.000081
Silicon	mg/L	-	-	-	-	-	-	1.74	1.98	1.84	1.8	1.72	1.78	1.73	1.68	1.92	1.7	1.72	1.77	1.72	1.75	1.69
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.146	0.126	0.131	0.142	0.148	0.128	0.137	0.132	0.136	0.145	0.146	0.136	0.132	0.135	0.137
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000163	0.00015	0.000154	0.000149	0.000192	0.000158	0.000169	0.000158	0.000159	0.000156	0.000174	0.000161	0.000161	0.000181	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria													
Date Parameter								2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Field Parameters																				
Specific conductivity	uS/cm	-	-	-	-	-	-	145.1	-	150	108.2	102.5	105.3	-	-	106.6	108	110.7	116.5	111.2	110.4	110.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.63	-	7.6	7.4	7.96	7.69	-	-	7.53	7.26	-	7.34	7.59	7.76	7.52
Turbidity	NTU	1	-	-	-	-	1	0.64	-	0.37	0.5	0.36	0.15	-	-	0.23	0.3	0.24	0.44	1.99	0.35	0.95
Temperature	C	-	-	-	-	-	-	4.667	-	4.843	3.108	4.196	4.451	-	-	4.764	4.732	5.231	5.481	3.238	3.991	4.568
Dissolved oxygen	%	-	-	-	-	-	-	80.8	-	83.1	81.9	87.5	85.7	-	-	77.9	81.5	80.8	78.4	78.8	89.2	86.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.4	-	10.66	11	11.41	11.1	-	-	10.01	10.48	10.25	9.88	10.53	11.69	11.17
Conventional Parameters																				
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	51	50.3	47.7	48.4	50.5	48.9	47.1	51.2	52.7	50.5	50.4	50.5	50	50.1	46.5
Specific conductivity	uS/cm	-	-	-	-	-	-	112	114	110	111	115	108	107	113	113	108	115	115	120	112	108
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.86	7.8	7.77	7.84	7.92	7.79	7.8	7.78	7.83	7.85	7.65	7.84	7.92	7.83	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<1.0	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.31	0.84	0.31	0.37	0.4	1.39	0.26	0.34	0.31	0.18	0.62	0.4	1.3	0.37	0.39
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.4	55.3	54.9	54.9	53.5	53.9	54.1	54.6	54.4	49.8	52.6	54.2	54.1	53	52
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	75	75	64	69	65	68	78	84	65	80	74	73	69	75	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.74	1.81	1.51	1.68	1.54	1.74	1.59	1.87	1.75	1.56	1.64	1.81	1.63	1.55	1.65
Nutrients and Biological Indicators																				
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.151	0.149	0.105	0.121	0.126	0.131	0.14	0.153	0.154	0.142	0.181	0.175	0.154	0.134	0.138
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.151	0.149	0.105	0.121	0.126	0.131	0.14	0.153	0.154	0.142	0.181	0.175	0.154	0.134	0.138
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0032	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0021	0.004	0.0022	0.0082	<0.0020	0.013	0.0046	0.0061	<0.0020	0.0032	<0.020	0.0029	0.0026	0.0028	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0018	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.199	0.213	0.149	0.165	0.188	0.195	0.193	0.199	0.201	0.2	0.24	0.225	0.197	0.176	0.196
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																				
Calcium	mg/L	-	-	-	1000	-	1000	19.1	18.7	18.6	18.6	18.1	18.2	18.3	18.4	18.1	16.7	17.8	18.1	18	17.7	17.3
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.034	0.035	0.032	0.034	0.034	0.032	0.035	0.035	0.034	0.037	0.035	0.037	0.032	0.032	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.1	2.06	2.06	2.04	2.04	2.08	2.08	2.13	2.2	1.99	1.99	2.18	2.2	2.11	2.13
Potassium	mg/L	-	-	-	-	-	-	0.494	0.483	0.465	0.487	0.47	0.575	0.503	0.493	0.576	0.524	0.538	0.561	0.585	0.52	0.525
Sodium	mg/L	-	-	-	-	-	-	0.969	1.04	0.893	0.942	0.981	1.03	0.964	1.02	1.17	1.02	1.17	1.24	1.19	0.986	1.05
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.32	6.62	6.55	6.86	6.7	6.56	6.6	7.46	7.54	6.47	8.72	8.61	8.3	6.7	6.86

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0257	0.0525	0.0177	0.0263	0.0236	0.14	0.0163	0.0206	0.0189	0.0107	0.028	0.0278	0.0606	0.0166	0.02
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00014	0.00011	0.0001	0.00011	0.00021	0.00012	0.00011	0.00013	0.00011	0.00012	0.00012	0.00014	<0.00010	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00565	0.00626	0.00521	0.00573	0.00545	0.0089	0.00505	0.00528	0.00555	0.00526	0.00586	0.00686	0.00665	0.00515	0.00527
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.3	18.8	17.8	18.1	17.8	18.2	17.1	18.3	18.3	17.9	17.7	17.7	18.5	18.3	16.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00133	0.00181	0.0008	0.00104	0.00131	0.00331	0.00087	0.00108	0.00106	0.00086	0.00126	0.00156	0.00205	0.00066	0.00083
Iron	mg/L	-	-	1	-	-	1	<0.030	0.035	<0.030	<0.030	<0.030	0.107	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.037	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	0.000073	0.000163	0.000101	0.000054	0.000089	0.000109	0.000161	0.000095	0.000104	0.000164	0.000129	0.000194	0.000076	0.000052	0.000071
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.14	1.98	2.1	2.03	2.16	1.99	2.13	2.19	2.02	2.06	2.47	2.23	2.12	1.99
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00144	0.00208	0.00209	0.0012	0.00144	0.00333	0.00136	0.00145	0.00143	0.00124	0.00149	0.00155	0.00204	0.00121	0.00138
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00044	0.000579	0.00034	0.000471	0.00044	0.000452	0.000357	0.000645	0.000762	0.000339	0.00103	0.00096	0.000924	0.000426	0.000496
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00074	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.49	0.505	0.471	0.489	0.478	0.638	0.503	0.487	0.552	0.493	0.582	0.601	0.58	0.51	0.487
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000103	0.000102	0.000091	0.000116	0.000121	0.000115	0.000091	0.000163	0.000182	0.000107	0.000232	0.000218	0.000203	0.000086	0.000117
Silicon	mg/L	-	-	-	-	-	-	1.73	1.95	1.6	1.65	1.75	2	1.71	1.78	1.74	1.77	1.81	1.79	1.9	1.76	1.71
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1	1.08	0.901	0.956	1	1.03	0.974	1.01	1.18	0.89	1.23	1.33	1.25	1.01	0.994
Strontium	mg/L	-	-	-	-	-	-	0.136	0.143	0.134	0.138	0.139	0.135	0.135	0.142	0.143	0.138	0.143	0.144	0.145	0.14	0.131
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000169	0.000176	0.000157	0.000167	0.00017	0.000163	0.00016	0.000169	0.00016	0.000167	0.000167	0.000167	0.00017	0.000164	0.000158
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	0.0068	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0044

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station								QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	2015-10-28	2015-11-09	2015-12-07	2016-01-20	2016-04-26	2016-05-19	2016-06-28	2016-07-20	2016-08-15	2016-09-12	2016-10-26	2016-11-21	2017-04-10	2017-05-09	2017-06-19
Date																					
Parameter																					
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0057	0.0055	0.0051	0.0053	0.0058	0.0064	0.0053	0.0062	0.0065	0.0052	0.0051	0.0064	0.006	0.0052	0.0067
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00024	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00567	0.00548	0.00511	0.00513	0.00521	0.00568	0.00508	0.00517	0.00538	0.00527	0.0054	0.00579	0.00533	0.0053	0.00546
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00083	0.00096	0.00054	0.0007	0.00099	0.00086	0.00093	0.00074	0.00088	0.0009	0.00096	0.00112	0.0009	0.00068	0.00067
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000086	0.000146	0.000117	0.000062	0.00008	0.000081	0.000246	0.00017	0.000217	0.000181	0.000257	0.000319	0.000109	0.000075	0.000055
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00015	0.00031	0.00012	0.00023	0.00031	0.00023	0.00027	0.00022	0.00021	0.00023	0.00035	0.0002	0.00018	0.00026	0.00011
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000448	0.000505	0.000342	0.00042	0.000405	0.000432	0.000362	0.000594	0.000738	0.000307	0.00101	0.000911	0.000872	0.000374	0.000493
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000069	0.000082	0.000087	0.000112	0.000099	0.000117	0.000101	0.000144	0.000143	0.000093	0.000217	0.00022	0.000197	0.000081	0.000117
Silicon	mg/L	-	-	-	-	-	-	1.74	1.76	1.63	1.61	1.71	1.71	1.74	1.75	1.75	1.87	1.63	1.72	1.71	1.69	1.79
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.131	0.138	0.134	0.135	0.135	0.133	0.133	0.139	0.142	0.127	0.139	0.141	0.141	0.136	0.134
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000173	0.000162	0.000156	0.000156	0.000152	0.000156	0.000158	0.000161	0.000158	0.000147	0.000153	0.000152	0.000163	0.000142	0.000151
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30
Parameter																						
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	117.7	108	112.4	108.2	110.8	109.1	114.6	109.8	-	-	114.7	114.6	114.5
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	7.43	-	7.49	7.27	7.57	7.44	7.27	7.78	-	-	7.56	7.51	7.71
Turbidity	NTU	1	-	-	-	-	1	-	-	0.16	0.07	0.72	0.71	0	0.07	0	0	-	-	0.53	0	0
Temperature	C	-	-	-	-	-	-	-	-	5.223	5.634	3.979	4.083	4.349	4.556	4.709	4.367	-	-	4.238	4.482	5.014
Dissolved oxygen	%	-	-	-	-	-	-	-	-	89.9	93.5	89.1	96.2	85.6	85.6	82.5	88.8	-	-	85.2	85.4	86.9
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	-	11.42	11.75	11.68	11.56	11.11	11.06	10.61	11.52	-	-	11.1	11.05	11.09
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.2	50.6	49.7	49.2	51.2	49.3	49.6	50.6	49.4	48.5	48.8	48.9	48.7	51.8	58.8
Specific conductivity	uS/cm	-	-	-	-	-	-	108	107	105	103	107	109	112	116	113	106	116	113	112	114	116
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.89	7.95	7.91	7.9	7.84	7.91	7.99	8	7.9	7.82	7.99	8.01	7.88	7.99	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.28	0.18	0.29	0.21	0.42	0.37	0.2	0.15	0.19	0.22	0.34	0.16	0.14	0.17	0.18
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54	51.6	48.8	54.3	54.5	52.1	50	52.8	54.6	54.9	58.5	54.1	52.3	51.8	52.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	72	74	80	60	63	68	74	65	76	67	65	74	63	72	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.77	1.86	1.86	1.21	2.01	2.05	4.7	1.66	1.73	1.58	1.96	1.64	1.86	1.84	1.74
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.148	0.146	0.152	0.127	0.138	0.141	0.144	0.156	0.163	0.12	0.133	0.143	0.147	0.156	0.153
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.148	0.146	0.152	0.127	0.138	0.141	0.144	0.156	0.163	0.12	0.133	0.143	0.147	0.156	0.153
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0064	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	0.002	<0.0020	0.0038	<0.0020	0.0023	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	<0.0020	0.0026	0.0053	0.0027	0.0028	0.0044	0.0042	0.0022	0.0034	0.0053	0.0062	0.0023	0.0042
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.193	0.202	0.187	0.173	0.168	0.194	0.192	0.212	0.207	0.216	0.189	0.235	0.223	0.226	0.287
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18	17.2	16.1	18.3	18.1	17.3	16.7	17.6	18.5	18.3	19.6	18.3	17.5	17	17.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.032	0.03	0.035	0.035	0.036	0.034	0.032	0.035	0.036	0.033	0.037	0.039	0.039	0.036	0.038
Magnesium	mg/L	-	-	-	-	-	-	2.19	2.07	2.1	2.08	2.25	2.13	2.01	2.16	2.02	2.26	2.3	2.07	2.11	2.3	2.07
Potassium	mg/L	-	-	-	-	-	-	0.512	0.511	0.51	0.472	0.557	0.51	0.485	0.513	0.573	0.514	0.568	0.511	0.512	0.49	0.517
Sodium	mg/L	-	-	-	-	-	-	1.01	1.03	1.06	0.925	1.06	0.977	0.996	1.18	1.15	1.04	1.16	1.06	1.14	1.14	1.01
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.82	6.67	7.26	6.72	6.43	6.3	6.67	8.22	7.91	6.72	7.24	7.38	7.95	7.76	7.93

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30
Parameter																						
Total Metals																						
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0126	0.0108	0.0119	0.0149	0.0202	0.0171	0.0205	0.0148	0.0102	0.0131	0.0183	0.0152	0.0167	0.012	0.0175
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00013	0.0001	0.00011	0.00011	0.00014	0.00012	0.00013	0.00014	0.0001	0.00013	<0.00010	0.00011	0.00011	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00571	0.0054	0.0056	0.00528	0.00542	0.00554	0.00572	0.00578	0.00541	0.00508	0.00544	0.00498	0.00591	0.00559	0.00535
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.9	18.3	17.5	18	16.7	17.2	18.6	17.5	18.7	17	17.8	18.3	18.1	18.3	18.5
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00191	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00066	0.00066	0.00092	0.00076	0.00062	0.00108	0.0014	0.00142	0.00071	0.0006	0.00081	0.00073	0.00123	0.00078	0.0009
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	0.000146	0.000096	0.000102	0.000295	0.000381	0.000254	0.000185	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.19	2.06	2.07	2.16	2.04	2.1	2.06	2.1	2.1	2.12	2.13	2.05	2.1	2.11	2
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00106	0.00124	0.00121	0.00104	0.00194	0.00141	0.00191	0.00133	0.00104	0.00112	0.00153	0.00106	0.00114	0.00106	0.00125
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	<0.00045	0.000465	0.000553	0.000456	0.000336	0.000334	0.00121	0.00093	0.000879	0.000429	0.000581	0.000576	0.000757	0.00071	0.000628
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00134	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.499	0.524	0.494	0.442	0.48	0.527	0.496	0.489	0.506	0.508	0.5	0.488	0.496	0.514	0.466
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000103	0.000086	0.000175	0.000119	0.000109	0.000085	0.000144	0.000224	0.000186	0.000121	0.000198	0.000173	0.000218	0.000206	0.000176
Silicon	mg/L	-	-	-	-	-	-	1.8	1.8	1.87	1.71	1.87	1.87	1.7	1.78	1.76	1.76	1.79	1.68	1.75	1.76	1.75
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.989	1.05	1.04	1.01	0.958	1.02	1.1	1.14	1.14	1.03	1.16	1.04	1.14	1.08	1.02
Strontium	mg/L	-	-	-	-	-	-	0.136	0.135	0.14	0.142	0.143	0.135	0.147	0.138	0.143	0.137	0.134	0.145	0.14	0.144	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000153	0.000164	0.000141	0.000183	0.000164	0.000165	0.000175	0.000166	0.000151	0.000163	0.000158	0.000169	0.000165	0.000175	0.000154
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	0.003	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station																				
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2017-08-21	2017-09-12	2017-10-26	2017-11-20	2018-05-22	2018-06-27	2018-07-25	2018-09-04	2018-10-18	2018-12-18	2019-05-08	2019-06-18	2019-07-25	2019-08-20	2019-10-30
Parameter																						
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0052	0.0051	0.0053	0.0049	0.0066	0.0057	0.0076	0.0084	0.0064	0.0058	0.0067	0.0055	0.0062	0.0067	0.0063
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00015	<0.00010	<0.00010	0.0001	0.0001	0.00011	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00508	0.0049	0.00586	0.00504	0.00567	0.00543	0.00551	0.00575	0.00525	0.00514	0.00566	0.00548	0.00528	0.00521	0.00522
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	0.00119	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00058	0.00059	0.00076	0.00061	0.00054	0.00065	0.00063	0.00086	0.00063	0.00052	0.00054	<0.00050	0.00064	0.00062	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000093	0.000085	0.000113	0.000105	0.000282	0.000344	0.000334	0.000186	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.0003	0.00026	0.00022	0.00017	0.00025	0.00018	0.00035	0.00032	0.00021	0.00015	0.00018	<0.00010	0.00013	0.00015	0.00021
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000351	0.000405	0.0005	0.000406	0.000319	0.000327	0.000529	0.000898	0.000787	0.000403	0.000601	0.000588	0.000756	0.000753	0.000602
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00009	0.000124	0.000159	0.000139	0.000114	0.000114	0.000123	0.000189	0.000196	0.000101	0.000151	0.00016	0.000192	0.000247	0.000129
Silicon	mg/L	-	-	-	-	-	-	1.68	1.73	1.81	1.64	1.75	1.74	1.55	1.73	1.53	1.54	1.64	1.83	1.86	1.8	1.67
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.133	0.132	0.138	0.138	0.138	0.132	0.131	0.139	0.143	0.138	0.14	0.135	0.137	0.142	0.136
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000143	0.000156	0.000133	0.000159	0.000173	0.000148	0.000155	0.000162	0.000173	0.000164	0.000186	0.000164	0.000158	0.000151	0.000147
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	0.0063	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station		BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit																		
Date								2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Parameter																			
Field Parameters																			
Specific conductivity	uS/cm	-	-	-	-	-	-	121.3	-	117	115.8	115.7	112.5	134.8	114.5	114.9	113	111.9	108.7	113.5
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.69	-	7.69	7.78	7.95	8.15	7.47	8.48	7.57	7.72	7.82	7.73	7.53
Turbidity	NTU	1	-	-	-	-	1	0	-	0	0.12	0.24	0	0.44	0.07	0.12	0	0.43	0	0
Temperature	C	-	-	-	-	-	-	4.43	-	4.523	4.526	4.879	4.222	4.629	4.535	5.188	4.022	4.427	4.424	4.648
Dissolved oxygen	%	-	-	-	-	-	-	93.8	-	89.7	88.7	85.1	91.3	89.7	88.4	86	92.2	90.6	88.2	85.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	12.15	-	11.6	11.46	10.9	11.9	11.56	11.43	10.92	12.08	11.74	11.43	11.06
Conventional Parameters																			
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.8	47.9	48.3	49.3	49	48.4	48	53.1	48.8	50.9	50	48	45.6
Specific conductivity	uS/cm	-	-	-	-	-	-	115	112	117	113	115	113	111	117	115	112	110	112	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.78	7.38	7.88	7.95	7.8	7.88	7.83	7.85	7.92	7.91	7.87	7.83	7.89
Total suspended solids	mg/L	-	-	-	-	-	-	1.1	<1.0	<1.0	<1.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.2	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.26	0.18	0.17	0.13	0.12	0.18	0.11	0.11	<0.10	0.2	0.25	0.12	<0.10
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54.7	51.6	54.1	54.3	57.4	51.1	51.8	51.5	56.6	53.5	54.6	51	56
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	53.9	57.4	56.6	52.3	54	51.5	51.6	56.2	55.2	53.2	53.4	50.8	54.6
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	70	78	72	72	79	104	74	70	78	68	75	90
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.04	2.1	2.33	1.88	12.9	2.1	1.96	1.77	1.88	2.05	2.38	2.06	2.02
Nutrients and Biological Indicators																			
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.135	0.138	0.153	0.143	0.172	0.133	0.145	0.144	0.16	0.127	0.134	0.14	0.159
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.135	0.138	0.153	0.143	0.172	0.133	0.145	0.144	0.16	0.127	0.134	0.14	0.159
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.42-2.02	0.0103	<0.0050	<0.0050	0.0348	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0081	0.0035	<0.0020	0.0028	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	0.0027	0.0034	<0.0020	0.0028
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.216	0.2	0.223	0.222	0.22	0.174	0.188	0.198	0.193	0.219	0.18	0.182	0.218
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																			
Calcium	mg/L	-	-	-	1000	-	1000	18.3	17.2	18.1	18.3	19.2	17.1	17.6	17.3	19.2	18	18.3	16.9	18.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.75	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	1.00-0.79	0.037	0.037	0.04	0.037	0.04	0.038	0.039	0.032	0.04	0.036	0.034	0.033	0.039
Magnesium	mg/L	-	-	-	-	-	-	2.18	2.12	2.18	2.09	2.28	2.05	1.92	2.01	2.11	2.08	2.16	2.15	2.14
Potassium	mg/L	-	-	-	-	-	-	0.514	0.517	0.531	0.509	0.546	0.488	0.478	0.486	0.524	0.475	0.494	0.534	0.518
Sodium	mg/L	-	-	-	-	-	-	1.04	0.974	1.18	1.08	1.15	0.996	0.912	0.956	1.05	0.941	0.974	1.02	1.08
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.57	6.48	8.7	7.27	8.59	7.42	6.88	6.72	8.69	6.7	6.53	6.31	7.94

Appendix 2-4
Table 2-4A: Surfacewater Quality Screening at Reference Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station								QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a	QUL-2a
Sample Point	Unit	BC ENV Drinking Water Screening Criteria	Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Date								2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Parameter																				
Total Metals																				
Aluminum	mg/L	9.5	0.16[n]	-	-	5	0.05 - 0.75	0.0192	0.0201	0.0171	0.011	0.0147	0.0126	0.0115	0.0097	0.0138	0.0143	0.0118	0.013	0.0129
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	<0.00010	0.00012	0.0001	<0.00010	0.00012	<0.00010	<0.00010	0.00014	0.00012	0.00012	0.00011	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00538	0.00594	0.00539	0.00515	0.00567	0.00505	0.00498	0.00506	0.00539	0.0053	0.00518	0.00522	0.00543
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	0.0000091	0.000006	<0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18	19.2	18.8	17.6	18.1	17.2	17.2	19	18.6	17.8	17.9	16.9	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	-	-	-	0.3	0.3	0.00078	0.00074	0.00085	0.00072	0.00075	0.00072	0.00054	0.0006	0.00069	0.00175	0.00054	0.00058	0.00062
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044-0.0049	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.001	0.001	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.15	2.31	2.33	2.06	2.13	2.07	2.11	2.12	2.12	2.14	2.11	2.1	2.16
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.61-0.88	0.00122	0.00129	0.00138	0.00118	0.00115	0.00107	0.00119	0.001	0.00097	0.00149	0.00115	0.0013	0.00125
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000607	0.00039	0.000939	0.000566	0.000789	0.000525	0.000473	0.000377	0.000978	0.000442	0.000421	0.00045	0.000778
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.505	0.566	0.504	0.474	0.497	0.473	0.508	0.52	0.525	0.5	0.476	0.508	0.508
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000137	0.000114	0.000255	0.000149	0.00024	0.000154	0.000136	0.000127	0.000262	0.000144	0.000123	0.00014	0.000209
Silicon	mg/L	-	-	-	-	-	-	1.85	1.87	1.86	1.71	1.84	1.93	1.84	1.77	1.92	1.85	1.96	1.95	1.85
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.04	1.1	1.14	0.954	1.08	1.02	1	1.02	1.09	1.02	0.954	1.01	1.04
Strontium	mg/L	-	-	-	-	-	-	0.143	0.138	0.15	0.136	0.144	0.134	0.137	0.14	0.149	0.14	0.137	0.141	0.148
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000159	0.000168	0.000163	0.000162	0.000152	0.000171	0.000151	0.000158	0.000181	0.000161	0.000159	0.000162	0.000163
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type			BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life			Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a	Quesnel Lake QUL-2a
Station		BC ENV Drinking Water Screening Criteria						QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC	QUL-2a-60m - QUL Between Cariboo Island and HAC
Sample Point	Unit		Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute	Selected Screening Criteria												
Date								2020-06-16	2020-07-21	2020-08-11	2020-09-16	2020-11-04	2021-05-19	2021-07-21	2021-09-15	2021-10-27	2022-05-09	2022-06-27	2022-08-15	2022-10-19
Parameter																			
Dissolved Metals																			
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0077	0.0059	0.008	0.0068	0.0076	0.0119	0.006	0.0062	0.0114	0.0084	0.0072	0.0068	0.0084
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	<0.00010	0.0001	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.0001	0.00015
Barium	mg/L	-	-	-	-	-	-	0.0055	0.00494	0.00544	0.00547	0.00527	0.00484	0.00467	0.00501	0.0051	0.00519	0.00521	0.00511	0.00572
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011-0.00015	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00040[g]	0.0024[g]	-	-	0.0002 - 0.0062	0.00066	0.00059	0.00061	0.00078	0.00052	0.00061	<0.00050	0.00052	0.00062	0.00053	0.00052	0.00054	0.00055
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00015	0.00015	0.00019	0.00021	0.00018	0.00013	0.00026	0.0002	0.00022	0.00035	0.00012	0.00032	0.00025
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00063	0.000392	0.000899	0.000575	0.000856	0.000502	0.000465	0.000347	0.000909	0.00044	0.000439	0.000455	0.000753
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00017	0.000096	0.000231	0.00019	0.00016	0.000128	0.000167	0.00012	0.000183	0.000113	0.00012	0.000108	0.0002
Silicon	mg/L	-	-	-	-	-	-	1.84	1.91	1.88	1.68	1.76	1.72	1.71	1.77	1.72	1.82	1.9	1.87	1.83
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.143	0.135	0.145	0.138	0.159	0.135	0.15	0.141	0.145	0.142	0.137	0.136	0.147
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000149	0.000164	0.000158	0.000161	0.00016	0.00015	0.000166	0.000152	0.000165	0.000159	0.000154	0.000162	0.000156
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0018 - 0.010[s]	0.011 - 0.040[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Notes: Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 7°C and 7.8 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) Hardness, dissolved organic carbon, and pH dependent copper guidelines selected from the BC ENV look up table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-B 2020-11-10	Quesnel Lake QUL-57 QUL-57-MID 2020-11-10	Quesnel Lake QUL-57 QUL-57-S 2018-05-03	Quesnel Lake QUL-57 QUL-57-S 2018-05-22	Quesnel Lake QUL-57 QUL-57-S 2018-06-13	Quesnel Lake QUL-57 QUL-57-S 2018-07-16	Quesnel Lake QUL-57 QUL-57-S 2018-08-27	Quesnel Lake QUL-57 QUL-57-S 2018-09-04	Quesnel Lake QUL-57 QUL-57-S 2018-10-11	Quesnel Lake QUL-57 QUL-57-S 2018-10-18	Quesnel Lake QUL-57 QUL-57-S 2018-10-24	Quesnel Lake QUL-57 QUL-57-S 2018-10-29	Quesnel Lake QUL-57 QUL-57-S 2018-11-07	Quesnel Lake QUL-57 QUL-57-S 2019-10-30	Quesnel Lake QUL-57 QUL-57-S 2020-06-02
Long-Term Chronic																								
Short-Term Acute																								
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	110.7	110.6	115.9	111.1	100.6	96.3	97.3	100	104	107	103.1	100.3	103.3	108.7	122.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.53	7.55	7.74	7.46	7.75	7.92	7.72	7.87	7.6	7.71	7.76	7.58	7.72	7.9	8.08
Turbidity	NTU	1	-	-	-	-	1	1.63	1.63	-	0.41	-	-	0.52	0.11	-	-	0.49	-	-	0.03	1.7
Temperature	C	-	-	-	-	-	-	5.704	5.731	3.523	14.254	9.559	17.749	15.723	15.935	9.8	8.728	9.006	8.333	7.885	7.731	9.084
Dissolved oxygen	%	-	-	-	-	-	-	89	89.1	84.1	85.7	94.2	85.4	96.5	98.1	92.2	91.1	90.2	98.3	85.6	92.1	90.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.17	11.16	11.17	8.75	10.74	7.86	9.59	9.69	10.45	10.6	10.43	11.56	10.17	10.99	10.37
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	250[p]	150	600	-	600	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	1W	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	5	1.2	-	5	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	0.2	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-B 2020-11-10	Quesnel Lake QUL-57 QUL-57-MID 2020-11-10	Quesnel Lake QUL-57 QUL-57-S 2018-05-03	Quesnel Lake QUL-57 QUL-57-S 2018-05-22	Quesnel Lake QUL-57 QUL-57-S 2018-06-13	Quesnel Lake QUL-57 QUL-57-S 2018-07-16	Quesnel Lake QUL-57 QUL-57-S 2018-08-27	Quesnel Lake QUL-57 QUL-57-S 2018-09-04	Quesnel Lake QUL-57 QUL-57-S 2018-10-11	Quesnel Lake QUL-57 QUL-57-S 2018-10-18	Quesnel Lake QUL-57 QUL-57-S 2018-10-24	Quesnel Lake QUL-57 QUL-57-S 2018-10-29	Quesnel Lake QUL-57 QUL-57-S 2018-11-07	Quesnel Lake QUL-57 QUL-57-S 2019-10-30	Quesnel Lake QUL-57 QUL-57-S 2020-06-02
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	0.35	-	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2020-06-16	Quesnel Lake QUL-57 QUL-57-S 2020-06-29	Quesnel Lake QUL-57 QUL-57-S 2020-11-10	Quesnel Lake QUL-58 QUL-58-B 2016-04-11	Quesnel Lake QUL-58 QUL-58-B 2016-04-25	Quesnel Lake QUL-58 QUL-58-B 2017-12-07	Quesnel Lake QUL-58 QUL-58-MID 2017-12-07	Quesnel Lake QUL-58 QUL-58-MID 2019-02-26	Quesnel Lake QUL-58 QUL-58-S 2015-12-07	Quesnel Lake QUL-58 QUL-58-S 2017-12-07	Quesnel Lake QUL-58 QUL-58-S 2018-07-16	Quesnel Lake QUL-59 QUL-59-B 2020-11-10	Quesnel Lake QUL-59 QUL-59-MID 2020-11-10	Quesnel Lake QUL-59 QUL-59-S 2015-12-02	Quesnel Lake QUL-59 QUL-59-S 2018-01-04
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	112.2	103	111.2	117	109.3	111.1	111	111.2	116.4	112.7	100.1	110.8	110.7	146.1	107.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.8	7.83	7.72	7.79	7.79	7.77	7.84	7.81	7.76	8.17	7.81	7.33	7.37	7.8	7.77
Turbidity	NTU	1	-	-	-	-	1	0.53	0.59	1.66	0.64	0.88	0.31	0.43	0.36	0.65	0.48	-	1.47	1.47	0.73	-
Temperature	C	-	-	-	-	-	-	10.701	11.253	5.735	3.748	3.227	5.323	5.335	2.873	5.054	5.268	17.479	5.722	5.728	5.194	1.89
Dissolved oxygen	%	-	-	-	-	-	-	102.9	94	90.8	87.1	83.6	87.9	87.9	85.1	86.6	93.3	91.1	89.2	89.1	85.1	88.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.01	10.31	11.37	11.49	11.18	11.13	11.12	11.49	11.04	11.83	8.67	11.18	11.16	10.81	12.21
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	250[p]	150	600	-	600	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	1W	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	5	1.2	-	5	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	0.2	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2020-06-16	Quesnel Lake QUL-57 QUL-57-S 2020-06-29	Quesnel Lake QUL-57 QUL-57-S 2020-11-10	Quesnel Lake QUL-58 QUL-58-B 2016-04-11	Quesnel Lake QUL-58 QUL-58-B 2016-04-25	Quesnel Lake QUL-58 QUL-58-B 2017-12-07	Quesnel Lake QUL-58 QUL-58-MID 2017-12-07	Quesnel Lake QUL-58 QUL-58-MID 2019-02-26	Quesnel Lake QUL-58 QUL-58-S 2015-12-07	Quesnel Lake QUL-58 QUL-58-S 2017-12-07	Quesnel Lake QUL-58 QUL-58-S 2018-07-16	Quesnel Lake QUL-59 QUL-59-B 2020-11-10	Quesnel Lake QUL-59 QUL-59-MID 2020-11-10	Quesnel Lake QUL-59 QUL-59-S 2015-12-02	Quesnel Lake QUL-59 QUL-59-S 2018-01-04
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	0.35	-	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2018-05-03	Quesnel Lake QUL-59 QUL-59-S 2018-05-22	Quesnel Lake QUL-59 QUL-59-S 2018-06-13	Quesnel Lake QUL-59 QUL-59-S 2018-07-16	Quesnel Lake QUL-59 QUL-59-S 2018-08-27	Quesnel Lake QUL-59 QUL-59-S 2018-09-04	Quesnel Lake QUL-59 QUL-59-S 2018-10-11	Quesnel Lake QUL-59 QUL-59-S 2018-10-18	Quesnel Lake QUL-59 QUL-59-S 2018-10-24	Quesnel Lake QUL-59 QUL-59-S 2018-10-29	Quesnel Lake QUL-59 QUL-59-S 2018-11-07	Quesnel Lake QUL-59 QUL-59-S 2019-10-30	Quesnel Lake QUL-59 QUL-59-S 2020-06-02	Quesnel Lake QUL-59 QUL-59-S 2020-06-16	Quesnel Lake QUL-59 QUL-59-S 2020-06-29
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																		
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	106.4	110.3	101	101.5	95.6	99.8	104	106.9	105.5	100.8	104.1	108.3	21	109.1	103.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.58	7.43	7.88	7.95	7.94	7.94	7.42	7.89	7.99	7.69	7.57	7.91	7.86	7.75	7.77
Turbidity	NTU	1	-	-	-	-	1	0.91	0.52	-	-	0.58	0.5	-	-	-	-	-	0.45	1.88	0.45	0.81
Temperature	C	-	-	-	-	-	-	3.336	13.932	9.297	18.015	15.252	15.865	9.819	8.926	8.999	8.384	7.646	7.624	9.024	12.115	10.713
Dissolved oxygen	%	-	-	-	-	-	-	87.7	90.1	94.4	89.5	93.4	97.6	91.1	90.8	89.5	100.4	90.8	93	92.6	102.3	86.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.7	9.3	10.83	8.46	9.41	9.66	10.33	10.51	10.34	11.78	10.85	11.11	10.71	11	9.62
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific conductivity	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	250[p]	150	600	-	600	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	1W	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	5	1.2	-	5	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	1000	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	0.2	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2018-05-03	Quesnel Lake QUL-59 QUL-59-S 2018-05-22	Quesnel Lake QUL-59 QUL-59-S 2018-06-13	Quesnel Lake QUL-59 QUL-59-S 2018-07-16	Quesnel Lake QUL-59 QUL-59-S 2018-08-27	Quesnel Lake QUL-59 QUL-59-S 2018-09-04	Quesnel Lake QUL-59 QUL-59-S 2018-10-11	Quesnel Lake QUL-59 QUL-59-S 2018-10-18	Quesnel Lake QUL-59 QUL-59-S 2018-10-24	Quesnel Lake QUL-59 QUL-59-S 2018-10-29	Quesnel Lake QUL-59 QUL-59-S 2018-11-07	Quesnel Lake QUL-59 QUL-59-S 2019-10-30	Quesnel Lake QUL-59 QUL-59-S 2020-06-02	Quesnel Lake QUL-59 QUL-59-S 2020-06-16	Quesnel Lake QUL-59 QUL-59-S 2020-06-29
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	-	-	0.35	-	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2020-11-10	Quesnel Lake QUL-57 QUL-57-AP 2020-09-16	Quesnel Lake QUL-57 QUL-57-AP 2021-09-16	Quesnel Lake QUL-57 QUL-57-AP 2022-10-19	Quesnel Lake QUL-57 QUL-57-AT 2019-05-08	Quesnel Lake QUL-57 QUL-57-AT 2019-05-15	Quesnel Lake QUL-57 QUL-57-AT 2019-05-21	Quesnel Lake QUL-57 QUL-57-AT 2019-06-18	Quesnel Lake QUL-57 QUL-57-AT 2019-08-20	Quesnel Lake QUL-57 QUL-57-AT 2020-06-24	Quesnel Lake QUL-57 QUL-57-AT 2020-08-11	Quesnel Lake QUL-57 QUL-57-AT 2022-06-27	Quesnel Lake QUL-57 QUL-57-B 2015-12-09	Quesnel Lake QUL-57 QUL-57-B 2015-12-14	Quesnel Lake QUL-57 QUL-57-B 2015-12-21
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	110.6	105	107.7	104.5	113.7	112.5	113.2	103.1	101.4	100.5	100.1	106.3	150.1	144.5	151.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.66	8.19	8.57	7.92	7.85	7.82	7.9	7.93	7.95	7.62	7.91	8.06	7.84	7.76	7.67
Turbidity	NTU	1	-	-	-	-	1	1.47	0.08	0.04	0.31	0.14	0.75	0	0.83	0.12	0.57	0	0.48	0.8	0.58	0.59
Temperature	C	-	-	-	-	-	-	5.748	10.517	15.406	10.294	5.283	5.53	9.499	10.126	16.826	12.651	10.021	8.57	5.013	4.797	4.474
Dissolved oxygen	%	-	-	-	-	-	-	88.9	90.4	93.8	88.7	91.4	89.2	98.3	11.13	97	102	89.9	95.2	83.6	84.5	82.3
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.13	10.06	9.37	9.87	11.58	11.2	11.2	103.1	9.4	10.83	10.09	11.05	10.66	10.84	10.66
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	-	47	45.8	43.8	50.8	49.7	48.4	44.4	46.2	45.6	42.9	48.2	47.9	50.3	48.3
Specific conductivity	uS/cm	-	-	-	-	-	-	-	103	104	106	117	116	115	102	101	99.1	97.6	106	112	113	114
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.87	7.92	7.87	7.88	7.95	8.04	7.99	7.94	7.79	7.95	7.9	7.8	7.87	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	1	<1.0	1.1	<1.0	1.5	<1.1	<1.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	-	0.16	0.15	0.18	0.19	0.31	0.57	0.22	0.26	0.75	0.42	0.7	0.49	0.55	0.55
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	-	50.4	51.6	53.3	58.6	53.5	51.2	46.3	46.3	49.2	46.5	51.9	53.2	56.8	55.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	55.8	52.3	49.8	-	-	-	-	-	47.2	45	51.2	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	-	66	76	68	81	69	69	65	68	70	70	72	67	71	65
Dissolved organic carbon	mg/L	-	-	-	-	-	-	-	2.28	1.78	1.88	1.97	2.17	2.27	1.89	2.04	2.93	3.23	2.89	1.56	1.38	1.77
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	-	0.075	0.0415	0.0596	0.132	0.124	0.106	0.086	0.0474	0.0803	0.0291	0.092	0.109	0.114	0.115
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	-	0.0752	0.0415	0.0596	0.132	0.124	0.106	0.086	0.0474	0.081	0.0294	0.092	0.109	0.114	0.115
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	-	0.0054	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	-	<0.0020	0.0024	<0.0020	0.0032	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	0.0022	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	-	<0.0020	0.0025	0.002	0.004	0.0066	0.0331	0.0033	0.0036	0.0057	0.0034	0.0078	<0.0020	<0.0020	0.0023
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	-	0.147	0.112	0.162	0.196	0.203	0.246	0.165	0.13	0.366	0.155	0.172	0.156	0.171	0.152
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	-	17	17.6	17.9	19.7	17.7	16.9	15.4	15.2	16.4	15.3	17.2	18	19.3	18.7
Chloride	mg/L	250[p]	150	600	-	600	150	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	-	0.032	0.032	0.035	0.036	0.04	0.038	0.038	0.033	0.038	0.034	0.032	0.033	0.035	0.036
Magnesium	mg/L	-	-	-	-	-	-	-	1.95	1.86	2.08	2.29	2.26	2.18	1.9	2.03	2.03	2	2.17	2.02	2.1	2.03
Potassium	mg/L	-	-	-	-	-	-	-	0.485	0.487	0.509	0.559	0.472	0.523	0.5	0.467	0.482	0.536	0.516	0.472	0.475	0.487
Sodium	mg/L	-	-	-	-	-	-	-	0.951	0.879	0.955	1.19	1.11	1.07	0.961	0.953	0.973	0.98	1.03	0.923	0.934	0.96
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	-	5.9	6.45	6.31	7.41	7.57	6.69	5.86	5.8	5.85	5.58	5.83	6.69	6.55	6.87
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	-	0.0139	0.0119	0.0119	0.0147	0.0218	0.0139	0.0168	0.0138	0.0282	0.0238	0.038	0.0426	0.0364	0.042
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	-	0.00014	0.00011	0.0001	0.00018	0.00024	0.00016	0.00012	0.00011	0.00013	0.00015	0.00015	0.00018	0.00012	0.00014
Barium	mg/L	-	1W	-	-	-	1	-	0.00495	0.00528	0.00467	0.00503	0.0053	0.0056	0.00534	0.00571	0.00583	0.00574	0.00589	0.00571	0.00589	0.00595
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	-	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000054	<0.0000050	0.0000053	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	-	19.1	17.6	16.8	17.1	16.2	17	16.6	16.6	15.6	14.8	17	17.7	18.6	18.5
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	-	0.00083	0.00051	<0.00050	0.00075	0.00105	0.0007	0.00064	0.0007	0.00082	0.00079	0.00075	0.00159	0.00131	0.00158
Iron	mg/L	-	-	1	-	-	1	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.044	0.034	0.042	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	-	<0.000050	<0.000050	<0.000050	<0.000050	0.000292	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000068	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Magnesium	mg/L	-	-	-	-	-	-	-	2	2.03	1.9	2.07	2.11	2.06	2	1.95	1.99	1.95	2.12	2.04	2.06	2.06
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	-	0.00138	0.00082	0.00158	0.00105	0.00169	0.00182	0.00189	0.00123	0.00253	0.00208	0.00231	0.00164	0.00124	0.00166
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	-	0.000365	0.000331	0.000365	0.000639	0.000596	0.00048	0.000363	0.000327	0.000407	0.000362	0.000425	0.000445	0.000419	0.000465
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	-	0.428	0.5	0.46	0.494	0.465	0.487	0.51	0.495	0.503	0.523	0.494	0.507	0.488	0.51
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	-	0.000094	0.000108	0.000094	0.000163	0.000182	0.000151	0.000132	0.000128	0.000148	0.000134	0.000141	0.000115	0.000093	0.000111
Silicon	mg/L	-	-	-	-	-	-	-	1.72	1.48	1.49	1.72	1.75	1.73	1.67	1.69	1.98	2.03	2.08	1.67	1.71	1.71
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	-	0.876	0.872	0.842	1.13	1.12	1.07	0.959	0.93	0.963	0.96	1.02	0.953	0.958	1
Strontium	mg/L	-	-	-	-	-	-	-	0.139	0.134	0.133	0.146	0.131	0.125	0.121	0.125	0.116	0.112	0.122	0.134	0.126	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	-	0.00014	0.000157	0.000164	0.00016	0.000158	0.000155	0.000148	0.000148	0.000133	0.000127	0.000147	0.000174	0.000155	0.00016
Vanadium	mg/L	-	-	-	0.1	-	0.1	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2020-11-10	Quesnel Lake QUL-57 QUL-57-AP 2020-09-16	Quesnel Lake QUL-57 QUL-57-AP 2021-09-16	Quesnel Lake QUL-57 QUL-57-AP 2022-10-19	Quesnel Lake QUL-57 QUL-57-AT 2019-05-08	Quesnel Lake QUL-57 QUL-57-AT 2019-05-15	Quesnel Lake QUL-57 QUL-57-AT 2019-05-21	Quesnel Lake QUL-57 QUL-57-AT 2019-06-18	Quesnel Lake QUL-57 QUL-57-AT 2019-08-20	Quesnel Lake QUL-57 QUL-57-AT 2020-06-24	Quesnel Lake QUL-57 QUL-57-AT 2020-08-11	Quesnel Lake QUL-57 QUL-57-AT 2022-06-27	Quesnel Lake QUL-57 QUL-57-B 2015-12-09	Quesnel Lake QUL-57 QUL-57-B 2015-12-14	Quesnel Lake QUL-57 QUL-57-B 2015-12-21
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	-	0.0094	0.0073	0.0073	0.0063	0.0068	0.0068	0.0107	0.0093	0.0121	0.0138	0.0104	0.0055	0.0048	0.0052
Antimony	mg/L	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	-	0.0001	0.00011	0.00013	0.0001	0.00012	0.00011	0.00012	0.00011	0.0001	0.00015	0.00013	0.00014	0.0001	0.0001
Barium	mg/L	-	-	-	-	-	-	-	0.0053	0.00505	0.0052	0.00569	0.00545	0.00577	0.00548	0.00517	0.00548	0.00574	0.0058	0.00514	0.00529	0.00518
Beryllium	mg/L	-	-	-	-	-	-	-	<0.00100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.000100	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	-	0.00063	<0.00050	<0.00050	0.00056	0.00063	0.00057	<0.00050	<0.00050	0.00058	0.0006	0.00067	0.00081	0.00077	0.00089
Iron	mg/L	-	-	0.35	-	-	0.35	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00006	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	-	0.00042	0.00027	0.00124	0.00032	0.00037	0.00028	0.00078	0.00013	0.00022	0.00014	0.00042	0.0003	0.00015	0.00033
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	-	0.000329	0.000309	0.000349	0.000631	0.000615	0.00048	0.000353	0.000343	0.000406	0.000375	0.000419	0.000367	0.000391	0.000444
Nickel	mg/L	-	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	-	0.000115	0.000126	0.000096	0.000191	0.00017	0.000158	0.000123	0.000128	0.000159	0.000116	0.000168	0.000089	0.000089	0.000121
Silicon	mg/L	-	-	-	-	-	-	-	1.72	1.41	1.42	1.68	1.74	1.75	1.71	1.57	1.92	2.02	2.06	1.61	1.67	1.61
Silver	mg/L	-	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	-	0.123	0.127	0.136	0.147	0.142	0.142	0.117	0.121	0.126	0.109	0.122	0.133	0.125	0.134
Thallium	mg/L	-	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	-	0.00023	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	-	0.000147	0.000142	0.000159	0.00018	0.000166	0.00016	0.00015	0.000136	0.000137	0.000123	0.000141	0.000157	0.00015	0.000154
Vanadium	mg/L	-	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-B 2016-01-25	Quesnel Lake QUL-57 QUL-57-B 2016-03-28	Quesnel Lake QUL-57 QUL-57-B 2018-06-04	Quesnel Lake QUL-57 QUL-57-B 2019-04-25	Quesnel Lake QUL-57 QUL-57-B 2019-05-02	Quesnel Lake QUL-57 QUL-57-B 2019-05-08	Quesnel Lake QUL-57 QUL-57-B 2019-05-15	Quesnel Lake QUL-57 QUL-57-B 2019-05-21	Quesnel Lake QUL-57 QUL-57-B 2019-06-18	Quesnel Lake QUL-57 QUL-57-B 2019-08-20	Quesnel Lake QUL-57 QUL-57-B 2020-06-24	Quesnel Lake QUL-57 QUL-57-B 2020-08-11	Quesnel Lake QUL-57 QUL-57-B 2020-09-16	Quesnel Lake QUL-57 QUL-57-B 2021-05-19	Quesnel Lake QUL-57 QUL-57-B 2021-06-02
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	108.6	-	112.3	111.7	114.8	114	113.5	112.9	109.3	110.2	110.6	109.3	110.2	113.3	110.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	-	7.53	7.78	7.79	7.85	7.75	7.82	7.71	7.7	7.55	7.7	7.97	8.25	7.68
Turbidity	NTU	1	-	-	-	-	1	0.47	-	0	0.81	0.8	0.13	0.69	0.25	0.76	0.15	0.42	0	0.08	0.02	1
Temperature	C	-	-	-	-	-	-	2.949	-	4.777	3.43	3.784	4.675	3.931	6.915	4.397	5.307	5.455	4.977	5.246	5.602	5.509
Dissolved oxygen	%	-	-	-	-	-	-	87.2	-	91.5	87.6	88	89.9	87.6	95	92.6	85.3	93.9	89.3	86.3	94.3	96.2
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.75	-	11.74	11.66	11.6	11.57	11.51	11.55	12.01	10.79	11.83	11.4	10.93	11.85	12.12
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.8	49.3	47.7	49.2	51.2	50.5	49.7	49.2	49.5	49	48.3	46.4	48.7	48.8	47.9
Specific conductivity	uS/cm	-	-	-	-	-	-	112	114	105	112	113	117	114	117	113	110	106	109	109	112	109
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.84	7.94	7.85	7.83	7.88	7.98	8.04	7.97	7.99	7.82	7.81	7.9	7.75	7.91
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	1	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	1	<1.1	<1.1	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.5	0.53	0.35	0.39	0.3	0.21	0.13	0.18	0.13	0.17	1.2	0.2	<0.10	0.25	0.16
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	55.2	53.5	48.1	57.1	53.4	57.9	53.5	54.9	50.9	51.3	54.6	53.1	53	55.8	52.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	50.8	55.6	53.3	52.5
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	68	74	68	74	81	69	70	68	74	73	79	70	73	68
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.77	1.47	2.05	2.17	2.21	1.92	2.15	2.23	1.65	1.7	2.42	2.58	1.95	2.18	2.15
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.12	0.129	0.132	0.142	0.136	0.133	0.125	0.129	0.142	0.134	0.122	0.139	0.139	0.124	0.126
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.12	0.129	0.132	0.142	0.136	0.133	0.125	0.129	0.142	0.134	0.122	0.139	0.139	0.124	0.126
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0063	<0.0050	0.014	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0025	<0.0020	<0.0020	0.0036	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0031	0.0085	0.0028	0.0049	0.0048	0.0041	0.0033	0.004	<0.0020	<0.0020	0.0032	0.0028	0.0024	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.17	0.17	0.19	0.199	0.198	0.181	0.219	0.201	0.205	0.193	0.192	0.218	0.204	0.172	0.193
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	18.7	18	15.7	19.5	17.8	19.6	17.7	18.2	17.1	16.9	18.4	17.8	17.8	18.8	17.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.033	0.036	0.036	0.036	0.033	0.038	0.033	0.038	0.04	0.035	0.037	0.035	0.033	0.029	0.03
Magnesium	mg/L	-	-	-	-	-	-	2.04	2.06	2.18	2.05	2.17	2.18	2.24	2.27	2.03	2.23	2.09	2.07	2.1	2.15	2.18
Potassium	mg/L	-	-	-	-	-	-	0.471	0.538	0.543	0.485	0.53	0.514	0.486	0.533	0.502	0.482	0.472	0.54	0.512	0.532	0.541
Sodium	mg/L	-	-	-	-	-	-	0.946	1.06	1.05	1.16	1.16	1.13	1.14	1.16	1.04	1.06	0.989	1.06	1.03	1.06	1.08
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.83	7.27	6.82	7.45	7.8	7.41	6.86	7.38	6.65	6.53	6.65	6.7	6.55	7.12	7.1
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0232	0.044	0.0194	0.0234	0.0255	0.0185	0.0162	0.0135	0.0095	0.01	0.0199	0.0228	0.0136	0.0157	0.0189
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00012	0.00011	0.00013	0.00014	0.00018	0.00013	0.00011	<0.00010	<0.00010	0.00011	0.00012	0.00013	0.00013	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00525	0.00605	0.00545	0.00537	0.00527	0.00553	0.00553	0.00536	0.00509	0.00518	0.00538	0.00523	0.00505	0.00539	0.00559
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.4	17.9	16.1	18.3	18.8	17.3	17.7	17.8	18.2	16.6	17.4	17	18.8	17.8	17.4
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00117	0.00162	0.00085	0.00109	0.00102	0.0008	0.00094	0.00072	0.00057	0.00064	0.00074	0.0007	0.00075	0.00084	0.00082
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000239	0.000218	0.000254	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.02	2.1	2.11	2.02	2.11	2.16	1.98	2.09	2.06	2.05	2.05	2.03	2.09	2.16	2.2
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00109	0.00179	0.0017	0.00141	0.00149	0.00121	0.00121	0.00108	0.00055	0.00085	0.00147	0.00124	0.00085	0.00143	0.00159
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00055	0.000595	0.00039	0.000816	0.000764	0.000685	0.000789	0.000616	0.000427	0.000413	0.000442	0.000398	0.000426	0.000555	0.000553
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.484	0.533	0.493	0.518	0.497	0.527	0.471	0.479	0.492	0.497	0.496	0.516	0.451	0.496	0.525
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000135	0.000122	0.000119	0.000111	0.000168	0.000144	0.000204	0.000177	0.000119	0.000142	0.000124	0.000101	0.000128	0.000158	0.000157
Silicon	mg/L	-	-	-	-	-	-	1.7	1.76	1.78	1.61	1.81	1.84	1.62	1.67	1.69	1.82	1.86	2	1.86	1.88	2.01
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.96	1.03	1.01	1.14	1.15	1.17	1.03	1.11	1.01	1.01	0.976	1	0.939	1.09	1.08
Strontium	mg/L	-	-	-	-	-	-	0.138	0.14	0.131	0.143	0.138	0.149	0.132	0.134	0.143	0.133	0.136	0.142	0.144	0.135	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000165	0.000172	0.000172	0.000171	0.000149	0.000168	0.00017	0.000169	0.000168	0.000151	0.000152	0.000158	0.000147	0.00017	0.000168
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-B 2016-01-25	Quesnel Lake QUL-57 QUL-57-B 2016-03-28	Quesnel Lake QUL-57 QUL-57-B 2018-06-04	Quesnel Lake QUL-57 QUL-57-B 2019-04-25	Quesnel Lake QUL-57 QUL-57-B 2019-05-02	Quesnel Lake QUL-57 QUL-57-B 2019-05-08	Quesnel Lake QUL-57 QUL-57-B 2019-05-15	Quesnel Lake QUL-57 QUL-57-B 2019-05-21	Quesnel Lake QUL-57 QUL-57-B 2019-06-18	Quesnel Lake QUL-57 QUL-57-B 2019-08-20	Quesnel Lake QUL-57 QUL-57-B 2020-06-24	Quesnel Lake QUL-57 QUL-57-B 2020-08-11	Quesnel Lake QUL-57 QUL-57-B 2020-09-16	Quesnel Lake QUL-57 QUL-57-B 2021-05-19	Quesnel Lake QUL-57 QUL-57-B 2021-06-02
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0054	0.0059	0.0076	0.0073	0.0065	0.0059	0.0071	0.0066	0.0076	0.0053	0.0074	0.007	0.007	0.0088	0.0089
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	0.0001	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00489	0.00541	0.00558	0.00536	0.00516	0.00552	0.00556	0.00602	0.0053	0.00515	0.00516	0.00528	0.00543	0.00531	0.00543
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.0007	0.00103	0.0008	0.00061	0.00065	0.00055	0.00065	0.0006	0.00051	<0.00050	0.00056	<0.00050	0.00071	0.00073	0.00075
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000206	0.000143	0.00008	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00026	0.00072	0.00023	0.00022	0.00025	0.00029	0.00017	0.00012	0.00082	<0.00010	0.00012	0.00017	0.00011	0.00038	0.00018
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000427	0.000626	0.000374	0.000871	0.000741	0.000672	0.000749	0.000677	0.000432	0.000452	0.00041	0.00037	0.000397	0.00062	0.00055
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000104	0.000108	0.000104	0.000219	0.000186	0.000142	0.000177	0.000162	0.000124	0.000119	0.000148	0.000143	0.000078	0.000137	0.00016
Silicon	mg/L	-	-	-	-	-	-	1.67	1.65	1.67	1.59	1.75	1.67	1.7	1.76	1.7	1.78	1.83	1.87	1.9	1.84	1.81
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.138	0.123	0.151	0.143	0.147	0.143	0.151	0.131	0.136	0.143	0.135	0.131	0.145	0.137
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000153	0.000159	0.00015	0.000175	0.000162	0.000177	0.000172	0.000163	0.000159	0.000156	0.000148	0.000149	0.000152	0.000156	0.000152
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-B 2021-07-21	Quesnel Lake QUL-57 QUL-57-B 2021-09-16	Quesnel Lake QUL-57 QUL-57-B 2021-10-27	Quesnel Lake QUL-57 QUL-57-B 2022-05-10	Quesnel Lake QUL-57 QUL-57-B 2022-06-27	Quesnel Lake QUL-57 QUL-57-B 2022-08-16	Quesnel Lake QUL-57 QUL-57-B 2022-10-19	Quesnel Lake QUL-57 QUL-57-BT 2019-05-15	Quesnel Lake QUL-57 QUL-57-BT 2019-05-21	Quesnel Lake QUL-57 QUL-57-BT 2019-06-18	Quesnel Lake QUL-57 QUL-57-BT 2022-06-27	Quesnel Lake QUL-57 QUL-57-MID 2015-12-09	Quesnel Lake QUL-57 QUL-57-MID 2015-12-14	Quesnel Lake QUL-57 QUL-57-MID 2015-12-21	Quesnel Lake QUL-57 QUL-57-MID 2016-01-25
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																		
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	129.8	112.6	107.7	113.7	110.7	109.6	108.5	113.4	112.8	108.9	111.1	150.3	144.3	151.7	108.5
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.62	8.61	7.85	7.7	7.87	7.89	7.81	7.79	7.83	7.79	7.96	7.83	7.77	7.73	7.89
Turbidity	NTU	1	-	-	-	-	1	0	0.11	0.21	0	0.45	0.29	0.16	0.76	0	0.77	0.39	0.79	0.62	0.74	0.45
Temperature	C	-	-	-	-	-	-	6.086	5.288	8.87	4.015	4.98	4.628	6.413	3.964	6.996	4.862	5.312	5.036	4.813	4.495	2.935
Dissolved oxygen	%	-	-	-	-	-	-	91.7	87.4	90.1	90.8	91	86.1	85.1	88	95.2	93.6	90.9	84.1	85.1	85.2	88.2
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.38	11.08	10.44	11.89	11.62	11.1	10.46	11.54	11.56	11.99	11.5	10.73	10.92	11.02	11.89
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.8	44.8	49.1	47.5	50.6	47.3	44.6	50.1	47.5	47.8	49.7	48.3	50.9	49.1	49.1
Specific conductivity	uS/cm	-	-	-	-	-	-	108	109	114	114	112	111	109	117	113	112	110	112	114	114	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.89	7.89	7.95	7.83	7.93	7.91	7.88	7.96	8.04	8.03	7.91	7.79	7.86	7.9	7.92
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.1	<1.0	3.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<3.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	<0.10	<0.10	<0.10	0.18	0.25	0.15	0.12	0.23	0.41	0.19	0.43	0.49	0.55	0.49	0.43
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	50.8	53.2	51.6	54.9	54.6	52.6	53.5	56.7	52.2	50.6	52.7	53.1	56.2	55.4	55.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	54.4	54.7	52.5	56.4	52.7	54.3	50.1	-	-	-	52.1	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	73	81	62	71	72	65	76	68	73	73	70	65	67	66	69
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.92	1.89	1.75	2.28	2.46	2.04	1.89	2.17	2.3	1.71	2.66	1.57	1.26	1.7	1.65
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.139	0.146	0.0839	0.128	0.129	0.143	0.117	0.133	0.115	0.133	0.119	0.109	0.115	0.114	0.119
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.139	0.146	0.0839	0.128	0.129	0.143	0.119	0.133	0.115	0.133	0.119	0.109	0.115	0.114	0.119
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	0.0074	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0023	0.0032	0.0126	0.0021	0.0031	<0.0020	0.0023	0.0041	0.0056	0.0042	0.0056	0.0022	0.002	0.0023	0.0033
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.201	0.197	0.123	0.214	0.168	0.179	0.187	0.205	0.203	0.27	0.166	0.153	0.172	0.163	0.164
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	16.8	18	17.5	18.4	18.3	17.6	17.9	18.8	17.2	17.1	17.6	17.9	19.1	18.8	18.8
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	0.55	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.032	0.037	0.036	0.04	0.031	0.039	0.036	0.04	0.038	0.04	0.031	0.033	0.035	0.036	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.15	2	1.91	2.17	2.16	2.1	2.14	2.35	2.22	1.94	2.12	2.02	2.07	2.03	2.05
Potassium	mg/L	-	-	-	-	-	-	0.517	0.504	0.464	0.494	0.511	0.525	0.52	0.493	0.536	0.484	0.506	0.49	0.49	0.484	0.475
Sodium	mg/L	-	-	-	-	-	-	0.967	1.01	0.85	1.03	1	0.966	1	1.16	1.07	1	0.992	0.973	0.939	0.952	0.966
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.68	7.19	6.99	7.59	6.31	6.78	6.41	7.89	6.6	6.55	6.19	6.69	6.59	6.76	6.82
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0137	0.0133	0.0111	0.0478	0.0192	0.0113	0.0112	0.0276	0.0157	0.0228	0.0263	0.0387	0.036	0.0378	0.0236
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.00012	0.00011	0.00013	0.00011	0.00014	0.00011	0.00014	0.00012	0.00012	0.00013	0.00012	0.00012	0.00012	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.0053	0.00543	0.00511	0.00567	0.00509	0.00519	0.0049	0.00548	0.00506	0.00529	0.00522	0.00588	0.00591	0.0058	0.00523
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.3	18.3	17.8	19.1	17.7	18.3	16.9	16.9	16.8	18.2	17.4	17.6	17.9	18.4	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00056	0.00062	0.00052	0.00215	0.00065	0.0006	<0.00050	0.00103	0.00065	0.00143	0.00072	0.00149	0.00144	0.0017	0.00114
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	0.047	<0.030	<0.030	<0.030	0.03	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000092	<0.000050	<0.000050	0.000323
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.12	2.19	1.96	2.11	2.07	2.08	1.91	2.15	1.94	2.11	2.11	2.05	2.02	2.05	2.01
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00108	0.00079	0.00096	0.00248	0.0014	0.00093	0.00102	0.00173	0.00213	0.00134	0.0017	0.00143	0.00127	0.00135	0.00104
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000411	0.000504	0.00039	0.000719	0.000462	0.000449	0.000369	0.000712	0.000473	0.000397	0.000495	0.000431	0.000398	0.000464	0.000453
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.508	0.521	0.483	0.507	0.513	0.485	0.463	0.483	0.459	0.504	0.518	0.51	0.496	0.504	0.486
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000118	0.000124	0.000089	0.000131	0.000149	0.000106	0.000092	0.000185	0.000132	0.000073	0.000146	0.000095	0.000093	0.00011	0.000109
Silicon	mg/L	-	-	-	-	-	-	2.01	1.86	1.49	1.87	1.92	2.04	1.69	1.81	1.67	1.69	1.96	1.66	1.66	1.7	1.68
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.988	1	0.868	1.05	0.984	0.978	0.886	1.16	0.992	1.03	1.01	1.01	0.938	0.974	0.971
Strontium	mg/L	-	-	-	-	-	-	0.135	0.136	0.142	0.15	0.149	0.143	0.128	0.135	0.136	0.136	0.148	0.137	0.124	0.139	0.139
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.0100	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.00016	0.000162	0.000162	0.000178	0.000162	0.000167	0.000158	0.000156	0.000156	0.00016	0.000161	0.000174	0.000152	0.000176	0.000161
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.021	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type			BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake	Quesnel Lake
Station									QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57	QUL-57
Sample Point									QUL-57-B	QUL-57-B	QUL-57-B	QUL-57-B	QUL-57-B	QUL-57-B	QUL-57-B	QUL-57-BT	QUL-57-BT	QUL-57-BT	QUL-57-BT	QUL-57-MID	QUL-57-MID	QUL-57-MID
Date									2021-07-21	2021-09-16	2021-10-27	2022-05-10	2022-06-27	2022-08-16	2022-10-19	2019-05-15	2019-05-21	2019-06-18	2022-06-27	2015-12-09	2015-12-14	2015-12-21	2016-01-25
Parameter		Unit		Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Dissolved Metals																							
Aluminum		mg/L	0.2	-	-	-	-	0.2	0.0066	0.0066	0.0066	0.0077	0.0095	0.0076	0.0069	0.0074	0.0077	0.0053	0.0108	0.0053	0.0052	0.0049	0.0053
Antimony		mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.0001	0.00012	<0.00010	<0.00010	0.0001	0.00011	0.00011	0.00011	<0.00010
Barium		mg/L	-	-	-	-	-	-	0.00526	0.0051	0.00475	0.00539	0.00546	0.00512	0.00528	0.00573	0.00586	0.00494	0.00547	0.00515	0.00534	0.00521	0.00492
Beryllium		mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth		mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium		mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt		mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	<0.00050	0.00051	<0.00050	0.00073	0.00076	0.00064	0.00054	0.00069	0.00055	<0.00050	0.00063	0.00081	0.00078	0.00083	0.00076
Iron		mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead		mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000095	<0.000050	<0.000050	0.000304
Lithium		mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Manganese		mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00026	0.00022	0.00025	0.00015	0.00019	0.00036	0.00019	<0.00010	0.00025	0.00017	0.00017	0.00018	0.00025
Mercury		mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum		mg/L	-	-	-	-	-	-	0.000395	0.000442	0.000388	0.00071	0.00043	0.000479	0.000358	0.00073	0.000457	0.000401	0.00042	0.00038	0.000385	0.000405	0.000426
Nickel		mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium		mg/L	-	-	-	-	-	-	0.000096	0.000144	0.000108	0.000188	0.000145	0.000102	0.000108	0.000158	0.000113	0.000124	0.000166	0.000099	0.000096	0.000093	0.000119
Silicon		mg/L	-	-	-	-	-	-	1.8	1.65	1.38	1.73	1.96	1.9	1.71	1.7	1.74	1.68	1.96	1.6	1.65	1.61	1.66
Silver		mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium		mg/L	-	-	-	-	-	-	0.132	0.131	0.127	0.148	0.136	0.138	0.138	0.147	0.136	0.128	0.13	0.135	0.124	0.131	0.136
Thallium		mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.0100	<0.010	<0.010	<0.010	<0.010
Uranium		mg/L	-	-	-	-	-	-	0.000161	0.000151	0.00015	0.000166	0.000154	0.000161	0.000158	0.000169	0.000158	0.000165	0.000154	0.000162	0.00015	0.00015	0.000153
Vanadium		mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc		mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-MID 2016-03-28	Quesnel Lake QUL-57 QUL-57-MID 2018-06-04	Quesnel Lake QUL-57 QUL-57-MID 2019-04-25	Quesnel Lake QUL-57 QUL-57-MID 2019-05-02	Quesnel Lake QUL-57 QUL-57-MID 2021-05-19	Quesnel Lake QUL-57 QUL-57-MID 2021-06-02	Quesnel Lake QUL-57 QUL-57-MID 2021-07-21	Quesnel Lake QUL-57 QUL-57-MID 2021-10-27	Quesnel Lake QUL-57 QUL-57-MID 2022-05-10	Quesnel Lake QUL-57 QUL-57-MID 2022-08-16	Quesnel Lake QUL-57 QUL-57-S 2015-12-09	Quesnel Lake QUL-57 QUL-57-S 2015-12-14	Quesnel Lake QUL-57 QUL-57-S 2015-12-21	Quesnel Lake QUL-57 QUL-57-S 2016-01-25	Quesnel Lake QUL-57 QUL-57-S 2016-03-28
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	-	107.6	111.7	114.7	112	108.2	124.5	107.5	114.5	107.4	150.2	143.9	151.3	107.8	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.58	7.79	7.81	8.29	7.74	7.8	7.86	7.65	8.24	7.82	7.8	7.78	7.92	-
Turbidity	NTU	1	-	-	-	-	1	-	0	0.75	0.89	0	1.15	0	0.21	0	0.27	0.76	0.52	0.69	0.7	-
Temperature	C	-	-	-	-	-	-	-	7.088	3.438	3.801	6.761	6.875	9.022	8.93	4.001	5.936	5.057	4.798	4.481	2.904	-
Dissolved oxygen	%	-	-	-	-	-	-	-	94.2	88.3	88.2	95.6	97	94.8	90.3	90.6	85.6	84.9	86.1	85.9	92.2	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	11.41	11.74	11.61	11.65	11.81	10.59	10.45	11.88	10.66	10.83	11.05	11.12	12.44	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.9	46.3	49.7	51.8	48.3	47.6	47.2	48.3	48.1	44.1	47.5	50.3	49.3	48	49.5
Specific conductivity	uS/cm	-	-	-	-	-	-	114	100	112	114	109	108	102	114	115	102	112	113	113	114	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.84	7.89	7.83	7.9	7.74	7.9	7.91	7.95	7.83	7.9	7.8	7.85	7.89	7.86	7.83
Total suspended solids	mg/L	-	-	-	-	-	-	3.6	<1.0	<1.0	<1.0	<1.1	<1.1	<1.0	<1.0	1.3	<1.1	<3.0	<3.0	<3.0	<3.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.59	0.44	0.37	0.26	0.22	0.24	0.17	0.11	0.22	0.27	0.5	0.61	0.46	0.47	0.96
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53.8	51	56.9	51.7	53.7	53	49.2	52.9	55.7	48.9	52.9	56.6	54.6	55.2	53.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	53.6	49.1	52.8	54.2	56.3	51.8	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	71	67	79	78	65	67	69	81	90	59	67	64	66	75
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.5	2.14	2.6	2.12	2.3	2.71	2.56	1.74	2.05	2.24	1.49	1.3	1.65	1.59	1.46
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.131	0.113	0.143	0.137	0.12	0.119	0.105	0.0838	0.127	0.11	0.109	0.114	0.115	0.119	0.13
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.131	0.113	0.143	0.137	0.12	0.119	0.105	0.0838	0.127	0.11	0.109	0.114	0.115	0.119	0.13
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.0099	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0028	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.005	0.0033	0.0046	0.003	<0.0020	<0.0020	0.0071	<0.0020	<0.0020	0.0028	0.0022	0.0058	<0.0020	0.0043	0.0037
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.177	0.192	0.203	0.196	0.179	0.192	0.168	0.124	0.205	0.164	0.156	0.17	0.185	0.172	0.182
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.1	16.9	19.4	17.2	18	17.7	16.4	18	18.7	16.5	17.9	19.2	18.5	18.7	17.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.036	0.036	0.036	0.033	0.029	0.03	0.03	0.036	0.039	0.037	0.033	0.035	0.036	0.033	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.08	2.13	2.01	2.16	2.13	2.14	2	1.94	2.18	1.87	2.01	2.09	2.02	2.04	2.07
Potassium	mg/L	-	-	-	-	-	-	0.575	0.546	0.464	0.522	0.522	0.525	0.502	0.46	0.499	0.495	0.497	0.492	0.493	0.468	0.538
Sodium	mg/L	-	-	-	-	-	-	1.14	1.03	1.15	1.16	1.03	1.06	0.878	0.862	1.03	0.853	0.991	0.959	0.965	0.959	1.04
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.34	6.47	7.43	7.76	6.81	6.65	6.11	6.99	7.6	6.31	6.65	6.57	6.8	6.78	7.2
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0376	0.0267	0.0204	0.0267	0.0177	0.0252	0.0147	0.0134	0.0419	0.0169	0.0393	0.0397	0.0343	0.0276	0.0358
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	0.00013	<0.00010	0.00013	0.00013	0.00015	<0.00010	0.00012	0.00015	0.00013	0.00012	0.00012	0.00013	0.00012	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00577	0.00569	0.00547	0.00535	0.0055	0.00529	0.00509	0.00518	0.00615	0.00516	0.00586	0.00593	0.00578	0.00543	0.00574
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000057	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.9	15.2	18.6	18.7	17.8	16.3	17.9	18.2	19.1	17.6	17.6	18.6	18.2	18.6	17.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00178	0.00076	0.00109	0.00098	0.00076	0.00076	<0.00050	0.00062	0.00208	0.0006	0.00155	0.00141	0.00141	0.00126	0.00138
Iron	mg/L	-	-	1	-	-	1	<0.030	0.036	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	0.063	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000253	0.00023	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.1	2.08	2.06	2.08	2.23	2.04	1.96	2.12	2.09	1.9	2.02	2.11	2.02	2.04	2.08
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00185	0.00214	0.00144	0.0015	0.00147	0.0022	0.00122	0.00105	0.00764	0.00139	0.00122	0.00122	0.00122	0.00264	0.00161
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000598	0.000382	0.000827	0.000786	0.000486	0.000422	0.000323	0.000382	0.000738	0.000313	0.000422	0.000413	0.000445	0.000483	0.000617
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.515	0.507	0.519	0.49	0.524	0.486	0.49	0.52	0.511	0.479	0.505	0.516	0.495	0.495	0.51
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000117	0.000124	0.000223	0.000197	0.000122	0.00017	0.000094	0.00012	0.000238	0.000076	0.000093	0.000105	0.000096	0.000102	0.000138
Silicon	mg/L	-	-	-	-	-	-	1.74	1.8	1.73	1.8	2	1.94	1.82	1.49	1.9	1.87	1.64	1.74	1.67	1.69	1.73
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.01	1.01	1.16	1.13	1.1	1	0.892	0.977	1.04	0.872	1	0.981	0.988	1	0.995
Strontium	mg/L	-	-	-	-	-	-	0.141	0.123	0.15	0.137	0.141	0.125	0.132	0.131	0.148	0.127	0.135	0.128	0.135	0.14	0.144
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000172	0.000162	0.000173	0.000156	0.000176	0.000155	0.000163	0.000171	0.000181	0.000154	0.000171	0.000156	0.000162	0.000166	0.000176
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-MID 2016-03-28	Quesnel Lake QUL-57 QUL-57-MID 2018-06-04	Quesnel Lake QUL-57 QUL-57-MID 2019-04-25	Quesnel Lake QUL-57 QUL-57-MID 2019-05-02	Quesnel Lake QUL-57 QUL-57-MID 2021-05-19	Quesnel Lake QUL-57 QUL-57-MID 2021-06-02	Quesnel Lake QUL-57 QUL-57-MID 2021-07-21	Quesnel Lake QUL-57 QUL-57-MID 2021-10-27	Quesnel Lake QUL-57 QUL-57-MID 2022-05-10	Quesnel Lake QUL-57 QUL-57-MID 2022-08-16	Quesnel Lake QUL-57 QUL-57-S 2015-12-09	Quesnel Lake QUL-57 QUL-57-S 2015-12-14	Quesnel Lake QUL-57 QUL-57-S 2015-12-21	Quesnel Lake QUL-57 QUL-57-S 2016-01-25	Quesnel Lake QUL-57 QUL-57-S 2016-03-28
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0069	0.0086	0.0069	0.0073	0.0088	0.01	0.0093	0.0062	0.0168	0.0106	0.0061	0.0053	0.0057	0.0068	0.0065
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	0.0001	0.00012	0.0001	0.00013	<0.00010	0.00011	<0.00010	0.0001	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00585	0.0059	0.00542	0.00507	0.00524	0.0055	0.00536	0.00487	0.0055	0.00484	0.00514	0.00537	0.00533	0.00501	0.00546
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000083	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00107	0.00069	0.00058	0.00064	0.00072	0.00081	<0.00050	<0.00050	0.00107	<0.00050	0.00077	0.00078	0.00085	0.00076	0.00085
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000135	0.000138	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00075	0.00055	0.00018	0.00027	0.00043	0.00032	0.00014	0.00026	0.00048	0.00025	0.00013	0.00017	0.00021	0.00038	0.00067
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000595	0.000387	0.000823	0.000742	0.000512	0.00046	0.000306	0.000403	0.00074	0.000308	0.000376	0.000397	0.000423	0.000417	0.000533
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00065
Selenium	mg/L	-	-	-	-	-	-	0.000146	0.000113	0.000178	0.000243	0.00014	0.000132	0.000082	0.000086	0.000166	0.00008	0.000086	0.000092	0.000096	0.000109	0.000101
Silicon	mg/L	-	-	-	-	-	-	1.67	1.71	1.55	1.73	1.81	1.84	1.6	1.4	1.72	1.79	1.6	1.65	1.59	1.66	1.66
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.14	0.128	0.148	0.138	0.135	0.128	0.124	0.13	0.151	0.126	0.134	0.125	0.132	0.135	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000161	0.000156	0.000176	0.00016	0.000154	0.000148	0.000157	0.000156	0.000168	0.000148	0.000158	0.000149	0.000153	0.000153	0.000159
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2018-06-04	Quesnel Lake QUL-57 QUL-57-S 2019-04-25	Quesnel Lake QUL-57 QUL-57-S 2019-05-02	Quesnel Lake QUL-57 QUL-57-S 2019-05-08	Quesnel Lake QUL-57 QUL-57-S 2019-05-15	Quesnel Lake QUL-57 QUL-57-S 2019-05-21	Quesnel Lake QUL-57 QUL-57-S 2019-06-18	Quesnel Lake QUL-57 QUL-57-S 2019-08-20	Quesnel Lake QUL-57 QUL-57-S 2020-06-24	Quesnel Lake QUL-57 QUL-57-S 2020-08-11	Quesnel Lake QUL-57 QUL-57-S 2020-09-16	Quesnel Lake QUL-57 QUL-57-S 2021-05-19	Quesnel Lake QUL-57 QUL-57-S 2021-06-02	Quesnel Lake QUL-57 QUL-57-S 2021-07-21	Quesnel Lake QUL-57 QUL-57-S 2021-09-16
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	100.3	111.6	117.5	113.1	-	114.8	99.5	98.3	104.4	98.6	104.8	109.8	115	118.8	107.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.58	7.79	7.98	8.02	-	8.13	7.94	7.96	7.66	7.95	8.14	8.15	7.77	7.9	8.51
Turbidity	NTU	1	-	-	-	-	1	0	0.75	0.67	0.04	-	0	0.77	0.21	0.23	0	0.11	0.08	1.06	0	0.05
Temperature	C	-	-	-	-	-	-	10.628	3.397	4.773	6.206	-	12.764	15.255	17.588	15.344	16.508	15.395	8.379	12.969	19.768	15.556
Dissolved oxygen	%	-	-	-	-	-	-	97.6	88.9	79	83.2	-	82.8	108.6	98.2	95.7	98	98.6	98.3	101.4	9.24	94
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.86	11.83	10.19	10.3	-	8.78	10.89	9.37	9.52	9.57	9.85	11.54	10.64	101.2	9.36
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	44.2	49.3	51.3	50	51.3	48.6	44	45.8	52	43.4	46.3	47.9	53.4	44.5	46
Specific conductivity	uS/cm	-	-	-	-	-	-	93.5	111	113	116	113	115	101	101	107	98.8	104	107	121	97.5	104
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.86	7.83	7.86	7.87	7.93	8.06	7.99	7.96	7.82	7.96	7.96	7.74	7.95	7.96	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	1.4	<1.1	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.65	0.38	0.28	0.24	0.75	0.23	0.21	0.34	0.78	0.35	0.19	0.31	0.46	0.26	0.18
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	48.7	57.7	53.2	57.4	53	52.4	47.9	46.1	54.7	47.1	51.3	53.1	65.5	47.1	54
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56.2	44.4	54.1	52.6	60.8	47.8	50.9
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	66	79	67	84	69	66	68	75	68	67	73	81	66	77
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.42	2.27	1.98	2.16	7.4	2.5	1.95	2.02	4.52	3.32	2.24	2.41	6.47	2.04	1.97
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0864	0.143	0.136	0.127	0.0814	0.108	0.0835	0.0453	0.071	0.0273	0.0306	0.13	0.0902	0.0554	0.042
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0864	0.143	0.136	0.127	0.0814	0.108	0.0835	0.0453	0.0716	0.0273	0.0307	0.13	0.0902	0.0554	0.042
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	0.0051	<0.0050	<0.0050	<0.0050	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0034	<0.0020	<0.0020	0.0026	0.004	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	0.0022	<0.0020	0.0025	<0.0020	0.002
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0044	0.0028	0.0053	0.0055	0.0052	0.0036	<0.0020	0.0227	0.0042	0.0059	0.0026	0.0034	0.0043	<0.0020	0.0032
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.175	0.204	0.206	0.194	0.29	0.186	0.167	0.127	0.22	0.16	0.114	0.169	0.228	0.123	0.113
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	16.1	19.6	17.8	19.3	16.4	17.3	16	15.1	17.7	15.6	17.2	17.8	20.7	15.6	18.5
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.035	0.032	0.033	0.037	0.043	0.031	0.038	0.033	0.041	0.034	0.03	0.029	0.034	0.03	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.06	2.12	2.14	2.23	2.89	2.24	1.92	2.05	2.53	2	2.02	2.11	3.35	1.98	1.89
Potassium	mg/L	-	-	-	-	-	-	0.556	0.51	0.507	0.551	0.464	0.527	0.516	0.462	0.5	0.533	0.492	0.55	0.668	0.513	0.489
Sodium	mg/L	-	-	-	-	-	-	1.02	1.2	1.14	1.17	1.47	1.11	0.972	0.956	1.35	0.988	0.942	1.03	2.57	0.88	0.896
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.03	7.41	7.78	7.2	5.6	6.58	5.86	5.79	6.5	5.56	5.74	6.69	8.65	5.93	6.46
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0277	0.0263	0.0281	0.0162	0.0641	0.0141	0.0163	0.0141	0.0469	0.0258	0.016	0.0207	0.0357	0.015	0.0109
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00012	0.00014	0.00015	0.00025	0.00013	0.00012	0.00013	0.00026	0.00015	0.00015	0.00014	0.00029	0.00012	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00565	0.00558	0.0053	0.00507	0.00685	0.0053	0.00506	0.00548	0.00737	0.00573	0.00518	0.00545	0.00788	0.00559	0.0052
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000088	0.0000051	<0.0000050	<0.0000050	0.0000054	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	14.5	18.7	18.6	16.7	16.3	17	16.2	15.4	18.2	14.6	18.3	17.5	19.3	16	17.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00075	0.00133	0.00115	0.00078	0.00175	0.00085	0.00071	0.00063	0.00182	0.00098	0.00066	0.00086	0.00223	0.00061	0.00055
Iron	mg/L	-	-	1	-	-	1	0.04	<0.030	<0.030	<0.030	<0.030	0.103	0.052	<0.030	<0.030	0.083	0.033	<0.030	<0.030	0.059	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.97	2.13	2.09	2.04	2.77	2.03	1.86	1.93	2.61	1.92	2.03	2.15	3.06	1.92	1.99
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00252	0.00152	0.00162	0.00111	0.0037	0.00215	0.00167	0.00136	0.00652	0.00208	0.001	0.00179	0.00733	0.00173	0.00094
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000379	0.000741	0.000757	0.000664	0.00052	0.000492	0.000346	0.000412	0.000702	0.000354	0.000337	0.00044	0.00117	0.000373	0.000346
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	0.00066	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.511	0.532	0.491	0.489	0.469	0.471	0.467	0.483	0.538	0.497	0.438	0.507	0.624	0.497	0.478
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000122	0.00015	0.000208	0.000117	0.000138	0.000141	0.000086	0.000091	0.000323	0.000104	0.000108	0.00014	0.000225	0.000153	0.000116
Silicon	mg/L	-	-	-	-	-	-	1.84	1.68	1.77	1.71	2.5	1.79	1.65	1.7	2.3	2.02	1.75	2.04	2.5	1.82	1.48
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.944	1.17	1.13	1.11	1.51	1.09	0.903	0.912	1.48	0.934	0.883	1.06	2.13	0.896	0.857
Strontium	mg/L	-	-	-	-	-	-	0.113	0.147	0.138	0.136	0.121	0.125	0.118	0.122	0.13	0.109	0.133	0.133	0.144	0.114	0.128
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	0.00023	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000148	0.00018	0.000162	0.000163	0.000133	0.000155	0.000153	0.000144	0.000134	0.000128	0.000135	0.00016	0.00016	0.000142	0.000154
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2018-06-04	Quesnel Lake QUL-57 QUL-57-S 2019-04-25	Quesnel Lake QUL-57 QUL-57-S 2019-05-02	Quesnel Lake QUL-57 QUL-57-S 2019-05-08	Quesnel Lake QUL-57 QUL-57-S 2019-05-15	Quesnel Lake QUL-57 QUL-57-S 2019-05-21	Quesnel Lake QUL-57 QUL-57-S 2019-06-18	Quesnel Lake QUL-57 QUL-57-S 2019-08-20	Quesnel Lake QUL-57 QUL-57-S 2020-06-24	Quesnel Lake QUL-57 QUL-57-S 2020-08-11	Quesnel Lake QUL-57 QUL-57-S 2020-09-16	Quesnel Lake QUL-57 QUL-57-S 2021-05-19	Quesnel Lake QUL-57 QUL-57-S 2021-06-02	Quesnel Lake QUL-57 QUL-57-S 2021-07-21	Quesnel Lake QUL-57 QUL-57-S 2021-09-16
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0116	0.0077	0.0062	0.0078	0.0317	0.007	0.0108	0.0097	0.0157	0.0133	0.0103	0.01	0.0197	0.0113	0.0071
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	<0.00010	0.00012	0.00011	0.00024	0.00011	0.00011	0.00011	0.00016	0.00014	0.00011	0.0001	0.00029	0.00014	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00591	0.00591	0.00517	0.00579	0.00674	0.00613	0.00553	0.0052	0.00666	0.00598	0.00528	0.00529	0.00871	0.00569	0.00514
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	0.0000056	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000076	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00061	0.00063	0.00063	0.00057	0.00155	0.00061	0.0005	<0.00050	0.00104	0.0006	0.00059	0.00064	0.00239	0.00052	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	0.046	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.036	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00108	0.00033	0.00031	0.00031	0.00166	0.00067	0.00094	0.00022	0.00036	<0.00010	0.00027	0.00067	0.00688	0.00067	0.00028
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000398	0.000843	0.000743	0.000616	0.000541	0.000485	0.000357	0.000365	0.00054	0.000373	0.000348	0.00047	0.00145	0.00037	0.000291
Nickel	mg/L	-	-	-	-	-	-	0.00062	<0.00050	<0.00050	<0.00050	0.00065	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000107	0.000212	0.000226	0.000146	0.000165	0.00011	0.000128	0.000123	0.000134	0.000114	0.000096	0.000122	0.000251	0.000091	0.000081
Silicon	mg/L	-	-	-	-	-	-	1.74	1.62	1.79	1.68	2.46	1.79	1.71	1.68	2.18	1.99	1.73	1.85	2.47	1.68	1.44
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.118	0.154	0.141	0.144	0.144	0.127	0.141	0.116	0.119	0.13	0.11	0.127	0.136	0.149	0.113	0.123
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000144	0.000185	0.00016	0.00018	0.000139	0.000153	0.000154	0.000137	0.000135	0.000121	0.000146	0.000155	0.000151	0.000137	0.00015
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2021-10-27	Quesnel Lake QUL-57 QUL-57-S 2022-05-10	Quesnel Lake QUL-57 QUL-57-S 2022-06-27	Quesnel Lake QUL-57 QUL-57-S 2022-08-16	Quesnel Lake QUL-57 QUL-57-S 2022-10-19	Quesnel Lake QUL-58 QUL-58-AP 2015-12-21	Quesnel Lake QUL-58 QUL-58-AP 2016-11-21	Quesnel Lake QUL-58 QUL-58-AP 2018-01-10	Quesnel Lake QUL-58 QUL-58-AP 2018-01-31	Quesnel Lake QUL-58 QUL-58-AP 2018-10-11	Quesnel Lake QUL-58 QUL-58-AP 2019-05-15	Quesnel Lake QUL-58 QUL-58-AP 2019-05-21	Quesnel Lake QUL-58 QUL-58-AP 2019-10-30	Quesnel Lake QUL-58 QUL-58-AP 2020-09-16	Quesnel Lake QUL-58 QUL-58-AP 2021-05-19
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	107.3	114	106.1	97.8	103.6	151.9	110.3	-	-	106.2	114.1	117.3	108.3	104.7	109.7
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.69	7.93	8.04	8	7.59	7.68	-	-	7.63	7.75	7.6	7.88	8.16	8.59
Turbidity	NTU	1	-	-	-	-	1	0.15	0	0.72	0.32	0.19	0.74	0.2	-	-	0.14	0.55	0	0.13	0.07	0.13
Temperature	C	-	-	-	-	-	-	9.008	4.104	15.913	20.526	13.703	4.478	7.672	-	-	9.065	3.819	3.881	7.477	9.766	7.959
Dissolved oxygen	%	-	-	-	-	-	-	90.5	90.8	107.7	99.4	95	82.7	86.5	-	-	90.3	87.1	87.9	91.3	88.9	96.7
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.46	11.87	10.65	8.94	9.86	10.7	10.33	-	-	10.41	11.47	11.56	10.94	10.04	11.46
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	46.6	47.9	48.7	42.1	44.4	49.4	49.8	49.2	50.4	45	50.5	48.8	48.1	47.9	48.3
Specific conductivity	uS/cm	-	-	-	-	-	-	114	115	105	98.1	106	113	110	122	110	104	114	118	110	104	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.88	7.84	7.88	7.93	7.87	7.88	7.93	7.79	7.95	7.89	7.97	8.03	7.9	7.92	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	1.2	<1.0	<1.0	<3.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.3	<1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.13	0.16	0.7	0.23	0.22	0.58	0.26	0.33	0.31	0.24	0.23	0.29	0.2	0.18	0.29
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51.6	54	50.1	47.9	52.4	54.7	53.4	54.7	53.1	48.5	54.2	55.7	50.1	51.6	53.3
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	51.6	54.5	49.6	47.5	51.4	-	-	-	-	-	-	-	-	52.1	51.2
Total dissolved solids	mg/L	-	-	-	1000	-	1000	63	84	72	60	68	65	71	66	67	74	77	66	67	66	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.64	2.12	3.68	2.29	1.91	1.54	1.91	1.71	1.69	1.06	1.89	2.11	2.02	2.11	2.38
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0841	0.129	0.0635	0.0194	0.0272	0.115	0.104	0.147	0.128	0.0687	0.139	0.139	0.0894	0.0678	<0.0050
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0841	0.129	0.0635	0.0194	0.0272	0.115	0.104	0.147	0.128	0.0687	0.139	0.139	0.0894	0.0678	<0.0051
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	0.0069	<0.0050	0.0106	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.005	0.0056	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0028	0.0051	<0.0020	0.0025	0.002	0.0022	0.0024	0.0022	0.0048	0.0079	0.003	0.0073	0.0022	0.0036
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0024	<0.0010	<0.0010	<0.0010	0.0016	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.127	0.209	0.173	0.086	0.112	0.158	0.173	0.187	0.155	0.276	0.198	0.216	0.201	0.138	0.188
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.5	18.2	16.4	16.1	17.6	18.6	18	18.2	17.5	16.3	18.1	18.6	16.8	17.4	17.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.037	0.039	0.035	0.035	0.035	0.035	0.035	0.038	0.035	0.033	0.042	0.038	0.03	0.034	<0.020
Magnesium	mg/L	-	-	-	-	-	-	1.92	2.07	2.22	1.88	2.06	2	2.08	2.21	2.29	1.93	2.21	2.25	2	1.98	2.1
Potassium	mg/L	-	-	-	-	-	-	0.456	0.475	0.523	0.502	0.507	0.49	0.522	0.476	0.518	0.459	0.48	0.546	0.496	0.499	0.527
Sodium	mg/L	-	-	-	-	-	-	0.855	0.984	1.11	0.824	0.942	0.963	1.03	1.11	1.09	0.913	1.16	1.18	0.916	0.944	1.04
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	8.73	7.63	5.65	5.62	6.28	6.81	7.66	8.15	6.88	6.48	8.05	7.85	6.69	5.96	<0.30
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.012	0.0157	0.0293	0.0161	0.0108	0.0427	0.0208	0.0238	0.0228	0.0097	0.0205	0.0146	0.0234	0.0146	0.0193
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.0001	0.00017	0.00012	0.00012	0.00016	0.00014	0.00013	0.00027	0.00012	0.00012	0.00011	0.00012	0.00016	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.0048	0.00521	0.0061	0.00509	0.00495	0.0059	0.00583	0.006	0.00597	0.00504	0.00537	0.0051	0.00552	0.00496	0.00539
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	0.0000058	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.5	18.5	16.2	16	17.3	18.3	17.7	17.9	19.2	16.5	16.8	17.6	17.5	17.6	17
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00059	0.00078	0.00103	0.0005	0.00053	0.00161	0.001	0.00129	0.00154	0.00062	0.0009	0.00085	0.0012	0.00061	0.0008
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	0.041	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	0.000345	0.000735	0.000221	0.000517	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.93	2.02	2.22	1.83	1.99	2.03	2.12	2.22	2.24	1.99	2.11	2.03	1.95	1.94	2.12
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00095	0.00106	0.00288	0.00128	0.00097	0.00161	0.00156	0.00113	0.00111	0.00099	0.00122	0.00114	0.00126	0.00104	0.00161
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00043	0.000751	0.000467	0.000332	0.000363	0.000455	0.000685	0.000701	0.000463	0.000327	0.000743	0.000768	0.000432	0.000328	0.000416
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061	<0.00050	<0.00050	0.00058	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.478	0.479	0.504	0.454	0.478	0.509	0.576	0.481	0.504	0.479	0.478	0.469	0.448	0.417	0.498
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000121	0.000167	0.000172	0.000095	0.00013	0.000114	0.000164	0.000238	0.000106	0.0001	0.000186	0.00019	0.000168	0.000142	0.000132
Silicon	mg/L	-	-	-	-	-	-	1.48	1.86	2.19	1.64	1.3	1.7	1.68	1.68	1.63	1.53	1.77	1.64	1.63	1.68	2.02
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.863	1	1.08	0.814	0.891	0.992	1.13	1.12	0.997	0.966	1.2	1.11	0.945	0.85	1.04
Strontium	mg/L	-	-	-	-	-	-	0.142	0.143	0.114	0.114	0.136	0.136	0.14	0.141	0.142	0.132	0.137	0.134	0.13	0.131	0.131
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000164	0.000182	0.000133	0.000139	0.000169	0.000163	0.000163	0.000163	0.000166	0.000159	0.000159	0.000159	0.000146	0.000132	0.000166
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-57 QUL-57-S 2021-10-27	Quesnel Lake QUL-57 QUL-57-S 2022-05-10	Quesnel Lake QUL-57 QUL-57-S 2022-06-27	Quesnel Lake QUL-57 QUL-57-S 2022-08-16	Quesnel Lake QUL-57 QUL-57-S 2022-10-19	Quesnel Lake QUL-58 QUL-58-AP 2015-12-21	Quesnel Lake QUL-58 QUL-58-AP 2016-11-21	Quesnel Lake QUL-58 QUL-58-AP 2018-01-10	Quesnel Lake QUL-58 QUL-58-AP 2018-01-31	Quesnel Lake QUL-58 QUL-58-AP 2018-10-11	Quesnel Lake QUL-58 QUL-58-AP 2019-05-15	Quesnel Lake QUL-58 QUL-58-AP 2019-05-21	Quesnel Lake QUL-58 QUL-58-AP 2019-10-30	Quesnel Lake QUL-58 QUL-58-AP 2020-09-16	Quesnel Lake QUL-58 QUL-58-AP 2021-05-19
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0066	0.0083	0.0171	0.0114	0.0072	0.0053	0.0084	0.0052	0.0041	0.009	0.0071	0.007	0.0078	0.0092	0.0098
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00015	0.00011	<0.00010	0.00012	0.00011	0.00011	<0.00010	<0.00010	0.0001	0.00011	0.00012	0.00012	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00487	0.00506	0.0061	0.00512	0.00527	0.0052	0.00555	0.00552	0.0056	0.00519	0.0055	0.00609	0.00507	0.00536	0.00512
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	<0.00050	0.00068	0.00097	<0.00050	<0.00050	0.00089	0.00141	0.00074	0.00082	0.00084	0.00062	0.00065	0.00185	0.0007	0.00067
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055	0.000327	0.000222	0.000219	0.000387	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.0003	0.00028	0.00152	0.00043	0.00028	0.00026	0.00023	0.00022	0.0001	0.00051	0.00014	0.00015	0.00022	0.0002	0.00062
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000393	0.000742	0.000486	0.000333	0.000327	0.000402	0.000657	0.00062	0.000371	0.000363	0.000755	0.000789	0.000433	0.000359	0.000424
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000113	0.000183	0.000136	0.000102	0.000075	0.000087	0.000216	0.000258	0.000104	0.000071	0.000168	0.000162	0.000112	0.000106	0.000097
Silicon	mg/L	-	-	-	-	-	-	1.39	1.73	2.19	1.57	1.32	1.59	1.61	1.54	1.56	1.42	1.71	1.7	1.61	1.73	1.84
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.128	0.151	0.116	0.112	0.133	0.131	0.136	0.142	0.139	0.134	0.142	0.147	0.135	0.129	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.00015	0.000162	0.000131	0.000134	0.000158	0.000152	0.00015	0.000163	0.00015	0.000151	0.000161	0.000156	0.000146	0.000143	0.00015
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AP 2021-07-21	Quesnel Lake QUL-58 QUL-58-AP 2021-09-16	Quesnel Lake QUL-58 QUL-58-AP 2021-10-27	Quesnel Lake QUL-58 QUL-58-AP 2022-06-27	Quesnel Lake QUL-58 QUL-58-AP 2022-08-16	Quesnel Lake QUL-58 QUL-58-AP 2022-10-19	Quesnel Lake QUL-58 QUL-58-AT 2016-06-28	Quesnel Lake QUL-58 QUL-58-AT 2016-07-06	Quesnel Lake QUL-58 QUL-58-AT 2016-08-01	Quesnel Lake QUL-58 QUL-58-AT 2016-09-05	Quesnel Lake QUL-58 QUL-58-AT 2016-10-05	Quesnel Lake QUL-58 QUL-58-AT 2016-11-09	Quesnel Lake QUL-58 QUL-58-AT 2016-11-16	Quesnel Lake QUL-58 QUL-58-AT 2016-11-30	Quesnel Lake QUL-58 QUL-58-AT 2017-03-06
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	124.4	109.2	107.9	110.9	110.6	104.8	97	102.4	99.2	100.4	100	104.2	106.5	106.8	106.7
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	8.36	7.85	7.79	7.79	7.86	7.87	7.99	8	8.11	-	-	7.68	7.72	7.82
Turbidity	NTU	1	-	-	-	-	1	0.14	0.03	0.17	0.41	0.41	0	0	0	0	0.17	0.03	0.57	0.38	0	0.44
Temperature	C	-	-	-	-	-	-	8.733	15.386	8.813	4.506	4.502	10.346	13.663	14.401	11.523	16.189	12.564	7.435	8.143	6.794	2.243
Dissolved oxygen	%	-	-	-	-	-	-	94.7	93.7	89.8	90.9	86.8	88.7	95.6	88.6	90.1	93.5	94.1	83.7	88.8	85	85.2
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.98	9.37	10.42	11.75	11.23	9.87	9.89	8.92	9.79	9.19	10.02	9.97	10.47	10.37	11.71
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	47.4	50.3	48.6	51	47.4	43.3	43.2	44.6	46.3	49.5	48.7	50	48.7	49.7	49.2
Specific conductivity	uS/cm	-	-	-	-	-	-	103	112	109	112	112	106	97.4	99.1	102	103	102	110	110	109	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.9	7.94	7.87	7.91	7.84	7.84	7.92	7.7	8	7.82	7.84	7.77	7.85	7.84
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	1.3	<1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.18	0.16	0.13	0.24	0.16	0.22	0.81	0.41	0.35	0.3	0.28	0.55	0.41	0.47	0.74
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	49	50.1	54.5	54.4	54.2	52.4	48.1	47.5	51.1	49.6	52.8	52.5	49.1	53.1	58.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	49.9	52.3	52.1	53.2	55	50	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	75	78	71	73	66	94	70	74	71	54	72	62	73	83	67
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.07	1.76	1.64	2.22	1.88	2.31	2.27	2.22	2.64	1.86	1.8	1.83	1.88	2	1.75
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.108	0.0427	0.0856	0.133	0.147	0.0275	0.0689	0.0664	0.0947	0.0517	0.055	0.137	0.0944	0.112	0.135
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.108	0.0427	0.0856	0.133	0.147	0.0275	0.0689	0.0664	0.0947	0.0517	0.055	0.137	0.0944	0.112	0.135
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	0.0055	<0.0050	0.01	<0.0050	<0.0050	<0.0050	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0035	0.12
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0043	0.0026	<0.0020	0.0031	0.002	<0.0020	0.0042	<0.0020	0.007	0.0028	0.0088	0.0055	<0.0020	0.0049	0.128
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0126
Total nitrogen	mg/L	-	-	-	-	-	-	0.164	0.184	0.163	0.182	0.183	0.112	0.164	0.146	0.235	0.122	0.288	0.219	0.156	0.168	0.187
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	16.6	16.9	18.6	18.2	18.2	17.6	16	15.8	17.3	16.7	18	17.6	16.4	17.8	19.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.03	0.03	0.036	0.034	0.039	0.036	0.034	0.032	0.03	0.034	0.03	0.034	0.033	0.037	0.035
Magnesium	mg/L	-	-	-	-	-	-	1.84	1.91	1.96	2.18	2.13	2.05	1.96	1.98	1.94	1.92	1.93	2.09	1.98	2.12	2.22
Potassium	mg/L	-	-	-	-	-	-	0.482	0.482	0.506	0.501	0.536	0.505	0.524	0.523	0.598	0.483	0.51	0.537	0.488	0.537	0.524
Sodium	mg/L	-	-	-	-	-	-	0.875	0.884	0.88	0.99	1.01	0.951	0.946	0.956	1.01	0.864	0.934	1.11	0.953	1.09	1.68
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.14	6.36	6.99	6.68	7.05	6.32	5.78	5.59	5.81	6.41	6.37	8.04	7.22	7.75	7.16
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0133	0.0116	0.0104	0.0151	0.0114	0.0119	0.0268	0.0251	0.0252	0.0149	0.0288	0.04	0.0233	0.0358	0.0142
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	<0.00010	0.00011	0.00011	0.00011	0.00012	0.00012	0.00018	0.00011	0.00011	0.00013	<0.00010	0.00011	0.00013	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00494	0.00478	0.00502	0.00531	0.00522	0.00524	0.0057	0.00585	0.00546	0.00532	0.00551	0.0059	0.00547	0.00551	0.00511
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	16.9	17.6	17.6	17.7	18.5	16.8	15.5	16.2	16.9	17	18.1	15.7	18.2	16.6	17.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00131
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	<0.00050	0.0006	0.00057	0.00058	0.00062	0.00054	0.00105	0.00099	0.0018	0.00064	0.00183	0.00129	0.00133	0.00132	0.00205
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000272	0.000133	0.000724	0.000077	0.000403	0.000262	0.00102	0.000304	0.000305
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.0012	0.0011	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.88	2.02	1.98	2.19	2.13	1.96	1.91	2.02	1.89	1.94	1.9	2.03	2.07	1.8	2.11
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00107	0.00098	0.00096	0.00131	0.00088	0.00172	0.0023	0.00247	0.00162	0.00112	0.00149	0.00186	0.00141	0.00172	0.00087
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000313	0.00034	0.000415	0.000455	0.000549	0.000341	0.000336	0.000367	0.000338	0.00031	0.000453	0.000747	0.000584	0.00072	0.000609
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.46	0.514	0.499	0.491	0.492	0.473	0.492	0.541	0.491	0.479	0.507	0.557	0.52	0.489	0.501
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000105	0.000105	0.000134	0.000117	0.000134	0.000067	0.000106	0.000107	0.000095	0.00011	0.000112	0.000178	0.000121	0.000169	0.000131
Silicon	mg/L	-	-	-	-	-	-	1.76	1.45	1.61	1.9	1.94	1.34	1.75	1.83	1.6	1.56	1.62	1.7	1.66	1.6	1.69
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.854	0.939	0.912	0.998	1.01	0.861	0.931	0.969	0.92	0.94	0.923	1.14	1.02	0.939	1.43
Strontium	mg/L	-	-	-	-	-	-	0.124	0.133	0.136	0.137	0.142	0.139	0.113	0.114	0.128	0.126	0.139	0.125	0.141	0.14	0.147
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000154	0.00015	0.000173	0.000164	0.000166	0.000156	0.000139	0.000137	0.00015	0.00016	0.000172	0.000163	0.000162	0.000165	0.000147
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	<0.0030	<0.0030	<0.0030	0.0065	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AP 2021-07-21	Quesnel Lake QUL-58 QUL-58-AP 2021-09-16	Quesnel Lake QUL-58 QUL-58-AP 2021-10-27	Quesnel Lake QUL-58 QUL-58-AP 2022-06-27	Quesnel Lake QUL-58 QUL-58-AP 2022-08-16	Quesnel Lake QUL-58 QUL-58-AP 2022-10-19	Quesnel Lake QUL-58 QUL-58-AT 2016-06-28	Quesnel Lake QUL-58 QUL-58-AT 2016-07-06	Quesnel Lake QUL-58 QUL-58-AT 2016-08-01	Quesnel Lake QUL-58 QUL-58-AT 2016-09-05	Quesnel Lake QUL-58 QUL-58-AT 2016-10-05	Quesnel Lake QUL-58 QUL-58-AT 2016-11-09	Quesnel Lake QUL-58 QUL-58-AT 2016-11-16	Quesnel Lake QUL-58 QUL-58-AT 2016-11-30	Quesnel Lake QUL-58 QUL-58-AT 2017-03-06
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0085	0.0086	0.0068	0.0078	0.0074	0.0074	0.013	0.0148	0.0145	0.0086	0.0115	0.0058	0.0065	0.0077	0.0063
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	0.00012	<0.00010	<0.00010	0.00011	0.00011	<0.00010	0.0001	0.0001
Barium	mg/L	-	-	-	-	-	-	0.00491	0.00511	0.00485	0.00545	0.00522	0.00526	0.00547	0.00562	0.00579	0.0051	0.00523	0.00522	0.00507	0.00535	0.0053
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000123	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	<0.00050	0.00062	<0.00050	0.00053	0.00065	0.00051	0.00086	0.00085	0.00476	0.0016	0.00104	0.0008	0.00077	0.00083	0.00345
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000334	0.000235	0.00118	0.000138	0.000468	0.000237	0.00107	0.00022	0.000609
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
Manganese	mg/L	-	-	-	-	-	-	0.00013	0.0003	0.00029	0.00015	0.00019	0.00054	0.001	0.00121	0.00176	0.00033	0.00045	0.00018	0.00016	0.00028	0.00011
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000315	0.000292	0.000399	0.000442	0.000569	0.000345	0.000337	0.000331	0.00038	0.00031	0.000449	0.000783	0.000502	0.000675	0.000666
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000093	0.000073	0.000086	0.000128	0.000128	0.000067	0.000105	0.000096	0.000098	0.000095	0.000113	0.000187	0.000136	0.000148	0.00014
Silicon	mg/L	-	-	-	-	-	-	1.62	1.38	1.4	1.94	1.9	1.3	1.72	1.77	1.59	1.5	1.51	1.6	1.5	1.75	1.67
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.127	0.116	0.139	0.129	0.132	0.13	0.114	0.111	0.127	0.128	0.136	0.139	0.134	0.136	0.164
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000148	0.000141	0.000162	0.000149	0.000164	0.000155	0.000138	0.000129	0.000147	0.000141	0.000156	0.000156	0.000157	0.000155	0.000145
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0119	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AT 2017-04-10	Quesnel Lake QUL-58 QUL-58-AT 2017-06-05	Quesnel Lake QUL-58 QUL-58-AT 2017-06-12	Quesnel Lake QUL-58 QUL-58-AT 2017-06-19	Quesnel Lake QUL-58 QUL-58-AT 2017-06-27	Quesnel Lake QUL-58 QUL-58-AT 2017-08-22	Quesnel Lake QUL-58 QUL-58-AT 2017-10-01	Quesnel Lake QUL-58 QUL-58-AT 2017-10-26	Quesnel Lake QUL-58 QUL-58-AT 2018-06-04	Quesnel Lake QUL-58 QUL-58-AT 2018-06-13	Quesnel Lake QUL-58 QUL-58-AT 2018-06-18	Quesnel Lake QUL-58 QUL-58-AT 2018-06-27	Quesnel Lake QUL-58 QUL-58-AT 2018-07-02	Quesnel Lake QUL-58 QUL-58-AT 2018-08-23	Quesnel Lake QUL-58 QUL-58-AT 2018-09-04
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	109.9	109.5	104.3	102.9	122.2	105.1	122	112.9	111.3	104.3	101.2	99.6	94.1	101.5	100.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.35	7.68	7.71	7.78	7.78	8.32	-	7.85	7.32	7.62	7.57	7.9	7.58	7.8	7.84
Turbidity	NTU	1	-	-	-	-	1	0.83	0.64	0.34	0.74	0	0	0.32	0.2	0	0	0	0	0.22	6.19	0.05
Temperature	C	-	-	-	-	-	-	2.679	9.944	10.08	8.723	5.347	10.715	5	8.911	6.146	6.784	9.383	13.937	7.346	16.376	14.856
Dissolved oxygen	%	-	-	-	-	-	-	85.3	94.6	93.6	91.3	86.1	91.4	-	94.4	92.2	90.5	94.4	97.4	94.1	94.2	94.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.58	10.69	10.55	10.61	10.89	10.12	-	10.94	11.41	11	10.79	10.01	11.28	9.16	9.56
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.1	48.8	45.6	46.4	51.4	47.8	49.2	48.6	47.6	48.4	46.5	46.2	48	46.5	48.4
Specific conductivity	uS/cm	-	-	-	-	-	-	117	108	101	100	119	105	105	103	102	106	100	101	105	99.4	107
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.93	7.86	7.99	7.89	7.9	7.89	7.88	7.93	7.9	7.92	7.92	7.88	7.93	7.93	8.01
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	3.8	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.59	0.63	0.73	0.41	0.31	0.28	0.25	0.35	0.54	0.39	0.38	0.4	0.54	0.28	0.35
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54.8	50.3	49	48.1	57.4	49.2	49.3	49.5	51.3	51.1	50.3	48.2	50.4	49	49.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	61	72	67	72	79	69	62	65	72	67	68	59	70	69	64
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.89	2.33	1.89	1.94	2.11	2.47	1.57	1.74	2.19	2.25	2.36	2.49	2.06	1.74	1.73
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.137	0.121	0.111	0.118	0.195	0.0862	0.112	0.0776	0.116	0.122	0.0983	0.0833	0.105	0.0373	0.0501
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.137	0.121	0.111	0.118	0.195	0.0862	0.112	0.0776	0.116	0.122	0.0983	0.0833	0.105	0.0373	0.0501
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.007	0.0091
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0032	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0031	<0.0020	0.0047	<0.0020	<0.0020	<0.0020	<0.0020	0.0038	0.0031	0.0043	0.0042	0.005	0.0054	0.0049	0.0058
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.0023	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.0022	<0.0010	0.0016	0.0018
Total nitrogen	mg/L	-	-	-	-	-	-	0.198	0.197	0.204	0.185	0.241	0.16	0.17	0.144	0.175	0.185	0.138	0.186	0.172	0.122	0.16
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.3	16.7	16.2	16.1	19.1	16.7	16.5	16.5	17	17	16.7	15.9	16.8	16.5	16.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.032	0.034	0.033	0.032	0.037	0.03	0.032	0.033	0.036	0.037	0.035	0.033	0.032	0.032	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.21	2.09	2.08	1.95	2.35	1.85	1.98	2	2.13	2.09	2.09	2.05	2.05	1.88	1.94
Potassium	mg/L	-	-	-	-	-	-	0.571	0.517	0.513	0.506	0.548	0.47	0.48	0.477	0.544	0.519	0.518	0.515	0.51	0.506	0.487
Sodium	mg/L	-	-	-	-	-	-	1.12	1.02	1.01	0.964	1.41	0.874	0.938	0.902	1.06	0.998	0.962	0.942	0.961	0.918	0.938
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.4	6.52	6.17	6.2	10.6	6.2	6.49	6.63	6.57	6.2	6.01	5.95	6.1	6.3	6.34
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0311	0.0264	0.0345	0.0256	0.02	0.0107	0.0112	0.0109	0.0254	0.016	0.018	0.0148	0.0128	0.0158	0.0195
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00013	0.00014	0.00013	0.00014	<0.00010	0.00011	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00024	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00583	0.00566	0.0061	0.00551	0.00606	0.00509	0.00559	0.00574	0.00565	0.00567	0.00583	0.00599	0.00551	0.00589	0.00552
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.9	16.7	17.5	16.1	19.4	17.1	17.4	17.3	15.5	16.6	16.5	15.7	15.7	16.5	16.4
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.0012	0.00083	0.00081	0.0007	0.0009	0.00057	0.00068	0.00066	0.0008	0.00093	0.00082	0.00081	0.00097	0.00135	0.00097
Iron	mg/L	-	-	1	-	-	1	<0.030	0.033	0.04	0.032	<0.030	<0.030	<0.030	<0.030	0.036	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000136	0.000203	0.000097	0.00006	0.000218	0.00006	0.000153	0.000149	0.000243	0.00089	0.000445	0.000448	0.000684	0.000805	0.000303
Lithium	mg/L	-	-	-	-	-	-	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.21	1.99	2.12	1.96	2.33	1.93	1.98	2.08	2.04	2.11	2.15	2.02	2.01	1.92	1.87
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.002	0.00195	0.00236	0.00181	0.0019	0.00134	0.00164	0.00103	0.00215	0.00162	0.00173	0.00138	0.00109	0.00154	0.00133
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000657	0.000468	0.000425	0.000426	0.00153	0.000331	0.000373	0.000335	0.000401	0.00038	0.000388	0.000372	0.000353	0.000355	0.000318
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.532	0.505	0.52	0.521	0.576	0.432	0.491	0.495	0.513	0.523	0.519	0.536	0.513	0.47	0.444
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000149	0.000097	0.000112	0.000096	0.000393	0.000092	0.000074	0.000122	0.000137	0.000109	0.000161	0.000113	0.000116	0.000118	0.000115
Silicon	mg/L	-	-	-	-	-	-	1.9	1.68	1.83	1.83	1.82	1.52	1.64	1.6	1.8	1.84	1.97	1.76	1.8	1.61	1.51
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.12	0.989	0.971	0.961	1.38	0.842	0.954	0.949	1.01	0.987	0.978	0.991	0.999	0.871	0.84
Strontium	mg/L	-	-	-	-	-	-	0.144	0.13	0.127	0.121	0.155	0.131	0.134	0.134	0.125	0.13	0.125	0.12	0.121	0.12	0.129
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000166	0.000144	0.00014	0.000149	0.000181	0.000152	0.000156	0.000138	0.000157	0.000146	0.000146	0.000144	0.000155	0.000145	0.000157
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AT 2017-04-10	Quesnel Lake QUL-58 QUL-58-AT 2017-06-05	Quesnel Lake QUL-58 QUL-58-AT 2017-06-12	Quesnel Lake QUL-58 QUL-58-AT 2017-06-19	Quesnel Lake QUL-58 QUL-58-AT 2017-06-27	Quesnel Lake QUL-58 QUL-58-AT 2017-08-22	Quesnel Lake QUL-58 QUL-58-AT 2017-10-01	Quesnel Lake QUL-58 QUL-58-AT 2017-10-26	Quesnel Lake QUL-58 QUL-58-AT 2018-06-04	Quesnel Lake QUL-58 QUL-58-AT 2018-06-13	Quesnel Lake QUL-58 QUL-58-AT 2018-06-18	Quesnel Lake QUL-58 QUL-58-AT 2018-06-27	Quesnel Lake QUL-58 QUL-58-AT 2018-07-02	Quesnel Lake QUL-58 QUL-58-AT 2018-08-23	Quesnel Lake QUL-58 QUL-58-AT 2018-09-04
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0072	0.0096	0.01	0.0089	0.0084	0.0076	0.0058	0.0054	0.008	0.0077	0.0101	0.0117	0.0083	0.008	0.0407
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00011	0.00013	0.00012	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.00012	0.00012	0.00017	0.00011	0.00011	0.00013
Barium	mg/L	-	-	-	-	-	-	0.00534	0.00545	0.00535	0.00537	0.00557	0.00508	0.00527	0.00546	0.00597	0.00559	0.00585	0.00576	0.00573	0.00579	0.0102
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00076	0.00089	0.0007	0.00057	0.0009	0.0006	0.00059	0.00055	0.0007	0.00062	0.00065	0.00054	0.00079	0.00088	0.00156
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032
Lead	mg/L	-	-	-	-	-	-	0.000275	0.000385	0.000131	0.000053	0.000284	0.000117	0.000138	0.000077	0.000272	0.00104	0.000302	0.000369	0.000901	0.000462	0.000242
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00066	0.00053	0.00043	0.00024	0.00084	0.00027	0.00088	0.00015	0.00074	0.00029	0.00037	0.00054	0.00032	0.00032	0.00122
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000604	0.000444	0.000422	0.000446	0.00157	0.000274	0.000338	0.000303	0.000434	0.000376	0.000354	0.000353	0.000356	0.000337	0.000334
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000119	0.000137	0.000107	0.000109	0.000336	0.000078	0.000065	0.000062	0.000106	0.000095	0.000101	0.000106	0.000104	0.000081	0.000107
Silicon	mg/L	-	-	-	-	-	-	1.71	1.68	1.79	1.79	1.68	1.55	1.56	1.53	1.77	1.71	1.72	1.71	1.69	1.52	1.53
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.126	0.125	0.121	0.149	0.127	0.126	0.133	0.13	0.13	0.126	0.118	0.129	0.124	0.131
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000156	0.00015	0.000154	0.000139	0.000153	0.000136	0.000156	0.000126	0.000154	0.000148	0.000158	0.000135	0.000145	0.000149	0.000149
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AT 2018-10-18	Quesnel Lake QUL-58 QUL-58-AT 2018-10-24	Quesnel Lake QUL-58 QUL-58-AT 2018-10-29	Quesnel Lake QUL-58 QUL-58-AT 2018-11-07	Quesnel Lake QUL-58 QUL-58-AT 2019-05-08	Quesnel Lake QUL-58 QUL-58-AT 2019-05-15	Quesnel Lake QUL-58 QUL-58-AT 2019-06-18	Quesnel Lake QUL-58 QUL-58-AT 2019-07-11	Quesnel Lake QUL-58 QUL-58-AT 2019-07-25	Quesnel Lake QUL-58 QUL-58-AT 2019-08-20	Quesnel Lake QUL-58 QUL-58-AT 2020-06-16	Quesnel Lake QUL-58 QUL-58-AT 2020-06-24	Quesnel Lake QUL-58 QUL-58-AT 2020-06-29	Quesnel Lake QUL-58 QUL-58-AT 2020-07-21	Quesnel Lake QUL-58 QUL-58-AT 2020-08-11
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	107.2	105.9	101.6	104.5	113.8	112.8	99.6	101.7	109.1	101.4	111.4	-	104.3	-	99.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.31	7.68	7.8	7.89	7.86	7.93	7.99	7.9	7.94	7.75	-	7.63	-	7.6
Turbidity	NTU	1	-	-	-	-	1	0	0	0.1	0.26	0.22	0.44	0.48	1.11	0.38	0	0.52	-	0.24	-	0
Temperature	C	-	-	-	-	-	-	8.557	8.545	8.429	6.583	5.056	4.746	13.512	15.728	8.062	16.712	9.058	-	7.846	-	10.545
Dissolved oxygen	%	-	-	-	-	-	-	88.3	88.1	98.6	89.5	91.3	90.1	105.4	97.7	88.4	96.7	97.1	-	90.8	-	90.7
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.3	10.3	11.55	10.97	11.64	11.55	10.96	9.69	10.44	9.39	11.2	-	10.79	-	10.09
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.6	50	50.3	49.6	52	50.1	44.8	46.4	45	45.4	48	46.6	45.4	43.2	43.9
Specific conductivity	uS/cm	-	-	-	-	-	-	107	109	109	110	117	113	101	99.9	101	100	107	96.5	105	98.4	99.6
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.91	7.98	7.87	7.95	7.84	7.97	8	7.91	7.89	7.96	7.8	7.79	7.85	7.45	7.95
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.4	1.7
Turbidity	NTU	1	-	-	-	-	1	0.26	0.25	0.25	0.17	0.23	0.17	0.24	0.2	0.33	0.28	0.78	0.55	0.3	1.18	0.47
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51.6	52.3	50.6	54.3	56.5	54.4	48.3	51.9	47.7	46.1	51.2	48.6	52	47	45.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49.6	47.3	50	48.9	49.5
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	68	68	64	76	70	64	59	58	64	68	60	70	73	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.66	1.6	2.73	1.83	1.84	2.25	1.77	1.83	2.21	2.03	3.12	2.96	2.42	3.92	3.14
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0813	0.0757	0.0792	0.087	0.13	0.133	0.0864	0.0819	0.0916	0.0474	0.0933	0.0824	0.11	0.0164	0.0284
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0813	0.0757	0.0792	0.087	0.13	0.133	0.0864	0.0819	0.0916	0.0474	0.0937	0.0828	0.11	<0.0500	0.0288
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	0.0053	<0.0050	<0.0050	0.0053	<0.0050	0.0061	<0.0050	0.0056	<0.0050	0.0078	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0023	<0.0020	<0.0020	<0.0020	0.0034	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0032
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0033	<0.0020	<0.0020	0.0045	0.0032	0.0041	0.0134	0.0065	0.0129	0.0028	0.007	0.005	0.0137	0.0069	0.0035
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0018	0.0012	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.167	0.144	0.138	0.162	0.198	0.199	0.186	0.156	0.183	0.134	0.204	0.18	0.2	0.159	0.15
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.3	17	18.1	19	18.1	16.2	17.7	15.9	15.1	16.9	16.1	17.5	15.3	15
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.033	0.035	0.032	0.032	0.036	0.039	0.036	0.037	0.037	0.033	0.037	0.038	0.038	0.037	0.035
Magnesium	mg/L	-	-	-	-	-	-	1.88	2.2	2	2.19	2.24	2.26	1.88	1.85	1.95	2.07	2.17	2.01	2	2.14	2.03
Potassium	mg/L	-	-	-	-	-	-	0.497	0.504	0.486	0.53	0.539	0.481	0.497	0.475	0.483	0.464	0.526	0.473	0.513	0.561	0.51
Sodium	mg/L	-	-	-	-	-	-	0.913	1.04	0.923	0.984	1.16	1.12	0.902	0.94	0.93	0.952	1.04	0.952	0.974	1.04	0.979
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.63	6.57	6.11	6.59	7.43	7.52	5.99	6.32	6.07	5.79	6.31	5.79	6.26	5.18	5.63
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0081	0.008	0.0095	0.0178	0.0162	0.0181	0.0165	0.0123	0.0168	0.0114	0.0417	0.0291	0.0218	0.0697	0.0343
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	<0.00010	0.00013	0.00012	0.00017	0.00013	0.00011	0.00011	0.00011	0.00012	0.00014	0.00014	0.00015	0.00019	0.00016
Barium	mg/L	-	1W	-	-	-	1	0.00516	0.00504	0.00544	0.00567	0.00506	0.00514	0.00504	0.00576	0.00569	0.00531	0.00609	0.00576	0.00536	0.00716	0.00595
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000074	0.0000056	0.0000055	0.0000058	0.0000051
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.4	17.4	17.4	17.1	17.1	15.8	16.4	15.9	14.5	16.4	15.7	16.6	16	16.2
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00052	<0.00050	0.00054	0.00092	0.00079	0.00085	0.00062	0.00053	0.00089	0.00051	0.00096	0.00074	0.00063	0.0011	0.00101
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.058	0.043	<0.030	0.085	0.04
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.95	1.84	2.06	2.01	2.01	2.19	1.87	1.86	1.9	1.83	2.11	1.98	2.07	2.14	2.22
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00095	0.00084	0.00104	0.00099	0.00104	0.0012	0.00167	0.00109	0.00139	0.00108	0.00333	0.00226	0.00152	0.00307	0.0036
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000355	0.000349	0.000346	0.00039	0.00066	0.000633	0.000351	0.000325	0.000368	0.000325	0.000453	0.000376	0.000364	0.00044	0.000361
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	0.00051	<0.00050	0.00067	0.00052
Potassium	mg/L	-	-	-	-	-	-	0.461	0.459	0.497	0.512	0.484	0.477	0.476	0.503	0.466	0.481	0.538	0.49	0.505	0.568	0.51
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.0001	0.000093	0.000078	0.00013	0.000143	0.000145	0.000068	0.000113	0.000134	0.00008	0.000142	0.000137	0.00014	0.00017	0.000125
Silicon	mg/L	-	-	-	-	-	-	1.51	1.48	1.5	1.53	1.69	1.79	1.66	1.66	1.66	1.57	2.1	1.9	1.91	2.25	2.03
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.875	0.897	0.937	0.988	1.1	1.17	0.882	0.898	0.944	0.893	1.05	0.918	1	1.06	1
Strontium	mg/L	-	-	-	-	-	-	0.134	0.13	0.127	0.137	0.142	0.137	0.121	0.123	0.125	0.109	0.123	0.112	0.122	0.108	0.11
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000148	0.00014	0.000152	0.000162	0.000164	0.000156	0.000147	0.000144	0.000153	0.000129	0.000142	0.000132	0.000139	0.000131	0.000138
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-AT 2018-10-18	Quesnel Lake QUL-58 QUL-58-AT 2018-10-24	Quesnel Lake QUL-58 QUL-58-AT 2018-10-29	Quesnel Lake QUL-58 QUL-58-AT 2018-11-07	Quesnel Lake QUL-58 QUL-58-AT 2019-05-08	Quesnel Lake QUL-58 QUL-58-AT 2019-05-15	Quesnel Lake QUL-58 QUL-58-AT 2019-06-18	Quesnel Lake QUL-58 QUL-58-AT 2019-07-11	Quesnel Lake QUL-58 QUL-58-AT 2019-07-25	Quesnel Lake QUL-58 QUL-58-AT 2019-08-20	Quesnel Lake QUL-58 QUL-58-AT 2020-06-16	Quesnel Lake QUL-58 QUL-58-AT 2020-06-24	Quesnel Lake QUL-58 QUL-58-AT 2020-06-29	Quesnel Lake QUL-58 QUL-58-AT 2020-07-21	Quesnel Lake QUL-58 QUL-58-AT 2020-08-11
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0053	0.0057	0.0054	0.006	0.0062	0.0067	0.0103	0.0094	0.0086	0.0095	0.0133	0.0121	0.0095	0.019	0.0131
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.0001	<0.00010	0.0001	<0.00010	0.00011	0.0001	<0.00010	<0.00010	0.00012	0.00013	<0.00010	0.00011	0.00018	0.00017
Barium	mg/L	-	-	-	-	-	-	0.00487	0.00528	0.00527	0.00553	0.00566	0.0056	0.00551	0.00516	0.00526	0.00539	0.00605	0.00552	0.00562	0.00585	0.00609
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00053	0.00056	<0.00050	0.00058	0.00056	0.00058	<0.00050	<0.00050	<0.00050	<0.00050	0.00077	0.00054	0.00052	0.00084	0.00074
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00024	0.00025	0.0001	0.00013	0.00025	0.00016	0.00072	<0.00010	<0.00010	0.0001	0.0005	0.0002	0.00012	0.00024	0.00011
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000329	0.000361	0.000359	0.000396	0.000708	0.000636	0.000329	0.000323	0.000337	0.000361	0.000445	0.000361	0.000376	0.00045	0.000439
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000083	0.000083	0.000062	0.000092	0.000166	0.000165	0.000113	0.000099	0.000097	0.000135	0.000124	0.00014	0.000103	0.000141	0.00014
Silicon	mg/L	-	-	-	-	-	-	1.32	1.4	1.41	1.45	1.72	1.68	1.73	1.52	1.74	1.66	2.02	1.97	1.91	2.18	1.88
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.141	0.137	0.148	0.145	0.144	0.117	0.12	0.119	0.117	0.121	0.122	0.127	0.102	0.113
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000163	0.000154	0.00015	0.000171	0.000188	0.000173	0.00015	0.000144	0.00014	0.00014	0.000133	0.000132	0.000138	0.000135	0.000122
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2015-11-05	Quesnel Lake QUL-58 QUL-58-B 2015-11-30	Quesnel Lake QUL-58 QUL-58-B 2015-12-02	Quesnel Lake QUL-58 QUL-58-B 2015-12-09	Quesnel Lake QUL-58 QUL-58-B 2015-12-14	Quesnel Lake QUL-58 QUL-58-B 2015-12-30	Quesnel Lake QUL-58 QUL-58-B 2016-01-25	Quesnel Lake QUL-58 QUL-58-B 2016-02-23	Quesnel Lake QUL-58 QUL-58-B 2016-03-28	Quesnel Lake QUL-58 QUL-58-B 2016-04-27	Quesnel Lake QUL-58 QUL-58-B 2016-05-05	Quesnel Lake QUL-58 QUL-58-B 2016-05-10	Quesnel Lake QUL-58 QUL-58-B 2016-05-17	Quesnel Lake QUL-58 QUL-58-B 2016-05-25	Quesnel Lake QUL-58 QUL-58-B 2016-06-07
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	-	150.8	148.2	150.3	143.1	160.1	-	108.9	110.4	104.2	108.7	109.3	112.1	109.2	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.78	7.74	7.74	7.45	7.62	-	7.67	7.9	7.98	7.81	7.46	7.56	7.42	-
Turbidity	NTU	1	-	-	-	-	1	-	0.71	0.71	0.76	0.81	0.62	-	1.05	0.69	0.85	0.79	1	0.57	0.4	-
Temperature	C	-	-	-	-	-	-	-	5.396	5.163	5.001	4.788	3.72	-	2.683	3.128	4.086	4.26	4.449	4.85	4.637	-
Dissolved oxygen	%	-	-	-	-	-	-	-	82.2	81.9	81.7	83	83.3	-	84.1	87	88.4	87.6	85.3	86.1	86.2	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	10.39	10.41	10.43	10.66	11	-	11.41	11.67	11.56	11.4	11.05	11.04	11.1	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.7	50.8	48	47.8	50.3	49.4	48.6	48.6	49.2	50.3	49.3	49.4	51.6	47.5	52
Specific conductivity	uS/cm	-	-	-	-	-	-	111	112	111	112	113	113	113	115	113	115	114	113	120	114	123
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.95	7.8	7.57	7.79	7.86	7.76	7.84	7.78	7.83	7.87	7.92	7.87	7.98	7.42	7.82
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	1.9	<1.0	<1.0	<1.0	<1.0	4.3	2.2	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.25	0.91	0.79	0.46	0.66	0.9	0.63	0.64	0.73	0.44	0.45	0.37	1.95	0.37	0.36
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.5	52.9	53.2	54	57.6	53.2	55.1	53.5	53	54.4	55.7	56.1	55.4	55.3	58.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	60	71	63	71	72	71	58	74	63	69	75	54	73	74
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.52	1.49	1.5	1.68	1.46	1.76	1.61	1.6	1.48	1.78	1.88	1.82	1.67	1.69	1.91
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0679	0.104	0.105	0.112	0.114	0.116	0.124	0.123	0.13	0.128	0.149	0.129	0.168	0.144	0.198
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0679	0.104	0.105	0.112	0.114	0.116	0.124	0.123	0.13	0.128	0.149	0.129	0.168	0.144	0.198
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0041	0.0022	0.0031	0.0041	0.003	0.0082	0.0041	0.0067	<0.0020	0.0027	<0.0020	0.0045	0.0056	0.0035
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.124	0.146	0.143	0.159	0.165	0.169	0.172	0.162	0.183	0.193	0.188	0.17	0.215	0.203	0.25
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17.8	17.9	17.9	18.3	19.6	18	18.7	18.1	17.8	18.3	18.7	18.9	18.5	18.6	19.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.032	0.035	0.035	0.033	0.035	0.037	0.033	0.035	0.033	0.038	0.04	0.036	0.035	0.036	0.038
Magnesium	mg/L	-	-	-	-	-	-	1.95	2	2.03	2.02	2.1	2.02	2.06	2.02	2.06	2.12	2.17	2.16	2.21	2.16	2.36
Potassium	mg/L	-	-	-	-	-	-	0.503	0.523	0.431	0.496	0.503	0.518	0.487	0.492	0.541	0.498	0.512	0.503	0.568	0.502	0.631
Sodium	mg/L	-	-	-	-	-	-	0.887	0.982	0.854	0.997	0.951	0.99	1.02	1	1.05	1.02	1.16	1.05	1.18	1.11	1.49
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.66	6.72	6.6	6.84	6.58	6.75	7.15	7	7.25	7.48	8.59	7.29	9.38	7.81	11.4
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0113	0.037	0.0358	0.0452	0.0501	0.0328	0.033	0.0348	0.0457	0.0353	0.038	0.0346	0.136	0.0363	0.0248
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00013	0.00014	0.00013	0.00013	0.00012	0.00013	0.00011	0.0001	0.0001	0.00012	0.00012	0.00012	0.0002	0.00014	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00548	0.00582	0.00566	0.0058	0.00648	0.00584	0.0057	0.00531	0.0059	0.00583	0.00598	0.00562	0.00775	0.00607	0.0061
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.4	18.1	17.8	17.9	18.9	17.6	18.7	17.7	17.8	18	18.9	18.1	18.4	18.3	18.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00066	0.00142	0.00136	0.00281	0.00157	0.00169	0.00151	0.00144	0.00187	0.00151	0.00769	0.00142	0.00437	0.00152	0.00127
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	0.031	<0.030	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.093	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000137	0.000095	0.000132	0.000308	0.000258	0.000062	0.000192	0.000626	0.000108	0.000181	0.000666	0.000071	0.000152	0.000071	0.000063
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.0012	<0.0010	0.0012	<0.0010	0.0011
Magnesium	mg/L	-	-	-	-	-	-	1.91	2.05	2.04	2.04	2.09	2.1	2.08	2.05	2.11	2.12	2.23	2.1	2.28	2.14	2.3
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00109	0.00161	0.00167	0.00158	0.00196	0.00121	0.00156	0.00142	0.00189	0.00212	0.00251	0.00164	0.0039	0.00177	0.00266
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	<0.0000050	-	-	<0.0000050	-	<0.0000050	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000301	0.000412	0.000404	0.000474	0.000443	0.000474	0.000591	0.000498	0.00061	0.000583	0.000873	0.000569	0.00118	0.000805	0.00183
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.503	0.504	0.5	0.524	0.511	0.548	0.509	0.478	0.539	0.521	0.542	0.511	0.62	0.512	0.65
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000088	0.000134	0.000089	0.000103	0.00011	0.000127	0.000108	0.000115	0.000128	0.000146	0.000177	0.000116	0.000218	0.00017	0.000394
Silicon	mg/L	-	-	-	-	-	-	1.47	1.65	1.66	1.67	1.78	1.63	1.73	1.69	1.75	1.79	1.78	1.8	1.97	1.78	1.78
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.878	0.97	0.958	1.02	0.96	1.06	1.06	0.993	1.05	1.05	1.19	1.06	1.21	1.12	1.52
Strontium	mg/L	-	-	-	-	-	-	0.119	0.137	0.134	0.139	0.128	0.142	0.14	0.139	0.141	0.135	0.141	0.138	0.138	0.14	0.157
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0005	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000162	0.000168	0.000164	0.000173	0.000156	0.000163	0.000166	0.000171	0.000174	0.000169	0.000169	0.000163	0.000172	0.000171	0.00017
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00092	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2015-11-05	Quesnel Lake QUL-58 QUL-58-B 2015-11-30	Quesnel Lake QUL-58 QUL-58-B 2015-12-02	Quesnel Lake QUL-58 QUL-58-B 2015-12-09	Quesnel Lake QUL-58 QUL-58-B 2015-12-14	Quesnel Lake QUL-58 QUL-58-B 2015-12-30	Quesnel Lake QUL-58 QUL-58-B 2016-01-25	Quesnel Lake QUL-58 QUL-58-B 2016-02-23	Quesnel Lake QUL-58 QUL-58-B 2016-03-28	Quesnel Lake QUL-58 QUL-58-B 2016-04-27	Quesnel Lake QUL-58 QUL-58-B 2016-05-05	Quesnel Lake QUL-58 QUL-58-B 2016-05-10	Quesnel Lake QUL-58 QUL-58-B 2016-05-17	Quesnel Lake QUL-58 QUL-58-B 2016-05-25	Quesnel Lake QUL-58 QUL-58-B 2016-06-07
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0049	0.006	0.0056	0.0046	0.0064	0.0063	0.0049	0.0054	0.0066	0.0063	0.0064	0.007	0.0074	0.0075	0.008
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	0.00011	<0.00010	0.00011	0.0001	0.00011	0.0001	<0.00010	<0.00010	0.00011	0.00011	0.0001	0.00012	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00517	0.00523	0.00452	0.0052	0.00539	0.00546	0.00499	0.00496	0.0053	0.0053	0.00542	0.00528	0.00546	0.00535	0.00608
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000058	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00056	0.00078	0.00078	0.00086	0.0008	0.00078	0.00087	0.00093	0.00097	0.00098	0.00104	0.00114	0.00103	0.00129	0.00095
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000159	0.000109	0.000149	0.000172	0.000102	<0.000050	0.000365	0.000451	0.000194	0.000097	0.000278	0.000125	0.000098	0.000106	0.000126
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.0011
Manganese	mg/L	-	-	-	-	-	-	0.00031	0.00033	0.00022	0.00023	0.0002	0.0002	0.00038	0.00031	0.00075	0.00077	0.00099	0.00032	0.00076	0.00037	0.00131
Mercury	mg/L	-	-	-	-	-	-	-	<0.0000050	-	-	<0.0000050	-	<0.0000050	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000277	0.000393	0.000397	0.000412	0.000414	0.000446	0.000535	0.000468	0.000553	0.000552	0.000786	0.000533	0.00105	0.000687	0.00178
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000074	0.000091	0.000127	0.000091	0.00011	0.000108	0.000113	0.000116	0.000141	0.000115	0.00019	0.000138	0.000271	0.000158	0.000376
Silicon	mg/L	-	-	-	-	-	-	1.47	1.55	1.58	1.61	1.69	1.57	1.65	1.65	1.66	1.72	1.69	1.76	1.72	1.72	1.75
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.121	0.135	0.131	0.136	0.124	0.136	0.137	0.135	0.138	0.132	0.135	0.135	0.135	0.137	0.155
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000156	0.000158	0.000161	0.000158	0.000153	0.000155	0.000157	0.000163	0.000161	0.000164	0.000161	0.000156	0.000161	0.00016	0.000168
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2016-06-20	Quesnel Lake QUL-58 QUL-58-B 2016-06-28	Quesnel Lake QUL-58 QUL-58-B 2016-07-06	Quesnel Lake QUL-58 QUL-58-B 2016-08-01	Quesnel Lake QUL-58 QUL-58-B 2016-09-05	Quesnel Lake QUL-58 QUL-58-B 2016-10-05	Quesnel Lake QUL-58 QUL-58-B 2016-11-09	Quesnel Lake QUL-58 QUL-58-B 2016-11-16	Quesnel Lake QUL-58 QUL-58-B 2016-11-30	Quesnel Lake QUL-58 QUL-58-B 2017-02-02	Quesnel Lake QUL-58 QUL-58-B 2017-03-06	Quesnel Lake QUL-58 QUL-58-B 2017-04-10	Quesnel Lake QUL-58 QUL-58-B 2017-05-09	Quesnel Lake QUL-58 QUL-58-B 2017-05-15	Quesnel Lake QUL-58 QUL-58-B 2017-05-22
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	111.2	109.7	108.7	108.4	111.1	111	108.5	113	106.6	119.8	108.5	110.9	113.4	114.2	110.8	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.68	7.5	7.65	7.7	7.72	-	-	7.52	7.75	7.67	7.78	7.37	7.42	7.52	7.53	
Turbidity	NTU	1	-	-	-	-	1	0	0	0	0	0.34	0.48	1.41	1.07	0	0.76	1.17	1.14	0.64	0	0	
Temperature	C	-	-	-	-	-	-	4.916	4.52	4.464	4.667	4.96	5.082	5.386	5.468	5.95	3.044	3.276	2.988	3.928	4.048	4.014	
Dissolved oxygen	%	-	-	-	-	-	-	84.9	86.1	83.8	82.5	83.2	82.9	81	81.3	81.9	82.7	80.9	80.4	87.8	93	84.8	
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.9	11.1	10.85	10.63	10.63	10.56	10.24	10.26	10.21	11.11	10.81	10.83	11.53	12.18	11.11	
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.9	47	49.8	48.6	52.3	51.7	49.9	49.1	50.2	49.6	49.4	49.5	49.4	49.8	50.4	
Specific conductivity	uS/cm	-	-	-	-	-	-	116	110	114	116	117	113	113	113	112	115	114	118	112	113	114	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.81	7.8	7.89	7.67	7.87	7.79	7.81	7.7	7.79	7.92	7.86	7.91	7.81	7.88	7.94	
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	1.6	<1.0	<1.0	4	1	<1.0	
Turbidity	NTU	1	-	-	-	-	1	0.42	0.35	0.31	0.31	0.26	0.74	0.67	0.97	0.94	0.5	0.62	0.99	0.89	0.65	0.44	
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.9	55.7	54.4	56	54.8	55.6	54.2	51.3	53.5	57.1	50.7	54.5	54.9	53.3	51.8	
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total dissolved solids	mg/L	-	-	-	1000	-	1000	82	79	88	78	80	79	64	74	83	83	71	68	71	76	70	
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.66	1.56	1.55	2.27	1.89	1.77	1.77	1.85	1.92	1.75	1.88	1.74	1.79	1.94	2.2	
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.183	0.142	0.145	0.179	0.197	0.181	0.18	0.169	0.154	0.17	0.164	0.147	0.138	0.141	0.138	
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.183	0.142	0.145	0.179	0.197	0.181	0.18	0.169	0.154	0.17	0.164	0.147	0.138	0.141	0.138	
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	0.0052	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	0.0231	0.0115	<0.0020	<0.0020	<0.0020	
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.003	0.0033	<0.0020	<0.0020	0.0043	0.0066	0.002	<0.0020	0.0054	<0.0020	0.023	<0.010	0.0022	<0.0020	<0.0020	
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.007	0.0099	<0.0010	<0.0010	<0.0010	
Total nitrogen	mg/L	-	-	-	-	-	-	0.238	0.215	0.187	0.264	0.235	0.225	0.226	0.218	0.211	0.219	0.212	0.197	0.188	0.201	0.192	
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.1	18.7	18.3	18.8	18.1	18.8	18.1	17.4	17.7	19.2	16.9	18.2	18.2	17.9	17	
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.038	0.035	0.035	0.035	0.039	0.034	0.037	0.036	0.038	0.034	0.037	0.034	0.033	0.036	0.034	
Magnesium	mg/L	-	-	-	-	-	-	2.21	2.19	2.13	2.2	2.3	2.11	2.18	1.89	2.27	2.21	2.04	2.17	2.28	2.1	2.26	
Potassium	mg/L	-	-	-	-	-	-	0.567	0.539	0.542	0.605	0.638	0.584	0.577	0.482	0.569	0.604	0.568	0.57	0.56	0.507	0.522	
Sodium	mg/L	-	-	-	-	-	-	1.34	1.04	1.06	1.38	1.31	1.24	1.22	1.03	1.22	1.35	1.32	1.19	1.16	1.08	1.17	
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	10.1	7.21	7.33	8.87	10.1	8.75	8.77	8.54	8.32	9.88	9.19	8	7.53	7.64	7.49	
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0244	0.0198	0.0221	0.0428	0.0228	0.0376	0.0634	0.0584	0.0641	0.0408	0.0229	0.0437	0.051	0.0295	0.0342	
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	0.00013	0.00014	0.00013	0.00011	0.00013	0.00011	0.00012	0.00013	0.00021	0.00013	0.00014	0.00012	0.00013	0.00013	
Barium	mg/L	-	1W	-	-	-	1	0.00607	0.00567	0.00567	0.00646	0.00605	0.00609	0.00674	0.00656	0.0065	0.00617	0.00542	0.00611	0.00606	0.00577	0.00585	
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000082	<0.0000050	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
Calcium	mg/L	-	-	-	1000	-	1000	18.8	17.8	18.3	19	18.4	19.6	16.1	18.9	17.1	18	18	18	18.6	18.9	18.6	
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.0012	0.00138	0.00137	0.00284	0.00143	0.00194	0.00201	0.00196	0.00219	0.00149	0.00134	0.00178	0.0015	0.00156	0.00133	
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	0.042	0.042	0.039	<0.030	<0.030	0.03	0.033	<0.030	<0.030	
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000368	0.000094	0.000101	0.000319	0.000155	0.000194	0.000187	0.000185	0.000157	0.000177	0.000051	0.000269	0.000157	0.000176	0.000164	
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0014	0.0013	0.0011	0.0012	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.001	0.0013	<0.0010	<0.0010	
Magnesium	mg/L	-	-	-	-	-	-	2.29	2.06	2.13	2.25	2.23	2.12	2.16	2.21	1.82	2.35	2.21	2.19	2.23	2.27	2.24	
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00173	0.00126	0.00117	0.00203	0.00171	0.00165	0.00259	0.00226	0.00212	0.00182	0.0016	0.0018	0.00191	0.00178	0.00171	
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00146	0.000572	0.00072	0.00133	0.00149	0.00122	0.001	0.001	0.000952	0.0014	0.00123	0.000887	0.000686	0.000739	0.000713	
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Potassium	mg/L	-	-	-	-	-	-	0.588	0.548	0.561	0.586	0.604	0.589	0.6	0.588	0.521	0.602	0.546	0.544	0.552	0.535	0.517	
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000324	0.000127	0.000168	0.000264	0.000342	0.000237	0.000208	0.000213	0.000177	0.00027	0.000237	0.0002	0.000148	0.000139	0.000157	
Silicon	mg/L	-	-	-	-	-	-	1.77	1.74	1.76	1.83	1.81	1.86	1.89	1.82	1.71	1.78	1.79	1.82	1.87	1.76	1.81	
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium	mg/L	-	-	-	-	-	-	1.38	1.1	1.09	1.37	1.42	1.24	1.28	1.22	1.02	1.45	1.4	1.2	1.15	1.14	1.13	
Strontium	mg/L	-	-	-	-	-	-	0.152	0.141	0.141	0.154	0.147	0.155	0.132	0.15	0.144	0.151	0.155	0.145	0.148	0.15	0.142	
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000173	0.000172	0.000169	0.000169	0.000173	0.000177	0.000166	0.000166	0.00017	0.000188	0.000153	0.000172	0.000164	0.000158	0.000168	
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2016-06-20	Quesnel Lake QUL-58 QUL-58-B 2016-06-28	Quesnel Lake QUL-58 QUL-58-B 2016-07-06	Quesnel Lake QUL-58 QUL-58-B 2016-08-01	Quesnel Lake QUL-58 QUL-58-B 2016-09-05	Quesnel Lake QUL-58 QUL-58-B 2016-10-05	Quesnel Lake QUL-58 QUL-58-B 2016-11-09	Quesnel Lake QUL-58 QUL-58-B 2016-11-16	Quesnel Lake QUL-58 QUL-58-B 2016-11-30	Quesnel Lake QUL-58 QUL-58-B 2017-02-02	Quesnel Lake QUL-58 QUL-58-B 2017-03-06	Quesnel Lake QUL-58 QUL-58-B 2017-04-10	Quesnel Lake QUL-58 QUL-58-B 2017-05-09	Quesnel Lake QUL-58 QUL-58-B 2017-05-15	Quesnel Lake QUL-58 QUL-58-B 2017-05-22
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0079	0.0063	0.0064	0.0133	0.0056	0.005	0.013	0.005	0.0062	0.0061	0.007	0.0056	0.0074	0.0066	0.0068
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	<0.00010	0.00011	0.0001	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	0.00011	0.0001	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00581	0.00538	0.00534	0.00598	0.00573	0.00563	0.00565	0.0051	0.00569	0.00581	0.00533	0.00535	0.00568	0.00525	0.00549
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	0.0000064	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000059	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00097	0.00104	0.00106	0.00325	0.00096	0.00096	0.00139	0.00075	0.00105	0.00081	0.00108	0.00092	0.00098	0.00097	0.00089
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000506	0.000128	0.000136	0.000443	0.000122	0.000173	0.000484	0.000327	0.000188	0.000197	0.000133	0.000239	0.000294	0.000295	0.000329
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.0011
Manganese	mg/L	-	-	-	-	-	-	0.00074	0.00018	0.00012	0.00092	0.00034	0.00024	0.00065	0.00018	0.00022	0.00047	0.00053	0.00023	0.00026	0.0002	0.00022
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00137	0.000545	0.000626	0.00124	0.0014	0.00113	0.00105	0.000861	0.000896	0.00135	0.00114	0.000826	0.000641	0.00062	0.000688
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000278	0.000127	0.00012	0.000254	0.000306	0.000253	0.000236	0.000236	0.000214	0.000272	0.000241	0.000176	0.000165	0.000175	0.000108
Silicon	mg/L	-	-	-	-	-	-	1.74	1.76	1.72	1.73	1.67	1.77	1.71	1.7	1.86	1.64	1.63	1.68	1.73	1.67	1.75
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.147	0.136	0.138	0.143	0.149	0.149	0.144	0.145	0.139	0.153	0.139	0.139	0.14	0.136	0.137
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000169	0.00016	0.000147	0.000164	0.000155	0.00016	0.000162	0.000162	0.000154	0.000155	0.000153	0.000155	0.000147	0.000152	0.00016
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2017-05-29	Quesnel Lake QUL-58 QUL-58-B 2017-06-05	Quesnel Lake QUL-58 QUL-58-B 2017-06-12	Quesnel Lake QUL-58 QUL-58-B 2017-06-19	Quesnel Lake QUL-58 QUL-58-B 2017-06-27	Quesnel Lake QUL-58 QUL-58-B 2017-08-22	Quesnel Lake QUL-58 QUL-58-B 2017-10-01	Quesnel Lake QUL-58 QUL-58-B 2017-10-26	Quesnel Lake QUL-58 QUL-58-B 2017-11-20	Quesnel Lake QUL-58 QUL-58-B 2018-01-04	Quesnel Lake QUL-58 QUL-58-B 2018-01-18	Quesnel Lake QUL-58 QUL-58-B 2018-05-03	Quesnel Lake QUL-58 QUL-58-B 2018-05-13	Quesnel Lake QUL-58 QUL-58-B 2018-05-22	Quesnel Lake QUL-58 QUL-58-B 2018-06-04
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	111.3	118.7	-	-	113.6	111.7	145	117.4	107	110.4	110	115.6	108.4	116	126.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.4	7.65	-	-	7.8	7.54	-	7.47	-	7.8	7.66	6.95	7.45	7.07	6.98
Turbidity	NTU	1	-	-	-	-	1	0.71	0.66	-	-	0	0	0.31	0.51	0.62	0.28	0.41	0.01	-	0.94	0
Temperature	C	-	-	-	-	-	-	4.224	4.084	-	-	4.544	4.708	1.3	5.262	5.997	3.813	3.119	3.272	3.851	3.867	4.506
Dissolved oxygen	%	-	-	-	-	-	-	87.7	86.2	-	-	84.4	83.4	-	90.1	95.4	85.1	85.2	87.9	88.7	88.8	91.3
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.42	11.27	-	-	10.91	10.72	-	11.42	11.87	11.2	11.42	11.74	11.67	11.68	11.8
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.5	50.8	49.9	48.6	50.3	46.3	51	50.3	50	49.3	49.4	49.8	48.3	52.3	48.8
Specific conductivity	uS/cm	-	-	-	-	-	-	113	112	111	105	112	105	116	105	103	108	103	115	111	112	106
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	7.86	7.96	7.88	7.91	7.83	7.88	7.88	7.93	7.87	7.73	7.88	7.86	7.8	7.91
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.43	0.55	0.36	0.35	0.37	0.21	0.24	0.35	0.29	0.49	0.31	0.75	0.68	0.37	0.3
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.5	53	52.3	51.2	55.4	53.7	53.6	49.6	53.3	53.8	55.3	50.8	44.4	54.8	55.1
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	74	65	69	75	80	74	77	79	65	59	53	70	78	66	75
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.68	2.03	1.87	1.59	1.82	2	1.65	1.8	1.66	1.51	1.72	1.99	1.77	1.88	2.06
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.138	0.139	0.147	0.135	0.151	0.148	0.19	0.153	0.113	0.12	0.123	0.144	0.144	0.144	0.141
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.138	0.139	0.147	0.135	0.151	0.148	0.19	0.153	0.113	0.12	0.123	0.144	0.144	0.144	0.141
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0028
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.010	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	0.0025	0.0031	0.0042	0.0039	0.0032	0.0044
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.198	0.198	0.19	0.2	0.193	0.197	0.246	0.196	0.167	0.167	0.167	0.214	0.178	0.182	0.182
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.6	17.2	17	18.5	18.1	17.7	16.4	17.7	18.2	18.8	17	14.8	18.2	18.3
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.042	0.035	0.035	0.033	0.036	0.032	0.037	0.035	0.033	0.033	0.034	0.035	0.034	0.037	0.036
Magnesium	mg/L	-	-	-	-	-	-	2.08	2.17	2.29	2.11	2.2	2.1	2.28	2.12	2.24	2.01	2.02	2.03	1.79	2.25	2.26
Potassium	mg/L	-	-	-	-	-	-	0.494	0.536	0.521	0.52	0.511	0.504	0.551	0.508	0.497	0.46	0.471	0.469	0.413	0.541	0.555
Sodium	mg/L	-	-	-	-	-	-	1.06	1.11	1.19	1.07	1.11	1.07	1.4	1.04	0.986	0.996	0.91	1.02	0.884	1.15	1.12
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.41	7.26	7.76	6.98	7.69	7.2	10.8	7.19	6.71	6.93	6.57	7.93	7.63	7.56	7.19
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0282	0.0263	0.023	0.0194	0.0237	0.0126	0.0152	0.0097	0.0185	0.0237	0.019	0.0358	0.0367	0.0223	0.0205
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00012	0.00011	0.00012	0.00011	0.00011	0.00013	0.00011	0.00012	0.00011	0.00016	0.00013	0.00013	0.00013	0.0001
Barium	mg/L	-	1W	-	-	-	1	0.00578	0.00542	0.00598	0.00533	0.00556	0.00542	0.00592	0.00551	0.00554	0.00604	0.00524	0.0058	0.00621	0.00623	0.00537
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.4	17.1	19.6	17	17	18.2	18	17.1	18.4	18.1	19.9	18	17.6	17.8	16.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.0013	0.00122	0.00107	0.00079	0.00127	0.00091	0.00093	0.00057	0.00092	0.00109	0.00104	0.00172	0.00125	0.00123	0.00086
Iron	mg/L	-	-	1	-	-	1	0.041	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.00011	0.000131	0.000107	<0.000050	0.00016	0.000066	0.000099	<0.000050	0.000095	0.000289	0.000257	0.000452	<0.000050	0.000712	0.000662
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0011	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.001	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.21	1.98	2.34	2.09	2.13	2.15	2.28	2.12	1.94	2.18	2	2.28	2.23	2.23	2.14
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.0018	0.00146	0.00176	0.00138	0.0014	0.0008	0.00186	0.00086	0.00125	0.00171	0.00103	0.00237	0.00172	0.00157	0.00152
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000661	0.000658	0.000757	0.000522	0.000761	0.000615	0.00131	0.000332	0.00043	0.000441	0.000442	0.000719	0.000632	0.000656	0.000466
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.539	0.49	0.522	0.523	0.502	0.465	0.552	0.488	0.458	0.447	0.484	0.501	0.54	0.519	0.501
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000162	0.000141	0.000173	0.000126	0.000179	0.000144	0.000313	0.000102	0.000112	0.000099	0.000118	0.000249	0.000161	0.000161	0.000148
Silicon	mg/L	-	-	-	-	-	-	1.81	1.63	1.74	1.76	1.8	1.76	1.78	1.59	1.63	1.63	1.64	1.74	1.67	1.84	1.75
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.13	1.04	1.19	1.06	1.11	1.02	1.4	0.946	0.908	1.07	0.914	1.12	1.09	1.11	1.05
Strontium	mg/L	-	-	-	-	-	-	0.139	0.136	0.147	0.132	0.136	0.141	0.15	0.135	0.139	0.137	0.146	0.142	0.142	0.151	0.134
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000163	0.000152	0.000157	0.000159	0.000182	0.000168	0.000167	0.000136	0.000188	0.000159	0.000153	0.000177	0.00016	0.000172	0.000169
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2017-05-29	Quesnel Lake QUL-58 QUL-58-B 2017-06-05	Quesnel Lake QUL-58 QUL-58-B 2017-06-12	Quesnel Lake QUL-58 QUL-58-B 2017-06-19	Quesnel Lake QUL-58 QUL-58-B 2017-06-27	Quesnel Lake QUL-58 QUL-58-B 2017-08-22	Quesnel Lake QUL-58 QUL-58-B 2017-10-01	Quesnel Lake QUL-58 QUL-58-B 2017-10-26	Quesnel Lake QUL-58 QUL-58-B 2017-11-20	Quesnel Lake QUL-58 QUL-58-B 2018-01-04	Quesnel Lake QUL-58 QUL-58-B 2018-01-18	Quesnel Lake QUL-58 QUL-58-B 2018-05-03	Quesnel Lake QUL-58 QUL-58-B 2018-05-13	Quesnel Lake QUL-58 QUL-58-B 2018-05-22	Quesnel Lake QUL-58 QUL-58-B 2018-06-04
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0064	0.0065	0.0066	0.0052	0.0067	0.0058	0.0062	0.005	0.0054	0.0046	<0.0052	0.0063	0.006	0.0069	0.0074
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00518	0.00524	0.0052	0.00532	0.00524	0.00554	0.00577	0.00565	0.00535	0.00542	0.00513	0.00497	0.0048	0.00558	0.0059
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00075	0.00092	0.00077	0.00065	0.0009	0.00078	0.00079	0.00068	0.00065	0.00069	0.00078	0.001	0.00061	0.00082	0.00076
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	0.000192	0.000167	<0.000050	0.000171	0.000115	0.000092	0.000058	0.000072	0.000226	0.000122	0.000321	<0.000050	0.000509	0.000305
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.0002	0.00025	0.0003	0.0001	0.00031	0.00013	0.00097	0.00013	0.00014	0.00077	<0.00015	0.0008	0.00029	0.00021	0.00021
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00064	0.000617	0.000755	0.000494	0.000757	0.000498	0.00127	0.000486	0.000378	0.000383	0.000374	0.000629	0.000515	0.000621	0.000513
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000132	0.000157	0.000182	0.00013	0.000194	0.000133	0.000312	0.000148	0.000076	0.000109	0.000102	0.000192	0.000157	0.000163	0.000116
Silicon	mg/L	-	-	-	-	-	-	1.68	1.67	1.77	1.76	1.65	1.69	1.69	1.82	1.63	1.54	1.61	1.52	1.35	1.66	1.67
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.134	0.135	0.145	0.132	0.139	0.141	0.145	0.138	0.128	0.139	0.144	0.134	0.12	0.141	0.141
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.00016	0.00016	0.000174	0.00015	0.000146	0.000147	0.000165	0.000132	0.000151	0.000157	0.000151	0.000157	0.000136	0.000172	0.000167
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2018-06-13	Quesnel Lake QUL-58 QUL-58-B 2018-06-18	Quesnel Lake QUL-58 QUL-58-B 2018-06-27	Quesnel Lake QUL-58 QUL-58-B 2018-07-02	Quesnel Lake QUL-58 QUL-58-B 2018-08-23	Quesnel Lake QUL-58 QUL-58-B 2018-09-04	Quesnel Lake QUL-58 QUL-58-B 2018-10-11	Quesnel Lake QUL-58 QUL-58-B 2018-10-18	Quesnel Lake QUL-58 QUL-58-B 2018-10-24	Quesnel Lake QUL-58 QUL-58-B 2018-10-29	Quesnel Lake QUL-58 QUL-58-B 2018-11-07	Quesnel Lake QUL-58 QUL-58-B 2018-12-18	Quesnel Lake QUL-58 QUL-58-B 2019-02-26	Quesnel Lake QUL-58 QUL-58-B 2019-03-05	Quesnel Lake QUL-58 QUL-58-B 2019-04-25
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	110.3	112	113.5	111.9	111.7	109.2	114.9	118	117.3	107.1	112.3	119.9	126.7	110.7	115
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.32	7.33	7.58	7.11	7.78	7.57	7.32	7.5	6.95	7.45	7.58	7.81	7.74	7.77	7.71
Turbidity	NTU	1	-	-	-	-	1	0	0	0.54	0.78	1.71	0.13	0.17	0	0	2.99	0	0	6.45	0.08	1
Temperature	C	-	-	-	-	-	-	4.166	4.396	4.196	4.242	7.881	4.555	4.914	4.739	4.779	6.254	4.865	4.49	2.932	3.15	3.493
Dissolved oxygen	%	-	-	-	-	-	-	89.3	89.9	89.3	92.6	86	85.7	87.2	82.6	82.4	97.6	86.5	89.1	84.7	85.7	87.7
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.65	11.67	11.64	12.06	11.2	11.07	11.16	10.62	10.59	12.05	11.09	11.52	11.41	11.49	11.65
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.3	50.3	47.3	50.8	50	50.2	49.7	49.5	51.7	51.2	51.2	47.8	48.8	45.8	50
Specific conductivity	uS/cm	-	-	-	-	-	-	114	111	101	110	110	115	114	114	122	114	117	110	113	113	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.93	7.83	8	7.92	8	7.93	7.89	7.91	7.9	7.95	7.82	7.93	7.8	7.85
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.39	0.38	0.33	0.31	0.27	0.26	0.24	0.24	0.19	0.25	0.25	0.33	0.24	0.22	0.38
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	52.1	53.2	50.5	55.6	52.5	52.9	54.4	57.7	59.4	53.3	56	53.2	53.4	54.7	57.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	75	74	74	73	79	80	77	77	72	75	66	66	102	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.93	2.01	2.2	1.89	1.78	1.66	1.15	1.81	1.78	1.78	1.81	1.7	1.68	1.64	2.76
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.141	0.153	0.103	0.141	0.154	0.154	0.173	0.175	0.177	0.154	0.177	0.127	0.142	0.143	0.143
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.141	0.153	0.103	0.141	0.154	0.154	0.173	0.175	0.177	0.154	0.177	0.127	0.142	0.143	0.143
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	0.0052	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0031	<0.0020	0.0026	<0.0020	0.0024	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0042	0.0024	0.0036	0.0036	0.0041	0.005	0.0033	0.0029	<0.0020	<0.0020	0.0024	0.0025	0.012	0.007	0.0034
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0021	<0.0010	<0.0010	0.0019	0.0013	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.227	0.158	0.192	0.207	0.264	0.213	0.213	0.293	0.226	0.226	0.239	0.201	0.197	0.175	0.207
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	17.3	17.8	16.7	18.6	17.7	17.5	18.2	19.7	19.7	17.8	18.8	17.9	18.2	18.6	19.8
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.035	0.038	0.032	0.033	0.034	0.035	0.038	0.037	<0.10	0.034	0.036	0.035	0.039	0.036	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.14	2.15	2.12	2.24	2.02	2.25	2.16	2.06	2.45	2.13	2.21	2.07	1.95	2.01	2.02
Potassium	mg/L	-	-	-	-	-	-	0.516	0.549	0.514	0.538	0.529	0.511	0.527	0.595	0.614	0.553	0.568	0.496	0.505	0.523	0.485
Sodium	mg/L	-	-	-	-	-	-	1.06	1.13	0.973	1.12	1.1	1.16	1.29	1.25	1.56	1.2	1.33	1.07	1.06	1.09	1.14
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.96	7.93	6.08	7.05	7.74	7.81	9.12	8.73	9.7	7.29	8.69	7.59	8.27	7.07	7.42
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0187	0.0215	0.0152	0.0175	0.0142	0.0154	0.0182	0.0139	0.0155	0.0167	0.0162	0.0232	0.017	0.0221	0.0243
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00014	0.00013	0.00011	0.00011	0.00012	0.00013	0.00012	0.00013	0.00014	0.00013	0.00011	0.00011	0.00013	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00573	0.00598	0.0056	0.00552	0.00561	0.00573	0.00599	0.00574	0.00543	0.00576	0.00604	0.00541	0.00529	0.00529	0.00554
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.8	18.3	16.2	16.7	17.7	17.5	17.6	18.8	18.2	17.5	18.2	17.2	18.4	18.8	18
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00124	0.00103	0.00104	0.00105	0.00099	0.00081	0.00109	0.00077	0.00084	0.00092	0.00095	0.00089	0.00083	0.00103	0.00105
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000543	0.000516	0.000543	0.00145	0.000878	0.000462	0.000325	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.16	2.35	2.05	2.14	2.03	2.13	2.17	2.13	2	2.29	2.19	2.17	1.93	1.99	2.04
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00138	0.00168	0.00123	0.00126	0.00088	0.00103	0.00116	0.00098	0.00096	0.00103	0.00117	0.0014	0.00111	0.00132	0.00146
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000543	0.000928	0.00036	0.000524	0.000712	0.000852	0.0011	0.00107	0.0014	0.000838	0.0012	0.00067	0.000801	0.000712	0.000766
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00077	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.53	0.564	0.529	0.533	0.486	0.495	0.546	0.528	0.552	0.564	0.593	0.541	0.507	0.511	0.535
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000123	0.000275	0.000118	0.000129	0.000153	0.000203	0.00025	0.000192	0.000225	0.000163	0.000213	0.000176	0.000159	0.000169	0.000185
Silicon	mg/L	-	-	-	-	-	-	1.81	1.98	1.81	1.88	1.78	1.79	1.8	1.82	1.79	1.83	1.84	1.8	1.64	1.68	1.76
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.15	1.23	1	1.1	1.05	1.12	1.35	1.23	1.32	1.18	1.31	1.18	1.03	1.09	1.13
Strontium	mg/L	-	-	-	-	-	-	0.14	0.142	0.125	0.132	0.133	0.142	0.147	0.149	0.147	0.133	0.147	0.138	0.14	0.135	0.139
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000157	0.000175	0.000154	0.000167	0.000164	0.000165	0.00017	0.00015	0.000152	0.000168	0.000165	0.000168	0.000162	0.000168	0.000158
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2018-06-13	Quesnel Lake QUL-58 QUL-58-B 2018-06-18	Quesnel Lake QUL-58 QUL-58-B 2018-06-27	Quesnel Lake QUL-58 QUL-58-B 2018-07-02	Quesnel Lake QUL-58 QUL-58-B 2018-08-23	Quesnel Lake QUL-58 QUL-58-B 2018-09-04	Quesnel Lake QUL-58 QUL-58-B 2018-10-11	Quesnel Lake QUL-58 QUL-58-B 2018-10-18	Quesnel Lake QUL-58 QUL-58-B 2018-10-24	Quesnel Lake QUL-58 QUL-58-B 2018-10-29	Quesnel Lake QUL-58 QUL-58-B 2018-11-07	Quesnel Lake QUL-58 QUL-58-B 2018-12-18	Quesnel Lake QUL-58 QUL-58-B 2019-02-26	Quesnel Lake QUL-58 QUL-58-B 2019-03-05	Quesnel Lake QUL-58 QUL-58-B 2019-04-25
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0065	0.0074	0.0094	0.0069	0.0072	0.0074	0.0073	0.0071	0.0076	0.0066	0.0075	0.0071	0.0059	0.006	0.007
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	<0.00010	0.00017	<0.00010	0.00011	<0.00010	<0.00010	0.0001	0.00012	0.0001	0.00011	0.00012	<0.00010	0.0001	0.00011
Barium	mg/L	-	-	-	-	-	-	0.0056	0.00542	0.00579	0.00588	0.00525	0.00587	0.00541	0.00538	0.00575	0.00563	0.00564	0.00535	0.00541	0.00536	0.00532
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000066	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00075	0.00097	0.00065	0.00086	0.00074	0.00075	0.00075	0.00062	0.0007	0.00071	0.0007	0.00058	0.00056	0.00056	0.00063
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.00041	0.000359	0.000345	0.00151	0.000394	0.000295	0.000239	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00011	0.0003	0.00031	0.00013	0.00018	0.00039	0.00028	0.00025	0.00041	0.00014	0.00021	0.00018	0.00012	<0.00010	0.00026
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000533	0.000833	0.000349	0.000568	0.000709	0.000818	0.00112	0.000984	0.00151	0.000824	0.0011	0.000702	0.000793	0.00071	0.000819
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000123	0.000174	0.000133	0.000187	0.000185	0.00017	0.000217	0.000207	0.00027	0.00017	0.000237	0.000199	0.000156	0.000126	0.000195
Silicon	mg/L	-	-	-	-	-	-	1.69	1.79	1.82	1.75	1.72	1.71	1.71	1.55	1.73	1.71	1.75	1.74	1.54	1.58	1.58
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.139	0.137	0.126	0.143	0.137	0.145	0.147	0.145	0.157	0.143	0.149	0.133	0.133	0.139	0.154
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000151	0.000161	0.000147	0.000158	0.000161	0.000158	0.000152	0.000165	0.000165	0.000158	0.00017	0.000151	0.000153	0.000166	0.000174
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2019-05-02	Quesnel Lake QUL-58 QUL-58-B 2019-05-08	Quesnel Lake QUL-58 QUL-58-B 2019-05-21	Quesnel Lake QUL-58 QUL-58-B 2019-06-18	Quesnel Lake QUL-58 QUL-58-B 2019-07-11	Quesnel Lake QUL-58 QUL-58-B 2019-07-25	Quesnel Lake QUL-58 QUL-58-B 2019-08-20	Quesnel Lake QUL-58 QUL-58-B 2019-10-30	Quesnel Lake QUL-58 QUL-58-B 2020-06-02	Quesnel Lake QUL-58 QUL-58-B 2020-06-09	Quesnel Lake QUL-58 QUL-58-B 2020-06-16	Quesnel Lake QUL-58 QUL-58-B 2020-06-24	Quesnel Lake QUL-58 QUL-58-B 2020-06-29	Quesnel Lake QUL-58 QUL-58-B 2020-07-21	Quesnel Lake QUL-58 QUL-58-B 2020-08-11
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	127	130.9	123.9	125.1	112.7	116.9	113.7	115	120.1	-	126.5	114.9	113.5	-	119
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.76	7.8	7.6	7.71	7.8	7.61	7.47	7.72	7.69	-	7.64	7.33	7.55	-	7.33
Turbidity	NTU	1	-	-	-	-	1	0.33	0.31	0	0.52	1.12	0.57	0	0.09	0.51	-	0.22	0.35	0.24	-	0
Temperature	C	-	-	-	-	-	-	3.819	4.138	4.017	4.095	8.357	7.61	4.314	5.376	4.189	-	4.697	4.341	4.304	-	4.627
Dissolved oxygen	%	-	-	-	-	-	-	88.2	87.9	88.3	93	92.8	85.5	85.4	87.1	92.9	-	94.4	96	90	-	90.1
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.61	11.48	11.57	12.16	10.92	11.13	11.1	11.01	12.12	-	12.14	12.47	11.7	-	11.61
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	51.1	50.6	48.9	49.8	50.1	48.1	50.3	50	48.5	47.6	51.1	51.4	48.2	48	48.2
Specific conductivity	uS/cm	-	-	-	-	-	-	111	119	130	119	111	113	114	117	115	116	113	112	119	114	115
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.84	7.85	8.03	8.02	7.89	7.86	8.01	7.84	7.83	7.95	7.79	7.82	7.87	7.46	7.89
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1.1	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1
Turbidity	NTU	1	-	-	-	-	1	0.37	0.39	0.23	0.12	0.17	0.2	0.19	0.14	0.33	0.2	0.32	0.25	0.24	0.29	0.19
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54	54.3	59.8	60.9	57.6	54.6	53.4	52.7	56.5	55.8	55	56.7	58	55	52.3
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53.2	53.8	56	57.1	54.8
Total dissolved solids	mg/L	-	-	-	1000	-	1000	78	103	74	76	67	67	81	68	76	83	70	75	81	76	72
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.98	2.37	2.33	1.7	1.96	1.99	1.71	1.73	2.12	2.73	2.12	2.32	2.22	2.16	2.42
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.138	0.138	0.195	0.168	0.146	0.152	0.15	0.156	0.129	0.136	0.13	0.136	0.148	0.134	0.144
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.138	0.138	0.196	0.168	0.146	0.152	0.15	0.156	0.129	0.136	0.13	0.136	0.148	0.134	0.144
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0051	<0.0050	<0.0050	<0.0050	0.0072	0.0078	0.005	0.0076	0.006	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.002	0.0034	<0.0020	0.0026	<0.0020	0.0028	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0038
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0023	0.0027	0.0086	0.002	0.0068	0.0055	0.004	0.0051	0.0031	0.0067	0.007	0.002	0.0125	0.0048	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.207	0.211	0.261	0.237	0.217	0.231	0.204	0.335	0.203	0.222	0.213	0.205	0.222	0.207	0.214
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.1	18	19.8	20.4	19.6	18.2	17.5	17.7	18.8	18.7	18.4	19	19.6	18.5	17.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.034	0.037	0.042	0.039	0.04	0.039	0.036	0.033	0.037	0.034	0.039	0.04	0.039	0.041	0.037
Magnesium	mg/L	-	-	-	-	-	-	2.12	2.23	2.5	2.42	2.07	2.22	2.33	2.08	2.31	2.21	2.19	2.2	2.24	2.13	2.17
Potassium	mg/L	-	-	-	-	-	-	0.51	0.522	0.616	0.588	0.5	0.523	0.493	0.525	0.547	0.531	0.516	0.466	0.513	0.504	0.518
Sodium	mg/L	-	-	-	-	-	-	1.14	1.2	1.6	1.48	1.12	1.16	1.14	1.03	1.21	1.18	1.04	1.11	1.2	1.03	1.12
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.9	7.85	12.4	10	7.86	8.18	7.34	7.93	7.68	8.21	7.26	8.31	9.56	7.15	7.91
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0296	0.0293	0.0209	0.0181	0.0128	0.0161	0.0118	0.0165	0.0187	0.0194	0.0207	0.0162	0.0204	0.0229	0.0167
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00015	0.00019	0.00011	0.00011	0.00012	0.00012	0.0001	0.00013	0.00012	0.00012	0.00015	0.00012	0.00012	0.00012	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00559	0.00554	0.00554	0.00587	0.00563	0.00563	0.00575	0.00565	0.00597	0.00546	0.00539	0.00538	0.00527	0.00577	0.0053
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000059
Calcium	mg/L	-	-	-	1000	-	1000	18.7	17	18.6	18.9	18.1	18.2	18	17.9	18.4	19.2	17.8	17.9	18.7	19.2	18.2
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00109	0.00096	0.00082	0.00124	0.00078	0.00081	0.00091	0.00089	0.001	0.00134	0.00082	0.001	0.00089	0.00086	0.00081
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.1	2.1	2.17	2.3	2.06	2.12	2.18	2.09	2.09	2.23	2.11	2.17	2.28	2.2	2.27
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.0017	0.00162	0.0014	0.00111	0.00083	0.00103	0.00085	0.00102	0.00139	0.00136	0.00128	0.00122	0.00159	0.00118	0.00121
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00078	0.000742	0.00196	0.00125	0.000656	0.000909	0.000666	0.000739	0.000652	0.00079	0.000532	0.000749	0.00105	0.000553	0.000711
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.495	0.499	0.507	0.538	0.528	0.483	0.531	0.519	0.493	0.526	0.507	0.503	0.516	0.526	0.509
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000168	0.000214	0.000547	0.000322	0.000177	0.000284	0.000137	0.000167	0.000222	0.000175	0.000125	0.000173	0.000296	0.000124	0.000215
Silicon	mg/L	-	-	-	-	-	-	1.8	1.81	1.66	1.7	1.84	1.77	1.82	1.72	1.75	1.8	1.88	1.75	1.89	1.88	1.9
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.15	1.19	1.45	1.41	1.08	1.17	1.14	1.01	1.08	1.12	1.03	1.08	1.22	1.1	1.1
Strontium	mg/L	-	-	-	-	-	-	0.136	0.143	0.145	0.155	0.143	0.141	0.138	0.134	0.143	0.143	0.137	0.142	0.147	0.14	0.143
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.00016	0.00017	0.000163	0.000184	0.000163	0.00016	0.000164	0.000155	0.000153	0.000161	0.000161	0.000156	0.000164	0.000174	0.000168
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2019-05-02	Quesnel Lake QUL-58 QUL-58-B 2019-05-08	Quesnel Lake QUL-58 QUL-58-B 2019-05-21	Quesnel Lake QUL-58 QUL-58-B 2019-06-18	Quesnel Lake QUL-58 QUL-58-B 2019-07-11	Quesnel Lake QUL-58 QUL-58-B 2019-07-25	Quesnel Lake QUL-58 QUL-58-B 2019-08-20	Quesnel Lake QUL-58 QUL-58-B 2019-10-30	Quesnel Lake QUL-58 QUL-58-B 2020-06-02	Quesnel Lake QUL-58 QUL-58-B 2020-06-09	Quesnel Lake QUL-58 QUL-58-B 2020-06-16	Quesnel Lake QUL-58 QUL-58-B 2020-06-24	Quesnel Lake QUL-58 QUL-58-B 2020-06-29	Quesnel Lake QUL-58 QUL-58-B 2020-07-21	Quesnel Lake QUL-58 QUL-58-B 2020-08-11
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0075	0.0097	0.0136	0.0098	0.0059	0.0075	0.0059	0.0079	0.0074	0.0081	0.0072	0.0074	0.0109	0.0075	0.008
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	0.00011	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	0.00011	0.00011	<0.00010	<0.00010	<0.00010	0.00012
Barium	mg/L	-	-	-	-	-	-	0.00528	0.00583	0.00651	0.00586	0.00532	0.00524	0.00503	0.00525	0.00568	0.00559	0.0054	0.00524	0.00572	0.00514	0.00549
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00065	0.00068	0.00065	0.00069	0.00056	0.00062	0.00061	0.00051	0.00074	0.00084	0.00065	0.00067	0.00067	0.00059	0.00063
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00028	0.0003	0.00026	0.00018	0.00012	0.00015	<0.00010	0.00016	0.00015	0.00014	0.00013	0.00024	0.0003	<0.00010	0.00012
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000777	0.000809	0.00199	0.00139	0.00063	0.000881	0.00068	0.000685	0.000671	0.000737	0.000555	0.000756	0.00112	0.000584	0.000753
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000203	0.000212	0.000498	0.000333	0.000153	0.000209	0.000169	0.000229	0.000167	0.000171	0.000156	0.000186	0.000266	0.000147	0.000222
Silicon	mg/L	-	-	-	-	-	-	1.67	1.79	1.76	1.76	1.68	1.83	1.77	1.76	1.81	1.8	1.93	1.83	1.79	1.88	1.79
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.142	0.145	0.164	0.16	0.133	0.134	0.142	0.137	0.147	0.149	0.141	0.151	0.151	0.133	0.148
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000163	0.000172	0.000166	0.000177	0.000156	0.000161	0.00015	0.000152	0.000153	0.000161	0.000151	0.00017	0.000166	0.000169	0.000154
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2020-09-16	Quesnel Lake QUL-58 QUL-58-B 2020-11-04	Quesnel Lake QUL-58 QUL-58-B 2021-05-04	Quesnel Lake QUL-58 QUL-58-B 2021-05-11	Quesnel Lake QUL-58 QUL-58-B 2021-05-19	Quesnel Lake QUL-58 QUL-58-B 2021-05-25	Quesnel Lake QUL-58 QUL-58-B 2021-06-02	Quesnel Lake QUL-58 QUL-58-B 2021-07-21	Quesnel Lake QUL-58 QUL-58-B 2021-09-16	Quesnel Lake QUL-58 QUL-58-B 2021-10-27	Quesnel Lake QUL-58 QUL-58-B 2022-05-09	Quesnel Lake QUL-58 QUL-58-B 2022-05-25	Quesnel Lake QUL-58 QUL-58-B 2022-05-31	Quesnel Lake QUL-58 QUL-58-B 2022-06-06	Quesnel Lake QUL-58 QUL-58-B 2022-06-27
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	119.3	110.8	115.2	119.9	119.7	114.4	117	139.8	116	114.3	114.7	136.1	118.6	-	115.9
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.77	8.1	7.72	7.76	8.36	7.66	7.53	7.43	8.41	7.57	7.64	7.38	7.7	-	7.79
Turbidity	NTU	1	-	-	-	-	1	0.15	0.28	1.18	0	0.1	0.17	0.99	0.11	0.13	0.11	0	0.33	0.23	-	0.42
Temperature	C	-	-	-	-	-	-	4.684	5.836	4.032	4.167	4.115	4.077	4.783	4.805	4.765	5.088	3.927	4.243	4.478	-	4.552
Dissolved oxygen	%	-	-	-	-	-	-	88.3	86.5	92.8	94.1	91.3	92.4	95.1	90.2	86.7	86.5	89.6	89.9	90.2	-	90.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.36	10.81	12.16	12.28	11.93	12.08	12.21	11.57	11.14	11.01	11.77	11.7	11.68	-	11.72
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.3	47.6	49.8	48.7	48.7	48.1	48.8	50.1	53.2	48.2	50.3	51.5	50.7	53.1	50.6
Specific conductivity	uS/cm	-	-	-	-	-	-	122	110	113	114	115	116	112	116	125	115	115	113	119	122	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.94	7.82	7.95	7.9	7.86	7.9	7.89	7.88	7.85	7.93	7.91	7.89	7.96	7.9	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.6	<1.1	1.5	<1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	<0.10	0.22	0.25	0.14	0.18	0.14	0.28	<0.10	0.15	<0.10	0.31	0.34	0.23	0.17	0.19
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	58.3	54.3	57.5	54.6	55.3	54.8	53.4	54.6	57.6	57.8	54.4	49.4	55.4	56.2	54.3
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	60.8	51.6	55.1	51	49.8	53.2	53.2	55.4	60.8	55.1	54	53.4	54.6	59.7	52.1
Total dissolved solids	mg/L	-	-	-	1000	-	1000	78	66	67	67	68	82	70	71	85	69	76	64	81	79	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.34	13	2.19	2.1	2.3	1.94	2.22	2.16	1.88	1.86	2.32	2.25	2.09	1.98	2.36
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.169	0.123	0.136	0.133	0.139	0.131	0.141	0.155	0.168	0.161	0.127	0.133	0.143	0.159	0.136
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.169	0.124	0.136	0.133	0.139	0.131	0.141	0.155	0.168	0.161	0.127	0.133	0.143	0.159	0.136
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	0.0022	0.0025	<0.0020	0.0021	0.0026
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.216	0.218	0.187	0.185	0.185	0.187	0.201	0.216	0.221	0.198	0.208	0.18	0.204	0.224	0.189
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.4	18.2	19.4	18.3	18.6	18.2	17.8	18	19.4	19.6	18.2	16.9	18.3	18.7	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.038	0.036	0.038	0.034	0.039	0.036	0.032	0.034	0.037	0.039	0.037	0.036	0.041	0.037	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.41	2.12	2.19	2.16	2.16	2.26	2.18	2.35	2.22	2.14	2.18	1.76	2.36	2.32	2.22
Potassium	mg/L	-	-	-	-	-	-	0.554	0.515	0.471	0.538	0.522	0.516	0.518	0.552	0.526	0.522	0.506	0.481	0.518	0.489	0.496
Sodium	mg/L	-	-	-	-	-	-	1.38	1.01	1.05	1.08	1.1	1.11	1.11	1.18	1.23	1.06	1.06	1.03	1.1	1.26	1.03
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	10	7.27	7.85	7.72	8.07	8	8.39	9.21	9.89	8.41	7.59	7.83	9.33	10.8	7.52
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0201	0.0179	0.0173	0.0185	0.017	0.0156	0.0277	0.0161	0.0164	0.0166	0.0228	0.0217	0.0205	0.0273	0.0123
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00014	0.00012	0.00012	0.00012	0.0001	0.00013	<0.00010	0.00011	0.00011	0.00013	0.00013	0.00011	0.00014	0.0001
Barium	mg/L	-	1W	-	-	-	1	0.00542	0.00524	0.00517	0.00522	0.00506	0.00549	0.00569	0.00542	0.00496	0.00539	0.0057	0.00512	0.00555	0.00556	0.00516
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	20.5	17.1	18.5	16.7	16.6	17.7	17.6	18.5	20.6	18.5	18	17.8	17.8	19.9	17.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	0.00063	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00095	0.00076	0.00088	0.00087	0.00088	0.0008	0.00146	0.0007	0.00073	0.0008	0.00092	0.00095	0.00099	0.001	0.00065
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.35	2.14	2.16	2.27	2.03	2.18	2.24	2.23	2.28	2.16	2.2	2.17	2.48	2.44	2.16
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00128	0.00138	0.00137	0.00132	0.001	0.00112	0.00148	0.00094	0.00104	0.00097	0.00148	0.00141	0.00197	0.00258	0.001
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00151	0.000543	0.000775	0.00067	0.000719	0.000694	0.00079	0.00119	0.00139	0.00089	0.000743	0.000772	0.00106	0.00152	0.000686
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.488	0.508	0.509	0.552	0.459	0.53	0.52	0.501	0.548	0.529	0.512	0.504	0.513	0.497	0.47
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00036	0.000155	0.000184	0.000164	0.000213	0.000176	0.000207	0.000328	0.000352	0.000218	0.000148	0.000168	0.000387	0.000475	0.000202
Silicon	mg/L	-	-	-	-	-	-	1.88	1.75	1.78	1.88	1.98	1.91	2	2.01	1.82	1.95	1.9	1.87	1.86	1.84	1.91
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.22	1.03	1.06	1.12	1.04	1.08	1.14	1.14	1.25	1.09	1.1	1.07	1.13	1.33	1
Strontium	mg/L	-	-	-	-	-	-	0.16	0.145	0.136	0.138	0.128	0.139	0.145	0.146	0.149	0.145	0.144	0.146	0.153	0.154	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000162	0.000155	0.000158	0.000165	0.00016	0.000165	0.000168	0.000168	0.000172	0.000176	0.000168	0.000163	0.000167	0.000186	0.000158
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2020-09-16	Quesnel Lake QUL-58 QUL-58-B 2020-11-04	Quesnel Lake QUL-58 QUL-58-B 2021-05-04	Quesnel Lake QUL-58 QUL-58-B 2021-05-11	Quesnel Lake QUL-58 QUL-58-B 2021-05-19	Quesnel Lake QUL-58 QUL-58-B 2021-05-25	Quesnel Lake QUL-58 QUL-58-B 2021-06-02	Quesnel Lake QUL-58 QUL-58-B 2021-07-21	Quesnel Lake QUL-58 QUL-58-B 2021-09-16	Quesnel Lake QUL-58 QUL-58-B 2021-10-27	Quesnel Lake QUL-58 QUL-58-B 2022-05-09	Quesnel Lake QUL-58 QUL-58-B 2022-05-25	Quesnel Lake QUL-58 QUL-58-B 2022-05-31	Quesnel Lake QUL-58 QUL-58-B 2022-06-06	Quesnel Lake QUL-58 QUL-58-B 2022-06-27
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.011	0.0096	0.0085	0.009	0.0104	0.0088	0.0093	0.01	0.012	0.0082	0.0104	0.009	0.0103	0.0114	0.0078
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	0.00011	0.0001	0.0001	0.0001	0.00011	0.00011	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00011	0.00011	0.00011
Barium	mg/L	-	-	-	-	-	-	0.0058	0.005	0.00546	0.00516	0.00518	0.00526	0.00547	0.00559	0.00532	0.00523	0.00522	0.00498	0.0054	0.00547	0.00545
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00108	<0.00050	0.00067	0.00075	0.00086	0.0007	0.00076	0.00077	0.0007	0.00061	0.00071	0.00075	0.00094	0.00076	0.00056
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00048	0.00044	0.00023	0.00017	0.00014	0.0001	0.0002	0.00022	0.00037	0.00011	0.00028	0.00015	0.00061	0.00135	0.00016
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00154	0.000518	0.000696	0.000706	0.000707	0.000634	0.00081	0.00114	0.00124	0.000823	0.000734	0.000755	0.00103	0.00144	0.000688
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000384	0.000143	0.000169	0.000197	0.00014	0.000172	0.000224	0.000224	0.000199	0.000175	0.000163	0.000182	0.000298	0.000424	0.000176
Silicon	mg/L	-	-	-	-	-	-	1.99	1.65	1.65	1.87	1.76	1.8	1.74	1.87	1.82	1.7	1.78	1.8	1.89	1.78	1.99
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.156	0.144	0.149	0.134	0.142	0.143	0.142	0.145	0.142	0.146	0.145	0.14	0.154	0.147	0.138
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.00017	0.00015	0.000182	0.000168	0.000158	0.000157	0.000151	0.000167	0.000166	0.000172	0.000164	0.000171	0.000158	0.000181	0.000157
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2022-08-16	Quesnel Lake QUL-58 QUL-58-B 2022-10-19	Quesnel Lake QUL-58 QUL-58-BP 2016-11-16	Quesnel Lake QUL-58 QUL-58-BP 2019-10-30	Quesnel Lake QUL-58 QUL-58-BT 2016-06-28	Quesnel Lake QUL-58 QUL-58-BT 2016-07-06	Quesnel Lake QUL-58 QUL-58-BT 2016-08-01	Quesnel Lake QUL-58 QUL-58-BT 2016-09-05	Quesnel Lake QUL-58 QUL-58-BT 2016-10-05	Quesnel Lake QUL-58 QUL-58-BT 2016-11-09	Quesnel Lake QUL-58 QUL-58-BT 2017-03-06	Quesnel Lake QUL-58 QUL-58-BT 2017-04-10	Quesnel Lake QUL-58 QUL-58-BT 2017-06-05	Quesnel Lake QUL-58 QUL-58-BT 2017-06-12	Quesnel Lake QUL-58 QUL-58-BT 2017-06-19
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	126.1	119.7	112	114.6	109	109.8	104.9	108.5	115.6	107.1	111.1	110	118.3	117.3	109.6
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.65	7.51	7.66	7.73	7.72	7.72	7.76	7.71	-	-	7.79	7.36	7.68	7.75	7.71
Turbidity	NTU	1	-	-	-	-	1	0.38	0	1.19	0	0	0	0	0.27	0	0.55	0.62	0.94	0.44	0.34	0.73
Temperature	C	-	-	-	-	-	-	4.79	4.797	6.098	5.567	5.666	5.352	5.577	5.232	5.784	6.403	3.009	2.79	5.818	5.136	5.032
Dissolved oxygen	%	-	-	-	-	-	-	87.7	86.1	82.3	86.6	88.2	85.7	84.2	84.1	83.9	82.9	82.5	83.4	88.7	88.6	87.9
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.25	11.05	10.22	10.89	11.1	10.84	10.6	10.68	10.48	10.21	11.11	11.28	11.07	11.27	11.21
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	47.6	46.3	50.4	49.4	46.8	48.5	47.7	51.4	51.5	50.1	50.8	49.2	51.5	48.2	48.6
Specific conductivity	uS/cm	-	-	-	-	-	-	125	123	112	116	112	114	109	112	121	112	126	117	113	107	108
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.91	7.87	7.73	7.84	7.83	7.91	7.67	7.87	7.8	7.82	7.85	7.94	7.89	7.99	7.88
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	6.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	4	1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.16	<0.10	0.63	0.17	0.35	0.28	0.18	0.29	0.26	0.38	0.62	0.69	0.47	0.39	0.31
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	57.7	60.7	51.5	52.5	54.7	54.3	52.9	52.9	59.2	53	56.5	53.4	52.7	50.3	55.6
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	56.7	57.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	79	84	75	67	76	89	67	71	85	62	79	64	78	71	79
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.32	2.13	2.19	1.75	1.57	1.55	2.18	1.81	1.83	1.79	1.67	2.11	2.32	1.67	1.68
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.193	0.202	0.152	0.155	0.158	0.155	0.143	0.168	0.24	0.157	0.216	0.136	0.134	0.129	0.135
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.193	0.202	0.152	0.155	0.158	0.155	0.143	0.168	0.24	0.157	0.216	0.136	0.134	0.129	0.135
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.007	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	0.002	0.0025	<0.0020	0.0473	0.0028	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0023	<0.0020	<0.0020	0.0042	0.0022	<0.0020	0.0041	<0.0020	0.0035	0.0037	0.0485	0.0024	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.007	0.0016	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.223	0.251	0.204	0.237	0.232	0.192	0.211	0.208	0.27	0.188	0.264	0.195	0.195	0.183	0.192
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.2	20.1	17.4	17.7	18.4	18.2	17.8	17.6	19.9	17.7	19	17.6	17.5	16.5	18.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.043	0.042	0.035	0.033	0.038	0.036	0.033	0.039	0.038	0.034	0.04	0.032	0.034	0.034	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.37	2.55	1.95	2.06	2.16	2.13	2.04	2.17	2.3	2.14	2.22	2.31	2.15	2.19	2.25
Potassium	mg/L	-	-	-	-	-	-	0.562	0.566	0.501	0.519	0.582	0.558	0.547	0.597	0.718	0.558	0.584	0.52	0.519	0.496	0.551
Sodium	mg/L	-	-	-	-	-	-	1.29	1.46	1.04	1.04	1.22	1.13	1.1	1.12	1.67	1.15	1.67	1.14	1.11	1.07	1.15
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	11.7	12	8.33	7.95	8.55	7.95	6.64	8.22	12.9	8.48	12.7	7.38	7.29	6.83	6.94
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0166	0.0156	0.0382	0.0202	0.0165	0.0149	0.0646	0.0123	0.022	0.0411	0.02	0.0398	0.0234	0.0231	0.0174
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00013	0.00011	0.00013	0.00011	0.00013	0.00014	0.00011	0.00012	<0.00010	0.00013	0.00014	0.00011	0.00012	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00552	0.00592	0.00602	0.00514	0.00563	0.00542	0.00663	0.00548	0.00636	0.00614	0.00571	0.00569	0.00533	0.00578	0.00541
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000066	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.8	18.9	19	18	18	18	18	17.6	20.7	15.9	20.2	18.5	17.3	18.5	17
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00075	0.00075	0.00178	0.00085	0.00102	0.00095	0.00552	0.00081	0.00152	0.0018	0.00159	0.00122	0.00099	0.0008	0.0008
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.063	<0.030	<0.030	<0.030	<0.030	0.043	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	0.000344	<0.000050	0.000087	0.0001	0.000445	<0.000050	0.000378	0.000706	<0.000050	0.000117	0.000139	0.000066	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	0.0012	0.001	0.0013	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.38	2.41	2.19	2.09	2.13	2.13	2.09	2.11	2.32	2.06	2.45	2.24	2.01	2.14	2.08
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00157	0.00169	0.00165	0.0012	0.00135	0.00139	0.00252	0.00096	0.00195	0.00177	0.0022	0.00239	0.00187	0.00179	0.00125
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00213	0.00212	0.000964	0.000722	0.000945	0.00085	0.000597	0.000901	0.00265	0.000862	0.00246	0.000654	0.000609	0.000505	0.000528
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.501	0.548	0.581	0.514	0.576	0.564	0.537	0.548	0.712	0.566	0.65	0.527	0.483	0.495	0.526
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000615	0.000585	0.000227	0.00016	0.000191	0.000179	0.000122	0.000201	0.000476	0.000207	0.000459	0.000164	0.000138	0.000111	0.000097
Silicon	mg/L	-	-	-	-	-	-	1.98	1.91	1.75	1.75	1.69	1.72	1.84	1.75	1.88	1.77	1.73	1.9	1.61	1.73	1.76
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.3	1.32	1.19	1.03	1.24	1.13	1.1	1.21	1.7	1.19	1.93	1.16	1.05	1	1.05
Strontium	mg/L	-	-	-	-	-	-	0.149	0.16	0.152	0.131	0.142	0.141	0.141	0.137	0.173	0.129	0.18	0.142	0.137	0.136	0.131
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.00019	0.000184	0.000167	0.000149	0.00017	0.000163	0.000163	0.000163	0.000187	0.000164	0.000169	0.000167	0.000152	0.000145	0.000159
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0039	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-B 2022-08-16	Quesnel Lake QUL-58 QUL-58-B 2022-10-19	Quesnel Lake QUL-58 QUL-58-BP 2016-11-16	Quesnel Lake QUL-58 QUL-58-BP 2019-10-30	Quesnel Lake QUL-58 QUL-58-BT 2016-06-28	Quesnel Lake QUL-58 QUL-58-BT 2016-07-06	Quesnel Lake QUL-58 QUL-58-BT 2016-08-01	Quesnel Lake QUL-58 QUL-58-BT 2016-09-05	Quesnel Lake QUL-58 QUL-58-BT 2016-10-05	Quesnel Lake QUL-58 QUL-58-BT 2016-11-09	Quesnel Lake QUL-58 QUL-58-BT 2017-03-06	Quesnel Lake QUL-58 QUL-58-BT 2017-04-10	Quesnel Lake QUL-58 QUL-58-BT 2017-06-05	Quesnel Lake QUL-58 QUL-58-BT 2017-06-12	Quesnel Lake QUL-58 QUL-58-BT 2017-06-19
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0115	0.0105	0.0056	0.007	0.0066	0.0067	0.0105	0.0059	0.0065	0.0103	0.009	0.0071	0.0103	0.0069	0.0071
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	<0.00010	0.0001	<0.00010	0.0001	<0.00010	0.0001	0.00012	<0.00010	<0.00010	0.00011	<0.00010	0.00011	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00561	0.00594	0.00516	0.00531	0.00551	0.00539	0.0055	0.00547	0.00622	0.00563	0.00533	0.00526	0.00546	0.005	0.00571
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000059	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00074	0.00073	0.00079	<0.00050	0.0009	0.00083	0.0036	0.00259	0.00094	0.00113	0.00099	0.00082	0.00081	0.00066	0.00075
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	0.000477	<0.000050	0.000163	0.000155	0.000529	0.00009	0.00025	0.000309	0.00011	0.000221	0.000287	0.000104	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	0.001	0.0011	<0.0010	0.0011	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00086	0.0006	<0.00010	0.00019	0.00041	0.00044	0.00075	0.00025	0.00083	0.00038	0.0012	0.00086	0.00064	0.0002	0.00021
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00217	0.00206	0.000715	0.000703	0.00096	0.000791	0.000576	0.000844	0.00243	0.000896	0.00217	0.00062	0.000594	0.000499	0.000447
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000503	0.000616	0.000198	0.000186	0.000218	0.000205	0.000111	0.000198	0.0005	0.000192	0.000524	0.000109	0.000107	0.000101	0.000116
Silicon	mg/L	-	-	-	-	-	-	1.99	1.91	1.63	1.75	1.71	1.74	1.7	1.68	1.76	1.64	1.99	1.74	1.66	1.79	1.83
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.152	0.159	0.144	0.134	0.141	0.14	0.137	0.14	0.168	0.141	0.168	0.136	0.134	0.135	0.108
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000178	0.000182	0.000165	0.000147	0.000162	0.000161	0.000157	0.000149	0.000174	0.000142	0.000163	0.000151	0.000158	0.000165	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0046	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-BT 2017-06-27	Quesnel Lake QUL-58 QUL-58-BT 2017-08-22	Quesnel Lake QUL-58 QUL-58-BT 2017-10-01	Quesnel Lake QUL-58 QUL-58-BT 2017-10-26	Quesnel Lake QUL-58 QUL-58-BT 2018-05-13	Quesnel Lake QUL-58 QUL-58-BT 2018-06-04	Quesnel Lake QUL-58 QUL-58-BT 2018-06-13	Quesnel Lake QUL-58 QUL-58-BT 2018-06-18	Quesnel Lake QUL-58 QUL-58-BT 2018-06-27	Quesnel Lake QUL-58 QUL-58-BT 2018-07-02	Quesnel Lake QUL-58 QUL-58-BT 2018-08-23	Quesnel Lake QUL-58 QUL-58-BT 2018-09-04	Quesnel Lake QUL-58 QUL-58-BT 2018-10-18	Quesnel Lake QUL-58 QUL-58-BT 2018-10-24	Quesnel Lake QUL-58 QUL-58-BT 2018-10-29
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	111.4	109.2	131	113.3	107.1	111.4	107.7	107.5	108	107.7	107.5	104.4	111.6	109.1	102.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.79	8.21	-	7.82	7.7	7.29	7.62	7.45	7.79	7.43	7.77	7.69	7.62	7.04	7.6
Turbidity	NTU	1	-	-	-	-	1	0	0	0.26	0.07	-	0	0	0	0.13	0.35	2.54	0	0	0	1.03
Temperature	C	-	-	-	-	-	-	4.756	5.628	1.8	8.695	4.332	4.613	4.8	4.599	4.809	4.728	7.349	4.622	4.946	5.251	8.282
Dissolved oxygen	%	-	-	-	-	-	-	85.2	84.9	-	93.9	90.4	90.4	89.3	89.5	88.2	91.7	84.6	84.9	82.3	82.2	98.3
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.94	10.66	-	10.92	11.74	11.66	11.45	11.54	11.31	11.78	10.92	10.95	10.53	10.43	11.55
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.9	45.4	50	49.3	49.3	48.2	48.7	49.3	49.3	50.3	47.7	50.3	49.7	51.5	50.5
Specific conductivity	uS/cm	-	-	-	-	-	-	123	104	105	102	112	104	108	106	108	109	106	112	111	114	110
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.91	7.82	7.87	7.94	7.89	7.93	7.91	7.95	7.9	8	7.89	8	7.87	7.89	7.9
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.3	0.21	0.19	0.3	0.65	0.35	0.36	0.32	0.33	0.3	0.17	0.3	0.2	0.19	0.3
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	59.1	51.6	50.7	49.8	44.9	53.2	52.2	54.2	52.3	54.8	51.1	50.7	52.4	54.2	51.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	84	71	68	66	62	74	60	76	78	73	71	67	72	72	65
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.84	2.2	1.94	1.7	2.27	2.36	2.12	1.31	1.99	2.03	1.7	1.74	1.72	3	1.74
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.205	0.141	0.15	0.0813	0.138	0.132	0.132	0.134	0.132	0.132	0.144	0.14	0.159	0.15	0.0823
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.205	0.141	0.15	0.0813	0.138	0.132	0.132	0.134	0.132	0.132	0.144	0.14	0.159	0.15	0.0823
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0029	<0.0020	<0.0020	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	<0.0020	0.0023	0.0041	0.0049	0.0042	0.0025	0.0033	0.005	0.0035	0.0061	<0.0020	<0.0020	<0.0020
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0018	<0.0010	0.0012	0.0013	<0.0010	0.0012	0.0012
Total nitrogen	mg/L	-	-	-	-	-	-	0.258	0.245	0.209	0.146	0.208	0.204	0.201	0.157	0.194	0.196	0.205	0.189	0.213	0.197	0.151
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.7	17.3	17	16.8	15	17.8	17.4	18.1	17.4	18.3	17.2	17.1	17.7	18	17.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.039	0.031	0.033	0.033	0.034	0.035	0.035	0.036	0.034	0.032	0.033	0.034	0.035	0.036	0.032
Magnesium	mg/L	-	-	-	-	-	-	2.42	2.02	2	1.93	1.81	2.14	2.11	2.2	2.17	2.22	1.99	1.95	1.97	2.25	2.02
Potassium	mg/L	-	-	-	-	-	-	0.574	0.491	0.489	0.46	0.433	0.541	0.525	0.533	0.525	0.534	0.511	0.477	0.553	0.548	0.493
Sodium	mg/L	-	-	-	-	-	-	1.52	0.999	1.01	0.869	0.908	1.04	1	0.993	1	1.06	0.989	0.998	1.08	1.18	0.938
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	11.4	6.8	6.87	6.65	7.36	6.72	6.38	6.46	6.42	6.42	6.72	6.76	7.29	7.05	6.16
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0225	0.0075	0.012	0.0133	0.0326	0.0225	0.0173	0.0175	0.0158	0.0155	0.0154	0.0135	0.0092	0.0119	0.0175
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	<0.00010	0.00012	0.0001	0.00016	0.00011	0.00012	0.00013	0.00013	0.00011	0.00013	0.00013	0.00011	0.0001	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00617	0.0055	0.00521	0.00562	0.00611	0.00542	0.00566	0.00586	0.00569	0.00544	0.00555	0.00538	0.00538	0.00515	0.00541
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	19.7	18.3	16.9	16.9	17.2	16	17.3	17.4	16.9	16.3	17.6	17.1	17.4	17.2	16.9
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00098	0.00065	0.00073	0.00099	0.0011	0.00074	0.00145	0.00087	0.00089	0.00089	0.00123	0.00123	0.00062	0.0007	0.00079
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.03	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000161	0.000055	0.000127	0.000196	<0.000050	0.00027	0.000618	0.000255	0.000426	0.000976	0.000379	0.000375	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.36	2.25	1.99	2.09	2.18	2.11	2.12	2.18	2.15	2.11	2.02	1.94	2.06	1.91	2.08
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00212	0.00081	0.0011	0.00121	0.00167	0.00169	0.00139	0.00167	0.00125	0.00124	0.00084	0.00087	0.0008	0.00081	0.00117
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	<0.0000050	-	-	<0.0000050	<0.0000050	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00173	0.000496	0.000455	0.000328	0.00059	0.000373	0.000425	0.000446	0.00038	0.000372	0.000426	0.000469	0.000621	0.000568	0.000379
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00067	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.588	0.49	0.49	0.489	0.537	0.504	0.528	0.509	0.538	0.529	0.469	0.457	0.501	0.487	0.489
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000424	0.000122	0.000126	0.000091	0.000157	0.000121	0.000122	0.000135	0.000133	0.000113	0.000128	0.000104	0.000108	0.000142	0.000106
Silicon	mg/L	-	-	-	-	-	-	1.86	1.78	1.68	1.61	1.72	1.79	1.81	1.85	1.87	1.88	1.83	1.73	1.8	1.78	1.53
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.45	1.04	1.01	0.933	1.08	1	1.02	1.01	1.05	1.04	0.951	0.925	1.09	0.978	0.944
Strontium	mg/L	-	-	-	-	-	-	0.158	0.141	0.131	0.135	0.141	0.129	0.135	0.135	0.133	0.128	0.134	0.138	0.142	0.136	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000179	0.000165	0.000153	0.000132	0.000167	0.00016	0.000155	0.00016	0.000162	0.000164	0.000157	0.000165	0.000146	0.000147	0.000163
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-BT 2017-06-27	Quesnel Lake QUL-58 QUL-58-BT 2017-08-22	Quesnel Lake QUL-58 QUL-58-BT 2017-10-01	Quesnel Lake QUL-58 QUL-58-BT 2017-10-26	Quesnel Lake QUL-58 QUL-58-BT 2018-05-13	Quesnel Lake QUL-58 QUL-58-BT 2018-06-04	Quesnel Lake QUL-58 QUL-58-BT 2018-06-13	Quesnel Lake QUL-58 QUL-58-BT 2018-06-18	Quesnel Lake QUL-58 QUL-58-BT 2018-06-27	Quesnel Lake QUL-58 QUL-58-BT 2018-07-02	Quesnel Lake QUL-58 QUL-58-BT 2018-08-23	Quesnel Lake QUL-58 QUL-58-BT 2018-09-04	Quesnel Lake QUL-58 QUL-58-BT 2018-10-18	Quesnel Lake QUL-58 QUL-58-BT 2018-10-24	Quesnel Lake QUL-58 QUL-58-BT 2018-10-29
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0088	0.0059	0.0054	0.006	0.0069	0.0072	0.0061	0.0073	0.0068	0.0075	0.0072	0.006	0.006	0.0061	0.0061
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.0001	0.00016	0.00012	0.0001	<0.00010	0.00011	<0.00010	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00577	0.00536	0.0052	0.00582	0.00492	0.0057	0.00555	0.00557	0.0057	0.00608	0.0051	0.00533	0.0051	0.00559	0.00532
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	0.0000095	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00085	0.00065	0.00062	0.00072	0.00063	0.00068	0.00059	0.00065	0.00067	0.00073	0.00098	0.00075	0.00057	0.00171	0.00058
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000244	0.000126	0.000098	0.000115	<0.000050	0.000293	0.000586	0.000297	0.00035	0.00107	0.000325	0.000339	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00116	0.00019	0.00037	0.00019	0.00042	0.00028	0.0001	0.00016	0.00013	0.00021	0.00024	0.00034	0.00018	0.00036	0.00017
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.00162	0.000416	0.000452	0.000308	0.000477	0.000398	0.000437	0.000407	0.000378	0.00041	0.000424	0.000478	0.000573	0.000611	0.000366
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.00038	0.000098	0.000107	0.000082	0.00011	0.000121	0.00013	0.000086	0.000092	0.000104	0.000104	0.000107	0.000118	0.0001	0.000081
Silicon	mg/L	-	-	-	-	-	-	1.65	1.67	1.7	1.49	1.48	1.69	1.69	1.74	1.76	1.78	1.72	1.69	1.55	1.71	1.45
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.154	0.133	0.13	0.13	0.12	0.134	0.135	0.138	0.133	0.142	0.129	0.139	0.135	0.144	0.137
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000155	0.000145	0.000154	0.00013	0.000133	0.000161	0.00015	0.000165	0.000153	0.000165	0.000159	0.000157	0.000157	0.000159	0.000151
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-BT 2018-11-07	Quesnel Lake QUL-58 QUL-58-BT 2019-05-08	Quesnel Lake QUL-58 QUL-58-BT 2019-06-18	Quesnel Lake QUL-58 QUL-58-BT 2019-07-11	Quesnel Lake QUL-58 QUL-58-BT 2019-07-25	Quesnel Lake QUL-58 QUL-58-BT 2019-08-20	Quesnel Lake QUL-58 QUL-58-BT 2020-06-16	Quesnel Lake QUL-58 QUL-58-BT 2020-06-24	Quesnel Lake QUL-58 QUL-58-BT 2020-06-29	Quesnel Lake QUL-58 QUL-58-BT 2020-07-21	Quesnel Lake QUL-58 QUL-58-BT 2020-08-11	Quesnel Lake QUL-58 QUL-58-MID 2015-11-30	Quesnel Lake QUL-58 QUL-58-MID 2015-12-02	Quesnel Lake QUL-58 QUL-58-MID 2015-12-09	Quesnel Lake QUL-58 QUL-58-MID 2015-12-14
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	107.1	114.1	109.8	110.4	109.8	111.1	118.5	-	108.9	-	110.5	149.3	146.3	150.4	143.5	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.6	7.86	7.72	7.99	7.71	7.59	7.66	-	7.59	-	7.42	7.73	7.73	7.74	7.33	
Turbidity	NTU	1	-	-	-	-	1	0	0.27	0.45	1.13	0.29	0	0.18	-	0.23	-	0	0.68	0.73	0.82	0.55	
Temperature	C	-	-	-	-	-	-	6.159	4.032	4.403	8.348	4.995	4.719	4.871	-	4.986	-	4.673	5.419	5.184	5.045	4.793	
Dissolved oxygen	%	-	-	-	-	-	-	89.6	87.9	92.6	94.3	86	85.4	93.9	-	88.5	-	89.2	84.2	83.9	83.5	84.5	
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.1	11.51	12.01	11.7	10.98	10.97	12.03	-	11.3	-	11.48	10.63	10.66	10.65	10.85	
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.5	51.5	48.7	49.2	48.5	49.8	49	50.2	46.6	43.7	47.2	49.8	48.6	48.2	50.9	
Specific conductivity	uS/cm	-	-	-	-	-	-	113	117	110	108	108	110	111	107	109	102	110	112	111	111	113	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.97	7.84	8.03	7.88	7.87	8	7.83	7.8	7.86	7.38	7.89	7.79	7.54	7.8	7.87	
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.1	<1.0	<1.0	<3.0	<3.0	<3.0	<3.0	
Turbidity	NTU	1	-	-	-	-	1	0.28	0.29	<0.10	0.16	0.29	0.1	0.31	0.34	0.29	1.39	0.19	0.77	0.83	0.51	0.53	
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54.6	55.1	52.4	55.2	50.8	52.5	53.9	53.7	53	48.2	52.1	53.9	52.3	53.7	56.4	
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	52.3	52.5	52	52.4	54.2	-	-	-	-	
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	98	67	62	63	79	67	70	74	71	72	65	71	66	66	
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.13	2.06	1.66	2.21	1.93	1.99	2.24	2.35	2.22	2.83	2.27	1.52	1.37	1.52	1.63	
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0957	0.136	0.138	0.132	0.13	0.144	0.129	0.133	0.123	0.0998	0.139	0.103	0.106	0.11	0.115	
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0957	0.136	0.138	0.132	0.13	0.144	0.129	0.133	0.123	0.1	0.139	0.103	0.106	0.11	0.115	
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	0.0053	<0.0050	0.0055	<0.0050	0.007	0.0093	0.0212	0.0085	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.002	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.003	0.0061	0.0071	0.0056	0.0076	<0.0020	0.008	0.003	0.0096	0.0063	0.0039	0.0028	0.0027	0.0026	0.0023	
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Total nitrogen	mg/L	-	-	-	-	-	-	0.174	0.268	0.197	0.2	0.212	0.202	0.205	0.199	0.202	0.191	0.208	0.144	0.138	0.158	0.165	
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	18.2	18.4	17.6	18.8	16.9	17.3	18	18	17.8	16.1	17.5	18.2	17.6	18.2	19.1	
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.033	0.036	0.041	0.039	0.038	0.035	0.036	0.04	0.038	0.036	0.035	0.034	0.035	0.033	0.035	
Magnesium	mg/L	-	-	-	-	-	-	2.22	2.2	2.06	2.02	2.1	2.24	2.16	2.15	2.06	1.97	2.04	2.03	1.99	2.02	2.08	
Potassium	mg/L	-	-	-	-	-	-	0.516	0.532	0.463	0.494	0.51	0.481	0.508	0.469	0.506	0.537	0.492	0.507	0.487	0.496	0.496	
Sodium	mg/L	-	-	-	-	-	-	1.11	1.16	0.97	1.04	1.02	1.07	1	1.02	1.01	0.94	1	0.95	0.957	0.993	0.949	
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.54	7.55	6.71	7	6.69	6.69	6.94	6.89	6.67	5.66	6.69	6.65	6.6	6.7	6.63	
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.02	0.0206	0.0159	0.0124	0.0084	0.0084	0.0218	0.0192	0.0189	0.101	0.0166	0.0359	0.0474	0.0375	0.043	
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00017	0.00011	0.00012	0.00011	<0.00010	0.00012	0.00011	0.00013	0.00014	<0.00010	0.00012	0.00013	0.00015	0.00013	
Barium	mg/L	-	1W	-	-	-	1	0.00535	0.00509	0.00525	0.00574	0.00562	0.00489	0.00544	0.00532	0.00529	0.00686	0.0053	0.00576	0.00577	0.00573	0.00614	
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
Calcium	mg/L	-	-	-	1000	-	1000	18.4	17.1	17.3	17.7	17	17.1	17.5	17.6	17.3	17.6	18	18.4	18	17.9	18.5	
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00086	0.00098	0.00103	0.00092	0.00064	0.00066	0.00082	0.0008	0.00071	0.00091	0.00092	0.00129	0.00149	0.0015	0.00138	
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.093	<0.030	<0.030	<0.030	<0.030	<0.030	
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00248	0.000184	0.000234	0.000234	
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Magnesium	mg/L	-	-	-	-	-	-	2.31	2.04	2.04	2.01	2	2.01	2.08	2.1	2.14	2.06	2.25	2.06	2.05	2.03	2.07	
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00187	0.00119	0.00127	0.00091	0.00083	0.00065	0.00136	0.00131	0.00131	0.00323	0.00117	0.00167	0.00157	0.00131	0.00132	
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	<0.0000050	<0.0000050	-	-	-	<0.0000050	-	-	-	0.0000106	<0.0000050	-	-	<0.0000050	
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000501	0.000743	0.000381	0.0004	0.000429	0.000452	0.000465	0.000451	0.000433	0.000358	0.00042	0.000398	0.000414	0.000441	0.000426	
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00058	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Potassium	mg/L	-	-	-	-	-	-	0.509	0.499	0.494	0.512	0.485	0.501	0.501	0.49	0.51	0.553	0.51	0.506	0.499	0.507	0.534	
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000189	0.000227	0.000097	0.00013	0.000145	0.000145	0.00014	0.000139	0.00011	0.000131	0.000155	0.000128	0.000096	0.000089	0.000108	
Silicon	mg/L	-	-	-	-	-	-	1.53	1.74	1.71	1.76	1.74	1.67	1.91	1.8	1.86	2.01	1.94	1.64	1.67	1.66	1.72	
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium	mg/L	-	-	-	-	-	-	1.05	1.12	0.98	0.987	1.02	0.992	0.997	0.982	1.03	0.991	1.02	0.967	0.954	0.993	0.975	
Strontium	mg/L	-	-	-	-	-	-	0.129	0.146	0.133	0.134	0.133	0.129	0.136	0.136	0.13	0.122	0.135	0.139	0.136	0.138	0.127	
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000163	0.00016	0.00017	0.000153	0.000163	0.000158	0.000155	0.000152	0.000149	0.000152	0.000164	0.000166	0.000169	0.000167	0.000157	
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-BT 2018-11-07	Quesnel Lake QUL-58 QUL-58-BT 2019-05-08	Quesnel Lake QUL-58 QUL-58-BT 2019-06-18	Quesnel Lake QUL-58 QUL-58-BT 2019-07-11	Quesnel Lake QUL-58 QUL-58-BT 2019-07-25	Quesnel Lake QUL-58 QUL-58-BT 2019-08-20	Quesnel Lake QUL-58 QUL-58-BT 2020-06-16	Quesnel Lake QUL-58 QUL-58-BT 2020-06-24	Quesnel Lake QUL-58 QUL-58-BT 2020-06-29	Quesnel Lake QUL-58 QUL-58-BT 2020-07-21	Quesnel Lake QUL-58 QUL-58-BT 2020-08-11	Quesnel Lake QUL-58 QUL-58-MID 2015-11-30	Quesnel Lake QUL-58 QUL-58-MID 2015-12-02	Quesnel Lake QUL-58 QUL-58-MID 2015-12-09	Quesnel Lake QUL-58 QUL-58-MID 2015-12-14
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0081	0.0074	0.0054	0.0049	0.0053	0.0052	0.0081	0.0068	0.0078	0.0144	0.0065	0.0046	0.0216	0.006	0.0054
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00011	0.0001	<0.00010	<0.00010	0.0001	0.00012	0.00011	<0.00010	0.00012	0.00011	<0.00010	0.00011	0.00011	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00554	0.00566	0.00516	0.00527	0.0053	0.00504	0.00551	0.00514	0.0055	0.0053	0.00541	0.00537	0.00534	0.0051	0.00552
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00081	0.00062	<0.00050	<0.00050	0.00051	0.0005	0.00064	0.00056	0.00052	0.00059	0.00064	0.00066	0.00138	0.00095	0.00083
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000184	0.000308	0.000273	0.000183
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00088	0.00024	0.00013	0.00012	<0.00010	0.00013	0.00014	<0.00010	0.00014	0.00028	0.00011	0.0003	0.00055	0.00019	0.00023
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	<0.0000050
Molybdenum	mg/L	-	-	-	-	-	-	0.00053	0.000695	0.000392	0.000394	0.000414	0.000479	0.000458	0.000443	0.000437	0.000358	0.000424	0.000375	0.000384	0.000383	0.000422
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000124	0.000154	0.000155	0.000097	0.000109	0.000111	0.000129	0.000091	0.000126	0.000122	0.000101	0.000122	0.000098	0.000094	0.000097
Silicon	mg/L	-	-	-	-	-	-	1.49	1.7	1.79	1.69	1.8	1.8	1.82	1.76	1.83	2.02	1.75	1.58	1.59	1.62	1.67
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.145	0.141	0.137	0.131	0.128	0.134	0.138	0.143	0.135	0.118	0.14	0.135	0.132	0.134	0.125
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000173	0.000172	0.000179	0.000156	0.000158	0.00015	0.00015	0.000159	0.000153	0.000149	0.000142	0.000161	0.00016	0.000157	0.000152
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2015-12-30	Quesnel Lake QUL-58 QUL-58-MID 2016-01-25	Quesnel Lake QUL-58 QUL-58-MID 2016-02-23	Quesnel Lake QUL-58 QUL-58-MID 2016-03-28	Quesnel Lake QUL-58 QUL-58-MID 2016-04-11	Quesnel Lake QUL-58 QUL-58-MID 2016-04-27	Quesnel Lake QUL-58 QUL-58-MID 2016-05-05	Quesnel Lake QUL-58 QUL-58-MID 2016-05-10	Quesnel Lake QUL-58 QUL-58-MID 2016-05-17	Quesnel Lake QUL-58 QUL-58-MID 2016-05-25	Quesnel Lake QUL-58 QUL-58-MID 2016-06-07	Quesnel Lake QUL-58 QUL-58-MID 2016-06-20	Quesnel Lake QUL-58 QUL-58-MID 2017-02-02	Quesnel Lake QUL-58 QUL-58-MID 2017-05-09	Quesnel Lake QUL-58 QUL-58-MID 2017-05-15
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	150.9	108.8	108.9	110.3	113.5	105.6	107.5	107	106.8	104.7	113	103.8	123	112.2	115.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.67	7.88	7.69	7.94	7.8	8	7.88	7.5	7.64	7.46	7.66	7.84	7.63	7.42	7.54
Turbidity	NTU	1	-	-	-	-	1	0.42	0.45	0.53	0.43	0.6	0.48	0.51	0.88	0.46	0.44	0.8	0	0.69	0.54	0
Temperature	C	-	-	-	-	-	-	3.697	3.056	2.671	3.121	3.725	4.573	5.16	4.862	4.847	4.633	5.055	5.236	2.907	3.876	4.33
Dissolved oxygen	%	-	-	-	-	-	-	84.7	86.2	86.3	92.2	87.5	91	91	86.1	87.6	87.1	76.2	86.6	84.5	88.6	93.2
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.18	11.59	11.72	12.36	11.54	11.75	11.57	11.04	11.23	11.2	9.72	11	11.4	11.65	12.11
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.8	47.9	48.3	49.4	50.6	49.6	48.2	47.9	50.9	47.2	50.9	48.2	50.7	50	49.2
Specific conductivity	uS/cm	-	-	-	-	-	-	112	111	115	115	115	116	110	112	114	111	113	107	117	113	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.77	7.84	7.79	7.83	7.97	7.87	7.93	7.85	7.98	7.42	7.82	7.79	7.92	7.81	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<1.0	1	<1.0	<1.0	<1.0	1.1	3.6	1.2	<1.0	<1.0	<1.0	<1.0	4.2
Turbidity	NTU	1	-	-	-	-	1	0.77	0.45	0.44	0.58	0.54	0.38	0.3	0.31	2.28	0.39	0.37	0.71	0.66	0.63	0.64
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53.2	55.3	53.8	52.8	53.5	54.6	54.2	54.4	53.7	54.2	55.4	54.3	57.4	54.4	53.6
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	74	67	62	49	60	59	71	73	71	66	76	84	81	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.72	1.71	1.46	1.51	1.82	1.86	1.82	1.64	1.59	1.55	1.73	1.75	1.88	1.95	1.72
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.115	0.121	0.123	0.13	0.127	0.128	0.128	0.135	0.133	0.132	0.144	0.134	0.184	0.138	0.142
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.115	0.121	0.123	0.13	0.127	0.128	0.128	0.135	0.133	0.132	0.144	0.134	0.184	0.138	0.142
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0027	0.0026	0.0024	0.0042	0.0032	0.0025	0.0046	0.0058	0.011	<0.0020	0.0021	0.003	<0.0020	0.0025	0.0027
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.164	0.173	0.165	0.176	0.178	0.191	0.178	0.18	0.186	0.202	0.187	0.196	0.231	0.187	0.184
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	17.9	18.7	18.2	17.8	18	18.4	18.3	18.4	18	18.3	18.6	18.3	19.4	18	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.037	0.033	0.035	0.036	0.037	0.038	0.039	0.036	0.035	0.035	0.035	0.035	0.038	0.033	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.04	2.06	2.04	2.05	2.06	2.13	2.08	2.09	2.1	2.09	2.16	2.08	2.14	2.26	2.05
Potassium	mg/L	-	-	-	-	-	-	0.509	0.486	0.483	0.544	0.498	0.508	0.486	0.491	0.534	0.496	0.533	0.5	0.597	0.558	0.498
Sodium	mg/L	-	-	-	-	-	-	0.976	0.996	0.992	1.05	1.01	1.07	1	1	0.982	1.01	1.09	1.03	1.36	1.15	1.06
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.78	6.88	6.98	7.26	7.25	7.56	7.07	7.12	6.85	6.8	7.55	6.91	10.8	7.5	7.5
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0252	0.0269	0.034	0.0388	0.035	0.0307	0.0252	<0.024	0.177	0.0236	0.0254	0.0188	0.0317	0.0441	0.0338
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00012	0.00012	0.00012	0.00014	0.00014	0.00011	<0.00010	0.00023	0.0001	0.00013	0.0001	0.00022	0.00011	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00562	0.00544	0.00531	0.00571	0.00603	0.00575	0.00539	0.00533	0.00885	0.00564	0.00574	0.00563	0.00598	0.00593	0.00564
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.3	18.4	17.8	18	18.3	18.3	18.2	18.1	18.3	18.2	18.2	18.1	18.6	18.9	18.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00149	0.00136	0.00133	0.00192	0.00166	0.00148	0.00159	0.00112	0.00545	0.00121	0.00124	0.00111	0.00178	0.0012	0.00133
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.121	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000081	0.000294	0.00111	0.00012	0.000835	0.000208	0.000329	0.00021	0.000307	0.000065	0.000106	0.000647	0.000255	0.000122	0.000139
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.001	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	0.0011	0.0013	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.05	2.04	2.06	2.12	2.14	2.16	2.1	2.08	2.21	2.1	2.14	2.12	2.4	2.19	2.26
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00105	0.00124	0.00138	0.00169	0.0017	0.00238	0.00152	0.00143	0.00401	0.00126	0.00144	0.00103	0.00192	0.00163	0.00175
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000471	0.000492	0.000542	0.000633	0.000774	0.000579	0.000419	0.000497	0.000483	0.000467	0.000718	0.000503	0.00166	0.000679	0.0007
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.54	0.483	0.513	0.526	0.51	0.522	0.501	0.5	0.62	0.513	0.547	0.495	0.617	0.544	0.536
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000107	0.000118	0.000133	0.000104	0.000115	0.000141	0.000086	0.000127	0.00014	0.000115	0.000198	0.000119	0.000354	0.000142	0.000156
Silicon	mg/L	-	-	-	-	-	-	1.59	1.72	1.7	1.75	1.77	1.81	1.73	1.8	2.09	1.78	1.8	1.76	1.82	1.82	1.77
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000023	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.03	0.995	1.08	1.02	1.04	1.05	1.03	1.03	1.04	1.05	1.1	1.02	1.54	1.11	1.13
Strontium	mg/L	-	-	-	-	-	-	0.14	0.137	0.144	0.143	0.14	0.135	0.123	0.136	0.132	0.139	0.14	0.142	0.157	0.147	0.147
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000163	0.000164	0.000176	0.000179	0.000181	0.000171	0.000153	0.000163	0.000172	0.000169	0.000168	0.000169	0.000196	0.00017	0.000158
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00112	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2015-12-30	Quesnel Lake QUL-58 QUL-58-MID 2016-01-25	Quesnel Lake QUL-58 QUL-58-MID 2016-02-23	Quesnel Lake QUL-58 QUL-58-MID 2016-03-28	Quesnel Lake QUL-58 QUL-58-MID 2016-04-11	Quesnel Lake QUL-58 QUL-58-MID 2016-04-27	Quesnel Lake QUL-58 QUL-58-MID 2016-05-05	Quesnel Lake QUL-58 QUL-58-MID 2016-05-10	Quesnel Lake QUL-58 QUL-58-MID 2016-05-17	Quesnel Lake QUL-58 QUL-58-MID 2016-05-25	Quesnel Lake QUL-58 QUL-58-MID 2016-06-07	Quesnel Lake QUL-58 QUL-58-MID 2016-06-20	Quesnel Lake QUL-58 QUL-58-MID 2017-02-02	Quesnel Lake QUL-58 QUL-58-MID 2017-05-09	Quesnel Lake QUL-58 QUL-58-MID 2017-05-15
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0064	0.0052	0.0056	0.0066	0.005	0.0066	0.0062	0.0075	0.0069	0.005	0.0066	0.0074	0.0049	0.007	0.0077
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.0001	0.00011	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.00011	0.0001	0.0001	0.0001	<0.00010	0.0001	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00526	0.00498	0.00499	0.00549	0.00539	0.00539	0.00515	0.0052	0.0054	0.00527	0.00537	0.00549	0.00553	0.00577	0.00527
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00084	0.00088	0.00086	0.00099	0.00111	0.00103	0.00125	0.00085	0.00108	0.00092	0.00092	0.00093	0.00076	0.00088	0.00092
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	0.000642	0.000871	0.000153	0.000864	0.000135	0.000792	0.000109	0.000235	0.000114	0.000166	0.000951	0.000205	0.000227	0.000174
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	0.001	<0.0010	0.0011	<0.0010	0.0011	<0.0010	0.0011
Manganese	mg/L	-	-	-	-	-	-	0.00024	0.00025	0.00031	0.00069	0.00059	0.00101	0.00045	0.00038	0.00045	0.00014	0.00029	0.00023	0.00067	0.00029	0.00022
Mercury	mg/L	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000431	0.000426	0.000474	0.000551	0.000491	0.00057	0.000414	0.000462	0.000509	0.00041	0.000711	0.000491	0.00157	0.000622	0.000579
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000116	0.000119	0.000093	0.000132	0.000137	0.000137	0.000115	0.000122	0.00014	0.000105	0.000185	0.000127	0.000306	0.000176	0.000127
Silicon	mg/L	-	-	-	-	-	-	1.57	1.65	1.64	1.66	1.66	1.73	1.69	1.79	1.72	1.73	1.76	1.75	1.63	1.7	1.62
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.136	0.136	0.136	0.138	0.133	0.133	0.129	0.134	0.128	0.131	0.141	0.137	0.156	0.138	0.136
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000156	0.00015	0.000162	0.000161	0.000169	0.000162	0.000157	0.000158	0.000162	0.000154	0.000159	0.000158	0.000158	0.000143	0.000152
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2017-05-22	Quesnel Lake QUL-58 QUL-58-MID 2017-05-29	Quesnel Lake QUL-58 QUL-58-MID 2017-11-20	Quesnel Lake QUL-58 QUL-58-MID 2018-01-04	Quesnel Lake QUL-58 QUL-58-MID 2018-01-18	Quesnel Lake QUL-58 QUL-58-MID 2018-05-03	Quesnel Lake QUL-58 QUL-58-MID 2018-05-22	Quesnel Lake QUL-58 QUL-58-MID 2018-12-18	Quesnel Lake QUL-58 QUL-58-MID 2019-02-26	Quesnel Lake QUL-58 QUL-58-MID 2019-03-05	Quesnel Lake QUL-58 QUL-58-MID 2019-04-25	Quesnel Lake QUL-58 QUL-58-MID 2019-05-02	Quesnel Lake QUL-58 QUL-58-MID 2019-05-21	Quesnel Lake QUL-58 QUL-58-MID 2020-06-02	Quesnel Lake QUL-58 QUL-58-MID 2020-06-09
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	110.8	111.4	106.9	109.8	110.2	113.7	115.4	113.6	111.2	108.7	111.7	114.9	116	117.9	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.54	7.41	-	7.8	7.64	6.95	7.06	7.84	7.81	7.79	7.72	7.77	7.64	7.76	-
Turbidity	NTU	1	-	-	-	-	1	0	0.55	0.24	0	0.67	0	0.86	0	0.36	0	0.88	0.25	0	0.48	-
Temperature	C	-	-	-	-	-	-	4.619	4.587	6.005	3.62	2.984	3.255	3.867	4.56	2.873	2.895	3.462	3.767	4.121	4.33	-
Dissolved oxygen	%	-	-	-	-	-	-	86.5	89.1	95.2	85.3	85.5	87.8	88.3	88.7	85.1	86.8	87.3	88.1	88.8	92.3	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.15	11.5	11.84	11.29	11.52	11.72	11.61	11.46	11.49	11.71	11.6	11.62	11.59	11.99	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50.1	50.8	49.5	50.1	49.4	49.3	50.7	48.6	49.2	47.2	49.4	50.7	48.9	48.5	48.3
Specific conductivity	uS/cm	-	-	-	-	-	-	114	112	103	107	106	114	111	110	112	112	112	113	117	114	114
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.94	7.85	7.93	7.87	7.71	7.88	7.81	7.8	7.93	7.83	7.85	7.88	8.03	7.83	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.43	0.34	0.31	0.33	0.31	0.6	0.31	0.38	0.21	0.12	0.32	0.27	0.2	0.26	0.2
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	54.7	52	53.8	52.6	56.9	52.2	55.2	56.2	53.1	53.8	57.8	53.4	55.7	55.9	54
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	72	81	73	68	64	72	67	65	67	90	70	73	66	70	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.14	1.58	1.61	1.63	1.59	1.96	2	1.71	1.64	1.69	2.11	1.92	2.19	2.09	2.39
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.134	0.133	0.109	0.12	0.121	0.141	0.142	0.127	0.135	0.137	0.143	0.138	0.133	0.138	0.132
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.134	0.133	0.109	0.12	0.121	0.141	0.142	0.127	0.135	0.137	0.143	0.138	0.133	0.139	0.132
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0151	<0.0050	0.0078
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.010	<0.010	<0.0020	<0.0020	0.0028	0.004	0.0045	0.0025	0.0109	0.0056	0.0038	0.0029	0.0087	0.0027	0.0064
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Total nitrogen	mg/L	-	-	-	-	-	-	0.191	0.189	0.163	0.164	0.167	0.2	0.183	0.196	0.194	0.175	0.192	0.203	0.198	0.203	0.215
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18.1	17.5	17.8	17.8	19.4	17.4	18.3	18.7	18.1	18.2	19.6	17.9	18.6	18.6	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.034	0.035	0.034	0.033	0.035	0.035	0.037	0.034	0.039	0.036	0.032	0.034	0.038	0.037	0.034
Magnesium	mg/L	-	-	-	-	-	-	2.31	2.01	2.27	1.99	2.04	2.1	2.29	2.28	1.9	2	2.12	2.14	2.25	2.27	2.14
Potassium	mg/L	-	-	-	-	-	-	0.522	0.477	0.506	0.425	0.481	0.49	0.552	0.549	0.487	0.515	0.504	0.526	0.54	0.543	0.523
Sodium	mg/L	-	-	-	-	-	-	1.21	1	0.989	0.944	0.913	1.03	1.16	1.16	0.977	1.08	1.19	1.13	1.15	1.14	1.12
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.58	7.02	6.69	6.78	6.58	7.44	7.44	7.58	7.79	7	7.47	7.77	7.37	7.12	7.49
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0256	0.0195	0.0221	0.0196	0.0215	0.0297	0.0234	0.0203	0.0142	0.0134	0.0237	0.0287	0.0137	0.0152	0.0168
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	0.00011	0.00011	0.00012	0.00014	0.00014	0.00012	0.00012	<0.00010	0.00013	<0.00010	0.00016	0.00012	0.00013	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00553	0.00574	0.00549	0.00588	0.00521	0.00544	0.0057	0.00544	0.00538	0.00536	0.00558	0.0054	0.00528	0.00533	0.00536
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000055	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.4	18.1	17.6	18.8	19.1	18	17.3	17.5	18.2	18.2	18.7	19.1	17.7	18.6	18.7
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00113	0.00097	0.00087	0.00101	0.00121	0.00135	0.00127	0.00109	0.00077	0.00087	0.00108	0.00138	0.00079	0.00071	0.00088
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000285	0.000188	0.000053	0.000942	0.000336	0.000259	0.000439	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.0011	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.27	2.2	1.85	2.11	1.97	2.21	2.16	2.14	1.94	2	2.05	2.06	2.07	2.06	2.15
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00228	0.00175	0.00121	0.00091	0.00097	0.00181	0.00166	0.00146	0.00079	0.00075	0.00147	0.00162	0.0011	0.0013	0.00134
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	<0.0000050	<0.0000050	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000655	0.000545	0.000406	0.000441	0.000468	0.000549	0.000591	0.000708	0.000647	0.000694	0.000756	0.000748	0.000677	0.000516	0.000604
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.524	0.532	0.433	0.443	0.487	0.489	0.493	0.55	0.5	0.515	0.54	0.481	0.477	0.481	0.519
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000152	0.000112	0.000116	0.000109	0.00013	0.000135	0.000163	0.000163	0.000115	0.000176	0.000223	0.000175	0.000176	0.000185	0.000161
Silicon	mg/L	-	-	-	-	-	-	1.77	1.84	1.57	1.63	1.66	1.75	1.83	1.81	1.61	1.63	1.73	1.8	1.69	1.7	1.83
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.17	1.1	0.872	1.02	0.911	1.08	1.07	1.2	0.976	1.09	1.14	1.13	1.1	1.03	1.08
Strontium	mg/L	-	-	-	-	-	-	0.132	0.136	0.137	0.135	0.14	0.138	0.143	0.14	0.134	0.138	0.147	0.137	0.137	0.134	0.141
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000164	0.00016	0.000184	0.000163	0.000154	0.000174	0.000164	0.000169	0.000166	0.000152	0.000171	0.000161	0.000162	0.000146	0.000162
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2017-05-22	Quesnel Lake QUL-58 QUL-58-MID 2017-05-29	Quesnel Lake QUL-58 QUL-58-MID 2017-11-20	Quesnel Lake QUL-58 QUL-58-MID 2018-01-04	Quesnel Lake QUL-58 QUL-58-MID 2018-01-18	Quesnel Lake QUL-58 QUL-58-MID 2018-05-03	Quesnel Lake QUL-58 QUL-58-MID 2018-05-22	Quesnel Lake QUL-58 QUL-58-MID 2018-12-18	Quesnel Lake QUL-58 QUL-58-MID 2019-02-26	Quesnel Lake QUL-58 QUL-58-MID 2019-03-05	Quesnel Lake QUL-58 QUL-58-MID 2019-04-25	Quesnel Lake QUL-58 QUL-58-MID 2019-05-02	Quesnel Lake QUL-58 QUL-58-MID 2019-05-21	Quesnel Lake QUL-58 QUL-58-MID 2020-06-02	Quesnel Lake QUL-58 QUL-58-MID 2020-06-09
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0074	0.006	0.0057	0.0045	0.0055	0.0067	0.0087	0.0069	0.0057	0.0055	0.0081	0.0062	0.0063	0.0071	0.0073
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00011	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	0.00014	<0.00010	<0.00010	0.00011	0.00013	0.00012	<0.00010	0.0001
Barium	mg/L	-	-	-	-	-	-	0.00557	0.00513	0.00521	0.00528	0.00517	0.00511	0.00565	0.00543	0.00518	0.00523	0.00571	0.0052	0.006	0.00557	0.00548
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00101	0.00065	0.0006	0.00071	0.00069	0.00072	0.00087	0.00066	0.00054	0.00055	0.00063	0.00065	0.00061	0.00067	0.00074
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000672	<0.000050	0.00009	0.000414	0.000244	0.00018	0.000356	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00085	0.00037	0.00015	0.00011	<0.00015	0.00038	0.00019	0.0002	<0.00010	<0.00010	0.00028	0.00028	0.00013	0.00015	0.00014
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000663	0.000521	0.000377	0.000384	0.000395	0.000545	0.000617	0.000675	0.000625	0.000647	0.000831	0.000749	0.000656	0.000525	0.00058
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000136	0.000119	0.000113	0.000129	0.000112	0.000215	0.000164	0.000167	0.000182	0.000186	0.0002	0.000218	0.000127	0.000132	0.000124
Silicon	mg/L	-	-	-	-	-	-	1.76	1.72	1.64	1.55	1.62	1.64	1.69	1.55	1.53	1.58	1.62	1.69	1.7	1.81	1.74
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.137	0.132	0.126	0.138	0.143	0.136	0.143	0.139	0.131	0.141	0.15	0.139	0.147	0.148	0.143
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000165	0.000157	0.000147	0.000148	0.000156	0.000163	0.000173	0.000161	0.000153	0.000162	0.000177	0.00016	0.000163	0.000154	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2020-11-04	Quesnel Lake QUL-58 QUL-58-MID 2021-05-04	Quesnel Lake QUL-58 QUL-58-MID 2021-05-11	Quesnel Lake QUL-58 QUL-58-MID 2021-05-25	Quesnel Lake QUL-58 QUL-58-MID 2021-06-02	Quesnel Lake QUL-58 QUL-58-MID 2022-05-09	Quesnel Lake QUL-58 QUL-58-MID 2022-05-18	Quesnel Lake QUL-58 QUL-58-MID 2022-05-25	Quesnel Lake QUL-58 QUL-58-MID 2022-05-31	Quesnel Lake QUL-58 QUL-58-MID 2022-06-06	Quesnel Lake QUL-58 QUL-58-MP 2015-12-21	Quesnel Lake QUL-58 QUL-58-MP 2016-04-11	Quesnel Lake QUL-58 QUL-58-MP 2016-11-16	Quesnel Lake QUL-58 QUL-58-MP 2016-11-21	Quesnel Lake QUL-58 QUL-58-MP 2018-01-10
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	109	113.2	114.2	113.9	111	114	114.3	129.8	113.8	-	152	-	111.7	113.6	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.18	7.73	7.84	7.66	7.59	7.71	7.8	7.39	7.82	-	7.65	-	7.68	7.69	-
Turbidity	NTU	1	-	-	-	-	1	0.21	1.07	0	0.18	0.97	0	0.29	0.24	0.25	-	0.85	-	0.47	0.38	-
Temperature	C	-	-	-	-	-	-	6.199	3.941	4.299	4.253	5.044	3.927	4.324	4.281	4.596	-	4.481	-	8.024	7.627	-
Dissolved oxygen	%	-	-	-	-	-	-	87.5	92.3	94.5	92.3	95.1	89.6	91.9	89.9	90.8	-	82.4	-	87.2	85	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.83	12.12	12.28	12.01	12.13	11.76	11.94	11.7	11.72	-	10.67	-	10.31	10.15	-
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.5	48.1	48.4	48.7	48.4	50.6	51.5	51.7	50.5	53.1	48.3	50.5	49.5	49.7	48.8
Specific conductivity	uS/cm	-	-	-	-	-	-	109	114	116	114	109	114	116	114	115	113	114	118	112	116	126
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	7.95	7.92	7.85	7.89	7.91	7.9	7.9	7.96	7.72	7.88	7.97	7.86	7.91	7.8
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	1.2	<1.0	1.7	1.4	<1.0	<1.0	1.3	<1.0	<3.0	1.1	2.4	1.2	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.24	0.21	0.16	0.14	0.22	0.25	0.23	0.33	0.28	0.24	0.58	0.61	0.42	0.44	0.41
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53.5	57.2	54.6	53.8	54.4	50.4	58.7	51.1	53	48.3	55	54.7	51.2	56.2	54.5
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	52.7	53.1	55.8	50.9	52.4	54.5	55.2	53.2	54.4	55.6	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	71	71	65	111	67	80	67	53	81	72	64	75	79	73	67
Dissolved organic carbon	mg/L	-	-	-	-	-	-	12.8	2.14	2.2	1.98	2.2	2.24	2.14	1.88	2.14	2.11	1.65	1.83	1.74	1.95	1.6
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.111	0.138	0.131	0.131	0.131	0.129	0.13	0.132	0.128	0.128	0.115	0.132	0.117	0.139	0.178
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.111	0.138	0.131	0.131	0.131	0.129	0.13	0.132	0.128	0.128	0.115	0.132	0.117	0.139	0.178
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.003	<0.0020	0.0032	0.0024	0.0024	0.0031	<0.0020	0.0035	0.0028
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.183	0.199	0.187	0.191	0.196	0.212	0.181	0.179	0.188	0.191	0.151	0.184	0.185	0.206	0.216
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	18	19.2	18.3	17.9	18.2	16.9	20	17.4	17.5	16	18.7	18.4	17.2	18.9	18.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.031	0.038	0.035	0.036	0.031	0.037	0.039	0.036	0.039	0.034	0.036	0.037	0.035	0.038	0.039
Magnesium	mg/L	-	-	-	-	-	-	2.08	2.24	2.16	2.21	2.17	1.98	2.12	1.86	2.26	2.03	2.04	2.13	2.03	2.2	2.24
Potassium	mg/L	-	-	-	-	-	-	0.503	0.488	0.53	0.516	0.535	0.433	0.474	0.522	0.503	0.44	0.491	0.5	0.521	0.594	0.495
Sodium	mg/L	-	-	-	-	-	-	0.973	1.07	1.07	1.07	1.08	0.934	1.08	1.08	1.07	1	0.971	1.04	1.1	1.28	1.14
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.98	7.84	7.66	7.11	7.29	7.64	7.77	7.81	7.75	7.5	6.85	7.7	8.69	9.96	9.82
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0149	0.0157	0.0195	0.0126	0.0242	0.0211	0.0391	0.0226	0.0204	0.0182	0.0379	0.0419	0.0275	0.033	0.0319
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00011	0.00011	0.00012	0.00012	0.00013	0.00011	0.00013	0.00011	0.00012	0.00015	0.00015	0.00013	0.00013	0.00016	0.00014
Barium	mg/L	-	1W	-	-	-	1	0.00488	0.00522	0.00526	0.00534	0.00542	0.00562	0.00586	0.00536	0.00527	0.00549	0.00581	0.00625	0.00576	0.0063	0.00575
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.6	17.8	18.7	16.9	17.4	18.2	18.3	17.7	17.8	18.6	18.1	18.7	18.7	18.1	18.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00068	0.00081	0.00086	0.00069	0.00116	0.0009	0.00131	0.00097	0.00091	0.00084	0.00177	0.00173	0.00121	0.00148	0.00126
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.038	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000164	0.000208	0.000739	0.000488	0.000663
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	0.001	<0.0010	<0.0010	0.001	0.0011	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.16	2.11	2.21	2.12	2.18	2.19	2.3	2.18	2.42	2.22	2.01	2.21	2.2	2.25	2.3
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00136	0.00116	0.00126	0.00084	0.00151	0.00143	0.00206	0.00154	0.00139	0.00141	0.00152	0.00217	0.002	0.00258	0.00147
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	<0.0000050	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000422	0.000738	0.000684	0.000547	0.000568	0.000744	0.000798	0.000744	0.000705	0.000624	0.000453	0.000897	0.00104	0.00137	0.00102
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.486	0.496	0.527	0.508	0.517	0.506	0.553	0.504	0.514	0.484	0.498	0.528	0.567	0.636	0.493
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00013	0.000159	0.000171	0.000139	0.000172	0.000209	0.000198	0.000191	0.000186	0.000171	0.000107	0.000167	0.000218	0.000274	0.000359
Silicon	mg/L	-	-	-	-	-	-	1.76	1.77	1.82	1.92	2	1.83	2.03	1.88	1.93	1.85	1.67	1.8	1.67	1.76	1.65
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.03	1.03	1.08	1	1.08	1.08	1.16	1.08	1.11	1.1	0.996	1.07	1.21	1.39	1.24
Strontium	mg/L	-	-	-	-	-	-	0.135	0.137	0.148	0.142	0.138	0.146	0.151	0.144	0.15	0.143	0.134	0.143	0.15	0.15	0.156
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000153	0.000154	0.000172	0.000162	0.000168	0.000166	0.000182	0.000167	0.000164	0.000174	0.000158	0.000184	0.000162	0.000174	0.000169
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MID 2020-11-04	Quesnel Lake QUL-58 QUL-58-MID 2021-05-04	Quesnel Lake QUL-58 QUL-58-MID 2021-05-11	Quesnel Lake QUL-58 QUL-58-MID 2021-05-25	Quesnel Lake QUL-58 QUL-58-MID 2021-06-02	Quesnel Lake QUL-58 QUL-58-MID 2022-05-09	Quesnel Lake QUL-58 QUL-58-MID 2022-05-18	Quesnel Lake QUL-58 QUL-58-MID 2022-05-25	Quesnel Lake QUL-58 QUL-58-MID 2022-05-31	Quesnel Lake QUL-58 QUL-58-MID 2022-06-06	Quesnel Lake QUL-58 QUL-58-MP 2015-12-21	Quesnel Lake QUL-58 QUL-58-MP 2016-04-11	Quesnel Lake QUL-58 QUL-58-MP 2016-11-16	Quesnel Lake QUL-58 QUL-58-MP 2016-11-21	Quesnel Lake QUL-58 QUL-58-MP 2018-01-10
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute															
Dissolved Metals																					
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0072	0.0082	0.0082	0.0083	0.008	0.0096	0.0107	0.0084	0.0081	0.0077	0.0056	0.0056	0.0077	0.0092	0.0076
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00011	0.00011	0.00011	0.0001	0.00011	0.00012	0.0001	0.0001	0.00015
Barium	mg/L	-	-	-	-	-	-	0.00508	0.00552	0.00523	0.00523	0.00547	0.0049	0.00515	0.00526	0.00529	0.00481	0.00526	0.0055	0.00526	0.00595	0.00548
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000085	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00056	0.00066	0.00067	0.00066	0.00073	0.00064	0.00095	0.00081	0.00068	0.00062	0.00096	0.00121	0.00067	0.00192	0.00094
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000084	0.000384	0.000717	0.00042	0.000259
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00043	0.00015	0.00013	0.00016	0.00016	0.00024	0.00049	0.00021	0.00018	0.00012	0.00035	0.00102	0.00045	0.00096	0.00044
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000449	0.000828	0.000641	0.00051	0.0006	0.000702	0.000803	0.000738	0.000668	0.000614	0.000416	0.000639	0.000891	0.00132	0.000803
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000123	0.000216	0.000194	0.000159	0.000146	0.000212	0.000165	0.000158	0.000156	0.000192	0.000109	0.000179	0.00025	0.000323	0.000325
Silicon	mg/L	-	-	-	-	-	-	1.63	1.62	1.82	1.79	1.75	1.73	1.86	1.81	1.91	1.74	1.61	1.7	1.51	1.58	1.54
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.146	0.148	0.132	0.143	0.143	0.138	0.146	0.142	0.146	0.132	0.132	0.136	0.144	0.15	0.147
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000158	0.000175	0.00017	0.000158	0.000157	0.000156	0.000161	0.000179	0.000152	0.000169	0.000148	0.000166	0.000162	0.00016	0.000162
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MP 2018-01-31	Quesnel Lake QUL-58 QUL-58-MP 2018-10-11	Quesnel Lake QUL-58 QUL-58-MP 2019-05-15	Quesnel Lake QUL-58 QUL-58-MP 2019-10-30	Quesnel Lake QUL-58 QUL-58-MP 2020-09-16	Quesnel Lake QUL-58 QUL-58-MP 2021-05-19	Quesnel Lake QUL-58 QUL-58-MP 2021-07-21	Quesnel Lake QUL-58 QUL-58-MP 2021-09-16	Quesnel Lake QUL-58 QUL-58-MP 2021-10-27	Quesnel Lake QUL-58 QUL-58-MP 2022-06-27	Quesnel Lake QUL-58 QUL-58-MP 2022-08-16	Quesnel Lake QUL-58 QUL-58-MP 2022-10-19	Quesnel Lake QUL-58 QUL-58-S 2015-11-05	Quesnel Lake QUL-58 QUL-58-S 2015-11-30	Quesnel Lake QUL-58 QUL-58-S 2015-12-02
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	-	109.5	119.3	114.1	111.7	113.4	132.1	112.8	113.8	114.1	116.5	112.5	-	-	146.3
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	-	7.43	7.74	7.75	7.88	8.5	7.57	8.56	7.64	7.79	7.68	7.57	-	-	7.72
Turbidity	NTU	1	-	-	-	-	1	-	0.02	0.6	0.05	0.11	0	0.14	0.07	0.12	0.32	0.41	0	-	-	0.73
Temperature	C	-	-	-	-	-	-	-	5.582	3.862	5.773	4.78	4.104	4.764	5.169	5.589	4.515	4.571	4.776	-	-	5.208
Dissolved oxygen	%	-	-	-	-	-	-	-	88	87.1	86.5	87.6	91.6	89.8	87.2	86.4	90.8	87.2	86.1	-	-	85.1
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	-	11.6	11.46	10.83	11.25	11.97	11.53	11.09	10.87	11.74	11.25	11.06	-	-	10.81
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.7	44.5	50.3	49.6	49.7	48.7	49.5	52.2	48.2	50.8	47.1	45.7	51	50.7	53.9
Specific conductivity	uS/cm	-	-	-	-	-	-	113	108	117	116	111	114	109	118	121	113	115	114	110	112	111
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.97	7.87	7.98	7.86	7.91	7.87	7.87	7.86	7.95	7.88	7.93	7.88	8.01	7.76	7.45
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0	<3.0	<3.0	<3.0
Turbidity	NTU	1	-	-	-	-	1	0.35	0.14	0.3	0.11	<0.10	0.14	<0.10	<0.10	0.13	0.17	0.14	<0.10	0.24	0.73	0.74
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	58.4	51.6	54.3	52.5	56.7	54.4	53.4	53.9	59	55.6	56.3	56.2	52.8	53.9	52.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	56.8	53	54.9	57	55.1	52	55.4	52.2	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	61	77	75	70	69	74	78	82	79	70	69	94	61	68	70
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.61	1.22	1.78	1.94	2.06	2.21	2.13	1.86	1.78	2.35	2.09	2.09	1.67	1.83	1.58
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.151	0.164	0.15	0.149	0.147	0.14	0.143	0.146	0.165	0.132	0.153	0.161	0.0667	0.103	0.105
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.151	0.164	0.15	0.149	0.147	0.14	0.143	0.146	0.165	0.132	0.153	0.161	0.0667	0.103	0.105
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	<0.0020	0.0022	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0027	0.0049	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	0.0028	<0.0020	0.0025	<0.0020	0.0024	0.0022
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.194	0.201	0.22	0.232	0.193	0.176	0.181	0.198	0.203	0.169	0.184	0.211	0.126	0.145	0.143
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.6	17.1	18	17.6	19	18.3	18	18.2	20	18.6	19	18.8	17.9	18.2	17.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.036	0.034	0.041	0.033	0.034	0.038	0.032	0.038	0.04	0.035	0.04	0.042	0.032	0.033	0.036
Magnesium	mg/L	-	-	-	-	-	-	2.3	2.19	2.26	2.07	2.25	2.11	2.05	2.05	2.19	2.22	2.15	2.26	1.96	2.03	2.02
Potassium	mg/L	-	-	-	-	-	-	0.523	0.487	0.486	0.51	0.528	0.507	0.515	0.491	0.517	0.497	0.527	0.528	0.508	0.507	0.488
Sodium	mg/L	-	-	-	-	-	-	1.23	1.09	1.23	1.03	1.12	1.07	1	1.02	1.17	1.03	1.04	1.14	0.904	0.95	0.946
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	8.29	7.05	9.1	7.78	6.55	7.91	7.02	7.13	10.7	7.2	7.7	8.1	6.67	6.64	6.66
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0189	0.0103	0.0296	0.014	0.0114	0.016	0.0126	0.0133	0.0172	0.0118	0.0123	0.0114	0.011	0.0365	0.0437
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00012	0.00013	0.00011	0.00013	0.00012	0.0001	<0.00010	0.00012	0.00011	0.00012	0.00012	0.00011	0.00013	0.00016
Barium	mg/L	-	1W	-	-	-	1	0.00603	0.00541	0.00559	0.00546	0.00502	0.00527	0.00533	0.00473	0.0055	0.0052	0.00527	0.00539	0.00536	0.00578	0.00593
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	19.8	17.4	17.1	17.9	19.2	17.6	18.5	19.4	18.4	17.3	18.6	17.3	17.3	18.5	18
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.0013	0.00094	0.00118	0.00072	0.00088	0.00084	0.0006	0.00065	0.00092	0.00062	0.00069	0.00062	0.00061	0.00128	0.00163
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	0.000419	0.000478	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.41	2.11	2.19	2.04	2.14	2.19	2.12	2.08	2.23	2.14	2.17	2.2	1.9	2.07	2.06
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00116	0.00086	0.00162	0.00093	0.00086	0.00107	0.00093	0.00079	0.00117	0.00096	0.00104	0.00116	0.00108	0.00175	0.00183
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000903	0.00055	0.00107	0.000711	0.000503	0.000662	0.000488	0.000552	0.00163	0.000613	0.000734	0.000818	0.000308	0.00043	0.000452
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.00066	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.536	0.515	0.493	0.463	0.454	0.507	0.498	0.51	0.534	0.459	0.506	0.517	0.498	0.519	0.519
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000226	0.000127	0.000226	0.000212	0.000134	0.000172	0.000146	0.00015	0.000417	0.000195	0.000167	0.000249	0.00009	0.00025	0.000113
Silicon	mg/L	-	-	-	-	-	-	1.67	1.81	1.82	1.73	1.92	1.92	2.01	1.76	1.92	1.9	1.98	1.88	1.45	1.67	1.67
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.18	1.16	1.29	1.06	0.987	1.11	1.01	1.03	1.23	0.982	1.06	1.07	0.847	0.981	0.981
Strontium	mg/L	-	-	-	-	-	-	0.15	0.139	0.141	0.144	0.148	0.14	0.135	0.145	0.148	0.135	0.143	0.147	0.128	0.139	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000171	0.000164	0.000163	0.000147	0.000144	0.000172	0.000162	0.000164	0.000188	0.00016	0.000166	0.000165	0.000168	0.000168	0.00017
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-MP 2018-01-31	Quesnel Lake QUL-58 QUL-58-MP 2018-10-11	Quesnel Lake QUL-58 QUL-58-MP 2019-05-15	Quesnel Lake QUL-58 QUL-58-MP 2019-10-30	Quesnel Lake QUL-58 QUL-58-MP 2020-09-16	Quesnel Lake QUL-58 QUL-58-MP 2021-05-19	Quesnel Lake QUL-58 QUL-58-MP 2021-07-21	Quesnel Lake QUL-58 QUL-58-MP 2021-09-16	Quesnel Lake QUL-58 QUL-58-MP 2021-10-27	Quesnel Lake QUL-58 QUL-58-MP 2022-06-27	Quesnel Lake QUL-58 QUL-58-MP 2022-08-16	Quesnel Lake QUL-58 QUL-58-MP 2022-10-19	Quesnel Lake QUL-58 QUL-58-S 2015-11-05	Quesnel Lake QUL-58 QUL-58-S 2015-11-30	Quesnel Lake QUL-58 QUL-58-S 2015-12-02
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0048	0.006	0.0084	0.0079	0.007	0.0087	0.0065	0.0096	0.0116	0.0078	0.0086	0.0067	0.0063	0.0061	0.0051
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.00012	0.00011	<0.00010	0.0001	<0.00010	<0.00010	0.00011	0.00011	0.0001	<0.00010	0.00011	0.00011	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00562	0.00497	0.00552	0.00531	0.0056	0.00508	0.00528	0.00524	0.00525	0.00538	0.00524	0.00536	0.00539	0.00534	0.00522
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000053
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.0009	0.00071	0.00066	0.00051	0.00077	0.00078	0.0006	0.00063	0.00076	0.00058	0.00071	0.00062	<0.00050	0.00067	0.00073
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000306	0.00027	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.0003	0.00024	0.0002	0.00019	<0.00010	0.00011	0.00011	0.00016	0.00036	0.00011	0.00018	0.00014	0.00034	0.00035	0.00026
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000735	0.000587	0.0011	0.000685	0.000455	0.000663	0.000467	0.000463	0.00156	0.00061	0.000755	0.000834	0.000281	0.000362	0.000392
Nickel	mg/L	-	-	-	-	-	-	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000213	0.000131	0.000255	0.00019	0.000118	0.000155	0.000151	0.000159	0.000371	0.00015	0.0002	0.000228	0.000076	0.000146	0.000116
Silicon	mg/L	-	-	-	-	-	-	1.63	1.69	1.74	1.72	1.91	1.77	1.82	1.63	1.63	1.9	1.91	1.82	1.45	1.58	1.57
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.142	0.138	0.145	0.134	0.135	0.142	0.14	0.132	0.153	0.138	0.139	0.146	0.118	0.135	0.134
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000157	0.000152	0.000167	0.000147	0.000165	0.00015	0.000153	0.000154	0.000175	0.000156	0.000161	0.000175	0.000154	0.000157	0.000168
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2015-12-09	Quesnel Lake QUL-58 QUL-58-S 2015-12-14	Quesnel Lake QUL-58 QUL-58-S 2015-12-21	Quesnel Lake QUL-58 QUL-58-S 2015-12-30	Quesnel Lake QUL-58 QUL-58-S 2016-01-25	Quesnel Lake QUL-58 QUL-58-S 2016-02-23	Quesnel Lake QUL-58 QUL-58-S 2016-03-28	Quesnel Lake QUL-58 QUL-58-S 2016-04-11	Quesnel Lake QUL-58 QUL-58-S 2016-04-27	Quesnel Lake QUL-58 QUL-58-S 2016-05-05	Quesnel Lake QUL-58 QUL-58-S 2016-05-10	Quesnel Lake QUL-58 QUL-58-S 2016-05-17	Quesnel Lake QUL-58 QUL-58-S 2016-05-25	Quesnel Lake QUL-58 QUL-58-S 2016-06-07	Quesnel Lake QUL-58 QUL-58-S 2016-06-20
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	150.2	143	150.6	151.1	108.6	109	110.7	113.4	102.2	106.4	105.3	96.7	97.8	94.5	92.4	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.74	6.99	7.67	7.38	7.91	7.77	7.95	7.78	8.09	7.99	7.55	7.52	7.44	7.92	8.12	
Turbidity	NTU	1	-	-	-	-	1	0.76	0.64	0.79	0.53	1.26	0.63	0.87	0.54	0.23	0.54	0.77	0.55	0.82	0.01	0.11	
Temperature	C	-	-	-	-	-	-	5.05	4.761	4.464	3.687	2.878	2.687	3.262	3.662	9.898	7.686	6.932	12.165	10.989	14.81	15.505	
Dissolved oxygen	%	-	-	-	-	-	-	85.1	89.5	90.6	96.1	90.5	89.7	95.5	85.4	96.9	87.8	88.6	101.4	93.9	87.4	94.9	
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.85	11.51	11.73	12.7	12.2	12.17	12.73	11.28	10.96	10.47	10.78	10.89	10.5	8.85	9.47	
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.3	51.1	48.9	50.4	48.2	49.6	49.4	49.8	49.9	50.3	49	48.3	44.8	47.4	44	
Specific conductivity	uS/cm	-	-	-	-	-	-	113	113	113	112	112	116	113	115	114	110	111	107	105	102	95.6	
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.86	7.86	7.77	7.85	7.81	7.83	7.95	7.89	7.95	7.84	7.94	7.35	7.82	7.88	
Total suspended solids	mg/L	-	-	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	9.2	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	
Turbidity	NTU	1	-	-	-	-	1	0.43	0.66	0.48	0.71	0.44	0.48	0.49	0.37	0.33	0.34	0.38	0.52	0.36	0.31	0.35	
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53.6	56.8	54.9	53.1	55.4	54	53.4	54	53.7	53.6	54.7	50.8	51.6	51.3	48.2	
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total dissolved solids	mg/L	-	-	-	1000	-	1000	66	72	64	72	65	73	63	60	61	62	77	68	68	58	74	
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.52	1.64	1.68	1.65	1.67	1.5	1.53	1.94	1.88	2.03	1.8	1.97	2.12	1.92	1.96	
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.11	0.116	0.116	0.116	0.119	0.123	0.13	0.127	0.112	0.117	0.121	0.0957	0.0901	0.0829	0.0702	
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.11	0.116	0.116	0.116	0.119	0.123	0.13	0.127	0.112	0.117	0.121	0.0957	0.0901	0.0829	0.0702	
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.003	0.0023	0.0025	0.0033	0.0028	0.0031	0.0021	<0.0020	<0.0020	<0.0020	0.0045	<0.0020	<0.0020	0.0036	0.0026	
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	
Total nitrogen	mg/L	-	-	-	-	-	-	0.162	0.169	0.166	0.172	0.167	0.167	0.179	0.178	0.183	0.196	0.18	0.17	0.182	0.157	0.146	
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.716	
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	18.2	19.3	18.6	17.9	18.8	18.3	18	18.2	18.1	18.1	18.4	17	17.3	17.2	16.2	
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.033	0.035	0.036	0.037	0.033	0.033	0.036	0.037	0.037	0.039	0.036	0.034	0.034	0.033	0.032	
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.1	2.03	2.04	2.06	2.03	2.08	2.08	2.08	2.06	2.11	2.03	2.03	2.02	1.88	
Potassium	mg/L	-	-	-	-	-	-	0.494	0.498	0.498	0.511	0.487	0.472	0.492	0.482	0.48	0.481	0.493	0.527	0.491	0.492	0.477	
Sodium	mg/L	-	-	-	-	-	-	0.982	0.938	0.969	0.992	0.997	1	0.963	1	0.972	1	1.01	0.938	0.979	0.903	0.903	
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.67	6.68	6.82	6.8	6.79	6.98	7.22	7.26	6.83	6.97	6.88	6.16	6.08	5.91	5.78	
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0363	0.0411	0.0334	0.0296	0.024	0.0268	0.042	0.0313	0.0177	0.021	<0.027	0.0237	0.0179	0.0217	0.0177	
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00014	0.00016	0.00013	0.00013	0.00011	0.00011	0.00014	0.00013	<0.00010	0.00012	0.00017	0.00013	0.00011	0.00013	
Barium	mg/L	-	1W	-	-	-	1	0.00579	0.00619	0.00568	0.00593	0.00542	0.00511	0.00565	0.00592	0.00546	0.00511	0.00545	0.00566	0.00546	0.00544	0.00576	
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
Calcium	mg/L	-	-	-	1000	-	1000	17.9	18.9	18	17.8	18.2	17.9	17.7	18.2	18	17.5	18	16.8	17.4	16.5	16.5	
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00143	0.0013	0.00142	0.00145	0.00118	0.00125	0.00138	0.00145	0.00102	0.00107	0.00108	0.00163	0.00082	0.00102	0.0007	
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	0.000334	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	
Magnesium	mg/L	-	-	-	-	-	-	2.02	2.12	2.01	2.08	2.13	2.06	2.09	2.13	2.11	2.02	2.07	2.02	2.05	1.95	2.02	
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00115	0.00132	0.00121	0.00117	0.00117	0.00123	0.0016	0.00147	0.00118	0.00147	0.00147	0.00188	0.00175	0.00169	0.00167	
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	<0.0000050	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.00046	0.000466	0.00044	0.000503	0.000459	0.000547	0.000687	0.000619	0.000425	0.000406	0.000473	0.000378	0.000366	0.000338	0.000362	
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Potassium	mg/L	-	-	-	-	-	-	0.511	0.523	0.498	0.541	0.494	0.495	0.504	0.508	0.508	0.475	0.497	0.564	0.508	0.484	0.485	
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000099	0.00011	0.000119	0.000119	0.000096	0.000106	0.000102	0.000112	0.00011	0.000066	0.000108	0.000128	0.000127	0.000099	0.000104	
Silicon	mg/L	-	-	-	-	-	-	1.66	1.76	1.64	1.63	1.66	1.68	1.72	1.73	1.79	1.67	1.77	1.8	1.84	1.79	1.82	
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium	mg/L	-	-	-	-	-	-	1	0.98	0.991	1.07	1.01	1.09	0.969	1.03	0.978	0.972	1.02	0.968	1.02	0.874	0.934	
Strontium	mg/L	-	-	-	-	-	-	0.138	0.129	0.134	0.142	0.139	0.14	0.139	0.141	0.131	0.124	0.137	0.115	0.128	0.121	0.121	
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000171	0.00016	0.000156	0.000164	0.00016	0.000174	0.00017	0.000176	0.000165	0.000151	0.000168	0.000159	0.000165	0.000145	0.000145	
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00103	<0.00050	<0.00050	<0.00050	
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2015-12-09	Quesnel Lake QUL-58 QUL-58-S 2015-12-14	Quesnel Lake QUL-58 QUL-58-S 2015-12-21	Quesnel Lake QUL-58 QUL-58-S 2015-12-30	Quesnel Lake QUL-58 QUL-58-S 2016-01-25	Quesnel Lake QUL-58 QUL-58-S 2016-02-23	Quesnel Lake QUL-58 QUL-58-S 2016-03-28	Quesnel Lake QUL-58 QUL-58-S 2016-04-11	Quesnel Lake QUL-58 QUL-58-S 2016-04-27	Quesnel Lake QUL-58 QUL-58-S 2016-05-05	Quesnel Lake QUL-58 QUL-58-S 2016-05-10	Quesnel Lake QUL-58 QUL-58-S 2016-05-17	Quesnel Lake QUL-58 QUL-58-S 2016-05-25	Quesnel Lake QUL-58 QUL-58-S 2016-06-07	Quesnel Lake QUL-58 QUL-58-S 2016-06-20
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0052	0.0072	0.0053	0.006	0.005	0.005	0.0083	0.0051	0.0062	0.0071	0.0063	0.0091	0.0089	0.0098	0.0098
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	0.00013
Barium	mg/L	-	-	-	-	-	-	0.00523	0.00561	0.00527	0.00523	0.00506	0.00493	0.00495	0.00548	0.0053	0.00512	0.00522	0.00533	0.00523	0.00532	0.00548
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00077	0.00079	0.00078	0.00082	0.00077	0.00076	0.0008	0.00091	0.00076	0.00076	0.00081	0.00083	0.00066	0.00066	0.00057
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	0.000055	0.000082	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00016	0.00018	0.0002	0.0002	0.00028	0.00033	0.0007	0.00055	0.00074	0.00062	0.00061	0.00101	0.00078	0.00096	0.00091
Mercury	mg/L	-	-	-	-	-	-	-	<0.0000050	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000365	0.000411	0.000417	0.000433	0.000416	0.00047	0.000552	0.000502	0.00041	0.000401	0.000428	0.000338	0.000338	0.000324	0.000355
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000083	0.000096	0.000101	0.00011	0.000115	0.0001	0.000106	0.000104	0.000121	0.000123	0.000103	0.00011	0.000111	0.000093	0.000104
Silicon	mg/L	-	-	-	-	-	-	1.6	1.66	1.59	1.58	1.66	1.64	1.68	1.66	1.76	1.69	1.76	1.8	1.78	1.78	1.71
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.131	0.126	0.132	0.137	0.134	0.136	0.139	0.136	0.129	0.128	0.134	0.116	0.121	0.12	0.115
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.00015	0.000153	0.000148	0.000156	0.000153	0.000163	0.00016	0.000158	0.000156	0.000156	0.000158	0.000145	0.000146	0.000138	0.000141
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2016-06-28	Quesnel Lake QUL-58 QUL-58-S 2016-07-06	Quesnel Lake QUL-58 QUL-58-S 2016-08-01	Quesnel Lake QUL-58 QUL-58-S 2016-09-05	Quesnel Lake QUL-58 QUL-58-S 2016-10-05	Quesnel Lake QUL-58 QUL-58-S 2016-11-09	Quesnel Lake QUL-58 QUL-58-S 2016-11-16	Quesnel Lake QUL-58 QUL-58-S 2016-11-30	Quesnel Lake QUL-58 QUL-58-S 2017-02-02	Quesnel Lake QUL-58 QUL-58-S 2017-03-06	Quesnel Lake QUL-58 QUL-58-S 2017-04-10	Quesnel Lake QUL-58 QUL-58-S 2017-05-09	Quesnel Lake QUL-58 QUL-58-S 2017-05-15	Quesnel Lake QUL-58 QUL-58-S 2017-05-22	Quesnel Lake QUL-58 QUL-58-S 2017-05-29
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	97.5	93.8	96.1	99.9	101.9	100.8	106.1	101.7	118.3	125.8	109.5	114.9	114.1	104.3	105.2
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	8.06	7.83	7.97	-	-	7.39	7.49	7.67	7.82	7.27	7.42	7.48	7.34	7.36
Turbidity	NTU	1	-	-	-	-	1	0	0.63	2.23	0.23	1.57	0.21	0.45	0.72	0.56	0.45	0.74	0.68	0	0.75	0.63
Temperature	C	-	-	-	-	-	-	18.759	18.049	17.153	16.177	12.406	8.58	8.054	6.791	0.523	0.894	2.81	4.038	4.725	11.96	12.01
Dissolved oxygen	%	-	-	-	-	-	-	103.8	93	89.7	95.4	100.9	91.2	96	93.7	89	96.3	87.6	91.2	95.2	88.9	102.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	9.68	8.8	8.64	9.38	10.76	10.64	11.36	11.45	12.84	13.6	11.76	11.94	12.24	9.49	11.08
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	43.3	43.5	44.5	49.3	50.3	49.3	49.7	48.6	53.6	57.6	50.6	49.6	51.8	50.1	49.4
Specific conductivity	uS/cm	-	-	-	-	-	-	97.4	98.4	99.4	103	103	108	110	110	120	125	114	116	116	112	111
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.85	7.79	7.74	7.98	7.87	7.85	7.83	7.79	7.9	7.9	7.92	7.82	7.93	7.94	7.91
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	1.8	7.3	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.3	0.3	0.25	0.32	0.25	0.28	0.21	0.41	0.26	0.27	0.92	0.7	0.55	0.28	0.34
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	48	46.7	48.9	50	51.2	51.1	47.5	52.5	58.8	70.2	54.5	53.8	53.9	51.2	51.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	71	87	74	65	73	60	74	72	87	78	75	82	76	75	72
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.23	2.04	2.27	1.82	1.85	1.9	1.97	2.11	1.94	2.01	2.35	2	2.26	2.02	1.9
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0606	0.0549	0.064	0.0534	0.0541	0.0868	0.0937	0.112	0.158	<0.0050	0.136	0.136	0.14	0.127	0.118
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0606	0.0549	0.064	0.0534	0.0541	0.0868	0.0937	0.112	0.158	<0.0051	0.136	0.136	0.14	0.127	0.118
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0115	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	0.0037	0.0021	<0.0020	0.0024	0.002	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0024	<0.0020	<0.0020	0.0023	0.0057	0.0022	<0.0020	0.0021	<0.0020	0.0026	0.0035	0.0034	<0.0020	<0.0020	<0.010
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.152	0.149	0.124	0.115	0.159	0.156	0.157	0.167	0.216	0.224	0.225	0.202	0.194	0.18	0.191
Chlorophyll a	ug/L	-	-	-	-	-	-	0.442	-	0.599	-	-	-	-	-	-	-	-	-	0.336	-	0.352
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	16	15.5	16.4	16.7	17.4	17.2	15.7	17.5	19.9	23.5	18.2	17.9	18.1	16.8	17.2
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.034	0.032	0.03	0.033	0.03	0.032	0.033	0.037	0.036	0.036	0.032	0.033	0.033	0.034	0.035
Magnesium	mg/L	-	-	-	-	-	-	1.97	1.92	1.89	2.02	1.86	2.01	2.03	2.15	2.22	2.77	2.2	2.23	2.11	2.25	2.08
Potassium	mg/L	-	-	-	-	-	-	0.505	0.521	0.469	0.493	0.494	0.487	0.5	0.543	0.582	0.665	0.556	0.553	0.51	0.505	0.5
Sodium	mg/L	-	-	-	-	-	-	0.925	0.909	0.911	0.9	0.891	0.956	0.981	1.14	1.12	1.31	1.14	1.17	1.12	1.12	1
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	5.78	5.5	5.6	6.41	6.3	6.93	7.23	7.85	7.67	7.35	7.63	8.05	7.45	6.94	6.56
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0173	0.0182	0.0143	0.0152	0.0286	0.0169	0.0187	0.0386	0.0132	0.0116	0.0868	0.0396	0.0379	0.0147	0.0233
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00014	0.00013	0.00012	0.00017	<0.00010	0.00011	0.00013	0.00021	0.00016	0.00019	0.0002	0.00013	0.00012	0.00014
Barium	mg/L	-	1W	-	-	-	1	0.00566	0.00563	0.0054	0.00519	0.00532	0.00557	0.00543	0.00583	0.00566	0.00586	0.00662	0.00622	0.00583	0.00533	0.00569
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	15.4	15.6	16.8	16.9	18.1	15.4	18.1	16.4	18.5	21	17.7	17.9	19.1	18.8	17
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.0008	0.00072	0.0008	0.00076	0.0012	0.00068	0.00074	0.00126	0.00105	0.00127	0.00174	0.00143	0.0014	0.00083	0.00093
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.095	<0.030	0.032	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000058	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	0.001	0.0012	0.0011	0.0012	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	0.001	0.0011	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.91	1.94	1.94	1.9	1.89	1.9	2.08	1.83	2.37	2.48	2.37	2.27	2.25	2.27	2.15
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00196	0.00195	0.0012	0.00126	0.00118	0.00125	0.0013	0.00186	0.00098	0.00101	0.00432	0.00337	0.00253	0.00118	0.00169
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000357	0.000356	0.000339	0.000313	0.000386	0.000419	0.000623	0.000802	0.000583	0.000431	0.000652	0.00076	0.000706	0.000538	0.000482
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.0006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.53	0.536	0.477	0.465	0.512	0.508	0.519	0.498	0.564	0.595	0.557	0.551	0.527	0.524	0.511
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000112	0.000105	0.000104	0.000086	0.000097	0.000122	0.000162	0.00016	0.000139	0.000114	0.000213	0.000175	0.000134	0.000111	0.00012
Silicon	mg/L	-	-	-	-	-	-	1.76	1.77	1.63	1.55	1.68	1.54	1.62	1.59	1.89	2	2.14	1.85	1.82	1.84	1.89
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.99	0.932	0.929	0.923	0.921	1.1	1.02	0.971	1.19	1.28	1.26	1.23	1.16	1.09	1.05
Strontium	mg/L	-	-	-	-	-	-	0.115	0.111	0.124	0.125	0.136	0.121	0.142	0.141	0.15	0.173	0.134	0.141	0.147	0.138	0.124
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000142	0.000133	0.000146	0.000155	0.000162	0.000156	0.000158	0.000168	0.000204	0.000174	0.000163	0.00017	0.00016	0.000164	0.000149
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0054	0.0032	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2016-06-28	Quesnel Lake QUL-58 QUL-58-S 2016-07-06	Quesnel Lake QUL-58 QUL-58-S 2016-08-01	Quesnel Lake QUL-58 QUL-58-S 2016-09-05	Quesnel Lake QUL-58 QUL-58-S 2016-10-05	Quesnel Lake QUL-58 QUL-58-S 2016-11-09	Quesnel Lake QUL-58 QUL-58-S 2016-11-16	Quesnel Lake QUL-58 QUL-58-S 2016-11-30	Quesnel Lake QUL-58 QUL-58-S 2017-02-02	Quesnel Lake QUL-58 QUL-58-S 2017-03-06	Quesnel Lake QUL-58 QUL-58-S 2017-04-10	Quesnel Lake QUL-58 QUL-58-S 2017-05-09	Quesnel Lake QUL-58 QUL-58-S 2017-05-15	Quesnel Lake QUL-58 QUL-58-S 2017-05-22	Quesnel Lake QUL-58 QUL-58-S 2017-05-29
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0123	0.0119	0.0112	0.0084	0.0067	0.0075	0.0077	0.0081	0.0056	0.0067	0.0095	0.0071	0.0063	0.0067	0.0078
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00012	0.00011	0.00011	0.00011	0.00012
Barium	mg/L	-	-	-	-	-	-	0.00554	0.00553	0.00526	0.0051	0.00496	0.00493	0.00529	0.00533	0.00573	0.00662	0.00538	0.00563	0.00535	0.00548	0.0053
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00067	0.00061	0.00052	<0.00050	<0.00050	0.0005	0.00051	0.00137	0.00066	0.00085	0.00092	0.00091	0.00078	0.00069	0.00067
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.0012	<0.0010	<0.0010	0.0011	0.001	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00114	0.00087	0.00061	0.0003	0.00016	0.00012	0.00012	0.00024	0.00042	0.00053	0.00115	0.00102	0.0003	0.00076	0.00074
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000344	0.000328	0.00031	0.000298	0.000333	0.00043	0.00048	0.000717	0.000568	0.000468	0.000639	0.000663	0.000561	0.00052	0.000462
Nickel	mg/L	-	-	-	-	-	-	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000117	0.00008	0.00009	0.000077	0.000073	0.000105	0.000144	0.000172	0.000122	0.000112	0.000129	0.000141	0.000144	0.000115	0.000143
Silicon	mg/L	-	-	-	-	-	-	1.77	1.75	1.59	1.51	1.52	1.51	1.51	1.75	1.74	2.34	1.76	1.71	1.65	1.74	1.8
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.112	0.109	0.121	0.128	0.133	0.134	0.128	0.135	0.151	0.194	0.139	0.139	0.135	0.133	0.126
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000137	0.000127	0.000141	0.000141	0.000152	0.000152	0.000153	0.000151	0.000165	0.000169	0.000154	0.000144	0.000144	0.00016	0.000149
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2017-06-05	Quesnel Lake QUL-58 QUL-58-S 2017-06-12	Quesnel Lake QUL-58 QUL-58-S 2017-06-19	Quesnel Lake QUL-58 QUL-58-S 2017-06-27	Quesnel Lake QUL-58 QUL-58-S 2017-08-22	Quesnel Lake QUL-58 QUL-58-S 2017-10-01	Quesnel Lake QUL-58 QUL-58-S 2017-10-26	Quesnel Lake QUL-58 QUL-58-S 2017-11-20	Quesnel Lake QUL-58 QUL-58-S 2018-01-04	Quesnel Lake QUL-58 QUL-58-S 2018-01-10	Quesnel Lake QUL-58 QUL-58-S 2018-01-18	Quesnel Lake QUL-58 QUL-58-S 2018-01-31	Quesnel Lake QUL-58 QUL-58-S 2018-05-03	Quesnel Lake QUL-58 QUL-58-S 2018-05-13	Quesnel Lake QUL-58 QUL-58-S 2018-05-22
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	108.4	101.9	100.5	101	104.6	118	113	107.1	110.5	-	110	-	114.2	106.5	110.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.71	7.79	7.76	7.81	8.13	-	8.13	-	7.79	-	7.53	-	6.83	7.7	7.22
Turbidity	NTU	1	-	-	-	-	1	0.49	0.52	0.81	0.01	0	0.19	0.18	0.09	1.06	-	0.09	-	0.04	-	0.24
Temperature	C	-	-	-	-	-	-	13.149	12.462	11.068	14.166	19.022	8.7	8.659	5.971	1.59	-	2.721	-	3.293	6.228	14.011
Dissolved oxygen	%	-	-	-	-	-	-	90.8	91	89.7	92.2	91.2	-	98.8	101.2	86.4	-	84.3	-	87.8	89.2	89.3
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	9.48	9.68	9.89	9.47	8.47	-	11.57	12.61	12.09	-	11.43	-	11.72	10.71	9.2
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	48.1	45.2	44.2	46.9	48.4	48.9	49	50.5	49.8	48.7	49.9	50.9	49.9	47.5	50
Specific conductivity	uS/cm	-	-	-	-	-	-	103	104	100	99.9	106	100	102	103	110	122	106	109	115	101	107
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.86	8	7.84	7.88	7.94	7.93	7.94	7.94	7.87	7.78	7.63	7.96	7.86	7.92	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	4.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	1.4
Turbidity	NTU	1	-	-	-	-	1	0.49	0.56	0.37	0.41	0.31	0.28	0.26	0.27	0.26	0.26	0.29	0.28	0.64	1.59	0.49
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	48.1	48.2	48.4	49.6	50	51	48.4	52	53.5	50.7	54.4	54.2	51.7	42.9	51.7
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	76	65	71	72	68	65	74	54	62	67	64	61	71	72	65
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.56	2	1.92	2.05	2.12	1.58	1.92	1.55	1.6	1.69	1.72	1.69	1.99	8.61	2.38
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.106	0.105	0.11	0.0981	0.0462	0.0507	0.077	0.108	0.119	0.12	0.12	0.129	0.144	0.0767	0.104
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.106	0.105	0.11	0.0981	0.0476	0.0507	0.077	0.108	0.119	0.12	0.12	0.129	0.144	0.0767	0.104
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	0.006	<0.0050	<0.0050	0.0101	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	0.0023	0.0021	0.0046	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0036	<0.0040	<0.0020	<0.0020	0.0034	<0.0020	0.0024	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	0.0043	0.0129	0.0041
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Total nitrogen	mg/L	-	-	-	-	-	-	0.191	0.174	0.194	0.152	1.39	0.133	0.139	0.172	0.171	0.156	0.162	0.186	0.21	0.347	0.168
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	0.848	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	16	15.9	16.1	16.6	16.9	17.1	16.2	17.3	18	17.1	18.4	18.1	17.2	13.6	17.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.034	0.032	0.031	0.032	0.029	0.031	0.033	0.034	0.033	0.037	0.034	0.035	0.035	0.037	0.041
Magnesium	mg/L	-	-	-	-	-	-	1.96	2.07	1.99	1.99	1.88	2.01	1.95	2.12	2.08	1.94	2.03	2.19	2.11	2.14	2.17
Potassium	mg/L	-	-	-	-	-	-	0.501	0.514	0.529	0.486	0.483	0.486	0.472	0.485	0.454	0.462	0.476	0.508	0.496	0.393	0.538
Sodium	mg/L	-	-	-	-	-	-	0.943	1.02	0.993	0.917	0.879	0.918	0.886	0.93	1	0.984	0.911	1.06	1.04	1.2	1.06
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.03	6.06	6.05	5.9	6.23	6.39	6.64	6.67	6.8	6.75	6.6	6.88	7.53	5.16	6.47
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.026	0.037	0.0225	0.0334	0.0092	0.0117	0.0121	0.0181	0.0158	0.0214	0.0169	0.0168	0.0325	0.133	0.0222
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00014	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00016	0.00015	0.00014	0.00011	0.00011	0.0001	0.00011	0.00011	0.00075	0.00014	0.00013	0.00016	0.00032	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00547	0.00692	0.00568	0.00593	0.00546	0.0053	0.00547	0.00564	0.00658	0.00549	0.00542	0.00563	0.00537	0.0082	0.00588
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000058	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000088	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	15.9	17.2	16.1	17	17.1	16.5	17.1	18	18.7	17.9	19.3	18.5	17.8	15.6	17.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00077	0.00098	0.00078	0.00101	0.00052	0.00058	0.0006	0.00083	0.00093	0.00302	0.00103	0.00093	0.0013	0.00279	0.00077
Iron	mg/L	-	-	1	-	-	1	0.032	0.034	0.041	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.135	0.03
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.001	<0.0010	0.001	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.95	2.41	1.93	1.95	1.98	1.92	1.96	2.2	2.18	2.17	1.98	2.23	2.19	2.83	2.15
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00208	0.00263	0.00168	0.00166	0.00145	0.00092	0.00103	0.00119	0.00067	0.00104	0.00089	0.00087	0.00173	0.0054	0.00238
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000444	0.000411	0.000457	0.000424	0.000352	0.000298	0.000341	0.000459	0.000461	0.000405	0.000663	0.000421	0.000598	0.000554	0.000408
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	0.00088	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.502	0.602	0.526	0.502	0.446	0.468	0.461	0.458	0.45	0.475	0.47	0.511	0.493	0.595	0.503
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000112	0.000117	0.000112	0.000122	0.000114	0.000084	0.000083	0.000129	0.000125	0.0001	0.000137	0.000109	0.000193	0.000148	0.000084
Silicon	mg/L	-	-	-	-	-	-	1.79	1.83	1.81	1.85	1.52	1.44	1.56	1.65	1.6	1.64	1.65	1.61	1.76	2.62	1.96
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.96	1.11	0.967	0.929	0.844	0.9	0.887	1.02	1	1.06	0.912	0.999	1.08	1.55	1.02
Strontium	mg/L	-	-	-	-	-	-	0.121	0.121	0.12	0.125	0.125	0.128	0.137	0.146	0.144	0.138	0.144	0.142	0.136	0.116	0.137
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000136	0.000134	0.00015	0.000155	0.000148	0.000157	0.000142	0.000185	0.00016	0.000162	0.000152	0.000163	0.000167	0.000123	0.00015
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00068	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2017-06-05	Quesnel Lake QUL-58 QUL-58-S 2017-06-12	Quesnel Lake QUL-58 QUL-58-S 2017-06-19	Quesnel Lake QUL-58 QUL-58-S 2017-06-27	Quesnel Lake QUL-58 QUL-58-S 2017-08-22	Quesnel Lake QUL-58 QUL-58-S 2017-10-01	Quesnel Lake QUL-58 QUL-58-S 2017-10-26	Quesnel Lake QUL-58 QUL-58-S 2017-11-20	Quesnel Lake QUL-58 QUL-58-S 2018-01-04	Quesnel Lake QUL-58 QUL-58-S 2018-01-10	Quesnel Lake QUL-58 QUL-58-S 2018-01-18	Quesnel Lake QUL-58 QUL-58-S 2018-01-31	Quesnel Lake QUL-58 QUL-58-S 2018-05-03	Quesnel Lake QUL-58 QUL-58-S 2018-05-13	Quesnel Lake QUL-58 QUL-58-S 2018-05-22
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.01	0.0116	0.0089	0.0102	0.0087	0.0073	0.006	0.0051	0.0051	0.0043	0.0059	0.0041	0.0068	0.031	0.0086
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00012	0.00012	0.00013	0.0003	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	0.00017	0.0001
Barium	mg/L	-	-	-	-	-	-	0.00554	0.00541	0.00555	0.00532	0.00552	0.0056	0.00549	0.00532	0.00538	0.00517	0.00528	0.00548	0.00523	0.00549	0.00539
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00072	0.00071	0.00059	0.00069	0.00084	<0.00050	<0.00050	0.00057	0.00064	0.00067	0.00057	0.00067	0.00077	0.00175	0.00085
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.037	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00101	0.00076	0.00037	0.0006	0.00047	0.00014	0.00019	0.00011	0.00016	<0.00010	<0.00015	<0.00010	0.00048	0.00205	0.00109
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000401	0.000437	0.000351	0.000342	0.000304	0.000288	0.000301	0.000378	0.000403	0.000322	0.00041	0.000368	0.000564	0.000448	0.000413
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000101	0.000112	0.000139	0.000107	0.000124	0.00009	0.000095	0.000104	0.000111	0.000111	0.000109	0.000088	0.000158	0.000129	0.000138
Silicon	mg/L	-	-	-	-	-	-	1.76	1.88	1.81	1.64	1.51	1.41	1.51	1.62	1.56	1.54	1.59	1.54	1.64	2.13	1.84
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.119	0.122	0.12	0.119	0.124	0.128	0.132	0.127	0.144	0.135	0.142	0.134	0.134	0.101	0.129
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000139	0.000163	0.000139	0.000125	0.000148	0.000144	0.000127	0.000145	0.00015	0.000158	0.000154	0.000154	0.000161	0.000108	0.000157
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2018-06-04	Quesnel Lake QUL-58 QUL-58-S 2018-06-13	Quesnel Lake QUL-58 QUL-58-S 2018-06-18	Quesnel Lake QUL-58 QUL-58-S 2018-06-27	Quesnel Lake QUL-58 QUL-58-S 2018-07-02	Quesnel Lake QUL-58 QUL-58-S 2018-08-23	Quesnel Lake QUL-58 QUL-58-S 2018-09-04	Quesnel Lake QUL-58 QUL-58-S 2018-10-11	Quesnel Lake QUL-58 QUL-58-S 2018-10-18	Quesnel Lake QUL-58 QUL-58-S 2018-10-24	Quesnel Lake QUL-58 QUL-58-S 2018-10-29	Quesnel Lake QUL-58 QUL-58-S 2018-11-07	Quesnel Lake QUL-58 QUL-58-S 2018-12-18	Quesnel Lake QUL-58 QUL-58-S 2019-02-26	Quesnel Lake QUL-58 QUL-58-S 2019-03-05
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																		
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	99.7	100.2	101.8	99.5	100.5	100.4	100	103.9	106.9	105.4	100.9	103.7	111.8	110.6	180.9
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.45	7.71	7.6	7.86	7.51	7.93	7.85	7.55	7.9	7.57	7.62	7.71	7.84	8	7.8
Turbidity	NTU	1	-	-	-	-	1	0	0	0	0	0.29	0.57	0.08	0.8	0	0	1.55	0.4	0	0.16	0.53
Temperature	C	-	-	-	-	-	-	10.804	9.635	14.854	14.908	14.464	17.406	15.106	9.769	8.885	8.986	8.357	6.365	4.547	0.288	1.382
Dissolved oxygen	%	-	-	-	-	-	-	99.1	95.5	101	98.9	101.7	91.2	95.8	90.8	90.6	89.7	101.2	90.7	90.5	87.1	92.7
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.97	10.88	10.21	9.99	10.37	9.31	9.64	10.31	10.5	10.37	11.89	11.18	11.69	12.63	13.04
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	43.1	46.5	45.5	45.2	46.9	46.6	48.6	46.6	48.8	50.1	49.8	49.6	48.6	50.2	47.5
Specific conductivity	uS/cm	-	-	-	-	-	-	100	102	101	100	101	98.8	106	110	106	109	110	109	110	113	122
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.88	7.92	7.89	7.96	7.93	8	7.95	7.86	7.97	7.83	7.95	7.94	7.96	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.55	0.35	0.3	0.38	0.25	0.27	0.23	0.28	0.25	0.23	0.23	0.19	0.39	0.25	0.18
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	47.9	49.4	49.6	48.8	51	48.6	49.6	49.6	51.7	53.4	50.7	58	55.2	55.4	57.8
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	66	59	67	69	67	83	86	70	70	69	59	74	65	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.38	2.3	2.47	2.15	2.2	1.78	1.73	1.16	1.67	1.86	1.86	1.6	1.65	1.61	1.84
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0844	0.092	0.0913	0.0808	0.078	0.0373	0.0487	0.0668	0.0783	0.0773	0.0837	0.0901	0.129	0.136	0.149
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0844	0.092	0.0913	0.0808	0.078	0.0373	0.0487	0.0668	0.0783	0.0773	0.0837	0.0901	0.129	0.136	0.149
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0074	0.0093	<0.0050	<0.0050	<0.0050	<0.0050	0.0391	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0025	0.0022	<0.0020	0.0029	<0.0020	0.0023	<0.0020	0.0023	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0025	0.0049	0.0027	0.0076	0.0055	0.0039	0.0057	0.0043	0.0032	<0.0020	<0.0020	0.0021	0.0091	0.0083	0.0156
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	0.0015	<0.0010	0.0023	<0.0010	0.0019	0.0012	0.0026	<0.0010	0.0017	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.175	0.172	0.138	0.161	0.15	0.153	0.131	0.157	0.151	0.135	0.158	0.213	0.192	0.21	0.219
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	0.514	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	15.9	16.4	16.5	16.1	17	16.4	16.8	16.7	17.5	17.7	17.1	19.5	18.3	18.8	19.4
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.035	0.034	0.035	0.032	0.031	0.032	0.031	0.032	0.033	0.034	0.032	0.033	0.033	0.039	0.037
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.07	2.04	2.08	2.06	1.84	1.9	1.94	1.94	2.23	1.93	2.28	2.3	2.04	2.3
Potassium	mg/L	-	-	-	-	-	-	0.551	0.54	0.515	0.533	0.522	0.501	0.478	0.459	0.523	0.521	0.467	0.553	0.543	0.508	0.801
Sodium	mg/L	-	-	-	-	-	-	1.01	1	0.976	0.972	0.981	0.909	0.886	0.929	0.938	1.03	0.97	1.01	1.13	0.979	1.17
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	5.98	5.9	6.09	5.93	6	6.32	6.37	6.49	6.57	6.55	5.97	6.52	7.57	7.2	7.07
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0333	0.0258	0.0171	0.0185	0.0191	0.0138	0.0106	0.0146	0.0071	0.0162	0.0096	0.0118	0.0305	0.0156	0.0154
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00025	0.00019	0.00014	0.00016	0.00014	0.00014	0.00013	0.00012	0.0001	0.00014	0.00013	0.00011	0.00013	0.00011	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00586	0.0061	0.00587	0.0061	0.00568	0.00575	0.00564	0.00541	0.00527	0.00522	0.00544	0.0052	0.00554	0.0053	0.00592
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000072	0.0000057	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	14.2	15.9	16.4	15.9	14.8	16.5	16.7	16.5	18.1	16.8	17.2	18.6	17.4	18.1	19.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00079	0.0012	0.00095	0.00079	0.0013	0.0007	0.00065	0.00116	<0.00050	0.00103	0.00056	0.00093	0.00136	0.00136	0.00102
Iron	mg/L	-	-	1	-	-	1	0.045	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Magnesium	mg/L	-	-	-	-	-	-	1.93	2.06	2.14	2.03	1.93	1.87	1.87	2	1.98	1.81	2.05	2.26	2.15	2.01	2.26
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00263	0.00206	0.0015	0.00146	0.00146	0.00175	0.00123	0.00123	0.00083	0.00096	0.00026	0.00099	0.00167	0.00116	0.00093
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000353	0.000476	0.00039	0.000371	0.00047	0.000324	0.00032	0.000326	0.000357	0.000355	0.000383	0.000357	0.000676	0.000427	0.000523
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	0.00065	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.522	0.528	0.54	0.537	0.515	0.459	0.436	0.487	0.468	0.456	0.501	0.5	0.539	0.501	0.715
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000145	0.000109	0.000131	0.000127	0.000119	0.00011	0.000096	0.000102	0.00009	0.000117	0.00009	0.000136	0.000193	0.000115	0.00011
Silicon	mg/L	-	-	-	-	-	-	1.81	1.9	1.98	1.85	1.76	1.58	1.59	1.53	1.5	1.44	1.53	1.53	1.86	1.7	1.86
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.947	0.999	1.02	1.01	0.983	0.848	0.849	0.981	0.868	0.861	0.943	0.966	1.23	0.954	1.15
Strontium	mg/L	-	-	-	-	-	-	0.112	0.121	0.123	0.117	0.113	0.122	0.126	0.129	0.135	0.127	0.136	0.127	0.14	0.134	0.156
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000146	0.000136	0.000148	0.000143	0.000146	0.000147	0.00016	0.000154	0.000141	0.000143	0.000166	0.000164	0.000172	0.000165	0.000186
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0045	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2018-06-04	Quesnel Lake QUL-58 QUL-58-S 2018-06-13	Quesnel Lake QUL-58 QUL-58-S 2018-06-18	Quesnel Lake QUL-58 QUL-58-S 2018-06-27	Quesnel Lake QUL-58 QUL-58-S 2018-07-02	Quesnel Lake QUL-58 QUL-58-S 2018-08-23	Quesnel Lake QUL-58 QUL-58-S 2018-09-04	Quesnel Lake QUL-58 QUL-58-S 2018-10-11	Quesnel Lake QUL-58 QUL-58-S 2018-10-18	Quesnel Lake QUL-58 QUL-58-S 2018-10-24	Quesnel Lake QUL-58 QUL-58-S 2018-10-29	Quesnel Lake QUL-58 QUL-58-S 2018-11-07	Quesnel Lake QUL-58 QUL-58-S 2018-12-18	Quesnel Lake QUL-58 QUL-58-S 2019-02-26	Quesnel Lake QUL-58 QUL-58-S 2019-03-05
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0124	0.0155	0.0108	0.0093	0.0091	0.0075	0.0072	0.0057	0.0056	0.0057	0.0249	0.01	0.0134	0.0049	0.0062
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00016	0.00012	0.00019	0.00012	0.0001	<0.00010	<0.00010	<0.00010	0.0001	0.00012	<0.00010	0.00011	<0.00010	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00601	0.00597	0.00572	0.00588	0.0059	0.00524	0.0056	0.00518	0.00533	0.00538	0.00567	0.00564	0.0055	0.00521	0.0059
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000053	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00072	0.00085	0.0007	0.00056	0.00064	<0.00050	0.00051	<0.00050	<0.00050	0.00053	0.00161	0.00074	0.00066	0.00056	0.00066
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00116	0.0008	0.00098	0.0006	0.0007	0.00038	0.00067	0.0004	0.00024	0.00024	0.00173	0.00028	0.00027	0.00035	0.00022
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	<0.00045	0.000744	0.000399	0.00037	0.000376	0.00033	0.000347	0.000347	0.000335	0.000358	0.000334	0.000363	0.000685	0.000436	0.000482
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000119	0.000123	0.000098	0.000124	0.000092	0.000098	0.000076	0.000095	0.000106	0.000064	0.000089	0.000098	0.000147	0.000098	0.000147
Silicon	mg/L	-	-	-	-	-	-	1.77	1.76	1.74	1.73	1.66	1.53	1.45	1.39	1.26	1.41	1.36	1.47	1.58	1.64	1.82
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.115	0.124	0.125	0.117	0.127	0.122	0.131	0.137	0.137	0.14	0.123	0.151	0.142	0.136	0.139
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000148	0.000139	0.000156	0.000137	0.000142	0.000147	0.000155	0.000148	0.000158	0.000154	0.000148	0.000172	0.000162	0.000161	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2019-04-25	Quesnel Lake QUL-58 QUL-58-S 2019-05-02	Quesnel Lake QUL-58 QUL-58-S 2019-05-08	Quesnel Lake QUL-58 QUL-58-S 2019-05-15	Quesnel Lake QUL-58 QUL-58-S 2019-05-21	Quesnel Lake QUL-58 QUL-58-S 2019-06-18	Quesnel Lake QUL-58 QUL-58-S 2019-06-19	Quesnel Lake QUL-58 QUL-58-S 2019-07-11	Quesnel Lake QUL-58 QUL-58-S 2019-07-25	Quesnel Lake QUL-58 QUL-58-S 2019-08-20	Quesnel Lake QUL-58 QUL-58-S 2019-10-30	Quesnel Lake QUL-58 QUL-58-S 2020-06-02	Quesnel Lake QUL-58 QUL-58-S 2020-06-09	Quesnel Lake QUL-58 QUL-58-S 2020-06-16	Quesnel Lake QUL-58 QUL-58-S 2020-06-24
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	112	114.6	112.3	110	113.1	99.3	109.3	109.8	101.8	101.4	108.2	94.2	107.6	119.9	100
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.78	7.92	7.83	7.53	7.95	7.85	7.68	8.12	7.96	7.8	7.82	7.39	7.74	7.45
Turbidity	NTU	1	-	-	-	-	1	0.85	0.99	0.14	0.52	0.32	0.53	2.16	0.92	0.35	0	0.25	1.24	7.69	0.53	0.59
Temperature	C	-	-	-	-	-	-	3.454	3.913	6.1	8.835	13.266	14.845	10.34	4.901	18.453	17.431	7.621	9.316	9.369	10.816	14.15
Dissolved oxygen	%	-	-	-	-	-	-	85.3	90.6	93.1	96.9	75.2	107.1	96.3	85.7	98.7	98.1	94.1	94.5	97.2	99.4	104.2
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.34	11.9	11.56	11.25	7.8	10.83	10.81	10.96	9.25	9.39	11.25	10.85	11.11	10.99	10.7
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.5	51.9	52.2	50	49.8	44.8	46.2	45.8	44.7	46.1	48.2	48.9	46.6	51	45.8
Specific conductivity	uS/cm	-	-	-	-	-	-	112	113	117	111	114	100	104	98.9	98	102	110	112	106	112	97.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.82	7.89	7.86	7.93	8.03	8.01	8.01	7.9	7.89	7.96	7.91	7.87	7.83	7.8	7.74
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	1	<1.0	1.4	1.8	<1.1	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.35	0.26	0.25	0.24	0.66	0.25	0.23	0.19	0.3	0.23	0.21	0.98	0.76	0.8	0.46
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	57.3	55	55.7	54	54.6	48.5	53.6	51.4	49.8	46.3	50.1	55.5	51.7	54.1	47.1
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53	48
Total dissolved solids	mg/L	-	-	-	1000	-	1000	68	80	100	65	77	63	67	57	50	70	63	74	80	71	55
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.04	1.81	2.11	2.64	6.32	1.9	1.8	1.91	2.46	2.05	2.04	4.7	4.45	3.94	2.67
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.143	0.136	0.127	0.12	0.0856	0.0824	0.0961	0.0771	0.0547	0.0452	0.0913	0.0917	0.1	0.091	0.0865
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.143	0.136	0.127	0.12	0.0856	0.0824	0.0961	0.0771	0.0547	0.0452	0.0913	0.0919	0.1	0.0915	0.0868
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	0.0067	0.0051	<0.0050	<0.0050	<0.0050	<0.0050	0.0067	<0.0050	0.0077	0.0062	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0037	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0029	0.0031	0.0022	0.0058	0.0071	0.0107	0.0061	0.0058	0.0027	0.0022	0.0071	0.0065	0.0107	0.0073	0.0032
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.189	0.2	0.193	0.197	0.286	0.19	0.183	0.163	0.158	0.173	0.204	0.252	0.24	0.224	0.177
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1.21	-	-	1.53	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	19.5	18.5	18.7	17.9	17.3	16.3	18	17.5	16.7	15.1	16.8	17.8	17	17.7	15.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.032	0.034	0.037	0.039	0.04	0.038	0.038	0.038	0.038	0.034	0.036	0.039	0.037	0.039	0.038
Magnesium	mg/L	-	-	-	-	-	-	2.11	2.11	2.2	2.28	2.78	1.89	2.09	1.85	2	2.08	2	2.67	2.27	2.39	1.94
Potassium	mg/L	-	-	-	-	-	-	0.496	0.518	0.53	0.479	0.549	0.515	0.529	0.471	0.505	0.466	0.502	0.598	0.558	0.559	0.467
Sodium	mg/L	-	-	-	-	-	-	1.21	1.13	1.12	1.06	1.49	0.921	1.05	0.949	0.971	0.957	0.911	1.37	1.2	1.28	0.926
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.42	7.75	7	7.02	5.96	5.96	6.4	6.32	5.98	5.77	7.1	6.2	5.96	7.1	5.76
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0262	0.0268	0.0157	0.0162	0.0489	0.0154	0.0193	0.0136	0.0687	0.013	0.0135	0.0462	0.058	0.0447	0.0247
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00014	0.00018	0.00013	0.00023	0.00012	0.00011	0.00013	0.00015	0.00012	0.00012	0.00023	0.00016	0.00021	0.00014
Barium	mg/L	-	1W	-	-	-	1	0.00558	0.00557	0.00492	0.00531	0.00668	0.00497	0.00526	0.00554	0.00685	0.00531	0.0053	0.00649	0.00642	0.00668	0.00552
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000061	<0.0000050	<0.0000050	<0.0000050	0.0000066	0.0000054	0.0000164
Calcium	mg/L	-	-	-	1000	-	1000	18.8	18.7	17.1	16.4	16.9	16.1	15.9	16	16	16.1	17.3	17.6	17.4	17.3	16
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00114	0.00123	0.0007	0.00072	0.00148	0.00056	0.00217	0.00066	0.00583	0.00068	0.00063	0.00113	0.0013	0.0013	0.00076
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	0.068	<0.030	<0.030	<0.030	0.065	<0.030	<0.030	0.061	0.08	0.062	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.07	2.09	2.03	2.02	2.72	1.87	1.8	1.87	1.91	1.89	1.94	2.34	2.3	2.36	1.95
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.0013	0.00157	0.00118	0.00147	0.00403	0.00171	0.00134	0.00129	0.00341	0.00111	0.00098	0.00411	0.00374	0.0047	0.00168
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000793	0.000761	0.000575	0.000528	0.000497	0.000351	0.000379	0.000337	0.000375	0.000333	0.000402	0.000454	0.000435	0.000618	0.000359
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	0.00058	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	0.00062	0.00076	0.00051
Potassium	mg/L	-	-	-	-	-	-	0.536	0.492	0.487	0.461	0.484	0.469	0.433	0.491	0.487	0.474	0.453	0.536	0.55	0.556	0.498
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000126	0.000198	0.000157	0.000138	0.000163	0.000102	0.000124	0.000119	0.000098	0.000085	0.000113	0.000124	0.000121	0.000151	0.000125
Silicon	mg/L	-	-	-	-	-	-	1.74	1.81	1.71	1.8	2.26	1.63	1.75	1.61	1.78	1.59	1.6	2.08	2.19	2.26	1.8
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.16	1.15	1.09	1.03	1.4	0.897	0.84	0.893	0.996	0.918	0.947	1.18	1.16	1.29	0.908
Strontium	mg/L	-	-	-	-	-	-	0.146	0.134	0.151	0.13	0.121	0.118	0.131	0.122	0.117	0.115	0.132	0.127	0.126	0.125	0.118
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000174	0.000148	0.00016	0.000151	0.000144	0.000142	0.000148	0.000147	0.000149	0.000132	0.000154	0.000144	0.000144	0.000148	0.000131
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2019-04-25	Quesnel Lake QUL-58 QUL-58-S 2019-05-02	Quesnel Lake QUL-58 QUL-58-S 2019-05-08	Quesnel Lake QUL-58 QUL-58-S 2019-05-15	Quesnel Lake QUL-58 QUL-58-S 2019-05-21	Quesnel Lake QUL-58 QUL-58-S 2019-06-18	Quesnel Lake QUL-58 QUL-58-S 2019-06-19	Quesnel Lake QUL-58 QUL-58-S 2019-07-11	Quesnel Lake QUL-58 QUL-58-S 2019-07-25	Quesnel Lake QUL-58 QUL-58-S 2019-08-20	Quesnel Lake QUL-58 QUL-58-S 2019-10-30	Quesnel Lake QUL-58 QUL-58-S 2020-06-02	Quesnel Lake QUL-58 QUL-58-S 2020-06-09	Quesnel Lake QUL-58 QUL-58-S 2020-06-16	Quesnel Lake QUL-58 QUL-58-S 2020-06-24
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0073	0.007	0.0063	0.0073	0.0228	0.0106	0.0085	0.0091	0.0097	0.0093	0.009	0.0193	0.0194	0.0154	0.0119
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	0.0001	0.00011	0.0002	<0.00010	0.00011	0.00011	0.00012	0.00011	0.00013	0.00019	0.00015	0.00016	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00566	0.00511	0.00567	0.00557	0.00739	0.0056	0.00523	0.00507	0.00569	0.00505	0.00516	0.00661	0.00616	0.00657	0.00507
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00064	0.00061	0.00053	0.00056	0.00139	<0.00050	<0.00050	<0.00050	0.00055	<0.00050	<0.00050	0.00112	0.00091	0.00111	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00034	0.00028	0.00033	0.00047	0.00208	0.00083	0.00039	0.00035	0.00029	0.00013	0.00021	0.00197	0.00044	0.00196	0.00014
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000809	0.000729	0.000529	0.000534	0.000489	0.000357	0.000356	0.000355	0.000369	0.000342	0.00039	0.000506	0.000463	0.000624	0.000332
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.0002	0.000196	0.000119	0.000117	0.000148	0.000128	0.000101	0.000113	0.000096	0.000132	0.00015	0.000113	0.000115	0.00019	0.0001
Silicon	mg/L	-	-	-	-	-	-	1.61	1.73	1.7	1.78	2.21	1.81	1.71	1.5	1.69	1.65	1.56	2.22	2.06	2.13	1.81
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.147	0.139	0.14	0.143	0.129	0.116	0.132	0.125	0.11	0.116	0.13	0.138	0.13	0.129	0.118
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000176	0.000157	0.00018	0.000167	0.000144	0.000148	0.000163	0.000146	0.000145	0.000133	0.000143	0.000136	0.000133	0.000137	0.00014
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2020-06-29	Quesnel Lake QUL-58 QUL-58-S 2020-07-21	Quesnel Lake QUL-58 QUL-58-S 2020-08-11	Quesnel Lake QUL-58 QUL-58-S 2020-09-16	Quesnel Lake QUL-58 QUL-58-S 2020-11-04	Quesnel Lake QUL-58 QUL-58-S 2021-05-04	Quesnel Lake QUL-58 QUL-58-S 2021-05-11	Quesnel Lake QUL-58 QUL-58-S 2021-05-25	Quesnel Lake QUL-58 QUL-58-S 2021-06-02	Quesnel Lake QUL-58 QUL-58-S 2021-07-21	Quesnel Lake QUL-58 QUL-58-S 2021-09-16	Quesnel Lake QUL-58 QUL-58-S 2021-10-27	Quesnel Lake QUL-58 QUL-58-S 2022-05-09	Quesnel Lake QUL-58 QUL-58-S 2022-05-18	Quesnel Lake QUL-58 QUL-58-S 2022-05-25
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	107.8	-	99	104.7	108.9	112	112.8	111.8	108.6	119.3	107.5	107.8	114.2	114.4	130.4
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.65	-	7.76	8.15	7.92	7.77	7.79	7.86	7.75	7.92	8.52	7.9	7.76	8.24	7.44
Turbidity	NTU	1	-	-	-	-	1	0.32	-	0	0.08	0.26	1.12	0	0.23	1.3	0.14	0.13	0.06	0	0.17	0.42
Temperature	C	-	-	-	-	-	-	10.145	-	16.218	15.167	6.22	4.957	5.796	9.023	12.918	19.634	15.433	9.032	4.066	4.406	4.607
Dissolved oxygen	%	-	-	-	-	-	-	91.4	-	97.3	97.9	87.7	94.8	97.8	99	100.9	100.8	93.6	90.5	89.9	88.3	86
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	9.89	-	9.56	9.83	10.85	12.12	12.23	11.44	10.59	9.22	9.35	10.44	11.76	11.44	11.09
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	44.7	42.4	42.8	47.4	47.7	48.2	48.8	49	47.3	45.3	50.9	47.8	50.4	51	52.4
Specific conductivity	uS/cm	-	-	-	-	-	-	104	97.8	98.9	104	109	111	117	112	106	97.8	115	108	114	116	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.83	7.4	7.9	7.93	7.84	7.93	7.97	7.85	7.88	7.94	7.9	7.95	7.9	7.89	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1	1.3	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
Turbidity	NTU	1	-	-	-	-	1	0.28	0.98	0.4	0.24	0.17	0.26	0.15	0.24	0.52	0.22	0.13	0.14	0.35	0.22	0.41
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51.5	47	45.2	52.2	53.2	55.3	52	53.4	52.8	46.4	52.1	54.1	54.1	57.4	51.5
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	49.9	50.2	48.4	52.6	50.7	55.7	56.3	52.8	53.9	48.7	52.8	52.7	53.8	54.3	53.8
Total dissolved solids	mg/L	-	-	-	1000	-	1000	78	76	66	61	70	71	70	75	69	59	72	70	82	74	64
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.99	4.12	3.19	2.36	13.1	2.43	2.22	2.2	4.44	2.26	1.75	1.73	2.2	2.15	2.37
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.116	0.0138	0.0293	0.0308	0.111	0.133	0.127	0.113	0.0975	0.0568	0.0429	0.0843	0.128	0.126	0.13
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.116	<0.0500	0.0297	0.0311	0.111	0.133	0.127	0.113	0.0975	0.0568	0.0429	0.0843	0.128	0.126	0.13
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	0.0068	<0.0050	0.005	0.0065	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0086	<0.0050	<0.0050	0.0051	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0028	0.0024	<0.0020	<0.0020	0.0022	0.0026	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0098	0.008	0.004	0.0095	0.0025	<0.0020	<0.0020	0.0024	0.0028	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.193	0.156	0.154	0.119	0.177	0.187	0.176	0.206	0.198	0.118	0.121	0.132	0.216	0.176	0.187
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17.3	15.4	14.8	17.5	17.7	18.7	17.4	17.7	17.2	15.6	17.8	18.5	18.2	19.5	17.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.037	0.038	0.035	0.027	0.04	0.038	0.035	0.036	0.032	0.03	0.032	0.036	0.036	0.036	0.036
Magnesium	mg/L	-	-	-	-	-	-	2.03	2.08	1.99	2.09	2.18	2.1	2.08	2.24	2.4	1.8	1.85	1.93	2.1	2.12	1.83
Potassium	mg/L	-	-	-	-	-	-	0.522	0.546	0.509	0.494	0.52	0.461	0.49	0.514	0.594	0.485	0.468	0.491	0.471	0.484	0.508
Sodium	mg/L	-	-	-	-	-	-	1.01	0.994	0.972	0.97	1	0.992	1.02	1.08	1.41	0.872	0.873	0.87	0.978	1.11	1.11
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.11	5.15	5.53	5.68	7	7.41	7.51	7.75	6.99	5.99	6.36	6.98	7.66	7.66	7.87
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0232	0.0701	0.0232	0.0281	0.0146	0.0148	0.0143	0.0184	0.0341	0.0157	0.0099	0.011	0.0219	0.0341	0.0238
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00014	0.00022	0.00017	0.00017	0.00013	0.00014	0.00012	0.00012	0.00019	0.00014	0.00011	0.00013	0.00013	0.00015	0.00013
Barium	mg/L	-	1W	-	-	-	1	0.00563	0.00713	0.00565	0.00554	0.00519	0.00543	0.00512	0.00549	0.00671	0.00548	0.00451	0.00509	0.00568	0.00598	0.00578
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	0.0000108	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000054	0.0000064	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	16.5	16.5	15.9	17.8	16.8	18.7	19	17.5	17.6	16.4	18.1	17.8	17.9	18	17.7
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00114	0.00137	0.00081	0.001	0.0007	0.00072	0.00076	0.00071	0.00128	0.00063	<0.00050	0.00057	0.00097	0.00127	0.00104
Iron	mg/L	-	-	1	-	-	1	<0.030	0.079	0.05	<0.030	<0.030	<0.030	<0.030	<0.030	0.052	<0.030	<0.030	<0.030	<0.030	0.043	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.12	2.18	2.12	1.97	2.1	2.19	2.15	2.2	2.42	1.88	1.84	2	2.22	2.28	2.32
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00187	0.0031	0.00206	0.00147	0.00137	0.00122	0.00107	0.00147	0.00448	0.00183	0.00068	0.00089	0.00152	0.00238	0.00173
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.0004	0.00047	0.000392	0.000319	0.000437	0.00061	0.000651	0.000511	0.000672	0.00038	0.000326	0.000413	0.000745	0.000895	0.000765
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.00069	0.00082	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.528	0.576	0.503	0.433	0.486	0.517	0.509	0.532	0.575	0.481	0.444	0.5	0.506	0.531	0.517
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000135	0.00014	0.000107	0.000097	0.00013	0.000142	0.000155	0.000135	0.000157	0.000123	0.000114	0.000121	0.00023	0.000236	0.000204
Silicon	mg/L	-	-	-	-	-	-	1.99	2.24	2.02	1.74	1.74	1.89	1.86	2.01	2.4	1.8	1.47	1.62	1.82	2.04	1.93
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.04	1.1	0.963	0.875	0.988	1.05	1.06	1.05	1.42	0.887	0.845	0.923	1.09	1.15	1.15
Strontium	mg/L	-	-	-	-	-	-	0.119	0.102	0.114	0.133	0.138	0.139	0.147	0.139	0.126	0.112	0.125	0.138	0.146	0.153	0.147
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000139	0.000136	0.000127	0.000133	0.000156	0.000161	0.000175	0.000162	0.000151	0.000139	0.000149	0.000174	0.000168	0.000181	0.000163
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	0.0279	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2020-06-29	Quesnel Lake QUL-58 QUL-58-S 2020-07-21	Quesnel Lake QUL-58 QUL-58-S 2020-08-11	Quesnel Lake QUL-58 QUL-58-S 2020-09-16	Quesnel Lake QUL-58 QUL-58-S 2020-11-04	Quesnel Lake QUL-58 QUL-58-S 2021-05-04	Quesnel Lake QUL-58 QUL-58-S 2021-05-11	Quesnel Lake QUL-58 QUL-58-S 2021-05-25	Quesnel Lake QUL-58 QUL-58-S 2021-06-02	Quesnel Lake QUL-58 QUL-58-S 2021-07-21	Quesnel Lake QUL-58 QUL-58-S 2021-09-16	Quesnel Lake QUL-58 QUL-58-S 2021-10-27	Quesnel Lake QUL-58 QUL-58-S 2022-05-09	Quesnel Lake QUL-58 QUL-58-S 2022-05-18	Quesnel Lake QUL-58 QUL-58-S 2022-05-25
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0105	0.017	0.0134	0.0106	0.0083	0.0079	0.0081	0.0095	0.0163	0.0115	0.0079	0.011	0.0118	0.0119	0.013
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	0.0002	0.00016	0.00011	<0.00010	0.0001	<0.00010	<0.00010	0.00017	0.0001	<0.00010	<0.00010	0.0001	0.00011	0.00012
Barium	mg/L	-	-	-	-	-	-	0.00574	0.00582	0.00588	0.00572	0.00499	0.00537	0.00492	0.00526	0.00651	0.00541	0.00497	0.00478	0.00515	0.00513	0.00547
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	0.0000485	0.0000082	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000243	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00064	0.00084	0.0007	0.00069	0.00051	0.00058	0.00068	0.00063	0.0012	0.00057	<0.00050	<0.00050	0.00087	0.00094	0.00092
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.0003	0.00022	<0.00010	0.00022	0.00047	0.00033	0.00034	0.00057	0.00299	0.00074	0.00032	0.00028	0.00039	0.00058	0.00054
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000413	0.00042	0.0004	0.000339	0.000411	0.000748	0.000658	0.000462	0.000713	0.000361	0.000294	0.000394	0.000783	0.000994	0.00075
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000116	0.000162	0.000133	0.000074	0.000096	0.000161	0.000197	0.000144	0.000128	0.00014	0.000136	0.000097	0.000136	0.000164	0.000185
Silicon	mg/L	-	-	-	-	-	-	1.92	2.22	1.86	1.83	1.64	1.63	1.84	1.89	2.07	1.62	1.32	1.38	1.69	1.82	1.88
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.127	0.102	0.112	0.126	0.142	0.144	0.127	0.135	0.128	0.114	0.123	0.138	0.148	0.146	0.139
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00022	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000137	0.00013	0.000121	0.000147	0.000154	0.000173	0.000157	0.000149	0.000137	0.00013	0.000148	0.000168	0.000168	0.000162	0.000168
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2022-05-31	Quesnel Lake QUL-58 QUL-58-S 2022-06-06	Quesnel Lake QUL-58 QUL-58-S 2022-06-27	Quesnel Lake QUL-58 QUL-58-S 2022-08-16	Quesnel Lake QUL-58 QUL-58-S 2022-10-19	Quesnel Lake QUL-59 QUL-59-AP 2020-09-16	Quesnel Lake QUL-59 QUL-59-AP 2021-07-21	Quesnel Lake QUL-59 QUL-59-AP 2021-09-16	Quesnel Lake QUL-59 QUL-59-AP 2021-10-27	Quesnel Lake QUL-59 QUL-59-AP 2022-08-16	Quesnel Lake QUL-59 QUL-59-AP 2022-10-19	Quesnel Lake QUL-59 QUL-59-AT 2019-05-08	Quesnel Lake QUL-59 QUL-59-AT 2019-05-15	Quesnel Lake QUL-59 QUL-59-AT 2019-06-18	Quesnel Lake QUL-59 QUL-59-AT 2019-08-20
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	115.8	-	107.6	98	103.5	105.6	124.5	107.1	107.4	110.6	104.8	113.8	112.8	103.1	101.5
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.03	-	7.87	8.06	8.06	8.19	7.8	8.25	7.83	7.72	7.88	7.88	7.7	7.95	7.87
Turbidity	NTU	1	-	-	-	-	1	0.31	-	0.63	0.27	0	0.05	0	0.07	0.2	0.33	0.13	0.47	0.77	0.79	0
Temperature	C	-	-	-	-	-	-	9.085	-	14.512	20.543	13.525	10.455	8.789	15.375	8.833	4.614	10.502	5.139	4.366	11.19	16.653
Dissolved oxygen	%	-	-	-	-	-	-	96.7	-	100.6	99.1	94.9	90.2	94	93.8	89.8	87	89.4	91.7	90.3	100.6	96.5
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.15	-	9.75	8.92	9.88	10.05	10.86	9.39	10.42	11.22	9.94	11.66	11.71	11.03	9.39
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	52.8	52.6	47.5	42.4	44.1	46.6	47.5	51.8	47.7	46.9	44.8	50.1	49.9	44.6	46.1
Specific conductivity	uS/cm	-	-	-	-	-	-	118	112	101	99.6	104	106	102	112	110	113	109	117	113	101	101
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.98	7.71	7.83	7.89	7.85	7.94	7.91	7.91	7.94	7.92	7.88	7.87	7.97	7.99	7.95
Total suspended solids	mg/L	-	-	-	-	-	-	1	<1.0	<1.0	1	<1.0	<1.1	<1.0	<1.2	<1.0	<1.1	<1.1	<1.0	1.2	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.6	0.36	0.67	0.26	0.44	0.18	0.15	0.16	0.14	0.14	0.21	0.26	0.22	0.24	0.28
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.7	48.8	50.5	46.8	52.4	52.3	48.5	52.9	55.2	53.7	52.5	58.1	54.2	49.9	47.3
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	56.6	53	48	47.6	48.8	55.5	49.3	54.3	51.1	54.9	49.3	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	114	67	66	60	85	68	73	68	67	82	59	67	74	64	61
Dissolved organic carbon	mg/L	-	-	-	-	-	-	7.4	2.56	3.65	2.17	2.08	2.11	1.92	1.75	1.61	2.07	2.09	2.02	1.99	1.82	2.24
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0978	0.111	0.0616	0.0196	0.0269	0.0656	0.11	0.0432	0.0862	0.148	0.0272	0.132	0.119	0.0863	0.0477
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0978	0.111	0.0616	0.0196	0.0269	0.0662	0.11	0.0432	0.0862	0.149	0.0272	0.132	0.119	0.0863	0.0477
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	0.0199	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0021	<0.0020	0.0034	<0.0020	0.0021	0.0034	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0038	<0.0020	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0035	0.0024	0.0051	<0.0020	0.0022	0.0028	0.0038	0.0033	<0.0020	<0.0020	0.0024	0.0078	0.0024	0.0085	0.003
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.219	0.198	0.157	0.088	0.11	0.145	0.282	0.123	0.133	0.184	0.15	0.18	0.204	0.186	0.131
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	18.2	16.2	16.5	15.7	17.6	17.5	16.2	18	18.8	17.9	17.6	19.6	18	16.6	15.6
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.042	0.034	0.034	0.035	0.035	0.03	0.03	0.031	0.036	0.04	0.035	0.036	0.033	0.04	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.73	2.02	2.27	1.85	2.06	2.06	1.96	1.94	2	2.18	2.07	2.25	2.27	2.05	2.05
Potassium	mg/L	-	-	-	-	-	-	0.532	0.436	0.547	0.501	0.495	0.499	0.486	0.486	0.501	0.545	0.503	0.552	0.479	0.519	0.465
Sodium	mg/L	-	-	-	-	-	-	1.56	1.02	1.11	0.823	0.952	0.996	0.862	0.902	0.887	1.02	0.954	1.17	1.14	1.02	0.912
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	8.1	6.91	5.65	5.62	6.33	5.91	6.14	6.36	7.01	7.17	6.24	7.41	6.72	6.14	5.78
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0385	0.0276	0.0326	0.0183	0.0135	0.0151	0.0139	0.0106	0.0131	0.0134	0.0118	0.0173	0.02	0.0155	0.0127
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00018	0.00017	0.00018	0.00015	0.00013	0.00016	<0.00010	0.00011	0.00012	0.00011	0.00013	0.00016	0.00013	0.00011	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00609	0.00556	0.00622	0.00545	0.00529	0.00499	0.00509	0.0047	0.005	0.00546	0.0049	0.00523	0.00551	0.00526	0.00562
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	0.0000062	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18.2	17.6	15.6	15.8	16.3	18.9	16.5	18.5	17.2	18.5	16.6	17.3	17.9	15.6	15.8
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00157	0.00092	0.00097	0.0006	0.00063	0.00066	<0.00050	0.00055	0.00056	0.00074	<0.00050	0.00096	0.0009	0.00058	0.00064
Iron	mg/L	-	-	1	-	-	1	0.045	<0.030	0.045	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.7	2.21	2.2	1.99	1.96	2.03	1.96	1.98	1.97	2.11	1.9	2.07	2	1.9	1.93
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00386	0.00205	0.00293	0.00139	0.00119	0.00151	0.00108	0.00082	0.00096	0.00096	0.00113	0.00112	0.00132	0.00166	0.00123
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.0008	0.000553	0.00046	0.000346	0.000316	0.000339	0.000326	0.000314	0.00042	0.000585	0.000391	0.000644	0.000673	0.000352	0.000366
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	0.00051	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.532	0.488	0.52	0.496	0.487	0.435	0.48	0.482	0.493	0.501	0.477	0.497	0.47	0.484	0.492
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000152	0.000169	0.00016	0.000122	0.000112	0.000107	0.000108	0.000107	0.000127	0.000131	0.000078	0.000183	0.00017	0.000118	0.000075
Silicon	mg/L	-	-	-	-	-	-	2.24	1.92	2.2	1.65	1.32	1.74	1.77	1.44	1.66	1.98	1.32	1.79	1.67	1.64	1.65
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.47	1.12	1.06	0.881	0.864	0.892	0.894	0.897	0.906	1	0.928	1.13	1.02	0.906	0.917
Strontium	mg/L	-	-	-	-	-	-	0.146	0.135	0.118	0.114	0.132	0.134	0.128	0.13	0.136	0.141	0.125	0.141	0.134	0.113	0.118
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000157	0.000171	0.000134	0.000144	0.000144	0.000142	0.000152	0.000152	0.000168	0.000167	0.000167	0.00016	0.000159	0.000152	0.000137
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-58 QUL-58-S 2022-05-31	Quesnel Lake QUL-58 QUL-58-S 2022-06-06	Quesnel Lake QUL-58 QUL-58-S 2022-06-27	Quesnel Lake QUL-58 QUL-58-S 2022-08-16	Quesnel Lake QUL-58 QUL-58-S 2022-10-19	Quesnel Lake QUL-59 QUL-59-AP 2020-09-16	Quesnel Lake QUL-59 QUL-59-AP 2021-07-21	Quesnel Lake QUL-59 QUL-59-AP 2021-09-16	Quesnel Lake QUL-59 QUL-59-AP 2021-10-27	Quesnel Lake QUL-59 QUL-59-AP 2022-08-16	Quesnel Lake QUL-59 QUL-59-AP 2022-10-19	Quesnel Lake QUL-59 QUL-59-AT 2019-05-08	Quesnel Lake QUL-59 QUL-59-AT 2019-05-15	Quesnel Lake QUL-59 QUL-59-AT 2019-06-18	Quesnel Lake QUL-59 QUL-59-AT 2019-08-20
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0229	0.0103	0.0177	0.0124	0.0076	0.0106	0.0087	0.0084	0.0065	0.0079	0.0068	0.007	0.007	0.0112	0.0088
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0002	0.00012	0.00017	<0.00010	0.0001	0.00011	<0.00010	0.0001	<0.00010	<0.00010	0.00012	0.0001	0.0001	0.0001	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00653	0.00493	0.00626	0.0051	0.00527	0.00571	0.00508	0.00532	0.00499	0.00511	0.00521	0.00581	0.0054	0.0055	0.00521
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	0.0000074	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00163	0.00072	0.00095	0.00053	0.00053	0.00064	<0.00050	<0.00050	<0.00050	0.00077	<0.00050	0.00082	0.0006	0.0005	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00321	0.0008	0.00142	0.00036	0.00026	0.00048	0.00011	0.0003	0.00025	0.00016	0.00026	0.00038	0.00016	0.00075	<0.00010
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000863	0.000524	0.000451	0.000348	0.000314	0.000378	0.000306	0.000298	0.000391	0.000556	0.000352	0.000652	0.000702	0.000338	0.000358
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000197	0.000131	0.000124	0.000113	0.000104	0.000132	0.000069	0.000099	0.000094	0.000144	0.000079	0.000191	0.000147	0.000113	0.000118
Silicon	mg/L	-	-	-	-	-	-	2.31	1.88	2.13	1.56	1.31	1.75	1.68	1.4	1.4	1.92	1.28	1.68	1.7	1.72	1.64
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.14	0.124	0.112	0.113	0.134	0.126	0.124	0.127	0.14	0.137	0.133	0.146	0.138	0.121	0.119
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000144	0.000158	0.000131	0.000136	0.000155	0.000151	0.000156	0.000145	0.000162	0.000162	0.000158	0.000188	0.000168	0.00014	0.000133
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-AT 2020-06-24	Quesnel Lake QUL-59 QUL-59-AT 2020-08-11	Quesnel Lake QUL-59 QUL-59-AT 2022-06-27	Quesnel Lake QUL-59 QUL-59-B 2015-12-09	Quesnel Lake QUL-59 QUL-59-B 2015-12-14	Quesnel Lake QUL-59 QUL-59-B 2015-12-21	Quesnel Lake QUL-59 QUL-59-B 2016-01-25	Quesnel Lake QUL-59 QUL-59-B 2016-03-28	Quesnel Lake QUL-59 QUL-59-B 2016-05-17	Quesnel Lake QUL-59 QUL-59-B 2018-06-04	Quesnel Lake QUL-59 QUL-59-B 2019-04-25	Quesnel Lake QUL-59 QUL-59-B 2019-05-02	Quesnel Lake QUL-59 QUL-59-B 2019-05-08	Quesnel Lake QUL-59 QUL-59-B 2019-05-15	Quesnel Lake QUL-59 QUL-59-B 2019-06-18
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																		
Field Parameters																								
Specific conductivity	uS/cm	-	-	-	-	-	-	100.5	99.6	107.1	150.5	144.5	152.6	111.6	110.4	108.1	115	112.5	-	115.4	-	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.59	7.95	8.05	7.85	7.78	7.68	7.86	7.96	7.66	7.48	7.78	-	7.85	-	7.69
Turbidity	NTU	1	-	-	-	-	1	0.7	0	0.42	0.9	0.54	0.82	0.37	0.52	0.53	0	0.94	-	0.64	-	0.96
Temperature	C	-	-	-	-	-	-	12.579	10.201	8.415	5.023	4.766	4.463	2.998	3.165	4.724	4.282	3.47	-	4.266	-	4.167
Dissolved oxygen	%	-	-	-	-	-	-	101.9	90.5	93.8	83.1	84.1	82.3	85.7	87.9	86.8	91.2	87.4	-	88.4	-	92.6
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.83	10.14	10.94	10.6	10.8	10.66	11.54	11.78	11.16	11.87	11.61	-	11.5	-	12.08
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	45.7	42.6	49	49.9	50.4	48.2	48.1	49	50.1	49	49.3	52.3	50.3	50.1	48.8
Specific conductivity	uS/cm	-	-	-	-	-	-	96.9	98.9	106	112	113	114	116	114	121	109	121	114	118	113	116
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.8	7.81	7.87	7.8	7.85	7.89	7.86	7.86	7.98	7.94	7.95	7.9	7.88	7.97	8.02
Total suspended solids	mg/L	-	-	-	-	-	-	1.6	<1.1	<1.0	<3.0	<3.0	<3.0	<3.0	<1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.58	0.33	0.6	0.48	0.57	0.59	0.46	0.56	1.07	0.33	0.38	0.42	0.29	0.2	0.13
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	47	47.5	50.8	53.3	56.8	55.2	56.5	53.3	55.5	53.8	58	55.6	61.1	54.7	56.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	47.4	46.7	49.8	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	69	67	71	63	67	65	85	76	73	72	64	77	86	64	72
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.76	2.98	2.91	1.5	1.32	1.61	1.67	1.64	1.61	1.98	2.05	6.06	2	1.91	1.69
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0829	0.0669	0.091	0.11	0.115	0.121	0.137	0.131	0.173	0.142	0.143	0.137	0.138	0.131	0.143
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0837	0.0675	0.091	0.11	0.115	0.121	0.137	0.131	0.173	0.142	0.143	0.137	0.138	0.131	0.143
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0384	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0075
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	0.0042	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0025	0.0033	<0.0020	0.0037	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0033	0.0047	0.0048	<0.0020	0.0031	0.0021	0.0035	0.003	0.0091	0.0031	0.0049	0.0032	0.0072	0.0043	0.0053
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.167	0.187	0.15	0.163	0.175	0.169	0.186	0.174	0.217	0.187	0.193	0.203	0.191	0.205	0.217
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	-	-	1000	-	1000	15.5	15.8	16.8	18	19.3	18.7	19.1	17.9	18.6	17.9	19.9	18.6	20.5	18.1	19.1
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.038	0.034	0.031	0.033	0.035	0.037	0.034	0.036	0.035	0.036	0.034	0.034	0.037	0.035	0.041
Magnesium	mg/L	-	-	-	-	-	-	2.02	1.94	2.15	2.01	2.11	2.05	2.12	2.08	2.21	2.22	2.03	2.25	2.39	2.28	2.23
Potassium	mg/L	-	-	-	-	-	-	0.467	0.51	0.534	0.502	0.477	0.494	0.486	0.512	0.569	0.546	0.481	0.53	0.584	0.486	0.522
Sodium	mg/L	-	-	-	-	-	-	0.946	0.918	1.02	0.993	0.932	1	1.06	1.02	1.23	1.11	1.16	1.24	1.29	1.19	1.19
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	5.77	5.79	5.77	6.71	6.6	7.28	8.02	7.33	9.57	7.33	7.67	8.33	7.94	7.43	7.36
Total Metals																								
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0279	0.027	0.0295	0.0424	0.0383	0.0419	0.0278	0.0411	0.128	0.0198	0.025	0.0295	0.0223	0.0192	0.0128
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00014	0.00015	0.0001	0.00011	0.00015	0.00011	0.00012	0.00021	0.00011	0.00011	0.00014	0.00017	0.00013	0.00011
Barium	mg/L	-	1W	-	-	-	1	0.00563	0.00551	0.00594	0.00578	0.00612	0.0061	0.00551	0.00617	0.00791	0.00541	0.00562	0.00535	0.00511	0.00576	0.00529
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	15.8	15.5	16.4	17.5	18.9	18.8	18.6	18.3	19.2	16.4	18.9	18.9	17.5	18.2	18.3
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00075	0.00088	0.00074	0.0015	0.00141	0.00181	0.00124	0.00177	0.00428	0.0008	0.0012	0.00109	0.00084	0.00093	0.00075
Iron	mg/L	-	-	1	-	-	1	0.043	0.042	0.041	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.081	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	0.000098	<0.000050	0.000054	0.000615	0.000062	0.000155	0.000228	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.0013	<0.0010	0.001	<0.0010	0.001	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.94	1.93	2.14	2.02	2.11	2.11	2.09	2.16	2.37	2.17	2.12	2.17	2.04	2.01	2.14
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00228	0.00297	0.00232	0.00152	0.00144	0.0019	0.00148	0.00196	0.00378	0.00157	0.00196	0.00229	0.00148	0.00145	0.00095
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000402	0.00037	0.000413	0.00044	0.00043	0.000594	0.000791	0.000632	0.0014	0.0005	0.000871	0.000851	0.000801	0.000722	0.000594
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.505	0.491	0.509	0.509	0.519	0.526	0.506	0.528	0.656	0.497	0.554	0.503	0.495	0.474	0.503
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000149	0.000095	0.000147	0.000099	0.000101	0.000138	0.00019	0.000108	0.000286	0.000117	0.000128	0.00019	0.000183	0.000146	0.000141
Silicon	mg/L	-	-	-	-	-	-	2.01	1.86	2.08	1.66	1.75	1.73	1.71	1.78	2	1.72	1.81	1.86	1.72	1.68	1.68
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.92	0.936	0.989	0.996	0.982	1.08	1.1	1.06	1.33	1.07	1.2	1.22	1.16	1.04	1.09
Strontium	mg/L	-	-	-	-	-	-	0.114	0.117	0.122	0.136	0.13	0.143	0.144	0.144	0.148	0.133	0.146	0.139	0.147	0.134	0.134
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.00013	0.000148	0.000145	0.000175	0.000158	0.000172	0.000165	0.000177	0.000183	0.000173	0.00017	0.000149	0.000162	0.000157	0.000168
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00085	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	0.0105	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-AT 2020-06-24	Quesnel Lake QUL-59 QUL-59-AT 2020-08-11	Quesnel Lake QUL-59 QUL-59-AT 2022-06-27	Quesnel Lake QUL-59 QUL-59-B 2015-12-09	Quesnel Lake QUL-59 QUL-59-B 2015-12-14	Quesnel Lake QUL-59 QUL-59-B 2015-12-21	Quesnel Lake QUL-59 QUL-59-B 2016-01-25	Quesnel Lake QUL-59 QUL-59-B 2016-03-28	Quesnel Lake QUL-59 QUL-59-B 2016-05-17	Quesnel Lake QUL-59 QUL-59-B 2018-06-04	Quesnel Lake QUL-59 QUL-59-B 2019-04-25	Quesnel Lake QUL-59 QUL-59-B 2019-05-02	Quesnel Lake QUL-59 QUL-59-B 2019-05-08	Quesnel Lake QUL-59 QUL-59-B 2019-05-15	Quesnel Lake QUL-59 QUL-59-B 2019-06-18
Dissolved Metals																							
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0115	0.0119	0.0139	0.0063	0.0047	0.005	0.006	0.0055	0.0073	0.0074	0.0082	0.0087	0.0076	0.0067	0.0068
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.0001	0.00012	0.00013	0.00012	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00012	<0.00010	0.00012	<0.00010
Barium	mg/L	-	-	-	-	-	-	0.00542	0.00564	0.00596	0.0052	0.00535	0.00536	0.00502	0.0053	0.00547	0.0057	0.00529	0.0052	0.00594	0.00537	0.00548
Beryllium	mg/L	-	-	-	-	-	-	<0.00100	<0.00100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00054	0.00059	0.00074	0.00082	0.00077	0.00088	0.00077	0.00102	0.00092	0.00073	0.00067	0.00075	0.0006	0.00063	0.00057
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	0.000087	<0.000050	<0.000050	0.000203	0.000087	0.000096	0.000162	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00014	0.00012	0.00044	0.00017	0.0002	0.00045	0.00052	0.00074	0.00088	0.00027	0.00068	0.00067	0.00035	0.00022	0.00011
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000436	0.000329	0.000427	0.000382	0.000405	0.00052	0.000722	0.000541	0.0012	0.00051	0.000887	0.000843	0.000801	0.000751	0.000606
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000114	0.00008	0.000214	0.000101	0.00009	0.000091	0.000171	0.000133	0.000287	0.000141	0.000194	0.000202	0.000184	0.000183	0.000172
Silicon	mg/L	-	-	-	-	-	-	1.96	1.9	2.08	1.59	1.67	1.59	1.67	1.67	1.72	1.68	1.54	1.73	1.74	1.72	1.78
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.126	0.114	0.122	0.134	0.125	0.134	0.141	0.139	0.139	0.135	0.152	0.145	0.15	0.138	0.143
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.00014	0.00013	0.00014	0.000162	0.000153	0.000156	0.000155	0.000159	0.000168	0.000166	0.000174	0.000157	0.000178	0.000162	0.000171
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-B 2019-08-20	Quesnel Lake QUL-59 QUL-59-B 2020-06-24	Quesnel Lake QUL-59 QUL-59-B 2020-08-11	Quesnel Lake QUL-59 QUL-59-B 2020-09-16	Quesnel Lake QUL-59 QUL-59-B 2021-05-19	Quesnel Lake QUL-59 QUL-59-B 2021-06-02	Quesnel Lake QUL-59 QUL-59-B 2021-07-21	Quesnel Lake QUL-59 QUL-59-B 2021-09-16	Quesnel Lake QUL-59 QUL-59-B 2021-10-27	Quesnel Lake QUL-59 QUL-59-B 2022-05-10	Quesnel Lake QUL-59 QUL-59-B 2022-06-27	Quesnel Lake QUL-59 QUL-59-B 2022-08-16	Quesnel Lake QUL-59 QUL-59-B 2022-10-19	Quesnel Lake QUL-59 QUL-59-BT 2019-05-08	Quesnel Lake QUL-59 QUL-59-BT 2019-05-15
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	112	112.4	114.9	112	114.2	113.7	132.8	113.7	124.6	113.1	110.7	113.9	111.3	114.6	-
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.44	7.49	7.72	7.81	8.14	7.66	7.52	8.35	7.65	7.73	7.79	7.65	7.57	7.86	-
Turbidity	NTU	1	-	-	-	-	1	0	0.49	0	0.15	0.11	0.94	0	0.05	0.16	0	0.41	0.38	0.06	0.57	-
Temperature	C	-	-	-	-	-	-	4.514	4.736	4.627	4.745	4.685	4.895	4.757	4.895	6.102	4.009	4.663	4.594	4.878	4.427	-
Dissolved oxygen	%	-	-	-	-	-	-	86	95.3	89.9	88	92.7	95.1	89.7	86.8	86.7	90.9	90.8	87.4	86.6	89	-
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.12	12.25	11.59	11.3	11.93	12.18	11.53	11.12	10.76	11.9	11.69	11.28	11.09	11.53	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	50	51.1	47.6	48.5	49.1	48	50	44.7	47.7	47.4	53	47.1	45.9	50.9	50.5
Specific conductivity	uS/cm	-	-	-	-	-	-	111	108	112	111	110	112	111	111	126	116	112	113	113	117	113
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8	7.82	7.83	7.92	7.74	7.91	7.89	7.9	7.91	7.81	7.91	7.91	7.9	7.88	7.98
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1	<1.1	<1.1	<1.0	<1.0	<1.0	<1.2	<1.0	<1.1	<1.0	<1.1	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.12	0.28	0.15	<0.10	0.21	0.18	<0.10	<0.10	<0.10	0.15	0.22	0.2	<0.10	0.23	0.18
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51.6	53.3	53.5	53.7	55.5	52.2	53.8	55	55.6	54.2	55	53.4	56.1	55.7	53.9
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	53.1	52.5	56.6	53.8	52.9	54.8	55	57.3	56.3	53.2	54.2	51.3	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	69	77	75	79	76	70	74	73	72	62	70	77	78	79	73
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.77	2.35	2.34	1.91	2.52	2.2	1.98	2.01	1.63	2.15	2.35	2.07	2.05	2.04	2.08
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.145	0.128	0.14	0.141	0.126	0.131	0.144	0.154	0.152	0.128	0.132	0.148	0.151	0.133	0.128
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.145	0.128	0.14	0.141	0.126	0.131	0.144	0.154	0.152	0.128	0.132	0.148	0.151	0.133	0.128
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	0.0057	<0.0050	0.008	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0031	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0028	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	0.0024	<0.0020	<0.0020	0.0028	<0.0020	<0.0020	0.0038	0.0031
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.209	0.19	0.218	0.196	0.181	0.191	0.183	0.196	0.178	0.207	0.169	0.182	0.215	0.186	0.209
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17	17.8	18	18.1	18.6	17.4	18.2	18.7	18.7	18.3	18.4	17.8	18.8	18.6	17.9
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.28	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.035	0.037	0.036	0.033	0.03	0.031	0.032	0.036	0.042	0.04	0.036	0.041	0.038	0.038	0.035
Magnesium	mg/L	-	-	-	-	-	-	2.25	2.14	2.09	2.08	2.2	2.12	2.04	2.02	2.16	2.06	2.2	2.17	2.22	2.23	2.21
Potassium	mg/L	-	-	-	-	-	-	0.487	0.469	0.527	0.507	0.538	0.516	0.485	0.506	0.504	0.474	0.519	0.538	0.532	0.531	0.475
Sodium	mg/L	-	-	-	-	-	-	1.09	1.02	1.1	1.05	1.12	1.07	0.981	1.04	1.15	0.976	1.02	1.02	1.1	1.15	1.16
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.85	6.99	7.31	6.56	7.57	7.44	7.2	7.67	10.8	7.62	6.42	7.24	7.33	7.43	7.23
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0096	0.016	0.0184	0.0135	0.0187	0.0206	0.0126	0.0106	0.0168	0.0192	0.0148	0.0116	0.0117	0.0143	0.0168
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.0001	0.0001	<0.00010	0.00013	0.00014	0.00012	<0.00010	0.00011	0.00014	<0.00010	0.00011	0.00013	<0.00010	0.00015	0.00012
Barium	mg/L	-	1W	-	-	-	1	0.00556	0.00519	0.00536	0.00509	0.00561	0.00544	0.00539	0.00547	0.00539	0.00565	0.00546	0.00527	0.00495	0.0051	0.00558
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	0.0000071	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.3	17.9	17.7	19.1	17.9	17.6	18.3	18.4	19.3	19	17.7	18.2	17.2	17.2	18.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00069	0.00075	0.00081	0.00094	0.001	0.00083	0.00062	0.00063	0.00088	0.00081	0.00055	0.00068	0.00057	0.00081	0.00097
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.07	2.06	2.04	2.14	2.2	2.18	2.2	2.2	2.22	2.16	2.2	2.13	2.03	2.02	2.03
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00083	0.00121	0.00114	0.00086	0.00165	0.00142	0.00106	0.00085	0.00112	0.0014	0.00125	0.00103	0.00136	0.00106	0.00132
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000497	0.000468	0.000513	0.000505	0.000655	0.000597	0.000528	0.000623	0.00164	0.000767	0.000429	0.000607	0.000636	0.00066	0.000664
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.508	0.495	0.513	0.446	0.507	0.512	0.512	0.526	0.541	0.523	0.498	0.514	0.479	0.494	0.488
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.00014	0.000128	0.000126	0.000138	0.000156	0.000191	0.000203	0.000171	0.00038	0.000187	0.000135	0.000181	0.000193	0.000158	0.000158
Silicon	mg/L	-	-	-	-	-	-	1.79	1.83	2.01	1.94	1.97	1.93	2.06	1.89	1.71	1.89	1.97	2.02	1.82	1.73	1.68
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.05	0.994	1.03	0.981	1.14	1.07	1.05	1.04	1.2	1.1	0.991	1.03	0.971	1.12	1.05
Strontium	mg/L	-	-	-	-	-	-	0.14	0.137	0.142	0.148	0.137	0.142	0.138	0.137	0.162	0.151	0.141	0.142	0.133	0.143	0.131
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000162	0.000154	0.000157	0.000149	0.000173	0.000165	0.000162	0.000166	0.000181	0.000175	0.000159	0.000165	0.000167	0.000159	0.000162
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.008	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-B 2019-08-20	Quesnel Lake QUL-59 QUL-59-B 2020-06-24	Quesnel Lake QUL-59 QUL-59-B 2020-08-11	Quesnel Lake QUL-59 QUL-59-B 2020-09-16	Quesnel Lake QUL-59 QUL-59-B 2021-05-19	Quesnel Lake QUL-59 QUL-59-B 2021-06-02	Quesnel Lake QUL-59 QUL-59-B 2021-07-21	Quesnel Lake QUL-59 QUL-59-B 2021-09-16	Quesnel Lake QUL-59 QUL-59-B 2021-10-27	Quesnel Lake QUL-59 QUL-59-B 2022-05-10	Quesnel Lake QUL-59 QUL-59-B 2022-06-27	Quesnel Lake QUL-59 QUL-59-B 2022-08-16	Quesnel Lake QUL-59 QUL-59-B 2022-10-19	Quesnel Lake QUL-59 QUL-59-BT 2019-05-08	Quesnel Lake QUL-59 QUL-59-BT 2019-05-15
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0053	0.0064	0.0066	0.0071	0.0105	0.0084	0.0064	0.007	0.0101	0.008	0.0123	0.0093	0.0069	0.0066	0.0072
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00012	<0.00010	<0.00010	0.0001	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0001	<0.00010	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00536	0.00502	0.0054	0.0052	0.00543	0.00527	0.00493	0.00524	0.00508	0.00501	0.0056	0.00534	0.00528	0.00547	0.0054
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00066	0.00052	0.00056	0.00064	0.0008	0.00078	0.00057	0.00053	0.0007	0.00062	0.0009	0.00063	0.00059	0.00056	0.00061
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00017	<0.00010	0.00012	0.00012	0.00043	0.0002	0.00012	0.00011	0.00042	0.00021	0.00035	0.00022	0.00015	0.00021	0.00018
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000512	0.000467	0.000518	0.000463	0.000649	0.00065	0.000536	0.000555	0.00162	0.000772	0.000437	0.00059	0.000621	0.000648	0.000722
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000154	0.000126	0.000162	0.000168	0.000164	0.000178	0.000187	0.00013	0.000316	0.000163	0.000112	0.000166	0.000175	0.000139	0.000169
Silicon	mg/L	-	-	-	-	-	-	1.75	1.76	1.92	1.88	1.83	1.78	1.81	1.76	1.58	1.69	1.95	1.9	1.85	1.69	1.72
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.139	0.146	0.14	0.136	0.143	0.136	0.15	0.135	0.14	0.154	0.139	0.139	0.145	0.139	0.142
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000149	0.000164	0.000148	0.000162	0.000154	0.000148	0.000156	0.000155	0.000159	0.000161	0.00016	0.000166	0.000165	0.000172	0.000166
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type / Station / Sample Point / Date / Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life: Long-Term Chronic	BC ENV Guideline for the Protection of Aquatic Life: Short-Term Acute	BC ENV Guideline for the Protection of Wildlife Life: Long-Term Chronic	BC ENV Guideline for the Protection of Wildlife Life: Short-Term Acute	Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-BT 2019-06-18	Quesnel Lake QUL-59 QUL-59-BT 2019-08-20	Quesnel Lake QUL-59 QUL-59-BT 2020-06-24	Quesnel Lake QUL-59 QUL-59-BT 2020-08-11	Quesnel Lake QUL-59 QUL-59-BT 2022-06-27	Quesnel Lake QUL-59 QUL-59-MID 2015-12-02	Quesnel Lake QUL-59 QUL-59-MID 2015-12-09	Quesnel Lake QUL-59 QUL-59-MID 2015-12-14	Quesnel Lake QUL-59 QUL-59-MID 2015-12-21	Quesnel Lake QUL-59 QUL-59-MID 2016-01-25	Quesnel Lake QUL-59 QUL-59-MID 2016-03-28	Quesnel Lake QUL-59 QUL-59-MID 2016-05-17	Quesnel Lake QUL-59 QUL-59-MID 2018-06-04	Quesnel Lake QUL-59 QUL-59-MID 2019-04-25	Quesnel Lake QUL-59 QUL-59-MID 2019-05-02
Field Parameters																						
Specific conductivity	uS/cm	-	-	-	-	-	-	109.7	111.5	111.4	110	110	146.6	150.3	144.2	152.4	109.3	113.1	101.4	110.8	111.7	114.7
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.71	7.44	7.5	7.79	7.86	7.82	7.84	7.82	7.69	7.91	8.03	7.65	7.52	7.79	7.79
Turbidity	NTU	1	-	-	-	-	1	0.93	0	0.48	0	0.45	0.74	0.82	0.62	0.76	0.41	0.46	0.4	0	0.83	0.75
Temperature	C	-	-	-	-	-	-	4.42	4.583	4.97	4.809	5.339	5.203	5.049	4.798	4.488	2.961	3.14	4.923	5.169	3.457	3.794
Dissolved oxygen	%	-	-	-	-	-	-	92.8	86.1	94.6	89.2	91	84.1	83.7	85	83.9	87.5	92.6	88.3	91.2	87.5	88.4
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	12.02	11.11	12.08	11.44	11.5	10.68	10.67	10.91	10.85	11.79	12.41	11.3	11.59	11.63	11.65
Conventional Parameters																						
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49	49.5	50.3	47.5	50.7	47.8	48.9	51.1	48.6	48.7	49.6	50.3	47.4	47.9	51.5
Specific conductivity	uS/cm	-	-	-	-	-	-	112	111	107	111	111	111	113	113	113	113	114	114	106	120	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.02	8	7.81	7.82	7.89	7.58	7.8	7.87	7.89	7.86	7.86	7.99	7.92	7.94	7.84
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.1	<1.0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0	4	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.1	0.13	0.32	0.19	0.38	1.07	0.52	0.54	0.46	0.4	0.53	2.15	0.38	0.37	0.29
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.9	52.2	57.4	53.5	52	52.8	53.2	56.6	54.5	55.3	53.8	53.1	53	58.2	53.3
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	51.3	50	53.1	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	70	74	68	75	68	70	58	73	62	68	69	56	72	72	79
Dissolved organic carbon	mg/L	-	-	-	-	-	-	10.1	1.74	2.44	2.39	2.44	1.58	1.5	1.36	1.5	1.71	1.62	2	2.1	1.83	2.05
Nutrients and Biological Indicators																						
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.141	0.143	0.126	0.136	0.126	0.106	0.11	0.115	0.115	0.12	0.131	0.132	0.129	0.14	0.135
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.141	0.143	0.126	0.136	0.126	0.106	0.11	0.115	0.115	0.12	0.131	0.132	0.129	0.14	0.135
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	0.0052	<0.0050	0.0084	0.0075	0.0051	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0027	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0066	<0.0020	0.0028	<0.0020	0.0032	0.0033	0.0025	0.0034	<0.0020	0.0034	0.0044	0.0124	0.0063	0.004	0.005
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.219	0.211	0.201	0.21	0.167	0.142	0.209	0.167	0.163	0.173	0.175	0.195	0.224	0.202	0.202
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																						
Calcium	mg/L	-	-	-	1000	-	1000	19.1	17.2	19.4	18	17.3	17.8	18	19.3	18.5	18.8	18.1	17.9	17.6	19.8	17.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.042	0.034	0.037	0.036	0.033	0.033	0.033	0.035	0.037	0.033	0.036	0.035	0.036	0.046	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.21	2.23	2.16	2.08	2.15	2.03	2.01	2.08	2.01	2.05	2.09	2.07	2.19	2.12	2.19
Potassium	mg/L	-	-	-	-	-	-	0.526	0.483	0.475	0.532	0.513	0.482	0.498	0.48	0.489	0.483	0.536	0.519	0.546	0.508	0.524
Sodium	mg/L	-	-	-	-	-	-	1.12	1.05	1.03	1.03	0.994	0.942	0.988	0.932	0.965	0.971	1.06	0.963	1.06	1.2	1.16
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.22	6.73	6.83	6.86	6.29	6.62	6.7	6.61	6.83	6.84	7.3	6.83	6.79	7.49	7.69
Total Metals																						
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.01	0.0093	0.0196	0.0179	0.0183	0.0471	0.045	0.0411	0.0383	0.0261	0.0607	0.242	0.0196	0.0225	0.0279
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	<0.00010	0.0001	0.00011	0.00013	0.00012	0.00015	0.00013	0.00012	0.00014	0.00012	<0.00010	0.00027	0.00012	0.00016	0.00015
Barium	mg/L	-	1W	-	-	-	1	0.00498	0.00543	0.00524	0.00525	0.00556	0.00587	0.00572	0.0061	0.00577	0.0054	0.00594	0.0101	0.00559	0.00546	0.00541
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	0.0000064	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000053
Calcium	mg/L	-	-	-	1000	-	1000	18	18.3	17.2	16.8	17.7	18	17.7	19	18.3	18.2	18.1	18.7	16	18.5	18.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00064	0.00065	0.00073	0.00078	0.0006	0.0019	0.00156	0.00158	0.00142	0.00116	0.00159	0.00703	0.00078	0.00125	0.00098
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	0.165	<0.030	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000395	0.000141	<0.000050	0.000051	0.00141	0.000064	0.000213	0.000251	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.03	2.07	2.04	1.97	2.17	2.04	2.04	2.09	2.04	2	2.12	2.28	2.13	2.04	2.09
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00087	0.00076	0.0013	0.00119	0.00149	0.00192	0.00141	0.00154	0.00131	0.00112	0.002	0.00521	0.00172	0.00135	0.00153
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000475	0.000492	0.000434	0.00042	0.000444	0.000421	0.000442	0.000452	0.000454	0.000477	0.000611	0.000493	0.000396	0.000837	0.000754
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.481	0.5	0.495	0.493	0.498	0.5	0.502	0.524	0.501	0.488	0.532	0.65	0.5	0.526	0.49
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000088	0.000169	0.000103	0.000108	0.00015	0.00008	0.0001	0.000114	0.00011	0.000121	0.000127	0.000133	0.00012	0.000176	0.000209
Silicon	mg/L	-	-	-	-	-	-	1.71	1.77	1.83	1.87	2	1.66	1.67	1.74	1.68	1.7	1.75	2.26	1.77	1.67	1.83
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.994	1.03	0.98	0.986	0.992	0.952	1.01	0.994	0.999	0.989	1.05	1.09	1.03	1.15	1.13
Strontium	mg/L	-	-	-	-	-	-	0.14	0.14	0.136	0.135	0.132	0.137	0.136	0.135	0.136	0.136	0.143	0.134	0.129	0.147	0.134
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000176	0.000161	0.00015	0.000155	0.00016	0.000165	0.000171	0.00016	0.000162	0.00016	0.000172	0.000175	0.000168	0.000177	0.000154
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00121	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-BT 2019-06-18	Quesnel Lake QUL-59 QUL-59-BT 2019-08-20	Quesnel Lake QUL-59 QUL-59-BT 2020-06-24	Quesnel Lake QUL-59 QUL-59-BT 2020-08-11	Quesnel Lake QUL-59 QUL-59-BT 2022-06-27	Quesnel Lake QUL-59 QUL-59-MID 2015-12-02	Quesnel Lake QUL-59 QUL-59-MID 2015-12-09	Quesnel Lake QUL-59 QUL-59-MID 2015-12-14	Quesnel Lake QUL-59 QUL-59-MID 2015-12-21	Quesnel Lake QUL-59 QUL-59-MID 2016-01-25	Quesnel Lake QUL-59 QUL-59-MID 2016-03-28	Quesnel Lake QUL-59 QUL-59-MID 2016-05-17	Quesnel Lake QUL-59 QUL-59-MID 2018-06-04	Quesnel Lake QUL-59 QUL-59-MID 2019-04-25	Quesnel Lake QUL-59 QUL-59-MID 2019-05-02
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0056	0.0055	0.0067	0.0059	0.0086	0.0056	0.0067	0.0051	0.0056	0.0048	0.0061	0.0076	0.0115	0.0075	0.0072
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00011	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012
Barium	mg/L	-	-	-	-	-	-	0.00539	0.00495	0.00515	0.00542	0.00545	0.00522	0.00512	0.00543	0.00522	0.00486	0.0054	0.00525	0.00592	0.00539	0.00505
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00100	<0.00100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	<0.00050	<0.00050	0.00058	0.00054	0.00056	0.00087	0.00085	0.00076	0.00081	0.00073	0.00097	0.00105	0.00104	0.00062	0.00062
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00014	0.000121	<0.000050	<0.000050	0.000244	0.000092	0.00013	0.000223	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	0.00012	0.0002	0.00034	0.00017	0.00017	0.00022	0.00021	0.00085	0.00042	0.00038	0.00021	0.00027
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000439	0.00051	0.000461	0.00042	0.000424	0.000375	0.000385	0.000414	0.000417	0.000432	0.00056	0.000429	0.000375	0.000878	0.000732
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000086	0.00015	0.000097	0.000126	0.000126	0.000104	0.000101	0.000086	0.000096	0.000094	0.000118	0.000102	0.000136	0.000265	0.000163
Silicon	mg/L	-	-	-	-	-	-	1.77	1.78	1.79	1.85	1.98	1.59	1.61	1.66	1.58	1.67	1.68	1.72	1.72	1.66	1.74
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.14	0.137	0.144	0.136	0.13	0.132	0.135	0.126	0.131	0.135	0.139	0.128	0.136	0.153	0.14
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000161	0.000156	0.000151	0.000151	0.00015	0.000156	0.000163	0.000152	0.000151	0.000153	0.000157	0.000158	0.000163	0.000184	0.000155
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-MID 2021-05-19	Quesnel Lake QUL-59 QUL-59-MID 2021-06-02	Quesnel Lake QUL-59 QUL-59-MID 2021-07-21	Quesnel Lake QUL-59 QUL-59-MID 2022-05-10	Quesnel Lake QUL-59 QUL-59-MP 2020-09-16	Quesnel Lake QUL-59 QUL-59-MP 2021-09-16	Quesnel Lake QUL-59 QUL-59-S 2015-12-09	Quesnel Lake QUL-59 QUL-59-S 2015-12-14	Quesnel Lake QUL-59 QUL-59-S 2015-12-21	Quesnel Lake QUL-59 QUL-59-S 2016-01-25	Quesnel Lake QUL-59 QUL-59-S 2016-03-28	Quesnel Lake QUL-59 QUL-59-S 2016-05-17	Quesnel Lake QUL-59 QUL-59-S 2018-06-04	Quesnel Lake QUL-59 QUL-59-S 2019-04-25	Quesnel Lake QUL-59 QUL-59-S 2019-05-02
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute																	
Field Parameters																							
Specific conductivity	uS/cm	-	-	-	-	-	-	113	110	129.8	114.5	111.3	112.8	150.2	143.8	151.7	109	111.5	97.7	99.8	111.4	114.8
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	8.25	7.74	7.65	7.71	7.91	8.41	7.84	7.77	7.7	7.95	8.15	7.57	7.71	7.74	7.83
Turbidity	NTU	1	-	-	-	-	1	0.07	0.91	0	0	0.06	0.07	0.69	0.58	0.62	0.57	0.44	1.67	0	0.82	0.65
Temperature	C	-	-	-	-	-	-	5.374	5.755	5.504	3.961	4.823	5.131	5.055	4.746	4.508	2.905	3.208	11.85	10.925	3.838	3.991
Dissolved oxygen	%	-	-	-	-	-	-	94	95.8	90.4	90.7	87.6	86.9	85.7	88.1	85.7	89.6	97.2	101.1	97.4	86.4	114.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.88	11.99	11.39	11.9	11.24	11.06	10.93	11.33	11.09	12.07	13.01	10.94	10.76	11.37	86.5
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	49.2	47.8	49.6	50.5	48.1	47.6	48.4	50.1	49.5	48	49.1	49.3	43.8	49.6	51.8
Specific conductivity	uS/cm	-	-	-	-	-	-	114	110	108	114	111	110	112	113	115	112	116	108	93.9	112	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.9	7.88	7.91	7.93	7.89	7.79	7.86	7.9	7.85	7.84	7.95	7.87	7.84	7.87
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.1	1.6	<1.0	<1.4	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0	<1.0	<1.0	1.2
Turbidity	NTU	1	-	-	-	-	1	0.22	0.2	0.14	0.2	<0.10	<0.10	0.47	0.47	0.49	0.38	0.49	0.41	0.57	0.32	0.28
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	51.7	50.2	52.4	54.5	54	53.3	53.9	56.6	54.8	55.3	53.8	51.6	48	58.2	53.4
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	54	54.2	53.8	54	57.2	55.7	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	1000	-	1000	79	67	83	71	72	81	65	64	64	65	69	55	72	67	77
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.27	2.16	1.89	2.03	1.96	1.88	1.53	1.34	1.63	1.64	1.61	2.07	2.5	1.86	2.03
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.126	0.127	0.138	0.13	0.145	0.149	0.11	0.115	0.115	0.119	0.135	0.0968	0.0841	0.143	0.136
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.126	0.127	0.138	0.13	0.145	0.149	0.11	0.115	0.115	0.119	0.135	0.0968	0.0841	0.143	0.136
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0031	0.0021	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	0.0021	0.0023	<0.0020	<0.0020	0.0028	0.003	0.0021	0.0022	0.0035	0.0028	0.0026	0.0048	0.0072	0.0043
Orthophosphate	mg-P/L	-	-	-	-	-	-	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.179	0.194	0.183	0.212	0.19	0.195	0.162	0.165	0.16	0.173	0.185	0.167	0.174	0.203	0.209
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	1000	-	1000	17.2	16.7	17.5	18.4	18.2	18.1	18.2	19.2	18.6	18.7	18.1	17.3	15.8	19.9	17.8
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.038	0.031	0.032	0.036	0.036	0.036	0.033	0.035	0.037	0.033	0.033	0.033	0.034	0.037	0.033
Magnesium	mg/L	-	-	-	-	-	-	2.13	2.07	2.12	2.07	2.1	1.98	2.03	2.1	2.03	2.07	2.09	2.07	2.07	2.09	2.16
Potassium	mg/L	-	-	-	-	-	-	0.493	0.505	0.51	0.472	0.517	0.491	0.51	0.493	0.49	0.472	0.526	0.513	0.561	0.505	0.518
Sodium	mg/L	-	-	-	-	-	-	1.06	1.03	0.959	0.992	1.05	0.993	1	0.945	0.973	0.965	1.06	0.943	1	1.19	1.15
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	7.58	7.03	6.64	7.63	6.55	7.33	6.69	6.56	6.8	6.82	7.6	6.23	5.99	7.41	7.69
Total Metals																							
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.018	0.0183	0.012	0.0189	0.012	0.0108	0.0349	0.0331	0.0341	0.0299	0.0389	0.0226	0.0293	0.0244	0.0297
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00011	0.0001	0.00013	0.00012	0.00011	0.00014	0.00013	0.00015	0.00012	0.00011	0.00016	0.00012	<0.00010	0.00017
Barium	mg/L	-	1W	-	-	-	1	0.00534	0.00557	0.00542	0.00588	0.00505	0.00537	0.00572	0.00609	0.00581	0.00551	0.00568	0.00562	0.00585	0.00566	0.00544
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000086	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000079	<0.0000050	<0.0000050	0.0000054	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	18	18.1	18.1	18	19.4	18.7	17.7	18.8	18.2	18.5	17.9	17.1	14.3	18.3	18.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00087	0.00081	0.0006	0.00083	0.00066	0.00058	0.00146	0.00131	0.00143	0.00135	0.00157	0.00137	0.00078	0.00114	0.00151
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.04	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	0.0011	<0.0010	0.001	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.19	2.19	2.1	2.21	2.12	2.19	2.02	2.08	2.05	2.06	2.12	2.07	1.97	2.1	2.09
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00144	0.00156	0.00119	0.00132	0.00091	0.00086	0.00118	0.00116	0.00121	0.00143	0.0021	0.00198	0.0025	0.00131	0.00166
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000577	0.000521	0.000424	0.000738	0.000454	0.000551	0.000554	0.000417	0.000512	0.000491	0.00068	0.00039	0.000383	0.000844	0.000746
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.504	0.518	0.506	0.503	0.446	0.521	0.508	0.521	0.504	0.492	0.533	0.551	0.51	0.525	0.497
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000143	0.000215	0.000119	0.0002	0.000165	0.000169	0.000114	0.000091	0.000104	0.00012	0.000149	0.000106	0.000107	0.000143	0.000171
Silicon	mg/L	-	-	-	-	-	-	1.96	1.99	2.01	1.8	1.9	1.84	1.65	1.73	1.67	1.73	1.74	1.81	1.85	1.77	1.83
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.11	1.09	0.987	1.08	0.964	1.02	0.997	0.954	1.01	0.998	1.06	0.964	0.942	1.17	1.15
Strontium	mg/L	-	-	-	-	-	-	0.137	0.14	0.138	0.145	0.15	0.146	0.137	0.127	0.136	0.139	0.144	0.121	0.112	0.145	0.136
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000168	0.000161	0.000159	0.000167	0.000147	0.000165	0.000172	0.000154	0.00016	0.000162	0.000177	0.000153	0.000142	0.000165	0.000155
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00066	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-MID 2021-05-19	Quesnel Lake QUL-59 QUL-59-MID 2021-06-02	Quesnel Lake QUL-59 QUL-59-MID 2021-07-21	Quesnel Lake QUL-59 QUL-59-MID 2022-05-10	Quesnel Lake QUL-59 QUL-59-MP 2020-09-16	Quesnel Lake QUL-59 QUL-59-MP 2021-09-16	Quesnel Lake QUL-59 QUL-59-S 2015-12-09	Quesnel Lake QUL-59 QUL-59-S 2015-12-14	Quesnel Lake QUL-59 QUL-59-S 2015-12-21	Quesnel Lake QUL-59 QUL-59-S 2016-01-25	Quesnel Lake QUL-59 QUL-59-S 2016-03-28	Quesnel Lake QUL-59 QUL-59-S 2016-05-17	Quesnel Lake QUL-59 QUL-59-S 2018-06-04	Quesnel Lake QUL-59 QUL-59-S 2019-04-25	Quesnel Lake QUL-59 QUL-59-S 2019-05-02
Dissolved Metals																						
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0089	0.0101	0.0073	0.0079	0.0064	0.0079	0.0055	0.008	0.0053	0.0058	0.0069	0.009	0.0136	0.007	0.0076
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	0.00016	0.0001	<0.00010	<0.00010	<0.00010	0.00011	0.00011	0.00012	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.0001
Barium	mg/L	-	-	-	-	-	-	0.005	0.00529	0.00533	0.00513	0.0053	0.00516	0.00513	0.00547	0.0053	0.00503	0.00534	0.00532	0.0059	0.00553	0.00513
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.00100	<0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00068	0.00082	0.00051	0.00065	0.0009	0.00051	0.00079	0.0008	0.0008	0.00072	0.00085	0.00079	0.00072	0.00063	0.00061
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00034	0.00023	0.0001	0.00024	0.0002	<0.00010	0.00017	0.00022	0.0002	0.00045	0.00096	0.00105	0.00099	0.00029	0.00029
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000579	0.000539	0.000374	0.000728	0.000454	0.000473	0.000385	0.000443	0.000403	0.000425	0.000612	0.000341	0.000383	0.000801	0.000713
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000158	0.000132	0.000083	0.000176	0.000155	0.000148	0.000099	0.000107	0.000086	0.000107	0.000127	0.00011	0.000141	0.000176	0.00018
Silicon	mg/L	-	-	-	-	-	-	1.8	1.78	1.82	1.72	1.83	1.74	1.61	1.67	1.6	1.66	1.68	1.8	1.74	1.57	1.82
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.136	0.13	0.135	0.146	0.138	0.13	0.135	0.124	0.129	0.134	0.141	0.119	0.116	0.149	0.141
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	-	-	-	-	0.000153	0.000147	0.000158	0.000164	0.00016	0.000155	0.000158	0.000152	0.000147	0.00015	0.00016	0.00014	0.000143	0.000178	0.000154
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2019-05-08	Quesnel Lake QUL-59 QUL-59-S 2019-05-15	Quesnel Lake QUL-59 QUL-59-S 2019-06-18	Quesnel Lake QUL-59 QUL-59-S 2019-08-20	Quesnel Lake QUL-59 QUL-59-S 2020-06-24	Quesnel Lake QUL-59 QUL-59-S 2020-08-11	Quesnel Lake QUL-59 QUL-59-S 2020-09-16	Quesnel Lake QUL-59 QUL-59-S 2021-05-19	Quesnel Lake QUL-59 QUL-59-S 2021-06-02	Quesnel Lake QUL-59 QUL-59-S 2021-07-21	Quesnel Lake QUL-59 QUL-59-S 2021-09-16
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute													
Field Parameters																			
Specific conductivity	uS/cm	-	-	-	-	-	-	112.2	111	99.5	101.5	103.6	98.6	104.8	110.5	115.6	119.4	107.6
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.9	7.69	7.96	7.9	7.56	8.01	8.2	8.22	7.88	7.84	8.28
Turbidity	NTU	1	-	-	-	-	1	0.44	0.95	0.94	0	0.59	0	0.14	0.05	0.93	0	0.02
Temperature	C	-	-	-	-	-	-	6.396	8.067	15.368	17.447	14.423	16.426	15.405	8.517	12.334	19.962	15.532
Dissolved oxygen	%	-	-	-	-	-	-	94.4	95.9	108.3	97.9	104.1	97.9	98.5	98.4	101.6	100.5	93.8
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	11.64	11.28	10.83	9.37	10.63	9.57	9.84	11.5	10.83	9.13	9.35
Conventional Parameters																			
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	51.1	52.1	45	45.8	52	42.6	46.9	48.6	65.5	45.7	51.7
Specific conductivity	uS/cm	-	-	-	-	-	-	115	110	101	102	106	98.8	104	111	154	98.1	112
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.96	8	7.96	7.84	6.88	7.96	7.86	8.02	7.94	7.93
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	1.1	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	1.6	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.19	0.83	0.23	0.26	1.18	0.38	0.2	0.26	0.52	0.19	0.16
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	56.6	58.3	51.3	47.1	54.6	47.4	51.7	52.7	74.3	47.5	52
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	48.8	47.9	54.9	47.8	72.4	48.6	53.4
Total dissolved solids	mg/L	-	-	-	1000	-	1000	84	82	66	68	82	70	68	72	95	60	66
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.05	5.86	1.93	2.19	5.03	3.44	2	2.26	8.28	2.29	1.74
Nutrients and Biological Indicators																			
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.127	0.0844	0.0787	0.0453	0.0653	0.0281	0.0302	0.122	0.057	0.0513	0.0427
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.127	0.0844	0.0787	0.0453	0.0661	0.0285	0.0306	0.122	0.057	0.0513	0.0427
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	<0.0050	0.0103	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.0031	0.0031	<0.0020	<0.0020	0.0028	0.0038	0.0026	<0.0020	0.0049	<0.0020	0.0021
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	0.0032	0.0044	0.002	0.0032	0.0038	0.003	0.0022	<0.0020	0.0118	<0.0020	0.0022
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	0.0014	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.176	0.27	0.195	0.129	0.211	0.148	0.113	0.172	0.295	0.127	0.121
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																			
Calcium	mg/L	-	-	-	1000	-	1000	19	18.6	17.2	15.6	16.9	15.6	17.3	17.6	23	15.8	17.7
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.036	0.038	0.034	0.033	0.042	0.035	0.034	0.038	0.043	0.03	0.03
Magnesium	mg/L	-	-	-	-	-	-	2.2	2.86	2.04	2.01	2.98	2.02	2.07	2.13	4.09	1.95	1.89
Potassium	mg/L	-	-	-	-	-	-	0.532	0.49	0.521	0.462	0.506	0.536	0.494	0.522	0.756	0.515	0.469
Sodium	mg/L	-	-	-	-	-	-	1.09	1.48	1.02	0.942	1.46	0.983	0.96	1.04	3.33	0.882	0.884
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.92	5.64	5.96	5.81	4.73	5.44	5.76	6.88	13.7	5.98	6.36
Total Metals																			
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0142	0.0663	0.0179	0.0125	0.0344	0.0228	0.0142	0.0142	0.0524	0.0167	0.0118
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00019	0.00025	0.0001	0.00011	0.00016	0.00016	0.00014	0.00014	0.00038	0.00013	<0.00010
Barium	mg/L	-	1W	-	-	-	1	0.00515	0.00695	0.00527	0.00553	0.00602	0.00555	0.00503	0.00491	0.00999	0.00561	0.00474
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000054	0.0000069	<0.0000050	<0.0000050	0.0000061	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.2	17.3	15.9	14.8	16	15.7	18.7	15.9	22.5	16.3	18.1
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00068	0.00198	0.00063	0.00058	0.00098	0.0008	0.0006	0.00073	0.00376	0.00064	0.00055
Iron	mg/L	-	-	1	-	-	1	<0.030	0.093	<0.030	<0.030	0.052	<0.030	<0.030	<0.030	0.087	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	2.01	2.52	1.9	1.91	2.11	2.11	2.02	1.96	3.95	1.93	1.99
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00113	0.00381	0.0019	0.00114	0.003	0.00204	0.00103	0.0013	0.0126	0.00193	0.0008
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000534	0.000517	0.000342	0.000336	0.00042	0.000376	0.000322	0.00044	0.00184	0.000393	0.000321
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	0.00064	<0.00050	<0.00050	0.00055	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.49	0.475	0.473	0.482	0.507	0.504	0.424	0.453	0.718	0.492	0.499
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000154	0.000171	0.000096	0.000125	0.00016	0.000114	0.000126	0.000113	0.000317	0.00011	0.000087
Silicon	mg/L	-	-	-	-	-	-	1.75	2.26	1.63	1.65	2.01	2.03	1.72	1.98	3.08	1.79	1.5
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	1.06	1.29	0.916	0.908	1.03	0.939	0.86	0.984	3.25	0.894	0.92
Strontium	mg/L	-	-	-	-	-	-	0.138	0.121	0.115	0.115	0.118	0.111	0.133	0.123	0.163	0.114	0.133
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000158	0.000133	0.000151	0.000138	0.000133	0.00013	0.000134	0.000157	0.000176	0.000141	0.000157
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00068	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	0.0071	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2019-05-08	Quesnel Lake QUL-59 QUL-59-S 2019-05-15	Quesnel Lake QUL-59 QUL-59-S 2019-06-18	Quesnel Lake QUL-59 QUL-59-S 2019-08-20	Quesnel Lake QUL-59 QUL-59-S 2020-06-24	Quesnel Lake QUL-59 QUL-59-S 2020-08-11	Quesnel Lake QUL-59 QUL-59-S 2020-09-16	Quesnel Lake QUL-59 QUL-59-S 2021-05-19	Quesnel Lake QUL-59 QUL-59-S 2021-06-02	Quesnel Lake QUL-59 QUL-59-S 2021-07-21	Quesnel Lake QUL-59 QUL-59-S 2021-09-16
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute													
Dissolved Metals																			
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0064	0.027	0.011	0.0096	0.023	0.0128	0.0115	0.0089	0.0227	0.0102	0.0091
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	<0.00010	0.00022	<0.00010	0.00012	0.00023	0.00016	0.00013	<0.00010	0.00037	0.00013	0.00011
Barium	mg/L	-	-	-	-	-	-	0.00538	0.00667	0.00556	0.00535	0.00703	0.00588	0.00557	0.00508	0.0104	0.00569	0.00507
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000053	<0.0000050	<0.0000050	<0.0000050	0.0000055	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00080	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	<0.00050	0.0015	0.0005	0.00053	0.0012	0.00062	0.00081	0.00065	0.00323	<0.00050	<0.00050
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	0.039	<0.030	<0.030	0.043	<0.030	<0.030	<0.030	0.046	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00029	0.00145	0.00099	0.00022	0.00065	<0.00010	0.00027	0.00068	0.00981	0.00081	0.00034
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000523	0.000635	0.000375	0.000343	0.000429	0.000357	0.000328	0.000427	0.00196	0.000332	0.000293
Nickel	mg/L	-	-	-	-	-	-	<0.00050	0.00064	<0.00050	<0.00050	0.00061	<0.00050	<0.00050	<0.00050	0.00055	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000104	0.000157	0.000131	0.000113	0.000117	0.000133	0.000082	0.000116	0.000256	0.000098	0.00006
Silicon	mg/L	-	-	-	-	-	-	1.65	2.3	1.69	1.65	2.41	1.92	1.72	1.83	2.67	1.63	1.33
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.14	0.142	0.129	0.119	0.126	0.107	0.123	0.135	0.162	0.114	0.128
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000177	0.000155	0.000146	0.000137	0.000124	0.000121	0.00015	0.000147	0.000154	0.000134	0.000145
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2021-10-27	Quesnel Lake QUL-59 QUL-59-S 2022-05-10	Quesnel Lake QUL-59 QUL-59-S 2022-06-27	Quesnel Lake QUL-59 QUL-59-S 2022-08-16	Quesnel Lake QUL-59 QUL-59-S 2022-10-19
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute						
Field Parameters												
Specific conductivity	uS/cm	-	-	-	-	-	-	107.3	114.2	108.3	97.7	103.6
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.87	7.73	7.81	8.03	8.02
Turbidity	NTU	1	-	-	-	-	1	0.19	0	0.68	0.3	0.07
Temperature	C	-	-	-	-	-	-	9.036	4.154	15.142	20.748	13.65
Dissolved oxygen	%	-	-	-	-	-	-	90.6	91	96	99.5	94.7
Dissolved oxygen	mg/L	-	8[r]	5[r]	-	-	8	10.46	11.88	9.23	8.91	9.83
Conventional Parameters												
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	47.6	47.7	48	41.5	43.8
Specific conductivity	uS/cm	-	-	-	-	-	-	109	115	97.8	97.1	104
pH	pH units	6.5 to 8.5	6.5 to 9	6.5 to 9	5 to 9.5	5 to 9.5	6.5 to 8.5	7.88	7.84	7.8	7.92	7.86
Total suspended solids	mg/L	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	1	-	-	-	-	1	0.11	0.24	0.76	0.22	0.19
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	53	54.6	50.8	47.7	52.2
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	52.8	55.8	49.1	47.3	49.4
Total dissolved solids	mg/L	-	-	-	1000	-	1000	62	57	70	66	78
Dissolved organic carbon	mg/L	-	-	-	-	-	-	1.76	2.15	3.65	2.12	1.9
Nutrients and Biological Indicators												
Nitrate	mg-N/L	10	3	32.8	-	100	3	0.0839	0.129	0.0617	0.0198	0.0268
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	0.0839	0.129	0.0617	0.0198	0.0268
Nitrite	mg-N/L	1	0.02[e]	0.060[e]	-	10	0.02	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg-N/L	-	1.63[d]	8.48[d]	-	-	0.29 - 1.99	<0.0050	<0.0050	<0.0050	0.0091	<0.0050
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	<0.0020	<0.0020	0.0024	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.01[p]	0.005–0.015	-	-	-	0.005	<0.0020	<0.0020	0.0058	<0.0020	0.0024
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	0.132	0.209	0.162	0.087	0.109
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	-	-	-	1000	-	1000	18.1	18.4	16.7	16	17.5
Chloride	mg/L	250[p]	150	600	-	600	150	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	1.5	-	1.1[b]	1	1.5	0.99 - 1.2	0.035	0.04	0.033	0.035	0.035
Magnesium	mg/L	-	-	-	-	-	-	1.9	2.1	2.2	1.88	2.06
Potassium	mg/L	-	-	-	-	-	-	0.468	0.48	0.527	0.494	0.504
Sodium	mg/L	-	-	-	-	-	-	0.857	1.01	1.07	0.813	0.963
Sulphate	mg/L	500[p]	218[c]	-	1000	-	218	6.99	7.63	5.67	5.62	6.31
Total Metals												
Aluminum	mg/L	9.5	0.19[n]	-	-	5	0.01 - 0.18	0.0148	0.0172	0.0299	0.0194	0.0103
Antimony	mg/L	0.006	0.009W	-	-	-	0.006	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.01	0.005	-	0.025M	-	0.005	0.00012	0.00013	0.00017	0.00014	0.00014
Barium	mg/L	-	1W	-	-	-	1	0.00505	0.00538	0.00614	0.00526	0.00504
Beryllium	mg/L	0.004W	0.00013W	-	0.1	-	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	5	1.2	-	5	-	1.2	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.005	-	-	-	0.08	0.005	<0.0000050	<0.0000050	0.0000055	<0.0000050	<0.0000050
Calcium	mg/L	-	-	-	1000	-	1000	17.9	19	16.1	15.8	16.6
Chromium	mg/L	-	0.001W[f]	-	0.05W[f]	-	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.004	0.11	1	-	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	2	0.0022[g]	0.0070[g]	-	0.3	2	0.00266	0.00084	0.001	0.00078	<0.00050
Iron	mg/L	-	-	1	-	-	1	<0.030	<0.030	0.042	<0.030	<0.030
Lead	mg/L	0.005	0.0048[h]	0.037[h]	-	0.1	0.0044 - 0.005	<0.000050	<0.000050	0.000176	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	-	-	-	-	1.98	2.03	2.17	1.9	1.93
Manganese	mg/L	-	0.84[i]	1.1[i]	-	-	0.605 - 0.932	0.00106	0.00125	0.00289	0.00138	0.00103
Mercury	mg/L	0.001	0.00001[j]	-	-	0.003	0.00001	-	-	-	-	-
Molybdenum	mg/L	0.088	7.6	46	0.034/0.284[q]	-	0.034	0.000417	0.000794	0.000465	0.000317	0.000306
Nickel	mg/L	0.08	0.025W[k]	-	1	-	0.025	<0.00050	<0.00050	0.00057	<0.00050	<0.00050
Potassium	mg/L	-	-	-	-	-	-	0.493	0.492	0.508	0.476	0.481
Selenium	mg/L	0.01	0.002	-	0.002	-	0.002	0.000078	0.000196	0.000142	0.000067	0.000108
Silicon	mg/L	-	-	-	-	-	-	1.63	1.83	2.18	1.66	1.32
Silver	mg/L	-	0.00005[l]	0.0001[l]	-	-	0.00005	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	0.913	1.05	1.05	0.844	0.855
Strontium	mg/L	-	-	-	-	-	-	0.142	0.146	0.114	0.116	0.133
Thallium	mg/L	0.002	0.0008W	-	-	-	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	0.2	-	0.2	0.000176	0.000179	0.000131	0.00014	0.00015
Vanadium	mg/L	-	-	-	0.1	-	0.1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	3	0.0075[m]	0.033[m]	2	-	0.0075	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 2-4
Table 2-4B: Surfacewater Quality Screening at Initial Dilution Zone Locations from 2015 to 2023
Mount Polley Mine

Location Type Station Sample Point Date Parameter	Unit	BC ENV Drinking Water Screening Criteria	BC ENV Guideline for the Protection of Aquatic Life		BC ENV Guideline for the Protection of Wildlife Life		Selected Screening Criteria	Quesnel Lake QUL-59 QUL-59-S 2021-10-27	Quesnel Lake QUL-59 QUL-59-S 2022-05-10	Quesnel Lake QUL-59 QUL-59-S 2022-06-27	Quesnel Lake QUL-59 QUL-59-S 2022-08-16	Quesnel Lake QUL-59 QUL-59-S 2022-10-19
			Long-Term Chronic	Short-Term Acute	Long-Term Chronic	Short-Term Acute						
Dissolved Metals												
Aluminum	mg/L	0.2	-	-	-	-	0.2	0.0199	0.0124	0.0164	0.011	0.0119
Antimony	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	-	-	-	-	0.00011	<0.00010	0.00014	0.0001	0.00012
Barium	mg/L	-	-	-	-	-	-	0.00474	0.00508	0.00615	0.00504	0.00538
Beryllium	mg/L	-	-	-	-	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	0.00013[o]	0.00031[o]	-	-	0.00011 - 0.00017	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.0022[g]	0.0070[g]	-	0.3	0.00036 - 0.0012	0.00492	0.00084	0.00091	0.00052	0.00066
Iron	mg/L	-	-	0.35	-	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/L	-	-	-	-	-	-	0.00081	0.00036	0.00144	0.00059	0.00061
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.000384	0.000725	0.000448	0.000305	0.000336
Nickel	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	-	-	-	-	-	0.000079	0.000183	0.000156	0.000112	0.000063
Silicon	mg/L	-	-	-	-	-	-	1.38	1.72	2.21	1.52	1.32
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	0.136	0.147	0.112	0.116	0.132
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	-	-	-	-	-	0.000159	0.000168	0.000127	0.000134	0.000151
Vanadium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	0.0002 - 0.0065[s]	0.0014 - 0.039[s]	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes

Values are taken from the approved guidelines unless otherwise noted.

W = working guideline; M = interim guideline, Min = Minimum concentration requirement based on life stage.

Guidelines based on toxicity modifying factors are presented based on the mean baseline values (hardness of 54 mg/L, pH of 7.8, DOC 2.2 mg/L, temperature of 7 oC, and chloride of 0.50 mg/L) in Quesnel Lake, considered representative of average conditions in the receiving environment.

Shaded values indicates concentrations exceed the most conservative guideline of each maximum and chronic WQG for ecological receptors.

a) up to 4 - highly sensitive to acid inputs; 4 to 8 - moderately sensitive; over 8 - low sensitivity.

b) hardness dependent fluoride guideline: BC Max WQG (mg/L) = 0.4 mg/L if hardness <10, otherwise use -51.73+(92.57*log(hardness))*0.01 mg/L.

c) hardness dependent sulphate guideline: BC 30-day WQG (mg/L) = 128 at hardness <30 mg/L, at hardness 31-75 mg/L = 218, at hardness 76-180 mg/L = 309, at hardness 181-250 mg/L = 429, at hardness >250 mg/L determine base on site water.

d) pH and temperature dependent ammonia guideline: values selected from Table 3 (Max WQG) and Table 4 (30-day WQG) in BC WQG based on a temperature of 20°C and 8.7 pH.

e) chloride dependent nitrite guideline: BC Max WQG (mg/L) = 0.06 at Cl <2 mg/L, at Cl 2-4 mg/L = 0.12, at Cl 4-6 mg/L = 0.18, at Cl 6-8 mg/L = 0.24, at Cl 8-10 = 0.30, at Cl >10 = 0.6; BC 30-day WQG (mg/L) = 0.02 mg/L at Cl <2 mg/L, at Cl 2-4 mg/l = 0.04, at Cl 4-6 mg/L = 0.06, at Cl 6-8 mg/L = 0.08, at Cl 8-10 mg/L = 0.1, at Cl >10 = 0.2, determined based on Cl <2 mg/L considered representative of average conditions in the receiving environment.

f) guideline is for chromium VI (Cr(VI)).

g) hardness, dissolved organic carbon, and pH dependent copper guideline selected from BC ENV copper guideline lookup table.

h) hardness dependent lead guideline: BC Max WQG (mg/L) = 0.003 mg/L if hardness < 8, otherwise use exp(1.273*ln(hardness)-1.46)/1000 mg/L; BC 30-day WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness > 8 mg/L.

i) hardness dependent manganese guideline: BC Max WQG (mg/L) = 0.01102*(hardness)+0.54; BC 30-day WQG (mg/L) = 0.0044*hardness+0.605.

j) mercury BC 30-day WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.

k) hardness dependent nickel guideline: BC 30-day WQG (mg/L) = 0.025 at hardness < 60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.11 at hardness > 180 mg/L.

l) hardness dependent silver guideline: BC Max WQG (mg/L) = 0.0001 at hardness ≤100 mg/L, at hardness >100 mg/L = 0.003; BC 30-day WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, at hardness > 100 mg/L = 0.0015.

m) hardness dependent zinc guideline: BC Max WQG (mg/L) = (33+0.75(hardness-90))/1000; BC 30-day WQG (mg/L) = (7.5+0.75(hardness-90))/1000.

n) total aluminum guideline is hardness, pH, and dissolved organic carbon dependent: BC 30-day WQG (mg/L) = ((((0.645 ln(DOC)+(2.255 ln(hardness))+(1.995 pH)+(−0.284 (ln(hardness) pH))−9.898))/3)/1000

o) hardness dependent dissolved cadmium guideline: BC Max WQG (mg/L) = (exp(1.03*ln(hardness)-5.274))/1000; BC 30-day WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.

p) guideline is based on an aesthetic objective rather than a health-based objective.

q) molybdenum guideline for wildlife is specific to wildlife physiology, ruminant (0.034) and non-ruminant (0.284) wildlife

r) guideline is a minimum value.

s) guideline is pH, DOC, and hardness dependent. BC Max WQG (mg/L) = exp(0.833[ln(hardness)] + 0.240[ln(DOC)] + 0.526)/2*1000 between hardness 23.4 and 399 (mg CaCO3/L), pH 6.5 and 8.13 and DOC of 0.3 to 22.9 (mg/L) and BC 30-day WQG (mg/L) = exp(0.947[ln(hardness)] − 0.815[pH] + 0.398[ln(DOC)] + 4.625)/2*1000 between hardness 23.4 and 399 mg CaCO3/L, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg/L

- = no guideline or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; BC WQGs = British Columbia water quality guidelines; $CaCO_3$ = calcium carbonate; FDA = field duplicate available; FD = field duplicate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units; QA/QC = quality assurance/quality control.

APPENDIX 2-5: Sediment and Aquatic Life Monitoring Report



Mount Polley Mine Comprehensive Environmental Monitoring Program 2022 – Sediment and Aquatic Life

Prepared for:
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Mount Polley Mine Comprehensive Environmental Monitoring Program 2022 – Sediment and Aquatic Life



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ACRONYMS AND ABBREVIATIONS

AFDM – Ash Free Dry Mass
ANCOVA – Analysis of Covariance
ANOVA – Analysis of Variance
BC – British Columbia
BCMOE – British Columbia Ministry of Environment
BCMOECCS – British Columbia Ministry of Environment Climate Change Strategy
BCWQG – British Columbia Water Quality Guidelines
BCF – Bioconcentration Factor
BLM – Biotic Ligand Model
CA – Correspondence Analysis
CABIN – Canadian Aquatic Biomonitoring Network
CALA – Canadian Association for Laboratory Accreditation
CASQO – California Sediment Quality Objectives
CCME – Canadian Council of Ministers of the Environment
CEMP – Comprehensive Environmental Monitoring Plan
CES – Critical Effect Size
COC – Chain of Custody
CPUE – Catch-per-Unit-Effort
CRC-ICP-MS – Collision Reaction Cell Inductively Coupled Plasma – Mass Spectrometry
CRFD – Cumulative Relative Frequency Distributions
CVAAS – Cold Vapour Atomic Absorption Spectrophotometry
DFO – Department of Fisheries and Oceans Canada
DOC – Dissolved Organic Carbon
DQO – Data Quality Objectives
DQR – Data Quality Review
DW – dry weight
EMA – Environmental Management Act
ENV – BC Ministry of Environment and Climate Change Strategy
EPT – Ephemeroptera, Plecoptera, and Trichoptera
ERA – Ecological Risk Assessment
FLNRORD – BC Ministry of Forest, Lands and Natural Resource Operations and Rural Development
FOV – Field of View
GEF – Guideline Exceedance Factor

GPS – Global Positioning System
HHRA – Human Health Risk Assessment
HRWG – Habitat Remediation Working Group
ICP-MS – Inductively Coupled Plasma – Mass Spectrometry
IP – Indicator Parameter
K-M – Kaplan-Meier
K-S – Kolmogorov-Smirnov
LPL – Lowest Practicable Level
LRL – Laboratory Reporting Limit
MAD – Median Absolute Deviation
MB – Method Blank
MCE – Mixed Cellulose Ester
MCT – Measure of Central Tendency
MDMER *– Metal and Diamond Mining Effluent Regulations*
MLE – Maximum Likelihood Estimation
MOD – Magnitude of Difference
MPMC – Mount Polley Mining Corporation
PCA – Principal Component Analysis
PDF – Portable Document Format
PNAMP – Pacific Northwest Aquatic Monitoring Partnership
POI – Parameter of Interest
QA/QC – Quality Assurance / Quality Control
SAFIT – Southwest Association of Freshwater Invertebrate Taxonomists
SALM – Strong Acid Leachable Metals
SD – Standard Deviation
SCCWRP – Southern California Coastal Water Research Project
SPIN – Summer Profundal Index Netting
TOC – Total Organic Carbon
TOR – Terms of Reference
TSF – Tailings Storage Facility
TTF – Trophic Transfer Factor
USEPA – United States Environmental Protection Agency
YOY – Young-of-the-Year
WSQG – Working Sediment Quality Guidelines
WTP – Water Treatment Plant
WW – wet weight

1 INTRODUCTION

1.1 Site Description and Background

Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals, owns and operates the Mount Polley copper-gold mine (Mount Polley) located approximately 9 kilometers southwest of Likely, British Columbia (BC) and 56 km (100 km by road) northeast of Williams Lake, BC (Figure 1.1). Infrastructure at the Mount Polley Mine site includes open pits, an underground mine, a crusher, a mill and office spaces, a Tailings Storage Facility (TSF), a Water Treatment Plant (WTP), waste rock disposal areas, collection and settling ponds, a surface water collection system, haul roads, access roads, and storage facilities (Figure 1.2). The total lease area associated with the mine is 18,892 hectares (ha).

Mount Polley began operating in 1997 and operated from 1997 to 2001, when it entered into care and maintenance. The discovery of new ore reserves at the site and improved commodity prices prompted MPMC to reopen the mine in 2005 (MPMC 2009). Mount Polley continued operating until August 4, 2014, when a foundation failure at the perimeter embankment of the TSF resulted in a breach (Ministry of Energy and Mines 2015; Province of British Columbia 2015). The TSF perimeter embankment breach ("the breach") resulted in the release of approximately 25 million cubic meters of water, tailings slurry, and dam construction material into nearby Polley Lake, Hazeltine Creek, and Quesnel Lake (Figure 1.1).

MPMC ceased operations immediately after the breach to focus on impact assessment, cleanup, and remediation. Restricted operations were permitted to commence on August 5, 2015. During restricted operations, all tailings were placed under water in the Springer Pit (Figure 1.2). Approval for discharge of treated mine effluent to Quesnel Lake was granted under the *Environmental Management Act* (EMA*)* on November 29, 2015, and MPMC initiated discharge of treated effluent to Quesnel Lake on December 1, 2015 (Figure 1.2). Restrictions on operations were lifted on June 23, 2016, and the mine began operating at full capacity on June 27, 2016 (MPMC 2017). On January 7, 2019, MPMC announced that Mount Polley Mine operations would be suspended in May 2019 due to declining copper prices. MPMC was placed under care and maintenance on May 31, 2019 and remained so until September 2021 when MPMC initiated a transition back to active operations. Full active operations at MPMC have currently resumed, with the resumption of active pit mining operations in November 2021, and the resumption of milling and copper concentrate production in summer 2022. Discharge of treated effluent to Quesnel Lake has been ongoing since 2015 (including during care and maintenance) and is currently permitted to June 30, 2025.

585,000 590,000 595,000 600,000 605,000 610,000 615,000

5,830,000 5,825,000 5,820,000 5,815,000

Quesnel River Research Centre
Quesnel River
Likely
Morehead Lake
Frypan Lake
Frypan Creek
Morehead Creek
Trio Creek
Mount Polley Mine Perimeter
Polley Lake
Cedar Creek
Spanish Lake
Nina Lake
Bootjack Lake
Jacobie Lake
Trio Lake
Bootjack Lake Dam
Bootjack Creek
WTP
Tailings Storage Facility (TSF)
Horsefly Lake Forest Service Road
Boswell Lake
Winkley Creek Road
Hazeltine Creek
Gavin Lake Road
Quesnel Lake
Edney Creek
Gavin Lake
Edney Lake Road
Teasdale Creek Road
Edney Lake
Mitchell Bay
Fire Lake
Horsefly Bay
Horsefly River



LEGEND

- Water Treatment Plant (WTP)
- Remediation Zone for Hazeltine Creek
- Historic Watercourse
- Active Mine Operation
- Tailings Storage Facility

0 1 2 4 km

N W E S

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Location and General Layout of the Mount Polley Mine

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Figure 1.1

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LEGEND

- Central Collection Sump
- Effluent Mixing Tank
- Water Treatment Plant (WTP)
- Diffuser (Treated Effluent Discharge, December 2015 to present)
- Discharge to Diffusers (2015 to present)
- Discharge to Hazeltine Creek (Apr 10 2014 to Aug 14 2014 and Nov 29 2015 to Sept 30 2017)
- Effluent Discharge Pipeline (January 2018 to present)
- Mine Infrastructure
- Historic Watercourse

0 0.5 1 2 km

N W E S

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Mount Polley Mine Site Operations and Infrastructure

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Figure 1.2

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1.2 Regulatory Environment

Mount Polley is required to comply with Permit 11678, which was first issued under the British Columbia EMA on May 30, 1997. Conditions of the permit include criteria for effluent quality and non-lethality, water quality monitoring, and biological monitoring. Permit 11678 was amended on November 7, 2012, to allow for effluent discharge from the TSF to Hazeltine Creek, which began on April 10, 2014. Discharges were halted in response to the August 4, 2014, breach.

Following extensive clean-up and remediation efforts, the British Columbia Ministry of Environment and Climate Change Strategy (BCMOECCS; i.e., ENV) issued an amendment to Permit 11678 on November 29, 2015, which allowed MPMC to discharge treated effluent into Quesnel Lake via Hazeltine Creek as part of a short-term water management strategy. Permit 11678 was amended again on April 7, 2017, allowing for the use of a pipeline to convey treated water from the WTP to diffusers in Quesnel Lake (see Figure 1.2). Permit 11678 was most recently amended on December 1, 2022, and included an update to the permitted date for the direct discharge of treated effluent to Quesnel Lake via the pipeline and diffusers, which is now allowed under Permit 11678 until June 30, 2025.

Section 3.2 of the amended Permit 11678 requires MPMC to develop and implement a Comprehensive Environmental Monitoring Plan (CEMP) for the Mount Polley Mine site and surrounding receiving environment that combines pre-existing monitoring programs into an integrated plan:

> *3.2.1 "The Permittee must continue to develop, submit, and implement an ongoing Comprehensive Environmental Monitoring Plan to evaluate the effects of mining-related activities on the physical, chemical, and biological characteristics of Hazeltine Creek, Edney Creek, Bootjack Lake, Morehead Creek, Polley Lake, Quesnel Lake, Quesnel River, and associated riparian and upland areas."*
>
> *3.2.4 "The CEMP must meet all the following requirements:*
>
> *(a) Consolidate and integrate all of the monitoring programs that are being conducted in the vicinity of the mine site and include, at minimum, surface water (quality and quantity), groundwater (characterization and interactions with surface water), sediments, soils, periphyton, phytoplankton, benthic invertebrates, zooplankton, fish, floodplain and upland vegetation, and wildlife.*
>
> *(b) At a minimum address a three-year time span.*

> *(c) At a minimum include all sampling sites, frequency of sampling, variables to be analyzed, method detection limits, sampling methods, sample analysis methods, and data analysis methods.*
>
> *(d) The updated CEMP must be approved by the Director"*

In accordance with this requirement, the CEMP (MPMC 2019) covers the 2018 to 2020 period and was developed based on an approved updated Terms of Reference (TOR) provided by ENV. The 2019 CEMP (MPMC 2019) was submitted to ENV on October 31, 2019, and was approved by ENV on February 10, 2021, subject to additional monitoring requirements (BCMOECCS 2021c). Monitoring in 2022 was completed in accordance with the approved CEMP (MPMC 2019) and the additional CEMP requirements (outlined in BCMOECCS 2021c), although the CEMP covers the 2018 to 2020 period. Based on the requirements of Permit 11678, an updated CEMP will be submitted by March 31, 2023.

The CEMP is an integrated monitoring plan that has been developed to capture in one document a number of independent and interdependent monitoring programs, including: site monitoring, water discharge monitoring, Metal and Diamond Mining Effluent Regulations (MDMER) monitoring, and breach response monitoring, and monitoring following completion of remediation efforts. The CEMP has been developed through an extensive consultative process that encompasses several permitting and other regulatory processes. This integrated monitoring plan offers the additional benefit of facilitating more efficient monitoring plan review by regulatory agencies, First Nations, and stakeholders.

1.3 Scope of this Report

This report covers a subset of the CEMP. It includes monitoring of the aquatic receiving environment adjacent to, and downstream of the Mount Polley Mine in 2022. Where relevant, data collected prior to 2022 (as far back as baseline data collected in 1995) are used in data interpretation in reference to the previous reports that provided the raw data.

This report specifically includes lakes, creeks, and rivers with the potential to have been influenced by the Mount Polley Mine through effluent discharge, the breach, or general mine operations, including Polley Lake, Bootjack Lake, Hazeltine Creek, Edney Creek, Quesnel Lake, and the Quesnel River (Figure 1.1). Additional areas were also evaluated as references for the potentially affected areas to facilitate interpretation of potential effects (as outlined in the Study Design Overview; Section 2). This report is focused on sediment quality, periphyton, plankton, benthic invertebrates, and fish. However, additional supporting data (e.g., physical habitat characteristics, water quality) are used in the interpretation of the key monitoring components.

1.4 Monitoring Objectives

The overarching objective of the monitoring undertaken under the CEMP is to support the evaluation of the potential for effects of mine-related activities on the physical, chemical, and biological characteristics of the environment surrounding the Mount Polley Mine (i.e., the receiving environment). Monitoring under the CEMP is completed to:

1. Evaluate if pollution[1] is occurring in the receiving environment as a result of the existing water discharge or mine-related activities;
2. Evaluate the environmental impacts of the August 2014 TSF embankment breach, to inform the remediation plan, as well as to evaluate the effects of mitigation measures that are implemented as part of the remediation strategy; and
3. Inform management decisions, including reclamation and closure.

General objectives of the CEMP elements reported herein (i.e., sediment quality, periphyton, plankton, benthic invertebrates, and fish) are to:

1. Evaluate the influence of mine activities on the receiving environments in comparison to baseline/pre-breach and/or reference conditions;
2. Determine potential implications to aquatic life; and
3. Provide data to support exposure assessment as part of Ecological Risk Assessment (ERA) and Human Health Risk Assessment (HHRA).

Specific questions being addressed under these objectives are:

1. Are there differences in conditions at exposed areas relative to baseline/pre-breach and/or reference conditions?
2. If yes, are the differences mine-related?
3. Does the weight-of-evidence indicate that the usefulness of the aquatic environment is impaired?

Specific objectives associated with the CEMP elements herein are provided in Table 1.1.

[1] Pollution as defined in the BC EMA (S.1(1)) means "*…the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment*".

Table 1.1: Objectives of Specific Mount Polley CEMP Monitoring Components Covered in this Report

Component	Objectives	Sub-Components
Sediment	1. Evaluate the influence of mine activities on depositional receiving environments (e.g., Polley Lake, Quesnel Lake, and limited locations in Hazeltine Creek) in comparison to baseline and/or reference conditions; 2. Determine potential implications to aquatic life (e.g., relative to available sediment quality guidelines); 3. Provide supporting information for benthic invertebrate community monitoring; and 4. Provide data to support exposure assessment as part of ERA and HHRA[a].	1. Sediment Quality 2. Sediment Toxicity
Periphyton[b]	1. Evaluate the influence of mine activities on erosional receiving environments (e.g., Hazeltine Creek and Edney Creek) in comparison to baseline and/or reference conditions; 2. Serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish); 3. Provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity; and 4. Provide data to support exposure assessment as part of ERA and HHRA[a].	1. Productivity 2. Community Composition 3. Tissue Quality
Plankton	1. Evaluate the influence of mine activities on lake environments (Polley Lake and Quesnel Lake) in comparison to baseline and/or reference conditions; 2. Serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (fish); 3. Provide supporting information for the assessment of fish habitat productivity and fish tissue quality; and 4. Provide data to support exposure assessment as part of ERA and HHRA[a].	1. Phytoplankton Productivity 2. Phytoplankton Community Composition 3. Zooplankton Productivity 4. Zooplankton Community Composition 5. Zooplankton Tissue Quality
Benthic Invertebrates	1. Evaluate the influence of mine activities on receiving environments (e.g., Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions; 2. Determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines); 3. Provide supporting information for the assessment of potential effects to higher trophic levels (e.g., fish); and 4. Provide data to support exposure assessment as part of ERA and HHRA[a].	1. Productivity[b] 2. Community Composition 3. Tissue Quality[b]
Fish	1. Evaluate the influence of mine activities on receiving environments (e.g., Hazeltine Creek, Edney Creek, Polley Lake, Quesnel Lake, and Quesnel River) in comparison to baseline and/or reference conditions; 2. Determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines); 3. Document fish habitat utilization in creek and lake areas that were physically impacted by the TSF breach (most notably Hazeltine Creek and lower Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts; and 4. Provide data to support exposure assessment as part of ERA and HHRA[a].	1. Fish Habitat and Usage[b] 2. Community Composition 3. Fish Health 4. Tissue Quality

[a] Ecological Risk Assessment and Human Health Risk Assessment.
[b] Denotes a component or sub-component that only applies to creeks.

1.5 Report Organization

This report is presented in eight sections, the first of which is this introduction (Section 1). Section 2 provides an overview of the approach and study design for the CEMP elements reported herein (i.e., sediment quality, periphyton, plankton, benthic invertebrates, and fish). Section 3 provides the methods used for data collection, treatment, and interpretation applicable to lake habitat. Section 4 provides the same for creek habitat. Sections 5 and 6 provide the results, assessment, and interpretation of data collected in lake habitat and creek habitat, respectively. Section 7 provides an integrated summary of key findings and recommendations. All references cited throughout the report are provided in Section 8.

2 STUDY DESIGN OVERVIEW

2.1 Conceptual Overview

The overall study design for the MPMC CEMP, including rationale for the design, is provided in the approved 2019 CEMP study design document (MPMC 2019). That document provides an overview of the mine site and its surrounding environment, an overview of environmental management on the mine site, and a detailed description of every component of the CEMP. The latter includes the monitoring objective, a summary of historic findings, a study design overview and rationale, and methodology associated with quality assurance / quality control (QA/QC), sample collection, laboratory analyses, data quality review (DQR), data handling, data interpretation, and reporting (MPMC 2019).

This report covers a subset of MPMC's CEMP – it is specifically focused on sediment and aquatic biological monitoring under the CEMP (i.e., sediment, periphyton, plankton, benthic invertebrate, and fish components of the CEMP). Briefly, sediment and aquatic biological monitoring under the CEMP was developed in consideration of:

- Pathways of potential effects (MPMC 2019);
- Accepted biological monitoring tools and measurement endpoints sensitive to mine-related influences (Table 2.1; MPMC 2019);
- The availability of baseline and/or pre-breach data (MPMC 2019);
- The findings of previous studies (MPMC 2019);
- Statistical considerations for comparisons of exposed-area data to reference, baseline, and/or over time (MPMC 2019);
- Needs of the ERA and HHRA (Golder 2017b,d); and
- Consultation (MPMC 2019).

Key pathways of potential effects to the aquatic environment include diffuse influences of the mine footprint and mining operations, the direct influence of the breach on Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake, and the direct discharge of treated mine water to Quesnel Lake. Sediment and aquatic biological monitoring endpoints used under the CEMP include chemical tools that address key questions and biological monitoring endpoints that are typically recognized as being the most sensitive to metals and to the potential influence of mine operations in general (Table 2.1; ESG 1999, Environment Canada 2012b; British Columbia Ministry of Environment [BCMOE] 2013, 2016; Arche et al. 2016; Simpson and Batley 2016). Baseline and/or pre-breach data are available for lakes and creeks immediately adjacent to

Table 2.1: Mount Polley CEMP Sediment and Aquatic Biological Monitoring Components and Measurement Endpoints, 2022[a]

Monitoring Component	Habitat Type	Sub-Component	Measurement Endpoints
Sediment	Lake and Creek[b]	Sediment Texture	moisture particle size distribution total organic carbon
		Sediment Quality	metals (CRC-ICP-MS scan[d]) total nitrogen total sulphur mercury
		Sediment Toxicity	14-day test of *Hyalella azteca* survival and growth (static)
Periphyton	Creek	Productivity	chlorophyll-a biomass (ash free dry mass)
		Community Composition	density (organisms/surface area) taxon richness[e] diatom taxon richness Simpson's index of diversity Simpson's index of evenness density and proportions of major taxon groups
		Tissue Quality	moisture metals (CRC-ICP-MS scan[d]) mercury
Phytoplankton	Lake	Productivity	chlorophyll-a
		Community Composition	density (organisms/volume) taxon richness[e] Simpson's index of diversity Simpson's index of evenness density and proportions of major taxon groups
Zooplankton	Lake	Productivity	biomass
		Community Composition	density (organisms/volume) taxon richness[e] Simpson's index of diversity Simpson's index of evenness density and proportions of major taxon groups
		Tissue Quality	moisture metals (CRC-ICP-MS scan[d]) mercury
Benthic Invertebrates	Lake and Creek	Productivity[c]	biomass
		Community Composition	density (organisms/surface area) taxon richness[e] Simpson's index of diversity Simpson's index of evenness density and proportions of major taxon groups Correspondence analysis[f]
		Tissue Quality	moisture metals (CRC-ICP-MS scan[d]) mercury
Fish	Lake and Creek	Habitat[g]	water depth and velocity wetted and bankfull width substrate characteristics riparian vegetation and canopy cover instream cover
		Habitat Usage[g]	repeated observation counts fish collection counts and catch-per-unit-effort[h]
		Catchability	fish collection counts and catch-per-unit-effort[h]
		Population Health	size-at-age condition size-frequency distribution
		Tissue Quality	moisture metals (CRC-ICP-MS scan[d]) mercury

[a] A number of additional supporting measures were collected to assist in the interpretation of results associated with the core measurement endpoints displayed.

[b] Due to the predominantly erosional habitat of the creek habitats assessed, measurement endpoints for sediment collected from these creek habitats were limited to the sub-components texture and chemistry.

[c] Benthic invertebrate biomass as a measure of secondary productivity was limited to creek habitats only.

[d] Metal scans by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) or Collision Reaction Cell ICP-MS (CRC-ICP-MS). "Metals" includes non-metallic parameters, such as phosphorus, which are common in CRC-ICP-MS analysis packages.

[e] Taxa reported at the lowest practicable level of taxonomy.

[f] Correspondence analysis was employed in cases where differences in community composition were not evident based on the evaluation of the density and proportions of major taxon groups.

[g] Fish habitat and fish habitat usage were monitored in creek habitats only.

[h] Fish collection and catch-per-unit-effort using a variety of techniques: minnow trapping and backpack electrofishing in creek habitats; minnow trapping, hoop netting, and gill netting in lake habitats; angling in Quesnel Lake and Quesnel River.

the mine (Polley Lake, Hazeltine Creek, Edney Creek, Bootjack Lake, and Quesnel Lake). To the extent possible, monitoring is designed to make the best use of baseline and/or pre-breach data in interpretation. Findings of previous studies (reviewed in the CEMP; MPMC 2019) also informed the study design, with the design focused on areas of greatest potential impact and on addressing key questions of effect or of recovery.

The assessment of potential mine-related effects is predicated on the detection of differences between exposed areas and baseline, pre-breach, or reference areas, or over time. Therefore, the study design was driven by considering statistical requirements (e.g., the number of reference areas and replication within each exposed and reference area) to support sufficiently powerful comparisons among areas and over time (replication level is typically n=5 to n=8). The design was also developed in consideration of data needs to support future iterations of ERA and HHRA.

2.2 Lake Habitat

Monitoring of lake habitat in the vicinity of the Mount Polley Mine in 2022 focused on two lakes: Polley Lake, which is located to the immediate east of the mine and Quesnel Lake, which is located further to the east of Polley Lake and approximately 3.7 kilometers from the mine at its nearest point (Figure 2.1). As indicated above, Polley Lake may be influenced by mining operations, and was also influenced by the breach in August 2014. Quesnel Lake was influenced by the breach in August 2014 (via Hazeltine Creek) and is currently also influenced by the direct discharge of treated mine water to Quesnel Lake (as of January 8, 2018[2]; Figure 2.1). Bootjack Lake serves as reference for Polley Lake, and unexposed/unimpacted areas within Quesnel Lake serve as references for exposed/impacted areas of the lake (Figures 1.2 and 2.1).

CEMP monitoring in lakes is outlined in detail in the CEMP study design document (MPMC 2019), including detailed description of each monitoring component and associated rationale for the study design and for the selected measurement endpoints. This section provides a general overview of the sediment and aquatic biological monitoring of lakes completed in 2022 (see Figure 2.1, Table 2.2). Briefly, CEMP monitoring of lakes in 2022 included the following components: sediment quality, sediment toxicity, phytoplankton productivity and community, zooplankton productivity and community, zooplankton tissue quality, benthic invertebrate community, fish community/population, and fish tissue quality. Not all monitoring components were completed at every area/station (Figure 2.1, Table 2.2). Detailed descriptions of monitoring conducted in lake habitats in 2022 are provided in Section 3.

[2] Discharge of treated mine water to Quesnel Lake via Hazeltine Creek was initiated on December 1, 2015. Direct discharge to Quesnel Lake (via a pipe) was initiated on January 8, 2018.

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5,830,000 5,825,000 5,820,000 5,815,000 5,810,000

Quesnel River
Likely
Quesnel River
Near Cedar Point
Near Grain Creek
Frypan Lake
Frypan Creek
Spanish Lake
Nina Lake
Cedar Creek
Hobenly Likely Forest Service Road
Mount Polley Mine Perimeter
Polley Lake
Bootjack Lake
POL-P2
POL-S
BOL-B2
BOL-S
Bootjack Creek
Bootjack Lake Dam
Central Collection Sump
WTP
Tailings Storage Facility (TSF)
Boswell Lake
Winkley Creek Road
Quesnel Lake
QUL-ZOO-1
QUL-PNF
QUL-LNF1
Gavin Lake Road
Hazeltine Creek
Edney Creek
Near Hazeltine Creek
Quesnel Lake
QUL-ZOO-7
Edney Lake Road
Teasdale Creek Road
Edney Lake
Horsefly Bay
QUL-LREF1
Horsefly River

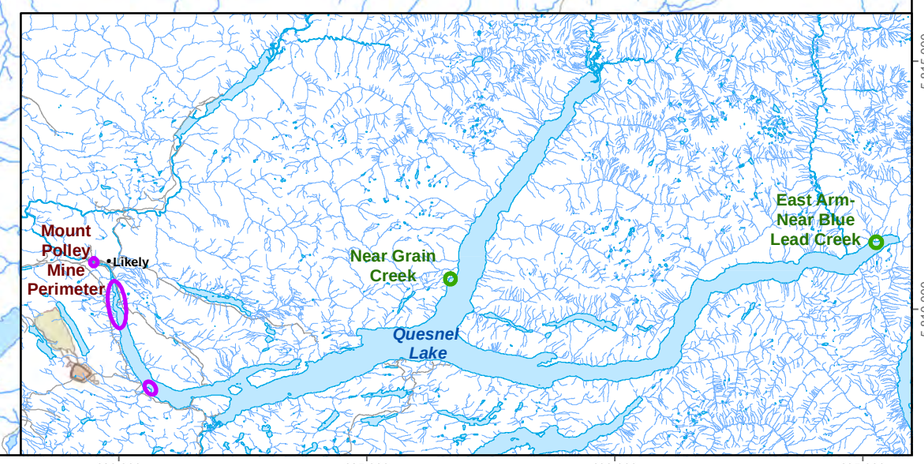

LEGEND

- Reference
- Exposed
- Sediment Chemistry
- Sediment Toxicity
- Zooplankton Community and Biomass
- Zooplankton Tissue Chemistry
- Phytoplankton Community
- Benthic Invertebrate Community
- Phytoplankton Productivity

Fish Colection Area

- Exposed Area
- Reference Area
- Reference Lake
- Exposed Lake

- Historic Watercourse

Note: Quesnel Lake bathymetry lines are an approximate representation only and may not precisely delineate accurate depths at larger scales.

0 1.5 3 6 km

Projection: North American Datum 1983 UTM Zone 10U

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N W E S

Monitoring Areas on Polley, Bootjack, and Quesnel Lakes, and Quesnel River, 2022

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Figure 2.1

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Table 2.2: General Overview of Mount Polley CEMP Monitoring in Lakes, 2022[a]

Waterbody	Sampling Area	Type	Sediment Quality	Sediment Toxicity	Phytoplankton Productivity and Community	Zooplankton Productivity and Community	Zooplankton Tissue Quality	Benthic Invertebrate Community	Fish Community / Population	Fish Tissue Quality[b]
Bootjack Lake	BOL - S (Shallow)	Reference	✓	✓	-	-	-	-	✓	✓
	BOL - B2 (Southeast Basin)	Reference	-	-	✓	✓	✓	-		
Polley Lake	POL - S (Shallow)	Exposed	✓	✓	-	-	-	-	✓	✓
	POL - P2 (Southeast Basin)	Exposed	-	-	✓	✓	✓	-		
Quesnel Lake	QUL - PNF	Exposed	✓	-	-	-	-	✓	✓	✓
	QUL - LREF1	Reference	✓	✓	-	-	-	-		
	QUL - LNF1	Exposed	✓	✓	-	-	-	-		
	QUL - ZOO - 7 (south of Cariboo Island)	Reference	-	-	✓	✓	✓	-		
	QUL - ZOO - 1 (central West Arm)	Exposed	-	-	✓	✓	✓	-		

Notes: Checkmarks indicate sampling was completed at the area indicated, dashes indicate sampling was not completed at the area indicated.

[a] Detailed descriptions of each monitoring element and associated rationale based on historical findings are provided in the CEMP (MPMC 2019); detailed methods are provided in Section 3 of this report.

[b] Fish tissue quality monitoring includes multiple species (rainbow trout and longnose sucker in Polley and Bootjack Lakes; lake trout, northern pikeminnow, and peamouth chub in Quesnel Lake; rainbow trout in Quesnel River).

2.3 Creek Habitat

Monitoring of creek habitat in the vicinity of the Mount Polley Mine in 2022 focused on two creeks: Hazeltine Creek, which flows from Polley Lake to Quesnel Lake, and Edney Creek which conflows with Hazeltine Creek before entering Quesnel Lake (Figure 2.2). Hazeltine Creek is influenced by mining operations, was impacted by the breach in August 2014, and has conveyed Mount Polley mine water over two periods (April 11 to August 4, 2014, and November 29, 2015 to September 30, 2017). The lower 775 m of Edney Creek was also impacted by the breach. Remediation efforts of Hazeltine Creek and lower Edney Creek following the breach were initiated in 2014. Edney Creek con-flowed with Hazeltine prior to the breach, but remediation efforts separated the two creeks (Edney Creek near Quesnel Lake flowed adjacent to Hazeltine Creek) from 2014 until September 2020 when the creeks were rejoined. Two creeks (Edney Creek upstream of the impacted area and Frypan Creek) serve as references for Hazeltine Creek and the impacted area of Edney Creek (Figure 2.2).

CEMP monitoring in creeks is outlined in detail in the CEMP study design document (MPMC 2019), including detailed description of each monitoring component and associated rationale for the study design and for the selected measurement endpoints. This section provides a general overview of the sediment and aquatic biological monitoring of creeks completed in 2022 (see Figure 2.2, Table 2.3). Briefly, CEMP monitoring of creeks in 2022 included the following components: sediment quality, periphyton community and productivity, benthic invertebrate community and productivity, periphyton and benthic invertebrate tissue quality, and fish habitat usage and community. Not all components were completed at every area/station (Figure 2.2, Table 2.3). Although fish habitat characterization and fish usage monitoring (for spawning and rearing purposes) in upper and lower Hazeltine Creek and lower Edney Creek is part of the CEMP (Table 2.3), this monitoring focuses on a set of objectives identified and reviewed by the Habitat Remediation Working Group[3] (HRWG). As such, results of this monitoring in 2022, and prior years, are summarized in a separate report (Minnow 2023). Detailed descriptions of monitoring conducted in creek habits in 2022 are provided in Section 4.

2.4 Interpretive Approach

The interpretation of sediment and aquatic biological data collected under the CEMP (i.e., data reported herein) is based on a number of key interpretive tools. The approach to data

[3] The HRWG was established at the request of Fisheries and Oceans Canada (DFO; April 9, 2015), in response to regulatory requirements set out in Section 38(6) of the *Fisheries Act*. Members of the working group include: DFO, British Columbia Ministry of Environment (BCMOE), British Columbia Ministry of Forest Lands and Natural Resource Operations and Rural Development (FLNRORD), Soda Creek Indian Band, Williams Lake Indian Band, and Mount Polley Mining Company.

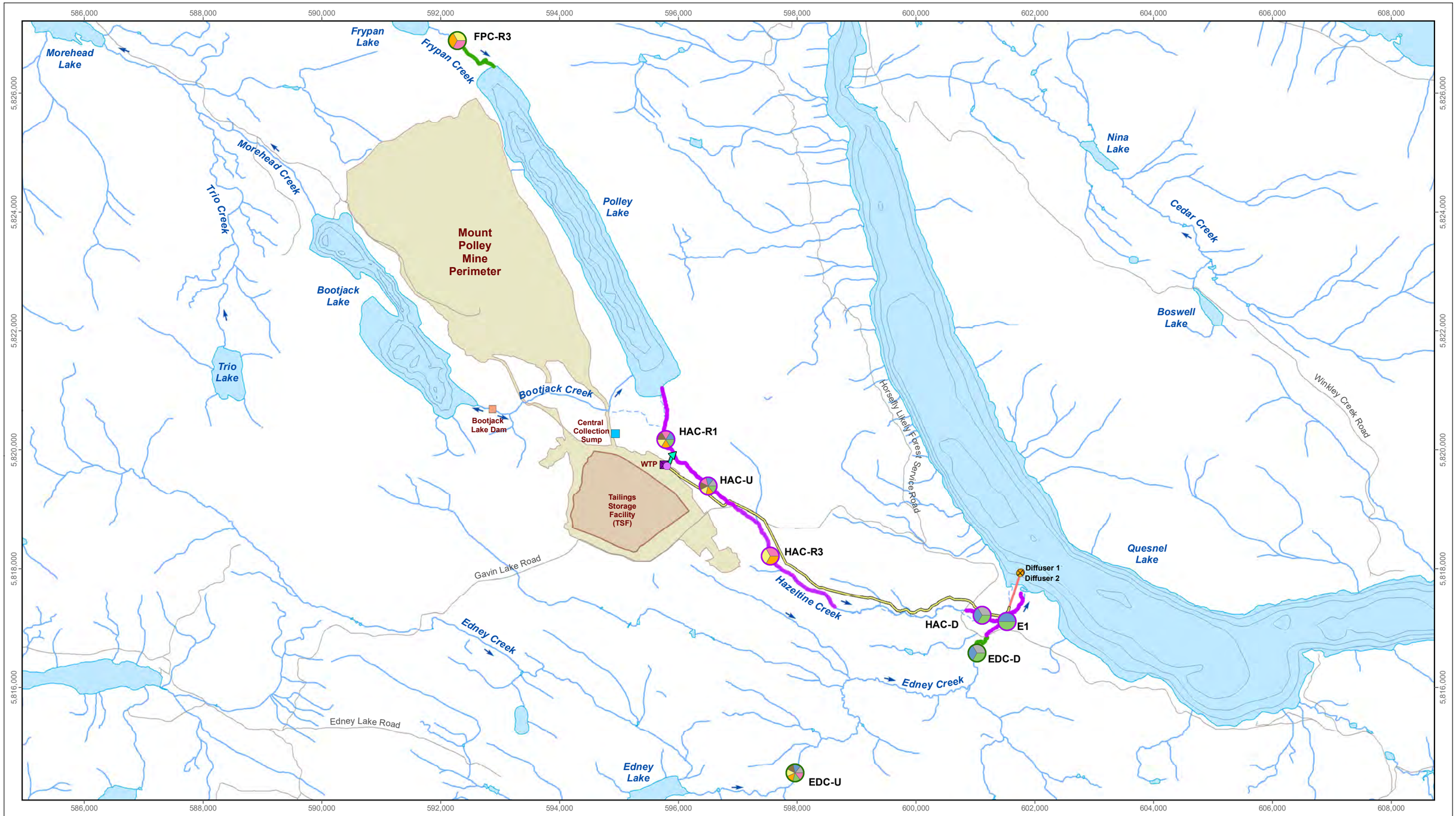

LEGEND

- Reference
- Exposed
- Sediment Chemistry
- Periphyton Tissue Chemistry
- Periphyton Community
- Benthic Invertebrate Community
- Benthic Invertebrate Biomass
- Benthic Invertebrate Tissue Chemistry
- Periphyton Chlorophyll-a and Ash-Free Dry Mass

Fish Collection Creek

- Exposed Creek
- Reference Creek

- Effluent Mixing Tank
- Historic Watercourse

0 1 2 4 km

N W E S

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Monitoring Areas on Hazeltine, Edney, and Frypan Creeks, 2022

Date: January 2023
Project 227202.0029

minnow environmental inc.

Figure 2.2

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Table 2.3: General Overview of Mount Polley CEMP Monitoring in Creeks, 2022 [a]

Waterbody	Sampling Area	Type	Sediment Quality	Periphyton			Benthic Invertebrate			Fish Habitat Assessment, Usage, and Community[b]
				Community	Productivity	Tissue Quality	Community	Productivity	Tissue Quality	
Frypan Creek	FPC-R2 (Reach 2)	Reference	-	-	-	-	-	-	-	✓
	FPC-R3 (Reach 3)	Reference	-	-	✓	-	✓	✓	-	-
Edney Creek	EDC - U (Upper)	Reference	✓	✓	✓	✓	✓	✓	✓	-
	EDC - D (Lower, unimpacted)	Reference	✓	-	-	✓	-	-	✓	✓
	E1 (Lowermost, impacted)	Exposed	-	-	-	✓	-	-	✓	
Hazeltine Creek	HAC-R1 (Upper, Reach 1)	Exposed	-	✓	✓	✓	✓	✓	✓	✓
	HAC-U (Upper, Reach 2)	Exposed	✓	✓	✓	✓	✓	✓	✓	
	HAC-R3 (Upper, Reach 3)	Exposed	-	-	✓	-	✓	✓	-	
	HAC-D (Lower, Reach 5)	Exposed	✓	-	-	✓	-	-	✓	

Notes: Checkmarks indicate sampling was completed at the area indicated, dashes indicate sampling was not completed at the area indicated.

[a] Detailed descriptions of each monitoring element and associated rationale based on historical findings are provided in the CEMP (MPMC 2019); detailed methods are provided in Section 4 of this report.

[b] Fish habitat assessment, fish habitat usage and community monitoring documented fish habitat conditions, and the usage of fish habitat by any / all fish species.

interpretation is outlined in the CEMP (MPMC 2019) and detailed methods are provided in Sections 3 and 4 of this document. Briefly, chemical data collected at potentially impacted areas are evaluated in comparison to environmental quality guidelines (as available), and based on statistical comparison to reference, to baseline and/or pre-breach, and over time (replication [n] is 5 to 8).

Presentation of chemical data incorporates results for all analytes reported by the laboratory; however, detailed analyses and discussion are focused on "primary" and "secondary" analytes (Table 2.4).[4] Primary and secondary analytes are constituents that have been identified in previous monitoring as being indicative of a mine influence on the receiving environment. Specifically, primary analytes are those that were previously identified as strongly indicative of a mine influence for most monitoring components and for which environmental quality guidelines are available. Secondary analytes are those that were previously identified as potentially indicative of a mine influence in only a subset of monitoring components. Evaluation of primary and secondary analytes was completed for all chemical data in the present report (i.e., water, sediment, and tissue quality data). To focus the interpretation of primary and secondary analyte results, discussion was limited to those analytes for which temporal differences (at the exposed areas) and/or spatial differences (between the exposed and reference or baseline/pre-breach areas) were reported. Biological data for potentially impacted areas are evaluated based on the measurement endpoints presented in Table 2.1 and are based on statistical comparison to reference, to baseline and/or pre-breach, and over time (replication [n] is typically 5).

Relationships between chemical and physical features (e.g., sediment chemistry and particle size distribution) and relationships between biological measurement endpoints and chemistry (e.g., benthic invertebrate community taxon richness and water or sediment chemistry) are evaluated using correlation or regression analysis to enhance understanding of potential cause. Although it is recognized that a significant correlation does not indicate cause, it can be useful in identifying potential cause and/or in distinguishing among different potential causes (e.g., Suter 2015). Lastly, data interpretation includes a step to bring the sediment and aquatic biological data together to identify consistencies (or inconsistencies) in the findings and to assist in the derivation of conclusions in consideration of all lines of evidence and relationships among them.

[4] Primary and secondary analytes are analytes that were classified as POIs (parameters of interest) and IPs (indicator parameters) for monitoring components in previous evaluations (see Minnow 2019a for details).

Table 2.4: Primary and Secondary Analytes used in the Evaluation of Chemical Data, 2022[a]

Category	Analyte
Primary	Arsenic
	Copper
	Iron
	Selenium
Secondary	Barium
	Cadmium
	Calcium
	Cobalt
	Manganese
	Mercury
	Molybdenum
	Nickel
	Phosphorus
	Silver
	Sodium
	Strontium
	Tin
	Titanium
	Uranium
	Vanadium
	Zinc

[a] See Section 2.4 and Minnow (2019a) for the rationale associated with selection of these analytes.

3 METHODS – LAKE HABITAT

3.1 Sediment Quality

Sediment was collected from shallow areas of Polley Lake (POL-S), Bootjack Lake (BOL-S), and Quesnel Lake (QUL-LNF1[5] and QUL-LREF1) in 2022 to support 14-day *Hyalella* Azteca toxicity testing (Figures 3.1 and 3.2, Tables 3.1 and 3.2). This sampling was completed in accordance with the requirements for shallow sediment monitoring outlined in the CEMP approval conditions dated February 10, 2021 (BCMOECCS 2021c; Section 1.2). Sediment was collected from the deep near-field area of Quesnel Lake (QUL-PNF), but not reference (QUL-PREF1)[6], to support benthic invertebrate community monitoring in this area (see Section 3.5).

Sample collection and analysis methods for 2022 are described herein and are consistent with those outlined in the CEMP (MPMC 2019). For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Tables 3.1 and 3.2.

3.1.1 Sample Collection

Sediment samples were collected from Polley Lake (and the associated reference, Bootjack Lake) and Quesnel Lake between August 24 and August 27, 2022 (Appendix Table A.1.1). Five replicate stations were sampled to represent each monitoring area (Tables 3.1 and 3.2). Samples were collected using a stainless-steel Petite Ponar for the analysis of total organic carbon (TOC), total sulphur, total nitrogen, particle size, and metal concentrations. Sampling was conducted in accordance with technical guidance outlined in the British Columbia Field Sampling Manual (BCMOE 2013) and in federal Technical Guidance Manual for (Environment Canada 2012b) and was also consistent with previous years of monitoring (Minnow 2020a, 2022a; Table 3.1).

At each sampling station, samples were collected using a stainless-steel Petite Ponar as follows. The Petite Ponar used is a 6” x 6” (15.24 cm x 15.24 cm) grab sampler with jaws that can be held open by shear-pressure on a spring-loaded pin which is released when the sampler is lowered to the substrate and the shear-pressure on the pin is eliminated. The collection of each grab sample was initiated by carefully lowering the ponar to the sediment surface.

[5] Due to changing water levels in Quesnel Lake, the shallow near-field area (QUL-LNF1) was moved in 2019 to a deeper and continually submerged location nearby (see Minnow 2020a for details). Samples collected in 2020 to 2022 were also from this deeper monitoring location, consistent with 2019 monitoring locations.

[6] Evaluation of benthic invertebrate community recovery at the deep near-field area (QUL-PNF) in 2022 could be addressed without comparison to the deep reference area (QUL-PREF1). See Section 3.5 for details.

588,000 590,000 592,000 594,000 596,000 598,000

5,826,000

5,824,000

5,822,000

Trio Creek

Morehead Creek

Mount Polley Mine Perimeter

Polley Lake

P1

B1

Bootjack Lake

P2

B2

Trio Lake

POL-S

Hazeltine Creek

Bootjack Creek

BOL-S

Bootjack Lake Dam

LEGEND

- Exposed Area
- Reference Area
- Routine Water Monitoring Station
- Historic Watercourse

Note: Bathymetry is displayed in meters.

0 0.5 1 2 km

N W E S

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Sediment Chemistry and Toxicity Monitoring Areas, Polley Lake and Bootjack Lake, 2022

Date: January 2023
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Figure 3.1

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595,000 600,000 605,000 610,000

5,820,000

5,815,000

Mount Polley Mine Perimeter

Polley Lake

Boswell Lake

Bootjack Creek

Horsefly Lake Forest Service Road

Winkley Creek Road

WTP

Tailings Storage Facility (TSF)

Lake Road

Hazeltine Creek

QUL-PNF

QUL-LNF1

Diffuser 1
Diffuser 2

Quesnel Lake

Creek

Edney Creek

Edney Lake

Horsefly Bay

QUL-LREF1

Horsefly River

595,000 600,000 605,000 610,000

LEGEND

- Exposed Area
- Reference Area
- Diffuser (Treated Effluent Discharge, December 2015 to present)
- Central Collection Sump
- Water Treatment Plant (WTP)
- Effluent Discharge Pipeline (January 2018 to present)
- Discharge to Diffusers (2015 to present)
- Historic Watercourse

[a] Not all monitoring components were completed at all areas shown. Monitoring included at least one of: sediment chemistry, sediment toxicity, and benthic invertebrate community. See Tables 3.2, 3.3, and 3.7 for details of monitoring components.

Note: Bathymetry is displayed in meters.

0 0.5 1 2 km

Projection: North American Datum 1983 UTM Zone 10U

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N W E S

Sediment Chemistry, Sediment Toxicity, and Benthic Invertebrate Community Monitoring Areas, Quesnel Lake, 2022[a]

Date: January 2023
Project 227202.0029

minnow environmental inc.

Figure 3.2

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 7\22-29 Figure 3.2 Sediment and BI Quesnel Lake.mxd

Table 3.1: Sediment Quality Monitoring in Polley Lake (Exposed) and Bootjack Lake (Reference) Shallow Areas, 2019 to 2022[a]

Program Component	Waterbody Area	Area Type	Area Codes	Analyses	Post-Breach	
					2019 (Minnow 2020a)	2022
Breach-Related	Bootjack Lake	Reference	BOL-S	Sediment Quality[b]	5	5
	Polley Lake	Exposed	POL-S	Sediment Quality[b]	5	5

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Sediment Quality analyses included: metals and Total Organic Carbon (TOC) in < 63 µm fraction, moisture, particle size, pH, total nitrogen, and total sulphur.

Table 3.2: Overview of Sediment Quality Monitoring in Quesnel Lake, 2007 to 2022[a]

Program Component	Waterbody Area	Area Type	Area Codes	Pre-Breach	Post-Breach							
				2007 (Minnow 2009)	2014 (Minnow 2015a)	2015 (Minnow 2015b)	2016 (Minnow 2016c)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Breach-Related	Deep	Exposed	QUL-PNF	-	5	5	5	5				
	Shallow	Reference	QUL-LREF1	-	5	5		-	5	5		
		Exposed	QUL-LNF1 (QUL in 2007)	5	5	3		-	5	5	5	5

Notes: "-" = not applicable. Sediment Quality analyses included: metals and Total Organic Carbon (TOC) in < 63 µm fraction, moisture, particle size, pH, total nitrogen, and total sulphur for sampling completed between 2014 and 2022.

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

Care was taken to control the rate at which the ponar was lowered to allow appropriate sediment penetration and to minimize sediment disturbance. Once the ponar was lowered to the sediment surface, surficial sediment was collected by pulling upwards on the sampler so that the jaws of the ponar closed, capturing the surficial sediment. The ponar was then carefully retrieved to surface, the sediment grab was placed into a plastic tote, and observed for completeness and unusual characteristics. If the sample was deemed acceptable (i.e., the sampler was full to each end and was representative of surface sediment), material to a depth of 3 cm was transferred to a second tote using a stainless-steel spoon, and the remaining sediment was discarded. This procedure was repeated at each station for a minimum of five successful grabs. At that point, the composite material within the tote was homogenized using a stainless-steel spoon and transferred into two 250 mL glass sampling jars labeled with the project number, sample location, and collection date. All sampling equipment was rinsed between stations using site water. At the deep near-field area of Quesnel Lake (QUL-PNF; Figure 3.2, Table 3.2), the ponar sampler was retrieved with the assistance of a commercial line hauler (Ace Line Hauler Brutus Plus 40).

Duplicate (split) sediment samples were collected at a target frequency of 10% for QA/QC purposes. Immediately after collection, samples were stored in a cooler with ice packs until they were placed in a refrigerator at the field laboratory, where they were held until shipment (on ice) to the analytical laboratory.

Supporting measures were collected at each sampling station to support data interpretation (Appendix Tables A.1.1, A.1.2; see Section 3.8.1 for details).

3.1.2 Laboratory Analysis

Laboratory analysis of sediment quality samples from lake habitats was completed by ALS Environmental in Burnaby BC, a laboratory that is accredited by the Canadian Association for Laboratory Accreditation (CALA). Upon receipt of the sample shipment(s), ALS Environmental measured temperature in each cooler to verify the maintenance of cold samples, logged each sample, and assigned each sample a unique sample identification code. A sample receipt notification (SRN) was then sent to MPMC and Minnow for verification.

Laboratory analysis included moisture content, pH, particle size distribution, TOC, total nitrogen, total sulphur, and total metal concentrations for all samples. Analysis methods for all parameters were consistent with previous post-breach sampling years (Tables 3.1 and 3.2). Analyses except for moisture, pH, total nitrogen, total sulphur, and particle size distribution were completed on the silt/clay fraction (<63 µm diameter) in accordance with recommendations (BCMOE 2016) and consistent with previous methods (2014 to 2021; Tables 3.1 and 3.2). Analysis of pH was completed by electrode; particle size analysis was completed by sieve and pipette; TOC was completed by combustion and titration (total carbon minus total inorganic carbon); and total

nitrogen and total sulphur were completed by combustion. Analysis of metals was based on the BC Strong Acid Leachable Metals digestion (SALM; BCMOE 2016), with total metals analysis completed by Collision Reaction Cell Inductively Coupled Plasma – Mass Spectrometry (CRC-ICP-MS; United States Environmental Protection Agency [USEPA] Method 6020B; USEPA 2014]), and mercury analysis completed by Cold Vapour Atomic Absorption Spectrophotometry (CVAAS; USEPA Methods EPA 200.2/1631; USEPA 1994, 2001).

QA/QC sampling completed by the laboratory included method blanks (MBs), laboratory replicates, and laboratory accuracy measures (i.e., laboratory control samples, and/or internal reference materials). Upon completion of the analyses, a data report was provided by ALS to MPMC and Minnow in Adobe Acrobat Portable Document Format (PDF) and Microsoft Excel files (Appendix G).

3.1.3 Data Analysis

3.1.3.1 Data Screening and Analytes of Interest

Upon receipt of the initial analytical data, a DQR was completed, including an examination of data completeness, laboratory reporting limits (LRLs) achieved, laboratory precision, laboratory accuracy, and field precision (Appendix B). Following completion of the DQR, raw data were summarized by area by calculating mean, median, standard deviation (SD), minimum, and maximum. Summary statistics were calculated using the Kaplan-Meier (K-M) method as described in Section 3.8.3.1.

Data were evaluated in comparison to British Columbia Working Sediment Quality Guidelines for the protection of aquatic life (BCMOECCS 2021a) and the British Columbia Approved Water Quality Guideline for selenium in sediment (BCMOECCS 2021b), collectively termed Working Sediment Quality Guidelines (WSQG) in this report. WSQGs are numerical criteria that are protective of sediment-dwelling organisms based on long-term exposure. Most WSQGs have been adopted from the Canadian Council of Ministers of the Environment (CCME; CCME 1999) or from Ontario (OMOE 1993) and have two levels – a Lower WSQG and an Upper WSQG. The Lower WSQG is intended to represent a concentration that will protect aquatic life from adverse effects of a toxic substance in most situations. The Upper WSQG is intended to represent a concentration that, if exceeded, will likely cause severe effects on aquatic life (BCMOECCS 2021a). However, WSQGs (even the Upper WSQGs) are often naturally exceeded in mineralized areas. In addition, WSQGs were developed based on co-occurring bulk surficial sediment data and biological effect data (CCME 1995). Bulk sediment chemistry can differ substantially from the <63 µm fraction. This discrepancy between measurement

(<63 µm fraction) and exposure (to bulk sediment to which WSQGs are most applicable) should be considered in interpretation, as "caution should be used in interpreting the biological significance of chemical concentrations in sediments for different types based on these guidelines" (CCME 1995).

Sediment quality data from exposed areas were also evaluated relative to 1) "reference data" and 2) "pre-breach data". Reference data included all post-breach data (2014 to 2022) from reference areas that were sampled in 2022. Reference and pre-breach data were compiled separately and used to calculate reference and pre-breach 95th percentile screening values, respectively. Reference 95th percentile screening values were calculated from each post-breach reference dataset (i.e., separately for Bootjack Lake shallow [BOL-S] and Quesnel Lake shallow [QUL-LREF1] and deep [QUL-PREF1][7] reference areas). Pre-breach 95th percentile screening values were calculated from each available pre-breach dataset (i.e., Quesnel Lake shallow area QUL-LNF1 [2007]). Once calculated, the 95th percentile reference and pre-breach screening values were compared, and the highest value for each analyte was then used to screen the associated exposed data. If pre-breach data were not available, as is the case for the shallow areas of Polley Lake and the deep monitoring areas of Quesnel Lake, only the 95th percentile reference values were used. The reference and pre-breach data used in the calculation of the 95th percentiles and used in data screening are presented in Appendix C.

All analytes (including primary and secondary analytes) were screened against WSQG and reference/pre-breach 95th percentile values. Analytes at exposed areas with mean concentrations that exceeded all the following criteria were termed "Analytes of Interest": 1) the WSQG, 2) the associated reference 95th percentile value, and 3) the associated pre-breach 95th percentile value (if available). Analytes of Interest were determined separately for each monitoring area (i.e., separately for shallow area of Polley Lake, and deep and shallow areas of Quesnel Lake). Concentrations of the Analytes of Interest, along with TOC, were the focus of more detailed interpretation which included graphical plots, formal statistical contrasts of temporal changes, and spatial differences in concentrations, and examination of relationships to physical and chemical sediment variables.

3.1.3.2 Statistical Analyses

Statistical analyses of Analyte of Interest and TOC concentrations in lake sediments were conducted using post-breach data (i.e., 2014 to 2022) to answer the following questions:

[7] The deep reference area of Quesnel Lake (QUL-PREF1) was not sampled in 2022 (see above), therefore reference 95th percentile values for this area were calculated using post-breach data from previous years (2014 to 2021; data previously presented in Minnow 2022a).

1. Have mean analyte concentrations at the exposed area changed relative to the reference area?[8]
2. Are there differences in mean analyte concentrations between exposed and reference areas, and does the difference depend on year?
3. Have mean analyte concentrations at the exposed area changed over time since the breach?

To answer these questions, data were grouped into three categories for separate tabular and graphical presentation and statistical analyses:

1. Shallow Polley Lake (POL-S; exposed) compared to a shallow reference area (Bootjack Lake; BOL-S).
2. Deep exposed area of Quesnel Lake (QUL-PNF) compared to an un-impacted deep reference area (QUL-PREF1)[9].
3. Shallow exposed area of Quesnel Lake (QUL-LNF1) compared to an un-impacted shallow reference area (QUL-LREF1).

Questions 1 and 2 were answered by conducting a two-way Analysis of Variance (ANOVA) assessing the exposed:reference ratios of results, with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year.* The two-way ANOVA included all data with paired exposed and reference results (i.e., excluded QUL-PNF data from 2020 and 2022 which did not have corresponding reference results). Except for TOC, the data used in the two-way ANOVA model were $\log_{10}$ transformed. As such, differences between the exposed and reference areas were multiplicative when testing the significance of the interaction between *Area* and *Year* (i.e., if the concentration in the reference area decreases by 50%, then the null hypothesis would be that the concentration in the exposed area also decreases by 50%). Few data points were below the LRL but were replaced with the highest LRL when present. If the *Area*×*Year* interaction term was significant ($\alpha = 0.05$), then the ratios of the concentrations from the exposed area to the reference area differed among years. In this case, pairwise contrasts among years were completed to compare the relative difference in means (in $\log_{10}$ units) between areas among years. The hypotheses tested were:

$$H_0: \left(\mu_{\text{Exposed}} - \mu_{\text{Reference}}\right)_i = \left(\mu_{\text{Exposed}} - \mu_{\text{Reference}}\right)_j \text{ for all years i, j, i} \neq \text{j}$$

[8] i.e., has the ratio of concentrations (exposed:reference) changed over time?

[9] Although the deep reference area of Quesnel Lake (QUL-PREF1) was not sampled in 2022, results from this area (2014 to 2021; Minnow 2022a) were included in tabular and graphical presentation and in statistical analyses to provide additional context for the interpretation of temporal changes at the deep near-field area (QUL-PNF) from 2014 to 2022.

The contrasts were completed for all pairwise comparisons among years, where paired exposed and reference data were available. The analysis for metals assumed data were $\log_{10}$ distributed so the hypothesis of testing differences between means is equivalent to testing the ratios of exposed to reference concentrations on the untransformed scale because of the following property of logarithms:

$$log\left(x_{\text{Exposed}}\right) - log\left(x_{\text{Exposed}}\right) = log\left(\frac{x_{\text{Exposed}}}{x_{\text{Reference}}}\right).$$

Comparisons of TOC were conducted on untransformed data and thus significant interactions tested for absolute rather than relative differences between reference and exposed areas. The results of the multiple comparisons among years were displayed by assigning letters (e.g., A, B, C) to each year. Letters were assigned such that the year with the highest ratio (or absolute difference for TOC) of exposed:reference was assigned the letter "A" and years that do not differ significantly (α = 0.05) share a letter. When the *Area*×*Year* interaction term was not significant (α = 0.05), the differences between areas were consistent among years and no exposed:reference relative contrasts were conducted.

Temporal changes in the ratio of exposed:reference (or absolute difference for TOC) were quantified by calculating a Magnitude of Difference (MOD), which is the difference between the value for the exposed area and the predicted value for the exposed area, assuming the same ratio (i.e., exposed:reference) from the baseline year (the first year the data were collected). This MOD was expressed as a percent change as:

$$MOD = \frac{10\text{^}\bar{x}_{Exposed\ Observed} - 10\text{^}\bar{x}_{\text{Exposed }Predicted}}{10\text{^}\bar{x}_{\text{Exposed }Predicted}} \times 100\%$$

where $\bar{x}_{Exposed\ Observed}$ is the mean for the exposed area (in $\log_{10}$ units) for the given year and $\bar{x}_{\text{Exposed }Predicted}$ is the predicted mean (log units), assuming the relative difference between the exposed area and reference area did not change from the baseline year (i.e., $\bar{x}_{\text{Exposed }Predicted} = \bar{x}_{\text{Reference}} + \left(\bar{x}_{\text{Exposed Baseline}} - \bar{x}_{\text{Reference Baseline}}\right)$). The MODs for TOC did not need to be back-transformed but were calculated using the same formula otherwise.

Question 3 was answered using the results of the same two-way ANOVA used to answer Question 1 but considered exposed and reference data independently (rather than assessing the exposed:reference ratio as outlined for Questions 1 and 2). These analyses included unpaired exposed and reference data that were not assessed as part of the analyses addressing in Questions 1 and 2 (i.e., QUL-PNF results from 2020 and 2022). When the interaction term of this two-way ANOVA was significant, spatial and temporal *post hoc* contrasts were conducted to test for differences among years for each area and between reference and exposed areas in

each year. The MOD between the exposed and reference areas for significant spatial comparisons was calculated in each year as:

$$MOD = \frac{10\text{^}\bar{x}_{Exposed} - 10\text{^}\bar{x}_{\text{Reference}}}{10\text{^}\bar{x}_{\text{Reference}}} \times 100\%$$

where $\bar{x}_{Exposed}$ and $\bar{x}_{Reference}$ are the exposed and reference area means (in log units), respectively. The MOD for temporal differences from the base year were similarly calculated as:

$$MOD = \frac{10\text{^}\bar{x}_{Yeari} - 10^{\bar{x}}{}_{\text{Base year}}}{10\text{^}\bar{x}_{\text{Base year}}} \times 100\%$$

where $\bar{x}_{Yeari}$ and $\bar{x}_{Baseyear}$ are the means for the selected year and base year of monitoring (in log units), respectively. For both MOD calculations, the means for TOC were not back-transformed because the model used untransformed data. When the interaction term was not significant, the differences between exposed and reference areas were consistent over time and a spatial MOD (i.e., between areas) was calculated for all years combined if the *Area* term was significant, and temporal contrasts and MODs were conducted for the pooled areas (i.e., combined reference and exposed).

Analytes of Interest and TOC concentrations were plotted to support the two-way ANOVA results. Where relevant, these plots included comparison of post-breach data (i.e., those data included in the analyses) to WSQG and reference/pre-breach 95th percentile values. Pre-breach data were also included in a sub-set of the plots for context.

Relationships between the Analytes of Interest concentrations and sediment physical (i.e., particle size) and chemical variables (TOC, total nitrogen, and total sulfur content) were evaluated using Spearman correlation analysis. Correlation analyses were conducted separately for each of the three data groupings outlined above (1: shallow Polley Lake and Bootjack Lake areas; 2: deep Quesnel Lake areas; 3: shallow Quesnel Lake areas) using all available post-breach data (i.e., 2014 to 2022) to evaluate these relationships over time. For both deep and shallow monitoring areas, differing relationships were apparent for the exposed areas relative to reference. As such, correlations were run separately for two groups of data: 1) the paired exposed and reference areas combined (i.e., POL-S and BOL-S; QUL-PNF and QUL-PREF1, and QUL-LNF1 and QUL-LREF1); 2) exposed areas only (i.e., POL-S, QUL-PNF, QUL-LNF1 independently and separate from reference). Metal concentrations were measured in the <63 µm fraction of sediment (see Section 3.1.2), therefore relationships between Analyte of Interest concentrations and particle size were completed for this fraction of sediment only, with clay content used in correlations calculated as (% clay)/(% silt and clay). Following the derivation

of correlation coefficients, a Bonferroni-type correction (i.e., α = 0.05 divided by the total number of independent variables) was applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected α of 0.05. Any significant correlations found at the Bonferroni-adjusted α were further investigated using scatter plots.

Sediment quality data were analysed using Principal Component Analysis (PCA) as a means of summarizing the data for use in correlation analyses to assess potential physical and/or chemical causes of differences in benthic invertebrate community condition (see Section 3.5.3.2). PCA is a multivariate statistical ordination technique that can be used to reduce many variables (in this case 34 analytes for sediment quality) and to assist in the identification of patterns in datasets. PCA was completed using data from the deep exposed area of Quesnel Lake (QUL-PNF) collected from 2014 to 2022. Prior to running PCA, analytes for which more than 25% of the data were below the LRL, or analytes for which an incomplete dataset existed were excluded from the data matrix. All concentration data were transformed using a $\log_{10}$-transformation and principal component axes were then generated. Subsequently, the correlation between each parameter and the first two principal components (PCs) were tested using a Pearson's correlation coefficient and plotted to identify analytes that best explained similarities and differences in sediment chemistry among stations.

All sediment statistical analyses and plots were completed using R (R Core Team 2022).

3.2 Sediment Toxicity

Toxicity testing was completed in 2022 using sediments from shallow areas of Polley Lake, Bootjack Lake, and Quesnel Lake to satisfy Condition 9 of the CEMP approval issued by ENV (BCMOECCS 2021c) which specified the following:

> *"The 14-day sediment toxicity test on H. azteca must be conducted every three years (i.e., next in 2022) using sediment of shallow habitat from Polley Lake unless MPMC can clearly show that copper concentrations in all Polley Lake shallow sediment samples are below the 95th percentile of the copper concentrations in the Bootjack Lake reference area shallow sediment samples. H. azteca toxicity testing using sediment from shallow areas of Quesnel Lake must be continued as stated in the March 14, 2019 approval letter. "No effect to H. azteca" in that letter shall mean "no unacceptable response" relative to the reference area, as defined on page 37 of "Mount Polley Comprehensive Environmental Monitoring Program 2019 – Sediment and Aquatic Life".*

In accordance with this CEMP condition (BCMOECCS 2021c), 14-day toxicity testing using *H. azteca* (an epi-benthic amphipod) was completed in 2022 using shallow

breach-impacted sediments from Polley Lake (POL-S; with shallow Bootjack Lake sediments serving as reference [BOL-S]) and from Quesnel Lake (QUL-LNF1; with shallow un-impacted sediments from Quesnel Lake serving as reference [QUL-LREF1]; Figures 3.1 and 3.2, Table 3.3).

Sample collection and analysis methods for 2022 are described herein are consistent with those outlined in the CEMP (MPMC 2019). For details pertaining to prior sampling years refer to the references listed in Table 3.3.

3.2.1 Sample Collection

Sediment samples for toxicity testing using *H. azteca* in 2022 were collected from shallow areas of Polley Lake (POL-S), Bootjack Lake (BOL-S), and Quesnel Lake (QUL-LNF1, QUL-LREF1; Figures 3.1 and 3.2, Table 3.3) as described in Section 3.1.1. Sediments were collected at a total of five replicate stations per area, with the field replicates serving as replicates in the laboratory. Sediment samples for toxicity testing were shipped to Nautilus Environmental (Nautilus) in Burnaby BC following the methods used for sediment quality samples, described in Section 3.1.1.

3.2.2 Laboratory Analysis

Upon receipt, Nautilus opened the coolers, measured temperature to verify the maintenance of cold samples, removed each sample from the coolers, logged the sample, and confirmed sample receipt with MPMC and Minnow. Static water toxicity testing of *H. azteca* is outlined in detail in Nautilus (2022; Appendix G) and was conducted according to procedures described in the Biological Test Method for the 14-day survival and growth test using *H. azteca* (Environment Canada 2017). Briefly, for the 14-day test of *H. azteca*, Nautilus set up five field-replicate test vessels per area (i.e., with each replicate representing a sampling station). A laboratory control (beach sand in accordance with the biological test method) was also set up with five laboratory replicates.

In the toxicity test laboratory, several supporting measurements were collected within the toxicity test vessels as described by Nautilus (2022; Appendix G). Briefly, this included meter measurements of overlying water (temperature, dissolved oxygen, conductivity, and pH) and the collection of overlying water for analysis of ammonia and dissolved copper by ALS Environmental (Burnaby, BC). Collection of overlying water samples for analysis of dissolved copper was completed at test termination (Nautilus 2022; Appendix G).

Table 3.3: Overview of Sediment Toxicity Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 2014 to 2022 [a]

Waterbody		Area Type	Area Code	2014 (Minnow 2015a)		2016 (Minnow 2017d)		2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
				Chironomus dilutus	*Hyalella azteca*	*Chironomus dilutus*	*Hyalella azteca*	*Hyalella azteca*	*Hyalella azteca*	*Hyalella azteca*	*Hyalella azteca*
				10-day survival and growth	14-day survival and growth	10-day survival and growth	14-day survival and growth	14-day survival and growth	14-day survival and growth	14-day survival and growth	14-day survival and growth
Bootjack Lake	Shallow	Reference	BOL-S	-	-	-	-	5	-	-	5
Polley Lake		Exposed	POL-S	-	-	-	-	5	-	-	5
Quesnel Lake	Shallow	Reference	QUL-LREF1	5 (5)	5 (5)	5	5	5	5	5[b]	5
		Near-field	QUL-LNF1	5 (5)	5 (5)	5	5	5	5	5[b]	5

Notes: "-" = not applicable/ not tested.

[a] Values indicate the number of stations sampled per area. Values in brackets, e.g., (x), indicate the number of replicates per station. If no value in brackets is given, the number of replicates was one per station. Only sampling areas that were monitored between in 2022 are displayed, as well as historical data for these areas.

[b] 14-day survival and growth tests were completed using two methodologies in 2021 as part of an investigation: 1) the standard static exposure methods that have been employed in all prior years; and 2) static-renewal exposure methods that differ from methods used in prior years. See Minnow 2022a for details.

3.2.3 Data Analysis

Statistical analyses for the tests were performed by Nautilus using CETIS software (Tidepool Scientific Software 2021) and included contrasts of the exposed area against laboratory controls and the matched reference area. Statistical contrasts were completed following guidance provided by Environment Canada (2005) and involved the use of an ANOVA with Dunnett's test for quantitative data that met parametric test assumptions. When nonparametric techniques were required, the data were analyzed using the Steel Many-one rank sum test. For quantile data, the Fisher Exact/Bonferroni Holm test was performed. Significant differences were determined at a significance level $\alpha = 0.05$.

Sediment toxicity test results were interpreted based on a combination of statistical contrasts and effect size by comparing exposed area results relative to both the laboratory control and reference area results. For this evaluation, results were grouped into two categories for separate tabular and graphical presentation, statistical analyses, and interpretation:

1. Shallow Polley Lake area (POL-S; exposed) compared to a shallow reference area (Bootjack Lake; BOL-S), tested using *H. azteca*.
2. Shallow exposed area of Quesnel Lake (QUL-LNF1) compared to an un-impacted shallow reference area (QUL-LREF1), tested using *H. azteca*.

Comparisons for each test endpoint were evaluated using a stepwise procedure similar to that of the Southern California Coastal Water Research Project (SCCWRP) California Sediment Quality Objectives (CASQO; Bay et al. 2014):

1. Mean responses (percent survival and growth [dry weight per surviving organism]) were expressed as a percentage of the mean laboratory control result and the mean field reference result.
2. Results of the statistical contrasts of mean responses in tests of impacted sediment against the laboratory control and the field reference sediment were compiled (i.e., the impacted area was identified as significantly different or not significantly different from the mean laboratory control result and the mean field reference result).
3. Results were categorized as follows:
    a. No unacceptable response was identified as a mean response within 20% of the mean laboratory control result and the mean field reference result (i.e., survival or growth were ≥80% of the control and field reference);
    b. Low to moderate response was identified as a mean response of between 20% and 50% of the mean laboratory control result and the mean field reference result (i.e., survival or growth were 50% to 80% of the control and field reference);

c. High (large) response was identified as a mean response of >50% of mean laboratory control result and the mean field reference result (i.e., survival or growth were <50% of the control and field reference);

1. Results that were in the low to moderate response category were subject to a further categorization step:

   a. If the “low to moderate” response did not differ statistically from the laboratory control and the field reference, it was categorized as a low response;
   b. If the “low to moderate” response differed statistically from the laboratory control and the field reference, it was categorized as a moderate response.

2. Where comparisons to mean laboratory control result and the mean field reference result did not fall into the same response category, the result was discussed relative to both the control and the field reference.

Application of a 20% reduction in survival relative to the field reference to define acceptability is consistent with thresholds used elsewhere (e.g., Suter et al. 1995; BCMELP 1998; Government of Canada 2010; Mebane 2010; Nautilus and Zajdlik 2011; Bay et al. 2014). The 20% threshold is the same as the acceptability threshold for laboratory control survival identified in the test method (i.e., a test is considered acceptable if fewer than 20% of organisms in the laboratory control die; Environment Canada 2017).

Toxicity test results were evaluated relative to *in situ* water quality measures *(*field and laboratory) and relative to results of other components of the CEMP. Control normalized survival and growth results (i.e., presented as a percentage of the average laboratory control result) were plotted over time for each exposed and corresponding reference monitoring area. Relationships between control normalized survival and growth results and supporting chemical and physical variables (i.e., sediment TOC and copper concetrations and overlying water dissolved copper concentrations [field and laboratory]) were evaluated using a simple linear regression model. Data were explored for outliers based on studentized residuals of the linear regression; data points with values > 3 were considered outliers. When outliers were identified, correlations were run with and without outliers included in the data and results of both analyses presented.

The regression analysis included all avaliable data for each monitoring area (2014 to 2022 for shallow Quesnel Lake areas, and 2019 and 2022 for shallow Polley Lake and refererence) and relationships were plotted along with the line of best fit. Statistically significant regressions were identified using an α of 0.05. All analyses were conducted using R (R Core Team 2022).

3.3 Plankton Community and Productivity

Plankton community and productivity monitoring in 2022 was completed at an exposed area in Polley Lake (POL-P2) with Bootjack Lake (BOL-B2) serving as a reference, and exposed (QUL-ZOO-1) and reference (QUL-ZOO-7) areas of Quesnel Lake (Figure 3.3, Tables 3.4 and 3.5; Appendix Table A.1.3). Monitoring was completed in June, July, and August, with each sampling event occurring at least 30 days apart. Single (n = 1) phytoplankton and zooplankton samples were collected in June and August at each monitoring area, and five replicate (n = 5) samples were collected in July at each monitoring area (Tables 3.4 and 3.5), in accordance with the CEMP (MPMC 2019). As outlined in the CEMP (MPMC 2019), the frequency of plankton community and productivity sampling is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a). It should be noted that phytoplankton productivity has been evaluated solely based on chlorophyll-a concentrations since (including 2022; see Minnow 2021a for details).

Sample collection and analysis methods for 2022 are described herein. For details pertaining to prior sampling years, refer to the references listed in Tables 3.4 and 3.5.[10]

3.3.1 Sample Collection

3.3.1.1 Phytoplankton

Phytoplankton sampling was completed in June (n=1 per area), July (n=5 per area), and August (n=1 per area) 2022 and included the collection of community composition and productivity (chlorophyll-a) samples (Table 3.4; Appendix Table A.1.3).

Phytoplankton samples were collected using a depth-integrated tube water sampler that is weighted at the bottom. The depth-integrated sampler (length ~13 m) enables collection of water and phytoplankton throughout the photic zone (the upper layer of the water column receiving light penetration). Depth-integrated samples were collected using nearly the full length of the tube whenever station depth is greater than 12 m, or only a portion of the tube in areas < 12 m deep (Appendix Table A.1.3) to prevent collection of sediment or water from the sediment-water interface. To collect one sample, the weighted end of the plastic tubing was lowered to the required sampling depth, the hose was crimped, and the depth-integrated sampler was pulled to the surface with the hose remaining crimped the entire time.

[10] Minnow has completed interpretive reporting for plankton community and productivity monitoring data collected since 2018 (Minnow 2019a, 2020a, 2021a, 2022a) and has completed monitoring implementation since 2019 after providing monitoring program design modifications (Minnow 2019c) at the request of MPMC. A complete description of historic plankton sampling activities was included in Minnow (2019a) and the modified monitoring program design was included in the approved CEMP (MPMC 2019).

590,000 595,000 600,000 605,000 610,000 615,000 620,000

5,825,000

5,820,000

5,815,000

Frypan Lake
Cedar Creek
Spanish Lake
Nina Lake
Horsefly Lake Forest Service Road
POL-P1
Polley Lake
Mount Polley Mine Perimeter
BOL-B1
Bootjack Lake
POL-P2
BOL-B2
BOL-B2
Boswell Lake
Winkley Creek Road
Bootjack Creek
Bootjack Creek Dam
QUL-ZOO-1
WTP
QUL-18
Tailings Storage Facility (TSF)
QUL-58
Diffuser 1
Diffuser 2
Quesnel Lake
QUL-120A
Hazeltine Creek
QUL-2a
QUL-ZOO-7
Gavin Lake Road
Edney Creek
Edney Lake Road
Horsefly Bay
Horsefly River

590,000 595,000 600,000 605,000 610,000 615,000 620,000

LEGEND

- Exposure
- Reference
- Routine Water Monitoring Station
- Diffuser (Treated Effluent Discharge, December 2015 to present)
- Water Treatment Plant (WTP)
- Central Collection Sump
- Effluent Discharge Pipeline (January 2018 to present)
- Discharge to Diffusers (2015 to present)
- Historic Watercourse

[a]Monitoring at each plankton monitoring area included at least one of: phytoplankton community and productivity, zooplankton community and productivity, and zooplankton tissue chemistry. See Tables 3.4, 3.5 and 3.6 for details of monitoring components.

Note: Bathymetry is displayed in meters.

0 1 2 4 Km

Projection: North American Datum 1983 UTM Zone 10U
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N W E S

Plankton and Supporting Water Quality Monitoring Areas, Polley, Bootjack, and Quesnel Lakes, 2022[a]

Date: January 2023
Project 227202.0029

minnow environmental inc.

Figure 3.3

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 5\22-29 Figure 3.3 Plankton and WQ Monitoring.mxd

Table 3.4: Overview of Phytoplankton Community and Productivity Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 1995 to 2022[a]

Waterbody	Area Type	Area Code	Component	Baseline		Post-Breach														
				1995 (HKP 1996)	1996 (HKP 1997a)	2015 (Golder 2016a)	2016	2017	2018 (Minnow 2019a)	2019[b] (Minnow 2020a)			2020 (Minnow 2021a)			2021 (Minnow 2022a)			2022		
										June	July	August	June	July	August	June	July	August	June	July	August
Polley Lake	Exposed	POL-P2	community	7	5	6	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			chlorophyll-a	9	5	4	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
	Reference	BOL-B2	community	9	6	-	-	-	-	1	5	1	1	5	1	1	5	1	1	5	1
			chlorophyll-a	4	6	-	-	-	-	1	5	1	1	5	1	1	5	1	1	5	1
Quesnel Lake	Exposed	QUL-ZOO-1	community	-	-	-	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			chlorophyll-a	-	-	-	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
	Reference	QUL-ZOO-7	community	-	-	-	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			chlorophyll-a	-	-	-	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1

Notes: "-" = not applicable; data from 2015 to 2018 were provided in electronic form to Minnow from the Mount Polley Mine database. References are not displayed for data from 2016 and 2017 because these data were not contained in a specific report (to Minnow's knowledge) and these data were provided by MPMC to Minnow as a Microsoft Excel file.

[a] Values indicate the number of samples collected per area per year or month. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Phytoplankton sampling in 2019 was performed at all areas using two methodologies (surface grab and depth-integrated sampler) to facilitate a statistical comparison of methods

Table 3.5: Overview Zooplankton Community and Productivity Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 1995 to 2022[a]

Waterbody	Area Type	Area Code	Component	Baseline		Post-Breach																	
				1995 (HKP 1996)	1996 (HKP 1997a)	2014 (Golder 2017a)	2015 (Golder 2017a)	2016 (Golder 2017a)	2017 (Golder 2017a)	2018 (Minnow 2019a)	2019[b] (Minnow 2020a)			2020 (Minnow 2021a)			2021 (Minnow 2022a)			2022		
											June	July	August	June	July	August	June	July	August	June	July	August
Polley Lake	Exposed	POL-P2	community	5	5	-	5	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			biomass	-	-	-	-	-	-	-	1	5	1	1	5	1	1	5	1	1	5	1
	Reference	BOL-B2	community	6	6	-	-	-	-	-	1	5	1	1	5	1	1	5	1	1	5	1
			biomass	-	-	-	-	-	-	-	1	5	1	1	5	1	1	5	1	1	5	1
Quesnel Lake	Exposed	QUL-ZOO-1	community	-	-	8	5	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			biomass	-	-	8	5	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
	Reference	QUL-ZOO-7	community	-	-	5	5	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1
			biomass	-	-	5	5	2	2	2	1	5	1	1	5	1	1	5	1	1	5	1

Notes: "-" = not applicable. Data from 2014 to 2018 were provided in electronic form to Minnow from the Mount Polley Mine database.

[a] Values indicate the number of samples collected per area per year or month. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Analysis of zooplankton samples from Quesnel Lake was performed using two mesh sizes (50 µm and 150 µm) to facilitate comparison to historical samples collected using 150 µm mesh size. See (Minnow 2020a) for details.

The weighted end was then placed into a clean plastic pail and the crimped end was released allowing the water to flow into the clean bucket.

Upon retrieval of the depth-integrated sample into the clean bucket, *in situ* water measurements were immediately taken with a YSI EXO™ (see Section 3.8.1). Phytoplankton and water samples were then taken by decanting water from the bucket into appropriate sample bottle(s), and samples were preserved and stored as follows. Samples for phytoplankton community composition were decanted into an opaque 250 mL plastic bottle and then preserved using Lugol's solution, which was added using an eyedropper until the sample colour was like that of weak tea, mixed thoroughly and stored in a cool dark environment prior to shipment to the laboratory for analysis. Samples for chlorophyll-a were decanted into an opaque 250 mL plastic bottle and supporting water samples were decanted into pre-cleaned routine water quality sample bottles and preserved as required. Routine water quality samples were kept on ice in the field and refrigerated until being shipped (on ice) to the analytical laboratory. Duplicate (split) routine water quality and chlorophyll-a samples were collected at a target frequency of 10% for QA/QC purposes Appendix Table A.1.3.

Water collected for phytoplankton chlorophyll-a was kept cool until same-day filtration as follows.[11] A measured volume of sample was decanted into the vacuum filter apparatus and filtered through 0.45 µm pore diameter Whatman mixed cellulose ester (MCE) filter paper. The filter paper (containing sample) was then placed into a labeled opaque centrifuge tube and frozen until shipment (on ice) to the analytical laboratory. All filter apparatus equipment was rinsed with distilled water between each sample.

Supporting *in situ* water quality depth profiles were recorded at every area (n=1) and Secchi depth was measured at every station (n=1 per area in June and August, n=5 per area in July; Appendix Table A.1.3; see Section 3.8.1 for description of supporting measures collection).

3.3.1.2 Zooplankton

Zooplankton sampling was carried out concurrently with phytoplankton sampling in June (n=1 per area), July (n=5 per area), and August (n=1 per area) 2022 and included collection of samples for assessment of community composition and productivity (Table 3.5; Appendix Table A.1.3).

Samples were collected using a using a 30 cm diameter, 90 cm long, zooplankton haul net with a 0.5 m diameter mouth opening and 50 µm Nitex mesh. Zooplankton community samples were

[11] Chlorophyll-a samples collected during the August sampling event could not be field-filtered due to a sampling supply shortage. These samples refrigerated until shipment on ice to the analytical laboratory where they were filtered prior to analysis.

collected by lowering the zooplankton haul net to ~2 m above the lake bottom, then retrieving the net vertically through the water column at a rate of ~0.5 m/sec. (a single vertical haul). Each zooplankton sample consisted of a single vertical haul.[12] Haul depths differed among lakes based on lake depth (~2 m less than bottom depth), with hauls beginning at a 33 m depth in Quesnel Lake, at ~26 m in Polley Lake, and at ~16 m in Bootjack Lake (Appendix Table A.1.3).

Upon retrieval, material on the inside of the net was rinsed into the cod end by lifting the net in and out of the water without submerging the mouth of the net. Sample material was then rinsed from the cod end of the net into a 250 mL plastic bottle using a squeeze bottle filled with filtered water. Samples were then preserved with buffered formalin solution to a nominal concentration of 4%. Preserved samples were stored in a dark, cool place prior to shipment to the laboratory for taxonomic analysis.

Supporting measures collected included those outlined above for phytoplankton sample collection (Section 3.3.1.1; Appendix Table A.1.3; see Section 3.8.1 for description of supporting measures collection).

3.3.2 Laboratory Analysis

3.3.2.1 Phytoplankton

3.3.2.1.1 Community

Phytoplankton samples were sent to Biologica Environmental Services Ltd. (Victoria, BC) for taxonomic identification and enumeration. Upon arrival, samples were examined, and additional Lugol's preservative was added (if required) to ensure adequate preservation. An inventory form was created and verified with the Chain of Custody (COC) to ensure that all

[12] The CEMP approval amendment letter from ENV (dated July 15, 2019; BCMOECCS 2019b) stipulated that zooplankton samples must be collected using a modified horizontal tow method; which is a condition that applies to all zooplankton sample collection. This was not the intent of the plankton program recommendations provided by Minnow (dated May 28, 2019; Minnow 2019c) which included the use of different plankton tow methods for the collection of: 1) zooplankton productivity and community samples, and 2) zooplankton tissue chemistry samples. Minnow maintains that zooplankton productivity and community samples should be collected using a vertical tow method only (consistent with the recommendations provided by Minnow in May 2019; Minnow 2019c). A modified horizontal tow method was not recommended for the collection of zooplankton community samples for two reasons. Firstly, zooplankton samples for community analysis have previously been collected by a single vertical tow. Changing the collection method for this sample type to a modified horizontal tow would limit comparability with previously collected data. Secondly, it is difficult to ensure that the sampling net ascends through the water column at a constant speed when conducting a horizontal tow. Since zooplankton community composition differs through the water column, variability in the amount of time that the net samples a given depth during a horizontal tow could influence the community results. Use of a vertical tow method eliminates this consideration entirely. Following consultation with MPMC regarding the above rationale and the best methodological approach to implement, Minnow collected zooplankton community and productivity samples using a vertical haul methodology between 2019 and 2022. For a comparison of zooplankton community and productivity samples collected using both vertical and modified horizontal haul methodologies, see Minnow (2020a).

samples were accounted for, and each sample had the appropriate number of jars as indicated on the COC.

For processing, plankton community samples were first thoroughly mixed by shaking the sample container and sub-samples (50 to 100 mL), then were dispensed into Utermöhl settling chambers and allowed to settle for 36 to 48 hours, depending on sub-sample volume. Sub-samples were then systematically scanned using a Zeiss Axio Vert A.1 inverted phase contrast microscope at 400x magnification. All algal cells were counted in a series of randomly located field of view (FOV) until a minimum of 300 algal units were identified and enumerated. Algal units represent single cells of all algal groups, as well as colonies or filaments of blue-green algae. Given that blue-green algal colonies and filaments may contain hundreds of cells, enumerating units (rather than individual cells) allows for a more equal representation of algal groups. The mean number of cells per unit (1 for single cells, >1 for all other algal forms) were estimated for all taxa and used to calculate total densities. Only "viable" cells (those that appeared to be alive at the time of collection) were identified and enumerated. *Chrysophyte loricas*, cellulose cups formed by some chrysophyte species, were also counted (USEPA 2010).

Phytoplankton were identified to genus, where possible, following the most up-to-date taxonomic references and collaborations with international and local algal taxonomic experts. Species-level identifications were only given to identifiable taxa for which there are reliable taxonomic references available that encompass the species-level morphological diversity in North America. This approach ensures long-term consistency of data sets and is in accordance with the trend in algal taxonomic practice to be more conservative with delineation of species. Species-level identifications for some taxa are problematic due to widespread phenotypic plasticity that can artificially inflate species richness (Wehr et al. 2015). When applicable, the terms "cf." (*confertim*, possibly for species) and "sp.1", "sp. 2", etc. (a single undetermined species) were employed to distinguish between different species in the same genus.

Taxa were grouped according to their major ecological groupings (e.g., Diatoms, Cyanobacteria, etc.). Data were reported as density (cells per liter) for each taxon, for each ecological grouping, and as total density at each station. Laboratory QA/QC included evaluation of sub-sampling accuracy on at least 10% of samples. Data were provided to MPMC and Minnow as a Microsoft Excel spreadsheet along with a methods and QA/QC report as an Adobe Acrobat PDF file (Appendix G).

3.3.2.1.2 Productivity

Phytoplankton chlorophyll-a analysis was completed by ALS Environmental (Burnaby, BC). Upon receipt, ALS Environmental measured the internal temperature of shipping coolers to verify

the integrity of samples, logged each sample, and assigned each sample a unique identification code. A sample receipt confirmation was then sent to Minnow and MPMC. Samples were laboratory filtered if required (i.e., for samples collected in August; see Section 3.3.1.1) prior to analysis of chlorophyll-a followed procedures adapted from USEPA Method 445.0 (USEPA 1997) Chlorophyll-a concentrations were determined by routine acetone extraction followed by fluorescence detection using a non-acidification procedure, a method that is not subject to interferences from chlorophyll-b.

Laboratory QA/QC included reagent blanks and laboratory accuracy measures (i.e., laboratory control samples). Upon completion of the analyses, a data report was provided by ALS to MPMC and Minnow as an Adobe Acrobat PDF file and a Microsoft Excel spreadsheet (Appendix G).

3.3.2.2 Zooplankton

3.3.2.2.1 Community

Zooplankton community samples were sent to Biologica Environmental Services Ltd. (Victoria, BC) for taxonomic analysis. The sample receipt procedure was as described above for phytoplankton (Section 3.3.2.1.1). Samples were transferred from their formalin solution into 70% ethanol and assigned a unique identification number.

The zooplankton community samples were processed through a 45 µm screen and analyzed in two fractions as follows:

1. A “coarse” fraction comprised of Cladocera, adult Copepoda, and copepodids, in which a minimum count of 200 organisms was obtained; and
2. A “fine” or “micro” fraction, in which Copepod Nauplii and Rotifera were identified and enumerated. Processing of the micro fraction was completed to either a 100-count or a minimum of three sub-samples.

The coarse fraction was analyzed in a Bogorov tray through a stereo microscope at 10-40x magnification and the micro fraction was analyzed using a 1-mL Sedgewick-Rafter counting chamber. Sub-sampling for all fractions was performed using Hensen-Stempel pipettes. Generally, subsamples were 1/10th of total sample volume for the coarse fraction and 1/100th for the micro fraction. Organisms were identified by taxonomic experts to the lowest practicable taxonomic level (LPL)[13] using a compound microscope (100–400x magnification),

[13] The term “Lowest Practical Level” is commonly used to describe the level of resolution for taxonomic identification (often relating to benthic invertebrate taxonomy; e.g., Environment Canada 2012b). However, the term “Lowest Practicable Level" (e.g. Carter and Resh 2001; Bailey et al. 2001) has been used throughout this report because it is a

appropriate dissection tools, and standard taxonomic references. Crustacean zooplankton were identified to species wherever possible, although this was not possible for immature copepods that lack differentiating features required for identification beyond order (e.g., Calanoida, Cyclopoida, or Harpacticoida). For Copepoda, the stage of development was recorded as Nauplii or copepodite stages I-V as was the sex for mature individuals (copepod stage VI). Rotifera were identified to the genus level. All identifications were performed using taxonomic references and collaborations with external experts, where necessary.

Laboratory QA/QC included evaluation of sub-sampling accuracy on at least 10% of samples. Data were provided to Minnow as a Microsoft Excel spreadsheet (Appendix G).

3.3.2.2.2 Productivity

Zooplankton productivity was evaluated as biomass values derived from biovolume estimates based on cell measurements performed by Biologica Environmental Services Ltd. Biomass calculations were performed for the seven most dominant zooplankton taxa by measuring at least five to 10 specimens of each taxon and applying length/weight regression formulae (USEPA 2003). Biomass estimates were presented as total wet weight (ww) and dry weight (dw) values derived from per-sample abundances. Data were provided to Minnow as a Microsoft Excel spreadsheet (Appendix G).

3.3.3 Data Analysis

3.3.3.1 Phytoplankton

Upon receipt of the analytical data, a DQR was performed, including an examination of data completeness, formulae checks, and evaluation of percent agreement of laboratory sub-sampling accuracy samples (see Appendix B).

3.3.3.1.1 Community Metrics

Phytoplankton community data were evaluated in terms of total density (cells/L), taxon richness (# of taxa), Simpson's Diversity and Evenness (calculated as in Smith and Wilson 1996; Environment Canada 2012b), and the relative density (%) and cell densities of major ecological groups (cells/L). These endpoints were calculated at the LPL of taxonomy. Phytoplankton community results at the LPL taxonomy level can contain a mixture of taxonomic levels (e.g., species, family, order, and phylum), which can affect the calculation of metrics such as taxon richness and Simpson's Diversity and Evenness. To address this issue, a series of decision criteria were applied to the data to reassign taxon abundance across levels of

more accurate description of the taxonomic decision (the term "practicable" implies the level of identification that is attainable).

taxa, while conserving the relative abundances within the higher taxon levels (see Appendix E.2 text for details). For the calculation of relative densities (%) of major phytoplankton groups, taxa were grouped as Diatoms, green algae (Chlorophytes), blue-green algae (Cyanobacteria), golden algae (Chrysophytes and Cryptomonads), Dinoflagellates, and Euglenophytes, and the densities and relative densities of all groups were determined for each sample. Phytoplankton productivity was evaluated using chlorophyll-a concentrations (µg/L).

Phytoplankton community and productivity metrics were calculated for each monitoring area in each year and were summarized by area and year using the following statistics: sample size, mean, median, minimum, maximum, and SD (where replicate data were available).

3.3.3.1.2 Statistical Analyses

Statistical analyses of phytoplankton community and productivity data were conducted to answer the following questions:

1. Are there differences in phytoplankton community and productivity between the exposed and reference areas in 2022?
2. Has the phytoplankton community and productivity of exposed areas changed among years (2019 to 2022) relative to changes at reference areas over this time?

To answer these questions, data were grouped into two categories for the separate calculation of community metrics, tabular and graphical presentation, and statistical analyses:

1. Polley Lake (POL-P2) compared to reference (Bootjack Lake; BOL-B2).
2. Quesnel Lake exposed area (QUL-ZOO-1) compared to an un-impacted reference (QUL-ZOO-7).

Phytoplankton data cannot be pooled across different sampling events due to high variability among seasons. As such, statistical analyses focused on replicate samples (n=5) collected in July, as per the CEMP (MPMC 2019). Results of single samples collected in June and August were interpreted without the use of formal statistical contrasts.

Statistical comparisons of data from July 2019 to 2022 were conducted as two--way ANOVAs with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year*. If the *Area*×*Year* interaction term was significant, all pairwise contrasts were evaluated. If the interaction term was not significant but the *Area* term was significant, pairwise contrasts were conducted between areas pooling years; if the *Year* term was significant, pairwise contrasts were conducted between years pooling areas. Pairwise contrasts were evaluated using Sidak correction to account for multiple comparisons. Regardless of which overall ANOVA terms were significant, Magnitudes of Difference (MOD) were calculated based on Measures of

Central Tendency (MCT) of individual samples described below. The results of the multiple comparisons were displayed by assigning letters (e.g., A, B, C) to each unique combination of year and method.

Prior to analysis, the assumptions of normality and homogeneity of variances were tested on the residuals of the two-way ANOVA model using the Shapiro-Wilk test and Levene's test based on median values, respectively using α=0.05. Data were transformed as necessary to satisfy assumptions of normality and homogeneity of variance (log_{10}, $log_{10}(X+1)$ when zeros were present in the data). In instances where the residuals of the ANOVA model did not meet the assumptions of normality and homogeneity of variances, the analysis was conducted on ranks (equivalent to a non-parametric test).

MOD between the exposed area and reference area was calculated as:

$$MOD = \frac{MCT_{Exposed} - MCT_{Reference}}{SD_{Pooled}}$$

MOD between years was calculated as:

$$MOD_{Year} = \frac{MCT_{Year} - MCT_{Baseline\ Year}}{SD_{Pooled}}$$

where MCT is the Measure of Central Tendency (mean for untransformed data and geometric mean for log_{10}-transformed data) and the SD is the pooled standard deviation from the ANOVA model. The effect size calculations were conducted on the transformed scale when the data were transformed for analysis. When the analysis was done on the rank--transformed scale, the observed effect size was estimated using median values instead of means, and the Median Absolute Deviation (MAD) instead of SD:

$$MAD = median(|x_i - median(dataset)|)$$

where x_i is each observation in the dataset and $|f(x)|$ is the absolute value of $f(x)$.

All statistical comparisons were conducted using R (R Core Team 2022). Statistically significant differences in phytoplankton community between areas were identified using an α of 0.1 (as used for evaluation of all biological data in this report). Significant differences with a MOD that exceeded ±2 SD/MAD were further identified as potentially ecologically meaningful in both statistical analyses results and in data interpretation (Environment Canada 2012b[14]).

[14] Environment Canada (2012b) identifies a critical effect size (CES) of ± 2 SDs for evaluating ecologically meaningful changes in benthic invertebrate community. This criterion has been applied here to the interpretation of phytoplankton community.

Total phytoplankton density (cells/L), taxon richness, and chlorophyll-a concentrations were plotted as time-series figures comparing sampling areas over time (including all seasonal data from baseline, where applicable, to present). Proportional densities (%) and densities of major phytoplankton groups were plotted from 2019 to 2022 as stacked bar charts. Phytoplankton community metrics from July 2019 to 2022 only were also plotted to support the two-way ANOVA results. Untransformed data were plotted for ease of interpretation and plots were generated using R (R Core Team 2022). Historic phytoplankton proportional density data had low comparability with 2019 to 2022 data due to changes in taxonomist and were therefore excluded from plots (see Minnow 2019a for details regarding the previous taxonomist and data limitations that affect comparability).

3.3.3.2 Zooplankton

Upon receipt of the analytical data, a DQR was performed, including an examination of data completeness, formulae checks, and evaluation of percent agreement of laboratory sub-sampling accuracy samples (see Appendix B).

3.3.3.2.1 Community Metrics

Zooplankton community data were evaluated in terms of total density (# of organisms/L), taxon richness (# of taxa), Simpson's Diversity and Evenness (calculated as in Smith and Wilson 1996; Environment Canada 2012b), and the relative abundance (%) and organism densities (# of organisms/L) of major ecological groups. Zooplankton endpoints were calculated at the LPL of taxonomy. Zooplankton community results at the LPL taxonomy level can contain a mixture of taxonomic levels, which can affect the calculation of metrics such as taxon richness and Simpson's Diversity and Evenness. To address this issue, a series of decision criteria were applied to the data to reassign taxon abundance across levels of taxa, while conserving the relative abundances within the higher taxon levels (see Appendix E.2 text for details). Zooplankton data were converted from per-sample abundance values to volumetric density values (# of organisms/L) by dividing total densities by the volume of water through which the net passed (see Appendix E.2 text for details). For the calculation of relative abundance (%) of major zooplankton groups, taxa were grouped as Calanoida, Cyclopoida, Cladocera, and Rotifera, with Copepoda Nauplii (the earliest juvenile stage of Copepoda) left as their own grouping. Zooplankton productivity was evaluated using dry weight biomass (mg/L).

Zooplankton community and productivity metrics were calculated for each monitoring area in each year and were summarized by area and year using the following statistics: sample size, mean, median, minimum, maximum, and SD (where replicate data were available).

3.3.3.2.2 Statistical Analyses

Zooplankton community data were evaluated to answer the following questions:

1. Are there differences in zooplankton community and productivity between exposed and reference areas in 2022?
2. Has the zooplankton community and productivity of exposed areas changed among years (2019 and 2022) relative to changes at reference areas over this time?

To answer these questions, data were grouped into two categories for the separate calculation of community metrics, tabular and graphical presentation, and statistical analyses:

1. Polley Lake (POL-P2) compared to reference (Bootjack Lake; BOL-B2).
2. Quesnel Lake exposed area (QUL-ZOO-1) compared to an unimpacted reference (QUL-ZOO-7).

Methods for replicate analysis, data pooling, statistical analyses, presentation of historic data, and current limitations of data for temporal statistical analyses of zooplankton data are the same as those outlined for phytoplankton in Section 3.3.3.1.2, with the one exception that dry weight biomass served as the measure of productivity in both statistical analyses and plots.

3.4 Zooplankton Tissue Quality

Zooplankton tissue quality monitoring in 2022 was completed at an exposed area in Polley Lake (POL-P2) with Bootjack Lake (BOL-B2) serving as a reference, and an exposed (QUL-ZOO-1) and a reference (QUL-ZOO-7) area of Quesnel Lake (Figure 3.3, Table 3.6; Appendix Table A.1.3). Monitoring was completed in June, July, and August, with each sampling event occurring at least 30 days apart (Appendix Table A.1.3). Single (n=1) zooplankton tissue quality samples were collected in June and August at each monitoring area and five replicate (n = 5) samples were collected in July at each monitoring area (Table 3.6), in accordance with the CEMP (MPMC 2019). As outlined in the CEMP (MPMC 2019), the frequency of zooplankton tissue quality sampling is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a).

Sample collection and analysis methods for 2022 are described herein. For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Table 3.6.[15]

[15] Minnow has completed interpretive reporting for plankton community and productivity monitoring data collected since 2018 (Minnow 2019a, 2020a, 2021a, 2022a) and has completed monitoring implementation since 2019 after providing monitoring program design modifications (Minnow 2019c) at the request of MPMC. A complete description of historic plankton sampling activities was included in Minnow (2019a) and the modified monitoring program design was included in the approved CEMP (MPMC 2019).

Table 3.6: Overview of Zooplankton Tissue Chemistry Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 2014 to 2022[a]

Waterbody		Area Type	Area Code	2014[b] (Golder 2017a)	2015[c] (Golder 2017a)	2016[c] (Golder 2017a)	2017[c] (Golder 2017a)	2018[c] (Minnow 2019a)	2019[d] (Minnow 2020a)	2020[d] (Minnow 2021a)	2021[d] (Minnow 2022a)	2022[d]
				September to December	May to September	Early and Late Season	Early and Late Season	Early and Late Season	June to August	June to August	June to August	June to August
Polley Lake	South Basin	Exposed	POL-P2	-	4	2	2	2	3	3	3	3
Bootjack Lake		Reference	BOL-B2	-	-	-	-	-	3	3	3	3
Quesnel Lake	Central West Arm	Exposed	QUL-ZOO-1 (ZP 2, 4, 6, 9, 12, 15, 18, 21)	8	5	2	2	2	3	3	3	3
	Near Cariboo Island	Reference	QUL-ZOO-7 (ZP 8, 11, 14, 17, 20)	5	5	2	2	2	3	3	3	3

Notes: "-" = not sampled, "ZP" = zooplankton. In 2014, QUL-ZOO-1 and QUL-ZOO-7 were reported as ZP stations. Data from 2014 to 2018 were provided in electronic form to Minnow from the Mount Polley Mine database.

[a] Values indicate the number of samples collected per area per year. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Values represent the number of single samples that were collected over the four month period.

[c] Values represent the number of months for which single samples were collected.

[d] Values represent the number of months for which samples were collected. Single samples were collected in June and August; five replicate samples were collected in July.

3.4.1 Sample Collection

Zooplankton tissue quality samples were collected in June (n =1 per area), July (n = 5 per area), and August (n=1 per area; Appendix Table A.1.3), 2022, using methods largely consistent with the CEMP (MPMC 2019). [16]

Zooplankton tissue samples were collected using a 30 cm diameter, 90 cm long, zooplankton haul net with a 0.5 m diameter mouth opening and 50 µm Nitex mesh. Sampling in Polley Lake (POL-P2) and Bootjack Lake (BOL-B2) was completed using the vertical haul method described in Section 3.3.1.2, with a maximum start depth of approximately 22 to 26 m in Polley Lake and 10 to 16 m in Bootjack Lake (Appendix Table A.1.3). Vertical hauls were completed until a sufficient sample weight was obtained (minimum 1.5 g wet weight).

Zooplankton tissue quality samples were collected from Quesnel Lake (QUL-ZOO-1 and QUL-ZOO-7) by completing a single modified horizontal haul at each area[17]. Each horizontal haul was completed by lowering the net to a start depth of 33 m and then towing the net through the water column for a set time (e.g., 4 to 10 minutes; Appendix Table A.1.3) while slowly retrieving the net to the surface.

Upon retrieval of each vertical or horizontal haul, the plankton net was rinsed towards the cod end to concentrate the sample. Excess water was decanted through the mesh of the cod end or the net, and the remaining sample was transferred into a pre-labelled plastic scintillation vial using a scoopula. Duplicate (split) sediment samples were collected at a target frequency of 10% for QA/QC purposes. Immediately after collection, samples were stored in a cooler with ice packs until being frozen prior to shipment (on ice) to the analytical laboratory.

Supporting measures included one vertical depth profile of *in situ* water quality measures and one supporting depth-integrated water quality sample collected from each area during each

[16] Zooplankton tissue quality samples were historically collected using multiple vertical hauls until a sufficient sample weight was obtained. Due to the low productivity in Quesnel Lake, this process was labour-intensive for Quesnel Lake. Therefore, Minnow recommended substitution of the vertical tow method for a modified horizontal tow method in Quesnel Lake to decrease the time required to collect sufficient sample material. Minnow recommended the continuation of vertical haul methods in Polley Lake (Minnow 2019c). The modified horizontal tow method for the collection of zooplankton tissue quality samples from Quesnel Lake was incorporated into the CEMP approval amendment letter from ENV (dated July 15, 2019; BCMOECCS 2019b). However, the letter stipulated that all zooplankton samples must be collected using the modified horizontal tow method. This methodology was only recommended for use in Quesnel Lake (not Polley or Bootjack Lakes) and specifically for zooplankton tissue quality sample collection for the reasons outlined above (Minnow 2019c). Minnow maintains that the use of a vertical tow method for the collection of zooplankton tissue quality samples is suitable for Polley and Bootjack lakes and has implemented this methodology in 2019 to 2022. The haul method used (vertical or horizontal) does not affect the characteristics of the resulting zooplankton tissue quality sample; only the time associated with sample collection.

[17] Modified horizontal tow methods were consistent with those approved by ENV (as part of the plankton program amendments in July 2019) and incorporated into the CEMP (MPMC 2019).

sampling event (see Section 3.3.1.1 for depth-integrated sample collection methods). See Section 3.8.1 for a description of supporting measures collection.

3.4.2 Laboratory Analysis

Laboratory analysis of zooplankton tissue quality samples was completed by ALS Environmental in Burnaby BC. Upon receipt of the sample shipment(s), ALS Environmental measured temperature in each cooler to verify the maintenance of cold samples, logged each sample, and assigned each sample a unique sample identification code. A SRN was then sent to MPMC and Minnow for verification.

Laboratory analysis of zooplankton tissue quality samples included metals by CRC-ICP-MS (USEPA Method 6020B; USEPA 2014), mercury by CVAAS (USEPA Methods EPA 200.2/1631E; USEPA 1994, 2001), and moisture content. Laboratory QA/QC included MB samples, laboratory duplicates, and laboratory accuracy measures (i.e., laboratory control samples and/or internal reference materials). Upon completion of the analyses, a data report was provided by ALS to MPMC and Minnow (Appendix G).

3.4.3 Data Analysis

Upon receipt of the initial analytical data, a DQR was completed, including an examination of data completeness, LRLs achieved, laboratory precision, laboratory accuracy, and field precision (Appendix B).

Data analysis of zooplankton tissue quality results focused on replicate samples (n=5) collected in July of each year (2019 to 2022). Results of single (n=1) samples collected from 2014 to 2019 were interpreted without the use of formal statistical contrasts. Zooplankton tissue quality data from each sampling event in 2022 (June, July, and August) were screened against the British Columbia selenium guideline for the protection of aquatic life (for invertebrate tissue) of 4 milligrams per kilogram dry weight (mg/kg dw; BCMOE 2014). Replicated zooplankton tissue quality data (i.e., collected in July) were summarized by area by calculating sample size, mean, SD, minimum, median, and maximum. Summary statistics were calculated using the K-M method as described in Section 3.8.3.1.

Statistical analyses of metal concentrations in zooplankton tissues were conducted using replicated data (i.e., data from July 2019 to 2022) to answer the following questions:

1. Have mean analyte concentrations at the exposed area changed relative to the reference area?[18]

[18] I.e., has the ratio of concentrations (exposed:reference) changed over time?

2. Are there differences in mean analyte concentrations between exposed and reference areas, and does the difference depend on year?

To answer these questions, data were grouped into two categories for separate tabular and graphical presentation and statistical analyses:

1. Polley Lake (POL-P2; exposed) compared to Bootjack Lake (BOL-B2; reference).
2. Quesnel Lake exposed area (QUL-ZOO-1) compared to an un-impacted reference (QUL-ZOO-7).

Question 1 was answered by conducting a two-way ANOVA assessing the exposed:reference ratios of results, with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year.* The two-way ANOVA model was conducted assuming data were log distributed, and thus differences between the exposed and reference areas were multiplicative when testing the significance of the interaction between *Area* and *Year* (i.e., if the concentration in the reference area decreases by 50%, then the null hypothesis would be that the concentration in the exposed area also decreases by 50%). Due to the prevalence of analyte results which were below the LRL, the two-way ANOVA was completed with Maximum Likelihood Estimation (MLE) using a censored regression, assuming a lognormal distribution. If the *Area*×*Year* interaction term was significant (α = 0.05), then the ratios of the concentrations from the exposed area to the reference area differed among years. In this case, pairwise contrasts among years were completed to compare the relative difference in means (in log-units) between areas among years. To address question 1 the hypotheses tested were:

$$H_0: \left(\mu_{\text{Exposed}} - \mu_{\text{Reference}}\right)_i = \left(\mu_{\text{Exposed}} - \mu_{\text{Reference}}\right)_j \text{ for all years i, j, i} \neq \text{j}$$

The contrasts were completed for all pairwise comparisons among years. The analysis assumed data were log distributed so the hypothesis of testing differences between means is equivalent to testing the ratios of exposed to reference concentrations on the untransformed scale because of the following property of logarithms:

$$log\left(x_{\text{Exposed}}\right) - log\left(x_{\text{Exposed}}\right) = log\left(\frac{x_{\text{Exposed}}}{x_{\text{Reference}}}\right).$$

The results of the multiple comparisons among years were displayed by assigning letters (e.g., A, B, C) to each year. Letters were assigned such that the year with the highest ratio of exposed:reference was assigned the letter “A” and years that do not differ significantly (α = 0.05) share a letter. When the *Area*×*Year* interaction term was not significant (α = 0.05), the differences between areas were consistent among years and no relative contrasts were conducted.

Temporal changes in the ratio of exposed:reference were quantified by calculating a MOD, which is the difference between the value for the exposed area and the predicted value for the exposed area, assuming the same ratio (i.e., exposed:reference) from the baseline year (the first year the data were collected). This MOD was expressed as a percent change as:

$$MOD = \frac{exp\hat{}\bar{x}_{Exposed\ Observed} - exp\hat{}\bar{x}_{\text{Exposed }Predicted}}{exp\hat{}\bar{x}_{\text{Exposed }Predicted}} \times 100\%$$

where $\bar{x}_{Exposed\ Observed}$ is the mean for the exposed area (in log units) for the given year and $\bar{x}_{\text{Exposed }Predicted}$ is the predicted mean (log units), assuming the relative difference between the exposed area and reference area did not change from the baseline year (i.e., $\bar{x}_{\text{Exposed }Predicted} = \bar{x}_{\text{Reference}} + \left(\bar{x}_{\text{Exposed B}aseline} - \bar{x}_{\text{Reference B}aseline}\right)$).

Question 2 was answered using the results of the two-way ANOVA. When the *Area*×*Year* interaction term was significant (α = 0.05), contrasts were conducted for each year to compare the exposed and reference areas. When the *Area*×*Year* interaction term was not significant, (i.e., the difference between areas did not depend on year) the area comparison was assessed using the *Area* term of the two-way ANOVA. The MOD between the exposed area and reference area was calculated in each year as:

$$MOD = \frac{exp\hat{}\bar{x}_{Exposed} - exp\hat{}\bar{x}_{\text{Reference}}}{exp\hat{}\bar{x}_{\text{Reference}}} \times 100\%$$

where $\bar{x}_{Exposed}$ and $\bar{x}_{Reference}$ are the exposed and reference area means (in log units), respectively. When the interaction term was not significant the MOD between reference and exposed areas was calculated across all years combined.

Statistical comparisons were completed for all available analytes; however, data interpretation focused on primary and secondary analytes (see Table 2.4). Plots of data from July 2019 to 2022 that support the two-way ANOVA were presented for primary and secondary analytes that: 1) had a significant *Area* × *Time* interaction in the analyses; and 2) lacked a significant *Area* × *Time* interaction in the analyses but had a positive MOD (i.e., exposed concentrations were significantly higher than reference and the difference did not depend on year). Concentrations of primary and secondary analytes from all seasons from 2014 to 2022 were also plotted to allow qualitative comparison among seasons and qualitative temporal comparison of results. Years with more than 50% of the data reported below the LRL for any given year were excluded from the analysis. All statistical comparisons and plots were completed using R (R Core Team 2022).

Routine water quality monitoring data collected by MPMC staff between 2015[19] and 2022 in Polley Lake, Bootjack Lake, and Quesnel Lake were used to aid in tissue quality interpretation and to evaluate how water quality has changed following the breach. The evaluation included water quality data collected at the surface of the north and south basin of Polley Lake (POL-P1 and POL-P2, respectively), and from stations QUL-18 (exposed), QUL-2a (exposed), and QUL-120a (reference) of Quesnel Lake (Figure 3.3). Post-breach trends (2015 to 2022) of total and dissolved concentrations of primary and secondary analytes (Table 2.4) were evaluated at these routinely monitored stations using a seasonal Kendall test (as described in Section 3.8.3.4) and were also graphically compared to approved and working British Columbia Water Quality Guidelines (BCWQG; refer to Sections 3.8.3.2 and 3.8.3.3 for details). Results of depth-integrated water quality samples collected concurrently with the zooplankton tissue samples in 2022 were also compared to BCWQG (for details, refer to Section 3.8.3.2).

3.5 Benthic Invertebrate Community

Benthic invertebrate community monitoring was completed at the deep near-field area of Quesnel Lake in 2022 (QUL-PNF; approximately 100 meters depth; Figure 3.2, Table 3.7). Benthic invertebrate community monitoring of lake habitats last completed in 2021 (Minnow 2022a) to fulfill the requirements of the CEMP, and monitoring of these areas in 2022 was not a CEMP requirement (MPMC 2019). Monitoring was completed at QUL-PNF in 2022 with the objective of continuing the ongoing monitored natural recovery of the benthic invertebrate community in this area. This objective could be achieved by making temporal comparisons within the deep near-field area; therefore, a deep reference area was not sampled in 2022 (similar to the monitoring approach used in 2020; Minnow 2021a). As the benthic invertebrate community at the deep near-field area recovers to a condition more similar to the reference area (particularly in terms of organism density), the comparison reference condition will be more important for the monitoring the natural recovery of this area.

Sample collection and analysis methods for 2022 are described herein are consistent with those outlined in the CEMP (MPMC 2019). For details pertaining to prior sampling years, refer to the references listed in Table 3.7.

[19] Routine water quality data prior to 2015 are available for Polley Lake, Bootjack Lake, and Quesnel Lake but were excluded from plots and statistical analyses to distinguish between short-term effects from potential long-term effects of the breach on water quality trends analysis in these waterbodies. The exclusion of data prior to January 2015 was based on the rationale explained in Minnow (2019a). Briefly, laboratory turbidity data resulting from the suspension of fine particulate matter immediately after the breach were used to qualitatively identify a “breach” period (i.e., a period characterized by short-term effects on water quality). By late 2014, laboratory turbidity had decreased to values more similar to pre- breach. Based on these results, the 'breach” period was defined as beginning on August 4, 2014, and ending in December 2014. Therefore, use of data starting in January 2015 should be effective in excluding short-term breach effects on water quality.

Table 3.7: Overview of Benthic Invertebrate Community Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 2014 to 2022[a]

Program Component	Waterbody	Area Code	Post-Breach							
			2014 (Minnow 2015a)	2015 (Minnow 2016a)	2016 (Minnow 2017a)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Breach-Related Monitoring	Quesnel Lake	QUL-PNF	5	5						

Notes: Displayed monitoring efforts used the following sampling methodology: petite-ponar grab sampler, 5-grab composite, 250 µm sieve, LPL (Lowest Practicable Level) taxonomy.

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

3.5.1 Sample Collection

Benthic invertebrate community samples were collected on August 26 and 27, 2022, from five replicate stations within the deep near-field monitoring area of Quesnel Lake (QUL-PNF; Figure 3.2, Table 3.7). The level of replication (n = 5 per area) provides adequate statistical power to detect differences of ± two SDs at α and β of 0.10. One sample was collected at each replicate station. To ensure that the sample was representative of the station, each single sample was a composite of five sub-samples (grabs; 0.116 m^2 of bottom area in total; Appendix Table A.1.1).

Samples were collected using a Petite Ponar grab sampler according to methods consistent with provincial and federal guidance (i.e., BCMOE 2013; Environment Canada 2012b) and with previous monitoring (see Table 3.7). Samples were retrieved from each station using the ponar sampling methods described in Section 3.1.1 for the deep near-field area of Quesnel Lake. Upon retrieval, grab samples were closely examined to verify that only high quality, comparable samples were retained. Each grab was placed into a tub to evaluate whether the grab was complete (i.e., that the grab captured the surface material and was full to each edge), to evaluate the depth to which the grab penetrated, and to verify consistency in terms of particle size, organic matter, and the presence or absence of plants or algae. Incomplete or unusual grabs were discarded. Acceptable grab samples were rinsed from the Ponar into a plastic tub to ensure the complete removal of all material from the grab sampler. This grab sampling method was repeated until five acceptable grabs were collected at a given station.

At each replicate station, the composite sample of five grabs was placed into a 250 µm mesh sieve bag and sieved free of all material less than 250 µm in diameter. After sieving, the retained material (sample) was carefully transferred to internally and externally labelled 1 L wide mouth plastic jars using a wash bottle. The transfer was completed while working over a plastic tub to avoid any potential loss of organisms. Any organisms that fell into the tub or adhered to the sieve bag were removed and added to the sample. Each sample was then preserved with buffered formalin solution to achieve a nominal concentration of 10% and stored at room temperature until shipment to the laboratory.

Supporting measures were collected at each sampling station, including *in situ* water measures, Secchi depth, and supporting sediment measures (sediment quality; see Section 3.1). Refer to Section 3.8.1 for additional details about supporting measures.

3.5.2 Laboratory Analysis

Taxonomic identification of the benthic invertebrate community samples was completed by Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland BC, using standard

methods that incorporate QA/QC measures (e.g., Environment Canada 2012b, 2014). Taxonomists at Cordillera have achieved Level 2 certification by the Taxonomic Certification Program of the Society for Freshwater Science (formerly the North American Benthological Society), including certification for Group 1 (general Arthropods East/West), 2 (Ephemeroptera, Plecoptera and Trichoptera [EPT] East/West), 3 (Chironomidae East/West), and 4 (Oligochaeta) benthic organisms. Organisms were identified to the LPL[20] (typically genus or species) using up-to-date taxonomic keys.

Upon arrival, each benthic sample was logged into proprietary software, followed by a preservation check and the addition of Rose Bengal dye. Sample processing was initiated with sample washing, including elutriation to remove sand and gravel. The remaining organic material was then examined to estimate the total number of invertebrates and preserved in 70% ethanol. If the estimated number of invertebrates was greater than 600 individuals and the sample was fine and non-clumping, a subsample was taken using a Marchant Box (Marchant 1989) as described by Environment Canada (2014). All samples were sieved and processed in the laboratory using the same mesh size as used in during field collections (250 µm).

Samples (or sub-samples) were sorted using a gridded Petri dish under a low power stereo microscope into family/order while maintaining counts (counts excluded Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera, and any terrestrial drop-ins). When specimens were broken, only heads were counted towards the total, and larval and pupal exuviae were not counted. All samples were processed to a minimum 300 organism count. If the 300th organism was found part way through counting a cell, the entire cell was completed, and if 300 organisms had not been reached by the 50th cell of the Marchant Box, then the entire sample was sorted. All sorted organisms were stored in 80% ethanol by family/order in separate labeled vials and debris was preserved and labeled separately.

Insects were identified to the genus/species level and non-insects were identified to a minimum of family level (and to the genus/species level where possible). Identification was completed by experienced, certified taxonomists using standard keys. Taxonomists made comparisons to an externally verified reference collection, and to Standard Taxonomic Effort lists compiled by the Canadian Aquatic Biomonitoring Network (CABIN), Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP) to ensure accuracy. Following identification, newly identified representative specimens of each taxon were placed in separate vials to update an ongoing reference collection.

[20] The term “Lowest Practical Level” is commonly used to describe the level of resolution for benthic invertebrate taxonomic identification (e.g., Environment Canada 2012b). However, the term “Lowest Practicable Level" (e.g., Carter and Resh 2001; Bailey et al. 2001) has been used throughout this report to more accurately described the taxonomic effort.

Laboratory QA/QC included an assessment of sub-sampling error, sorting efficiency, and taxonomic quality control on at least 10% of the samples (Environment Canada 2012b, 2014). Data were entered into proprietary software (INSTAR1), which was also used to calculate benthic invertebrate community metrics and to generate the taxonomic report. Data were provided to Minnow as a Microsoft Excel spreadsheet along with a methods and QA/QC report as an Adobe Acrobat PDF file (Appendix G).

3.5.3 Data Analysis

Upon receipt of the analytical data, a DQR was performed, including an examination of data completeness, organism sorting efficiency, subsampling precision and accuracy, and taxonomic identification error (see Appendix B). Following completion of the DQR, benthic invertebrate community results were analyzed as described below.

3.5.3.1 Metrics

Benthic invertebrate community condition was evaluated using metrics of organism density, taxon richness, Simpson's Diversity and Evenness, and the density and relative density of dominant taxa groups. These endpoints were calculated at the LPL of taxonomy. Benthic invertebrate community results at the LPL taxonomy level can contain a mixture of taxonomic levels (e.g., species, family, order, and class), which can affect the calculation of metrics such as taxon richness and Simpson's diversity. To address this issue, a decision key was applied to the benthic invertebrate data to reassign taxon abundance across levels of taxa, while conserving the relative abundances within the higher taxon levels (see Appendix E.4 text and Appendix Figure E.4.1 for details). Several taxa were excluded from total organism counts by the laboratory (see Section 3.5.2) prior to application of the decision key and endpoint calculation. Rare members of the benthic invertebrate community for which the level of identification was insufficient to determine whether the individual was a member of the aquatic or terrestrial community were also excluded.

Following taxa exclusions, application of the decision key, and the collapsing of taxonomic data to maintain consistency among years, the metrics outlined above were calculated for all years included in the evaluation (2014 to 2022; Table 3.7): organism density (organisms per m^2), taxon richness, Simpson's Diversity and Evenness (calculated as in Smith and Wilson 1996; Environment Canada 2012b). The densities and relative densities (%) of the most abundant taxa were also calculated. Dominant/indicator taxon groups were defined as those groups representing more than 5% of total organism abundance within each set of data, or any taxon groups considered to be important indicators of environmental stress. The benthic invertebrate

community metrics were calculated and summarized for each year using the following statistics: sample size, mean, median, minimum, maximum, and SD.

Correspondence Analysis (CA) was used to further examine benthic invertebrate community structure across all sampling years (2014 to 2022) at the deep near-field and reference areas of Quesnel Lake. CA is a multivariate ordination method that is used to reduce complex multivariate data into a smaller number of independent variables (Gauch 1982; Pielou 1984). The analysis extracts theoretical values (CA axis scores) that capture the variation in the abundance of benthic taxa. The CA produces axis scores for each deep station (near-field and reference[21]) in each year as the sum of a weighted average of $ln_{(x+1)}$-transformed species densities (#/m^2). Taxa scores are also produced as the sum of weighted averages of their densities across stations and years. The structure of the data can then be depicted in scatter plots of one CA axis against another, showing both taxa and station scores. Taxa that tend to co-occur plot together and those that rarely co-occur plot farther apart. Similarly, years at the deep near-field and reference areas that share many taxa plot closer to one another, while those with few in common plot further apart. Thus, CA can be used to describe which benthic invertebrate taxa best accounts for observed differences in the overall benthic invertebrate community between years and/or stations. The CA analysis was conducted at the LPL of taxonomic organization using $ln_{(x+1)}$-transformed density data. CA is sensitive to the presence of rare taxa (Legendre and Legendre 1983; Poos and Jackson 2012). Taxa occurring in fewer than 1% of samples or those that made up less than 1% of the total abundance of Quesnel Lake dataset were excluded from the analysis (Dolédec and Chessel 1991). The ordination was conducted using the cca() function in the vegan package (Oksanen et al. 2020) of R statistical software (R Core Team 2022). Results of the CA were summarized by sampling station and year. Taxa with the highest magnitude weights on the CA axes were identified and used in interpretation of the separation of stations on the CA axes.

3.5.3.2 Statistical Analyses

Statistical analyses of benthic invertebrate community data were conducted using post-breach data from the deep near-field (QUL-PNF; 2014 to 2022; Table 3.7) and un-impacted reference

[21] Although the deep reference area of Quesnel Lake (QUL-PREF1) was not sampled in 2022, results from this area (2014 to 2021; Minnow 2022a) were included in the CA to provide additional context for the interpretation of temporal changes at the deep near-field area (QUL-PNF) from 2014 to 2022.

(QUL-PREF1; 2014 to 2021; Minnow 2022a)[22] areas of Quesnel Lake to answer the following question:

> Has the benthic invertebrate community at the deep near-field area of Quesnel Lake changed among years since the TSF breach?

To answer this question, statistical analyses were completed following the two-way ANOVA methods outlined in Section 3.3.3.1.2 using post-breach results from the deep near-field and reference Quesnel Lake areas for the calculation of community metrics, tabular and graphical presentation, and statistical analyses.

Interpretation of benthic invertebrate community metrics was enhanced by inspection of raw data and taxonomic proportions to detect patterns of ecologically relevant spatial and temporal differences. Ecological and habitat requirements of benthic invertebrates, as outlined in standard references (Clarke 1981; Edmunds et al. 1976; Weiderholm 1983; Wiggins 1996; Vieira et al. 2006; Merritt et al. 2008) were also used in data interpretation. All statistical comparisons were conducted using R (R Core Team 2022). Statistically significant differences in benthic invertebrate community between areas were identified using an α of 0.1 (as used for evaluation of all biological data in this report). Significant differences with a MOD that exceeded ±2 SD/MAD were identified as potentially ecologically meaningful in statistical analyses results and in data interpretation (Environment Canada 2012b[23]). Densities and relative densities (%) of major benthic invertebrate groups were plotted as stacked bar charts. Benthic invertebrate community metrics were plotted to support the two-way ANOVA results. Untransformed data were plotted for ease of interpretation and plots were generated using R (R Core Team 2022).

Potential relationships between benthic invertebrate community metrics and physical and chemical conditions of the monitoring areas were explored using correlation analysis as part of causal assessment. Correlation analyses were completed using available data from the deep near-field (2014 to 2022) and reference (2014 to 2021) areas of Quesnel Lake. Although correlation is not causation (e.g., Suter 2015; Pearl et al. 2016), it is a fundamental tool applied for exploring data and generating evidence of causation (Suter 2015). Benthic invertebrate community metrics (including CA axis scores) were compared to environmental variables including physical measures (station depth), *in situ* water quality measures (temperature, dissolved oxygen, pH, and specific conductance),

[22] Although the deep reference area of Quesnel Lake (QUL-PREF1) was not sampled in 2022, results from this area (2014 to 2021; Minnow 2022a) were included in the statistical analyses to provide additional context for the interpretation of temporal changes at the deep near-field area (QUL-PNF) from 2014 to 2022.

[23] Environment Canada (2012b) identifies a CES of ± 2 SDs for evaluating ecologically meaningful changes in benthic invertebrate community.

physical/chemical sediment measures (% fines and TOC content), sediment Analyte of Interest concentrations (see Section 3.1.3.1 for details), and sediment chemistry Principal Component Analysis [PCA] axis scores (see Section 3.1.3.2 for details). Following derivation of correlation coefficients using Spearman's Rank correlation, a Bonferroni-type correction (i.e., α [0.05] divided by the total number of independent variables) was applied to minimize the risk of declaring false positive correlations.

Statistically significant correlations found at the Bonferroni-adjusted p-value were further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were leveraged by outlying points (or groups of points). The effects of leverage were carefully considered because any differences in benthic community attributes observed at the exposed areas relative to reference, or temporal differences at the exposed area, might be correlated with breach-related differences in water or sediment quality regardless of cause. Leverage is a particularly important consideration in cases where substantially impacted areas are compared to unimpacted reference areas, because physical, chemical, and biological features may all be impacted and relationships among them may not actually indicate a cause other than "they were all impacted". Statistically significant correlations, coupled with careful examination of scatterplots, were used to identify the factors that most contribute to temporal and spatial variability in benthic invertebrate community endpoints. These factors were then considered considering known physical and chemical influences on benthic invertebrate communities (e.g., limitation due to low nutrient availability, toxicity by exposure to high metal concentrations).

3.6 Fish Catchability, Usage, and Population Health

3.6.1 Overview

Fish population monitoring in Polley Lake was completed in 2022, in accordance with the CEMP (MPMC 2019), to continue to document population structure and abundance, provide an estimate of young-of-the-year (YOY) survival in Polley Lake, and to assess the success of remediation efforts in Hazeltine Creek. As outlined in the CEMP (MPMC 2019), the frequency of fish population monitoring in Polley Lake is annual, and monitoring was last completed in 2021 (Minnow 2022a). A brief background and summary of historic findings of this monitoring is provided below.

Historically, the majority of Polley Lake rainbow trout (*Oncorhynchus mykiss*) recruitment was supported by spawning and rearing in Hazeltine Creek and lower Bootjack Creek, downstream of Polley Lake (Bruce and Slaney 1991). Following the breach, both Hazeltine Creek and Bootjack Creek were inaccessible to Polley Lake fish and spawning and juvenile rearing habitat for the

Polley Lake rainbow trout population was limited to Frypan Creek and a few unnamed intermittent tributaries around the lake (Figure 3.4). However, production of rainbow trout fry from these creeks was insufficient to sustain the historic rainbow trout population within Polley Lake (Minnow 2018d).

Post-breach monitoring in Polley Lake was initiated in 2014 to assess the impact of the breach and monitor the health of fish populations (particularly rainbow trout and longnose sucker [*Catostomus catostomus*]) over time. Notably, age- and size-frequency distributions for rainbow trout caught in 2016 indicated that far fewer age-1 and age-2 individuals were captured than in 2014 (Minnow 2017d) and an absence and near absence of age-1, age-2, and age-3 fish was reported in 2017 and 2018, respectively (Minnow 2018d, Minnow 2019a). This is indicative of limited recruitment associated with Hazeltine Creek being inaccessible for spawning and rearing from 2014 to 2017.

After remediation efforts in Hazeltine Creek were completed in the fall of 2017, fish from Polley Lake were allowed access to upper Hazeltine Creek (HAC-R1 and HAC-U) on April 26, 2018, and subsequently to the entire length of Hazeltine Creek on October 7, 2020.[24] Following re-establishment of access to upper Hazeltine Creek, rainbow trout catch-per-unit-effort (CPUE) in spring of 2019 was higher than in 2018 and 2017 but substantially lower than in 2016. Rainbow trout CPUE in the spring subsequently decreased from 2019 to 2021, consistent with loss of recruitment and natural mortality of older fish since the breach. However, CPUE in the fall, when fishing is randomized in Polley Lake, was higher from 2019 to 2021 than in 2016 and 2018 with the highest CPUE documented in 2021 (Minnow 2022a). More smaller rainbow trout were caught from 2019 to 2021 than in 2016 and 2018 and based on predicted length-at-age from a linear model, many of these individuals likely represented YOY to age-2, indicating successful recruitment of rainbow trout to Polley Lake and overwintering survival. In 2021, the length frequency distribution indicated a relatively diverse range of size classes (including YOY to age-4 or 5), further suggesting successful rainbow trout survival and recruitment from 2018 to 2021 (Minnow 2022b). In particular, more age-4 rainbow trout (which are from the 2018 cohort)

[24] High water levels associated with the spring freshet in May 2020 caused flooding that enabled adult rainbow trout to bypass the fish fence located at the downstream extent of HAC-U and access the creek downstream (Minnow 2021b). In response, MPMC extended monitoring to include Reach 3 of Hazeltine Creek (HAC-R3) in the 2020 Hazeltine Creek Monitoring Program (Minnow 2021b). On July 4, 2020, the fish fence at the downstream extent of HAC-U was moved to lower Hazeltine Creek (in the vicinity of HAC-D). On October 7, 2020, the fish fence in lower Hazeltine Creek was removed (following completion of remediation works in this area), and fish were allowed access to the entire length of Hazeltine Creek. The entirety of Hazeltine Creek remained accessible to fish from October 2020 until present, except for a brief period (July to August 2021) when lower Hazeltine Creek was inaccessible during the completion of final instream remediation works in this area (Minnow 2022b).

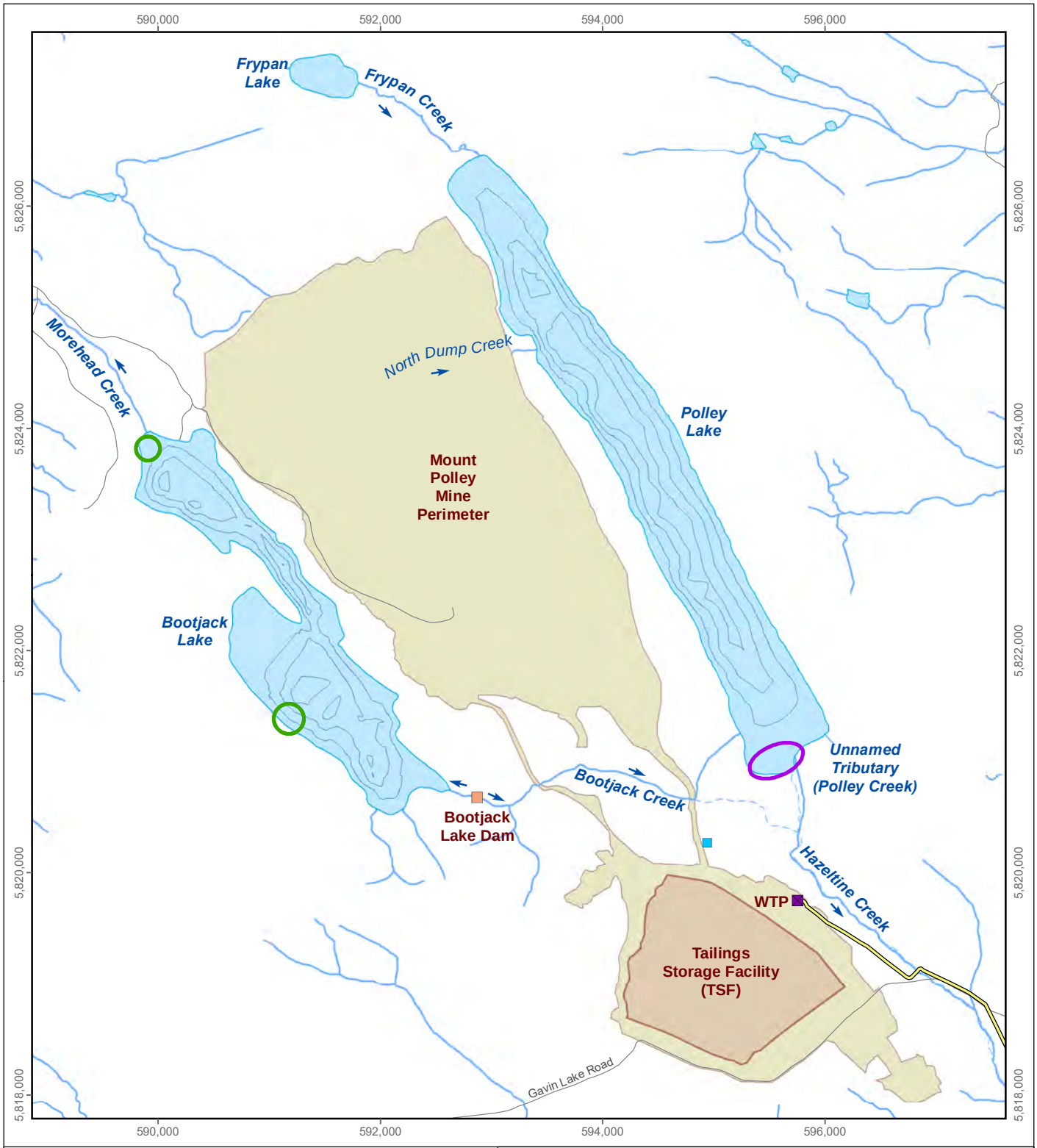

LEGEND

- Exposed Monitoring Location
- Reference Monitoring Location
- Water Treatment Plant (WTP)
- Central Collection Sump
- Effluent Discharge Pipeline (January 2018 to present)
- Historic Watercourse

Note: Bathymetry is displayed in meters.

Spring Fish Tissue Quality Monitoring Areas, Polley Lake and Bootjack Lake, 2022

0 0.5 1 2 km

Projection: North American Datum 1983 UTM Zone 10U

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N W E S

Date: January 2023
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Figure 3.4

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 3\22-29 Figure 3.4 Spring Fish Tissue Quality.mxd

were captured in 2021 compared to 2020 and 2019 and were anticipated to spawn for the first time in 2022. Rainbow trout older than age-5 were absent in 2021 but this was expected as all spawners that were present in 2018 will likely have reached the end of their life expectancy with little replacement by recruits from 2014 to 2017 when Hazeltine Creek was inaccessible.

Sampling methodologies for fish surveys completed in 2022 are described herein are consistent with those outlined in the CEMP (MPMC 2019). The methodologies associated with historic monitoring to assess fish population structure and abundance in Polley Lake are described elsewhere (MPMC 2019; Minnow 2019a).

Two fish surveys were completed in 2022: spring sampling was completed in May (May 26 to 30, 2022; Appendix Table C.6.1) in Polley Lake with Bootjack Lake serving as reference, and fall sampling was completed in September (September 21 to 26, 2022; Appendix Table C.6.2) in Polley Lake. The monitoring completed in spring 2022 served two purposes: 1) to provide data for the evaluation of fish population structure and abundance in Polley Lake; and 2) to provide data for the evaluation of fish tissue quality in Polley Lake compared to reference (Bootjack Lake; see Section 3.7).

Fish sampling described herein was conducted under British Columbia Ministry of Forest, Lands and Natural Resource Operations and Rural Development (FLNRORD) fish Permit WL22-714043.

3.6.2 Spring Survey

The spring survey was initiated shortly after ice-out in Polley and Bootjack lakes and when water temperatures approached 5°C (i.e., May 13, 2022) in Polley Lake (and a similar date in Bootjack Lake). Ice cover, water temperature, and fish “homing” to natal streams (e.g., Hazeltine Creek or Bootjack Creek which is currently diverted directly into the south-west end of Polley Lake; Figure 3.4) were closely monitored by mine staff to support the timing of program commencement and initial fish aggregation in Hazeltine Creek was observed on May 3, 2022.

Spring fishing was conducted using five hoop net sets in Polley Lake and four in Bootjack Lake (0.75 m diameter, 3.8 cm stretched mesh; Appendix Table C.6.1). Hoop nets were set for one to three nights; key spawning areas such as Hazeltine Creek and Bootjack Creek (for Polley Lake) and small tributary streams of Bootjack Lake were targeted to capture individuals that were ready to spawn (Figure 3.4).

For each hoop net set, the level of sampling effort was recorded (i.e., set duration), along with supporting Global Positioning System (GPS) coordinates (Appendix Table C.6.1). Supporting measures also included vertical depth profiles of *in situ* water quality measures at the

two deep basins of each lake (Polley and Bootjack Lakes; see Section 3.8.1 for details). Captured fish were identified and enumerated to characterize the fish community. Species and catch totals were recorded on field sheets.

3.6.3 Fall Survey

Fall fishing was conducted in Polley Lake using seven hoop nets (four 0.6 m diameter nets [2 cm stretched mesh] and three 0.75 m diameter nets [3.8 cm stretched mesh]). The seven hoop nets were each set overnight at randomized locations in Polley Lake for five nights (Appendix Table C.6.2). The randomized net set locations were selected by separating Polley Lake into 28 fish sampling areas (Figure 3.5) and using a random number table to select the sampling area where any given net would be set in the lake on a given day. Set locations were determined *a priori*, with some adjustments made to ensure that only a single hoop net was set at a sampling area at any given time.

For each hoop net, sampling effort (i.e., set duration, configuration), and supporting GPS coordinates were recorded (Appendix Table C.6.2). Supporting measures also included vertical depth profiles of *in situ* water quality measures at the two deep basins of Polley Lake and supporting habitat data (see Section 3.8.1 for details). Captured fish were identified and enumerated to characterize the fish community. Species and catch totals were recorded on field sheets.

3.6.4 Fish Processing

Target species that were captured during the spring and fall surveys were retained for non-lethal evaluation of total length and weight. Target sample sizes for non-lethal measures were n ≥ 30 per lake (Polley and Bootjack lakes) for rainbow trout and longnose sucker in the spring (Appendix Tables C.6.3 to C.6.6). In the fall, non-lethal measurements were completed for rainbow trout, longnose sucker, and redside shiner (*Richardsonius balteatus*) from Polley Lake; target sample sizes were n ≥ 100 fish for longnose sucker and redside shiner (Appendix Tables C.6.7 and C.6.8). For rainbow trout, physical measurements were recorded for n ≥ 100 each of juvenile and adults to ensure collection of measurements from a relatively large sample size across the entire size range of rainbow trout captured (Appendix Table C.6.9). Prior to the collection of measurements in the field, rainbow trout were assigned as juvenile or adult based on the presence (juvenile) or absence (adult) of observable parr marks and/or body length (i.e., rainbow trout ≥ 25 cm in fork length were typically assigned as adults). This approximation was for field-based determination of maturity only. Incidental mortalities were disposed of in an approved manner. All other fish were released live immediately following capture.

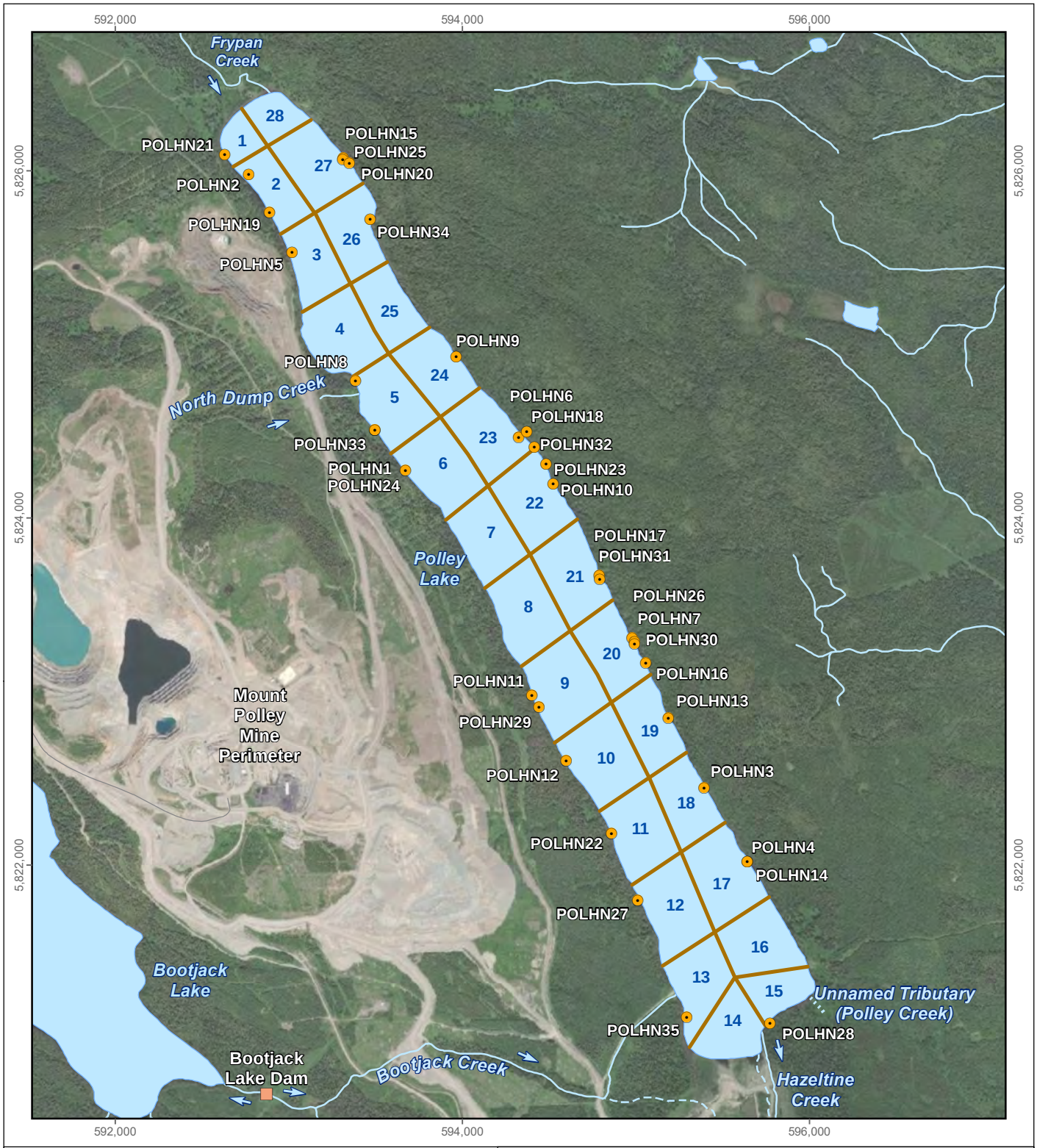

LEGEND

- Hoop Net
- Fish Sampling Section
- Historic Watercourse
- Seasonal Watercourse

Fall Fish Population Health Monitoring Stations, Polley Lake, 2022

0 0.5 1 2 Kilometers

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Figure 3.5

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Fish retained for non-lethal sampling were anesthetized using clove oil solution and measured for fork length, total length, and body weight (Appendix Table C.6.3 to C.6.9). A measuring board was used to measure fork and total length to the nearest millimeter. Fresh body weight was measured using a set of Pesola™ spring scales (depending on fish weight). The Pesola™ scales were demarcated at intervals of 1 to 2% of the total scale range, providing an accuracy of ± 0.3% of the fish mass. The Pesola™ spring scale for individual weight measurement was selected so that the fish weight was near the top of the scale's range to ensure that measurements achieved a resolution near 1%.

In May, a subset of eight female rainbow trout and longnose sucker from each lake (Polley Lake and Bootjack Lake) were sacrificed for the assessment of condition, tissue metal concentrations, and age distribution. See Section 3.7.1 for details of the processing methods for these fish.

3.6.5 Data Analysis

Three endpoints were used to evaluate the health of rainbow trout, longnose sucker, and redside shiner populations from Polley Lake over time (2014 to 2022). Firstly, cumulative relative frequency distributions (CRFD) of fork lengths were used as an indicator of recruitment (rainbow trout, longnose sucker, and redside shiner). Secondly, weight-at-age was used as an indicator of energy use (rainbow trout and longnose sucker). Thirdly, condition (weight-at-length) was used as an indicator of energy storage (rainbow trout and longnose sucker). CRFD included data from the randomized sampling efforts conducted in the fall only, when fish are not aggregating for spawning (which could influence the CFRD results). Condition and weight-at-age were analyzed separately for spring and fall sampling events (for years and seasons in which the necessary data were collected) and were analyzed for males and females separately (if data on sex was available) or for both sexes combined. For rainbow trout and longnose sucker, condition analyses in spring and fall were initially conducted using all fish captured; condition was then analyzed again using only fish with the greatest overlap in size (i.e., fork length) among years. Interpretation of condition analysis results was focused on the tests which included individuals with the greatest overlap in fork length (i.e., those tests that only included fish larger than a given fork length) to ensure interpretation of temporal contrasts were based on the analyses with the most robust and temporally comparable data sets.

Summary statistics (sample size, mean, SD, minimum and maximum value) were calculated separately by area and species for each measurement variable recorded in 2022 (weight, length, and age where available).

3.6.5.1 Weight-at-Age and Condition

Rainbow trout and longnose sucker condition and weight-at-age (females in spring only) were compared among years (i.e., 2016 to 2022 for spring surveys and 2014 to 2022 for fall surveys) using an Analysis of Covariance (ANCOVA) with $\log_{10}$-transformed body weight as the response, Year as a factor, and $\log_{10}$-transformed age or fork length as a covariate. Significant interactions between the covariate and year (i.e., the assumption of homogeneity of regression slopes among years) in the ANCOVA were assessed using $\alpha = 0.1$.

When the interaction term was significant, the coefficients of determination (R^2) of the interaction model and parallel slope model were compared to assess whether the slopes were practically significant. Briefly, if the R^2 was >0.8 and within 0.02 between the two models, then the conclusion was that the interaction model and parallel slope models were practically the same (Environment Canada 2012b) and the ANCOVA proceeded with the parallel slope model. Influence was also assessed using Cook's distance statistic when a significant interaction was detected. If the interaction was driven by influential points, these were removed from the analysis (Environment Canada 2012b). If the interaction could not be removed by comparison of R^2 values or removal of influential points, the conclusion was that the difference in the response variable between areas was dependent on the covariate values. When the interaction term was not significant it was removed from the model and the parallel slope ANCOVA model was fit.

Statistical comparisons were run as all pairwise contrasts over time. Statistically significant *post hoc* contrasts were identified at $\alpha = 0.1$ using Tukey's Honestly Significant Difference. The results of the pairwise comparisons among years were expressed using a compact letter system. Capital letters were assigned to years (e.g., A, B, and C) such that years that share a letter are not significantly different. The letters were assigned such that the year with the highest mean was assigned the letter "A."

Statistical outliers were defined to be observations with Studentized residuals with magnitude > 4 (Environment Canada 2012b) and statistical analyses were completed with these outliers excluded and an inventory of excluded outliers was provided with the analyses results.

A MOD was calculated for each endpoint in each year relative to the baseline year (defined as the minimum year used in the statistical comparison) as:

$$\text{MOD} = \frac{\bar{x}_{\text{i}} - \bar{x}_{\text{baseline}}}{\bar{x}_{\text{baseline}}} \times 100\% \text{ ,}$$

where $\bar{X}_i$ is the mean of a given year, and $\bar{X}_{Baseline}$ is the mean of the baseline (earliest) year (for ANOVA), or the covariate-adjusted mean (for ANCOVA, without interaction). When an interaction was observed, the MOD was estimated for small and large fish at the minimum and maximum values of the overlap in covariate values between areas using the predicted values of

the response variables from the interaction ANCOVA regression model (Environment Canada 2012b). When response variables were log_{10}-transformed, means were reported in the original data units (i.e., anti-logged), equivalent to geometric means.

Weight-at-age and condition were plotted using scatterplots with regression lines separated by year. The statistical analyses and regression model fitting for these endpoints were completed with the outliers excluded (as outlined above) and outliers were identified in plots as symbols with an "×" through them. All statistical analyses and plots were conducted using R (R Core Team 2022).

3.6.5.2 Length Frequency Distributions

Length frequency distributions of data from the randomized sampling efforts conducted in the fall were plotted using histograms and CRFD. The CRFD is a plot of the proportion of fish on the y-axis and length on the x-axis and shows the proportion of fish that have a length less than the length value on the x-axis. Statistical comparisons of length frequency distribution between years were conducted using the two-sample Kolmogorov-Smirnov (K-S) test. The two-sample K-S test compares the maximum difference in the CRFDs between areas and evaluates whether this maximum difference varies significantly among years ($p < 0.1$).

3.7 Fish Tissue Quality

Fish tissue quality monitoring in 2022 was completed in Polley Lake with Bootjack Lake serving as a reference (Figure 3.4), Quesnel Lake exposed and reference areas, and Quesnel River (Figure 3.6, Table 3.8), in accordance with the CEMP (MPMC 2019). Two fish tissue quality monitoring surveys were completed in 2022, one in spring in Polley and Bootjack lakes and one in fall in Quesnel Lake and Quesnel River. The spring (May) sampling in Polley and Bootjack lakes targeted the collection of one sport-fish species (rainbow trout) and one small home-range species (longnose sucker; Table 3.9). The fall (October) sampling targeted the collection of two small home-range species (northern pikeminnow [*Ptychocheilus oregonensis*] and peamouth chub [*Mylocheilus caurinus*]) from Quesnel Lake, and the collection of one sport fish species from each of Quesnel Lake and Quesnel River (lake trout [*Salvelinus namaycush*] and rainbow trout, respectively; Tables 3.8 and 3.9). As outlined in the CEMP (MPMC 2019), the frequency of fish tissue quality monitoring of these species in these waterbodies is annual, and monitoring following this design was last completed in 2021 (Minnow 2022a).

Sample collection and analysis methods for 2022 are described herein and are consistent with the CEMP (MPMC 2019). For details pertaining to prior sampling years, refer to the references listed in Table 3.8.

595,000 600,000 605,000 610,000 615,000 620,000 625,000 630,000 635,000 640,000 645,000 650,000 655,000 660,000 665,000 670,000 675,000 680,000

5,850,000 5,845,000 5,840,000 5,835,000 5,830,000 5,825,000 5,820,000 5,815,000 5,810,000 5,805,000

Cariboo Lake

Quesnel River

•Likely

Quesnel River

Near Cedar Point

Mount Polley Mine Perimeter

Polley Lake

Bootjack Lake

Hazeltine Creek

Near Hazeltine Creek

Edney Creek

Horsefly River

Grain Creek

Near Grain Creek

Quesnel Lake

Horsefly Lake

Blue Lead Creek

East Arm- Near Blue Lead Creek

LEGEND

Exposed Area

Reference Area

0 3.5 7 14 km

Projection: North American Datum 1983 UTM Zone 10U

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N W E S

Fish Tissue Quality Monitoring Areas, Quesnel Lake and Quesnel River, 2022

Date: January 2023
Project 227202.0029

minnow environmental inc.

Figure 3.6

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 8\22-29 Figure 3.6 Fish Tissue Quality Monitoring.mxd

Table 3.8: Fish Tissue Quality Monitoring in Lake Habitats in the Vicinity of the Mount Polley Mine, 2015 to 2022

Time Period	Waterbody or Area	Fish Species (Species Code)	Target Sample Size	Target Tissue(s)[c]
Spring 2015 (Minnow 2017e)	Polley Lake Tributary (Frypan Creek)	rainbow trout (RB)	8[a]	muscle, liver, kidney, ovary
	Bootjack Lake Tributary (Reference)		8[a]	
Fall 2015 (Minnow 2017e)	Quesnel Lake West Arm near Hazeltine Creek	burbot (BB), lake trout (LT), largescale sucker (CSU), northern pikeminnow (NSC), peamouth chub (PCC), redside shiner (RSC)	8	muscle, liver, kidney, ovary, or whole body
	Quesnel Lake near Grain Creek (Reference)	largescale sucker (CSU), peamouth chub (PCC), redside shiner (RSC)	8	muscle or whole body
	Quesnel Lake East Arm near Blue Lead Creek (Reference)	burbot (BB), lake trout (LT)	8	muscle, liver, kidney, ovary
	Quesnel Lake West Arm near Poquette Creek	kokanee (KO)	8	muscle, liver, kidney
	Quesnel River	rainbow trout (RB)	8	muscle, liver, kidney
	Trio Lake (Reference)	rainbow trout (RB)	8	muscle, liver, kidney
Spring 2016	Polley Lake	longnose sucker (LSU), rainbow trout (RB), redside shiner (RSC)	8[a]	muscle, liver, ovary
	Quesnel Lake West Arm near Hazeltine Creek	largescale sucker (CSU), northern pikeminnow (NSC), peamouth chub (PCC)	8	muscle and liver, or whole body
	Quesnel Lake near Grain Creek (Reference)			
Spring 2017 (Minnow 2018e)	Polley Lake	longnose sucker (LSU), rainbow trout (RB)	8	muscle, liver, ovary
	Bootjack Lake (Reference)	longnose sucker (LSU), rainbow trout (RB)	8	muscle, liver, ovary
Fall 2017 (Minnow 2018e)	Quesnel River	rainbow trout (RB)	8	muscle, liver, kidney
	Quesnel Lake West Arm near Hazeltine Creek	northern pikeminnow (NSC)	8	whole body
Spring 2018 to 2022 (Annually) (Minnow 2019a, 2020a, 2021a, 2022a)	Polley Lake	longnose sucker (LSU), rainbow trout (RB)	8	muscle, liver, kidney, ovary
	Bootjack Lake (Reference)	longnose sucker (LSU), rainbow trout (RB)	8	muscle, liver, kidney, ovary
Fall 2018 (Minnow 2019a)	Quesnel Lake West Arm near Poquette Creek	kokanee (KO)	8	muscle, liver, kidney, ovary (if present)
	Quesnel Lake North Arm near Mitchell River (Reference)	kokanee (KO)	8	muscle, liver, kidney, ovary (if present)
Fall 2018 to 2022 (Annually) (Minnow 2019a, 2020a, 2021a, 2022a)	Quesnel Lake West Arm near Hazeltine Creek	northern pikeminnow (NSC)	8	whole body
		peamouth chub (PCC)	8	muscle, liver, kidney, ovary (n=7)
	Quesnel Lake West Arm near Cedar Point	lake trout (LT)	8[b]	muscle, liver, kidney, ovary (n=5)
	Quesnel Lake near Grain Creek (Reference)	northern pikeminnow (NSC)	8	whole body
		peamouth chub (PCC)	8	muscle, liver, kidney, ovary (n=6)
	Quesnel Lake East Arm near Blue Lead Creek (Reference)	lake trout (LT)	8	muscle, liver, kidney, ovary (n=1)
	Quesnel River	rainbow trout (RB)	8	muscle, liver, kidney, ovary (n=5)

Grey shading indicates fish tissue sampling completed in 2022.

[a] The target for these collections was n = 8 ovary samples. For the spring 2015 and 2016 data set, this resulted in more than 8 muscle and liver samples.

[b] The target for these collections was n = 8 samples of each tissue type. For the fall 2019 data set, this resulted in more than 8 muscle, liver, and kidney samples for lake trout.

[c] The target sample size indicated was achieved in 2022 for each species and target tissue unless otherwise indicated. Ovary sample sizes that differed from the target sample size in 2022 are indicated in parentheses (e.g., n=5).

Table 3.9: Life History and Habitat Preferences of Target Fish Species in the Vicinity of the Mount Polley Mine[a]

	Lake Trout (LT)	Longnose Sucker (LSU)	Northern Pikeminnow (NSC)	Peamouth Chub (PCC)	Rainbow Trout (RB)
	Salvelinus namaycush	*Catostomus catostomus*	*Ptychocheilus oregonensis*	*Mylocheilus caurinus*	*Oncorhynchus mykiss*
Home Range	move within lake to spawning sites.	move to spring spawning sites, but tagged fish have often been re-captured close to where they were originally captured.	move to spring spawning sites, but and considered to have small home range (tagged fish in the Columbia River were generally found within 3 km of the tagging location).	move to spawn in spring. Movement limited to diel inshore movement in evening and offshore in morning.	move from lake habitat to spawning creeks (generally tributaries to, or outlets of, their native lake).
Spawning	in the fall (September-November), usually at night, when water temperatures drop below 10 °C , usually in lakes over boulder or rubble bottom from depths ranging from 0.3 to 12 m, although some populations spawn in rivers.	in spring shortly after ice-out at a threshold temperature of 5 °C, although some populations in the Peace and Cariboo regions delay to a water temperature of 15 to 16 °C. Usually spawn in streams over gravel substrates in moderate currents.	in the spring at a threshold temperature of 12 °C (April to July), typically in gravel or cobble of inlet streams, generally close to the lake.	in spring/early summer (April-July) at water temperatures between 9 and 15 °C. Typically in lake inlet or outlet streams in areas of flowing water over gravel substrate. Rarely more than a few hundred metres from the lake.	in spring (April-June) at water temperatures between 8 and 15 °C. Triggered by rising water temperature above 5 °C. In fine gravel of riffle areas of tributary streams, typically at depths of 0.15 to 2.5 m and water velocity of 0.3 to 0.9 m/s. Can also spawn on gravel beaches in lakes.
Growth	growth is highly variable; in some lakes 2+ fish were in the 20 cm range.	3 to 6 cm by end of first growing season.	3.5 to 6.5 cm by end of first growing season.	3.5 to 6.0 cm by end of first growing season.	growth is highly variable depending on habitat type, productivity and food chain structure.
Maximum Age and Size	>20 years is common; oldest aged was 62 years; 75 cm.	19 years (probable under-estimate); 50 cm.	20 years; 50+ cm; females live longer and grow larger than males.	males live up to 8 years and females live up to 19 years; 25 cm.	8 years; maximum size is highly variable depending on habitat type, productivity and food chain structure.
Age at Maturity	between 5 and 13 years; males 1 to 2 years before females.	males - 5 to 6 years females - 6 to 7 years	males - 3 to 4 years females - 5 to 6 years	males - 3 years females- 4 years	3 to 5 years; as early as 1 year by males and as late as 6 years by females.
Food	young-of-year forage on plankton and aquatic insect larvae, adding larger benthic organisms as they grow. At a length of 35 to 40 cm, switch to piscivore if an appropriate prey species is available.	are benthivores as adults, but early stages forage in shallow water for a variety of prey, most commonly zooplankton. Mouth shifts from terminal to ventral with development. As adults, most common food is chironomid larvae and pupae.	mostly aquatic insects when small; diets include fish after 10 cm size. Are mostly piscivorous when larger than 30 cm (although they will eat almost any prey of suitable size).	juveniles consume a wide variety of prey (planktonic crustaceans, chironomid pupae, benthic invertebrates). Consume larger prey as they grow; adults primarily eat invertebrates, but occasionally eat fish.	in creeks, fry and juveniles forage on drifting aquatic insects. In lakes, fry forage on bottom and water column invertebrates; juveniles and adults have similar diets, but adults take larger prey and more adult insects. Large adults (> 40 cm) in large lakes often become piscivorous.
Habitat - Early Life Stages	young seek out deeper water within a month of being hatched, and prefer deeper water than adults (possibly due to cannibalism). When surface waters are cool, juveniles can also be found in shallow water about 1 to 2 m offshore.	young-of-year stay near shore near cover (vegetation or woody debris). Fry transition to deeper water.	young-of-year are typically found around lake margins in shallow water close to cover. Juveniles tend to move offshore into deeper water in the fall.	young-of-year are typically found in shallow water, and tend to move offshore at night. Juveniles also occupy shallow water, but generally deeper than young-of-year.	alevins take 1 to 4 weeks to emerge. Fry may move immediately to lakes, or reside in the stream as many as 3 years. Fry staying in the stream are territorial, and initially occupy slow, shallow areas (shallower than other species), moving to deeper and faster water as they get older.
Habitat - Adults	prefer cool water (below approximately 10 °C); during warmer summer months adults inhabit the hypolimnion (below the thermocline) and disperse throughout the lake during the winter months.	habitat generalists, found in lakes and rivers. In lakes, tend to forage inshore at night, but remain below the thermocline in the day.	often in the littoral zone about 1 m off the bottom and at the offshore side of weed beds. Move into deeper water in the fall.	habitat use changes seasonally. Generally near bottom in the winter. Move inshore in the spring and after spawning, exhibit a diel migration, moving inshore in the evening and offshore in the morning.	in lakes, prefer cool (7 to 18 °C) temperatures and high dissolved oxygen; tend to stay below the 18 °C isotherm. Spend most of the time within 3 m of surface and are often in cover in the lower littoral zone.

Notes: km = kilometres, °C = degrees Celsius, m = metres, m/s = metres per second, cm = centimetres, + = plus, > = greater than.

[a] Based on information in Scott and Crossman (1998), Roberge et al. (2001, 2002), McPhail (2007) and Barrett and Munkittrick (2010).

3.7.1 Sample Collection

Spring fishing in Polley and Bootjack lakes was completed from May 26 to 30, 2022 under FNLRORD Fish Collection Permit WL22-714043, using hoop nets to capture rainbow trout and longnose sucker (Figure 3.4), as described in Section 3.6.2. Fishing was completed in the spring to support collection of ripe ovary tissue from these two species, which is a key tissue for selenium monitoring (see Section 3.7.3.1).

Fall fishing in Quesnel Lake and Quesnel River was completed from October 1 to 6, 2022 under FLNRORD Permit WL22-714043 and Department of Fisheries and Oceans Canada (DFO) Permit XR 113 2022. Hoop nets were used specifically to target the species with small home ranges (i.e., northern pikeminnow and peamouth chub) in the exposed (West Arm-near Hazeltine Creek) and reference areas (North Arm-near Grain Creek) of Quesnel Lake (Figure 3.6, Table 3.8). Hoop netting was completed from October 3 to 6, 2022, with hoop nets set for 1 to 2 nights. Fishing to specifically target lake trout was completed in the exposed (West Arm-near Cedar Point) and reference (East Arm-near Blue Lead Creek) areas of Quesnel Lake using gill nets with mesh sizes ranging from 3 to 5 inches stretched mesh (Figure 3.6). Gill netting activities were restricted to daylight hours from October 3 to 6, 2022. The duration of gill net deployment was limited to less than 1.5 hours in accordance with the DFO permit conditions and to minimize incidental mortalities and nets were deployed using Summer Profundal Index Netting (SPIN) methods (Sandstrom and Lester 2009). Gill nets were deployed perpendicular to shore in benthic habitat at depths from 3 m (i.e., nearest to shore) to 37 m. Fish were captured from the Quesnel River (Figure 3.6, Table 3.8) by angling on October 1 and 2, 2022.

For each sampling area, the target sample size per species (e.g., rainbow trout) and tissue type (e.g., muscle, ovary, liver, and kidney, or whole-body[25]) was n = 8 to facilitate meaningful statistical comparison of fish tissue chemistry between exposed and reference areas (Table 3.8).

Supporting data recorded for the 2022 fish tissue monitoring in lake habitats included GPS coordinates of each fishing location (net set or angling effort), level of effort (net deployment and retrieval times, angling duration), *in situ* water quality measurements (i.e., depth profiles of temperature, pH, dissolved oxygen, conductivity, and specific conductance), and habitat data (see Section 3.8.1; for details).

Upon collection of fishing gear, captured fish were identified to species. Target species that were captured in the hoop nets, gill nets, or by angling and were of an appropriate size were retained for processing. Incidental mortalities were disposed of in an approved manner. All other fish were released live immediately following capture. Fish retained for lethal sampling were

[25] The tissue types collected varied by species and location; see Table 3.8.

anesthetized using a clove oil solution or euthanized with a decisive blow to the head and spinal severance and measured for fork length, total length, and body weight as described in Section 3.6.4.

Fish retained for lethal sampling were opened using dissecting scissors and any internal abnormalities were noted. All dissected fish were also examined internally to confirm sex. Internal tissues (liver, kidney, and ovary if available[26]) were then removed using dissecting tweezers and scissors, weighed to the nearest 0.001 g (±1% precision) using an analytical balance and placed in labelled Whirl-Pak™ bags. A boneless, skinless muscle sample was also collected and placed in a clean, labeled Whirl-Pak™ bag. Tissue samples were collected using clean implements (cutting boards, filet knives, and tweezers). Duplicate (split) samples were collected at a target frequency of 10% for QA/QC purposes and were evenly distributed among fish species and tissue types. Whirl-Pak™ bags containing whole carcasses (northern pikeminnow) or individual tissue samples (all other species) were stored frozen until shipment (on ice) to the analytical laboratory.

Aging structures from lethally sampled fish were then collected for age determination; specific age structures that were retained included:

- Otoliths (rainbow trout, lake trout, peamouth chub) or whole heads (northern pikeminnow);
- Pectoral fins (longnose sucker)[27]; and
- Scales as a secondary age structure.

For rainbow trout, longnose sucker, lake trout, and peamouth chub, age structures were removed, wrapped in waxed paper, placed in labelled coin envelopes, and frozen until shipment to the laboratory for aging analyses. For juvenile northern pikeminnow (that are typically smaller in size), whole heads were removed, stored, frozen, and shipped (on ice) to the aging laboratory for otolith extraction and age determination.

3.7.2 Laboratory Analysis

Laboratory analysis of fish tissue quality samples was completed by ALS Environmental (Burnaby, BC) using the same methods and QA/QC measures outlined in Section 3.4.2.

[26] Fully-developed ovaries were sampled from mature females. During fishing efforts in Quesnel Lake and Quesnel River, additional fish (i.e., more than n = 8 per area) were not targeted and sacrificed to achieve an n = 8 sample size for ovary tissue.

[27] Catostomidae spp. are known to have low-quality otoliths for aging, therefore fin rays are the preferred structure with which to derive age estimates.

Determination of fish ages using aging structures was completed by AAE Tech Services in La Salle, Manitoba. Sample shipments were accompanied by COC forms. Prior to aging, samples were thawed and otoliths were extracted from fish heads, as required. Otolith pairs for each relevant fish were examined under magnification for any issues related to structural integrity (e.g., cracks, fractures, etc.) and deformation (e.g., crystallization or misshapen lobes). Based on this evaluation, one otolith of the pair was selected for processing and embedded in Cold Cure epoxy resin, then allowed to cure for 48 hours before sectioning and polishing. Age estimation was carried out by submerging the otolith section in water under magnification with the polished surface facing up.

Pectoral fin rays from longnose sucker were processed and analyzed using a similar sectioning method to that used for the otoliths. Fin rays were embedded in Cold Cure epoxy resin to increase the structural integrity of the sample and prevent damage or degradation of the sample during processing. Samples were cured for 48 hours before sectioning. A minimum of three sections were taken to compensate for misalignment or staggering of the rays, due to shifting during the embedding process, or the inherent shape of the structure. The analysis of multiple rays enables age verification and improves the reliability of the age estimate, especially in the case of heavy checking or faint/thin annuli. The three sections were then submerged in a dish of water under magnification with the ageing surface facing up. Orientation was matched across all three sections to ensure accurate comparison.

For both otoliths and pectoral fin rays, ages were recorded with a corresponding Confidence Index value based on otolith/fin ray section condition, annuli assessment, and the confidence of the reader in the age determination. Scales that were collected as backup structures were used for age analysis only if an otolith or pectoral fin was damaged or otoliths were not collected successfully during sample processing. Data reports were provided to Minnow and MPMC as an Adobe Acrobat PDF file and Microsoft Excel spreadsheet (Appendix G).

3.7.3 Data Analysis

Fish catch data were compiled and summarized to provide a catch list for each sampling area and gear type. The catch compilations, along with data on fishing efforts completed in May and October 2022, were used to calculate CPUE for each species and sampling area. For hoop netting efforts, CPUE was expressed as number of fish per day. For gill nets, CPUE was calculated based on the number of fish captured per square meter-hour. For angling, CPUE was calculated as the number of fish per angler day. Fish length, weight, and age data were also compiled and summarized by calculating the mean, median, SD, and total range (minimum and maximum) by species and area.

Upon receipt of the chemical data from ALS, a DQR was performed. This included the assessment of field precision, laboratory precision, and laboratory accuracy against data quality objectives (DQOs) established at the outset of the project. Following the DQR, summary statistics were calculated for each analyte (% moisture, metals), species, tissue type (i.e., muscle, liver, ovary, and kidney or whole-body), and area. Summary statistics included the sample size, % of samples less than the LRL, mean, SD, minimum, median, and maximum. Summary statistics were calculated using the K-M method as described in Section 3.8.3.1.

3.7.3.1 Data Screening

Fish tissue quality data were evaluated in comparison to tissue quality guidelines for human health and/or for aquatic ecosystem health (available for mercury and selenium) and the tissue quality of fish collected from reference areas. Tissue quality guidelines included the Canadian Food Inspection Agency/Health Canada mercury guideline for the protection of human health (0.5 milligrams per kilogram wet weight [mg/kg ww]; CFIA 2015) and the BC selenium guidelines (BCMOE 2014). Selenium guidelines for BC include guidelines for the protection of human health, which are based on fish consumption levels (7.3 mg/kg dw for subsistence consumers, 14.5 mg/kg dw for the general population, and 75 mg/kg dw for the recommended two servings of fish per week). The intermediate (general population) and subsistence consumption rate was selected as most applicable for evaluation of Polley Lake, Quesnel Lake, and Quesnel River fish tissue quality (i.e., the guideline of 7.3 and 14.5 mg/kg dw, respectively). Selenium guidelines for BC also include guidelines for the protection of aquatic life, which are 4 mg/kg dw in muscle tissue and whole-body samples, and 11 mg/kg dw in egg/ovary tissues.

Scientific consensus is that the best tissues for evaluating the potential adverse effects of selenium to fish (which are considered to be the most selenium sensitive organisms) are ripe ovaries or eggs (Luoma and Presser 2009; Janz et al. 2010; Stewart et al. 2010; DeForest et al. 2012; Janz 2012). Therefore, ovary tissues were used as the primary basis for evaluating potential effects of selenium on aquatic life. The BC guideline for selenium in egg/ovary tissue (11 mg/kg dw) includes a two-fold uncertainty factor that may not be justified given a very steep dose-response curve (DeForest et al. 2012), therefore selenium concentrations in fish ovaries were also compared to the threshold (5th percentile of the distribution of 10th percentile Effect Concentrations [EC_{10}]) for reproductive effects in eggs and ovaries (20 mg/kg dw; DeForest et al. 2012).

3.7.3.2 Statistical Analyses

Statistical analyses of metal concentrations in fish tissues were conducted using post-breach data (i.e., 2015 to 2022) to answer the following questions:

1. Have mean analyte concentrations at the exposed area changed over time relative to the reference area?[28]
2. Are there differences in mean analyte concentrations between exposed and reference areas, and does the difference depend on year?

To answer these questions, data were grouped into two categories for separate tabular and graphical presentation and statistical analyses:

1. Polley Lake (exposed) compared to reference (Bootjack Lake).
2. Quesnel Lake exposed (near Hazeltine Creek or near Cedar Point) compared to reference (near Grain Creek or East Arm).[29]

Questions 1 and 2 were answered by conducting a two-way ANOVA assessing the exposed:reference ratios of results, with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year.* The two-way ANOVA was competed as detailed in Section 3.4.3 (for Questions 1 and 2) to address the same questions. Similar statistical comparisons were also completed for fish ages, lengths, and weights to answer the question: is there a difference in mean fish length between exposed and reference areas, and does the difference depend on year? The comparisons of lengths, weights and age followed the two-way ANOVA methods listed above with the exception that data were fit with least-squares estimation (i.e., not MLE) because data were all uncensored (i.e., not < LRL) and data were analyzed as $\log_{10}$-transformed (length and weight) or untransformed (Age) response variables.

When reference area data were not collected concurrently with the exposed area over time (i.e., for Quesnel River), statistical comparisons of concentrations of metals in fish tissues were conducted to answer the following question:

Is there a difference in mean concentration at the exposed area over time?

The question was answered by conducting a one-way ANOVA with *Year* as the factor. Due to the prevalence of analyte results which were below the LRL (i.e., censored data), analyses of tissue metal concentration data were completed using a censored regression one-way ANOVA fit with MLE and assuming a lognormal distribution. Length, weight, and age data did not contain censored data and thus were fit with least-squares estimation (i.e., not MLE) and were analyzed as $\log_{10}$-transformed (length and weight) or untransformed (age) response variables. The MOD

[28] i.e., has the ratio of concentrations (exposed:reference) changed over time?

[29] Data from Quesnel River were considered separately since these data do not have an associated reference for comparison (i.e., statistical contrasts can be temporal only).

between the exposed area in each year relative to the first year of data collection was estimated as:

$$MOD = \frac{MCT_{Year} - MCT_{First\ Year}}{MCT_{First\ Year}} \times 100\%$$

where MCT is the measure of central tendency for the statistical test (i.e., back-transformed marginal means).

R software (R Core Team 2022) was used to conduct all statistical analyses. Censored regressions (i.e., MLE) were completed using the *survreg* function in the survival package (Therneau 2017) in R and contrasts were completed using the methods described in Oehlert (2010). Marginal means were estimated using the *emmeans*() function in R and were used to calculate MODs for the two-way ANOVA analyses. These estimates of the mean are equivalent to geometric means because the ANOVA analyses were completed on log-transformed concentrations. Consequently, the means used for the MOD calculations were not the same as the K-M mean concentrations reported in Appendix C.7 (see Section 3.8.3.1 for description of the K-M method).

Mercury concentrations were analyzed using units of mg/kg ww, in keeping with the reporting units for mercury guidelines. Mercury analyses were completed using ANCOVA with $\log_{10}$(fork length) as a covariate when the covariate was a significant predictor of mercury concentration, since mercury is known to bioaccumulate (i.e., larger fish have higher tissue concentrations; Kidd and Batchelar 2012). If fork-length was not a significant covariate ($\alpha = 0.05$) in the ANCOVA, the analysis proceeded using the ANOVA methods described above, consistent with the other analytes.

Statistical comparisons were completed for all available analytes; however, data interpretation focused on primary and secondary analytes (see Table 2.4). Plots of data that support the two-way ANOVA were presented for primary and secondary analytes that: 1) had a significant *Area* × *Time* interaction in the analyses; and 2) lacked a significant *Area* × *Time* interaction in the analyses but had a positive MOD (i.e., exposed concentrations were significantly higher than reference and the difference did not depend on year). Years with more than 50% of the data at the LRL for any given year were excluded from the analysis.

3.8 Supporting Measures

A variety of supporting physical and chemical information was used to support the interpretation of sediment and aquatic biological data collected from lakes as part of the CEMP. This information falls into two categories: 1) supporting information that was collected by Minnow during field collections of sediment, plankton, benthic invertebrates, and fish; and 2) supporting information

that was collected routinely by MPMC as part of ongoing CEMP monitoring and provided to Minnow. Unless otherwise specified, the supporting measures outlined below belong to the first category (measures collected by Minnow). Data analysis approaches for the supporting information are also detailed below.

3.8.1 Measures Collection

Supporting spot water samples were collected from specific depths using a water sampling bottle (Beta bottle or Van Dorn sampler) in support of data interpretation of the lake monitoring programs. During sediment sampling, spot water samples were collected from just above the sediment water interface (≤ 0.5 m above) at the shallow exposed (POL-S and QUL-LNF; n = 5 per area) and reference (BOL-S and QUL-LREF1; n = 5 per area) sediment sampling areas (Figures 3.1 and 3.2). The purpose of this sampling was to support the interpretation of sediment toxicity results from these shallow monitoring areas.

Water samples collected using a sampling bottle (Beta bottle or Van Dorn sampler) were obtained as follows. Prior to sampling, the sampling bottle was rinsed with site water and then lowered to the desired depth. For the collection of samples where the sampling bottle was not visible during sampling, a 5 kg steel weight was attached approximately 0.5 m below bottle to assist with collecting the sample at the appropriate depth. Once at the appropriate depth, the sampling bottle was moved side to side gently without disturbing the substrate (to ensure a representative sample was collected) prior to tripping the closure mechanism with a steel messenger. Upon retrieval, water samples were collected from a spigot fitted to the bottle. Samples collected into precleaned bottles were then preserved immediately (as required). Duplicate (split) water samples were collected at a target frequency of 10% for QA/QC purposes. Water samples were kept on ice in the field and refrigerated until being shipped (on ice) to ALS Environmental (Burnaby, BC).

One depth-integrated water sample was collected at each plankton monitoring area, during each sampling event, to support the interpretation of zooplankton tissue quality results (Appendix Table A.1.3). Samples were collected using a depth-integrated tube sampler (length ~13 m) as described in Section 3.3.1.1. Upon retrieval, the water samples were poured into a clean bucket (to collect *in situ* measures) before being decanted in pre-cleaned sample bottles, preserved (as required), stored, and shipped to the analytical laboratory as described above. Duplicate (split) depth-integrate water quality samples were collected at a target frequency of 10% for QA/QC purposes.

In addition to the spot water quality samples collected in 2022 by Minnow, water quality samples were collected routinely by MPMC staff as part of their ongoing water quality monitoring program (MPMC 2019) and were used to support data interpretation (see routine water quality monitoring station locations in Figure 3.3). These data were subjected to an internal DQR by MPMC,

including screening of laboratory QA/QC data, sample integrity issues, detection limits achieved, data accuracy, as well as potential outliers/extreme values. As such their quality were not further assessed in this report. Data were provided to Minnow by MPMC as a Microsoft Excel file.

Additional supporting information collected at each lake monitoring station in 2022 included GPS coordinates, date and time of sampling efforts, sampling depth, field meter measurements of temperature, specific conductance, dissolved oxygen, and pH at surface and bottom[30] and site and sample photographs (Appendix Tables A.1.1 to A.1.3). At one station per area per monitoring event, a minimum of one vertical depth profile of *in situ* water quality measures was recorded (Appendix Figures A.1.1 to A.1.6), as well as at least one Secchi depth measure. *In situ* water quality measures were collected using a YSI EXO™ handheld portable field meter equipped with a YSI EXO1™ or YSI EXO2™ sonde which was calibrated at least every second day. Field notes that would aid interpretation were also recorded. For sediment quality and benthic invertebrate sampling these included notes on the presence or absence of aquatic vegetation in sediment, other physical observations of sediment (sediment texture, colour, density, etc.). For fish monitoring these included notes on the habitat present (Appendix Tables A.1.4 and A.1.5).

3.8.2 Laboratory Analysis

Upon receipt of water samples, ALS opened the coolers, measured temperature to verify the maintenance of cold samples, logged each sample, and assigned each sample a unique identification code. A SRN was then sent to MPMC and Minnow for verification.

Laboratory analyses included the parameters in the CEMP routine surface water quality monitoring program (MPMC 2019): dissolved organic carbon (DOC), total metals, dissolved metals, anions (nitrate, nitrite, sulphate, chloride, and fluoride), ammonia, total nitrogen, total phosphorus, dissolved phosphorus, orthophosphate, alkalinity, hardness, turbidity, total suspended solids, total dissolved solids, pH, and conductivity. Upon completion of the analyses, a data report was provided by ALS to MPMC and Minnow as an Adobe Acrobat PDF file and Microsoft Excel spreadsheet (Appendix G)[31].

[30] Surface and bottom *in situ* water quality measures were collected at each monitoring station sediment and benthic invertebrate community sampling stations only.

[31] Data reports for spot water quality sampling are included in Appendix G. Data from routine water quality monitoring completed by MPMC were provided to Minnow in Microsoft Excel format from the MPMC database and these are not included in Appendix G.

3.8.3 Data Analysis

3.8.3.1 Summary Statistics

Summary statistics (means, percentiles, and SDs) were calculated for select chemical parameters using the K-M method (Helsel 2012). Additional information about the application of this summary statistic calculation method (i.e., which monitoring components and analytes this method was applied to) are found within the methods sections for analysis of chemical data above (Sections 3.1.3, 3.4.3, and 3.7.3).

The K-M method (Helsel 2012) involves transforming left-censored data (i.e., data prefaced with a "<" symbol) to right-censored data (i.e., values prefaced with a greater than [>] symbol), and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculation was completed using the *survfit*() function in the survival package (Therneau 2017) in R software (R Core Team 2022) and involves calculating the area under the K-M survival curve.

The K-M method is non-parametric and can accommodate multiple LRLs. This method of estimating the mean is equivalent to using the distribution of detected values below the maximum LRL to represent values that are <LRL. For example, the mean of the data set {1, 2, <4, 5} is estimated as the mean of 1, 2, [½×1 + ½×2], and 5 which is 2.375. The value <4 is replaced by the distribution of values below 4 (i.e., 1 and 2 with equal weight of ½). Similarly, the mean of the data set {1, 1.6, 2, 2.1, <4, 5} is estimated as the mean of 1, 1.6, 2, 2.1, [¼×1 + ¼×1.6 + ¼×2 + ¼×2.1], and 5 which is 2.229. Again, the value <4 is replaced by the distribution of values below 4 (i.e., 1, 1.6, 2, and 2.1 with equal weight of ¼). If the minimum value in the data set is <LRL, it is replaced with the LRL. Therefore, if there is only one LRL and no detected values <LRL, the K-M estimate of the mean is equivalent to replacing the value <LRL with the LRL (i.e., the best guess for the values <LRL is the LRL). If a SD could not be estimated (e.g., all data <LRL), then one was not reported.

For percentiles, estimates were first calculated using K-M estimator based on survival analyses. The percentiles were calculated using the quantile() function for a survival model generated in the survival package in R software (R Core Team 2022). Estimates of percentiles cannot be generated for highly censored data using the K-M method, and so a second method was used to provide practical estimates of the percentiles. For example, for the data set: <2, <2, <2, <2, 5; the K-M method will not produce an estimate of the median. However, the median value of this data set is clearly <2. The second method of estimating percentiles was used whenever the K-M method could not generate an estimate. This method involved calculating the percentile after

substitution with the LRL, then identifying the value in the dataset equal to this value (or the next detected value in the dataset that is below this value).

Summary statistics for biological endpoints (sediment toxicity, plankton community and productivity, benthic invertebrate community, and fish community and population health; Sections 3.2.3, 3.3.3, 3.5.3, and 3.6.5) were calculated using standard methods and formulae.

3.8.3.2 Water Quality Guideline Screening

Results of spot water quality samples were screened against available approved or working BCWQG (collectively termed "BCWQG"; Appendix Table C.1.1; BCMOECCS 2021a,b). For guidelines that are dependent on other water quality parameters (e.g., hardness-based, pH, temperature), concurrent water quality parameter values were used in their calculation (BCMOECCS 2021a,b). If hardness was outside the accepted range, then the bound of that range (either upper or lower) was used to calculate the guideline (BCMOECCS 2021a,b). If concurrent data were not available, the conservative values were chosen using the historical data for that station (e.g., the minimum hardness recoded for that station was used). Surficial water quality samples collected by MPMC staff from Polley, Bootjack, and Quesnel Lake routine water quality stations (Figure 3.3) were also screened against BCWQG with the results of this screening presented in plots. Plots of routinely collected water quality samples relative to BCWQG were limited to total and dissolved concentrations of primary and secondary analytes (Table 2.4). In addition, temperature and nutrient results (total phosphorus, dissolved phosphorus, orthophosphate, total nitrogen, and nitrate) were plotted for Polley, Bootjack, and Quesnel Lake routine water quality stations (Figure 3.3) to help support the interpretation of plankton community results. Tabular and graphical screening against BCWQG was completed using R (R Core Team 2022).

3.8.3.3 Biotic Ligand Model-derived BCWQG for Copper

The BCWQG Biotic Ligand Model (BLM)-based software was used to calculate acute and chronic guidelines for dissolved copper (BCMOECCS 2019d,e). This was used to support interpretation of zooplankton tissue quality by evaluating surface waters of Polley Lake and Quesnel Lake.

The BLM integrates exposure and toxicity modifying factors other than hardness that are known to modify copper bioavailability. Using this approach, the BLM defines dissolved copper concentrations below which chronic adverse effects would not be expected under the specific water quality that co-occurs with the copper concentration. Specifically, the BCWQG BLM produces acute and chronic guidelines for dissolved copper that are based on the 12 modifying water chemistry inputs required to run the model: temperature, pH, DOC, humic acid content,

calcium, magnesium, sodium, potassium, sulphate, chloride, alkalinity, and hardness (BCMOECCS 2019d).

If required input parameters for the BCWQG BLM were missing for a data set, these data were replaced to increase the sample size, when possible. This was done using professional judgement to replace the missing data as closely as possible or by using a conservative replacement value. Data missing for the parameters chloride, pH, and DOC were replaced by substituting the mean value from sampling events conducted in close temporal proximity to the missing data or using the most conservative values (e.g., using the minimum value collected at a station). Temperature data were missing for entire years for some stations. Thus, a conservative approach was used to estimate seasonal temperatures. The maximum temperature was taken in each month for the bottom and surface monitoring stations in each lake. These temperatures were used for samples taken in their respective months for each station to ensure that changes in guideline calculations were not driven by differences in the availability of temperature data.

3.8.3.4 Water Quality Trends

Temporal trends in surface water quality data were evaluated to support interpretation of chemical monitoring components. Specifically, surface water quality data collected routinely by MPMC post-breach (i.e., 2015[32] to 2021) in Polley Lake and Quesnel Lake were evaluated to support the interpretation of zooplankton tissue quality from these areas (refer to Section 3.4.3). This evaluation was completed using the seasonal Kendall test detailed below and included evaluation of aqueous total and dissolved concentrations of primary and secondary analytes (Table 2.4), and acute and chronic Guideline Exceedance Factors (GEFs) for copper (the ratio of observed dissolved copper concentrations divided by BCWQG BLM-derived guidelines).

The non-parametric seasonal Kendall test described by Hirsch et al. (1982) was used to evaluate temporal trends in surface water quality data from the north and south basins of Polley Lake (POL-P1 and POL-P2, respectively) and from three stations in Quesnel Lake (QUL-18 and QUL-2a [exposed], and QUL-120a [reference]; Figure 3.3). The seasonal Kendall test assesses temporal trends separately for each season (or month in this case) and combines

[32] Routine water quality data prior to 2015 are available for Polley Lake, Bootjack Lake, and Quesnel Lake but were excluded from plots and statistical analyses to distinguish between short-term effects from potential long-term effects of the breach on water quality trends analysis in these waterbodies. The exclusion of data prior to January 2015 was based on the rationale explained in Minnow (2019a). Briefly, laboratory turbidity data resulting from the suspension of fine particulate matter immediately after the breach were used to qualitatively identify a “breach” period (i.e., a period characterized by short-term effects on water quality). By late 2014, laboratory turbidity had decreased to values more similar to pre- breach. Based on these results, the 'breach” period was defined as beginning on August 4, 2014, and ending in December 2014. Therefore, use of data starting in January 2015 should be effective in excluding short-term breach effects on water quality.

the results for each season into an overall test for trend. The test is non-parametric and assesses whether there is a monotonic increasing or monotonic decreasing trend over time. The test is conducted by calculating the test statistic S_i which is equal to the sum of the number of increases and decreases from a time period t to all time periods after t for each observation in season i. The overall test statistic S is computed as the sum of S_i for all seasons. The significance of the observed S is determined by comparing it to a critical value of S (at the significance level α = 0.05) determined from the exact sampling distribution of S (calculated by determining all possible permutations and combinations of S based on the increases and decreases from the number of pairwise comparisons made; Hirsch et al. 1982). If more than 45 pairwise comparisons are made (equivalent to the number of pairwise comparisons for n = 10 in a single season), then the normal approximation is used to calculate a p-value and to assess significance (Hirsch et al. 1982). The standard normal deviate Z is calculated as:

$$Z = \begin{cases} \frac{S-1}{\sqrt{\sigma_S}} if\ S > 0 \\ 0 \quad if\ S = 0 \\ \frac{S+1}{\sqrt{\sigma_S}} if\ S < 0 \end{cases}$$

where $\sigma_S = \sum_{i=1}^{k} \frac{n_i(n_i-1)(2n_i+5) - \sum_{T_i} t_i(t_i-1)(2t_i+5)}{18}$ and n_i is the number of samples in month i, t_i is the number of tied values for each tied value T_i, and k is the number of seasons (Hirsch et al. 1982).

An estimate of the trend slope over time was calculated by computing the median of all slopes between data pairs within the same month (Helsel and Hirsch 2002). The slope was reported as a change in concentration per year and as a percentage change in concentration per year. The intercept of a line through the time series was estimated as the median intercept of all lines through each point with the estimated slope (Pohlert 2016). The trend analysis was only conducted with a minimum number of 5 pairwise comparisons, the minimum number required for all consecutive increases or decreases to be significant at α = 0.05.

4 METHODS – CREEK HABITAT

4.1 Sediment Quality

Sediment quality monitoring of creek habitats in 2022 targeted one area in upper Hazeltine Creek (HAC-U) and one area in lower Hazeltine Creek (HAC-D), with areas in upper and lower Edney Creek serving as reference (EDC-U and EDC-D, respectively; Figure 4.1, Table 4.1), in accordance with the CEMP (MPMC 2019). Channel remediation works in the vicinity of HAC-U and HAC-D were completed in 2017 and 2021, respectively (Table 4.1). As outlined in the CEMP (MPMC 2019), the frequency of sediment quality monitoring in creek habitats is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a).

Sample collection and analysis methods for 2022 are described herein. For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Table 4.1.

4.1.1 Sample Collection

Sediment samples were collected from Hazeltine Creek and Edney Creek between August 4th and 7th, 2022. Five replicate stations were sampled to represent each monitoring area (Figure 4.1, Table 4.1; Appendix Table A.2.1).

Hazeltine Creek and Edney Creek are predominantly erosional (HKP 1996, 1997a; Minnow 2007) and there are few locations of true sediment deposition. The limited sediment within these creeks tends to wash through during spring freshet and deposit as a thin layer of fines in quiescent areas on the lowering hydrograph. Due to the non-uniform nature of sediment deposition in these erosional areas, wetted locations that support some accumulation of fine materials (i.e., small pools, backwaters, or interstices between boulders) were selected opportunistically for sample collection. Collection of true sediment (i.e., fines in the silt and clay size category) could not be completed by conventional grab sampling due to the dominant presence of sand, gravel, and cobble in these areas. Sediment fines were therefore targeted using a clean stainless-steel- spoon.

At each sampling station selected, the location was approached by foot in a manner that did not disturb the sediment prior to sampling. Surficial sediment was then collected carefully by slowly placing the spoon on the sediment surface in a manner that minimized disturbance and inserting

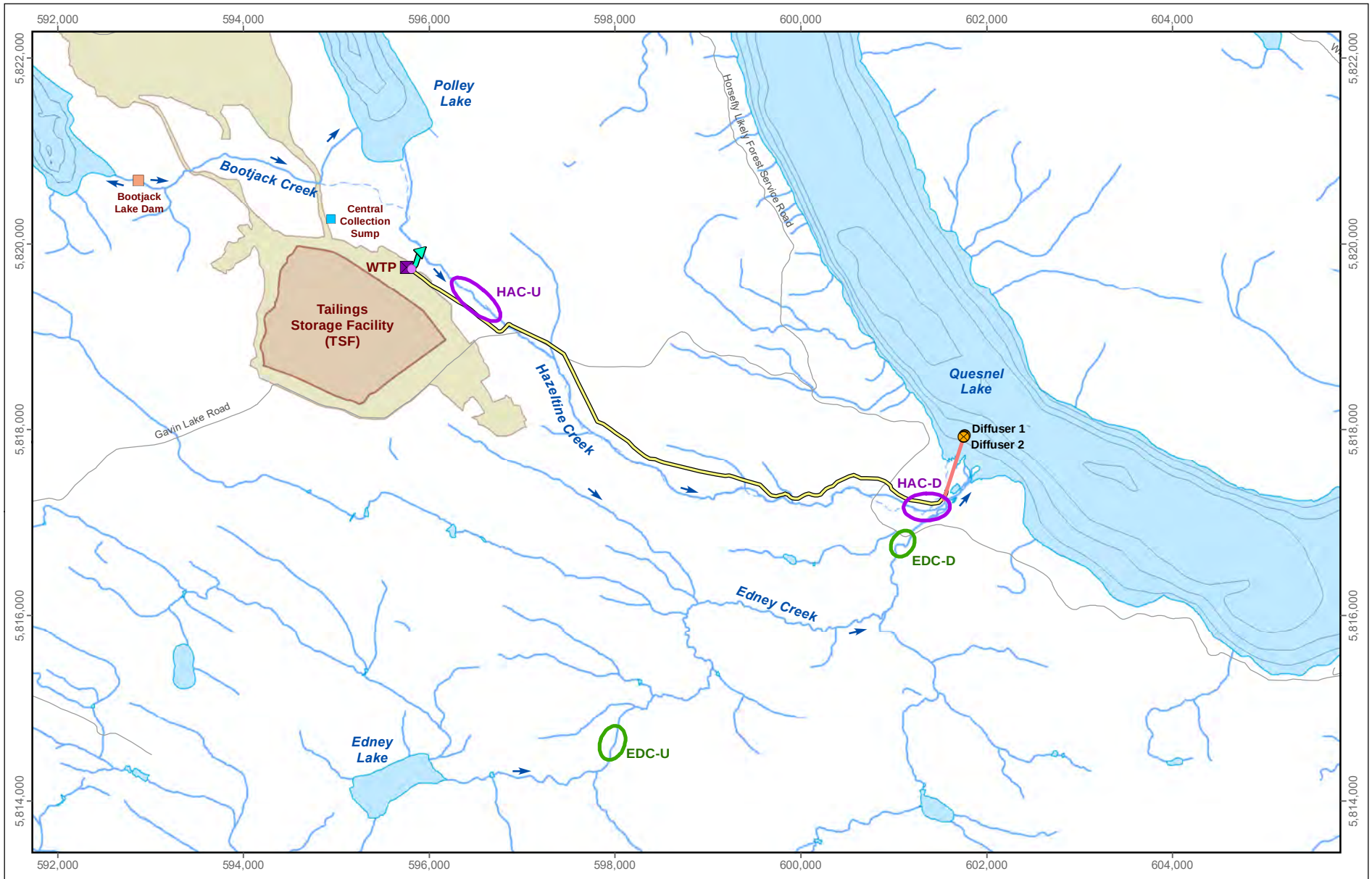

LEGEND

- Exposed Area
- Reference Area
- Effluent Mixing Tank
- Historic Watercourse
- Discharge to Diffusers (2015 to present)
- Effluent Discharge Pipeline (January 2018 to present)
- Diffuser (Treated Effluent Discharge, December 2015 to present)

Note: Bathymetry is displayed in meters.

0 0.75 1.5 3 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Sediment Quality Monitoring Areas, Hazeltine and Edney Creeks, 2022

Date: January 2023
Project 227202.0029

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Figure 4.1

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 6\22-29 Figure 4.1 Sediment Creeks.mxd

Table 4.1: Overview of Sediment Quality Monitoring in Creek Habitats in the Vicinity of the Mount Polley Mine, 1995 to 2022 [a]

Waterbody		Area Type	Area Code	Baseline			Pre-Breach					Post-Breach						
				1995 (HKP 1996)	1996 (HKP 1997a)	1999 (Beak 2000)	2007 (Minnow 2009)	2009 (Minnow 2011)	2010 (Minnow 2011)	2012 (Minnow 2013a)	2013 (Minnow 2013b)	2014 (Minnow 2015a)	2015 (Minnow 2015b)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Hazeltine Creek	Upper	Exposed (Remediated 2017)	HAC-U (W7 2009 to 2018; ST16 in 2014; W7 Pond in 2012; UHC in 2007; W6 in 1999 W7 in 1995 and 1996)	6	6	3	3	5	5	8	8 (W7) 5 (USW7-Pond) 16[b] (W7 Pond)	5	-	5	5	5	5	5
	Lower	Exposed (Remediated 2020/2021)	HAC-D (ST02 in 2014; DSW11 in 2012 LHC in 2007; W11 in 1995, 1996, 1999 and 2010)	6	6	3	3	-	5	5[c]	-	5	-	5	5	5	5	5
Edney Creek	Upper	Reference	EDC-U (W8 in 2012; UEC in 2007; W8, W8a, and W9 in 1995, 1996; W9 and W8 in 1999)	6 (W9) 6 (W8) 6 (W8a)	6 (W9) 6 (W8) 6 (W8a)	3 (W9) 3 (W8)	3	-	-	5[c]	-	-	-	5	5	5	5	5
	Lower	Reference	EDC-D (W10 prior to 2015)	6	6	-	-	-	-	-	-	-	5[d]	5	5	5	5	5

Sediment quality samples collected in 1996 had unusually high concentrations for some parameters. Values are suspect and were not used in data analyses, display, or interpretation.

Notes: "-" = not sampled/not applicable. Sediment Quality analyses included: metals and Total Organic Carbon (TOC) in <63 µm fraction, moisture, particle size, pH, total nitrogen, and total sulphur, for sampling completed between 2014 and 2021. Prior to 2019, sediment geochemistry, porewater quality, Polycyclic Aromatic Hydrocarbon (PAH), and oil and grease analyses were also employed, but are not displayed herein. For details of these alternate analyses, see Minnow 2019a, 2020a, 2021a.

[a] Numbers indicate the number of stations sampled per area. Where multiple areas were sampled in a given year, the area is identified in parentheses after the number of stations. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Eight samples were collected in separate spring and fall sampling events.

[c] Selenium was the only parameter reported.

[d] Sediment quality data for EDC-D in 2015 were not used in the calculation of post-breach summary statistics in Minnow (2015b). See Minnow (2019a) for presentation of raw data.

the spoon into the sediment to capture sediment to a depth of no greater than 3 cm.[33] The spoon was then moved horizontally until full, and slowly retrieved to the surface to avoid sample washout.

The contents of each spoonful were inspected to ensure that it was predominantly fine sediment (i.e., silt and clay), and, if acceptable, was placed into one or more pre-labelled 250 mL glass sampling jars. This procedure was repeated approximately 20 times at each station to form a composite sample representative of the sampling station and to collect sufficient sample material for analysis (Appendix Table A.2.1). Sampling equipment was rinsed between all stations using site water. Duplicate sediment samples were collected at a target frequency of 10% for QA/QC purposes. Samples were kept on ice in the field then stored in a refrigerator until shipment (on ice) to the analytical laboratory.

Supporting information was collected at each sampling station to support data interpretation (see Section 4.5.1 for details).

4.1.2 Laboratory Analysis

Laboratory analysis of sediment quality samples from creek habitats was completed by ALS Environmental (Burnaby, BC) using the same methods and QA/QC measures described for sediment quality samples from lakes (Section 3.1.2).

4.1.3 Data Analysis

4.1.3.1 Data Screening and Analytes of Interest

Upon receipt of the analytical data, a DQR was completed, including an examination of data completeness, LRLs achieved, laboratory precision, laboratory accuracy, and field precision. Following completion of the DQR, raw data were summarized by area by calculating mean, median, SD, minimum, and maximum. Summary statistics were calculated using the K-M method as described in Section 3.8.3.1.

Sediment quality data were evaluated relative to British Columbia WSQG (BCMOECCS 2021a,b) and relative to reference and pre-breach 95th percentile concentrations (as described for lake sediment quality samples in Section 3.1.3.1). Guidelines and pre-breach/reference values were used in a two-way screening to identify analytes at exposed areas with mean concentrations that exceeded WSQG as well as reference and pre-breach 95th percentile values. Reference and pre-breach data used for screening values were compiled and calculated separately. Reference data included all available post-breach results (excluding data from 2015)

[33]Collection depth was often less than 3 cm, as fines often settle in a thin layer over coarser material, (and sampling seeks to avoid coarse material).

from Edney Creek, and pre-breach data included all results from Hazeltine Creek prior to 2014 (excluding data from 1996; Table 4.1; Appendix Tables D.2.1, D.2.2, D.2.3, D.2.4 and D.2.5).

All analytes (including primary and secondary analytes) were screened against the WSQG and reference/pre-breach 95th percentile values as described above (and as described in Section 3.1.3.1). Analytes at exposed areas with mean concentrations that exceeded all the following criteria were termed "Analytes of Interest": 1) the WSQG, 2) the associated reference 95th percentile value, and 3) the associated pre-breach 95th percentile value (if available). Analytes of Interest were determined separately for each monitoring area (i.e., separately for upper [HAC-U] and lower [HAC-D] areas of Hazeltine Creek). Concentrations of the Analytes of Interest, along with TOC, were the focus of more detailed interpretation which included graphical plots, formal statistical contrasts of temporal changes in concentrations, and examination of relationships to physical and chemical sediment variables.

4.1.3.2 Statistical Analyses

Statistical analyses of Analyte of Interest and TOC concentrations in creek sediments were conducted using post-breach data (i.e., 2018 to 2022) to answer the following questions:

1. Have mean analyte concentrations at the exposed area changed relative to the reference area?[34]
2. Are there differences in mean analyte concentrations between exposed and reference areas, and does the difference depend on year?
3. Have mean analyte concentrations at the exposed area changed over time since the breach?

To answer these questions, data were grouped into two categories for separate tabular and graphical presentation and statistical analyses:

1. Upper Hazeltine Creek (HAC-U) compared to an upper creek reference area (Upper Edney Creek; EDC-U).
2. Lower Hazeltine Creek (HAC-D) compared to a lower creek reference area (Edney Creek; EDC-U).

Questions 1 to 3 were answered by using the same statistical approach (i.e., two-way ANOVA with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year)* described for lake sediments in Section 3.1.3.2. Sediment concentrations from 2014 were excluded from temporal comparisons because this sediment represented freshly deposited breach-material that was removed during remediation efforts in 2015.

[34] i.e., has the ratio of concentrations (exposed:reference) changed over time?

Analytes of Interest and TOC concentrations were plotted to support the two-way ANOVA results. Where relevant, these plots included comparison of post-breach data (i.e., those data included in the analyses) to WSQG and reference/pre-breach 95th percentile values. Pre-breach data were also included in a sub-set of the plots for context.

Relationships between the Analytes of Interest concentrations and physical variables (particle size) and other chemical variables (TOC, total nitrogen, and total sulphur content) were evaluated using Spearman correlation analysis described for lake sediment (Section 3.1.3.2). Correlation analysis was completed using data from 2018 to 2022 combined from upper and lower areas of Hazeltine Creek. These data were combined because the upper and lower areas of Hazeltine Creek are connected, and the objective was to evaluate these relationships over time within the entire exposed area.

All sediment statistical analyses and plots were completed using R (R Core Team 2022).

4.2 Periphyton Community and Productivity

Periphyton community and productivity monitoring of creek habitats in 2022 targeted two areas of upper Hazeltine Creek (HAC-R1, HAC-U), with one area of upper Edney Creek (EDC-U) serving as reference (Figure 4.2, Table 4.2), in accordance with the CEMP (MPMC 2019). Channel remediation works in the vicinity of HAC-R1 and HAC-U were completed in 2016 and 2017, respectively (Table 4.2). As outlined in the CEMP (MPMC 2019), the frequency of periphyton community and productivity monitoring in upper creek habitats is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a). The frequency of periphyton community and productivity monitoring in lower creek habitats is every second year, and monitoring at these areas was also last completed in 2021 (Minnow 2022a).

Periphyton productivity monitoring was also completed in 2022 in an additional area of upper Hazeltine Creek Reach 3 (HAC-R3; remediated in 2019) and an area of Frypan Creek (reference; FPC-R3) for the specific purpose of providing data to support the evaluation of fish habitat in upper Hazeltine Creek (Figures 4.2 and 4.3, Table 4.2; MPMC 2019). Frypan Creek differs from upper Hazeltine Creek in terms of habitat and flow, and the upper Edney Creek area (EDC-U) is a more suitable reference for evaluating periphyton productivity and community in upper Hazeltine Creek outside of the specific focus on evaluating fish habitat. For the above reasons, periphyton productivity data collected from Frypan Creek (FPC-R3) and upper Hazeltine Creek Reach 3 (HAC-R3) are presented in tabular form only in the present report and are excluded from data analyses and interpretation. These data will be interpreted in a separate report which focuses on the assessment of Hazeltine Creek as fish habitat (Minnow 2023).

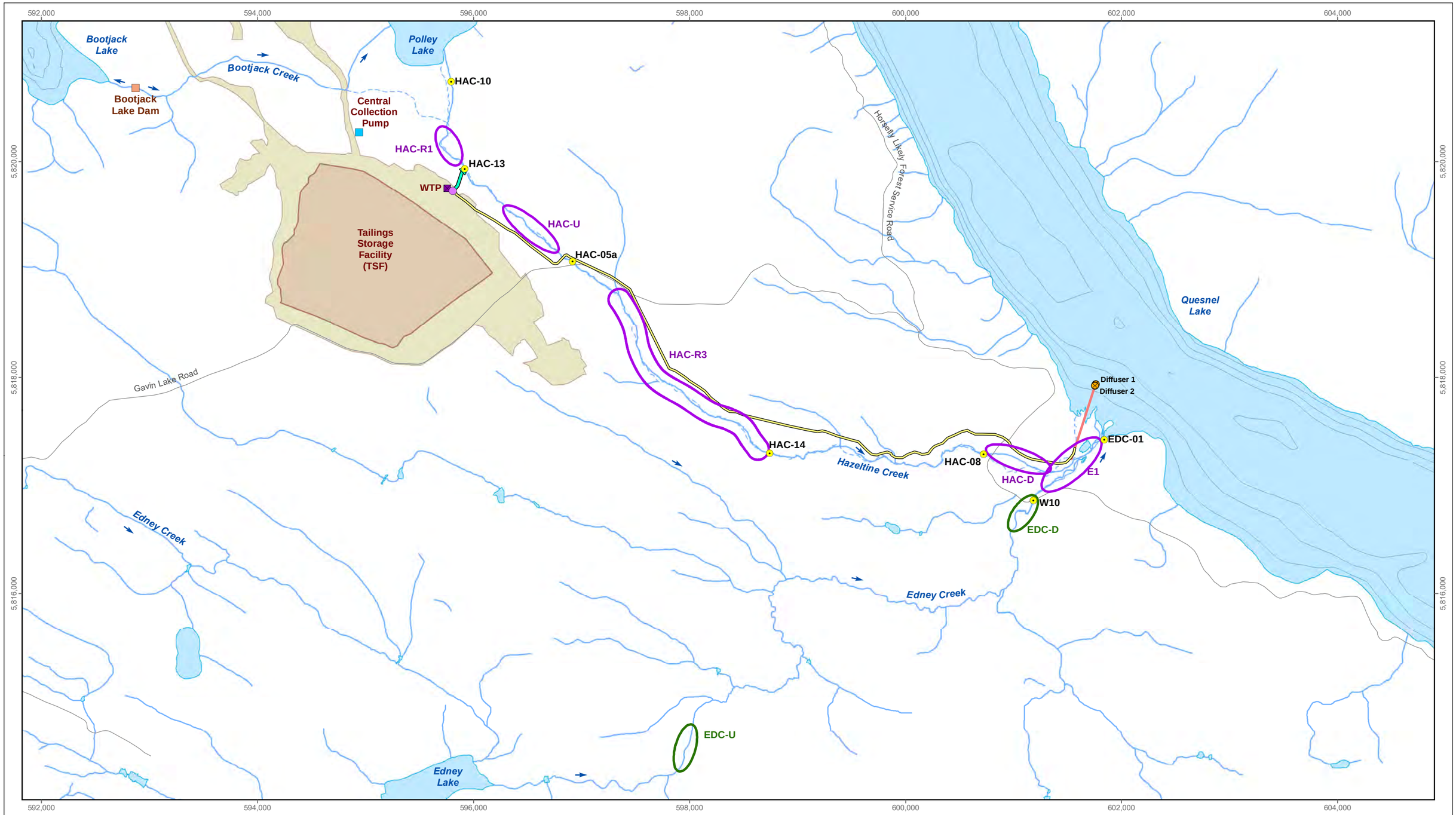

LEGEND

- Exposed
- Reference
- Routine Water Monitoring Station
- Diffuser (Treated Effluent Discharge, December 2015 to present)
- Effluent Mixing Tank
- Discharge to Diffusers (2015 to present)
- Discharge to Hazeltine Creek (Apr 10 2014 to Aug 14 2014 and Nov 29 2015 to Sept 30 2017)
- Effluent Discharge Pipeline (January 2018 to present)
- Historic Watercourse

[a] Not all monitoring components were completed at all areas shown. Monitoring at each area included one or more of the following components: periphyton community, productivity, and tissue quality, and benthic invertebrate community, productivity, and tissue quality. See Tables 4.2, 4.3, and 4.4 for details of monitoring components.

Note: Bathymetry is displayed in meters.

0 0.5 1 2 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Periphyton, Benthic Invertebrate Monitoring Areas, and Water Monitoring Stations, Hazeltine and Edney Creeks, 2022[a]

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Figure 4.2

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 6\22-29 Figure 4.2 Periphyton and BI Creeks.mxd

Table 4.2: Overview of Periphyton Community and Productivity Monitoring in Creek Habitats in the Vicinity of the Mount Polley Mine, 1995 to 2022[a]

Waterbody		Area Type	Area Code	Component	Baseline[b]		Pre-Breach[c]	Post-Breach[d]					
					1995 (HKP 1996)	1996 (HKP 1997)	2011 (Minnow 2012)	2017 (Minnow 2018a)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Hazeltine Creek	Upper	Exposed (Remediated in 2016)	HAC-R1	community	-	-	-	-	5	5	5	5	5
				chlorophyll-a	-	-	-	5	5	5	5	5	5
				AFDM	-	-	-	5	5	5	5	5	5
		Exposed (Remediated in 2017)	HAC-U (W7 prior to 2018)	community	3	3	1	-	5	5	5	5	5
				chlorophyll-a	6	3	1	-	5	5	5	5	5
				AFDM	-	-	-	-	5	5	5	5	5
		Exposed (Remediated in 2019)	HAC-R3	chlorophyll-a	-	-	-	-	-	-	5	5	5
				AFDM	-	-	-	-	-	-	5	5	5
Edney Creek	Upper	Reference	EDC-U (W9 prior to 2018)	community	3	3	-	-	5	5	5	5	5
				chlorophyll-a	6	3	-	-	5	5	5	5	5
				AFDM	-	-	-	-	5	5	5	5	5
Frypan Creek		Reference	FPC-R3	chlorophyll-a	-	-	-	3	5	5	5	5	5
				AFDM	-	-	-	3	5	5	5	5	5

Notes: "-" = not applicable/ not sampled, "AFDM" = Ash Free Dry Mass.

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Baseline community and chlorophyll-a samples collected by Stockner sampler from n=1 rocks per station, total scraped area = 4.91 cm^2

[c] Pre-Breach community and chlorophyll-a samples collected by scraping n=10 rocks per station, scraped area = 3.3 cm^2 per rock

[d] Post-Breach community, chlorophyll-a and AFDM samples collected by scraping from n=5 rocks per station, total scraped area = 4 cm^2 per rock

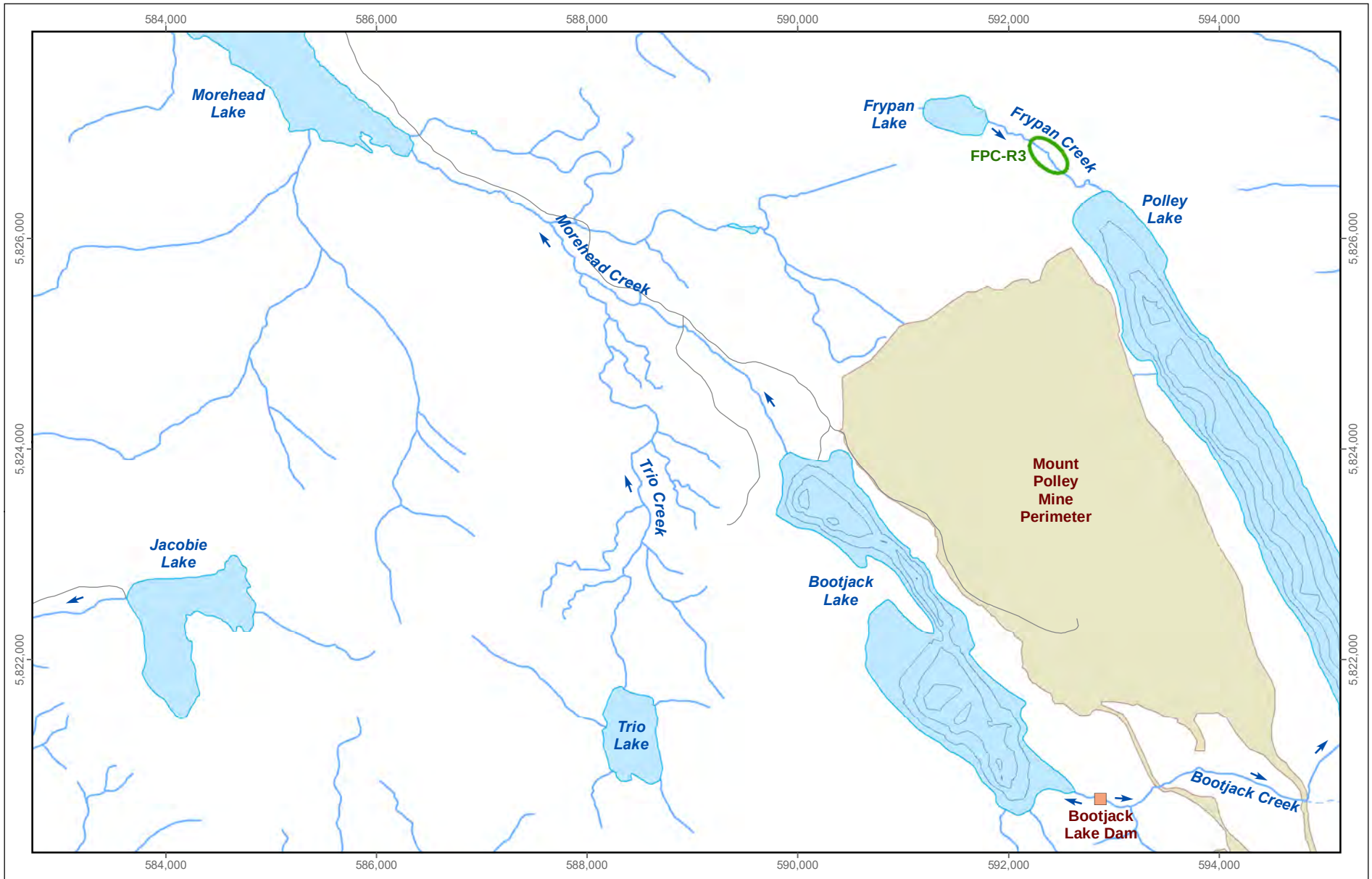

LEGEND

Reference Area

[a] Monitoring included the following components: periphyton productivity and benthic invertebrate community and productivity. See Tables 4.2 and 4.3 for details.

Note: Bathymetry is displayed in meters.

0 0.5 1 2
km

N
W E
S

Projection: North American Datum 1983 UTM Zone 10U
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Periphyton and Benthic Invertebrate Monitoring Areas, Frypan Creek, 2022[a]

Date: January 2023
Project 227202.0029

minnow environmental inc.

Figure 4.3

Document Path: C:\Users\CApol\Trinity Consultants, Inc\Imperial Metals - 227202.0029 - 2022 MPMC\D - GIS\Task 6\22-29 Figure 4.3 Periphyton and BI, Frypan Creek.mxd

Sample collection and analysis methods for 2022 are described herein. For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Table 4.2.

4.2.1 Sample Collection

Periphyton samples for the assessment of community and productivity (chlorophyll-a and ash free dry mass [AFDM]) were collected between August 5 and August 10, 2022. Five stations were sampled in each area (Figures 4.2 and 4.3, Table 4.2), and each station was established at a minimum distance of approximately three bankfull widths from adjacent stations. Periphyton sampling stations coincided with those for benthic invertebrate community monitoring. Sampling was completed at each station by selecting five representative submerged rocks (excluding those that were too small, highly angular, or uncharacteristic in surface texture). Selected rocks were taken to shore for processing as described below for productivity and community sample collection (Sections 4.2.1.1 and 4.2.1.2, respectively).

A concerted effort was made to ensure that habitat characteristics (water depth, velocity, and substrate characteristics) were comparable among sampling stations and areas to minimize natural influences on the variability of productivity and community endpoints. From 2018 to 2022, the flow of water in Hazeltine Creek in 2022 was modified by controlling the discharge of water to the creek from Polley Lake (using a weir), and by pumping water from below the thermocline in Polley Lake into the creek for the specific purpose of maintaining conditions that support the use of upper Hazeltine Creek as fish habitat. This supplemental pumping increased water depth and velocity in Hazeltine Creek relative to natural conditions. This made matching habitat conditions between the remediated (Hazeltine Creek) and reference (Edney Creek) areas particularly challenging. Despite these challenges, remediated and reference sampling locations were matched for habitat as closely as possible in 2022. The flow augmentation to Hazeltine Creek also presented challenges for matching remediated and reference area conditions in previous years of monitoring (Minnow 2019a, 2020a, 2021a, 2022a).

Supporting measures were collected at each periphyton sampling station to support data interpretation. Refer to Section 4.5.1 for additional details about supporting measures.

4.2.1.1 Productivity

Periphyton samples were collected for chlorophyll-a analysis using methods consistent with technical guidance (BCMOE 2013, 2016) and the CEMP (MPMC 2019). Briefly, samples were collected at each station by firmly placing a thin acetate template with a 2x2 cm (4 cm²) opening in the middle of each selected rock and scraping off the periphyton within this area using a stainless-steel razor blade or scalpel. This was completed for the five rocks selected at each

sampling station. Sample material scraped from each of the five rocks was then transferred from the razor blade or scalpel to a large (47 mm) 0.45 µm pore diameter MCE filter paper until a single composite sample of approximately 200 mg to 1 g wet weight was obtained per station. If material collected from the five rocks sampled was insufficient (i.e., <200 mg), additional rocks from the same location and habitat characteristics were sampled until the required sample volume was obtained. The total area scraped at each station was recorded (0.002 m²: 5 x 4 cm², or any deviations from this surface area) to allow calculation of chlorophyll-a concentration per-unit area for comparison to the BCWQG (100 mg/m²; BCMOECCS 2021b). The filter paper was then folded and placed into a labeled opaque centrifuge tube. This process was repeated for each of the five stations per monitoring area.

The same five rocks sampled for chlorophyll-a analysis (and additional rocks if they were required) were used to collect separate scrapings for analysis of AFDM. Sampling methods for AFDM followed those outlined above for chlorophyll-a (0.002 m² per station); however, material on the razor blade or scalpel from scraping of each rock was rinsed into a small pre-labelled plastic jar with additional water added to cover the tissue (as necessary). Immediately after collection, all chlorophyll-a and AFDM samples were stored in a cooler with ice packs until being frozen prior to shipment (on ice) to the analytical laboratory.

4.2.1.2 Community

Periphyton community samples were collected from the same five rocks used for productivity sampling whenever possible (and additional rocks if they were required), or from rocks of a similar size collected from the same general location and habitat (i.e., depth and velocity). Sample collection methods were similar to those outlined for AFDM (Section 4.2.1.1). Periphyton was collected from a 2x2 cm area on five rocks at each station to form a single composite sample representing 0.002 m² (5 x 4 cm²) surface area. The periphyton was removed from each rock using a scalpel and/or brush and a squirt bottle filled with site water (BCMOE 2013, 2016; Stevenson and Bahls 2006). This process was repeated for each of the five stations per monitoring area. Immediately after collection, the sample was preserved with Lugol's iodine solution until the sample was the colour of weak tea (approximately 1 mL of Lugol's per 250 mL of sample; BCMOE 2013, 2016) and was mixed gently by inverting the sampling jar. All samples were stored at room temperature prior to shipment to the laboratory for taxonomic analyses.

4.2.2 Laboratory Analysis

4.2.2.1 Productivity

Laboratory analysis of periphyton productivity (chlorophyll-a and AFDM) was completed by ALS Environmental (Burnaby, BC). Upon receipt, laboratory staff opened the coolers, measured temperature to verify the maintenance of cold samples, logged each sample, and assigned each sample a unique sample identification code. A SRN was then sent to MPMC and Minnow for verification.

Analysis of chlorophyll-a followed procedures adapted from USEPA Method 445.0 (USEPA 1997). Briefly, chlorophyll-a concentration was determined by routine acetone extraction followed by fluorescence detection using a non-acidification procedure (a method that is not subject to interferences from chlorophyll-b). Determination of total AFDM followed procedures adapted from APHA Method 10200 I (APHA 2010). Total AFDM was calculated as the difference between the dried sample weight and the ash weight, both determined gravimetrically. Dry weight was determined following drying at 105°C. The remaining sample was subsequently ignited at 500°C, rewetted to hydrate clays and minerals and brought to a constant weight at 104°C to determine ash weight. Laboratory QA/QC included reagent blanks and laboratory control samples. Upon completion of the analyses, data reports were provided by ALS Environmental to MPMC and Minnow electronically as an Adobe Acrobat PDF file and a Microsoft Excel spreadsheet (Appendix G).

4.2.2.2 Community

Taxonomic identification and enumeration of periphyton community samples was completed by Biologica Environmental Services Ltd. in Victoria, BC. Briefly, samples were homogenized by sonication, settled in Ütermohl chambers for 24 hours, and all cells within randomly selected FOV were enumerated until a minimum count of 300 algal units (1 unit = >1 cell for colonial or filamentous taxa) were enumerated or until 80 FOV were scanned. Cell units were enumerated rather than individual cells, due to colonial/filamentous algae species containing hundreds of cells per unit. Identification was performed using an inverted phase contrast microscope at 400x magnification, and algal taxa were identified to a minimum of genus-level (whenever possible) according to the most up-to-date taxonomic references (see laboratory methods description in Appendix G). Periphyton density (cells/cm^2) was determined using the number of units counted, number of cells per unit, proportion subsampled, and the total area of the selected fields of view.

Laboratory QA/QC included a re-analysis of at least 10% of samples and a calculation of percent agreement among results. Upon completion of the analyses, the data and quality control reports

were provided by Biologica to MPMC and Minnow electronically as an Adobe Acrobat PDF file and a Microsoft Excel spreadsheet (Appendix G).

4.2.3 Data Analysis

Upon receipt of the 2022 analytical data, a DQR was performed, including assessments of laboratory internal quality control checks, data completeness, calculations and unit conversions, and laboratory precision. Following completion of the DQR for the periphyton productivity endpoints, productivity results were analyzed as described below. In 2021, the DQR of periphyton community resulted in a request for an investigation of the data by the laboratory that ultimately led to the reissuing of periphyton cell density data from 2018 to 2021 (see Minnow 2022a for details). Once the quality of the 2022 periphyton community data were confirmed through the DQR process, periphyton community results were analyzed as described below, with the corrected periphyton community results from 2018 to 2021 used for all analyses (Minnow 2022a).

4.2.3.1 Metrics

The periphyton community was evaluated using the metrics of organism density, taxon richness, Simpson's Evenness and Diversity, diatom richness, and the density and relative density (%) of dominant taxa groups. These metrics were calculated using LPL taxonomy as outlined in Section 3.5.3.1. Taxonomic groups evaluated included major ecological groups (Diatoms, Chlorophytes [green algae], Chrysophytes [golden algae], Cyanobacteria [blue-green algae], Dinoflagellates, Phaeophytes [brown algae], Rhodophytes [red algae])[35].

Periphyton productivity was evaluated using chlorophyll-a and AFDM data, which were converted to standard area-based measurements (mg/m^2 and g/m^2, respectively). Chlorophyll-a concentrations were compared to water quality guidelines for eutrophic conditions (BCWQG = 100 mg/m^2; BCMOECCS 2021b) and a classification for moderately enriched streams (21 mg/m^2; Biggs 1996). Periphyton and community endpoints were summarized by area and year, including sample size, mean, median, minimum, maximum, and SD.

[35] Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 and although the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic identification of these organisms), they were suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category was therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018.

Total richness, diatom richness, Simpson's Evenness, and Diversity were calculated under the assumption that each taxonomic group identified by the lab was unique. As a result, richness values reported herein differ slightly from those reported directly by the laboratory (see Appendix G), which considers only taxa that are certainly unique. For example, for the purposes of this report, the taxa Pennate Diatoms and *Diatoma sp.* were considered as two separate taxa, whereas the richness calculations completed by the laboratory were considered as one taxon. Although this approach may slightly overestimate richness, this is consistent across data sets.

Evaluation of the periphyton community and productivity included comparison to baseline and pre-breach samples collected at the same areas as post-breach samples, where possible. However, the comparability of 2018 to 2022 periphyton community data with historic (1995, 1996, 2011) datasets is limited due to differences in taxonomic practices and sampling effort across these years. Specifically, the use of multiple taxonomic laboratories since 1995 may have resulted in problems related to misidentifications and/or the use of multiple naming conventions for a single taxon (see Minnow 2019a for details). Furthermore, the taxonomic resolution of historic data was lower than 2018 to 2022 taxonomic analysis, limiting the potential for comparison. The periphyton community data from 2018 to 2022 has greater taxonomic resolution and is considerably more reliable than the historic datasets. The use of varying degrees of qualitative taxonomic analysis (categorizing the degree to which taxa were present as opposed to enumerating them) in 1995 (HKP 1996), 1996 (HKP 1997a), and 2011 (Minnow 2012), substantially limited comparisons that could be made with these data.[36] Due to these data limitations, periphyton metrics for baseline (1995, 1996) and pre-breach (2011) data excluded Simpson's Evenness and Diversity, and also excluded density based metrics for baseline results. Furthermore, statistical comparisons that included baseline and pre-breach data were limited to chlorophyll-a results only.

4.2.3.2 Statistical Analyses

Statistical comparisons of periphyton community and productivity metrics were conducted using baseline (1995, 1996) and pre-breach (2011) data (for chlorophyll-a only) and post-breach data (i.e., 2018 to 2022) to answer the following questions:

[36] Periphyton taxonomy data from 1995, 1996, and 2011 were qualitative, mostly consisting of characterization of presence/absence ("predominant", "common", "abundant," etc.) as opposed to discrete density values. In 1995 and 1996, proportions were reported for some dominant genera and groupings, however the degree to which those data represent quantitative data is unknown without density data. Even in 2011, when data were presented as density, many taxa were presented with "less than" values because the methodology employed by the taxonomist (Fraser Environmental Services) involved some qualitative elements.

1. Are there differences in periphyton community and productivity between exposed and reference areas in 2022?
2. Has the periphyton community and productivity of exposed areas changed among years relative to changes at the reference area over this time, and where pre-breach data exist, has the community recovered to pre-breach conditions?

To answer these questions, results from upper Hazeltine Creek (HAC-R1 and HAC-U) were compared to reference (EDC-U), and to pre-breach (W7; 1995, 1996, 2011, for productivity endpoints only), including calculation of community metrics, tabular and graphical presentation, and statistical analyses.

Periphyton productivity (AFDM and chlorophyll-a) data collected from upper Hazeltine Creek Reach 3 (HAC-R3; 2020 to 2022) and Frypan Creek (FPC-R3; 2017 to 2022) were excluded from data analyses and interpretation (see Section 4.2 for details and rationale) and are presented in tabular form only in the present report (Appendix Tables D.3.4 and D.3.5). These data will be interpreted in a separate report which focused on the re-opening of Hazeltine Creek as fish habitat (Minnow 2023).

Statistical comparisons of productivity and community endpoints were completed using two-way ANOVAs with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year*. The analyses were completed using the two-way ANOVA methods described in Section 3.3.3.1.2 with baseline, pre-breach, and post-breach (exposed [remediated] and reference) data from the creeks.

Periphyton productivity results (chlorophyll-a) from post-breach monitoring were compared to baseline data from 1995 (HKP 1996) and 1996 (HKP 1997a), and pre-breach data from 2011 (Minnow 2012) where possible (see Table 4.2). In addition, baseline data (1995 and 1996) were compared between upper Hazeltine (W7) and upper Edney (W9) creeks to evaluate the baseline condition in these areas. Pre-breach data from upper Hazeltine Creek (W7; 2011) were treated as a separate area from HAC-R1 and HAC-U in the two-way ANOVA of chlorophyll-a because baseline and pre-breach data from W7 (2011) were used in comparison to both HAC-R1 and HAC-U. Pairwise contrasts were conducted as described in Section 3.3.3.1.2, except for those completed for upper Hazeltine Creek (HAC-R1, HAC-U). If the *Area* term was significant for the ANOVA, temporal pairwise contrasts were completed among the areas (EDC-U, W7, HAC-R1 and HAC-U; as though a significant interaction had been detected) due to the inherent temporal contrasts of the *Area* term (i.e., baseline and pre-breach data for W7 compared to post-breach data for HAC-R1 and HAC-U). Results of the contrasts of chlorophyll-a from HAC-R1 and HAC-U to data from W7 were shown on plots with an "*" for 1995, a "†" for 1996, and a "‡" for 2011.

All statistical comparisons were conducted using R (R Core Team 2022). Statistically significant differences in periphyton community and productivity between areas were identified using an α of 0.1 (as used for evaluation of all biological data in this report). Significant differences with a MOD that exceeded ±2 SD/MAD were identified as potentially ecologically meaningful in both statistical analyses results and in data interpretation (Environment Canada 2012b[37]). Densities and relative densities (%) of major periphyton taxon groups were plotted as stacked bar charts.[38] Periphyton community and productivity metrics were plotted to support the two-way ANOVA results. Untransformed data were plotted for ease of interpretation and plots were generated using R (R Core Team 2022). As outlined above, periphyton community endpoints for baseline and pre-breach were excluded from statistical contrasts due to data quality limitations but were included in plots for visualization purposes only.

4.3 Benthic Invertebrate Community and Productivity

Benthic invertebrate community and productivity monitoring of creek habitats in 2022 targeted two areas of upper Hazeltine Creek (HAC-R1, HAC-U), with one area of upper Edney Creek (EDC--U) serving as reference (Figure 4.2, Table 4.3), in accordance with the CEMP (MPMC 2019). Channel remediation works in the vicinity of HAC-R1 and HAC-U were completed in 2016 and 2017, respectively (Table 4.3). As outlined in the CEMP (MPMC 2019), the frequency of benthic invertebrate community and productivity monitoring in upper creek habitats is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a). The frequency of benthic invertebrate community and productivity monitoring in lower creek habitats is every second year, and monitoring at these areas was also last completed in 2021 (Minnow 2022a).

Benthic invertebrate community and productivity monitoring was also completed in 2022 in an additional area of upper Hazeltine Creek Reach 3 (HAC--R3; remediated in 2019) and an area of Frypan Creek (reference; FPC-R3) for the specific purpose of providing data to support the evaluation of fish habitat in upper Hazeltine Creek (Figures 4.2 and 4.3, Table 4.3; MPMC 2019). The benthic invertebrate community and productivity data collected from upper Hazeltine Creek Reach 3 (HAC-R3) and Frypan Creek (FPC-R3) are presented in tabular form only in the present report. These data will be interpreted in a separate report which focuses on the re-opening of Hazeltine Creek as fish habitat (Minnow 2023).

[37] Environment Canada (2012b) identifies a CES of ± 2 SDs for evaluating ecologically meaningful changes in benthic invertebrate community. This criterion has been applied here to the interpretation of periphyton community.

[38] In 2018 and earlier, Chrysophytes, Phaeophytes, and Rhodophytes were grouped into an 'Other' category in stacked bar charts. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic identification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018."

Table 4.3: Overview of Benthic Invertebrate Community and Productivity Monitoring in Creek Habitats in the Vicinity of the Mount Polley Mine, 1995 to 2022[a]

Waterbody		Area Type	Area Code	Baseline[b]			Pre-Breach		Post-Breach					
				1995 (HKP 1996)	1996 (HKP 1997a)	1999 (Beak 2000)	2002 (Morrow / Azimuth 2003)	2007 (Minnow 2009)	2017 (Minnow 2018a)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Hazeltine Creek	Upper	Exposed (Remediated in 2016)	HAC-R1	-	-	-	-	-	-	5	5	5	5	5
		Exposed (Remediated in 2017)	HAC-U (W7 in 1995 to 1999, UHC in 2007)	3	3	3	-	5	-	5	5	5	5	5
		Exposed (Remediated in 2019)	HAC-R3	-	-	-	-	-	-	-	-	5	5	5
Edney Creek	Upper	Reference	EDC-U (W9 in 1995 to 2002, UER in 2007)	3	3	3	3	5	-	5	5	-[c]	5	5
Frypan Creek		Reference	FPC-R3	-	-	-	-	-	1	5	5	5	5	5

Laboratory analysis did not include determination of total wet and dry biomass.

Notes: "-" = not applicable, LPL = Lowest Practicable Level taxonomy. Only monitoring efforts that used the following methodology are displayed: Surber/ Hess sampler, 3-grab composite, 250 µm sieve, LPL. Prior to 2019, alternate sampling methodologies were employed. See Minnow 2019a for a detailed list of these alternate sampling methods.

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas. Collection of benthic invertebrate biomass data was initiated in 2017.

[b] In 1995 and 1996, each sample was a single grab collected by Surber with 243 µm mesh (HKP 1996, 1997a). In 1999, each sample was a composite of 3 Surber grabs with a 250 µm mesh (Beak 2000).

[c] Monitoring was not completed at the upper Edney Creek reference area (EDC-U) in 2020 due to differences in habitat variables (water depth and velocity) relative to the remediated areas of upper Hazeltine Creek (HAC-R1 and HAC-U) for which it is a reference.

Sample collection and analysis methods for 2022 only are described herein. For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Table 4.3.

4.3.1 Sample Collection

Benthic invertebrate community samples were collected between August 5 and 10, 2022. Five stations were sampled in each area (Figures 4.2 and 4.3, Table 4.3), and each station was established at a minimum distance of approximately three bankfull widths from adjacent stations. This level of replication provides adequate statistical power to detect differences of ± two SDs at α and β of 0.10. Sampling methods were in accordance with technical guidance (BCMOE 2013, 2016) and the CEMP (MPMC 2019). One sample was collected at each station, and each sample was a composite of three sub-samples to ensure that each sample was representative of the sampling station.

Samples were collected using a Hess sampler in Hazeltine Creek (HAC-R1, HAC-U, HAC-R3; 0.1 m^2) and a Surber sampler in Edney Creek (EDC-U) and Frypan Creek (FPC-R3; 30.5 x 30.5 cm square; 0.093 m^2). The samplers were each equipped with 250 µm mesh, which was selected to allow comparability to pre-breach data (Minnow 2009). Each sub-sample was collected from by carefully inserting the base of the sampler into undisturbed substrate. Cobble and gravel contained within the sampler was carefully washed, allowing the current to carry dislodged organisms into the collection net. Once the organisms were rinsed into the collection net, the sampler was moved to the next sub-sampling location within a station. This procedure was repeated until three sub-samples were collected from a station to complete the collection of a single sample (i.e., approximately 0.300 m^2 and 0.279 m^2 of total creek surface area for a Hess and Surber sampler, respectively). Material and organisms retained in the collection net were then carefully transferred to 1 L wide mouth plastic jars that were internally and externally labelled. This transfer was completed using a wash bottle over a plastic tub to avoid any potential loss of organisms. Any organisms that fell into the tub or adhered to the sieve bag were removed and added to the sample. Each sample was preserved with buffered formalin solution to achieve a nominal concentration of 10% and stored at room temperature until shipment to the laboratory.

A concerted effort was made to ensure that water depth, water velocity, and substrate characteristics were comparable among sub-samples, stations, and sampling areas, to minimize the influence of natural variability on benthic invertebrate community and productivity endpoints. As outlined for periphyton (see Section 4.2.1), the flow of water in Hazeltine Creek in 2022 was modified by controlling the discharge of water to the creek from Polley Lake (using a weir), and by pumping water from below the thermocline in Polley Lake into the creek for the specific purpose

of maintaining conditions that support the use of upper Hazeltine Creek as fish habitat. This supplemental flow in Hazeltine Creek presented challenges for matching habitat conditions between the exposed (Hazeltine Creek) and reference (Edney Creek) areas in 2022 similar to previous years of monitoring (Minnow 2019a, 2020a, 2021a, Minnow 2022a).

Supporting measures were collected at each sampling station to support data interpretation. Refer to Section 4.5.1 for additional details about supporting measures.

4.3.2 Laboratory Analysis

Taxonomic identification of benthic invertebrate community samples from creek habitats was completed by Cordillera Consulting using the standard methods and QA/QC measures described in Section 3.5.2 for benthic invertebrate community samples from lakes.

Following taxonomic identification, the wet and dry biomass of each sample was determined as follows[39]. For wet biomass, samples were poured out of their storage vials onto a piece of pre-weighed 212 µm Nitex mesh and were dried gently using absorbent paper. Each sample was then weighed to the nearest 0.0001 g using a Sartorius Secura Analytical balance, and the total sample wet weight was determined by subtracting the weight of the mesh from the total weight. For dry biomass, samples were placed on a piece of pre-dried and pre-weighed glass fiber filter before being dried at 160°F for 6 hours. Following a standardized short period of cooling, samples were weighed as described above, and total sample dry weight was calculated.

Laboratory QA/QC measures and the delivery of data were completed as described in Section 3.5.2 for lake benthic invertebrate community samples

4.3.3 Data Analysis

Upon receipt of the analytical data, a DQR was performed, including an examination of data completeness, organism sorting efficiency, subsampling precision and accuracy error, and taxonomic identification error (see Appendix B). Following completion of the DQR, benthic invertebrate community results were analyzed as described below.

4.3.3.1 Metrics

Benthic invertebrate community condition was evaluated using metrics of organism density, taxon richness, Simpson's Diversity and Evenness, and the density and relative density of dominant taxa groups. These endpoints were calculated at the LPL of taxonomy, following taxa exclusions, application of the decision key, and the collapsing of taxonomic data to maintain consistency among years as outlined in Section 3.5.3.1. Further analysis of benthic community structure using

[39] Total wet and dry biomass analysis was initiated in 2017 (Table 4.3).

multivariate analyses (CA) was not completed because differences in community structure between the remediated areas and pre-breach or reference conditions were easily identifiable without use of these techniques. Benthic invertebrate productivity was evaluated using total wet and dry biomass, which was converted to a standard area-based measurement (g/m^2). Benthic invertebrate community metrics were calculated for each monitoring area in each year[40] and were summarized by area and year using the following statistics: sample size, mean, median, minimum, maximum, and SD.

Evaluation of the benthic invertebrate community of upper (HAC-R1 and HAC-U) Hazeltine Creek included comparison of post-breach results to samples collected from a similar location during pre-breach monitoring in 2007 (UHC; Minnow 2009; Table 4.3). Methods employed in post-breach monitoring were consistent with those used during pre-breach sampling in 2007, enabling comparisons to pre-breach conditions (Table 4.3). Post-breach results were not compared to baseline results from HAC-U and EDC-U in 1989, 1995, and 1996 (W7 and W9, respectively; Table 4.3) because differences in sample collection methods and in taxonomic resolution precluded comparison. Adequate baseline for comparison to post-breach results is provided by the 2007 results.

Despite the consistencies between pre-breach and post-breach data, comparison of these results is still challenging due to the use of different laboratories for the taxonomic analyses, and the large time span (15 years) between data collection for the two studies (over which general improvements in laboratory protocols have occurred). A major difference between the pre-breach and post-breach data is that aquatic mites were not identified to a taxonomic level more specific than Subclass (Acari) in 2007 but were identified to genus in post-breach data, and spring-tails were identified to Class (Collembola) in 2007 but were identified to Family in post-breach data. Therefore, to keep data consistent and comparable to the pre-breach (2007) results, the aquatic mite and spring-tail data were collapsed to Class (Arachnida and Collembola, respectively). These reassignments were all completed prior to calculation of benthic community endpoints described above.

4.3.3.2 Statistical Analyses

Statistical analyses of benthic invertebrate community and productivity metrics were conducted using pre-breach (2007) and post-breach (2018 to 2022) to answer the following questions:

1. Are there differences in benthic invertebrate community and productivity between exposed and reference areas in 2022?

[40] Total biomass data are not available prior to initiation of biomass monitoring in 2017.

2. Has the benthic invertebrate community and productivity of exposed areas changed among years relative to changes at reference areas over this time, and where pre-breach data exist, has the community recovered to pre-breach conditions?

To answer these questions, results from upper Hazeltine Creek (HAC-R1 and HAC-U) were compared to reference (EDC-U), and to pre-breach (UHC; 2007), including calculation of community metrics, tabular and graphical presentation, and statistical analyses.

Benthic invertebrate community and productivity data collected from upper Hazeltine Creek Reach 3 (HAC-R3; 2020 to 2022) and Frypan Creek (FPC-R3; 2017 to 2022) were excluded from data analyses and interpretation (see Section 4.3 for details and rationale) and are presented in tabular form only in the present report (Appendix Tables D.4.1 to D.4.4). These data will be interpreted in a separate report which focused on the re-opening of Hazeltine Creek as fish habitat (Minnow 2023).

Statistical comparisons were completed using two-way ANOVAs with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year*. The analyses were completed using the two-way ANOVA methods described in Section 3.3.3.1.2 with pre-breach and post-breach (exposed [remediated] and reference) data from the creeks. Comparisons between the exposed areas of upper Hazeltine Creek (HAC-R1 and HAC-U) and the associated reference (EDC-U) were completed for each year that remediated and reference data were available (i.e., 2018 to 2022; see Table 4.3). In addition, pre-breach data (2007) were compared between upper Hazeltine (UHC) and upper Edney (UER) creeks to evaluate the baseline condition in these areas. As described in Section 4.2.3.2, UHC (pre-breach data; 2007) was treated as a separate area from HAC-R1 and HAC-U in the upper Hazeltine Creek two-way ANOVA analyses because pre-breach data from UHC was used in comparison to both HAC-R1 and HAC-U. Pairwise contrasts were conducted as described in section 3.3.3.1.2, except for those completed for upper Hazeltine Creek (HAC-R1, HAC-U). If the *Area* term was significant for the ANOVA, temporal pairwise contrasts were completed among the areas (EDC-U, UHC, HAC-R1 and HAC-U; as though a significant interaction had been detected) due to the inherent temporal contrasts of the *Area* term (i.e., pre-breach data for UHC compared to post-breach data for HAC-R1 and HAC-U). Pairwise comparisons to pre-breach data in tables are shown using the standard letter display (years that share a letter were not significantly different). Results of the contrasts of HAC-R1 and HAC-U to pre-breach data from UHC (2007) are shown on figures with an asterisk "*" indicating a significant difference relative to pre-breach.

Interpretation of benthic invertebrate community metrics was enhanced by inspection of raw data and taxonomic proportions to detect patterns of ecologically relevant differences between the exposed and pre-breach areas. Ecological and habitat requirements of benthic invertebrates, as

outlined in standard references (Clarke 1981; Edmunds et al. 1976; Weiderholm 1983; Wiggins 1996; Vieira et al. 2006, Merritt et al. 2008) were used in data interpretation. All statistical comparisons were conducted using R (R Core Team 2022). Statistically significant differences in benthic invertebrate community between areas were identified using an α of 0.1 (as used for evaluation of all biological data in this report). Significant differences with a MOD that exceeded ±2 SD/MAD were identified as potentially ecologically meaningful in statistical analyses results and in data interpretation (Environment Canada 2012b[41]). Densities and relative densities (%) of major benthic invertebrate groups were plotted as stacked bar charts. Benthic invertebrate community metrics were plotted to support the two-way ANOVA results. Untransformed data were plotted for ease of interpretation and plots were generated using R (R Core Team 2022).

Correlation analyses were completed for upper Hazeltine Creek (HAC-R1, HAC-U) using data from 2018 to 2022 to investigate the relationships between benthic invertebrate community metrics and supporting measures of physical and chemical conditions in these areas that have been recovering since 2016 and 2017, respectively (following the completion of remediation works). Benthic invertebrate community metrics were compared to the environmental variables water depth, velocity, temperature, dissolved oxygen (concentration and %), pH, specific conductivity, and substrate size using Spearman's Rank correlation (as described in Section 3.5.3.2). A Bonferroni-type correction (i.e., α [0.05] divided by the total number of independent variables) was applied to minimize the risk of declaring false positive correlations. Statistically significant correlations found at the Bonferroni-adjusted p-value were further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were leveraged by outlying points (or groups of points).

4.4 Periphyton and Benthic Invertebrate Tissue Quality

Periphyton and tissue quality monitoring of creek habitats in 2022 was completed in accordance with the CEMP (MPMC 2019) and targeted upper (HAC-R1, HAC-U) and lower (HAC-D) areas of Hazeltine Creek and an impacted area of lower Edney Creek (E1), with un-impacted areas of upper (EDC-U) and lower (EDC-D) Edney Creek serving as reference (Figure 4.2, Table 4.4). Channel remediation works in the vicinity of HAC-R1 and HAC-U were completed in 2016 and 2017, respectively, and in 2020/2021 in the vicinity of HAC-D and E1[42] (Table 4.4).

[41] Environment Canada (2012b) identifies a CES of ± 2 SDs for evaluating ecologically meaningful changes in benthic invertebrate community.

[42] Monitoring stations within the remediated lower creek areas (HAC-D and E1) were relocated in 2021 relative to previous years due to the recent remediation efforts in these areas (Minnow 2022a). Briefly, in the case of HAC-D, this included relocation of the monitoring stations further upstream within the lower Hazeltine Creek. In the case of E1, this

Table 4.4: Overview of Periphyton and Benthic Invertebrate Tissue Quality Monitoring in Creek Habitats in the Vicinity of the Mount Polley Mine, 2009 to 2022[a]

Waterbody		Area Type	Area Code	Tissue	Year[b]												
					Pre-Breach					Post-Breach							
					2009 (Minnow 2011)	2010 (Minnow 2011)	2011 (Minnow 2012)	2012 (Minnow 2013a)	2013 (Minnow 2013b)	2015 (Minnow 2016b)	2016 (Minnow 2017b)	2017 (Minnow 2018b)	2018 (Minnow 2019a)	2019 (Minnow 2020a)	2020 (Minnow 2021a)	2021 (Minnow 2022a)	2022
Hazeltine Creek	Upper	Exposed (Remediated in 2016)	HAC-R1	Periphyton	-	-	-	-	-	-	-	8	8	8	8	8	8
				Benthic Invertebrates	-	-	-	-	-	-	-	8	8	8	8	8	8
		Exposed (Remediated in 2017)	HAC-U (W7 prior to 2015)	Periphyton	-	5	5	8	5	-	-	-	8	8	8	8	8
				Benthic Invertebrates	5	5	-	8	8	5	3	-	8	8	8	8	8
	Lower	Exposed (Remediated in 2020/2021)	HAC-D (W11 prior to 2015)	Periphyton	-	5	5	5	5	-	-	8	8	8	8	8	8
				Benthic Invertebrates	-	5	-	5	5	8	3	12[c]	8	8	8	8	8
Edney Creek	Upper	Reference	EDC-U (Upper Edney Creek)	Periphyton	-	-	-	-	-	-	-	-	8	8	8	8	8
				Benthic Invertebrates	-	-	-	-	-	-	-	-	8	8	8	8	8
	Lower	Reference	EDC-D (Lower Edney Creek)	Periphyton	-	-	-	-	-	-	-	8	8	8	8	8	8
				Benthic Invertebrates	-	-	-	-	-	5	3	8	8	8	8	8	8
		Exposed (Remediated in 2020/2021)	E1	Periphyton	-	-	-	-	-	-	-	-	-	8	8	8	8
				Benthic Invertebrates	-	-	-	-	-	-	-	-	-	8	8	8	8

Shading indicates only selenium was monitored.
Shading indicates stations were exposed to effluent being conveyed by Hazeltine Creek to Quesnel Lake.

Notes: "-" = not applicable/not sampled.

[a] Numbers indicate the number of stations sampled per area. Only sampling areas that were monitored in 2022 are displayed, as well as historical data for these areas.

[b] Composite-taxa benthic invertebrate samples were collected from 2009 to 2015. In 2016 and 2017, stoneflies and caddisflies were sampled at reference and remediated areas, respectively. In 2018 to 2022, both composite-taxa samples and single taxon (caddisfly) samples were collected at all areas.

[c] Eight samples for stoneflies and eight samples for caddisflies were sampled at a total of 12 stations.

As outlined in the CEMP (MPMC 2019), the frequency of periphyton and benthic invertebrate tissue quality monitoring in creek habitats is annual, and monitoring at these areas was last completed in 2021 (Minnow 2022a).

Some temporal differences exist in the composition of benthic invertebrate samples, including the collection of composite-taxa and/or single taxon (caddisfly) sample types (Table 4.4). Composite-taxa samples are representative of the range of taxa present at a sampling area and are reflective of dietary exposure for fish, therefore may be used in assessment of fish habitat. Single-taxon samples represent one taxon group and were collected to decrease the potential variability in results related to differences among benthic invertebrate taxa in tissue quality. Both single taxon (caddisfly) and composite-taxa samples were collected at each sampling area from 2018 to 2022, consistent with the CEMP (MPMC 2019). Prior to 2018, either composite-taxa (2009 to 2015) or single taxon (2016 and 2017) benthic invertebrate tissue quality samples were collected (see Table 4.4 and Minnow 2018c, 2019a for details).

Sample collection and analysis methods for 2022 are described herein. For details pertaining to prior sampling years, including equivalent historic sampling areas, refer to the references listed in Table 4.4.

4.4.1 Sample Collection

Periphyton and benthic invertebrate tissue samples were collected from 8 replicate stations within each area (Figure 4.2, Table 4.4) between August 2 and 10, 2022. Periphyton tissue samples were collected at each station by scraping periphyton from the surface of at least five rocks using a scalpel until a sufficient sample weight (i.e., more than 0.5 g wet weight) was attained for analysis. Periphyton scrapings were placed in labeled scintillation vials.

Benthic invertebrate tissue samples were collected at each station using a combination of kick-and-sweep and hand picking. The kick-and-sweep method involved a field technician moving upstream and across the stream channel (in a zig-zag pattern) while holding a kick net (a net with a triangular opening and a 400 µm mesh bag) immediately downstream and disturbing the substrate with their feet to dislodge benthic organisms into the net. The net was then rinsed with water to move all debris and invertebrates to the collection cup at the bottom of the net.

included relocation of the monitoring stations in lower Edney Creek to upstream of the confluence with Hazeltine Creek which was constructed in summer 2020 (Minnow 2022a). Monitoring station locations for HAC-D in 2022 were returned to similar locations to previous monitoring years (i.e., prior to 2021) and monitoring station locations for E1 in 2022 were consistent with the relocated locations sampled in 2021 (i.e., remained upstream of the confluence with Hazeltine Creek (Figure 4.2).

The collection cup was removed and the contents (i.e., invertebrates and debris) were poured into a white tub. Benthic invertebrates were then picked free of debris and transferred to labelled scintillation vials. Hand picking entailed overturning rocks in the streambed and collecting any benthic invertebrates observed. Both kick-and-sweep and hand-picking methods were employed at each erosional sampling station to collect benthic invertebrate samples. Two types of benthic invertebrate tissue samples were collected from each station: composite-taxa and single taxon (caddisfly).

Duplicate (split) samples were collected at a target frequency of 10% for QA/QC purposes and were evenly distributed among sampling areas and tissue types. Following collection, samples were stored in a cooler with ice packs until being frozen prior to shipment (on ice) to the analytical laboratory.

4.4.2 Laboratory Analysis

Laboratory analysis of periphyton and benthic invertebrate tissue quality samples was completed by ALS Environmental (Burnaby, BC) using the same methods and QA/QC measures outlined in Section 3.4.2.

4.4.3 Data Analysis

Upon receipt of periphyton and benthic invertebrate tissue chemistry data, a DQR was completed, including an examination of data completeness, LRLs achieved, laboratory precision, laboratory accuracy, and field precision (Appendix B).

Benthic invertebrate tissue quality data collected from 2022 were screened against the British Columbia selenium guideline for the protection of aquatic life (for invertebrate tissue) of 4 mg/kg dw (BCMOE 2014). Summary statistics were calculated for each analyte by area and tissue type for 2022 and for prior years (2010 to 2021) that were used in analyses, and included mean, SD, minimum, median, and maximum values. Summary statistics were calculated using the K-M method as described in Section 3.8.3.1. Data analysis and interpretation of periphyton and benthic invertebrate tissue quality focused on primary and secondary analytes representing a mine influence (see Table 2.4).

4.4.3.1 BCF and TTF Calculation

Concentrations of the primary and secondary analytes in periphyton tissue and benthic invertebrate were evaluated relative to concentrations in water. The ratio of ([tissue sample concentration]/ [dissolved water concentration]) is referred to as a Bioconcentration Factor (BCF). These ratios are often used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes

other than diet (i.e., Arnot and Gobas 2006) and are applicable to erosional areas where sediment is generally rare. BCFs were calculated using mean tissue metal concentrations (dry weight) and mean aqueous dissolved metal concentrations from routine water quality monitoring stations near each tissue sampling area (Figure 4.2). Mean aqueous analyte concentrations were calculated as described in Section 3.8.3.1) using data from the one-year period prior to sampling (i.e., September 2021 to August 2022). Mean values at the LRL were replaced with the LRL for the calculation of the BCF ratios. For EDC-U, routine water quality data were not collected by MPMC, and so BCFs were calculated using data from the spot water samples collected during tissue collection.

Concentrations of primary and secondary analytes in benthic invertebrate tissue were also evaluated relative to concentrations in periphyton tissue. These ratios of concentrations are referred to as Trophic Transfer Factors (TTFs) and can be estimated for benthic invertebrates assuming they inhabit a single trophic level above periphyton (i.e., TTF = [benthic invertebrate sample]/[periphyton sample]). TTFs can be used to describe the extent to which analyte concentrations increase between lower and higher trophic levels (e.g., Presser and Luoma 2010). Paired observations of benthic invertebrate and periphyton tissue chemistry were used to calculate TTFs for each replicate station in 2022 (i.e., 8 replicate TTFs per area in 2022). In addition, data collected in prior years (2010 [pre-breach], and 2017 to 2021 (post-breach; in years when both periphyton and benthic invertebrate tissue samples were collected) were also used to calculate TTFs in Hazeltine Creek (refer to previous reports outlined in Table 4.4). If an analyte concentration for either the nominator (benthic invertebrate tissue metal concentration) or denominator (periphyton tissue metal concentration) in the TTF calculation was censored (i.e., < LRL), the TTF was not calculated. These calculated TTFs were then summarized by year and area calculating the mean, SD, median, minimum, and maximum.

4.4.3.2 Statistical Analyses

Statistical analyses of metal concentrations in 1) periphyton tissue, 2) composite-taxa benthic invertebrate tissue, and 3) caddisfly tissue samples of TTFs were conducted using pre-breach (2010) and post-breach (2015 to 2022) data to answer the following questions:

1. Have mean analyte concentrations or TTFs at the exposed area changed over time relative to the reference area?[43]
2. Are there differences in mean analyte concentrations TTFs between exposed and reference areas, and does the difference depend on year?

[43] i.e., has the ratio of concentrations (exposed:reference) changed over time?

3. Do mean analyte concentrations or TTFs at exposed areas differ from pre-breach conditions?

To answer these questions, data were grouped into three categories for separate tabular and graphical presentation and statistical analyses:

1. The exposed areas of upper Hazeltine Creek (HAC-R1 and HAC-U; 2018 to 2022 for periphyton and composite and single-taxon benthic invertebrates) compared to reference (EDC-U; 2018 to 2022 for periphyton and composite and single-taxon benthic invertebrates).
2. The exposed area of lower Hazeltine Creek (HAC-D; 2017 to 2022 for periphyton, 2015 and 2018 to 2022 for composite-taxa and 2018 to 2022 for single-taxon benthic invertebrates) compared to reference (EDC-D; 2017 to 2022 for periphyton, 2015 and 2018 to 2022 for composite-taxa and 2018 to 2022 for single-taxon benthic invertebrates).
3. The exposed area of lower Edney Creek (E1; 2019 to 2022 for periphyton and composite and single-taxon benthic invertebrates) compared to reference (EDC-U; 2019 to 2022 for periphyton and composite and single-taxon benthic invertebrates).

Questions 1 and 2 were answered by conducting a two-way ANOVA assessing the exposed:reference ratios of results, with *Area* and *Year* as factors and assessing the interaction between *Area* and *Year.* The two-way ANOVA was competed *as* detailed in Section 3.4.3 (for Questions 1 and 2) to address the same questions.

Post-breach results (2015 to 2022) were also statistically contrasted to pre-breach data, where possible. Pre-breach data were collected for periphyton and composite-taxa benthic invertebrate tissue quality from HAC-U and HAC-D in 2010 (Table 4.4).[44] The comparisons to pre-breach were conducted using a censored one-way ANOVA with *Year* as the factor as described in Section 3.7.3.2 and were used to contrast post-breach results for periphyton tissue quality, composite-taxa benthic invertebrate tissue quality, and TTFs to pre-breach conditions. TTF data (calculated as described in Section 4.4.3.1) did not contain censored (i.e., < LRL) values, therefore the ANOVA models for comparison of TTFs were fit with least-squares estimation (i.e., not MLE) and $\log_{10}$ transformed response variables. Data used in these comparisons included the following:

[44] Pre-breach periphyton and composite-taxa benthic invertebrate tissue quality samples were also collected in 2011 to 2013 at HAC-U and HAC-D, and from HAC-U in 2009. Reported data for these samples included selenium as the only analyte, therefore these results were not included in statistical contrasts to pre-breach data.

1. Post-breach periphyton tissue quality, composite-taxa benthic invertebrate tissue quality, and TTF results from HAC-R1 and HAC-U compared to pre-breach results from HAC-U; and
2. Post-breach periphyton tissue quality, composite-taxa benthic invertebrate tissue quality, and TTF results from HAC-D compared to pre-breach results from HAC-D.

Although statistical analyses were conducted for all metals detected in the chemical analyses, data presentation, interpretation, and discussion were focused on the identified primary and secondary analytes (see Table 2.4). Plots of data that support the two-way ANOVA were presented for primary and secondary analytes that: 1) had a significant *Area* × *Time* interaction in the analyses; and 2) lacked a significant *Area* × *Time* interaction in the analyses but had a positive MOD (i.e., exposed concentrations were significantly higher than reference and the difference did not depend on year). Results of the contrasts to pre-breach (2010) are shown on the two-way ANOVA figures with an "*" indicating a significant difference relative to pre-breach.

All statistical analyses were conducted using R software (R Core Team 2022). A significance level $\alpha = 0.05$ was used for statistical comparisons, as was used for the evaluation of all chemical data in this report.

4.5 Supporting Measures

A variety of supporting physical and chemical information was used to support the interpretation of sediment and aquatic biological data collected from creeks as part of the CEMP. This information falls into two categories: 1) supporting information that was collected by Minnow during field collections; and 2) supporting information that was collected routinely by MPMC as part of ongoing CEMP monitoring components. Unless otherwise specified, the supporting measures outlined below belong to the first category (measures collected by Minnow).

4.5.1 Measures Collection

Supporting single spot water samples were collected from creek stations concurrent with periphyton community, benthic invertebrate community, and tissue quality sampling for comparison to BCWQG. These samples were collected on August 8, 2022 (not concurrent with biological sample collection) to ensure sample arrival at the laboratory was within the recommended hold times. Water samples were collected by wading into a mid-channel area, moving from downstream to upstream, so as not to collect water downstream of disturbed substrates, and collecting the samples from approximately half of the total water depth. Water quality data collected routinely by MPMC staff at stations near to the biological monitoring areas were also used in support of data interpretation (Figure 4.2). These data were subjected to an internal DQR by MPMC and were not further assessed for data quality in this report

(for details refer to Section 3.8.1). Immediately after collection, both spot and routine water quality samples were placed into a cooler with ice packs before being stored in a refrigerator until shipment (on ice) to the analytical laboratory (as detailed in Section 3.8.1).

Supporting measures and sampling information were collected at each of the creek monitoring stations to support data interpretation (Appendix Figure A.2.1, Appendix Tables A.2.1 to A.2.5). These included those described in Section 3.8.1 (excluding vertical depth profiles and Secchi depth) as well as the following: water velocity, substrate size (20 randomly selected substrate pieces measured per station), and general habitat characteristics assessed once for each monitoring area (channel measures, canopy cover, instream cover, periphyton coverage, and substrate characteristics) using methods adapted from Environment Canada (2012a).

4.5.2 Laboratory Analysis

Laboratory analyses of supporting spot and routine water quality samples were completed as described in Section 3.8.2 and included the parameters outlined in the CEMP routine surface water quality monitoring program (MPMC 2019). Upon completion of the analyses, a data report was provided by ALS to MPMC and Minnow as an Adobe Acrobat PDF file and a Microsoft Excel spreadsheet (Appendix G)[45].

4.5.3 Data Analysis

4.5.3.1 Summary Statistics

Summary statistics were calculated for water, sediment, and tissue quality parameters following the K-M methods described in Section 3.8.3.1. Additional information on specific parameters and applications of the summary statistics for chemical data are found within the methods sections for analysis of these data above (Sections 4.1.3 and 4.4.3 above). Summary statistics for biological endpoints (periphyton and benthic invertebrate community and productivity) were calculated using standard methods and formulae.

4.5.3.2 Water Quality Guideline Screening

Results of spot water quality sampling were screened against BCWQG (Appendix Table D.1.1; BCMOECCS 2021a,b) as outlined in Sections 3.8.3.2 and 3.8.3.3. Results of creek water quality sampling completed routinely by MPMC staff in the year preceding monitoring (i.e., September 2021 to August 2022) were also screened against BCWQG (see Sections 3.8.3.2 and 3.8.3.3 for details). These routine water quality data were also summarized by calculating sample size,

[45] Data reports for spot water quality sampling are included in Appendix G. Data from routine water quality monitoring completed by MPMC were provided to Minnow in Microsoft Excel format from the MPMC database and are these not included in Appendix G.

mean, SD, minimum, maximum, and % LRL values as described in Section 3.8.3.1. Plots comparing total and dissolved concentrations of primary and secondary analytes to BCWQG were prepared for routinely collected water quality samples (Table 2.4). Tabular screening against BCWQG was completed using Microsoft Excel and plots were generated using R (R Core Team 2022).

5 RESULTS – LAKE HABITAT

5.1 Polley Lake

5.1.1 Sediment Quality

Sediment quality monitoring in 2022 was completed in a shallow exposed area of Polley Lake (POL-S) with a similar shallow area of Bootjack Lake (BOL-S) serving as reference (Figure 3.1, Table 3.1). A review of 2022 sediment data quality (Appendix B) indicated that the data met the established DQOs. Specifically, the data were characterized by appropriate LRLs, negligible analyte concentrations in MB samples, excellent laboratory precision and field sampling precision, and excellent laboratory accuracy. Overall, the 2022 sediment quality data can be used with a high level of confidence for interpretation. A review of 2022 supporting water data quality (Appendix B) indicated the data were characterized by appropriate LRLs, negligible analyte concentrations in MB samples, and excellent laboratory precision and field sampling precision. Laboratory accuracy for supporting water samples was considered acceptable since all laboratory control samples met the DQO, although some matrix spikes (MS) results could not be detected due to high background concentrations. Hold time exceedances occurred for four analytes in six separate samples. Most of these hold time exceedances occurred after receipt of the samples by the laboratory (i.e., samples were received by the laboratory in sufficient time for analysis). For two samples, the hold times were exceeded prior to laboratory receipt due to a combination of challenges associated with the logistics of expedited sample shipments from a remote area and the short hold times. Analyte results with hold time exceedances were similar to those samples without hold time exceedances 2022 and were within the range of historic results, suggesting little if any impact of the hold time exceedances on analyte results. Overall, the 2022 water quality data can be used with a good level of confidence for interpretation.

Sediments collected from the shallow monitoring area of Polley Lake (POL-S) in 2022 were composed of predominantly silt and sand (mean = 53.7% and 38.5%, respectively) while the reference area sediments had higher sand and lower silt content (station BOL-S; mean = 50.7% and 41.9%, respectively; Table 5.1; Appendix Tables C.2.1 to C.2.3). Sediments from POL-S in 2022 had a lower sand and higher silt content than in 2019 when the area was last sampled (mean = 67.0% and 29.8%, respectively). The mean TOC and total nitrogen content of POL-S sediments in 2022 (mean = 1.03% and 0.0958%, respectively) were lower than the associated reference sediments (mean = 8.80% and 0.447%, respectively), as was also observed in 2019 (Table 5.1; Appendix Tables C.2.2 and C.2.3). For TOC content, the lower content in POL-S sediments was significant in both 2019 and 2022, and the exposed TOC content of POL-S

Table 5.1: Summary of Sediment Quality Data for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Reference (BOL-S; 2019 and 2022)[b]	Reference				Exposed			
					Bootjack Lake				Polley Lake			
					BOL-S				POL-S			
					2019		2022		2019		2022	
		Lower	Upper		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Tests												
Moisture	%	-	-	89.7	77.1	11.9	67.7	11.5	39.5	7.20	42.5	4.96
pH (1:2 soil:water)	pH	-	-	5.98	6.45	0.857	7.15	0.724	7.97	0.175	7.54	0.0707
Particle Size												
% Gravel (>2 mm)	%	-	-	5.80	1.86	1.92	2.50	2.13	1.00	-	1.00	-
% Sand (2.0 mm - 0.063 mm)	%	-	-	79.3	32.7	28.0	50.7	18.2	67.0	26.3	38.5	8.11
% Silt (0.063 mm - 4 µm)	%	-	-	86.2	58.8	24.7	41.9	16.6	29.8	22.9	53.7	6.55
% Clay (<4 µm)	%	-	-	19.1	7.34	6.84	5.12	1.96	3.42	3.38	7.62	2.32
Organic / Inorganic Carbon (<63 µm)												
Total Organic Carbon	%	-	-	14.6	10.8	3.52	8.80	3.34	0.810	0.256	1.03	0.137
Nutrients (Bulk Sediment)												
Total Nitrogen by LECO	%	-	-	1.17	0.705	0.449	0.447	0.296	0.0452	0.0345	0.0958	0.0270
Metals (<63 µm)[c]												
Aluminum	mg/kg	-	-	12,900	9,420	2,799	7,878	1,906	***14,102***	4,749	***21,260***	1,394
Antimony	mg/kg	-	-	0.790	0.592	0.201	0.352	0.138	0.378	0.0476	0.454	0.0288
Arsenic	mg/kg	5.9	17	6.70	4.66	1.53	4.15	1.05	***13.5***	1.57	***14.0***	0.733
Barium	mg/kg	-	-	193	153	26.9	129	8.69	155	50.3	182	9.09
Beryllium	mg/kg	-	-	0.510	0.380	0.113	0.292	0.0904	***0.584***	0.130	***0.784***	0.0541
Bismuth	mg/kg	-	-	0.100	0.100	-	0.100	-	***0.102***	0.00447	0.100	-
Boron	mg/kg	-	-	12.0	10.4	0.894	7.92	1.86	10.0	-	10.7	0.428
Cadmium	mg/kg	0.6	3.5	0.282	0.199	0.0654	0.177	0.0329	0.159	0.0264	0.132	0.0119
Calcium	mg/kg	-	-	183,000	41,606	75,691	105,138	88,807	25,160	2,861	27,880	2,263
Chromium	mg/kg	37.3	90	29.2	22.1	5.34	16.2	3.55	24.0	8.22	13.1	0.279
Cobalt	mg/kg	-	-	7.58	5.82	1.56	4.75	1.07	***25.7***	6.05	***20.5***	0.581
Copper	mg/kg	35.7	197	215	137	64.7	90.1	41.0	***767***	194	***673***	47.5
Iron	mg/kg	21,200	43,766	15,900	12,980	2,594	12,060	1,574	***136,800***	73,054	***64,820***	7,048
Lead	mg/kg	35	91.3	5.13	3.36	1.12	2.55	0.429	5.05	0.579	4.80	0.580
Lithium	mg/kg	-	-	8.30	6.42	1.50	5.06	0.948	***14.3***	4.04	***18.4***	1.79
Magnesium	mg/kg	-	-	5,600	3,550	923.4	4,180	1,196	***8,272***	2,896	***12,580***	1,066
Manganese	mg/kg	460	1,100	1,070	666	261	689	196	712	31.0	764	56.5
Mercury	mg/kg	0.17	0.486	0.146	0.0921	0.0386	0.0697	0.0347	0.0769	0.00800	0.0693	0.00257
Molybdenum	mg/kg	25	23,000	5.57	3.27	1.66	2.58	1.02	3.72	0.449	4.87	0.321
Nickel	mg/kg	16	75	22.9	16.1	5.61	11.4	2.36	13.2	1.99	10.6	0.300
Phosphorus	mg/kg	-	-	703	639	48.4	561	78.2	***2,178***	302	***1,900***	62.0
Potassium	mg/kg	-	-	990	692	210	620	145	982	356	***1,680***	123
Selenium	mg/kg	2	-	2.74	1.66	0.703	1.98	0.579	1.53	0.272	1.44	0.133
Silver	mg/kg	0.5	-	0.181	0.131	0.0525	0.0882	0.0354	***0.425***	0.148	***0.301***	0.0245
Sodium	mg/kg	-	-	248	185	7.11	213	31.2	***637***	206	***932.6***	53.2
Strontium	mg/kg	-	-	1,060	275	439	532	428	143	59.4	213	13.9
Sulphur	mg/kg	-	-	6,600	4,700	1,666	2,210	1,590	1,080	205	1,996	332
Thallium	mg/kg	-	-	0.0810	0.0614	0.0146	0.0536	0.00805	0.0500	-	0.0500	-
Tin	mg/kg	-	-	0.430	0.292	0.0881	0.236	0.0541	***1.45***	0.109	***2.14***	0.150
Titanium	mg/kg	-	-	578	442	58.6	385	152	***1,252***	162	***1,888***	143
Uranium	mg/kg	-	-	2.15	1.39	0.386	1.54	0.553	1.32	0.606	1.34	0.0738
Vanadium	mg/kg	-	-	45.0	36.5	8.00	29.5	6.35	***547***	292	***257***	27.6
Zinc	mg/kg	123	315	50.0	37.7	9.89	29.8	5.63	***67.9***	8.03	***62.9***	4.81
Zirconium	mg/kg	-	-	4.10	-	-	2.76	1.17	-	-	***5.94***	1.33

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, SD - Standard Deviation. ***Bold/Italics -*** Exposed value (Polley Lake) is > reference 95th percentile values (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of reference 95th percentile values (2019 to 2022) see Appendix Table C.2.1.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

sediments did not change significantly between the two sampling events, relative to reference (Figure 5.1; Appendix Tables E.1.1 and E.1.2).

The mean concentration of 17 out of 34 analytes in POL-S sediments (<63 µm fraction) in 2022 exceeded the reference (BOL-S) 95th percentile concentrations. Among these analytes, arsenic, copper, and iron were the only analytes with mean concentrations in 2022 that exceeded both the WSQG and the reference 95th percentile values (Analytes of Interest; Table 5.1; Appendix Tables C.2.2 and C.2.3). Mean arsenic concentrations in POL-S sediments exceeded the lower WSQG by 2.4 times, and mean copper and iron concentrations exceeded the upper WSQG by 3.4 and 1.5 times, respectively (Table 5.1; Appendix Table C.2.3). Copper concentrations at the reference area (BOL-S) also exceeded the lower WSQG by 2.5 times, indicating sediments in the region have naturally elevated copper concentrations (Figure 5.1; Appendix Table E.1.2).

Mean concentrations of these three Analytes of Interest in POL-S sediments were significantly elevated relative to reference sediments in 2019 and 2022, and the exposed:reference ratio was temporally stable between 2019 and 2022 (i.e., exposed concentrations did not differ temporally relative to reference (Figure 5.1; Appendix Table E.1.1). Mean iron concentrations, were substantially lower in 2022 (mean = 64,820 mg/kg) than in 2019 (mean = 136,800 mg/kg), but not significantly so, due to the high variability observed in 2019 (range = 55,800 to 221,000 mg/kg; Table 5.1; Appendix Tables E.1.1, E.1.2, C.2.3).

Arsenic, copper, and iron concentrations were significantly negatively correlated with TOC and total nitrogen content when sediments from both POL-S and BOL-S were considered (Appendix Table E.1.3, Appendix Figure E.1.1). These results were highly leveraged by the highest analyte concentrations and lowest TOC content occurring in POL-S sediments and highest TOC and total nitrogen content occurring in BOL-S sediments (Appendix Figure E.1.1). These relationships are consistent with a breach-related influence defined by the input of inorganic sediments with elevated analyte concentrations to Polley Lake.

5.1.2 Sediment Toxicity

Sediment toxicity testing using *H. azteca* in 2022 (14-day standard test) was completed at a shallow exposed area of Polley Lake (POL-S), with a similar shallow area of Bootjack Lake (BOL-S) serving as reference (Figure 3.1; Section 3.3). A review of sediment toxicity test data quality indicated that tests met control acceptability criteria and all water quality parameters remained within acceptable ranges throughout the tests (Nautilus 2022; Appendix G). Reference toxicant test results fell within the acceptable range and therefore the sensitivity of organisms used in the tests was considered appropriate (see the DQR for details; Appendix B). All ammonia concentrations were at levels that are not expected to cause adverse effects to *H. azteca* (Appendix G). Examination of laboratory bench sheets indicated that temperature,

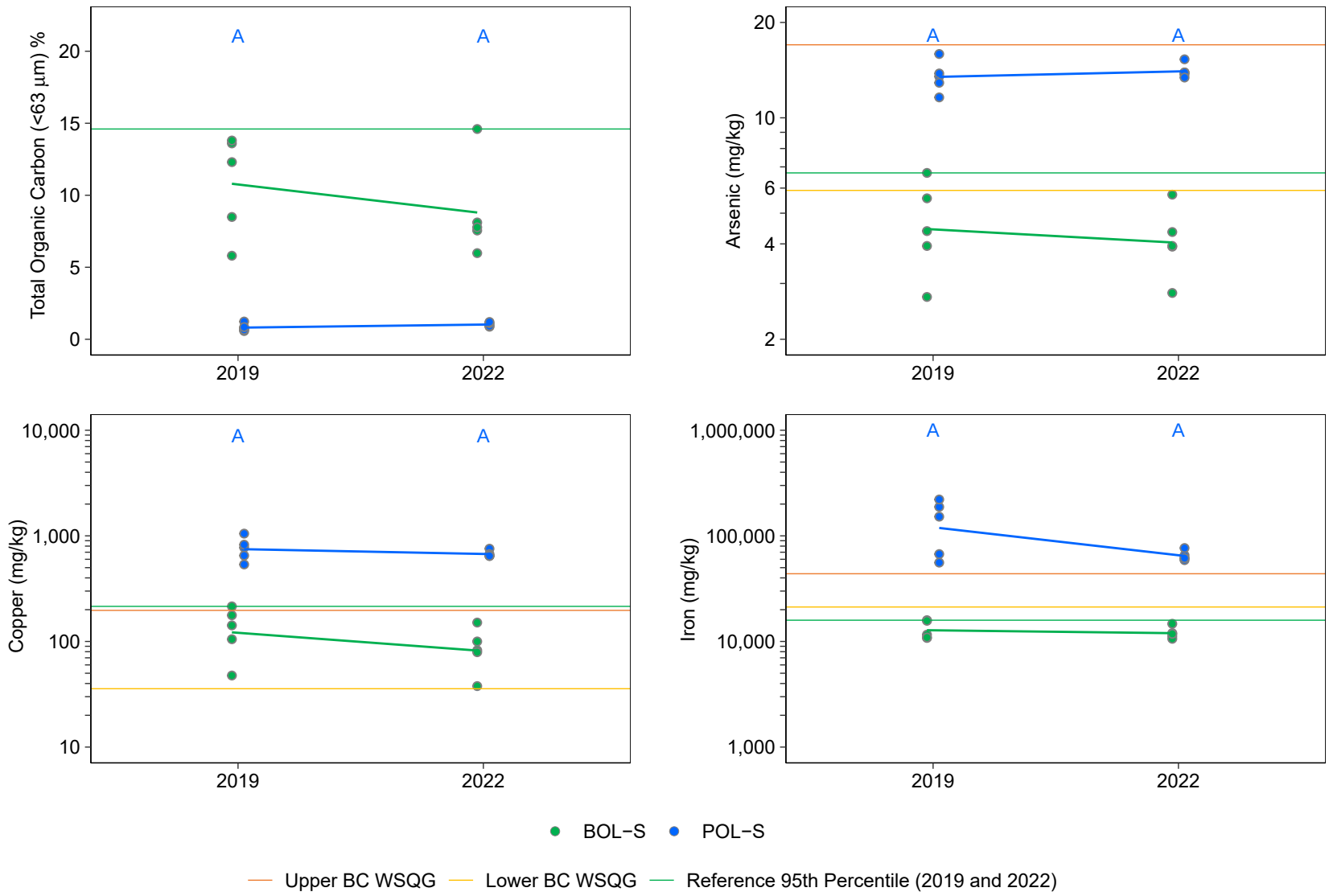

Figure 5.1: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022

Notes: BC WSQG = British Columbia Working Sediment Quality Guideline (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). The reference 95th Percentile was calculated using data from 2019 and 2022. Green represents reference areas and blue represents exposed areas. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year and $\log_{10}$-transformed data for all analytes except Total Organic Carbon (TOC) (no transformation). Years that share a letter (e.g., A,B,C) have ratios (or differences - TOC) of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio (or difference) of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

dissolved oxygen, conductivity, and pH were all stable over the course of the toxicity tests (Appendix G).

Survival of *H. azteca* exposed to POL-S sediments in 2022 showed no unacceptable response relative to the reference sediments (BOL-S) and the laboratory control. Growth of *H. azteca* exposed to POL-S sediments also showed no unacceptable response, with growth 14% greater than reference (BOL-S) sediments and 26% greater than the laboratory control (Table 5.2). The survival and growth responses observed in 2022 were similar to those in 2019 (Figure 5.2); which indicated a low survival response relative to the lab sand control (but no unacceptable response relative to the reference sediments) and no unacceptable growth response (Minnow 2020a).

The overlying water of the bioassay test vessels in 2022 had concentrations of dissolved copper that were notably higher for POL-S sediments (mean = 0.028 mg/L measured on day 14 of the test; Appendix G) than the overlying waters for reference sediments (BOL-S; 0.0049 mg/L). Dissolved copper concentrations in the bioassay test vessels for POL-S sediments were also notably higher than those documented in field-collected water samples (mean = 0.0036 mg/L; Appendix Table C.1.2). This suggests some copper mobilization in the test set-up that has either not occurred *in situ* or has attenuated over time. Despite the elevated dissolved copper concentations in the bioassay test vessels relative to *in situ* conditions, the absence of survival or growth effects to *H. azteca* in toxicity testing indicates the shallow exposed sediments from Polley Lake are able to support benthic invertebrate organisms.

5.1.3 Plankton Community and Productivity

Plankton community and productivity monitoring in 2022 was completed three times (June, July, and August) in Polley Lake (POL-P2) and at a corresponding reference area (Bootjack Lake; BOL-B2; Figure 3.3, Tables 3.4 and 3.5). A review of the 2022 plankton data quality (Appendix B) indicated that the data met the established DQOs. Specifically, the data were characterized by good agreement between laboratory duplicates for both phytoplankton and zooplankton community results, indicating good laboratory precision and accuracy. Additionally, phytoplankton productivity measurements (chlorophyll-a) results were of acceptable detectability (above the LRL), negligible analyte concentrations in MB samples, excellent laboratory precision, and excellent laboratory accuracy. Chlorophyll-a sample hold times were exceeded by one day in one sample from August due to a combination of field sampling logistics (field filtration was not possible), challenges associated shipping from a remote area, and the short (two day) recommended hold time for unfiltered chlorophyll-a samples (see Appendix B for details). The chlorophyll-a result for the single sample that exceeded the hold time was similar to results from samples without hold time exceedances 2022 and were

Table 5.2: Summary of *Hyalella azteca* 14-day Survival and Growth Responses for Sediment Toxicity Testing of Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-S; Reference) Shallow Areas, 2022

Results and Classification	Polley Lake	
	POL-S	
	Survival	Growth[a]
	%	mg
Raw Area Result	94.0 ± 8.9	0.24 ± 0.03
Raw Laboratory Control Result	96.5 ± 5.50	0.19 ± 0.03
Raw Reference Result (BOL-S)	90.0 ± 7.10	0.21 ± 0.01
Control Normalized Response	97%	126%
Reference Normalized Response	104%	114%
Statistically Significant Reduction from Control	N	N
Statistically Significant Reduction from Reference	N	N
CLASSIFICATION	**NR**	**NR**

no unacceptable response (<20% reduction) - **NR**.
low response (20-50% reduction) and not significantly different than control and reference - **LR**.
moderate response (20-50% reduction) and significantly different than control and reference - **MR**.
high response (>50% reduction) - **HR**.

Note: Y = Yes, N = No.

[a] Growth = dry weight per surviving organism (mg).

[b] Where comparisons to mean laboratory control result and the mean field reference result did not fall into the same response classification, the result was discussed relative to both the control and the field reference.

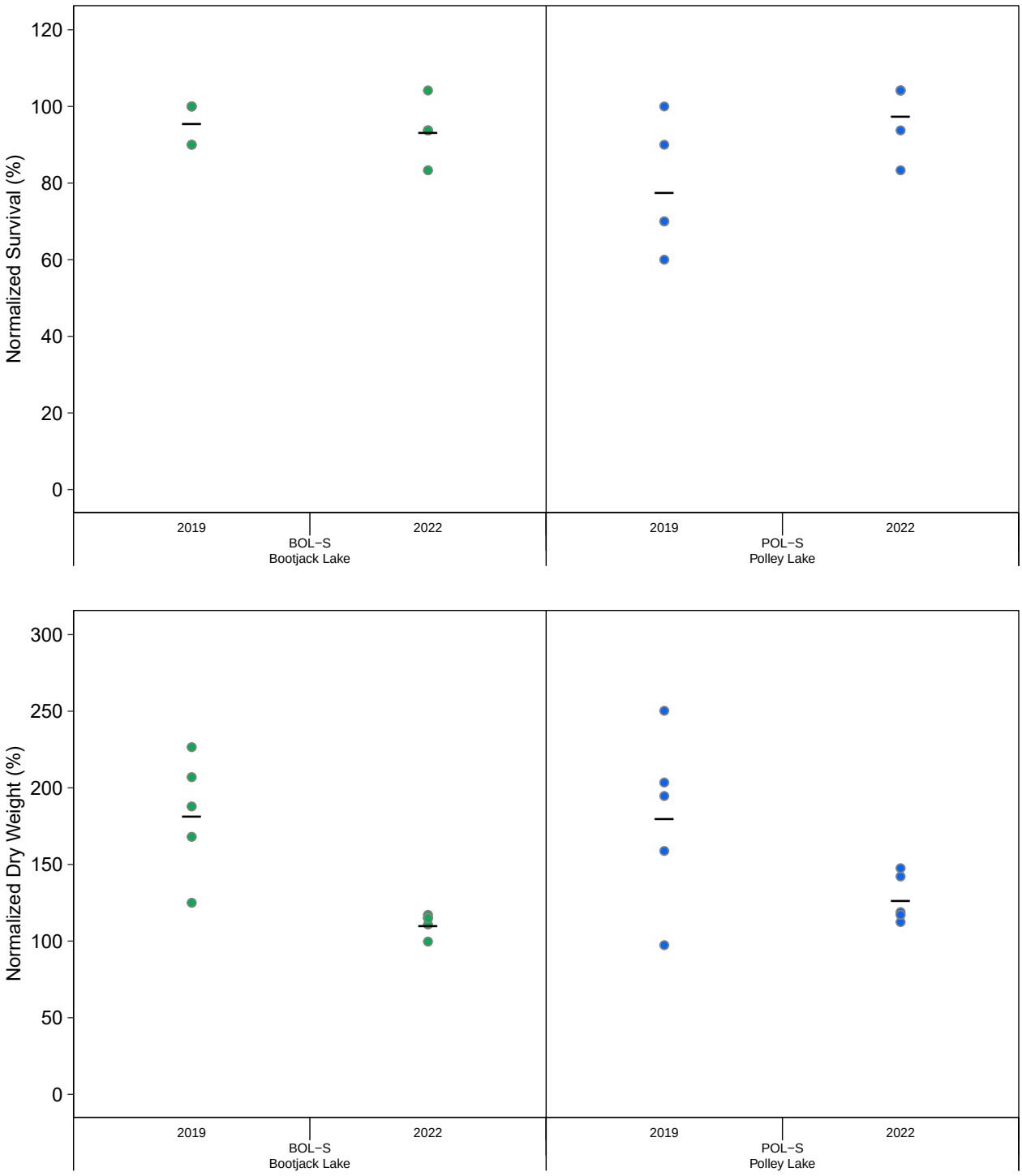

Figure 5.2: *Hyalella azteca* 14-day Survival and Growth Responses for Sediment Toxicity Testing of Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-S; Reference) Shallow Areas, 2019 to 2022

Notes: Plots are only included for primary or secondary analytes with a significant postive exposed - reference difference in 2022 or in all monitoring years. Survival data were normalized to the control acceptance criteria, and the samples were calculated as a percentage of normalized control performance. Growth data were normalized to laboratory controls run during the test with the reference site for that area.

within the range of historic results, suggesting little if any impact of the hold time exceedances on analyte results. Overall, the plankton community and productivity data for Polley Lake can be used with a high level of confidence for data interpretation. A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

5.1.3.1 Phytoplankton

5.1.3.1.1 Community

Phytoplankton densities in Polley Lake (POL-P2) in 2022 were highest in August and were mid-range in July, while densities at Bootjack Lake (reference area; BOL-B2) in 2022 were highest in July. The taxon richness reported in June was within the range observed in July at both POL P2 and BOL-B2 in 2022, but richness in both lakes was highest in August (Appendix Figure E.2.1, Appendix Table C.3.1). Phytoplankton density, and Simpson's Diversity and Evenness were significantly higher at POL-P2 compared to BOL-B2 in July 2022, while taxon richness was significantly lower (Figure 5.3, Table 5.3; Appendix Tables C.3.1, C.3.2). Total phytoplankton density at POL-P2 was higher than at BOL-B2 in 2022 due to the combined effects of higher densities of Chlorophytes, Chrysophytes, and Cryptomonads (Appendix Figure E.2.2, Appendix Table E.2.1).

Temporal analyses indicated variability in density and Simpson's Diversity and Evenness at POL-P2 from 2019 to 2022, but these endpoints were largely similar to or higher than reference over that period. Taxon richness showed temporal stability from 2019 to 2022 and was similar to or lower than reference over that period. Specifically, mean phytoplankton density at POL-P2 in 2022 was significantly lower than in 2019 and 2020; however, a similar significant decrease in density was observed at BOL-B2 among these years (Figure 5.3, Table 5.3). Densities were also lower in 2021 compared to 2019 in both lakes. The significant decrease in phytoplankton densities at both POL-P2 and BOL-B2 in 2022 relative to previous years (relative to 2019 and 2020 at POL-P2 and relative to 2019 to 2020 at BOL-B2; Figure 5.3, Table 5.3) was driven by decreased densities of Cyanobacteria at both locations since 2019 (Appendix Figure E.2.2, Appendix Table E.2.1). Given that the densities of Cyanobacteria decreased in a similar manner in both waterbodies, it is likely that this decrease was related to local environmental factors (e.g., water temperature), with seasonal fluctuations in surface water temperature being very similar in both waterbodies (Appendix Figures A.1.1, C.1.1). Taxon richness at POL-P2 from 2019 to 2022 was lower than at BOL-B2 except in 2020, was temporally stable over this period, was generally within the range of post-breach (2015 to 2018) and was lower than baseline at both POL-P2 and BOL-B2 (Figure 5.3, Table 5.3; Appendix Figure E.2.1). It is possible that some of the variability in richness among the baseline (1995 and 1996), post-breach (2015 to 2018),

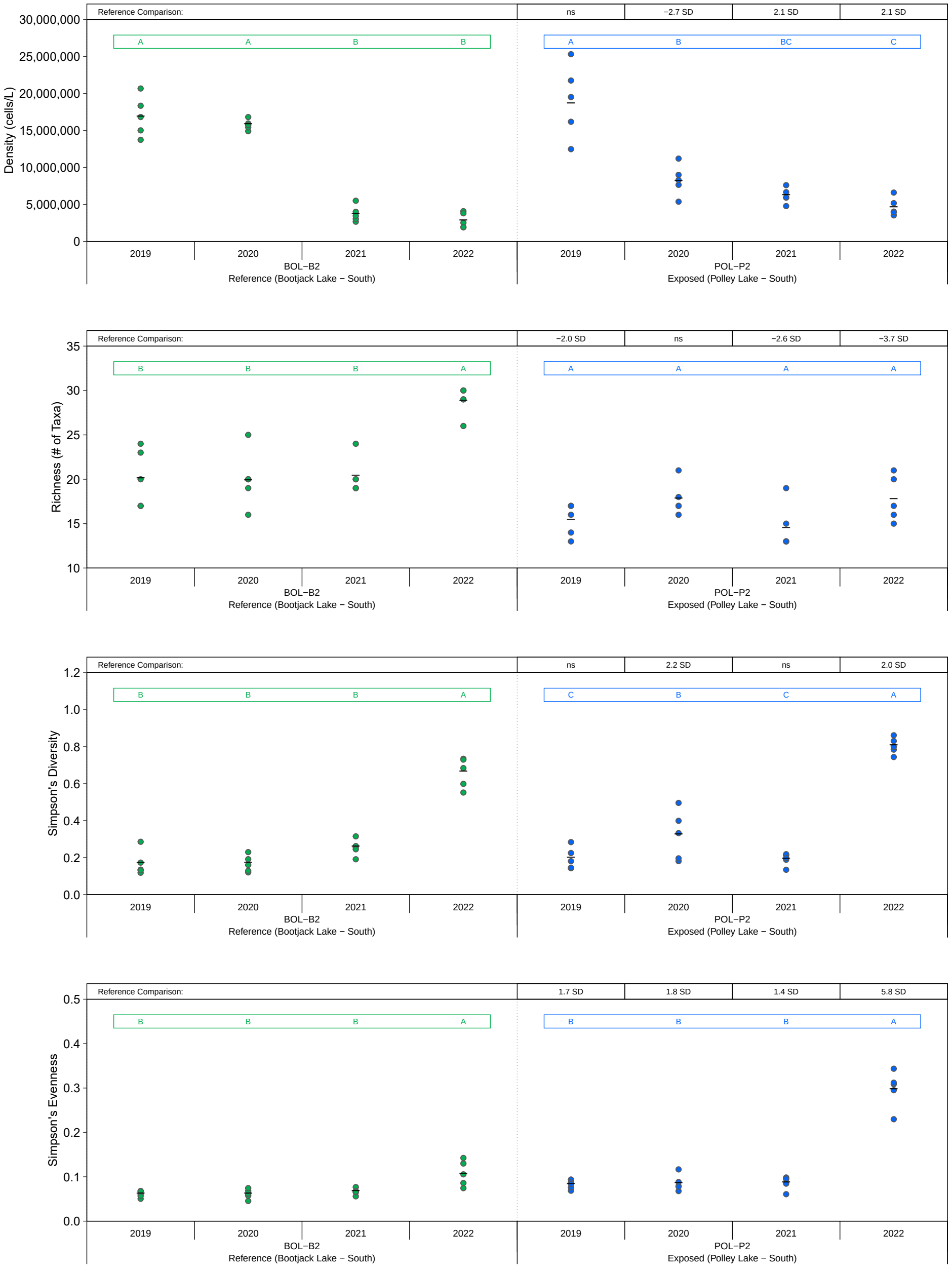

Figure 5.3: Phytoplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

Table 5.3: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year	Mean	MCT[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
										Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year						2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Density (cells/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	16,920,021	16,745,017	A	A	B	B	Baseline	ns	-6.3	-7.5	ns
							2020	15,769,285	15,756,799									-2.7
							2021	3,737,530	3,618,303									2.1
							2022	2,856,805	2,710,389									2.1
					Exposed	POL-P2	2019	19,050,107	18,506,530	A	B	BC	C	Baseline	-3.4	-4.5	-5.8	
							2020	8,310,083	8,083,492									
							2021	6,188,644	6,117,587									
							2022	4,657,243	4,534,837									
Richness (# of Taxa)	log10	-	-	0.025	Reference	BOL-B2	2019	20.2	20.0	B	B	B	A	Baseline	ns	ns	2.8	-2.0
							2020	20.0	20.0									ns
							2021	20.4	20.0									-2.6
							2022	28.8	29.0									-3.7
					Exposed	POL-P2	2019	15.4	15.0	A	A	A	A	Baseline	ns	ns	ns	
							2020	17.8	18.0									
							2021	14.6	14.0									
							2022	17.8	18.0									
Simpson's Diversity	none	-	-	0.004	Reference	BOL-B2	2019	0.168	0.170	B	B	B	A	Baseline	ns	ns	6.9	ns
							2020	0.166	0.170									2.2
							2021	0.254	0.250									ns
							2022	0.660	0.660									2.0
					Exposed	POL-P2	2019	0.196	0.200	C	B	C	A	Baseline	1.8	ns	8.6	
							2020	0.321	0.320									
							2021	0.190	0.190									
							2022	0.804	0.800									
Simpson's Evenness	log10	-	-	<0.001	Reference	BOL-B2	2019	0.0607	0.0600	B	B	B	A	Baseline	ns	ns	3.1	1.7
							2020	0.0615	0.0610									1.8
							2021	0.0664	0.0660									1.4
							2022	0.108	0.100									5.8
					Exposed	POL-P2	2019	0.0819	0.0810	B	B	B	A	Baseline	ns	ns	7.2	
							2020	0.0859	0.0840									
							2021	0.0869	0.0860									
							2022	0.298	0.300									
Chlorophyll-a (µg/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	2.76	2.70	A	B	B	B	Baseline	-2.2	-3.5	-2.0	ns
							2020	2.05	2.00									ns
							2021	1.68	1.70									-2.2
							2022	2.08	2.10									2.0
					Exposed	POL-P2	2019	2.46	2.50	A	B	C	A	Baseline	-2.3	-4.9	ns	
							2020	1.76	1.80									
							2021	1.23	1.20									
							2022	2.82	2.80									

Magnitude of Difference (MOD) < -2.

Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available, nc = no comparison, ns = no significance, nm = contrast Magnitudes of Difference (MODs) could not be calculated because the Median Absolute Deviation (MAD) = 0, cells/L = Cells per litre. µg/L = micrograms per litre.

[a] MCT = Measures of Central Tendency. Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log $_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

and 2019 to 2022 sampling periods was related to changes in phytoplankton taxonomists (see Minnow 2020a for details). Simpson's Diversity was higher in 2022 compared to previous years (2019 to 2021) at POL-P2 and was either similar to (in 2019 and 2021) or significantly higher (2020 and 2022) than at BOL-B2. Similarly, Simpson's Evenness at POL-P2 was higher in 2022 compared to previous years (2019 to 2021) and was consistently higher than at BOL-B2 from 2019 to 2022 (Figure 5.3, Table 5.3; Appendix Tables C.3.1, C.3.2).

In 2022, the phytoplankton community at POL-P2 was dominated by Cyanobacteria in July and August but was dominated by Diatoms and Chlorophytes in June (Figure 5.4; Appendix Tables C.3.1 and C.3.2). At BOL-B2, the phytoplankton community was dominated by Cyanobacteria in June, July, and August, although the extent of community dominance was lowest in June (Figure 5.4; Appendix Tables C.3.1 and C.3.2). The mean relative densities (%) of the dominant phytoplankton taxa (Chlorophytes and Chrysophytes) were similar or higher at POL-P2 compared to BOL-B2 in July 2022, except Cyanobacteria which was significantly lower. Specifically, % Cyanobacteria decreased significantly at both POL-P2 and BOL-B2 in 2022 relative to previous years (2019 to 2021) and was lower at POL-P2 than reference in 2020 and 2022. The relative densities of Chrysophytes and Chlorophytes were significantly higher at both POL-P2 and BOL-B2 in 2022 compared to 2019 to 2021. The relative density of Chrysophytes was higher at POL-P2 than at BOL-B2 from 2019 to 2022 while the relative density of Chlorophytes was higher in 2020 and 2022 (Figure 5.4; Appendix Figure E.2.2, Appendix Tables C.3.1, C.3.2). Cryptomonad relative density was significantly higher from 2020 to 2022 at POL-P2 compared to 2019, and the relative density of Cryptomonads at POL-P2 has varied compared to BOL-B2 across these monitoring years but was similar to reference in 2022. The relative density of Diatoms at POL-P2 decreased significantly between 2019 and 2021, but significantly increased in 2022 compared to previous years at both POL-P2 and BOL-B2. Diatom relative density at POL-P2 was not significantly different than at BOL-B2 in 2022, despite being higher and lower than BOL-B2 in 2020 and 2021, respectively (Figure 5.4; Appendix Figures E.2.2, Appendix Tables C.3.1, C.3.2, E.2.1). The increases observed in Diatom, Chlorophyte, and Chrysophyte relative densities in 2022 relative to prior years were a direct result of lower Cyanobacteria densities and therefore relative densities. The absence of compensatory increases in the densities of Diatoms, Chlorophytes, and Chrysophytes indicates that this decline in Cyanobacteria densities did not lead to a significant increase in the densities of other types of phytoplankton within the community (Appendix Figure E.2.2, Appendix Tables C.3.1, C.3.2, E.2.1), which is reflected in the decreased total density in Polley Lake in 2022 compared to prior years (2019 and 2020; Table 5.3).

Phytoplankton density data at POL-P2 showed patterns that were generally similar to those for relative densities, with the following exceptions. The relative densities of Diatoms, Chlorophytes,

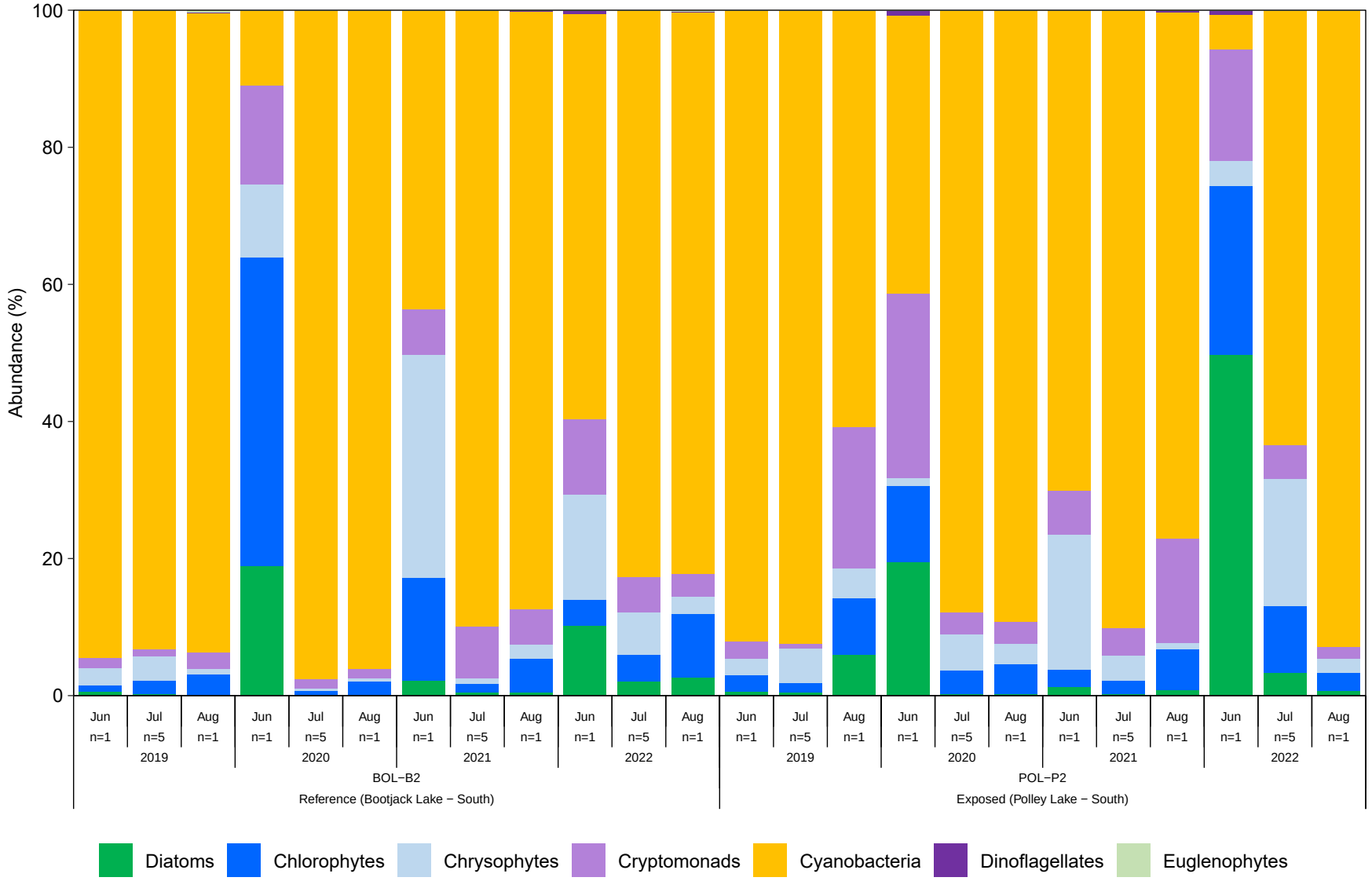

Figure 5.4: Relative Mean Densities of Major Phytoplankton Community Taxonomic Groups for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas, 2019 to 2022

and Chrysophytes at POL-P2 and BOL-B2 increased between 2019 and 2022 but cell densities of these groups in 2022 were similar to cell densities in 2019 (Appendix Figures E.2.2, E.2.3, Appendix Tables C.3.1, C.3.2, and E.2.1). The density of Cryptomonads was higher at POL-P2 than at BOL-B2 in 2022 while the relative density of Cryptomonads was similar between the two areas. The relative density of Cyanobacteria was lower at POL-P2 than at BOL-B2 in 2022 while the density of Cyanobacteria was similar between the two areas. Cyanobacteria density decreased significantly at POL-P2 in 2022 relative to 2019 to 2021, and as outlined above, this was the primary driver for the corresponding decreases in total density among the same years (Appendix Figure E.2.2, Appendix Table C.3.1, C.3.2, E.2.1). As in previous years, phytoplankton densities and relative densities at both POL-P2 and BOL-B2 show a succession towards communities being more dominated by Cyanobacteria as the summer progressed from June to August (Figure 5.4; Appendix Table C.3.1), which was likely a result of increasing water temperatures (Appendix Figures A.1.1, C.1.1; Schnurr and Allen 2015).

Overall, the phytoplankton community in Polley Lake in July 2022 was characterized by total densities, and Simpson's Diversity and Evenness that were significantly higher than Bootjack Lake (reference), but taxon richness that was significantly lower than reference. Total density in Polley Lake was lower in July 2022 than in 2019 and 2020, a decrease that was driven by decreased Cyanobacteria densities that was also observed at the reference. Both Polley and Bootjack Lake experienced succession to Cyanobacteria dominance of the phytoplankton community in July and August, likely due to higher water temperatures in the photic zone in late summer which favour Cyanobacteria. Taxon richness was lower in Polley Lake compared to the reference area from 2019 to 2022, except for 2020 when richness was similar between the two areas. Simpson's Diversity and Evenness in Polley Lake was similar to or higher than the reference area in each monitoring year (2019 to 2022). Phytoplankton community composition in Polley Lake has consistently (i.e., in each year from 2019 to 2022) been characterized by higher relative densities of Chrysophytes compared to Bootjack Lake while the differences in relative densities between Polley Lake and Bootjack Lake in other taxonomic groups (i.e., Diatoms, Chlorophytes, Cyanobacteria, and Cryptomonads) have been variable over time. The similarity or higher result for most primary endpoints in Polley Lake compared to reference (density, Simpson's Diversity and Evenness), and the temporal stability (either within Polley Lake or relative to the reference area) for those endpoints in Polley Lake that were lower than reference (e.g., taxon richness), are suggestive of a lack of mine-related influence on the phytoplankton community of Polley Lake.

5.1.3.1.2 Productivity

Chlorophyll-a concentrations were highest in July and August at POL-P2 and highest in June at BOL-B2 in 2022, with the mean of July samples similar to June at POL-P2 and similar to August at BOL-B2 (Appendix Table C.3.1, Appendix Figure E.2.1). Chlorophyll-a concentrations were significantly higher at POL-P2 than at BOL-B2 in July 2022 despite being significantly lower in 2021, and similar between the two lakes in 2019 and 2020. Although chlorophyll-a concentrations have been consistent at BOL-B2 from 2020 to 2022, they have fluctuated across these years at POL-P2, which has largely driven the variability in comparisons between the two lakes (Figure 5.5, Table 5.3; Appendix Tables C.3.1 and C.3.2). Changes in phytoplankton productivity at POL-P2 over time may be related to local natural variability in physical (e.g., light exposure and water temperatures) and chemical factors (e.g., nutrient concentrations) that has affected the two lakes differently. For instance, the peak summer temperature reported in Polley Lake exceeded that in Bootjack Lake in 2022, while nutrient (nitrogen and phosphorus) concentrations were similar (Appendix Figure C.1.1; Appendix Table C.1.3).

A lake's trophic status classification corresponds to its overall productivity in terms of algal biomass (chlorophyll-a) and nutrient concentration (Wetzel 2001). The trophic statuses of Polley Lake and Bootjack Lake in 2022, based on July chlorophyll-a concentrations (range = 2.46 to 3.78 µg/L for POL-P2, 1.82 to 2.5 µg/L for BOL-B2, were classified as mesotrophic (2.5 to 8.0 µg/L) and oligotrophic (<2.5 µg/L; Vollenweider and Kerekes 1982), respectively (Figure 5.5; Appendix Tables C.3.1 and C.3.2). Total chlorophyll-a concentrations in 2022 in Polley Lake and Bootjack Lake were within the range of baseline (1995 and 1996) and post-breach values for both lakes, except for a single anomalous result at BOL-B2 in June 2022 which was higher than most previous results (except the June 2021 result; Appendix Figure E.2.1, Appendix Tables C.3.1 and C.3.2). While the trophic state of Polley Lake increased from oligotrophic to mesotrophic between 2021 and 2022 (based on July data), this represented a return to the same mesotrophic status observed in 2019 (Figure 5.5; Appendix Tables C.3.1 and C.3.2).

5.1.3.2 Zooplankton

5.1.3.2.1 Community

Zooplankton densities in 2022 in Polley Lake (POL-P2) and Bootjack Lake (BOL-B2) were highest in July and June, respectively, while densities at both lakes were lowest in August (Appendix Figure E.2.4, Appendix Tables C.3.3, C.3.4). Zooplankton taxon richness at POL-P2 in 2022 was highest in July and lowest in both June and August, while richness at BOL-B2 was



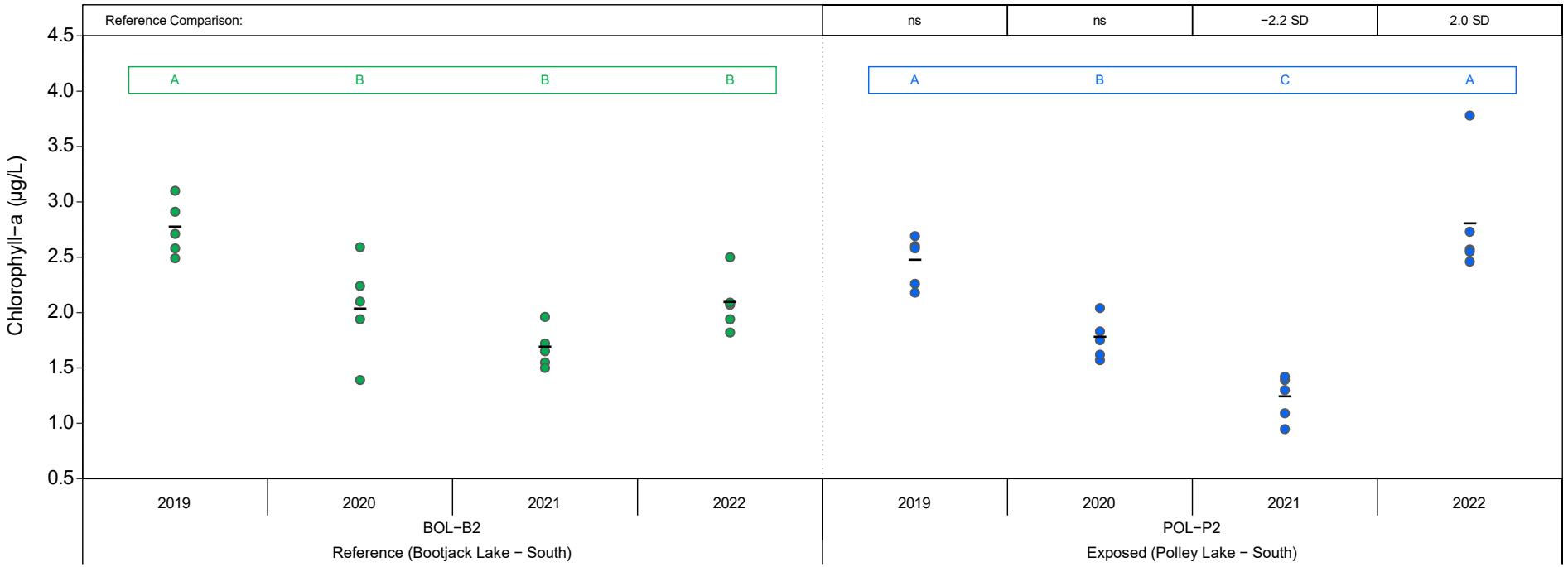

Figure 5.5: Phytoplankton Chlorophyll−a Concentrations for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

highest in August and lowest in July. Zooplankton density, taxon richness, and Simpson's Diversity and Evenness at POL-P2 were similar to BOL-B2 in July 2022 (Figure 5.6, Table 5.4).

Temporal analyses indicated that mean zooplankton density at POL-P2 in July 2022 was significantly higher than in 2019 or 2021 but similar to 2020. Density at POL-P2 was also similar to BOL-B2 in both 2020 and 2022 despite within-lake temporal variation at POL-P2. This temporal variability was reflected in part in temporal changes of zooplankton densities at BOL-B2, where density in 2022 was also higher than in 2019 (Figure 5.6, Table 5.4; Appendix Tables C.3.3, C.3.4). Taxon richness at POL-P2 was significantly higher in 2022 compared to 2020 but was similar to richness in 2019 and 2021, while richness at BOL-B2 was higher in 2022 compared to 2019 but similar in 2020 and 2021 (Figure 5.6, Table 5.4). Simpson's Diversity and Evenness at POL-P2 in 2022 was similar to prior monitoring years (2019 to 2021; Figure 5.6, Table 5.4). While Simpson's Diversity and Evenness were lower at POL-P2 than at BOL-B2 in 2019 and 2020, the lack of change in these indices at POL-P2 over time combined with decreasing Diversity and Evenness at BOL-B2 has led to the similarity of these endpoints between the two areas in 2021 and 2022.

The zooplankton community at POL-P2 in 2022 was dominated by Rotifera in June, Copepod Nauplii and Rotifera in July, and Copepod Nauplii and Cyclopoida in August, which differed from the dominance of Rotifera observed in June, July, and August at BOL-B2 (Figure 5.7; Appendix Tables C.3.3, C.3.4). In July 2022, the relative densities (%) of Calanoida, Cladocera, and Copepod Nauplii were significantly higher at POL-P2 than at BOL-B2, while the relative densities of Cyclopoida and Rotifera were similar and significantly lower, respectively (Appendix Figure E.2.5, Appendix Tables C.3.4 and E.2.2). The relative densities of Copepod Nauplii and Rotifera have been consistently higher and lower, respectively, at POL-P2 compared to BOL-B2 in each year from 2019 to 2022, while the relative densities of Calanoida, Cladocera, Copepod Nauplii, and Cyclopoida have been more variable (Appendix Figure E.2.5, Appendix Table E.2.2). The consistently lower relative density of Rotifera at POL-P2 than at BOL-B2 could potentially be due to differing predation on crustacean zooplankton in Polley Lake versus Bootjack Lake. Planktivorous fish species, including rainbow trout and longnose sucker which occur in both Polley and Bootjack lakes, can decrease populations of the larger crustacean zooplankton by predation, freeing smaller Rotifera from competition and predation (Brooks and Dodson 1965, Fussman 1996). Relative densities of Cyclopoida and Rotifera at POL-P2 were lower and higher, respectively, in 2022 than from 2019 to 2021, while the relative densities of the remaining taxa were either stable from 2019 to 2022 or similar in 2022 to 2019 (indicating temporal stability; Appendix Figure E.2.5, Appendix Table E.2.2). The temporal increase in Rotifera relative density was also observed at Bootjack Lake from 2019 to 2022, suggesting this was related to natural environmental factors. The decrease in Cyclopoida relative density at POL-P2 in 2022 relative to

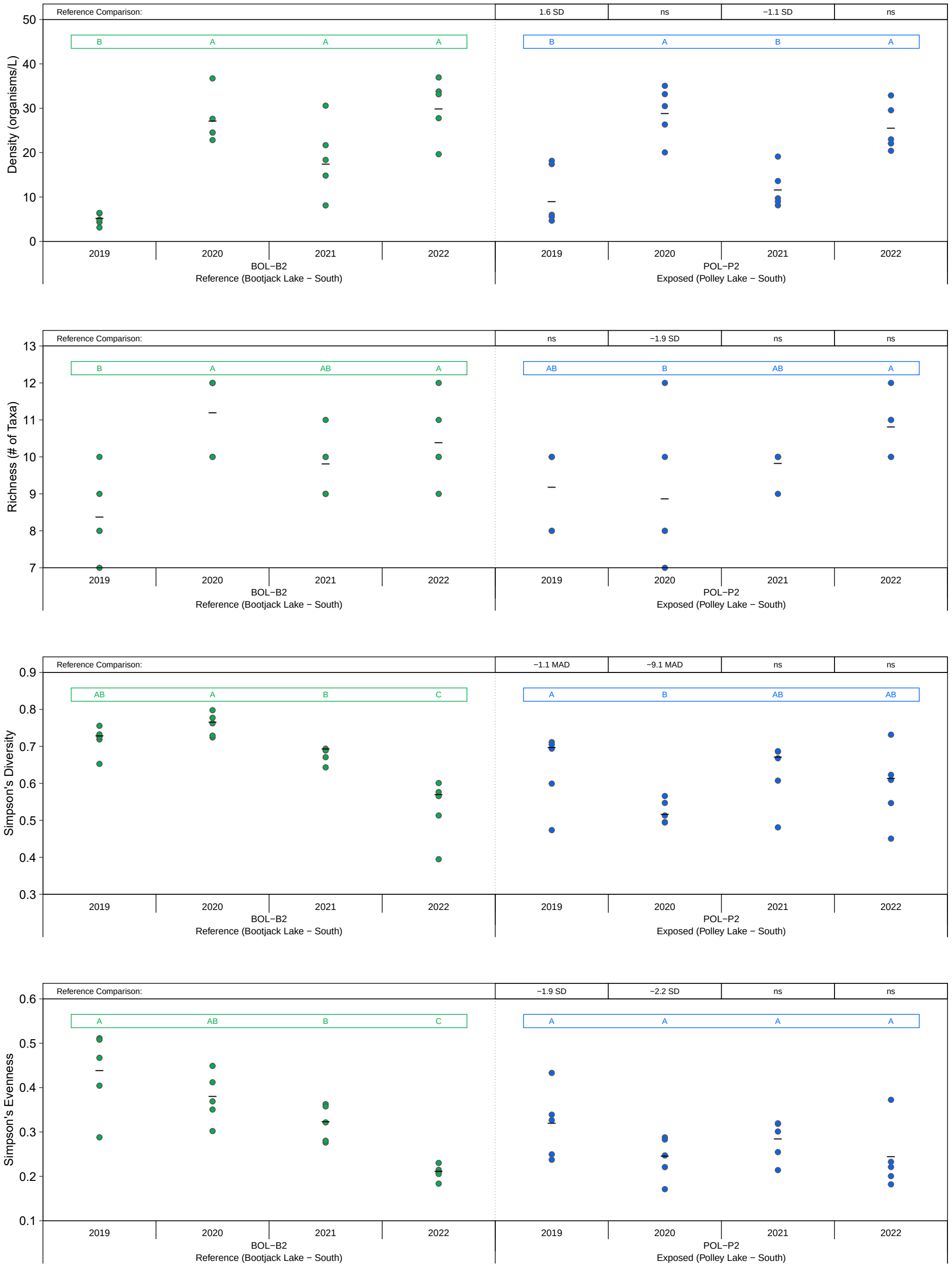

Figure 5.6: Zooplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.3.

Table 5.4: Results of Statistical Comparisons of Zooplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year	Mean	MCT[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
										Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year						2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Density (organisms/L)	log10	-	-	0.032	Reference	BOL-B2	2019	5.01	4.80	B	A	A	A	Baseline	4.7	3.4	4.9	1.6
							2020	27.2	27.0									ns
							2021	18.7	17.0									-1.1
							2022	30.3	30.0									ns
					Exposed	POL-P2	2019	10.4	8.70	B	A	B	A	Baseline	3.2	ns	2.9	
							2020	29.0	28.0									
							2021	11.9	11.0									
							2022	25.6	25.0									
Richness (# of Taxa)	log10	-	-	0.025	Reference	BOL-B2	2019	8.40	8.30	B	A	AB	A	Baseline	2.4	ns	1.8	ns
							2020	11.2	11.0									-1.9
							2021	9.80	9.80									ns
							2022	10.4	10.0									ns
					Exposed	POL-P2	2019	9.20	9.10	AB	B	AB	A	Baseline	ns	ns	ns	
							2020	9.00	8.80									
							2021	9.80	9.80									
							2022	10.8	11.0									
Simpson's Diversity	rank	-	-	<0.001	Reference	BOL-B2	2019	0.717	0.730	AB	A	B	C	Baseline	ns	ns	-5.8	-1.1
							2020	0.758	0.760									-9.1
							2021	0.677	0.690									ns
							2022	0.530	0.570									ns
					Exposed	POL-P2	2019	0.637	0.690	A	B	AB	AB	Baseline	-6.6	ns	ns	
							2020	0.523	0.510									
							2021	0.626	0.670									
							2022	0.592	0.610									
Simpson's Evenness	none	-	-	0.016	Reference	BOL-B2	2019	0.436	0.440	A	AB	B	C	Baseline	ns	-1.9	-3.7	-1.9
							2020	0.377	0.380									-2.2
							2021	0.320	0.320									ns
							2022	0.208	0.210									ns
					Exposed	POL-P2	2019	0.317	0.320	A	A	A	A	Baseline	ns	ns	ns	
							2020	0.242	0.510									
							2021	0.282	0.280									
							2022	0.242	0.240									
Dry Weight Biomass (mg/L)	log10	-	-	0.004	Reference	BOL-B2	2019	0.00544	0.00520	B	A	B	A	Baseline	3.5	ns	4.2	3.4
							2020	0.0163	0.0160									1.1
							2021	0.00631	0.00610									ns
							2022	0.0204	0.0200									ns
					Exposed	POL-P2	2019	0.0176	0.0150	A	A	B	A	Baseline	ns	-2.2	ns	
							2020	0.0229	0.0230									
							2021	0.00762	0.00760									
							2022	0.0210	0.0200									

Magnitude of Difference (MOD) < -2.

Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available, nc = no comparison, ns = no significance, nm = contrast Magnitudes of Difference (MODs) could not be calculated because the Median Absolute Deviation (MAD) = 0, organisms/L = organisms per litre. mg/L = milligrams per litre.

[a] MCT = Measures of Central Tendency. Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log $_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

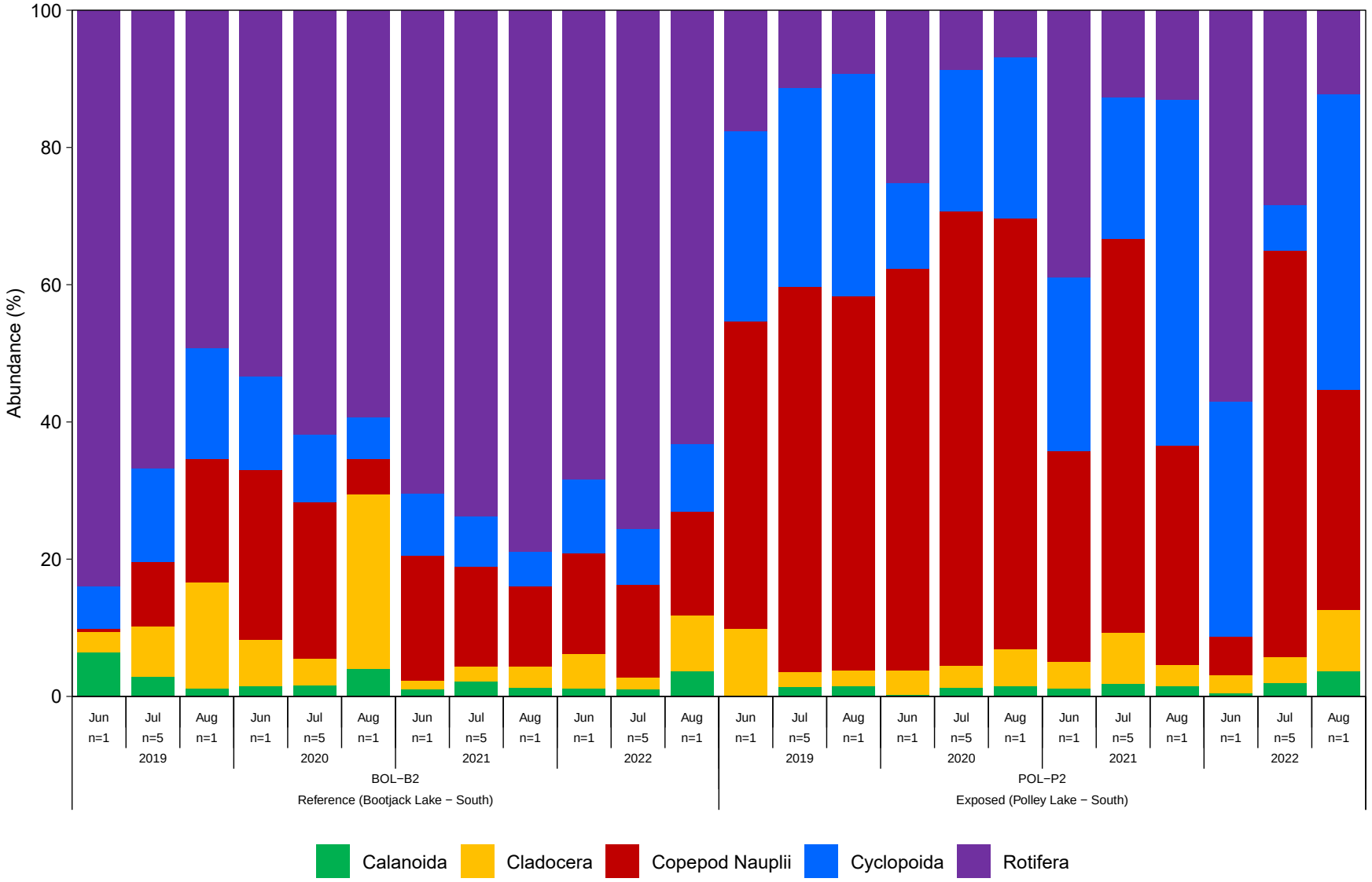

Figure 5.7: Relative Mean Densities of Major Zooplankton Community Taxonomic Groups for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas, 2019 to 2022

Notes: Results displayed for POL-P2 (August 2019) in the current figure differ from those presented in previous reports (Minnow 2020a, 2021a, 2022a) for the same sampling area and date. This discrepany is due to an incorrect calculation for these results in the prior reporting years.

previous years (2019 to 2021) reflected a change from results that were greater than reference in 2019 to 2021 to results in 2022 that were similar to reference conditions (Appendix Figure E.2.5, Appendix Table E.2.2).

Densities of major taxonomic groups generally followed the same pattern of spatial and temporal differences described above for the relative densities of major taxonomic groups, with the following exceptions. In July 2022, densities of Calanoida and Cyclopoida at POL-P2 were similar to and lower, respectively, than at BOL-B2. Densities of Calanoida have also increased from 2019 to 2022 at POL-P2, while densities of Cladocera have been stable from 2020 to 2022 and densities of Cyclopoida have been stable from 2019 to 2022, except for an increase in 2020 (Appendix Figure E.2.5, Appendix Table E.2.2).

Overall, the zooplankton community of Polley Lake was similar to the reference area in terms of total density, taxon richness, and Simpson's Diversity and Evenness in July 2022. From 2019 to 2022, the zooplankton community of Polley Lake differed from the reference area in terms of significantly higher and lower density in 2019 and 2021, respectively, lower taxon richness in 2020, and lower Simpson's Diversity and Evenness in 2019 and 2020. Zooplankton community composition in Polley Lake has consistently (i.e., in most years from 2019 to 2022) been characterized by higher relative densities of Cyclopoida and Copepod Nauplii and lower relative densities of Rotifera compared to Bootjack Lake. The consistent differences in zooplankton community composition between Polley and Bootjack Lakes suggests that these differences are likely driven by natural variability in environmental parameters (e.g., water temperature, nutrient availability, phytoplankton community, predation) in each of the two lakes.

5.1.3.2.2 Productivity

Zooplankton total biomass (dw) in 2022 in Polley Lake (POL-P2) and Bootjack Lake (BOL-B2) was highest in July and June, respectively, and lowest in August at both areas (Appendix Figure E.2.4, Appendix Table C.3.3). Mean total zooplankton biomass at POL-P2 was similar to that at BOL-B2 in July 2022 (Figure 5.8, Table 5.4; Appendix Table C.3.4). This was consistent with the similarity in zooplankton total biomass between POL-P2 and BOL-B2 in 2021 and similar changes in zooplankton biomass over time in both lakes, including a significant decrease in biomass at both POL-P2 and BOL-B2 in 2021 (relative to 2020) and a significant increase in biomass between 2021 and 2022. Zooplankton total biomass at POL-P2 was significantly higher than at BOL-B2 in 2019 and 2020 (Figure 5.8, Table 5.4; Appendix Table C.3.4). The consistently similar or significantly higher total biomass of zooplankton in Polley Lake compared to the reference area (Bootjack Lake) is indicative of a healthy lentic system, providing critical habitat for fish (Jeppesen et al. 2011).

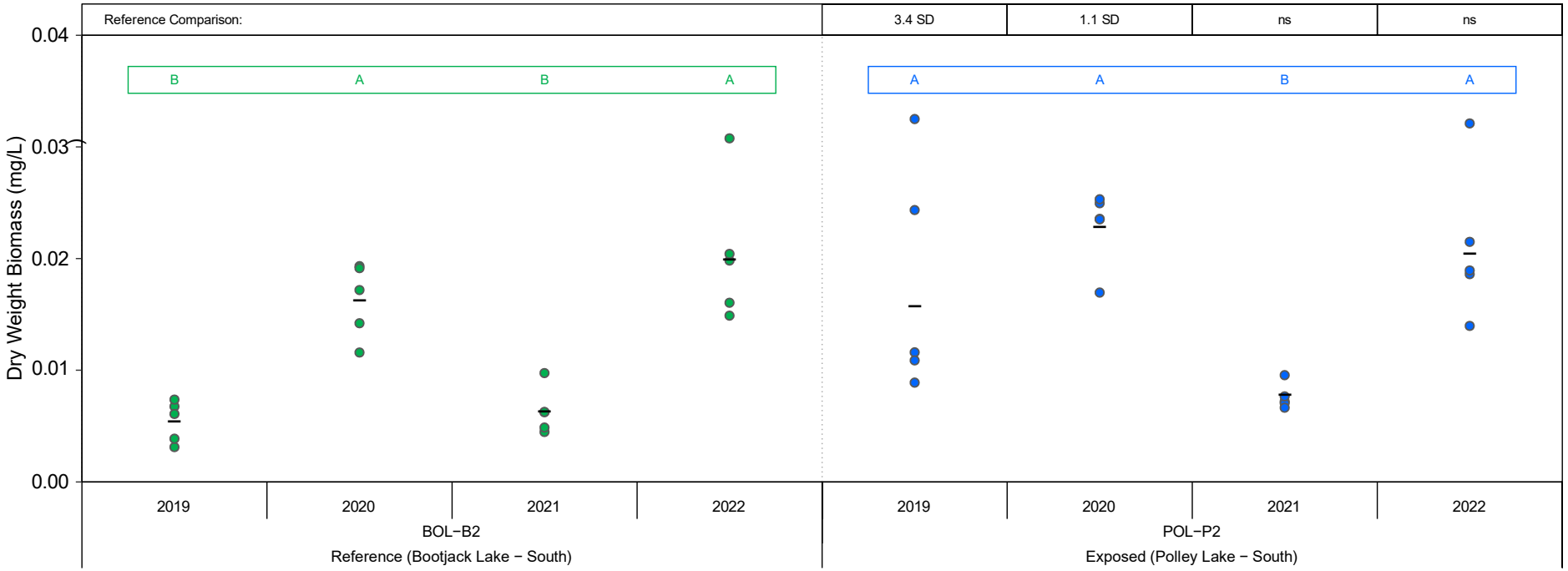

Figure 5.8: Zooplankton Biomass (Total Dry Weight) for Polley Lake (POL−P2; Exposed) and Bootjack L ake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, o r median depending o n if analysis was conducted o n untransformed, log_{10}-transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box o f the same colour d o not differ significantly within a n area. A number above the plot indicates significant exposed vs. reference post −hoc comparisons within a given year. The magnitude o f difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non −significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected i n June and August 2022, see Appendix Table C.3.3.

5.1.4 Zooplankton Tissue Quality

Zooplankton tissue quality monitoring in 2022 was completed three times (June, July, and August) in Polley Lake (POL-P2) and at a corresponding reference area in Bootjack Lake (BOL-B2; Figure 3.3, Table 3.6). Replicated results from July (n=5) were used for statistical comparisons (see Section 3.4.3). A review of the 2022 zooplankton tissue data quality (Appendix B) indicated that the data largely met the established DQOs. Specifically, the data were characterized by appropriate detectability, with LRLs for selenium remaining below the BC interim guidelines (4 mg/kg dw; Appendix B). Laboratory accuracy and field sampling precision were excellent, with fewer than 20% of analytes from each duplicate set exceeding the DQO of 30% RPD. Several analytes of interest exceeded the DQO for RPD in one or more laboratory sets, but not in all of them. This variability suggests some natural heterogeneity. Laboratory precision could not be properly assessed, since data review was limited to one analyte in a single laboratory duplicate sample. A combination of insufficient sample volume, high moisture content in samples, and laboratory protocols (sample dilution, sample weight used for analysis, etc.) prevented the analysis of additional laboratory duplicate samples. The intentional collection of greater sample volume in future monitoring efforts will allow for a more thorough assessment of laboratory precision. Overall, the 2022 zooplankton tissue quality data can be used with a high level of confidence for interpretation, although the occurrence of some natural heterogeneity in analyte results were considered during data interpretation. A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

As indicated in Section 3.4.3, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significantly positive exposed-reference difference (i.e., analytes with exposed concentrations significantly higher than reference) in 2022 (if the analysis *Area*×*Year* interaction was significant) or in all monitoring years (if the *Area*×*Year* interaction was not significant[46]). The secondary analyte sodium was the only primary or secondary analyte with concentrations in zooplankton tissue that were higher in Polley Lake than Bootjack Lake in 2022 or in all monitoring years. Sodium concentrations did not exhibit a significant *Area*×*Year* interaction (Figure 5.9; Appendix Table E.3.1), indicating temporal stability in the ratio of exposed:reference concentrations (i.e., the geometric mean concentration at the exposed area was trending the same as at the reference area). Therefore, sodium concentrations were significantly higher in zooplankton tissue from Polley Lake than Bootjack Lake from July 2019

[46] If no significant change was detected in the exposed-reference difference among years (i.e., the *Area* x *Year* interaction was not significant), then data from 2019 to 2022 were combined for the analyses.

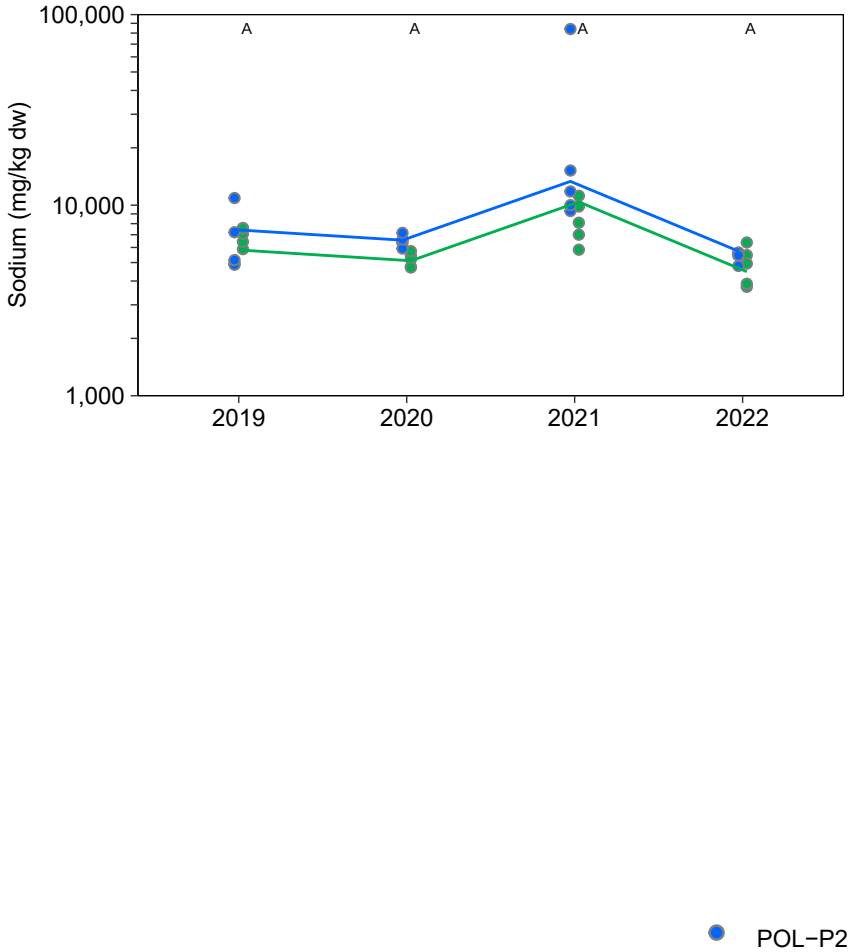

Figure 5.9: Zooplankton Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Notes: dw = dry weight. Plots are only included for primary or secondary analytes with a significant postive exposed - reference difference in 2022 or in all monitoring years. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed : Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed : Reference). Only years with samples from both reference and exposed areas are plotted.

to 2022 (MOD = 28%; Table 5.5; Appendix Table E.3.1) but remained within the range of tissue sodium concentrations since the initiation of monitoring in 2015 (Appendix Figure C.4.1).

The remaining primary and secondary analytes had concentrations that were either similar to or significantly lower than reference in 2022 (if the *Area×Year* interaction was significant) or in all monitoring years (if the *Area×Year* interaction was not significant; Appendix Figure E.3.1, Appendix Table E.3.1). In addition, concentrations of two primary (arsenic and copper) and three secondary analytes (manganese, mercury, molybdenum) in zooplankton tissue from Polley Lake were significantly lower in 2022 compared to the baseline year (2019), relative to reference (Appendix Table E.3.1). Selenium concentrations were lower in 2022 compared to 2020 and 2021 (but not 2019), relative to reference, and decreased to concentrations in 2022 that were similar to reference (Appendix Table E.3.1). In previous monitoring years, cadmium, selenium, tin, and zinc concentrations were significantly higher than reference in 2020 and 2021 (as well as in 2019 for selenium), while concentrations of calcium, copper, molybdenum, phosphorous, and strontium were significantly higher than reference either 2020 or 2021, but not both (Appendix Table E.3.1). The concentrations of these analytes that were significantly higher in Polley Lake zooplankton tissue than reference in previous years (2020 and/or 2021) did not continue to significantly exceed reference concentrations in 2022, except for sodium (Table 5.5; Appendix Table E.3.1). Despite these temporal fluctuations in 2020 and 2021, analyte concentrations in 2022 were similar to 2019 (baseline year) for all primary and secondary analytes, except those noted above which decreased in 2022 relative to baseline (arsenic, copper, manganese, mercury, molybdenum; Appendix Table E.3.1). Except for copper, this is supported by temporal trends in surface water quality which showed similarly stable or decreasing concentrations for all aqueous primary and secondary analytes except copper and vanadium, as outlined below.

Temporal evaluation of post-breach (2015 to 2022) surface water quality trends in Polley Lake indicated that, except for total and dissolved copper and vanadium, the surface aqueous concentrations (total and dissolved) of primary and secondary analytes in Polley Lake either decreased significantly or did not change significantly over time (Appendix Figures C.1.2 to C.1.4, C.4.1, Appendix Table E.3.2). Concentrations of both aqueous dissolved and total copper and vanadium concentrations increased significantly in the surface waters of both the north and south basins of Polley Lake (POL-P1 and POL-P2) between 2015 and 2022 (Appendix Figures C.1.2 to C.1.4, Appendix Table E.3.2). A BCWQG does not exist for vanadium (Appendix Table C.1.1), and comparison of dissolved copper to the BCWQG is discussed below. Aqueous total selenium concentrations at POL-P2 were less than half the BCWQG for total selenium from 2015 to 2022 (2 µg/L; BCMOECCS 2021b; Appendix Figure C.1.4). Aqueous total and dissolved concentrations of arsenic, manganese, molybdenum, and selenium decreased significantly in

Table 5.5: Summary of Statistical Contrasts of Exposed - Reference Relative Differences for Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Analyte	Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[a]				Magnitude of Difference for Polley Mean Relative to Bootjack (%)[b]			
	Post-Breach Period				Post-Breach Period			
	2019	2020	2021	2022	2019	2020	2021	2022
Sodium	baseline	ns	ns	ns	28			

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: ns = not significant, baseline= first year of data included in analysis, ANOVA = two way analysis of variance. Data were analysed in units of mg/kg dry weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted}) / (Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Polley Lake surface waters from 2015 to 2022 (Appendix Table E.3.2). This corroborates the decrease in zooplankton tissue concentrations of these analytes between 2019 and 2022 for arsenic, manganese, molybdenum, and from 2020/2021 to 2022 for selenium (Appendix Tables E.3.1, E.3.2).

To evaluate the potential impact of copper concentrations on aquatic life in Polley Lake, dissolved concentrations were compared to the relevant BLM-based BCWQG to calculate GEFs for dissolved copper (refer to Section 3.8.3.3 for details). The copper GEFs in surface water increased significantly from 2015 to 2022 at both the north and south basins of Polley Lake (Appendix Figure C.1.3, Appendix Table E.3.2). Though a significant increase has been observed since 2015, the GEFs observed for Polley Lake in 2022 were typically within the range of previous years and results largely remained within the range of copper GEFs reported for the reference (Bootjack Lake), which suggests there is little risk to aquatic life in the near term (Appendix Figure C.1.3). As outlined above, copper concentrations in zooplankton tissue from Polley Lake were lower in 2022 than in 2019 (when replicated sampling was initiated), relative to reference (Appendix Table E.3.1), indicating a decrease risk to aquatic life. A BCWQG for vanadium does not exist (BCMOECCS 2021a,b), therefore aqueous concentrations of this analyte could not be contrasted to guideline values but zooplankton tissue concentrations of vanadium in Polley Lake did not differ significantly from reference (Bootjack Lake; Appendix Table E.3.1).

Selenium concentrations in zooplankton tissue results from both Polley Lake and Bootjack Lake in 2022 were below the BC interim guideline for selenium of 4 mg/kg dw and were within the range of results reported since 2015 (BCMOECCS 2021b; Appendix Figure C.4.1, Appendix Table C.4.1). Tissue concentrations of selenium in 2022 from Polley and Bootjack lakes ranged from 2.14 to 3.34 mg/kg dw (Appendix Table C.4.1). In prior years, individual zooplankton tissue results from both exposed and reference areas have exceeded the BC guideline, though mean concentrations have remained below the guideline since 2019 (when replicated sampling was initiated), except in 2021 for Polley Lake[47] (Appendix Figure C.4.1). The variability among years in zooplankton tissue selenium concentrations may be due to environmental factors such as differences in feeding/uptake rates or species composition of the zooplankton tissue samples, which is supported by the absence of a significant temporal trend for selenium in water quality results (Appendix Table E.3.2).

[47] In 2021, one zooplankton replicate from Polley Lake had a selenium concentration of 35.2 mg/L; approximately 6 times higher than the median concentration of 5.54 mg/kg dw (see Minnow 2022a).

5.1.5 Fish Usage and Population Health

Fish usage and population health were evaluated for rainbow trout, longnose sucker, and redside shiner at Polley Lake in 2022, with Bootjack Lake serving as a reference (Figures 3.4 and 3.5), consistent with previous monitoring (see Section 3.7 for details).

5.1.5.1 Community and Catch

Spring fishing in 2022 in Polley and Bootjack lakes was undertaken after ice-out when lake water temperatures were approximately 5 °C. Similar to previous years, rainbow trout and longnose sucker were caught in both Polley and Bootjack lakes whereas redside shiner were caught in Polley Lake only (Table 5.6; Appendix Table C.6.1). Two largescale sucker (*Catostomus macrocheilus*) were also caught in Bootjack Lake in spring 2022. Largescale sucker have previously been caught in low numbers in Bootjack Lake (in 2019 and 2021) but have never been caught in Polley Lake.

The CPUE for Polley Lake rainbow trout in spring was higher in 2022 than all previous years since 2016 (2.0- to 5.0-fold) and was similar to CPUE in Bootjack Lake (Table 5.6). Spring fish collections each year have targeted rainbow trout spawners aggregating near the mouth of Hazeltine Creek and Bootjack Creek (Figure 3.4). From 2019 to 2021, temporal changes in CPUE indicated progressively fewer rainbow trout aggregated for spawning (Table 5.6) which is consistent with the observation that most spawners present in 2018 would have reached the end of their life expectancy in 2021, with low replacement by recruits from 2014 to 2017 when Hazeltine was inaccessible to spawning rainbow trout (see Section 3.6 for details). Natural mortality of older age classes and decreasing number of spawners observed in Hazeltine Creek during spawning surveys since 2018 resulted in fewer recruits being added to the population in each year (Minnow 2023). However, because rainbow trout generally begin spawning between age three and five (Scott and Crossman 1998), it was anticipated that some portion of the 2018 cohort would reach sexual maturity by 2021 and that most would be sexually mature by 2022, which is consistent with the result for spring CPUE.

Since 2016, the CPUE for longnose sucker in spring has varied in Polley Lake but declined from 2020 to 2022 to the lowest CPUE among monitoring years except 2019 (Table 5.6). As described above, spring sampling targets specific locations where fish have been known to aggregate prior to spawning, therefore differences in CPUE over time may be due in part to the non-random sampling design implemented during this period (Appendix Table C.6.1). Moreover, longnose sucker CPUE was slightly higher in Polley Lake than Bootjack Lake in spring 2022. The CPUE for redside shiner in spring has also varied over time and is likely due to non-random sampling in spring (Table 5.6; Appendix Table C.6.1).

Table 5.6: Catch-Per-Unit-Effort Results for Hoopnetting Collections in a) Spring and b) Fall for Polley Lake (POL; Exposed) and Bootjack Lake (BOL; Reference), 2016 to 2022

a)

Species		Spring												
		2016	2017		2018		2019		2020		2021		2022	
		Polley Lake	Bootjack Lake	Polley Lake	Bootjack Lake	Polley Lake	Bootjack Lake	Polley Lake	Bootjack Lake	Polley Lake	Bootjack Lake	Polley Lake	Bootjack Lake	Polley Lake
Effort (days)		33.5	4.85	0.870	3.38	5.37	7.46	3.71	14.0	8.98	10.4	23.1	11.9	11.0
Rainbow Trout	Catch	1,737	289	8	76	22	201	35	322	72	319	87	224	207
	CPUE[a]	51.9	59.6	9.22	22.5	4.10	26.9	9.45	23.1	8.02	30.7	3.76	18.8	18.8
Longnose Sucker	Catch	2,422	25	247	25	227	242	37	1,228	901	583	892	339	329
	CPUE[a]	72.4	5.15	284	7.39	42.3	32.4	10.0	88.0	100.4	56.2	38.6	28.5	29.9
Redside Shiner	Catch	1,179	0	0	0	155	0	29	0	15	0	103	0	27
	CPUE[a]	35.3	0	0	0	28.9	0	7.83	0	1.67	0	4.46	0	2.46

b)

Species		Fall					
		Polley Lake					
		2016	2018	2019	2020	2021	2022
Effort (days)		108	22.2	33.0	32.0	32.4	32.0
Rainbow Trout	Catch	497	63	329	291	383	213
	CPUE[a]	4.58	2.84	10.0	9.1	11.8	6.7
Longnose Sucker	Catch	3,288	627	623	429	451	200
	CPUE[a]	30.3	28.2	18.9	13.5	13.9	6.3
Redside Shiner	Catch	8,288	267	787	2,497	923	463
	CPUE[a]	76.3	12.0	23.9	78.3	28.5	14.5

[a] CPUE - Catch-per-unit-effort (# fish / trap / day).

Fish collections in the fall in Polley Lake followed a randomized design using a standardized level of effort (see Section 3.6.3). The randomized sampling methods used in the fall (which reflect the CPUE of the whole fish population) differ from the methods used in spring that specifically target aggregating spawners (and which largely reflect the CPUE of the spawning population).

Fall rainbow trout CPUE initially decreased from 2016 to 2018, likely reflecting the lower recruitment of YOY (as previously discussed). However, CPUE was higher in 2019 (2-fold greater than 2016); many rainbow trout captured in Polley Lake in 2019 were likely age-2 or younger based on length (Minnow 2020a) suggesting that the higher CPUE was due to successful recruitment after restoration of access to Hazeltine Creek spawning habitat in 2018. Rainbow trout CPUE in the fall was relatively consistent from 2019 to 2021 but was lower in 2022 while remaining higher in 2022 than in 2016 and 2018 (Table 5.6; Appendix Table C.6.2). Temporal comparisons of CPUE are subject to variability resulting from several factors that can affect the success of netting efforts, such as weather, water temperature, water level, and year-to-year variability in net placement and efficacy. This is true even when considering the fish collection methods employed in the fall in Polley Lake (2016 to 2022) that follow a randomized design using a standardized level of effort. Continued annual monitoring is planned in Polley Lake using the randomized design which will help to evaluate whether the lower CPUE observed in 2022 is part of a longer-term trend. Additionally, the assessment of rainbow trout size distribution results from 2016 to 2022 provides a more comparable means for temporally evaluating the population recovery in Polley Lake, with the distribution of rainbow trout in 2022 having a similar pattern to 2016 (see Section 5.1.5.2.2). Although the fall CPUE for rainbow trout was lower in 2022 than the previous three years, the number of adult rainbow trout observed during spawning surveys in Hazeltine Creek in the spring of 2022 was the highest since 2019 as most of the remaining individuals from the 2018 cohort reached maturity in 2022 (Minnow 2020b, 2021b, 2022b). Subsequently, the mean density of YOY in Hazeltine Creek from closed-station electrofishing in 2022 (62 to 119 fish/100 m^2) was also substantially higher than 2021 (2 to 12 fish /100 m^2) and 2020 (36 to 98 fish /100 m^2; Minnow 2023).

Similar to the rainbow trout CPUE, longnose sucker CPUE in Polley Lake was lower in fall 2022 than 2021 (2.1-fold) and has generally decreased over time since 2016 (approximately 5.0-fold difference in CPUE between 2016 and 2022; Table 5.6). As indicated above, temporal variability in CPUE can be the result of several factors that may influence the success of hoop netting efforts, some of which may have influenced, at least in part, the changes in longnose sucker observed from 2016 to 2022 (Table 5.6). As described above for rainbow trout, continued annual monitoring is planned in Polley Lake using the randomized design which will help to evaluate whether the lower CPUE observed in 2022 is part of a longer-term trend. The CPUE of redside shiner in fall

has varied since 2016 but decreased from 2020 to 2022. Redside shiner CPUE in 2022 was 1.7 to 5.4-fold lower than in 2019 to 2021 but was 1.2-fold higher than in 2018 (Table 5.6).

5.1.5.2 Fish Population Health

5.1.5.2.1 Spring

Spring condition (weight-at-length) of all rainbow trout in Polley Lake in 2022 was statistically similar to 2018 to 2021 but significantly lower than 2016 and 2017 although the difference relative to the baseline year (2016) was only 4.9%. When the analysis was constrained to the length range that overlapped among all seven years (greater than 23 cm fork length [FL]) condition in 2022 was signficantly lower than all years from 2016 to 2020 except 2019, but the difference relative to baseline was still less than 10% (Table 5.7; Appendix Figure E.5.1, Appendix Tables C.6.3, C.6.10, E.5.1, E.5.2). Analysis by sex showed that condition of females (constrained to individuals selected for lethal sampling; *n* = 8) in 2022 was similar to 2021 but significantly lower in 2016 to 2020, with a difference relative to the baseline year (2016) of 9.0% (Table 5.7; Appendix Figure E.5.1). Growth (weight-at-age) of lethally sampled female rainbow trout in 2022 (the only group with available age data) was similar to all prior years except 2020 (Table 5.7; Appendix Figure E.5.2, Appendix Table E.5.1). Condition of male rainbow trout was not assessed for spring of 2022 since sex was not identified for non-lethally sampled rainbow trout (and lethal sampling targeted female rainbow trout).[48]

For longnose sucker, whether assessed for all fish sampled or constrained by the subset of fish greater than 32 cm FL (i.e., greatest overlap among years), spring condition of longnose sucker from Polley Lake in 2022 was statistically similar to 2021 and significantly lower than all other years, although the MOD relative to baseline (2016) was less than 10% in both cases (Table 5.7; Appendix Figure E.5.3, Appendix Tables C.6.4, C.6.11, E.5.1). Examining only females (constrained to lethally sampled fish; *n* = 8), condition in 2022 was not significantly different from 2021, 2019, or baseline, but was significantly lower than other years; the outcome of the analysis was the same when constraining the data to fish greater than 32 cm FL (Table 5.7; Appendix Figure E.5.3). Growth (weight-at-age) of longnose sucker females in spring of 2022 was statistically similar to all years except 2018 (Table 5.7; Appendix Figure E.5.2, Appendix Table E.5.1). Examining only males (constrained to lethally sampled fish; *n* = 9), condition in 2022 was not significantly different from 2021, but was significantly lower than other years; when

[48] In previous years, the sex of male rainbow trout was confirmed during the lethal collection of tissue quality samples. Fish tissue quality sampling in Polley Lake (and reference) targets the collection of samples from females (see Section 3.7.1). Historically, some male rainbow trout were collected as incidental mortalities while targeting collection of tissue quality samples from female rainbow trout. In 2022, no males were collected as incidental mortalities during the tissue quality sampling process, therefore the sex of male rainbow trout could not be confirmed.

Table 5.7: Summary of Statistical Comparisons of Condition and Weight-at-Age of Rainbow Trout and Longnose Sucker for Polley Lake in Spring and Fall, 2014 to 2022

Season	Endpoint	Group	Rainbow Trout								Longnose Sucker							
			2014	2016	2017	2018	2019	2020	2021	2022	2014	2016	2017	2018	2019	2020	2021	2022
Spring	Energy Storage (Condition)	All	na	AB	A	BC	BC	ABC	ABC	C (-4.9)	na	B	A (+14)	AB	BC	B	CD (-4.5)	D (-9.1)
		All (FL filtered)[a]	na	A	A	A	AB	A	B (-5.5)	B (-6.8)	na	B	A (+15)	AB	B	B	BC	C (-5.8)
		Female	na	AB	A	AB	AB	A	BC	C (-9.0)	na	BC	A (+12)	AB	BC	AB	BC	C
		Female (FL filtered)[a]	na	na	na	na	na	na	na	na	na	BC	A (+14)	AB	BC	AB	BC	C
		Male	na	=	=	=	=	=	=	na	na	AB	na	na	A	AB	B	na
		Male (FL filtered)[b]	na	na	na	na	na	na	na	na	na	=	na	na	=	=	=	na
	Energy Use (Weight-at-age)	Female	na	AB	AB	AB	AB	A	AB	B	na	BC	ABC	A (+37)	AB	ABC	C	BC
Fall	Energy Storage (Condition)	All	A	CD (-11)	na	BC (-8.8)	A	B (-6.5)	B (-5.6)	D (-13)	B	BC	na	A (+8.5)	B	BC	BC	C (-5.3)
Fall	Energy Storage (Condition)	All (FL filtered)[c]	A	CD (-10)	na	BC (-8.5)	A	B (-6.6)	B (-5.6)	D (-13)	B	BC	na	A (+8.4)	B	BC	BC	C (-5.1)

Notes: Different letters signify that an endpoint is significantly different among years while the value in brackets indicates the magnitude of difference between the given year and the baseline year (baseline year is 2016 for spring and 2014 for fall data); "na" = not applicable or no sampling was conducted in the given year; "=" = no statistically significant difference in the endpoint across years; "-" = insufficient data available to conduct comparisons.

[a] Analysis conducted only on individuals with fork length greater than 23 cm for rainbow trout and 32 cm for longnose sucker.

[b] Analysis conducted only on individuals with fork length greater than 30 cm for longnose sucker.

[c] Analysis conducted only on individuals with fork length greater than 12 cm for rainbow trout and 11 cm for longnose sucker.

constraining the data to fish greater than 32 cm FL, condition was statistically similar across all years (Table 5.7; Appendix Figure E.5.3). Growth (weight-at-age) of longnose sucker males in spring of 2022 was not estimated due to data limitations (Table 5.7; Appendix Figure E.5.2, Appendix Table E.5.1).

5.1.5.2.2 Fall

The condition of rainbow trout from Polley Lake, whether including or excluding YOY fish (i.e., fork length less than 12 cm) was significantly lower in 2022 than all other monitoring years except 2016, including a 13% difference from baseline (2014), though condition was generally consistent from 2018 to 2021 (Table 5.7; Appendix Figure E.5.4, Appendix Table C.6.7, E.5.1). Interannual differences in fall condition during post-breach monitoring has frequently exceeded 7% (Table 5.7; Appendix Table E.5.1). Growth dynamics and weight-length relationships of fish species can be quite variable in the life stages that precede maturity. Given the average size (sub-mature) of rainbow trout in Polley Lake captured over the duration of post-breach monitoring efforts (for which condition is being reported), such variance is not unexpected.

Aging data was not available for rainbow trout in 2022 to assess weight-at-age. In years prior to 2019 aging was completed opportunistically via incidental mortalities that occurred during gill netting, but gill netting has not been conducted since 2018 (see Minnow 2022a for details). In the absence of recent age data, length frequency distributions and predicted length-at-age provide an indication of recruitment and survival over time. Comparison of length frequency distributions for rainbow trout caught from fall hoop netting from 2016 to 2022 show an encouraging trend for both recruitment and sustainability of the Polley Lake population, with significantly more smaller fish than in 2016 and a more even distribution of fish lengths in 2022 than in prior years (Appendix Figure E.5.5, Appendix Table E.5.3).

In 2016, the rainbow trout population in Polley Lake was dominated by age 3+ individuals (Figure 5.10), an artifact of low recruitment from 2014 to 2017 when spawning habitat in Hazeltine Creek was inaccessible. In 2018, the first year after access to Hazeltine Creek was restored, the population continued to be dominated by older fish (age-4+), however recruits from the 2018 cohort were also present. These recruits subsequently became the dominant year class in 2019 with the likely higher mortality of older fish, most of which had likely reached the end of their life expectancy (Figure 5.10). In 2020 and 2021, the population continued to shift towards a more balanced distribution among size classes with the survivorship of the 2018 and 2019 cohorts and further successful recruitment of individuals from the 2020 and 2021 cohorts. In 2022, the length frequency distribution resembled 2016 but with a lower frequency of age 3+ fish in lieu of greater strength of younger age classes. The lengt frequency distribution in 2022 had greater

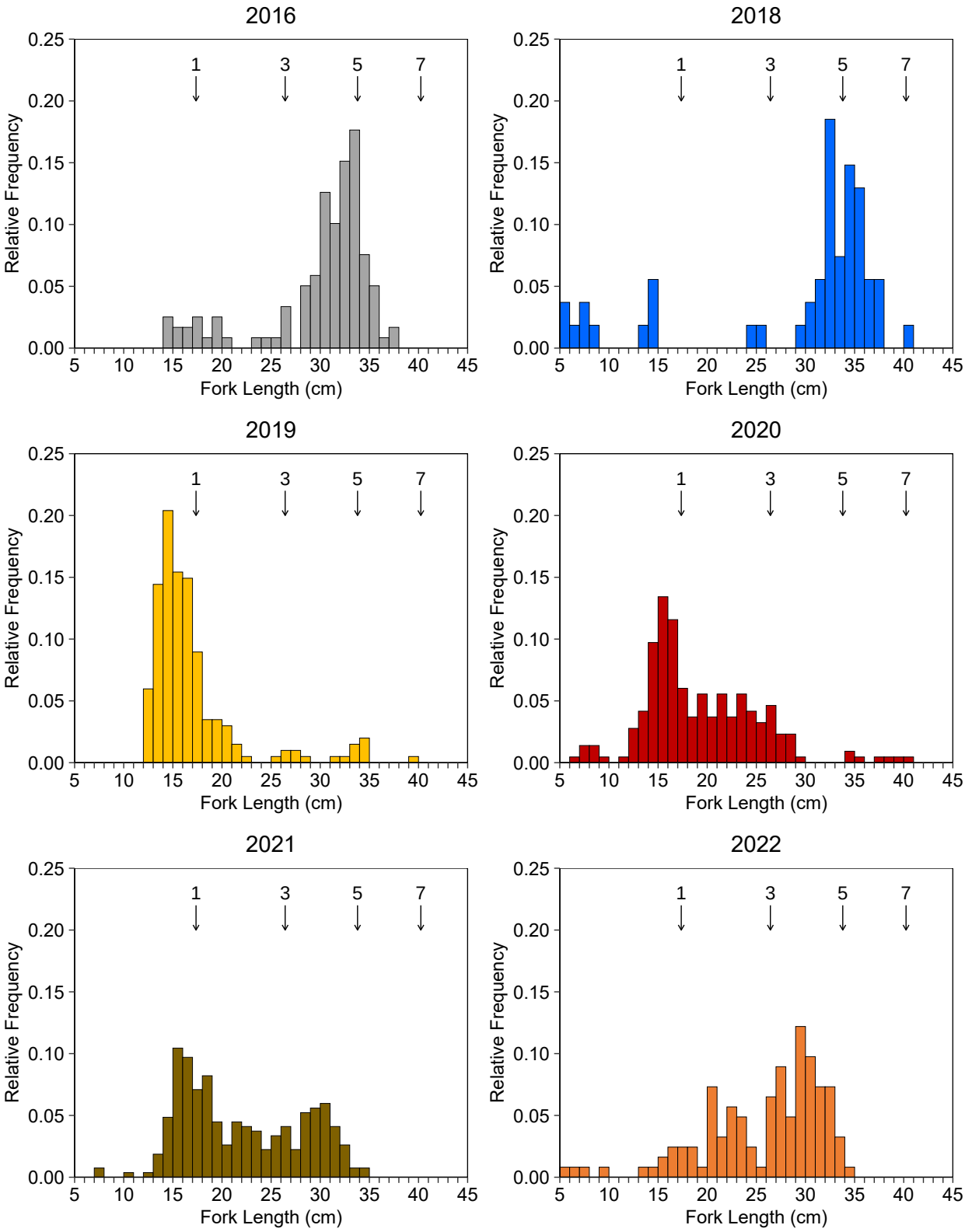

Figure 5.10: Rainbow Trout Length Frequency Distributions for Randomized Fall Hoopnetting in Polley Lake, 2016 to 2022

Notes: Numbers and arrows along the tops of figures represent predicted fork lengths at various ages from a linear model: $\log_{10}$(Fork Length) = 1.0569 + $\log_{10}$(Age+1)x0.6064, with R^2 = 0.79. The linear model to predict fork lengths at various ages uses fish collected in spring and fall, but the fork length frequency data presented for each year includes data from fall only.

resemblance to 2016 than the length frequency distributions from any of the other years (2018 to 2021; Figure 5.10), suggesting the population has returned to a pre-breach size class distribution. The relative frequency of age-1 rainbow trout decreased from 2019 to 2022 (Figure 5.10) as expected. It is likely that the mortality rate of rainbow trout spawners was higher from 2018 to 2022 (due to the cohort age) combined with low replacement of younger spawning recruits from 2014 to 2017 which resulted in progressively fewer spawners observed in Hazeltine Creek during each spawning survey since 2018 and subsequently, lower YOY densities observed in Hazeltine Creek (Minnow 2022b). However, as described above, the number of adults observed in Hazeltine Creek in spring of 2022 was the highest since 2019 as it would be expected that the individuals from the 2018 cohort would reach maturity in 2022 and subsequently, the YOY density in Hazeltine Creek was also higher than the previous two years (Minnow 2023).

Condition of longnose sucker in fall 2022, whether including or excluding YOY, was statistically similar to the previous two years of monitoring and 2016, but significantly lower than the remaining years (including baseline). However, the MOD of 2022 condition relative to 2014 (baseline) was low (less than 10%) in ecological terms, suggesting relative stability in the energy pathways supporting the longnose sucker population (Table 5.7; Appendix Figure E.5.4, Appendix Tables C.6.8, E.5.1). Similar to rainbow trout, comparison of length-frequency distributions showed that significantly more smaller fish were caught in 2022 compared to 2016, as was the case in 2018, 2020, and 2021 (Appendix Figure E.5.5, Appendix Table E.5.3). Length-frequency histograms for longnose sucker in Polley Lake from 2016 to 2022 showed that from 2016 through 2018, and to a lesser extent in 2019, catches were dominated by age-4 and age-5 fish (Figure 5.11). Moreover, 2016 and 2018 showed evidence of strong within year recruitment (high frequency of YOY and age-1; Figure 5.11). In 2020, catches shifted to a higher frequency of younger age classes (including the 2018 and 2019 cohorts, the first recruited age classes following restored access to Hazeltine Creek) and this pattern persisted in catches from 2021 and 2022 (Figure 5.11).

Redside shiner length-frequency distribution was also significantly different in 2022 compared to 2016, with more smaller fish caught in 2022 than in 2016, which was also the case each year from 2018 to 2021 (Appendix Figure E.5.5, Appendix Tables C.6.9 and E.5.3). Examination of cumulative relative frequency distributions also indicated that more smaller fish were caught in 2022 than all previous monitoring years (Appendix Figure E.5.6). The absence or near absence of small redside shiner in 2016 and 2018 and subsequent lower numbers of larger individuals in 2019 and 2020 is likely indicative of low recruitment in the years immediately following the breach. It is likely that the 2018 cohort that appears dominant in 2019 to 2021, and reached maturity in 2022, produced a strong YOY class that dominated catches in fall. Relative to 2016 and 2018

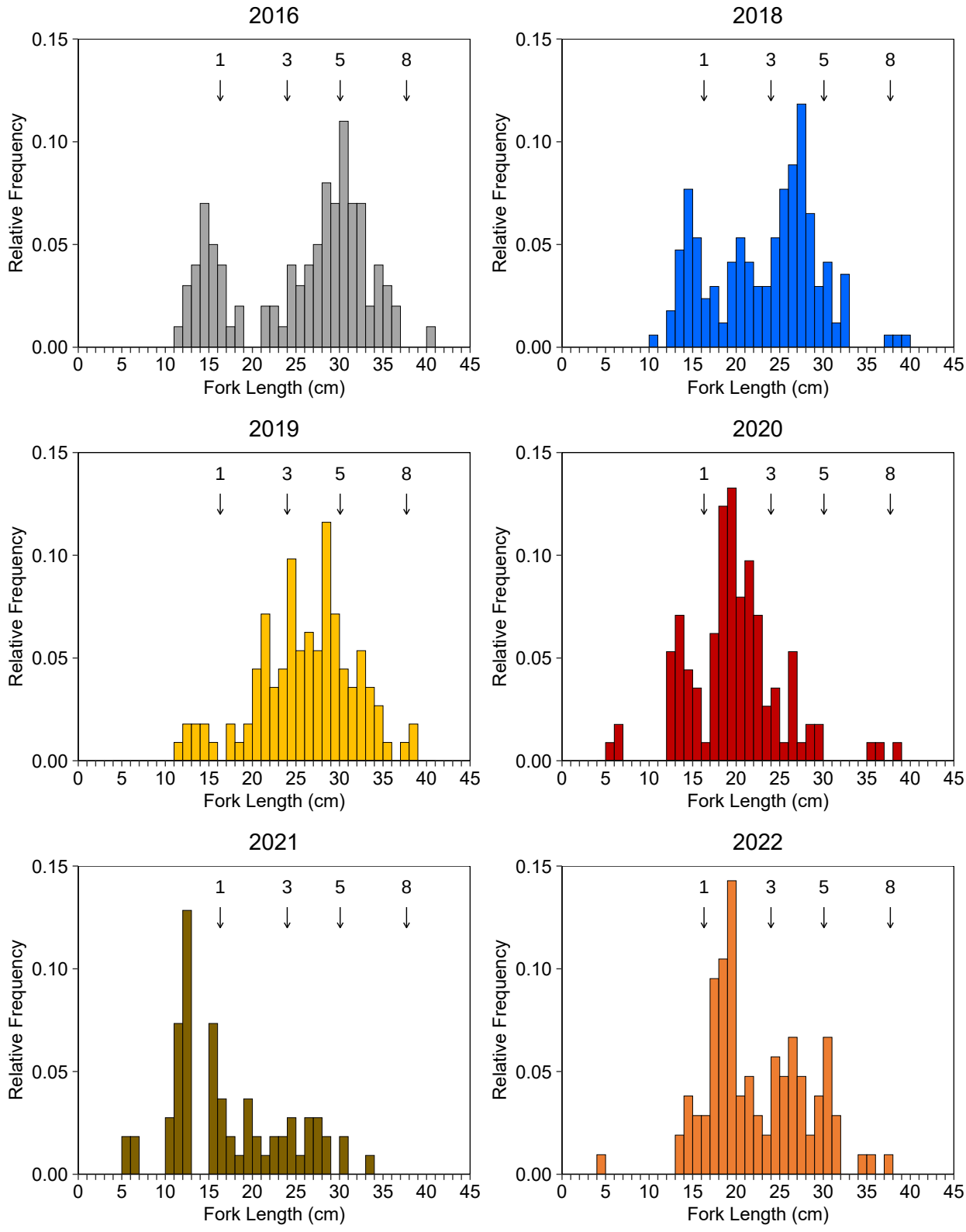

Figure 5.11: Longnose Sucker Length Frequency Distributions from Randomized Fall Hoop Netting in Polley Lake, 2016 to 2022

Notes: Numbers and arrows along the tops of figures represent predicted fork lengths at various ages from a linear model: $\log_{10}(\text{Fork Length}) = 1.0446 + \log_{10}(\text{Age}+1) \times 0.5573$, with $R^2 = 0.88$. The linear model to predict fork lengths at various ages uses fish collected in spring and fall, but the fork length frequency data presented for each year includes data from fall only.

when they were almost entirely absent from Polley Lake, over 50% of the catch in 2022 was comprised of younger fish (smaller than 7 cm; Appendix Figures E.5.5, E.5.6, Appendix Table C.6.9).

5.1.6 Fish Tissue Quality

Fish tissue quality was evaluated for rainbow trout and longnose sucker from Polley (exposed) and Bootjack (reference) lakes in 2022 (Figure 3.4, Table 3.4). A review of the 2022 fish tissue data quality (Appendix B) indicated that data collected in the spring (from Polley and Bootjack Lakes) and the fall (from Quesnel Lake and Quesnel River) had appropriate LRLs, good detectability and excellent laboratory accuracy. Field precision was moderate, with just under half of field duplicate sets having >20% of analyte comparisons above the DQO of 30%. Kidney samples had the most DQO exceedances while ovary and liver had the fewest. This suggests natural heterogeneity within the tissue samples and between tissue types (muscle, liver, kidney, and ovary); however, the level of replication employed (n = 8 per tissue type) serves to help capture this variability. Laboratory data precision was excellent, with most duplicate samples meeting DQOs. Overall, the 2022 fish tissue quality data can be used with a high level of confidence for interpretation, although the occurrence of some natural heterogeneity in analyte results were considered during data interpretation. Historic data used for comparisons are also considered high quality; however, it is considered likely that a subset of the selenium concentrations measured in fish tissues collected by MPMC in 2015 (rainbow trout ovary from exposed area Frypan Creek; included in the Polley Lake analysis) were subject to laboratory error or contamination (Minnow 2017e).

5.1.6.1 Comparison to Guidelines and Thresholds

Mean mercury concentrations in muscle from rainbow trout and longnose sucker were below the mercury guideline for human health (0.5 mg/kg ww) for both Polley and Bootjack lakes in 2022 (Table 5.8). This result was consistent with those for rainbow trout and longnose sucker captured from Polley and Bootjack lakes in 2015 to 2021 (Table 5.8). Moreover, mercury concentrations in individual samples were below the guideline for all fish captured in 2022 (Appendix Tables C.7.1 to C.7.4). In 2021, a single rainbow trout exceeded the guideline; however, individual mercury concentrations were below the guideline for all rainbow trout and longnose sucker captured from 2015 to 2020 (Table 5.8). For selenium, mean and individual tissue concentrations in muscle of rainbow trout and longnose sucker collected from both lakes were consistently below the human health guideline for moderate fish consumption (i.e., a consumption rate of 110 g per day), consistent with sampling completed between 2015 and 2021 (Table 5.8; Appendix Tables C.7.1 to C.7.4). In Polley Lake, the mean selenium concentration in rainbow trout muscle was also below the guideline for high consumption in 2022 but the guideline

Table 5.8: Fish Muscle Mercury and Selenium Concentrations from Polley Lake (Exposed) and Bootjack Lake (Reference) Relative to Human Health Consumption Guidelines, 2015 to 2022

Waterbody or Area	Species	Year/Season	Sample Size	Mercury (Hg) mg/kg ww		Selenium (Se) mg/kg dw		
				Health Canada Human Health		BCMOE Human Health		
				Guideline = 0.5 mg/kg ww		Moderate Consumption = 14.5 mg/kg dw		
						High Consumption = 7.3 mg/kg dw		
				Mean	Frequency > Guideline	Mean	Frequency > Moderate	Frequency > High
Bootjack Lake Tributary 10 (Reference)	Rainbow Trout	Spring 2015 (Minnow 2017g)	8	0.0801	0%	2.46	0%	0%
Polley Lake Tributary (Frypan Creek)	Rainbow Trout		8	0.0861	0%	4.92	0%	0%
Trio Lake (Reference)	Rainbow Trout	Fall 2015 (Minnow 2017g)	8	0.353	0%	0.709	0%	0%
Polley Lake	Rainbow Trout	Spring 2016 (Minnow 2017g)	17	0.0775	0%	5.83	0%	12%
	Longnose Sucker		16	0.0885	0%	7.44	0%	56%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2017 (Minnow 2018e)	8	0.0787	0%	2.13	0%	0%
	Longnose Sucker		8	0.0817	0%	2.03	0%	0%
Polley Lake	Rainbow Trout		8	0.0798	0%	5.49	0%	0%
	Longnose Sucker		8	0.0735	0%	6.64	0%	25%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2018 (Minnow 2019a)	8	0.0930	0%	2.20	0%	0%
	Longnose Sucker		8	0.0790	0%	2.40	0%	0%
Polley Lake	Rainbow Trout		8	0.0920	0%	5.60	0%	0%
	Longnose Sucker		8	0.0950	0%	7.36	0%	38%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2019 (Minnow 2020a)	8	0.0873	0%	2.16	0%	0%
	Longnose Sucker		8	0.0942	0%	2.72	0%	0%
Polley Lake	Rainbow Trout		8	0.0677	0%	5.34	0%	0%
	Longnose Sucker		8	0.0599	0%	8.07	0%	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2020 (Minnow 2021a)	8	0.0704	0%	2.42	0%	0%
	Longnose Sucker		8	0.103	0%	2.51	0%	0%
Polley Lake	Rainbow Trout		8	0.111	0%	5.41	0%	0%
	Longnose Sucker		8	0.0734	0%	8.10	0%	88%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2021 (Minnow 2022a)	8	0.0916	0%	2.12	0%	0%
	Longnose Sucker		8	0.134	0%	2.10	0%	0%
Polley Lake	Rainbow Trout		8	0.274	13%	4.57	0%	0%
	Longnose Sucker		8	0.0714	0%	6.08	0%	13%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2022	8	0.101	0%	2.31	0%	0%
	Longnose Sucker		8	0.122	0%	2.61	0%	0%
Polley Lake	Rainbow Trout		8	0.140	0%	4.52	0%	13%
	Longnose Sucker		8	0.0629	0%	7.84	0%	63%

Indicates mean mercury concentration greater than Health Canada's Human Health guideline for muscle tissue in fish (0.5 mg/kg dw; CFIA 2015).
Indicates mean selenium concentration greater than the BCMOE Human Health guideline for moderate fish consumption (14.5 mg/kg dw; BCMOE 2014).
Indicates mean selenium concentration greater than the BCMOE Human Health guideline for high fish consumption (7.3 mg/kg dw; BCMOE 2014).

Notes: mg/kg ww = milligrams per kilogram wet weight; mg/kg dw = milligrams per kilogram dry weight; BCMOE = British Columbia Ministry of Environment; > = greater than; % = percent.

was exceeded in a single individual (7.41 mg/kg dw; Appendix Table C.7.1). The mean selenium concentration in muscle tissue of longnose sucker from Polley Lake marginally exceeded the high consumption guideline in 2022 (mean = 7.84 mg/kg dw; Appendix Table C.7.3) with 63% of the samples exceeding the guideline, consistent with rates in Polley Lake from 2016 to 2021 (25 to 100%; Table 5.8). However, the likelihood that longnose sucker would be consumed at a high rate (i.e., subsistence consumers) is low.

Mean selenium concentrations in muscle of rainbow trout and longnose sucker from Polley Lake in 2022 were higher than the guideline for the protection of aquatic life (4 mg/kg dw; Table 5.9). The guideline was exceeded in 50% of rainbow trout and all longnose sucker muscle tissue samples, consistent with rates in Polley Lake from 2015 to 2021 (63% to 100% of fish sampled each year). Selenium concentrations remained below the guideline in all fish muscle tissue samples from Bootjack Lake (Table 5.9; Appendix Tables C.7.1 to C.7.4). The mercury guideline for fish muscle tissue is specific to human health and a mercury guideline for the protection of aquatic life does not exist.

Embryo toxicity is the primary mechanism of selenium-associated effects to egg laying vertebrates, the most selenium-sensitive organisms, and ovary tissue is recommended for assessing the potential effects of selenium on fish (e.g., Luoma and Presser 2009, Janz et al. 2010, DeForest et al. 2012, Janz 2012). The mean concentration of selenium in ovary tissue of rainbow trout collected from Polley Lake in 2022 (8.27 mg/kg dw) was lower than the 11 mg/kg dw guideline for the protection of aquatic life[49]. The mean concentration in 2022 was also lower than those reported from 2016 to 2021, representing the lowest post-breach mean concentration recorded in Polley Lake for rainbow trout ovary tissue (BCMOE 2014; Table 5.10; Appendix Table C.7.1). Of the ovaries collected from Polley Lake in 2022, one rainbow trout sample had a concentration above the guideline for the protection of aquatic life, and only marginally so (11.1 mg/kg dw; Appendix Table C.7.1). Furthermore, the mean and individual ovary selenium concentrations of rainbow trout from Polley Lake in 2022 (8.27 mg/kg dw) and in previous years were well below the 20 mg/kg dw effect threshold developed by DeForest et al. (2012; Table 5.10). Selenium concentrations in ovaries of rainbow trout from Bootjack Lake (2015 to 2022) were consistently below the tissue-specific selenium guideline for the protection of aquatic life and the threshold for reproductive effects (DeForest et al. 2012; Table 5.10; Appendix Table C.7.2). From 2016 to 2022, mean selenium concentrations in ovaries of longnose sucker captured from Polley and Bootjack lakes were lower than the tissue-specific guideline for

[49] This guideline includes a two-fold uncertainty factor (BCMOE 2014).

Table 5.9: Fish Muscle Selenium Concentrations from Polley Lake (POL; Exposed) and Bootjack Lake (BOL; Reference) Relative to the British Columbia Guideline for the Protection of Aquatic Life, 2015 to 2022

Waterbody or Area	Species	Year/ Season	Sample Size	Selenium (Se) mg/kg dw	
				BCMOE Guideline (4 mg/kg dw)	
				Mean	Frequency > Guideline
Bootjack Lake Tributary 10 (Reference)	Rainbow Trout	Spring 2015 (Minnow 2017g)	8	2.46	0%
Polley Lake Tributary (Frypan Creek)	Rainbow Trout		8	4.92	63%
Trio Lake (Reference)	Rainbow Trout	Fall 2015 (Minnow 2017g)	8	0.709	0%
Polley Lake	Rainbow Trout	Spring 2016 (Minnow 2017g)	17	5.83	88%
	Longnose Sucker		16	7.44	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2017 (Minnow 2018e)	8	2.13	0%
	Longnose Sucker		8	2.03	0%
Polley Lake	Rainbow Trout		8	5.49	100%
	Longnose Sucker		8	6.64	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2018 (Minnow 2019a)	8	2.20	0%
	Longnose Sucker		8	2.40	0%
Polley Lake	Rainbow Trout		8	5.60	100%
	Longnose Sucker		8	7.40	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2019 (Minnow 2020a)	8	2.16	0%
	Longnose Sucker		8	2.72	0%
Polley Lake	Rainbow Trout		8	5.34	100%
	Longnose Sucker		8	8.07	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2020 (Minnow 2021a)	8	2.42	0%
	Longnose Sucker		8	2.51	0%
Polley Lake	Rainbow Trout		8	5.41	100%
	Longnose Sucker		8	8.10	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2021 (Minnow 2022a)	8	2.12	0%
	Longnose Sucker		8	2.10	0%
Polley Lake	Rainbow Trout		8	4.57	75%
	Longnose Sucker		8	6.08	100%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2022	8	2.31	0%
	Longnose Sucker		8	2.61	0%
Polley Lake	Rainbow Trout		8	4.52	50%
	Longnose Sucker		8	7.84	100%

Indicates mean selenium concentration greater than the BCMOE guideline for muscle tissue or whole body in fish (4 mg/kg dw; BCMOE 2014).

Notes: mg/kg dw = milligrams per kilogram dry weight; BCMOE = British Columbia Ministry of Environment; > = greater than; % = percent.

Table 5.10: Fish Ovary Selenium Concentrations from Polley Lake (Exposed) and Bootjack Lake (Reference) Relative to Guidelines and Thresholds, 2015 to 2022

Waterbody or Area	Species	Year/Season	Sample Size	Selenium (Se) mg/kg dw		
				Mean	Frequency > Guideline or Threshold	
					BCMOE Guideline (11 mg/kg dw)	DeForest et al. (2012) Threshold (20 mg/kg dw)
Bootjack Lake Tributary 10 (Reference)	Rainbow Trout	Spring 2015 (Minnow 2017g)	8	5.87	0%	0%
Polley Lake Tributary (Frypan Creek)	Rainbow Trout		8	40.0[a]	100%	88%
Polley Lake	Rainbow Trout	Spring 2016 (Minnow 2017g)	8	10.3	38%	0%
	Longnose Sucker		8	10.4	25%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2017 (Minnow 2018e)	8	4.52	0%	0%
	Longnose Sucker		8	8.65	0%	0%
Polley Lake	Rainbow Trout		8	11.1	25%	0%
	Longnose Sucker		8	3.56	0%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2018 (Minnow 2019a)	8	4.30	0%	0%
	Longnose Sucker		8	3.70	0%	0%
Polley Lake	Rainbow Trout		8	10.1	50%	0%
	Longnose Sucker		8	9.19	0%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2019 (Minnow 2020a)	8	4.11	0%	0%
	Longnose Sucker		8	3.80	0%	0%
Polley Lake	Rainbow Trout		8	11.5	75%	0%
	Longnose Sucker		8	9.36	13%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2020 (Minnow 2021a)	8	4.67	0%	0%
	Longnose Sucker		8	3.72	0%	0%
Polley Lake	Rainbow Trout		8	9.04	13%	0%
	Longnose Sucker		8	8.41	0%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2021 (Minnow 2022a)	8	4.28	0%	0%
	Longnose Sucker		8	3.84	0%	0%
Polley Lake	Rainbow Trout		8	9.50	25%	0%
	Longnose Sucker		8	7.78	0%	0%
Bootjack Lake (Reference)	Rainbow Trout	Spring 2022	8	4.88	0%	0%
	Longnose Sucker		8	4.63	0%	0%
Polley Lake	Rainbow Trout		8	8.27	13%	0%
	Longnose Sucker		8	8.69	0%	0%

Indicates mean selenium concentration greater than the BCMOE guideline for ovary tissue in fish (11 mg/kg dw; BCMOE 2014).

Indicates mean selenium concentration greater than DeForest et al (2012) threshold for ovary tissue in fish (20 mg/kg dw) and the BCMOE guideline.

Notes: mg/kg dw = milligrams per kilogram dry weight, > = greater than, BCMOE = British Columbia Ministry of Environment, % = percent.

[a] Data are considered suspect and are likely influenced by laboratory error or contamination (Golder 2016b; Minnow 2017g).

the protection of aquatic life, as well as the 20 mg/kg dw threshold for reproductive effects (DeForest et al. 2012, BCMOE 2014; Table 5.10; Appendix Tables C.7.3, C.7.4).

5.1.6.2 Spatial and Temporal Comparisons

Data collected from Polley and Bootjack lakes in baseline (1995; HKP 1996), pre-breach (2009; Minnow 2011), and post-breach monitoring studies (2015 to 2021; Table 3.9)[50] were compared spatially (exposed versus reference) and temporally (annual change; see Section 3.7.3.2). These comparisons included up to 36 elements[51], two species (rainbow trout and longnose sucker), and four tissues (muscle, liver, ovary, and kidney; Appendix Figures E.6.1 to E.6.8, Appendix Tables E.6.1 to E.6.8).

Age and morphological measures (fork length and body weight) of rainbow trout and longnose sucker captured from Polley and Bootjack lakes between 2015 and 2022 are summarized in Table 5.11 (see Appendix Tables C.6.10 to C.6.11 for detailed 2022 data). Statistical comparisons of these physical measures exhibited a significant *Area*×*Year* interaction for rainbow trout fork length and body weight (based on data from 1995 to 2022; Table 5.12; Appendix Table E.6.1).[52] Rainbow trout sampled from Polley Lake were similar in size and age to those sampled those from Bootjack Lake in 2022. This was also true in prior years except 2015, 2019, 2020 when rainbow trout from Polley Lake were significantly longer (8% to 17%) and heavier (27% to 46%) than those from the reference lake (Table 5.12; Appendix Table E.6.1). The greater size and weight of rainbow trout collected from Polley Lake in 2015, 2019, and 2020 relative to Bootjack Lake may be related to limited rainbow trout recruitment associated with Hazeltine Creek being inaccessible for spawning and rearing from 2014 to 2017 (see Section 3.6.1). Conversely, longnose sucker collected from Polley Lake were significantly younger (90% in all years) and lighter (30% in 2022) than longnose sucker from Bootjack Lake (Table 5.12; Appendix Table E.6.2). In previous monitoring years, longnose sucker from Polley Lake were younger, and either not significantly different in size or were shorter and/or lighter compared to those from Bootjack Lake, consistent with trends observed during baseline data collection for size and weight (i.e., 1995; Table 5.12; Appendix Table E.6.2).

[50] The reference area (Bootjack Lake) was not sampled in 2016; therefore, statistical comparisons were not completed for 2016 (i.e., concurrent exposed and reference data are required; see Section 3.7.3.2).

[51] Silver and titanium were added to fish tissue analyses in 2020.

[52] Results of the two-way ANOVA for age, fork length, and body size may differ among tissue types for the same species in the same area due to sub-sampling (i.e., the number of females sampled for ovary tissue may be a subset of the total samples) or differences in data availability across years for the different tissue types (e.g., rainbow trout kidney data were collected from 2018 to 2022 compared to 1995 to 2022 for rainbow trout muscle tissue). For all species sampled for tissue in 2022, discussion of age and body size is focused on results of two-way ANOVA for muscle and ovary tissues.

Table 5.11: Age and Body Size Data of Fish Collected for Tissue Quality Monitoring from Polley Lake (Exposed) and Bootjack Lake (Reference), 2015 to 2022

Waterbody or Area	Fish Species	Year/Season	Sample Size	Age (Years)		Fork Length (cm)		Body Weight (Grams)	
				Mean	Range	Mean	Range	Mean	Range
Bootjack Lake Tributary 10 (Reference)	Rainbow Trout	Spring 2015 (Minnow 2017g)	8	5.3	4 - 6	28.9	25.3 - 31.3	250	188 - 325
Polley Lake Tributary (Frypan Creek)			8	4.8	4 - 6	24.7	21.8 - 28.0	187	140 - 233
Trio Lake (Reference)	Rainbow Trout	Fall 2015 (Minnow 2017g)	8	4.6	3 - 6	26.3	17.0 - 34.2	197	105 - 280
Polley Lake	Rainbow Trout	Spring 2016 (Minnow 2017g)	18	4.6	3 - 7	31.5	23.6 - 35.7	335	152 - 455
	Longnose Sucker		16	6.3	2 - 12	33.4	24.5 - 42.0	498	145 - 980
Bootjack Lake (Reference)	Rainbow Trout	Spring 2017 (Minnow 2018e)	8	5.4	4 - 6	31.6	29.2 - 33.5	327	250 - 365
	Longnose Sucker		8	8.8	7 - 12	41.6	38.8 - 44.2	1,144	890 - 1,300
Polley Lake	Rainbow Trout		8	5.0	4 - 7	32.3	28.8 - 34.5	376	260 - 430
	Longnose Sucker		8	8.4	7 - 12	38.3	34.2 - 40.8	851	660 - 1,120
Bootjack Lake (Reference)	Rainbow Trout	Spring 2018 (Minnow 2019a)	9	5.1	4 - 7	31.7	29.4 - 33.7	338	278 - 445
	Longnose Sucker		8	6.9	4 - 9	42.1	39.9 - 43.9	1,116	990 - 1,280
Polley Lake	Rainbow Trout		8	4.5	4 - 5	32.8	31.0 - 34.4	335	250 - 420
	Longnose Sucker		8	8.0	4 - 11	40.9	34.1 - 44.2	989	505 - 1,240
Bootjack Lake (Reference)	Rainbow Trout	Spring 2019 (Minnow 2020a)	8	5.1	4 - 7	31.2	27.9 - 33.0	310	225 - 360
	Longnose Sucker		8	7.4	6 - 9	40.2	37.7 - 42.8	983	820 - 1,160
Polley Lake	Rainbow Trout		8	6.3	4 - 7	33.7	32.5 - 35.4	393	350 - 435
	Longnose Sucker		8	5.9	4 - 11	36.5	30.8 - 42.9	691	405 - 1,320
Bootjack Lake (Reference)	Rainbow Trout	Spring 2020 (Minnow 2021a)	8	4.5	4 - 7	31.7	26.5 - 34.5	335	234 - 360
	Longnose Sucker		8	8.5	7 - 10	41.9	39 - 46.7	1,035	810 - 1,440
Polley Lake	Rainbow Trout		8	6.0	4 - 7	35.8	31.5 - 38.3	498	315 - 694
	Longnose Sucker		8	9.0	5 - 12	39.9	32.7 - 44.4	920	425 - 1,260
Bootjack Lake (Reference)	Rainbow Trout	Spring 2021 (Minnow 2022a)	8	4.5	4 - 5	33	30.8 - 35.4	348	302 - 445
	Longnose Sucker		8	8.9	6 - 11	43.9	41.7 - 46.8	1,143	860 - 1,380
Polley Lake	Rainbow Trout		8	4.6	3 - 6	34	25.8 - 38.6	389	176 - 590
	Longnose Sucker		8	6.0	3 - 11	34.6	24.8 - 41.6	545	196 - 960
Bootjack Lake (Reference)	Rainbow Trout	Spring 2022	8	4.1	3 - 6	29.8	24.1 - 35.0	257	156 - 360
	Longnose Sucker		8	8.9	6 - 12	40.3	32.8 - 44.6	1,017	550 - 1,360
Polley Lake	Rainbow Trout		8	3.8	3 - 4	30.8	24.8 - 34.1	278	160 - 355
	Longnose Sucker		8	7.6	5 - 13	38.4	27.7 - 44	733	262 - 960

Table 5.12: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Fish Tissue Primary and Secondary Analyte Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022[a]

Parameter		Tissue	Rainbow Trout: Two-way ANOVA																				Longnose Sucker: Two-way ANOVA													
			Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)										Magnitude of Difference for Polley Lake (Exposed) Mean Relative to Bootjack Lake (Reference) (%)										Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)								Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)							
			Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Post-Release Period	Post-Breach Period						Before Period	Post-Release Period	Post-Breach Period					
			1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022
Age		muscle	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	baseline	ns	ns	ns	ns	ns	ns	-	-90						
Fork Length		muscle	baseline	ns	ns	17	ns	ns	ns	ns	ns	ns	ns	ns	ns	17	ns	ns	8.0	12	ns	ns	baseline	ns	ns	ns	ns	ns	ns	ns	-13	ns	ns	ns	-9.6	ns	-22	ns
Body Weight		muscle	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	30	ns	ns	27	46	ns	ns	baseline	ns	ns	ns	ns	-41	ns	-30	ns	-26	ns	-33	ns	-59	-30
Primary Analytes	Arsenic	muscle	baseline	ns	-	ns	ns	ns	ns	ns	ns	ns	66		-	66							baseline	-	ns	ns	ns	ns	ns	70	-	231	ns	ns	ns	81	ns
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	22							-	-	baseline	ns	-63	-57	-51	-50	-	-	113	ns	ns	ns	ns	ns
	(essential)	liver[b]	baseline	-	-	ns	-52	ns	-48	-53	ns	ns	116	-	-	70	ns	39	ns	ns	99	77	baseline	-	ns	ns	ns	ns	ns	ns	57	-	119	91	ns	50	ns	88
		kidney[b]	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	68					-	-	-	baseline	ns	ns	ns	ns	-	-	-	36				
	Copper	muscle	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	ns	ns	ns	-	-	baseline	ns	ns	ns	ns	53	-	-	ns	ns	ns	ns	45	62
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	11							-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	(essential)	liver[b]	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	45							-	-	baseline	ns	ns	ns	ns	104	-	-	ns	ns	ns	ns	69	204
		kidney[b]	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	11					-	-	-	baseline	ns	ns	ns	ns	-	-	-	8.0				
	Iron	muscle	-	-	-	baseline	-46	ns	ns	ns	ns	ns	-	-	-	ns	-45	38	ns	ns	ns	44	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	ns	ns	ns	ns	ns	ns	ns	-	-	baseline	ns	ns	ns	ns	ns	-	-	-24					
	(essential)	liver[b]	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	42							-	-	baseline	ns	ns	ns	ns	ns	-	-	-19					
		kidney[b]	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	21					-	-	-	baseline	ns	ns	ns	91	-	-	-	ns	ns	ns	ns	53
	Selenium	muscle	baseline	268	316	173	271	267	257	224	211	174	-30	157	190	90	159	156	149	125	117	91	baseline	440	261	240	230	263	221	229	ns	389	227	208	198	229	190	198
		ovary[b]	-	-	baseline	201	ns	ns	ns	ns	ns	ns	-	-	121	564	146	133	180	93	121	70	-	baseline	-19	-16	-17	-24	-31	-37	-	197	140	148	146	126	103	88
	(essential)	liver[b]	baseline	-	-	672	148	314	690	394	306	186	ns	-	-	422	67	180	434	234	174	93	baseline	-	102	87	75	69	23	62	17	-	135	118	104	97	43	88
		kidney[b]	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	71					-	-	-	baseline	ns	ns	-23	ns	-	-	-	74	83	66	33	82
Secondary Analytes	Cobalt	muscle	-	<LRL	-	<LRL	baseline	129	115	<LRL	120	159	-	<LRL	-	<LRL	-39	ns	ns	<LRL	ns	57	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	29							-	-	baseline	ns	ns	ns	ns	ns	-	-	17					
	(essential)	liver	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	30							-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	-26	-22	-24	ns
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	171					-	-	-	baseline	ns	ns	ns	ns	-	-	-	ns	ns	ns	ns	ns
	Manganese	muscle	-	baseline	-	ns	-58	ns	ns	-39	ns	ns	-	ns	-	ns	-63	-24	-33	-46	ns	ns	-	-	baseline	ns	ns	82	81	ns	-	-	ns	ns	ns	39	39	ns
		ovary	-	-	-	baseline	ns	ns	-46	-66	ns	-47	-	-	-	ns	ns	ns	ns	-52	ns	ns	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	(essential)	liver	-	-	-	baseline	-28	ns	ns	ns	ns	61	-	-	-	ns	-39	ns	ns	-25	ns	36	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
		kidney	-	-	-	-	-	baseline	ns	ns	ns	166	-	-	-	-	-	-42	ns	ns	ns	53	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-57	-57	-57	-57	-57

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available for analysis (i.e., either no data was collected for the given time period or the data were <LRL and could not be analysed); "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis, "ns" = not significant; "ww" = wet weight; "Exp" = exposed; "Ref" = reference; "ANOVA" = Analysis of Variance; "MLE" = Maximum Likelihood Estimation. Data were analysed in units of mg/kg dry weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Age, fork length, and body weight results are those that are associated with muscle tissue analyses.

[a] Statistical approaches included ANOVA, ANCOVA, and MLE and for each case depended on data suitability (see complete statistical results in Appendix Table E.6.1 to E.6.8). This table only presents results for primary and secondary analytes that had a significant postive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types in one or both species.

[b] Organ in which the specific metal is known to accumulate (references in Appendix Table E.6.22).

[c] Magnitude of difference (MOD) calculated on back transformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[d] Magnitude of difference (MOD) calculated on back transformed least-squares means as (Exp-Ref)/Ref x 100%.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Table 5.12: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Fish Tissue Primary and Secondary Analyte Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022[a]

	Parameter	Tissue	Rainbow Trout: Two-way ANOVA																			Longnose Sucker: Two-way ANOVA														
			Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)										Magnitude of Difference for Polley Lake (Exposed) Mean Relative to Bootjack Lake (Reference) (%)										Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)										Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)									
			Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Post-Release Period	Post-Breach Period							Before Period	Post-Release Period	Post-Breach Period						
			1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022
Secondary Analytes	Molybdenum (essential)	muscle	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	baseline	<LRL	<LRL	ns	ns	ns	-	-	120	<LRL	<LRL	120		
		ovary	-	-	-	baseline	ns	ns	ns	-62	-45	ns	-	-	-	ns	68	ns	ns	-47	ns	ns	-	-	baseline	ns	-26	ns	ns	ns	-	-	36	50	ns	64	34	27
		liver	-	-	-	baseline	-57	ns	ns	-50	-41	-44	-	-	-	132	ns	58	59	ns	36	ns	-	-	baseline	ns	ns	ns	ns	30	-	-	ns	27	ns	21	ns	50
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	baseline	ns	ns	ns	ns	-	-	-	76				
	Nickel (essential)	muscle	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		ovary	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		liver	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	33					-	-	-	baseline	ns	ns	ns	92	-	-	-	-37	-62	-45	ns	ns
	Sodium (essential)	muscle	-	-	-	baseline	ns	ns	ns	-37	ns	-38	-	-	-	ns	ns	ns	ns	ns	ns	-23	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	21
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	ns	ns	ns	ns	ns	ns	ns	-	-	baseline	ns	-27	ns	ns	ns	-	-	ns	ns	-33	ns	ns	ns
		liver	-	-	-	baseline	ns	-35	-34	-41	-48	-55	-	-	-	71	74	ns	ns	ns	ns	ns	-	-	baseline	-34	-31	-51	-41	-54	-	-	36	ns	ns	-34	-20	-38
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-25				
	Tin (essential)	muscle	-	<LRL	-	<LRL	baseline	ns	<LRL	<LRL	ns	ns	-	<LRL	-	<LRL	ns	ns	<LRL	<LRL	ns	ns	-	-	baseline	-43	<LRL	-89[e]	2,392[e]	ns	-	-	ns	-47	<LRL	ns	ns	-39
		ovary	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		liver	-	-	-	<LRL	baseline	ns	ns	ns	ns	ns	-	-	-	<LRL	ns	ns	ns	ns	ns	ns	-	-	baseline	ns	<LRL	<LRL	<LRL	ns	-	-	76		<LRL	<LRL	<LRL	76
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	ns	ns	ns	ns	ns	-	-	-	baseline	ns	ns	<LRL	ns	-	-	-	ns	ns	ns	<LRL	ns
	Vanadium (essential)	muscle	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		ovary	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
		liver	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	164							-	-	baseline	139	ns	ns	ns	ns	-	-	ns	154	76	ns	ns	79
		kidney	-	-	-	-	-	baseline	ns	ns	ns	ns	-	-	-	-	-	97					-	-	-	baseline	ns	ns	ns	ns	-	-	-	99				
	Zinc (essential)	muscle	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	-18	ns	ns	-	-	baseline	ns	ns	ns	ns	ns	-	-	85					
		ovary	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	ns	ns	ns	ns	ns	ns	ns	-	-	baseline	ns	ns	ns	ns	ns	-	-	9.4					
		liver	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	11							-	-	baseline	-23	-20	ns	-22	ns	-	-	27	ns	ns	ns	ns	53
		kidney	-	-	-	-	-	baseline	ns	ns	108	ns	-	-	-	-	-	ns	ns	ns	63	ns	-	-	-	baseline	ns	ns	ns	ns	-	-	-	42				

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available for analysis (i.e., either no data was collected for the given time period or the data were <LRL and could not be analysed); "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis, "ns" = not significant; "ww" = wet weight; "Exp" = exposed; "Ref" = reference; "ANOVA" = Analysis of Variance; "MLE" = Maximum Likelihood Estimation. Data were analysed in units of mg/kg dry weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Age, fork length, and body weight results are those that are associated with muscle tissue analyses.

[a] Statistical approaches included ANOVA, ANCOVA, and MLE and for each case depended on data suitability (see complete statistical results in Appendix Table E.6.1 to E.6.8). This table only presents results for primary and secondary analytes that had a significant postive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types in one or both species.

[b] Organ in which the specific metal is known to accumulate (references in Appendix Table E.6.22).

[c] Magnitude of difference (MOD) calculated on back transformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[d] Magnitude of difference (MOD) calculated on back transformed least-squares means as (Exp-Ref)/Ref x 100%.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

As indicated in Section 3.7.3, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significant positive exposed-reference difference (i.e., analytes with concentrations that were significantly higher in tissues from the exposed area compared to those from the reference area) in 2022 (if the analysis *Area×Year* interaction was significant) or in all monitoring years (if the *Area×Year* interaction was not significant[53]). Increasing concentrations at exposed areas relative to reference areas over time, or consistently elevated concentrations at the exposed area relative to reference, were not detected for most metals (Appendix Figures E.6.1 to E.6.8, Appendix Tables E.6.1 to E.6.8). The primary analytes arsenic, copper, iron, and selenium, and secondary analytes cobalt, manganese, molybdenum, nickel, sodium, tin, vanadium met the criteria for inclusion in data interpretation outlined above (Table 5.12). Of these primary and secondary analytes, only sodium concentrations were consistently higher in zooplankton from Polley Lake than reference (Bootjack Lake) between 2019 and 2022 (Table 5.5), while concentrations of arsenic, copper, manganese, and molybdenum in zooplankton tissue from Polley Lake decreased significantly between 2019 and 2022 (Appendix Table E.3.1). In previous years, concentrations of three of these analytes were also higher in zooplankton from Polley Lake than reference (Bootjack Lake) in one (copper and molybdenum) or two (zinc) years from 2019 to 2021 (Appendix Table E.3.1). Selenium concentrations in zooplankton tissue from Polley Lake in 2022 were similar to reference after being significantly higher than reference from 2019 to 2021 and were significantly lower in 2022 compared to 2020 and 2021 (but not 2019), relative to reference (Appendix Table E.3.1; see Section 5.1.4 for details).

Significant *Area×Year* interactions were detected for selenium concentrations in exposed rainbow trout and longnose sucker for most tissue types except for kidney in rainbow trout. The significant *Area×Year* interaction indicates that the ratio of exposed:reference concentrations differed among years (i.e., the geometric mean concentrations at the exposed area were not trending the same as the geometric mean concentrations at the reference area). The timing of the interactions indicated that selenium accumulation began between 1995 and 2009 (i.e., may be associated with the 2006 to 2009 uncontrolled surface runoff to Polley Lake; Figure 5.12, Table 5.12; Appendix Tables E.6.1 to E.6.8). In general, selenium concentrations in tissues did not continue to increase after the post-release period (2012), except for tissue selenium concentrations in rainbow trout ovary that were significantly higher, relative to reference, in 2015 compared to 2012

[53] If no significant change was detected in the exposed-reference difference among years (i.e., the *Area* x *Year* interaction was not significant), then data from all available years were combined for the analyses.

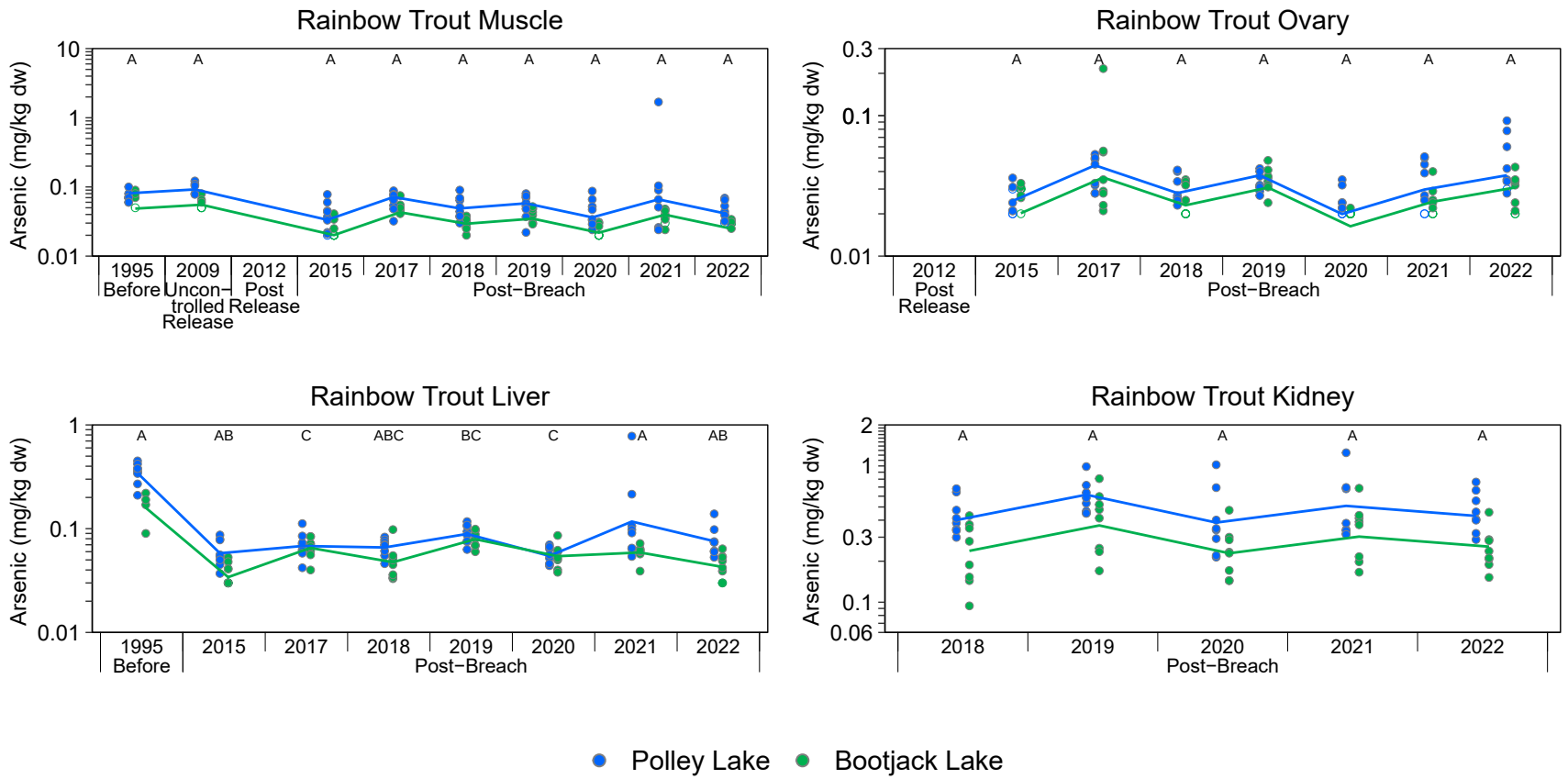

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

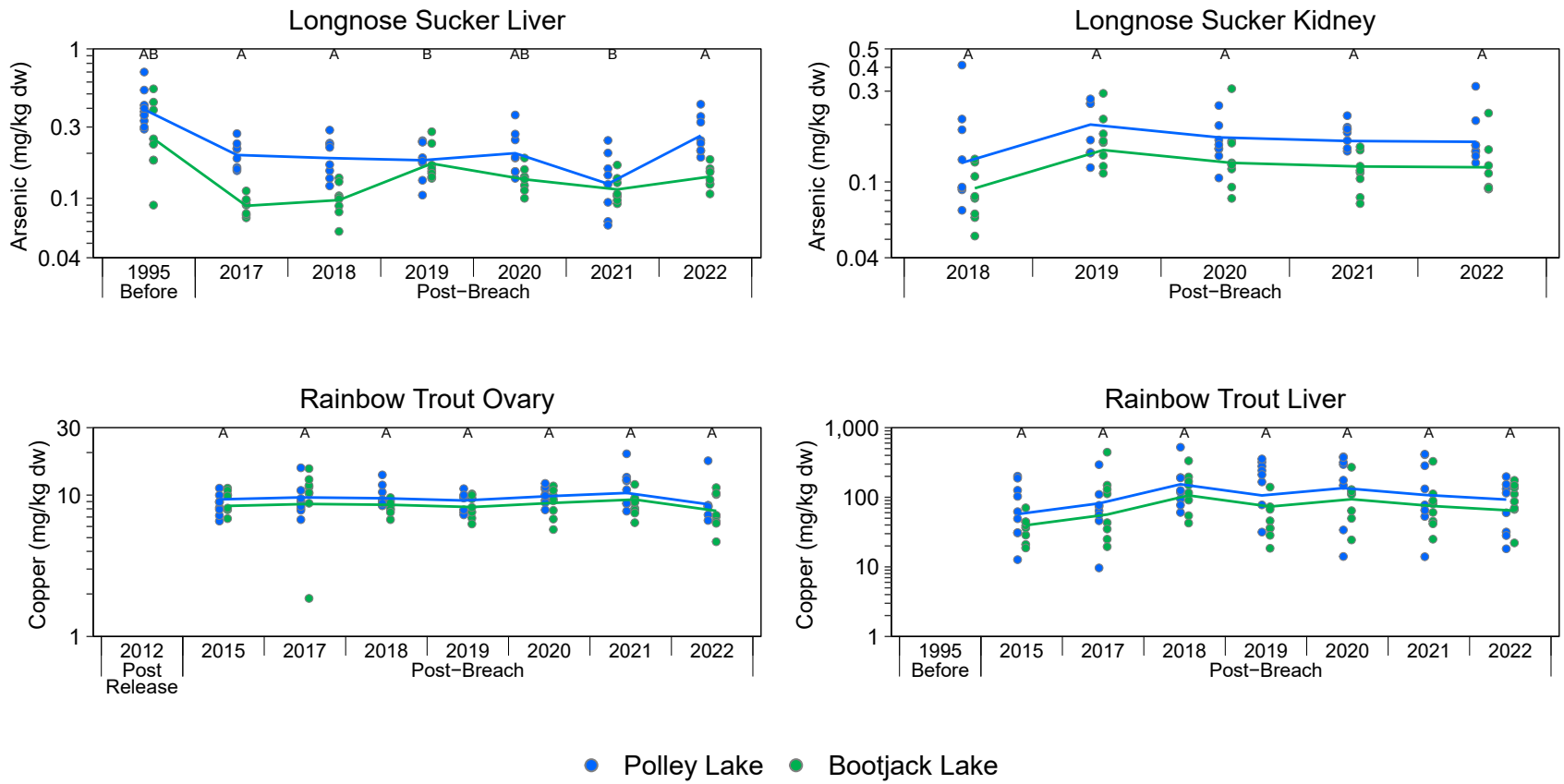

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

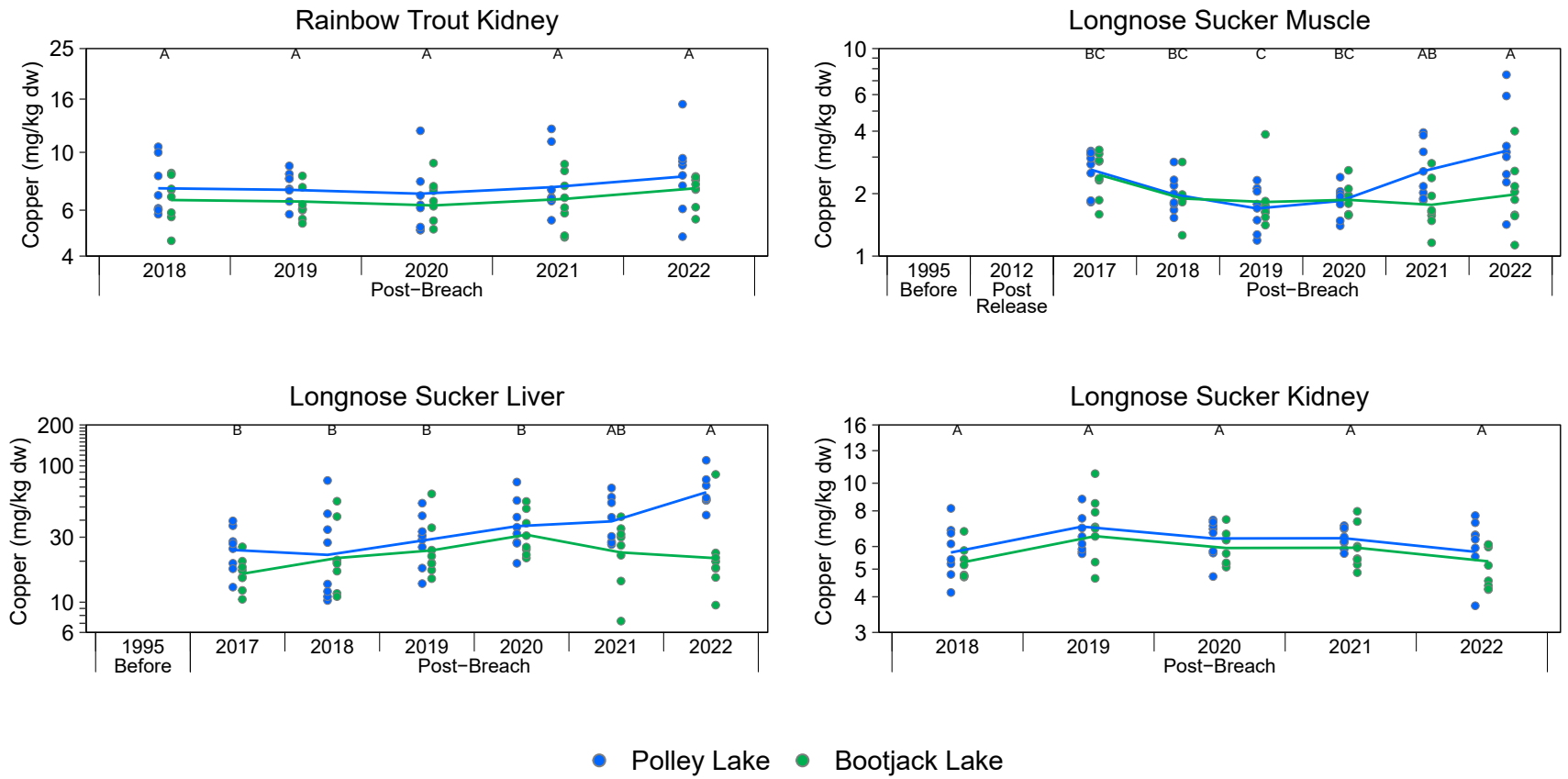

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

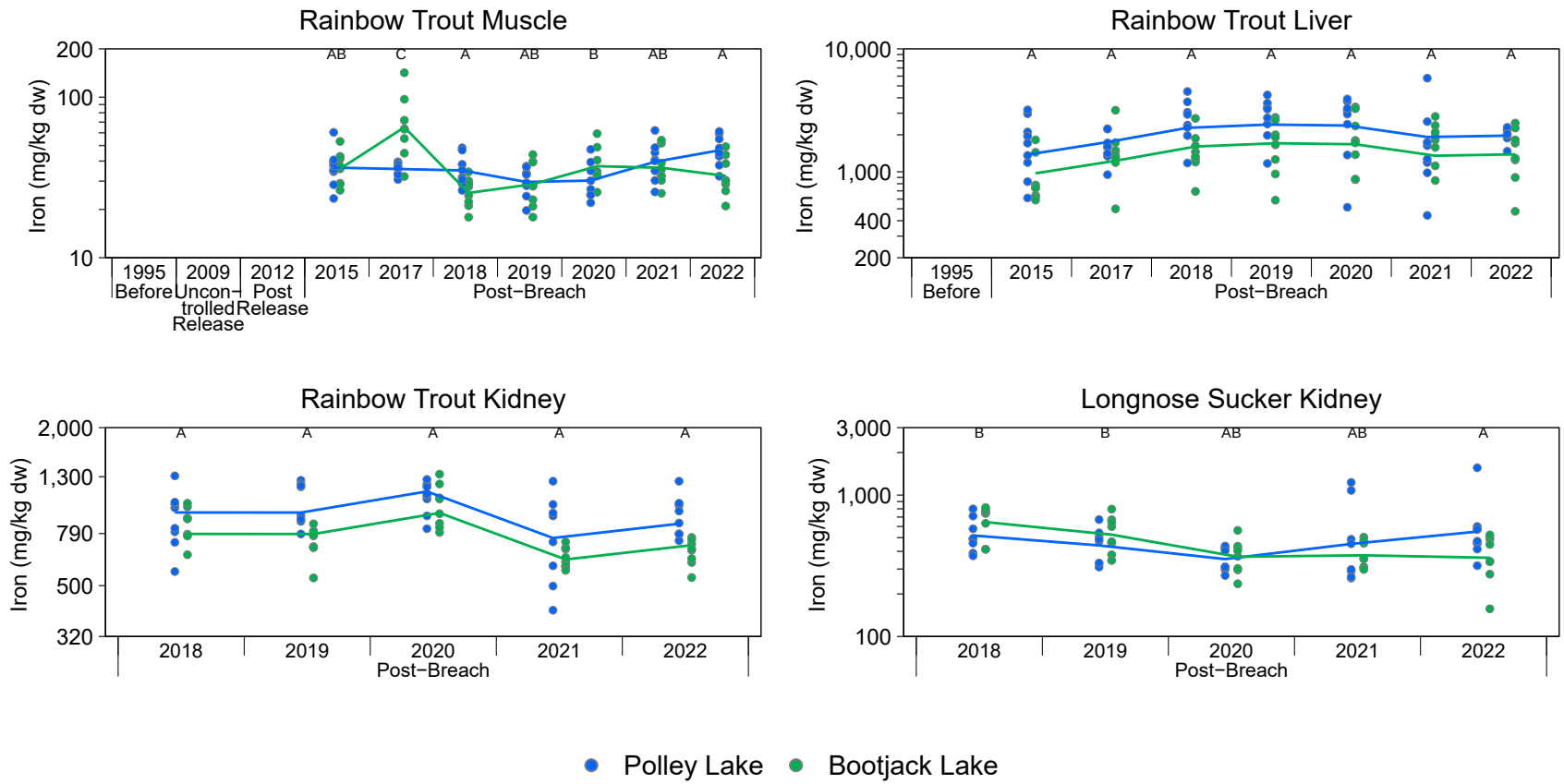

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

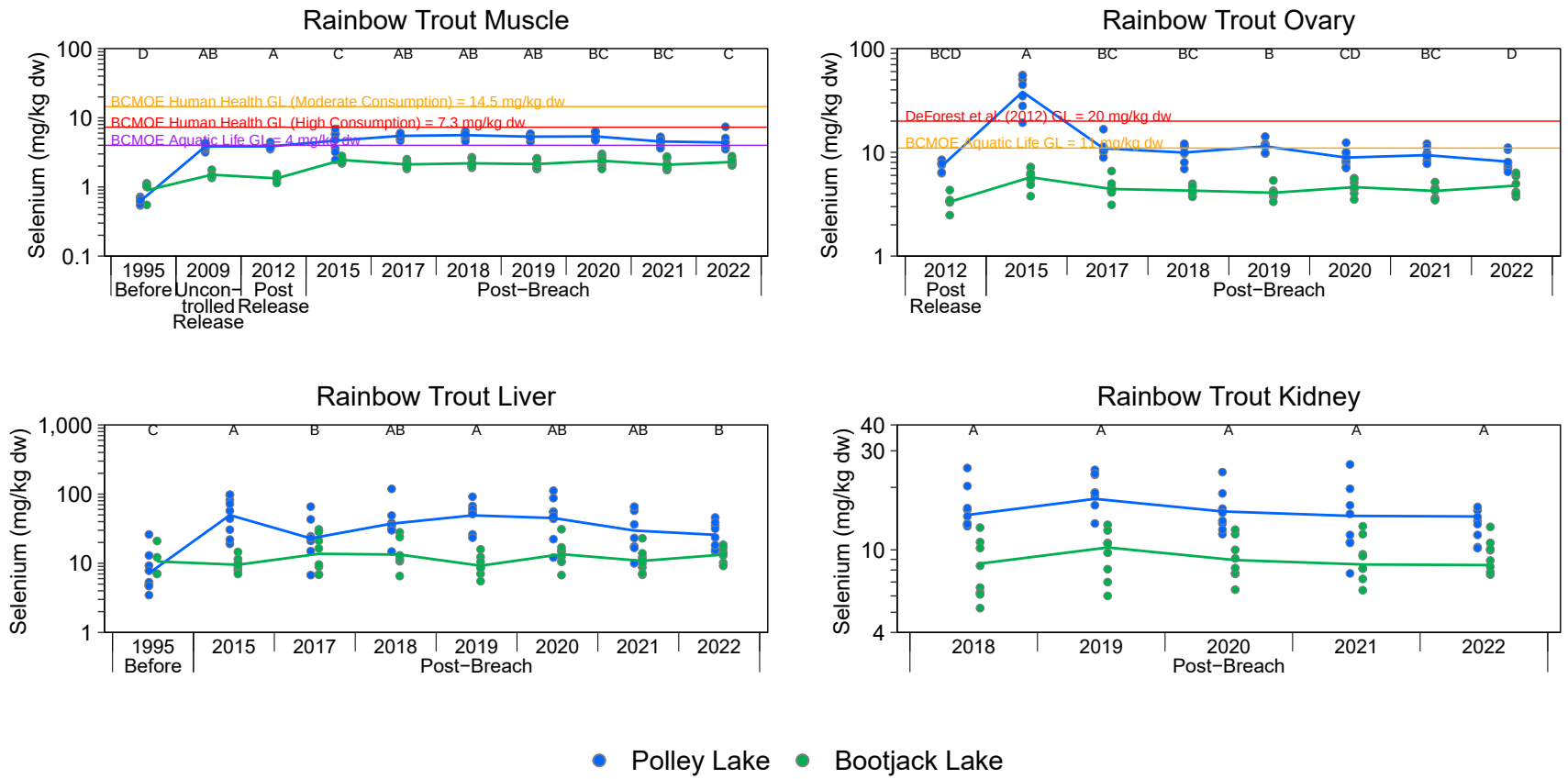

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

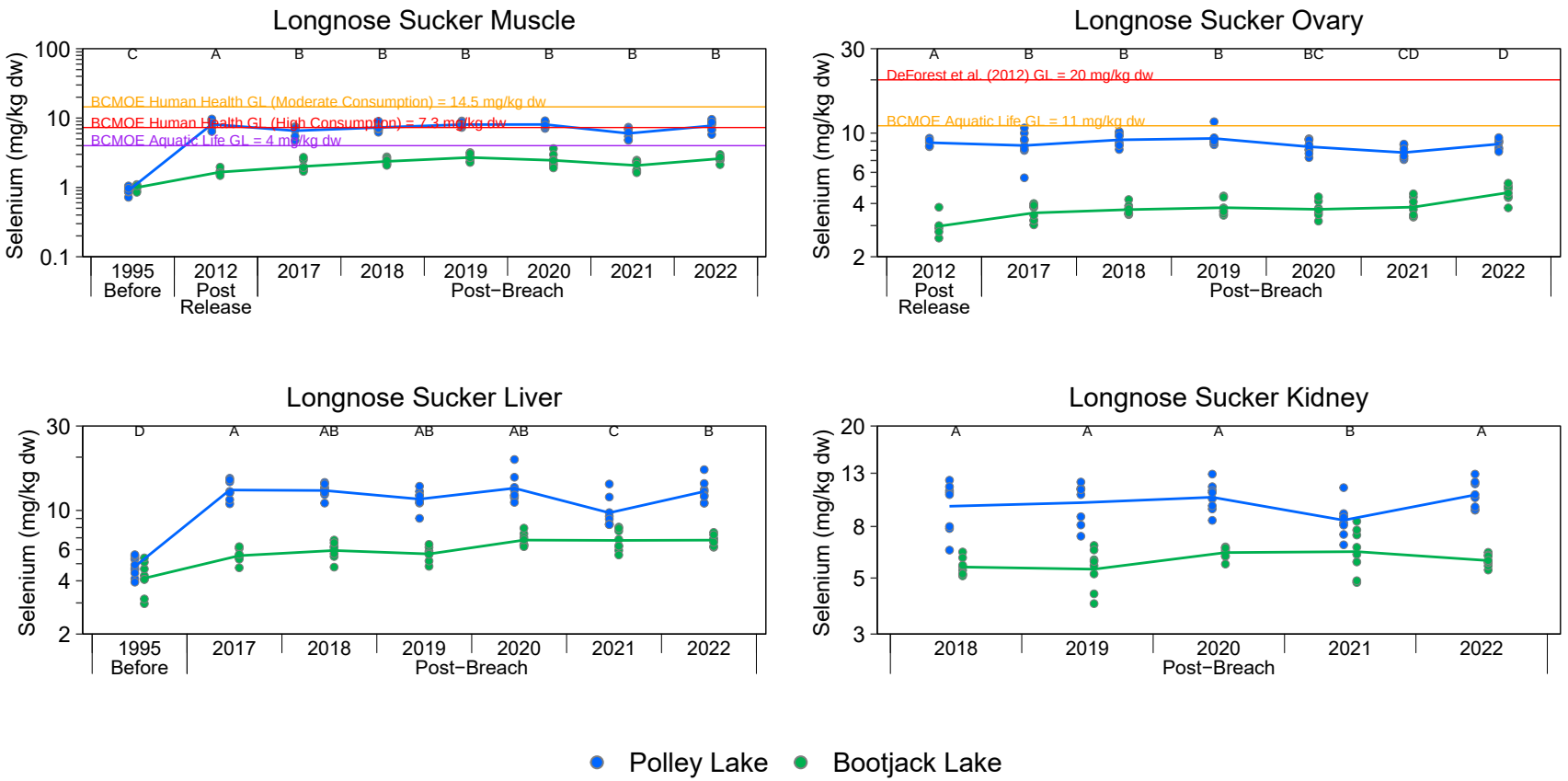

Figure 5.12: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

(Figure 5.12, Table 5.12; Appendix Table E.6.3)[54]. It is possible that the 2015 peak in rainbow trout ovary selenium concentrations may reflect a short-term impact associated with the breach or possible laboratory error (previously mentioned) that cannot be separated from potential mine influence between 1995 and 2015.

Post-breach selenium concentrations in rainbow trout muscle, ovary, liver, and kidney have been consistently higher than reference (67% to 564%; Table 5.12), although there is no indication that selenium is consistently increasing in rainbow trout tissue over time. In fact, the exposed:reference ratios in muscle and liver concentrations in 2022 were at their lowest since 2017 relative to baseline, and differences between areas for ovary and kidney were not significantly different from baseline (Figure 5.12, Table 5.12; Appendix Tables E.6.1, E.6.3, E.6.4, E.6.8). In addition, selenium concentrations in rainbow trout muscle and ovary tissues were both significantly lower in 2022, relative to reference, than in 2017 to 2019 (Figure 5.12). Tissue selenium concentrations in longnose sucker have been consistently higher than reference in each year since the breach (33% to 229% across tissue types). However, selenium concentrations in longnose sucker tissues (i.e., muscle ovary, liver, and kidney) have shown temporal stability or have decreased in Polley Lake relative to Bootjack Lake since the post-release period (2012). For instance, selenium concentrations in longnose sucker ovary tissues were significantly lower in 2022, relative to reference, than reported in 2015 to 2020 (Figure 5.12, Table 5.12; Appendix Tables E.6.2, E.6.5 to E.6.7).

Concentrations of the primary analytes arsenic, copper, and iron were significantly higher in most rainbow trout tissues (muscle, ovary, liver, and kidney) from Polley Lake compared to Bootjack Lake in 2022 (or in all monitoring years if the *Area×Year* interaction was not significant), with two exceptions. These two exceptions are that copper in rainbow trout muscle and iron in rainbow trout ovary did not differ between the waterbodies in 2022 (Figure 5.12, Table 5.12; Appendix Tables E.6.1, E.6.3, E.6.4, E.6.8). Arsenic, copper, and iron concentrations in rainbow trout tissues were unchanged over time (i.e., temporally stable) in most instances, relative to reference. Where temporal changes occurred, the magnitude of the exposed:reference ratio in 2022 was either similar to or lower than baseline (Figure 5.12; Appendix Tables E.6.1, E.6.3, E.6.4, E.6.8). Therefore, there is no evidence that arsenic, copper, and iron concentrations in rainbow trout tissues from Polley Lake are increasing over time due to mine-related influence.

In longnose sucker tissues, arsenic concentrations in liver and kidney, copper concentrations in all tissues except ovary, and iron concentrations in kidney were significantly higher in samples

[54] It is considered likely that a subset of the selenium concentrations measured in exposed rainbow trout ovaries from 2015 were subject to laboratory error or contamination, resulting in reporting of increased selenium concentrations (Minnow 2017e).

from Polley Lake relative to Bootjack Lake in 2022 (or in all monitoring years; Figure 5.12, Table 5.12). However, these exposed:reference ratios in 2022 did not differ significantly from baseline, with three exceptions (Figure 5.12, Table 5.12; Appendix Tables E.6.2, E.6.5 to E.6.7). Specifically, copper concentrations in muscle and liver and iron concentrations in kidney tissues of longnose sucker had exposed:reference ratios that were significantly higher in 2022 compared to 2017 (baseline) to 2020 for copper in muscle and liver and compared to 2018 (baseline) and 2019 for iron in kidney (Figure 5.12, Table 5.12; Appendix Tables E.6.2, E.6.5 to E.6.7). The lack of consistency in the observed increases of copper and iron concentrations among longnose sucker tissue types (i.e., increases not observed in all tissues) suggests that these results are somewhat equivocal. In addition, the increases in copper and iron concentrations in longnose sucker tissues from Polley Lake in 2022 are not supported by the results of zooplankton monitoring which have indicated that copper and iron concentrations in zooplankton tissues from Polley Lake were either similar to or lower than reference in 2022 (see Section 5.1.4; Appendix Table E.3.1). Despite these inconsistencies, continued monitoring and evaluation will help to understand whether these changes were isolated or are part of a longer-term pattern.

Of the secondary analytes, cobalt, manganese, molybdenum, nickel, sodium, tin, vanadium, and zinc had significant *Area×Year* interaction terms for one or more tissue types in rainbow trout and/or longnose sucker and/or were elevated in fish caught in Polley Lake relative to Bootjack Lake in 2022 (Figure 5.13, Table 5.12; Appendix Tables E.6.1 to E.6.8). For most secondary analyte-tissue combinations, for either species, this difference was not indicative of an increase in concentrations over time due to mine influence. This is because the significant positive exposed-reference differences in 2022 were either not significantly different from prior years, or the *Area×Year* interaction and significant positive exposed-reference difference in 2022 was only reported in one tissue type in one species. For simplicity, only those secondary analyte-tissue combinations with a significant positive exposed-reference difference in 2022 or in all years (if the *Area×Year* interaction was not significant) in more than one tissue type within a species are discussed further (i.e., nickel, sodium, and tin were not discussed further).

Cobalt concentrations in rainbow trout ovary, liver, and kidney have been consistently higher in Polley Lake compared to Bootjack Lake since 2018, though cobalt concentrations in exposed tissues, relative to reference, have not changed significantly since monitoring began (Figure 5.13, Table 5.12; Appendix Tables E.6.3, E.6.4, E.6.8). For rainbow trout muscle, 2022 represents the first time since initiation of monitoring that cobalt concentrations were significantly greater in Polley Lake relative to reference. Despite this, the cobalt concentrations in rainbow trout muscle from Polley Lake, relative to reference, have been stable (i.e., did not change significantly) since 2018 (Figure 5.13, Table 5.12; Appendix Table E.6.1). Manganese concentrations in

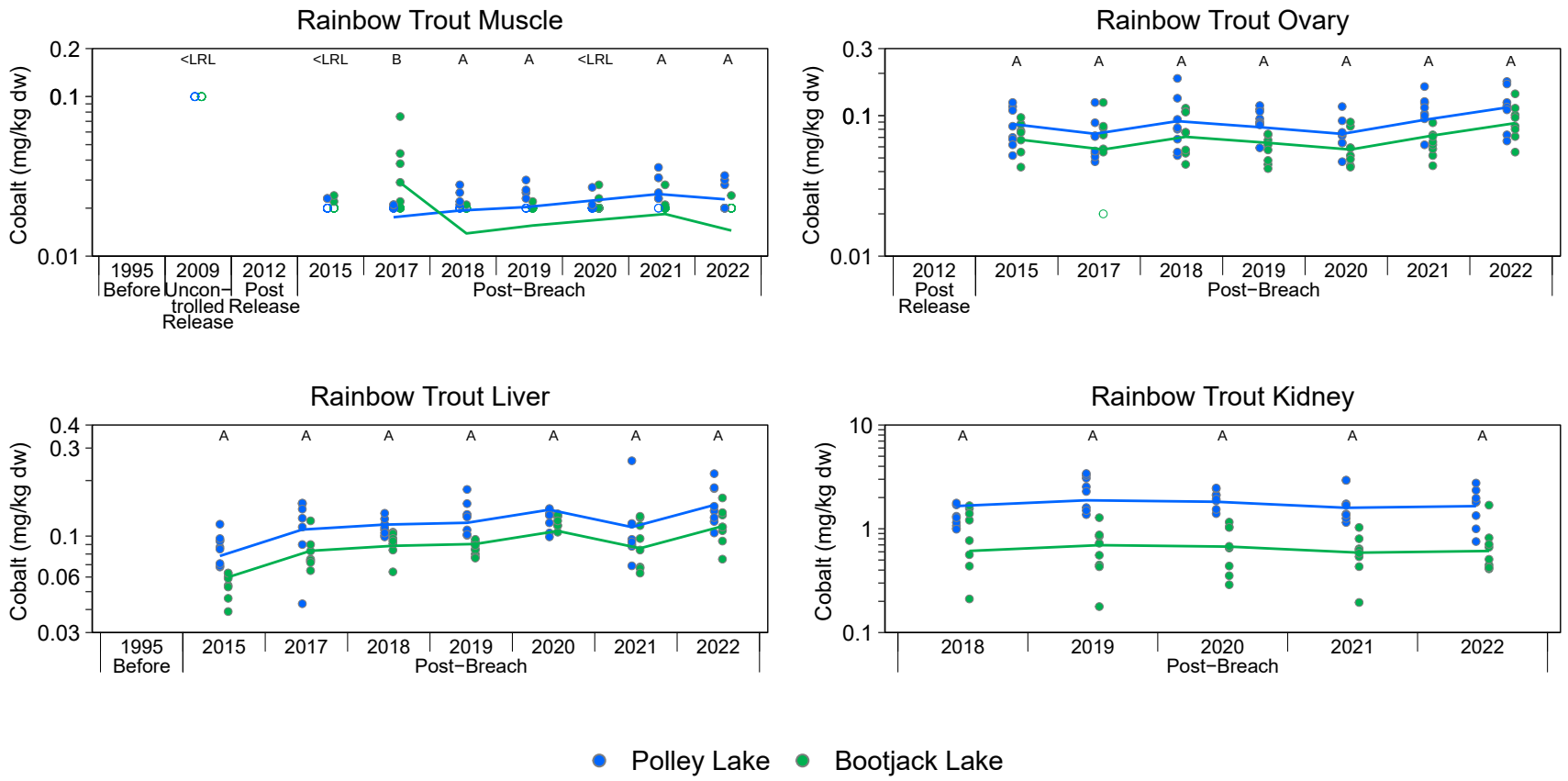

Figure 5.13: Fish Tissue Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p-value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

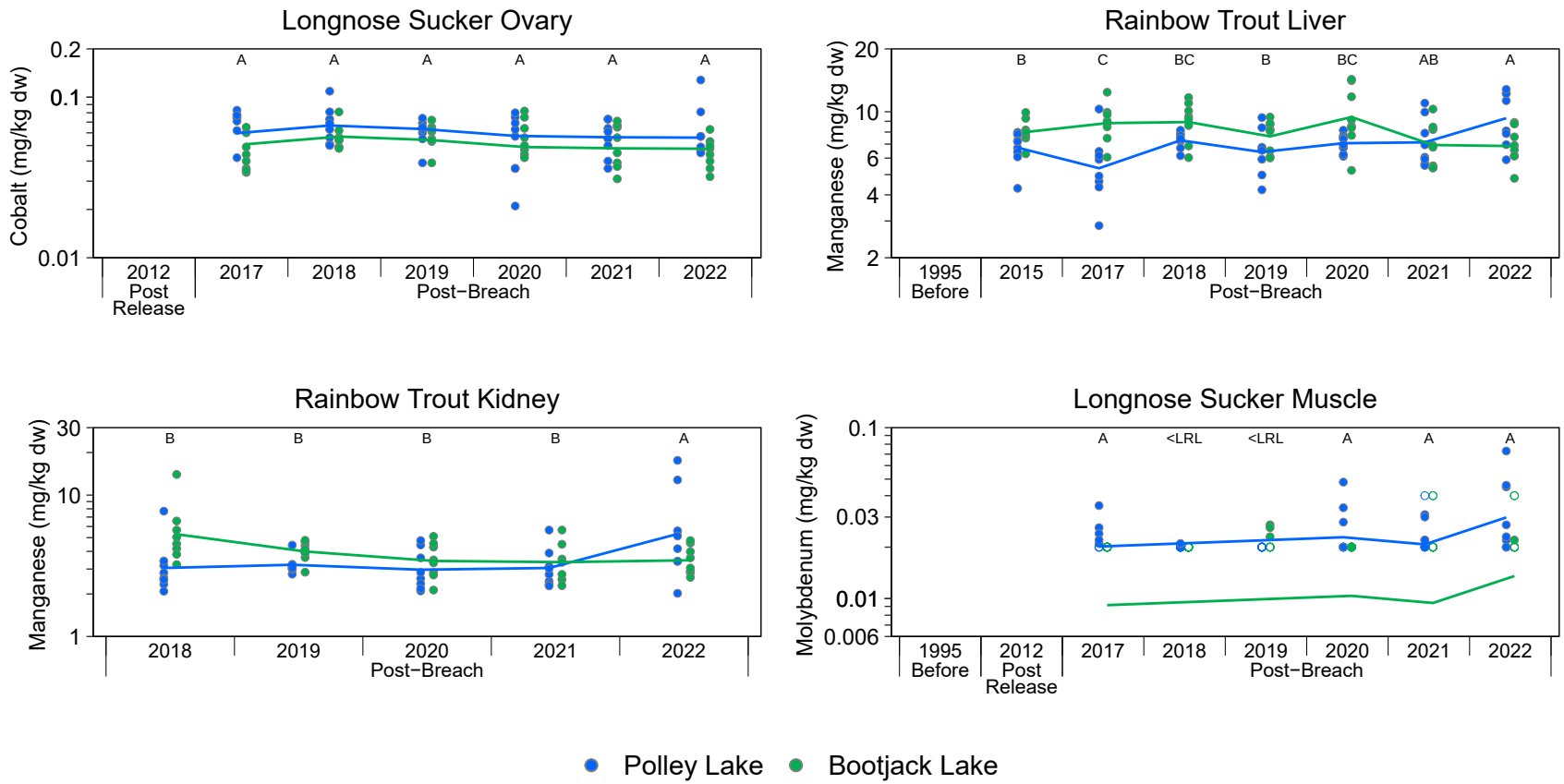

Figure 5.13: Fish Tissue Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022, or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p-value <0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

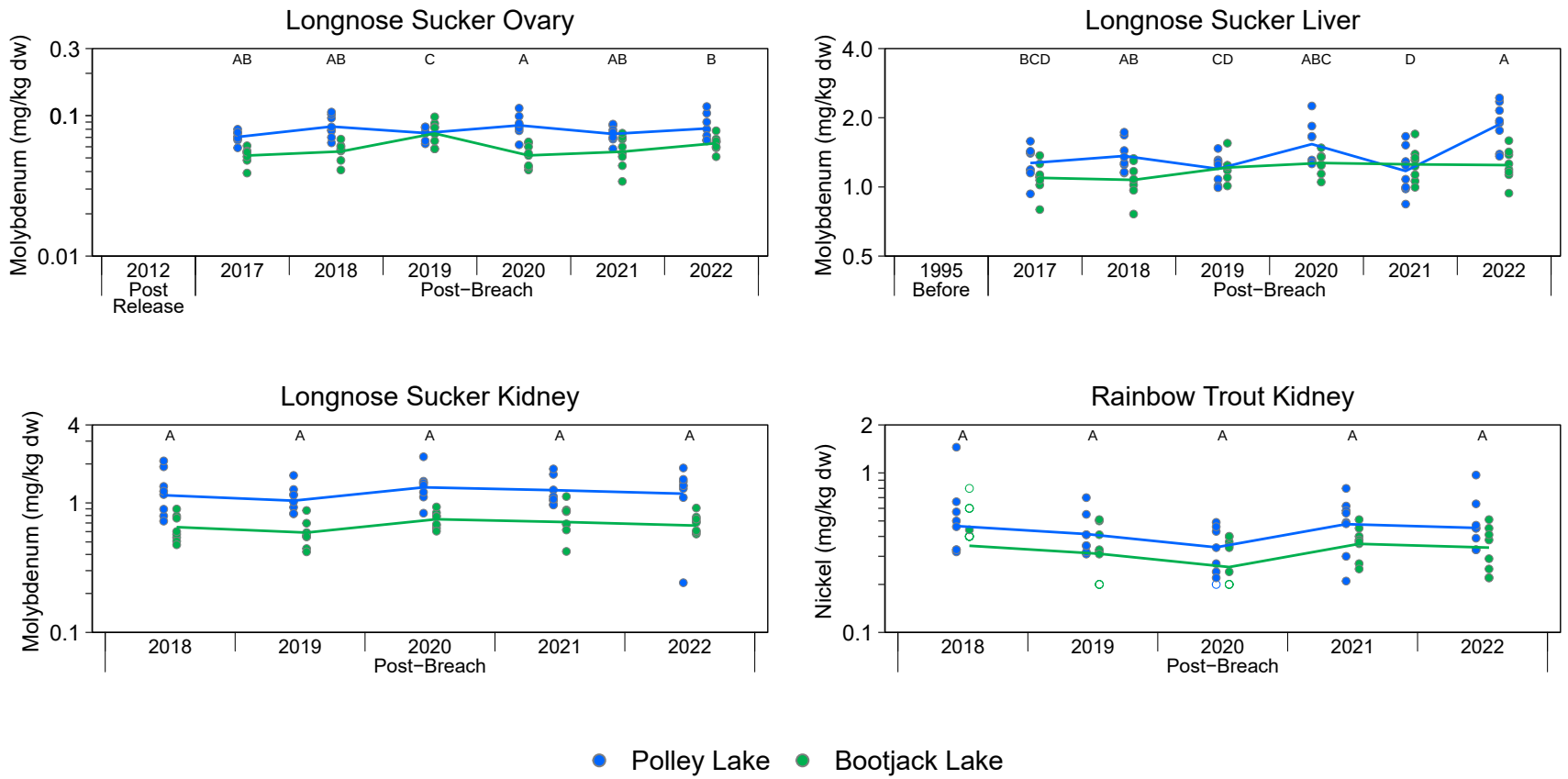

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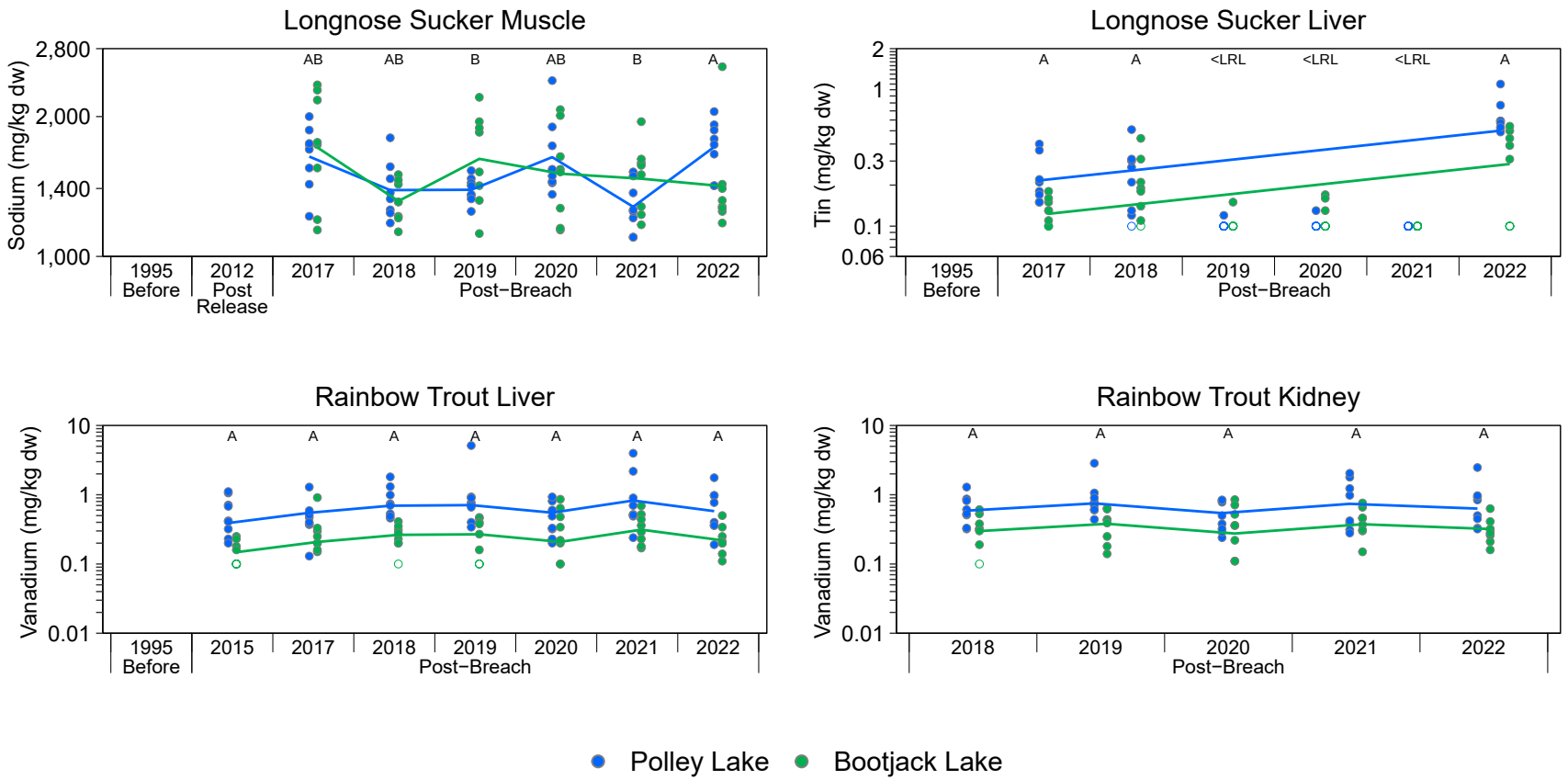

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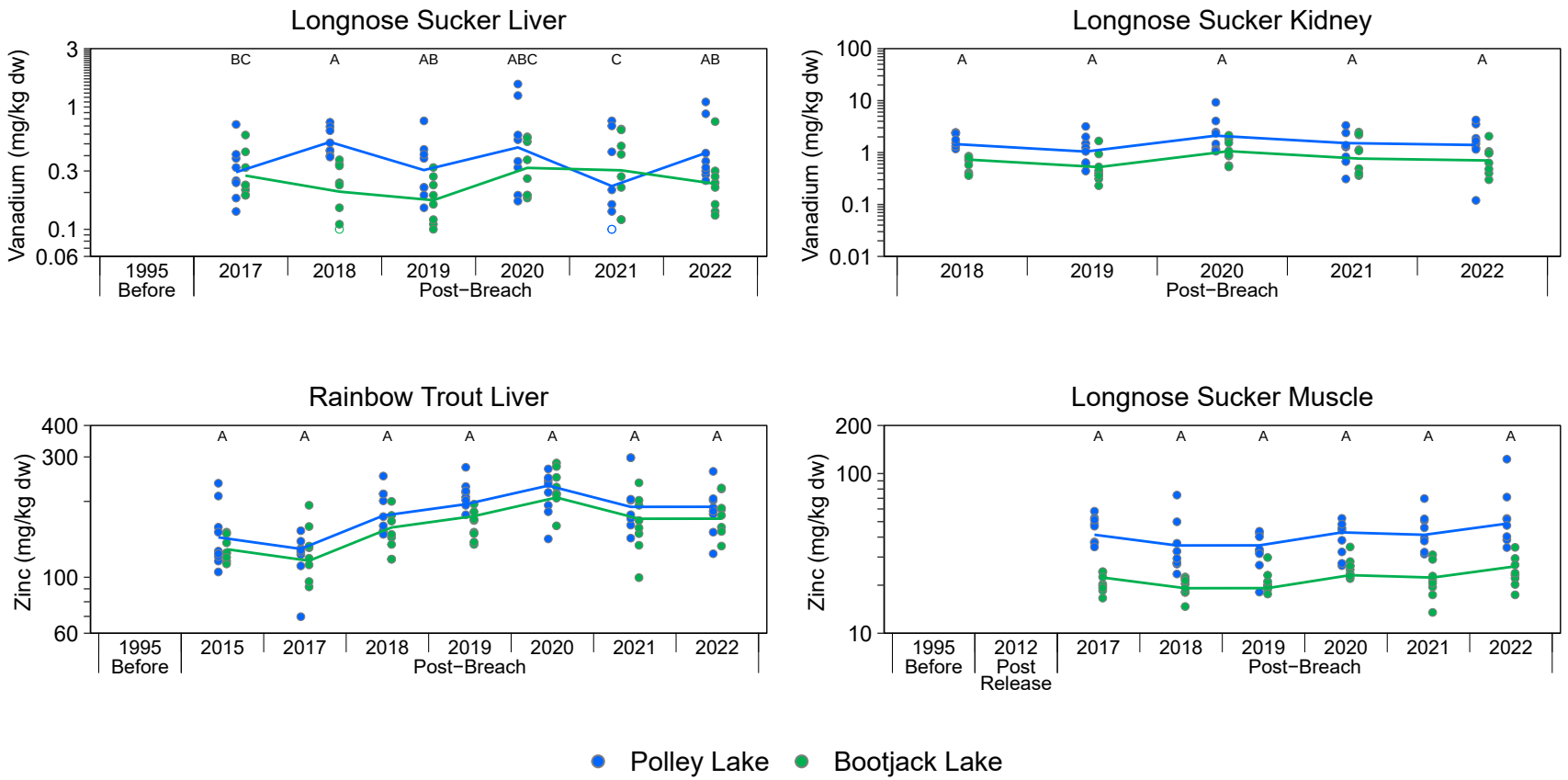

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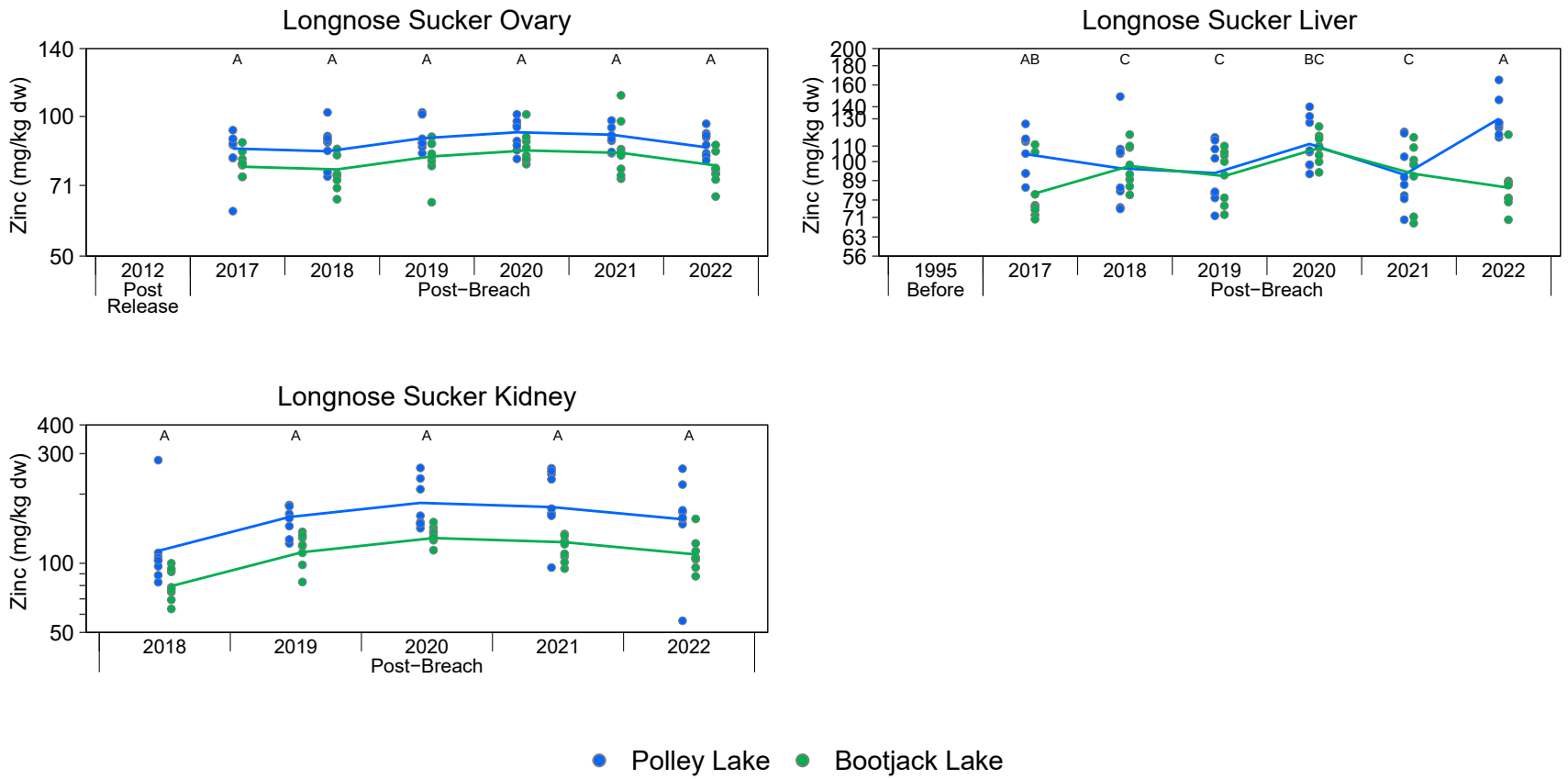

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rainbow trout liver and kidney were higher in Polley Lake relative to Bootjack Lake in 2022 and the exposed:reference ratios were also significantly greater in 2022 compared to 2015 to 2020 for liver and compared to 2018 to 2021 for kidney (Figure 5.13, Table 5.12; Appendix Tables E.6.4 and E.6.8). Molybdenum concentrations in all longnose sucker tissue types were significantly higher in the fish from Polley Lake relative to reference in 2022. However, molybdenum concentrations in exposed longnose sucker tissues in 2022 were similar to the baseline year, relative to reference, except for liver which had significantly higher concentrations in 2022 than baseline (compared to reference; Figure 5.13, Table 5.12; Appendix Tables E.6.2, E.6.5 to E.6.7). Vanadium concentrations were significantly greater in rainbow trout and longnose sucker liver and kidney in Polley Lake relative to reference, but the exposed:reference ratios in 2022 did not differ significantly from the baseline period. Zinc concentrations in Polley Lake were significantly greater than in Bootjack Lake across all longnose sucker tissues as well as rainbow trout liver; however, in no instance was the exposed:reference ratio in 2022 significantly different from the baseline period (Figure 5.13, Table 5.12; Appendix Tables E.6.4, E.6.8). The lack of consistency in secondary analyte results among tissues, between species, and temporally, suggests the observed changes in secondary analyte concentrations are unlikely to be the result of any persistent mine related effect and could be related to natural variability.

Overall, the results of Polley Lake rainbow trout and longnose sucker tissue quality analysis suggest that selenium concentrations in Polley Lake fish tissue increased in response to the uncontrolled surface runoff (2006 to 2009), and concentrations have remained elevated relative to reference conditions. Selenium concentrations in muscle and ovaries of rainbow trout in 2022 were significantly lower than in 2017 to 2019, relative to reference, and represent their lowest levels throughout the post-breach period. Selenium concentrations in longnose sucker tissues in 2022 were either similar to or lower than in most years since 2017. Increases in the concentrations of other analytes (i.e., arsenic, copper, iron, cobalt, manganese, molybdenum, sodium, vanadium, and zinc) in fish tissues from Polley Lake were also observed (relative to reference) but were inconsistent among tissues, species, and temporally, and are considered equivocal and inconclusive at this time. Continued post-breach monitoring will evaluate potential future changes in metal concentrations in Polley Lake rainbow trout and longnose sucker tissues.

5.1.7 Summary

Sediments were collected from the shallow area of Polley Lake (and reference) in 2022 to support the evaluation of sediment toxicity. Sediments from this area were characterized by concentrations of arsenic, copper, and iron greater than reference concentrations and WSQG. Copper was the most substantially elevated Analyte of Interest, with a mean concentration 3.4

times the upper WSQG. Copper was also the only Analyte of Interest to exceed the lower WSQG in reference sediments, which it exceeded by approximately 2.5 times. Arsenic, copper, and iron concentrations in shallow Polley Lake sediments in 2022 were similar to those reported in the previous sampling event (i.e., 2019), relative to reference, indicating temporal stability of these analyte concentrations. The TOC content of Polley Lake shallow sediments in 2022 was significantly lower than reference and did not change from 2019 to 2022, relative to reference. Overall, the 2022 sediment quality results from the shallow area of Polley Lake indicate temporal stability in the physical and chemical characteristics of these sediments since initiation of monitoring in 2019.

Sediment toxicity testing of the shallow area of Polley Lake (and reference) in 2022 indicated no unacceptable response to survival or growth of *H. azteca* relative to the reference area or the sand control. The survival and growth responses observed in 2022 were similar to those in 2019 when sampling was initiated. Conditions of the CEMP outlined that sediment toxicity testing of the shallow Polley Lake area must be continued "*unless MPMC can clearly show that copper concentrations in all Polley Lake shallow sediment samples are below the 95th percentile of the copper concentrations in the Bootjack Lake reference area shallow sediment samples.*" (BCMOECCS 2021c). This condition was not met in 2022 in Polley Lake shallow sediments, indicating that toxicity testing of these shallow sediments must be completed in three years (in 2025) in accordance with the CEMP conditions.

Phytoplankton community and productivity monitoring in Polley Lake in 2022 indicated that phytoplankton productivity (in terms of chlorophyll-a concentrations) was higher than reference, despite being significantly lower in 2021 and similar between the two lakes in 2019 and 2020. The chlorophyll-a results characterize Polley Lake as mesotrophic and reference (Bootjack Lake) as oligotrophic. While the trophic state of Polley Lake increased from oligotrophic to mesotrophic between 2021 and 2022, this represented a return to the same mesotrophic status observed in Polley Lake in 2019. The phytoplankton community in Polley Lake in 2022 was characterized by higher total density, lower taxon richness, higher Simpson's Diversity and Evenness, higher relative densities of Chlorophytes and Chrysophytes, and lower relative densities of Cyanobacteria compared to reference. Overall, result for most primary endpoints in Polley Lake were similar to or higher than reference in 2022 (density, Simpson's Diversity and Evenness), while those endpoints that were lower than reference (e.g., taxon richness) were temporally stable, suggesting there is no mine-related influence on the phytoplankton community of Polley Lake.

Zooplankton community and productivity monitoring in Polley Lake in 2022 indicated that total zooplankton biomass (dw) was similar to reference, which is consistent with prior years



(2019 to 2021) when biomass was either similar to or higher than reference. The consistently similar or significantly higher total biomass of zooplankton in Polley Lake compared to the reference is indicative of a healthy lentic system, providing critical habitat for fish. The zooplankton community of Polley Lake in 2022 was characterized by total density, taxon richness, and Simpson's Diversity and Evenness that were similar to reference. From 2019 to 2022, the zooplankton community of Polley Lake differed from the reference area in terms of significantly higher and lower density in 2019 and 2021, respectively, lower taxon richness in 2020, and lower Simpson's Diversity and Evenness in 2019 and 2020. Community composition from 2019 to 2022 has consistently been characterized by higher relative densities of Copepod Nauplii and Cyclopoida, and lower relative densities of Rotifera compared to reference. The consistent differences in zooplankton community composition between Polley Lake and the reference area suggests that temporal changes in community composition (which were similar in both areas over time) were likely driven by natural variability in environmental parameters (e.g., water temperature, nutrient availability, phytoplankton community).

Zooplankton tissue quality monitoring in Polley Lake in 2022 indicated that concentrations of primary and secondary analytes in tissues from Polley Lake were similar to or lower than reference except for sodium. Sodium concentrations were significantly greater than reference between 2019 and 2022 but demonstrated temporal stability relative to reference (i.e., did not differ between 2019 and 2022). Concentrations of two primary analytes (arsenic and copper) and three secondary analytes (manganese, mercury, molybdenum) in zooplankton tissue from Polley Lake in 2022 were significantly lower, relative to reference, than in 2019 when replicated sampling was initiated. Concentrations of selenium in zooplankton tissue from Polley Lake were below the BC interim guideline for aquatic life in 2022, which contrasts with prior years when individual zooplankton tissue selenium results have exceeded the guideline (2016, 2017, 2019, and 2021). Selenium concentrations in zooplankton tissue from Polley Lake in 2022 were similar to reference and were significantly lower than in 2020 and 2021 (but not 2019), relative to reference. The temporal stability or decreases in primary and secondary analyte concentrations in zooplankton tissue from Polley Lake in 2022 compared to 2019 was supported by trend analyses of surface water quality data which similarly showed stable or decreasing concentrations for all aqueous primary and secondary analytes except copper and vanadium.

Fish community and population health assessments undertaken from 2019 to 2022 documented the influence of the temporary loss of Hazeltine Creek due to the breach (August 2014 to April 2018), which previously supported the majority of fish recruitment to Polley Lake. Rainbow trout CPUE in spring was higher in 2022 than in all previous years since 2016. Prior to 2022, spring CPUE progressively decreased from 2019 to 2021, and was also substantially lower in all three years than in 2016, consistent with loss of recruitment and

natural mortality of older fish since the breach. As such, the spring CPUE in 2022 suggests that most of the remaining 2018 and a portion of the 2019 cohort has reached maturity which is further supported by spring spawning surveys conducted in Hazeltine Creek that documented the highest abundance of adults since 2019 (Minnow 2023). In the fall of 2022, when fishing was randomized in Polley Lake, CPUE was lower than from 2019 to 2021. However it should be noted that temporal comparisons of CPUE are subject to variability resulting from several factors that can affect the success of netting efforts, which is true even when considering the randomized and standardized fish collection methods employed. The assessment of rainbow trout size distribution provides a more comparable basis for temporally evaluating the population recovery in Polley Lake. Length frequency distributions for rainbow trout over time showed a proportional shift towards smaller and younger fish in 2019, a continued to shift towards a more balanced distribution among size classes with the survivorship of the 2018 and 2019 cohorts, and in 2022, a size class distribution more closely resembling 2016. The length frequency distribution in 2022 had greater resemblance to 2016 than the length frequency distributions from any of the other years (2018 to 2021), suggesting the population has returned to a pre-breach size class distribution. Condition of female rainbow trout in spring 2022 was similar to 2021 but lower than in all prior years (2016 to 2020) whereas growth rate in 2022 was similar to prior years but lower than in 2020. CPUE for longnose sucker in the spring has varied without evidence of a consistent directional trend over time, but CPUE in the fall has progressively decreased from 2016 to 2022. As indicated above, there are several sources of variability that can affect temporal comparisons of CPUE. Length frequency distributions for longnose sucker in Polley Lake from 2016 to 2022 showed more smaller fish were caught in 2022 compared to 2016, as was the case in 2018, 2020, and 2021, suggesting ongoing recruitment success despite the decrease in CPUE since 2016. Condition of longnose sucker females in spring has varied since 2016 but in 2022 was similar to baseline (2016) and weight-at-age also varied, although growth rate in 2022 did not significantly differ from prior years.

Fish tissue quality, evaluated in four tissues (muscle, liver, kidney, and ovary) from rainbow trout and longnose sucker, indicated that mean mercury and selenium concentrations in muscle tissue in 2022 were below guidelines for the protection of human health based on moderate consumption (i.e., indicating that fish are safe for moderate human consumption). The mean selenium concentration in muscle of longnose sucker from Polley Lake in 2022 exceeded the guideline for the protection of human health based on high consumption, which was consistent with data from 2016 (except 2017 and 2021). However, the likelihood that longnose sucker would be consumed at a high rate (i.e., subsistence consumers) is low. Selenium concentrations in ovary tissue in 2022 (the tissue most valuable in the assessment of potential selenium-associated effects on fish) for both species were lower than the BCWQG for the protection of aquatic life in

all individuals except one rainbow trout in 2022 and were below the threshold for reproductive effects in all fish. Selenium concentrations in muscle tissue of rainbow trout and longnose sucker were moderately greater than the guideline for aquatic life, which was consistent with data from 2015 to 2021. Overall, selenium concentrations in Polley Lake fish tissue have remained elevated relative to reference conditions since the uncontrolled runoff from 2006 to 2009 but the difference has not increased over the post-breach period. In fact, selenium concentrations in rainbow trout muscle and ovary tissues were significantly lower in 2022, relative to reference, than in 2017 to 2019. Additionally, selenium concentrations in longnose sucker ovary tissues were significantly lower in 2022, relative to reference, than in 2015 to 2020. This decrease in fish tissue selenium concentrations in Polley Lake corresponds with a decrease in the selenium concentrations in zooplankton tissue (i.e., dietary exposure) in 2022 compared to 2020 and 2021, and with a significant decrease in total and dissolved selenium concentrations in surface waters of Polley Lake from 2015 to 2022. Evidence of a persistent mine influence was not detected for most other analytes assessed in fish tissue in 2022. All primary analytes (arsenic, copper, iron, and selenium), and the secondary analytes cobalt, manganese, molybdenum, nickel, sodium, tin, vanadium, and zinc were elevated relative to reference in 2022 in at least one tissue type in one or both species. However, results for most these analytes (excluding selenium) were inconsistent among tissues and species, and/or were temporally stable or decreased relative to reference, indicating that the weight of evidence does not support a pattern of increasing analyte concentrations over time due to mine-exposure.

5.2 Quesnel Lake

5.2.1 Sediment Quality

Sediment quality monitoring in 2022 was completed at deep (QUL-PNF) and shallow (QUL-LNF1) exposed areas of Quesnel Lake. An unimpacted shallow (QUL-LREF1) area served as reference for the corresponding shallow exposed area (Figure 3.2, Table 3.2). An unimpacted deep reference area (QUL-PREF1) was not sampled in 2022 because monitoring of the deep impacted area (QUL-PNF) focused on evaluating temporal changes within the exposed area. Comparisons to the deep reference area results from prior years (2014 to 2021) are incorporated to support qualitative data interpretation where appropriate (see Section 3.1.3 for details of data analyses). A review of the 2022 sediment and supporting water data quality (Appendix B) indicated that these data can be used with a high or good level of confidence for interpretation, respectively (see Section 5.1.1 for details).

5.2.1.1 Deep Lake Areas

Sediments collected from the exposed deep near-field area (QUL-PNF) of Quesnel Lake in 2022 were composed primarily of silt and clay particles (mean = 46.0% and 43.8%, respectively; Table 5.13). Although QUL-PNF sediment is predominantly fine grained, and has been since 2014, sediments in 2022 had the highest sand content (mean = 10.2%) since initiation of monitoring in 2014 (Table 5.13). Sediments from the deep reference station were not collected in 2022, however, sediments from QUL-PREF1 were composed primarily of silt and sand in 2021 (mean = 68.7% and 20.1%, respectively) and had higher sand content than QUL-PNF sediments (Table 5.13; Appendix Tables C.2.4 and C.2.5). The TOC and total nitrogen content of sediments from QUL-PNF in 2022 (0.614% and 0.0786 %, respectively) were lower than those reported for the reference area in 2021 (2.10% and 0.154%, respectively). Although the TOC content of QUL-PNF has not changed significantly since 2015 (Figure 5.14), mean TOC has increased steadily (but not significantly) from 0.29% in 2015 to 0.61% in 2022 (Table 5.13; Appendix Table E.1.5).

Mean concentrations of 25 out of 34 metal analytes in QUL-PNF sediments (<63 µm fraction) collected in 2022 exceeded reference 95th percentile values (Table 5.13). Among these elements, four (arsenic, copper, iron, and manganese) had mean concentrations which also exceeded the WSQG values (Table 5.13; Appendix Table C.2.5). Specifically, mean arsenic concentrations were greater than the lower WSQG by 2.6 times and mean copper, iron, and manganese concentrations exceeded the upper WSQG by 4.2, 1.03, and 1.2 times, respectively (Figure 5.14, Table 5.13). Mean arsenic, copper, iron, and manganese concentrations in reference sediments collected in 2021 were naturally elevated above the lower BC WSQG (Table 5.13; Appendix Table C.2.4), demonstrating that these elements are somewhat naturally elevated in parts of Quesnel Lake. The mean concentrations of arsenic, copper, and iron in QUL-PNF sediments collected in 2022 were similar to those reported in 2014, and the mean manganese concentration in 2022 was similar to 2015 (Figure 5.14; Appendix Table E.1.5) indicating temporal stability of these analytes in the exposed sediments.

In the fine exposed sediments from QUL-PNF, arsenic and copper were positively correlated with % clay and total sulphur content, and manganese was positively correlated with % clay and total nitrogen and sulphur content (Appendix Figure E.1.4, Appendix Table E.1.11). The correlation of higher analyte concentrations in QUL-PNF sediments with higher clay content (% clay) is consistent with the input of fine tailings-influenced sediments with elevated analyte concentrations to the deep near-field area of Quesnel Lake.

Table 5.13: Summary of Sediment Quality Data for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile[b]	Reference QUL-PREF1											
					2014		2015		2016		2018		2019		2021	
		Lower	Upper	QUL-PREF1 (2014 to 2021)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Tests																
Moisture	%	-	-	62.2	51.8	2.56	53.4	0.802	55	0.828	58.6	4.72	56.1	1.39	53.7	1.45
pH (1:2 soil:water)	pH	-	-	6.44	6.9	0.0744	7.02	0.335	6.52	0.0251	6.78	0.0661	6.48	0.0251	6.5	0.0917
Particle Size																
% Gravel (>2 mm)	%	-	-	1	0.1	-	0.1	-	0.1	-	1	-	1	-	1	-
% Sand (2.0 mm - 0.063 mm)	%	-	-	30.6	23.5	7.23	19.5	5.54	19.8	6.9	15.1	1.67	13.4	3.82	20.1	1.77
% Silt (0.063 mm - 4 µm)	%	-	-	79.4	67.4	7.24	69.8	4.79	69.3	6.17	75.7	1.39	77.5	3.59	68.7	1.87
% Clay (<4 µm)	%	-	-	12.1	9.08	1.17	10.7	1.11	10.9	1.44	9.14	0.434	9.06	0.297	11.2	0.647
Organic / Inorganic Carbon (<63 µm)																
Total Organic Carbon	%	-	-	2.22	1.68	0.0449	1.82	0.144	1.92	0.153	2.12	0.134	1.8	0.191	2.1	0.0546
Nutrients (Bulk sediment)																
Total Nitrogen by LECO	%	-	-	0.182	0.14	0.00829	0.17	0.012	0.158	0.011	0.177	0.0105	0.161	0.0129	0.154	0.0143
Metals (<63 µm)[c]																
Aluminum	mg/kg	-	-	17,100	14,780	760	16,567	945.2	16,060	871	14,880	687	15,900	453	16,480	722
Antimony	mg/kg	-	-	0.47	0.416	0.0182	0.437	0.0306	0.436	0.0219	0.394	0.00894	0.406	0.00894	0.446	0.0134
Arsenic	mg/kg	5.9	17	9.89	7.75	0.69	8.88	0.209	9.58	0.982	7.96	0.514	7.9	0.475	9.02	0.713
Barium	mg/kg	-	-	169	144	6.5	147	4	163	12	145	7.89	159	3.35	157	8.53
Beryllium	mg/kg	-	-	0.5	0.412	0.0228	0.49	0.0361	0.456	0.0195	0.452	0.00837	0.466	0.0114	0.456	0.0329
Bismuth	mg/kg	-	-	0.16	0.14	0.00707	0.157	0.0115	0.154	0.00548	0.142	0.00447	0.144	0.00548	0.128	0.00837
Boron	mg/kg	-	-	10	10	-	10	-	10	-	10	-	10	-	5	-
Cadmium	mg/kg	0.6	3.5	0.475	0.384	0.0289	0.42	0.0555	0.445	0.0374	0.42	0.0203	0.414	0.0253	0.402	0.0219
Calcium	mg/kg	-	-	8,780	7,742	296	8,747	114	7,900	251	7,800	176	7,370	141	8,014	342
Chromium	mg/kg	37.3	90	59.8	52	3.21	57.7	3.59	56.7	3.83	53.7	1.53	54.3	1.55	56.3	1.19
Cobalt	mg/kg	-	-	15.2	13.3	0.658	14.5	0.987	14.6	0.901	13.4	0.297	13.7	0.283	14	0.427
Copper	mg/kg	35.7	197	59.4	42.2	3.34	55.1	4.74	56.1	5.24	46.2	2.1	49	1.28	45.3	2.98
Iron	mg/kg	21,200	43,766	32,300	28,580	1,341	31,300	2,088	30,420	1,244	28,700	612	30,040	871	30,460	537
Lead	mg/kg	35	91.3	8.06	7	0.235	7.65	0.357	7.65	0.423	6.63	0.228	7.09	0.191	6.58	0.161
Lithium	mg/kg	-	-	15.2	13.1	0.518	14.4	1.59	13.5	0.598	13.4	0.268	14.4	0.329	14.3	0.783
Magnesium	mg/kg	-	-	8,510	7,666	382	8,150	678	8,082	454	7,402	205	7,972	229	8,172	234
Manganese	mg/kg	460	1,100	516	470	31.8	491	22	470	17.7	418	20.1	413	18.6	471	61.8
Mercury	mg/kg	0.17	0.486	0.0627	0.0486	0.0024	0.0579	0.00576	0.0551	0.00239	0.0546	0.00235	0.0472	0.0013	0.0578	0.0224
Molybdenum	mg/kg	25	23,000	1.11	0.91	0.0458	1.08	0.107	1.01	0.0636	0.916	0.078	0.964	0.0723	1.02	0.0522
Nickel	mg/kg	16	75	41.2	35.6	2.07	39.1	2.68	39.4	2.76	35.8	0.934	37.1	1.11	38.1	0.94
Phosphorus	mg/kg	-	-	1,400	1,094	32.9	1,180	26.5	1,314	76.7	1,236	62.7	1,274	55.9	1,356	65
Potassium	mg/kg	-	-	1,570	1,312	70.9	1,517	75.7	1,492	87	1,282	23.9	1,270	20	1,390	79.7
Selenium	mg/kg	2	-	1.28	0.86	0.0731	0.97	0.115	0.968	0.0572	0.946	0.0924	0.94	0.0381	1.25	0.132
Silver	mg/kg	0.5	-	0.238	0.188	0.0136	0.214	0.0245	0.223	0.0136	0.195	0.0095	0.214	0.00557	0.204	0.0157
Sodium	mg/kg	-	-	500	396	23	497	25.2	436	27	370	19.6	384	8.92	442	31.3
Strontium	mg/kg	-	-	88.9	74.6	3.17	85.1	3.49	79.3	2.87	74.1	0.63	76.8	2.36	84.6	3.82
Sulphur	mg/kg	-	-	1,400	-	-	1,167	321	1,180	192	1,040	152	1,280	148	866	79.6
Thallium	mg/kg	-	-	0.175	0.157	0.0086	0.174	0.0182	0.166	0.00635	0.146	0.00207	0.152	0.00444	0.148	0.00684
Tin	mg/kg	-	-	0.51	0.408	0.0536	0.453	0.0404	0.466	0.111	0.402	0.0642	0.39	0.0141	0.468	0.0259
Titanium	mg/kg	-	-	1,160	1,036	47	1,130	79.4	1,049	56.4	925.4	62.8	955.8	38	989	67.8
Uranium	mg/kg	-	-	1.51	1.3	0.051	1.46	0.0945	1.44	0.063	1.28	0.0365	1.39	0.0152	1.29	0.0483
Vanadium	mg/kg	-	-	72.3	62.2	3.56	70.1	4.49	67.9	3.74	61.5	1.59	63	1.37	65.1	2.2
Zinc	mg/kg	123	315	85.1	73.7	2.95	79.8	7.18	80.4	7.3	74.3	2.37	80.5	3.6	80.1	3.23
Zirconium	mg/kg	-	-	4.2	-	-	-	-	-	-	-	-	-	-	3.9	0.224

Value is > Lower BC Working Sediment Quality Guideline.
Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/Italics -*** Value is > reference 95th percentile value (<5th percentile value for pH), SD - Standard Deviation. QUL-PREF1 was not sampled in 2022, therefore displayed data include to 2021 only and the reference 95th percentile value was calculated using data from 2014 to 2021.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation of reference 95th percentile values see Appendix Table C.2.4

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction

Table 5.13: Summary of Sediment Quality Data for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile[b]	Exposed QUL-PNF															
					2014		2015		2016		2018		2019		2020		2021		2022	
		Lower	Upper	QUL-PREF1 (2014 to 2021)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Tests																				
Moisture	%	-	-	62.2	37.7	7.38	49.2	16.7	61	2.31	58.5	5	59.9	7.86	57.5	4.73	57.7	2.73	58.9	5.44
pH (1:2 soil:water)	pH	-	-	6.44	8.51	0.09	8.45	0.123	8.43	0.0471	8.25	0.141	8.46	0.073	8.1	0.0688	8.11	0.186	8.1	0.0913
Particle Size																				
% Gravel (>2 mm)	%	-	-	1	0.102	0.00447	0.1	-	0.1	-	1	-	1	-	1	-	1	-	1	-
% Sand (2.0 mm - 0.063 mm)	%	-	-	30.6	7.75	12.6	7	11.9	1.75	1.39	7.28	9.49	3.44	2.69	4.66	3.73	5.36	2.48	10.2	8.04
% Silt (0.063 mm - 4 µm)	%	-	-	79.4	69.6	10.8	57.5	14.6	47.1	4.02	52.5	5.09	50.9	3.65	54.8	10.3	51.8	4.31	46	3.12
% Clay (<4 µm)	%	-	-	12.1	***22.6***	11.9	***35.5***	***19.4***	***51.1***	4.89	***40.4***	***13***	***45.7***	5.6	***40.6***	10.3	***42.9***	4.95	***43.8***	6.46
Organic / Inorganic Carbon (<63 µm)																				
Total Organic Carbon	%	-	-	2.22	0.166	0.0619	0.294	0.173	0.346	0.0844	0.568	0.495	0.518	0.12	0.507	0.0836	0.567	0.186	0.614	0.111
Nutrients (Bulk sediment)																				
Total Nitrogen by LECO	%	-	-	0.182	0.0228	0.00522	0.0434	0.0163	0.0388	0.00606	0.063	0.0345	0.047	0.00927	0.0742	0.0106	0.058	0.0215	0.0786	0.0174
Metals (<63 µm)[c]																				
Aluminum	mg/kg	-	-	17,100	***20,800***	3,949	***26,520***	8,065	***35,340***	1,341	***31,060***	3,112	***32,680***	4,954	***27,020***	2,500	***28,700***	2,482	***30,560***	2,315
Antimony	mg/kg	-	-	0.47	***0.516***	0.0688	***0.554***	0.0907	***0.628***	0.0179	***0.542***	0.0402	***0.65***	0.0735	***0.56***	0.0579	***0.642***	0.0363	***0.506***	0.0134
Arsenic	mg/kg	5.9	17	9.89	***15.4***	2.01	***15.4***	1.53	***18.5***	0.652	***15.4***	1.45	***16.5***	1.17	***14.9***	0.526	***15.7***	0.887	***15.6***	0.469
Barium	mg/kg	-	-	169	***225***	35.8	***255***	58	***361***	12.9	***296***	44.3	***357***	35.5	***294***	22.8	***274***	24.7	***271***	16.8
Beryllium	mg/kg	-	-	0.5	***0.79***	0.161	***0.96***	0.253	***1.12***	0.0492	***0.99***	0.11	***1.11***	0.134	***0.936***	0.104	***0.946***	0.0594	***1***	0.0802
Bismuth	mg/kg	-	-	0.16	0.104	0.00894	0.134	0.0329	0.158	0.00837	0.15	0.0158	0.156	0.0207	***0.174***	0.0313	0.146	0.0182	0.158	0.00837
Boron	mg/kg	-	-	10	***10.6***	0.548	***11.4***	1.34	***11.8***	0.447	***11***	0.707	***11.8***	1.3	***10.4***	0.577	***10.3***	0.541	***10.3***	0.873
Cadmium	mg/kg	0.6	3.5	0.475	0.164	0.0271	0.197	0.0446	0.263	0.0141	0.238	0.0186	0.259	0.0349	0.221	0.0203	0.226	0.0274	0.246	0.00453
Calcium	mg/kg	-	-	8,780	***33,340***	4,053	***31,160***	2,792	***31,840***	1,036	***24,360***	5,178	***28,360***	2,405	***20,400***	3,310	***23,220***	3,869	***22,040***	2,318
Chromium	mg/kg	37.3	90	59.8	14.3	3.02	20.9	4.27	23.9	1.42	30.6	6.7	26.3	3.61	28	5.08	27.9	4.59	29.4	1.87
Cobalt	mg/kg	-	-	15.2	***19.4***	2.9	***25.5***	8.57	***34.6***	1.69	***26.8***	3.26	***30.1***	5.79	***22.3***	2.14	***23.8***	2.95	***25.8***	1.86
Copper	mg/kg	35.7	197	59.4	***714***	***111***	***859***	***304***	***1,210***	54.3	***846***	***185***	***1,059***	***201***	***784***	***81.9***	***806***	***113***	***835***	***80.2***
Iron	mg/kg	21,200	43,766	32,300	***37,240***	17,475	***40,620***	5,418	***38,620***	1,117	***40,860***	3,004	***41,220***	2,678	***39,260***	6,523	***38,780***	4,713	***45,100***	3,421
Lead	mg/kg	35	91.3	8.06	7.09	1.46	***9.9***	2.98	***12.6***	0.436	***11.3***	1.48	***12.1***	1.56	***12.3***	2.2	***11.1***	1.45	***12***	0.548
Lithium	mg/kg	-	-	15.2	***20.5***	4.21	***29.8***	10.9	***36.6***	2.59	***30***	3.76	***35.5***	6.7	***27.9***	2.95	***29.5***	3.96	***30.1***	2.44
Magnesium	mg/kg	-	-	8,510	***12,958***	2,560	***17,320***	6,916	***24,740***	1,488	***18,920***	2,943	***21,580***	4,593	***15,300***	1,744	***16,920***	2,756	***18,180***	1,933
Manganese	mg/kg	460	1,100	516	***797***	119	***1,033***	265	***1,348***	71.6	***1,290***	179	***1,358***	195	***1,344***	165	***1,398***	283	***1,292***	82.3
Mercury	mg/kg	0.17	0.486	0.0627	***0.0697***	0.00747	***0.0954***	0.0192	***0.101***	0.0061	-	-	***0.0983***	0.0107	***0.0896***	0.00735	***0.0909***	0.0117	***0.099***	0.00402
Molybdenum	mg/kg	25	23,000	1.11	***3.76***	0.27	***4.05***	0.718	***4.44***	0.154	***3.6***	0.681	***4.38***	0.559	***3.48***	0.216	***3.56***	0.307	***3.41***	0.214
Nickel	mg/kg	16	75	41.2	12.9	2.26	20.2	5.51	25.7	1.62	26.8	3.77	25.5	3.78	25.9	4.29	25.1	3.98	27.3	1.64
Phosphorus	mg/kg	-	-	1,400	***1,706***	125	1,352	240	1,400	105	1,198	121	1,292	137	1,224	173	1,296	219	1,260	66.7
Potassium	mg/kg	-	-	1,570	***1,942***	353	***2,640***	713	***4,140***	259	***2,922***	327	***3,198***	397	***2,450***	334	***2,500***	217	***2,736***	219
Selenium	mg/kg	2	-	1.28	1.07	0.177	1.23	0.368	***1.53***	0.087	1.21	0.0952	***1.46***	0.282	1.02	0.0847	1.18	0.161	1.13	0.0917
Silver	mg/kg	0.5	-	0.238	***0.332***	0.0399	***0.369***	0.0857	***0.446***	0.0151	***0.354***	0.0503	***0.423***	0.0645	***0.354***	0.0255	***0.349***	0.0231	***0.353***	0.0152
Sodium	mg/kg	-	-	500	***1,118***	206	***1,396***	331	***2,018***	165	***1,400***	174	***1,502***	143	***1,093***	82	***1,124***	137	***1,142***	76.9
Strontium	mg/kg	-	-	88.9	***188***	29.4	***212***	36.4	***238***	6.11	***205***	31	***239***	25.5	***223***	10.3	***229***	20.6	***213***	13.3
Sulphur	mg/kg	-	-	1,400	-	-	***1,560***	182	1,360	54.8	-	-	960	89.4	790	87.5	694	173	940	141
Thallium	mg/kg	-	-	0.175	0.05	-	0.0596	0.00879	0.0688	0.00295	0.0764	0.0203	0.0722	0.00792	0.0786	0.0155	0.075	0.0123	0.0836	0.00802
Tin	mg/kg	-	-	0.51	***2.05***	0.39	***1.99***	0.425	***2.32***	0.105	***1.83***	0.314	***2.19***	0.304	***1.66***	0.0936	***1.88***	0.123	***1.74***	0.118
Titanium	mg/kg	-	-	1,160	***1,946***	277	***1,996***	410	***2,380***	82.8	***1,984***	239	***2,192***	290	***1,758***	108	***1,832***	128	***1,786***	133
Uranium	mg/kg	-	-	1.51	1.43	0.285	1.39	0.191	***1.62***	0.0434	1.45	0.161	***1.52***	0.168	1.49	0.0999	1.37	0.08	1.48	0.104
Vanadium	mg/kg	-	-	72.3	***145***	68.1	***142***	26.3	***140***	5.1	***129***	14.5	***134***	6.83	***125***	23.1	***123***	10.3	***140***	15.9
Zinc	mg/kg	123	315	85.1	69	11.1	***96***	33.2	***129***	6.94	***101***	9.11	***119***	21.9	***87***	10.4	***95.5***	10.7	***101***	6.69
Zirconium	mg/kg	-	-	4.2	-	-	-	-	-	-	-	-	-	-	***6.52***	0.487	***6.94***	1.05	***5.18***	0.409

Value is > Lower BC Working Sediment Quality Guideline.
Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/Italics -*** Value is > reference 95th percentile value (<5th percentile value for pH), SD - Standard Deviation. QUL-PREF1 was not sampled in 2022, therefore displayed data include to 2021 only and the reference 95th percentile value was calculated using data from 2014 to 2021.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation of reference 95th percentile values see Appendix Table C.2.4

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction

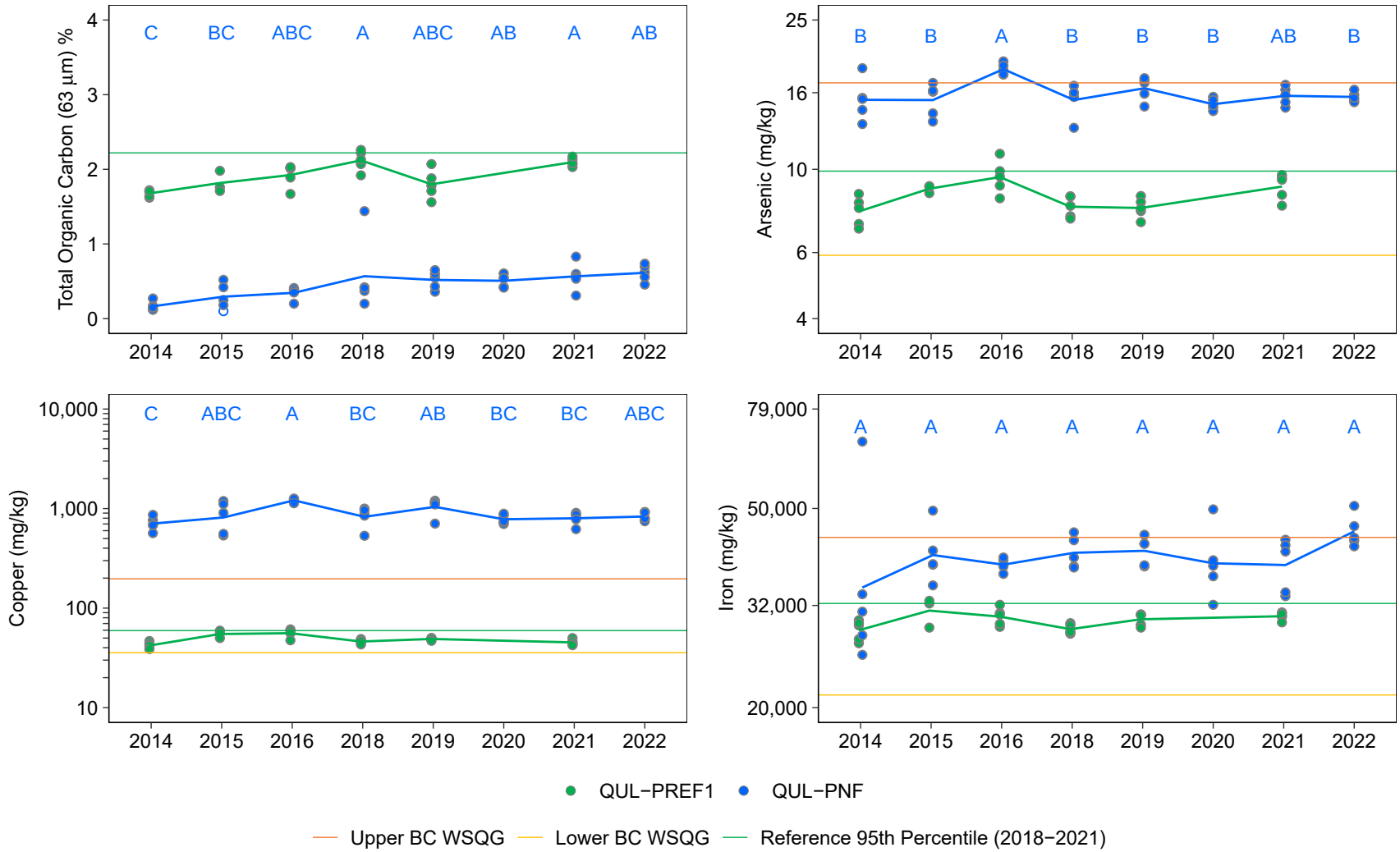

Figure 5.14: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: BC WSQG = British Columbia Working Sediment Quality Guideline (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). The reference 95th Percentile (QUL-PREF1) was calculated using data from 2014 to 2021. Green represents reference areas and other colours represent exposed areas. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest concentration.

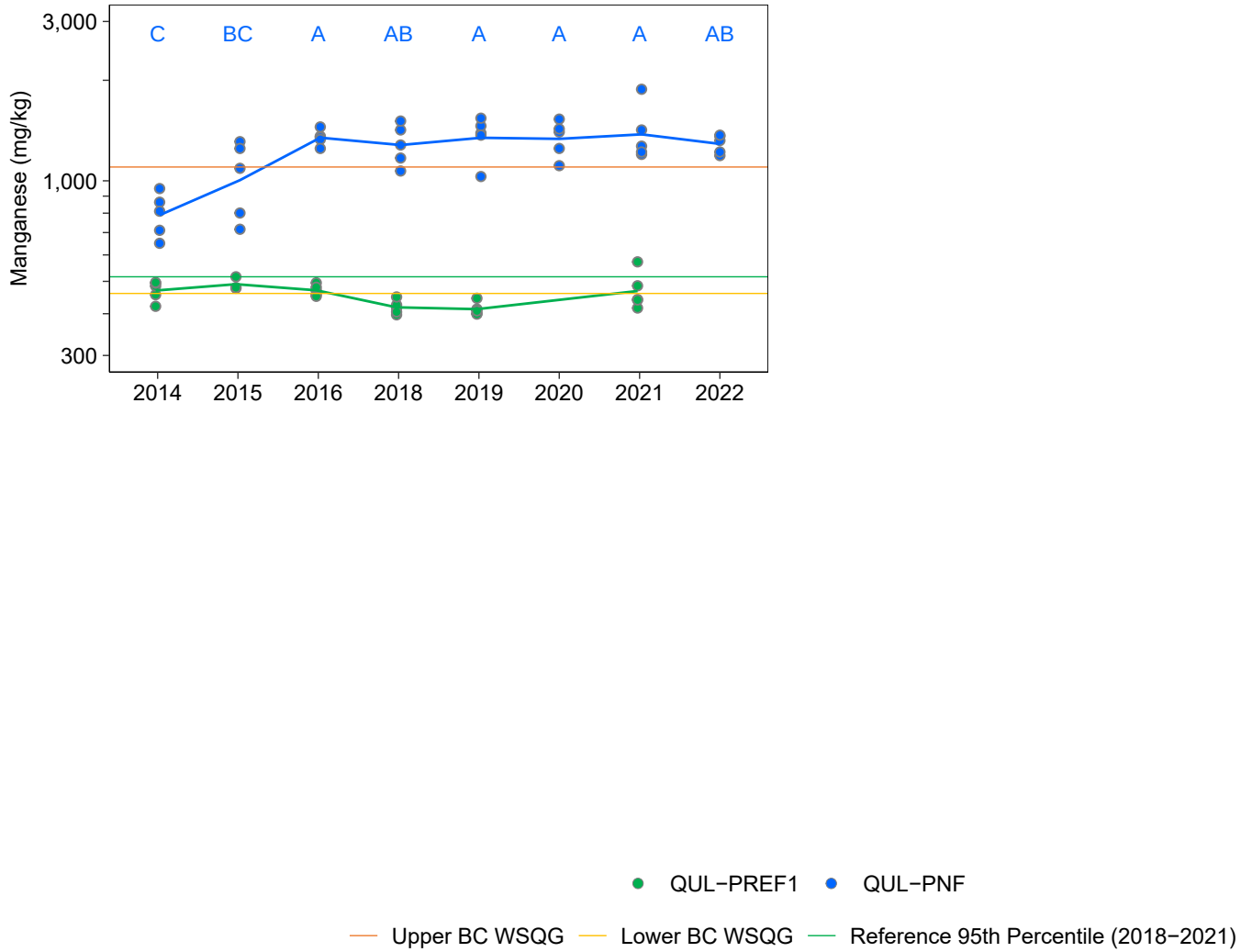

Figure 5.14: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: BC WSQG = British Columbia Working Sediment Quality Guideline (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). The reference 95th Percentile (QUL-PREF1) was calculated using data from 2014 to 2021. Green represents reference areas and other colours represent exposed areas. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest concentration.

The 2022 monitoring results indicate that physical and chemical characteristics of the exposed near-field sediments appear stable, with few changes occurring since post-breach monitoring began. This is consistent with the low sediment deposition rate observed at this deep exposed area, with approximately 1 cm of fresh sediment deposition after 7 to 10 years (Minnow 2019a).

5.2.1.2 Shallow Lake Areas

Sediments collected from the shallow near-field exposed area of Quesnel Lake (QUL-LNF1) in 2022 were predominantly sand with some silt (mean = 92.8% and 6.02%, respectively) which was consistent with the sediments collected from this area in previous post-breach years (2015 to 2021; Table 5.14). The high sand content was visually evident during sample collection and was likely a result of continued washing of fine particles from these shallow sampling locations towards deeper areas of the lake. The exposed sediments in 2022 were higher in sand content and lower in silt content than the corresponding reference sediments (QUL-LREF1; mean = 61.4% sand, 32.5% silt; Table 5.14), which were also consistent with the sediments collected from prior years (2014 to 2021; Table 5.14; Appendix Tables C.2.7 to C.2.9). The TOC and total nitrogen content of the shallow near-field exposed sediment collected in 2022 (mean = 0.826% and 0.0236%, respectively) were lower than in the reference sediment (mean = 1.40% and 0.078%, respectively; Table 5.14; Appendix Tables C.2.7 and C.2.9), which was consistent with the dominance of sand at this exposed area. Mean TOC concentrations of QUL-LNF1 sediments have been stable, relative to reference, since the initiation of sampling in 2014 (Figure 5.15; Appendix Table E.1.9). Although not significant relative to reference, mean TOC concentrations at QUL-LNF1 have been slightly higher since 2019 (compared to 2014 to 2016; Appendix Table E.1.10), when the shallow near-field area was relocated[55] due to low water levels in Quesnel Lake (see Minnow 2020a for details).

The mean concentrations of 22 out of 34 analytes in the exposed sediments (<63 µm fraction) collected in 2022 at QUL-LNF1 exceeded both reference and pre-breach 95th percentile values (Table 5.14; Appendix Tables C.2.7 and C.2.8). Among these elements, five analytes (arsenic, copper, iron, manganese, and silver) also had mean concentrations that exceeded the WSQG (Figure 5.15, Table 5.14; Appendix Table C.2.9). Specifically, arsenic and silver concentrations in QUL-LNF1 sediments exceeded the lower WSQG by 2.6 and 1.04

[55] The shallow near-field area of Quesnel Lake (QUL-LNF1) was moved in 2019 from its previous location due to variable water levels in the lake. Specifically, QUL-LNF1 stations that were originally sampled in 2015 to 2016 were either dry in 2019 or only very shallow (<0.5 m depth). As such, the QUL-LNF1 monitoring locations were moved in 2019 to adjacent locations that were deeper and continually submerged. These sediment stations established in 2019 were resampled in 2020, 2021, and 2022 (see Minnow 2020 for details).

Table 5.14: Summary of Sediment Quality Data for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2007 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile [b]		Reference QUL-LREF1													
						2014		2015		2016		2019		2020		2021		2022	
		Lower	Upper	Pre-Breach (QUL-LNF1; 2007)	Reference (QUL-LREF1; 2014 to 2022)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Tests																			
Moisture	%	-	-	-	44.9	40.7	2.73	40.8	3.76	33.4	3.73	43.2	3.41	41.4	1.23	36.3	5.17	30.5	2.97
pH (1:2 soil:water)	pH	-	-	-	5.92	6.56	0.16	6.97	0.235	6.14	0.32	6.5	0.386	6.43	0.196	6.3	0.3	6.12	0.165
Particle Size																			
% Gravel (>2 mm)	%	-	-	7	5.4	1.02	0.647	1.49	0.782	1.81	1.23	2.38	2.01	5.4	9.4	2.42	1.61	2.5	1.2
% Sand (2.0 mm - 0.063 mm)	%	-	-	58	74.9	59.7	6.37	60	4.65	64	17.3	52.8	9.32	66.3	10.3	60.1	2.63	61.4	8.9
% Silt (0.063 mm - 4 µm)	%	-	-	53	58.1	35.1	6.48	33.9	3.73	30.8	16.4	42.1	10.1	26.2	6.86	34.5	4.33	32.5	8.17
% Clay (<4 µm)	%	-	-	9	5.85	4.17	0.59	4.64	1.66	3.39	1.62	3.1	1.11	2.46	0.305	3.4	0.485	3.72	0.691
Organic / Inorganic Carbon (<63 µm)																			
Total Organic Carbon	%	-	-	2.45	1.87	1.12	0.186	1.47	0.214	1.19	0.137	1.27	0.331	1.52	0.316	1.43	0.406	1.4	0.354
Nutrients (Bulk sediment)																			
Total Nitrogen by LECO	%	-	-	-	0.101	0.0658	0.00497	***0.104***	0.00945	0.0534	0.0114	0.0792	0.0128	0.0766	0.00351	0.057	0.0119	0.078	0.0134
Metals (<63 µm)[c]																			
Aluminum	mg/kg	-	-	12,500	17,100	13,260	1,383	13,133	723	11,294	1,726	12,440	1,050	14,160	1,260	13,840	2,297	15,800	1,355
Antimony	mg/kg	-	-	<10.0	0.35	0.296	0.0513	0.31	0.0173	0.256	0.0219	0.264	0.027	0.304	0.0313	0.292	0.0402	0.288	0.0356
Arsenic	mg/kg	5.9	17	7.5	5.71	4.08	0.774	4.54	0.781	3.95	0.643	3.56	0.388	4.74	0.7	4.56	1.07	4.72	0.709
Barium	mg/kg	-	-	91.4	149	124	7.76	115	7.64	109	9.48	114	23.7	129	14.4	128	10.5	126	11.1
Beryllium	mg/kg	-	-	<0.50	0.45	0.35	0.0354	0.367	0.0351	0.324	0.0336	0.324	0.0261	0.386	0.0451	0.348	0.0476	0.412	0.0286
Bismuth	mg/kg	-	-	<20.0	0.14	0.112	0.0179	0.11	0.01	0.1	-	0.1	-	0.116	0.0182	0.106	0.00894	0.108	0.013
Boron	mg/kg	-	-	-	10	10	-	10	-	10	-	10	-	5	-	5	-	5	-
Cadmium	mg/kg	0.6	3.5	<0.50	0.388	0.313	0.0341	0.33	0.0378	0.296	0.028	0.279	0.0275	0.329	0.0575	0.307	0.0488	0.326	0.049
Calcium	mg/kg	-	-	5,660	8,680	7,136	533	7,483	603	6,420	555	6,746	238	7,446	519	7,872	1,107	8,070	399
Chromium	mg/kg	37.3	90	32.3	60.3	49.5	4.11	49.7	3.66	47.8	5.91	49.1	2.26	54.7	3.99	54.3	4.53	55.8	2.69
Cobalt	mg/kg	-	-	9.6	13.3	10.3	1.41	10.8	0.927	9.6	0.972	9.85	0.814	11.2	1.42	11.1	2.09	11.5	1.17
Copper	mg/kg	35.7	197	29.6	35.8	30.3	3.69	31.6	3.2	27.8	2.68	26.6	3.52	33.3	2.39	30.2	4.8	32.1	3.8
Iron	mg/kg	21,200	43,766	23,100	28,200	23,680	2,187	23,200	1,709	22,240	1,817	22,060	611	24,720	1,711	24,400	2,913	26,040	1,762
Lead	mg/kg	35	91.3	<30.0	6.47	5.27	0.613	5.78	0.658	5.06	0.394	4.53	0.48	5.74	0.698	5.17	0.756	5.63	0.637
Lithium	mg/kg	-	-	13.2	13.7	11.5	1.43	11	0.85	11.1	1.49	10.2	1.27	12.1	1.29	10.7	1.74	11.9	1.45
Magnesium	mg/kg	-	-	5,770	8,320	6,360	501	6,420	495	5,892	640	6,122	478	7,004	473	7,384	876	7,536	560
Manganese	mg/kg	460	1,100	514	443	309	53.2	322	41.3	254	22.4	281	38.6	353	69.7	347	99.2	363	53.9
Mercury	mg/kg	0.17	0.486	0.0729	0.0471	0.0377	0.00611	0.0438	0.0066	0.0357	0.00698	0.0289	0.00269	0.0334	0.00312	0.031	0.00611	0.0354	0.00576
Molybdenum	mg/kg	25	23,000	<4.0	1.1	0.782	0.0817	0.833	0.15	0.796	0.121	0.748	0.113	0.95	0.135	0.838	0.188	0.776	0.151
Nickel	mg/kg	16	75	21.1	34.6	29.3	3.4	30.7	2.74	28.2	2.63	26.7	2.28	31.1	2.89	29.2	4.12	31.5	2.62
Phosphorus	mg/kg	-	-	-	1,240	1,136	88.5	1,143	41.6	1,055	58.9	1,130	103	1,184	56.8	1,148	89.3	1,138	47.6
Potassium	mg/kg	-	-	890	1,510	1,120	170	1,213	125	992	104	1,026	75.7	1,166	118	1,216	202	1,390	186
Selenium	mg/kg	2	-	<2.0	0.93	0.584	0.107	0.637	0.0945	0.562	0.0507	0.506	0.121	0.826	0.123	0.664	0.165	0.678	0.139
Silver	mg/kg	0.5	-	<2.0	0.174	0.144	0.0194	0.148	0.0119	0.138	0.00986	0.127	0.0221	0.152	0.0188	0.15	0.038	0.144	0.0181
Sodium	mg/kg	-	-	240	546	386	16.7	460	20	348	21.7	380	20.2	413	19.7	446	53.2	516	38.9
Strontium	mg/kg	-	-	58.5	83.7	63.3	6.58	68.9	6.3	55.7	5.97	62.5	4.66	71.8	5.47	71.2	11.3	75.5	5.29
Sulphur	mg/kg	-	-	-	720	-	-	500	-	680	192	560	89.4	594	83.5	500	-	508	13
Thallium	mg/kg	-	-	<1.0	0.147	0.123	0.0198	0.12	0.0146	0.103	0.00868	0.098	0.00957	0.116	0.0158	0.108	0.0175	0.125	0.0165
Tin	mg/kg	-	-	<5.0	0.57	0.354	0.0467	0.38	0.01	0.352	0.113	0.35	0.0265	0.384	0.0619	0.464	0.0835	0.502	0.0438
Titanium	mg/kg	-	-	607	1,180	989.8	85.9	935.7	34.9	864	114	965	54.8	1,065	76.3	1,071	116	1,076	53.7
Uranium	mg/kg	-	-	-	1.39	0.988	0.142	1.14	0.137	1.04	0.0771	0.958	0.0675	1.25	0.147	1.07	0.181	1.23	0.124
Vanadium	mg/kg	-	-	54.9	68.7	56.9	4.08	57	3.76	53.4	5.28	55.5	2.61	61.9	4.16	62.2	5.62	64.4	2.64
Zinc	mg/kg	123	315	46.7	70.4	60.8	6.45	62.3	4.42	54.3	4.8	57.3	5.41	61.4	6.1	62.6	8.37	63.8	5.36
Zirconium	mg/kg	-	-	-	4.3	-	-	-	-	-	-	-	-	3.82	0.327	4.12	0.13	3.34	0.241

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/Italics*** **-** Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (<5th percentile value for pH); SD - Standard Deviation. Mean values reported as < the laboratory reporting limit were not screened against guidelines or reference 95th percentile. Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. For calculation of reference 95th percentile values see Appendix Table C.2.2 and for calculation of pre-breach 95th percentile values see Appendix Table C.2.4.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table 5.14: Summary of Sediment Quality Data for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2007 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile [b]		Exposed QUL-LNF1															
						2007		2014		2015		2016		2019		2020		2021		2022	
		Lower	Upper	Pre-Breach (QUL-LNF1; 2007)	Reference (QUL-LREF1; 2014 to 2022)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Tests																					
Moisture	%	-	-	-	44.9	-	-	32.6	4.82	25.4	6.19	22.8	5.02	26.1	4.31	29.3	3.74	23.5	3.5	23.9	1.41
pH (1:2 soil:water)	pH	-	-	-	5.92	-	-	8.48	0.207	7.95	0.703	8.54	0.0554	8.68	0.136	8.31	0.722	8.51	0.224	8.35	0.218
Particle Size																					
% Gravel (>2 mm)	%	-	-	7	5.4	3.40	2.51	1.15	2.34	2.02	3	3.54	4.52	2.12	2.5	1.84	1.88	3.54	5.68	1.04	0.0894
% Sand (2.0 mm - 0.063 mm)	%	-	-	58	74.9	44.4	11.7	49.2	2.14	***82.4***	17.7	***89.2***	4.52	***95.1***	3.01	***91.2***	11.4	***90.7***	6.13	***92.8***	2.79
% Silt (0.063 mm - 4 µm)	%	-	-	53	58.1	44.6	8.08	41.7	2.01	14.8	14.7	6.67	3.55	3.34	1.65	7.46	9.26	6.26	1.64	6.02	2.93
% Clay (<4 µm)	%	-	-	9	5.85	7.20	2.05	8.07	1.82	0.786	0.405	0.628	0.129	1	-	1	-	1.12	0.268	1.12	0.164
Organic / Inorganic Carbon (<63 µm)																					
Total Organic Carbon	%	-	-	2.45	1.87	1.89	0.432	0.214	0.0706	0.35	0.198	0.122	0.0787	0.708	0.329	0.805	0.228	0.528	0.158	0.826	0.349
Nutrients (Bulk sediment)																					
Total Nitrogen by LECO	%	-	-	-	0.101	-	-	0.02	-	0.0316	0.00598	0.02	-	0.02	-	0.025	0.00959	0.02	-	0.0236	0.00568
Metals (<63 µm)[c]																					
Aluminum	mg/kg	-	-	12,500	17,100	10,700	1,380	***17,920***	887	12,314	2,265	10,632	2,246	14,960	1,780	14,860	2,321	13,564	2,787	13,980	2,848
Antimony	mg/kg	-	-	<10.0	0.35	***<10.0***	-	***0.426***	0.023	***0.43***	0.0464	***0.364***	0.055	***0.552***	0.0736	***0.544***	0.123	***0.524***	0.0764	***0.478***	0.0497
Arsenic	mg/kg	5.9	17	7.5	5.71	6.00	0.773	***13***	0.493	***15***	1.34	***14.6***	1.51	***18.7***	0.986	***15.5***	3.84	***16.4***	1.37	***15.4***	2.83
Barium	mg/kg	-	-	91.4	149	79.0	9.99	***195***	12.7	105	20.6	97.2	34.1	***156***	30.4	***155***	45.6	123	25.7	111	29.2
Beryllium	mg/kg	-	-	<0.50	0.45	***<0.500***	-	***0.676***	0.0477	***0.518***	0.0626	***0.488***	0.0698	***0.594***	0.0483	***0.53***	0.11	***0.514***	0.0669	***0.496***	0.0706
Bismuth	mg/kg	-	-	<20.0	0.14	***<20.0***	-	0.1	-	0.102	0.00447	0.11	0.0173	***0.15***	0.0212	***0.148***	0.0295	0.122	0.0179	0.13	0.02
Boron	mg/kg	-	-	-	10	-	-	10	-	10	-	10	-	10	-	7.84	1.84	7.54	1.24	7.3	1
Cadmium	mg/kg	0.6	3.5	<0.50	0.388	***<0.500***	-	0.133	0.0135	0.218	0.0464	0.168	0.0314	0.346	0.0782	0.285	0.0667	0.281	0.0465	0.343	0.128
Calcium	mg/kg	-	-	5,660	8,680	5,110	394	***28,300***	1,701	***20,300***	1,198	***20,920***	1,994	***22,740***	2,950	***19,220***	5,893	***20,860***	1,968	***16,780***	2,083
Chromium	mg/kg	37.3	90	32.3	60.3	27.7	3.63	15.5	1.58	34.7	7.84	35.9	10.3	52.5	13.8	58.9	21.6	54.5	18.4	51.4	11.8
Cobalt	mg/kg	-	-	9.6	13.3	8.02	1.12	***20.3***	0.85	***23.5***	6.05	***25.2***	6.19	***28.1***	7.21	***23.3***	6.94	***30.4***	9.31	***28***	9.49
Copper	mg/kg	35.7	197	29.6	35.8	23.0	3.99	***652***	52.6	***648***	140	***659***	212	***1,644***	433	***1,328***	676	***1,077***	208	***1,122***	510
Iron	mg/kg	21,200	43,766	23,100	28,200	19,600	2,880	***62,740***	7,313	***119,880***	54,185	***142,020***	48,744	***129,940***	64,269	***105,920***	45,297	***162,340***	83,211	***152,520***	98,091
Lead	mg/kg	35	91.3	<30.0	6.47	***<30.0***	-	5.76	0.203	6.4	0.66	5.92	1.01	***8.96***	1.03	***9.17***	2.22	***7.5***	0.831	***8.15***	1.68
Lithium	mg/kg	-	-	13.2	13.7	11.3	1.70	***18.2***	1.22	13.2	1.55	12.3	1.78	***16.4***	1.73	***15.7***	2.55	13.4	1.59	***13.9***	1.86
Magnesium	mg/kg	-	-	5,770	8,320	4,960	762	***11,320***	694	6,924	1,117	6,210	1,085	***9,400***	1,179	***8,652***	1,496	***8,774***	1,282	7,804	1,583
Manganese	mg/kg	460	1,100	514	443	359	92.4	***695***	38.4	***750***	100	***630***	96.2	***1,006***	97.3	***983.8***	250	***1,140***	184	***1,146***	266
Mercury	mg/kg	0.17	0.486	0.0729	0.0471	0.0517	0.0125	***0.0773***	0.00371	***0.101***	0.0151	***0.1***	0.0261	***0.127***	0.024	***0.103***	0.0243	***0.116***	0.0214	***0.129***	0.0375
Molybdenum	mg/kg	25	23,000	<4.0	1.1	***<4.00***	-	***3.75***	0.201	***3.38***	0.415	***3.17***	0.544	***5.44***	1.07	***5.44***	2.72	***4.02***	1.15	***2.68***	0.647
Nickel	mg/kg	16	75	21.1	34.6	17.5	2.60	12.2	0.456	18.8	2.51	17.6	3.96	27.5	3.94	31.1	7.54	24.7	3.6	25.6	2.54
Phosphorus	mg/kg	-	-	-	1,240	-	-	***1,660***	142	***1,946***	285	***2,024***	259	***1,766***	30.5	***1,572***	186	***1,758***	167	***1,542***	138
Potassium	mg/kg	-	-	890	1,510	736	131	***1,786***	87.9	920	231	736	213	992	144	1,028	132	978	214	990	245
Selenium	mg/kg	2	-	<2.0	0.93	***<2.00***	-	***1.02***	0.0324	***1.16***	0.166	***1.07***	0.264	***1.99***	0.416	***1.57***	0.556	***1.61***	0.302	***1.41***	0.416
Silver	mg/kg	0.5	-	<2.0	0.174	***<2.00***	-	***0.325***	0.0242	***0.368***	0.033	***0.414***	0.0987	***0.778***	0.179	***0.612***	0.251	***0.515***	0.101	***0.521***	0.217
Sodium	mg/kg	-	-	240	546	210	19.0	***1,160***	46.4	526	121	444	106	522	88	502	120	507	111	468	84.1
Strontium	mg/kg	-	-	58.5	83.7	53.2	4.78	***193***	11.5	***106***	21.1	***91.5***	21.2	***110***	15.7	***114***	22.1	***111***	27.5	***100***	18.2
Sulphur	mg/kg	-	-	-	720	-	-	-	-	***1,220***	259	520	44.7	***740***	207	***726***	58.6	***850***	80.3	***748***	50.2
Thallium	mg/kg	-	-	<1.0	0.147	***<1.00***	-	0.05	-	0.05	-	0.0514	0.00313	0.0562	0.00856	0.0562	0.00701	0.0522	0.00259	0.062	0.0126
Tin	mg/kg	-	-	<5.0	0.57	***<5.00***	-	***1.63***	0.0992	***1.31***	0.0918	***1.07***	0.157	***1.31***	0.272	***1.26***	0.353	***1.57***	0.22	***1.44***	0.275
Titanium	mg/kg	-	-	607	1,180	557	34.2	***1,690***	75.8	***1,326***	132	1,074	231	***1,488***	231	***1,512***	429	***1,622***	343	***1,470***	274
Uranium	mg/kg	-	-	-	1.39	-	-	1.21	0.105	1.08	0.0782	1.02	0.184	1.02	0.0979	1.14	0.158	1.02	0.0791	1.14	0.188
Vanadium	mg/kg	-	-	54.9	68.7	49.5	4.27	***235***	25.7	***461***	220	***561***	202	***501***	270	***422***	197	***673***	355	***575***	397
Zinc	mg/kg	123	315	46.7	70.4	39.2	7.10	63.1	4.35	***70.8***	9.41	67	11.2	***98.2***	18.8	***79.8***	17.4	***87.2***	15.3	***81.5***	11.2
Zirconium	mg/kg	-	-	-	4.3	-	-	-	-	-	-	-	-	-	-	***5.94***	1.49	***6.42***	1.04	***4.92***	0.589

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/Italics*** - Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (<5th percentile value for pH); SD - Standard Deviation. Mean values reported as < the laboratory reporting limit were not screened against guidelines or reference 95th percentile. Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. For calculation of reference 95th percentile values see Appendix Table C.2.2 and for calculation of pre-breach 95th percentile values see Appendix Table C.2.4.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

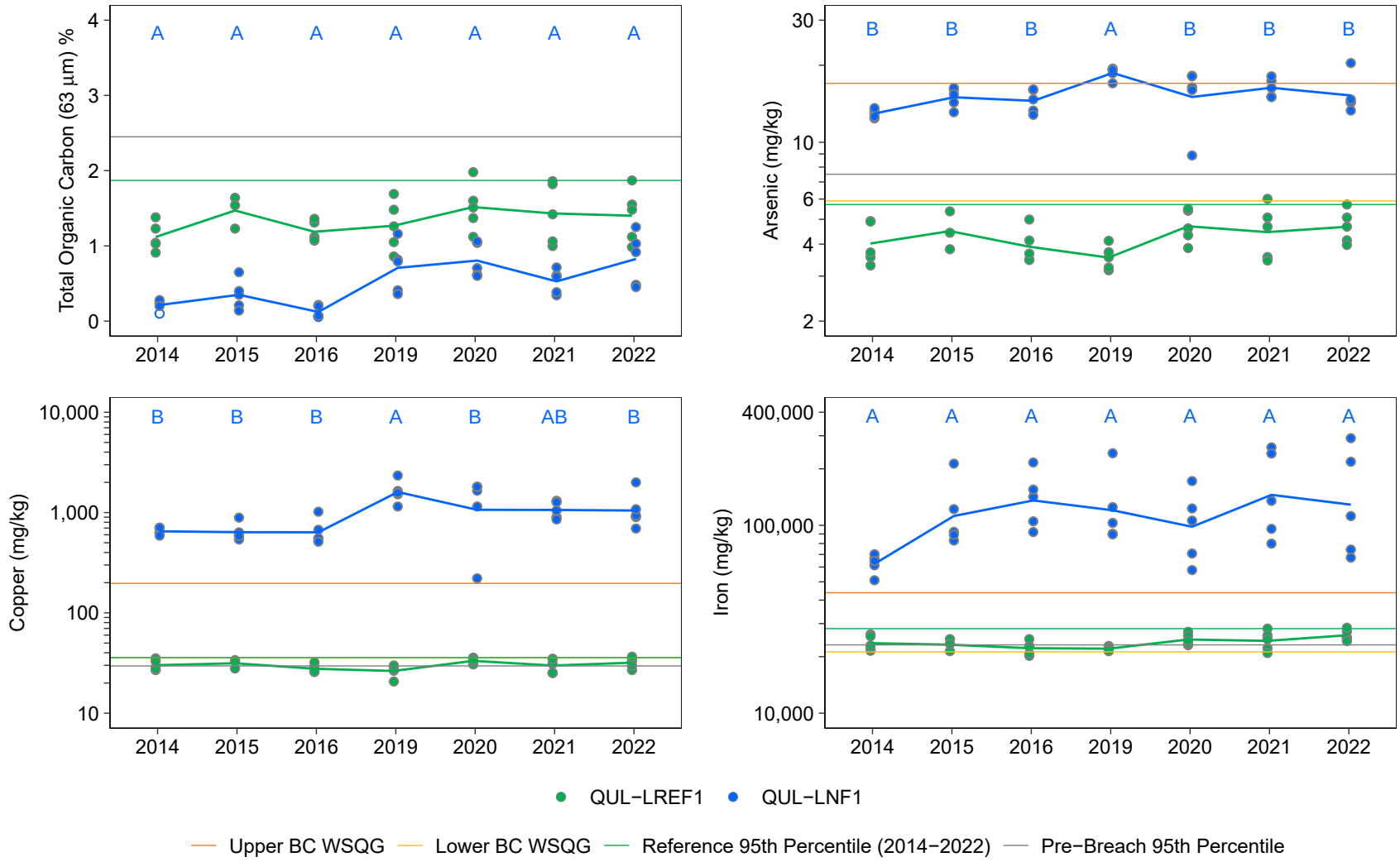

Figure 5.15: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: BC WSQG = British Columbia Working Sediment Quality Guideline (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). The reference 95th Percentile was calculated using data from 2014 to 2022. Green represents reference areas and other colours represent exposed areas. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year and log10 transformed data for all analytes except Total Organic Carbon (TOC) (no transformation). Years that share a letter (e.g., A,B,C) have ratios (or differences – TOC) of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio (or difference) of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

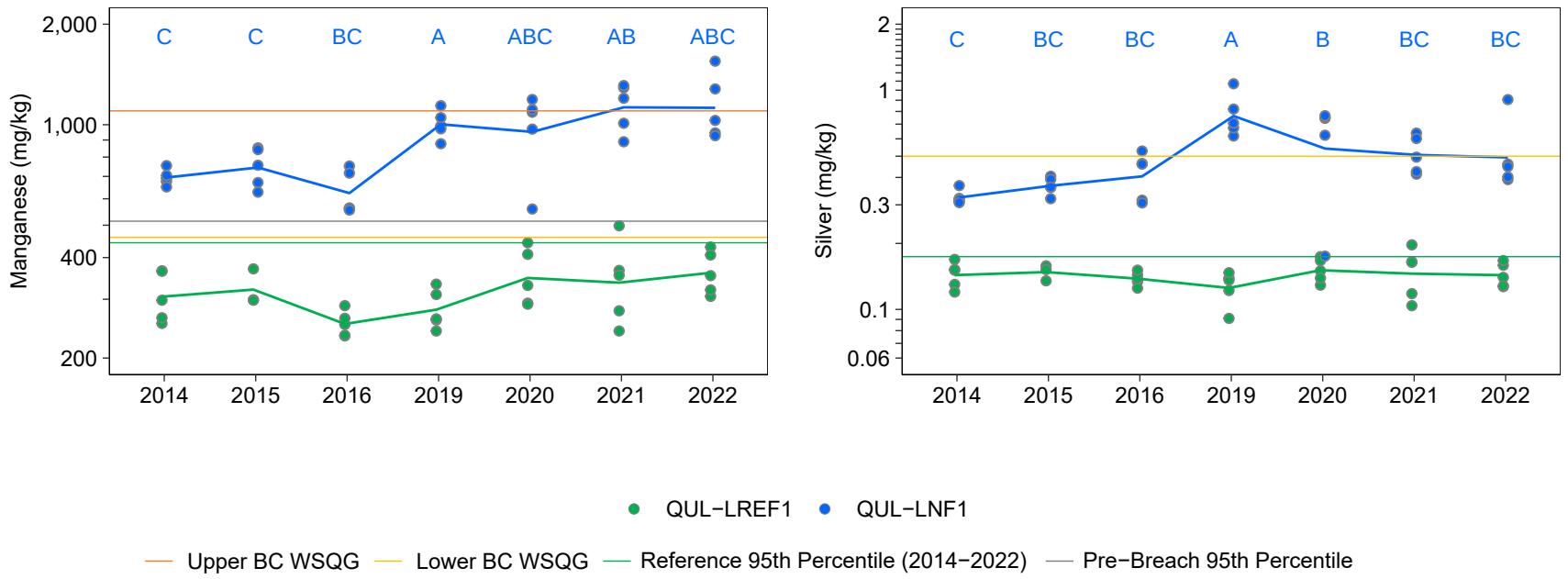

Figure 5.15: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: BC WSQG = British Columbia Working Sediment Quality Guideline (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). The reference 95th Percentile was calculated using data from 2014 to 2022. Green represents reference areas and other colours represent exposed areas. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year and log10 transformed data for all analytes except Total Organic Carbon (TOC) (no transformation). Years that share a letter (e.g., A,B,C) have ratios (or differences – TOC) of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio (or difference) of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

times, respectively, and copper, iron, and manganese exceeded the upper BC WSQG by 5.7, 3.5, and 1.04 times, respectively (Table 5.14; Appendix Table C.2.9). In previous monitoring years (2019) chromium had also exceeded both reference and pre-breach 95th percentile values and been identified as an Analyte of Interest, however chromium was not identified as such in 2022 because it did not exceed the reference 95th percentile value. In 2022, the mean iron concentration in reference sediment was naturally elevated above the lower BC WSQG (Table 5.14; Appendix Table C.2.6), demonstrating that this element is naturally elevated in parts of Quesnel Lake.

The mean concentrations of arsenic, copper, iron, manganese, and silver in QUL-LNF1 sediments have been higher than reference concentrations since monitoring began in 2014. Temporal comparisons indicated that the concentrations of these five analytes in QUL-LNF1 sediments have been temporally stable from 2014 to 2022, relative to reference, except for increased arsenic, copper, and manganese concentrations in 2019 when the QUL-LNF1 sampling location was moved (Figure 5.15; Appendix Table E.1.9).

In the exposed sediments from QUL-LNF1, copper and manganese concentrations were positively correlated with TOC and % clay content, and arsenic was positively correlated with clay content (Appendix Figure E.1.4, Appendix Table E.1.11). These significant correlations infer that the tailings-influenced sediments at the shallow sampling areas of Quesnel Lake with higher clay (% clay) and TOC content tend to have higher concentrations of Analytes of Interest (e.g., arsenic, copper).

5.2.2 Sediment Toxicity

Sediment toxicity testing using *H. azteca* in 2022 (14-day standard test) was completed at a shallow exposed area of Quesnel Lake (QUL-LNF1), with an unimpacted shallow area of Quesnel Lake serving as reference (QUL-LREF1; Figure 3.1; Table 3.3). A review of sediment toxicity test data quality indicated that tests met control acceptability criteria and all water quality parameters remained within acceptable ranges throughout the tests (Nautilus 2022; Appendix G). Reference toxicant test results fell within the acceptable range and therefore the sensitivity of organisms used in the tests was considered appropriate (see the DQR for details; Appendix B). All ammonia concentrations were at levels that are not expected to cause adverse effects to *H. azteca*. Examination of laboratory bench sheets indicated that temperature, dissolved oxygen, conductivity, and pH were all stable over the course of the toxicity tests (Appendix G).

Survival of *H. azteca* exposed to QUL-LNF1 sediments in 2022 showed a moderate response (44 to 45% mortality; Table 5.15) which is similar to results in 2021 (46% mortality), slightly lower survival than 2020 (39% mortality) and much higher survival than 2019 (100% mortality) for similar 14-day standard static tests (Figure 5.16; Minnow 2020a, 2021a, 2022a). Growth of *H. azteca*

Table 5.15: Summary of *Hyalella azteca* 14-day Survival and Growth Responses for Sediment Toxicity Testing of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2022

Results and Classification	Quesnel Lake	
	QUL-LNF	
	Survival	Growth[a]
	%	mg
Raw Area Result	54.0 ± 23.0	0.04 ± 0.01
Raw Laboratory Control Result	96.5 ± 5.50	0.19 ± 0.03
Raw Reference Result (QUL-LREF1)	98.0 ± 4.50	0.17 ± 0.03
Control Normalized Response	56%	21%
Reference Normalized Response	55%	24%
Statistically Significant Reduction from Control	Y	Y
Statistically Significant Reduction from Reference	Y	Y
CLASSIFICATION[b]	**MR**	**HR**

no unacceptable response (<20% reduction) - **NR**.
low response (20-50% reduction) and not significantly different than control and reference - **LR**.
moderate response (20-50% reduction) and significantly different than control and reference - MR.
high response (>50% reduction) - **HR**.

Note: Y = Yes, N = No.

[a] Growth = dry weight per surviving organism (mg).

[b] Where comparisons to mean laboratory control result and the mean field reference result did not fall into the same response classification, the result was discussed relative to both the control and the field reference.

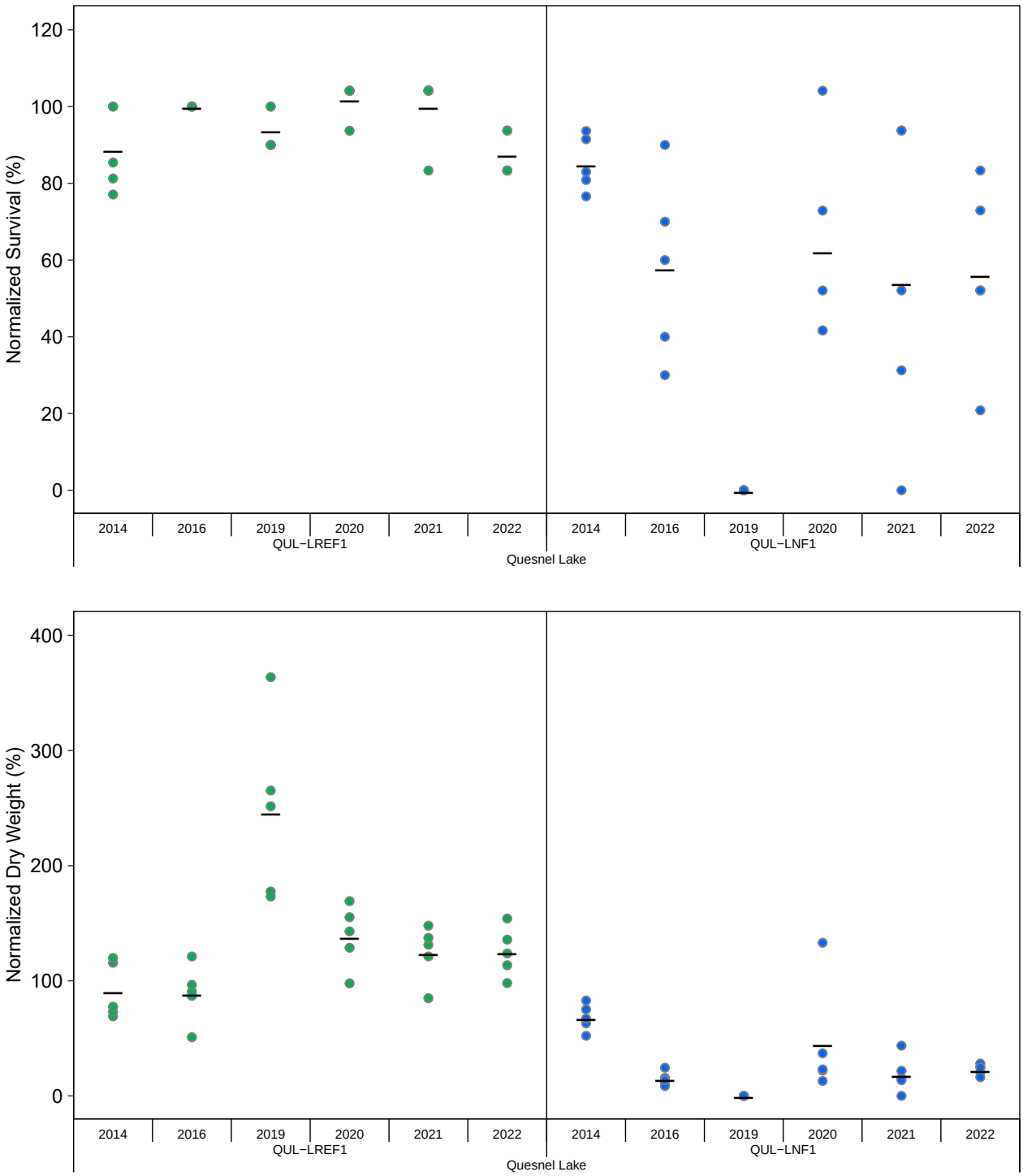

Figure 5.16: *Hyalella azteca* Survival and Growth Responses (14-day) for Sediment Toxicity Testing of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Survival data were normalized to the control acceptance criteria, and the samples were calculated as a percentage of normalized control performance. Growth data were normalized to laboratory controls run during the test with the reference site for that area.

exposed to QUL-LNF1 sediments showed a high response (76 to 79% reduction in growth; Table 5.15), which is similar to results in 2021 (78 to 82% reduction) and a higher response (i.e., lower growth) than those in 2020 (50 to 65% reduction) for similar 14-day standard static tests (Figure 5.16; Minnow 2021a, 2022a).

Mean sediment copper concentrations at QUL-LNF1 in 2022 were 1,122 ± 510 mg/kg (Appendix C.2.9), which was similar to a laboratory determined copper 10-day LC50 of 1,078 mg/kg for *H. azteca* (Cairns et al. 1984). The corresponding dissolved aqueous copper LC50 concentration from Cairns et al. (1984) study was 39 µg/L, which was lower than the mean concentrations observed in overlying water of QUL-LNF1 toxicity testing vessels on day 14 of the test (74 µg/L ± 41 µg/L; Appendix G). Dissolved copper concentrations in the bioassay test vessels for QUL-LNF1 were higher than those in the test overlying waters for reference sediments (QUL-LREF1; 18 µg/L ± 3.3 µg/L) and were also notably higher than those documented in field-collected water samples (mean = 0.762 µg/L; Figure 5.17; Appendix Table C.1.4). This suggests copper mobilization in the test set-up that has either not occurred *in situ* or has attenuated over time *in situ*. In 2021, the 14-day *H. azteca* testing was conducted using static and static-renewal methods (i.e., renewing the testing waters during the course of the test) to better understand the evolution of dissolved copper to overlying test waters and associated implications to toxicity test results (Minnow 2022a). While static-renewal techniques reduced the overlying water concentrations of copper in bioassay vessels, and therefore provided more environmentally relevant testing conditions than static testing, the concentrations remained higher than *in situ* dissolved copper concentrations (by an average of 56-times; Minnow 2022a).

In 2022, overlying test water concentrations of dissolved copper were 97-times higher than *in situ* concentrations (Appendix C.1.4), which was relatively similar to previous toxicity test concentrations in 2020 (74-times) and 2021 (114-times), but much lower than 2019 (175-times; Figure 5.17; Minnow 2020a, 2021a, 2022a). Evaluation of regression relationships indicated that control-normalized survival and growth of *H. azteca* were positively related to sediment TOC content, and negatively related to sediment copper concentrations and to aqueous dissolved copper concentrations in the overlying water of bioassay vessels (Figure 5.18, Table 5.16). The relationships with copper concentrations (sediment and aqueous) had strong r^2 values of 0.48 to 0.65 (which are consistent with high descriptive power; Milton and Arnold 2002). These relationships infer lower *H. azteca* growth and survival at higher dissolved copper concentrations in the overlying water, which is consistent with the fact that *H. azteca* have been documented to derive little nutrition from sediment and to respond primarily to contaminants in overlying water (Wang et al. 2004).

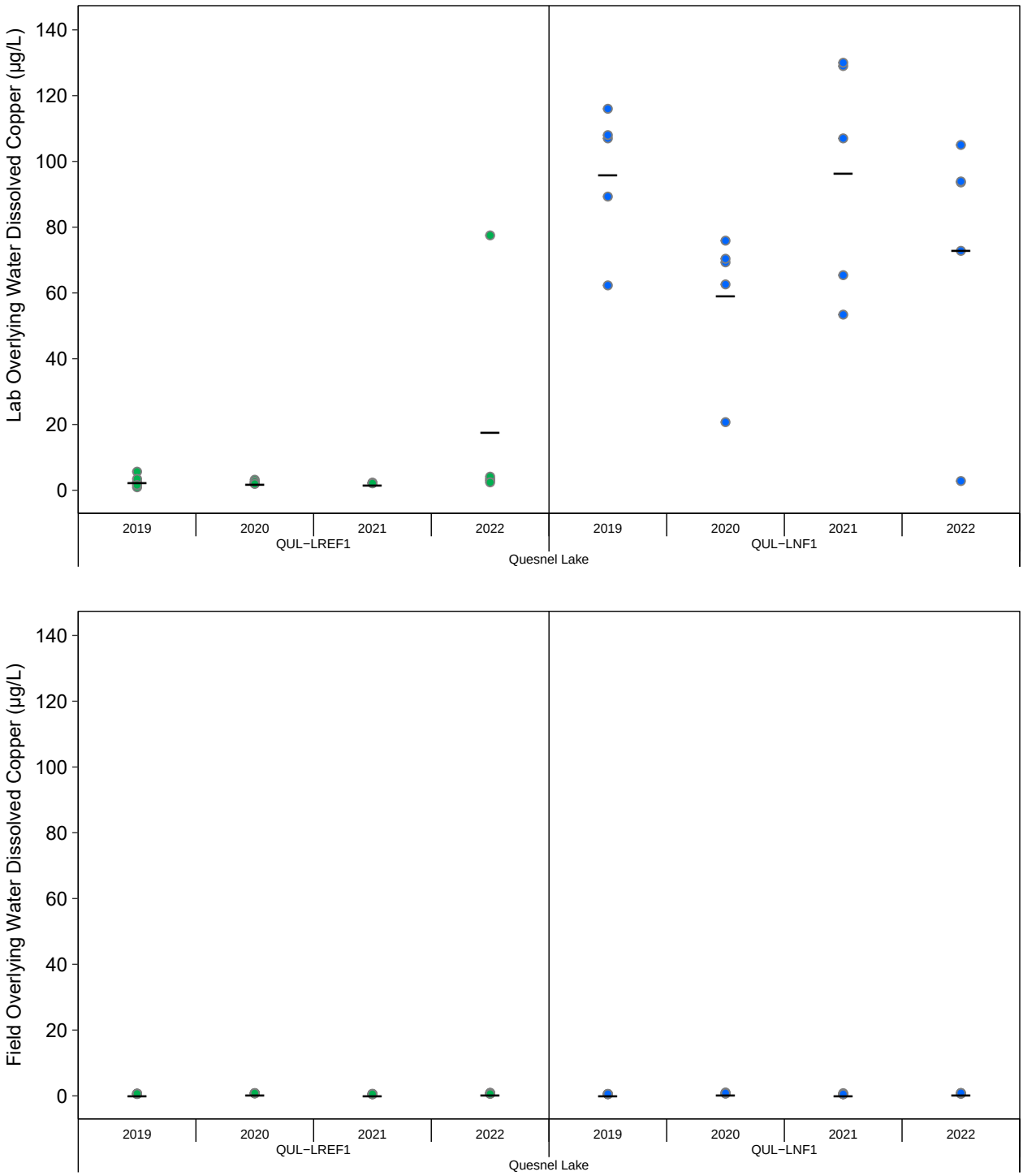

Figure 5.17: Dissolved Copper Concentrations in Laboratory and Field Overlying Water Associated with *Hyalella azteca* Survival and Growth (14-day) Sediment Toxicity Testing of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2019 to 2022

Notes: Survival data were normalized to the control acceptance criteria, and the samples were calculated as a percentage of normalized control performance. Growth data were normalized to laboratory controls run during the test with the reference site for that area.

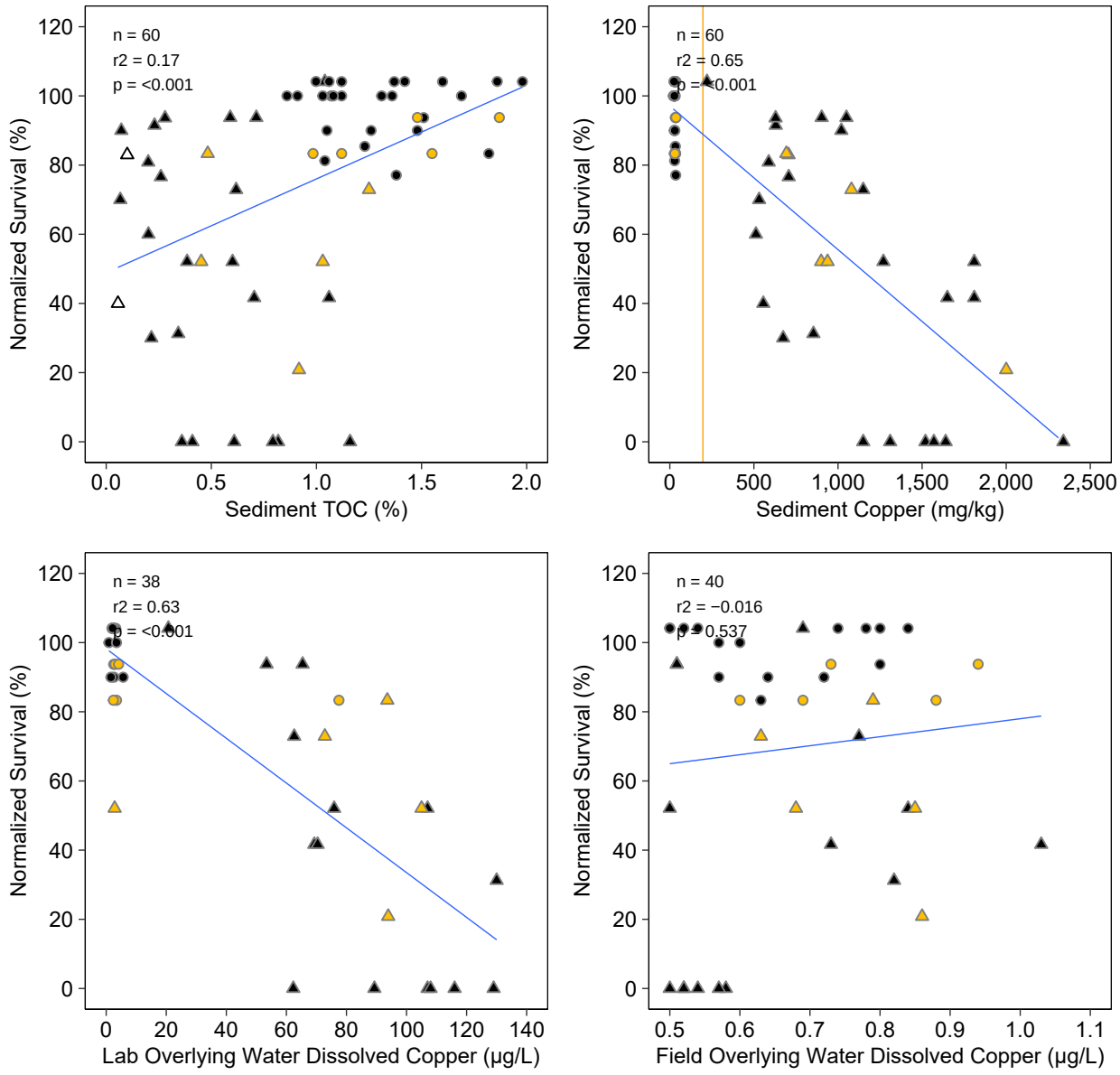

Figure 5.18: Simple Linear Regression Models of Control-Normalized *Hyalella azteca* Survival and Growth (14-day) Responses Relative to Sediment and Overyling Water Characteristics of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Lab water and in−situ lake copper data are only available from 2019 to 2022. Outliers removed from analysis are noted with an ×. 2022 samples are plotted in orange. Censored values are shown as hollow symbols. Vertical orange lines indicate the Upper WSQG for copper (BCMOE 2017).

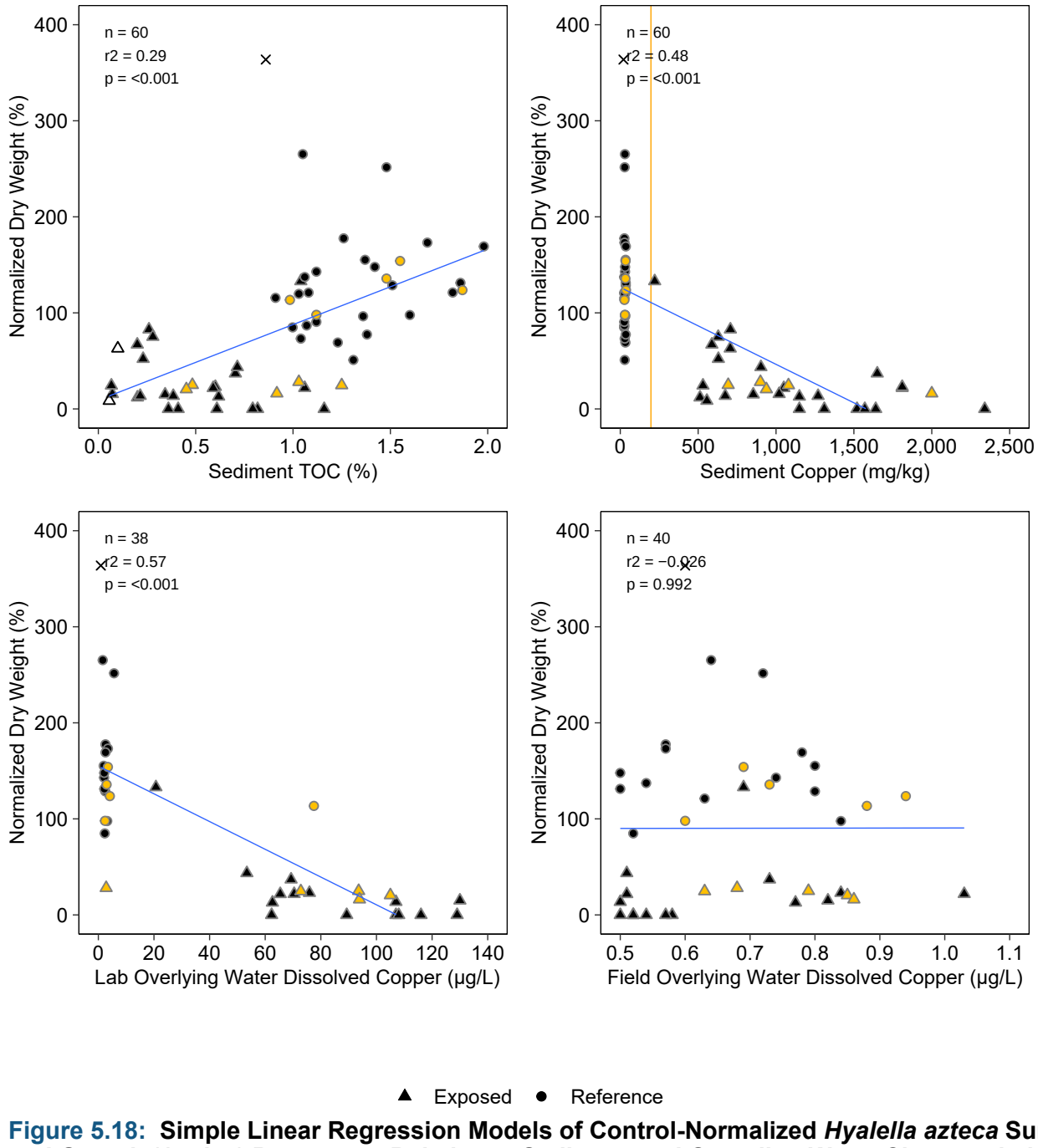

Figure 5.18: Simple Linear Regression Models of Control-Normalized *Hyalella azteca* Survival and Growth (14-day) Responses Relative to Sediment and Overyling Water Characteristics of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Lab water and in−situ lake copper data are only available from 2019 to 2022. Outliers removed from analysis are noted with an ×. 2022 samples are plotted in orange. Censored values are shown as hollow symbols. Vertical orange lines indicate the Upper WSQG for copper (BCMOE 2017).

Table 5.16: Simple Linear Regression Models of Control-Normalized *Hyalella azteca* 14-day Survival and Growth Responses Relative to Sediment and Overlying Water Characteristics of Quesnel Lake at QUL-LNF (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Response	Predictor	Data Set	n	Slope	Intercept	P-value	r^2
Normalized Survival (%)	Sediment TOC (%)	All Data	60	27.1	48.9	<0.001	0.170
	Sediment Copper (mg/kg)	All Data	60	-0.0415	97.1	<0.001	0.650
	Lab Overlying Water Dissolved Copper (µg/L)	All Data	38	-0.647	98.2	<0.001	0.630
	Field Overlying Water Dissolved Copper (µg/L)	All Data	40	26.0	52.0	0.537	-0.016
Normalized Dry Weight (%)	Sediment TOC (%)	All Data	60	78.7	9.10	<0.001	0.290
	Sediment TOC (%)	Outliers excluded[a]	59	80.0	3.08	<0.001	0.410
	Sediment Copper (mg/kg)	All Data	60	-0.080	127	<0.001	0.480
	Sediment Copper (mg/kg)	Outliers excluded[a]	59	-0.075	119	<0.001	0.550
	Lab Overlying Water Dissolved Copper (µg/L)	All Data	38	-1.44	155	<0.001	0.570
	Lab Overlying Water Dissolved Copper (µg/L)	Outliers excluded[a]	37	-1.32	143	<0.001	0.640
	Field Overlying Water Dissolved Copper (µg/L)	All Data	40	0.922	89.6	0.992	-0.026
	Field Overlying Water Dissolved Copper (µg/L)	Outliers excluded[a]	39	27.7	64.4	0.745	-0.024

P-value < 0.05

Notes: TOC = total organic carbon, mg/kg = milligrams per kilogram, µg/L = micrograms per liter. TOC content and copper concentrations measured in the <63 µm sediment fraction.

[a] One outlier was removed from the regression based on having Studentized residuals > 3.58 (Dohoo et al. 2009).

Overall, temporal trends of *H. azteca* toxicity test results suggest a residual breach-related influence on *H. azteca* toxicity for both growth and survival within the small shallow near-field area near the mouth of Hazeltine Creek. However, the substantial difference in overlying water chemistry between laboratory and field (as noted earlier) continues to raise questions about how well the laboratory results represent *in situ* (field) exposure.

5.2.3 Plankton Community and Productivity

Plankton community and productivity monitoring in 2022 was completed three times (June, July, and August) in exposed (QUL-ZOO-1) and reference (QUL-ZOO-7) areas of Quesnel Lake (Figure 3.3, Table 3.5). A review of the 2022 plankton community and productivity data quality (Appendix B) indicated that these data can be used with a good level of confidence for interpretation (see Section 5.1.3 for details). A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

5.2.3.1 Phytoplankton

5.2.3.1.1 Community

In 2022, phytoplankton densities at the exposed area (QUL-ZOO-1) and reference area (QUL-ZOO-7) of Quesnel Lake were highest in July compared to June and August (Appendix Figure E.2.7, Appendix Table C.3.5). Phytoplankton taxon richness at both QUL-ZOO-1 and QUL-ZOO-7 in 2022 was lowest in June and highest in August (Appendix Figure E.2.7, Appendix Table C.3.5). Phytoplankton density and richness were higher and lower, respectively, at QUL-ZOO-1 than at QUL-ZOO-7 in July 2022. Simpson's Diversity and Simpson's Evenness were similar between the two areas in 2022 (Figure 5.19, Table 5.17; Appendix Tables C.3.5 and C.3.6).

Temporal analyses indicated that mean phytoplankton density at QUL-ZOO-1 (exposed) was consistently higher than at QUL-ZOO-7 (reference) from 2019 to 2022, with similar temporal changes observed at each area over this period (Figure 5.19, Table 5.17). Higher densities of phytoplankton at QUL-ZOO-1 were attributed largely to greater densities of Chrysophytes and Dinoflagellates than at QUL-ZOO-7 (Appendix Figure E.2.8, Appendix Tables C.3.5 and E.2.3).

Taxon richness at QUL-ZOO-1 was stable and similar to reference from 2019 to 2021 but decreased significantly in 2022 to a mean result that was lower than the previous monitoring years (2019 to 2021) and lower than reference (Figure 5.19, Table 5.17; Appendix Tables C.3.5 and C.3.6). Although the lack of replication prior to 2019 prevented statistical comparisons of historic data, phytoplankton taxon richness at QUL-ZOO-1 in 2022 was lower than the range of results reported in previous post-breach years except August 2019 (2015 to 2021;

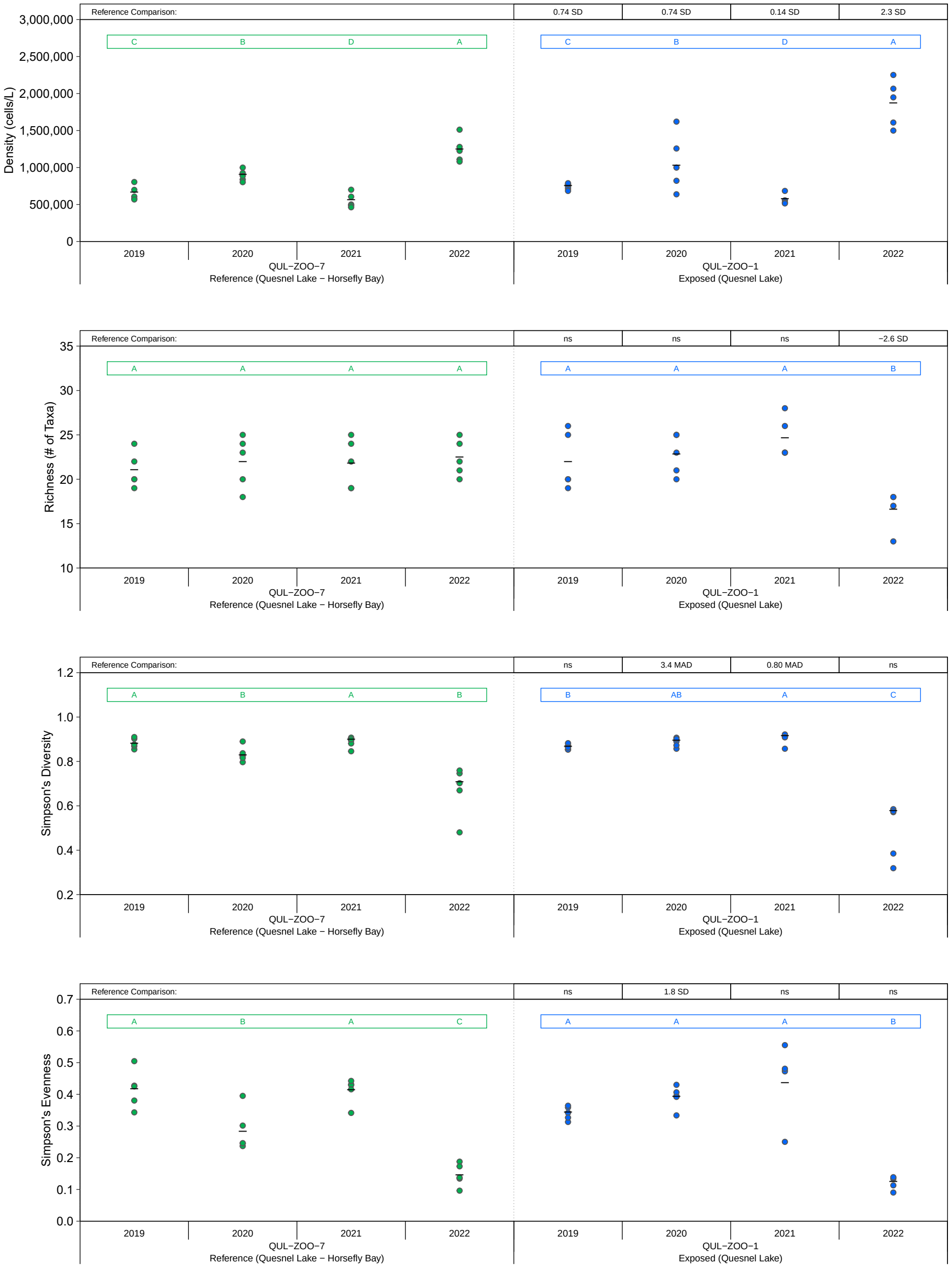

Figure 5.19: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

Table 5.17: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Mean	MCT[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
										Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year						2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Density (cells/L)	log10	0.006	<0.001	0.119	Reference	QUL-ZOO-7	2019	651,204	645,498	C	B	D	A	Baseline	1.8	-0.96	3.6	0.74
							2020	889,702	887,084									0.74
							2021	550,375	543,568									0.14
							2022	1,240,551	1,231,482									2.3
					Exposed	QUL-ZOO-1	2019	738,035	737,054	C	B	D	A	Baseline	1.8	-1.6	5.2	
							2020	1,066,664	1,012,408									
							2021	560,459	557,226									
							2022	1,873,993	1,852,441									
Richness (# of Taxa)	log10	-	-	0.001	Reference	QUL-ZOO-7	2019	21.0	21.0	A	A	A	A	Baseline	ns	ns	ns	ns
							2020	22.0	22.0									ns
							2021	21.8	22.0									ns
							2022	22.4	22.0									-2.6
					Exposed	QUL-ZOO-1	2019	22.0	22.0	A	A	A	B	Baseline	ns	ns	-2.4	
							2020	22.8	23.0									
							2021	24.6	24.0									
							2022	16.6	16.0									
Simpson's Diversity	rank	-	-	0.007	Reference	QUL-ZOO-7	2019	0.882	0.880	A	B	A	B	Baseline	-2.7	ns	-9.0	ns
							2020	0.833	0.820									3.4
							2020	0.886	0.820									3.4
							2021	0.672	0.890									0.80
					Exposed	QUL-ZOO-1	2019	0.865	0.860	B	AB	A	C	Baseline	ns	2.4	-15	
							2020	0.886	0.890									
							2021	0.903	0.910									
							2022	0.487	0.570									
Simpson's Evenness	log10	-	-	0.015	Reference	QUL-ZOO-7	2019	0.416	0.410	A	B	A	C	Baseline	-2.0	ns	-5.6	ns
							2020	0.285	0.280									1.8
							2021	0.412	0.410									ns
							2022	0.146	0.140									ns
					Exposed	QUL-ZOO-1	2019	0.341	0.340	A	A	A	B	Baseline	ns	ns	-5.4	
							2020	0.391	0.390									
							2021	0.447	0.430									
							2022	0.123	0.120									
Chlorophyll-a (µg/L)	rank	0.389	<0.001	0.325	Reference	QUL-ZOO-7	2019	1.77	2.00	B	C	D	A	Baseline	-3.3	-6.4	8.8	ns
							2020	1.51	1.50									ns
							2021	1.12	1.10									ns
							2022	3.22	3.10									ns
					Exposed	QUL-ZOO-1	2019	2.04	2.00	B	C	D	A	Baseline	-2.6	-6.9	5.7	
							2020	1.59	1.60									
							2021	1.05	1.10									
							2022	3.29	2.80									

Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0, cells/L = cells per litre, µg/L = micrograms per litre.

[a] MCT = Measures of Central Tendency. Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Appendix Figure E.2.7). The lower taxon richness observed at QUL-ZOO-1 compared to QUL-ZOO-7 in July 2022, and compared previous monitoring years, appears to be due to the absence of relatively rare (<1 % of total density) species in these samples (mostly Diatoms, Chlorophytes, and Chrysophytes; see laboratory data in Appendix G). The taxa that were absent from the QUL-ZOO-1 samples in July 2022 were distributed among different taxonomic groups; a fact that suggests their absence is not due to a discrete change in physical parameters at QUL-ZOO-1 in 2022 (that might preferentially affect one taxa) but rather that these relatively rare taxa were not captured by the five replicates collected during July sampling. This is supported by the consistent similarities in water temperature and nutrient concentrations between the exposed and reference areas in 2022 and at the exposed area over time (Appendix Figure C.1.5). In addition, the relative similarity of taxon richness results from August at QUL-ZOO-1 (22 taxa) and QUL-ZOO-7 (29 taxa) suggests this difference in taxon richness was temporary and possibly reflective of sampling variability (August results represent single samples that cannot be statistically compared; Appendix Table C.3.5). Three of the nine species of Diatoms, Chlorophytes, and Chrysophytes that were absent from QUL-ZOO-1 samples in July (but present in July QUL-ZOO-7 samples) were present QUL-ZOO-1 samples in August, providing further support that the absence of some these taxa from QUL-ZOO-1 samples in July 2022 was temporary. Continued monitoring will serve to confirm whether this decrease in richness at QUL-ZOO-1 is part of a longer-term trend at this exposed area or was reflective of a short-term community change. Mean Simpson's Diversity at QUL--ZOO-1 was similar to QUL-ZOO-7 from 2019 to 2022 except 2020 to 2021 when it was higher at the exposed area. Simpson's Evenness at QUL-ZOO-1 was also similar to QUL-ZOO-7 from 2019 to 2022 except 2020 when it was higher at the exposed area (Figure 5.19, Table 5.17; Appendix Table C.3.6).

The phytoplankton communities at QUL-ZOO-1 and QUL-ZOO-7 had a relatively even distribution of taxa in June 2022 and experienced succession toward more Chrysophytes in July and more Diatoms in August, with Diatoms becoming the dominant phytoplankton group at both monitoring areas by August (Figure 5.20; Appendix Table C.3.5). Seasonal succession observed at both areas was also characterized by a decrease in the relative densities of Chrysophytes and Cryptomonads from June to August. The above patterns in seasonal relative densities were also reflected in seasonal changes in cell densities (Appendix Figure E.2.9, Appendix Table C.3.5). Mean relative densities of Diatoms, Chlorophytes, and Cyanobacteria did not differ significantly between QUL-ZOO-1 and QUL-ZOO-7 in July 2022. Relative densities of Chrysophytes were significantly higher at QUL-ZOO-1 than at QUL-ZOO-7 in 2022, while the relative densities of Cryptomonads and Dinoflagellates were significantly lower (Appendix Figure E.2.8, Appendix Tables C.3.6 and E.2.3).



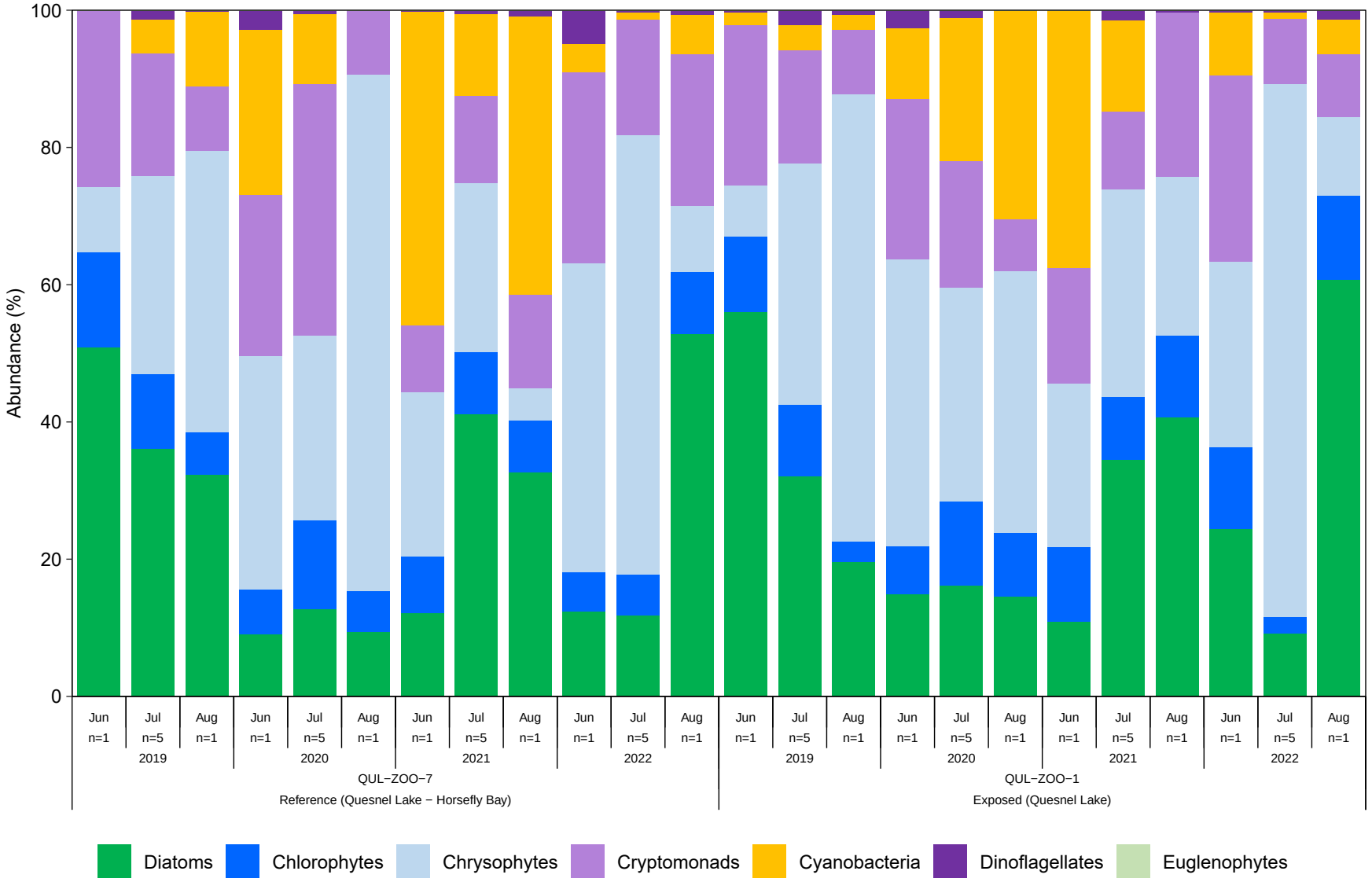

Figure 5.20: Relative Mean Densities of Major Phytoplankton Community Taxonomic Groups for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2019 to 2022

The relative densities of Diatoms, Chlorophytes, and Cyanobacteria at QUL-ZOO-1 were consistently similar to those at QUL-ZOO-7 from 2019 to 2022. Mean relative densities of Chrysophytes were significantly higher at QUL-ZOO-1 compared to QUL-ZOO-7 from 2019 to 2022, suggesting that this difference may be an inherent natural difference in communities between the two areas (Appendix Figure E.2.8, Appendix Tables C.3.5, E.2.3). Relative densities of Cryptomonads at QUL-ZOO-1 were significantly lower than at QUL-ZOO-7 in 2020 and 2022 but similar in 2019 and 2021. This variability at the exposed area compared to reference for relative densities of Cryptomonads was driven by changes at the reference area (QUL-ZOO-7) given the temporal stability of QUL-ZOO-1 results from 2019 to 2022. The relative densities of Dinoflagellates at QUL-ZOO-1 were significantly higher than at QUL-ZOO-7 from 2019 to 2021 and significantly lower than in 2022 (Appendix Figure E.2.8, Appendix Tables C.3.5, E.2.3). The densities of the major phytoplankton taxonomic groups showed very similar spatial and temporal patterns as the relative density data for these groups (Appendix Figures E.2.8, E.2.9; Appendix Tables C.3.5, E.2.3). The similarities in the phytoplankton communities at the exposed and reference areas of Quesnel Lake observed from 2019 to 2022 can likely be attributed to similar water temperatures at the surface and throughout their photic zones, and nutrient concentrations (Appendix Figures A.1.5, C.1.5, Appendix Table C.1.5) which are known factors affecting phytoplankton communities (Schnurr and Allen 2015).

Overall, the phytoplankton community at the exposed area of Quesnel Lake (QUL-ZOO-1) in 2022 was characterized by total density that was higher than at reference (QUL-ZOO-7), a pattern that has persisted since 2019. Taxon richness was lower at QUL-ZOO-1 than at QUL-ZOO-7 in 2022, which reflected a significant decrease from results observed in 2019 to 2021, when richness was similar to reference. This decrease in richness was attributable to the absence of relatively rare phytoplankton taxa at QUL-ZOO-1 in July 2022, and appeared to be a temporary change based on the results of samples collected in August 2022 which included some of these relatively rare taxa. Continued monitoring will help to further understand whether the decrease in taxon richness in 2022 is part of a longer-term change or a single variable result. Simpson's Diversity and Evenness have shown some temporal variability at the exposed area but have been either similar to or higher than reference in each year since 2019. Phytoplankton community composition at both the exposed and reference areas was characterized by succession towards Diatom dominance by August in 2022, with concurrent decreases in the relative densities of Chrysophytes and Cryptomonads. The community composition at the exposed area has been similar to reference in terms of the relative densities of Diatoms, Cyanobacteria, and Chlorophytes from 2019 to 2022. The relative densities of Chrysophytes, Cryptomonads, and Dinoflagellates at the exposed area differed from reference in 2022 but showed temporal stability either within the exposed area or temporal stability in the difference relative to reference. The demonstrated

similarity of the phytoplankton community at the exposed and reference areas of Quesnel Lake for most endpoints, and the temporal stability throughout the study period for those endpoints that differed between the areas (excluding taxon richness), are suggestive of a lack of mine-related influence on the phytoplankton community of Quesnel Lake.

5.2.3.1.2 Productivity

In 2022, chlorophyll-a concentrations recorded in July at both QUL-ZOO-1 and QUL-ZOO-7 were higher than concentrations observed in June or August (Appendix Figure E.2.7, Appendix Table C.3.5). Mean chlorophyll-a concentrations at QUL-ZOO-1 were consistently similar to those at QUL-ZOO-7 from 2019 to 2022 (Figure 5.21, Table 5.17; Appendix Tables C.3.5, C.3.6). At both QUL-ZOO-1 and QUL-ZOO-7, mean chlorophyll-a concentrations successively decreased significantly each year from 2019 to 2021 but were higher in 2022 relative to previous years (2019 to 2021; Figure 5.21, Table 5.17; Appendix Tables C.3.5, C.3.6). The similarity in phytoplankton productivity between QUL-ZOO-1 and QUL-ZOO-7 can be attributed to their similar nutrient concentrations, surface water temperatures, and water temperatures throughout the photic zone (Appendix Figures A.1.5, C.1.5, Appendix Table C.1.5).

A lake's trophic status classification corresponds to its overall productivity in terms of phytoplankton biomass (chlorophyll-a) and nutrient concentration (Wetzel 2001). Based on the concentration of chlorophyll-a at QUL-ZOO-1 and QUL-ZOO-7 in 2022, Quesnel Lake can be classified as a mesotrophic system (2.5 to 8 µg/L; Vollenweider and Kerekes 1980; Figure 5.21; Appendix Figure E.2.7, Appendix Tables C.3.5 and C.3.6). The trophic status of Quesnel Lake in previous years post-breach (i.e., 2016 to 2018) was classified as ultraoligotrophic (<1 µg/L) while the status from 2019 to 2021 was classified as oligotrophic (<2.5 µg/L; Vollenweider and Kerekes 1980; Table 5.17; Appendix Figure E.2.7, Appendix Tables C.3.5). The increase in trophic status from oligotrophic in 2021 to mesotrophic in 2022 occurred at both the exposed (QUL-ZOO-1) and reference (QUL-ZOO-7) areas. The similarity in chlorophyll-a concentrations between the two areas in 2022 indicates this increase in productivity in 2022 (Figure 5.21, Table 5.17) was related to factors that influenced both areas in the same way (e.g., environmental factors such as temperature).

The higher chlorophyll-a concentrations observed in 2019 to 2022 compared to previous years may have resulted from a combination of different sampling timing in June and August/September (in 2016 to 2018) instead of July and changes in sampling methodology. Depth-integrated sampling methods were adopted in 2019 which differed from the surface grab sampling methods used in prior post-breach years (2016 to 2018). A specific investigation of these differing sampling methods in Quesnel Lake indicated either no difference or significantly higher chlorophyll-a concentrations in surface grabs compared to depth-integrated samples, but a similar investigation

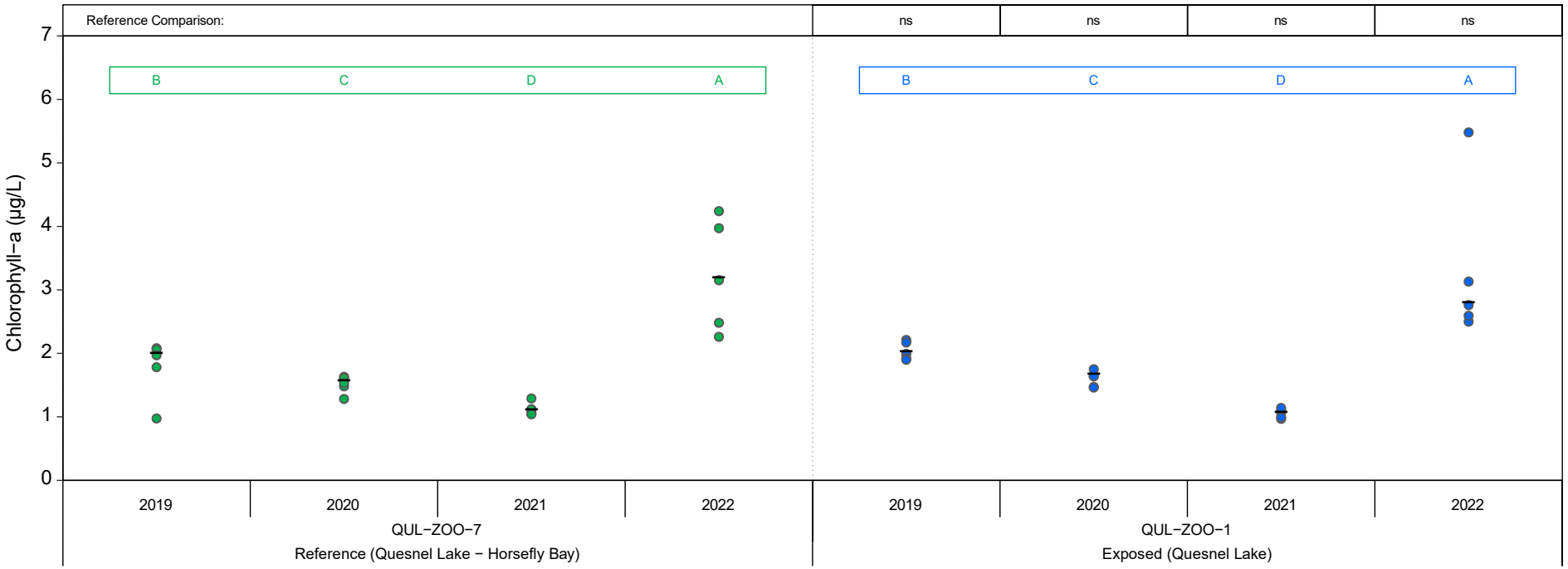

Figure 5.21: Phytoplankton Chlorophyll−a Concentrations for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference.'n c' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

in Polley and Bootjack lakes indicated significantly higher chlorophyll-a concentrations in samples collected using depth-integrated methods compared to surface sampling (Minnow 2020a). Therefore, it is plausible that the change in sampling methodology from 2019 to 2022 compared to 2016 to 2018 may have contributed to the observed increase in chlorophyll-a concentrations in 2019 to 2022.

5.2.3.2 Zooplankton

5.2.3.2.1 Community

Zooplankton densities at the exposed area (QUL-ZOO-1) and reference area (QUL-ZOO-7) of Quesnel Lake in 2022 were highest in July, while zooplankton taxon richness was highest in August at both monitoring areas (Appendix Figure E.2.10, Appendix Table C.3.7). Zooplankton density and Simpson's Evenness at QUL-ZOO-1 were both consistently similar to QUL-ZOO-7 in July from 2019 to 2022. Taxon richness was higher at QUL-ZOO-1 than at QUL-ZOO-7 in 2019, 2020, and 2022, but was lower in 2021. Simpson's Diversity at QUL-ZOO-1 was similar (2019 and 2021) or significantly higher (2020 and 2022) compared to QUL-ZOO-7 (Figure 5.22, Table 5.18; Appendix Tables C.3.7, C.3.8).

The zooplankton community at QUL-ZOO-1 (exposed) in 2022 was largely dominated by Copepod Nauplii and Rotifera in June, and by Rotifera in July and August. The June community and succession throughout summer at the exposed area was consistent with that observed at the reference area (Figure 5.23; Appendix Tables C.3.7, C.3.8). The relative density and density of dominant for zooplankton taxa groups have been similar at QUL-ZOO-1 and QUL-ZOO-7 for each of the monitoring years (2019 to 2022), with two exceptions. The relative density and density of Cyclopoida was lower at QUL-ZOO-1 than at QUL-ZOO-7 in 2019, and the relative density of Copepod Nauplii was higher at QUL-ZOO-1 than at QUL-ZOO-7 in each monitoring year and temporally stable at QUL-ZOO-1 from 2019 to 2022 (Appendix Figure E.2.11, Appendix Table E.2.4). Moreover, the relative densities of all major zooplankton taxonomic groups showed similar temporal changes from 2019 to 2022 at both QUL-ZOO-1 and QUL-ZOO-7 (Appendix Figure E.2.11, Appendix Table E.2.4). This similarity in temporal trends in community structure at the exposed and reference areas indicates these changes were likely driven by natural variability in environmental parameters that affected the two areas similarly (e.g., water temperature, nutrient availability, and phytoplankton community; Appendix Figures A.1.5, C.1.5; Appendix Table C.1.5). The densities of the major zooplankton taxonomic groups showed very similar spatial and temporal patterns to relative density data (Appendix Figure E.2.11; Appendix Tables C.3.7, C.3.8, and E.2.4).

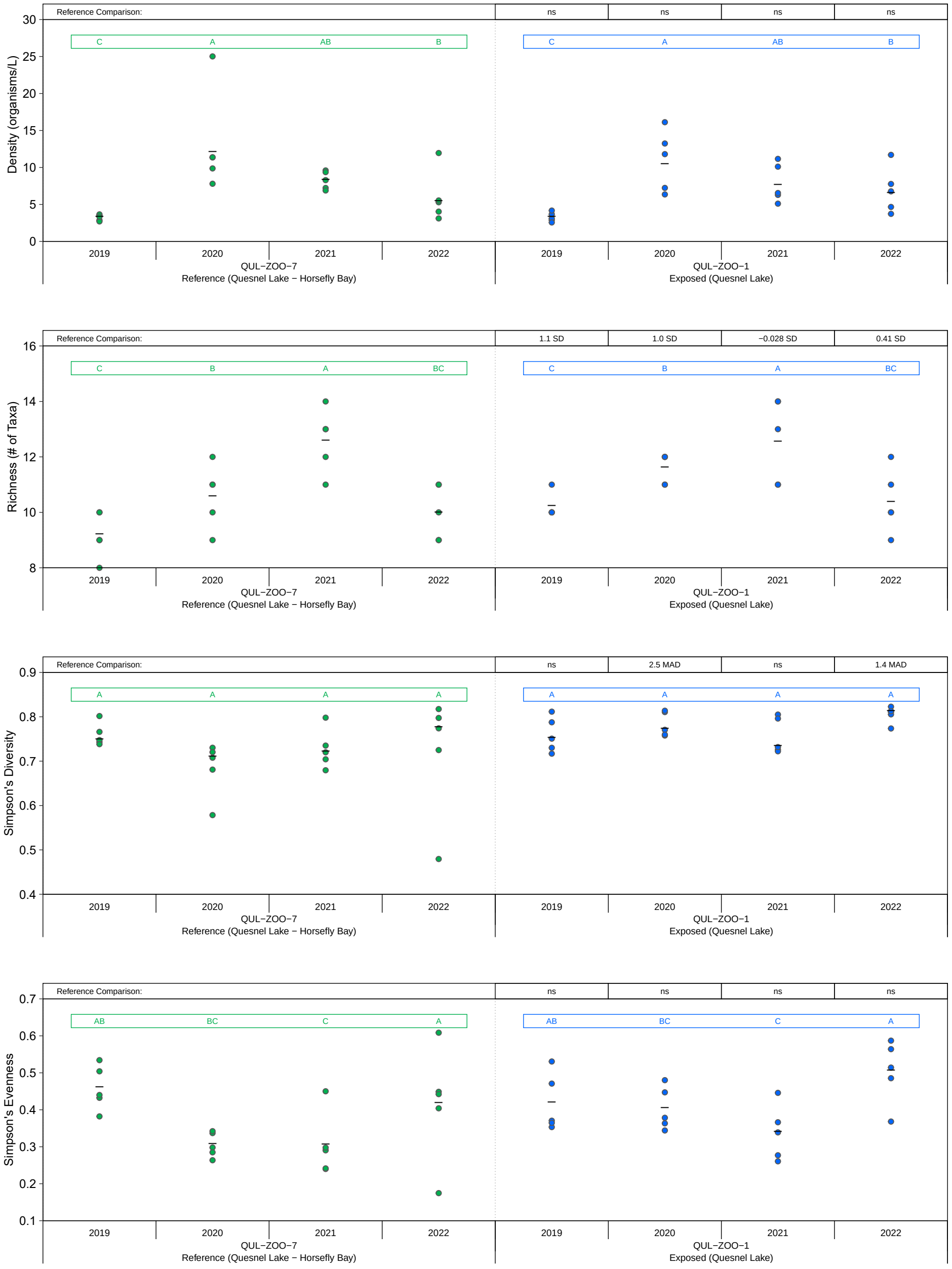

Figure 5.22: Zooplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non −significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.7.

Table 5.18: Results of Statistical Comparisons of Zooplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Mean	MCT[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
										Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Interaction						2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Density (organisms/L)	log10	0.903	<0.001	0.741	Reference	QUL-ZOO-7	2019	3.21	3.20	C	A	AB	B	Baseline	3.8	2.7	1.5	ns
							2020	13.1	12.0									ns
							2021	8.27	8.20									ns
							2022	5.98	5.30									ns
					Exposed	QUL-ZOO-1	2019	3.27	3.20	C	A	AB	B	Baseline	3.3	2.4	1.9	
							2020	10.9	10.0									
							2021	7.84	7.50									
							2022	6.92	6.40									
Richness (# of Taxa)	log10	0.052	<0.001	0.544	Reference	QUL-ZOO-7	2019	9.20	9.20	C	B	A	BC	Baseline	1.5	3.4	ns	1.1
							2020	10.6	10.0									1.0
							2021	12.6	13.0									-0.028
							2022	10.0	10.0									0.41
					Exposed	QUL-ZOO-1	2019	10.2	10.0	C	B	A	BC	Baseline	1.4	2.2	ns	
							2020	11.6	12.0									
							2021	12.6	12.0									
							2022	10.4	10.0									
Simpson's Diversity	rank	-	-	0.092	Reference	QUL-ZOO-7	2019	0.759	0.750	A	A	A	A	Baseline	ns	ns	ns	ns
							2020	0.684	0.710									2.5
							2021	0.727	0.720									ns
							2022	0.719	0.770									1.4
					Exposed	QUL-ZOO-1	2019	0.759	0.750	A	A	A	A	Baseline	ns	ns	ns	
							2020	0.782	0.770									
							2021	0.756	0.730									
							2022	0.805	0.810									
Simpson's Evenness	none	0.114	0.003	0.271	Reference	QUL-ZOO-7	2019	0.459	0.460	AB	BC	C	A	Baseline	ns	-1.8	ns	ns
							2020	0.305	0.310									ns
							2021	0.304	0.300									ns
							2022	0.416	0.420									ns
					Exposed	QUL-ZOO-1	2019	0.418	0.420	AB	BC	C	A	Baseline	ns	-0.93	ns	
							2020	0.403	0.400									
							2021	0.338	0.340									
							2022	0.504	0.500									
Dry Weight Biomass (mg/L)	log10	0.534	<0.001	0.257	Reference	QUL-ZOO-7	2019	0.00474	0.00470	B	A	B	B	Baseline	1.4	ns	ns	ns
							2020	0.00703	0.00690									ns
							2021	0.00412	0.00390									ns
							2022	0.00382	0.00370									ns
					Exposed	QUL-ZOO-1	2019	0.00390	0.00380	B	A	B	B	Baseline	2.3	ns	ns	
							2020	0.00724	0.00710									
							2021	0.00327	0.00310									
							2022	0.00455	0.00450									

Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the MAD = 0, organisms/L = organisms per litre, mg/L = milligrams per litre.

[a] MCT = Measures of Central Tendency. Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log $_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Remediated Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

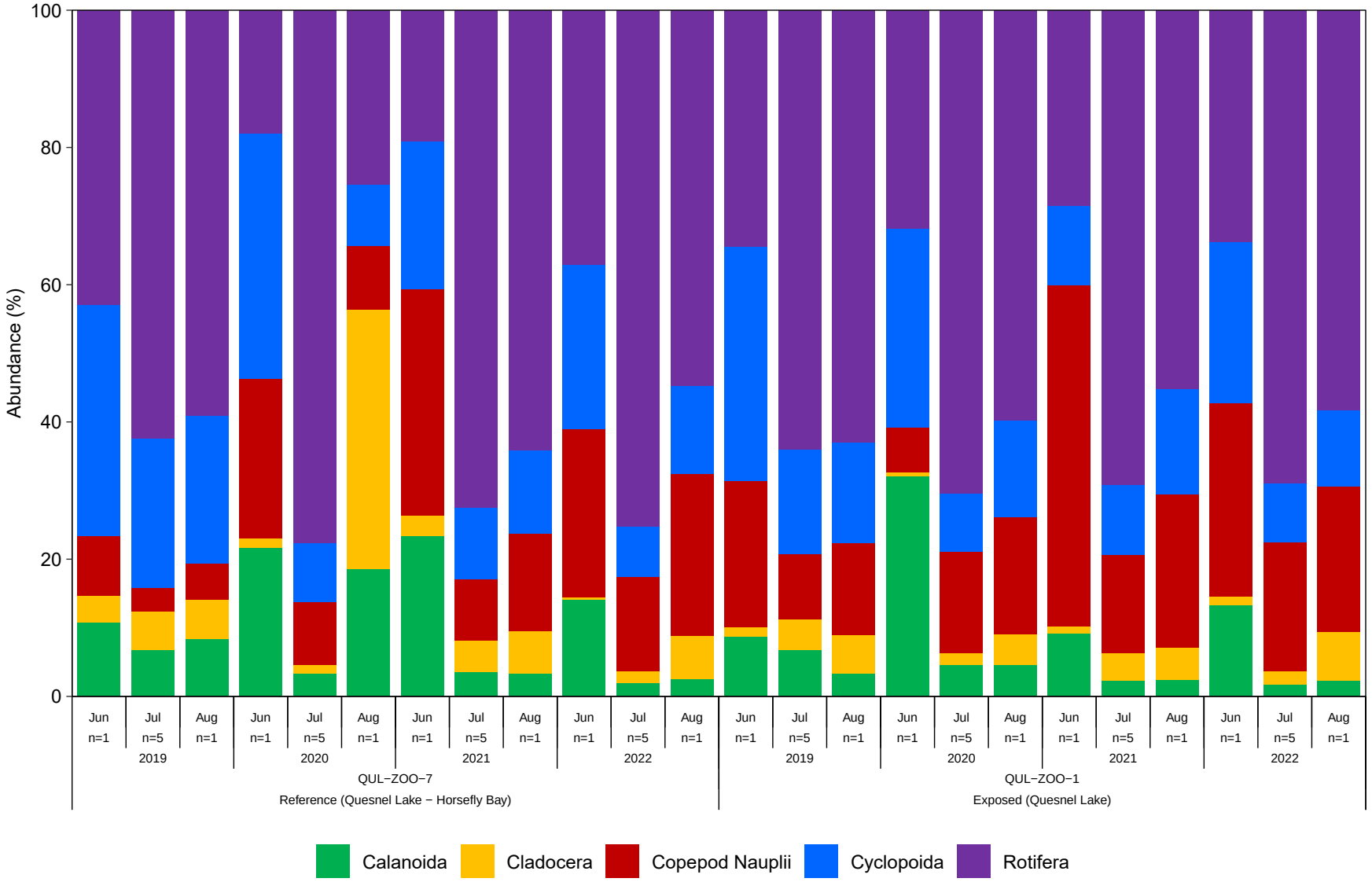

Figure 5.23: Relative Mean Densities of Major Zooplankton Community Taxonomic Groups for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2019 to 2022

Overall, zooplankton communities were very similar at the exposed and reference areas of Quesnel Lake in 2022, as all community metrics were statistically similar at both areas with the exceptions of higher taxon richness, higher Simpson's Diversity, and higher relative density and density of Copepod Nauplii relative to reference. While there was variability in community metrics when comparing 2019 to 2022 data, the changes (i.e., direction and relative magnitude) were generally the same at both QUL-ZOO-1 and QUL-ZOO-7, suggesting that changes in the zooplankton community were largely driven by environmental conditions common between both areas (e.g., water temperatures and nutrient concentrations). The similarity of zooplankton communities between the exposed and reference areas for most endpoints and temporal stability of those endpoints that differed between the areas (i.e., Copepod Nauplii) from 2019 to 2022 are suggestive of a lack of mine-related influence on the zooplankton community of Quesnel Lake.

5.2.3.2.2 Productivity

Zooplankton total biomass (dw) in 2022 was highest in July and June at QUL-ZOO-1 and QUL-ZOO-7, respectively, and lowest in August at both areas (Appendix Figure E.2.10, Appendix Table C.3.7). Mean total zooplankton biomass (dw) was consistently similar between QUL-ZOO-1 and QUL-ZOO-7 from July 2019 to 2022 (Figure 5.24, Table 5.18; Appendix Tables C.3.7 and C.3.8). The similar temporal changes in zooplankton biomass at both areas (i.e., significantly higher in 2020 than in 2019, 2021, and 2022 at both areas) was likely driven by natural variability in environmental parameters similar between the two areas (e.g., water temperature, nutrient availability, and phytoplankton community; Appendix Figures A.1.5, C.1.5, Appendix Table C.1.5). The consistent similarity in zooplankton productivity between exposed and reference areas throughout this period is indicative of a healthy lentic system and sufficient food for fish (Jeppesen et al. 2011).

5.2.4 Zooplankton Tissue Quality

Zooplankton tissue quality monitoring in 2022 was completed three times (June, July, and August) in exposed and reference areas of Quesnel Lake (Figure 3.3, Table 3.6) and replicated results from July (n=5) were statistically contrasted (see Section 3.4.3). A review of the 2022 zooplankton tissue data quality (Appendix B) indicated that these data can be used with a high level of confidence for interpretation (see Section 5.1.4 for details). A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

As indicated in Section 3.4.3, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significantly positive expose-reference difference (i.e., analytes with exposed

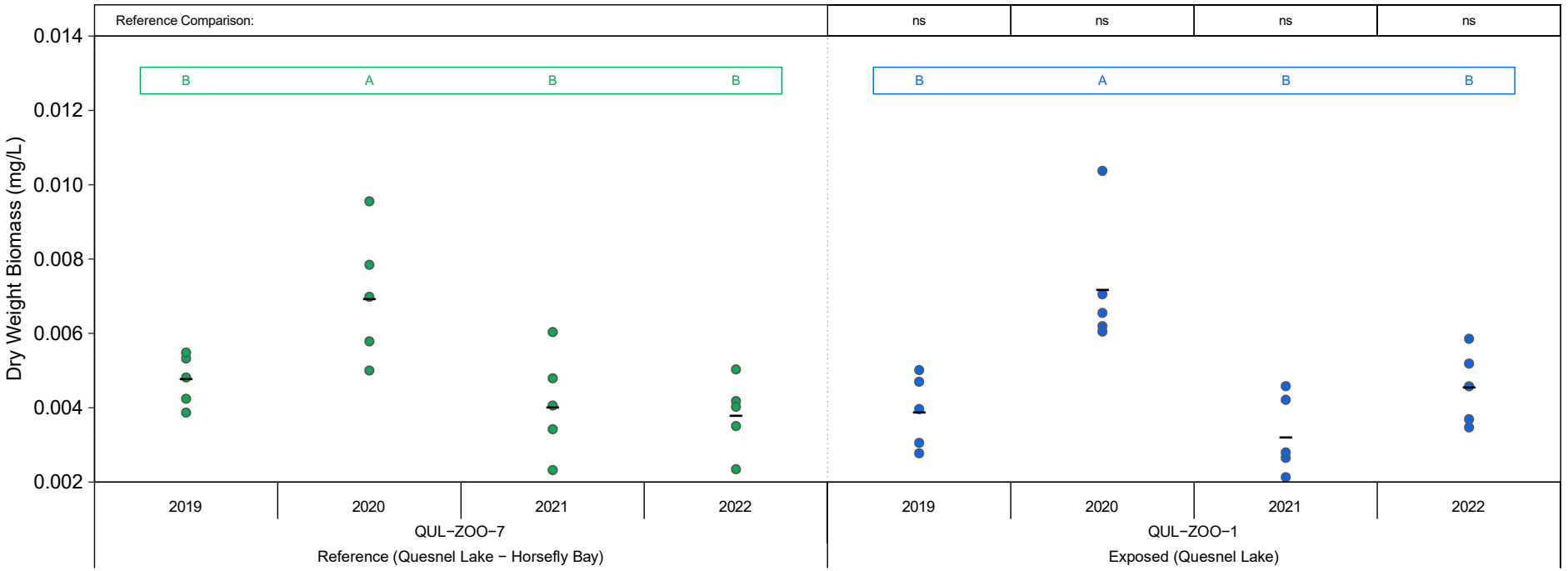

Figure 5.24: Zooplankton Biomass (Total Dry Weight) for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, o r median depending o n if analysis was conducted o n untransformed, log_{10}−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box o f the same colour d o not differ significantly within a n area. A number above the plot indicates significant exposed vs. reference posthoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.7.

concentrations significantly higher than reference) in 2022 (if the analysis *Area×Year* interaction was significant) or in all monitoring years (if the *Area×Year* interaction was not significant[56]). Zooplankton tissue from the exposed area of Quesnel Lake had concentrations of primary or secondary analytes that were similar to or lower than reference in 2022 or in all monitoring years. This has been true in each of the monitoring years evaluated statistically since 2019 (Appendix Table E.3.3). Thus, results indicate that zooplankton tissue quality in Quesnel Lake from 2019 to 2022 was unimpacted by the breach and potential effluent exposure.

Post-breach (2015 to 2022) surface water quality trends in exposed areas of Quesnel Lake also showed temporal stability for most analytes, with some exceptions. Specifically, total manganese, total phosphorus, and total and dissolved selenium, and dissolved barium, molybdenum and sodium were the only primary or secondary analytes that showed significant increasing trends from 2015 to 2022 in surface water from QUL-18 (near QUL-ZOO-1) and/or QUL-2a exposed water quality monitoring stations (Figure 3.3; Appendix Table E.3.4). Significant increasing trends in dissolved selenium and dissolved molybdenum were identified at both exposed stations (QUL-18 and QUL-2a), whereas an increasing trend was identified at only one of the two stations for the remaining analytes (QUL-18 [total manganese] or QUL-2a [total phosphorous and selenium, dissolved barium and sodium]; Appendix Figures C.1.5 to C.1.8, Appendix Tables C.1.5, E.3.4).

Although no BCWQG exists for dissolved selenium, total selenium concentrations at QUL-18 and QUL-2a remained approximately 10 times lower than the BCWQG for total selenium (2 µg/L; BCMOECCS 2021b) from 2015 to 2022 (Appendix Figure C.1.8). In addition, zooplankton selenium concentrations did not differ significantly between the exposed and reference areas in 2019 to 2022, as indicated above (Appendix Table E.3.2). Zooplankton selenium concentrations at both QUL-ZOO-1 (exposed) and QUL-ZOO-7 (reference) in 2022 were below the BC interim tissue guideline (4 mg/kg dw; Appendix Table C.4.2). Concentrations at QUL-ZOO-1 (exposed) were also below the guideline in 2019 to 2021, while results from 2015 to 2017 exceeded the guidelines (Appendix Figure C.4.2). Concentrations of selenium in zooplankton tissue at reference (QUL-ZOO-7 and QUL-ZOO-8) exceeded the BC interim tissue guideline in 2015 to 2017, 2019, and 2021, indicating that selenium concentrations in zooplankton tissue were naturally higher than the guideline in some areas of Quesnel Lake (Appendix Figure C.4.2, Appendix Table C.4.2). Of the remaining water quality analytes identified as increasing since 2015 at the exposed area(s), BCWQG exist only for total manganese (which remained well below the BCWQG from 2015 to 2022)

[56] If no significant change was detected in the exposed-reference difference among years (i.e., the *Area* x *Year* interaction was not significant), then data from 2019 to 2022 were combined for the analyses.

and phosphorus, but not for dissolved barium, molybdenum, or sodium (BCMOECCS 2021a,b; Figures C.1.5 to C.1.8). A measurable increase of these analytes in zooplankton tissue concentrations was not observed since 2019, indicating no sustained impact of the increased aqueous concentrations of these analytes on zooplankton tissue quality (Appendix Figure C.4.2). The evaluation of potential changes to plankton productivity associated with increased phosphorus concentrations is addressed in Sections 5.2.3.1.2 and 5.2.3.2.2.

To evaluate the potential impact of copper concentrations on aquatic life in Quesnel Lake, dissolved concentrations were compared to the relevant BLM-based BCWQG to calculate GEFs for dissolved copper (refer to Section 3.8.3.3 for details). The copper GEFs in surface water did not change significantly from 2015 to 2022 at any of the routine water quality monitoring stations (Appendix Figure C.1.7, Appendix Table E.3.4). The GEFs observed in 2022 for Quesnel Lake exposed (QUL-18 and QUL-2a) were typically within the range of previous years and results remained within the range of copper GEFs reported for the reference (QUL-12), which suggests there is likely little risk to aquatic life in the near term (Appendix Figure C.1.7)

5.2.5 Benthic Invertebrate Community

Benthic invertebrate community monitoring in 2022 was completed at the exposed deep near-field area of Quesnel Lake (QUL-PNF; Figure 3.2, Table 3.7). A comparable deep reference area located at Horsefly Bay (QUL-PREF1) was monitored from 2014 to 2021 (Minnow 2022a). Data for this area were displayed and incorporated in the interpretation to provide context for the temporal evaluation of QUL-PNF results where applicable (see Section 3.5.3 for details). A review of the 2022 benthic invertebrate community data quality (Appendix B) indicated excellent sampling sorting, efficiency, subsampling precision and accuracy, and taxonomic identification accuracy achieved the laboratory DQO, indicating the data were of excellent quality.

The mean benthic invertebrate density at QUL-PNF in 2022 (995 organisms/m^2) was unchanged since 2016 (i.e., temporally stable from 2016 to 2022; range = 590 organisms/m^2 in 2016 to 1,899 organisms/m^2 in 2019), but higher than densities reported in 2014 and 2015 (Figure 5.25, Table 5.19; Appendix Tables C.5.1, C.5.2, E.4.1). Density in 2022 at QUL-PNF remained much lower than the densities reported for the reference area (QUL-PREF1) in 2014 to 2021, but the difference relative to reference has steadily decreased (Figure 5.25, Table 5.19; Appendix Tables C.5.1 and C.5.2). Taxon richness in 2022 (mean = 6.2 taxa) was similar to all previous years (2014 to 2021; range = 2.2 to 8.2 taxa), indicating temporal stability since the initiation of monitoring in this area. Of the years when comparison to reference was possible, taxon richness was similar to reference in 2014 and 2019 but lower than reference in the remaining years (including the most recent sampling event in 2021; Figure 5.25, Table 5.16; Appendix Table E.4.1). Simpson's Evenness at QUL-PNF in 2022 was significantly lower than

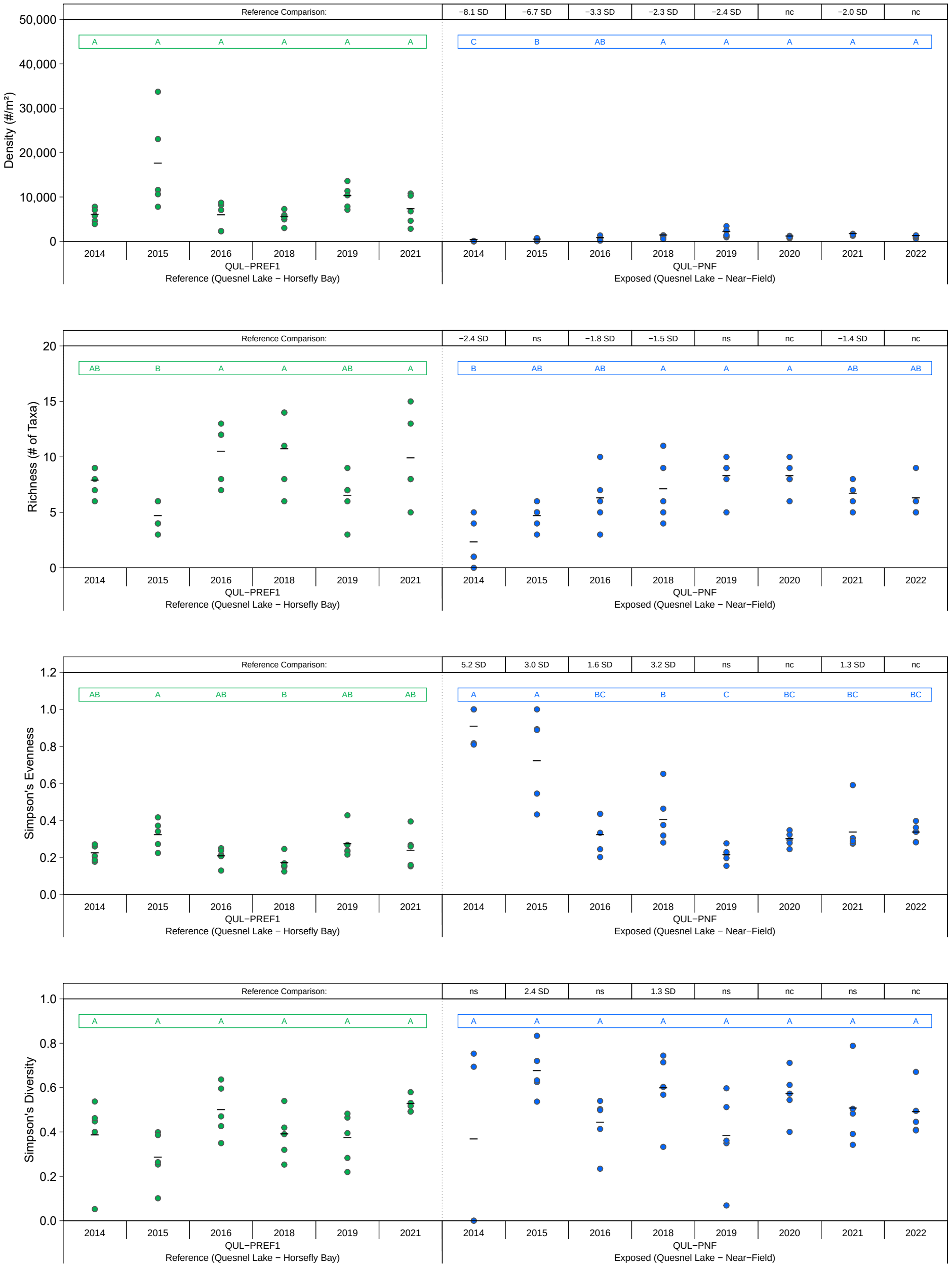

Figure 5.25: Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL−PNF (Exposed) and QUL−PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

Table 5.19: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Mean	MCT[a]	Temporal Contrasts Within Sites														Spatial Comparison Within Years
										Pairwise Comparisons Between Years								MOD Relative to Baseline[b]							
		Area	Year	Area x Year						2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022	QUL-PNF
Density (#/m²)	log10(x+1)	-	-	<0.001	Reference	QUL-PREF1	2014	5,843	5,659	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	-8.1
							2015	17,364	14,956																-6.7
							2016	5,711	4,839																-3.3
							2018	5,325	5,118																-2.3
							2019	10,065	9,787																-2.4
							2021	7,065	6,295																-2.0
					Exposed	QUL-PNF	2014	36.4	15.0	C	B	AB	A	A	A	A	A	Baseline	2.8	4.6	5.8	6.5	5.6	6.3	5.7	
							2015	216	120																
							2016	590	447																
							2018	1,061	1,009																
							2019	1,899	1,691																
							2020	915	894																
							2021	1,473	1,463																
							2022	995	957																
Richness (# of Taxa)	none	-	-	0.007	Reference	QUL-PREF1	2014	7.80	7.80	AB	B	A	A	AB	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	-2.4
							2015	4.60	4.60																ns
							2016	10.40	10.4																-1.8
							2018	10.60	10.6																-1.5
							2019	6.40	6.40																ns
							2021	9.80	9.80																-1.4
					Exposed	QUL-PNF	2014	2.20	2.20	B	AB	AB	A	A	A	AB	AB	Baseline	ns	ns	2.1	2.6	2.6	ns	ns	
							2015	4.60	4.60																
							2016	6.20	6.20																
							2018	7.00	7.00																
							2019	8.20	8.20																
							2020	8.20	8.20																
							2021	6.60	6.60																
							2022	6.20	6.20																
Simpson's Evenness	log10	-	-	<0.001	Reference	QUL-PREF1	2014	0.219	0.216	AB	A	AB	B	AB	nc	AB	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	5.2
							2015	0.324	0.316																3.0
							2016	0.206	0.201																1.6
							2018	0.168	0.163																3.2
							2019	0.275	0.266																ns
							2021	0.246	0.231																1.3
					Exposed	QUL-PNF	2014	0.907	0.902	A	A	BC	B	C	BC	BC	BC	Baseline	ns	-3.8	-3.0	-5.3	-4.1	-3.7	-3.7	
							2015	0.752	0.715																
							2016	0.329	0.315																
							2018	0.417	0.399																
							2019	0.213	0.210																
							2020	0.297	0.294																
							2021	0.347	0.330																
							2022	0.332	0.329																
Simpson's Diversity	none	-	-	0.023	Reference	QUL-PREF1	2014	0.380	0.380	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	0.281	0.281																2.4
							2016	0.496	0.496																ns
							2018	0.384	0.384																1.3
							2019	0.369	0.369																ns
							2021	0.522	0.522																ns
					Exposed	QUL-PNF	2014	0.362	0.362	A	A	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	0.670	0.670																
							2016	0.438	0.438																
							2018	0.592	0.592																
							2019	0.378	0.378																
							2020	0.568	0.568																
							2021	0.502	0.502																
							2022	0.486	0.486																

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available, "nc" = no comparison, "ns" = no significance, "nm" = Contrast MODs could not be calculated because the MAD=0, "MAD" = Median Absolute Deviation. No data available for QUL-PREF1 in 2020 or 2022, as area was not sampled.

[a] MCT = Measures of Central Tendency. Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

2014 and 2015 and temporally stable since 2016, while Simpson's Diversity showed no change between 2014 and 2022 (Figure 5.25, Table 5.16; Appendix Table E.4.1). Simpson's Evenness at QUL-PNF has remained higher than reference except in 2019, and Diversity has been similar to reference except in 2015 and 2018 when it was higher than reference (for years when comparison to reference is possible; Figure 5.25, Table 5.16; Appendix Table E.4.1).

The benthic invertebrate community at QUL-PNF in 2022 was dominated by Chironomidae, which has been observed in this area since 2014 (mean range = 46 to 91%; Figure 5.26; Appendix Figures E.4.2 and E.4.3, Appendix Table C.5.2). The relative densities of the major taxonomic groups (including Chironomidae) have shown temporal stability since 2014, except for a temporary increase in EPT proportions in 2019 (Appendix Figure E.4.2, Appendix Table E.4.1). Densities of Chironomidae at QUL-PNF have been temporally stable since 2016 and were significantly higher in 2018 to 2022 compared to 2014 and 2015. This was consistent with the stability in total organism density observed since 2016 and the significantly higher density in these monitoring years (2018 to 2022 compared to 2014 and 2015; Table 5.16; Appendix Figure E.4.2, Appendix Table E.4.1). Compared to reference, densities and relative densities (%) of EPT (taxon known to be sensitive to habitat disturbances and water pollution; Lenat 1988, Herman and Nejadhashemi 2015) and Arachnida have been similar to reference in all years. Chironomidae (%) has been similar to reference since 2018 (and in 2014), while Oligochaeta (%) was lower than reference in 2015, 2016, and 2021 (for years when comparison to reference is possible). Since 2014, densities of EPT and Arachnida have been similar to reference, while densities of Chironomidae and Oligochaeta have been lower than reference (Appendix Figure E.4.2, Appendix Table E.4.1)

Multivariate analysis (CA) was used to further evaluate temporal changes in community composition from 2014 to 2022 at QUL-PNF. The first two axes of the CA explained a total of 41.1% of the community variation at QUL-PNF (24.4% and 16.7% for CA Axis 1 and 2, respectively; Appendix Table E.4.2, Appendix Figure E.4.4). Evaluation of temporal changes in community composition indicated that the community QUL-PNF in 2022 only differed significantly from 2014 along CA Axis 1, and 2016 along CA Axis 2 (Appendix Figure E.4.4, Appendix Table E.4.2). The similarity of the benthic community composition in most monitoring years as determined by CA (except for the difference of 2016 relative to all other years along CA Axis 1) is indicative of minimal temporal changes in community composition at this area over time. This was consistent with the temporal stability observed in the proportion of major taxonomic groups over time (Appendix Figure E.4.2). Evaluation of spatial differences indicated that the community composition at QUL-PNF differed significantly from reference along CA Axis 1 in each comparable year (i.e., each year with paired reference and exposed results since 2014; Appendix Figure E.4.4, Appendix Tables E.4.1 to E.4.3). This difference was consistent with the

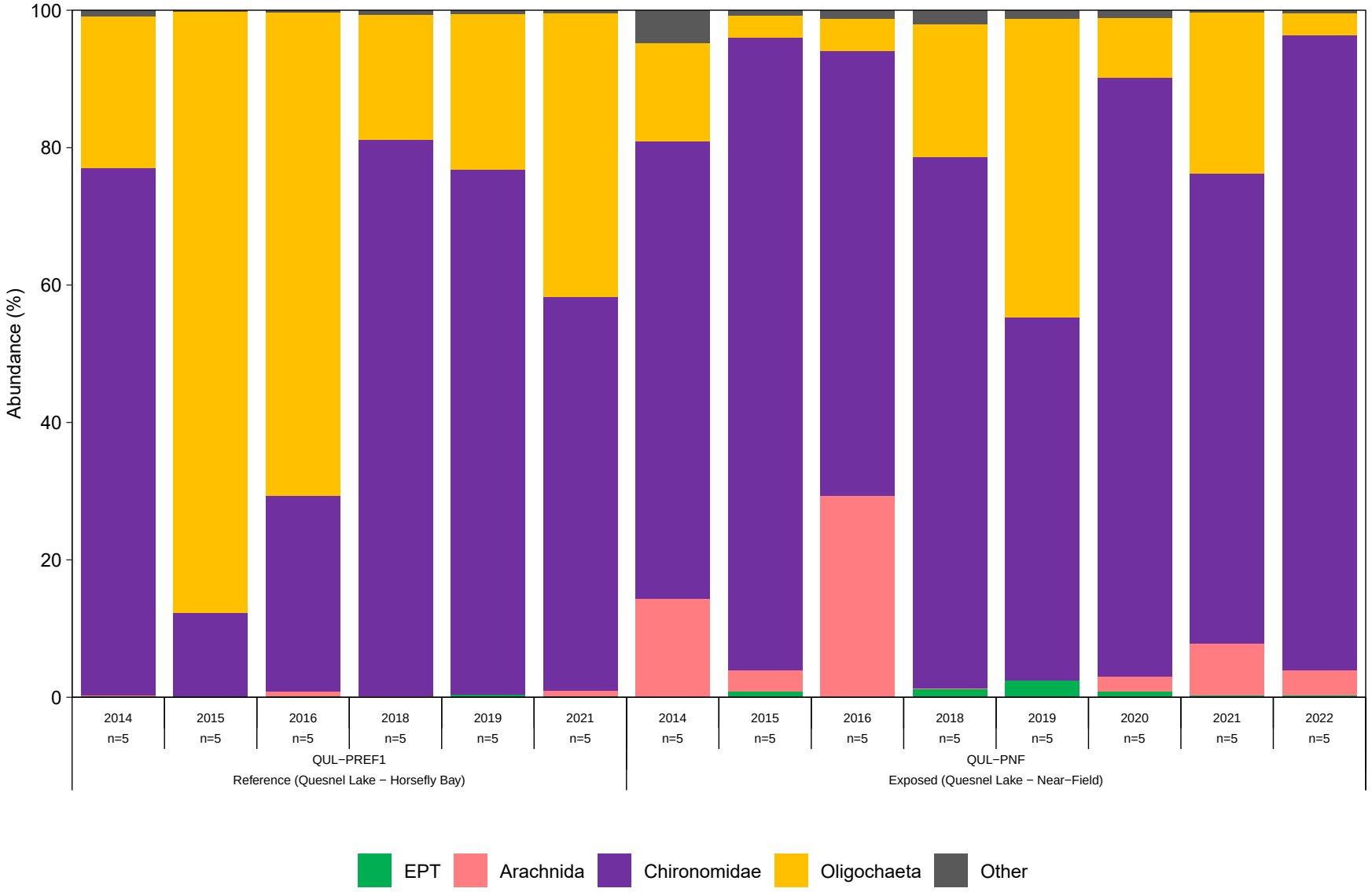

Figure 5.26: Relative Mean Densities of Major Benthic Invertebrate Community Taxonomic Groups for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

continued differences in community composition at QUL-PNF relative to reference; primarily the lower relative density of Oligochaeta. Like other metrics discussed previously, these CA results suggested some recovery of the benthic invertebrate community at QUL-PNF since the initial breach event in 2014, but that no substantial change in community from 2016 to 2021.

Benthic invertebrate community endpoints of total density, Chironomidae density, Oligochaeta density and relative density (%), and CA Axis 1 were negatively correlated with percent fines and the sediment concentration of all analytes of interest (arsenic, copper, iron, and manganese), and positively correlated with TOC and with lower concentrations of several metals as reflected by PCA Axis-1 (Appendix Figure E.1.3, E.4.5, Appendix Tables E.1.7, E.1.8, E.4.4). Richness was positively correlated with TOC and negatively correlated with the concentration of copper, whereas Evenness was negatively correlated with TOC and PCA Axis-1, and positively correlated with all analytes of interest (Appendix Figure E.4.5, Appendix Table E.4.4). Tailings-impacted sediments from the breach characteristically contained a higher proportion of fines, lower TOC content, and elevated concentrations of metals such as copper, the latter of which occurred at concentrations above the upper WSQG at QUL-PNF areas following the breach (see Section 5.2.1.1). Therefore, correlation analysis indicated that the physical and chemical characteristics of sediment at QUL-PNF, including finer particle size, lower TOC content, and elevation in concentrations of metals such as copper, were related to lower total density, richness, Chironomidae density, and Oligochaeta density and relative density compared to the reference area over time. The positive correlation between Chironomidae density, total density (which is dominated by Chironomidae) and TOC content is consistent with the documented intolerance of chironomids (*Chironomus tentans*) to sediments with TOC below 1% (Suedel et al. 1993), and poor survival in sediments with TOC below 0.5% (Suedel and Rodgers 1994). Mean TOC content at QUL-PNF in 2022 was 0.614 ± 0.111% (see Section 5.2.1.1; Table 5.13). Specific conductance and water temperature were negatively correlated with total density, Chironomidae density, and Oligochaeta density and abundance but the incremental differences between the exposed and reference areas for these measures were minor (Appendix Figure E.4.5, Appendix Table E.4.4). Similarly, dissolved oxygen was positively correlated with taxon richness and temperature was also negatively correlated with richness, Oligochaeta (%), and CA Axis 1, but these measures were minor (Appendix Figure E.4.5, Appendix Table E.4.4). Therefore, no adverse effects to the benthic invertebrate community were likely associated with differences of these parameters at QUL-PNF area over time.

Overall, temporal analysis of the benthic invertebrate community at the deep near-field area of Quesnel Lake has indicated some recovery since the initial breach event in 2014, but that no substantial change in community features has occurred from 2016 to 2022. The differences in

benthic invertebrate community structure between the exposed and reference areas that were apparent in previous years appeared related to a greater proportion of fines, lower proportion of TOC, and higher metal concentrations in sediment at the exposed areas than at the reference area; sediment properties which were consistent with the presence of breach-impacted sediments at this deep exposed near-field area.

5.2.6 Fish Community, Catchability, and Population

Total fish catches and CPUE associated with fish sampling completed in Quesnel Lake and Quesnel River in fall 2022 are summarized in Appendix Tables C.6.12 to C.6.14. The supporting *in situ* water quality measurements and habitat data recorded during fish efforts are summarized in Appendix Figure A.1.6 and Appendix Table A.1.5.

Comparisons of CPUE for hoop netting efforts in exposed and reference areas in Quesnel Lake in 2022 indicated that catchability of kokanee (*Oncorhynchus nerka)* and largescale sucker (*Catostomus macrocheilus*) were 75.5-fold and 44.9-fold higher, respectively, in the exposed fishing area near Hazeltine Creek relative to the reference fishing area Grain Creek (Appendix Table C.6.12). Rainbow trout, longnose sucker, and redside shiner were caught at the reference area but not at the exposed area near Hazeltine Creek in 2022 and were also the only species that had higher CPUE at reference area compared to exposed area (Appendix Table C.6.12). Catchability of northern pikeminnow and peamouth chub were higher in the exposed fishing area relative to the reference fishing area in 2022, which agreed with the findings from 2021 (Minnow 2022a).

Comparisons of CPUE for gill net sets in Quesnel Lake in 2022 indicated that catchability of all fish species except for kokanee and rainbow trout was lower at the exposed area near Cedar Point than at the reference area in the East Arm of Quesnel Lake (Appendix Table C.6.13). Lake trout catchability in 2022 was lower at both the reference (mean CPUE = 0.00061) and exposed (mean CPUE = 0.000058) areas of Quesnel Lake compared to 2021 (Appendix Table C.6.13). Though catchability declined between 2021 and 2022, the CPUE in 2022 was within historic range (range = 0.000033 to 0.00053 in the exposed area and range = 0.00061 to 0.14 in the reference area between 2019 and 2021; Appendix Table C.6.13; Minnow 2020a, 2021a, 2022a). The CPUE for rainbow trout in 2022 at the Quesnel River sampling area was 1.5-fold lower than 2021, 1.1-fold higher than 2020, and 2.5-fold higher than 2019 (Appendix Table C.6.14; Minnow 2020a, 2021a, 2022a).

5.2.7 Fish Tissue Quality

Fish tissue quality in 2022 was evaluated at exposed and unexposed (reference) areas of Quesnel Lake and Quesnel River (Figure 3.6, Table 3.8). In Quesnel Lake, fish tissue quality was



evaluated from northern pikeminnow and peamouth chub collected near Hazeltine Creek and lake trout collected near Cedar Point, with areas in the East Arm (lake trout) and near Grain Creek (northern pikeminnow and peamouth chub) of Quesnel Lake serving as reference. In Quesnel River, fish tissue quality was evaluated from rainbow trout (Figure 3.6, Table 3.8). A review of the 2022 fish tissue data quality (Appendix B) indicated that these data can be used with a high level of confidence for interpretation (see Section 5.1.6 for details).

5.2.7.1 Comparison to Guidelines and Thresholds

Mean selenium concentrations of fish muscle samples from Quesnel Lake and Quesnel River in 2022 were consistently below consumption guidelines for the protection of human health, as was the case from 2015 to 2021 (Table 5.20; Appendix Tables C.7.5 to C.7.11; CFIA 2015; BCMOE 2014). Mean mercury concentrations in 2022 were also below the human health guideline (0.5 mg/kg ww) in fish muscle from Quesnel Lake and Quesnel River, although two lake trout individuals from each of the exposed (near Cedar Point) and reference (East Arm) areas of Quesnel Lake did exceed this threshold (Table 5.20; Appendix Table C.7.5, C.7.6, C.7.9 to C.7.11; CFIA 2015; BCMOE 2014). Given the longevity of lake trout as well as their trophic position in Quesnel Lake, it is not unexpected to see some large individuals with natural muscle tissue concentrations in exceedance of the human health guideline. In fact, it has been typical that a proportion of lake trout individuals from the reference area exceed this threshold, with results from 2021, 2020, 2019, and 2018 that exceeded the guideline by 63%, 63%, 50%, and 13% respectively (Table 5.20).

Mean selenium concentrations in fish muscle or whole-body samples from Quesnel Lake and Quesnel River were below the guideline for the protection of aquatic life in 2022 (4 mg/kg dw; BCMOE 2014), except for peamouth chub from the exposed area (Table 5.21; Appendix Tables C.7.5 to C.7.11). The mean selenium concentration in muscle of peamouth chub from the exposed area of Quesnel Lake in 2022 was higher than the guideline for the protection of aquatic life (mean = 4.3 mg/kg dw; range = 4.06 to 5.88 mg/kg dw), with 63% of samples exceeding the guideline (Table 5.21; Appendix Table C.7.9). The rate of guideline exceedances in peamouth chub muscle samples from the exposed area in 2022 (63%) has increased relative to all prior years (38% in 2021, 13% in 2018 and 2015). The rate of guideline exceedances in 2022 for rainbow trout muscle from Quesnel River (13%) and northern pikeminnow whole-body from the Quesnel Lake exposed area (25%) were greater than 2021 but were within the historic range (Table 5.21). Selenium concentrations in peamouth chub muscle and northern pikeminnow whole-body from the reference area of Quesnel Lake were below the guideline for the protection of aquatic life in all years, as were selenium concentrations in lake trout muscle from both the exposed and reference areas (Table 5.21).

Table 5.20: Fish Muscle Mercury and Selenium Concentrations from Quesnel Lake (Exposed and Reference) and Quesnel River (Exposed) Relative to Human Health Consumption Guidelines, 2015 to 2022

Waterbody or Area		Species	Year/Season	Sample Size	Mercury		Selenium		
					Health Canada Human Health		BCMOE Human Health		
					Guideline = 0.5 mg/kg ww		Moderate Consumption = 14.5 mg/kg dw		
							High Consumption = 7.3 mg/kg dw		
					Mean	Frequency > Guideline	Mean	Frequency > Moderate	Frequency > High
Quesnel Lake	East Arm (Reference)	Lake Trout	Fall 2015 (Minnow 2017g)	10	0.260	10%	1.60	0%	0%
	near Cedar Point (Exposed)	Lake Trout		10	0.220	10%	1.90	0%	0%
	near Likely (Exposed)	Kokanee		8	0.0920	0%	2.40	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0646	0%	2.17	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Spring 2016 (Minnow 2017g)	8	0.150	0%	1.60	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.240	0%	2.80	0%	0%
Quesnel River (Exposed)		Rainbow Trout	Fall 2017 (Minnow 2018e)	8	0.0928	0%	3.23	0%	13%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2018 (Minnow 2019a)	8	0.139	0%	2.08	0%	0%
	East Arm (Reference)	Lake Trout		8	0.443	13%	2.21	0%	0%
	North Arm (Reference)	Kokanee		8	0.0944	0%	1.97	0%	0%
	near Cedar Point (Exposed)	Lake Trout		8	0.313	0%	2.18	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.123	0%	3.03	0%	0%
	near Likely (Exposed)	Kokanee		8	0.0873	0%	2.11	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0497	0%	2.36	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2019 (Minnow 2020a)	8	0.139	0%	2.08	0%	0%
	East Arm (Reference)	Lake Trout		8	0.481	50%	1.87	0%	0%
	near Cedar Point (Exposed)	Lake Trout		9	0.305	11%	1.76	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.137	0%	2.90	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0395	0%	2.35	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2020 (Minnow 2021a)	8	0.124	0%	1.72	0%	0%
	East Arm (Reference)	Lake Trout		8	0.625	63%	1.96	0%	0%
	near Cedar Point (Exposed)	Lake Trout		8	0.319	13%	1.87	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.144	0%	3.26	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0545	0%	1.96	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2021 (Minnow 2022a)	8	0.146	0%	1.76	0%	0%
	East Arm (Reference)	Lake Trout		8	0.632	63%	2.07	0%	0%
	near Cedar Point (Exposed)	Lake Trout		8	0.243	0%	1.77	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.182	0%	3.94	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0544	0%	2.48	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2022	8	0.163	0%	2.36	0%	0%
	East Arm (Reference)	Lake Trout		8	0.494	25%	1.90	0%	0%
	near Cedar Point (Exposed)	Lake Trout		8	0.316	25%	2.10	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	0.206	0%	4.30	0%	0%
Quesnel River (Exposed)		Rainbow Trout		8	0.0605	0%	3.00	0%	0%

Indicates mean mercury concentration greater than Health Canada's Human Health guideline for muscle tissue in fish (0.5 mg/kg dw; CFIA 2015).
Indicates mean selenium concentration greater than the BCMOE Human Health guideline for moderate fish consumption (14.5 mg/kg dw; BCMOE 2014).
Indicates mean selenium concentration greater than the BCMOE Human Health guideline for high fish consumption (7.3 mg/kg dw; BCMOE 2014).

Notes: mg/kg ww = milligrams per kilogram wet weight, mg/kg dw = milligrams per kilogram dry weight, BCMOE = British Columbia Ministry of Environment, > = greater than, % = percent, guidelines for the protection of human health were applied to edible fish tissues only (i.e., muscle) not whole body tissue results (e.g., northern pikeminnow results for 2016 to 2022).

Table 5.21: Fish Muscle Selenium Concentrations from Quesnel Lake (Exposed and Reference) and Quesnel River (Exposed) Relative to the British Columbia Guideline for the Protection of Aquatic Life, 2015 to 2022

Waterbody or Area		Species	Year/Season	Tissue	Sample Size	Selenium (mg/kg dw)	
						BCMOE Guideline (4 mg/kg dw)	
						Mean	Frequency > Guideline
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2015 (Minnow 2017g)	Whole Body	8	2.20	0%
		Redside Shiner		Whole Body	8	2.00	0%
	East Arm (Reference)	Lake Trout		Muscle	10	1.60	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	10	1.90	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Muscle	7	2.02	0%
		Peamouth Chub		Whole Body	8	3.10	13%
		Redside Shiner		Whole Body	8	2.70	0%
	near Likely (Exposed)	Kokanee		Muscle	8	2.40	0%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	2.17	0%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Spring 2016 (Minnow 2017g)	Whole Body	8	2.10	0%
		Peamouth Chub		Muscle	8	1.60	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	3.08	0%
		Peamouth Chub		Muscle	8	2.80	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow	Fall 2017 (Minnow 2018e)	Whole body	8	2.32	0%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	3.23	13%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2018 (Minnow 2019a)	Whole Body	8	1.72	0%
		Peamouth Chub		Muscle	8	2.08	0%
	East Arm (Reference)	Lake Trout		Muscle	8	2.21	0%
	North Arm (Reference)	Kokanee		Muscle	8	1.97	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	8	2.18	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	2.37	0%
		Peamouth Chub		Muscle	8	3.03	13%
	near Likely (Exposed)	Kokanee		Muscle	8	2.11	0%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	2.36	0%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2019 (Minnow 2020a)	Whole Body	8	1.60	0%
		Peamouth Chub		Muscle	8	2.08	0%
	East Arm (Reference)	Lake Trout		Muscle	8	1.87	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	8	1.76	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	3.36	38%
		Peamouth Chub		Muscle	8	2.90	0%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	2.35	0%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2020 (Minnow 2021a)	Whole Body	8	1.82	0%
		Peamouth Chub		Muscle	8	1.72	0%
	East Arm (Reference)	Lake Trout		Muscle	8	1.96	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	8	1.87	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	3.12	25%
		Peamouth Chub		Muscle	8	3.26	0%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	1.96	0%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2021 (Minnow 2022a)	Whole Body	8	1.81	0%
		Peamouth Chub		Muscle	8	1.76	0%
	East Arm (Reference)	Lake Trout		Muscle	8	2.07	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	8	1.77	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	2.95	0%
		Peamouth Chub		Muscle	8	3.94	38%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	2.48	0%
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2022	Whole Body	8	1.83	0%
		Peamouth Chub		Muscle	8	2.36	0%
	East Arm (Reference)	Lake Trout		Muscle	8	1.90	0%
	near Cedar Point (Exposed)	Lake Trout		Muscle	8	2.10	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		Whole Body	8	3.62	25%
		Peamouth Chub		Muscle	8	4.30	63%
Quesnel River (Exposed)		Rainbow Trout		Muscle	8	3.00	13%

Indicates mean selenium concentration greater than the BCMOE guideline for muscle tissue or whole body in fish (4 mg/kg dw; BCMOE 2014).

Notes: mg/kg dw = milligrams per kilogram dry weight; BCMOE = British Columbia Ministry of Environment; > = greater than; % = percent. The guideline for the protection of aquatic life was applied to fish muscle and whole body tissue concentrations.

As indicated previously (Section 5.1.6.1), embryo toxicity is the primary mechanism of selenium-associated effects to egg laying vertebrates, the most selenium-sensitive organisms, and analysis of ovary tissue is recommended for assessing the effects of selenium on fish (e.g., Luoma and Presser 2009; Janz et al. 2010; DeForest et al. 2012; Janz 2012). Selenium analysis was completed on 19 ovary samples from Quesnel Lake and five samples from the Quesnel River in 2022. Seven peamouth chub ovary samples were collected from the exposed area of Quesnel Lake in 2022. Of these, six (86%) had selenium concentrations that exceeded the threshold for the protection of aquatic life (11 mg/kg dw[57]; BCMOE 2014), and three (43%) also exceeded the threshold for reproductive effects (Table 5.22). The rate of the guideline/threshold exceedances in these exposed peamouth chub ovary tissues was higher in 2022 than in prior years, with only a single sample previously reaching a concentration above the threshold for reproductive effects (*n*=1 [25%] in 2018; Table 5.22). It should be noted that 50% of the peamouth chub ovary samples from the reference area in 2022 were also above the threshold for the protection of aquatic life (range = 12.7 to 14.8 mg/kg dw; Appendix Table C.7.9). This suggests natural elevation of selenium in peamouth chub ovaries but was the first year that this occurred (Table 5.22). Mean selenium concentrations 80% of ovary samples from rainbow trout in Quesnel River in 2022 exceeded the guideline for the protection of aquatic life, which was within the range of previous years (range = 50 to 100%; Table 5.22; Appendix Table C.7.11)

5.2.7.2 Spatial and Temporal Comparisons

Data from Quesnel Lake and Quesnel River collected between 2015 to 2022 (Table 3.9) were compared spatially (exposed vs. reference) and temporally (annual change; see Section 3.7.3.2). These comparisons included up to 36 elements[58], four species (lake trout, northern pikeminnow, peamouth chub, and rainbow trout), and up to four tissues per species (whole-body, muscle, liver, ovary, and kidney; Appendix Figures E.6.9 to E.6.17, Appendix Tables E.6.9 to E.6.17). For Quesnel River rainbow trout (which do not have an associated reference area), temporal comparisons within this exposed area were evaluated (Appendix Figures E.7.18 to E.7.21, Appendix Tables E.7.18 to E.7.21).

Age and morphological measures (fork length and body weight) of lake trout, northern pikeminnow, and peamouth chub from Quesnel Lake, and rainbow trout from Quesnel River between 2015 and 2022 are summarized in Table 5.23 (see Appendix Tables C.6.15 to C.6.18 for detailed 2022 data). Statistical comparisons exhibited a significant *Area×Year* interaction for

[57] This guideline includes a two-fold uncertainty factor (BCMOE 2014).

[58] Silver and titanium were added to fish tissue analyses in 2020.

Table 5.22: Fish Ovary Selenium Concentrations from Quesnel Lake (Exposed and Reference) and Quesnel River (Exposed) Relative to the British Columbia Guideline for the Protection of Aquatic Life, 2015 to 2022[a]

Waterbody or Area		Species	Year/Season	Sample Size	Selenium mg/kg dw		
					Mean	Frequency > Guideline or Threshold	
						BCMOE Guideline (11 mg/kg dw)	DeForest et al. (2012) Threshold (20 mg/kg dw)
Quesnel Lake	East Arm (Reference)	Lake Trout	Fall 2015 (Minnow 2017g)	2	3.30	0%	0%
	near Cedar Point (Exposed)	Lake Trout		3	5.10	0%	0%
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		4	5.08	0%	0%
	near Likely (Exposed)	Kokanee		1	5.40	0%	0%
Quesnel River (Exposed)		Rainbow Trout		1	9.51	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2018 (Minnow 2019a)	4	9.43	0%	0%
	East Arm (Reference)	Lake Trout		1	10.1	0%	0%
	North Arm (Reference)	Kokanee		5	3.73	0%	0%
	near Cedar Point (Exposed)	Lake Trout		4	6.96	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		4	14.3	50%	25%
	near Likely (Exposed)	Kokanee		8	4.28	0%	0%
Quesnel River (Exposed)		Rainbow Trout		2	2.76	50%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2019 (Minnow 2020a)	4	9.43	0%	0%
	East Arm (Reference)	Lake Trout		3	4.22	0%	0%
	near Cedar Point (Exposed)	Lake Trout		2	9.30	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		4	9.74	25%	0%
Quesnel River (Exposed)		Rainbow Trout		1	14.1	100%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2020 (Minnow 2021a)	1	6.04	0%	0%
	East Arm (Reference)	Lake Trout		3	3.02	0%	0%
	near Cedar Point (Exposed)	Lake Trout		4	4.72	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		6	8.57	33%	0%
Quesnel River (Exposed)		Rainbow Trout		1	5.39	0%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2021 (Minnow 2022a)	4	10.3	0%	0%
	near Cedar Point (Exposed)	Lake Trout		6	4.29	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		8	9.74	25%	0%
Quesnel River (Exposed)		Rainbow Trout		1	16.2	100%	0%
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2022	6	11.2	50%	0%
	East Arm (Reference)	Lake Trout		1	4.16	0%	0%
	near Cedar Point (Exposed)	Lake Trout		5	6.43	0%	0%
	near Hazeltine Creek (Exposed)	Peamouth Chub		7	17.7	86%	43%
Quesnel River (Exposed)		Rainbow Trout		5	11.5	80%	0%

Indicates mean selenium concentration greater than the BCMOE guideline for ovary tissue in fish (11 mg/kg dw; BCMOE 2014).

Indicates mean selenium concentration greater than DeForest et al. (2012) threshold for ovary tissue in fish (20 mg/kg dw) and the BCMOE guideline.

Notes: mg/kg dw = milligrams per kilogram dry weight, > = greater than, BCMOE = British Columbia Ministry of Environment, % = percent.

[a] No female lake trout were collected from the Quesnel Lake East Arm (reference) in 2021, therefore results for lake trout from this area are not displayed in 2021.

Table 5.23: Age and Body Size Data of Fish Collected for Tissue Quality Monitoring from Quesnel Lake (Exposed and Reference) and Quesnel River (Exposed), 2015 to 2022

Waterbody or Area		Species	Year/ Season	Sample Size	Age (Years)		Fork Length (cm)		Body Weight (Grams)	
					Mean	Range	Mean	Range	Mean	Range
Quesnel Lake	near Grain Creek (Reference)	Peamouth Chub	Fall 2015 (Minnow 2017g)	8	-	-	20.3	18.8 - 21.2	93.4	80.9 - 113
	East Arm (Reference)	Lake Trout		10	10	4 - 19[a]	48.7	34.4 - 63.4	1,230	430 - 2,670
	near Cedar Point (Exposed)	Lake Trout		10	9	4 - 14	51.4	37.2 - 66.2	1,573	550 - 3,220
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		7	7.7	3 - 10	29.2	18.2 - 35.3	375	68 - 650
		Peamouth Chub		8	-	-	20.5	18.0 - 23.0	103	65 - 145
	near Likely (Exposed)	Kokanee		8	3.0	-	25.8	25.2 - 26.6	182	140 - 215
Quesnel River (Exposed)		Rainbow Trout		8	4.0	2 - 6	28.8	21.5 - 34.0	296	143 - 443
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Spring 2016 (Minnow 2017g)	8	3.0	2 - 4	11.2	9.0 - 13.0	14.0	7.8 - 21.5
		Peamouth Chub		8	10	7 - 14	21.1	20.1 - 22.3	107	84 - 142
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	3.0	-	11.4	9.8 - 13.0	13.6	8.4 - 20.0
		Peamouth Chub		8	9.0	6 - 15	20.5	18.6 - 22.9	103	66 - 150
Quesnel Lake	near Hazeltine Creek (Exposed)	Northern Pikeminnow	Fall 2017 (Minnow 2018e)	8	2.9	2 - 3	8.9	7.4 - 10.9	7.6	3.9 - 14.0
Quesnel River (Exposed)		Rainbow Trout		8	4.4	2 - 6	31.3	21.5 - 37.1	343	97 - 523
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2018 (Minnow 2019a)	8	4.0	3 - 5	13.2	11.7 - 15.6	25.7	14.3 - 39.5
		Peamouth Chub		8	8.0	5 - 12	19.4	15.6 - 21.6	94.7	51.5 - 134
	East Arm (Reference)	Lake Trout		8	19	12 - 35	59.6	55.0 - 66.5	2,306	1,700 - 3,100
	North Arm (Reference)	Kokanee		8	2.7	2 - 3	30.4	29.0 - 31.6	335	250 - 370
	near Cedar Point (Exposed)	Lake Trout		8	12	8 - 19	57.7	53.0 - 67.0	2,000	1,460 - 3,200
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	2.7	2 - 3	13.4	11.4 - 15.6	24.7	15.3 - 38.0
		Peamouth Chub		8	7.0	4 - 10	18.6	15.3 - 23.3	81.8	36.5 - 156
	near Likely (Exposed)	Kokanee		8	2.4	2 - 3	30.7	29.5 - 32.6	373	330 - 425
Quesnel River (Exposed)		Rainbow Trout		8	5.0	3 - 6	32.5	27.0 - 36.8	415	245 - 640
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2019 (Minnow 2020a)	8	4.0	3 - 5	17.5	13.2 - 23.2	69.3	23.8 - 142
		Peamouth Chub		8	8.0	5 - 10	19.2	17.4 - 21.5	87.0	58.0 - 131
	East Arm (Reference)	Lake Trout		8	18	8 - 22	56.9	49.5 - 63.9	2,134	1,610 - 2,555
	near Cedar Point (Exposed)	Lake Trout		9	12	8 - 24	59.5	50.2 - 80.0	2,739	1,450 - 6,025
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	3.0	2 - 5	15.7	12.4 - 18.9	44.2	24.6 - 74.7
		Peamouth Chub		8	7.0	4 - 10	19.2	13.8 - 24.7	90.0	30.0 - 170
Quesnel River (Exposed)		Rainbow Trout		8	4.0	3 - 5	28.1	24.6 - 34.2	254	150 - 465
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2020 (Minnow 2021a)	8	3.8	3 - 6	15.3	13.2 - 23.7	45.4	24.6 - 152.1
		Peamouth Chub		8	5.4	2 - 9	17.5	12.9 - 21.4	67.9	25.1 - 112.2
	East Arm (Reference)	Lake Trout		8	14	5 - 28	59.3	52.3 - 71.6	2,472	1,750 - 3,950
	near Cedar Point (Exposed)	Lake Trout		8	13	5 - 20	56.9	37.8 - 67.8	2,455	580 - 4,550
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	4.4	3 - 6	18.3	13.5 - 21.7	76.4	29 - 119
		Peamouth Chub		8	8.1	5 - 10	21.5	17.2 - 24.9	134.3	61 - 221
Quesnel River (Exposed)		Rainbow Trout		8	3.4	2 - 5	30.1	23.6 - 34.2	309	140 - 500
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2021 (Minnow 2022a)	8	4.9	3 - 7	17.5	13.3 - 24	62.0	21.7 - 155
		Peamouth Chub		8	7.8	5 - 12	18.8	14.7 - 23.1	79.2	41 - 144
	East Arm (Reference)	Lake Trout		8	24	13 - 44	60.6	52.6 - 68.4	2,444	1,750 - 2,850
	near Cedar Point (Exposed)	Lake Trout		8	11	7 - 13	56.4	47.5 - 61.5	1,929	850 - 2,450
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	4.6	3 - 6	17.4	13.4 - 20.8	57.1	23.5 - 92
		Peamouth Chub		8	8.0	5 - 12	21.6	19.2 - 23.5	118	77 - 160
Quesnel River (Exposed)		Rainbow Trout		8	2.8	2 - 4	29.0	20.5 - 37.3	316	114 - 660
Quesnel Lake	near Grain Creek (Reference)	Northern Pikeminnow	Fall 2022	8	2.6	2 - 4	14.8	13.5 - 16.6	41.0	36.0 - 57.0
		Peamouth Chub		8	6.3	3 - 14	20.2	17.1 - 22.8	101	66.0 - 135
	East Arm (Reference)	Lake Trout		8	12.4	7 - 19	59.1	50.0 - 65.0	2,350	1,440 - 3,100
	near Cedar Point (Exposed)	Lake Trout		8	6.6	2 - 15	55.4	42.5 - 64.5	1,981	760 - 3,400
	near Hazeltine Creek (Exposed)	Northern Pikeminnow		8	3.8	2 - 6	17.3	13.6 - 21.8	64.9	33.0 - 130
		Peamouth Chub		8	8.1	6 - 10	21.6	20.0 - 22.9	138	115 - 170
Quesnel River (Exposed)		Rainbow Trout		8	3.4	2 - 5	27.4	19.4 - 33.6	258	110 - 450

Note: - = no data / not calculated.

[a] Sample size is n = 9 for age estimate.

one or more of the physical measures for each species monitored in 2022[59]. Exposed peamouth chub sampled did not differ from those from the reference area in 2022 but were significantly longer and heavier than reference in 2020 and 2021 (Table 5.24; Appendix Table E.6.10). Relative to prior years, peamouth chub length at the exposed area in 2022 was not significantly different from any other year in the time series (2016 to 2021), while weight was significantly greater than in 2018 (Appendix Table E.6.10). Northern pikeminnow age and length at the exposed area were significantly greater relative to those at the reference area in 2022, but there was no significant difference in weight (Table 5.24). Relative to previous years at the exposed area, northern pikeminnow in 2022 were significantly older than 2021, 2019, and 2018, but had mean length and weight measures in 2022 that were higher than in 2018 (Table 5.24; Appendix Table E.6.11). Exposed lake trout were of similar length and weight to those from the reference area in 2022 but were consistently younger than reference lake trout from 2015 to 2022 (Table 5.24; Appendix Table E.6.16). Measures of length, weight, and age of Quesnel River rainbow trout did not differ temporally from 2015 to 2022 (Appendix Table E.6.20).

As indicated in Section 3.7.3, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significant positive expose-reference difference (i.e., analytes with concentrations that were significantly higher in tissues from the exposed area compared to those from the reference area) in 2022 (if the analysis *Area*×*Year* interaction was significant) or in all monitoring years (if the *Area*×*Year* interaction was not significant[60]). For most metals, there was little to no evidence of increasing metal concentrations at exposed relative to reference areas over time in Quesnel Lake (Appendix Figures E.6.9 to E.6.17, Appendix Tables E.6.9 to E.6.17) or over time in Quesnel River (Appendix Figures E.6.18 to E.6.21, Appendix Tables E.6.18 to E.6.21). The primary analytes arsenic, copper, iron, and selenium and 14 secondary analytes (barium, cadmium, calcium, manganese, mercury, molybdenum, phosphorus, sodium, strontium, tin, titanium, uranium, vanadium, and zinc) met the criteria for inclusion in data interpretation outlined above for Quesnel Lake data (Table 5.24). None of these primary and secondary analytes showed higher concentrations in zooplankton from the exposed area relative to the reference area of Quesnel Lake (Appendix Table E.3.3; see Section 5.2.4 for details).

[59] Results of the two-way ANOVA for age, fork length, and body size may differ among tissue types for the same species in the same area due to sub-sampling (i.e., the number of females sampled for ovary tissue may be a subset of the total samples) or differences in data availability across years for the different tissue types (e.g., peamouth chub kidney and ovary data were collected from 2018 to 2022 compared to 2016 to 2022 for peamouth chub muscle and liver tissue). For all species sampled for tissue in 2022, discussion of age and body size is focused on results of two-way ANOVA for muscle tissues.

[60] If no significant change was detected in the exposed:reference ratio among years (i.e., the *Area* x *Year* interaction was not significant), then data from all available years were combined for the analyses.

Table 5.24: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Fish Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake (Exposed and Reference), 2015 to 2022[a]

Parameter		Tissue	Peamouth Chub: Two-way ANOVA												Lake Trout: Two-way ANOVA												Northern Pikeminnow: Two-way ANOVA											
			Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]					
			Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period					
			2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Age		muscle	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	ns	ns	ns	ns	-31						baseline	ns	ns	ns	ns	ns	ns	-27	-26	ns	ns	43
Fork Length		muscle	baseline	ns	ns	19	ns	ns	ns	ns	ns	23	15	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	ns	23	ns	ns	ns	ns	ns	21	ns	16
Body Weight		muscle	baseline	ns	ns	89	ns	ns	ns	ns	ns	102	56	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	ns	94	ns	ns	ns	ns	ns	95	ns	ns
Primary Analytes	Arsenic	muscle	baseline	ns	-56	ns	ns	ns	77	ns	ns	119	129	ns	baseline	ns	ns	ns	ns	ns	65						baseline	-71	ns	ns	ns	ns	125	ns	ns	216	81	94
	(essential)	liver[d]	baseline	ns	ns	-68	ns	-83	94	ns	ns	ns	ns	-66	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	-66	-75	ns	ns	-	ns	-42	-58	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	291	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	32					baseline	ns	ns	ns	ns	ns	40						-	-	-	-	-	-	-	-	-	-	-	-
	Copper	muscle	baseline	-35	ns	-32	-58	ns	48	ns	33	ns	-38	ns	baseline	ns	ns	ns	ns	ns	-12						baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	(essential)	liver[d]	baseline	ns	ns	ns	ns	ns	ns	108	45	ns	ns	ns	baseline	ns	ns	-77	-82	-80	ns	ns	ns	-59	-68	-64	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	373	ns	-	ns	ns	ns	621	ns	-	231	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	24					baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
	Iron	muscle	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	ns	ns	ns	ns	-35						baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	(essential)	liver[d]	baseline	ns	ns	ns	ns	ns	55						baseline	ns	ns	ns	ns	ns	-57						-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	20					baseline	ns	ns	ns	ns	ns	-36						-	-	-	-	-	-	-	-	-	-	-	-
	Selenium	muscle	baseline	ns	ns	ns	ns	ns	79						baseline	ns	ns	-19	-27	ns	17	ns	ns	ns	-15	ns	baseline	ns	ns	ns	ns	ns	70					
	(essential)	liver[d]	baseline	ns	ns	ns	ns	ns	30						baseline	ns	-37	ns	-54	ns	ns	ns	-31	-29	-49	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	24					baseline	ns	ns	ns	-	ns	45				-	45	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	45					baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available for analysis (i.e., no data was collected for the given time period); "LRL" = majority of data were <LRL and could not be analysed; "ns" = not significant; "ww" = wet weight; Exp = exposed; Ref = reference; ANOVA = Analysis of Variance; MLE = Maximum Likelihood Estimation. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Age, fork length, and body weight results are those that are associated with muscle tissue analyses for peamouth chub and lake trout, and whole body tissue analyses for northern pikeminnow. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded from the analysis of lake trout ovary tissues.

[a] Statistical approaches included ANOVA, ANCOVA, and MLE and for each case depended on data suitability (see complete statistical results in Appendix Table E.6.9 to E.6.21). This table only presents results for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types in one or more species.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Organ in which the specific primary analyte is known to accumulate (references in Appendix Table E.6.22).

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Table 5.24: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Fish Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake (Exposed and Reference), 2015 to 2022[a]

	Parameter	Tissue	Peamouth Chub: Two-way ANOVA												Lake Trout: Two-way ANOVA												Northern Pikeminnow: Two-way ANOVA											
			Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]					
			Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period					
			2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Secondary Analytes	Barium	muscle	baseline	ns	ns	ns	ns	ns	14						<LRL	baseline	ns	ns	2,926[e]	175	<LRL	ns	ns	ns	ns	120	baseline	ns	ns	ns	ns	ns	71	ns	93	ns	ns	96
	(essential)	liver	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	<LRL	baseline	-62	ns	4,402[e]	<LRL	<LRL	ns	-49	ns	ns	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	37					<LRL	baseline	293	1,877[e]	-	ns	<LRL	-62	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	92					baseline	ns	-65	-47	-46	ns	113	164	ns	ns	ns	131	-	-	-	-	-	-	-	-	-	-	-	-
	Cadmium	muscle	baseline	<LRL	<LRL	ns	ns	ns	128	<LRL	<LRL	128			<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	baseline	ns	ns	ns	ns	ns	119					
	(essential)	liver	baseline	ns	ns	ns	ns	ns	141						baseline	ns	-74	ns	ns	ns	ns	ns	-65	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	<LRL	-	ns	ns	ns	ns	<LRL	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	173					baseline	ns	ns	ns	ns	ns	29						-	-	-	-	-	-	-	-	-	-	-	-
	Calcium	muscle	baseline	ns	ns	-48	ns	ns	ns	ns	ns	-50	ns	46	baseline	ns	ns	81	119	ns	-41	ns	ns	ns	ns	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	108	ns	ns	ns	ns	ns	ns	-42	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	-21					baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	64					baseline	ns	ns	ns	ns	68	ns	ns	ns	ns	ns	43	-	-	-	-	-	-	-	-	-	-	-	-
	Manganese	muscle	baseline	ns	ns	ns	ns	57	ns	ns	ns	-29	ns	55	baseline	ns	ns	42	92	81	-18	ns	-26	ns	58	49	baseline	ns	ns	ns	ns	ns	ns	ns	128	ns	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	20						baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	45					baseline	ns	ns	ns	ns	ns	52						-	-	-	-	-	-	-	-	-	-	-	-
	Mercury (ww)	muscle	baseline	-42	ns	-45	-36	ns	62	ns	ns	ns	ns	ns	baseline	ns	ns	ns	ns	ns	-36						-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	59						baseline	ns	-56	ns	ns	ns	-41	-36	-74	ns	-67	-44	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	ns	41	ns	ns	82	baseline	ns	ns	ns	ns	ns	-37						-	-	-	-	-	-	-	-	-	-	-	-
	Molybdenum	muscle	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	baseline	-42	-37	-50	-36	ns	ns	ns	ns	-35	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	34						baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	-17					<LRL	baseline	ns	<LRL	-	ns	<LRL	ns	ns	<LRL	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	56					baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
	Phosphorus	muscle	baseline	ns	ns	-21	ns	ns	11	ns	ns	-12	ns	ns	baseline	-17	-22	-25	-15	ns	19	ns	ns	-10	ns	30	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	17						baseline	ns	-37	ns	ns	ns	ns	ns	-32	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	28					baseline	ns	ns	ns	24	70	ns	ns	ns	ns	19	63	-	-	-	-	-	-	-	-	-	-	-	-

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available for analysis (i.e., no data was collected for the given time period); "LRL" = majority of data were <LRL and could not be analysed; "ns" = not significant; "ww" = wet weight; Exp = exposed; Ref = reference; ANOVA = Analysis of Variance; MLE = Maximum Likelihood Estimation. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Age, fork length, and body weight results are those that are associated with muscle tissue analyses for peamouth chub and lake trout, and whole body tissue analyses for northern pikeminnow. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded from the analysis of lake trout ovary tissues.

[a] Statistical approaches included ANOVA, ANCOVA, and MLE and for each case depended on data suitability (see complete statistical results in Appendix Table E.6.9 to E.6.21). This table only presents results for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types in one or more species.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Organ in which the specific primary analyte is known to accumulate (references in Appendix Table E.6.22).

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Table 5.24: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Fish Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake (Exposed and Reference), 2015 to 2022[a]

	Parameter	Tissue	Peamouth Chub: Two-way ANOVA												Lake Trout: Two-way ANOVA												Northern Pikeminnow: Two-way ANOVA											
			Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]						Magnitude of Difference in (Exposed - Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference (%)[c]					
			Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period						Post-Breach Period					
			2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Secondary Analytes	Sodium	muscle	baseline	ns	-21	ns	ns	ns	26	43	ns	ns	27	ns	baseline	ns	ns	ns	ns	40	-30	ns	-35	-30	ns	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	20						baseline	ns	-39	-51	ns	ns	ns	ns	-33	-46	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	-45	-51	ns	-37	-	111	ns	ns	60	ns	baseline	-34	-35	-39	-44	ns	59	ns	ns	ns	ns	37	-	-	-	-	-	-	-	-	-	-	-	-
	Strontium	muscle	baseline	ns	ns	-65	ns	ns	ns	ns	ns	-67	ns	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	70	ns	ns	ns	ns	-36	ns	-37	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	89	ns	ns	ns	ns	ns	ns	ns	-44	ns	-41	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	-22					baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	68					baseline	ns	ns	ns	ns	ns	-18						-	-	-	-	-	-	-	-	-	-	-	-
	Tin	muscle	baseline	ns	<LRL	700	6,823[e]	ns	ns	ns	<LRL	438	ns	ns	<LRL	<LRL	<LRL	<LRL	baseline	80	<LRL	<LRL	<LRL	<LRL	ns	64	baseline	<LRL	<LRL	-74	ns	ns	ns	<LRL	<LRL	-67	ns	ns
	(essential)	liver	baseline	ns	<LRL	1,424[e]	<LRL	329	ns	235	<LRL	1,811	<LRL	438	baseline	<LRL	<LRL	<LRL	-95[e]	ns	ns	<LRL	<LRL	<LRL	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	<LRL	baseline	<LRL	<LRL	17,495[e]	-	<LRL	ns	<LRL	<LRL	ns	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	-100[e]	32,347[e]	<LRL	ns	-	428	ns	ns	<LRL	888	baseline	-89	<LRL	1,641[e]	ns	ns	120	-76	<LRL	ns	ns	158	-	-	-	-	-	-	-	-	-	-	-	-
	Titanium	muscle	-	-	-	baseline	<LRL	-92	-	-	-	472	<LRL	ns	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	baseline	ns	<LRL	-	-	-	ns	ns	<LRL
	(essential)	liver	-	-	-	baseline	ns	<LRL	-	-	-	ns	ns	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	-	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	-	<LRL	-	<LRL	<LRL	<LRL	-	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	-	<LRL	<LRL	<LRL	<LRL	-	-	<LRL	<LRL	<LRL	<LRL	-	-	-	baseline	ns	ns	-	-	-	235			-	-	-	-	-	-	-	-	-	-	-	-
	Uranium	muscle	baseline	<LRL	ns	ns	<LRL	ns	ns	<LRL	ns	ns	<LRL	ns	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	baseline	-81	ns	ns	ns	ns	ns	-77	ns	-56	ns	ns
	(essential)	liver	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	56					<LRL	baseline	ns	ns	ns	ns	<LRL	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
	Vanadium	muscle	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
	(essential)	liver	baseline	ns	ns	ns	ns	ns	136						<LRL	baseline	-99	<LRL	-76	<LRL	<LRL	ns	ns	<LRL	-68	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	110					<LRL	baseline	ns	ns	ns	<LRL	<LRL	ns	ns	ns	ns	<LRL	-	-	-	-	-	-	-	-	-	-	-	-
	Zinc	muscle	baseline	ns	ns	ns	-29	ns	ns	ns	ns	ns	-30	ns	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	baseline	ns	ns	ns	ns	ns	-8.3					
	(essential)	liver	baseline	ns	ns	ns	ns	ns	19						baseline	ns	-47	-44	-37	-32	ns	ns	-37	-33	-25	ns	-	-	-	-	-	-	-	-	-	-	-	-
		ovary	-	baseline	ns	ns	ns	ns	-	-17					baseline	ns	ns	ns	-	ns	ns	ns	ns	ns	-	ns	-	-	-	-	-	-	-	-	-	-	-	-
		kidney	-	baseline	ns	ns	ns	ns	-	17					baseline	-27	ns	ns	ns	ns	20	ns	ns	ns	ns	36	-	-	-	-	-	-	-	-	-	-	-	-

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available for analysis (i.e., no data was collected for the given time period); "LRL" = majority of data were <LRL and could not be analysed; "ns" = not significant; "ww" = wet weight; Exp = exposed; Ref = reference; ANOVA = Analysis of Variance; MLE = Maximum Likelihood Estimation. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Age, fork length, and body weight results are those that are associated with muscle tissue analyses for peamouth chub and lake trout, and whole body tissue analyses for northern pikeminnow. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded from the analysis of lake trout ovary tissues.

[a] Statistical approaches included ANOVA, ANCOVA, and MLE and for each case depended on data suitability (see complete statistical results in Appendix Table E.6.9 to E.6.21). This table only presents results for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types in one or more species.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Organ in which the specific primary analyte is known to accumulate (references in Appendix Table E.6.22).

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Concentrations of the primary analytes arsenic, copper, iron, and selenium in the majority fish tissues from the exposed areas of Quesnel Lake were either: 1) statistically similar to reference, 2) significantly lower than reference in 2022, or 3) lacked a significant *Area×Year* interaction in the analyses (Figure 5.27, Table 5.24; Appendix Tables E.6.9 to E.6.17). The absence of a significant *Area×Year* interaction indicates that the ratio of exposed:reference concentrations did not differ among years (i.e., the geometric mean concentrations at the exposed area were trending the same as the geometric mean concentrations at the reference area). Therefore, for most fish tissues sampled from Quesnel Lake there is no evidence that concentrations of these primary analytes are increasing over time due to mine-related influence. Arsenic concentrations in northern pikeminnow whole-body tissue and copper concentrations in lake trout ovary in 2022 were both significantly higher in tissues from the exposed area relative to the reference and had a significant *Area×Year* interaction, indicating a temporal change in the ratio of exposed:reference concentrations (Figure 5.27, Table 5.24; Appendix Tables E.6.9 and E.6.11). However, in both cases the exposed:reference ratio in 2022 was similar to the baseline year (2016 for northern pikeminnow and 2015 for lake trout) indicating that the analyte concentrations in the exposed fish have not increased over time, relative to reference (Figure 5.27, Appendix Tables E.6.9 and E.6.11). It should be noted that the temporal comparison of lake trout analyte concentrations between exposed and reference sites were often challenged by low sample sizes, which is dependent on the proportion of the total sample (*n*=8) that were female (Appendix Tables C.7.5, C.7.6, E.6.9).

It is important to note that for peamouth chub no significant *Area×Year* interaction was reported for selenium concentrations in each of the tissues (muscle liver, ovary, and kidney) indicating temporal stability in these concentrations, relative to reference (Figure 5.27, Table 5.24; Appendix Tables E.6.10, E.6.12, E.6.13, E.6.15). This was despite the higher rate of guideline/threshold exceedances identified in muscle and ovary in 2022 relative to prior years (see Section 5.2.7.1) and was owing to the similar temporal variability in the selenium concentrations of tissues from exposed and reference peamouth chub. The similarity of temporal variability in exposed and reference peamouth chub tissues suggests that this variability was related to natural factors influencing both the exposed and reference areas in a similar manner. Since data are not available for these tissues from before the breach, definitive conclusions as to the potential factors influencing tissue selenium concentrations cannot be made (e.g., due to mine-exposure or due to inherent differences between the areas). Despite the fact that selenium concentrations were consistently elevated in all tissues of peamouth chub since 2016, relative to reference, there is no evidence that selenium concentrations in fish tissues from Quesnel Lake are increasing over time due to mine exposure.

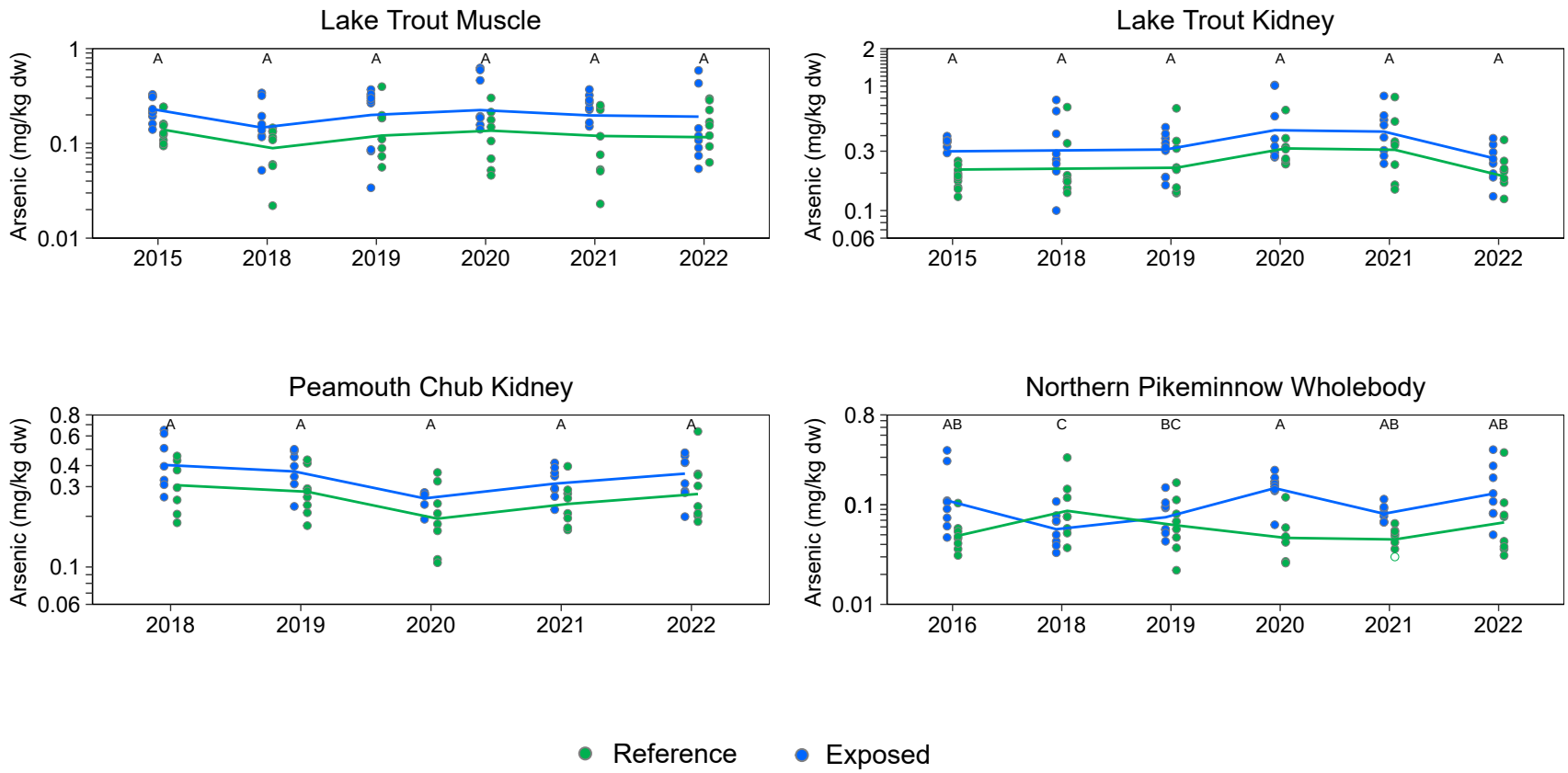

Figure 5.27: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Quesnel Lake (Exposed and Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

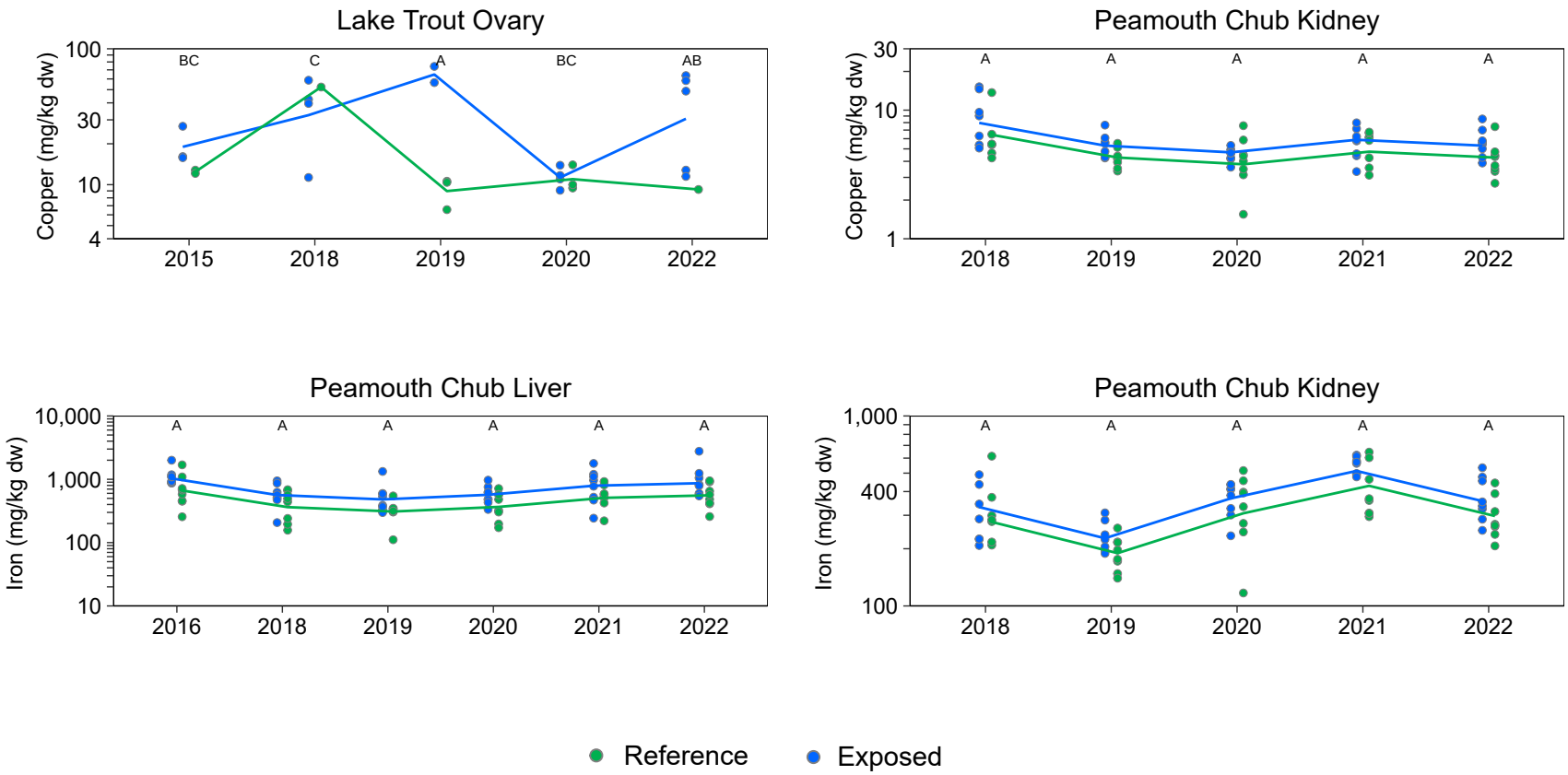

Figure 5.27: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Quesnel Lake (Exposed and Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

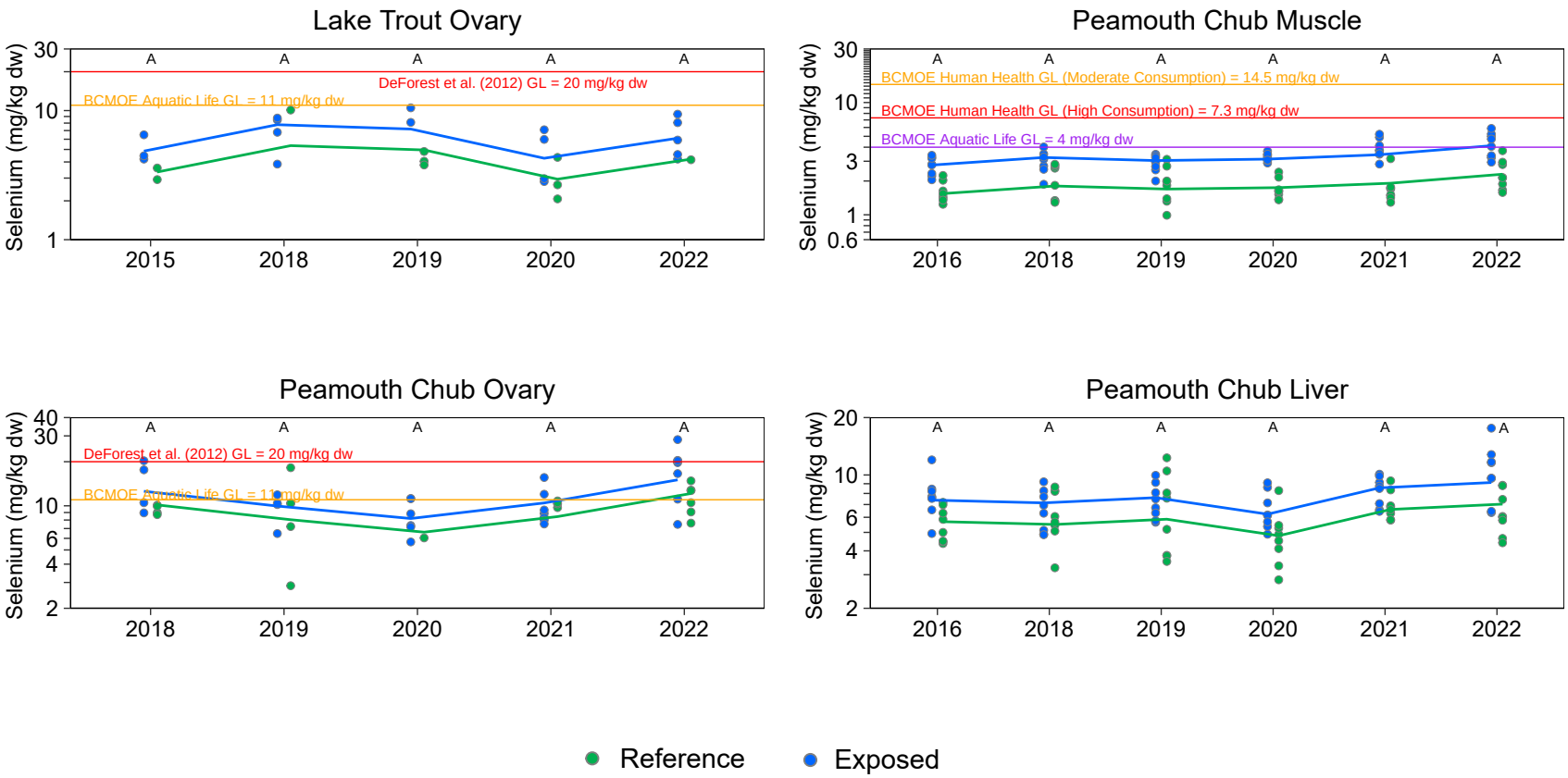

Figure 5.27: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Quesnel Lake (Exposed and Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

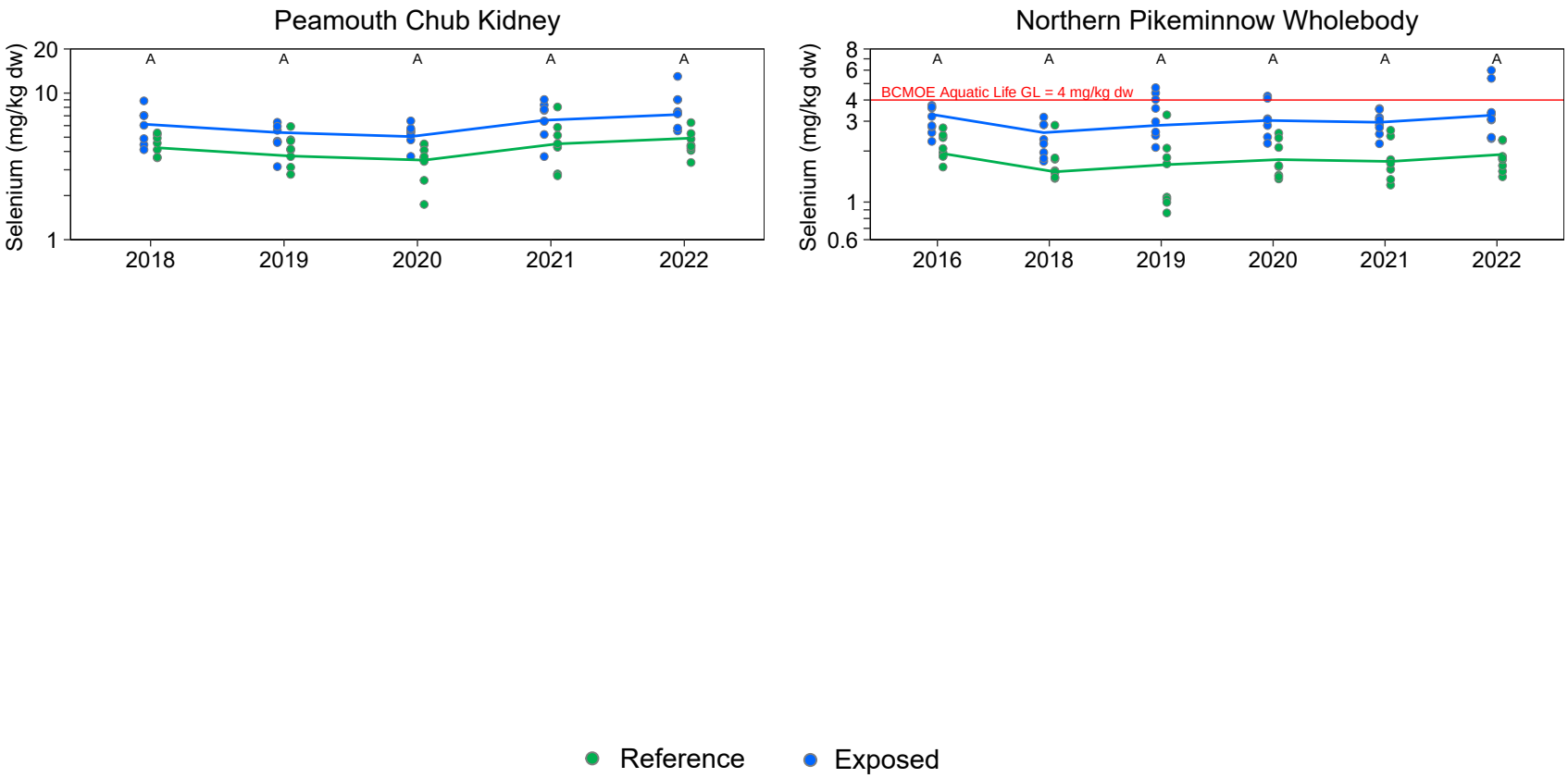

Figure 5.27: Fish Tissue Primary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Quesnel Lake (Exposed and Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for primary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

The secondary analytes, barium, cadmium, calcium, manganese, mercury, molybdenum, phosphorus, sodium, strontium, tin, titanium, uranium, vanadium, and zinc had significant interaction terms for one or more tissue types in one or more of the Quesnel Lake species (peamouth chub, northern pikeminnow, and lake trout) and/or were elevated in fish caught in the exposed area relative to the reference area in 2022 (Figure 5.28, Table 5.24; Appendix Tables E.6.9 to E.6.17). For most secondary analyte-tissue combinations for each of the three species, this difference was not indicative of an increase in concentrations over time due to mine influence. This is because the significant positive exposed-reference differences in 2022 were either not significantly different from prior years, or the *Area×Year* interaction and significant positive exposed-reference difference in 2022 was only reported in one tissue type in one species. For simplicity, only those secondary analyte-tissue combinations with a significant positive exposed-reference difference in 2022 or in all years (if the *Area×Year* interaction was not significant) in more than one tissue type within a species are discussed further (i.e., sodium, strontium, titanium, and uranium were not discussed further).

For most of the secondary analytes identified for further discussion (barium, cadmium, calcium, manganese, mercury, molybdenum, phosphorus, tin, vanadium, and zinc), there was no evidence of concentrations of these analytes increasing over time. This based on secondary analyte concentrations in the majority fish tissues from the exposed areas of Quesnel Lake were either: 1) statistically similar to reference, 2) significantly lower than reference in 2022 (if the *Area×Year* interaction in the analyses was significant), or 3) lacked a significant *Area×Year* interaction in the analyses (Figure 5.28, Table 5.24; Appendix Tables E.6.9 to E.6.17). As outlined above, the absence of a significant *Area×Year* interaction indicates that the ratio of exposed:reference concentrations did not differ among years. For instance, cadmium, molybdenum, and vanadium concentrations that were significantly higher in exposed tissues compared to reference were also temporally stable (i.e., lacked a significant *Area×Year* interaction; Table 5.24). For several secondary analytes (barium, calcium, manganese, mercury, phosphorus, tin, and zinc), some tissue types exhibited both a significant *Area×Year* interaction (i.e., a significant change in the ratio of exposed:reference concentrations over time) and higher exposed concentrations relative to reference in 2022. However, for most of these secondary analyte-tissue combinations, the analyte concentrations in exposed tissues in 2022 were similar to the baseline year, relative to reference, indicating no evidence of a mine-related temporal increase in analyte concentrations (Figure 5.28, Table 5.24; Appendix Tables E.6.9 to E.6.17). Some of these secondary analyte-tissue combinations showed increases in the exposed:reference ratio in 2022 compared to the baseline year. However, each occurred in a single tissue type within each species, and some were influenced by a high prevalence of data with results reported below the detection limit. This suggests that the observed increases may not be indicative of a persistent mine-related

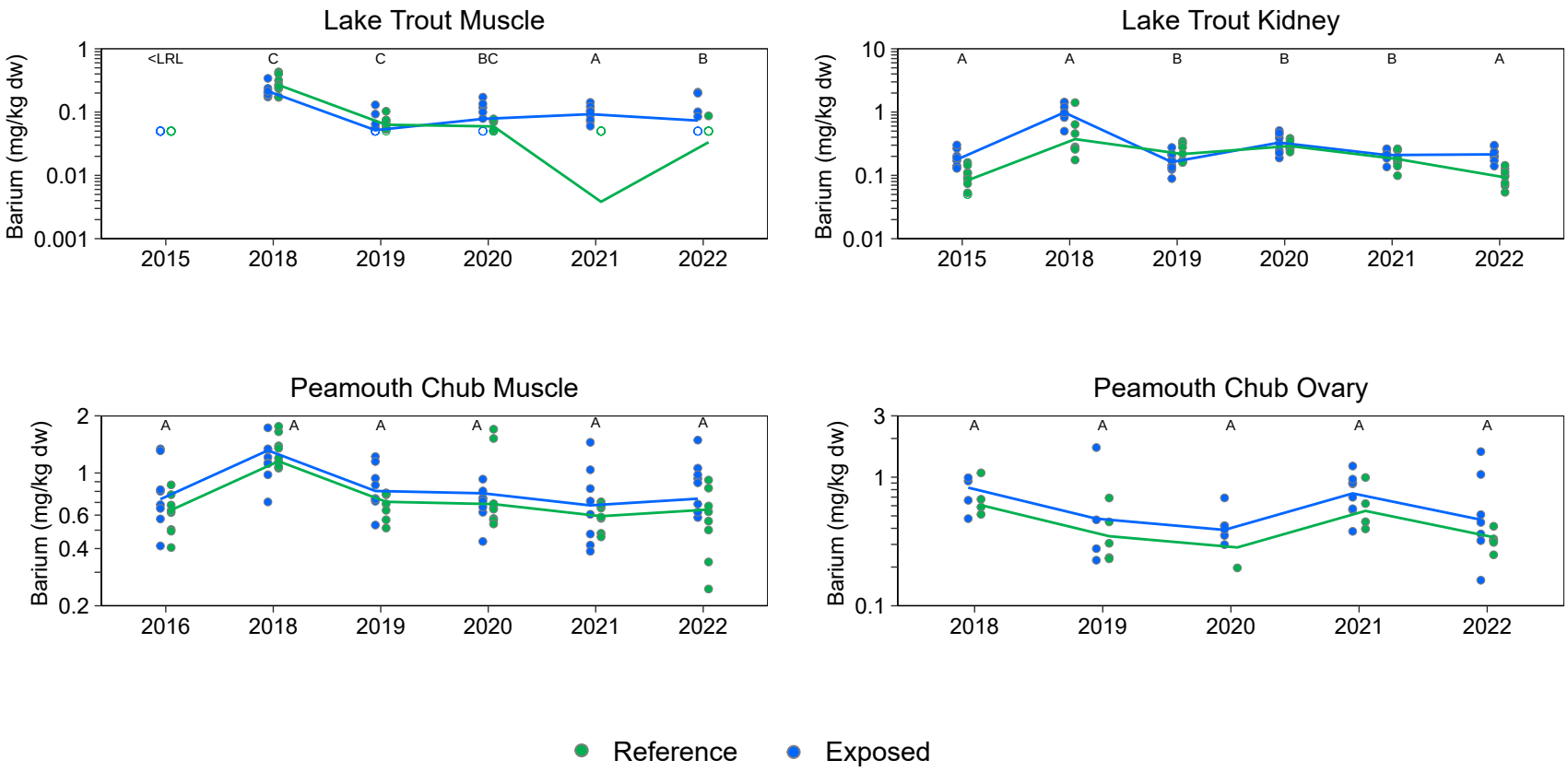

Figure 5.28: Fish Tissue Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Quesnel Lake (Exposed and Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. Plots are only included for secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given species and tissue type. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

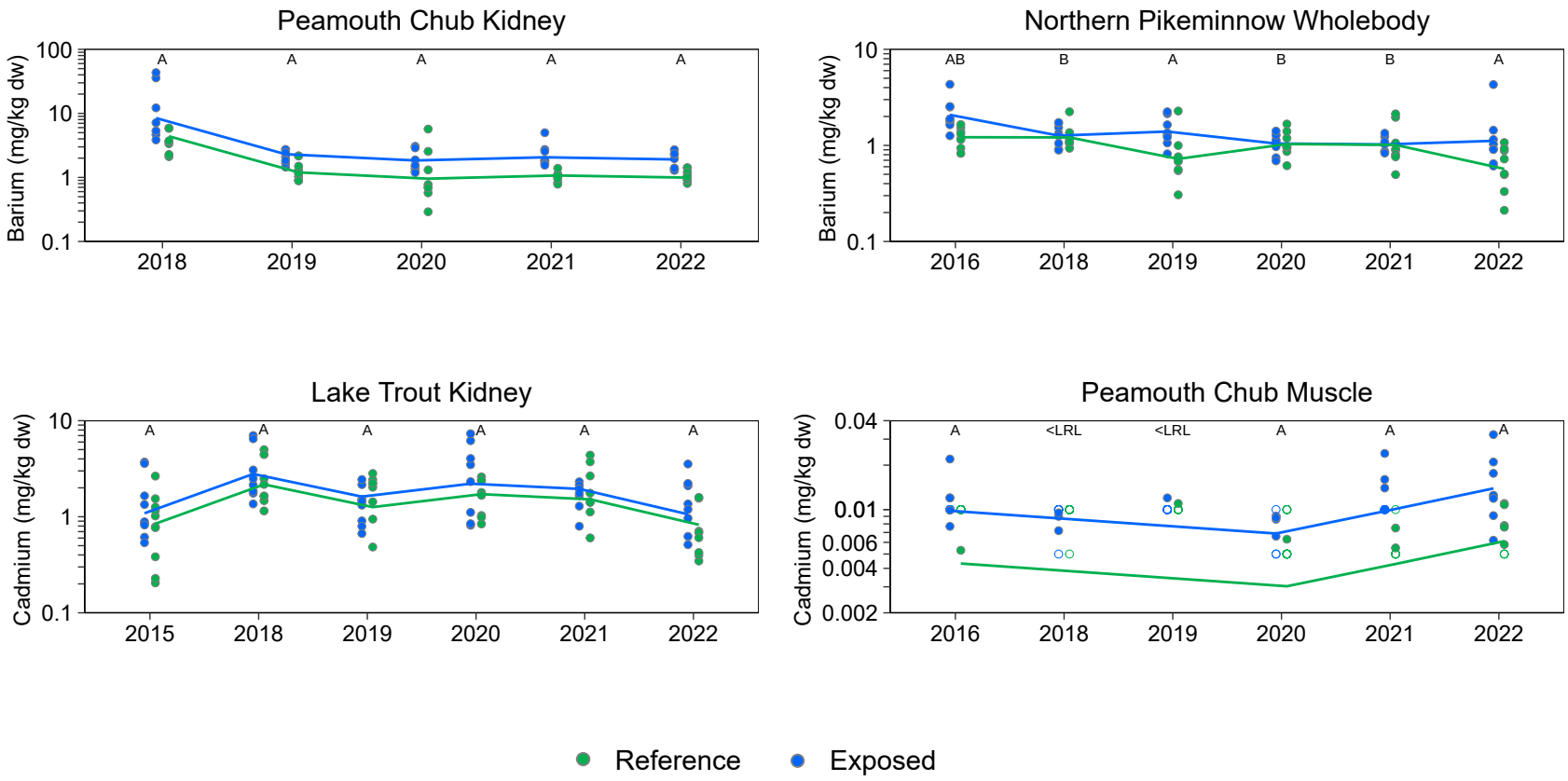

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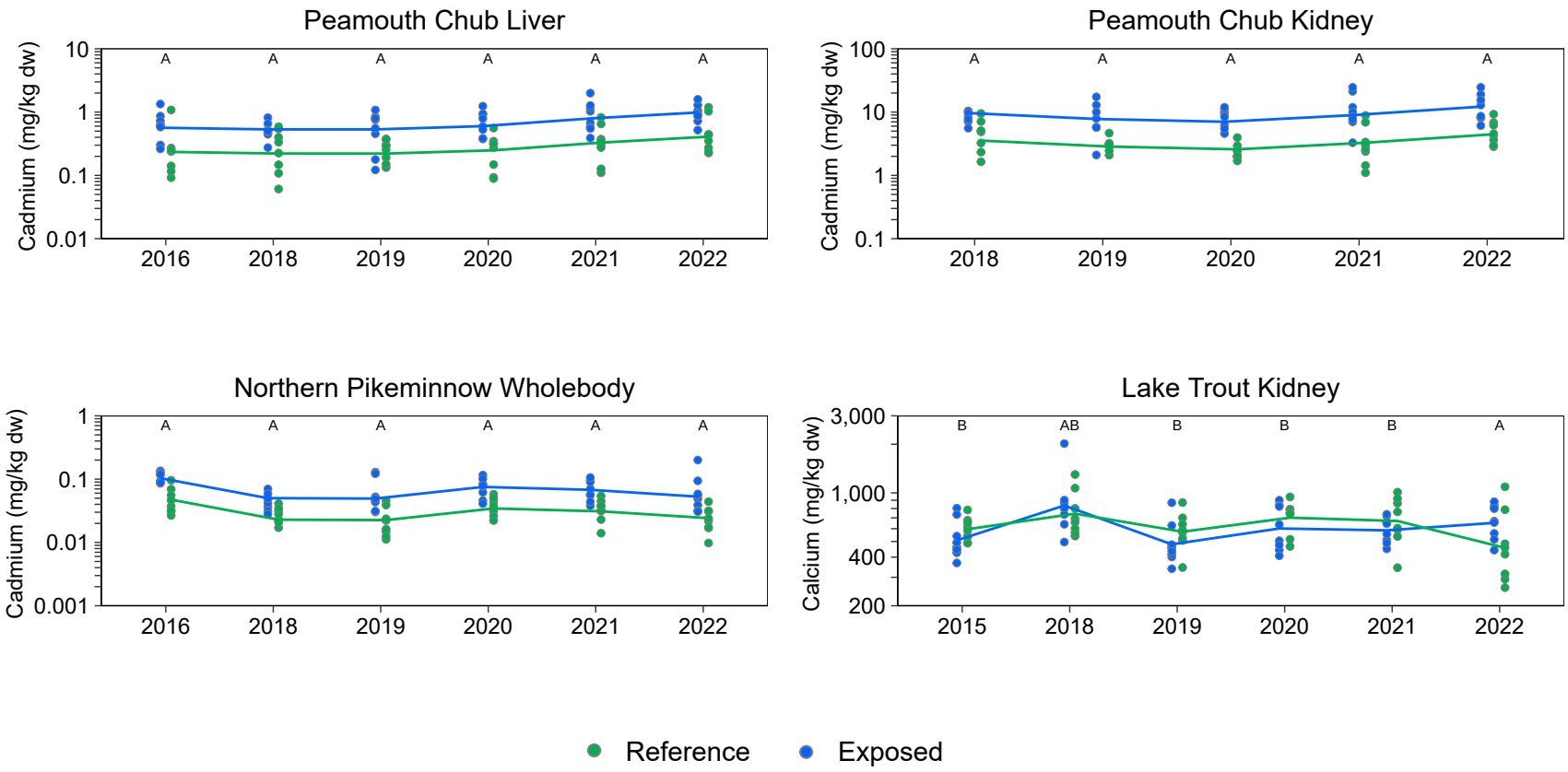

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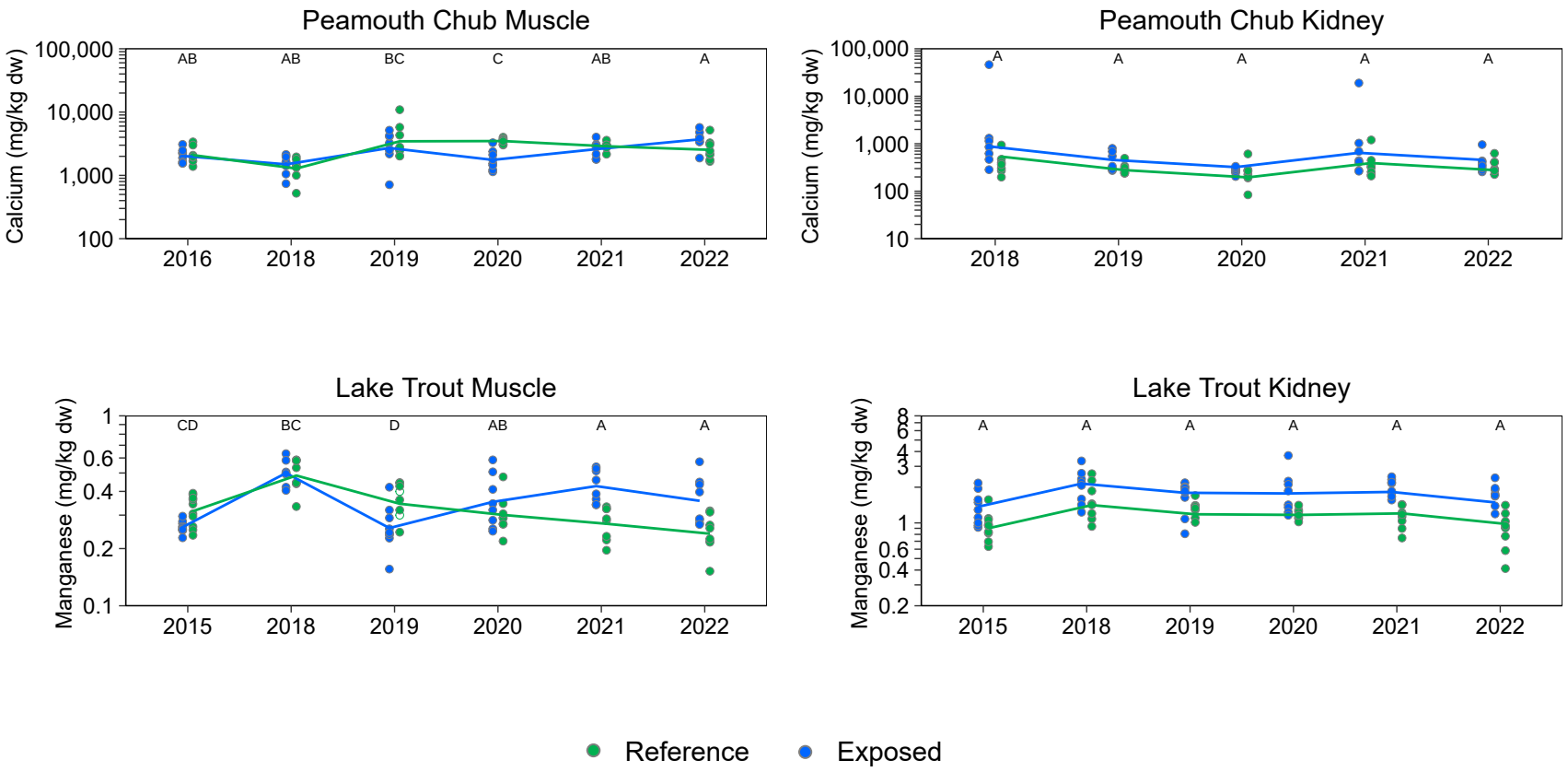

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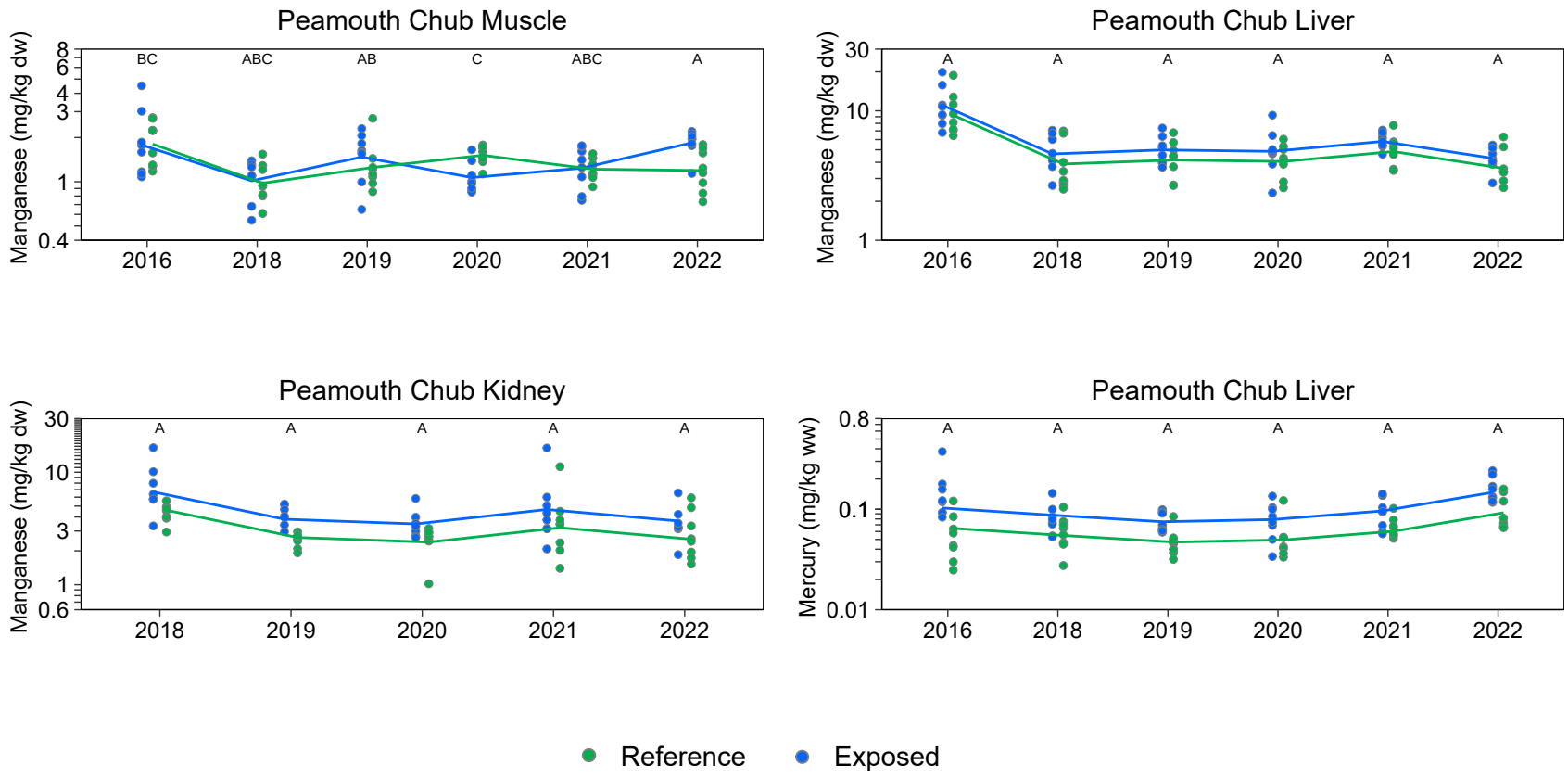

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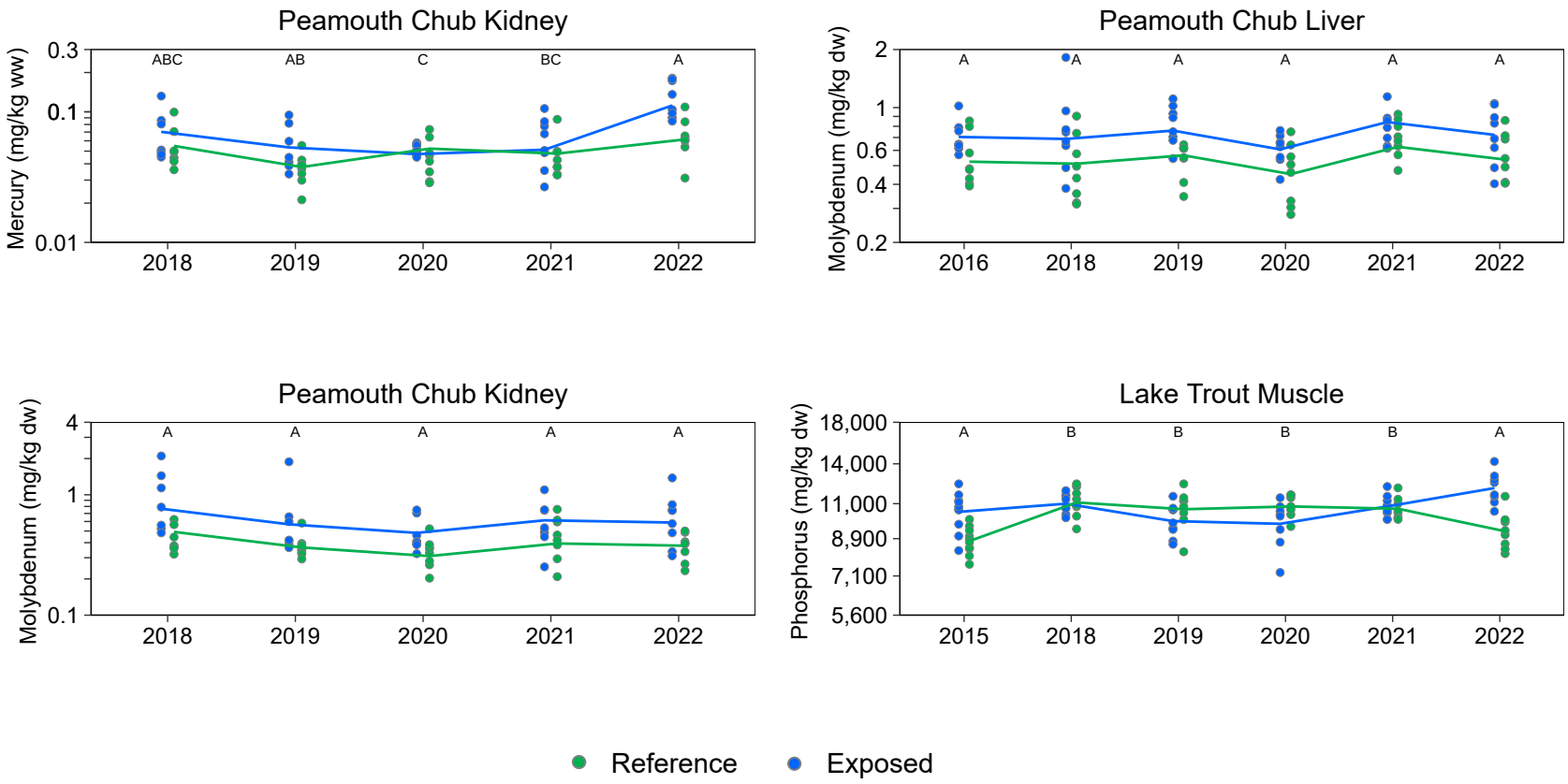

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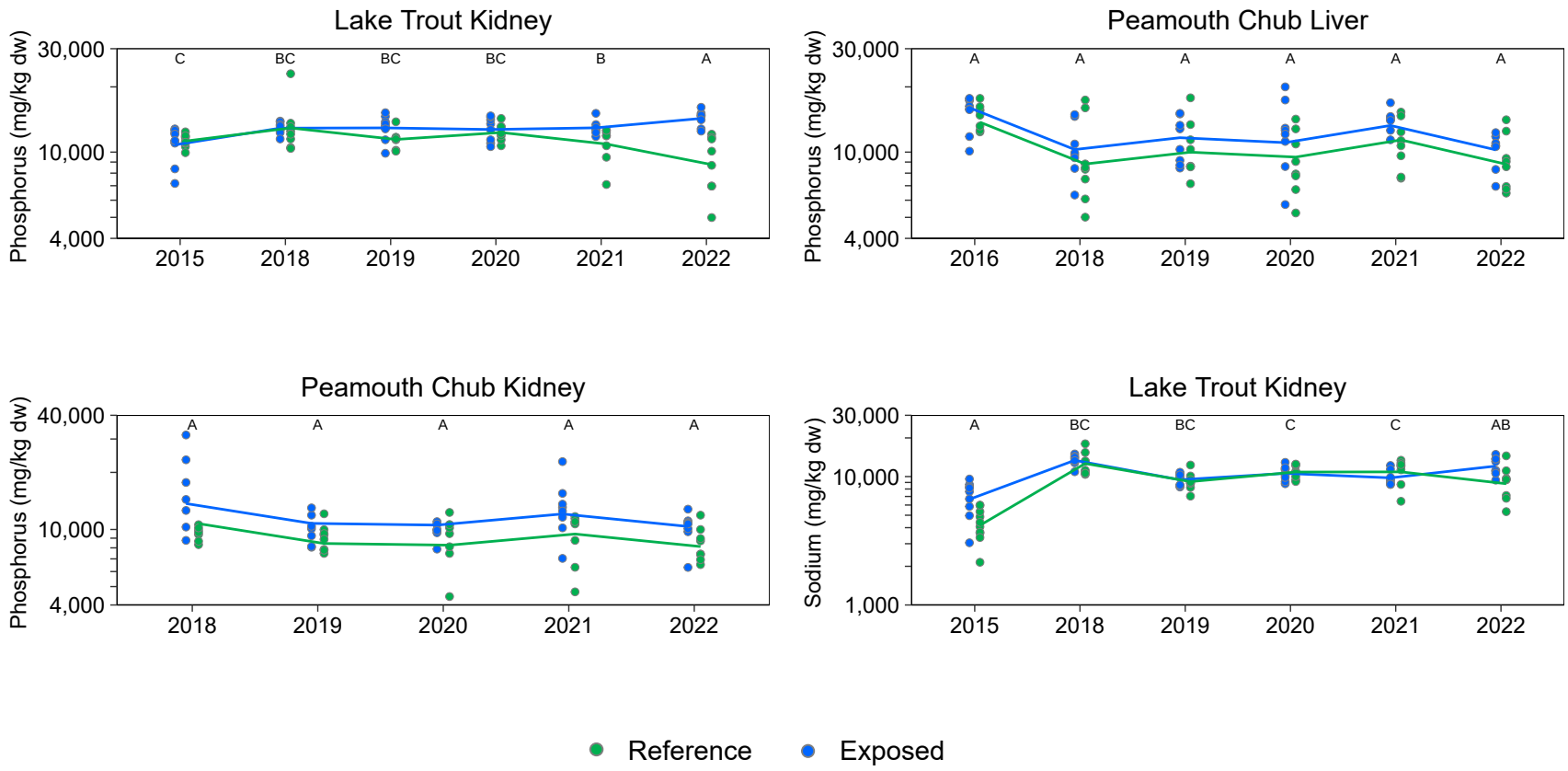

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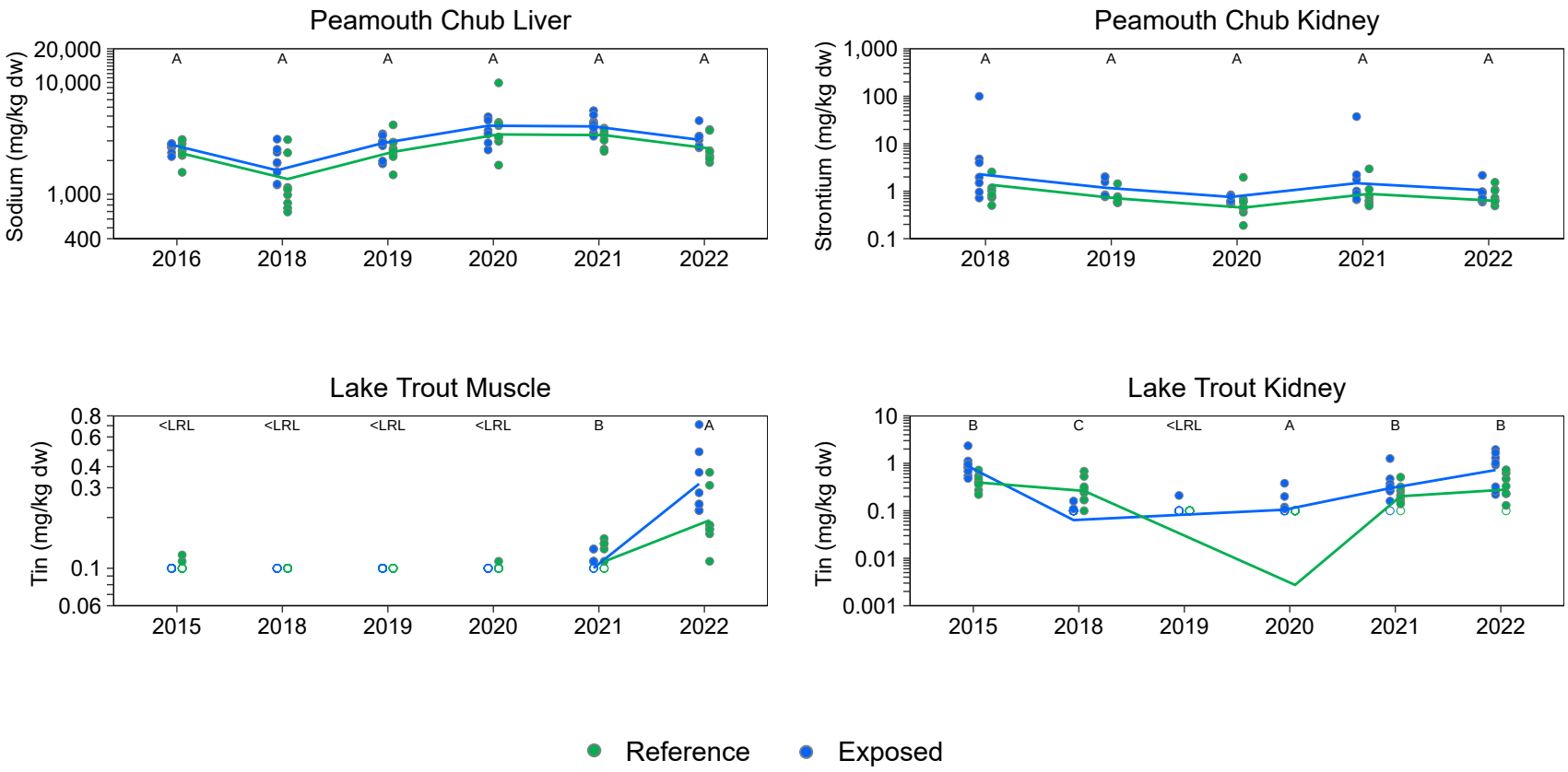

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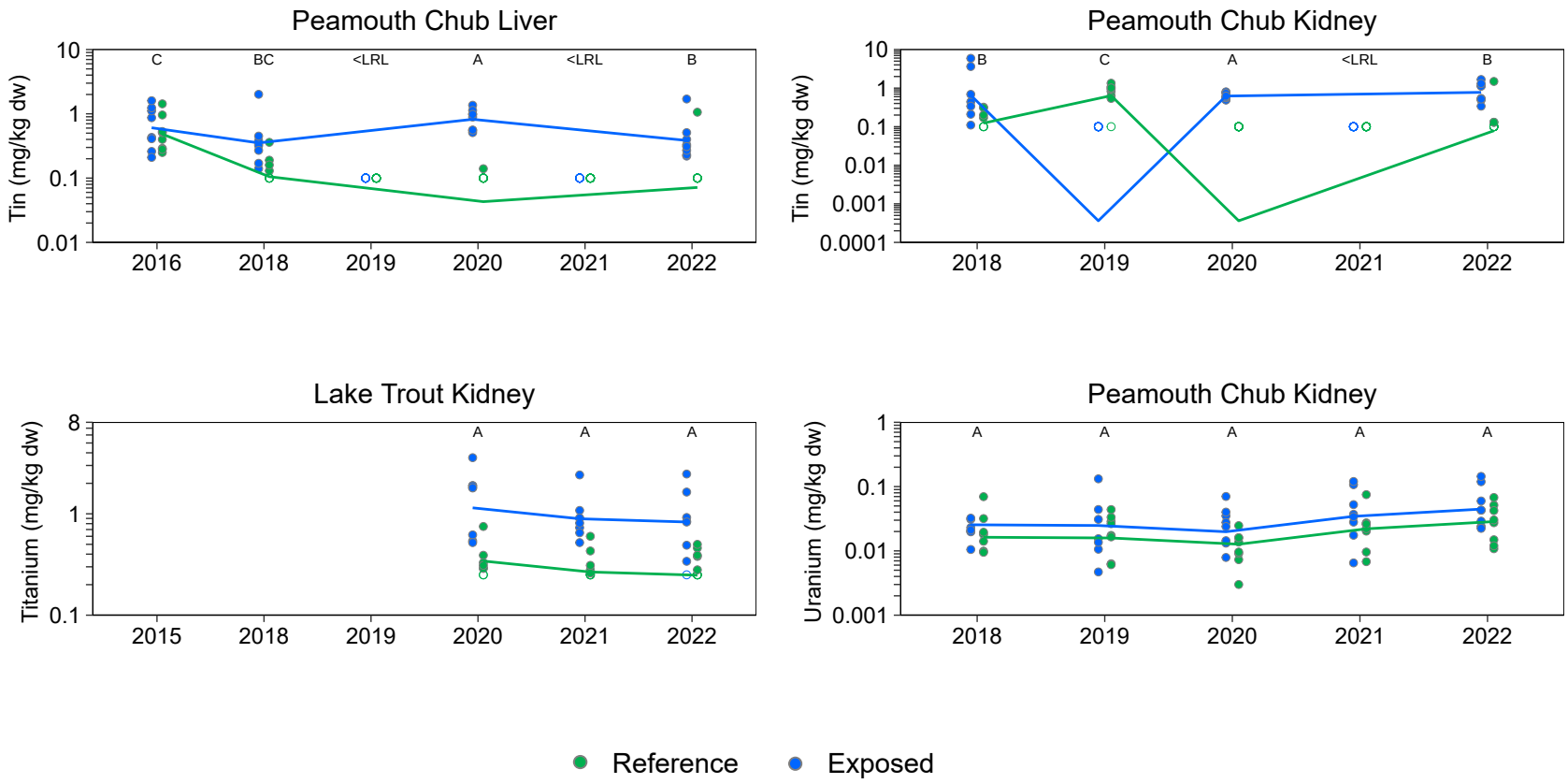

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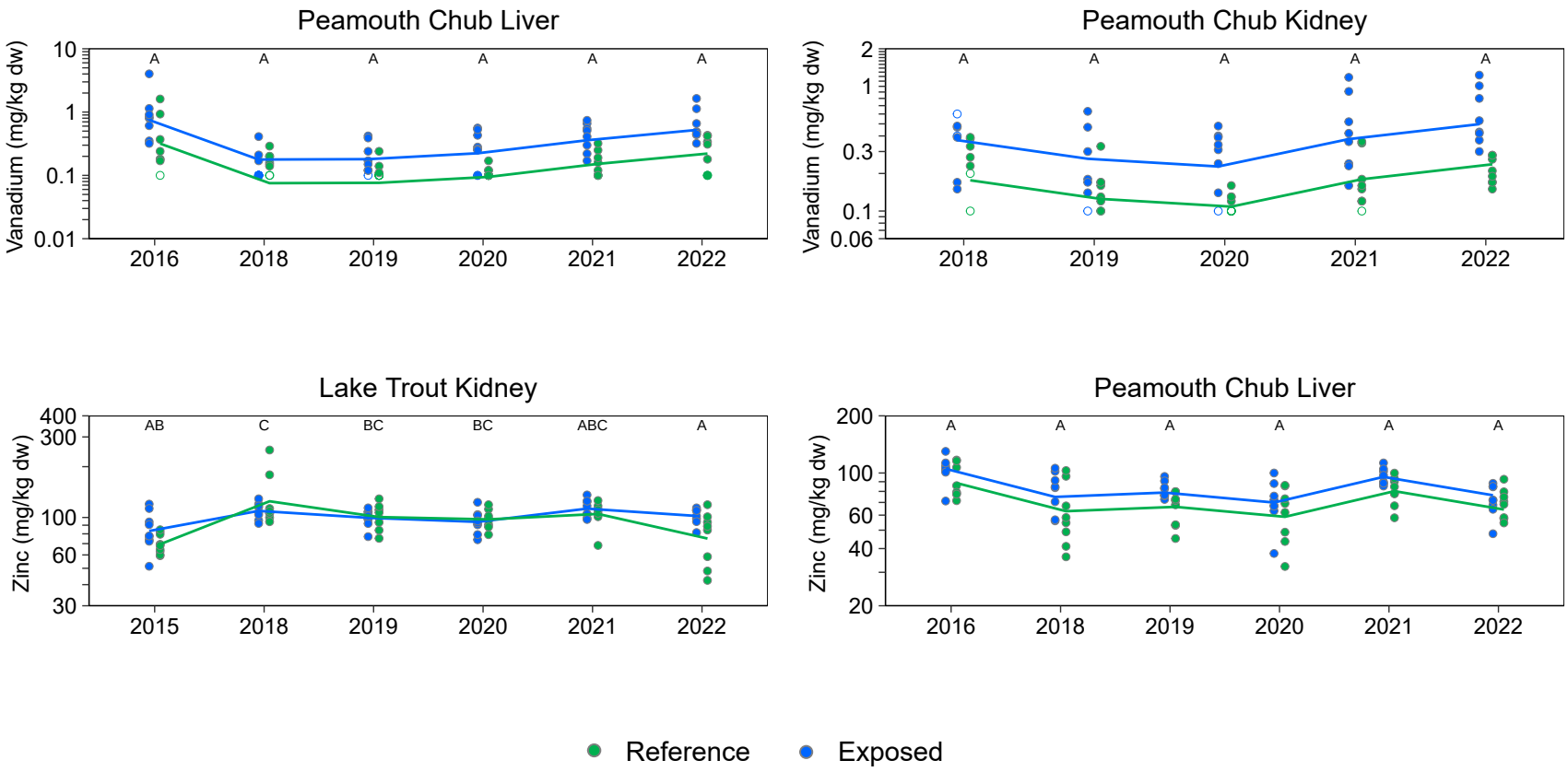

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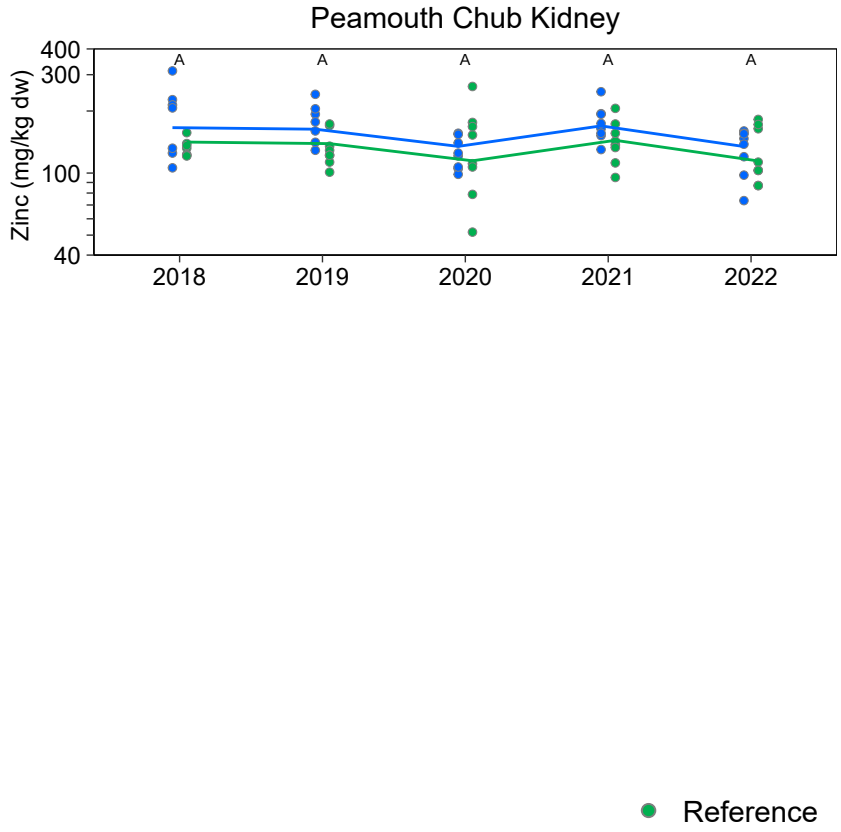

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influence which might affect all tissues within a given species. The secondary analyte-tissue combinations that showed increases in the exposed:reference ratio in 2022 compared to the baseline year are detailed below.

Barium concentrations in lake trout muscle from the exposed area were significantly higher in 2022 than in 2018 and 2019, relative to reference (Figure 5.28, Table 5.24; Appendix Table E.6.16). However, the results of temporal comparisons for barium were influenced by a relatively high frequency of results below the LRL, particularly at the reference area in 2021 and 2022. Calcium concentrations in lake trout kidney from the exposed area in 2022 were similar to 2018 but significantly higher than all other prior years (including baseline), relative to reference (Figure 5.28, Table 5.24; Appendix Table E.6.14).

Manganese concentrations in the muscle of peamouth chub and lake trout from the exposed area were significantly higher in 2022, relative to reference, than in the baseline year (Figure 5.28; Appendix Tables E.6.10, E.6.16). Specifically, manganese concentrations in peamouth chub muscle from the exposed area in 2022 was significantly higher than in 2016 and 2022, relative to reference, and 2022 was the first year where exposed area concentrations were significantly greater than reference (Figure 5.28, Table 5.24; Appendix Table E.6.10). Manganese concentrations in lake trout muscle from the exposed area in 2022 were significantly higher than in 2015 to 2019 but were similar to 2020 to 2021, relative to reference. The higher manganese concentrations in exposed lake trout muscle from 2020 to 2022 compared to 2015 to 2019, relative to reference, appears to be related (at least in part) to a steady decline in manganese concentrations at the reference site since 2018 (Figure 5.28, Table 5.24; Appendix Table E.6.16).

Phosphorus concentrations in lake trout kidney from the exposed area of Quesnel Lake were significantly higher in 2022 compared to all prior years (2015 to 2021), relative to reference. This appears to be related to both a slight increase in the phosphorus concentrations in lake trout muscle from the exposed area combined with a slight decrease in the reference results from 2020 to 2022 (Figure 5.28, Table 5.24; Appendix Table E.6.14).

Tin concentrations in peamouth chub liver and lake trout muscle from the exposed area were higher in 2022, relative to reference, than in the baseline year. For peamouth chub liver specifically, tin concentrations in the exposed tissues in 2022 were higher than in baseline (2016) but similar to or lower than the following years (2018 and 2020; when sufficient detectable data were available for analyses), relative to reference (Figure 5.28, Table 5.24; Appendix Table E.6.12). Tin concentrations in exposed lake trout muscle were higher in 2022 than in 2021,

relative to reference, which was the first year where there were sufficient detectable data for statistical comparisons (Figure 5.28, Table 5.24; Appendix Table E.6.16). Similar to barium, the results of temporal comparisons for tin were often influenced by results below the LRL, particularly for lake trout muscle results prior to and including 2021 (Figure 5.28, Table 5.24). In some of the comparisons for tin, the magnitude of the exposed-reference difference was inflated because data for one of the groups in the comparison were entirely less than the LRL, which was the case for one or more years of data for both peamouth chub liver and lake trout muscle (Table 5.24; Appendix Tables E.6.12, E.6.16).

Although there is no corresponding reference area for Quesnel River to assess *Area×Year* interaction, concentrations of three secondary analytes in rainbow trout tissues were significantly higher in 2022 compared to the baseline year (2015). Specifically, concentrations of phosphorus in muscle, sodium in kidney, and barium in liver were significantly higher than the baseline in more than one year (including 2022), sodium in kidney has been consistently elevated each year since baseline (including 2022), and sodium in ovary and barium in muscle were higher in 2022 only compared to baseline (Appendix Figures E.6.18 to E.6.21, Appendix Tables E.6.18 to E.6.21). Phosphorus concentrations in rainbow trout muscle were 18% and 34% higher in 2021 and 2022, respectively, relative to baseline (Appendix Table E.6.20). Sodium concentrations in rainbow trout kidney in 2022 were 93% greater than baseline, and sodium has shown consistently higher concentrations in lake trout kidney since 2017 relative to baseline (range = 82 to 189% higher than baseline; Appendix Table E.6.19). However, sodium concentrations in rainbow trout muscle were the lowest concentration reported post-baseline except for 2018 (Appendix Table E.6.19). Sodium concentrations in ovary in 2022 were also higher than baseline (by 163%; Appendix Table E.6.21). Barium was significantly elevated in both muscle (410% greater than baseline) and liver (503% greater than baseline) tissue of rainbow trout in 2022, relative to baseline. Barium concentrations in muscle were the highest observed since baseline, while those in liver were similar to those in 2018 to 2020 (Appendix Tables E.6.18 and E.6.20). Considering these analytes, the consistency among tissue types reflected in the increased concentrations of barium (in muscle and liver) and sodium (in ovary and kidney) infers a potential consistent influence on analyte concentrations in these exposed tissues. However, throughout the monitoring period (2015 to 2022) only kidney concentrations of sodium have consistently been significantly higher than the baseline year (2015) results. The increases in barium and sodium were not reflected in other rainbow trout tissues nor in the tissues of other fish species in Quesnel Lake, therefore may be reflective of natural variability of these analytes within the area.

5.2.8 Summary

Sediment monitoring in 2022 continued to indicate a breach influence on sediment chemistry at both the deep and shallow areas of Quesnel Lake. Sediment collected from the deep near-field area of Quesnel Lake was characterized by concentrations of several analytes (arsenic, copper, iron, and manganese) that were greater than reference concentrations and WSQG, and TOC content lower than reference, consistent with previous post-breach results. Copper was the most substantially elevated analyte, with mean concentrations 4.2 times the upper WSQG in 2022. Mean iron and manganese concentrations were also greater than reference and upper WSQG, although to a lesser degree, and mean concentrations of arsenic were greater than reference and the lower WSQG. Temporal stability of these analytes in the deep near-field area sediments was demonstrated by arsenic, copper, and iron concentrations in 2022 that were similar to those reported in 2014, and manganese concentrations and TOC content in 2022 similar to 2015. Sediments from the shallow near-field area in 2022 had a very high sand content (92.8%), and were characterized by concentrations of arsenic, copper, iron, manganese, and silver that were greater than reference concentrations and WSQG. Copper was the most substantially elevated analyte, with mean concentrations 5.7 times the upper WSQG. Mean iron and manganese concentrations were also greater than reference and the upper WSQG (to a lesser extent than copper), while mean concentrations of arsenic and silver were greater than reference and lower WSQG. Concentrations, arsenic, copper, iron, manganese, and silver and TOC content were temporally stable, relative to reference, with concentrations in 2022 remaining similar to 2014 values for each of these analytes (compared to reference).

Sediment toxicity testing of *H. azteca* using sediments from the shallow near-field area of Quesnel Lake (QUL-LNF1) in 2022 resulted in a moderate survival response (44 to 45% mortality) and a high growth response (76 to 79% reduction). However, concentrations of dissolved copper in overlying waters of the toxicity test vessels were highly dissimilar from those documented in field-collected water from these sites, which is consistent with previous years of monitoring. Dissolved copper concentrations in the toxicity test vessels in 2022 were an average of 97-times greater than in field-collected water, which is similar to 2020 and 2021 (74- and 114-times greater, respectively) and lower than 2019 (174-times). This strongly suggests copper mobilization in the test setup that has either not occurred *in situ* or has attenuated over time *in situ*. Under these conditions, the observed mortality and growth response are consistent with dissolved copper concentrations in overlying water, particularly given that *H. azteca* have been documented to derive little nutrition from sediment and to respond primarily to contaminants in overlying water. Significant regression relationships evaluating results from 2014 to 2022 inferred lower *H. azteca* growth and survival at higher overlying water dissolved copper concentrations and higher sediment copper concentrations. This further corroborates the observation that

toxicity responses of *H. azteca* are consistent with dissolved copper concentrations in the overlying test waters of these shallow sediments. Overall, the toxicity test results from the shallow near-field area cannot be reliably extrapolated to the field but suggest potential copper mobilization in this area with disturbance.

Phytoplankton community and productivity monitoring in Quesnel Lake in 2022 indicated that phytoplankton productivity (in terms of chlorophyll-a concentrations) was similar at the exposed and reference monitoring areas, as was also observed in previous years (2019 to 2021). These results characterize both the exposed and reference areas of Quesnel Lake as mesotrophic in 2022, which is a change from the classification of ultraoligotrophic in 2016 to 2018 and as oligotrophic in 2019 to 2021; a change likely owing in part to a switch from surface grab (2018 and earlier) to depth-integrated sampling methods (2019 onwards). The plankton community of the exposed area of Quesnel Lake in July 2022 was characterized by density higher than reference, taxon richness lower than reference, and Simpson's Evenness and Diversity indices similar to reference. Total density has consistently been higher at the exposed area compared to the reference area since 2019. Simpson's Diversity and Evenness at the exposed area have shown some temporal variability but have been either similar to or higher than reference in each year since 2019. Taxon richness at the exposed area in 2022 was lower than in previous years (2019 to 2021) reflecting a decrease from conditions that were similar to reference from 2019 to 2021, to lower than reference in 2022. This decrease in taxon richness was attributable to the absence of relatively rare phytoplankton taxa at QUL-ZOO-1 in July 2022, and appeared to be a temporary change based on the results of samples collected in August 2022 which included some of these relatively rare taxa. Continued monitoring will help to further understand whether the decrease in taxon richness in 2022 is part of a longer-term change or was a single variable result. The community composition at the exposed area has been similar to reference in terms of the relative densities of Diatoms, Cyanobacteria, and Chlorophytes from 2019 to 2022. The relative densities of Chrysophytes, Cryptomonads, and Dinoflagellates at the exposed area differed from reference in 2022 but showed temporal stability either within the exposed area or temporal stability in the difference relative to reference from 2019 to 2022. The similarity of the phytoplankton community at the exposed and reference areas of Quesnel Lake for most endpoints, and the temporal stability throughout the study period for most endpoints that differed between the areas (excluding taxon richness), are suggestive of a lack of mine-related influence on the phytoplankton community of Quesnel Lake.

Zooplankton community and productivity monitoring in Quesnel Lake in 2022 indicated that total biomass of zooplankton (dw) at the exposed area was similar to reference, which is consistent with prior years. The zooplankton community at the exposed area of Quesnel Lake in 2022 was characterized by total density and Simpson's Evenness that were similar to reference, and taxon

richness and Simpson's Diversity that were higher than reference. While there was temporal variability in these metrics at the exposed area from 2019 to 2022, the changes (i.e., direction and relative magnitude) were generally the same as those observed at the reference area, and metrics at the exposed area were largely similar to or greater than reference over this period. The community composition at the exposed area has been similar to reference in terms of the densities and relative densities of most zooplankton taxa (Calanoida, Cladocera, and Rotifera) from 2019 to 2022, with two exceptions, indicating that the communities at the exposed and reference areas were largely similar. The two exceptions were lower density and relative density of Cyclopoida in 2019, and consistently higher density and relative density of Copepod Nauplii in 2019 to 2022 at the exposed area compared to reference. The similarity of zooplankton communities between the exposed and reference areas for most endpoints and temporal stability of those endpoints that differed between the areas (i.e., Copepod Nauplii) from 2019 to 2022 are suggestive of a lack of mine-related influence on the zooplankton community of Quesnel Lake.

Zooplankton tissue quality monitoring in Quesnel Lake in 2022 indicated that concentrations of primary and secondary analytes in tissues from the exposed area were similar to or lower than reference, and also temporally stable from 2019 to 2022. The lack of temporal and spatial differences in zooplankton tissue quality results in 2022 was supported by trend analyses of surface water quality data which indicated temporal stability (from 2015 to 2022) for most analytes, except for increasing trends at one or both exposed monitoring stations for total manganese, total phosphorus, total and dissolved selenium, and dissolved barium, molybdenum, and sodium. A measurable increase in concentrations of these analytes in zooplankton tissue was not observed since 2019, indicating no sustained impact of the increased aqueous concentrations of these analytes on zooplankton tissue quality. In addition, aqueous total selenium and manganese concentrations remained well below the BCWQG from 2015 to 2022. Despite the identified increasing trend in aqueous selenium concentrations, zooplankton tissue selenium concentrations were below the BC interim guideline for aquatic life at the exposed area in 2022 (similar to 2019 to 2021), and tissue selenium concentrations at the exposed area were similar to reference from 2019 to 2022. As such, monitoring results indicate that zooplankton tissue quality in 2019 to 2022 was unimpacted by the breach and potential effluent exposure.

Benthic invertebrate community monitoring in the deep-near field area of Quesnel Lake in 2022 documented a community with total density and Simpson's Evenness that were unchanged since 2016, taxon richness that was similar to all years since 2014, and Simpson's Diversity that was unchanged since 2014. Total density at the deep near-field area in 2022 remained much lower than the densities reported for the reference area in previous years (2014 to 2021), but the difference relative to reference has steadily decreased. These results indicate some recovery of the benthic invertebrate community at the exposed areas from the initial breach event in 2014,

but no substantial change in community structure since 2016 at the deep near-field exposed area of Quesnel Lake. This lack of significant recovery is consistent with the stability of sediment TOC content and concentrations of arsenic, copper, iron, and manganese in these sediments since at least 2016. Chironomidae, which are the dominant taxa at the deep near-field area, are intolerant to sediments with organic content (TOC) of less than 1% (Suedel et al. 1993) and the TOC content of near-field area sediments (mean = 0.614%) remains well below this level. The community composition has shown temporal stability since 2014, and in 2022 continued to be characterized by Chironomidae dominance. Several characteristics of the benthic invertebrate community at the deep near-field area were related to sediment characteristics, including lower total density, richness, Chironomidae density, and Oligochaeta density and relative density associated with greater proportion of fines, lower proportion of TOC, and higher metal concentrations in sediment. These sediment properties are consistent with the presence of breach-impacted sediments at the deep near-field area.

The catchability of lake trout at the exposed area of Quesnel Lake in 2022 was lower than at the reference area, while catchability of peamouth chub and northern pikeminnow in 2022 were both higher at the exposed area relative to reference. The catchability of rainbow trout from the Quesnel River in 2022 was higher than in previous years. Fish tissue quality in 2022 was evaluated in up to four tissues (muscle, liver, kidney, and ovary) in four species (lake trout, northern pikeminnow, peamouth chub, and rainbow trout). Mean mercury and selenium concentrations in fish muscle tissue from Quesnel Lake and Quesnel River in 2022 were below the guidelines for the protection of human health (i.e., indicating that fish are safe for moderate human consumption). This was consistent with prior monitoring years except 2020 and 2021 when the mean mercury concentrations in muscle of reference lake trout exceeded the consumption guideline. Mean selenium concentrations in fish muscle or whole-body samples from Quesnel Lake and Quesnel River in 2022 were below the guideline for the protection of aquatic life except for peamouth chub from the exposed area which exceeded the guideline at a higher rate in 2022 (63%) than in previous years (2015 to 2021). Mean selenium concentrations in ovary tissue (the tissue most valuable in the assessment of potential selenium-associated effects on fish) from lake trout in 2022 were below the tissue specific guideline for the protection of aquatic life but exceeded the guideline in rainbow trout and peamouth chub. In rainbow trout ovary tissue, selenium concentrations in 2022 exceeded the guideline in 50% of samples which was within the range of previous years. In peamouth chub ovary tissue, selenium concentrations in the majority of exposed (86%) and reference (50%) samples in 2022 exceeded the tissue specific guideline for the protection of aquatic life, with 43% of exposed samples also exceeding the threshold for reproductive effects. The rate of the guideline/threshold exceedances in exposed peamouth chub ovary tissue was higher in 2022 than in prior years. Despite this,

selenium concentrations in peamouth chub tissues (muscle liver, ovary, and kidney) and in northern pikeminnow whole-body samples (also a small home-range species) have been temporally stable from 2016 to 2022, relative to reference. The absence of pre-breach data precludes drawing definitive conclusions about the potential factors influencing tissue selenium concentrations (e.g., due to mine-exposure or due to inherent differences between the areas). However, results from 2016 to 2022 indicated there is no evidence that selenium concentrations in fish tissues from Quesnel Lake are increasing over time due to mine exposure. Evidence of a persistent mine influence was not detected for most analytes assessed in fish tissue from Quesnel Lake and Quesnel River in 2022. All primary analytes (arsenic, copper, iron, and selenium), and the secondary analytes barium, cadmium, calcium, manganese, mercury, molybdenum, phosphorus, sodium, strontium, tin, titanium, uranium, vanadium, and zinc were elevated relative to reference in 2022 in at least one tissue type in at least one species. However, the results for most these analytes were inconsistent among tissues and species, and/or were temporally stable, and/or the results were not supported by zooplankton tissue quality results, indicating that the weight of evidence does not support a pattern of increasing analyte concentrations over time due to mine-exposure.

6 RESULTS – CREEK HABITAT

6.1 Hazeltine Creek

6.1.1 Sediment Quality

Creek sediment quality monitoring in 2022 targeted one area in upper (HAC-U) and one in lower (HAC-D) Hazeltine Creek, with areas in upper (EDC-U) and lower (EDC-D) Edney Creek serving as reference sites, respectively (Figure 4.1, Table 4.1). A review of the 2022 sediment data quality (Appendix B) indicated that the data met the established DQOs and can be used with a high level of confidence for interpretation (see Section 5.1.1 for details).

6.1.1.1 Upper Hazeltine Creek

Sediments collected from upper Hazeltine Creek (HAC-U) in 2022 were composed primarily of silt and clay particles (mean = 71.1% and 16.1%, respectively) and were higher in silt content than the reference sediments from EDC-U, which were composed predominantly of sand and silt (mean = 55.1% and 35.7%, respectively; Table 6.1; Appendix Tables D.2.1 to D.2.7). Sediments collected at HAC-U in 2022 (mean = 71.1% silt) had the highest silt content observed since 2018 (following the completion of remediation; Table 6.1). Silt content of sediments from HAC-U has been fairly consistent from 2019 to 2022 (53.2 to 71.1%) but higher than previous years (30.0 to 30.5% in 2014 and 2018), while sand (11.2 to 32.0%) and clay content (13.4 to 21.0%) have been more variable from 2019 to 2022 (Table 6.1; Appendix Tables D.2.6 to D.2.7). The presence of fine sediments in these erosional sampling areas has been limited in some years, and this limited availability of fine sediments has necessitated opportunistic sampling (as described in Section 4.1.1; Minnow 2019a, 2020a, 2021a, 2022a). Therefore, variability in particle size is likely related to variability among years in the presence of similarly fine sediments in these erosional habitats.

Total nitrogen content in HAC-U sediment (mean = 0.765%) was higher than the corresponding reference site (mean = 0.283%) in 2022 and was also higher than prior monitoring years (mean range = <0.020 to 0.656% in 2014 to 2021; Table 6.1). The mean TOC of sediments from HAC-U (mean = 6.74%) was similar to reference (EDC-U mean = 6.01%) in 2022 and was significantly higher at HAC-U in 2022 than in 2018 and 2020 at this area, relative to reference (Appendix Figure F.1.1, Appendix Tables F.1.1 and F.1.2). The mean TOC content of sediments from HAC-U has been similar to reference in each year except 2018 and 2020, when TOC content of HAC-U sediments was significantly lower than reference (Appendix Table F.1.2). The observed variability in both TOC and total nitrogen among years is likely primarily associated with differences in sediment texture. For instance, the significantly lower TOC content of HAC-U

Table 6.1: Summary of Sediment Quality Results for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2014 to 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/Pre-Breach 95th Percentile[b]		Reference (Upper Edney Creek)									
						2018 (EDC-U)		2019 (EDC-U)		2020 (EDC-U)		2021 (EDC-U)		2022 (EDC-U)	
		Lower	Upper	Reference (EDC-U; 2018 to 2022)	Pre-Breach (Upper Hazeltine Creek)	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Physical Tests															
Moisture	%	-	-	79.7	-	70.6	14.8	64.6	11.2	58.1	6.76	55.2	4.59	61.9	9.59
pH (1:2 soil:water)	pH	-	-	6.01	-	6.76	0.337	6.30	0.187	6.36	0.372	6.81	0.357	6.75	0.246
Particle Size															
% Gravel (>2 mm)	%	-	-	11.3	33.1	7.88	9.50	<1.0	-	1.06	-	4.52	3.98	1.20	0.566
% Sand (2.0 mm - 0.063 mm)	%	-	-	76.2	64.7	35.4	4.88	45.1	11.0	64.6	9.83	56.9	12.6	55.1	14.9
% Silt (0.063 mm - 4 µm)	%	-	-	56.4	76.2	48.3	7.12	43.4	8.33	28.8	8.02	31.4	10.6	35.7	11.8
% Clay (<4 µm)	%	-	-	16.4	13.9	8.80	4.41	11.4	4.21	6.24	2.49	7.20	3.84	8.42	3.52
Organic / Inorganic Carbon (<63 µm)															
Total Organic Carbon (TOC)	%	-	-	8.48	12.8	7.03	3.16	5.86	2.04	5.49	1.03	5.97	1.20	6.01	1.42
Nutrients (Bulk sediment)															
Total Nitrogen by LECO	%	-	-	0.485	-	0.355	0.127	0.386	0.143	0.303	0.0708	0.266	0.0943	0.283	0.0937
Metals (<63 µm)[c]															
Aluminum	mg/kg	-	-	22,800	17,960	18,800	2,550	19,800	1,720	15,860	1,529	21,300	3,152	14,740	1,571
Antimony	mg/kg	-	-	0.420	0.370	0.312	0.0327	0.348	0.0130	0.318	0.0239	0.352	0.0829	0.300	0.0367
Arsenic	mg/kg	5.90	17.0	12.0	8.23	***12.8***	5.47	10.8	0.537	8.90	0.836	10.4	0.441	8.07	1.40
Barium	mg/kg	-	-	200	136	159	26.6	146	4.04	130	12.5	189	13.4	108	18.3
Beryllium	mg/kg	-	-	0.620	0.460	0.484	0.0871	0.518	0.0466	0.438	0.0455	0.498	0.0763	0.372	0.0487
Bismuth	mg/kg	-	-	0.140	<0.20	0.116	0.0135	0.120	0.0122	0.102	0.00566	0.112	0.00924	0.100	-
Boron	mg/kg	-	-	5.40	5.40	***<10.0***	-	***<10.0***	-	<5.0	-	5.16	-	5.06	-
Cadmium	mg/kg	0.600	3.50	0.579	0.354	0.450	0.138	0.432	0.0978	0.381	0.0589	0.532	0.018	0.329	0.100
Calcium	mg/kg	-	-	11,000	13,395	9,610	1,080	9,900	1,190	8,404	509	9,796	232	7,846	1,022
Chromium	mg/kg	37.3	90.0	75.8	40.1	55.0	5.24	65.1	6.28	52.2	2.59	66.9	7.78	46.9	5.94
Cobalt	mg/kg	-	-	16.9	10.4	14.6	1.62	15.7	0.404	13.1	1.24	15.9	1.33	11.6	1.93
Copper	mg/kg	35.7	197	47.0	94.6	41.6	5.12	41.1	2.37	32.3	2.66	45.6	13.8	26.7	4.39
Iron	mg/kg	21,200	43,766	34,000	29,900	32,900	5,600	31,500	1,070	27,920	2,087	30,660	1,429	24,700	3,648
Lead	mg/kg	35.0	91.3	8.14	6.70	6.72	0.952	7.02	0.447	5.85	0.339	6.87	0.809	6.59	0.976
Lithium	mg/kg	-	-	17.8	14.8	14.6	2.33	15.7	1.25	14.1	0.976	14.2	1.47	12.0	0.990
Magnesium	mg/kg	-	-	7,930	6,430	7,240	527	7,400	269	6,526	318	7,842	600	6,108	536
Manganese	mg/kg	460	1,100	2,710	1,345	1,310	456	1,300	274	905	200	1,960	858	809	250
Mercury	mg/kg	0.170	0.486	0.125	0.145	0.118	0.0239	0.101	0.00416	0.101	0.0014	0.103	0.018	0.0751	0.0131
Molybdenum	mg/kg	25	23,000	2.39	1.50	0.818	0.200	1.91	0.562	0.620	0.0863	1.43	0.346	0.578	0.0746
Nickel	mg/kg	16.0	75.0	43.2	24.4	33.4	2.71	40.1	3.59	30.4	1.98	39.6	3.67	25.2	3.63
Phosphorus	mg/kg	-	-	1,370	1,375	1,260	83.4	1,310	83.8	1,132	82.0	1,204	63.5	1,025	48.8
Potassium	mg/kg	-	-	1,470	1,445	1,230	194	1,240	119	1,066	139	1,406	190	1,018	191
Selenium	mg/kg	2.00	-	0.880	3.32	0.668	0.131	0.622	0.0303	0.488	0.089	0.664	0.157	0.394	0.0961
Silver	mg/kg	0.500	-	0.205	0.160	0.187	0.0176	0.181	0.0148	0.139	0.0151	0.171	0.0246	0.131	0.0216
Sodium	mg/kg	-	-	340	350	251	20.2	245	20.2	266	14.0	293	53.2	255	33.3
Strontium	mg/kg	-	-	85.5	118	75.3	7.06	75.8	6.94	64.9	4.28	85.1	1.84	69.6	8.50
Sulphur	mg/kg	-	-	2,300	-	1,640	602	1,980	597	1,342	327	602	153	654	67.6
Thallium	mg/kg	-	-	0.166	0.0941	0.132	0.0254	0.141	0.0143	0.115	0.0108	0.138	0.0174	0.107	0.0161
Tin	mg/kg	-	-	0.620	<2.0	0.394	0.0391	0.506	0.0378	0.556	0.0607	0.5	0.282	0.362	0.0841
Titanium	mg/kg	-	-	736	776	600	102	617	57.3	634	70.0	637	110	593	61.3
Uranium	mg/kg	-	-	2.15	1.26	1.59	0.340	1.63	0.252	1.28	0.145	1.58	0.472	1.28	0.132
Vanadium	mg/kg	-	-	85.7	65.3	77.5	7.57	79.1	3.55	72.7	4.39	80.8	6.85	62.4	8.04
Zinc	mg/kg	123	315	89.7	67.6	75.7	4.83	79.8	6.22	67.5	5.42	87.6	5.20	63.3	10.8
Zirconium	mg/kg	-	-	1.90	-	-	-	-	-	1.10	0.103	1.30	0.354	1.02	0.0566

Value is > Lower BC Working Sediment Quality Guideline.
Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/ Italics*** - Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (< 5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of pre-breach 95th percentile values see Appendix Table D.2.2, for calculation of reference 95th percentile values see Appendix Table D.2.3. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table 6.1: Summary of Sediment Quality Results for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2014 to 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/Pre-Breach 95th Percentile[b]		Exposed (Upper Hazeltine Creek)											
						2014 (ST16)		2018 (HAC-U)		2019 (HAC-U)		2020 (HAC-U)		2021 (HAC-U)		2022 (HAC-U)	
		Lower	Upper	Reference (EDC-U; 2018 to 2022)	Pre-Breach (Upper Hazeltine Creek)	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Physical Tests																	
Moisture	%	-	-	79.7	-	25.4	3.80	36.6	4.48	***84.8***	8.89	***76.6***	5.60	***83.1***	3.3	***87.3***	2.11
pH (1:2 soil:water)	pH	-	-	6.01	-	8.87	0.172	8.32	0.179	7.41	0.106	7.50	0.124	7.31	0.0986	7.18	0.0898
Particle Size																	
% Gravel (>2 mm)	%	-	-	11.3	33.1	<0.10	-	12.7	4.07	1.06	-	1.78	-	2.3	0.85	<1	-
% Sand (2.0 mm - 0.063 mm)	%	-	-	76.2	64.7	69.6	6.13	38.5	2.28	11.2	12.0	32.0	11.3	12.7	3.03	12.7	2.29
% Silt (0.063 mm - 4 µm)	%	-	-	56.4	76.2	30.0	6.07	30.5	2.03	67.5	11.8	53.2	11.3	66.5	2.91	71.1	1.76
% Clay (<4 µm)	%	-	-	16.4	13.9	0.470	0.0742	***18.3***	0.989	***21.0***	0.945	13.4	0.653	***19.0***	1.36	16.1	1.21
Organic / Inorganic Carbon (<63 µm)																	
Total Organic Carbon (TOC)	%	-	-	8.48	12.8	<0.10	-	0.347	0.0634	4.44	1.12	2.28	0.550	4.47	0.725	6.74	0.682
Nutrients (Bulk sediment)																	
Total Nitrogen by LECO	%	-	-	0.485	-	<0.020	-	0.0244	0.0102	***0.656***	0.246	0.246	0.0780	***0.558***	0.116	***0.765***	0.114
Metals (<63 µm)[c]																	
Aluminum	mg/kg	-	-	22,800	17,960	10,600	286	***23,500***	1,790	15,700	1,760	17,520	1,096	18,580	1,399	16,120	536
Antimony	mg/kg	-	-	0.420	0.370	0.308	0.0268	***0.572***	0.0396	0.406	0.0688	***0.556***	0.0929	***0.426***	0.0658	0.328	0.0396
Arsenic	mg/kg	5.90	17.0	12.0	8.23	***14.7***	0.522	***12.7***	1.63	8.72	0.807	10.6	2.42	8.01	0.678	7.28	0.151
Barium	mg/kg	-	-	200	136	109	7.60	***229***	18.9	***226***	16.5	***274***	87.6	***276***	14.7	***260***	5.52
Beryllium	mg/kg	-	-	0.620	0.460	0.476	0.0230	0.618	0.0712	0.510	0.0292	0.558	0.0356	0.52	0.0245	0.534	0.0182
Bismuth	mg/kg	-	-	0.140	<0.20	<0.10	-	***0.158***	0.0110	0.104	-	0.102	0.00566	0.100	-	<0.10	-
Boron	mg/kg	-	-	5.40	5.40	***<10.0***	-	***10.2***	-	***14.2***	2.17	***13.2***	1.85	***16.5***	3.67	***19.8***	3.69
Cadmium	mg/kg	0.600	3.50	0.579	0.354	0.160	0.00857	0.257	0.0476	0.319	0.0338	0.299	0.0622	0.351	0.0236	0.354	0.0293
Calcium	mg/kg	-	-	11,000	13,395	***27,600***	702	***25,600***	8,070	***61,400***	5,990	***23,340***	5,625	***20,200***	3,973	***21,640***	1,701
Chromium	mg/kg	37.3	90.0	75.8	40.1	22.8	1.86	52.5	2.49	58.8	11.1	34.6	2.53	29.7	4	26.7	2.04
Cobalt	mg/kg	-	-	16.9	10.4	***24.0***	1.53	***17.1***	0.673	14.6	1.08	16.8	3.89	14.7	0.817	13.3	0.335
Copper	mg/kg	35.7	197	47.0	94.6	***687***	34.3	***151***	50.4	***360***	73.9	***331***	42.6	***417***	43.1	***392***	8.85
Iron	mg/kg	21,200	43,766	34,000	29,900	***139,000***	10,600	***41,400***	3,740	30,000	4,320	***44,640***	13,592	33,900	1,559	32,000	800
Lead	mg/kg	35.0	91.3	8.14	6.70	6.33	0.260	***8.77***	0.236	6.59	0.629	6.56	0.254	6.11	0.73	5.77	0.187
Lithium	mg/kg	-	-	17.8	14.8	11.8	0.713	***21.6***	0.653	14.5	1.75	17.1	0.762	13.9	1.5	13.1	0.642
Magnesium	mg/kg	-	-	7,930	6,430	6,570	185	***11,300***	669	***9,070***	850	***9,940***	1,037	***9,502***	595	***8,508***	80.7
Manganese	mg/kg	460	1,100	2,710	1,345	626	15.9	861	18.7	***2,880***	1,360	***2,737***	3,444	1,485	734	1,840	292
Mercury	mg/kg	0.170	0.486	0.125	0.145	0.0770	0.00198	0.108	0.0261	0.101	0.0153	0.111	0.00594	0.106	0.00568	0.107	0.00339
Molybdenum	mg/kg	25	23,000	2.39	1.50	***4.66***	0.356	1.35	0.277	***6.27***	1.43	***3.07***	0.64	***3.64***	1.24	***3.84***	0.308
Nickel	mg/kg	16.0	75.0	43.2	24.4	11.1	0.719	42.0	1.67	***46.4***	6.43	31.2	6.89	26.4	2.63	23.4	1.88
Phosphorus	mg/kg	-	-	1,370	1,375	***2,440***	133	1,050	56.3	***1,440***	202	1,352	79.8	***1,416***	79.6	***1,512***	128
Potassium	mg/kg	-	-	1,470	1,445	794	33.6	***2,730***	185	***1,680***	158	***1,624***	167	1,444	199	1,434	107
Selenium	mg/kg	2.00	-	0.880	3.32	1.38	0.121	0.562	0.197	2.27	0.656	1.67	0.230	3.09	0.483	***4.05***	0.622
Silver	mg/kg	0.500	-	0.205	0.160	***0.446***	0.0509	0.144	0.0158	0.164	0.0110	0.163	0.0164	0.173	0.00688	0.187	0.00834
Sodium	mg/kg	-	-	340	350	***552***	23.9	***446***	39.8	***472***	64.2	***468***	53.6	***441***	11.8	***473***	14.6
Strontium	mg/kg	-	-	85.5	118	85.7	2.76	***150***	22.0	***226***	11.3	***145***	19.8	***130***	8.14	***144***	6.31
Sulphur	mg/kg	-	-	2,300	-	-	-	660	-	***2,320***	335	1,632	629	***2,460***	397	***2,718***	485
Thallium	mg/kg	-	-	0.166	0.0941	<0.050	-	0.129	0.00802	0.0624	0.0149	0.073	0.00675	0.0662	0.0128	0.0540	0.00480
Tin	mg/kg	-	-	0.620	<2.0	***1.13***	0.0737	0.568	0.120	***0.666***	0.122	***0.816***	0.131	***0.788***	0.0497	***0.704***	0.0577
Titanium	mg/kg	-	-	736	776	***1,060***	34.2	***1,100***	155	714	181	***1,100***	103	***932.6***	108	744	74.5
Uranium	mg/kg	-	-	2.15	1.26	1.04	0.0489	0.893	0.0549	0.732	0.0975	0.754	0.0523	0.821	0.076	0.807	0.0391
Vanadium	mg/kg	-	-	85.7	65.3	***542***	53.0	***99.9***	16.7	79.9	14.5	***123***	13.6	***102***	6.57	***98.7***	3.91
Zinc	mg/kg	123	315	89.7	67.6	70.1	2.42	79.9	2.75	76.6	6.20	70.5	4.86	78.1	2.98	69.5	1.43
Zirconium	mg/kg	-	-	1.90	-	-	-	-	-	-	-	***2.68***	0.370	***2.00***	0.505	***2.02***	0.130

Value is > Lower BC Working Sediment Quality Guideline.
Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/ Italics*** - Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (< 5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of pre-breach 95th percentile values see Appendix Table D.2.2, for calculation of reference 95th percentile values see Appendix Table D.2.3. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

sediments observed in 2018 and 2020, compared to reference, was associated with the highest sand content of these sediments (excluding 2014; mean = 32.0 to 38.5% sand; Table 6.1; Appendix Table F.1.2). As indicated above, the observed variability in sediment texture is likely associated with the variable availability of similarly fine sediments among years in these erosional habitats; variability which may stabilize as sediment accumulation continues to occur in this remediated system.

Mean concentrations of 14 out of 34 elements in the HAC-U sediment (<63 µm fraction) collected in 2022 exceeded both pre-breach[61] and reference upper 95th percentile values. Among these elements, copper and selenium were the only Analytes of Interest with mean sediment concentrations that also exceeded WSQG in 2022 (Figure 6.1, Table 6.1; Appendix Table D.2.7). Specifically, the mean copper concentration of HAC-U sediments in 2022 exceeded the upper WSQG by 2.0 times (Table 6.1; Appendix Table D.2.7). Mean copper concentrations in reference (EDC-U) sediments were naturally elevated above the lower WSQG in previous years (2018, 2019, 2021; Table 6.1; Appendix Table D.2.3), demonstrating that copper is naturally elevated in stream habitats in the vicinity of the Mount Polley Mine. The mean selenium concentration in HAC-U sediments in 2022 exceeded the lower WSQG by 2.0 times (Figure 6.1, Table 6.1; Appendix Table D.2.7). Although the mean selenium concentration in HAC-U sediments previously exceeded the reference 95th percentile and the lower WSQG (in 2019 and 2021), 2022 represented the first year that the mean concentration also exceeded the pre-breach 95th percentile value (for HAC-U; Table 6.1; Appendix Figure F.1.1, Appendix Table D.2.7).

Mean copper concentrations in HAC-U sediments have been significantly higher than reference sediments from 2018 to 2022, and mean selenium concentrations have been significantly higher than reference sediments from 2019 to 2022 (Figure 6.1; Appendix Table F.1.2). The mean copper and selenium concentrations in HAC-U sediments were significantly higher in 2022 than previously observed (2018 to 2021), relative to reference (Figure 6.1; Appendix Table F.1.1). However, this change for both analytes was driven by a decrease in copper and selenium concentrations at the reference area (EDC-U), which were significantly lower in 2022 compared to all prior years except 2020 (which was similar to 2022; Appendix Table F.1.2). Evaluation of temporal changes within HAC-U only (i.e., not relative to reference) indicated that copper

[61] TOC and metal concentrations reported for pre-breach sediments were based predominantly on bulk sediment, but were reported for the <63 µm fraction of sediments collected post-breach. This difference in the fraction of sediment evaluated (i.e., bulk sediments for pre-breach and <63 µm fraction for post-breach) should be considered when making comparisons of TOC and metals concentrations between the two time periods. Formal statistical temporal comparisons were conducted using data from between 2018 to 2022 which reported TOC and metal concentrations in the <63 µm fraction of sediments (see Sections 4.1.2 and 4.1.3.2).

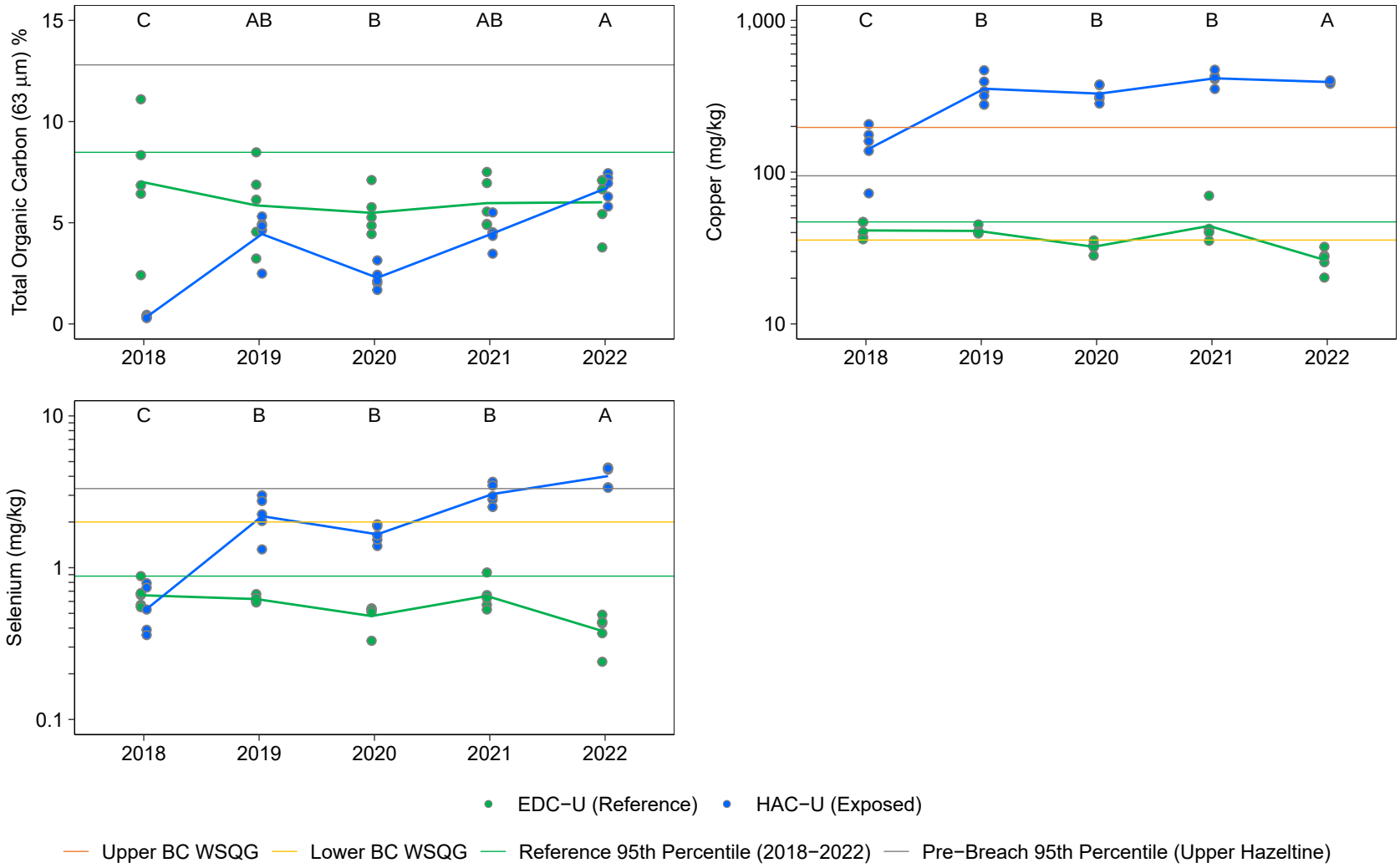

Figure 6.1: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

concentrations in HAC-U sediments have been temporally stable since 2019 (Appendix Table F.1.2). Selenium concentrations evaluated within HAC-U sediments only (not relative to reference) were similar in 2022 and 2021 and significantly higher in 2022 than the preceding years (2018 to 2020), with the greatest differences occurring relative to 2020 and 2018 (Appendix Table F.1.2). The significantly higher selenium concentrations in HAC-U sediments observed in 2022 (compared to 2018 and 2020) coincided with significantly lower TOC content of sediments in those years (2018 and 2020) compared to 2022 (Appendix Table F.1.2) and higher sand content (mean = 38.5 and 32.0% in 2018 and 2020, respectively; mean = 12.7% in 2022; Table 6.1). This suggests that the increase in selenium concentrations at HAC-U in 2022 was associated with temporal changes in the physical characteristics (i.e., TOC and sand content) that are driven by the necessity for opportunistic sampling due to limited availability of fine sediments in some monitoring years.

Copper and selenium concentrations in Hazeltine Creek sediment have demonstrated significant positive correlations with TOC, sulphur, and total nitrogen (Appendix Figure F.1.3; Appendix Table F.1.5). These relationships further support the observation that the slight (but not significant) changes in copper concentrations and the significant increase in selenium concentrations over time in upper Hazeltine Creek sediments are associated with temporal variability in the physical and chemical characteristics of the sampled sediment (i.e., significantly higher TOC content in 2022 compared to 2018 and 2020; Appendix Table F.1.2).

6.1.1.2 Lower Hazeltine Creek

Sediments collected from lower Hazeltine Creek (HAC-D) in 2022 were composed primarily of silt and sand particles (mean = 48.6% and 42.4%, respectively). Sediments from HAC-D in 2022 were higher in silt and lower in sand content than the reference sediments from EDC-D, which were composed predominantly of sand and silt (mean = 58.3% and 34.2%, respectively; Table 6.2; Appendix Tables D.2.8 and D.2.9). The particle size of sediments collected at HAC-D has shown some temporal variability, with sediments collected in 2022 having similar silt content to those from 2019 and 2021, but higher than in 2018 and 2020 (Table 6.2). The presence of fine sediment in the erosional areas has been limited in some years and was therefore sampled opportunistically (as described in Section 4.1.1; Minnow 2019a, 2020, 2021a, 2022a). As such, some of the variability in particle size is likely related to the ability to locate similarly fine sediment among areas and years. The TOC and total nitrogen content of HAC-D sediments in 2022 (mean = 1.68% and 0.152%, respectively) were the highest observed since 2018 (following initial remediation), though they remained lower than values observed at the reference area (EDC-D) in 2022 (mean = 3.63% and 0.170%, respectively; Table 6.2; Appendix

Table 6.2: Summary of Sediment Quality Results for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2014 to 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/Pre-Breach 95th Percentile [b]		Reference (Lower Edney Creek)											
						2015 (EDC-D)		2018 (EDC-D)		2019 (EDC-D)		2020 (EDC-D)		2021 (EDC-D)		2022 (EDC-D)	
		Lower	Upper	Reference (EDC-D; 2018 to 2022)	Pre-Breach (Lower Hazeltine Creek)	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Physical Tests																	
Moisture	%	-	-	70.6	-	***78.1***	7.58	40.3	12.0	59.6	15.6	34.2	3.34	48.4	10.4	53.4	7.02
pH (1:2 soil:water)	pH	-	-	6.74	-	7.70	0.246	7.93	0.241	7.18	0.330	7.67	0.154	7.50	0.203	7.41	0.556
Particle Size																	
% Gravel (>2 mm)	%	-	-	6.80	53.4	0.274	0.0283	5.48	3.58	<1.0	-	2.46	1.47	1.34	-	1.06	0.0566
% Sand (2.0 mm - 0.063 mm)	%	-	-	83.9	79.9	48.3	11.1	68.8	16.1	50.0	12.4	74.5	4.84	58.1	5.37	58.3	7.42
% Silt (0.063 mm - 4 µm)	%	-	-	43.8	31.2	***44.9***	10.4	21.6	11.8	41.5	11.1	19.7	3.65	35.4	5.83	34.2	6.47
% Clay (<4 µm)	%	-	-	9.70	9.80	6.59	1.18	4.12	1.26	8.20	1.67	3.64	0.336	5.60	0.66	6.72	0.593
Organic / Inorganic Carbon (<63 µm)																	
Total Organic Carbon (TOC)	%	-	-	3.82	9.03	3.73	1.70	2.85	0.806	3.14	0.642	2.29	0.398	2.42	0.884	3.63	0.970
Nutrients (Bulk sediment)																	
Total Nitrogen by LECO	%	-	-	0.237	-	0.206	0.0850	0.0854	0.0501	0.189	0.0769	0.104	0.0201	0.142	0.0372	0.170	0.0507
Metals (<63 µm)[c]																	
Aluminum	mg/kg	-	-	19,000	12,550	15,900	2,000	14,200	940	15,200	358	12,120	672	16,900	2,845	13,860	573
Antimony	mg/kg	-	-	0.460	1.33	0.366	0.0321	0.430	0.0806	0.390	0.0224	0.360	0.0122	0.346	0.0385	0.340	0.0158
Arsenic	mg/kg	5.90	17.0	19.5	12.1	18.2	6.94	13.8	6.39	13.0	1.45	11.7	1.30	12.6	2.83	9.80	1.13
Barium	mg/kg	-	-	184	104	175	35.5	145	39.9	125	10.9	118	6.80	152	34.9	117	6.91
Beryllium	mg/kg	-	-	0.480	0.300	0.400	0.0292	0.424	0.0654	0.406	0.0152	0.350	0.0122	0.388	0.0716	0.366	0.0207
Bismuth	mg/kg	-	-	0.140	<0.20	***0.148***	0.00447	0.122	0.00837	0.134	0.00894	0.106	0.00894	0.118	0.0146	0.114	0.00548
Boron	mg/kg	-	-	6.50	2.97	***<10.0***	-	***<10.0***	-	***<10.0***	-	<5.0	-	5.68	0.571	5.00	-
Cadmium	mg/kg	0.600	3.50	0.329	0.235	***0.373***	0.0458	0.274	0.0606	0.303	0.0176	0.238	0.00832	0.296	0.0647	0.262	0.0289
Calcium	mg/kg	-	-	11,000	7,026	10,300	1,240	9,240	1,220	10,000	1,060	8,580	567	9,276	1,223	8,594	241
Chromium	mg/kg	37.3	90.0	60.4	33.1	45.8	4.17	42.1	2.56	48.4	3.50	44.5	1.34	55.4	8.21	43.4	1.68
Cobalt	mg/kg	-	-	15.5	11.0	14.9	1.96	11.6	1.12	14.0	0.744	11.9	0.370	13.6	2.41	11.7	0.462
Copper	mg/kg	35.7	197	38.1	42.0	35.9	4.40	34.1	5.34	35.0	1.39	26.1	1.01	32.3	4.91	28.3	2.17
Iron	mg/kg	21,200	43,766	33,600	35,400	31,900	2,640	27,600	4,290	31,300	1,380	29,060	1,119	31,980	4,157	27,720	1,339
Lead	mg/kg	35.0	91.3	8.37	5.61	7.74	0.591	7.51	0.663	7.85	0.476	6.30	0.228	7.20	1.08	6.81	0.296
Lithium	mg/kg	-	-	16.8	12.9	16.3	0.822	15.7	1.39	16.1	0.680	13.2	0.305	14.1	2.63	13.9	0.676
Magnesium	mg/kg	-	-	8,140	6,159	7,600	970	6,640	300	7,200	260	6,166	219	7,418	1,091	6,762	248
Manganese	mg/kg	460	1,100	1,410	1,116	***1,830***	1,910	600	280	959	313	806	58.4	878	445	705	229
Mercury	mg/kg	0.170	0.486	0.0876	0.140	0.0846	0.0161	0.0743	0.0138	0.0591	0.00383	0.0592	0.00660	0.0617	0.0101	0.0598	0.00733
Molybdenum	mg/kg	25	23,000	1.51	0.752	0.902	0.238	0.890	0.405	0.974	0.179	0.622	0.0661	1.14	0.326	0.584	0.0439
Nickel	mg/kg	16.0	75.0	39.9	24.0	33.6	3.86	30.1	2.21	34.9	2.29	28.1	0.719	34.6	6.29	27.9	0.658
Phosphorus	mg/kg	-	-	1,190	729	1,090	109	1,040	84.4	1,130	65.7	1,033	77.9	1,108	84.1	972	45.7
Potassium	mg/kg	-	-	1,480	909	1,390	243	1,100	158	1,210	133	978	43.8	1,260	259	1,138	61.0
Selenium	mg/kg	2.00	-	1.06	1.30	0.898	0.246	0.812	0.240	0.610	0.119	0.422	0.0701	***1.24***	1.59	0.446	0.0680
Silver	mg/kg	0.500	-	0.174	0.0300	0.122	0.0139	0.158	0.0761	0.130	0.00831	0.0930	0.00725	0.114	0.0231	0.105	0.00796
Sodium	mg/kg	-	-	331	253	330	56.1	253	35.0	242	13.1	269	21.5	303	50.4	264	24.7
Strontium	mg/kg	-	-	105	67.1	90.5	10.6	86.0	12.5	76.4	4.70	72.0	2.39	83.1	14.8	81.3	4.83
Sulphur	mg/kg	-	-	1,200	-	***1,280***	110	500	-	820	259	732	543	508	-	548	44.7
Thallium	mg/kg	-	-	0.125	0.0508	0.110	0.00568	0.113	0.0149	0.111	0.00336	0.0850	0.0043	0.102	0.0237	0.0956	0.00635
Tin	mg/kg	-	-	0.540	1.10	0.370	0.0620	0.356	0.0503	0.540	0.172	0.376	0.0611	0.34	0.0596	0.364	0.0279
Titanium	mg/kg	-	-	796	701	644	63.7	583	68.4	679	18.4	683	40.6	766	86.7	677	83.0
Uranium	mg/kg	-	-	1.20	0.730	0.815	0.0994	0.977	0.331	0.971	0.0574	0.821	0.0242	1.02	0.137	1.00	0.0717
Vanadium	mg/kg	-	-	75.9	74.5	68.6	7.44	65.0	8.89	65.6	6.13	70.2	3.60	72.7	7.27	64.1	3.78
Zinc	mg/kg	123	315	80.9	60.2	70.6	8.13	59.5	5.10	69.6	2.24	57.0	1.51	71.8	10.4	63.5	2.53
Zirconium	mg/kg	-	-	1.90	-	-	-	-	-	-	-	1.48	0.0447	1.48	0.11	1.64	0.167

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/ Italics*** - Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (< 5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of pre-breach 95th percentile values see Appendix Table D.2.4, for calculation of reference 95th percentile values see Appendix Table D.2.5. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table 6.2: Summary of Sediment Quality Results for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2014 to 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/Pre-Breach 95th Percentile [b]		Exposed (Lower Hazeltine Creek)											
						2014 (ST02)		2018 (HAC-D)		2019 (HAC-D)		2020 (HAC-D)		2021 (HAC-D)		2022 (HAC-D)	
		Lower	Upper	Reference (EDC-D; 2018 to 2022)	Pre-Breach (Lower Hazeltine Creek)	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Physical Tests																	
Moisture	%	-	-	70.6	-	28.8	4.23	38.1	11.9	32.6	3.37	27.7	2.70	47.0	17.2	56.7	8.91
pH (1:2 soil:water)	pH	-	-	6.74	-	8.51	0.172	8.13	0.311	8.29	0.199	8.54	0.141	8.10	0.412	7.48	0.182
Particle Size																	
% Gravel (>2 mm)	%	-	-	6.80	53.4	0.128	-	1.14	-	<1.0	-	<1.0	-	1.18	-	<1.0	-
% Sand (2.0 mm - 0.063 mm)	%	-	-	83.9	79.9	30.4	15.2	65.0	13.7	49.0	10.1	73.9	4.92	38.3	13.4	42.4	13.4
% Silt (0.063 mm - 4 µm)	%	-	-	43.8	31.2	***60.6***	12.6	26.6	12.2	41.1	8.43	21.2	4.36	***44.9***	10.3	***48.6***	11.6
% Clay (<4 µm)	%	-	-	9.70	9.80	8.91	3.66	8.02	1.92	9.74	1.71	4.52	0.993	***16.3***	6.02	8.67	2.04
Organic / Inorganic Carbon (<63 µm)																	
Total Organic Carbon (TOC)	%	-	-	3.82	9.03	0.116	0.0269	1.14	0.422	0.442	0.0792	0.354	0.0313	1.06	1.29	1.68	0.197
Nutrients (Bulk sediment)																	
Total Nitrogen by LECO	%	-	-	0.237	-	<0.020	-	0.0686	0.0525	0.0350	0.0108	0.0218	0.000566	0.0922	0.14	0.152	0.0434
Metals (<63 µm)[c]																	
Aluminum	mg/kg	-	-	19,000	12,550	16,700	2,820	15,500	1,020	15,400	614	11,960	555	***23,040***	6,385	15,150	797
Antimony	mg/kg	-	-	0.460	1.33	0.402	0.0589	0.546	0.0378	0.600	0.0292	0.546	0.0207	0.632	0.105	0.552	0.133
Arsenic	mg/kg	5.90	17.0	19.5	12.1	11.7	2.38	***25.0***	3.59	16.8	1.55	16.6	1.33	***20.3***	7.28	15.6	1.43
Barium	mg/kg	-	-	184	104	166	58.7	***212***	9.13	175	12.5	157	6.54	***515***	256	***238***	17.1
Beryllium	mg/kg	-	-	0.480	0.300	***0.492***	0.139	***0.538***	0.0303	***0.512***	0.0110	0.434	0.0297	***0.736***	0.134	***0.558***	0.0256
Bismuth	mg/kg	-	-	0.140	<0.20	0.112	0.00924	***0.144***	0.00548	***0.152***	0.00447	0.140	0.0122	***0.15***	0.04	0.127	0.00816
Boron	mg/kg	-	-	6.50	2.97	***10.2***	-	***10.0***	-	***10.0***	-	6.20	0.485	***18.9***	4.78	***11.6***	1.01
Cadmium	mg/kg	0.600	3.50	0.329	0.235	0.191	0.0335	0.313	0.0254	0.282	0.0199	0.243	0.0133	***0.361***	0.0394	0.302	0.0440
Calcium	mg/kg	-	-	11,000	7,026	***27,900***	2,770	***22,800***	1,740	***31,900***	1,180	***19,760***	680	***26,900***	2,481	***23,100***	938
Chromium	mg/kg	37.3	90.0	60.4	33.1	28.4	8.23	35.6	2.85	39.6	2.57	45.5	3.34	35.9	6.48	33.9	1.65
Cobalt	mg/kg	-	-	15.5	11.0	***18.4***	3.14	***17.0***	0.344	15.3	0.559	15.0	0.568	***19.1***	4.11	14.7	0.622
Copper	mg/kg	35.7	197	38.1	42.0	***449***	256	***361***	22.4	***208***	30.2	***149***	9.93	***655***	387	***336***	21.8
Iron	mg/kg	21,200	43,766	33,600	35,400	***66,000***	16,000	***57,400***	7,470	***35,600***	1,560	***49,920***	6,834	***48,160***	10,960	***43,533***	1,767
Lead	mg/kg	35.0	91.3	8.37	5.61	7.53	0.522	***9.13***	0.544	***9.46***	0.415	***8.49***	0.454	***10.3***	1.38	***10.3***	4.22
Lithium	mg/kg	-	-	16.8	12.9	16.3	2.98	13.1	1.44	16.3	0.773	12.3	0.896	15.4	3.86	14.4	0.451
Magnesium	mg/kg	-	-	8,140	6,159	***10,400***	2,100	8,080	578	***8,680***	291	6,790	405	***12,160***	4,165	***8,155***	375
Manganese	mg/kg	460	1,100	1,410	1,116	676	111	1,060	263	728	64.0	654	95.4	1,234	340	1,161	188
Mercury	mg/kg	0.170	0.486	0.0876	0.140	0.0653	0.0141	0.0883	0.0105	0.0611	0.00565	0.0688	0.00242	0.102	0.0172	0.103	0.00831
Molybdenum	mg/kg	25	23,000	1.51	0.752	***2.44***	1.09	***1.82***	0.220	***1.66***	0.124	1.00	0.0594	***2.68***	1.25	***1.70***	0.126
Nickel	mg/kg	16.0	75.0	39.9	24.0	22.5	7.60	28.7	1.19	34.4	1.49	29.8	1.90	33.7	4.59	25.2	0.836
Phosphorus	mg/kg	-	-	1,190	729	***1,530***	256	***1,410***	95.3	1,160	50.5	***1,196***	95.6	***1,534***	353	***1,292***	158
Potassium	mg/kg	-	-	1,480	909	***1,530***	368	1,370	102	1,370	57.7	1,200	108	***1,670***	131	1,362	87.7
Selenium	mg/kg	2.00	-	1.06	1.30	0.886	0.252	0.994	0.151	0.556	0.0945	0.522	0.0835	1.13	0.0994	1.11	0.0712
Silver	mg/kg	0.500	-	0.174	0.0300	***0.244***	0.0958	***0.233***	0.0168	***0.252***	0.139	0.149	0.0182	***0.234***	0.0476	***0.222***	0.0640
Sodium	mg/kg	-	-	331	253	***718***	386	***380***	27.4	***345***	10.8	294	12.7	***394***	74.4	***376***	31.4
Strontium	mg/kg	-	-	105	67.1	***145***	13.8	***143***	9.54	***184***	10.3	***123***	6.27	***200***	20.5	***172***	13.8
Sulphur	mg/kg	-	-	1,200	-	-	-	700	141	<500	-	508	-	784	400	813	156
Thallium	mg/kg	-	-	0.125	0.0508	0.0602	0.0135	***0.167***	0.0256	***0.152***	0.0165	0.122	0.0148	***0.127***	0.0692	0.112	0.00628
Tin	mg/kg	-	-	0.540	1.10	1.09	0.486	0.744	0.0586	0.686	0.0780	0.570	0.064	0.866	0.104	0.663	0.0427
Titanium	mg/kg	-	-	796	701	***1,310***	325	***1,010***	54.8	***961***	46.2	***1,019***	52.7	***1,209***	574	***950.8***	88.9
Uranium	mg/kg	-	-	1.20	0.730	1.05	0.163	1.05	0.0627	0.885	0.0622	0.866	0.053	1.07	0.303	0.990	0.0261
Vanadium	mg/kg	-	-	75.9	74.5	***229***	77.5	***204***	34.2	***94.1***	6.75	***160***	26.9	***152***	48.3	***135***	9.79
Zinc	mg/kg	123	315	80.9	60.2	68.2	4.29	79.8	3.69	69.1	4.34	63.8	2.75	***89.4***	7.91	76.8	5.12
Zirconium	mg/kg	-	-	1.90	-	-	-	-	-	-	-	***5.58***	0.192	***6.24***	4.16	***2.77***	0.350

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" = no data, ***Bold/ Italics*** - Exposed value is > both reference and pre-breach 95th percentile values; reference value is > reference 95th percentile value (< 5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of pre-breach 95th percentile values see Appendix Table D.2.4, for calculation of reference 95th percentile values see Appendix Table D.2.5. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Tables D.2.8 and D.2.9). Sediments from HAC-D had significantly lower TOC content than reference sediments from 2018 to 2022 and TOC content was also temporally stable over this period, relative to reference (Figure 6.2; Appendix Tables F.1.3 and F.1.4).

The mean concentration of 16 out of 34 elements in the sediments (<63 µm fraction) collected in 2022 at HAC-D exceeded both pre-breach and reference upper 95th percentile values (Table 6.2). Among these elements, copper and iron were the only Analytes of Interest with mean sediment concentrations that also exceeded the WSQG in 2022 (Figure 6.2, Table 6.2; Appendix Table D.2.9). Specifically, the mean iron concentration of HAC-D sediments in 2022 exceeded the lower WSQG by 2.1 times, while the mean copper concentration exceeded the upper WSQG by 1.7 times (Table 6.2). However, mean sediment iron concentrations were naturally elevated above the lower WSQG in reference sediments (EDC-D) in each monitoring year (2018 to 2022; Figure 6.2, Table 6.2) indicating that iron is somewhat naturally elevated in stream habitats in the vicinity of the Mount Polley Mine.

Mean copper and iron concentrations in HAC-D sediments have been significantly higher than reference sediments from 2018 to 2022, except iron concentrations in 2019 that were similar to reference (Appendix Table F.1.4). The mean copper concentrations in HAC-D sediments in 2022 were similar to 2018 and 2021, but higher than 2019 and 2020, relative to reference (Figure 6.2; Appendix Table F.1.3). Mean iron concentrations in HAC-D sediments in 2022 were similar to the previous two years (2020 and 2021), higher than in 2019, and lower than in 2018, relative to reference (Figure 6.2; Appendix Table F.1.3). The similar (copper) or lower (iron) Analyte of Interest concentrations in HAC-D sediments in 2022 compared to 2018 indicates these analyte concentrations do not appear to be increasing over time, relative to reference (Figure 6.2).

Copper and iron concentrations in Hazeltine Creek sediment have demonstrated significant correlations with TOC, sulphur, and total nitrogen (Appendix Figure F.1.3, Appendix Table F.1.5). For copper, these relationships were positive and for iron these relationships were negative. These relationships suggest that the changes in copper and iron concentrations over time in lower Hazeltine Creek sediments are associated with temporal variability in the physical and chemical characteristics of the sampled sediment (Appendix Figure F.1.3, Appendix Table F.1.5).

6.1.2 Periphyton Community and Productivity

Periphyton community and productivity monitoring in 2022 was completed in remediated (exposed) areas of upper Hazeltine Creek (HAC-R1, HAC-U) with upper Edney Creek (EDC-U) serving as reference (Figure 4.2, Table 4.2). Post-breach periphyton productivity (chlorophyll-a) results from upper Hazeltine Creek were compared to those collected during baseline (1995, 1996) and pre-breach (2011; Table 4.2). Periphyton productivity monitoring

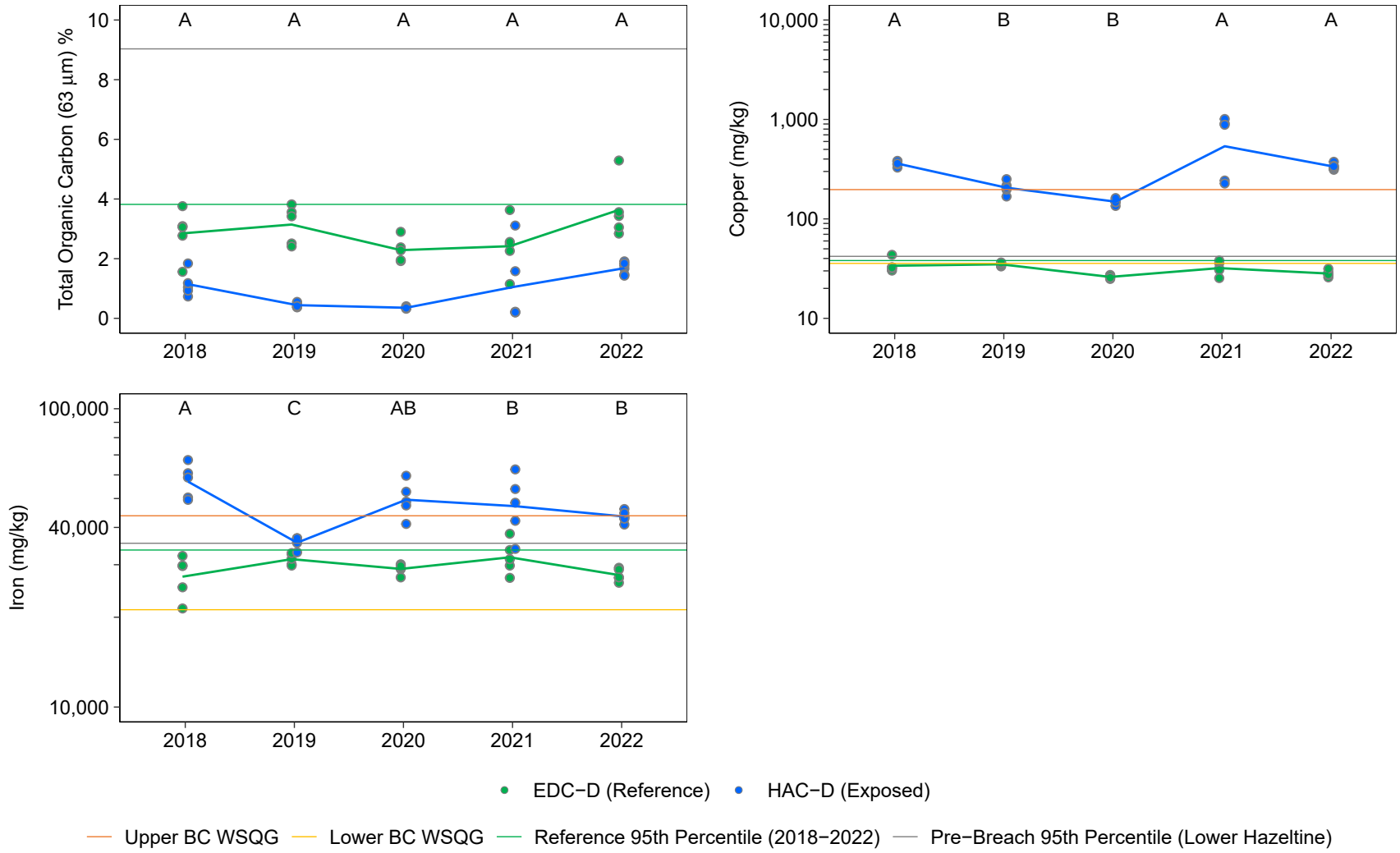

Figure 6.2: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

(excluding community monitoring) was also completed in upper Hazeltine Creek (HAC-R3) with an area of Frypan Creek (FPC-R3) serving as reference (Figures 4.2 and 4.3, Table 4.2). Periphyton productivity monitoring at HAC-R3 and FPC-R3 was completed for the purpose of assessing fish habitat and data from this monitoring in 2022 were tabulated in the current report to meet CEMP requirements but were interpreted in a separate report (Minnow 2023). A review of the 2022 periphyton productivity and community data (Appendix B) indicated that the data met the established DQOs. Specifically, the community data were characterized by high subsampling agreement and data precision and accuracy checks, and the productivity data were characterized by appropriate LRLs, and negligible analyte concentrations in MB samples (Appendix B). Overall, the 2022 periphyton community and productivity data can be used with a high level of confidence in the derivation of conclusions. A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

6.1.2.1 Area Characteristics

During sampling in upper Hazeltine Creek and upper Edney Creek (i.e., reference), careful attention was paid to matching sampling habitats both year-to-year, and between the paired exposed and reference sampling areas. However, matching habitats characteristics of sampling areas was difficult in 2022 and in prior years (2018 to 2021; Minnow 2019a, 2020a, 2021a, 2022a) due a combination of factors. In 2022, matching habitat variables in upper Hazeltine Creek to those in upper Edney Creek was challenging due to supplemental pumping of water from Polley Lake to Hazeltine Creek that increased water depth and velocity in Hazeltine Creek (see Section 4.2.1 for details). This was consistent with challenges encountered in previous monitoring years due to the supplemental pumping (2018 to 2021) which were exacerbated in some years by extreme climate events in the area (i.e., drought conditions in summer 2021; Minnow 2022a). As such, the variability in water depth and velocity among years and between the exposed and reference areas were considered when interpreting temporal changes, and these physical habitat variables are summarized below.

Examination of the physical habitat characteristics of the upper Hazeltine Creek areas (HAC-R1 and HAC-U) indicated that mean water depth and velocity was similar between the two exposed areas within a year (controllable by sample station selection) but was variable among years (Table 6.3). Water depth and velocity differed between the upper Hazeltine Creek areas and reference area in most years (Table 6.3). In 2022, mean water depth at HAC-R1 and HAC-U was approximately three times greater than the mean water depth measured at EDC-U, and mean water velocity at HAC-U was approximately two times greater than the mean water velocity measured at EDC-U and HAC-R1 (Table 6.3; Appendix Table A.2.3). Substrate size,

Table 6.3: Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Habitat Variables	Units	Reference									
		Upper Edney Creek (EDC-U)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	19.3		19.4		11.4		13.6		11.0	
Mean Water Velocity	m/s	0.002		0.472		0.127		0		0.212	
Median Substrate Size[a]	cm	4.7		4.2		-		5.5		5.7	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Gravel	
Canopy Cover[b]	%	60		70		70		85		80	
Water Quality		**15-Aug-18[c]**	**Seasonal Range[d]**	**12-Aug-19[c]**	**Seasonal Range[d]**	**10-Aug-20[c]**	**Seasonal Range[d]**	**2-Aug-21[c]**	**Seasonal Range[d]**	**8-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	81.5	-	72.0	-	86.6	-	59.9	-	77.3	-
Temperature	°C	11.5	-	20.0	-	14.6	-	15.7	-	13.0	-
Specific Conductivity	µS/cm	119	-	116	-	138	-	141	-	125.4	-
Total Phosphorus	mg/L	0.0107	-	0.0270	-	0.0160	-	0.0227	-	0.0107	-
Total Nitrogen	mg/L	0.460	-	0.720	-	0.627	-	0.540	-	0.509	-
Dissolved Orthophosphate	mg/L	0.00300	-	<0.0010	-	0.00380	-	0.00530	-	0.0017	-
Periphyton Productivity											
Mean AFDM	g/m^2	6.66		9.60		8.05		4.89		10.6	
Mean Chlorophyll-a	mg/m^2	11.5		25.0		8.46		5.44		39.5	

Notes: AFDM = Ash Free Dry Mass. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when periphyton community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50 th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with periphyton sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2020, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2020]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]). Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

Table 6.3: Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Habitat Variables	Units	Exposed									
		Upper Hazeltine Creek - Reach 1 (HAC-R1)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	22.3		20.9		34.5		24.2		37.8	
Mean Water Velocity	m/s	0.159		0.411		0.133		0.088		0.216	
Median Substrate Size[a]	cm	4.9		5.0		4.5		5.4		5.2	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Cobble	
Canopy Cover[b]	%	0		0		0		0		0	
Water Quality		**19-Aug-18[c]**	**Seasonal Range[d]**	**12-Aug-19[c]**	**Seasonal Range[d]**	**11-Aug-20[c]**	**Seasonal Range[d]**	**3-Aug-21[c]**	**Seasonal Range[d]**	**8-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	85.1	75.1 - 105.6	92.0	83.2 - 105.2	96.7	90.1 - 99.6	81.5	93.1 - 99.0	78.4	8 - 11
Temperature	°C	14.6	12.3 - 22.9	18.0	12.5 - 18.2	16.6	4.0 - 22.0	19.5	6.16 - 21.9	17.9	4.86 - 19.8
Specific Conductivity	µS/cm	288	261 - 293	278	275 - 288	240	146 - 271	243	194 - 260	247.9	246 - 288
Total Phosphorus	mg/L	0.0120	0.0110 - 0.0284	0.0140	0.0122 - 0.0264	0.0141	0.0132 - 0.0290	0.0134	0.0108 - 0.0165	0.0127	0.0119 - 0.0157
Total Nitrogen	mg/L	0.280	0.267 - 0.381	0.350	0.291 - 0.406	0.311	0.292 - 0.431	0.284	0.283 - 0.305	0.294	0.268 - 0.362
Dissolved Orthophosphate	mg/L	0.00410	<0.0010 - 0.0074	0.00180	0.0015 - 0.0085	0.00460	0.0012 - 0.0046	0.00640	0.0027 - 0.0079	0.0010	0.0014 - 0.0046
Periphyton Productivity											
Mean AFDM	g/m^2	15.5		58.1		126		15.9		96.7	
Mean Chlorophyll-a	mg/m^2	17.7		47.2		56.7		34.0		87.4	

Notes: AFDM = Ash Free Dry Mass. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when periphyton community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50 th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with periphyton sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2020, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2020]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]). Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

Table 6.3: Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Habitat Variables	Units	Exposed									
		Upper Hazeltine Creek - Reach 2 (HAC-U)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	19.7		19.6		29.8		26.3		32.8	
Mean Water Velocity	m/s	0.222		0.454		0.240		0.160		0.460	
Median Substrate Size[a]	cm	5.5		4.8		4.2		4.6		5.5	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Cobble	
Canopy Cover[b]	%	0		0		0		0		0	
Water Quality		**19-Aug-18[b]**	**Seasonal Range[c]**	**12-Aug-19[b]**	**Seasonal Range[c]**	**11-Aug-20[c]**	**Seasonal Range[d]**	**3-Aug-21[c]**	**Seasonal Range[d]**	**8-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	113	85.6 - 116.3	102	95.0 - 115.4	84.1	93.9 - 114.6	82.1	95.9 - 114	90.8	8.6 - 12
Temperature	°C	16.7	11.6 - 16.9	20.0	11.9 - 16.7	17.2	4.98 - 21.5	17.4	6.84 - 21.3	18.3	4.64 - 17.9
Specific Conductivity	µS/cm	308	231 - 333	307	315 - 341	313	172 - 288	314	216 - 314	273.3	257 - 342
Total Phosphorus	mg/L	0.0110	0.011 - 0.0229	0.0130	0.0106 - 0.0277	0.0140	0.0142 - 0.0264	0.0104	0.0098 - 0.0187	0.0138	0.0142 - 0.0156
Total Nitrogen	mg/L	0.370	0.305 - 0.458	0.350	0.372 - 0.530	0.349	0.317 - 0.426	0.321	0.295 - 0.357	0.318	0.294 - 0.384
Dissolved Orthophosphate	mg/L	0.00270	0.0012 - 0.0074	<0.00100	<0.0010 - 0.0084	0.00410	0.0016 - 0.0050	0.00420	0.0014 - 0.0087	0.0034	0.0012 - 0.0067
Periphyton Productivity											
Mean AFDM	g/m^2	10.2		30.0		59.4		37.3		37.8	
Mean Chlorophyll-a	mg/m^2	12.6		35.7		14.9		22.9		26.8	

Notes: AFDM = Ash Free Dry Mass. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when periphyton community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50 th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with periphyton sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2020, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2020]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]). Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

which is controlled for during sampling, was similar between areas and among years (Table 6.3; Appendix Table A.2.5).

Remediation work following the breach was completed at HAC-R1 and HAC-U in 2016 and 2017, respectively (Table 4.2; see Section 4.2), and the regeneration of riparian vegetation at these remediated areas is a long-term process. Although the riparian vegetation in these upper Hazeltine Creek areas has shown substantial growth since the completion of remediation works, canopy cover over the creek channel remained absent in 2022, which was consistent with all previous sampling years (2018 to 2021; Table 6.3). Canopy coverage in 2022 remained a key difference between the remediated areas of Hazeltine Creek and the Edney Creek reference area (0% canopy coverage at HAC-R1 and HAC-U versus 80% canopy coverage at EDC-U; Table 6.3; Appendix A.2.2).

6.1.2.2 Community

In 2022, the periphyton community at HAC-R1 was similar to the reference area (EDC-U) in terms of mean density, total taxon richness, and Simpson's Evenness and Diversity. The periphyton community at HAC-U in 2022 had lower mean density and higher total richness at HAC-U compared to reference, and Simpson's Evenness and Diversity that were similar to reference (Figure 6.3, Table 6.4). Diatom richness at both HAC-R1 and HAC-U in 2022 was significantly higher than reference (Figure 6.3, Table 6.4).

The periphyton communities of the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) in 2022 were similar to each other in terms of all primary metrics (density, total taxon richness, Simpson's Evenness and Diversity, and Diatom richness; Table 6.4). Temporally, the periphyton communities of HAC-R1 and HAC-U have also been consistently similar to each other from 2018 to 2022 in terms of the primary metrics, with a few exceptions. These exceptions included significantly higher density in 2019, lower total richness in 2018, and higher Simpson's Evenness and Diversity in 2021 at HAC-U compared to HAC-R1 (Figure 6.3; Table 6.4). The similarity in periphyton communities at the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) in 2022, and for most metrics in prior years, indicates that recovery of the periphyton community in these two areas has been similar.

Mean periphyton densities at the upper Hazeltine Creek areas (HAC-R1 and HAC-U) have been similar to the reference area (EDC-U) from 2018 to 2022, except in 2022 when density at HAC-U was significantly lower than reference (Figure 6.3, Table 6.4; Appendix Tables D.3.1 and D.3.2). The lower mean periphyton density at HAC-U than reference in 2022 was due to a significant temporal increase in periphyton density at the reference area (significantly higher in 2022 than in 2019 to 2021), rather than a decrease in density at HAC-U (Figure 6.3, Table 6.4). Periphyton densities at HAC-U have remained temporally stable from 2018 to 2022 (Figure 6.3,

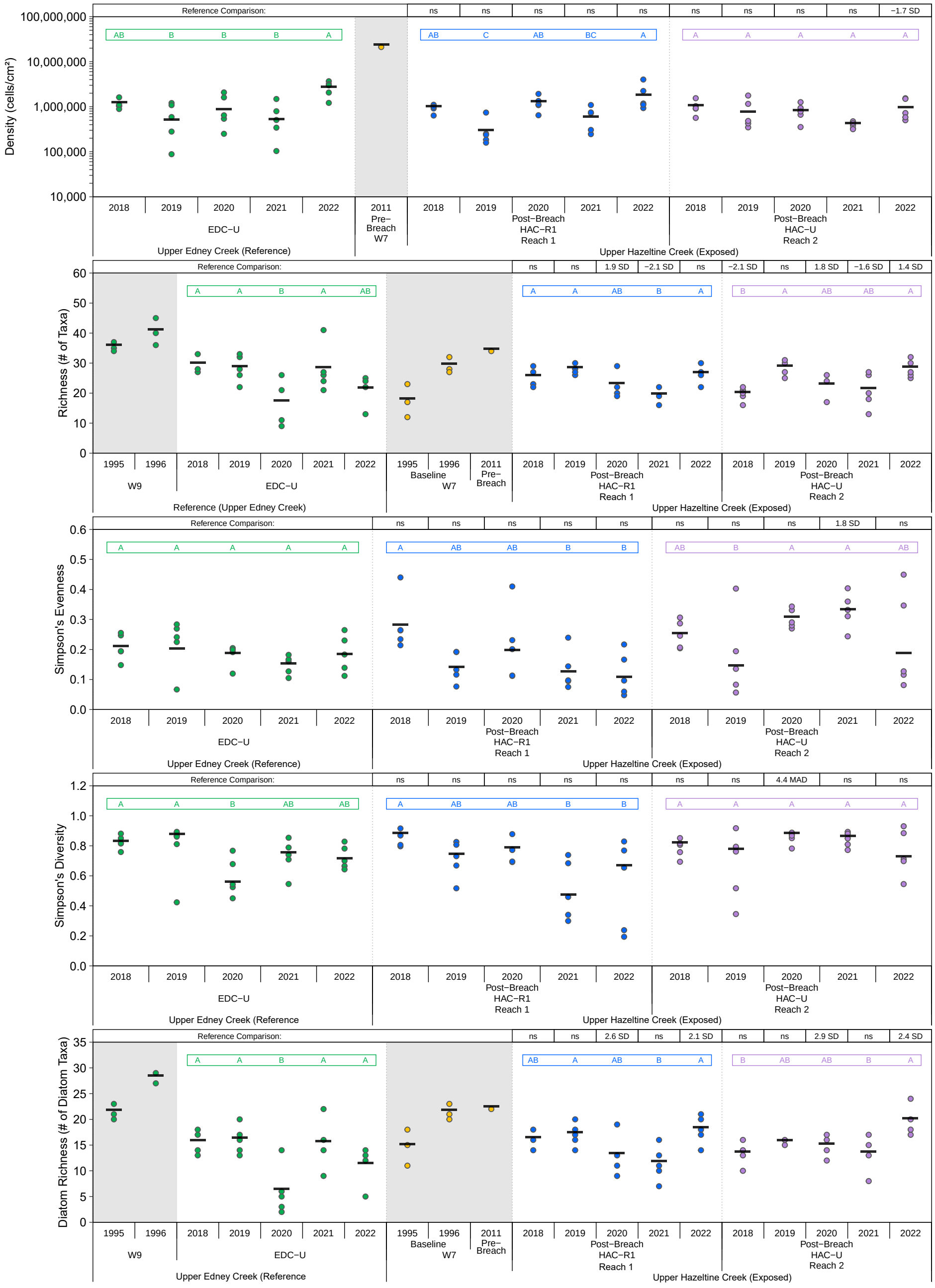

Figure 6.3: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only.

Table 6.4: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year[a]	Mean	Measures of Central Tendency[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
										Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Interaction						2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Density (cells/cm²)	log10	-	-	0.096	Reference	EDC-U	2018	1,138,405	1,114,480	AB	B	B	B	A	Baseline	ns	ns	ns	ns	ns	ns
							2019	650,148	453,327											ns	ns
							2020	1,025,442	782,145											ns	ns
							2021	646,922	463,190											ns	ns
							2022	2,629,813	2,450,576											ns	-1.7
					Exposed	HAC-R1	2018	928,580	913,229	AB	C	AB	BC	A	Baseline	-2.0	ns	ns	ns		ns
							2019	315,025	264,869												1.5
							2020	1,226,087	1,154,247												ns
							2021	622,251	535,936												ns
							2022	1,896,058	1,614,583												ns
					Exposed	HAC-U	2018	995,413	946,120	A	A	A	A	A	Baseline	ns	ns	ns	ns		
							2019	837,310	681,485												
							2020	801,041	737,791												
							2021	387,310	382,691												
							2022	969,187	866,272												
Total Richness (# of Taxa)	none	-	-	<0.001	Reference	EDC-U	2018	28.8	29.0	A	A	B	A	AB	Baseline	ns	-3.0	ns	ns	ns	-2.1
							2019	28.2	28.0											ns	ns
							2020	15.6	16.0											1.9	1.8
							2021	27.8	28.0											-2.1	-1.6
							2022	21.8	22.0											ns	1.4
					Exposed	HAC-R1	2018	26.0	26	A	A	AB	B	A	Baseline	ns	ns	-1.7	ns		-1.5
							2019	27.6	28												ns
							2020	23.8	24												ns
							2021	18.4	18												ns
							2022	26.2	26												ns
					Exposed	HAC-U	2018	19.6	20	B	A	AB	AB	A	Baseline	1.8	ns	ns	1.9		
							2019	27.6	28												
							2020	23.4	23												
							2021	20.8	21												
							2022	28.0	28												
Simpson's Evenness	log10	-	-	0.045	Reference	EDC-U	2018	0.208	0.200	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns
							2019	0.217	0.190											ns	ns
							2020	0.183	0.180											ns	ns
							2021	0.148	0.150											ns	1.8
							2022	0.186	0.180											ns	ns
					Exposed	HAC-R1	2018	0.283	0.270	A	AB	AB	B	B	Baseline	ns	ns	-1.9	-2.3		ns
							2019	0.142	0.130												ns
							2020	0.213	0.190												ns
							2021	0.130	0.120												2.3
							2022	0.117	0.100												ns
					Exposed	HAC-U	2018	0.250	0.250	AB	B	A	A	AB	Baseline	ns	ns	ns	ns		
							2019	0.174	0.140												
							2020	0.303	0.300												
							2021	0.330	0.330												
							2022	0.224	0.180												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Remediated Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Remediated Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table 6.4: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year[a]	Mean	Measures of Central Tendency[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
										Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Interaction						2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Simpson's Diversity	rank	-	-	0.003	Reference	EDC-U	2018	0.824	0.820	A	A	B	AB	AB	Baseline	ns	-3.7	ns	ns	ns	ns
							2019	0.771	0.860											ns	ns
							2020	0.593	0.540											ns	4.4
							2021	0.727	0.740											ns	ns
							2022	0.724	0.700											ns	ns
					Exposed	HAC-R1	2018	0.852	0.870	A	AB	AB	B	B	Baseline	ns	ns	-5.6	-2.9		ns
							2019	0.710	0.730												ns
							2020	0.762	0.770												ns
							2021	0.504	0.460												5.3
							2022	0.537	0.650												ns
					Exposed	HAC-U	2018	0.785	0.810	A	A	A	A	A	Baseline	ns	ns	ns	ns		
							2019	0.667	0.760												
							2020	0.853	0.870												
							2021	0.841	0.850												
							2022	0.754	0.710												
Diatom Richness (# of Taxa)	none	-	-	<0.001	Reference	EDC-U	2018	15.2	15	A	A	B	A	A	Baseline	ns	-2.9	ns	ns	ns	ns
							2019	16.0	16											ns	ns
							2020	6.0	6											2.6	2.9
							2021	15.4	15											ns	ns
							2022	11.4	11											2.1	2.4
					Exposed	HAC-R1	2018	15.6	16	AB	A	AB	B	A	Baseline	ns	ns	ns	ns		ns
							2019	17.0	17												ns
							2020	14.2	14												ns
							2021	11.4	11												ns
							2022	18.0	18												ns
					Exposed	HAC-U	2018	13.2	13	B	AB	AB	B	A	Baseline	ns	ns	ns	1.9		
							2019	15.4	15												
							2020	15.2	15												
							2021	12.2	12												
							2022	19.2	19												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Remediated Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals.
MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Remediated Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table 6.4). Temporal changes in periphyton density at HAC-R1 from 2018 to 2022 were similar to those observed at the reference area, resulting in consistently similar densities at HAC-R1 and the reference area over this period (Figure 6.3, Table 6.4). The similarity in the temporal changes at HAC-R1 relative to the reference area indicates that the changes were likely related to natural variability in physical and chemical factors (e.g., light exposure, water temperature, nutrient availability).

Temporal comparisons of total taxon richness from 2018 to 2022 demonstrated variability at HAC-R1 and HAC-U when compared to the reference area. Total richness at both exposed areas was similar to or higher than reference in most years, except at HAC-U in 2018 and at both areas in 2021, when total richness was significantly lower than reference (Figure 6.3, Table 6.4). Despite this variability relative to reference, total richness within each of the exposed areas has been largely temporally stable, with total richness in 2022 similar to or higher than in prior years (2018 to 2021; Figure 6.3, Table 6.4; Appendix Tables D.3.1 and D.3.2). Total taxon richness of the periphyton community is generally used as a relative measure for assessment of stream health in that differences in number of taxa are interpreted as improvement (increasing taxon richness) or degradation (decreasing taxon richness; Amblard 1990). Despite the temporal variability in total richness at the exposed areas relative to reference, the similar (at HAC-R1) or significantly higher (at HAC-U) mean total richness in 2022, relative to reference, is a positive indicator of good periphyton community health in upper Hazeltine Creek. Similar to total taxon richness, Diatom taxon richness is used as a metric for determining relative stream health (Barbour et al. 1999). Diatom richness at both exposed areas (HAC-R1 and HAC-U) has been similar to or significantly higher than reference (EDC-U) from 2018 to 2022 (Figure 6.3, Table 6.4; Appendix Tables D.3.1 and D.3.2). This is a further positive indicator of good periphyton community health in the areas of upper Hazeltine Creek.

Temporal comparisons indicated that Simpson's Evenness and Diversity at the exposed areas were not significantly different from the reference area from 2018 to 2022 except for higher Simpson's Evenness (2021) and Diversity (2020), which were significantly higher at HAC-U (Figure 6.3, Table 6.4). There have been no significant differences in Simpson's Evenness or Diversity among monitoring years (2018 to 2022) at HAC-U indicating temporal stability within this area. In the past two years (2021 and 2022) at HAC-R1, Simpson's Evenness and Diversity were significantly lower compared to 2018 (Figure 6.3, Table 6.4), but did not differ relative to reference over time. The consistent similarity between both exposed (HAC-R1 and HAC-U) and reference (EDC-U) areas further indicates good periphyton community health within upper Hazeltine Creek.

In 2022, periphyton communities of upper Hazeltine Creek and the reference area were dominated by Cyanobacteria (blue-green algae; Figure 6.4). The remainder of the periphyton community at HAC-R1 and HAC-U in 2022 was primarily composed of Diatoms, Phaeophytes, and Chlorophytes (Figure 6.4). The periphyton community at HAC-R1 in 2022 had relative densities (%) of most taxa that were similar relative to reference area, except for significantly higher relative densities of Phaeophytes (brown algae) that were absent from the reference area in 2022 (Appendix Figure F.2.1, Appendix Tables D.3.1, D.3.2, and F.2.1). The periphyton community at HAC-U in 2022 had significantly higher relative densities of Phaeophytes and Diatoms than the reference area, and significantly lower relative densities of Cyanobacteria. In addition, Rhodophytes (red algae) were not observed at either exposed area in 2022 despite being present at the reference area (EDC-U). The periphyton communities of HAC-R1 and HAC-U in 2022 were similar to each other in terms of the relative densities of the most dominant taxa except for a significantly higher mean relative density of Chlorophytes at HAC-U compared to HAC-R1 (Figure 6.4; Appendix Figure F.2.1, Appendix Table F.2.1). Evaluations of the dominant taxa in 2022 (i.e., Cyanobacteria, Diatoms, and Chlorophytes) based on density were largely similar to those based on relative densities, except that the density of Diatoms at HAC-U was not significantly different than the reference area (but relative density was significantly higher; Appendix Figures F.2.1, F.2.2, Appendix Table F.2.1).

Temporal evaluation of periphyton community composition has demonstrated relative densities of Diatoms and Chlorophytes at HAC-R1 and HAC-U that were similar to or significantly higher than reference from 2018 to 2022, except significantly lower relative densities of Chlorophytes at HAC-R1 in 2021 compared to reference. In contrast, the relative densities of Cyanobacteria at HAC-R1 and HAC-U from 2018 to 2022 were similar to or lower than reference (Appendix Figure F.2.1, Appendix Table F.2.1). The significantly lower relative densities of Cyanobacteria, and higher relative densities of Diatoms at HAC-R1 and HAC-U, relative to reference, are indicative of healthy periphyton communities (Pandey et al. 2018; Xue et al. 2019). Within HAC-R1 and HAC-U, the relative densities of Cyanobacteria have been similar from 2019 to 2022, as have the relative densities of Diatoms at HAC-U. The relative densities of Diatoms and Chlorophytes at HAC-R1 in 2022 were similar to both 2019 and 2020, while relative densities of Chlorophytes at HAC-U in 2022 were similar to all prior years (2018 to 2021; Appendix Figure F.2.1, Appendix Table F.2.1). The relative densities of less prevalent taxa have been similar to reference since 2018 for Chrysophytes and Dinoflagellates, while the relative densities of Phaeophytes were consistently higher than reference (due to a near absence at the reference area in all years). Rhodophytes were consistently absent from the upper Hazeltine Creek areas but present at the reference area (Appendix Figure F.2.1, Appendix Tables D.3.1, D.3.2

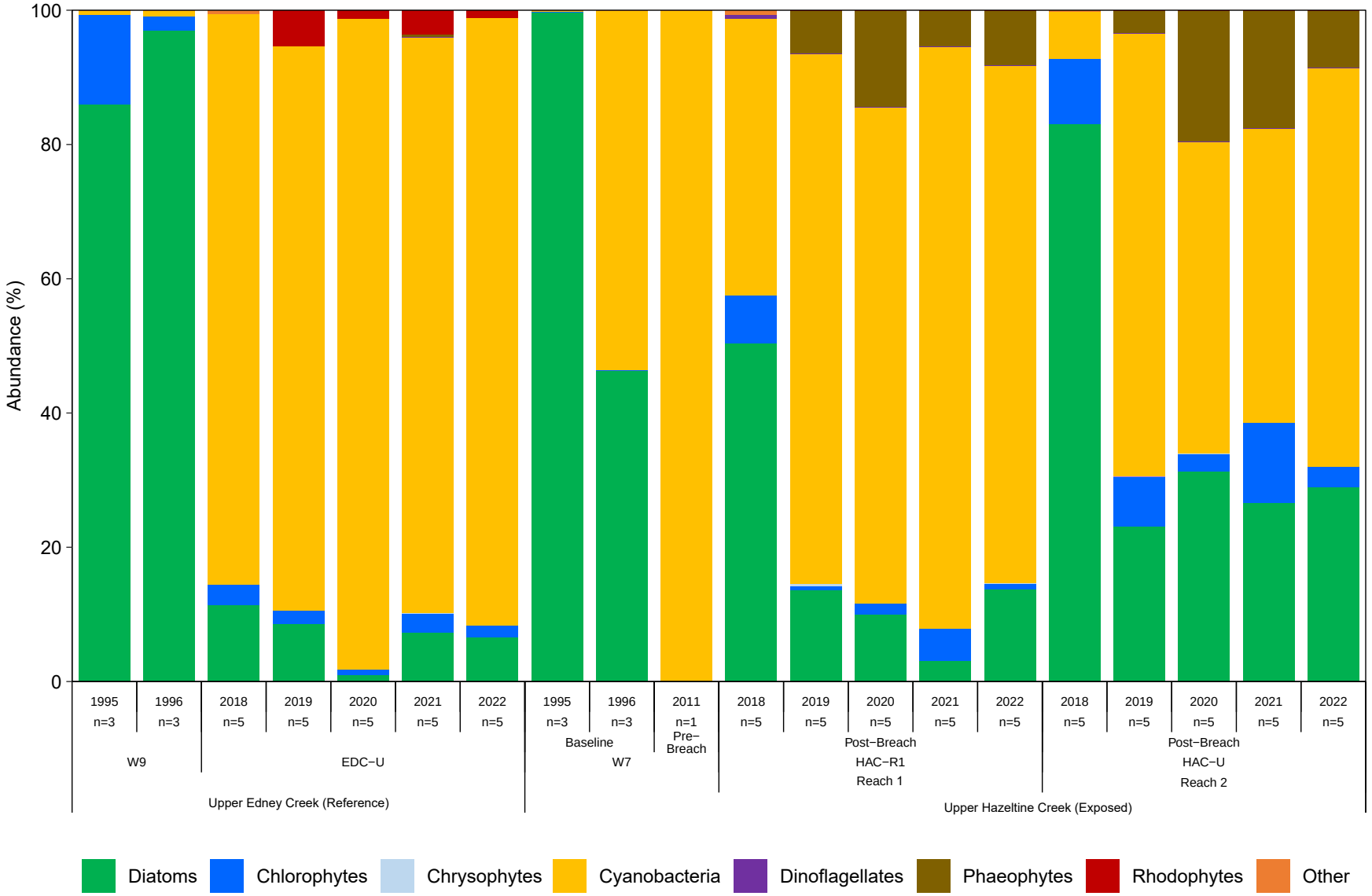

Figure 6.4: Relative Mean Densities of Major Periphyton Community Taxonomic Groups for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Notes: The sampling area W7 (2011) is the pre-breach equivalent of the post-breach sampling areas HAC-R1 and HAC-U (2018 to 2022). In 2018 and earlier, Chrysophytes, Phaeophytes, and Rhodophytes are grouped into the 'Other' category. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

and F.2.1). The relative temporal stability of the dominant taxa within the exposed areas and/or relative to reference, and the similar or lower relative densities of Cyanobacteria and the similar or higher relative densities of Diatoms compared to reference are indicative of relatively stable periphyton communities at the upper Hazeltine Creek areas.

Overall, the periphyton community of upper Hazeltine Creek (HAC-R1 and HAC-U) in 2022 had total taxon richness and Simpson's Evenness and Diversity that were similar or higher than the reference area, and higher Diatom richness than reference. Periphyton density at HAC-R1 was similar to reference in 2022 and all prior years. At HAC-U, periphyton density in 2022 was lower than reference but has been temporally stable from 2018 to 2022 within HAC-U. The periphyton communities at the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) were similar in 2022 in terms of density, total richness, Simpson's Evenness and Diversity, and Diatom richness, indicating similar recovery of the periphyton community in these two areas. The community composition at HAC-R1 (as measured by relative densities of dominant taxa) was similar to the reference area in 2022 for most groups (except Phaeophytes [brown algae] that were absent from the reference area). At HAC-U, the community composition in 2022 differed from the reference area in terms of higher relative densities of Diatoms and Phaeophytes, and lower relative densities of Cyanobacteria than the reference area. The higher and lower proportions of Diatoms and Cyanobacteria, respectively, relative to reference, are indicative of healthy periphyton communities. The similarity (or exceedance) of the periphyton community metrics (density, total richness, Simpson's Evenness and Diversity, Diatom richness) in upper Hazeltine Creek compared to the reference area in most years and/or temporal stability of these metrics are indicative of relatively stable periphyton communities at the upper Hazeltine Creek areas. Combined with the relative temporal stability of the dominant taxa within the exposed areas and/or relative to reference, and the similarity in community endpoints between the two areas (HAC-R1 and HAC-U), these are indicative of the health and robustness of the periphyton community in both areas of upper Hazeltine Creek.

6.1.2.3 Productivity

Mean periphyton chlorophyll-a (mass per unit area; mg/m²) in upper Hazeltine Creek (HAC-R1 and HAC-U) in 2022 was below the BCWQG of 100 mg/m² (BCMOECCS 2021b) but means at both areas were above a threshold indicative of moderately enriched streams (21 mg/m²; Biggs 1996; Figure 6.5; Appendix Tables D.3.2 and D.3.3). Two of the replicate samples from HAC-R1 in 2022 had chlorophyll-a (mg/m²) that exceeded the BCWQG, but samples from this area in 2022 showed a high degree of variability (mean = 87.4 ± 37.1 mg/m²; Figure 6.5; Appendix Table D.3.2). Periphyton chlorophyll-a (mg/m²) in 2022 at HAC-U was similar to the reference area (EDC-U), while the mean at HAC-R1 was significantly higher

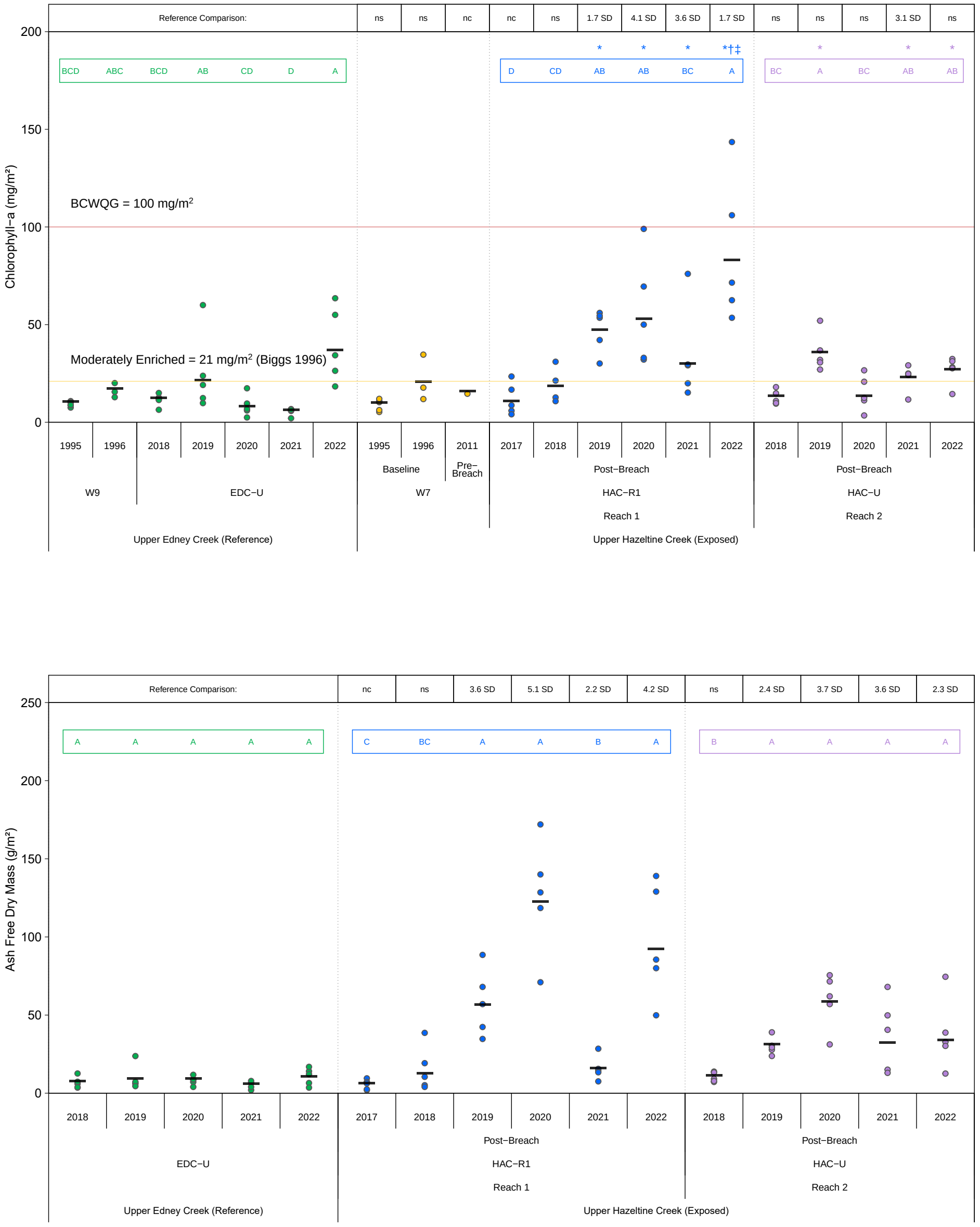

Figure 6.5: Periphyton Productivity Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. For statistical contrasts of Chlorophyll−a data, the analyses compared post−breach (2017 to 2022) to baseline (1995 and 1996) to pre−breach conditions (2011) at W7. The sampling area W7 (2011) is the pre−breach equivalent of the post−breach sampling areas HAC−R1 and HAC−U (2017 to 2022). Significant differences between HAC−R1 or HAC−U post−breach (2017 to 2022) results compared to baseline (1995 and 1996) or pre−breach (2011) results for W7 are indicated as follows: an * indicates significant differences to W7 in 1995, a † indicates significant differences to W7 in 1996, and a ‡ indicates significant differences to W7 in 2011. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

than reference (Figure 6.5; Appendix Table F.2.2). The higher chlorophyll-a (mg/m²) at HAC-R1 in 2022 compared to reference (EDC-U) may be related, at least in part, to elevated water temperatures and increased exposure to sunlight from lack of canopy cover at the upper Hazeltine Creek areas (Table 6.3; Schnurr and Allen 2015).

From 2019 to 2022, chlorophyll-a (mg/m²) at HAC-R1 was significantly higher than reference. The magnitude of this difference was the same in 2019 and 2022 (1.7 SD) indicating that productivity at HAC-R1 has not increased progressively over time, relative to reference (Figure 6.5; Appendix Table F.2.2). Conversely, mean chlorophyll-a at HAC-U was similar to reference from 2018 to 2022, except for 2021, when chlorophyll-a was higher at HAC-U compared to reference (Figure 6.5; Appendix Table F.2.2). This was likely a result of chlorophyll-a (mg/m²) at the reference area in 2021 that was lower than other monitoring years (2019 and 2022; Figure 6.5; Appendix Tables D.3.2, D.3.3 and F.2.2). Except for 2021, chlorophyll-a in upper Hazeltine Creek generally followed similar temporal patterns as the reference area (EDC-U; Figure 6.5), suggesting that temporal changes may be related to natural variability in physical and chemical factors (e.g., temperature and nutrient availability). Chlorophyll-a (mg/m²) at HAC-U in 2022 was significantly higher than 1995 but similar to the 1996 baseline, pre-breach (2011), and prior post-breach years (2018 to 2021; Figure 6.5; Appendix Table F.2.2). Conversely, chlorophyll-a at HAC-R1 in 2022 was significantly higher than baseline (1995, 1996), pre-breach (2011), and most post-breach years (2017, 2018 and 2021; Appendix Table F.2.2). Chlorophyll-a at HAC-R1 was significantly higher than at HAC-U in 2020 and 2022 (Appendix Table F.2.2). *In situ* measures of dissolved oxygen recorded in upper Hazeltine Creek indicate that dissolved oxygen concentrations measured during periphyton sampling, and in the year preceding sampling, were consistently higher than the short-term BCWQG but occasionally lower than the long-term BCWQG by a maximum of 7% in August (Appendix Tables D.1.2 to D.1.4). These results indicate that dissolved oxygen concentrations largely remain above the long-term BCWQG despite increased periphyton growth in upper Hazeltine Creek.

Productivity measured as AFDM at HAC-R1 and HAC-U in 2022 was significantly higher than the reference area (EDC-U), which was consistent with the chlorophyll-a results for HAC-R1 but not the chlorophyll-a results for HAC-U in 2022 (Figure 6.5; Appendix Tables D.3.2, D.3.3 and F.2.2). Mean AFDM at HAC-R1 and HAC-U increased significantly between 2018 and 2019, and has remained stable since 2019, except at HAC-R1 in 2021 when drought conditions occurred in the area (Figure 6.5). Mean AFDM in upper Hazeltine Creek (HAC-R1 and HAC-U) has been significantly higher than reference (EDC-U) since 2019, suggesting recovery to stable periphyton biomass conditions. The significantly higher periphyton AFDM in areas of upper Hazeltine Creek compared to reference may be related, at least in part, to the elevated water temperature and increased exposure to sunlight from lack of canopy cover (Table 6.3; Schnurr and Allen 2015).

Like chlorophyll-a (mg/m²), AFDM at HAC-R1 was significantly higher than at HAC-U in 2020 and 2022 (Appendix Table F.2.2).

Overall, the chlorophyll-a and AFDM results indicated that productivity was significantly higher in upper Hazeltine Creek than in the reference area in 2022 but mean chlorophyll-a (mg/m²) at all areas remained below the BCWQG. Greater periphyton productivity at the remediated (exposed) areas relative to reference was likely related, at least in part, to greater exposure to direct sunlight due to the absence of canopy cover at these areas. The lack of cover in the remediated areas also drives higher water temperatures in upper Hazeltine Creek, which although mitigated to some extent by supplemental pumping from below the thermocline in Polley Lake (see Section 6.1.2), could also contribute to higher productivity. Both chlorophyll-a and AFDM at HAC-R1 in 2022 were significantly higher than at HAC-U, indicating this area had greater periphyton productivity. Periphyton productivity in upper Hazeltine Creek increased following remediation efforts and has remained temporally stable since 2019 except at HAC-R1 where AFDM decreased in 2021, potentially due to the drought conditions during this year. Despite the increased productivity following remediation efforts, water quality monitoring indicates that dissolved oxygen concentrations largely remain above the long-term BCWQG in upper Hazeltine Creek. The recovery of periphyton productivity in upper Hazeltine Creek since completion of remediation indicates there are appropriate environmental conditions (e.g., nutrients, sunlight, lack of turbidity, adequate water quality) to support periphyton growth in this area.

6.1.3 Benthic Invertebrate Community and Productivity

Benthic invertebrate community and productivity monitoring in 2022 was completed in exposed (remediated) areas of upper Hazeltine Creek (HAC-R1, HAC-U) with an area of upper Edney Creek (EDC-U) [62] serving as reference (Figure 4.2, Table 4.3). Post-breach benthic invertebrate community results from upper Hazeltine Creek were compared to those collected in 2007 (from UHC) to evaluate changes relative to pre-breach conditions (Table 4.3). Benthic invertebrate community and productivity monitoring was also completed in upper Hazeltine Creek (HAC-R3) with an area of Frypan Creek (FPC-R3) serving as reference (Figures 4.2 and 4.3, Table 4.3). The monitoring at HAC-R3 and FPC-R3 in 2022 was completed for the purpose of assessing fish habitat, and these data were tabulated in the current report to meet CEMP requirements (Appendix Tables D.4.1 to D.4.4) but were interpreted in a separate report (Minnow 2023). A review of the 2022 benthic invertebrate community data quality (Appendix B) indicated these data were of excellent quality (see Section 5.2.5 for details).

[62] Upper Edney Creek (EDC-U; reference) was not sampled in 2020 due to habitat differences relative to upper Hazeltine Creek (Minnow 2021a). As such, temporal data interpretation for reference does not refer to 2020.

A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

6.1.3.1 Area Characteristics

The challenges associated with matching sampling habitats between the paired exposed and reference sampling areas outlined for periphyton monitoring (see Section 6.1.2.1) also applied to benthic invertebrate community and productivity monitoring in 2022 (Table 6.5; Appendix Table A.2.3). Briefly, supplemental pumping of water from Polley Lake to Hazeltine Creek in 2022 increased water depth and velocity in Hazeltine Creek (see Section 4.2.1 for details), which presented challenges for matching habitat variables in the upper Edney Creek reference area to those in upper Hazeltine Creek. This was consistent with challenges encountered in previous monitoring years due to the supplemental pumping (2018 to 2021; Minnow 2019a, 2020a, 2021a, 2022a) which were exacerbated in some years by extreme climate events in the area (i.e., drought conditions in summer 2021; Minnow 2022a). For instance, mean water velocity at the reference area was highly dissimilar to upper Hazeltine Creek in 2018 and 2021 due to local drought conditions (0 to 0.002 m/s), and the reference area was not sampled in 2020 due to obvious habitat differences relative to the upper Hazeltine Creek areas (Table 6.5; Minnow 2021a). In 2022, water velocity at the exposed areas (mean = 0.371 to 0.448 m/s) was similar to the reference area (mean = 0.339 m/s) but water depth at the exposed areas (mean = 28.8 to 28.9 cm) was approximately 2.4 times that in the reference area (mean = 12.0 cm; Table 6.5). In consideration of the temporal variability in water depth and velocity, data interpretation focused on the following comparisons for the upper Hazeltine Creek areas in the post-breach period: 1) comparisons to reference conditions at upper Edney Creek (EDC-U) in post-breach years (2018 to 2022), 2) comparisons to pre-breach conditions (UHC in 2007), and 3) temporal changes within the exposed areas (HAC-R1, HAC-U) from 2018 to 2022.

Evaluation of water quality collected routinely in upper Hazeltine Creek (at HAC-13 and HAC-05a; Figure 4.2) indicated that concentrations of total and dissolved metals exceeded the long-term BCWQG in samples collected during the year preceding sampling (i.e., September 2021 to August 2022). Specifically, at HAC-13 (which is located closest to the HAC-R1 sampling area), dissolved aluminum and copper exceeded the long-term BCWQG in 17 % and 75% of samples, respectively (Appendix Figures D.1.1 and D.1.2, Appendix Table D.1.3). At HAC-05a (which is located closest to the HAC-U sampling area), the long-term BCWQG was exceeded by total chromium (8% of samples) and total selenium (42% of samples), and dissolved aluminum (17% of samples) and dissolved copper (75% of samples; Appendix Figures D.1.1 and D.1.2, Appendix Table D.1.3). No analyte concentrations exceeded the short-term BCWQG in samples



Table 6.5: **Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Habitat Variables	Units	Reference									
		Upper Edney Creek (EDC-U)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	19.3		19.4		-		10.3		12.0	
Mean Water Velocity	m/s	0.002		0.472		-		0		0.339	
Median Substrate Size[a]	cm	4.7		4.2		-		5.5		5.7	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Gravel	
Canopy Cover[b]	%	60		70		70		85		80	
Water Quality		**15-Aug-18[c]**	**Seasonal Range[d]**	**12-Aug-19[c]**	**Seasonal Range[d]**	**10-Aug-20[c]**	**Seasonal Range[d]**	**2-Aug-21[c]**	**Seasonal Range[d]**	**3-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	81.5	-	72.0	-	86.6	-	59.9	-	77.3	-
Temperature	°C	11.5	-	20.0	-	14.6	-	15.7	-	13.0	-
Specific Conductivity	µS/cm	119	-	116	-	138	-	141	-	125.4	-
Total Phosphorus	mg/L	0.0107	-	0.0270	-	0.0160	-	0.0227	-	0.0107	-
Total Nitrogen	mg/L	0.460	-	0.720	-	0.627	-	0.540	-	0.509	-
Dissolved Orthophosphate	mg/L	0.00300	-	<0.0010	-	0.00380	-	0.00530	-	0.0017	-
Benthic Invertebrate Productivity											
Benthic Organism Density	#/m^2	6,458		15,432		-		4,529		22,389	
Mean Biomass	g/m^2 DW	1.39		1.09		-		0.537		5.09	

Notes: DW = dry weight. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when benthic invertebrate community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with benthic invertebrate community sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2022, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2022]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]) . Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

Table 6.5: **Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Habitat Variables	Units	Exposed									
		Upper Hazeltine Creek - Reach 1 (HAC-R1)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	22.3		20.9		23.7		20.0		28.8	
Mean Water Velocity	m/s	0.159		0.411		0.242		0.183		0.371	
Median Substrate Size[a]	cm	4.9		5.0		4.5		5.4		5.2	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Cobble	
Canopy Cover[b]	%	0		0		0		0		0	
Water Quality		**19-Aug-18[c]**	**Seasonal Range[d]**	**12-Aug-19[c]**	**Seasonal Range[d]**	**11-Aug-20[c]**	**Seasonal Range[d]**	**3-Aug-21[c]**	**Seasonal Range[d]**	**8-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	85.1	75.1 - 105.6	92.0	83.2 - 105.2	96.7	90.1 - 99.6	81.5	93.1 - 99.0	78.4	7.98 - 11.27
Temperature	°C	14.6	12.3 - 22.9	18.0	12.5 - 18.2	16.6	4.0 - 22.0	19.5	6.16 - 21.9	17.9	4.86 - 19.76
Specific Conductivity	µS/cm	288	261 - 293	278	275 - 288	240	146 - 271	243	194 - 260	247.9	246 - 288
Total Phosphorus	mg/L	0.0120	0.0110 - 0.0284	0.0140	0.0122 - 0.0264	0.0141	0.0132 - 0.0290	0.0134	0.0108 - 0.0165	0.0127	0.0119 - 0.0157
Total Nitrogen	mg/L	0.280	0.267 - 0.381	0.350	0.291 - 0.406	0.311	0.292 - 0.431	0.284	0.283 - 0.305	0.294	0.268 - 0.362
Dissolved Orthophosphate	mg/L	0.00410	<0.0010 - 0.0074	0.00180	0.0015 - 0.0085	0.00460	0.0012 - 0.0046	0.00640	0.0027 - 0.0079	0.0010	0.0014 - 0.0046
Benthic Invertebrate Productivity											
Benthic Organism Density	#/m^2	19,750		35,493		36,987		10,097		44,467	
Mean Biomass	g/m^2 DW	0.804		3.59		3.97		2.86		2.13	

Notes: DW = dry weight. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when benthic invertebrate community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with benthic invertebrate community sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2022, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2022]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]) . Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

Table 6.5: **Physical and Chemical Characteristics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Habitat Variables	Units	Exposed									
		Upper Hazeltine Creek - Reach 2 (HAC-U)									
		2018		2019		2020		2021		2022	
Mean Water Depth	cm	19.7		19.6		22.3		19.1		28.9	
Mean Water Velocity	m/s	0.222		0.454		0.459		0.363		0.448	
Median Substrate Size[a]	cm	5.5		4.8		4.2		4.6		5.5	
Dominant Substrate Type	-	Gravel		Cobble		Cobble		Cobble		Cobble	
Canopy Cover[b]	%	0		0		0		0		0	
Water Quality		**19-Aug-18[b]**	**Seasonal Range[c]**	**12-Aug-19[b]**	**Seasonal Range[c]**	**11-Aug-20[c]**	**Seasonal Range[d]**	**3-Aug-21[c]**	**Seasonal Range[d]**	**8-Aug-22[c]**	**Seasonal Range[d]**
Dissolved Oxygen	%	113	85.6 - 116.3	102	95.0 - 115.4	84.1	93.9 - 114.6	82.1	95.9 - 114	90.8	8.61 - 11.99
Temperature	°C	16.7	11.6 - 16.9	20.0	11.9 - 16.7	17.2	4.98 - 21.5	17.4	6.84 - 21.3	18.3	4.64 - 17.9
Specific Conductivity	µS/cm	308	231 - 333	307	315 - 341	313	172 - 288	314	216 - 314	273.3	257 - 342
Total Phosphorus	mg/L	0.0110	0.011 - 0.0229	0.0130	0.0106 - 0.0277	0.0140	0.0142 - 0.0264	0.0104	0.0098 - 0.0187	0.0138	0.0142 - 0.0156
Total Nitrogen	mg/L	0.370	0.305 - 0.458	0.350	0.372 - 0.530	0.349	0.317 - 0.426	0.321	0.295 - 0.357	0.318	0.294 - 0.384
Dissolved Orthophosphate	mg/L	0.00270	0.0012 - 0.0074	<0.00100	<0.0010 - 0.0084	0.00410	0.0016 - 0.0050	0.00420	0.0014 - 0.0087	0.0034	0.0012 - 0.0067
Benthic Invertebrate Productivity											
Benthic Organism Density	#/m^2	39,326		47,280		45,996		15,597		33,747	
Mean Biomass	g/m2 DW	1.24		5.31		5.33		2.73		4.57	

Notes: DW = dry weight. mg/m^2 = milligrams per square metre. Physical and chemical characteristic data are compiled for years when benthic invertebrate community monitoring was completed (2018 to 2022). *In situ* measures of dissolved oxygen, temperature, and specific conductivity are presented.

[a] The displayed median substrate size represents the median (50th percentile) of 100 pebble measures recorded for each sampling area. See Appendix Table A.2.5 for pebble count data.

[b] Canopy cover includes dense and partially open cover.

[c] Water quality results are from a single grab water sample collected within a week of biological sampling at a given area. The date of sample collection is shown.

[d] Seasonal range indicates the range of water quality parameters reported from routine water quality sampling. This included data from approximately 3 months preceding/concurrent with benthic invertebrate community sampling (2018 to 2022: late April to late July [n = 4 for HAC-U from 2018 to 2022, n = 11 for HAC-R1 in 2018, n=4 for HAC-R1 in 2019 and 2022]; 2021 and 2022: late April to early August [n = 4 for HAC-R1 and HAC-U]) . Routine water quality data from station HAC-13 was used for HAC-R1, and data from station HAC-05a was used for HAC-U (see Figure 4.2). Water quality is not monitored routinely near EDC-U or HAC-R3. See Appendix Tables D.1.3 and D.1.4 for 2022 results, and Minnow (2019a, 2020a, 2021a, 2022a) for 2018, 2019, 2020, and 2021 results, respectively.

collected from these exposed areas (Appendix Tables D.1.3 and D.1.4). Water quality is not routinely monitored at the upper Edney Creek reference area (EDC-U), but the single sample collected concurrently with biological monitoring (in August 2022) demonstrated analyte concentrations that were all below the BCWQG (Appendix Table D.1.2).

6.1.3.2 Community

The benthic invertebrate communities at HAC-U and HAC-R1 in 2022 were similar to reference (EDC-U) in terms of mean density, taxon richness, and Simpson's Evenness and Diversity except for significantly higher density at HAC-R1 (44,467 organisms/m^2) compared to reference (22,389 organisms/m^2; Figure 6.6, Table 6.6; Appendix Tables D.4.5 and D.4.6). Densities at HAC-R1 and HAC-U (33,747 organisms/m^2) in 2022 were also similar to pre-breach conditions (39,228 organisms/m^2), as were Simpson's Evenness and Diversity (Figure 6.6, Table 6.6). Mean taxon richness at HAC-R1 in 2022 (29 taxa) was significantly lower than pre-breach (44 taxa) while taxon richness at HAC-U in 2022 (32 taxa) was similar to pre-breach (Figure 6.6, Table 6.6). Overall, the benthic invertebrate community at HAC-R1 and HAC-U in 2022 was similar to both reference and pre-breach in terms of most primary metrics (density, richness, Simpson's Evenness and Diversity), except higher density than reference (but similar to pre-breach) at HAC-R1 and lower taxon richness than pre-breach (but similar to reference) at HAC-R1. These results indicate the benthic invertebrate community of Upper Hazeltine Creek has largely recovered to reference and/or pre-breach conditions when primary metrics (density, richness, Simpson's Evenness and Diversity) are considered.

The benthic invertebrate communities of the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) in 2022 were similar to each other in terms of all primary metrics (density, taxon richness, and Simpson's Evenness and Diversity; Table 6.6). Temporally, the benthic invertebrate communities of these two areas have also been consistently similar to each other from 2018 to 2022 in terms of the primary metrics with few exceptions. These exceptions included significantly lower taxon richness in 2021, and significantly higher Simpson's Diversity in 2020 at HAC-U compared to HAC-R1 (Figure 6.6; Table 6.4). The similarity in benthic invertebrate communities at the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) in 2022 and most prior years indicates that recovery of the benthic invertebrate community in these two areas has been largely similar when primary metrics are considered.

Mean benthic invertebrate densities at HAC-U and HAC-R1 have been significantly higher than the reference area (EDC-U) from 2018 to 2022 with one exception: density at HAC-U in 2022 was similar to reference (Figure 6.6, Table 6.6; Appendix Tables D.4.5 and D.4.6). The benthic invertebrate densities at HAC-R1 and HAC-U from 2018 to 2022 were similar to pre-breach densities with the exception of HAC-R1 in 2021, when density was significantly lower

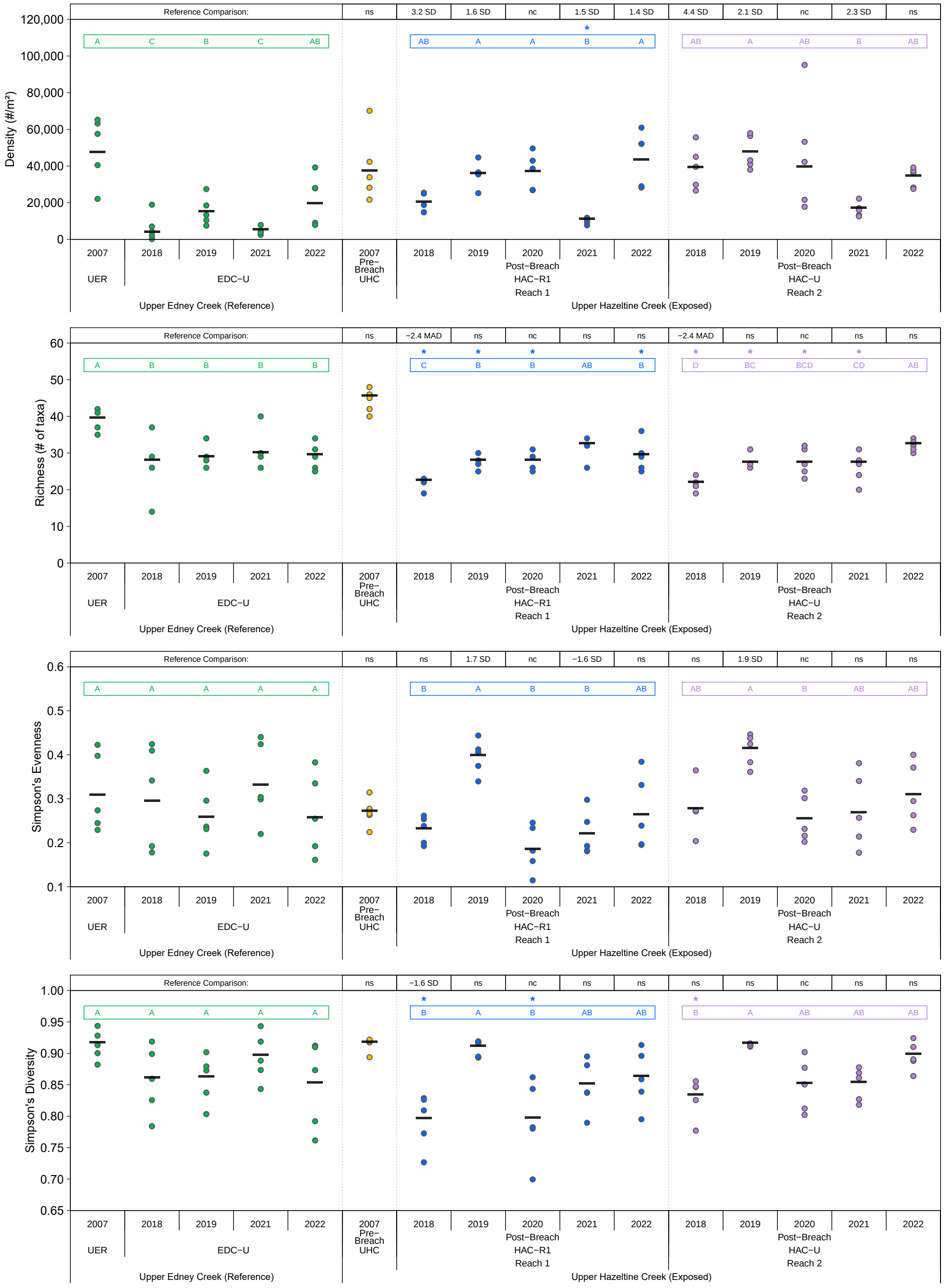

Figure 6.6: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post−breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post −hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

Table 6.6: **Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022**

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year[a]	Mean	Measures of Central Tendency[b]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years						Temporal Contrasts Within Sites: MOD Relative to Baseline[c]						Spatial Comparison Within Years[c,e]	
		Area	Year	Area x Year						2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Density (#/m²)	log10	-	-	0.032	Reference	EDC-U	2007	49,703	46,264	A	C	B	nc	C	AB	Baseline	-4.7	-2.1	nc	-4.1	ns	ns	
							2018	6,458	2,889													3.2	4.4
							2019	15,432	13,953													1.6	2.1
							2020	-	-													nc	nc
							2021	4,529	4,220													1.5	2.3
							2022	22,389	18,505													1.4	ns
					Exposed	HAC-R1	2007	-	36,099	A	AB	A	A	B	A	Baseline	ns	ns	ns	-2.2	ns		nc
							2018	19,750	19,199														ns
							2019	35,493	34,919														ns
							2020	36,987	35,882														ns
							2021	10,097	9,982														ns
							2022	44,467	42,290														ns
					Exposed	HAC-U	2007	39,228	36,099	AB	AB	A	AB	B	AB	Baseline	ns	ns	ns	ns	ns		
							2018	39,326	37,938														
							2019	47,280	46,578														
							2020	45,996	38,275														
							2021	15,597	15,864														
							2022	33,747	33,383														
Richness (# of taxa)	rank	-	-	0.010	Reference	EDC-U	2007	39.4	41.0	A	B	B	nc	B	B	Baseline	-4.0	-4.4	nc	-4.0	-4.0	ns	
							2018	27.0	29.0													-2.4	-2.4
							2019	29.0	28.0													ns	ns
							2020	-	-													nc	nc
							2021	30.8	29.0													ns	ns
							2022	29.0	29.0													ns	ns
					Exposed	HAC-R1	2007	-	45.0	A	C	B	B	AB	B	Baseline	-7.8	-5.7	-5.4	ns	-5.4		nc
							2018	21.6	22.0														ns
							2019	28.0	28.0														ns
							2020	28.0	29.0														ns
							2021	31.6	32.0														-1.7
							2022	29.2	29.0														ns
					Exposed	HAC-U	2007	44.2	45.0	A	D	BC	BCD	CD	AB	Baseline	-7.8	-6.1	-6.1	-6.1	ns		
							2018	22.0	22.0														
							2019	28.2	27.0														
							2020	27.6	27.0														
							2021	26.3	27.0														
							2022	32.0	32.0														

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available, nc = no comparison, ns = no significance, nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts against of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure 6.9.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 not calculated because UHC in 2007 represents baseline for both HAC-R1 and HAC-U.

Table 6.6: **Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022**

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year[a]	Mean	Measures of Central Tendency[b]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years						Temporal Contrasts Within Sites: MOD Relative to Baseline[c]						Spatial Comparison Within Years[c,e]	
		Area	Year	Area x Year						2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Simpson's Evenness	log10	-	-	0.017	Reference	EDC-U	2007	0.314	0.300	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	ns		
							2018	0.309	0.290													ns	ns
							2019	0.260	0.250													1.7	1.9
							2020	-	-													nc	nc
							2021	0.337	0.330													-1.6	ns
							2022	0.265	0.250													ns	ns
					Exposed	HAC-R1	2007	-	0.270	AB	B	A	B	B	AB	Baseline	ns	ns	ns	ns	ns		nc
							2018	0.229	0.230														ns
							2019	0.395	0.390														ns
							2020	0.187	0.180														ns
							2021	0.220	0.220														ns
							2022	0.269	0.260														ns
					Exposed	HAC-U	2007	0.269	0.270	AB	AB	A	B	AB	AB	Baseline	ns	ns	ns	ns	ns		
							2018	0.277	0.270														
							2019	0.411	0.410														
							2020	0.254	0.250														
							2021	0.271	0.260														
							2022	0.312	0.300														
Simpson's Diversity	none	-	-	0.016	Reference	EDC-U	2007	0.913	0.910	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	ns		
							2018	0.857	0.860													-1.6	ns
							2019	0.859	0.860													ns	ns
							2020	-	-													nc	nc
							2021	0.893	0.890													ns	ns
							2022	0.850	0.850													ns	ns
					Exposed	HAC-R1	2007	-	0.910	A	B	A	B	AB	AB	Baseline	-3.1	ns	-3.0	ns	ns		nc
							2018	0.793	0.790														ns
							2019	0.908	0.910														ns
							2020	0.793	0.790														1.4
							2021	0.848	0.850														ns
							2022	0.860	0.860														ns
					Exposed	HAC-U	2007	0.915	0.910	A	B	A	AB	AB	AB	Baseline	-2.1	ns	ns	ns	ns		
							2018	0.830	0.830														
							2019	0.913	0.910														
							2020	0.849	0.850														
							2021	0.852	0.850														
							2022	0.895	0.900														

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available, nc = no comparison, ns = no significance, nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts against of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure 6.9.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 not calculated because UHC in 2007 represents baseline for both HAC-R1 and HAC-U.

than pre-breach (Figure 6.6, Table 6.6). The significantly lower total density at HAC-R1 in 2021 was driven by significantly lower Chironomidae densities that occurred at both HAC-R1 and HAC-U in 2021 compared to all other post-breach monitoring years (Appendix Figure F.3.1, Appendix Table F.3.1). Within both HAC-R1 and the reference area (EDC-U), benthic invertebrate densities at each area in 2021 were similar to 2018, but significantly lower than all remaining monitoring years within each area (Figure 6.6, Table 6.6). These similar year-over-year changes at HAC-R1 and the reference area suggest that the decreased benthic invertebrate densities at HAC-R1 in 2021 compared to pre-breach were likely related to environmental conditions that similarly affected HAC-R1 and the reference area (EDC-U); namely the drought-like conditions that occurred in 2018 and 2021 (Minnow 2022a). Density at HAC-U has been temporally stable from 2018 to 2022 except that density in 2021 was significantly lower than in 2019 (Figure 6.6, Table 6.6). The temporal evaluation indicates that recovery of benthic invertebrate densities at HAC-R1 and HAC-U to pre-breach and/or reference conditions has been consistently observed since 2018.

Taxon richness at HAC-R1 and HAC-U was similar to reference from 2019 to 2022, but significantly lower than pre-breach from 2018 to 2022, except in 2021 at HAC-R1 and in 2022 at HAC-U when richness was similar to pre-breach values (Figure 6.6, Table 6.6). Simpson's Diversity at HAC-R1 and HAC-U was similar to reference and to pre-breach from 2019 to 2022 except in 2020 at HAC-R1 when Simpson's Diversity was lower than pre-breach (Figure 6.6, Table 6.6). Simpson's Evenness showed more temporal variability relative to reference but was similar to pre-breach from 2018 to 2022 in both exposed areas (HAC-R1 and HAC-U; Figure 6.6, Table 6.6). Simpson's Evenness and Diversity indices at both HAC-R1 and HAC-U in 2022 were temporally similar to prior post-breach monitoring years (i.e., 2018 to 2021; Figure 6.6, Table 6.6). The similarities of taxon richness and Simpson's Evenness and Diversity at HAC-R1 and HAC-U in 2022 to pre-breach and/or reference (EDC-U) conditions indicate that both upper Hazeltine Creek areas support a diverse benthic invertebrate community similar to that of reference and pre-breach conditions. The continued lower taxon richness at HAC-R1 in 2022 relative to pre-breach, but not reference, indicates that some recovery in community structure at this area is ongoing relative to pre-breach conditions.

Chironomidae was the most abundant taxon present at the upper Hazeltine Creek areas in 2022 (Figure 6.7). The mean relative densities of Chironomidae at HAC-R1 (62%) and HAC-U (36%) in 2022 were significantly higher than pre-breach (22%) and the reference area (EDC-U; 19%; Figure 6.7; Appendix Figure F.3.1, Appendix Table F.3.1). This contrasted with 2021 when the relative densities of Chironomidae at both HAC-R1 and HAC-U were similar to pre-breach and significantly lower than reference; a change that was owing to a significant increase in both relative density and density of Chironomidae at both areas between 2021

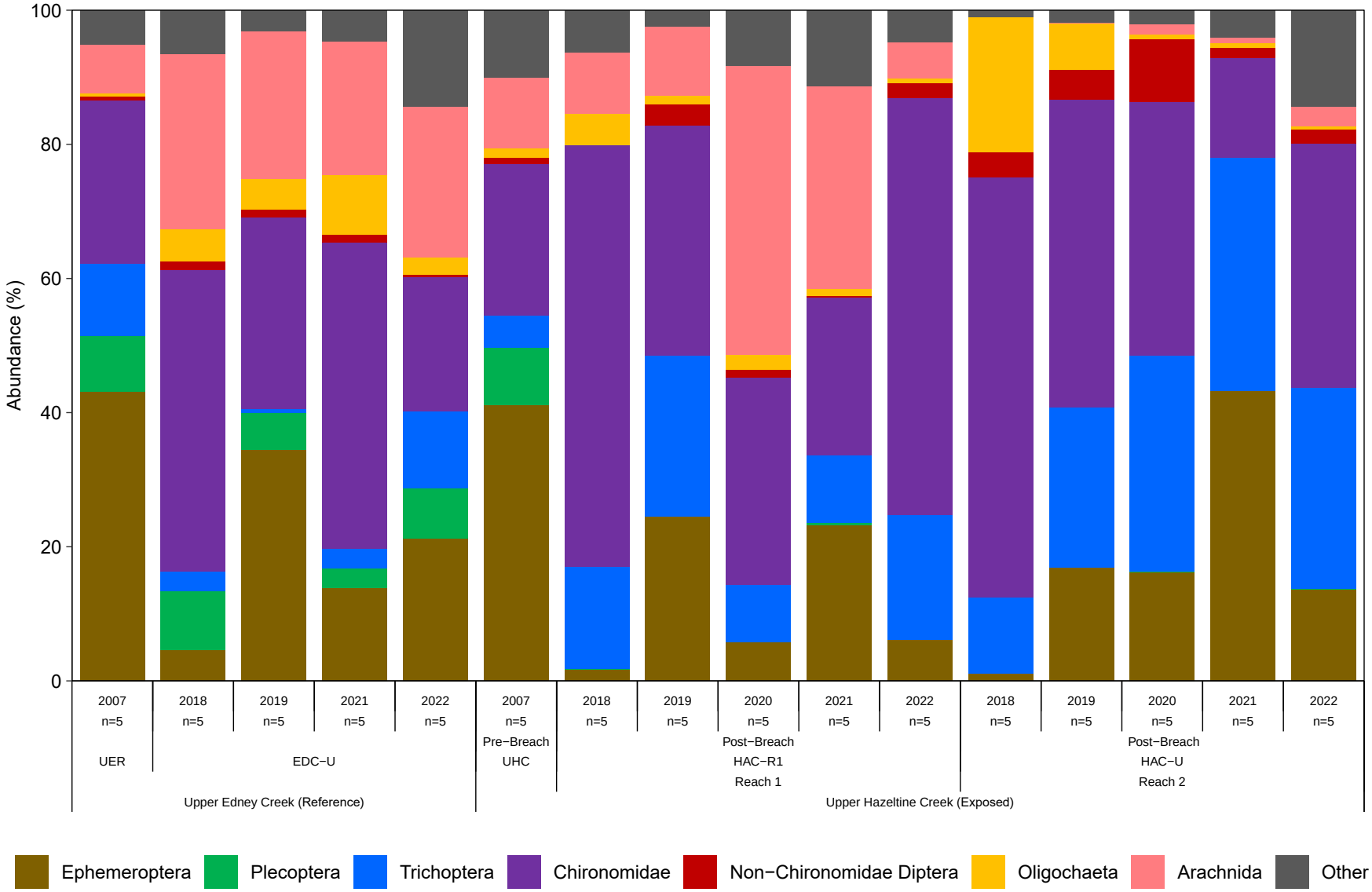

Figure 6.7: Relative Mean Densities of Major Benthic Invertebrate Community Taxonomic Groups for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

and 2022 (Appendix Figures F.3.1 and F.3.2, Appendix Tables F.3.1). For both HAC-R1 and HAC-U, the increase in Chironomidae density between 2021 and 2022 reflected a return to densities that were similar to prior years (2018 to 2020) and was the primary driver of the temporal changes in total density observed between 2021 and 2022 at HAC-R1 (Appendix Figure F.3.1, Appendix Table F.3.1). For relative densities of Chironomidae, the significant increase between 2021 and 2022 reflected a return to 2018 conditions at HAC-R1 (i.e., significantly higher than 2019 to 2021) and a return to conditions similar to 2019 and 2020 at HAC-U (i.e., significantly higher than 2021; Appendix Figure F.3.1, Appendix Tables D.4.5, D.4.6, F.3.1). The relative density of Chironomidae in 2022 at HAC-R1 was significantly higher compared to HAC-U and showed a higher magnitude of difference to both reference and pre-breach. Chironomidae are tolerant of environmental stress (Mandaville 2002) and are generally expected to be present in greater proportion with increasing environmental disturbance (Barbour 1999). The significantly higher relative densities of Chironomidae in 2022 at HAC-R1 and HAC-U compared to reference and pre-breach indicate that the community in these areas have not yet fully recovered to pre-breach and reference conditions. In addition, the higher relative density and the greater magnitude of difference compared to reference for Chironomidae at HAC-R1 in 2022 compared to HAC-U suggest that the recovery of the benthic invertebrate community at HAC-R1 may be less advanced than at HAC-U.

The relative density of EPT at HAC-R1 in 2022 (25%) was significantly lower than pre-breach (55%) and the reference area (EDC-U; 43%), while the mean relative density of EPT at HAC-U (43%) was similar to pre-breach and the reference area in 2022 (Appendix Figures F.3.1, Appendix Table F.3.1). The lower relative density of EPT at HAC-R1 in 2022 contrasts with 2021 when EPT relative density at HAC-R1 was higher than reference. This temporal change in the relative density of EPT at HAC-R1 (from higher to lower than reference between 2021 and 2022) was driven by the significant increase in density of Chironomidae between 2021 and 2022, as evidenced by densities of EPT at HAC-R1 and HAC-U in 2022 that were similar to all prior years (i.e., a decrease in EPT density did not occur in 2022; Appendix Figures F.3.1 and F.3.2, Appendix Table F.3.1). Furthermore, the densities of EPT at HAC-R1 and HAC-U in 2022 were similar to both pre-breach and reference conditions, which suggests recovery of these taxa that are sensitive indicators of environmental disturbances (Lenat 1988, Herman and Nejadhashemi 2015). At HAC-R1 however, the relative density of EPT has remained significantly lower than pre-breach in all years except 2019, indicating that the proportion of the community that these sensitive taxa occupy has not yet recovered to pre-breach conditions (owing to a higher relative contribution of Chironomidae and/or Arachnida; Appendix Figures F.3.1 and F.3.2, Appendix Table F.3.1).



Within the EPT group, there were significant differences between areas and among years in the densities and relative densities of the individual Ephemeroptera, Plecoptera, and Trichoptera taxa. Most notably, the taxa Plecoptera (stoneflies), which were present pre-breach (8%) and at the reference area (EDC-U; 10%) in 2022, were not present at the upper Hazeltine Creek areas for all post-breach monitoring years including 2022 (Figure 6.7; Appendix Figure F.3.1, Appendix Table F.3.1). Plecoptera have narrow ecological requirements and are vulnerable to water pollution, habitat fragmentation, and alteration of water courses and their banks (Mandaville 2002). The lack of Plecoptera at the upper Hazeltine Creek areas since initiation of monitoring in 2018, suggest habitat conditions in these remediated areas are currently better suited for the colonization of Ephemeroptera and Trichoptera than Plecoptera for the EPT taxa.

The relative densities of Ephemeroptera (mayflies) at HAC-R1 (6%) and HAC-U (14%) in 2022 were significantly lower (-7.3 SD and -3.4 SD, respectively) than the reference area (EDC-U; 21%), and lower than pre-breach (41%; Figure 6.7; Appendix Table F.3.1). The lower relative density of Ephemeroptera at HAC-R1 and HAC-U in 2022 (compared to reference and pre-breach) contrasts with 2021 when relative densities at both areas were higher than reference and at HAC-U were similar to pre-breach (Appendix Figure F.3.1, Appendix Table F. 3.1). This temporal change in Ephemeroptera relative density was driven by the significant increase in Chironomidae density between 2021 and 2022 (similar to the temporal change observed for EPT), as evidenced by Ephemeroptera densities at HAC-R1 and HAC-U in 2022 that were similar to those in 2019 to 2021 (i.e., a decrease in Ephemeroptera density did not occur in 2022; Appendix Figures F.3.1 and F.3.2, Appendix Table F.3.1). Similar to most previous post-breach monitoring years (2018, 2020 2021), the mean density of Ephemeroptera at HAC-R1 in 2022 was still significantly lower (-2.2 SD) than pre-breach but significantly higher than in 2018. The mean density of Ephemeroptera at HAC-U has been consistently similar to pre-breach since 2019 (Appendix Tables D.4.6 and F.3.1). In comparison, the relative densities of Ephemeroptera at both HAC-R1 and HAC-U have been consistently lower than pre-breach since 2018 at both areas, except in 2021 at HAC-U when the relative density was similar to pre-breach (Figure 6.7; Appendix Figures F.3.1 and F.3.2, Appendix Table F.3.1). Further investigation of Ephemeroptera showed that the most abundant families (Leptophlebiidae and Baetidae) at HAC-R1 and HAC-U in 2022 are relatively intolerant to water pollution, whereas the most abundant family at the reference area (EDC-U; Heptageniidae) have a higher tolerance to water pollution (Mandaville 2002; Appendix G). The occurrence of Ephemeroptera families at the exposed areas that are less pollutant tolerant than those at the reference area suggests the significantly lower proportion of Ephemeroptera at the exposed areas

(compared to reference and pre-breach) is likely related to physical habitat conditions rather than chemical conditions (i.e., water chemistry).

The other notable change within EPT was the significantly higher relative density of Trichoptera (caddisflies) at both areas of upper Hazeltine Creek compared to pre-breach (in 2018, 2019, and 2022 at HAC-R1; in 2018 to 2022 at HAC-R1) and compared to the reference area in each year (2018 to 2022; Appendix Figure F.3.1, Appendix Table F.3.1). Examination of the relative density of EPT at both areas of upper Hazeltine Creek showed that Trichoptera was the dominant taxa in 2022 (i.e., greatest contributor to EPT relative density), while Ephemeroptera was the dominant taxa in 2021 (Figure 6.7; Appendix Table F.3.1, Appendix Figures F.3.1 and F.3.2). The density and relative density of Trichoptera in 2022 were similar to prior years (2019 to 2021) at both HAC-R1 and HAC-U, indicating temporal stability within each area (Appendix Figure F.3.1, Appendix Table F.3.1). The relative density of Trichoptera at HAC-U (29%) was significantly higher compared to HAC-R1 (18%) in 2022 and showed a higher magnitude of difference in 2022 to both reference and pre-breach. This higher relative density of Trichoptera at HAC-U (29%) in 2022 positively contributed to the higher relative density of EPT observed at HAC-U compared to HAC-R1 in 2022, discussed above (Appendix Figures F.3.1 and F.3.2, Appendix Table F.3.1). The significantly higher mean relative density of Trichoptera at both areas of upper Hazeltine Creek, compared to pre-breach and reference conditions, suggests that the remediated habitat is well suited to specific families within this group. Specifically, net-spinning caddisflies of the family Hydropsychidae composed greater than 74% and 83% of the mean relative density of Trichoptera at HAC-R1 and HAC-U, respectively in 2022. This is similar to results observed since 2018 and much higher than those observed during pre-breach conditions (46%; Appendix G; Minnow 2019a, 2020a, 2021a). A higher relative density of Hydropsychidae has been correlated with habitat disturbance in small streams (Houghton 2004), therefore the significantly higher mean relative density of this group at both areas of upper Hazeltine Creek in 2022 (since 2018 at HAC-R1 and 2019 at HAC-U) was consistent with early recovery of the benthic invertebrate community at this area.

For the remaining taxon evaluated (Arachnida, non-Chironomidae Diptera, and Oligochaeta), only Arachnida had relative densities in 2022 that differed from pre-breach. Specifically, Arachnida relative densities at HAC-U in 2022 were significantly lower than pre-breach, which is consistent with all prior years (2018 to 2022) while the relative densities of Arachnida at HAC-R1 have been similar to or significantly higher than pre-breach from 2018 to 2022 (Figure 6.7; Appendix Figure F.3.1, Appendix Table F.3.1). Reach 1 of Hazeltine Creek (where HAC-R1 is located) was characterized as having more pool habitat and lower water velocities than Reach 2 (where HAC-U is located; Minnow 2021a) and in 2022 periphyton productivity was greater at HAC-R1 compared to HAC-U (See Section 6.1.2.3). Arachnida mainly

inhabit aquatic vegetation (Schatz and Behan-Pelletier 2008), therefore the similar or higher relative densities of Arachnida at HAC-R1 compared to pre-breach was likely reflective of the recovery of aquatic vegetation in this remediated area.

Comparison of the community composition of HAC-R1 and HAC-U in 2022 based on the dominant taxa indicated that the densities and relative densities of most taxa were similar in 2022 between the two exposed areas with three exceptions. These exceptions are noted and discussed above and included significantly higher relative densities of Chironomidae and lower relative densities of EPT and Trichoptera at HAC-R1 compared to HAC-U in 2022 (Appendix Figure F.3.1, Appendix Table F.3.1). As indicated above, these differences in community composition suggest that benthic invertebrate community recovery is more advanced at HAC-U than at HAC-R1.

Correlation analysis indicated that some of differences in benthic invertebrate community metrics at the upper Hazeltine Creek areas (from 2018 to 2022) were related to water velocity, which is modified by the augmentation of water flows in Hazeltine Creek for the purposes of maintaining fish habitat (as outlined in Section 6.1.3.1; Minnow 2023). For instance, Simpson's Evenness and Diversity, the mean density and mean relative density of Ephemeroptera, Trichoptera, EPT and non-Chironomidae Diptera were positively correlated with mean water velocity, whereas the mean relative density of Arachnida was negatively correlated with mean water velocity. Specific conductance, which is reflective of water quality constituent concentrations, was positively correlated with Simpson's Evenness, and density and relative density of Chironomidae and Oligochaeta and negatively correlated with richness and density and density of Arachnida (Appendix Figure F.3.3, Appendix Table F.3.2). The correlations with specific conductance were driven by the highest values that were observed in 2018 and 2019 (immediately after remediation), with lower specific conductance results observed in 2020 onwards (Appendix Figure F.3.3). Of the benthic invertebrate endpoints correlated with specific conductance, taxon richness, Chironomidae density and relative, and Arachnida relative density were the only endpoints in 2022 that differed significantly from pre-breach. Taxon richness was also positively correlated with temperature (with a stronger relationship than observed with specific conductance) suggesting the influence of multiple factors on taxon richness. The significant positive correlation between density and relative density of Chironomidae and specific conductance is consistent with the tolerance of this taxon (Mandaville 2002). However, as indicated above, the occurrence of Ephemeroptera families at the exposed areas that are less pollutant tolerant than those at the reference area suggests the chemical conditions (i.e., water chemistry) of the exposed areas are not limiting for benthic invertebrate community recovery. This is further supported by the absence of significant correlations between Ephemeroptera or EPT and specific conductance. Density of Ephemeroptera and relative density of EPT were negatively, and mean relative density of

Chironomidae was positively correlated, respectively, with substrate size (Appendix Figure F.3.3, Appendix Table F.3.2)

Overall, benthic invertebrate community at both areas of Upper Hazeltine Creek in 2022 was characterized by density, richness, and Simpson's Evenness and Diversity that were similar between the two areas (HAC-R1 and HAC-U) and that were similar to reference and/or pre-breach conditions. Compared specifically to pre-breach, taxon richness at HAC-R1 in 2022 remained significantly decreased but was similar to reference conditions. These results indicate the benthic invertebrate community at these upper Hazeltine Creek areas have largely recovered to reference and/or pre-breach conditions when primary metrics (density, richness, Simpson's Evenness and Diversity) are considered. Chironomidae was the most abundant taxon at both upper Hazeltine Creek areas and was present in proportions at both areas in 2022 that were significantly higher than reference and pre-breach conditions. However, Chironomidae densities at HAC-R1 or HAC-U were only slightly higher than, or similar, respectively, to pre-breach conditions. Although lower relative density of EPT was shown at HAC-R1, but not HAC-U, compared to pre-breach and reference conditions, mean densities of EPT at both areas were similar to each other, pre-breach, and reference conditions. Notable differences in EPT at both upper Hazeltine Creek areas, compared to reference and pre-breach, were the lack of Plecoptera and the higher relative density of Trichoptera, which were dominated by a family of net-spinning caddisflies (Hydropsychidae). The occurrence of Ephemeroptera families at the exposed areas that are less pollutant tolerant than those at the reference area suggests the chemical conditions (i.e., water chemistry) of the exposed areas are not limiting for benthic invertebrate community recovery. Comparison of community composition between the two upper Hazeltine Creek areas suggested that benthic invertebrate community recovery is more advanced in Reach 2 (at HAC-U) than in Reach 1 (at HAC-R1). In summary, these results indicate both areas of upper Hazeltine Creek have recovered substantially since remediation to a condition that is similar to reference and/or pre-breach conditions based on primary metrics, but with some remaining differences in community composition compared to reference and pre-breach.

6.1.3.3 Productivity

Mean total dry biomass of benthic invertebrates at HAC-R1 and HAC-U was similar between the two upper Hazeltine Creek areas in 2022 and was also similar to prior years within each area (2019 to 2021; Figure 6.8; Appendix Table F.3.1). Similar to previous monitoring years, HAC-R1 and HAC-U had significantly higher (2.0 and 3.6 SD, respectively) dry biomass of benthic invertebrates in 2022 than the reference area (EDC-U; Figure 6.8), which at HAC-R1 was corroborated by significantly higher benthic invertebrate density than reference

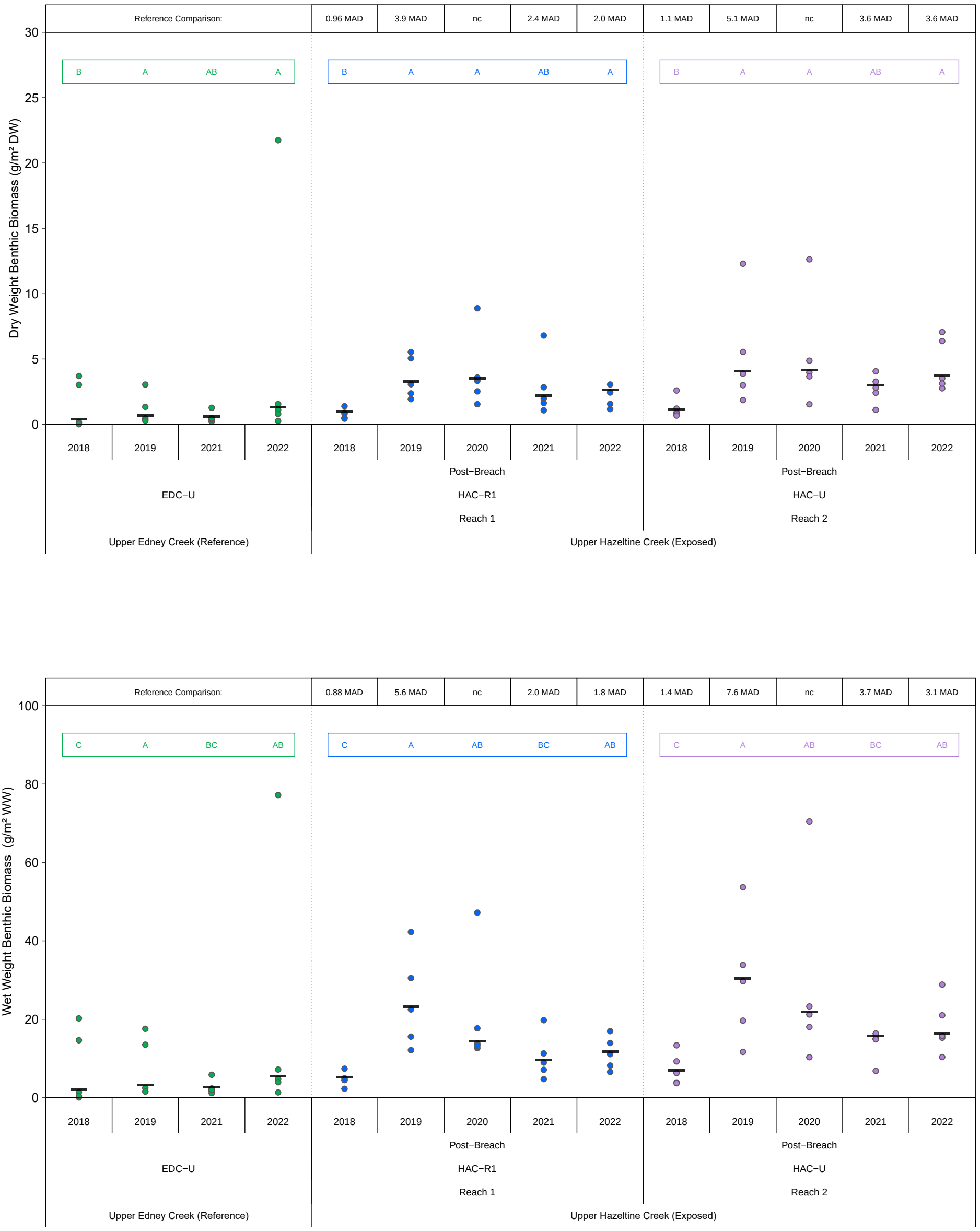

Figure 6.8: Benthic Invertebrate Biomass for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2018 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

(Figure 6.6; Appendix Table F.3.1). Benthic invertebrate dry weight biomass was positively correlated with mean water velocity (Appendix Figure F.3.3, Appendix Table F.3.2). The consistently higher benthic invertebrate dry biomass at the remediated areas relative to reference indicates benthic invertebrate productivity that has recovered to (and exceeded) reference conditions.

6.1.4 Periphyton and Benthic Invertebrate Tissue Quality

6.1.4.1 Overview

Periphyton and benthic invertebrate tissue samples were collected from remediated (exposed) areas of upper Hazeltine Creek (HAC-R1 and HAC-U) with upper Edney Creek (EDC-U) serving as reference, and at lower Hazeltine Creek (HAC-D) with an unimpacted area of lower Edney Creek (EDC-D) serving as reference (Figure 4.2; Table 4.4). A review of the 2022 periphyton and benthic invertebrate tissue quality data (Appendix B) indicated that the data largely met the established DQOs. Specifically, the data were characterized by appropriate detectability, negligible analyte concentrations in MB samples, low laboratory and field sampling precision, and excellent laboratory accuracy. The low laboratory and field precision were a result of sample heterogeneity (e.g., taxonomic variability in composite-taxa samples or natural variability within a single taxon); however, the collection of replicated samples (n = 8 per area in accordance with the CEMP; MPMC 2019) helped to characterize this variability. Overall, the tissue quality data can be used with a high level of confidence for interpretation, although the occurrence of some natural heterogeneity in analyte results were considered during data interpretation. A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

As indicated in Section 4.4.3.2, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significant positive exposed-reference difference (i.e., analytes with concentrations that were significantly higher in tissues from the remediated [exposed] area compared to those from the reference area) in 2022 (if the analysis *Area*×*Year* interaction was significant) or in all monitoring years (if the *Area*×*Year* interaction was not significant[63]) for at least one tissue type (periphyton, caddisfly, or composite-taxa benthic invertebrate) in at least one area. Data interpretations were further focused by integrating the results of water quality monitoring (i.e., bioconcentration) and trophic transfer factors (TTFs) of benthic invertebrate tissue analyte concentrations. Specifically, water quality data (and BCFs) for the analytes selected for data interpretation were examined to determine whether the

[63] If no significant change was detected in the exposed:reference ratio among years (i.e., the *Area* x *Year* interaction was not significant), then data from all available years were combined for the analyses.

significantly higher analyte concentrations in exposed tissues (relative to reference) were related to water chemistry. The TTFs for the analytes selected for data interpretation were also evaluated to determine if these analytes were bioaccumulating in the aquatic biota in Hazeltine Creek. Combined, these approaches were used to identify analytes for which concentrations in biota and TTFs at the exposed areas have increased at a rate that differs from reference and that may represent a potential risk to aquatic biota. This interpretive approach was completed separately for upper and lower Hazeltine Creek areas because the results for these areas differed slightly. Results for composite-taxa benthic invertebrate tissue samples are referred to as composite-taxa for the remainder of this section.

6.1.4.2 Upper Hazeltine Creek

For most metals evaluated, there was no evidence of increasing concentrations in periphyton and/or benthic invertebrate tissues at the exposed areas relative to the reference area over time (Appendix Figures F.4.1 to F.4.6, Appendix Tables D.5.1 to D.5.6, F.4.1 to F.4.10). The primary analytes arsenic, copper, iron, and selenium, and nine secondary analytes (barium, calcium, nickel, phosphorus, sodium, strontium, titanium, uranium, and vanadium) met the criteria for inclusion in data interpretation outlined above (i.e., were significantly higher for at least one exposed area of upper Hazeltine Creek relative to reference in 2022 or in all years; Table 6.7). Of these analytes, only titanium did not show a significant *Area×Year* interaction for at least one tissue type for at least one upper Hazeltine Creek area (Table 6.7).

MPMC implements routine water quality monitoring in upper Hazeltine Creek at HAC-13 (a station within the sampling area of HAC-R1) and at HAC-05a (a station downstream of HAC-U; Figure 4.2). Results from these routine water quality monitoring stations indicated that aqueous concentrations of two primary or secondary analytes (copper and selenium) exceeded the BCWQG during the year preceding sampling (i.e., September 2021 to August 2022). Specifically, the chronic BCWQG for dissolved copper, which is based on the BLM (BCMOECCS 2019b,c, 2021b) was exceeded in 75% of the samples collected from both station HAC-13 (HAC-R1) and station HAC-05a (HAC-U; Appendix Tables D.1.3 and D.1.4). The chronic BCWQG for total selenium (0.002 mg/L; BCMOECCS 2021b) was exceeded in 42% of the samples collected from station HAC-05a (HAC-U); selenium did not exceed the BCWQG at station HAC-13 (HAC-R1; Appendix Tables D.1.3 and D.1.4).

Of the four primary and nine secondary analytes identified for inclusion in data interpretation, mean dissolved aqueous concentrations of copper and selenium were elevated at HAC-R1 and

Table 6.7: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Primary and Secondary Analyte Concentrations in Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2015 to 2022 [a]

Analytes		Upper Hazeltine Creek Reach 1 (HAC-R1; Exposed) — Upper Edney Creek (EDC-U; Reference)															Upper Hazeltine Creek Reach 2 (HAC-U; Exposed) — Upper Edney Creek (EDC-U; Reference)														
		Periphyton					Caddisfly					Composite-Taxa Benthic Invertebrate					Periphyton					Caddisfly					Composite-Taxa Benthic Invertebrate				
		2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Primary Analyte	Arsenic	A (↓)	A (↓)	C (↓)	BC (↓)	B (↓)	AB	A	BC	C	C	A (ns)	B (ns)	B (ns)	B (ns)	A (ns)	A (↓)	A (↓)	C (↓)	AB (↓)	BC (↓)	AB	A	CD	D	BC	B (ns)	B (ns)	C (↓)	BC (ns)	A (ns)
	Copper	A (ns)	AB (ns)	AB (ns)	B (↓)	A (ns)	A	A	BC	B	C	A (↑)	BC (↑)	C (ns)	AB (↑)	BC (↑)	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)	B	A	D	CD	C	B (ns)	B (↑)	C (ns)	B (↑)	A (↑)
	Iron	A (↓)	A (↓)	A (↓)	B (↓)	A (↓)	A	A	B	B	B	B (-)	B (-)	B (-)	AB (-)	A (-)	A (↓)	A (↓)	AB (↓)	B (↓)	A (↓)	A	A	B	B	A	A (-)	A (-)	B (-)	A (-)	A (-)
	Selenium	B (↓)	AB (↓)	A (↓)	A (↓)	A (↓)	C	C	BC	A	AB	D (↓)	CD (↓)	AB (↓)	A (↓)	BC (↓)	C (↓)	BC (↓)	AB (↓)	AB (↓)	A (ns)	D	C	B	B	A	B (↓)	B (↓)	A (↓)	A (↓)	A (↓)
Secondary Analyte	Barium	A (ns)	AB (ns)	C (ns)	AB (ns)	BC (ns)	AB	A	CD	D	BC	BC (ns)	AB (ns)	C (ns)	C (ns)	A (ns)	A (ns)	A (ns)	B (ns)	A (ns)	A (ns)	B	A	C	C	AB	B (↓)	A (ns)	C (↓)	B (ns)	A (ns)
	Cadmium	A (ns)	A (ns)	B (↓)	B (↓)	B (↓)	B	A	C	C	BC	A (↑)	A (↑)	B (ns)	AB (↑)	A (ns)	AB (ns)	A (ns)	C (ns)	B (↓)	C (↓)	BC	A	D	C	B	A (↑)	AB (ns)	C (ns)	BC (ns)	A (ns)
	Calcium	B (↑)	A (↑)	A (↑)	A (↑)	A (↑)	A	A	B	B	B	A (↑)	BC (ns)	C (ns)	BC (ns)	B (ns)	BC (↑)	A (↑)	BC (↑)	AB (↑)	C (↑)	A	A	D	C	B	C (ns)	B (↑)	D (ns)	C (↑)	A (↑)
	Manganese	AB (↓)	A (↓)	C (↓)	AB (↓)	BC (↓)	B	A	C	C	B	B (↓)	A (ns)	B (↓)	A (ns)	A (↓)	B (↓)	A (↓)	B (↓)	A (↓)	B (↓)	C	A	D	C	B	C (↓)	A (ns)	D (↓)	BC (ns)	B (↓)
	Molybdenum	A (ns)	A (ns)	B (ns)	B (ns)	B (ns)	A	B	A	A	B	B (ns)	B (ns)	A (ns)	AB (ns)	C (ns)	A (↓)	A (ns)	A (ns)	A (ns)	A (ns)	B	C	A	B	C	B (ns)	AB (ns)	A (↑)	B (ns)	C (↓)
	Nickel	A (↓)	A (↓)	A (↓)	A (↓)	A (↓)	AB	A	C	C	BC	AB (↓)	BC (↓)	C (↓)	BC (ns)	A (↓)	AB (↓)	A (↓)	C (↓)	BC (↓)	BC (↓)	B	A	D	C	AB	B (↓)	AB (↓)	C (↓)	B (↓)	A (↓)
	Phosphorus	A (↓)	A (↓)	A (↓)	A (↓)	A (↓)	A	A	B	A	A	C (-)	BC (-)	AB (-)	A (-)	AB (-)	AB (↓)	B (↓)	AB (↓)	A (↓)	A (ns)	AB	A	B	AB	A	B (-)	C (-)	C (-)	BC (-)	A (-)
	Sodium	AB (ns)	D (ns)	BC (ns)	CD (↓)	A (↓)	AB	A	C	B	AB	ABC (-)	C (-)	BC (-)	AB (-)	A (-)	A (ns)	B (ns)	AB (ns)	A (ns)	A (ns)	B	A	C	C	B	AB (-)	C (-)	BC (-)	BC (-)	A (-)
	Strontium	AB (↑)	A (↑)	BC (↑)	A (↑)	C (↑)	A	A	C	BC	B	A (↑)	BC (ns)	C (ns)	BC (ns)	B (ns)	A (↑)	A (↑)	B (↑)	A (↑)	B (↑)	AB	A	D	C	B	C (ns)	B (↑)	D (ns)	C (ns)	A (↑)
	Titanium	-	A (↓)	A (↓)	B (↓)	A (↓)	-	A	B	B	B	-	A (-)	A (-)	A (-)	A (-)	-	A (↓)	A (↓)	B (↓)	A (↓)	-	A	B	B	A	-	A (-)	A (-)	A (-)	A (-)
	Uranium	A (↓)	B (↓)	B (↓)	C (↓)	AB (↓)	AB	A	D	CD	BC	B (ns)	B (ns)	B (↓)	B (ns)	A (ns)	A (↓)	A (↓)	A (↓)	A (↓)	A (↓)	B	A	D	C	A	B (↓)	B (ns)	C (↓)	B (ns)	A (ns)
	Vanadium	A (↓)	AB (↓)	B (↓)	C (↓)	A (↓)	A	A	B	B	B	B (ns)	B (ns)	B (ns)	B (↑)	A (ns)	A (↓)	A (↓)	AB (↓)	B (↓)	A (↓)	A	A	B	B	A	A (ns)	A (ns)	B (ns)	A (ns)	A (ns)

Indicates significantly higher tissue concentration at exposed compared to reference area, and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

(↑) = Indicates significantly higher tissue concentration relative to pre-breach in 2010 (α = 0.05).
(↓) = Indicates significantly lower tissue concentration relative to pre-breach in 2010 (α = 0.05).
(ns) = no significant different in analyte concentration relative to pre-breach in 2010 (α = 0.05).
Notes: "-" = no statistical comparison could be made because data were not available or all results below Laboratory Reporting Limit (LRL), refer to Appendix Tables F.4.1 to F.4.10 and F.4.17 to F.4.21 for statistical analyses results and magnitude of difference calculations. Data were analysed in units of mg/kg dry weight.

[a] Results are shown for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types (periphyton, caddisfly, or composite benthic invertebrate) in at least one area. Years that share a letter (e.g., A,B,C) had ratios of analyte concentrations (Exposed:Reference) that did not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

Table 6.7: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Primary and Secondary Analyte Concentrations in Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2015 to 2022 [a]

Analytes		Lower Hazeltine Creek Reach 5 (HAC-D; Exposed) / Lower Edney Creek (EDC-D; Reference)																	
		Periphyton						Caddisfly					Composite-Taxa Benthic Invertebrate						
		2017	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	
Primary Analyte	Arsenic	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)	C	A	AB	AB	B	A (ns)	C (↓)	AB (ns)	AB (ns)	B (ns)	AB (ns)	
	Copper	A (↑)	AB (↑)	C (↑)	C (↑)	A (↑)	BC (↑)	D	BC	B	A	CD	A (↑)	C (ns)	C (↑)	C (↑)	B (↑)	C (↑)	
	Iron	A (ns)	A (ns)	BC (ns)	BC (ns)	AB (ns)	C (ns)	B	A	B	A	B	A (-)	C (-)	B (-)	BC (-)	B (-)	BC (-)	
	Selenium	BC (ns)	D (ns)	CD (↓)	AB (ns)	C (ns)	A (ns)	D	CD	BC	A	AB	ABC (↓)	C (ns)	BC (↓)	AB (ns)	ABC (↑)	A (↑)	
Secondary Analyte	Barium	B (ns)	A (ns)	B (ns)	AB (ns)	A (ns)	AB (ns)	C	AB	B	A	B	A (ns)	C (↓)	B (ns)	B (ns)	B (ns)	B (ns)	
	Cadmium	A (ns)	A (ns)	A (ns)	A (↑)	A (ns)	A (ns)	C	B	B	A	B	A (ns)	B (ns)	B (ns)	B (↑)	B (ns)	B (↑)	
	Calcium	E (ns)	C (↑)	B (↑)	AB (↑)	D (ns)	A (↑)	C	B	B	A	B	A (ns)	C (ns)	C (ns)	BC (ns)	A (ns)	AB (ns)	
	Manganese	AB (ns)	AB (ns)	BC (ns)	AB (ns)	C (↓)	A (ns)	C	AB	B	A	AB	AB (↓)	D (↓)	BC (↓)	AB (ns)	C (↓)	A (ns)	
	Molybdenum	A (↑)	B (ns)	B (ns)	B (ns)	B (ns)	B (ns)	A	B	C	D	BC	C (↓)	B (ns)	A (ns)	B (ns)	B (↓)	B (↓)	
	Nickel	A (ns)	AB (ns)	BC (ns)	BC (ns)	B (ns)	C (ns)	D	AB	BC	A	CD	A (↓)	B (↓)	B (↓)	B (↓)	B (↓)	B (↓)	
	Phosphorus	CD (ns)	D (ns)	CD (ns)	BC (ns)	AB (ns)	A (↑)	A	B	A	A	AB	C (-)	A (-)	B (-)	A (-)	A (-)	A (-)	
	Sodium	AB (ns)	B (ns)	B (ns)	AB (ns)	A (ns)	A (ns)	B	B	A	B	B	C (-)	A (-)	BC (-)	AB (-)	BC (-)	AB (-)	
	Strontium	D (ns)	C (↑)	B (↑)	AB (↑)	C (ns)	A (↑)	C	AB	B	A	B	A (ns)	B (ns)	B (ns)	B (ns)	A (ns)	A (ns)	
	Titanium	-	-	A (ns)	A (ns)	A (ns)	A (ns)	-	A	B	A	B	A (-)	-	BC (-)	C (-)	AB (-)	C (-)	
	Uranium	A (ns)	AB (ns)	C (ns)	BC (ns)	AB (ns)	BC (ns)	C	B	B	A	B	A (ns)	C (↓)	B (ns)	B (ns)	B (ns)	B (ns)	
	Vanadium	A (ns)	A (ns)	BC (ns)	BC (ns)	AB (ns)	C (ns)	B	A	B	A	B	A (↑)	C (ns)	BC (ns)	BC (ns)	B (ns)	BC (ns)	

Indicates significantly higher tissue concentration at exposed compared to reference area, and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

(↑) = Indicates significantly higher tissue concentration relative to pre-breach in 2010 (α = 0.05).
(↓) = Indicates significantly lower tissue concentration relative to pre-breach in 2010 (α = 0.05).
(ns) = no significant different in analyte concentration relative to pre-breach in 2010 (α = 0.05).
Notes: "-" = no statistical comparison could be made because data were not available or all results below Laboratory Reporting Limit (LRL), refer to Appendix Tables F.4.1 to F.4.10 and F.4.17 to F.4.21 for statistical analyses results and magnitude of difference calculations. Data were analysed in units of mg/kg dry weight.

[a] Results are shown for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types (periphyton, caddisfly, or composite benthic invertebrate) in at least one area. Years that share a letter (e.g., A,B,C) had ratios of analyte concentrations (Exposed:Reference) that did not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

HAC-U relative to reference, as were the secondary analytes calcium, sodium, strontium, and uranium (Table 6.8)[64]. Despite elevated dissolved aqueous concentrations of copper and selenium relative to reference, periphyton BCFs for these primary analytes in upper Hazeltine Creek were generally lower than reference in 2022, as expected[65], and similar to results from 2021 (Minnow 2022a). The BCF for copper was 4.4 times greater than reference at HAC-U and 1.2 times greater than reference at HAC-R1 for composite-taxa tissues, and not elevated for caddisfly tissues. The BCF for selenium was slightly (< 2 times) greater than reference for caddisfly at both HAC-R1 and HAC-U and not elevated in composite-taxa tissues (Table 6.8; Appendix Tables D.5.1 to D.5.6). The BCFs were at least 2.0 times greater than reference for arsenic, iron, barium, calcium, nickel, phosphorus, strontium, titanium, and vanadium in at least one tissue type for at least one area of upper Hazeltine Creek (Table 6.8).

Concentrations of copper in most tissue types from upper Hazeltine Creek were consistently elevated relative to the reference area (EDC-U) from 2018 to 2022, with the exception of caddisfly tissues at HAC-R1 (in 2022) and HAC-U (in 2020 and 2021), and periphyton tissues from HAC-R1 (in 2019 to 2021; Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables F.4.1 to F.4.10). Specifically, copper concentrations in periphyton tissues from HAC-R1 were significantly higher than reference in 2018 and 2022 but similar to reference in the interim years (2019 to 2021), and at HAC-U have been consistently elevated relative to reference from 2018 to 2022 (Figures 6.9 and 6.10, Table 6.7). Copper concentrations in periphyton tissues from both areas (HAC-R1 and HAC-U) in 2022 were similar to those in 2018, relative to reference, indicating no temporal increase has occurred (Figures 6.9 and 6.10, Table 6.7). Concentrations of copper in caddisfly tissue samples in 2022 at HAC-R1 were similar to reference but at HAC-U were significantly higher than reference. However, the magnitude of these differences relative to reference in 2022 were significantly lower than in 2018, 2019 and 2021 at HAC-R1, and lower than in 2018 and 2019 (but not different from 2021 and higher than 2020) at HAC-U (Table 6.7). Most notable, concentrations of copper in composite-taxa tissues from HAC-U have steadily increased since 2020 and were significantly higher in 2022 compared to all previous monitoring years, relative to reference (Figure 6.10, Table 6.7). In contrast, the concentrations of copper in composite-taxa tissues from HAC-R1 have varied among previous monitoring years and in 2022 exposed:reference ratios were significantly lower than 2018 (Figure 6.9, Table 6.7). Copper concentrations in composite-taxa tissue for both areas of upper Hazeltine Creek in 2022

[64] Elevated analytes were identified as those with mean concentrations at the exposed station that were at least twice the mean concentration at the reference station.

[65] Both BCFs and trophic TTFs are generally expected to decrease with increasing concentration. Increased BCFs and TTFs with increasing concentrations can be suggestive of enhanced bioavailability or reduced ability of organisms to regulate metals.

Table 6.8: Summary of Primary and Secondary Analytes Concentrations in Water, Periphyton, Composite-Taxa, and Caddisfly Tissues, BCFs and TTFs for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2022

Analytes		Component	Metric	Units	n	Area				
						Reference		Breach-exposed	Breach-exposed Previously Effluent Exposed	
						Upper Edney Creek	Lower Edney Creek	Upper Hazeltine Creek		Lower Hazeltine Creek
						EDC-U	EDC-D	HAC-R1	HAC-U	HAC-D
Primary Analytes	Arsenic (As)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.000410	0.00102	0.000474	0.000536	0.000629
		Periphyton	Tissue Mean	mg/kg	8	22.8	15.5	2.48	3.15	13.3
			BCF[e]	unitless	-	55,610	15,196	5,232	5,877	21,145
		Caddisfly	Tissue Mean	mg/kg	8	0.746	3.46	0.304	0.432	0.925
			BCF[e]	unitless	-	1,820	3,392	641	806	1,471
			TTF[f]	unitless	-	0.0382	0.270	0.131	0.154	0.140
		Composite	Tissue Mean	mg/kg	8	1.02	1.96	2.04	3.06	2.35
			BCF[e]	unitless	-	2,488	1,922	4,304	5,709	3,736
			TTF[f]	unitless	-	0.0682	0.139	0.875	1.08	0.253
	Copper (Cu)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.00181	***0.00195***	***0.00784***	***0.00871***	***0.0102***
		Periphyton	Tissue Mean	mg/kg	8	37.1	25.8	69.5	116	230
			BCF[e]	unitless	-	20,497	13,231	8,865	13,318	22,549
		Caddisfly	Tissue Mean	mg/kg	8	15.8	19.8	15.6	20.2	32.5
			BCF[e]	unitless	-	8,729	10,154	1,990	2,319	3,186
			TTF[f]	unitless	-	0.442	0.787	0.282	0.391	0.335
		Composite	Tissue Mean	mg/kg	8	23.5	33.6	119	500	73
			BCF[e]	unitless	-	12,983	17,231	15,179	57,405	7,157
			TTF[f]	unitless	-	0.658	1.34	2.18	10.3	0.682
	Iron (Fe)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.106	0.118	0.0450	0.0458	0.0586
		Periphyton	Tissue Mean	mg/kg	8	23,658	22,250	3,195	3,481	19,100
			BCF[e]	unitless	-	223,189	188,559	71,000	76,004	325,939
		Caddisfly	Tissue Mean	mg/kg	8	601	3,708	164	247	722
			BCF[e]	unitless	-	5,670	31,424	3,644	5,393	12,321
			TTF[f]	unitless	-	0.0312	0.204	0.0666	0.0905	0.136
		Composite	Tissue Mean	mg/kg	8	1,262	1,368	3,299	1,835	1,996
			BCF[e]	unitless	-	11,906	11,593	73,311	40,066	34,061
			TTF[f]	unitless	-	0.0745	0.0627	1.46	0.746	0.261
	Selenium (Se)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.000130	0.000128	0.000793	0.00152	0.00112
		Periphyton	Tissue Mean	mg/kg	8	0.770	1.10	1.98	4.11	2.82
			BCF[e]	unitless	-	5,923	8,594	2,497	2,704	2,518
		Caddisfly	Tissue Mean	mg/kg	8	0.689	1.46	**6.69**	**13.1**	**4.58**
			BCF[e]	unitless	-	5,300	11,406	8,436	8,618	4,089
			TTF[f]	unitless	-	0.988	1.36	3.55	4.52	2.16
		Composite	Tissue Mean	mg/kg	8	0.978	1.82	**4.97**	**6.77**	**4.94**
			BCF[e]	unitless	-	7,523	14,219	6,267	4,454	4,411
			TTF[f]	unitless	-	1.43	1.77	2.56	2.55	2.28
Secondary Analytes	Barium (Ba)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.00842	0.0142	0.0119	0.0142	0.0167
		Periphyton	Tissue Mean	mg/kg	8	461	148	124	235	293
			BCF[e]	unitless	-	54,751	10,423	10,420	16,549	17,545
		Caddisfly	Tissue Mean	mg/kg	8	18.1	46	3.28	5.22	17.9
			BCF[e]	unitless	-	2,150	3,239	276	368	1,072
			TTF[f]	unitless	-	0.0289	0.329	0.0327	0.0394	0.104
		Composite	Tissue Mean	mg/kg	8	10.7	17.8	42.4	41.9	32.7
			BCF[e]	unitless	-	1,271	1,254	3,563	2,951	1,958
			TTF[f]	unitless	-	0.0361	0.119	0.372	0.313	0.153
	Cadmium (Cd)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.00000920	0.00000633	0.00000556	0.00000594	0.00000565
		Periphyton	Tissue Mean	mg/kg	8	1.81	0.547	0.176	0.195	0.583
			BCF[e]	unitless	-	196,739	86,414	31,655	32,828	103,186
		Caddisfly	Tissue Mean	mg/kg	8	0.193	0.310	0.0366	0.0648	0.350
			BCF[e]	unitless	-	20,978	48,973	6,583	10,909	61,947
			TTF[f]	unitless	-	0.110	0.867	0.282	0.340	1.00
		Composite	Tissue Mean	mg/kg	8	1.09	1.07	0.628	0.581	1.15
			BCF[e]	unitless	-	118,478	169,036	112,950	97,811	203,540
			TTF[f]	unitless	-	0.861	3.18	3.30	3.19	2.69
	Calcium (Ca)	Dissolved[a,b,c]	Mean[d]	mg/L	-	16.2	26.2	40.6	46.0	42.0
		Periphyton	Tissue Mean	mg/kg	8	10,382	10,804	239,500	192,875	312,000
			BCF[e]	unitless	-	641	412	5,899	4,193	7,429
		Caddisfly	Tissue Mean	mg/kg	8	702	1,839	624	1,173	1,418
			BCF[e]	unitless	-	43	70.2	15	26	33.8
			TTF[f]	unitless	-	0.0696	0.203	0.00263	0.00620	0.00572
		Composite	Tissue Mean	mg/kg	8	1,475	1,968	7,826	25,699	3,388
			BCF[e]	unitless	-	91	75	193	559	80.7
			TTF[f]	unitless	-	0.148	0.208	0.0330	0.138	0.0112
	Manganese (Mn)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.0118	0.00572	0.0178	0.0268	0.0104
		Periphyton	Tissue Mean	mg/kg	8	16,114	2,678	1,354	2,868	4,324
			BCF[e]	unitless	-	1,365,593	468,182	76,067	107,015	415,769
		Caddisfly	Tissue Mean	mg/kg	8	716	511	172	324	561
			BCF[e]	unitless	-	60,678	89,336	9,663	12,090	53,942
			TTF[f]	unitless	-	0.0362	0.211	0.136	0.120	0.305
		Composite	Tissue Mean	mg/kg	8	731	307	923	987	889
			BCF[e]	unitless	-	61,949	53,671	51,854	36,828	85,481
			TTF[f]	unitless	-	0.0659	0.128	0.761	0.373	0.333

Dissolved concentration at exposed area exceeded reference area by less than 2-times.
Dissolved concentration at exposed area exceeded reference area by at least 2-times.
Dissolved concentration at exposed area exceeded reference area by at least than 5-times.
Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05).
Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05).
BCF for exposed area exceeded reference area by less than 2-times.
BCF for exposed area exceeded reference area by at least 2-times.
BCF for exposed area exceeded reference area by at least 10-times.
Mean TTF exceeds 1.
Mean TTF at exposed area exceeds 1 and the corresponding reference area TTF for a given year.
Mean TTF at exposed area exceeds 1, the corresponding reference area TTF for a given year, and mean TTFs for all previous years (pre-breach and 2017 when applicable).

BOLD = mean tissue selenium value exceeds long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

BOLD/ITALICS = Indicates dissolved water value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2021a,b).

Notes: Results are shown for primary and secondary analytes that are presented in Table 6.7 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). "-" = no data for dissolved water concentration/ BCF was not calculated for analytes due to no data for dissolved water concentration. "na" = not applicable. Summary statistics reported to 3 significant figures for display purposes.

[a] Monitoring stations included W10, HAC-13, HAC-05a, and HAC-08 for corresponding tissue sampling stations EDC-D, HAC-R1, HAC-U, and HAC-D, respectively (refer to Appendix Tables D.1.3, D.1.4, D.1.6, and D.1.7). For EDC-U routine water quality data were not available, so BCFs were calculated using spot water quality samples taken during tissue collection.

[b] Sample sizes for water quality monitoring are 1, 3, 8, 8, and 8 for EDC-U (EDC-U spot water quality monitoring), EDC-D (W10), HAC-R1 (HAC-13), HAC-U (HAC-05a), and HAC-D (HAC-08).

[c] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2021a,b) outlined in Table D.1.1.

[d] Means were calculated for routine water quality stations using data collected between January 1, 2022 and the time of sampling in August 2022 in order to be consistent with means calculated during previous years (Minnow 2016d, 2017c, 2018c, 2019, 2020a, 2021a, 2022a).

[e] Bioconcentration Factor (BCF) = Mean Tissue Concentration (mg/kg dw) / Mean Dissolved Water Concentration (mg/L), if the dissolved water concentration was reported as below the Laboratory Reporting Limit (LRL), then the LRL was substituted for the BCF calculation.

[f] Trophic Transfer Function (TTF) = Benthic Invertebrate Tissue Concentration / Periphyton Tissue Concentration. If the reported analyte concentrations for either periphyton or benthic invertebrate tissue were below the LRL, the TTF was not calculated.

Table 6.8: Summary of Primary and Secondary Analytes Concentrations in Water, Periphyton, Composite-Taxa, and Caddisfly Tissues, BCFs and TTFs for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2022

Analytes		Component	Metric	Units	n	Area				
						Reference		Breach-exposed	Breach-exposed Previously Effluent Exposed	
						Upper Edney Creek	Lower Edney Creek	Upper Hazeltine Creek		Lower Hazeltine Creek
						EDC-U	EDC-D	HAC-R1	HAC-U	HAC-D
Secondary Analytes	Molybdenum (Mo)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.000331	0.000722	0.00690	0.00662	0.00558
		Periphyton	Tissue Mean	mg/kg	8	2.88	1.51	1.45	1.32	2.08
			BCF[e]	unitless	-	8,701	2,091	210	199	373
		Caddisfly	Tissue Mean	mg/kg	8	11.1	3.46	6.52	10.1	3.74
			BCF[e]	unitless	-	33,535	4,792	945	1,526	670
			TTF[f]	unitless	-	4.32	2.72	4.88	8.01	4.44
		Composite	Tissue Mean	mg/kg	8	5.83	0.762	3.66	2.75	2.08
			BCF[e]	unitless	-	17,613	1,055	530	415	373
			TTF[f]	unitless	-	2.29	0.557	2.73	2.36	2.70
	Nickel (Ni)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.00100	0.000887	0.000514	<0.0005	0.000558
		Periphyton	Tissue Mean	mg/kg	8	54.1	31.5	4.52	3.60	18.6
			BCF[e]	unitless	-	54,100	35,513	8,794	7,200	33,333
		Caddisfly	Tissue Mean	mg/kg	8	1.64	8.20	0.301	0.355	1.06
			BCF[e]	unitless	-	1,640	9,245	586	710	1,900
			TTF[f]	unitless	-	0.0345	0.302	0.105	0.113	0.176
		Composite	Tissue Mean	mg/kg	8	1.94	3.86	3.58	2.82	13.7
			BCF[e]	unitless	-	1,940	4,352	6,965	5,640	24,552
			TTF[f]	unitless	-	0.0420	0.127	0.947	0.882	2.81
	Phosphorus (P)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.0112	0.0100	0.00901	0.00976	0.00965
		Periphyton	Tissue Mean	mg/kg	8	3,064	1,728	869	1,656	3,336
			BCF[e]	unitless	-	273,571	172,800	96,448	169,672	345,699
		Caddisfly	Tissue Mean	mg/kg	8	8,006	7,932	6,986	7,431	7,186
			BCF[e]	unitless	-	714,821	793,200	775,361	761,373	744,663
			TTF[f]	unitless	-	2.66	4.83	8.34	5.74	3.35
		Composite	Tissue Mean	mg/kg	8	8,265	8,422	8,179	9,916	7,829
			BCF[e]	unitless	-	737,946	842,200	907,769	1,015,984	811,295
			TTF[f]	unitless	-	2.76	5.24	9.58	7.30	3.78
	Sodium (Na)	Dissolved[a,b,c]	Mean[d]	mg/L	-	2.08	4.58	7.32	7.64	7.25
		Periphyton	Tissue Mean	mg/kg	8	221	334	306	323	625
			BCF[e]	unitless	-	106	73	41.8	42.3	86.2
		Caddisfly	Tissue Mean	mg/kg	8	2,844	3,121	2,390	2,494	2,378
			BCF[e]	unitless	-	1,367	681	327	326	328
			TTF[f]	unitless	-	13.8	9.60	7.96	7.90	6.59
		Composite	Tissue Mean	mg/kg	8	3,269	3,689	4,009	3,146	3,901
			BCF[e]	unitless	-	1,572	805	548	412	538
			TTF[f]	unitless	-	15.6	11.5	13.4	9.82	11.2
	Strontium (Sr)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.110	0.172	0.281	0.305	0.296
		Periphyton	Tissue Mean	mg/kg	8	101	93	521	495	832
			BCF[e]	unitless	-	918	541	1,854	1,623	2,811
		Caddisfly	Tissue Mean	mg/kg	8	5.21	13.8	4.05	7.88	8.22
			BCF[e]	unitless	-	47	80.2	14	26	27.8
			TTF[f]	unitless	-	0.0522	0.175	0.00786	0.0163	0.0129
		Composite	Tissue Mean	mg/kg	8	9.28	11.0	30.8	75.3	19.2
			BCF[e]	unitless	-	84	64	110	247	64.9
			TTF[f]	unitless	-	0.0983	0.131	0.0590	0.157	0.0245
	Titanium (Ti)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.0100	<0.01	<0.01	<0.01	<0.01
		Periphyton	Tissue Mean	mg/kg	8	338	521	148	183	521
			BCF[e]	unitless	-	33,800	52,100	14,800	18,300	52,100
		Caddisfly	Tissue Mean	mg/kg	8	11.2	79.3	3.63	7.99	29.0
			BCF[e]	unitless	-	1,120	7,930	363	799	2,900
			TTF[f]	unitless	-	0.0545	0.187	0.0341	0.0531	0.169
		Composite	Tissue Mean	mg/kg	8	28.9	24.5	111	47.8	46.4
			BCF[e]	unitless	-	2,890	2,450	11,100	4,780	4,640
			TTF[f]	unitless	-	0.102	0.0521	1.11	0.457	0.237
	Uranium (U)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.0000610	0.000147	0.000297	0.000363	0.000387
		Periphyton	Tissue Mean	mg/kg	8	0.710	0.542	0.149	0.159	0.658
			BCF[e]	unitless	-	11,639	3,687	502	438	1,700
		Caddisfly	Tissue Mean	mg/kg	8	0.0317	0.103	0.00680	0.0181	0.0406
			BCF[e]	unitless	-	520	701	23	50	104.9
			TTF[f]	unitless	-	0.0516	0.225	0.0591	0.116	0.166
		Composite	Tissue Mean	mg/kg	8	0.0778	0.0576	0.142	0.142	0.0868
			BCF[e]	unitless	-	1,275	392	478	391	224
			TTF[f]	unitless	-	0.117	0.109	1.05	0.903	0.286
	Vanadium (V)	Dissolved[a,b,c]	Mean[d]	mg/L	-	0.000570	0.000587	0.00112	0.00107	0.000948
		Periphyton	Tissue Mean	mg/kg	8	53.4	46.2	12.0	14.0	61.5
			BCF[e]	unitless	-	93,684	78,705	10,714	13,084	64,873
		Caddisfly	Tissue Mean	mg/kg	8	1.25	9.47	0.370	0.742	2.55
			BCF[e]	unitless	-	2,193	16,133	330	693	2,690
			TTF[f]	unitless	-	0.0260	0.252	0.0402	0.0649	0.151
		Composite	Tissue Mean	mg/kg	8	2.79	3.00	11.1	6.20	5.79
			BCF[e]	unitless	-	4,895	5,111	9,911	5,794	6,108
			TTF[f]	unitless	-	0.0650	0.0620	1.31	0.623	0.239

Dissolved concentration at exposed area exceeded reference area by less than 2-times.
Dissolved concentration at exposed area exceeded reference area by at least 2-times.
Dissolved concentration at exposed area exceeded reference area by at least than 5-times.
Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05).
Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05).
BCF for exposed area exceeded reference area by less than 2-times.
BCF for exposed area exceeded reference area by at least 2-times.
BCF for exposed area exceeded reference area by at least 10-times.
Mean TTF exceeds 1.
Mean TTF at exposed area exceeds 1 and the corresponding reference area TTF for a given year.
Mean TTF at exposed area exceeds 1, the corresponding reference area TTF for a given year, and mean TTFs for all previous years (pre-breach and 2017 when applicable).

BOLD = mean tissue selenium value exceeds long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

BOLD/ITALICS = Indicates dissolved water value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2021a,b).

Notes: Results are shown for primary and secondary analytes that are presented in Table 6.7 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). "-" = no data for dissolved water concentration/ BCF was not calculated for analytes due to no data for dissolved water concentration. "na" = not applicable. Summary statistics reported to 3 significant figures for display purposes.

[a] Monitoring stations included W10, HAC-13, HAC-05a, and HAC-08 for corresponding tissue sampling stations EDC-D, HAC-R1, HAC-U, and HAC-D, respectively (refer to Appendix Tables D.1.3, D.1.4, D.1.6, and D.1.7). For EDC-U routine water quality data were not available, so BCFs were calculated using spot water quality samples taken during tissue collection.

[b] Sample sizes for water quality monitoring are 1, 3, 8, 8, and 8 for EDC-U (EDC-U spot water quality monitoring), EDC-D (W10), HAC-R1 (HAC-13), HAC-U (HAC-05a), and HAC-D (HAC-08).

[c] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2021a,b) outlined in Table D.1.1.

[d] Means were calculated for routine water quality stations using data collected between January 1, 2022 and the time of sampling in August 2022 in order to be consistent with means calculated during previous years (Minnow 2016d, 2017c, 2018c, 2019, 2020a, 2021a, 2022a).

[e] Bioconcentration Factor (BCF) = Mean Tissue Concentration (mg/kg dw) / Mean Dissolved Water Concentration (mg/L), if the dissolved water concentration was reported as below the Laboratory Reporting Limit (LRL), then the LRL was substituted for the BCF calculation.

[f] Trophic Transfer Function (TTF) = Benthic Invertebrate Tissue Concentration / Periphyton Tissue Concentration. If the reported analyte concentrations for either periphyton or benthic invertebrate tissue were below the LRL, the TTF was not calculated.

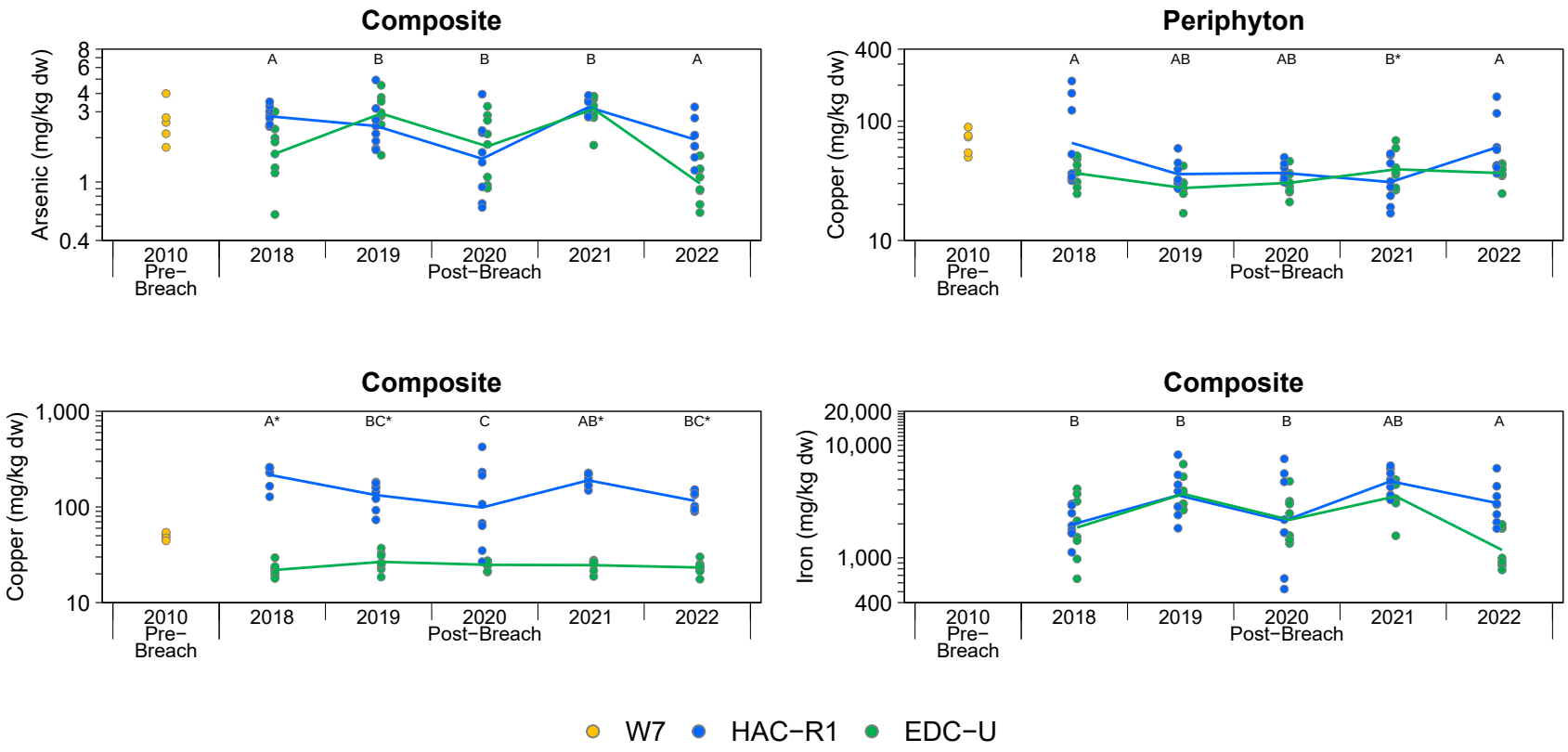

Figure 6.9: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

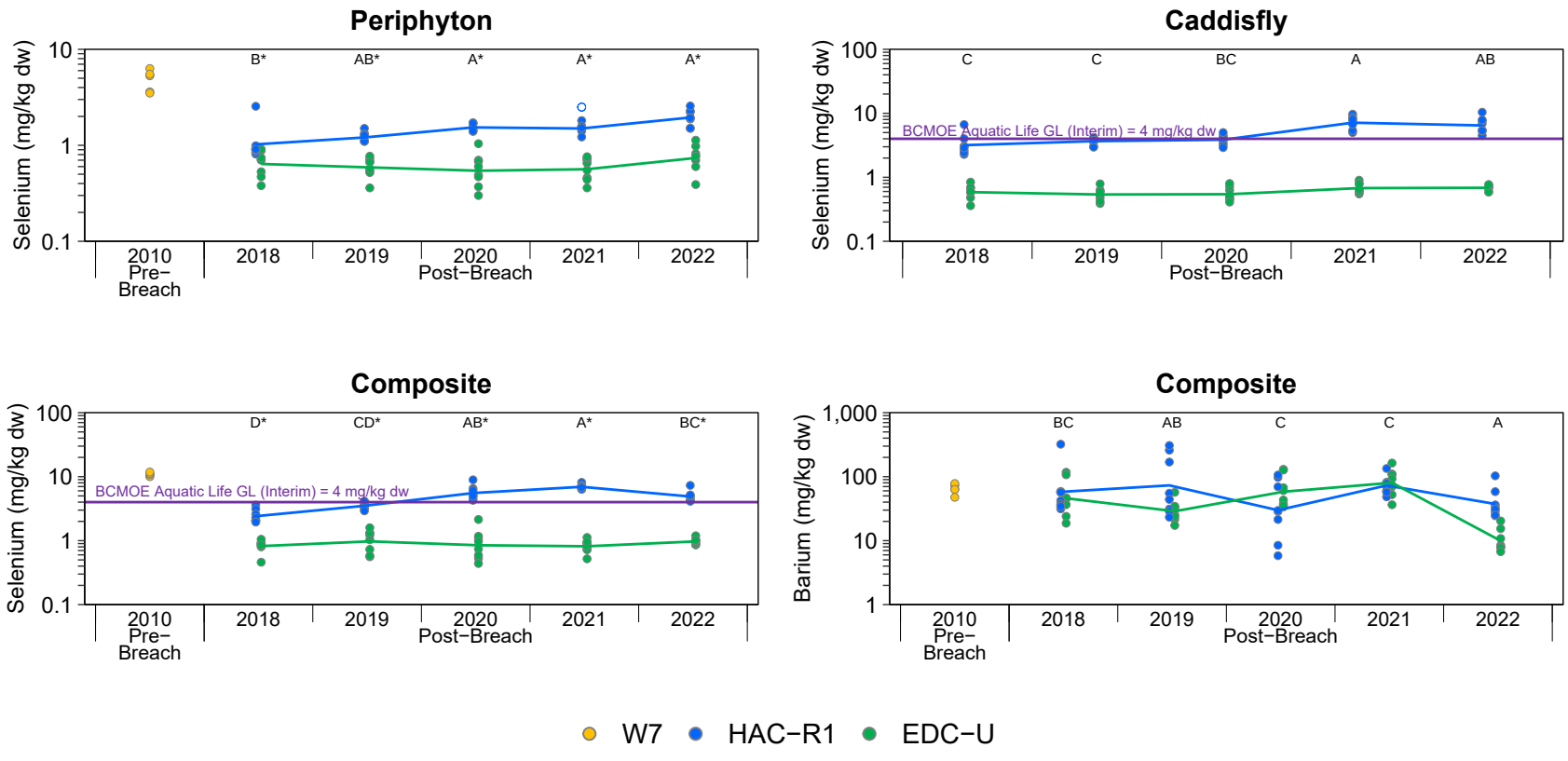

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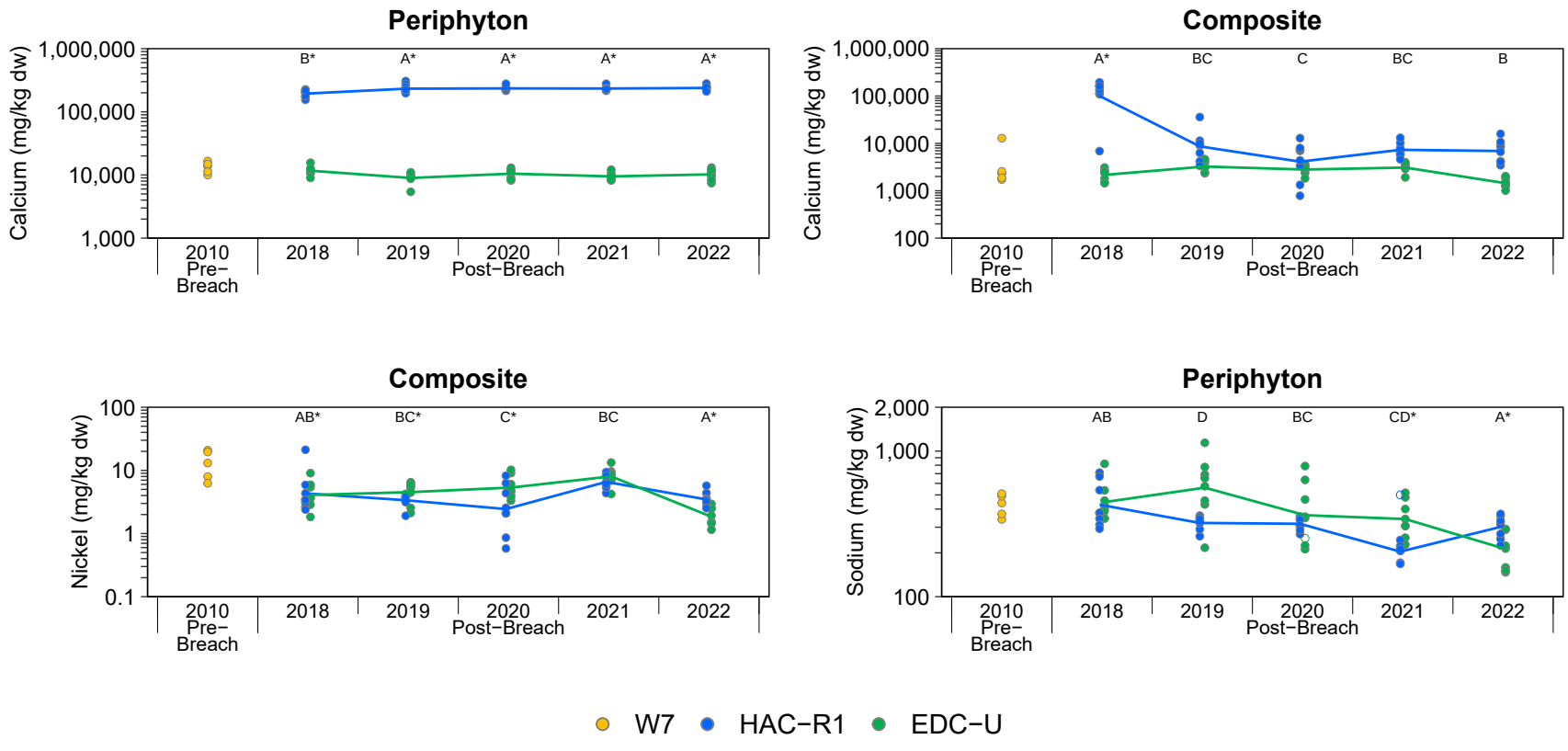

Figure 6.9: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

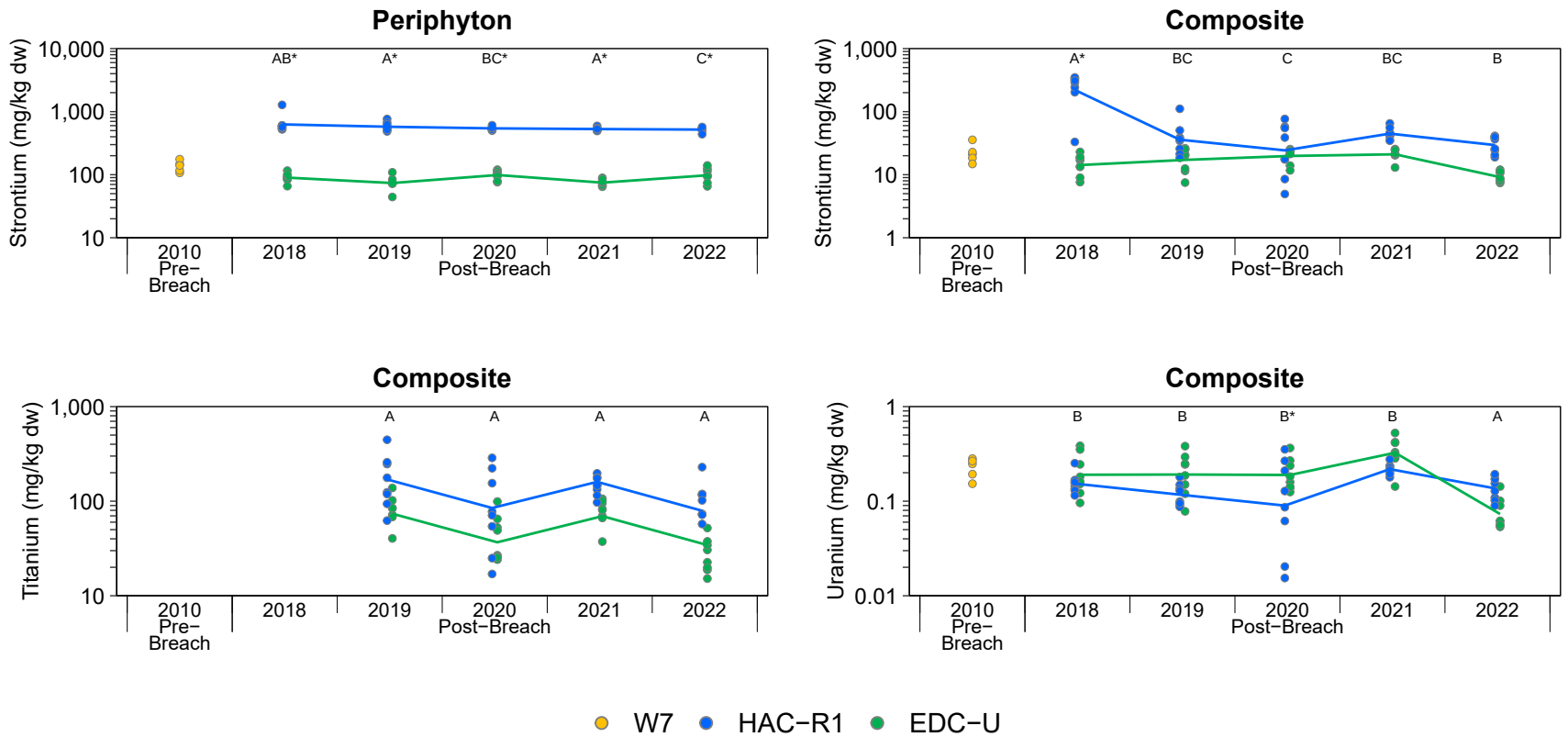

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Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

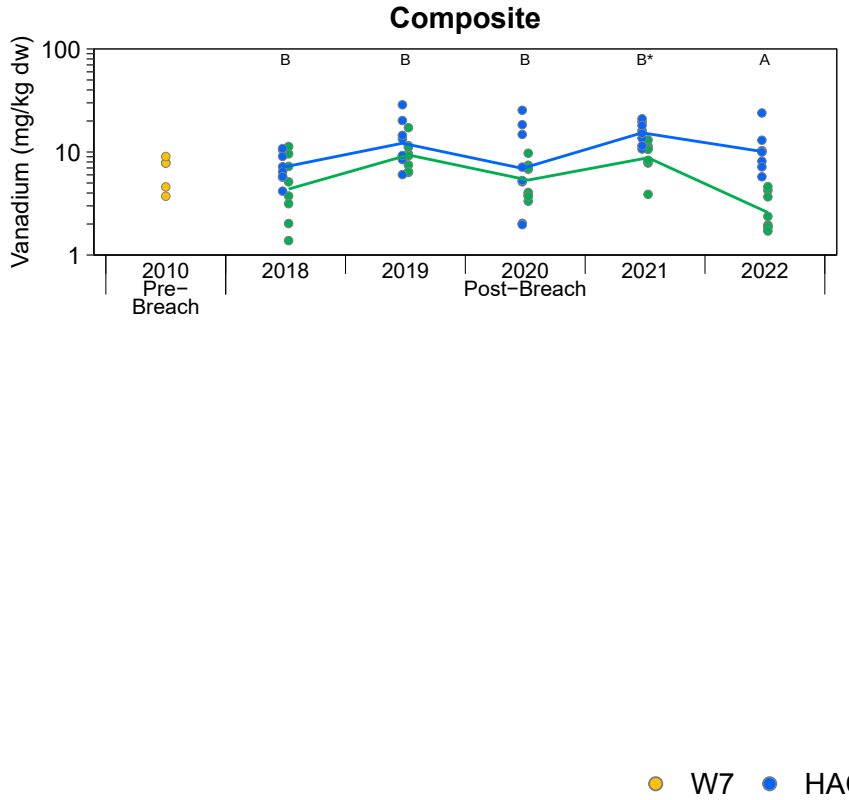

Figure 6.9: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

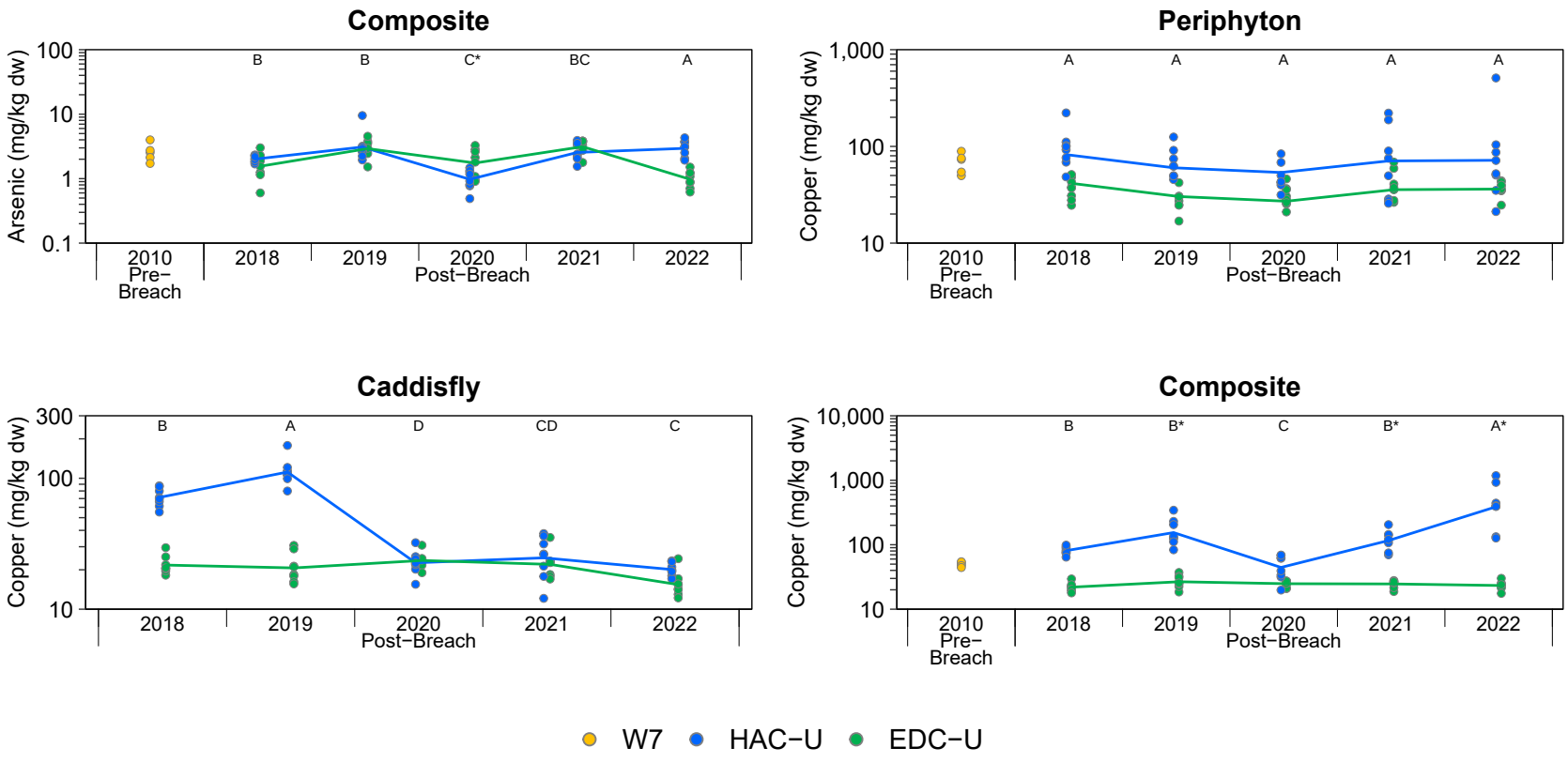

Figure 6.10: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

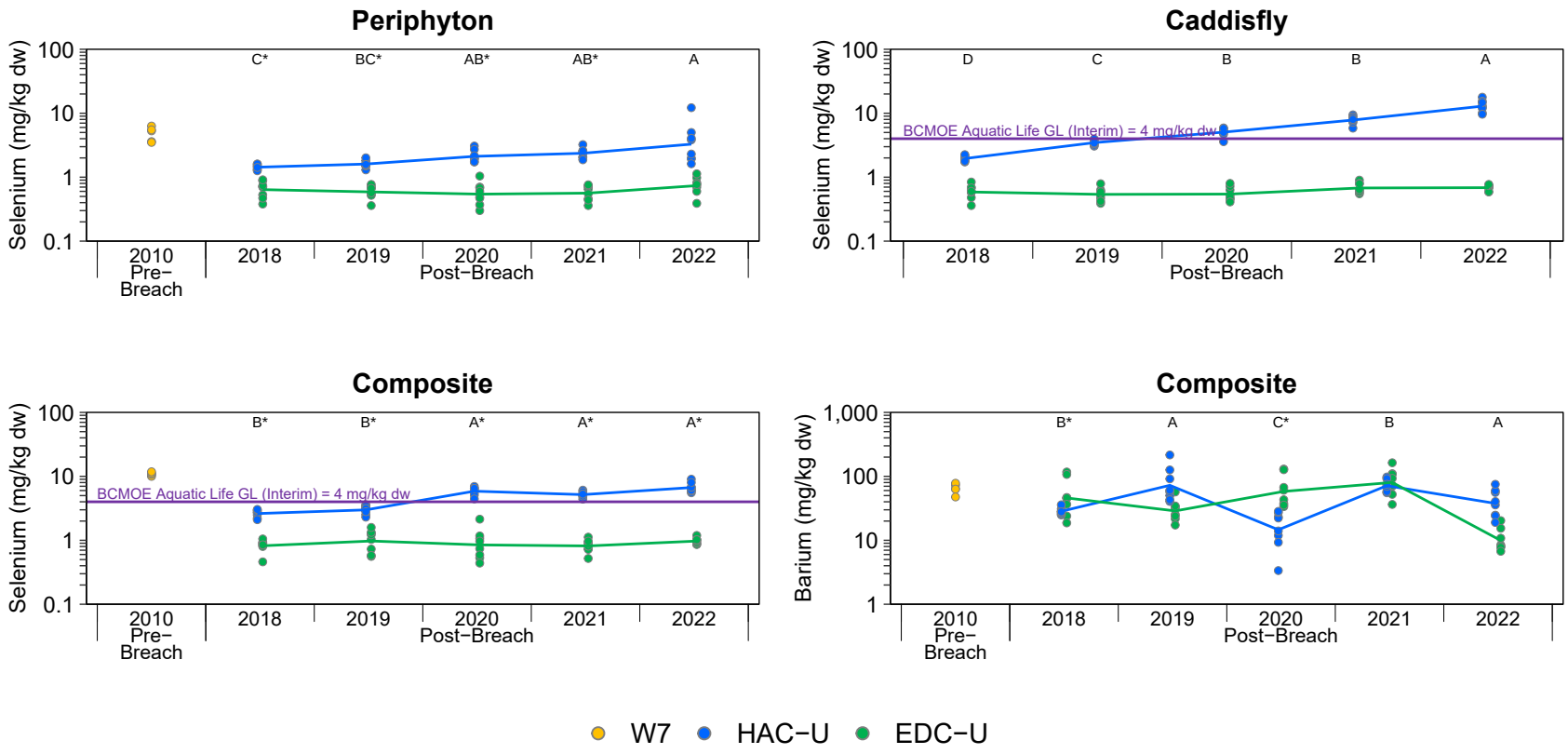

Figure 6.10: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

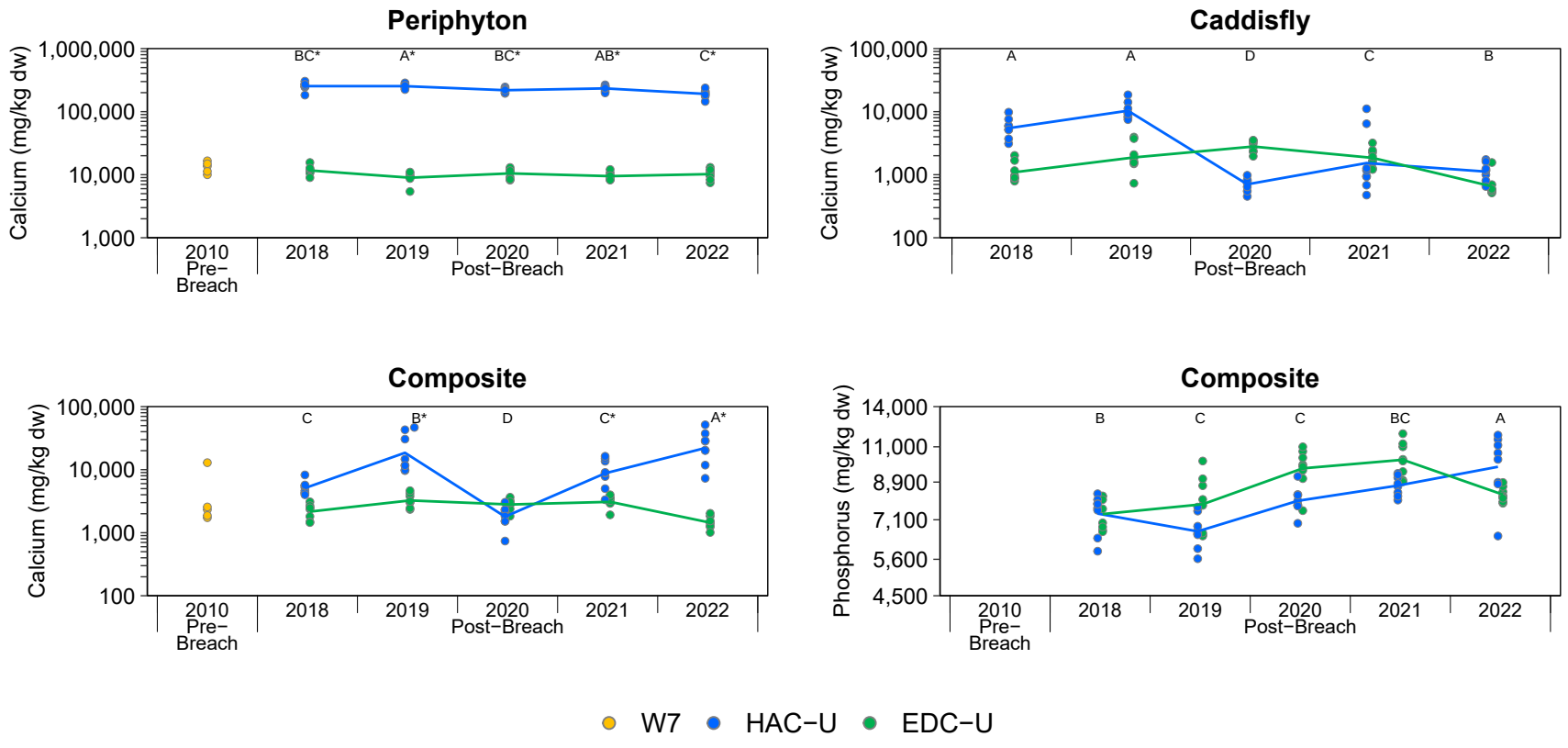

Figure 6.10: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

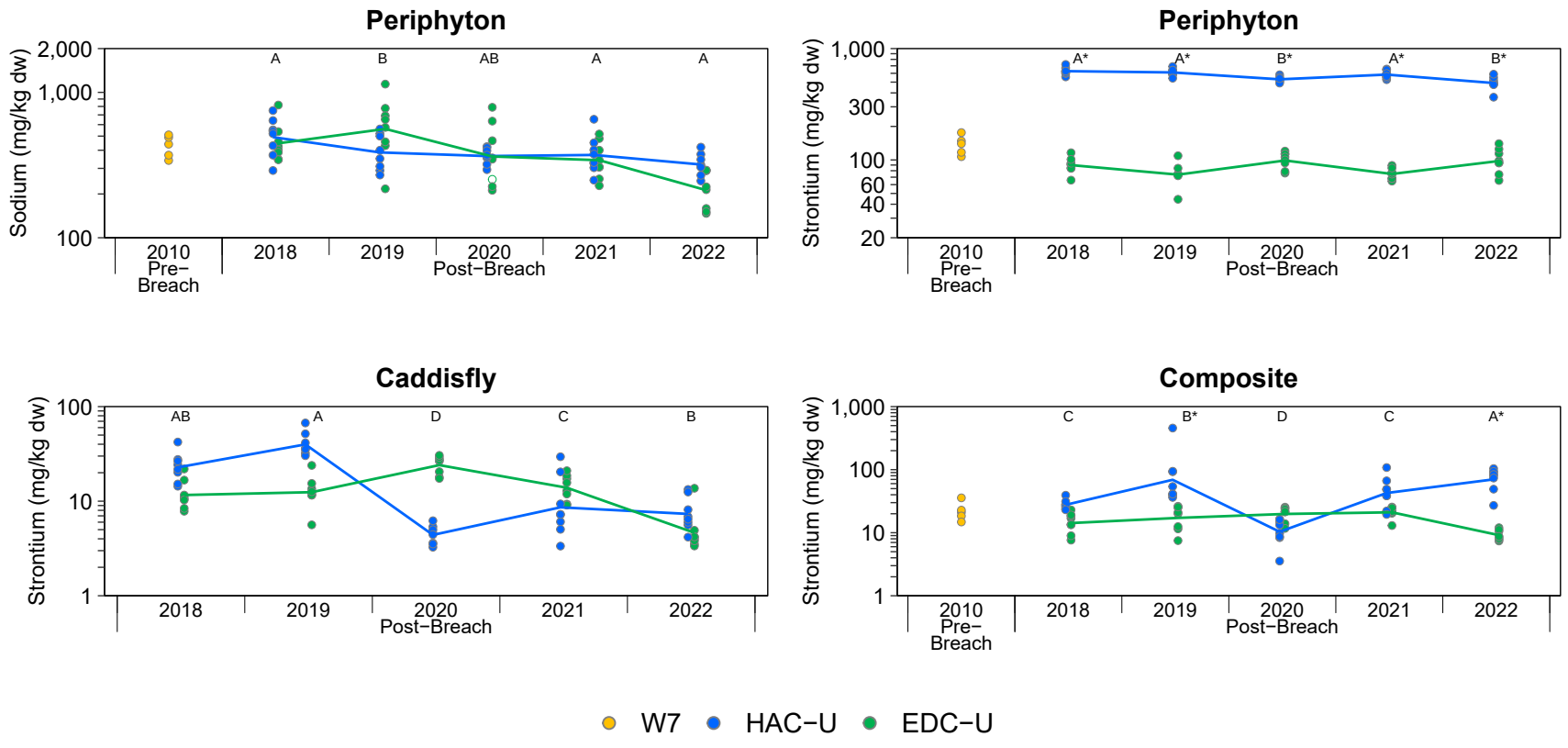

Figure 6.10: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

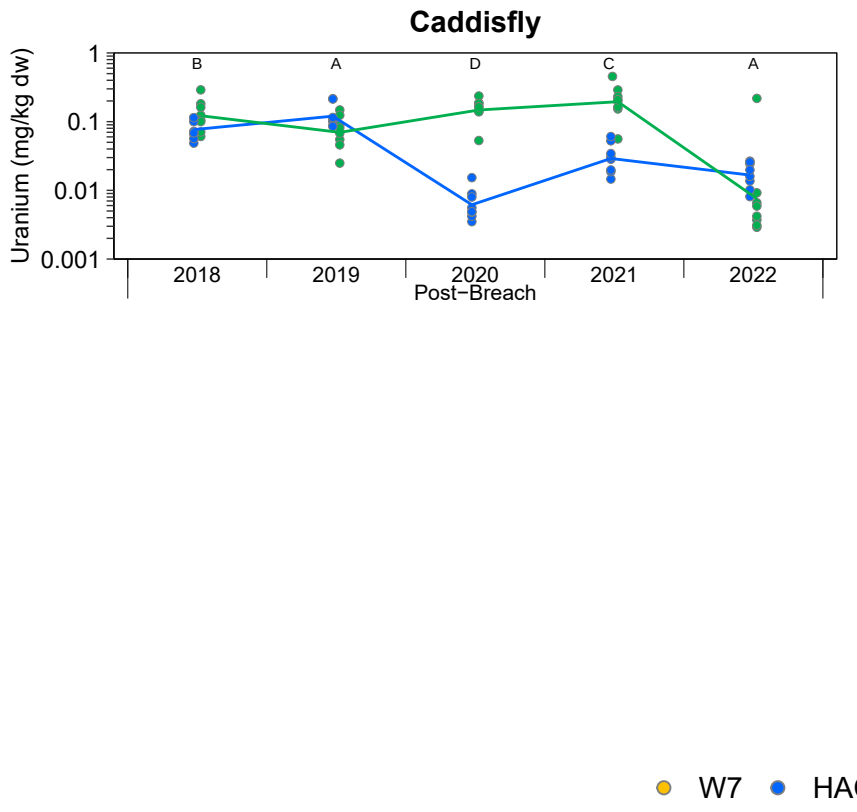

Figure 6.10: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

were significantly higher than pre-breach, which was consistent with all previous monitoring years (Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables F.4.1 to F.4.10). Copper TTFs in caddisfly tissues in 2022 for both exposed areas were lower than reference, and significantly lower than 2018, 2019 and 2021 at HAC-R1, and only lower than 2019 at HAC-U (Table 6.9; Appendix Figures F.4.7 to F.4.10, Appendix Tables D.5.7 and D.5.8, F.4.11 to F.4.16). Composite-taxa TTFs for copper at HAC-R1 were consistently higher than reference from 2018 to 2022 but in 2022 were significantly lower than in 2021, relative to reference, which represented a decrease from higher than pre-breach in prior years (2018 to 2021) to similar to pre-breach in 2022 (Table 6.9; Appendix Figures F.4.7 to F.4.10). In contrast, composite-taxa TTFs for copper at HAC-U in 2022 were significantly higher than reference and pre-breach, and were significantly higher than all previous monitoring years, relative to reference (Table 6.9). In summary, copper concentrations in 2022 were elevated relative to reference in most tissue types, were higher than pre-breach in composite-taxa samples but not periphyton for both exposed areas, were similar or lower over time at HAC-R1 for all tissue types, and similar (periphyton and caddisfly tissues) or increased (composite-taxa tissues) over time at HAC-U. Results from 2021 showed little evidence of bioaccumulation of copper in benthic invertebrate tissues (Minnow 2022a). In contrast, results from 2022 for copper in composite-taxa tissues showed evidence of BCFs that were higher than reference and a significant temporal increase in TTFs at HAC-U between 2021 and 2022 (to TTFs that were higher than pre-breach), relative to reference. There is therefore some evidence of copper bioaccumulation in benthic invertebrate biota in 2022 in Reach 2 of upper Hazeltine Creek. However, this was limited to composite-taxa benthic invertebrate tissues from Reach 2 (HAC-U) and was not observed in caddisfly tissues from HAC-U nor in benthic invertebrate tissues (caddisfly or composite-taxa) from Reach 1 (HAC-R1), indicating a potentially localized increase.

Concentrations of selenium in all tissue types from upper Hazeltine Creek were consistently elevated relative to the reference area (EDC-U) from 2018 to 2022 (Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables D.5.1 to D.5.6, F.4.1 to F.4.10). Selenium concentrations in periphyton tissues in 2022 were significantly higher at both exposed areas compared to 2018 but have been temporally stable since 2019 at HAC-R1, and temporally stable since 2020 at HAC-U, relative to reference (Figures 6.9 and 6.10, Table 6.7). In caddisfly tissue, concentrations of selenium in 2022 were similar to 2020 and 2021 but significantly higher than 2018 and 2019 at HAC-R1, and were significantly higher in 2022 than all prior years (2018 to 2021) at HAC-U. For composite-taxa tissue, concentrations of selenium in 2022 were lower than 2021, and similar to 2019 and 2020 but higher than 2018 at HAC-R1, and stable from 2020 to 2022 but higher than 2018 and 2019 at HAC-U (Figures 6.9 and 6.10, Table 6.7). Mean concentrations of selenium in caddisfly (6.69 mg/kg dw at HAC-R1 and 13.1 mg/kg dw

Table 6.9: Summary of Statistical Contrasts of Exposed - Reference Relative Differences in Trophic Transfer Factors of Primary and Secondary Analytes in Caddisfly and Composite-Taxa Benthic Invertebrate Tissue for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2018 to 2022 [a]

Analytes		Upper Hazeltine Creek Reach 1 (HAC-R1; Exposed) / Upper Edney Creek (EDC-U; Reference)										Upper Hazeltine Creek Reach 2 (HAC-U; Exposed) / Upper Edney Creek (EDC-U; Reference)										Lower Hazeltine Creek (HAC-D; Exposed) / Lower Edney Creek (EDC-D; Reference)									
		Caddisfly					Composite-Taxa Benthic Invertebrate					Caddisfly					Composite-Taxa Benthic Invertebrate					Caddisfly					Composite-Taxa Benthic Invertebrate				
		2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Primary Analyte	Arsenic	A	A	A	A	A	B (↑)	C (↑)	AB (↑)	AB (↑)	A (↑)	AB	A	A	B	A	B (ns)	B (↑)	B (ns)	B (↑)	A (↑)	C	A	AB	AB	B	C (ns)	A (ns)	AB (ns)	B (ns)	AB (ns)
	Copper	A	A	BC	AB	C	AB (↑)	B (↑)	B (↑)	A (↑)	B (ns)	AB	A	B	B	B	B (ns)	B (ns)	B (ns)	B (ns)	A (↑)	B	A	A	AB	A	A (↓)	A (ns)	A (ns)	A (ns)	A (ns)
	Iron	A	A	A	A	A	B (-)	B (-)	B (-)	A (-)	B (-)	AB	A	C	BC	AB	A (-)	A (-)	A (-)	A (-)	A (-)	B	A	A	A	A	B (-)	A (-)	A (-)	A (-)	A (-)
	Selenium	A	A	A	A	A	A (ns)	A (ns)	A (↑)	A (↑)	A (ns)	C	BC	BC	AB	A	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)	A	AB	BC	A	C	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)
Secondary Analyte	Barium	AB	A	B	C	AB	B (ns)	AB (ns)	B (ns)	B (ns)	A (ns)	B	A	BC	C	A	C (ns)	AB (ns)	C (ns)	BC (ns)	A (↑)	C	A	AB	AB	B	B (↓)	A (ns)	A (ns)	A (ns)	A (ns)
	Cadmium	ABC	A	BC	C	AB	B (↑)	B (↑)	AB (ns)	AB (↑)	A (ns)	B	A	C	BC	A	B (↑)	B (ns)	B (ns)	B (↑)	A (ns)	C	B	B	A	B	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)
	Calcium	A	A	B	B	B	A (ns)	BC (↓)	C (↓)	BC (↓)	B (↓)	A	A	D	C	B	B (↓)	B (↓)	C (↓)	B (↓)	A (ns)	B	B	BC	A	C	B (↓)	BC (↓)	C (↓)	A (ns)	BC (↓)
	Manganese	B	A	BC	C	B	C (ns)	AB (↑)	BC (ns)	AB (↑)	A (ns)	B	A	C	C	AB	B (ns)	A (↑)	B (ns)	B (↑)	A (ns)	C	B	B	A	B	B (ns)	A (ns)	A (ns)	A (ns)	A (ns)
	Molybdenum	A	B	A	A	B	B (ns)	B (ns)	A (ns)	A (↑)	B (ns)	B	C	A	B	B	B (ns)	B (ns)	A (ns)	B (ns)	C (ns)	A	A	A	B	A	A (ns)	A (ns)	A (ns)	A (↓)	A (ns)
	Nickel	AB	A	C	BC	ABC	A (ns)	A (ns)	A (ns)	A (↑)	A (ns)	AB	A	BC	C	A	BC (ns)	BC (ns)	C (ns)	B (↑)	A (ns)	C	AB	AB	A	B	A (ns)	A (ns)	A (ns)	A (ns)	A (ns)
	Phosphorus	A	A	A	A	A	B (-)	AB (-)	AB (-)	A (-)	A (-)	AB	A	B	B	AB	A (-)	A (-)	AB (-)	B (-)	A (-)	A	A	A	B	B	A (-)	AB (-)	AB (-)	BC (-)	C (-)
	Sodium	BC	A	CD	AB	D	A (-)	A (-)	A (-)	A (-)	A (-)	B	A	B	B	B	A (-)	A (-)	A (-)	A (-)	A (-)	AB	AB	A	C	BC	A (-)	AB (-)	AB (-)	B (-)	B (-)
	Strontium	A	A	C	BC	B	A (ns)	C (ns)	C (↓)	BC (ns)	B (ns)	A	A	C	B	A	B (↓)	B (ns)	C (↓)	B (ns)	A (ns)	BC	B	BC	A	C	B (↓)	B (↓)	B (↓)	A (ns)	B (↓)
	Titanium	-	A	AB	A	B	-	B (-)	B (-)	A (-)	B (-)	-	A	C	BC	AB	-	AB (-)	B (-)	A (-)	B (-)	-	A	A	A	A	-	A (-)	A (-)	A (-)	A (-)
	Uranium	AB	A	C	BC	AB	C (ns)	BC (↑)	C (↑)	A (↑)	AB (↑)	B	AB	D	C	A	BC (ns)	AB (↑)	C (ns)	B (↑)	A (ns)	B	A	A	A	A	B (↓)	A (ns)	A (ns)	A (ns)	A (ns)
	Vanadium	A	A	B	AB	B	B (↑)	B (↑)	B (↑)	A (↑)	AB (↑)	AB	A	C	BC	AB	A (ns)	A (↑)	A (ns)	A (↑)	A (ns)	B	A	A	A	A	B (ns)	A (ns)	A (ns)	A (ns)	A (ns)

Indicates significantly higher tissue concentration at exposed compared to reference area, and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

(↑) = Indicates significantly higher tissue concentration relative to pre-breach in 2010 (α = 0.05).
(↓) = Indicates significantly lower tissue concentration relative to pre-breach in 2010 (α = 0.05).
(ns) = no significant different in analyte concentration relative to pre-breach in 2010 (α = 0.05).

Notes: "-" = no statistical comparison could be made since data were not available or all results were below Laboratory Reporting Limit (LRL). Trophic Transfer Function (TTF) = Benthic Invertebrate Tissue Concentration / Periphyton Tissue Concentration. If the reported analyte concentrations for either periphyton or benthic invertebrate tissue were below the LRL, the TTF was not calculated. Refer to Appendix Tables F.4.11 to F.4.16 and F.4.22 to F.4.24 for statistical analyses results and magnitude of difference calculations.

[a] Results are shown for primary and secondary analytes that are presented in Table 6.7 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). Years that share a letter (e.g., A,B,C) had ratios of TTFs (Exposed:Reference) that did not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

at HAC-U) and composite-taxa (4.97 mg/kg dw at HAC-R1 and 6.67 mg/kg dw at HAC-U) tissue samples in 2022 were above the BC interim guideline (4 mg/kg dw; BCMOE 2014) in upper Hazeltine Creek. This is consistent with results from 2020 and 2021 (Figures 6.9 and 6.10) and suggests potential selenium-associated risks to aquatic life. Similar to previous monitoring years, selenium concentrations in periphyton and composite-taxa tissues[66] remained significantly lower than or similar to pre-breach tissue concentrations for both areas of upper Hazeltine Creek (Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables D.5.1 to D.5.6, F.4.1 to F.4.10).

Evaluation of temporal changes in TTFs for selenium showed no significant change in the exposed:reference ratio over time and compared to pre-breach for most tissue types and areas, with one exception. The exception is TTFs for selenium in caddisfly tissue from HAC-U, which were significantly higher in 2022 compared to 2018 to 2020, relative to reference (Table 6.9; Appendix Figures F.4.7 to F.4.10, Appendix Tables D.5.7 and D.5.8, F.4.11 to F.4.16). The increased selenium TTFs for caddisfly tissue at HAC-U in 2022 corresponded with higher dissolved aqueous concentrations and BCFs than reference in 2022, and caddisfly tissue concentrations that were significantly higher than reference and higher than in prior years (2018 to 2021; Tables 6.8 and 6.9). Overall, the significantly higher concentrations of selenium in all tissue types from upper Hazeltine Creek relative to reference, higher TTFs relative to reference, and an increase in the exposed:reference ratio for most tissues since 2018 (except composite-taxa tissues at HAC-R1), suggests a mine-related influence on selenium concentrations in aquatic biota. Since 2021, a significant increase in selenium concentrations and associated TTFs occurred, relative to reference, for caddisfly tissue from Reach 2 (HAC-U) only. The presence of mean selenium concentrations above the guideline for protection of aquatic life indicates potential risks to aquatic biota; however, it is important to note that tissue selenium concentrations in 2022 remained similar to or significantly lower than pre-breach. For periphyton and composite-taxa benthic invertebrate tissue, the occurrence of BCFs for selenium below reference and TTFs results which show no temporal change indicate that the bioavailability and bioaccumulation of selenium in these tissues has not increased due to mine-exposure. However, there is some evidence of increased bioaccumulation of selenium in caddisfly tissues from Reach 2 (HAC-U) of upper Hazeltine Creek, based on increasing TTFs for this tissue over time.

The two other primary analytes (arsenic and iron) only had elevated tissue concentrations relative to reference for composite-taxa tissues (Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables F.4.1 to F.4.10). Although the exposed:reference ratios for arsenic and iron in

[66] Caddisfly tissue results cannot be compared to pre-breach values because monitoring of this tissue type was initiated in 2018.

composite-taxa tissues from HAC-R1 and arsenic in composite-taxa tissues from HAC-U were significantly higher than previous monitoring years, these differences were due to a temporal decrease in analyte concentrations at the reference area (EDC-U) rather than an increased analyte concentrations at the exposed areas (Figures 6.9 and 6.10, Table 6.7). Composite-taxa tissue concentrations of arsenic in 2022 were similar to pre-breach concentrations at both areas of upper Hazeltine Creek (no pre-breach data exists for iron; Table 6.7; Appendix Tables F.4.7 and F.4.10). The TTFs for arsenic and iron in composite-taxa have been significantly higher than reference for all monitoring years, and for arsenic in composite-taxa tissue the TTFs for both HAC-R1 and HAC-U in 2022 were higher than pre-breach and similar to or higher than previous monitoring years (Table 6.9; Appendix Figures F.4.7 to F.4.10, Appendix Tables F.4.11 to F.4.16). Although composite-taxa tissues BCFs and TTFs were elevated relative to reference in 2022 (Tables 6.8 and 6.9), the absence of increased concentrations of arsenic and iron in composite-taxa tissue (outside of reference contrasts) indicate there is little evidence that either analyte is bioaccumulating in these tissues over time.

Concentrations and TTFs for the nine secondary analytes identified for data interpretation (barium, calcium, nickel, phosphorus, sodium, strontium, titanium, uranium, and vanadium) varied among tissue types (Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1 to F.4.6, Appendix Tables D.5.1 to D.5.8, F.4.1 to F.4.10). Most notable in 2022 was that concentrations of all secondary analytes in caddisfly tissues from HAC-R1 were similar to or lower than reference (Table 6.7). Furthermore, in contrast to 2021 when concentrations of molybdenum and mercury were elevated relative to reference in most caddisfly and all composite tissues (Minnow 2022a), neither analyte was elevated relative to reference in 2022 in benthic invertebrate tissues. Benthic invertebrate tissue concentrations of both molybdenum and mercury were similar to or lower than previous monitoring years (Table 6.7; Appendix Tables F.4.5 to F.4.10), therefore TTFs for these analytes were not included in data interpretation. Periphyton tissues from both upper Hazeltine Creek areas had concentrations of calcium and strontium that were consistently higher than reference and higher than pre-breach in all years (2018 to 2022). Although the concentrations of calcium and strontium in periphyton tissues changed significantly over time, concentrations in 2022 for both analytes were either similar to or lower than previous monitoring years (relative to reference) for both exposed areas (Figures 6.9 and 6.10, Table 6.7; Appendix Figures F.4.1, F.4.2, Appendix Tables F.4.1 to F.4.4). Calcium and strontium in exposed composite-taxa tissues from HAC-R1 and caddisfly and composite-taxa tissues from HAC-U were higher than reference in 2022 (Figures 6.9 and 6.10; Appendix Figures F.4.4 and F.4.6). Composite-taxa tissue concentrations of calcium and strontium in 2022 at both exposed areas were significantly higher than reference. At HAC-R1, concentrations of both analytes were similar to pre-breach and lower than most previous monitoring years (except 2020),

relative to reference, whereas at HAC-U composite-taxa tissue concentrations of these analytes were higher than pre-breach and the concentration (relative to reference) was higher than all previous monitoring years (Figures 6.9 and 6.10, Table 6.7; Appendix Tables F.4.6, F.4.7, F.4.9, F.4.10). Caddisfly tissue concentrations of calcium and strontium in 2022 at HAC-U were also significantly higher than reference but were lower than those observed in 2018 and/or 2019 (Figure 6.10, Table 6.7; Appendix Table F.4.8). Periphyton (but not caddisfly or composite-taxa) tissue concentrations of sodium were significantly higher than reference in 2022 but similar to or lower than pre-breach concentrations for both areas (Figures 6.9 and 6.10, Table 6.7). Evaluation TTFs indicated that calcium, sodium and strontium were similar to or lower than reference in caddisfly or composite-taxa tissues from both exposed areas of upper Hazeltine Creek (Tables 6.9 and 6.10; Appendix Tables F.4.11 to F.4.16).

Composite-taxa tissues from HAC-R1 had concentrations of barium, nickel, titanium, uranium, and vanadium that were significantly higher than reference, but concentrations in 2022 were similar to or lower than pre-breach (where pre-breach data exist) or were temporally stable (Figure 6.9, Table 6.7). Tissues collected from HAC-U in 2022 had analyte concentrations that were higher than reference for uranium in caddisfly, and barium and phosphorous in composite-taxa tissues. However, composite-taxa tissue concentrations of barium were similar to pre-breach (no pre-breach data for phosphorus) and caddisfly tissue uranium concentrations in 2022 were similar to 2019, indicating no temporal increase (Figures 6.9 and 6.10, Table 6.7; Appendix Tables F.4.5 to F.4.10). The similarity (or lower) concentrations of these analytes in 2022 compared to pre-breach, lack of temporal increase relative to 2018/2019, and inconsistencies among tissue types and sampling areas, indicates there is no equivocal evidence that concentrations of these analytes are increased due to a mine-related influence.

6.1.4.3 Lower Hazeltine Creek

For most metals evaluated, there was no evidence of increasing concentrations in periphyton and/or benthic invertebrate tissues at the lower Hazeltine Creek area relative to the reference area over time (Appendix Figures F.4.11 to F.4.13, Appendix Tables D.5.2, D.5.4, D.5.6, D.5.9 to D.5.11, F.4.17 to F.4.21). The primary analytes copper and selenium and seven secondary analytes barium, cadmium, calcium, manganese, molybdenum, phosphorus, and strontium met the criteria for inclusion in data interpretation (i.e., were significantly higher for at the lower Hazeltine Creek exposed area relative to reference in 2022 or in all years; Table 6.7). Of these analytes, only cadmium did not show a significant (*Area×Year*) interaction for at least one tissue type in lower Hazeltine Creek.

MPMC routinely monitors water quality in lower Hazeltine Creek at Station HAC-08 (a station upstream of HAC-D; Figure 4.2). Results from this routine water quality monitoring station

indicated that aqueous concentrations of two primary or secondary analytes (copper and selenium) exceeded the BCWQG during the year preceding sampling (i.e., September 2021 to August 2022). Specifically, concentrations of dissolved copper consistently (100% of samples) exceeded the BLM-based chronic guideline and total selenium concentrations exceeded the chronic BCWQG in one sample (Appendix Table D.1.6). Of the two primary and seven secondary analytes identified for further investigation (above), only dissolved aqueous concentrations of copper, selenium and molybdenum were elevated at HAC-D relative to reference (Table 6.8)[67]. BCFs were slightly elevated (< 2 times higher than reference) for copper in periphyton tissues and not elevated in any tissues for selenium (Table 6.8). The BCFs for barium, cadmium, and manganese were also slightly elevated relative to reference (< 2 times), while BCFs for phosphorus and strontium were 2.0 and 5.2 times higher than reference, and the BCF for calcium in periphyton tissue was the most elevated (18 times higher than reference; Table 6.8). For the most part, BCFs were lower than those observed for upper Hazeltine Creek for the secondary analytes evaluated in 2022, except for calcium and phosphorus (Table 6.8).

Concentrations of copper in periphyton, caddisfly, and composite-taxa tissues from lower Hazeltine Creek were consistently elevated relative to the lower Edney creek reference area (EDC-D) in most sampling years, except for caddisfly tissue in 2018. In addition, copper concentrations in periphyton and caddisfly tissues were consistently higher than pre-breach in most sampling years, except 2018 for composite-taxa tissues (pre-breach data do not exist for caddisflies; Figure 6.11, Table 6.7; Appendix Figures F.4.11 to F.4.13, Appendix Tables D.5.2, D.5.4, D.5.6, D.5.9 to D.5.11, F.4.17 to F.4.21). However, the mean copper concentrations in each tissue type in 2022 were significantly lower than in 2021 and were similar to or lower than previous monitoring years, relative to reference (Figure 6.11, Table 6.7). Evaluation of temporal changes in TTFs for copper showed results different to those from upper Hazeltine Creek. The copper TTFs for caddisfly and composite taxa-tissues were similar to or lower than reference in all years, and for composite-taxa tissues were temporally stable and similar to or lower than pre-breach (Table 6.9; Appendix Tables D.5.7 and D.5.8, F.4.22 to F.4.24). Overall, although copper concentrations in periphyton and benthic invertebrate tissues were significantly higher than reference and pre-breach (where pre-breach data exist), the BCFs were only slightly higher (periphyton, by 1.7 times) or lower than reference (caddisfly and composite-taxa; Table 6.8), and the TTFs were similar to or lower than reference and pre-breach.

[67] Elevated analytes were identified as those with mean concentrations at the exposed station that were at least twice the mean concentration at the reference station.



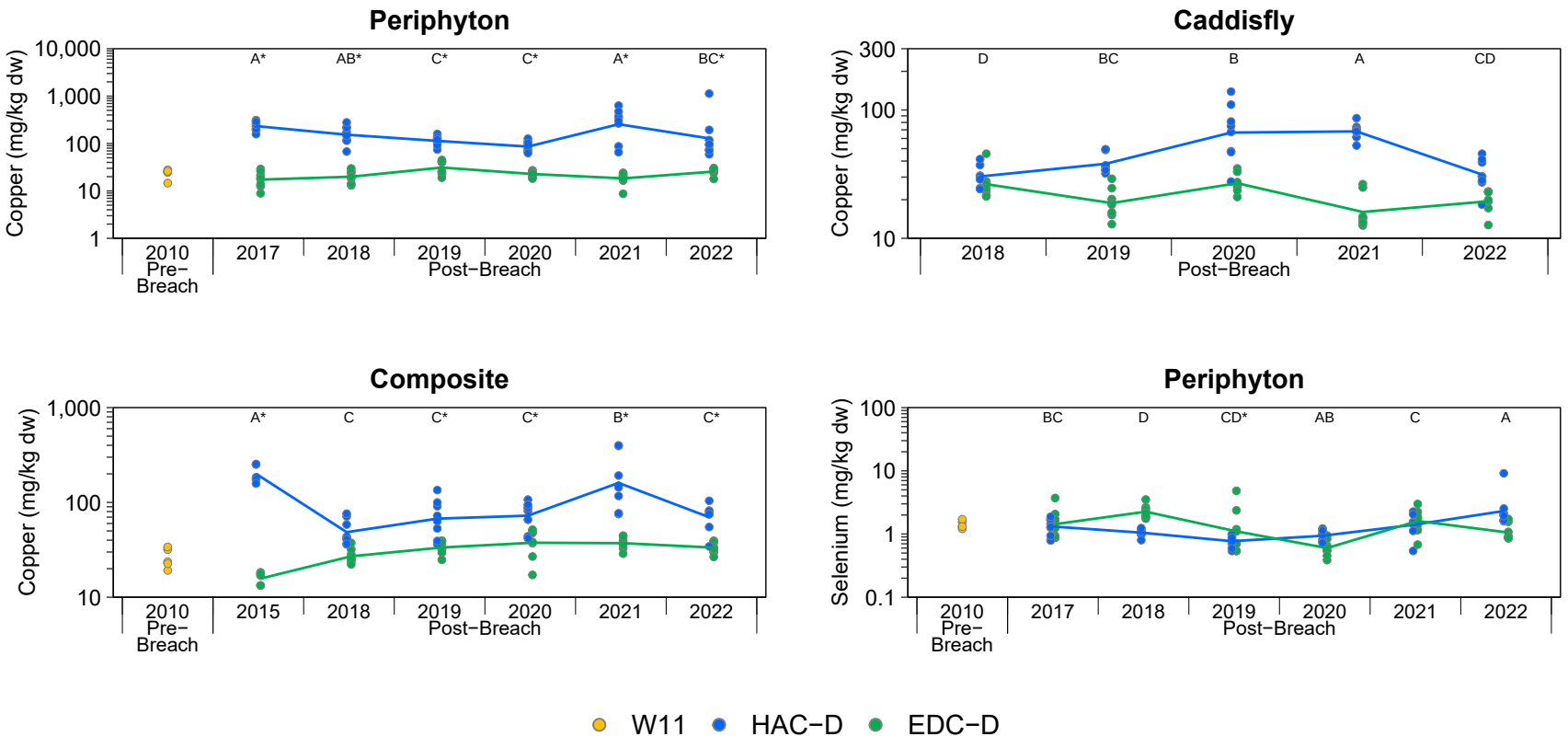

Figure 6.11: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

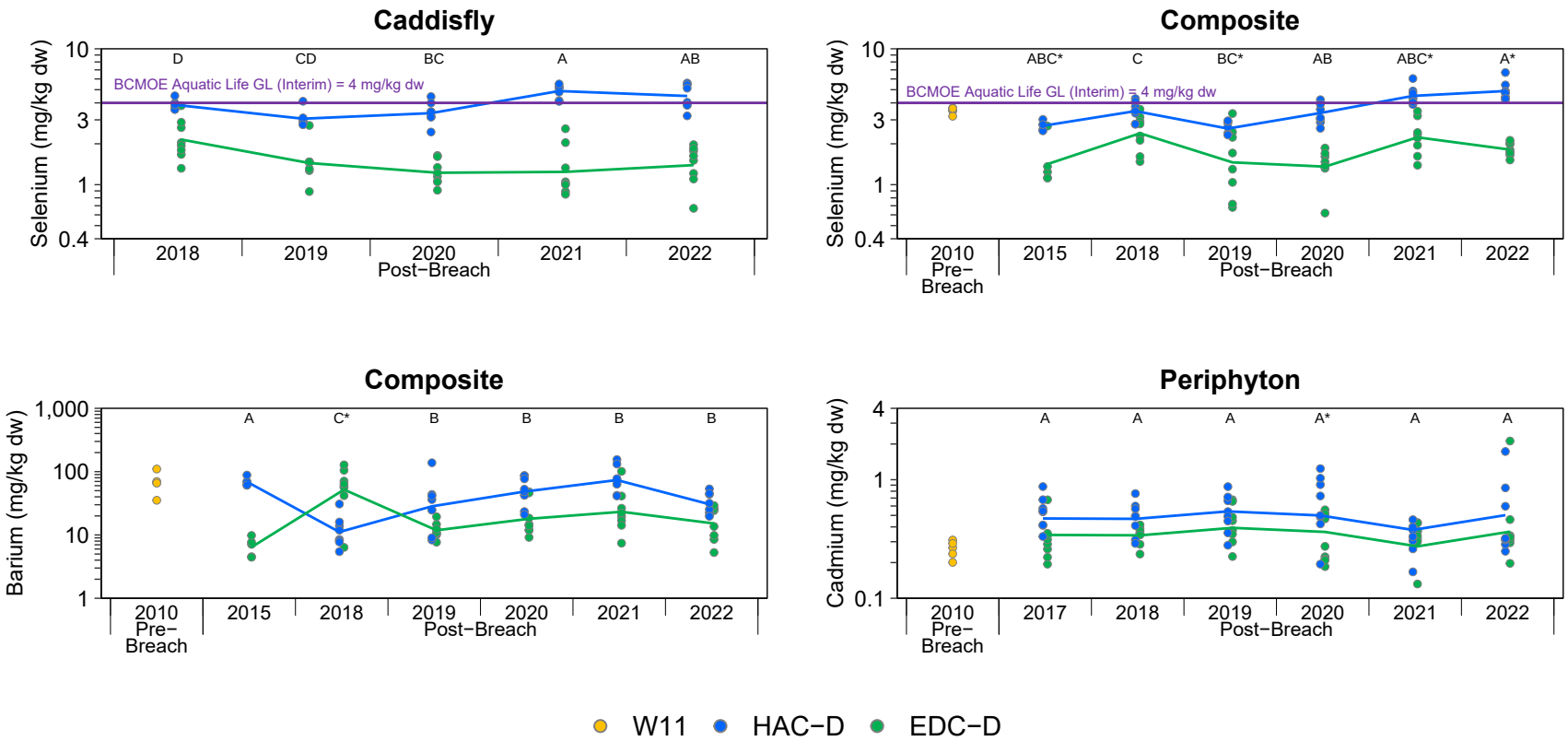

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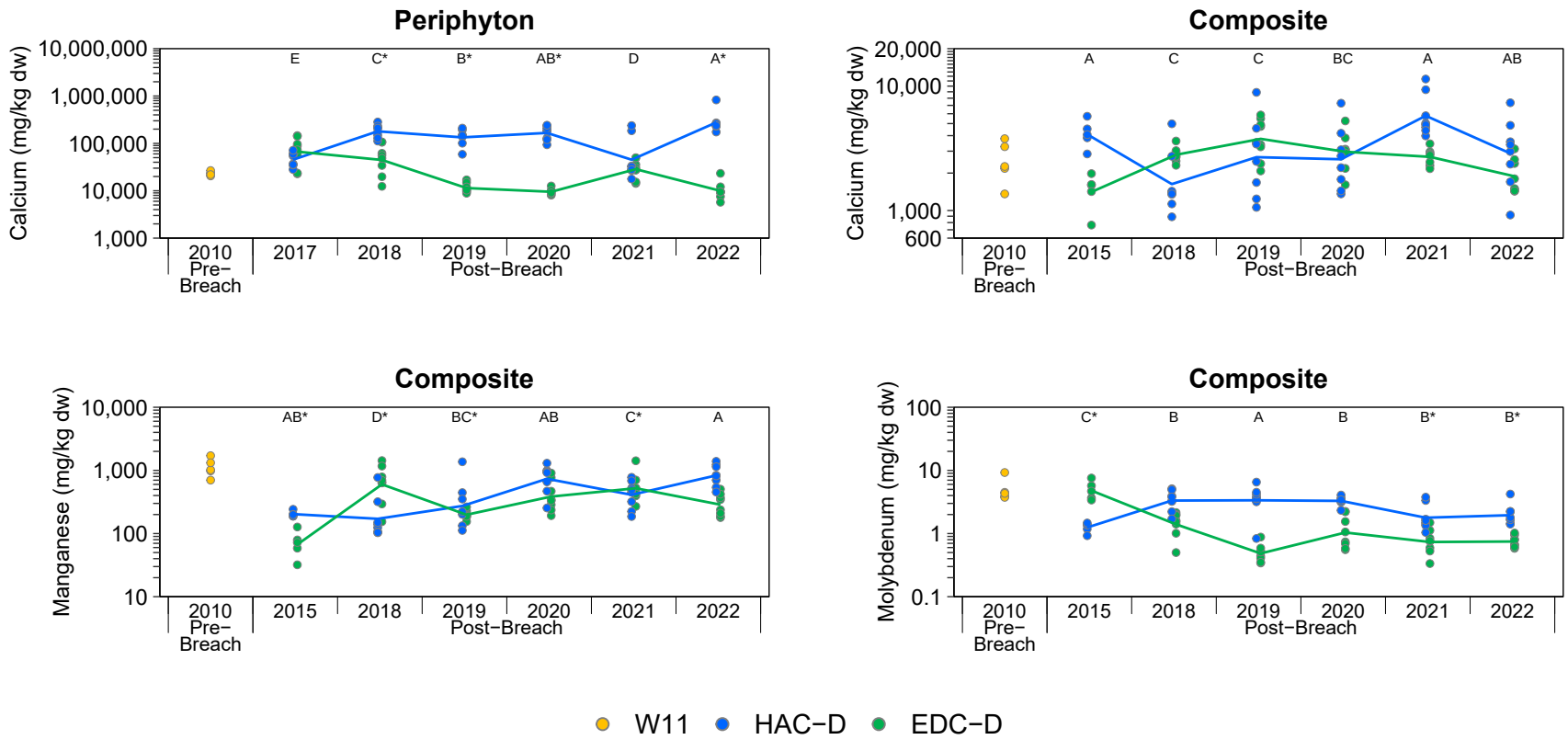

Figure 6.11: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

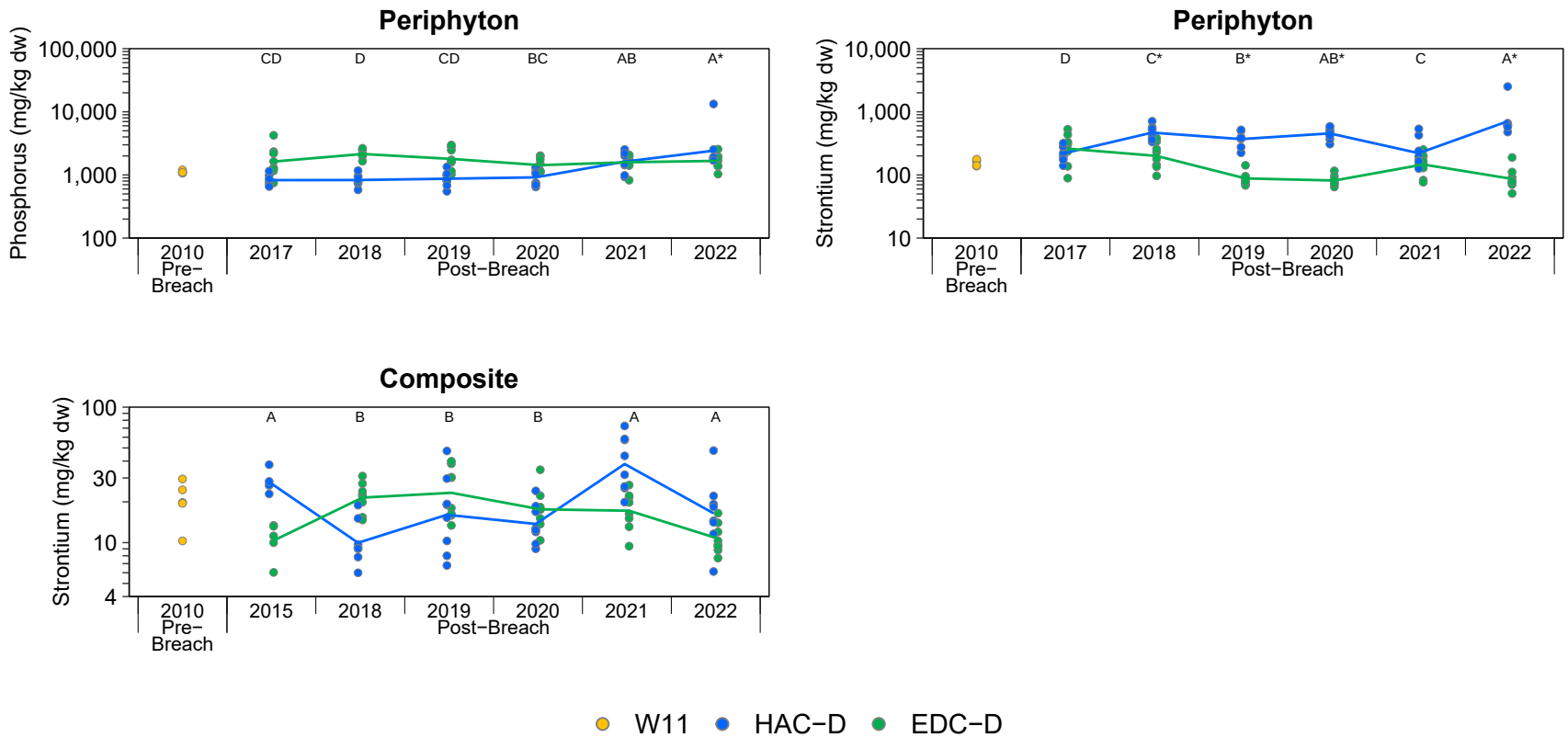

Figure 6.11: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight. W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre-breach conditions, as determined using a one-way temporal ANOVA.

These findings indicate there is no evidence of increasing tissue concentrations or bioavailability of copper over time in biota from lower Hazeltine Creek.

Selenium concentrations in periphyton, caddisfly and composite-taxa tissues from lower Hazeltine Creek were significantly higher compared to the reference area in 2022 (Figure 6.11, Table 6.7; Appendix Figures F.4.11 to F.4.13, Appendix Tables F.4.17 to F.4.21). Selenium concentrations in periphyton and caddisfly in 2022 were higher than most prior years (periphyton: 2017 to 2021 except 2020; caddisfly: 2018 to 2020). In composite-taxa tissues, selenium concentrations in 2022 were similar to most prior years but higher than in 2018 and 2019 (Figure 6.11, Table 6.7). Compared to pre-breach conditions, selenium concentrations in periphyton tissue were similar to or lower than pre-breach in all years. In contrast, selenium concentrations in composite-taxa were lower than pre-breach in 2015, 2019, similar to pre-breach in 2018 and 2020, and increased to higher than pre-breach in 2021 and 2022 (Figure 6.11, Table 6.7; Appendix Tables F.4.18 and F.4.21). Mean selenium concentrations in caddisfly (4.58 mg/kg dw) and composite-taxa (4.54 mg/kg dw) were slightly above the BC interim guideline (4 mg/kg dw; BCMOE 2014) in 2022, which is consistent with 2021 but differs from prior years (2015 to 2020) when mean concentrations were below the guideline (Figure 6.11, Table 6.8; Appendix Tables D.5.5, D.5.7, D.5.10, D.5.11). The elevation of mean selenium concentrations over the guideline, although slight, suggests potential selenium-associated risks to aquatic life. The TTFs for selenium were similar to reference in 2022 (caddisfly tissues) or were higher than reference but temporally stable (composite-taxa tissues), which indicate selenium is not accumulating in aquatic biota over time (Table 6.9; Appendix Tables D.5.7 and D.5.8, F.4.22 to F.4.24). Overall, BCFs were lower than reference for all tissue types (Table 6.8) and the TTFs indicate there is no evidence of increasing bioavailability of selenium over time in lower Hazeltine Creek (Table 6.9). However, selenium concentrations in all exposed tissues in 2022 were significantly elevated relative to reference and were significantly higher in 2022 compared to 2018 and 2019 (for all tissues), relative to reference. In benthic invertebrate tissues, selenium concentrations that were previously below the interim guideline and pre-breach concentrations (2015 and 2019) were higher than the guideline and pre-breach concentrations in 2021 and 2022. Therefore, there is some evidence of a temporal increase in tissue selenium concentrations in lower Hazeltine Creek, and the elevation of mean selenium concentrations over the guideline for protection of aquatic life, although slight, suggests potential selenium-associated risks to aquatic life.

Temporal changes in the seven secondary analytes identified for data interpretation (barium, cadmium, calcium, manganese, molybdenum, phosphorus, and strontium) differed between tissue types from lower Hazeltine Creek (Figure 6.11, Table 6.7; Appendix Figures F.4.11 to F.4.13, Appendix Tables F.4.17 to F.4.21). Most notable in 2022 was that concentrations of all secondary analytes in caddisfly tissues from lower Hazeltine Creek were

either similar to or lower than reference (Table 6.7; Appendix Table F.4.16). A similar result was observed for caddisfly tissues at HAC-R1 in 2022 (see Section 6.1.4.2). Periphyton tissue concentrations of cadmium, calcium, phosphorus, and strontium were significantly elevated relative to reference in 2022 (Figure 6.11, Table 6.7; Appendix Tables F.4.17 and F.4.18). Tissue concentrations of cadmium were similar to pre-breach in 2022, which is consistent with previous monitoring years, and concentrations were temporally stable from 2017 to 2022, relative to reference (Figure 6.11, Table 6.7). Periphyton tissue concentrations of calcium and strontium in 2022 were significantly higher than pre-breach, and while differences in concentration (relative to reference) have varied from 2017, these differences were significantly higher than most previous monitoring years (except 2020; Figure 6.11, Table 6.7). However, these changes in the concentrations of calcium and strontium (relative to reference) in 2022 were driven by both a decrease in tissue concentration at the reference area and an increase in tissue concentrations at HAC-D in 2022 (with the exposed:reference ratio in 2022 being significantly higher than previous years; Figure 6.11, Table 6.7). Periphyton tissue concentrations for phosphorus were higher than pre-breach, the difference between exposed and reference were significantly higher than all previous monitoring years from 2017 except 2021, and the concentration of phosphorus (for the first time since monitoring began in 2017) was higher than reference in exposed tissues (Figure 6.11, Table 6.7; Appendix Tables F.4.17 and F.4.18).

Composite-taxa tissues from lower Hazeltine Creek had concentrations of barium, calcium, manganese, molybdenum, and strontium that were significantly elevated relative to reference, but that were similar to or lower than pre-breach tissue concentrations in 2022 (Figure 6.11, Table 6.7). Concentrations of these analytes in composite-taxa tissues in 2022 were similar to or lower than in the first year of monitoring (2015), except for molybdenum which was similar to or lower than concentrations from 2018 to 2021, relative to reference (Figure 6.11, Table 6.7; Appendix Tables F.4.14, F.4.15). Therefore, there is no evidence of a temporal increase in the concentrations of these secondary analytes in composite-taxa tissues, relative to reference. Calcium and strontium were the only two secondary analytes that were also significantly higher than reference in 2022 in other tissue types (i.e., periphyton) and which also showed a temporal increase, relative to reference (see description above).

The TTFs for most of the secondary analytes discussed above (barium, calcium, manganese, molybdenum, and strontium) in caddisfly and composite-taxa tissues from lower Hazeltine Creek in 2022 were similar to or lower than reference (Table 6.9; Appendix Figures F.4.14 and F.4.15, Appendix Tables D.5.7, D.5.8, F.4.22 to F.4.24). For manganese and molybdenum in composite taxa tissues, the TTFs in 2022 were significantly higher than reference (Table 6.9). A significant increase in the exposed:reference ratio for composite-taxa TTFs has not been observed since 2019 for any of the five secondary analytes assessed (including manganese

and molybdenum), and the TTFs for these five secondary analytes in composite-taxa tissue were lower than or similar to pre-breach (Appendix Tables F.5.18 to F.5.20, Appendix Figures F.5.13 and F.5.14). In addition, manganese and molybdenum did not have BCFs higher than reference. Overall, the TTFs for barium, calcium, manganese, molybdenum, and strontium in benthic invertebrate tissues were either similar to or lower than reference, temporally stable since 2019 (for those analytes with TTFs higher than reference), and similar to or lower than pre-breach, indicating there is no evidence of increased bioaccumulation of these analytes in aquatic biota in lower Hazeltine Creek.

6.1.4.4 Tissue-Type Comparison

A comparison between benthic invertebrate (caddisfly and composite) tissue findings was completed to evaluate if results were consistent between the two tissue types. This qualitative comparison focused on analytes with a significant positive exposed-reference difference (i.e., analytes with concentrations that were significantly higher in tissues from the exposed area compared to those from the reference area) in 2022 or in all monitoring years for at least one tissue type in at least one area.

In upper Hazeltine Creek, selenium was the only primary analyte for which both benthic invertebrate tissue concentrations (caddisfly and composite-taxa) and TTFs in 2022 were higher at HAC-R1 and HAC-U than reference. However, for selenium only the TTFs in caddisfly tissues from HAC-U had a significant (*AreaxYear*) interaction which indicates there has been a significant increase in TTFs over time (Tables 6.9 and 6.10). For both areas of upper Hazeltine Creek, the TTFs for arsenic, iron, cadmium, manganese, nickel, phosphorus, uranium, and vanadium were elevated relative to reference in both caddisfly and composite-taxa tissues, however tissue concentrations for most of these analytes were not similarly elevated in both tissue types (Table 6.10; see Section 6.1.4.2 for detailed discussion of these results). Molybdenum and titanium were the only analytes for which tissue concentrations were similar to reference (for at least one area) and TTFs were elevated in caddisfly tissues but not composite-taxa tissues (Table 6.10). Barium was the only analyte for which only composite-taxa tissues had a higher concentration and TTFs for both exposed areas (Table 6.10). Overall, there were only a handful of instances when higher tissue concentrations or TTFs relative to reference occurred in caddisfly tissues from upper Hazeltine Creek that were undetected in composite-taxa samples (i.e., molybdenum and titanium TTFs at HAC-U, and uranium tissue concentrations at HAC-U; Table 6.10). In addition, there were also a few instances when significant temporal increases in the TTFs for analytes in caddisfly tissues occurred that were undetected in composite-taxa samples (i.e., no temporal change in analyte TTFs was detected in composite-taxa tissues): nickel at HAC-R1, and iron, selenium, and vanadium at HAC-U (Table 6.10).

Table 6.10: Summary Magnitude of Difference (MOD)[a] of Exposed - Reference Contrasts of Primary and Secondary Analyte Concentrations and Trophic Transfer Factors (TTFs) in Caddisfly and Composite-Taxa Benthic Invertebrate Tissue for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek (EDC-D; Reference), 2022

Analytes		Upper Hazeltine Creek Reach 1 (HAC-R1; Exposed)				Upper Hazeltine Creek Reach 2 (HAC-U; Exposed)				Lower Hazeltine Creek Reach 5 (HAC-D; Exposed)			
		Upper Edney Creek (EDC-U; Reference)				Upper Edney Creek (EDC-U; Reference)				Lower Edney Creek (EDC-D; Reference)			
		Caddisfly		Composite-Taxa		Caddisfly		Composite-Taxa		Caddisfly		Composite-Taxa	
		Tissue	TTF	Tissue	TTF	Tissue	TTF	Tissue	TTF	Tissue	TTF	Tissue	TTF
Primary Analytes	Arsenic	-44	557	99	1490	ns	419	202	1,849	-70	ns	ns	ns
	Copper	ns	ns	398	203	30	ns	1,564	759	62	-68	110	ns-i
	Iron	ns	1167	161	1832	ns	548	ns	613	-76	ns	ns	242
	Selenium	842	223	403	111	1,781	323	587	46	223	ns	170	105
Secondary Analytes	Barium	ns	ns	276	1,152	ns	ns	280	736	ns	-71	101	ns
	Cadmium	-65	398	-53	313	ns	560	-47	325	ns	ns	ns	ns
	Calcium	ns	-96	379	-80	72	-91	1,426	ns	ns	-98	53	-94
	Manganese	ns	451	ns	1,386	ns	438	ns	597	ns	ns	190	137
	Molybdenum	ns	ns	ns	126	ns	161	ns	ns	ns	ns	161	397
	Nickel	-58	440	88	1172	ns	641	ns	1,948	-85	ns	ns	83
	Phosphorus	ns	159	ns	250	ns	97	18	151	ns	-37	ns	-36
	Sodium	ns	-41	ns	ns	ns	-41	ns	ns-i	-21	-39	ns	ns
	Strontium	ns	-84	222	ns	58	-68	666	ns	-37	-92	54	-81
	Titanium	ns	ns	ns-i	838	ns	302	ns	ns	-71	ns	ns	178
	Uranium	ns	352	87	792	120	861	ns	573	-58	ns	ns	140
	Vanadium	ns	193	291	1,702	ns	432	ns	466	-74	ns	ns	225

Indicates significantly higher tissue concentration or TTF at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly higher tissue concentrations or TTF at exposed compared to reference area (α = 0.05), without a significant (Area x Year) interaction of the two-way ANOVA. Values represent the MOD exposed:reference, which did not change significantly among monitoring years.

Notes: Results are shown for primary and secondary analytes that are presented in Table 6.7 (i.e., analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). "-" = not enough data available for test or comparison, ns = no significant difference between exposed at reference area. TTF calculated as (benthic invertebrate tissue analyte concentration) / (periphyton tissue analyte concentration).

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

At lower Hazeltine Creek (HAC-D) in 2022, none of the secondary analytes had higher concentrations or TTFs relative to reference in caddisfly tissues, but copper and selenium (primary analytes) were significantly higher than reference (Table 6.10). Only selenium, manganese, and molybdenum had both elevated tissues concentrations and TTFs relative to reference in composite-taxa tissue, and of these analytes, only TTFs for manganese increased significantly over time (but not since 2019; Tables 6.9 and 6.10). Iron, nickel, titanium, uranium, and vanadium had elevated TTFs, however tissue concentrations of these analytes were not similarly elevated in 2022 (Table 6.10). For lower Hazeltine Creek, there were no instances when higher tissue concentrations or TTFs relative to reference occurred in caddisfly tissues from upper Hazeltine Creek that were undetected in composite-taxa samples from this area (Table 6.10).

When comparing the magnitude of the exposed:reference ratio of analyte concentrations and TTF results in 2022, the magnitude of most ratios was lower in caddisfly samples compared to composite samples (Table 6.10). However, differences in exposed:reference ratios for tissue concentrations were consistently higher in caddisfly tissues compared composite-taxa tissues for selenium for all three exposed areas, and for uranium at HAC-U (Table 6.10). Among all areas (HAC-R1, HAC-U, and HAC-D), there were only a few instances when higher tissue concentrations or TTFs relative to reference occurred in caddisfly tissues that were undetected in composite-taxa samples (these are outlined above). Combined, these results indicate that if sampling were limited to composite-taxa tissue samples only, potential changes in tissue concentrations and TTFs in caddisfly tissues would largely be detected by continued monitoring composite-taxa tissues, which is consistent with results reported in 2020 and 2021 (Minnow 2021a, 2022a).

6.1.5 Summary

Sediment quality monitoring completed in upper and lower Hazeltine Creek in 2022 continued to document the physical and chemical characteristics of sediments from this erosional habitat. Sediments were characterized by concentrations of several analytes that were greater than reference/pre-breach concentrations and WSQG values: copper and selenium in upper Hazeltine Creek, and copper and iron in lower Hazeltine Creek. In both upper and lower Hazeltine Creek in 2022, copper was the most substantially elevated analyte with concentrations 2.0 and 1.7 times higher than the upper WSQG, respectively, and higher than reference/pre-breach concentrations. The TOC content of sediments from upper Hazeltine Creek was significantly higher in 2022 than in 2018, relative to reference, as were the concentrations of copper and selenium. Mean concentrations of copper and selenium in upper Hazeltine Creek sediments were significantly higher in 2022 than previously observed (2018 to 2021), relative to reference. For both analytes, this change was driven by a significant decrease in sediment copper and

selenium concentrations at the reference area, with copper concentrations within upper Hazeltine Creek sediments (i.e., not evaluated relative to reference) showing temporal stability. Sediment selenium concentrations evaluated within upper Hazeltine Creek in 2022 (not relative to reference) were significantly higher than in preceding years (2018 to 2020) which was associated with higher TOC and lower sand content of these sediments. In lower Hazeltine Creek, the TOC content of lower Hazeltine Creek sediments has remained unchanged relative to reference from 2018 to 2022. Copper and iron concentrations in lower Hazeltine Creek sediments in 2022 were similar to or lower than those observed in 2018, relative to reference, indicating sediment concentrations of these analytes have not increased significantly over that period. The 2022 sediment quality monitoring results continue to indicate that results related to variable sediment physical characteristics (i.e., TOC and sand content) that are driven by the necessity for opportunistic sampling due to limited availability of fine sediments in some monitoring years. The variability in sediment physical characteristics may stabilize as sediment accumulation continues to occur in this remediated system.

Periphyton monitoring indicated that primary productivity of upper Hazeltine Creek, as assessed by mean chlorophyll-a (mass per unit area; mg/m^2), was below BCWQG but above the threshold indicative of moderate enrichment in lower Hazeltine Creek. Primary productivity as measured by both chlorophyll-a and AFDM at both upper Hazeltine Creek areas (HAC-R1, HAC-U) has been consistently similar to or significantly higher than reference from 2018, and higher than pre-breach since 2019 at HAC-R1 and since 2021 at HAC-U. Chlorophyll-a concentrations and AFDM at HAC-R1 in 2022 were significantly higher than at HAC-U, indicating this area had greater periphyton productivity. Despite the increased productivity following remediation, water quality monitoring indicates that dissolved oxygen concentrations largely remain above the long-term BCWQG in upper Hazeltine Creek. The periphyton community of upper Hazeltine Creek in 2022 was characterized by taxon richness, Simpson's Evenness and Diversity, and diatom richness that were similar to or higher than the reference area. Periphyton densities in 2022 at HAC-R1 and HAC-U were similar to and lower than reference, respectively, but were temporally stable at HAC-U despite being lower than reference in 2022. The periphyton communities at the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) were similar in 2022 in terms of all primary metrics (density, taxon richness, Simpson's Evenness and Diversity, and diatom richness) indicating similar recovery of the periphyton community in these two areas. Periphyton community composition at HAC-R1, but not HAC-U, was similar to reference in 2022. Community composition at HAC-U continued to differ from the reference area, with higher and lower relative densities of Diatoms and Cyanobacteria, respectively; differences which are indicative of healthy periphyton communities. The similarity (or exceedance) of the primary periphyton community metrics (density, richness, Simpson's Evenness, and Simpson's Diversity)

in upper Hazeltine Creek compared to the reference area in most years and/or temporal stability of these metrics are indicative of relatively stable periphyton communities at the remediated upper Hazeltine Creek areas and good periphyton community health.

The benthic invertebrate community of upper Hazeltine Creek in 2022 was characterized by total density, taxon richness, and Simpson's Evenness and Diversity that were similar between the two areas (HAC-R1 and HAC-U) and that were similar to reference and/or pre-breach conditions. Taxon richness at HAC-R1 in 2022 remained significantly lower than pre-breach conditions but was similar to reference conditions. These results indicate that the benthic invertebrate community at these areas of upper Hazeltine Creek have largely recovered to reference and/or pre-breach conditions when primary metrics (density, richness, Simpson's Evenness and Diversity) are considered. Key differences in the benthic community structure in 2022 at both areas of upper Hazeltine Creek, compared to pre-breach conditions, included higher relative densities of Chironomidae and Trichoptera, and lower relative densities of EPT (at HAC-R1 only), Arachnida (at HAC-U only), Ephemeroptera, and Plecoptera. Notable differences in EPT at both areas of upper Hazeltine Creek, compared to reference and pre-breach, were due to the lack of Plecoptera and the higher relative density of Trichoptera, which were dominated by a family of net-spinning caddisflies (Hydropsychidae) that are tolerant of habitat disturbances. The occurrence of Ephemeroptera families at the exposed areas that are less pollutant tolerant than those at the reference area suggests the chemical conditions (i.e., water chemistry) of the exposed areas are not limiting for benthic invertebrate community recovery. Comparison of community composition between the two upper Hazeltine Creek areas suggested greater recovery of the benthic invertebrate community in Reach 2 (at HAC-U) compared to Reach 1 (at HAC-R1), based on lower and higher relative densities of Chironomidae and Trichoptera at HAC-U compared to HAC-R1, respectively. Benthic invertebrate total dry weight biomass at both upper Hazeltine Creek areas in 2022 was unchanged since 2019 and was either similar to or higher than reference in each year from 2018 to 2022. In summary, these results indicate that both areas of upper Hazeltine Creek have recovered substantially since remediation to a condition that is similar to reference and/or pre-breach conditions based on primary metrics, but with some remaining differences in community composition compared to reference and pre-breach.

Periphyton and benthic invertebrate tissue quality monitoring in upper and lower Hazeltine Creek indicated that the primary analytes arsenic, copper, iron, and selenium had higher tissue concentrations compared to reference in 2022 for which the exposed-reference difference also increased significantly over time. There is some evidence of increased bioavailability and trophic transfer of copper in benthic invertebrate tissues in upper Hazeltine Creek, since BCFs and TTFs were elevated relative to reference and TTFs for composite-taxa tissues from HAC-U increased in 2022 to higher than pre-breach conditions. However, this was limited to composite-taxa benthic

invertebrate tissues from Reach 2 (HAC-U) and was not observed in caddisfly tissues from HAC-U nor in benthic invertebrate tissues (caddisfly or composite-taxa) from Reach 1 (HAC-R1) of upper Hazeltine Creek, indicating a potentially localized increase. In contrast, there is no evidence of increasing tissue concentrations or bioavailability and trophic transfer of copper over time in biota from lower Hazeltine Creek. For selenium, BCFs were lower than reference in periphyton tissues and elevated in caddisfly, but not composite-taxa samples (upper Hazeltine Creek only) and TTFs were typically stable over time compared to reference (except for caddisflies in Reach 2 of upper Hazeltine Creek). These results indicate that the bioavailability and trophic transfer of selenium has not increased due to mine influence, except for increased trophic transfer in caddisflies from Reach 2 of upper Hazeltine Creek. Selenium concentrations in most tissues in Hazeltine Creek (upper and lower) have increased since 2018 compared to reference (except composite-taxa benthic invertebrate samples from lower Hazeltine Creek), suggesting a mine influence on tissue concentrations, if not bioavailability and trophic transfer of selenium. In upper Hazeltine Creek, tissue selenium concentrations in 2022 were similar to or lower than pre-breach results in comparable tissues, while those in composite-taxa benthic invertebrate samples from lower Hazeltine Creek in 2022 exceeded pre-breach results. Mean selenium concentrations in benthic invertebrates from upper and lower Hazeltine Creek were above the BC interim guideline for aquatic life, suggesting potential selenium-associated risks to aquatic life. In composite-taxa benthic invertebrate samples from upper Hazeltine Creek, arsenic and iron concentrations in tissues from Reach 2 (HAC-U) and Reach 1 (HAC-R1), respectively, were higher in 2022 than previous monitoring years compared to reference, but this was owing to a temporal decrease at the reference area rather than an increase in tissues from upper Hazeltine Creek. Elevated concentrations of some secondary analytes in periphyton and/or benthic invertebrate tissues over time were also observed, relative to reference, but evidence was equivocal as to whether these observed increases in tissue concentrations were mine-related, and there was little or no evidence of increased metal bioavailability (based on assessment of BCFs and TTFs relative to reference and pre-breach). In comparison to 2021 when higher tissue concentrations and trophic transfer of mercury were identified compared to reference, mercury results in 2022 did not continue to demonstrate higher bioaccumulation in the aquatic biota compared to reference (as evidenced by tissue concentrations and TTFs similar to or lower than reference and/or prior years). Overall, periphyton and benthic invertebrate tissue quality data showed some evidence of moderately higher bioavailability and/or trophic transfer of selenium and copper in upper Hazeltine Creek, and selenium in lower Hazeltine Creek. Comparison of the two benthic invertebrate tissue types (caddisfly and composite-taxa) indicated that although some variability exists between the tissues, potential changes in analyte concentrations and TTFs in caddisfly tissues would largely be detected if sampling were limited to composite-taxa tissue samples only.

6.2 Edney Creek

6.2.1 Periphyton and Benthic Invertebrate Tissue Quality

Periphyton and benthic invertebrate tissue samples were collected from the remediated (exposed) section of lower Edney Creek (E1), with an upstream area of Edney Creek unaffected by the breach (EDC-D) serving as reference (Figure 4.2, Table 4.4). A review of the 2022 periphyton and benthic invertebrate tissue quality data (Appendix B) indicated that the data largely met the established DQOs, although laboratory and field precision were low (see Section 6.1.4.1 for details) and the heterogeneity in analyte results were considered during data interpretation. A review of 2022 supporting water data quality indicated these data can be used with a good level of confidence for interpretation (see Section 5.1.1 for details).

As indicated in Section 4.4.3.2, data interpretation was focused on primary and secondary analytes (Table 2.4) with a significant positive exposed-reference difference (i.e., analytes with concentrations that were significantly higher in tissues from the remediated [exposed] area compared to those from the reference area) in 2022 (if the analysis *Area*×*Year* interaction was significant) or in all monitoring years (if the *Area*×*Year* interaction was not significant[68]) for at least one tissue type (periphyton, caddisfly, or composite-taxa benthic invertebrate). Data interpretations were further focused by integrating the results of water quality monitoring (i.e., bioconcentration) and trophic transfer factors (TTFs) of benthic invertebrate tissue analyte concentrations as detailed in Section 6.1.4.1. Combined, these approaches were used to identify analytes for which concentrations in biota and TTFs at the exposed areas have increased at a rate that differs from reference and that may represent a potential risk to aquatic biota. Results for composite-taxa benthic invertebrate tissue samples are referred to as composite-taxa for the remainder of this section.

For most metals evaluated, there was no evidence of increasing metal concentrations in periphyton and/or benthic invertebrate tissues from the exposed (E1) relative to the reference (EDC-D) area over time (Appendix Figures F.4.16 to F.4.18, Appendix Tables D.5.2, D.5.4, D.5.6, D.5.9 to D.5.11, F.4.25 to F.4.27). The primary analyte copper and the nine secondary analytes cadmium, calcium, cobalt, silver, sodium, strontium, titanium, vanadium, and zinc met the criteria for inclusion in data interpretation (i.e., were significantly higher at the lower Edney Creek exposed area relative to reference in 2022 or in all years; Table 6.11). Of these analytes, only copper

[68] If no significant change was detected in the exposed:reference ratio among years (i.e., the *Area* x *Year* interaction was not significant), then data from all available years were combined for the analyses.

Table 6.11: Summary of Statistical Contrasts of Exposed - Reference Relative Differences of Primary and Secondary Analyte Concentrations in Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022 [a]

Analytes		Lower Edney Creek (E1; Exposed) / Lower Edney Creek (EDC-D; Reference)											
		Periphyton				Caddisfly				Composite-Taxa Benthic Invertebrate			
		2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Primary Analyte	Copper	A	A	A	A	C	B	B	A	B	AB	A	AB
Secondary Analyte	Cadmium	A	A	A	A	A	A	A	A	A	A	A	A
	Calcium	BC	B	A	C	B	B	B	A	A	A	A	A
	Cobalt	A	A	A	A	A	A	A	A	A	A	A	A
	Silver	AB	A	AB	B	B	B	AB	A	A	A	A	A
	Sodium	B	AB	A	B	A	A	A	A	A	A	A	A
	Strontium	B	B	A	B	B	B	B	A	B	AB	A	A
	Titanium	BC	AB	A	C	A	A	A	A	A	A	A	A
	Vanadium	BC	A	AB	C	A	A	A	A	A	A	A	A
	Zinc	A	A	A	A	B	A	AB	A	A	A	A	A

Indicates significantly higher tissue concentration at exposed compared to reference area, and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Notes: "-" = no statistical comparison could be made because data were not available or all were results below Laboratory Reporting Limit (LRL). Refer to Appendix Tables F.4.25 to F.4.27 for statistical analyses results and magnitude of difference calculations.

[a] Results are shown for primary and secondary analytes that had a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types (periphyton, caddisfly, or composite benthic invertebrate) in at least one area. Years that share a letter (e.g., A,B,C) had ratios of analyte concentrations (Exposed:Reference) that did not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

calcium, silver, strontium, and zinc had a significant (*Area×Year*) interaction and significant positive exposed-reference difference for at least one tissue type in 2022 (Table 6.11; Appendix Tables F.4.25 to F.4.27).

MPMC implements routine water quality monitoring in lower Edney Creek at Station EDC-01a, a station within sampling area E1 (Figure 4.2). Results from this routine water quality monitoring station indicated that aqueous concentrations of dissolved copper exceeded the BLM-based chronic BCWQG in 75% of samples in the year preceding sampling (i.e., September 2021 to August 2022). Of the one primary analyte (copper) and the nine secondary analytes identified above for further evaluation (above), only dissolved aqueous concentrations of copper exceeded the reference concentrations by more than two times, while the cadmium, calcium, sodium, strontium, and vanadium were slightly (< 2 times) higher than the reference area (EDC-U; Table 6.12)[69]. Overall, this indicates very similar water quality between the exposed and reference areas, except for elevated dissolved copper concentrations, which was consistent with little to no upstream mine-related influence in lower Edney Creek. Mean BCFs were slightly (less than two-times) higher than reference for calcium, sodium, strontium, and vanadium and slightly greater than two-times reference for copper and cadmium for at least one tissue type (Table 6.12).

Copper concentrations in all three tissue types (periphyton, caddisfly, and composite-taxa) were significantly higher at the exposed area in 2022 relative to reference (Table 6.11; Appendix Tables D.5.9, F.4.25). Concentrations of copper in exposed periphyton tissues were consistently higher than the reference area (from 2019 to 2022), but the difference relative to reference was temporally stable (i.e., *AreaxYear* interaction was not significant; Figure 6.12, Table 6.11; Appendix Table F.4.25). Copper concentrations in exposed caddisfly tissues were higher than reference from 2020 to 2022 and were significantly higher in 2022 than in all prior years (2019 to 2021), relative to reference (Figure 6.12, Table 6.11; Appendix Tables D.5.4, D.5.10, F.4.26). For exposed composite-taxa tissues, copper concentrations were higher than reference in 2021 and 2022, but concentrations in 2022 were similar to all previous monitoring years (2019 to 2021) indicating temporal stability (Figure 6.12, Table 6.11; Appendix Tables D.5.6, D.5.11, F.4.27). Despite concentrations of copper in caddisfly and composite-taxa tissue in 2022 that were significantly higher than reference, TTFs for copper in both tissues from the exposed area were lower than reference in all years (Table 6.13; Appendix Figures F.4.19, F.4.20, Appendix Tables D.5.7, D.5.8, F.4.28, F.4.29). The elevated concentrations of copper in exposed caddisfly and composite-taxa tissues compared to reference in 2022, but lower TTFs in

[69] Elevated analytes were identified as those with mean concentrations at the exposed station that were at least twice the mean concentration at the reference station.

Table 6.12: Summary of Primary and Secondary Analytes Concentrations in Water, Periphyton, Composite-Taxa, and Caddisfly Tissues, BCFs and TTFs for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2022

Analytes		Component	Metric	Units	n	Area	
						Reference	Breach-exposed
						Lower Edney Creek	
						EDC-D	E1
Primary Analytes	Copper (Cu)	Dissolved [a,b,c]	Mean [d]	mg/L	-	0.00195	***0.00602***
		Periphyton	Tissue Mean	mg/kg	8	25.8	208
			BCF [e]	unitless	-	13,231	34,551
		Caddisfly	Tissue Mean	mg/kg	8	19.8	84.9
			BCF [e]	unitless	-	10,154	14,103
			TTF [f]	unitless	-	0.787	0.951
		Composite	Tissue Mean	mg/kg	8	33.6	57.0
			BCF [e]	unitless	-	17,231	9,468
			TTF [f]	unitless	-	1.34	0.704
Secondary Analytes	Cadmium (Cd)	Dissolved [a,b,c]	Mean [d]	mg/L	-	0.00000633	0.00000753
		Periphyton	Tissue Mean	mg/kg	8	0.547	0.237
			BCF [e]	unitless	-	86,414	31,474
		Caddisfly	Tissue Mean	mg/kg	8	0.310	0.822
			BCF [e]	unitless	-	48,973	109,163
			TTF [f]	unitless	-	0.867	4.10
		Composite	Tissue Mean	mg/kg	8	1.07	1.67
			BCF [e]	unitless	-	169,036	221,780
			TTF [f]	unitless	-	3.18	9.66
	Calcium (Ca)	Dissolved [a,b,c]	Mean [d]	mg/L	-	26.2	32.7
		Periphyton	Tissue Mean	mg/kg	8	10,804	9,522
			BCF [e]	unitless	-	412	291
		Caddisfly	Tissue Mean	mg/kg	8	1,839	2,755
			BCF [e]	unitless	-	70	84
			TTF [f]	unitless	-	0.203	0.469
		Composite	Tissue Mean	mg/kg	8	1,968	2,222
			BCF [e]	unitless	-	75	68
			TTF [f]	unitless	-	0.208	0.420
	Cobalt (Co)	Dissolved [a,b,c]	Mean [d]	mg/L	-	<0.0001	<0.0001
		Periphyton	Tissue Mean	mg/kg	8	11.1	7.62
			BCF [e]	unitless	-	-	-
		Caddisfly	Tissue Mean	mg/kg	8	2.04	4.49
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	0.223	0.803
		Composite	Tissue Mean	mg/kg	8	1.06	2.02
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	0.101	0.377
	Silver (Ag)	Dissolved [a,b,c]	Mean [d]	mg/L	-	<0.00001	<0.00001
		Periphyton	Tissue Mean	mg/kg	8	0.103	0.0832
			BCF [e]	unitless	-	-	-
		Caddisfly	Tissue Mean	mg/kg	8	0.0496	0.0837
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	0.559	1.52
		Composite	Tissue Mean	mg/kg	8	0.153	0.102
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	1.76	2.52
	Sodium (Na)	Dissolved [a,b,c]	Mean [d]	mg/L	-	4.58	5.80
		Periphyton	Tissue Mean	mg/kg	8	334	318
			BCF [e]	unitless	-	73	55
		Caddisfly	Tissue Mean	mg/kg	8	3,121	3,359
			BCF [e]	unitless	-	681	579
			TTF [f]	unitless	-	9.60	11.4
		Composite	Tissue Mean	mg/kg	8	3,689	7,525
			BCF [e]	unitless	-	805	1,297
			TTF [f]	unitless	-	11.5	26.8

Dissolved concentration at exposed area exceeded reference area by less than 2-times.
Dissolved concentration at exposed area exceeded reference area by at least 2-times.
Dissolved concentration at exposed area exceeded reference area by at least than 5-times.
Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05).
Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05).
BCF for exposed area exceeded reference area by less than 2-times.
BCF for exposed area exceeded reference area by at least 2-times.
BCF for exposed area exceeded reference area by at least 10-times.
Mean TTF exceeds 1.
Mean TTF at exposed area exceeds 1 and the corresponding reference area TTF for a given year.

BOLD = mean tissue selenium value exceeds long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

BOLD/ITALICS = Indicates dissolved water value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2021a,b).

Notes: Results are shown for primary and secondary analytes that are presented in Table 6.11 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). "-" = Dissolved water concentration not data available or BCF/TTF was not calculated for analytes because no data available for calculation or one or more result used in the calculation was below the Laboratory Reporting Limit (LRL); "na" = not applicable; summary statistics reported to 3 significant figures for display purposes.

[a] Monitoring stations included EDC-01 and W10 for corresponding tissue sampling stations E1 and EDC-D, respectively (refer to Appendix Tables D.1.7 and D.1.8).

[b] Sample size for water quality monitoring is n=12 for EDC-01a (E1) and n=6 for EDC-D (W10).

[c] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2021a,b) outlined in Table D.1.1.

[d] Means were calculated for routine water quality stations using data collected between January 1, 2022 and the time of sampling in August 2022 in order to be consistent with means calculated during previous years (Minnow 2016d, 2017c, 2018c, 2019, 2020a, 2021a, 2022a). See Appendix Tables D.1.7 to D.1.8 for raw data used in the calculation of mean values.

[e] Bioconcentration Factor (BCF) = Mean Tissue Concentration (mg/kg dw) / Mean Dissolved Water Concentration (mg/L). If the reported dissolved water or tissue analyte concentration was below the LRL, the BCF was not calculated.

[f] Trophic Transfer Factor (TTF) = Benthic Invertebrate Tissue Concentration / Periphyton Tissue Concentration. If the reported analyte concentrations for either periphyton or benthic invertebrate tissue were below the LRL, the TTF was not calculated.

Table 6.12: Summary of Primary and Secondary Analytes Concentrations in Water, Periphyton, Composite-Taxa, and Caddisfly Tissues, BCFs and TTFs for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2022

Analytes		Component	Metric	Units	n	Area	
						Reference	Breach-exposed
						Lower Edney Creek	
						EDC-D	E1
Secondary Analytes	Strontium (Sr)	Dissolved [a,b,c]	Mean [d]	mg/L	-	0.172	0.224
		Periphyton	Tissue Mean	mg/kg	8	93	106
			BCF [e]	unitless	-	541	473
		Caddisfly	Tissue Mean	mg/kg	8	13.8	20.8
			BCF [e]	unitless	-	80	93
			TTF [f]	unitless	-	0.175	0.366
		Composite	Tissue Mean	mg/kg	8	11.0	11.1
			BCF [e]	unitless	-	64	50
			TTF [f]	unitless	-	0.131	0.255
	Titanium (Ti)	Dissolved [a,b,c]	Mean [d]	mg/L	-	<0.01	<0.01
		Periphyton	Tissue Mean	mg/kg	8	521	397
			BCF [e]	unitless	-	-	-
		Caddisfly	Tissue Mean	mg/kg	8	79.3	156
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	0.187	0.446
		Composite	Tissue Mean	mg/kg	8	24.5	58.3
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	0.0521	0.190
	Vanadium (V)	Dissolved [a,b,c]	Mean [d]	mg/L	-	0.000587	0.000808
		Periphyton	Tissue Mean	mg/kg	8	46.2	38.8
			BCF [e]	unitless	-	78,705	48,020
		Caddisfly	Tissue Mean	mg/kg	8	9.47	14.9
			BCF [e]	unitless	-	16,133	18,441
			TTF [f]	unitless	-	0.252	0.490
		Composite	Tissue Mean	mg/kg	8	3.00	5.50
			BCF [e]	unitless	-	5,111	6,807
			TTF [f]	unitless	-	0.0620	0.206
	Zinc (Zn)	Dissolved [a,b,c]	Mean [d]	mg/L	-	<0.003	<0.003
		Periphyton	Tissue Mean	mg/kg	8	62.6	42.5
			BCF [e]	unitless	-	-	-
		Caddisfly	Tissue Mean	mg/kg	8	110	137
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	1.76	4.57
		Composite	Tissue Mean	mg/kg	8	162	122
			BCF [e]	unitless	-	-	-
			TTF [f]	unitless	-	2.69	4.43

Dissolved concentration at exposed area exceeded reference area by less than 2-times.
Dissolved concentration at exposed area exceeded reference area by at least 2-times.
Dissolved concentration at exposed area exceeded reference area by at least than 5-times.
Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05).
Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05).
BCF for exposed area exceeded reference area by less than 2-times.
BCF for exposed area exceeded reference area by at least 2-times.
BCF for exposed area exceeded reference area by at least 10-times.
Mean TTF exceeds 1.
Mean TTF at exposed area exceeds 1 and the corresponding reference area TTF for a given year.

BOLD = mean tissue selenium value exceeds long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

BOLD/ITALICS = Indicates dissolved water value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2021a,b).

Notes: Results are shown for primary and secondary analytes that are presented in Table 6.11 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). "-" = Dissolved water concentration not data available or BCF/TTF was not calculated for analytes because no data available for calculation or one or more result used in the calculation was below the Laboratory Reporting Limit (LRL); "na" = not applicable; summary statistics reported to 3 significant figures for display purposes.

[a] Monitoring stations included EDC-01 and W10 for corresponding tissue sampling stations E1 and EDC-D, respectively (refer to Appendix Tables D.1.7 and D.1.8).

[b] Sample size for water quality monitoring is n=12 for EDC-01a (E1) and n=6 for EDC-D (W10).

[c] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2021a,b) outlined in Table D.1.1.

[d] Means were calculated for routine water quality stations using data collected between January 1, 2022 and the time of sampling in August 2022 in order to be consistent with means calculated during previous years (Minnow 2016d, 2017c, 2018c, 2019, 2020a, 2021a, 2022a). See Appendix Tables D.1.7 to D.1.8 for raw data used in the calculation of mean values.

[e] Bioconcentration Factor (BCF) = Mean Tissue Concentration (mg/kg dw) / Mean Dissolved Water Concentration (mg/L). If the reported dissolved water or tissue analyte concentration was below the LRL, the BCF was not calculated.

[f] Trophic Transfer Factor (TTF) = Benthic Invertebrate Tissue Concentration / Periphyton Tissue Concentration. If the reported analyte concentrations for either periphyton or benthic invertebrate tissue were below the LRL, the TTF was not calculated.

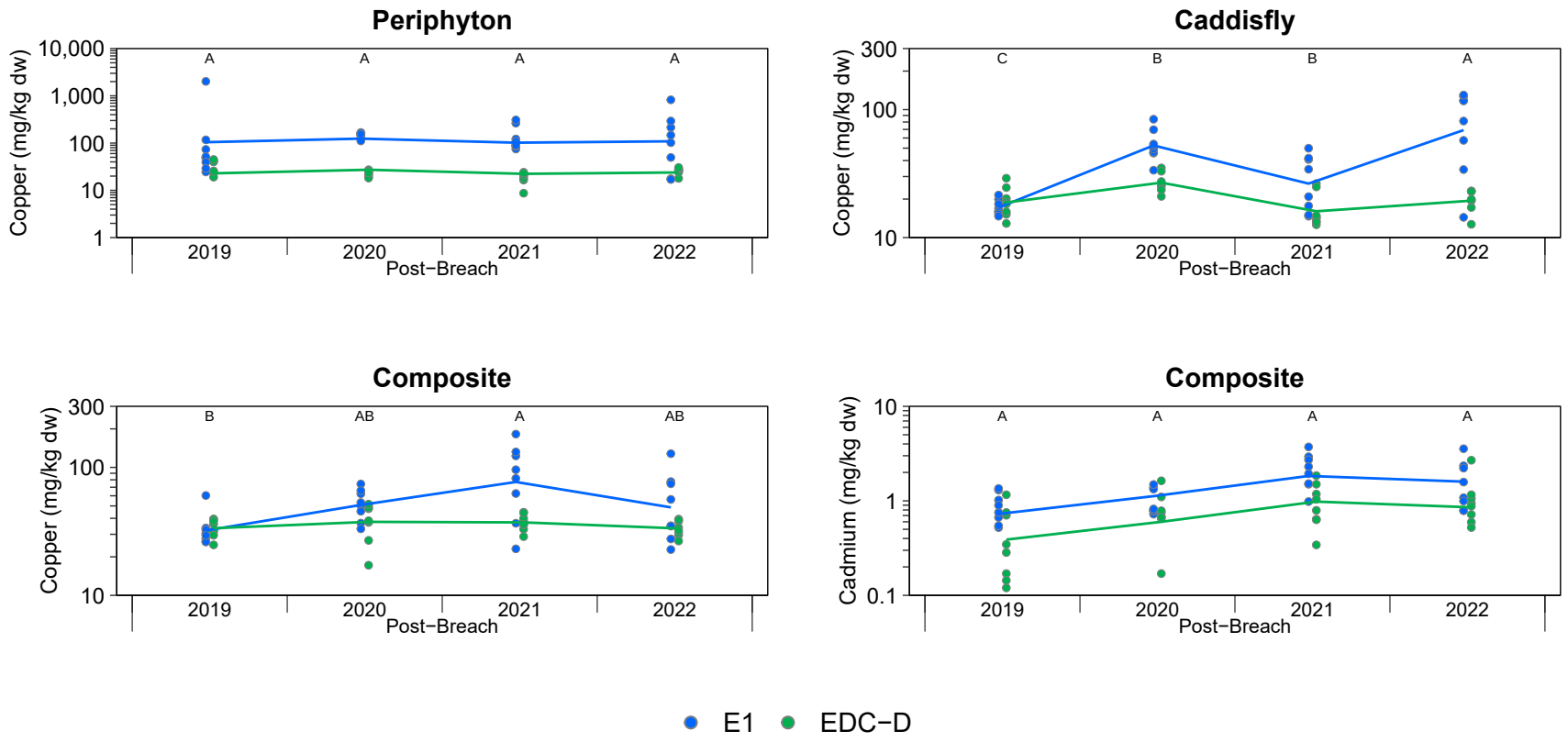

Figure 6.12: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

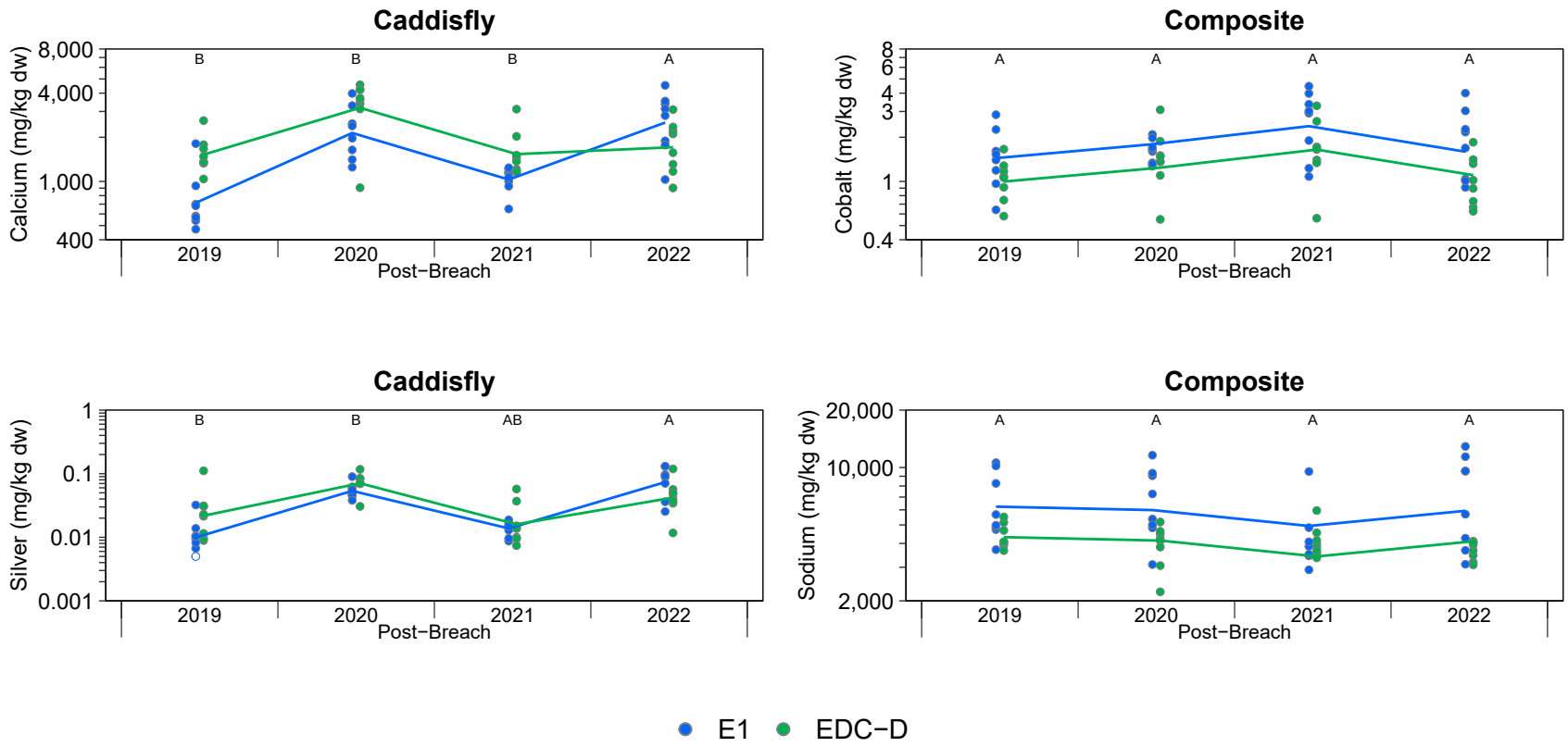

Figure 6.12: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

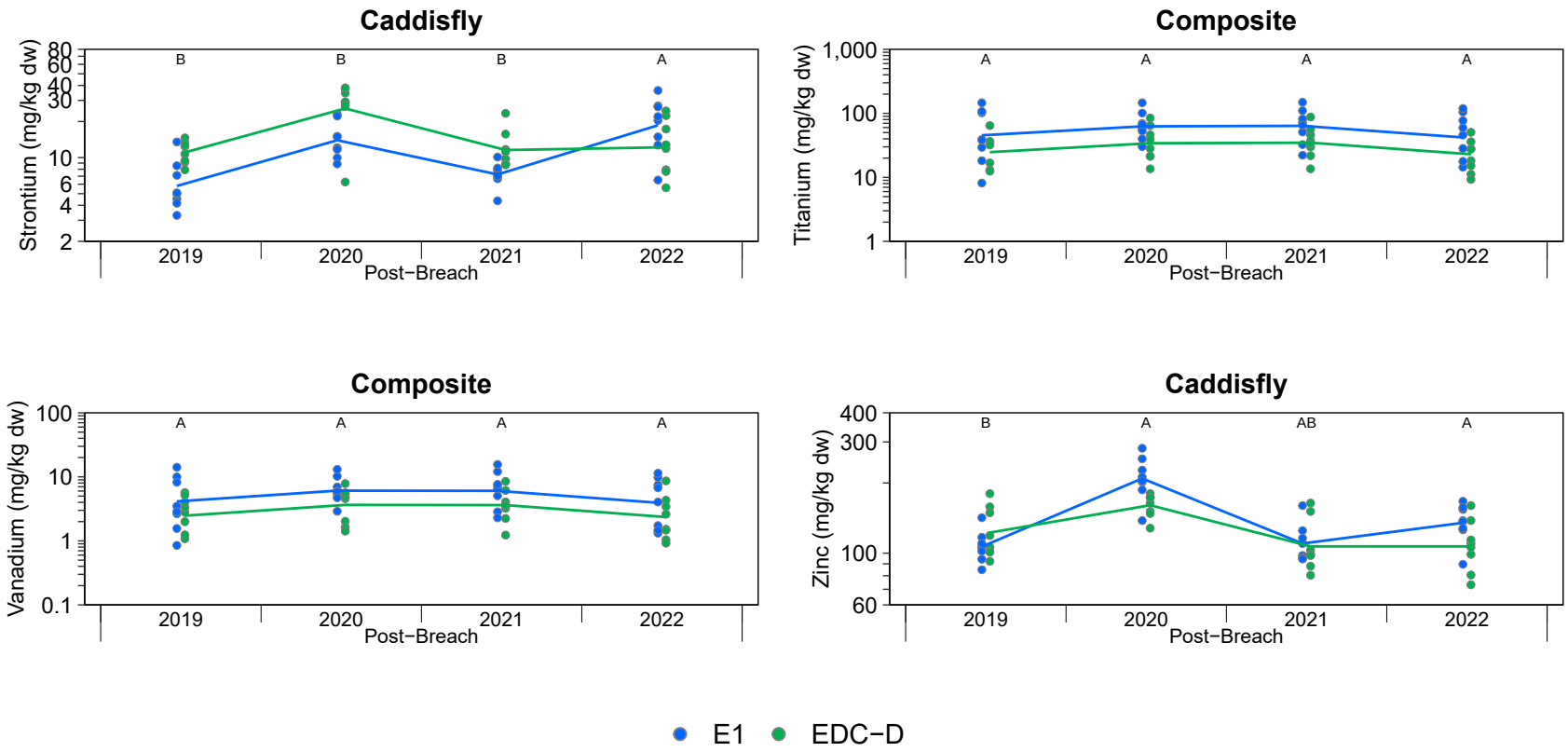

Figure 6.12: Periphyton, Caddisfly, and Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Positive Exposed - Reference Difference for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Plots are only included for primary and secondary analytes that had either a significant Area × Time interaction term and were higher at exposed than reference areas in 2022 or had no significant interaction but had a higher exposed magnitude of difference across all years for a given tissue type. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

Table 6.13: Summary of Statistical Contrasts of Exposed - Reference Relative Differences in Trophic Transfer Factors of Primary and Secondary Analytes in Caddisfly and Composite-Taxa Benthic Invertebrate Tissue for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022[a]

Analytes		Lower Edney Creek (E1; Exposed) / Lower Edney Creek (EDC-U; Reference)							
		Caddisfly				Composite-Taxa Benthic Invertebrate			
		2019	2020	2021	2022	2019	2020	2021	2022
Primary Analyte	Copper	A	A	A	A	A	A	A	A
Secondary Analyte	Cadmium	B	AB	A	A	A	A	A	A
	Calcium	B	B	C	A	B	B	C	A
	Cobalt	B	B	AB	A	A	A	A	A
	Silver	B	B	AB	A	A	B	AB	A
	Sodium	AB	AB	B	A	A	A	B	A
	Strontium	B	BC	C	A	B	AB	B	A
	Titanium	B	B	B	A	A	A	A	A
	Vanadium	B	B	B	A	A	A	A	A
	Zinc	B	A	A	A	A	A	A	A

Indicates significantly higher tissue concentration at exposed compared to reference area, and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was not significant (α = 0.05; i.e., the difference between exposed and reference did not change significantly among years).

Indicates significantly higher tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Indicates significantly lower tissue concentration at exposed compared to reference area (α = 0.05), and the interaction (Area x Year) term of the two-way ANOVA was significant (α = 0.05; i.e., the difference between exposed and reference changed significantly among years).

Notes: "-" = no statistical comparison could be made because data were not available or all were results below Laboratory Reporting Limit (LRL). Refer to Appendix Tables F.4.7, F.5.10, and F.5.11 for statistical analyses results and magnitude of difference calculations.

[a] Results are shown for primary and secondary analytes that are presented in Table 6.11 (i.e., those with a significant positive exposed - reference difference in 2022 or in all monitoring years for one or more tissue types [periphyton, caddisfly, or composite benthic invertebrate] in at least one area). Years that share a letter (e.g., A,B,C) had ratios of TTFs (Exposed:Reference) that did not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

all years, indicated there is no evidence of increased copper bioaccumulation in aquatic biota in lower Edney Creek. However, the significant increase in exposed caddisfly copper concentrations in 2020 and again in 2022, relative to reference, is consistent with the recent completion of final remediation works in this area (in the summer of 2020 and 2021).

Evaluation of the nine secondary analytes identified for data interpretation (cadmium, calcium, cobalt, silver, sodium, strontium, titanium, vanadium, and zinc) indicated that concentrations of these analytes in exposed periphyton tissues in 2022 were similar to or lower than reference (Table 6.11). This contrasts with 2021 when barium, calcium, strontium, titanium, and vanadium were elevated in exposed periphyton tissues relative to reference (Minnow 2022a; Table 6.11; Appendix Figure F.4.16, Appendix Tables D.5.2, D.5.9, F.4.25). For caddisfly tissues, the secondary analytes calcium, silver, strontium, and zinc had concentrations in exposed tissues in 2022 that were significantly higher than reference (Figure 6.12, Table 6.11; Appendix Figure 4.17, Appendix Table F.4.26). Temporal evaluation of these analytes showed that caddisfly tissue concentrations of calcium and strontium from the exposed area in 2022 were significantly higher than all prior years (2019 to 2021), relative to reference. However, the BCFs for calcium and strontium in caddisflies in 2022 were only slightly (< 1.2 times) higher than reference which did not suggest increased bioaccumulation of either analyte in caddisfly tissues (Figure 6.12, Table 6.12). Evaluation of the TTFs for calcium and strontium in caddisflies is discussed below. The exposed caddisfly tissue concentrations of silver in 2022 were higher than 2019 and 2020, relative to reference, while exposed caddisfly concentrations of zinc in 2022 were higher than 2019 but similar to other monitoring years, relative to reference (2020 and 2021; Figure 6.12, Table 6.11). Composite-taxa tissue concentrations of cadmium, cobalt, sodium, titanium, and vanadium were significantly elevated at the exposed area relative to reference in all years (2019 to 2022) but were temporally stable over this period (Figure 6.12, Tables 6.11; Appendix Figure F.4.18, Appendix Table F.4.27). The lack of consistency between exposed caddisfly and composite-taxa results for calcium, silver, strontium, and zinc concentrations indicate there is no consistent evidence of a mine-related influence on benthic invertebrate concentrations of these analytes. Lastly, the mean concentrations of selenium in caddisfly and composite benthic invertebrate tissue samples at E1 (1.5 and 1.9 mg/kg dw, respectively) were well below the BC interim guideline (4 mg/kg dw; BCMOE 2014) and pre-breach concentrations (3.5 mg/kg dw) and were similar to EDC-D (1.5 and 1.8 mg/kg dw, respectively; Appendix Figures F.4.17, F.4.18, Appendix Tables D.5.4, D.5.6, D.5.10, D.5.11, F.4.26, F.4.27). These results are consistent with previous years (2019 to 2021) and indicate mine related activities are not affecting the selenium concentrations in lower Hazeltine Creek, and the risk to aquatic biota from selenium is low.

The four secondary analytes (calcium, silver, strontium, and zinc) identified as having significantly higher exposed tissue concentrations in caddisflies relative to reference in 2022 also had

significantly higher TTFs in exposed tissues compared to reference in 2022 (Table 6.13; Appendix Table 4.28; Appendix Figure F.4.19). The TTFs for zinc in exposed caddisfly tissues have been significantly higher than reference since 2020. The exposed caddisfly TTFs for calcium, silver, and strontium were significantly higher than reference in 2022, and were significantly higher in 2022 than in all prior years (2019 to 2021) for calcium and strontium, and higher in 2022 than in 2019 and 2020 for silver, relative to reference (Table 6.13; Appendix Figure F.4.19, Appendix Table F.4.28). The temporal increases in exposed caddisfly TTFs for calcium, silver, strontium, and zinc suggest there is some evidence of increased bioavailability and bioaccumulation of these analytes in caddisflies, however this is not supported by the composite-taxa TTF results. The exposed composite-taxa TTF for cadmium, cobalt, sodium, and titanium were significantly higher than reference in 2022, but the TTFs in 2022 for all these analytes were similar to those in 2019, indicating no temporal increase in TTFs has occurred from 2019 to 2022 (Table 6.13; Appendix Figure F.4.20, Appendix Table F.4.29). As indicated above for tissue concentrations, the lack of consistency between exposed caddisfly and composite-taxa TTFs for calcium, silver, strontium, and zinc indicate there is no consistent evidence of increased bioavailability of these analytes in benthic invertebrate tissues from lower Edney Creek.

Overall, tissue concentrations did not exceed the guideline for protection of aquatic life for selenium. The BCFs were lower than or similar to reference for most analytes evaluated (except copper, cadmium, calcium, sodium, strontium, and vanadium), and TTFs showed little evidence of increasing bioavailability for most analytes, with the exception of calcium, silver, strontium, and zinc in caddisfly tissues. Increased tissue concentrations and TTFs of calcium, silver, strontium, and zinc in exposed caddisfly tissues were not corroborated by composite-taxa benthic invertebrate tissue results. As such, periphyton and benthic invertebrate tissues in Edney Creek did not exhibit consistent changes over time in tissue concentrations or the bioavailability for most analytes, except for copper. Tissue concentrations of copper from the exposed area in 2022 were higher than reference in all tissues, and copper BCFs were elevated for periphyton and caddisfly tissues, but TTFs in exposed benthic invertebrate tissues were lower than reference in all years. The elevated concentrations of copper in exposed caddisfly and composite-taxa tissues compared to reference in 2022, but lower TTFs in all years, indicated there is no evidence of increased copper bioavailability in aquatic biota in lower Edney Creek. However, the significant increase in exposed caddisfly copper concentrations in 2020, and again in 2022, relative to reference, is consistent with the recent completion of final remediation works in this area (in the summer of 2020 and 2021).

6.2.2 Summary

Periphyton and benthic invertebrate tissue quality monitoring in lower Edney Creek in 2022 indicated that tissue concentrations of several primary and secondary analytes were significantly higher at the exposed area (E1) than reference. However, for most metals, there was no consistent evidence of increasing metal concentrations in periphyton and/or benthic invertebrate tissues from the exposed area relative to the reference area over time. Copper was an exception, with concentrations in all exposed area tissues (i.e., periphyton, caddisfly, and composite-taxa benthic invertebrates) that were higher than reference. Most analytes demonstrated a lack of consistency among tissue types in concentrations and TTFs (except copper), BCFs that were only slightly above reference (except copper and cadmium), and TTFs that did not demonstrate increased bioavailability. These results collectively indicate that the potential mine-influence on analyte concentrations in lower Edney Creek appears limited to increased copper concentrations in benthic invertebrate tissues. Copper concentrations in exposed caddisfly and composite-taxa tissues were higher than reference in 2022, but copper TTFs were lower than reference in all years, indicating there is no evidence of increased copper bioavailability in aquatic biota in lower Edney Creek. However, the significant increase in copper concentrations in exposed caddisfly tissues in 2020, and again in 2022, relative to reference, is consistent with the recent completion of final remediation works in this area (in the summer of 2020 and 2021). Mean concentrations of selenium in caddisfly and composite benthic invertebrate tissue samples were well below the BC interim guideline for aquatic life, indicating that no selenium-associated effects to aquatic life would be expected.

7 SUMMARY OF FINDINGS

This section provides an overall summary of the findings of sediment and aquatic biological monitoring completed under the Mount Polley CEMP from 2022, drawing on additional historic monitoring results for data interpretation as required. As identified in Section 2, this section considers multiple lines of evidence to identify well supported findings versus those that are not fully supported and/or those for which uncertainty exists. Throughout the following sub-sections, each monitoring component builds on evidence from others, typically over the line of evidence sequence from sediment quality to primary producer to secondary producer/benthic invertebrates to fish.

7.1 Polley Lake

7.1.1 Sediment Quality

Sediments were collected from the shallow area of Polley Lake (and reference) in 2022 to support the evaluation of sediment toxicity. Sediments from this area were characterized by concentrations of arsenic, copper, and iron greater than reference concentrations and WSQG. Copper was the most substantially elevated Analyte of Interest, with a mean concentration 3.4 times the upper WSQG. Copper was also the only Analyte of Interest to exceed the lower WSQG in reference sediments, which it exceeded by approximately 2.5 times. Arsenic, copper, and iron concentrations in shallow Polley Lake sediments in 2022 were similar to those reported in the previous sampling event (i.e., 2019), relative to reference, indicating temporal stability of these analyte concentrations. The TOC content of Polley Lake shallow sediments in 2022 was significantly lower than reference and did not change from 2019 to 2022, relative to reference. Overall, the 2022 sediment quality results from the shallow area of Polley Lake indicate temporal stability in the physical and chemical characteristics of these sediments since initiation of monitoring in 2019.

Sediment toxicity testing of the shallow area of Polley Lake (and reference) in 2022 indicated no unacceptable response to survival or growth of *H. azteca* relative to the reference area or the sand control. The survival and growth responses observed in 2022 were similar to those in 2019 when sampling was initiated. Conditions of the CEMP outlined that sediment toxicity testing of the shallow Polley Lake area must be continued "*unless MPMC can clearly show that copper concentrations in all Polley Lake shallow sediment samples are below the 95th percentile of the copper concentrations in the Bootjack Lake reference area shallow sediment samples.*" (BCMOECCS 2021c). This condition was not met in 2022 in Polley Lake shallow sediments, indicating that toxicity testing of these shallow sediments must be completed in three years (in 2025) in accordance with the CEMP conditions.

7.1.2 Aquatic Life

Phytoplankton community and productivity monitoring in Polley Lake in 2022 indicated that phytoplankton productivity (in terms of chlorophyll-a concentrations) was higher than reference, despite being significantly lower in 2021 and similar between the two lakes in 2019 and 2020. The chlorophyll-a results characterize Polley Lake as mesotrophic and reference (Bootjack Lake) as oligotrophic. While the trophic state of Polley Lake increased from oligotrophic to mesotrophic between 2021 and 2022, this represented a return to the same mesotrophic status observed in Polley Lake in 2019. The phytoplankton community in Polley Lake in 2022 was characterized by higher total density, lower taxon richness, higher Simpson's Diversity and Evenness, higher relative densities of Chlorophytes and Chrysophytes, and lower relative densities of Cyanobacteria compared to reference. Overall, result for most primary endpoints in Polley Lake were similar to or higher than reference in 2022 (density, Simpson's Diversity and Evenness), while those endpoints that were lower than reference (e.g., taxon richness) were temporally stable, suggesting there is no mine-related influence on the phytoplankton community of Polley Lake.

Zooplankton community and productivity monitoring in Polley Lake in 2022 indicated that total zooplankton biomass (dw) was similar to reference, which is consistent with prior years (2019 to 2021) when biomass was either similar to or higher than reference. The consistently similar or significantly higher total biomass of zooplankton in Polley Lake compared to the reference is indicative of a healthy lentic system, providing critical habitat for fish. The zooplankton community of Polley Lake in 2022 was characterized by total density, taxon richness, and Simpson's Diversity and Evenness that were similar to reference. From 2019 to 2022, the zooplankton community of Polley Lake differed from the reference area in terms of significantly higher and lower density in 2019 and 2021, respectively, lower taxon richness in 2020, and lower Simpson's Diversity and Evenness in 2019 and 2020. Community composition from 2019 to 2022 has consistently been characterized by higher relative densities of Copepod Nauplii and Cyclopoida, and lower relative densities of Rotifera compared to reference. The consistent differences in zooplankton community composition between Polley Lake and the reference area suggests that temporal changes community composition (which were similar in both areas over time) were likely driven by natural variability in environmental parameters (e.g., water temperature, nutrient availability, phytoplankton community).

Zooplankton tissue quality monitoring in Polley Lake in 2022 indicated that concentrations of primary and secondary analytes in tissues from Polley Lake were similar to or lower than reference except for sodium. Sodium concentrations were significantly greater than reference between 2019 and 2022 but demonstrated temporal stability relative to reference (i.e., did not

differ between 2019 and 2022). Concentrations of two primary analytes (arsenic and copper) and three secondary analytes (manganese, mercury, molybdenum) in zooplankton tissue from Polley Lake in 2022 were significantly lower, relative to reference, than in 2019 when replicated sampling was initiated. Concentrations of selenium in zooplankton tissue from Polley Lake were below the BC interim guideline for aquatic life in 2022, which contrasts with prior years when individual zooplankton tissue selenium results have exceeded the guideline (2016, 2017, 2019, and 2021). Selenium concentrations in zooplankton tissue from Polley Lake in 2022 were similar to reference and were significantly lower than in 2020 and 2021 (but not 2019), relative to reference. The temporal stability or decreases in primary and secondary analyte concentrations in zooplankton tissue from Polley Lake in 2022 compared to 2019 was supported by trend analyses of surface water quality data which similarly showed stable or decreasing concentrations for all aqueous primary and secondary analytes except copper and vanadium.

Fish community and population health assessments undertaken from 2019 to 2022 documented the influence of the temporary loss of Hazeltine Creek due to the breach (August 2014 to April 2018), which previously supported the majority of fish recruitment to Polley Lake. Rainbow trout CPUE in spring was higher in 2022 than in all previous years since 2016. Prior to 2022, spring CPUE progressively decreased from 2019 to 2021, and was also substantially lower in all three years than in 2016, consistent with loss of recruitment and natural mortality of older fish since the breach. As such, the spring CPUE in 2022 suggests that most of the remaining 2018 and a portion of the 2019 cohort has reached maturity which is further supported by spring spawning surveys conducted in Hazeltine Creek that documented the highest abundance of adults since 2019 (Minnow 2023). In the fall of 2022, when fishing was randomized in Polley Lake, CPUE was lower than 2019 to 2021. However it should be noted that temporal comparisons of CPUE are subject to variability resulting from several factors that can affect the success of netting efforts, which is true even when considering the randomized and standardized fish collection methods employed. The assessment of rainbow trout size distribution provides a more temporally comparable basis for evaluating population recovery in Polley Lake. Length frequency distributions for rainbow trout over time showed a proportional shift towards smaller and younger fish in 2019, a continued to shift towards a more balanced distribution among size classes with the survivorship of the 2018 and 2019 cohorts, and in 2022, a size class distribution more closely resembling 2016. The length frequency distribution in 2022 had greater resemblance to 2016 than the length frequency distributions from any of the other years (2018 to 2021), suggesting the population has returned to a pre-breach size class distribution. Condition of female rainbow trout in spring 2022 was similar to 2021 but lower than in all prior years (2016 to 2020) whereas growth rate in 2022 was similar to prior years but lower than in 2020. CPUE for longnose sucker in the spring has varied without evidence of a consistent

directional trend over time, but CPUE in the fall has progressively decreased from 2016 to 2022. As indicated above, there are several sources of variability that can affect temporal comparisons of CPUE. Length frequency distributions for longnose sucker in Polley Lake from 2016 to 2022 showed more smaller fish were caught in 2022 compared to 2016, as was the case in 2018, 2020, and 2021, suggesting ongoing recruitment success despite the decrease in CPUE since 2016. Condition of longnose sucker females in spring has varied since 2016 but in 2022 was similar to baseline (2016) and weight-at-age also varied, although growth rate in 2022 did not significantly differ from prior years.

Fish tissue quality, evaluated in four tissues (muscle, liver, kidney, and ovary) from rainbow trout and longnose sucker, indicated that mean mercury and selenium concentrations in muscle tissue in 2022 were below guidelines for the protection of human health based on moderate consumption (i.e., indicating that fish are safe for moderate human consumption). The mean selenium concentration in muscle of longnose sucker from Polley Lake in 2022 exceeded the guideline for the protection of human health based on high consumption, which was consistent with data from 2016 (except 2017 and 2021). However, the likelihood that longnose sucker would be consumed at a high rate (i.e., subsistence consumers) is low. Selenium concentrations in ovary tissue in 2022 (the tissue most valuable in the assessment of potential selenium-associated effects on fish) for both species were lower than the BCWQG for the protection of aquatic life in all individuals except one rainbow trout in 2022 and were below the threshold for reproductive effects in all fish. Selenium concentrations in muscle tissue of rainbow trout and longnose sucker were moderately greater than the guideline for aquatic life, which was consistent with data from 2015 to 2021. Overall, selenium concentrations in Polley Lake fish tissue have remained elevated relative to reference conditions since the uncontrolled runoff from 2006 to 2009 but the difference has not increased over the post breach period. In fact, selenium concentrations in rainbow trout muscle and ovary tissues were both significantly lower in 2022, relative to reference, than in 2017 to 2019. Additionally, selenium concentrations in longnose sucker ovary tissues were significantly lower in 2022, relative to reference, than in 2015 to 2020. This decrease in fish tissue selenium concentrations in Polley Lake corresponds with a decrease in the selenium concentrations in zooplankton tissue (i.e., dietary exposure) in 2022 compared to 2020 and 2021, and with a significant decrease in total and dissolved selenium concentrations in surface waters of Polley Lake from 2015 to 2022. Evidence of a persistent mine influence was not detected for most other analytes assessed in fish tissue in 2022. All primary analytes (arsenic, copper, iron, and selenium), and the secondary analytes cobalt, manganese, molybdenum, nickel, sodium, tin, vanadium, and zinc were elevated relative to reference in 2022 in at least one tissue type in one or both species. However, results for most these analytes (excluding selenium) were inconsistent among tissues and species, and/or were temporally stable or decreased relative to reference,

indicating that the weight of evidence does not support a pattern of increasing analyte concentrations over time due to mine-exposure.

7.1.3 Key Findings

Key findings of CEMP monitoring of Polley Lake in 2022 (Table 7.1) are:

- Arsenic, copper and iron in shallow Polley Lake sediments were elevated relative to guidelines and reference while TOC content was lower than reference. Copper concentrations in all shallow Polley Lake sediment samples in 2022 were greater than the reference 95th percentile value, indicating a continued requirement for sediment toxicity testing of these shallow sediments. Arsenic, copper, and iron concentrations and TOC content were temporally stable since initiation of monitoring in 2019.
- Toxicity testing of sediment collected from shallow areas of Polley Lake (using *Hyalella azteca*) indicated no unacceptable responses to survival or growth relative to both field reference and laboratory controls.
- Phytoplankton productivity (chlorophyll-a) in 2022 was slightly higher than reference and 2020 and 2021, but similar to 2019. Chlorophyll-a measures resulted in the classification of Polley Lake as mesotrophic in 2022, similar to 2019. Phytoplankton community composition differed from reference, but differences relative to reference were generally stable over time (2019 to 2022). Zooplankton productivity was similar to or higher than reference from 2019 to 2022 and although community composition differed from reference, the differences compared to reference were stable from 2019 to 2022.
- Zooplankton tissue quality was similar to or lower than reference except the secondary analyte sodium which was higher than reference, but stable from 2019 to 2022 (compared to reference). Concentrations of two primary analytes (arsenic and copper) and four secondary analytes (manganese, mercury, molybdenum, and selenium) were lower in 2022 than prior years, relative to reference. Selenium concentrations in 2022 were below the BC interim guideline for aquatic life (which is different from the prior years 2016, 2017, 2019 when selenium concentrations were higher than the guideline).
- The number of rainbow trout spawners (assessed in spring) was higher in 2022 than in 2016 to 2021 due to accessibility to Hazeltine Creek since 2018 and successful recruitment of YOY from 2019 onwards. In the spring of 2022 growth of female rainbow trout was similar to prior years but lower than 2020 and CPUE was higher than 2016 to 2021. Although fall rainbow trout CPUE in 2022 was lower than 2019 to 2021, the length frequency distribution resembled 2016, suggesting the population has returned to

Table 7.1: Summary of Mount Polley CEMP Results for Polley Lake, 2022[a]

Area		Sediment			Plankton			Fish	
		Basic Chemistry[b]	Toxicity[c] *Hyalella azteca* (14-day)		Productivity[d]	Community[d]	Zooplankton Tissue Quality[e]	Usage and Population Health	Tissue Quality[f]
			Survival	Growth					
Shallow	POL-S	Analytes of Interest = As, Cu, Fe Cu, Fe > upper WSQG and reference 95th As > lower WSQG and reference 95th As, Cu, Fe in 2022 = 2019, relative to reference TOC < reference; TOC in 2022 = 2019, relative to reference	No unacceptable response (97% of Control; 104% of Reference) Survival in 2022 = 2019	No unacceptable response (126% of Control; 114% of Reference) Growth in 2022 = 2019	-	-	-	CPUE for RB in spring in 2022 > 2017 to 2021 CPUE for RB in spring = reference RB (all) condition spring 2022 < 2016, 2017, = 2018 to 2021 CPUE for LSU in spring 2022 <2017 to 2018, 2021, 2021, > 2019 CPUE for LSU in spring = reference LSU (all) condition spring 2022 < 2016 to 2020, = 2021 CPUE for RB in fall 2022 < 2019 to 2021, > 2016 and 2018 CPUE for LSU in fall 2022 < 2016, 2018 to 2021 RB condition fall 2022 < 2018 to 2021 LSU condition in fall 2022 < 2014, 2018 and 2019, = 2016, 2020 and 2021 RB female growth rate (spring) in 2022 < 2016 to 2020, = 2021 RB size distribution in fall 2022 similar to 2016, suggesting the population has returned to a pre-breach size class distribution LSU size distribution in fall 2022 showed more smaller fish than in 2016, suggesting ongoing recruitment success despite the decrease in CPUE since 2016.	RB and LSU (M) Hg < Human Health GL RB (M) Mean Se < Human Health GL (13% of samples > Se GL for high consumption) LSU (M) Mean Se > Human Health GL for high consumption (63% of samples > Se GL for high consumption) RB (M) and LSU (M) Mean Se > BCWQG Protection of Aquatic Life: RB (M) 50% and LSU (M) 100% of samples exceeded the GL RB (O) Mean Se < BCWQG Protection of Aquatic Life (13% of samples exceeded the GL) LSU (O) Mean Se < BCWQG Protection of Aquatic Life RB (M,O,L,K) and LSU (M,L,O,K) Se concentrations > reference Se (M) > reference since 2009 in RB and since 2012 in LSU Se in RB and LSU tissues stable or decreasing over time, relative to reference As in RB (M,O,L,K) and LSU (L,K) > reference, LSU (M,O) < reference (relative to reference); As stable or decreasing over time (relative to reference) Cu in RB (O,L,K) and LSU (M,L) > reference, RB (M) and LSU (O,K) = reference; Cu stable over time except in 2022 LSU (M,L) > 2017 to 2020 (relative to reference); Fe in RB (M,L,K) and LSU (K) > reference, RB (O) and LSU (M,O,L) ≤ reference; Fe stable over time except in 2022 RB (M) >2020, 2017 and LSU (K) > 2018, 2019; Concentration of most secondary analytes < reference except Co, Mn, Mo, V, and Zn > reference in more than one tissue type and species (relative to reference) but equivocal whether a mine-related effect Na, Ni, and Sn limited to a single tissue per species with exposed > reference and therefore equivocal whether a mine-related effect
Deep	POL-P2 (South Basin)	-	-	-	Phytoplankton: Chl-a > reference (Slightly 2.0 SD) Chl-a 2022 = 2019, > 2020 and 2021 Classified as mesotrophic Zooplankton: Dry biomass = reference Dry Biomass in 2022 = 2019 and 2020, > 2021	Phytoplankton: Density > reference (Moderately 2.1 SD); Richness < reference (Moderately -3.7 SD) Density in 2022 < 2019 and 2020, = 2021; Richness in 2022 = 2019 to 2022 Zooplankton: Density and richness = reference Density in 2022 >2019 and 2021, = 2020; Richness in 2022 = 2019 and 2021, >2020	Se tissue < BCWQG Protection of Aquatic Life Primary analytes ≤ reference; Secondary analyte Na > reference but stable over time (relative to reference);		

Notes: "-" = not applicable / no data available, WSQG = British Columbia Working Sediment Quality Guidelines, BCWQG = British Columbia Water Quality Guideline, Chl-a = Chlorophyll-a, 95th = 95th Percentile (applicable to sediment quality evaluation), CPUE = catch-per-unit-effort, YOY = young-of-the-year, RB = rainbow trout, LSU = longnose sucker, M = muscle tissue, O = ovary tissue, K = kidney tissue, L = liver tissue, GL = guideline. Temporal changes presented as "relative to reference" refer to changes in the exposed-reference difference over time as evaluated using a 2-way Analysis of Variance. Analytes presented for zooplankton and fish tissue quality endpoints are primary and secondary analytes (Table 2.4) with a significant positive exposed - reference difference in 2022 or in all monitoring years.

[a] Findings from 2022 are included at minimum. Additional years are displayed (as available) to support temporal comparisons.

[b] WSQG Lower = Lower BC Working Sediment Guideline; WSQG Upper = Upper BC Working Sediment Quality Guideline (BCMOECCS 2021a,b).

[c] Significant reductions in survival and growth are classed as high response (>50% reduction compared to control/reference); moderate response (20-50% reduction compared to control/reference, and significantly different than reference); low response (20-50% reduction compared to control/reference, and not significantly different than reference), and no unacceptable response (< 20% reduction compared to control/reference). Results relative to control or reference are shown in parentheses.

[d] Magnitude of significant differences are classed as highly (>5x SD), moderately (5x to 2x SD), and slightly (<2x SD) different, where SD is the pooled standard deviation.

[e] BCWQG = British Columbia Water Quality Guideline for the protection of aquatic life - interim selenium guideline for benthic invertebrates (4 mg/kg dw; BCMOE 2014).

[f] Human Health guideline for Hg in muscle tissue of fish (0.5 mg/kg dw; CFIA 2015); Human Health guideline for Se in fish muscle (moderate consumption; 14.5 mg/kg dw; BCMOE 2014); Guideline for the protection of aquatic life: Se in muscle tissue or whole body of fish (4 mg/kg dw; BCMOE 2014); Guideline for the protection of aquatic life: Se in fish ovary tissue (11 mg/kg dw; BCMOE 2014).

a pre-breach size class distribution. For longnose sucker,CPUE in the spring has varied and CPUE in the fall has progressively decreased from 2016 to 2022. Length frequency distributions for longnose sucker in Polley Lake from 2016 to 2022 showed more smaller fish were caught in 2022 compared to 2016, which was similar to previous years and suggests ongoing recruitment success despite the decrease in CPUE since 2016.

- Mercury and selenium concentrations in fish muscle in 2022 were below applicable human health guidelines for moderate consumption, while selenium concentrations in 13% of rainbow trout and 63% of longnose sucker samples exceeded the human health guideline for high consumption. Selenium concentations in rainbow trout (50% of samples) and longnose sucker (100% of samples) muscle in 2022 were above the BCWQG for the protection of aquatic life, exceeded the BCWQG in 13% of rainbow trout ovaries, and were below the threshold for reproductive effects. Selenium concentrations in fish tissues have been stable over time or decreasing over time (relative to reference) which is consistent with the temporal decrease in zooplankton tissue selenium concentrations.

7.2 Quesnel Lake

7.2.1 Sediment Quality

Sediment monitoring in 2022 continued to indicate a breach influence on sediment chemistry at both the deep and shallow areas of Quesnel Lake. Sediment collected from the deep near-field area of Quesnel Lake was characterized by concentrations of several analytes (arsenic, copper, iron, and manganese) that were greater than reference concentrations and WSQG, and TOC content lower than reference, consistent with previous post-breach results. Copper was the most substantially elevated analyte, with mean concentrations 4.2 times the upper WSQG in 2022. Mean iron and manganese concentrations were also greater than reference and upper WSQG, although to a lesser degree, and mean concentrations of arsenic were greater than reference and the lower WSQG. Temporal stability of these analytes in the deep near-field area sediments was demonstrated by arsenic, copper, and iron concentrations in 2022 that were similar to those reported in 2014, and manganese concentrations and TOC content in 2022 similar to 2015. Sediments from the shallow near-field area in 2022 had a very high sand content (92.8%), and were characterized by concentrations of arsenic, copper, iron, manganese, and silver that were greater than reference concentrations and WSQG. Copper was the most substantially elevated analyte, with mean concentrations 5.7 times the upper WSQG. Mean iron and manganese concentrations were also greater than reference and the upper WSQG (to a lesser extent than copper), while mean concentrations of arsenic and silver were greater than reference and lower WSQG. Concentrations, arsenic, copper, iron, manganese, silver, and TOC were

temporally stable, relative to reference, with concentrations in 2022 remaining similar to 2014 values for each of these analytes (compared to reference).

Sediment toxicity testing of *H. azteca* using sediments from the shallow near-field area of Quesnel Lake (QUL-LNF1) in 2022 resulted in a moderate survival response (44 to 45% mortality) and a high growth response (76 to 79% reduction). However, concentrations of dissolved copper in overlying waters of the toxicity test vessels were highly dissimilar from those documented in field-collected water from these sites, which is consistent with previous years of monitoring. Dissolved copper concentrations in the toxicity test vessels in 2022 were an average of 97-times greater than in field-collected water, which is similar to 2020 and 2021 (74- and 114-times greater, respectively) and lower than 2019 (174-times). This strongly suggests copper mobilization in the test setup that has either not occurred *in situ* or has attenuated over time *in situ*. Under these conditions, the observed mortality and growth response are consistent with dissolved copper concentrations in overlying water, particularly given that *H. azteca* have been documented to derive little nutrition from sediment and to respond primarily to contaminants in overlying water. Significant regression relationships evaluating results from 2014 to 2022 inferred lower *H. azteca* growth and survival at higher overlying water dissolved copper concentrations and higher sediment copper concentrations. This further corroborates the observation that toxicity responses of *H. azteca* are consistent with dissolved copper concentrations in overlying test waters of these shallow sediments. Overall, the toxicity test results from the shallow near-field area cannot be reliably extrapolated to the field but suggests potential for copper mobilization in this area with disturbance.

7.2.2 Aquatic Life

Phytoplankton community and productivity monitoring in Quesnel Lake in 2022 indicated that phytoplankton productivity (in terms of chlorophyll-a concentrations) was similar at the exposed and reference monitoring areas, as also observed in previous years (2019 to 2021). These results characterize both the exposed and reference areas of Quesnel Lake as mesotrophic in 2022, which is a change from the classification of ultraoligotrophic in 2016 to 2018 and as oligotrophic in 2019 to 2021; a change likely owing in part to a switch from surface grab (2018 and earlier) to depth-integrated sampling methods (2019 onwards). The plankton community of the exposed area of Quesnel Lake in July 2022 was characterized by density higher than reference, taxon richness lower than reference, and Simpson's Evenness and Diversity indices similar to reference. Total density has consistently been higher at the exposed compared to the reference area since 2019. Simpson's Diversity and Evenness at the exposed area have shown some temporal variability but have been either similar to or higher than reference in each year since 2019. Taxon richness at the exposed area in 2022 was lower than in previous years

(2019 to 2021) reflecting a decrease from conditions that were similar to reference from 2019 to 2021, to lower than reference in 2022. This decrease in taxon richness was attributable to the absence of relatively rare phytoplankton taxa at QUL-ZOO-1 in July 2022, and appeared to be a temporary change based on the results of samples collected in August 2022 which included some of these relatively rare taxa. Continued monitoring will help to further understand whether the decrease in taxon richness in 2022 is part of a longer-term change or was a single variable result. The community composition at the exposed area has been similar to reference in terms of the relative densities of Diatoms, Cyanobacteria, and Chlorophytes from 2019 to 2022. The relative densities of Chrysophytes, Cryptomonads, and Dinoflagellates at the exposed area differed from reference in 2022 but showed temporal stability either within the exposed area or temporal stability in the difference relative to reference from 2019 to 2022. The similarity of the phytoplankton community at the exposed and reference areas of Quesnel Lake for most endpoints, and the temporal stability throughout the study period for most endpoints that differed between the areas (excluding taxon richness), are suggestive of a lack of mine-related influence on the phytoplankton community of Quesnel Lake.

Zooplankton community and productivity monitoring in Quesnel Lake in 2022 indicated that total biomass of zooplankton (dw) at the exposed area was similar to reference, which is consistent with prior years. The zooplankton community at the exposed area of Quesnel Lake in 2022 was characterized by total density and Simpson's Evenness that were similar to reference, and taxon richness and Simpson's Diversity that were higher than reference. While there was temporal variability in these metrics at the exposed area from 2019 to 2022, the changes (i.e., direction and relative magnitude) were generally the same as those observed at the reference area, and metrics at the exposed area were largely similar to or greater than reference over this period. The community composition at the exposed area has been similar to reference in terms of the densities and relative densities of most zooplankton taxa (Calanoida, Cladocera, and Rotifera) from 2019 to 2022, with two exceptions, indicating that the communities at the exposed and reference areas were largely similar. The two exceptions were lower density and relative density of Cyclopoida in 2019, and consistently higher density and relative density of Copepod Nauplii in 2019 to 2022 at the exposed area compared to reference. The similarity of zooplankton communities between the exposed and reference areas for most endpoints and temporal stability of those endpoints that differed between the areas (i.e., Copepod Nauplii) from 2019 to 2022 are suggestive of a lack of mine-related influence on the zooplankton community of Quesnel Lake.

Zooplankton tissue quality monitoring in Quesnel Lake in 2022 indicated that concentrations of primary and secondary analytes in tissues from the exposed area were similar to or lower than reference, and also temporally stable from 2019 to 2022. The lack of temporal and spatial differences in zooplankton tissue quality results in 2022 was supported by trend analyses of

surface water quality data which indicated temporal stability (from 2015 to 2022) for most analytes, except for increasing trends at one or both exposed monitoring stations for total manganese, total phosphorus, total and dissolved selenium, and dissolved barium, molybdenum, and sodium. A measurable increase in concentrations of these analytes in zooplankton tissue was not observed since 2019, indicating no sustained impact of the increased aqueous concentrations of these analytes on zooplankton tissue quality. In addition, aqueous total selenium and manganese concentrations remained well below the BCWQG from 2015 to 2022. Despite the identified increasing trend in aqueous selenium concentrations, zooplankton tissue selenium concentrations were below the BC interim guideline for aquatic life at the exposed area in 2022 (similar to 2019 to 2021), and tissue selenium concentrations at the exposed area were similar to reference from 2019 to 2022. As such, monitoring results indicate that zooplankton tissue quality in 2019 to 2022 was unimpacted by the breach and potential effluent exposure.

Benthic invertebrate community monitoring in the deep-near field area of Quesnel Lake in 2022 documented a community with total density and Simpson's Evenness that were unchanged since 2016, taxon richness that was similar to all years since 2014, and Simpson's Diversity that was unchanged since 2014. Total density at the deep near-field area in 2022 remained much lower than the densities reported for the reference area in previous years (2014 to 2021), but the difference relative to reference has steadily decreased. These results indicate some recovery of the benthic invertebrate community at the exposed areas from the initial breach event in 2014, but no substantial change in community features since 2016 at the deep near-field exposed area of Quesnel Lake. This lack of significant recovery is consistent with the stability of sediment TOC content and concentrations of arsenic, copper, iron, and manganese in these sediments since at least 2016. Chironomidae, which are the dominant taxa at the deep near-field area, are intolerant to sediments with organic content (TOC) of less than 1% (Suedel et al. 1993) and the TOC content of near-field area sediments (mean = 0.614%) remains well below this level. The community composition has shown temporal stability since 2014, and in 2022 continued to be characterized by Chironomidae dominance. Several characteristics of the benthic invertebrate community at the deep near-field area were related to sediment characteristics, including lower total density, richness, Chironomidae density, and Oligochaeta density and relative density associated with greater proportion of fines, lower proportion of TOC, and higher metal concentrations in sediment. These sediment properties are consistent with the presence of breach-impacted sediments at the deep near-field area.

The catchability of lake trout at the exposed area of Quesnel Lake in 2022 was lower than at the reference area, while catchability of peamouth chub and northern pikeminnow in 2022 were both higher at the exposed area relative to reference. The catchability of rainbow trout from the Quesnel River in 2022 was higher than in previous years. Fish tissue quality in 2022 was

evaluated in up to four tissues (muscle, liver, kidney, and ovary) in four species (lake trout, northern pikeminnow, peamouth chub, and rainbow trout). Mean mercury and selenium concentrations in fish muscle tissue from Quesnel Lake and Quesnel River in 2022 were below the guidelines for the protection of human health (i.e., indicating that fish are safe for moderate human consumption). This was consistent with prior monitoring years except 2020 and 2021 when the mean mercury concentrations in muscle of reference lake trout exceeded the consumption guideline. Mean selenium concentrations in fish muscle or whole-body samples from Quesnel Lake and Quesnel River in 2022 were below the guideline for the protection of aquatic life except for peamouth chub from the exposed area which exceeded the guideline at a higher rate in 2022 (63%) than in previous years (2015 to 2021). Mean selenium concentrations in ovary tissue (the tissue most valuable in the assessment of potential selenium-associated effects on fish) from lake trout in 2022 were below the tissue specific guideline for the protection of aquatic life but exceeded the guideline in rainbow trout and peamouth chub. In rainbow trout ovary tissue, selenium concentrations in 2022 exceeded the guideline in 50% of samples which was within the range of previous years. In peamouth chub ovary tissue, selenium concentrations in the majority of exposed (86%) and reference (50%) samples in 2022 exceeded the tissue specific guideline for the protection of aquatic life, with 43% of exposed samples also exceeding the threshold for reproductive effects. The rate of the guideline/threshold exceedances in exposed peamouth chub ovary tissue was higher in 2022 than in prior years. Despite this, selenium concentrations in peamouth chub tissues (muscle liver, ovary, and kidney) and in northern pikeminnow whole-body samples (also a small home-range species) have been temporally stable from 2016 to 2022, relative to reference. The absence of pre-breach data precludes drawing definitive conclusions about the potential factors influencing tissue selenium concentrations (e.g., due to mine-exposure or due to inherent differences between the areas). However, results from 2016 to 2022 indicated there is no evidence that selenium concentrations in fish tissues from Quesnel Lake are increasing over time due to mine exposure. Evidence of a persistent mine influence was not detected for most analytes assessed in fish tissue from Quesnel Lake and Quesnel River in 2022. All primary analytes (arsenic, copper, iron, and selenium), and the secondary analytes barium, cadmium, calcium, manganese, mercury, molybdenum, phosphorus, sodium, strontium, tin, titanium, uranium, vanadium, and zinc were elevated relative to reference in 2022 in at least one tissue type in at least one species. However, the results for most these analytes were inconsistent among tissues and species, and/or were temporally stable, and/or the results were not supported by zooplankton tissue quality results, indicating that the weight of evidence does not support a pattern of increasing analyte concentrations over time due to mine-exposure.

7.2.3 Key Findings

Key findings of CEMP monitoring of Quesnel Lake in 2022 (Table 7.2) are:

- Arsenic, copper, iron, and manganese remain the analytes most elevated in Quesnel Lake deep near-field sediments relative to guidelines. Concentrations of these analytes in 2022 were similar to 2014 except manganese which was similar to 2015 (compared to reference). Mean TOC concentration (0.614% in 2022) of the deep near-field sediments remains very low and has increased slightly since 2014, although not significantly since 2016, relative to reference. In shallow near-field sediments, arsenic, copper, iron, manganese, and silver concentrations remained greater than guidelines and reference, and concentrations of these analytes in 2022 were similar to 2014 (compared to reference). Mean TOC content (0.826% in 2022) of the shallow near-field area sediments remains lower than reference and temporally unchanged since initiation of sampling (2014)
- Toxicity testing of shallow exposed sediments (using *H. azteca*) indicated a moderate survival response (44 to 45% mortality) and a high growth response (76 to 79% reduction in growth) in 2022. Survival and growth in 2022 were similar to 2021 (46% mortality, 78 to 82% reduction), slightly lower than 2020 (39% mortality, 50 to 65% reduction) but higher than 2019 (100% mortality) However, concentrations of dissolved copper in overlying waters of the toxicity test vessels in 2022 were highly dissimilar (an average of 97-times greater) than in field-collected water from these sites, consistent with previous years of monitoring. This suggests that the sediment toxicity test results cannot be reliably extrapolated to the field, but suggests potential for copper mobilization in this area with disturbance.
- Plankton productivity was similar to reference based on chorophyll-a concentrations and zooplankton biomass in 2022. Chlorophyll-a measures resulted in the classification of Quesnel Lake as mesotrophic (at exposed and reference areas). Phytoplankton and zooplankton community condition and structure were similar to reference and/or temporally stable (excluding phytoplankton taxon richness). Phytoplankton taxon richness decreased between 2021 to 2022 to richness that was lower than reference in 2022; a change that was due to the absence of relatively rare taxa.
- Concentrations of primary and secondary analytes in zooplankton tissues were consistently similar to or lower than reference from 2019 to 2022. Selenium concentrations in all exposed samples from 2019 to 2022 were below the BCWQG for the protection of aquatic life.

Table 7.2: Summary of Mount Polley CEMP Results for Quesnel Lake, 2019 to 2022[a]

Area		Sediment			Plankton			Benthic Invertebrate	Fish	
		Basic Chemistry[b]	Toxicity[c] *Hyalella azteca* (14-day)		Productivity[d]	Community[d]	Zooplankton Tissue Quality[e]	Community[d]	Community and Catchability	Tissue Quality[f]
			Survival	Growth						
Shallow	QUL-LNF1 (Near-field)	Analytes of Interest = As, Cu, Fe, Mn, Ag Cu, Fe, Mn > upper WSQG, and reference and pre-breach 95th; As and Ag > lower WSQG, and reference and pre-breach 95th As, Cu, Fe, Mn, and Ag in 2022 = 2014, relative to reference; TOC in 2022 = 2014, relative to reference Highest As, Cu, and Ag concentrations in 2019 likely related to movement of sampling location in 2019 (due to lower water levels)	Moderate response (56% of control, 55% of reference) Survival 2022 = 2016, 2020, 2021 (Moderate response) < 2019 (High response)	High response (21% of control, 24% of reference) Growth 2022 = 2016 to 2021 (High response)	-	-	-	-	CPUE for LT < reference and 2021; CPUE for PCC, NSC > reference CPUE for RB (Quesnel River) in 2022 < 2021, > 2019 and 2020	Mean Hg (M) and Se (M) < Human Health GL (25% of reference LT samples and 25% of exposed LT samples > Hg GL) Mean Se (M) < BCWQG Protection of Aquatic Life except exposed PCC (NSC WB: 25% of samples > GL; RB: 13% of samples > GL) Mean Se (M) > BCWQG Protection of Aquatic Life for exposed PCC (63% of samples < GL) Mean Se (O) > BCWQG Protection of Aquatic Life except LT (PCC exposed: 86% > GL; PCC reference: 50% > GL; RB: 80% > GL) Se (O) < Effects Threshold except exposed PCC (43% of PCC samples > Effects Threshold) Se concentrations in 2022 ≤ reference except PCC (M,O,L,K), LT (O), NSC (WB) Se in 2022 > reference; Se concentrations stable over time (relative to reference) As concentrations in 2022 ≤ reference except PCC (K), LT (M,K), and NSC (WB) As in 2022 > reference; As concentrations stable or decreasing over time (relative to reference) Cu concentrations in 2022 ≤ reference except LT (O) and PCC (K) Cu in 2022 > reference; Cu concentrations stable or decreasing over time (relative to reference) Fe concentrations in 2022 ≤ reference except PCC (L,K) Fe in 2022 > reference; Fe concentrations stable or decreasing over time (relative to reference) LT (M,K) and PCC (M,L,K) Mn concentrations > reference; Mn in LT (M) in 2022 > 2015 to 2018, = 2020, 2021 (relative to reference) but change was driven by a decrease in reference concentrations; Mn in PCC (M) in 2022 > 2016, 2020, = 2018, 2019, 2021 and PCC (L,K) stable over time; Concentrations of most secondary analytes < reference except Ba, Cd, Ca, Mn, Hg, Mo, P, Ti, V and Zn > reference in more than one tissue type and/or species (relative to reference) but equivocal whether a mine-related effect; Na, Sr, Ti and U > reference limited to single tissue per species with exposed > reference and therefore equivocal whether a mine-related effect
			Dissolved Cu concentrations in overlying water during laboratory testing were substantially higher in 2022 (97x) than *in situ* field-collected measures (compared to 56x, 74x, and 175x higher than *in situ* in 2021, 2020, 2019, respectively), indicating toxicity test results cannot be reliably extrapolated to the field.							
Deep	QUL-PNF (Near-field; QUL-ZOO-1 for plankton)	Analytes of Interest = As, Cu, Fe, Mn Cu, Fe, Mn > upper WSQG and reference 95th As > lower WSQG and reference 95th As, Cu, Fe in 2022 = 2014, relative to reference; Mn, TOC in 2022 = 2015, relative to reference	-	-	Phytoplankton: Chl-a = reference Classified as mesotrophic Zooplankton: Dry biomass = reference Phytoplankton: Chl-a in 2022 > 2019 to 2021 Zooplankton: Dry biomass in 2022 = 2019 and 2021, < 2020	Phytoplankton: Density > reference (Moderately 2.3 SD); Richness < reference (Moderately -2.6 SD) Zooplankton: Density = reference; Richness > reference (Slightly 0.41 SD) Phytoplankton: Density in 2022 > 2019 to 2021; Richness in 2022 < 2019 to 2021 Zooplankton: Density in 2022 > 2019, < 2020, = 2021; Richness in 2022 = 2019 and 2020, < 2021	Se tissue < BCWQG Protection of Aquatic Life; Primary and secondary analytes ≤ reference;	Density in 2022 > 2014 and 2015, = 2016 to 2021; Richness in 2022 = 2014 to 2021 (Reference area monitored most recently in 2021)		

Notes: "-" = no data available, WSQG = British Columbia Working Sediment Quality Guidelines, BCWQG = British Columbia Water Quality Guideline, TOC = total organic carbon, Chl-a = Chlorophyll-a, 95th = 95th Percentile (applicable to sediment quality evaluation), CPUE = catch-per-unit-effort, LT = lake trout, NSC = northern pikeminnow, PCC = peamouth chub, RB = rainbow trout, M = muscle tissue, O = ovary tissue, L = liver tissue, K = kidney tissue, WB = whole body, GL = guideline. Temporal changes presented as "relative to reference" refer to changes in the exposed-reference difference over time as evaluated using a 2-way Analysis of Variance. Analytes presented for zooplankton and fish tissue quality endpoints are primary and secondary analytes (Table 2.4) with a significant positive exposed - reference difference in 2022 or in all monitoring years.

[a] Findings in 2022 are included at minimum. Additional years are displayed (as available) to support temporal comparisons.

[b] WSQG Lower = Lower BC Working Sediment Guideline; WSQG Upper = Upper BC Working Sediment Quality Guideline (BCMOECCS 2021a,b).

[c] Significant reductions in survival and growth are classed as high response (>50% reduction compared to control/reference); moderate response (20-50% reduction compared to control/reference, and significantly different than reference); low response (20-50% reduction compared to control/reference, and not significantly different than reference), and no unacceptable response (< 20% reduction compared to control/reference). Results relative to control or reference are shown in parentheses.

[d] Magnitude of significant differences are classed as highly (>5x SD), moderately (5x to 2x SD), and slightly (<2x SD) different, where SD is the pooled standard deviation.

[c] BCWQG = British Columbia Water Quality Guideline for the protection of aquatic life - interim selenium guideline for benthic invertebrates (4 mg/kg dw; BCMOE 2014).

[e] Human Health guideline for Hg in muscle tissue of fish (0.5 mg/kg dw; CFIA 2015); Human Health guideline for Se in fish muscle (moderate consumption; 14.5 mg/kg dw; BCMOE 2014); Guideline for the protection of aquatic life: Se in muscle tissue or whole body of fish (4 mg/kg dw; BCMOE 2014); Guideline for the protection of aquatic life: Se in fish ovary tissue (11 mg/kg dw; BCMOE 2014); Effects Threshold indicates mean selenium concentration greater than DeForest et al. (2012) threshold for ovary tissue in fish (20 mg/kg dw) and the BCMOE guideline.

- The benthic invertebrate community at the deep near-field area showed initial recovery in the years immediately after the breach (i.e., between 2014 and 2015). Since then, there has been no substantial change in community at this area (i.e., from 2016 to 2022), which is consistent with the stability of sediment quality and the limited increase in sediment TOC content over this period.
- Mercury and selenium concentrations in fish muscle were below human health guidelines in 2022 except in 25% of exposed and reference lake trout which exceeded the mercury guideline. Selenium concentrations in most fish muscle or whole-body tissues were below the BCWQG for the protection of aquatic life in 2022, except for exposed peamouth chub muscle (63%), northern pikeminnow (25%), and rainbow trout (13%) samples. Selenium concentrations in ovary tissues of exposed (86%) and reference (50%) peamouth chub and exposed rainbow trout (80%) samples were above the guideline for the protection of aquatic life, and above the threshold for reproductive effects for exposed peamouth chub (43%) samples. Despite the guideline/threshold exceedances for tissue selenium concentrations, there is no evidence that selenium concentrations in fish tissues from Quesnel Lake or Quesnel River are increasing over time due to mine exposure.

7.3 Hazeltine Creek

7.3.1 Sediment Quality

Sediment quality monitoring completed in upper and lower Hazeltine Creek in 2022 continued to document the physical and chemical characteristics of sediments from this erosional habitat. Sediments were characterized by concentrations of several analytes that were greater than reference/pre-breach concentrations and WSQG values: copper and selenium in upper Hazeltine Creek, and copper and iron in lower Hazeltine Creek. In both upper and lower Hazeltine Creek in 2022, copper was the most substantially elevated analyte with concentrations 2.0 and 1.7 times higher than the upper WSQG, respectively, and higher than reference/pre-breach concentrations. The TOC content of sediments from upper Hazeltine Creek was significantly higher in 2022 than in 2018, relative to reference, as were the concentrations of copper and selenium. Mean concentrations of copper and selenium in upper Hazeltine Creek sediments were significantly higher in 2022 than previously observed (2018 to 2021), relative to reference. For both analytes, this change was driven by a significant decrease in sediment copper and selenium concentrations at the reference area, with copper concentrations within upper Hazeltine Creek sediments (i.e., not evaluated relative to reference) showing temporal stability. Sediment selenium concentrations evaluated within upper Hazeltine Creek in 2022 (not relative to reference) were significantly higher than in preceding years (2018 to 2020) which was

associated with higher TOC and lower sand content of these sediments. In lower Hazeltine Creek, the TOC content of lower Hazeltine Creek sediments has remained unchanged relative to reference from 2018 to 2022. Copper and iron concentrations in lower Hazeltine Creek sediments in 2022 were similar to or lower than those observed in 2018, relative to reference, indicating sediment concentrations of these analytes have not increased significantly over that period. The 2022 sediment quality monitoring results continue to indicate that results related to variable sediment physical characteristics (i.e., TOC and sand content) that are driven by the necessity for opportunistic sampling due to limited availability of fine sediments in some monitoring years. The variability in sediment physical characteristics may stabilize as sediment accumulation continues to occur in this remediated system.

7.3.2 Aquatic Life

Periphyton monitoring indicated that primary productivity of upper Hazeltine Creek, as assessed by mean chlorophyll-a (mass per unit area; mg/m²), was below BCWQG but above the threshold indicative of moderate enrichment in lower Hazeltine Creek. Primary productivity as measured by both chlorophyll-a and AFDM at both upper Hazeltine Creek areas (HAC-R1, HAC-U) has been consistently similar to or significantly higher than reference from 2018, and higher than pre-breach since 2019 at HAC-R1 and since 2021 at HAC-U. Chlorophyll-a concentrations and AFDM at HAC-R1 in 2022 were significantly higher than at HAC-U, indicating this area had greater periphyton productivity. Despite the increased productivity following remediation, water quality monitoring indicates that dissolved oxygen concentrations largely remain above the long-term BCWQG in upper Hazeltine Creek. The periphyton community of upper Hazeltine Creek in 2022 was characterized by taxon richness, Simpson's Evenness and Diversity, and diatom richness that were similar to or higher than the reference area. Periphyton densities in 2022 at HAC-R1 and HAC-U were similar to and lower than reference, respectively, but were temporally stable at HAC-U despite being lower than reference in 2022. The periphyton communities at the two upper Hazeltine Creek areas (HAC-R1 and HAC-U) were similar in 2022 in terms of all primary metrics (density, taxon richness, Simpson's Evenness and Diversity, and diatom richness) indicating similar recovery of the periphyton community in these two areas. Periphyton community composition at HAC-R1, but not HAC-U, was similar to reference in 2022. Community composition at HAC-U continued to differ from the reference area, with higher and lower relative densities of Diatoms and Cyanobacteria, respectively; differences which are indicative of healthy periphyton communities. The similarity (or exceedance) of the primary periphyton community metrics (density, richness, Simpson's Evenness, and Simpson's Diversity) in upper Hazeltine Creek compared to the reference area in most years and/or temporal stability of these metrics are indicative of relatively stable periphyton communities at the remediated upper Hazeltine Creek areas and good periphyton community health.

The benthic invertebrate community of upper Hazeltine Creek in 2022 was characterized by total density, taxon richness, and Simpson's Evenness and Diversity that were similar between the two areas (HAC-R1 and HAC-U) and that were similar to reference and/or pre-breach conditions. Taxon richness at HAC-R1 in 2022 remained significantly lower than pre-breach conditions but was similar to reference conditions. These results indicate that the benthic invertebrate community at these areas of upper Hazeltine Creek have largely recovered to reference and/or pre-breach conditions when primary metrics (density, richness, Simpson's Evenness and Diversity) are considered. Key differences in the benthic community structure in 2022 at both areas of upper Hazeltine Creek, compared to pre-breach conditions, included higher relative densities of Chironomidae and Trichoptera, and lower relative densities of EPT (at HAC-R1 only), Arachnida (at HAC-U only), Ephemeroptera, and Plecoptera. Notable differences in EPT at both areas of upper Hazeltine Creek, compared to reference and pre-breach, were due to the lack of Plecoptera and the higher relative density of Trichoptera, which were dominated by a family of net-spinning caddisflies (Hydropsychidae) that are tolerant of habitat disturbances. The occurrence of Ephemeroptera families at the exposed areas that are less pollutant tolerant than those at the reference area suggests the chemical conditions (i.e., water chemistry) of the exposed areas are not limiting for benthic invertebrate community recovery. Comparison of community composition between the two upper Hazeltine Creek areas suggested greater recovery of the benthic invertebrate community in Reach 2 (at HAC-U) compared to Reach 1 (at HAC-R1), based on lower and higher relative densities of Chironomidae and Trichoptera at HAC-U compared to HAC-R1, respectively. Benthic invertebrate total dry weight biomass at both upper Hazeltine Creek areas in 2022 was unchanged since 2019 and was either similar to or higher than reference in each year from 2018 to 2022. In summary, these results indicate that both areas of upper Hazeltine Creek have recovered substantially since remediation to a condition that is similar to reference and/or pre-breach conditions based on primary metrics, but with some remaining differences in community composition compared to reference and pre-breach.

Periphyton and benthic invertebrate tissue quality monitoring in upper and lower Hazeltine Creek indicated that the primary analytes arsenic, copper, iron, and selenium had higher tissue concentrations compared to reference in 2022 for which the exposed-reference difference also increased significantly over time. There is some evidence of increased bioavailability and trophic transfer of copper in benthic invertebrate tissues in upper Hazeltine Creek, since BCFs and TTFs were elevated relative to reference and TTFs for composite-taxa tissues from HAC-U increased in 2022 to higher than pre-breach conditions. However, this was limited to composite-taxa benthic invertebrate tissues from Reach 2 (HAC-U) and was not observed in caddisfly tissues from HAC-U nor in benthic invertebrate tissues (caddisfly or composite-taxa) from Reach 1 (HAC-R1) of upper Hazeltine Creek, indicating a potentially localized increase. In contrast, there is no evidence of

increasing tissue concentrations or bioavailability and trophic transfer of copper over time in biota from lower Hazeltine Creek. For selenium, BCFs were lower than reference in periphyton tissues and elevated in caddisfly, but not composite-taxa samples (upper Hazeltine Creek only) and TTFs were typically stable over time compared to reference (except for caddisflies in Reach 2 of upper Hazeltine Creek). These results indicate that the bioavailability and trophic transfer of selenium has not increased due to mine influence, except for increased trophic transfer in caddisflies from Reach 2 of upper Hazeltine Creek. Selenium concentrations in most tissues in Hazeltine Creek (upper and lower) have increased since 2018 compared to reference (except composite-taxa benthic invertebrate samples from lower Hazeltine Creek), suggesting a mine influence on tissue concentrations, if not bioavailability and trophic transfer of selenium. In upper Hazeltine Creek, tissue selenium concentrations in 2022 were similar to or lower than pre-breach results in comparable tissues, while those in composite-taxa benthic invertebrate samples from lower Hazeltine Creek in 2022 exceeded pre-breach results. Mean selenium concentrations in benthic invertebrates from upper and lower Hazeltine Creek were above the BC interim guideline for aquatic life, suggesting potential selenium-associated risks to aquatic life. In composite-taxa benthic invertebrate samples from upper Hazeltine Creek, arsenic and iron concentrations in tissues from Reach 2 (HAC-U) and Reach 1 (HAC-R1), respectively, were higher in 2022 than previous monitoring years compared to reference, but this was owing to a temporal decrease at the reference area rather than an increase in tissues from upper Hazeltine Creek. Elevated concentrations of some secondary analytes in periphyton and/or benthic invertebrate tissues over time were also observed, relative to reference, but evidence was equivocal as to whether these observed increases in tissue concentrations were mine-related, and there was little or no evidence of increased metal bioavailability (based on assessment of BCFs and TTFs relative to reference and pre-breach). In comparison to 2021 when higher tissue concentrations and trophic transfer of mercury were identified compared to reference, mercury results in 2022 did not continue to demonstrate higher bioaccumulation in the aquatic biota compared to reference (as evidenced by tissue concentrations and TTFs similar to or lower than reference and/or prior years). Overall, periphyton and benthic invertebrate tissue quality data showed some evidence of moderately higher bioavailability and/or trophic transfer of selenium and copper in upper Hazeltine Creek, and selenium in lower Hazeltine Creek. Comparison of the two benthic invertebrate tissue types (caddisfly and composite-taxa) indicated that although some variability exists between the tissues, potential changes in analyte concentrations and TTFs in caddisfly tissues would largely be detected if sampling were limited to composite-taxa tissue samples only.

7.3.3 Key Findings

Key findings of CEMP monitoring of Hazeltine Creek from 2022 (Table 7.3) are:

Table 7.3: Summary of Mount Polley CEMP Results for Hazeltine Creek, 2022[a]

Area	Sediment	Periphyton		Benthic Invertebrate		Periphyton and Benthic Invertebrate Tissue Quality[d]
	Basic Chemistry[b]	Productivity[c]	Community[c]	Productivity[c]	Community[c]	
Reach 1 (HAC-R1)	-	Mean Chl-a < BCWQG and > moderately enriched stream threshold Chl-a > reference (slightly 1.7 SD) and baseline (1995, 1996) and pre-breach, > HAC-U (moderately 2.4 SD) AFDM > reference (moderate 4.2 SD) and HAC-U (slightly 1.9) Chl-a and AFDM in 2022 > 2017, 2018 and 2021, = 2019, 2020	Density = reference and HAC-U; Richness = reference and HAC-U Density in 2022 > 2021, 2019, = 2018 and 2020; Richness in 2022 > 2021, = 2018 to 2020	Dry biomass > reference (slightly 2.0 SD), = HAC-U; Dry biomass in 2022 = 2019 to 2021, > 2018	Density > reference (slightly 1.4 SD), = pre-breach and HAC-U; Richness = reference and HAC-U, < pre-breach (highly -5.4 SD) Density in 2022 = 2018 to 2020, >2021; Taxonomic richness in 2022 = 2019 to 2021, > 2018	Mean Se in caddisfly and BIC at HAC-U, HAC-R1, and HAC-D in 2022 > BCWQG Protection of Aquatic Life Se concentrations in 2022 > reference; Se concentrations in 2022 > 2018 (except HAC-D [BIC] = 2018), relative to reference; Se concentrations in 2022 ≤ pre-breach (except HAC-D [BIC] > pre-breach); Se BCFs in 2022 < reference, except HAC-R1 (Caddis) and HAC-U (Caddis) slightly > than reference; Se TTFs > reference but stable or decreasing over time except HAC-U (Caddis) in 2022 = 2021, > 2018 to 2020 Cu concentrations in 2022 > reference (except HAC-R1 [Caddis] < reference); Cu concentrations in 2022 ≤ 2018 (except HAC-U (BIC) > 2018 to 2021), relative to reference; Cu concentrations in 2022 > pre-breach (HAC-R1 and HAC-U [BIC], HAC-D [Peri, BIC]), = pre-breach (HAC-R1 and HAC-U [Peri]); Cu BCFs in 2022 = or slightly > reference (except HAC-U [BIC] > 2x reference); Cu TTFs in 2022 > reference at HAC-R1 (BIC) and HAC-U (BIC), ≤ 2018 (except HAC-U [BIC] and HAC-D [Caddis] > 2018), ≤ to pre-breach (except HAC-U [BIC] > pre-breach) Secondary analytes at HAC-R1, HAC-U and HAC-D showed some increases in concentration relative to reference and pre-breach but equivocal as to whether observed increases were mine-related and there was little or no evidence of increased metal bioavailability.
Upper (HAC-U)	Analytes of Interest = Cu, Se Cu > upper WSQG, and reference and pre-breach 95th percentile; Se > lower WSQG, and reference and pre-breach 95th percentile Cu in 2022 > 2018 to 2021, relative to reference; Se in 2022 > 2018 to 2021, relative to reference Cu and Se at reference in 2022 < 2018 to 2021, so temporal changes evaluated independent of reference: Cu in 2022 = 2019 to 2021, > 2018; Se in 2022 = 2021, > 2018 to 2020 TOC in 2022 = 2019 and 2021, > 2018 and 2020, relative to reference Temporal changes in metal concentrations associated with variability in sediment texture and physical characteristics among years	Chl-a < BCWQG and > moderately enriched stream threshold and baseline (1995) Chl-a = reference, = pre-breach, > baseline (1995); AFDM > reference (moderate 2.3 SD) Chl-a in 2022 = 2018 to 2021; AFDM in 2022 = 2019 to 2021, > 2018	Density < reference (slightly -1.7 SD); Richness > reference (slightly 1.4 SD) Density in 2022 = 2018 to 2021; Richness in 2022 > 2018, = 2019 to 2021	Dry biomass > reference (moderately 3.6 SD); Dry biomass in 2022 = 2019 to 2021, > 2018	Density = reference and pre-breach; Taxonomic richness = reference and pre-breach Density in 2022 = 2018 to 2021; Taxonomic richness in 2022 = 2019, 2020, > 2018, 2021	
Lower (HAC-D)	Analytes of Interest = Cu, Fe Cu > upper WSQG, and reference and pre-breach 95th; Fe > lower WSQG, and reference and pre-breach 95th Cu in 2022 = 2018, 2021, > 2019, 2020 relative to reference; Fe in 2022 < 2018, > 2019, = 2020, 2021 relative to reference; TOC in 2022 = 2018 to 2021 relative to reference Temporal changes in metal concentrations associated with variability in sediment texture and physical characteristics among years	-		-	-	

Notes: "-" = no data available, WSQG = British Columbia Working Sediment Quality Guidelines, Chl-a = Chlorophyll-a, AFDM = Ash Free Dry Mass, BCF = Bioconcentration Factor, TTF = Trophic Transfer Factor; Peri = Periphyton; Caddis = Caddisfly; BIC = Composite-taxa benthic invertebrate, GL = guideline. Temporal changes presented as "relative to reference" refer to changes in the exposed-reference difference over time as evaluated using a 2-way Analysis of Variance. Analytes presented for zooplankton and fish tissue quality endpoints are primary and secondary analytes (Table 2.4) with a significant positive exposed - reference difference in 2022 or in all monitoring years.

[a] Findings in 2022 are included at minimum. Additional years are displayed (as available) to support temporal comparisons.

[b] WSQG Lower = Lower BC Working Sediment Guideline; WSQG Upper = Upper BC Working Sediment Quality Guideline (BCMOECCS 2021a,b).

[c] Magnitude of significant differences are classed as highly (>5x SD), moderately (5x to 2x SD), and slightly (<2x SD) different, where SD is the pooled standard deviation.

[d] BCWQG = British Columbia Water Quality Guideline for the protection of aquatic life - interim selenium guideline for benthic invertebrates (4 mg/kg dw; BCMOE 2014).

- Copper and selenium in upper Hazeltine Creek and copper and iron in lower Hazeltine Creek were the analytes most elevated relative to sediment quality guidelines and reference. Copper concentrations in upper Hazeltine Creek sediments were temporally stable from 2019 to 2022, while selenium concentrations in 2022 were higher than in 2018 to 2020 but this increase was associated with higher TOC and lower sand content of sediments in 2022 (when evaluated independently of reference comparisons). Copper and iron concentrations in lower Hazeltine Creek sediments in 2022 were similar to or lower than in 2018 and TOC content of these sediments was temporally stable from 2018 to 2022, relative to reference.
- Periphyton productivity (measured as chlorophyll-a) in upper Hazeltine Creek areas was similar to or higher than reference and/or pre-breach from 2018 to 2022. Mean chlorophyll-a (mass per unit area) in upper Hazeltine Creek in 2022 was below the BCWQG and above the threshold for moderately enriched streams. Periphyton community condition was similar to reference and/or temporally stable for most endpoints. Community composition differences relative to reference were indicative of healthy periphyton communities in upper Hazeltine Creek.
- Benthic invertebrate community monitoring indicated that the community in upper Hazeltine Creek areas has recovered to reference and/or pre-breach conditions when primary metrics (density, richness, Simpson's Evenness and Diversity) are considered. Some remaining key differences in the benthic community structure at both areas of upper Hazeltine Creek, compared to pre-breach conditions, indicate the community composition has not fully recovered to pre-breach conditions, and differences between the two areas suggest greater recovery at HAC-U than HAC-R1.
- Concentrations of copper and selenium were higher than reference and increased over time and showed some evidence of moderately higher bioavailability and/or trophic transfer of selenium and copper in upper Hazeltine Creek, and selenium in lower Hazeltine Creek. Selenium concentrations in most tissues in Hazeltine Creek (upper and lower) have increased since 2018 compared to reference (except composite-taxa benthic invertebrate samples from lower Hazeltine Creek) but remained similar to or lower than pre-breach in upper Hazeltine Creek while those in lower Hazeltine Creek were higher than pre-breach in 2022. Mean selenium concentrations in benthic invertebrate tissue have exceeded the BC interim guideline since 2020 and 2022 in upper (HAC-R1 and HAC-U) and lower (HAC-D) Hazeltine Creek (1.23-, 1.67- and 1.14-times guideline, respectively). Copper was elevated relative to reference in 2022, and higher than pre-breach in most tissues and sampling years but the

difference relative to reference has been similar to reference over monitoring years except at HAC-U where concentrations in composite taxa-benthic invertebrate tissue samples were higher in 2022 than 2018 to 2021 (relative to reference). Copper TTFs were stable or decreasing over time and lower than pre-breach except for composite taxa-benthic invertebrate tissue samples from HAC-U which increased over time, and higher than pre-breach. This temporal increase in copper concentrations and TTFs in benthic invertebrates was limited to composite-taxa benthic invertebrate tissues from Reach 2 (HAC-U), indicating a potentially localized increase. The concentration and TTFs of most secondary analytes were similar to reference and pre-breach, and for analytes with increased concentrations, none showed bioaccumulation in tissues indicating equivocal mine-related effects over time.

7.4 Edney Creek

7.4.1 Aquatic Life

Periphyton and benthic invertebrate tissue quality monitoring in lower Edney Creek in 2022 indicated that tissue concentrations of several primary and secondary analytes were significantly higher at the exposed area (E1) than reference. However, for most metals, there was no consistent evidence of increasing metal concentrations in periphyton and/or benthic invertebrate tissues from the exposed area relative to the reference area over time. Copper was an exception, with concentrations in all exposed area tissues (i.e., periphyton, caddisfly, and composite-taxa benthic invertebrates) that were higher than reference. Most analytes demonstrated a lack of consistency among tissue types in concentrations and TTFs (except copper), BCFs that were only slightly above reference (except copper and cadmium), and TTFs that did not demonstrate increased bioavailability. These results collectively indicate that the potential mine-influence on analyte concentrations in lower Edney Creek appears limited to increased copper concentrations in benthic invertebrate tissues. Copper concentrations in exposed caddisfly and composite-taxa tissues were higher than reference in 2022, but copper TTFs were lower than reference in all years, indicating there is no evidence of increased copper bioavailability in aquatic biota in lower Edney Creek. However, the significant increase in copper concentrations in exposed caddisfly tissues in 2020, and again in 2022, relative to reference, is consistent with the recent completion of final remediation works in this area (in the summer of 2020 and 2021). Mean concentrations of selenium in caddisfly and composite benthic invertebrate tissue samples were well below the BC interim guideline for aquatic life, indicating that no selenium-associated effects to aquatic life would be expected.

7.4.2 Key Findings

Key findings of CEMP monitoring of Edney Creek in 2022 (Table 7.4) are:

- Periphyton and benthic invertebrate tissue from lower Edney Creek (E1) showed significantly elevated concentrations of several primary and secondary analytes relative to reference, including copper. For most analytes there was no evidence of increasing concentrations or bioavailability, and results were inconsistent among tissue types. Copper concentrations were higher in all tissue types in 2022 than 2019 to 2021, relative to reference, which was accompanied by higher BCFs than reference, but TTFs remained lower than reference. Mean selenium concentrations in benthic invertebrate tissue were below the BC interim guideline for aquatic life.

Table 7.4: Summary of Mount Polley CEMP Results for Lower Edney Creek, 2022 [a]

Periphyton and Benthic Invertebrate Tissue Quality [b]
Mean Se in caddisfly and BIC < BCWQG Protection of Aquatic Life Cu concentrations in 2022 (Peri, BIC, Caddis) > reference; Cu concentrations in 2022 = 2019 to 2021 (Peri and BIC), > 2019 to 2021 (Caddis), relative to reference Cu BCFs in 2022 = reference (BIC), slightly > reference (Caddis), moderately > reference (Peri) Cu TTFs in 2022 < reference, = 2019 to 2021 Secondary analytes showed some increases in concentration relative to reference but equivocal as to whether observed increases were mine-related and there was little or no evidence of increased metal bioavailability

Notes: TTFs = Trophic Transfer Factors; BCF = Bioconcentration Factor; Peri = Periphyton; Caddis = Caddisfly; BIC = Composite-taxa benthic invertebrate. Temporal changes presented as "relative to reference" refer to changes in the exposed-reference difference over time as evaluated using a 2-way Analysis of Variance. Analytes presented for zooplankton and fish tissue quality endpoints are primary and secondary analytes (Table 2.4) with a significant positive exposed - reference difference in 2022 or in all monitoring years.

[a] Findings in 2022 are included at minimum. Additional years are displayed (as available) to support temporal comparisons.

[b] BCWQG = British Columbia Water Quality Guideline for the protection of aquatic life - interim selenium guideline for benthic invertebrates (4 mg/kg dw; BCMOE 2014).

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APPENDIX A
SAMPLING LOCATIONS AND SUPPORTING INFORMATION

APPENDIX A.1
LAKES

Bootjack Lake (BOL-B2; Reference)

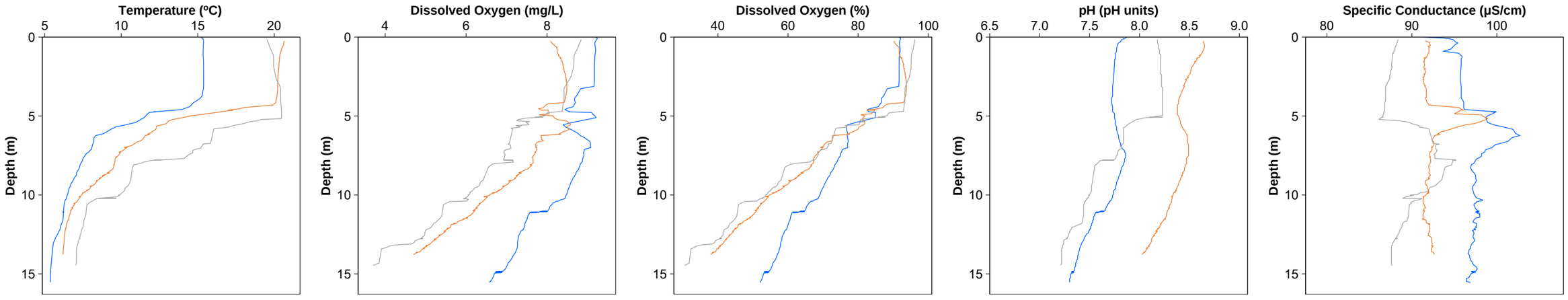

Polley Lake (POL-P2; Exposed)

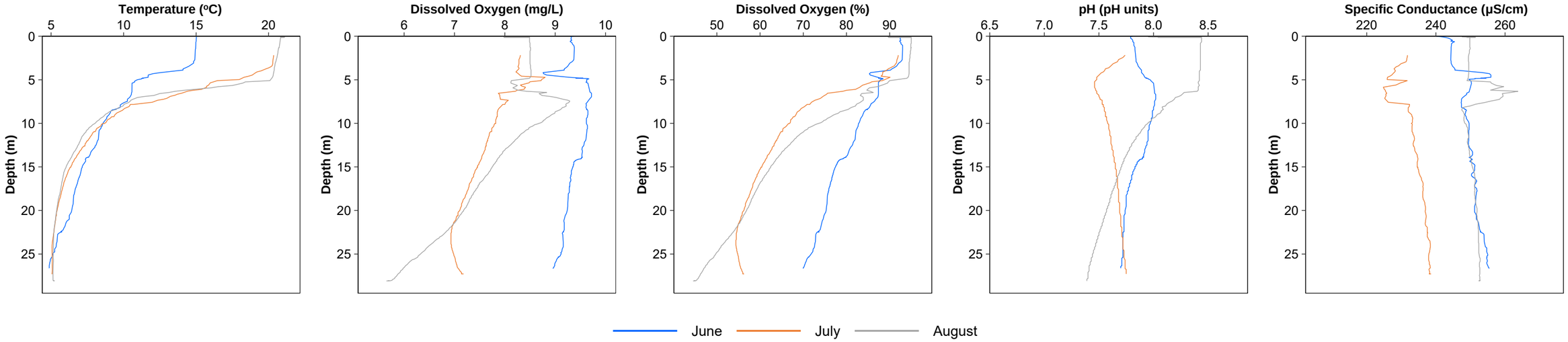

Figure A.1.1: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Plankton Sampling Events for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas, June to August 2022

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, ºC = degrees Celsius, % = percent.

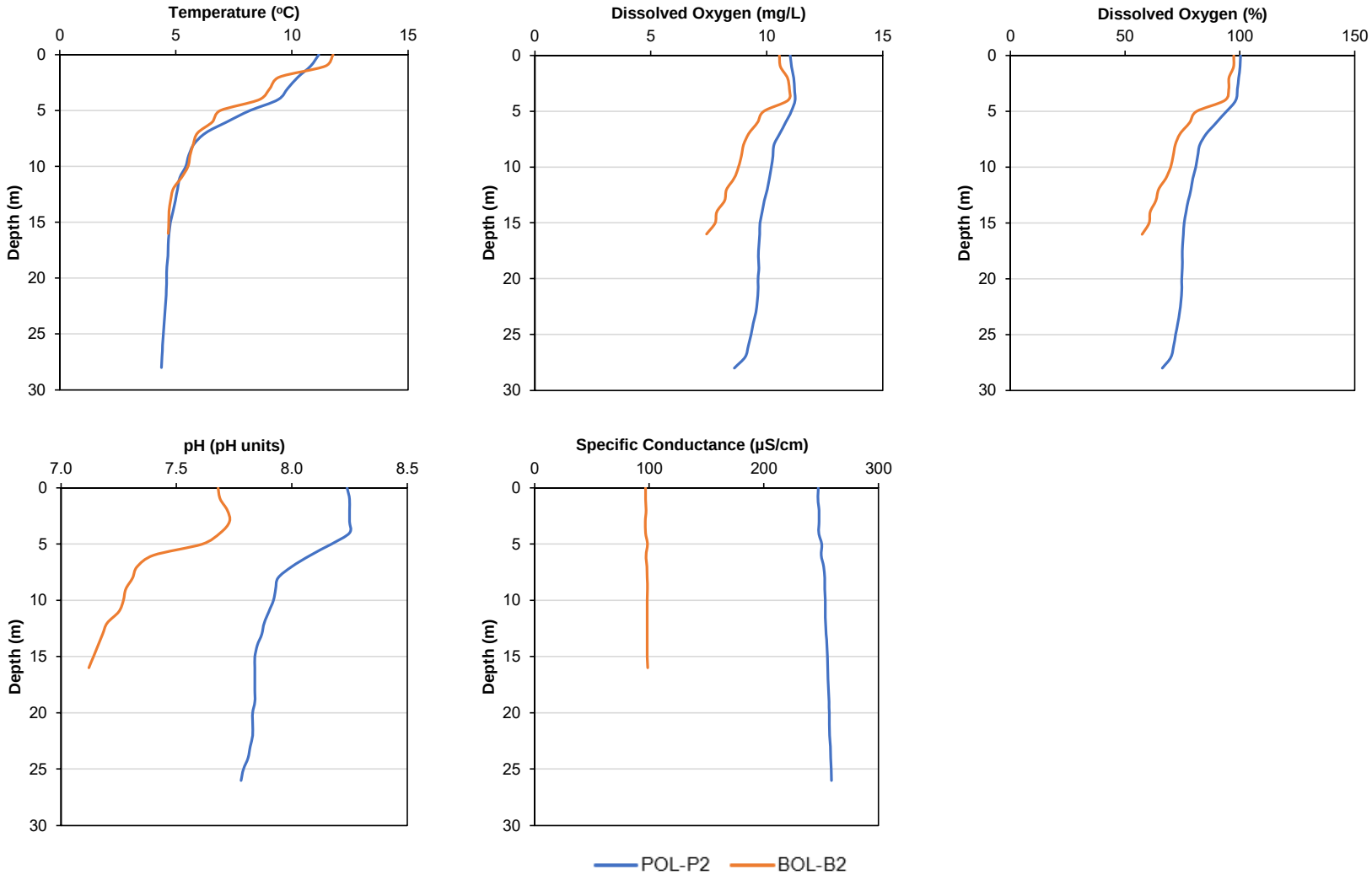

Figure A.1.2: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Fish Monitoring for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas, May 2022

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, °C = degrees Celsius, % = percent.

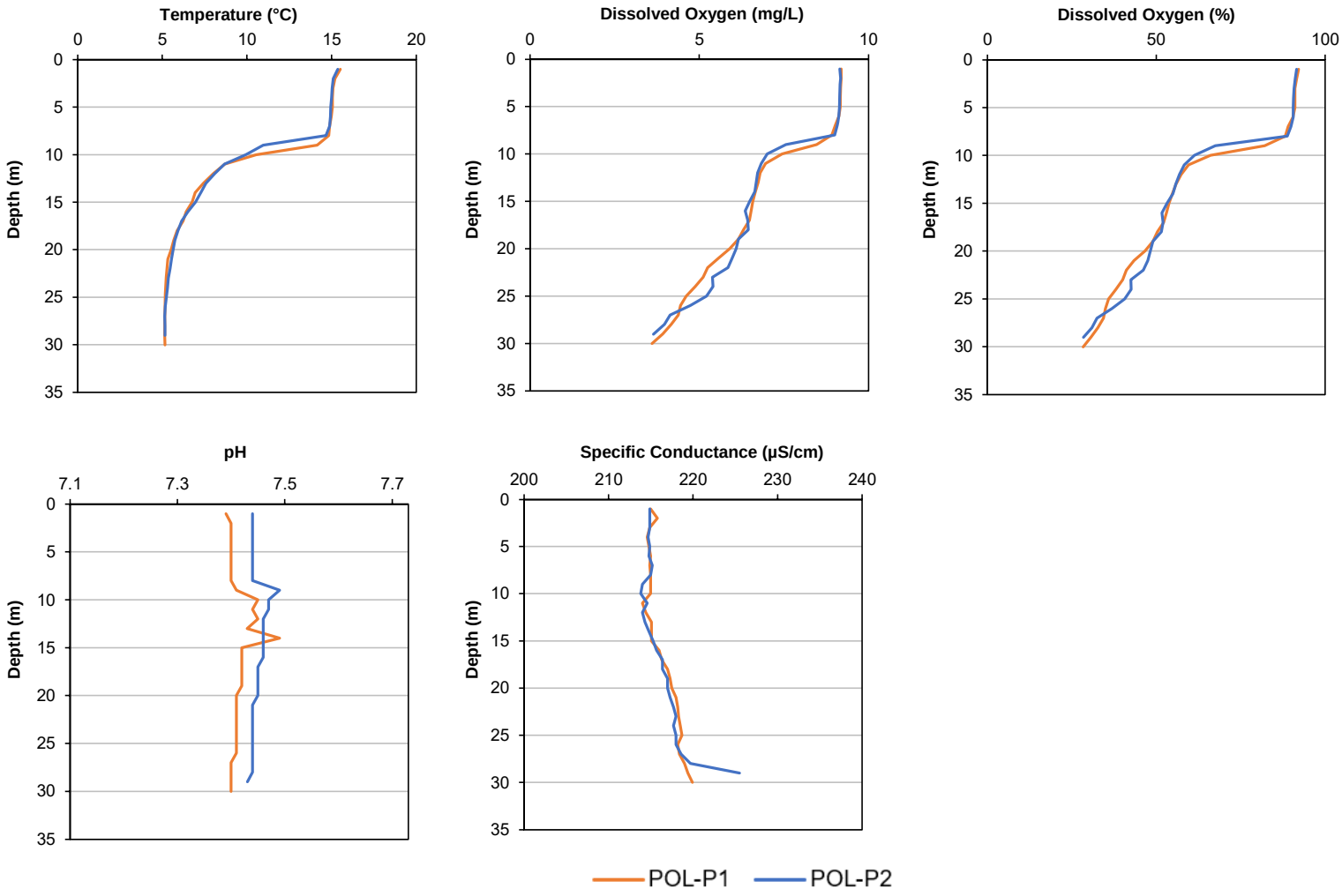

Figure A.1.3: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Fish Monitoring for Polley Lake (POL-P1, POL-P2; Exposed), September 2022

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, °C = degrees Celsius, % = percent.

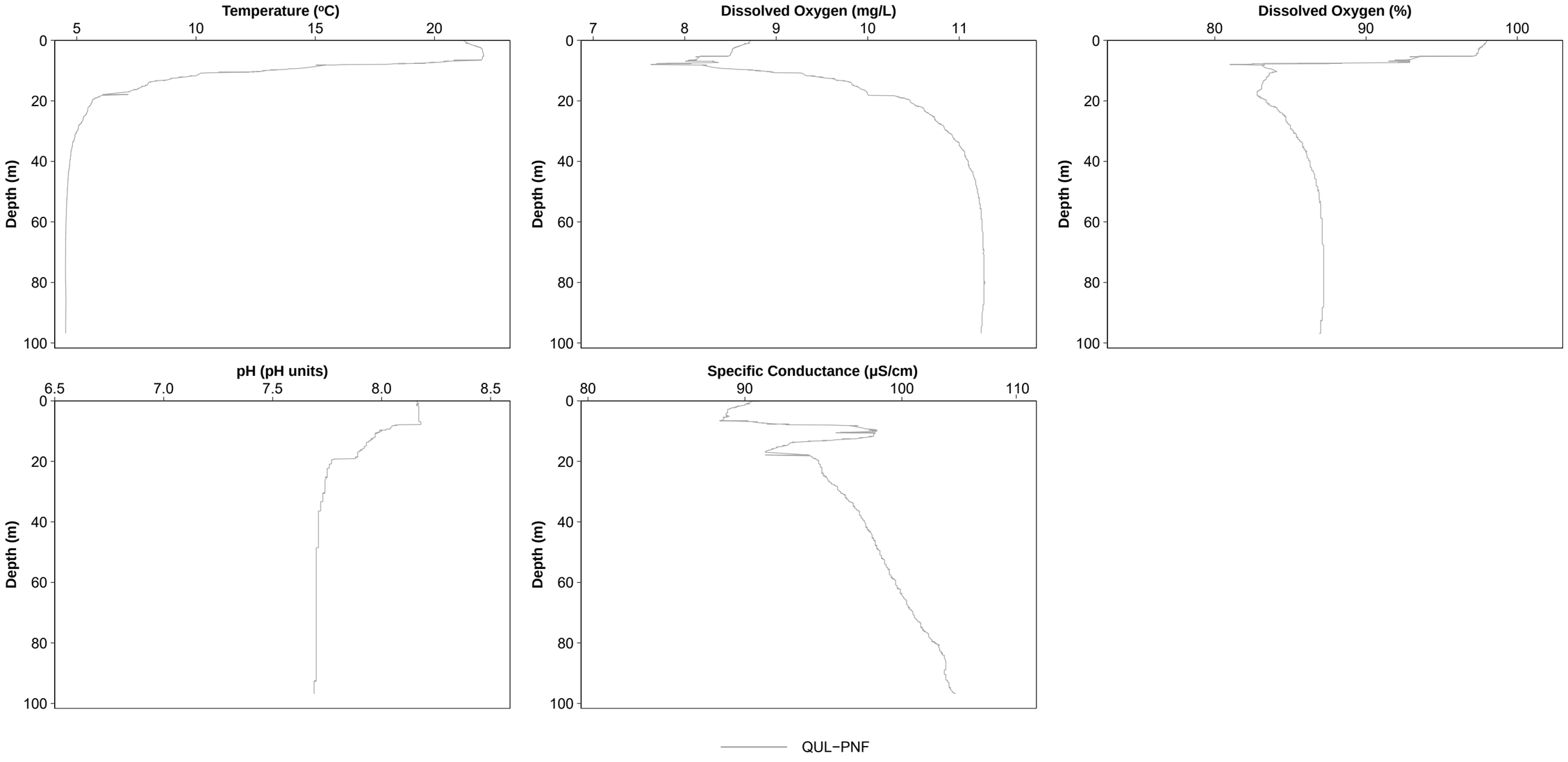

Figure A.1.4: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Sediment Quality and Benthic Invertebrate Monitoring for Quesnel Lake at QUL-PNF (Exposed) Deep Area, August 2022

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, °C = degrees Celsius, % = percent.

Quesnel Lake – QUL-ZOO-7 (Reference)

Quesnel Lake – QUL-ZOO-1 (Exposed)

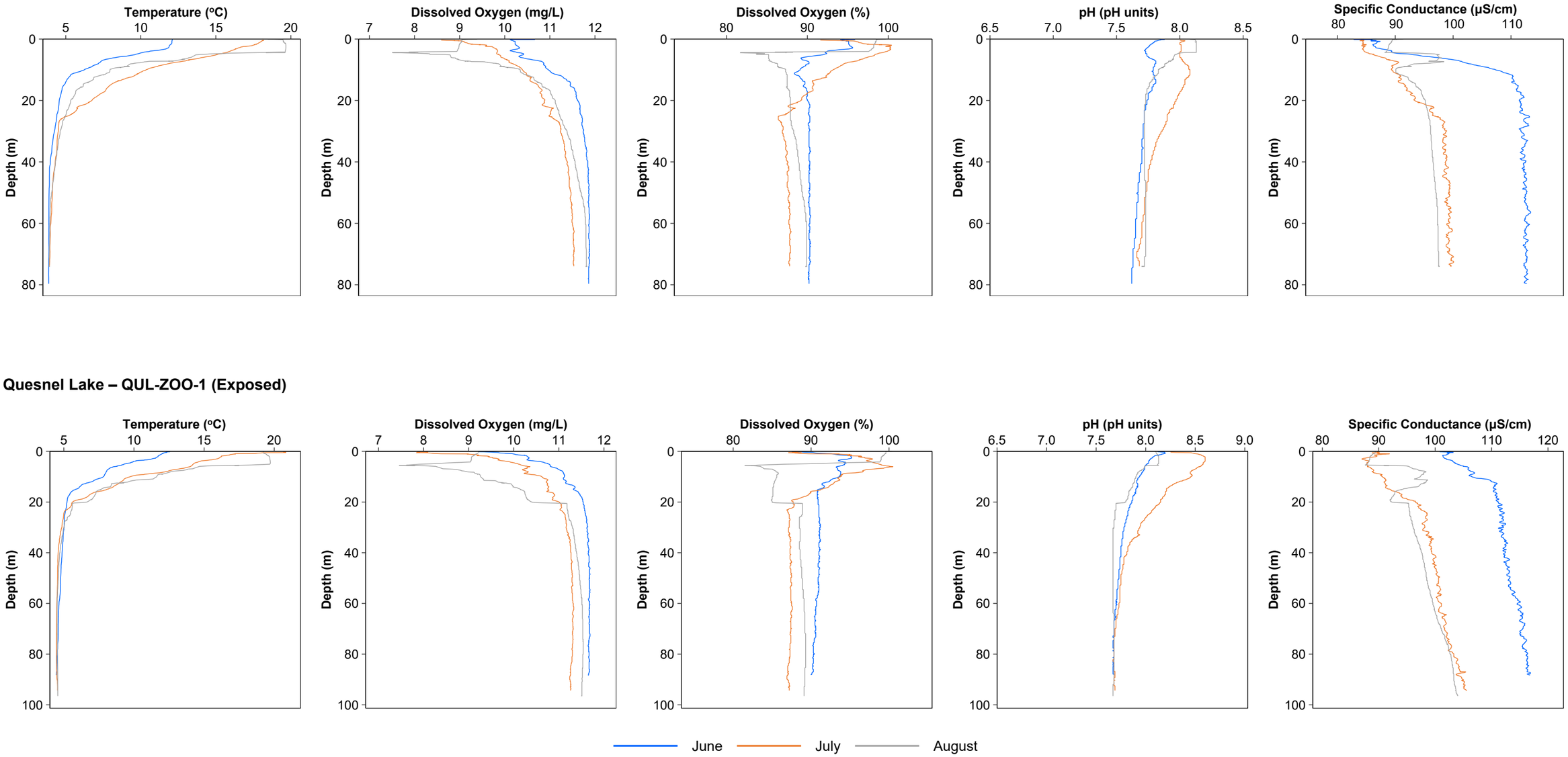

Figure A.1.5: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Plankton Sampling Events for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, June to August, 2022

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, ºC = degrees Celsius, % = percent.

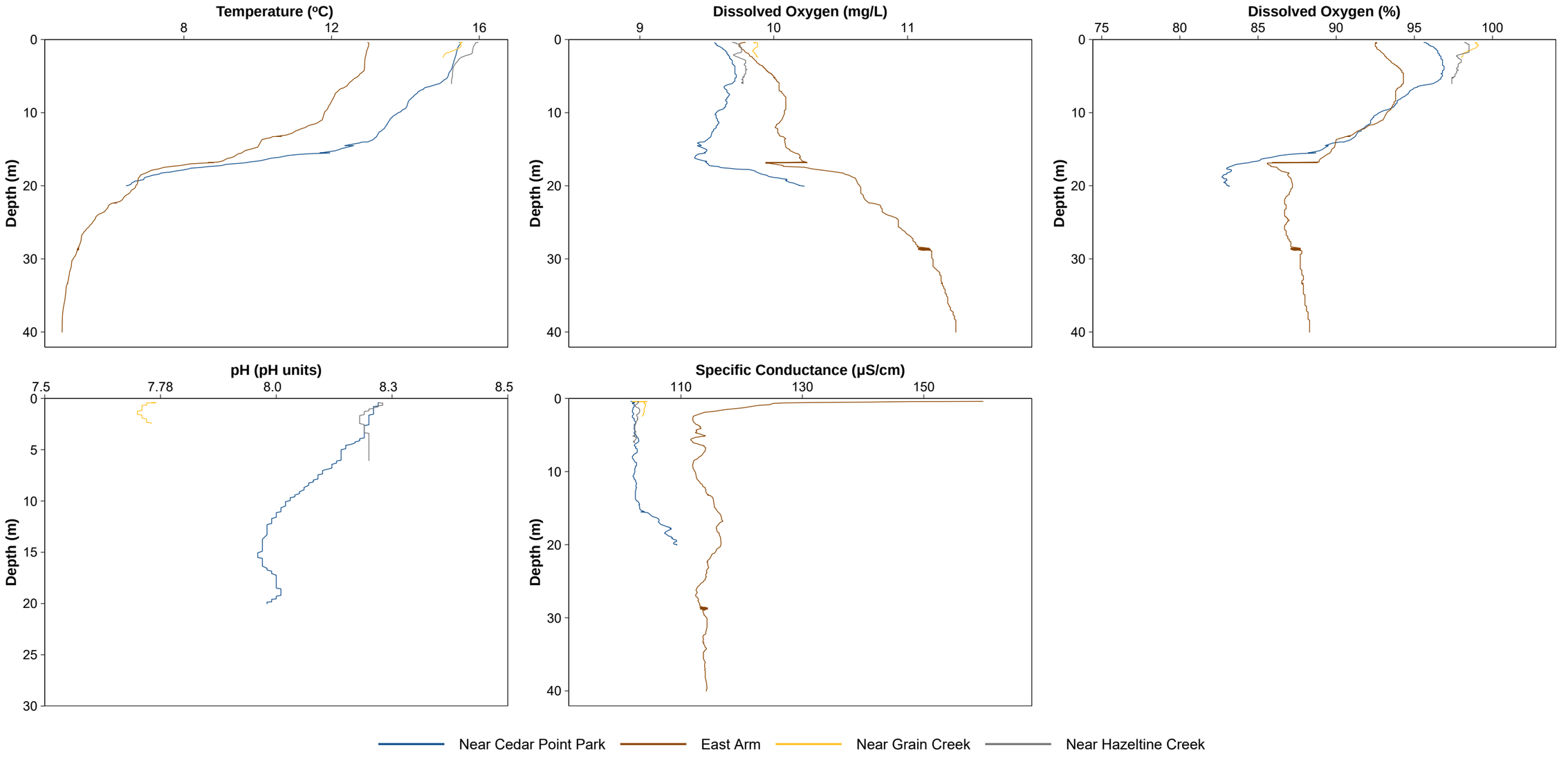

Figure A.1.6: Vertical Profiles of Temperature, Dissolved Oxygen, pH, and Specific Conductance during Fish Monitoring for Quesnel Lake (Exposed and Reference) Areas, October 2022

Notes: Accurate pH results for the East Arm (Reference) could not be recorded due to an equipment malfunction, therefore are not displayed. mg/L = milligrams per litre, µS/cm = microSiemens per centimeter, ºC = degrees Celsius, % = percent

Table A.1.1: Sediment and Benthic Invertebrate Community Monitoring Methods and Locations for Polley Lake (Exposed), Bootjack Lake (Reference), and Quesnel Lake (Exposed and Reference) Shallow and Deep Areas, August 2022

Location		Area Code	Type	Replicate	UTM (NAD 83, Zone 10U)		Water Sample	Sediment Sample			Benthic Invertebrate Community Sample [a]
					Easting	Northing	Date	Date	Sampling Method	Grabs per Sample	Date
Bootjack Lake Shallow	Bootjack Lake (South)	BOL-S	Reference	1	591914	5820690	24-Aug-22	24-Aug-22	Petite Ponar	5	-
				2	591899	5820721				5	
				3	591921	5820672				5	
				4	591933	5820662				5	
				5	591931	5820670				5	
Polley Lake Shallow	Polley Lake (South)	POL-S	Exposed	1	595591	5820969	25-Aug-22	25-Aug-22	Petite Ponar	5	-
				2	595625	5820980				5	
				3	595630	5821150				6	
				4	595633	5821039				5	
				5	595616	5821020				5	
Quesnel Lake Shallow	Reference (Horsefly Bay)	QUL-LREF1	Reference	1	610136	5813949	24-Aug-22	23-Aug-22	Petite Ponar	6	-
				2	610003	5813958				7	
				3	610097	5813939				5	
				4	610164	5813960				5	
				5	610031	5813948				8	
	Near-field	QUL-LNF1	Exposed	1	601431	5818141	24-Aug-22	23-Aug-22	Petite Ponar	8	-
				2	601468	5818105				9	
				3	601420	5818165				6	
				4	601491	5818072				5	
				5	601518	5818017				7	
Quesnel Lake Deep	Near-field	QUL-PNF	Exposed	1	601814	5818205	-	26-Aug-22	Petite Ponar	5	26-Aug-22
				2	601666	5818294				5	27-Aug-22
				3	601909	5818117		27-Aug-22		5	
				4	601545	5818372				5	
				5	601489	5818469				5	

Note: "-" = no data available or not applicable.

[a] Benthic invertebrate community samples were collected using a Petite Ponar, with 5 grabs per sample, 250 µm sieve size. No macrophytes or algae were documented in the samples collected.

Table A.1.2: **Supporting Measures Collected during Sediment and Benthic Invertebrate Community Monitoring for Polley Lake (Exposed), Bootjack Lake (Reference), and Quesnel Lake (Exposed and Reference) Shallow and Deep Areas, August 2022**

Location		Area Code	Type	Date	Replicate	Station Depth	Secchi Depth	Surface					Bottom				
								Temperature	Dissolved Oxygen		pH	Specific Conductance	Temperature	Dissolved Oxygen		pH	Specific Conductance
						(m)	(m)	°C	mg/L	%	pH units	µS/cm	°C	mg/L	%	pH units	µS/cm
Bootjack Lake Shallow	Bootjack Lake (South)	BOL-S	Reference	24-Aug-22	1	3.0	TSB	25.382	8.21	98.9	8.32	85.8	22.610	8.62	100.3	8.56	84.7
				24-Aug-22	2	1.5	TSB	25.000	8.29	100.3	8.35	85.8	22.591	8.68	100.5	8.57	84.6
				24-Aug-22	3	2.0	TSB	24.060	8.86	105.5	8.40	85.5	22.494	8.93	103.6	8.63	85.2
				24-Aug-22	4	2.5	TSB	25.133	8.27	100.6	8.40	85.7	22.705	9.66	112.1	8.91	85.3
				24-Aug-22	5	3.5	TSB	24.890	8.48	102.2	8.47	85.6	22.465	8.59	99.1	8.48	85.0
Polley Lake Shallow	Polley Lake (South)	POL-S	Exposed	25-Aug-22	1	3.0	TSB	22.638	8.80	101.8	8.63	216.1	22.662	8.94	103.0	8.62	210.9
				25-Aug-22	2	2.5	TSB	22.749	9.30	108.0	8.70	214.5	22.391	9.85	113.6	8.51	213.1
				25-Aug-22	3	3.5	TSB	22.701	8.61	99.9	8.63	216.6	22.366	9.20	105.9	8.70	214.2
				25-Aug-22	4	2.5	TSB	22.855	9.15	106.5	8.70	215.4	22.763	9.22	107.1	8.69	214.8
				25-Aug-22	5	2.0	TSB	22.888	9.30	108.2	8.73	214.7	22.669	10.10	117.1	8.78	212.6
Quesnel Lake Shallow	Reference (Horsefly Bay)	QUL-LREF1	Reference	24-Aug-22	1	2.1	TSB	21.682	9.36	106.4	8.45	89.1	21.753	9.34	106.3	8.45	89.1
				24-Aug-22	2	1.5	TSB	21.563	9.53	108.0	8.45	88.4	21.627	9.74	110.6	8.55	88.2
				24-Aug-22	3	2.1	TSB	21.689	9.69	109.9	8.43	88.6	21.704	10.03	114.1	8.63	88.2
				24-Aug-22	4	2.0	TSB	21.751	9.22	105.0	8.37	89.4	21.740	9.16	104.2	8.35	89.9
				24-Aug-22	5	-	TSB	21.770	9.86	112.2	8.65	88.3	21.690	9.81	111.0	8.59	88.2
	Near-field	QUL-LNF1	Exposed	24-Aug-22	1	1.6	TSB	21.660	8.92	101.4	8.06	87.2	21.744	8.93	101.7	8.07	87.0
				24-Aug-22	2	2.5	TSB	21.678	8.94	101.8	8.08	86.9	21.811	8.95	102.0	8.07	86.8
				24-Aug-22	3	2.1	TSB	21.681	8.90	101.1	8.05	87.3	21.705	8.90	101.2	8.05	87.2
				24-Aug-22	4	1.7	TSB	21.642	8.89	101.0	8.06	87.2	21.660	8.87	100.8	8.09	87.2
				24-Aug-22	5	1.5	TSB	21.703	8.91	101.4	8.15	87.3	21.694	8.91	101.3	8.16	87.1
Quesnel Lake Deep	Near-field	QUL-PNF	Exposed	26-Aug-22	1	113	8.3	20.978	8.79	98.1	8.16	91.0	4.539	11.24	86.9	7.69	103.4
				26-Aug-22	2	112	7.3	21.073	8.77	98.1	8.16	90.8	4.539	11.24	86.9	7.69	103.4
				27-Aug-22	3	110	6.5	20.199	8.80	96.6	8.15	89.7	4.700	11.18	86.9	7.68	106.0
				27-Aug-22	4	112	7.0	19.267	9.36	100.9	8.10	91.5	4.561	11.20	86.8	7.69	103.5
				27-Aug-22	5	110	8.5	19.893	8.85	96.7	8.03	90.6	4.551	11.19	86.7	7.70	103.3

Notes: TSB = to substrate bed material, "-" = not available.

Table A.1.3: **Plankton Monitoring Sampling Methods and Locations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) and for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, June to August 2022**

Area	Station ID	Date	Time (24 hr)	UTM (NAD 83, 10U)		Station Total Depth (m)	Secchi Depth (m)	Temperature	Dissolved Oxygen		Conductivity	Specific Conductance	pH	Phytoplankton Community and Productivity	Zooplankton					Water Quality
														DI Sampler Depth (m)	Community	Tissue				
				Easting	Northing			°C	mg/L	%	µS/cm	µS/cm	pH units		Tow Depth (m)	Haul Type	Tow Depth (m)	# of Hauls	Time (min)	DI Sample? (Y/N)
Bootjack Lake (Reference)	BOL-B2-1	21-Jun-2022	14:25	591256	5821677	17.9	4.0	11.554	8.77	80.6	71.6	97.0	7.54	11.5	15.0	Vertical	15.0	1	-	Y
	BOL-B2-1	26-Jul-2022	08:30	591252	5821630	19.7	5.6	14.183	7.32	71.4	73.3	92.2	7.68	12.0	16.0	Vertical	15.5[a]	2	-	Y[c]
	BOL-B2-2	26-Jul-2022	10:40	591239	5821692	19.6	5.9	15.680	7.64	76.9	76.6	92.2	7.59	11.5	14.0	Vertical	14.0	2	-	N
	BOL-B2-3	26-Jul-2022	11:30	591259	5821749	15.4	5.4	14.800	7.16	70.6	74.2	92.6	7.31	11.5	11.5	Vertical	11.0[c]	3	-	N
	BOL-B2-4	26-Jul-2022	12:45	591312	5821796	11.0	6.6	16.380	8.13	83.0	77.8	93.1	7.77	10.0	10.0	Vertical	10.0	2	-	N
	BOL-B2-5	26-Jul-2022	14:00	591333	5821568	16.0	4.7	15.240	7.29	72.7	74.1	91.7	7.48	11.5	12.0	Vertical	12.0	2	-	N
	BOL-B2-1	28-Aug-2022	8:10	591256	5821677	18.5	4.8	14.000	6.32	61.4	68.1	86.2	7.47	12.0	14.0	Vertical	14.0	2	-	Y
Polley Lake (Exposed)	POL-P2-1	21-Jun-2022	12:00	595346	5821859	29.6	4.5	11.679	9.66	89.1	186.1	249.1	7.64	11.5	26.0	Vertical	26.0	2	-	Y
	POL-P2-1	25-Jul-2022	11:56	595173	5822030	28.0	4.3	16.107	8.62	87.7	193.0	232.0	8.10	12.0[c]	26.0	Vertical	26.0	1	-	Y[c]
	POL-P2-2	25-Jul-2022	13:30	595377	5822077	26.0	4.3	17.030	8.57	88.7	197.0	232.5	8.18	11.5	24.0	Vertical	24.0	1	-	N
	POL-P2-3	25-Jul-2022	14:25	595436	5821798	27.5	4.0	17.120	8.55	88.7	198.3	233.4	8.12	11.5	24.5	Vertical	25.0	1	-	N
	POL-P2-4	25-Jul-2022	15:00	594869	5822411	25.5	4.3	17.980	8.55	90.3	203.3	234.1	8.19	11.5	23.5	Vertical	23.5	1	-	N
	POL-P2-5	25-Jul-2022	15:45	595134	5821976	23.0	4.2	17.670	8.58	90.0	191.3	231.9	8.23	11.5	21.5	Vertical	21.5	1	-	N
	POL-P2-1	25-Aug-2022	10:55	595346	5821859	31.0	6.0	16.222	8.40	85.8	178.5	214.1	8.12	12.0	26.0	Vertical	26.0	2	-	Y
Quesnel Lake (Reference)	QUL-ZOO-7-1	22-Jun-2022	11:00	612448	5816654	84.5	2.5	9.590	10.83	95.1	68.0	96.3	7.67	12.0	33.0	Horizontal	33.0	1	5	Y
	QUL-ZOO-7-1	27-Jul-2022	09:00	612427	5816677	75.8	5.0	16.070	9.92	100.5	74.4	89.7	7.28	11.0	33.0	Horizontal	33.0	1	5	Y[c]
	QUL-ZOO-7-2	27-Jul-2022	10:30	612087	5816568	82.9	4.2	15.450	10.13	101.2	63.1	89.0	7.76	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-7-3	27-Jul-2022	11:15	612568	5816302	161	4.9	15.300	10.12	100.5	71.6	88.2	7.94	11.0	33.0	Horizontal	33.0	1	5	N
	QUL-ZOO-7-4	27-Jul-2022	11:45	612621	5816968	44.3	5.8	15.510	10.22	102.5	71.7	87.3	7.95	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-7-5	27-Jul-2022	12:36	612220	5816796	64.0	5.1	15.750	10.20	102.9	72.9	88.4	7.93	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-7-1	28-Aug-2022	12:45	612448	5816654	79.3	-	13.720	10.02	96.5	70.4	89.7	7.86	11.5	33.0	Horizontal	33.0	1	5	Y
Quesnel Lake (Exposed)	QUL-ZOO-1-1	22-Jun-2022	11:00	601053	5819934	94.0	4.0	9.741	11.02	97.0	75.1	105.5	7.85	11.5[c]	33.0	Horizontal	33.0[c]	1	5	Y[c]
	QUL-ZOO-1-1	27-Jul-2022	13:40	601062	5819924	99.9	5.9	14.710	10.41	102.5	70.8	88.9	7.98	11.0	33.0	Horizontal	33.0	1	4	Y[c]
	QUL-ZOO-1-2	27-Jul-2022	14:45	601282	5819755	60.0	6.6	15.990	10.33	103.3	73.6	88.9	7.94	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-1-3	28-Jul-2022	07:20	600975	5819623	115	4.8	14.630	10.37	101.6	71.0	88.7	-[b]	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-1-4	28-Jul-2022	08:10	600786	5819932	114	4.8	14.880	10.45	103.3	70.4	87.6	-[b]	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-1-5	28-Jul-2022	08:50	600945	5820229	84.0	6.1	14.960	10.34	102.4	70.1	87.1	-[b]	11.0	33.0	Horizontal	33.0	1	4	N
	QUL-ZOO-1-1	28-Aug-2022	11:10	601053	5819934	98.0	8.0	14.190	10.04	97.8	71.2	89.7	7.90	11.5	33.0	Horizontal	33.0[c]	1	10	Y[c]

Notes: "-" = no data available, Y = Yes, N = No. DI = Depth-Integrated. Measurement increments on Secchi disk rope were more precise in July (to nearest 0.10 m) than in June and August (to nearest 0.5 m).

[a] Zooplankton tissue hauls for BOL-B2-1 in July were collected at a depth of 16 m (Haul #1) and 15 m (Haul #2), as the first haul potentially had some suspended sediment present. The presented depth is a mean of these two haul depths.

[b] pH not recorded due to probe malfunction.

[c] Field duplicate sample collected at this station. For phytoplankton sampling, the duplicate identified was a chlorophyll-a productivity sample, for zooplankton tissue it was a split duplicate zooplankton tissue sample, and for water quality sampling it was a split duplicate water quality sample.

Table A.1.4: Habitat Information Associated with Fish Population Monitoring in Polley Lake, September 2022

Station ID		Exposed
		Polley Lake
Date Sampled		26-Sep-22
UTM (NAD83, Zone 10U)	Easting	595166
	Northing	5822183
Habitat Characteristics		
Surrounding Land Use		Mining, recreational
Riparian Vegetation (decreasing dominance)		Alder, cedar, spruce, grasses, reeds
Evidence of Anthropogenic Disturbances		Mining, access road, water intake pipe, public boat launch
Aquatic Vegetation	% Emergent	5
	% Submergent	15
	% Floating	5
	% Attached Algae	10
Shoreline (% area coverage)	% Bedrock	0
	% Boulder	0
	% Cobble	5
	% Gravel	5
	% Sand / Finer	75
	% Organic Debris	15
Littoral Substrate (% area coverage)	% Bedrock	0
	% Boulder	0
	% Cobble	5
	% Gravel	5
	% Sand / Finer	75
	% Organic Debris	15

Note: Littoral assessment largely based on shoreline observations, as majority of lake could not be observed.

Table A.1.5: Habitat Information Associated with Fish Tissue Collections in Quesnel Lake, October 2022

Station ID		Reference		Exposed	
		East Arm	Near Grain Creek	Near Hazeltine Creek	Near Cedar Point
Date Sampled		4-Oct-22	6-Oct-22	4-Oct-22	3-Oct-22
UTM (NAD83, Zone 10U)	Easting	677255	633132	602368	598832
	Northing	5832530	5828731	5817479	5827205
Habitat Characteristics					
Surrounding Land Use		Forest	Burned forest	Mining, residential	Residential, recreational
Riparian Vegetation (decreasing dominance)		Shrubs, mixed forest	Mixed forest, cottonwood, cedar	Spruce, cottonwood, fir, cedar, birch	Spruce, cedar, birch, fir, alder
Evidence of Anthropogenic Disturbances		Fishing cabin	Recent fire	Mining, boat traffic	Boat traffic
Aquatic Vegetation	% Emergent	0	0	0	0
	% Submergent	0	10	5	5
	% Floating	0	0	0	0
	% Attached Algae	0	0	0	0
Shoreline (% area coverage)	% Bedrock	0	0	0	0
	% Boulder	0	0	0	0
	% Cobble	5	20	5	10
	% Gravel	45	70	25	80
	% Sand / Finer	40	5	70	10
	% Organic Debris	10	5	0	0
Littoral Substrate (% area coverage)	% Bedrock	0	0	0	0
	% Boulder	0	0	0	0
	% Cobble	5	25	0	5
	% Gravel	5	65	5	30
	% Sand / Finer	90	10	70	35
	% Organic Debris	0	0	25	30

APPENDIX A.2
CREEKS



Figure A.2.1: Representative Periphyton Coverage at FPC-R3 (Frypan Creek, Reference; top panel) and EDC-U (Upper Edney Creek, Reference; bottom panel), August 2022



Figure A.2.1: Representative Periphyton Coverage at HAC-R1 (Upper Hazeltine Creek, Reach 1, Exposed; top panel) and HAC-U (Upper Hazeltine Creek, Reach 2, Exposed; bottom panel), August 2022



Figure A.2.1: Representative Periphyton Coverage at Station HAC-R3 (Upper Hazeltine Creek, Reach 3; Exposed; top panel) and HAC-D (Lower Hazeltine Creek; Exposed; bottom panel), August 2022



Figure A.2.1: Representative Periphyton Coverage at EDC-D (Lower Edney Creek, Reference; top panel) and E1 (Lower Edney Creek, Exposed; bottom panel), August 2022

Table A.2.1: Supporting Measures and Sampling Locations for Sediment Monitoring for Upper (HAC-R1, HAC-U; Exposed) and Lower (HAC-D; Exposed) Hazeltine Creek and Upper (EDC-U; Reference) and Lower (EDC-D; Reference) Edney Creek, August 2022

Station ID		Reference					Exposed				
		Upper Edney Creek					Upper Hazeltine Creek				
		EDC-U					HAC-U				
		EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	HAC-U-1	HAC-U-2	HAC-U-3	HAC-U-4	HAC-U-5
Date Sampled		7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22
UTM (NAD83, 10U)	Easting	597938	597980	598009	598002	597994	596351	596414	596481	596623	596668
	Northing	5814539	5814582	5814647	5814676	5814704	5819526	5819484	5819414	5819303	5819259
Sediment Quality Measures											
Sampling Device		Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon
Grabs in Composite		>20	>20	>20	>20	>20	>20	>20	>20	>20	>20
Sample Stratum (cm)		0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3

Table A.2.1: Supporting Measures and Sampling Locations for Sediment Monitoring for Upper (HAC-R1, HAC-U; Exposed) and Lower (HAC-D; Exposed) Hazeltine Creek and Upper (EDC-U; Reference) and Lower (EDC-D; Reference) Edney Creek, August 2022

Station ID		Reference					Exposed				
		Lower Edney Creek					Lower Hazeltine Creek				
		EDC-D					HAC-D				
		EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5
Date Sampled		3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22
UTM (NAD83, 10U)	Easting	601040	601110	601108	601120	601163	601189	601300	601400	601428	601515
	Northing	5816765	5816767	5816742	5816733	5816817	5817168	5817131	5817134	5817133	5817183
Sediment Quality Measures											
Sampling Device		Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon	Spoon
Grabs in Composite		>20	>20	>20	>20	>20	>20	>20	>20	>20	>20
Sample Stratum (cm)		0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3

Table A.2.2: Habitat Information Associated with Biological Monitoring for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID		Upper Creek Areas					Lower Creek Areas		
		Reference		Exposed			Reference	Exposed	
		Frypan Creek (Reach 3)	Edney Creek	Hazeltine Creek (Reach 1)	Hazeltine Creek (Reach 2)	Hazeltine Creek (Reach 3)	Edney Creek	Hazeltine Creek	Edney Creek
		FPC-R3	EDC-U	HAC-R1	HAC-U	HAC-R3	EDC-D	HAC-D	E1
Date Sampled		9-Aug-22	7-Aug-22	10-Aug-22	6-Aug-22	10-Aug-22	4-Aug-22	5-Aug-22	5-Aug-22
UTM (NAD83, 10U)	Easting	592419	597948	595737	596331	597435	601022	600800	601315
	Northing	5826720	5814503	5820098	5819541	5818500	5816625	5817300	5817002
Length of Reach Assessed (m)		25	40	20	30	25	60	40	90
Channel Measurements	Bankfull Width (m)	2.4	6.7	6.9	4.8	5.4	8.70	4.80	14.7
	Wetted Width (m)	1.3	3.3	4.8	3.3	3.5	4.60	2.95	4.00
	Mean depth (cm)	10	14	18	2.1	17	15	17	14
	Maximum depth (cm)	13	38	34	75	83	93	38	31
	Gradient (%)	2	3.0	3	1	2	2	3.0	1
Residual (refuge) pool depth (cm)		7.0	30	36	60	50	93	63	31
Anthropogenic Disturbances		None	Bridge upstream of stations 2 through 8	Mine upstream; remediated channel from breach	Mine upstream; remediated channel from breach	Mine upstream; remediated channel from breach	None	Remediated creek channel; public road	Mining; remediated channel from breach; public road
Weather notes		Clear, hot	Clear, sunny, warm	Clear	Warm, partly cloudy	Clear	Steady rain	Overcast, warm	Warm, partly cloudy
Other instream features		LWD overhanging creek (>1 m from water surface)	-	-	Anchored LWD and root wads	-	LWD jams at side of channel; LWD cover	Sand and fines accumulation in pools	Point gravel bar
Bank Stability		Stable	Moderate	Stable	Moderate	-	Moderate	Moderate	Stable
Water Colour & Clarity		Clear, colourless	Clear, colourless	Clear	Clear, colourless	Clear	Clear, colourless	Clear	Clear, colourless
General Morphology	% Pool / Back Eddy	0	20	50	70	0	30	40	0
	% Riffle	15	10	40	20	20	40	60	50
	% Run	85	70	10	10	80	30	0	50
Substrate	% Bedrock	0	0	0	0	0	0	0	0
	% Boulder	0	0	20	5	5	10	10	10
	% Cobble	10	40	70	40	75	60	30	50
	% Gravel	30	50	10	30	20	30	30	30
	% Sand / Finer	60	10	0	25	0	10	30	10
	% Organic	-	-	-	-	-	-	-	-
Instream Cover	% Undercut banks	10	5	0	0	0	5	0	0
	% Boulder	0	0	5	5	5	<5	15	5
	% Woody debris	0	5	10	10	20	<5	5	0
	% Deep pool	0	10	20	15	5	10	5	5
	% Macrophytes	0	0	0	<5	0	0	0	0
	% Other	30 (OV)	15 (OV)	0	-	-	-	-	-
Riparian Vegetation (most dominant first)		Devil's club, alder, young cedar	Alder, dogwood	Willow, alder	-	Alder (90%)	Alder, willow, cedar	Grasses, small shrubs and plantings	Willow, alder, young cedar
Aquatic Vegetation	% Emergent	0	0	1 (Cattail)	0	0	0	0	0
	% Submergent	0	0	0	0	0	0	0	0
	% Floating	0	0	0	0	<2 (Water buttercup)	0	0	0
	% Attached algae (Type)	<5 (Brown periphyton)	<5 (Brown periphyton)	5 (Green periphyton)	0	Sparse (Periphyton)	0	<5	<5
Canopy Coverage (%)	Dense	40	60	0	0	0	20	0	0
	Partially Open	40	20	0	0	0	40	0	0
	Open	20	20	100	100	100	40	100	100
Surrounding land use		Forest	Forest; some logging in area	Mining, logging	Mining, logging	Mining, forest	Logging upstream, forest in immediate area	Mining, remediated area	Mining, forest

Notes: m = meters. cm = centimeters. "-" = no data available. LWD = large woody debris. OV = overhanging vegetation. Pool depth may exceed mean channel depth.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Reference				
			Frypan Creek				
			FPC-R3				
			FPC-R3-1	FPC-R3-2	FPC-R3-3	FPC-R3-4	FPC-R3-5
Biological Sampling		Date	9-Aug-22	9-Aug-22	9-Aug-22	9-Aug-22	9-Aug-22
UTM (NAD83, 10U)		Easting	592265	592360	592400	592419	592466
		Northing	5826883	5826844	5826751	5826720	5826708
Periphyton	**Productivity & Community**						
	Sample Collection Type		AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a
	Surface Area Sampled (m^2)		0.002	0.002	0.002	0.002	0.002
	Water Depth (cm)		6.0	9.0	11.0	8.0	4.0
	Water Velocity (m/s)		0.113	0.203	0.0150	0.113	0.192
Benthic Invertebrate	**Productivity & Community**						
	Sampling Device (and size, cm)		Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)
	Mesh Size (µm)		250	250	250	250	250
	Grabs in Composite		3	3	3	3	3
	Mean Water Depth (cm)		7.7	6.0	7.0	6.7	5.3
	Mean Water Velocity (m/s)		0.175	0.244	0.222	0.295	0.209
	Average Depth Sampler is Pushed into Substrate (cm)		4	4	5	4	3
	Average Depth Which Substrate is Sampled (cm)		7	6	7	6	5
	Average Sampling Time per Grab (min)		9	8	7	8	9
	Sample Texture	% Cobble	70	80	60	70	80
		% Gravel	20	20	40	30	20
		% Sand and Finer	10	0	0	0	0
		% Organic	0	0	0	0	0
	Macrophytes		None	None	None	None	None
	Algae		Sparse	Sparse	Sparse	Sparse	Sparse
	Macrophyte / Algae Type / Species		-	Periphyton	Periphyton	Periphyton	Periphyton
	Tissue Chemistry						
	Taxa (Composite Samples)		-	-	-	-	-
	Taxa (Single-Taxon Samples)		-	-	-	-	-
Water Quality Measures	Temperature	°C	16.3	14.4	13.4	12.7	12.0
	Dissolved Oxygen	mg/L	4.57	5.96	7.79	8.12	8.76
		%	46.6	58.6	74.8	76.7	79.4
	pH	pH units	7.22	7.26	7.71	7.64	7.69
	Conductance	µS/cm	124.9	123.8	125.5	123.4	56.0
	Specific Conductance	µS/cm	149.7	155.4	161.1	161.2	161.3

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Reference							
			Upper Edney Creek							
			EDC-U[a]							
			EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-6	EDC-U-7	EDC-U-8
Biological Sampling		Date	8-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22
UTM (NAD83, 10U)		Easting	597935	597948	597941	597965	597986	598008	597996	597994
		Northing	5814447	5814503	5814556	5814574	5814604	5814642	5814688	5814704
Periphyton	**Productivity & Community**									
	Sample Collection Type		AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		0.002	0.002	0.002	0.002	0.002	-	-	-
	Water Depth (cm)		15.0	11.0	10.0	9.0	10.0	-	-	-
	Water Velocity (m/s)		0.211	0.197	0.210	0.339	0.103	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	Surber (30 cm x 30 cm)	-	-	-
	Mesh Size (µm)		250	250	250	250	250	-	-	-
	Grabs in Composite		3	3	3	3	3	-	-	-
	Mean Water Depth (cm)		14.3	9.3	10.7	12.0	13.7	-	-	-
	Mean Water Velocity (m/s)		0.290	0.403	0.377	0.324	0.302	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		4	3	5	3	3	-	-	-
	Average Depth Which Substrate is Sampled (cm)		7	5	7	10	10	-	-	-
	Average Sampling Time per Grab (min)		7	8	8	8	8	-	-	-
	Sample Texture	% Cobble	90	30	80	25	30	-	-	-
		% Gravel	10	60	20	65	60	-	-	-
		% Sand and Finer	0	10	0	10	10	-	-	-
		% Organic	0	0	0	0	0	-	-	-
	Macrophytes		None	None	None	None	None	-	-	-
	Algae		Sparse	Sparse	Sparse	None	None	-	-	-
	Macrophyte / Algae Type / Species		Brown periphyton	Brown periphyton	Brown periphyton	-	-	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		Caddisfly, Mayfly and Stonefly	Stonefly	Caddisfly, Mayfly, Stonefly	Stonefly, Mayfly, Caddisfly	Stonefly, Mayfly, Caddisfly	Stonefly, Mayfly	Stonefly, Mayfly, Caddisfly	Stonefly, Mayfly, Caddisfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	13.1	16.0	15.9	15.0	13.9	12.8	12.3	12.2
	Dissolved Oxygen	mg/L	8.05	8.55	8.65	8.56	8.72	8.69	8.49	8.77
		%	76.6	86.7	87.4	84.9	84.5	82.0	79.5	81.9
	pH	pH units	7.58	7.67	7.72	7.59	7.61	7.57	7.51	7.56
	Conductance	µS/cm	96.4	91.8	103.9	102.0	57.2	96.9	95.7	95.3
	Specific Conductance	µS/cm	125.2	111.1	125.9	126.2	69.5	126.3	126.1	126.0

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Exposed							
			Upper Hazeltine Creek (Reach 1)							
			HAC-R1							
			HAC-R1-1	HAC-R1-2	HAC-R1-3	HAC-R1-4	HAC-R1-5	HAC-R1-6	HAC-R1-7	HAC-R1-8
Biological Sampling		Date	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22
UTM (NAD83, 10U)		Easting	595751	595756	595693	595694	595737	595798	595835	595862
		Northing	5820278	5820256	5820188	5820147	5820098	5820033	5820022	5820015
Periphyton	**Productivity & Community**									
	Sample Collection Type		AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		0.002	0.002	0.002	0.002	0.002	-	-	-
	Water Depth (cm)		46.0	37.0	40.0	40.0	26.0	-	-	-
	Water Velocity (m/s)		0.251	0.309	0.147	0.194	0.179	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	-	-	-
	Mesh Size (µm)		250	250	250	250	250	-	-	-
	Grabs in Composite		3	3	3	3	3	-	-	-
	Mean Water Depth (cm)		21.3	35.3	27.3	31.3	28.7	-	-	-
	Mean Water Velocity (m/s)		0.423	0.407	0.397	0.297	0.330	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		5	5	5	5	5	-	-	-
	Average Depth Which Substrate is Sampled (cm)		7	8	10	10	8	-	-	-
	Average Sampling Time per Grab (min)		7	8	8	7	8	-	-	-
	Sample Texture	% Cobble	40	25	30	15	70	-	-	-
		% Gravel	60	75	70	80	30	-	-	-
		% Sand and Finer	0	0	0	5	0	-	-	-
		% Organic	0	0	0	0	0	-	-	-
	Macrophytes		None	None	None	None	None	-	-	-
	Algae		Sparse	Sparse	Sparse	Sparse	Sparse	-	-	-
	Macrophyte / Algae Type / Species		Green and brown Periphyton	Periphyton	Green and brown Periphyton	Green and brown Periphyton	Periphyton	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		Caddisfly, Oligochaete, Mayfly	Caddisfly, Amphipod, Oligochaete	Caddisfly, Amphipod, Mayfly	Caddisfly, Diptera, Oligochaete	Caddisfly, Mayfly, Oligochaete	Caddisfly, Mayfly	Caddisfly, Mayfly, Stonefly	Tipulidae, Mayfly, Caddisfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	20.5	20.4	20.3	20.2	19.9	20.0	19.9	19.7
	Dissolved Oxygen	mg/L	9.42	10.30	10.17	10.03	8.85	8.10	7.54	8.30
		%	102.1	114.1	112.4	110.8	97.2	88.5	82.5	90.8
	pH	pH units	8.79	8.81	8.54	8.54	8.53	8.52	8.32	8.34
	Conductance	µS/cm	226.7	226.9	226.4	-	225.5	198.3	225.7	225.2
	Specific Conductance	µS/cm	248.3	248.7	248.8	249.1	249.9	219.3	250.4	250.4

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Exposed							
			Upper Hazeltine Creek (Reach 2)							
			HAC-U							
			HAC-U-1	HAC-U-2	HAC-U-3	HAC-U-4	HAC-U-5	HAC-U-6	HAC-U-7	HAC-U-8
Biological Sampling		Date	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	5-Aug-22	6-Aug-22	5-Aug-22
UTM (NAD83, 10U)		Easting	596331	596397	596480	596602	596668	596687	596717	596744
		Northing	5819543	5819501	5819433	5819302	5819259	5819230	5819203	5819194
Periphyton	**Productivity & Community**									
	Sample Collection Type		AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	AFDM, Chlorophyll-a, Community, Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		0.002	0.002	0.002	0.002	0.002	-	-	-
	Water Depth (cm)		37.0	37.0	34.0	31.0	25.0	-	-	-
	Water Velocity (m/s)		0.331	0.270	0.345	0.703	0.652	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	-	-	-
	Mesh Size (µm)		250	250	250	250	250	-	-	-
	Grabs in Composite		3	3	3	3	3	-	-	-
	Mean Water Depth (cm)		24.7	24.7	33.0	31.0	31.3	-	-	-
	Mean Water Velocity (m/s)		0.433	0.415	0.458	0.528	0.406	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		5	5	5	5	5	-	-	-
	Average Depth Which Substrate is Sampled (cm)		10	10	5	10	10	-	-	-
	Average Sampling Time per Grab (min)		8	8	8	10	7	-	-	-
	Sample Texture	% Cobble	25	30	20	20	50	-	-	-
		% Gravel	70	60	70	70	40	-	-	-
		% Sand and Finer	5	10	10	10	10	-	-	-
		% Organic	0	0	0	0	0	-	-	-
	Macrophytes		None	None	None	None	None	-	-	-
	Algae		None	None	None	None	None	-	-	-
	Macrophyte / Algae Type / Species		-	-	-	-	-	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		-	Snail, Caddisfly	Snail, Caddisfly, Amphipod	Snail, Caddisfly, Mayfly	Snail, Caddisfly	Caddisfly, Snail, Mayfly	Snail, Caddisfly	Caddisfly, Snail, Mayfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	19.5	18.9	18.1	16.5	16.2	19.4	16.0	19.5
	Dissolved Oxygen	mg/L	7.92	8.10	8.23	8.00	7.35	7.63	7.85	7.42
		%	86.2	87.2	87.1	82.0	74.9	83.0	79.5	80.9
	pH	pH units	8.40	8.37	8.32	8.17	8.10	8.46	8.03	8.51
	Conductance	µS/cm	245.0	241.3	237.1	230.3	229.1	243.4	228.4	243.9
	Specific Conductance	µS/cm	273.8	273.3	273.5	274.8	275.3	272.4	276.0	272.5

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Exposed				
			Upper Hazeltine Creek (Reach 3)				
			HAC-R3				
			HAC-R3-1	HAC-R3-2	HAC-R3-3	HAC-R3-4	HAC-R3-5
Biological Sampling		Date	10-Aug-22	10-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22
UTM (NAD83, 10U)		Easting	597368	597485	598043	598120	598634
		Northing	5818703	5810500	5817747	5817691	5817350
Periphyton	**Productivity & Community**						
	Sample Collection Type		AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a	AFDM, Chlorophyll-a
	Surface Area Sampled (m^2)		0.002	0.002	0.002	0.002	0.002
	Water Depth (cm)		33.0	28.0	19.0	29.0	20.0
	Water Velocity (m/s)		0.281	0.272	0.420	0.508	0.300
Benthic Invertebrate	**Productivity & Community**						
	Sampling Device (and size, cm)		Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)	Hess (0.1m^2)
	Mesh Size (µm)		250	250	250	250	250
	Grabs in Composite		3	3	3	3	3
	Mean Water Depth (cm)		25.0	26.7	22.7	22.3	23.0
	Mean Water Velocity (m/s)		0.384	0.472	0.563	0.496	0.469
	Average Depth Sampler is Pushed into Substrate (cm)		5	5	5	7	6
	Average Depth Which Substrate is Sampled (cm)		10	10	9	10	10
	Average Sampling Time per Grab (min)		8	8	7	8	7
	Sample Texture	% Cobble	90	90	80	70	60
		% Gravel	10	10	20	30	40
		% Sand and Finer	0	0	0	0	0
		% Organic	0	0	0	0	0
	Macrophytes		None	None	None	None	None
	Algae		Sparse	Sparse	Sparse	Sparse	Sparse
	Macrophyte / Algae Type / Species		Periphyton	Periphyton	Green and brown periphyton	Brown periphyton	Periphyton
	Tissue Chemistry						
	Taxa (Composite Samples)		-	-	-	-	-
	Taxa (Single-Taxon Samples)		-	-	-	-	-
Water Quality Measures	Temperature	°C	17.9	17.1	20.1	20.2	20.3
	Dissolved Oxygen	mg/L	7.15	8.24	7.52	7.43	7.67
		%	80.9	85.6	84.0	81.6	85.0
	pH	pH units	8.24	8.22	8.63	8.37	8.50
	Conductance	µS/cm	240.0	236.1	253.9	253.3	255.6
	Specific Conductance	µS/cm	277.7	277.7	280.2	279.2	280.7

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Reference							
			Lower Edney Creek							
			EDC-D							
			EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-6	EDC-D-7	EDC-D-8
Biological Sampling		Date	4-Aug-22	4-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22
UTM (NAD83, 10U)		Easting	601022	601016	601024	601027	601058	601119	601119	601169
		Northing	5816625	5816686	5816731	5816766	5816766	5816735	5816761	5816817
Periphyton	**Productivity & Community**									
	Sample Collection Type		Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		-	-	-	-	-	-	-	-
	Water Depth (cm)		-	-	-	-	-	-	-	-
	Water Velocity (m/s)		-	-	-	-	-	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		-	-	-	-	-	-	-	-
	Mesh Size (µm)		-	-	-	-	-	-	-	-
	Grabs in Composite		-	-	-	-	-	-	-	-
	Mean Water Depth (cm)		-	-	-	-	-	-	-	-
	Mean Water Velocity (m/s)		-	-	-	-	-	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		-	-	-	-	-	-	-	-
	Average Depth Which Substrate is Sampled (cm)		-	-	-	-	-	-	-	-
	Average Sampling Time per Grab (min)		-	-	-	-	-	-	-	-
	Sample Texture	% Cobble	-	-	-	-	-	-	-	-
		% Gravel	-	-	-	-	-	-	-	-
		% Sand and Finer	-	-	-	-	-	-	-	-
		% Organic	-	-	-	-	-	-	-	-
	Macrophytes		-	-	-	-	-	-	-	-
	Algae		-	-	-	-	-	-	-	-
	Macrophyte / Algae Type / Species		-	-	-	-	-	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		Stonefly, Mayfly, Caddisfly	Stonefly, Mayfly	Stonefly, Mayfly, Caddisfly	Stonefly, Caddisfly	Stonefly, Caddisfly	Stonefly, Caddisfly	Mayfly, Caddisfly	Stonefly, Mayfly, Caddisfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	12.1	12.1	14.2	14.3	14.4	14.6	14.6	14.6
	Dissolved Oxygen	mg/L	10.58	10.36	8.82	9.47	9.34	9.99	10.19	9.51
		%	98.4	96.4	86.0	92.0	91.5	97.7	100.6	93.3
	pH	pH units	8.10	8.10	8.16	8.19	8.21	8.31	8.27	8.22
	Conductance	µS/cm	199.2	198.7	230.2	230.9	230.6	232.6	233.9	230.8
	Specific Conductance	µS/cm	264.5	263.6	290.0	290.3	289.4	290.5	291.2	288.0

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Exposed							
			Lower Edney Creek							
			E1							
			E1-1	E1-2	E1-3	E1-4	E1-5	E1-6	E1-7	E1-8
Biological Sampling		Date	5-Aug-22	5-Aug-22	5-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22
UTM (NAD83, 10U)		Easting	601315	601338	601399	601432	601466	601537	601561	601586
		Northing	5817002	5817014	5817070	5817078	5817121	5817137	5817176	5817227
Periphyton	**Productivity & Community**									
	Sample Collection Type		Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		-	-	-	-	-	-	-	-
	Water Depth (cm)		-	-	-	-	-	-	-	-
	Water Velocity (m/s)		-	-	-	-	-	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		-	-	-	-	-	-	-	-
	Mesh Size (µm)		-	-	-	-	-	-	-	-
	Grabs in Composite		-	-	-	-	-	-	-	-
	Mean Water Depth (cm)		-	-	-	-	-	-	-	-
	Mean Water Velocity (m/s)		-	-	-	-	-	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		-	-	-	-	-	-	-	-
	Average Depth Which Substrate is Sampled (cm)		-	-	-	-	-	-	-	-
	Average Sampling Time per Grab (min)		-	-	-	-	-	-	-	-
	Sample Texture	% Cobble	-	-	-	-	-	-	-	-
		% Gravel	-	-	-	-	-	-	-	-
		% Sand and Finer	-	-	-	-	-	-	-	-
		% Organic	-	-	-	-	-	-	-	-
	Macrophytes		-	-	-	-	-	-	-	-
	Algae		-	-	-	-	-	-	-	-
	Macrophyte / Algae Type / Species		-	-	-	-	-	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		Stonefly, Tipulidae, Mayfly	Mayfly, Diptera	Tipulidae, Stonefly, Mayfly	Mayfly, Stonefly, Caddisfly	Tipulidae, Stonefly, Caddisfly	Caddisfly, Stonefly, Tipulidae	Mayfly, Stonefly, Caddisfly	Stonefly, Mayfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	12.0	11.8	11.8	14.6	13.9	14.3	14.3	13.7
	Dissolved Oxygen	mg/L	9.30	9.81	8.96	9.11	9.06	9.56	9.59	9.68
		%	86.3	90.3	82.9	89.6	87.8	93.4	93.6	92.8
	pH	pH units	8.34	8.19	8.16	8.28	8.23	8.22	8.20	8.13
	Conductance	µS/cm	-	168.9	174.6	210.9	205.2	210.2	211.1	207.3
	Specific Conductance	µS/cm	214.4	225.5	233.5	263.5	260.6	264.4	265.3	264.5

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.3: Supporting Measures and Locations for Biological Sample Collection for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Station ID			Exposed							
			Lower Hazeltine Creek							
			HAC-D							
			HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5	HAC-D-6	HAC-D-7	HAC-D-8
Biological Sampling		Date	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22
UTM (NAD83, 10U)		Easting	600800	600928	601081	601189	601300	601391	601428	601517
		Northing	5817300	5817290	5817225	5817168	5817131	5817130	5817133	5817189
Periphyton	**Productivity & Community**									
	Sample Collection Type		Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry	Tissue Chemistry
	Surface Area Sampled (m^2)		-	-	-	-	-	-	-	-
	Water Depth (cm)		-	-	-	-	-	-	-	-
	Water Velocity (m/s)		-	-	-	-	-	-	-	-
Benthic Invertebrate	**Productivity & Community**									
	Sampling Device (and size, cm)		-	-	-	-	-	-	-	-
	Mesh Size (µm)		-	-	-	-	-	-	-	-
	Grabs in Composite		-	-	-	-	-	-	-	-
	Mean Water Depth (cm)		-	-	-	-	-	-	-	-
	Mean Water Velocity (m/s)		-	-	-	-	-	-	-	-
	Average Depth Sampler is Pushed into Substrate (cm)		-	-	-	-	-	-	-	-
	Average Depth Which Substrate is Sampled (cm)		-	-	-	-	-	-	-	-
	Average Sampling Time per Grab (min)		-	-	-	-	-	-	-	-
	Sample Texture	% Cobble	-	-	-	-	-	-	-	-
		% Gravel	-	-	-	-	-	-	-	-
		% Sand and Finer	-	-	-	-	-	-	-	-
		% Organic	-	-	-	-	-	-	-	-
	Macrophytes		-	-	-	-	-	-	-	-
	Algae		-	-	-	-	-	-	-	-
	Macrophyte / Algae Type / Species		-	-	-	-	-	-	-	-
	Tissue Chemistry									
	Taxa (Composite Samples)		Caddisfly, Stonefly, Annelids, Diptera	Tipulidae, Caddisfly, Stonefly, Diptera	Caddisfly, Diptera, Mayfly	Caddisfly, Diptera, Mayfly	Caddisfly, Mayfly	Tipulidae, Caddisfly, Mayfly	Tipulidae, Caddisfly, Mayfly	Tipulidae, Caddisfly
	Taxa (Single-Taxon Samples)		Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly	Caddisfly
Water Quality Measures	Temperature	°C	17.8	18.0	18.3	18.2	17.7	17.0	16.6	16.0
	Dissolved Oxygen	mg/L	7.56	7.30	8.07	7.75	8.03	8.45	8.69	8.55
		%	79.6	77.2	85.5	82.3	84.3	87.7	89.2	86.8
	pH	pH units	8.46	8.46	8.46	8.47	8.55	8.35	8.56	8.28
	Conductance	µS/cm	248.2	250.0	255.1	255.8	254.6	251.2	249.9	247.4
	Specific Conductance	µS/cm	287.5	288.2	292.4	293.7	296.0	296.2	297.7	299.0

Notes: "-" = not applicable, µS = micrometer, cm = centimeters, m = meters, mg/L = milligrams per liter, µS/cm = micro Siemens per centimeter, m^3/s = metres cubed per second. AFDM = ash free dry mass.

Table A.2.4: In Situ Water Quality Measures Collected during Spot Water Quality Sampling for Upper (HAC-R1, HAC-U, HAC-R3) and Lower (HAC-D) Hazeltine Creek (Exposed), Lower Edney Creek (E1; Exposed), Upper (EDC-U) and Lower (EDC-D) Edney Creek (Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Area			Area ID	Sampling Date	Temperature	Dissolved Oxygen		Specific Conductance	Conductivity	pH
					°C	mg/L	%	µS/cm	µS/cm	pH units
Upper Creek Areas	Frypan Creek[a]	Reference	FPC-R3	8-Aug-22	12.0	8.76	79.4	161.3	56.0	7.69
	Edney Creek		EDC-U	8-Aug-22	13.0	8.16	77.3	125.4	96.8	7.65
	Hazeltine Creek	Exposed	HAC-R1	8-Aug-22	17.9	7.43	78.4	247.9	214.1	8.31
			HAC-U	8-Aug-22	18.3	8.46	90.8	273.3	238.2	8.32
			HAC-R3	8-Aug-22	20.0	7.39	86.9	280.6	253.2	8.42
Lower Creek Areas	Edney Creek	Reference	EDC-D	8-Aug-22	13.1	8.85	84.3	236.9	182.9	8.18
		Exposed	E1	8-Aug-22	14.9	9.04	89.4	237.2	191.3	8.25
	Hazeltine Creek	Exposed	HAC-D	8-Aug-22	19.3	7.95	86.4	281.4	259.9	8.41

Notes: mg/L = milligrams per litre, µS/cm = microSiemens per centimetre. "-" indicates no data available.

[a] *In situ* measurements displayed are those recorded at the benthic invertebrate community monitoring station located closest to the where the water sample was collected.

Table A.2.5: Substrate Size and Embeddedness Measures Associated with Biological Monitoring for Upper Hazeltine Creek (HAC-R1, HAC-U, HAC-R3; Exposed), Upper Edney Creek (EDC-U; Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Cobble Number	Upper Creek Areas															
	Reference						Exposed									
	Frypan Creek			Edney Creek			Hazeltine Creek									
	FPC-R3			EDC-U			HAC-R1			HAC-U			HAC-R3			
	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]
1	FPC-R3-1	11.8	-	EDC-U-1	5.5	-	HAC-R1-1	10.1	-	HAC-U-1	13.0	-	HAC-R3-1	5.6	-
2		8.9	-		5.7	-		6.2	-		7.1	-		5.5	-
3		7.7	-		5.5	-		8.8	-		6.9	-		5.0	-
4		6.8	-		3.9	-		3.6	-		4.7	-		4.4	-
5		5.5	-		5.6	-		5.5	-		6.2	-		5.2	-
6		6.2	-		4.8	-		4.2	-		7.4	-		4.4	-
7		9.8	-		6.7	-		6.2	-		5.7	-		5.3	-
8		6.8	-		8.2	-		3.1	-		6.5	-		4.1	-
9		7.4	-		9.3	-		7.2	-		6.1	-		4.2	-
10		8.2	50		6.1	0		3.7	50		4.4	50		4.1	25
11		4.2	-		5.5	-		6.1	-		4.9	-		3.9	-
12		4.4	-		3.8	-		4.9	-		7.3	-		4.3	-
13		5.8	-		5.9	-		6.2	-		6.9	-		3.1	-
14		4.3	-		7.1	-		5.4	-		3.9	-		4.5	-
15		4.3	-		5.7	-		4.8	-		5.6	-		3.7	-
16		4.4	-		4.5	-		4.5	-		4.9	-		5.2	-
17		5.1	-		2.4	-		4.4	-		4.6	-		4.3	-
18		5.2	-		5.0	-		5.1	-		2.8	-		3.6	-
19		5.0	-		3.5	-		6.8	-		5.9	-		3.8	-
20		3.5	25		4.5	50		5.0	25		3.3	50		3.7	25
Minimum		**3.5**	**25**		**2.4**	**0**		**3**	**25**		**2.8**	**50.0**		**3.1**	**25**
Maximum		**11.8**	**50**		**9.3**	**50**		**10.1**	**50**		**13.0**	**50**		**5.6**	**25**
Mean		**6.3**	**38**		**5.5**	**25**		**5.6**	**38**		**5.9**	**50.0**		**4.4**	**25**
Median		**5.7**	**38**		**5.5**	**25**		**5.3**	**38**		**5.8**	**50.0**		**4.3**	**25**
Standard Deviation		**2.2**	**-**		**1.6**	**-**		**1.7**	**-**		**2.1**	**-**		**0.7**	**-**
1	FPC-R3-2	4.6	-	EDC-U-2	6.1	-	HAC-R1-2	7.8	-	HAC-U-2	6.5	-	HAC-R3-2	10.4	-
2		4.9	-		4.7	-		6.4	-		6.6	-		3.9	-
3		3.8	-		8.0	-		5.9	-		6.2	-		5.5	-
4		7.8	-		4.7	-		4.9	-		5.7	-		4.6	-
5		8.7	-		7.4	-		5.7	-		5.6	-		3.7	-
6		7.4	-		5.3	-		4.9	-		3.0	-		9.1	-
7		6.4	-		8.4	-		5.9	-		7.7	-		8.6	-
8		3.4	-		6.3	-		5.5	-		4.0	-		5.1	-
9		7.3	-		7.8	-		4.6	-		7.2	-		4.5	-
10		10.2	75		5.9	50		5.5	50		4.8	50		4.7	0
11		6.6	-		6.7	-		4.9	-		5.7	-		4.8	-
12		2.5	-		4.8	-		5.2	-		4.0	-		2.7	-
13		9.6	-		5.6	-		5.1	-		7.4	-		2.5	-
14		5.7	-		8.1	-		5.0	-		5.5	-		4.4	-
15		5.0	-		6.1	-		4.5	-		5.4	-		4.9	-
16		6.5	-		5.8	-		4.8	-		4.1	-		3.6	-
17		7.2	-		5.7	-		4.4	-		3.9	-		4.4	-
18		6.5	-		5.7	-		4.0	-		4.3	-		3.2	-
19		8.4	-		6.2	-		4.5	-		4.3	-		5.7	-
20		5.0	50		3.8	25		3.9	25		3.9	25		4.3	25
Minimum		**2.5**	**50**		**3.8**	**25**		**3.9**	**25**		**3.0**	**25**		**2.5**	**0**
Maximum		**10.2**	**75**		**8.4**	**50**		**7.8**	**50**		**7.7**	**50**		**10.4**	**25**
Mean		**6.4**	**63**		**6.2**	**37.5**		**5.2**	**38**		**5.3**	**38**		**5.0**	**13**
Median		**6.5**	**63**		**6.0**	**37.5**		**5.0**	**38**		**5.5**	**38**		**4.6**	**13**
Standard Deviation		**2.0**	**-**		**1.3**	**-**		**0.9**	**-**		**1.3**	**-**		**2.07**	**-**
1	FPC-R3-3	2.7	-	EDC-U-3	6.3	-	HAC-R1-3	5.6	-	HAC-U-3	6.1	-	HAC-R3-3	5.2	-
2		4.3	-		8.0	-		12.5	-		6.9	-		3.9	-
3		3.9	-		7.0	-		6.0	-		4.4	-		5.6	-
4		3.7	-		6.5	-		4.8	-		5.9	-		10.5	-
5		2.8	-		6.1	-		6.0	-		3.4	-		3.0	-
6		3.4	-		4.9	-		6.0	-		5.0	-		6.0	-
7		4.2	-		6.9	-		4.5	-		5.6	-		5.2	-
8		4.5	-		5.6	-		5.6	-		3.2	-		5.1	-
9		3.5	-		7.6	-		5.0	-		6.3	-		4.1	-
10		3.2	50		4.9	25		5.6	25		4.7	50		4.0	25
11		3.4	-		6.0	-		4.1	-		11.1	-		4.1	-
12		2.9	-		7.6	-		5.5	-		8.3	-		3.9	-
13		3.6	-		3.5	-		10.5	-		6.8	-		3.9	-
14		3.2	-		4.9	-		6.8	-		3.7	-		5.1	-
15		3.4	-		4.8	-		4.0	-		4.0	-		4.9	-
16		3.3	-		4.0	-		4.2	-		6.2	-		6.3	-
17		4.7	-		3.4	-		3.6	-		5.2	-		5.4	-
18		5.4	-		3.7	-		7.0	-		9.8	-		5.5	-
19		5.4	-		4.6	-		4.2	-		13.6	-		4.6	-
20		4.4	75		5.0	25		3.3	50		8.1	75		4.7	0
Minimum		**2.7**	**50**		**3.4**	**25**		**3.3**	**25**		**3.2**	**50**		**3.0**	**0**
Maximum		**5.4**	**75**		**8.0**	**25**		**12.5**	**50**		**13.6**	**75**		**10.5**	**25**
Mean		**3.8**	**63**		**5.6**	**25**		**5.7**	**38**		**6.4**	**63**		**5.1**	**13**
Median		**3.6**	**63**		**5.3**	**25**		**5.6**	**38**		**6.0**	**63**		**5.0**	**13**
Standard Deviation		**0.8**	**-**		**1.4**	**-**		**2.2**	**-**		**2.7**	**-**		**1.5**	**-**

Note: "-" = not applicable or data not collected.

[a] Intermediate axis length is measured perpendicular to the longest axis.

[b] Embeddedness measured for every tenth rock.

Table A.2.5: Substrate Size and Embeddedness Measures Associated with Biological Monitoring for Upper Hazeltine Creek (HAC-R1, HAC-U, HAC-R3; Exposed), Upper Edney Creek (EDC-U; Reference), and Frypan Creek (FPC-R3; Reference), August 2022

Cobble Number	Upper Creek Areas															
	Reference						Exposed									
	Frypan Creek			Edney Creek			Hazeltine Creek									
	FPC-R3			EDC-U			HAC-R1			HAC-U			HAC-R3			
	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]	Station	Intermediate Axis Length (cm)[a]	Embeddedness (%)[b]
1	FPC-R3-4	7.9	-	EDC-U-4	3.1	-	HAC-R1-4	3.7	-	HAC-U-4	8.4	-	HAC-R3-4	7.2	-
2		6.5	-		8.0	-		7.1	-		6.3	-		3.1	-
3		5.7	-		4.0	-		4.5	-		6.6	-		5.9	-
4		6.3	-		2.9	-		6.0	-		4.6	-		3.2	-
5		4.2	-		5.4	-		3.9	-		3.8	-		6.2	-
6		5.1	-		3.4	-		4.2	-		3.9	-		6.8	-
7		4.3	-		3.5	-		4.3	-		5.7	-		5.8	-
8		3.9	-		7.6	-		5.2	-		4.8	-		4.7	-
9		4.9	-		4.4	-		4.8	-		11.5	-		4.3	-
10		5.5	25		6.3	50		4.3	0		6.5	25		3.7	25
11		8.2	-		4.8	-		4.8	-		5.9	-		3.4	-
12		2.0	-		4.4	-		6.3	-		3.2	-		5.5	-
13		3.4	-		8.1	-		4.5	-		3.4	-		3.8	-
14		7.5	-		4.8	-		5.4	-		4.8	-		3.9	-
15		6.4	-		7.1	-		4.1	-		6.3	-		4.1	-
16		5.5	-		5.7	-		7.3	-		4.9	-		3.8	-
17		7.6	-		6.2	-		3.4	-		6.5	-		4.6	-
18		11.6	-		4.9	-		3.4	-		4.3	-		3.9	-
19		3.4	-		5.6	-		4.0	-		3.0	-		3.5	-
20		5.5	0		6.4	25		5.0	75		3.8	75		3.2	25
Minimum		**2.0**	**0**		**2.9**	**25**		**3.4**	**0**		**3.0**	**25**		**3.1**	**25**
Maximum		**11.6**	**25**		**8.1**	**50**		**7.3**	**75**		**11.5**	**75**		**7.2**	**25**
Mean		**5.8**	**13**		**5.3**	**37.5**		**4.8**	**38**		**5.4**	**50**		**4.5**	**25**
Median		**5.5**	**13**		**5.2**	**37.5**		**4.5**	**38**		**4.9**	**50**		**4.0**	**25**
Standard Deviation		**2.1**	**-**		**1.6**	**-**		**1.1**	**-**		**2.0**	**-**		**1.26**	**-**
1	FPC-R3-5	7.4	-	EDC-U-5	8.5	-	HAC-R1-5	6.0	-	HAC-U-5	10.6	-	HAC-R3-5	6.2	-
2		7.5	-		6.9	-		7.4	-		6.7	-		7.1	-
3		4.8	-		7.1	-		9.9	-		10.7	-		4.5	-
4		4.5	-		7.2	-		7.4	-		6.7	-		4.2	-
5		6.3	-		8.8	-		4.6	-		7.6	-		5.0	-
6		9.6	-		9.5	-		6.5	-		7.0	-		7.4	-
7		5.5	-		7.8	-		5.6	-		4.7	-		5.9	-
8		6.7	-		4.4	-		7.3	-		5.7	-		5.4	-
9		6.4	-		6.3	-		6.8	-		3.8	-		8.7	-
10		5.2	50		8.7	-		3.7	50		4.9	0		6.8	0
11		7.6	-		11.7	-		6.4	-		4.5	-		6.0	-
12		7.0	-		5.5	-		5.5	-		3.1	-		5.7	-
13		4.4	-		4.6	-		6.7	-		3.9	-		4.0	-
14		6.6	-		6.2	-		5.2	-		4.3	-		5.1	-
15		7.3	-		5.3	-		6.4	-		5.1	-		4.2	-
16		6.2	-		4.7	-		6.3	-		4.2	-		4.9	-
17		6.3	-		7.4	-		4.8	-		4.1	-		7.1	-
18		7.1	-		6.1	-		4.0	-		5.1	-		4.6	-
19		7.6	-		4.9	-		6.1	-		4.8	-		6.4	-
20		6.2	50		4.1	-		5.5	25		4.6	50		4.6	25
Minimum		**4.4**	**50**		**4.1**	**-**		**3.7**	**25**		**3.1**	**0**		**4.0**	**0**
Maximum		**9.6**	**50**		**11.7**	**-**		**9.9**	**50**		**10.7**	**50**		**8.7**	**25**
Mean		**6.5**	**50**		**6.8**	**-**		**6.1**	**38**		**5.6**	**25**		**5.7**	**13**
Median		**6.5**	**50**		**6.6**	**-**		**6.2**	**38**		**4.9**	**25**		**5.6**	**13**
Standard Deviation		**1.2**	**-**		**2.0**	**-**		**1.4**	**-**		**2.1**	**-**		**1.3**	**-**

Note: "-" = not applicable or data not collected.

[a] Intermediate axis length is measured perpendicular to the longest axis.

[b] Embeddedness measured for every tenth rock.

APPENDIX B
DATA QUALITY REVIEW

APPENDIX B DATA QUALITY REVIEW

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B1 INTRODUCTION

B1.1 Background

A variety of factors can influence the physical, chemical, and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Depending on the magnitude of inaccuracy or imprecision within the data, these sources of variation have the potential to affect interpretation and the reliability of conclusions made from the data. Therefore, it is important to ensure that programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment) and thus assure the quality of the data. Data quality as a concept is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. A data quality review (DQR) involves comparison of actual field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRL), blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials). Trusted analytical laboratories certified by Canadian Association for Laboratory Accreditation (CALA) with a rigorous internal quality assurance program were selected to ensure the highest possible data quality. DQOs were established *a priori* to reflect reasonable and achievable performance expectations. Programs involving a large number of samples and analytes usually yield some results that exceed DQOs. This is particularly so for multi-element scans since the analytical conditions are not necessarily optimal for every element included in the scan. Scan results may be considered acceptable if no more than 20% of the parameters fail to meet DQOs. Overall, the intent of DQR is not to reject any measurement that did not meet a DQO, but to ensure that any questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of the project.

B1.2 Quality Control Samples

A DQR was conducted on all laboratory data collected as part of the Mount Polley Mine Comprehensive Environmental Monitoring Program (CEMP) 2022. The objective of a DQR is to define the overall quality of the data presented in the report, and, by extension, the confidence with which the data can be used to derive conclusions.

A DQR involves the examination of analytical results associated with several types of Quality Control (QC) samples collected (or prepared) in the field and laboratory. General QC samples collected for this project, and a description of each, include the following:

- **Blanks** are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed in the same way as regular samples. These samples will reflect any contamination of samples occurring in the field (in the case of field or trip blanks) or in the laboratory (in the case of laboratory or method blanks). Analyte concentrations should be non-detectable.
- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect any variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.
- **Field Duplicates** are samples collected from a randomly selected field station that are homogenized to the extent possible, split and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory.
- **Spike Recovery Samples** are created in the laboratory by adding a known amount/concentration of a given analyte (or mixture of analytes) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in the spiked sample minus the amount in the original sample) relative to the known spike amount (as a percentage). Two types of spike recovery samples are commonly analyzed. Spiked blanks (or blank spikes) are created by adding a known concentration of analytes to an uncontaminated blank (e.g. resin gel, distilled water) whereas matrix spikes (MS) are created using field-collected samples. The analysis of spiked samples provides an indication of the accuracy of analytical results.
- **Certified Reference Materials** are commercially prepared (or commercially homogenized) samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known concentration that was recovered in the analysis.
- **Laboratory Control Samples** are created in the laboratory to have a known analyte concentration in a matrix free of interferences, such as deionized water or reference sand.

The sample results are compared to the target results to confirm that the analytical method is accurate in a purified reference sample. The results are reported as the percent of the known concentration that was recovered in the analysis.

- **Reference Toxicant Tests** are toxicity tests run concurrent to the sediment toxicity test where a reference toxicant with laboratory-developed limits are used. The results of the reference toxicant testing should fall within the developed limits. This testing ensures that internal test systems are in check and that the sensitivity of the test organisms are within an expected range.

- **Laboratory Sorting Duplicates** are randomly selected grabs of the initially sorted benthic invertebrate community material. These samples are recounted and the number of benthic invertebrates that were not recovered during the initial sort was determined. In order to reduce bias, the recounting was conducted by an analyst uninvolved in the initial sample processing. This check was performed on 10% of samples and determines the accuracy through assessment of recovery (sorting) efficiency and quantifies any under-estimation of organism enumeration.

- **Taxonomic Quality Control Samples** are a randomly selected portion of a benthic invertebrate community field sample to be assessed by the laboratory using an internal quality control audit. A blind re-enumeration and re-identification of random samples is performed by an analyst uninvolved in the original sample processing. This assessment quantifies taxonomic misidentification among laboratory analysts and ensures accurate organism identities are reported.

- **Laboratory Subsamples** are community samples prepared by the laboratory to ensure that the fraction of the total sample examined was an accurate representation of the total number of organisms. By comparing the amount recovered between at least two sub-samples, one can assess the analytical precision. In addition, comparisons of the sub-samples from the whole community sample allows for an evaluation of sub-sampling accuracy.

B2 WATER CHEMISTRY

B2.1 Laboratory Reporting Limits

The analytical ALS laboratory reports for water chemistry (VA222B4117, VA22B4435, KS2202711, VA22B7687, VA22B8478, VA22C0064, VA22C0091, and VA22C0362; Appendix G) were examined to provide an inventory of analytes for which one or more results were below the LRL. The range of reported LRLs for these analytes (were assessed relative to existing British Columbia water quality guidelines (BCMOECCS 2021a,b; Table B.1). For analytes with results <LRL, all reported LRLs were lower than applicable BCWQG guidelines. Overall, the achieved LRLs were appropriate for this study.

B2.2 Laboratory and Field Blanks

A total of 134 method blank (MB) samples were analyzed in the ALS Laboratory Reports (VA222B4117, VA22B4435, KS2202711, VA22B7687, VA22B8478, VA22C0064, VA22C0091, and VA22C0362; Appendix G). Of the 756 reported MB results, only two (total alkalinity in one sample and total manganese in one sample; see laboratory reports VA22B7687 and VA22C0091, respectively; Appendix G) exceeded the laboratory DQO and had detectable concentrations. However, results for these analytes were considered reliable by the laboratory, as they were greater than five-times the detected MB result. As the number of MBs that exceeded the laboratory DQO was low (0.294%), and the MB results were deemed as not having impact on the reliability of the results, these laboratory flags had a negligible impact on data reliability.

One field blank and one trip blank sample were submitted to ALS for water chemistry analyses to assess the potential for field sampling and shipping/transport contamination (KS2202711; Appendix G). Field and trip blanks were subject to the same laboratory DQOs as were used for MBs (i.e., concentrations should be <LRL). All analytes in the field blank and trip blank samples were below detection, indicating no appreciable field sampling or shipping/transportation contamination.

B2.3 Data Precision

A total of 22 laboratory duplicate samples were used to evaluate precision within the ALS Laboratory Reports (VA222B4117, VA22B4435, KS2202711, VA22B7687, VA22B8478, VA22C0064, VA22C0091, and VA22C0362; Appendix G), totaling 743 individual analyte results. All measurements were within the laboratory DQO, indicating that the laboratory analytical precision can be considered excellent.

Table B.1: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Relative to BCWQG, Mount Polley Mine, 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Range of LRLs	No. Sample Results < LRL
		Long-term	Short-Term		
Anions, Organics, Nutrients, and Physical Properties					
Nitrite (as N)	mg/L	0.02	0.06	0.001	48 (100%)
Nitrate (as N)	mg/L	3	32.8	0.005	24 (50.0%)
Sulfate (as SO_4)	mg/L	218	-	0.3	3 (6.25%)
Ammonia Total (As N)	mg/L	0.102	0.752	0.005	23 (47.9%)
Chloride	mg/L	150	600	0.5	25 (52.1%)
Fluoride	mg/L	-	0.983	0.02	2 (4.17%)
Total Metals					
Antimony	mg/L	0.009	-	0.0001	41 (85.4%)
Arsenic	mg/L	-	0.005	0.0001	2 (4.17%)
Barium	mg/L	1	-	0.0001	2 (4.17%)
Beryllium	mg/L	0.00013	-	0.0001	48 (100%)
Bismuth	mg/L	1.2	-	0.00005	48 (100%)
Chromium	mg/L	0.001	-	0.0005	45 (93.8%)
Cobalt	mg/L	0.004	0.11	0.0001	47 (97.9%)
Iron	mg/L	-	1	0.03	22 (45.8%)
Manganese	mg/L	0.789	1	0.0001	2 (4.17%)
Nickel	mg/L	0.025	-	0.0005	40 (83.3%)
Selenium	mg/L	0.002	-	0.00005	2 (4.17%)
Silver	mg/L	0.00005	0.0001	0.00001	47 (97.9%)
Thallium	mg/L	0.0008	-	0.00001	48 (100%)
Uranium	mg/L	0.0085	-	0.00001	2 (4.17%)
Zinc	mg/L	0.0075	0.033	0.003	41 (85.4%)
Dissolved Metals					
Aluminum	mg/L	0.0121	0.0334	0.003	2 (4.35%)
Cadmium	mg/L	0.111	0.24	0.000005	13 (28.3%)
Iron	mg/L	-	0.35	0.03	41 (89.1%)
Lead	mg/L	0.00436	0.0269	0.00005	23 (50.0%)

Notes: "-" = no applicable guideline. Only analytes one or more result <LRL or LRLs above applicable guidelines are displayed. are displayed. The total number of water chemistry samples collected in 2022 was 217, which included six field duplicate samples. <LRL counts include results for one trip and one field blank (n=2 samples).

[a] British Columbia Water Quality Guidelines (BCWQG; BCMOECCS 2021a,b).

Field sampling precision looks at relative percent difference (RPD), calculated as follows:

$$RPD = \frac{|R1 - R2|}{(|R1 + R2|/2)} * 100$$

Where R1 is the value of the original ("parent") sample and R2 is the value of the duplicate sample, with the absolute difference and sum of the two samples used. RPDs cannot be calculated if both values are below the LRL. If the original and duplicate sample have the same value, then the RPD is 0%.

There are two applicable DQOs for field duplicates:

1. Each RPD comparison between the original and duplicate result should be ≤ 30%; and,
2. Within each original and duplicate pairing (i.e., each duplicate pair), fewer than 20% of the total comparisons should be above the 30% DQO.

Six pairs of field duplicate samples were collected to assess water chemistry field sampling precision (Table B.2). Several RPDs could not be calculated as both analyte concentrations were below the LRL. Of the six field duplicate sets, five of six sets had <20% of analyte comparisons in exceedance of the RPD DQO (Table B.2), indicating excellent field precision. Several analytes of interest exceeded the RPD DQO. Though RPDs for these analytes were above the 30% DQO, they were not consistently above the DQO in all duplicate sets (i.e., were >30% RPD in only one or two duplicate sets; Table B.2). High RPDs could be a result of field sampling inconsistencies, contamination (field or laboratory), or variability associated with multi-element scans (see section B2.6). Overall, water chemistry samples can be considered to have excellent field precision and reproducibility.

B2.4 Data Accuracy

Data accuracy was evaluated based on results of 139 Laboratory Control Samples (LCS) and 19 Matrix Spike (MS) samples within the ALS Laboratory Reports (VA222B4117, VA22B4435, KS2202711, VA22B7687, VA22B8478, VA22C0064, VA22C0091, and VA22C0362; Appendix G). All of 688 LCS individual analyte results met the laboratory DQO. Out of 614 individual MS analyte results, 118 (19.2%) individual MS results could not be reliably calculated due to high background concentrations (Appendix G); however, the remainder of the MS results met the laboratory DQO. As all LCS and MS results that could be reliably calculated met the laboratory DQO, the accuracy achieved by the laboratory in this study can be considered acceptable.

Table B.2: Field Duplicate Results for Water Chemistry, Mount Polley Mine CEMP, 2022

Parameter	Units	HAC-U_WS-1_2022-08	HAC-U_WS-1X_2022-08	RPD (%)	POL-P2_WS_DI-1_2022-07	POL-P2_WS_DI-1X_2022-07	RPD (%)	POL-S_WS-1_2022-08	POL-S_WS-1X_2022-08	RPD (%)	QUL-LREF1_WS-1_2022-08	QUL-LREF1_WS-1X_2022-08	RPD (%)	QUL-ZOO1_WS_DI-1_2022-06	QUL-ZOO1_WS_DI-1X_2022-06	RPD (%)	QUL-ZOO1_WS_DI-1_2022-08	QUL-ZOO1_WS_DI-1X_2022-08	RPD (%)
Anions, Organics, Nutrients, and Physical Properties																			
Alkalinity (as $CaCO_3$)	mg/L	93	91.8	1.30	91.7	92.3	0.65	87.9	90.9	3.36	44.8	47.5	5.85	48.1	46.3	3.81	46.8	46.1	1.51
Ammonia (as N)	mg/L	0.0227	0.0147	42.8	0.0085	0.0054	44.6	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-	0.0072	0.0107	39.1
Chloride (Cl)	mg/L	0.92	0.92	0	0.80	0.810	1.24	0.80	0.78	2.53	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Conductivity	µS/cm	271	274	1.10	239	241	0.83	246	236	4.15	101	98.9	2.10	113	116	2.62	103	101	1.96
Dissolved Organic Carbon	mg/L	5.83	6.54	11.5	6.56	6.54	0.31	6.60	6.67	1.06	2.74	3.43	22.4	2.92	3.40	15.2	2.62	3	13.5
Fluoride (F)	mg/L	0.062	0.062	0	0.062	0.058	6.67	0.08	0.074	7.79	0.036	0.035	2.82	0.033	0.033	0	0.03	0.037	20.9
Hardness (as $CaCO_3$)	mg/L	114	114	0	106	106	0	108	111	2.74	50.3	48.7	3.23	49.4	50.5	2.20	46.3	49.3	6.28
Hardness (as $CaCO_3$) from total Ca/Mg	mg/L	123	122	0.82	105	103	1.92	112	113	0.89	50.2	50.1	0.2	44.6	49	9.40	46.6	47.4	1.70
Nitrate (as N)	mg/L	0.0343	0.0319	7.25	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-	0.1	0.0992	0.8	0.0696	0.0642	8.07
Nitrate and Nitrite (as N)	mg/L	0.0343	0.0319	7.25	<0.0051	<0.0051	-	<0.0051	<0.0051	-	<0.0051	<0.0051	-	0.1	0.0992	0.8	0.0696	0.0642	8.07
Nitrite (as N)	mg/L	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Orthophosphate	mg/L	0.0034	0.0033	2.99	0.0037	0.0044	17.3	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
pH	pH units	8.11	8.11	0	8.20	8.2	0	8.34	8.15	2.30	8	7.75	3.17	7.89	7.87	0.25	7.73	7.69	0.519
Phosphorus (P; dissolved)	mg/L	0.0094	0.0092	2.15	0.0126	0.0121	4.05	0.0036	0.0037	2.74	0.0022	<0.0020	9.52	0.003	0.0025	18.2	0.0029	0.0029	0
Phosphorus (P; total)	mg/L	0.0138	0.0116	17.3	0.0145	0.0155	6.67	0.0091	0.0061	39.5	0.0047	0.005	6.19	0.0064	0.009	33.8	0.0092	0.0074	21.7
Sulphate	mg/L	44.1	44	0.23	34.1	34.2	0.29	36.1	35.1	2.81	5.85	5.65	3.48	5.92	8.08	30.9	5.58	6.01	7.42
Dissolved Solids	mg/L	191	167	13.4	169	181	6.86	203	188	7.67	76	69	9.66	80	76	5.13	80	70	13.3
Nitrogen (N; total)	mg/L	0.318	0.314	1.27	0.324	0.296	9.03	0.272	0.288	5.71	0.104	0.095	9.05	0.232	0.247	6.26	1.67	1.54	8.10
Total Suspended Solids	mg/L	1.60	<1.0	46.2	1.30	1.40	7.41	<1.0	<1.0	-	<1.0	<1.0	-	1.50	1.20	22.2	-	-	-
Turbidity	NTU	0.58	0.58	0	0.59	0.52	12.6	0.34	0.36	5.71	0.46	0.38	19	1.25	1.03	19.3	1.67	1.54	8.10
Total Metals																			
Aluminum	mg/L	0.0297	0.0258	14.1	0.0242	0.0146	49.5	0.0085	0.0068	22.2	0.0185	0.0188	1.61	0.0285	0.0445	43.8	0.0111	0.0631	140
Antimony	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic	mg/L	0.00061	0.0006	1.65	0.00051	0.00051	0	0.00055	0.00052	5.61	0.00026	0.00024	8	0.00014	0.00019	30.3	0.00012	0.00021	54.5
Barium	mg/L	0.0116	0.0116	0	0.0103	0.0101	1.96	0.0106	0.0106	0	0.00711	0.00715	0.56	0.00544	0.00629	14.5	0.00571	0.00644	12.0
Beryllium	mg/L	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-
Bismuth	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Boron	mg/L	0.021	0.023	9.09	0.021	0.021	0	0.02	0.02	0	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium	mg/L	<0.0000050	<0.0000100	-	0.0000379	0.0000872	78.8	<0.0000100	<0.0000100	-	0.0000125	0.0000098	24.2	0.0000072	0.0000067	7.19	0.000118	0.000261	75.5
Calcium	mg/L	38.9	38.8	0.26	33.6	33.2	1.20	36.1	36.5	1.10	16.3	16.3	0	14.8	16.2	9.03	15.6	15.8	1.27
Chromium	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper	mg/L	0.00506	0.00518	2.34	0.00543	0.00497	8.85	0.00419	0.00419	0	0.00074	0.00084	12.7	0.00168	0.00223	28.1	0.00091	0.00328	113
Iron	mg/L	0.036	0.033	8.70	<0.030	<0.030	-	<0.030	<0.030	-	0.05	0.049	2.02	0.035	0.057	47.8	<0.030	0.059	-
Lead	mg/L	<0.000050	<0.000050	-	0.000117	0.000128	8.98	<0.000050	0.00006	18.2	0.000107	0.00012	11.5	<0.000050	0.000052	3.92	<0.000050	0.000279	-
Lithium	mg/L	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Magnesium	mg/L	6.28	6.23	0.8	5.03	5	0.6	5.41	5.31	1.87	2.32	2.29	1.30	1.85	2.07	11.2	1.86	1.92	3.17
Manganese	mg/L	0.0385	0.0371	3.70	0.00462	0.00404	13.4	0.00711	0.00682	4.16	0.00668	0.00674	0.89	0.00224	0.00327	37.4	0.00125	0.00409	106
Molybdenum	mg/L	0.0069	0.0071	2.86	0.00666	0.00654	1.82	0.00691	0.00702	1.58	0.000512	0.000498	2.77	0.000396	0.000419	5.64	0.000363	0.000362	0.276
Nickel	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	0.00092	0.00102	10.3	<0.00050	<0.00050	-
Potassium	mg/L	1	1.01	1	1.11	1.10	0.91	0.942	0.907	3.79	0.502	0.508	1.19	0.489	0.557	13	0.46	0.524	13.0
Selenium	mg/L	0.0012	0.00135	11.8	0.000565	0.000675	17.7	0.000787	0.000732	7.24	0.000208	0.000165	23.1	0.000156	0.000141	10.1	0.00016	0.000163	1.86
Silicon	mg/L	3.45	3.60	4.26	3.11	3.10	0.32	2.87	2.67	7.22	2	1.89	5.66	2.05	2.04	0.49	1.71	1.86	8.40
Silver	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium	mg/L	7.50	7.82	4.18	7.27	7.46	2.58	7.51	7.40	1.48	1.08	1.07	0.93	0.943	1.02	7.85	0.863	0.93	7.47
Strontium	mg/L	0.271	0.266	1.86	0.242	0.235	2.94	0.252	0.256	1.57	0.108	0.111	2.74	0.11	0.129	15.9	0.129	0.127	1.56
Thallium	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Tin	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium	mg/L	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-
Uranium	mg/L	0.00023	0.000247	7.13	0.000197	0.000192	2.57	0.000183	0.000187	2.16	0.000128	0.000125	2.37	0.00014	0.000154	9.52	0.00015	0.000149	0.669
Vanadium	mg/L	0.00143	0.00142	0.7	0.00132	0.00129	2.30	0.00144	0.00135	6.45	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Zinc	mg/L	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: LRL = Laboratory Reporting Limit. If one result in a duplicate pair was below the LRL, RPD was calculated using the LRL in place of the value below detection results. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Table B.2: Field Duplicate Results for Water Chemistry, Mount Polley Mine CEMP, 2022

Parameter	Units	HAC-U_WS-1_2022-08	HAC-U_WS-1X_2022-08	RPD (%)	POL-P2_WS_DI-1_2022-07	POL-P2_WS_DI-1X_2022-07	RPD (%)	POL-S_WS-1_2022-08	POL-S_WS-1X_2022-08	RPD (%)	QUL-LREF1_WS-1_2022-08	QUL-LREF1_WS-1X_2022-08	RPD (%)	QUL-ZOO1_WS_DI-1_2022-06	QUL-ZOO1_WS_DI-1X_2022-06	RPD (%)	QUL-ZOO1_WS_DI-1_2022-08	QUL-ZOO1_WS_DI-1X_2022-08	RPD (%)
Dissolved Metals																			
Aluminum	mg/L	0.0041	0.0034	18.7	0.004	0.0049	20.2	0.0032	<0.0030	6.45	0.0113	0.0107	5.45	0.0142	0.0129	9.59	0.0439	0.011	119.9
Antimony	mg/L	0.0001	<0.00010	0	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic	mg/L	0.00046	0.00046	0	0.00047	0.00042	11.2	0.00052	0.00051	1.94	0.00023	0.00021	9.09	0.00012	0.00012	0	0.00017	0.00012	34.5
Barium	mg/L	0.00932	0.00919	1.40	0.00946	0.00876	7.68	0.00991	0.00939	5.39	0.00634	0.00641	1.10	0.00568	0.00561	1.24	0.00615	0.00577	6.38
Beryllium	mg/L	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-	<0.000100	<0.000100	-
Bismuth	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Boron	mg/L	0.02	0.02	0	0.02	0.019	5.13	0.018	0.019	5.41	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium	mg/L	<0.0000050	<0.0000050	-	0.0000653	0.0000504	25.8	0.0000188	0.00001	61.1	0.0000205	0.000029	34.3	0.000009	0.0000054	50	0.000178	0.000189	5.99
Calcium	mg/L	37.4	37.4	0	34.2	34.9	2.03	34.6	35.6	2.85	16.5	16	3.08	16.5	16.9	2.40	15.4	16.5	6.90
Chromium	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper	mg/L	0.00367	0.00371	1.08	0.00436	0.00419	3.98	0.00372	0.00359	3.56	0.00069	0.0008	14.8	0.0012	0.001	18.2	0.0024	0.00092	89.2
Iron	mg/L	<0.030	<0.030	-	<0.030	<0.030	-	<0.030	<0.030	-	<0.030	<0.030	-	<0.030	<0.030	-	0.044	<0.030	-
Lead	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	0.00007	0.000293	123	0.000052	0.000146	94.9	<0.000050	<0.000050	-	0.000167	<0.000050	-
Lithium	mg/L	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Magnesium	mg/L	5.11	5.04	1.38	4.90	4.56	7.19	5.25	5.42	3.19	2.20	2.13	3.23	2	2.01	0.5	1.91	1.96	2.58
Manganese	mg/L	0.0221	0.0214	3.22	0.00184	0.00194	5.29	0.00096	0.00097	1.04	0.00131	0.00117	11.3	0.00086	0.0007	20.5	0.00309	0.00113	92.9
Molybdenum	mg/L	0.00663	0.00667	0.6	0.00617	0.00634	2.72	0.00677	0.00675	0.3	0.000468	0.000496	5.81	0.000488	0.000397	20.6	0.000318	0.000334	4.91
Nickel	mg/L	<0.00050	<0.00050	-	0.00062	0.00059	4.96	<0.00050	<0.00050	-	<0.00050	<0.00050	-	0.00089	0.00086	3.43	<0.00050	<0.00050	-
Potassium	mg/L	0.821	0.815	0.73	1.05	0.995	5.38	0.924	0.919	0.54	0.528	0.501	5.25	0.532	0.526	1.13	0.482	0.513	6.23
Selenium	mg/L	0.00126	0.00131	3.89	0.000461	0.000476	3.20	0.000763	0.000702	8.33	0.000159	0.000155	2.55	0.00014	0.000146	4.20	0.000119	0.000108	9.69
Silicon	mg/L	3.11	3.25	4.40	3.10	2.94	5.30	2.69	2.70	0.37	1.88	1.83	2.70	2.03	1.97	3	1.64	1.63	0.612
Silver	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium	mg/L	6.42	6.44	0.31	7.71	7.42	3.83	6.99	7	0.14	1.04	0.973	6.66	0.983	0.963	2.06	0.856	0.906	5.68
Strontium	mg/L	0.252	0.259	2.74	0.252	0.256	1.57	0.235	0.24	2.11	0.101	0.0978	3.22	0.122	0.118	3.33	0.122	0.121	0.823
Thallium	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Tin	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-	0.00064	<0.00010	146	<0.00010	<0.00010	-
Titanium	mg/L	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-	<0.0100	<0.0100	-
Uranium	mg/L	0.000224	0.000245	8.96	0.000196	0.000196	0	0.000189	0.000184	2.68	0.000118	0.000122	3.33	0.000144	0.000138	4.26	0.000148	0.000142	4.14
Vanadium	mg/L	0.0011	0.0011	0	0.00132	0.00122	7.87	0.00124	0.00124	0	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Zinc	mg/L	<0.0030	<0.0030	-	<0.0030	<0.0030	-	0.0059	0.0046	24.8	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: LRL = Laboratory Reporting Limit. If one result in a duplicate pair was below the LRL, RPD was calculated using the LRL in place of the value below detection results. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

B2.5 Hold Times

The recommended hold times were exceeded for several physical tests, such as laboratory pH (hold time of 15 minutes; exceeded in all samples collected), turbidity, and conductivity (Appendix G)[1]. For these physical tests (pH, turbidity, conductivity), *in situ* measures were used for data interpretation and, as such, hold time exceedances for these laboratory results have no impact on data interpretability. The recommended hold time for total suspended solids (TSS), total dissolved solids (TDS), and dissolved orthophosphate were exceeded in two samples (TSS and orthophosphate) and four samples (TDS; VA22B4435, VA22B4117; Appendix G). Hold time for nitrite and nitrate were exceeded in two samples each (VA22B7687; Appendix G). Most of these hold time exceedances occurred after receipt of the samples by the laboratory (i.e., samples were received by the laboratory in sufficient time for analysis). For two samples, the hold times were exceeded prior to laboratory receipt due to a combination of challenges associated with the logistics of expedited sample shipments from a remote area and the short hold times. Analyte results with hold time exceedances were similar to those samples without hold time exceedances 2022 and were within the range of historic results, suggesting little if any impact of the hold time exceedances on analyte results

B2.6 Other Concerns

Results for several analytes showed dissolved concentrations that were greater than the corresponding total concentrations (VA220362, VA22B4435, VA22C0091; Appendix G). Differences were less than two-times the concentration of total analytes and these results were verified by repeat analysis. This unexpected result could be a result of contamination during field filtration, during the sample preparation at the laboratory, or could represent inevitable variability associated with multi-element scans.

B2.7 Data Quality Statement

Water chemistry data collected for the 2022 CEMP were of acceptable quality as characterized by good detectability, appropriate LRLs, negligible analyte concentrations in MBs, good laboratory precision and accuracy, and few hold time exceedances. Only three primary analytes (arsenic, and copper, and iron) and four secondary analytes (cadmium, manganese, total phosphorous, and dissolved tin) were identified as having failed a DQO (in field duplicate samples), and these analytes were not consistently elevated across sample pairs. Since all other quality control samples for these analytes were good, overall

[1] Laboratory-filtered chlorophyll-a results exceeded the recommended hold times as reported in laboratory reports VA22B4117 and VA22B4435. These results were excluded from the DQR section field-filtered chlorophyll-a results reported in VA22B4431 were used for data analysis.

quality of these analyte data would be good. Overall, the 2022 water quality data can be used with a good level of confidence for interpretation.

B3 SEDIMENT CHEMISTRY

B3.1 Laboratory Reporting Limits

The analytical ALS laboratory reports for sediment chemistry (VA22B8489 and VA22C0370; Appendix G) were examined to provide an inventory of analytes for which for which one or more results were below the LRL. The range of reported LRLs for these analytes were assessed relative to applicable British Columbia working sediment guidelines (BCMOECCS 2021a,b; Appendix Table B.3). Analytes that had LRLs that were frequently below detection did not have associated guidelines (i.e., all analytes that had associated guidelines were 100% detectable; Appendix Table B.3). Overall, the achieved LRLs were appropriate for this study.

B3.2 Laboratory Blanks

A total of 12 MB samples were analyzed in the ALS Laboratory Reports (VA22B8489 and VA22C0370; Appendix G). All 144 reported MB results met the laboratory DQO, indicating no inadvertent contamination within the laboratory.

B3.3 Data Precision

A total of 12 laboratory duplicate samples were used to evaluate precision in the ALS Laboratory Reports (VA22B8489 and VA22C0370; Appendix G). Of the 148 analyte results, only two results (antimony and lead; VA22B8489) did not meet the laboratory DQO due to sample heterogeneity. As these results only represents 1.35% of all laboratory duplicate analyte results, laboratory analytical precision was considered excellent.

A total of five sets of field duplicate samples were collected to assess sediment chemistry field sampling precision (Appendix Table B.4; see Section B.2.3 for explanation on RPD calculation and DQOs). Several RPDs could not be calculated as both analyte concentrations were below the LRL. Of the 202 comparisons that could be calculated, only seven RPDs exceeded the DQO of 30% (3.47% of all comparisons; Appendix Table B.4). These exceedances were isolated to two of the five sets of samples, and included one comparison for each total nitrogen, antimony, cadmium, lead, titanium, and zirconium. As such, it is expected that differences were related to sample heterogeneity and/or variability during the multi-element scan. Since the overall occurrence of field duplicate analyses DQO exceedances was low, samples were considered to have excellent field precision and reproducibility.

B3.4 Data Accuracy

Table B.3: Laboratory Reporting Limits (LRLs) for Sediment Chemistry Analyses, Mount Polley Mine, 2022

Analyte	Unit	BCWSG[a]		Range of LRLs	No. Sample Results < LRL
		Long-term	Short-term		
Anions and Nutrients					
Total Nitrogen	%	-	-	0.02	3 (6.0%)
Metals					
Bismuth	mg/kg	-	-	0.1	22 (44.0%)
Boron	mg/kg	-	-	5.0	14 (28.0%)
Thallium	mg/kg	-	-	0.05	14 (28.0%)
Tin	mg/kg	-	-	0.20	2 (4.00%)
Zirconium	mg/kg	-	-	1.0	3 (6.00%)

Notes: "-" = no applicable guideline. Only analytes with one or more results < LRL or LRLs above applicable guidelines are displayed. The total number of sediment samples collected in 2022 was 50, which includes six field duplicate samples.

[a] British Columbia Working Sediment Guidelines (BCWSG; BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

Table B.4: Field Duplicate Results for Sediment Analyses, Mount Polley Mine CEMP, 2022

Analyte	Unit	HAC-D_SE-5_2022-08	HAC-D_SE-5X_2022-08	RPD (%)	QUL-LNF1_SE-2_2022-08	QUL-LNF1_SE-2X_2022-08	RPD (%)	EDC-D_SE-4_2022-08	EDC-D_SE-4X_2022-08	RPD (%)	QUL-PNF_SE-2_2022-08	QUL-PNF_SE-2X_2022-08	RPD (%)	POL-S_SE-1_2022-08	POL-S_SE-1X_2022-08	RPD (%)
Physical Tests																
Moisture	%	69.7	63.4	9.47	25.8	25.4	1.56	43.8	40.8	7.09	63.0	63.5	0.79	40.6	42.2	3.86
pH (1:2 soil:water)	pH	7.22	7.39	2.33	8.19	8.21	0.24	7.69	7.47	2.90	8.02	8.03	0.13	7.63	7.63	0
Particle Size																
Gravel (>2mm)	%	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Sand (2.0mm - 0.063mm)	%	23.7	35.2	39.0	90.6	91.3	0.77	70.0	66.5	5.13	3.10	3.70	17.6	33.9	31.2	8.29
Silt (0.063mm - 0.004mm)	%	65.4	55.0	17.3	7.70	7.40	3.97	24.1	27.7	13.9	50.5	51.8	2.54	55.8	58.2	4.21
Clay (<0.004mm)	%	10.0	9.80	2.02	1.10	1.20	8.70	5.80	5.40	7.14	46.4	44.5	4.18	10.3	10.6	2.87
Organic / Inorganic Carbon																
Carbon total organic [TOC] <63µm	%	1.91	1.84	3.73	1.03	1.02	0.98	3.05	2.59	16.3	0.70	0.75	7.88	0.87	1.00	13.7
Nutrients (Bulk sediment)																
Total Nitrogen	%	0.23	0.18	22.1	<0.020	0.03	49.1	0.09	0.10	11.9	0.10	0.09	13.5	0.08	0.10	15.9
Metals (<63 µm)																
Aluminum	mg/kg	14,500	15,300	5.37	15,800	15,500	1.92	13,100	14,600	10.8	29,900	31,300	4.58	22,900	21,800	4.92
Antimony	mg/kg	0.49	0.82	50.4	0.45	0.35	25.0	0.35	0.38	8.22	0.50	0.54	7.69	0.50	0.50	0
Arsenic	mg/kg	15.5	17.8	13.8	13.3	10.4	24.5	11.3	12.0	6.01	15.3	15.2	0.66	15.3	14.3	6.76
Barium	mg/kg	244	229	6.34	104	109	4.69	126	115	9.13	265	272	2.61	192	189	1.57
Beryllium	mg/kg	0.57	0.53	7.27	0.53	0.53	0	0.37	0.38	2.67	0.97	1.03	6.00	0.86	0.82	4.76
Bismuth	mg/kg	0.13	0.12	8.00	0.11	0.10	9.52	0.12	0.12	0	0.16	0.16	0	<0.10	<0.10	-
Boron	mg/kg	11.3	10.8	4.52	7.80	6.60	16.7	<5.0	<5.0	-	9.80	11.4	15.1	11.5	11.4	0.87
Cadmium	mg/kg	0.27	0.39	34.4	0.35	0.37	6.92	0.28	0.28	1.78	0.24	0.24	2.09	0.15	0.15	3.37
Calcium	mg/kg	23,400	21,900	6.62	16,700	16,300	2.42	8,700	8,670	0.35	20,300	21,600	6.21	29,900	29,600	1.01
Chromium	mg/kg	33.3	32.9	1.21	38.0	34.3	10.2	43.9	45.0	2.47	30.5	30.6	0.33	13.0	12.4	4.72
Cobalt	mg/kg	14.3	14.7	2.76	18.5	17.6	4.99	12.1	13.2	8.70	24.9	24.8	0.40	21.2	20.6	2.87
Copper	mg/kg	325	337	3.63	900	864	4.08	27.6	28.1	1.80	794	793	0.13	756	739	2.27
Iron	mg/kg	42,800	44,700	4.34	74,300	66,000	11.8	28,900	30,400	5.06	43,100	42,900	0.47	61,500	59,900	2.64
Lead	mg/kg	8.61	18.9	74.8	7.48	7.07	5.64	6.87	7.56	9.56	12.0	12.0	0	5.78	5.43	6.24
Lithium	mg/kg	14.5	14.8	2.05	14.2	14.0	1.42	13.4	14.6	8.57	29.0	29.6	2.05	20.5	20.0	2.47
Magnesium	mg/kg	7,710	8,020	3.94	8,370	8,330	0.48	6,620	6,790	2.54	17,600	17,500	0.57	13,600	13,400	1.48
Manganese	mg/kg	1,110	1,050	5.56	1,030	959	7.14	904	839	7.46	1,360	1,350	0.74	862	843	2.23
Mercury	mg/kg	0.11	0.11	1.87	0.13	0.13	3.89	0.05	0.05	0.38	0.10	0.11	5.83	0.07	0.08	6.45
Molybdenum	mg/kg	1.60	1.78	10.7	2.50	2.87	13.8	0.54	0.57	5.41	3.35	3.44	2.65	5.05	5.22	3.31
Nickel	mg/kg	24.4	24.9	2.03	23.3	22.0	5.74	27.9	29.1	4.21	28.3	27.9	1.42	10.9	10.3	5.66
Phosphorus	mg/kg	1,220	1,580	25.7	1,470	1,150	24.4	960	1,240	25.5	1,200	1,170	2.53	1,910	1,870	2.12
Potassium	mg/kg	1,360	1,260	7.63	1,180	1,150	2.58	1,110	1,040	6.51	2,620	2,980	12.9	1,780	1,760	1.13
Selenium	mg/kg	1.06	1.03	2.87	1.20	0.99	19.2	0.39	0.45	14.3	1.08	1.20	10.5	1.43	1.48	3.44
Silver	mg/kg	0.29	0.31	7.26	0.40	0.41	0.99	0.10	0.11	1.92	0.35	0.36	1.97	0.34	0.32	5.18
Sodium	mg/kg	357	360	0.84	540	537	0.56	257	244	5.19	1,110	1,160	4.41	956	950	0.63
Strontium	mg/kg	171	149	13.8	116	115	0.87	80.5	67.7	17.3	207	223	7.44	204	201	1.48
Sulfur Total	mg/kg	780	870	10.9	720	850	16.6	<500	580	14.8	880	1,080	20.4	1,740	2,090	18.3
Thallium	mg/kg	0.12	0.11	6.22	0.07	0.06	4.65	0.09	0.09	2.20	0.09	0.09	6.82	<0.050	<0.050	-
Tin	mg/kg	0.63	0.69	9.09	1.20	1.06	12.4	0.37	0.45	19.5	1.68	1.67	0.60	2.35	2.16	8.43
Titanium	mg/kg	901	953	5.61	1,380	692	66.4	666	683	2.52	1,690	1,870	10.1	2,120	1,970	7.33
Uranium	mg/kg	0.99	0.96	3.28	1.18	0.93	23.3	0.97	0.92	4.88	1.44	1.48	2.74	1.46	1.36	7.09
Vanadium	mg/kg	129	140	8.18	266	230	14.5	68.5	70.0	2.17	130	129	0.77	238	229	3.85
Zinc	mg/kg	75.2	86.9	14.4	64.5	63.2	2.04	62.7	65.0	3.60	99.6	98.4	1.21	70.9	66.5	6.40
Zirconium	mg/kg	2.70	2.90	7.14	5.10	2.20	79.5	1.70	1.80	5.71	4.80	5.30	9.90	8.30	7.90	4.94

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using < Laboratory Reporting Limit (LRL) results at the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Data accuracy for sediment chemistry analyses completed by ALS was evaluated based on the analysis of 16 LCS samples and 10 reference material (RM) samples. Of the 148 individual LCS results, only one result for zirconium (0.676% of LCS samples) did not meet the laboratory DQO due to a greater recovery limit compared to the upper control limit (VA22B8489; Appendix G). However, this result exceeded the DQO by fewer than 10% of analytes in a multi-element scan, which is considered acceptable as per the OMOE and the CCME (VA22B8489; Appendix G). All 130 individual RM results met the laboratory DQO. Overall, accuracy achieved by the laboratory was considered excellent.

B3.5 Hold Times and General Laboratory Flags

There were no exceedances in hold times for any samples. All samples were delivered to the laboratory and were analyzed within the appropriate hold times.

B3.6 Other Concerns

The measurement uncertainty for particle size analysis in samples BOL-S_SE-3 and BOL-S_SE-4 from August 2022 were higher than usual due to limited sample availability (VA22C0370; Appendix G). The minimum standard sample size is 100g, but this may sometimes be hard to achieve at sites with fine substrate (as is found at Bootjack Lake) since decanting water may also lead to loss of important sample material. Results for calcium and iron were flagged in one sample each due to the result exceeding the maximum concentration inputted for the method used (VA22C0370; Appendix G)[2]. However, the results were correct and within the calibration range and are not expected to affect data interpretation.

B3.7 Data Quality Statement

Sediment chemistry data collected for the 2022 CEMP were of good quality as characterized by appropriate LRLs, appropriate detectability, negligible concentrations in MB samples, laboratory blanks, excellent laboratory precision and field sampling precision, and excellent laboratory accuracy. All quality control samples generally met the laboratory DQOs, and overall the associated data can be used with a high level of confidence in the derivation of conclusions.

[2] Samples were diluted for the analysis so that the results were within the laboratory's calibration range. When these results were back-calculated using the dilution factor, the final results were higher than the range input by laboratory staff for the analysis method. The qualifier/flag was automatically added to these results,

B4 SEDIMENT TOXICITY

B4.1 Laboratory Control

Sediment toxicity test laboratory controls met the acceptable criteria and water quality requirements of the Environment Canada protocols (Nautilus Environmental; Appendix G). Sediment toxicity data were considered of excellent quality for data interpretation.

B4.2 Reference Toxicants

The results of the reference toxicant (NaCl) on *Hyallela azteca* produced toxicity endpoints that met the passing control criterion of >80% survival. The results for the test were within the acceptable range of organism performance (mean LC_{50} within two standard deviations of historical laboratory values; Nautilus Environmental; Appendix G). The required one-day holding period before test initiation was not met due to the late arrival of *H. azteca* from the supplier. However, this delay did not appear to affect the test results as water quality was within the acceptable ranges and there were no mortalities upon arrival.

B4.3 Data Quality Statement

Based on acceptability criteria, water quality requirements of the Environment Canada protocols and reference toxicant test results, data from sediment toxicity tests can be used with a high degree of confidence in the 2022 CEMP.

B5 PHYTOPLANKTON COMMUNITY AND PRODUCTIVITY

B5.1 Laboratory Reporting Limits

The analytical ALS Laboratory Reports for phytoplankton productivity were examined to assess the LRLs for chlorophyll-a results (see laboratory reports VA22B4431, VA22B7705, VA22C0064, and VA22C0362; Appendix G)[3]. All individual measures of chlorophyll-a were above the LRL; therefore, the achieved LRLs were appropriate for the study.

B5.2 Laboratory Blanks

A total of three MB samples were analyzed in the ALS Laboratory Reports (VA22B4431, and VA22B7705; Appendix G). All chlorophyll-a results met the laboratory DQO, indicating that no inadvertent laboratory contamination occurred.

B5.3 Data Precision

Three sets of field duplicates were collected to assess the precision of field sampling for chlorophyll-a (Appendix Table B.5; see Section B.2.3 for explanation on RPD calculation and DQOs). All RPDs met the DQO of 30%, and therefore, chlorophyll-a samples can be considered to have excellent field precision and reproducibility. An analysis of laboratory analytical precision using laboratory duplicates was not conducted for chlorophyll-a as the entire sample must be consumed for analysis.

B5.4 Data Accuracy

Chlorophyll-a accuracy was evaluated based on results of three LCS samples which all met the laboratory DQO (within 20% of accepted value; VA22B4431, VA22B7705; Appendix G). The accuracy achieved by the laboratory in this study was therefore considered excellent.

B5.5 Hold Times

Recommended preparation hold times for chlorophyll-a were exceeded by one day in four samples from August (VA22C0362; Appendix G). Chlorophyll-a samples from August were not field filtered due to logistical issues, and as such, had shorter hold times (48 hours) than the field filtered chlorophyll-a samples collected in June and July. Overall, hold times for chlorophyll-a were exceeded in 21.1% of samples. Upon examination, chlorophyll-a concentrations in samples that exceeded hold times appear similar to those in similar samples

[3] Reports with field filtered chlorophyll-a from June and July (VA22B4431 and VA22B7705) were used for control/blank counts. Laboratory quality control/blank counts for unfiltered (aqueous) chlorophyll-a results from reports VA22C0064 and VA22C0062 were tabulated along with the water chemistry results in Section B2. LRL analysis was conducted with all four reports.

Table B.5: Field Duplicate Results for Aqueous Chlorophyll-a, Mount Polley Mine CEMP, 2022

Parameter	Units	QUL-ZOO-1_CHLA-1_2022-06	QUL-ZOO-1_CHLA-1X_2022-06	RPD (%)	POL-P2_CHLA-1_2022-07	POL-P2_CHLA-1X_2022-07	RPD (%)	QUL-ZOO-1_WS_DI-1_2022-08	QUL-ZOO-1_WS_DI-1X_2022-08	RPD (%)
Chlorophyll-a	µg/L	1.58	1.63	3.12	2.57	2.56	0.390	1.04	1.01	2.93

that did not exceed hold times, suggesting that these exceeded hold times did not impact chlorophyll-a results. However, these hold time exceedances will be taken into consideration during interpretation (mainly, comparison to historical data from prior years).

B5.6 Phytoplankton Density Accuracy

Phytoplankton density was re-measured in a total of three samples to evaluate sub-sampling accuracy within the phytoplankton enumeration and identification laboratory report (10% of all samples; fp22-078, Appendix G). Since there was a high percent of agreement between the duplicate pairs (mean = 89.0%), the samples can be considered to have good laboratory subsampling precision and reproducibility (Appendix Table B.6).

B5.7 Zooplankton Abundance Accuracy

Zooplankton density was re-measured in a total of three samples to evaluate sub-sampling accuracy and taxonomic consistency within the zooplankton enumeration and identification laboratory report (10% of all samples; fz22-078, Appendix G). Since there was a high percent of agreement between the duplicate pairs (mean = 95.6%) the samples are considered to have excellent laboratory subsampling precision and reproducibility (Appendix Table B.7).

B5.8 Data Quality Statement

Plankton community data collected for the 2022 CEMP were of good quality as characterized by good or excellent sub-sampling accuracy. Additionally, productivity measurements (chlorophyll-a) results were characterized by appropriate LRLs, excellent detectability, negligible analyte concentrations in MBs, good laboratory precision, and good laboratory accuracy. Therefore, the associated data can be used with a good level of confidence in the derivation of conclusions.

Table B.6: Duplicate Freshwater Phytoplankton Density Samples, Mount Polley Mine CEMP, 2022

Sample ID	Laboratory ID	Original Density	Quality Assurance Density	Percent Agreement[a] (%)
BOL-B2_PHYTO-1_2022-06	fp22-078-002	2,081,855	1,757,654	84.4
POL-P2_PHYTO-5_2022-07	fp22-078-038	5,177,576	6,082,124	82.5
QUL-ZOO-7_PHYTO-3_2022-07	fp22-078-046	1,225,803	1,225,803	100
			Average	**89.0**

[a] Percent agreement calculated as: (100- [(difference in abundance between samples) / total abundance of original sample)] *100)%.

Table B.7: Duplicate Zooplankton Density Samples, Mount Polley Mine CEMP, 2022

Sample ID	Laboratory ID	Abundance #/ L (Original Replicate)	Abundance #/ L (QA Replicate)	Percent Agreement[a] (%)
BOL-B2_ZOO-3_2022-07	fz22-078-011	83,425	87,875	94.7
POL-P2_ZOO-5_2022-07	fz22-078-018	124,766	118,666	95.1
QUL-ZOO-7_ZOO-1_2022-08	fz22-078-056	14,974	14,534	97.1
			Average	**95.6**

[a] Percent agreement calculated as: (100- [(difference in abundance between samples) / total abundance of original sample)] *100)%.

B6 ZOOPLANKTON TISSUE CHEMISTRY

B6.1 Laboratory Reporting Limits

The analytical ALS Laboratory Reports for zooplankton tissue chemistry (VA22B7702, VA22B4432, and VA22C0442; Appendix G) were examined to provide an inventory of analytes for which sample results were less than the LRL. LRLs for selenium were compared to the British Columbia benthic invertebrate dietary guidelines (BCMOE 2014). The LRL was adjusted for several analytes across samples due to sample dilution, high moisture content, insufficient sample, or amount of sample used by the laboratory. For sample POL-P2_ZOOT-1_2022-08, LRLs for 35 of 37 analytes were adjusted due to laboratory dilution of sample (VA22C0442; Appendix G). All resulting selenium LRLs were below the available guideline for selenium (Appendix Table B.8), indicating that the achieved LRLs were appropriate for the study.

B6.2 Laboratory Blanks

A total of 11 MB samples were analyzed in the ALS Laboratory Reports (VA22B7702, VA22B4432, and VA22C0442; Appendix G). All 190 individual analyte results met the laboratory DQO, indicating that laboratory analytical precision was excellent.

B6.3 Data Precision

One laboratory duplicate sample was analyzed to evaluate laboratory precision for moisture within the zooplankton tissue chemistry results (VA22B7702; Appendix G). The number of laboratory duplicates for zooplankton tissue chemistry was low as sample volumes were limited and needed to be conserved for metals analysis. Efforts will be made in future sampling (where possible) to collect more sample volume and/or drain off more water when submitting the sample. The resulting one analyte result met the laboratory DQO. Due to limited laboratory duplicate sample results (i.e., one comparison), laboratory precision and reproducibility could not be assessed.

A total of three sets of field duplicate zooplankton tissue samples were collected to assess field sampling and reproducibility (Appendix Table B.9; see Section B.2.3 for explanation on RPD calculation and DQOs). Several RPDs could not be calculated as both analyte concentrations were below the LRL. For all three sets of field duplicate samples, <20% of analyte comparisons exceeded the DQO of 30% (Appendix Table B.9); as such, field precision was considered good. RPDs for certain analytes of interest (arsenic, iron, lead, nickel, tin, titanium, and vanadium) exceeded the DQO in one or more duplicate sets, but not in all three

Table B.8: Evaluation of Laboratory Reporting Limits (LRL) in Zooplankton Tissue Chemistry Results, Mount Polley Mine CEMP, 2022

Parameter	Units	Range of LRLs	No. Sample Results <LRL
Metals			
Bismuth	mg/kg	0.01 to 0.016	13 (41.9%)
Boron	mg/kg	1 to 2.2	5 (16.1%)
Lithium	mg/kg	0.5 to 0.83	4 (12.9%)
Mercury	mg/kg	0.01 to 0.055	2 (6.45%)
Mercury	mg/kg wwt	0.001 to 0.002	25 (80.6%)
Tellurium	mg/kg	0.02 to 0.033	30 (96.8%)

Notes: Only analytes for which at least one sample was <LRL are displayed. mg/kg = milligrams per kilogram dry weight, wwt = wet weight. The total number of samples in 2022 was 31, which included three field duplicate samples.

Table B.9: Field Duplicate Results for Zooplankton Tissue Chemistry, Mount Polley Mine CEMP, 2022

Analyte	Units	BOL-B2_ZOOT-3_2022-07	BOL-B2_ZOOT-3X_2022-07	RPD (%)	QUL-ZOO-1_ZOOT-1_2022-06	QUL-ZOO-1_ZOOT-1X_2022-06	RPD (%)	QUL-ZOO-1_ZOOT-1_2022-08	QUL-ZOO-1_ZOOT-1X_2022-08	RPD (%)
Physical Tests										
Moisture	%	97.4	96.9	0.515	94.6	94.7	0.106	97.9	98.0	0.102
Metals										
Aluminum	mg/kg	5,430	5,590	2.90	1,220	1,210	0.823	1,450	1,240	15.6
Antimony	mg/kg	0.237	0.493	70.1	0.0790	0.171	73.6	0.170	0.0710	82.2
Arsenic	mg/kg	38.3	63.1	48.9	2.62	2.63	0.381	4.24	3.70	13.6
Barium	mg/kg	109	108	0.922	20.0	19.6	2.02	26.0	25.0	3.92
Beryllium	mg/kg	0.196	0.218	10.6	0.0560	0.0580	3.51	0.0520	0.0450	14.4
Bismuth	mg/kg	0.0370	0.0420	12.7	<0.010	<0.010	-	0.0140	0.0120	15.4
Boron	mg/kg	10.2	10.3	0.976	1.20	<1.0	18.2	3.30	3.80	14.1
Cadmium	mg/kg	0.384	0.393	2.32	0.940	0.926	1.50	1.50	1.51	0.664
Calcium	mg/kg	25,900	27,000	4.16	3,360	3,440	2.35	34,500	36,900	6.72
Cesium	mg/kg	0.664	0.717	7.68	0.103	0.0927	10.5	0.177	0.166	6.41
Chromium	mg/kg	52.8	98.5	60.4	2.69	3.37	22.4	21.3	12.8	49.9
Cobalt	mg/kg	3.64	3.81	4.56	0.983	0.983	0	1.97	1.59	21.3
Copper	mg/kg	174	178	2.27	16.5	18.1	9.25	36.3	31.6	13.8
Iron	mg/kg	9,390	9,760	3.86	1,180	1,190	0.844	3,110	2,090	39.2
Lead	mg/kg	4.45	6.65	39.6	0.464	0.514	10.2	0.933	0.750	21.7
Lithium	mg/kg	3.68	4.09	10.6	0.900	0.920	2.20	1.63	1.13	36.2
Magnesium	mg/kg	2,920	2,800	4.20	1,300	1,330	2.28	2,330	1,770	27.3
Manganese	mg/kg	1,210	1,210	0.00	97.7	97.3	0.410	164	145	12.3
Mercury	mg/kg	0.131	0.133	1.52	0.0370	0.0360	2.74	0.0820	0.0750	8.92
	mg/kg ww	0.00340	0.00410	18.7	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Molybdenum	mg/kg	1.55	2.03	26.8	0.308	0.318	3.19	0.744	0.552	29.6
Nickel	mg/kg	8.89	14.3	46.7	2.50	2.81	11.7	10.0	6.01	49.8
Phosphorus	mg/kg	10,200	10,100	0.985	11,300	11,500	1.75	11,200	11,500	2.64
Potassium	mg/kg	6,860	5,640	19.5	9,280	9,500	2.34	8,840	9,130	3.23
Rubidium	mg/kg	10.0	8.92	11.4	15.4	15.9	3.19	13.7	13.4	2.21
Selenium	mg/kg	2.99	2.70	10.2	2.88	2.87	0.348	2.65	2.67	0.752
Silver	mg/kg	0.170	0.174	2.33	0.0547	0.0506	7.79	0.0587	0.0560	4.71
Sodium	mg/kg	3,870	3,230	18.0	3,300	3,350	1.50	7,070	7,490	5.77
Strontium	mg/kg	173	183	5.62	20.4	20.8	1.94	167	186	10.8
Tellurium	mg/kg	<0.020	<0.029	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0641	0.0727	12.6	0.0307	0.0304	0.982	0.0192	0.0189	1.57
Tin	mg/kg	0.730	0.880	18.6	0.300	0.220	30.8	0.210	0.220	4.65
Titanium	mg/kg	232	235	1.28	35.1	36.3	3.36	85.7	59.7	35.8
Uranium	mg/kg	0.701	0.770	9.38	0.0901	0.0883	2.02	0.143	0.131	8.76
Vanadium	mg/kg	21.8	21.8	0	2.48	2.56	3.17	10.4	6.85	41.2
Zinc	mg/kg	133	142	6.55	84.6	81.5	3.73	71.0	74.7	5.08
Zirconium	mg/kg	4.98	5.43	8.65	0.610	0.570	6.78	1.50	1.13	28.1

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using < Laboratory Reporting Limit (LRL) results at the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

duplicate pairs. Differences are believed to be a result of natural variability, and these variations will be taken into consideration when interpreting the findings.

B6.4 Data Accuracy

Data accuracy was evaluated based on the results of 11 LCS samples (VA22B7702, VA22B4432, and VA22C0442; Appendix G). Of the 190 individual LCS results, only three samples (for silver) did not meet the laboratory DQO (VA22B7702 and VA22C0442; Appendix G). For these three samples, the laboratory DQO was marginally exceeded but results were considered acceptable as per CCME standards. As these results only represent 1.58% of LCS analyte results, the accuracy achieved by the laboratory in this study was considered excellent.

B6.5 Hold Times

Recommended hold times for the zooplankton tissue chemistry samples were met for all parameters in all samples (Appendix G).

B6.6 Data Quality Statement

Zooplankton tissue chemistry collected as part of the 2022 CEMP was of good quality as characterized by appropriate detection limits, no detectable concentrations in MBs, and good field sampling precision. Laboratory accuracy and precision could not be assessed, as comparisons were limited to analysis of moisture in one sample. The number of laboratory duplicates was low due to limited sample volume, laboratory dilution, and/or high moisture content. Field sampling precision was considered good, as fewer than 20% of all analyte comparisons from each field duplicate set exceeded the 30% DQO for RPDs. Overall, zooplankton tissue chemistry collected as part of the 2022 CEMP can be used with a high level of confidence in the derivation of conclusions, provided that natural variability is considered.

B7 PERIPHYTON COMMUNITY AND PRODUCTIVITY

B7.1 Laboratory Reporting Limits

Periphyton dry weight, ash weight, ash free dry weight, and chlorophyll-a results (VA22B8786; Appendix G) were examined to provide an inventory of analytes that were less than the LRL. All individual measures were found to be above the LRL. Therefore, the achieved LRLs were appropriate for the study.

B7.2 Laboratory Blanks

Four MB samples were analyzed in the ALS Laboratory Report (VA22B8786; Appendix G). All eight results for dry weight, ash weight, ash free, dry weight, and chlorophyll-a met the laboratory DQO, meaning that laboratory contamination had no impact on the results.

B7.3 Data Accuracy

Accuracy of periphyton productivity analytes was evaluated based on results of four LCS. All eight results met the laboratory DQO (within 30% of accepted value; VA22B8786, Appendix G). Therefore, accuracy achieved by the laboratory in this study was considered excellent.

B7.4 Density Accuracy

Periphyton density was re-measured in a total of two samples to evaluate sub-sampling accuracy and taxonomic consistency within the periphyton enumeration and identification laboratory report (10% of all samples; pp22-078; Appendix G). Since there was a high percent of agreement between the duplicate pairs (mean = 85.0%) the samples were considered to have good laboratory subsampling precision and reproducibility (Appendix Table B.10).

B7.5 Data Quality Statement

Periphyton community data collected for the 2022 CEMP were of acceptable quality as characterized by good sub-sampling accuracy. Additionally, productivity measurements (ash free dry weight and chlorophyll-a) results had appropriate LRLs, were of acceptable detectability, and demonstrated good laboratory precision and laboratory accuracy. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

Table B.10: Duplicate Freshwater Periphyton Density Samples, Mount Polley Mine CEMP, 2022

Sample ID	Laboratory ID	Original Density	Quality Assurance Density	Percent Agreement[a] (%)
EDC-U_PERI-2_2022-08	pp22-078-050	3,685,304	3,174,032	86.1
HAC-R1_PERI-4_2022-08	pp22-078-057	2,239,208	1,876,189	83.8
			Average	**85.0**

[a] Percent agreement calculated as: (100- [(difference in abundance between samples) / total abundance of original sample)] *100)%.

B8 BENTHIC INVERTEBRATE COMMUNITY

B8.1 Sorting Efficiency

The analytical laboratory reports for benthic invertebrate community composition (Appendix H) assessed the organism sorting efficiency relative to the laboratory's DQO (≥ 90%) in four samples (Appendix Table B.11). The average recovery was 99.3% and so organism sorting efficiency was considered excellent.

B8.2 Subsampling Precision and Accuracy

Of the 30 benthic invertebrate community samples analyzed, 25 were subsampled. The proportion of sub-sampled material ranged from 5% to 20% of the total sample material (Appendix Table B.12). Of the samples that were sub-sampled, four (13% of all samples) were assessed for precision and accuracy. All assessed samples met the laboratory DQO (<20%) for both precision and accuracy (Appendix Table B.13). Thus, the precision and accuracy for sub-sampling of the benthic invertebrate community samples was considered excellent.

B8.3 Taxonomic Identification Accuracy

The laboratory performed an internal audit of taxonomic identification for 13% of all samples (n = 4; Appendix Table B.14). The analysts reported total identification error rate (TIR) of 0%, percent difference in enumeration (PDE) of 0 to 0.645%, percent taxonomic disagreement (PTD) of 0% to 1.603%, and Bray Curtis Dissimilarity Index (BCDI, a measure of the differences in identifications between different analysts) of 0 to 0.01 (Appendix Table B.14). All TIRs were below the laboratory DQO (<5% TIR), which is based on CABIN laboratory methods (Environment Canada 2014), so the taxonomic accuracy of analyses was considered excellent.

B8.4 Data Quality Statement

Benthic community data collected for the 2022 CEMP were of excellent quality as characterized by excellent sorting efficiency, subsampling precision and accuracy, and excellent taxonomic identification accuracy. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

Table B.11: Benthic Invertebrate Community Sorting Efficiency, Mount Polley Mine CEMP, 2022

Habitat	Sample ID	Laboratory ID	Number of Organisms Recovered (Initial Sort)	Number of Organisms in Re-sort	Sorting Efficiency (%)
Creek	HAC-R1_BIC-1_2022- 08	CC230214	781	5	99.0
	HAC-U_BIC-4_2022-08	CC230222	388	5	99.0
	HAC-R3_BIC-3_2022-08	CC230211	342	6	99.0
Lake	QUL-PNF_BIC-1_2022-08	CC230336	95	0	100
				Average Recovery	**99.3**

Table B.12: Percent of Sample Sorted and the Total Number of Invertebrates Recovered from the Sampled Fraction, Mine Polley Mine CEMP, 2022

Habitat	Sample ID	Sieve Size (µm)	Laboratory ID	% Sampled	# Invertebrates
Creek	FPC-R3_BIC-1_2022-08	250	CC230204	7%	377
	FPC-R3_BIC-2_2022-08	250	CC230205	5%	371
	FPC-R3_BIC-3_2022-08	250	CC230206	10%	403
	FPC-R3_BIC-4_2022-08	250	CC230207	6%	308
	FPC-R3_BIC-5_2022-08	250	CC230208	9%	411
	HAC-R3_BIC-1_2022-08	250	CC230209	6%	329
	HAC-R3_BIC-2_2022-08	250	CC230210	6%	333
	HAC-R3_BIC-3_2022-08	250	CC230211	5%	342
	HAC-R3_BIC-4_2022-08	250	CC230212	6%	376
	HAC-R3_BIC-5_2022-08	250	CC230213	10%	328
	HAC-R1_BIC-1_2022-08	250	CC230214	5%	781
	HAC-R1_BIC-2_2022-08	250	CC230215	5%	782
	HAC-R1_BIC-3_2022-08	250	CC230216	5%	914
	HAC-R1_BIC-4_2022-08	250	CC230217	5%	424
	HAC-R1_BIC-5_2022-08	250	CC230218	5%	434
	HAC-U_BIC-1_2022-08	250	CC230219	5%	545
	HAC-U_BIC-2_2022-08	250	CC230220	5%	424
	HAC-U_BIC-3_2022-08	250	CC230221	5%	561
	HAC-U_BIC-4_2022-08	250	CC230222	5%	588
	HAC-U_BIC-5_2022-08	250	CC230223	5%	413
	EDC-U_BIC-1_2022-08	250	CC230224	5%	388
	EDC-U_BIC-2_2022-08	250	CC230225	5%	391
	EDC-U_BIC-3_2022-08	250	CC230226	5%	547
	EDC-U_BIC-4_2022-08	250	CC230227	20%	504
	EDC-U_BIC-5_2022-08	250	CC230228	14%	307
Lake	QUL-PNF_BIC-1_2022-08	250	CC230336	100%	95
	QUL-PNF_BIC-2_2022-08	250	CC230337	100%	70
	QUL-PNF_BIC-3_2022-08	250	CC230338	100%	118
	QUL-PNF_BIC-4_2022-08	250	CC230339	100%	137
	QUL-PNF_BIC-5_2022-08	250	CC230340	100%	158

Table B.13: Benthic Invertebrate Community Sub-sampling Precision and Accuracy, Mount Polley Mine CEMP, 2022

Habitat	Station ID		Organisms in Subsample										Total	Precision Error		Accuracy Error	
	Sample ID	Laboratory ID	1	2	3	4	5	6	7	8	9	10		Min (%)	Max (%)	Min (%)	Max (%)
Creek	HAC-R3_BIC- 5_2022-08	CC230213	328	335	401	403	382	404	333	392	350	332	3,660	0.25	18.8	4.370	10.4
	EDC-U_BIC- 4_2022-08	CC230227	532	491	525	564	488	-	-	-	-	-	2,600	0.61	13.48	0.96	8.46
	HAC-U_BIC- 5_2022-08	CC230223	413	402	385	420	348	-	-	-	-	-	1,968	1.67	17.14	2.13	11.59
Lake	QUL-PREF1-3	CC220762	394	393	-	-	-	-	-	-	-	-	787	0.25	0.25	0.13	0.13
													Average	**0.70**	**12.4**	**1.90**	**7.64**

Note: "-" indicates no data available.

Table B.14: Percent Benthic Invertebrate Community Organism Recovery[a], Mount Polley Mine CEMP, 2022

Habitat	Sample ID	Laboratory ID	Percent Sampled (%)	Taxa Identified	TIR (%)	PDE (%)	PTD (%)	BCDI
Creek	FPC-R3_BIC-4_2022-08	CC230207	6	312	0	0.645	1.603	0.010
	HAC-R1_BIC-1_2022-8	CC230214	5	780	0	0.064	0.512	0.004
	HAC-U_BIC-4_2022-08	CC230222	5	588	0	0	0.680	0.007
Lake	QUL-PNF_BIC-2_2022-08	CC230337	100	70	0	0	0	0

Notes: TIR = Total Identification Error Rate, PDE = Percent Difference in Enumeration, PTD = Percent Taxonomic Disagreement, BCDI = Bray Curtis Dissimilarity Index to quantify differences in identifications.

[a] For error rationale and calculations, refer to Cordillera report (Appendix G).

B9 BENTHIC INVERTEBRATE AND PERIPHYTON TISSUE CHEMISTRY

B9.1 Laboratory Reporting Limits

One analytical ALS Laboratory Report for benthic invertebrate and periphyton tissue chemistry (VA22B8779; Appendix G) was examined to provide an inventory of analytes for which sample results were less than the LRL. The maximum LRLs for these analytes were assessed relative to existing British Columbia benthic invertebrate dietary guidelines (available only for selenium; BCMOE 2014). Achieved LRLs were below the available guideline for selenium (Appendix Table B.15), indicating the achieved LRLs were appropriate for the study.

B9.2 Laboratory Blanks

A total of 22 MB samples were analyzed in the ALS Laboratory Report (VA22B8779; Appendix G). All the 407 individual results met the laboratory DQO. Therefore, laboratory precision was considered excellent.

B9.3 Data Precision

A total of 17 laboratory duplicate samples were used to evaluate precision within the ALS Laboratory Report (VA22B8779; Appendix G). Out of the 259 laboratory duplicate results, 29 results in five samples did not pass the laboratory DQO (i.e., 11.2% of all pairs) due to sample heterogeneity. For primary analytes, this included one duplicate result each for arsenic and copper and two duplicate results for iron that did not pass the laboratory DQO. For secondary analytes, this included one duplicate result each for barium, cobalt and uranium, and two duplicate pairs each for silver, titanium, and vanadium that did not pass the laboratory DQO. Since these analytes have been identified as potentially indicative of mine influence, consideration will be given to other quality control samples and interpretation of data. Since the overall occurrence of lab duplicate DQO exceedances was low, samples can be considered to have overall good laboratory precision and reproducibility.

A total of 10 sets of field duplicate benthic invertebrate samples were collected (five of each composite-taxa and caddisfly samples) and five sets periphyton tissue samples were collected to assess the precision associated with field sampling (Appendix Table B.16; see Section B.2.3 for explanation on RPD calculation and DQOs). Of the 15 sets of duplicate samples, 11 sets had >20% of analytes with RPDs >30%: all five of the periphyton duplicate sets (100%), four of five composite-taxa duplicate sets (80%), and two of five caddisfly duplicate sets (40%) had >20% of analytes with RPDs >30%. All primary and secondary analytes had at least one

Table B.15: Evaluation of Laboratory Reporting Limits (LRLs) in Benthic Invertebrate and Periphyton Tissue Chemistry Results Relative to Guidelines, Mount Polley

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Antimony	mg/kg	0.01 to 0.054	5 (3.14%)
Beryllium	mg/kg	0.01 to 0.035	38 (23.9%)
Bismuth	mg/kg	0.01 to 0.035	91 (57.2%)
Boron	mg/kg	1 to 3.6	54 (34.0%)
Cadmium	mg/kg	0.01 to 0.035	4 (2.52%)
Cesium	mg/kg	0.005 to 0.0174	6 (3.77%)
Chromium	mg/kg	0.2 to 0.7	6 (3.77%)
Lead	mg/kg	0.05 to 0.174	13 (8.18%)
Lithium	mg/kg	0.5 to 1.74	54 (34.0%)
Nickel	mg/kg	0.2 to 0.7	7 (4.40%)
Silver	mg/kg	0.005 to 0.0174	20 (12.6%)
Tellurium	mg/kg	0.02 to 0.07	133 (83.6%)
Thallium	mg/kg	0.002 to 0.0072	23 (14.5%)
Tin	mg/kg	0.1 to 0.35	133 (83.6%)
Uranium	mg/kg	0.002 to 0.007	2 (1.26%)
Zirconium	mg/kg	0.2 to 0.7	37 (23.3%)

Notes: All concentrations are in milligrams per kilogram dry weight (mg/kg dw). The total number of samples in 2022 was 159, which included 15 field duplicate samples.

Table B.16: **Field Duplicate Results for Benthic Invertebrate and Periphyton Tissue Analyses, Mount Polley Mine CEMP, 2022**

Analyte	Unit	E1_INV-5_2022-08	E1_INV-5X_2022-08	RPD (%)	E1_INV-7_2022-08	E1_INV-7X_2022-08	RPD (%)	E1_INVCAD-5_2022-08	E1_INVCAD-5X_2022-08	RPD (%)	E1_INVCAD-7_2022-08	E1_INVCAD-7X_2022-08	RPD (%)	E1_PERT-5_2022-08	E1_PERT-5X_2022-08	RPD (%)
Physical Tests																
Moisture	%	84.3	79.6	5.74	77.4	78.2	1.03	80.4	82.4	2.46	76.8	78	1.55	78.4	91.2	15.1
Metals																
Aluminum	mg/kg	1,730	1,930	10.9	356	1,910	137	4,140	4,750	13.7	4,520	3,900	14.7	12,300	19,300	44.3
Antimony	mg/kg	0.0440	0.0450	2.25	0.0160	0.0480	100	0.0730	0.0760	4.03	0.0760	0.0670	12.6	0.0490	0.0570	15.1
Arsenic	mg/kg	3.03	3.91	25.4	1.44	3.38	80.5	6.05	6.66	9.60	6.24	6.20	0.643	11.4	9.62	16.9
Barium	mg/kg	87.6	68.1	25.0	11.7	70.0	143	163	215	27.5	179	171	4.57	157	550	111
Beryllium	mg/kg	0.0590	0.0580	1.71	0.0120	0.0670	139	0.148	0.161	8.41	0.164	0.135	19.4	0.411	0.417	1.45
Bismuth	mg/kg	0.0140	0.0150	6.90	<0.010	0.0160	46.2	0.0320	0.0380	17.1	0.0330	0.0300	9.52	0.0890	0.0730	19.8
Boron	mg/kg	1.70	2.30	30.0	<1.0	2.40	82.4	5.30	4.90	7.84	4.40	4.30	2.30	11.9	14.8	21.7
Cadmium	mg/kg	2.22	1.84	18.7	0.786	1.50	62.5	0.903	1.10	19.7	0.923	0.895	3.08	0.275	0.256	7.16
Calcium	mg/kg	2,350	2,240	4.79	1,050	2,540	83.0	3,120	3,920	22.7	3,530	3,130	12.0	9,300	13,200	34.7
Cesium	mg/kg	0.210	0.226	7.34	0.0440	0.214	132	0.392	0.453	14.4	0.447	0.407	9.37	1.36	1.18	14.2
Chromium	mg/kg	5.06	6.49	24.8	1.14	6.16	138	23.2	16.1	36.1	13.8	10.4	28.1	32.0	65.6	68.9
Cobalt	mg/kg	3.03	3.76	21.5	1.01	3.42	109	6.32	6.80	7.32	6.06	5.61	7.71	11.7	14.6	22.1
Copper	mg/kg	77.4	87.9	12.7	34.8	90.0	88.5	118	137	14.9	130	121	7.17	214	164	26.5
Iron	mg/kg	3,610	3,950	8.99	671	4,040	143	8,410	9,940	16.7	9,370	8,180	13.6	25,000	35,700	35.3
Lead	mg/kg	0.881	0.914	3.68	0.190	0.985	135	1.96	2.34	17.7	2.05	1.87	9.18	5.97	5.78	3.23
Lithium	mg/kg	1.60	1.77	10.1	<0.50	1.82	114	4.09	4.26	4.07	4.20	3.51	17.9	13.4	14.7	9.25
Magnesium	mg/kg	2,420	2,090	14.6	1,480	2,260	41.7	3,240	3,590	10.2	3,240	2,960	9.03	7,020	11,000	44.2
Manganese	mg/kg	597	481	21.5	206	848	122	1,310	1,640	22.4	1,650	1,630	1.22	1,200	1,300	8.00
Mercury	mg/kg	0.0780	0.0554	33.9	0.0642	0.0700	8.64	0.0480	0.0578	18.5	0.0489	0.0531	8.24	0.0637	0.0451	34.2
Molybdenum	mg/kg	0.815	0.874	6.99	2.52	1.06	81.6	1.86	1.53	19.5	1.84	1.54	17.8	1.44	1.85	24.9
Nickel	mg/kg	3.18	5.91	60.1	6.54	5.91	10.1	16.8	14.5	14.7	12.2	10.5	15.0	25.4	40.6	46.1
Phosphorus	mg/kg	9,580	8,550	11.4	8,080	7,780	3.78	6,890	7,430	7.54	6,870	7,020	2.16	1,860	2,580	32.4
Potassium	mg/kg	11,100	9,940	11.0	7,720	9,830	24.0	13,700	15,300	11.0	13,200	14,100	6.59	2,420	3,510	36.8
Rubidium	mg/kg	5.52	6.66	18.7	3.18	5.63	55.6	6.10	7.21	16.7	6.40	7.09	10.2	10.4	9.43	9.78
Selenium	mg/kg	1.91	2.04	6.58	1.74	2.03	15.4	1.44	1.65	13.6	1.59	1.69	6.10	0.940	0.970	3.14
Silver	mg/kg	0.108	0.0970	10.7	0.0362	0.0955	90.1	0.0882	0.0993	11.8	0.0919	0.0882	4.11	0.129	0.109	16.8
Sodium	mg/kg	9,590	3,820	86.1	3,110	3,010	3.27	3,380	3,520	4.06	2,690	2,710	0.741	447	1,560	111
Strontium	mg/kg	13.3	17.1	25.0	5.93	16.5	94.2	27.0	31.6	15.7	26.5	24.2	9.07	87.1	148	51.8
Tellurium	mg/kg	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	0.0320	0.0210	41.5
Thallium	mg/kg	0.0240	0.0226	6.01	0.0063	0.0226	113	0.0351	0.0416	16.9	0.0306	0.0327	6.64	0.0766	0.0498	42.4
Tin	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	0.120	0.160	28.6	0.110	0.120	8.70	0.280	0.310	10.2
Titanium	mg/kg	105	109	3.74	17.8	100	140	224	262	15.6	232	213	8.54	647	1,260	64.3
Uranium	mg/kg	0.157	0.159	1.27	0.0321	0.183	140	0.383	0.451	16.3	0.352	0.319	9.84	0.544	0.652	18.1
Vanadium	mg/kg	9.79	10.1	3.12	1.46	9.34	146	19.3	23.8	20.9	24.6	20.8	16.7	59.5	121	68.1
Zinc	mg/kg	143	139	2.84	106	132	21.8	154	171	10.5	137	138	0.727	61.8	62.6	1.29
Zirconium	mg/kg	1.34	1.52	12.6	0.280	1.65	142	3.12	3.49	11.2	3.45	3.10	10.7	7.58	13.0	52.7

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using < Laboratory Reporting Limit (LRL) results at the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Table B.16: **Field Duplicate Results for Benthic Invertebrate and Periphyton Tissue Analyses, Mount Polley Mine CEMP, 2022**

Analyte	Unit	E1_PERT-7_2022-08	E1_PERT-7X_2022-08	RPD (%)	HAC-D_INV-7_2022-08	HAC-D_INV-7X_2022-08	RPD (%)	HAC-D_INVCAD-7_2022-08	HAC-D_INVCAD-7X_2022-08	RPD (%)	HAC-D_PERT-7_2022-08	HAC-D_PERT-7X_2022-08	RPD (%)	HAC-R1_INV-7_2022-08	HAC-R1_INV-7X_2022-08	RPD (%)
Physical Tests																
Moisture	%	87.3	79.9	8.85	79.6	80.3	0.876	70.1	70.6	0.711	61.9	56.8	8.59	81.8	77	6.05
Metals																
Aluminum	mg/kg	6,810	14,500	72.2	541	1,820	108	186	166	11.4	2,320	2,700	15.1	2,360	838	95.2
Antimony	mg/kg	0.0850	0.0700	19.4	0.0300	0.0890	99.2	0.0190	0.0190	0	0.0820	0.0650	23.1	0.0470	0.0360	26.5
Arsenic	mg/kg	9.48	11.9	22.6	2.10	3.39	47.0	0.782	0.547	35.4	6.29	5.47	13.9	1.75	1.60	8.96
Barium	mg/kg	103	573	139	31.7	35.9	12.4	12.7	6.08	70.5	222	163	30.6	103	26.0	119
Beryllium	mg/kg	0.224	0.447	66.5	0.0210	0.0840	120	<0.010	<0.010	-	0.105	0.0960	8.96	0.0580	0.0290	66.7
Bismuth	mg/kg	0.0510	0.0840	48.9	<0.010	0.0100	0	<0.010	<0.010	-	<0.024	0.0190	23.3	<0.010	<0.010	-
Boron	mg/kg	56.2	24.8	77.5	4.00	3.10	25.4	<1.0	<1.0	-	88.8	39.9	76.0	3.40	2.60	26.7
Cadmium	mg/kg	0.248	0.342	31.9	2.31	1.31	55.2	0.193	0.0790	83.8	0.597	0.317	61.3	0.935	0.873	6.86
Calcium	mg/kg	16,800	12,600	28.6	4,840	4,640	4.22	980	790	21.5	260,000	202,000	25.1	4,080	2,600	44.3
Cesium	mg/kg	0.808	1.28	45.2	0.0860	0.399	129	0.0269	0.0261	3.02	0.315	0.325	3.13	0.152	0.0752	67.6
Chromium	mg/kg	23.2	33.1	35.2	2.29	5.17	77.2	0.860	0.470	58.6	7.85	8.89	12.4	2.67	2.63	1.51
Cobalt	mg/kg	6.87	11.1	47.1	1.61	2.51	43.7	0.488	0.243	67.0	3.93	3.39	14.8	2.09	1.46	35.5
Copper	mg/kg	147	520	112	81.5	68.0	18.1	28.3	20.6	31.5	194	102	62.2	134	107	22.4
Iron	mg/kg	15,000	27,100	57.5	1,270	4,730	115	396	376	5.18	4,740	6,470	30.9	3,020	1,530	65.5
Lead	mg/kg	3.28	5.25	46.2	0.350	1.62	129	0.130	0.113	14.0	1.12	1.47	27.0	0.693	0.344	67.3
Lithium	mg/kg	7.19	13.0	57.6	0.560	1.86	107	<0.50	<0.50	-	2.65	2.70	1.87	1.31	0.670	64.6
Magnesium	mg/kg	4,800	7,290	41.2	1,500	2,160	36.1	1,070	1,090	1.85	4,170	3,540	16.3	1,800	1,440	22.2
Manganese	mg/kg	1,490	1,600	7.12	1,390	983	34.3	534	354	40.5	7,210	3,820	61.5	981	780	22.8
Mercury	mg/kg	0.0450	0.0602	28.9	0.0842	0.0656	24.8	0.0353	0.0480	30.5	0.0212	0.0245	14.4	0.0761	0.0460	49.3
Molybdenum	mg/kg	1.72	1.77	2.87	1.79	1.74	2.83	4.15	5.68	31.1	0.998	1.19	17.6	3.60	4.54	23.1
Nickel	mg/kg	16.8	25.0	39.2	2.23	3.53	45.1	0.860	0.420	68.8	6.17	5.67	8.45	3.24	2.82	13.9
Phosphorus	mg/kg	2,930	2,300	24.1	9,300	8,190	12.7	6,340	6,480	2.18	1,910	1,440	28.1	7,980	8,290	3.81
Potassium	mg/kg	6,040	3,170	62.3	8,210	7,820	4.87	6,210	5,850	5.97	3,480	2,920	17.5	8,380	7,940	5.39
Rubidium	mg/kg	11.4	10.4	9.17	3.35	2.66	23.0	1.38	1.14	19.0	5.26	5.07	3.68	3.09	2.82	9.14
Selenium	mg/kg	0.830	2.03	83.9	4.23	3.59	16.4	3.21	4.18	26.3	2.53	1.78	34.8	4.91	4.48	9.16
Silver	mg/kg	0.0709	0.150	71.6	0.0296	0.0337	13.0	0.0065	<0.0050	26.1	0.0265	0.0285	7.27	0.0356	0.0219	47.7
Sodium	mg/kg	351	441	22.7	8,240	6,690	20.8	2,170	2,070	4.72	341	267	24.3	3,420	3,040	11.8
Strontium	mg/kg	87.7	117	28.6	19.2	21.4	10.8	7.72	5.90	26.7	618	522	16.8	39.7	14.4	93.5
Tellurium	mg/kg	<0.020	0.0280	33.3	<0.020	<0.020	-	<0.020	<0.020	-	<0.048	<0.024	-	<0.020	<0.020	-
Thallium	mg/kg	0.0649	0.0737	12.7	0.0120	0.0229	62.5	0.0040	0.0022	58.1	0.0344	0.0285	18.8	0.0070	0.0044	45.6
Tin	mg/kg	0.220	0.380	53.3	<0.10	<0.10	-	0.100	<0.10	0	<0.24	0.120	66.7	<0.10	<0.10	-
Titanium	mg/kg	386	786	68.3	34.4	204	142	11.0	9.79	11.6	142	190	28.9	102	45.8	76.0
Uranium	mg/kg	0.386	0.613	45.4	0.0721	0.118	48.3	0.0190	0.0131	36.8	0.210	0.215	2.35	0.128	0.0908	34.0
Vanadium	mg/kg	34.7	71.7	69.5	3.94	13.2	108	1.02	0.970	5.03	16.9	19.4	13.8	9.99	5.12	64.5
Zinc	mg/kg	39.6	57.5	36.9	142	116	20.2	84.3	81.4	3.50	28.6	21.1	30.2	119	108	9.69
Zirconium	mg/kg	4.68	7.97	52.0	0.420	1.98	130	<0.20	<0.20	-	1.22	1.65	30.0	1.11	0.570	64.3

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using < Laboratory Reporting Limit (LRL) results at the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Table B.16: **Field Duplicate Results for Benthic Invertebrate and Periphyton Tissue Analyses, Mount Polley Mine CEMP, 2022**

Analyte	Unit	HAC-R1_INV-8_2022-08	HAC-R1_INV-8X_2022-08	RPD (%)	HAC-R1_INVCAD-7_2022-08	HAC-R1_INVCAD-7X_2022-08	RPD (%)	HAC-R1_INVCAD-8_2022-08	HAC-R1_INVCAD-8X_2022-08	RPD (%)	HAC-R1_PERT-7_2022-08	HAC-R1_PERT-7X_2022-08	RPD (%)	HAC-R1_PERT-8_2022-08	HAC-R1_PERT-8X_2022-08	RPD (%)
Physical Tests																
Moisture	%	82.6	85.3	3.22	71	72.9	2.64	73.6	73.1	0.682	69.8	72.4	3.66	71.3	60.2	16.9
Metals																
Aluminum	mg/kg	898	2,200	84.1	64.4	84.8	27.3	56.3	33.7	50.2	4,720	1,650	96.4	4,470	1,880	81.6
Antimony	mg/kg	0.0360	0.0800	75.9	0.0210	0.0190	10.0	0.0260	0.0180	36.4	0.0720	0.0690	4.26	0.0780	0.0840	7.41
Arsenic	mg/kg	2.08	3.48	50.4	0.317	0.321	1.25	0.338	0.272	21.6	3.41	2.16	44.9	3.97	2.78	35.3
Barium	mg/kg	25.0	50.9	68.2	2.49	2.93	16.2	5.84	3.80	42.3	246	96.1	87.6	165	90.7	58.1
Beryllium	mg/kg	0.0290	0.0780	91.6	<0.010	<0.010	-	<0.010	<0.010	-	0.171	0.0560	101	0.138	0.0640	73.3
Bismuth	mg/kg	<0.010	0.0130	26.1	<0.010	<0.010	-	<0.010	<0.010	-	<0.012	<0.010	-	0.0160	0.0140	13.3
Boron	mg/kg	2.30	4.00	54.0	<1.0	<1.0	-	<1.0	<1.0	-	232	284	20.2	150	179	17.6
Cadmium	mg/kg	1.97	1.15	52.6	0.0350	0.0200	54.5	0.0430	0.0130	107	0.180	0.218	19.1	0.238	0.218	8.77
Calcium	mg/kg	6,620	5,560	17.4	664	643	3.21	701	748	6.49	247,000	196,000	23.0	210,000	204,000	2.90
Cesium	mg/kg	0.0978	0.210	72.9	0.0082	0.0100	19.8	0.0078	0.0060	26.1	0.258	0.176	37.8	0.267	0.173	42.7
Chromium	mg/kg	1.88	5.04	91.3	0.400	0.310	25.4	0.250	<0.20	22.2	19.3	11.2	53.1	88.5	123	32.6
Cobalt	mg/kg	1.68	2.83	51.0	0.140	0.128	8.96	0.269	0.0790	109	3.01	2.99	0.667	3.47	2.14	47.4
Copper	mg/kg	138	223	47.1	14.3	16.5	14.3	16.4	13.7	17.9	57.5	56.8	1.22	160	56.0	96.3
Iron	mg/kg	1,820	4,080	76.6	175	210	18.2	177	119	39.2	4,450	3,850	14.5	7,680	4,250	57.5
Lead	mg/kg	0.386	0.832	73.2	0.0560	<0.050	11.3	<0.050	<0.050	-	0.747	0.512	37.3	1.17	0.828	34.2
Lithium	mg/kg	0.810	1.76	73.9	<0.50	<0.50	-	<0.50	<0.50	-	2.56	1.47	54.1	2.80	1.60	54.5
Magnesium	mg/kg	1,740	2,440	33.5	999	1,010	1.10	1,020	1,070	4.78	3,260	3,220	1.23	3,660	2,730	29.1
Manganese	mg/kg	828	1,140	31.7	151	125	18.8	368	170	73.6	1,780	2,410	30.1	2,100	1,580	28.3
Mercury	mg/kg	0.0844	0.0637	28.0	0.0329	0.0366	10.6	0.0429	0.0364	16.4	0.0160	0.0088	58.1	0.0243	0.0102	81.7
Molybdenum	mg/kg	2.52	5.68	77.1	8.77	7.37	17.3	5.49	9.03	48.8	1.23	1.67	30.3	2.29	1.05	74.3
Nickel	mg/kg	2.52	4.96	65.2	0.270	0.230	16.0	0.230	<0.20	14.0	4.68	6.42	31.4	11.1	8.33	28.5
Phosphorus	mg/kg	10,600	8,220	25.3	6,450	6,400	0.778	6,540	6,880	5.07	880	879	0.114	1,340	1,040	25.2
Potassium	mg/kg	8,350	10,300	20.9	6,130	5,520	10.5	5,850	5,680	2.95	3,410	4,280	22.6	3,370	2,680	22.8
Rubidium	mg/kg	3.95	4.04	2.25	1.01	1.24	20.4	1.14	1.09	4.48	4.05	4.52	11.0	4.55	2.98	41.7
Selenium	mg/kg	5.16	6.07	16.2	7.87	6.17	24.2	5.35	7.35	31.5	1.51	1.82	18.6	1.92	1.62	16.9
Silver	mg/kg	0.0332	0.0557	50.6	<0.0050	<0.0050	-	<0.0050	<0.0050	-	0.0259	0.0195	28.2	0.0295	0.0228	25.6
Sodium	mg/kg	3,620	5,710	44.8	2,400	2,200	8.70	2,440	2,160	12.2	333	306	8.45	370	295	22.6
Strontium	mg/kg	25.8	28.1	8.53	3.95	3.95	0	4.80	5.48	13.2	571	432	27.7	439	429	2.30
Tellurium	mg/kg	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	0.0270	0.0220	20.4	0.0210	<0.024	13.3
Thallium	mg/kg	0.0067	0.0167	85.5	<0.0020	<0.0020	-	<0.0020	<0.0020	-	0.0068	0.0066	2.99	0.0087	0.0066	27.5
Tin	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.12	<0.10	-	0.220	<0.12	58.8
Titanium	mg/kg	57.4	128	76.2	3.56	5.59	44.4	3.54	2.17	48.0	228	304	28.6	365	162	77.0
Uranium	mg/kg	0.0896	0.237	90.3	0.0065	0.0072	10.2	0.0116	0.0035	107	0.215	0.132	47.8	0.195	0.152	24.8
Vanadium	mg/kg	5.75	14.2	84.7	0.400	0.520	26.1	0.420	0.210	66.7	18.2	11.8	42.7	25.7	12.8	67.0
Zinc	mg/kg	131	122	7.11	87.0	79.0	9.64	99.3	92.3	7.31	27.4	19.7	32.7	59.8	40.8	37.8
Zirconium	mg/kg	0.620	1.30	70.8	<0.20	<0.20	-	<0.20	<0.20	-	2.10	2.67	23.9	2.38	1.35	55.2

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using < Laboratory Reporting Limit (LRL) results at the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

RPD that exceeded the 30% RPD DQO, with iron (primary), barium, cadmium, cobalt, titanium, uranium, and vanadium (all secondary) exceeding the DQO in over half of the duplicate sets (Appendix Table B.16). This variability is not a result of inconsistent field sampling, but as a result of sample heterogeneity (e.g., taxonomic variability in composite-taxa samples or natural variability within a single taxon). Field crews strived to collect and/or split sample between duplicate sample sets evenly, but a perfect split is not always feasible. It should be mentioned that tissue samples were collected in replicates of eight for each periphyton, composite-taxa, and caddisfly tissue to account for sampling heterogeneity (i.e., a total of 24 tissue samples per sampling area). As a high proportion of all field duplicate analyses exceeded the DQO, samples were considered to have poor field precision. These sources of variability will be considered during data interpretation.

B9.4 Data Accuracy

Data accuracy was evaluated based on results of 12 RM samples and 22 LCS samples, which yielded 291 RM results and 407 LCS results (VA22B8779; Appendix G). Of these, one RM result (titanium) exceeded the DQO. As the laboratory DQO was only exceeded in 0.344% of RM results and all LCS results met the laboratory DQO, accuracy achieved by the laboratory in this study is therefore considered excellent.

B9.5 Hold Times

Recommended hold times for the benthic and periphyton tissue chemistry samples were met for all parameters (VA22B8779; Appendix G).

B9.6 Data Quality Statement

Benthic and periphyton tissue chemistry data collected as part of the 2022 CEMP was of good quality as characterized by good detectability and appropriate LRLs (below the BCMOE guideline for selenium), no detectable analyte concentrations in MBs, and good laboratory accuracy and precision. Evaluation of field precision indicated high variability among parents and duplicate sample results (high relative percent differences) for composite-taxa, caddisfly, and periphyton tissue quality. Though field duplicates exceeded the DQO in a high percentage of comparisons, this does not reflect incorrect sampling methods, but rather natural variability due to sample heterogeneity. Collection of replicate samples should help to address the natural variability in biological tissue samples. Interpretation benthic invertebrate and periphyton chemistry tissue results from the 2022 CEMP should be approached carefully and compared relative to historic results before derivation of conclusions. Several primary and secondary analytes did not meet the DQO in laboratory and field duplicate samples, further

suggesting natural heterogeneity in samples. These sources of variability will be considered during data interpretation.

B10 FISH TISSUE CHEMISTRY

B10.1 Laboratory Reporting Limits

The analytical ALS Laboratory Reports for fish tissue chemistry (see laboratory reports VA22B2820, VA22B2821, VA22B4917, and VA22B5055; Appendix G) were examined to provide an inventory of analytes for which the sample results were less than the LRL. The LRL range for these analytes were also assessed relative to available guidelines, namely for mercury and selenium (BCMOE 2014, CFIA 2015; Appendix Table B.17). Results for several analytes were frequently below the LRL; however, fish tissue guidelines did not exist for those analytes (Appendix Table B.17). All achieved LRLs were below the available guidelines for mercury and selenium; therefore the achieved LRLs were appropriate for this study.

B10.2 Laboratory Blanks

A total of 60 MB samples were analyzed in the ALS Laboratory Reports (see laboratory reports VA22B2820, VA22B2821, VA22B4917, and VA22B5055; Appendix G). All reported MB results (1,029) met the laboratory DQO (VA22B2820, VA22B2821, VA22B4917, and VA22B5055; Appendix G), therefore, laboratory precision was considered excellent.

B10.3 Data Precision

A total of 32 laboratory duplicate samples were used to evaluate laboratory precision within the ALS Laboratory Reports (see laboratory reports VA22B2820, VA22B2821, and VA22B4917, and VA22B5055; Appendix G). Of the 930 duplicate pair results, 11 (1.18%) did not meet the laboratory DQO due to sample heterogeneity (VA22B2820, VA22B2821, and VA22B4917, and VA22B5055; Appendix G), including one result each for calcium, manganese, and phosphorous, two results each for barium and strontium, and four results for chromium. As a relatively low number of laboratory duplicate samples exceeded the laboratory DQO, laboratory precision and reproducibility were overall considered good.

A total of 32 sets of field duplicate samples were collected to assess field sampling precision (Appendix Table B.18), with 12 sets collected during spring fish tissue monitoring and 20 sets collected during fall fish tissue monitoring. These samples consisted of eight kidney, eight liver, eight muscle, and eight ovary duplicate samples from longnose sucker and rainbow trout (spring tissue monitoring at Polley and Bootjack Lakes), lake trout, peamouth chub (fall tissue monitoring at Quesnel Lake), and rainbow trout (fall tissue monitoring at Quesnel River). Several RPDs could not be calculated as both analyte concentrations were below the LRL (see Section B.2.3 for explanation on RPD calculation and DQOs). Of the 32 field duplicate sets, 14 sets (43.8 % of sets) had >20% of analytes that exceeded the DQO of 30%.

Table B.17: Evaluation of Laboratory Reporting Limits (LRL) in Fish Tissue Chemistry Results, Mount Polley Mine CEMP, 2022

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Metals			
Aluminum	mg/kg	2 to 6.4	98 (55.1%)
Antimony	mg/kg	0.01 to 0.026	144 (80.9%)
Arsenic	mg/kg	0.02 to 0.064	9 (5.06%)
Beryllium	mg/kg	0.01 to 0.013	178 (100%)
Bismuth	mg/kg	0.01 to 0.013	161 (90.4%)
Boron	mg/kg	1 to 1.7	155 (87.1%)
Cadmium	mg/kg	0.005 to 0.013	59 (33.1%)
Chromium	mg/kg	0.05 to 0.26	87 (48.9%)
Colbat	mg/kg	0.02 to 0.026	23 (12.9%)
Led	mg/kg	0.02 to 0.064	157 (88.2%)
Lithium	mg/kg	0.5 to 0.64	178 (100%)
Molybdenum	mg/kg	0.02 to 0.051	28 (15.7%)
Nickle	mg/kg	0.2 to 3.6	123 (69.1%)
Silver	mg/kg	0.005 to 0.0064	80 (57.1%)
Tellurium	mg/kg	0.02 to 0.026	159 (89.3%)
Thallium	mg/kg	0.002 to 0.0034	65 (36.5%)
Tin	mg/kg	0.1 to 0.13	61 (34.3%)
Titanium	mg/kg	0.25 to 0.85	113 (80.7%)
Uranium	mg/kg	0.002 to 0.0026	76 (42.7%)
Vanadium	mg/kg	0.1 to 0.13	72 (40.4%)
Zirconium	mg/kg	0.2 to 0.26	111 (62.4%)

Notes: Only analytes with at least one result below the LRL is displayed. Fish tissue guidelines only exist for mercury and selenium. The total number of samples in 2022 was 178, which included 32 field duplicate samples.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	BOL_LSU-Ki-6_2022-05	BOL_LSU-Ki-6X_2022-05	RPD (%)	BOL_LSU-Li-2_2022-05	BOL_LSU-Li-2X_2022-05	RPD (%)	BOL_RB-M-7_2022-05	BOL_RB-M-7X_2022-05	RPD (%)	BOL_RB-O-8_2022-05	BOL_RB-O-8X_2022-05	RPD (%)
Physical Test													
Moisture	%	79	79	0	80.4	80.6	0.248	79.5	79.4	0.126	68.5	68.5	0
Metals													
Aluminum	mg/kg	<5.0	<5.0	-	<5.0	<5.0	-	<5.0	<5.0	-	<2.0	<2.0	-
Antimony	mg/kg	<0.010	<0.010	-	0.022	0.022	0	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.093	0.091	2.17	0.152	0.153	0.656	0.031	0.031	0	0.024	0.021	13.3
Barium	mg/kg	3.15	2.28	32.0	0.454	0.708	43.7	0.622	1.26	67.8	1.12	1.04	7.41
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	1.75	1.7	2.90	0.469	0.459	2.16	<0.010	<0.010	-	<0.0050	<0.0050	-
Calcium	mg/kg	2520	1040	83.1	285	293	2.77	516	828	46.4	1440	1410	2.11
Cesium	mg/kg	0.0459	0.0483	5.10	0.0216	0.0201	7.19	0.0611	0.0614	0.490	0.0174	0.0168	3.51
Chromium	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.050	<0.050	-
Cobalt	mg/kg	0.452	0.423	6.63	0.12	0.112	6.90	<0.020	<0.020	-	0.08	0.078	2.53
Copper	mg/kg	4.24	4.3	1.41	23	26	12.2	2.14	1.94	9.80	10.3	10.5	1.92
Iron	mg/kg	338	513	41.1	424	449	5.73	30.4	26.8	12.6	61.9	67.4	8.51
Lead	mg/kg	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050	-	<0.020	<0.020	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	692	646	6.88	1030	959	7.14	1390	1170	17.2	1650	1610	2.45
Manganese	mg/kg	66.1	14.3	129	14.2	12.7	11.2	0.714	0.843	16.6	12.9	12	7.23
Mercury	mg/kg dwt	0.306	0.282	8.16	0.192	0.186	3.17	0.343	0.32	6.94	0.006	0.0066	9.52
	mg/kg wwt	0.0641	0.0592	7.95	0.0376	0.0362	3.79	0.0703	0.0659	6.46	0.0192	0.0209	8.48
Molybdenum	mg/kg	0.595	0.566	5.00	1.13	1.08	4.52	<0.040	<0.040	-	0.045	0.047	4.35
Nickel	mg/kg	0.61	0.52	15.9	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	14500	12800	12.5	15900	15100	5.16	14100	14400	2.11	12800	12100	5.62
Potassium	mg/kg	12600	13100	3.89	11300	10600	6.39	23700	23600	0.423	8440	7920	6.36
Rubidium	mg/kg	6.44	6.39	0.779	6.43	6.21	3.48	11.9	11.9	0	5.12	5.11	0.196
Selenium	mg/kg	6.11	5.93	2.99	6.89	6.37	7.84	2.28	2.2	3.57	6.35	6.22	2.07
Silver	mg/kg	<0.0050	<0.0050	-	0.0284	0.0316	10.7	<0.0050	<0.0050	-	0.0059	0.0072	19.8
Sodium	mg/kg	6460	6110	5.57	6940	6690	3.67	2190	1820	18.5	3860	3860	0
Strontium	mg/kg	6.84	2.16	104	0.64	0.64	0	0.67	1.3	64.0	4.16	4.07	2.19
Tellurium	mg/kg	0.024	0.021	13.3	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0125	0.0138	9.89	0.0021	<0.0020	4.88	0.0129	0.0142	9.59	<0.0020	<0.0020	-
Tin	mg/kg	0.66	0.74	11.4	0.5	0.5	0	1.34	0.89	40.4	<0.10	0.14	33.3
Titanium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.25	<0.25	-
Uranium	mg/kg	0.0186	0.0153	19.5	0.0051	0.0048	6.06	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Vanadium	mg/kg	0.97	0.86	12.0	0.3	0.31	3.28	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	105	107	1.89	79.9	77.5	3.05	18.3	17.6	3.90	104	106	1.90
Zirconium	mg/kg	0.2	0.2	0	0.24	<0.20	18.2	0.25	<0.20	22.2	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	POL_LSU-Ki-3_2022-05	POL_LSU-Ki-3X_2022-05	RPD (%)	POL_LSU-Li-3_2022-05	POL_LSU-Li-3X_2022-05	RPD (%)	POL_LSU-M-8_2022-05	POL_LSU-M-8X_2022-05	RPD (%)	POL_RB-Ki-1_2022-05	POL_RB-Ki-1X_2022-05	RPD (%)
Physical Test													
Moisture	%	78.2	78.7	0.637	77.4	78	0.772	76	74.8	1.59	79.8	75.4	5.67
Metals													
Aluminum	mg/kg	<5.0	<5.0	-	<2.0	3.1	43.1	7.2	<2.0	113	10	10	0
Antimony	mg/kg	<0.010	<0.010	-	0.035	0.032	8.96	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.156	0.115	30.3	0.244	0.278	13.0	0.101	0.077	27.0	0.662	0.421	44.5
Barium	mg/kg	1.38	0.606	77.9	0.427	0.663	43.3	0.654	0.905	32.2	0.32	0.113	95.6
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	4.61	3.42	29.6	0.63	0.627	0.477	<0.0050	<0.0050	-	0.847	0.51	49.7
Calcium	mg/kg	534	491	8.39	209	243	15.0	528	394	29.1	638	411	43.3
Cesium	mg/kg	0.0423	0.0382	10.2	0.0309	0.035	12.4	0.0821	0.0707	14.9	0.0438	0.0318	31.7
Chromium	mg/kg	<0.20	0.23	14.0	0.073	0.105	36.0	0.234	0.065	113	0.29	<0.20	36.7
Cobalt	mg/kg	0.52	0.398	26.6	0.109	0.128	16.0	<0.020	<0.020	-	2.35	1.78	27.6
Copper	mg/kg	7.7	6	24.8	56	67.1	18.0	3.01	4.15	31.8	8.16	6.64	20.5
Iron	mg/kg	317	385	19.4	230	256	10.7	37.7	45.4	18.5	788	1100	33.1
Lead	mg/kg	<0.050	<0.050	-	<0.020	<0.020	-	<0.020	<0.020	-	0.078	0.075	3.92
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	642	654	1.85	1270	1300	2.33	1350	1080	22.2	661	558	16.9
Manganese	mg/kg	4.3	4.61	6.96	11.1	11.7	5.26	0.985	0.89	10.1	3.4	2.7	23.0
Mercury	mg/kg dwt	0.197	0.148	28.4	0.022	0.023	4.44	0.0556	0.0502	10.2	0.405	0.418	3.16
	mg/kg wwt	0.043	0.0315	30.9	0.0971	0.104	6.86	0.231	0.199	14.9	0.0818	0.103	22.9
Molybdenum	mg/kg	1.86	1.3	35.4	1.9	2.1	10.0	0.023	0.029	23.1	0.499	0.347	35.9
Nickel	mg/kg	0.58	0.55	5.31	<0.20	<0.20	-	<0.20	0.34	51.9	0.45	0.34	27.8
Phosphorus	mg/kg	14000	14200	1.42	20200	21400	5.77	11200	10100	10.3	10900	10800	0.922
Potassium	mg/kg	11600	12400	6.67	16400	17100	4.18	19200	16200	16.9	10800	9990	7.79
Rubidium	mg/kg	12	11.7	2.53	15	15.6	3.92	13.8	12.3	11.5	6.24	5.59	11.0
Selenium	mg/kg	12.9	11.7	9.76	14.2	15.4	8.11	8.74	7.44	16.1	13.8	11.5	18.2
Silver	mg/kg	<0.0050	<0.0050	-	0.0224	0.0302	29.7	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Sodium	mg/kg	6560	6380	2.78	4520	5050	11.1	1740	1790	2.83	8850	6210	35.1
Strontium	mg/kg	0.77	0.71	8.11	0.291	0.373	24.7	0.555	0.459	18.9	2.26	1.11	68.2
Tellurium	mg/kg	0.057	0.042	30.3	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0025	<0.0020	22.2	<0.0020	<0.0020	-	<0.0020	<0.0020	-	0.078	0.0694	11.7
Tin	mg/kg	0.77	<0.10	154	0.59	0.62	4.96	0.73	0.5	37.4	<0.10	<0.10	-
Titanium	mg/kg	<0.50	<0.50	-	<0.25	<0.25	-	<0.25	<0.25	-	0.68	0.68	0
Uranium	mg/kg	0.0059	0.0049	18.5	<0.0020	<0.0020	-	<0.0020	<0.0020	-	0.0042	0.0041	2.41
Vanadium	mg/kg	4.24	3.53	18.3	0.88	0.93	5.52	<0.10	<0.10	-	0.5	0.47	6.19
Zinc	mg/kg	220	172	24.5	123	138	11.5	34.4	42.7	21.5	195	186	4.72
Zirconium	mg/kg	0.26	<0.20	26.1	0.26	<0.20	26.1	0.26	<0.20	26.1	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	POL_RB-Li-6_2022-05	POL_RB-Li-6X_2022-05	RPD (%)	POL_RB-M-2_2022-05	POL_RB-M-2X_2022-05	RPD (%)	POL_RB-O-4_2022-05	POL_RB-O-4X_2022-05	RPD (%)	POL_RB-O-7_2022-05	POL_RB-O-7X_2022-05	RPD (%)
Physical Test													
Moisture	%	76.7	77	0.390	81.1	82.5	1.71	65.9	70.4	6.60	66.5	61.8	7.33
Metals													
Aluminum	mg/kg	25.4	11.9	72.4	<5.0	27	138	<5.0	<5.0	-	<2.0	<2.0	-
Antimony	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.139	0.122	13.0	<0.030	0.031	3.28	0.034	0.032	6.06	0.042	0.04	4.88
Barium	mg/kg	1.57	1.12	33.5	0.582	1.24	72.2	0.631	0.866	31.4	0.265	0.148	56.7
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	1.4	<1.0	33.3	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	0.248	0.218	12.9	<0.010	<0.010	-	<0.010	<0.010	-	<0.0050	<0.0050	-
Calcium	mg/kg	469	310	40.8	1470	1500	2.02	1210	1540	24.0	1150	1190	3.42
Cesium	mg/kg	0.0574	0.0453	23.6	0.112	0.0976	13.7	0.0143	0.0157	9.33	0.0228	0.0195	15.6
Chromium	mg/kg	0.24	<0.20	18.2	<0.20	<0.20	-	<0.20	<0.20	-	0.055	<0.050	9.52
Cobalt	mg/kg	0.145	0.108	29.2	0.02	0.032	46.2	0.073	0.078	6.62	0.11	0.096	13.6
Copper	mg/kg	153	134	13.2	1.84	1.87	1.62	6.62	6.01	9.66	8.28	8.9	7.22
Iron	mg/kg	1990	2060	3.46	48.2	87.2	57.6	76.2	90.6	17.3	64.1	48.5	27.7
Lead	mg/kg	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050	-	<0.020	<0.020	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	856	562	41.5	1300	1190	8.84	1400	1400	0	1520	1580	3.87
Manganese	mg/kg	12.2	13.7	11.6	1.24	1.8	36.8	4.23	4.02	5.09	3.09	3	2.96
Mercury	mg/kg dwt	1.07	1.22	13.1	0.991	0.842	16.3	0.0224	0.0252	11.8	0.0044	0.0021	70.8
	mg/kg wwt	0.249	0.28	11.7	0.188	0.147	24.5	0.0076	0.0072	5.41	0.013	0.0056	79.6
Molybdenum	mg/kg	1.3	1.35	3.77	<0.040	<0.040	-	0.056	0.062	10.2	0.05	0.056	11.3
Nickel	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	14900	13500	9.86	15200	15000	1.32	11300	12100	6.84	12200	12100	0.823
Potassium	mg/kg	12000	10300	15.2	26700	25100	6.18	7560	8120	7.14	7660	7280	5.09
Rubidium	mg/kg	8.54	7.39	14.4	18.5	17.1	7.87	3.28	3.39	3.30	4.6	4.34	5.82
Selenium	mg/kg	38.9	36.2	7.19	7.41	6.6	11.6	6.49	6.61	1.83	7.64	7.26	5.10
Silver	mg/kg	0.599	0.475	23.1	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	0.005	0
Sodium	mg/kg	4940	4170	16.9	1550	1080	35.7	2350	3130	28.5	3150	2090	40.5
Strontium	mg/kg	0.74	0.53	33.1	1.71	2.04	17.6	3.5	3.81	8.48	3.1	3.28	5.64
Tellurium	mg/kg	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0337	0.0342	1.47	0.0036	0.0032	11.8	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Tin	mg/kg	1.29	0.53	83.5	0.95	0.78	19.7	0.37	0.2	59.6	0.12	<0.10	18.2
Titanium	mg/kg	1.67	<0.50	108	<0.50	4.59	161	<0.50	<0.50	-	<0.25	<0.25	-
Uranium	mg/kg	0.0127	0.0162	24.2	<0.0020	<0.0020	-	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Vanadium	mg/kg	0.98	0.98	0	<0.10	0.23	78.8	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	183	186	1.63	21.3	18	16.8	85.9	98.4	13.6	66.2	64.1	3.22
Zirconium	mg/kg	0.25	<0.20	22.2	<0.20	0.29	36.7	<0.20	<0.20	-	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	QUL-EAA_LT-Ki-4_2022-10	QUL-EAA_LT-Ki-4X_2022-10	RPD (%)	QUL-EAA_LT-Li-4_2022-10	QUL-EAA_LT-Li-4X_2022-10	RPD (%)	QUL-EAA_LT-M-4_2022-10	QUL-EAA_LT-M-4X_2022-10	RPD (%)	QUL-EAA_LT-O-4_2022-10	QUL-EAA_LT-O-4X_2022-10	RPD (%)
Physical Test													
Moisture	%	71.5	77.3	7.80	80.2	80.2	0	72.2	71	1.68	87.2	84.4	3.26
Metals													
Aluminum	mg/kg	3.7	6.2	50.5	<2.0	<2.0	-	<2.0	<2.0	-	<2.0	<2.0	-
Antimony	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.168	0.314	60.6	0.36	0.348	3.39	0.168	0.207	20.8	0.092	0.059	43.7
Barium	mg/kg	0.069	0.181	89.6	<0.050	<0.050	-	<0.050	0.056	11.3	0.104	<0.050	70.1
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	0.398	0.553	32.6	0.251	0.226	10.5	<0.0050	<0.0050	-	0.0132	0.0169	24.6
Calcium	mg/kg	417	545	26.6	537	629	15.8	462	4670	164	1130	985	13.7
Cesium	mg/kg	0.137	0.17	21.5	0.203	0.207	1.95	0.289	0.262	9.80	0.381	0.296	25.1
Chromium	mg/kg	0.193	0.503	89.1	0.291	0.257	12.4	0.058	0.055	5.31	0.084	0.057	38.3
Cobalt	mg/kg	0.074	0.095	24.9	0.132	0.134	1.50	<0.020	<0.020	-	0.096	0.082	15.7
Copper	mg/kg	4.56	5.73	22.7	144	135	6.45	1.13	1.19	5.17	9.22	9.38	1.72
Iron	mg/kg	513	446	14.0	609	799	27.0	16.5	20.8	23.1	276	216	24.4
Lead	mg/kg	<0.020	0.023	14.0	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	0.02	0
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	469	457	2.59	795	782	1.65	902	916	1.54	835	896	7.05
Manganese	mg/kg	0.906	1.07	16.6	3.51	3.25	7.69	0.311	0.482	43.1	5.04	3.9	25.5
Mercury	mg/kg dwt	0.698	0.658	5.90	0.668	0.669	0.150	0.346	0.318	8.43	0.184	0.17	7.91
	mg/kg wwt	2.45	2.9	16.8	3.37	3.38	0.296	1.24	1.1	12.0	1.44	1.09	27.7
Molybdenum	mg/kg	0.097	0.14	36.3	0.276	0.268	2.94	<0.020	<0.020	-	0.083	0.063	27.4
Nickel	mg/kg	<0.20	0.24	18.2	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	6970	8060	14.5	14600	14600	0	8130	9290	13.3	12500	11600	7.47
Potassium	mg/kg	6390	7120	10.8	12100	12100	0	14900	11200	28.4	15300	12600	19.4
Rubidium	mg/kg	18.3	20.5	11.3	30.8	31.6	2.56	35	25.2	32.6	47.1	35.8	27.3
Selenium	mg/kg	3.95	6.67	51.2	6.12	5.96	2.65	1.37	1.22	11.6	4.16	3.8	9.05
Silver	mg/kg	0.0164	0.0206	22.7	1.36	1.16	15.9	<0.0050	<0.0050	-	0.0156	0.0164	5.00
Sodium	mg/kg	7120	8240	14.6	9480	9600	1.26	1090	1060	2.79	16300	13000	22.5
Strontium	mg/kg	1.13	1.31	14.8	0.774	2.15	94.1	0.448	6.85	175	1.36	1.68	21.1
Tellurium	mg/kg	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0617	0.0768	21.8	0.401	0.368	8.58	0.0288	0.0325	12.1	0.0966	0.0838	14.2
Tin	mg/kg	0.33	0.7	71.8	0.67	0.66	1.50	0.16	0.16	0	0.32	0.28	13.3
Titanium	mg/kg	0.38	0.51	29.2	<0.25	<0.25	-	<0.25	0.26	3.92	<0.25	0.29	14.8
Uranium	mg/kg	<0.0020	0.0024	18.2	<0.0020	<0.0020	-	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Vanadium	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	48.2	66	31.2	157	151	3.90	9.88	11.9	18.5	152	122	21.9
Zirconium	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022

Analyte	Unit	QUL-NCP_LT-Ki-1_2022-10	QUL-NCP_LT-Ki-1X_2022-10	RPD (%)	QUL-NCP_LT-Li-1_2022-10	QUL-NCP_LT-Li-1X_2022-10	RPD (%)	QUL-NCP_LT-M-1_2022-10	QUL-NCP_LT-M-1X_2022-10	RPD (%)	QUL-NCP_LT-O-1_2022-10	QUL-NCP_LT-O-1X_2022-10	RPD (%)
Physical Test													
Moisture	%	84.1	82.3	2.16	79.7	78.8	1.14	76.9	76.2	0.914	64.8	64.4	0.619
Metals													
Aluminum	mg/kg	15.9	11.8	29.6	3.3	3.1	6.25	<2.0	<2.0	-	<2.0	<2.0	-
Antimony	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.239	0.19	22.8	0.265	0.222	17.7	0.09	0.092	2.20	0.046	0.042	9.09
Barium	mg/kg	0.195	0.161	19.1	<0.050	0.052	3.92	<0.050	<0.050	-	<0.050	<0.050	-
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	3.54	2.52	33.7	0.519	0.422	20.6	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Calcium	mg/kg	830	729	13.0	345	337	2.35	826	428	63.5	1060	978	8.05
Cesium	mg/kg	0.246	0.224	9.36	0.296	0.308	3.97	0.309	0.297	3.96	0.0725	0.0694	4.37
Chromium	mg/kg	1.16	0.859	29.8	0.28	0.228	20.5	<0.050	<0.050	-	0.053	<0.050	5.83
Cobalt	mg/kg	0.217	0.174	22.0	0.098	0.09	8.51	<0.020	<0.020	-	0.045	0.042	6.90
Copper	mg/kg	3.56	3.18	11.3	12.6	11.1	12.7	0.71	0.74	4.14	12.8	12.4	3.17
Iron	mg/kg	718	635	12.3	354	347	2.00	8.6	8.6	0	53.7	47.7	11.8
Lead	mg/kg	0.032	0.028	13.3	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	719	632	12.9	1070	1070	0	1110	1060	4.61	1330	1350	1.49
Manganese	mg/kg	1.39	0.901	42.7	6.53	5.94	9.46	0.272	0.28	2.90	0.799	0.747	6.73
Mercury	mg/kg dwt	1.26	1.16	8.26	0.624	0.547	13.2	0.515	0.498	3.36	0.0955	0.0957	0.209
	mg/kg wwt	7.89	6.57	18.3	3.08	2.58	17.7	2.23	2.09	6.48	0.271	0.269	0.741
Molybdenum	mg/kg	0.276	0.227	19.5	0.336	0.338	0.593	<0.020	<0.020	-	<0.020	<0.020	-
Nickel	mg/kg	0.7	0.51	31.4	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	15100	11400	27.9	21400	18200	16.2	11100	10300	7.48	11200	9800	13.3
Potassium	mg/kg	14200	10100	33.7	21300	17300	20.7	19600	18700	4.70	6430	5250	20.2
Rubidium	mg/kg	36.9	27	31.0	89.8	83.7	7.03	40.5	38.7	4.55	11.9	10.1	16.4
Selenium	mg/kg	13.1	10.2	24.9	6.12	5.35	13.4	1.88	1.58	17.3	4.21	3.96	6.12
Silver	mg/kg	0.0179	0.0151	17.0	0.0718	0.0569	23.2	<0.0050	<0.0050	-	0.04	0.0355	11.9
Sodium	mg/kg	14900	12800	15.2	5570	5270	5.54	1090	1050	3.74	3320	3040	8.81
Strontium	mg/kg	1.9	1.76	7.65	0.366	0.387	5.58	1.02	0.385	90.4	2.56	2.53	1.18
Tellurium	mg/kg	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.12	0.0929	25.5	0.695	0.646	7.31	0.0254	0.0246	3.20	0.0202	0.0183	9.87
Tin	mg/kg	1.3	0.73	56.2	0.22	0.21	4.65	0.22	0.26	16.7	0.11	0.1	9.52
Titanium	mg/kg	0.84	0.84	0	<0.25	0.29	14.8	<0.25	<0.25	-	<0.25	<0.25	-
Uranium	mg/kg	0.0105	0.0074	34.6	<0.0020	<0.0020	-	<0.0020	<0.0020	-	<0.0020	<0.0020	-
Vanadium	mg/kg	0.22	0.14	44.4	0.1	<0.10	0	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	98.4	71.1	32.2	110	97.2	12.4	11.5	9.99	14.1	75.4	69.7	7.86
Zirconium	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022

Analyte	Unit	QUL-NGC_PCC-Ki-7_2022-10	QUL-NGC_PCC-Ki-7X_2022-10	RPD (%)	QUL-NGC_PCC-Li-5_2022-10	QUL-NGC_PCC-Li-5X_2022-10	RPD (%)	QUL-NGC_PCC-M-5_2022-10	QUL-NGC_PCC-M-5X_2022-10	RPD (%)	QUL-NGC_PCC-O-5_2022-10	QUL-NGC_PCC-O-5X_2022-10	RPD (%)
Physical Test													
Moisture	%	60.8	69.9	13.9	62.2	57	8.72	76.7	78.3	2.06	69	68.4	0.873
Metals													
Aluminum	mg/kg	<5.0	<5.0	-	13.5	15.6	15.6	2.7	<2.0	29.8	<2.0	<2.0	-
Antimony	mg/kg	<0.020	<0.020	-	0.011	<0.020	58.1	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.351	0.505	36.0	1.29	1.11	14.0	0.26	0.274	5.24	0.106	0.114	7.27
Barium	mg/kg	0.927	0.931	0.431	0.099	0.149	50.5	0.918	0.336	92.8	0.415	0.483	15.1
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	0.059	0.094	45.8	0.031	0.032	3.23	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	<1.0	1.3	26.1	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	6.21	10.9	54.8	1.19	1.11	6.72	0.0108	<0.0050	73.4	0.031	0.0298	3.95
Calcium	mg/kg	269	275	2.21	121	126	4.13	2160	2190	1.38	662	687	3.71
Cesium	mg/kg	0.0443	0.0746	51.0	0.0259	0.0199	23.2	0.136	0.143	5.02	0.067	0.0675	0.743
Chromium	mg/kg	0.25	0.42	50.7	0.28	0.33	17.9	0.194	<0.050	118	<0.050	<0.050	-
Cobalt	mg/kg	1.49	2.47	49.5	0.236	0.228	3.39	0.03	0.037	20.9	0.186	0.185	0.539
Copper	mg/kg	3.7	5.6	40.9	13.9	11.2	19.4	1.09	1.85	51.7	4.61	4.62	0.217
Iron	mg/kg	314	334	6.17	421	518	23.0	14	19.4	32.3	70.4	70.7	0.425
Lead	mg/kg	<0.050	<0.050	-	<0.050	<0.050	-	<0.020	<0.020	-	<0.020	<0.020	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	342	603	55.2	532	425	20.1	1630	1660	1.82	927	960	3.50
Manganese	mg/kg	1.73	3.18	59.1	3.4	3.03	10.9	0.837	0.917	9.12	15.1	14.2	6.14
Mercury	mg/kg dwt	0.279	0.517	59.8	0.317	0.315	0.631	0.24	0.237	1.26	0.0158	0.0168	6.13
	mg/kg wwt	0.109	0.156	35.5	0.12	0.135	12.5	1.03	1.09	5.66	0.0512	0.0532	3.83
Molybdenum	mg/kg	0.5	0.845	51.3	0.715	0.579	19.0	<0.020	<0.020	-	0.154	0.155	0.647
Nickel	mg/kg	<1.00	<3.50	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	6930	11700	51.2	9360	8340	10.9	12300	12400	0.810	10700	9500	11.9
Potassium	mg/kg	6160	10700	53.9	7090	6180	12.8	22200	21100	5.08	10900	9450	14.3
Rubidium	mg/kg	9.61	16.8	54.4	11.5	10.2	11.3	32.5	31.9	1.86	19.4	17.1	12.6
Selenium	mg/kg	4.33	6.71	43.1	6.01	5.90	1.83	1.66	1.74	4.71	9.08	8.98	1.11
Silver	mg/kg	<0.0050	0.006	18.2	0.0372	0.0234	37.1	<0.0050	<0.0050	-	0.0205	0.0205	0
Sodium	mg/kg	2910	4260	37.7	2450	2110	13.9	1160	1230	5.86	2240	2120	5.50
Strontium	mg/kg	0.6	0.63	4.88	0.31	0.29	6.45	3.66	4.01	9.13	0.716	0.753	5.04
Tellurium	mg/kg	0.04	0.07	54.5	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0268	0.0393	37.8	0.0165	0.0165	0	0.0049	0.0069	33.9	0.0059	0.0058	1.71
Tin	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	0.74	0.26	96.0	0.52	0.53	1.90
Titanium	mg/kg	0.65	1.04	46.2	<0.50	<0.50	-	1.06	0.29	114	<0.25	0.27	7.69
Uranium	mg/kg	0.0303	0.0513	51.5	0.0511	0.0580	13.5	0.0035	0.003	15.4	0.0104	0.01	3.92
Vanadium	mg/kg	0.28	0.48	52.6	0.31	0.36	16.1	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	103	135	26.9	70.7	69.9	1.13	20.2	28.1	32.7	140	151	7.56
Zirconium	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	QUL-NHC_PCC-Ki-6_2022-10	QUL-NHC_PCC-Ki-6X_2022-10	RPD (%)	QUL-NHC_PCC-Li-6_2022-10	QUL-NHC_PCC-Li-6X_2022-10	RPD (%)	QUL-NHC_PCC-M-6_2022-10	QUL-NHC_PCC-M-6X_2022-10	RPD (%)	QUL-NHC_PCC-O-6_2022-10	QUL-NHC_PCC-O-6X_2022-10	RPD (%)
Physical Test													
Moisture	%	50	59.1	16.7	61	71	15.2	80.5	77.6	3.67	61	64.2	5.11
Metals													
Aluminum	mg/kg	7.1	8.2	14.4	15.4	16.7	8.10	<2.0	<2.0	-	<2.0	<2.0	-
Antimony	mg/kg	<0.020	<0.020	-	0.016	0.016	0	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	0.419	0.289	36.7	0.299	0.34	12.8	0.384	0.276	32.7	0.166	0.159	4.31
Barium	mg/kg	2.29	1.57	37.3	0.212	0.199	6.33	1.06	0.73	36.9	0.511	0.367	32.8
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	0.038	0.029	26.9	0.033	0.037	11.4	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	1.2	<1.0	18.2	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium	mg/kg	24.6	18.9	26.2	1.59	2.02	23.8	0.021	0.0417	66.0	0.027	0.0544	67.3
Calcium	mg/kg	958	2720	95.8	170	199	15.7	3400	4350	24.5	272	270	0.738
Cesium	mg/kg	0.0462	0.0315	37.8	0.0224	0.0331	38.6	0.103	0.0852	18.9	0.0298	0.033	10.2
Chromium	mg/kg	0.48	0.41	15.7	0.37	0.4	7.79	0.129	<0.050	88.3	0.082	<0.050	48.5
Cobalt	mg/kg	4	3.14	24.1	0.25	0.33	27.6	0.046	0.038	19.0	0.106	0.124	15.7
Copper	mg/kg	7	4.69	39.5	24.7	26.6	7.41	2.75	1.42	63.8	4.33	5.54	24.5
Iron	mg/kg	336	236	35.0	1240	1380	10.7	31.5	17.6	56.6	47.1	74.8	45.4
Lead	mg/kg	0.181	0.149	19.4	0.06	0.054	10.5	0.024	0.027	11.8	<0.020	<0.020	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	673	498	29.9	585	850	36.9	2100	1730	19.3	641	670	4.42
Manganese	mg/kg	6.54	5.42	18.7	5.15	6.36	21.0	1.76	1.62	8.28	10.1	9.91	1.90
Mercury	mg/kg dwt	0.347	0.266	26.4	0.407	0.432	5.96	0.167	0.17	1.78	0.0097	0.0122	22.8
	mg/kg wwt	0.173	0.109	45.4	0.159	0.125	23.9	0.856	0.76	11.9	0.0249	0.034	30.9
Molybdenum	mg/kg	0.742	0.569	26.4	1.04	1.1	5.61	<0.020	<0.020	-	0.088	0.108	20.4
Nickel	mg/kg	<2.40	<1.80	-	<0.20	0.39	64.4	<0.20	<0.20	-	<0.20	<0.20	-
Phosphorus	mg/kg	12800	9900	25.6	11000	14000	24.0	16400	12600	26.2	10600	10600	0
Potassium	mg/kg	10800	7630	34.4	8390	10900	26.0	25600	18800	30.6	7940	7650	3.72
Rubidium	mg/kg	14.9	10.6	33.7	9.62	13	29.9	28.7	20.7	32.4	10.4	9.92	4.72
Selenium	mg/kg	8.99	6.6	30.7	9.62	10.9	12.5	5.24	4.23	21.3	16.6	18.6	11.4
Silver	mg/kg	0.0118	0.0073	47.1	0.118	0.101	15.5	<0.0050	<0.0050	-	0.018	0.0238	27.8
Sodium	mg/kg	4950	3270	40.9	3290	3920	17.5	1400	1150	19.6	1580	1700	7.32
Strontium	mg/kg	2.16	7.12	107	0.45	0.5	10.5	5.79	7.48	25.5	0.317	0.378	17.6
Tellurium	mg/kg	0.045	0.036	22.2	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.0488	0.0352	32.4	0.0276	0.0282	2.15	0.0104	0.0062	50.6	0.0054	0.0058	7.14
Tin	mg/kg	0.52	<0.10	135	0.27	1.91	150	1.52	1.47	3.34	0.22	0.31	34.0
Titanium	mg/kg	0.55	0.87	45.1	<0.50	<0.50	-	0.25	0.28	11.3	<0.25	<0.25	-
Uranium	mg/kg	0.144	0.112	25.0	0.0605	0.077	24.0	0.0054	0.0056	3.64	0.0103	0.0126	20.1
Vanadium	mg/kg	1.23	0.92	28.8	1.13	1.3	14.0	<0.10	<0.10	-	<0.10	<0.10	-
Zinc	mg/kg	156	102	41.9	85	105	21.1	29.8	21	34.6	93	101	8.25
Zirconium	mg/kg	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-	<0.20	<0.20	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Table B.18: **Field Duplicate Results for Fish Tissue Chemistry, Mount Polley Mine CEMP, 2022**

Analyte	Unit	QUR_RB-Ki-5_2022-10	QUR_RB-Ki-5X_2022-10	RPD (%)	QUR_RB-Li-5_2022-10	QUR_RB-Li-5X_2022-10	RPD (%)	QUR_RB-M-5_2022-10	QUR_RB-M-5X_2022-10	RPD (%)	QUR_RB-O-5_2022-10	QUR_RB-O-5X_2022-10	RPD (%)
Physical Test													
Moisture	%	78.4	77.6	1.03	69.7	70.4	0.999	78.1	77.5	0.771	72.7	69.5	4.50
Metals													
Aluminum	mg/kg	19.2	21.4	10.8	50.2	34.7	36.5	3.4	3.1	9.23	12.7	9.3	30.9
Antimony	mg/kg	0.022	0.016	31.6	0.055	<0.010	138	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic	mg/kg	3.25	2.34	32.6	1.01	0.769	27.1	5.27	4.98	5.66	0.35	0.288	19.4
Barium	mg/kg	1.62	1.16	33.1	0.69	0.343	67.2	0.82	0.491	50.2	0.704	0.524	29.3
Beryllium	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron	mg/kg	1.7	2	16.2	1	<1.0	0	<1.0	<1.0	-	1.2	1	18.2
Cadmium	mg/kg	3.32	1.85	56.9	1.82	1.38	27.5	<0.0050	0.0084	50.7	0.04	0.032	22.2
Calcium	mg/kg	1330	754	55.3	247	238	3.71	644	870	29.9	845	835	1.19
Cesium	mg/kg	0.0773	0.0507	41.6	0.0631	0.0467	29.9	0.117	0.106	9.87	0.0519	0.0486	6.57
Chromium	mg/kg	0.44	0.5	12.8	<0.20	<0.20	-	0.11	0.054	68.3	<0.20	<0.20	-
Cobalt	mg/kg	1.57	1.35	15.1	0.264	0.218	19.1	0.077	0.079	2.56	0.732	0.612	17.9
Copper	mg/kg	8.18	5.6	37.4	46.8	39.6	16.7	1.59	1.69	6.10	45.3	38.7	15.7
Iron	mg/kg	956	1170	20.1	2960	2150	31.7	23.5	23.3	0.855	335	271	21.1
Lead	mg/kg	0.081	0.093	13.8	0.082	0.064	24.7	<0.020	0.028	33.3	<0.050	<0.050	-
Lithium	mg/kg	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-	<0.50	<0.50	-
Magnesium	mg/kg	806	740	8.54	776	640	19.2	1520	1370	10.4	1220	1060	14.0
Manganese	mg/kg	3.38	2.76	20.2	11.9	9.49	22.5	0.648	0.647	0.154	19.1	16.5	14.6
Mercury	mg/kg dwt	0.708	0.899	23.8	0.251	0.211	17.3	0.128	0.129	0.778	0.0869	0.074	16.0
	mg/kg wwt	0.153	0.202	27.6	0.076	0.0625	19.5	0.583	0.574	1.56	0.0237	0.0226	4.75
Molybdenum	mg/kg	0.684	0.41	50.1	1.4	1.04	29.5	<0.020	<0.020	-	0.043	<0.040	7.23
Nickel	mg/kg	1.56	1.77	12.6	<0.20	<0.20	-	<0.20	0.51	87.3	<0.20	<0.20	-
Phosphorus	mg/kg	11000	10400	5.61	17300	13500	24.7	14000	13400	4.38	9860	8470	15.2
Potassium	mg/kg	13800	12500	9.89	14100	10500	29.3	25000	23500	6.19	8480	7140	17.2
Rubidium	mg/kg	16.4	13.8	17.2	18.3	13.9	27.3	26.4	24.9	5.85	11.3	9.81	14.1
Selenium	mg/kg	16.2	15.1	7.03	17	13.8	20.8	2.83	2.71	4.33	14.7	13	12.3
Silver	mg/kg	0.0639	0.0335	62.4	2.35	1.92	20.1	<0.0050	<0.0050	-	0.12	0.114	5.13
Sodium	mg/kg	8970	6180	36.8	3650	3150	14.7	1700	1830	7.37	5490	4280	24.8
Strontium	mg/kg	5.43	2.76	65.2	0.38	0.38	0	0.744	1.07	35.9	2.13	2	6.30
Tellurium	mg/kg	0.038	0.054	34.8	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Thallium	mg/kg	0.109	0.0747	37.3	0.143	0.109	27.0	0.0276	0.0258	6.74	0.0114	0.0104	9.17
Tin	mg/kg	0.1	<0.10	0	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Titanium	mg/kg	0.52	<0.50	3.92	<0.50	<0.50	-	<0.25	<0.25	-	<0.50	<0.50	-
Uranium	mg/kg	0.0796	0.102	24.7	0.074	0.0486	41.4	<0.0020	<0.0020	-	0.0123	0.0107	13.9
Vanadium	mg/kg	0.78	1.13	36.6	0.67	0.5	29.1	<0.10	<0.10	-	0.15	0.12	22.2
Zinc	mg/kg	117	120	2.53	105	87.2	18.5	16	16.7	4.28	168	147	13.3
Zirconium	mg/kg	0.31	0.53	52.4	0.68	0.23	98.9	<0.20	<0.20	-	0.23	<0.20	14.0

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: Relative Percent Difference (RPD) was calculated using the LRL if one result in a duplicate pair was below the LRL. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated; "wwt" indicates wet weight.

Kidney tissue had the highest rate of DQO exceedances (21.9% of duplicate sets) and liver and ovary tissue had the lowest average rate of DQO exceedances (3.13% of duplicate sets, each). These relatively high rates of DQO exceedances were likely due to sample heterogeneity expected in biological tissues and this source of variability will be considered during data interpretation, especially with regards to kidney and muscle tissue. Generally, field duplicate samples of fish tissue were considered to have acceptable field precision and reproducibility.

B10.4 Data Accuracy

Data accuracy was evaluated based on results of 28 RM samples and 57 LCS samples (see laboratory reports VA22B2820, VA22B2821, VA22B4917, and VA22B5055; Appendix G). Out of 756 individual analyte results for RM samples, three did not meet the laboratory DQO (0.40% of analyte results), including one result for nickel and two results for lead. Both of these DQO exceedances occurred in multi-element scans where >10% of analytes met the laboratory DQO, which is a level deemed acceptable by the CCME (VA22B2820, VA22B2821; Appendix G). Out of the 1,029 individual LCS results, eight did not meet the laboratory DQO (0.78% of analyte results), including one result for iron, two results each for lithium and silver, and three results for boron. All of the above DQO exceedances were due to multi-element scans where >10% of analytes met the laboratory DQO, which is a level deemed acceptable by the CCME (VA22B2820, VA22B2821, VA22B4917, and VA22B5055; Appendix G). As these DQO exceedances only represent 0.40 and 0.78% of all individual analyte results for RM and LSC samples respectively, laboratory accuracy can be considered excellent.

B10.5 Hold Times

Recommended hold times for fish tissue samples were met for all parameters in all samples (VA22B2820, VA22B2821, and VA22B4917, and VA22B5055; Appendix G).

B10.6 Data Quality Statement

Fish tissue chemistry data collected as part of the 2022 CEMP were of good quality as characterized by appropriate LRLs, excellent laboratory precision, no evidence of laboratory contamination, and excellent laboratory accuracy. Field sampling precision, as quantified using field duplicate samples, was relatively low, especially in kidney and muscle tissue; however, this is likely compensated for by the number of replicate fish tissue samples employed in this study. Therefore, fish tissue chemistry data can be used with a high level of confidence in the derivation of conclusions for the 2022 CEMP, though these sources of variability will be considered during data interpretation.



B11 FISH AGING

Data Accuracy

Analytical reports of fish age estimates from AAE Tech Services Inc. (see laboratory reports in Appendix G) were examined to evaluate data accuracy. To determine the accuracy of rainbow trout, longnose sucker, peamouth chub, lake trout, and northern pikeminnow age estimates, all aging structures that were analyzed by AAE Technical Service were re-processed by a second analyst. The original and second analyst assigned a confidence index to each age estimate and check. Original and re-assessed age estimates were in agreement for all samples. Accuracy achieved by the laboratory in this study can therefore be considered excellent.

B12 DATA QUALITY REVIEW SUMMARY

Data collected for the 2022 CEMP were of acceptable quality as characterized by appropriate LRLs, good detectability, negligible analyte concentration in MB samples, good laboratory precision, and good laboratory accuracy. Field sampling precision, as measured by RPD in field duplicate pairs, was low in benthic invertebrate and periphyton tissue samples, reflecting natural variability. The hold times for chlorophyll-a were exceeded in four samples from August as these samples were not field-filtered, which highlights the importance of filtering these samples in the field to ensure the highest data quality possible. Additionally, the concentrations of several dissolved analytes were greater than the concentration of the corresponding total analyte. These unexpected results could be due to contamination during field filtration or could represent inaccuracies that are inevitable when conducting multi-element scans.

Overall, data collected as part of the 2022 Mount Polley Mine CEMP can be used with a high level of confidence in the derivation of conclusions.

B13 REFERENCES

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BCMOECCS. 2021b. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture – Guideline Summary. Water Quality Guideline Series, WQG-20. Water Protection and Sustainability Branch, Province of British Columbia, Victoria, B.C.

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Environment Canada. 2014. CABIN (Canadian Aquatic Biomonitoring Network) Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples. Environment Canada. May 2014.

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APPENDIX C
DATA - LAKES

APPENDIX C.1
WATER QUALITY

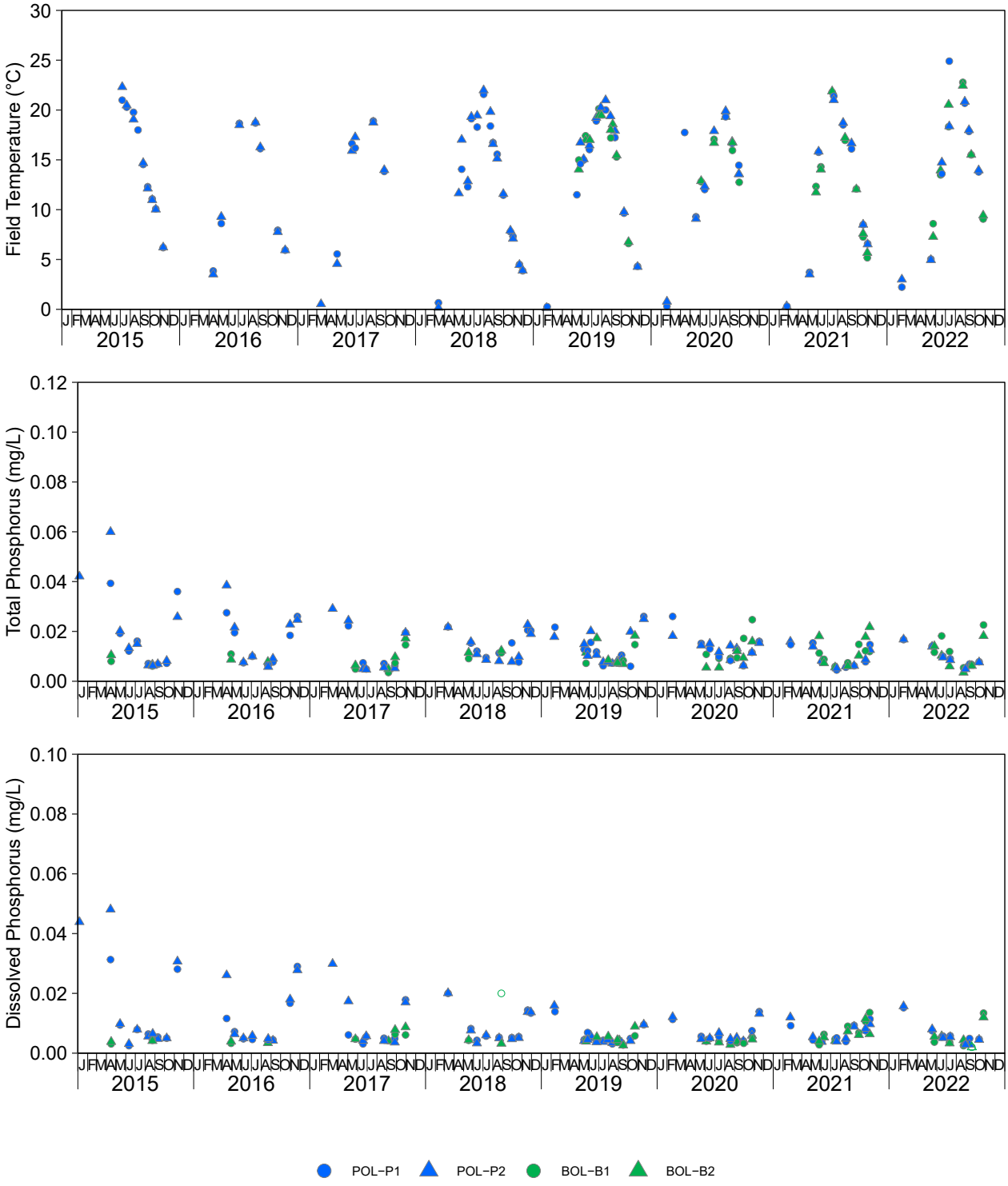

Figure C.1.1: Temperature and Nutrient Concentrations in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

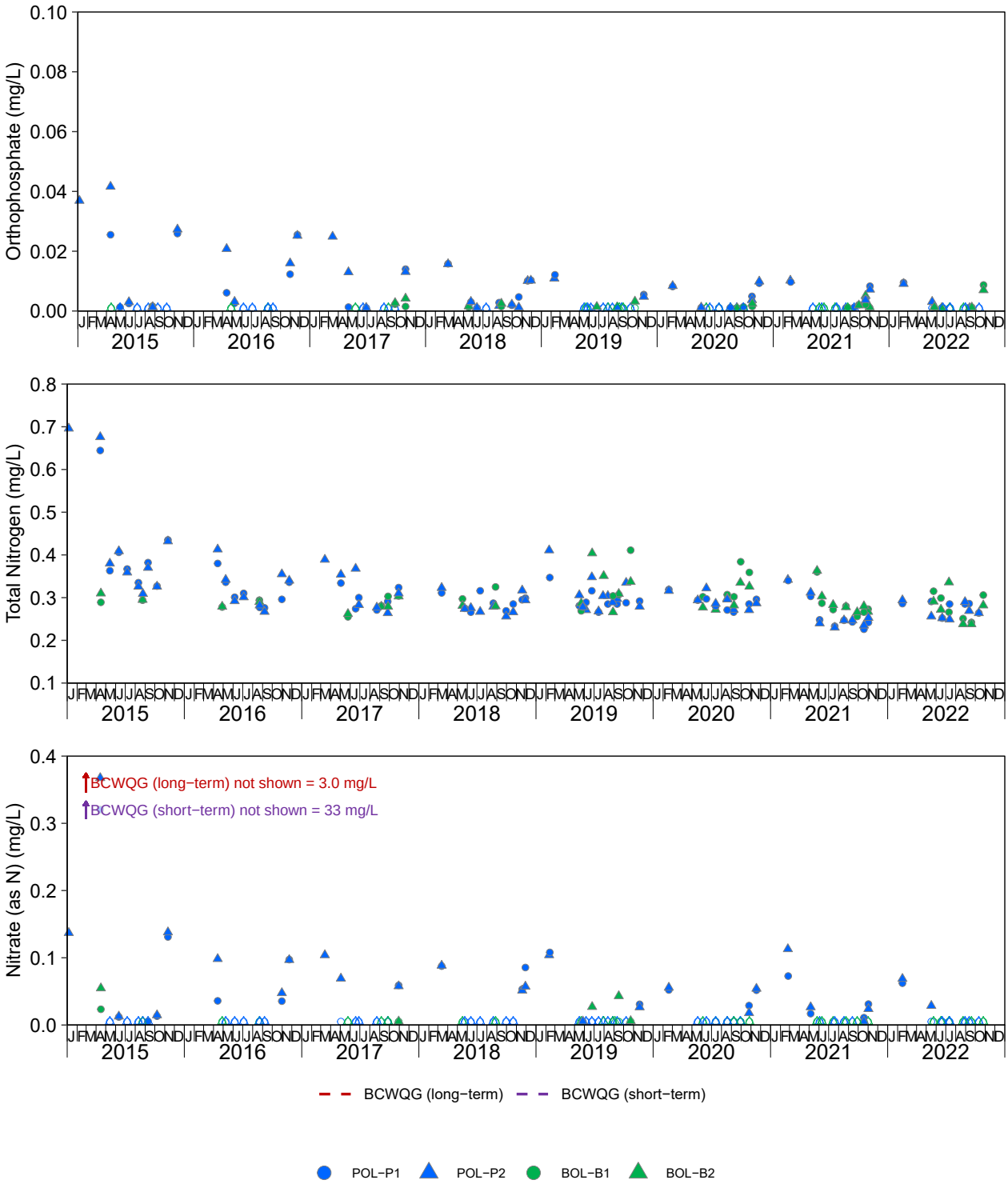

Figure C.1.1: Temperature and Nutrient Concentrations in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

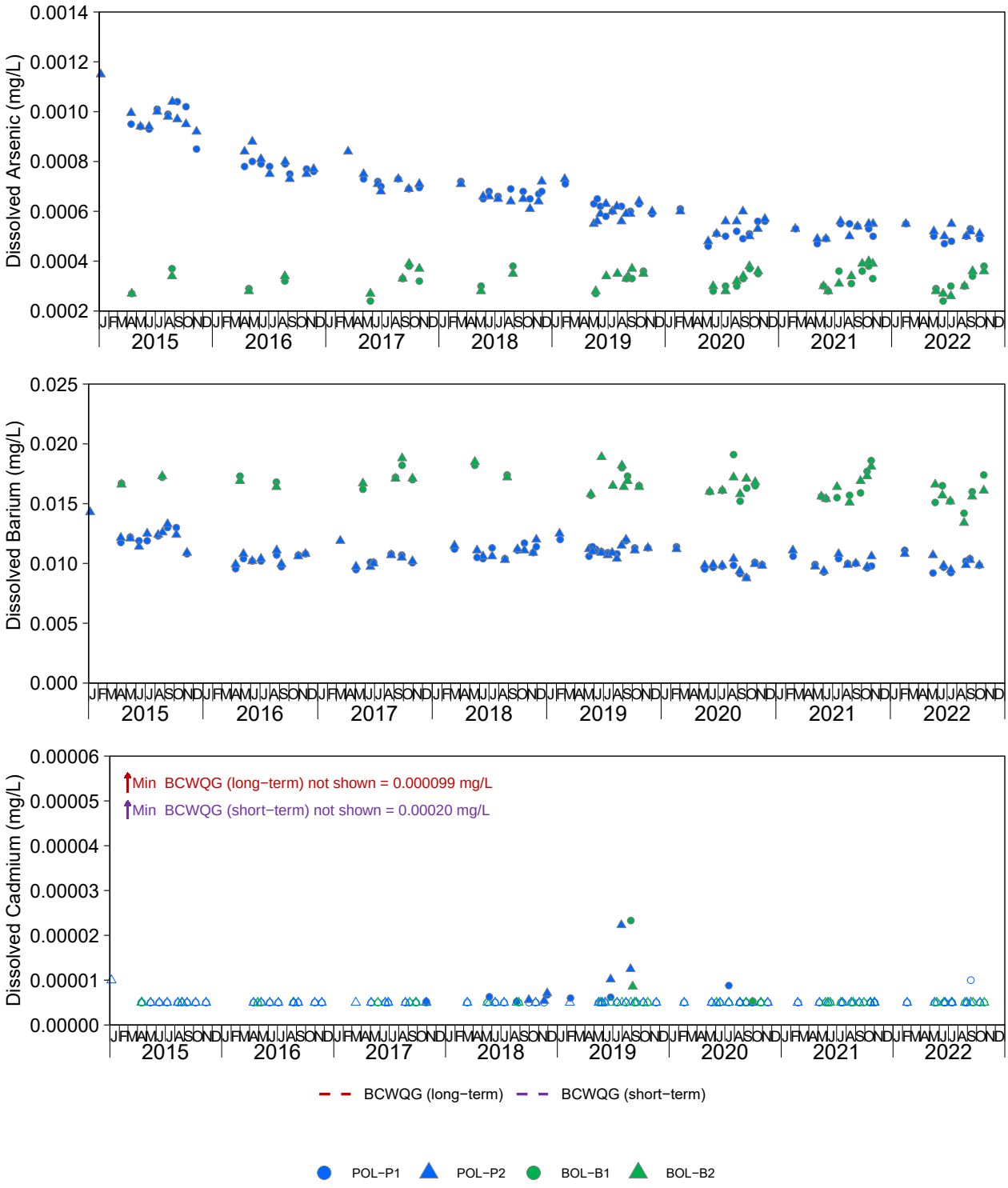

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

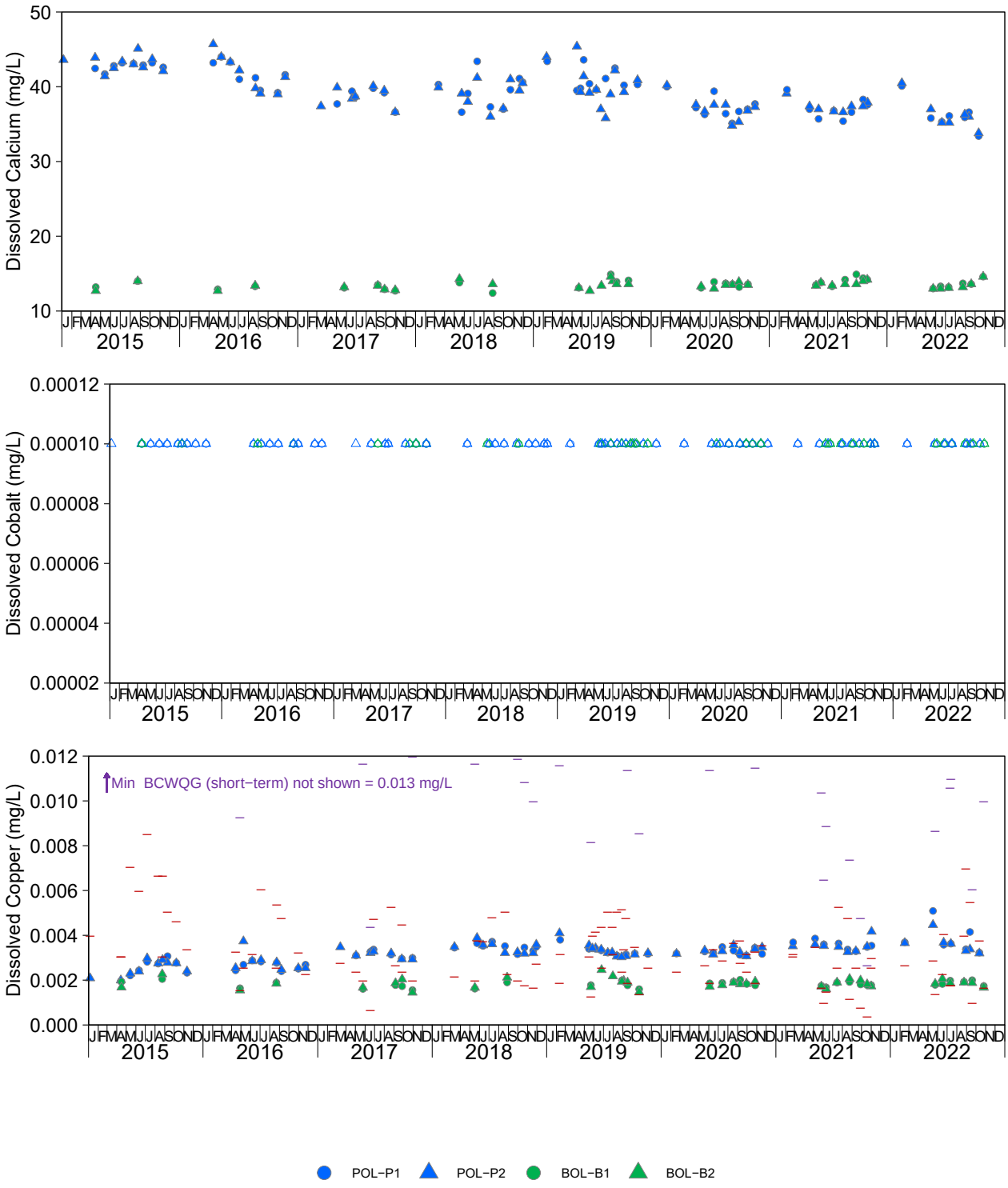

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

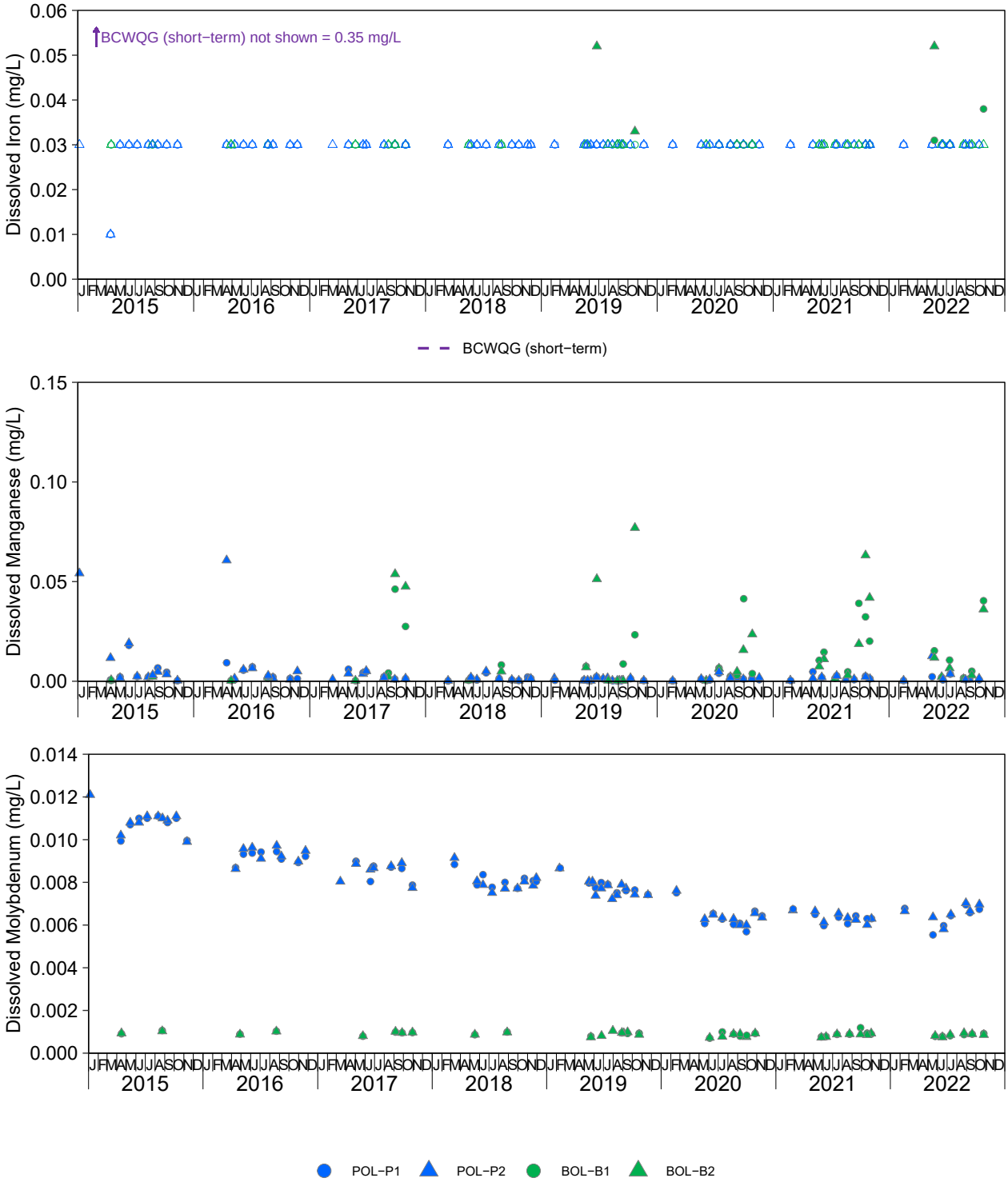

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

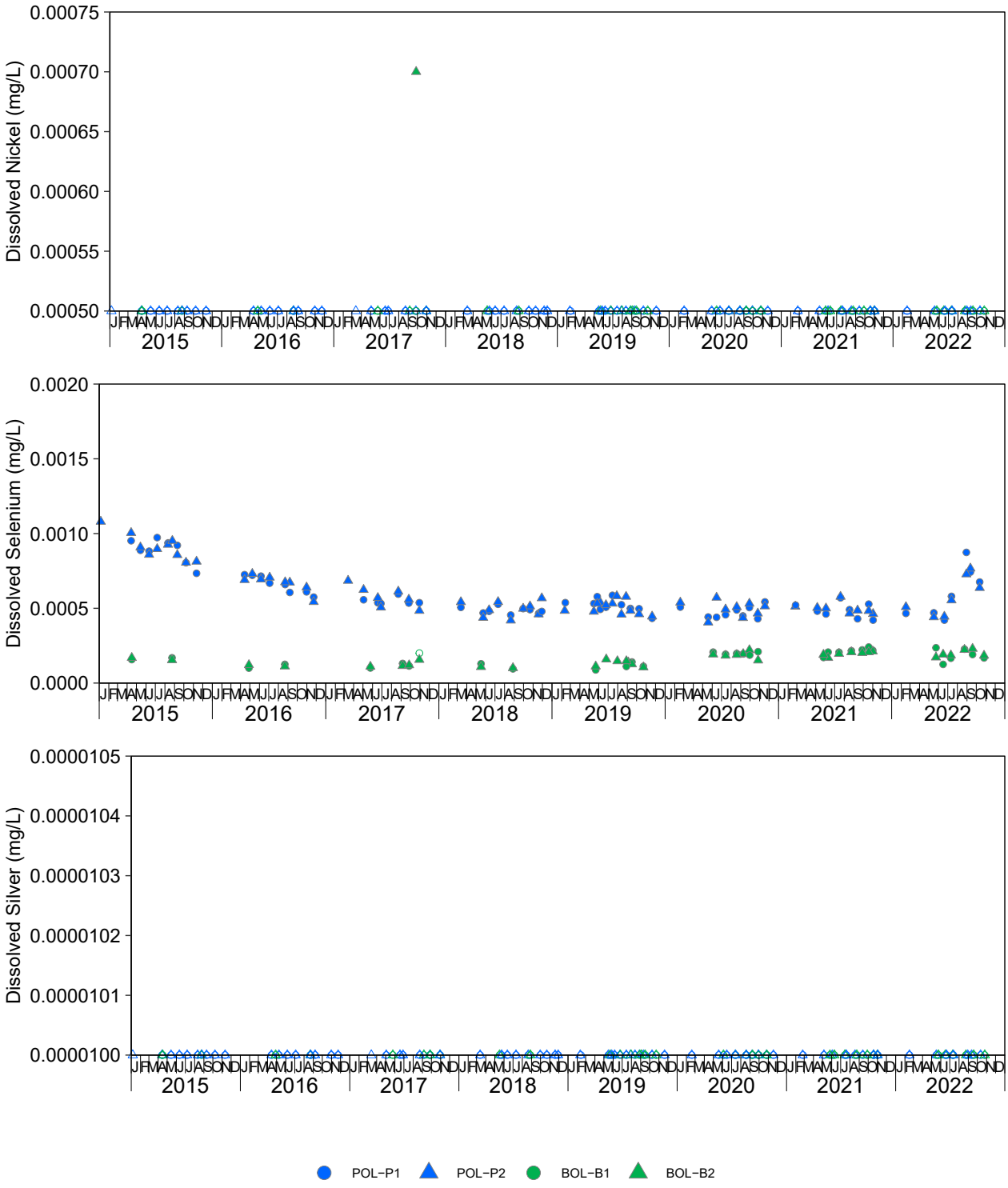

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

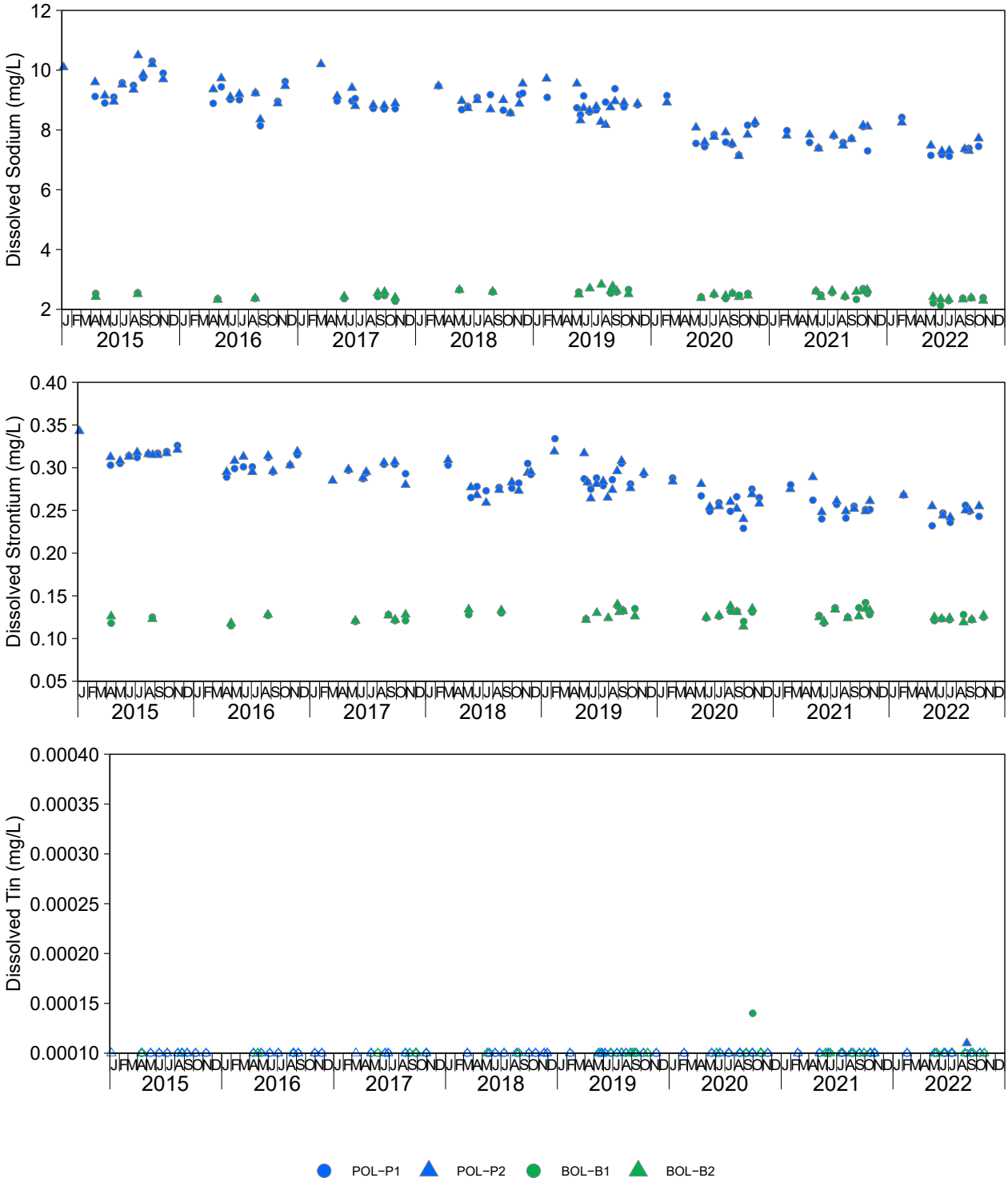

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

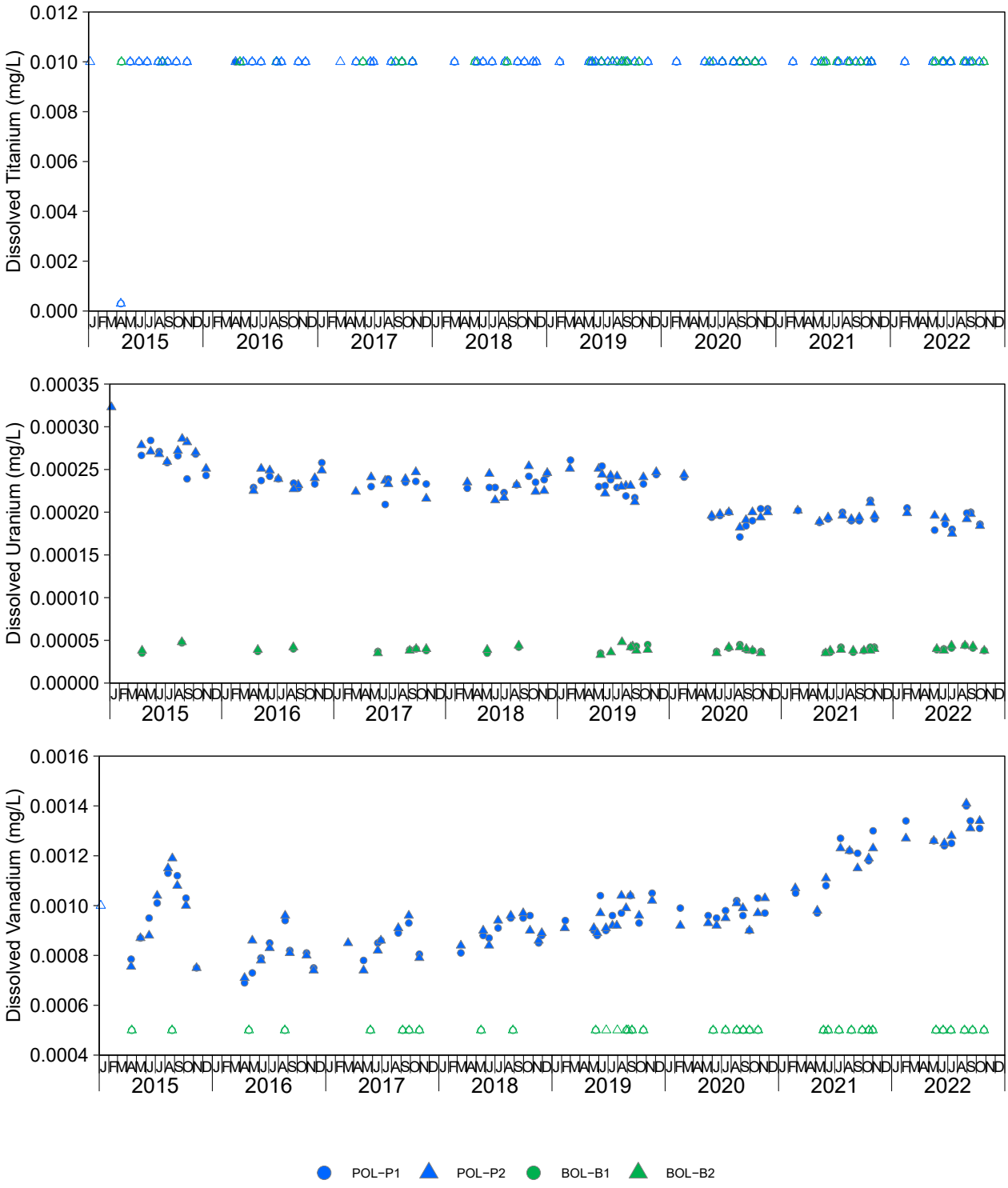

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

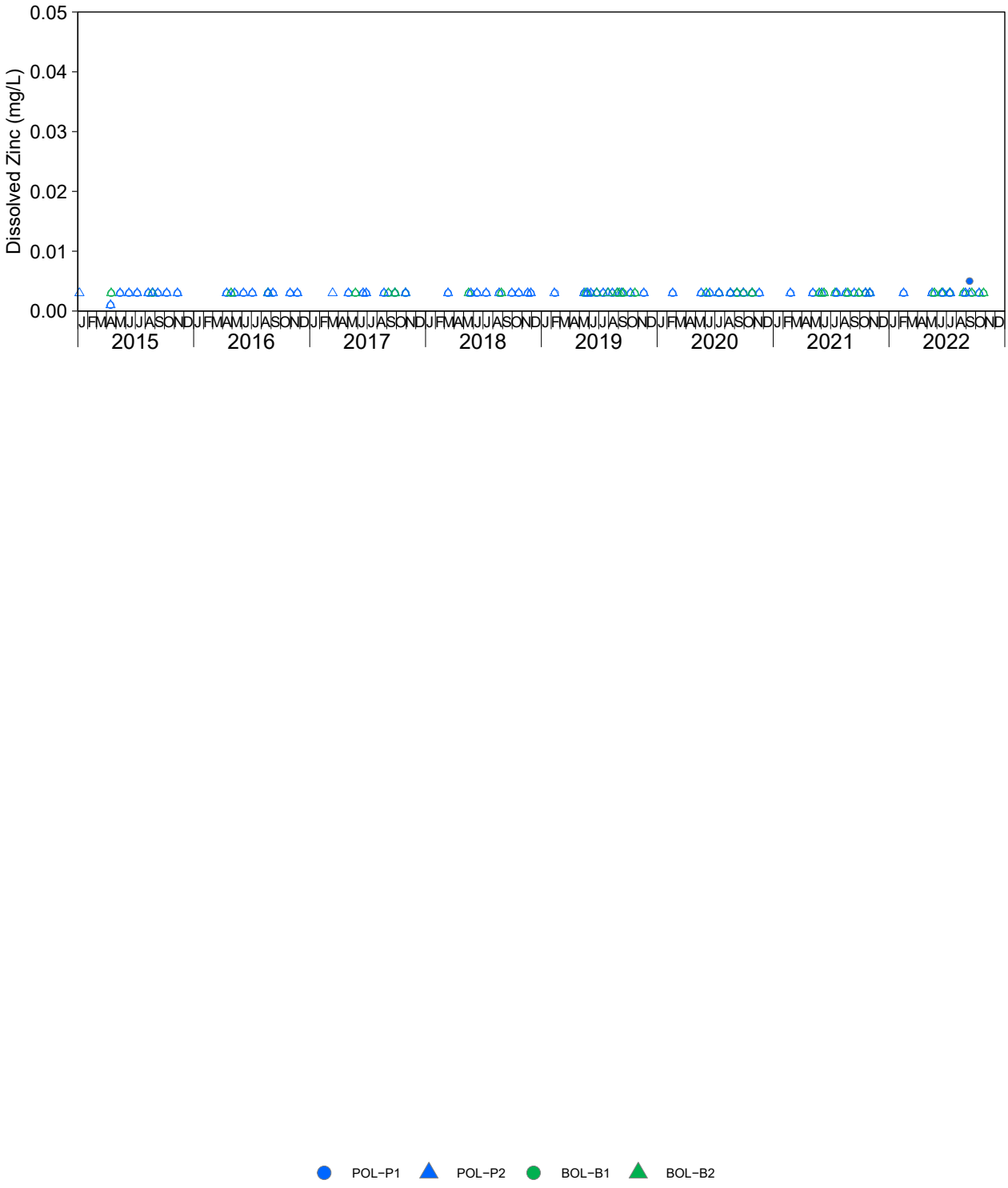

Figure C.1.2: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Dissolved phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

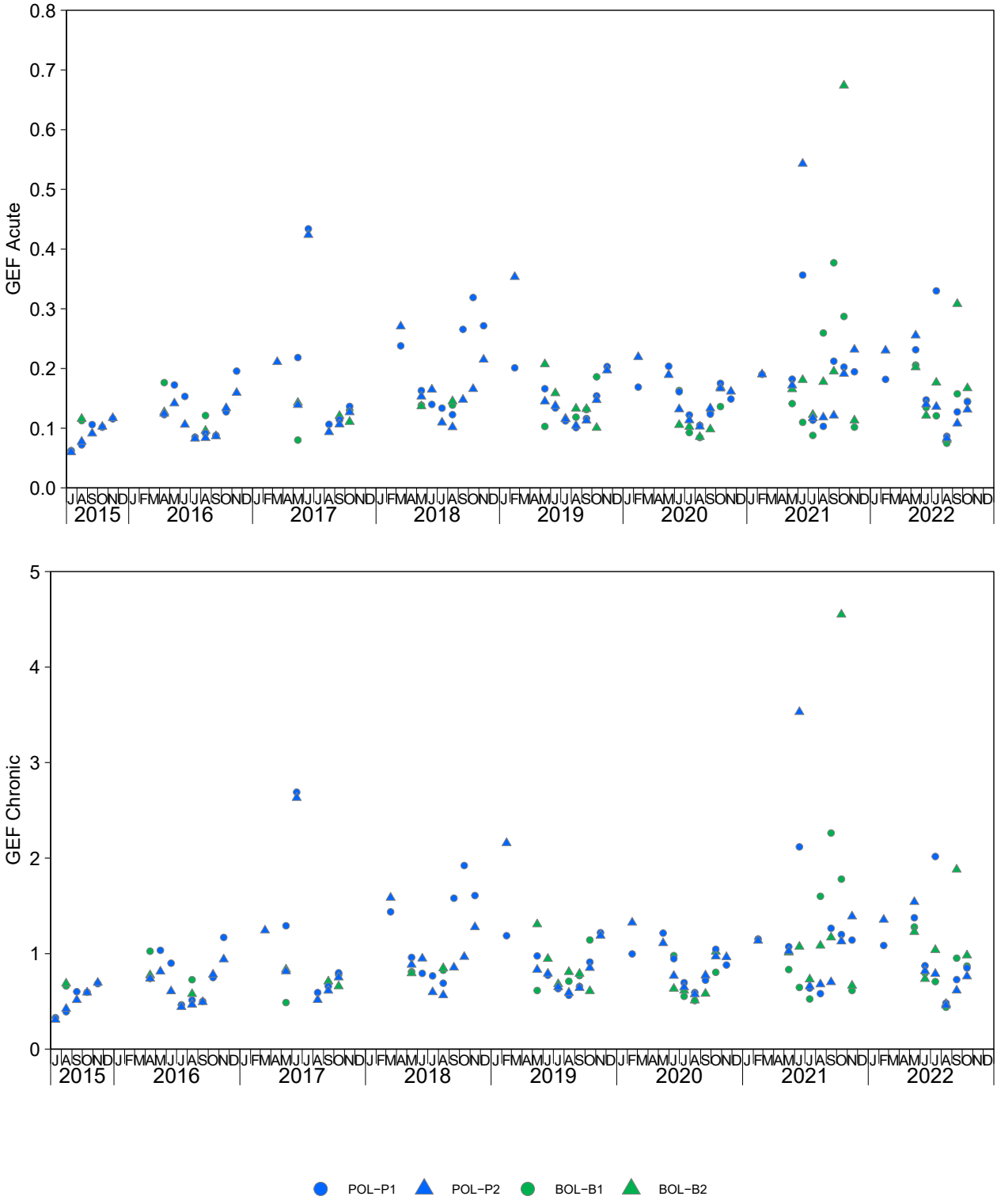

Figure C.1.3: Guideline Exceedance Factor (GEF) of Dissolved Copper in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: GEF = Guideline Exceedance Factor. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Acute and Chronic GEF's calculated from monthly averages. Green represents reference stations and blue represents exposed stations.

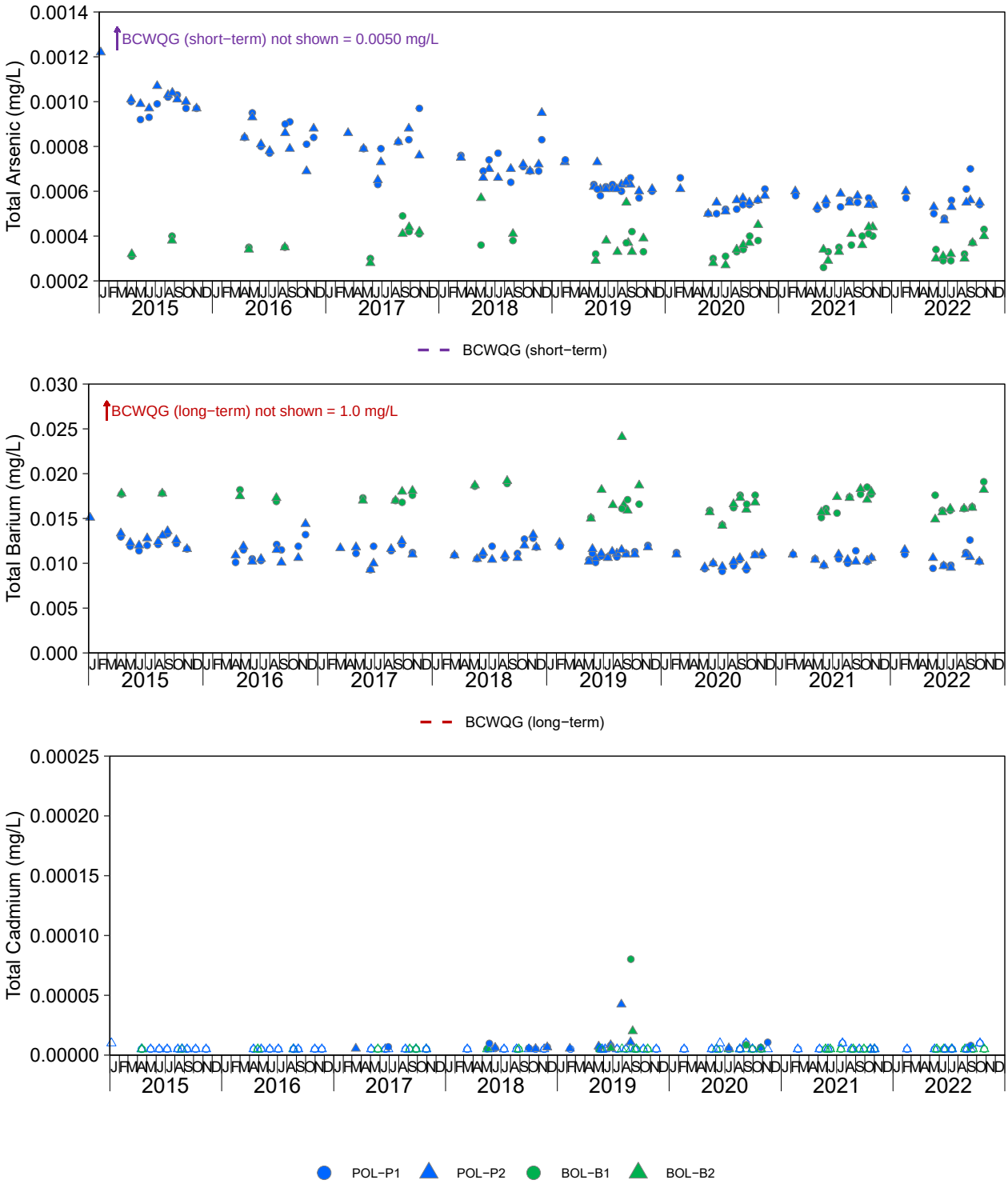

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Total phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

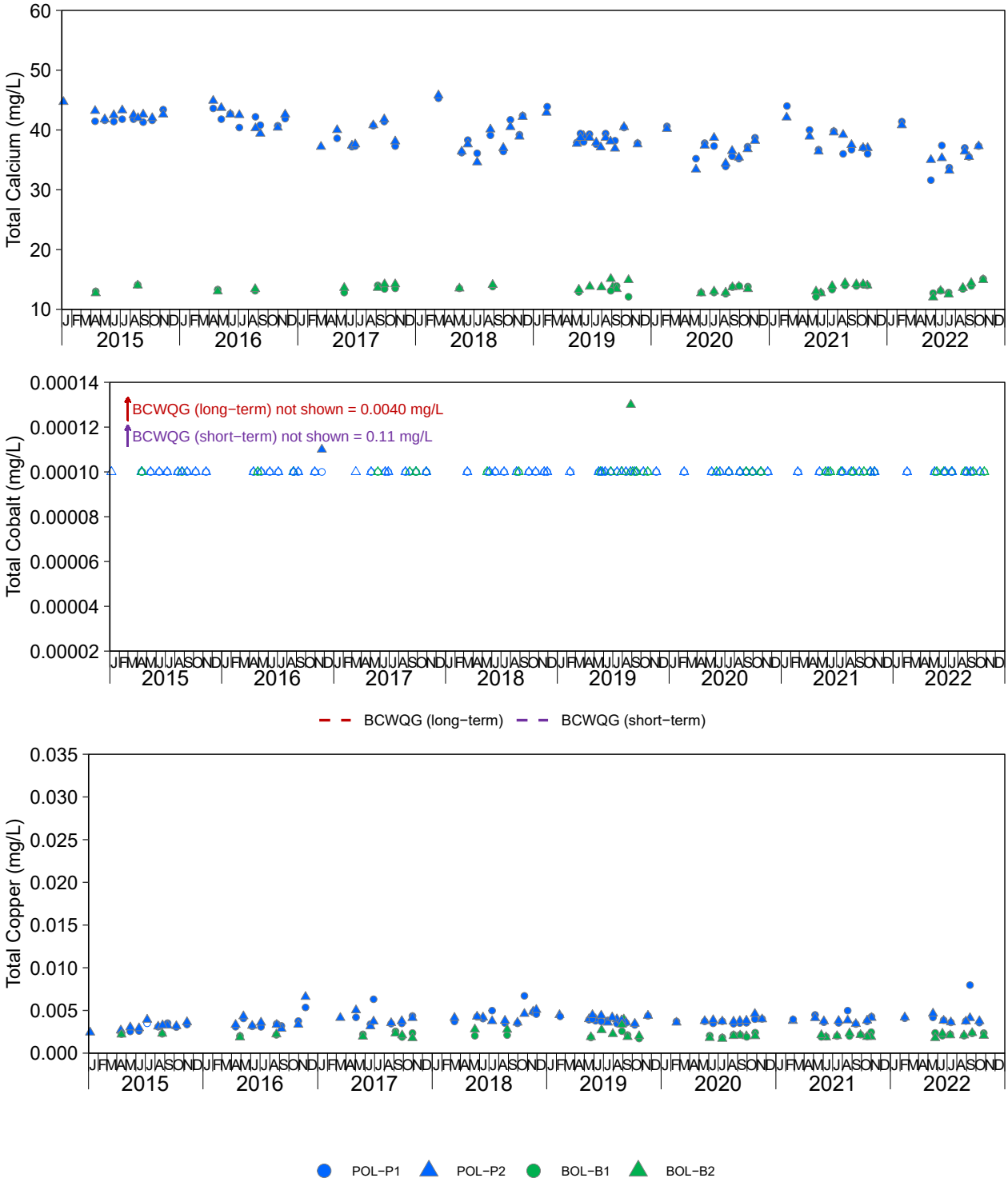

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

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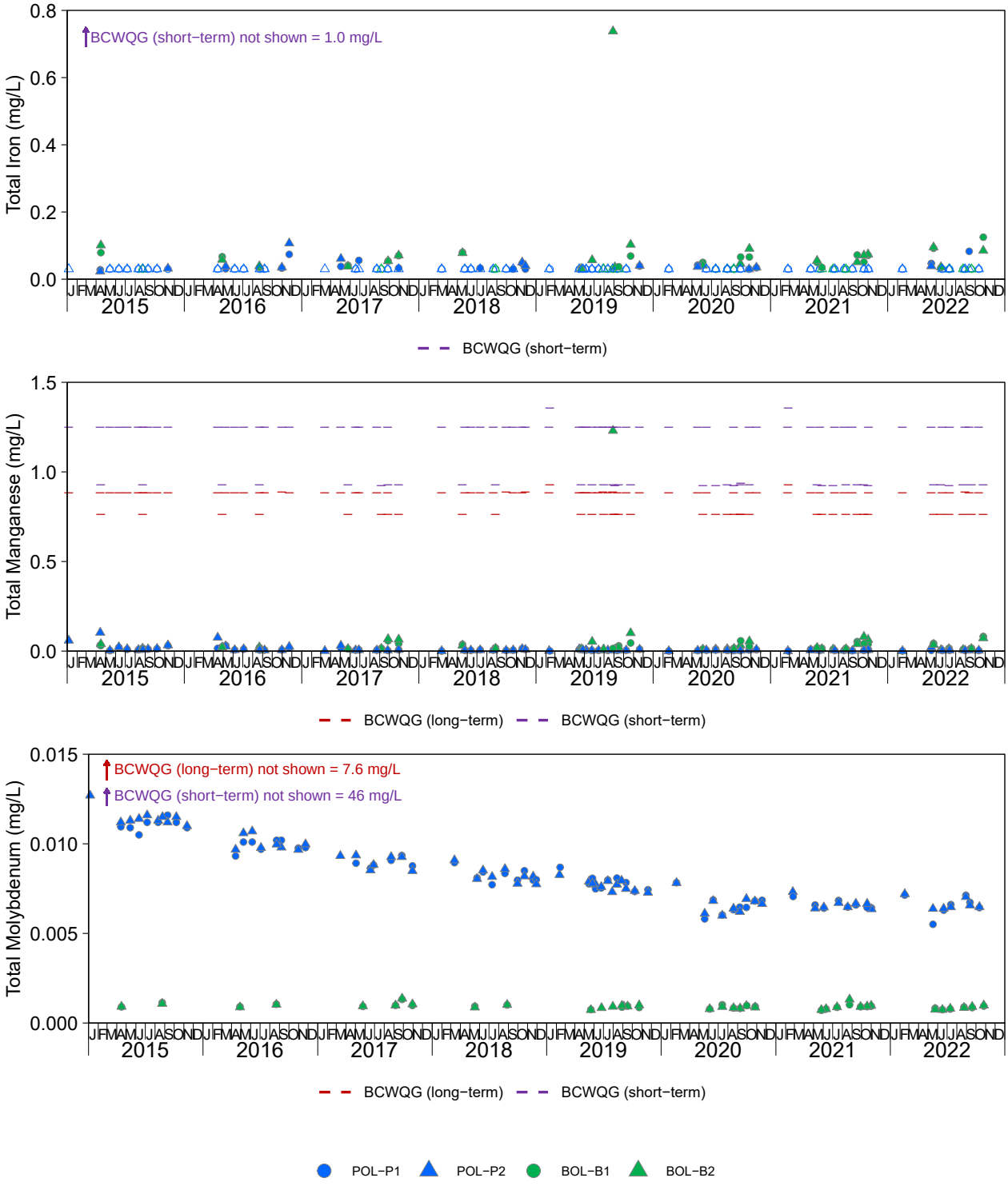

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Total phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

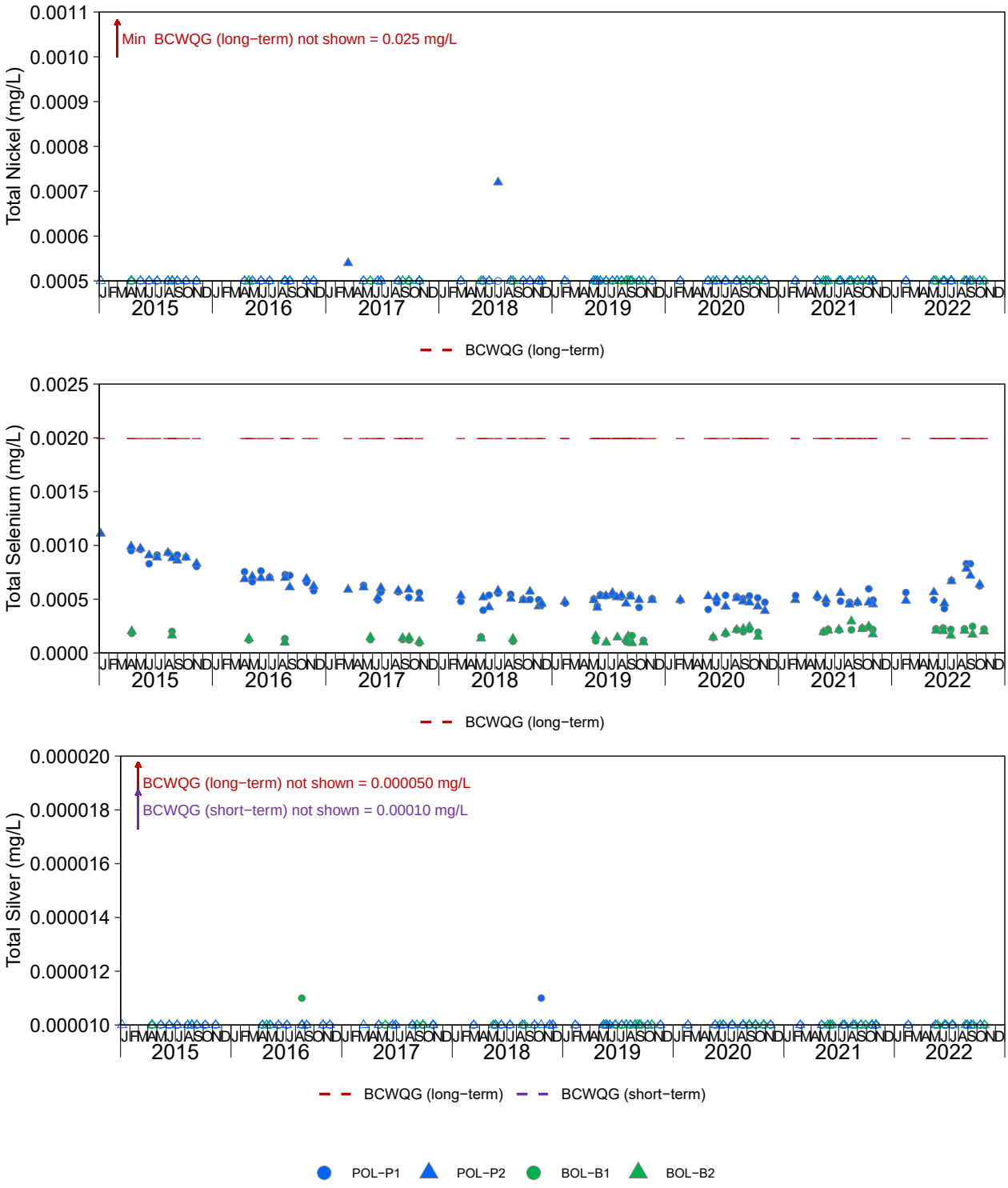

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

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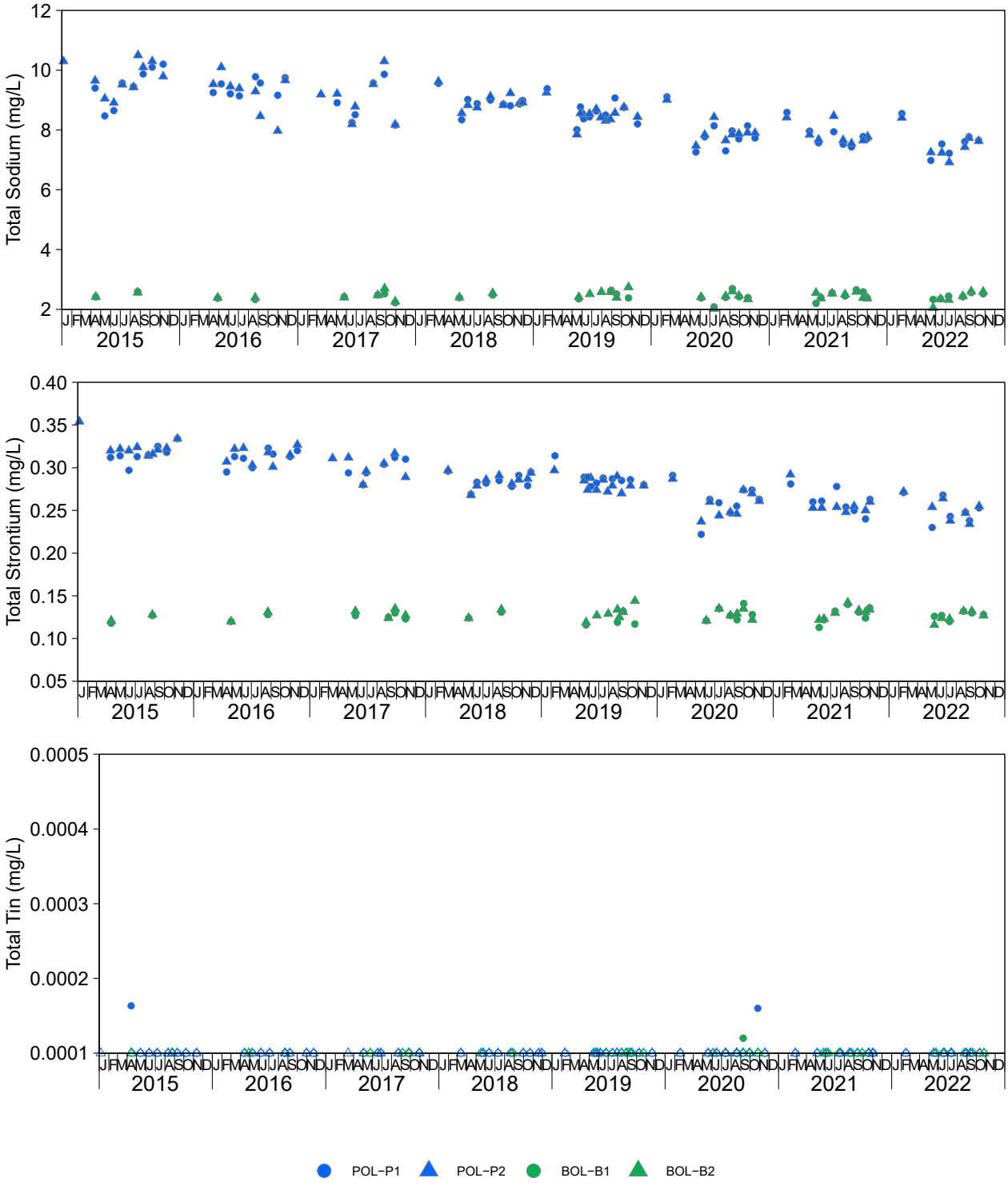

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Total phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

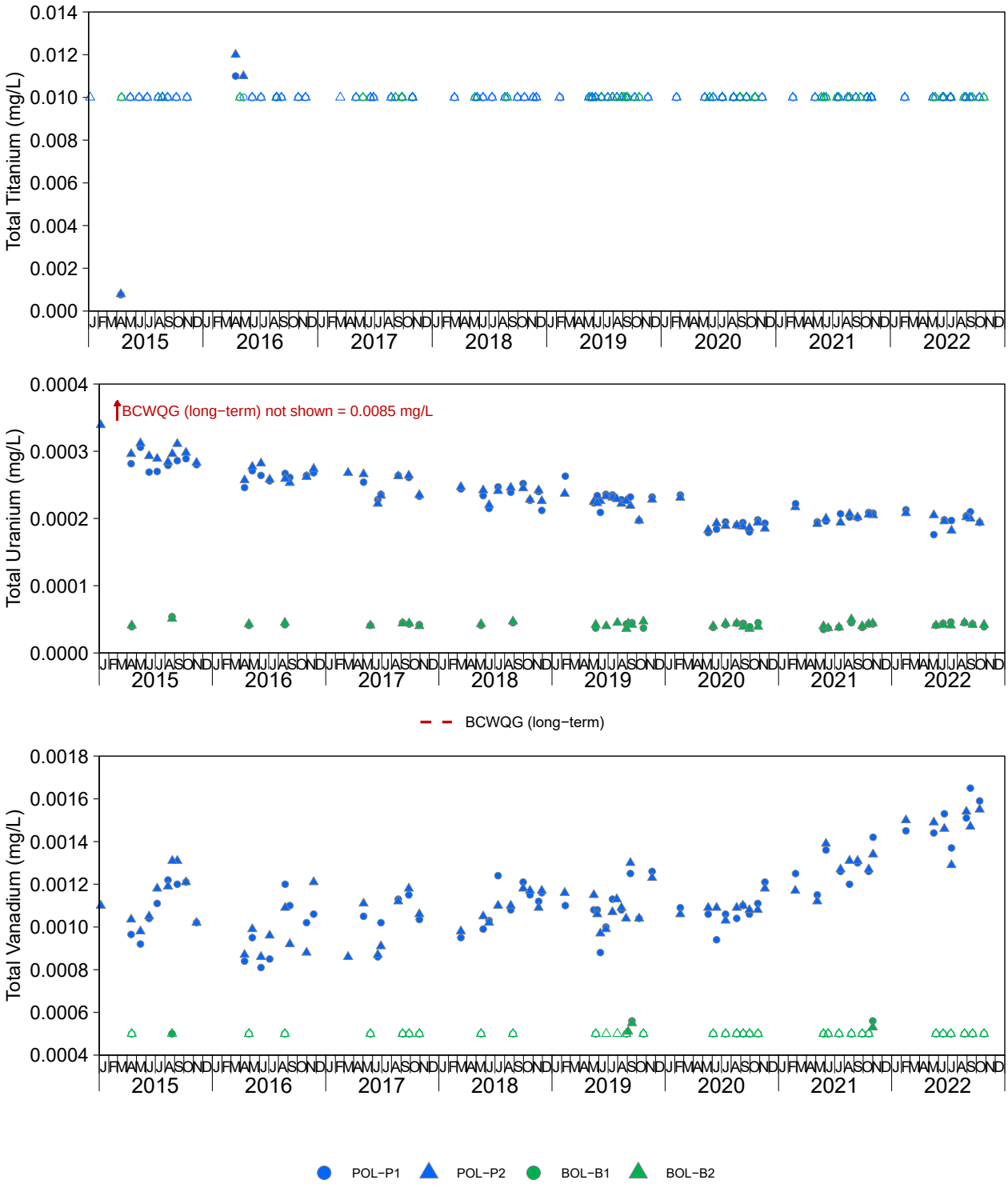

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Total phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

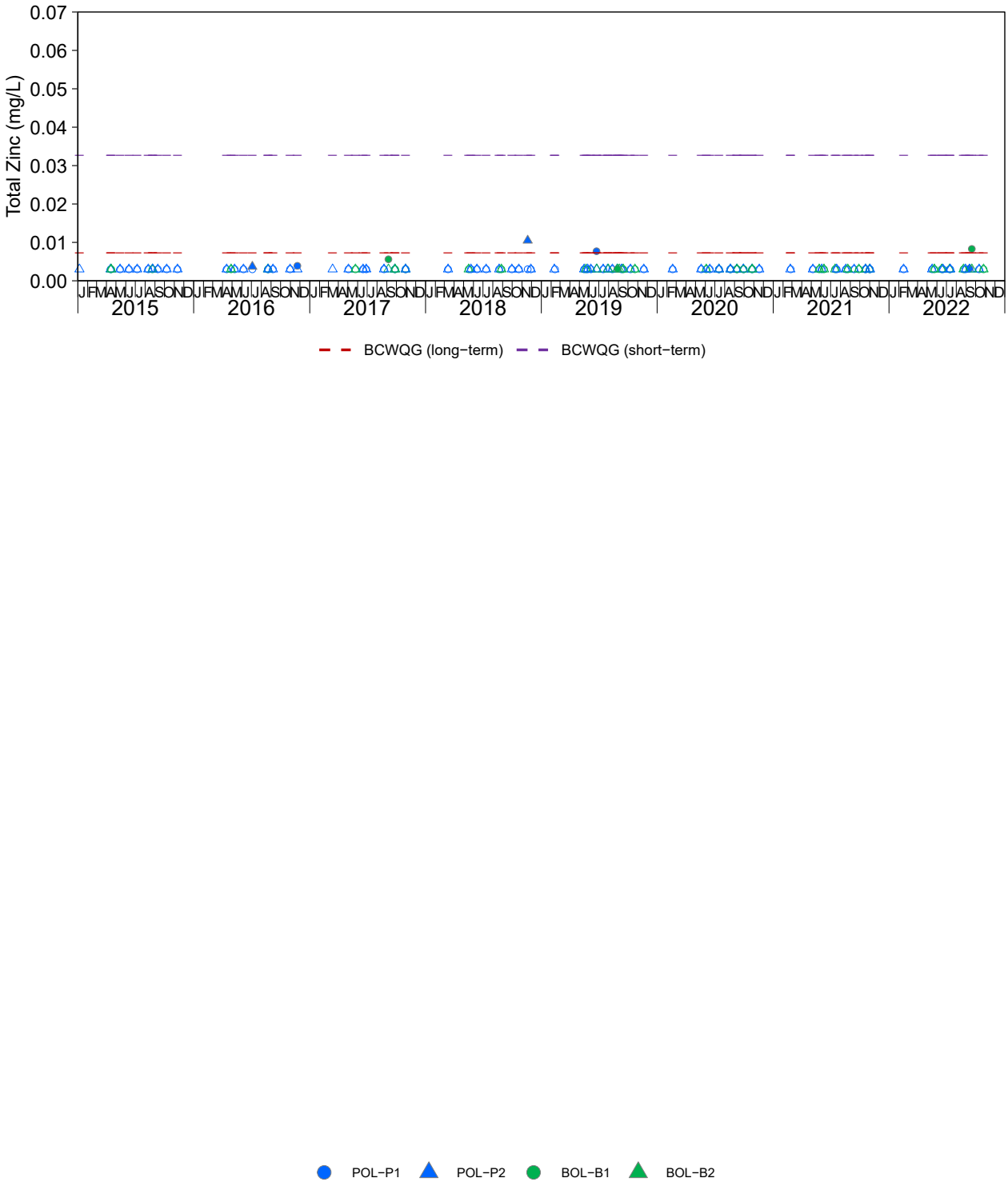

Figure C.1.4: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Polley Lake (POL−P1, POL−P2; Exposed) and Bootjack Lake (BOL−B1, BOL−B2; Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Total phosphorus data are plotted in Figure C.1.1. Dissolved mercury data were not collected.

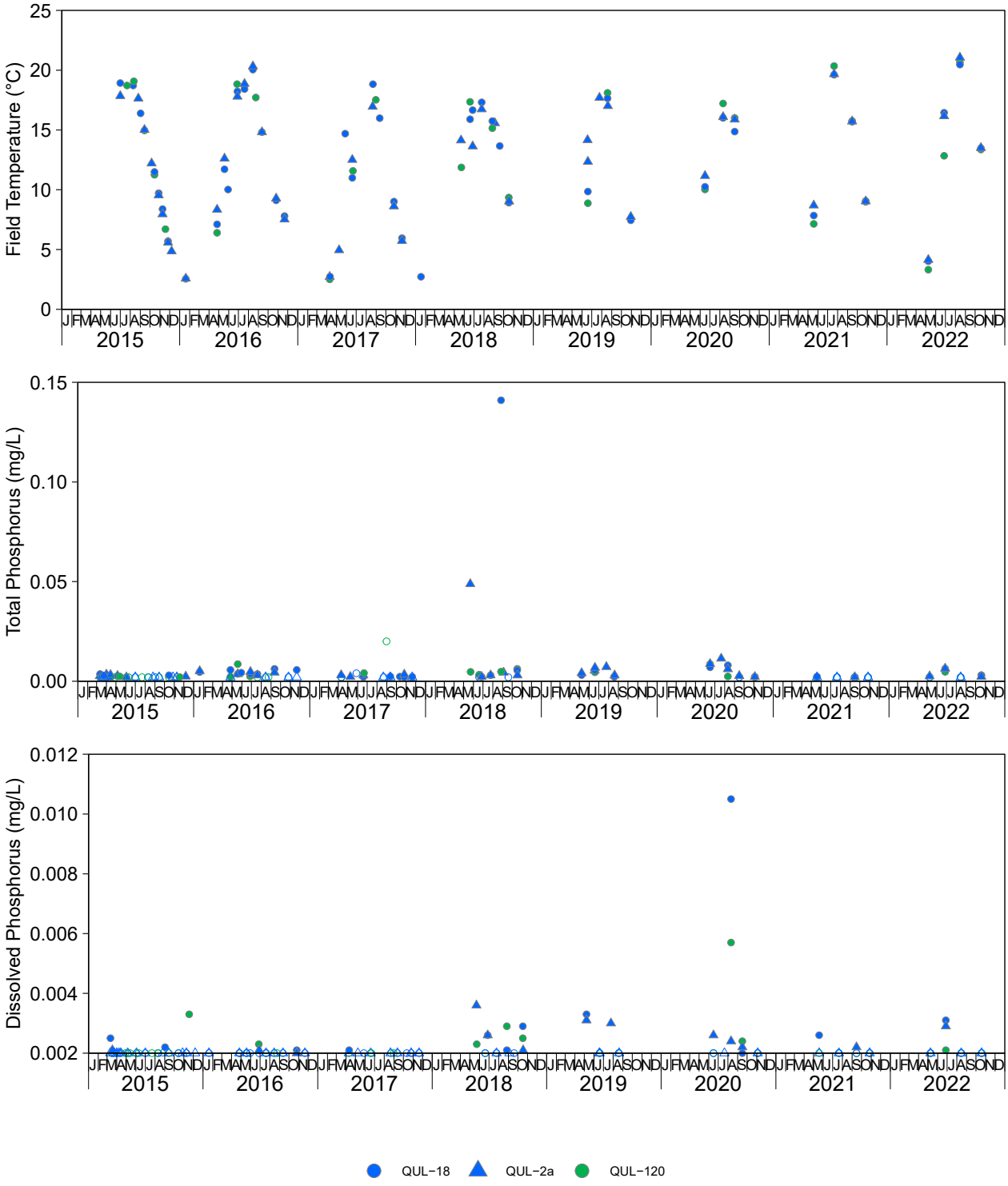

Figure C.1.5: Temperature and Nutrient Concentrations in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Station QUL−120 was named QUL−120a in 2021 and 2022.

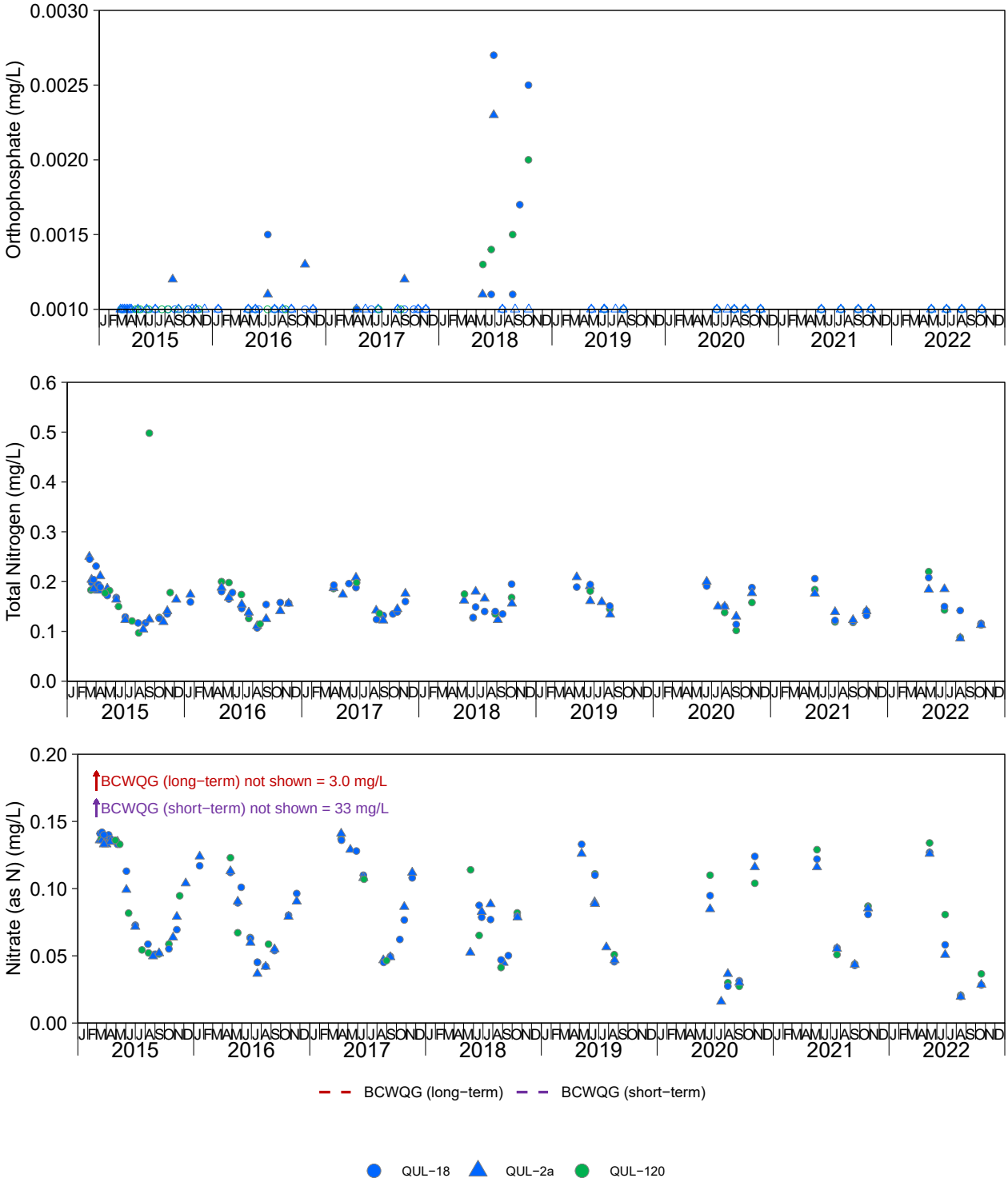

Figure C.1.5: Temperature and Nutrient Concentrations in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Station QUL−120 was named QUL−120a in 2021 and 2022.

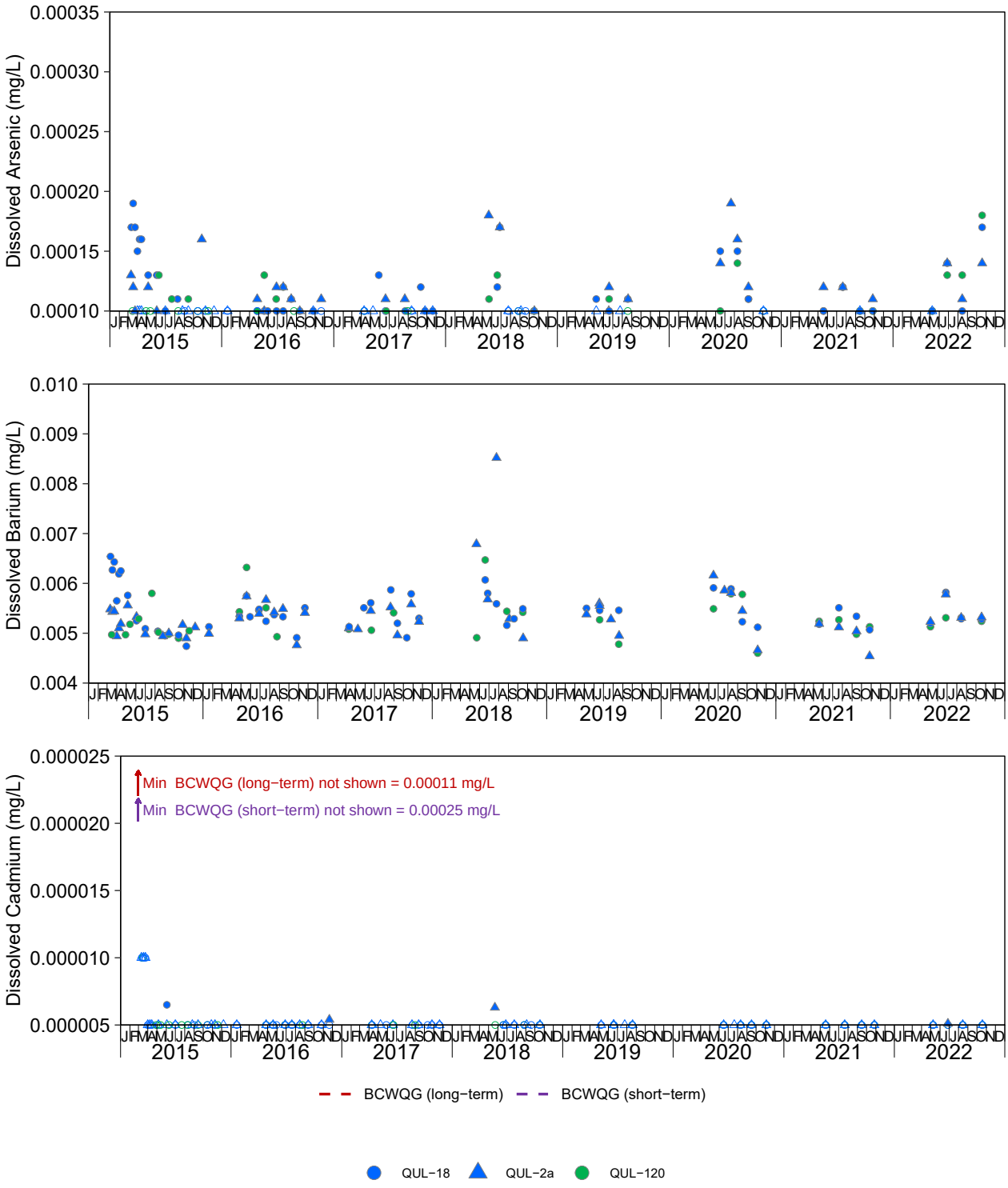

Figure C.1.6: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

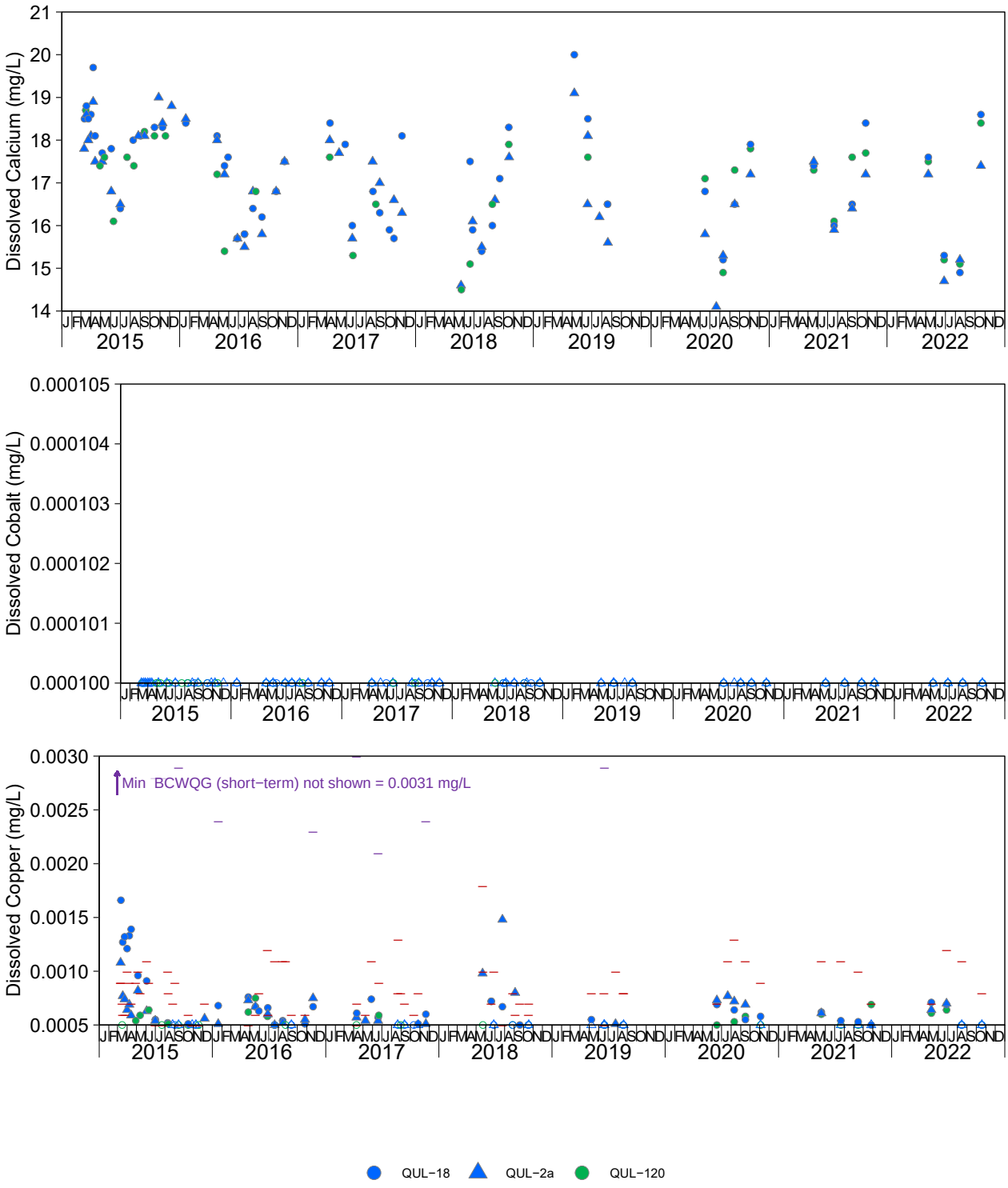

Figure C.1.6: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

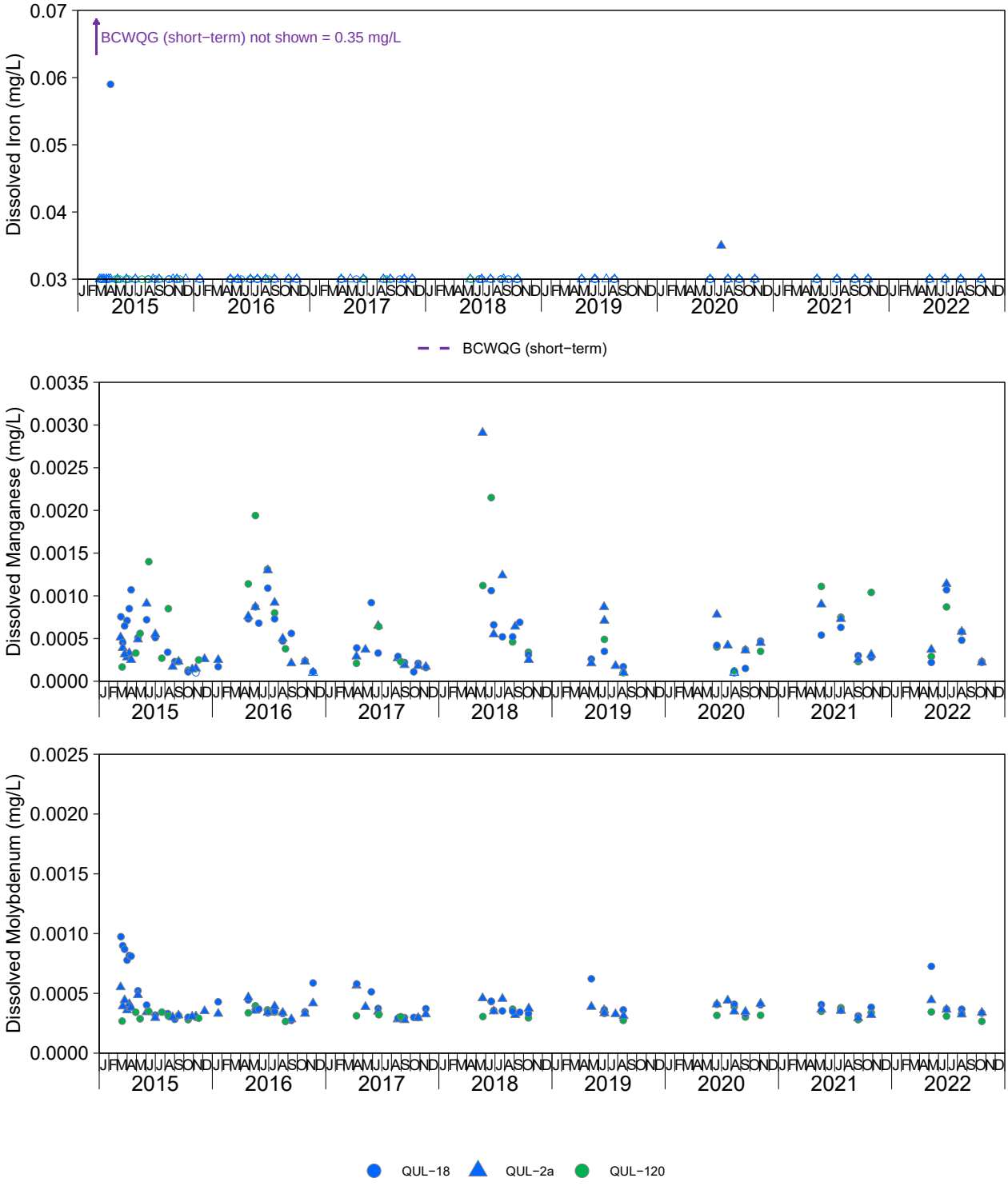

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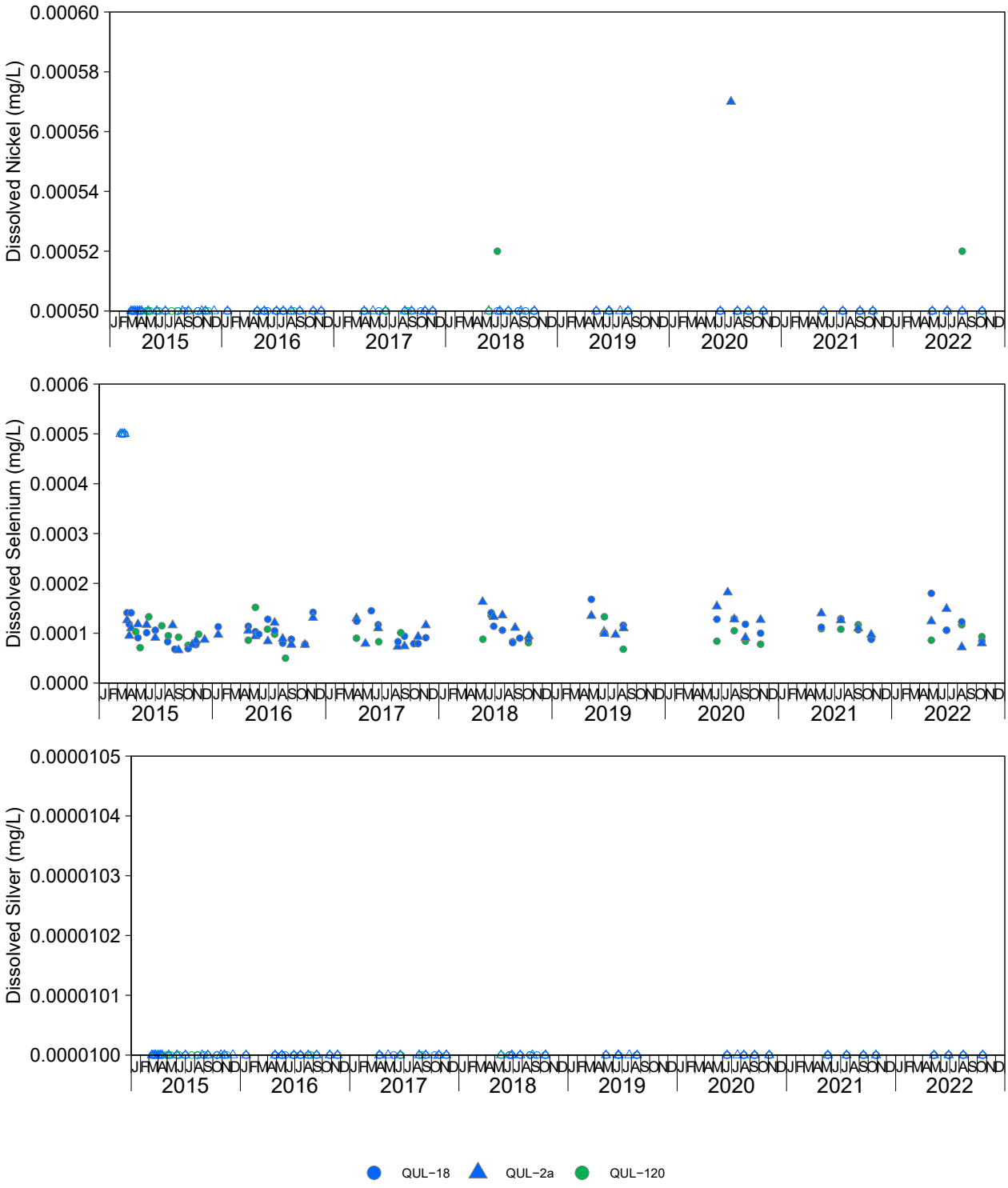

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Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

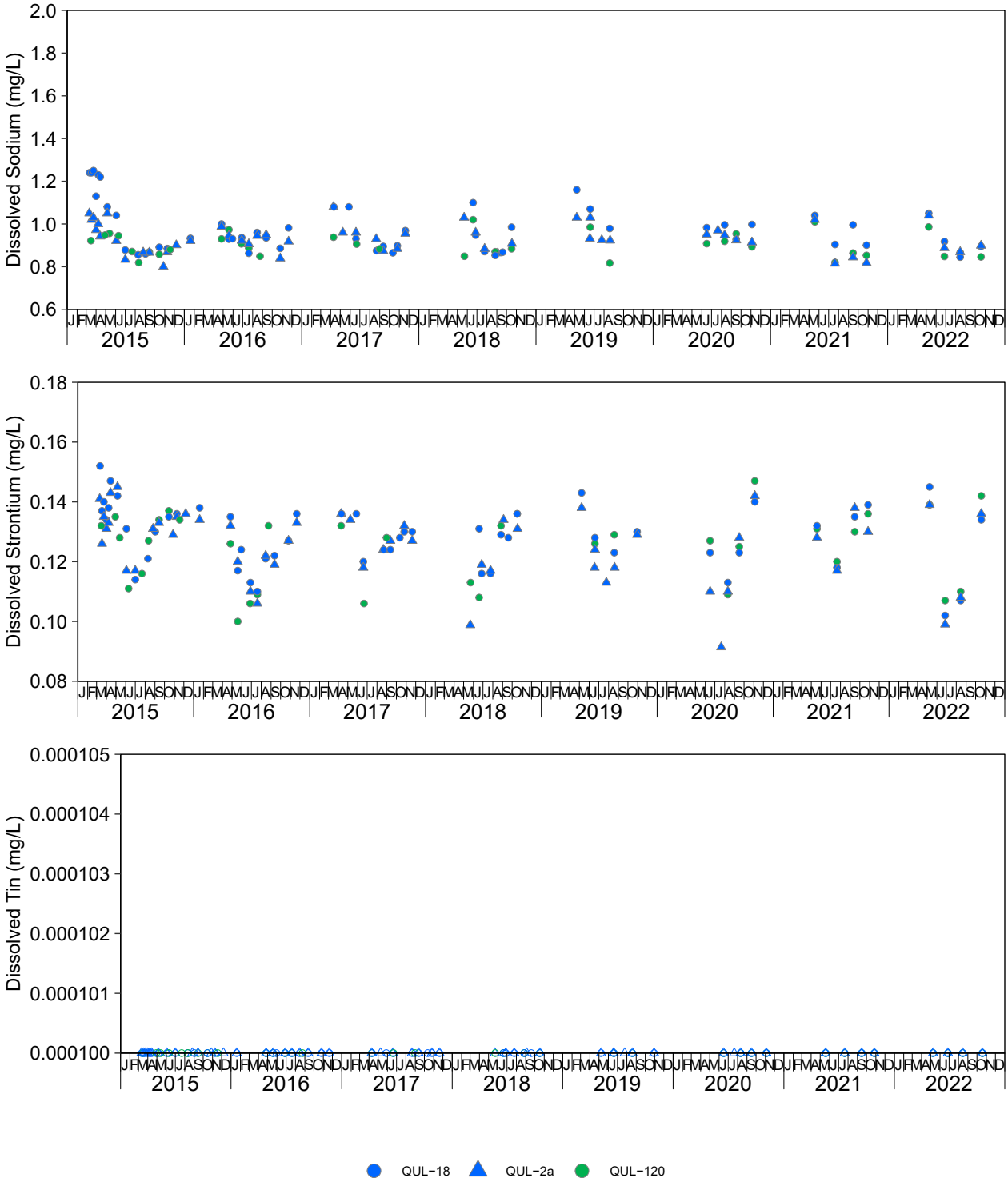

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Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

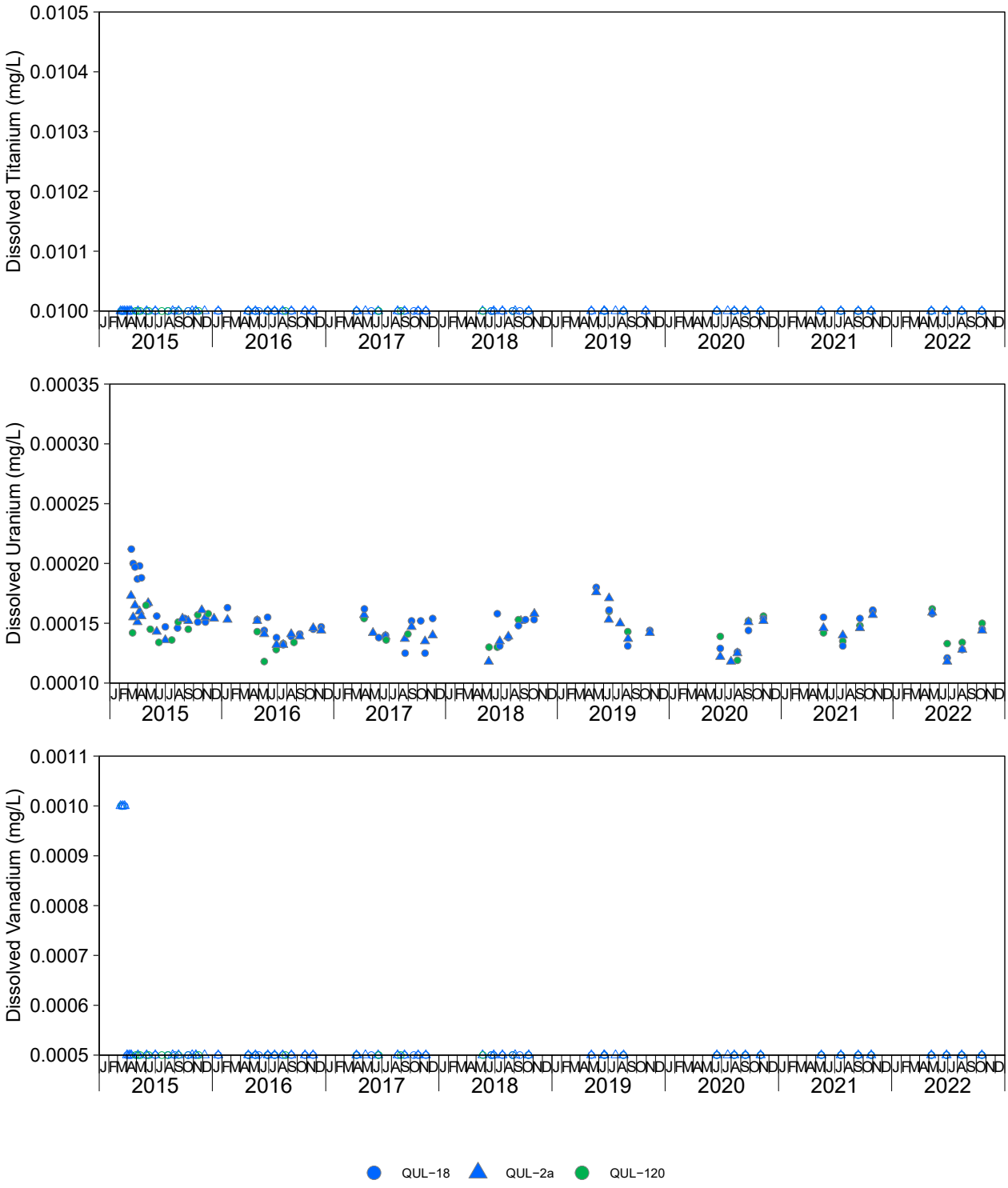

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Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

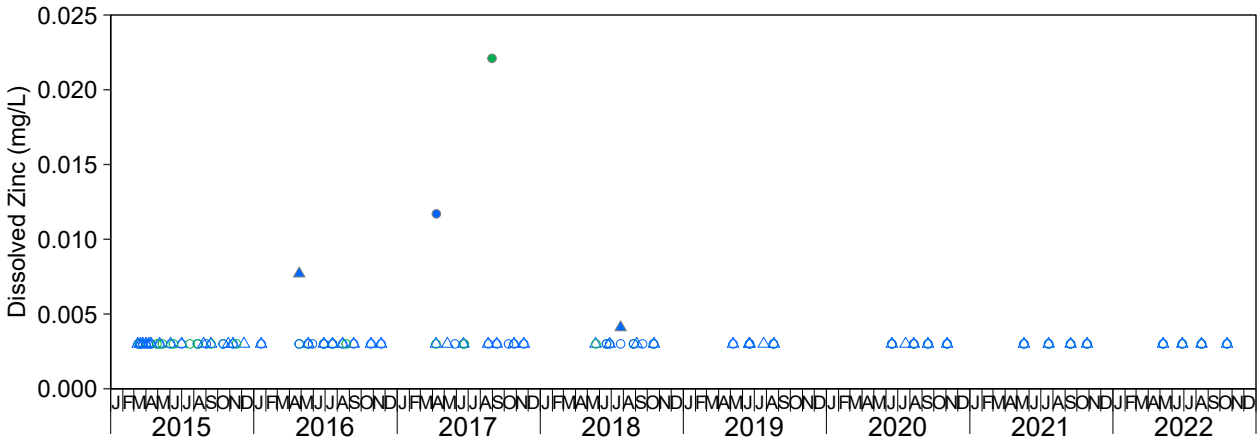

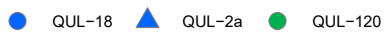

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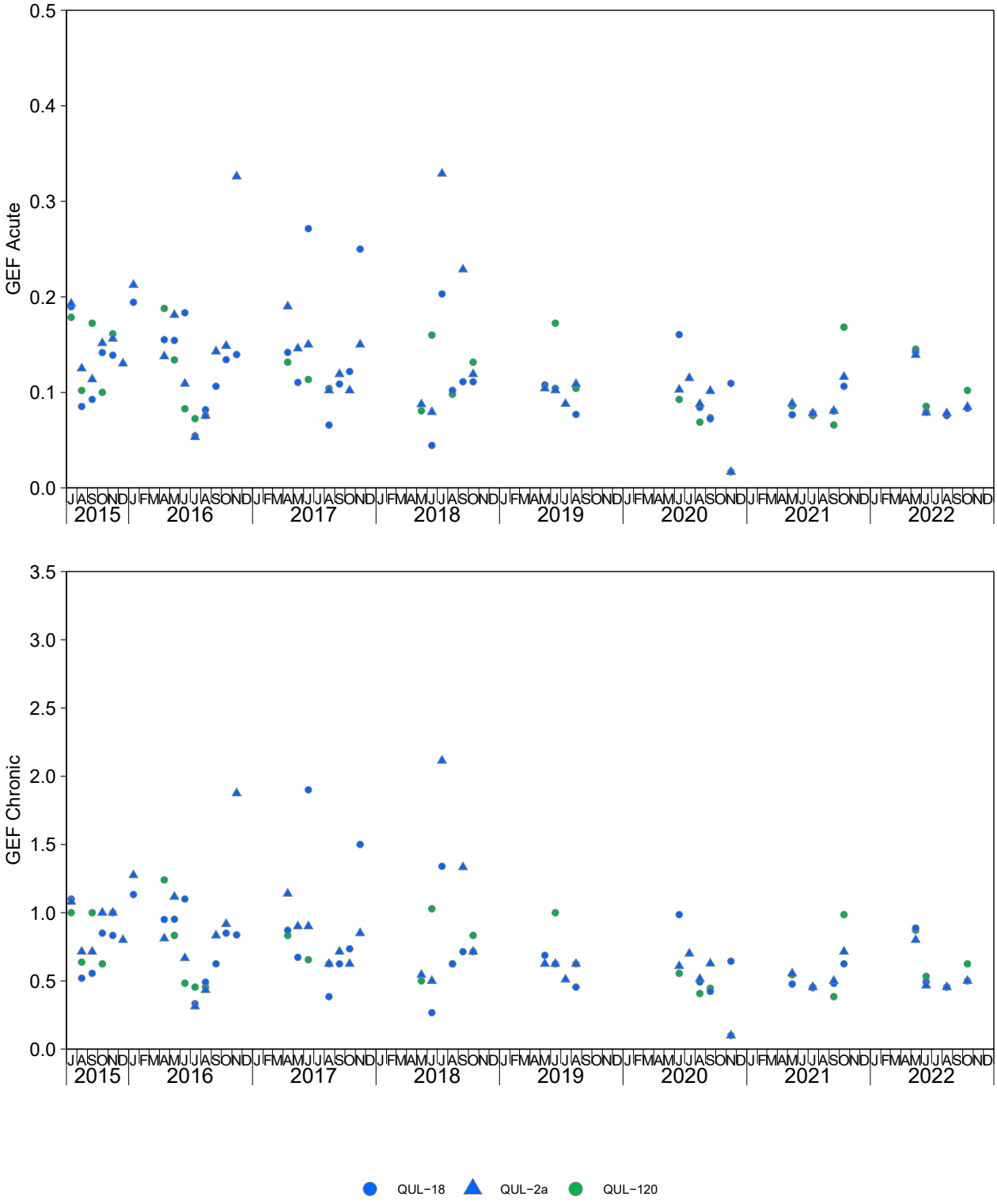

Figure C.1.7: Guideline Exceedance Factor (GEF) of Dissolved Copper in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: GEF = Guideline Exceedance Factor. Acute and Chronic GEF's calculated from monthly averages. Green represents reference stations and blue represents exposed stations. Station QUL−120 was named QUL−120a in 2021 and 2022.

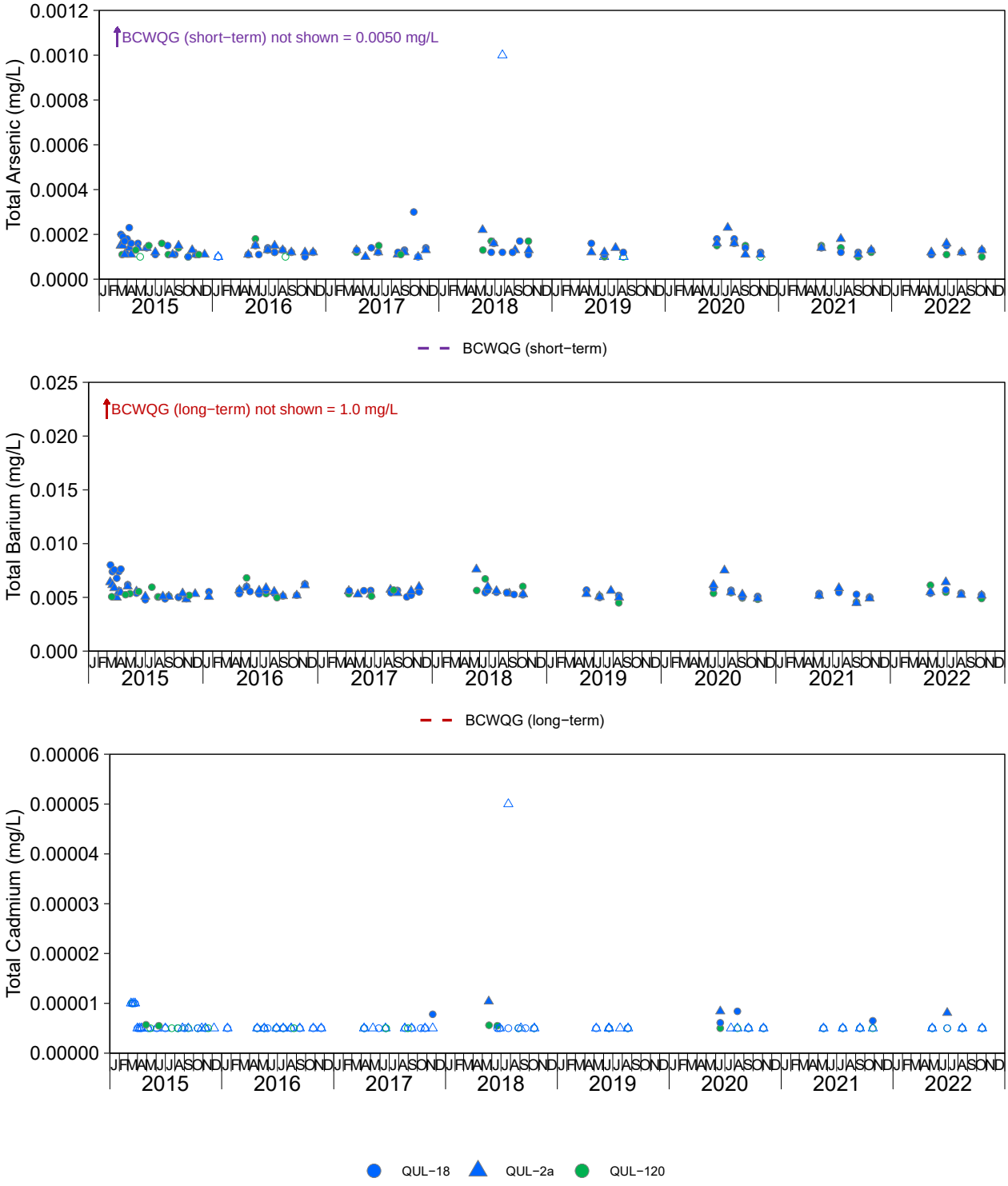

Figure C.1.8: Total Aqueous Concentrations of Primary and Secondary Analytes in Post−Breach Surface Water for Quesnel Lake at QUL−18, QUL−2a (Exposed) and QUL−120 (Reference) Monitoring Stations, 2015 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Values displayed for BCWQG that are condition specific (i.e., hardness dependent) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Station QUL−120 was named QUL−120a in 2021 and 2022. Dissolved phosphorus data are plotted in Figure C.1.5. Dissolved mercury data were not collected.

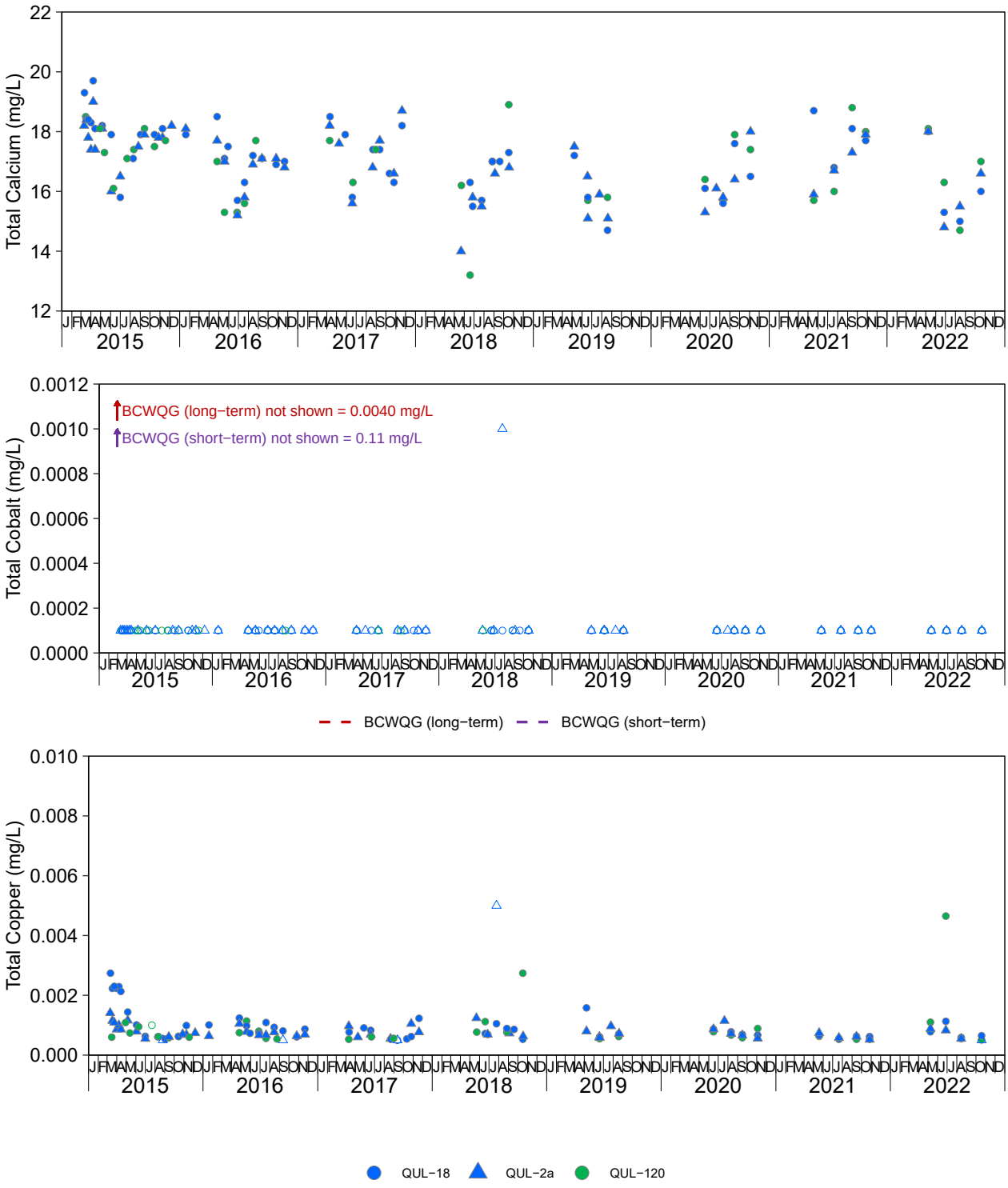

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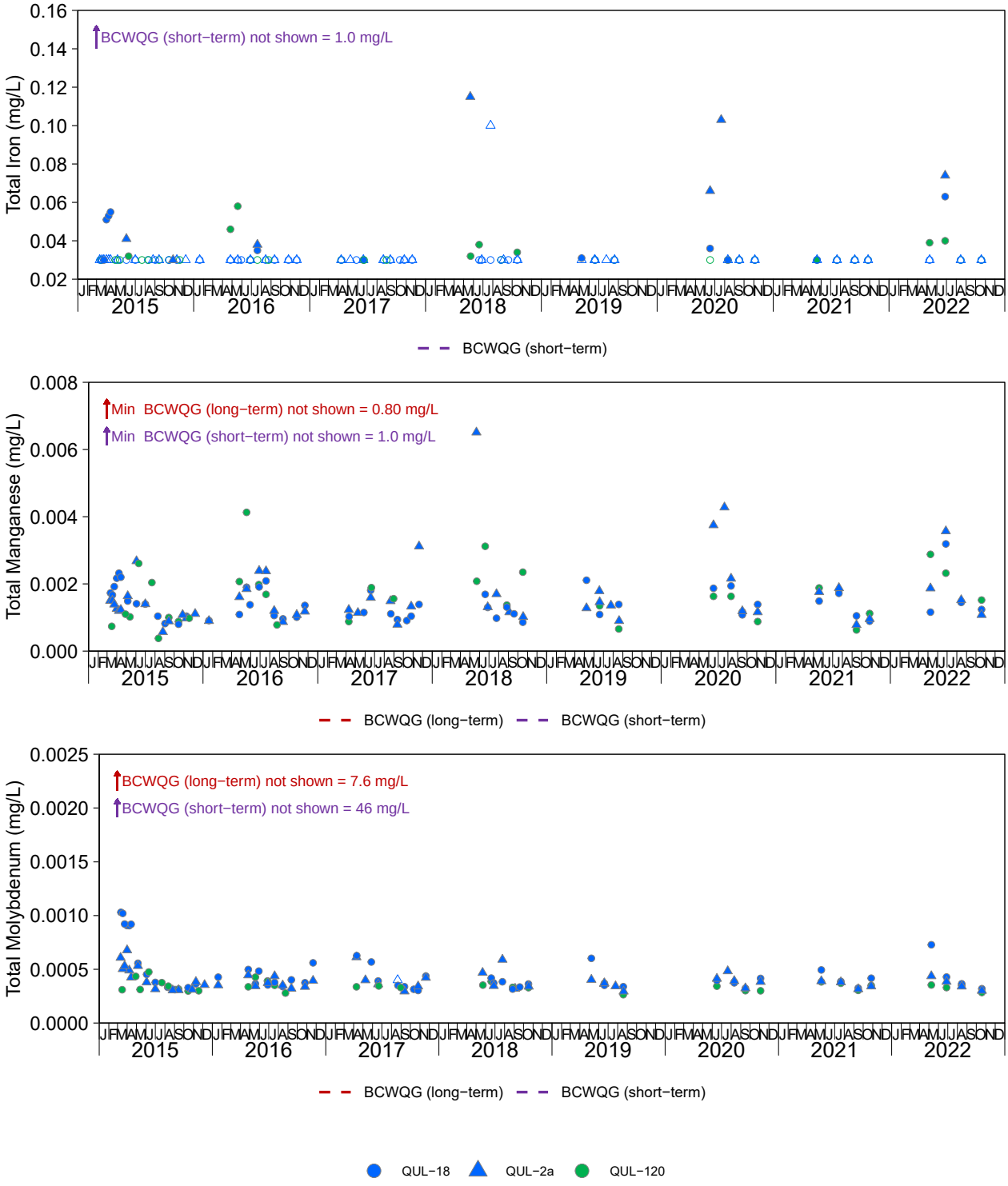

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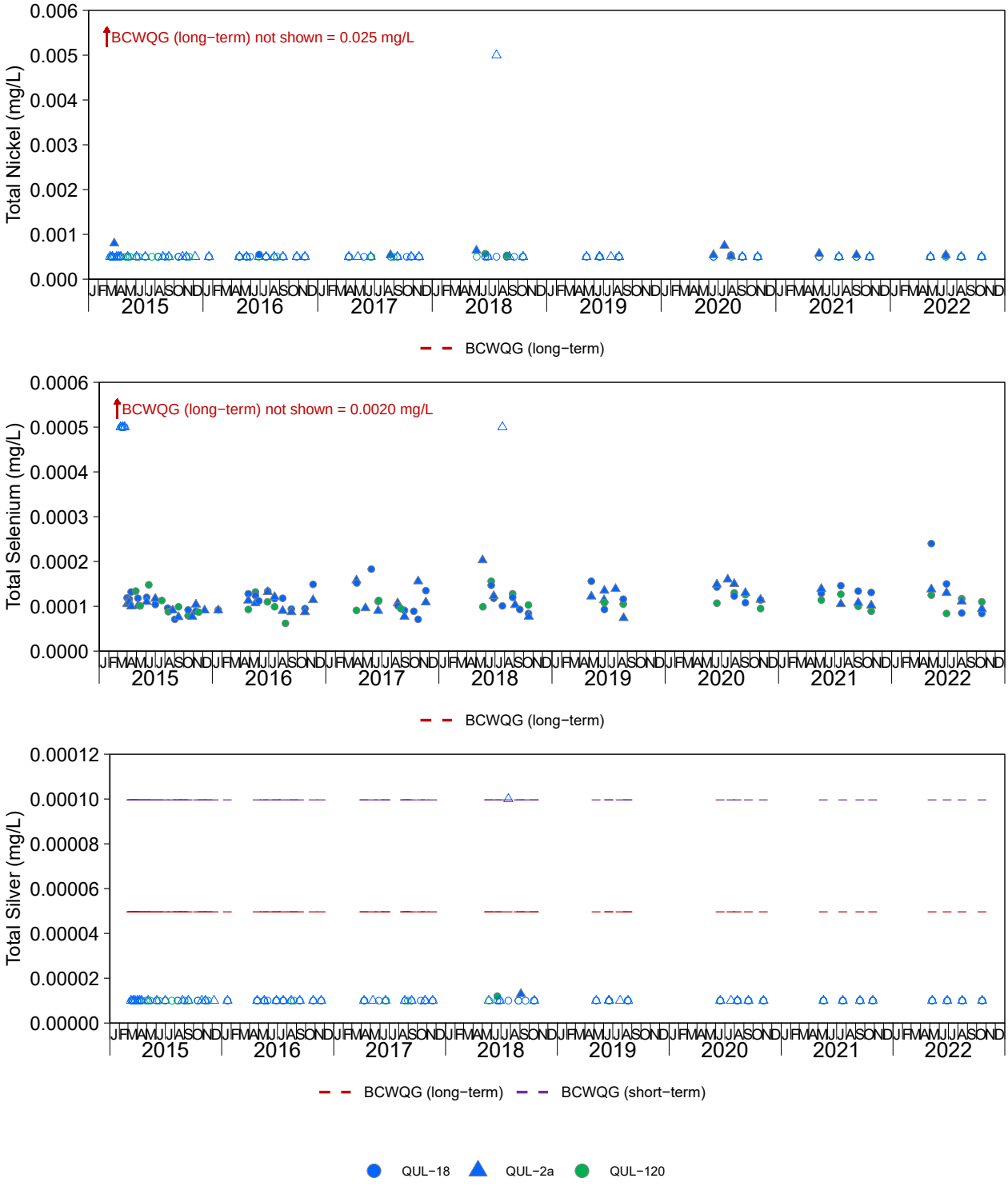

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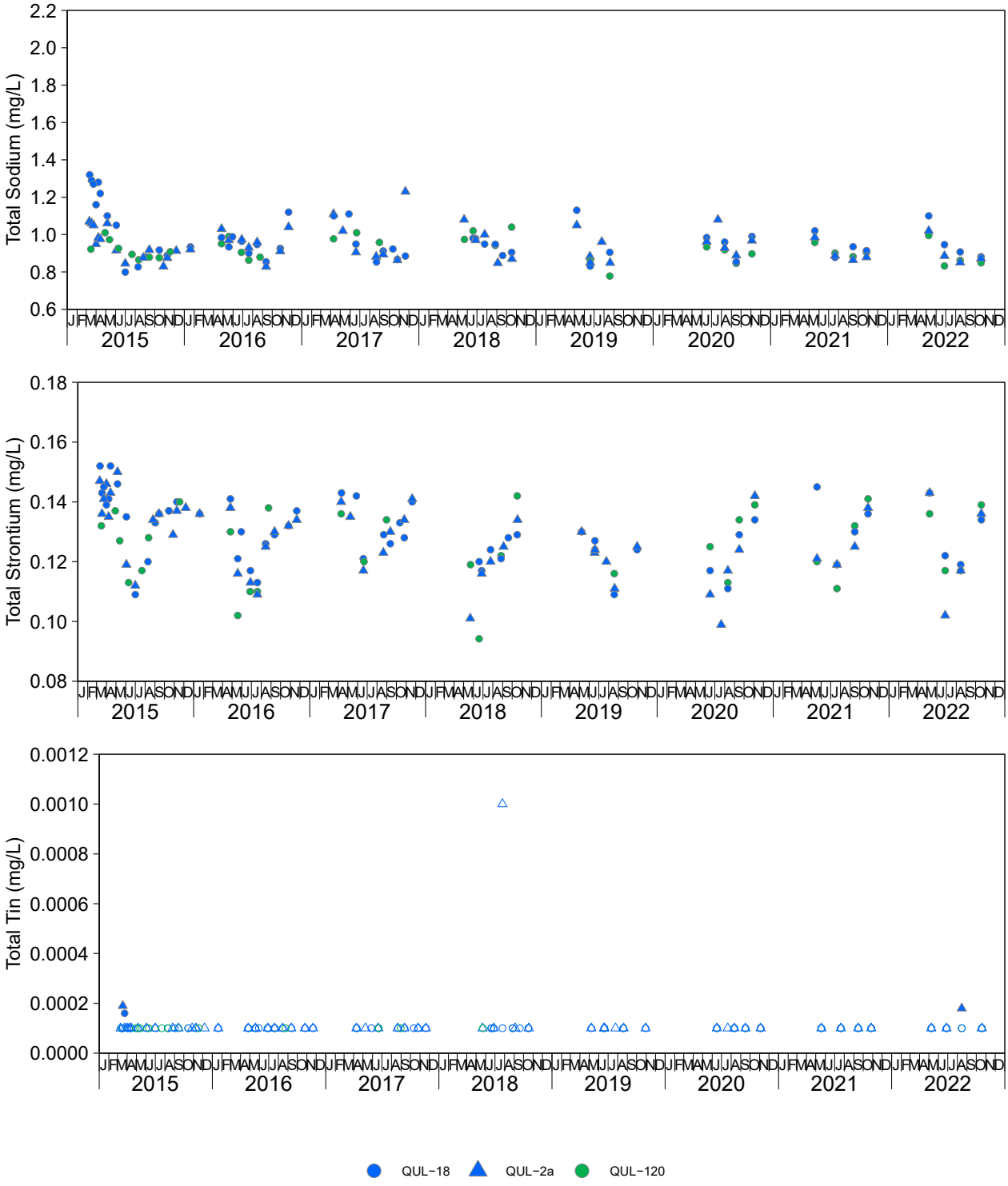

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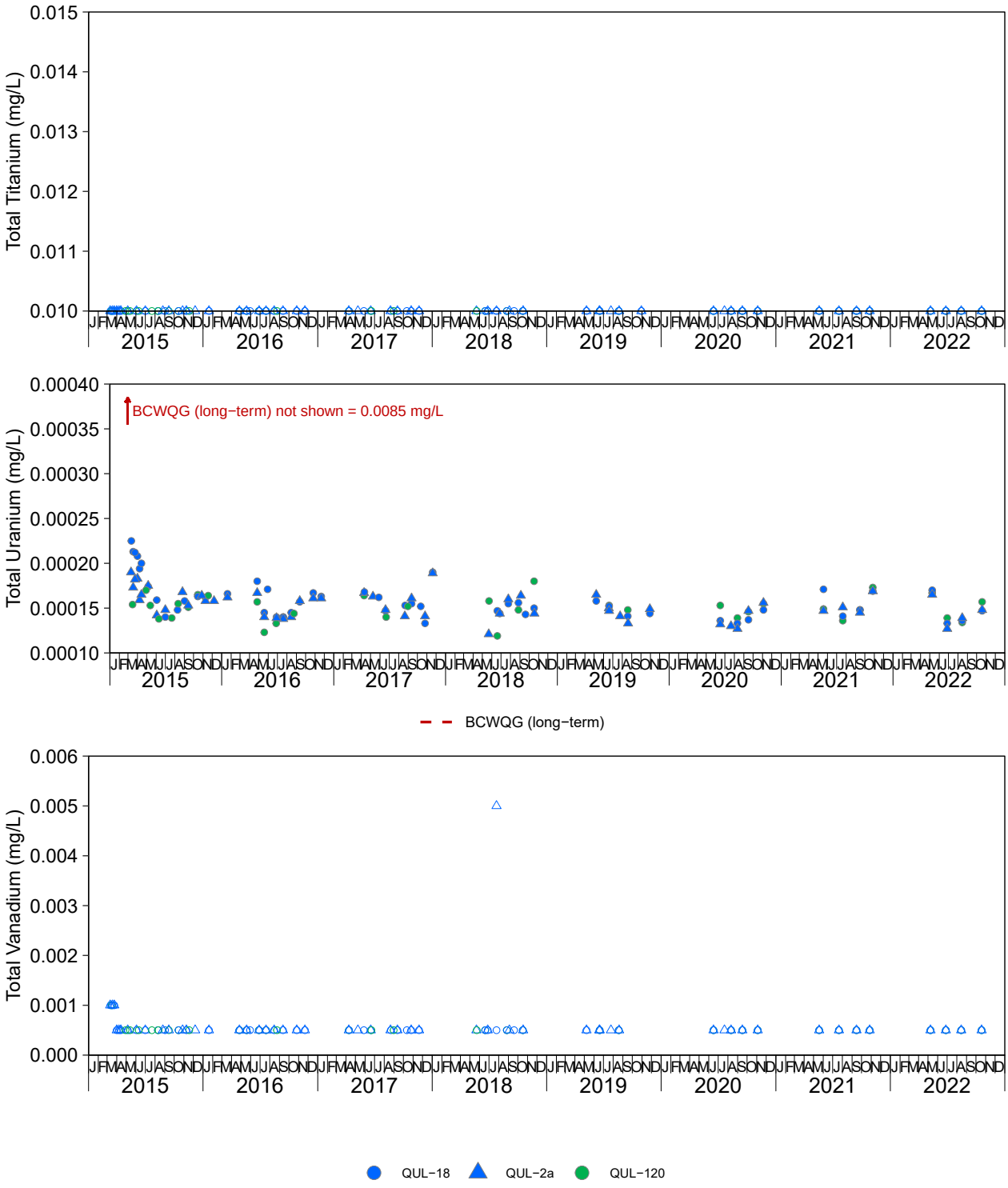

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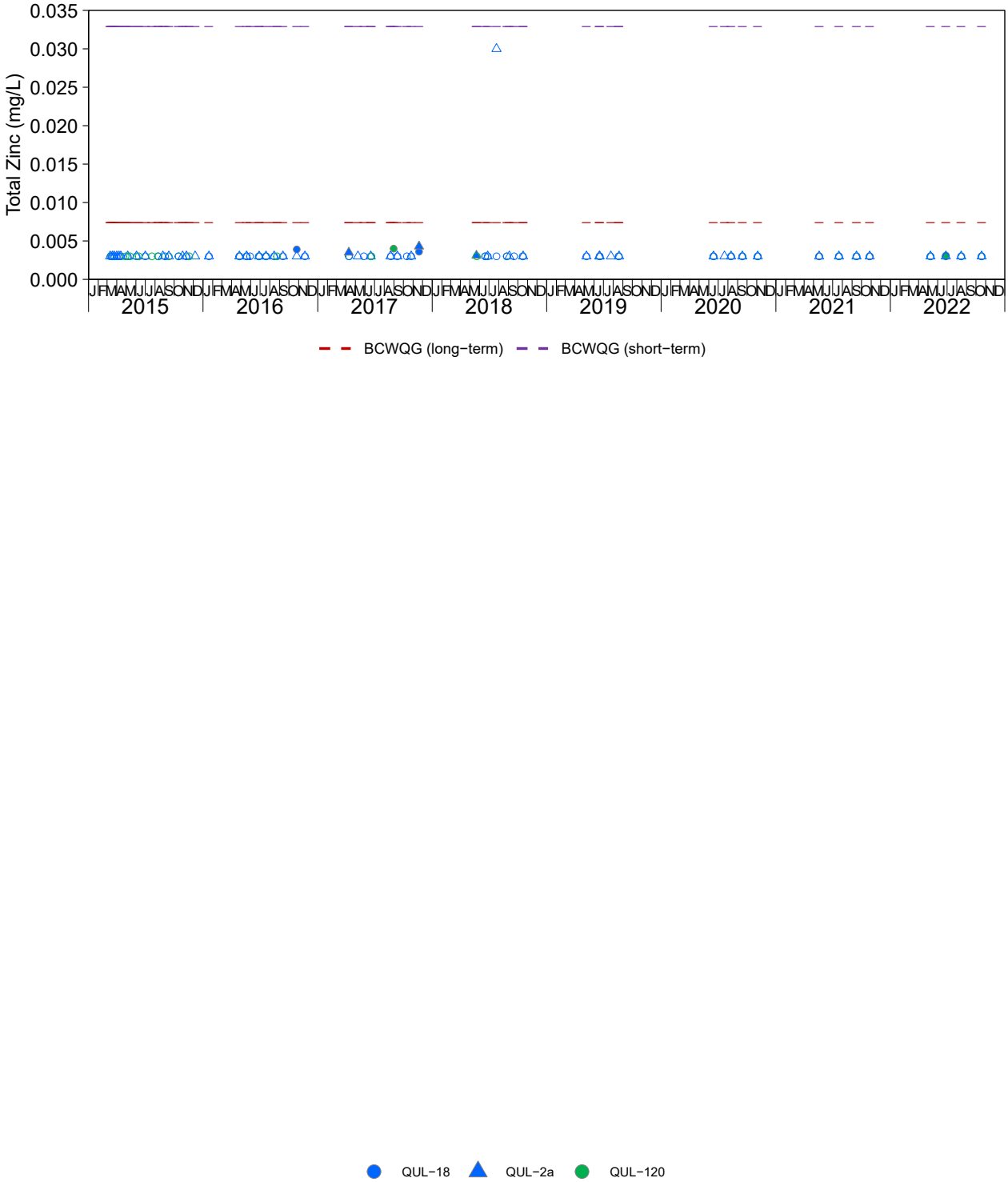

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Table C.1.1: British Columbia Water Quality Guidelines for the Protection of Aquatic Life (BCMOECCS 2019b, 2019c, 2021a, 2021b), 2022

Parameter	Units	Long-term Average	Short-term Maximum
Anions, Organics, Nutrients, and Physical Properties			
pH	pH units	6.5 - 9.0	
Temperature (*in situ*)[a]	°C	± 1	
Alkalinity ($CaCO_3$)	mg/L	> 20[b]	-
Conductivity	µS/cm	-	-
Dissolved Oxygen (*in situ*)[c]	mg/L	> 8	> 5
Dissolved Oxygen (*in situ*)[d]	mg/L	> 11	> 9
Total Suspended Solids[e]	mg/L	+ 5	+ 25
Turbidity[e]	NTU	+ 2	+ 8
Chloride	mg/L	150	600
Fluoride[f]	mg/L	-	For hardness ≤ 10 mg/L, WQG = 0.4 For hardness > 10 mg/L, WQG = [-51.73 + 92.57 × log10]×0.01 Maximum applicable hardness = 385 mg/L
Sulphate[g]	mg/L	hardness dependent	-
Ammonia (as N)[h]	mg/L	temperature and pH dependent	temperature and pH dependent
Nitrate (as N)	mg/L	3.0	32.8
Nitrite (as N)[i]	mg/L	chloride dependent	chloride dependent
Phosphorus - Total[j]	mg/L	0.005 - 0.015	
Dissolved Organic Carbon[k]	mg/L	-	± 20%[k]
Total Metals			
Antimony	µg/L	9	-
Arsenic	µg/L	-	5
Beryllium	µg/L	0.13	-
Boron	mg/L	1.2	-
Chromium[l]	µg/L	For Cr, WQG = 0.001 For Cr, WQG = 0.0089	-
Cobalt	µg/L	4	110
Iron	mg/L	-	1
Lead[f]	µg/L	For hardness ≤ 8 mg/L, none proposed For hardness 8 to 360 mg/L, WQG = 0.001×{3.31+ exp[1.273 × ln - 4.704]} Maximum applicable hardness = 360 mg/L	For hardness ≤ 8 mg/L, WQG ≤ 0.003 For hardness 8 to 360 mg/L, WQG = 0.001×{exp[1.273 × ln - 1.460]} Maximum applicable hardness = 360 mg/L
Manganese[f]	mg/L	For hardness 37 to 450 mg/L, WQG ≤ 0.004 × hardness + 0.605 Maximum applicable hardness = 450 mg/L	For hardness 25 to 259 mg/L, WQG ≤ 0.01102 × hardness + 0.54 Maximum applicable hardness = 259 mg/L
Mercury[m]	mg/L	WQG = [0.0001/] OR When MeHg = 0.5% of THg, WQG= 0.00002	-
Molybdenum	mg/L	7.6	46
Nickel[f]	µg/L	For hardness ≤60, WQG = 0.025 For hardness 60 to 180, WQG = exp{0.76[ln]+1.06} For hardness ≥180, WQG = 0.15	-
Selenium	µg/L	2	-
Silver	mg/L	For hardness ≤ 100 mg/L, WQG = 0.00005 For hardness > 100 mg/L, WQG = 0.0015	For hardness ≤ 100 mg/L, WQG = 0.0001 For hardness > 100 mg/L, WQG = 0.003
Thallium	µg/L	0.8	-
Uranium	µg/L	8.5	-
Zinc[f]	µg/L	For hardness ≤ 90 mg/L, WQG = 0.0075 For hardness 90 to 330 mg/L, WQG = [7.5 + 0.75]; Maximum applicable hardness = 330 mg/L	For hardness ≤ 90 mg/L, WQG = 0.033 For hardness 90 to 500 mg/L, WQG = [33 + 0.75]; Maximum applicable hardness = 500 mg/L
Dissolved Metals			
Aluminum	mg/L	0.05	0.1
Cadmium[f]	µg/L	For hardness = 3.4 to 285 mg/L, WQG = {exp[0.736×ln - 4.943]} Maximum applicable hardness = 285 mg/L	For hardness = 7 to 455 mg/L, WQG = {exp[1.03×ln-5.274]} Maximum applicable hardness = 455 mg/L
Copper[n]	mg/L	Biotic Ligand Model	Biotic Ligand Model
Iron	mg/L	-	0.35

Notes: "-" indicates no applicable guideline. BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] Change from optimal . No guideline applied.

[b] For waterbodies with low sensitivity to acid inputs.

[c] Minimum for all life stages other than buried embryo / alevin.

[d] Minimum for buried embryo / alevin life stages.

[e] Increase relative to background; no guideline applied.

[f] For hardness-based guidelines, concurrent hardness values were used for calculating guidelines. If hardness values exceeding the maximum applicable hardness, then guidelines were determined using the maximum applicable hardness. If hardness values are lower than the minimum hardness, then guidelines were determined using the minimum hardness.

[g] 128 mg/L at hardness 0-30 mg/L; 218 mg/L at hardness 31-75 mg/L; 309 mg/L at hardness 76-180 mg/L; 429 mg/L at hardness > 250 mg/L.

[h] Use tables in BCMOECCS 2021b.

[i] When chloride < 2 mg/L, long-term = 0.02 mg/L and short-term = 0.06 mg/L; increase with increasing chloride.

[j] Aquatic Life - Lakes; minimum guideline was applied.

[k] ±20% of the background median; no guideline applied.

[l] Chromium is the dominant oxidation state in oxygenated environments, and so its guideline was applied.

[m] Values were screened against 0.00002 mg/L which assumes MeHg = 0.5% of THg.

[n] Site specific guidelines developed using the BLM model and calculated concurrently for each sample .

Table C.1.2: Supporting Overlying Water Quality Data Collected Concurrently with Sediment Quality Sampling in Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-S; Reference) Shallow Areas, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		BOL-S (Reference)							POL-S (Exposed)						
				BOL-S-1	BOL-S-2	BOL-S-3	BOL-S-4	BOL-S-5	Mean	Standard Deviation	POL-S-1	POL-S-2	POL-S-3	POL-S-4	POL-S-5	Mean	Standard Deviation
		Long-term Average	Short-term Maximum	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22			25-Aug-22	25-Aug-22	25-Aug-22	25-Aug-22	25-Aug-22		
Anions, Organics, Nutrients, and Physical Properties																	
Alkalinity (as $CaCO_3$)	mg/L	>20	-	40.2	39.9	39.3	39.2	39.5	39.6	0.421	87.9	88.3	88.8	89.9	88.9	88.8	0.754
Ammonia (as N)	mg/L	0.65 to 1.8	3.6 to 12	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	-
Chloride	mg/L	150	600	0.580	0.580	0.580	0.580	0.590	0.582	0.00447	0.800	0.810	0.820	0.820	0.830	0.816	0.0114
Conductivity	µS/cm	-	-	98.0	97.7	98.8	97.1	97.4	97.8	0.652	246	244	247	247	245	246	1.30
Specific Conductance (*in situ*)	µS/cm	-	-	84.7	84.6	85.2	85.3	85.0	85.0	0.305	211	213	214	215	213	213	1.52
Dissolved Organic Carbon[b]	mg/L	-	-	7.51	7.54	7.90	7.55	7.56	7.61	0.162	6.60	6.20	6.92	6.87	7.08	6.73	0.345
Dissolved Oxygen (*in situ*)	%	-	-	100	100	104	112	99.1	103	5.29	103	114	106	107	117	109	5.82
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	8.62	8.68	8.93	9.66	8.59	8.90	0.448	8.94	9.85	9.20	9.22	10.1	9.46	0.489
Fluoride	mg/L	-	0.98 to 1.4	0.0590	0.0620	0.0620	0.0630	0.0630	0.0618	0.00164	0.0800	0.0820	0.0820	0.0810	0.0800	0.0810	0.00100
Hardness (as $CaCO_3$)	mg/L	-	-	43.4	44.6	42.7	43.3	43.8	43.6	0.702	108	109	110	109	115	110	2.77
Hardness, from Total CaMg (as $CaCO_3$)	mg/L	-	-	45.0	44.8	45.0	44.6	44.8	44.8	0.167	112	112	116	114	114	114	1.67
Nitrate (as N)	mg/L	3.0	33	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	-
Nitrate and Nitrite (as N)	mg/L	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	0.00510	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	0.00510	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Orthophosphate-Dissolved (as P)	mg/L	-	-	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	0.00102	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
pH (*in situ*)	pH units	6.5 - 9.0	6.5 - 9.0	8.56	8.57	8.63	8.91	8.48	8.63	0.165	8.62	8.51	8.70	8.69	8.78	8.66	0.101
pH (lab)	pH units	-	-	7.91	7.91	7.95	7.92	7.93	7.92	0.0167	8.34	8.36	8.36	8.36	8.36	8.36	0.00894
Phosphorus - Total Dissolved	mg/L	-	-	0.00290	0.00270	0.00290	0.00300	0.00290	0.00288	0.000110	0.00360	0.00410	0.00370	0.00420	0.00310	0.00374	0.000439
Phosphorus - Total	mg/L	0.0050		0.0160	0.00630	0.00700	0.00660	0.00880	0.00894	0.00406	0.00910	0.00830	0.0297	0.00800	0.00970	0.0130	0.00938
Sulphate	mg/L	218 to 309	-	7.57	7.56	7.58	7.53	7.54	7.56	0.0207	36.1	36.2	36.6	36.6	36.7	36.4	0.270
Temperature (*in situ*)	°C	-	-	22.6	22.6	22.5	22.7	22.5	22.6	0.0962	22.7	22.4	22.4	22.8	22.7	22.6	0.180
Total Dissolved Solids	mg/L	-	-	91.0	91.0	90.0	88.0	94.0	90.8	2.17	203	196	196	185	199	196	6.69
Total Nitrogen	mg/L	-	-	0.276	0.277	0.264	0.264	0.367	0.290	0.0437	0.272	0.275	0.259	0.250	0.262	0.264	0.0101
Total Suspended Solids[b]	mg/L	-	-	<1.0	<1.0	1.20	1.00	1.30	1.10	0.155	<1.0	<1.0	2.20	1.70	<1.0	1.38	0.283
Turbidity[b]	NTU	-	-	0.410	0.420	0.340	0.330	0.410	0.382	0.0432	0.340	0.460	0.350	0.330	0.320	0.360	0.0570
Total Metals																	
Aluminum	mg/L	-	-	0.0107	0.0121	0.00700	0.00880	0.00710	0.00914	0.00224	0.00850	0.00790	0.0120	0.00800	0.0208	0.0114	0.00550
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	0.000120	0.000120	0.000108	0
Arsenic	mg/L	-	0.0050	0.000340	0.000340	0.000340	0.000380	0.000350	0.000350	0.0000173	0.000550	0.000560	0.000570	0.000570	0.000640	0.000578	0.0000356
Barium	mg/L	1.0	-	0.0156	0.0159	0.0156	0.0157	0.0160	0.0158	0.000182	0.0106	0.0107	0.0107	0.0105	0.0108	0.0107	0.000114
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-
Boron	mg/L	1.2	-	0.0430	0.0440	0.0440	0.0440	0.0440	0.0438	0.000447	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0
Cadmium	mg/L	-	-	0.00000620	<0.0000050	<0.0000050	<0.0000050	0.00000710	0.00000566	0.000000509	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.000010	0.00000500	-
Calcium	mg/L	-	-	13.7	13.7	13.7	13.6	13.7	13.7	0.0447	36.1	35.9	37.5	36.5	36.8	36.6	0.631
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Copper	mg/L	-	-	0.00235	0.00248	0.00218	0.00279	0.00232	0.00242	0.000231	0.00419	0.00393	0.00420	0.00389	0.00488	0.00422	0.000397
Iron	mg/L	-	1.0	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-
Lead	mg/L	0.0043 to 0.0068	0.026 to 0.090	0.0000880	0.000258	0.000144	0.000564	<0.000050	0.000221	0.000207	<0.000050	0.000171	0.000143	0.000158	0.000549	0.000214	0.000183
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Magnesium	mg/L	-	-	2.61	2.58	2.61	2.59	2.58	2.59	0.0152	5.41	5.38	5.55	5.56	5.43	5.47	0.0832
Manganese	mg/L	0.79 to 1.1	0.99 to 1.7	0.0122	0.0105	0.0113	0.0124	0.0140	0.0121	0.00131	0.00711	0.00734	0.00678	0.00524	0.00556	0.00641	0.000946
Molybdenum	mg/L	7.6	46	0.000916	0.000906	0.000878	0.000885	0.000873	0.000892	0.0000186	0.00691	0.00694	0.00713	0.00694	0.00707	0.00700	0.0000963
Nickel	mg/L	0.025 to 0.10	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Potassium	mg/L	-	-	0.431	0.454	0.437	0.439	0.431	0.438	0.00942	0.942	0.928	0.962	0.949	0.939	0.944	0.0126
Selenium	mg/L	0.0020	-	0.000241	0.000235	0.000244	0.000189	0.000164	0.000215	0.0000360	0.000787	0.000749	0.000846	0.000873	0.000751	0.000801	0.0000561
Silicon	mg/L	-	-	1.55	1.58	1.54	1.56	1.53	1.55	0.0192	2.87	2.83	3.02	3.02	2.98	2.94	0.0885
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Sodium	mg/L	-	-	2.42	2.41	2.44	2.40	2.42	2.42	0.0148	7.51	7.48	7.57	7.58	7.45	7.52	0.0563
Strontium	mg/L	-	-	0.134	0.133	0.133	0.133	0.135	0.134	0.000894	0.252	0.252	0.255	0.254	0.256	0.254	0.00179
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Uranium	mg/L	0.0085	-	0.0000410	0.0000440	0.0000440	0.0000450	0.0000430	0.0000434	0.00000152	0.000183	0.000186	0.000194	0.000192	0.000191	0.000189	0.00000455
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	0.00144	0.00136	0.00141	0.00140	0.00144	0.00141	0.0000332
Zinc	mg/L	0.0075 to 0.021	0.033 to 0.046	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00300	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00300	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Notes: "-" indicates data not available. Standard deviation was not calculated where all results were below the laboratory reporting limit.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table C.1.1.
[b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table C.1.2: Supporting Overlying Water Quality Data Collected Concurrently with Sediment Quality Sampling in Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-S; Reference) Shallow Areas, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		BOL-S (Reference)							POL-S (Exposed)						
				BOL-S-1	BOL-S-2	BOL-S-3	BOL-S-4	BOL-S-5	Mean	Standard Deviation	POL-S-1	POL-S-2	POL-S-3	POL-S-4	POL-S-5	Mean	Standard Deviation
		Long-term Average	Short-term Maximum	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22			25-Aug-22	25-Aug-22	25-Aug-22	25-Aug-22	25-Aug-22		
Dissolved Metals																	
Aluminum	mg/L	0.050	0.10	0.00520	0.00450	0.00430	0.00440	0.00510	0.00470	0.000418	0.00320	<0.0030	0.00410	0.00400	0.00360	0.00358	0.000441
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Arsenic	mg/L	-	-	0.000330	0.000300	0.000340	0.000310	0.000310	0.000318	0.0000164	0.000520	0.000550	0.000560	0.000540	0.000510	0.000536	0.0000207
Barium	mg/L	-	-	0.0145	0.0141	0.0139	0.0151	0.0148	0.0145	0.000492	0.00991	0.00962	0.00936	0.00946	0.00950	0.00957	0.000212
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-
Boron	mg/L	-	-	0.0400	0.0420	0.0400	0.0420	0.0420	0.0412	0.00110	0.0180	0.0180	0.0180	0.0180	0.0190	0.0182	0.000447
Cadmium	mg/L	0.00011 to 0.00022	0.00023 to 0.00064	0.00000890	<0.0000050	0.00000820	0.0000102	0.0000117	0.00000880	0.00000155	0.0000188	<0.0000050	<0.0000050	<0.0000050	0.00000580	0.00000792	0.00000735
Calcium	mg/L	-	-	13.2	13.7	13.0	13.2	13.4	13.3	0.265	34.6	34.7	35.4	34.5	37.0	35.2	1.05
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Copper	mg/L	0.0021 to 0.0048	0.013 to 0.028	0.00218	0.00215	0.00199	0.00198	0.00209	0.00208	0.0000909	0.00372	0.00362	0.00370	0.00357	0.00355	0.00363	0.0000760
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-
Lead	mg/L	-	-	<0.000050	0.000358	0.0000580	0.0000910	0.0000530	0.000122	0.000137	0.0000700	0.0000540	0.000898	0.0000610	0.000187	0.000254	0.000364
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Magnesium	mg/L	-	-	2.54	2.52	2.49	2.51	2.52	2.52	0.0182	5.25	5.43	5.38	5.52	5.46	5.41	0.102
Manganese	mg/L	-	-	0.00364	0.00224	0.00255	0.00421	0.00506	0.00354	0.00117	0.000960	0.000920	0.00112	0.000730	0.000940	0.000934	0.000139
Molybdenum	mg/L	-	-	0.000846	0.000822	0.000809	0.000840	0.000858	0.000835	0.0000195	0.00677	0.00691	0.00688	0.00698	0.00692	0.00689	0.0000773
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Potassium	mg/L	-	-	0.457	0.443	0.434	0.440	0.456	0.446	0.0101	0.924	0.950	0.953	0.953	0.938	0.944	0.0126
Selenium	mg/L	-	-	0.000186	0.000158	0.000196	0.000246	0.000239	0.000205	0.0000370	0.000763	0.000763	0.000799	0.000755	0.000813	0.000779	0.0000257
Silicon	mg/L	-	-	1.49	1.49	1.47	1.52	1.51	1.50	0.0195	2.69	2.68	2.82	2.86	2.84	2.78	0.0861
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Sodium	mg/L	-	-	2.42	2.43	2.42	2.35	2.47	2.42	0.0432	6.99	7.26	7.13	7.14	7.18	7.14	0.0982
Strontium	mg/L	-	-	0.121	0.122	0.121	0.125	0.123	0.122	0.00167	0.235	0.236	0.241	0.237	0.231	0.236	0.00361
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Uranium	mg/L	-	-	0.0000450	0.0000410	0.0000440	0.0000430	0.0000420	0.0000430	0.00000158	0.000189	0.000189	0.000196	0.000195	0.000184	0.000191	0.00000493
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	0.00124	0.00131	0.00131	0.00132	0.00137	0.00131	0.0000464
Zinc	mg/L	-	-	0.00420	<0.0030	<0.0030	<0.0030	0.00300	0.00324	0.000679	0.00590	<0.0030	0.00360	<0.0030	<0.0030	0.00370	0.00130

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Notes: "-" indicates data not available. Standard deviation was not calculated where all results were below the laboratory reporting limit.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table C.1.1. [b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table C.1.3: Supporting Spot Water Quality Data Collected During Plankton Sampling in Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference), 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		BOL-B2 (Reference)			POL-P2 (Exposed)		
				June	July	August	June	July	August
		Long-term Average	Short-term Maximum	21-Jun-22	26-Jul-22	28-Aug-22	21-Jun-22	25-Jul-22	25-Aug-22
Anions, Organics, Nutrients, and Physical Properties									
Alkalinity (as $CaCO_3$)	mg/L	>20	-	38.1	41.8	42.5	88.2	91.7	89.1
Ammonia (as N)	mg/L	0.65 to 1.8	3.6 to 12	0.00520	0.00520	0.00720	<0.0050	0.00850	0.0107
Chloride	mg/L	150	600	0.620	0.560	0.640	1.03	0.800	0.870
Conductivity	µS/cm	-	-	92.2	95.8	98.7	242	239	242
Specific Conductance (*in situ*)	µS/cm	-	-	97.0	92.2	86.2	249	232	214
Dissolved Organic Carbon[b]	mg/L	-	-	7.43	7.85	7.81	6.77	6.56	7.40
Dissolved Oxygen (*in situ*)	%	-	-	80.6	71.4	61.4	89.1	87.7	85.8
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	8.77	7.32	6.32	9.66	8.62	8.40
Fluoride	mg/L	-	0.98 to 1.4	0.0570	0.0480	0.0560	0.0740	0.0620	0.0800
Hardness (as $CaCO_3$)	mg/L	-	-	44.2	41.8	45.0	109	106	111
Hardness, from Total CaMg (as $CaCO_3$)	mg/L	-	-	44.2	41.0	44.8	106	105	108
Nitrate (as N)	mg/L	3.0	33	<0.0050	<0.0050	0.00640	<0.0050	<0.0050	0.00780
Nitrate and Nitrite (as N)	mg/L	-	-	<0.0051	<0.0051	0.00640	<0.0051	<0.0051	0.00780
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Orthophosphate-Dissolved (as P)	mg/L	-	-	<0.0010	<0.0010	0.00160	<0.0010	0.00370	<0.0010
pH (*in situ*)	pH units	6.5 - 9.0	6.5 - 9.0	7.54	7.68	7.47	7.64	8.10	8.12
pH	pH units	-	-	7.72	7.80	7.49	8.12	8.20	8.12
Phosphorus - Total Dissolved	mg/L	-	-	0.00610	0.00530	0.00720	0.00720	0.0126	0.00590
Phosphorus - Total	mg/L	0.0050		0.0130	0.0120	0.0170	0.0180	0.0145	0.0134
Sulphate	mg/L	218 to 309	-	7.16	6.98	6.78	33.8	34.1	34.9
Temperature (*in situ*)	°C	-	-	11.6	14.2	14.0	11.7	16.1	16.2
Total Dissolved Solids	mg/L	-	-	79.0	91.0	83.0	162	169	174
Total Nitrogen	mg/L	-	-	0.314	0.287	-	0.367	0.324	0.388
Total Suspended Solids[b]	mg/L	-	-	3.00	2.00	3.60	3.00	1.30	2.80
Turbidity[b]	NTU	-	-	1.27	0.810	2.47	1.44	0.590	1.73
Total Metals									
Aluminum	mg/L	-	-	0.0586	0.0354	0.0551	0.103	0.0242	0.0399
Antimony	mg/L	0.0090	-	0.000150	<0.00010	0.000120	0.000120	<0.00010	0.000100
Arsenic	mg/L	-	0.0050	0.000580	0.000360	0.000710	0.000850	0.000510	0.000580
Barium	mg/L	1.0	-	0.0181	0.0167	0.0168	0.0126	0.0103	0.0111
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	1.2	-	0.0450	0.0460	0.0440	0.0200	0.0210	0.0200
Cadmium	mg/L	-	-	0.0000120	0.0000222	0.00000750	0.00000700	0.0000379	0.00000570
Calcium	mg/L	-	-	13.6	12.4	13.8	34.2	33.6	34.6
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	0.000530	<0.00050	<0.00050
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	-	0.00554	0.00342	0.00528	0.00807	0.00543	0.00623
Iron	mg/L	-	1.0	0.0740	0.0500	0.0890	0.101	<0.030	0.0360
Lead	mg/L	0.0043 to 0.0068	0.026 to 0.090	0.0000980	0.0000970	0.000107	0.000210	0.000117	0.000144
Lithium	mg/L	-	-	0.00110	<0.0010	<0.0010	0.00140	<0.0010	<0.0010
Magnesium	mg/L	-	-	2.50	2.43	2.52	4.97	5.03	5.27
Manganese	mg/L	0.79 to 1.1	0.99 to 1.7	0.0140	0.0212	0.0431	0.00857	0.00462	0.00746
Molybdenum	mg/L	7.6	46	0.000788	0.000824	0.000853	0.00596	0.00666	0.00658
Nickel	mg/L	0.025 to 0.10	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	-	0.517	0.496	0.541	1.28	1.11	1.07
Selenium	mg/L	0.0020	-	0.000192	0.000253	0.000180	0.000509	0.000565	0.000658
Silicon	mg/L	-	-	1.99	1.89	2.40	3.68	3.11	3.32
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	0.0000160	<0.000010	<0.000010
Sodium	mg/L	-	-	2.43	2.45	2.54	7.00	7.27	7.04
Strontium	mg/L	-	-	0.126	0.127	0.137	0.233	0.242	0.258
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	0.000230	<0.00010	<0.00010	0.000110	<0.00010	<0.00010
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	0.0085	-	0.0000410	0.0000390	0.0000410	0.000192	0.000197	0.000192
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	0.00159	0.00132	0.00141
Zinc	mg/L	0.0075 to 0.021	0.033 to 0.046	0.00450	<0.0030	0.00370	0.00340	<0.0030	<0.0030
Dissolved Metals									
Aluminum	mg/L	0.050	0.10	0.0103	0.00690	0.00890	0.00560	0.00400	0.00370
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	0.000290	0.000280	0.000340	0.000500	0.000470	0.000520
Barium	mg/L	-	-	0.0173	0.0142	0.0160	0.0101	0.00946	0.00958
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	0.0460	0.0410	0.0480	0.0200	0.0200	0.0200
Cadmium	mg/L	0.00011 to 0.00022	0.00023 to 0.00064	<0.0000050	0.0000142	0.00000680	<0.0000050	0.0000653	<0.0000050
Calcium	mg/L	-	-	13.5	12.9	13.8	35.2	34.2	35.9
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.0021 to 0.0048	0.013 to 0.028	0.00265	0.00232	0.00282	0.00435	0.00436	0.00428
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000158
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	0.00120	<0.0010	<0.0010
Magnesium	mg/L	-	-	2.54	2.33	2.56	5.11	4.90	5.16
Manganese	mg/L	-	-	0.00233	0.00279	0.00646	0.00155	0.00184	0.00176
Molybdenum	mg/L	-	-	0.000765	0.000794	0.000777	0.00586	0.00617	0.00629
Nickel	mg/L	-	-	<0.00050	0.000500	<0.00050	<0.00050	0.000620	<0.00050
Potassium	mg/L	-	-	0.494	0.495	0.536	1.27	1.05	1.02
Selenium	mg/L	-	-	0.000178	0.000180	0.000185	0.000469	0.000461	0.000634
Silicon	mg/L	-	-	1.99	1.83	2.19	3.44	3.10	3.23
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	2.62	2.38	2.55	7.35	7.71	7.22
Strontium	mg/L	-	-	0.135	0.136	0.128	0.235	0.252	0.229
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	0.0000380	0.0000370	0.0000380	0.000190	0.000196	0.000191
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	0.00136	0.00132	0.00130
Zinc	mg/L	-	-	0.00500	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Note: "-" indicates data not available.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table C.1.1. [b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table C.1.4: Supporting Overlying Water Quality Data Collected During Sediment Quality Sampling in Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		Reference							Exposed (Near-Field)						
				QUL-LREF1-1	QUL-LREF1-2	QUL-LREF1-3	QUL-LREF1-4	QUL-LREF1-5	Mean	Standard Deviation	QUL-LNF-1	QUL-LNF-2	QUL-LNF-3	QUL-LNF-4	QUL-LNF-5	Mean	Standard Deviation
		Long-term Average	Short-term Maximum	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22			24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22		
Anions, Organics, Nutrients, and Physical Properties																	
Alkalinity (as $CaCO_3$)	mg/L	>20	-	44.8	44.6	45.2	45.0	44.6	44.8	0.261	43.5	43.4	43.7	43.8	43.7	43.6	0.164
Ammonia (as N)	mg/L	0.65 to 1.8	3.6 to 12	<0.0050	0.00740	<0.0050	<0.0050	<0.0050	0.00548	-	0.0107	0.00510	0.00760	0.00950	<0.0050	0.00758	0.00262
Chloride	mg/L	150	600	<0.50	<0.50	<0.50	<0.50	<0.50	0.500	-	<0.50	<0.50	<0.50	<0.50	<0.50	0.500	-
Conductivity	µS/cm	-	-	101	101	101	102	102	101	0.548	101	99.7	99.4	99.9	100	100	0.604
Specific Conductance (*in situ*)	µS/cm	-	-	89.1	88.2	88.2	89.9	88.2	88.7	0.766	87.0	86.8	87.2	87.2	87.1	87.1	0.167
Dissolved Organic Carbon[b]	mg/L	-	-	2.74	2.65	2.80	2.73	2.77	2.74	0.0563	2.80	2.58	2.52	2.38	2.38	2.53	0.174
Dissolved Oxygen (*in situ*)	%	-	-	106	111	114	104	111	109	3.96	102	102	101	101	101	101	0.464
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	9.34	9.74	10.0	9.16	9.81	9.62	0.357	8.93	8.95	8.90	8.87	8.91	8.91	0.0303
Fluoride	mg/L	-	0.98 to 1.4	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0	0.0350	0.0340	0.0340	0.0340	0.0340	0.0342	0.000447
Hardness (as $CaCO_3$)	mg/L	-	-	50.3	48.0	47.6	48.1	47.4	48.3	1.16	46.9	47.6	48.3	48.2	47.7	47.7	0.559
Hardness, from Total CaMg (as $CaCO_3$)	mg/L	-	-	50.2	49.9	49.7	50.5	50.4	50.1	0.336	48.8	49.2	48.4	48.4	48.8	48.7	0.335
Nitrate (as N)	mg/L	3.0	33	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	-	0.0131	0.0127	0.0121	0.0125	0.0120	0.0125	0.000449
Nitrate and Nitrite (as N)	mg/L	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	0.00510	-	0.0131	0.0127	0.0121	0.0125	0.0120	0.0125	0.000449
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Orthophosphate-Dissolved (as P)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
pH (*in situ*)	pH units	6.5 - 9.0	6.5 - 9.0	8.45	8.55	8.63	8.35	8.59	8.51	0.113	8.07	8.07	8.05	8.09	8.16	8.09	0.0427
pH	pH units	-	-	8.00	8.02	8.00	8.00	8.00	8.00	0.00894	7.96	7.97	7.98	7.98	7.97	7.97	0.00837
Phosphorus - Total Dissolved	mg/L	-	-	0.00220	<0.0020	<0.0020	0.00240	0.00200	0.00212	0.000196	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00200	-
Phosphorus - Total	mg/L	0.0050		0.00470	0.0109	0.00500	0.00550	0.00540	0.00630	0.00259	0.00270	0.00270	0.00270	0.00370	0.00390	0.00314	0.000607
Sulphate	mg/L	218 to 309	-	5.85	5.80	5.85	5.83	5.83	5.83	0.0205	5.92	5.82	5.85	5.86	5.85	5.86	0.0367
Temperature (*in situ*)	°C	-	-	21.8	21.6	21.7	21.7	21.7	21.7	0.0495	21.7	21.8	21.7	21.7	21.7	21.7	0.0577
Total Dissolved Solids	mg/L	-	-	76.0	70.0	69.0	68.0	62.0	69.0	5.00	68.0	68.0	69.0	67.0	72.0	68.8	1.92
Total Nitrogen	mg/L	-	-	0.104	0.106	0.100	0.104	0.115	0.106	0.00559	0.101	0.0920	0.0960	0.0950	0.101	0.0970	0.00394
Total Suspended Solids[b]	mg/L	-	-	<1.0	<1.2	<1.3	<1.0	<1.0	1.00	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.00	-
Turbidity[b]	NTU	-	-	0.460	0.480	0.450	0.480	0.610	0.496	0.0650	0.250	0.220	0.240	0.190	0.290	0.238	0.0370
Total Metals																	
Aluminum	mg/L	-	-	0.0185	0.0208	0.0261	0.0217	0.0247	0.0224	0.00305	0.0153	0.0141	0.0142	0.0152	0.0185	0.0155	0.00179
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Arsenic	mg/L	-	0.0050	0.000260	0.000270	0.000220	0.000260	0.000230	0.000248	0.0000217	0.000140	0.000140	0.000130	0.000140	0.000150	0.000140	0.00000707
Barium	mg/L	1.0	-	0.00711	0.00710	0.00720	0.00709	0.00723	0.00715	0.0000643	0.00542	0.00557	0.00544	0.00544	0.00560	0.00549	0.0000841
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-
Boron	mg/L	1.2	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Cadmium	mg/L	-	-	0.0000125	0.00000690	0.00000980	0.00000560	0.00000530	0.00000802	0.00000307	0.0000191	0.0000101	0.00000770	0.00000740	<0.0000050	0.00000986	0.00000519
Calcium	mg/L	-	-	16.3	16.2	16.2	16.4	16.5	16.3	0.130	16.3	16.4	16.1	16.2	16.2	16.2	0.114
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Copper	mg/L	-	-	0.000740	0.00102	0.00115	0.000960	0.00110	0.000994	0.000160	0.000880	0.000690	0.000720	0.000660	0.00129	0.000848	0.000261
Iron	mg/L	-	1.0	0.0500	0.0560	0.0600	0.0570	0.0650	0.0576	0.00550	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-
Lead	mg/L	0.0043 to 0.0068	0.026 to 0.090	0.000107	0.000780	0.000382	0.000348	0.000662	0.000456	0.000268	0.0000880	<0.000050	<0.000050	<0.000050	0.000992	0.000246	0.000511
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Magnesium	mg/L	-	-	2.32	2.29	2.24	2.31	2.23	2.28	0.0409	1.96	2.01	1.98	1.94	2.02	1.98	0.0335
Manganese	mg/L	0.79 to 1.1	0.99 to 1.7	0.00668	0.00626	0.00692	0.00844	0.00842	0.00734	0.00102	0.00174	0.00176	0.00175	0.00177	0.00187	0.00178	0.0000526
Molybdenum	mg/L	7.6	46	0.000512	0.000498	0.000495	0.000515	0.000521	0.000508	0.0000112	0.000366	0.000377	0.000364	0.000354	0.000376	0.000367	0.00000948
Nickel	mg/L	0.025 to 0.10	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Potassium	mg/L	-	-	0.502	0.464	0.478	0.496	0.473	0.483	0.0159	0.450	0.462	0.459	0.450	0.452	0.455	0.00555
Selenium	mg/L	0.0020	-	0.000208	0.000163	0.000183	0.000129	0.000179	0.000172	0.0000291	0.000133	0.000101	0.000127	0.000117	0.0000930	0.000114	0.0000169
Silicon	mg/L	-	-	2.00	1.92	1.94	1.97	1.91	1.95	0.0370	1.59	1.61	1.60	1.66	1.62	1.62	0.0270
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Sodium	mg/L	-	-	1.08	1.04	1.04	1.08	1.04	1.06	0.0219	0.878	0.894	0.886	0.868	0.900	0.885	0.0127
Strontium	mg/L	-	-	0.108	0.109	0.107	0.108	0.114	0.109	0.00277	0.117	0.119	0.119	0.119	0.118	0.118	0.000894
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Uranium	mg/L	0.0085	-	0.000128	0.000127	0.000128	0.000120	0.000128	0.000126	0.00000349	0.000135	0.000137	0.000135	0.000133	0.000134	0.000135	0.00000148
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Zinc	mg/L	0.0075 to 0.021	0.033 to 0.046	<0.0030	<0.0030	0.00430	<0.0030	<0.0030	0.00326	-	0.00710	<0.0030	<0.0030	<0.0030	<0.0030	0.00382	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Notes: "-" indicates data not available. Standard deviation was not calculated where all results were below the laboratory reporting limit.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table C.1.1.
[b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table C.1.4: Supporting Overlying Water Quality Data Collected During Sediment Quality Sampling in Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		Reference							Exposed (Near-Field)						
				QUL-LREF1-1	QUL-LREF1-2	QUL-LREF1-3	QUL-LREF1-4	QUL-LREF1-5	Mean	Standard Deviation	QUL-LNF-1	QUL-LNF-2	QUL-LNF-3	QUL-LNF-4	QUL-LNF-5	Mean	Standard Deviation
		Long-term Average	Short-term Maximum	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22			24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22		
Dissolved Metals																	
Aluminum	mg/L	0.050	0.10	0.0113	0.0108	0.0103	0.0103	0.00970	0.0105	0.000602	0.00970	0.00980	0.0106	0.0104	0.0105	0.0102	0.000418
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Arsenic	mg/L	-	-	0.000230	0.000200	0.000230	0.000250	0.000210	0.000224	0.0000195	0.000120	<0.00010	0.000120	0.000140	0.000120	0.000120	0.00000924
Barium	mg/L	-	-	0.00634	0.00639	0.00606	0.00623	0.00645	0.00629	0.000154	0.00491	0.00474	0.00500	0.00479	0.00503	0.00489	0.000127
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.0000500	-
Boron	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Cadmium	mg/L	0.00011 to 0.00022	0.00023 to 0.00064	0.0000205	0.00000910	0.0000193	0.0000118	<0.0000050	0.0000131	0.00000573	0.0000200	0.0000269	0.0000263	0.00000760	0.0000252	0.0000212	0.00000808
Calcium	mg/L	-	-	16.5	15.5	15.5	15.6	15.4	15.7	0.453	15.7	16.0	16.3	16.2	16.0	16.0	0.230
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Copper	mg/L	0.0021 to 0.0048	0.013 to 0.028	0.000690	0.000880	0.000730	0.000940	0.000600	0.000768	0.000140	0.000790	0.000680	0.000850	0.000630	0.000860	0.000762	0.000103
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-	<0.030	<0.030	<0.030	<0.030	<0.030	0.0300	-
Lead	mg/L	-	-	0.0000520	0.000128	0.000123	0.000188	0.000101	0.000118	0.0000492	0.0000850	0.0000660	0.000117	<0.000050	0.000174	0.0000984	0.0000470
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	-
Magnesium	mg/L	-	-	2.20	2.26	2.17	2.23	2.17	2.21	0.0391	1.88	1.87	1.85	1.88	1.88	1.87	0.0130
Manganese	mg/L	-	-	0.00131	0.00124	0.00148	0.00222	0.00193	0.00164	0.000423	0.000480	0.000440	0.000680	0.000510	0.000580	0.000538	0.0000944
Molybdenum	mg/L	-	-	0.000468	0.000460	0.000466	0.000492	0.000486	0.000474	0.0000138	0.000374	0.000344	0.000368	0.000360	0.000373	0.000364	0.0000124
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Potassium	mg/L	-	-	0.528	0.485	0.492	0.505	0.484	0.499	0.0183	0.475	0.466	0.474	0.471	0.483	0.474	0.00622
Selenium	mg/L	-	-	0.000159	0.000159	0.000149	0.000197	0.000171	0.000167	0.0000185	0.000117	0.000116	0.000103	0.000115	0.000124	0.000115	0.00000758
Silicon	mg/L	-	-	1.88	1.80	1.77	1.85	1.80	1.82	0.0442	1.53	1.53	1.53	1.53	1.58	1.54	0.0224
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Sodium	mg/L	-	-	1.04	1.00	0.993	1.04	0.991	1.01	0.0251	0.855	0.847	0.847	0.862	0.862	0.855	0.00750
Strontium	mg/L	-	-	0.101	0.103	0.0999	0.0986	0.0978	0.100	0.00205	0.113	0.108	0.114	0.113	0.115	0.113	0.00270
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000100	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	-
Uranium	mg/L	-	-	0.000118	0.000125	0.000122	0.000120	0.000121	0.000121	0.00000259	0.000135	0.000136	0.000134	0.000136	0.000138	0.000136	0.00000148
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000500	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00300	-	0.0109	0.00840	0.00760	<0.0030	0.00430	0.00684	0.00292

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b)

Notes: "-" indicates data not available. Standard deviation was not calculated where all results were below the laboratory reporting limit.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table C.1.1.
[b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table C.1.5: Supporting Spot Water Quality Data Collected During Plankton Sampling in Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		QUL-ZOO-7 (Reference)			QUL-ZOO-1 (Exposed)		
				June	July	August	June	July	August
		Long-term Average	Short-term Maximum	22-Jun-22	27-Jul-22	28-Aug-22	22-Jun-22	27-Jul-22	28-Aug-22
Anions, Organics, Nutrients, and Physical Properties									
Alkalinity (as $CaCO_3$)	mg/L	>20	-	46.2	44.1	46.8	48.1	44.8	46.8
Ammonia (as N)	mg/L	0.65 to 1.8	3.6 to 12	<0.0050	0.00730	0.00900	<0.0050	0.0100	0.00720
Chloride	mg/L	150	600	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Conductivity	µS/cm	-	-	107	94.4	103	113	98.1	103
Specific Conductance (*in situ*)	µS/cm	-	-	96.3	89.7	89.7	106	88.9	89.7
Dissolved Organic Carbon[b]	mg/L	-	-	3.60	2.69	2.62	2.92	2.42	2.62
Dissolved Oxygen (*in situ*)	%	-	-	95.1	100	96.5	97.0	102	97.8
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	10.8	9.92	10.0	11.0	10.4	10.0
Fluoride	mg/L	-	0.98 to 1.4	0.0310	0.0300	0.0300	0.0330	0.0310	0.0300
Hardness (as $CaCO_3$)	mg/L	-	-	46.0	46.6	49.1	49.4	46.2	46.3
Hardness, from Total CaMg (as $CaCO_3$)	mg/L	-	-	41.0	47.7	48.9	44.6	45.6	46.6
Nitrate (as N)	mg/L	3.0	33	0.0750	0.0694	0.0712	0.100	0.0690	0.0696
Nitrate and Nitrite (as N)	mg/L	-	-	0.0750	0.0694	0.0712	0.100	0.0690	0.0696
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Orthophosphate-Dissolved (as P)	mg/L	-	-	<0.0010	<0.0010	0.00160	<0.0010	<0.0010	<0.0010
pH (*in situ*)	pH units	6.5 - 9.0	6.5 - 9.0	7.67	7.28	7.86	7.85	7.98	7.90
pH	pH units	-	-	7.87	7.90	7.70	7.89	7.94	7.73
Phosphorus - Total Dissolved	mg/L	-	-	0.00420	0.00220	0.00320	0.00300	<0.0020	0.00290
Phosphorus - Total	mg/L	0.0050		0.00880	0.00330	0.00830	0.00640	0.00750	0.00920
Sulphate	mg/L	218 to 309	-	5.03	5.36	5.63	5.92	5.38	5.58
Temperature (*in situ*)	°C	-	-	9.59	16.1	13.7	9.74	14.7	14.2
Total Dissolved Solids	mg/L	-	-	69.0	63.0	73.0	80.0	68.0	80.0
Total Nitrogen	mg/L	-	-	0.210	0.156	-	0.232	0.209	-
Total Suspended Solids[b]	mg/L	-	-	2.20	<1.0	2.70	1.50	<1.0	2.50
Turbidity[b]	NTU	-	-	2.16	0.720	1.83	1.25	0.330	1.67
Total Metals									
Aluminum	mg/L	-	-	0.0443	0.0303	0.0808	0.0285	0.0237	0.0111
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	0.0050	0.000220	0.000340	0.000230	0.000140	0.000140	0.000120
Barium	mg/L	1.0	-	0.00605	0.00606	0.00648	0.00544	0.00530	0.00571
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	1.2	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	-	-	0.0000115	0.0000309	0.0000578	0.00000720	0.0000119	0.000118
Calcium	mg/L	-	-	13.4	16.1	16.4	14.8	15.3	15.6
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	-	0.00166	0.00195	0.00396	0.00168	0.00102	0.000910
Iron	mg/L	-	1.0	0.0720	0.0490	0.0720	0.0350	<0.030	<0.030
Lead	mg/L	0.0043 to 0.0068	0.026 to 0.090	<0.000050	0.0000930	0.000183	<0.000050	0.0000910	<0.000050
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	1.83	1.83	1.94	1.85	1.80	1.86
Manganese	mg/L	0.79 to 1.1	0.99 to 1.7	0.00394	0.00341	0.00422	0.00224	0.00168	0.00125
Molybdenum	mg/L	7.6	46	0.000414	0.000432	0.000364	0.000396	0.000348	0.000363
Nickel	mg/L	0.025 to 0.10	-	0.000620	<0.00050	0.000520	0.000920	<0.00050	<0.00050
Potassium	mg/L	-	-	0.495	0.541	0.569	0.489	0.486	0.460
Selenium	mg/L	0.0020	-	0.000170	0.000135	0.000113	0.000156	0.000101	0.000160
Silicon	mg/L	-	-	2.19	1.86	1.97	2.05	1.76	1.71
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	0.930	0.879	0.932	0.943	0.856	0.863
Strontium	mg/L	-	-	0.0983	0.116	0.131	0.110	0.117	0.129
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	0.0085	-	0.000120	0.000131	0.000147	0.000140	0.000146	0.000150
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.0075 to 0.021	0.033 to 0.046	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals									
Aluminum	mg/L	0.050	0.10	0.0190	0.0125	0.0122	0.0142	0.0118	0.0439
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	-	-	0.000180	0.000170	0.000120	0.000120	0.000110	0.000170
Barium	mg/L	-	-	0.00624	0.00557	0.00582	0.00568	0.00520	0.00615
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.00011 to 0.00022	0.00023 to 0.00064	0.0000160	0.0000246	0.0000561	0.00000900	0.0000200	0.000178
Calcium	mg/L	-	-	15.1	15.5	16.4	16.5	15.4	15.4
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.0021 to 0.0048	0.013 to 0.028	0.00107	0.00138	0.00107	0.00120	0.000640	0.00240
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	0.0440
Lead	mg/L	-	-	<0.000050	0.0000570	<0.000050	<0.000050	<0.000050	0.000167
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	2.01	1.91	1.99	2.00	1.88	1.91
Manganese	mg/L	-	-	0.00147	0.00118	0.000870	0.000860	0.000560	0.00309
Molybdenum	mg/L	-	-	0.000453	0.000371	0.000328	0.000488	0.000346	0.000318
Nickel	mg/L	-	-	0.000550	0.000520	<0.00050	0.000890	<0.00050	<0.00050
Potassium	mg/L	-	-	0.545	0.598	0.557	0.532	0.541	0.482
Selenium	mg/L	-	-	0.000160	0.000126	0.0000960	0.000140	0.000112	0.000119
Silicon	mg/L	-	-	2.26	1.79	1.71	2.03	1.71	1.64
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	0.972	0.912	0.916	0.983	0.881	0.856
Strontium	mg/L	-	-	0.101	0.113	0.121	0.122	0.120	0.122
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	0.000640	<0.00010	<0.00010
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	0.000118	0.000123	0.000138	0.000144	0.000135	0.000148
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019e, 2021a,b)

Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019e, 2021a,b)

Note: "-" indicates data not available.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019e, 2021a,b) outlined in Table C.1.1.

[b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

APPENDIX C.2
SEDIMENT QUALITY

Table C.2.1: Sediment Quality Data for Bootjack Lake (BOL-S; Reference) Shallow Area, 2019 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Bootjack Lake BOL-S										95th Percentile (2019 and 2022)[b]
		Lower	Upper	2019					2022					
Physical Tests														
Moisture	%	-	-	60.1	70.7	79.7	89.7	85.4	51.5	68.8	83.7	69.3	65.1	89.7
pH (1:2 soil:water)	pH	-	-	***7.97***	***6.01***	***5.98***	6.02	***6.28***	***6.34***	***7.67***	***6.37***	***7.67***	***7.69***	5.98
Particle Size														
% Gravel (>2 mm)	%	-	-	5.30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.20	3.50	5.80	5.80
% Sand (2.0 mm - 0.063 mm)	%	-	-	63.4	59.5	29.3	4.50	6.90	79.3	30.5	40.8	52.1	50.6	79.3
% Silt (0.063 mm - 4 µm)	%	-	-	29.4	36.9	65.0	76.4	86.2	18.2	63.0	50.8	39.1	38.3	86.2
% Clay (<4 µm)	%	-	-	1.90	3.60	5.10	19.1	7.00	1.90	5.90	7.20	5.30	5.30	19.1
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	5.80	8.49	13.6	12.3	13.8	8.11	5.98	14.6	7.55	7.77	14.6
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.182	0.337	0.705	1.13	1.17	0.195	0.341	0.961	0.371	0.369	1.17
Metals (<63 µm)														
Aluminum	mg/kg	-	-	5,210	8,870	9,620	12,900	10,500	9,710	6,470	10,200	6,380	6,630	12,900
Antimony	mg/kg	-	-	0.290	0.540	0.580	0.760	0.790	0.410	0.350	0.520	0.140	0.340	0.790
Arsenic	mg/kg	5.9	17	2.72	3.94	4.39	5.57	6.70	3.92	2.80	5.72	3.94	4.36	6.70
Barium	mg/kg	-	-	163	124	135	193	148	124	143	123	132	123	193
Beryllium	mg/kg	-	-	0.200	0.370	0.400	0.510	0.420	0.360	0.190	0.410	0.260	0.240	0.510
Bismuth	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.100
Boron	mg/kg	-	-	<10	<10	<10	<10	12.0	9.10	7.50	10.2	5.30	7.50	12.0
Cadmium	mg/kg	0.6	3.5	0.143	0.134	0.186	0.251	0.282	0.136	0.172	0.228	0.175	0.172	0.282
Calcium	mg/kg	-	-	177,000	7,830	7,760	6,660	8,780	7,850	183,000	8,840	168,000	158,000	183,000
Chromium	mg/kg	37.3	90	15.1	20.7	20.4	29.2	25.2	19.9	16.2	19.6	11.9	13.6	29.2
Cobalt	mg/kg	-	-	4.14	4.72	5.30	7.35	7.58	4.60	4.59	6.58	4.03	3.95	7.58
Copper	mg/kg	35.7	197	47.6	105	142	177	215	100	37.8	151	82.5	79.1	215
Iron	mg/kg	21,200	43,766	10,800	11,600	10,900	15,900	15,700	12,000	11,200	14,700	10,600	11,800	15,900
Lead	mg/kg	35	91.3	2.06	3.41	3.03	5.13	3.15	2.83	2.20	3.17	2.30	2.25	5.13
Lithium	mg/kg	-	-	4.20	6.40	6.10	8.30	7.10	5.70	4.60	6.40	4.20	4.40	8.30
Magnesium	mg/kg	-	-	4,980	2,820	2,680	3,810	3,460	2,810	5,600	3,070	4,850	4,570	5,600
Manganese	mg/kg	460	1,100	642	343	596	679	1,070	384	635	904	775	747	1,070
Mercury	mg/kg	0.17	0.486	0.0376	0.0857	0.0925	0.146	0.0985	0.0906	0.0321	0.119	0.0521	0.0549	0.146
Molybdenum	mg/kg	25	23,000	1.33	2.22	3.08	4.16	5.57	1.27	1.87	2.68	3.35	3.74	5.57
Nickel	mg/kg	16	75	9.61	12.7	14.4	22.9	20.9	11.5	9.77	15.5	10.3	10.1	22.9
Phosphorus	mg/kg	-	-	639	667	583	703	602	694	528	549	488	547	703
Potassium	mg/kg	-	-	420	610	670	990	770	750	590	790	460	510	990
Selenium	mg/kg	2	-	1.83	0.850	1.32	1.56	2.74	1.11	2.21	1.81	2.08	2.68	2.74
Silver	mg/kg	0.5	-	0.0570	0.106	0.129	0.181	0.180	0.100	0.0510	0.143	0.0680	0.0790	0.181
Sodium	mg/kg	-	-	187	192	177	178	191	248	230	227	175	186	248
Strontium	mg/kg	-	-	1,060	76.5	80.0	73.7	86.9	78.8	1,030	88.6	768	694	1,060
Sulphur[c]	mg/kg	-	-	2,300	3,900	5,000	5,700	6,600	910	2,810	4,730	1,130	1,470	6,600
Thallium	mg/kg	-	-	<0.050	<0.050	0.0530	0.0810	0.0730	<0.050	<0.050	0.0680	<0.050	<0.050	0.0810
Tin	mg/kg	-	-	0.220	0.300	0.300	0.430	0.210	0.330	<0.20	0.220	<0.20	0.230	0.430
Titanium	mg/kg	-	-	383	490	435	390	514	578	455	419	187	284	578
Uranium	mg/kg	-	-	0.848	1.17	1.45	1.83	1.63	1.13	0.958	1.36	2.10	2.15	2.15
Vanadium	mg/kg	-	-	24.9	37.5	32.8	45.0	42.4	35.3	28.3	36.8	22.3	24.9	45.0
Zinc	mg/kg	123	315	27.5	30.6	34.3	46.3	50.0	29.8	28.5	39.4	25.7	25.8	50.0

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, mg/kg = milligrams per kilogram, ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.2: Sediment Quality Data for Bootjack Lake (BOL-S; Reference) Shallow Area, 2022

Parameter	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile[b]	BOL-S									
				BOL-S	BOL-S-1	BOL-S-2	BOL-S-3	BOL-S-4	BOL-S-5	Mean	Median	Standard Deviation	Minimum	Maximum
		Lower	Upper	(2019 to 2022)	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22	24-Aug-22					
Physical Tests														
Moisture	%	-	-	89.7	51.5	68.8	83.7	69.3	65.1	67.7	68.8	11.5	51.5	83.7
pH (1:2 soil:water)	pH	-	-	5.98	6.34	7.67	6.37	7.67	7.69	7.15	7.67	0.724	6.34	7.69
Particle Size														
% Gravel (>2 mm)	%	-	-	5.80	<1.0	<1.0	1.20	3.50	5.80	2.50	1.20	2.13	1.00	5.80
% Sand (2.0 mm - 0.063 mm)	%	-	-	79.3	79.3	30.5	40.8	52.1	50.6	50.7	50.6	18.2	30.5	79.3
% Silt (0.063 mm - 4 µm)	%	-	-	86.2	18.2	63.0	50.8	39.1	38.3	41.9	39.1	16.6	18.2	63.0
% Clay (<4 µm)	%	-	-	19.1	1.90	5.90	7.20	5.30	5.30	5.12	5.30	1.96	1.90	7.20
Organic / Inorganic Carbon														
Total Organic Carbon (63 µm)	%	-	-	14.6	8.11	5.98	14.6	7.55	7.77	8.80	7.77	3.34	5.98	14.6
Nutrients (Bulk sediment)														
Total Nitrogen by LECO	%	-	-	1.17	0.195	0.341	0.961	0.371	0.369	0.447	0.369	0.296	0.195	0.961
Metals (<63 µm)														
Aluminum	mg/kg	-	-	12,900	9,710	6,470	10,200	6,380	6,630	7,878	6,630	1,906	6,380	10,200
Antimony	mg/kg	-	-	0.790	0.410	0.350	0.520	0.140	0.340	0.352	0.350	0.138	0.140	0.520
Arsenic	mg/kg	5.90	17.0	6.70	3.92	2.80	5.72	3.94	4.36	4.15	3.94	1.05	2.80	5.72
Barium	mg/kg	-	-	193	124	143	123	132	123	129	124	8.69	123	143
Beryllium	mg/kg	-	-	0.510	0.360	0.190	0.410	0.260	0.240	0.292	0.260	0.0904	0.190	0.410
Bismuth	mg/kg	-	-	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	0.100	0.100	-	0.100	0.100
Boron	mg/kg	-	-	12.0	9.10	7.50	10.2	5.30	7.50	7.92	7.50	1.86	5.30	10.2
Cadmium	mg/kg	0.600	3.50	0.282	0.136	0.172	0.228	0.175	0.172	0.177	0.172	0.0329	0.136	0.228
Calcium	mg/kg	-	-	183,000	7,850	183,000	8,840	168,000	158,000	105,138	158,000	88,807	7,850	183,000
Chromium	mg/kg	37.3	90.0	29.2	19.9	16.2	19.6	11.9	13.6	16.2	16.2	3.55	11.9	19.9
Cobalt	mg/kg	-	-	7.58	4.60	4.59	6.58	4.03	3.95	4.75	4.59	1.07	3.95	6.58
Copper	mg/kg	35.7	197	215	100	37.8	151	82.5	79.1	90.1	82.5	41.0	37.8	151
Iron	mg/kg	21,200	43,766	15,900	12,000	11,200	14,700	10,600	11,800	12,060	11,800	1,574	10,600	14,700
Lead	mg/kg	35.0	91.3	5.13	2.83	2.20	3.17	2.30	2.25	2.55	2.30	0.429	2.20	3.17
Lithium	mg/kg	-	-	8.30	5.70	4.60	6.40	4.20	4.40	5.06	4.60	0.948	4.20	6.40
Magnesium	mg/kg	-	-	5,600	2,810	5,600	3,070	4,850	4,570	4,180	4,570	1,196	2,810	5,600
Manganese	mg/kg	460	1,100	1,070	384	635	904	775	747	689	747	196	384	904
Mercury	mg/kg	0.170	0.486	0.146	0.0906	0.0321	0.119	0.0521	0.0549	0.0697	0.0549	0.0347	0.0321	0.119
Molybdenum	mg/kg	-	-	5.57	1.27	1.87	2.68	3.35	3.74	2.58	2.68	1.02	1.27	3.74
Nickel	mg/kg	16.0	75.0	22.9	11.5	9.77	15.5	10.3	10.1	11.4	10.3	2.36	9.77	15.5
Phosphorus	mg/kg	-	-	703	694	528	549	488	547	561	547	78.2	488	694
Potassium	mg/kg	-	-	990	750	590	790	460	510	620	590	145	460	790
Selenium	mg/kg	2.00	-	2.74	1.11	2.21	1.81	2.08	2.68	1.98	2.08	0.579	1.11	2.68
Silver	mg/kg	0.500	-	0.181	0.100	0.0510	0.143	0.0680	0.0790	0.0882	0.0790	0.0354	0.0510	0.143
Sodium	mg/kg	-	-	248	248	230	227	175	186	213	227	31.2	175	248
Strontium	mg/kg	-	-	1,060	78.8	1,030	88.6	768	694	532	694	428	78.8	1,030
Sulphur[c]	mg/kg	-	-	6,600	910	2,810	4,730	1,130	1,470	2,210	1,470	1,590	910	4,730
Thallium	mg/kg	-	-	0.0810	<0.050	<0.050	0.0680	<0.050	<0.050	0.0536	0.0500	0.00805	0.0500	0.0680
Tin	mg/kg	-	-	0.430	0.330	<0.20	0.220	<0.20	0.230	0.236	0.220	0.0541	0.200	0.330
Titanium	mg/kg	-	-	578	578	455	419	187	284	385	419	152	187	578
Uranium	mg/kg	-	-	2.15	1.13	0.958	1.36	2.10	2.15	1.54	1.36	0.553	0.958	2.15
Vanadium	mg/kg	-	-	45.0	35.3	28.3	36.8	22.3	24.9	29.5	28.3	6.35	22.3	36.8
Zinc	mg/kg	123	315	50.0	29.8	28.5	39.4	25.7	25.8	29.8	28.5	5.63	25.7	39.4

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation reference 95th percentile values see Appendix Table C.2.1.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.3: **Sediment Quality Data for Polley Lake (POL-S; Exposed) Shallow Area, 2022**

Parameter	Units	BC Working Sediment Quality Guidelines [a]		Reference 95th Percentile[b]	POL-S									
		Lower	Upper	BOL-S (2019 to 2022)	POL-S-1 24-Aug-22	POL-S-2 24-Aug-22	POL-S-3 24-Aug-22	POL-S-4 24-Aug-22	POL-S-5 24-Aug-22	Mean	Median	Standard Deviation	Minimum	Maximum
Physical Tests														
Moisture	%	-	-	-	40.6	37.6	38.9	48.9	46.6	42.5	40.6	4.96	37.6	48.9
pH (1:2 soil:water)	pH	-	-	-	7.63	7.57	7.55	7.51	7.44	7.54	7.55	0.0707	7.44	7.63
Particle Size														
% Gravel (>2 mm)	%	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.00	1.00	-	1.00	1.00
% Sand (2.0 mm - 0.063 mm)	%	-	-	-	33.9	45.0	49.1	30.2	34.2	38.5	34.2	8.11	30.2	49.1
% Silt (0.063 mm - 4 µm)	%	-	-	-	55.8	47.8	45.8	60.7	58.3	53.7	55.8	6.55	45.8	60.7
% Clay (<4 µm)	%	-	-	-	10.3	7.00	4.20	9.10	7.50	7.62	7.50	2.32	4.20	10.3
Organic / Inorganic Carbon														
Total Organic Carbon (63 µm)	%	-	-	-	0.872	1.02	0.914	1.12	1.20	1.03	1.02	0.137	0.872	1.20
Nutrients (Bulk sediment)														
Total Nitrogen by LECO	%	-	-	-	0.0810	0.0920	0.0610	0.118	0.127	0.0958	0.0920	0.0270	0.0610	0.127
Metals (<63 µm)														
Aluminum	mg/kg	-	-	-	***22,900***	***20,900***	***19,200***	***22,100***	***21,200***	***21,260***	***21,200***	1,394	***19,200***	***22,900***
Antimony	mg/kg	-	-	-	0.500	0.450	0.450	0.450	0.420	0.454	0.450	0.0288	0.420	0.500
Arsenic	mg/kg	5.90	17.0	17.00	***15.3***	***13.9***	***13.7***	***13.9***	***13.4***	***14.0***	***13.9***	0.733	***13.4***	***15.3***
Barium	mg/kg	-	-	-	192	180	169	189	179	182	180	9.09	169	192
Beryllium	mg/kg	-	-	-	***0.860***	***0.800***	***0.710***	***0.780***	***0.770***	***0.784***	***0.780***	0.0541	***0.710***	***0.860***
Bismuth	mg/kg	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	0.100	0.100	-	0.100	0.100
Boron	mg/kg	-	-	-	11.5	10.5	10.6	10.6	10.5	10.7	10.6	0.428	10.5	11.5
Cadmium	mg/kg	0.600	3.50	3.500	0.146	0.119	0.128	0.124	0.143	0.132	0.128	0.0119	0.119	0.146
Calcium	mg/kg	-	-	-	29,900	28,900	24,200	29,100	27,300	27,880	28,900	2,263	24,200	29,900
Chromium	mg/kg	37.3	90.0	90.0	13.0	13.2	13.3	12.6	13.2	13.1	13.2	0.279	12.6	13.3
Cobalt	mg/kg	-	-	-	***21.2***	***20.8***	***19.7***	***20.7***	***20.2***	***20.5***	***20.7***	0.581	***19.7***	***21.2***
Copper	mg/kg	35.7	197	197	***756***	***672***	***646***	***647***	***646***	***673***	***647***	47.5	***646***	***756***
Iron	mg/kg	21,200	43,766	43,766	***61,500***	***65,500***	***76,700***	***58,900***	***61,500***	***64,820***	***61,500***	7,048	***58,900***	***76,700***
Lead	mg/kg	35.0	91.3	91.30	***5.78***	4.77	4.27	4.50	4.69	4.80	4.69	0.580	4.27	***5.78***
Lithium	mg/kg	-	-	-	***20.5***	***18.3***	***15.6***	***19.1***	***18.4***	***18.4***	***18.4***	1.79	***15.6***	***20.5***
Magnesium	mg/kg	-	-	-	***13,600***	***12,500***	***10,900***	***13,400***	***12,500***	***12,580***	***12,500***	1,066	***10,900***	***13,600***
Manganese	mg/kg	460	1,100	1,100	862	764	735	730	730	764	735	56.5	730	862
Mercury	mg/kg	0.170	0.486	0.486	0.0735	0.0676	0.0695	0.0669	0.0689	0.0693	0.0689	0.00257	0.0669	0.0735
Molybdenum	mg/kg	-	-	-	5.05	4.96	4.35	5.18	4.80	4.87	4.96	0.321	4.35	5.18
Nickel	mg/kg	16.0	75.0	75.0	10.9	10.6	10.1	10.7	10.7	10.6	10.7	0.300	10.1	10.9
Phosphorus	mg/kg	-	-	-	***1,910***	***1,860***	***1,980***	***1,820***	***1,930***	***1,900***	***1,910***	62.0	***1,820***	***1,980***
Potassium	mg/kg	-	-	-	***1,780***	***1,690***	***1,480***	***1,780***	***1,670***	***1,680***	***1,690***	123	***1,480***	***1,780***
Selenium	mg/kg	2.00	-	-	1.43	1.43	1.23	1.50	1.59	1.44	1.43	0.133	1.23	1.59
Silver	mg/kg	0.500	-	-	***0.337***	***0.292***	***0.312***	***0.274***	***0.288***	***0.301***	***0.292***	0.0245	***0.274***	***0.337***
Sodium	mg/kg	-	-	-	***956***	***936***	***849***	***994***	***928***	***932.6***	***936***	53.2	***849***	***994***
Strontium	mg/kg	-	-	-	204	217	195	230	221	213	217	13.9	195	230
Sulphur[c]	mg/kg	-	-	-	1,740	2,270	1,550	2,140	2,280	1,996	2,140	332	1,550	2,280
Thallium	mg/kg	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	0.0500	0.0500	-	0.0500	0.0500
Tin	mg/kg	-	-	-	***2.35***	***2.16***	***2.06***	***2.19***	***1.95***	***2.14***	***2.16***	0.150	***1.95***	***2.35***
Titanium	mg/kg	-	-	-	***2,120***	***1,820***	***1,790***	***1,930***	***1,780***	***1,888***	***1,820***	143	***1,780***	***2,120***
Uranium	mg/kg	-	-	-	1.46	1.36	1.29	1.31	1.28	1.34	1.31	0.0738	1.28	1.46
Vanadium	mg/kg	-	-	-	***238***	***268***	***300***	***234***	***243***	***257***	***243***	27.6	***234***	***300***
Zinc	mg/kg	123	315	315.0	***70.9***	***63.1***	***58.1***	***61.6***	***61.0***	***62.9***	***61.6***	4.81	***58.1***	***70.9***

Value is > Lower BC Working Sediment Quality Guideline.

Value is > Upper BC Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation reference 95th percentile values see Appendix Table C.2.1.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.4: Sediment Quality Data for Quesnel Lake at QUL-PREF1 (Reference) Deep Area, 2014 to 2021

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Quesnel Lake QUL-PREF1													
		Lower	Upper	2014					2015					2016					
Physical Tests																			
Moisture	%	-	-	51.8	47.6	53.3	54.3	52.0	52.6	-	53.3	-	54.2	54.2	54.2	55.9	55.8	54.9
pH (1:2 soil:water)	pH	-	-	6.89	6.86	7.03	6.84	6.90	7.36	-	6.69	-	7.01	6.52	6.49	6.53	6.52	6.56
Particle Size																			
% Gravel (>2 mm)	%	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%	-	-	30.6	***31.7***	21.4	16.7	17.1	21.1	28.1	15.2	18.7	14.3	29.1	23.5	20.2	13.5	12.7
% Silt (0.063 mm - 4 µm)	%	-	-	58.8	60.9	69.3	74.1	74.1	67.7	62.5	73.0	71.7	74.3	60.8	66.4	69.2	76.4	73.9
% Clay (<4 µm)	%	-	-	10.7	7.43	9.31	9.18	8.79	11.2	9.34	11.8	9.64	11.4	10.1	10.1	10.6	10.1	***13.4***
Organic / Inorganic Carbon (<63 µm)																			
Total Organic Carbon	%	-	-	1.62	1.70	1.72	1.64	1.71	1.76	-	1.71	-	1.98	2.02	2.01	2.03	1.67	1.89
Nutrients (Bulk sediment)																			
Total Nitrogen	%	-	-	0.140	0.127	0.141	0.149	0.145	0.169	-	0.158	-	0.182	0.164	0.170	0.162	0.146	0.146
Metals (<63 µm)																			
Aluminum	mg/kg	-	-	15,300	14,000	15,400	15,300	13,900	16,900	-	***17,300***	-	15,500	16,800	15,800	16,800	16,200	14,700
Antimony	mg/kg	-	-	0.430	0.400	0.400	0.440	0.410	0.470	-	0.430	-	0.410	0.460	0.440	0.440	0.440	0.400
Arsenic	mg/kg	5.9	17	7.15	6.95	8.60	8.15	7.89	8.64	-	8.98	-	9.02	9.89	9.57	***11.0***	9.05	8.37
Barium	mg/kg	-	-	147	140	152	144	135	147	-	151	-	143	167	164	***172***	169	142
Beryllium	mg/kg	-	-	0.450	0.410	0.390	0.410	0.400	***0.520***	-	0.500	-	0.450	0.470	0.430	0.480	0.450	0.450
Bismuth	mg/kg	-	-	0.150	0.140	0.140	0.140	0.130	***0.170***	-	0.150	-	0.150	0.160	0.150	0.160	0.150	0.150
Boron	mg/kg	-	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	-	<10.0	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cadmium	mg/kg	0.6	3.5	0.416	0.346	0.404	0.390	0.363	0.475	-	0.422	-	0.364	***0.476***	0.457	0.471	0.435	0.384
Calcium	mg/kg	-	-	8,050	7,650	7,970	7,740	7,300	8,780	-	***8,840***	-	8,620	8,130	7,500	8,080	7,950	7,840
Chromium	mg/kg	37.3	90	56.3	50.2	53.6	52.1	47.9	***60.1***	-	59.5	-	53.6	59.8	57.6	59.4	56.3	50.3
Cobalt	mg/kg	-	-	14.0	12.7	13.8	13.3	12.5	15.2	-	15.0	-	13.4	15.1	14.3	***15.7***	14.5	13.3
Copper	mg/kg	35.7	197	46.7	39.1	44.0	42.2	38.8	59.4	-	55.8	-	50.0	***61.1***	56.4	59.4	56.3	47.5
Iron	mg/kg	21,200	43,766	29,200	26,900	29,900	29,500	27,400	32,300	-	***32,700***	-	28,900	30,900	29,000	32,100	30,700	29,400
Lead	mg/kg	35	91.3	7.09	6.84	7.27	7.11	6.68	8.06	-	7.51	-	7.39	7.97	7.53	***8.11***	7.59	7.03
Lithium	mg/kg	-	-	12.8	13.0	13.9	13.4	12.6	***15.5***	-	15.2	-	12.6	13.7	12.8	14.4	13.2	13.6
Magnesium	mg/kg	-	-	8,040	7,350	8,020	7,720	7,200	8,410	-	***8,660***	-	7,380	8,450	7,930	8,510	8,130	7,390
Manganese	mg/kg	460	1,100	456	421	484	494	496	477	-	479	-	516	469	457	495	451	480
Mercury	mg/kg	0.17	0.486	0.0461	0.0474	0.0517	0.0506	0.0473	0.0627	-	0.0515	-	0.0594	0.0519	0.0557	0.0535	0.0574	0.0572
Molybdenum	mg/kg	25	23,000	0.960	0.840	0.940	0.910	0.900	***1.20***	-	1.02	-	1.01	1.08	0.980	1.07	0.990	0.930
Nickel	mg/kg	16	75	38.1	33.8	36.9	36.0	33.2	41.2	-	40.1	-	36.1	41.2	38.9	***42.3***	39.3	35.1
Phosphorus	mg/kg	-	-	1,110	1,070	1,110	1,130	1,050	1,150	-	1,190	-	1,200	1,350	1,280	1,400	1,340	1,200
Potassium	mg/kg	-	-	1,370	1,230	1,370	1,350	1,240	1,550	-	1,570	-	1,430	***1,580***	1,440	1,560	1,510	1,370
Selenium	mg/kg	2	-	0.950	0.820	0.900	0.870	0.760	1.10	-	0.930	-	0.880	0.970	0.980	1.04	0.880	0.970
Silver	mg/kg	0.5	-	0.205	0.172	0.196	0.191	0.177	0.238	-	0.216	-	0.189	***0.239***	0.220	0.228	0.226	0.202
Sodium	mg/kg	-	-	420	370	420	390	380	470	-	***520***	-	500	480	420	440	430	410
Strontium	mg/kg	-	-	75.6	71.3	78.6	76.0	71.4	82.0	-	84.5	-	88.9	81.4	76.2	82.3	80.3	76.3
Sulphur[c]	mg/kg	-	-	-	-	-	-	-	1,400	-	1,300	-	800	1,400	1,200	1,100	900	1,300
Thallium	mg/kg	-	-	0.147	0.161	0.161	0.167	0.149	***0.194***	-	0.171	-	0.158	0.170	0.162	0.175	0.159	0.166
Tin	mg/kg	-	-	0.470	0.350	0.380	0.460	0.380	0.490	-	0.460	-	0.410	***0.660***	0.390	0.450	0.420	0.410
Titanium	mg/kg	-	-	1,090	1,010	1,060	1,050	969	1,160	-	***1,190***	-	1,040	1,100	1,050	1,060	1,080	954
Uranium	mg/kg	-	-	1.32	1.30	1.36	1.30	1.22	***1.57***	-	1.43	-	1.39	1.50	1.43	1.51	1.41	1.36
Vanadium	mg/kg	-	-	66.8	60.5	64.1	62.1	57.4	***73.0***	-	72.3	-	64.9	71.7	67.9	70.2	67.6	61.9
Zinc	mg/kg	123	315	74.1	71.4	77.6	75.3	70.3	85.1	-	82.6	-	71.6	84.4	80.6	***87.7***	80.7	68.4
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, mg/kg = milligrams per kilogram, ***Bold/Italics:*** Value is > reference 95th percentile value (<5th percentile value for pH). QUL-PREF1 was not sampled in 2022, therefore displayed data include to 2021 only and the reference 95th percentile value was calculated using data from 2014 to 2021.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.4: Sediment Quality Data for Quesnel Lake at QUL-PREF1 (Reference) Deep Area, 2014 to 2021

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Quesnel Lake QUL-PREF1															95th Percentile (2014 to 2021)[b]
		Lower	Upper	2018					2019					2021					
Physical Tests																			
Moisture	%	-	-	55.7	62.2	***65.1***	55.3	54.8	56.9	53.7	57.2	56.5	56.0	52.5	52.0	53.8	55.6	54.4	62.2
pH (1:2 soil:water)	pH	-	-	6.80	6.79	6.85	6.67	6.78	6.45	6.50	6.50	6.48	6.45	6.52	6.44	6.50	***6.40***	6.64	6.44
Particle Size																			
% Gravel (>2 mm)	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
% Sand (2.0 mm - 0.063 mm)	%	-	-	15.1	17.8	13.4	15.3	14.1	10.1	19.8	11.5	13.9	11.8	20.0	22.8	20.1	17.9	19.5	30.6
% Silt (0.063 mm - 4 µm)	%	-	-	75.2	73.7	77.2	75.6	76.8	***80.4***	71.5	79.4	77.0	79.3	67.9	66.5	68.2	71.5	69.4	79.4
% Clay (<4 µm)	%	-	-	9.70	8.50	9.30	9.10	9.10	9.50	8.70	9.10	9.10	8.90	12.1	10.7	11.7	10.6	11.1	12.1
Organic / Inorganic Carbon (<63 µm)																			
Total Organic Carbon	%	-	-	2.07	2.22	2.13	***2.26***	1.92	2.07	1.78	1.56	1.71	1.88	2.13	2.07	2.03	2.08	2.17	2.22
Nutrients (Bulk sediment)																			
Total Nitrogen	%	-	-	***0.191***	0.180	0.170	0.181	0.164	0.182	0.148	0.155	0.164	0.157	0.137	0.149	0.161	0.175	0.150	0.182
Metals (<63 µm)																			
Aluminum	mg/kg	-	-	14,300	15,800	15,100	15,100	14,100	16,300	16,100	15,700	16,200	15,200	17,100	15,700	17,100	15,700	16,800	17,100
Antimony	mg/kg	-	-	0.410	0.390	0.390	0.390	0.390	0.410	0.420	0.400	0.400	0.400	0.470	0.440	0.440	0.440	0.440	0.470
Arsenic	mg/kg	5.9	17	8.47	8.47	7.99	7.50	7.39	8.49	8.18	7.74	7.86	7.23	8.00	9.50	9.66	8.55	9.38	9.89
Barium	mg/kg	-	-	150	139	153	147	134	159	164	157	159	155	158	152	166	146	165	169
Beryllium	mg/kg	-	-	0.450	0.460	0.460	0.440	0.450	0.470	0.480	0.470	0.450	0.460	0.480	0.440	0.500	0.420	0.440	0.500
Bismuth	mg/kg	-	-	0.150	0.140	0.140	0.140	0.140	0.150	0.150	0.140	0.140	0.140	0.130	0.120	0.140	0.120	0.130	0.160
Boron	mg/kg	-	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
Cadmium	mg/kg	0.6	3.5	0.442	0.436	0.409	0.422	0.392	0.442	0.429	0.408	0.414	0.375	0.432	0.392	0.418	0.387	0.381	0.475
Calcium	mg/kg	-	-	7,570	7,850	8,050	7,720	7,810	7,320	7,590	7,330	7,400	7,210	8,030	7,860	8,350	7,520	8,310	8,780
Chromium	mg/kg	37.3	90	53.4	55.9	53.9	53.9	51.6	54.9	56.4	53.4	54.4	52.3	58.0	55.7	56.4	54.8	56.7	59.8
Cobalt	mg/kg	-	-	13.8	13.5	13.3	13.1	13.1	14.0	14.0	13.6	13.5	13.4	14.4	13.9	14.4	13.4	13.8	15.2
Copper	mg/kg	35.7	197	48.9	46.8	45.3	46.7	43.2	49.7	50.2	48.8	49.4	46.9	50.0	44.4	46.3	43.5	42.4	59.4
Iron	mg/kg	21,200	43,766	29,500	29,200	28,400	28,100	28,300	30,700	30,700	29,300	30,600	28,900	30,400	30,500	31,000	29,600	30,800	32,300
Lead	mg/kg	35	91.3	7.00	6.67	6.41	6.60	6.49	7.25	7.27	7.09	7.03	6.80	6.80	6.43	6.70	6.52	6.46	8.06
Lithium	mg/kg	-	-	13.8	13.2	13.5	13.2	13.2	14.9	14.5	14.5	14.3	14.0	15.1	13.4	15.2	13.9	14.1	15.2
Magnesium	mg/kg	-	-	7,640	7,560	7,410	7,250	7,150	8,250	8,180	7,860	7,840	7,730	8,330	7,990	8,500	7,960	8,080	8,510
Manganese	mg/kg	460	1,100	416	397	425	405	449	401	413	399	408	445	416	441	485	440	***572***	516
Mercury	mg/kg	0.17	0.486	0.0552	0.0578	0.0525	0.0555	0.0521	0.0493	0.0458	0.0473	0.0466	0.0472	0.0477	0.0440	0.0558	***0.0971***	0.0446	0.0627
Molybdenum	mg/kg	25	23,000	1.05	0.910	0.890	0.850	0.880	1.06	0.980	0.990	0.870	0.920	1.11	0.990	1.01	0.990	0.990	1.11
Nickel	mg/kg	16	75	37.1	36.2	35.6	35.4	34.6	38.4	38.0	36.8	36.8	35.6	39.4	37.5	38.9	37.4	37.5	41.2
Phosphorus	mg/kg	-	-	1,260	1,310	1,220	1,250	1,140	1,300	1,330	1,230	1,310	1,200	1,290	***1,460***	1,340	1,320	1,370	1,400
Potassium	mg/kg	-	-	1,240	1,300	1,290	1,290	1,290	1,290	1,260	1,280	1,280	1,240	1,440	1,290	1,430	1,320	1,470	1,570
Selenium	mg/kg	2	-	1.06	1.01	0.840	0.950	0.870	0.990	0.970	0.920	0.920	0.900	1.25	1.07	***1.44***	1.28	1.23	1.28
Silver	mg/kg	0.5	-	0.212	0.193	0.189	0.191	0.191	0.221	0.219	0.209	0.211	0.210	0.231	0.191	0.196	0.201	0.200	0.238
Sodium	mg/kg	-	-	339	379	390	378	364	373	376	388	393	390	449	421	461	400	478	500
Strontium	mg/kg	-	-	73.6	73.7	74.4	75.1	73.8	73.4	78.9	78.6	75.3	77.7	87.2	81.8	81.3	82.7	***90.0***	88.9
Sulphur[c]	mg/kg	-	-	1,200	1,200	900	1,000	900	***1,500***	1,300	1,300	1,200	1,100	940	830	850	950	760	1,400
Thallium	mg/kg	-	-	0.149	0.148	0.145	0.146	0.144	0.156	0.155	0.151	0.154	0.145	0.157	0.139	0.152	0.145	0.149	0.175
Tin	mg/kg	-	-	0.350	0.410	0.510	0.370	0.370	0.370	0.380	0.400	0.400	0.400	0.490	0.440	0.460	0.450	0.500	0.510
Titanium	mg/kg	-	-	816	963	961	959	928	899	977	959	1,000	944	974	937	1,000	934	1,100	1,160
Uranium	mg/kg	-	-	1.30	1.34	1.25	1.27	1.26	1.41	1.40	1.40	1.39	1.37	1.35	1.25	1.30	1.24	1.33	1.51
Vanadium	mg/kg	-	-	59.8	63.5	61.9	62.2	59.9	62.9	65.1	62.6	63.2	61.3	66.2	64.7	66.1	61.5	67.1	72.3
Zinc	mg/kg	123	315	77.7	75.8	73.3	72.9	71.9	85.0	82.5	79.3	80.1	75.4	84.9	78.2	81.7	76.9	78.6	85.1
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	4.20	4.00	3.60	3.90	3.80	4.20

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, mg/kg = milligrams per kilogram, ***Bold/Italics:*** Value is > reference 95th percentile value (<5th percentile value for pH). QUL-PREF1 was not sampled in 2022, therefore displayed data include to 2021 only and the reference 95th percentile value was calculated using data from 2014 to 2021.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.5: Sediment Quality Data for Quesnel Lake at QUL-PNF (Exposed) Deep Area, 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference 95th Percentile[b]	QUL-PNF									
		Lower	Upper	QUL-PREF1 (2014 to 2021)	QUL-PNF-1	QUL-PNF-2	QUL-PNF-3	QUL-PNF-4	QUL-PNF-5	Mean	Median	Standard Deviation	Minimum	Maximum
					26-Aug-22	26-Aug-22	27-Aug-22	27-Aug-22	28-Aug-22					
Physical Tests														
Moisture	%	-	-	62.2	60.1	***63.0***	49.4	61.0	61.2	58.9	61.0	5.44	49.4	***63.0***
pH (1:2 soil:water)	pH	-	-	6.44	8.01	8.02	8.22	8.07	8.16	8.10	8.07	0.0913	8.01	8.22
Particle Size														
% Gravel (>2 mm)	%	-	-	1.00	<1	<1	<1	<1	<1	1.00	1.00	-	1.00	1.00
% Sand (2.0 mm - 0.063 mm)	%	-	-	30.6	12.8	3.10	23.0	7.50	4.70	10.2	7.50	8.04	3.10	23.0
% Silt (0.063 mm - 4 µm)	%	-	-	79.4	45.4	50.5	43.6	42.9	47.7	46.0	45.4	3.12	42.9	50.5
% Clay (<4 µm)	%	-	-	12.1	***41.8***	***46.4***	***33.4***	***49.6***	***47.6***	***43.8***	***46.4***	6.46	***33.4***	***49.6***
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	2.22	0.622	0.695	0.456	0.736	0.559	0.614	0.622	0.111	0.456	0.736
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.182	0.0800	0.103	0.0560	0.0840	0.0700	0.0786	0.0800	0.0174	0.0560	0.103
Metals (<63 µm)														
Aluminum	mg/kg	-	-	17,100	***31,900***	***29,900***	***26,800***	***31,700***	***32,500***	***30,560***	***31,700***	2,315	***26,800***	***32,500***
Antimony	mg/kg	-	-	0.470	***0.500***	***0.500***	***0.500***	***0.500***	***0.530***	***0.506***	***0.500***	0.0134	***0.500***	***0.530***
Arsenic	mg/kg	5.9	17	9.89	***15.8***	***15.3***	***15.1***	***15.5***	***16.3***	***15.6***	***15.5***	0.469	***15.1***	***16.3***
Barium	mg/kg	-	-	169	***279***	***265***	***244***	***280***	***286***	***271***	***279***	16.8	***244***	***286***
Beryllium	mg/kg	-	-	0.500	***1.04***	***0.970***	***0.880***	***1.05***	***1.08***	***1.00***	***1.04***	0.0802	***0.880***	***1.08***
Bismuth	mg/kg	-	-	0.160	0.150	0.160	0.150	***0.170***	0.160	0.158	0.160	0.00837	0.150	***0.170***
Boron	mg/kg	-	-	10.0	***11.1***	9.80	9.30	9.90	***11.3***	***10.3***	9.90	0.873	9.30	***11.3***
Cadmium	mg/kg	0.6	3.5	0.475	0.246	0.242	0.241	0.251	0.250	0.246	0.246	0.00453	0.241	0.251
Calcium	mg/kg	-	-	8,780	***24,800***	***20,300***	***21,200***	***19,700***	***24,200***	***22,040***	***21,200***	2,318	***19,700***	***24,800***
Chromium	mg/kg	37.3	90	59.8	27.1	30.5	28.7	32.0	28.9	29.4	28.9	1.87	27.1	32.0
Cobalt	mg/kg	-	-	15.2	***27.8***	***24.9***	***23.4***	***25.5***	***27.6***	***25.8***	***25.5***	1.86	***23.4***	***27.8***
Copper	mg/kg	35.7	197	59.4	***925***	***794***	***745***	***797***	***915***	***835***	***797***	80.2	***745***	***925***
Iron	mg/kg	21,200	43,766	32,300	***46,100***	***43,100***	***50,600***	***42,000***	***43,700***	***45,100***	***43,700***	3,421	***42,000***	***50,600***
Lead	mg/kg	35	91.3	8.06	***11.8***	***12.0***	***11.2***	***12.6***	***12.4***	***12.0***	***12.0***	0.548	***11.2***	***12.6***
Lithium	mg/kg	-	-	15.2	***32.6***	***29.0***	***26.6***	***30.3***	***32.1***	***30.1***	***30.3***	2.44	***26.6***	***32.6***
Magnesium	mg/kg	-	-	8,510	***20,100***	***17,600***	***15,300***	***18,100***	***19,800***	***18,180***	***18,100***	1,933	***15,300***	***20,100***
Manganese	mg/kg	460	1,100	516	***1,190***	***1,360***	***1,220***	***1,320***	***1,370***	***1,292***	***1,320***	82.3	***1,190***	***1,370***
Mercury	mg/kg	0.17	0.486	0.0627	***0.0997***	***0.100***	***0.0922***	***0.0999***	***0.103***	***0.0990***	***0.0999***	0.00402	***0.0922***	***0.103***
Molybdenum	mg/kg	25	23,000	1.11	***3.61***	***3.35***	***3.19***	***3.24***	***3.66***	***3.41***	***3.35***	0.214	***3.19***	***3.66***
Nickel	mg/kg	16	75	41.2	25.7	28.3	25.9	29.6	27.2	27.3	27.2	1.64	25.7	29.6
Phosphorus	mg/kg	-	-	1,400	1,280	1,200	1,310	1,180	1,330	1,260	1,280	66.7	1,180	1,330
Potassium	mg/kg	-	-	1,570	***2,780***	***2,620***	***2,420***	***2,910***	***2,950***	***2,736***	***2,780***	219	***2,420***	***2,950***
Selenium	mg/kg	2	-	1.28	1.23	1.08	1.02	1.10	1.22	1.13	1.10	0.0917	1.02	1.23
Silver	mg/kg	0.5	-	0.238	***0.363***	***0.351***	***0.334***	***0.343***	***0.372***	***0.353***	***0.351***	0.0152	***0.334***	***0.372***
Sodium	mg/kg	-	-	500	***1,150***	***1,110***	***1,030***	***1,190***	***1,230***	***1,142***	***1,150***	76.9	***1,030***	***1,230***
Strontium	mg/kg	-	-	88.9	***211***	***207***	***195***	***224***	***228***	***213***	***211***	13.3	***195***	***228***
Sulphur[c]	mg/kg	-	-	1,400	1,190	880	900	860	870	940	880	141	860	1,190
Thallium	mg/kg	-	-	0.175	0.0770	0.0850	0.0760	0.0960	0.0840	0.0836	0.0840	0.00802	0.0760	0.0960
Tin	mg/kg	-	-	0.510	***1.86***	***1.68***	***1.62***	***1.66***	***1.87***	***1.74***	***1.68***	0.118	***1.62***	***1.87***
Titanium	mg/kg	-	-	1,160	***1,920***	***1,690***	***1,660***	***1,720***	***1,940***	***1,786***	***1,720***	133	***1,660***	***1,940***
Uranium	mg/kg	-	-	1.51	***1.53***	1.44	1.32	***1.52***	***1.59***	1.48	***1.52***	0.104	1.32	***1.59***
Vanadium	mg/kg	-	-	72.3	***142***	***130***	***166***	***125***	***137***	***140***	***137***	15.9	***125***	***166***
Zinc	mg/kg	123	315	85.1	***106***	***99.6***	***90.4***	***103***	***107***	***101***	***103***	6.69	***90.4***	***107***
Zirconium	mg/kg	-	-	4.20	***5.60***	***4.80***	***5.30***	***4.70***	***5.50***	***5.18***	***5.30***	0.409	***4.70***	***5.60***

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" = no current BC Working Sediment Quality Guidelines/ no data. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation of reference 95th percentile values see Appendix Table C.2.4.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.6: Sediment Quality Data for Quesnel Lake at QUL-LREF1 (Reference) Shallow Area, 2014 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Quesnel Lake QUL-LREF1															
		Lower	Upper	2014					2015			2016				2019			
Physical Tests																			
Moisture	%	-	-	44.1	36.9	39.6	42.3	40.4	43.5	42.4	36.5	39.7	30.6	33.7	32.5	30.7	***46.3***	44.9	44.4	43.1	37.5
pH (1:2 soil:water)	pH	-	-	6.73	6.36	6.60	6.68	6.43	7.02	7.17	6.71	6.16	5.98	6.46	6.42	***5.69***	6.71	6.96	6.48	6.44	5.92
Particle Size																			
% Gravel (>2 mm)	%	-	-	2.01	0.240	1.10	0.740	1.02	1.78	0.600	2.08	0.730	0.990	3.59	1.16	2.57	<1.0	<1.0	3.50	5.40	<1.0
% Sand (2.0 mm - 0.063 mm)	%	-	-	61.1	53.6	52.4	66.0	65.2	57.8	56.8	65.3	33.9	73.1	69.7	***76.8***	66.5	52.3	57.2	57.0	60.6	37.0
% Silt (0.063 mm - 4 µm)	%	-	-	31.9	42.1	42.2	29.1	30.4	35.8	36.3	29.6	***59.5***	24.1	22.7	18.9	28.9	43.5	41.2	36.9	31.0	58.1
% Clay (<4 µm)	%	-	-	4.99	4.04	4.29	4.20	3.34	4.62	***6.30***	2.99	5.85	1.84	3.99	3.14	2.12	3.60	1.60	2.70	3.00	4.60
Organic / Inorganic Carbon (<63 µm)																			
Total Organic Carbon	%	-	-	1.23	0.910	1.04	1.38	1.03	1.64	1.23	1.54	1.07	1.12	1.31	1.36	1.08	1.48	0.860	1.26	1.69	1.05
Nutrients (Bulk sediment)																			
Total Nitrogen	%	-	-	0.0710	0.0610	0.0680	0.0690	0.0600	***0.115***	0.101	0.0970	0.0730	0.0450	0.0530	0.0460	0.0500	0.0880	0.0590	0.0750	0.0830	0.0910
Metals (<63 µm)																			
Aluminum	mg/kg	-	-	14,600	12,300	12,900	14,800	11,700	13,600	12,300	13,500	10,700	9,570	10,500	14,100	11,600	13,700	10,800	12,800	12,400	12,500
Antimony	mg/kg	-	-	***0.370***	0.260	0.260	0.330	0.260	0.330	0.300	0.300	0.250	0.230	0.260	0.290	0.250	0.280	0.220	0.290	0.260	0.270
Arsenic	mg/kg	5.9	17	4.90	3.30	3.56	4.92	3.71	5.37	3.82	4.43	3.47	3.47	4.13	4.99	3.67	4.12	3.16	3.55	3.72	3.24
Barium	mg/kg	-	-	126	135	114	124	120	117	107	122	100	104	104	111	124	114	85.5	111	107	***151***
Beryllium	mg/kg	-	-	0.370	0.340	0.330	0.400	0.310	0.400	0.330	0.370	0.300	0.300	0.330	0.380	0.310	0.340	0.300	0.300	0.320	0.360
Bismuth	mg/kg	-	-	0.140	<0.10	<0.10	0.120	<0.10	0.120	<0.10	0.110	<0.10	<0.10	<0.10	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	0.6	3.5	0.341	0.286	0.311	0.354	0.275	0.345	0.287	0.358	0.282	0.273	0.286	0.344	0.297	0.309	0.237	0.270	0.295	0.283
Calcium	mg/kg	-	-	7,760	6,690	6,970	7,640	6,620	8,170	7,040	7,240	6,780	5,770	6,490	7,100	5,960	6,940	6,990	6,810	6,500	6,490
Chromium	mg/kg	37.3	90	53.6	46.3	46.1	54.4	47.3	51.4	45.5	52.2	43.2	43.0	44.4	52.9	55.4	49.0	52.8	48.6	46.7	48.3
Cobalt	mg/kg	-	-	11.5	8.99	9.90	12.0	8.99	11.6	9.78	11.0	9.63	8.66	9.79	11.1	8.82	10.8	8.68	10.4	9.77	9.58
Copper	mg/kg	35.7	197	33.1	26.9	28.7	35.2	27.4	33.8	27.9	33.0	26.7	25.8	28.8	32.1	25.8	28.5	20.7	26.5	27.2	29.9
Iron	mg/kg	21,200	43,766	25,700	21,500	22,000	26,300	22,900	24,800	21,400	23,400	20,200	20,800	22,700	24,800	22,700	22,800	22,500	22,100	21,400	21,500
Lead	mg/kg	35	91.3	5.78	4.72	4.99	6.07	4.80	6.29	5.04	6.02	4.82	4.58	5.30	5.58	5.00	5.03	3.77	4.45	4.60	4.82
Lithium	mg/kg	-	-	12.4	10.5	11.1	13.4	9.90	11.8	10.1	11.0	10.2	9.80	10.8	13.6	10.9	11.1	8.00	10.1	10.6	11.0
Magnesium	mg/kg	-	-	6,790	5,980	6,170	6,990	5,870	6,800	5,860	6,600	5,600	5,300	5,790	6,980	5,790	6,520	5,440	6,070	5,950	6,630
Manganese	mg/kg	460	1,100	364	254	298	365	264	370	299	298	252	233	263	287	234	310	260	333	262	241
Mercury	mg/kg	0.17	0.486	0.0403	0.0316	0.0354	0.0470	0.0340	***0.0481***	0.0362	0.0471	0.0319	0.0363	0.0383	0.0454	0.0268	0.0323	0.0254	0.0277	0.0308	0.0285
Molybdenum	mg/kg	25	23,000	0.870	0.820	0.690	0.830	0.700	0.990	0.690	0.820	0.650	0.690	0.830	0.880	0.930	0.810	0.550	0.820	0.800	0.760
Nickel	mg/kg	16	75	32.6	26.3	28.1	33.2	26.2	32.2	27.5	32.3	26.5	25.1	28.1	31.8	29.7	29.0	23.1	26.6	26.7	28.3
Phosphorus	mg/kg	-	-	1,230	1,040	1,080	1,100	1,230	1,110	1,130	1,190	1,100	955	1,090	1,050	1,080	1,070	***1,290***	1,160	1,020	1,110
Potassium	mg/kg	-	-	1,280	950	1,060	1,320	990	1,300	1,070	1,270	990	900	1,000	1,160	910	1,110	910	1,060	1,050	1,000
Selenium	mg/kg	2	-	0.700	0.480	0.520	0.700	0.520	0.710	0.530	0.670	0.510	0.520	0.610	0.620	0.550	0.570	0.310	0.500	0.630	0.520
Silver	mg/kg	0.5	-	0.152	0.130	0.151	0.169	0.120	0.158	0.135	0.152	0.134	0.138	0.144	0.151	0.125	0.139	0.0910	0.122	0.136	0.147
Sodium	mg/kg	-	-	410	390	370	390	370	480	440	460	350	320	350	380	340	402	364	395	355	386
Strontium	mg/kg	-	-	70.6	58.4	62.2	69.5	55.8	76.0	63.9	66.9	57.8	50.9	56.8	64.1	49.1	67.3	58.2	67.3	62.0	57.8
Sulphur[c]	mg/kg	-	-	-	-	-	-	-	<500	<500	<500	***1,000***	700	600	<500	600	600	500	<500	<500	700
Thallium	mg/kg	-	-	***0.153***	0.119	0.110	0.130	0.102	0.135	0.106	0.118	0.100	0.0950	0.103	0.118	0.101	0.106	0.0830	0.0950	0.100	0.106
Tin	mg/kg	-	-	0.400	0.370	0.340	0.380	0.280	0.380	0.370	0.390	0.300	0.270	0.320	0.550	0.320	0.360	0.320	0.390	0.340	0.340
Titanium	mg/kg	-	-	1,090	962	961	1,060	876	945	897	965	862	743	770	1,020	927	1,020	975	1,010	890	930
Uranium	mg/kg	-	-	1.13	0.855	0.935	1.15	0.869	1.25	0.985	1.18	0.981	0.996	1.08	1.15	0.971	1.03	0.925	1.01	0.963	0.862
Vanadium	mg/kg	-	-	61.6	53.8	53.3	61.1	54.8	59.0	52.7	59.4	50.6	48.1	51.6	61.8	54.7	56.6	57.8	56.6	51.1	55.2
Zinc	mg/kg	123	315	66.8	55.5	58.7	68.5	54.6	64.3	57.2	65.3	51.4	50.1	54.8	62.3	52.9	61.5	48.2	57.7	58.0	61.3
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "**-**" indicates no guideline available or no data, mg/kg = milligrams per kilogram, ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b)

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction

Table C.2.6: Sediment Quality Data for Quesnel Lake at QUL-LREF1 (Reference) Shallow Area, 2014 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		Quesnel Lake QUL-LREF1														95th Percentile (2014 to 2022)[b]
		Lower	Upper	2020					2021					2022				
Physical Tests																		
Moisture	%	-	-	40.3	41.1	42.1	40.4	43.2	37.1	43.8	32.3	37.6	30.6	30.6	26.6	30.6	34.9	29.6	44.9
pH (1:2 soil:water)	pH	-	-	6.52	6.20	6.62	6.56	6.23	6.73	6.16	6.40	6.28	5.92	6.19	5.97	6.07	6.38	6.01	5.92
Particle Size																		
% Gravel (>2 mm)	%	-	-	1.80	<1.0	<1.0	<1.0	***22.2***	4.20	<1.0	4.10	1.80	<1.0	2.00	4.00	3.40	<1.0	2.10	5.40
% Sand (2.0 mm - 0.063 mm)	%	-	-	71.6	58.8	74.9	74.3	52.1	63.9	56.8	58.8	60.9	60.0	60.3	64.4	60.4	73.3	48.6	74.9
% Silt (0.063 mm - 4 µm)	%	-	-	23.9	38.4	22.4	22.7	23.5	28.6	40.0	33.5	33.2	37.2	33.6	29.0	32.3	22.5	44.9	58.1
% Clay (<4 µm)	%	-	-	2.70	2.80	2.10	2.50	2.20	3.30	3.20	3.60	4.10	2.80	4.10	2.60	3.90	3.60	4.40	5.85
Organic / Inorganic Carbon (<63 µm)																		
Total Organic Carbon	%	-	-	1.60	1.12	1.51	***1.98***	1.37	1.86	0.998	1.42	1.82	1.06	1.55	0.984	1.48	1.87	1.12	1.87
Nutrients (Bulk sediment)																		
Total Nitrogen	%	-	-	0.0790	0.0760	0.0720	0.0750	0.0810	0.0620	0.0480	0.0570	0.0740	0.0440	0.0780	0.0580	0.0930	0.0740	0.0870	0.101
Metals (<63 µm)																		
Aluminum	mg/kg	-	-	14,200	12,800	16,000	14,600	13,200	17,100	12,000	14,500	14,300	11,300	15,600	14,200	16,300	***17,800***	15,100	17,100
Antimony	mg/kg	-	-	0.310	0.270	0.350	0.310	0.280	0.340	0.250	0.310	0.310	0.250	0.290	0.250	0.340	0.300	0.260	0.350
Arsenic	mg/kg	5.9	17	4.61	3.86	5.40	5.49	4.33	***6.01***	3.56	4.68	5.08	3.45	4.68	4.14	5.08	5.71	3.97	5.71
Barium	mg/kg	-	-	113	118	149	129	136	144	115	130	128	124	128	108	130	138	124	149
Beryllium	mg/kg	-	-	0.380	0.340	0.450	0.410	0.350	0.410	0.300	0.370	0.360	0.300	0.430	0.380	0.410	0.450	0.390	0.450
Bismuth	mg/kg	-	-	0.110	<0.10	0.140	0.130	0.100	0.120	<0.10	<0.10	0.110	<0.10	0.110	<0.10	0.100	0.130	<0.10	0.140
Boron	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10.0
Cadmium	mg/kg	0.6	3.5	0.310	0.276	***0.408***	0.368	0.281	0.357	0.245	0.308	0.352	0.273	0.358	0.268	0.328	0.388	0.289	0.388
Calcium	mg/kg	-	-	7,510	7,110	8,150	7,660	6,800	***9,400***	7,380	8,660	7,100	6,820	7,790	7,970	8,230	8,680	7,680	8,680
Chromium	mg/kg	37.3	90	52.9	51.7	***60.5***	57.2	51.3	60.3	50.8	56.9	54.3	49.1	53.9	58.0	55.6	59.0	52.6	60.3
Cobalt	mg/kg	-	-	11.2	9.76	13.3	11.8	10.1	13.3	9.29	12.0	12.5	8.52	11.8	10.1	12.2	12.9	10.5	13.3
Copper	mg/kg	35.7	197	30.9	30.7	35.2	35.8	34.0	35.0	25.1	31.0	34.5	25.3	34.1	26.9	33.0	***36.6***	29.7	35.8
Iron	mg/kg	21,200	43,766	23,000	23,400	27,100	25,800	24,300	28,200	22,200	25,900	24,800	20,900	25,300	25,000	27,200	***28,500***	24,200	28,200
Lead	mg/kg	35	91.3	5.75	4.86	***6.72***	6.02	5.37	6.08	4.25	5.38	5.58	4.54	5.96	4.88	5.69	6.47	5.14	6.47
Lithium	mg/kg	-	-	12.1	10.4	***13.8***	12.8	11.5	12.7	8.70	11.4	11.7	9.10	12.6	10.0	12.1	13.7	10.9	13.7
Magnesium	mg/kg	-	-	6,830	6,490	7,590	7,410	6,700	***8,360***	6,500	7,700	7,940	6,420	7,570	6,770	7,670	8,320	7,350	8,320
Manganese	mg/kg	460	1,100	330	292	443	409	290	***498***	277	366	354	241	353	306	430	407	320	443
Mercury	mg/kg	0.17	0.486	0.0337	0.0288	0.0364	0.0361	0.0322	0.0342	0.0253	0.0302	0.0397	0.0255	0.0370	0.0292	0.0357	0.0439	0.0310	0.0471
Molybdenum	mg/kg	25	23,000	0.940	0.750	0.980	***1.13***	0.950	1.10	0.600	0.830	0.920	0.740	0.860	0.610	0.850	0.940	0.620	1.10
Nickel	mg/kg	16	75	30.6	27.7	34.6	33.4	29.1	33.6	25.3	30.5	32.3	24.5	32.7	28.2	32.3	***34.8***	29.6	34.6
Phosphorus	mg/kg	-	-	1,090	1,240	1,210	1,200	1,180	1,220	1,000	1,200	1,130	1,190	1,090	1,160	1,210	1,110	1,120	1,240
Potassium	mg/kg	-	-	1,160	1,020	1,330	1,220	1,100	1,470	1,100	1,280	1,290	940	1,360	1,150	1,510	***1,630***	1,300	1,510
Selenium	mg/kg	2	-	0.700	0.710	0.930	***0.970***	0.820	0.880	0.510	0.660	0.770	0.500	0.710	0.520	0.700	0.880	0.580	0.930
Silver	mg/kg	0.5	-	0.150	0.129	0.174	0.167	0.139	0.165	0.104	***0.197***	0.164	0.118	0.159	0.127	0.140	0.167	0.128	0.174
Sodium	mg/kg	-	-	403	393	445	414	408	514	462	468	406	380	463	496	546	***560***	515	546
Strontium	mg/kg	-	-	73.1	64.8	78.6	74.7	68.0	***86.6***	64.5	78.1	68.8	57.9	74.3	70.2	77.2	83.7	72.0	83.7
Sulphur[c]	mg/kg	-	-	720	610	540	500	600	<500	<500	<500	<500	<500	530	<500	<500	<500	510	720
Thallium	mg/kg	-	-	0.119	0.102	0.138	0.123	0.100	0.131	0.0920	0.111	0.116	0.0890	0.130	0.105	0.129	0.147	0.112	0.147
Tin	mg/kg	-	-	0.360	0.330	0.480	0.410	0.340	0.570	0.390	0.510	0.480	0.370	0.490	0.510	0.490	0.570	0.450	0.570
Titanium	mg/kg	-	-	1,070	1,060	1,180	1,050	966	***1,210***	1,070	1,160	981	934	991	1,090	1,140	1,080	1,080	1,180
Uranium	mg/kg	-	-	1.32	1.06	***1.41***	1.34	1.14	1.30	0.936	1.18	1.07	0.852	1.20	1.19	1.30	1.39	1.06	1.39
Vanadium	mg/kg	-	-	59.9	59.6	68.7	62.8	58.3	***70.1***	58.8	65.3	60.8	55.8	61.6	65.5	65.1	67.8	61.8	68.7
Zinc	mg/kg	123	315	58.9	55.1	70.4	64.7	58.1	***71.2***	54.2	65.8	68.7	53.2	66.4	56.2	65.0	70.3	61.2	70.4
Zirconium	mg/kg	-	-	3.80	4.20	4.10	3.50	3.50	4.10	4.00	4.30	4.20	4.00	3.20	3.60	3.40	3.00	3.50	4.30

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" indicates no guideline available or no data, mg/kg = milligrams per kilogram, ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b)

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction

Table C.2.7 Sediment Quality Data for Quesnel Lake at QUL-LREF1 (Reference) Shallow Area, 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference 95th Percentile[b]	QUL-LREF1									
		Lower	Upper	QUL-LREF1 (2014 to 2022)	QUL-LREF1-1	QUL-LREF1-2	QUL-LREF1-3	QUL-LREF1-4	QUL-LREF1-5	Mean	Median	Standard Deviation	Minimum	Maximum
					23-Aug-22	23-Aug-22	23-Aug-22	23-Aug-22	23-Aug-22					
Physical Tests														
Moisture	%	-	-	44.9	30.6	26.6	30.6	34.9	29.6	30.5	30.6	2.97	26.6	34.9
pH (1:2 soil:water)	pH	-	-	5.92	6.19	5.97	6.07	6.38	6.01	6.12	6.07	0.165	5.97	6.38
Particle Size														
% Gravel (>2 mm)	%	-	-	5.40	2.00	4.00	3.40	<1	2.10	2.50	2.10	1.20	1.00	4.00
% Sand (2.0 mm - 0.063 mm)	%	-	-	74.9	60.3	64.4	60.4	73.3	48.6	61.4	60.4	8.90	48.6	73.3
% Silt (0.063 mm - 4 µm)	%	-	-	58.1	33.6	29.0	32.3	22.5	44.9	32.5	32.3	8.17	22.5	44.9
% Clay (<4 µm)	%	-	-	5.85	4.10	2.60	3.90	3.60	4.40	3.72	3.90	0.691	2.60	4.40
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	1.87	1.55	0.984	1.48	1.87	1.12	1.40	1.48	0.354	0.984	1.87
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.101	0.0780	0.0580	0.0930	0.0740	0.0870	0.0780	0.0780	0.0134	0.0580	0.0930
Metals (<63 µm)														
Aluminum	mg/kg	-	-	17,100	15,600	14,200	16,300	***17,800***	15,100	15,800	15,600	1,355	14,200	***17,800***
Antimony	mg/kg	-	-	0.350	0.290	0.250	0.340	0.300	0.260	0.288	0.290	0.0356	0.250	0.340
Arsenic	mg/kg	5.9	17	5.71	4.68	4.14	5.08	5.71	3.97	4.72	4.68	0.709	3.97	5.71
Barium	mg/kg	-	-	149	128	108	130	138	124	126	128	11.1	108	138
Beryllium	mg/kg	-	-	0.450	0.430	0.380	0.410	0.450	0.390	0.412	0.410	0.0286	0.380	0.450
Bismuth	mg/kg	-	-	0.140	0.110	<0.1	0.100	0.130	<0.1	0.108	0.100	0.0130	0.100	0.130
Boron	mg/kg	-	-	10.0	<5	<5	<5	<5	<5	5.00	5.00	-	5.00	5.00
Cadmium	mg/kg	0.6	3.5	0.388	0.358	0.268	0.328	0.388	0.289	0.326	0.328	0.0490	0.268	0.388
Calcium	mg/kg	-	-	8,680	7,790	7,970	8,230	8,680	7,680	8,070	7,970	399	7,680	8,680
Chromium	mg/kg	37.3	90	60.3	53.9	58.0	55.6	59.0	52.6	55.8	55.6	2.69	52.6	59.0
Cobalt	mg/kg	-	-	13.3	11.8	10.1	12.2	12.9	10.5	11.5	11.8	1.17	10.1	12.9
Copper	mg/kg	35.7	197	35.8	34.1	26.9	33.0	***36.6***	29.7	32.1	33.0	3.80	26.9	***36.6***
Iron	mg/kg	21,200	43,766	28,200	25,300	25,000	27,200	***28,500***	24,200	26,040	25,300	1,762	24,200	***28,500***
Lead	mg/kg	35	91.3	6.47	5.96	4.88	5.69	6.47	5.14	5.63	5.69	0.637	4.88	6.47
Lithium	mg/kg	-	-	13.7	12.6	10.0	12.1	13.7	10.9	11.9	12.1	1.45	10.0	13.7
Magnesium	mg/kg	-	-	8,320	7,570	6,770	7,670	8,320	7,350	7,536	7,570	560	6,770	8,320
Manganese	mg/kg	460	1,100	443	353	306	430	407	320	363	353	53.9	306	430
Mercury	mg/kg	0.17	0.486	0.0471	0.0370	0.0292	0.0357	0.0439	0.0310	0.0354	0.0357	0.00576	0.0292	0.0439
Molybdenum	mg/kg	25	23,000	1.10	0.860	0.610	0.850	0.940	0.620	0.776	0.850	0.151	0.610	0.940
Nickel	mg/kg	16	75	34.6	32.7	28.2	32.3	***34.8***	29.6	31.5	32.3	2.62	28.2	***34.8***
Phosphorus	mg/kg	-	-	1,240	1,090	1,160	1,210	1,110	1,120	1,138	1,120	47.6	1,090	1,210
Potassium	mg/kg	-	-	1,510	1,360	1,150	1,510	***1,630***	1,300	1,390	1,360	186	1,150	***1,630***
Selenium	mg/kg	2	-	0.930	0.710	0.520	0.700	0.880	0.580	0.678	0.700	0.139	0.520	0.880
Silver	mg/kg	0.5	-	0.174	0.159	0.127	0.140	0.167	0.128	0.144	0.140	0.0181	0.127	0.167
Sodium	mg/kg	-	-	546	463	496	546	***560***	515	516	515	38.9	463	***560***
Strontium	mg/kg	-	-	83.7	74.3	70.2	77.2	83.7	72.0	75.5	74.3	5.29	70.2	83.7
Sulphur[c]	mg/kg	-	-	720	530	<500	<500	<500	510	508	500	13.0	500	530
Thallium	mg/kg	-	-	0.147	0.130	0.105	0.129	0.147	0.112	0.125	0.129	0.0165	0.105	0.147
Tin	mg/kg	-	-	0.570	0.490	0.510	0.490	0.570	0.450	0.502	0.490	0.0438	0.450	0.570
Titanium	mg/kg	-	-	1,180	991	1,090	1,140	1,080	1,080	1,076	1,080	53.7	991	1,140
Uranium	mg/kg	-	-	1.39	1.20	1.19	1.30	1.39	1.06	1.23	1.20	0.124	1.06	1.39
Vanadium	mg/kg	-	-	68.7	61.6	65.5	65.1	67.8	61.8	64.4	65.1	2.64	61.6	67.8
Zinc	mg/kg	123	315	70.4	66.4	56.2	65.0	70.3	61.2	63.8	65.0	5.36	56.2	70.3
Zirconium	mg/kg	-	-	4.30	3.20	3.60	3.40	3.00	3.50	3.34	3.40	0.241	3.00	3.60

Value is > BC Lower Working Sediment Quality Guideline.
Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" = no current BC Working Sediment Quality Guidelines/ no data. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] The 5th percentile is reported and screened for the pH reference data. For calculation of reference 95th percentile values see Appendix Table C.2.6.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table C.2.8: Pre-Breach Sediment Quality Data for Quesnel Lake at QUL-LNF1 (Exposed) Shallow Area, 2007

Sample ID	Units	BC Working Sediment Quality Guidelines[a]		QUL-LNF1					95th Percentile[b]
				QUL-LNF1-1	QUL-LNF1-2	QUL-LNF1-3	QUL-LNF1-4	QUL-LNF1-5	
		Lower	Upper	2007					
Physical Tests									
Moisture	%	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-
Particle Size									
% Gravel (>2 mm)	%	-	-	7.00	2.00	1.00	2.00	5.00	7.00
% Sand (2.0 mm - 0.063 mm)	%	-	-	36.0	56.0	39.0	58.0	33.0	58.0
% Silt (0.063 mm - 4 µm)	%	-	-	48.0	37.0	50.0	35.0	53.0	53.0
% Clay (<4 µm)	%	-	-	8.00	5.00	9.00	5.00	9.00	9.00
Organic / Inorganic Carbon									
Total Organic Carbon	%	-	-	1.92	1.72	2.45	1.28	2.07	2.45
Nutrients (Bulk sediment)									
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-
Metals									
Aluminum	mg/kg	-	-	11,300	8,820	12,500	10,100	11,000	12,500
Antimony	mg/kg	-	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Arsenic	mg/kg	5.9	17.0	5.90	<5.0	7.50	6.60	<5.0	7.50
Barium	mg/kg	-	-	82.4	65.1	91.4	73.7	82.6	91.4
Beryllium	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bismuth	mg/kg	-	-	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Boron	mg/kg	-	-	-	-	-	-	-	-
Cadmium	mg/kg	0.600	3.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Calcium	mg/kg	-	-	5,320	4,680	5,660	4,810	5,080	5,660
Chromium	mg/kg	37.3	90.0	30.1	23.0	32.3	25.8	27.4	32.3
Cobalt	mg/kg	-	-	8.40	6.50	9.60	7.80	7.80	9.60
Copper	mg/kg	35.7	197	23.7	19.4	29.6	20.7	21.8	29.6
Iron	mg/kg	21,200	43,766	21,100	15,400	23,100	19,700	18,600	23,100
Lead	mg/kg	35.0	91.3	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0
Lithium	mg/kg	-	-	12.3	8.80	13.2	10.6	11.8	13.2
Magnesium	mg/kg	-	-	5,300	3,730	5,770	5,130	4,850	5,770
Manganese	mg/kg	460	1,100	337	265	514	334	345	514
Mercury	mg/kg	0.170	0.486	0.0529	0.0465	0.0729	0.0442	0.0420	0.0729
Molybdenum	mg/kg	25	23,000	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Nickel	mg/kg	16.0	75.0	18.8	14.2	21.1	16.3	17.3	21.1
Phosphorus	mg/kg	-	-	-	-	-	-	-	-
Potassium	mg/kg	-	-	810	550	890	670	760	890
Selenium	mg/kg	2.00	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silver	mg/kg	0.500	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium	mg/kg	-	-	200	<200	210	240	<200	240
Strontium	mg/kg	-	-	55.3	45.7	58.5	54.4	52.1	58.5
Sulphur	mg/kg	-	-	-	-	-	-	-	-
Thallium	mg/kg	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tin	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium	mg/kg	-	-	561	512	607	546	561	607
Uranium	mg/kg	-	-	-	-	-	-	-	-
Vanadium	mg/kg	-	-	49.8	44.8	54.9	52.2	45.7	54.9
Zinc	mg/kg	123	315	44.2	28.3	46.7	38.7	38.1	46.7

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" indicates no data. Sediment metal concentrations are based on bulk (<2 mm fraction) sediment samples.

[a] Pre-breach values that were reported as < the laboratory reporting limit were not used for screening.

[b] 5th percentile value for pH.

Table C.2.9: Sediment Quality Data for Quesnel Lake at QUL-LNF1 (Exposed) Shallow Area, 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference 95th Percentile[b]		QUL-LNF1									
		Lower	Upper	Pre-Breach (QUL-LNF1; 2007)	Reference (QUL-LREF1; 2014 to 2022)	QUL-LNF1-1	QUL-LNF1-2	QUL-LNF1-3	QUL-LNF1-4	QUL-LNF1-5	Mean	Median	Standard Deviation	Minimum	Maximum
						23-Aug-22	23-Aug-22	23-Aug-22	23-Aug-22	23-Aug-22					
Physical Tests															
Moisture	%	-	-	-	44.9	22.2	25.8	24.7	23.5	23.1	23.9	23.5	1.41	22.2	25.8
pH (1:2 soil:water)	pH	-	-	-	5.92	8.38	8.19	8.54	8.06	8.56	8.35	8.38	0.218	8.06	8.56
Particle Size															
% Gravel (>2 mm)	%	-	-	7.00	5.40	<1	<1	<1	1.20	<1	1.04	1.00	0.0894	1.00	1.20
% Sand (2.0 mm - 0.063 mm)	%	-	-	58.0	74.9	***90.0***	***90.6***	***92.2***	***94.5***	***96.7***	***92.8***	***92.2***	2.79	***90.0***	***96.7***
% Silt (0.063 mm - 4 µm)	%	-	-	53.0	58.1	8.90	7.70	7.80	2.90	2.80	6.02	7.70	2.93	2.80	8.90
% Clay (<4 µm)	%	-	-	9.00	5.85	1.10	1.10	<1	1.40	<1	1.12	1.10	0.164	1.00	1.40
Organic / Inorganic Carbon (<63 µm)[c]															
Total Organic Carbon	%	-	-	2.45	1.87	0.483	1.03	0.452	1.25	0.917	0.826	0.917	0.349	0.452	1.25
Nutrients (Bulk sediment)															
Total Nitrogen	%	-	-	-	0.101	0.0330	<0.02	<0.02	<0.02	0.0250	0.0236	0.0200	0.00568	0.0200	0.0330
Metals (<63 µm)[c]															
Aluminum	mg/kg	-	-	12,500	17,100	10,400	15,800	11,400	16,500	15,800	13,980	15,800	2,848	10,400	16,500
Antimony	mg/kg	-	-	<10.0	0.350	***0.480***	***0.450***	***0.430***	***0.470***	***0.560***	***0.478***	***0.470***	0.0497	***0.430***	***0.560***
Arsenic	mg/kg	5.9	17	7.50	5.71	***14.3***	***13.3***	***14.4***	***14.7***	***20.4***	***15.4***	***14.4***	2.83	***13.3***	***20.4***
Barium	mg/kg	-	-	91.4	149	83.2	104	85.6	138	146	111	104	29.2	83.2	146
Beryllium	mg/kg	-	-	<0.50	0.450	0.410	***0.530***	0.430	***0.550***	***0.560***	***0.496***	***0.530***	0.0706	0.410	***0.560***
Bismuth	mg/kg	-	-	<20.0	0.140	0.120	0.110	0.120	0.140	***0.160***	0.130	0.120	0.0200	0.110	***0.160***
Boron	mg/kg	-	-	-	10.0	6.40	7.80	6.50	7.00	8.80	7.30	7.00	1.00	6.40	8.80
Cadmium	mg/kg	0.6	3.5	<0.50	0.388	0.183	0.349	0.248	***0.477***	***0.456***	0.343	0.349	0.128	0.183	***0.477***
Calcium	mg/kg	-	-	5,660	8,680	***15,800***	***16,700***	***17,900***	***14,000***	***19,500***	***16,780***	***16,700***	2,083	***14,000***	***19,500***
Chromium	mg/kg	37.3	90	32.3	60.3	***68.6***	38.0	57.0	46.0	47.3	51.4	47.3	11.8	38.0	***68.6***
Cobalt	mg/kg	-	-	9.60	13.3	***40.8***	***18.5***	***34.1***	***19.8***	***26.7***	***28.0***	***26.7***	9.49	***18.5***	***40.8***
Copper	mg/kg	35.7	197	29.6	35.8	***693***	***900***	***938***	***1,080***	***2,000***	***1,122***	***938***	510	***693***	***2,000***
Iron	mg/kg	21,200	43,766	23,100	28,200	***291,000***	***74,300***	***218,000***	***67,300***	***112,000***	***152,520***	***112,000***	98,091	***67,300***	***291,000***
Lead	mg/kg	35	91.3	<30.0	6.47	6.46	***7.48***	***6.97***	***9.56***	***10.3***	***8.15***	***7.48***	1.68	6.46	***10.3***
Lithium	mg/kg	-	-	13.2	13.7	11.8	***14.2***	12.2	***15.6***	***15.8***	***13.9***	***14.2***	1.86	11.8	***15.8***
Magnesium	mg/kg	-	-	5,770	8,320	5,690	***8,370***	6,610	***9,020***	***9,330***	7,804	***8,370***	1,583	5,690	***9,330***
Manganese	mg/kg	460	1,100	514	443	***945***	***1,030***	***927***	***1,280***	***1,550***	***1,146***	***1,030***	266	***927***	***1,550***
Mercury	mg/kg	0.17	0.486	0.0729	0.0471	***0.0842***	***0.126***	***0.109***	***0.143***	***0.184***	***0.129***	***0.126***	0.0375	***0.0842***	***0.184***
Molybdenum	mg/kg	25	23,000	<4.0	1.10	***2.23***	***2.50***	***2.47***	***2.37***	***3.82***	***2.68***	***2.47***	0.647	***2.23***	***3.82***
Nickel	mg/kg	16	75	21.1	34.6	25.6	23.3	23.5	29.6	25.8	25.6	25.6	2.54	23.3	29.6
Phosphorus	mg/kg	-	-	-	1,240	***1,500***	***1,470***	***1,770***	***1,410***	***1,560***	***1,542***	***1,500***	138	***1,410***	***1,770***
Potassium	mg/kg	-	-	890	1,510	710	1,180	740	1,210	1,110	990	1,110	245	710	1,210
Selenium	mg/kg	2	-	<2.0	0.930	***1.18***	***1.20***	***1.31***	***1.22***	***2.15***	***1.41***	***1.22***	0.416	***1.18***	***2.15***
Silver	mg/kg	0.5	-	<2.0	0.174	***0.391***	***0.402***	***0.460***	***0.448***	***0.906***	***0.521***	***0.448***	0.217	***0.391***	***0.906***
Sodium	mg/kg	-	-	240	546	365	540	389	517	530	468	517	84.1	365	540
Strontium	mg/kg	-	-	58.5	83.7	78.1	***116***	83.3	***112***	***113***	***100***	***112***	18.2	78.1	***116***
Sulphur[d]	mg/kg	-	-	-	720	***810***	720	***790***	690	***730***	***748***	***730***	50.2	690	***810***
Thallium	mg/kg	-	-	<1.0	0.147	<0.05	0.0660	<0.05	0.0800	0.0640	0.0620	0.0640	0.0126	0.0500	0.0800
Tin	mg/kg	-	-	<5.0	0.570	***1.83***	***1.20***	***1.42***	***1.17***	***1.58***	***1.44***	***1.42***	0.275	***1.17***	***1.83***
Titanium	mg/kg	-	-	607	1,180	***1,870***	***1,380***	***1,510***	1,110	***1,480***	***1,470***	***1,480***	274	1,110	***1,870***
Uranium	mg/kg	-	-	-	1.39	***1.45***	1.18	1.04	1.00	1.02	1.14	1.04	0.188	1.00	***1.45***
Vanadium	mg/kg	-	-	54.9	68.7	***1,140***	***266***	***831***	***227***	***409***	***575***	***409***	397	***227***	***1,140***
Zinc	mg/kg	123	315	46.7	70.4	***94.2***	64.5	***86.1***	***77.4***	***85.3***	***81.5***	***85.3***	11.2	64.5	***94.2***
Zirconium	mg/kg	-	-	-	4.30	***5.60***	***5.10***	***5.10***	4.00	***4.80***	***4.92***	***5.10***	0.589	4.00	***5.60***

Value is > BC Lower Working Sediment Quality Guideline.

Value is > BC Upper Working Sediment Quality Guideline.

Notes: "-" = no current BC Working Sediment Quality Guidelines/ no data. ***Bold/ Italics*** indicates value is > pre-breach and is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. The 5th percentile is reported and screened for the pH reference data. For calculation of reference and pre-breach 95th percentile values, see Appendix Tables C.2.6 and C.2.8, respectively.

[c] Total Organic Carbon (TOC) and metals data are presented for the <63 µm sediment fraction for post-breach (2014 to 2022) data only. TOC and metals data presented for pre-breach results represent bulk sediment samples (see Appendix Table C.2.8).

[d] Total sulphur measured in bulk sediment, not the <63 µm fraction.

APPENDIX C.3
PLANKTON COMMUNITY & PRODUCTIVITY

Table C.3.1: Phytoplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Density (cells/L)	Richness (# of Taxa)	Simpson's Diversity	Simpson's Evenness	Chlorophyll-a (µg/L)	Diatom (cells/L)	Chlorophyte (cells/L)	Chrysophyte (cells/L)	Cryptomonad (cells/L)	Cyanobacteria (cells/L)
2019	BOL-B2	Reference	Jun 25	-	16,710,532	19	0.114	0.0594	2.03	80,380	168,799	417,979	257,218	15,778,118
			Jul 31	1	16,818,503	17	0.135	0.0680	2.58	48,228	116,552	522,473	156,742	15,974,508
			Jul 31	2	13,739,324	23	0.286	0.0609	2.49	63,156	688,976	1,016,239	206,693	11,758,519
			Jul 31	3	20,677,883	24	0.173	0.0504	2.71	16,076	152,723	614,911	257,218	19,636,956
			Jul 31	4	18,345,174	20	0.118	0.0567	2.91	20,095	337,598	534,530	188,894	17,264,057
			Jul 31	5	15,019,218	17	0.131	0.0677	3.10	10,717	401,902	324,201	88,419	14,193,978
			Sep 4	-	5,919,483	25	0.334	0.0601	0.0910	6,430	181,660	41,798	141,470	5,522,403
	POL-P2	Exposed	Jun 24	-	3,958,740	21	0.464	0.0889	1.40	18,755	100,476	95,117	99,136	3,642,576
			Jul 29	1	25,314,116	17	0.143	0.0686	2.18	114,829	172,244	895,668	126,312	23,999,321
			Jul 29	2	19,520,978	13	0.181	0.0939	2.69	45,932	482,283	1,194,225	114,829	17,677,968
			Jul 29	3	16,181,958	16	0.284	0.0873	2.26	63,156	235,400	1,010,498	149,278	14,723,626
			Jul 29	4	12,479,073	17	0.225	0.0759	2.60	64,304	281,332	795,767	92,438	11,241,213
			Jul 29	5	21,754,408	14	0.146	0.0836	2.58	40,190	206,693	970,307	132,054	20,405,164
			Aug 28	-	732,162	15	0.655	0.193	0.400	42,811	61,159	32,327	151,150	444,714
2020	BOL-B2	Reference	Jun 22	-	1,240,656	21	0.786	0.222	2.47	234,152	559,169	132,803	178,235	136,297
			Jul 29	1	15,951,510	25	0.120	0.0455	1.39	34,162	62,295	40,190	245,161	15,567,693
			Jul 29	2	16,813,067	20	0.129	0.0574	1.94	0	68,149	43,685	174,740	16,526,493
			Jul 29	3	14,903,672	20	0.191	0.0618	2.10	4,728	134,756	42,554	257,690	14,463,944
			Jul 29	4	15,433,056	19	0.230	0.0683	2.59	4,728	156,033	101,658	210,408	14,960,229
			Jul 29	5	15,745,121	16	0.160	0.0744	2.24	2,364	99,294	66,196	226,957	15,350,311
			Aug 30	-	13,795,274	16	0.566	0.144	2.38	0	287,515	58,740	191,677	13,257,343
	POL-P2	Exposed	Jun 22	-	696,631	21	0.775	0.212	1.20	135,307	77,701	8,038	187,554	282,671
			Jul 27	1	7,654,935	21	0.399	0.0792	1.57	12,366	420,452	491,558	247,325	6,480,143
			Jul 27	2	8,306,655	17	0.496	0.117	2.04	8,038	357,693	622,949	305,446	7,008,510
			Jul 27	3	5,379,539	17	0.332	0.0881	1.62	32,748	226,256	339,384	297,706	4,483,446
			Jul 27	4	11,202,774	18	0.181	0.0678	1.83	9,275	228,775	404,994	287,515	10,269,124
			Jul 27	5	9,006,513	16	0.196	0.0777	1.75	5,359	222,386	332,239	214,348	8,226,822
			Aug 30	-	7,656,332	17	0.673	0.180	2.68	10,717	345,636	219,707	251,859	6,825,733
2021	BOL-B2	Reference	Jun 22	-	2,824,035	23	0.773	0.192	20.2	58,946	428,696	916,338	187,554	1,232,501
			Jul 27	1	2,668,930	19	0.315	0.0768	1.50	4,466	56,564	50,610	324,499	2,228,326
			Jul 27	2	3,038,383	24	0.256	0.0560	1.65	16,076	53,051	32,152	323,130	2,604,328
			Jul 27	3	4,013,088	20	0.262	0.0678	1.72	12,179	36,537	30,447	213,130	3,717,141
			Jul 27	4	5,506,064	19	0.191	0.0651	1.55	13,397	28,011	32,883	226,527	5,200,375
			Jul 27	5	3,461,184	20	0.245	0.0662	1.96	38,583	56,266	20,899	326,345	3,019,092
			Aug 30	-	5,314,570	27	0.501	0.0742	2.30	23,641	267,147	104,022	276,603	4,631,335
	POL-P2	Exposed	Jun 22	-	3,443,995	17	0.493	0.116	1.69	43,282	86,564	680,143	219,501	2,411,415
			Jul 26	1	7,608,014	19	0.134	0.0608	0.947	26,124	108,514	215,018	176,837	7,081,522
			Jul 26	2	5,924,516	15	0.212	0.0846	1.30	2,364	122,935	368,805	182,038	5,248,374
			Jul 26	3	5,961,554	13	0.189	0.0948	1.09	11,164	93,777	189,787	305,892	5,360,933
			Jul 26	4	4,784,649	13	0.218	0.0984	1.39	0	142,675	172,818	249,180	4,219,976
			Jul 26	5	6,664,489	13	0.198	0.0959	1.42	2,364	170,218	196,223	338,071	5,957,614
			Aug 30	-	1,697,368	21	0.492	0.0938	1.02	12,057	103,155	14,736	258,557	1,303,504
2022	BOL-B2	Reference	Jun 21	-	2,081,855	28	0.704	0.121	6.28	211,669	80,381	318,843	227,745	1,232,501
			Jul 26	1	1,921,549	29	0.734	0.130	1.82	69,764	66,731	160,761	142,562	1,480,215
			Jul 26	2	4,093,135	30	0.684	0.106	2.07	68,409	172,733	198,386	123,136	3,527,051
			Jul 26	3	2,531,093	26	0.730	0.142	1.94	71,449	64,304	225,065	153,616	2,014,871
			Jul 26	4	1,928,735	29	0.599	0.0859	2.50	53,587	125,036	207,203	151,830	1,385,720
			Jul 26	5	3,809,516	30	0.552	0.0744	2.09	19,716	131,945	107,680	151,661	3,398,514
			Aug 28	-	1,388,071	31	0.622	0.0852	2.18	35,166	129,614	36,171	45,214	1,137,886
	POL-P2	Exposed	Jun 21	-	1,026,397	17	0.744	0.230	2.60	510,107	253,508	37,099	166,944	52,556
			Jul 25	1	4,035,101	15	0.784	0.309	2.57	257,218	375,109	803,805	251,859	2,347,111
			Jul 25	2	3,531,383	21	0.861	0.343	2.46	144,685	439,413	841,316	203,631	1,902,338
			Jul 25	3	3,933,286	20	0.831	0.295	2.55	198,272	471,566	707,348	246,500	2,309,600
			Jul 25	4	6,608,867	16	0.800	0.312	3.78	43,282	636,861	1,174,792	166,944	4,586,988
			Jul 25	5	5,177,576	17	0.744	0.230	2.73	128,609	348,315	787,729	289,370	3,618,194
			Aug 25	-	9,239,164	27	0.461	0.0688	3.47	53,587	251,859	192,913	155,402	8,582,724

Notes: "-" = only one sample (replicate) collected. Cells/L = cells per litre. µg/L = micrograms per litre. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Phytoplankton data for area POL-P1 collected in June 2019 are not displayed. These data were presented in Minnow (2020a).

Table C.3.1: Phytoplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Dinoflagellates (cells/L)	Euglenophytes (cells/L)	Diatoms (%)	Chlorophytes (%)	Chrysophytes (%)	Cryptomonads (%)	Cyanobacteria (%)	Dinoflagellates (%)	Euglenophytes (%)
2019	BOL-B2	Reference	Jun 25	-	8,038	0	0.481	1.01	2.50	1.54	94.4	0.0481	0
			Jul 31	1	0	0	0.287	0.693	3.11	0.932	95.0	0	0
			Jul 31	2	5,741	0	0.460	5.01	7.40	1.50	85.6	0.0418	0
			Jul 31	3	0	0	0.0777	0.739	2.97	1.24	95.0	0	0
			Jul 31	4	0	0	0.110	1.84	2.91	1.03	94.1	0	0
			Jul 31	5	0	0	0.0714	2.68	2.16	0.589	94.5	0	0
			Sep 4	-	6,430	19,291	0.109	3.07	0.706	2.39	93.3	0.109	0.326
	POL-P2	Exposed	Jun 24	-	0	2,679	0.474	2.54	2.40	2.50	92.0	0	0.0677
			Jul 29	1	5,741	0	0.454	0.680	3.54	0.499	94.8	0.0227	0
			Jul 29	2	0	5,741	0.235	2.47	6.12	0.588	90.6	0	0.0294
			Jul 29	3	0	0	0.390	1.45	6.24	0.922	91.0	0	0
			Jul 29	4	4,019	0	0.515	2.25	6.38	0.741	90.1	0.0322	0
			Jul 29	5	0	0	0.185	0.950	4.46	0.607	93.8	0	0
			Aug 28	-	0	0	5.85	8.35	4.42	20.6	60.7	0	0
2020	BOL-B2	Reference	Jun 22	-	0	0	18.9	45.1	10.7	14.4	11.0	0	0
			Jul 29	1	2,010	0	0.214	0.391	0.252	1.54	97.6	0.0126	0
			Jul 29	2	0	0	0	0.405	0.260	1.04	98.3	0	0
			Jul 29	3	0	0	0.0317	0.904	0.286	1.73	97.0	0	0
			Jul 29	4	0	0	0.0306	1.01	0.659	1.36	96.9	0	0
			Jul 29	5	0	0	0.0150	0.631	0.420	1.44	97.5	0	0
			Aug 30	-	0	0	0	2.08	0.426	1.39	96.1	0	0
	POL-P2	Exposed	Jun 22	-	5,359	0	19.4	11.2	1.15	26.9	40.6	0.769	0
			Jul 27	1	3,092	0	0.162	5.49	6.42	3.23	84.7	0.0404	0
			Jul 27	2	4,019	0	0.0968	4.31	7.50	3.68	84.4	0.0484	0
			Jul 27	3	0	0	0.609	4.21	6.31	5.53	83.3	0	0
			Jul 27	4	3,092	0	0.0828	2.04	3.62	2.57	91.7	0.0276	0
			Jul 27	5	5,359	0	0.0595	2.47	3.69	2.38	91.3	0.0595	0
			Aug 30	-	2,679	0	0.140	4.51	2.87	3.29	89.2	0.0350	0
2021	BOL-B2	Reference	Jun 22	-	0	0	2.09	15.2	32.5	6.64	43.6	0	0
			Jul 27	1	2,977	1,489	0.167	2.12	1.90	12.2	83.5	0.112	0.0558
			Jul 27	2	3,215	6,430	0.529	1.75	1.06	10.6	85.7	0.106	0.212
			Jul 27	3	3,654	0	0.303	0.910	0.759	5.31	92.6	0.0910	0
			Jul 27	4	1,218	3,654	0.243	0.509	0.597	4.11	94.5	0.0221	0.0664
			Jul 27	5	0	0	1.11	1.63	0.604	9.43	87.2	0	0
			Aug 30	-	9,457	2,364	0.445	5.03	1.96	5.20	87.1	0.178	0.0445
	POL-P2	Exposed	Jun 22	-	0	3,092	1.26	2.51	19.8	6.37	70.0	0	0.0898
			Jul 26	1	0	0	0.343	1.43	2.83	2.32	93.1	0	0
			Jul 26	2	0	0	0.0399	2.08	6.23	3.07	88.6	0	0
			Jul 26	3	0	0	0.187	1.57	3.18	5.13	89.9	0	0
			Jul 26	4	0	0	0	2.98	3.61	5.21	88.2	0	0
			Jul 26	5	0	0	0.0355	2.55	2.94	5.07	89.4	0	0
			Aug 30	-	5,359	0	0.710	6.08	0.868	15.2	76.8	0.316	0
2022	BOL-B2	Reference	Jun 21	-	10,717	0	10.2	3.86	15.3	10.9	59.2	0.515	0
			Jul 26	1	1,517	0	3.63	3.47	8.37	7.42	77.0	0.0789	0
			Jul 26	2	3,420	0	1.67	4.22	4.85	3.01	86.2	0.0836	0
			Jul 26	3	1,786	0	2.82	2.54	8.89	6.07	79.6	0.0706	0
			Jul 26	4	5,359	0	2.78	6.48	10.7	7.87	71.8	0.278	0
			Jul 26	5	0	0	0.518	3.46	2.83	3.98	89.2	0	0
			Aug 28	-	2,010	2,010	2.53	9.34	2.61	3.26	82.0	0.145	0.145
	POL-P2	Exposed	Jun 21	-	6,183	0	49.7	24.7	3.61	16.3	5.12	0.602	0
			Jul 25	1	0	0	6.37	9.30	19.9	6.24	58.2	0	0
			Jul 25	2	0	0	4.10	12.4	23.8	5.77	53.9	0	0
			Jul 25	3	0	0	5.04	12.0	18.0	6.27	58.7	0	0
			Jul 25	4	0	0	0.655	9.64	17.8	2.53	69.4	0	0
			Jul 25	5	5,359	0	2.48	6.73	15.2	5.59	69.9	0.103	0
			Aug 25	-	2,679	0	0.580	2.73	2.09	1.68	92.9	0.0290	0

Notes: "-" = only one sample (replicate) collected. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Phytoplankton data for area POL-P1 collected in June 2019 are not displayed. These data were presented in Minnow (2020a).

Table C.3.2: Summary Statistics for Phytoplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (cells/L)	2019	BOL-B2	Reference	5	16,920,021	2,733,715	13,739,324	16,818,503	20,677,883
		POL-P2	Exposed	5	19,050,107	4,954,229	12,479,073	19,520,978	25,314,116
	2020	BOL-B2	Reference	5	15,769,285	704,558	14,903,672	15,745,121	16,813,067
		POL-P2	Exposed	5	8,310,083	2,113,646	5,379,539	8,306,655	11,202,774
	2021	BOL-B2	Reference	5	3,737,530	1,108,008	2,668,930	3,461,184	5,506,064
		POL-P2	Exposed	5	6,188,644	1,040,862	4,784,649	5,961,554	7,608,014
	2022	BOL-B2	Reference	5	2,856,805	1,034,200	1,921,549	2,531,093	4,093,135
		POL-P2	Exposed	5	4,657,243	1,250,831	3,531,383	4,035,101	6,608,867
Richness (# of Taxa)	2019	BOL-B2	Reference	5	20.2	3.3	17	20	24
		POL-P2	Exposed	5	15.4	1.8	13	16	17
	2020	BOL-B2	Reference	5	20.0	3.2	16	20	25
		POL-P2	Exposed	5	17.8	1.9	16	17	21
	2021	BOL-B2	Reference	5	20.4	2.1	19	20	24
		POL-P2	Exposed	5	14.6	2.6	13	13	19
	2022	BOL-B2	Reference	5	28.8	1.6	26	29	30
		POL-P2	Exposed	5	17.8	2.6	15	17	21
Simpson's Diversity	2019	BOL-B2	Reference	5	0.168	0.0686	0.118	0.135	0.286
		POL-P2	Exposed	5	0.196	0.0595	0.143	0.181	0.284
	2020	BOL-B2	Reference	5	0.166	0.0453	0.120	0.160	0.230
		POL-P2	Exposed	5	0.321	0.134	0.181	0.332	0.496
	2021	BOL-B2	Reference	5	0.254	0.0442	0.191	0.256	0.315
		POL-P2	Exposed	5	0.190	0.0333	0.134	0.198	0.218
	2022	BOL-B2	Reference	5	0.660	0.0813	0.552	0.684	0.734
		POL-P2	Exposed	5	0.804	0.0448	0.744	0.800	0.861
Simpson's Evenness	2019	BOL-B2	Reference	5	0.0607	0.00749	0.0504	0.0609	0.0680
		POL-P2	Exposed	5	0.0819	0.00985	0.0686	0.0836	0.0939
	2020	BOL-B2	Reference	5	0.0615	0.0110	0.0455	0.0618	0.0744
		POL-P2	Exposed	5	0.0859	0.0186	0.0678	0.0792	0.117
	2021	BOL-B2	Reference	5	0.0664	0.00743	0.0560	0.0662	0.0768
		POL-P2	Exposed	5	0.0869	0.0155	0.0608	0.0948	0.0984
	2022	BOL-B2	Reference	5	0.108	0.0287	0.0744	0.106	0.142
		POL-P2	Exposed	5	0.298	0.0420	0.230	0.309	0.343
Chlorophyll-a (µg/L)	2019	BOL-B2	Reference	5	2.76	0.248	2.49	2.71	3.10
		POL-P2	Exposed	5	2.46	0.227	2.18	2.58	2.69
	2020	BOL-B2	Reference	5	2.05	0.441	1.39	2.10	2.59
		POL-P2	Exposed	5	1.76	0.186	1.57	1.75	2.04
	2021	BOL-B2	Reference	5	1.68	0.180	1.50	1.65	1.96
		POL-P2	Exposed	5	1.23	0.204	0.947	1.30	1.42
	2022	BOL-B2	Reference	5	2.08	0.257	1.82	2.07	2.50
		POL-P2	Exposed	5	2.82	0.547	2.46	2.57	3.78
Diatom (cells/L)	2019	BOL-B2	Reference	5	31,655	22,813	10,717	20,095	63,156
		POL-P2	Exposed	5	65,682	29,426	40,190	63,156	114,829
	2020	BOL-B2	Reference	5	9,196	14,093	0	4,728	34,162
		POL-P2	Exposed	5	13,557	11,019	5,359	9,275	32,748
	2021	BOL-B2	Reference	5	16,940	12,845	4,466	13,397	38,583
		POL-P2	Exposed	5	8,403	10,784	0	2,364	26,124
	2022	BOL-B2	Reference	5	56,585	21,810	19,716	68,409	71,449
		POL-P2	Exposed	5	154,413	80,005	43,282	144,685	257,218
Chlorophyte (cells/L)	2019	BOL-B2	Reference	5	339,550	229,468	116,552	337,598	688,976
		POL-P2	Exposed	5	275,590	122,268	172,244	235,400	482,283
	2020	BOL-B2	Reference	5	104,105	40,927	62,295	99,294	156,033
		POL-P2	Exposed	5	291,113	92,165	222,386	228,775	420,452
	2021	BOL-B2	Reference	5	46,086	13,037	28,011	53,051	56,564
		POL-P2	Exposed	5	127,624	29,890	93,777	122,935	170,218
	2022	BOL-B2	Reference	5	112,150	46,315	64,304	125,036	172,733
		POL-P2	Exposed	5	454,253	113,305	348,315	439,413	636,861
Chrysophyte (cells/L)	2019	BOL-B2	Reference	5	602,471	254,857	324,201	534,530	1,016,239
		POL-P2	Exposed	5	973,293	148,109	795,767	970,307	1,194,225
	2020	BOL-B2	Reference	5	58,857	26,125	40,190	43,685	101,658
		POL-P2	Exposed	5	438,225	121,526	332,239	404,994	622,949
	2021	BOL-B2	Reference	5	33,398	10,759	20,899	32,152	50,610
		POL-P2	Exposed	5	228,530	79,856	172,818	196,223	368,805
	2022	BOL-B2	Reference	5	179,819	46,661	107,680	198,386	225,065
		POL-P2	Exposed	5	862,998	181,026	707,348	803,805	1,174,792
Cryptomonad (cells/L)	2019	BOL-B2	Reference	5	179,593	62,613	88,419	188,894	257,218
		POL-P2	Exposed	5	122,982	21,120	92,438	126,312	149,278
	2020	BOL-B2	Reference	5	222,991	32,395	174,740	226,957	257,690
		POL-P2	Exposed	5	270,468	38,539	214,348	287,515	305,446
	2021	BOL-B2	Reference	5	282,726	57,624	213,130	323,130	326,345
		POL-P2	Exposed	5	250,404	72,201	176,837	249,180	338,071
	2022	BOL-B2	Reference	5	144,561	12,731	123,136	151,661	153,616
		POL-P2	Exposed	5	231,661	47,256	166,944	246,500	289,370
Cyanobacteria (cells/L)	2019	BOL-B2	Reference	5	15,765,604	2,991,785	11,758,519	15,974,508	19,636,956
		POL-P2	Exposed	5	17,609,458	4,937,955	11,241,213	17,677,968	23,999,321
	2020	BOL-B2	Reference	5	15,373,734	769,046	14,463,944	15,350,311	16,526,493
		POL-P2	Exposed	5	7,293,609	2,142,697	4,483,446	7,008,510	10,269,124
	2021	BOL-B2	Reference	5	3,353,852	1,170,714	2,228,326	3,019,092	5,200,375
		POL-P2	Exposed	5	5,573,684	1,049,356	4,219,976	5,360,933	7,081,522
	2022	BOL-B2	Reference	5	2,361,274	1,034,754	1,385,720	2,014,871	3,527,051
		POL-P2	Exposed	5	2,952,846	1,117,738	1,902,338	2,347,111	4,586,988
Dinoflagellates (cells/L)	2019	BOL-B2	Reference	5	1,148	2,568	0	0	5,741
		POL-P2	Exposed	5	1,952	2,742	0	0	5,741
	2020	BOL-B2	Reference	5	402	899	0	0	2,010
		POL-P2	Exposed	5	3,112	1,972	0	3,092	5,359
	2021	BOL-B2	Reference	5	2,213	1,545	0	2,977	3,654
		POL-P2	Exposed	5	0	0	0	0	0
	2022	BOL-B2	Reference	5	2,416	2,044	0	1,786	5,359
		POL-P2	Exposed	5	1,072	2,396	0	0	5,359
Euglenophytes (cells/L)	2019	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	1,148	2,568	0	0	5,741
	2020	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	0	0	0	0	0
	2021	BOL-B2	Reference	5	2,315	2,745	0	1,489	6,430
		POL-P2	Exposed	5	0	0	0	0	0
	2022	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	0	0	0	0	0

Notes: Cell/L = cells per litre. µg/L = micrograms per litre. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.1.

Table C.3.2: Summary Statistics for Phytoplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Diatoms (%)	2019	BOL-B2	Reference	5	0.201	0.169	0.0714	0.110	0.460
		POL-P2	Exposed	5	0.356	0.141	0.185	0.390	0.515
	2020	BOL-B2	Reference	5	0.0583	0.0881	0	0.0306	0.214
		POL-P2	Exposed	5	0.202	0.231	0.0595	0.0968	0.609
	2021	BOL-B2	Reference	5	0.472	0.384	0.167	0.303	1.11
		POL-P2	Exposed	5	0.121	0.144	0	0.0399	0.343
	2022	BOL-B2	Reference	5	2.28	1.21	0.518	2.78	3.63
		POL-P2	Exposed	5	3.73	2.23	0.655	4.10	6.37
Chlorophytes (%)	2019	BOL-B2	Reference	5	2.19	1.78	0.693	1.84	5.01
		POL-P2	Exposed	5	1.56	0.786	0.680	1.45	2.47
	2020	BOL-B2	Reference	5	0.668	0.283	0.391	0.631	1.01
		POL-P2	Exposed	5	3.70	1.42	2.04	4.21	5.49
	2021	BOL-B2	Reference	5	1.38	0.656	0.509	1.63	2.12
		POL-P2	Exposed	5	2.12	0.655	1.43	2.08	2.98
	2022	BOL-B2	Reference	5	4.04	1.49	2.54	3.47	6.48
		POL-P2	Exposed	5	10.0	2.31	6.73	9.64	12.4
Chrysophytes (%)	2019	BOL-B2	Reference	5	3.71	2.09	2.16	2.97	7.40
		POL-P2	Exposed	5	5.35	1.28	3.54	6.12	6.38
	2020	BOL-B2	Reference	5	0.375	0.172	0.252	0.286	0.659
		POL-P2	Exposed	5	5.51	1.76	3.62	6.31	7.50
	2021	BOL-B2	Reference	5	0.983	0.544	0.597	0.759	1.90
		POL-P2	Exposed	5	3.76	1.41	2.83	3.18	6.23
	2022	BOL-B2	Reference	5	7.13	3.22	2.83	8.37	10.7
		POL-P2	Exposed	5	18.9	3.20	15.2	18.0	23.8
Cryptomonads (%)	2019	BOL-B2	Reference	5	1.06	0.343	0.589	1.03	1.50
		POL-P2	Exposed	5	0.671	0.165	0.499	0.607	0.922
	2020	BOL-B2	Reference	5	1.42	0.254	1.04	1.44	1.73
		POL-P2	Exposed	5	3.48	1.26	2.38	3.23	5.53
	2021	BOL-B2	Reference	5	8.33	3.47	4.11	9.43	12.2
		POL-P2	Exposed	5	4.16	1.36	2.32	5.07	5.21
	2022	BOL-B2	Reference	5	5.67	2.12	3.01	6.07	7.87
		POL-P2	Exposed	5	5.28	1.57	2.53	5.77	6.27
Cyanobacteria (%)	2019	BOL-B2	Reference	5	92.8	4.07	85.6	94.5	95.0
		POL-P2	Exposed	5	92.0	2.11	90.1	91.0	94.8
	2020	BOL-B2	Reference	5	97.5	0.538	96.9	97.5	98.3
		POL-P2	Exposed	5	87.1	4.07	83.3	84.7	91.7
	2021	BOL-B2	Reference	5	88.7	4.65	83.5	87.2	94.5
		POL-P2	Exposed	5	89.8	1.93	88.2	89.4	93.1
	2022	BOL-B2	Reference	5	80.8	6.99	71.8	79.6	89.2
		POL-P2	Exposed	5	62.0	7.22	53.9	58.7	69.9
Dinoflagellates (%)	2019	BOL-B2	Reference	5	0.00836	0.0187	0	0	0.0418
		POL-P2	Exposed	5	0.0110	0.0154	0	0	0.0322
	2020	BOL-B2	Reference	5	0.00252	0.00563	0	0	0.0126
		POL-P2	Exposed	5	0.0352	0.0228	0	0.0404	0.0595
	2021	BOL-B2	Reference	5	0.0661	0.0514	0	0.0910	0.112
		POL-P2	Exposed	5	0	0	0	0	0
	2022	BOL-B2	Reference	5	0.102	0.104	0	0.0789	0.278
		POL-P2	Exposed	5	0.0207	0.0463	0	0	0.103
Euglenophytes (%)	2019	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	0.00588	0.0132	0	0	0.0294
	2020	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	0	0	0	0	0
	2021	BOL-B2	Reference	5	0.0668	0.0866	0	0.0558	0.212
		POL-P2	Exposed	5	0	0	0	0	0
	2022	BOL-B2	Reference	5	0	0	0	0	0
		POL-P2	Exposed	5	0	0	0	0	0

Notes: Cell/L = cells per litre. µg/L = micrograms per litre. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.1.

Table C.3.3: Zooplankton Community Metrics from Polley Lake (POL-P2) and Reference (Bootjack Lake; BOL-B2), 2019 to 2022 [a]

Year	Area	Type	Date	Replicate	Density (cells/L)	Richness (# of Taxa)	Simpson's Diversity	Simpson's Evenness	Wet Weight Biomass (mg/L)	Dry Weight Biomass (mg/L)	Calanoida (#/L)	Cladocera (#/L)
2019	BOL-B2	Reference	Jun 25	-	36.1	11	0.351	0.140	0.161	0.0319	2.32	1.05
			Jul 31	1	6.31	10	0.653	0.288	0.0162	0.00311	0.101	0.204
			Jul 31	2	3.13	8	0.756	0.511	0.0196	0.00387	0.0725	0.367
			Jul 31	3	4.33	7	0.719	0.508	0.0342	0.00675	0.242	0.395
			Jul 31	4	4.88	9	0.725	0.404	0.0308	0.00608	0.186	0.296
			Jul 31	5	6.42	8	0.732	0.467	0.0377	0.00737	0.134	0.561
			Sep 4	-	1.92	10	0.841	0.629	0.0169	0.00334	0.0216	0.296
	POL-P2	Exposed	Jun 24	-	20.9	8	0.689	0.402	0.204	0.0408	0.0262	2.04
			Jul 29	1	17.4	8	0.473	0.237	0.122	0.0243	0.210	0.252
			Jul 29	2	18.2	10	0.599	0.250	0.163	0.0325	0.183	0.262
			Jul 29	3	5.99	10	0.694	0.327	0.0581	0.0116	0.0905	0.249
			Jul 29	4	4.67	8	0.711	0.433	0.0445	0.00889	0.118	0.219
			Jul 29	5	5.57	10	0.705	0.339	0.0544	0.0109	0.125	0.125
			Aug 28	-	38.4	7	0.646	0.404	0.375	0.0749	0.588	0.849
2020	BOL-B2	Reference	Jun 22	-	68.8	12	0.759	0.346	0.292	0.0575	1.02	4.70
			Jul 29	1	22.8	12	0.762	0.351	0.0729	0.0142	0.523	1.27
			Jul 29	2	27.6	12	0.724	0.302	0.0992	0.0193	0.364	0.909
			Jul 29	3	24.5	10	0.777	0.449	0.0979	0.0191	0.444	1.25
			Jul 29	4	36.7	10	0.729	0.369	0.0901	0.0172	0.525	0.891
			Jul 29	5	24.5	12	0.798	0.412	0.0598	0.0116	0.327	1.07
			Aug 30	-	7.32	7	0.701	0.478	0.0934	0.0185	0.296	1.86
	POL-P2	Exposed	Jun 22	-	44.2	11	0.623	0.241	0.0941	0.0187	0.113	1.58
			Jul 27	1	30.5	8	0.566	0.288	0.125	0.0249	0.340	0.905
			Jul 27	2	20.1	10	0.547	0.221	0.0849	0.0170	0.186	0.584
			Jul 27	3	26.3	7	0.495	0.283	0.118	0.0236	0.218	0.618
			Jul 27	4	33.2	8	0.494	0.247	0.118	0.0235	0.728	1.27
			Jul 27	5	35.1	12	0.513	0.171	0.127	0.0253	0.340	1.40
			Aug 30	-	13.1	8	0.587	0.302	0.0525	0.0105	0.196	0.712
2021	BOL-B2	Reference	Jun 22	-	70.3	10	0.553	0.224	0.106	0.0202	0.764	0.873
			Jul 27	1	14.8	9	0.694	0.363	0.0327	0.00624	0.400	0.280
			Jul 27	2	8.11	10	0.689	0.322	0.0236	0.00446	0.373	0.286
			Jul 27	3	18.4	11	0.671	0.276	0.0339	0.00626	0.301	0.443
			Jul 27	4	30.6	9	0.689	0.358	0.0543	0.00974	0.819	0.568
			Jul 27	5	21.7	10	0.643	0.280	0.0263	0.00487	0.190	0.475
			Aug 30	-	12.2	10	0.782	0.459	0.0174	0.00275	0.153	0.382
	POL-P2	Exposed	Jun 22	-	35.8	11	0.734	0.342	0.119	0.0235	0.431	1.38
			Jul 26	1	19.1	9	0.481	0.214	0.0362	0.00720	0.380	1.26
			Jul 26	2	8.13	10	0.668	0.301	0.0354	0.00706	0.0784	0.556
			Jul 26	3	9.70	10	0.607	0.255	0.0332	0.00663	0.0646	0.736
			Jul 26	4	13.6	10	0.686	0.318	0.0480	0.00956	0.373	1.31
			Jul 26	5	8.98	10	0.687	0.319	0.0384	0.00766	0.216	0.597
			Aug 30	-	9.94	10	0.645	0.282	0.0601	0.0120	0.154	0.308
2022	BOL-B2	Reference	Jun 21	-	40.6	10	0.539	0.217	0.175	0.0347	0.475	2.04
			Jul 26	1	19.6	11	0.576	0.215	0.101	0.0198	0.129	0.272
			Jul 26	2	33.8	12	0.601	0.209	0.158	0.0308	0.309	0.509
			Jul 26	3	37.0	9	0.395	0.184	0.0849	0.0160	0.509	0.365
			Jul 26	4	27.8	10	0.566	0.230	0.0774	0.0149	0.306	0.418
			Jul 26	5	33.2	10	0.513	0.205	0.107	0.0204	0.357	0.959
			Aug 28	-	8.61	12	0.794	0.405	0.0611	0.0120	0.314	0.704
	POL-P2	Exposed	Jun 21	-	13.8	9	0.591	0.272	0.129	0.0258	0.0646	0.366
			Jul 25	1	20.4	10	0.732	0.372	0.161	0.0321	0.496	1.49
			Jul 25	2	22.1	11	0.547	0.201	0.0705	0.0140	0.354	0.639
			Jul 25	3	32.9	10	0.450	0.182	0.0939	0.0186	0.375	0.732
			Jul 25	4	23.0	11	0.609	0.233	0.0955	0.0189	0.586	0.860
			Jul 25	5	29.6	12	0.623	0.221	0.109	0.0215	0.699	1.14
			Aug 25	-	4.52	9	0.695	0.365	0.0810	0.0161	0.167	0.402

Note: "-" = only one sample (replicate) collected. #/L = organisms per litre. mg/L = miligrams per litre. Results displayed for POL-P2 (August 2019) in the current figure differ from those presented in previous reports (Minnow 2020a, 2021a, 2022a) for the same sampling area and date. This discrepany is due to an incorrect calculation for these results in the prior reporting years.

[a] Zooplankton data for area POL-P1 collected in June 2019 are not displayed. These data were presented in Minnow (2020a).

Table C.3.3: Zooplankton Community Metrics from Polley Lake (POL-P2) and Reference (Bootjack Lake; BOL-B2), 2019 to 2022 [a]

Year	Area	Type	Date	Replicate	Copepod Nauplii (#/L)	Cyclopoida (#/L)	Rotifera (#/L)	Calanoida (%)	Cladocera (%)	Copepod Nauplii (%)	Cyclopoida (%)	Rotifera (%)
2019	BOL-B2	Reference	Jun 25	1	0.202	2.22	30.3	6.44	2.91	0.560	6.16	83.9
			Jul 31	1	0.896	0.437	4.67	1.60	3.24	14.2	6.93	74.0
			Jul 31	2	0.472	0.403	1.81	2.32	11.7	15.1	12.9	58.0
			Jul 31	3	0.157	0.784	2.75	5.58	9.12	3.63	18.1	63.5
			Jul 31	4	0.514	0.797	3.09	3.82	6.06	10.5	16.3	63.2
			Jul 31	5	0.326	1.00	4.39	2.09	8.74	5.09	15.7	68.4
			Sep 04	1	0.346	0.310	0.943	1.12	15.5	18.0	16.2	49.2
	POL-P2	Exposed	Jun 24	1	9.33	5.79	3.67	0.126	9.80	44.7	27.8	17.6
			Jul 29	1	12.3	4.07	0.629	1.20	1.44	70.4	23.4	3.61
			Jul 29	2	10.1	5.87	1.78	1.01	1.44	55.4	32.3	9.81
			Jul 29	3	2.52	1.95	1.19	1.51	4.15	42.0	32.5	19.8
			Jul 29	4	2.06	1.32	0.943	2.53	4.69	44.2	28.3	20.2
			Jul 29	5	2.16	1.85	1.31	2.25	2.25	38.7	33.2	23.6
			Aug 28	1	21.0	12.5	3.53	1.53	2.21	54.6	32.5	9.18
2020	BOL-B2	Reference	Jun 22	-	17.0	9.39	36.7	1.48	6.83	24.7	13.7	53.3
			Jul 29	1	2.73	3.02	15.3	2.29	5.58	11.9	13.2	66.9
			Jul 29	2	3.82	3.25	19.3	1.32	3.29	13.8	11.8	69.8
			Jul 29	3	4.88	2.24	15.7	1.81	5.11	19.9	9.13	64.0
			Jul 29	4	13.5	2.21	19.6	1.43	2.43	36.7	6.02	53.4
			Jul 29	5	6.00	2.76	14.4	1.33	4.37	24.5	11.3	58.6
			Aug 30	-	0.382	0.439	4.34	4.04	25.4	5.22	6.00	59.3
	POL-P2	Exposed	Jun 22	-	25.8	5.53	11.1	0.256	3.59	58.5	12.5	25.2
			Jul 27	1	19.1	6.60	3.58	1.11	2.97	62.5	21.7	11.8
			Jul 27	2	12.7	4.75	1.80	0.926	2.91	63.5	23.7	8.99
			Jul 27	3	17.6	6.58	1.27	0.829	2.35	67.0	25.0	4.83
			Jul 27	4	23.0	5.28	2.88	2.19	3.81	69.4	15.9	8.67
			Jul 27	5	23.6	6.79	2.97	0.969	4.00	67.2	19.4	8.47
			Aug 30	-	8.19	3.08	0.890	1.50	5.45	62.7	23.6	6.81
2021	BOL-B2	Reference	Jun 22	-	12.7	6.44	49.5	1.09	1.24	18.1	9.16	70.4
			Jul 27	1	2.60	1.44	10.1	2.70	1.89	17.5	9.72	68.2
			Jul 27	2	0.407	0.862	6.18	4.61	3.52	5.02	10.6	76.2
			Jul 27	3	1.86	1.76	14.0	1.64	2.41	10.1	9.60	76.2
			Jul 27	4	4.56	1.47	23.2	2.68	1.86	14.9	4.79	75.8
			Jul 27	5	4.14	1.33	15.5	0.877	2.19	19.1	6.14	71.7
			Aug 30	-	1.42	0.628	9.60	1.25	3.13	11.6	5.15	78.8
	POL-P2	Exposed	Jun 22	-	11.0	9.09	13.9	1.20	3.85	30.7	25.4	38.9
			Jul 26	1	13.9	1.48	2.04	1.99	6.61	73.0	7.74	10.7
			Jul 26	2	3.81	2.75	0.927	0.965	6.84	46.9	33.9	11.4
			Jul 26	3	5.54	2.51	0.853	0.666	7.59	57.1	25.8	8.79
			Jul 26	4	6.71	2.92	2.29	2.75	9.62	49.3	21.5	16.9
			Jul 26	5	4.10	2.65	1.41	2.40	6.65	45.7	29.6	15.7
			Aug 30	-	3.17	5.02	1.29	1.55	3.10	31.9	50.5	13.0
2022	BOL-B2	Reference	Jun 21	-	5.98	4.38	27.8	1.17	5.01	14.7	10.8	68.3
			Jul 26	1	2.64	2.86	13.8	0.656	1.38	13.4	14.6	70.0
			Jul 26	2	5.18	4.24	23.6	0.915	1.51	15.3	12.5	69.7
			Jul 26	3	3.01	1.88	31.2	1.38	0.989	8.15	5.09	84.4
			Jul 26	4	5.81	1.58	19.7	1.10	1.50	20.9	5.69	70.8
			Jul 26	5	3.82	1.88	26.1	1.07	2.89	11.5	5.68	78.8
			Aug 28	-	1.30	0.858	5.44	3.64	8.18	15.1	9.96	63.2
	POL-P2	Exposed	Jun 21	-	0.776	4.74	7.89	0.467	2.65	5.61	34.3	57.0
			Jul 25	1	7.66	3.24	7.52	2.43	7.29	37.5	15.9	36.9
			Jul 25	2	14.3	1.03	5.78	1.60	2.89	64.7	4.65	26.2
			Jul 25	3	23.8	1.51	6.45	1.14	2.23	72.4	4.59	19.6
			Jul 25	4	13.3	1.46	6.83	2.55	3.74	57.7	6.34	29.7
			Jul 25	5	16.8	1.23	9.71	2.36	3.86	56.8	4.17	32.9
			Aug 25	-	1.45	1.95	0.548	3.69	8.89	32.1	43.2	12.2

Note: "-" = only one sample (replicate) collected. #/L = organisms per litre. mg/L = miligrams per litre. Results displayed for POL-P2 (August 2019) in the current figure differ from those presented in previous reports (Minnow 2020a, 2021a, 2022a) for the same sampling area and date. This discrepany is due to an incorrect calculation for these results in the prior reporting years.

[a] Zooplankton data for area POL-P1 collected in June 2019 are not displayed. These data were presented in Minnow (2020a).

Table C.3.4: Summary Statistics for Zooplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/L)	2019	BOL-B2	Reference	5	5.01	1.39	3.13	4.88	6.42
		POL-P2	Exposed	5	10.4	6.80	4.67	5.99	18.2
	2020	BOL-B2	Reference	5	27.2	5.58	22.8	24.5	36.7
		POL-P2	Exposed	5	29.0	5.99	20.1	30.5	35.1
	2021	BOL-B2	Reference	5	18.7	8.33	8.11	18.4	30.6
		POL-P2	Exposed	5	11.9	4.54	8.13	9.70	19.1
	2022	BOL-B2	Reference	5	30.3	6.79	19.6	33.2	37.0
		POL-P2	Exposed	5	25.6	5.36	20.4	23.0	32.9
Richness (# of Taxa)	2019	BOL-B2	Reference	5	8.40	1.14	7	8	10
		POL-P2	Exposed	5	9.20	1.10	8	10	10
	2020	BOL-B2	Reference	5	11.2	1.10	10	12	12
		POL-P2	Exposed	5	9.00	2.00	7	8	12
	2021	BOL-B2	Reference	5	9.80	0.837	9	10	11
		POL-P2	Exposed	5	9.80	0.447	9	10	10
	2022	BOL-B2	Reference	5	10.4	1.14	9	10	12
		POL-P2	Exposed	5	10.8	0.837	10	11	12
Simpson's Diversity	2019	BOL-B2	Reference	5	0.717	0.0385	0.653	0.725	0.756
		POL-P2	Exposed	5	0.637	0.102	0.473	0.694	0.711
	2020	BOL-B2	Reference	5	0.758	0.0314	0.724	0.762	0.798
		POL-P2	Exposed	5	0.523	0.0321	0.494	0.513	0.566
	2021	BOL-B2	Reference	5	0.677	0.0210	0.643	0.689	0.694
		POL-P2	Exposed	5	0.626	0.0872	0.481	0.668	0.687
	2022	BOL-B2	Reference	5	0.530	0.0821	0.395	0.566	0.601
		POL-P2	Exposed	5	0.592	0.103	0.450	0.609	0.732
Simpson's Evenness	2019	BOL-B2	Reference	5	0.436	0.0932	0.288	0.467	0.511
		POL-P2	Exposed	5	0.317	0.0789	0.237	0.327	0.433
	2020	BOL-B2	Reference	5	0.377	0.0565	0.302	0.369	0.449
		POL-P2	Exposed	5	0.242	0.0482	0.171	0.247	0.288
	2021	BOL-B2	Reference	5	0.320	0.0411	0.276	0.322	0.363
		POL-P2	Exposed	5	0.282	0.0460	0.214	0.301	0.319
	2022	BOL-B2	Reference	5	0.208	0.0169	0.184	0.209	0.230
		POL-P2	Exposed	5	0.242	0.0756	0.182	0.221	0.372
Wet Weight Biomass (mg/L)	2019	BOL-B2	Reference	5	0.0277	0.00936	0.0162	0.0308	0.0377
		POL-P2	Exposed	5	0.0883	0.0515	0.0445	0.0581	0.163
	2020	BOL-B2	Reference	5	0.0840	0.0171	0.0598	0.0901	0.0992
		POL-P2	Exposed	5	0.114	0.0170	0.0849	0.118	0.127
	2021	BOL-B2	Reference	5	0.0342	0.0120	0.0236	0.0327	0.0543
		POL-P2	Exposed	5	0.0383	0.00576	0.0332	0.0362	0.0480
	2022	BOL-B2	Reference	5	0.106	0.0315	0.0774	0.101	0.158
		POL-P2	Exposed	5	0.106	0.0338	0.0705	0.0955	0.161
Dry Weight Biomass (mg/L)	2019	BOL-B2	Reference	5	0.00544	0.00185	0.00311	0.00608	0.00737
		POL-P2	Exposed	5	0.0176	0.0103	0.00889	0.0116	0.0325
	2020	BOL-B2	Reference	5	0.0163	0.00334	0.0116	0.0172	0.0193
		POL-P2	Exposed	5	0.0229	0.00340	0.0170	0.0236	0.0253
	2021	BOL-B2	Reference	5	0.00631	0.00208	0.00446	0.00624	0.00974
		POL-P2	Exposed	5	0.00762	0.00114	0.00663	0.00720	0.00956
	2022	BOL-B2	Reference	5	0.0204	0.00627	0.0149	0.0198	0.0308
		POL-P2	Exposed	5	0.0210	0.00676	0.0140	0.0189	0.0321
Calanoida (#/L)	2019	BOL-B2	Reference	5	0.147	0.0678	0.0725	0.134	0.242
		POL-P2	Exposed	5	0.145	0.0493	0.0905	0.125	0.210
	2020	BOL-B2	Reference	5	0.437	0.0903	0.327	0.444	0.525
		POL-P2	Exposed	5	0.362	0.216	0.186	0.340	0.728
	2021	BOL-B2	Reference	5	0.417	0.239	0.190	0.373	0.819
		POL-P2	Exposed	5	0.222	0.153	0.0646	0.216	0.380
	2022	BOL-B2	Reference	5	0.322	0.136	0.129	0.309	0.509
		POL-P2	Exposed	5	0.502	0.145	0.354	0.496	0.699
Cladocera (#/L)	2019	BOL-B2	Reference	5	0.365	0.132	0.204	0.367	0.561
		POL-P2	Exposed	5	0.221	0.0561	0.125	0.249	0.262
	2020	BOL-B2	Reference	5	1.08	0.182	0.891	1.07	1.27
		POL-P2	Exposed	5	0.955	0.370	0.584	0.905	1.40
	2021	BOL-B2	Reference	5	0.410	0.125	0.280	0.443	0.568
		POL-P2	Exposed	5	0.892	0.366	0.556	0.736	1.31
	2022	BOL-B2	Reference	5	0.505	0.268	0.272	0.418	0.959
		POL-P2	Exposed	5	0.972	0.345	0.639	0.860	1.49
Copepod Nauplii (#/L)	2019	BOL-B2	Reference	5	0.473	0.275	0.157	0.472	0.896
		POL-P2	Exposed	5	5.81	4.95	2.06	2.52	12.3
	2020	BOL-B2	Reference	5	6.19	4.26	2.73	4.88	13.5
		POL-P2	Exposed	5	19.2	4.41	12.7	19.1	23.6
	2021	BOL-B2	Reference	5	2.71	1.69	0.407	2.60	4.56
		POL-P2	Exposed	5	6.82	4.15	3.81	5.54	13.9
	2022	BOL-B2	Reference	5	4.09	1.37	2.64	3.82	5.81
		POL-P2	Exposed	5	15.2	5.88	7.66	14.3	23.8
Cyclopoida (#/L)	2019	BOL-B2	Reference	5	0.685	0.258	0.403	0.784	1.00
		POL-P2	Exposed	5	3.01	1.91	1.32	1.95	5.87
	2020	BOL-B2	Reference	5	2.70	0.465	2.21	2.76	3.25
		POL-P2	Exposed	5	6.00	0.923	4.75	6.58	6.79
	2021	BOL-B2	Reference	5	1.37	0.327	0.862	1.44	1.76
		POL-P2	Exposed	5	2.46	0.569	1.48	2.65	2.92
	2022	BOL-B2	Reference	5	2.49	1.09	1.58	1.88	4.24
		POL-P2	Exposed	5	1.69	0.888	1.03	1.46	3.24
Rotifera (#/L)	2019	BOL-B2	Reference	5	3.34	1.18	1.81	3.09	4.67
		POL-P2	Exposed	5	1.17	0.430	0.629	1.19	1.78
	2020	BOL-B2	Reference	5	16.9	2.42	14.4	15.7	19.6
		POL-P2	Exposed	5	2.50	0.939	1.27	2.88	3.58
	2021	BOL-B2	Reference	5	13.8	6.38	6.18	14.0	23.2
		POL-P2	Exposed	5	1.50	0.646	0.853	1.41	2.29
	2022	BOL-B2	Reference	5	22.9	6.59	13.8	23.6	31.2
		POL-P2	Exposed	5	7.26	1.51	5.78	6.83	9.71

Notes: #/L = organisms per litre. mg/L = milligrams per litre.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022,see Appendix Table C.3.3.

Table C.3.4: Summary Statistics for Zooplankton Community Metrics for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Calanoida (%)	2019	BOL-B2	Reference	5	3.08	1.63	1.60	2.32	5.58
		POL-P2	Exposed	5	1.70	0.660	1.01	1.51	2.53
	2020	BOL-B2	Reference	5	1.64	0.417	1.32	1.43	2.29
		POL-P2	Exposed	5	1.21	0.561	0.829	0.969	2.19
	2021	BOL-B2	Reference	5	2.50	1.40	0.877	2.68	4.61
		POL-P2	Exposed	5	1.75	0.904	0.666	1.99	2.75
	2022	BOL-B2	Reference	5	1.02	0.265	0.656	1.07	1.38
		POL-P2	Exposed	5	2.02	0.615	1.14	2.36	2.55
Cladocera (%)	2019	BOL-B2	Reference	5	7.78	3.24	3.24	8.74	11.7
		POL-P2	Exposed	5	2.80	1.53	1.44	2.25	4.69
	2020	BOL-B2	Reference	5	4.16	1.30	2.43	4.37	5.58
		POL-P2	Exposed	5	3.21	0.684	2.35	2.97	4.00
	2021	BOL-B2	Reference	5	2.37	0.680	1.86	2.19	3.52
		POL-P2	Exposed	5	7.46	1.27	6.61	6.84	9.62
	2022	BOL-B2	Reference	5	1.66	0.723	0.989	1.50	2.89
		POL-P2	Exposed	5	4.00	1.95	2.23	3.74	7.29
Copepod Nauplii (%)	2019	BOL-B2	Reference	5	9.71	5.20	3.63	10.5	15.1
		POL-P2	Exposed	5	50.1	12.9	38.7	44.2	70.4
	2020	BOL-B2	Reference	5	21.4	9.92	11.9	19.9	36.7
		POL-P2	Exposed	5	65.9	2.85	62.5	67.0	69.4
	2021	BOL-B2	Reference	5	13.3	5.75	5.02	14.9	19.1
		POL-P2	Exposed	5	54.4	11.3	45.7	49.3	73.0
	2022	BOL-B2	Reference	5	13.9	4.75	8.15	13.4	20.9
		POL-P2	Exposed	5	57.8	13.0	37.5	57.7	72.4
Cyclopoida (%)	2019	BOL-B2	Reference	5	14.0	4.37	6.93	15.7	18.1
		POL-P2	Exposed	5	29.9	4.15	23.4	32.3	33.2
	2020	BOL-B2	Reference	5	10.3	2.80	6.02	11.3	13.2
		POL-P2	Exposed	5	21.1	3.61	15.9	21.7	25.0
	2021	BOL-B2	Reference	5	8.18	2.55	4.79	9.60	10.6
		POL-P2	Exposed	5	23.7	10.0	7.74	25.8	33.9
	2022	BOL-B2	Reference	5	8.72	4.49	5.09	5.69	14.6
		POL-P2	Exposed	5	7.13	4.97	4.17	4.65	15.9
Rotifera (%)	2019	BOL-B2	Reference	5	65.5	6.05	58.0	63.5	74.0
		POL-P2	Exposed	5	15.4	8.37	3.61	19.8	23.6
	2020	BOL-B2	Reference	5	62.5	6.59	53.4	64.0	69.8
		POL-P2	Exposed	5	8.55	2.47	4.83	8.67	11.8
	2021	BOL-B2	Reference	5	73.6	3.59	68.2	75.8	76.2
		POL-P2	Exposed	5	12.7	3.44	8.79	11.4	16.9
	2022	BOL-B2	Reference	5	74.7	6.59	69.7	70.8	84.4
		POL-P2	Exposed	5	29.1	6.58	19.6	29.7	36.9

Notes: #/L = organisms per litre. mg/L = milligrams per litre.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022,see Appendix Table C.3.3.

Table C.3.5: Phytoplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Density (cells/L)	Richness (# of Taxa)	Simpson's Diversity	Simpson's Evenness	Chlorophyll-a (µg/L)	Diatom (cells/L)	Chlorophyte (cells/L)	Chrysophyte (cells/L)	Cryptomonad (cells/L)
2019	QUL-ZOO-7	Reference	Jun 25	-	608,882	17	0.757	0.242	1.25	309,465	84,400	58,276	156,742
			Jul 30	1	697,301	20	0.854	0.343	2.08	269,275	76,361	227,075	116,552
			Jul 30	2	803,805	24	0.903	0.427	1.78	279,322	114,542	208,989	102,485
			Jul 30	3	580,138	20	0.869	0.380	2.06	206,193	52,422	131,055	136,297
			Jul 30	4	606,873	19	0.876	0.425	0.974	241,142	32,152	202,961	112,533
			Jul 30	5	567,906	22	0.910	0.505	1.97	178,235	80,380	167,751	117,076
			Aug 29	-	1,181,593	20	0.781	0.229	0.571	380,468	75,022	484,962	109,853
	QUL-ZOO-1	Exposed	Jun 25	-	653,092	21	0.712	0.165	1.39	365,731	72,342	48,228	152,723
			Jul 30	1	711,367	19	0.853	0.359	2.21	287,360	60,285	190,904	118,561
			Jul 30	2	737,609	25	0.872	0.313	1.99	234,049	134,756	260,055	92,201
			Jul 30	3	770,707	20	0.854	0.342	1.92	212,772	47,283	319,158	122,935
			Jul 30	4	683,234	26	0.882	0.327	2.17	190,904	60,285	253,199	118,561
			Jul 30	5	787,256	20	0.863	0.364	1.90	255,326	85,109	276,603	156,033
			Aug 29	-	852,033	17	0.633	0.160	0.442	166,120	26,793	554,625	80,380
2020	QUL-ZOO-7	Reference	Jun 23	-	793,321	24	0.880	0.347	1.22	71,643	52,422	269,100	186,972
			Jul 28	1	836,903	24	0.824	0.237	1.28	134,756	108,750	198,587	340,435
			Jul 28	2	924,376	25	0.837	0.245	1.48	78,016	115,842	222,228	345,163
			Jul 28	3	801,795	20	0.797	0.246	1.63	86,409	70,333	128,609	343,627
			Jul 28	4	886,865	18	0.816	0.301	1.61	142,006	115,212	257,218	359,033
			Jul 28	5	998,573	23	0.890	0.395	1.53	120,571	170,036	389,536	247,325
			Aug 27	-	1,029,489	16	0.643	0.175	1.93	95,838	61,831	775,981	95,838
	QUL-ZOO-1	Exposed	Jun 23	-	622,075	24	0.879	0.345	1.15	92,612	43,685	260,363	145,034
			Jul 28	1	637,802	25	0.907	0.430	1.64	188,719	101,349	197,456	50,675
			Jul 28	2	998,573	23	0.890	0.395	1.47	120,571	170,036	389,536	247,325
			Jul 28	3	820,354	25	0.902	0.406	1.46	172,582	127,663	269,511	179,674
			Jul 28	4	1,619,976	21	0.857	0.334	1.64	238,050	151,486	439,001	244,233
			Jul 28	5	1,256,615	20	0.872	0.392	1.75	139,326	104,495	364,392	267,935
			Aug 27	-	1,425,208	19	0.833	0.315	1.47	207,134	132,937	544,114	108,205
2021	QUL-ZOO-7	Reference	Jun 23	-	757,184	24	0.874	0.331	1.07	91,634	62,697	181,660	73,950
			Jul 28	1	499,967	19	0.846	0.341	1.06	274,901	59,482	136,647	25,722
			Jul 28	2	699,310	25	0.907	0.431	1.11	331,570	52,247	116,552	124,590
			Jul 28	3	485,260	22	0.894	0.429	1.12	171,181	41,679	189,043	56,564
			Jul 28	4	605,150	19	0.881	0.442	1.29	186,023	37,894	126,312	25,262
			Jul 28	5	462,188	24	0.900	0.416	1.04	166,944	60,285	106,659	120,571
			Aug 29	-	629,647	28	0.905	0.377	1.34	204,970	48,228	29,473	85,739
	QUL-ZOO-1	Exposed	Jun 23	-	620,537	22	0.901	0.458	1.15	67,520	67,520	147,900	104,495
			Jul 28	1	555,674	23	0.909	0.476	0.969	225,415	85,623	192,214	41,938
			Jul 28	2	520,927	26	0.919	0.472	1.06	211,772	43,282	165,398	88,109
			Jul 28	3	527,715	23	0.922	0.555	1.10	185,225	57,664	195,709	76,886
			Jul 28	4	514,744	23	0.910	0.481	0.991	247,325	26,278	148,395	71,106
			Jul 28	5	683,234	28	0.857	0.250	1.14	95,308	47,080	143,537	41,339
			Aug 29	-	415,299	22	0.878	0.371	1.22	168,799	49,568	96,457	99,136
2022	QUL-ZOO-7	Reference	Jun 22	-	709,645	26	0.855	0.266	2.02	87,270	41,339	319,225	197,506
			Jul 27	1	1,511,153	20	0.480	0.0962	3.97	88,419	76,361	1,173,555	140,666
			Jul 27	2	1,107,853	25	0.702	0.134	2.26	139,792	41,938	698,961	213,183
			Jul 27	3	1,225,803	22	0.670	0.138	2.48	148,704	68,323	775,672	229,084
			Jul 27	4	1,278,050	21	0.746	0.188	4.24	192,913	100,476	703,329	265,256
			Jul 27	5	1,079,895	24	0.759	0.173	3.15	157,266	90,865	615,086	195,709
			Aug 28	-	436,734	29	0.897	0.335	1.09	230,424	40,190	41,530	96,457
	QUL-ZOO-1	Exposed	Jun 22	-	471,863	21	0.863	0.348	1.58	114,617	56,564	128,013	128,013
			Jul 27	1	2,065,161	18	0.585	0.134	2.76	216,409	61,831	1,415,933	296,790
			Jul 27	2	1,498,860	17	0.572	0.137	2.50	226,957	42,554	1,040,218	189,131
			Jul 28	3	1,947,681	13	0.319	0.113	3.13	117,479	68,014	1,687,990	74,197
			Jul 28	4	2,250,654	18	0.385	0.0904	5.48	123,662	49,465	1,929,132	123,662
			Jul 28	5	1,607,610	17	0.576	0.139	2.59	166,120	16,076	1,205,707	208,989
			Aug 28	-	632,996	22	0.866	0.339	1.04	383,817	78,371	72,342	58,276

Notes: "-" = only one sample (replicate) collected. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Phytoplankton data for areas QUL-18, QUL-58S, QUL-2A, QUL-120A, and QUL-ZOO-8 collected in June 2019 are not displayed. These data were presented in Minnow (2020a

Table C.3.5: Phytoplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Cyanobacteria (cells/L)	Dinoflagellates (cells/L)	Diatoms (%)	Chlorophytes (%)	Chrysophytes (%)	Cryptomonads (%)	Cyanobacteria (%)	Dinoflagellates (%)
2019	QUL-ZOO-7	Reference	Jun 25	-	0	0	50.8	13.9	9.57	25.7	0	0
			Jul 30	1	0	8,038	38.6	10.9	32.6	16.7	0	1.15
			Jul 30	2	96,457	2,010	34.8	14.2	26.0	12.8	12.0	0.250
			Jul 30	3	48,927	5,242	35.5	9.04	22.6	23.5	8.43	0.904
			Jul 30	4	0	18,086	39.7	5.30	33.4	18.5	0	2.98
			Jul 30	5	13,979	10,484	31.4	14.2	29.5	20.6	2.46	1.85
			Aug 29	-	128,609	2,679	32.2	6.35	41.0	9.30	10.9	0.227
	QUL-ZOO-1	Exposed	Jun 25	-	12,057	2,010	56.0	11.1	7.38	23.4	1.85	0.308
			Jul 30	1	42,200	12,057	40.4	8.47	26.8	16.7	5.93	1.69
			Jul 30	2	0	16,549	31.7	18.3	35.3	12.5	0	2.24
			Jul 30	3	42,554	26,005	27.6	6.13	41.4	15.9	5.52	3.37
			Jul 30	4	44,209	16,076	27.9	8.82	37.1	17.4	6.47	2.35
			Jul 30	5	7,092	7,092	32.4	10.8	35.1	19.8	0.901	0.901
			Aug 29	-	18,755	5,359	19.5	3.14	65.1	9.43	2.20	0.629
2020	QUL-ZOO-7	Reference	Jun 23	-	190,467	22,716	9.03	6.61	33.9	23.6	24.0	2.86
			Jul 28	1	54,375	0	16.1	13.0	23.7	40.7	6.50	0
			Jul 28	2	160,761	2,364	8.44	12.5	24.0	37.3	17.4	0.256
			Jul 28	3	164,780	8,038	10.8	8.77	16.0	42.9	20.6	1.00
			Jul 28	4	10,717	2,679	16.0	13.0	29.0	40.5	1.21	0.302
			Jul 28	5	58,740	12,366	12.1	17.0	39.0	24.8	5.88	1.24
			Aug 27	-	0	0	9.31	6.01	75.4	9.31	0	0
	QUL-ZOO-1	Exposed	Jun 23	-	64,654	15,727	14.9	7.02	41.9	23.3	10.4	2.53
			Jul 28	1	92,612	6,990	29.6	15.9	31.0	7.95	14.5	1.10
			Jul 28	2	58,740	12,366	12.1	17.0	39.0	24.8	5.88	1.24
			Jul 28	3	66,196	4,728	21.0	15.6	32.9	21.9	8.07	0.576
			Jul 28	4	531,748	15,458	14.7	9.35	27.1	15.1	32.8	0.954
			Jul 28	5	359,033	21,435	11.1	8.32	29.0	21.3	28.6	1.71
			Aug 27	-	432,818	0	14.5	9.33	38.2	7.59	30.4	0
2021	QUL-ZOO-7	Reference	Jun 23	-	345,636	1,608	12.1	8.28	24.0	9.77	45.6	0.212
			Jul 28	1	0	3,215	55.0	11.9	27.3	5.14	0	0.643
			Jul 28	2	72,342	2,010	47.4	7.47	16.7	17.8	10.3	0.287
			Jul 28	3	26,794	0	35.3	8.59	39.0	11.7	5.52	0
			Jul 28	4	229,659	0	30.7	6.26	20.9	4.17	38.0	0
			Jul 28	5	0	7,729	36.1	13.0	23.1	26.1	0	1.67
			Aug 29	-	255,878	5,359	32.5	7.66	4.68	13.6	40.6	0.851
	QUL-ZOO-1	Exposed	Jun 23	-	233,103	0	10.9	10.9	23.8	16.8	37.6	0
			Jul 28	1	0	10,484	40.6	15.4	34.6	7.55	0	1.89
			Jul 28	2	6,183	6,183	40.6	8.31	31.8	16.9	1.19	1.19
			Jul 28	3	0	12,232	35.1	10.9	37.1	14.6	0	2.32
			Jul 28	4	18,549	3,092	48.0	5.11	28.8	13.8	3.60	0.601
			Jul 28	5	347,933	8,038	13.9	6.89	21.0	6.05	50.9	1.18
			Aug 29	-	0	1,340	40.6	11.9	23.2	23.9	0	0.323
2022	QUL-ZOO-7	Reference	Jun 22	-	29,856	34,449	12.3	5.83	45.0	27.8	4.21	4.85
			Jul 27	1	32,152	0	5.85	5.05	77.7	9.31	2.13	0
			Jul 27	2	3,495	10,484	12.6	3.79	63.1	19.2	0.315	0.946
			Jul 27	3	4,019	0	12.1	5.57	63.3	18.7	0.328	0
			Jul 27	4	16,076	0	15.1	7.86	55.0	20.8	1.26	0
			Jul 27	5	13,979	6,990	14.6	8.41	57.0	18.1	1.29	0.647
			Aug 28	-	25,454	2,679	52.8	9.20	9.51	22.1	5.83	0.613
	QUL-ZOO-1	Exposed	Jun 22	-	43,167	1,489	24.3	12.0	27.1	27.1	9.15	0.315
			Jul 27	1	68,014	6,183	10.5	2.99	68.6	14.4	3.29	0.299
			Jul 27	2	0	0	15.1	2.84	69.4	12.6	0	0
			Jul 28	3	0	0	6.03	3.49	86.7	3.81	0	0
			Jul 28	4	18,549	6,183	5.49	2.20	85.7	5.49	0.824	0.275
			Jul 28	5	0	10,717	10.3	1.00	75.0	13.0	0	0.667
			Aug 28	-	32,152	8,038	60.6	12.4	11.4	9.21	5.08	1.27

Notes: "-" = only one sample (replicate) collected. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Phytoplankton data for areas QUL-18, QUL-58S, QUL-2A, QUL-120A, and QUL-ZOO-8 collected in June 2019 are not displayed. These data were presented in Minnow (2020a

Table C.3.6: Summary Statistics for Phytoplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (cells/L)	2019	QUL-ZOO-7	Reference	5	651,204	99,205	567,906	606,873	803,805
		QUL-ZOO-1	Exposed	5	738,035	42,440	683,234	737,609	787,256
	2020	QUL-ZOO-7	Reference	5	889,702	76,777	801,795	886,865	998,573
		QUL-ZOO-1	Exposed	5	1,066,664	384,533	637,802	998,573	1,619,976
	2021	QUL-ZOO-7	Reference	5	550,375	99,674	462,188	499,967	699,310
		QUL-ZOO-1	Exposed	5	560,459	70,394	514,744	527,715	683,234
	2022	QUL-ZOO-7	Reference	5	1,240,551	171,951	1,079,895	1,225,803	1,511,153
		QUL-ZOO-1	Exposed	5	1,873,993	314,457	1,498,860	1,947,681	2,250,654
Richness (# of Taxa)	2019	QUL-ZOO-7	Reference	5	21.0	2.00	19.0	20.0	24.0
		QUL-ZOO-1	Exposed	5	22.0	3.24	19.0	20.0	26.0
	2020	QUL-ZOO-7	Reference	5	22.0	2.92	18.0	23.0	25.0
		QUL-ZOO-1	Exposed	5	22.8	2.28	20.0	23.0	25.0
	2021	QUL-ZOO-7	Reference	5	21.8	2.77	19.0	22.0	25.0
		QUL-ZOO-1	Exposed	5	24.6	2.30	23.0	23.0	28.0
	2022	QUL-ZOO-7	Reference	5	22.4	2.07	20.0	22.0	25.0
		QUL-ZOO-1	Exposed	5	16.6	2.07	13.0	17.0	18.0
Simpson's Diversity	2019	QUL-ZOO-7	Reference	5	0.882	0.0233	0.854	0.876	0.910
		QUL-ZOO-1	Exposed	5	0.865	0.0124	0.853	0.863	0.882
	2020	QUL-ZOO-7	Reference	5	0.833	0.0352	0.797	0.824	0.890
		QUL-ZOO-1	Exposed	5	0.886	0.0207	0.857	0.890	0.907
	2021	QUL-ZOO-7	Reference	5	0.886	0.0242	0.846	0.894	0.907
		QUL-ZOO-1	Exposed	5	0.903	0.0263	0.857	0.910	0.922
	2022	QUL-ZOO-7	Reference	5	0.672	0.113	0.480	0.702	0.759
		QUL-ZOO-1	Exposed	5	0.487	0.126	0.319	0.572	0.585
Simpson's Evenness	2019	QUL-ZOO-7	Reference	5	0.416	0.0605	0.343	0.425	0.505
		QUL-ZOO-1	Exposed	5	0.341	0.0214	0.313	0.342	0.364
	2020	QUL-ZOO-7	Reference	5	0.285	0.0667	0.237	0.246	0.395
		QUL-ZOO-1	Exposed	5	0.391	0.0356	0.334	0.395	0.430
	2021	QUL-ZOO-7	Reference	5	0.412	0.0406	0.341	0.429	0.442
		QUL-ZOO-1	Exposed	5	0.447	0.115	0.250	0.476	0.555
	2022	QUL-ZOO-7	Reference	5	0.146	0.0359	0.0962	0.138	0.188
		QUL-ZOO-1	Exposed	5	0.123	0.0208	0.0904	0.134	0.139
Chlorophyll-a (µg/L)	2019	QUL-ZOO-7	Reference	5	1.77	0.462	0.974	1.97	2.08
		QUL-ZOO-1	Exposed	5	2.04	0.143	1.90	1.99	2.21
	2020	QUL-ZOO-7	Reference	5	1.51	0.140	1.28	1.53	1.63
		QUL-ZOO-1	Exposed	5	1.59	0.124	1.46	1.64	1.75
	2021	QUL-ZOO-7	Reference	5	1.12	0.0986	1.04	1.11	1.29
		QUL-ZOO-1	Exposed	5	1.05	0.0720	0.969	1.06	1.14
	2022	QUL-ZOO-7	Reference	5	3.22	0.877	2.26	3.15	4.24
		QUL-ZOO-1	Exposed	5	3.29	1.25	2.50	2.76	5.48
Diatom (cells/L)	2019	QUL-ZOO-7	Reference	5	234,833	42,511	178,235	241,142	279,322
		QUL-ZOO-1	Exposed	5	236,082	37,378	190,904	234,049	287,360
	2020	QUL-ZOO-7	Reference	5	112,351	28,726	78,016	120,571	142,006
		QUL-ZOO-1	Exposed	5	171,850	45,703	120,571	172,582	238,050
	2021	QUL-ZOO-7	Reference	5	226,124	73,531	166,944	186,023	331,570
		QUL-ZOO-1	Exposed	5	193,009	59,073	95,308	211,772	247,325
	2022	QUL-ZOO-7	Reference	5	145,419	37,708	88,419	148,704	192,913
		QUL-ZOO-1	Exposed	5	170,125	50,790	117,479	166,120	226,957
Chlorophyte (cells/L)	2019	QUL-ZOO-7	Reference	5	71,172	31,092	32,152	76,361	114,542
		QUL-ZOO-1	Exposed	5	77,544	34,792	47,283	60,285	134,756
	2020	QUL-ZOO-7	Reference	5	116,035	35,562	70,333	115,212	170,036
		QUL-ZOO-1	Exposed	5	131,006	29,733	101,349	127,663	170,036
	2021	QUL-ZOO-7	Reference	5	50,317	10,199	37,894	52,247	60,285
		QUL-ZOO-1	Exposed	5	51,985	21,934	26,278	47,080	85,623
	2022	QUL-ZOO-7	Reference	5	75,593	22,575	41,938	76,361	100,476
		QUL-ZOO-1	Exposed	5	47,588	20,261	16,076	49,465	68,014
Chrysophyte (cells/L)	2019	QUL-ZOO-7	Reference	5	187,566	38,220	131,055	202,961	227,075
		QUL-ZOO-1	Exposed	5	259,984	46,357	190,904	260,055	319,158
	2020	QUL-ZOO-7	Reference	5	239,236	96,298	128,609	222,228	389,536
		QUL-ZOO-1	Exposed	5	331,979	97,231	197,456	364,392	439,001
	2021	QUL-ZOO-7	Reference	5	135,043	32,181	106,659	126,312	189,043
		QUL-ZOO-1	Exposed	5	169,051	24,177	143,537	165,398	195,709
	2022	QUL-ZOO-7	Reference	5	793,321	220,034	615,086	703,329	1,173,555
		QUL-ZOO-1	Exposed	5	1,455,796	358,748	1,040,218	1,415,933	1,929,132
Cryptomonad (cells/L)	2019	QUL-ZOO-7	Reference	5	116,989	12,280	102,485	116,552	136,297
		QUL-ZOO-1	Exposed	5	121,658	22,749	92,201	118,561	156,033
	2020	QUL-ZOO-7	Reference	5	327,117	45,169	247,325	343,627	359,033
		QUL-ZOO-1	Exposed	5	197,968	88,744	50,675	244,233	267,935
	2021	QUL-ZOO-7	Reference	5	70,542	49,190	25,262	56,564	124,590
		QUL-ZOO-1	Exposed	5	63,875	21,201	41,339	71,106	88,109
	2022	QUL-ZOO-7	Reference	5	208,780	45,912	140,666	213,183	265,256
		QUL-ZOO-1	Exposed	5	178,554	85,031	74,197	189,131	296,790
Cyanobacteria (cells/L)	2019	QUL-ZOO-7	Reference	5	31,873	41,273	0	13,979	96,457
		QUL-ZOO-1	Exposed	5	27,211	21,761	0	42,200	44,209
	2020	QUL-ZOO-7	Reference	5	89,875	69,158	10,717	58,740	164,780
		QUL-ZOO-1	Exposed	5	221,666	213,536	58,740	92,612	531,748
	2021	QUL-ZOO-7	Reference	5	65,759	96,272	0	26,794	229,659
		QUL-ZOO-1	Exposed	5	74,533	153,023	0	6,183	347,933
	2022	QUL-ZOO-7	Reference	5	13,944	11,660	3,495	13,979	32,152
		QUL-ZOO-1	Exposed	5	17,313	29,459	0	0	68,014
Dinoflagellates (cells/L)	2019	QUL-ZOO-7	Reference	5	8,772	6,091	2,010	8,038	18,086
		QUL-ZOO-1	Exposed	5	15,556	6,970	7,092	16,076	26,005
	2020	QUL-ZOO-7	Reference	5	5,090	5,020	0	2,679	12,366
		QUL-ZOO-1	Exposed	5	12,195	6,688	4,728	12,366	21,435
	2021	QUL-ZOO-7	Reference	5	2,591	3,184	0	2,010	7,729
		QUL-ZOO-1	Exposed	5	8,006	3,587	3,092	8,038	12,232
	2022	QUL-ZOO-7	Reference	5	3,495	4,942	0	0	10,484
		QUL-ZOO-1	Exposed	5	4,617	4,603	0	6,183	10,717
Euglenophytes (cells/L)	2019	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2020	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2021	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2022	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0

Notes: Cell/L = cells per litre. µg/L = micrograms per litre. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.5.

Table C.3.6: Summary Statistics for Phytoplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Diatoms (%)	2019	QUL-ZOO-7	Reference	5	36.0	3.31	31.4	35.5	39.7
		QUL-ZOO-1	Exposed	5	32.0	5.16	27.6	31.7	40.4
	2020	QUL-ZOO-7	Reference	5	12.7	3.35	8.44	12.1	16.1
		QUL-ZOO-1	Exposed	5	17.7	7.70	11.1	14.7	29.6
	2021	QUL-ZOO-7	Reference	5	40.9	9.98	30.7	36.1	55.0
		QUL-ZOO-1	Exposed	5	35.7	13.0	13.9	40.6	48.0
	2022	QUL-ZOO-7	Reference	5	12.1	3.69	5.85	12.6	15.1
		QUL-ZOO-1	Exposed	5	9.50	3.92	5.49	10.3	15.1
Chlorophytes (%)	2019	QUL-ZOO-7	Reference	5	10.7	3.76	5.30	10.9	14.2
		QUL-ZOO-1	Exposed	5	10.5	4.65	6.13	8.82	18.3
	2020	QUL-ZOO-7	Reference	5	12.9	2.93	8.77	13.0	17.0
		QUL-ZOO-1	Exposed	5	13.2	4.07	8.32	15.6	17.0
	2021	QUL-ZOO-7	Reference	5	9.45	2.90	6.26	8.59	13.0
		QUL-ZOO-1	Exposed	5	9.33	4.01	5.11	8.31	15.4
	2022	QUL-ZOO-7	Reference	5	6.14	1.95	3.79	5.57	8.41
		QUL-ZOO-1	Exposed	5	2.50	0.960	1.00	2.84	3.49
Chrysophytes (%)	2019	QUL-ZOO-7	Reference	5	28.8	4.55	22.6	29.5	33.4
		QUL-ZOO-1	Exposed	5	35.1	5.29	26.8	35.3	41.4
	2020	QUL-ZOO-7	Reference	5	26.4	8.45	16.0	24.0	39.0
		QUL-ZOO-1	Exposed	5	31.8	4.58	27.1	31.0	39.0
	2021	QUL-ZOO-7	Reference	5	25.4	8.51	16.7	23.1	39.0
		QUL-ZOO-1	Exposed	5	30.6	6.21	21.0	31.8	37.1
	2022	QUL-ZOO-7	Reference	5	63.2	8.87	55.0	63.1	77.7
		QUL-ZOO-1	Exposed	5	77.1	8.69	68.6	75.0	86.7
Cryptomonads (%)	2019	QUL-ZOO-7	Reference	5	18.4	4.05	12.8	18.5	23.5
		QUL-ZOO-1	Exposed	5	16.5	2.65	12.5	16.7	19.8
	2020	QUL-ZOO-7	Reference	5	37.2	7.24	24.8	40.5	42.9
		QUL-ZOO-1	Exposed	5	18.2	6.74	7.95	21.3	24.8
	2021	QUL-ZOO-7	Reference	5	13.0	9.16	4.17	11.7	26.1
		QUL-ZOO-1	Exposed	5	11.8	4.72	6.05	13.8	16.9
	2022	QUL-ZOO-7	Reference	5	17.2	4.53	9.31	18.7	20.8
		QUL-ZOO-1	Exposed	5	9.86	4.83	3.81	12.6	14.4
Cyanobacteria (%)	2019	QUL-ZOO-7	Reference	5	4.58	5.39	0	2.46	12.0
		QUL-ZOO-1	Exposed	5	3.77	3.06	0	5.52	6.47
	2020	QUL-ZOO-7	Reference	5	10.3	8.25	1.21	6.50	20.6
		QUL-ZOO-1	Exposed	5	18.0	12.1	5.88	14.5	32.8
	2021	QUL-ZOO-7	Reference	5	10.8	15.8	0	5.52	38.0
		QUL-ZOO-1	Exposed	5	11.1	22.3	0	1.19	50.9
	2022	QUL-ZOO-7	Reference	5	1.06	0.762	0.315	1.26	2.13
		QUL-ZOO-1	Exposed	5	0.824	1.43	0	0	3.29
Dinoflagellates (%)	2019	QUL-ZOO-7	Reference	5	1.43	1.04	0.250	1.15	2.98
		QUL-ZOO-1	Exposed	5	2.11	0.910	0.901	2.24	3.37
	2020	QUL-ZOO-7	Reference	5	0.560	0.531	0	0.302	1.24
		QUL-ZOO-1	Exposed	5	1.11	0.412	0.576	1.10	1.71
	2021	QUL-ZOO-7	Reference	5	0.521	0.696	0	0.287	1.67
		QUL-ZOO-1	Exposed	5	1.43	0.672	0.601	1.19	2.32
	2022	QUL-ZOO-7	Reference	5	0.319	0.449	0	0	0.946
		QUL-ZOO-1	Exposed	5	0.248	0.275	0	0.275	0.667
Euglenophytes (%)	2019	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2020	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2021	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0
	2022	QUL-ZOO-7	Reference	5	0	0	0	0	0
		QUL-ZOO-1	Exposed	5	0	0	0	0	0

Notes: Cell/L = cells per litre. µg/L = micrograms per litre. Displayed data were collected using depth-integrated (DI) sampling methods. Sampling methods employed in 2019 included both surface (S) and DI methods. See Minnow (2019a, 2020a) for results of surface phytoplankton sampling completed in 2018 and 2019. See Minnow 2020a for a comparison of results from the S and DI sampling methodologies, and for rationale regarding the selection of DI methods for ongoing phytoplankton monitoring.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.5.

Table C.3.7: Zooplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Density (organisms/L)	Richness (# of Taxa)	Simpson's Diversity	Simpson's Evenness	Wet Weight Biomass (mg/L)	Dry Weight Biomass (mg/L)	Calanoida (#/L)	Cladocera (#/L)
2019	QUL-ZOO-7	Reference	Jun 25	1	7.60	10	0.760	0.417	0.0767	0.0153	0.821	0.297
			Jul 30	1	3.47	10	0.802	0.504	0.0269	0.00532	0.274	0.205
			Jul 30	2	2.86	8	0.766	0.534	0.0214	0.00424	0.169	0.146
			Jul 30	3	3.65	9	0.743	0.432	0.0277	0.00548	0.292	0.178
			Jul 30	4	2.70	9	0.747	0.440	0.0195	0.00387	0.132	0.183
			Jul 30	5	3.35	10	0.738	0.382	0.0243	0.00481	0.224	0.187
			Aug 29	1	1.47	10	0.804	0.511	0.0110	0.00219	0.123	0.0844
	QUL-ZOO-1	Exposed	Jun 25	1	5.90	7	0.743	0.555	0.0520	0.0104	0.513	0.0799
			Jul 30	1	2.87	10	0.730	0.370	0.0154	0.00305	0.180	0.116
			Jul 30	2	3.08	10	0.717	0.353	0.0142	0.00277	0.155	0.116
			Jul 30	3	3.67	10	0.788	0.471	0.0253	0.00501	0.292	0.173
			Jul 30	4	4.17	11	0.751	0.365	0.0238	0.00470	0.292	0.164
			Jul 30	5	2.56	10	0.812	0.531	0.0200	0.00396	0.196	0.151
			Aug 29	1	1.26	9	0.811	0.589	0.00632	0.00125	0.0426	0.0700
2020	QUL-ZOO-7	Reference	Jun 23	-	8.72	8	0.761	0.524	0.107	0.0214	1.89	0.123
			Jul 28	1	9.87	11	0.730	0.337	0.0492	0.00955	0.616	0.189
			Jul 28	2	11.3	12	0.720	0.298	0.0268	0.00500	0.296	0.0641
			Jul 28	3	7.79	10	0.708	0.342	0.0301	0.00578	0.409	0.0986
			Jul 28	4	11.4	11	0.681	0.285	0.0368	0.00698	0.414	0.246
			Jul 28	5	25.0	9	0.578	0.264	0.0442	0.00784	0.419	0.279
			Aug 27	-	7.69	13	0.817	0.421	0.153	0.0306	1.43	2.91
	QUL-ZOO-1	Exposed	Jun 23	-	10.9	11	0.771	0.397	0.164	0.0327	3.48	0.0657
			Jul 28	1	13.2	11	0.811	0.480	0.0532	0.0104	0.634	0.176
			Jul 28	2	6.35	12	0.814	0.447	0.0317	0.00619	0.401	0.232
			Jul 28	3	11.8	12	0.758	0.344	0.0346	0.00655	0.511	0.166
			Jul 28	4	7.23	12	0.771	0.363	0.0313	0.00605	0.527	0.133
			Jul 28	5	16.1	11	0.760	0.378	0.0379	0.00705	0.468	0.242
			Aug 27	-	5.36	10	0.770	0.434	0.0284	0.00554	0.246	0.240
2021	QUL-ZOO-7	Reference	Jun 23	-	18.1	12	0.814	0.447	0.177	0.0352	4.23	0.534
			Jul 28	1	9.59	11	0.798	0.450	0.0324	0.00604	0.442	0.524
			Jul 28	2	8.28	13	0.735	0.290	0.0259	0.00479	0.370	0.518
			Jul 28	3	7.22	13	0.679	0.240	0.0187	0.00342	0.178	0.308
			Jul 28	4	9.36	14	0.704	0.241	0.0228	0.00406	0.288	0.364
			Jul 28	5	6.88	12	0.720	0.298	0.0133	0.00232	0.181	0.195
			Aug 29	-	3.23	16	0.804	0.319	0.00535	0.000975	0.109	0.198
	QUL-ZOO-1	Exposed	Jun 23	-	14.7	10	0.797	0.493	0.0658	0.0129	1.36	0.151
			Jul 28	1	11.2	14	0.726	0.261	0.0249	0.00458	0.271	0.592
			Jul 28	2	5.10	13	0.722	0.277	0.0117	0.00213	0.0904	0.152
			Jul 28	3	6.28	14	0.805	0.366	0.0145	0.00265	0.146	0.178
			Jul 28	4	10.1	11	0.796	0.446	0.0233	0.00421	0.263	0.435
			Jul 28	5	6.54	11	0.732	0.339	0.0152	0.00279	0.160	0.177
			Aug 29	-	4.43	12	0.781	0.381	0.00873	0.00162	0.108	0.210
2022	QUL-ZOO-7	Reference	Jun 22	1	5.46	9	0.817	0.607	0.0510	0.00992	0.772	0.0154
			Jul 27	1	5.29	11	0.797	0.449	0.0226	0.00418	0.154	0.0803
			Jul 27	2	11.9	11	0.479	0.175	0.0360	0.00503	0.0782	0.0761
			Jul 27	3	3.10	9	0.725	0.404	0.0135	0.00234	0.0759	0.0537
			Jul 27	4	4.03	9	0.817	0.608	0.0212	0.00403	0.163	0.163
			Jul 27	5	5.53	10	0.774	0.442	0.0203	0.00350	0.102	0.157
			Aug 28	1	2.31	11	0.793	0.439	0.0127	0.00246	0.0597	0.144
	QUL-ZOO-1	Exposed	Jun 22	-	2.88	10	0.828	0.581	0.0261	0.00508	0.384	0.0340
			Jul 27	1	6.77	9	0.811	0.587	0.0254	0.00458	0.133	0.136
			Jul 27	2	7.76	10	0.805	0.514	0.0287	0.00518	0.163	0.153
			Jul 28	3	11.7	12	0.774	0.368	0.0352	0.00585	0.139	0.139
			Jul 28	4	3.72	10	0.823	0.564	0.0196	0.00369	0.0988	0.121
			Jul 28	5	4.65	11	0.813	0.485	0.0191	0.00347	0.0926	0.0895
			Aug 28	-	3.65	12	0.799	0.415	0.0205	0.00401	0.0833	0.262

Notes: "-" = only one sample (replicate) collected. Organisms/L = number of organisms per litre. mg/L = milligrams per litre.

[a] Zooplankton data for area QUL-ZOO-8 collected in June 2019 are not displayed. These data were presented in Minnow (2020a)

Table C.3.7: Zooplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2019 to 2022[a]

Year	Area	Type	Date	Replicate	Copepod Nauplii (#/L)	Cyclopoida (#/L)	Rotifera (#/L)	Calanoida (%)	Cladocera (%)	Copepod Nauplii (%)	Cyclopoida (%)	Rotifera (%)
2019	QUL-ZOO-7	Reference	Jun 25	1	0.662	2.56	3.26	10.8	3.90	8.71	33.6	42.9
			Jul 30	1	0.205	0.712	2.08	7.88	5.91	5.91	20.5	59.8
			Jul 30	2	0.0913	0.689	1.76	5.90	5.11	3.19	24.1	61.7
			Jul 30	3	0.0913	0.808	2.28	8.00	4.88	2.50	22.1	62.5
			Jul 30	4	0.0913	0.589	1.70	4.90	6.76	3.38	21.8	63.1
			Jul 30	5	0.0685	0.698	2.17	6.68	5.59	2.05	20.9	64.8
			Aug 29	1	0.0761	0.317	0.867	8.39	5.75	5.18	21.6	59.1
	QUL-ZOO-1	Exposed	Jun 25	1	1.25	2.02	2.03	8.70	1.35	21.3	34.2	34.4
			Jul 30	1	0.297	0.383	1.89	6.26	4.03	10.3	13.4	66.0
			Jul 30	2	0.205	0.347	2.26	5.03	3.75	6.66	11.2	73.3
			Jul 30	3	0.434	0.648	2.12	7.96	4.73	11.8	17.7	57.8
			Jul 30	4	0.297	0.584	2.83	7.01	3.94	7.12	14.0	67.9
			Jul 30	5	0.319	0.539	1.35	7.67	5.89	12.5	21.1	52.9
			Aug 29	1	0.167	0.186	0.791	3.39	5.57	13.3	14.8	63.0
2020	QUL-ZOO-7	Reference	Jun 23	-	2.03	3.12	1.56	21.7	1.41	23.2	35.8	17.9
			Jul 28	1	1.28	1.47	6.31	6.24	1.92	13.0	14.9	64.0
			Jul 28	2	1.48	0.838	8.67	2.61	0.564	13.0	7.38	76.4
			Jul 28	3	0.789	0.877	5.62	5.25	1.27	10.1	11.3	72.1
			Jul 28	4	1.28	1.30	8.13	3.64	2.17	11.3	11.4	71.5
			Jul 28	5	1.15	1.15	22.0	1.67	1.12	4.60	4.60	88.0
			Aug 27	-	0.715	0.690	1.95	18.6	37.8	9.29	8.97	25.3
	QUL-ZOO-1	Exposed	Jun 23	-	0.712	3.15	3.45	32.1	0.605	6.55	29.0	31.8
			Jul 28	1	3.37	1.75	7.31	4.79	1.33	25.4	13.2	55.2
			Jul 28	2	0.986	0.838	3.89	6.32	3.66	15.5	13.2	61.3
			Jul 28	3	1.28	0.622	9.22	4.33	1.41	10.9	5.27	78.1
			Jul 28	4	0.542	0.606	5.42	7.29	1.84	7.50	8.38	75.0
			Jul 28	5	1.87	0.818	12.7	2.91	1.50	11.6	5.08	78.9
			Aug 27	-	0.912	0.758	3.20	4.60	4.48	17.0	14.1	59.8
2021	QUL-ZOO-7	Reference	Jun 23	-	6.00	3.90	3.45	23.4	2.95	33.1	21.5	19.1
			Jul 28	1	1.44	1.27	5.91	4.61	5.46	15.0	13.3	61.7
			Jul 28	2	0.575	0.986	5.83	4.47	6.25	6.94	11.9	70.4
			Jul 28	3	0.329	0.904	5.50	2.47	4.27	4.55	12.5	76.2
			Jul 28	4	0.780	0.786	7.15	3.07	3.88	8.33	8.40	76.3
			Jul 28	5	0.575	0.387	5.54	2.64	2.83	8.35	5.62	80.6
			Aug 29	-	0.460	0.391	2.07	3.38	6.13	14.2	12.1	64.1
	QUL-ZOO-1	Exposed	Jun 23	-	7.31	1.71	4.19	9.21	1.02	49.7	11.6	28.5
			Jul 28	1	1.38	1.09	7.82	2.43	5.30	12.4	9.79	70.1
			Jul 28	2	0.493	0.587	3.78	1.77	2.98	9.66	11.5	74.1
			Jul 28	3	0.986	0.662	4.31	2.32	2.83	15.7	10.5	68.6
			Jul 28	4	1.81	0.986	6.61	2.60	4.31	17.9	9.76	65.5
			Jul 28	5	0.945	0.698	4.56	2.45	2.70	14.4	10.7	69.7
			Aug 29	-	0.986	0.682	2.44	2.44	4.73	22.3	15.4	55.2
2022	QUL-ZOO-7	Reference	Jun 22	1	1.34	1.31	2.02	14.1	0.282	24.6	24.0	37.0
			Jul 27	1	1.42	0.549	3.09	2.92	1.52	26.8	10.4	58.3
			Jul 27	2	0.648	0.434	10.7	0.654	0.637	5.43	3.63	89.7
			Jul 27	3	0.574	0.289	2.11	2.45	1.73	18.5	9.31	68.0
			Jul 27	4	0.722	0.496	2.48	4.05	4.05	17.9	12.3	61.6
			Jul 27	5	0.741	0.423	4.11	1.84	2.84	13.4	7.64	74.3
			Aug 28	1	0.545	0.296	1.27	2.58	6.24	23.6	12.8	54.8
	QUL-ZOO-1	Exposed	Jun 22	-	0.815	0.676	0.973	13.3	1.18	28.3	23.4	33.8
			Jul 27	1	1.39	0.602	4.51	1.96	2.01	20.5	8.90	66.6
			Jul 27	2	2.07	0.689	4.69	2.10	1.97	26.7	8.88	60.4
			Jul 28	3	1.54	0.692	9.18	1.19	1.19	13.2	5.92	78.5
			Jul 28	4	0.633	0.509	2.36	2.65	3.24	17.0	13.7	63.4
			Jul 28	5	0.895	0.460	3.12	1.99	1.92	19.2	9.88	67.0
			Aug 28	-	0.772	0.407	2.13	2.28	7.18	21.1	11.2	58.3

Note: "-" = only one sample (replicate) collected. Cells/L = cells per litre. mg/l = milligrams per litre.

[a] Zooplankton data for area QUL-ZOO-8 collected in June 2019 are not displayed. These data were presented in Minnow (2020a)

Table C.3.8: Summary Statistics for Zooplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/L)	2019	QUL-ZOO-7	Reference	5	3.21	0.408	2.70	3.35	3.65
		QUL-ZOO-1	Exposed	5	3.27	0.645	2.56	3.08	4.17
	2020	QUL-ZOO-7	Reference	5	13.1	6.83	7.79	11.3	25.0
		QUL-ZOO-1	Exposed	5	10.9	4.11	6.35	11.8	16.1
	2021	QUL-ZOO-7	Reference	5	8.27	1.22	6.88	8.28	9.59
		QUL-ZOO-1	Exposed	5	7.84	2.63	5.10	6.54	11.2
	2022	QUL-ZOO-7	Reference	5	5.98	3.48	3.10	5.29	11.9
		QUL-ZOO-1	Exposed	5	6.92	3.12	3.72	6.77	11.7
Richness (# of Taxa)	2019	QUL-ZOO-7	Reference	5	9.20	0.837	8	9	10
		QUL-ZOO-1	Exposed	5	10.2	0.447	10	10	11
	2020	QUL-ZOO-7	Reference	5	10.6	1.14	9	11	12
		QUL-ZOO-1	Exposed	5	11.6	0.548	11	12	12
	2021	QUL-ZOO-7	Reference	5	12.6	1.14	11	13	14
		QUL-ZOO-1	Exposed	5	12.6	1.52	11	13	14
	2022	QUL-ZOO-7	Reference	5	10.0	1.00	9	10	11
		QUL-ZOO-1	Exposed	5	10.4	1.14	9	10	12
Simpson's Diversity	2019	QUL-ZOO-7	Reference	5	0.759	0.0259	0.738	0.747	0.802
		QUL-ZOO-1	Exposed	5	0.759	0.0395	0.717	0.751	0.812
	2020	QUL-ZOO-7	Reference	5	0.684	0.0616	0.578	0.708	0.730
		QUL-ZOO-1	Exposed	5	0.782	0.0275	0.758	0.771	0.814
	2021	QUL-ZOO-7	Reference	5	0.727	0.0445	0.679	0.720	0.798
		QUL-ZOO-1	Exposed	5	0.756	0.0407	0.722	0.732	0.805
	2022	QUL-ZOO-7	Reference	5	0.719	0.138	0.479	0.774	0.817
		QUL-ZOO-1	Exposed	5	0.805	0.0186	0.774	0.811	0.823
Simpson's Evenness	2019	QUL-ZOO-7	Reference	5	0.459	0.0606	0.382	0.440	0.534
		QUL-ZOO-1	Exposed	5	0.418	0.0787	0.353	0.370	0.531
	2020	QUL-ZOO-7	Reference	5	0.305	0.0338	0.264	0.298	0.342
		QUL-ZOO-1	Exposed	5	0.403	0.0582	0.344	0.378	0.480
	2021	QUL-ZOO-7	Reference	5	0.304	0.0860	0.240	0.290	0.450
		QUL-ZOO-1	Exposed	5	0.338	0.0744	0.261	0.339	0.446
	2022	QUL-ZOO-7	Reference	5	0.416	0.156	0.175	0.442	0.608
		QUL-ZOO-1	Exposed	5	0.504	0.0857	0.368	0.514	0.587
Wet Weight Biomass (mg/L)	2019	QUL-ZOO-7	Reference	5	0.0240	0.00348	0.0195	0.0243	0.0277
		QUL-ZOO-1	Exposed	5	0.0197	0.00491	0.0142	0.0200	0.0253
	2020	QUL-ZOO-7	Reference	5	0.0374	0.00938	0.0268	0.0368	0.0492
		QUL-ZOO-1	Exposed	5	0.0377	0.00904	0.0313	0.0346	0.0532
	2021	QUL-ZOO-7	Reference	5	0.0226	0.00720	0.0133	0.0228	0.0324
		QUL-ZOO-1	Exposed	5	0.0180	0.00583	0.0117	0.0152	0.0249
	2022	QUL-ZOO-7	Reference	5	0.0227	0.00821	0.0135	0.0212	0.0360
		QUL-ZOO-1	Exposed	5	0.0256	0.00670	0.0191	0.0254	0.0352
Dry Weight Biomass (mg/L)	2019	QUL-ZOO-7	Reference	5	0.00474	0.000690	0.00387	0.00481	0.00548
		QUL-ZOO-1	Exposed	5	0.00390	0.000983	0.00277	0.00396	0.00501
	2020	QUL-ZOO-7	Reference	5	0.00703	0.00178	0.00500	0.00698	0.00955
		QUL-ZOO-1	Exposed	5	0.00724	0.00179	0.00605	0.00655	0.0104
	2021	QUL-ZOO-7	Reference	5	0.00412	0.00140	0.00232	0.00406	0.00604
		QUL-ZOO-1	Exposed	5	0.00327	0.00106	0.00213	0.00279	0.00458
	2022	QUL-ZOO-7	Reference	5	0.00382	0.000989	0.00234	0.00403	0.00503
		QUL-ZOO-1	Exposed	5	0.00455	0.00100	0.00347	0.00458	0.00585
Calanoida (#/L)	2019	QUL-ZOO-7	Reference	5	0.218	0.0678	0.132	0.224	0.292
		QUL-ZOO-1	Exposed	5	0.223	0.0647	0.155	0.196	0.292
	2020	QUL-ZOO-7	Reference	5	0.431	0.116	0.296	0.414	0.616
		QUL-ZOO-1	Exposed	5	0.508	0.0854	0.401	0.511	0.634
	2021	QUL-ZOO-7	Reference	5	0.292	0.116	0.178	0.288	0.442
		QUL-ZOO-1	Exposed	5	0.186	0.0784	0.0904	0.160	0.271
	2022	QUL-ZOO-7	Reference	5	0.115	0.0415	0.0759	0.102	0.163
		QUL-ZOO-1	Exposed	5	0.125	0.0293	0.0926	0.133	0.163
Cladocera (#/L)	2019	QUL-ZOO-7	Reference	5	0.180	0.0216	0.146	0.183	0.205
		QUL-ZOO-1	Exposed	5	0.144	0.0271	0.116	0.151	0.173
	2020	QUL-ZOO-7	Reference	5	0.175	0.0926	0.0641	0.189	0.279
		QUL-ZOO-1	Exposed	5	0.190	0.0459	0.133	0.176	0.242
	2021	QUL-ZOO-7	Reference	5	0.382	0.141	0.195	0.364	0.524
		QUL-ZOO-1	Exposed	5	0.307	0.197	0.152	0.178	0.592
	2022	QUL-ZOO-7	Reference	5	0.106	0.0504	0.0537	0.0803	0.163
		QUL-ZOO-1	Exposed	5	0.128	0.0241	0.0895	0.136	0.153
Copepod Nauplii (#/L)	2019	QUL-ZOO-7	Reference	5	0.110	0.0545	0.0685	0.0913	0.205
		QUL-ZOO-1	Exposed	5	0.310	0.0816	0.205	0.297	0.434
	2020	QUL-ZOO-7	Reference	5	1.20	0.256	0.789	1.28	1.48
		QUL-ZOO-1	Exposed	5	1.61	1.10	0.542	1.28	3.37
	2021	QUL-ZOO-7	Reference	5	0.739	0.422	0.329	0.575	1.44
		QUL-ZOO-1	Exposed	5	1.12	0.495	0.493	0.986	1.81
	2022	QUL-ZOO-7	Reference	5	0.821	0.341	0.574	0.722	1.42
		QUL-ZOO-1	Exposed	5	1.31	0.564	0.633	1.39	2.07
Cyclopoida (#/L)	2019	QUL-ZOO-7	Reference	5	0.699	0.0779	0.589	0.698	0.808
		QUL-ZOO-1	Exposed	5	0.500	0.130	0.347	0.539	0.648
	2020	QUL-ZOO-7	Reference	5	1.13	0.271	0.838	1.15	1.47
		QUL-ZOO-1	Exposed	5	0.927	0.472	0.606	0.818	1.75
	2021	QUL-ZOO-7	Reference	5	0.867	0.323	0.387	0.904	1.27
		QUL-ZOO-1	Exposed	5	0.805	0.221	0.587	0.698	1.09
	2022	QUL-ZOO-7	Reference	5	0.438	0.0978	0.289	0.434	0.549
		QUL-ZOO-1	Exposed	5	0.590	0.105	0.460	0.602	0.692
Rotifera (#/L)	2019	QUL-ZOO-7	Reference	5	2.00	0.253	1.70	2.08	2.28
		QUL-ZOO-1	Exposed	5	2.09	0.538	1.35	2.12	2.83
	2020	QUL-ZOO-7	Reference	5	10.2	6.75	5.62	8.13	22.0
		QUL-ZOO-1	Exposed	5	7.71	3.44	3.89	7.31	12.7
	2021	QUL-ZOO-7	Reference	5	5.99	0.671	5.50	5.83	7.15
		QUL-ZOO-1	Exposed	5	5.42	1.72	3.78	4.56	7.82
	2022	QUL-ZOO-7	Reference	5	4.50	3.55	2.11	3.09	10.7
		QUL-ZOO-1	Exposed	5	4.77	2.65	2.36	4.51	9.18

Notes: #/L = organisms per litre. mg/L = milligrams per litre.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.7.

Table C.3.8: Summary Statistics for Zooplankton Community Metrics for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022[a]

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Calanoida (%)	2019	QUL-ZOO-7	Reference	5	6.68	1.32	4.90	6.68	8.00
		QUL-ZOO-1	Exposed	5	6.79	1.18	5.03	7.01	7.96
	2020	QUL-ZOO-7	Reference	5	3.88	1.87	1.67	3.64	6.24
		QUL-ZOO-1	Exposed	5	5.13	1.72	2.91	4.79	7.29
	2021	QUL-ZOO-7	Reference	5	3.45	1.02	2.47	3.07	4.61
		QUL-ZOO-1	Exposed	5	2.32	0.320	1.77	2.43	2.60
	2022	QUL-ZOO-7	Reference	5	2.38	1.26	0.654	2.45	4.05
		QUL-ZOO-1	Exposed	5	1.98	0.523	1.19	1.99	2.65
Cladocera (%)	2019	QUL-ZOO-7	Reference	5	5.65	0.743	4.88	5.59	6.76
		QUL-ZOO-1	Exposed	5	4.47	0.874	3.75	4.03	5.89
	2020	QUL-ZOO-7	Reference	5	1.41	0.642	0.564	1.27	2.17
		QUL-ZOO-1	Exposed	5	1.95	0.976	1.33	1.50	3.66
	2021	QUL-ZOO-7	Reference	5	4.54	1.34	2.83	4.27	6.25
		QUL-ZOO-1	Exposed	5	3.62	1.14	2.70	2.98	5.30
	2022	QUL-ZOO-7	Reference	5	2.16	1.32	0.637	1.73	4.05
		QUL-ZOO-1	Exposed	5	2.06	0.738	1.19	1.97	3.24
Copepod Nauplii (%)	2019	QUL-ZOO-7	Reference	5	3.41	1.50	2.05	3.19	5.91
		QUL-ZOO-1	Exposed	5	9.68	2.67	6.66	10.3	12.5
	2020	QUL-ZOO-7	Reference	5	10.4	3.47	4.60	11.3	13.0
		QUL-ZOO-1	Exposed	5	14.2	6.91	7.50	11.6	25.4
	2021	QUL-ZOO-7	Reference	5	8.63	3.88	4.55	8.33	15.0
		QUL-ZOO-1	Exposed	5	14.0	3.15	9.66	14.4	17.9
	2022	QUL-ZOO-7	Reference	5	16.4	7.83	5.43	17.9	26.8
		QUL-ZOO-1	Exposed	5	19.3	4.96	13.2	19.2	26.7
Cyclopoida (%)	2019	QUL-ZOO-7	Reference	5	21.9	1.40	20.5	21.8	24.1
		QUL-ZOO-1	Exposed	5	15.5	3.88	11.2	14.0	21.1
	2020	QUL-ZOO-7	Reference	5	9.92	3.99	4.60	11.3	14.9
		QUL-ZOO-1	Exposed	5	9.03	4.03	5.08	8.38	13.2
	2021	QUL-ZOO-7	Reference	5	10.3	3.23	5.62	11.9	13.3
		QUL-ZOO-1	Exposed	5	10.4	0.725	9.76	10.5	11.5
	2022	QUL-ZOO-7	Reference	5	8.66	3.28	3.63	9.31	12.3
		QUL-ZOO-1	Exposed	5	9.45	2.79	5.92	8.90	13.7
Rotifera (%)	2019	QUL-ZOO-7	Reference	5	62.4	1.85	59.8	62.5	64.8
		QUL-ZOO-1	Exposed	5	63.6	8.15	52.9	66.0	73.3
	2020	QUL-ZOO-7	Reference	5	74.4	8.84	64.0	72.1	88.0
		QUL-ZOO-1	Exposed	5	69.7	10.8	55.2	75.0	78.9
	2021	QUL-ZOO-7	Reference	5	73.0	7.30	61.7	76.2	80.6
		QUL-ZOO-1	Exposed	5	69.6	3.10	65.5	69.7	74.1
	2022	QUL-ZOO-7	Reference	5	70.4	12.4	58.3	68.0	89.7
		QUL-ZOO-1	Exposed	5	67.2	6.88	60.4	66.6	78.5

Notes: #/L = organisms per litre. mg/L = milligrams per litre.

[a] Summary statistics are displayed for replicated data collected in July 2019 to 2022. For results without replicates collected in June and August 2019 to 2022, see Appendix Table C.3.7.

APPENDIX C.4
ZOOPLANKTON TISSUE QUALITY

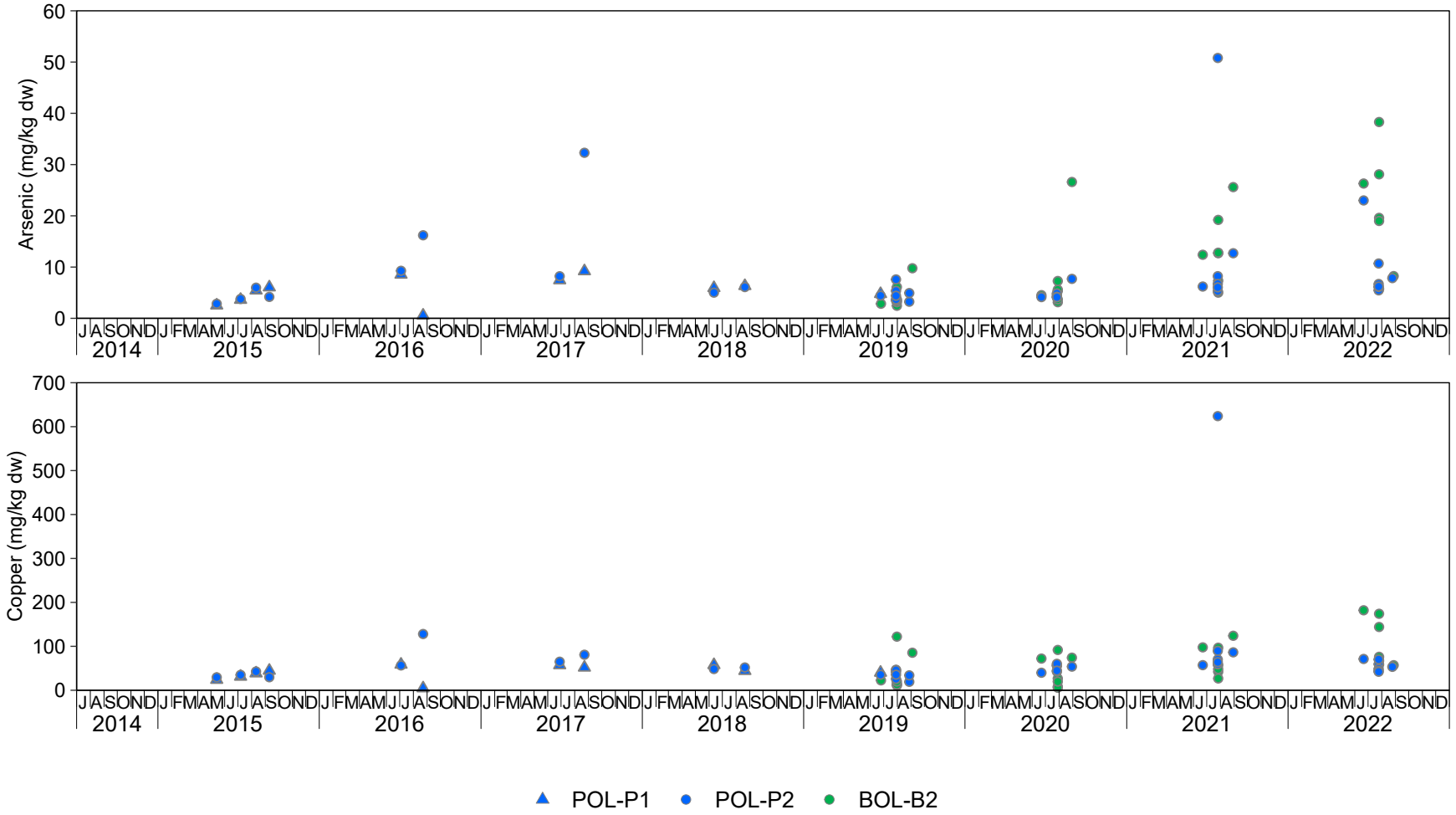

Figure C.4.1: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P1, POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas, 2014 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red horizontal line represents British Columbia interim long-term guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014). Green symbols indicate reference while blue symbols indicate exposed. Sampling at POL-P1 was discontinued after 2019.

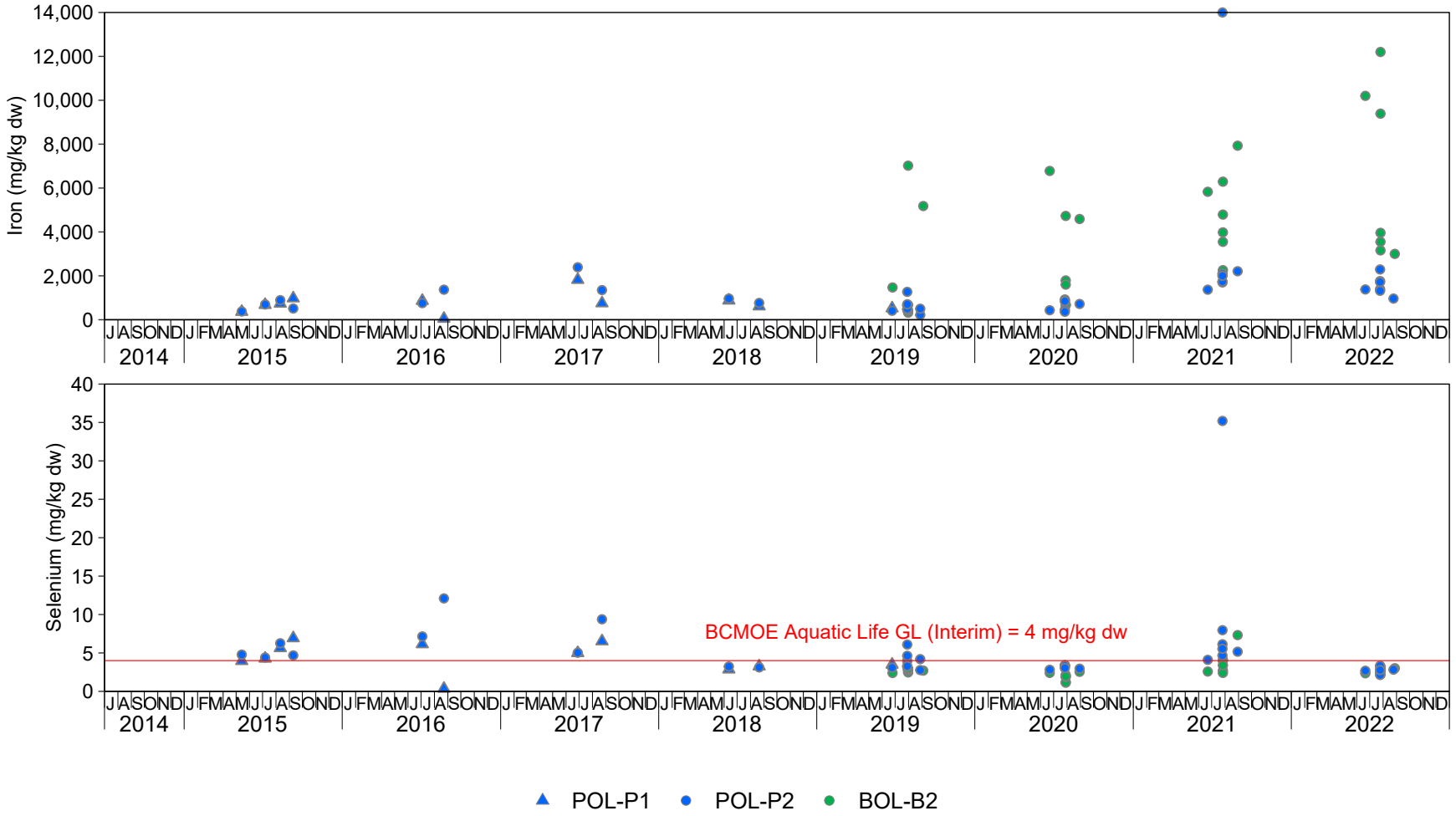

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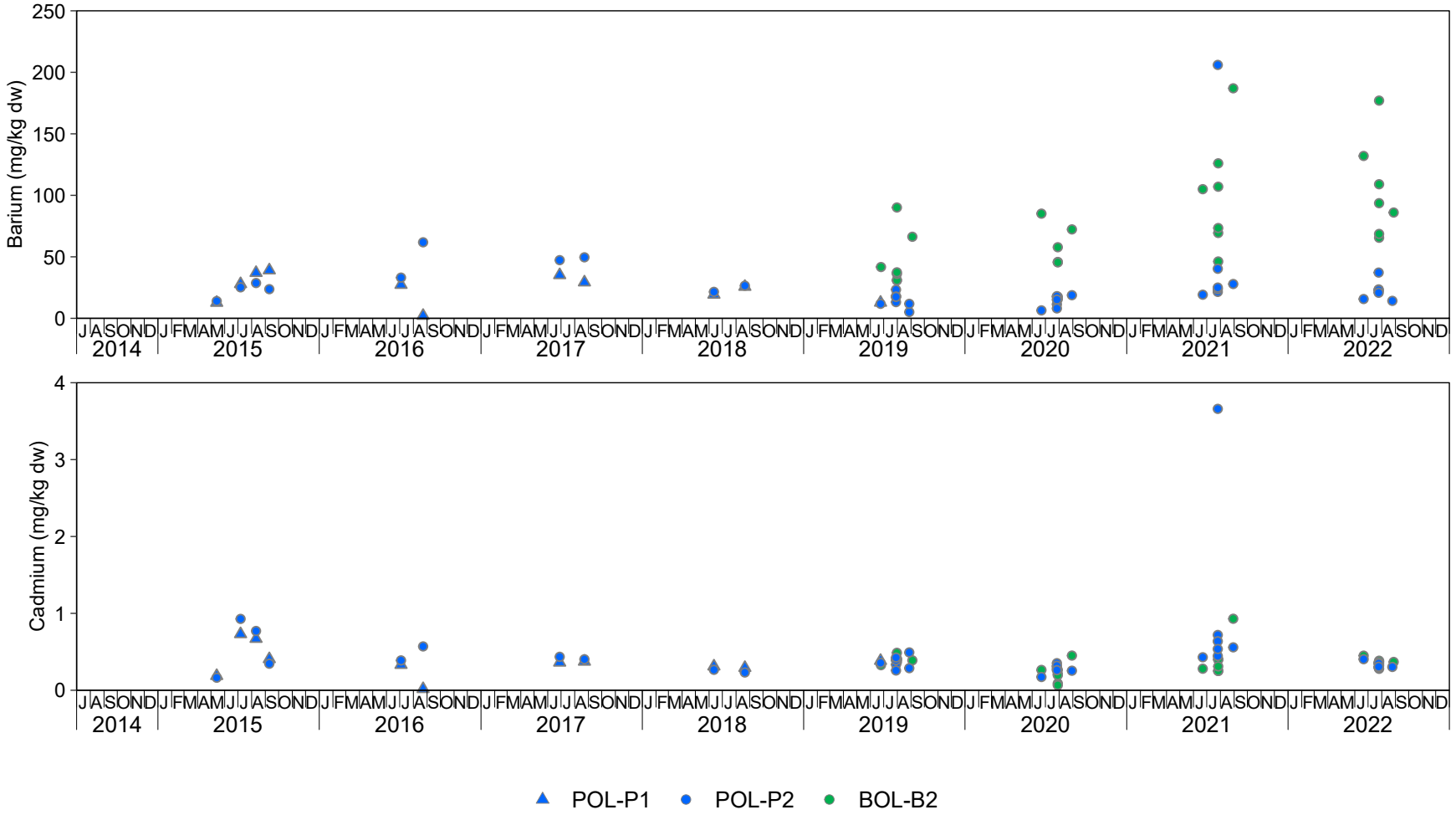

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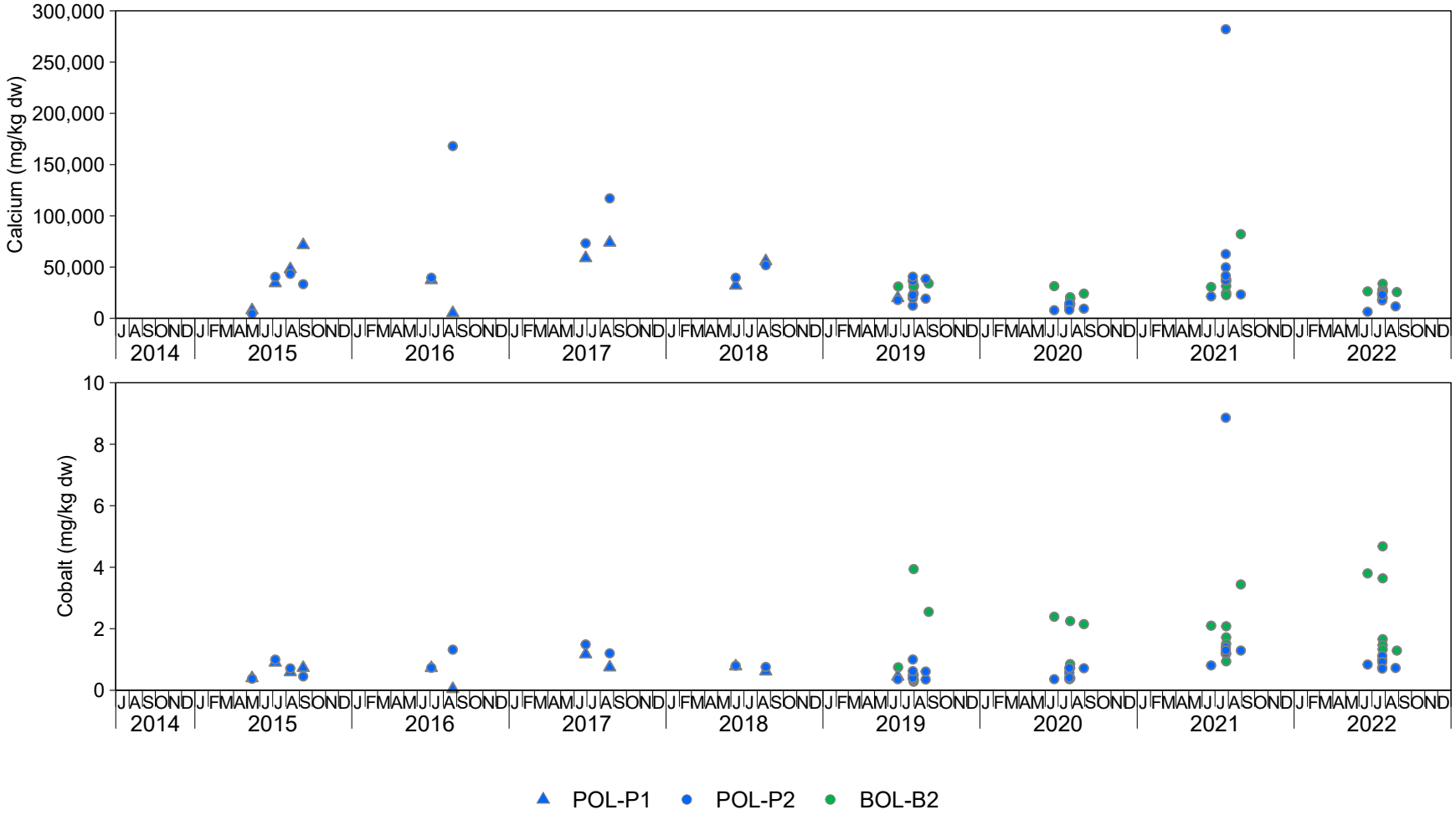

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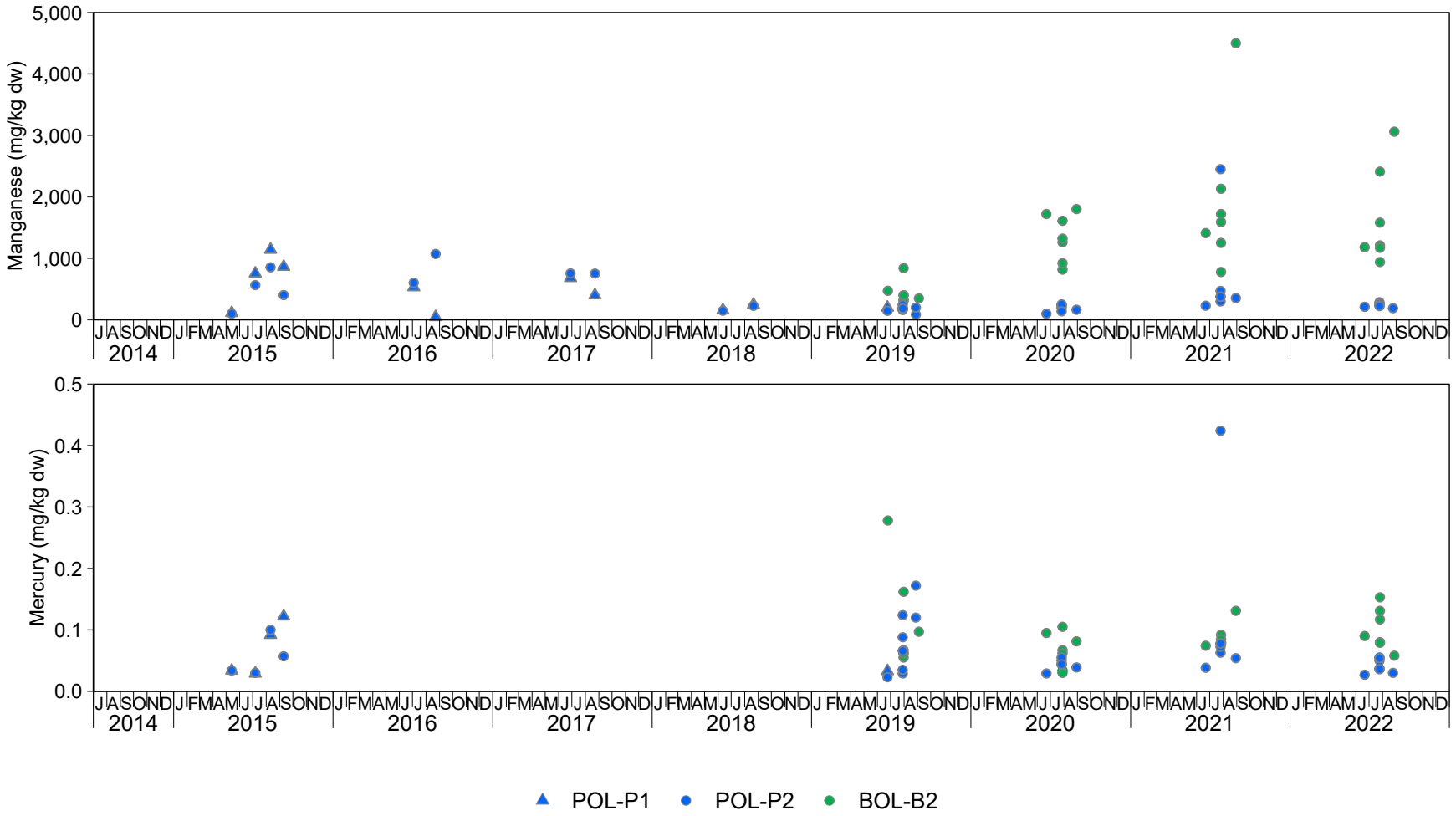

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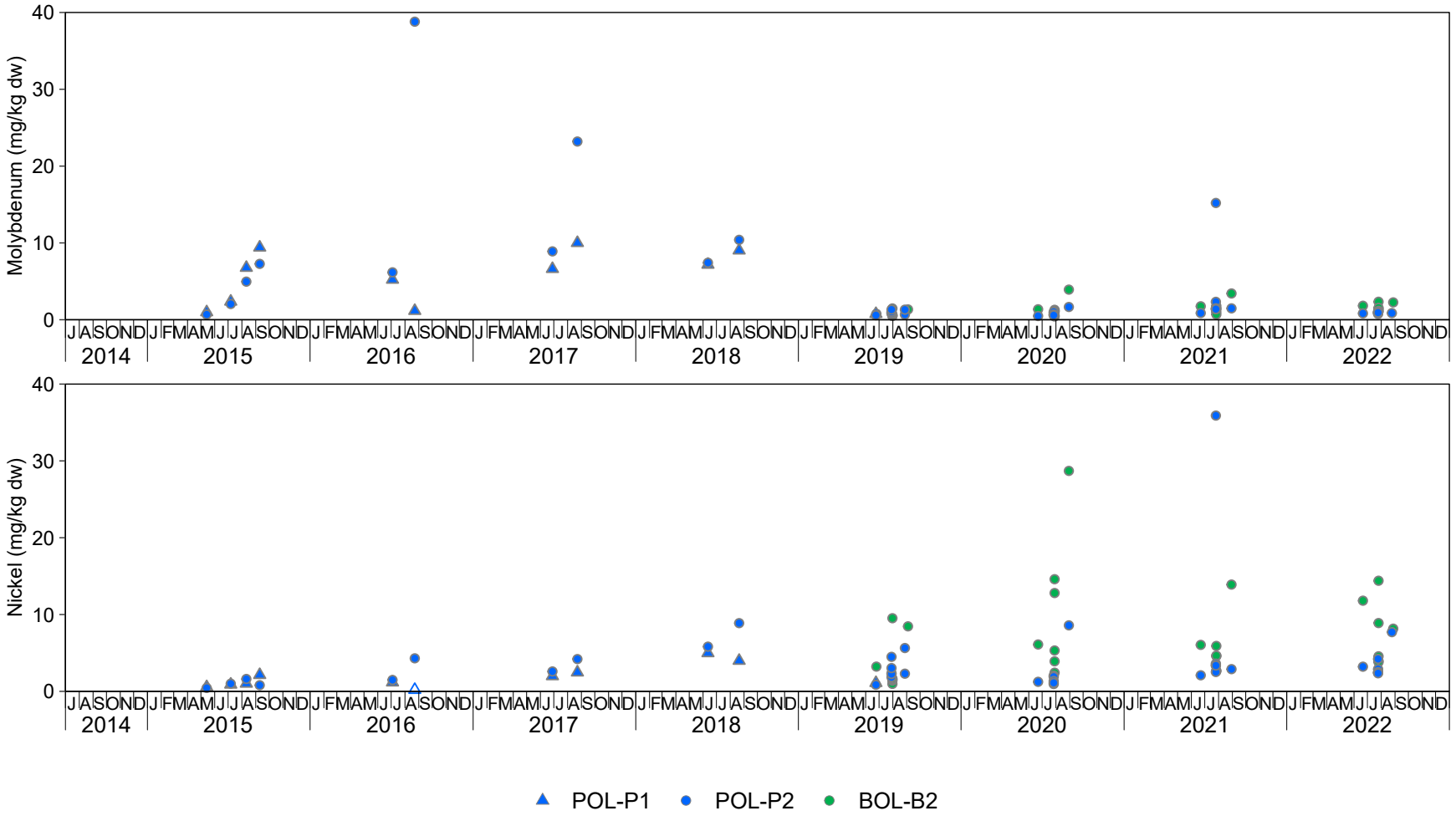

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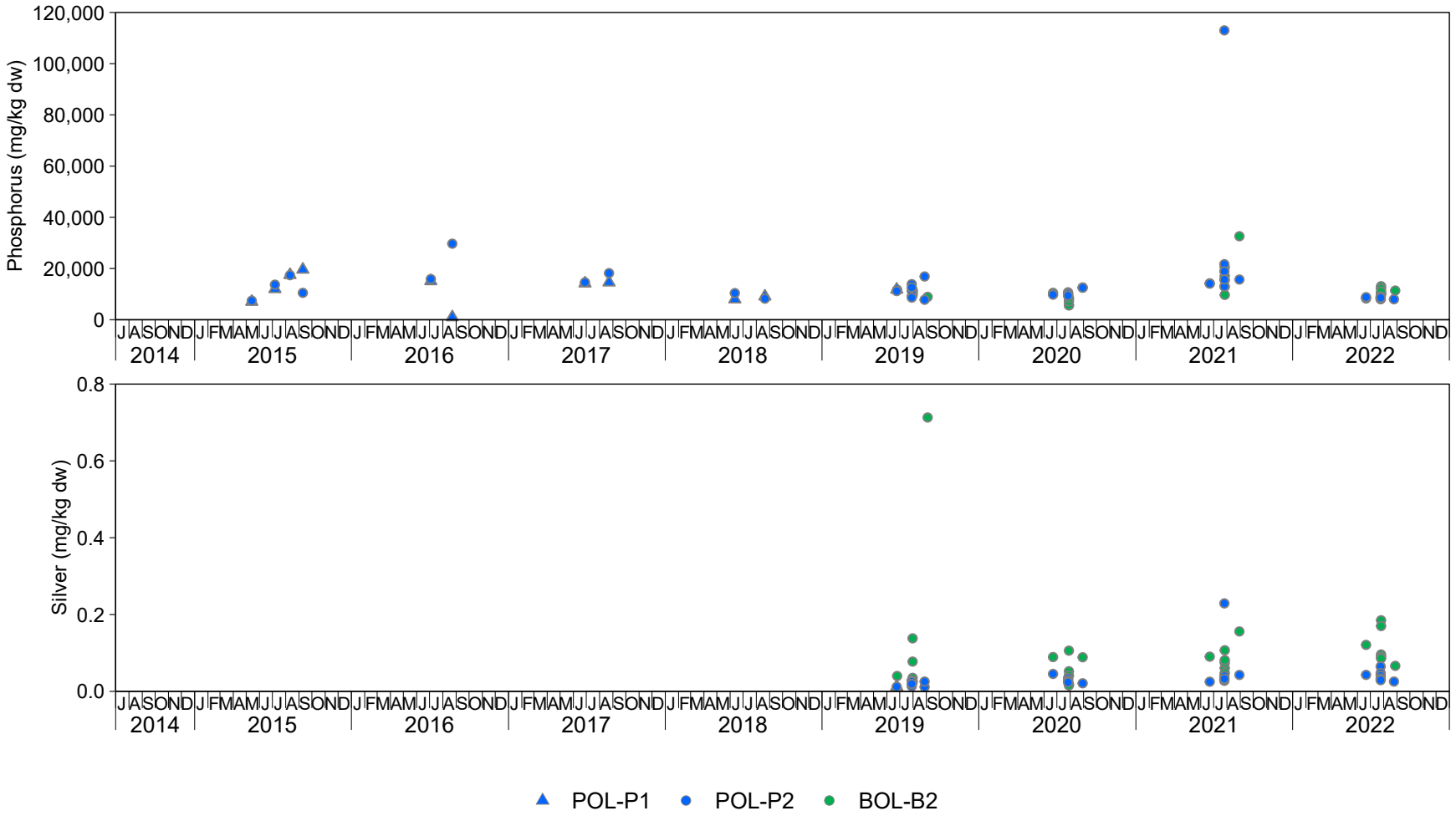

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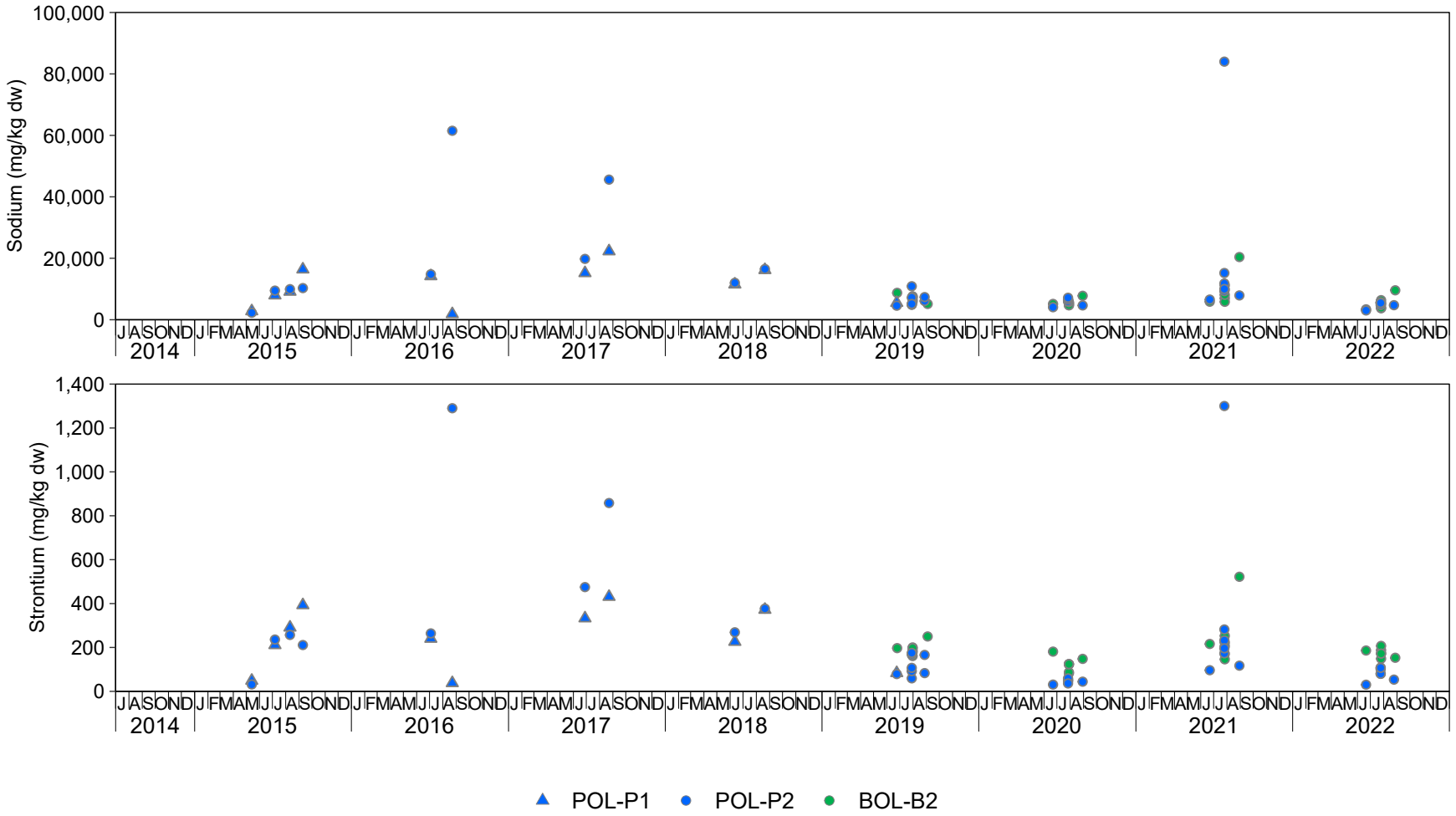

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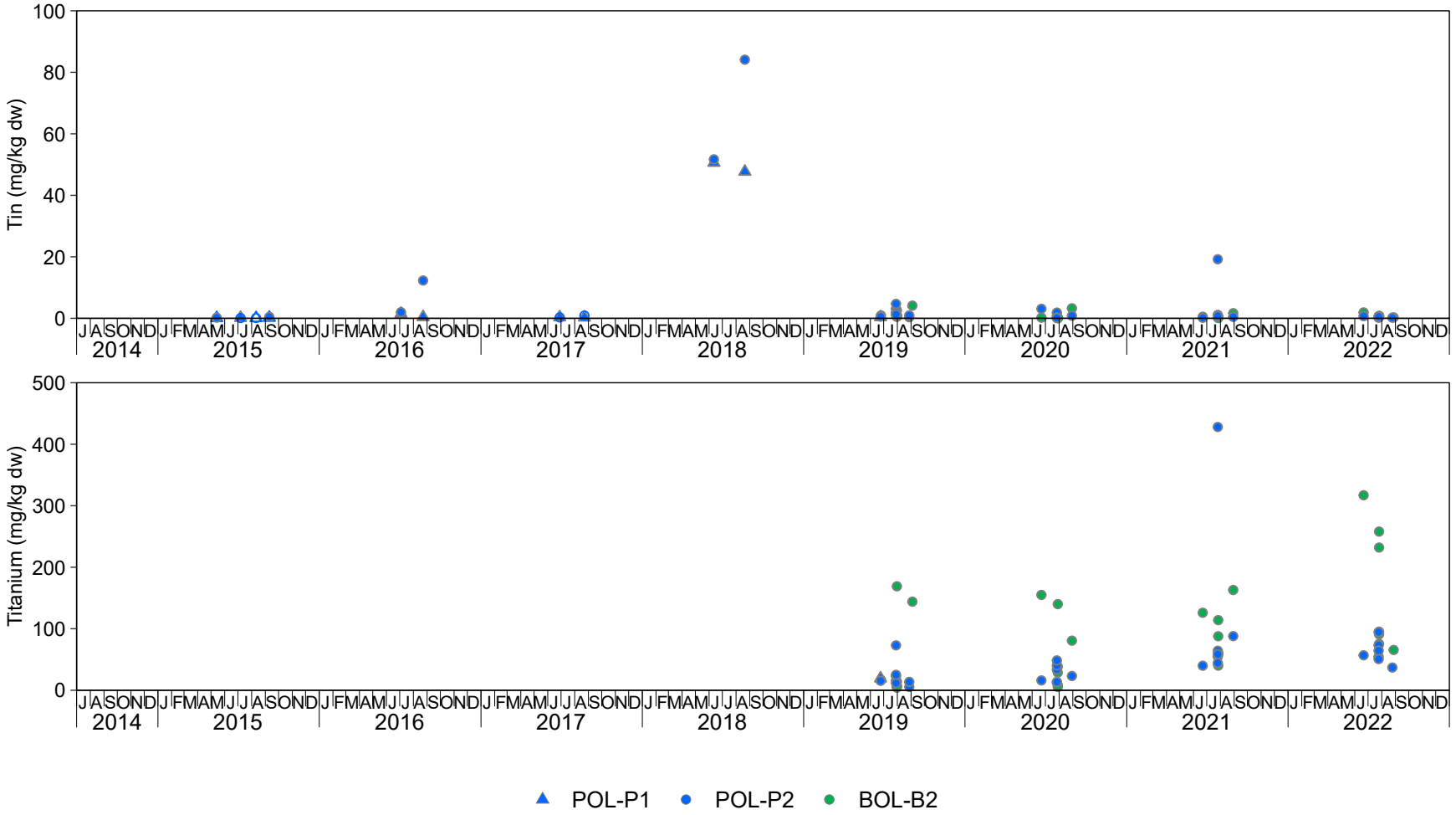

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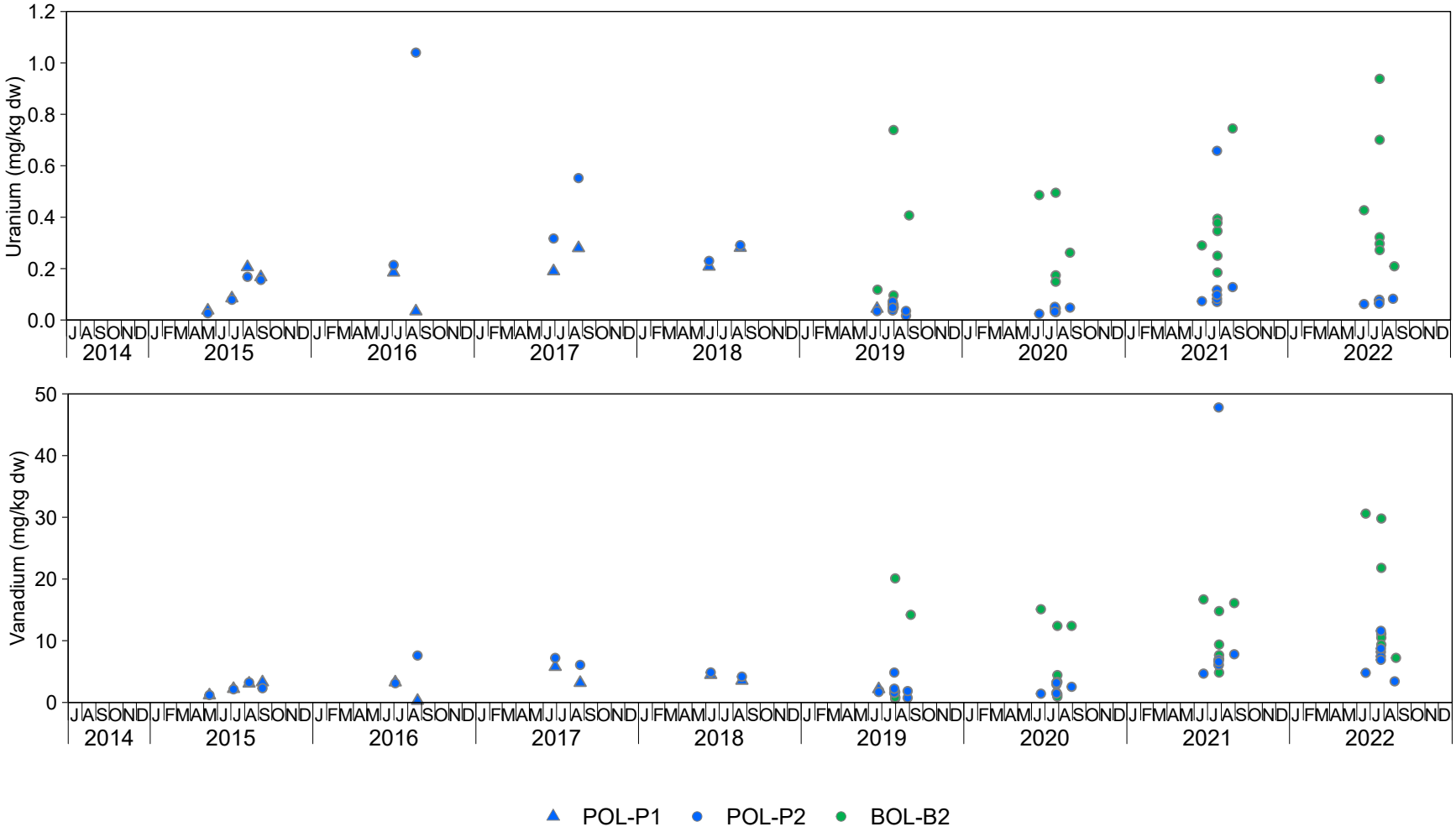

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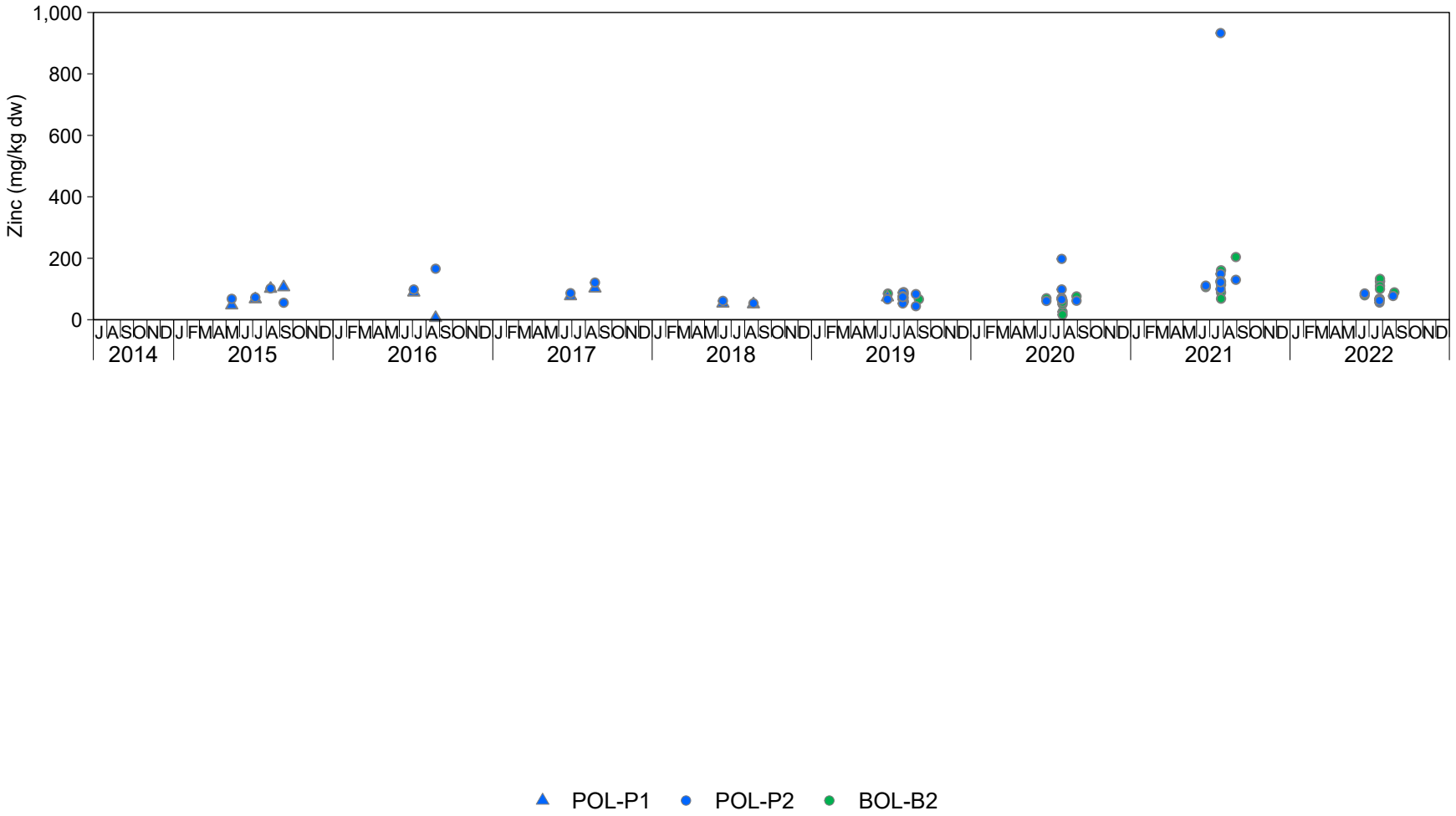

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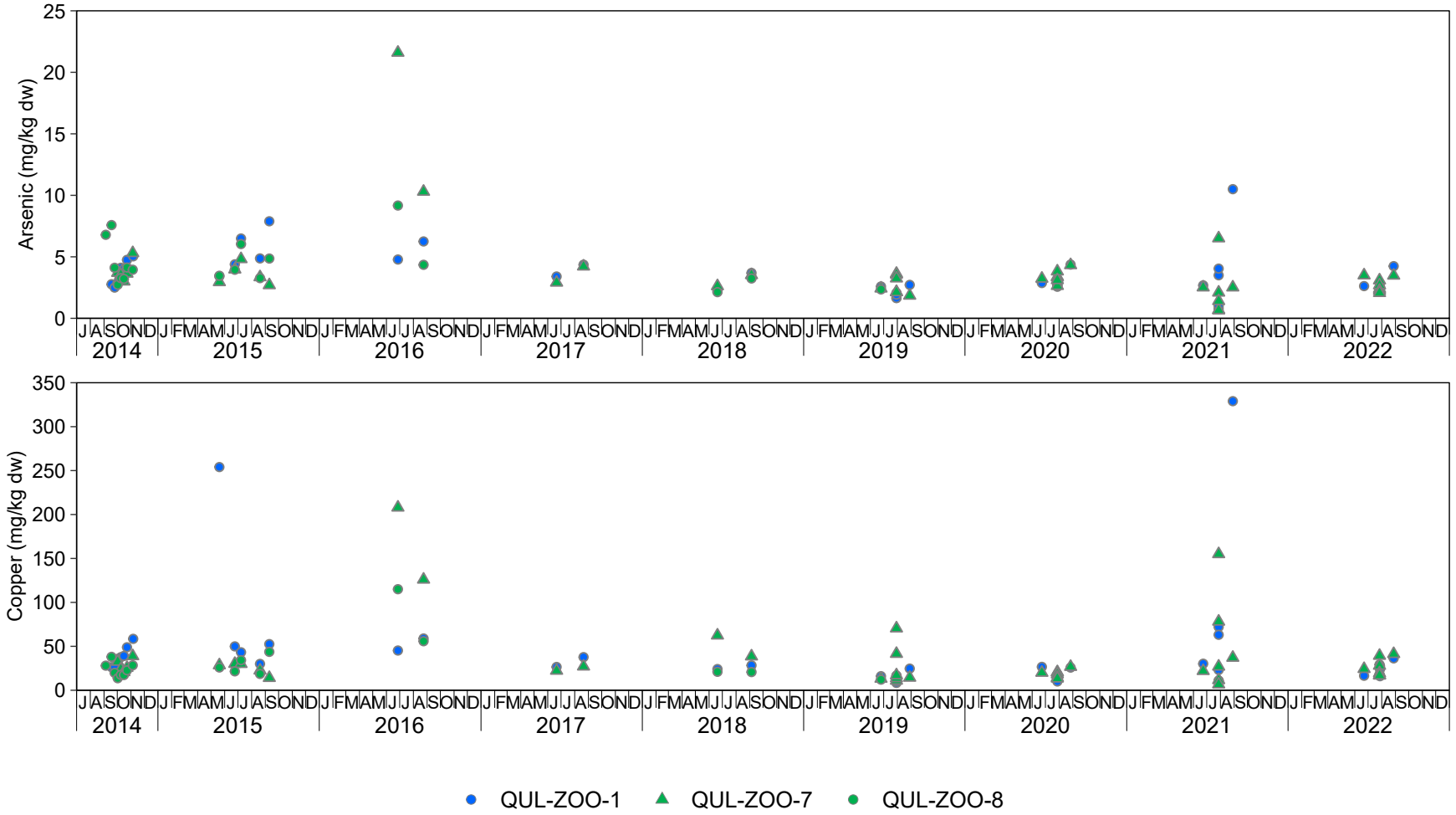

Figure C.4.2: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2014 to 2022

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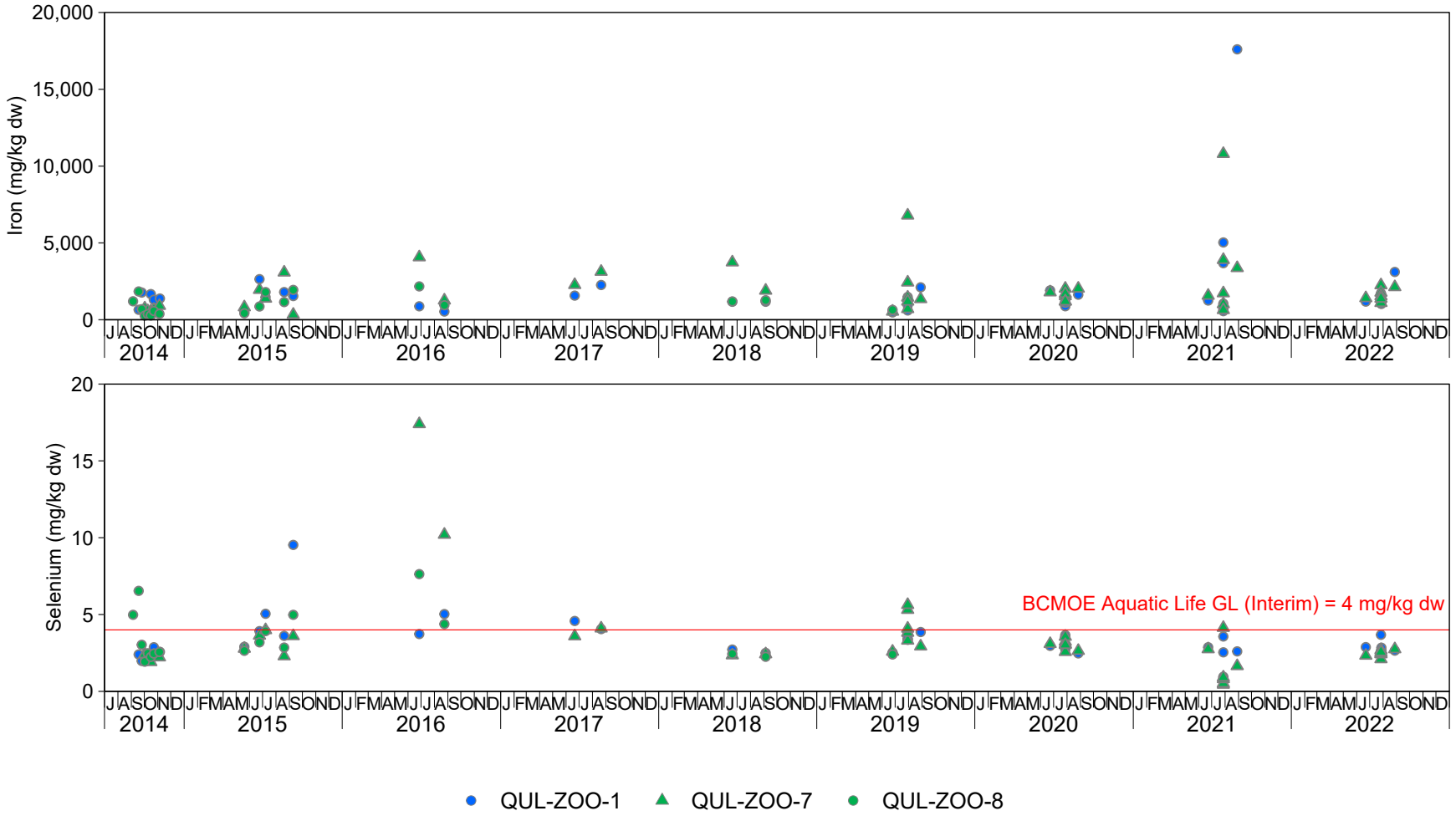

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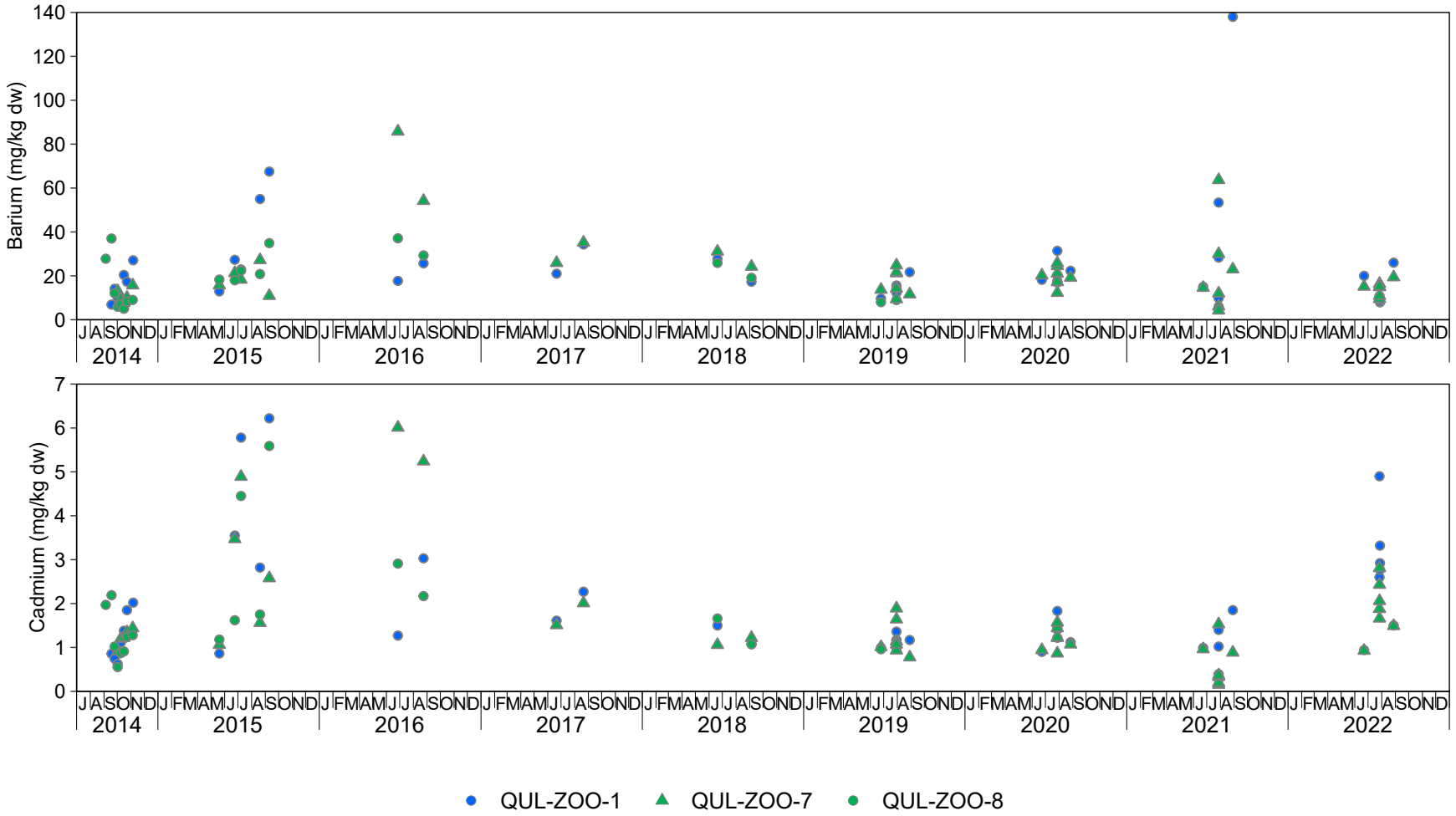

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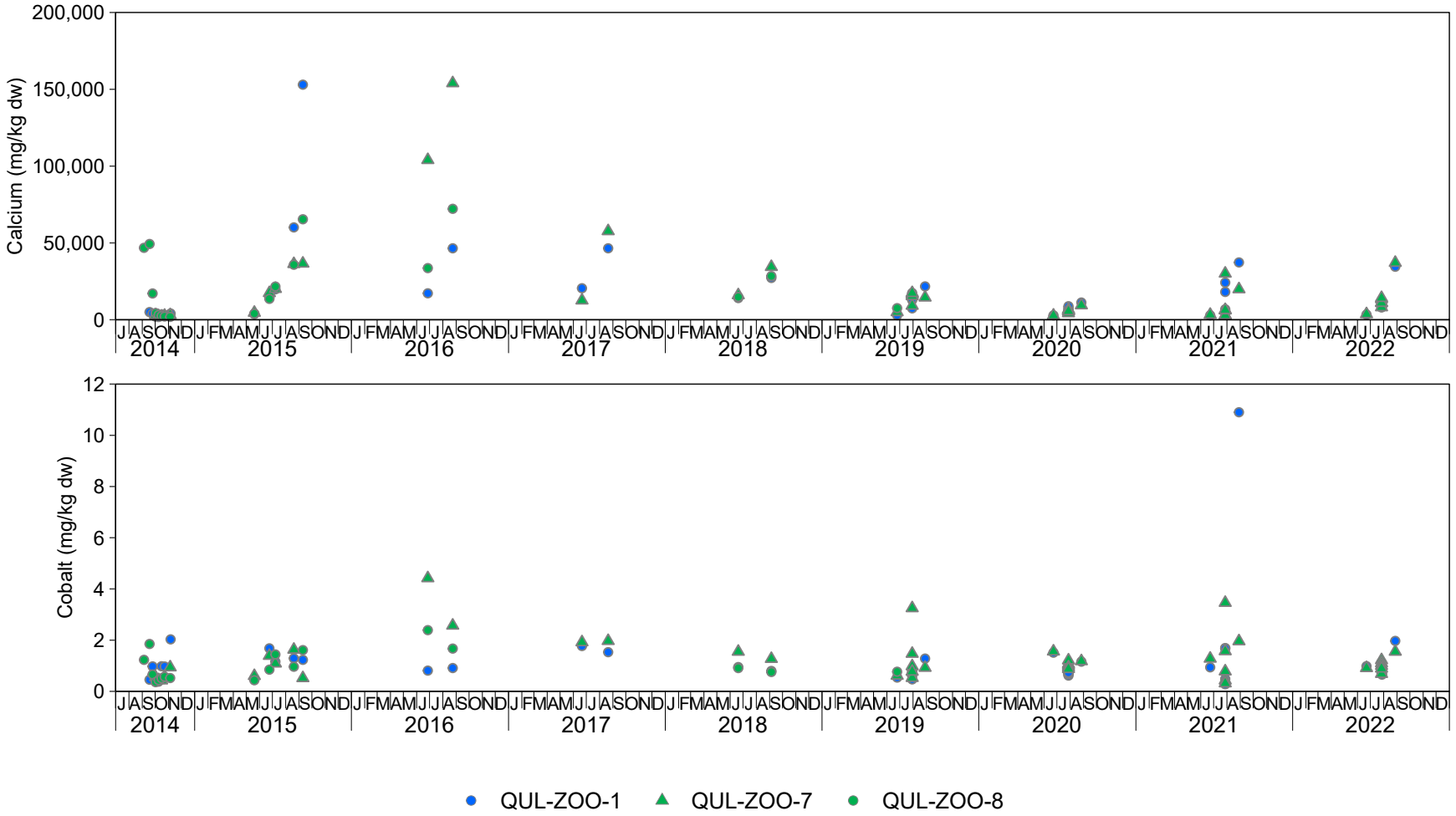

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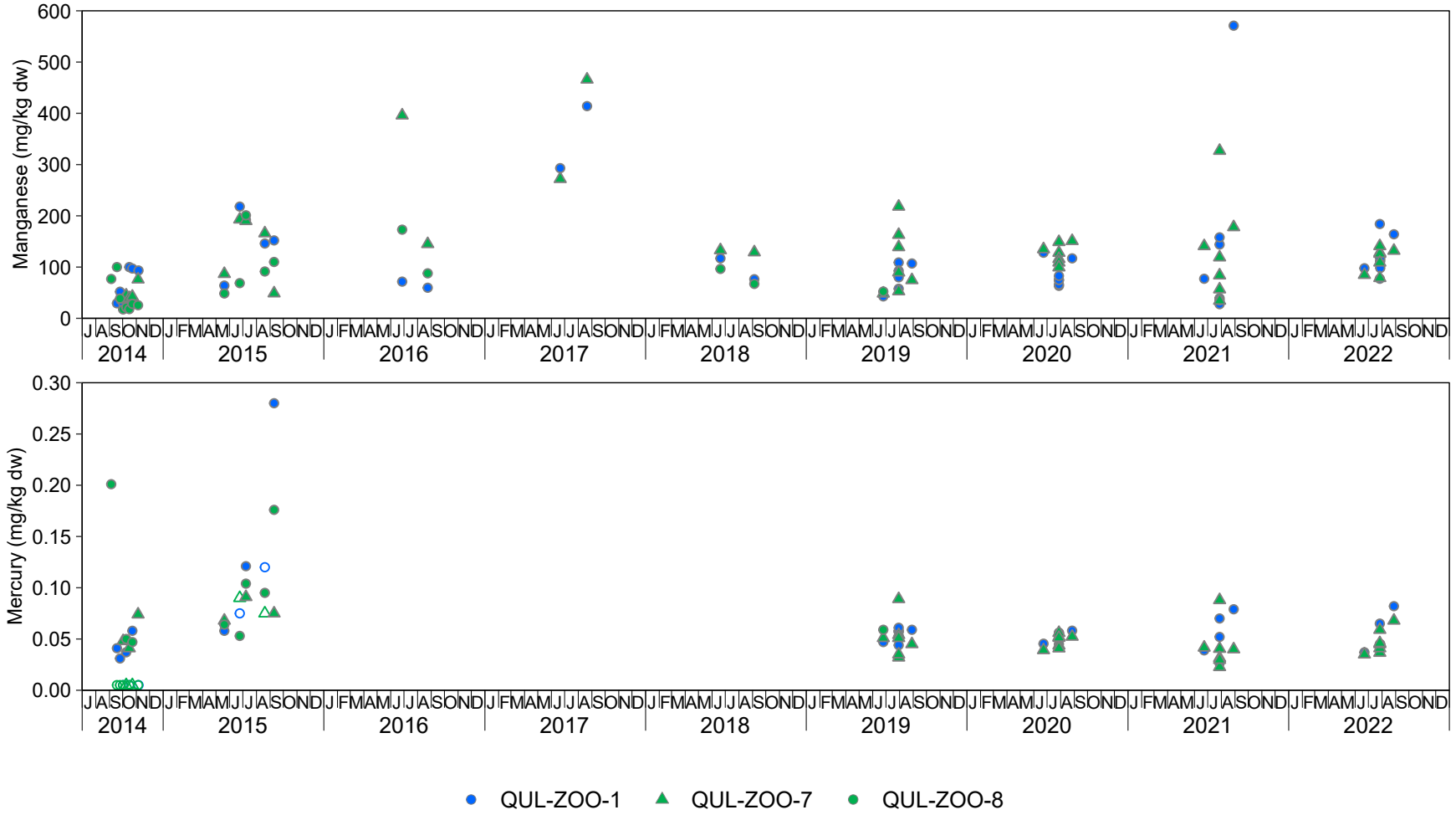

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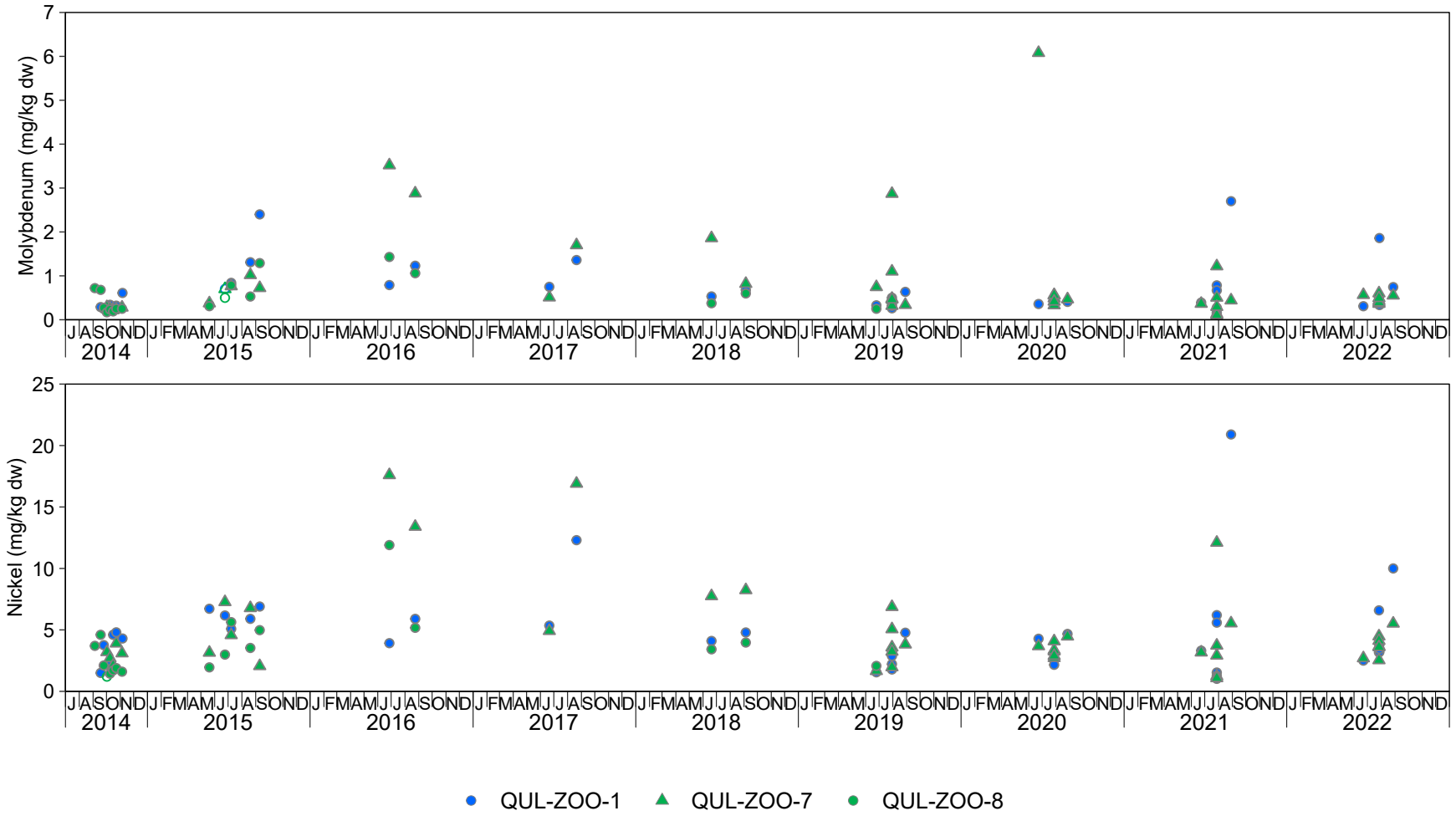

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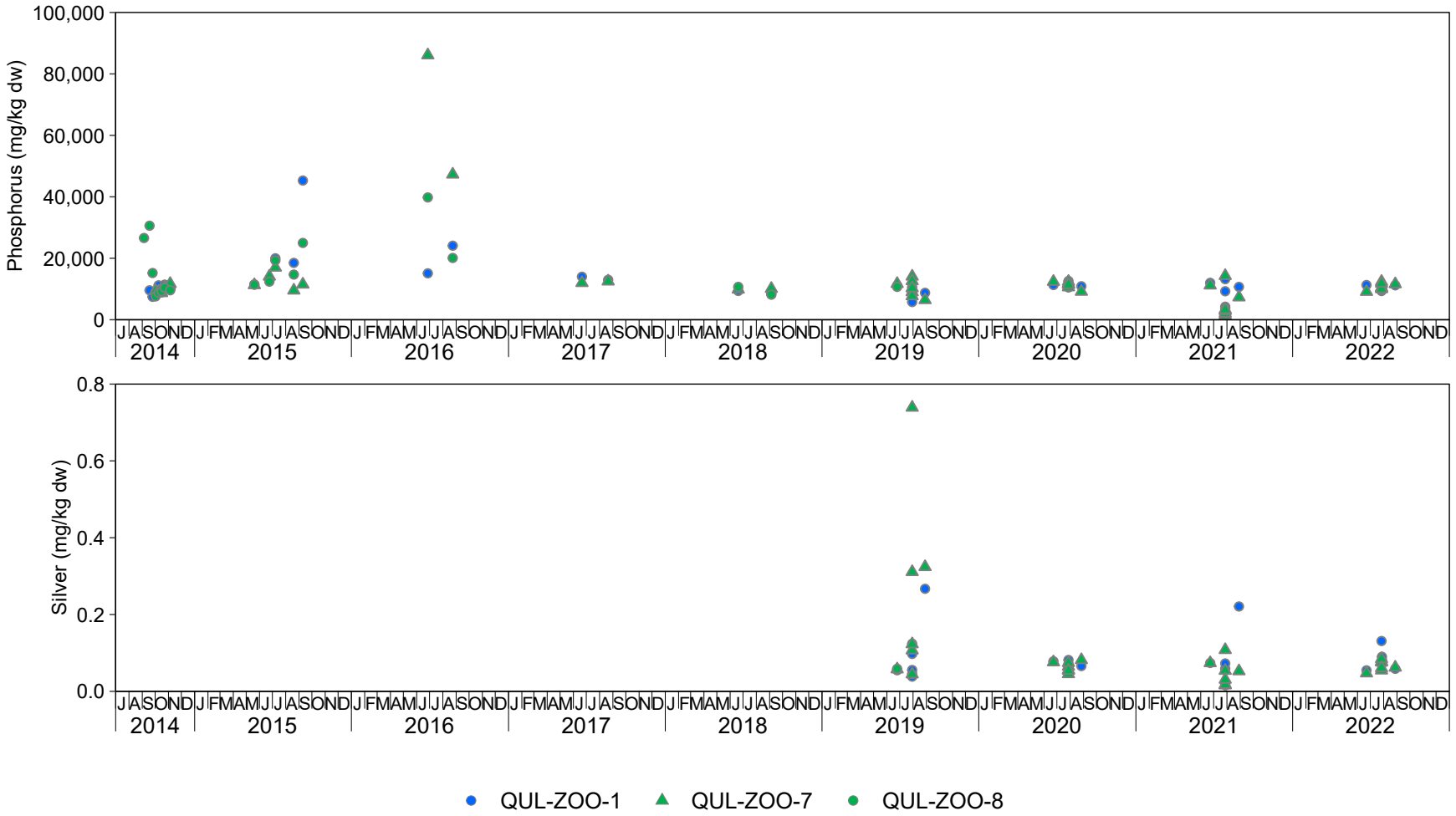

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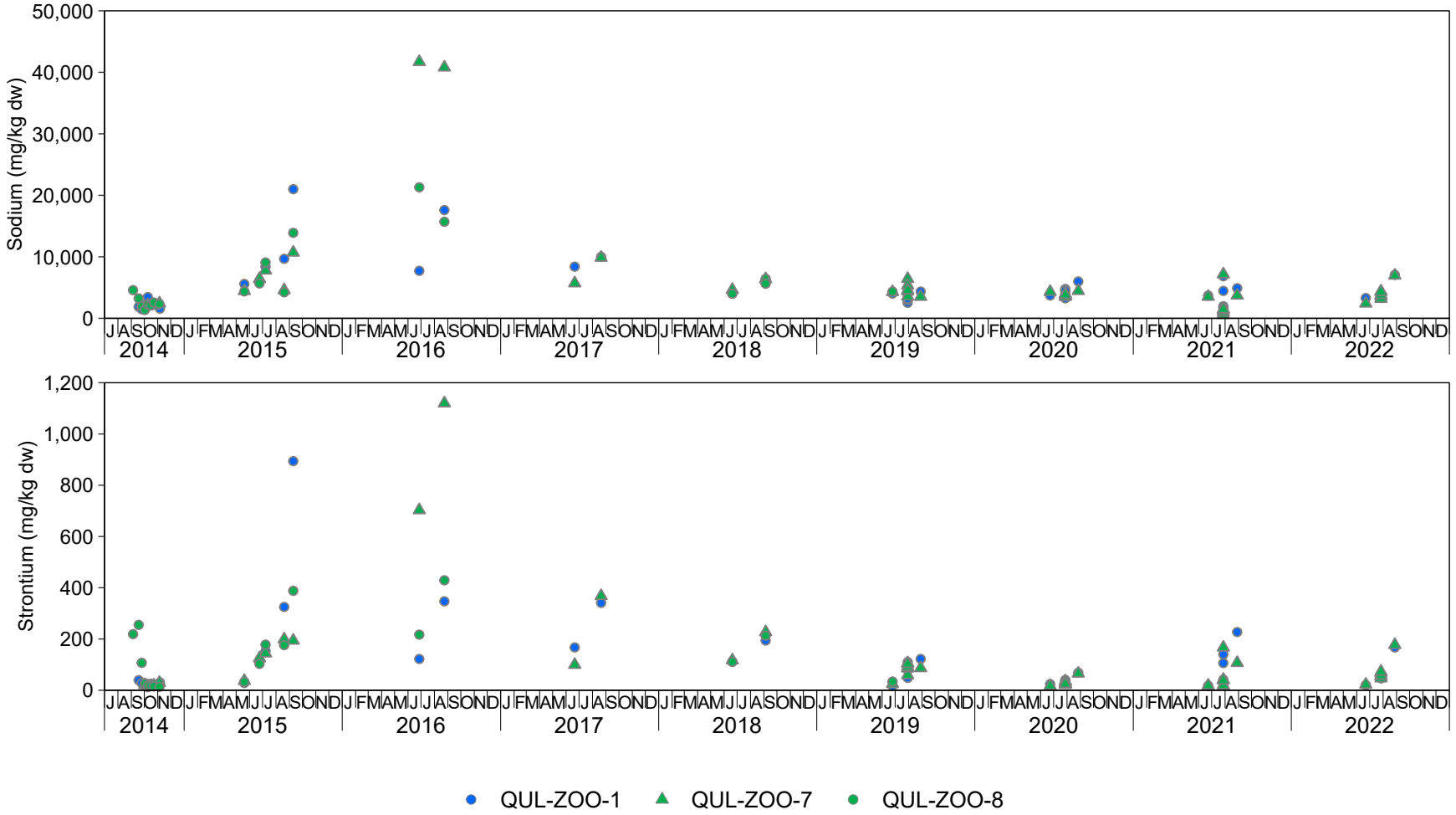

Figure C.4.2: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2014 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red horizontal line represents British Columbia interim long-term guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014). Green symbols indicate reference while blue symbols indicate exposed. Sampling at QUL-ZOO-8 was discontinued after 2019.

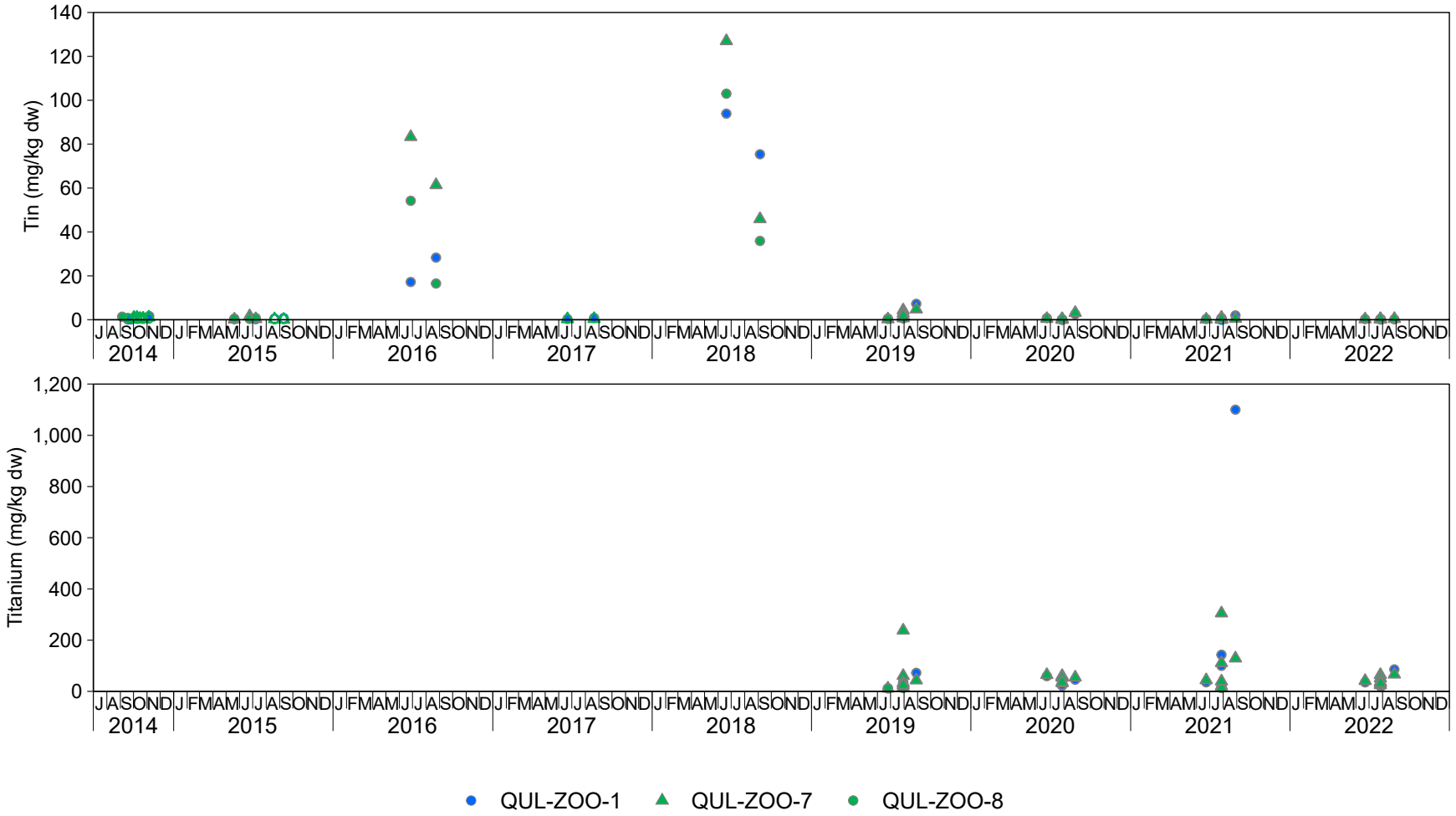

Figure C.4.2: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2014 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red horizontal line represents British Columbia interim long-term guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014). Green symbols indicate reference while blue symbols indicate exposed. Sampling at QUL-ZOO-8 was discontinued after 2019.

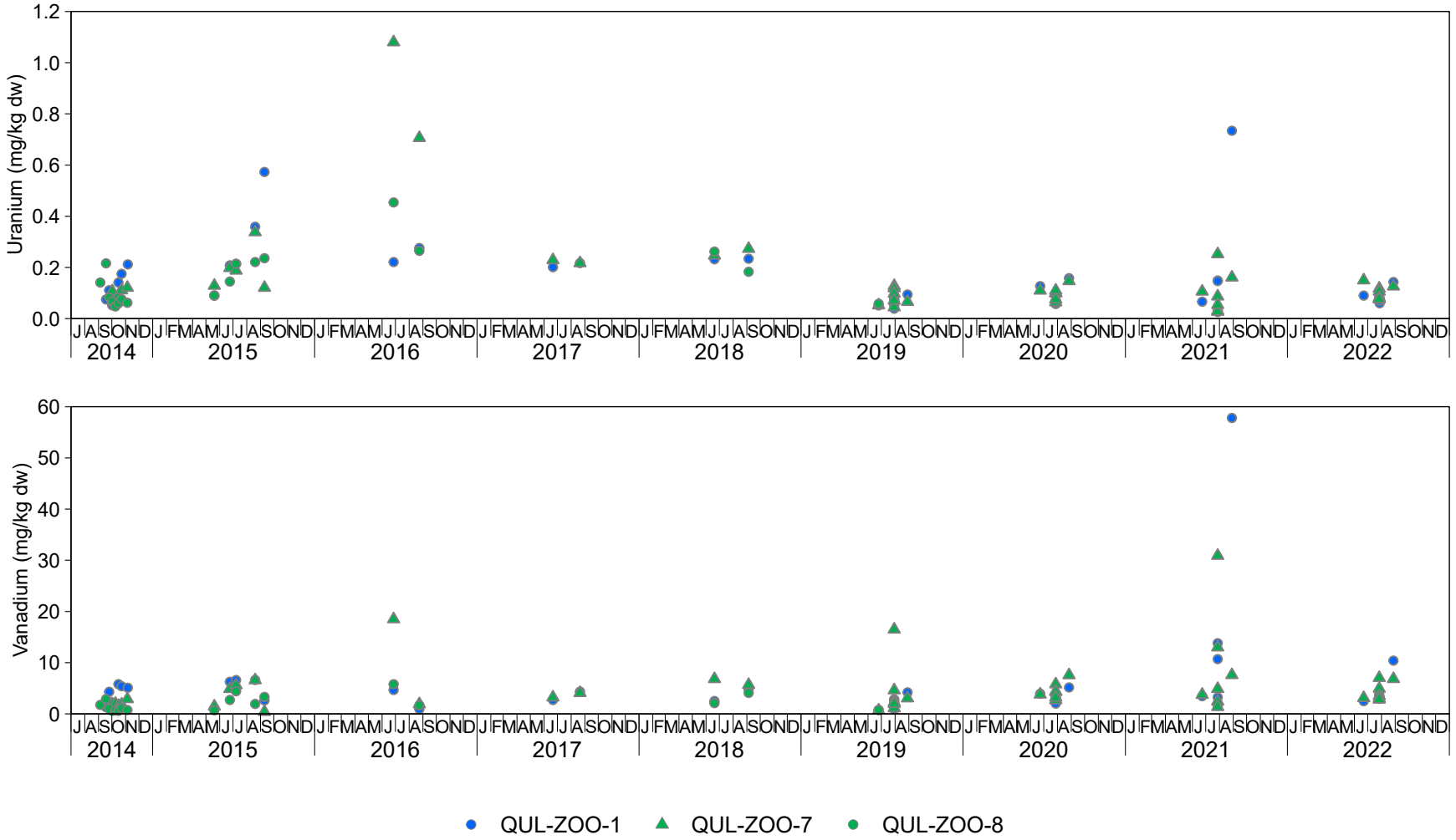

Figure C.4.2: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2014 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red horizontal line represents British Columbia interim long-term guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014). Green symbols indicate reference while blue symbols indicate exposed. Sampling at QUL-ZOO-8 was discontinued after 2019.

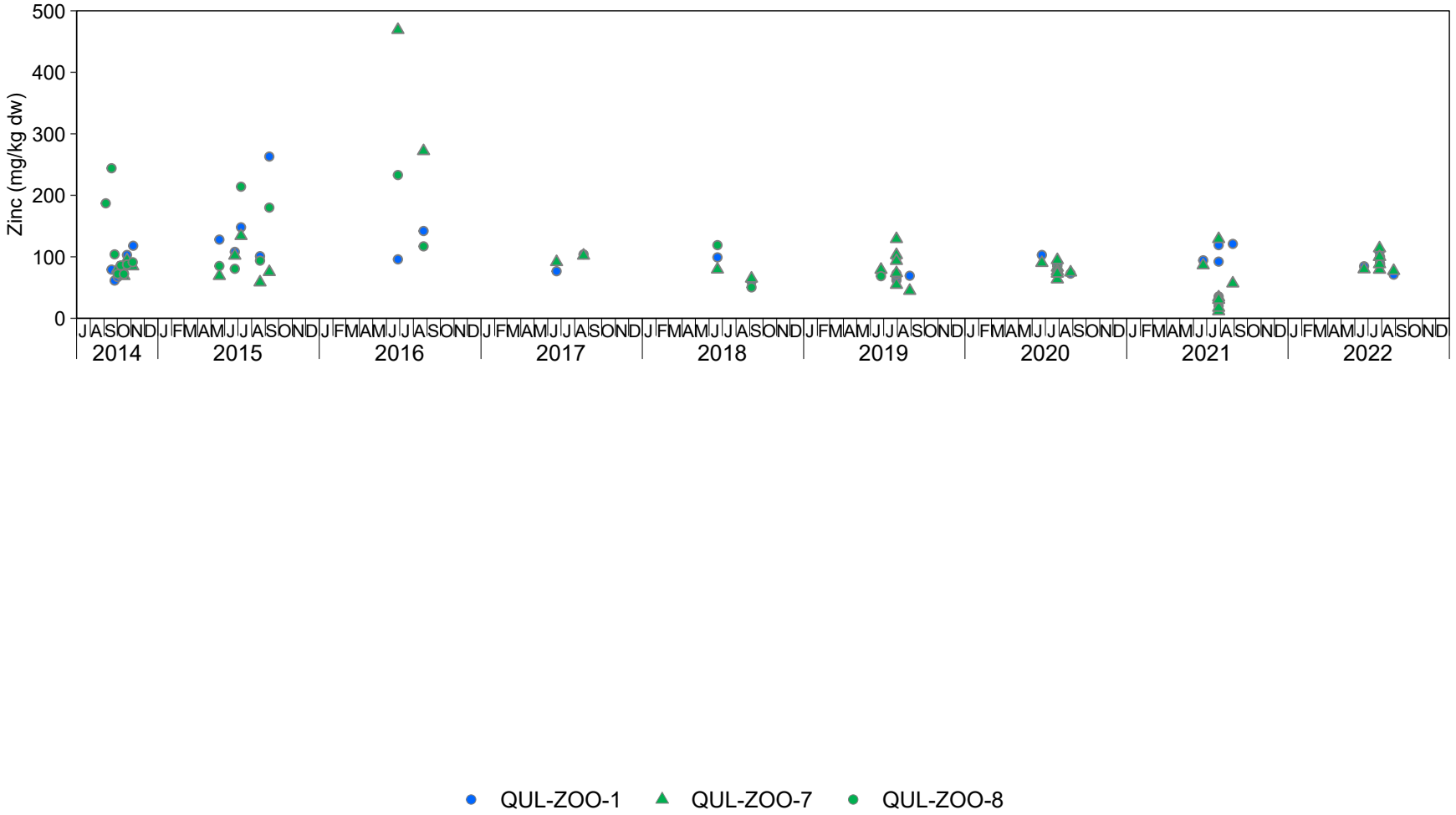

Figure C.4.2: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2014 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red horizontal line represents British Columbia interim long-term guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014). Green symbols indicate reference while blue symbols indicate exposed. Sampling at QUL-ZOO-8 was discontinued after 2019.

Table C.4.1: Zooplankton Tissue Chemistry Data for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference), 2022

Analyte	Units	Reference											
		BOL-B2											
		21-Jun-22	26-Jul-22	28-Aug-22	26-Jul-22	26-Jul-22	26-Jul-22	26-Jul-22	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	99.1	95.9	98.4	97.7	97.4	97.7	97.8	97.7	0.982	95.9	97.7	99.1
Aluminum	mg/kg dw	5,240	7,530	1,150	2,100	5,430	1,920	1,520	3,556	2,479	1,150	2,100	7,530
Antimony	mg/kg dw	0.603	0.194	0.249	0.176	0.237	0.162	0.180	0.257	0.156	0.162	0.194	0.603
Arsenic	mg/kg dw	26.3	5.74	8.24	19.6	38.3	28.1	19.0	20.8	11.4	5.74	19.6	38.3
Barium	mg/kg dw	132	177	86.0	93.6	109	65.5	68.6	105	39.4	65.5	93.6	177
Beryllium	mg/kg dw	0.202	0.293	0.0440	0.0800	0.196	0.0740	0.0640	0.136	0.0942	0.0440	0.0800	0.293
Bismuth	mg/kg dw	0.0410	0.0500	0.0100	0.0170	0.0370	0.0160	0.0130	0.0263	0.0160	0.0100	0.0170	0.0500
Boron	mg/kg dw	12.9	11.0	9.50	6.90	10.2	6.90	6.10	9.07	2.52	6.10	9.50	12.9
Cadmium	mg/kg dw	0.450	0.371	0.368	0.349	0.384	0.322	0.279	0.360	0.0532	0.279	0.368	0.450
Calcium	mg/kg dw	26,300	20,200	25,600	28,300	25,900	33,700	26,800	26,686	3,996	20,200	26,300	33,700
Cesium	mg/kg dw	0.579	0.904	0.149	0.280	0.664	0.257	0.199	0.433	0.285	0.149	0.280	0.904
Chromium	mg/kg dw	49.9	23.6	16.2	23.8	52.8	35.8	21.7	32.0	14.5	16.2	23.8	52.8
Cobalt	mg/kg dw	3.80	4.68	1.29	1.66	3.64	1.47	1.33	2.55	1.43	1.29	1.66	4.68
Copper	mg/kg dw	182	144	57.0	76.1	174	67.3	58.5	108	56.1	57.0	76.1	182
Iron	mg/kg dw	10,200	12,200	3,000	3,960	9,390	3,550	3,160	6,494	3,939	3,000	3,960	12,200
Lead	mg/kg dw	4.27	4.33	5.72	3.13	4.45	2.44	2.19	3.79	1.26	2.19	4.27	5.72
Lithium	mg/kg dw	3.54	4.97	0.840	1.40	3.68	1.36	1.08	2.41	1.62	0.840	1.40	4.97
Magnesium	mg/kg dw	2,960	2,960	2,090	2,240	2,920	2,150	1,870	2,456	473	1,870	2,240	2,960
Manganese	mg/kg dw	1,180	2,410	3,060	1,580	1,210	939	1,170	1,650	788	939	1,210	3,060
Mercury	mg/kg dw	0.0900	0.153	0.0580	0.0800	0.131	0.0790	0.117	0.101	0.0336	0.0580	0.0900	0.153
	mg/kg ww	<0.0020	0.00620	<0.0020	<0.0020	0.00340	<0.0020	0.00250	0.00287	0.00157	<0.0020	<0.0020	0.00620
Molybdenum	mg/kg dw	1.82	2.34	2.26	1.41	1.55	1.07	1.15	1.66	0.505	1.07	1.55	2.34
Nickel	mg/kg dw	11.8	14.4	8.16	4.56	8.89	3.95	3.80	7.94	4.12	3.80	8.16	14.4
Phosphorus	mg/kg dw	8,300	9,900	11,400	13,100	10,200	12,200	11,000	10,871	1,583	8,300	11,000	13,100
Potassium	mg/kg dw	6,570	6,360	9,800	9,410	6,860	8,090	7,430	7,789	1,371	6,360	7,430	9,800
Rubidium	mg/kg dw	8.70	10.0	9.11	10.8	10.0	9.23	8.15	9.43	0.898	8.15	9.23	10.8
Selenium	mg/kg dw	2.35	2.62	3.01	3.24	2.99	2.88	2.17	2.75	0.386	2.17	2.88	3.24
Silver	mg/kg dw	0.121	0.185	0.0664	0.0960	0.170	0.0898	0.0858	0.116	0.0450	0.0664	0.0960	0.185
Sodium	mg/kg dw	3,380	3,730	9,580	6,370	3,870	5,470	4,940	5,334	2,153	3,380	4,940	9,580
Strontium	mg/kg dw	186	149	153	188	173	207	172	175	20.4	149	173	207
Tellurium	mg/kg dw	0.0230	<0.023	<0.020	<0.020	<0.020	<0.020	<0.020	0.0204	-	<0.020	<0.020	0.0230
Thallium	mg/kg dw	0.0283	0.0726	0.0475	0.0328	0.0641	0.0352	0.0275	0.0440	0.0181	0.0275	0.0352	0.0726
Tin	mg/kg dw	1.92	0.490	0.290	0.660	0.730	0.720	0.760	0.796	0.523	0.290	0.720	1.92
Titanium	mg/kg dw	317	258	65.5	95.2	232	90.9	75.4	162	104	65.5	95.2	317
Uranium	mg/kg dw	0.427	0.938	0.209	0.322	0.701	0.297	0.272	0.452	0.268	0.209	0.322	0.938
Vanadium	mg/kg dw	30.6	29.8	7.22	11.1	21.8	10.5	9.36	17.2	10.0	7.22	11.1	30.6
Zinc	mg/kg dw	79.5	125	89.1	125	133	110	100	109	20.1	79.5	110	133
Zirconium	mg/kg dw	2.74	5.71	1.92	2.58	4.98	2.38	2.09	3.20	1.51	1.92	2.58	5.71

Value exceeds interim long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

Notes:"-" = standard deviation not calculated as all results were below laboratory reporting limit. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.4.1: Zooplankton Tissue Chemistry Data for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference), 2022

Analyte	Units	Exposed											
		POL-P2											
		21-Jun-22	25-Jul-22	25-Aug-22	25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	94.8	97.6	96.5	97.9	98.2	98.0	98.4	97.3	1.28	94.8	97.9	98.4
Aluminum	mg/kg dw	895	1,150	576	1,450	948	1,200	888	1,015	280	576	948	1,450
Antimony	mg/kg dw	0.167	0.108	0.0860	0.0740	0.0650	0.0330	0.0780	0.0873	0.0418	0.0330	0.0780	0.167
Arsenic	mg/kg dw	23.0	6.70	7.85	5.46	10.7	6.12	6.20	9.43	6.23	5.46	6.70	23.0
Barium	mg/kg dw	15.7	22.3	14.2	37.2	23.5	23.1	20.8	22.4	7.48	14.2	22.3	37.2
Beryllium	mg/kg dw	0.0360	0.0490	0.0190	0.0710	0.0490	0.0540	0.0440	0.0460	0.0160	0.0190	0.0490	0.0710
Bismuth	mg/kg dw	0.0110	0.0170	<0.014	<0.012	<0.011	<0.010	<0.012	0.0113	0.00297	<0.010	<0.011	0.0170
Boron	mg/kg dw	3.40	5.50	4.50	5.60	5.20	4.80	5.10	4.87	0.752	3.40	5.10	5.60
Cadmium	mg/kg dw	0.404	0.349	0.303	0.362	0.349	0.292	0.306	0.338	0.0399	0.292	0.349	0.404
Calcium	mg/kg dw	6,430	17,500	11,700	24,900	23,600	17,900	23,000	17,861	6,803	6,430	17,900	24,900
Cesium	mg/kg dw	0.0982	0.119	0.0789	0.128	0.0962	0.124	0.0880	0.105	0.0191	0.0789	0.0982	0.128
Chromium	mg/kg dw	27.9	7.21	19.0	3.23	9.71	3.54	3.96	10.6	9.40	3.23	7.21	27.9
Cobalt	mg/kg dw	0.836	0.989	0.725	1.12	0.740	0.919	0.703	0.862	0.156	0.703	0.836	1.12
Copper	mg/kg dw	71.2	59.5	53.3	70.2	48.8	44.1	42.1	55.6	11.8	42.1	53.3	71.2
Iron	mg/kg dw	1,380	1,760	964	2,290	1,390	1,720	1,320	1,546	423	964	1,390	2,290
Lead	mg/kg dw	1.44	1.18	0.649	0.982	0.981	2.72	0.820	1.25	0.694	0.649	0.982	2.72
Lithium	mg/kg dw	0.760	0.920	<0.71	1.13	0.750	0.970	0.700	0.847	0.166	0.700	0.760	1.13
Magnesium	mg/kg dw	1,340	1,560	1,160	1,870	1,570	1,630	1,560	1,527	224	1,160	1,560	1,870
Manganese	mg/kg dw	210	285	187	252	257	232	222	235	32.6	187	232	285
Mercury	mg/kg dw	0.0270	<0.055	0.0300	0.0500	<0.037	0.0360	0.0540	0.0380	0.0128	0.0270	0.0360	<0.055
	mg/kg ww	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020	<0.0020
Molybdenum	mg/kg dw	0.827	1.00	0.867	1.04	0.878	0.757	0.924	0.899	0.0979	0.757	0.878	1.04
Nickel	mg/kg dw	3.21	4.22	7.71	2.90	2.46	2.50	2.35	3.62	1.91	2.35	2.90	7.71
Phosphorus	mg/kg dw	8,820	8,120	8,000	8,730	9,120	8,040	8,560	8,484	437	8,000	8,560	9,120
Potassium	mg/kg dw	6,660	6,220	6,360	6,860	6,360	7,060	6,640	6,594	301	6,220	6,640	7,060
Rubidium	mg/kg dw	6.77	5.86	5.67	6.34	6.07	7.30	6.36	6.34	0.557	5.67	6.34	7.30
Selenium	mg/kg dw	2.68	2.50	2.83	3.34	2.27	2.14	2.77	2.65	0.398	2.14	2.68	3.34
Silver	mg/kg dw	0.0429	0.0648	0.0255	0.0478	0.0409	0.0333	0.0291	0.0406	0.0133	0.0255	0.0409	0.0648
Sodium	mg/kg dw	3,020	4,800	4,730	5,600	5,460	5,650	5,460	4,960	933.4	3,020	5,460	5,650
Strontium	mg/kg dw	30.2	79.8	53.4	108	101	80.1	107	79.9	29.3	30.2	80.1	108
Tellurium	mg/kg dw	<0.020	<0.033	<0.028	<0.024	<0.022	<0.020	<0.024	<0.020	-	<0.020	<0.024	<0.033
Thallium	mg/kg dw	0.00690	0.00780	0.00750	0.00760	0.00590	0.00640	0.00740	0.00707	0.000702	0.00590	0.00740	0.00780
Tin	mg/kg dw	0.710	0.590	0.210	0.400	0.320	0.210	0.500	0.420	0.191	0.210	0.400	0.710
Titanium	mg/kg dw	56.8	73.3	36.9	94.6	54.6	64.4	50.7	61.6	18.4	36.9	56.8	94.6
Uranium	mg/kg dw	0.0622	0.0789	0.0827	0.0761	0.0661	0.0773	0.0638	0.0724	0.00820	0.0622	0.0761	0.0827
Vanadium	mg/kg dw	4.80	8.18	3.42	11.6	7.47	8.73	6.90	7.30	2.67	3.42	7.47	11.6
Zinc	mg/kg dw	85.6	68.6	77.3	66.0	67.5	55.9	62.4	69.0	9.76	55.9	67.5	85.6
Zirconium	mg/kg dw	0.970	1.70	1.04	1.41	1.24	1.15	0.980	1.21	0.266	0.970	1.15	1.70

Value exceeds interim long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

Notes:"-" = standard deviation not calculated as all results were below laboratory reporting limit. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.4.2: Zooplankton Tissue Chemistry Data for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2022

Analyte	Units	Reference											
		QUL-ZOO-7											
		22-Jun-22	27-Jul-22	28-Aug-22	27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	94.0	97.1	97.8	97.8	98.3	98.7	95.6	97.0	1.67	94.0	97.8	98.7
Aluminum	mg/kg dw	2,290	618	1,190	1,250	911	671	584	1,073	600	584	911	2,290
Antimony	mg/kg dw	0.0490	0.0230	0.0530	0.0430	0.0540	0.0430	0.0460	0.0444	0.0104	0.0230	0.0460	0.0540
Arsenic	mg/kg dw	3.50	2.40	3.48	3.09	2.69	2.25	2.07	2.78	0.583	2.07	2.69	3.50
Barium	mg/kg dw	15.1	9.50	19.4	16.4	14.9	15.1	10.9	14.5	3.33	9.50	15.1	19.4
Beryllium	mg/kg dw	0.162	0.0330	0.0440	0.0530	0.0360	0.0330	0.0230	0.0549	0.0482	0.0230	0.0360	0.162
Bismuth	mg/kg dw	<0.010	<0.013	0.0200	0.0130	0.0120	0.0130	0.0140	0.0133	0.00297	<0.010	0.0130	0.0200
Boron	mg/kg dw	<1.0	<1.3	4.60	1.90	1.40	1.10	<1.8	1.74	1.37	<1.0	1.10	4.60
Cadmium	mg/kg dw	0.927	1.66	1.49	1.88	2.43	2.81	2.06	1.89	0.620	0.927	1.88	2.81
Calcium	mg/kg dw	3,650	11,000	37,100	13,400	8,160	11,000	14,200	14,073	10,749	3,650	11,000	37,100
Cesium	mg/kg dw	0.0870	0.0789	0.147	0.141	0.114	0.0929	0.0971	0.108	0.0267	0.0789	0.0971	0.147
Chromium	mg/kg dw	4.11	2.08	7.31	5.26	2.60	2.02	4.39	3.97	1.93	2.02	4.11	7.31
Cobalt	mg/kg dw	0.912	0.685	1.55	1.22	1.10	1.00	0.893	1.05	0.277	0.685	1.00	1.55
Copper	mg/kg dw	24.3	17.3	41.3	39.3	28.0	19.4	16.8	26.6	10.2	16.8	24.3	41.3
Iron	mg/kg dw	1,410	1,100	2,130	2,250	1,770	1,540	1,380	1,654	418	1,100	1,540	2,250
Lead	mg/kg dw	0.580	0.635	0.892	0.846	0.928	0.945	0.579	0.772	0.167	0.579	0.846	0.945
Lithium	mg/kg dw	0.720	<0.65	1.17	0.970	0.800	0.700	<0.68	0.809	0.188	<0.65	0.720	1.17
Magnesium	mg/kg dw	1,470	1,130	1,770	1,650	1,420	1,330	1,210	1,426	229	1,130	1,420	1,770
Manganese	mg/kg dw	84.9	78.8	132	128	126	141	109	114	24.2	78.8	126	141
Mercury	mg/kg dw	0.0350	0.0366	0.0680	0.0410	0.0450	0.0590	0.0460	0.0472	0.0121	0.0350	0.0450	0.0680
	mg/kg ww	0.00210	0.00110	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00124	0.000495	0.00110	0.00110	0.00210
Molybdenum	mg/kg dw	0.566	0.364	0.554	0.604	0.431	0.392	0.494	0.486	0.0929	0.364	0.494	0.604
Nickel	mg/kg dw	2.70	2.54	5.52	4.48	3.66	4.12	3.60	3.80	1.03	2.54	3.66	5.52
Phosphorus	mg/kg dw	9,130	10,500	11,600	12,400	10,200	10,000	11,800	10,804	1,160	9,130	10,500	12,400
Potassium	mg/kg dw	7,590	7,150	8,690	8,360	6,970	7,340	7,350	7,636	644	6,970	7,350	8,690
Rubidium	mg/kg dw	12.1	11.8	13.5	13.0	11.6	11.9	11.5	12.2	0.757	11.5	11.9	13.5
Selenium	mg/kg dw	2.33	2.10	2.75	2.42	2.46	2.69	2.56	2.47	0.221	2.10	2.46	2.75
Silver	mg/kg dw	0.0472	0.0547	0.0622	0.0779	0.0754	0.0843	0.0607	0.0661	0.0135	0.0472	0.0622	0.0843
Sodium	mg/kg dw	2,420	3,570	6,970	4,370	3,180	3,810	4,310	4,090	1,437	2,420	3,810	6,970
Strontium	mg/kg dw	22.2	54.1	177	66.9	46.7	57.2	72.6	71.0	49.5	22.2	57.2	177
Tellurium	mg/kg dw	<0.020	<0.026	<0.020	<0.020	<0.020	<0.020	<0.027	<0.020	-	<0.020	<0.020	<0.027
Thallium	mg/kg dw	0.0269	0.0288	0.0209	0.0308	0.0221	0.0263	0.0252	0.0259	0.00350	0.0209	0.0263	0.0308
Tin	mg/kg dw	0.240	0.130	0.430	0.320	0.250	0.330	0.180	0.269	0.101	0.130	0.250	0.430
Titanium	mg/kg dw	41.1	24.5	66.2	64.2	51.1	36.5	30.9	44.9	16.1	24.5	41.1	66.2
Uranium	mg/kg dw	0.150	0.0766	0.126	0.118	0.106	0.0820	0.0761	0.105	0.0283	0.0761	0.106	0.150
Vanadium	mg/kg dw	3.11	2.98	6.83	7.04	4.94	3.51	2.81	4.46	1.83	2.81	3.51	7.04
Zinc	mg/kg dw	79.8	79.2	77.2	100	114	88.1	99.9	91.2	13.9	77.2	88.1	114
Zirconium	mg/kg dw	0.770	0.540	1.43	1.07	0.950	0.750	0.600	0.873	0.307	0.540	0.770	1.43

Value exceeds interim long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

Notes:"-" = standard deviation not calculated as all results were below laboratory reporting limit. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.4.2: Zooplankton Tissue Chemistry Data for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas, 2022

Analyte	Units	Exposed											
		QUL-ZOO-1											
		22-Jun-22	27-Jul-22	28-Aug-22	27-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	94.6	99.2	97.9	98.3	98.5	98.6	98.9	98.0	1.56	94.6	98.5	99.2
Aluminum	mg/kg dw	1,220	604	1,450	530	512	602	631	793	379	512	604	1,450
Antimony	mg/kg dw	0.0790	0.0600	0.170	0.0480	0.436	0.0370	0.0440	0.125	0.145	0.0370	0.0600	0.436
Arsenic	mg/kg dw	2.62	2.37	4.24	2.49	2.58	2.30	2.44	2.72	0.679	2.30	2.49	4.24
Barium	mg/kg dw	20.0	10.8	26.0	9.44	7.93	8.40	9.33	13.1	7.02	7.93	9.44	26.0
Beryllium	mg/kg dw	0.0560	0.0260	0.0520	0.0240	0.0260	0.0320	0.0330	0.0356	0.0131	0.0240	0.0320	0.0560
Bismuth	mg/kg dw	<0.010	0.0120	0.0140	<0.010	<0.010	<0.010	<0.010	0.0109	0.000990	<0.010	<0.010	0.0140
Boron	mg/kg dw	1.20	1.40	3.30	1.20	<1.0	1.20	1.20	1.50	0.796	<1.0	1.20	3.30
Cadmium	mg/kg dw	0.940	4.90	1.50	2.60	2.77	2.92	3.32	2.71	1.28	0.940	2.77	4.90
Calcium	mg/kg dw	3,360	8,760	34,500	8,000	9,200	8,420	9,180	11,631	10,288	3,360	8,760	34,500
Cesium	mg/kg dw	0.103	0.0808	0.177	0.0788	0.0631	0.0656	0.0703	0.0912	0.0401	0.0631	0.0788	0.177
Chromium	mg/kg dw	2.69	2.67	21.3	2.02	1.84	1.68	1.31	4.79	7.30	1.31	2.02	21.3
Cobalt	mg/kg dw	0.983	1.13	1.97	0.701	0.652	0.715	0.806	0.994	0.463	0.652	0.806	1.97
Copper	mg/kg dw	16.5	29.2	36.3	18.1	16.0	23.9	27.5	23.9	7.59	16.0	23.9	36.3
Iron	mg/kg dw	1,180	1,720	3,110	1,060	1,030	1,130	1,220	1,493	750	1,030	1,180	3,110
Lead	mg/kg dw	0.464	0.966	0.933	0.662	0.559	0.545	0.612	0.677	0.196	0.464	0.612	0.966
Lithium	mg/kg dw	0.900	0.660	1.63	0.590	<0.50	0.550	0.550	0.769	0.403	<0.50	0.590	1.63
Magnesium	mg/kg dw	1,300	1,530	2,330	1,270	1,220	1,260	1,350	1,466	394	1,220	1,300	2,330
Manganese	mg/kg dw	97.7	184	164	77.2	98.2	112	117	121	38.5	77.2	112	184
Mercury	mg/kg dw	0.0370	0.0650	0.0820	0.0450	0.0440	0.0430	0.0450	0.0516	0.0160	0.0370	0.0450	0.0820
	mg/kg ww	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020	<0.0020
Molybdenum	mg/kg dw	0.308	0.512	0.744	0.405	0.334	1.86	0.426	0.656	0.551	0.308	0.426	1.86
Nickel	mg/kg dw	2.50	6.59	10.0	3.17	3.21	3.45	3.80	4.67	2.69	2.50	3.45	10.0
Phosphorus	mg/kg dw	11,300	9,350	11,200	10,700	10,200	9,710	10,300	10,394	727	9,350	10,300	11,300
Potassium	mg/kg dw	9,280	7,760	8,840	7,770	7,410	7,420	7,850	8,047	724	7,410	7,770	9,280
Rubidium	mg/kg dw	15.4	13.4	13.7	13.1	12.4	12.7	13.4	13.4	0.971	12.4	13.4	15.4
Selenium	mg/kg dw	2.88	3.68	2.65	2.63	2.64	2.64	2.84	2.85	0.380	2.63	2.65	3.68
Silver	mg/kg dw	0.0547	0.131	0.0587	0.0723	0.0720	0.0813	0.0900	0.0800	0.0256	0.0547	0.0723	0.131
Sodium	mg/kg dw	3,300	3,320	7,070	3,680	3,480	3,560	3,700	4,016	1,356	3,300	3,560	7,070
Strontium	mg/kg dw	20.4	53.2	167	46.8	50.9	47.0	50.9	62.3	47.5	20.4	50.9	167
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0307	0.0198	0.0192	0.0192	0.0229	0.0204	0.0195	0.0217	0.00418	0.0192	0.0198	0.0307
Tin	mg/kg dw	0.300	0.270	0.210	0.270	0.160	0.160	0.180	0.221	0.0581	0.160	0.210	0.300
Titanium	mg/kg dw	35.1	32.3	85.7	25.7	18.2	22.0	21.2	34.3	23.5	18.2	25.7	85.7
Uranium	mg/kg dw	0.0901	0.0824	0.143	0.0708	0.0600	0.0706	0.0788	0.0851	0.0273	0.0600	0.0788	0.143
Vanadium	mg/kg dw	2.48	3.79	10.4	3.15	2.93	3.19	3.10	4.15	2.78	2.48	3.15	10.4
Zinc	mg/kg dw	84.6	108	71.0	96.0	87.3	89.5	100	90.9	11.9	71.0	89.5	108
Zirconium	mg/kg dw	0.610	0.630	1.50	0.860	0.380	0.550	0.720	0.750	0.362	0.380	0.630	1.50

Value exceeds interim long-term benthic invertebrate tissue guideline for selenium (4 mg/kg dw; BCMOE 2014).

Notes:"-" = standard deviation not calculated as all results were below laboratory reporting limit. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

APPENDIX C.5
BENTHIC COMMUNITY

Table C.5.1: **Benthic Invertebrate Community Metrics for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022**

Year	Area	Type	Replicate	Density (#/m²)	Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	EPT (#/m²)	Arachnida (#/m²)	Chironomidae (#/m²)	Oligochaeta (#/m²)	EPT (%)	Arachnida (%)	Chironomidae (%)	Oligochaeta (%)	CA1 (24.4%)	CA2 (16.7%)	CA3 (9.1%)
2014	QUL-PNF	Exposed	1	0	0	-	-	0	0	0	0	0	0	0	0	-	-	-
			2	17.3	1	1.00	0	0	0	17.3	0	0	0	100	0	-2.26	-0.298	0.635
			3	60.6	4	0.817	0.694	0	8.66	34.6	17.3	0	14.3	57.1	28.6	0.587	-0.204	1.50
			4	8.66	1	1.00	0	0	0	0	8.66	0	0	0	100	1.17	-0.295	1.13
			5	95.2	5	0.810	0.753	0	17.3	69.2	0	0	18.2	72.7	0	-0.672	-0.412	-2.77
	QUL-PREF1	Reference	1	5,783	7	0.259	0.448	17.3	17.3	4,553	1,177	0.299	0.299	78.7	20.4	0.876	-0.347	0.287
			2	7,808	6	0.176	0.0523	0	17.3	7,635	104	0	0.222	97.8	1.33	0.875	-0.894	0.415
			3	7,064	9	0.207	0.462	0	17.3	5,038	1,922	0	0.245	71.3	27.2	0.743	-0.720	0.587
			4	4,649	9	0.185	0.400	8.66	8.66	3,428	1,160	0.186	0.186	73.7	24.9	0.589	-0.616	-0.0112
			5	3,913	8	0.270	0.537	0	11.5	1,754	2,089	0	0.295	44.8	53.4	0.936	-0.788	0.596
2015	QUL-PNF	Exposed	1	43.3	4	0.893	0.720	0	0	26.0	8.66	0	0	60.0	20.0	0.112	-0.519	-0.391
			2	51.9	6	1.00	0.833	8.66	8.66	26.0	8.66	16.7	16.7	50.0	16.7	0.0714	-0.611	-1.81
			3	104	3	0.889	0.625	0	0	104	0	0	0	100	0	-1.54	-0.200	0.213
			4	139	5	0.545	0.633	0	17.3	121	0	0	12.5	87.5	0	-1.33	-0.236	0.293
			5	744	5	0.432	0.537	0	8.66	718	17.3	0	1.16	96.5	2.33	-0.495	-0.683	-0.501
	QUL-PREF1	Reference	1	11,600	4	0.416	0.399	0	0	2,805	8,795	0	0	24.2	75.8	0.625	-0.543	-0.138
			2	7,802	6	0.271	0.386	0	0	1,708	6,094	0	0	21.9	78.1	0.640	-0.537	-0.130
			3	23,061	6	0.223	0.253	0	0	2,874	20,187	0	0	12.5	87.5	0.601	-0.505	-0.120
			4	33,726	3	0.371	0.101	0	0	1,801	31,925	0	0	5.34	94.7	0.483	-0.539	-0.474
			5	10,630	4	0.340	0.264	0	0	1,489	9,003	0	0	14.0	84.7	0.674	-0.737	-0.0237
2016	QUL-PNF	Exposed	1	667	7	0.244	0.414	0	0	571	77.9	0	0	85.7	11.7	0.0256	1.37	-0.242
			2	1,333	10	0.201	0.503	0	866	424	34.6	0	64.9	31.8	2.60	-0.163	0.712	-1.88
			3	580	6	0.332	0.498	0	0	580	0	0	0	100	0	-1.38	0.586	-0.282
			4	199	3	0.435	0.234	0	0	190	0	0	0	95.7	0	-0.0111	2.48	-0.609
			5	173	5	0.435	0.540	0	0	147	26.0	0	0	85.0	15.0	0.175	1.00	-0.208
	QUL-PREF1	Reference	1	7,064	7	0.249	0.426	23.1	23.1	2,008	5,009	0.327	0.327	28.4	70.9	0.457	1.09	0.0511
			2	2,268	13	0.212	0.637	0	139	1,359	770	0	6.11	59.9	34.0	0.532	0.427	-0.320
			3	8,195	8	0.236	0.470	23.1	23.1	2,378	5,771	0.282	0.282	29.0	70.4	0.506	0.980	0.195
			4	8,708	12	0.128	0.350	0	0	1,575	7,116	0	0	18.1	81.7	0.683	0.906	0.0737
			5	2,320	12	0.206	0.596	0	0	822	1,437	0	0	35.5	61.9	0.624	0.423	0.567
2018	QUL-PNF	Exposed	1	1,281	11	0.318	0.714	51.9	0	589	589	4.05	0	46.0	46.0	-0.584	-0.460	-0.339
			2	1,376	9	0.280	0.603	0	0	1,229	113	0	0	89.3	8.18	-0.830	-0.425	-0.209
			3	1,065	4	0.375	0.333	0	0	1,047	0	0	0	98.4	0	-1.68	-0.220	0.298
			4	1,056	6	0.652	0.744	8.66	0	718	329	0.820	0	68.0	31.1	-0.621	-0.474	-0.270
			5	528	5	0.463	0.568	0	8.66	519	0	0	1.64	98.4	0	-1.38	-0.517	-0.297
	QUL-PREF1	Reference	1	3,012	11	0.149	0.390	8.66	8.66	2,355	623	0.287	0.287	78.2	20.7	0.517	-0.529	-0.753
			2	5,938	6	0.245	0.319	0	0	4,882	1,004	0	0	82.2	16.9	0.558	-0.529	0.210
			3	7,289	8	0.167	0.253	0	0	6,510	779	0	0	89.3	10.7	0.823	-0.702	0.319
			4	4,952	14	0.123	0.420	0	8.66	3,965	961	0	0.175	80.1	19.4	0.823	-0.528	0.641
			5	5,436	14	0.155	0.540	0	0	3,878	1,489	0	0	71.3	27.4	0.861	-0.471	0.626

Notes: " - " indicates no data, EPT = Ephemeroptera, Plecoptera, Trichoptera, CA = Correspondence Analysis.

Table C.5.1: **Benthic Invertebrate Community Metrics for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022**

Year	Area	Type	Replicate	Density (#/m²)	Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	EPT (#/m²)	Arachnida (#/m²)	Chironomidae (#/m²)	Oligochaeta (#/m²)	EPT (%)	Arachnida (%)	Chironomidae (%)	Oligochaeta (%)	CA1 (24.4%)	CA2 (16.7%)	CA3 (9.1%)
2019	QUL-PNF	Exposed	1	3,437	5	0.215	0.0688	0	0	121	3,315	0	0	3.53	96.5	-0.182	0.698	-0.297
			2	2,476	9	0.276	0.597	26.0	0	1,636	796	1.05	0	66.1	32.2	-0.794	0.515	0.643
			3	926	10	0.154	0.349	77.9	8.66	814	17.3	8.41	0.935	87.8	1.87	-1.19	-0.202	1.16
			4	1,212	9	0.228	0.512	60.6	0	1,117	0	5.00	0	92.1	0	-1.48	0.106	1.25
			5	1,446	8	0.196	0.361	60.6	0	1,324	8.66	4.19	0	91.6	0.599	-1.11	0.0838	0.818
	QUL-PREF1	Reference	1	7,127	7	0.267	0.465	40.3	0	4,711	2,315	0.565	0	66.1	32.5	0.331	1.62	0.0585
			2	11,357	3	0.427	0.219	0	0	9,938	1,385	0	0	87.5	12.2	0.585	2.28	-0.700
			3	7,860	7	0.236	0.395	17.3	34.6	5,834	1,956	0.220	0.441	74.2	24.9	0.538	1.42	0.331
			4	10,388	6	0.232	0.283	72.1	0	8,681	1,563	0.694	0	83.6	15.1	0.509	1.92	0.0513
			5	13,591	9	0.215	0.483	43.3	0	9,262	4,198	0.318	0	68.2	30.9	0.120	1.60	-0.0528
2020	QUL-PNF	Exposed	1	689	10	0.347	0.711	25.8	0	327	336	3.75	0	47.5	48.8	-0.575	0.748	-0.400
			2	784	8	0.322	0.612	0	17.2	741	17.2	0	2.20	94.5	2.20	-1.18	-0.265	-0.567
			3	818	9	0.244	0.544	8.61	17.2	784	0	1.05	2.11	95.8	0	-1.21	-0.336	-0.672
			4	1,240	8	0.292	0.573	0	43.1	1,137	43.1	0	3.47	91.7	3.47	-1.04	0.0147	0.449
			5	1,042	6	0.278	0.400	0	25.8	999	0	0	2.48	95.9	0	-1.44	0.113	0.725
2021	QUL-PNF	Exposed	1	1,266	8	0.590	0.788	17.2	379	577	293	1.36	29.9	45.6	23.1	-0.336	-0.415	-1.25
			2	1,705	5	0.304	0.342	0	17.2	319	1,369	0	1.01	18.7	80.3	-0.318	-0.337	0.0915
			3	1,309	6	0.274	0.391	0	25.8	1,283	0	0	1.97	98.0	0	-1.21	-0.0452	1.08
			4	1,550	7	0.276	0.483	0	25.8	1,473	43.1	0	1.67	95.0	2.78	-1.23	-0.124	0.689
			5	1,533	7	0.288	0.504	0	112	1,386	25.8	0	7.30	90.5	1.69	-1.04	-0.231	-0.0697
	QUL-PREF1	Reference	1	2,833	5	0.394	0.492	0	0	1,757	1,068	0	0	62.0	37.7	0.545	-0.506	-0.320
			2	10,781	8	0.266	0.531	0	172	4,891	5,718	0	1.60	45.4	53.0	0.834	-0.572	-0.776
			3	6,768	13	0.151	0.492	0	138	4,461	2,118	0	2.04	65.9	31.3	0.620	-0.583	-0.802
			4	4,641	8	0.259	0.517	8.61	25.8	2,118	2,454	0.186	0.557	45.6	52.9	0.515	-0.765	-0.957
			5	10,299	15	0.159	0.579	17.2	0	6,992	3,255	0.167	0	67.9	31.6	0.658	-0.227	0.883
2022	QUL-PNF	Exposed	1	818	5	0.396	0.495	0	34.4	749	17.2	0	4.21	91.6	2.11	-1.42	0.123	0.725
			2	603	9	0.337	0.671	0	86.1	456	60.3	0	14.3	75.7	10.0	-0.763	-0.331	-1.12
			3	1,016	5	0.361	0.446	0	0	999	17.2	0	0	98.3	1.69	-1.80	-0.286	-0.0611
			4	1,180	6	0.282	0.410	8.61	0	1,111	60.3	0.730	0	94.2	5.11	-1.19	-0.504	0.117
			5	1,361	6	0.281	0.407	0	68.9	1,283	8.61	0	5.06	94.3	0.633	-1.51	-0.247	0.332

Notes: " - " indicates no data, EPT = Ephemeroptera, Plecoptera, Trichoptera, CA = Correspondence Analysis.

Table C.5.2: Summary Statistics for Benthic Invertebrate Community Metrics for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/m²)	2014	QUL-PREF1	Reference	5	5,843	1,621	3,913	5,783	7,808
		QUL-PNF	Exposed	5	36.4	40.3	0	17.3	95.2
	2015	QUL-PREF1	Reference	5	17,364	10,842	7,802	11,600	33,726
		QUL-PNF	Exposed	5	216	298	43.3	104	744
	2016	QUL-PREF1	Reference	5	5,711	3,176	2,268	7,064	8,708
		QUL-PNF	Exposed	5	590	470	173	580	1,333
	2018	QUL-PREF1	Reference	5	5,325	1,560	3,012	5,436	7,289
		QUL-PNF	Exposed	5	1,061	329	528	1,065	1,376
	2019	QUL-PREF1	Reference	5	10,065	2,632	7,127	10,388	13,591
		QUL-PNF	Exposed	5	1,899	1,039	926	1,446	3,437
	2020	QUL-PNF	Exposed	5	915	223	689	818	1,240
	2021	QUL-PREF1	Reference	5	7,065	3,469	2,833	6,768	10,781
		QUL-PNF	Exposed	5	1,473	182	1,266	1,533	1,705
	2022	QUL-PNF	Exposed	5	995	297	603	1,016	1,361
Richness (# of Taxa)	2014	QUL-PREF1	Reference	5	7.80	1.30	6	8	9
		QUL-PNF	Exposed	5	2.20	2.17	0	1	5
	2015	QUL-PREF1	Reference	5	4.60	1.34	3	4	6
		QUL-PNF	Exposed	5	4.60	1.14	3	5	6
	2016	QUL-PREF1	Reference	5	10.4	2.70	7	12	13
		QUL-PNF	Exposed	5	6.20	2.59	3	6	10
	2018	QUL-PREF1	Reference	5	10.6	3.58	6	11	14
		QUL-PNF	Exposed	5	7.00	2.92	4	6	11
	2019	QUL-PREF1	Reference	5	6.40	2.19	3	7	9
		QUL-PNF	Exposed	5	8.20	1.92	5	9	10
	2020	QUL-PNF	Exposed	5	8.20	1.48	6	8	10
	2021	QUL-PREF1	Reference	5	9.80	4.09	5	8	15
		QUL-PNF	Exposed	5	6.60	1.14	5	7	8
	2022	QUL-PNF	Exposed	5	6.20	1.64	5	6	9
Simpson's Evenness	2014	QUL-PREF1	Reference	5	0.219	0.0428	0.176	0.207	0.270
		QUL-PNF	Exposed	5	0.907	0.108	0.810	0.908	1.00
	2015	QUL-PREF1	Reference	5	0.324	0.0771	0.223	0.340	0.416
		QUL-PNF	Exposed	5	0.752	0.248	0.432	0.889	1.00
	2016	QUL-PREF1	Reference	5	0.206	0.0470	0.128	0.212	0.249
		QUL-PNF	Exposed	5	0.329	0.107	0.201	0.332	0.435
	2018	QUL-PREF1	Reference	5	0.168	0.0460	0.123	0.155	0.245
		QUL-PNF	Exposed	5	0.417	0.148	0.280	0.375	0.652
	2019	QUL-PREF1	Reference	5	0.275	0.0868	0.215	0.236	0.427
		QUL-PNF	Exposed	5	0.213	0.0446	0.154	0.215	0.276
	2020	QUL-PNF	Exposed	5	0.297	0.0397	0.244	0.292	0.347
	2021	QUL-PREF1	Reference	5	0.246	0.0987	0.151	0.259	0.394
		QUL-PNF	Exposed	5	0.347	0.137	0.274	0.288	0.590
	2022	QUL-PNF	Exposed	5	0.332	0.0501	0.281	0.337	0.396
Simpson's Diversity	2014	QUL-PREF1	Reference	5	0.380	0.190	0.0523	0.448	0.537
		QUL-PNF	Exposed	5	0.362	0.418	0	0.347	0.753
	2015	QUL-PREF1	Reference	5	0.281	0.121	0.101	0.264	0.399
		QUL-PNF	Exposed	5	0.670	0.112	0.537	0.633	0.833
	2016	QUL-PREF1	Reference	5	0.496	0.119	0.350	0.470	0.637
		QUL-PNF	Exposed	5	0.438	0.123	0.234	0.498	0.540
	2018	QUL-PREF1	Reference	5	0.384	0.108	0.253	0.390	0.540
		QUL-PNF	Exposed	5	0.592	0.163	0.333	0.603	0.744
	2019	QUL-PREF1	Reference	5	0.369	0.115	0.219	0.395	0.483
		QUL-PNF	Exposed	5	0.378	0.202	0.0688	0.361	0.597
	2020	QUL-PNF	Exposed	5	0.568	0.113	0.400	0.573	0.711
	2021	QUL-PREF1	Reference	5	0.522	0.0361	0.492	0.517	0.579
		QUL-PNF	Exposed	5	0.502	0.173	0.342	0.483	0.788
	2022	QUL-PNF	Exposed	5	0.486	0.109	0.407	0.446	0.671
EPT (#/m²)	2014	QUL-PREF1	Reference	5	5.19	7.74	0	0	17.3
		QUL-PNF	Exposed	5	0	0	0	0	0
	2015	QUL-PREF1	Reference	5	0	0	0	0	0
		QUL-PNF	Exposed	5	1.73	3.87	0	0	8.66
	2016	QUL-PREF1	Reference	5	9.23	12.6	0	0	23.1
		QUL-PNF	Exposed	5	0	0	0	0	0
	2018	QUL-PREF1	Reference	5	1.73	3.87	0	0	8.66
		QUL-PNF	Exposed	5	12.1	22.6	0	0	51.9
	2019	QUL-PREF1	Reference	5	34.6	27.4	0	40.3	72.1
		QUL-PNF	Exposed	5	45.0	31.4	0	60.6	77.9
	2020	QUL-PNF	Exposed	5	6.89	11.2	0	0	25.8
	2021	QUL-PREF1	Reference	5	5.17	7.70	0	0	17.2
		QUL-PNF	Exposed	5	3.44	7.70	0	0	17.2
	2022	QUL-PNF	Exposed	5	1.72	3.85	0	0	8.61
Arachnida (#/m²)	2014	QUL-PREF1	Reference	5	14.4	4.08	8.66	17.3	17.3
		QUL-PNF	Exposed	5	5.19	7.74	0	0	17.3
	2015	QUL-PREF1	Reference	5	0	0	0	0	0
		QUL-PNF	Exposed	5	6.93	7.24	0	8.66	17.3
	2016	QUL-PREF1	Reference	5	36.9	57.9	0	23.1	139
		QUL-PNF	Exposed	5	173	387	0	0	866
	2018	QUL-PREF1	Reference	5	3.46	4.74	0	0	8.66
		QUL-PNF	Exposed	5	1.73	3.87	0	0	8.66
	2019	QUL-PREF1	Reference	5	6.93	15.5	0	0	34.6
		QUL-PNF	Exposed	5	1.73	3.87	0	0	8.66
	2020	QUL-PNF	Exposed	5	20.7	15.6	0	17.2	43.1
	2021	QUL-PREF1	Reference	5	67.2	81.8	0	25.8	172
		QUL-PNF	Exposed	5	112	154	17.2	25.8	379
	2022	QUL-PNF	Exposed	5	37.9	39.3	0	34.4	86.1
Chironomidae (#/m²)	2014	QUL-PREF1	Reference	5	4,482	2,168	1,754	4,553	7,635
	2015	QUL-PREF1	Reference	5	2,135	653	1,489	1,801	2,874
		QUL-PNF	Exposed	5	199	294	26.0	104	718
	2016	QUL-PREF1	Reference	5	1,629	598	822	1,575	2,378
		QUL-PNF	Exposed	5	383	205	147	424	580
	2018	QUL-PREF1	Reference	5	4,318	1,524	2,355	3,965	6,510
		QUL-PNF	Exposed	5	821	306	519	718	1,229
	2019	QUL-PREF1	Reference	5	7,685	2,282	4,711	8,681	9,938
		QUL-PNF	Exposed	5	1,002	577	121	1,117	1,636
	2020	QUL-PNF	Exposed	5	797	308	327	784	1,137
	2021	QUL-PREF1	Reference	5	4,044	2,152	1,757	4,461	6,992
		QUL-PNF	Exposed	5	1,008	523	319	1,283	1,473
	2022	QUL-PNF	Exposed	5	920	323	456	999	1,283

Notes: " - " indicates no data. EPT = Ephemeroptera, Plecoptera, Trichoptera. CA = Correspondence Analysis.

Table C.5.2: Summary Statistics for Benthic Invertebrate Community Metrics for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Year	Area	Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Oligochaeta (#/m²)	2014	QUL-PREF1	Reference	5	1,290	786	104	1,177	2,089
		QUL-PNF	Exposed	5	5.19	7.74	0	0	17.3
	2015	QUL-PREF1	Reference	5	15,201	10,804	6,094	9,003	31,925
		QUL-PNF	Exposed	5	6.93	7.24	0	8.66	17.3
	2016	QUL-PREF1	Reference	5	4,021	2,778	770	5,009	7,116
		QUL-PNF	Exposed	5	27.7	32.0	0	26.0	77.9
	2018	QUL-PREF1	Reference	5	971	327	623	961	1,489
		QUL-PNF	Exposed	5	206	253	0	113	589
	2019	QUL-PREF1	Reference	5	2,284	1,129	1,385	1,956	4,198
		QUL-PNF	Exposed	5	828	1,432	0	17.3	3,315
	2020	QUL-PNF	Exposed	5	79.2	145	0	17.2	336
	2021	QUL-PREF1	Reference	5	2,923	1,749	1,068	2,454	5,718
		QUL-PNF	Exposed	5	346	584	0	43.1	1,369
	2022	QUL-PNF	Exposed	5	32.7	25.4	8.61	17.2	60.3
EPT (%)	2014	QUL-PREF1	Reference	5	0.0971	0.139	0	0	0.299
		QUL-PNF	Exposed	5	0	0	0	0	0
	2015	QUL-PREF1	Reference	5	0	0	0	0	0
		QUL-PNF	Exposed	5	3.33	7.45	0	0	16.7
	2016	QUL-PREF1	Reference	5	0.122	0.167	0	0	0.327
		QUL-PNF	Exposed	5	0	0	0	0	0
	2018	QUL-PREF1	Reference	5	0.0575	0.129	0	0	0.287
		QUL-PNF	Exposed	5	0.975	1.76	0	0	4.05
	2019	QUL-PREF1	Reference	5	0.360	0.276	0	0.318	0.694
		QUL-PNF	Exposed	5	3.73	3.35	0	4.19	8.41
	2020	QUL-PNF	Exposed	5	0.961	1.62	0	0	3.75
	2021	QUL-PREF1	Reference	5	0.0706	0.0968	0	0	0.186
		QUL-PNF	Exposed	5	0.272	0.608	0	0	1.36
	2022	QUL-PNF	Exposed	5	0.146	0.326	0	0	0.730
Arachnida (%)	2014	QUL-PREF1	Reference	5	0.249	0.0484	0.186	0.245	0.299
		QUL-PNF	Exposed	5	6.49	9.00	0	0	18.2
	2015	QUL-PREF1	Reference	5	0	0	0	0	0
		QUL-PNF	Exposed	5	6.07	7.93	0	1.16	16.7
	2016	QUL-PREF1	Reference	5	1.34	2.67	0	0.282	6.11
		QUL-PNF	Exposed	5	13.0	29.0	0	0	64.9
	2018	QUL-PREF1	Reference	5	0.0924	0.133	0	0	0.287
		QUL-PNF	Exposed	5	0.328	0.733	0	0	1.64
	2019	QUL-PREF1	Reference	5	0.0881	0.197	0	0	0.441
		QUL-PNF	Exposed	5	0.187	0.418	0	0	0.935
	2020	QUL-PNF	Exposed	5	2.05	1.27	0	2.20	3.47
	2021	QUL-PREF1	Reference	5	0.838	0.935	0	0.557	2.04
		QUL-PNF	Exposed	5	8.38	12.3	1.01	1.97	29.9
	2022	QUL-PNF	Exposed	5	4.71	5.84	0	4.21	14.3
Chironomidae (%)	2014	QUL-PREF1	Reference	5	73.3	19.0	44.8	73.7	97.8
		QUL-PNF	Exposed	5	46.0	44.7	0	57.1	100
	2015	QUL-PREF1	Reference	5	15.6	7.60	5.34	14.0	24.2
		QUL-PNF	Exposed	5	78.8	22.5	50.0	87.5	100
	2016	QUL-PREF1	Reference	5	34.2	15.7	18.1	29.0	59.9
		QUL-PNF	Exposed	5	79.6	27.5	31.8	85.7	100
	2018	QUL-PREF1	Reference	5	80.2	6.52	71.3	80.1	89.3
		QUL-PNF	Exposed	5	80.0	22.7	46.0	89.3	98.4
	2019	QUL-PREF1	Reference	5	75.9	9.38	66.1	74.2	87.5
		QUL-PNF	Exposed	5	68.2	37.7	3.53	87.8	92.1
	2020	QUL-PNF	Exposed	5	85.1	21.1	47.5	94.5	95.9
	2021	QUL-PREF1	Reference	5	57.4	11.0	45.4	62.0	67.9
		QUL-PNF	Exposed	5	69.5	35.6	18.7	90.5	98.0
	2022	QUL-PNF	Exposed	5	90.8	8.78	75.7	94.2	98.3
Oligochaeta (%)	2014	QUL-PREF1	Reference	5	25.4	18.6	1.33	24.9	53.4
		QUL-PNF	Exposed	5	25.7	43.3	0	0	100
	2015	QUL-PREF1	Reference	5	84.2	7.55	75.8	84.7	94.7
		QUL-PNF	Exposed	5	7.80	9.74	0	2.33	20.0
	2016	QUL-PREF1	Reference	5	63.8	18.1	34.0	70.4	81.7
		QUL-PNF	Exposed	5	5.86	7.01	0	2.60	15.0
	2018	QUL-PREF1	Reference	5	19.0	6.06	10.7	19.4	27.4
		QUL-PNF	Exposed	5	17.1	20.6	0	8.18	46.0
	2019	QUL-PREF1	Reference	5	23.1	9.16	12.2	24.9	32.5
		QUL-PNF	Exposed	5	26.2	41.6	0	1.87	96.5
	2020	QUL-PNF	Exposed	5	10.9	21.2	0	2.20	48.8
	2021	QUL-PREF1	Reference	5	41.3	10.9	31.3	37.7	53.0
		QUL-PNF	Exposed	5	21.6	34.1	0	2.78	80.3
	2022	QUL-PNF	Exposed	5	3.91	3.79	0.633	2.11	10.0
CA1 (24.4%)	2014	QUL-PREF1	Reference	5	0.804	0.139	0.589	0.875	0.936
		QUL-PNF	Exposed	5	-0.294	1.52	-2.26	-0.0427	1.17
	2015	QUL-PREF1	Reference	5	0.605	0.0729	0.483	0.625	0.674
		QUL-PNF	Exposed	5	-0.636	0.771	-1.54	-0.495	0.112
	2016	QUL-PREF1	Reference	5	0.560	0.0914	0.457	0.532	0.683
		QUL-PNF	Exposed	5	-0.271	0.633	-1.38	-0.0111	0.175
	2018	QUL-PREF1	Reference	5	0.716	0.165	0.517	0.823	0.861
		QUL-PNF	Exposed	5	-1.02	0.488	-1.68	-0.830	-0.584
	2019	QUL-PREF1	Reference	5	0.416	0.192	0.120	0.509	0.585
		QUL-PNF	Exposed	5	-0.950	0.494	-1.48	-1.11	-0.182
	2020	QUL-PNF	Exposed	5	-1.09	0.322	-1.44	-1.18	-0.575
	2021	QUL-PREF1	Reference	5	0.634	0.126	0.515	0.620	0.834
		QUL-PNF	Exposed	5	-0.827	0.462	-1.23	-1.04	-0.318
	2022	QUL-PNF	Exposed	5	-1.34	0.390	-1.80	-1.42	-0.763
CA2 (16.7%)	2014	QUL-PREF1	Reference	5	-0.673	0.209	-0.894	-0.720	-0.347
		QUL-PNF	Exposed	5	-0.302	0.0851	-0.412	-0.297	-0.204
	2015	QUL-PREF1	Reference	5	-0.572	0.0931	-0.737	-0.539	-0.505
		QUL-PNF	Exposed	5	-0.449	0.220	-0.683	-0.519	-0.200
	2016	QUL-PREF1	Reference	5	0.765	0.317	0.423	0.906	1.09
		QUL-PNF	Exposed	5	1.23	0.760	0.586	1.00	2.48
	2018	QUL-PREF1	Reference	5	-0.552	0.0875	-0.702	-0.529	-0.471
		QUL-PNF	Exposed	5	-0.419	0.116	-0.517	-0.460	-0.220
	2019	QUL-PREF1	Reference	5	1.77	0.339	1.42	1.62	2.28
		QUL-PNF	Exposed	5	0.240	0.362	-0.202	0.106	0.698
	2020	QUL-PNF	Exposed	5	0.0551	0.430	-0.336	0.0147	0.748
	2021	QUL-PREF1	Reference	5	-0.531	0.195	-0.765	-0.572	-0.227
		QUL-PNF	Exposed	5	-0.230	0.151	-0.415	-0.231	-0.0452
	2022	QUL-PNF	Exposed	5	-0.249	0.230	-0.504	-0.286	0.123
CA3 (9.1%)	2014	QUL-PREF1	Reference	5	0.375	0.251	-0.0112	0.415	0.596
		QUL-PNF	Exposed	5	0.125	1.96	-2.77	0.883	1.50
	2015	QUL-PREF1	Reference	5	-0.177	0.172	-0.474	-0.130	-0.0237
		QUL-PNF	Exposed	5	-0.440	0.844	-1.81	-0.391	0.293
	2016	QUL-PREF1	Reference	5	0.113	0.319	-0.320	0.0737	0.567
		QUL-PNF	Exposed	5	-0.645	0.711	-1.88	-0.282	-0.208
	2018	QUL-PREF1	Reference	5	0.209	0.570	-0.753	0.319	0.641
		QUL-PNF	Exposed	5	-0.164	0.262	-0.339	-0.270	0.298
	2019	QUL-PREF1	Reference	5	-0.0626	0.384	-0.700	0.0513	0.331
		QUL-PNF	Exposed	5	0.715	0.617	-0.297	0.818	1.25
	2020	QUL-PNF	Exposed	5	-0.0931	0.636	-0.672	-0.400	0.725
	2021	QUL-PREF1	Reference	5	-0.394	0.753	-0.957	-0.776	0.883
		QUL-PNF	Exposed	5	0.109	0.891	-1.25	0.0915	1.08
	2022	QUL-PNF	Exposed	5	-0.000921	0.690	-1.12	0.117	0.725

Notes: " - " indicates no data. EPT = Ephemeroptera, Plecoptera, Trichoptera. CA = Correspondence Analysis.

Table C.5.3: Benthic Invertebrate Community Supporting Measures for Quesnel Lake at QUL-PNF (Exposed) Deep Area, 2014 to 2022

Year	Area Code	Type	Station	Station Depth (m)	Bottom Water Quality					Sediment Parameters							
					Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductance (µS/cm)	pH	% Fines	% TOC	PC Axis 1 (76 %)	PC Axis 2 (15 %)	Arsenic (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)
2014	QUL-PREF1	Reference	QUL-PREF1-1	115	4.61	10.8	83.8	116	7.71	69.5	1.62	5.02	-0.488	7.15	46.7	29,200	456
			QUL-PREF1-2	108	4.61	2.14	14.9	119	7.71	68.3	1.70	5.93	0.393	6.95	39.1	26,900	421
			QUL-PREF1-3	117	4.48	10.8	83.8	117	7.48	78.6	1.72	5.04	-0.352	8.60	44.0	29,900	484
			QUL-PREF1-4	107	4.63	10.5	81.3	118	7.52	83.3	1.64	5.19	-0.0945	8.15	42.2	29,500	494
			QUL-PREF1-5	103	4.57	10.8	83.5	115	7.61	82.9	1.71	5.92	0.935	7.89	38.8	27,400	496
	QUL-PNF	Exposed	QUL-PNF-1	106	6.72	6.42	52.5	169	8.00	95.8	0.120	-2.37	4.02	15.5	766	27,900	863
			QUL-PNF-2	109	6.86	6.12	50.3	167	8.06	99.6	0.120	-3.96	1.74	18.6	865	31,100	948
			QUL-PNF-3	104	7.04	5.24	43.8	172	8.06	99.7	0.270	-2.17	4.48	15.4	690	25,500	811
			QUL-PNF-4	104	7.09	5.13	42.7	176	8.09	96.0	0.170	-1.08	6.44	14.4	566	33,700	650
			QUL-PNF-5	107	6.99	7.21	59.2	156	8.15	69.9	0.150	-1.44	5.55	13.2	681	68,000	711
2015	QUL-PREF1	Reference	QUL-PREF1-1	115	3.80	11.1	84.5	110	7.51	78.9	1.76	3.86	-2.23	8.64	59.4	32,300	477
			QUL-PREF1-2	103	3.83	11.0	83.4	110	7.35	71.8	-	-	-	-	-	-	-
			QUL-PREF1-3	120	4.45	10.4	81.0	110	7.50	84.8	1.71	4.20	-1.10	8.98	55.8	32,700	479
			QUL-PREF1-4	102	4.12	10.3	80.0	113	7.66	81.3	-	-	-	-	-	-	-
			QUL-PREF1-5	103	4.26	10.4	79.8	112	7.40	85.7	1.98	4.89	-0.262	9.02	50.0	28,900	516
	QUL-PNF	Exposed	QUL-PNF-1	112	4.42	11.0	83.4	115	7.46	98.6	0.420	-5.02	-1.09	16.2	1,110	38,700	1,250
			QUL-PNF-2	111	4.40	10.3	79.4	146	7.41	98.4	0.520	-5.61	-1.67	17.0	1,190	41,200	1,310
			QUL-PNF-3	104	4.31	10.3	79.1	146	7.46	98.2	0.250	-3.82	0.597	16.1	904	38,600	1,090
			QUL-PNF-4	97.3	4.32	10.1	77.8	147	7.51	98.1	<0.1	-0.208	5.93	13.4	536	35,100	716
			QUL-PNF-5	106	4.32	10.2	78.2	151	7.57	71.8	0.180	-1.47	4.95	14.1	557	49,500	801
2016	QUL-PREF1	Reference	QUL-PREF1-1	116	3.82	10.4	78.8	118	7.60	70.9	2.02	3.89	-1.71	9.89	61.1	30,900	469
			QUL-PREF1-2	103	3.80	10.5	79.7	116	7.76	76.5	2.01	4.60	-1.15	9.57	56.4	29,000	457
			QUL-PREF1-3	119	3.81	10.5	79.5	116	7.25	79.8	2.03	3.90	-1.95	11.0	59.4	32,100	495
			QUL-PREF1-4	100	3.79	10.3	78.0	117	7.41	86.5	1.67	4.50	-0.960	9.05	56.3	30,700	451
			QUL-PREF1-5	98.8	3.88	10.2	77.6	118	7.29	87.3	1.89	5.24	-0.232	8.37	47.5	29,400	480
	QUL-PNF	Exposed	QUL-PNF-1	109	4.51	10.6	82.2	115	7.38	99.0	0.390	-5.55	-1.82	17.9	1,230	38,500	1,360
			QUL-PNF-2	112	4.51	10.6	81.8	115	7.04	97.7	0.410	-5.70	-1.64	18.4	1,250	38,300	1,350
			QUL-PNF-3	105	4.50	10.3	79.4	116	7.18	96.1	0.200	-5.40	-0.916	19.4	1,180	39,400	1,330
			QUL-PNF-4	112	4.76	10.1	78.7	118	7.02	99.0	0.380	-5.83	-2.17	18.9	1,260	39,900	1,450
			QUL-PNF-5	113	4.60	10.5	81.5	119	7.18	99.5	0.350	-5.24	-1.08	17.9	1,130	37,000	1,250
2018	QUL-PREF1	Reference	QUL-PREF1-1	112	3.73	11.8	89.1	113	7.57	84.9	2.07	5.34	-0.632	8.47	48.9	29,500	416
			QUL-PREF1-2	105	3.78	11.8	89.3	113	7.52	82.2	2.22	5.38	-0.300	8.47	46.8	29,200	397
			QUL-PREF1-3	112	3.76	11.8	89.4	113	7.43	86.5	2.13	5.57	0.295	7.99	45.3	28,400	425
			QUL-PREF1-4	107	3.97	11.4	87.2	113	7.50	84.7	2.26	5.70	0.0492	7.50	46.7	28,100	405
			QUL-PREF1-5	97.0	3.75	11.7	88.9	113	7.50	85.9	1.92	5.85	0.360	7.39	43.2	28,300	449
	QUL-PNF	Exposed	QUL-PNF-1	108	4.46	11.5	88.8	121	7.19	97.6	0.370	-3.44	-0.491	15.6	881	43,200	1,420
			QUL-PNF-2	112	4.39	11.0	84.5	114	7.17	98.5	0.420	-4.32	-0.363	16.7	1,000	38,300	1,280
			QUL-PNF-3	105	4.40	11.5	88.6	120	7.52	92.1	0.200	-3.59	1.54	15.6	850	44,800	1,170
			QUL-PNF-4	113	4.47	10.9	84.5	114	7.57	76.5	1.44	-1.11	-0.927	12.9	533	38,100	1,070
			QUL-PNF-5	113	4.47	11.0	84.6	115	7.52	99.4	0.410	-3.91	-1.18	16.0	964	39,900	1,510

Notes: "-" indicates no data, TOC = Total Organic Carbon, PC Axis = Principal Components Axis, mg/kg = milligrams per kilogram.

Table C.5.3: Benthic Invertebrate Community Supporting Measures for Quesnel Lake at QUL-PNF (Exposed) Deep Area, 2014 to 2022

Year	Area Code	Type	Station	Station Depth (m)	Bottom Water Quality					Sediment Parameters							
					Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductance (µS/cm)	pH	% Fines	% TOC	PC Axis 1 (76 %)	PC Axis 2 (15 %)	Arsenic (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)
2019	QUL-PREF1	Reference	QUL-PREF1-1	115	3.74	11.2	84.8	112	7.61	89.9	2.07	4.90	-1.09	8.49	49.7	30,700	401
			QUL-PREF1-2	99.0	3.84	11.0	84	111	7.73	80.2	1.78	4.84	-0.977	8.18	50.2	30,700	413
			QUL-PREF1-3	117	3.77	11.0	83.7	112	7.75	88.5	1.56	5.16	-0.456	7.74	48.8	29,300	399
			QUL-PREF1-4	97.0	3.84	11.1	84.4	111	7.63	86.1	1.71	5.11	-0.501	7.86	49.4	30,600	408
			QUL-PREF1-5	97.0	3.82	11.1	84.6	111	7.66	88.2	1.88	5.30	-0.123	7.23	46.9	28,900	445
	QUL-PNF	Exposed	QUL-PNF-1	110	4.27	11.8	90.8	119	7.77	97.7	0.550	-5.63	-1.64	17.0	1,200	42,500	1,390
			QUL-PNF-2	108	4.26	11.8	90.6	120	7.71	98.7	0.600	-5.45	-2.19	17.3	1,140	42,500	1,460
			QUL-PNF-3	105	4.22	11.1	85.1	136	7.55	93.7	0.360	-2.18	2.55	14.7	706	38,300	1,030
			QUL-PNF-4	101	4.32	11.8	90.5	118	7.79	93.6	0.650	-5.65	-2.63	17.5	1,150	44,300	1,540
			QUL-PNF-5	110	4.30	11.8	90.7	119	7.71	99.6	0.430	-4.63	-1.27	15.9	1,100	38,500	1,370
2020	QUL-PNF	Exposed	QUL-PNF-1	112	4.51	11.2	86.2	122	7.20	96.9	0.0680	-1.56	2.98	14.6	700	32,100	1,110
			QUL-PNF-2	113	4.51	11.1	86.1	122	7.38	96.2	0.0890	-3.19	-0.999	15.6	854	38,400	1,250
			QUL-PNF-3	108	4.51	11.2	86.9	122	7.52	95.5	0.0610	-2.23	-0.301	14.3	735	39,400	1,400
			QUL-PNF-4	113	4.51	11.2	86.5	122	7.46	89.1	0.0780	-2.95	-0.941	14.8	743	49,800	1,430
			QUL-PNF-5	112	4.52	11.2	86.4	122	7.42	99.1	0.0750	-3.25	-1.61	15.3	888	36,600	1,530
2021	QUL-PREF1	Reference	QUL-PREF1-1	116	3.75	11.4	86.3	99.9	7.32	80.0	2.13	4.40	-0.858	8.00	50.0	30,400	416
			QUL-PREF1-2	107	3.85	11.2	85.4	100	7.28	77.2	2.07	4.93	0.249	9.50	44.4	30,500	441
			QUL-PREF1-3	120	3.76	11.3	85.5	100	7.35	79.9	2.03	4.26	-0.933	9.66	46.3	31,000	485
			QUL-PREF1-4	100	3.88	10.7	81.5	102	7.31	82.1	2.08	4.98	0.0689	8.55	43.5	29,600	440
			QUL-PREF1-5	105	3.79	11.2	85.0	100	7.34	80.5	2.17	4.28	-0.362	9.38	42.4	30,800	572
	QUL-PNF	Exposed	QUL-PNF-1	110	4.63	11.6	90.3	115	7.41	96.4	0.599	-4.04	-1.31	16.3	906	43,300	1,880
			QUL-PNF-2	111	4.63	11.5	89.5	114	7.43	92.4	0.830	-3.55	-0.377	16.8	857	42,200	1,270
			QUL-PNF-3	106	4.63	11.5	89.2	114	7.42	98.0	0.309	-2.88	1.70	14.6	865	33,400	1,200
			QUL-PNF-4	96.0	4.64	11.5	89.4	114	7.44	93.9	0.562	-2.09	1.56	15.8	621	34,000	1,220
			QUL-PNF-5	105	4.63	11.5	89.1	115	7.40	92.5	0.534	-2.52	-0.326	15.1	780	41,000	1,420
2022	QUL-PNF	Exposed	QUL-PNF-1	113	4.54	11.2	86.9	103	7.69	87.2	0.622	-3.55	-0.484	15.8	925	46,100	1,190
			QUL-PNF-2	112	4.54	11.2	86.9	103	7.69	96.9	0.695	-2.69	-0.519	15.3	794	43,100	1,360
			QUL-PNF-3	110	4.70	11.2	86.9	106	7.68	77.0	0.456	-2.41	0.572	15.1	745	50,600	1,220
			QUL-PNF-4	112	4.56	11.2	86.8	104	7.69	92.5	0.736	-2.78	-1.19	15.5	797	42,000	1,320
			QUL-PNF-5	110	4.55	11.2	86.7	103	7.70	95.3	0.559	-3.69	-1.05	16.3	915	43,700	1,370

Notes: "-" indicates no data, TOC = Total Organic Carbon, PC Axis = Principal Components Axis, mg/kg = milligrams per kilogram.

APPENDIX C.6
FISH CATCH & MERISTICS

Table C.6.1: **Hoop Net Catch Data for Polley Lake (POL; Exposed) and Bootjack Lake (BOL; Reference), May 2022**

Area	Station ID	Net Size	UTM (NAD83, 10U)		Set Date	Lift Date	Set Time	Removal Time	Depth Range (m)		Effort (Fishing days)	Largescale Sucker					Longnose Sucker					Rainbow Trout					Redside Shiner				
			Easting	Northing								Catch	Sacrificed	Released Alive	Mortalities	CPUE[a]	Catch	Sacrificed	Released Alive	Mortalities	CPUE[a]	Catch	Sacrificed	Released Alive	Mortalities	CPUE[a]	Catch	Sacrificed	Released Alive	Mortalities	CPUE[a]
Polley Lake	POL_HN-1_2022-05	2.5	595698	5821073	26-May-22	28-May-22	16:07	9:32	2.1	2.3	1.73	0	0	0	0	0	60	8	52	0	34.8	14	3	6	2	8.11	3	0	2	1	1.74
	POL_HN-2_2022-05	2.5	595695	5820981	26-May-22	29-May-22	16:40	9:31	1.2	1.2	2.70	0	0	0	0	0	77	0	77	0	28.5	70	5	65	0	25.9	16	0	14	2	6
	POL_HN-3_2022-05	2.5	595383	5820933	26-May-22	29-May-22	17:14	12:36	0.8	1.3	2.81	0	0	0	0	0	58	0	58	0	20.7	116	0	116	0	41.3	2	0	2	0	0.713
	POL_HN-4_2022-05	2.5	595514	5820906	26-May-22	29-May-22	17:47	13:10	3.9	4.4	2.81	0	0	0	0	0	42	0	42	0	15.0	7	0	7	0	2.49	6	0	6	0	2.14
	POL_HN-5_2022-05	2.5	595698	5821073	28-May-22	29-May-22	16:27	15:22	2.1	2.3	0.955	0	0	0	0	0	92	0	92	0	96.3	0	0	0	0	0	0	0	0	0	0
										Total	**11.0**	**0**	**0**	**0**	**0**	**0**	**329**	**8**	**321**	**0**	**29.9**	**207**	**8**	**194**	**2**	**18.8**	**27**	**0**	**24**	**3**	**2.46**
Bootjack Lake	BOL_HN-1_2022-05	2.5	591173	5821307	27-May-22	30-May-22	12:23	15:30	2.4	3.4	3.13	0	0	0	0	0	123	0	123	0	39.3	45	0	39	6	14.4	0	0	0	0	0
	BOL_HN-2_2022-05	2.5	591091	5821382	27-May-22	30-May-22	12:50	16:25	1.7	1.8	3.15	0	0	0	0	0	38	0	38	0	12.1	55	0	55	0	17.5	0	0	0	0	0
	BOL_HN-3_2022-05	2.5	589873	5823897	27-May-22	30-May-22	15:30	8:57	1.0	1.0	2.73	1	0	1	0	0	67	8	59	0	24.6	94	8	74	12	34.5	0	0	0	0	0
	BOL_HN-4_2022-05	2.5	589845	5823770	27-May-22	30-May-22	16:08	13:12	1.3	1.6	2.88	1	0	1	0	0	111	0	111	0	38.6	30	0	30	0	10.4	0	0	0	0	0
										Total	**11.9**	**2**	**0**	**2**	**0**	**0.168**	**339**	**8**	**331**	**0**	**28.5**	**224**	**8**	**198**	**18**	**18.8**	**0**	**0**	**0**	**0**	**0**

Notes: ID = identifier. UTM = Universal Transverse Mercator. NAD = North American Datum. CPUE = catch-per-unit-effort. HN = hoop net.

[a] CPUE is calculated as the number of fish per days of fishing effort. Total CPUE is calculated as the total catch of a single species over the total effort for all the hoop net sets in one area.

Table C.6.2: Hoop Net Catch Data from Polley Lake (POL; Exposed), September 2022

Net ID	Net Size (hoop diameter, ft)	UTM (NAD83, Zone 10U)		Set Date	Lift Date	Set Time	Lift Time	Depth Range (m)		Effort (days)	Rainbow Trout			Longnose Sucker			Redside Shiner		
		Easting	Northing								Catch	Mortalities	CPUE [a]	Catch	Mortalities	CPUE [a]	Catch	Mortalities	CPUE [a]
POL_HN-1_2022-09	2.0	593496	5824505	21-Sep-22	22-Sep-22	15:53	11:25	1.0	2.0	0.814	0	0	0	0	0	0	0	0	0
POL_HN-2_2022-09	2.0	592769	5825978			14:30	8:15	-	-	0.740	2	0	2.70	2	0	2.70	114	1	154
POL_HN-3_2022-09	2.0	595393	5822445			16:39	13:55	1.0	1.5	0.886	2	0	2.26	0	0	0	52	3	58.7
POL_HN-4_2022-09	2.5	595643	5822021			16:56	14:45	1.5	2.0	0.909	0	0	0	8	0	8.80	0	0	0
POL_HN-5_2022-09	2.5	593020	5825529			15:00	10:40	-	-	0.819	1	0	1.22	8	0	9.76	0	0	0
POL_HN-6_2022-09	2.5	594324	5824464			15:20	12:05	1.5	3.0	0.865	0	0	0	4	0	4.63	0	0	0
POL_HN-7_2022-09	2.5	594979	5823310			16:23	12:55	1.0	2.0	0.856	1	0	1.17	7	0	8.18	0	0	0
POL_HN-8_2022-09	2.5	593385	5824789	22-Sep-22	23-Sep-22	11:06	11:32	2.5	3.0	1.02	2	0	1.96	3	0	2.95	0	0	0
POL_HN-9_2022-09	2.0	593964	5824927			11:32	12:05	1.5	2.0	1.02	1	0	0.978	0	0	0	30	1	29.3
POL_HN-10_2022-09	2.5	594523	5824196			12:15	11:00	1.0	2.5	0.948	0	0	0	0	0	0	0	0	0
POL_HN-11_2022-09	2.0	594402	5822978			13:45	10:35	1.5	2.0	0.868	0	0	0	2	0	2.30	40	0	46.1
POL_HN-12_2022-09	2.5	594600	5822602			13:20	10:00	2.0	3.0	0.861	5	0	5.81	10	0	11.6	3	2	3.48
POL_HN-13_2022-09	2.0	595187	5822847			14:18	9:30	0.5	1.0	0.800	0	0	0	0	0	0	1	0	1.25
POL_HN-14_2022-09	2.5	595643	5822021			14:54	8:40	1.0	2.5	0.740	17	1	23.0	4	0	5.40	2	1	2.70
POL_HN-15_2022-09	2.5	593314	5826074	23-Sep-22	24-Sep-22	9:10	8:00	0.5	1.0	0.951	4	0	4.20	3	0	3.15	0	0	0
POL_HN-16_2022-09	2.0	595056	5823163			9:45	13:50	0.5	1.0	1.17	0	0	0	0	0	0	0	0	0
POL_HN-17_2022-09	2.0	594788	5823667			10:50	8:39	0.8	1.5	0.909	2	0	2.20	0	0	0	9	0	9.90
POL_HN-18_2022-09	2.5	594370	5824495			11:20	9:00	2.0	3.0	0.903	9	0	9.97	19	0	21.0	0	0	0
POL_HN-19_2022-09	2.5	592889	5825758			12:45	12:15	2.0	3.0	0.98	27	0	27.6	27	0	27.6	0	0	0
POL_HN-20_2022-09	2.5	593313	5826064			13:00	11:00	1.5	3.0	0.917	11	0	12.0	26	0	28.36	0	0	0
POL_HN-21_2022-09	2.0	592631	5826091			12:30	10:45	-	-	0.927	0	0	0	0	0	0	1	0	1.08
POL_HN-22_2022-09	2.5	594858	5822183	24-Sep-22	25-Sep-22	8:20	8:40	1.0	2.0	1.01	38	0	37.5	5	0	4.93	1	0	0.986
POL_HN-23_2022-09	2.5	594481	5824309			10:02	10:20	0.8	1.0	1.01	0	0	0	0	0	0	0	0	0
POL_HN-24_2022-09	2.0	593672	5824275			10:15	11:00	1.5	2.0	1.03	2	0	1.94	0	0	0	20	0	19.4
POL_HN-25_2022-09	2.0	593351	5826042			11:00	11:30	0.5	1.0	1.02	2	0	1.96	1	0	0.980	52	0	50.9
POL_HN-26_2022-09	2.5	594991	5823288			13:30	9:40	1.0	1.8	0.840	30	0	35.7	4	0	4.76	0	0	0
POL_HN-27_2022-09	2.0	595011	5821797			14:10	12:00	1.0	1.3	0.910	0	0	0	0	0	0	2	0	2.20
POL_HN-28_2022-09	2.5	595772	5821089			14:20	7:50	1.0	1.5	0.729	17	0	23.3	7	0	9.60	3	0	4.11
POL_HN-29_2022-09	2.5	594442	5822907	25-Sep-22	26-Sep-22	9:00	10:20	1.0	2.5	1.06	1	0	0.947	2	1	1.89	1	0	0.947
POL_HN-30_2022-09	2.5	594992	5823275			10:00	9:05	1.0	1.8	0.962	5	0	5.20	3	0	3.12	2	0	2.08
POL_HN-31_2022-09	2.5	594791	5823644			10:10	9:30	1.0	2.0	0.972	25	0	25.7	11	0	11.3	0	0	0
POL_HN-32_2022-09	2.5	594415	5824406			10:30	8:25	2.5	3.0	0.913	2	0	2.19	2	0	2.19	0	0	0
POL_HN-33_2022-09	2.0	593496	5824505			11:20	8:10	1.0	1.5	0.868	3	0	3.46	1	0	1.15	13	0	15.0
POL_HN-34_2022-09	2.0	593468	5825719			11:40	7:45	0.8	1.0	0.837	4	0	4.78	2	0	2.39	21	0	25.1
POL_HN-35_2022-09	2.0	595293	5821122			12:30	10:20	1.0	1.8	0.910	0	0	0	39	0	42.9	96	0	106
									Total	**32.0**	**213**	**1**	**6.66**	**200**	**1**	**6.25**	**463**	**8**	**14.5**

Notes: ID = identifier. UTM = Universal Transverse Mercator. NAD = North American Datum. CPUE = catch-per-unit-effort. HN =

[a] CPUE = number of fish caught per trap day.

Table C.6.3: Non-Destructive Physical Measurements of Rainbow Trout Caught by Hoop Netting in Polley Lake (POL; Exposed), May 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate	Comments
28-May-22	POL_RB-1_2022-05	30.7	29.1	248	Ligula	M	Adult; sacrificed
	POL_RB-10_2022-05	35.3	33.4	345	None	R	Adult; sacrificed
	POL_RB-11_2022-05	22.9	20.8	95	None	R	Adult; sacrificed
	POL_RB-12_2022-05	33.3	31.3	260	Red spots on cheeks, scar behind dorsal fin	R	Adult; sacrificed
	POL_RB-13_2022-05	33.1	30.9	274	None	M	Adult; sacrificed
	POL_RB-14_2022-05	18.2	16.9	45	None	M	Adult; sacrificed
	POL_RB-15_2022-05	24.4	22.9	128	None	M	Adult; sacrificed
	POL_RB-16_2022-05	32.5	30.6	290	None	M	Adult; sacrificed
	POL_RB-17_2022-05	32.6	30.8	295	None	R	Unknown
	POL_RB-18_2022-05	24.7	23.0	124	None	R	Unknown
	POL_RB-9_2022-05	36.9	34.7	405	None	R	Juvenile (parr)
29-May-22	POL_RB-19_2022-05	22.1	20.3	82	None	R	Unknown
	POL_RB-2_2022-05	34.0	33.1	305	None	M	Unknown
	POL_RB-20_2022-05	19.9	18.0	62	None	R	Juvenile (parr)
	POL_RB-21_2022-05	20.6	19.1	64	None	R	Juvenile (parr)
	POL_RB-22_2022-05	18.5	17.1	46	None	R	Unknown
	POL_RB-23_2022-05	21.4	19.8	76	None	R	Unknown
	POL_RB-24_2022-05	19.2	17.8	61	None	R	Juvenile (parr)
	POL_RB-25_2022-05	27.4	25.7	158	None	R	Juvenile (parr)
	POL_RB-26_2022-05	33.3	31.1	270	None	R	Juvenile (parr)
	POL_RB-27_2022-05	27.8	26.1	186	None	R	Juvenile (parr)
	POL_RB-28_2022-05	30.9	29.1	224	None	R	Juvenile (parr)
	POL_RB-29_2022-05	31.6	29.6	256	Pale gills	R	Juvenile (parr)
	POL_RB-3_2022-05	32.3	30.9	250	Ligula	M	Juvenile (parr)
	POL_RB-30_2022-05	31.6	29.4	252	None	R	Unknown
	POL_RB-31_2022-05	31.7	29.7	264	None	R	Unknown
	POL_RB-32_2022-05	29.1	27.2	188	Compressed gills	R	Unknown
	POL_RB-33_2022-05	34.6	32.3	325	None	R	Unknown
	POL_RB-34_2022-05	35.3	33.0	330	Cut lip, pale gills, split dorsal fin	R	Unknown
	POL_RB-35_2022-05	32.9	30.8	265	Gill lice	R	Unknown
	POL_RB-36_2022-05	37.2	35.2	400	Split pectoral fin with lice	R	Unknown
	POL_RB-37_2022-05	26.4	24.6	154	Gill lice	R	Unknown
	POL_RB-38_2022-05	20.7	19.2	65	None	R	Unknown
	POL_RB-39_2022-05	21.8	20.3	87	None	R	Unknown
	POL_RB-4_2022-05	32.3	30.6	284	Ligula, white lesions on intestines	M	Unknown
	POL_RB-40_2022-05	23.5	21.8	99	None	R	Unknown
	POL_RB-41_2022-05	19.4	18.0	49	None	R	Unknown
	POL_RB-42_2022-05	20.2	18.6	63	Cut on dorsal fin	R	Juvenile (parr)
	POL_RB-43_2022-05	26.0	24.2	148	None	R	Juvenile (parr)
	POL_RB-44_2022-05	20.9	20.0	62	None	R	Juvenile (parr)
	POL_RB-45_2022-05	27.6	25.6	162	Compressed gills	R	Juvenile (parr)
	POL_RB-46_2022-05	32.5	30.4	285	Lice on mouth and caudal fin	R	Juvenile (parr)
	POL_RB-47_2022-05	31.7	29.6	250	Gill lice	R	Unknown
	POL_RB-48_2022-05	29.5	27.7	220	Eroded gills, gill lice	R	Juvenile (parr)
	POL_RB-49_2022-05	21.0	19.5	69	None	R	Unknown
	POL_RB-5_2022-05	26.2	24.8	160	None	M	Unknown
	POL_RB-50_2022-05	21.5	19.9	96	None	R	Unknown
	POL_RB-51_2022-05	23.2	21.8	102	None	R	Unknown
	POL_RB-52_2022-05	18.4	17.2	48	None	R	Juvenile (parr)
	POL_RB-53_2022-05	19.3	17.9	55	None	R	Juvenile (parr)
	POL_RB-54_2022-05	20.0	18.8	54	Gill lice	R	Juvenile (parr)
	POL_RB-55_2022-05	19.2	17.9	52	Gill lice	R	Juvenile (parr)
	POL_RB-56_2022-05	21.3	20.0	74	Gill lice	R	Juvenile (parr)
	POL_RB-57_2022-05	21.5	19.8	76	Gill lice	R	Juvenile (parr)
	POL_RB-58_2022-05	32.3	30.5	262	Gill lice, split dorsal fin	R	Juvenile (parr)
	POL_RB-59_2022-05	29.6	27.7	232	Gill lice	R	Juvenile (parr)
	POL_RB-6_2022-05	36.0	34.1	355	Ligula	M	Juvenile (parr)
	POL_RB-60_2022-05	35.1	33.2	340	None	R	Unknown
	POL_RB-61_2022-05	26.3	24.5	154	None	R	Unknown
	POL_RB-62_2022-05	28.1	26.2	174	Gill lice	R	Unknown
	POL_RB-63_2022-05	29.5	27.4	208	Gill lice	R	Unknown
	POL_RB-64_2022-05	18.6	17.4	54	None	R	Unknown
	POL_RB-65_2022-05	17.9	16.6	43	None	R	Unknown
	POL_RB-66_2022-05	22.4	20.8	98	None	R	Juvenile (parr)
	POL_RB-67_2022-05	19.8	18.4	60	None	R	Juvenile (parr)
	POL_RB-68_2022-05	16.4	15.3	34	Lice on dorsal fin	R	Juvenile (parr)
	POL_RB-7_2022-05	34.3	33.1	325	Ligula	M	Juvenile (parr)
	POL_RB-8_2022-05	32.5	30.8	300	Ligula	M	Juvenile (parr)
Sample Size (n)		**68**	**68**	**68**	-	-	-
Average		**26.7**	**25.1**	**175**			
Median		**26.9**	**25.2**	**159**			
Standard Deviation		**6.1**	**5.9**	**107.7**			
Minimum		**16.4**	**15.3**	**34**			
Maximum		**37.2**	**35.2**	**405**			

Notes: "-" = data not available or no comment, M = mortality, R = released.

Table C.6.4: Non-Destructive Physical Measurements of Longnose Sucker Caught by Hoop Netting in Polley Lake (POL; Exposed), May 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate	Comments
28-May-22	POL_LSU-1_2022-05	39.6	37.2	670	None	M	Adult; sacrificed
	POL_LSU-2_2022-05	47.2	44.0	940	None	M	Adult; sacrificed
	POL_LSU-3_2022-05	45.4	42.1	960	Lump on caudal fin	M	Adult; sacrificed
	POL_LSU-4_2022-05	44.5	41.9	930	Missing top of caudal fin, white lesion on liver	M	Adult; sacrificed
	POL_LSU-5_2022-05	30.0	27.7	262	Scars on body	M	Adult; sacrificed
	POL_LSU-6_2022-05	37.4	35.5	510	Scars on body	M	Adult; sacrificed
	POL_LSU-7_2022-05	43.6	40.9	955	None	M	Adult; sacrificed
	POL_LSU-8_2022-05	40.1	37.6	640	None	M	Adult; sacrificed
	POL_LSU-9_2022-05	39.8	37.5	640	Hole in snout, missing scales[a]	R	-
	POL_LSU-10_2022-05	35.6	33.4	400	None	R	Adult (male)
	POL_LSU-11_2022-05	29.5	27.5	265	None	R	Adult (male)
	POL_LSU-12_2022-05	30.9	28.9	256	None	R	-
	POL_LSU-13_2022-05	34.3	31.6	365	None	R	Adult (male)
	POL_LSU-14_2022-05	30.9	29.2	270	None	R	-
	POL_LSU-15_2022-05	40.7	38.0	690	None	R	-
	POL_LSU-16_2022-05	30.2	28.3	254	None	R	Adult (male)
	POL_LSU-17_2022-05	37.1	34.4	520	None	R	-
	POL_LSU-18_2022-05	33.0	30.6	320	None	R	-
	POL_LSU-19_2022-05	43.0	40.0	880	None	R	-
	POL_LSU-20_2022-05	42.9	39.8	850	None	R	-
	POL_LSU-21_2022-05	42.0	39.2	670	Hole in snout[a]	R	-
	POL_LSU-22_2022-05	37.1	34.4	460	None	R	Adult (male)
	POL_LSU-23_2022-05	26.7	25.2	196	Yellow and black spots on ventral side	R	-
	POL_LSU-24_2022-05	31.6	29.0	305	Yellow and black spots on ventral side	R	-
	POL_LSU-25_2022-05	31.0	28.4	270	Yellow and black spots on ventral side	R	-
	POL_LSU-26_2022-05	37.9	35.6	590	None	R	-
	POL_LSU-27_2022-05	32.6	31.9	325	None	R	-
	POL_LSU-28_2022-05	34.6	32.5	375	None	R	-
	POL_LSU-29_2022-05	27.6	25.4	176	None	R	Adult (male)
	POL_LSU-30_2022-05	30.2	28.4	258	None	R	-
	POL_LSU-31_2022-05	28.8	26.9	196	None	R	-
	POL_LSU-32_2022-05	30.6	28.5	270	None	R	Adult (male)
	POL_LSU-33_2022-05	29.2	27.2	218	None	R	Adult (male)
	POL_LSU-34_2022-05	25.3	23.4	150	None	R	-
	POL_LSU-35_2022-05	41.0	38.4	810	None	R	-
	POL_LSU-36_2022-05	39.8	36.8	570	None	R	-
	POL_LSU-37_2022-05	35.8	33.5	445	None	R	-
	POL_LSU-38_2022-05	29.6	27.7	248	None	R	Adult (male)
Sample Size (n)		**38**	**38**	**38**	-	-	-
Average		**35.5**	**33.1**	**477**			
Median		**35.1**	**33.0**	**388**			
Standard Deviation		**5.9**	**5.5**	**257**			
Standard Error		**0.96**	**0.90**	**41.7**			
Minimum		**25.3**	**23.4**	**150**			
Maximum		**47.2**	**44.0**	**960**			

Notes: "-" = data not available or no comment, M = mortality, R = released.

[a] Injuries / deformities were possibly a result of predation by muskrats that were present in hoop net.

Table C.6.5: Non-Destructive Physical Measurements of Rainbow Trout Caught by Hoop Netting in Bootjack Lake (BOL; Reference), May 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate	Comments
30-May-22	BOL_RB-1_2022-05	35.3	33.8	315	Ligula	M	Adult; sacrificed
	BOL_RB-2_2022-05	37.1	35.0	360	Ligula	M	Adult; sacrificed
	BOL_RB-3_2022-05	27.5	26.2	218	Ligula	M	Adult; sacrificed
	BOL_RB-4_2022-05	25.5	24.1	156	Ligula	M	Adult; sacrificed
	BOL_RB-5_2022-05	29.5	28.0	204	Ligula	M	Adult; sacrificed
	BOL_RB-6_2022-05	33.0	31.2	294	Ligula	M	Adult; sacrificed
	BOL_RB-7_2022-05	30.5	28.8	212	Ligula	M	Adult; sacrificed
	BOL_RB-8_2022-05	33.4	31.5	300	Ligula	M	Adult; sacrificed
	BOL_RB-9_2022-05	27.5	25.9	172	None	R	Unknown
	BOL_RB-10_2022-05	31.3	29.2	258	None	R	Unknown
	BOL_RB-11_2022-05	23.3	22.0	114	None	R	Juvenile (parr)
	BOL_RB-12_2022-05	35.0	33.5	320	Lice on caudal fin	R	Unknown
	BOL_RB-13_2022-05	27.1	25.6	174	Gill lice	R	Juvenile (parr)
	BOL_RB-14_2022-05	28.3	26.5	190	Lice on caudal fin	R	Unknown
	BOL_RB-15_2022-05	32.1	29.9	282	None	R	Unknown
	BOL_RB-16_2022-05	26.2	24.4	132	Gill lice	R	Unknown
	BOL_RB-17_2022-05	27.7	26.0	202	Lice on caudal fin	R	Unknown
	BOL_RB-18_2022-05	26.4	24.9	166	None	R	Unknown
	BOL_RB-19_2022-05	32.7	31.0	290	None	R	Unknown
	BOL_RB-20_2022-05	29.5	27.7	208	Lice on pectoral fin	R	Unknown
	BOL_RB-21_2022-05	24.8	23.4	128	None	R	Unknown
	BOL_RB-22_2022-05	26.0	24.3	140	None	R	Juvenile (parr)
	BOL_RB-23_2022-05	27.9	26.3	178	None	R	Juvenile (parr)
	BOL_RB-24_2022-05	31.0	28.8	235	None	R	Unknown
	BOL_RB-25_2022-05	34.5	32.6	355	Lice on gills and caudal fin	R	Unknown
	BOL_RB-26_2022-05	32.3	30.9	252	Lice on gills and pectoral fin	R	Unknown
	BOL_RB-27_2022-05	26.5	25.3	164	None	R	Unknown
	BOL_RB-28_2022-05	28.4	26.6	208	None	R	Unknown
	BOL_RB-29_2022-05	26.9	25.4	180	None	R	Unknown
	BOL_RB-30_2022-05	31.1	29.4	232	Gill lice	R	Unknown
	BOL_RB-31_2022-05	26.0	24.4	156	None	R	Unknown
	BOL_RB-32_2022-05	24.7	22.8	128	None	M	Unknown
	BOL_RB-33_2022-05	18.1	16.5	47	None	M	Juvenile (parr)
	BOL_RB-34_2022-05	21.4	20.1	86	None	M	Juvenile (parr)
	BOL_RB-35_2022-05	17.5	16.4	43	None	M	Juvenile (parr)
	BOL_RB-36_2022-05	17.5	16.4	45	None	M	Juvenile (parr)
	BOL_RB-37_2022-05	17.8	16.7	47	None	M	Juvenile (parr)
	BOL_RB-38_2022-05	20.2	19.0	70	None	M	Juvenile (parr)
Sample Size (n)		**38**	**38**	**38**	-	-	-
Average		**27.7**	**26.1**	**191**			
Median		**27.6**	**26.1**	**185**			
Standard Deviation		**5.1**	**4.9**	**86.5**			
Minimum		**17.5**	**16.4**	**43**			
Maximum		**37.1**	**35.0**	**360**			

Notes: "-" = data not available or no comment, M = mortality, R = released.

Table C.6.6: Non-Destructive Physical Measurements of Longnose Sucker Caught by Hoop Netting in Bootjack Lake (BOL; Reference), May 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate	Comments
30-May-22	BOL_LSU-1_2022-05	44.0	41.2	1,075	None	M	Adult; sacrificed
	BOL_LSU-2_2022-05	47.0	43.9	1,175	None	M	Adult; sacrificed
	BOL_LSU-3_2022-05	37.0	35.1	625	Scars on body surface	M	Adult; sacrificed
	BOL_LSU-4_2022-05	44.4	41.5	1,050	None	M	Adult; sacrificed
31-May-22	BOL_LSU-5_2022-05	47.7	44.6	1,360	None	M	Adult; sacrificed
	BOL_LSU-6_2022-05	44.8	42.1	1,180	None	M	Adult; sacrificed
	BOL_LSU-7_2022-05	34.8	32.8	550	None	M	Adult; sacrificed
	BOL_LSU-8_2022-05	43.5	41.0	1,120	None	M	Adult; sacrificed
30-May-22	BOL_LSU-9_2022-05	42.6	39.6	870	None	R	Adult (male)
	BOL_LSU-10_2022-05	42.5	39.5	810	None	R	Adult (male)
	BOL_LSU-11_2022-05	32.5	30.5	385	None	R	Adult (male)
	BOL_LSU-12_2022-05	42.3	39.4	840	Deformed operculum	R	Adult (male)
	BOL_LSU-13_2022-05	40.5	39.4	910	None	R	Adult (male)
	BOL_LSU-14_2022-05	42.5	39.6	830	None	R	Adult (male)
	BOL_LSU-15_2022-05	29.3	27.2	250	None	R	Adult (male)
	BOL_LSU-16_2022-05	43.4	40.8	930	None	R	Adult (male)
	BOL_LSU-17_2022-05	43.2	40.5	880	Scar near pelvic fin	R	Adult (male)
	BOL_LSU-18_2022-05	36.1	33.8	515	Scars around lateral line	R	Adult (male)
	BOL_LSU-19_2022-05	40.9	38.6	740	None	R	Adult (male)
	BOL_LSU-20_2022-05	38.8	36.6	700	None	R	Adult (male)
	BOL_LSU-21_2022-05	42.0	40.2	790	None	R	Adult (male)
	BOL_LSU-22_2022-05	28.4	26.7	248	None	R	Adult (male)
	BOL_LSU-23_2022-05	26.4	24.6	194	Deformed operculum	R	Adult (male)
	BOL_LSU-24_2022-05	43.0	40.8	1,000	None	R	Adult (female)
	BOL_LSU-25_2022-05	31.0	28.9	305	None	R	Adult (male)
	BOL_LSU-26_2022-05	33.7	31.8	380	None	R	Adult (male)
	BOL_LSU-27_2022-05	43.4	40.0	820	None	R	Adult (male)
	BOL_LSU-28_2022-05	45.6	42.5	1,200	None	R	Adult (female)
	BOL_LSU-29_2022-05	22.5	21.0	102	None	R	Unknown
	BOL_LSU-30_2022-05	27.7	26.1	244	None	R	Adult (male)
	BOL_LSU-31_2022-05	29.9	28.1	292	None	R	Adult (male)
	BOL_LSU-32_2022-05	29.8	28.2	290	Split caudal fin	R	Adult (male)
	BOL_LSU-33_2022-05	42.1	39.5	840	Deformed operculum	R	Adult (male)
	BOL_LSU-34_2022-05	34.0	32.5	435	None	R	Adult (male)
	BOL_LSU-35_2022-05	41.7	38.9	790	None	R	Adult (male)
	BOL_LSU-36_2022-05	44.9	41.2	901	None	R	Adult (male)
	BOL_LSU-37_2022-05	43.1	39.2	760	None	R	Adult (male)
	BOL_LSU-38_2022-05	47.6	44.6	1,150	None	R	Adult (female)
Sample Size (n)		**38**	**38**	**38**	-	-	-
Average		**38.8**	**36.4**	**725**			
Median		**42.1**	**39.4**	**800**			
Standard Deviation		**6.8**	**6.3**	**337**			
Minimum		**22.5**	**21.0**	**102**			
Maximum		**47.7**	**44.6**	**1,360**			

Note: "-" = data not available or no comment; M = mortality, R = released.

Table C.6.7: Non-Destructive Physical Measurements of Rainbow Trout Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
22-Sep-22	POL_RB-1_2022-09	33.5	31.5	230	-	R
	POL_RB-2_2022-09	6.8	6.5	3	-	R
	POL_RB-3_2022-09	17.9	16.8	51	-	R
	POL_RB-4_2022-09	34.7	33.0	320	Hatchery (clipped adipose)	R
	POL_RB-5_2022-09	30.1	28.4	220	-	R
	POL_RB-6_2022-09	8.0	7.5	3	-	R
	POL_RB-7_2022-09	6.5	6.0	2	-	R
23-Sep-22	POL_RB-8_2022-09	20.4	19.2	60	-	R
	POL_RB-9_2022-09	26.9	26.0	140	-	R
	POL_RB-10_2022-09	28.8	27.0	180	-	R
	POL_RB-11_2022-09	27.8	26.4	95	-	R
	POL_RB-12_2022-09	25.0	23.5	130	Gill lice	R
	POL_RB-13_2022-09	22.4	20.6	100	-	R
	POL_RB-14_2022-09	28.7	27.2	170	-	R
	POL_RB-15_2022-09	29.3	27.6	195	-	R
	POL_RB-16_2022-09	29.8	28.2	185	-	R
	POL_RB-17_2022-09	35.5	33.5	310	Hatchery (clipped adipose)	R
	POL_RB-18_2022-09	36.0	34.6	375	Gill lice	R
	POL_RB-19_2022-09	31.5	30.0	220	Gill lice	R
	POL_RB-20_2022-09	23.5	22.1	112	-	R
	POL_RB-21_2022-09	32.5	31.0	260	Hatchery (clipped adipose)	R
	POL_RB-22_2022-09	30.0	28.8	210.0	Gill lice	R
	POL_RB-23_2022-09	15.0	14.0	32	-	M
	POL_RB-24_2022-09	34.5	32.5	310.0	Hatchery (clipped adipose)	R
	POL_RB-25_2022-09	30.2	29.5	290	-	R
	POL_RB-26_2022-09	34.0	32.5	300	Gill lice	R
	POL_RB-27_2022-09	28.5	26.7	175	-	R
	POL_RB-28_2022-09	23.2	21.5	95	-	R
	POL_RB-29_2022-09	29.4	27.5	195	-	R
	POL_RB-30_2022-09	19.8	18.5	65	-	R
	POL_RB-31_2022-09	28.3	26.6	175	-	R
	POL_RB-32_2022-09	32.0	30.2	220.0	Hatchery (clipped adipose)	R
24-Sep-22	POL_RB-33_2022-09	31.1	29.5	240.0	-	R
	POL_RB-34_2022-09	32.8	30.9	270	-	R
	POL_RB-35_2022-09	33.0	31.3	260	-	R
	POL_RB-36_2022-09	22.5	20.9	95	Ripped dorsal	R
	POL_RB-37_2022-09	18.5	17.0	60	-	R
	POL_RB-38_2022-09	10.2	9.4	8	-	R
	POL_RB-39_2022-09	33.8	32.2	330	-	R
	POL_RB-40_2022-09	19.3	18.0	60	-	R
	POL_RB-41_2022-09	29.4	27.6	210.0	-	R
	POL_RB-42_2022-09	34.4	32.5	290.0	-	R
	POL_RB-43_2022-09	31.4	29.4	250.0	-	R
	POL_RB-44_2022-09	28.6	27.0	180.0	-	R
	POL_RB-45_2022-09	32.5	31.5	280.0	-	R
	POL_RB-46_2022-09	29.2	27.5	200	-	R
	POL_RB-47_2022-09	21.6	20.2	90.0	-	R
	POL_RB-48_2022-09	32.8	31.0	300.0	Hatchery (clipped adipose)	R
	POL_RB-49_2022-09	31.5	30.0	250.0	-	R
	POL_RB-50_2022-09	32.8	31.0	310	-	R
	POL_RB-51_2022-09	33.5	31.7	300.0	-	R
	POL_RB-52_2022-09	33.2	31.4	310.0	-	R
	POL_RB-53_2022-09	32.5	29.7	265.0	-	R
	POL_RB-54_2022-09	26.5	24.9	170.0	-	R
	POL_RB-55_2022-09	29.0	27.4	170.0	-	R
	POL_RB-56_2022-09	36.0	33.4	340.0	Hatchery (clipped adipose)	R
	POL_RB-57_2022-09	24.4	22.7	120.0	-	R
	POL_RB-58_2022-09	24.0	22.6	115	-	R
	POL_RB-59_2022-09	35.0	33.0	320	Gill lice	R
	POL_RB-60_2022-09	29.6	27.9	220.0	-	R
	POL_RB-61_2022-09	33.2	31.6	290	Gill lice	R
	POL_RB-62_2022-09	32.5	30.8	245	Hatchery (clipped adipose)	R
	POL_RB-63_2022-09	33.1	31.0	255	-	R
	POL_RB-64_2022-09	30.8	28.6	245	-	R
	POL_RB-65_2022-09	25.1	23.4	135	-	R
	POL_RB-66_2022-09	21.6	20.2	85	-	R
	POL_RB-67_2022-09	22.2	20.5	97	-	R
	POL_RB-68_2022-09	24.5	22.9	140	-	R
	POL_RB-69_2022-09	32.5	30.8	260	Hatchery (clipped adipose)	R
	POL_RB-70_2022-09	22.3	21.0	90	-	R
	POL_RB-71_2022-09	36.0	34.0	325	Hatchery (clipped adipose)	R
	POL_RB-72_2022-09	31.7	29.7	275	Gill lice	R
	POL_RB-73_2022-09	23.6	21.9	90	-	R
	POL_RB-74_2022-09	32.2	29.7	255	Gill lice	R
	POL_RB-75_2022-09	30.6	29.1	235	-	R
	POL_RB-76_2022-09	24.7	23.6	130	-	R
	POL_RB-77_2022-09	30.2	28.2	220.0	-	R
	POL_RB-78_2022-09	25.8	24.5	145	-	R
	POL_RB-79_2022-09	23.5	21.2	95	-	R
	POL_RB-80_2022-09	31.8	30.3	195	-	R
	POL_RB-81_2022-09	30.0	28.4	230	-	R
	POL_RB-82_2022-09	29.2	27.0	195	-	R
	POL_RB-83_2022-09	29.0	27.3	210	Gill lice	R
	POL_RB-84_2022-09	20.3	18.9	72	-	R
	POL_RB-85_2022-09	23.2	21.8	95	-	R

Notes: RB = rainbow trout, R = released, M = mortality, "-" = data not available or no comment.

Table C.6.7: Non-Destructive Physical Measurements of Rainbow Trout Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
25-Sep-22	POL_RB-86_2022-09	25.9	24.0	137	-	R
	POL_RB-87_2022-09	32.6	30.8	205	-	R
	POL_RB-88_2022-09	28.2	26.4	187	Gill lice	R
	POL_RB-89_2022-09	31.8	30.0	250	Gill lice	R
	POL_RB-90_2022-09	34.2	32.2	315	-	R
	POL_RB-91_2022-09	19.1	17.8	62	-	R
	POL_RB-92_2022-09	33.6	31.4	310	-	R
	POL_RB-93_2022-09	16.8	15.6	40	-	R
	POL_RB-94_2022-09	25.5	23.8	130	-	R
	POL_RB-95_2022-09	31.3	29.2	250	-	R
	POL_RB-96_2022-09	24.5	23.3	140	-	R
	POL_RB-97_2022-09	24.0	22.7	115	-	R
	POL_RB-98_2022-09	29.4	27.7	275	-	R
	POL_RB-99_2022-09	22.8	21.0	95	-	R
	POL_RB-100_2022-09	33.0	31.2	290	Gill lice	R
	POL_RB-101_2022-09	31.4	29.7	230	-	R
	POL_RB-102_2022-09	34.8	32.8	335	Gill lice	R
	POL_RB-103_2022-09	18.2	17.2	55	-	R
	POL_RB-104_2022-09	17.6	16.3	48	-	R
	POL_RB-105_2022-09	26.3	24.6	145	-	R
	POL_RB-106_2022-09	31.3	29.4	230	-	R
	POL_RB-107_2022-09	32.0	30.4	190	-	R
	POL_RB-108_2022-09	16.2	15.3	37	-	R
26-Sep-22	POL_RB-109_2022-09	28.8	27.2	175	-	R
	POL_RB-110_2022-09	35.3	33.3	350	-	R
	POL_RB-111_2022-09	33.8	32.2	290	Gill lice	R
	POL_RB-112_2022-09	32.7	30.6	285	Gill lice	R
	POL_RB-113_2022-09	22.5	21.0	90	-	R
	POL_RB-114_2022-09	22.0	20.6	70	-	R
	POL_RB-115_2022-09	33.0	31.2	255	-	R
	POL_RB-116_2022-09	29.2	27.4	205	-	R
	POL_RB-117_2022-09	23.6	22.3	110	-	R
	POL_RB-118_2022-09	19.7	18.4	69	-	R
	POL_RB-119_2022-09	28.2	26.5	160	-	R
	POL_RB-120_2022-09	24.4	22.6	150	-	R
	POL_RB-121_2022-09	31.7	29.9	245	Gill lice	R
	POL_RB-122_2022-09	30.8	29.2	230	-	R
	POL_RB-123_2022-09	15.9	14.8	32	-	R
Sample Size (n)		**123**	**123**	**123**	-	-
Average		**27.5**	**25.9**	**186**		
Median		**29.2**	**27.5**	**195**		
Standard Deviation		**6.4**	**6.1**	**93**		
Minimum		**6.5**	**6.0**	**2**		
Maximum		**36.0**	**34.6**	**375**		

Notes: RB = rainbow trout, R = released, M = mortality, "-" = data not available or no comment.

[a] Fish mortalities due to predation.

Table C.6.8: Non-Destructive Physical Measurements of Longnose Sucker Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
22-Sep-22	POL_LSU-1_2022-09	23.2	21.1	115	Black spot	R
	POL_LSU-2_2022-09	5.0	4.7	1	-	R
	POL_LSU-3_2022-09	32.6	30.6	295	-	R
	POL_LSU-4_2022-09	36.5	34.5	460	Black spot	R
	POL_LSU-5_2022-09	26.6	24.6	180	Black spot	R
	POL_LSU-6_2022-09	22.0	20.6	80	Black spot	R
	POL_LSU-7_2022-09	21.0	19.6	50	-	R
	POL_LSU-8_2022-09	19.8	18.4	66	Black spot	R
	POL_LSU-9_2022-09	26.0	24.1	150	Black spot	R
	POL_LSU-10_2022-09	18.3	17.1	56	-	R
	POL_LSU-11_2022-09	23.0	21.5	110	Black spot	R
	POL_LSU-12_2022-09	20.6	19.0	70	-	R
	POL_LSU-13_2022-09	24.8	23.4	150	Black spot	R
	POL_LSU-14_2022-09	25.5	23.5	160	Black spot	R
	POL_LSU-15_2022-09	22.2	21.5	110	Black spot	R
	POL_LSU-16_2022-09	26.0	24.2	180	Black spot	R
	POL_LSU-17_2022-09	18.5	17.3	65	-	R
	POL_LSU-18_2022-09	30.0	28.0	250	Black spot	R
	POL_LSU-19_2022-09	32.0	30.0	300	-	R
	POL_LSU-20_2022-09	28.0	26.0	200	Black spot	R
	POL_LSU-21_2022-09	19.5	18.0	72	Black spot	R
	POL_LSU-22_2022-09	20.0	18.7	90	Black spot	R
	POL_LSU-23_2022-09	18.5	17.1	55	Black spot	R
	POL_LSU-24_2022-09	18.8	17.5	65	Black spot	R
	POL_LSU-25_2022-09	24.3	22.6	120	Black spot	R
23-Sep-22	POL_LSU-26_2022-09	15.2	14.2	35	Black spot	R
	POL_LSU-27_2022-09	29.0	27.0	260	Black spot	R
	POL_LSU-28_2022-09	27.8	26.3	210	Black spot	R
	POL_LSU-29_2022-09	20.5	19.0	80	Black spot	R
	POL_LSU-30_2022-09	20.8	19.2	73	Black spot	R
	POL_LSU-31_2022-09	26.3	24.5	155	Black spot	R
	POL_LSU-32_2022-09	30.2	28.2	250	Black spot	R
	POL_LSU-33_2022-09	29.1	26.9	220	Black spot	R
	POL_LSU-34_2022-09	32.8	30.6	310	-	R
	POL_LSU-35_2022-09	28.5	26.6	220	-	R
	POL_LSU-36_2022-09	21.7	19.9	105	Black spot	R
	POL_LSU-37_2022-09	20.7	19.3	90	-	R
	POL_LSU-38_2022-09	19.5	18.0	80	Black spot	R
	POL_LSU-39_2022-09	19.6	18.0	70	Black spot	R
	POL_LSU-40_2022-09	15.5	14.5	35	Black spot	R
	POL_LSU-41_2022-09	21.2	20.0	100	Black spot	R
	POL_LSU-42_2022-09	21.5	19.8	90	Black spot	R
	POL_LSU-43_2022-09	40.0	37.2	580	Black spot	R
	POL_LSU-44_2022-09	20.5	19.2	75	Black spot	R
	POL_LSU-45_2022-09	17.8	16.2	45	Black spot	R
24-Sep-22	POL_LSU-46_2022-09	21.2	19.5	82	-	R
	POL_LSU-47_2022-09	20.1	18.7	75	Black spot	R
	POL_LSU-48_2022-09	20.0	18.5	70	Black spot	R
	POL_LSU-49_2022-09	32.6	30.3	320	Black spot	R
	POL_LSU-50_2022-09	27.8	25.6	240	-	R
	POL_LSU-51_2022-09	29.5	27.3	225	Black spot	R
	POL_LSU-52_2022-09	23.5	22.0	115	Black spot	R
	POL_LSU-53_2022-09	27.8	26.2	190	-	R
	POL_LSU-54_2022-09	20.8	19.2	85	Black spot	R
	POL_LSU-55_2022-09	26.5	25.0	160	Black spot	R
	POL_LSU-56_2022-09	20.8	19.2	87	-	R
	POL_LSU-57_2022-09	24.5	23.0	140	Black spot	R
	POL_LSU-58_2022-09	23.0	20.2	100	Black spot	R
	POL_LSU-59_2022-09	27.5	25.5	190	Black spot	R
	POL_LSU-60_2022-09	21.0	19.5	75	-	R
	POL_LSU-61_2022-09	20.0	18.5	85	Black spot	R
	POL_LSU-62_2022-09	21.5	20.0	90	Black spot	R
	POL_LSU-63_2022-09	22.4	21.0	105	Black spot	R
	POL_LSU-64_2022-09	20.0	18.4	75	Black spot	R
	POL_LSU-65_2022-09	19.6	18.5	80	Black spot	R
	POL_LSU-66_2022-09	16.8	15.8	45	Black spot	R
	POL_LSU-67_2022-09	19.2	17.9	74	-	R
	POL_LSU-68_2022-09	27.6	26.0	200	Black spot	R
	POL_LSU-69_2022-09	34.0	31.8	380	-	R
	POL_LSU-70_2022-09	29.0	27.0	230	Black spot	R

Notes: "-" = no comment, LSU = longnose sucker, R = released.

Table C.6.8: Non-Destructive Physical Measurements of Longnose Sucker Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
24-Sep-22	POL_LSU-71_2022-09	30.0	28.0	240	Black spot	R
	POL_LSU-72_2022-09	29.0	27.0	220	Black spot	R
	POL_LSU-73_2022-09	33.0	30.8	310	Black spot	R
	POL_LSU-74_2022-09	18.5	17.1	60	Black spot	R
	POL_LSU-75_2022-09	18.5	17.0	63	-	R
	POL_LSU-76_2022-09	21.5	20.0	92	Black spot	R
	POL_LSU-77_2022-09	28.5	27.2	250	Black spot	R
	POL_LSU-78_2022-09	22.0	21.2	100	-	R
	POL_LSU-79_2022-09	19.5	18.0	68	Black spot	R
	POL_LSU-80_2022-09	16.0	15.3	38	Black spot	R
	POL_LSU-81_2022-09	15.0	13.8	34	Black spot	R
	POL_LSU-82_2022-09	32.5	30.8	330	Black spot	R
	POL_LSU-83_2022-09	32.6	30.5	315	Black spot	R
	POL_LSU-84_2022-09	31.5	29.4	280	Black spot	R
	POL_LSU-85_2022-09	31.8	29.8	290	Black spot	R
	POL_LSU-86_2022-09	31.3	29.2	290	Black spot	R
	POL_LSU-87_2022-09	33.7	31.5	350	Black spot	R
	POL_LSU-88_2022-09	32.0	30.4	290	Black spot	R
	POL_LSU-89_2022-09	34.0	31.8	390	Black spot	R
	POL_LSU-90_2022-09	37.8	35.2	500	-	R
	POL_LSU-91_2022-09	30.4	28.6	270	Black spot	R
	POL_LSU-92_2022-09	27.0	25.2	155	-	R
	POL_LSU-93_2022-09	17.0	16.0	48	Black spot	R
25-Sep-22	POL_LSU-94_2022-09	14.7	13.7	28	Black spot	R
	POL_LSU-95_2022-09	26.5	24.8	165	Black spot	R
	POL_LSU-96_2022-09	24.3	22.1	118	Black spot	R
	POL_LSU-97_2022-09	18.2	16.8	68	Black spot	R
	POL_LSU-98_2022-09	20.2	18.7	70	Black spot	R
	POL_LSU-99_2022-09	20.2	18.8	78	Black spot	R
	POL_LSU-100_2022-09	15.8	14.6	33	Black spot	R
	POL_LSU-101_2022-09	21.2	19.8	80	-	R
	POL_LSU-102_2022-09	21.2	19.4	93	Black spot	R
	POL_LSU-103_2022-09	22.2	20.5	100	Black spot	R
	POL_LSU-104_2022-09	15.5	14.4	42	-	R
	POL_LSU-105_2022-09	29.2	27.2	240	Black spot	R
Sample Size (n)		**105**	**105**	**105**	-	-
Average		**24.1**	**22.5**	**154**		
Median		**22.2**	**21.0**	**105**		
Standard Deviation		**6.0**	**5.7**	**112**		
Minimum		**5.0**	**4.7**	**1.0**		
Maximum		**40.0**	**37.2**	**580**		

Notes: "-" = no comment, LSU = longnose sucker, R = released.

Table C.6.9: Non-Destructive Physical Measurements of Redside Shiner Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
22-Sep-22	POL_RSC-1_2022-09	11.6	10.4	15.0	Black spot	R
	POL_RSC-2_2022-09	7.5	6.4	4.0	Black spot	R
	POL_RSC-3_2022-09	10.5	9.2	10.0	Black spot	R
	POL_RSC-4_2022-09	5.5	5.1	1.0	-	R
	POL_RSC-5_2022-09	8.4	6.8	6.0	Black spot	R
	POL_RSC-6_2022-09	9.3	8.2	6.0	Black spot	R
	POL_RSC-7_2022-09	5.6	5.0	1.0	Black spot	R
	POL_RSC-8_2022-09	8.7	7.8	7.0	Black spot	R
	POL_RSC-9_2022-09	10.4	9.0	11.0	Black spot	R
	POL_RSC-10_2022-09	10.1	8.7	10.0	Black spot	R
	POL_RSC-11_2022-09	7.6	6.7	4.0	Black spot	R
	POL_RSC-12_2022-09	10.8	9.5	14.0	Black spot	R
	POL_RSC-13_2022-09	9.7	8.6	9.0	Black spot	R
	POL_RSC-14_2022-09	6.1	5.2	2.0	Black spot	R
	POL_RSC-15_2022-09	11.5	10.2	15.0	Black spot	R
	POL_RSC-16_2022-09	5.3	4.5	1.0	-	R
	POL_RSC-17_2022-09	5.5	4.7	1.0	-	R
	POL_RSC-18_2022-09	3.7	3.4	<1.0	-	R
	POL_RSC-19_2022-09	5.9	5.1	2.0	-	R
	POL_RSC-20_2022-09	8.2	7.1	5.0	Black spot	R
	POL_RSC-21_2022-09	5.1	4.5	1.0	-	R
	POL_RSC-22_2022-09	5.0	4.4	1.0	Black spot	R
	POL_RSC-23_2022-09	10.2	9.0	12.0	Black spot	R
	POL_RSC-24_2022-09	7.1	6.2	4.0	-	R
	POL_RSC-25_2022-09	10.3	9.4	10.0	Black spot	R
	POL_RSC-26_2022-09	6.0	5.4	2.0	Black spot	R
	POL_RSC-27_2022-09	9.0	8.3	8.0	Black spot	R
	POL_RSC-28_2022-09	6.3	5.5	2.0	-	R
	POL_RSC-29_2022-09	9.1	8.0	7.0	-	R
	POL_RSC-30_2022-09	12.0	10.7	20.0	Black spot	R
	POL_RSC-31_2022-09	5.9	5.6	1.0	-	R
	POL_RSC-32_2022-09	6.5	5.8	2.0	Black spot	R
	POL_RSC-33_2022-09	8.4	7.5	5.0	Black spot	R
	POL_RSC-34_2022-09	5.0	4.5	1.0	-	R
	POL_RSC-35_2022-09	8.5	7.5	6.0	Black spot	R
	POL_RSC-36_2022-09	10.0	8.8	9.0	Black spot	R
	POL_RSC-37_2022-09	8.7	7.5	5.0	Black spot	R
	POL_RSC-38_2022-09	9.2	8.7	7.0	Black spot	R
	POL_RSC-39_2022-09	5.1	4.5	1.0	-	R
	POL_RSC-40_2022-09	5.5	5.0	1.0	Black spot	R
	POL_RSC-41_2022-09	7.1	6.3	3.0	Black spot	R
	POL_RSC-42_2022-09	6.4	5.5	2.0	Black spot	R
	POL_RSC-43_2022-09	5.4	4.6	1.0	-	R
	POL_RSC-44_2022-09	3.7	3.3	<1.0	-	R
	POL_RSC-45_2022-09	5.6	4.9	1.0	-	R
	POL_RSC-46_2022-09	5.4	4.6	1.0	-	R
	POL_RSC-47_2022-09	5.4	4.7	1.0	-	R
	POL_RSC-48_2022-09	10.2	9.0	10.0	Black spot	R
	POL_RSC-49_2022-09	10.2	9.0	10.0	Black spot	R
	POL_RSC-50_2022-09	3.7	3.3	<1.0	-	R
	POL_RSC-51_2022-09	5.2	4.5	1.0	-	R
	POL_RSC-52_2022-09	6.9	6.0	3.0	Black spot	R
	POL_RSC-53_2022-09	9.8	8.5	9.0	Black spot	R
	POL_RSC-54_2022-09	9.5	8.4	9.0	Black spot	R
	POL_RSC-55_2022-09	9.3	8.2	7.0	Black spot	R
	POL_RSC-56_2022-09	7.6	6.7	4.0	Black spot	R
	POL_RSC-57_2022-09	9.9	8.7	8.0	Black spot	R
	POL_RSC-58_2022-09	8.3	7.3	5.0	-	R
	POL_RSC-59_2022-09	4.7	4.1	1.0	-	R

Notes: RSC = redside shiner; R = released; "-" = data not available or no comment.

Table C.6.9: Non-Destructive Physical Measurements of Redside Shiner Caught by Hoop Netting in Polley Lake (POL; Exposed), September 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Abnormalities	Fate
22-Sep-22	POL_RSC-60_2022-09	3.8	3.4	<1.0	-	R
	POL_RSC-61_2022-09	11.0	9.6	12.0	-	R
	POL_RSC-62_2022-09	12.4	10.9	19.0	Black spot	R
	POL_RSC-63_2022-09	8.0	7.0	4.0	-	R
	POL_RSC-64_2022-09	5.7	5.0	2.0	Black spot	R
	POL_RSC-65_2022-09	8.5	7.5	5.0	Black spot	R
	POL_RSC-66_2022-09	11.3	9.9	15.0	Black spot	R
	POL_RSC-67_2022-09	11.9	10.5	17.0	Black spot	R
	POL_RSC-68_2022-09	11.6	10.2	15.0	-	R
	POL_RSC-69_2022-09	6.9	6.5	3.0	-	R
	POL_RSC-70_2022-09	10.5	9.2	11.0	Black spot	R
	POL_RSC-71_2022-09	8.6	7.5	5.0	Black spot	R
	POL_RSC-72_2022-09	10.8	9.4	13.0	Black spot	R
	POL_RSC-73_2022-09	5.2	4.5	1.0	-	R
	POL_RSC-74_2022-09	11.5	10.1	16.0	Black spot	R
	POL_RSC-75_2022-09	4.7	4.1	1.0	-	R
	POL_RSC-76_2022-09	7.6	6.6	4.0	Black spot	R
	POL_RSC-77_2022-09	10.2	8.9	12.0	-	R
	POL_RSC-78_2022-09	5.1	4.5	1.0	-	M
	POL_RSC-79_2022-09	8.6	7.5	6.0	Black spot	R
	POL_RSC-80_2022-09	7.1	6.2	4.0	-	-
	POL_RSC-81_2022-09	7.0	6.0	3.0	-	R
	POL_RSC-82_2022-09	5.1	4.5	1.0	-	R
	POL_RSC-83_2022-09	9.0	7.9	8.0	Black spot	R
	POL_RSC-84_2022-09	5.3	4.6	1.0	Black spot	R
	POL_RSC-85_2022-09	8.0	6.9	4.0	Black spot	R
	POL_RSC-86_2022-09	4.7	4.1	1.0	-	R
	POL_RSC-87_2022-09	5.0	4.4	1.0	-	R
	POL_RSC-88_2022-09	8.1	7.1	4.0	Black spot	R
	POL_RSC-89_2022-09	6.9	6.0	3.0	-	R
	POL_RSC-90_2022-09	9.5	8.5	8.0	Black spot	R
	POL_RSC-91_2022-09	4.7	4.1	1.0	-	R
	POL_RSC-92_2022-09	8.9	7.8	9.0	Black spot	R
	POL_RSC-93_2022-09	9.5	8.3	7.0	Black spot	R
	POL_RSC-94_2022-09	5.2	4.5	1.0	-	R
	POL_RSC-95_2022-09	6.6	5.8	3.0	Black spot	R
	POL_RSC-96_2022-09	5.9	5.1	2.0	-	R
	POL_RSC-97_2022-09	7.0	6.0	3.0	Black spot	R
	POL_RSC-98_2022-09	12.1	10.1	17.0	Black spot	R
	POL_RSC-99_2022-09	10.5	9.3	11.0	-	R
	POL_RSC-100_2022-09	10.5	9.2	14.0	Black spot	R
	POL_RSC-101_2022-09	10.3	9.2	13.0	Black spot	R
	POL_RSC-102_2022-09	6.7	5.8	3.0	-	R
	POL_RSC-103_2022-09	10.2	9.0	10.0	Black spot	R
	POL_RSC-104_2022-09	9.6	8.0	7.0	Black spot	R
	POL_RSC-105_2022-09	5.5	4.7	1.0	-	R
	POL_RSC-106_2022-09	5.4	4.6	1.0	-	R
	POL_RSC-107_2022-09	5.6	4.8	1.0	-	R
	POL_RSC-108_2022-09	3.4	2.9	<1.0	-	R
	POL_RSC-109_2022-09	3.5	3.3	<1.0	-	R
	POL_RSC-110_2022-09	7.7	6.7	4.0	-	R
	POL_RSC-111_2022-09	5.5	4.8	1.0	-	R
	POL_RSC-112_2022-09	6.9	6.0	3.0	Black spot	R
	POL_RSC-113_2022-09	4.5	3.9	<1.0	-	R
Sample Size (n)		**113**	**113**	**113**	-	-
Average		**7.6**	**6.7**	**5.8**		
Median		**7.6**	**6.6**	**4.0**		
Standard Deviation		**2.4**	**2.1**	**5.0**		
Minimum		**3.4**	**2.9**	**1.0**		
Maximum		**12.4**	**10.9**	**20.0**		

Notes: RSC = redside shiner; R = released; "-" = data not available or no comment.

Table C.6.10: Destructive Physical Measurements of Longnose Sucker Caught by Hoop Netting in Polley Lake (POL; Exposed) and Bootjack Lake (BOL; Reference), May 2022

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Age Structure Collected[a]	Age (years)	Sex	Liver Weight (g)	Gonad Weight (g)	Kidney Weight (g)	Tissue Collected[b]	Abnormalities
Bootjack Lake	30-May-22	BOL_LSU-1_2022-05	44.0	41.2	1,075	PF, SC	7	F	18.555	161.543	4.000	M, L, K, O	-
		BOL_LSU-2_2022-05	47.0	43.9	1,175	PF, SC	12	F	19.259	185.308	5.816	M, L, K, O	-
		BOL_LSU-3_2022-05	37.0	35.1	625	PF, SC	6	F	10.548	56.560	5.499	M, L, K, O	Scars on body surface
		BOL_LSU-4_2022-05	44.4	41.5	1,050	PF, SC	10	F	26.652	146.478	5.528	M, L, K, O	-
	31-May-22	BOL_LSU-5_2022-05	47.7	44.6	1,360	PF, SC	12	F	27.620	184.439	8.326	M, L, K, O	-
		BOL_LSU-6_2022-05	44.8	42.1	1,180	PF, SC	9	F	29.749	197.434	9.569	M, L, K, O	-
		BOL_LSU-7_2022-05	34.8	32.8	550	PF, SC	6	F	13.273	59.349	4.512	M, L, K, O	-
		BOL_LSU-8_2022-05	43.5	41.0	1,120	PF, SC	9	F	28.155	194.415	7.273	M, L, K, O	-
	Sample Size (n)		**8**	**8**	**8**	-	**8**	-	**8**	**8**	**8**	-	-
	Average		**42.9**	**40.3**	**1,017**		**9**		**21.726**	**148.191**	**6.315**		
	Median		**44.2**	**41.4**	**1,098**		**9**		**22.956**	**172.991**	**5.672**		
	Standard Deviation		**4.59**	**4.15**	**282**		**2.4**		**7.34**	**58.2**	**1.92**		
	Minimum		**34.8**	**32.8**	**550**		**6**		**10.548**	**56.560**	**4.000**		
	Maximum		**47.7**	**44.6**	**1,360**		**12**		**29.749**	**197.434**	**9.569**		
Polley Lake	28-May-22	POL_LSU-1_2022-05	39.6	37.2	670	PF, SC	7	F	8.649	120.245	2.907	M,L,K,O	-
		POL_LSU-2_2022-05	47.2	44.0	940	PF, SC	13	F	11.774	196.800	4.009	M,L,K,O	-
		POL_LSU-3_2022-05	45.4	42.1	960	PF, SC	8	F	14.615	182.956	3.722	M,L,K,O	Lesion on caudal fin
		POL_LSU-4_2022-05	44.5	41.9	930	PF, SC	9	F	12.287	169.287	2.873	M,L,K,O	Tip of caudal fin absent, white lesion on liver
		POL_LSU-5_2022-05	30.0	27.7	262	PF, SC	5	F	4.850	30.893	0.898	M,L,K,O	Scars on body
		POL_LSU-6_2022-05	37.4	35.5	510	PF, SC	5	F	8.688	56.742	0.570	M,L,K,O	Scars on body
		POL_LSU-7_2022-05	43.6	40.9	955	PF, SC	7	F	11.531	154.643	1.916	M,L,K,O	-
		POL_LSU-8_2022-05	40.1	37.6	640	PF, SC	7	F	11.211	83.123	2.572	M,L,K,O	-
	Sample Size (n)		**8**	**8**	**8**	-	**8**	-	**8**	**8**	**8**	-	-
	Average		**41.0**	**38.4**	**733**		**8**		**10.451**	**124.336**	**2.433**		
	Median		**41.9**	**39.3**	**800**		**7**		**11.371**	**137.444**	**2.723**		
	Standard Deviation		**5.5**	**5.2**	**258**		**2.6**		**3.0**	**61.7**	**1.2**		
	Minimum		**30.0**	**27.7**	**262**		**5**		**4.850**	**30.893**	**0.570**		
	Maximum		**47.2**	**44.0**	**960**		**13**		**14.615**	**196.800**	**4.009**		

Notes: "-" = data not available. M = Male. F = female.

[a] Age structures collected: PF = pectoral fin, SC = scales.

[b] Tissues collected: M = muscle, L = liver, K = kidney, O = ovary.

Table C.6.11: Destructive Physical Measurements of Rainbow Trout Caught by Hoop Netting in Polley Lake (POL; Exposed) and Bootjack Lake (BOL; Reference), May 2022

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Age Structure Collected[a]	Age (years)	Sex	Liver Weight (g)	Gonad Weight (g)	Kidney Weight (g)	Tissue Collected[b]	Abnormalities
Bootjack Lake	30-May-22	BOL_RB-1_2022-05	35.3	33.8	315	OTO, SC	5	F	6.316	29.765	5.287	M,L,K,O	Ligula
		BOL_RB-2_2022-05	37.1	35.0	360	SC	6	F	5.714	49.312	2.994	M,L,K,O	Ligula
		BOL_RB-3_2022-05	27.5	26.2	218	OTO, SC	3	F	3.197	38.049	1.663	M,L,K,O	Ligula
		BOL_RB-4_2022-05	25.5	24.1	156	OTO, SC	4	F	1.829	27.230	1.327	M,L,K,O	Ligula
		BOL_RB-5_2022-05[c]	29.5	28.0	204	OTO, SC	4	F	3.191	2.314	1.825	M,L,K,O	Ligula
		BOL_RB-6_2022-05	33.0	31.2	294	OTO, SC	3	F	4.106	6.908	2.274	M,L,K,O	Ligula
		BOL_RB-7_2022-05[c]	30.5	28.8	212	OTO, SC	3	F	2.818	2.176	1.821	M,L,K,O	Ligula
		BOL_RB-8_2022-05	33.4	31.5	300	OTO, SC	5	F	3.950	34.043	2.382	M,L,K,O	Ligula
	Sample Size (n)		**8**	**8**	**8**	-	**8**	-	**8**	**8**	**8**	-	-
	Average		**31.5**	**29.8**	**257**		**4**		**3.890**	**23.725**	**2.447**		
	Median		**31.8**	**30.0**	**256**		**4**		**3.574**	**28.498**	**2.050**		
	Standard Deviation		**3.9**	**3.7**	**69.4**		**1.1**		**1.5**	**17.8**	**1.3**		
	Minimum		**25.5**	**24.1**	**156**		**3**		**1.829**	**2.176**	**1.327**		
	Maximum		**37.1**	**35.0**	**360**		**6**		**6.316**	**49.312**	**5.287**		
Polley Lake	28-May-22	POL_RB-1_2022-05	30.7	29.1	248	OTO, SC	4	F	2.944	11.100	2.317	M,L,K,O	Ligula
	29-May-22	POL_RB-2_2022-05	34.0	33.1	305	OTO, SC	4	F	3.508	5.692	1.408	M,L,K,O	-
		POL_RB-3_2022-05	32.3	30.9	250	OTO, SC	4	F	2.719	7.690	3.173	M,L,K,O	Ligula
		POL_RB-4_2022-05	32.3	30.6	284	OTO, SC	4	F	3.200	10.394	2.106	M,L,K,O	Ligula, white lesions on intestines
		POL_RB-5_2022-05	26.2	24.8	160	OTO, SC	3	F	1.610	0.492	1.434	M,L,K,O	-
		POL_RB-6_2022-05	36.0	34.1	355	OTO, SC	4	F	3.583	9.846	3.366	M,L,K,O	Ligula
		POL_RB-7_2022-05	34.3	33.1	325	OTO, SC	3	F	3.024	65.678	3.152	M,L,K,O	Ligula
		POL_RB-8_2022-05	32.5	30.8	300	OTO, SC	4	F	2.792	51.793	2.276	M,L,K,O	Ligula
	Sample Size (n)		**8**	**8**	**8**	-	**8**	-	**8**	**8**	**8**	-	-
	Average		**32.3**	**30.8**	**278**		**3.75**		**2.923**	**20.336**	**2.404**		
	Median		**32.4**	**30.9**	**292**		**4**		**2.984**	**10.120**	**2.297**		
	Standard Deviation		**2.9**	**2.9**	**59.8**		**0.5**		**0.6**	**24.2**	**0.8**		
	Minimum		**26.2**	**24.8**	**160**		**3**		**1.610**	**0.492**	**1.408**		
	Maximum		**36.0**	**34.1**	**355**		**4**		**3.583**	**65.678**	**3.366**		

Notes: "-" = data not available. M = Male. F = female.

[a] Age structures collected: OTO = otoliths, SC = scales.

[b] Tissues collected: M = muscle, L = liver, K = kidney, O = ovary.

[c] Though there was sufficient ovary tissue for tissue quality analysis, ovary weights were much lower as the fish were spent

Table C.6.12: Hoop Net Catch Data near Grain Creek (QUL-NGC; Reference) and Hazeltine Creek (QUL-NHC; Exposed) in Quesnel Lake, October 2022

Area	Net ID	Net Size[a]	UTM (NAD83, Zone 10U)		Set Date	Lift Date	Set Time	Lift Time	Depth Range (m)		Effort (days)	Burbot				Kokanee				Largescale Sucker				Longnose Sucker				Northern Pikeminnow				Peamouth Chub				Rainbow Trout				Redside Shiner				Sockeye Salmon			
			Easting	Northing								Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]	Catch	Mortalities	Sacrificed	CPUE[b]	Catch	Sacrificed	Mortalities	CPUE[b]
Reference (near Grain Creek)	QUL-NGC_HN-1_2022-10	2.5	633132	5828731	4-Oct-22	6-Oct-22	16:15	14:39	0	1.0	1.93	1	0	0	0.517	0	0	0	0	0	0	0	0	1	0	0	0.517	1	0	0	0.517	2	1	1	1.03	1	0	0	0.517	0	0	0	0	2	0	1	1.03
	QUL-NGC_HN-2_2022-10	2.5	633096	5828687	4-Oct-22	6-Oct-22	16:30	14:13	0	1.3	1.90	2	0	0	1.05	0	0	0	0	1	0	0	0.525	12	0	0	6.30	23	8	0	12.1	5	0	5	2.62	0	0	0	0	1	0	0	0.525	1	0	0	0.525
	QUL-NGC_HN-3_2022-10	2.5	633259	5828879	4-Oct-22	6-Oct-22	16:50	15:08	0	1.2	1.93	1	0	0	0.518	2	0	0	1.04	4	0	0	2.07	5	0	0	2.59	19	0	2	9.85	30	7	0	15.6	0	0	0	0	0	0	0	0	2	0	1	1.04
								Total			**5.77**	**4**	**0**	**0**	**0.694**	**2**	**0**	**0**	**0.347**	**5**	**0**	**0**	**0.867**	**18**	**0**	**0**	**3.12**	**43**	**8**	**2**	**7.46**	**37**	**8**	**6**	**6.42**	**1**	**0**	**0**	**0.173**	**1**	**0**	**0**	**0.173**	**5**	**0**	**2**	**0.867**
Exposed (near Hazeltine Creek)	QUL-NHC_HN-1_2022-10	2.5	602231	5817500	3-Oct-22	4-Oct-22	16:20	14:51	0	3.0	0.938	0	0	0	0	1	0	0	1.07	26	0	0	27.7	0	0	0	0	9	8	0	9.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NHC_HN-2_2022-10	2.5	602295	5817479	3-Oct-22	4-Oct-22	17:00	15:30	0	1.5	0.938	6	0	0	6.40	4	0	0	4.27	5	0	0	5.33	0	0	0	0	8	0	5	8.53	17	8	0	18.1	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NHC_HN-3_2022-10	2.5	602384	5817446	3-Oct-22	4-Oct-22	17:21	16:10	0	3.0	0.951	0	0	0	0	69	0	3	72.6	79	0	5	83.1	0	0	0	0	6	0	3	6.31	6	0	0	6.31	0	0	0	0	0	0	0	0	1	0	1	1.05
								Total			**2.83**	**6**	**0**	**0**	**2.12**	**74**	**0**	**3**	**26.2**	**110**	**0**	**5**	**38.9**	**0**	**0**	**0**	**0**	**23**	**8**	**8**	**8.14**	**23**	**8**	**0**	**8.14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0.354**

Notes: ID = identifier. UTM = Universal Transverse Mercator. NAD = North American Datu. CPUE = catch-per-unit-effort.

[a] Net size represents diameter in feet.

[b] CPUE = number of fish caught per trap day.

Table C.6.13: Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Burbot					Bull Trout					Sockeye Salmon					Lake Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Reference (East Arm)	QUL-EAA_GN-1_2022-10	677524	5832619	8.4	32	4-Oct-22	4-Oct-22	10:13	11:05	0.867	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0414
											4	16	3	0	13	0.662	0	0	0	0	0	1	1	0	0	0.0414	0	0	0	0	0
											5	3	0	0	3	0.124	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0.166
	QUL-EAA_GN-2_2022-10	677107	5832498	9.6	26.7	4-Oct-22	4-Oct-22	10:30	11:45	1.25	3	0	0	0	0	0	1	0	0	1	0.0287	1	0	0	1	0.0287	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-3_2022-10	677560	5832652	7.8	27.2	4-Oct-22	4-Oct-22	12:00	12:44	0.733	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	1	0	0	1	0.0489	0	0	0	0	0	5	0	0	5	0.245	1	0	1	0	0.0489
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-4_2022-10	677107	5832498	30.7	36.5	4-Oct-22	4-Oct-22	13:01	13:45	0.733	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-5_2022-10	677107	5832498	17.9	34.5	4-Oct-22	4-Oct-22	13:08	13:55	0.783	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	2	1	0	1	0.0916	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0458
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-6_2022-10	676905	5832470	18.1	27.4	4-Oct-22	4-Oct-22	14:08	14:42	0.567	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0633
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									Total	**4.93**	-	**22**	**4**	**0**	**18**	**0.00889**	**1**	**0**	**0**	**1**	**0.000404**	**7**	**1**	**0**	**6**	**0.00283**	**8**	**0**	**8**	**0**	**0.00323**
Exposed (near Cedar Point)	QUL-NCP_GN-1_2022-10	598832	5827205	9	20	3-Oct-22	3-Oct-22	8:26	9:40	1.23	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0291
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0.0582	0	0	0	0	0
	QUL-NCP_GN-2_2022-10	598599	5827484	5	21	3-Oct-22	3-Oct-22	8:40	9:55	1.25	3	0	0	0	0	0	1	0	0	1	0.0287	2	0	0	2	0.0574	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-3_2022-10	598820	5827206	5	21	3-Oct-22	3-Oct-22	9:45	10:45	1.00	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0287	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-4_2022-10	598599	5827484	4	22	3-Oct-22	3-Oct-22	10:05	11:03	0.967	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0371	0	0	0	0	0
	QUL-NCP_GN-5_2022-10	598742	5827350	6	26	3-Oct-22	3-Oct-22	10:37	11:30	0.883	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0406	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0406	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-6_2022-10	598820	5827206	6	17	3-Oct-22	3-Oct-22	10:50	11:41	0.850	3	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0.0406	1	0	1	0	0.0406
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-7_2022-10	598599	5827484	3	22	3-Oct-22	3-Oct-22	11:11	12:30	1.32	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0273	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0.0545	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0273	1	0	1	0	0.0273
	QUL-NCP_GN-8_2022-10	598747	5827359	4	24	3-Oct-22	3-Oct-22	11:36	12:40	0.750	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-9_2022-10	598796	5827241	6	20	3-Oct-22	3-Oct-22	11:58	12:58	1.00	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0359	1	0	1	0	0.0359
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-10_2022-10	598578	5827465	3	21	3-Oct-22	3-Oct-22	12:35	13:37	1.03	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-11_2022-10	598730	5827358	5	23	3-Oct-22	3-Oct-22	12:47	13:53	0.750	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.
[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.13: **Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022**

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Burbot					Bull Trout					Sockeye Salmon					Lake Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Exposed (near Cedar Point)	QUL-NCP_GN-12_2022-10	598813	5827286	7	18	3-Oct-22	3-Oct-22	13:06	14:10	1.07	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0336	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-13_2022-10	598812	5827146	12	22	3-Oct-22	3-Oct-22	13:46	14:46	1.00	3	0	0	0	0	0	1	1	0	0	0.0359	1	0	0	1	0.0359	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	3	1	0	2	0.108	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-14_2022-10	598709	5827373	4	24	3-Oct-22	3-Oct-22	14:00	15:05	0.750	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-15_2022-10	598763	5827310	9	23	3-Oct-22	3-Oct-22	14:16	15:15	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-16_2022-10	598845	5827177	6	21	4-Oct-22	4-Oct-22	10:40	11:30	0.833	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-17_2022-10	598789	5827323	7	21	4-Oct-22	4-Oct-22	10:52	11:52	1.00	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-18_2022-10	598692	5827413	7	20	4-Oct-22	4-Oct-22	11:04	12:06	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-19_2022-10	598839	5827133	9	23	4-Oct-22	4-Oct-22	11:37	12:38	1.02	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0353
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-20_2022-10	598775	5827304	8	20	4-Oct-22	4-Oct-22	12:00	13:02	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-21_2022-10	598695	5827424	5	20	4-Oct-22	4-Oct-22	12:10	13:34	1.40	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-22_2022-10	598839	5827133	8	21	4-Oct-22	4-Oct-22	12:45	13:47	1.03	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0347	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0347	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-23_2022-10	598749	5827026	5	20	4-Oct-22	4-Oct-22	13:20	14:22	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-24_2022-10	598841	5827142	19	20	5-Oct-22	5-Oct-22	8:17	9:20	1.05	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-25_2022-10	598808	5827053	18	27	5-Oct-22	5-Oct-22	8:26	9:25	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-26_2022-10	598816	5827295	9	17	5-Oct-22	5-Oct-22	9:30	10:35	1.08	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0331	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0331	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-27_2022-10	598817	5827137	12	20	5-Oct-22	5-Oct-22	9:42	10:50	1.13	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0317	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-28_2022-10	598745	5827423	7	21	5-Oct-22	5-Oct-22	10:57	11:58	1.02	3	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0.106	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0353	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-29_2022-10	598761	5827759	8	17	5-Oct-22	5-Oct-22	11:04	12:08	1.07	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0336	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0336	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-30_2022-10	598762	5826947	13	25	5-Oct-22	5-Oct-22	12:29	13:28	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-31_2022-10	598683	5826723	15	19	5-Oct-22	5-Oct-22	13:36	14:37	0.750	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.
[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.13: **Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022**

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Burbot					Bull Trout					Sockeye Salmon					Lake Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Exposed (near Cedar Point)	QUL-NCP_GN-32_2022-10	598926	5825436	14	16	5-Oct-22	5-Oct-22	13:55	15:00	1.08	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-33_2022-10	599068	5824173	17	29	5-Oct-22	5-Oct-22	14:05	15:15	1.17	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0308	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-34_2022-10	598845	5827274	15	21	5-Oct-22	5-Oct-22	15:28	16:31	1.05	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0342	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-35_2022-10	598861	5827119	17	16	5-Oct-22	5-Oct-22	15:33	16:37	1.07	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-36_2022-10	598800	5827166	9	19	5-Oct-22	5-Oct-22	16:47	17:49	1.03	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0.0347
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-37_2022-10	598775	5827377	8	24	5-Oct-22	5-Oct-22	17:00	17:59	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-38_2022-10	598851	5827189	11	20	5-Oct-22	5-Oct-22	18:12	18:46	0.567	3	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0.190	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-39_2022-10	598789	5827082	13	26	5-Oct-22	5-Oct-22	18:19	18:56	0.617	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-40_2022-10	598822	5827150	8	20	6-Oct-22	6-Oct-22	7:15	8:17	1.03	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0.0694	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-41_2022-10	598746	5827357	10	23	6-Oct-22	6-Oct-22	7:25	8:32	1.12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0321	1	0	1	0	0.0321
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-42_2022-10	598770	5827300	10	23	6-Oct-22	6-Oct-22	7:35	8:42	1.12	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0321	1	0	1	0	0.0321
											4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.0321	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-43_2022-10	598746	5827357	10	22	6-Oct-22	6-Oct-22	8:37	8:55	0.300	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									Total	**42.4**	-	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**1**	**0.0000144**	**40**	**2**	**0**	**38**	**0.000288**	**8**	**0**	**8**	**0**	**0.0000577**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.

[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.13: Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Kokanee					Mountain Whitefish					Rainbow Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Reference (East Arm)	QUL-EAA_GN-1_2022-10	677524	5832619	8.4	32	4-Oct-22	4-Oct-22	10:13	11:05	0.867	3	0	0	0	0	0	2	0	0	2	0.0828	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-2_2022-10	677107	5832498	9.6	26.7	4-Oct-22	4-Oct-22	10:30	11:45	1.25	3	1	0	0	1	0.0287	1	0	0	1	0.0287	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-3_2022-10	677560	5832652	7.8	27.2	4-Oct-22	4-Oct-22	12:00	12:44	0.733	3	0	0	0	0	0	1	0	0	1	0.0489	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-4_2022-10	677107	5832498	30.7	36.5	4-Oct-22	4-Oct-22	13:01	13:45	0.733	3	0	0	0	0	0	1	0	0	1	0.0489	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-5_2022-10	677107	5832498	17.9	34.5	4-Oct-22	4-Oct-22	13:08	13:55	0.783	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-EAA_GN-6_2022-10	676905	5832470	18.1	27.4	4-Oct-22	4-Oct-22	14:08	14:42	0.567	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									Total	**4.93**	-	**1**	**0**	**0**	**1**	**0.000404**	**5**	**0**	**0**	**5**	**0.00202**	**0**	**0**	**0**	**0**	**0**
Exposed (near Cedar Point)	QUL-NCP_GN-1_2022-10	598832	5827205	9	20	3-Oct-22	3-Oct-22	8:26	9:40	1.23	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-2_2022-10	598599	5827484	5	21	3-Oct-22	3-Oct-22	8:40	9:55	1.25	3	2	0	0	2	0.0574	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-3_2022-10	598820	5827206	5	21	3-Oct-22	3-Oct-22	9:45	10:45	1.00	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-4_2022-10	598599	5827484	4	22	3-Oct-22	3-Oct-22	10:05	11:03	0.967	3	3	0	0	3	0.111	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-5_2022-10	598742	5827350	6	26	3-Oct-22	3-Oct-22	10:37	11:30	0.883	3	1	0	0	1	0.0406	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-6_2022-10	598820	5827206	6	17	3-Oct-22	3-Oct-22	10:50	11:41	0.850	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-7_2022-10	598599	5827484	3	22	3-Oct-22	3-Oct-22	11:11	12:30	1.32	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-8_2022-10	598747	5827359	4	24	3-Oct-22	3-Oct-22	11:36	12:40	0.750	3	2	0	0	2	0.0957	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-9_2022-10	598796	5827241	6	20	3-Oct-22	3-Oct-22	11:58	12:58	1.00	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-10_2022-10	598578	5827465	3	21	3-Oct-22	3-Oct-22	12:35	13:37	1.03	3	1	0	0	1	0.0347	0	0	0	0	0	1	0	0	1	0.0347
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-11_2022-10	598730	5827358	5	23	3-Oct-22	3-Oct-22	12:47	13:53	0.750	3	5	0	0	5	0.239	0	0	0	0	0	2	0	0	2	0.0957
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.

[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.13: **Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022**

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Kokanee					Mountain Whitefish					Rainbow Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Exposed (near Cedar Point)	QUL-NCP_GN-12_2022-10	598813	5827286	7	18	3-Oct-22	3-Oct-22	13:06	14:10	1.07	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-13_2022-10	598812	5827146	12	22	3-Oct-22	3-Oct-22	13:46	14:46	1.00	3	8	1	0	7	0.287	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-14_2022-10	598709	5827373	4	24	3-Oct-22	3-Oct-22	14:00	15:05	0.750	3	1	0	0	1	0.0478	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-15_2022-10	598763	5827310	9	23	3-Oct-22	3-Oct-22	14:16	15:15	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-16_2022-10	598845	5827177	6	21	4-Oct-22	4-Oct-22	10:40	11:30	0.833	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-17_2022-10	598789	5827323	7	21	4-Oct-22	4-Oct-22	10:52	11:52	1.00	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-18_2022-10	598692	5827413	7	20	4-Oct-22	4-Oct-22	11:04	12:06	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-19_2022-10	598839	5827133	9	23	4-Oct-22	4-Oct-22	11:37	12:38	1.02	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-20_2022-10	598775	5827304	8	20	4-Oct-22	4-Oct-22	12:00	13:02	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-21_2022-10	598695	5827424	5	20	4-Oct-22	4-Oct-22	12:10	13:34	1.40	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-22_2022-10	598839	5827133	8	21	4-Oct-22	4-Oct-22	12:45	13:47	1.03	3	3	0	0	3	0.104	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-23_2022-10	598749	5827026	5	20	4-Oct-22	4-Oct-22	13:20	14:22	1.03	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-24_2022-10	598841	5827142	19	20	5-Oct-22	5-Oct-22	8:17	9:20	1.05	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-25_2022-10	598808	5827053	18	27	5-Oct-22	5-Oct-22	8:26	9:25	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-26_2022-10	598816	5827295	9	17	5-Oct-22	5-Oct-22	9:30	10:35	1.08	3	1	0	0	1	0.0331	0	0	0	0	0	0	0	0	0	0
											4	1	0	0	1	0.0331	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-27_2022-10	598817	5827137	12	20	5-Oct-22	5-Oct-22	9:42	10:50	1.13	3	1	0	0	1	0.0317	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-28_2022-10	598745	5827423	7	21	5-Oct-22	5-Oct-22	10:57	11:58	1.02	3	1	0	0	1	0.0353	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-29_2022-10	598761	5827759	8	17	5-Oct-22	5-Oct-22	11:04	12:08	1.07	3	4	0	0	4	0.135	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-30_2022-10	598762	5826947	13	25	5-Oct-22	5-Oct-22	12:29	13:28	0.983	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-31_2022-10	598683	5826723	15	19	5-Oct-22	5-Oct-22	13:36	14:37	0.750	3	1	0	0	1	0.0478	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.
[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.13: **Gill Net Catch Data from the East Arm (QUL-EAA; Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022**

Area	Net ID	UTM (NAD83, Zone 10U)		Depth Range (m)		Set Date	Lift Date	Set Time	Lift Time	Effort (Hrs)	Mesh (inches)	Kokanee					Mountain Whitefish					Rainbow Trout				
		Easting	Northing									Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]	Catch	Mortalities	Sacrificed	Released	CPUE[a]
Exposed (near Cedar Point)	QUL-NCP_GN-32_2022-10	598926	5825436	14	16	5-Oct-22	5-Oct-22	13:55	15:00	1.08	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-33_2022-10	599068	5824173	17	29	5-Oct-22	5-Oct-22	14:05	15:15	1.17	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-34_2022-10	598845	5827274	15	21	5-Oct-22	5-Oct-22	15:28	16:31	1.05	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-35_2022-10	598861	5827119	17	16	5-Oct-22	5-Oct-22	15:33	16:37	1.07	3	2	0	0	2	0.0673	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-36_2022-10	598800	5827166	9	19	5-Oct-22	5-Oct-22	16:47	17:49	1.03	3	2	0	0	2	0.0694	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-37_2022-10	598775	5827377	8	24	5-Oct-22	5-Oct-22	17:00	17:59	0.983	3	10	0	0	10	0.365	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-38_2022-10	598851	5827189	11	20	5-Oct-22	5-Oct-22	18:12	18:46	0.567	3	1	0	0	1	0.0633	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-39_2022-10	598789	5827082	13	26	5-Oct-22	5-Oct-22	18:19	18:56	0.617	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-40_2022-10	598822	5827150	8	20	6-Oct-22	6-Oct-22	7:15	8:17	1.03	3	7	0	0	7	0.243	1	0	0	1	0.0347	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-41_2022-10	598746	5827357	10	23	6-Oct-22	6-Oct-22	7:25	8:32	1.12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-42_2022-10	598770	5827300	10	23	6-Oct-22	6-Oct-22	7:35	8:42	1.12	3	2	0	0	2	0.0643	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QUL-NCP_GN-43_2022-10	598746	5827357	10	22	6-Oct-22	6-Oct-22	8:37	8:55	0.300	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									Total	**42.4**	-	**59**	**1**	**0**	**58**	**0.000425**	**1**	**0**	**0**	**1**	**0.00000721**	**3**	**0**	**0**	**3**	**0.0000216**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort; QUL = Quesnel; GN = gill net.
[a] CPUE = number of fish per m^2 per hour (# fish/[m^2 x hour]).

Table C.6.14: Angling Catch Data for Quesnel River (QUR; Exposed), October 2022

Area	Station ID	UTM (NAD83, Zone 10U)		Date	Start Time	End Time	Angling Hours (hrs)	# of Lines	Effort (angler days)	Bull Trout				Rainbow Trout			
		Easting	Northing							Catch	Mortalities	Sacrificed	CPUE [a]	Catch	Mortalities	Sacrificed	CPUE [a]
Quesnel River	QUR_AG-1_2022-10	596537	5830512	1-Oct-22	13:00	14:50	1.83	1	0.0764	0	0	0	0	4	0	4	52.4
	QUR_AG-2_2022-10	596537	5830512	2-Oct-22	12:00	13:40	1.67	1	0.0694	1	0	0	14.4	4	0	4	57.6
								Total	**0.146**	**1**	**0**	**0**	**6.86**	**8**	**0**	**8**	**54.9**

Notes: ID = identifier. UTM = Universal Transverse Mercator. NAD = North American Datum. CPUE = catch-per-unit-effort.

[a] CPUE is calculated as the number of fish captured per angler day.

Table C.6.15: Destructive Physical Measurements of Lake Trout Caught by Gill Netting in the East Arm (QUL-EAA Reference) and near Cedar Point Park (QUL-NCP; Exposed) of Quesnel Lake, October 2022

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Age Structure Collected[a]	Age (years)	Sex[b]	Liver Weight (g)	Gonad Weight (g)	Kidney Weight (g)	Tissue Collected[c]	Abnormalities
Reference (East Arm)	4-Oct-22	QUL-EAA_LT-1_2022-10	66.5	61.5	2,500	OTO, SC	11	M	22.042	-	19.875	M, L, K	None
		QUL-EAA_LT-2_2022-10	70.5	65.0	3,100	OTO, SC	19	M	33.447	-	45.186	M, L, K	None
		QUL-EAA_LT-3_2022-10	58.7	53.9	1,562	OTO, SC	10	M	14.317	-	10.397	M, L, K	None
		QUL-EAA_LT-4_2022-10	64.3	59.1	2,500	OTO, SC	8	F	26.790	126.979	18.502	M, L, K, O	None
		QUL-EAA_LT-5_2022-10	65.5	60.0	2,600	OTO, SC	12	M	27.446	-	27.749	M, L, K	None
		QUL-EAA_LT-6_2022-10	66.2	60.1	2,450	OTO, SC	18	M	31.087	-	25.200	M, L, K	None
		QUL-EAA_LT-7_2022-10	54.2	50.0	1,440	OTO, SC	7	M	19.738	-	10.565	M, L, K	None
		QUL-EAA_LT-8_2022-10	68.0	62.8	2,650	OTO, SC	14	M	35.409	-	42.975	M, L, K	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	**8**	-	**8**	-	-
		Average	**64.2**	**59.1**	**2,350**		**12**		**26.285**		**25.056**		
		Median	**65.9**	**60.1**	**2,500**		**12**		**27.118**		**22.538**		
		Standard Deviation	**5.3**	**4.9**	**563**		**4.4**		**7.20**		**13.2**		
		Minimum	**54.2**	**50.0**	**1,440**		**7**		**14.317**		**10.397**		
		Maximum	**70.5**	**65.0**	**3,100**		**19**		**35.409**		**45.186**		
Exposed (near Cedar Point)	3-Oct-22	QUL-NCP_LT-1_2022-10	69.5	64.5	3,100	OTO, SC	10	F	79.057	427.853	28.288	M, L, K, O	None
		QUL-NCP_LT-2_2022-10	53.0	48.3	1,200	OTO, SC	3	M	14.655	-	7.921	M, L, K	None
		QUL-NCP_LT-3_2022-10	70.0	64.0	3,400	OTO, SC	11	F	90.039	340.478	34.411	M, L, K, O	None
		QUL-NCP_LT-4_2022-10	57.6	52.5	1,550	OTO, SC	4	F	18.389	10.837	14.409	M, L, K, O	None
	4-Oct-22	QUL-NCP_LT-5_2022-10	47.0	42.5	760	SC	3	F	10.285	4.610	5.028	M, L, K, O	None
	5-Oct-22	QUL-NCP_LT-6_2022-10	67.0	61.5	2,600	OTO, SC	15	M	28.817	-	35.750	M, L, K	None
	6-Oct-22	QUL-NCP_LT-7_2022-10	64.0	58.5	2,090	OTO, SC	5	M	69.430	-	18.658	M, L, K	None
		QUL-NCP_LT-8_2022-10	56.5	51.0	1,150	SC	2	F	15.319	7.536	8.079	M, L, K, O	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	**8**	**5**	**8**	-	-
		Average	**60.6**	**55.4**	**1,981**		**7**		**40.749**	**158.263**	**19.068**		
		Median	**60.8**	**55.5**	**1,820**		**5**		**23.603**	**10.837**	**16.534**		
		Standard Deviation	**8.4**	**8.0**	**974**		**4.7**		**33.0**	**209**	**12.3**		
		Minimum	**47.0**	**42.5**	**760**		**2**		**10.285**	**4.610**	**5.028**		
		Maximum	**70.0**	**64.5**	**3,400**		**15**		**90.039**	**427.853**	**35.750**		

Notes: "-" = data not available or no ovary weight available. QUL = Quesnel Lake. LT = lake trout.

[a] Age structures collected: OTO = otoliths, SC = scales.

[b] F = female, M = male, U = unknown.

[c] Tissues collected: M = muscle; L = liver; K = kidney; O = ovary.

Table C.6.16: Destructive Physical Measurements of Northern Pikeminnow Caught by Hoop Netting near Grain Creek (QUL-NGC; Reference) and Hazeltine Creek (QUL-NHC; Exposed) in Quesnel Lake, October 2022

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Age Structure Collected[a]	Age (years)	Sex[b]	Tissue Collected[c]	Abnormalities
Reference (near Grain Creek)	6-Oct-22	QUL-NGC_NSC-1_2022-10	16.0	14.0	37	OTO, SC	3	Unknown	WB	None
		QUL-NGC_NSC-2_2022-10	15.5	13.8	36	OTO, SC	2	Unknown	WB	None
		QUL-NGC_NSC-3_2022-10	15.1	13.5	37	OTO, SC	3	Unknown	WB	None
		QUL-NGC_NSC-4_2022-10	16.4	14.8	36	OTO, SC	2	Unknown	WB	None
		QUL-NGC_NSC-5_2022-10	18.5	16.6	57	OTO, SC	2	Unknown	WB	None
		QUL-NGC_NSC-6_2022-10	16.9	15.3	40	OTO, SC	3	Unknown	WB	None
		QUL-NGC_NSC-7_2022-10	16.7	15.3	42	OTO, SC	4	Unknown	WB	None
		QUL-NGC_NSC-8_2022-10	16.8	15.2	40	OTO, SC	2	Unknown	WB	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	-	-
		Average	**16.5**	**14.8**	**40.6**		**3**			
		Median	**16.6**	**15.0**	**38.5**		**3**			
		Standard Deviation	**1**	**1**	**7**		**0.7**			
		Minimum	**15.1**	**13.5**	**36.0**		**2**			
		Maximum	**18.5**	**16.6**	**57.0**		**4**			
Exposed (near Hazeltine Creek)	4-Oct-22	QUL-NHC_NSC-1_2022-10	24.0	21.8	130	OTO, SC	6	Unknown	WB	None
		QUL-NHC_NSC-2_2022-10	20.2	18.5	70	OTO, SC	5	Unknown	WB	None
		QUL-NHC_NSC-3_2022-10	20.0	18.0	76	OTO, SC	4	Unknown	WB	None
		QUL-NHC_NSC-4_2022-10	18.0	16.3	50	OTO, SC	3	Unknown	WB	None
		QUL-NHC_NSC-5_2022-10	20.5	18.6	69	OTO, SC	3	Unknown	WB	None
		QUL-NHC_NSC-6_2022-10	18.1	16.3	51	OTO, SC	5	Unknown	WB	None
		QUL-NHC_NSC-7_2022-10	16.5	15.1	40	OTO, SC	2	Unknown	WB	None
		QUL-NHC_NSC-8_2022-10	15.4	13.6	33	OTO, SC	2	Unknown	WB	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	-	-
		Average	**19.1**	**17.3**	**64.9**		**4**			
		Median	**19.1**	**17.2**	**60.0**		**4**			
		Standard Deviation	**2.7**	**2.5**	**30.4**		**1.5**			
		Minimum	**15.4**	**13.6**	**33.0**		**2**			
		Maximum	**24.0**	**21.8**	**130**		**6**			

Notes: "-" = data not available or no ovary weight available. QUL = Quesnel Lake. NSC = Northern Pikeminnow.

[a] Age structures collected: OTO = otoliths, SC = scales.

[b] Unknown/undetermined as fish were submitted as whole body sample.

[c] Tissues collected: WB = whole body.

Table C.6.17: Destructive Physical Measurements of Peamouth Chub Caught by Hoop Netting near Grain Creek (QUL-NGC; Reference) and Hazeltine Creek (QUL-NHC; Exposed) in Quesnel Lake, October 2022

Area	Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Age Structure Collected[a]	Age (years)	Sex[b]	Liver Weight (g)	Gonad Weight (g)	Kidney Weight (g)	Tissue Collected[c]	Abnormalities
Reference (near Grain Creek)	6-Oct-22	QUL-NGC_PCC-1_2022-10	19.0	17.1	66	OTO, SC	3	U	0.957	-	0.308	M, L, K	None
		QUL-NGC_PCC-2_2022-10	25.2	22.8	110	SC	4	F	1.671	8.848	2.452	M, L, K, O	None
		QUL-NGC_PCC-3_2022-10	24.1	21.6	135	SC	4	F	1.585	8.491	1.067	M, L, K, O	None
		QUL-NGC_PCC-4_2022-10	22.0	20.0	100	OTO, SC	6	M	1.697	-	1.525	M, L, K	None
		QUL-NGC_PCC-5_2022-10	24.1	21.6	110	OTO, SC	14	F	1.574	5.192	0.919	M, L, K, O	None
		QUL-NGC_PCC-6_2022-10	21.6	19.6	85	OTO, SC	5	F	0.805	3.255	0.822	M, L, K, O	None
		QUL-NGC_PCC-7_2022-10	23.5	21.2	130	OTO, SC	9	F	1.799	7.139	1.401	M, L, K, O	None
		QUL-NGC_PCC-8_2022-10	19.6	17.7	71	OTO, SC	5	F	0.469	2.601	0.450	M, L, K,O	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	**8**	**6**	**8**	-	-
		Average	**22.4**	**20.2**	**101**		**6**		**1.320**	**5.921**	**1.118**		
		Median	**22.8**	**20.6**	**105**		**5**		**1.580**	**6.166**	**0.993**		
		Standard Deviation	**2.2**	**2.0**	**25.5**		**3.6**		**0.5**	**2.7**	**0.7**		
		Minimum	**19.0**	**17.1**	**66.0**		**3**		**0.469**	**2.601**	**0.308**		
		Maximum	**25.2**	**22.8**	**135**		**14**		**1.799**	**8.848**	**2.452**		
Exposed (near Hazeltine Creek)	4-Oct-22	QUL-NHC_PCC-1_2022-10	25.2	22.9	170	OTO, SC	9	F	2.899	7.927	1.559	M, L, K,O	None
		QUL-NHC_PCC-2_2022-10	24.5	22.4	130	OTO, SC	8	F	1.855	2.872	1.403	M, L, K, O	Parasite in ovary
		QUL-NHC_PCC-3_2022-10	23.9	21.5	130	OTO, SC	9	F	1.620	9.607	0.816	M, L, K, O	None
		QUL-NHC_PCC-4_2022-10	23.7	21.8	140	OTO, SC	7	F	1.652	11.573	1.192	M, L, K, O	None
		QUL-NHC_PCC-5_2022-10	24.1	21.5	145	OTO, SC	8	F	2.010	8.703	1.655	M, L, K, O	None
		QUL-NHC_PCC-6_2022-10	24.5	22.3	160	OTO, SC	10	F	4.923	11.300	1.301	M, L, K, O	None
		QUL-NHC_PCC-7_2022-10	22.8	20.7	115	OTO, SC	6	F	1.830	6.880	1.216	M, L, K, O	None
		QUL-NHC_PCC-8_2022-10	22.4	20.0	115	OTO, SC	8	M	2.194	-	1.290	M, L, K	None
		Sample Size (n)	**8**	**8**	**8**	-	**8**	-	**8**	**7**	**8**	-	-
		Average	**23.9**	**21.6**	**138**		**8**		**2.373**	**8.409**	**1.304**		
		Median	**24.0**	**21.7**	**135**		**8**		**1.933**	**8.703**	**1.296**		
		Standard Deviation	**0.9**	**0.9**	**19.8**		**1.2**		**1.1**	**3.0**	**0.3**		
		Minimum	**22.4**	**20.0**	**115**		**6**		**1.620**	**2.872**	**0.816**		
		Maximum	**25.2**	**22.9**	**170**		**10**		**4.923**	**11.573**	**1.655**		

Notes: "-" = data not available or no ovary weight available. QUL = Quesnel Lake. PCC = peamouth chub.

[a] Age structures collected: OTO = otoliths, SC = scales.

[b] F = female, M = male, U = unknown.

[c] Tissues collected: M = muscle; L = liver; K = kidney; O = ovary.

Table C.6.18: Destructive Physical Measurements of Rainbow Trout Caught by Angling in Quesnel River (QUR; Exposed), October 2022

Processing Date	Fish ID	Total Length (cm)	Fork Length (cm)	Body Weight (g)	Age Structure Collected[a]	Age (years)	Sex[b]	Liver Weight (g)	Gonad Weight (g)	Kidney Weight (g)	Tissue Collected[c]	Abnormalities
1-Oct-22	QUR_RB-1_2022-10	35.5	33.6	450	OTO, SC	5	F	3.897	0.897	5.140	M, L, K, O	None
	QUR_RB-2_2022-10	28.4	26.5	230	OTO, SC	3	F	1.834	0.365	2.235	M, L, K, O	None
	QUR_RB-3_2022-10	20.8	19.4	110	SC	2	M	0.639	-	0.885	M, L, K	None
	QUR_RB-4_2022-10	32.8	30.9	310	OTO, SC	3	F	2.195	-	2.487	M, L, K, O	None
2-Oct-22	QUR_RB-5_2022-10	35.1	33.2	390	OTO, SC	5	F	3.861	5.427	4.385	M, L, K, O	None
	QUR_RB-6_2022-10	24.5	23.0	150	OTO, SC	2	F	1.265	0.241	1.522	M, L, K, O	None
	QUR_RB-7_2022-10	34.1	32.4	300	OTO, SC	5	M	3.512	-	4.140	M, L, K	None
	QUR_RB-8_2022-10	21.6	20.1	120	OTO, SC	2	M	0.973	-	1.063	M, L, K	None
Sample Size (n)		**8**	**8**	**8**	-	**8**	-	**8**	**4**	**8**	-	-
Average		**29.1**	**27.4**	**258**		**3**		**2.272**	**1.733**	**2.732**		
Median		**30.6**	**28.7**	**265**		**3**		**2.015**	**0.631**	**2.361**		
Standard Deviation		**6.1**	**5.9**	**127**		**1.4**		**1.3**	**2.5**	**1.6**		
Minimum		**20.8**	**19.4**	**110**		**2**		**0.639**	**0.241**	**0.885**		
Maximum		**35.5**	**33.6**	**450**		**5**		**3.897**	**5.427**	**5.140**		

Notes: "-" = data not available or no comment. QUR = Quesnel River. RB = rainbow trout.

[a] Age structures collected: OTO = otoliths, SC = scales.

[b] F = female, M = male.

[c] Tissues collected: M = muscle; L = liver; K = kidney; O = ovary.

APPENDIX C.7
FISH TISSUE QUALITY

Table C.7.1: Rainbow Trout Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Muscle														
		POL-RB-1	POL-RB-2	POL-RB-3	POL-RB-4	POL-RB-5	POL-RB-6	POL-RB-7	POL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	79.7	81.1	82.4	82.0	77.4	80.6	79.5	76.9	8	0%	80	2.00	76.9	80.2	82.4
Aluminum	mg/kg dw	<5.0	<5.0	<5.0	5.70	<5.0	8.50	<5.0	<5.0	8	75%	5.52	1.98	<5.0	5.00	8.50
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0400	<0.030	0.0440	0.0690	0.0390	0.0530	0.0650	0.0320	8	13%	0.0465	0.0139	<0.030	0.0420	0.0690
Barium	mg/kg dw	0.787	0.582	0.729	1.03	0.790	1.04	0.480	0.557	8	0%	0.749	0.208	0.480	0.758	1.04
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	1.00	<1.0	<1.0	<1.0	<1.0	<1.0	8	88%	1.00	-	<1.0	1.00	1.00
Cadmium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Calcium	mg/kg dw	835	1,470	459	628	1,020	432	711	1,870	8	0%	928	507	1,020	773	835
Cesium	mg/kg dw	0.0698	0.112	0.0654	0.0593	0.0531	0.0715	0.0619	0.0620	8	0%	0.0694	0.0182	0.0531	0.0637	0.112
Chromium	mg/kg dw	<0.20	<0.20	0.320	0.430	0.290	<0.20	0.520	0.230	8	38%	0.299	0.116	<0.20	0.260	0.520
Cobalt	mg/kg dw	0.0200	0.0200	0.0280	0.0300	<0.020	0.0200	0.0320	0.0200	8	13%	0.0238	0.00547	<0.020	0.0200	0.0320
Copper	mg/kg dw	2.64	1.84	3.71	3.48	1.30	1.63	2.67	1.96	8	0%	2.40	0.872	1.30	2.30	3.71
Iron	mg/kg dw	37.7	48.2	59.3	61.2	32.2	42.9	54.9	44.9	8	0%	47.7	10.3	32.2	46.5	61.2
Lead	mg/kg dw	<0.050	<0.050	<0.050	<0.050	0.0600	<0.050	<0.050	<0.050	8	88%	0.0512	-	<0.050	0.0500	0.0600
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,410	1,300	1,270	1,430	1,290	1,580	1,350	874	8	0%	1,313	204	1,270	1,325	874
Manganese	mg/kg dw	0.516	1.24	0.771	0.931	0.863	1.24	0.761	1.30	8	0%	0.953	0.281	0.516	0.897	1.30
Mercury	mg/kg dw	0.523	0.991	1.01	0.759	0.335	1.05	0.537	0.512	8	0%	0.715	0.276	0.335	0.648	1.05
	mg/kg ww	0.106	0.188	0.178	0.136	0.0760	0.205	0.110	0.118	8	0%	0.140	0.0457	0.0760	0.127	0.205
Molybdenum	mg/kg dw	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	8	100%	<0.040	-	<0.040	<0.040	<0.040
Nickel	mg/kg dw	<0.20	<0.20	<0.20	0.210	<0.20	<0.20	0.260	<0.20	8	75%	0.209	0.0354	<0.20	0.200	0.260
Phosphorus	mg/kg dw	12,600	15,200	14,500	14,200	12,800	14,200	12,800	11,800	8	0%	13,512	1,168	11,800	13,500	15,200
Potassium	mg/kg dw	21,300	26,700	26,100	23,900	21,000	24,700	20,900	19,600	8	0%	23,025	2,669	19,600	22,600	26,700
Rubidium	mg/kg dw	10.2	18.5	12.1	8.97	8.86	11.2	10.6	9.43	8	0%	11.2	3.14	10.2	10.4	9.43
Selenium	mg/kg dw	3.65	7.41	4.52	3.72	3.50	5.10	3.89	4.33	8	0%	4.51	1.29	3.50	4.11	7.41
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,840	1,550	3,360	1,380	866	1,110	2,060	2,440	8	0%	1,826	801	1,110	1,695	866
Strontium	mg/kg dw	1.04	1.71	0.400	0.760	1.43	0.560	0.820	2.36	8	0%	1.14	0.659	0.400	0.930	2.36
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0103	0.00360	0.00780	0.00590	0.00630	0.00560	0.00680	0.00360	8	0%	0.00624	0.00219	0.00360	0.00610	0.0103
Tin	mg/kg dw	0.750	0.950	0.670	1.66	0.650	1.07	0.930	0.590	8	0%	0.909	0.347	0.590	0.840	1.66
Titanium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	0.550	<0.50	<0.50	8	88%	0.506	-	<0.50	0.500	0.550
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	14.4	21.3	24.6	23.9	20.5	22.3	24.3	19.4	8	0%	21.3	3.37	14.4	21.8	24.6
Zirconium	mg/kg dw	<0.20	<0.20	0.240	0.430	0.200	<0.20	0.380	<0.20	8	50%	0.256	0.110	<0.20	0.200	0.430

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).

Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.1: Rainbow Trout Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Ovary														
		POL-RB-1	POL-RB-2	POL-RB-3	POL-RB-4	POL-RB-5	POL-RB-6	POL-RB-7	POL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	72.1	71.1	88.6	65.9	73.0	68.6	66.5	64.2	8	0%	71.2	7.68	64.2	69.8	88.6
Aluminum	mg/kg dw	<2.0	<5.0	18.1	<5.0	12.8	<2.0	<2.0	<2.0	8	75%	5.36	3.75	<2.0	5.00	18.1
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0350	<0.030	0.0780	0.0340	0.0920	0.0600	0.0420	0.0280	8	13%	0.0496	0.0246	<0.030	0.0385	0.0920
Barium	mg/kg dw	0.524	0.704	1.23	0.631	0.338	0.525	0.265	0.261	8	0%	0.560	0.317	0.261	0.524	1.23
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.00550	<0.010	0.0106	<0.010	0.0240	0.00760	<0.0050	<0.0050	8	50%	0.00866	0.00832	<0.0050	0.00550	0.0240
Calcium	mg/kg dw	1,120	886	1,070	1,210	756	1,270	1,150	1,140	8	0%	1,075	171	1,070	1,130	886
Cesium	mg/kg dw	0.0258	0.0470	0.0317	0.0143	0.0429	0.0191	0.0228	0.0170	8	0%	0.0276	0.0120	0.0143	0.0243	0.0470
Chromium	mg/kg dw	<0.050	<0.20	0.629	<0.20	<0.20	<0.050	0.0550	<0.050	8	75%	0.123	0.406	<0.050	0.200	0.629
Cobalt	mg/kg dw	0.118	0.124	0.175	0.0730	0.168	0.115	0.110	0.0660	8	0%	0.119	0.0389	0.0660	0.116	0.175
Copper	mg/kg dw	7.25	8.44	8.47	6.62	17.5	8.25	8.28	8.29	8	0%	9.14	3.44	17.5	8.28	8.47
Iron	mg/kg dw	111	101	305	76.2	303	86.1	64.1	56.6	8	0%	138	104	101	93.5	86.1
Lead	mg/kg dw	0.0300	<0.050	0.0320	<0.050	<0.050	<0.020	<0.020	<0.020	8	75%	0.0244	0.00141	<0.020	0.0320	0.0320
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,480	1,680	1,030	1,400	735	1,720	1,520	1,710	8	0%	1,409	354	1,030	1,500	735
Manganese	mg/kg dw	3.23	6.57	4.63	4.23	22.8	4.54	3.09	3.57	8	0%	6.58	6.64	22.8	4.38	6.57
Mercury	mg/kg dw	0.0358	0.0499	0.247	0.0224	0.0685	0.0654	0.0130	0.0113	8	0%	0.0642	0.0771	0.0113	0.0428	0.247
	mg/kg ww	0.0100	0.0144	0.0282	0.00760	0.0185	0.0205	0.00440	0.00400	8	0%	0.0134	0.00854	0.00400	0.0122	0.0282
Molybdenum	mg/kg dw	0.0570	0.0990	0.105	0.0560	0.0840	0.0600	0.0500	0.0400	8	0%	0.0689	0.0240	0.0400	0.0585	0.105
Nickel	mg/kg dw	<0.20	<0.20	0.300	<0.20	<0.20	<0.20	<0.20	<0.20	8	88%	0.212	-	<0.20	0.200	0.300
Phosphorus	mg/kg dw	12,000	11,800	10,600	11,300	11,400	12,500	12,200	12,100	8	0%	11,738	609	10,600	11,900	12,500
Potassium	mg/kg dw	8,670	8,080	10,400	7,560	13,700	8,170	7,660	7,780	8	0%	9,002	2,106	10,400	8,125	8,670
Rubidium	mg/kg dw	4.95	7.14	5.45	3.28	8.15	4.54	4.60	4.31	8	0%	5.30	1.59	3.28	4.78	8.15
Selenium	mg/kg dw	7.30	10.6	6.95	6.49	11.1	8.05	7.64	8.03	8	0%	8.27	1.68	10.6	7.84	8.05
Silver	mg/kg dw	<0.0050	<0.0050	0.00510	<0.0050	<0.0050	0.00640	<0.0050	<0.0050	8	75%	0.00519	0.000919	<0.0050	0.00500	0.00640
Sodium	mg/kg dw	5,030	3,300	23,700	2,350	3,120	3,270	3,150	2,630	8	0%	5,819	7,268	2,350	3,210	5,030
Strontium	mg/kg dw	3.27	2.45	2.36	3.50	1.28	3.27	3.10	3.59	8	0%	2.85	0.779	1.28	3.18	3.59
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00270	<0.0020	0.00400	<0.0020	0.0111	<0.0020	<0.0020	<0.0020	8	63%	0.00348	0.00452	<0.0020	0.00200	0.0111
Tin	mg/kg dw	0.320	0.480	1.33	0.370	0.100	0.280	0.120	<0.10	8	13%	0.388	0.419	<0.10	0.300	1.33
Titanium	mg/kg dw	<0.25	<0.50	1.48	<0.50	1.01	<0.25	<0.25	<0.25	8	75%	0.499	0.332	<0.25	0.500	1.48
Uranium	mg/kg dw	<0.0020	0.00440	0.00480	<0.0020	0.00250	0.00260	<0.0020	<0.0020	8	50%	0.00279	0.00120	<0.0020	0.00225	0.00480
Vanadium	mg/kg dw	<0.10	0.230	0.320	<0.10	0.160	<0.10	<0.10	<0.10	8	63%	0.151	0.0802	<0.10	0.100	0.320
Zinc	mg/kg dw	103	82.5	184	85.9	250	77.1	66.2	67.8	8	0%	115	66.6	103	84.2	85.9
Zirconium	mg/kg dw	<0.20	<0.20	0.550	<0.20	<0.20	<0.20	<0.20	<0.20	8	88%	0.244	-	<0.20	0.200	0.550

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).

Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.1: Rainbow Trout Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Liver														
		POL-RB-1	POL-RB-2	POL-RB-3	POL-RB-4	POL-RB-5	POL-RB-6	POL-RB-7	POL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	80.7	78.7	77.6	75.6	74.3	76.7	81.0	80.8	8	0%	78.2	2.55	74.3	78.2	81.0
Aluminum	mg/kg dw	<5.0	8.80	<5.0	<5.0	6.70	25.4	<5.0	<5.0	8	63%	8.24	10.2	<5.0	5.00	8.80
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0610	0.0530	0.0740	0.0750	0.0980	0.139	0.0740	0.0600	8	0%	0.0792	0.0277	0.0530	0.0740	0.139
Barium	mg/kg dw	0.663	0.762	0.785	0.786	1.37	1.57	1.30	1.08	8	0%	1.04	0.340	0.663	0.933	1.57
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	1.20	1.40	<1.0	<1.0	8	75%	1.08	0.141	<1.0	1.00	1.40
Cadmium	mg/kg dw	0.181	0.212	0.131	0.109	0.200	0.248	0.204	0.193	8	0%	0.185	0.0448	0.109	0.196	0.248
Calcium	mg/kg dw	410	335	290	337	528	469	424	394	8	0%	398	77.6	290	402	528
Cesium	mg/kg dw	0.0561	0.0828	0.0549	0.0432	0.0292	0.0574	0.0618	0.0396	8	0%	0.0531	0.0162	0.0292	0.0555	0.0828
Chromium	mg/kg dw	0.280	0.270	<0.20	0.320	0.370	0.240	0.240	<0.20	8	25%	0.265	0.0505	<0.20	0.255	0.370
Cobalt	mg/kg dw	0.137	0.181	0.104	0.120	0.126	0.145	0.218	0.183	8	0%	0.152	0.0386	0.104	0.141	0.218
Copper	mg/kg dw	31.7	198	132	18.2	115	153	59.8	28.2	8	0%	92	66.8	115	87.4	59.8
Iron	mg/kg dw	2,200	2,200	2,030	1,880	1,470	1,990	2,300	2,040	8	0%	2,014	258	1,470	2,035	2,300
Lead	mg/kg dw	0.0530	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	88%	0.0504	-	<0.050	0.0500	0.0530
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	660	1,050	868	859	892	856	690	705	8	0%	822	130	1,050	858	892
Manganese	mg/kg dw	5.89	8.10	11.3	12.3	7.86	12.2	12.8	6.96	8	0%	9.68	2.76	11.3	9.70	8.10
Mercury	mg/kg dw	0.498	0.653	0.909	0.536	0.198	1.07	0.435	0.435	8	0%	0.592	0.280	0.198	0.517	1.07
	mg/kg ww	0.0963	0.139	0.203	0.130	0.0509	0.249	0.0826	0.0836	8	0%	0.129	0.0669	0.0509	0.113	0.249
Molybdenum	mg/kg dw	0.941	1.14	1.42	0.934	1.17	1.30	1.08	1.15	8	0%	1.14	0.165	0.934	1.14	1.42
Nickel	mg/kg dw	<0.20	<0.20	<0.20	0.390	0.210	<0.20	<0.20	<0.20	8	75%	0.225	0.127	<0.20	0.200	0.390
Phosphorus	mg/kg dw	14,300	17,300	15,000	14,600	16,500	14,900	13,800	14,300	8	0%	15,088	1,199	13,800	14,750	17,300
Potassium	mg/kg dw	12,400	14,100	13,300	11,600	13,300	12,000	13,300	12,500	8	0%	12,812	825	11,600	12,900	14,100
Rubidium	mg/kg dw	7.69	14.7	11.2	7.21	10.7	8.54	9.18	6.95	8	0%	9.52	2.60	10.7	8.86	9.18
Selenium	mg/kg dw	14.8	34.8	31.6	15.6	45.9	38.9	23.6	18.3	8	0%	27.9	11.6	14.8	27.6	45.9
Silver	mg/kg dw	0.0725	0.184	0.623	0.0492	0.360	0.599	0.263	0.168	8	0%	0.290	0.221	0.0492	0.224	0.623
Sodium	mg/kg dw	9,130	4,070	6,510	3,780	3,440	4,940	9,300	9,420	8	0%	6,324	2,622	3,440	5,725	9,420
Strontium	mg/kg dw	0.780	0.530	0.480	0.500	0.990	0.740	0.710	0.650	8	0%	0.672	0.172	0.480	0.680	0.990
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.142	0.0494	0.0851	0.0751	0.0391	0.0337	0.105	0.0916	8	0%	0.0776	0.0366	0.0337	0.0801	0.142
Tin	mg/kg dw	1.18	1.08	1.60	1.89	1.58	1.29	1.46	1.69	8	0%	1.47	0.273	1.08	1.52	1.89
Titanium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	1.67	<0.50	<0.50	8	88%	0.646	-	<0.50	0.500	1.67
Uranium	mg/kg dw	0.00240	0.0189	0.00840	0.00270	0.00340	0.0127	0.00620	0.0101	8	0%	0.00810	0.00572	0.00240	0.00730	0.0189
Vanadium	mg/kg dw	0.360	1.76	0.970	0.400	0.190	0.980	0.360	0.770	8	0%	0.724	0.515	0.190	0.585	1.76
Zinc	mg/kg dw	189	263	202	178	124	183	205	151	8	0%	187	40.9	124	186	263
Zirconium	mg/kg dw	0.280	0.300	0.240	0.300	0.250	0.250	0.310	0.340	8	0%	0.284	0.0350	0.240	0.290	0.340

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.1: Rainbow Trout Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Kidney														
		POL-RB-1	POL-RB-2	POL-RB-3	POL-RB-4	POL-RB-5	POL-RB-6	POL-RB-7	POL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	79.8	80.2	81.8	81.1	77.9	80.8	83.3	78.3	8	0%	80.4	1.78	77.9	80.5	83.3
Aluminum	mg/kg dw	10.0	41.4	6.20	6.50	5.00	12.3	6.60	7.80	8	0%	12.0	12.1	10.0	7.20	7.80
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.662	0.288	0.460	0.405	0.320	0.762	0.400	0.555	8	0%	0.482	0.166	0.288	0.432	0.762
Barium	mg/kg dw	0.320	2.55	1.35	0.253	1.46	2.22	1.21	0.375	8	0%	1.22	0.870	0.253	1.28	2.55
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	1.50	<1.0	<1.0	<1.0	8	88%	1.06	-	<1.0	1.00	1.50
Cadmium	mg/kg dw	0.847	0.307	0.894	0.819	0.588	0.761	0.496	0.824	8	0%	0.692	0.207	0.307	0.790	0.894
Calcium	mg/kg dw	638	20,500	542	490	587	638	623	926	8	0%	3,118	7,025	20,500	630	926
Cesium	mg/kg dw	0.0438	0.0963	0.0417	0.0384	0.0349	0.0548	0.0568	0.0452	8	0%	0.0515	0.0196	0.0349	0.0445	0.0963
Chromium	mg/kg dw	0.290	1.13	0.270	0.580	0.210	0.260	0.310	0.200	8	0%	0.406	0.316	0.200	0.280	1.13
Cobalt	mg/kg dw	2.35	1.80	1.82	0.999	2.76	1.34	1.97	0.754	8	0%	1.72	0.671	0.754	1.81	2.76
Copper	mg/kg dw	8.16	15.3	8.92	9.23	6.07	9.49	4.75	7.45	8	0%	8.67	3.14	15.3	8.54	9.49
Iron	mg/kg dw	788	742	1,010	786	866	1,030	1,250	962	8	0%	929	169	1,010	914	962
Lead	mg/kg dw	0.0780	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	88%	0.0535	-	<0.050	0.0500	0.0780
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	661	1,160	765	864	817	718	611	688	8	0%	786	172	1,160	742	864
Manganese	mg/kg dw	3.40	17.6	5.59	5.14	3.41	12.8	2.02	4.18	8	0%	6.77	5.47	12.8	4.66	5.59
Mercury	mg/kg dw	0.405	0.517	0.871	0.609	0.229	1.19	0.553	0.545	8	0%	0.615	0.295	0.229	0.549	1.19
	mg/kg ww	0.0818	0.102	0.158	0.115	0.0505	0.230	0.0921	0.118	8	0%	0.118	0.0547	0.0505	0.108	0.230
Molybdenum	mg/kg dw	0.499	0.538	0.432	0.445	0.434	0.586	0.272	0.517	8	0%	0.465	0.0953	0.272	0.472	0.586
Nickel	mg/kg dw	0.450	0.970	0.330	0.450	0.640	0.470	0.390	0.330	8	0%	0.504	0.213	0.330	0.450	0.970
Phosphorus	mg/kg dw	10,900	27,100	14,100	14,300	12,300	13,900	11,700	11,600	8	0%	14,488	5,256	10,900	13,100	27,100
Potassium	mg/kg dw	10,800	15,200	13,600	12,800	12,600	13,200	13,800	11,800	8	0%	12,975	1,329	10,800	13,000	15,200
Rubidium	mg/kg dw	6.24	13.2	7.17	6.13	7.18	8.03	8.72	7.30	8	0%	8.00	2.27	13.2	7.24	8.72
Selenium	mg/kg dw	13.8	15.5	13.3	10.3	10.2	16.1	11.8	14.4	8	0%	13.2	2.23	10.2	13.6	16.1
Silver	mg/kg dw	<0.0050	0.00530	0.0143	0.00590	<0.0050	0.00740	<0.0050	<0.0050	8	50%	0.00661	0.00415	<0.0050	0.00515	0.0143
Sodium	mg/kg dw	8,850	6,530	9,050	6,980	4,530	7,130	13,800	7,970	8	0%	8,105	2,709	13,800	7,550	9,050
Strontium	mg/kg dw	2.26	42.2	1.51	1.21	1.84	1.80	1.72	2.48	8	0%	6.88	14.3	1.21	1.82	42.2
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0780	0.0210	0.0385	0.0464	0.0556	0.0378	0.0348	0.0488	8	0%	0.0451	0.0169	0.0210	0.0424	0.0780
Tin	mg/kg dw	<0.10	<0.10	2.69	<0.10	2.65	1.43	2.63	<0.10	8	50%	1.23	0.614	<0.10	0.765	2.69
Titanium	mg/kg dw	0.680	3.46	<0.50	0.580	<0.50	0.970	<0.50	0.580	8	38%	0.971	1.24	<0.50	0.580	3.46
Uranium	mg/kg dw	0.00420	0.0328	0.0101	0.00360	0.00500	0.0174	0.00570	0.0128	8	0%	0.0114	0.00988	0.00360	0.00790	0.0328
Vanadium	mg/kg dw	0.500	2.47	0.840	0.450	0.330	0.920	0.320	0.970	8	0%	0.850	0.705	0.320	0.670	2.47
Zinc	mg/kg dw	195	361	266	265	174	214	148	209	8	0%	229	67.0	148	212	361
Zirconium	mg/kg dw	<0.20	<0.20	0.300	<0.20	0.200	0.240	0.340	<0.20	8	50%	0.235	0.0622	<0.20	0.200	0.340

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.2: Rainbow Trout Tissue Chemistry Data for Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Muscle														
		BOL-RB-1	BOL-RB-2	BOL-RB-3	BOL-RB-4	BOL-RB-5	BOL-RB-6	BOL-RB-7	BOL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	82.7	77.9	77.3	79.7	76.6	80.6	79.5	80.8	8	0%	79.4	2.03	76.6	79.6	82.7
Aluminum	mg/kg dw	<5.0	<5.0	<5.0	5.70	<5.0	<5.0	<5.0	<2.0	8	88%	2.46	-	<2.0	5.00	5.70
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	<0.030	<0.030	<0.030	0.0320	<0.030	0.0340	0.0310	0.0250	8	50%	0.0278	0.00387	<0.030	0.0250	0.0340
Barium	mg/kg dw	1.00	0.508	0.630	0.826	0.816	0.758	0.622	0.890	8	0%	0.756	0.161	0.508	0.787	1.00
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	1.30	<1.0	<1.0	<1.0	8	88%	1.04	-	<1.0	1.00	1.30
Cadmium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.010
Calcium	mg/kg dw	564	477	988	845	836	1,310	516	1,790	8	0%	916	449	1,310	840	988
Cesium	mg/kg dw	0.0665	0.0413	0.0624	0.0875	0.0594	0.0624	0.0611	0.0721	8	0%	0.0641	0.0130	0.0413	0.0624	0.0875
Chromium	mg/kg dw	0.250	<0.20	<0.20	<0.20	0.300	0.570	<0.20	0.150	8	50%	0.234	0.180	<0.20	0.150	0.570
Cobalt	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	0.0240	<0.020	<0.020	8	88%	0.0205	-	<0.020	0.0200	0.0240
Copper	mg/kg dw	1.97	1.53	2.39	2.53	2.12	2.86	2.14	1.19	8	0%	2.09	0.537	1.19	2.13	2.86
Iron	mg/kg dw	49.2	43.7	21.0	26.1	28.8	38.6	30.4	30.1	8	0%	33.5	9.49	21.0	30.2	49.2
Lead	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,400	958	1,310	1,300	1,420	1,160	1,390	1,390	8	0%	1,291	159	1,160	1,350	958
Manganese	mg/kg dw	0.799	0.525	0.798	1.03	0.850	0.954	0.714	0.789	8	0%	0.807	0.152	0.525	0.798	1.03
Mercury	mg/kg dw	0.584	0.734	0.359	0.389	0.474	0.471	0.343	0.574	8	0%	0.491	0.134	0.343	0.472	0.734
	mg/kg ww	0.101	0.162	0.0814	0.0790	0.111	0.0911	0.0703	0.110	8	0%	0.101	0.0288	0.0703	0.0960	0.162
Molybdenum	mg/kg dw	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.040
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	14,700	11,200	12,100	11,900	13,600	13,000	14,100	15,700	8	0%	13,288	1,528	11,200	13,300	15,700
Potassium	mg/kg dw	23,200	18,500	20,000	18,700	21,600	21,500	23,700	25,500	8	0%	21,588	2,472	18,500	21,550	25,500
Rubidium	mg/kg dw	12.8	8.15	11.8	13.1	9.70	11.0	11.9	13.6	8	0%	11.5	1.84	11.0	11.8	9.70
Selenium	mg/kg dw	2.05	2.11	2.53	2.78	2.24	2.06	2.28	2.41	8	0%	2.31	0.255	2.05	2.26	2.78
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	3,230	2,020	1,430	2,100	2,220	3,130	2,190	1,760	8	0%	2,260	624	1,430	2,145	3,230
Strontium	mg/kg dw	0.660	0.630	1.50	1.09	1.23	2.11	0.670	2.74	8	0%	1.33	0.762	0.630	1.16	2.74
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00750	0.00770	0.0109	0.00650	0.0106	0.0102	0.0129	0.0155	8	0%	0.0102	0.00301	0.00650	0.0104	0.0155
Tin	mg/kg dw	1.24	0.610	0.610	0.730	1.08	1.11	1.34	1.14	8	0%	0.982	0.289	0.610	1.10	1.34
Titanium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.50
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	23.2	23.2	16.7	24.7	17.4	24.8	18.3	19.0	8	0%	20.9	3.39	16.7	21.1	24.8
Zirconium	mg/kg dw	0.630	0.350	0.380	<0.20	<0.20	0.330	0.250	0.430	8	25%	0.346	0.130	<0.20	0.340	0.630

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).

Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.2: Rainbow Trout Tissue Chemistry Data for Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Ovary														
		BOL-RB-1	BOL-RB-2	BOL-RB-3	BOL-RB-4	BOL-RB-5	BOL-RB-6	BOL-RB-7	BOL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	67.7	68.4	64.0	63.4	83.5	74.0	82.6	68.5	8	0%	71.5	7.82	63.4	68.5	83.5
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<5.0	<2.0	<5.0	<2.0	8	100%	<2.0	-	<2.0	<2.0	<5.0
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	<0.020	0.0320	0.0210	<0.020	0.0430	0.0340	0.0350	0.0240	8	25%	0.0286	0.00797	<0.020	0.0280	0.0430
Barium	mg/kg dw	0.548	0.599	0.502	0.738	0.188	0.632	0.378	1.12	8	0%	0.588	0.273	0.188	0.574	1.12
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	0.0180	0.0128	0.0120	<0.0050	8	63%	0.00848	0.00326	<0.0050	0.00500	0.0180
Calcium	mg/kg dw	1,360	1,490	1,460	1,190	581	1,110	637	1,440	8	0%	1,158	364	1,110	1,275	637
Cesium	mg/kg dw	0.0186	0.0150	0.0161	0.0258	0.0319	0.0211	0.0444	0.0174	8	0%	0.0238	0.0100	0.0150	0.0198	0.0444
Chromium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	0.220	0.0780	<0.20	<0.050	8	75%	0.0753	0.100	<0.050	0.0500	0.220
Cobalt	mg/kg dw	0.0840	0.101	0.0550	0.0710	0.113	0.0970	0.143	0.0800	8	0%	0.0930	0.0271	0.0550	0.0905	0.143
Copper	mg/kg dw	7.06	10.1	11.3	7.20	4.68	6.50	6.32	10.3	8	0%	7.93	2.34	10.1	7.13	7.20
Iron	mg/kg dw	55.4	96.3	55.2	57.6	283	142	291	61.9	8	0%	130	101	142	79.1	96.3
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.050	<0.020	<0.050	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,880	1,550	1,690	1,690	638	1,550	668	1,650	8	0%	1,414	481	1,550	1,600	668
Manganese	mg/kg dw	7.70	7.67	4.10	7.82	6.45	5.48	5.44	12.9	8	0%	7.20	2.66	12.9	7.06	7.82
Mercury	mg/kg dw	0.0201	0.0345	0.00800	0.0124	0.154	0.0597	0.108	0.0192	8	0%	0.0520	0.0528	0.00800	0.0273	0.154
	mg/kg ww	0.00650	0.0109	0.00290	0.00460	0.0254	0.0155	0.0189	0.00600	8	0%	0.0113	0.00794	0.00290	0.00870	0.0254
Molybdenum	mg/kg dw	<0.020	0.0390	0.0430	0.0480	0.0800	0.0510	0.0730	0.0450	8	13%	0.0499	0.0159	<0.020	0.0465	0.0800
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	12,500	12,000	12,400	12,100	9,980	12,000	10,300	12,800	8	0%	11,760	1,040	10,300	12,050	9,980
Potassium	mg/kg dw	8,170	8,320	7,330	7,290	11,000	9,470	11,700	8,440	8	0%	8,965	1,634	11,000	8,380	9,470
Rubidium	mg/kg dw	5.05	3.99	4.63	6.24	6.15	5.91	7.82	5.12	8	0%	5.61	1.18	3.99	5.52	7.82
Selenium	mg/kg dw	3.92	5.97	5.92	4.98	3.72	4.15	3.99	6.35	8	0%	4.88	1.07	3.72	4.57	6.35
Silver	mg/kg dw	<0.0050	0.0125	0.0105	0.00620	0.00700	0.0135	<0.0050	0.00590	8	25%	0.00820	0.00334	<0.0050	0.00660	0.0135
Sodium	mg/kg dw	3,280	3,490	2,790	2,200	11,000	5,820	9,200	3,860	8	0%	5,205	3,235	11,000	3,675	9,200
Strontium	mg/kg dw	3.58	3.97	4.75	3.57	1.53	3.66	1.70	4.16	8	0%	3.36	1.15	1.53	3.62	4.75
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	0.00970	0.00320	0.0108	<0.0020	8	63%	0.00421	0.00411	<0.0020	0.00200	0.0108
Tin	mg/kg dw	<0.10	0.130	0.190	<0.10	<0.10	0.360	0.120	<0.10	8	50%	0.150	0.111	<0.10	0.110	0.360
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.50	<0.25	<0.50	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.50
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	0.00220	<0.0020	0.00200	<0.0020	8	75%	0.00202	0.000141	<0.0020	0.00200	0.00220
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	88.3	95.5	70.5	65.6	190	79.1	182	104	8	0%	109	49	104	91.9	95.5
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).

Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.2: Rainbow Trout Tissue Chemistry Data for Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Liver														
		BOL-RB-1	BOL-RB-2	BOL-RB-3	BOL-RB-4	BOL-RB-5	BOL-RB-6	BOL-RB-7	BOL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	82.8	82.5	76.9	78.8	79.6	79.1	74.5	82.5	8	0%	79.6	2.96	74.5	79.3	82.8
Aluminum	mg/kg dw	5.40	2.60	<5.0	6.40	<5.0	<5.0	<5.0	7.10	8	50%	3.99	1.98	<5.0	2.60	7.10
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0300	0.0540	<0.030	0.0390	0.0640	0.0420	0.0490	0.0530	8	13%	0.0451	0.0112	<0.030	0.0455	0.0640
Barium	mg/kg dw	0.526	0.804	1.18	1.51	0.791	0.822	0.0850	0.905	8	0%	0.828	0.421	0.0850	0.813	1.51
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	1.50	<1.0	<1.0	<1.0	<1.0	8	88%	1.06	-	<1.0	1.00	1.50
Cadmium	mg/kg dw	0.158	0.232	0.123	0.317	0.118	0.142	0.135	0.233	8	0%	0.182	0.0710	0.118	0.150	0.317
Calcium	mg/kg dw	418	596	446	368	365	322	279	543	8	0%	417	108	279	393	596
Cesium	mg/kg dw	0.0483	0.0350	0.0299	0.0666	0.0292	0.0295	0.0336	0.0412	8	0%	0.0392	0.0129	0.0292	0.0343	0.0666
Chromium	mg/kg dw	0.257	0.0870	0.320	0.280	<0.20	0.220	<0.20	0.175	8	25%	0.200	0.0832	<0.20	0.198	0.320
Cobalt	mg/kg dw	0.0940	0.130	0.0750	0.161	0.107	0.112	0.112	0.134	8	0%	0.116	0.0262	0.0750	0.112	0.161
Copper	mg/kg dw	175	111	66.9	69.7	86.9	22.1	137	148	8	0%	102	50.2	111	99	86.9
Iron	mg/kg dw	1,710	2,490	900	477	1,250	1,820	1,290	2,270	8	0%	1,526	679	1,250	1,500	900
Lead	mg/kg dw	<0.020	<0.020	<0.050	<0.050	<0.050	<0.050	<0.050	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	966	901	704	721	749	834	706	868	8	0%	806	100	704	792	966
Manganese	mg/kg dw	8.89	6.90	4.80	6.57	8.74	6.15	6.14	7.58	8	0%	6.97	1.38	4.80	6.74	8.89
Mercury	mg/kg dw	0.485	0.686	0.329	0.380	0.308	0.264	0.242	0.520	8	0%	0.402	0.152	0.242	0.354	0.686
	mg/kg ww	0.0834	0.120	0.0761	0.0805	0.0627	0.0552	0.0616	0.0910	8	0%	0.0788	0.0207	0.0552	0.0783	0.120
Molybdenum	mg/kg dw	1.11	1.33	0.657	0.631	0.680	0.866	0.871	1.03	8	0%	0.897	0.247	0.631	0.868	1.33
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	18,300	18,400	14,400	14,500	14,600	16,300	15,900	17,500	8	0%	16,238	1,678	14,400	16,100	18,400
Potassium	mg/kg dw	16,000	15,400	12,700	13,600	13,300	14,400	11,800	14,700	8	0%	13,988	1,404	11,800	14,000	16,000
Rubidium	mg/kg dw	10.2	7.35	8.53	11.5	7.47	9.74	7.75	9.77	8	0%	9.04	1.50	10.2	9.14	9.77
Selenium	mg/kg dw	10.2	13.9	13.0	14.1	13.8	9.16	16.6	18.5	8	0%	13.7	3.05	10.2	13.8	9.16
Silver	mg/kg dw	1.57	1.17	0.793	0.969	0.941	0.283	1.16	1.26	8	0%	1.02	0.379	0.283	1.06	1.57
Sodium	mg/kg dw	10,000	11,100	6,370	6,120	8,230	7,200	5,170	8,220	8	0%	7,801	2,008	10,000	7,710	8,230
Strontium	mg/kg dw	0.704	1.07	0.990	0.930	0.730	0.600	0.560	1.08	8	0%	0.833	0.210	0.560	0.830	1.08
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.124	0.321	0.124	0.169	0.175	0.149	0.127	0.224	8	0%	0.177	0.0675	0.124	0.159	0.321
Tin	mg/kg dw	0.570	0.710	0.900	0.950	0.790	1.18	<0.10	1.04	8	13%	0.780	0.206	<0.10	0.845	1.18
Titanium	mg/kg dw	<0.25	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.50
Uranium	mg/kg dw	0.00630	0.00850	<0.0020	0.00640	0.00360	0.00520	0.00400	0.0117	8	13%	0.00596	0.00281	<0.0020	0.00575	0.0117
Vanadium	mg/kg dw	0.250	0.340	0.110	0.210	0.140	0.200	0.200	0.500	8	0%	0.244	0.125	0.110	0.205	0.500
Zinc	mg/kg dw	224	158	152	133	226	186	188	176	8	0%	180	33.0	133	181	226
Zirconium	mg/kg dw	<0.20	<0.20	0.290	0.310	0.250	0.470	<0.20	<0.20	8	50%	0.265	0.0966	<0.20	0.225	0.470

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.2: Rainbow Trout Tissue Chemistry Data for Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Kidney														
		BOL-RB-1	BOL-RB-2	BOL-RB-3	BOL-RB-4	BOL-RB-5	BOL-RB-6	BOL-RB-7	BOL-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	83.7	81.5	80.6	81.1	80.2	81.4	78.2	82.3	8	0%	81.1	1.60	78.2	81.2	83.7
Aluminum	mg/kg dw	4.00	7.30	<5.0	5.70	<5.0	6.50	<5.0	11.1	8	38%	5.82	2.64	<5.0	4.85	7.30
Antimony	mg/kg dw	0.0120	0.0220	<0.010	<0.010	<0.010	<0.010	<0.010	0.0120	8	63%	0.0120	0.00577	<0.010	0.0100	0.0220
Arsenic	mg/kg dw	0.189	0.457	0.152	0.288	0.237	0.208	0.211	0.283	8	0%	0.253	0.0942	0.152	0.224	0.457
Barium	mg/kg dw	1.22	2.16	0.388	1.21	0.488	0.683	0.911	1.88	8	0%	1.12	0.638	0.388	1.06	2.16
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.268	0.717	0.470	0.710	0.618	0.643	0.587	0.729	8	0%	0.593	0.157	0.268	0.630	0.729
Calcium	mg/kg dw	533	904	723	931	611	490	510	604	8	0%	663	173	490	608	931
Cesium	mg/kg dw	0.0568	0.0344	0.0412	0.0747	0.0359	0.0402	0.0394	0.0420	8	0%	0.0456	0.0136	0.0344	0.0407	0.0747
Chromium	mg/kg dw	0.297	0.300	<0.20	0.480	0.250	0.340	<0.20	0.530	8	25%	0.325	0.112	<0.20	0.298	0.530
Cobalt	mg/kg dw	0.411	0.664	0.448	0.508	0.423	1.69	0.818	0.709	8	0%	0.709	0.423	0.411	0.586	1.69
Copper	mg/kg dw	7.20	7.83	6.16	5.54	8.08	8.02	7.24	7.54	8	0%	7.20	0.910	5.54	7.39	8.08
Iron	mg/kg dw	682	763	613	537	721	689	749	634	8	0%	674	75.7	537	686	763
Lead	mg/kg dw	<0.020	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	894	726	641	771	776	839	689	752	8	0%	761	80.2	641	762	894
Manganese	mg/kg dw	3.60	2.83	2.62	2.91	4.58	3.98	4.77	3.05	8	0%	3.54	0.826	2.62	3.32	4.77
Mercury	mg/kg dw	0.445	0.695	0.304	0.328	0.466	0.422	0.370	0.445	8	0%	0.434	0.121	0.304	0.434	0.695
	mg/kg ww	0.0726	0.129	0.0591	0.0619	0.0923	0.0785	0.0806	0.0787	8	0%	0.0816	0.0219	0.0591	0.0786	0.129
Molybdenum	mg/kg dw	0.522	0.641	0.367	0.454	0.390	0.500	0.400	0.680	8	0%	0.494	0.116	0.367	0.477	0.680
Nickel	mg/kg dw	0.250	0.380	0.290	0.450	0.220	0.410	0.220	0.510	8	0%	0.341	0.111	0.220	0.335	0.510
Phosphorus	mg/kg dw	16,700	11,500	13,300	13,600	13,600	14,700	12,700	12,900	8	0%	13,625	1,541	11,500	13,450	16,700
Potassium	mg/kg dw	15,900	11,500	12,000	14,000	14,200	14,600	12,600	13,100	8	0%	13,488	1,460	11,500	13,550	15,900
Rubidium	mg/kg dw	10.0	6.04	9.04	12.2	7.91	9.45	8.05	8.99	8	0%	8.96	1.78	10.0	9.02	9.45
Selenium	mg/kg dw	9.95	12.9	7.60	10.1	7.82	8.88	8.29	10.8	8	0%	9.54	1.78	10.1	9.41	9.95
Silver	mg/kg dw	0.00920	0.0146	0.00560	<0.0050	0.0279	0.0184	0.00660	0.00660	8	13%	0.0117	0.00821	<0.0050	0.00790	0.0279
Sodium	mg/kg dw	12,300	12,700	9,520	8,880	9,500	9,790	6,940	10,200	8	0%	9,979	1,842	10,200	9,655	9,790
Strontium	mg/kg dw	1.56	3.76	2.03	3.10	2.11	1.74	1.69	2.26	8	0%	2.28	0.767	1.56	2.07	3.76
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0226	0.0556	0.0434	0.0356	0.0636	0.0710	0.0628	0.0578	8	0%	0.0516	0.0163	0.0226	0.0567	0.0710
Tin	mg/kg dw	1.06	1.50	<0.10	<0.10	<0.10	<0.10	<0.10	0.870	8	63%	0.491	0.323	<0.10	0.100	1.50
Titanium	mg/kg dw	0.250	<0.50	<0.50	0.500	<0.50	0.640	<0.50	0.570	8	50%	0.370	0.170	<0.50	0.250	0.640
Uranium	mg/kg dw	0.00780	0.0116	0.00480	0.0135	0.00640	0.00830	0.00740	0.0156	8	0%	0.00942	0.00374	0.00480	0.00805	0.0156
Vanadium	mg/kg dw	0.310	0.410	0.210	0.320	0.160	0.260	0.280	0.630	8	0%	0.322	0.145	0.160	0.295	0.630
Zinc	mg/kg dw	109	103	146	108	272	321	164	136	8	0%	170	82	103	141	321
Zirconium	mg/kg dw	0.210	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	88%	0.201	-	<0.20	0.200	0.210

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.3: Longnose Sucker Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Muscle														
		POL-LSU-1	POL-LSU-2	POL-LSU-3	POL-LSU-4	POL-LSU-5	POL-LSU-6	POL-LSU-7	POL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	78.7	74.1	79.2	77.9	78.5	77.0	77.7	76.0	8	0%	77.4	1.67	74.1	77.8	79.2
Aluminum	mg/kg dw	<2.0	2.40	<2.0	<2.0	3.50	4.00	<2.0	7.20	8	50%	3.14	2.06	<2.0	2.20	7.20
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.156	0.145	0.0920	0.110	0.144	0.184	0.105	0.101	8	0%	0.130	0.0323	0.0920	0.127	0.184
Barium	mg/kg dw	0.804	0.976	0.922	0.804	1.01	0.725	0.836	0.654	8	0%	0.841	0.122	0.654	0.820	1.01
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Calcium	mg/kg dw	601	238	433	913	844	698	1,060	528	8	0%	664	270	1,060	650	913
Cesium	mg/kg dw	0.161	0.0446	0.162	0.148	0.0937	0.136	0.100	0.0821	8	0%	0.116	0.0424	0.0446	0.118	0.162
Chromium	mg/kg dw	0.0580	0.0950	0.0750	<0.050	0.116	0.210	0.0680	0.234	8	13%	0.113	0.0710	<0.050	0.0850	0.234
Cobalt	mg/kg dw	<0.020	0.0460	0.0220	<0.020	<0.020	<0.020	<0.020	<0.020	8	75%	0.0235	0.0170	<0.020	0.0200	0.0460
Copper	mg/kg dw	1.42	7.48	5.91	2.48	2.27	3.17	3.39	3.01	8	0%	3.64	2.03	1.42	3.09	7.48
Iron	mg/kg dw	17.4	90.4	64.7	31.5	22.2	30.5	33.9	37.7	8	0%	41.0	24.4	17.4	32.7	90.4
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,800	775	1,240	1,500	1,550	1,430	1,370	1,350	8	0%	1,377	295	1,240	1,400	775
Manganese	mg/kg dw	0.726	1.11	0.832	1.38	1.49	1.37	1.50	0.985	8	0%	1.17	0.303	0.726	1.24	1.50
Mercury	mg/kg dw	0.286	0.291	0.315	0.327	0.283	0.237	0.258	0.231	8	0%	0.278	0.0345	0.231	0.284	0.327
	mg/kg ww	0.0610	0.0755	0.0656	0.0723	0.0610	0.0546	0.0576	0.0556	8	0%	0.0629	0.00767	0.0546	0.0610	0.0755
Molybdenum	mg/kg dw	<0.020	0.0730	0.0450	0.0460	0.0220	0.0200	0.0270	0.0230	8	13%	0.0345	0.0194	<0.020	0.0250	0.0730
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	13,400	9,630	12,200	12,700	12,800	11,600	12,700	11,200	8	0%	12,029	1,197	11,200	12,450	9,630
Potassium	mg/kg dw	23,800	11,800	19,700	22,600	21,600	20,200	22,700	19,200	8	0%	20,200	3,756	11,800	20,900	23,800
Rubidium	mg/kg dw	15.8	10.0	14.0	16.9	11.9	13.0	16.1	13.8	8	0%	13.9	2.31	10.0	13.9	16.9
Selenium	mg/kg dw	6.79	5.80	9.59	8.68	8.02	8.33	6.78	8.74	8	0%	7.84	1.27	5.80	8.18	9.59
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,420	2,050	1,920	1,660	1,790	1,420	1,870	1,740	8	0%	1,734	226	1,420	1,765	2,050
Strontium	mg/kg dw	0.484	0.278	0.413	1.15	0.950	0.744	1.53	0.555	8	0%	0.763	0.423	0.278	0.650	1.53
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	0.230	0.470	0.320	0.210	0.510	0.700	0.250	0.730	8	0%	0.428	0.208	0.210	0.395	0.730
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	0.270	<0.25	<0.25	8	88%	0.252	-	<0.25	0.250	0.270
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	38.5	123	71.2	40.3	52.3	51.8	47.3	34.4	8	0%	57.4	28.9	123	49.5	71.2
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	0.280	<0.20	0.260	8	75%	0.218	0.0141	<0.20	0.200	0.280

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).

Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.3: Longnose Sucker Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Ovary														
		POL-LSU-1	POL-LSU-2	POL-LSU-3	POL-LSU-4	POL-LSU-5	POL-LSU-6	POL-LSU-7	POL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	64.3	68.3	62.5	63.8	63.7	63.0	63.0	63.7	8	0%	64.0	1.81	62.5	63.7	68.3
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	8	100%	<2.0	-	<2.0	<2.0	<2.0
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0780	0.0630	0.0420	0.0470	0.0470	0.0710	0.0540	0.0430	8	0%	0.0556	0.0136	0.0420	0.0505	0.0780
Barium	mg/kg dw	0.152	0.0950	0.146	0.177	0.160	0.165	0.327	0.134	8	0%	0.170	0.0683	0.0950	0.156	0.327
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	0.00580	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	88%	0.00510	-	<0.0050	0.00500	0.00580
Calcium	mg/kg dw	537	546	421	525	414	442	464	445	8	0%	474	53.6	414	454	546
Cesium	mg/kg dw	0.0162	0.0126	0.0145	0.0168	0.0115	0.0206	0.0103	0.0113	8	0%	0.0142	0.00349	0.0103	0.0136	0.0206
Chromium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	100%	<0.050	-	<0.050	<0.050	<0.050
Cobalt	mg/kg dw	0.0470	0.0570	0.0460	0.0450	0.0810	0.128	0.0490	0.0570	8	0%	0.0638	0.0285	0.0450	0.0530	0.128
Copper	mg/kg dw	3.07	3.22	3.54	3.45	4.12	4.02	3.50	4.00	8	0%	3.62	0.390	3.07	3.52	4.12
Iron	mg/kg dw	44.4	38.5	31.2	39.4	36.2	40.1	47.2	53.3	8	0%	41.3	6.86	31.2	39.8	53.3
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	660	770	672	668	755	693	679	756	8	0%	707	45.7	660	686	770
Manganese	mg/kg dw	12.2	10.0	12.2	16.6	24.2	18.4	14.1	23.4	8	0%	16.4	5.28	10.0	15.4	24.2
Mercury	mg/kg dw	0.00520	0.0119	0.00790	0.00700	0.0118	0.00520	0.00700	0.00520	8	0%	0.00765	0.00278	0.00520	0.00700	0.0119
	mg/kg ww	0.00180	0.00380	0.00300	0.00250	0.00430	0.00190	0.00260	0.00190	8	0%	0.00272	0.000925	0.00180	0.00255	0.00430
Molybdenum	mg/kg dw	0.0670	0.104	0.0800	0.116	0.0660	0.0720	0.0670	0.0900	8	0%	0.0828	0.0189	0.0660	0.0760	0.116
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	11,600	12,000	12,400	12,300	11,700	12,300	12,200	12,400	8	0%	12,112	314	11,600	12,250	12,400
Potassium	mg/kg dw	6,400	7,190	6,360	6,590	5,980	6,400	5,990	6,400	8	0%	6,414	379	5,980	6,400	7,190
Rubidium	mg/kg dw	5.53	6.37	6.06	6.34	4.61	5.33	5.66	6.08	8	0%	5.75	0.594	4.61	5.86	6.37
Selenium	mg/kg dw	8.25	8.14	8.83	8.96	8.90	9.11	7.86	9.43	8	0%	8.68	0.541	7.86	8.86	9.43
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	2,060	2,580	1,580	1,780	1,550	1,790	1,700	1,590	8	0%	1,829	345	1,550	1,740	2,580
Strontium	mg/kg dw	0.603	0.402	0.351	0.551	0.477	0.505	0.616	0.559	8	0%	0.508	0.0941	0.351	0.528	0.616
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	<0.10	<0.10	<0.10	0.100	<0.10	<0.10	0.130	0.130	8	63%	0.108	0.0173	<0.10	0.100	0.130
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	0.140	0.140	<0.10	<0.10	<0.10	<0.10	<0.10	8	75%	0.110	0	<0.10	0.100	0.140
Zinc	mg/kg dw	96.4	91.9	90.1	86.8	83.3	82.2	80.4	91.0	8	0%	87.8	5.52	80.4	88.5	96.4
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).

Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.3: Longnose Sucker Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Liver														
		POL-LSU-1	POL-LSU-2	POL-LSU-3	POL-LSU-4	POL-LSU-5	POL-LSU-6	POL-LSU-7	POL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	76.7	76.8	77.4	77.3	78.4	77.1	77.0	78.8	8	0%	77.4	0.761	76.7	77.2	78.8
Aluminum	mg/kg dw	3.00	2.30	<2.0	7.70	14.9	<2.0	<5.0	<2.0	8	50%	4.52	5.80	<2.0	2.30	7.70
Antimony	mg/kg dw	0.0320	0.0450	0.0350	0.0300	0.0160	0.0120	0.0170	0.0150	8	0%	0.0253	0.0119	0.0120	0.0235	0.0450
Arsenic	mg/kg dw	0.353	0.426	0.244	0.323	0.188	0.208	0.234	0.209	8	0%	0.273	0.0847	0.188	0.239	0.426
Barium	mg/kg dw	0.311	0.152	0.427	0.624	1.25	0.654	0.659	0.455	8	0%	0.566	0.329	0.152	0.540	1.25
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	0.0150	<0.010	<0.010	8	88%	0.0106	-	<0.010	0.0100	0.0150
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.394	0.715	0.630	0.233	0.114	0.212	0.253	0.311	8	0%	0.358	0.211	0.114	0.282	0.715
Calcium	mg/kg dw	190	165	209	329	319	162	218	251	8	0%	230	64.6	162	214	329
Cesium	mg/kg dw	0.0327	0.0234	0.0309	0.0356	0.0223	0.0216	0.0226	0.0251	8	0%	0.0268	0.00546	0.0216	0.0242	0.0356
Chromium	mg/kg dw	0.115	0.0920	0.0730	0.129	0.620	0.255	<0.20	0.0720	8	13%	0.182	0.198	<0.20	0.115	0.620
Cobalt	mg/kg dw	0.124	0.133	0.109	0.127	0.108	0.121	0.112	0.131	8	0%	0.121	0.00987	0.108	0.122	0.133
Copper	mg/kg dw	71.8	79.5	56.0	43.6	56.0	110	56.9	58.3	8	0%	66.5	20.7	110	57.6	79.5
Iron	mg/kg dw	232	430	230	221	160	503	389	308	8	0%	309	120	160	270	503
Lead	mg/kg dw	<0.020	<0.020	<0.020	0.0280	<0.050	<0.020	<0.050	<0.020	8	88%	0.0213	-	<0.020	0.0200	0.0280
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,230	1,010	1,270	1,170	920	873	1,040	1,050	8	0%	1,070	142	1,010	1,045	920
Manganese	mg/kg dw	15.0	9.90	11.1	15.1	12.0	11.5	10.8	13.5	8	0%	12.4	1.95	10.8	11.8	9.90
Mercury	mg/kg dw	0.0708	0.172	0.0971	0.0848	0.0728	0.0633	0.0762	0.0571	8	0%	0.0868	0.0366	0.0571	0.0745	0.172
	mg/kg ww	0.0165	0.0400	0.0220	0.0192	0.0157	0.0145	0.0175	0.0121	8	0%	0.0197	0.00873	0.0121	0.0170	0.0400
Molybdenum	mg/kg dw	2.35	2.44	1.90	1.94	1.39	1.36	2.15	1.76	8	0%	1.91	0.402	1.36	1.92	2.44
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	21,000	18,300	20,200	19,000	17,200	14,300	18,500	18,100	8	0%	18,325	2,024	14,300	18,400	21,000
Potassium	mg/kg dw	17,800	13,900	16,400	14,000	13,400	12,900	14,200	14,800	8	0%	14,675	1,639	12,900	14,100	17,800
Rubidium	mg/kg dw	14.2	11.4	15.0	12.6	9.41	9.72	12.7	12.3	8	0%	12.2	1.96	11.4	12.4	9.72
Selenium	mg/kg dw	13.1	17.0	14.2	12.8	11.0	11.0	12.2	12.0	8	0%	12.9	1.97	11.0	12.5	17.0
Silver	mg/kg dw	0.0223	0.0851	0.0224	0.0172	0.0209	0.0359	0.0226	0.0262	8	0%	0.0316	0.0223	0.0172	0.0225	0.0851
Sodium	mg/kg dw	4,100	3,520	4,520	5,040	5,320	4,600	4,110	5,560	8	0%	4,596	686	3,520	4,560	5,560
Strontium	mg/kg dw	0.288	0.223	0.291	0.698	1.03	0.310	0.420	0.456	8	0%	0.464	0.273	0.223	0.365	1.03
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	0.770	0.520	0.590	0.490	0.590	0.570	1.10	0.530	8	0%	0.645	0.203	0.490	0.580	1.10
Titanium	mg/kg dw	<0.25	<0.25	<0.25	0.480	0.890	<0.25	<0.50	<0.25	8	75%	0.364	0.290	<0.25	0.250	0.890
Uranium	mg/kg dw	<0.0020	0.00290	<0.0020	0.00240	<0.0020	<0.0020	<0.0020	<0.0020	8	75%	0.00216	0.000354	<0.0020	0.00200	0.00290
Vanadium	mg/kg dw	0.280	1.10	0.880	0.360	0.300	0.250	0.320	0.420	8	0%	0.489	0.319	0.250	0.340	1.10
Zinc	mg/kg dw	165	127	123	146	116	125	127	118	8	0%	131	16.5	116	126	165
Zirconium	mg/kg dw	<0.20	<0.20	0.260	<0.20	<0.20	0.210	0.290	0.280	8	50%	0.230	0.0356	<0.20	0.205	0.290

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.3: Longnose Sucker Tissue Chemistry Data for Polley Lake (POL; Exposed), May 2022 [a]

Analyte	Units	Kidney														
		POL-LSU-1	POL-LSU-2	POL-LSU-3	POL-LSU-4	POL-LSU-5	POL-LSU-6	POL-LSU-7	POL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	79.9	78.9	78.2	78.6	81.5	78.8	79.3	80.3	8	0%	79.4	1.08	78.2	79.1	81.5
Aluminum	mg/kg dw	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8	100%	<5.0	-	<5.0	<5.0	<5.0
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.210	0.146	0.156	0.144	0.156	0.318	0.126	0.137	8	0%	0.174	0.0633	0.126	0.151	0.318
Barium	mg/kg dw	2.48	0.968	1.38	2.04	0.634	0.270	1.02	0.753	8	0%	1.19	0.741	0.270	0.994	2.48
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	1.89	2.80	4.61	1.02	1.37	0.133	2.00	2.52	8	0%	2.04	1.34	0.133	1.94	4.61
Calcium	mg/kg dw	386	417	534	361	481	411	352	530	8	0%	434	72.3	352	414	534
Cesium	mg/kg dw	0.0409	0.0250	0.0423	0.0337	0.0441	0.0202	0.0358	0.0309	8	0%	0.0341	0.00848	0.0202	0.0348	0.0441
Chromium	mg/kg dw	0.230	<0.20	<0.20	0.840	1.15	2.16	<0.20	<0.20	8	50%	0.648	0.806	<0.20	0.215	2.16
Cobalt	mg/kg dw	0.530	0.374	0.520	0.272	0.650	0.165	0.308	0.416	8	0%	0.404	0.158	0.165	0.395	0.650
Copper	mg/kg dw	6.59	5.93	7.70	5.53	7.27	3.72	6.57	6.36	8	0%	6.21	1.22	3.72	6.46	7.70
Iron	mg/kg dw	600	453	317	571	415	1,560	472	574	8	0%	620	391	1,560	522	600
Lead	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	100%	<0.050	-	<0.050	<0.050	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	639	571	642	527	750	377	638	669	8	0%	602	112	377	638	750
Manganese	mg/kg dw	3.94	3.44	4.30	3.93	9.00	1.66	4.47	7.18	8	0%	4.74	2.29	1.66	4.12	9.00
Mercury	mg/kg dw	0.0701	0.265	0.197	0.104	0.0930	0.0210	0.109	0.0721	8	0%	0.116	0.0780	0.0210	0.0985	0.265
	mg/kg ww	0.0141	0.0561	0.0430	0.0222	0.0172	0.00440	0.0224	0.0142	8	0%	0.0242	0.0170	0.00440	0.0197	0.0561
Molybdenum	mg/kg dw	1.36	1.46	1.86	1.29	1.36	0.242	1.52	1.10	8	0%	1.27	0.470	0.242	1.36	1.86
Nickel	mg/kg dw	0.500	0.370	0.580	0.460	0.840	1.12	0.330	0.490	8	0%	0.586	0.266	0.330	0.495	1.12
Phosphorus	mg/kg dw	12,900	12,300	14,000	11,300	16,900	7,880	13,600	14,700	8	0%	12,948	2,647	11,300	13,250	7,880
Potassium	mg/kg dw	12,300	10,500	11,600	10,100	14,700	12,100	12,300	14,000	8	0%	12,200	1,567	10,100	12,200	14,700
Rubidium	mg/kg dw	11.1	9.68	12.0	10.5	12.0	8.34	13.9	14.5	8	0%	11.5	2.06	10.5	11.6	9.68
Selenium	mg/kg dw	10.4	10.7	12.9	9.28	11.8	9.33	9.57	12.0	8	0%	10.7	1.36	10.4	10.6	9.57
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	6,900	6,010	6,560	6,960	8,360	8,510	5,790	7,040	8	0%	7,016	984	5,790	6,930	8,510
Strontium	mg/kg dw	0.710	0.630	0.770	0.600	0.960	0.770	0.710	0.980	8	0%	0.766	0.139	0.600	0.740	0.980
Tellurium	mg/kg dw	0.0210	0.0690	0.0570	0.0290	0.0220	<0.020	0.0230	<0.020	8	25%	0.0326	0.0208	<0.020	0.0225	0.0690
Thallium	mg/kg dw	0.00780	0.00280	0.00250	0.00590	0.00340	<0.0020	0.00430	0.00480	8	13%	0.00419	0.00187	<0.0020	0.00385	0.00780
Tin	mg/kg dw	1.31	0.700	0.770	1.30	<0.10	0.160	<0.10	<0.10	8	38%	0.568	0.479	<0.10	0.430	1.31
Titanium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	0.710	<0.50	<0.50	8	88%	0.526	-	<0.50	0.500	0.710
Uranium	mg/kg dw	0.00330	0.00550	0.00590	0.00310	0.00250	<0.0020	0.00520	0.00310	8	13%	0.00382	0.00139	<0.0020	0.00320	0.00590
Vanadium	mg/kg dw	1.23	3.53	4.24	1.48	1.15	0.120	1.88	1.68	8	0%	1.91	1.34	0.120	1.58	4.24
Zinc	mg/kg dw	258	148	220	167	170	56.2	156	158	8	0%	167	58.5	148	162	56.2
Zirconium	mg/kg dw	0.260	<0.20	0.260	0.320	<0.20	<0.20	<0.20	<0.20	8	63%	0.230	0.0346	<0.20	0.200	0.320

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.4: Chemistry Data and Guideline Screening for Tissues from Longnose Sucker Collected from Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Muscle														
		BOL-LSU-1	BOL-LSU-2	BOL-LSU-3	BOL-LSU-4	BOL-LSU-5	BOL-LSU-6	BOL-LSU-7	BOL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	75.5	77.4	74.2	75.4	79.3	73.1	71.3	77.1	8	0%	75.4	2.55	71.3	75.5	79.3
Aluminum	mg/kg dw	<2.0	3.20	<5.0	<2.0	4.00	6.30	7.30	<2.0	8	50%	3.68	1.92	<2.0	3.20	7.30
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.175	0.0370	0.433	0.0480	0.0360	0.0790	0.139	0.0980	8	0%	0.131	0.132	0.0360	0.0885	0.433
Barium	mg/kg dw	0.682	1.34	0.558	0.887	0.948	1.22	1.16	0.862	8	0%	0.957	0.269	0.558	0.918	1.34
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.010
Calcium	mg/kg dw	586	503	500	536	721	1,200	913	932	8	0%	736	256	1,200	654	932
Cesium	mg/kg dw	0.123	0.115	0.226	0.108	0.137	0.0863	0.0910	0.235	8	0%	0.140	0.0581	0.0863	0.119	0.235
Chromium	mg/kg dw	0.0900	0.206	<0.20	0.103	0.0940	0.165	<0.20	0.111	8	25%	0.124	0.0468	<0.20	0.103	0.206
Cobalt	mg/kg dw	<0.020	0.0220	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	88%	0.0202	-	<0.020	0.0200	0.0220
Copper	mg/kg dw	2.04	2.57	1.13	1.58	1.87	2.17	4.00	1.56	8	0%	2.12	0.878	1.13	1.96	4.00
Iron	mg/kg dw	26.5	46.0	15.1	19.7	40.0	38.7	30.2	19.4	8	0%	29.4	11.2	15.1	28.4	46.0
Lead	mg/kg dw	<0.020	<0.020	<0.050	<0.020	<0.020	<0.020	<0.050	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,200	1,390	1,310	1,410	1,370	1,260	1,010	1,520	8	0%	1,309	155	1,010	1,340	1,520
Manganese	mg/kg dw	1.02	1.46	0.866	0.881	1.29	3.39	2.45	1.90	8	0%	1.66	0.886	0.866	1.38	3.39
Mercury	mg/kg dw	0.355	0.614	0.330	0.764	0.595	0.623	0.170	0.608	8	0%	0.507	0.199	0.170	0.602	0.764
	mg/kg ww	0.0871	0.139	0.0850	0.188	0.123	0.168	0.0490	0.139	8	0%	0.122	0.0462	0.0490	0.131	0.188
Molybdenum	mg/kg dw	<0.020	0.0220	<0.040	<0.020	<0.020	<0.020	<0.040	<0.020	8	88%	0.0203	-	<0.020	0.0200	0.0220
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	9,980	11,800	10,700	12,400	11,400	10,400	8,220	12,800	8	0%	10,962	1,474	10,400	11,050	9,980
Potassium	mg/kg dw	16,800	20,800	19,000	20,200	19,100	15,000	12,400	21,600	8	0%	18,113	3,152	12,400	19,050	21,600
Rubidium	mg/kg dw	11.0	9.79	14.3	9.36	7.77	6.64	8.21	11.9	8	0%	9.87	2.48	11.0	9.57	9.79
Selenium	mg/kg dw	2.74	2.62	2.99	2.46	2.13	2.59	2.63	2.74	8	0%	2.61	0.248	2.13	2.62	2.99
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,250	1,430	1,180	1,280	2,560	1,270	1,320	1,400	8	0%	1,461	451	1,180	1,300	2,560
Strontium	mg/kg dw	0.928	0.694	0.760	0.770	1.17	2.73	1.93	1.53	8	0%	1.31	0.716	0.694	1.05	2.73
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	0.550	0.820	0.450	0.580	0.830	0.480	0.600	0.910	8	0%	0.652	0.175	0.450	0.590	0.910
Titanium	mg/kg dw	<0.25	0.260	<0.50	<0.25	0.360	0.640	1.47	<0.25	8	50%	0.469	0.549	<0.25	0.260	1.47
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	23.1	34.5	22.1	29.4	23.8	26.8	20.2	17.4	8	0%	24.7	5.43	17.4	23.4	34.5
Zirconium	mg/kg dw	0.400	0.430	0.230	0.360	0.370	0.330	0.250	0.330	8	0%	0.338	0.0690	0.230	0.345	0.430

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).

Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).

Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.4: Chemistry Data and Guideline Screening for Tissues from Longnose Sucker Collected from Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Ovary														
		BOL-LSU-1	BOL-LSU-2	BOL-LSU-3	BOL-LSU-4	BOL-LSU-5	BOL-LSU-6	BOL-LSU-7	BOL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	63.2	65.9	67.2	65.4	67.0	66.7	64.6	64.2	8	0%	65.5	1.44	63.2	65.7	67.2
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	2.60	<2.0	<2.0	<2.0	8	88%	2.08	-	<2.0	2.00	2.60
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0910	0.0260	0.133	0.0340	0.0260	0.0410	0.0690	0.0560	8	0%	0.0595	0.0373	0.0260	0.0485	0.133
Barium	mg/kg dw	0.364	0.232	0.290	0.307	0.280	0.264	0.195	0.264	8	0%	0.274	0.0503	0.195	0.272	0.364
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	0.00720	<0.0050	0.00540	<0.0050	<0.0050	0.00510	8	63%	0.00534	0.00114	<0.0050	0.00500	0.00720
Calcium	mg/kg dw	511	606	590	508	510	532	448	574	8	0%	535	52.2	448	522	606
Cesium	mg/kg dw	0.0191	0.0164	0.0395	0.0113	0.0182	0.0179	0.0314	0.0311	8	0%	0.0231	0.00966	0.0113	0.0186	0.0395
Chromium	mg/kg dw	<0.050	0.0680	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	88%	0.0522	-	<0.050	0.0500	0.0680
Cobalt	mg/kg dw	0.0440	0.0530	0.0630	0.0480	0.0400	0.0500	0.0320	0.0360	8	0%	0.0458	0.00995	0.0320	0.0460	0.0630
Copper	mg/kg dw	4.07	3.80	5.31	3.54	3.74	3.98	3.49	3.70	8	0%	3.95	0.582	3.49	3.77	5.31
Iron	mg/kg dw	54.8	57.3	29.6	55.9	79.0	64.8	45.0	48.8	8	0%	54.4	14.4	29.6	55.4	79.0
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	726	747	913	761	758	792	726	780	8	0%	775	60.3	726	760	913
Manganese	mg/kg dw	16.3	12.6	12.2	5.48	6.11	16.5	13.6	16.0	8	0%	12.3	4.37	12.2	13.1	6.11
Mercury	mg/kg dw	0.0142	0.0160	0.0128	0.0184	0.0178	0.0170	0.00910	0.0170	8	0%	0.0153	0.00312	0.00910	0.0165	0.0184
	mg/kg ww	0.00520	0.00550	0.00420	0.00640	0.00590	0.00570	0.00320	0.00610	8	0%	0.00528	0.00107	0.00320	0.00560	0.00640
Molybdenum	mg/kg dw	0.0650	0.0680	0.0780	0.0590	0.0650	0.0660	0.0510	0.0600	8	0%	0.0640	0.00782	0.0510	0.0650	0.0780
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	11,800	11,100	12,300	11,700	11,800	12,100	11,300	11,900	8	0%	11,750	393	11,100	11,800	12,300
Potassium	mg/kg dw	6,290	6,770	7,760	7,000	6,940	7,100	6,760	6,870	8	0%	6,936	412	6,290	6,905	7,760
Rubidium	mg/kg dw	5.28	3.97	8.20	4.26	3.43	4.07	5.98	5.19	8	0%	5.05	1.52	3.43	4.72	8.20
Selenium	mg/kg dw	4.83	5.00	4.94	4.32	3.78	4.38	5.21	4.58	8	0%	4.63	0.462	3.78	4.70	5.21
Silver	mg/kg dw	<0.0050	0.00570	<0.0050	0.00640	0.00640	0.00810	<0.0050	<0.0050	8	50%	0.00582	0.00102	<0.0050	0.00535	0.00810
Sodium	mg/kg dw	1,640	2,520	1,990	1,920	2,260	2,150	1,710	1,630	8	0%	1,978	319	1,630	1,955	2,520
Strontium	mg/kg dw	0.687	0.632	0.924	0.672	0.733	0.757	0.537	0.691	8	0%	0.704	0.111	0.537	0.689	0.924
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	<0.10	<0.10	0.160	<0.10	0.100	<0.10	0.130	0.130	8	50%	0.115	0.0245	<0.10	0.100	0.160
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	67.2	84.1	86.8	75.2	76.8	75.2	73.1	77.4	8	0%	77	6.15	67.2	76.0	86.8
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).

Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.4: Chemistry Data and Guideline Screening for Tissues from Longnose Sucker Collected from Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Liver														
		BOL-LSU-1	BOL-LSU-2	BOL-LSU-3	BOL-LSU-4	BOL-LSU-5	BOL-LSU-6	BOL-LSU-7	BOL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	80.3	80.4	81.5	82.1	82.3	81.7	80.7	79.7	8	0%	81.1	0.942	79.7	81.1	82.3
Aluminum	mg/kg dw	2.50	<5.0	5.90	<2.0	14.6	3.70	2.30	3.20	8	25%	4.62	4.70	<2.0	3.20	5.90
Antimony	mg/kg dw	0.0120	0.0220	0.0100	0.0200	0.0410	0.0170	0.0100	0.0150	8	0%	0.0184	0.0102	0.0100	0.0160	0.0410
Arsenic	mg/kg dw	0.158	0.152	0.150	0.125	0.182	0.124	0.107	0.133	8	0%	0.141	0.0237	0.107	0.142	0.182
Barium	mg/kg dw	0.300	0.454	0.678	0.119	0.439	0.195	0.343	0.311	8	0%	0.355	0.172	0.119	0.327	0.678
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.209	0.469	0.221	0.411	0.313	0.318	0.0803	0.352	8	0%	0.297	0.124	0.0803	0.316	0.469
Calcium	mg/kg dw	362	285	386	354	396	334	319	483	8	0%	365	59.7	285	358	483
Cesium	mg/kg dw	0.0246	0.0216	0.0449	0.0164	0.0353	0.0361	0.0397	0.0575	8	0%	0.0345	0.0134	0.0164	0.0357	0.0575
Chromium	mg/kg dw	0.0730	<0.20	0.0980	<0.050	0.144	0.0900	0.109	0.0700	8	25%	0.0906	0.0272	<0.050	0.0900	0.144
Cobalt	mg/kg dw	0.0860	0.120	0.0980	0.102	0.135	0.126	0.102	0.106	8	0%	0.109	0.0162	0.0860	0.104	0.135
Copper	mg/kg dw	15.2	23.0	86.7	9.52	17.7	19.9	17.9	21.2	8	0%	26.4	24.7	15.2	18.9	9.52
Iron	mg/kg dw	158	424	84.5	147	503	584	261	313	8	0%	309	181	147	287	84.5
Lead	mg/kg dw	<0.020	<0.050	<0.020	<0.020	0.0270	<0.020	<0.020	<0.020	8	88%	0.0210	-	<0.020	0.0200	0.0270
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,040	1,030	1,220	930	1,260	1,200	994	1,150	8	0%	1,103	120	1,030	1,095	994
Manganese	mg/kg dw	11.4	14.2	21.2	9.72	30.8	12.6	9.69	16.8	8	0%	15.8	7.19	11.4	13.4	9.72
Mercury	mg/kg dw	0.138	0.192	0.137	0.200	0.215	0.166	0.0966	0.139	8	0%	0.160	0.0399	0.0966	0.152	0.215
	mg/kg ww	0.0272	0.0376	0.0254	0.0358	0.0381	0.0303	0.0187	0.0283	8	0%	0.0302	0.00672	0.0187	0.0293	0.0381
Molybdenum	mg/kg dw	1.26	1.13	1.59	0.939	1.38	1.19	1.42	1.16	8	0%	1.26	0.201	0.939	1.23	1.59
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	16,400	15,900	17,500	14,800	19,100	18,100	15,900	17,600	8	0%	16,913	1,404	14,800	16,950	19,100
Potassium	mg/kg dw	13,600	11,300	15,600	12,800	13,800	14,900	13,500	14,200	8	0%	13,712	1,305	11,300	13,700	15,600
Rubidium	mg/kg dw	10.5	6.43	15.5	7.77	7.93	8.39	10.2	10.6	8	0%	9.66	2.79	10.2	9.30	8.39
Selenium	mg/kg dw	6.19	6.89	6.79	6.92	7.51	6.26	7.28	6.60	8	0%	6.80	0.457	6.19	6.84	7.51
Silver	mg/kg dw	0.0181	0.0284	0.110	0.00910	0.0184	0.0261	0.0230	0.0280	8	0%	0.0326	0.0319	0.00910	0.0246	0.110
Sodium	mg/kg dw	6,780	6,940	7,090	8,080	8,240	7,610	7,100	6,870	8	0%	7,339	566	6,780	7,095	8,240
Strontium	mg/kg dw	0.883	0.640	1.37	0.864	1.55	0.782	0.705	1.97	8	0%	1.10	0.479	0.640	0.874	1.97
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	0.00210	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	88%	0.00201	-	<0.0020	0.00200	0.00210
Tin	mg/kg dw	0.310	0.500	0.540	0.390	0.440	<0.10	<0.10	<0.10	8	38%	0.310	0.0907	<0.10	0.350	0.540
Titanium	mg/kg dw	<0.25	<0.50	0.310	<0.25	0.750	<0.25	<0.25	<0.25	8	75%	0.321	0.311	<0.25	0.250	0.750
Uranium	mg/kg dw	0.00290	0.00510	0.00320	0.00400	0.0102	0.00490	<0.0020	0.00320	8	13%	0.00444	0.00254	<0.0020	0.00360	0.0102
Vanadium	mg/kg dw	0.240	0.300	0.140	0.220	0.760	0.270	0.130	0.160	8	0%	0.278	0.204	0.130	0.230	0.760
Zinc	mg/kg dw	80.0	79.9	118	70.0	88.8	87.9	86.5	78.0	8	0%	86.1	14.3	118	83.2	88.8
Zirconium	mg/kg dw	<0.20	0.240	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	88%	0.205	-	<0.20	0.200	0.240

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.4: Chemistry Data and Guideline Screening for Tissues from Longnose Sucker Collected from Bootjack Lake (BOL; Reference), May 2022 [a]

Analyte	Units	Kidney														
		BOL-LSU-1	BOL-LSU-2	BOL-LSU-3	BOL-LSU-4	BOL-LSU-5	BOL-LSU-6	BOL-LSU-7	BOL-LSU-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	79.3	81.4	79.2	78.4	83.1	79.0	78.4	80.1	8	0%	79.9	1.63	78.4	79.2	83.1
Aluminum	mg/kg dw	<5.0	<5.0	6.30	<5.0	7.80	<5.0	<5.0	<2.0	8	75%	3.26	1.06	<2.0	5.00	7.80
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	0.0120	<0.010	<0.010	<0.010	8	88%	0.0102	-	<0.010	0.0100	0.0120
Arsenic	mg/kg dw	0.148	0.0940	0.230	0.0920	0.0920	0.0930	0.122	0.111	8	0%	0.123	0.0476	0.0920	0.102	0.230
Barium	mg/kg dw	1.06	2.82	1.61	2.17	3.27	3.15	1.70	2.20	8	0%	2.25	0.785	1.06	2.18	3.27
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	1.11	1.89	1.08	2.49	1.76	1.75	0.448	2.23	8	0%	1.59	0.672	0.448	1.76	2.49
Calcium	mg/kg dw	670	856	633	968	1,380	2,520	794	1,300	8	0%	1,140	621	1,300	912	968
Cesium	mg/kg dw	0.0281	0.0350	0.0734	0.0188	0.0553	0.0459	0.0481	0.100	8	0%	0.0506	0.0261	0.0188	0.0470	0.100
Chromium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	0.0990	<0.20	<0.20	0.0630	8	75%	0.0810	0.0255	<0.20	0.0810	0.0990
Cobalt	mg/kg dw	0.134	0.283	0.266	0.294	0.181	0.452	0.299	0.214	8	0%	0.265	0.0957	0.134	0.274	0.452
Copper	mg/kg dw	4.55	5.97	6.08	4.38	6.10	4.24	4.26	5.15	8	0%	5.09	0.844	4.24	4.85	6.10
Iron	mg/kg dw	486	276	157	340	502	338	448	523	8	0%	384	128	157	394	523
Lead	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.020	<0.050	<0.050	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.050
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	516	612	609	448	680	692	556	698	8	0%	601	90.1	448	610	698
Manganese	mg/kg dw	11.7	20.4	22.7	12.2	25.2	66.1	10.0	12.0	8	0%	22.5	18.5	10.0	16.3	66.1
Mercury	mg/kg dw	0.128	0.277	0.108	0.266	0.340	0.306	0.0822	0.217	8	0%	0.216	0.0978	0.0822	0.242	0.340
	mg/kg ww	0.0265	0.0514	0.0224	0.0572	0.0575	0.0641	0.0178	0.0431	8	0%	0.0425	0.0180	0.0178	0.0472	0.0641
Molybdenum	mg/kg dw	0.575	0.719	0.913	0.706	0.777	0.595	0.610	0.751	8	0%	0.706	0.113	0.575	0.712	0.913
Nickel	mg/kg dw	0.290	0.580	0.410	0.660	0.510	0.610	0.290	0.420	8	0%	0.471	0.142	0.290	0.465	0.660
Phosphorus	mg/kg dw	11,600	13,600	13,200	10,000	14,500	14,500	11,900	13,900	8	0%	12,900	1,595	10,000	13,400	14,500
Potassium	mg/kg dw	9,540	10,800	10,200	8,230	13,800	12,600	10,700	14,200	8	0%	11,259	2,093	10,200	10,750	9,540
Rubidium	mg/kg dw	7.70	7.06	11.4	5.50	6.82	6.44	8.31	9.39	8	0%	7.83	1.87	11.4	7.38	9.39
Selenium	mg/kg dw	5.38	6.32	5.59	5.75	6.17	6.11	5.79	5.87	8	0%	5.87	0.314	5.38	5.83	6.32
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	8,280	9,340	7,870	7,290	11,400	6,460	7,020	7,900	8	0%	8,195	1,558	11,400	7,885	9,340
Strontium	mg/kg dw	1.55	1.72	1.59	2.26	3.09	6.84	1.46	2.83	8	0%	2.67	1.79	1.46	1.99	6.84
Tellurium	mg/kg dw	<0.020	0.0440	<0.020	0.0300	0.0600	0.0240	<0.020	0.0250	8	38%	0.0304	0.0153	<0.020	0.0245	0.0600
Thallium	mg/kg dw	0.0174	0.0161	0.0143	0.0158	0.00630	0.0125	0.00630	0.00920	8	0%	0.0122	0.00445	0.00630	0.0134	0.0174
Tin	mg/kg dw	<0.10	<0.10	0.910	0.630	0.660	0.660	0.650	0.530	8	25%	0.530	0.126	<0.10	0.640	0.910
Titanium	mg/kg dw	<0.50	<0.50	0.670	<0.50	0.630	<0.50	<0.50	<0.25	8	75%	0.350	0.0283	<0.25	0.500	0.670
Uranium	mg/kg dw	0.00780	0.0157	0.00860	0.0141	0.0215	0.0186	0.00440	0.00910	8	0%	0.0125	0.00592	0.00440	0.0116	0.0215
Vanadium	mg/kg dw	0.630	1.05	0.300	0.970	2.06	0.970	0.400	0.480	8	0%	0.858	0.564	0.300	0.800	2.06
Zinc	mg/kg dw	95.8	156	122	106	104	105	113	87.8	8	0%	111	20.8	104	106	95.8
Zirconium	mg/kg dw	<0.20	<0.20	0.230	0.220	<0.20	0.200	<0.20	<0.20	8	63%	0.206	0.0153	<0.20	0.200	0.230

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.5: Lake Trout Tissue Chemistry Data for Quesnel Lake near Cedar Point (QUL-NCP; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Cedar Point (QUL-NCP)														
		Muscle														
		QUL-NCP-LT-1	QUL-NCP-LT-2	QUL-NCP-LT-3	QUL-NCP-LT-4	QUL-NCP-LT-5	QUL-NCP-LT-6	QUL-NCP-LT-7	QUL-NCP-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	76.9	76.4	76.4	79.8	75.0	78.4	74.9	76.4	8	0%	76.8	1.64	74.9	76.4	79.8
Aluminum	mg/kg dw	<2.0	3.20	<2.0	<2.0	9.00	<2.0	<2.0	2.30	8	63%	3.06	3.64	<2.0	2.00	9.00
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0900	0.589	0.108	0.144	0.120	0.0740	0.0540	0.431	8	0%	0.201	0.197	0.0540	0.114	0.589
Barium	mg/kg dw	<0.050	0.101	<0.050	0.206	0.199	<0.050	<0.050	0.0850	8	50%	0.0989	0.0636	<0.050	0.0675	0.206
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00510	<0.0050	8	88%	0.00501	-	<0.0050	0.00500	0.00510
Calcium	mg/kg dw	826	415	220	741	374	248	210	290	8	0%	416	239	210	332	826
Cesium	mg/kg dw	0.309	0.182	0.270	0.257	0.198	0.314	0.281	0.217	8	0%	0.254	0.0497	0.182	0.264	0.314
Chromium	mg/kg dw	<0.050	0.0530	0.0530	0.264	0.0660	<0.050	<0.050	0.0570	8	38%	0.0804	0.0926	<0.050	0.0530	0.264
Cobalt	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Copper	mg/kg dw	0.710	2.92	1.14	0.950	1.67	1.06	1.23	1.41	8	0%	1.39	0.684	0.710	1.18	2.92
Iron	mg/kg dw	8.60	32.4	8.80	11.3	30.4	11.6	10.6	12.5	8	0%	15.8	9.75	10.6	11.4	8.80
Lead	mg/kg dw	<0.020	0.0220	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	88%	0.0202	-	<0.020	0.0200	0.0220
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,110	1,080	1,110	1,690	1,320	1,240	1,160	1,420	8	0%	1,266	208	1,080	1,200	1,690
Manganese	mg/kg dw	0.272	0.448	0.284	0.435	0.573	0.287	0.268	0.397	8	0%	0.370	0.111	0.268	0.342	0.573
Mercury	mg/kg dw	2.23	0.672	2.40	0.987	0.734	1.82	1.17	0.929	8	0%	1.37	0.684	0.672	1.08	2.40
	mg/kg ww	0.515	0.159	0.568	0.199	0.183	0.394	0.293	0.219	8	0%	0.316	0.158	0.159	0.256	0.568
Molybdenum	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	11,100	11,500	11,600	14,200	12,500	12,700	10,500	13,000	8	0%	12,138	1,189	10,500	12,050	14,200
Potassium	mg/kg dw	19,600	17,200	19,900	24,900	21,600	24,000	18,900	22,500	8	0%	21,075	2,640	17,200	20,750	24,900
Rubidium	mg/kg dw	40.5	33.1	36.0	46.5	40.8	39.3	33.7	41.2	8	0%	38.9	4.45	33.1	39.9	46.5
Selenium	mg/kg dw	1.88	2.04	2.04	2.46	2.14	2.15	1.84	2.21	8	0%	2.10	0.196	1.84	2.09	2.46
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,090	1,060	1,030	1,660	1,140	1,330	992	976	8	0%	1,160	231	1,030	1,075	992
Strontium	mg/kg dw	1.02	0.461	0.153	0.855	0.354	0.150	0.141	0.194	8	0%	0.416	0.344	0.141	0.274	1.02
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0254	0.0493	0.0293	0.0436	0.0403	0.0283	0.0288	0.0270	8	0%	0.0340	0.00903	0.0254	0.0290	0.0493
Tin	mg/kg dw	0.220	0.220	0.490	0.710	0.240	0.240	0.370	0.280	8	0%	0.346	0.174	0.220	0.260	0.710
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	0.910	<0.25	<0.25	<0.25	8	88%	0.332	-	<0.25	0.250	0.910
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	11.5	20.9	11.8	14.7	13.6	13.4	11.9	13.2	8	0%	13.9	3.04	11.5	13.3	20.9
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.5: Lake Trout Tissue Chemistry Data for Quesnel Lake near Cedar Point (QUL-NCP; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Cedar Point (QUL-NCP)											
		Ovary											
		QUL-NCP-LT-1	QUL-NCP-LT-3	QUL-NCP-LT-4	QUL-NCP-LT-5	QUL-NCP-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	64.8	70.0	78.5	79.4	79.4	5	0%	74.4	6.68	64.8	78.5	79.4
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	2.70	3.20	5	60%	2.38	0.354	<2.0	2.00	3.20
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	5	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0460	0.0750	0.105	0.143	0.169	5	0%	0.108	0.0497	0.0460	0.105	0.169
Barium	mg/kg dw	<0.050	<0.050	0.0950	0.156	0.0880	5	40%	0.0878	0.0374	<0.050	0.0880	0.156
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	5	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	5	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	5	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	0.0108	0.0116	0.0118	5	40%	0.00884	0.000529	<0.0050	0.0108	0.0118
Calcium	mg/kg dw	1,060	958	1,150	1,480	1,410	5	0%	1,212	225	1,060	1,150	958
Cesium	mg/kg dw	0.0725	0.0805	0.192	0.195	0.206	5	0%	0.149	0.0666	0.0725	0.192	0.206
Chromium	mg/kg dw	0.0530	<0.050	0.0850	0.194	0.0720	5	20%	0.0908	0.0634	<0.050	0.0720	0.194
Cobalt	mg/kg dw	0.0450	0.0640	0.341	0.518	0.321	5	0%	0.258	0.201	0.0450	0.321	0.518
Copper	mg/kg dw	12.8	11.5	48.8	63.5	58.3	5	0%	39.0	25.1	11.5	48.8	63.5
Iron	mg/kg dw	53.7	81.7	321	375	264	5	0%	219	144	264	264	81.7
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	5	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	5	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,330	1,260	543	645	718	5	0%	899	367	1,260	718	718
Manganese	mg/kg dw	0.799	2.39	7.66	9.72	10.3	5	0%	6.17	4.33	0.799	7.66	9.72
Mercury	mg/kg dw	0.271	0.247	0.243	0.256	0.225	5	0%	0.248	0.0169	0.225	0.247	0.271
	mg/kg ww	0.0955	0.0742	0.0523	0.0529	0.0462	5	0%	0.0642	0.0205	0.0462	0.0529	0.0955
Molybdenum	mg/kg dw	<0.020	0.0200	0.0680	0.0870	0.0890	5	20%	0.0568	0.0321	<0.020	0.0680	0.0890
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	5	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	11,200	11,300	8,660	11,300	12,000	5	0%	10,892	1,288	11,200	11,300	8,660
Potassium	mg/kg dw	6,430	6,830	12,800	15,100	15,400	5	0%	11,312	4,393	12,800	12,800	6,830
Rubidium	mg/kg dw	11.9	13.7	33.4	39.8	43.3	5	0%	28.4	14.7	11.9	33.4	43.3
Selenium	mg/kg dw	4.21	4.57	5.91	9.38	8.06	5	0%	6.43	2.24	4.21	5.91	9.38
Silver	mg/kg dw	0.0400	0.0214	0.0487	0.0746	0.0451	5	0%	0.0460	0.0192	0.0214	0.0451	0.0746
Sodium	mg/kg dw	3,320	5,230	9,160	8,060	8,400	5	0%	6,834	2,464	3,320	8,060	9,160
Strontium	mg/kg dw	2.56	1.95	1.44	1.20	1.26	5	0%	1.68	0.573	1.20	1.44	2.56
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	5	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0202	0.0194	0.0494	0.0995	0.0574	5	0%	0.0492	0.0329	0.0194	0.0494	0.0995
Tin	mg/kg dw	0.110	0.100	0.400	0.580	0.700	5	0%	0.378	0.271	0.100	0.400	0.700
Titanium	mg/kg dw	<0.25	<0.25	<0.25	0.270	<0.25	5	80%	0.254	-	<0.25	0.250	0.270
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	5	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	5	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	75.4	98.7	183	215	225	5	0%	159	68.4	183	183	98.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	5	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).

Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.5: Lake Trout Tissue Chemistry Data for Quesnel Lake near Cedar Point (QUL-NCP; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Cedar Point (QUL-NCP)														
		Liver														
		QUL-NCP-LT-1	QUL-NCP-LT-2	QUL-NCP-LT-3	QUL-NCP-LT-4	QUL-NCP-LT-5	QUL-NCP-LT-6	QUL-NCP-LT-7	QUL-NCP-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	79.7	68.1	80.1	74.8	67.0	76.7	63.6	65.8	8	0%	72	6.59	63.6	71.5	80.1
Aluminum	mg/kg dw	3.30	<2.0	3.60	<2.0	5.60	4.00	<2.0	<2.0	8	50%	3.06	1.02	<2.0	2.65	5.60
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.265	0.630	0.452	0.298	0.329	0.485	0.233	0.281	8	0%	0.372	0.137	0.233	0.314	0.630
Barium	mg/kg dw	<0.050	0.0610	0.0580	<0.050	0.136	<0.050	<0.050	<0.050	8	63%	0.0631	0.0442	<0.050	0.0500	0.136
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.519	0.167	0.459	0.179	0.216	0.589	0.126	0.193	8	0%	0.306	0.184	0.126	0.204	0.589
Calcium	mg/kg dw	345	198	448	324	180	212	137	110	8	0%	244	116	110	205	448
Cesium	mg/kg dw	0.296	0.0526	0.195	0.0873	0.0440	0.193	0.0736	0.0589	8	0%	0.125	0.0918	0.0440	0.0804	0.296
Chromium	mg/kg dw	0.280	0.0780	0.325	0.106	0.0970	0.223	0.0530	0.0820	8	0%	0.156	0.105	0.0530	0.102	0.325
Cobalt	mg/kg dw	0.0980	0.0980	0.121	0.117	0.220	0.140	0.207	0.194	8	0%	0.149	0.0500	0.0980	0.130	0.220
Copper	mg/kg dw	12.6	107	17.5	55.2	38.8	131	61.6	38.9	8	0%	57.8	41.7	107	47.0	61.6
Iron	mg/kg dw	354	569	369	409	209	1,010	379	210	8	0%	439	258	1,010	374	569
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,070	434	981	550	435	597	398	452	8	0%	615	263	1,070	501	981
Manganese	mg/kg dw	6.53	3.41	9.00	4.48	3.48	5.62	3.60	3.53	8	0%	4.96	2.00	3.41	4.04	9.00
Mercury	mg/kg dw	3.08	0.689	2.39	1.05	0.488	2.34	0.661	0.580	8	0%	1.41	1.03	0.488	0.870	3.08
	mg/kg ww	0.624	0.220	0.477	0.265	0.161	0.546	0.241	0.198	8	0%	0.342	0.179	0.161	0.253	0.624
Molybdenum	mg/kg dw	0.336	0.463	0.360	0.550	0.376	0.650	0.382	0.485	8	0%	0.450	0.109	0.336	0.422	0.650
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	21,400	9,860	20,000	12,300	10,100	13,300	8,880	10,400	8	0%	13,280	4,804	10,100	11,350	9,860
Potassium	mg/kg dw	21,300	8,320	19,200	10,300	8,670	12,300	7,310	8,440	8	0%	11,980	5,353	10,300	9,485	8,670
Rubidium	mg/kg dw	89.8	19.8	62.6	22.8	21.0	35.3	15.4	19.3	8	0%	35.8	26.6	15.4	21.9	89.8
Selenium	mg/kg dw	6.12	6.56	6.33	9.21	5.57	16.2	5.89	6.09	8	0%	7.75	3.60	16.2	6.22	9.21
Silver	mg/kg dw	0.0718	0.791	0.0912	0.331	0.274	1.21	0.347	0.232	8	0%	0.418	0.389	0.0718	0.302	1.21
Sodium	mg/kg dw	5,570	4,740	7,540	6,450	4,370	6,730	3,350	2,900	8	0%	5,206	1,653	2,900	5,155	7,540
Strontium	mg/kg dw	0.366	0.345	0.560	0.624	0.341	0.308	0.261	0.190	8	0%	0.374	0.146	0.190	0.343	0.624
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.695	0.234	0.327	0.205	0.116	0.204	0.138	0.151	8	0%	0.259	0.188	0.116	0.204	0.695
Tin	mg/kg dw	0.220	0.270	0.430	0.460	0.290	0.230	0.220	0.210	8	0%	0.291	0.0991	0.210	0.250	0.460
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	0.480	<0.25	<0.25	<0.25	8	88%	0.279	-	<0.25	0.250	0.480
Uranium	mg/kg dw	<0.0020	<0.0020	0.00200	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	88%	0.00200	-	<0.0020	0.00200	0.00200
Vanadium	mg/kg dw	0.100	<0.10	0.350	<0.10	<0.10	0.140	<0.10	<0.10	8	63%	0.136	0.134	<0.10	0.100	0.350
Zinc	mg/kg dw	110	114	106	126	78.8	136	90.9	104	8	0%	108	18.2	104	108	90.9
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.5: Lake Trout Tissue Chemistry Data for Quesnel Lake near Cedar Point (QUL-NCP; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Cedar Point (QUL-NCP)														
		Kidney														
		QUL-NCP-LT-1	QUL-NCP-LT-2	QUL-NCP-LT-3	QUL-NCP-LT-4	QUL-NCP-LT-5	QUL-NCP-LT-6	QUL-NCP-LT-7	QUL-NCP-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	84.1	81.0	82.5	84.2	80.4	83.5	79.2	81.1	8	0%	82.0	1.85	79.2	81.8	84.2
Aluminum	mg/kg dw	15.9	13.6	31.2	7.90	14.0	55.6	4.00	4.30	8	0%	18.3	17.4	13.6	13.8	7.90
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	0.0100	<0.010	<0.010	8	88%	0.0100	-	<0.010	0.0100	0.0100
Arsenic	mg/kg dw	0.239	0.339	0.294	0.198	0.381	0.260	0.130	0.185	8	0%	0.253	0.0832	0.130	0.250	0.381
Barium	mg/kg dw	0.195	0.291	0.203	0.171	0.236	0.300	0.231	0.140	8	0%	0.221	0.0555	0.140	0.217	0.300
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	3.54	0.964	2.10	0.624	1.36	2.22	0.512	1.19	8	0%	1.56	1.01	0.512	1.27	3.54
Calcium	mg/kg dw	830	881	668	799	561	655	442	515	8	0%	669	158	442	662	881
Cesium	mg/kg dw	0.246	0.142	0.142	0.164	0.141	0.175	0.164	0.156	8	0%	0.166	0.0346	0.141	0.160	0.246
Chromium	mg/kg dw	1.16	0.363	0.966	0.490	0.371	0.620	0.135	0.247	8	0%	0.544	0.355	0.135	0.430	1.16
Cobalt	mg/kg dw	0.217	0.739	0.202	0.309	0.349	0.447	0.358	0.558	8	0%	0.397	0.180	0.202	0.354	0.739
Copper	mg/kg dw	3.56	5.34	3.75	4.65	5.13	4.89	3.00	3.86	8	0%	4.27	0.843	3.00	4.26	5.34
Iron	mg/kg dw	718	787	1,000	829	537	1,380	693	550	8	0%	812	274	1,000	752	829
Lead	mg/kg dw	0.0320	0.0430	0.0220	0.0240	0.0310	0.0270	<0.020	<0.020	8	25%	0.0274	0.00752	<0.020	0.0255	0.0430
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	719	679	648	744	556	745	611	762	8	0%	683	73.3	556	699	762
Manganese	mg/kg dw	1.39	2.40	1.75	1.91	1.68	1.70	1.19	1.96	8	0%	1.75	0.367	1.19	1.72	2.40
Mercury	mg/kg dw	7.89	1.95	6.27	1.58	1.72	5.39	1.94	1.75	8	0%	3.56	2.54	1.58	1.94	7.89
	mg/kg ww	1.26	0.369	1.10	0.249	0.338	0.889	0.403	0.330	8	0%	0.617	0.401	0.249	0.386	1.26
Molybdenum	mg/kg dw	0.276	0.203	0.171	0.158	0.252	0.223	0.129	0.216	8	0%	0.204	0.0490	0.129	0.210	0.276
Nickel	mg/kg dw	0.700	0.360	0.510	0.420	0.250	0.640	<0.20	0.240	8	13%	0.415	0.180	<0.20	0.390	0.700
Phosphorus	mg/kg dw	15,100	14,800	12,800	14,600	14,800	14,100	12,500	16,100	8	0%	14,350	1,194	12,500	14,700	16,100
Potassium	mg/kg dw	14,200	14,200	12,600	15,100	14,900	13,500	12,200	15,000	8	0%	13,962	1,104	12,200	14,200	15,100
Rubidium	mg/kg dw	36.9	34.9	28.5	33.0	35.3	27.1	28.0	37.4	8	0%	32.6	4.18	27.1	34.0	37.4
Selenium	mg/kg dw	13.1	7.07	10.6	7.63	7.71	14.1	5.36	7.13	8	0%	9.09	3.15	10.6	7.67	7.71
Silver	mg/kg dw	0.0179	0.00740	0.0307	0.00720	0.00510	0.0141	<0.0050	0.00520	8	13%	0.0116	0.00936	<0.0050	0.00730	0.0307
Sodium	mg/kg dw	14,900	11,200	13,100	13,700	9,380	13,700	11,000	10,600	8	0%	12,198	1,911	10,600	12,150	9,380
Strontium	mg/kg dw	1.90	1.55	1.26	2.15	1.08	1.91	1.01	0.994	8	0%	1.48	0.460	0.994	1.40	2.15
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.120	0.136	0.0866	0.0833	0.149	0.0967	0.0792	0.110	8	0%	0.108	0.0257	0.0792	0.103	0.149
Tin	mg/kg dw	1.30	0.920	0.220	1.02	1.95	0.260	0.320	1.67	8	0%	0.958	0.660	0.220	0.970	1.95
Titanium	mg/kg dw	0.840	0.920	1.64	0.490	0.830	2.47	0.340	<0.25	8	13%	0.972	0.740	<0.25	0.835	2.47
Uranium	mg/kg dw	0.0105	<0.0020	0.0124	0.00210	0.00210	0.00800	<0.0020	<0.0020	8	38%	0.00514	0.00475	<0.0020	0.00210	0.0124
Vanadium	mg/kg dw	0.220	<0.10	0.500	<0.10	<0.10	0.200	<0.10	<0.10	8	63%	0.178	0.168	<0.10	0.100	0.500
Zinc	mg/kg dw	98.4	102	81.4	111	110	114	94.5	110	8	0%	103	11.0	102	106	98.4
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.6: Lake Trout Tissue Chemistry Data for Quesnel Lake East Arm (QUL-EAA; Reference), October 2022[a]

Analyte	Units	Quesnel Lake East Arm (QUL-EAA)														
		Muscle														
		QUL-EAA-LT-1	QUL-EAA-LT-2	QUL-EAA-LT-3	QUL-EAA-LT-4	QUL-EAA-LT-5	QUL-EAA-LT-6	QUL-EAA-LT-7	QUL-EAA-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	70.9	76.1	74.5	72.2	76.1	76.5	72.4	79.5	8	0%	74.8	2.83	70.9	75.3	79.5
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	8	100%	<2.0	-	<2.0	<2.0	<2.0
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.121	0.0930	0.225	0.168	0.0630	0.297	0.155	0.286	8	0%	0.176	0.0865	0.0630	0.162	0.297
Barium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	0.0870	<0.050	<0.050	8	88%	0.0546	-	<0.050	0.0500	0.0870
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Calcium	mg/kg dw	371	478	544	462	196	1,390	313	263	8	0%	502	377	1,390	416	544
Cesium	mg/kg dw	0.295	0.283	0.317	0.289	0.276	0.273	0.249	0.264	8	0%	0.281	0.0206	0.249	0.280	0.317
Chromium	mg/kg dw	<0.050	<0.050	<0.050	0.0580	0.0730	0.0710	<0.050	<0.050	8	63%	0.0565	0.00814	<0.050	0.0500	0.0730
Cobalt	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Copper	mg/kg dw	0.870	0.970	0.860	1.13	1.18	2.62	0.880	0.680	8	0%	1.15	0.615	0.680	0.925	2.62
Iron	mg/kg dw	13.7	11.0	9.30	16.5	14.9	43.8	9.00	21.9	8	0%	17.5	11.4	11.0	14.3	9.30
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	957	1,080	1,120	902	1,080	1,030	1,000	1,160	8	0%	1,041	85.9	1,000	1,055	957
Manganese	mg/kg dw	0.266	0.219	0.316	0.311	0.216	0.256	0.225	0.152	8	0%	0.245	0.0541	0.152	0.240	0.316
Mercury	mg/kg dw	1.66	2.62	1.29	1.24	2.05	2.12	1.04	4.35	8	0%	2.05	1.07	1.04	1.86	4.35
	mg/kg ww	0.483	0.628	0.329	0.346	0.490	0.498	0.289	0.893	8	0%	0.494	0.196	0.289	0.486	0.893
Molybdenum	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	8,620	9,110	9,350	8,130	9,840	9,980	8,350	11,500	8	0%	9,360	1,091	11,500	9,230	9,980
Potassium	mg/kg dw	16,000	16,600	17,300	14,900	18,100	16,900	15,400	20,100	8	0%	16,913	1,647	14,900	16,750	20,100
Rubidium	mg/kg dw	32.1	30.2	33.8	35.0	31.9	32.5	30.9	25.7	8	0%	31.5	2.80	25.7	32.0	35.0
Selenium	mg/kg dw	1.47	2.04	1.76	1.37	1.81	2.33	1.48	2.97	8	0%	1.90	0.537	1.37	1.78	2.97
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	941	1,010	962	1,090	1,220	1,570	826	2,140	8	0%	1,220	436	1,010	1,050	962
Strontium	mg/kg dw	0.254	0.526	0.550	0.448	0.115	1.68	0.196	0.148	8	0%	0.490	0.510	0.115	0.351	1.68
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0233	0.0229	0.0203	0.0288	0.0221	0.0275	0.0235	0.0263	8	0%	0.0243	0.00290	0.0203	0.0234	0.0288
Tin	mg/kg dw	0.110	0.170	0.180	0.160	0.310	0.180	0.170	0.370	8	0%	0.206	0.0870	0.110	0.175	0.370
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	9.30	12.2	10.6	9.88	11.3	17.9	9.17	17.7	8	0%	12.3	3.57	10.6	11.0	9.88
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.6: Lake Trout Tissue Chemistry Data for Quesnel Lake East Arm (QUL-EAA; Reference), October 2022[a]

Analyte	Units	Quesnel Lake East Arm (QUL-EAA)						
		Ovary						
		QUL-EAA-LT-4	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	87.2		87.2	-	87.2	87.2	87.2
Aluminum	mg/kg dw	<2.0	100%	<2.0	-	<2.0	<2.0	<2.0
Antimony	mg/kg dw	<0.010	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0920	0%	0.0920	-	0.0920	0.0920	0.0920
Barium	mg/kg dw	0.104	0%	0.104	-	0.104	0.104	0.104
Beryllium	mg/kg dw	<0.010	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.0132	0%	0.0132	-	0.0132	0.0132	0.0132
Calcium	mg/kg dw	1,130	0%	1,130	-	1,130	1,130	1,130
Cesium	mg/kg dw	0.381	0%	0.381	-	0.381	0.381	0.381
Chromium	mg/kg dw	0.0840	0%	0.0840	-	0.0840	0.0840	0.0840
Cobalt	mg/kg dw	0.0960	0%	0.0960	-	0.0960	0.0960	0.0960
Copper	mg/kg dw	9.22	0%	9.22	-	9.22	9.22	9.22
Iron	mg/kg dw	276	0%	276	-	276	276	276
Lead	mg/kg dw	<0.020	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.5	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	835	0%	835	-	835	835	835
Manganese	mg/kg dw	5.04	0%	5.04	-	5.04	5.04	5.04
Mercury	mg/kg dw	1.44	0%	1.44	-	1.44	1.44	1.44
	mg/kg ww	0.184	0%	0.184	-	0.184	0.184	0.184
Molybdenum	mg/kg dw	0.0830	0%	0.0830	-	0.0830	0.0830	0.0830
Nickel	mg/kg dw	<0.20	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	12,500	0%	12,500	-	12,500	12,500	12,500
Potassium	mg/kg dw	15,300	0%	15,300	-	15,300	15,300	15,300
Rubidium	mg/kg dw	47.1	0%	47.1	-	47.1	47.1	47.1
Selenium	mg/kg dw	4.16	0%	4.16	-	4.16	4.16	4.16
Silver	mg/kg dw	0.0156	0%	0.0156	-	0.0156	0.0156	0.0156
Sodium	mg/kg dw	16,300	0%	16,300	-	16,300	16,300	16,300
Strontium	mg/kg dw	1.36	0%	1.36	-	1.36	1.36	1.36
Tellurium	mg/kg dw	<0.020	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0966	0%	0.0966	-	0.0966	0.0966	0.0966
Tin	mg/kg dw	0.320	0%	0.320	-	0.320	0.320	0.320
Titanium	mg/kg dw	<0.25	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	152	0%	152	-	152	152	152
Zirconium	mg/kg dw	<0.20	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).
Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.6: Lake Trout Tissue Chemistry Data for Quesnel Lake East Arm (QUL-EAA; Reference), October 2022[a]

Analyte	Units	Quesnel Lake East Arm (QUL-EAA)														
		Liver														
		QUL-EAA-LT-1	QUL-EAA-LT-2	QUL-EAA-LT-3	QUL-EAA-LT-4	QUL-EAA-LT-5	QUL-EAA-LT-6	QUL-EAA-LT-7	QUL-EAA-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	70.7	74.3	71.6	80.2	68.2	79.9	63.4	75.4	8	0%	73	5.72	63.4	73	80.2
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<2.0	3.60	<2.0	2.40	8	75%	2.25	0.849	<2.0	2.00	3.60
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.384	0.387	0.955	0.360	0.352	0.663	0.242	0.220	8	0%	0.445	0.246	0.220	0.372	0.955
Barium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	8	100%	<0.050	-	<0.050	<0.050	<0.050
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.219	0.245	0.168	0.251	0.146	0.438	0.0920	0.223	8	0%	0.223	0.103	0.0920	0.221	0.438
Calcium	mg/kg dw	213	381	257	537	217	506	182	1,130	8	0%	428	315	1,130	319	537
Cesium	mg/kg dw	0.120	0.100	0.118	0.203	0.0866	0.148	0.0819	0.0663	8	0%	0.115	0.0437	0.0663	0.109	0.203
Chromium	mg/kg dw	0.165	0.266	0.119	0.291	0.127	0.429	0.0750	0.316	8	0%	0.224	0.121	0.0750	0.216	0.429
Cobalt	mg/kg dw	0.165	0.158	0.130	0.132	0.124	0.134	0.0850	0.234	8	0%	0.145	0.0432	0.0850	0.133	0.234
Copper	mg/kg dw	244	223	151	144	80.2	93.9	132	46.5	8	0%	139	68	132	138	93.9
Iron	mg/kg dw	947	978	760	609	860	1,860	312	2,270	8	0%	1,074	656	1,860	904	978
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	483	491	562	795	403	581	350	511	8	0%	522	134	350	501	795
Manganese	mg/kg dw	4.41	3.48	5.84	3.51	3.84	4.55	3.27	2.82	8	0%	3.96	0.949	2.82	3.68	5.84
Mercury	mg/kg dw	3.07	3.55	1.56	3.37	2.22	4.90	0.928	6.35	8	0%	3.24	1.76	0.928	3.22	6.35
	mg/kg ww	0.898	0.912	0.444	0.668	0.707	0.984	0.339	1.56	8	0%	0.814	0.377	0.339	0.802	1.56
Molybdenum	mg/kg dw	0.423	0.570	0.403	0.276	0.472	0.568	0.297	0.665	8	0%	0.459	0.137	0.276	0.448	0.665
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	10,100	9,570	12,900	14,600	8,360	11,600	7,250	10,100	8	0%	10,560	2,393	10,100	10,100	9,570
Potassium	mg/kg dw	7,540	7,470	7,750	12,100	6,150	8,770	5,310	9,250	8	0%	8,042	2,076	12,100	7,645	9,250
Rubidium	mg/kg dw	18.3	15.3	18.4	30.8	13.1	20.5	13.8	14.5	8	0%	18.1	5.75	13.1	16.8	30.8
Selenium	mg/kg dw	14.7	7.56	9.16	6.12	5.70	11.8	5.36	13.6	8	0%	9.25	3.69	11.8	8.36	9.16
Silver	mg/kg dw	1.43	1.16	1.33	1.36	0.504	0.950	0.749	0.373	8	0%	0.982	0.406	0.373	1.06	1.43
Sodium	mg/kg dw	5,370	7,900	5,750	9,480	4,910	9,000	3,700	5,990	8	0%	6,512	2,055	3,700	5,870	9,480
Strontium	mg/kg dw	0.346	0.710	0.441	0.774	0.362	0.985	0.328	1.59	8	0%	0.692	0.435	0.328	0.576	1.59
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.307	0.168	0.316	0.401	0.212	0.326	0.187	0.102	8	0%	0.252	0.100	0.102	0.260	0.401
Tin	mg/kg dw	0.310	0.240	0.570	0.670	0.130	0.190	0.160	0.160	8	0%	0.304	0.205	0.130	0.215	0.670
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	0.120	<0.10	0.140	8	75%	0.108	0.0141	<0.10	0.100	0.140
Zinc	mg/kg dw	160	148	145	157	106	152	108	106	8	0%	135	24.1	106	146	160
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.
[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.6: Lake Trout Tissue Chemistry Data for Quesnel Lake East Arm (QUL-EAA; Reference), October 2022[a]

Analyte	Units	Quesnel Lake East Arm (QUL-EAA)														
		Kidney														
		QUL-EAA-LT-1	QUL-EAA-LT-2	QUL-EAA-LT-3	QUL-EAA-LT-4	QUL-EAA-LT-5	QUL-EAA-LT-6	QUL-EAA-LT-7	QUL-EAA-LT-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	77.0	67.0	77.1	71.5	69.6	82.2	78.3	83.8	8	0%	75.8	5.96	67.0	77.0	83.8
Aluminum	mg/kg dw	6.60	3.10	6.50	3.70	3.70	12.5	3.50	16.4	8	0%	7.00	4.90	12.5	5.10	6.60
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	0.0140	<0.010	0.0140	8	75%	0.0110	0	<0.010	0.0100	0.0140
Arsenic	mg/kg dw	0.250	0.214	0.370	0.168	0.181	0.207	0.124	0.217	8	0%	0.216	0.0727	0.124	0.210	0.370
Barium	mg/kg dw	0.100	0.0540	0.127	0.0690	0.0760	0.144	0.0960	0.112	8	0%	0.0972	0.0303	0.0540	0.0980	0.144
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.706	0.346	0.685	0.398	0.424	1.56	0.605	1.59	8	0%	0.789	0.503	0.346	0.645	1.59
Calcium	mg/kg dw	484	259	457	417	292	787	315	1,090	8	0%	513	286	1,090	437	787
Cesium	mg/kg dw	0.209	0.0764	0.198	0.137	0.111	0.208	0.206	0.139	8	0%	0.161	0.0516	0.0764	0.168	0.209
Chromium	mg/kg dw	0.240	0.175	0.174	0.193	0.205	0.739	0.147	1.25	8	0%	0.390	0.398	0.147	0.199	1.25
Cobalt	mg/kg dw	0.385	0.155	0.529	0.0740	0.267	0.370	0.553	0.394	8	0%	0.341	0.168	0.0740	0.378	0.553
Copper	mg/kg dw	3.07	1.44	3.26	4.56	2.05	3.94	3.26	3.92	8	0%	3.19	1.03	1.44	3.26	4.56
Iron	mg/kg dw	994	722	542	513	751	1,230	611	2,650	8	0%	1,002	708	1,230	736	994
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	0.0430	<0.020	0.0250	8	75%	0.0235	0.0127	<0.020	0.0200	0.0430
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	516	272	561	469	389	703	649	728	8	0%	536	158	272	538	728
Manganese	mg/kg dw	0.772	0.412	1.03	0.906	0.584	0.946	1.20	1.41	8	0%	0.908	0.321	0.412	0.926	1.41
Mercury	mg/kg dw	4.26	2.65	1.77	2.45	2.31	5.23	1.78	10.9	8	0%	3.92	3.07	1.77	2.55	5.23
	mg/kg ww	0.980	0.874	0.405	0.698	0.703	0.928	0.385	1.76	8	0%	0.842	0.433	0.385	0.788	1.76
Molybdenum	mg/kg dw	0.202	0.0830	0.157	0.0970	0.115	0.214	0.208	0.464	8	0%	0.192	0.121	0.0830	0.180	0.464
Nickel	mg/kg dw	0.410	<0.20	0.250	<0.20	<0.20	0.680	0.230	0.670	8	38%	0.355	0.219	<0.20	0.240	0.680
Phosphorus	mg/kg dw	8,690	4,990	10,100	6,970	6,970	12,100	11,700	11,500	8	0%	9,128	2,636	10,100	9,395	8,690
Potassium	mg/kg dw	8,560	5,310	9,270	6,390	7,080	12,300	11,500	12,100	8	0%	9,064	2,702	11,500	8,915	9,270
Rubidium	mg/kg dw	26.5	12.3	23.9	18.3	16.7	29.6	32.0	17.5	8	0%	22.1	6.95	12.3	21.1	32.0
Selenium	mg/kg dw	10.4	4.05	7.13	3.95	5.78	14.1	5.40	21.8	8	0%	9.08	6.19	10.4	6.46	7.13
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	0.0164	<0.0050	0.00860	<0.0050	0.0127	8	63%	0.00784	0.00390	<0.0050	0.00500	0.0164
Sodium	mg/kg dw	9,660	5,330	9,440	7,120	6,770	11,100	9,500	14,500	8	0%	9,178	2,860	11,100	9,470	9,660
Strontium	mg/kg dw	1.80	0.745	1.51	1.13	1.15	1.90	0.844	4.06	8	0%	1.64	1.06	0.745	1.33	4.06
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.101	0.0341	0.0803	0.0617	0.0572	0.106	0.0925	0.0965	8	0%	0.0787	0.0253	0.0341	0.0864	0.106
Tin	mg/kg dw	0.230	<0.10	0.470	0.330	0.130	0.620	0.730	0.230	8	13%	0.355	0.223	<0.10	0.280	0.730
Titanium	mg/kg dw	<0.25	<0.25	0.460	0.380	<0.25	0.500	0.280	0.390	8	38%	0.345	0.0844	<0.25	0.330	0.500
Uranium	mg/kg dw	0.00210	<0.0020	<0.0020	<0.0020	<0.0020	0.00330	<0.0020	0.0103	8	63%	0.00321	0.00443	<0.0020	0.00200	0.0103
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.170	8	88%	0.109	-	<0.10	0.100	0.170
Zinc	mg/kg dw	93.7	42.4	84.2	48.2	58.6	119	88.7	101	8	0%	79.5	27.1	101	86.5	93.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.7: Northern Pikeminnow Tissue Chemistry Data for Quesnel Lake near Hazeltine Creek (QUL-NHC; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Hazeltine Creek (QUL-NHC)														
		Wholebody														
		QUL-NHC-NSC-1	QUL-NHC-NSC-2	QUL-NHC-NSC-3	QUL-NHC-NSC-4	QUL-NHC-NSC-5	QUL-NHC-NSC-6	QUL-NHC-NSC-7	QUL-NHC-NSC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	72.8	69.6	75.3	71.3	70.0	74.6	77.0	74.0	8	0%	73.1	2.63	69.6	73.4	77.0
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	333	<2.0	8	88%	43.4	-	<2.0	2.00	333
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.108	0.130	0.0500	0.246	0.187	0.0820	0.358	0.0820	8	0%	0.155	0.104	0.0500	0.119	0.358
Barium	mg/kg dw	0.610	1.15	1.44	1.03	0.646	0.918	4.30	0.905	8	0%	1.37	1.21	0.610	0.974	4.30
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.0487	0.0940	0.0545	0.0583	0.0388	0.0321	0.200	0.0307	8	0%	0.0696	0.0564	0.0307	0.0516	0.200
Calcium	mg/kg dw	13,700	15,400	41,800	22,400	18,400	20,600	25,200	20,800	8	0%	22,288	8,706	13,700	20,700	41,800
Cesium	mg/kg dw	0.0866	0.0770	0.103	0.0366	0.0806	0.0668	0.102	0.0761	8	0%	0.0786	0.0211	0.0366	0.0788	0.103
Chromium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	0.0640	0.0590	0.714	0.0520	8	50%	0.136	0.328	<0.050	0.0510	0.714
Cobalt	mg/kg dw	0.0380	0.0240	0.0490	<0.020	<0.020	0.0370	0.474	0.0220	8	25%	0.0855	0.180	<0.020	0.0305	0.474
Copper	mg/kg dw	2.19	2.14	2.47	2.34	1.90	2.03	7.11	2.42	8	0%	2.82	1.74	1.90	2.26	7.11
Iron	mg/kg dw	29.2	19.4	20.7	27.1	17.3	37.4	567	20.8	8	0%	92.4	192	17.3	24.0	567
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.164	<0.020	8	88%	0.0380	-	<0.020	0.0200	0.164
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,650	1,290	2,050	1,340	1,310	1,400	1,800	1,390	8	0%	1,529	277	1,290	1,395	2,050
Manganese	mg/kg dw	3.30	3.51	7.39	4.04	3.98	7.95	24.6	4.26	8	0%	7.38	7.18	24.6	4.15	7.95
Mercury	mg/kg dw	0.509	0.282	0.398	0.376	0.308	0.272	0.423	0.352	8	0%	0.365	0.0795	0.272	0.364	0.509
	mg/kg ww	0.138	0.0856	0.0980	0.108	0.0927	0.0691	0.0972	0.0915	8	0%	0.0975	0.0198	0.0691	0.0950	0.138
Molybdenum	mg/kg dw	0.0280	<0.020	0.0340	0.0240	<0.020	0.0250	0.0810	<0.020	8	38%	0.0315	0.0241	<0.020	0.0245	0.0810
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.810	<0.20	8	88%	0.276	-	<0.20	0.200	0.810
Phosphorus	mg/kg dw	17,500	16,800	35,200	21,600	18,600	20,900	23,600	19,600	8	0%	21,725	5,882	16,800	20,250	35,200
Potassium	mg/kg dw	14,100	13,800	15,700	14,800	12,600	15,300	14,500	11,900	8	0%	14,088	1,300	11,900	14,300	15,700
Rubidium	mg/kg dw	29.2	18.0	27.7	16.3	26.7	22.4	21.1	20.6	8	0%	22.8	4.68	16.3	21.8	29.2
Selenium	mg/kg dw	3.30	5.37	3.38	5.99	2.37	3.05	3.09	2.41	8	0%	3.62	1.33	2.37	3.20	5.99
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0114	<0.0050	8	88%	0.00580	-	<0.0050	0.00500	0.0114
Sodium	mg/kg dw	2,060	1,980	2,310	2,190	1,770	1,970	2,070	1,480	8	0%	1,979	257	1,480	2,020	2,310
Strontium	mg/kg dw	18.8	21.5	51.9	24.7	25.6	25.6	50.1	31.1	8	0%	31.2	12.8	18.8	25.6	51.9
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00440	0.00400	0.0126	0.00480	0.00580	0.00310	0.0199	0.00640	8	0%	0.00762	0.00576	0.00310	0.00530	0.0199
Tin	mg/kg dw	0.230	0.130	0.310	0.330	0.220	0.340	0.350	0.460	8	0%	0.296	0.101	0.130	0.320	0.460
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	17.6	<0.25	8	88%	2.42	-	<0.25	0.250	17.6
Uranium	mg/kg dw	0.00230	<0.0020	0.00320	<0.0020	<0.0020	0.00520	0.0321	0.00460	8	38%	0.00668	0.0127	<0.0020	0.00275	0.0321
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.12	<0.10	8	88%	0.228	-	<0.10	0.100	1.12
Zinc	mg/kg dw	70.2	82.9	98.2	80.3	72.2	70.7	97.7	96.4	8	0%	83.6	12.3	70.2	81.6	98.2
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.210	<0.20	8	88%	0.201	-	<0.20	0.200	0.210

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.8: Northern Pikeminnow Tissue Chemistry Data for Quesnel Lake near Grain Creek (QUL-NGC; Reference), October 2022[a]

Analyte	Units	Quesnel Lake near Grain Creek (QUL-NGC)														
		Wholebody														
		QUL-NGC-NSC-1	QUL-NGC-NSC-2	QUL-NGC-NSC-3	QUL-NGC-NSC-4	QUL-NGC-NSC-5	QUL-NGC-NSC-6	QUL-NGC-NSC-7	QUL-NGC-NSC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	68.3	70.1	73.0	77.3	73.1	74.3	74.2	74.7	8	0%	73.1	2.80	68.3	73.7	77.3
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.60	8	88%	2.08	-	<2.0	2.00	2.60
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0360	0.0430	0.0310	0.335	0.105	0.0760	0.0790	0.0380	8	0%	0.0929	0.101	0.0310	0.0595	0.335
Barium	mg/kg dw	0.497	1.07	0.211	0.882	0.723	0.504	0.925	0.331	8	0%	0.643	0.305	0.211	0.614	1.07
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.0173	0.0312	0.00980	0.0314	0.0441	0.0217	0.0240	0.0170	8	0%	0.0246	0.0107	0.00980	0.0228	0.0441
Calcium	mg/kg dw	18,800	30,700	5,620	22,800	27,300	18,200	32,900	12,800	8	0%	21,140	9,219	12,800	20,800	5,620
Cesium	mg/kg dw	0.190	0.0770	0.118	0.0867	0.271	0.163	0.158	0.148	8	0%	0.151	0.0619	0.0770	0.153	0.271
Chromium	mg/kg dw	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0700	8	88%	0.0525	-	<0.050	0.0500	0.0700
Cobalt	mg/kg dw	0.0460	0.134	0.146	0.0490	0.0450	0.0430	0.0550	0.0960	8	0%	0.0768	0.0427	0.0430	0.0520	0.146
Copper	mg/kg dw	2.23	2.45	2.67	2.26	2.20	2.23	2.14	3.39	8	0%	2.45	0.418	2.14	2.24	3.39
Iron	mg/kg dw	21.7	24.3	27.1	43.1	18.2	25.0	28.1	70.7	8	0%	32.3	17.2	18.2	26.0	70.7
Lead	mg/kg dw	0.0250	0.0240	<0.020	0.0210	0.0270	<0.020	0.0210	0.0240	8	25%	0.0228	0.00234	<0.020	0.0225	0.0270
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,420	2,290	1,990	1,590	1,640	1,370	1,770	1,050	8	0%	1,640	384	1,050	1,615	2,290
Manganese	mg/kg dw	5.23	7.39	3.40	7.57	3.98	3.87	9.32	2.69	8	0%	5.43	2.38	2.69	4.61	9.32
Mercury	mg/kg dw	0.372	0.202	0.380	0.594	0.517	0.606	0.299	0.342	8	0%	0.414	0.144	0.202	0.376	0.606
	mg/kg ww	0.118	0.0606	0.103	0.135	0.139	0.156	0.0770	0.0865	8	0%	0.109	0.0333	0.0606	0.110	0.156
Molybdenum	mg/kg dw	0.0330	0.0220	0.0260	0.0370	0.0210	0.0240	0.0310	0.0600	8	0%	0.0318	0.0127	0.0210	0.0285	0.0600
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	19,000	25,300	11,000	22,400	25,200	19,600	29,400	15,500	8	0%	20,925	5,914	11,000	21,000	29,400
Potassium	mg/kg dw	12,100	11,400	13,000	16,800	14,100	15,600	15,100	15,700	8	0%	14,225	1,908	11,400	14,600	16,800
Rubidium	mg/kg dw	32.0	16.7	26.7	21.0	38.0	30.8	29.8	26.4	8	0%	27.7	6.62	16.7	28.2	38.0
Selenium	mg/kg dw	1.41	2.31	1.52	2.33	1.64	1.78	1.86	1.82	8	0%	1.83	0.336	1.41	1.80	2.33
Silver	mg/kg dw	<0.0050	0.00930	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00670	8	75%	0.00575	0.00184	<0.0050	0.00500	0.00930
Sodium	mg/kg dw	1,620	2,040	2,350	2,610	2,280	2,360	2,450	2,520	8	0%	2,279	316	1,620	2,355	2,610
Strontium	mg/kg dw	33.8	56.6	9.20	37.7	42.0	32.9	55.3	19.5	8	0%	35.9	16.2	19.5	35.8	9.20
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00770	0.00630	0.00670	0.00530	0.00670	0.00380	0.00750	0.00560	8	0%	0.00620	0.00128	0.00380	0.00650	0.00770
Tin	mg/kg dw	0.280	0.520	0.580	0.300	0.330	0.280	0.220	0.410	8	0%	0.365	0.127	0.220	0.315	0.580
Titanium	mg/kg dw	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	8	100%	<0.25	-	<0.25	<0.25	<0.25
Uranium	mg/kg dw	<0.0020	0.00390	<0.0020	0.00910	0.00350	0.00250	0.00620	0.00360	8	25%	0.00410	0.00244	<0.0020	0.00355	0.00910
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	88.7	111	64.8	103	86.0	67.4	80.5	63.1	8	0%	83.1	17.7	103	83.2	88.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.9: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Hazeltine Creek (QUL-NHC; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Hazeltine Creek (QUL-NHC)														
		Muscle														
		QUL-NHC-PCC-1	QUL-NHC-PCC-2	QUL-NHC-PCC-3	QUL-NHC-PCC-4	QUL-NHC-PCC-5	QUL-NHC-PCC-6	QUL-NHC-PCC-7	QUL-NHC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	76.5	76.7	75.7	73.5	77.2	80.5	78.2	77.2	8	0%	76.9	2.00	73.5	77	80.5
Aluminum	mg/kg dw	4.50	2.30	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	8	75%	2.35	1.56	<2.0	2.00	4.50
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.433	0.379	0.194	0.208	0.365	0.384	0.775	0.352	8	0%	0.386	0.179	0.194	0.372	0.775
Barium	mg/kg dw	0.935	0.888	0.583	0.686	1.49	1.06	0.622	0.979	8	0%	0.905	0.294	0.583	0.912	1.49
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.0124	0.0176	0.0322	0.0125	0.00910	0.0210	0.00620	0.0119	8	0%	0.0154	0.00822	0.00620	0.0124	0.0322
Calcium	mg/kg dw	3,390	4,000	4,800	1,880	5,720	3,400	3,880	3,860	8	0%	3,866	1,116	1,880	3,870	5,720
Cesium	mg/kg dw	0.0881	0.0860	0.108	0.0825	0.0821	0.103	0.0932	0.0794	8	0%	0.0903	0.0104	0.0794	0.0870	0.108
Chromium	mg/kg dw	0.914	0.182	0.0870	0.0550	0.486	0.129	0.0740	0.0870	8	0%	0.252	0.302	0.0550	0.108	0.914
Cobalt	mg/kg dw	0.0330	0.0270	0.0300	0.0320	0.0300	0.0460	0.0300	0.0260	8	0%	0.0318	0.00620	0.0260	0.0300	0.0460
Copper	mg/kg dw	2.38	1.57	1.12	1.60	2.57	2.75	1.76	2.20	8	0%	1.99	0.567	1.12	1.98	2.75
Iron	mg/kg dw	33.6	23.4	13.5	15.9	30.4	31.5	19.2	23.3	8	0%	23.8	7.45	13.5	23.4	33.6
Lead	mg/kg dw	0.0220	<0.020	<0.020	<0.020	<0.020	0.0240	0.0220	<0.020	8	63%	0.0210	0.00115	<0.020	0.0200	0.0240
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,790	1,570	1,670	1,480	1,610	2,100	1,420	1,640	8	0%	1,660	211	1,420	1,625	2,100
Manganese	mg/kg dw	2.20	1.95	1.96	1.14	2.12	1.76	2.04	1.82	8	0%	1.87	0.330	1.14	1.96	2.20
Mercury	mg/kg dw	0.963	1.33	0.893	0.515	0.730	0.856	0.758	1.15	8	0%	0.899	0.254	0.515	0.874	1.33
	mg/kg ww	0.226	0.310	0.217	0.136	0.167	0.167	0.165	0.263	8	0%	0.206	0.0588	0.136	0.192	0.310
Molybdenum	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	13,900	13,600	13,400	11,300	13,200	16,400	14,300	14,100	8	0%	13,775	1,410	11,300	13,750	16,400
Potassium	mg/kg dw	21,800	21,900	19,700	18,500	21,400	25,600	22,500	21,100	8	0%	21,563	2,085	18,500	21,600	25,600
Rubidium	mg/kg dw	28.0	35.2	22.2	22.8	18.3	28.7	29.4	24.9	8	0%	26.2	5.24	18.3	26.4	35.2
Selenium	mg/kg dw	4.06	3.23	3.36	2.94	5.00	5.24	4.73	5.88	8	0%	4.30	1.07	2.94	4.39	5.88
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,140	1,490	1,250	1,050	1,260	1,400	1,100	1,380	8	0%	1,259	156	1,050	1,255	1,490
Strontium	mg/kg dw	6.26	7.40	9.15	3.45	10.9	5.79	7.25	7.14	8	0%	7.17	2.22	10.9	7.20	9.15
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0133	0.0101	<0.0020	0.00490	0.00400	0.0104	0.00860	0.0164	8	13%	0.00871	0.00438	<0.0020	0.00935	0.0164
Tin	mg/kg dw	0.700	1.02	1.78	0.740	2.98	1.52	0.410	0.880	8	0%	1.25	0.828	0.410	0.950	2.98
Titanium	mg/kg dw	0.360	0.250	<0.25	<0.25	<0.25	0.250	<0.25	<0.25	8	63%	0.264	0.0635	<0.25	0.250	0.360
Uranium	mg/kg dw	0.00600	0.00520	0.00430	<0.0020	<0.0020	0.00540	0.00240	0.00360	8	25%	0.00386	0.00133	<0.0020	0.00395	0.00600
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	19.0	29.7	20.4	27.5	28.4	29.8	30.7	27.3	8	0%	26.6	4.43	19.0	28.0	30.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.9: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Hazeltine Creek (QUL-NHC; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Hazeltine Creek (QUL-NHC)													
		Ovary													
		QUL-NHC-PCC-1	QUL-NHC-PCC-2	QUL-NHC-PCC-3	QUL-NHC-PCC-4	QUL-NHC-PCC-5	QUL-NHC-PCC-6	QUL-NHC-PCC-7	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	62.1	76.3	66.4	62.5	64.9	61.0	59.3	7	0%	64.6	5.66	59.3	62.5	76.3
Aluminum	mg/kg dw	3.00	9.10	<2.0	<2.0	<2.0	<2.0	<2.0	7	71%	3.16	4.31	<2.0	2.00	9.10
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.282	0.289	0.151	0.159	0.0500	0.166	0.126	7	0%	0.175	0.0850	0.0500	0.159	0.289
Barium	mg/kg dw	1.05	1.58	0.445	0.362	0.158	0.511	0.321	7	0%	0.632	0.503	0.158	0.445	1.58
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.140	0.176	0.0553	0.0175	0.0237	0.0270	0.0151	7	0%	0.0649	0.0657	0.0151	0.0270	0.176
Calcium	mg/kg dw	384	616	372	277	470	272	305	7	0%	385	124	272	372	616
Cesium	mg/kg dw	0.0303	0.0502	0.0508	0.0290	0.0363	0.0298	0.0394	7	0%	0.0380	0.00935	0.0290	0.0363	0.0508
Chromium	mg/kg dw	0.210	0.263	<0.050	<0.050	0.0710	0.0820	<0.050	7	43%	0.111	0.0950	<0.050	0.0710	0.263
Cobalt	mg/kg dw	0.117	0.210	0.126	0.0970	0.101	0.106	0.0890	7	0%	0.121	0.0412	0.0890	0.106	0.210
Copper	mg/kg dw	5.02	6.80	5.35	4.11	4.52	4.33	3.74	7	0%	4.84	1.02	3.74	4.52	6.80
Iron	mg/kg dw	84.6	250	67.8	60.5	78.3	47.1	41.6	7	0%	90	72.2	250	67.8	84.6
Lead	mg/kg dw	<0.020	0.0380	<0.020	<0.020	<0.020	<0.020	<0.020	7	86%	0.0226	-	<0.020	0.0200	0.0380
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	7	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	635	864	715	547	706	641	540	7	0%	664	112	540	641	864
Manganese	mg/kg dw	9.57	5.64	11.0	9.67	13.2	10.1	9.76	7	0%	9.85	2.25	10.1	9.76	9.76
Mercury	mg/kg dw	0.0548	0.168	0.0448	0.0230	0.0398	0.0249	0.0281	7	0%	0.0548	0.0512	0.0230	0.0398	0.168
	mg/kg ww	0.0207	0.0398	0.0150	0.00860	0.0140	0.00970	0.0114	7	0%	0.0170	0.0108	0.00860	0.0140	0.0398
Molybdenum	mg/kg dw	0.122	0.230	0.126	0.106	0.125	0.0880	0.0860	7	0%	0.126	0.0488	0.0860	0.122	0.230
Nickel	mg/kg dw	<0.20	0.300	<0.20	<0.20	<0.20	<0.20	<0.20	7	86%	0.214	-	<0.20	0.200	0.300
Phosphorus	mg/kg dw	10,000	12,600	13,200	9,790	10,800	10,600	9,610	7	0%	10,943	1,413	10,000	10,600	9,790
Potassium	mg/kg dw	8,020	14,100	9,530	6,770	8,670	7,940	7,470	7	0%	8,929	2,441	14,100	8,020	9,530
Rubidium	mg/kg dw	12.3	26.2	13.4	10.5	8.88	10.4	12.6	7	0%	13.5	5.82	10.4	12.3	8.88
Selenium	mg/kg dw	19.7	11.1	20.4	7.47	28.3	16.6	20.3	7	0%	17.7	6.83	11.1	19.7	7.47
Silver	mg/kg dw	0.0154	0.0176	0.0138	0.0152	0.0165	0.0180	0.00970	7	0%	0.0152	0.00281	0.00970	0.0154	0.0180
Sodium	mg/kg dw	1,750	6,580	1,720	1,340	1,770	1,580	1,500	7	0%	2,320	1,885	1,340	1,720	6,580
Strontium	mg/kg dw	0.514	0.972	0.492	0.326	0.528	0.317	0.459	7	0%	0.515	0.219	0.317	0.492	0.972
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	7	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0104	0.0215	0.00350	0.00450	0.00320	0.00540	0.00530	7	0%	0.00769	0.00654	0.00320	0.00530	0.0215
Tin	mg/kg dw	0.160	3.50	<0.10	0.210	0.220	0.220	0.370	7	14%	0.683	1.33	<0.10	0.220	3.50
Titanium	mg/kg dw	<0.25	0.520	<0.25	<0.25	<0.25	<0.25	<0.25	7	86%	0.289	-	<0.25	0.250	0.520
Uranium	mg/kg dw	0.0112	0.0182	0.00480	0.00340	0.00610	0.0103	0.00260	7	0%	0.00809	0.00553	0.00260	0.00610	0.0182
Vanadium	mg/kg dw	<0.10	0.210	<0.10	<0.10	<0.10	<0.10	<0.10	7	86%	0.116	-	<0.10	0.100	0.210
Zinc	mg/kg dw	93.3	220	116	82.8	98.0	93.0	88.2	7	0%	113	48.3	116	93.3	98.0
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	7	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).
Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.9: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Hazeltine Creek (QUL-NHC; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Hazeltine Creek (QUL-NHC)														
		Liver														
		QUL-NHC-PCC-1	QUL-NHC-PCC-2	QUL-NHC-PCC-3	QUL-NHC-PCC-4	QUL-NHC-PCC-5	QUL-NHC-PCC-6	QUL-NHC-PCC-7	QUL-NHC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	53.3	69.9	61.2	55.8	62.6	61.0	57.3	60.0	8	0%	60.1	5.03	53.3	60.5	69.9
Aluminum	mg/kg dw	11.0	29.5	11.3	7.70	<5.0	15.4	<5.0	15.6	8	25%	12.6	7.66	<5.0	11.2	7.70
Antimony	mg/kg dw	<0.010	0.0190	0.0110	<0.010	0.0160	0.0160	<0.010	0.0180	8	38%	0.0138	0.00308	<0.010	0.0135	0.0190
Arsenic	mg/kg dw	0.367	0.374	0.231	0.232	0.144	0.299	0.217	0.622	8	0%	0.311	0.148	0.144	0.266	0.622
Barium	mg/kg dw	0.577	0.379	0.155	0.349	0.149	0.212	0.174	0.292	8	0%	0.286	0.147	0.149	0.252	0.577
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	0.0120	0.0550	0.0290	0.0300	0.0330	0.0200	0.0130	8	13%	0.0253	0.0147	<0.010	0.0245	0.0550
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.722	1.06	1.29	0.939	0.519	1.59	0.870	0.872	8	0%	0.983	0.334	0.519	0.906	1.59
Calcium	mg/kg dw	148	223	170	210	156	170	138	166	8	0%	173	29.5	138	168	223
Cesium	mg/kg dw	0.0159	0.0307	0.0411	0.0232	0.0266	0.0224	0.0305	0.0205	8	0%	0.0264	0.00777	0.0159	0.0249	0.0411
Chromium	mg/kg dw	0.240	0.490	0.260	<0.20	<0.20	0.370	<0.20	0.280	8	38%	0.280	0.103	<0.20	0.250	0.490
Cobalt	mg/kg dw	0.152	0.297	0.217	0.232	0.136	0.250	0.168	0.169	8	0%	0.203	0.0555	0.136	0.193	0.297
Copper	mg/kg dw	7.97	17.3	18.0	13.1	10.6	24.7	20.9	18.7	8	0%	16.4	5.52	10.6	17.6	7.97
Iron	mg/kg dw	558	2,770	1,050	823	793	1,240	599	546	8	0%	1,047	738	1,050	808	823
Lead	mg/kg dw	<0.050	0.0660	<0.050	<0.050	<0.050	0.0600	<0.050	0.0670	8	63%	0.0554	0.00379	<0.050	0.0500	0.0670
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	432	649	698	593	615	585	616	525	8	0%	589	80.8	432	604	698
Manganese	mg/kg dw	2.77	5.44	4.25	4.66	3.85	5.15	4.08	4.05	8	0%	4.28	0.829	2.77	4.16	5.44
Mercury	mg/kg dw	0.286	0.804	0.436	0.265	0.346	0.407	0.282	0.556	8	0%	0.423	0.182	0.265	0.376	0.804
	mg/kg ww	0.133	0.242	0.169	0.117	0.129	0.159	0.120	0.222	8	0%	0.161	0.0475	0.117	0.146	0.242
Molybdenum	mg/kg dw	0.403	1.05	0.690	0.829	0.488	1.04	0.620	0.889	8	0%	0.751	0.242	0.403	0.760	1.05
Nickel	mg/kg dw	<0.20	0.380	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	88%	0.222	-	<0.20	0.200	0.380
Phosphorus	mg/kg dw	6,950	11,800	12,300	10,700	10,700	11,000	10,600	8,320	8	0%	10,296	1,785	10,600	10,700	8,320
Potassium	mg/kg dw	5,530	11,400	9,620	7,430	8,900	8,390	7,580	7,290	8	0%	8,268	1,760	11,400	7,985	9,620
Rubidium	mg/kg dw	7.63	18.6	12.2	10.2	8.56	9.62	10.5	8.94	8	0%	10.8	3.45	10.2	9.91	9.62
Selenium	mg/kg dw	6.35	12.8	9.61	6.45	11.6	9.62	11.7	17.6	8	0%	10.7	3.65	11.6	10.6	9.62
Silver	mg/kg dw	0.0172	0.0703	0.0422	0.0694	0.0106	0.118	0.0514	0.122	8	0%	0.0626	0.0414	0.0106	0.0604	0.122
Sodium	mg/kg dw	2,600	4,550	3,080	2,720	3,310	3,290	2,650	3,280	8	0%	3,185	627	2,600	3,180	4,550
Strontium	mg/kg dw	0.370	0.570	0.460	0.490	0.380	0.450	0.380	0.420	8	0%	0.440	0.0680	0.370	0.435	0.570
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0190	0.0673	0.0124	0.0201	0.0111	0.0276	0.0150	0.0367	8	0%	0.0262	0.0186	0.0111	0.0196	0.0673
Tin	mg/kg dw	0.220	1.70	0.330	0.400	0.230	0.270	0.510	0.310	8	0%	0.496	0.496	0.220	0.320	1.70
Titanium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Uranium	mg/kg dw	0.0240	0.104	0.0264	0.0174	0.0263	0.0605	0.0104	0.0145	8	0%	0.0354	0.0317	0.0104	0.0252	0.104
Vanadium	mg/kg dw	0.490	1.64	0.480	0.440	0.450	1.13	0.320	0.660	8	0%	0.701	0.453	0.320	0.485	1.64
Zinc	mg/kg dw	47.9	88.2	84.6	67.8	72.1	85.0	71.8	64.4	8	0%	72.7	13.3	47.9	72	88.2
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.9: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Hazeltine Creek (QUL-NHC; Exposed), October 2022[a]

Analyte	Units	Quesnel Lake near Hazeltine Creek (QUL-NHC)														
		Kidney														
		QUL-NHC-PCC-1	QUL-NHC-PCC-2	QUL-NHC-PCC-3	QUL-NHC-PCC-4	QUL-NHC-PCC-5	QUL-NHC-PCC-6	QUL-NHC-PCC-7	QUL-NHC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	31.6	69.0	48.2	53.9	57.0	50.0	50.0	56.0	8	0%	52	10.5	31.6	52	69.0
Aluminum	mg/kg dw	6.60	6.80	<5.0	<5.0	<5.0	7.10	9.60	6.10	8	38%	6.40	1.37	<5.0	6.35	9.60
Antimony	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Arsenic	mg/kg dw	0.458	0.416	0.282	0.276	0.199	0.419	0.313	0.477	8	0%	0.355	0.101	0.199	0.364	0.477
Barium	mg/kg dw	2.71	1.96	1.40	1.31	1.29	2.29	1.39	2.34	8	0%	1.84	0.561	1.29	1.68	2.71
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	0.0110	0.0130	0.0370	0.0210	0.0240	0.0380	0.0180	0.0180	8	0%	0.0225	0.0101	0.0110	0.0195	0.0380
Boron	mg/kg dw	<1.0	1.50	<1.0	2.00	<1.0	1.20	1.90	2.10	8	38%	1.46	0.378	<1.0	1.35	2.10
Cadmium	mg/kg dw	8.14	19.0	12.9	8.14	6.12	24.6	8.61	15.5	8	0%	12.9	6.44	12.9	10.8	8.61
Calcium	mg/kg dw	256	434	277	363	310	958	412	340	8	0%	419	226	256	352	958
Cesium	mg/kg dw	0.0276	0.0508	0.0529	0.0470	0.0470	0.0462	0.0572	0.0401	8	0%	0.0461	0.00904	0.0276	0.0470	0.0572
Chromium	mg/kg dw	0.360	0.360	0.240	<0.20	0.280	0.480	<0.20	0.310	8	25%	0.304	0.0835	<0.20	0.295	0.480
Cobalt	mg/kg dw	0.941	1.17	2.88	2.90	1.64	4.00	2.16	2.13	8	0%	2.23	1.01	0.941	2.14	4.00
Copper	mg/kg dw	3.88	8.54	5.42	5.01	4.29	7.00	5.61	5.78	8	0%	5.69	1.49	3.88	5.52	8.54
Iron	mg/kg dw	324	534	250	477	286	336	353	455	8	0%	377	100	250	344	534
Lead	mg/kg dw	0.0660	0.0520	0.107	0.0650	<0.050	0.181	0.0880	0.0780	8	13%	0.0859	0.0435	<0.050	0.0720	0.181
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	412	615	488	563	515	673	556	569	8	0%	549	79.3	412	560	673
Manganese	mg/kg dw	1.85	3.25	3.14	4.22	3.18	6.54	3.25	3.52	8	0%	3.62	1.35	1.85	3.25	6.54
Mercury	mg/kg dw	0.265	0.336	0.263	0.196	0.197	0.347	0.195	0.405	8	0%	0.276	0.0800	0.195	0.264	0.405
	mg/kg ww	0.181	0.104	0.136	0.0901	0.0848	0.173	0.0974	0.178	8	0%	0.131	0.0417	0.0848	0.120	0.181
Molybdenum	mg/kg dw	0.337	0.741	1.38	0.483	0.311	0.742	0.576	0.828	8	0%	0.675	0.343	0.311	0.658	1.38
Nickel	mg/kg dw	<1.0	2.29	<1.9	0.830	0.760	<2.4	<1.6	<3.6	8	63%	1.04	0.864	<1.0	0.830	2.29
Phosphorus	mg/kg dw	6,310	11,100	9,730	10,900	10,100	12,800	10,800	10,700	8	0%	10,305	1,850	10,100	10,750	9,730
Potassium	mg/kg dw	6,360	11,300	8,740	10,100	10,000	10,800	9,100	9,990	8	0%	9,549	1,529	10,000	10,000	9,990
Rubidium	mg/kg dw	9.48	21.3	12.2	15.2	10.6	14.9	15.0	14.4	8	0%	14.1	3.62	10.6	14.6	9.48
Selenium	mg/kg dw	5.52	7.22	7.49	5.77	7.23	8.99	9.04	13.0	8	0%	8.03	2.38	13.0	7.36	9.04
Silver	mg/kg dw	<0.0050	0.0168	<0.0050	<0.0050	<0.0050	0.0118	<0.0050	<0.0050	8	75%	0.00732	0.00354	<0.0050	0.00500	0.0168
Sodium	mg/kg dw	2,820	5,960	3,310	4,420	4,310	4,950	4,710	5,000	8	0%	4,435	991	2,820	4,565	5,960
Strontium	mg/kg dw	0.590	0.980	0.650	0.730	0.640	2.16	0.920	0.700	8	0%	0.921	0.519	0.590	0.715	2.16
Tellurium	mg/kg dw	<0.020	0.0210	0.0360	<0.020	0.0310	0.0450	<0.020	0.0520	8	38%	0.0306	0.0121	<0.020	0.0260	0.0520
Thallium	mg/kg dw	0.0207	0.0365	0.0325	0.0284	0.0167	0.0488	0.0319	0.0395	8	0%	0.0319	0.0102	0.0167	0.0322	0.0488
Tin	mg/kg dw	0.490	1.67	0.340	1.14	0.540	0.520	1.12	1.31	8	0%	0.891	0.481	0.340	0.830	1.67
Titanium	mg/kg dw	<0.5	0.530	<0.5	<0.5	<0.5	0.550	0.690	<0.5	8	63%	0.534	0.0872	<0.50	0.500	0.690
Uranium	mg/kg dw	0.0429	0.119	0.0597	0.0241	0.0290	0.144	0.0224	0.0431	8	0%	0.0605	0.0459	0.0224	0.0430	0.144
Vanadium	mg/kg dw	0.430	0.800	0.530	0.300	0.370	1.23	0.420	1.01	8	0%	0.636	0.339	0.300	0.480	1.23
Zinc	mg/kg dw	73.5	160	147	120	97.7	156	155	138	8	0%	131	31.4	120	142	97.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.10: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Grain Creek (QUL-NGC; Reference), October 2022 [a]

Analyte	Units	Quesnel Lake near Grain Creek (QUL-NGC)														
		Muscle														
		QUL-NGC-PCC-1	QUL-NGC-PCC-2	QUL-NGC-PCC-3	QUL-NGC-PCC-4	QUL-NGC-PCC-5	QUL-NGC-PCC-6	QUL-NGC-PCC-7	QUL-NGC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	77.4	76.5	75.9	78.0	76.7	78.2	78.8	76.9	8	0%	77.3	0.977	75.9	77.2	78.8
Aluminum	mg/kg dw	7.50	3.30	3.00	3.00	2.70	2.80	2.80	4.40	8	0%	3.69	1.63	2.70	3.00	7.50
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.175	0.266	0.425	0.304	0.260	0.496	0.532	0.155	8	0%	0.327	0.142	0.155	0.285	0.532
Barium	mg/kg dw	0.340	0.501	0.558	0.832	0.918	0.245	0.625	0.670	8	0%	0.586	0.228	0.245	0.592	0.918
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0140	0.0120	8	75%	0.0107	0.00141	<0.010	0.0100	0.0140
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.0050	0.00780	0.00580	0.0110	0.0108	<0.0050	0.00760	<0.0050	8	38%	0.00725	0.00224	<0.0050	0.00670	0.0110
Calcium	mg/kg dw	1,660	1,760	3,270	2,120	2,160	2,440	5,190	3,060	8	0%	2,708	1,154	1,660	2,300	5,190
Cesium	mg/kg dw	0.158	0.154	0.148	0.155	0.136	0.212	0.230	0.179	8	0%	0.172	0.0331	0.136	0.156	0.230
Chromium	mg/kg dw	0.0790	0.103	<0.050	0.164	0.194	<0.050	0.0810	0.0900	8	25%	0.101	0.0486	<0.050	0.0855	0.194
Cobalt	mg/kg dw	0.0330	<0.020	0.0320	0.0230	0.0300	<0.020	0.0260	0.0380	8	25%	0.0278	0.00532	<0.020	0.0280	0.0380
Copper	mg/kg dw	1.57	2.24	1.59	2.27	1.09	1.19	1.44	1.67	8	0%	1.63	0.433	1.09	1.58	2.27
Iron	mg/kg dw	20.2	27.2	18.1	23.8	14.0	12.4	17.8	19.2	8	0%	19.1	4.82	12.4	18.6	27.2
Lead	mg/kg dw	<0.020	<0.020	<0.020	0.0200	<0.020	<0.020	<0.020	0.0230	8	75%	0.0204	0.00212	<0.020	0.0200	0.0230
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,750	1,240	1,480	1,850	1,630	1,800	2,270	1,790	8	0%	1,726	299	1,240	1,770	2,270
Manganese	mg/kg dw	0.985	0.731	1.57	1.15	0.837	1.24	1.79	1.69	8	0%	1.25	0.398	0.731	1.20	1.79
Mercury	mg/kg dw	0.428	0.716	0.508	0.492	1.03	0.838	1.15	0.629	8	0%	0.724	0.263	0.428	0.672	1.15
	mg/kg ww	0.0966	0.168	0.122	0.108	0.240	0.183	0.245	0.145	8	0%	0.163	0.0567	0.0966	0.156	0.245
Molybdenum	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	11,500	11,800	13,300	14,000	12,300	13,800	16,100	13,300	8	0%	13,262	1,467	11,500	13,300	16,100
Potassium	mg/kg dw	18,400	20,200	20,200	23,600	22,200	24,000	24,000	21,800	8	0%	21,800	2,062	18,400	22,000	24,000
Rubidium	mg/kg dw	22.2	23.8	26.4	25.8	32.5	37.2	34.0	31.9	8	0%	29.2	5.38	22.2	29.2	37.2
Selenium	mg/kg dw	2.14	2.80	2.94	3.72	1.66	1.88	2.14	1.58	8	0%	2.36	0.737	1.58	2.14	3.72
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,030	1,170	1,090	1,280	1,160	1,180	1,430	1,370	8	0%	1,214	137	1,030	1,175	1,430
Strontium	mg/kg dw	2.77	2.93	6.98	3.70	3.66	5.16	10.7	6.55	8	0%	5.31	2.69	10.7	4.43	6.98
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00750	0.00410	0.00420	0.00640	0.00490	0.00440	0.0106	0.00870	8	0%	0.00635	0.00241	0.00410	0.00565	0.0106
Tin	mg/kg dw	1.45	0.760	0.450	1.99	0.740	0.910	1.22	1.36	8	0%	1.11	0.493	0.450	1.06	1.99
Titanium	mg/kg dw	0.460	0.270	<0.25	0.310	1.06	0.280	0.260	0.400	8	13%	0.411	0.286	<0.25	0.295	1.06
Uranium	mg/kg dw	<0.0020	0.00240	0.00270	<0.0020	0.00350	0.00230	0.00350	<0.0020	8	38%	0.00255	0.000585	<0.0020	0.00235	0.00350
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	24.1	27.6	23.0	39.9	20.2	24.3	30.3	31.2	8	0%	27.6	6.22	20.2	26.0	39.9
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.10: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Grain Creek (QUL-NGC; Reference), October 2022 [a]

Analyte	Units	Quesnel Lake near Grain Creek (QUL-NGC)												
		Ovary												
		QUL-NGC-PCC-2	QUL-NGC-PCC-3	QUL-NGC-PCC-5	QUL-NGC-PCC-6	QUL-NGC-PCC-7	QUL-NGC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	66.2	65.1	69.0	68.8	65.8	65.8	6	0%	66.8	1.68	65.1	66.0	69.0
Aluminum	mg/kg dw	<2.0	<2.0	<2.0	3.50	<2.0	<2.0	6	83%	2.25	-	<2.0	2.00	3.50
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	6	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	0.0850	0.196	0.106	0.277	0.202	0.120	6	0%	0.164	0.0732	0.0850	0.158	0.277
Barium	mg/kg dw	0.323	0.331	0.415	0.320	0.311	0.249	6	0%	0.325	0.0532	0.249	0.322	0.415
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	6	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	6	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.0121	0.0292	0.0310	0.0354	0.0315	0.0451	6	0%	0.0307	0.0108	0.0121	0.0312	0.0451
Calcium	mg/kg dw	412	386	662	622	365	507	6	0%	492	126	365	460	662
Cesium	mg/kg dw	0.0562	0.0504	0.0670	0.0879	0.0626	0.0993	6	0%	0.0706	0.0191	0.0504	0.0648	0.0993
Chromium	mg/kg dw	<0.050	0.0500	<0.050	<0.050	<0.050	0.148	6	67%	0.0663	0.0693	<0.050	0.0500	0.148
Cobalt	mg/kg dw	0.0720	0.144	0.186	0.0930	0.118	0.172	6	0%	0.131	0.0447	0.0720	0.131	0.186
Copper	mg/kg dw	4.26	5.15	4.61	5.04	4.96	5.18	6	0%	4.87	0.361	4.26	5.00	5.18
Iron	mg/kg dw	57.5	61.2	70.4	67.2	56.0	86.1	6	0%	66.4	11.1	56.0	64.2	86.1
Lead	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	0.0210	6	83%	0.0202	-	<0.020	0.0200	0.0210
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	694	761	927	854	681	929	6	0%	808	112	681	808	929
Manganese	mg/kg dw	8.87	8.72	15.1	15.8	10.2	17.3	6	0%	12.7	3.83	10.2	12.6	8.87
Mercury	mg/kg dw	0.0454	0.0252	0.0512	0.0417	0.0568	0.0284	6	0%	0.0414	0.0125	0.0252	0.0436	0.0568
	mg/kg ww	0.0154	0.00880	0.0158	0.0130	0.0194	0.00970	6	0%	0.0137	0.00401	0.00880	0.0142	0.0194
Molybdenum	mg/kg dw	0.120	0.108	0.154	0.193	0.123	0.180	6	0%	0.146	0.0349	0.108	0.138	0.193
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	6	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	10,800	12,600	10,700	10,300	12,000	11,100	6	0%	11,250	873	10,300	10,950	12,600
Potassium	mg/kg dw	8,890	9,400	10,900	10,600	8,920	10,700	6	0%	9,902	934	10,600	10,000	9,400
Rubidium	mg/kg dw	12.5	14.4	19.4	19.4	14.4	18.9	6	0%	16.5	3.08	12.5	16.6	19.4
Selenium	mg/kg dw	12.8	14.8	9.08	7.62	10.5	12.7	6	0%	11.2	2.67	10.5	11.6	9.08
Silver	mg/kg dw	0.0171	0.0164	0.0205	0.0267	0.0191	0.0250	6	0%	0.0208	0.00421	0.0164	0.0198	0.0267
Sodium	mg/kg dw	1,950	1,610	2,240	1,880	1,700	1,640	6	0%	1,837	239	1,610	1,790	2,240
Strontium	mg/kg dw	0.461	0.579	0.716	0.697	0.474	0.677	6	0%	0.601	0.114	0.461	0.628	0.716
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	6	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00360	0.00440	0.00590	0.00600	0.00470	0.0108	6	0%	0.00590	0.00257	0.00360	0.00530	0.0108
Tin	mg/kg dw	0.240	0.320	0.520	0.380	0.120	0.440	6	0%	0.337	0.143	0.120	0.350	0.520
Titanium	mg/kg dw	<0.25	0.320	<0.25	0.300	<0.25	<0.25	6	67%	0.270	0.0141	<0.25	0.250	0.320
Uranium	mg/kg dw	0.00820	0.00790	0.0104	0.00840	0.0119	<0.0020	6	17%	0.00813	0.00173	<0.0020	0.00830	0.0119
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	6	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	111	114	140	139	116	148	6	0%	128	16.1	111	128	148
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	6	100%	<0.20	-	<0.20	<0.20	<0.20

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).
Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.10: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Grain Creek (QUL-NGC; Reference), October 2022 [a]

Analyte	Units	Quesnel Lake near Grain Creek (QUL-NGC)														
		Liver														
		QUL-NGC-PCC-1	QUL-NGC-PCC-2	QUL-NGC-PCC-3	QUL-NGC-PCC-4	QUL-NGC-PCC-5	QUL-NGC-PCC-6	QUL-NGC-PCC-7	QUL-NGC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	57.0	68.2	56.0	59.0	62.2	64.4	72.3	64.9	8	0%	63.0	5.62	56.0	63.3	72.3
Aluminum	mg/kg dw	29.2	18.0	5.20	67.2	13.5	5.60	9.00	5.20	8	0%	19.1	21.1	13.5	11.2	9.00
Antimony	mg/kg dw	<0.010	0.0160	<0.010	<0.010	0.0110	<0.010	0.0110	<0.020	8	63%	0.0111	0.00289	<0.010	0.0110	0.0160
Arsenic	mg/kg dw	0.184	1.82	0.455	0.358	1.29	4.86	5.64	0.139	8	0%	1.84	2.19	0.139	0.872	5.64
Barium	mg/kg dw	0.462	0.201	0.136	0.308	0.0990	0.247	0.160	0.0730	8	0%	0.211	0.127	0.0730	0.180	0.462
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	0.0330	0.112	0.0200	0.0290	0.0310	0.0170	0.0820	0.0670	8	0%	0.0489	0.0343	0.0170	0.0320	0.112
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8	100%	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	0.226	0.441	0.271	0.442	1.19	0.351	1.03	0.233	8	0%	0.523	0.374	0.226	0.396	1.19
Calcium	mg/kg dw	530	233	118	154	121	321	186	131	8	0%	224	141	118	170	530
Cesium	mg/kg dw	0.0416	0.0418	0.0180	0.0326	0.0259	0.0446	0.0482	0.0483	8	0%	0.0376	0.0111	0.0180	0.0417	0.0483
Chromium	mg/kg dw	<0.20	0.300	<0.20	<0.20	0.280	<0.20	0.370	<0.20	8	63%	0.244	0.0473	<0.20	0.200	0.370
Cobalt	mg/kg dw	0.194	0.202	0.182	0.117	0.236	0.149	0.293	0.204	8	0%	0.197	0.0531	0.117	0.198	0.293
Copper	mg/kg dw	16.2	10.9	13.1	8.81	13.9	7.36	24.3	15.7	8	0%	13.8	5.28	10.9	13.5	8.81
Iron	mg/kg dw	258	914	410	483	421	650	947	572	8	0%	582	244	258	528	947
Lead	mg/kg dw	0.0500	<0.050	<0.050	0.0920	<0.050	<0.050	<0.050	<0.050	8	75%	0.0552	0.0297	<0.050	0.0500	0.0920
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	408	811	446	438	532	534	887	454	8	0%	564	183	408	493	887
Manganese	mg/kg dw	3.37	5.26	2.55	2.88	3.40	3.56	6.29	3.35	8	0%	3.83	1.27	2.55	3.38	6.29
Mercury	mg/kg dw	0.156	0.469	0.153	0.178	0.317	0.184	0.572	0.232	8	0%	0.283	0.158	0.153	0.208	0.572
	mg/kg ww	0.0672	0.149	0.0673	0.0730	0.120	0.0654	0.159	0.0815	8	0%	0.0978	0.0390	0.0654	0.0772	0.159
Molybdenum	mg/kg dw	0.406	0.686	0.410	0.406	0.715	0.545	0.858	0.492	8	0%	0.565	0.170	0.406	0.518	0.858
Nickel	mg/kg dw	<0.20	<0.20	<0.20	0.340	<0.20	<0.20	0.230	<0.20	8	75%	0.221	0.0778	<0.20	0.200	0.340
Phosphorus	mg/kg dw	6,470	12,500	6,940	6,750	9,360	9,050	14,100	8,560	8	0%	9,216	2,775	12,500	8,805	9,360
Potassium	mg/kg dw	4,880	10,100	5,060	6,000	7,090	7,360	11,300	7,260	8	0%	7,381	2,280	10,100	7,175	7,360
Rubidium	mg/kg dw	6.60	12.4	6.85	6.51	11.5	12.6	16.4	12.3	8	0%	10.6	3.61	11.5	11.9	6.85
Selenium	mg/kg dw	4.65	7.45	6.06	8.83	6.01	4.41	8.79	5.79	8	0%	6.50	1.70	4.41	6.04	8.83
Silver	mg/kg dw	0.0928	0.0252	0.0524	0.0248	0.0372	0.0227	0.130	0.0632	8	0%	0.0560	0.0383	0.0227	0.0448	0.130
Sodium	mg/kg dw	2,160	3,790	1,920	2,210	2,450	2,400	3,720	2,070	8	0%	2,590	739	1,920	2,305	3,790
Strontium	mg/kg dw	1.79	0.660	0.320	0.500	0.310	0.960	0.500	0.290	8	0%	0.666	0.506	0.290	0.500	1.79
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0138	0.0151	0.0128	0.0153	0.0165	0.0210	0.0264	0.0233	8	0%	0.0180	0.00493	0.0128	0.0159	0.0264
Tin	mg/kg dw	<0.10	1.06	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	88%	0.220	-	<0.10	0.100	1.06
Titanium	mg/kg dw	1.48	<0.5	<0.5	0.750	<0.5	<0.5	<0.5	0.520	8	63%	0.656	0.501	<0.50	0.500	1.48
Uranium	mg/kg dw	0.00550	0.0781	0.0104	0.0260	0.0511	0.0199	0.0217	0.00500	8	0%	0.0272	0.0253	0.00500	0.0208	0.0781
Vanadium	mg/kg dw	0.100	0.430	0.180	0.340	0.310	<0.10	0.420	<0.10	8	25%	0.248	0.132	<0.10	0.245	0.430
Zinc	mg/kg dw	57.5	79.6	58.2	54.6	70.7	68.4	92.7	74.7	8	0%	69.5	12.9	54.6	69.5	92.7
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.10: Peamouth Chub Tissue Chemistry Data for Quesnel Lake near Grain Creek (QUL-NGC; Reference), October 2022 [a]

Analyte	Units	Quesnel Lake near Grain Creek (QUL-NGC)														
		Kidney														
		QUL-NGC-PCC-1	QUL-NGC-PCC-2	QUL-NGC-PCC-3	QUL-NGC-PCC-4	QUL-NGC-PCC-5	QUL-NGC-PCC-6	QUL-NGC-PCC-7	QUL-NGC-PCC-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	60.0	66.9	64.7	60.2	56.0	69.6	60.8	70.6	8	0%	63.6	5.17	56.0	62.8	70.6
Aluminum	mg/kg dw	8.30	<5.0	<5.0	<5.0	6.00	5.20	<5.0	5.10	8	50%	5.58	1.49	<5.0	5.05	8.30
Antimony	mg/kg dw	<0.026	<0.010	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.010	-	<0.010	<0.010	<0.026
Arsenic	mg/kg dw	0.201	0.229	0.357	0.303	0.208	0.638	0.351	0.186	8	0%	0.309	0.149	0.186	0.266	0.638
Barium	mg/kg dw	1.42	0.805	1.41	1.08	0.899	1.21	0.927	1.02	8	0%	1.10	0.231	0.805	1.05	1.42
Beryllium	mg/kg dw	<0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.013
Bismuth	mg/kg dw	0.0290	0.0330	0.0220	0.0150	0.0250	0.0320	0.0590	0.0550	8	0%	0.0338	0.0155	0.0150	0.0305	0.0590
Boron	mg/kg dw	2.90	<1.0	<1.0	<1.0	1.90	1.20	<1.0	1.20	8	50%	1.40	0.804	<1.0	1.10	2.90
Cadmium	mg/kg dw	2.84	4.29	9.26	3.63	6.82	4.56	6.21	2.97	8	0%	5.07	2.21	2.84	4.42	9.26
Calcium	mg/kg dw	290	412	290	225	275	404	269	627	8	0%	349	130	225	290	627
Cesium	mg/kg dw	0.0678	0.0473	0.0480	0.0362	0.0436	0.0698	0.0443	0.0972	8	0%	0.0568	0.0202	0.0362	0.0476	0.0972
Chromium	mg/kg dw	0.260	<0.20	0.220	<0.20	0.260	0.220	0.250	0.220	8	25%	0.229	0.0204	<0.20	0.220	0.260
Cobalt	mg/kg dw	3.55	1.25	1.86	0.754	1.36	1.42	1.49	2.98	8	0%	1.83	0.947	0.754	1.46	3.55
Copper	mg/kg dw	4.35	3.34	4.46	2.70	3.49	4.74	3.70	7.44	8	0%	4.28	1.44	2.70	4.03	7.44
Iron	mg/kg dw	238	390	444	269	262	207	314	265	8	0%	299	80.3	207	267	444
Lead	mg/kg dw	<0.064	<0.050	<0.050	<0.050	<0.050	0.0590	<0.050	0.0590	8	75%	0.0526	0	<0.050	0.0500	0.0590
Lithium	mg/kg dw	<0.64	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.64
Magnesium	mg/kg dw	478	422	459	352	407	519	342	624	8	0%	450	92.4	342	440	624
Manganese	mg/kg dw	3.33	1.95	2.56	1.53	2.43	4.84	1.73	5.92	8	0%	3.04	1.58	1.53	2.50	5.92
Mercury	mg/kg dw	0.157	0.162	0.170	0.0780	0.191	0.215	0.279	0.207	8	0%	0.182	0.0576	0.0780	0.180	0.279
	mg/kg ww	0.0630	0.0538	0.0599	0.0311	0.0839	0.0654	0.109	0.0609	8	0%	0.0659	0.0227	0.0311	0.0620	0.109
Molybdenum	mg/kg dw	0.407	0.266	0.391	0.234	0.337	0.488	0.500	0.395	8	0%	0.377	0.0950	0.234	0.393	0.500
Nickel	mg/kg dw	<0.80	0.530	<0.90	0.370	<1.6	<1.3	<1.0	<0.60	8	75%	0.450	0.113	<0.6	0.450	0.530
Phosphorus	mg/kg dw	8,710	7,420	8,960	6,530	7,400	10,000	6,930	11,900	8	0%	8,481	1,804	10,000	8,065	8,960
Potassium	mg/kg dw	7,800	7,050	8,180	6,540	7,220	9,150	6,160	10,800	8	0%	7,862	1,517	10,800	7,510	9,150
Rubidium	mg/kg dw	10.4	9.79	12.6	8.11	12.5	16.3	9.61	19.6	8	0%	12.4	3.86	10.4	11.4	9.79
Selenium	mg/kg dw	4.06	4.41	6.29	4.86	3.36	4.21	4.33	5.30	8	0%	4.60	0.887	3.36	4.37	6.29
Silver	mg/kg dw	<0.0064	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	8	88%	0.00500	-	<0.0050	0.00500	0.00500
Sodium	mg/kg dw	2,360	3,560	3,650	2,530	3,290	4,040	2,910	4,100	8	0%	3,305	655	2,360	3,425	4,100
Strontium	mg/kg dw	0.640	1.08	0.640	0.490	0.730	1.03	0.600	1.54	8	0%	0.844	0.350	0.490	0.685	1.54
Tellurium	mg/kg dw	<0.026	<0.020	0.0250	<0.020	<0.020	0.0350	0.0400	0.0240	8	50%	0.0257	0.00779	<0.020	0.0240	0.0400
Thallium	mg/kg dw	0.0496	0.0118	0.0237	0.0136	0.0218	0.0334	0.0268	0.0472	8	0%	0.0285	0.0141	0.0118	0.0253	0.0496
Tin	mg/kg dw	<0.13	0.130	<0.10	<0.10	1.49	<0.10	<0.10	<0.10	8	75%	0.278	0.962	<0.10	0.100	1.49
Titanium	mg/kg dw	0.960	<0.5	<0.5	0.560	0.630	0.710	0.650	0.910	8	25%	0.678	0.162	<0.50	0.640	0.960
Uranium	mg/kg dw	0.0149	0.0514	0.0274	0.0108	0.0677	0.0423	0.0303	0.0120	8	0%	0.0321	0.0204	0.0108	0.0288	0.0677
Vanadium	mg/kg dw	0.210	0.170	0.280	0.150	0.260	0.170	0.280	0.190	8	0%	0.214	0.0526	0.150	0.200	0.280
Zinc	mg/kg dw	164	87.0	113	86.9	103	182	103	172	8	0%	126	39.6	103	108	87.0
Zirconium	mg/kg dw	<0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.26

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.11: Rainbow Trout Tissue Chemistry Data for Quesnel River (QUR; Exposed), October 2022[a]

Analyte	Units	Quesnel River (QUR)														
		Muscle														
		QUR-RB-1	QUR-RB-2	QUR-RB-3	QUR-RB-4	QUR-RB-5	QUR-RB-6	QUR-RB-7	QUR-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	75.8	75.6	76.9	77.5	78.1	75.7	79.5	78.3	8	0%	77.2	1.43	75.6	77.2	79.5
Aluminum	mg/kg dw	6.10	2.20	5.40	3.90	3.40	<2.0	2.50	2.10	8	13%	3.45	1.58	<2.0	2.95	6.10
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Arsenic	mg/kg dw	1.08	0.0540	0.240	2.20	5.27	0.136	0.175	0.142	8	0%	1.16	1.82	0.0540	0.208	5.27
Barium	mg/kg dw	0.280	0.640	0.500	0.593	0.820	0.462	0.544	0.438	8	0%	0.535	0.159	0.280	0.522	0.820
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	1.00	<1.0	<1.0	<1.0	<1.0	<1.0	8	88%	1.00	-	<1.0	1.00	1.00
Cadmium	mg/kg dw	<0.0050	<0.0050	<0.0050	0.00570	<0.0050	<0.0050	<0.0050	0.00680	8	75%	0.00531	0.000778	<0.0050	0.00500	0.00680
Calcium	mg/kg dw	660	1,620	1,880	2,090	644	1,070	1,190	1,530	8	0%	1,336	536	1,070	1,360	660
Cesium	mg/kg dw	0.0538	0.0875	0.0956	0.0359	0.117	0.0882	0.155	0.113	8	0%	0.0932	0.0372	0.0359	0.0919	0.155
Chromium	mg/kg dw	0.0890	0.189	0.184	0.0920	0.110	0.0930	0.0860	0.188	8	0%	0.129	0.0487	0.0860	0.102	0.189
Cobalt	mg/kg dw	0.0820	0.0450	0.0520	0.0400	0.0770	0.0700	0.0390	0.0500	8	0%	0.0569	0.0170	0.0390	0.0510	0.0820
Copper	mg/kg dw	1.06	0.980	1.71	1.00	1.59	1.77	0.850	1.23	8	0%	1.27	0.364	0.850	1.14	1.77
Iron	mg/kg dw	25.4	17.4	25.2	18.7	23.5	18.3	19.7	13.3	8	0%	20.2	4.22	13.3	19.2	25.4
Lead	mg/kg dw	<0.020	<0.020	<0.020	0.0330	<0.020	<0.020	0.0320	<0.020	8	75%	0.0231	0.000707	<0.020	0.0200	0.0330
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,360	1,560	1,590	1,580	1,520	1,820	1,620	1,710	8	0%	1,595	135	1,360	1,585	1,820
Manganese	mg/kg dw	0.590	0.951	1.20	0.979	0.648	0.907	0.569	0.963	8	0%	0.851	0.224	0.569	0.929	1.20
Mercury	mg/kg dw	0.248	0.248	0.161	0.130	0.583	0.192	0.477	0.114	8	0%	0.269	0.171	0.114	0.220	0.583
	mg/kg ww	0.0599	0.0603	0.0371	0.0292	0.128	0.0467	0.0980	0.0248	8	0%	0.0605	0.0358	0.0248	0.0533	0.128
Molybdenum	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Phosphorus	mg/kg dw	12,600	13,400	15,500	14,300	14,000	14,200	15,100	15,000	8	0%	14,262	953	12,600	14,250	15,500
Potassium	mg/kg dw	20,900	22,000	26,000	25,800	25,000	23,400	27,400	24,500	8	0%	24,375	2,168	20,900	24,750	27,400
Rubidium	mg/kg dw	12.8	24.8	27.4	13.9	26.4	24.4	32.8	33.4	8	0%	24.5	7.65	12.8	25.6	33.4
Selenium	mg/kg dw	3.58	2.10	2.61	5.72	2.83	2.08	2.71	2.33	8	0%	3.00	1.20	2.08	2.66	5.72
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	8	100%	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	1,500	1,340	1,900	1,320	1,700	1,420	1,550	1,440	8	0%	1,521	195	1,320	1,470	1,900
Strontium	mg/kg dw	0.690	2.51	2.58	2.25	0.744	1.44	1.34	1.99	8	0%	1.69	0.751	0.690	1.72	2.58
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	8	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0150	0.0243	0.0214	0.0190	0.0276	0.0232	0.0400	0.0190	8	0%	0.0237	0.00762	0.0150	0.0223	0.0400
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	<0.25	<0.25	0.510	0.350	<0.25	<0.25	<0.25	<0.25	8	75%	0.295	0.113	<0.25	0.250	0.510
Uranium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	8	100%	<0.0020	-	<0.0020	<0.0020	<0.0020
Vanadium	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Zinc	mg/kg dw	16.1	16.3	21.0	15.9	16.0	18.8	16.8	19.8	8	0%	17.6	2.00	15.9	16.6	21.0
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	0.380	0.520	<0.20	8	75%	0.262	0.0990	<0.20	0.200	0.520

Value exceeds Se Guideline for Aquatic Life, fish muscle or whole body tissue (4 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, high consumption (7.3 mg/kg dw; BCMOE 2014).
Value exceeds Se Guideline for Human Health, general population, moderate consumption (14.5 mg/kg dw; BCMOE 2014).
Value exceeds Hg Guideline for Human Health (0.5 mg/kg ww; CFIA 2015).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.11: Rainbow Trout Tissue Chemistry Data for Quesnel River (QUR; Exposed), October 2022[a]

Analyte	Units	Quesnel River (QUR)											
		Ovary											
		QUR-RB-1	QUR-RB-2	QUR-RB-4	QUR-RB-5	QUR-RB-6	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	81.6	78.1	83.0	72.7	84.0	5	0%	79.9	4.59	72.7	81.6	84.0
Aluminum	mg/kg dw	20.6	14.3	10.4	12.7	23.4	5	0%	16.3	5.49	10.4	14.3	23.4
Antimony	mg/kg dw	<0.010	<0.020	0.0150	<0.010	<0.020	5	80%	0.0117	-	<0.010	0.0150	0.0150
Arsenic	mg/kg dw	0.271	0.106	0.182	0.350	0.301	5	0%	0.242	0.0976	0.106	0.271	0.350
Barium	mg/kg dw	1.37	1.25	0.374	0.704	3.63	5	0%	1.47	1.28	0.374	1.25	3.63
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	5	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	5	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	3.10	3.20	<1.0	1.20	10.4	5	20%	3.78	4.06	<1.0	3.10	3.20
Cadmium	mg/kg dw	0.0390	0.0260	<0.0050	0.0400	0.0940	5	20%	0.0408	0.0302	<0.0050	0.0390	0.0940
Calcium	mg/kg dw	389	455	194	845	680	5	0%	513	254	194	455	845
Cesium	mg/kg dw	0.0440	0.0974	0.0301	0.0519	0.0920	5	0%	0.0631	0.0300	0.0301	0.0519	0.0974
Chromium	mg/kg dw	0.550	0.410	0.195	<0.20	0.510	5	20%	0.372	0.159	<0.20	0.410	0.550
Cobalt	mg/kg dw	0.724	0.384	0.227	0.732	0.591	5	0%	0.532	0.221	0.227	0.591	0.732
Copper	mg/kg dw	12.2	14.9	1.68	45.3	29.1	5	0%	20.6	16.9	1.68	14.9	45.3
Iron	mg/kg dw	479	290	45.3	335	297	5	0%	289	156	290	297	479
Lead	mg/kg dw	0.0740	0.0530	<0.020	<0.050	<0.050	5	60%	0.0374	0.0148	<0.020	0.0500	0.0740
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.50	5	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	928	1,160	1,530	1,220	1,290	5	0%	1,226	218	1,160	1,220	928
Manganese	mg/kg dw	5.68	16.6	2.10	19.1	25.9	5	0%	13.9	9.81	16.6	16.6	5.68
Mercury	mg/kg dw	0.101	0.114	0.0256	0.0869	0.142	5	0%	0.0939	0.0432	0.0256	0.101	0.142
	mg/kg ww	0.0187	0.0249	0.00430	0.0237	0.0227	5	0%	0.0189	0.00847	0.00430	0.0227	0.0249
Molybdenum	mg/kg dw	0.0590	0.0680	0.0240	0.0430	0.0750	5	0%	0.0538	0.0205	0.0240	0.0590	0.0750
Nickel	mg/kg dw	0.210	0.360	<0.20	<0.20	0.620	5	40%	0.318	0.207	<0.20	0.210	0.620
Phosphorus	mg/kg dw	16,000	18,200	31,600	9,860	17,100	5	0%	18,552	7,977	16,000	17,100	9,860
Potassium	mg/kg dw	21,300	24,400	31,200	8,480	24,300	5	0%	21,936	8,351	21,300	24,300	8,480
Rubidium	mg/kg dw	16.9	37.2	20.9	11.3	34.5	5	0%	24.2	11.2	11.3	20.9	37.2
Selenium	mg/kg dw	11.2	12.4	2.70	14.7	16.5	5	0%	11.5	5.33	11.2	12.4	2.70
Silver	mg/kg dw	0.0209	0.0269	<0.0050	0.120	0.0388	5	20%	0.0423	0.0462	<0.0050	0.0269	0.120
Sodium	mg/kg dw	5,100	4,330	4,120	5,490	5,570	5	0%	4,922	665	4,120	5,100	5,570
Strontium	mg/kg dw	0.890	0.970	0.345	2.13	1.09	5	0%	1.08	0.650	0.345	0.970	2.13
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	5	100%	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0132	0.0293	0.0632	0.0114	0.0177	5	0%	0.0270	0.0214	0.0114	0.0177	0.0632
Tin	mg/kg dw	<0.10	0.170	<0.10	<0.10	0.220	5	60%	0.138	0.0354	<0.10	0.100	0.220
Titanium	mg/kg dw	1.26	1.18	0.660	<0.5	1.92	5	20%	1.10	0.517	<0.50	1.18	1.92
Uranium	mg/kg dw	0.00240	0.00340	<0.0020	0.0123	0.00780	5	20%	0.00558	0.00454	<0.0020	0.00340	0.0123
Vanadium	mg/kg dw	0.160	<0.10	<0.10	0.150	0.130	5	40%	0.128	0.0153	<0.10	0.130	0.160
Zinc	mg/kg dw	268	368	65.3	168	348	5	0%	243	127	168	268	65.3
Zirconium	mg/kg dw	1.09	1.04	0.310	0.230	1.26	5	0%	0.786	0.479	0.230	1.04	1.26

Value exceeds Se Guideline for Aquatic Life, fish ovary tissue (11 mg/kg dw; BCMOE 2014).
Value exceeds Se Threshold for Effects, fish ovary tissue (20 mg/kg dw; DeForest et al 2012).

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.
[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.11: Rainbow Trout Tissue Chemistry Data for Quesnel River (QUR; Exposed), October 2022[a]

Analyte	Units	Quesnel River (QUR)														
		Liver														
		QUR-RB-1	QUR-RB-2	QUR-RB-3	QUR-RB-4	QUR-RB-5	QUR-RB-6	QUR-RB-7	QUR-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	71.6	68.4	74.8	73.8	69.7	68.7	74.5	68.9	8	0%	71.3	2.73	68.4	70.7	74.8
Aluminum	mg/kg dw	7.20	6.60	<5.0	6.70	50.2	<5.0	8.00	<5.0	8	38%	11.7	19.3	<5.0	6.65	8.00
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	0.0550	<0.010	<0.010	<0.010	8	88%	0.0156	-	<0.010	0.0100	0.0550
Arsenic	mg/kg dw	0.395	0.189	0.309	0.350	1.01	0.365	0.242	0.382	8	0%	0.405	0.255	0.189	0.358	1.01
Barium	mg/kg dw	0.547	0.671	0.968	0.520	0.690	0.389	0.481	0.525	8	0%	0.599	0.178	0.389	0.536	0.968
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	1.20	1.80	2.30	1.00	1.00	<1.0	<1.0	1.70	8	25%	1.38	0.522	<1.0	1.10	2.30
Cadmium	mg/kg dw	0.658	0.510	0.361	1.48	1.82	0.309	0.655	0.210	8	0%	0.750	0.584	0.210	0.582	1.82
Calcium	mg/kg dw	173	190	201	170	247	168	152	173	8	0%	184	29.3	152	173	247
Cesium	mg/kg dw	0.0164	0.0229	0.0462	0.0109	0.0631	0.0336	0.0217	0.0531	8	0%	0.0335	0.0188	0.0109	0.0282	0.0631
Chromium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	8	100%	<0.20	-	<0.20	<0.20	<0.20
Cobalt	mg/kg dw	0.340	0.160	0.127	0.180	0.264	0.210	0.113	0.110	8	0%	0.188	0.0807	0.110	0.170	0.340
Copper	mg/kg dw	91.8	56.9	135	143	46.8	266	26.7	61.9	8	0%	104	77.6	135	76.8	91.8
Iron	mg/kg dw	1,440	982	374	750	2,960	476	1,070	245	8	0%	1,037	872	1,070	866	982
Lead	mg/kg dw	<0.050	<0.050	<0.050	<0.050	0.0820	<0.050	<0.050	<0.050	8	88%	0.0540	-	<0.050	0.0500	0.0820
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	582	639	662	642	776	556	617	596	8	0%	634	67.1	556	628	776
Manganese	mg/kg dw	4.83	6.41	6.78	5.91	11.9	5.93	6.27	6.51	8	0%	6.82	2.14	11.9	6.34	6.78
Mercury	mg/kg dw	0.184	0.204	0.101	0.125	0.251	0.124	0.237	0.0414	8	0%	0.158	0.0725	0.0414	0.154	0.251
	mg/kg ww	0.0524	0.0645	0.0254	0.0327	0.0760	0.0386	0.0604	0.0129	8	0%	0.0454	0.0215	0.0129	0.0455	0.0760
Molybdenum	mg/kg dw	0.894	1.00	0.785	1.18	1.40	0.817	0.768	0.480	8	0%	0.916	0.280	0.480	0.856	1.40
Nickel	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.230	8	88%	0.204	-	<0.20	0.200	0.230
Phosphorus	mg/kg dw	12,500	13,900	13,900	14,000	17,300	12,400	12,800	14,200	8	0%	13,875	1,562	12,400	13,900	17,300
Potassium	mg/kg dw	9,810	11,100	11,600	13,400	14,100	9,610	11,500	10,600	8	0%	11,465	1,593	10,600	11,300	9,810
Rubidium	mg/kg dw	6.84	15.6	16.8	8.28	18.3	11.0	14.5	17.1	8	0%	13.6	4.31	11.0	15.0	8.28
Selenium	mg/kg dw	34.9	20.2	37.6	63.3	17.0	60.0	12.6	18.6	8	0%	33.0	19.7	12.6	27.6	63.3
Silver	mg/kg dw	2.37	1.32	1.97	3.70	2.35	2.69	0.768	0.822	8	0%	2.00	1.00	0.768	2.16	3.70
Sodium	mg/kg dw	4,000	3,920	3,430	3,430	3,650	3,820	4,230	2,830	8	0%	3,664	436	2,830	3,735	4,230
Strontium	mg/kg dw	0.430	0.400	0.410	0.260	0.380	0.330	0.230	0.280	8	0%	0.340	0.0760	0.230	0.355	0.430
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	0.0220	<0.020	<0.020	<0.020	<0.020	8	88%	0.0202	-	<0.020	0.0200	0.0220
Thallium	mg/kg dw	0.0504	0.0801	0.108	0.128	0.143	0.101	0.0835	0.118	8	0%	0.102	0.0296	0.0504	0.104	0.143
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8	100%	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Uranium	mg/kg dw	0.00560	0.00360	<0.0020	0.00320	0.0740	0.00260	0.00570	<0.0020	8	25%	0.0123	0.0285	<0.0020	0.00340	0.0740
Vanadium	mg/kg dw	0.160	<0.10	<0.10	0.160	0.670	<0.10	0.120	<0.10	8	50%	0.189	0.262	<0.10	0.110	0.670
Zinc	mg/kg dw	85.4	100	93.5	88.8	105	96.0	96.9	70.1	8	0%	92	10.7	100	94.8	96.9
Zirconium	mg/kg dw	<0.20	0.290	0.440	0.700	0.680	<0.20	0.240	0.960	8	25%	0.464	0.277	<0.20	0.365	0.960

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

[a] All summary statistics are reported to three significant digits for display purposes. All summary statistics were calculated using the Kaplan-Meier method.

Table C.7.11: Rainbow Trout Tissue Chemistry Data for Quesnel River (QUR; Exposed), October 2022[a]

Analyte	Units	Quesnel River (QUR)														
		Kidney														
		QUR-RB-1	QUR-RB-2	QUR-RB-3	QUR-RB-4	QUR-RB-5	QUR-RB-6	QUR-RB-7	QUR-RB-8	n	% < LRL	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	%	77.0	74.4	74.6	80.3	78.4	75.1	79.4	75.8	8	0%	76.9	2.27	74.4	76.4	80.3
Aluminum	mg/kg dw	7.70	5.80	<5.0	32.3	19.2	<5.0	7.80	10.4	8	25%	11.6	10.2	<5.0	7.75	7.80
Antimony	mg/kg dw	<0.010	<0.010	<0.010	<0.010	0.0220	<0.010	<0.010	<0.010	8	88%	0.0115	-	<0.010	0.0100	0.0220
Arsenic	mg/kg dw	0.783	0.324	0.364	0.517	3.25	0.500	0.918	0.362	8	0%	0.877	0.982	0.324	0.508	3.25
Barium	mg/kg dw	1.02	1.49	1.08	1.20	1.62	1.47	2.94	1.14	8	0%	1.50	0.623	1.02	1.34	2.94
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8	100%	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	1.40	1.70	1.50	1.70	2.00	1.10	1.60	8	13%	1.50	0.281	<1.0	1.55	2.00
Cadmium	mg/kg dw	1.46	0.596	0.526	2.53	3.32	0.644	1.45	0.473	8	0%	1.37	1.06	0.473	1.05	3.32
Calcium	mg/kg dw	524	997	728	521	1,330	515	1,110	865	8	0%	824	306	1,110	796	997
Cesium	mg/kg dw	0.0280	0.0377	0.0493	0.0237	0.0773	0.0380	0.0606	0.0618	8	0%	0.0470	0.0185	0.0237	0.0436	0.0773
Chromium	mg/kg dw	0.480	<0.20	<0.20	0.330	0.440	0.320	0.240	<0.20	8	38%	0.301	0.0971	<0.20	0.280	0.480
Cobalt	mg/kg dw	1.67	0.842	0.561	1.45	1.57	1.18	1.71	0.794	8	0%	1.22	0.444	0.561	1.32	1.71
Copper	mg/kg dw	4.07	3.70	5.45	4.50	8.18	7.29	5.83	7.51	8	0%	5.82	1.69	3.70	5.64	8.18
Iron	mg/kg dw	760	770	409	513	956	656	1,070	375	8	0%	689	250	1,070	708	956
Lead	mg/kg dw	0.0520	<0.050	<0.050	0.0870	0.0810	<0.050	<0.050	<0.050	8	63%	0.0588	0.0187	<0.050	0.0500	0.0870
Lithium	mg/kg dw	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8	100%	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	574	564	641	698	806	549	789	663	8	0%	660	99.1	549	652	806
Manganese	mg/kg dw	1.91	2.42	2.67	2.51	3.38	3.15	3.19	5.65	8	0%	3.11	1.13	1.91	2.91	5.65
Mercury	mg/kg dw	0.324	0.345	0.235	0.264	0.708	0.391	0.609	0.147	8	0%	0.378	0.190	0.147	0.334	0.708
	mg/kg ww	0.0746	0.0883	0.0598	0.0521	0.153	0.0973	0.126	0.0355	8	0%	0.0858	0.0392	0.0355	0.0814	0.153
Molybdenum	mg/kg dw	0.234	0.268	0.325	0.237	0.684	0.348	0.461	0.379	8	0%	0.367	0.149	0.234	0.336	0.684
Nickel	mg/kg dw	0.450	0.390	<0.20	0.380	1.56	0.340	0.630	<0.20	8	25%	0.519	0.469	<0.20	0.385	1.56
Phosphorus	mg/kg dw	9,770	10,100	10,100	12,300	11,000	9,990	13,300	11,700	8	0%	11,032	1,288	10,100	10,550	9,990
Potassium	mg/kg dw	11,800	11,400	11,200	14,200	13,800	10,200	15,000	10,900	8	0%	12,312	1,764	10,200	11,600	15,000
Rubidium	mg/kg dw	8.76	14.6	13.8	9.96	16.4	12.0	18.4	16.9	8	0%	13.9	3.41	12.0	14.2	9.96
Selenium	mg/kg dw	10.9	9.21	13.3	9.77	16.2	10.9	20.6	13.6	8	0%	13.1	3.82	10.9	12.1	9.77
Silver	mg/kg dw	0.00530	0.00550	0.00680	0.00890	0.0639	0.0140	0.0118	0.0133	8	0%	0.0162	0.0196	0.00530	0.0104	0.0639
Sodium	mg/kg dw	6,760	4,960	5,340	7,220	8,970	6,260	8,040	5,760	8	0%	6,664	1,371	4,960	6,510	8,970
Strontium	mg/kg dw	1.77	2.15	1.54	1.08	5.43	1.38	2.49	1.76	8	0%	2.20	1.38	1.08	1.76	5.43
Tellurium	mg/kg dw	0.0250	<0.020	<0.020	0.0330	0.0380	<0.020	0.0260	<0.020	8	50%	0.0253	0.00614	<0.020	0.0225	0.0380
Thallium	mg/kg dw	0.0458	0.0533	0.0463	0.0556	0.109	0.0609	0.0931	0.0464	8	0%	0.0638	0.0240	0.0458	0.0544	0.109
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	0.100	<0.10	<0.10	<0.10	8	88%	0.100	-	<0.10	0.100	0.100
Titanium	mg/kg dw	<0.5	<0.5	<0.5	1.82	0.520	<0.5	<0.5	1.96	8	63%	0.850	0.794	<0.50	0.500	1.96
Uranium	mg/kg dw	0.00930	0.00800	0.00300	0.00860	0.0796	0.00490	0.0168	0.00340	8	0%	0.0167	0.0258	0.00300	0.00830	0.0796
Vanadium	mg/kg dw	0.270	<0.10	<0.10	0.310	0.780	<0.10	0.270	0.130	8	38%	0.258	0.249	<0.10	0.200	0.780
Zinc	mg/kg dw	83.4	88.9	113	105	117	103	124	102	8	0%	105	13.7	102	104	88.9
Zirconium	mg/kg dw	<0.20	0.210	<0.20	0.460	0.310	0.550	0.290	0.870	8	25%	0.386	0.241	<0.20	0.300	0.870

Notes: "-" = no data available or standard deviation not calculated. mg/kg = milligrams per kilogram. dw = dry weight. ww = wet weight. LRL = laboratory reporting limit.

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APPENDIX D
DATA - CREEKS

APPENDIX D.1
WATER QUALITY

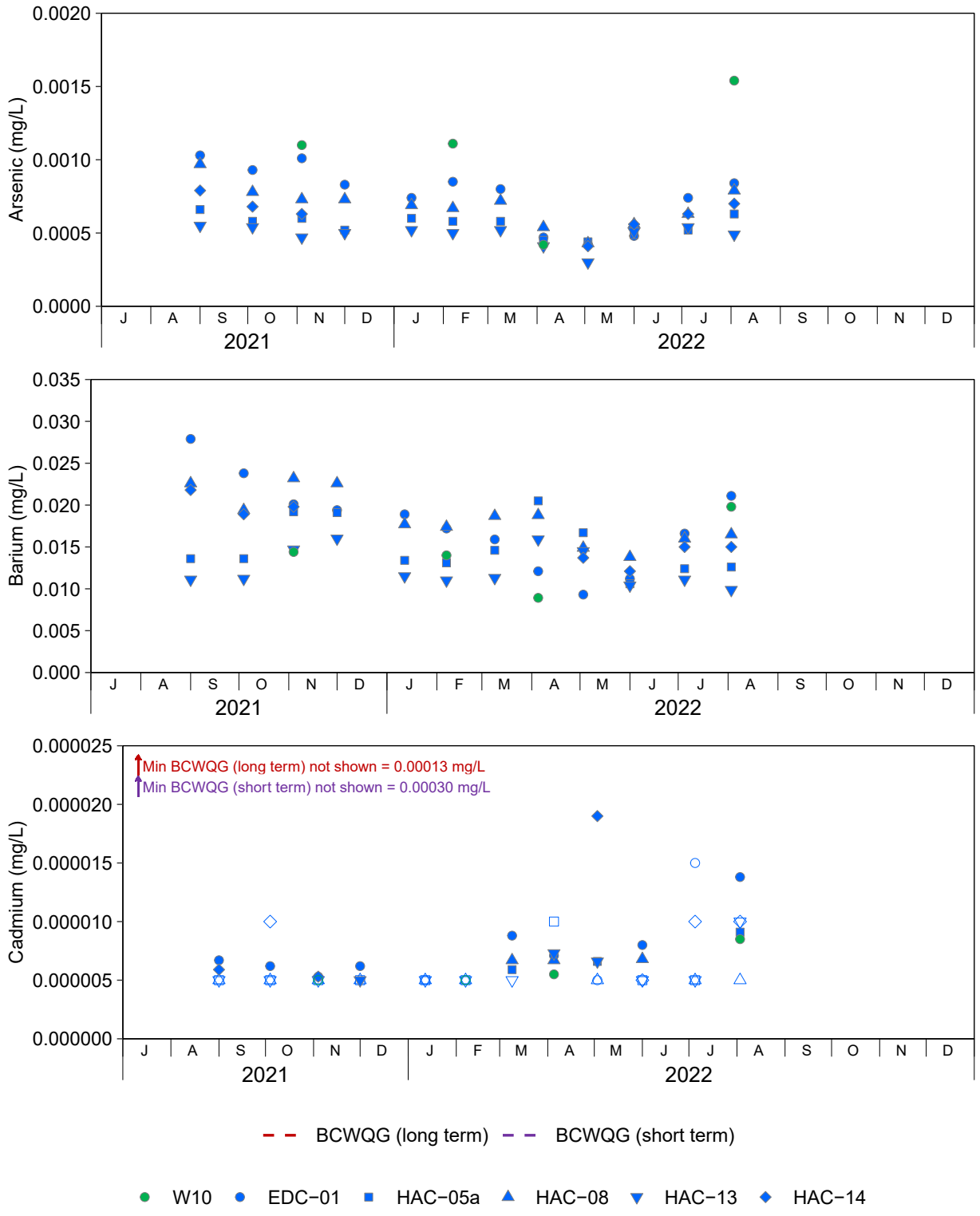

Figure D.1.1: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), September 2021 to August 2022

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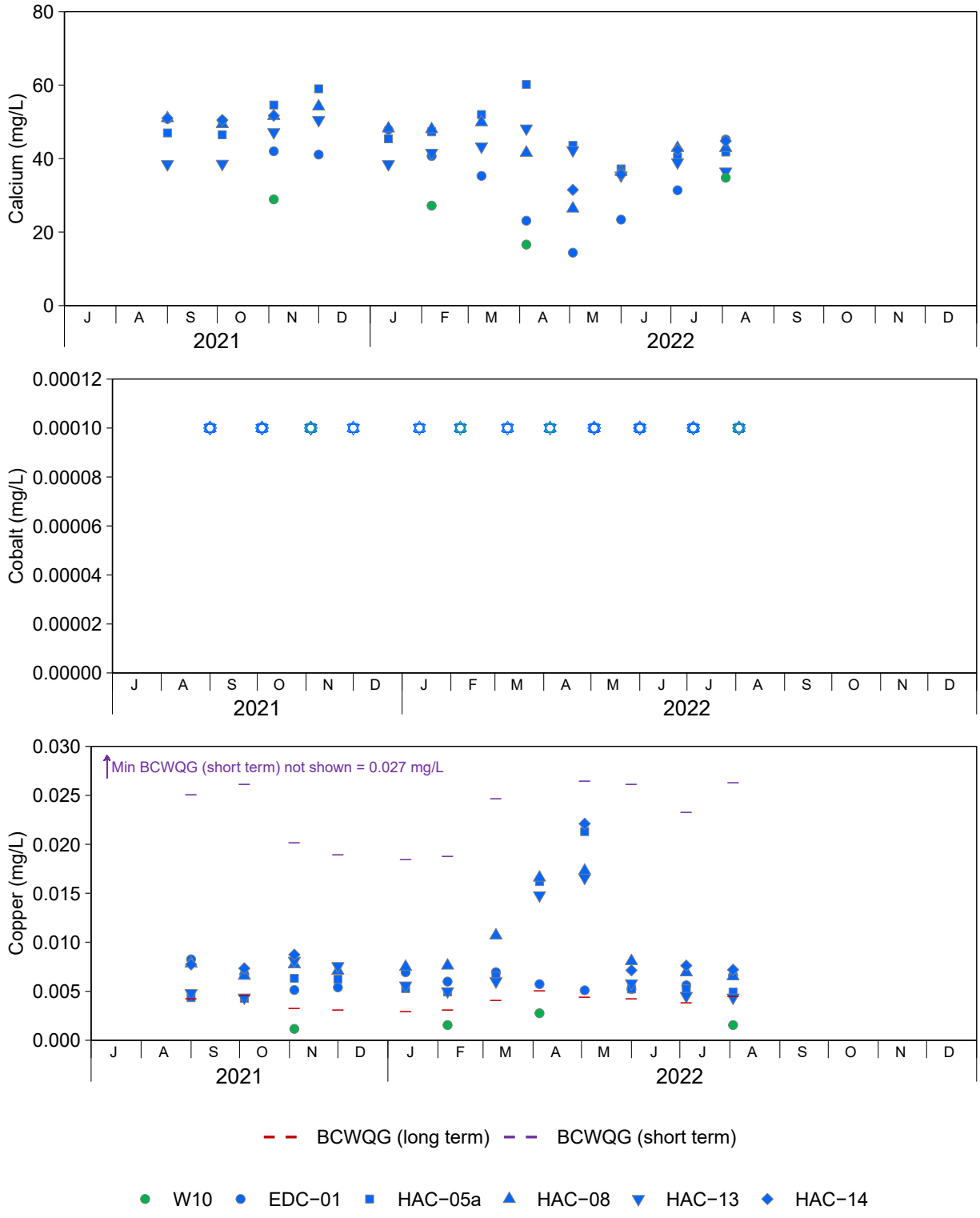

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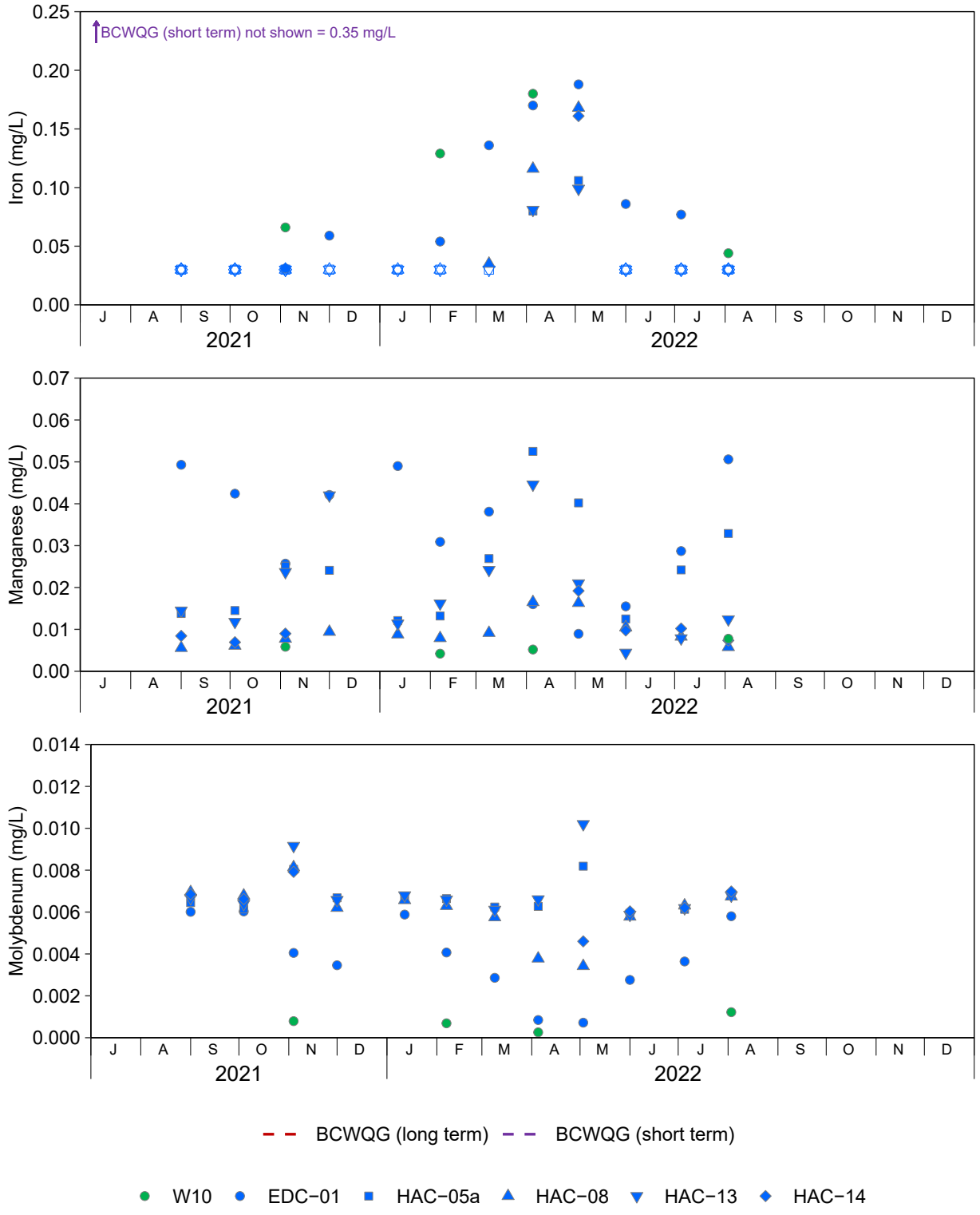

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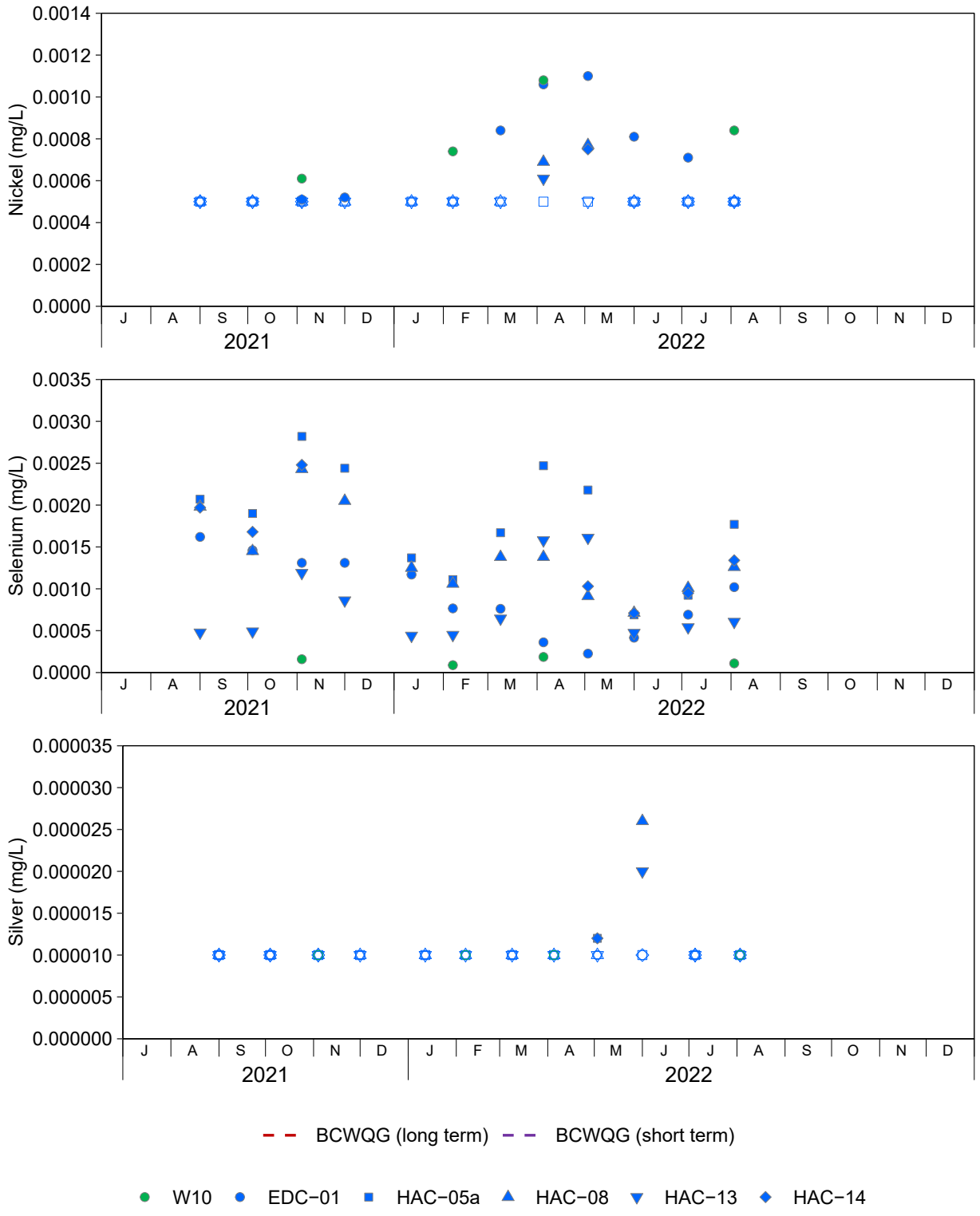

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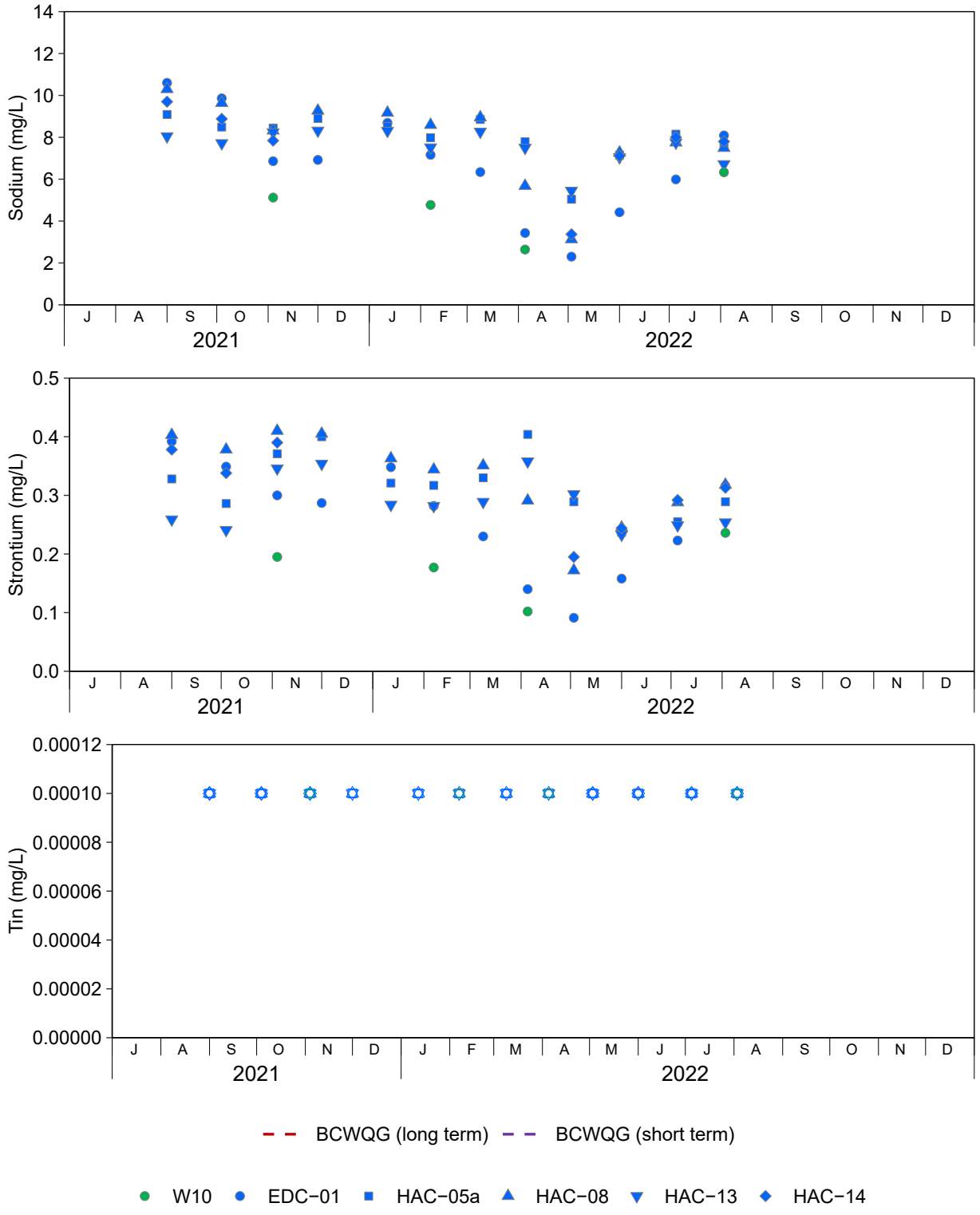

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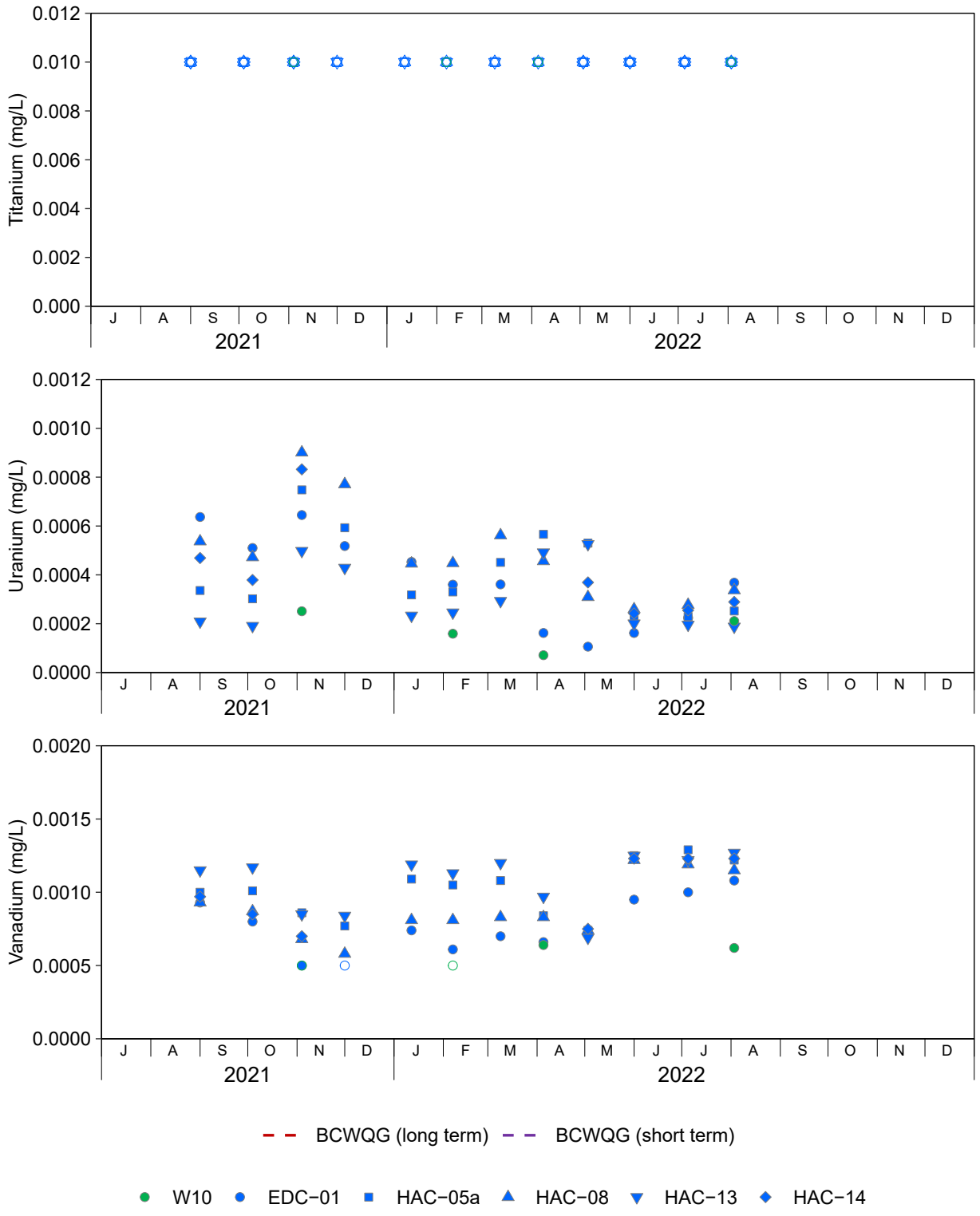

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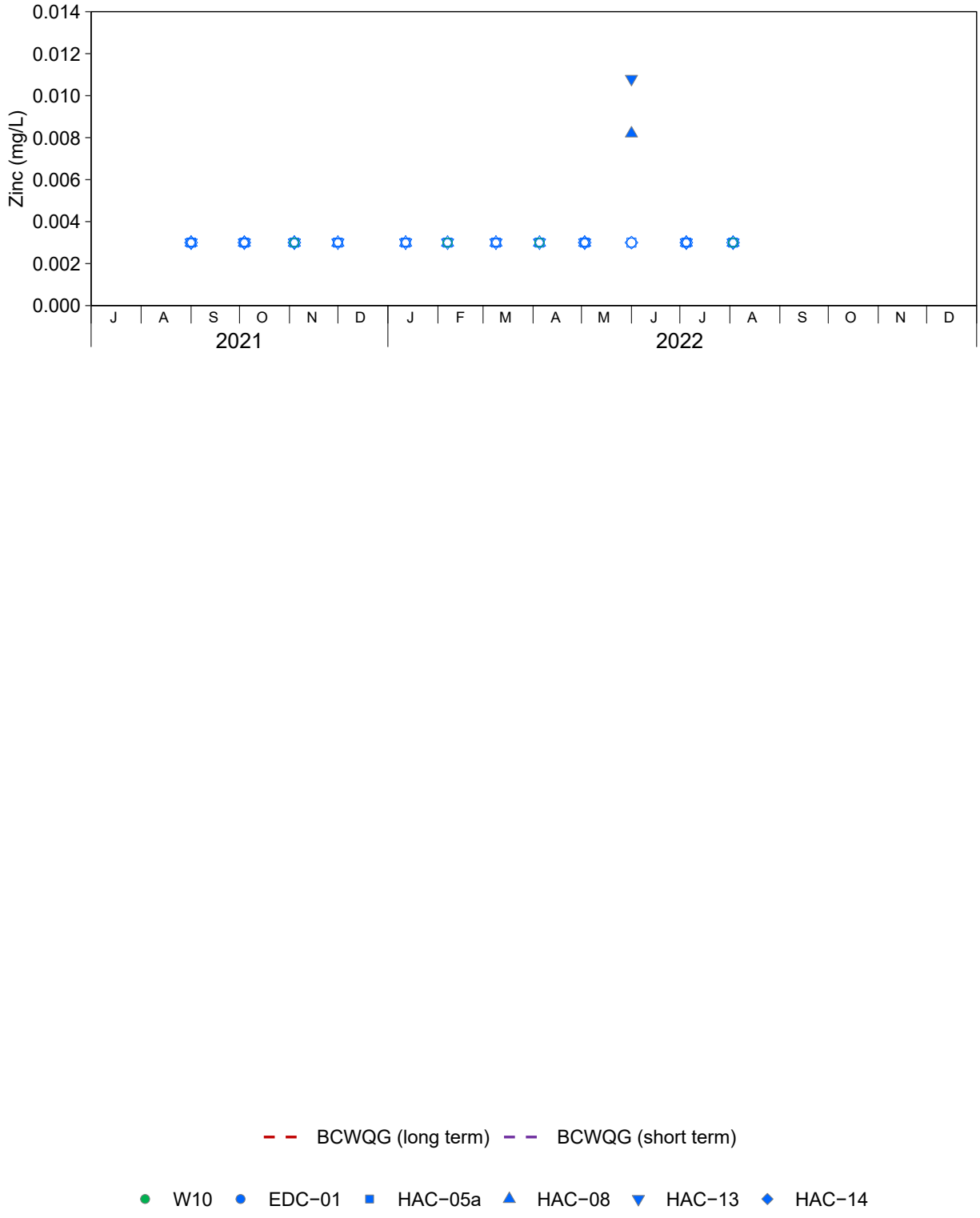

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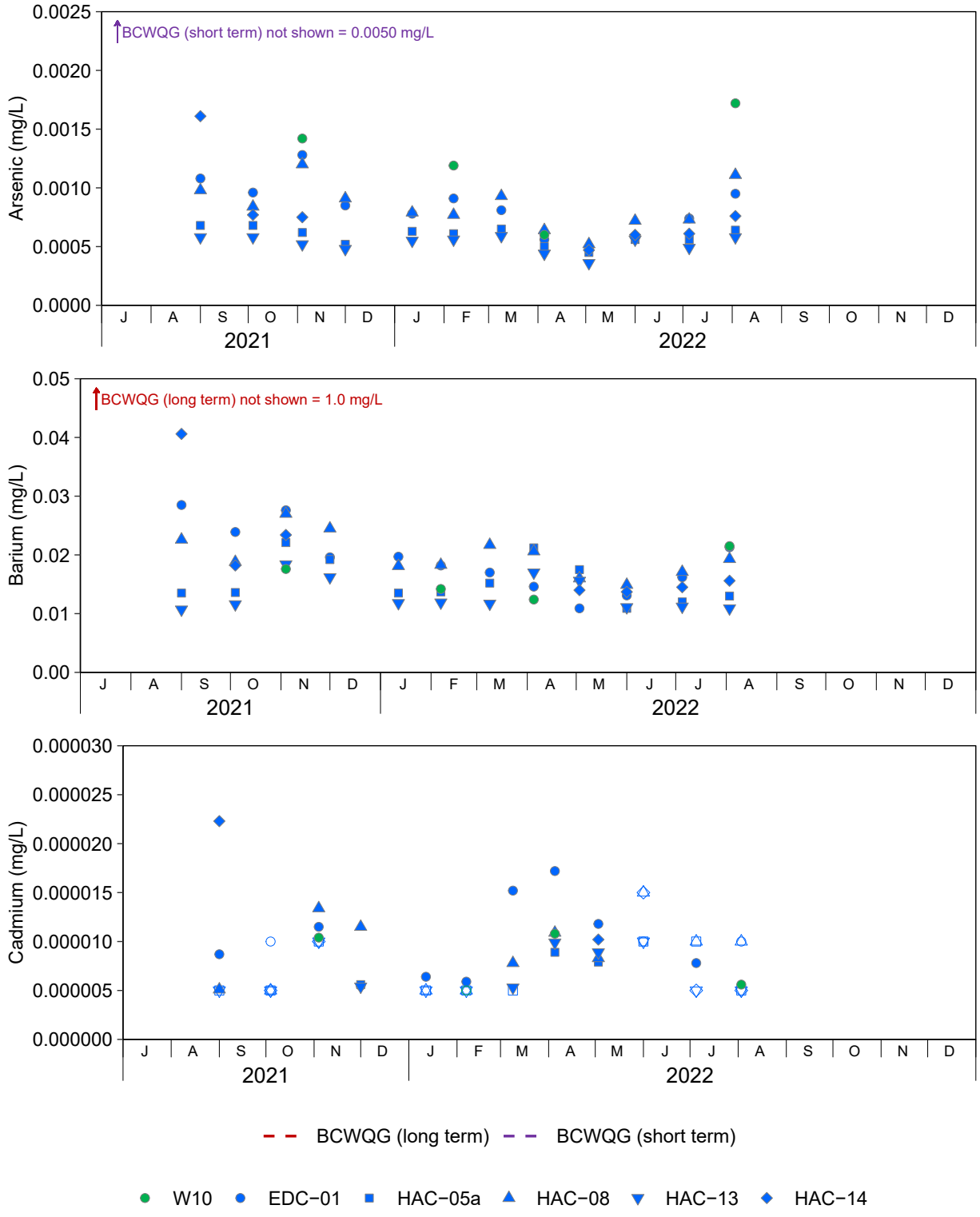

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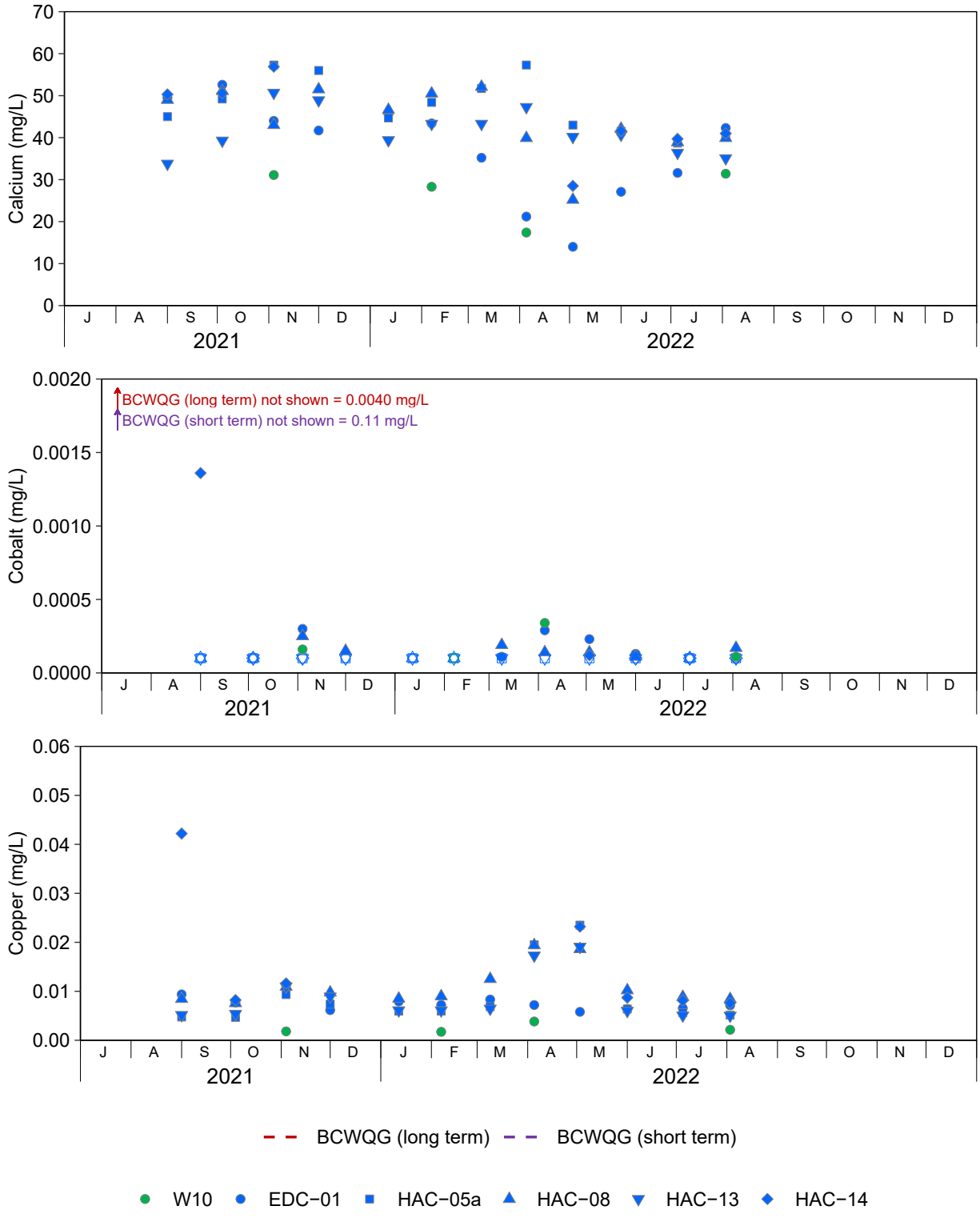

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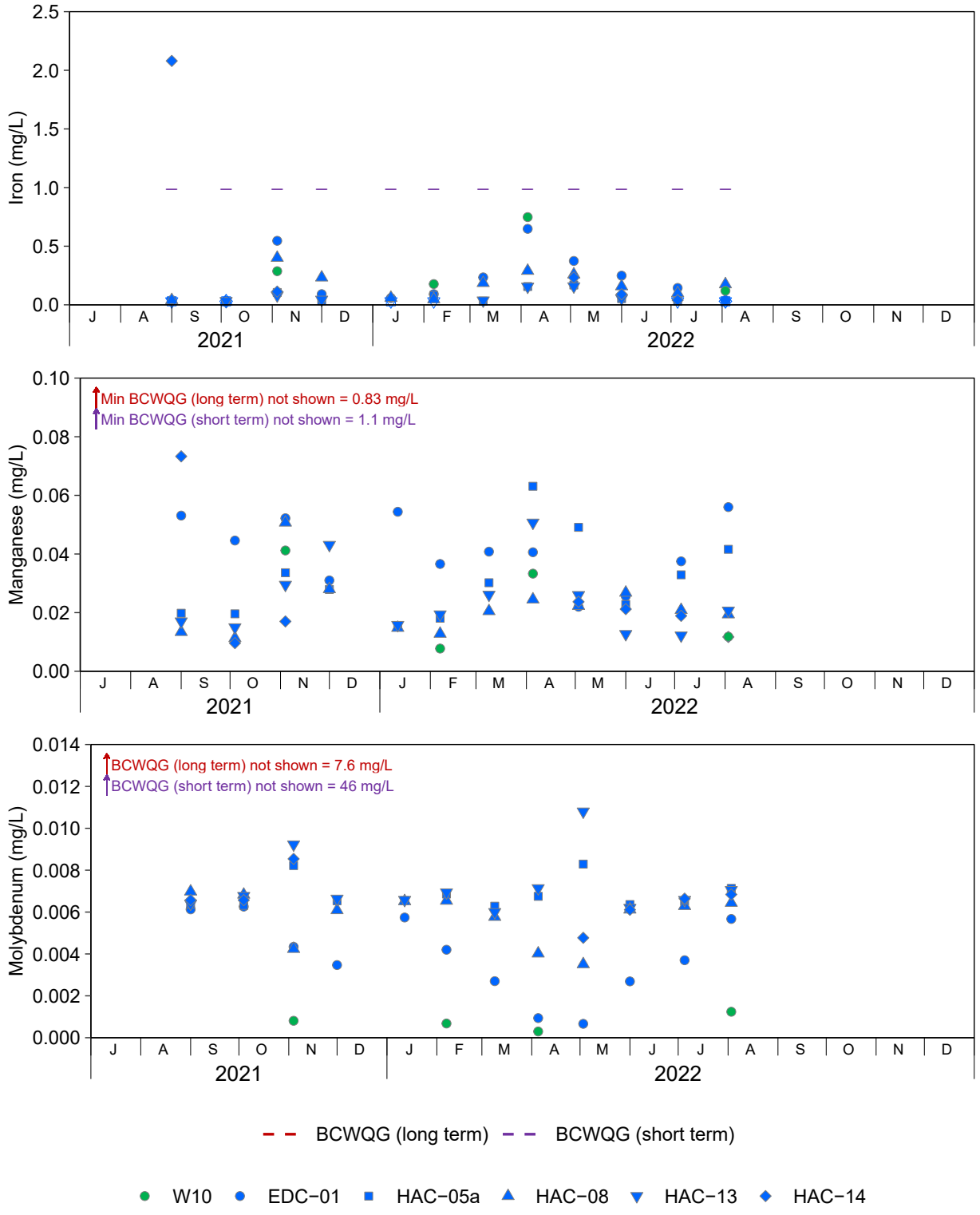

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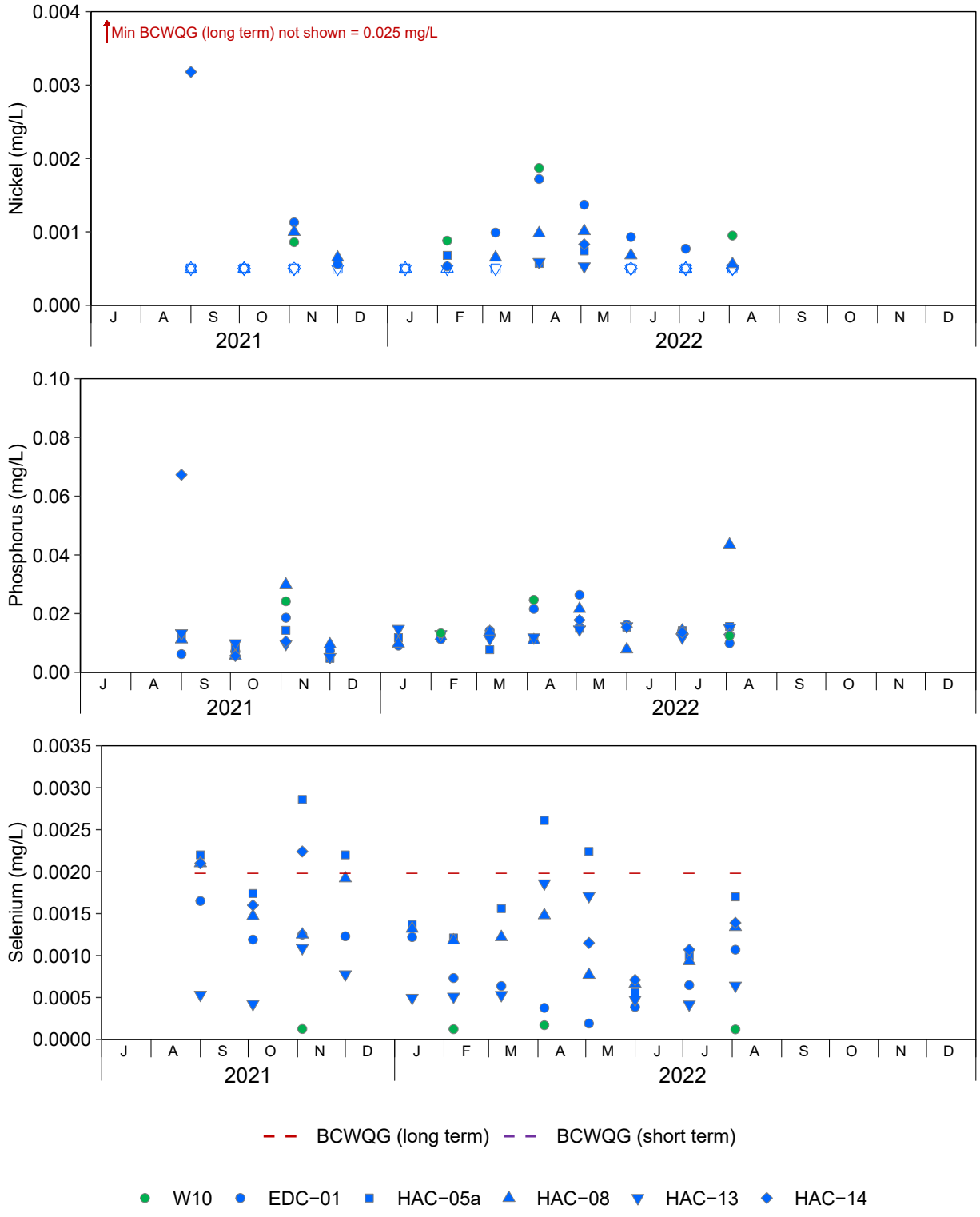

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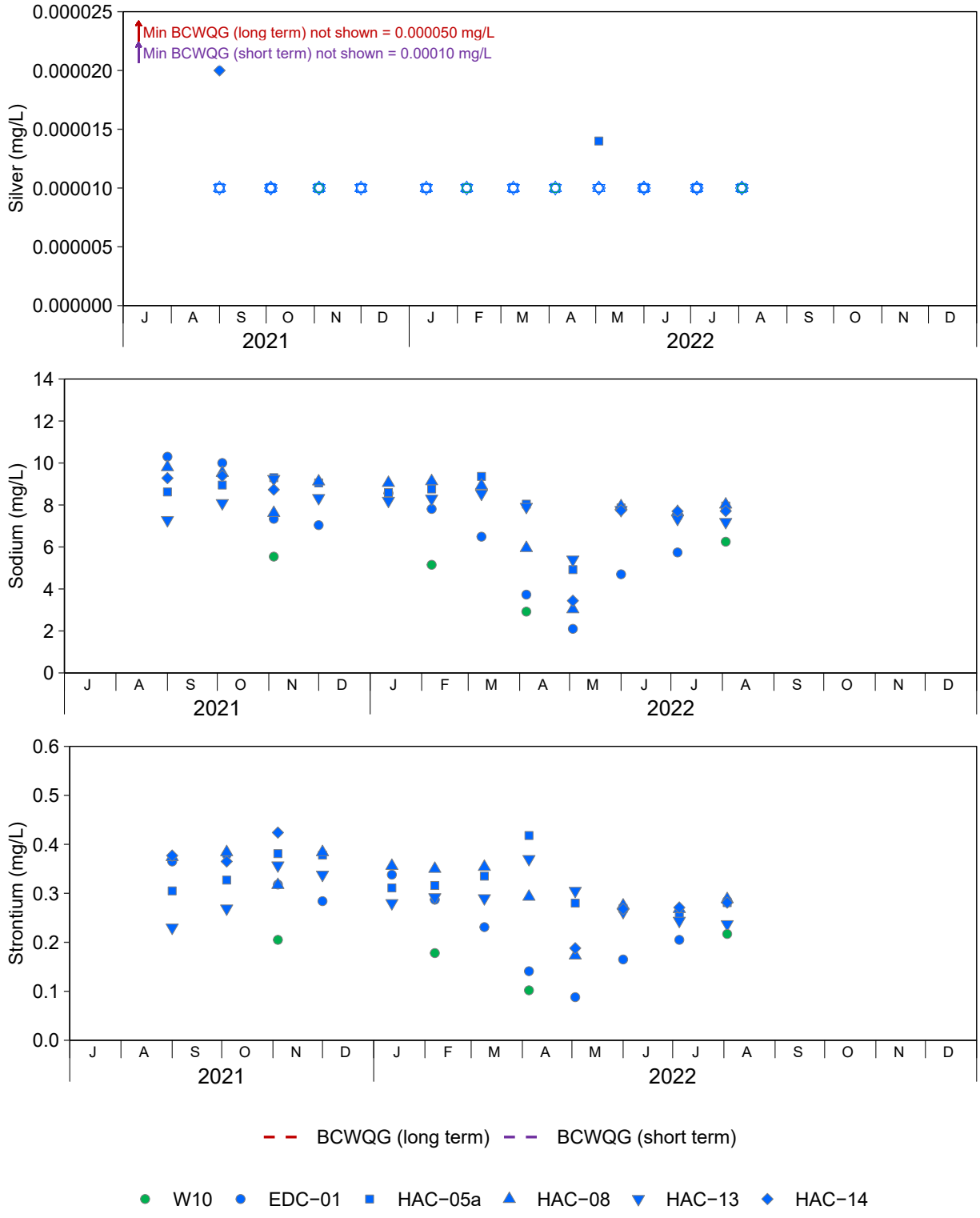

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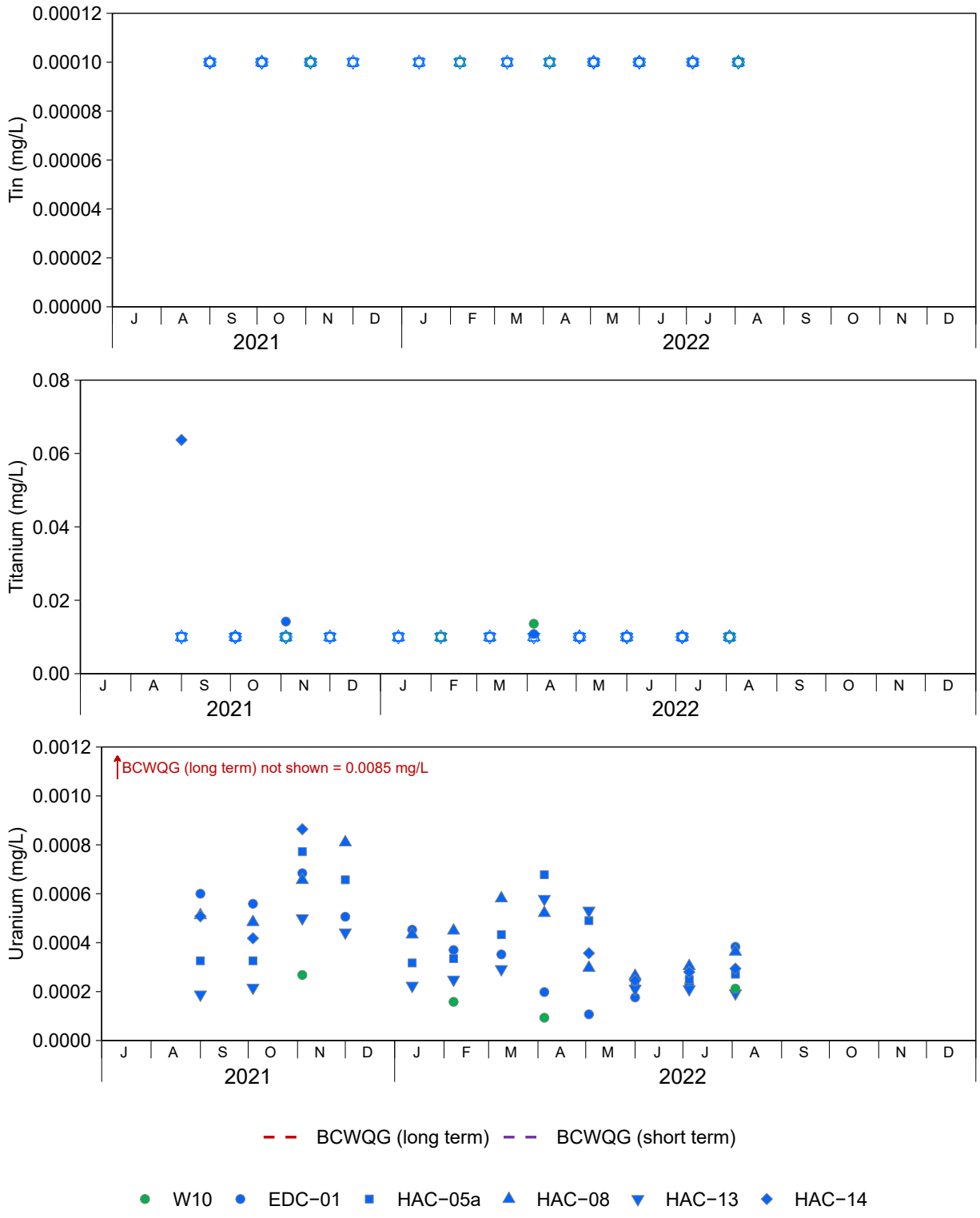

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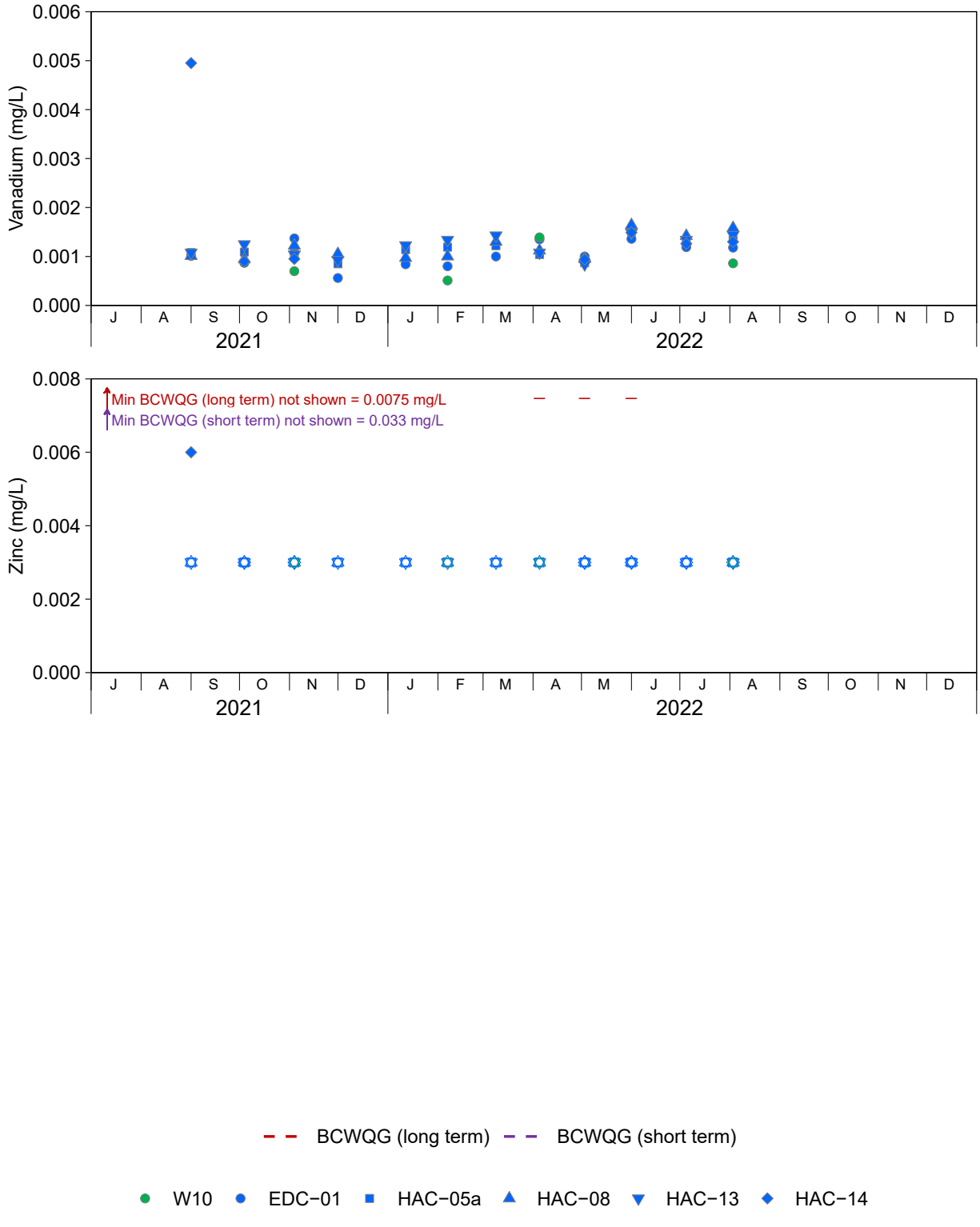

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Table D.1.1: British Columbia Water Quality Guidelines for the Protection of Aquatic Life (BCMOECCS 2019b, 2019c, 2021a, 2021b), 2022

Parameter	Units	Long-term Average	Short-term Maximum
Anions, Organics, Nutrients, and Physical Properties			
pH	pH units	6.5 - 9.0	
Temperature (*in situ*)[a]	°C	± 1	
Alkalinity ($CaCO_3$)	mg/L	> 20[b]	-
Conductivity	µS/cm	-	-
Dissolved Oxygen (*in situ*)[c]	mg/L	> 8	> 5
Dissolved Oxygen (*in situ*)[d]	mg/L	> 11	> 9
Total Suspended Solids[e]	mg/L	+ 5	+ 25
Turbidity[e]	NTU	+ 2	+ 8
Chloride	mg/L	150	600
Fluoride[f]	mg/L	-	For hardness ≤ 10 mg/L, WQG = 0.4 For hardness > 10 mg/L, WQG = [-51.73 + 92.57 × log10]×0.01 Maximum applicable hardness = 385 mg/L
Sulphate[g]	mg/L	hardness dependent	-
Ammonia (as N)[h]	mg/L	temperature and pH dependent	temperature and pH dependent
Nitrate (as N)	mg/L	3.0	32.8
Nitrite (as N)[i]	mg/L	chloride dependent	chloride dependent
Phosphorus - Total[j]	mg/L	0.005 - 0.015	
Dissolved Organic Carbon[k]	mg/L	-	± 20%[k]
Total Metals			
Antimony	µg/L	9	-
Arsenic	µg/L	-	5
Beryllium	µg/L	0.13	-
Boron	mg/L	1.2	-
Chromium[l]	µg/L	For Cr, WQG = 0.001 For Cr, WQG = 0.0089	-
Cobalt	µg/L	4	110
Iron	mg/L	-	1
Lead[f]	µg/L	For hardness ≤ 8 mg/L, none proposed For hardness 8 to 360 mg/L, WQG = 0.001×{3.31+ exp[1.273 × ln - 4.704]} Maximum applicable hardness = 360 mg/L	For hardness ≤ 8 mg/L, WQG ≤ 0.003 For hardness 8 to 360 mg/L, WQG = 0.001×{exp[1.273 × ln - 1.460]} Maximum applicable hardness = 360 mg/L
Manganese[f]	mg/L	For hardness 37 to 450 mg/L, WQG ≤ 0.004 × hardness + 0.605 Maximum applicable hardness = 450 mg/L	For hardness 25 to 259 mg/L, WQG ≤ 0.01102 × hardness + 0.54 Maximum applicable hardness = 259 mg/L
Mercury[m]	mg/L	WQG = [0.0001/] OR When MeHg = 0.5% of THg, WQG= 0.00002	-
Molybdenum	mg/L	7.6	46
Nickel[f]	µg/L	For hardness ≤60, WQG = 0.025 For hardness 60 to 180, WQG = exp{0.76[ln]+1.06} For hardness ≥180, WQG = 0.15	-
Selenium	µg/L	2	-
Silver	mg/L	For hardness ≤ 100 mg/L, WQG = 0.00005 For hardness > 100 mg/L, WQG = 0.0015	For hardness ≤ 100 mg/L, WQG = 0.0001 For hardness > 100 mg/L, WQG = 0.003
Thallium	µg/L	0.8	-
Uranium	µg/L	8.5	-
Zinc[f]	µg/L	For hardness ≤ 90 mg/L, WQG = 0.0075 For hardness 90 to 330 mg/L, WQG = [7.5 + 0.75]; Maximum applicable hardness = 330 mg/L	For hardness ≤ 90 mg/L, WQG = 0.033 For hardness 90 to 500 mg/L, WQG = [33 + 0.75]; Maximum applicable hardness = 500 mg/L
Dissolved Metals			
Aluminum	mg/L	0.05	0.1
Cadmium[f]	µg/L	For hardness = 3.4 to 285 mg/L, WQG = {exp[0.736×ln - 4.943]} Maximum applicable hardness = 285 mg/L	For hardness = 7 to 455 mg/L, WQG = {exp[1.03×ln-5.274]} Maximum applicable hardness = 455 mg/L
Copper[n]	mg/L	Biotic Ligand Model	Biotic Ligand Model
Iron	mg/L	-	0.35

Notes: "-" indicates no applicable guideline, BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy, WQG = water quality guideline.

[a] Change from optimal . No guideline applied.

[b] For waterbodies with low sensitivity to acid inputs.

[c] Minimum for all life stages other than buried embryo / alevin.

[d] Minimum for buried embryo / alevin life stages.

[e] Increase relative to background; no guideline applied.

[f] For hardness-based guidelines, concurrent hardness values were used for calculating guidelines. If hardness values exceeding the maximum applicable hardness, then guidelines were determined using the maximum applicable hardness. If hardness values are lower than the minimum hardness, then guidelines were determined using the minimum hardness.

[g] 128 mg/L at hardness 0-30 mg/L; 218 mg/L at hardness 31-75 mg/L; 309 mg/L at hardness 76-180 mg/L; 429 mg/L at hardness > 250 mg/L.

[h] Use tables in BCMOECCS 2021b.

[i] When chloride < 2 mg/L, long-term = 0.02 mg/L and short-term = 0.06 mg/L; increase with increasing chloride.

[j] Aquatic Life - Lakes; minimum guideline was applied.

[k] ±20% of the background median; no guideline applied.

[l] Chromium is the dominant oxidation state in oxygenated environments, and so its guideline was applied.

[m] Values were screened against 0.00002 mg/L which assumes MeHg = 0.5% of THg.

[n] Site specific guidelines developed using the BLM model and calculated concurrently for each sample .

Table D.1.2: Supporting Spot Water Quality Data Collected During Periphyton and Benthic Invertebrate Sampling in Hazeltine Creek, Edney Creek, and Frypan Creek, 2022

Analyte	Units	Guidelines for the Protection of Aquatic Life[a]		Upper Creek Areas					Lower Creek Areas		
				Reference		Exposed			Reference	Exposed	
				FPC-R3	EDC-U	HAC-R1	HAC-U	HAC-R3	EDC-D	E1	HAC-D
		Long-term Average	Short-term Maximum	8-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22
Anions, Organics, Nutrients, and Physical Properties											
Alkalinity (as $CaCO_3$)	mg/L	>20	-	84.2	63.2	89.5	93.0	99.4	125	125	109
Ammonia (as N)	mg/L	0.26 to 1.8	1.9 to 9.5	0.0205	0.0101	0.00940	0.0227	0.00650	0.0107	0.0200	0.0122
Chloride (Cl)	mg/L	150	600	<0.50	<0.50	0.740	0.920	0.900	<0.50	<0.50	0.870
Conductivity	µS/cm	-	-	160	126	248	271	280	242	239	293
Specific Conductance (*in situ*)	µS/cm	-	-	161	125	248	273	281	237	237	281
Dissolved Organic Carbon[b]	mg/L	-	-	17.4	16.9	6.40	5.83	5.91	13.2	13.2	5.65
Dissolved Oxygen (*in situ*)	%	-	-	79.4	77.3	78.4	90.8	86.9	84.3	89.4	86.4
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	8.76	8.16	7.43	8.46	7.39	8.85	9.04	7.95
Fluoride (F)	mg/L	-	1.2 to 1.5	0.0440	0.0370	0.0580	0.0620	0.0650	0.0600	0.0590	0.0710
Hardness (as $CaCO_3$)	mg/L	-	-	74.8	59.2	100	114	119	114	116	125
Hardness, from Total CaMg (as $CaCO_3$)	mg/L	-	-	81.6	66.6	113	123	123	122	118	136
Nitrate (as N)	mg/L	3.0	33	0.0915	0.0234	0.00680	0.0343	0.0351	0.00660	0.00910	0.0239
Nitrate and Nitrite (as N)	mg/L	-	-	0.0915	0.0234	0.00680	0.0343	0.0351	0.00660	0.00910	0.0239
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Orthophosphate-Dissolved (as P)	mg/L	-	-	0.0306	0.00170	0.00100	0.00340	0.00490	0.00210	0.00230	0.00460
pH (*in situ*)	pH units	6.5 - 9.0	6.5 - 9.0	7.69	7.65	8.31	8.32	8.42	8.18	8.25	8.41
pH (laboratory)	pH units	-	-	8.01	7.88	8.09	8.11	8.14	8.24	8.24	8.17
Phosphorus (P) Total Dissolved	mg/L	-	-	0.0449	0.0112	0.00690	0.00940	0.00910	0.00900	0.00570	0.0121
Phosphorus (P) Total	mg/L	-	-	0.0489	0.0107	0.0127	0.0138	0.0122	0.00680	0.00680	0.00900
Sulphate	mg/L	218 to 309	-	<0.30	0.480	35.4	44.1	44.2	4.08	4.06	44.3
Temperature (*in situ*)	°C	-	-	12.0	13.0	17.9	18.3	20.0	13.1	14.9	19.3
Total Dissolved Solids	mg/L	-	-	102	114	164	191	187	158	176	203
Total Nitrogen	mg/L	-	-	0.809	0.509	0.294	0.318	0.277	0.380	0.371	0.268
Total Suspended Solids[b]	mg/L	-	-	2.50	<1.0	1.80	1.60	1.20	<1.0	<1.0	1.60
Turbidity[b]	NTU	-	-	1.53	0.670	0.580	0.580	0.540	0.230	0.260	0.470
Total Metals											
Aluminum	mg/L	-	-	0.397	0.0593	0.0386	0.0297	0.0319	0.0231	0.0272	0.0524
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100
Arsenic	mg/L	-	0.0050	0.000840	0.000520	0.000510	0.000610	0.000690	0.00154	0.00133	0.000810
Barium	mg/L	1.0	-	0.00566	0.0108	0.0108	0.0116	0.0142	0.0180	0.0193	0.0174
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	1.2	-	<0.010	<0.010	0.0210	0.0210	0.0230	0.0140	0.0140	0.0220
Cadmium	mg/L	-	-	0.00000640	0.00000860	<0.000010	<0.0000050	<0.000010	0.00000720	<0.0000050	<0.0000050
Calcium	mg/L	-	-	24.9	17.4	36.2	38.9	38.5	33.0	31.7	42.4
Chromium	mg/L	0.0010	-	0.00123	0.000690	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	0.0040	0.11	0.000320	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	-	0.00270	0.00221	0.00477	0.00506	0.00784	0.00179	0.00306	0.00801
Iron	mg/L	-	1.0	0.719	0.140	0.0430	0.0360	0.0420	0.0830	0.0680	0.0600
Lead	mg/L	0.0052 to 0.0080	0.049 to 0.12	0.0000970	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00100	<0.0010	0.00100
Magnesium	mg/L	-	-	4.71	5.63	5.48	6.28	6.57	9.55	9.51	7.21
Manganese	mg/L	0.90 to 1.2	1.3 to 2.0	0.0408	0.0199	0.0147	0.0385	0.0201	0.00795	0.00466	0.0195
Molybdenum	mg/L	7.6	46	0.000197	0.000329	0.00685	0.00690	0.00703	0.00103	0.00105	0.00718
Nickel	mg/L	0.070 to 0.12	-	0.00107	0.00121	<0.00050	<0.00050	<0.00050	0.00116	0.000900	<0.00050
Potassium	mg/L	-	-	0.305	0.510	0.987	1.00	1.07	0.909	0.907	1.12
Selenium	mg/L	0.0020	-	0.000109	0.000129	0.000607	0.00120	0.00126	0.000128	0.000155	0.00122
Silicon	mg/L	-	-	7.43	3.34	3.13	3.45	3.82	5.42	5.18	3.90
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	4.83	2.44	7.16	7.50	7.97	5.36	5.31	7.98
Strontium	mg/L	-	-	0.0936	0.113	0.251	0.271	0.271	0.223	0.220	0.302
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	0.0149	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	0.0085	-	0.0000420	0.0000600	0.000189	0.000230	0.000277	0.000166	0.000185	0.000305
Vanadium	mg/L	-	-	0.00289	0.000800	0.00148	0.00143	0.00147	0.000640	0.000770	0.00148
Zinc	mg/L	0.0075 to 0.042	0.033 to 0.068	0.00500	<0.0030	<0.0030	<0.0030	<0.0030	0.00610	<0.0030	<0.0030
Dissolved Metals											
Aluminum	mg/L	0.050	0.10	0.0392	0.0333	0.00470	0.00410	0.00560	0.0142	0.0150	0.00620
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	0.000100	<0.00010	<0.00010	<0.00010	0.000100
Arsenic	mg/L	-	-	0.000780	0.000410	0.000460	0.000460	0.000700	0.00150	0.00130	0.000780
Barium	mg/L	-	-	0.00274	0.00842	0.00832	0.00932	0.0130	0.0168	0.0193	0.0164
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	<0.010	<0.010	0.0200	0.0200	0.0200	0.0130	0.0130	0.0200
Cadmium	mg/L	0.00016 to 0.00027	0.00039 to 0.00081	0.00000500	0.00000920	<0.0000050	<0.0000050	0.00000610	<0.0000050	0.00000510	<0.0000050
Calcium	mg/L	-	-	22.9	16.2	33.0	37.4	37.0	31.0	31.1	38.6
Chromium	mg/L	-	-	<0.00050	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.0049 to 0.0094	0.028 to 0.054	0.00177	0.00181	0.00336	0.00367	0.00644	0.00150	0.00287	0.00684
Iron	mg/L	-	0.35	0.307	0.106	<0.030	<0.030	<0.030	0.0740	0.0530	<0.030
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	-	-	4.28	4.55	4.28	5.11	6.43	8.97	9.33	6.90
Manganese	mg/L	-	-	0.0122	0.0118	0.00504	0.0221	0.00537	0.00605	0.00356	0.00766
Molybdenum	mg/L	-	-	0.000214	0.000331	0.00673	0.00663	0.00694	0.00102	0.00106	0.00691
Nickel	mg/L	-	-	0.000700	0.00100	<0.00050	<0.00050	<0.00050	0.000860	0.000880	<0.00050
Potassium	mg/L	-	-	0.247	0.402	0.782	0.821	1.02	0.862	0.906	1.05
Selenium	mg/L	-	-	0.0000900	0.000130	0.000625	0.00126	0.00129	0.000148	0.000173	0.00120
Silicon	mg/L	-	-	6.64	3.11	2.83	3.11	3.73	5.32	5.35	3.76
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	4.75	2.08	6.14	6.42	7.52	5.16	5.36	8.12
Strontium	mg/L	-	-	0.0903	0.110	0.242	0.252	0.275	0.211	0.214	0.289
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	-	0.0000300	0.0000610	0.000194	0.000224	0.000266	0.000171	0.000188	0.000310
Vanadium	mg/L	-	-	0.00174	0.000570	0.00114	0.00110	0.00131	0.000540	0.000620	0.00128
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00500

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019c, 2021a,b).
Note: "-" indicates data not available or no applicable guideline exists.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019c, 2021a,b) outlined in Table D.1.1.
[b] Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

Table D.1.3: Surface Water Sample Data Collected Routinely at HAC-13 in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties																							
Alkalinity (as $CaCO_3$)	mg/L	>20	-	96.4	99.4	112	112	105	104	106	99.2	84.3	89.8	88.5	90.4	12	99	9.2	84	112	0%	0%	-
Ammonia (as N)	mg/L	0.36 to 2.0	1.9 to 14	0.00860	0.00920	0.00760	0.00520	0.00770	<0.0050	0.00590	0.00720	0.00800	0.00960	0.00680	0.0182	12	0.0082	0.0035	<0.0050	0.018	8%	0%	0%
Chloride	mg/L	150	600	0.860	0.880	0.940	0.740	0.940	0.920	0.880	0.560	<0.50	0.800	0.750	0.770	12	0.80	0.13	<0.50	0.94	8%	0%	0%
Conductivity	µS/cm	-	-	259	262	342	301	283	277	291	315	275	252	246	254	12	280	29	246	342	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	259	-	342	341	286	273	281	313	268	246	252	288	11	286	33	246	342	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	6.39	5.86	6.82	6.44	6.62	5.98	7.87	14.2	11.1	6.92	6.71	6.65	12	7.6	2.5	5.9	14	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	104	-	84.1	79.8	87.6	91.6	90.9	89.5	88.0	93.1	92.4	87.4	11	90	6.0	80	104	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	10.4	-	10.6	11.4	12.7	12.8	12.2	12.5	11.3	10.2	9.02	7.98	11	11	1.6	8.0	13	0%	9%	0%
Fluoride	mg/L	-	1.4 to 1.5	0.0720	0.0820	0.0920	0.0600	0.0840	0.0850	0.0770	0.0920	0.113	0.0710	0.0670	0.0690	12	0.080	0.014	0.060	0.11	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	119	120	148	155	120	126	134	154	129	110	118	111	12	129	16	110	155	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.00980	<0.0050	0.0190	0.0203	0.0520	0.0356	0.0213	0.0564	0.00980	<0.0050	0.00620	0.0174	12	0.021	0.018	<0.0050	0.056	17%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.00980	<0.0051	0.0190	0.0214	0.0520	0.0356	0.0213	0.0564	0.00980	<0.0051	0.00620	0.0174	12	0.022	0.018	<0.0051	0.056	17%	-	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	0.0010	-	<0.0010	0.0011	92%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00520	0.00190	0.00140	0.00320	0.00820	0.00720	0.00260	0.00120	<0.0010	0.00180	0.00140	0.00460	12	0.0033	0.0024	<0.0010	0.0082	8%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.44	-	7.84	7.80	8.04	7.98	7.95	7.45	7.60	8.26	8.07	8.10	11	8.0	0.28	7.4	8.4	0%	0%	0%
pH (laboratory)	pH units	6.5-9.0	6.5-9.0	8.26	8.26	8.11	7.87	7.97	8.12	8.14	7.93	8.14	8.16	8.20	8.18	12	8.1	0.13	7.9	8.3	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00970	0.00700	0.00730	0.00410	0.0107	0.0118	0.00840	0.00610	0.00800	0.00800	0.00910	0.0100	12	0.0084	0.0021	0.0041	0.012	0%	-	-
Total Phosphorus	mg/L	-	-	0.0133	0.00990	0.00970	0.00520	0.0148	0.0130	0.0115	0.0119	0.0146	0.0157	0.0119	0.0151	12	0.012	0.0030	0.0052	0.016	0%	-	-
Sulphate	mg/L	309	-	36.2	36.3	62.7	61.4	42.4	43.8	44.6	61.6	53.1	35.0	34.9	34.7	12	46	11	35	63	0%	0%	-
Temperature (*in situ*)	°C	-	-	15.1	-	5.59	0.825	0.273	1.53	2.90	1.60	4.86	10.9	16.5	19.8	11	7.2	7.1	0.27	20	0%	-	-
Total Dissolved Solids	mg/L	-	-	174	169	228	154	174	176	182	213	131	171	171	160	12	175	25	131	228	0%	-	-
Total Nitrogen	mg/L	-	-	0.286	0.265	0.272	0.227	0.286	0.298	0.308	0.483	0.362	0.290	0.268	0.297	12	0.30	0.065	0.23	0.48	0%	-	-
Total Suspended Solids	mg/L	-	-	<1.0	1.40	1.50	<1.0	3.30	<1.0	<1.0	<1.0	1.40	2.50	1.60	1.00	12	1.5	0.75	<1.0	3.3	42%	-	-
Turbidity (*in situ*)	NTU	-	-	0.680	-	1.21	1.02	0.200	0.370	0.800	1.39	2.08	0.630	1.97	0.900	11	1.0	0.60	0.20	2.1	0%	-	-
Turbidity	NTU	-	-	0.340	0.510	1.20	1.71	0.410	0.410	0.410	1.04	1.46	0.660	0.300	0.510	12	0.75	0.48	0.30	1.7	0%	-	-
Total Metals																							
Aluminum	mg/L	-	-	0.0104	0.0260	0.0518	0.0346	0.0163	0.0152	0.0196	0.104	0.124	0.0520	0.0203	0.0189	12	0.041	0.037	0.010	0.12	0%	-	-
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	0.000100	0.000110	<0.00010	0.000100	<0.00010	<0.00010	0.000100	<0.00010	<0.00010	<0.00010	12	0.00010	0.0000032	<0.00010	0.00011	67%	0%	-
Arsenic	mg/L	-	0.0050	0.000580	0.000580	0.000520	0.000480	0.000550	0.000560	0.000590	0.000440	0.000360	0.000560	0.000490	0.000580	12	0.00052	0.000070	0.00036	0.00059	0%	-	0%
Barium	mg/L	1.0	-	0.0107	0.0116	0.0184	0.0162	0.0118	0.0119	0.0117	0.0170	0.0156	0.0111	0.0112	0.0109	12	0.013	0.0028	0.011	0.018	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0210	0.0210	0.0190	0.0200	0.0210	0.0220	0.0210	0.0160	0.0120	0.0190	0.0220	0.0210	12	0.020	0.0029	0.012	0.022	0%	0%	-
Cadmium	mg/L	-	-	<0.0000050	<0.0000050	<0.000010	0.00000540	<0.0000050	<0.0000050	0.00000530	0.00000990	0.00000890	<0.000010	<0.0000050	<0.0000050	12	0.0000060	0.0000021	<0.0000050	0.0000099	67%	-	-
Calcium	mg/L	-	-	33.8	39.3	50.7	48.9	39.4	43.3	43.3	47.3	40.2	40.7	36.4	35.1	12	42	5.4	34	51	0%	-	-
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	12	<0.00050	-	<0.00050	<0.00050	100%	0%	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	0%
Copper	mg/L	-	-	0.00516	0.00540	0.0110	0.00893	0.00612	0.00611	0.00646	0.0173	0.0191	0.00601	0.00507	0.00502	12	0.0085	0.0049	0.0050	0.019	0%	-	-
Iron	mg/L	-	1.0	<0.030	0.0320	0.0800	0.0440	<0.030	<0.030	0.0370	0.155	0.158	0.0550	<0.030	<0.030	12	0.059	0.049	<0.030	0.16	42%	-	0%
Lead	mg/L	0.0069 to 0.0089	0.092 to 0.14	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	0%	0%
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	5.08	5.56	7.86	7.28	5.96	5.93	6.48	8.22	5.94	5.70	5.36	5.20	12	6.2	1.0	5.1	8.2	0%	-	-
Manganese	mg/L	1.1 to 1.3	1.8 to 2.2	0.0170	0.0150	0.0295	0.0431	0.0158	0.0194	0.0261	0.0507	0.0260	0.0127	0.0122	0.0207	12	0.024	0.012	0.012	0.051	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.00640	0.00677	0.00923	0.00664	0.00658	0.00694	0.00600	0.00714	0.0108	0.00620	0.00658	0.00705	12	0.0072	0.0014	0.0060	0.011	0%	0%	0%
Nickel	mg/L	0.10 to 0.13	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000590	0.000530	<0.00050	<0.00050	<0.00050	12	0.00051	0.000023	<0.00050	0.00059	83%	0%	-
Potassium	mg/L	-	-	0.996	1.13	1.44	1.18	1.10	1.12	1.12	1.18	1.01	0.943	1.02	1.03	12	1.1	0.13	0.94	1.4	0%	-	-
Selenium	mg/L	0.0020	-	0.000533	0.000423	0.00109	0.000777	0.000496	0.000510	0.000530	0.00186	0.00171	0.000476	0.000417	0.000642	12	0.00079	0.00050	0.00042	0.0019	0%	0%	-
Silicon	mg/L	-	-	2.95	3.04	3.26	3.16	3.49	3.70	3.70	4.77	4.05	3.30	2.87	3.04	12	3.4	0.55	2.9	4.8	0%	-	-
Silver	mg/L	0.0015	0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	0%
Sodium	mg/L	-	-	7.28	8.09	9.24	8.33	8.20	8.30	8.54	7.91	5.40	7.76	7.34	7.19	12	7.8	0.95	5.4	9.2	0%	-	-
Strontium	mg/L	-	-	0.230	0.269	0.357	0.338	0.280	0.292	0.290	0.370	0.305	0.262	0.244	0.237	12	0.29	0.046	0.23	0.37	0%	-	-
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	0.0085	-	0.000188	0.000216	0.000500	0.000442	0.000224	0.000249	0.000292	0.000579	0.000531	0.000212	0.000210	0.000193	12	0.00032	0.00015	0.00019	0.00058	0%	0%	-
Vanadium	mg/L	-	-	0.00108	0.00125	0.00104	0.000930	0.00123	0.00134	0.00143	0.00108	0.000840	0.00149	0.00134	0.00144	12	0.0012	0.00021	0.00084	0.0015	0%	-	-
Zinc	mg/L	0.022 to 0.056	0.048 to 0.082	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.3: Surface Water Sample Data Collected Routinely at HAC-13 in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Dissolved Metals																							
Aluminum	mg/L	0.050	0.10	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00840	0.0625	0.0618	0.0134	0.00350	0.00500	12	0.014	0.023	<0.0030	0.062	50%	17%	0%
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Arsenic	mg/L	-	-	0.000550	0.000540	0.000470	0.000500	0.000520	0.000500	0.000520	0.000410	0.000300	0.000510	0.000540	0.000490	12	0.00049	0.000070	0.00030	0.00055	0%	-	-
Barium	mg/L	-	-	0.0111	0.0112	0.0147	0.0160	0.0115	0.0110	0.0113	0.0159	0.0145	0.0104	0.0111	0.00987	12	0.012	0.0022	0.0099	0.016	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0210	0.0180	0.0190	0.0210	0.0200	0.0210	0.0180	0.0140	0.0120	0.0190	0.0180	0.0200	12	0.018	0.0028	0.012	0.021	0%	-	-
Cadmium	mg/L	0.00023 to 0.00029	0.00065 to 0.00092	<0.0000050	<0.0000050	<0.0000050	0.00000500	<0.0000050	<0.0000050	<0.0000050	0.00000730	0.00000660	<0.0000050	<0.0000050	<0.000010	12	0.0000054	0.00000098	<0.0000050	0.0000073	75%	0%	0%
Calcium	mg/L	-	-	38.5	38.6	47.2	50.5	38.5	41.6	43.3	48.2	42.3	35.4	39.0	36.5	12	42	4.8	35	50	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	12	<0.00050	-	<0.00050	<0.00050	100%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0032 to 0.0052	0.019 to 0.031	0.00482	0.00436	0.00812	0.00757	0.00559	0.00500	0.00602	0.0148	0.0166	0.00581	0.00453	0.00436	12	0.0073	0.0041	0.0044	0.017	0%	75%	0%
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.0810	0.0990	<0.030	<0.030	<0.030	12	0.040	0.0070	<0.030	0.099	83%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	5.46	5.72	7.26	7.09	5.88	5.40	6.36	8.27	5.72	5.18	5.14	4.81	12	6.0	1.0	4.8	8.3	0%	-	-
Manganese	mg/L	-	-	0.0145	0.0118	0.0237	0.0420	0.0114	0.0162	0.0242	0.0446	0.0210	0.00444	0.00787	0.0124	12	0.020	0.013	0.0044	0.045	0%	-	-
Molybdenum	mg/L	-	-	0.00667	0.00639	0.00916	0.00658	0.00680	0.00660	0.00611	0.00661	0.0102	0.00587	0.00619	0.00679	12	0.0070	0.0013	0.0059	0.010	0%	-	-
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000610	<0.00050	<0.00050	<0.00050	<0.00050	12	0.00051	-	<0.00050	0.00061	92%	-	-
Potassium	mg/L	-	-	1.08	1.03	1.33	1.24	1.15	1.03	1.07	1.06	0.964	1.06	0.981	0.899	12	1.1	0.12	0.90	1.3	0%	-	-
Selenium	mg/L	-	-	0.000478	0.000491	0.00119	0.000862	0.000440	0.000450	0.000645	0.00158	0.00161	0.000474	0.000541	0.000606	12	0.00078	0.00044	0.00044	0.0016	0%	-	-
Silicon	mg/L	-	-	3.17	2.95	3.08	3.20	3.28	3.20	3.78	4.16	3.60	3.32	3.14	2.87	12	3.3	0.37	2.9	4.2	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000200	<0.000010	<0.000010	12	0.000011	-	<0.000010	0.000020	92%	-	-
Sodium	mg/L	-	-	8.05	7.72	8.24	8.32	8.31	7.52	8.27	7.50	5.45	7.05	7.75	6.72	12	7.6	0.84	5.4	8.3	0%	-	-
Strontium	mg/L	-	-	0.259	0.241	0.346	0.354	0.284	0.282	0.289	0.358	0.302	0.233	0.249	0.254	12	0.29	0.044	0.23	0.36	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000209	0.000191	0.000498	0.000429	0.000233	0.000246	0.000293	0.000492	0.000526	0.000201	0.000196	0.000188	12	0.00031	0.00014	0.00019	0.00053	0%	-	-
Vanadium	mg/L	-	-	0.00115	0.00117	0.000850	0.000840	0.00119	0.00113	0.00120	0.000970	0.000690	0.00125	0.00122	0.00127	12	0.0011	0.00019	0.00069	0.0013	0%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0108	<0.0030	<0.0030	12	0.0036	-	<0.0030	0.011	92%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.

[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.4: Surface Water Sample Data Collected Routinely at HAC-05a in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties																							
Alkalinity (as $CaCO_3$)	mg/L	>20	-	112	116	118	123	110	109	116	112	88.5	90.3	93.0	4.90	12	99	32	4.9	123	0%	8%	-
Ammonia (as N)	mg/L	0.24 to 1.9	1.2 to 10	0.0146	0.00590	0.00720	0.00530	0.00860	0.00650	0.00670	0.00880	0.00810	0.0100	0.0108	0.0176	12	0.0092	0.0037	0.0053	0.018	0%	0%	0%
Chloride	mg/L	150	600	1.55	1.44	1.37	1.10	1.28	1.30	1.23	0.820	0.520	0.870	0.880	1.14	12	1.1	0.30	0.52	1.6	0%	0%	0%
Conductivity	µS/cm	-	-	329	326	392	359	325	316	355	373	294	262	266	301	12	325	40	262	392	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	330	-	389	213	315	310	341	372	287	257	265	342	11	311	52	213	389	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	6.42	5.87	5.88	5.64	6.03	6.18	8.19	13.5	12.4	7.58	5.90	6.43	12	7.5	2.7	5.6	14	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	108	-	87.6	83.5	83.0	91.3	88.5	92.1	93.1	99.7	94.2	90.9	11	92	7.2	83	108	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	11.4	-	11.1	12.1	12.1	12.9	12.7	12.9	12.0	10.8	9.20	8.61	11	11	1.4	8.6	13	0%	0%	0%
Fluoride	mg/L	-	1.4 to 1.6	0.0760	0.0850	0.0960	0.0650	0.0900	0.0910	0.0810	0.0970	0.110	0.0720	0.0730	0.0750	12	0.084	0.013	0.065	0.11	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	153	150	176	186	144	146	165	194	136	116	126	132	12	152	24	116	194	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.0682	0.0520	0.0944	0.0880	0.128	0.0917	0.0643	0.0847	0.0409	<0.0050	0.0241	0.0697	12	0.068	0.031	<0.0050	0.13	8%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.0695	0.0533	0.0944	0.0893	0.128	0.0929	0.0643	0.0847	0.0409	<0.0051	0.0241	0.0709	12	0.068	0.031	<0.0051	0.13	8%	-	-
Nitrite (as N)	mg/L	0.020	0.060	0.00130	0.00130	<0.0010	0.00130	<0.0010	0.00120	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00120	12	0.0011	0.000048	<0.0010	0.0013	58%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00500	0.00270	0.00150	0.00240	0.00910	0.00720	0.00260	0.00190	0.00120	0.00160	0.00190	0.00670	12	0.0036	0.0027	0.0012	0.0091	0%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.62	-	7.97	7.95	7.88	7.99	8.00	7.71	7.61	8.46	8.10	8.09	11	8.0	0.29	7.6	8.6	0%	0%	0%
pH (laboratory)	pH units	6.5-9.0	6.5-9.0	8.37	8.29	8.15	7.97	8.02	8.14	8.16	8.06	8.16	8.18	8.20	8.21	12	8.2	0.11	8.0	8.4	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00960	0.0141	0.00670	0.00330	0.0110	0.0114	0.00900	0.00780	0.00780	0.00760	0.0101	0.0134	12	0.0093	0.0030	0.0033	0.014	0%	-	-
Total Phosphorus	mg/L	-	-	0.0120	0.00820	0.0143	0.00480	0.0118	0.0124	0.00770	0.0112	0.0150	0.0154	0.0142	0.0156	12	0.012	0.0034	0.0048	0.016	0%	-	-
Sulphate	mg/L	309 to 429	-	61.3	57.1	81.5	82.2	57.7	56.9	64.7	80.8	59.3	38.8	41.5	50.8	12	61	14	39	82	0%	0%	-
Temperature (*in situ*)	°C	-	-	13.2	-	5.26	0.543	1.00	1.18	0.577	1.63	4.64	11.4	16.5	17.9	11	6.7	6.7	0.54	18	0%	-	-
Total Dissolved Solids	mg/L	-	-	236	214	260	187	210	201	222	257	171	167	174	193	12	208	32	167	260	0%	-	-
Total Nitrogen	mg/L	-	-	0.317	0.278	0.303	0.291	0.333	0.339	0.339	0.470	0.384	0.371	0.294	0.324	12	0.34	0.052	0.28	0.47	0%	-	-
Total Suspended Solids	mg/L	-	-	<1.0	1.00	2.10	<1.0	<1.0	<1.0	<1.0	1.10	<1.0	1.20	1.10	<1.0	12	1.1	0.34	<1.0	2.1	58%	-	-
Turbidity (*in situ*)	NTU	-	-	0.420	-	1.93	0.830	0.0500	0.230	0.390	1.51	1.37	0.830	0.190	0.760	11	0.77	0.61	0.050	1.9	0%	-	-
Turbidity	NTU	-	-	0.270	0.320	1.62	1.32	0.280	0.240	0.320	1.20	1.55	0.750	0.390	0.490	12	0.73	0.54	0.24	1.6	0%	-	-
Total Metals																							
Aluminum	mg/L	-	-	0.00720	0.0104	0.123	0.0272	0.00880	0.00920	0.0166	0.0939	0.145	0.0481	0.0204	0.0124	12	0.044	0.049	0.0072	0.14	0%	-	-
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	0.00010	-	<0.00010	0.00010	92%	0%	-
Arsenic	mg/L	-	0.0050	0.000680	0.000680	0.000620	0.000520	0.000630	0.000610	0.000650	0.000500	0.000450	0.000560	0.000560	0.000640	12	0.00059	0.000074	0.00045	0.00068	0%	-	0%
Barium	mg/L	1.0	-	0.0135	0.0136	0.0221	0.0192	0.0135	0.0137	0.0152	0.0212	0.0175	0.0109	0.0120	0.0130	12	0.015	0.0037	0.011	0.022	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0220	0.0220	0.0180	0.0200	0.0220	0.0210	0.0220	0.0160	0.0110	0.0190	0.0210	0.0220	12	0.020	0.0033	0.011	0.022	0%	0%	-
Cadmium	mg/L	-	-	<0.0000050	<0.0000050	<0.000010	0.00000560	<0.0000050	<0.0000050	<0.0000050	0.00000890	0.00000790	<0.000010	<0.000010	<0.0000050	12	0.0000058	0.0000017	<0.0000050	0.0000089	75%	-	-
Calcium	mg/L	-	-	45.0	49.2	57.3	56.0	44.7	48.4	51.7	57.3	43.0	41.5	38.7	40.2	12	48	6.6	39	57	0%	-	-
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0110	<0.00050	<0.00050	0.000520	<0.00050	<0.00050	<0.00050	12	0.0014	0.0041	<0.00050	0.011	83%	8%	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	0%
Copper	mg/L	-	-	0.00475	0.00468	0.00933	0.00738	0.00594	0.00596	0.00685	0.0195	0.0235	0.00637	0.00565	0.00515	12	0.0088	0.0061	0.0047	0.024	0%	-	-
Iron	mg/L	-	1.0	<0.030	<0.030	0.105	0.0360	<0.030	0.0800	0.0320	0.156	0.169	0.0530	0.0310	<0.030	12	0.065	0.052	<0.030	0.17	33%	-	0%
Lead	mg/L	0.0072 to 0.011	0.099 to 0.19	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	0%	0%
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	8.52	8.02	10.4	9.55	7.75	7.36	8.36	10.2	6.61	6.06	5.86	6.83	12	8.0	1.5	5.9	10	0%	-	-
Manganese	mg/L	1.1 to 1.5	1.8 to 2.7	0.0198	0.0196	0.0336	0.0279	0.0154	0.0181	0.0302	0.0631	0.0491	0.0228	0.0329	0.0416	12	0.031	0.014	0.015	0.063	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.00638	0.00632	0.00822	0.00654	0.00655	0.00686	0.00628	0.00675	0.00829	0.00636	0.00652	0.00713	12	0.0068	0.00070	0.0063	0.0083	0%	0%	0%
Nickel	mg/L	0.11 to 0.15	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000680	<0.00050	0.000570	0.000740	<0.00050	<0.00050	<0.00050	12	0.00054	0.000066	<0.00050	0.00074	75%	0%	-
Potassium	mg/L	-	-	1.17	1.17	1.36	1.19	1.16	1.14	1.20	1.26	1.02	0.966	1.02	1.12	12	1.1	0.11	0.97	1.4	0%	-	-
Selenium	mg/L	0.0020	-	0.00220	0.00174	0.00286	0.00220	0.00137	0.00121	0.00156	0.00261	0.00224	0.000560	0.000996	0.00170	12	0.0018	0.00068	0.00056	0.0029	0%	42%	-
Silicon	mg/L	-	-	3.53	3.56	3.88	3.63	4.07	4.00	4.07	4.94	4.47	3.18	3.20	3.68	12	3.9	0.51	3.2	4.9	0%	-	-
Silver	mg/L	0.0015	0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000140	<0.000010	<0.000010	<0.000010	12	0.000010	-	<0.000010	0.000014	92%	0%	0%
Sodium	mg/L	-	-	8.62	8.95	9.30	9.05	8.59	8.76	9.36	8.04	4.92	7.86	7.51	7.95	12	8.2	1.2	4.9	9.4	0%	-	-
Strontium	mg/L	-	-	0.305	0.327	0.381	0.378	0.311	0.316	0.335	0.418	0.280	0.269	0.253	0.281	12	0.32	0.050	0.25	0.42	0%	-	-
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	0.0085	-	0.000326	0.000326	0.000772	0.000657	0.000317	0.000335	0.000433	0.000678	0.000490	0.000230	0.000249	0.000271	12	0.00042	0.00018	0.00023	0.00077	0%	0%	-
Vanadium	mg/L	-	-	0.00108	0.00109	0.00106	0.000850	0.00114	0.00119	0.00122	0.00104	0.000870	0.00151	0.00130	0.00134	12	0.0011	0.00019	0.00085	0.0015	0%	-	-
Zinc	mg/L	0.027 to 0.086	0.052 to 0.11	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.4: Surface Water Sample Data Collected Routinely at HAC-05a in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date											Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22							
Dissolved Metals																						
Aluminum	mg/L	0.050	0.10	<0.0030	<0.0030	0.00440	0.00320	<0.0030	<0.0030	0.00610	0.0517	0.0759	0.00780	0.00390	0.00340	12	0.014	0.024	<0.0030	0.076	33%	17%	0%
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	12	0.00010	-	<0.00010	0.00010	92%	-	-
Arsenic	mg/L	-	-	0.000660	0.000580	0.000600	0.000520	0.000600	0.000580	0.000580	0.000450	0.000440	0.000490	0.000520	0.000630	12	0.00055	0.000070	0.00044	0.00066	0%	-	-
Barium	mg/L	-	-	0.0136	0.0136	0.0192	0.0191	0.0134	0.0131	0.0146	0.0205	0.0167	0.0106	0.0124	0.0126	12	0.015	0.0032	0.011	0.020	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0220	0.0200	0.0180	0.0210	0.0210	0.0220	0.0190	0.0150	0.0110	0.0180	0.0180	0.0210	12	0.019	0.0032	0.011	0.022	0%	-	-
Cadmium	mg/L	0.00024 to 0.00034	0.00069 to 0.0012	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00000590	<0.000010	0.00000660	<0.0000050	<0.0000050	0.00000910	12	0.0000056	0.0000012	<0.0000050	0.0000091	75%	0%	0%
Calcium	mg/L	-	-	47.0	46.5	54.6	59.0	45.4	47.3	52.0	60.2	43.6	37.2	40.5	41.8	12	48	7.2	37	60	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	12	<0.00050	-	<0.00050	<0.00050	100%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0031 to 0.0067	0.019 to 0.040	0.00435	0.00428	0.00632	0.00623	0.00528	0.00493	0.00655	0.0162	0.0213	0.00524	0.00524	0.00492	12	0.0076	0.0054	0.0043	0.021	0%	75%	0%
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.0800	0.106	<0.030	<0.030	<0.030	12	0.040	0.010	<0.030	0.11	83%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	8.61	8.25	9.86	9.31	7.62	6.83	8.55	10.5	6.61	5.54	6.02	6.76	12	7.9	1.6	5.5	10	0%	-	-
Manganese	mg/L	-	-	0.0138	0.0145	0.0251	0.0241	0.0121	0.0132	0.0269	0.0525	0.0402	0.0125	0.0242	0.0329	12	0.024	0.013	0.012	0.052	0%	-	-
Molybdenum	mg/L	-	-	0.00645	0.00615	0.00804	0.00668	0.00669	0.00664	0.00624	0.00627	0.00819	0.00594	0.00613	0.00686	12	0.0067	0.00072	0.0059	0.0082	0%	-	-
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	12	<0.00050	-	<0.00050	<0.00050	100%	-	-
Potassium	mg/L	-	-	1.16	1.08	1.31	1.23	1.17	1.08	1.16	1.17	1.03	1.03	1.05	1.01	12	1.1	0.092	1.0	1.3	0%	-	-
Selenium	mg/L	-	-	0.00207	0.00190	0.00282	0.00244	0.00137	0.00111	0.00167	0.00247	0.00218	0.000689	0.000923	0.00177	12	0.0018	0.00066	0.00069	0.0028	0%	-	-
Silicon	mg/L	-	-	3.79	3.52	3.57	3.63	3.75	3.57	4.09	4.41	3.97	3.19	3.30	3.46	12	3.7	0.34	3.2	4.4	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000120	<0.000010	<0.000010	<0.000010	12	0.000010	-	<0.000010	0.000012	92%	-	-
Sodium	mg/L	-	-	9.09	8.49	8.44	8.90	8.51	7.98	8.85	7.79	5.04	7.15	8.15	7.64	12	8.0	1.1	5.0	9.1	0%	-	-
Strontium	mg/L	-	-	0.328	0.286	0.371	0.400	0.321	0.317	0.330	0.404	0.289	0.237	0.255	0.289	12	0.32	0.053	0.24	0.40	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000336	0.000302	0.000748	0.000593	0.000318	0.000330	0.000451	0.000566	0.000530	0.000226	0.000229	0.000252	12	0.00041	0.00017	0.00023	0.00075	0%	-	-
Vanadium	mg/L	-	-	0.00100	0.00101	0.000860	0.000770	0.00109	0.00105	0.00108	0.000840	0.000740	0.00125	0.00129	0.00122	12	0.0010	0.00018	0.00074	0.0013	0%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.5: Surface Water Sample Data Collected Routinely at HAC-14 in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date							Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties																		
Alkalinity (as $CaCO_3$)	mg/L	>20	-	124	126	122	67.0	92.1	100	108	7	106	21	67	126	0%	0%	-
Ammonia (as N)	mg/L	0.24 to 1.7	1.2 to 8.8	0.00730	0.00520	0.00600	0.00720	0.00840	0.00880	0.0116	7	0.0078	0.0021	0.0052	0.012	0%	0%	0%
Chloride	mg/L	150	600	1.47	1.33	1.18	<0.50	0.840	0.850	1.05	7	1.0	0.26	<0.50	1.5	14%	0%	0%
Conductivity	µS/cm	-	-	353	347	394	202	262	273	305	7	305	65	202	394	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	357	-	395	197	261	272	349	6	305	74	197	395	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	5.19	5.12	5.74	16.3	6.92	6.23	5.72	7	7.3	4.0	5.1	16	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	92.4	-	88.2	91.2	95.0	94.1	90.9	6	92	2.4	88	95	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	9.41	-	11.3	12.0	9.73	9.04	8.63	6	10	1.3	8.6	12	0%	0%	0%
Fluoride	mg/L	-	1.3 to 1.5	0.0900	0.0970	0.0960	0.0800	0.0740	0.0770	0.0790	7	0.085	0.0094	0.074	0.097	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	168	165	171	98.2	112	132	141	7	141	29	98	171	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.100	0.0380	0.112	0.0190	0.0120	0.0430	0.0721	7	0.057	0.039	0.012	0.11	0%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.100	0.0380	0.112	0.0190	0.0120	0.0430	0.0721	7	0.057	0.039	0.012	0.11	0%	-	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	7	<0.0010	-	<0.0010	<0.0010	100%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00580	0.00270	0.00280	0.00220	0.00280	0.00440	0.00590	7	0.0038	0.0016	0.0022	0.0059	0%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.68	-	8.13	7.73	8.26	8.15	8.24	6	8.2	0.30	7.7	8.7	0%	0%	0%
pH (laboratory)	pH units	6.5-9.0	6.5-9.0	8.26	8.31	8.18	8.01	8.17	8.21	8.26	7	8.2	0.097	8.0	8.3	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00920	0.0160	0.00620	0.0122	0.00870	0.0102	0.0102	7	0.010	0.0031	0.0062	0.016	0%	-	-
Total Phosphorus	mg/L	-	-	0.0673	0.00560	0.0105	0.0178	0.0154	0.0136	0.0129	7	0.020	0.021	0.0056	0.067	0%	-	-
Sulphate	mg/L	309	-	63.1	57.2	80.5	32.9	38.3	41.1	48.2	7	52	17	33	80	0%	0%	-
Temperature (*in situ*)	°C	-	-	14.5	-	4.84	3.96	13.3	17.3	17.8	6	12	6.1	4.0	18	0%	-	-
Total Dissolved Solids	mg/L	-	-	252	226	252	137	189	180	206	7	206	42	137	252	0%	-	-
Total Nitrogen	mg/L	-	-	0.268	0.210	0.288	0.422	0.310	0.283	0.295	7	0.30	0.064	0.21	0.42	0%	-	-
Total Suspended Solids	mg/L	-	-	32.2	1.60	1.80	<1.0	2.30	<1.0	<1.0	7	5.8	12	<1.0	32	43%	-	-
Turbidity (*in situ*)	NTU	-	-	30.7	-	2.49	3.30	0.930	1.14	1.04	6	6.6	12	0.93	31	0%	-	-
Turbidity	NTU	-	-	43.3	0.250	1.45	3.93	0.720	0.420	0.560	7	7.2	16	0.25	43	0%	-	-
Total Metals																		
Aluminum	mg/L	-	-	1.49	0.0107	0.0811	0.237	0.0782	0.0330	0.0177	7	0.28	0.54	0.011	1.5	0%	-	-
Antimony	mg/L	0.0090	-	0.000120	<0.00010	<0.00010	<0.00010	0.000120	<0.00010	<0.00010	7	0.00011	0	<0.00010	0.00012	71%	0%	-
Arsenic	mg/L	-	0.0050	0.00161	0.000770	0.000750	0.000470	0.000600	0.000610	0.000760	7	0.00080	0.00038	0.00047	0.0016	0%	-	0%
Barium	mg/L	1.0	-	0.0406	0.0182	0.0234	0.0140	0.0137	0.0145	0.0156	7	0.020	0.0097	0.014	0.041	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	7	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0260	0.0240	0.0180	<0.010	0.0180	0.0220	0.0240	7	0.020	0.0035	<0.010	0.026	14%	0%	-
Cadmium	mg/L	-	-	0.0000223	<0.0000050	<0.000010	0.0000102	<0.000015	<0.0000050	<0.0000050	7	0.0000084	0.0000060	<0.0000050	0.000022	71%	-	-
Calcium	mg/L	-	-	50.3	50.6	56.9	28.5	41.6	39.7	41.0	7	44	9.3	28	57	0%	-	-
Chromium	mg/L	0.0010	-	0.00259	<0.00050	<0.00050	0.000760	<0.00050	<0.00050	<0.00050	7	0.00084	0.00091	<0.00050	0.0026	71%	14%	-
Cobalt	mg/L	0.0040	0.11	0.00136	<0.00010	<0.00010	0.000120	<0.00010	<0.00010	<0.00010	7	0.00028	0.00061	<0.00010	0.0014	71%	0%	0%
Copper	mg/L	-	-	0.0422	0.00821	0.0116	0.0232	0.00871	0.00813	0.00760	7	0.016	0.013	0.0076	0.042	0%	-	-
Iron	mg/L	-	1.0	2.08	<0.030	0.113	0.233	0.0900	0.0400	<0.030	7	0.37	0.78	<0.030	2.1	29%	-	14%
Lead	mg/L	0.0064 to 0.0096	0.080 to 0.16	0.00107	<0.000050	<0.000050	0.0000700	<0.000050	<0.000050	<0.000050	7	0.00020	0.00049	<0.000050	0.0011	71%	0%	0%
Lithium	mg/L	-	-	0.00240	0.00100	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	7	0.0012	0.00060	0.0010	0.0024	57%	-	-
Magnesium	mg/L	-	-	10.5	9.13	11.0	4.76	6.22	6.31	7.02	7	7.8	2.4	4.8	11	0%	-	-
Manganese	mg/L	1.0 to 1.4	1.6 to 2.4	0.0733	0.00960	0.0170	0.0237	0.0212	0.0189	0.0117	7	0.025	0.022	0.0096	0.073	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.00657	0.00657	0.00854	0.00477	0.00611	0.00664	0.00684	7	0.0066	0.0011	0.0048	0.0085	0%	0%	0%
Nickel	mg/L	0.094 to 0.14	-	0.00318	<0.00050	<0.00050	0.000830	<0.00050	<0.00050	<0.00050	7	0.00093	0.0012	<0.00050	0.0032	71%	0%	-
Potassium	mg/L	-	-	1.54	1.24	1.31	0.775	0.978	1.10	1.14	7	1.2	0.24	0.78	1.5	0%	-	-
Selenium	mg/L	0.0020	-	0.00210	0.00160	0.00224	0.00115	0.000710	0.00107	0.00139	7	0.0015	0.00056	0.00071	0.0022	0%	29%	-
Silicon	mg/L	-	-	6.73	3.89	4.03	4.41	3.37	3.32	3.95	7	4.2	1.2	3.3	6.7	0%	-	-
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	0.0000200	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	7	0.000011	-	<0.000010	0.000020	86%	0%	0%
Sodium	mg/L	-	-	9.28	9.39	8.73	3.44	7.74	7.70	7.71	7	7.7	2.0	3.4	9.4	0%	-	-
Strontium	mg/L	-	-	0.377	0.365	0.424	0.188	0.268	0.271	0.281	7	0.31	0.081	0.19	0.42	0%	-	-
Thallium	mg/L	0.00080	-	0.0000110	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	7	0.000010	-	<0.000010	0.000011	86%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	0.0637	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	0.018	-	<0.010	0.064	86%	-	-
Uranium	mg/L	0.0085	-	0.000508	0.000418	0.000864	0.000357	0.000245	0.000280	0.000294	7	0.00042	0.00021	0.00024	0.00086	0%	0%	-
Vanadium	mg/L	-	-	0.00495	0.000900	0.000950	0.000940	0.00149	0.00126	0.00130	7	0.0017	0.0015	0.00090	0.0050	0%	-	-
Zinc	mg/L	0.014 to 0.068	0.039 to 0.094	0.00600	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	7	0.0034	-	<0.0030	0.0060	86%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.5: Surface Water Sample Data Collected Routinely at HAC-14 in Upper Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date							Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Dissolved Metals																		
Aluminum	mg/L	0.050	0.10	0.00600	<0.0030	0.00480	0.158	0.0126	0.0119	0.00430	7	0.029	0.058	<0.0030	0.16	14%	14%	14%
Antimony	mg/L	-	-	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	0.00010	-	0.00010	0.00010	86%	-	-
Arsenic	mg/L	-	-	0.000790	0.000680	0.000630	0.000410	0.000560	0.000630	0.000700	7	0.00063	0.00012	0.00041	0.00079	0%	-	-
Barium	mg/L	-	-	0.0218	0.0189	0.0198	0.0137	0.0121	0.0150	0.0150	7	0.017	0.0036	0.012	0.022	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	7	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0250	0.0220	0.0190	<0.010	0.0180	0.0190	0.0210	7	0.019	0.0026	<0.010	0.025	14%	-	-
Cadmium	mg/L	0.00021 to 0.00031	0.00058 to 0.0010	0.00000590	<0.000010	0.00000530	0.0000190	<0.0000050	<0.000010	<0.000010	7	0.0000073	0.0000058	<0.0000050	0.000019	57%	0%	0%
Calcium	mg/L	-	-	51.0	50.5	51.7	31.5	35.7	42.4	44.8	7	44	7.9	32	52	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	0.000580	<0.00050	<0.00050	<0.00050	7	0.00051	-	<0.00050	0.00058	86%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0036 to 0.0068	0.021 to 0.040	0.00774	0.00734	0.00874	0.0221	0.00714	0.00762	0.00720	7	0.0097	0.0055	0.0071	0.022	0%	100%	0%
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	0.161	<0.030	<0.030	<0.030	7	0.049	-	<0.030	0.16	86%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	7	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	7	0.0010	-	<0.0010	0.0011	86%	-	-
Magnesium	mg/L	-	-	10.0	9.49	10.1	4.74	5.51	6.49	7.17	7	7.6	2.2	4.7	10	0%	-	-
Manganese	mg/L	-	-	0.00844	0.00693	0.00899	0.0192	0.00975	0.0102	0.00736	7	0.010	0.0042	0.0069	0.019	0%	-	-
Molybdenum	mg/L	-	-	0.00685	0.00662	0.00792	0.00460	0.00603	0.00620	0.00698	7	0.0065	0.0010	0.0046	0.0079	0%	-	-
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	0.000750	<0.00050	<0.00050	<0.00050	7	0.00054	-	<0.00050	0.00075	86%	-	-
Potassium	mg/L	-	-	1.30	1.15	1.21	0.839	1.02	1.09	1.06	7	1.1	0.15	0.84	1.3	0%	-	-
Selenium	mg/L	-	-	0.00197	0.00168	0.00248	0.00103	0.000710	0.000949	0.00134	7	0.0015	0.00063	0.00071	0.0025	0%	-	-
Silicon	mg/L	-	-	4.20	3.79	3.74	3.94	3.30	3.53	3.77	7	3.8	0.29	3.3	4.2	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	0.0000120	<0.000010	<0.000010	<0.000010	7	0.000010	-	<0.000010	0.000012	86%	-	-
Sodium	mg/L	-	-	9.70	8.88	7.84	3.37	7.11	8.00	7.80	7	7.5	2.0	3.4	9.7	0%	-	-
Strontium	mg/L	-	-	0.378	0.338	0.390	0.195	0.244	0.292	0.313	7	0.31	0.070	0.20	0.39	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	7	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	7	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000469	0.000379	0.000832	0.000369	0.000242	0.000255	0.000289	7	0.00040	0.00020	0.00024	0.00083	0%	-	-
Vanadium	mg/L	-	-	0.000970	0.000850	0.000700	0.000750	0.00123	0.00123	0.00123	7	0.00099	0.00024	0.00070	0.0012	0%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	7	<0.0030	-	<0.0030	<0.0030	100%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.

[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.6: Surface Water Sample Data Collected Routinely at HAC-08 in Lower Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties																							
Alkalinity (as $CaCO_3$)	mg/L	>20	-	129	131	125	128	118	116	124	88.2	64.4	94.3	105	108	12	111	20	64	131	0%	0%	-
Ammonia (as N)	mg/L	0.24 to 1.7	1.2 to 8.7	0.00720	<0.0050	0.00640	0.00590	<0.0050	<0.0050	<0.0050	0.00910	0.00500	0.00680	0.00680	0.00920	12	0.0064	0.0016	<0.0050	0.0092	33%	0%	0%
Chloride	mg/L	150	600	1.45	1.30	1.12	0.900	1.20	1.11	1.04	<0.50	<0.50	0.820	0.830	0.970	12	0.98	0.21	<0.50	1.4	17%	0%	0%
Conductivity	µS/cm	-	-	361	350	395	344	340	326	347	270	180	265	275	298	12	313	58	180	395	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	360	-	387	382	344	318	337	265	174	259	269	340	11	312	64	174	387	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	5.04	4.72	5.35	5.23	5.57	6.35	8.33	15.0	14.5	6.88	6.29	5.77	12	7.4	3.6	4.7	15	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	93.2	-	90.3	91.8	90.1	91.8	95.9	93.3	92.5	93.0	95.3	93.2	11	93	1.8	90	96	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	9.68	-	11.4	13.4	13.0	13.0	13.6	12.8	12.0	9.51	9.21	8.90	11	11	1.8	8.9	14	0%	0%	0%
Fluoride	mg/L	-	1.3 to 1.6	0.0920	0.100	0.0990	0.0600	0.0940	0.0910	0.0840	0.0770	0.0730	0.0710	0.0770	0.0780	12	0.083	0.012	0.060	0.10	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	170	162	173	177	158	153	163	136	84.8	114	134	136	12	147	27	85	177	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.0551	<0.0050	0.0948	0.0766	0.132	0.0914	0.0528	0.0210	0.00680	0.00500	0.0117	0.0430	12	0.050	0.042	<0.0050	0.13	8%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.0551	<0.0051	0.0948	0.0766	0.132	0.0914	0.0528	0.0210	0.00680	<0.0051	0.0117	0.0430	12	0.050	0.042	<0.0051	0.13	17%	-	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00320	0.00120	0.00180	0.00220	0.00770	0.00660	0.00300	0.00190	0.00160	0.00240	0.00280	0.00360	12	0.0032	0.0020	0.0012	0.0077	0%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.66	-	8.28	8.25	8.18	8.17	8.11	7.97	7.78	8.31	8.46	8.41	11	8.2	0.24	7.8	8.7	0%	0%	0%
pH (laboratory)	pH units	6.5-9.0	6.5-9.0	8.45	8.39	8.24	8.07	8.07	8.23	8.23	8.14	7.99	8.18	8.24	8.29	12	8.2	0.13	8.0	8.4	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00710	0.00390	0.00640	0.00360	0.00870	0.0104	0.00690	0.00670	0.00870	0.0183	0.00910	0.00840	12	0.0082	0.0038	0.0036	0.018	0%	-	-
Total Phosphorus	mg/L	-	-	0.0112	0.00560	0.0299	0.00950	0.00980	0.0122	0.0137	0.0109	0.0216	0.00780	0.0142	0.0435	12	0.016	0.011	0.0056	0.044	0%	-	-
Sulphate	mg/L	309	-	63.0	57.1	75.4	68.8	57.0	54.9	57.5	46.0	25.0	37.7	40.5	45.5	12	52	14	25	75	0%	0%	-
Temperature (*in situ*)	°C	-	-	13.6	-	5.51	-0.0140	0.396	0.835	1.14	1.73	4.59	14.3	17.0	17.5	11	7.0	7.1	-0.014	18	0%	-	-
Total Dissolved Solids	mg/L	-	-	246	215	246	178	230	220	222	185	111	184	178	200	12	201	38	111	246	0%	-	-
Total Nitrogen	mg/L	-	-	0.233	0.185	0.260	0.284	0.306	0.313	0.296	0.395	0.536	0.304	0.258	0.251	12	0.30	0.090	0.18	0.54	0%	-	-
Total Suspended Solids	mg/L	-	-	2.30	1.80	26.0	8.00	1.20	<1.0	8.30	<1.0	5.60	5.00	3.20	22.6	12	7.2	8.5	<1.0	26	17%	-	-
Turbidity (*in situ*)	NTU	-	-	0.680	-	16.7	4.63	0.680	0.520	1.19	2.99	6.80	1.88	1.72	6.60	11	4.0	4.8	0.52	17	0%	-	-
Turbidity	NTU	-	-	0.260	0.300	13.1	4.79	0.430	0.330	3.24	2.38	6.08	0.810	0.650	5.85	12	3.2	3.8	0.26	13	0%	-	-
Total Metals																							
Aluminum	mg/L	-	-	0.0268	0.0169	0.246	0.185	0.0333	0.0333	0.135	0.258	0.244	0.122	0.0759	0.137	12	0.13	0.091	0.017	0.26	0%	-	-
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	0.000120	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000100	<0.00010	<0.00010	12	0.00010	0.0000078	<0.00010	0.00012	83%	0%	-
Arsenic	mg/L	-	0.0050	0.000980	0.000840	0.00120	0.000910	0.000790	0.000770	0.000930	0.000640	0.000520	0.000720	0.000730	0.00111	12	0.00084	0.00019	0.00052	0.0012	0%	-	0%
Barium	mg/L	1.0	-	0.0226	0.0188	0.0270	0.0245	0.0181	0.0183	0.0217	0.0206	0.0160	0.0149	0.0171	0.0193	12	0.020	0.0035	0.015	0.027	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0240	0.0230	0.0150	0.0200	0.0230	0.0220	0.0220	0.0120	<0.010	0.0180	0.0210	0.0240	12	0.020	0.0044	<0.010	0.024	8%	0%	-
Cadmium	mg/L	-	-	0.00000510	<0.0000050	0.0000134	0.0000115	<0.0000050	<0.0000050	0.00000780	0.0000109	0.00000830	<0.000015	<0.000010	<0.000010	12	0.0000076	0.0000034	<0.0000050	0.000013	50%	-	-
Calcium	mg/L	-	-	49.0	51.1	43.0	51.5	46.6	50.5	52.1	39.9	25.2	42.1	38.9	39.9	12	44	7.8	25	52	0%	-	-
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	0.000600	<0.00050	<0.00050	<0.00050	<0.00050	0.000740	0.000810	<0.00050	<0.00050	<0.00050	12	0.00055	0.000082	<0.00050	0.00081	75%	0%	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	0.000250	0.000150	<0.00010	<0.00010	0.000190	0.000140	0.000140	0.000110	<0.00010	0.000170	12	0.00014	0.000045	<0.00010	0.00025	42%	0%	0%
Copper	mg/L	-	-	0.00843	0.00757	0.0109	0.00975	0.00849	0.00897	0.0125	0.0194	0.0186	0.0102	0.00884	0.00840	12	0.011	0.0040	0.0076	0.019	0%	-	-
Iron	mg/L	-	1.0	0.0400	<0.030	0.401	0.233	0.0600	0.0470	0.186	0.290	0.259	0.158	0.0990	0.175	12	0.16	0.12	<0.030	0.40	8%	-	0%
Lead	mg/L	0.0059 to 0.0099	0.066 to 0.17	<0.000050	<0.000050	0.000171	0.000100	<0.000050	<0.000050	0.0000800	0.0000720	0.0000970	0.0000520	<0.000050	0.000118	12	0.000078	0.000038	<0.000050	0.00017	42%	0%	0%
Lithium	mg/L	-	-	0.00130	0.00120	0.00140	0.00140	0.00120	0.00110	0.00130	0.00110	<0.0010	<0.0010	<0.0010	0.00130	12	0.0012	0.00012	<0.0010	0.0014	25%	-	-
Magnesium	mg/L	-	-	10.3	9.52	11.0	10.3	8.97	8.45	9.35	7.95	4.53	6.59	6.65	7.31	12	8.4	1.9	4.5	11	0%	-	-
Manganese	mg/L	0.98 to 1.4	1.5 to 2.5	0.0134	0.0113	0.0507	0.0280	0.0148	0.0128	0.0205	0.0245	0.0223	0.0268	0.0209	0.0194	12	0.022	0.011	0.011	0.051	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.00698	0.00683	0.00424	0.00609	0.00652	0.00654	0.00577	0.00402	0.00351	0.00612	0.00629	0.00644	12	0.0058	0.0012	0.0035	0.0070	0%	0%	0%
Nickel	mg/L	0.084 to 0.15	-	<0.00050	<0.00050	0.00100	0.000650	<0.00050	<0.00050	0.000650	0.000980	0.00101	0.000680	<0.00050	0.000560	12	0.00067	0.00019	<0.00050	0.0010	42%	0%	-
Potassium	mg/L	-	-	1.34	1.26	1.22	1.10	1.15	1.16	1.18	0.993	0.738	1.03	1.09	1.18	12	1.1	0.15	0.74	1.3	0%	-	-
Selenium	mg/L	0.0020	-	0.00210	0.00147	0.00125	0.00192	0.00132	0.00118	0.00122	0.00148	0.000770	0.000663	0.000933	0.00134	12	0.0013	0.00042	0.00066	0.0021	0%	8%	-
Silicon	mg/L	-	-	4.07	3.84	4.88	4.20	4.24	4.41	4.55	5.05	4.60	3.47	3.36	4.13	12	4.2	0.51	3.4	5.0	0%	-	-
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	0%
Sodium	mg/L	-	-	9.80	9.53	7.62	9.12	9.05	9.13	8.92	5.95	3.03	7.94	7.67	8.02	12	8.0	1.9	3.0	9.8	0%	-	-
Strontium	mg/L	-	-	0.374	0.384	0.317	0.384	0.356	0.350	0.354	0.293	0.173	0.275	0.268	0.288	12	0.32	0.062	0.17	0.38	0%	-	-
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	0.0085	-	0.000512	0.000484	0.000656	0.000810	0.000433	0.000449	0.000581	0.000521	0.000297	0.000264	0.000304	0.000363	12	0.00047	0.00016	0.00026	0.00081	0%	0%	-
Vanadium	mg/L	-	-	0.00101	0.000940	0.00122	0.00105	0.000970	0.00100	0.00130	0.00112	0.000950	0.00164	0.00142	0.00158	12	0.0012	0.00025	0.00094	0.0016	0%	-	-
Zinc	mg/L	0.0075 to 0.073	0.033 to 0.098	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.6: Surface Water Sample Data Collected Routinely at HAC-08 in Lower Hazeltine Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Dissolved Metals																							
Aluminum	mg/L	0.050	0.10	0.00400	<0.0030	0.00450	0.00700	<0.0030	0.00640	0.0215	0.122	0.162	0.0165	0.00860	0.00500	12	0.030	0.054	<0.0030	0.16	17%	17%	17%
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Arsenic	mg/L	-	-	0.000970	0.000780	0.000730	0.000730	0.000690	0.000670	0.000720	0.000540	0.000430	0.000560	0.000630	0.000790	12	0.00069	0.00014	0.00043	0.00097	0%	-	-
Barium	mg/L	-	-	0.0226	0.0194	0.0232	0.0226	0.0177	0.0174	0.0187	0.0188	0.0149	0.0138	0.0160	0.0165	12	0.018	0.0031	0.014	0.023	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0250	0.0210	0.0190	0.0200	0.0220	0.0220	0.0210	0.0110	<0.010	0.0180	0.0190	0.0220	12	0.019	0.0043	<0.010	0.025	8%	-	-
Cadmium	mg/L	0.00019 to 0.00032	0.00050 to 0.0011	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00000670	0.00000670	<0.0000050	0.00000680	<0.0000050	<0.0000050	12	0.0000054	0.000000034	<0.0000050	0.0000068	75%	0%	0%
Calcium	mg/L	-	-	51.0	49.4	51.6	54.2	48.2	48.0	49.9	41.6	26.4	36.4	42.9	42.9	12	45	7.8	26	54	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000540	<0.00050	<0.00050	<0.00050	12	0.00050	-	<0.00050	0.00054	92%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0034 to 0.0081	0.020 to 0.048	0.00783	0.00658	0.00776	0.00710	0.00749	0.00762	0.0107	0.0166	0.0173	0.00808	0.00693	0.00653	12	0.0092	0.0038	0.0065	0.017	0%	100%	0%
Iron	mg/L	-	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.0350	0.116	0.168	<0.030	<0.030	<0.030	12	0.049	0.051	<0.030	0.17	75%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	0.00140	0.00120	0.00140	0.00140	0.00120	0.00100	0.00130	<0.0010	<0.0010	<0.0010	<0.0010	0.00110	12	0.0012	0.00018	0.0010	0.0014	33%	-	-
Magnesium	mg/L	-	-	10.4	9.33	10.7	10.1	9.04	7.98	9.32	7.88	4.59	5.66	6.58	6.95	12	8.2	1.9	4.6	11	0%	-	-
Manganese	mg/L	-	-	0.00556	0.00610	0.00776	0.00941	0.00879	0.00790	0.00915	0.0165	0.0163	0.0105	0.00826	0.00577	12	0.0093	0.0036	0.0056	0.016	0%	-	-
Molybdenum	mg/L	-	-	0.00695	0.00679	0.00814	0.00620	0.00657	0.00629	0.00575	0.00378	0.00342	0.00578	0.00631	0.00674	12	0.0061	0.0013	0.0034	0.0081	0%	-	-
Nickel	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000690	0.000770	<0.00050	<0.00050	<0.00050	12	0.00054	0.000031	<0.00050	0.00077	83%	-	-
Potassium	mg/L	-	-	1.35	1.19	1.27	1.15	1.18	1.14	1.17	0.907	0.778	1.10	1.05	1.02	12	1.1	0.15	0.78	1.4	0%	-	-
Selenium	mg/L	-	-	0.00198	0.00145	0.00243	0.00205	0.00125	0.00106	0.00138	0.00138	0.000912	0.000713	0.00101	0.00126	12	0.0014	0.00051	0.00071	0.0024	0%	-	-
Silicon	mg/L	-	-	4.37	3.60	3.78	3.92	4.09	3.92	4.39	4.32	4.22	3.37	3.49	3.63	12	3.9	0.36	3.4	4.4	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000260	<0.000010	<0.000010	12	0.000011	-	<0.000010	0.000026	92%	-	-
Sodium	mg/L	-	-	10.3	9.64	8.32	9.27	9.17	8.59	8.95	5.68	3.13	7.27	7.75	7.49	12	8.0	2.0	3.1	10	0%	-	-
Strontium	mg/L	-	-	0.403	0.378	0.410	0.405	0.363	0.344	0.351	0.291	0.172	0.245	0.288	0.318	12	0.33	0.072	0.17	0.41	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000537	0.000472	0.000901	0.000771	0.000446	0.000448	0.000562	0.000456	0.000309	0.000259	0.000277	0.000337	12	0.00048	0.00019	0.00026	0.00090	0%	-	-
Vanadium	mg/L	-	-	0.000930	0.000870	0.000680	0.000580	0.000810	0.000810	0.000830	0.000830	0.000740	0.00122	0.00119	0.00115	12	0.00089	0.00020	0.00058	0.0012	0%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.00820	<0.0030	<0.0030	12	0.0034	-	<0.0030	0.0082	92%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.

[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.7: Surface Water Sample Data Collected Routinely at W10 in Lower Edney Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date				Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	4-Nov-21	7-Feb-22	5-Apr-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties															
Alkalinity (as $CaCO_3$)	mg/L	>20	-	116	104	52.4	136	4	102	36	52	136	0%	0%	-
Ammonia (as N)	mg/L	0.70 to 1.3	3.6 to 6.5	0.00630	0.00770	0.00760	0.0347	4	0.014	0.014	0.0063	0.035	0%	0%	0%
Chloride	mg/L	150	600	1.08	0.500	<0.50	0.600	4	0.67	0.29	0.50	1.1	25%	0%	0%
Conductivity	µS/cm	-	-	239	203	113	260	4	204	65	113	260	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	237	199	111	296	4	211	78	111	296	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	10.9	12.5	21.4	10.7	4	14	5.1	11	21	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	89.1	88.7	91.5	88.4	4	89	1.4	88	92	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	12.2	12.9	13.2	9.01	4	12	1.9	9.0	13	0%	0%	0%
Fluoride	mg/L	-	1.1 to 1.4	0.0640	0.0640	0.0380	0.0750	4	0.060	0.016	0.038	0.075	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	112	101	61.0	126	4	100	28	61	126	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.00790	0.0988	0.0468	0.0253	4	0.045	0.039	0.0079	0.099	0%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.00790	0.0988	0.0468	0.0253	4	0.045	0.039	0.0079	0.099	0%	-	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	4	<0.0010	-	<0.0010	<0.0010	100%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00370	0.00590	0.00280	0.00360	4	0.0040	0.0013	0.0028	0.0059	0%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.06	7.92	7.92	8.14	4	8.0	0.11	7.9	8.1	0%	0%	0%
pH	pH units	6.5-9.0	6.5-9.0	8.12	8.08	7.82	8.36	4	8.1	0.22	7.8	8.4	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00940	0.0115	0.0111	0.00740	4	0.0098	0.0019	0.0074	0.012	0%	-	-
Total Phosphorus	mg/L	-	-	0.0242	0.0133	0.0247	0.0124	4	0.019	0.0067	0.012	0.025	0%	-	-
Sulphate	mg/L	218 to 309	-	9.89	8.81	3.11	5.90	4	6.9	3.1	3.1	9.9	0%	0%	-
Temperature (*in situ*)	°C	-	-	2.27	0.0290	0.546	14.5	4	4.3	6.8	0.029	14	0%	-	-
Total Dissolved Solids	mg/L	-	-	154	145	97.0	180	4	144	35	97	180	0%	-	-
Total Nitrogen	mg/L	-	-	0.396	0.502	0.636	0.347	4	0.47	0.13	0.35	0.64	0%	-	-
Total Suspended Solids	mg/L	-	-	7.20	<1.0	7.50	1.50	4	4.3	3.6	<1.0	7.5	25%	-	-
Turbidity (*in situ*)	NTU	-	-	2.79	0.460	4.16	0.760	4	2.0	1.8	0.46	4.2	0%	-	-
Turbidity	NTU	-	-	2.15	0.640	6.96	1.73	4	2.9	2.8	0.64	7.0	0%	-	-
Total Metals															
Aluminum	mg/L	-	-	0.116	0.0355	0.461	0.0810	4	0.17	0.19	0.036	0.46	0%	-	-
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Arsenic	mg/L	-	0.0050	0.00142	0.00119	0.000600	0.00172	4	0.0012	0.00047	0.00060	0.0017	0%	-	0%
Barium	mg/L	1.0	-	0.0176	0.0142	0.0124	0.0215	4	0.016	0.0040	0.012	0.022	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	4	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0100	0.0110	<0.010	0.0170	4	0.012	0.0036	0.010	0.017	25%	0%	-
Cadmium	mg/L	-	-	0.0000104	<0.0000050	0.0000108	0.00000560	4	0.0000080	0.0000031	<0.0000050	0.000011	25%	-	-
Calcium	mg/L	-	-	31.1	28.3	17.4	31.4	4	27	6.6	17	31	0%	-	-
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	0.00144	<0.00050	4	0.00074	-	<0.00050	0.0014	75%	25%	-
Cobalt	mg/L	0.0040	0.11	0.000160	<0.00010	0.000340	0.000110	4	0.00018	0.00012	<0.00010	0.00034	25%	0%	0%
Copper	mg/L	-	-	0.00181	0.00172	0.00383	0.00214	4	0.0024	0.00099	0.0017	0.0038	0%	-	-
Iron	mg/L	-	1.0	0.287	0.177	0.748	0.120	4	0.33	0.29	0.12	0.75	0%	-	0%
Lead	mg/L	0.0050 to 0.0076	0.044 to 0.11	0.0000760	<0.000050	0.000177	<0.000050	4	0.000088	0.000062	<0.000050	0.00018	50%	0%	0%
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	4	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	10.1	8.61	4.96	9.96	4	8.4	2.4	5.0	10	0%	-	-
Manganese	mg/L	0.87 to 1.2	1.2 to 1.9	0.0412	0.00775	0.0333	0.0118	4	0.024	0.016	0.0078	0.041	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.000808	0.000679	0.000298	0.00124	4	0.00076	0.00039	0.00030	0.0012	0%	0%	0%
Nickel	mg/L	0.066 to 0.11	-	0.000860	0.000880	0.00187	0.000950	4	0.0011	0.00049	0.00086	0.0019	0%	0%	-
Potassium	mg/L	-	-	1.10	0.781	0.649	1.04	4	0.89	0.21	0.65	1.1	0%	-	-
Selenium	mg/L	0.0020	-	0.000124	0.000122	0.000170	0.000120	4	0.00013	0.000024	0.00012	0.00017	0%	0%	-
Silicon	mg/L	-	-	5.01	5.76	5.66	5.38	4	5.5	0.34	5.0	5.8	0%	-	-
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	4	<0.000010	-	<0.000010	<0.000010	100%	0%	0%
Sodium	mg/L	-	-	5.54	5.15	2.92	6.25	4	5.0	1.4	2.9	6.2	0%	-	-
Strontium	mg/L	-	-	0.205	0.178	0.102	0.217	4	0.18	0.052	0.10	0.22	0%	-	-
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	4	<0.000010	-	<0.000010	<0.000010	100%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	0.0136	<0.010	4	0.011	-	<0.010	0.014	75%	-	-
Uranium	mg/L	0.0085	-	0.000268	0.000158	0.0000930	0.000212	4	0.00018	0.000075	0.000093	0.00027	0%	0%	-
Vanadium	mg/L	-	-	0.000700	0.000510	0.00139	0.000860	4	0.00086	0.00038	0.00051	0.0014	0%	-	-
Zinc	mg/L	0.0075 to 0.034	0.033 to 0.060	<0.0030	<0.0030	<0.0030	<0.0030	4	<0.0030	-	<0.0030	<0.0030	100%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.7: Surface Water Sample Data Collected Routinely at W10 in Lower Edney Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date				Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	4-Nov-21	7-Feb-22	5-Apr-22	3-Aug-22								
Dissolved Metals															
Aluminum	mg/L	0.050	0.10	0.00750	0.0193	0.117	0.0134	4	0.039	0.052	0.0075	0.12	0%	25%	25%
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	-	-
Arsenic	mg/L	-	-	0.00110	0.00111	0.000420	0.00154	4	0.0010	0.00046	0.00042	0.0015	0%	-	-
Barium	mg/L	-	-	0.0144	0.0140	0.00892	0.0198	4	0.014	0.0044	0.0089	0.020	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	4	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0100	0.0100	<0.010	0.0180	4	0.012	0.0042	0.010	0.018	25%	-	-
Cadmium	mg/L	0.00015 to 0.00025	0.00035 to 0.00075	<0.0000050	<0.0000050	0.00000550	0.00000850	4	0.0000060	0.0000018	<0.0000050	0.0000085	50%	0%	0%
Calcium	mg/L	-	-	28.9	27.2	16.6	34.8	4	27	7.6	17	35	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	0.000650	<0.00050	4	0.00054	-	<0.00050	0.00065	75%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0058 to 0.0084	0.035 to 0.050	0.00116	0.00155	0.00276	0.00155	4	0.0018	0.00069	0.0012	0.0028	0%	0%	0%
Iron	mg/L	-	0.35	0.0660	0.129	0.180	0.0440	4	0.10	0.062	0.044	0.18	0%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	4	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	4	<0.0010	-	<0.0010	<0.0010	100%	-	-
Magnesium	mg/L	-	-	9.62	8.15	4.75	9.61	4	8.0	2.3	4.8	9.6	0%	-	-
Manganese	mg/L	-	-	0.00585	0.00420	0.00519	0.00777	4	0.0058	0.0015	0.0042	0.0078	0%	-	-
Molybdenum	mg/L	-	-	0.000791	0.000688	0.000257	0.00122	4	0.00074	0.00040	0.00026	0.0012	0%	-	-
Nickel	mg/L	-	-	0.000610	0.000740	0.00108	0.000840	4	0.00082	0.00020	0.00061	0.0011	0%	-	-
Potassium	mg/L	-	-	1.03	0.754	0.558	0.963	4	0.83	0.21	0.56	1.0	0%	-	-
Selenium	mg/L	-	-	0.000159	0.0000880	0.000186	0.000109	4	0.00014	0.000045	0.000088	0.00019	0%	-	-
Silicon	mg/L	-	-	4.58	5.16	4.47	5.10	4	4.8	0.35	4.5	5.2	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	4	<0.000010	-	<0.000010	<0.000010	100%	-	-
Sodium	mg/L	-	-	5.12	4.77	2.64	6.33	4	4.7	1.5	2.6	6.3	0%	-	-
Strontium	mg/L	-	-	0.195	0.177	0.102	0.236	4	0.18	0.056	0.10	0.24	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	4	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	4	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	4	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000251	0.000159	0.0000710	0.000211	4	0.00017	0.000078	0.000071	0.00025	0%	-	-
Vanadium	mg/L	-	-	<0.00050	<0.00050	0.000640	0.000620	4	0.00056	0.000012	<0.00050	0.00064	50%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	4	<0.0030	-	<0.0030	<0.0030	100%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.

[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.8: Surface Water Sample Data Collected Routinely at EDC-01a in Lower Edney Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Anions, Organics, Nutrients, and Physical Properties																							
Alkalinity (as $CaCO_3$)	mg/L	>20	-	149	145	125	116	124	113	97.6	61.3	44.0	67.5	88.2	122	12	104	33	44	149	0%	0%	-
Ammonia (as N)	mg/L	0.37 to 2.0	1.9 to 12	0.00680	0.00540	0.00650	0.00500	0.00600	<0.0050	0.00690	0.00720	0.00810	0.00700	0.00820	0.00920	12	0.0068	0.0013	0.0050	0.0092	8%	0%	0%
Chloride	mg/L	150	600	1.47	1.34	1.09	0.710	1.10	0.850	0.580	<0.50	<0.50	<0.50	<0.50	0.870	12	0.83	0.33	<0.50	1.5	33%	0%	0%
Conductivity	µS/cm	-	-	378	360	325	270	341	288	241	146	99.3	172	221	313	12	263	89	99	378	0%	-	-
Specific Conductance (*in situ*)	µS/cm	-	-	376	-	314	301	343	281	241	146	97.2	168	219	357	11	258	92	97	376	0%	-	-
Dissolved Organic Carbon	mg/L	-	-	4.89	4.63	7.93	7.97	6.01	8.18	14.0	20.5	17.4	13.3	11.0	6.08	12	10	5.1	4.6	20	0%	-	-
Dissolved Oxygen (*in situ*)	%	-	-	103	-	90.8	90.6	87.3	91.5	94.8	92.9	92.9	90.5	97.2	95.8	11	93	4.2	87	103	0%	-	-
Dissolved Oxygen (*in situ*)	mg/L	>8	>5	10.6	-	11.7	13.2	12.6	13.0	13.3	13.1	12.6	9.44	9.10	9.17	11	12	1.7	9.1	13	0%	0%	0%
Fluoride	mg/L	-	1.1 to 1.6	0.0940	0.104	0.0830	0.0520	0.0920	0.0800	0.0620	0.0450	0.0450	0.0560	0.0640	0.0790	12	0.071	0.020	0.045	0.10	0%	-	0%
Hardness (as $CaCO_3$)	mg/L	-	-	175	170	148	141	157	135	121	82.3	51.5	77.2	103	146	12	126	39	52	175	0%	-	-
Nitrate (as N)	mg/L	3.0	33	0.0396	<0.0050	0.0506	0.0514	0.123	0.0885	0.0915	0.0434	0.00920	<0.0050	0.0106	0.0333	12	0.046	0.038	<0.0050	0.12	17%	0%	0%
Nitrate and Nitrite (as N)	mg/L	-	-	0.0396	<0.0051	0.0506	0.0514	0.123	0.0885	0.0915	0.0434	0.00920	<0.0051	0.0106	0.0333	12	0.046	0.038	<0.0051	0.12	17%	-	-
Nitrite (as N)	mg/L	0.020	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	<0.0010	-	<0.0010	<0.0010	100%	0%	0%
Dissolved Orthophosphate	mg/L	-	-	0.00140	0.00160	0.00180	0.00170	0.00640	0.00510	0.00220	0.00220	<0.0010	0.00170	0.00140	0.00270	12	0.0024	0.0016	<0.0010	0.0064	8%	-	-
pH (*in situ*)	pH units	6.5-9.0	6.5-9.0	8.45	-	8.14	8.06	7.99	8.03	7.71	7.74	7.51	8.06	8.17	8.20	11	8.0	0.26	7.5	8.4	0%	0%	0%
pH	pH units	6.5-9.0	6.5-9.0	8.31	8.37	8.14	7.98	8.09	8.08	8.04	7.89	7.80	7.98	8.17	8.30	12	8.1	0.17	7.8	8.4	0%	-	-
Dissolved Phosphorus	mg/L	-	-	0.00460	0.00440	0.00590	0.00320	0.00800	0.00960	0.0123	0.0102	0.00740	0.00900	0.00970	0.00770	12	0.0077	0.0027	0.0032	0.012	0%	-	-
Total Phosphorus	mg/L	-	-	0.00620	0.00710	0.0186	0.00730	0.00910	0.0113	0.0142	0.0216	0.0264	0.0162	0.0142	0.00990	12	0.014	0.0063	0.0062	0.026	0%	-	-
Sulphate	mg/L	218 to 309	-	54.0	50.8	41.0	39.0	52.4	37.6	27.4	11.3	4.85	17.8	24.2	40.4	12	33	16	4.8	54	0%	0%	-
Temperature (*in situ*)	°C	-	-	14.1	-	4.50	0.0230	0.323	0.974	1.61	1.23	2.57	13.4	17.2	17.3	11	6.7	7.2	0.023	17	0%	-	-
Total Dissolved Solids	mg/L	-	-	258	230	212	165	212	186	178	116	69.0	130	162	183	12	175	52	69	258	0%	-	-
Total Nitrogen	mg/L	-	-	0.209	0.170	0.281	0.299	0.301	0.372	0.491	0.611	0.494	0.414	0.367	0.262	12	0.36	0.13	0.17	0.61	0%	-	-
Total Suspended Solids	mg/L	-	-	<1.0	1.40	11.2	1.80	<1.0	<1.0	1.90	6.30	9.80	6.40	2.20	<1.0	12	3.8	3.7	<1.0	11	33%	-	-
Turbidity (*in situ*)	NTU	-	-	0.800	-	6.50	1.76	0.750	0.820	1.35	4.36	6.92	2.01	0.980	0.780	11	2.5	2.3	0.75	6.9	0%	-	-
Turbidity	NTU	-	-	0.410	0.300	5.56	5.06	0.510	0.420	1.51	5.89	6.99	1.54	0.840	0.500	12	2.5	2.6	0.30	7.0	0%	-	-
Total Metals																							
Aluminum	mg/L	-	-	0.0243	0.0182	0.371	0.0418	0.0293	0.0345	0.122	0.410	0.271	0.186	0.0863	0.0203	12	0.13	0.14	0.018	0.41	0%	-	-
Antimony	mg/L	0.0090	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Arsenic	mg/L	-	0.0050	0.00108	0.000960	0.00128	0.000850	0.000780	0.000910	0.000810	0.000560	0.000480	0.000580	0.000740	0.000950	12	0.00083	0.00023	0.00048	0.0013	0%	-	0%
Barium	mg/L	1.0	-	0.0285	0.0239	0.0276	0.0196	0.0197	0.0182	0.0170	0.0146	0.0109	0.0131	0.0162	0.0213	12	0.019	0.0054	0.011	0.028	0%	0%	-
Beryllium	mg/L	0.00013	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	0%	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	1.2	-	0.0250	0.0240	0.0150	0.0160	0.0210	0.0180	0.0130	<0.010	<0.010	0.0120	0.0160	0.0220	12	0.017	0.0048	<0.010	0.025	17%	0%	-
Cadmium	mg/L	-	-	0.00000870	<0.000010	0.0000115	0.00000550	0.00000640	0.00000590	0.0000152	0.0000172	0.0000118	<0.000010	0.00000780	<0.000010	12	0.0000092	0.0000040	0.0000055	0.000017	25%	-	-
Calcium	mg/L	-	-	49.5	52.6	44.0	41.7	45.6	43.4	35.2	21.2	14.0	27.1	31.6	42.3	12	37	12	14	53	0%	-	-
Chromium	mg/L	0.0010	-	<0.00050	<0.00050	0.000730	<0.00050	<0.00050	<0.00050	0.000630	0.00128	0.00100	0.000640	<0.00050	<0.00050	12	0.00065	0.00022	<0.00050	0.0013	58%	8%	-
Cobalt	mg/L	0.0040	0.11	<0.00010	<0.00010	0.000300	<0.00010	<0.00010	<0.00010	0.000110	0.000290	0.000230	0.000130	<0.00010	<0.00010	12	0.00015	0.000080	<0.00010	0.00030	58%	0%	0%
Copper	mg/L	-	-	0.00937	0.00770	0.0114	0.00615	0.00792	0.00722	0.00832	0.00720	0.00580	0.00640	0.00656	0.00713	12	0.0076	0.0016	0.0058	0.011	0%	-	-
Iron	mg/L	-	1.0	0.0400	0.0320	0.546	0.0910	0.0580	0.0910	0.234	0.648	0.374	0.249	0.144	0.0380	12	0.21	0.21	0.032	0.65	0%	-	0%
Lead	mg/L	0.0047 to 0.0098	0.035 to 0.17	<0.000050	<0.000050	0.000201	<0.000050	<0.000050	<0.000050	0.0000690	0.000158	0.000148	0.0000560	<0.000050	<0.000050	12	0.000082	0.000056	<0.000050	0.00020	58%	0%	0%
Lithium	mg/L	-	-	0.00130	0.00120	0.00150	<0.0010	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	0.0011	0.00014	<0.0010	0.0015	67%	-	-
Magnesium	mg/L	-	-	11.5	10.7	11.0	9.37	9.04	8.75	8.30	5.93	3.55	5.28	6.12	8.16	12	8.1	2.5	3.6	12	0%	-	-
Manganese	mg/L	0.83 to 1.4	1.1 to 2.5	0.0531	0.0446	0.0522	0.0310	0.0544	0.0366	0.0408	0.0406	0.0220	0.0256	0.0375	0.0560	12	0.041	0.011	0.022	0.056	0%	0%	0%
Molybdenum	mg/L	7.6	46	0.00613	0.00626	0.00434	0.00347	0.00574	0.00420	0.00270	0.000937	0.000664	0.00269	0.00370	0.00567	12	0.0039	0.0019	0.00066	0.0063	0%	0%	0%
Nickel	mg/L	0.025 to 0.15	-	<0.00050	<0.00050	0.00113	0.000560	<0.00050	0.000530	0.000990	0.00172	0.00137	0.000930	0.000770	<0.00050	12	0.00083	0.00041	<0.00050	0.0017	33%	0%	-
Potassium	mg/L	-	-	1.38	1.27	1.24	0.938	1.09	1.02	0.879	0.754	0.542	0.717	0.885	1.13	12	0.99	0.25	0.54	1.4	0%	-	-
Selenium	mg/L	0.0020	-	0.00165	0.00119	0.00125	0.00123	0.00122	0.000732	0.000637	0.000376	0.000190	0.000387	0.000648	0.00107	12	0.00088	0.00045	0.00019	0.0016	0%	0%	-
Silicon	mg/L	-	-	4.37	4.29	5.05	4.56	4.43	5.00	5.24	5.59	4.81	3.83	3.63	4.34	12	4.6	0.57	3.6	5.6	0%	-	-
Silver	mg/L	0.000050 to 0.0015	0.00010 to 0.0030	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	0%
Sodium	mg/L	-	-	10.3	10.0	7.34	7.04	8.56	7.81	6.49	3.73	2.10	4.70	5.74	7.78	12	6.8	2.4	2.1	10	0%	-	-
Strontium	mg/L	-	-	0.365	0.379	0.318	0.284	0.338	0.287	0.231	0.141	0.0880	0.165	0.205	0.285	12	0.26	0.092	0.088	0.38	0%	-	-
Thallium	mg/L	0.00080	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	0%	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	0.0142	<0.010	<0.010	<0.010	<0.010	0.0108	<0.010	<0.010	<0.010	<0.010	12	0.010	0.0013	<0.010	0.014	83%	-	-
Uranium	mg/L	0.0085	-	0.000600	0.000559	0.000684	0.000506	0.000453	0.000370	0.000352	0.000198	0.000107	0.000176	0.000229	0.000383	12	0.00038	0.00018	0.00011	0.00068	0%	0%	-
Vanadium	mg/L	-	-	0.00101	0.000870	0.00137	0.000560	0.000840	0.000800	0.00100	0.00135	0.00100	0.00136	0.00119	0.00118	12	0.0010	0.00025	0.00056	0.0014	0%	-	-
Zinc	mg/L	0.0075 to 0.071	0.033 to 0.097	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	0%	0%

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c,2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.
[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

Table D.1.8: Surface Water Sample Data Collected Routinely at EDC-01a in Lower Edney Creek, September 2021 to August 2022

Analyte	Units	British Columbia Water Quality Guidelines[a]		Date												Sample Size	Mean	Standard Deviation	Minimum	Maximum	% <LRL	% >Chronic GL[b]	% >Acute GL[b]
		Long-term Average	Short-term Maximum	1-Sep-21	4-Oct-21	4-Nov-21	1-Dec-21	12-Jan-22	7-Feb-22	9-Mar-22	5-Apr-22	3-May-22	1-Jun-22	5-Jul-22	3-Aug-22								
Dissolved Metals																							
Aluminum	mg/L	0.050	0.10	0.00420	<0.0030	0.00470	0.0100	<0.0030	0.0103	0.0482	0.110	0.158	0.0558	0.0309	0.00630	12	0.037	0.050	<0.0030	0.16	17%	25%	17%
Antimony	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Arsenic	mg/L	-	-	0.00103	0.000930	0.00101	0.000830	0.000740	0.000850	0.000800	0.000470	0.000420	0.000480	0.000740	0.000840	12	0.00076	0.00021	0.00042	0.0010	0%	-	-
Barium	mg/L	-	-	0.0279	0.0238	0.0201	0.0194	0.0189	0.0172	0.0159	0.0121	0.00931	0.0112	0.0166	0.0211	12	0.018	0.0053	0.0093	0.028	0%	-	-
Beryllium	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Boron	mg/L	-	-	0.0240	0.0210	0.0160	0.0160	0.0210	0.0180	0.0130	<0.010	<0.010	0.0110	0.0140	0.0200	12	0.016	0.0045	<0.010	0.024	17%	-	-
Cadmium	mg/L	0.00013 to 0.00032	0.00030 to 0.0010	0.00000670	0.00000620	0.00000530	0.00000620	<0.0000050	<0.0000050	0.00000880	0.00000710	<0.0000050	0.00000800	<0.000015	0.0000138	12	0.0000070	0.0000027	<0.0000050	0.000014	33%	0%	0%
Calcium	mg/L	-	-	50.8	50.3	42.0	41.1	47.9	40.7	35.3	23.1	14.4	23.4	31.4	45.2	12	37	12	14	51	0%	-	-
Chromium	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.000560	0.000850	<0.00050	<0.00050	<0.00050	12	0.00053	0.00011	<0.00050	0.00085	83%	-	-
Cobalt	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Copper	mg/L	0.0034 to 0.0080	0.020 to 0.048	0.00826	0.00674	0.00513	0.00540	0.00694	0.00599	0.00695	0.00573	0.00510	0.00523	0.00561	0.00663	12	0.0061	0.00097	0.0051	0.0083	0%	75%	0%
Iron	mg/L	-	0.35	<0.030	<0.030	0.0310	0.0590	<0.030	0.0540	0.136	0.170	0.188	0.0860	0.0770	<0.030	12	0.077	0.059	<0.030	0.19	33%	-	0%
Lead	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	12	<0.000050	-	<0.000050	<0.000050	100%	-	-
Lithium	mg/L	-	-	0.00130	0.00110	0.00110	<0.0010	0.00110	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	12	0.0010	0.000064	<0.0010	0.0013	67%	-	-
Magnesium	mg/L	-	-	11.6	10.8	10.5	9.36	9.00	8.04	7.96	5.97	3.78	4.56	5.97	8.09	12	8.0	2.5	3.8	12	0%	-	-
Manganese	mg/L	-	-	0.0493	0.0424	0.0257	0.0421	0.0490	0.0309	0.0381	0.0160	0.00894	0.0155	0.0287	0.0506	12	0.033	0.014	0.0089	0.051	0%	-	-
Molybdenum	mg/L	-	-	0.00601	0.00603	0.00405	0.00346	0.00588	0.00407	0.00286	0.000845	0.000718	0.00276	0.00364	0.00580	12	0.0038	0.0019	0.00072	0.0060	0%	-	-
Nickel	mg/L	-	-	<0.00050	<0.00050	0.000510	0.000520	<0.00050	<0.00050	0.000840	0.00106	0.00110	0.000810	0.000710	<0.00050	12	0.00067	0.00023	<0.00050	0.0011	42%	-	-
Potassium	mg/L	-	-	1.37	1.19	1.13	0.931	1.13	0.958	0.863	0.656	0.590	0.747	0.851	1.08	12	0.96	0.23	0.59	1.4	0%	-	-
Selenium	mg/L	-	-	0.00162	0.00146	0.00131	0.00131	0.00117	0.000766	0.000761	0.000361	0.000226	0.000416	0.000691	0.00102	12	0.00093	0.00046	0.00023	0.0016	0%	-	-
Silicon	mg/L	-	-	4.63	4.11	4.25	4.47	4.30	4.42	5.10	4.63	4.52	3.62	3.89	4.27	12	4.4	0.38	3.6	5.1	0%	-	-
Silver	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	-	-
Sodium	mg/L	-	-	10.6	9.86	6.86	6.92	8.69	7.16	6.34	3.43	2.30	4.42	5.99	8.09	12	6.7	2.5	2.3	11	0%	-	-
Strontium	mg/L	-	-	0.392	0.349	0.300	0.287	0.348	0.282	0.230	0.140	0.0912	0.158	0.223	0.316	12	0.26	0.093	0.091	0.39	0%	-	-
Thallium	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	12	<0.000010	-	<0.000010	<0.000010	100%	-	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	12	<0.00010	-	<0.00010	<0.00010	100%	-	-
Titanium	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	12	<0.010	-	<0.010	<0.010	100%	-	-
Uranium	mg/L	-	-	0.000637	0.000510	0.000645	0.000518	0.000453	0.000360	0.000361	0.000162	0.000106	0.000162	0.000224	0.000368	12	0.00038	0.00018	0.00011	0.00064	0%	-	-
Vanadium	mg/L	-	-	0.000930	0.000800	0.000500	<0.00050	0.000740	0.000610	0.000700	0.000660	0.000720	0.000950	0.00100	0.00108	12	0.00077	0.00019	0.00050	0.0011	8%	-	-
Zinc	mg/L	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	12	<0.0030	-	<0.0030	<0.0030	100%	-	-

Indicates value greater than the long-term average British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Indicates value greater than the short-term maximum British Columbia Water Quality Guideline (BCMOECCS 2019b,c, 2021a,b).
Percent exceedance > 0%.

Notes: "-" = data not available or no applicable guideline exists. < LRL = below laboratory reporting limit. GL = guideline. Guidelines for these parameters (Total Suspended Solids, Turbidity, Dissolved Organic Carbon) are narrative and were not evaluated.

[a] Guidelines were derived from the British Columbia Water Quality Guidelines for the protection of aquatic life (BCMOECCS 2019b,c, 2021a,b) outlined in Table D.1.1.

[b] % displayed for pH indicates results falling outside the guideline range. % displayed for dissolved oxygen indicates results below the guideline.

APPENDIX D.2
SEDIMENT QUALITY

Table D.2.1: **Baseline Sediment Quality Data for Upper and Lower Edney Creek, 1995, 1996, and 1999**

Analyte	Units	1995 (HKP 1996)[a]																	
		WQ8						WQ8B						WQ9					
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Physical Tests																			
Moisture	%	39.3	90.4	38.2	43.6	52	88.2	36.1	30.5	35.2	31.1	21.3	18.4	16.5	10.6	14.9	12.9	10.5	8.5
Physical Characteristics																			
Gravel (> 2mm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand (2.0 mm - 0.050 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silt (0.050 mm - 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clay (< 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic / Inorganic Carbon																			
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																			
Aluminum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/kg	0.62	<0.050	<0.050	<0.050	<0.050	<0.050	0.52	0.53	0.99	0.46	0.56	0.27	1.54	<0.050	0.35	0.30	<0.050	0.13
Arsenic	mg/kg	5.52	6.73	6.72	4.53	3.43	11.5	2.7	4.91	3.86	5.31	5.53	6.36	5.73	3.23	1.95	8.81	5.22	5.16
Barium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	<0.10	8.7	<0.10	0.10	<0.10	0.60	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/kg	38	71	43	43	28	101	44	48	20	21	33	29	32	10	7	22	9	8
Cobalt	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/kg	21	55	26	23	20	69	36	27	44	118	19	22	27	26	10	17	28	9
Iron	mg/kg	30,800	39,200	29,200	28,200	24,700	56,600	37,700	30,700	20,100	24,600	23,200	32,500	27,700	23,200	9,920	27,100	25,700	11,900
Lead	mg/kg	4	13	4	4	4	10	5	4	4	4	3	4	<2.0	4	<2.0	3	2.0	3
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/kg	540	1,350	472	529	506	1,330	892	872	708	535	565	1,040	775	624	221	640	549	300
Mercury	mg/kg	0.040	0.071	0.064	0.036	0.032	0.078	0.036	0.033	0.015	0.022	0.023	0.024	0.019	0.013	0.012	0.014	0.014	0.015
Molybdenum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/kg	24	52	24	25	19	61	40	26	15	16	19	19	15	13	4	14	9	6
Phosphorus	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	0.20	1.3	0.10	0.20	0.20	0.90	<0.10	<0.10	<0.10	0.50	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/kg	54	128	52	55	49	138	58	43	29	36	30	42	37	31	15	37	29	17

Notes: Sediment metal concentrations are based predominantly on bulk sediment samples. Concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. Iron concentrations in sediment in 1999 were measured using both ICP-AA (Inductively Coupled Plasma Atomic Absorption) as well as ICP-MS (Inductively Coupled Plasma Mass Spectrometry for each sample collected (Beak 2000). Iron results measured using ICP-MS are displayed herein because this method is consistent with analysis methods used for post-breach monitoring (see Section 4.1.2). "-" indicates no data available.

[a] Monitoring areas WQ8, WQ8B, WQ9, and WQ10 sampled in 1995 (HKP 1996) were considered equivalent to sampling areas W8, W8A, W9, and W10 sampled in 1996 (HKP 1997a), respectively.

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997a) and are suspected errors.

Table D.2.1: **Baseline Sediment Quality Data for Upper and Lower Edney Creek, 1995, 1996, and 1999**

Analyte	Units	1995 (HKP 1996) [a]						1996 (HKP 1997a) [b]											
		WQ10						W8						W8A					
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Physical Tests																			
Moisture	%	29.4	26.1	14.6	11.2	8.1	12.6	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																			
Gravel (> 2mm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand (2.0 mm - 0.050 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silt (0.050 mm - 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clay (< 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic / Inorganic Carbon																			
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																			
Aluminum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/kg	0.12	0.80	0.45	0.38	0.38	0.25	0.48	0.47	0.30	0.25	0.45	0.23	0.58	0.58	0.53	1.1	0.59	0.41
Arsenic	mg/kg	8.54	4.08	18.1	9.83	14.4	10.1	5.67	4.88	6.56	2.12	7.08	6.19	15.9	21.9	9.96	13.5	14.1	10
Barium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	0.10	<0.10	0.40	0.10	0.20	0.30	0.40	0.50	0.40	0.10	0.60	<0.10	0.60	0.60	0.30	0.60	<0.10	0.40
Calcium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/kg	42	8	34	24	31	29	68	83	66	52	64	64	59	44	56	56	55	66
Cobalt	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/kg	34	12	28	21	38	32	691	1,770	1,320	605	596	1,590	2,070	1,830	2,770	4,340	2,120	1,860
Iron	mg/kg	30,000	12,700	51,900	29,100	28,000	56,600	35,700	34,000	32,700	22,500	37,400	31,200	38,900	39,900	29,100	3,160	30,900	34,700
Lead	mg/kg	4	<2.0	4	4	3	4	10	13	14	7	10	11	13	8	10	31	9	12
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/kg	644	527	1,470	823	733	1,170	876	1,150	2,490	421	1,080	835	12,200	13,700	5,040	5,120	2,160	1,290
Mercury	mg/kg	0.058	<0.0050	0.035	0.048	0.015	0.101	0.015	0.065	0.094	0.047	<0.0050	0.052	0.046	0.053	0.036	0.039	0.040	0.228
Molybdenum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/kg	30	10	30	20	20	42	41	48	38	16	45	42	45	38	36	35	35	35
Phosphorus	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	0.20	0.10	0.30	0.10	0.40	0.70	0.50	0.60	0.60	0.20	0.70	0.60	0.40	0.10	0.20	0.40	0.10	0.30
Silver	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/kg	60	23	126	54	51	97	191	321	266	126	174	295	389	398	462	792	630	351

Notes: Sediment metal concentrations are based predominantly on bulk sediment samples. Concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. Iron concentrations in sediment in 1999 were measured using both ICP-AA (Inductively Coupled Plasma Atomic Absorption) as well as ICP-MS (Inductively Coupled Plasma Mass Spectrometry for each sample collected (Beak 2000). Iron results measured using ICP-MS are displayed herein because this method is consistent with analysis methods used for post-breach monitoring (see Section 4.1.2). "-" indicates no data available.

[a] Monitoring areas WQ8, WQ8B, WQ9, and WQ10 sampled in 1995 (HKP 1996) were considered equivalent to sampling areas W8, W8A, W9, and W10 sampled in 1996 (HKP 1997a), respectively.

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997a) and are suspected errors.

Table D.2.1: **Baseline Sediment Quality Data for Upper and Lower Edney Creek, 1995, 1996, and 1999**

Analyte	Units	1996 (HKP 1997a)[b]												1999 (Beak 2000)					
		W9						W10						W8			W9		
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
Physical Tests																			
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																			
Gravel (> 2mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		5.4		-	-	-
Sand (2.0 mm - 0.050 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		15.1		-	-	-
Silt (0.050 mm - 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		44		-	-	-
Clay (< 2 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		36		-	-	-
Organic / Inorganic Carbon																			
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-		1.4		-	-	
Metals																			
Aluminum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	21,000	20,000	22,000	9,500	9,000	12,000
Antimony	mg/kg	0.32	0.69	0.42	0.49	0.60	0.42	0.41	0.64	0.55	0.65	1.54	0.73	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Arsenic	mg/kg	7.38	11.2	4.89	4.83	9.47	6.39	4.67	7.36	6.24	11.9	7.07	11.5	7.2	7.2	8	22	22	5.8
Barium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	150	160	160	170	180	120
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.50	0.50	0.50	0.30	0.30	0.30
Bismuth	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.90	0.40	0.30	0.30	>0.2	0.20
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	3.1	4.2	2.7	2.1	3.5	2.6
Cadmium	mg/kg	<0.10	<0.10	0.10	0.30	0.90	0.30	0.20	0.30	0.40	<0.10	0.50	<0.10	0.40	0.60	0.40	0.30	0.30	0.30
Calcium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	11,000	9,800	17,000	7,000	8,300	7,500
Chromium	mg/kg	44	109	40	61	81	49	30	49	51	44	61	50	47	46	48	24	23	30
Cobalt	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	17	16	17	11	11	12
Copper	mg/kg	1,130	6,740	698	2,900	4,100	2,120	442	2,590	3,350	2,450	12,200	4,060	56	54	62	19	20	25
Iron	mg/kg	19,200	24,900	18,400	19,400	21,800	19,700	15,900	17,800	19,000	20,500	17,800	20,100	38,000	35,000	40,000	48,000	52,000	23,000
Lead	mg/kg	8	32	6	12	18	9	6	11	12	21	41	10	12	10	12	5.3	6.5	5.6
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	11,000	10,000	13,000	5,800	5,800	6,000
Manganese	mg/kg	1,080	1,510	743	962	895	991	482	686	662	586	800	546	1,000	1,100	840	1,200	1,500	1,500
Mercury	mg/kg	0.0050	0.042	0.015	0.015	0.035	0.022	0.027	0.022	0.011	<0.0050	0.019	0.020	0.050	<0.040	<0.040	<0.040	<0.040	<0.040
Molybdenum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.70	0.60	0.70	1.1	1.3	0.60
Nickel	mg/kg	22	53	21	32	37	25	15	27	26	22	34	35	43	40	46	18	18	22
Phosphorus	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	790	910	830	1,000	1,200	910
Potassium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	2,100	1,900	2,300	950	1,000	820
Selenium	mg/kg	0.20	0.40	0.20	0.20	0.30	0.20	0.20	0.40	0.30	0.30	0.50	0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.20	0.10	0.10	0.10	0.10
Sodium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	170	160	190	190	230	160
Strontium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	100	100	120	69	72	69
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	290	500	180	560	730	530
Thallium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.20	0.20	0.20	<0.20	<0.20	<0.20
Tin	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	1.2	1.2	1.1	1.0	0.60	1.0
Titanium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	460	390	440	240	290	270
Uranium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.80	1.0	0.80	0.80	0.90	1.0
Vanadium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	52	46	56	48	48	45
Zinc	mg/kg	284	1,810	151	442	873	362	107	573	642	476	2,680	1,120	84	84	89	43	47	58

Notes: Sediment metal concentrations are based predominantly on bulk sediment samples. Concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. Iron concentrations in sediment in 1999 were measured using both ICP-AA (Inductively Coupled Plasma Atomic Absorption) as well as ICP-MS (Inductively Coupled Plasma Mass Spectrometry for each sample collected (Beak 2000). Iron results measured using ICP-MS are displayed herein because this method is consistent with analysis methods used for post-breach monitoring (see Section 4.1.2). "-" indicates no data available.

[a] Monitoring areas WQ8, WQ8B, WQ9, and WQ10 sampled in 1995 (HKP 1996) were considered equivalent to sampling areas W8, W8A, W9, and W10 sampled in 1996 (HKP 1997a), respectively.

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997a) and are suspected errors.

Table D.2.2: Baseline and Pre-Breach Sediment Quality Data for Upper Hazeltine Creek, 1995, 1996, 1999, 2007, 2009, 2010, 2012, and 2013

Analyte	Units	1995 (W7) HKP (1996)						1996 (W7)[a] HKP (1997)						1999 (W6)[b] Beak (2000)			2007 (W7) Minnow (2009)			2009 (W7) Minnow (2011)				
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	UHC-1	UHC-2	UHC-3	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Physical Tests																								
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																								
Gravel (> 2mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		8.90		2.00	8.00	1.00	4.00	2.00	5.00	11.0	2.00
Sand (2.0 mm - 0.063 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		49.3		38.0	35.0	46.0	45.0	50.0	***76.0***	58.0	62.0
Silt (0.063 mm - 4 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		31.0		46.0	43.0	41.0	38.0	39.0	16.0	27.0	30.0
Clay (< 4µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		10.0		***15.0***	***14.0***	12.0	13.0	9.00	4.00	4.00	5.00
Organic / Inorganic Carbon																								
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-		3.20		12.5	10.9	7.77	7.50	8.37	7.40	7.47	8.73
Anions and Nutrients																								
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																								
Aluminum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	12,000	13,000	10,000	14,400	14,300	16,500	-	-	-	-	-
Antimony	mg/kg	***0.810***	0.330	***0.510***	0.370	0.120	0.340	***0.720***	***0.620***	***0.610***	***1.75***	***0.870***	***0.590***	<0.20	<0.20	<0.20	***<10.0***	***<10.0***	***<10.0***	***<10.0***	***<10.0***	***<10.0***	***<10.0***	***<10.0***
Arsenic	mg/kg	***18.1***	6.87	3.69	***24.5***	***10.7***	2.67	6.77	3.17	4.12	***17.1***	5.56	5.05	2.50	3.00	3.20	<5.0	5.30	7.40	5.80	<5.0	<5.0	<5.0	<5.0
Barium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	110	110	84.0	115	104	***156***	117	127	83.2	97.5	96.6
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.300	0.400	0.300	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***
Bismuth	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	<0.20	<0.20	<20.0	<20.0	<20.0	-	-	-	-	-
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	***5.50***	4.50	3.60	-	-	-	-	-	-	-	-
Cadmium	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	***0.400***	0.300	***0.500***	***2.60***	0.100	***0.500***	0.100	0.100	0.100	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***	***<0.50***
Calcium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,470	8,910	10,600	-	-	-	-	-
Chromium	mg/kg	26.0	30.0	5.00	9.00	***45.0***	27.0	***138***	***146***	***110***	***201***	***74.0***	***131***	29.0	30.0	22.0	25.3	27.6	32.0	36.5	30.7	18.8	25.6	24.4
Cobalt	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	9.00	9.90	8.50	8.70	8.90	9.70	***10.8***	9.10	6.60	7.90	7.60
Copper	mg/kg	17.0	47.0	25.0	20.0	79.0	39.0	***5,250***	***7,670***	***7,980***	***22,000***	***2,340***	***8,420***	47.0	39.0	23.0	55.9	63.6	67.0	53.7	50.1	34.4	45.5	45.4
Iron	mg/kg	***33,000***	25,400	12,600	17,900	***57,500***	***35,100***	***31,700***	29,100	28,600	***55,500***	***31,000***	29,900	15,000	17,000	15,000	19,600	22,500	22,900	-	-	-	-	-
Lead	mg/kg	3.00	4.00	2.00	2.00	5.00	***8.00***	***35.0***	***29.0***	***21.0***	***103***	***14.0***	***26.0***	***6.70***	5.80	4.20	***<30.0***	***<30.0***	***<30.0***	***<30.0***	***<30.0***	***<30.0***	***<30.0***	***<30.0***
Lithium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.4	12.6	***14.8***	-	-	-	-	-
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,520	5,780	***6,430***	-	-	-	-	-
Manganese	mg/kg	858	613	362	480	1,300	743	1,260	***1,720***	***2,010***	***10,100***	***1,420***	***2,470***	320	340	320	***2,480***	1,290	868	-	-	-	-	-
Mercury	mg/kg	0.0250	0.0460	0.0460	0.0510	0.105	0.0470	0.0880	0.0470	0.0660	0.0920	0.0700	0.0920	<0.040	<0.040	<0.040	0.113	0.118	0.130	0.0960	0.0990	0.0640	0.101	0.0870
Molybdenum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.500	0.500	0.200	***<4.0***	***<4.0***	***<4.0***	***<4.0***	***<4.0***	***<4.0***	***<4.0***	***<4.0***
Nickel	mg/kg	16.0	24.0	5.00	8.00	***25.0***	18.0	***69.0***	***68.0***	***54.0***	***134***	***33.0***	***65.0***	20.0	22.0	16.0	15.7	16.4	19.2	***25.2***	19.2	12.2	16.0	15.3
Phosphorus	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	860	970	1,160	-	-	-	-	-
Selenium	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.600	0.400	0.600	1.40	0.500	0.500	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	0.540	0.790	1.14	0.600	0.770
Silver	mg/kg	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	***<2.0***	***<2.0***	***<2.0***	***<2.0***	***<2.0***	***<2.0***	***<2.0***	***<2.0***
Sodium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210	210	230	-	-	-	-	-
Strontium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	100	100	78.0	74.7	68.8	87.5	-	-	-	-	-
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	***<0.20***	***<0.20***	***<0.20***	***<1.0***	***<1.0***	***<1.0***	-	-	-	-	-
Tin	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.700	0.600	0.700	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Titanium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	390	390	380	542	568	596	-	-	-	-	-
Uranium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.500	0.500	0.300	-	-	-	-	-	-	-	-
Vanadium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	39.0	42.0	36.0	49.6	55.3	53.2	63.4	58.3	49.8	56.1	51.9
Zinc	mg/kg	41.0	53.0	33.0	29.0	***82.0***	51.0	***1,010***	***1,610***	***1,580***	***7,880***	***455***	***2,130***	51.0	46.0	35.0	50.7	57.6	53.8	54.6	46.6	43.8	51.6	51.2

Notes: ***Bold/Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. "-" no data. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall.

[a] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[b] Particle fractions for these samples are as follow: gravel (>2 mm), sand (2.0 mm - 0.050 mm), silt (0.050 mm - 0.002 mm), clay (<0.002 mm).

[c] 95th percentile includes all data except those from 1996 (HKP 1997) due to suspected errors.

Table D.2.2: Baseline and Pre-Breach Sediment Quality Data for Upper Hazeltine Creek, 1995, 1996, 1999, 2007, 2009, 2010, 2012, and 2013

Analyte	Units	2010 (W7) Minnow (2011)					2012 (W7 Pond) Minnow (2013a)								2013S (W7) Minnow (2013b)							
		UH SED-1	UH SED-2	UH SED-3	UH SED-4	UH SED-5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Physical Tests																						
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																						
Gravel (> 2mm)	%	20.0	29.9	***33.5***	29.2	***49.1***	6.40	<0.10	<0.10	<0.10	1.79	-	-	-	0.440							
Sand (2.0 mm - 0.063 mm)	%	37.8	63.2	59.0	***64.9***	49.5	39.0	11.4	19.3	14.1	22.3	-	-	-	20.4							
Silt (0.063 mm - 4 µm)	%	34.0	5.01	6.74	5.41	0.760	47.3	***76.4***	70.7	***76.4***	66.4	-	-	-	71.1							
Clay (< 4µm)	%	8.25	1.84	0.800	0.460	0.680	7.25	12.2	9.96	9.49	9.54	-	-	-	8.08							
Organic / Inorganic Carbon																						
Total Organic Carbon	%	7.36	0.580	0.520	0.490	0.540	8.32	12.0	11.2	***13.1***	12.6	9.95	***13.1***	10.4	-	-	-	-	-	-	-	-
Anions and Nutrients																						
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
Aluminum	mg/kg	13,900	10,200	9,220	8,120	9,710	-	-	-	11,000	14,100	14,500	13,800	14,100	14,500	15,400	13,900	17,300	16,200	16,000	14,900	14,200
Antimony	mg/kg	0.370	0.260	0.260	0.180	0.210	-	-	-	0.250	0.260	0.220	0.220	0.230	0.260	0.290	0.290	0.300	0.310	0.320	0.310	0.290
Arsenic	mg/kg	6.28	5.20	5.42	3.43	4.19	-	-	-	3.31	3.81	3.60	3.51	3.66	4.12	4.63	3.81	5.80	4.95	4.91	4.55	4.28
Barium	mg/kg	107	67.9	54.9	46.6	67.0	-	-	-	79.9	103	107	97.0	94.9	109	121	104	133	130	123	111	114
Beryllium	mg/kg	0.380	0.260	0.250	0.200	0.220	-	-	-	0.290	0.370	0.350	0.360	0.330	0.330	0.370	0.350	0.450	0.410	0.380	0.370	0.360
Bismuth	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	0.210	<0.10	<0.10	<0.10	<0.10	-	-	-	0.266	0.299	0.293	0.263	0.246	0.312	0.335	0.251	***0.354***	***0.432***	0.353	0.285	0.300
Calcium	mg/kg	9,000	6,070	5,290	5,140	6,180	-	-	-	11,400	11,500	11,000	12,000	9,550	10,700	***13,400***	10,600	13,300	***13,800***	12,600	11,000	11,400
Chromium	mg/kg	35.1	26.7	26.3	16.3	16.7	-	-	-	24.1	30.6	31.0	29.2	27.8	29.3	29.9	28.3	34.2	31.9	32.7	31.6	29.4
Cobalt	mg/kg	***10.5***	8.76	8.65	6.09	7.06	-	-	-	6.80	8.42	8.52	8.70	9.05	8.31	9.06	8.31	***10.5***	9.41	9.65	9.07	8.64
Copper	mg/kg	64.5	24.2	23.0	13.9	16.4	-	-	-	66.2	78.6	75.6	69.4	67.8	76.7	84.2	62.4	91.1	86.4	79.4	72.0	70.0
Iron	mg/kg	25,900	21,900	22,300	15,800	19,300	-	-	-	15,200	18,900	18,700	18,300	19,100	18,500	21,100	17,600	23,700	20,100	19,800	18,900	17,900
Lead	mg/kg	5.28	3.35	3.36	2.75	3.04	-	-	-	4.86	5.33	5.46	5.07	4.94	5.77	6.06	5.14	6.33	5.96	5.90	5.60	5.29
Lithium	mg/kg	12.0	9.80	8.90	7.20	8.40	-	-	-	9.50	11.6	11.9	11.6	12.2	10.8	12.2	12.2	14.4	14.1	12.8	12.5	12.1
Magnesium	mg/kg	6,080	***6,550***	6,270	4,490	5,380	-	-	-	3,850	4,920	5,140	5,040	5,740	4,790	5,170	4,930	5,750	5,300	5,340	5,010	5,000
Manganese	mg/kg	708	426	743	423	479	-	-	-	817	895	772	638	445	1,210	1,330	992	***1,360***	***1,580***	1,300	1,030	1,070
Mercury	mg/kg	0.0950	<0.050	0.0780	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	***1.56***	<0.50	<0.50	<0.50	<0.50	-	-	-	0.980	1.11	0.940	0.830	1.09	1.24	1.35	0.920	1.48	***1.57***	1.18	1.00	1.07
Nickel	mg/kg	21.0	15.9	14.9	9.47	10.9	-	-	-	15.7	19.6	19.7	18.9	19.2	19.5	20.4	17.7	23.1	21.8	21.0	19.8	18.8
Phosphorus	mg/kg	978	777	744	614	729	-	-	-	940	996	1,080	1,050	1,050	1,150	1,290	1,040	***1,470***	1,280	1,160	1,110	1,090
Potassium	mg/kg	930	470	350	290	380	-	-	-	760	930	980	880	940	870	950	820	1,300	1,070	1,070	990	850
Selenium	mg/kg	1.79	0.290	0.280	0.260	0.330	2.09	3.32	***3.51***	2.75	2.89	2.29	2.21	2.13	2.76	3.25	2.05	3.09	3.16	2.82	2.36	2.47
Silver	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	-	0.110	0.120	0.120	0.110	0.100	0.120	0.140	0.120	0.160	0.160	0.150	0.120	0.110
Sodium	mg/kg	***440***	***490***	310	190	170	-	-	-	350	190	210	220	180	190	200	190	220	200	230	200	190
Strontium	mg/kg	91.8	47.0	45.6	35.3	59.6	-	-	-	93.4	101	101	96.6	91.1	98.8	111	98.4	***119***	***118***	113	103	107
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	0.0640	<0.050	<0.050	<0.050	<0.050	-	-	-	0.0590	0.0730	0.0740	0.0730	0.0720	0.0670	0.0750	0.0620	0.0860	0.0890	0.0760	0.0760	0.0670
Tin	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	mg/kg	738	***785***	724	721	***819***	-	-	-	382	462	457	509	581	461	466	589	553	516	610	604	570
Uranium	mg/kg	0.755	0.376	0.346	0.335	0.372	-	-	-	0.796	0.868	0.819	0.815	0.845	1.13	1.23	0.979	1.20	***1.42***	1.20	1.04	1.10
Vanadium	mg/kg	***75.4***	***65.4***	***66.6***	47.6	57.0	-	-	-	37.6	45.7	45.1	46.5	51.9	45.7	49.3	47.4	53.4	50.0	52.8	52.1	48.6
Zinc	mg/kg	66.0	40.4	41.5	35.1	40.0	-	-	-	46.2	56.8	58.1	54.7	56.4	56.9	63.1	56.2	***70.7***	66.8	66.1	62.6	59.0

Notes: **Bold/Italics** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. "-" no data. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall.

[a] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[b] Particle fractions for these samples are as follow: gravel (>2 mm), sand (2.0 mm - 0.050 mm), silt (0.050 mm - 0.002 mm), clay (<0.002 mm).

[c] 95th percentile includes all data except those from 1996 (HKP 1997) due to suspected errors.

Table D.2.2: Baseline and Pre-Breach Sediment Quality Data for Upper Hazeltine Creek, 1995, 1996, 1999, 2007, 2009, 2010, 2012, and 2013

Analyte	Units	2013S (W7 Pond) Minnow (2013b)								2013F (USW7 Pond) Minnow (2013b)					2013F (W7 Pond) Minnow (2013b)								Pre-Breach 95th Percentile[c]
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	
Physical Tests																							
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																							
Gravel (> 2mm)	%	0.180								0.910					<0.10								33.1
Sand (2.0 mm - 0.063 mm)	%	22.8								24.1					12.8								64.7
Silt (0.063 mm - 4 µm)	%	68.1								63.9					74.6								76.2
Clay (< 4µm)	%	8.88								11.1					12.6								13.9
Organic / Inorganic Carbon																							
Total Organic Carbon	%	-	-	-	-	-	-	-	-	7.55	6.98	8.73	7.86	6.92	11.9	11.3	12.3	11.8	11.2	8.57	11.6	11.2	12.8
Anions and Nutrients																							
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
Aluminum	mg/kg	15,100	15,500	16,600	13,700	16,300	15,400	16,500	14,700	14,400	17,400	16,100	17,200	17,500	***19,000***	17,800	17,300	16,000	***18,200***	***18,000***	17,200	17,100	17,960
Antimony	mg/kg	0.270	0.270	0.300	0.270	0.320	0.310	0.320	0.300	0.270	0.290	0.290	0.270	0.270	0.310	0.310	0.300	0.310	0.300	0.300	0.290	0.270	0.370
Arsenic	mg/kg	3.87	4.18	4.12	3.89	4.63	4.49	4.71	4.15	3.11	3.34	3.33	3.19	2.90	3.87	4.12	3.62	4.17	3.93	3.87	4.13	4.04	8.23
Barium	mg/kg	116	124	118	109	127	120	131	118	106	122	120	121	97.7	***145***	***138***	133	127	132	125	132	127	136
Beryllium	mg/kg	0.400	0.410	0.420	0.360	0.430	0.400	0.440	0.400	0.360	0.440	0.410	0.420	0.390	***0.460***	***0.460***	***0.460***	0.410	0.430	0.430	0.430	0.400	0.460
Bismuth	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.40
Cadmium	mg/kg	0.334	0.341	0.352	0.279	0.319	0.317	0.319	0.290	0.208	0.224	0.200	0.213	0.193	***0.361***	0.336	0.342	0.322	0.321	0.297	0.352	0.302	0.354
Calcium	mg/kg	11,300	13,300	11,300	10,800	12,200	11,600	13,300	11,800	9,600	9,700	10,600	9,700	***34,500***	13,000	12,300	12,300	11,700	11,600	13,100	12,400	12,200	13,395
Chromium	mg/kg	31.0	32.5	34.5	28.4	33.7	31.9	34.2	30.6	35.5	***41.4***	38.6	39.8	34.8	***40.8***	37.8	36.8	34.1	38.6	36.9	36.0	36.1	40.1
Cobalt	mg/kg	8.79	9.22	9.17	7.97	9.33	8.67	9.54	8.54	9.15	9.99	9.45	9.84	10.3	10.2	9.53	9.59	9.22	9.62	9.39	9.10	8.77	10.4
Copper	mg/kg	85.7	89.2	91.8	71.5	87.2	83.6	86.2	76.6	76.9	90.5	82.3	91.4	67.4	***103***	90.9	***95.3***	94.3	***95.7***	89.4	88.0	86.5	94.6
Iron	mg/kg	18,700	19,100	20,000	16,900	20,200	18,900	20,600	18,100	20,400	24,000	22,000	24,200	26,800	23,400	22,200	22,000	19,800	22,000	21,400	21,400	20,100	29,900
Lead	mg/kg	5.95	6.08	6.21	5.02	6.06	5.69	6.26	5.62	5.65	6.45	6.22	6.63	5.24	***6.90***	6.41	6.69	6.37	6.59	6.39	6.25	5.86	6.70
Lithium	mg/kg	12.9	13.2	14.2	12.1	13.6	13.6	14.7	12.7	11.6	14.4	13.2	13.5	13.4	***15.3***	14.5	***14.8***	13.1	14.3	13.8	13.7	12.5	14.8
Magnesium	mg/kg	5,060	5,500	5,500	4,520	5,390	5,350	5,570	4,990	5,730	6,420	5,990	6,330	***6,930***	6,390	5,990	5,920	5,560	6,190	6,060	5,690	5,640	6,430
Manganese	mg/kg	873	979	662	1,050	1,190	910	1,230	1,050	343	295	361	351	355	616	716	593	458	564	552	783	605	1,345
Mercury	mg/kg	-	-	-	-	-	-	-	-	0.0921	0.102	0.0934	0.0965	0.0792	***0.154***	0.141	***0.147***	0.144	0.144	0.137	0.144	0.136	0.145
Molybdenum	mg/kg	1.26	1.49	1.32	1.02	1.25	1.24	1.22	1.09	0.930	1.04	1.12	1.03	0.890	1.11	1.09	1.11	***1.50***	0.980	0.960	1.14	1.14	1.50
Nickel	mg/kg	20.2	20.8	21.6	17.6	21.3	20.2	21.6	19.4	21.4	24.2	22.6	24.2	21.0	***25.0***	23.3	23.8	22.1	23.8	22.6	22.6	21.7	24.4
Phosphorus	mg/kg	1,140	1,310	1,120	1,000	1,260	1,070	1,250	1,160	1,150	1,370	1,290	1,250	1,040	***1,420***	1,330	1,350	1,170	1,330	1,300	1,230	1,100	1,375
Potassium	mg/kg	900	970	1,050	930	1,060	970	1,080	940	1,090	***1,450***	1,340	***1,480***	1,110	***1,470***	1,320	1,250	1,070	1,310	1,330	1,220	1,250	1,445
Selenium	mg/kg	3.08	3.04	3.15	2.67	3.24	2.85	3.07	2.74	1.73	1.85	2.23	1.96	1.24	***3.38***	2.92	***3.35***	3.27	3.00	2.88	3.28	3.05	3.32
Silver	mg/kg	0.150	0.140	0.150	0.110	0.150	0.140	***0.220***	0.140	0.110	0.120	0.110	0.120	<0.10	0.160	0.150	0.160	0.160	***0.170***	0.150	0.140	0.130	0.160
Sodium	mg/kg	190	210	190	180	200	200	220	200	240	250	280	280	350	260	240	230	210	300	290	230	310	350
Strontium	mg/kg	105	109	107	104	117	113	***125***	112	94.5	96.0	103	98.6	111	114	111	112	106	109	105	112	99.5	118
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	0.0780	0.0710	0.0800	0.0680	0.0820	0.0780	0.0800	0.0690	0.0730	0.0850	0.0750	0.0830	0.0610	***0.0980***	0.0940	0.0890	0.0830	***0.0950***	0.0930	0.0900	0.0850	0.0941
Tin	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	mg/kg	454	440	547	522	575	570	592	531	553	704	680	638	***962***	583	577	502	455	603	651	595	595	776
Uranium	mg/kg	1.08	1.05	1.08	1.01	***1.26***	1.12	***1.26***	1.11	0.650	0.697	0.800	0.712	0.653	1.06	1.04	1.06	1.06	0.970	1.03	1.11	1.02	1.26
Vanadium	mg/kg	47.9	49.2	51.3	45.5	53.2	51.0	54.2	49.0	51.4	58.1	56.2	55.6	65.1	55.7	55.0	52.6	50.5	54.6	55.5	51.9	52.2	65.3
Zinc	mg/kg	62.2	65.2	66.0	54.4	64.8	59.5	66.0	58.6	53.4	58.4	55.3	59.1	55.4	***70.1***	64.4	64.3	62.5	64.7	62.7	62.0	60.8	67.6

Notes: **Bold/Italics** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. "**-**" no data. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall.

[a] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[b] Particle fractions for these samples are as follow: gravel (>2 mm), sand (2.0 mm - 0.050 mm), silt (0.050 mm - 0.002 mm), clay (<0.002 mm).

[c] 95th percentile includes all data except those from 1996 (HKP 1997) due to suspected errors.

Table D.2.3: Sediment Quality Data for Upper Edney Creek Reference (EDC-U) Sampling Area used in Calculation of Reference 95th Percentile, 2018 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		2018					2019					2020				
		Lower	Upper	EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5
				15-Aug-18	15-Aug-18	15-Aug-18	15-Aug-18	15-Aug-18	9-Aug-19	8-Aug-19	8-Aug-19	8-Aug-19	8-Aug-19	8-Aug-20	8-Aug-20	8-Aug-20	8-Aug-20	8-Aug-20
Physical Tests																		
Moisture	%	-	-	54.8	***91.7***	58.1	73.0	75.3	58.4	50.0	66.2	68.9	79.7	57.6	54.8	50.1	68.4	59.4
pH (1:2 soil:water)	pH	-	-	7.00	6.68	6.90	7.00	6.20	6.59	6.37	6.14	6.15	6.25	***5.99***	6.70	6.33	6.01	6.78
Particle Size																		
% Gravel (>2 mm)	%	-	-	<1.0	9.80	<1.0	***26.6***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.30	<1.0	<1.0
% Sand (2.0 mm - 0.063 mm)	%	-	-	42.3	36.2	31.3	30.2	***37.20***	48.1	38.5	56.4	53.0	29.7	68.4	67.5	***77.1***	58.6	51.5
% Silt (0.063 mm - 4 µm)	%	-	-	50.5	45.2	51.5	37.7	56.40	43.1	43.6	34.9	38.6	***56.9***	26.7	26.8	17.5	35.4	37.6
% Clay (<4 µm)	%	-	-	6.80	8.80	16.4	5.60	***6.40***	8.60	***17.9***	8.70	8.30	13.4	4.90	5.70	4.10	6.00	10.5
Organic / Inorganic Carbon (<63 µm)																		
Total Organic Carbon	%	-	-	6.43	***11.1***	2.41	8.34	***6.85***	4.55	3.23	6.88	6.14	8.48	5.27	4.44	5.77	7.11	4.86
Nutrients (Bulk sediment)																		
Total Nitrogen	%	-	-	0.290	0.485	0.167	0.393	***0.44***	0.322	0.237	0.419	0.338	***0.615***	0.276	0.252	0.268	0.427	0.292
Metals (<63 µm)[c]																		
Aluminum	mg/kg	-	-	17,400	16,700	22,800	19,800	***17,200***	19,700	22,700	19,500	18,500	18,500	15,700	14,400	15,800	15,000	18,400
Antimony	mg/kg	-	-	0.300	0.320	0.320	0.310	***0.27***	0.340	0.370	0.350	0.340	0.340	0.340	0.280	0.330	0.310	0.330
Arsenic	mg/kg	5.90	17.0	9.85	***22.2***	12.0	11.4	***8.32***	10.4	11.0	10.4	11.6	10.4	8.72	7.72	9.90	9.47	8.69
Barium	mg/kg	-	-	138	200	165	157	***133.00***	140	146	147	151	148	123	113	145	138	131
Beryllium	mg/kg	-	-	0.430	0.460	***0.630***	0.490	***0.41***	0.500	0.600	0.490	0.490	0.510	0.440	0.360	0.470	0.450	0.470
Bismuth	mg/kg	-	-	0.110	0.110	0.140	0.120	<0.10	0.120	0.140	0.110	0.110	0.120	<0.10	<0.10	0.110	<0.10	0.100
Boron	mg/kg	-	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	mg/kg	0.600	3.50	0.422	***0.581***	0.247	0.579	***0.42***	0.413	0.270	0.509	0.467	0.499	0.331	0.337	0.454	0.436	0.348
Calcium	mg/kg	-	-	9,210	11,000	8,650	10,500	***8,680***	10,200	7,950	10,200	9,950	***11,200***	8,100	7,860	9,090	8,770	8,200
Chromium	mg/kg	37.3	90.0	53.1	51.0	63.6	56.0	***51.10***	60.0	75.8	63.4	61.3	64.9	52.3	48.2	54.5	51.7	54.5
Cobalt	mg/kg	-	-	13.7	15.2	14.8	16.9	***12.60***	15.4	15.8	15.9	16.3	15.3	11.9	11.8	14.6	14.0	13.0
Copper	mg/kg	35.7	197	37.5	46.8	47.0	40.4	***36.10***	39.4	45.2	40.8	39.7	40.2	32.5	28.2	33.4	32.0	35.5
Iron	mg/kg	21,200	43,766	29,300	***42,000***	34,000	31,700	***27,700***	30,100	32,500	30,700	32,500	31,500	27,100	25,300	30,600	29,400	27,200
Lead	mg/kg	35.0	91.3	6.58	6.48	***8.33***	6.45	***5.78***	7.18	7.74	6.72	6.69	6.78	6.00	5.38	6.20	5.61	6.04
Lithium	mg/kg	-	-	14.1	12.6	***18.5***	14.8	***13.10***	16.0	17.8	14.9	14.9	15.0	13.9	13.0	14.7	13.6	15.5
Magnesium	mg/kg	-	-	7,100	6,880	7,920	7,630	***6,650***	7,390	7,790	7,380	7,430	7,030	6,370	6,260	6,850	6,260	6,890
Manganese	mg/kg	460	1,100	1,320	1,420	1,100	1,980	***739.00***	1,230	1,040	1,440	1,710	1,100	717	734	845	1,160	1,070
Mercury	mg/kg	0.170	0.486	0.0972	***0.154***	0.119	0.123	***0.09***	0.0983	0.106	0.0957	0.101	0.104	0.102	0.103	0.0996	0.100	0.101
Molybdenum	mg/kg	25	23,000	0.780	1.12	0.800	0.830	***0.56***	1.29	***2.61***	1.66	1.60	2.39	0.760	0.540	0.630	0.560	0.610
Nickel	mg/kg	16.0	75.0	32.5	32.9	36.6	35.3	***29.60***	36.4	***45.7***	39.5	37.8	41.0	29.4	27.5	32.4	30.6	31.9
Phosphorus	mg/kg	-	-	1,180	1,360	1,180	1,330	***1,250***	1,250	1,190	1,350	***1,380***	1,370	1,000	1,160	1,220	1,160	1,120
Potassium	mg/kg	-	-	1,060	1,060	1,470	1,400	***1,150***	1,080	1,410	1,270	1,250	1,210	1,010	880	1,110	1,070	1,260
Selenium	mg/kg	2.00	-	0.570	0.880	0.660	0.680	***0.55***	0.590	0.670	0.610	0.610	0.630	0.540	0.330	0.530	0.530	0.510
Silver	mg/kg	0.500	-	0.158	0.192	0.194	0.188	0.21	0.173	0.196	0.167	0.171	0.198	0.128	0.118	0.148	0.146	0.154
Sodium	mg/kg	-	-	226	239	246	275	***267.00***	238	217	266	263	239	267	247	286	261	267
Strontium	mg/kg	-	-	71.6	81.4	73.8	83.5	***66.40***	75.7	64.3	79.6	76.8	82.5	62.3	58.9	66.9	66.5	69.8
Sulphur[c]	mg/kg	-	-	2,000	2,300	700	1,600	***1,600***	***3,000***	1,900	1,900	1,500	1,600	1,800	1,070	1,080	1,570	1,190
Thallium	mg/kg	-	-	0.118	0.118	***0.175***	0.135	***0.11***	0.140	0.166	0.129	0.135	0.137	0.122	0.100	0.115	0.110	0.128
Tin	mg/kg	-	-	0.360	0.390	0.460	0.390	***0.37***	0.540	0.470	0.550	0.470	0.500	0.580	0.460	0.580	0.620	0.540
Titanium	mg/kg	-	-	489	507	736	636	***633.00***	527	658	658	650	593	655	516	659	637	702
Uranium	mg/kg	-	-	1.37	1.67	2.15	1.46	***1.31***	1.60	2.07	1.51	1.43	1.56	1.31	1.05	1.27	1.32	1.45
Vanadium	mg/kg	-	-	70.6	***86.1***	84.7	75.9	***70.20***	77.6	84.5	80.1	78.6	74.9	75.0	66.6	78.4	72.2	71.4
Zinc	mg/kg	123	315	73.3	73.2	72.8	84.2	***74.80***	76.0	71.4	87.5	82.6	81.4	63.1	62.8	74.8	71.7	65.2
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	1.20	1.20	1.10	1.00	<1.0

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Uper Working Sediment Quality Guideline

Notes: ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH), "-" indicates no current BC Working Sediment Quality Guidelines/ no data.

Note: "-" indicates no current BC Working Sediment Quality Guideline.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2019c)

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.3: **Sediment Quality Data for Upper Edney Creek Reference (EDC-U) Sampling Area used in Calculation of Reference 95th Percentile, 2018 to 2022**

Analyte	Units	BC Working Sediment Quality Guidelines[a]		2021					2022					95th Percentile (2018 to 2022)[b]
		Lower	Upper	EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	
				2-Aug-21	2-Aug-21	1-Aug-21	1-Aug-21	1-Aug-21	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	
Physical Tests														
Moisture	%	-	-	51	60.4	52.1	59.9	52.4	63.9	70.8	64.9	64.5	45.5	79.7
pH (1:2 soil:water)	pH	-	-	6.58	7.32	6.47	6.63	7.03	6.67	6.64	6.44	7.03	6.97	6.01
Particle Size														
% Gravel (>2 mm)	%	-	-	1.2	4.6	3	2.5	11.3	2.00	<1	<1	<1	1.00	11.3
% Sand (2.0 mm - 0.063 mm)	%	-	-	65.3	50.5	64.8	37.7	66.3	44.9	37.7	60.7	55.8	76.2	76.2
% Silt (0.063 mm - 4 µm)	%	-	-	28.3	37	27	46.2	18.3	44.9	47.4	32.7	36.1	17.6	56.4
% Clay (<4 µm)	%	-	-	5.2	7.9	5.2	13.6	4.1	8.20	14.3	6.30	8.10	5.20	16.4
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	4.89	7.51	6.96	4.94	5.55	7.11	3.78	7.08	5.43	6.65	8.48
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.221	0.404	0.221	0.318	0.167	0.424	0.303	0.248	0.271	0.167	0.485
Metals (<63 µm)[c]														
Aluminum	mg/kg	-	-	20,700	17,400	21,300	***26,200***	20,900	16,600	12,300	14,600	14,800	15,400	22,800
Antimony	mg/kg	-	-	***0.46***	0.27	0.31	0.42	0.3	0.340	0.240	0.310	0.300	0.310	0.420
Arsenic	mg/kg	5.90	17.0	10.5	9.99	9.9	10.4	11	8.78	5.80	9.52	8.03	8.23	12.0
Barium	mg/kg	-	-	168	194	195	***203***	185	129	79.3	116	105	111	200
Beryllium	mg/kg	-	-	0.48	0.41	0.5	0.62	0.48	0.390	0.290	0.380	0.380	0.420	0.620
Bismuth	mg/kg	-	-	0.11	<0.1	0.11	0.13	0.11	0.100	<0.1	<0.1	<0.1	<0.1	0.140
Boron	mg/kg	-	-	5.4	<5	5.4	<5	<5	5.30	<5	<5	<5	<5	5.40
Cadmium	mg/kg	0.600	3.50	0.508	0.54	0.534	0.523	0.556	0.426	0.165	0.387	0.316	0.351	0.579
Calcium	mg/kg	-	-	9,510	9,590	10,000	9,880	10,000	8,850	6,170	7,820	7,950	8,440	11,000
Chromium	mg/kg	37.3	90.0	67.1	55.1	66.2	***76.7***	69.4	49.5	37.2	47.4	47.3	53.2	75.8
Cobalt	mg/kg	-	-	15.5	15.6	15.8	14.5	***18.1***	13.0	8.18	12.5	11.9	12.2	16.9
Copper	mg/kg	35.7	197	40.1	35.3	42.3	***69.9***	40.5	32.2	20.2	28.2	25.5	27.6	47.0
Iron	mg/kg	21,200	43,766	31,500	28,800	30,900	29,700	32,400	26,400	18,400	26,800	24,700	27,200	34,000
Lead	mg/kg	35.0	91.3	7.14	5.77	6.84	7.99	6.59	8.14	5.70	6.88	5.90	6.35	8.14
Lithium	mg/kg	-	-	13.9	12.3	14.3	16.4	13.9	12.8	10.4	12.2	11.8	12.8	17.8
Magnesium	mg/kg	-	-	7,850	6,950	7,840	***8,640***	7,930	6,570	5,210	6,150	6,150	6,460	7,930
Manganese	mg/kg	460	1,100	1,530	***3,050***	1,350	1,160	2,710	560	541	852	1,080	1,010	2,710
Mercury	mg/kg	0.170	0.486	0.105	0.0767	0.112	0.125	0.0967	0.0820	0.0530	0.0794	0.0747	0.0866	0.125
Molybdenum	mg/kg	25	23,000	1.11	1.07	1.52	1.52	1.91	0.670	0.470	0.570	0.560	0.620	2.39
Nickel	mg/kg	16.0	75.0	39.5	33.8	39.3	43.2	42.3	28.2	19.0	26.2	25.6	27.2	43.2
Phosphorus	mg/kg	-	-	1,170	1,220	1,300	1,130	1,200	1,060	954	1,010	1,020	1,080	1,370
Potassium	mg/kg	-	-	1,330	1,170	1,450	***1,690***	1,390	1,240	720	1,030	1,000	1,100	1,470
Selenium	mg/kg	2.00	-	0.63	0.53	0.66	***0.93***	0.57	0.490	0.240	0.370	0.430	0.440	0.880
Silver	mg/kg	0.500	-	0.157	0.153	0.175	***0.212***	0.157	0.159	0.100	0.139	0.124	0.132	0.205
Sodium	mg/kg	-	-	340	244	***358***	247	274	289	200	255	262	269	340
Strontium	mg/kg	-	-	83.6	83.3	85.5	85.3	***87.9***	77.1	55.7	68.9	70.5	75.8	85.5
Sulphur[c]	mg/kg	-	-	<500	890	<500	620	<500	760	710	690	610	<500	2,300
Thallium	mg/kg	-	-	0.136	0.115	0.138	0.164	0.136	0.128	0.0840	0.107	0.103	0.114	0.166
Tin	mg/kg	-	-	***1***	0.33	0.38	0.43	0.36	0.460	0.250	0.330	0.340	0.430	0.620
Titanium	mg/kg	-	-	***754***	460	688	658	623	626	492	588	608	652	736
Uranium	mg/kg	-	-	1.49	1.22	1.42	***2.41***	1.38	1.48	1.15	1.23	1.19	1.33	2.15
Vanadium	mg/kg	-	-	84.4	69.1	84.5	85.7	80.2	67.1	48.4	64.7	63.6	68.2	85.7
Zinc	mg/kg	123	315	88.7	80	89.7	***94***	85.6	73.4	45.4	68.3	62.0	67.6	89.7
Zirconium	mg/kg	-	-	1.00	1.10	1.20	1.90	1.30	1.10	<1	1.00	<1	<1	1.90

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Uper Working Sediment Quality Guideline

Notes: ***Bold/Italics*** : Value is > reference 95th percentile value (<5th percentile value for pH), "-" indicates no current BC Working Sediment Quality Guidelines/ no data.

Note: "-" indicates no current BC Working Sediment Quality Guideline.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2019c)

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.4: Baseline and Pre-Breach Sediment Quality Data for Lower Hazeltine Creek, 1995, 1996, 1999, 2007, 2010, and 2012

Analyte	Units	1995 (W11) HKP (1996)						1996 (W11)[a] HKP (1997a)						1999 (W11)[b] Beak (2000)		
		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 1	Rep 2	Rep 3
Physical Tests																
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics																
Gravel (>2 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		***57.0***	
Sand (2.0 mm - 0.063 mm)	%	-	-	-	-	-	-	-	-	-	-	-	-		34.0	
Silt (0.063 mm - 4 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		8.00	
Clay (<4 µm)	%	-	-	-	-	-	-	-	-	-	-	-	-		2.00	
Organic / Inorganic Carbon																
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-		-	
Anions and Nutrients																
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																
Aluminum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	11,000	9,700	10,000
Antimony	mg/kg	0.610	0.650	***1.85***	1.05	0.780	0.720	0.600	0.360	0.630	0.770	***25.4***	0.740	<0.20	<0.20	<0.20
Arsenic	mg/kg	9.87	10.9	8.79	8.01	10.0	12.0	4.01	5.29	***12.6***	6.94	***17.2***	9.27	6.50	8.70	6.60
Barium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	98.0	98.0	94.0
Beryllium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.300	0.300	0.300
Bismuth	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	<0.20	<0.20
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	***3.00***	2.70	2.00
Cadmium	mg/kg	0.200	<0.10	0.100	<0.10	0.200	<0.10	0.200	0.200	<0.10	<0.10	<0.10	***0.300***	***0.300***	0.200	0.200
Calcium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/kg	24.0	22.0	23.0	17.0	32.0	19.0	***112***	31.0	***47.0***	***65.0***	***117***	***49.0***	24.0	21.0	22.0
Cobalt	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	10.0	10.0	10.0
Copper	mg/kg	***46.0***	28.0	28.0	26.0	41.0	32.0	***4,080***	***480***	***4,180***	***9,060***	***16,200***	***3,010***	33.0	26.0	27.0
Iron	mg/kg	29,700	31,600	34,900	31,100	***37,400***	20,800	18,500	16,900	22,000	20,400	23,100	21,200	20,000	21,000	19,000
Lead	mg/kg	4.00	5.00	3.00	3.00	4.00	3.00	***19.0***	5.00	<2.0	***16.0***	***190***	***12.0***	***5.80***	4.90	5.50
Lithium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/kg	569	814	930	694	909	657	882	513	668	***1,390***	1,010	634	880	***1,500***	810
Mercury	mg/kg	***0.193***	0.0840	0.0330	0.0300	0.0590	0.127	0.0550	0.0290	<0.0050	0.0340	0.0330	0.0240	<0.040	<0.040	<0.040
Molybdenum	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	0.500	0.700	0.500
Nickel	mg/kg	13.0	17.0	17.0	15.0	***26.0***	13.0	***52.0***	16.0	23.0	***32.0***	***33.0***	***26.0***	22.0	20.0	21.0
Phosphorus	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	0.600	0.200	0.100	0.200	0.300	<0.10	0.200	0.200	0.400	0.800	0.800	0.300	<1.0	<1.0	<1.0
Silver	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	***0.100***	<0.10	<0.10
Sodium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	64.0	48.0	60.0
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	<0.20	<0.20
Tin	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	1.10	1.10	1.00
Titanium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	310	330	290
Uranium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	***0.800***	0.600	0.600
Vanadium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	37.0	44.0	37.0
Zinc	mg/kg	***61.0***	57.0	54.0	44.0	60.0	39.0	***785***	***109***	***1,030***	***2,280***	***4,040***	***690***	49.0	46.0	46.0

Notes: "-" no data, S = spring, F = fall. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Sediment metal concentrations are based predominantly on bulk sediment samples. Concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only.

[a] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997a) and are suspected errors.

[b] Particle fractions for these samples are as follow: gravel (>2 mm), sand (2.0 mm - 0.050 mm), silt (0.050 mm - 0.002 mm), clay (<0.002 mm).

[c] 95th percentile includes all data except those from 1996 (HKP 1997a) due to suspected errors.

Table D.2.4: Baseline and Pre-Breach Sediment Quality Data for Lower Hazeltine Creek, 1995, 1996, 1999, 2007, 2010, and 2012

Analyte	Units	2007 (W11) Minnow (2009)			2010 (W11) Minnow (2011)					2012 (W11 mouth) Minnow (2013a)					Pre-Breach 95th Percentile[c]
		LHC-1	LHC-2	LHC-3	LH SED-1	LH SED-2	LH SED-3	LH SED-4	LH SED-5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	
Physical Tests															
Moisture	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (1:2 soil:water)	pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Physical Characteristics															
Gravel (>2 mm)	%	1.00	3.00	<1.0	4.68	2.99	17.7	46.5	47.9	-	-	-	-	-	53.4
Sand (2.0 mm - 0.063 mm)	%	72.0	50.0	68.0	***85.1***	72.0	71.0	45.3	46.5	-	-	-	-	-	79.9
Silt (0.063 mm - 4 µm)	%	20.0	***36.0***	24.0	9.31	22.7	9.34	7.58	5.13	-	-	-	-	-	31.2
Clay (<4 µm)	%	7.00	***11.0***	8.00	0.940	2.28	2.06	0.580	0.430	-	-	-	-	-	9.80
Organic / Inorganic Carbon															
Total Organic Carbon	%	3.71	3.19	1.82	0.450	1.31	0.270	0.440	0.330	8.52	***9.80***	4.92	8.39	6.62	9.03
Anions and Nutrients															
Total Nitrogen by LECO	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals															
Aluminum	mg/kg	***12,800***	12,000	12,300	9,060	9,550	8,320	8,390	8,430	-	-	-	-	-	12,550
Antimony	mg/kg	<10.0	<10.0	<10.0	0.280	0.340	0.300	0.290	0.340	-	-	-	-	-	1.33
Arsenic	mg/kg	9.20	10.0	12.0	10.9	***12.4***	8.74	8.45	11.5	-	-	-	-	-	12.1
Barium	mg/kg	100	***109***	96.7	74.4	74.5	55.5	72.6	56.1	-	-	-	-	-	104
Beryllium	mg/kg	<0.50	<0.50	<0.50	0.270	0.300	0.260	0.260	0.270	-	-	-	-	-	0.300
Bismuth	mg/kg	<20.0	<20.0	<20.0	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	-	-	<0.20
Boron	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	2.97
Cadmium	mg/kg	<0.50	<0.50	<0.50	0.120	0.180	0.110	0.110	0.120	-	-	-	-	-	0.235
Calcium	mg/kg	6,850	***7,120***	6,390	5,270	5,780	4,980	5,440	4,780	-	-	-	-	-	7,026
Chromium	mg/kg	31.7	31.4	***35.5***	29.0	28.7	29.0	32.5	29.5	-	-	-	-	-	33.1
Cobalt	mg/kg	9.70	9.90	***11.8***	8.98	10.2	8.55	8.38	8.80	-	-	-	-	-	11.0
Copper	mg/kg	36.8	33.7	30.7	17.9	22.4	17.0	17.6	19.2	-	-	-	-	-	42.0
Iron	mg/kg	24,100	25,100	27,500	22,600	25,300	23,200	24,500	23,600	-	-	-	-	-	35,400
Lead	mg/kg	<30.0	<30.0	<30.0	4.01	4.87	4.39	4.15	4.54	-	-	-	-	-	5.61
Lithium	mg/kg	***13.0***	12.4	12.8	8.40	9.30	8.40	8.20	8.50	-	-	-	-	-	12.9
Magnesium	mg/kg	***6,190***	6,050	6,100	5,480	5,790	4,930	5,190	5,780	-	-	-	-	-	6,159
Manganese	mg/kg	385	1,020	1,010	605	633	401	537	512	-	-	-	-	-	1,116
Mercury	mg/kg	0.0688	0.108	0.0646	<0.050	0.0520	<0.050	<0.050	<0.050	-	-	-	-	-	0.140
Molybdenum	mg/kg	<4.0	<4.0	<4.0	0.620	***0.780***	0.590	0.530	0.630	-	-	-	-	-	0.752
Nickel	mg/kg	22.2	20.3	22.2	18.3	20.2	18.2	18.9	23.5	-	-	-	-	-	24.0
Phosphorus	mg/kg	-	-	-	596	***733***	579	713	654	-	-	-	-	-	729
Potassium	mg/kg	***940***	850	800	510	530	450	530	440	-	-	-	-	-	909
Selenium	mg/kg	<2.0	<5.0	<2.0	0.240	0.340	<0.20	0.280	0.280	1.28	***1.49***	0.740	1.14	0.970	1.30
Silver	mg/kg	<2.0	<2.0	<2.0	<0.10	<0.10	<0.10	<0.10	<0.10	-	-	-	-	-	0.0300
Sodium	mg/kg	240	220	240	***260***	200	170	220	210	-	-	-	-	-	253
Strontium	mg/kg	***68.1***	66.0	53.3	52.5	56.2	39.9	47.7	41.7	-	-	-	-	-	67.1
Sulphur	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	<1.0	<1.0	<1.0	0.0500	***0.0510***	<0.050	<0.050	<0.050	-	-	-	-	-	0.0508
Tin	mg/kg	<5.0	<5.0	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-	-	-	-	1.10
Titanium	mg/kg	574	564	621	654	652	664	***737***	574	-	-	-	-	-	701
Uranium	mg/kg	-	-	-	0.356	0.570	0.412	0.400	0.375	-	-	-	-	-	0.730
Vanadium	mg/kg	61.9	64.3	71.1	65.7	70.9	67.0	***77.9***	69.7	-	-	-	-	-	74.5
Zinc	mg/kg	49.3	46.1	47.3	40.0	45.1	39.9	40.1	41.7	-	-	-	-	-	60.2

Notes: "-" no data, S = spring, F = fall. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Sediment metal concentrations are based predominantly on bulk sediment samples. Concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only.

[a] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997a) and are suspected errors.

[b] Particle fractions for these samples are as follow: gravel (>2 mm), sand (2.0 mm - 0.050 mm), silt (0.050 mm - 0.002 mm), clay (<0.002 mm).

[c] 95th percentile includes all data except those from 1996 (HKP 1997a) due to suspected errors.

Table D.2.5: Sediment Quality Data for Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines [a]		2018					2019					2020				
				EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5
		Lower	Upper	16-Aug-18	16-Aug-18	16-Aug-18	15-Aug-18	15-Aug-18	11-Aug-19	11-Aug-19	11-Aug-19	10-Aug-19	9-Aug-19	7-Aug-20	7-Aug-20	7-Aug-20	7-Aug-20	7-Aug-20
Physical Tests																		
Moisture	%	-	-	27.2	28.7	43	48.1	54.6	***72.7***	67.7	50.5	36.4	70.6	39.2	34	34.8	30	32.9
pH (1:2 soil:water)	pH	-	-	8.15	7.9	7.88	8.14	7.56	6.74	6.99	7.48	7.52	7.16	7.53	7.67	7.76	7.88	7.52
Particle Size																		
% Gravel	%	-	-	2.40	1.90	5.60	***10.7***	6.80	<1.0	<1.0	<1.0	<1.0	<1.0	4.2	<1.0	<1.0	1.8	4.3
% Sand	%	-	-	***87.7***	83.9	57.6	51.8	62.8	31.9	57.0	46.4	65.0	49.5	66.9	78	74.6	79.3	73.8
% Silt	%	-	-	7.30	11.0	31.0	33.1	25.8	***58.3***	35.4	43.8	28.7	41.2	25.3	18.5	21.1	15.7	18.1
% Clay	%	-	-	2.60	3.20	5.80	4.30	4.70	***9.80***	7.20	9.70	5.90	8.40	3.6	3.5	4.1	3.2	3.8
Organic / Inorganic Carbon (<63 µm)																		
Total Organic Carbon	%	-	-	3.09	1.56	3.06	2.77	3.76	3.56	2.41	3.42	2.51	3.82	2.9	2.38	2.28	1.92	1.95
Nutrients (Bulk sediment)																		
Total Nitrogen	%	-	-	0.033	0.0370	0.121	0.146	0.0900	***0.284***	0.116	0.200	0.106	0.237	0.136	0.102	0.106	0.081	0.097
Metals (<63 µm)[c]																		
Aluminum	mg/kg	-	-	13,800	14,600	13,900	13,000	15,500	15,700	14,900	15,500	14,900	15,200	12,000	12,700	12,900	11,700	11,300
Antimony	mg/kg	-	-	***0.540***	0.430	0.400	0.320	0.460	0.360	0.400	0.420	0.390	0.380	0.34	0.37	0.36	0.37	0.36
Arsenic	mg/kg	5.9	17	19.5	***19.8***	15.4	7.57	6.48	11.2	12.9	15.1	12.2	13.4	9.37	12.6	11.9	12.2	12.2
Barium	mg/kg	-	-	184	***192***	127	104	120	118	129	141	113	122	111	128	119	118	112
Beryllium	mg/kg	-	-	***0.510***	0.470	0.380	0.350	0.410	0.400	0.400	0.410	0.430	0.390	0.33	0.36	0.35	0.36	0.35
Bismuth	mg/kg	-	-	0.130	0.120	0.120	0.110	0.130	0.120	0.140	0.140	0.140	0.130	0.1	0.12	0.11	0.1	0.1
Boron	mg/kg	-	-	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	mg/kg	0.6	3.5	0.307	0.318	0.313	0.256	0.175	0.285	0.314	0.328	0.292	0.296	0.236	0.252	0.24	0.231	0.233
Calcium	mg/kg	-	-	10,100	10,300	8,790	7,320	9,710	9,340	10,100	***11,800***	9,650	9,170	8,390	9,590	8,370	8,280	8,270
Chromium	mg/kg	37.3	90	44.0	45.5	41.5	40.0	39.6	47.1	49.0	50.6	52.3	43.2	43.2	45.6	43	45.9	44.7
Cobalt	mg/kg	-	-	12.2	13.0	11.9	10.5	10.4	13.6	14.1	15.2	13.5	13.4	11.4	12.3	12.2	11.7	12
Copper	mg/kg	35.7	197	31.8	32.7	32.3	30.2	***43.5***	36.4	35.1	36.2	33.8	33.3	24.9	27.3	27	25.7	25.6
Iron	mg/kg	21200	43,766	29,700	32,100	29,800	25,200	21,400	29,800	31,400	32,800	32,600	30,100	27,200	30,100	29,000	29,300	29,700
Lead	mg/kg	35	91.3	8.27	7.72	7.23	6.53	7.82	7.36	8.21	8.37	7.97	7.35	6	6.48	6.55	6.33	6.15
Lithium	mg/kg	-	-	15.9	15.4	15.3	14.1	***17.9***	16.3	16.7	16.5	15.8	15.0	13.2	13.4	13.5	12.9	12.8
Magnesium	mg/kg	-	-	6,580	6,850	6,810	6,140	6,820	7,150	7,140	7,630	7,160	6,920	5,880	6,360	6,410	6,120	6,060
Manganese	mg/kg	460	1,100	798	870	732	343	255	583	943	1,410	781	1,080	821	771	902	760	777
Mercury	mg/kg	0.17	0.486	***0.0891***	0.0589	0.0724	0.0633	0.0876	0.0614	0.0610	0.0576	0.0530	0.0623	0.0692	0.0545	0.0626	0.0554	0.0541
Molybdenum	mg/kg	25	23,000	1.51	1.01	0.780	0.420	0.730	1.05	1.09	1.13	0.910	0.690	0.53	0.59	0.69	0.68	0.62
Nickel	mg/kg	16	75	30.7	31.3	29.5	26.7	32.5	35.4	35.8	37.8	33.8	31.7	27.2	28.6	28.9	27.5	28.2
Phosphorus	mg/kg	-	-	1,000	1,140	1,070	1,060	915	1,120	1,070	***1,210***	1,190	1,070	959	1,050	964	1,040	1,150
Potassium	mg/kg	-	-	1,260	1,240	1,110	890	1,000	1,320	1,240	1,260	980	1,260	1,000	1,020	1,000	960	910
Selenium	mg/kg	2	-	0.760	1.05	0.680	0.510	1.06	0.620	0.550	0.800	0.480	0.600	0.39	0.51	0.47	0.41	0.33
Silver	mg/kg	0.5	-	***0.284***	0.110	0.118	0.102	0.174	0.129	0.139	0.138	0.121	0.123	0.084	0.091	0.103	0.097	0.09
Sodium	mg/kg	-	-	276	295	248	240	204	247	242	260	225	235	275	300	271	256	243
Strontium	mg/kg	-	-	***106***	86.9	80.5	72.2	84.5	71.6	74.8	82.2	72.8	80.4	68.4	73.5	71.9	74.7	71.5
Sulphur	mg/kg	-	-	500	<500	500	500	500	1,200	600	900	<500	900	***1,560***	<500	600	<500	<500
Thallium	mg/kg	-	-	***0.135***	0.109	0.107	0.095	0.118	0.111	0.116	0.110	0.109	0.107	0.082	0.087	0.089	0.088	0.079
Tin	mg/kg	-	-	0.400	0.410	0.360	0.300	0.310	0.410	0.410	0.510	***0.830***	0.540	0.32	0.43	0.32	0.45	0.36
Titanium	mg/kg	-	-	591	660	594	599	472	673	674	693	702	655	741	711	647	661	657
Uranium	mg/kg	-	-	0.915	0.803	0.839	0.766	***1.56***	0.994	0.986	0.887	1.04	0.946	0.851	0.832	0.816	0.822	0.785
Vanadium	mg/kg	-	-	70.6	75.7	65.9	59.3	53.3	60.8	63.4	66.2	75.9	61.6	66	74.2	66.8	72.4	71.5
Zinc	mg/kg	123	315	61.9	65.0	62.2	56.1	52.5	69.1	70.9	72.7	67.1	68.1	55.1	58.1	58.8	56	56.8
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	1.40	1.50	1.50	1.50	1.50

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: "-" indicates no current BC Working Sediment Quality Guidelines/ no data. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.5: Sediment Quality Data for Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Analyte	Units	BC Working Sediment Quality Guidelines[a]		2021					2022					95th Percentile (2018 to 2022)[b]
				EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	
		Lower	Upper	30-Jul-21	30-Jul-21	30-Jul-21	30-Jul-21	30-Jul-21	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	
Physical Tests														
Moisture	%	-	-	65.3	44.9	50.5	42.5	38.7	50.0	52.8	60.6	43.8	59.8	70.6
pH (1:2 soil:water)	pH	-	-	7.37	7.55	7.83	7.33	7.41	7.30	7.71	7.87	7.69	***6.49***	6.74
Particle Size														
% Gravel	%	-	-	<1.0	<1.0	<1.0	2.70	<1.0	<1.0	1.20	<1.0	<1.0	1.10	6.80
% Sand	%	-	-	54.8	65.7	56.2	61.5	52.5	59.5	52.7	51.2	70.0	58.1	83.9
% Silt	%	-	-	38.5	28.8	38.0	29.6	41.9	33.5	38.7	40.9	24.1	34.0	43.8
% Clay	%	-	-	6.30	5.10	5.60	6.20	4.80	6.60	7.40	7.00	5.80	6.80	9.70
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	3.63	2.49	2.26	2.56	1.15	3.43	2.84	3.56	3.05	***5.29***	3.82
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.203	0.113	0.139	0.142	0.111	0.189	0.158	0.210	0.0870	0.206	0.237
Metals (<63 µm)[c]														
Aluminum	mg/kg	-	-	19,000	16,500	***19,800***	16,700	12,500	13,800	14,600	14,200	13,100	13,600	19,000
Antimony	mg/kg	-	-	0.330	0.330	0.410	0.350	0.310	0.340	0.330	0.360	0.350	0.320	0.460
Arsenic	mg/kg	5.9	17	13.0	11.6	17.0	12.0	9.25	9.30	8.39	10.5	11.3	9.49	19.5
Barium	mg/kg	-	-	177	179	169	137	97.3	110	111	118	126	122	184
Beryllium	mg/kg	-	-	0.430	0.370	0.480	0.370	0.290	0.350	0.400	0.360	0.370	0.350	0.480
Bismuth	mg/kg	-	-	0.130	0.110	0.140	0.110	<0.1	0.110	0.110	0.110	0.120	0.120	0.140
Boron	mg/kg	-	-	6.40	5.50	6.50	<5.0	<5.0	<5.0	<5.0	5.00	<5.0	<5.0	6.50
Cadmium	mg/kg	0.6	3.5	***0.361***	0.292	0.329	0.310	0.190	0.264	0.213	0.265	0.278	0.288	0.329
Calcium	mg/kg	-	-	9,940	9,010	11,000	8,570	7,860	8,300	8,550	8,940	8,700	8,480	11,000
Chromium	mg/kg	37.3	90	60.4	50.9	***67.2***	51.6	47.0	42.3	44.8	45.0	43.9	41.1	60.4
Cobalt	mg/kg	-	-	15.5	12.8	***16.2***	13.4	10.1	11.4	11.2	12.3	12.1	11.7	15.5
Copper	mg/kg	35.7	197	35.8	31.6	38.1	30.7	25.4	25.8	29.2	27.3	27.6	31.5	38.1
Iron	mg/kg	21200	43,766	33,600	29,800	***38,100***	31,300	27,100	27,100	26,100	29,300	28,900	27,200	33,600
Lead	mg/kg	35	91.3	7.76	7.01	***8.62***	6.87	5.72	6.44	7.26	6.73	6.87	6.77	8.37
Lithium	mg/kg	-	-	16.0	14.0	16.8	13.9	10.0	13.3	15.0	14.0	13.4	13.9	16.8
Magnesium	mg/kg	-	-	8,140	7,060	***8,760***	7,220	5,910	6,450	6,880	7,100	6,620	6,760	8,140
Manganese	mg/kg	460	1,100	***1,460***	721	1,210	627	374	514	564	1,000	904	541	1,410
Mercury	mg/kg	0.17	0.486	0.0628	0.0635	0.0734	0.0636	0.0454	0.0530	0.0689	0.0578	0.0533	0.0661	0.0876
Molybdenum	mg/kg	25	23,000	1.27	1.11	***1.62***	0.890	0.800	0.600	0.580	0.650	0.540	0.550	1.51
Nickel	mg/kg	16	75	39.9	33.0	***41.7***	32.4	26.1	26.9	28.0	28.7	27.9	28.2	39.9
Phosphorus	mg/kg	-	-	1,180	989	1,170	1,050	1,150	930	953	1,050	960	968	1,190
Potassium	mg/kg	-	-	1,480	1,230	***1,500***	1,230	860	1,120	1,140	1,240	1,110	1,080	1,480
Selenium	mg/kg	2	-	0.620	***4.08***	0.640	0.520	0.340	0.380	0.490	0.430	0.390	0.540	1.06
Silver	mg/kg	0.5	-	0.121	0.112	0.142	0.117	0.0780	0.0940	0.116	0.107	0.103	0.107	0.174
Sodium	mg/kg	-	-	320	***359***	331	275	231	280	267	290	257	226	331
Strontium	mg/kg	-	-	87.9	76.8	105	80.7	65.0	77.8	87.4	84.9	80.5	75.8	105
Sulphur	mg/kg	-	-	540	<500	<500	<500	<500	620	530	570	<500	520	1,200
Thallium	mg/kg	-	-	0.125	0.101	0.124	0.0930	0.0680	0.0930	0.106	0.0970	0.0920	0.0900	0.125
Tin	mg/kg	-	-	0.360	0.350	0.420	0.310	0.260	0.340	0.350	0.410	0.370	0.350	0.540
Titanium	mg/kg	-	-	742	714	***900***	796	677	706	704	766	666	543	796
Uranium	mg/kg	-	-	1.02	0.961	1.20	1.08	0.830	1.06	1.06	1.03	0.965	0.894	1.20
Vanadium	mg/kg	-	-	71.7	67.7	***85.2***	71.6	67.4	63.1	62.3	67.2	68.5	59.2	75.9
Zinc	mg/kg	123	315	***82.2***	68.8	80.9	70.4	56.6	59.4	65.0	64.9	62.7	65.5	80.9
Zirconium	mg/kg	-	-	1.40	1.40	1.60	1.40	1.60	1.50	1.90	1.50	1.70	1.60	1.90

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: "-" indicates no current BC Working Sediment Quality Guidelines/ no data. ***Bold/ Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] 5th percentile value for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.6: Sediment Quality Data for Upper Edney Creek (EDC-U; Reference), 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference 95th Percentile (EDC-U 2018 to 2022)[b]	Reference (Upper Edney Creek; EDC-U)									
					EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	Mean	Median	Standard Deviation	Minimum	Maximum
		Lower	Upper		7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22					
Physical Tests														
Moisture	%	-	-	79.7	63.9	70.8	64.9	64.5	45.5	61.9	64.5	9.59	45.5	70.8
pH (1:2 soil:water)	pH	-	-	6.01	6.67	6.64	6.44	7.03	6.97	6.75	6.67	0.246	6.44	7.03
Particle Size														
% Gravel	%	-	-	11.3	2.00	<1	<1	<1	1.00	1.20	<1	0.566	<1	2.00
% Sand	%	-	-	76.2	44.9	37.7	60.7	55.8	76.2	55.1	55.8	14.9	37.7	76.2
% Silt	%	-	-	56.4	44.9	47.4	32.7	36.1	17.6	35.7	36.1	11.8	17.6	47.4
% Clay	%	-	-	16.4	8.20	14.3	6.30	8.10	5.20	8.42	8.10	3.52	5.20	14.3
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	8.48	7.11	3.78	7.08	5.43	6.65	6.01	6.65	1.42	3.78	7.11
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.485	0.424	0.303	0.248	0.271	0.167	0.283	0.271	0.0937	0.167	0.424
Metals (<63 µm)[c]														
Aluminum	mg/kg	-	-	22,800	16,600	12,300	14,600	14,800	15,400	14,740	14,800	1,571	12,300	16,600
Antimony	mg/kg	-	-	0.420	0.340	0.240	0.310	0.300	0.310	0.300	0.310	0.0367	0.240	0.340
Arsenic	mg/kg	5.90	17.0	12.0	8.78	5.80	9.52	8.03	8.23	8.07	8.23	1.40	5.80	9.52
Barium	mg/kg	-	-	200	129	79.3	116	105	111	108	111	18.3	79.3	129
Beryllium	mg/kg	-	-	0.620	0.390	0.290	0.380	0.380	0.420	0.372	0.380	0.0487	0.290	0.420
Bismuth	mg/kg	-	-	0.140	0.100	<0.1	<0.1	<0.1	<0.1	0.100	<0.1	-	<0.1	0.100
Boron	mg/kg	-	-	5.40	5.30	<5	<5	<5	<5	5.06	<5	-	<5	5.30
Cadmium	mg/kg	0.600	3.50	0.579	0.426	0.165	0.387	0.316	0.351	0.329	0.351	0.100	0.165	0.426
Calcium	mg/kg	-	-	11,000	8,850	6,170	7,820	7,950	8,440	7,846	7,950	1,022	6,170	8,850
Chromium	mg/kg	37.3	90.0	75.8	49.5	37.2	47.4	47.3	53.2	46.9	47.4	5.94	37.2	53.2
Cobalt	mg/kg	-	-	16.9	13.0	8.18	12.5	11.9	12.2	11.6	12.2	1.93	8.18	13.0
Copper	mg/kg	35.7	197	47.0	32.2	20.2	28.2	25.5	27.6	26.7	27.6	4.39	20.2	32.2
Iron	mg/kg	21,200	43,766	34,000	26,400	18,400	26,800	24,700	27,200	24,700	26,400	3,648	18,400	27,200
Lead	mg/kg	35.0	91.3	8.14	8.14	5.70	6.88	5.90	6.35	6.59	6.35	0.976	5.70	8.14
Lithium	mg/kg	-	-	17.8	12.8	10.4	12.2	11.8	12.8	12.0	12.2	0.990	10.4	12.8
Magnesium	mg/kg	-	-	7,930	6,570	5,210	6,150	6,150	6,460	6,108	6,150	536	5,210	6,570
Manganese	mg/kg	460	1,100	2,710	560	541	852	1,080	1,010	809	852	250	541	1,080
Mercury	mg/kg	0.170	0.486	0.125	0.0820	0.0530	0.0794	0.0747	0.0866	0.0751	0.0794	0.0131	0.0530	0.0866
Molybdenum	mg/kg	25	23,000	2.39	0.670	0.470	0.570	0.560	0.620	0.578	0.570	0.0746	0.470	0.670
Nickel	mg/kg	16.0	75.0	43.2	28.2	19.0	26.2	25.6	27.2	25.2	26.2	3.63	19.0	28.2
Phosphorus	mg/kg	-	-	1,370	1,060	954	1,010	1,020	1,080	1,025	1,020	48.8	954	1,080
Potassium	mg/kg	-	-	1,470	1,240	720	1,030	1,000	1,100	1,018	1,030	191	720	1,240
Selenium	mg/kg	2.00	-	0.880	0.490	0.240	0.370	0.430	0.440	0.394	0.430	0.0961	0.240	0.490
Silver	mg/kg	0.500	-	0.205	0.159	0.100	0.139	0.124	0.132	0.131	0.132	0.0216	0.100	0.159
Sodium	mg/kg	-	-	340	289	200	255	262	269	255	262	33.3	200	289
Strontium	mg/kg	-	-	85.5	77.1	55.7	68.9	70.5	75.8	69.6	70.5	8.50	55.7	77.1
Sulphur	mg/kg	-	-	2,300	760	710	690	610	<500	654	690	67.6	<500	760
Thallium	mg/kg	-	-	0.166	0.128	0.0840	0.107	0.103	0.114	0.107	0.107	0.0161	0.0840	0.128
Tin	mg/kg	-	-	0.620	0.460	0.250	0.330	0.340	0.430	0.362	0.340	0.0841	0.250	0.460
Titanium	mg/kg	-	-	736	626	492	588	608	652	593	608	61.3	492	652
Uranium	mg/kg	-	-	2.15	1.48	1.15	1.23	1.19	1.33	1.28	1.23	0.132	1.15	1.48
Vanadium	mg/kg	-	-	85.7	67.1	48.4	64.7	63.6	68.2	62.4	64.7	8.04	48.4	68.2
Zinc	mg/kg	123	315	89.7	73.4	45.4	68.3	62.0	67.6	63.3	67.6	10.8	45.4	73.4
Zirconium	mg/kg	-	-	1.90	1.10	<1	1.00	<1	<1	1.02	<1	0.0566	<1	1.10

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: "-" indicates no current BC Working Sediment Guideline/ no data. ***Bold/ Italics*** indicates value is > than reference 95th percentile value (< 5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of reference 95th percentile values see Appendix Table D.2.3. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.7: Sediment Quality Data for Upper Hazeltine Creek (HAC-U; Exposed), 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/ Pre-Breach 95th Percentile[b]		Exposed (Upper Hazeltine Creek; HAC-U)									
						HAC-U-1	HAC-U-2	HAC-U-3	HAC-U-4	HAC-U-5	Mean	Median	Standard Deviation	Minimum	Maximum
		Lower	Upper	Reference (Upper Edney Creek; EDC-U 2018 to 2022)	Pre-Breach (HAC-U)	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22					
Physical Tests															
Moisture	%	-	-	79.7	-	***88.4***	***85.0***	***87.1***	***85.8***	***90.3***	***87.3***	***87.1***	2.11	***85.0***	***90.3***
pH (1:2 soil:water)	pH	-	-	6.01	-	7.03	7.19	7.27	7.18	7.22	7.18	7.19	0.0898	7.03	7.27
Particle Size															
% Gravel	%	-	-	11.3	33.1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1
% Sand	%	-	-	76.2	64.7	12.9	14.6	14.6	12.6	9.00	12.7	12.9	2.29	9.00	14.6
% Silt	%	-	-	56.4	76.2	72.0	69.2	70.7	70.1	73.7	71.1	70.7	1.76	69.2	73.7
% Clay	%	-	-	16.4	13.9	15.1	16.2	14.7	***17.3***	***17.3***	16.1	16.2	1.21	14.7	***17.3***
Organic / Inorganic Carbon (<63 µm)[c]															
Total Organic Carbon	%	-	-	8.48	12.8	7.45	5.80	6.29	7.21	6.96	6.74	6.96	0.682	5.80	7.45
Nutrients (Bulk sediment)															
Total Nitrogen	%	-	-	0.485	-	***0.895***	***0.629***	***0.662***	***0.818***	***0.821***	***0.765***	***0.818***	0.114	***0.629***	***0.895***
Metals (<63 µm)[c,d]															
Aluminum	mg/kg	-	-	22,800	17,960	15,700	16,500	16,400	15,400	16,600	16,120	16,400	536	15,400	16,600
Antimony	mg/kg	-	-	0.420	0.370	0.280	0.360	0.350	0.290	0.360	0.328	0.350	0.0396	0.280	0.360
Arsenic	mg/kg	5.90	17.0	12.0	8.23	7.08	7.35	7.38	7.16	7.43	7.28	7.35	0.151	7.08	7.43
Barium	mg/kg	-	-	200	136	***266***	***255***	***257***	***266***	***256***	***260***	***257***	5.52	***255***	***266***
Beryllium	mg/kg	-	-	0.620	0.460	0.520	0.550	0.540	0.510	0.550	0.534	0.540	0.0182	0.510	0.550
Bismuth	mg/kg	-	-	0.140	<0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1
Boron	mg/kg	-	-	5.40	5.40	***23.3***	***15.1***	***16.6***	***22.2***	***21.8***	***19.8***	***21.8***	3.69	***15.1***	***23.3***
Cadmium	mg/kg	0.600	3.50	0.579	0.354	0.395	0.374	0.328	0.330	0.344	0.354	0.344	0.0293	0.328	0.395
Calcium	mg/kg	-	-	11,000	13,395	***23,600***	***20,700***	***22,800***	***21,800***	***19,300***	***21,640***	***21,800***	1,701	***19,300***	***23,600***
Chromium	mg/kg	37.3	90.0	75.8	40.05	26.7	29.4	25.9	23.9	27.6	26.7	26.7	2.04	23.9	29.4
Cobalt	mg/kg	-	-	16.9	10.41	13.2	13.6	13.6	12.8	13.4	13.3	13.4	0.335	12.8	13.6
Copper	mg/kg	35.7	197	47.0	94.6	***393***	***400***	***382***	***385***	***402***	***392***	***393***	8.85	***382***	***402***
Iron	mg/kg	21,200	43,766	34,000	29,900	30,700	31,800	32,300	32,700	32,500	32,000	32,300	800	30,700	32,700
Lead	mg/kg	35.0	91.3	8.14	6.70	5.50	5.99	5.82	5.69	5.87	5.77	5.82	0.187	5.50	5.99
Lithium	mg/kg	-	-	17.8	14.8	12.4	14.0	13.4	12.6	13.0	13.1	13.0	0.642	12.4	14.0
Magnesium	mg/kg	-	-	7,930	6,430	***8,460***	***8,620***	***8,420***	***8,480***	***8,560***	***8,508***	***8,480***	80.7	***8,420***	***8,620***
Manganese	mg/kg	460	1,100	2,710	1,345	1,860	1,430	1,880	2,250	1,780	1,840	1,860	292	1,430	2,250
Mercury	mg/kg	0.170	0.486	0.125	0.145	0.108	0.112	0.105	0.103	0.107	0.107	0.107	0.00339	0.103	0.112
Molybdenum	mg/kg	25	23,000	2.39	1.50	***4.06***	***3.67***	***4.16***	***3.40***	***3.92***	***3.84***	***3.92***	0.308	***3.40***	***4.16***
Nickel	mg/kg	16.0	75.0	43.2	24.4	25.2	25.4	22.4	21.0	23.0	23.4	23.0	1.88	21.0	25.4
Phosphorus	mg/kg	-	-	1,370	1,375	***1,650***	1,340	***1,420***	***1,580***	***1,570***	***1,512***	***1,570***	128	1,340	***1,650***
Potassium	mg/kg	-	-	1,470	1445	1,420	***1,610***	1,360	1,340	1,440	1,434	1,420	107	1,340	***1,610***
Selenium	mg/kg	2.00	-	0.880	3.32	***4.43***	***3.39***	***3.36***	***4.57***	***4.52***	***4.05***	***4.43***	0.622	***3.36***	***4.57***
Silver	mg/kg	0.500	-	0.205	0.16	0.185	0.198	0.193	0.178	0.181	0.187	0.185	0.00834	0.178	0.198
Sodium	mg/kg	-	-	340	350	***496***	***458***	***476***	***465***	***468***	***473***	***468***	14.6	***458***	***496***
Strontium	mg/kg	-	-	85.5	118	***147***	***143***	***151***	***143***	***134***	***144***	***143***	6.31	***134***	***151***
Sulphur[d]	mg/kg	-	-	2,300	-	2,120	***2,610***	***2,520***	***2,920***	***3,420***	***2,718***	***2,610***	485	2,120	***3,420***
Thallium	mg/kg	-	-	0.166	0.0941	<0.05	0.0630	0.0530	<0.05	0.0540	0.0540	0.0530	0.00480	<0.05	0.0630
Tin	mg/kg	-	-	0.620	<2.0	0.740	0.680	0.710	0.620	0.770	0.704	0.710	0.0577	0.620	0.770
Titanium	mg/kg	-	-	736	776	707	727	737	678	***871***	744	727	74.5	678	***871***
Uranium	mg/kg	-	-	2.15	1.26	0.798	0.749	0.835	0.802	0.850	0.807	0.802	0.0391	0.749	0.850
Vanadium	mg/kg	-	-	85.7	65.3	***96.8***	***96.0***	***99.9***	***95.7***	***105***	***98.7***	***96.8***	3.91	***95.7***	***105***
Zinc	mg/kg	123	315	89.7	67.6	68.3	71.1	69.8	67.8	70.6	69.5	69.8	1.43	67.8	71.1
Zirconium	mg/kg	-	-	1.90	-	1.90	***2.10***	***2.00***	1.90	***2.20***	***2.02***	***2.00***	0.130	1.90	***2.20***

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: "-" indicates no current BC Working Sediment Guideline/ no data. ***Bold/ Italics*** indicates value is > than both reference and pre-breach 95th percentile value (< 5th percentile value for pH).

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. For calculation of pre-breach 95th percentile values see Appendix Table D.2.2. For calculation of reference 95th percentile values see Appendix Table D.2.3. Pre-breach sediment metal concentrations are based predominantly on bulk sediment rather than the fines fraction (<63 µm). The 5th percentile is reported for pH.

[c] Total Organic Carbon (TOC) and metals data are presented for the <63 µm sediment fraction for post-breach (2014 to 2022) data only. TOC and metals data presented for pre-breach results represent bulk sediment samples (see Appendix Tables D.2.2)

[d] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.8: Sediment Quality Data for Lower Edney Creek (EDC-D; Reference), 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference 95th Percentile (EDC-D 2018 to 2022)[b]	Reference (Edney Creek; EDC-D)									
					EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	Mean	Median	Standard Deviation	Minimum	Maximum
		Lower	Upper		3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22					
Physical Tests														
Moisture	%	-	-	70.6	50.0	52.8	60.6	43.8	59.8	53.4	52.8	7.02	43.8	60.6
pH (1:2 soil:water)	pH	-	-	6.74	7.30	7.71	7.87	7.69	**6.49**	7.41	7.69	0.556	**6.49**	7.87
Particle Size														
% Gravel	%	-	-	6.80	<1	1.20	<1	<1	1.10	1.06	<1	0.0566	<1	1.20
% Sand	%	-	-	83.9	59.5	52.7	51.2	70.0	58.1	58.3	58.1	7.42	51.2	70.0
% Silt	%	-	-	43.8	33.5	38.7	40.9	24.1	34.0	34.2	34.0	6.47	24.1	40.9
% Clay	%	-	-	9.70	6.60	7.40	7.00	5.80	6.80	6.72	6.80	0.593	5.80	7.40
Organic / Inorganic Carbon (<63 µm)														
Total Organic Carbon	%	-	-	3.82	3.43	2.84	3.56	3.05	***5.29***	3.63	3.43	0.970	2.84	***5.29***
Nutrients (Bulk sediment)														
Total Nitrogen	%	-	-	0.237	0.189	0.158	0.210	0.0870	0.206	0.170	0.189	0.0507	0.0870	0.210
Metals (<63 µm)[c]														
Aluminum (Al)	mg/kg	-	-	19,000	13,800	14,600	14,200	13,100	13,600	13,860	13,800	573	13,100	14,600
Antimony (Sb)	mg/kg	-	-	0.460	0.340	0.330	0.360	0.350	0.320	0.340	0.340	0.0158	0.320	0.360
Arsenic (As)	mg/kg	5.90	17.0	19.5	9.30	8.39	10.5	11.3	9.49	9.80	9.49	1.13	8.39	11.3
Barium (Ba)	mg/kg	-	-	184	110	111	118	126	122	117	118	6.91	110	126
Beryllium (Be)	mg/kg	-	-	0.480	0.350	0.400	0.360	0.370	0.350	0.366	0.360	0.0207	0.350	0.400
Bismuth (Bi)	mg/kg	-	-	0.140	0.110	0.110	0.110	0.120	0.120	0.114	0.110	0.00548	0.110	0.120
Boron (B)	mg/kg	-	-	6.50	<5	<5	5.00	<5	<5	5.00	<5	-	<5	5.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.329	0.264	0.213	0.265	0.278	0.288	0.262	0.265	0.0289	0.213	0.288
Calcium (Ca)	mg/kg	-	-	11,000	8,300	8,550	8,940	8,700	8,480	8,594	8,550	241	8,300	8,940
Chromium (Cr)	mg/kg	37.3	90.0	60.4	42.3	44.8	45.0	43.9	41.1	43.4	43.9	1.68	41.1	45.0
Cobalt (Co)	mg/kg	-	-	15.5	11.4	11.2	12.3	12.1	11.7	11.7	11.7	0.462	11.2	12.3
Copper (Cu)	mg/kg	35.7	197	38.1	25.8	29.2	27.3	27.6	31.5	28.3	27.6	2.17	25.8	31.5
Iron (Fe)	mg/kg	21,200	43,766	33,600	27,100	26,100	29,300	28,900	27,200	27,720	27,200	1,339	26,100	29,300
Lead (Pb)	mg/kg	35.0	91.3	8.37	6.44	7.26	6.73	6.87	6.77	6.81	6.77	0.296	6.44	7.26
Lithium (Li)	mg/kg	-	-	16.8	13.3	15.0	14.0	13.4	13.9	13.9	13.9	0.676	13.3	15.0
Magnesium (Mg)	mg/kg	-	-	8,140	6,450	6,880	7,100	6,620	6,760	6,762	6,760	248	6,450	7,100
Manganese (Mn)	mg/kg	460	1,100	1,410	514	564	1,000	904	541	705	564	229	514	1,000
Mercury (Hg)	mg/kg	0.170	0.486	0.0876	0.0530	0.0689	0.0578	0.0533	0.0661	0.0598	0.0578	0.00733	0.0530	0.0689
Molybdenum (Mo)	mg/kg	25	23,000	1.51	0.600	0.580	0.650	0.540	0.550	0.584	0.580	0.0439	0.540	0.650
Nickel (Ni)	mg/kg	16.0	75.0	39.9	26.9	28.0	28.7	27.9	28.2	27.9	28.0	0.658	26.9	28.7
Phosphorus (P)	mg/kg	-	-	1,190	930	953	1,050	960	968	972.2	960	45.7	930	1,050
Potassium (K)	mg/kg	-	-	1,480	1,120	1,140	1,240	1,110	1,080	1,138	1,120	61.0	1,080	1,240
Selenium (Se)	mg/kg	2.00	-	1.06	0.380	0.490	0.430	0.390	0.540	0.446	0.430	0.0680	0.380	0.540
Silver (Ag)	mg/kg	0.500	-	0.174	0.0940	0.116	0.107	0.103	0.107	0.105	0.107	0.00796	0.0940	0.116
Sodium (Na)	mg/kg	-	-	331	280	267	290	257	226	264	267	24.7	226	290
Strontium (Sr)	mg/kg	-	-	105	77.8	87.4	84.9	80.5	75.8	81.3	80.5	4.83	75.8	87.4
Sulfur (S)	mg/kg	-	-	1,200	620	530	570	<500	520	548	530	44.7	<500	620
Thallium (Tl)	mg/kg	-	-	0.125	0.0930	0.106	0.0970	0.0920	0.0900	0.0956	0.0930	0.00635	0.0900	0.106
Tin (Sn)	mg/kg	-	-	0.540	0.340	0.350	0.410	0.370	0.350	0.364	0.350	0.0279	0.340	0.410
Titanium (Ti)	mg/kg	-	-	796	706	704	766	666	543	677	704	83.0	543	766
Uranium (U)	mg/kg	-	-	1.20	1.06	1.06	1.03	0.965	0.894	1.00	1.03	0.0717	0.894	1.06
Vanadium (V)	mg/kg	-	-	75.9	63.1	62.3	67.2	68.5	59.2	64.1	63.1	3.78	59.2	68.5
Zinc (Zn)	mg/kg	123	315	80.9	59.4	65.0	64.9	62.7	65.5	63.5	64.9	2.53	59.4	65.5
Zirconium (Zr)	mg/kg	-	-	1.90	1.50	1.90	1.50	1.70	1.60	1.64	1.60	0.167	1.50	1.90

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: ***Bold/ Italics*** = value is > reference 95th percentile values (< 5th percentile value for pH). "-" indicates no current BC Working Sediment Guidelines/no data. All summary stats calculated to 3 significant figures. [a] British Columbia Working Sediment Guidelines (BCMOECCS 2021) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of reference 95th percentile values see Appendix Table D.2.5. The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

Table D.2.9: Sediment Quality Data for Lower Hazeltine Creek (HAC-D; Exposed), 2022

Parameter	Units	BC Working Sediment Quality Guidelines[a]		Reference/ Pre-Breach 95th Percentile[b]		Exposed (Hazeltine Creek, HAC-D)									
						HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5	Mean	Median	Standard Deviation	Minimum	Maximum
		Lower	Upper	Reference (Upper Edney Creek; EDC-D 2018 to 2022)	Pre-Breach (HAC-D)	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22					
Physical Tests															
Moisture	%	-	-	70.6	-	59.0	50.3	51.8	46.1	69.7	56.7	55.4	8.91	46.1	69.7
pH (1:2 soil:water)	pH	-	-	6.74	-	7.66	7.65	7.36	7.60	7.22	7.48	7.49	0.182	7.22	7.66
Particle Size															
% Gravel	%	-	-	6.80	53.4	<1	<1	<1	<1	<1	<1	<1	-	<1	<1
% Sand	%	-	-	83.9	79.9	50.5	54.3	33.7	57.0	23.7	42.4	42.8	13.4	23.7	57.0
% Silt	%	-	-	43.8	31.2	42.5	38.6	***54.8***	35.5	***65.4***	***48.6***	***48.6***	11.6	35.5	***65.4***
% Clay	%	-	-	9.70	9.80	6.80	6.60	***11.5***	7.30	***10.0***	8.67	8.55	2.04	6.60	***11.5***
Organic / Inorganic Carbon (<63 µm)															
Total Organic Carbon	%	-	-	3.82	9.03	1.67	1.47	1.77	1.43	1.91	1.68	1.72	0.197	1.43	1.91
Nutrients (Bulk sediment)															
Total Nitrogen	%	-	-	0.237	-	0.133	0.115	0.140	0.117	0.226	0.152	0.136	0.0434	0.115	0.226
Metals (<63 µm)[c]															
Aluminum (Al)	mg/kg	-	-	19,000	12,550	14,900	15,600	16,400	14,200	14,500	15,150	15,100	797	14,200	16,400
Antimony (Sb)	mg/kg	-	-	0.460	1.33	0.480	0.530	0.500	0.490	0.490	0.552	0.495	0.133	0.480	0.820
Arsenic (As)	mg/kg	5.90	17.0	19.5	12.1	13.3	15.9	15.4	15.5	15.5	15.6	15.5	1.43	13.3	17.8
Barium (Ba)	mg/kg	-	-	184	104	***239***	***268***	***220***	***227***	***244***	***238***	***234***	17.1	***220***	***268***
Beryllium (Be)	mg/kg	-	-	0.480	0.300	***0.530***	***0.590***	***0.580***	***0.550***	***0.570***	***0.558***	***0.560***	0.0256	***0.530***	***0.590***
Bismuth (Bi)	mg/kg	-	-	0.140	<0.20	0.130	0.120	0.140	0.120	0.130	0.127	0.125	0.00816	0.120	0.140
Boron (B)	mg/kg	-	-	6.50	2.97	***11.5***	***13.6***	***11.1***	***11.2***	***11.3***	***11.6***	***11.2***	1.01	***10.8***	***13.6***
Cadmium (Cd)	mg/kg	0.600	3.50	0.329	0.235	0.280	0.293	0.312	0.267	0.272	0.302	0.286	0.0440	0.267	***0.385***
Calcium (Ca)	mg/kg	-	-	11,000	7,026	***22,900***	***24,200***	***22,200***	***24,000***	***23,400***	***23,100***	***23,150***	938.1	***21,900***	***24,200***
Chromium (Cr)	mg/kg	37.3	90.0	60.4	33.1	33.8	35.1	36.5	31.9	33.3	33.9	33.6	1.65	31.9	36.5
Cobalt (Co)	mg/kg	-	-	15.5	11.0	14.2	15.5	15.5	14.2	14.3	14.7	14.5	0.622	14.2	15.5
Copper (Cu)	mg/kg	35.7	197	38.1	42.0	***312***	***375***	***342***	***325***	***325***	***336***	***331***	21.8	***312***	***375***
Iron (Fe)	mg/kg	21,200	43,766	33,600	35,400	***40,900***	***46,100***	***43,600***	***43,100***	***42,800***	***43,533***	***43,350***	1,767	***40,900***	***46,100***
Lead (Pb)	mg/kg	35.0	91.3	8.37	5.61	***8.52***	***8.45***	***8.96***	8.29	***8.61***	***10.3***	***8.56***	4.22	8.29	***18.9***
Lithium (Li)	mg/kg	-	-	16.8	12.9	14.4	14.3	15.0	13.7	14.5	14.4	14.4	0.451	13.7	15.0
Magnesium (Mg)	mg/kg	-	-	8,140	6,159	7,900	***8,530***	***8,680***	8,090	7,710	***8,155***	8,055	375	7,710	***8,680***
Manganese (Mn)	mg/kg	460	1,100	1,410	1,116	1,030	***1,470***	996	1,310	1,110	1,161	1,080	188	996	***1,470***
Mercury (Hg)	mg/kg	0.170	0.486	0.0876	0.140	0.0926	0.115	0.101	0.0956	0.108	0.103	0.104	0.00831	0.0926	0.115
Molybdenum (Mo)	mg/kg	25	23,000	1.51	0.752	***1.57***	***1.70***	***1.66***	***1.91***	***1.60***	***1.70***	***1.68***	0.126	***1.57***	***1.91***
Nickel (Ni)	mg/kg	16.0	75.0	39.9	24.0	25.8	24.9	26.5	24.4	24.4	25.2	24.9	0.836	24.4	26.5
Phosphorus (P)	mg/kg	-	-	1,190	729	***1,220***	***1,370***	***1,200***	1,160	***1,220***	***1,292***	***1,220***	158	1,160	***1,580***
Potassium (K)	mg/kg	-	-	1,480	909	1,290	1,420	***1,500***	1,340	1,360	1,362	1,350	87.7	1,260	***1,500***
Selenium (Se)	mg/kg	2.00	-	1.06	1.30	1.19	1.19	1.05	1.12	1.06	1.11	1.09	0.0712	1.03	1.19
Silver (Ag)	mg/kg	0.500	-	0.174	0.0300	0.167	***0.177***	***0.201***	***0.182***	***0.292***	***0.222***	***0.192***	0.0640	0.167	***0.314***
Sodium (Na)	mg/kg	-	-	331	253	***340***	***417***	***412***	***371***	***357***	***376***	***366***	31.4	***340***	***417***
Strontium (Sr)	mg/kg	-	-	105	67.1	***176***	***192***	***171***	***174***	***171***	***172***	***172***	13.8	***149***	***192***
Sulfur (S)	mg/kg	-	-	1,200	-	1,090	740	630	770	780	813	775	156	630	1,090
Thallium (Tl)	mg/kg	-	-	0.125	0.0508	0.106	0.108	0.123	0.113	0.116	0.112	0.111	0.00628	0.106	0.123
Tin (Sn)	mg/kg	-	-	0.540	1.10	0.610	0.730	0.660	0.660	0.630	0.663	0.660	0.0427	0.610	0.730
Titanium (Ti)	mg/kg	-	-	796	701	***873***	***1,090***	***1,020***	***868***	***901***	***950.8***	***927***	88.9	***868***	***1,090***
Uranium (U)	mg/kg	-	-	1.20	0.730	0.979	1.02	1.02	0.966	0.992	0.990	0.986	0.0261	0.960	1.02
Vanadium (V)	mg/kg	-	-	75.9	74.5	***125***	***152***	***133***	***130***	***129***	***135***	***132***	9.79	***125***	***152***
Zinc (Zn)	mg/kg	123	315	80.9	60.2	74.0	76.2	75.9	72.6	75.2	76.8	75.6	5.12	72.6	***86.9***
Zirconium (Zr)	mg/kg	-	-	1.90	-	***2.30***	***3.30***	***2.90***	***2.50***	***2.70***	***2.77***	***2.80***	0.350	***2.30***	***3.30***

Value is > BC Lower Working Sediment Quality Guideline

Value is > BC Upper Working Sediment Quality Guideline

Notes: ***Bold/Italics*** - Value is > than both reference and pre-breach 95th percentile value (< 5th percentile value for pH). "-" indicates no current BC Working Sediment Guideline/parameter was not calculated.

[a] British Columbia Working Sediment Guidelines (BCMOECCS 2021) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b).

[b] For calculation of pre-breach 95th percentile values see Appendix Table D.2.4. For calculation of reference 95th percentile values see Appendix Table D.2.5. Pre-breach sediment metal concentrations are based predominantly on bulk sediment rather than the fines fraction (<63 µm). The 5th percentile is reported for pH.

[c] Total sulphur measured in bulk sediment, not the <63 µm fraction.

APPENDIX D.3
PERIPHYTON COMMUNITY & PRODUCTIVITY

Table D.3.1: Periphyton Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Year	Area	Area Type	Station	Density (cells/cm²)	Total Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	Diatom Richness (# of Taxa)	Diatoms (cells/cm²)	Chlorophytes (cells/cm²)	Chrysophytes (cells/cm²)	Cyanobacteria (cells/cm²)	Dinoflagellates (cells/cm²)
1995	EDC-U (W9)[a]	Reference (Baseline)	W9-1	-	37	-	-	23	-	-	-	-	-
			W9-2	-	35	-	-	21	-	-	-	-	-
			W9-3	-	34	-	-	20	-	-	-	-	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-A	-	12	-	-	15	-	-	-	-	-
			W7-B	-	23	-	-	18	-	-	-	-	-
			W7-C	-	17	-	-	11	-	-	-	-	-
1996	EDC-U (W9)[a]	Reference (Baseline)	W9-A	-	40	-	-	27	-	-	-	-	-
			W9-B	-	36	-	-	27	-	-	-	-	-
			W9-C	-	45	-	-	29	-	-	-	-	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-1	-	28	-	-	23	-	-	-	-	-
			W7-2	-	32	-	-	21	-	-	-	-	-
			W7-3	-	27	-	-	20	-	-	-	-	-
2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	W7	21,200,428	34	-	-	22	52,079	10,691	-	21,108,545	0
2018	EDC-U	Reference	EDC-U-1	1,055,389	27	0.247	0.850	13	112,365	28,552	-	909,867	0
			EDC-U-2	1,021,188	33	0.255	0.881	18	139,996	54,341	-	822,246	0
			EDC-U-3	889,906	28	0.194	0.816	14	93,777	20,765	-	770,005	0
			EDC-U-4	1,616,699	28	0.194	0.816	14	197,468	50,104	-	1,357,338	0
			EDC-U-5	1,108,844	28	0.148	0.759	17	109,786	13,263	-	982,110	0
	HAC-R1	Exposed	HAC-R1-1	1,107,074	23	0.214	0.797	14	383,147	112,365	-	604,193	0
			HAC-R1-2	992,498	22	0.234	0.806	14	565,879	110,523	-	309,465	0
			HAC-R1-3	915,040	29	0.263	0.869	16	419,988	40,525	-	412,159	29,473
			HAC-R1-4	990,411	29	0.265	0.870	18	486,302	27,631	-	474,636	0
			HAC-R1-5	637,877	27	0.440	0.916	16	416,830	44,209	-	176,837	0
	HAC-U		HAC-U-1	1,031,550	21	0.246	0.806	16	930,237	70,612	-	24,561	0
			HAC-U-2	908,746	19	0.287	0.816	13	692,612	58,946	-	154,732	0
			HAC-U-3	1,547,325	16	0.204	0.694	10	1,394,697	78,945	-	73,682	0
			HAC-U-4	923,483	20	0.207	0.758	14	857,169	31,929	-	34,385	0
			HAC-U-5	565,964	22	0.306	0.852	13	371,614	148,966	-	43,782	0
2019	EDC-U	Reference	EDC-U-1	1,207,383	28	0.269	0.867	14	50,640	13,598	0	1,121,577	0
			EDC-U-2	589,659	32	0.225	0.861	20	98,052	4,551	0	487,056	0
			EDC-U-3	88,329	22	0.241	0.811	13	7,207	3,821	0	68,010	0
			EDC-U-4	1,084,694	26	0.0667	0.424	16	27,216	8,256	0	1,046,164	0
			EDC-U-5	280,674	33	0.284	0.893	17	32,001	8,088	0	200,846	0
	HAC-R1	Exposed	HAC-R1-1	251,352	26	0.116	0.669	16	16,591	1,443	721	215,284	0
			HAC-R1-2	237,397	30	0.192	0.826	20	26,185	1,082	649	186,974	0
			HAC-R1-3	185,009	28	0.133	0.731	18	51,243	2,813	603	118,293	0
			HAC-R1-4	159,086	27	0.192	0.807	17	32,056	0	406	118,509	0
			HAC-R1-5	742,283	27	0.0767	0.517	14	20,439	1,803	601	683,973	0
	HAC-U		HAC-U-1	347,921	30	0.403	0.917	15	122,935	40,190	1,182	147,561	0
			HAC-U-2	1,157,479	25	0.0828	0.517	15	121,576	126,599	0	854,043	0
			HAC-U-3	1,771,522	27	0.0566	0.346	15	192,449	42,509	0	1,496,373	0
			HAC-U-4	426,184	31	0.136	0.762	16	84,902	23,612	0	317,670	0
			HAC-U-5	483,442	25	0.194	0.794	16	188,585	28,597	0	266,260	0

Notes: "-" indicates no data available. cells/cm^2 = cells per square centimetre. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.1: Periphyton Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Year	Area	Area Type	Station	Density (cells/cm²)	Total Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	Diatom Richness (# of Taxa)	Diatoms (cells/cm²)	Chlorophytes (cells/cm²)	Chrysophytes (cells/cm²)	Cyanobacteria (cells/cm²)	Dinoflagellates (cells/cm²)
2020	EDC-U	Reference	EDC-U-1	540,622	26	0.120	0.679	14	9,785	11,009	0	512,285	0
			EDC-U-2	1,608,224	11	0.191	0.524	3	2,679	0	0	1,590,138	0
			EDC-U-3	2,082,852	9	0.202	0.450	2	4,689	11,387	0	2,060,077	0
			EDC-U-4	644,856	21	0.205	0.767	6	3,517	8,206	0	612,269	0
			EDC-U-5	250,654	11	0.199	0.544	5	4,995	204	0	244,945	0
	HAC-R1	Exposed	HAC-R1-1	1,085,911	29	0.112	0.692	19	110,774	36,925	0	859,088	0
			HAC-R1-2	1,125,327	29	0.113	0.695	19	203,966	23,913	0	728,649	0
			HAC-R1-3	1,343,828	22	0.201	0.774	13	88,620	18,287	0	1,006,230	0
			HAC-R1-4	646,960	20	0.410	0.878	11	73,850	3,517	0	421,016	0
			HAC-R1-5	1,928,410	19	0.231	0.772	9	66,113	8,440	0	1,663,958	0
	HAC-U		HAC-U-1	939,866	24	0.331	0.874	14	221,046	7,536	0	509,076	0
			HAC-U-2	353,842	17	0.270	0.782	12	146,694	0	0	142,843	0
			HAC-U-3	1,264,235	24	0.280	0.851	17	334,081	0	0	705,088	0
			HAC-U-4	662,888	26	0.343	0.888	17	276,057	70,333	0	137,149	0
			HAC-U-5	784,377	26	0.290	0.868	16	185,723	9,891	0	482,165	0
2021	EDC-U	Reference	EDC-U-1	1,486,106	24	0.160	0.740	16	77,132	2,624	0	1,406,351	0
			EDC-U-2	794,143	21	0.105	0.546	9	24,136	7,346	0	682,380	0
			EDC-U-3	103,781	41	0.167	0.854	22	13,038	10,266	0	79,862	0
			EDC-U-4	342,829	26	0.182	0.789	14	28,890	3,611	0	280,883	0
			EDC-U-5	507,750	27	0.127	0.709	16	38,057	9,167	0	455,527	0
	HAC-R1	Exposed	HAC-R1-1	1,091,336	16	0.0948	0.340	10	5,431	11,334	0	1,061,113	0
			HAC-R1-2	721,023	19	0.0973	0.459	11	8,889	23,334	0	679,355	0
			HAC-R1-3	246,090	16	0.239	0.739	7	5,833	23,334	0	177,755	0
			HAC-R1-4	305,564	22	0.144	0.684	16	23,612	19,723	0	236,673	0
			HAC-R1-5	747,243	19	0.0751	0.299	13	25,556	27,779	0	689,742	0
	HAC-U		HAC-U-1	328,354	20	0.332	0.849	13	86,576	87,364	0	89,088	0
			HAC-U-2	383,656	26	0.360	0.893	15	145,606	14,167	0	149,900	0
			HAC-U-3	474,484	13	0.404	0.810	8	194,516	61,840	0	143,919	0
			HAC-U-4	317,353	27	0.311	0.881	17	73,084	23,050	0	145,325	0
			HAC-U-5	432,704	18	0.244	0.772	8	20,070	36,992	0	335,108	0
2022	EDC-U	Reference	EDC-U-1	1,217,368	13	0.230	0.666	5	15,853	75,492	0	1,089,786	0
			EDC-U-2	3,685,304	25	0.112	0.643	13	322,152	16,759	0	3,335,220	0
			EDC-U-3	3,196,274	22	0.265	0.828	12	444,767	23,635	0	2,727,872	0
			EDC-U-4	2,063,768	24	0.139	0.700	14	95,647	5,925	0	1,954,579	0
			EDC-U-5	2,986,351	25	0.183	0.782	13	134,732	23,003	0	2,764,536	0
	HAC-R1	Exposed	HAC-R1-1	1,178,821	30	0.0965	0.654	20	176,094	25,503	0	839,991	0
			HAC-R1-2	932,045	27	0.217	0.829	18	125,296	0	0	746,096	0
			HAC-R1-3	4,021,097	26	0.0477	0.194	14	61,937	23,074	0	3,755,134	0
			HAC-R1-4	2,239,208	22	0.0596	0.238	17	127,517	6,072	0	1,962,315	0
			HAC-R1-5	1,109,121	26	0.166	0.769	21	371,334	6,572	0	593,196	0
	HAC-U		HAC-U-1	723,839	30	0.116	0.712	20	124,481	13,966	0	569,605	0
			HAC-U-2	500,918	25	0.347	0.885	17	158,283	9,311	0	219,733	0
			HAC-U-3	583,291	32	0.449	0.930	24	414,054	26,289	0	85,440	0
			HAC-U-4	1,542,775	26	0.127	0.698	17	250,060	42,563	0	1,203,598	0
			HAC-U-5	1,495,113	27	0.0814	0.545	18	128,488	61,451	0	1,225,847	0

Notes: "-" indicates no data available. cells/cm^2 = cells per square centimetre. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.1: Periphyton Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Year	Area	Area Type	Station	Phaeophytes (cells/cm²)	Rhodophytes (cells/cm²)	Diatoms (%)	Chlorophytes (%)	Chrysophytes (%)	Cyanobacteria (%)	Dinoflagellates (%)	Phaeophytes (%)	Rhodophytes (%)
1995	EDC-U (W9)[a]	Reference (Baseline)	W9-1	-	-	80.0	20.0	-	0	0	-	-
			W9-2	-	-	90.0	10.0	-	1.00	0	-	-
			W9-3	-	-	89.0	10.0	-	1.00	0	-	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-A	-	-	100	0	-	0	0	-	-
			W7-B	-	-	99.0	0	-	1.00	0	-	-
			W7-C	-	-	100	0	-	0	0	-	-
1996	EDC-U (W9)[a]	Reference (Baseline)	W9-A	-	-	97.0	3.00	-	0	0	-	-
			W9-B	-	-	97.0	2.00	-	1.00	0	-	-
			W9-C	-	-	97.0	1.00	-	2.00	0	-	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-1	-	-	25.0	0	-	75.0	0	-	-
			W7-2	-	-	49.0	0	-	51.0	0	-	-
			W7-3	-	-	65.0	0	-	35.0	0	-	-
2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	W7	-	-	0	0	-	100	0	-	-
2018	EDC-U	Reference	EDC-U-1	-	-	10.6	2.71	-	86.2	0	-	-
			EDC-U-2	-	-	13.7	5.32	-	80.5	0	-	-
			EDC-U-3	-	-	10.5	2.33	-	86.5	0	-	-
			EDC-U-4	-	-	12.2	3.10	-	84.0	0	-	-
			EDC-U-5	-	-	9.90	1.20	-	88.6	0	-	-
	HAC-R1	Exposed	HAC-R1-1	-	-	34.6	10.2	-	54.6	0	-	-
			HAC-R1-2	-	-	57.0	11.1	-	31.2	0	-	-
			HAC-R1-3	-	-	45.9	4.43	-	45.0	3.22	-	-
			HAC-R1-4	-	-	49.1	2.79	-	47.9	0	-	-
			HAC-R1-5	-	-	65.3	6.93	-	27.7	0	-	-
	HAC-U		HAC-U-1	-	-	90.2	6.85	-	2.38	0	-	-
			HAC-U-2	-	-	76.2	6.49	-	17.0	0	-	-
			HAC-U-3	-	-	90.1	5.10	-	4.76	0	-	-
			HAC-U-4	-	-	92.8	3.46	-	3.72	0	-	-
			HAC-U-5	-	-	65.7	26.3	-	7.74	0	-	-
2019	EDC-U	Reference	EDC-U-1	0	21,569	4.19	1.13	0	92.9	0	0	1.79
			EDC-U-2	0	0	16.6	0.772	0	82.6	0	0	0
			EDC-U-3	0	9,291	8.16	4.33	0	77.0	0	0	10.5
			EDC-U-4	0	3,058	2.51	0.761	0	96.5	0	0	0.282
			EDC-U-5	0	39,738	11.4	2.88	0	71.6	0	0	14.2
	HAC-R1	Exposed	HAC-R1-1	17,313	0	6.60	0.574	0.287	85.7	0	6.89	0
			HAC-R1-2	22,507	0	11.0	0.456	0.273	78.8	0	9.48	0
			HAC-R1-3	12,057	0	27.7	1.52	0.326	63.9	0	6.52	0
			HAC-R1-4	8,115	0	20.1	0	0.255	74.5	0	5.10	0
			HAC-R1-5	35,467	0	2.75	0.243	0.0810	92.1	0	4.78	0
	HAC-U		HAC-U-1	36,053	0	35.3	11.6	0.340	42.4	0	10.4	0
			HAC-U-2	55,262	0	10.5	10.9	0	73.8	0	4.77	0
			HAC-U-3	40,190	0	10.9	2.40	0	84.5	0	2.27	0
			HAC-U-4	0	0	19.9	5.54	0	74.5	0	0	0
			HAC-U-5	0	0	39.0	5.92	0	55.1	0	0	0

Notes: "-" indicates no data available. cells/cm^2 = cells per square centimetre. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.1: **Periphyton Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022**

Year	Area	Area Type	Station	Phaeophytes (cells/cm²)	Rhodophytes (cells/cm²)	Diatoms (%)	Chlorophytes (%)	Chrysophytes (%)	Cyanobacteria (%)	Dinoflagellates (%)	Phaeophytes (%)	Rhodophytes (%)
2020	EDC-U	Reference	EDC-U-1	0	7,543	1.81	2.04	0	94.8	0	0	1.40
			EDC-U-2	0	15,406	0.167	0	0	98.9	0	0	0.958
			EDC-U-3	0	6,698	0.225	0.547	0	98.9	0	0	0.322
			EDC-U-4	0	20,865	0.545	1.27	0	95.0	0	0	3.24
			EDC-U-5	0	510	1.99	0.0813	0	97.7	0	0	0.203
	HAC-R1	Exposed	HAC-R1-1	79,125	0	10.2	3.40	0	79.1	0	7.29	0
			HAC-R1-2	168,799	0	18.1	2.12	0	64.8	0	15.0	0
			HAC-R1-3	230,692	0	6.59	1.36	0	74.9	0	17.2	0
			HAC-R1-4	148,578	0	11.4	0.544	0	65.1	0	23.0	0
			HAC-R1-5	189,899	0	3.43	0.438	0	86.3	0	9.85	0
	HAC-U		HAC-U-1	202,207	0	23.5	0.802	0	54.2	0	21.5	0
			HAC-U-2	64,304	0	41.5	0	0	40.4	0	18.2	0
			HAC-U-3	225,065	0	26.4	0	0	55.8	0	17.8	0
			HAC-U-4	179,349	0	41.6	10.6	0	20.7	0	27.1	0
			HAC-U-5	106,598	0	23.7	1.26	0	61.5	0	13.6	0
2021	EDC-U	Reference	EDC-U-1	0	0	5.19	0.177	0	94.6	0	0	0
			EDC-U-2	5,247	75,033	3.04	0.925	0	85.9	0	0.661	9.45
			EDC-U-3	0	616	12.6	9.89	0	77.0	0	0	0.594
			EDC-U-4	6,945	22,501	8.43	1.05	0	81.9	0	2.03	6.56
			EDC-U-5	0	5,000	7.50	1.81	0	89.7	0	0	0.985
	HAC-R1	Exposed	HAC-R1-1	13,459	0	0.498	1.04	0	97.2	0	1.23	0
			HAC-R1-2	9,445	0	1.23	3.24	0	94.2	0	1.31	0
			HAC-R1-3	39,168	0	2.37	9.48	0	72.2	0	15.9	0
			HAC-R1-4	25,556	0	7.73	6.45	0	77.5	0	8.36	0
			HAC-R1-5	4,167	0	3.42	3.72	0	92.3	0	0.558	0
	HAC-U		HAC-U-1	65,326	0	26.4	26.6	0	27.1	0	19.9	0
			HAC-U-2	73,984	0	38.0	3.69	0	39.1	0	19.3	0
			HAC-U-3	74,208	0	41.0	13.0	0	30.3	0	15.6	0
			HAC-U-4	75,895	0	23.0	7.26	0	45.8	0	23.9	0
			HAC-U-5	40,534	0	4.64	8.55	0	77.5	0	9.37	0
2022	EDC-U	Reference	EDC-U-1	0	36,236	1.30	6.20	0	89.5	0	0	2.98
			EDC-U-2	0	11,173	8.74	0.455	0	90.5	0	0	0.303
			EDC-U-3	0	0	13.9	0.739	0	85.3	0	0	0
			EDC-U-4	0	7,618	4.63	0.287	0	94.7	0	0	0.369
			EDC-U-5	0	64,080	4.51	0.770	0	92.6	0	0	2.15
	HAC-R1	Exposed	HAC-R1-1	137,232	0	14.9	2.16	0	71.3	0	11.6	0
			HAC-R1-2	60,653	0	13.4	0	0	80.0	0	6.51	0
			HAC-R1-3	180,952	0	1.54	0.574	0	93.4	0	4.50	0
			HAC-R1-4	143,304	0	5.69	0.271	0	87.6	0	6.40	0
			HAC-R1-5	138,018	0	33.5	0.593	0	53.5	0	12.4	0
	HAC-U		HAC-U-1	15,788	0	17.2	1.93	0	78.7	0	2.18	0
			HAC-U-2	113,591	0	31.6	1.86	0	43.9	0	22.7	0
			HAC-U-3	57,508	0	71.0	4.51	0	14.6	0	9.86	0
			HAC-U-4	46,554	0	16.2	2.76	0	78.0	0	3.02	0
			HAC-U-5	79,328	0	8.59	4.11	0	82.0	0	5.31	0

Notes: "-" indicates no data available. cells/cm^2 = cells per square centimetre. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.2: Summary Statistics of Periphyton Community and Productivity Metrics for Upper Hazeltine Creek (HAC-U, HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (cells/cm²)	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	21,200,428	-	21,200,428	21,200,428	21,200,428
	2018	EDC-U	Reference	5	1,138,405	279,295	889,906	1,055,389	1,616,699
		HAC-R1	Exposed	5	928,580	176,395	637,877	990,411	1,107,074
		HAC-U		5	995,413	354,621	565,964	923,483	1,547,325
	2019	EDC-U	Reference	5	650,148	488,659	88,329	589,659	1,207,383
		HAC-R1	Exposed	5	315,025	241,791	159,086	237,397	742,283
		HAC-U		5	837,310	614,208	347,921	483,442	1,771,522
	2020	EDC-U	Reference	5	1,025,442	780,696	250,654	644,856	2,082,852
		HAC-R1	Exposed	5	1,226,087	466,988	646,960	1,125,327	1,928,410
		HAC-U		5	801,041	336,590	353,842	784,377	1,264,235
	2021	EDC-U	Reference	5	646,922	532,153	103,781	507,750	1,486,106
		HAC-R1	Exposed	5	622,251	349,001	246,090	721,023	1,091,336
		HAC-U		5	387,310	67,162	317,353	383,656	474,484
	2022	EDC-U	Reference	5	2,629,813	984,564	1,217,368	2,986,351	3,685,304
		HAC-R1	Exposed	5	1,896,058	1,293,886	932,045	1,178,821	4,021,097
		HAC-U		5	969,187	508,426	500,918	723,839	1,542,775
Total Richness (# of Taxa)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	35	1.53	34	35	37
		HAC-U (W7)$_a$	Exposed (Baseline)	3	17	5.51	12	17	23
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	40	4.51	36	40	45
		HAC-U (W7)a	Exposed (Baseline)	3	29	2.65	27	28	32
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	34	-	34	34	34
	2018	EDC-U	Reference	5	29	2.39	27	28	33
		HAC-R1	Exposed	5	26	3.32	22	27	29
		HAC-U		5	20	2.30	16	20	22
	2019	EDC-U	Reference	5	28	4.49	22	28	33
		HAC-R1	Exposed	5	28	1.52	26	27	30
		HAC-U		5	28	2.79	25	27	31
	2020	EDC-U	Reference	5	16	7.47	9	11	26
		HAC-R1	Exposed	5	24	4.87	19	22	29
		HAC-U		5	23	3.71	17	24	26
	2021	EDC-U	Reference	5	28	7.73	21	26	41
		HAC-R1	Exposed	5	18	2.51	16	19	22
		HAC-U		5	21	5.81	13	20	27
	2022	EDC-U	Reference	5	22	5.07	13	24	25
		HAC-R1	Exposed	5	26	2.86	22	26	30
		HAC-U		5	28	2.92	25	27	32
Simpson's Evenness	2018	EDC-U	Reference	5	0.208	0.0440	0.148	0.194	0.255
		HAC-R1	Exposed	5	0.283	0.0902	0.214	0.263	0.440
		HAC-U		5	0.250	0.0462	0.204	0.246	0.306
	2019	EDC-U	Reference	5	0.217	0.0872	0.0667	0.241	0.284
		HAC-R1	Exposed	5	0.142	0.0500	0.0767	0.133	0.192
		HAC-U		5	0.174	0.138	0.0566	0.136	0.403
	2020	EDC-U	Reference	5	0.183	0.0360	0.120	0.199	0.205
		HAC-R1	Exposed	5	0.213	0.122	0.112	0.201	0.410
		HAC-U		5	0.303	0.0324	0.270	0.290	0.343
	2021	EDC-U	Reference	5	0.148	0.0315	0.105	0.160	0.182
		HAC-R1	Exposed	5	0.130	0.0661	0.0751	0.0973	0.239
		HAC-U		5	0.330	0.0595	0.244	0.332	0.404
	2022	EDC-U	Reference	5	0.186	0.0628	0.112	0.183	0.265
		HAC-R1	Exposed	5	0.117	0.0723	0.0477	0.0965	0.217
		HAC-U		5	0.224	0.164	0.0814	0.127	0.449
Simpson's Diversity	2018	EDC-U	Reference	5	0.824	0.0457	0.759	0.816	0.881
		HAC-R1	Exposed	5	0.852	0.0496	0.797	0.869	0.916
		HAC-U		5	0.785	0.0611	0.694	0.806	0.852
	2019	EDC-U	Reference	5	0.771	0.197	0.424	0.861	0.893
		HAC-R1	Exposed	5	0.710	0.125	0.517	0.731	0.826
		HAC-U		5	0.667	0.231	0.346	0.762	0.917
	2020	EDC-U	Reference	5	0.593	0.128	0.450	0.544	0.767
		HAC-R1	Exposed	5	0.762	0.0759	0.692	0.772	0.878
		HAC-U		5	0.853	0.0416	0.782	0.868	0.888
	2021	EDC-U	Reference	5	0.727	0.115	0.546	0.740	0.854
		HAC-R1	Exposed	5	0.504	0.199	0.299	0.459	0.739
		HAC-U		5	0.841	0.0503	0.772	0.849	0.893
	2022	EDC-U	Reference	5	0.724	0.0786	0.643	0.700	0.828
		HAC-R1	Exposed	5	0.537	0.300	0.194	0.654	0.829
		HAC-U		5	0.754	0.155	0.545	0.712	0.930
Diatom Richness (# of Taxa)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	21	1.53	20	21	23
		HAC-U (W7)[a]	Exposed (Baseline)	3	15	3.51	11	15	18
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	28	1.15	27	27	29
		HAC-U (W7)[a]	Exposed (Baseline)	3	21	1.53	20	21	23
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	22	-	22	22	22
	2018	EDC-U	Reference	5	15	2.17	13	14	18
		HAC-R1	Exposed	5	16	1.67	14	16	18
		HAC-U		5	13	2.17	10	13	16
	2019	EDC-U	Reference	5	16	2.74	13	16	20
		HAC-R1	Exposed	5	17	2.24	14	17	20
		HAC-U		5	15	0.548	15	15	16
	2020	EDC-U	Reference	5	6	4.74	2	5	14
		HAC-R1	Exposed	5	14	4.60	9	13	19
		HAC-U		5	15	2.17	12	16	17
	2021	EDC-U	Reference	5	15	4.67	9	16	22
		HAC-R1	Exposed	5	11	3.36	7	11	16
		HAC-U		5	12	4.09	8	13	17
	2022	EDC-U	Reference	5	11	3.65	5	13	14
		HAC-R1	Exposed	5	18	2.74	14	18	21
		HAC-U		5	19	2.95	17	18	24

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.2: Summary Statistics of Periphyton Community and Productivity Metrics for Upper Hazeltine Creek (HAC-U, HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Diatom (cells/cm²)	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	52,079	-	52,079	52,079	52,079
	2018	EDC-U	Reference	5	130,679	40,869	93,777	112,365	197,468
		HAC-R1	Exposed	5	454,429	72,660	383,147	419,988	565,879
		HAC-U		5	849,266	373,097	371,614	857,169	1,394,697
	2019	EDC-U	Reference	5	43,023	34,425	7,207	32,001	98,052
		HAC-R1	Exposed	5	29,303	13,590	16,591	26,185	51,243
		HAC-U		5	142,089	46,787	84,902	122,935	192,449
	2020	EDC-U	Reference	5	5,133	2,761	2,679	4,689	9,785
		HAC-R1	Exposed	5	108,664	55,927	66,113	88,620	203,966
		HAC-U		5	232,720	73,989	146,694	221,046	334,081
	2021	EDC-U	Reference	5	36,250	24,568	13,038	28,890	77,132
		HAC-R1	Exposed	5	13,864	9,901	5,431	8,889	25,556
		HAC-U		5	103,971	67,505	20,070	86,576	194,516
	2022	EDC-U	Reference	5	202,630	175,966	15,853	134,732	444,767
		HAC-R1	Exposed	5	172,436	118,347	61,937	127,517	371,334
		HAC-U		5	215,073	122,216	124,481	158,283	414,054
Chlorophytes (cells/cm²)	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	10,691	-	10,691	10,691	10,691
	2018	EDC-U	Reference	5	33,405	18,071	13,263	28,552	54,341
		HAC-R1	Exposed	5	67,051	40,996	27,631	44,209	112,365
		HAC-U		5	77,880	43,524	31,929	70,612	148,966
	2019	EDC-U	Reference	5	7,663	3,880	3,821	8,088	13,598
		HAC-R1	Exposed	5	1,428	1,027	0	1,443	2,813
		HAC-U		5	52,301	42,272	23,612	40,190	126,599
	2020	EDC-U	Reference	5	6,161	5,667	0	8,206	11,387
		HAC-R1	Exposed	5	18,216	13,173	3,517	18,287	36,925
		HAC-U		5	17,552	29,837	0	7,536	70,333
	2021	EDC-U	Reference	5	6,603	3,366	2,624	7,346	10,266
		HAC-R1	Exposed	5	21,101	6,162	11,334	23,334	27,779
		HAC-U		5	44,682	29,893	14,167	36,992	87,364
	2022	EDC-U	Reference	5	28,963	26,966	5,925	23,003	75,492
		HAC-R1	Exposed	5	12,244	11,328	0	6,572	25,503
		HAC-U		5	30,716	21,467	9,311	26,289	61,451
Chrysophytes (cells/cm²)	2018	EDC-U	Reference	5	-	-	-	-	-
		HAC-R1	Exposed	5	-	-	-	-	-
		HAC-U		5	-	-	-	-	-
	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	596	117	406	603	721
		HAC-U		5	236	529	0	0	1,182
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	-	0	0	0	0	0
		HAC-R1	Exposed	-	0	0	0	0	0
		HAC-U		-	0	0	0	0	0
Cyanobacteria (cells/cm²)	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	21,108,545	-	21,108,545	21,108,545	21,108,545
	2018	EDC-U	Reference	5	968,313	232,168	770,005	909,867	1,357,338
		HAC-R1	Exposed	5	395,458	162,256	176,837	412,159	604,193
		HAC-U		5	66,228	52,779	24,561	43,782	154,732
	2019	EDC-U	Reference	5	584,730	480,893	68,010	487,056	1,121,577
		HAC-R1	Exposed	5	264,607	238,264	118,293	186,974	683,973
		HAC-U		5	616,382	561,799	147,561	317,670	1,496,373
	2020	EDC-U	Reference	5	1,003,943	779,464	244,945	612,269	2,060,077
		HAC-R1	Exposed	5	935,788	460,699	421,016	859,088	1,663,958
		HAC-U		5	395,264	248,413	137,149	482,165	705,088
	2021	EDC-U	Reference	5	581,000	511,966	79,862	455,527	1,406,351
		HAC-R1	Exposed	5	568,928	364,844	177,755	679,355	1,061,113
		HAC-U		5	172,668	94,161	89,088	145,325	335,108
	2022	EDC-U	Reference	5	2,374,398	869,886	1,089,786	2,727,872	3,335,220
		HAC-R1	Exposed	5	1,579,346	1,331,743	593,196	839,991	3,755,134
		HAC-U		5	660,845	535,678	85,440	569,605	1,225,847
Dinoflagellates (cells/cm²)	2018	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	5,895	13,181	0	0	29,473
		HAC-U		5	0	0	0	0	0
	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.2: Summary Statistics of Periphyton Community and Productivity Metrics for Upper Hazeltine Creek (HAC-U, HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Phaeophytes (cells/cm²)	2018	EDC-U	Reference	5	-	-	-	-	-
		HAC-R1	Exposed	5	-	-	-	-	-
		HAC-U		5	-	-	-	-	-
	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	19,092	10,641	8,115	17,313	35,467
		HAC-U		5	26,301	25,051	0	36,053	55,262
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	163,419	56,084	79,125	168,799	230,692
		HAC-U		5	155,505	67,634	64,304	179,349	225,065
	2021	EDC-U	Reference	5	2,438	3,392	0	0	6,945
		HAC-R1	Exposed	5	18,359	14,051	4,167	13,459	39,168
		HAC-U		5	65,989	14,816	40,534	73,984	75,895
	2022	EDC-U	Reference	-	0	0	0	0	0
		HAC-R1	Exposed	-	132,032	43,812	60,653	138,018	180,952
		HAC-U		-	62,554	36,588	15,788	57,508	113,591
Rhodophytes (cells/cm²)	2018	EDC-U	Reference	5	-	-	-	-	-
		HAC-R1	Exposed	5	-	-	-	-	-
		HAC-U		5	-	-	-	-	-
	2019	EDC-U	Reference	5	14,731	16,240	0	9,291	39,738
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2020	EDC-U	Reference	5	10,205	7,970	510	7,543	20,865
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	20,630	31,755	0	5,000	75,033
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	-	23,821	26,291	0	11,173	64,080
		HAC-R1	Exposed	-	0	0	0	0	0
		HAC-U		-	0	0	0	0	0
Diatoms (%)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	86.3	5.51	80.0	89.0	90.0
		HAC-U (W7)[a]	Exposed (Baseline)	3	99.7	0.577	99.0	100	100
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	97.0	0	97.0	97.0	97.0
		HAC-U (W7)[a]	Exposed (Baseline)	3	46.3	20.1	25.0	49.0	65.0
	2018	EDC-U	Reference	5	11.4	1.55	9.90	10.6	13.7
		HAC-R1	Exposed	5	50.4	11.6	34.6	49.1	65.3
		HAC-U		5	83.0	11.7	65.7	90.1	92.8
	2019	EDC-U	Reference	5	8.58	5.68	2.51	8.16	16.6
		HAC-R1	Exposed	5	13.6	10.2	2.75	11.0	27.7
		HAC-U		5	23.1	13.4	10.5	19.9	39.0
	2020	EDC-U	Reference	5	0.948	0.885	0.167	0.545	1.99
		HAC-R1	Exposed	5	9.95	5.54	3.43	10.2	18.1
		HAC-U		5	31.3	9.39	23.5	26.4	41.6
	2021	EDC-U	Reference	5	7.34	3.59	3.04	7.50	12.6
		HAC-R1	Exposed	5	3.05	2.84	0.498	2.37	7.73
		HAC-U		5	26.6	14.4	4.64	26.4	41.0
	2022	EDC-U	Reference	5	6.62	4.86	1.30	4.63	13.9
		HAC-R1	Exposed	5	13.8	12.3	1.54	13.4	33.5
		HAC-U		5	28.9	24.9	8.59	17.2	71.0
Chlorophytes (%)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	13.3	5.77	10.0	10.0	20.0
		HAC-U (W7)[a]	Exposed (Baseline)	3	0	0	0	0	0
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	2.00	1.00	1.00	2.00	3.00
		HAC-U (W7)[a]	Exposed (Baseline)	3	0	0	0	0	0
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	0	-	0	0	0
	2018	EDC-U	Reference	5	2.93	1.51	1.20	2.71	5.32
		HAC-R1	Exposed	5	7.09	3.58	2.79	6.93	11.1
		HAC-U		5	9.64	9.42	3.46	6.49	26.3
	2019	EDC-U	Reference	5	1.97	1.58	0.761	1.13	4.33
		HAC-R1	Exposed	5	0.559	0.581	0	0.456	1.52
		HAC-U		5	7.27	3.88	2.40	5.92	11.6
	2020	EDC-U	Reference	5	0.787	0.862	0	0.547	2.04
		HAC-R1	Exposed	5	1.57	1.23	0.438	1.36	3.40
		HAC-U		5	2.53	4.55	0	0.802	10.6
	2021	EDC-U	Reference	5	2.77	4.02	0.177	1.05	9.89
		HAC-R1	Exposed	5	4.79	3.26	1.04	3.72	9.48
		HAC-U		5	11.8	8.91	3.69	8.55	26.6
	2022	EDC-U	Reference	5	1.69	2.53	0.287	0.739	6.20
		HAC-R1	Exposed	5	0.720	0.843	0	0.574	2.16
		HAC-U		5	3.03	1.23	1.86	2.76	4.51

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.2: Summary Statistics of Periphyton Community and Productivity Metrics for Upper Hazeltine Creek (HAC-U, HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Chrysophytes (%)	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0.244	0.0950	0.0810	0.273	0.326
		HAC-U		5	0.0680	0.152	0	0	0.340
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
Cyanobacteria (%)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	0.667	0.577	0	1.00	1.00
		HAC-U (W7)[a]	Exposed (Baseline)	3	0.333	0.577	0	0	1.00
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	1.00	1.00	0	1.00	2.00
		HAC-U (W7)[a]	Exposed (Baseline)	3	53.7	20.1	35.0	51.0	75.0
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	100	-	100	100	100
	2018	EDC-U	Reference	5	85.2	3.07	80.5	86.2	88.6
		HAC-R1	Exposed	5	41.3	11.4	27.7	45.0	54.6
		HAC-U		5	7.13	5.88	2.38	4.76	17.0
	2019	EDC-U	Reference	5	84.1	10.5	71.6	82.6	96.5
		HAC-R1	Exposed	5	79.0	10.8	63.9	78.8	92.1
		HAC-U		5	66.1	17.0	42.4	73.8	84.5
	2020	EDC-U	Reference	5	97.0	2.06	94.8	97.7	98.9
		HAC-R1	Exposed	5	74.0	9.26	64.8	74.9	86.3
		HAC-U		5	46.5	16.4	20.7	54.2	61.5
	2021	EDC-U	Reference	5	85.8	6.83	77.0	85.9	94.6
		HAC-R1	Exposed	5	86.7	11.1	72.2	92.3	97.2
		HAC-U		5	44.0	20.1	27.1	39.1	77.5
	2022	EDC-U	Reference	5	90.5	3.52	85.3	90.5	94.7
		HAC-R1	Exposed	5	77.2	15.6	53.5	80.0	93.4
		HAC-U		5	59.4	29.5	14.6	78.0	82.0
Dinoflagellates (%)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	0	0	0	0	0
		HAC-U (W7)[a]	Exposed (Baseline)	3	0	0	0	0	0
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	0	0	0	0	0
		HAC-U (W7)[a]	Exposed (Baseline)	3	0	0	0	0	0
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	0	-	0	0	0
	2018	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0.644	1.44	0	0	3.22
		HAC-U		5	0	0	0	0	0
	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
Phaeophytes (%)	2018	EDC-U	Reference	5	-	-	-	-	-
		HAC-R1	Exposed	5	-	-	-	-	-
		HAC-U		5	-	-	-	-	-
	2019	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	6.55	1.87	4.78	6.52	9.48
		HAC-U		5	3.48	4.32	0	2.27	10.4
	2020	EDC-U	Reference	5	0	0	0	0	0
		HAC-R1	Exposed	5	14.4	6.18	7.29	15.0	23.0
		HAC-U		5	19.6	5.02	13.6	18.2	27.1
	2021	EDC-U	Reference	5	0.537	0.880	0	0	2.03
		HAC-R1	Exposed	5	5.48	6.65	0.558	1.31	15.9
		HAC-U		5	17.6	5.47	9.37	19.3	23.9
	2022	EDC-U	Reference	-	0	0	0	0	0
		HAC-R1	Exposed	-	8.30	3.52	4.50	6.51	12.4
		HAC-U		-	8.61	8.41	2.18	5.31	22.7

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.2: Summary Statistics of Periphyton Community and Productivity Metrics for Upper Hazeltine Creek (HAC-U, HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Rhodophytes (%)	2019	EDC-U	Reference	5	5.35	6.54	0	1.79	14.2
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2020	EDC-U	Reference	5	1.22	1.23	0.203	0.958	3.24
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2021	EDC-U	Reference	5	3.52	4.24	0	0.985	9.45
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
	2022	EDC-U	Reference	5	1.16	1.32	0	0.369	2.98
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U		5	0	0	0	0	0
Chlorophyll-a (mg/m²)	1995	EDC-U (W9)[a]	Reference (Baseline)	3	9.60	1.81	7.52	10.5	10.8
		HAC-U (W7)[a]	Exposed (Baseline)	3	10.6	0.312	10.3	10.8	10.8
	1996	EDC-U (W9)[a]	Reference (Baseline)	3	16.2	3.65	12.8	15.6	20.1
		HAC-U (W7)[a]	Exposed (Baseline)	3	21.4	11.8	11.9	17.7	34.6
	2011	HAC-U (W7)[a]	Exposed (Pre-Breach)	1	14.6	-	14.6	14.6	14.6
	2017	HAC-U (W7[a)]	Exposed	5	11.8	8.12	4.08	8.70	23.4
	2018	EDC-U	Reference	5	11.5	3.16	6.40	12.1	15.0
		HAC-R1	Exposed	5	17.7	8.48	10.8	12.7	31.0
		HAC-U		5	12.6	3.67	9.55	10.9	18.0
	2019	EDC-U	Reference	5	25.0	20.3	9.80	19.1	60.0
		HAC-R1	Exposed	5	47.2	11.1	30.1	53.5	56.0
		HAC-U		5	35.7	9.77	27.0	31.9	52.0
	2020	EDC-U	Reference	5	8.46	5.61	2.46	6.80	17.4
		HAC-R1	Exposed	5	56.7	28.1	32.1	50.0	99.0
		HAC-U		5	14.9	8.96	3.49	12.4	26.6
	2021	EDC-U	Reference	5	5.44	1.93	2.05	6.20	6.75
		HAC-R1	Exposed	5	34.0	24.3	15.2	29.1	76.0
		HAC-U		5	22.9	6.61	11.6	24.8	29.1
	2022	EDC-U	Reference	5	39.5	19.1	18.4	34.3	63.5
		HAC-R1	Exposed	5	87.4	37.1	53.5	71.5	144
		HAC-U		5	26.8	7.18	14.4	28.1	32.4
Ash Free Dry Mass (g/m²)	2017	HAC-U (W7)[a]	Exposed	5	5.48	3.22	1.95	6.25	9.50
	2018	EDC-U	Reference	5	6.66	3.67	3.55	6.05	12.6
		HAC-R1	Exposed	5	15.5	14.3	4.00	10.4	38.6
		HAC-U		5	10.2	3.09	7.20	9.15	13.8
	2019	EDC-U	Reference	5	9.60	7.97	4.50	6.55	23.8
		HAC-R1	Exposed	5	58.1	21.3	34.7	57.0	88.5
		HAC-U		5	30.0	5.57	23.8	29.2	39.0
	2020	EDC-U	Reference	5	8.05	2.81	4.00	8.60	11.8
		HAC-R1	Exposed	5	126	36.7	71.0	128	172
		HAC-U		5	59.4	17.4	31.2	62.0	75.5
	2021	EDC-U	Reference	5	4.89	2.32	2.00	4.00	7.80
		HAC-R1	Exposed	5	15.9	7.68	7.55	14.4	28.4
		HAC-U		5	37.3	23.4	13.0	40.5	68.0
	2022	EDC-U	Reference	5	10.6	5.47	3.55	12.2	16.9
		HAC-R1	Exposed	5	96.7	36.9	49.9	85.5	139
		HAC-U		5	37.8	22.7	12.6	32.8	74.5

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.3: Periphyton Productivity Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Year	Area	Area Type	Station	Chlorophyll-a (mg/m²)	Ash Free Dry Mass (g/m²)
1995	EDC-U (W9)[a]	Reference (Baseline)	W9-1	10.8	-
			W9-2	10.5	-
			W9-3	7.52	-
			W9-4	10.0	-
			W9-5	8.68	-
			W9-6	8.84	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-1	10.3	-
			W7-2	10.8	-
			W7-3	10.8	-
			W7-4	12.0	-
			W7-5	5.28	-
			W7-6	6.23	-
1996	EDC-U (W9)[a]	Reference (Baseline)	W9-1	15.6	-
			W9-2	20.1	-
			W9-3	12.8	-
	HAC-U (W7)[a]	Exposed (Baseline)	W7-1	17.7	-
			W7-2	11.9	-
			W7-3	34.6	-
2011	W7[a]	Exposed (Pre-Breach)	HAC-U-1	14.6	-
2017	HAC-R1	Exposed	HAC-R1-1	23.4	9.50
			HAC-R1-2	5.90	7.25
			HAC-R1-3	4.08	1.95
			HAC-R1-4	16.7	6.25
			HAC-R1-5	8.70	2.45
2018	EDC-U	Reference	EDC-U-1	12.6	6.05
			EDC-U-2	12.1	7.30
			EDC-U-3	6.40	3.55
			EDC-U-4	15.0	12.6
			EDC-U-5	11.4	3.80
	HAC-R1	Exposed	HAC-R1-1	21.3	38.6
			HAC-R1-2	31.0	19.2
			HAC-R1-3	12.7	10.4
			HAC-R1-4	10.8	5.10
			HAC-R1-5	12.7	4.00
	HAC-U		HAC-U-1	9.55	7.20
			HAC-U-2	10.9	13.8
			HAC-U-3	9.83	9.15
			HAC-U-4	18.0	13.2
			HAC-U-5	14.8	7.80
2019	EDC-U	Reference	EDC-U-1	19.1	5.95
			EDC-U-2	23.8	6.55
			EDC-U-3	12.4	7.25
			EDC-U-4	60.0	23.8
			EDC-U-5	9.80	4.50
	HAC-R1	Exposed	HAC-R1-1	53.5	68.0
			HAC-R1-2	56.0	88.5
			HAC-R1-3	42.1	57.0
			HAC-R1-4	30.1	42.4
			HAC-R1-5	54.5	34.7
	HAC-U		HAC-U-1	27.0	39.0
			HAC-U-2	31.9	27.8
			HAC-U-3	52.0	30.4
			HAC-U-4	36.8	29.2
			HAC-U-5	30.6	23.8
2020	EDC-U	Reference	EDC-U-1	6.05	7.15
			EDC-U-2	17.4	8.60
			EDC-U-3	6.80	8.75
			EDC-U-4	9.60	11.8
			EDC-U-5	2.46	4.00
	HAC-R1	Exposed	HAC-R1-1	32.1	140
			HAC-R1-2	69.5	172
			HAC-R1-3	99.0	71.0
			HAC-R1-4	50.0	128
			HAC-R1-5	33.0	118
	HAC-U		HAC-U-1	11.2	57.0
			HAC-U-2	3.49	31.2
			HAC-U-3	20.8	75.5
			HAC-U-4	12.4	71.5
			HAC-U-5	26.6	62.0
2021	EDC-U	Reference	EDC-U-1	6.75	6.65
			EDC-U-2	5.80	7.80
			EDC-U-3	2.05	2.00
			EDC-U-4	6.20	4.00
			EDC-U-5	6.40	4.00
	HAC-R1	Exposed	HAC-R1-1	19.9	28.4
			HAC-R1-2	29.1	7.55
			HAC-R1-3	15.2	14.4
			HAC-R1-4	29.6	15.6
			HAC-R1-5	76.0	13.3
	HAC-U		HAC-U-1	24.9	68.0
			HAC-U-2	24.1	49.8
			HAC-U-3	29.1	15.1
			HAC-U-4	24.8	40.5
			HAC-U-5	11.6	13.0
2022	EDC-U	Reference	EDC-U-1	18.4	14.1
			EDC-U-2	26.4	6.50
			EDC-U-3	63.5	12.2
			EDC-U-4	55.0	16.9
			EDC-U-5	34.3	3.55
	HAC-R1	Exposed	HAC-R1-1	53.5	85.5
			HAC-R1-2	71.5	49.9
			HAC-R1-3	106	139
			HAC-R1-4	144	129
			HAC-R1-5	62.5	80.0
	HAC-U		HAC-U-1	32.4	32.8
			HAC-U-2	14.4	38.8
			HAC-U-3	31.2	74.5
			HAC-U-4	28.1	12.6
			HAC-U-5	27.6	30.2

Notes: "-" indicates no value. mg/m²= milligrams per metre suqared. g/m^2 = grams per metre squared.
[a] W7 is the pre-breach sampling area associated with HAC-R1 and HAC-U. W9 is the pre-breach sampling area associated with EDC-U.

Table D.3.4: Periphyton Productivity Metrics for Upper Hazeltine Creek (HAC-R3; Exposed) and Frypan Creek (FPC-R3; Reference, 2017 to 2022

Year	Area	Area Type	Station	Chlorophyll-a (mg/m²)	Ash Free Dry Mass (g/m²)
2017	FPC-R3	Reference	FPC-R3-1	6.10	3.30
			FPC-R3-2	5.45	5.55
			FPC-R3-3	13.9	7.45
2018	FPC-R3	Reference	FPC-R3-1	17.1	4.20
			FPC-R3-2	18.0	6.70
			FPC-R3-3	13.7	10.1
			FPC-R3-4	15.6	3.95
			FPC-R3-5	18.7	4.50
2019	FPC-R3	Reference	FPC-R3-1	50.0	11.9
			FPC-R3-2	37.1	11.9
			FPC-R3-3	27.4	7.75
			FPC-R3-4	26.1	11.2
			FPC-R3-5	11.6	3.00
2020	FPC-R3	Reference	FPC-R3-1	31.4	16.2
			FPC-R3-2	34.0	26.6
			FPC-R3-3	6.75	19.0
			FPC-R3-4	8.30	6.95
			FPC-R3-5	20.1	9.95
	HAC-R3	Exposed	HAC-R3-1	1.50	5.95
			HAC-R3-2	3.00	3.75
			HAC-R3-3	1.74	1.95
			HAC-R3-4	1.74	3.10
			HAC-R3-5	0.324	2.60
2021	FPC-R3	Reference	FPC-R3-1	47.1	6.75
			FPC-R3-2	39.8	7.35
			FPC-R3-3	35.8	9.15
			FPC-R3-4	21.1	3.80
			FPC-R3-5	44.4	8.50
	HAC-R3	Exposed	HAC-R3-1	4.54	2.40
			HAC-R3-2	8.55	4.55
			HAC-R3-3	1.96	1.50
			HAC-R3-4	6.50	1.75
			HAC-R3-5	0.895	0.550
2022	FPC-R3	Reference	FPC-R3-1	21.4	4.00
			FPC-R3-2	112	11.2
			FPC-R3-3	46.8	4.40
			FPC-R3-4	51.0	8.15
			FPC-R3-5	15.2	6.60
	HAC-R3	Exposed	HAC-R3-1	3.54	1.90
			HAC-R3-2	12.2	3.45
			HAC-R3-3	2.43	0.550
			HAC-R3-4	0.740	3.70
			HAC-R3-5	0.930	0.500

Notes: mg/m²= milligrams per metre suqared. g/m^2 = grams per metre squared.

Table D.3.5: Summary Statistics of Periphyton Productivity Metrics for Upper Hazeltine Creek (HAC-R3; Exposed) and Frypan Creek (FPC-R3; Reference), 2017 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Chlorophyll-a (mg/m²)	2017	FPC-R3	Reference	3	8.50	4.73	5.45	6.10	13.9
	2018	FPC-R3	Reference	5	16.6	2.00	13.7	17.1	18.7
	2019	FPC-R3	Reference	5	30.4	14.2	11.6	27.4	50.0
	2020	FPC-R3	Reference	5	20.1	12.6	6.75	20.1	34.0
		HAC-R3	Exposed	5	1.66	0.951	0.324	1.74	3.00
	2021	FPC-R3	Reference	5	37.6	10.2	21.1	39.8	47.1
		HAC-R3	Exposed	5	4.49	3.16	0.895	4.54	8.55
	2022	FPC-R3	Reference	5	49.2	38.1	15.2	46.8	112
		HAC-R3	Exposed	5	3.97	4.74	0.740	2.43	12.2
Ash Free Dry Mass (g/m²)	2017	FPC-R3	Reference	3	5.43	2.08	3.30	5.55	7.45
	2018	FPC-R3	Reference	5	5.88	2.57	3.95	4.50	10.1
	2019	FPC-R3	Reference	5	9.15	3.85	3.00	11.2	11.9
	2020	FPC-R3	Reference	5	15.8	7.76	6.95	16.2	26.6
		HAC-R3	Exposed	5	3.47	1.54	1.95	3.10	5.95
	2021	FPC-R3	Reference	5	7.11	2.08	3.80	7.35	9.15
		HAC-R3	Exposed	5	2.15	1.50	0.550	1.75	4.55
	2022	FPC-R3	Reference	5	6.87	2.95	4.00	6.60	11.2
		HAC-R3	Exposed	5	2.02	1.53	0.500	1.90	3.70

Notes: mg/m² = milligrams per metre suqared. g/m ^{2} = grams per metre squared.

APPENDIX D.4
BENTHIC COMMUNITY & PRODUCTIVITY

Table D.4.1: **Benthic Invertebrate Community Metrics for Frypan Creek (FPC-R3; Reference), 2018 to 2022**

Year	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2018	FPC-R3-1	13,964	27	0.345	0.893	4,875	2,896	172	7,943	631	4,588	0
	FPC-R3-2	12,724	28	0.295	0.879	609	681	71.7	1,362	179	8,925	287
	FPC-R3-3	7,419	35	0.430	0.934	1,075	2,384	89.6	3,548	71.7	2,186	53.8
	FPC-R3-4	17,491	36	0.308	0.910	968	1,183	179	2,330	645	11,864	143
	FPC-R3-5	6,949	32	0.307	0.898	159	518	59.7	737	39.8	4,062	179
2019	FPC-R3-1	5,867	36	0.352	0.921	585	623	56.6	1,264	358	3,207	132
	FPC-R3-2	9,677	37	0.405	0.933	3,011	860	263	4,134	836	3,202	71.7
	FPC-R3-3	6,756	29	0.469	0.927	1,810	806	17.9	2,634	53.8	3,280	0
	FPC-R3-4	5,806	30	0.181	0.816	2,509	1,452	35.8	3,996	71.7	1,416	53.8
	FPC-R3-5	7,551	26	0.358	0.893	2,103	932	47.8	3,082	550	2,366	71.7
2020	FPC-R3-1	9,370	30	0.290	0.885	2,714	1,536	102	4,352	538	2,279	102
	FPC-R3-2	23,441	30	0.286	0.884	11,613	2,581	358	14,552	1,147	3,584	573
	FPC-R3-3	19,764	36	0.160	0.827	13,415	1,997	410	15,822	358	2,407	154
	FPC-R3-4	5,634	37	0.253	0.893	2,222	1,133	86.0	3,441	330	1,233	71.7
	FPC-R3-5	6,680	29	0.358	0.904	1,776	1,597	65.2	3,438	114	2,476	48.9
2021	FPC-R3-1	12,079	25	0.331	0.879	1,111	251	108	1,470	108	7,778	35.8
	FPC-R3-2	18,024	38	0.398	0.934	6,042	2,919	768	9,729	1,126	3,533	512
	FPC-R3-3	12,151	37	0.395	0.932	4,910	1,254	215	6,380	215	3,369	179
	FPC-R3-4	4,989	36	0.406	0.932	1,032	573	100	1,706	71.7	2,136	28.7
	FPC-R3-5	19,068	36	0.251	0.890	9,720	2,552	315	12,588	832	4,158	172
2022	FPC-R3-1	19,304	31	0.137	0.765	7,629	1,741	102	9,473	410	2,714	205
	FPC-R3-2	26,595	25	0.161	0.752	16,559	5,520	1,219	23,297	789	1,362	71.7
	FPC-R3-3	14,444	29	0.203	0.830	8,781	3,405	502	12,688	430	466	108
	FPC-R3-4	18,399	24	0.316	0.868	9,379	4,301	717	14,397	418	2,210	59.7
	FPC-R3-5	16,368	34	0.311	0.905	5,695	5,894	518	12,107	358	2,111	398

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m2 = number per square metre. g/m2 = grams per square metre.

Table D.4.1: **Benthic Invertebrate Community Metrics for Frypan Creek (FPC-R3; Reference), 2018 to 2022**

Year	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2018	FPC-R3-1	86.0	34.9	20.7	1.23	56.9	4.52	32.9	0	0.616	1.17	22.9
	FPC-R3-2	430	4.79	5.35	0.563	10.7	1.41	70.1	2.25	3.38	0.358	1.86
	FPC-R3-3	358	14.5	32.1	1.21	47.8	0.966	29.5	0.725	4.83	3.14	13.6
	FPC-R3-4	1,039	5.53	6.76	1.02	13.3	3.69	67.8	0.820	5.94	2.55	11.6
	FPC-R3-5	677	2.29	7.45	0.860	10.6	0.573	58.5	2.58	9.74	0.434	2.13
2019	FPC-R3-1	151	9.97	10.6	0.965	21.5	6.11	54.7	2.25	2.57	1.11	5.00
	FPC-R3-2	263	31.1	8.89	2.72	42.7	8.64	33.1	0.741	2.72	5.51	28.5
	FPC-R3-3	161	26.8	11.9	0.265	39.0	0.796	48.5	0	2.39	0.201	1.05
	FPC-R3-4	143	43.2	25.0	0.617	68.8	1.23	24.4	0.926	2.47	0.186	0.953
	FPC-R3-5	430	27.9	12.3	0.633	40.8	7.28	31.3	0.949	5.70	0.992	5.22
2020	FPC-R3-1	128	29.0	16.4	1.09	46.5	5.74	24.3	1.09	1.37	0.486	2.29
	FPC-R3-2	1,505	49.5	11.0	1.53	62.1	4.89	15.3	2.45	6.42	9.23	54.8
	FPC-R3-3	154	67.9	10.1	2.07	80.0	1.81	12.2	0.777	0.777	0.696	3.84
	FPC-R3-4	143	39.4	20.1	1.53	61.1	5.85	21.9	1.27	2.54	0.737	3.61
	FPC-R3-5	228	26.6	23.9	0.976	51.5	1.71	37.1	0.732	3.41	0.199	0.621
2021	FPC-R3-1	71.7	9.20	2.08	0.890	12.2	0.890	64.4	0.297	0.593	0.441	2.76
	FPC-R3-2	2,663	33.5	16.2	4.26	54.0	6.25	19.6	2.84	14.8	1.99	11.3
	FPC-R3-3	1,398	40.4	10.3	1.77	52.5	1.77	27.7	1.47	11.5	1.32	5.58
	FPC-R3-4	430	20.7	11.5	2.01	34.2	1.44	42.8	0.575	8.62	1.29	5.22
	FPC-R3-5	258	51.0	13.4	1.65	66.0	4.36	21.8	0.902	1.35	1.04	4.16
2022	FPC-R3-1	512	39.5	9.02	0.531	49.1	2.12	14.1	1.06	2.65	5.35	24.6
	FPC-R3-2	143	62.3	20.8	4.58	87.6	2.96	5.12	0.270	0.539	0.638	4.41
	FPC-R3-3	179	60.8	23.6	3.47	87.8	2.98	3.23	0.744	1.24	4.21	19.7
	FPC-R3-4	179	51.0	23.4	3.90	78.2	2.27	12.0	0.325	0.974	1.68	10.3
	FPC-R3-5	239	34.8	36.0	3.16	74.0	2.19	12.9	2.43	1.46	2.64	15.4

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m2 = number per square metre. g/m2 = grams per square metre.

Table D.4.2: Summary Statistics of Benthic Invertebrate Community Metrics for Frypan Creek (FPC-R3; Reference), 2018 to 2022

Endpoint	Year	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/m²)	2018	5	11,710	4,489	6,949	12,724	17,491
	2019	5	7,132	1,593	5,806	6,756	9,677
	2020	5	12,978	8,095	5,634	9,370	23,441
	2021	5	13,262	5,645	4,989	12,151	19,068
	2022	5	19,022	4,632	14,444	18,399	26,595
Richness (# of taxa)	2018	5	31.6	4.04	27	32	36
	2019	5	31.6	4.72	26	30	37
	2020	5	32.4	3.78	29	30	37
	2021	5	34.4	5.32	25	36	38
	2022	5	28.6	4.16	24	29	34
Simpson's Evenness	2018	5	0.337	0.0552	0.295	0.308	0.430
	2019	5	0.353	0.107	0.181	0.358	0.469
	2020	5	0.269	0.0718	0.160	0.286	0.358
	2021	5	0.356	0.0660	0.251	0.395	0.406
	2022	5	0.226	0.0836	0.137	0.203	0.316
Simpson's Diversity	2018	5	0.903	0.0205	0.879	0.898	0.934
	2019	5	0.898	0.0483	0.816	0.921	0.933
	2020	5	0.878	0.0299	0.827	0.885	0.904
	2021	5	0.913	0.0266	0.879	0.932	0.934
	2022	5	0.824	0.0657	0.752	0.830	0.905
Ephemeroptera (#/m²)	2018	5	1,537	1,900	159	968	4,875
	2019	5	2,003	912	585	2,103	3,011
	2020	5	6,348	5,674	1,776	2,714	13,415
	2021	5	4,563	3,650	1,032	4,910	9,720
	2022	5	9,609	4,132	5,695	8,781	16,559
Plecoptera (#/m²)	2018	5	1,532	1,056	518	1,183	2,896
	2019	5	935	311	623	860	1,452
	2020	5	1,769	548	1,133	1,597	2,581
	2021	5	1,510	1,183	251	1,254	2,919
	2022	5	4,172	1,681	1,741	4,301	5,894
Trichoptera (#/m²)	2018	5	114	56.9	59.7	89.6	179
	2019	5	84.2	101	17.9	47.8	263
	2020	5	204	166	65.2	102	410
	2021	5	301	275	100	215	768
	2022	5	611	406	102	518	1,219
EPT (#/m²)	2018	5	3,184	2,864	737	2,330	7,943
	2019	5	3,022	1,165	1,264	3,082	4,134
	2020	5	8,321	6,295	3,438	4,352	15,822
	2021	5	6,374	4,892	1,470	6,380	12,588
	2022	5	14,392	5,283	9,473	12,688	23,297
Arachnida (#/m²)	2018	5	313	301	39.8	179	645
	2019	5	374	331	53.8	358	836
	2020	5	497	393	114	358	1,147
	2021	5	470	479	71.7	215	1,126
	2022	5	481	174	358	418	789
Chironomidae (#/m²)	2018	5	6,325	3,959	2,186	4,588	11,864
	2019	5	2,694	807	1,416	3,202	3,280
	2020	5	2,396	834	1,233	2,407	3,584
	2021	5	4,195	2,133	2,136	3,533	7,778
	2022	5	1,773	876	466	2,111	2,714
Non-Chironomidae Diptera (#/m²)	2018	5	133	112	0	143	287
	2019	5	65.8	47.3	0	71.7	132
	2020	5	190	218	48.9	102	573
	2021	5	186	196	28.7	172	512
	2022	5	168	141	59.7	108	398
Oligochaeta (#/m²)	2018	5	518	360	86.0	430	1,039
	2019	5	230	122	143	161	430
	2020	5	432	601	128	154	1,505
	2021	5	964	1,079	71.7	430	2,663
	2022	5	251	150	143	179	512
Ephemeroptera (%)	2018	5	12.4	13.4	2.29	5.53	34.9
	2019	5	27.8	11.9	9.97	27.9	43.2
	2020	5	42.5	16.9	26.6	39.4	67.9
	2021	5	31.0	16.4	9.20	33.5	51.0
	2022	5	49.7	12.3	34.8	51.0	62.3
Plecoptera (%)	2018	5	14.5	11.6	5.35	7.45	32.1
	2019	5	13.8	6.43	8.89	11.9	25.0
	2020	5	16.3	5.89	10.1	16.4	23.9
	2021	5	10.7	5.30	2.08	11.5	16.2
	2022	5	22.6	9.61	9.02	23.4	36.0
Trichoptera (%)	2018	5	0.977	0.276	0.563	1.02	1.23
	2019	5	1.04	0.969	0.265	0.633	2.72
	2020	5	1.44	0.434	0.976	1.53	2.07
	2021	5	2.12	1.27	0.890	1.77	4.26
	2022	5	3.13	1.55	0.531	3.47	4.58
EPT (%)	2018	5	27.9	22.6	10.6	13.3	56.9
	2019	5	42.6	16.9	21.5	40.8	68.8
	2020	5	60.2	12.9	46.5	61.1	80.0
	2021	5	43.8	21.0	12.2	52.5	66.0
	2022	5	75.3	15.9	49.1	78.2	87.8
Arachnida (%)	2018	5	2.23	1.76	0.573	1.41	4.52
	2019	5	4.81	3.58	0.796	6.11	8.64
	2020	5	4.00	2.08	1.71	4.89	5.85
	2021	5	2.94	2.28	0.890	1.77	6.25
	2022	5	2.51	0.429	2.12	2.27	2.98
Chironomidae (%)	2018	5	51.8	19.3	29.5	58.5	70.1
	2019	5	38.4	12.7	24.4	33.1	54.7
	2020	5	22.1	9.67	12.2	21.9	37.1
	2021	5	35.3	18.6	19.6	27.7	64.4
	2022	5	9.46	4.93	3.23	12.0	14.1
Non-Chironomidae Diptera (%)	2018	5	1.28	1.09	0	0.820	2.58
	2019	5	0.973	0.812	0	0.926	2.25
	2020	5	1.26	0.698	0.732	1.09	2.45
	2021	5	1.22	1.01	0.297	0.902	2.84
	2022	5	0.967	0.881	0.270	0.744	2.43
Oligochaeta (%)	2018	5	4.90	3.36	0.616	4.83	9.74
	2019	5	3.17	1.42	2.39	2.57	5.70
	2020	5	2.90	2.22	0.777	2.54	6.42
	2021	5	7.37	6.24	0.593	8.62	14.8
	2022	5	1.37	0.793	0.539	1.24	2.65
Dry Weight Benthic Biomass (g/m² DW)	2018	5	1.53	1.26	0.358	1.17	3.14
	2019	5	1.60	2.23	0.186	0.992	5.51
	2020	5	2.27	3.89	0.199	0.696	9.23
	2021	5	1.22	0.557	0.441	1.29	1.99
	2022	5	2.90	1.90	0.638	2.64	5.35
Wet Weight Benthic Biomass (g/m² WW)	2018	5	10.4	8.79	1.86	11.6	22.9
	2019	5	8.15	11.6	0.953	5.00	28.5
	2020	5	13.0	23.4	0.621	3.61	54.8
	2021	5	5.80	3.26	2.76	5.22	11.3
	2022	5	14.9	7.89	4.41	15.4	24.6

Notes: " - " = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m ^{2} = number per square metre. g/m^2 = grams per square metre.

Table D.4.3: **Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R3; Exposed), 2020 to 2022**

Year	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2020	HAC-R3-1	17,460	25	0.248	0.839	5,376	307	9,524	15,207	51.2	1,741	358
	HAC-R3-2	24,301	25	0.425	0.906	7,025	287	10,681	17,993	71.7	4,875	573
	HAC-R3-3	12,832	29	0.217	0.841	4,086	215	6,201	10,502	0	1,398	143
	HAC-R3-4	11,398	26	0.241	0.840	3,405	108	6,201	9,713	71.7	1,075	179
	HAC-R3-5	12,079	19	0.368	0.857	3,262	143	3,871	7,276	35.8	824	108
2021	HAC-R3-1	26,667	28	0.187	0.809	9,533	800	14,200	24,533	0	867	333
	HAC-R3-2	20,111	20	0.221	0.774	10,056	389	7,722	18,167	0	1,500	111
	HAC-R3-3	21,733	26	0.103	0.628	3,533	400	15,067	19,000	0	2,400	200
	HAC-R3-4	16,143	22	0.438	0.896	2,810	381	5,476	8,667	0	7,429	0
	HAC-R3-5	27,400	22	0.127	0.643	3,667	333	20,200	24,200	0	2,533	200
2022	HAC-R3-1	18,278	29	0.356	0.903	11,222	111	2,722	14,056	0	2,056	389
	HAC-R3-2	18,500	23	0.161	0.730	9,000	333	6,111	15,444	0	2,000	111
	HAC-R3-3	22,800	19	0.153	0.655	5,133	133	16,933	22,200	0	467	133
	HAC-R3-4	20,889	19	0.183	0.713	5,500	0	14,611	20,111	0	667	0
	HAC-R3-5	10,933	19	0.135	0.610	1,900	33.3	8,367	10,300	33.3	333	66.7

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared.

Table D.4.3: **Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R3; Exposed), 2020 to 2022**

Year	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2020	HAC-R3-1	102	30.8	1.76	54.5	87.1	0.293	9.97	2.05	0.587	0.900	4.65
	HAC-R3-2	0	28.9	1.18	44.0	74.0	0.295	20.1	2.36	0	2.36	9.65
	HAC-R3-3	573	31.8	1.68	48.3	81.8	0	10.9	1.12	4.47	0.380	1.48
	HAC-R3-4	358	29.9	0.943	54.4	85.2	0.629	9.43	1.57	3.14	0.573	2.67
	HAC-R3-5	3,333	27.0	1.19	32.0	60.2	0.297	6.82	0.890	27.6	0.543	2.04
2021	HAC-R3-1	133	35.8	3.00	53.2	92.0	0	3.25	1.25	0.500	1.44	6.29
	HAC-R3-2	0	50.0	1.93	38.4	90.3	0	7.46	0.552	0	1.22	5.54
	HAC-R3-3	0	16.3	1.84	69.3	87.4	0	11.0	0.920	0	2.89	9.22
	HAC-R3-4	0	17.4	2.36	33.9	53.7	0	46.0	0	0	2.20	12.3
	HAC-R3-5	66.7	13.4	1.22	73.7	88.3	0	9.25	0.730	0.243	5.48	33.2
2022	HAC-R3-1	167	61.4	0.608	14.9	76.9	0	11.2	2.13	0.912	2.69	10.4
	HAC-R3-2	55.6	48.6	1.80	33.0	83.5	0	10.8	0.601	0.300	1.34	8.22
	HAC-R3-3	0	22.5	0.585	74.3	97.4	0	2.05	0.585	0	1.71	7.31
	HAC-R3-4	111	26.3	0	70.0	96.3	0	3.19	0	0.532	1.53	6.17
	HAC-R3-5	0	17.4	0.305	76.5	94.2	0.305	3.05	0.610	0	0.467	1.54

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared.

Table D.4.4: Summary Statistics of Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R3; Exposed), 2020 to 2022

Endpoint	Year	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/m²)	2020	5	15,614	5,406	11,398	12,832	24,301
	2021	5	22,411	4,691	16,143	21,733	27,400
	2022	5	18,280	4,507	10,933	18,500	22,800
Richness (# of taxa)	2020	5	24.8	3.63	19	25	29
	2021	5	23.6	3.29	20	22	28
	2022	5	21.8	4.38	19	19	29
Simpson's Evenness	2020	5	0.300	0.0912	0.217	0.248	0.425
	2021	5	0.215	0.133	0.103	0.187	0.438
	2022	5	0.198	0.0901	0.135	0.161	0.356
Simpson's Diversity	2020	5	0.857	0.0284	0.839	0.841	0.906
	2021	5	0.750	0.114	0.628	0.774	0.896
	2022	5	0.722	0.112	0.610	0.713	0.903
Ephemeroptera (#/m²)	2020	5	4,631	1,578	3,262	4,086	7,025
	2021	5	5,920	3,557	2,810	3,667	10,056
	2022	5	6,551	3,625	1,900	5,500	11,222
Plecoptera (#/m²)	2020	5	212	87.0	108	215	307
	2021	5	461	191	333	389	800
	2022	5	122	130	0	111	333
Trichoptera (#/m²)	2020	5	7,295	2,764	3,871	6,201	10,681
	2021	5	12,533	5,936	5,476	14,200	20,200
	2022	5	9,749	5,911	2,722	8,367	16,933
EPT (#/m²)	2020	5	12,138	4,356	7,276	10,502	17,993
	2021	5	18,913	6,424	8,667	19,000	24,533
	2022	5	16,422	4,770	10,300	15,444	22,200
Arachnida (#/m²)	2020	5	46.1	29.9	0	51.2	71.7
	2021	5	0	0	0	0	0
	2022	5	6.67	14.9	0	0	33.3
Chironomidae (#/m²)	2020	5	1,983	1,653	824	1,398	4,875
	2021	5	2,946	2,597	867	2,400	7,429
	2022	5	1,104	851	333	667	2,056
Non-Chironomidae Diptera (#/m²)	2020	5	272	194	108	179	573
	2021	5	169	123	0	200	333
	2022	5	140	148	0	111	389
Oligochaeta (#/m²)	2020	5	874	1,393	0	358	3,333
	2021	5	40.0	59.6	0	0	133
	2022	5	66.7	72.4	0	55.6	167
Ephemeroptera (%)	2020	5	29.7	1.85	27.0	29.9	31.8
	2021	5	26.6	15.8	13.4	17.4	50.0
	2022	5	35.2	18.9	17.4	26.3	61.4
Plecoptera (%)	2020	5	1.35	0.352	0.943	1.19	1.76
	2021	5	2.07	0.661	1.22	1.93	3.00
	2022	5	0.660	0.684	0	0.585	1.80
Trichoptera (%)	2020	5	46.6	9.30	32.0	48.3	54.5
	2021	5	53.7	17.8	33.9	53.2	73.7
	2022	5	53.7	28.0	14.9	70.0	76.5
EPT (%)	2020	5	77.7	11.0	60.2	81.8	87.1
	2021	5	82.3	16.1	53.7	88.3	92.0
	2022	5	89.7	9.01	76.9	94.2	97.4
Arachnida (%)	2020	5	0.303	0.223	0	0.295	0.629
	2021	5	0	0	0	0	0
	2022	5	0.0610	0.136	0	0	0.305
Chironomidae (%)	2020	5	11.4	5.05	6.82	9.97	20.1
	2021	5	15.4	17.4	3.25	9.25	46.0
	2022	5	6.07	4.55	2.05	3.19	11.2
Non-Chironomidae Diptera (%)	2020	5	1.60	0.616	0.890	1.57	2.36
	2021	5	0.691	0.465	0	0.730	1.25
	2022	5	0.785	0.794	0	0.601	2.13
Oligochaeta (%)	2020	5	7.16	11.6	0	3.14	27.6
	2021	5	0.149	0.223	0	0	0.500
	2022	5	0.349	0.386	0	0.300	0.912
Dry Weight Benthic Biomass (g/m² DW)	2020	5	0.951	0.810	0.380	0.573	2.36
	2021	5	2.64	1.72	1.22	2.20	5.48
	2022	5	1.55	0.799	0.467	1.53	2.69
Wet Weight Benthic Biomass (g/m² WW)	2020	5	4.10	3.33	1.48	2.67	9.65
	2021	5	13.3	11.5	5.54	9.22	33.2
	2022	5	6.72	3.28	1.54	7.31	10.4

Notes: " - " = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m ^{2} = number per square metre. g/m^2 = grams per square metre.

Table D.4.5: **Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022**

Year	Area	Area Type	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2007	EDC-U (UER)[a]	Reference (Pre- Breach)	EDC-U-1	22,075	42	0.274	0.913	11,240	1,398	1,796	14,434	1,147	4,585	247
			EDC-U-2	57,534	42	0.423	0.944	18,473	4,731	7,950	31,154	5,849	17,319	344
			EDC-U-3	40,477	41	0.245	0.900	15,140	1,649	1,957	18,746	5,219	14,265	211
			EDC-U-4	63,208	35	0.398	0.928	25,118	5,086	11,882	42,086	2,186	15,484	233
			EDC-U-5	65,222	37	0.229	0.882	37,172	7,735	3,104	48,011	3,900	9,176	237
	HAC-U (UHC)[a]	Exposed (Pre- Breach)	HAC-U-1	70,143	46	0.263	0.917	28,986	4,602	2,943	36,530	1,778	20,416	459
			HAC-U-2	33,857	42	0.224	0.894	13,878	1,964	1,491	17,333	7,914	5,219	401
			HAC-U-3	28,201	45	0.277	0.920	11,989	2,136	1,108	15,233	1,204	8,774	229
			HAC-U-4	42,297	40	0.314	0.920	17,892	5,430	2,520	25,842	6,308	6,079	516
			HAC-U-5	21,642	48	0.266	0.922	7,986	2,573	1,319	11,878	3,563	3,928	201
2018	EDC-U	Reference	EDC-U-1	18,894	26	0.178	0.784	563	973	768	2,304	7,066	8,449	205
			EDC-U-2	179	14	0.410	0.826	0	0	0	0	57.4	100	3.58
			EDC-U-3	6,989	29	0.424	0.919	591	789	71.7	1,452	573	3,011	89.6
			EDC-U-4	4,211	29	0.341	0.899	230	474	51.2	755	410	2,317	89.6
			EDC-U-5	2,018	37	0.192	0.859	100	609	21.5	731	373	674	10.8
	HAC-R1	Exposed	HAC-R1-1	14,839	22	0.238	0.809	502	35.8	2,222	2,760	1,720	8,925	0
			HAC-R1-2	18,740	19	0.193	0.727	307	0	2,919	3,226	1,280	12,545	0
			HAC-R1-3	14,775	23	0.254	0.829	358	39.8	1,673	2,071	3,465	8,005	79.7
			HAC-R1-4	25,448	22	0.262	0.826	143	0	4,588	4,731	1,935	15,484	0
			HAC-R1-5	24,946	22	0.200	0.773	358	0	3,584	3,943	717	17,204	0
	HAC-U	Exposed	HAC-U-1	55,627	19	0.365	0.856	215	0	6,953	7,168	0	35,125	573
			HAC-U-2	39,570	24	0.271	0.846	717	0	5,878	6,595	0	24,301	2,366
			HAC-U-3	29,821	24	0.273	0.847	573	0	3,656	4,229	0	19,498	860
			HAC-U-4	45,018	22	0.204	0.777	215	0	2,509	2,724	0	28,029	287
			HAC-U-5	26,595	21	0.273	0.826	573	0	3,154	3,728	0	16,272	3,297
2019	EDC-U	Reference	EDC-U-1	18,500	26	0.237	0.837	6,667	1,444	222	8,333	4,889	4,444	222
			EDC-U-2	7,500	34	0.231	0.873	3,714	429	23.8	4,167	429	2,071	214
			EDC-U-3	27,400	29	0.175	0.803	7,533	1,333	0	8,867	10,467	6,600	400
			EDC-U-4	13,292	28	0.363	0.902	4,250	875	0	5,125	1,000	5,333	83.3
			EDC-U-5	10,467	28	0.296	0.879	4,400	233	167	4,800	233	3,533	66.7
	HAC-R1	Exposed	HAC-R1-1	35,667	25	0.375	0.893	11,600	0	9,000	20,600	5,133	8,267	267
			HAC-R1-2	36,533	27	0.444	0.917	8,333	0	9,467	17,800	5,400	10,333	2,000
			HAC-R1-3	44,667	30	0.412	0.919	10,533	0	9,867	20,400	3,400	18,933	800
			HAC-R1-4	35,400	30	0.406	0.918	6,933	0	6,067	13,000	4,200	15,267	400
			HAC-R1-5	25,200	28	0.340	0.895	6,133	66.7	8,067	14,267	267	8,000	2,267
	HAC-U		HAC-U-1	38,000	31	0.361	0.911	9,200	0	10,667	19,867	200	13,600	3,533
			HAC-U-2	56,400	26	0.446	0.914	9,533	0	12,667	22,200	0	27,667	1,867
			HAC-U-3	57,933	27	0.425	0.913	9,467	0	14,200	23,667	0	27,933	2,533
			HAC-U-4	40,933	26	0.438	0.912	5,867	66.7	11,067	17,000	200	18,467	1,867
			HAC-U-5	43,133	31	0.383	0.916	5,933	0	7,600	13,533	66.7	21,067	667
2020	HAC-R1	Exposed	HAC-R1-1	38,600	25	0.182	0.780	2,200	0	5,933	8,133	16,800	9,933	600
			HAC-R1-2	49,600	29	0.115	0.699	2,133	0	1,067	3,200	26,133	11,733	267
			HAC-R1-3	27,000	26	0.246	0.843	1,533	0	3,067	4,600	9,400	10,667	333
			HAC-R1-4	26,800	31	0.234	0.862	2,733	0	2,600	5,333	8,600	10,133	600
			HAC-R1-5	42,933	29	0.158	0.782	2,067	0	3,133	5,200	18,933	14,667	400
	HAC-U		HAC-U-1	17,778	25	0.202	0.802	7,167	0	5,056	12,222	333	3,722	1,000
			HAC-U-2	21,600	23	0.232	0.812	8,267	0	2,933	11,200	333	3,800	5,800
			HAC-U-3	95,133	27	0.301	0.877	9,600	0	32,000	41,600	1,267	42,800	8,000
			HAC-U-4	42,267	31	0.216	0.851	3,600	0	17,933	21,533	867	16,467	1,733
			HAC-U-5	53,200	32	0.318	0.902	8,800	0	16,000	24,800	1,067	20,333	5,067

Notes: "-" = no data available. EPT = Ephemeroptera, Trichoptera, Plecoptera. DW = dry weight. WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U.

Table D.4.5: **Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022**

Year	Area	Area Type	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2021	EDC-U	Reference	EDC-U-1	7,814	29	0.220	0.843	430	167	382	980	2,557	3,631	48.4
			EDC-U-2	2,452	40	0.440	0.943	480	136	108	724	251	1,104	21.5
			EDC-U-3	4,287	30	0.299	0.888	530	100	71.7	703	516	1,821	115
			EDC-U-4	4,344	29	0.424	0.919	946	115	43.0	1,104	244	2,437	71.7
			EDC-U-5	3,751	26	0.304	0.873	746	138	57.4	941	963	1,365	0
	HAC-R1	Exposed	HAC-R1-1	7,667	34	0.181	0.837	1,267	0	767	2,033	2,683	1,333	16.7
			HAC-R1-2	9,250	32	0.298	0.895	2,139	0	2,528	4,667	1,667	1,750	0
			HAC-R1-3	11,767	26	0.183	0.790	2,467	33.3	700	3,200	4,800	2,667	33.3
			HAC-R1-4	10,667	32	0.193	0.838	2,667	0	567	3,233	3,433	2,367	33.3
			HAC-R1-5	11,133	34	0.247	0.881	3,167	133	500	3,800	2,733	3,800	33.3
	HAC-U	Exposed	HAC-U-1	13,292	24	0.340	0.878	6,458	0	3,583	10,042	250	2,458	125
			HAC-U-2	16,952	20	0.381	0.869	9,714	0	4,000	13,714	143	2,571	47.6
			HAC-U-3	12,593	28	0.257	0.861	6,704	0	2,407	9,111	148	2,296	222
			HAC-U-4	22,200	27	0.214	0.827	7,600	0	10,667	18,267	200	2,533	533
			HAC-U-5	15,952	31	0.177	0.818	4,524	47.6	7,476	12,048	0	2,190	286
2022	EDC-U	Reference	EDC-U-1	27,814	26	0.161	0.761	4,086	3,441	358	7,885	12,903	4,875	143
			EDC-U-2	28,029	25	0.192	0.792	5,878	1,147	0	7,025	3,943	4,875	71.7
			EDC-U-3	39,211	31	0.255	0.873	8,961	1,434	10,538	20,932	5,806	9,749	0
			EDC-U-4	9,032	34	0.335	0.912	3,441	1,523	806	5,771	1,326	1,111	35.8
			EDC-U-5	7,860	29	0.383	0.910	1,382	794	1,126	3,303	1,357	1,920	102
	HAC-R1	Exposed	HAC-R1-1	52,067	26	0.239	0.839	3,133	0	10,067	13,200	2,733	32,467	1,333
			HAC-R1-2	52,133	25	0.195	0.795	3,000	0	13,933	16,933	1,133	31,200	1,600
			HAC-R1-3	60,933	36	0.197	0.859	3,333	0	7,733	11,067	6,333	38,800	1,267
			HAC-R1-4	28,267	30	0.384	0.913	2,667	0	5,200	7,867	1,133	15,933	267
			HAC-R1-5	28,933	29	0.331	0.896	1,533	0	4,333	5,867	933	19,867	400
			HAC-U-1	36,333	34	0.263	0.888	5,133	0	10,733	15,867	467	15,067	600
			HAC-U-2	28,267	30	0.371	0.910	3,933	66.7	7,067	11,067	1,867	10,533	200
			HAC-U-3	37,400	32	0.230	0.864	4,933	0	13,867	18,800	1,000	11,600	733
			HAC-U-4	39,200	31	0.295	0.891	4,933	0	13,467	18,400	733	15,261	1,473
			HAC-U-5	27,533	33	0.400	0.924	4,133	0	5,267	9,400	1,200	9,200	533

Notes: "-" = no data available. EPT = Ephemeroptera, Trichoptera, Plecoptera. DW = dry weight. WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U.

Table D.4.5: **Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022**

Year	Area	Area Type	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2007	EDC-U (UER)[a]	Reference (Pre- Breach)	EDC-U-1	344	50.9	6.33	8.13	65.4	5.20	20.8	1.12	1.56	-	-
			EDC-U-2	0	32.1	8.22	13.8	54.1	10.2	30.1	0.598	0	-	-
			EDC-U-3	115	37.4	4.07	4.83	46.3	12.9	35.2	0.522	0.283	-	-
			EDC-U-4	0	39.7	8.05	18.8	66.6	3.46	24.5	0.369	0	-	-
			EDC-U-5	459	57.0	11.9	4.76	73.6	5.98	14.1	0.363	0.703	-	-
	HAC-U (UHC)[a]	Exposed (Pre- Breach)	HAC-U-1	344	41.3	6.56	4.20	52.1	2.53	29.1	0.654	0.491	-	-
			HAC-U-2	746	41.0	5.80	4.40	51.2	23.4	15.4	1.19	2.20	-	-
			HAC-U-3	459	42.5	7.57	3.93	54.0	4.27	31.1	0.813	1.63	-	-
			HAC-U-4	229	42.3	12.8	5.96	61.1	14.9	14.4	1.22	0.542	-	-
			HAC-U-5	832	36.9	11.9	6.09	54.9	16.5	18.1	0.927	3.84	-	-
2018	EDC-U	Reference	EDC-U-1	256	2.98	5.15	4.07	12.2	37.4	44.7	1.08	1.36	3.03	20.2
			EDC-U-2	7.17	0	0	0	0	32.0	56.0	2.00	4.00	0.0100	0.0710
			EDC-U-3	753	8.46	11.3	1.03	20.8	8.21	43.1	1.28	10.8	3.70	14.6
			EDC-U-4	410	5.47	11.2	1.22	17.9	9.73	55.0	2.13	9.73	0.177	1.37
			EDC-U-5	93.2	4.97	30.2	1.07	36.2	18.5	33.4	0.533	4.62	0.0548	0.419
	HAC-R1	Exposed	HAC-R1-1	430	3.38	0.242	15.0	18.6	11.6	60.1	0	2.90	0.502	4.50
			HAC-R1-2	205	1.64	0	15.6	17.2	6.83	66.9	0	1.09	0.814	4.97
			HAC-R1-3	438	2.43	0.270	11.3	14.0	23.4	54.2	0.539	2.96	0.434	2.27
			HAC-R1-4	1,505	0.563	0	18.0	18.6	7.61	60.9	0	5.92	1.38	7.40
			HAC-R1-5	1,935	1.44	0	14.4	15.8	2.87	69.0	0	7.76	0.889	4.51
	HAC-U	Exposed	HAC-U-1	12,545	0.387	0	12.5	12.9	0	63.1	1.03	22.6	2.59	13.4
			HAC-U-2	6,165	1.81	0	14.9	16.7	0	61.4	5.98	15.6	1.20	9.26
			HAC-U-3	5,233	1.92	0	12.3	14.2	0	65.4	2.88	17.6	0.910	6.29
			HAC-U-4	12,545	0.478	0	5.57	6.05	0	62.3	0.637	27.9	0.824	3.89
			HAC-U-5	3,154	2.16	0	11.9	14.0	0	61.2	12.4	11.9	0.674	3.71
2019	EDC-U	Reference	EDC-U-1	55.6	36.0	7.81	1.20	45.0	26.4	24.0	1.20	0.300	1.34	13.5
			EDC-U-2	357	49.5	5.71	0.317	55.6	5.71	27.6	2.86	4.76	0.336	1.63
			EDC-U-3	400	27.5	4.87	0	32.4	38.2	24.1	1.46	1.46	3.04	17.6
			EDC-U-4	1,167	32.0	6.58	0	38.6	7.52	40.1	0.627	8.78	0.462	2.50
			EDC-U-5	1,533	42.0	2.23	1.59	45.9	2.23	33.8	0.637	14.6	0.287	1.56
	HAC-R1	Exposed	HAC-R1-1	533	32.5	0	25.2	57.8	14.4	23.2	0.748	1.50	5.53	42.3
			HAC-R1-2	133	22.8	0	25.9	48.7	14.8	28.3	5.47	0.365	5.05	30.5
			HAC-R1-3	267	23.6	0	22.1	45.7	7.61	42.4	1.79	0.597	3.07	22.5
			HAC-R1-4	1,000	19.6	0	17.1	36.7	11.9	43.1	1.13	2.82	1.93	12.1
			HAC-R1-5	267	24.3	0.265	32.0	56.6	1.06	31.8	8.99	1.06	2.37	15.6
	HAC-U		HAC-U-1	0	24.2	0	28.1	52.3	0.526	35.8	9.30	0	12.3	53.7
			HAC-U-2	4,600	16.9	0	22.5	39.4	0	49.0	3.31	8.16	3.88	29.7
			HAC-U-3	3,667	16.3	0	24.5	40.9	0	48.2	4.37	6.33	5.54	33.9
			HAC-U-4	3,200	14.3	0.163	27.0	41.5	0.489	45.1	4.56	7.82	2.99	19.7
			HAC-U-5	4,667	13.8	0	17.6	31.4	0.155	48.8	1.55	10.8	1.85	11.7
2020	HAC-R1	Exposed	HAC-R1-1	400	5.70	0	15.4	21.1	43.5	25.7	1.55	1.04	1.54	17.7
			HAC-R1-2	1,667	4.30	0	2.15	6.45	52.7	23.7	0.538	3.36	3.33	12.6
			HAC-R1-3	400	5.68	0	11.4	17.0	34.8	39.5	1.23	1.48	2.52	13.8
			HAC-R1-4	467	10.2	0	9.70	19.9	32.1	37.8	2.24	1.74	8.89	47.2
			HAC-R1-5	1,133	4.81	0	7.30	12.1	44.1	34.2	0.932	2.64	3.58	13.3
	HAC-U		HAC-U-1	0	40.3	0	28.4	68.8	1.87	20.9	5.62	0	3.97	21.2
			HAC-U-2	66.7	38.3	0	13.6	51.9	1.54	17.6	26.9	0.309	1.53	10.3
			HAC-U-3	133	10.1	0	33.6	43.7	1.33	45.0	8.41	0.140	12.6	70.4
			HAC-U-4	533	8.52	0	42.4	51.0	2.05	39.0	4.10	1.26	4.87	23.3
			HAC-U-5	667	16.5	0	30.1	46.6	2.01	38.2	9.52	1.25	3.67	18.1

Notes: "-" = no data available. EPT = Ephemeroptera, Trichoptera, Plecoptera. DW = dry weight. WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U.

Table D.4.5: Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Year	Area	Area Type	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2021	EDC-U	Reference	EDC-U-1	215	5.50	2.14	4.89	12.5	32.7	46.5	0.620	2.75	0.346	1.71
			EDC-U-2	151	19.6	5.56	4.39	29.5	10.2	45.0	0.877	6.14	1.27	5.84
			EDC-U-3	1,061	12.4	2.34	1.67	16.4	12.0	42.5	2.68	24.8	0.222	1.18
			EDC-U-4	330	21.8	2.64	0.990	25.4	5.61	56.1	1.65	7.59	0.376	2.36
			EDC-U-5	252	19.9	3.67	1.53	25.1	25.7	36.4	0	6.73	0.475	1.98
	HAC-R1	Exposed	HAC-R1-1	183	16.5	0	10.0	26.5	35.0	17.4	0.217	2.39	1.98	8.97
			HAC-R1-2	55.6	23.1	0	27.3	50.5	18.0	18.9	0	0.601	2.84	11.3
			HAC-R1-3	0	21.0	0.283	5.95	27.2	40.8	22.7	0.283	0	1.63	7.11
			HAC-R1-4	100	25.0	0	5.31	30.3	32.2	22.2	0.312	0.938	1.07	4.74
			HAC-R1-5	167	28.4	1.20	4.49	34.1	24.6	34.1	0.299	1.50	6.80	19.8
	HAC-U	Exposed	HAC-U-1	0	48.6	0	27.0	75.5	1.88	18.5	0.940	0	2.80	15.0
			HAC-U-2	47.6	57.3	0	23.6	80.9	0.843	15.2	0.281	0.281	1.10	6.82
			HAC-U-3	185	53.2	0	19.1	72.3	1.18	18.2	1.76	1.47	4.06	15.8
			HAC-U-4	133	34.2	0	48.0	82.3	0.901	11.4	2.40	0.601	2.41	16.4
			HAC-U-5	143	28.4	0.299	46.9	75.5	0	13.7	1.79	0.896	3.26	14.9
2022	EDC-U	Reference	EDC-U-1	1,434	14.7	12.4	1.29	28.4	46.4	17.5	0.515	5.15	21.7	77.2
			EDC-U-2	215	21.0	4.09	0	25.1	14.1	17.4	0.256	0.767	1.12	4.79
			EDC-U-3	645	22.9	3.66	26.9	53.4	14.8	24.9	0	1.65	1.55	7.18
			EDC-U-4	305	38.1	16.9	8.93	63.9	14.7	12.3	0.397	3.37	0.797	3.95
			EDC-U-5	179	17.6	10.1	14.3	42.0	17.3	24.4	1.30	2.28	0.264	1.35
	HAC-R1	Exposed	HAC-R1-1	467	6.02	0	19.3	25.4	5.25	62.4	2.56	0.896	2.47	13.9
			HAC-R1-2	0	5.75	0	26.7	32.5	2.17	59.9	3.07	0	3.05	17.0
			HAC-R1-3	267	5.47	0	12.7	18.2	10.4	63.7	2.08	0.438	1.56	8.21
			HAC-R1-4	400	9.43	0	18.4	27.8	4.01	56.4	0.943	1.42	2.43	11.1
			HAC-R1-5	333	5.30	0	15.0	20.3	3.23	68.7	1.38	1.15	1.17	6.56
			HAC-U-1	66.7	14.1	0	29.5	43.7	1.28	41.5	1.65	0.183	6.37	21.0
			HAC-U-2	133	13.9	0.236	25.0	39.1	6.60	37.3	0.708	0.472	2.75	10.4
			HAC-U-3	133	13.2	0	37.1	50.3	2.67	31.0	1.96	0.357	3.52	15.3
			HAC-U-4	66.7	12.6	0	34.4	46.9	1.87	38.9	3.76	0.170	3.12	15.8
			HAC-U-5	200	15.0	0	19.1	34.1	4.36	33.4	1.94	0.726	7.06	28.9

Notes: "-" = no data available. EPT = Ephemeroptera, Trichoptera, Plecoptera. DW = dry weight. WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U.

Table D.4.6: Summary Statistics of Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Density (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	49,703	18,255	22,075	57,534	65,222
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	39,228	18,874	21,642	33,857	70,143
	2018	EDC-U	Reference	5	6,458	7,401	179	4,211	18,894
		HAC-R1	Exposed	5	19,750	5,229	14,775	18,740	25,448
		HAC-U	Exposed	5	39,326	11,733	26,595	39,570	55,627
	2019	EDC-U	Reference	5	15,432	7,823	7,500	13,292	27,400
		HAC-R1	Exposed	5	35,493	6,914	25,200	35,667	44,667
		HAC-U	Exposed	5	47,280	9,223	38,000	43,133	57,933
	2020	HAC-R1	Exposed	5	36,987	10,007	26,800	38,600	49,600
		HAC-U	Exposed	5	45,996	31,112	17,778	42,267	95,133
	2021	EDC-U	Reference	5	4,529	1,988	2,452	4,287	7,814
		HAC-R1	Exposed	5	10,097	1,644	7,667	10,667	11,767
		HAC-U	Exposed	6	15,597	3,713	12,593	14,622	22,200
	2022	EDC-U	Reference	5	22,389	13,544	7,860	27,814	39,211
		HAC-R1	Exposed	5	44,467	14,928	28,267	52,067	60,933
		HAC-U	Exposed	5	33,747	5,441	27,533	36,333	39,200
Richness (# of taxa)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	39.4	3.21	35	41.0	42
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	44.2	3.19	40	45.0	48
	2018	EDC-U	Reference	5	27.0	8.34	14	29.0	37
		HAC-R1	Exposed	5	21.6	1.52	19	22.0	23
		HAC-U	Exposed	5	22.0	2.12	19	22.0	24
	2019	EDC-U	Reference	5	29.0	3.00	26	28.0	34
		HAC-R1	Exposed	5	28.0	2.12	25	28.0	30
		HAC-U	Exposed	5	28.2	2.59	26	27.0	31
	2020	HAC-R1	Exposed	5	28.0	2.45	25	29.0	31
		HAC-U	Exposed	5	27.6	3.85	23	27.0	32
	2021	EDC-U	Reference	5	30.8	5.36	26	29.0	40
		HAC-R1	Exposed	5	31.6	3.29	26	32.0	34
		HAC-U	Exposed	6	26.3	3.83	20	27.5	31
	2022	EDC-U	Reference	5	29.0	3.67	25	29.0	34
		HAC-R1	Exposed	5	29.2	4.32	25	29.0	36
		HAC-U	Exposed	5	32.0	1.58	30	32.0	34
Simpson's Evenness	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	0.314	0.0900	0.229	0.274	0.423
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	0.269	0.0323	0.224	0.266	0.314
	2018	EDC-U	Reference	5	0.309	0.117	0.178	0.341	0.424
		HAC-R1	Exposed	5	0.229	0.0314	0.193	0.238	0.262
		HAC-U	Exposed	5	0.277	0.0572	0.204	0.273	0.365
	2019	EDC-U	Reference	5	0.260	0.0716	0.175	0.237	0.363
		HAC-R1	Exposed	5	0.395	0.0397	0.340	0.406	0.444
		HAC-U	Exposed	5	0.411	0.0368	0.361	0.425	0.446
	2020	HAC-R1	Exposed	5	0.187	0.0540	0.115	0.182	0.246
		HAC-U	Exposed	5	0.254	0.0525	0.202	0.232	0.318
	2021	EDC-U	Reference	5	0.337	0.0929	0.220	0.304	0.440
		HAC-R1	Exposed	5	0.220	0.0511	0.181	0.193	0.298
		HAC-U	Exposed	6	0.271	0.0766	0.177	0.257	0.381
	2022	EDC-U	Reference	5	0.265	0.0934	0.161	0.255	0.383
		HAC-R1	Exposed	5	0.269	0.0848	0.195	0.239	0.384
		HAC-U	Exposed	5	0.312	0.0720	0.230	0.295	0.400
Simpson's Diversity	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	0.913	0.0239	0.882	0.913	0.944
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	0.915	0.0117	0.894	0.920	0.922
	2018	EDC-U	Reference	5	0.857	0.0545	0.784	0.859	0.919
		HAC-R1	Exposed	5	0.793	0.0432	0.727	0.809	0.829
		HAC-U	Exposed	5	0.830	0.0318	0.777	0.846	0.856
	2019	EDC-U	Reference	5	0.859	0.0387	0.803	0.873	0.902
		HAC-R1	Exposed	5	0.908	0.0131	0.893	0.917	0.919
		HAC-U	Exposed	5	0.913	0.00190	0.911	0.913	0.916
	2020	HAC-R1	Exposed	5	0.793	0.0639	0.699	0.782	0.862
		HAC-U	Exposed	5	0.849	0.0422	0.802	0.851	0.902
	2021	EDC-U	Reference	5	0.893	0.0389	0.843	0.888	0.943
		HAC-R1	Exposed	5	0.848	0.0417	0.790	0.838	0.895
		HAC-U	Exposed	6	0.852	0.0240	0.818	0.861	0.878
	2022	EDC-U	Reference	5	0.850	0.0693	0.761	0.873	0.912
		HAC-R1	Exposed	5	0.860	0.0469	0.795	0.859	0.913
		HAC-U	Exposed	5	0.895	0.0230	0.864	0.891	0.924
Ephemeroptera (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	21,429	10,168	11,240	18,473	37,172
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	16,146	8,014	7,986	13,878	28,986
	2018	EDC-U	Reference	5	297	269	0	230	591
		HAC-R1	Exposed	5	334	129	143	358	502
		HAC-U	Exposed	5	459	230	215	573	717
	2019	EDC-U	Reference	5	5,313	1,679	3,714	4,400	7,533
		HAC-R1	Exposed	5	8,707	2,325	6,133	8,333	11,600
		HAC-U	Exposed	5	8,000	1,921	5,867	9,200	9,533
	2020	HAC-R1	Exposed	5	2,133	427	1,533	2,133	2,733
		HAC-U	Exposed	5	7,487	2,346	3,600	8,267	9,600
	2021	EDC-U	Reference	5	627	215	430	530	946
		HAC-R1	Exposed	5	2,341	707	1,267	2,467	3,167
		HAC-U	Exposed	6	6,951	1,692	4,524	6,704	9,714
	2022	EDC-U	Reference	5	4,750	2,850	1,382	4,086	8,961
		HAC-R1	Exposed	5	2,733	713	1,533	3,000	3,333
		HAC-U	Exposed	5	4,613	540	3,933	4,933	5,133
Plecoptera (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	4,120	2,641	1,398	4,731	7,735
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	3,341	1,573	1,964	2,573	5,430
	2018	EDC-U	Reference	5	569	369	0	609	973
		HAC-R1	Exposed	5	15.1	20.8	0	0	39.8
		HAC-U	Exposed	5	0	0	0	0	0
	2019	EDC-U	Reference	5	863	535	233	875	1,444
		HAC-R1	Exposed	5	13.3	29.8	0	0	66.7
		HAC-U	Exposed	5	13.3	29.8	0	0	66.7
	2020	HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U	Exposed	5	0	0	0	0	0
	2021	EDC-U	Reference	5	131	25.4	100	136	167
		HAC-R1	Exposed	5	33.3	57.7	0	0	133
		HAC-U	Exposed	6	7.94	19.4	0	0	47.6
	2022	EDC-U	Reference	5	1,668	1,031	794	1,434	3,441
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U	Exposed	5	13.3	29.8	0	0	66.7

Notes: "-" = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared. EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the Exposed areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] W7 is the historical sampling area associated with HAC-U and UER is the historical sampling area associated with EDC-U.

Table D.4.6: Summary Statistics of Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Trichoptera (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	5,338	4,433	1,796	3,104	11,882
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	1,876	806	1,108	1,491	2,943
	2018	EDC-U	Reference	5	182	328	0	51.2	768
		HAC-R1	Exposed	5	2,997	1,144	1,673	2,919	4,588
		HAC-U	Exposed	5	4,430	1,896	2,509	3,656	6,953
	2019	EDC-U	Reference	5	82.5	104	0	23.8	222
		HAC-R1	Exposed	5	8,493	1,513	6,067	9,000	9,867
		HAC-U	Exposed	5	11,240	2,470	7,600	11,067	14,200
	2020	HAC-R1	Exposed	5	3,160	1,760	1,067	3,067	5,933
		HAC-U	Exposed	5	14,784	11,650	2,933	16,000	32,000
	2021	EDC-U	Reference	5	132	142	43.0	71.7	382
		HAC-R1	Exposed	5	1,012	854	500	700	2,528
		HAC-U	Exposed	6	5,090	3,306	2,407	3,792	10,667
	2022	EDC-U	Reference	5	2,566	4,477	0	806	10,538
		HAC-R1	Exposed	5	8,253	3,889	4,333	7,733	13,933
		HAC-U	Exposed	5	10,080	3,824	5,267	10,733	13,867
EPT (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	30,886	14,464	14,434	31,154	48,011
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	21,363	9,923	11,878	17,333	36,530
	2018	EDC-U	Reference	5	1,048	870	0	755	2,304
		HAC-R1	Exposed	5	3,346	1,032	2,071	3,226	4,731
		HAC-U	Exposed	5	4,889	1,909	2,724	4,229	7,168
	2019	EDC-U	Reference	5	6,258	2,173	4,167	5,125	8,867
		HAC-R1	Exposed	5	17,213	3,479	13,000	17,800	20,600
		HAC-U	Exposed	5	19,253	4,072	13,533	19,867	23,667
	2020	HAC-R1	Exposed	5	5,293	1,799	3,200	5,200	8,133
		HAC-U	Exposed	5	22,271	12,289	11,200	21,533	41,600
	2021	EDC-U	Reference	5	890	173	703	941	1,104
		HAC-R1	Exposed	5	3,387	962	2,033	3,233	4,667
		HAC-U	Exposed	6	12,049	3,542	9,111	11,045	18,267
	2022	EDC-U	Reference	5	8,983	6,899	3,303	7,025	20,932
		HAC-R1	Exposed	5	10,987	4,365	5,867	11,067	16,933
		HAC-U	Exposed	5	14,707	4,276	9,400	15,867	18,800
Arachnida (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	3,660	1,985	1,147	3,900	5,849
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	4,153	2,893	1,204	3,563	7,914
	2018	EDC-U	Reference	5	1,696	3,008	57.4	410	7,066
		HAC-R1	Exposed	5	1,824	1,029	717	1,720	3,465
		HAC-U	Exposed	5	0	0	0	0	0
	2019	EDC-U	Reference	5	3,403	4,381	233	1,000	10,467
		HAC-R1	Exposed	5	3,680	2,066	267	4,200	5,400
		HAC-U	Exposed	5	93.3	101	0	66.7	200
	2020	HAC-R1	Exposed	5	15,973	7,250	8,600	16,800	26,133
		HAC-U	Exposed	5	773	426	333	867	1,267
	2021	EDC-U	Reference	5	906	968	244	516	2,557
		HAC-R1	Exposed	5	3,063	1,157	1,667	2,733	4,800
		HAC-U	Exposed	6	148	83.7	0	148	250
	2022	EDC-U	Reference	5	5,067	4,769	1,326	3,943	12,903
		HAC-R1	Exposed	5	2,453	2,287	933	1,133	6,333
		HAC-U	Exposed	5	1,053	532	467	1,000	1,867
Chironomidae (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	12,166	5,205	4,585	14,265	17,319
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	8,883	6,687	3,928	6,079	20,416
	2018	EDC-U	Reference	5	2,910	3,314	100	2,317	8,449
		HAC-R1	Exposed	5	12,432	4,000	8,005	12,545	17,204
		HAC-U	Exposed	5	24,645	7,382	16,272	24,301	35,125
	2019	EDC-U	Reference	5	4,397	1,724	2,071	4,444	6,600
		HAC-R1	Exposed	5	12,160	4,778	8,000	10,333	18,933
		HAC-U	Exposed	5	21,747	6,142	13,600	21,067	27,933
	2020	HAC-R1	Exposed	5	11,427	1,941	9,933	10,667	14,667
		HAC-U	Exposed	5	17,424	16,021	3,722	16,467	42,800
	2021	EDC-U	Reference	5	2,072	1,008	1,104	1,821	3,631
		HAC-R1	Exposed	5	2,383	948	1,333	2,367	3,800
		HAC-U	Exposed	6	2,391	152	2,190	2,377	2,571
	2022	EDC-U	Reference	5	4,506	3,390	1,111	4,875	9,749
		HAC-R1	Exposed	5	27,653	9,460	15,933	31,200	38,800
		HAC-U	Exposed	5	12,332	2,722	9,200	11,600	15,261
Non-Chironomidae Diptera (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	254	51.8	211	237	344
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	361	140	201	401	516
	2018	EDC-U	Reference	5	79.7	81.2	3.58	89.6	205
		HAC-R1	Exposed	5	15.9	35.6	0	0	79.7
		HAC-U	Exposed	5	1,477	1,296	287	860	3,297
	2019	EDC-U	Reference	5	197	134	66.7	214	400
		HAC-R1	Exposed	5	1,147	927	267	800	2,267
		HAC-U	Exposed	5	2,093	1,049	667	1,867	3,533
	2020	HAC-R1	Exposed	5	440	153	267	400	600
		HAC-U	Exposed	5	4,320	2,916	1,000	5,067	8,000
	2021	EDC-U	Reference	5	51.3	44.6	0	48.4	115
		HAC-R1	Exposed	5	23.3	14.9	0	33.3	33.3
		HAC-U	Exposed	6	239	167	47.6	222	533
	2022	EDC-U	Reference	5	70.7	55.9	0	71.7	143
		HAC-R1	Exposed	5	973	599	267	1,267	1,600
		HAC-U	Exposed	5	708	470	200	600	1,473
Oligochaeta (#/m²)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	184	208	0	115	459
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	522	258	229	459	832
	2018	EDC-U	Reference	5	304	295	7.17	256	753
		HAC-R1	Exposed	5	903	767	205	438	1,935
		HAC-U	Exposed	5	7,928	4,353	3,154	6,165	12,545
	2019	EDC-U	Reference	5	703	619	55.6	400	1,533
		HAC-R1	Exposed	5	440	345	133	267	1,000
		HAC-U	Exposed	5	3,227	1,908	0	3,667	4,667
	2020	HAC-R1	Exposed	5	813	568	400	467	1,667
		HAC-U	Exposed	5	280	300	0	133	667
	2021	EDC-U	Reference	5	402	374	151	252	1,061
		HAC-R1	Exposed	5	101	76.4	0	100	183
		HAC-U	Exposed	6	116	75.8	0	138	185
	2022	EDC-U	Reference	5	556	524	179	305	1,434
		HAC-R1	Exposed	5	293	180	0	333	467
		HAC-U	Exposed	5	120	55.8	66.7	133	200

Notes: "-" = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared. EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the Exposed areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] W7 is the historical sampling area associated with HAC-U and UER is the historical sampling area associated with EDC-U.

Table D.4.6: Summary Statistics of Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Ephemeroptera (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	43.4	10.2	32.1	39.7	57.0
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	40.8	2.28	36.9	41.3	42.5
	2018	EDC-U	Reference	5	4.38	3.14	0	4.97	8.46
		HAC-R1	Exposed	5	1.89	1.07	0.563	1.64	3.38
		HAC-U	Exposed	5	1.35	0.849	0.387	1.81	2.16
	2019	EDC-U	Reference	5	37.4	8.63	27.5	36.0	49.5
		HAC-R1	Exposed	5	24.6	4.80	19.6	23.6	32.5
		HAC-U	Exposed	5	17.1	4.18	13.8	16.3	24.2
	2020	HAC-R1	Exposed	5	6.14	2.35	4.30	5.68	10.2
		HAC-U	Exposed	5	22.8	15.4	8.52	16.5	40.3
	2021	EDC-U	Reference	5	15.8	6.79	5.50	19.6	21.8
		HAC-R1	Exposed	5	22.8	4.46	16.5	23.1	28.4
		HAC-U	Exposed	6	45.8	11.7	28.4	50.9	57.3
	2022	EDC-U	Reference	5	22.8	9.09	14.7	21.0	38.1
		HAC-R1	Exposed	5	6.40	1.72	5.30	5.75	9.43
		HAC-U	Exposed	5	13.8	0.926	12.6	13.9	15.0
Plecoptera (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	7.71	2.86	4.07	8.05	11.9
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	8.93	3.21	5.80	7.57	12.8
	2018	EDC-U	Reference	5	11.6	11.4	0	11.2	30.2
		HAC-R1	Exposed	5	0.102	0.140	0	0	0.270
		HAC-U	Exposed	5	0	0	0	0	0
	2019	EDC-U	Reference	5	5.44	2.10	2.23	5.71	7.81
		HAC-R1	Exposed	5	0.0529	0.118	0	0	0.265
		HAC-U	Exposed	5	0.0326	0.0728	0	0	0.163
	2020	HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U	Exposed	5	0	0	0	0	0
	2021	EDC-U	Reference	5	3.27	1.41	2.14	2.64	5.56
		HAC-R1	Exposed	5	0.296	0.519	0	0	1.20
		HAC-U	Exposed	6	0.0498	0.122	0	0	0.299
	2022	EDC-U	Reference	5	9.42	5.62	3.66	10.1	16.9
		HAC-R1	Exposed	5	0	0	0	0	0
		HAC-U	Exposed	5	0.0472	0.105	0	0	0.236
Trichoptera (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	10.1	6.12	4.76	8.13	18.8
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	4.92	1.03	3.93	4.40	6.09
	2018	EDC-U	Reference	5	1.47	1.53	0	1.07	4.07
		HAC-R1	Exposed	5	14.8	2.41	11.3	15.0	18.0
		HAC-U	Exposed	5	11.4	3.47	5.57	12.3	14.9
	2019	EDC-U	Reference	5	0.622	0.732	0	0.317	1.59
		HAC-R1	Exposed	5	24.5	5.45	17.1	25.2	32.0
		HAC-U	Exposed	5	23.9	4.16	17.6	24.5	28.1
	2020	HAC-R1	Exposed	5	9.18	4.91	2.15	9.70	15.4
		HAC-U	Exposed	5	29.6	10.5	13.6	30.1	42.4
	2021	EDC-U	Reference	5	2.69	1.80	0.990	1.67	4.89
		HAC-R1	Exposed	5	10.6	9.58	4.49	5.95	27.3
		HAC-U	Exposed	6	30.6	13.4	19.1	25.3	48.0
	2022	EDC-U	Reference	5	10.3	11.0	0	8.93	26.9
		HAC-R1	Exposed	5	18.4	5.35	12.7	18.4	26.7
		HAC-U	Exposed	5	29.0	7.20	19.1	29.5	37.1
EPT (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	61.2	10.9	46.3	65.4	73.6
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	54.6	3.89	51.2	54.0	61.1
	2018	EDC-U	Reference	5	17.4	13.2	0	17.9	36.2
		HAC-R1	Exposed	5	16.8	1.96	14.0	17.2	18.6
		HAC-U	Exposed	5	12.8	4.00	6.05	14.0	16.7
	2019	EDC-U	Reference	5	43.5	8.69	32.4	45.0	55.6
		HAC-R1	Exposed	5	49.1	8.61	36.7	48.7	57.8
		HAC-U	Exposed	5	41.1	7.46	31.4	40.9	52.3
	2020	HAC-R1	Exposed	5	15.3	6.04	6.45	17.0	21.1
		HAC-U	Exposed	5	52.4	9.73	43.7	51.0	68.8
	2021	EDC-U	Reference	5	21.8	7.05	12.5	25.1	29.5
		HAC-R1	Exposed	5	33.7	9.82	26.5	30.3	50.5
		HAC-U	Exposed	6	76.5	4.22	72.3	75.5	82.3
	2022	EDC-U	Reference	5	42.5	16.4	25.1	42.0	63.9
		HAC-R1	Exposed	5	24.8	5.77	18.2	25.4	32.5
		HAC-U	Exposed	5	42.8	6.36	34.1	43.7	50.3
Arachnida (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	7.54	3.88	3.46	5.98	12.9
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	12.3	8.76	2.53	14.9	23.4
	2018	EDC-U	Reference	5	21.2	13.1	8.21	18.5	37.4
		HAC-R1	Exposed	5	10.5	7.89	2.87	7.61	23.4
		HAC-U	Exposed	5	0	0	0	0	0
	2019	EDC-U	Reference	5	16.0	15.6	2.23	7.52	38.2
		HAC-R1	Exposed	5	9.94	5.73	1.06	11.9	14.8
		HAC-U	Exposed	5	0.234	0.258	0	0.155	0.526
	2020	HAC-R1	Exposed	5	41.4	8.20	32.1	43.5	52.7
		HAC-U	Exposed	5	1.76	0.312	1.33	1.87	2.05
	2021	EDC-U	Reference	5	17.3	11.4	5.61	12.0	32.7
		HAC-R1	Exposed	5	30.1	8.94	18.0	32.2	40.8
		HAC-U	Exposed	6	0.996	0.612	0	1.04	1.88
	2022	EDC-U	Reference	5	21.4	14.0	14.1	14.8	46.4
		HAC-R1	Exposed	5	5.01	3.21	2.17	4.01	10.4
		HAC-U	Exposed	5	3.36	2.15	1.28	2.67	6.60
Chironomidae (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	24.9	8.19	14.1	24.5	35.2
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	21.6	7.89	14.4	18.1	31.1
	2018	EDC-U	Reference	5	46.4	9.35	33.4	44.7	56.0
		HAC-R1	Exposed	5	62.2	5.89	54.2	60.9	69.0
		HAC-U	Exposed	5	62.7	1.70	61.2	62.3	65.4
	2019	EDC-U	Reference	5	29.9	6.95	24.0	27.6	40.1
		HAC-R1	Exposed	5	33.7	8.78	23.2	31.8	43.1
		HAC-U	Exposed	5	45.4	5.60	35.8	48.2	49.0
	2020	HAC-R1	Exposed	5	32.2	7.13	23.7	34.2	39.5
		HAC-U	Exposed	5	32.1	12.1	17.6	38.2	45.0
	2021	EDC-U	Reference	5	45.3	7.17	36.4	45.0	56.1
		HAC-R1	Exposed	5	23.1	6.57	17.4	22.2	34.1
		HAC-U	Exposed	6	15.9	2.93	11.4	16.7	18.5
	2022	EDC-U	Reference	5	19.3	5.32	12.3	17.5	24.9
		HAC-R1	Exposed	5	62.2	4.57	56.4	62.4	68.7
		HAC-U	Exposed	5	36.4	4.21	31.0	37.3	41.5

Notes: "-" = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared. EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the Exposed areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] W7 is the historical sampling area associated with HAC-U and UER is the historical sampling area associated with EDC-U.

Table D.4.6: Summary Statistics of Benthic Invertebrate Community Metrics for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Year	Area	Area Type	n	Mean	Standard Deviation	Minimum	Median	Maximum
Non-Chironomidae Diptera (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	0.594	0.310	0.363	0.522	1.12
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	0.960	0.242	0.654	0.927	1.22
	2018	EDC-U	Reference	5	1.41	0.662	0.533	1.28	2.13
		HAC-R1	Exposed	5	0.108	0.241	0	0	0.539
		HAC-U	Exposed	5	4.59	4.85	0.637	2.88	12.4
	2019	EDC-U	Reference	5	1.36	0.913	0.627	1.20	2.86
		HAC-R1	Exposed	5	3.63	3.54	0.748	1.79	8.99
		HAC-U	Exposed	5	4.62	2.88	1.55	4.37	9.30
	2020	HAC-R1	Exposed	5	1.30	0.646	0.538	1.23	2.24
		HAC-U	Exposed	5	10.9	9.17	4.10	8.41	26.9
	2021	EDC-U	Reference	5	1.16	1.03	0	0.877	2.68
		HAC-R1	Exposed	5	0.223	0.130	0	0.283	0.312
		HAC-U	Exposed	6	1.49	0.753	0.281	1.76	2.40
	2022	EDC-U	Reference	5	0.494	0.491	0	0.397	1.30
		HAC-R1	Exposed	5	2.01	0.860	0.943	2.08	3.07
		HAC-U	Exposed	5	2.00	1.10	0.708	1.94	3.76
Oligochaeta (%)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	0.509	0.654	0	0.283	1.56
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	1.74	1.38	0.491	1.63	3.84
	2018	EDC-U	Reference	5	6.09	4.00	1.36	4.62	10.8
		HAC-R1	Exposed	5	4.13	2.67	1.09	2.96	7.76
		HAC-U	Exposed	5	19.1	6.24	11.9	17.6	27.9
	2019	EDC-U	Reference	5	5.99	5.86	0.300	4.76	14.6
		HAC-R1	Exposed	5	1.27	0.973	0.365	1.06	2.82
		HAC-U	Exposed	5	6.62	4.04	0	7.82	10.8
	2020	HAC-R1	Exposed	5	2.05	0.937	1.04	1.74	3.36
		HAC-U	Exposed	5	0.593	0.617	0	0.309	1.26
	2021	EDC-U	Reference	5	9.59	8.67	2.75	6.73	24.8
		HAC-R1	Exposed	5	1.09	0.910	0	0.938	2.39
		HAC-U	Exposed	6	0.786	0.609	0	0.748	1.47
	2022	EDC-U	Reference	5	2.64	1.69	0.767	2.28	5.15
		HAC-R1	Exposed	5	0.780	0.566	0	0.896	1.42
		HAC-U	Exposed	5	0.382	0.230	0.170	0.357	0.726
Dry Weight Benthic Biomass (g/m² DW)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	-	-	-	-	-
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	-	-	-	-	-
	2018	EDC-U	Reference	5	1.39	1.81	0.0100	0.177	3.70
		HAC-R1	Exposed	5	0.804	0.378	0.434	0.814	1.38
		HAC-U	Exposed	5	1.24	0.778	0.674	0.910	2.59
	2019	EDC-U	Reference	5	1.09	1.17	0.287	0.462	3.04
		HAC-R1	Exposed	5	3.59	1.62	1.93	3.07	5.53
		HAC-U	Exposed	5	5.31	4.13	1.85	3.88	12.3
	2020	HAC-R1	Exposed	5	3.97	2.86	1.54	3.33	8.89
		HAC-U	Exposed	5	5.33	4.26	1.53	3.97	12.6
	2021	EDC-U	Reference	5	0.537	0.417	0.222	0.376	1.27
		HAC-R1	Exposed	5	2.86	2.29	1.07	1.98	6.80
		HAC-U	Exposed	6	2.73	1.09	1.10	2.80	4.06
	2022	EDC-U	Reference	5	5.09	9.32	0.264	1.12	21.7
		HAC-R1	Exposed	5	2.13	0.758	1.17	2.43	3.05
		HAC-U	Exposed	5	4.57	2.00	2.75	3.52	7.06
Wet Weight Benthic Biomass (g/m² WW)	2007	EDC-U (UER)[a]	Reference (Pre-Breach)	5	-	-	-	-	-
		HAC-U (UHC)[a]	Exposed (Pre-Breach)	5	-	-	-	-	-
	2018	EDC-U	Reference	5	7.35	9.43	0.0710	1.37	20.2
		HAC-R1	Exposed	5	4.73	1.82	2.27	4.51	7.40
		HAC-U	Exposed	5	7.30	4.07	3.71	6.29	13.4
	2019	EDC-U	Reference	5	7.36	7.62	1.56	2.50	17.6
		HAC-R1	Exposed	5	24.6	12.1	12.1	22.5	42.3
		HAC-U	Exposed	5	29.7	15.9	11.7	29.7	53.7
	2020	HAC-R1	Exposed	5	20.9	14.8	12.6	13.8	47.2
		HAC-U	Exposed	5	28.7	23.9	10.3	21.2	70.4
	2021	EDC-U	Reference	5	2.61	1.86	1.18	1.98	5.84
		HAC-R1	Exposed	5	10.4	5.78	4.74	8.97	19.8
		HAC-U	Exposed	6	13.8	3.94	6.82	15.0	16.4
	2022	EDC-U	Reference	5	18.9	32.7	1.35	4.79	77.2
		HAC-R1	Exposed	5	11.4	4.22	6.56	11.1	17.0
		HAC-U	Exposed	5	18.3	7.02	10.4	15.8	28.9

Notes: "-" = no value. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. #/m^2 = number per metre squared. g/m^2 = grams per metre squared. EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the Exposed areas HAC-R1 and HAC-U. See Section 4.3 for details.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U.

APPENDIX D.5
PERIPHYTON AND BENTHOS
TISSUE QUALITY

Table D.5.1: Periphyton Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Reference												
		Upper Edney Creek (EDC-U)												
		EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-6	EDC-U-7	EDC-U-8	Mean	Standard Deviation	Minimum	Median	Maximum
		8-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22					
Moisture	mg/kg dw	73.8	89.1	89.5	77.9	87.2	86.8	88.9	84.3	84.7	5.81	73.8	87.0	89.5
Aluminum	mg/kg dw	1,960	13,300	10,600	6,490	14,700	10,900	8,020	8,050	9,252	4,042	1,960	9,325	14,700
Antimony	mg/kg dw	0.0940	0.0860	0.0860	0.0930	0.0710	0.0670	0.0850	0.110	0.0865	0.0135	0.0670	0.0860	0.110
Arsenic	mg/kg dw	6.75	12.8	14.4	37.9	41.0	10.8	24.5	34.0	22.8	13.4	6.75	19.4	41.0
Barium	mg/kg dw	232	229	319	824	480	225	242	1,140	461	343	225	280	1,140
Beryllium	mg/kg dw	0.206	0.447	0.374	0.392	0.629	0.339	0.336	0.422	0.393	0.120	0.206	0.383	0.629
Bismuth	mg/kg dw	0.0140	0.111	0.0840	0.0560	0.123	0.0780	0.0530	0.0560	0.0719	0.0349	0.0140	0.0670	0.123
Boron	mg/kg dw	18.6	7.80	8.80	11.9	7.40	15.1	8.40	9.90	11.0	3.99	7.40	9.35	18.6
Cadmium	mg/kg dw	1.03	0.949	1.07	2.83	1.82	0.991	1.13	4.69	1.81	1.33	0.949	1.10	4.69
Calcium	mg/kg dw	7,430	11,700	11,000	10,100	13,100	9,420	8,310	12,000	10,382	1,932	7,430	10,550	13,100
Cesium	mg/kg dw	0.0886	1.01	0.783	0.306	1.02	0.848	0.440	0.419	0.614	0.347	0.0886	0.612	1.02
Chromium	mg/kg dw	23.9	127	79.1	119	68.6	145	233	46.6	105	66.2	23.9	99.0	233
Cobalt	mg/kg dw	14.4	21.9	22.8	47.6	35.9	20.6	22.0	65.9	31.4	17.4	14.4	22.4	65.9
Copper	mg/kg dw	24.7	44.1	39.1	34.8	43.0	35.3	36.4	39.7	37.1	6.06	24.7	37.8	44.1
Iron	mg/kg dw	4,460	26,400	22,600	22,700	45,500	21,800	26,000	19,800	23,658	11,206	4,460	22,650	45,500
Lead	mg/kg dw	0.742	5.27	3.99	2.96	6.26	3.94	3.71	3.33	3.78	1.63	0.742	3.82	6.26
Lithium	mg/kg dw	1.39	12.2	9.04	4.18	12.0	9.95	6.82	5.51	7.64	3.84	1.39	7.93	12.2
Magnesium	mg/kg dw	1,910	6,170	5,340	3,540	6,250	5,040	4,330	3,640	4,528	1,476	1,910	4,685	6,250
Manganese	mg/kg dw	6,970	8,460	11,300	26,900	18,300	8,900	9,480	38,600	16,114	11,264	6,970	10,390	38,600
Mercury	mg/kg dw	0.0486	0.157	0.188	0.0972	0.176	0.122	0.0730	0.0777	0.117	0.0517	0.0486	0.110	0.188
Molybdenum	mg/kg dw	2.38	2.24	2.42	2.87	2.74	2.17	3.78	4.41	2.88	0.806	2.17	2.58	4.41
Nickel	mg/kg dw	25.2	45.0	45.3	66.3	56.0	48.1	51.1	95.6	54.1	20.4	25.2	49.6	95.6
Phosphorus	mg/kg dw	2,760	3,290	3,900	3,030	3,600	2,630	2,630	2,670	3,064	487	2,630	2,895	3,900
Potassium	mg/kg dw	6,070	4,780	5,880	4,850	4,140	3,080	4,260	3,810	4,609	1,011	3,080	4,520	6,070
Rubidium	mg/kg dw	7.02	16.7	15.1	8.09	14.7	11.5	9.40	8.27	11.3	3.71	7.02	10.4	16.7
Selenium	mg/kg dw	0.390	0.980	0.820	0.700	1.13	0.770	0.600	0.770	0.770	0.225	0.390	0.770	1.13
Silver	mg/kg dw	0.0337	0.200	0.164	0.0811	0.193	0.129	0.0847	0.100	0.123	0.0589	0.0337	0.114	0.200
Sodium	mg/kg dw	159	291	289	147	291	214	224	151	221	64.0	147	219	291
Strontium	mg/kg dw	65.4	98.2	94.0	114	125	94.2	74.0	140	101	25.0	65.4	96.2	140
Tellurium	mg/kg dw	<0.026	<0.038	<0.025	0.0340	<0.060	<0.062	<0.050	<0.068	0.0280	NaN	<0.025	0.0500	0.0340
Thallium	mg/kg dw	0.0419	0.116	0.116	0.200	0.152	0.105	0.0929	0.404	0.153	0.111	0.0419	0.116	0.404
Tin	mg/kg dw	<0.13	0.270	0.190	<0.15	<0.30	<0.31	<0.25	<0.34	0.174	0.0572	<0.13	0.270	0.270
Titanium	mg/kg dw	116	458	353	200	487	385	417	289	338	129	116	369	487
Uranium	mg/kg dw	0.388	0.809	0.658	0.612	1.00	0.704	0.660	0.851	0.710	0.182	0.388	0.682	1.00
Vanadium	mg/kg dw	16.2	54.4	45.0	55.4	98.8	45.7	58.8	53.0	53.4	22.7	16.2	53.7	98.8
Zinc	mg/kg dw	154	152	143	241	202	135	113	337	185	73.7	113	153	337
Zirconium	mg/kg dw	1.56	7.61	5.87	4.70	8.94	6.12	6.87	5.40	5.88	2.19	1.56	6.00	8.94

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.1: Periphyton Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 1 (HAC-R1)												
		HAC-R1-1	HAC-R1-2	HAC-R1-3	HAC-R1-4	HAC-R1-5	HAC-R1-6	HAC-R1-7	HAC-R1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22					
Moisture	mg/kg dw	65.7	67.7	64.7	61.0	72.3	67.4	69.8	71.3	67.5	3.71	61.0	67.5	72.3
Aluminum	mg/kg dw	2,010	1,750	868	920	1,400	857	4,720	4,470	2,124	1,584	857	1,575	4,720
Antimony	mg/kg dw	0.0800	0.0680	0.0640	0.0850	0.0680	0.0570	0.0720	0.0780	0.0715	0.00917	0.0570	0.0700	0.0850
Arsenic	mg/kg dw	2.30	2.24	1.78	1.87	2.11	2.17	3.41	3.97	2.48	0.781	1.78	2.20	3.97
Barium	mg/kg dw	133	99.3	68.3	125	84.5	71.6	246	165	124	59.4	68.3	112	246
Beryllium	mg/kg dw	0.0570	0.0620	0.0330	0.0360	0.0500	0.0370	0.171	0.138	0.0730	0.0521	0.0330	0.0535	0.171
Bismuth	mg/kg dw	<0.012	<0.010	<0.012	<0.015	<0.010	<0.012	<0.012	0.0160	0.0107	NaN	<0.010	0.0120	0.0160
Boron	mg/kg dw	363	288	289	295	325	117	232	150	257	85.3	117	288	363
Cadmium	mg/kg dw	0.148	0.169	0.148	0.152	0.182	0.190	0.180	0.238	0.176	0.0300	0.148	0.174	0.238
Calcium	mg/kg dw	224,000	246,000	236,000	250,000	223,000	280,000	247,000	210,000	239,500	21,527	210,000	241,000	280,000
Cesium	mg/kg dw	0.216	0.172	0.116	0.146	0.175	0.0775	0.258	0.267	0.178	0.0663	0.0775	0.174	0.267
Chromium	mg/kg dw	2.64	3.23	2.34	1.88	2.90	5.79	19.3	88.5	15.8	29.9	1.88	3.06	88.5
Cobalt	mg/kg dw	2.00	1.96	1.20	1.48	1.70	1.23	3.01	3.47	2.01	0.826	1.20	1.83	3.47
Copper	mg/kg dw	42.1	116	36.4	42.6	60.4	41.0	57.5	160	69.5	44.7	36.4	50.0	160
Iron	mg/kg dw	2,840	3,100	1,630	1,830	2,520	1,510	4,450	7,680	3,195	2,051	1,510	2,680	7,680
Lead	mg/kg dw	0.644	0.498	0.298	0.315	0.484	0.280	0.747	1.17	0.554	0.300	0.280	0.491	1.17
Lithium	mg/kg dw	1.59	1.49	0.910	0.990	1.39	0.960	2.56	2.80	1.59	0.724	0.910	1.44	2.80
Magnesium	mg/kg dw	3,090	2,840	2,570	2,750	2,840	2,610	3,260	3,660	2,952	367	2,570	2,840	3,660
Manganese	mg/kg dw	1,240	1,150	774	1,580	1,360	852	1,780	2,100	1,354	452	774	1,300	2,100
Mercury	mg/kg dw	0.00960	0.00910	0.00910	0.00640	0.00880	0.00600	0.0160	0.0243	0.0112	0.00612	0.00600	0.00910	0.0243
Molybdenum	mg/kg dw	1.50	1.35	1.17	1.31	1.71	1.01	1.23	2.29	1.45	0.401	1.01	1.33	2.29
Nickel	mg/kg dw	3.13	3.77	3.10	3.12	3.30	3.98	4.68	11.1	4.52	2.71	3.10	3.54	11.1
Phosphorus	mg/kg dw	866	886	731	681	787	780	880	1,340	869	204	681	826	1,340
Potassium	mg/kg dw	4,980	3,870	3,720	3,790	4,480	1,610	3,410	3,370	3,654	988	1,610	3,755	4,980
Rubidium	mg/kg dw	5.14	3.90	3.54	3.65	4.42	1.64	4.05	4.55	3.86	1.04	1.64	3.98	5.14
Selenium	mg/kg dw	2.22	1.88	2.28	2.57	1.95	1.50	1.51	1.92	1.98	0.371	1.50	1.94	2.57
Silver	mg/kg dw	0.0138	0.0246	0.0115	0.0150	0.0189	0.00930	0.0259	0.0295	0.0186	0.00738	0.00930	0.0170	0.0295
Sodium	mg/kg dw	326	358	249	270	313	225	333	370	306	52.2	225	320	370
Strontium	mg/kg dw	513	535	509	544	512	543	571	439	521	39.1	439	524	571
Tellurium	mg/kg dw	<0.025	0.0250	0.0310	0.0320	0.0250	0.0350	0.0270	0.0210	0.0271	0.00519	0.0210	0.0260	0.0350
Thallium	mg/kg dw	0.00700	0.00610	0.00480	0.00630	0.00640	0.00360	0.00680	0.00870	0.00621	0.00151	0.00360	0.00635	0.00870
Tin	mg/kg dw	<0.12	<0.10	<0.12	<0.15	<0.10	<0.12	<0.12	0.220	0.115	NaN	<0.10	0.120	0.220
Titanium	mg/kg dw	132	124	72.3	80.9	112	69.3	228	365	148	101	69.3	118	365
Uranium	mg/kg dw	0.156	0.150	0.117	0.122	0.138	0.0956	0.215	0.195	0.149	0.0401	0.0956	0.144	0.215
Vanadium	mg/kg dw	10.7	12.3	6.18	7.06	10.1	5.61	18.2	25.7	12.0	6.87	5.61	10.4	25.7
Zinc	mg/kg dw	19.2	20.7	16.9	16.4	21.4	11.6	27.4	59.8	24.2	15.1	11.6	20.0	59.8
Zirconium	mg/kg dw	1.42	1.26	0.960	0.910	1.23	0.710	2.10	2.38	1.37	0.586	0.710	1.25	2.38

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.1: Periphyton Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 2 (HAC-U)												
		HAC-U-1	HAC-U-2	HAC-U-3	HAC-U-4	HAC-U-5	HAC-U-6	HAC-U-7	HAC-U-8	Mean	Standard Deviation	Minimum	Median	Maximum
		6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	5-Aug-22	5-Aug-22	6-Aug-22	5-Aug-22					
Moisture	mg/kg dw	59.8	57.2	70.5	74.3	76.4	71.7	87.3	71.0	71.0	9.43	57.2	71.3	87.3
Aluminum	mg/kg dw	1,370	3,010	1,170	3,900	2,610	595	3,730	11,600	3,498	3,490	595	2,810	11,600
Antimony	mg/kg dw	0.0820	0.0830	0.0600	0.0720	0.0540	0.0530	0.0610	0.0710	0.0670	0.0118	0.0530	0.0660	0.0830
Arsenic	mg/kg dw	2.31	2.97	1.95	2.92	3.12	1.93	4.70	5.27	3.15	1.23	1.93	2.94	5.27
Barium	mg/kg dw	113	238	96.1	272	136	84.0	114	823	235	247	84.0	125	823
Beryllium	mg/kg dw	0.0480	0.162	0.0400	0.131	0.0640	0.0230	0.0940	0.180	0.0928	0.0590	0.0230	0.0790	0.180
Bismuth	mg/kg dw	<0.010	0.0140	<0.010	<0.010	<0.010	<0.011	0.0110	<0.010	0.0106	0.00140	<0.010	0.0100	0.0140
Boron	mg/kg dw	239	228	323	197	114	201	115	90.4	188	78.4	90.4	199	323
Cadmium	mg/kg dw	0.242	0.234	0.197	0.237	0.152	0.162	0.209	0.127	0.195	0.0435	0.127	0.203	0.242
Calcium	mg/kg dw	212,000	176,000	203,000	196,000	188,000	238,000	145,000	185,000	192,875	27,195	145,000	192,000	238,000
Cesium	mg/kg dw	0.243	0.365	0.192	0.202	0.249	0.134	0.189	0.225	0.225	0.0673	0.134	0.214	0.365
Chromium	mg/kg dw	2.28	4.74	2.66	1.96	7.92	1.28	17.5	7.08	5.68	5.36	1.28	3.70	17.5
Cobalt	mg/kg dw	1.75	3.20	1.29	2.50	2.23	0.800	2.89	3.09	2.22	0.874	0.800	2.37	3.20
Copper	mg/kg dw	50.5	86.8	35.1	510	52.2	21.2	71.5	104	116	161	21.2	61.9	510
Iron	mg/kg dw	2,320	4,680	1,610	3,940	3,420	950	5,860	5,070	3,481	1,736	950	3,680	5,860
Lead	mg/kg dw	0.541	1.43	0.385	0.885	0.729	0.226	2.53	1.12	0.981	0.738	0.226	0.807	2.53
Lithium	mg/kg dw	1.27	2.51	0.920	1.53	1.76	0.600	2.31	2.72	1.70	0.766	0.600	1.64	2.72
Magnesium	mg/kg dw	3,020	4,110	2,740	3,420	3,270	2,650	3,780	4,460	3,431	646	2,650	3,345	4,460
Manganese	mg/kg dw	3,500	3,200	2,820	4,260	2,620	2,120	2,220	2,200	2,868	750	2,120	2,720	4,260
Mercury	mg/kg dw	0.0153	0.0195	0.00970	0.0129	0.0148	0.00640	0.0362	0.0202	0.0169	0.00906	0.00640	0.0150	0.0362
Molybdenum	mg/kg dw	1.37	1.49	1.35	1.56	1.20	0.900	1.96	0.745	1.32	0.382	0.745	1.36	1.96
Nickel	mg/kg dw	3.11	6.97	2.66	2.59	3.20	1.79	5.49	2.97	3.60	1.73	1.79	3.04	6.97
Phosphorus	mg/kg dw	1,050	1,360	861	1,280	1,670	896	4,480	1,650	1,656	1,182	861	1,320	4,480
Potassium	mg/kg dw	6,350	7,010	6,070	5,410	6,100	4,930	6,820	5,490	6,022	715	4,930	6,085	7,010
Rubidium	mg/kg dw	6.78	8.68	6.17	6.20	7.95	5.15	7.94	8.08	7.12	1.22	5.15	7.36	8.68
Selenium	mg/kg dw	5.00	3.83	4.05	12.2	1.97	1.94	2.30	1.62	4.11	3.49	1.62	3.06	12.2
Silver	mg/kg dw	0.0162	0.0616	0.0101	0.0631	0.0171	<0.0057	0.0477	0.0214	0.0304	0.0230	<0.0057	0.0192	0.0631
Sodium	mg/kg dw	317	375	307	345	420	246	269	306	323	56.1	246	312	420
Strontium	mg/kg dw	518	488	479	494	474	550	366	589	495	65.2	366	491	589
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	0.0270	<0.020	<0.023	0.0210	0.0230	0.0214	0.00245	<0.020	0.0210	0.0270
Thallium	mg/kg dw	0.00970	0.0168	0.00880	0.0134	0.0123	0.00780	0.00640	0.00860	0.0105	0.00343	0.00640	0.00925	0.0168
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.11	0.100	<0.10	0.100	NaN	<0.10	0.100	0.100
Titanium	mg/kg dw	98.0	304	73.2	188	207	39.6	296	255	183	102	39.6	198	304
Uranium	mg/kg dw	0.186	0.189	0.144	0.163	0.165	0.123	0.130	0.174	0.159	0.0247	0.123	0.164	0.189
Vanadium	mg/kg dw	9.34	17.0	7.29	20.8	13.2	4.24	18.1	22.1	14.0	6.55	4.24	15.1	22.1
Zinc	mg/kg dw	43.1	31.7	14.5	13.2	12.4	6.40	19.7	15.3	19.5	12.0	6.40	14.9	43.1
Zirconium	mg/kg dw	0.890	2.15	0.800	1.30	1.14	0.600	1.13	1.90	1.24	0.537	0.600	1.14	2.15

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Edney Creek	EDC-U (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	9.13	14.3	7.99	10.1	12.8	9.89	13.1	13.2	11.3	2.31	7.99	11.4	14.3
				2019	10.4	8.81	8.98	8.9	8.67	5.32	10.3	16	9.67	2.99	5.32	8.94	16
				2020	16.8	77	29.9	18.7	25.8	10.6	28.3	55.2	32.8	22.3	10.6	27	77
				2021	7.31	23.1	12.3	9.78	18	11.2	15.9	19.8	14.7	5.42	7.31	14.1	23.1
		Copper	mg/kg	2018	37.9	30.9	24.6	27.8	48	42.9	37.2	51.2	37.6	9.5	24.6	37.6	51.2
				2019	29.9	27.3	30.6	24.8	24.7	16.9	30.1	42.2	28.3	7.18	16.9	28.6	42.2
				2020	30.5	36.6	21	25.4	46.1	35.8	28.3	26.2	31.2	7.96	21	29.4	46.1
				2021	26.4	40.8	27.6	35.9	59.3	35.7	68.8	37.5	41.5	15	26.4	36.7	68.8
		Iron	mg/kg	2018	18,400	24,100	14,500	20,700	25,700	27,100	17,500	26,100	21,763	4,654	14,500	22,400	27,100
				2019	20,300	24,200	16,500	17,200	21,200	12,700	20,200	21,000	19,163	3,545	12,700	20,250	24,200
				2020	22,000	72,300	13,000	13,600	34,900	27,900	38,000	42,700	33,050	19,237	13,000	31,400	72,300
				2021	14,300	27,800	25,400	23,100	35,600	29,600	21,700	19,700	24,650	6,521	14,300	24,250	35,600
		Selenium	mg/kg	2018	0.71	0.53	0.38	0.47	0.88	0.7	0.74	0.91	0.665	0.19	0.38	0.705	0.91
				2019	0.67	0.54	0.52	0.72	0.77	0.36	0.57	0.67	0.602	0.132	0.36	0.62	0.77
				2020	0.7	1.04	0.49	0.3	0.68	0.6	0.37	0.47	0.581	0.233	0.3	0.545	1.04
				2021	0.46	0.7	0.36	0.65	0.73	0.55	0.76	0.44	0.581	0.15	0.36	0.6	0.76
		Secondary Analytes															
		Barium	mg/kg	2018	177	220	211	201	243	195	218	243	214	22.8	177	214	243
				2019	180	158	186	181	153	95.5	213	422	199	96.6	95.5	180	422
				2020	785	243	916	370	787	248	851	380	572	288	243	582	916
				2021	146	177	139	168	235	148	290	436	217	102	139	172	436
		Cadmium	mg/kg	2018	0.735	0.518	0.454	0.52	0.878	0.645	1.15	0.933	0.729	0.243	0.454	0.69	1.15
				2019	0.729	0.498	0.844	0.627	0.555	0.312	0.924	1.44	0.741	0.343	0.312	0.678	1.44
				2020	2.62	1.36	3.52	1.5	2.71	0.71	2.01	1.42	1.98	0.915	0.71	1.76	3.52
				2021	0.532	0.804	0.382	0.69	0.937	0.481	1.63	1.67	0.891	0.501	0.382	0.747	1.67
		Calcium	mg/kg	2018	10,800	11,500	12,000	10,700	12,200	15,600	8,980	12,700	11,810	1,916	8,980	11,750	15,600
				2019	9,350	9,390	9,610	9,060	8,690	5,410	10,500	11,000	9,126	1,680	5,410	9,370	11,000
				2020	12,200	13,000	9,160	8,190	11,200	11,200	11,600	8,430	10,622	1,798	8,190	11,200	13,000
				2021	8,550	10,700	8,280	9,480	12,100	9,550	9,590	8,240	9,561	1,318	8,240	9,515	12,100
		Cobalt	mg/kg	2018	14.8	17	12.2	15.2	21.5	20.7	18.2	24.9	18.1	4.14	12.2	17.6	24.9
				2019	18.3	15.3	16.2	13.2	11.2	8.6	19.1	29.6	16.4	6.38	8.6	15.8	29.6
				2020	44.4	27.5	44.9	25	52	20.2	49.8	28.5	36.5	12.5	20.2	36.4	52
				2021	11.5	16.8	13.5	16.7	28	14.9	27.7	28.8	19.7	7.19	11.5	16.8	28.8
		Manganese	mg/kg	2018	4,430	6,120	4,950	5,280	8,170	5,790	6,830	9,730	6,412	1,777	4,430	5,955	9,730
				2019	6,220	4,460	7,610	5,740	4,990	2,270	8,070	13,800	6,645	3,419	2,270	5,980	13,800
				2020	20,900	8,250	34,200	14,000	27,000	5,840	21,500	11,700	17,924	9,730	5,840	17,450	34,200
				2021	4,650	6,670	3,120	5,460	10,600	2,670	13,700	14,200	7,634	4,603	2,670	6,065	14,200
		Mercury	mg/kg	2018	0.0988	0.101	0.0506	0.0785	0.118	0.127	0.0868	0.148	0.101	0.0303	0.0506	0.0999	0.148
				2019	0.096	0.078	0.072	0.223	0.21	0.115	0.1	0.12	0.127	0.0578	0.072	0.108	0.223
				2020	0.109	0.168	0.0484	0.052	0.0678	0.0713	0.0691	0.075	0.0826	0.0391	0.0484	0.0702	0.168
				2021	0.0582	0.0483	0.0688	0.0883	0.4	0.0827	0.0552	0.0419	0.105	0.12	0.0419	0.0635	0.4
		Molybdenum	mg/kg	2018	1.14	1.45	2.11	1.22	1.26	0.967	1.44	1.18	1.35	0.346	0.967	1.24	2.11
				2019	1.46	1.12	2.24	1.34	1.16	0.843	2.4	2.21	1.6	0.598	0.843	1.4	2.4
				2020	3.68	3.06	3.13	2.17	3.53	1.56	4.37	3.09	3.07	0.876	1.56	3.11	4.37
				2021	2.1	4.52	1.17	1.17	3.63	1.04	3.86	2.57	2.51	1.36	1.04	2.34	4.52
		Nickel	mg/kg	2018	29.1	27.9	27.3	25.8	36.6	33.4	45.5	38.1	33	6.77	25.8	31.2	45.5
				2019	29.9	27.2	31.7	25	26.9	15.4	36.7	47.8	30.1	9.41	15.4	28.6	47.8
				2020	71.5	53.3	69.8	35.1	85.1	59	62.1	41	59.6	16.4	35.1	60.5	85.1
				2021	29.2	34.9	24.7	34.2	51.6	34.8	83.1	49.7	42.8	18.8	24.7	34.8	83.1
		Phosphorus	mg/kg	2018	1,730	1,620	1,400	1,540	1,900	1,800	1,830	1,980	1,725	194	1,400	1,765	1,980
				2019	2,730	1,680	2,670	2,910	4,070	899	3,000	3,140	2,637	961	899	2,820	4,070
				2020	1,560	4,200	2,070	2,250	2,870	2,190	1,570	1,910	2,328	864	1,560	2,130	4,200
				2021	1,840	1,740	1,180	1,480	2,000	1,420	2,600	1,470	1,716	442	1,180	1,610	2,600
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.114	0.12	0.0854	0.123	0.145	0.0715	0.115	0.125	0.112	0.0233	0.0715	0.118	0.145
				2020	0.113	0.178	0.0493	0.0362	0.113	0.0997	0.089	0.0702	0.0935	0.0443	0.0362	0.0944	0.178
				2021	0.0891	0.142	0.0954	0.148	0.142	0.148	0.13	0.1	0.124	0.0252	0.0891	0.136	0.148
		Sodium	mg/kg	2018	424	402	457	537	387	818	346	344	464	156	344	413	818
				2019	430	574	1,140	457	777	217	690	651	617	275	217	612	1,140
				2020	212	354	<252	789	465	347	634	225	406	214	212	350	789
				2021	254	342	481	228	306	517	400	306	354	104	228	324	517
		Strontium	mg/kg	2018	84.7	90.3	91.5	84	93.6	116	65.8	101	90.9	14.4	65.8	90.9	116
				2019	73.8	74.9	74	72.9	72.1	44.3	84.2	109	75.7	17.7	44.3	73.9	109
				2020	120	113	113	76.2	106	99.9	94	78.6	100	16.2	76.2	103	120
				2021	64.5	67.9	68.3	75.1	89.2	74.6	77.4	84.6	75.2	8.49	64.5	74.8	89.2
		Tin	mg/kg	2018	<0.20	<0.30	<0.20	<0.20	0.28	0.25	0.21	0.22	0.223	0.0314	<0.2	0.21	0.28
				2019	1.09	0.47	0.91	0.53	2.17	1.3	1.88	1.47	1.23	0.605	0.47	1.2	2.17
				2020	<0.47	0.61	<1.26	<0.38	<0.38	0.3	<0.24	0.17	0.27	0.21	0.17	0.17	0.61
				2021	0.17	0.3	0.23	0.18	0.34	0.31	0.4	0.22	0.269	0.0815	0.17	0.265	0.4
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	323	511	585	234	267	264	469	395	381	130	234	359	585
				2020	411	508	278	273	738	847	760	424	530	224	273	466	847
				2021	331	407	579	430	777	640	426	397	498	152	331	428	777
		Uranium	mg/kg	2018	0.893	0.524	0.397	0.533	0.967	0.939	0.901	1.25	0.8	0.287	0.397	0.897	1.25
				2019	0.682	0.732	0.624	0.514	0.453	0.484	0.685	0.778	0.619	0.121	0.453	0.653	0.778
				2020	0.611	0.93	0.337	0.358	0.61	0.731	0.651	0.752	0.622	0.198	0.337	0.631	0.93
				2021	0.453	0.643	0.75	0.855	1.13	1.14	0.774	0.568	0.789	0.247	0.453	0.762	1.14
		Vanadium	mg/kg	2018	44.5	51.8	29.3	47.1	59.5	66.7	45.9	61.1	50.7	11.8	29.3	49.5	66.7
				2019	41.7	54.5	38.7	32.2	36.6	29.5	46.5	50.9	41.3	8.82	29.5	40.2	54.5
				2020	50.4	180	35.2	41.6	91.2	60.2	78.3	93.9	78.8	46.4	35.2	69.2	180
				2021	33.4	68	62	52.2	94.2	73	51.7	50.3	60.6	18.3	33.4	57.1	94.2
		Zinc	mg/kg	2018	63.6	66.4	57.9	74.1	92.2	80.2	94.3	80	76.1	13.1	57.9	77	94.3
				2019	71.9	62.5	95.1	83.3	63	39.4	71	144	78.8	31	39.4	71.5	144
				2020	142	90.8	192	113	156	73.9	126	125	127	37.1	73.9	126	192
				2021	57.3	74	61.4	72.3	93.3	77.7	121	110	83.4	22.8	57.3	75.8	121
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2017	3.88	4.88	5.71	5.28	4.38	4	8.07	5.19	5.17	1.33	3.88	5.04	8.07
				2018	1.88	1.75	3.15	4.56	7.85	2.23	1.87	1.96	3.16	2.12	1.75	2.1	7.85
				2019	2.38	2.3	2.54	2.19	2.49	2.04	2.07	2.01	2.25	0.207	2.01	2.24	2.54
				2020	1.97	1.9	2.17	2.16	2.19	2.01	1.69	1.81	1.99	0.182	1.69	1.99	2.19
				2021	2.18	1.31	1.94	1.42	1.43	1.11	1.76	1.02	1.52	0.405	1.02	1.42	2.18
		Copper	mg/kg	2017	79.3	122	183	149	95.7	92	180	186	136	44.4	79.3	136	186
				2018	36.3	31.7	123	171	238	52.8	33.1	34.2	90	78.9	31.7	44.5	238
				2019	32	31.5	59	39.6	44.7	30.1	27.2	32.4	37.1	10.5	27.2	32.2	59
				2020	30.7	32.4	35.9	49.7	40.8	43.9	31.8	33.1	37.3	6.83	30.7	34.5	49.7
				2021	31.2	23.7	44.3	51.9	28	19	53.4	16.9	33.6	14.5	16.9	29.6	53.4
		Iron	mg/kg	2017	5,280	11,700	6,910	9,400	5,020	7,720	11,000	7,420	8,056	2,464	5,020	7,570	11,700
				2018	1,510	1,500	4,790	8,130	11,000	2,560	1,560	953	4,000	3,712	953	2,060	11,000
				2019	1,470	1,390	1,630	1,940	1,770	1,460	1,100	931	1,461	332	931	1,465	1,940
				2020	1,630	1,880	1,900	2,820	2,390	2,370	1,710	1,700	2,050	427	1,630	1,890	2,820
				2021	1,280	460	1,260	405	276	359	1,170	296	688	459	276	432	1,280
		Selenium	mg/kg	2017	1.33	1.06	1.49	1.67	1.59	1.05	1.18	1.31	1.34	0.234	1.05	1.32	1.67
				2018	0.93	0.91	0.81	0.85	2.55	0.99	0.89	0.91	1.1	0.586	0.81	0.91	2.55
				2019	1.11	1.5	1.29	1.1	<1.3	1.1	1.32	1.27	1.23	0.15	1.1	1.27	1.5
				2020	1.54	1.47	1.68	1.72	1.7	1.4	1.42	1.4	1.54	0.139	1.4	1.5	1.72
				2021	<2.5	<2.5	1.53	1.81	1.41	1.59	1.52	1.22	1.51	0.226	1.22	1.52	1.81

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Secondary Analytes**															
		Barium	mg/kg	2017	243	128	372	345	102	487	701	499	360	202	102	358	701
				2018	75.4	72.9	119	1,050	178	101	83.9	73.4	219	338	72.9	92.5	1,050
				2019	79	108	88.1	152	133	116	87.4	69.9	104	28.3	69.9	98	152
				2020	68.6	67.1	108	80.3	81	82.2	71.6	78.9	79.7	12.9	67.1	79.6	108
				2021	236	103	180	82.3	80.8	81.6	68.5	157	124	60.6	68.5	92.7	236
		Cadmium	mg/kg	2017	0.238	0.222	0.202	0.226	0.179	0.35	0.316	0.2	0.242	0.0599	0.179	0.224	0.35
				2018	0.155	0.189	0.254	0.265	0.286	0.209	0.213	0.211	0.223	0.043	0.155	0.212	0.286
				2019	0.208	0.156	0.317	0.743	0.17	0.197	0.255	0.244	0.286	0.192	0.156	0.226	0.743
				2020	0.145	0.114	0.165	0.198	0.228	0.179	0.165	0.182	0.172	0.0341	0.114	0.172	0.228
				2021	<0.25	0.066	0.156	0.153	0.093	0.124	0.145	0.094	0.119	0.0374	0.066	0.124	0.156
		Calcium	mg/kg	2017	207,000	140,000	156,000	210,000	193,000	161,000	154,000	160,000	172,625	26,662	140,000	160,500	210,000
				2018	198,000	202,000	172,000	155,000	226,000	214,000	178,000	218,000	195,375	24,859	155,000	200,000	226,000
				2019	219,000	307,000	210,000	202,000	276,000	197,000	248,000	222,000	235,125	38,945	197,000	220,500	307,000
				2020	231,000	221,000	227,000	228,000	216,000	231,000	251,000	278,000	235,375	20,021	216,000	229,500	278,000
				2021	278,000	221,000	235,000	236,000	216,000	226,000	235,000	228,000	234,375	19,026	216,000	231,500	278,000
		Cobalt	mg/kg	2017	4.06	9.42	4.14	5.19	2.94	6.55	6.15	5.19	5.46	1.98	2.94	5.19	9.42
				2018	1.99	1.42	3.35	7.1	8.44	2.04	1.28	0.738	3.29	2.89	0.738	2.02	8.44
				2019	1.47	1.22	1.98	1.89	1.54	1.48	1.14	1.09	1.48	0.329	1.09	1.48	1.98
				2020	1.39	1.26	1.58	1.98	2	1.58	1.25	1.25	1.54	0.311	1.25	1.48	2
				2021	1.66	0.947	1.99	1.04	1.1	0.775	1.28	1.22	1.25	0.397	0.775	1.16	1.99
		Manganese	mg/kg	2017	1,050	927	863	953	716	1,120	1,000	1,000	954	123	716	976	1,120
				2018	1,080	710	1,260	1,400	2,410	778	783	636	1,132	585	636	932	2,410
				2019	1,510	1,050	2,280	1,750	1,050	1,260	1,240	1,350	1,436	413	1,050	1,305	2,280
				2020	949	814	1,180	1,560	1,740	1,250	1,110	1,030	1,204	310	814	1,145	1,740
				2021	1,060	653	1,180	1,260	1,080	1,040	1,020	1,000	1,037	178	653	1,050	1,260
		Mercury	mg/kg	2017	0.0192	0.023	0.0313	0.0343	0.0235	0.0205	0.0565	0.0361	0.0306	0.0123	0.0192	0.0274	0.0565
				2018	0.0111	0.012	0.0236	0.0278	0.0665	0.0214	0.0143	0.0101	0.0234	0.0186	0.0101	0.0178	0.0665
				2019	<0.010	0.017	<0.010	0.015	0.049	0.021	<0.010	<0.010	0.0177	0.0128	<0.01	0.0125	0.049
				2020	0.0057	0.0076	0.007	0.0098	0.0086	0.0076	0.0059	0.0087	0.00761	0.00141	0.0057	0.0076	0.0098
				2021	0.0068	<0.0050	0.0063	<0.0050	<0.0050	<0.0050	0.0068	0.0055	0.00568	0.000655	<0.005	0.00525	0.0068
		Molybdenum	mg/kg	2017	1.25	0.983	2.31	1.45	1.05	0.781	7.25	1.24	2.04	2.16	0.781	1.25	7.25
				2018	1.64	1.45	1.85	2.29	3.27	1.15	1.21	0.974	1.73	0.753	0.974	1.54	3.27
				2019	1.65	2.02	1.69	1.37	1.22	1.51	2.25	1.53	1.66	0.337	1.22	1.59	2.25
				2020	1.61	1.47	1.58	2.05	1.74	1.58	1.29	1.23	1.57	0.258	1.23	1.58	2.05
				2021	<1.0	0.725	0.986	1.04	0.908	0.779	0.946	0.892	0.894	0.117	0.725	0.908	1.04
		Nickel	mg/kg	2017	7.73	77.1	5.44	7.57	3.89	30.1	25.8	6.22	20.5	25	3.89	7.65	77.1
				2018	1.85	1.75	3.87	4.57	9.24	2.98	1.59	1.16	3.38	2.65	1.16	2.42	9.24
				2019	2.3	2.4	2.1	1.8	<2.5	3.7	2.3	2	2.34	0.598	1.8	2.3	3.7
				2020	2.86	2.75	3.18	3.39	3.69	3.2	3.09	3.23	3.17	0.293	2.75	3.19	3.69
				2021	<5	1.82	2.49	2.27	2.25	1.77	2.8	3.34	2.39	0.589	1.77	2.27	3.34
		Phosphorus	mg/kg	2017	890	1,060	1,090	1,160	921	835	866	1,130	994	130	835	990	1,160
				2018	476	525	723	579	1,270	546	463	594	647	264	463	562	1,270
				2019	860	740	760	860	860	740	660	730	776	75.2	660	750	860
				2020	716	730	811	837	831	801	651	669	756	73.8	651	766	837
				2021	808	512	809	513	567	468	839	335	606	188	335	540	839
		Silver	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	<0.025	<0.025	<0.025	<0.025	<0.063	<0.025	<0.025	<0.025	<0.025	-	<0.025	<0.025	<0.025
				2020	0.0112	0.0134	0.0084	0.034	0.0102	0.0091	0.0078	0.0102	0.013	0.00865	0.0078	0.0102	0.034
				2021	<0.125	0.006	0.0067	0.017	0.0088	0.0086	0.0135	0.0058	0.00949	0.00452	0.0058	0.0086	0.017
		Sodium	mg/kg	2017	437	337	481	484	407	345	342	403	404	60	337	405	484
				2018	376	376	539	711	669	343	311	293	452	165	293	376	711
				2019	330	360	260	350	290	320	330	340	322	32.8	260	330	360
				2020	302	355	338	348	338	308	269	286	318	31.3	269	323	355
				2021	<500	213	245	223	206	171	213	168	206	29.5	168	213	245
		Strontium	mg/kg	2017	587	381	453	647	502	473	452	461	494	84.4	381	467	647
				2018	588	602	526	1,280	528	604	557	569	657	254	526	578	1,280
				2019	523	765	486	534	674	543	624	515	583	96.2	486	538	765
				2020	556	501	533	525	517	552	558	608	544	32.9	501	542	608
				2021	593	525	548	543	502	494	505	532	530	32.1	494	528	593
		Tin	mg/kg	2017	0.1	<0.20	0.13	0.22	0.11	<0.20	<0.20	0.15	0.135	0.0448	0.1	0.13	0.22
				2018	<0.10	<0.10	<0.20	0.29	0.35	<0.20	<0.10	<0.10	0.155	0.0281	<0.1	0.2	0.35
				2019	<0.50	<0.50	<0.50	<0.50	<1.3	<0.50	<0.50	<0.50	<0.5	-	<0.5	<0.5	<0.5
				2020	0.14	0.16	<0.10	<0.10	<0.10	0.12	<0.10	0.15	0.121	0.0177	<0.1	0.11	0.16
				2021	<2.5	<0.10	<0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	86.9	77.8	84.9	101	102	114	59	43.1	83.6	23.5	43.1	85.9	114
				2020	77.4	97.7	89.7	116	111	124	94.2	94.2	101	15.3	77.4	96	124
				2021	58.4	9.66	23.2	8.98	3.3	2.6	35.6	8.94	18.8	19.5	2.6	9.32	58.4
		Uranium	mg/kg	2017	0.154	0.446	0.225	0.247	0.177	0.288	0.409	0.197	0.268	0.107	0.154	0.236	0.446
				2018	0.189	0.165	0.303	0.326	0.445	0.181	0.163	0.144	0.24	0.107	0.144	0.185	0.445
				2019	0.083	0.098	0.089	0.105	0.119	0.09	0.093	0.084	0.0951	0.012	0.083	0.0915	0.119
				2020	0.0864	0.094	0.1	0.113	0.1	0.0916	0.0836	0.0886	0.0946	0.00949	0.0836	0.0928	0.113
				2021	0.0828	0.0505	0.0641	0.0558	0.0481	0.0239	0.0682	0.0337	0.0534	0.0189	0.0239	0.0532	0.0828
		Vanadium	mg/kg	2017	21.7	37	23.9	34.9	17.9	23.3	26.3	25.7	26.3	6.49	17.9	24.8	37
				2018	6.72	6.78	18	28.2	39.3	9.83	6.53	4.63	15	12.6	4.63	8.3	39.3
				2019	7.05	6.36	7.07	8.34	7.1	6	5.26	4.33	6.44	1.25	4.33	6.7	8.34
				2020	6.57	7.68	8.18	11	9.75	9.61	6.91	7.38	8.38	1.57	6.57	7.93	11
				2021	4.09	1.99	3.92	2.5	1.99	1.07	4.09	1.81	2.68	1.19	1.07	2.24	4.09
		Zinc	mg/kg	2017	28.2	29.1	19.8	26.5	17	27.7	24.2	22.1	24.3	4.36	17	25.4	29.1
				2018	7.9	7.8	20.2	29.5	30	9.2	6.4	5.1	14.5	10.5	5.1	8.55	30
				2019	8.4	7.6	9.8	9.1	<13	8.4	7.7	7.4	8.34	0.932	7.4	8.4	9.8
				2020	11.7	9.7	11.8	13.7	15.2	10.4	8.62	10.2	11.4	2.17	8.62	11	15.2
				2021	<25	5.8	9	7.1	5.9	5.3	7.1	5.4	6.51	1.41	5.3	5.9	9
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	5.55	8.18	6.65	12.5	8.53	-	-	-	8.28	2.65	5.55	8.18	12.5
				2018	3.81	3.07	4.59	2.73	2.75	2.56	3.54	3.95	3.38	0.716	2.56	3.3	4.59
				2019	2	2.41	2.96	2.09	3.65	3.14	3.75	2.09	2.76	0.713	2	2.68	3.75
				2020	2.68	2.27	3.06	2.46	2.64	2.51	4.22	2.58	2.8	0.616	2.27	2.61	4.22
				2021	2.18	3.1	2.79	2.2	2.81	2.24	2.44	2.38	2.52	0.341	2.18	2.41	3.1
		Copper	mg/kg	2010	49.8	73.4	54.3	89	75.5	-	-	-	68.4	16.2	49.8	73.4	89
				2018	111	92.3	102	68.7	48.4	76.4	99.4	222	103	52.4	48.4	95.8	222
				2019	45.4	49.7	62.3	49.5	74.4	91.1	125	62.7	70	26.8	45.4	62.5	125
				2020	42	31.5	50.1	68.3	42.6	39.9	83.8	43.1	50.2	17.3	31.5	42.9	83.8
				2021	28.6	75.4	221	27.4	49.7	25.8	188	89.7	88.2	76	25.8	62.5	221
		Iron	mg/kg	2010	14,000	18,200	14,500	23,800	18,000	-	-	-	17,700	3,920	14,000	18,000	23,800
				2018	5,310	2,490	4,520	3,130	1,560	3,040	6,030	5,000	3,885	1,554	1,560	3,825	6,030
				2019	2,040	2,070	3,070	2,220	4,040	3,300	6,340	2,660	3,218	1,437	2,040	2,865	6,340
				2020	2,410	1,690	3,020	3,510	2,240	1,820	5,010	2,340	2,755	1,088	1,690	2,375	5,010
				2021	1,170	2,640	2,310	422	2,150	1,020	1,290	1,960	1,620	758	422	1,625	2,640
		Selenium	mg/kg	2010	3.6	5.3	3.5	6.3	5.5	-	-	-	4.84	1.24	3.5	5.3	6.3
				2018	1.59	1.3	1.51	1.47	1.34	1.61	1.26	1.42	1.44	0.131	1.26	1.44	1.61
				2019	1.3	1.5	1.65	1.51	1.81	2.01	1.57	1.58	1.62	0.214	1.3	1.58	2.01
				2020	2	1.93	3.07	1.92	2.72	2.16	1.73	1.74	2.16	0.484	1.73	1.96	3.07
				2021	2.08	2.39	2.44	2.03	3.23	2.57	2.58	1.87	2.4	0.426	1.87	2.42	3.23

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Secondary Analytes**															
		Barium	mg/kg	2010	143	208	144	233	195	-	-	-	185	39.9	143	195	233
				2018	319	105	162	106	97.8	101	122	192	151	75.9	97.8	114	319
				2019	99.4	112	137	127	140	130	128	96.2	121	16.7	96.2	128	140
				2020	107	86.9	111	96.8	91.5	100	128	108	104	12.9	86.9	104	128
				2021	81.9	118	148	88.5	202	113	98.2	124	122	38.7	81.9	116	202
		Cadmium	mg/kg	2010	0.254	0.337	0.246	0.404	0.368	-	-	-	0.322	0.0698	0.246	0.337	0.404
				2018	0.203	0.19	0.24	0.217	0.233	0.235	0.203	0.252	0.222	0.0217	0.19	0.225	0.252
				2019	0.27	0.24	0.451	0.296	0.351	0.361	0.241	0.25	0.308	0.0748	0.24	0.283	0.451
				2020	0.241	0.186	0.298	0.248	0.24	0.257	0.232	0.261	0.245	0.0314	0.186	0.244	0.298
				2021	0.124	0.168	0.403	0.161	0.2	0.154	0.178	0.166	0.194	0.087	0.124	0.167	0.403
		Calcium	mg/kg	2010	9,990	13,700	11,300	16,600	14,900	-	-	-	13,298	2,672	9,990	13,700	16,600
				2018	183,000	270,000	246,000	276,000	247,000	304,000	255,000	270,000	256,375	35,063	183,000	262,500	304,000
				2019	250,000	237,000	275,000	246,000	286,000	258,000	259,000	224,000	254,375	19,906	224,000	254,000	286,000
				2020	246,000	220,000	235,000	214,000	195,000	224,000	200,000	220,000	219,250	16,791	195,000	220,000	246,000
				2021	210,000	223,000	249,000	198,000	244,000	266,000	251,000	236,000	234,625	22,778	198,000	240,000	266,000
		Cobalt	mg/kg	2010	6.77	8.94	7.23	11.4	9.01	-	-	-	8.67	1.83	6.77	8.94	11.4
				2018	3.26	1.46	2.25	1.79	1.12	1.87	3.18	2.86	2.22	0.803	1.12	2.06	3.26
				2019	1.6	1.59	2.31	1.72	3.03	2.53	3.8	1.85	2.3	0.79	1.59	2.08	3.8
				2020	1.9	1.39	2.18	2.16	1.69	1.49	2.68	1.61	1.89	0.433	1.39	1.8	2.68
				2021	1.05	1.92	1.55	1.32	1.84	0.95	1.2	1.45	1.41	0.35	0.95	1.38	1.92
		Manganese	mg/kg	2010	4,360	6,670	4,440	7,250	7,320	-	-	-	6,008	1,490	4,360	6,670	7,320
				2018	1,490	1,100	1,380	1,440	1,160	1,400	1,130	1,320	1,302	152	1,100	1,350	1,490
				2019	2,300	2,240	3,310	2,170	2,920	3,210	2,120	1,960	2,529	532	1,960	2,270	3,310
				2020	2,640	2,280	2,970	2,540	2,300	2,380	2,220	2,340	2,459	249	2,220	2,360	2,970
				2021	1,880	2,380	2,060	2,370	3,240	2,170	2,540	2,460	2,388	408	1,880	2,375	3,240
		Mercury	mg/kg	2010	0.0608	0.0895	0.0642	0.0219	0.0176	-	-	-	0.0508	0.0305	0.0176	0.0608	0.0895
				2018	0.0354	0.0159	0.0193	0.0231	0.0181	0.0223	0.0413	0.025	0.025	0.00885	0.0159	0.0227	0.0413
				2019	0.014	0.016	0.02	0.019	0.023	0.026	0.032	0.017	0.0209	0.00591	0.014	0.0195	0.032
				2020	0.0168	0.0136	0.0157	0.0152	0.0126	0.0097	0.0147	0.0092	0.0134	0.00277	0.0092	0.0142	0.0168
				2021	0.0092	0.015	0.0249	0.0088	0.0183	0.0074	0.0101	0.0062	0.0125	0.00643	0.0062	0.00965	0.0249
		Molybdenum	mg/kg	2010	1.33	1.2	0.94	1.62	1.34	-	-	-	1.29	0.247	0.94	1.33	1.62
				2018	1.09	0.62	0.8	0.6	0.599	0.73	0.63	0.65	0.715	0.167	0.599	0.64	1.09
				2019	1	1.19	1.06	1.36	1.09	1.26	1.07	1.14	1.15	0.119	1	1.12	1.36
				2020	1.67	1.59	2.07	1.4	1.57	1.65	1.56	1.18	1.59	0.252	1.18	1.58	2.07
				2021	1.22	1.66	1.26	1.49	1.48	1.21	1.14	0.926	1.3	0.233	0.926	1.24	1.66
		Nickel	mg/kg	2010	17.9	18.6	15.1	23.3	18.9	-	-	-	18.8	2.95	15.1	18.6	23.3
				2018	4.88	2.5	4	2.7	1.37	2.9	4.7	3.8	3.36	1.2	1.37	3.35	4.88
				2019	2.6	2.4	3.6	2.6	3.7	4.7	5.9	2.8	3.54	1.23	2.4	3.2	5.9
				2020	3.65	2.34	4.07	3.78	3.11	2.65	3.12	2.73	3.18	0.606	2.34	3.12	4.07
				2021	1.94	3.55	2.95	2.76	2.95	1.99	2.2	2.43	2.6	0.557	1.94	2.6	3.55
		Phosphorus	mg/kg	2010	1,600	2,330	1,810	2,470	2,930	-	-	-	2,228	532	1,600	2,330	2,930
				2018	639	570	838	625	415	600	848	878	677	163	415	632	878
				2019	510	720	930	720	910	910	820	500	752	173	500	770	930
				2020	957	1,020	974	747	919	844	974	1,010	931	92.7	747	966	1,020
				2021	939	1,160	1,730	356	1,260	1,060	1,120	920	1,068	384	356	1,090	1,730
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	<0.063	<0.025	<0.025	<0.025	<0.025	<0.025	0.059	<0.025	0.0299	-	<0.025	0.025	0.059
				2020	0.0137	<0.0125	0.0182	0.0185	0.0134	0.0112	0.0315	0.011	0.0161	0.00699	0.011	0.0136	0.0315
				2021	0.0083	0.0249	0.0781	0.0119	0.0229	0.0141	0.0346	0.0108	0.0257	0.0229	0.0083	0.0185	0.0781
		Sodium	mg/kg	2010	340	440	370	490	510	-	-	-	430	73.8	340	440	510
				2018	552	430	640	540	290	370	750	520	512	147	290	530	750
				2019	290	350	400	270	520	500	560	310	400	113	270	375	560
				2020	355	423	294	320	417	360	397	370	367	45.2	294	365	423
				2021	325	450	653	303	402	376	329	249	386	124	249	352	653
		Strontium	mg/kg	2010	107	148	117	176	140	-	-	-	138	27.2	107	140	176
				2018	557	669	598	622	628	720	609	628	629	48.5	557	625	720
				2019	602	589	637	584	690	611	640	542	612	44.4	542	606	690
				2020	582	520	540	512	504	556	490	539	530	29.9	490	530	582
				2021	526	558	654	546	596	645	597	563	586	46	526	580	654
		Tin	mg/kg	2010	1	1.52	1.17	1.61	2.06	-	-	-	1.47	0.413	1	1.52	2.06
				2018	<0.20	<1.0	<0.50	<0.50	<0.20	<0.50	<0.50	<0.50	<0.2	-	<0.2	<0.2	<0.2
				2019	<1.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5	-	<0.5	<0.5	<0.5
				2020	<0.25	<0.25	<0.25	0.16	<0.10	0.24	0.16	0.14	0.16	0.0542	<0.1	0.16	0.24
				2021	<0.10	<0.12	<0.13	<0.10	<0.13	<0.10	<0.10	<0.12	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2010	571	679	552	884	654	-	-	-	668	132	552	654	884
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	97.6	95	147	95.3	177	138	267	106	140	59.2	95	122	267
				2020	117	83	136	165	118	88.8	239	108	132	50.5	83	118	239
				2021	37.1	113	98	12.2	87.8	31.6	37.8	78.9	62	36.8	12.2	58.4	113
		Uranium	mg/kg	2010	0.555	0.764	0.581	0.966	0.773	-	-	-	0.728	0.167	0.555	0.764	0.966
				2018	0.271	0.126	0.173	0.166	0.146	0.146	0.214	0.184	0.178	0.0461	0.126	0.17	0.271
				2019	0.116	0.115	0.142	0.111	0.188	0.171	0.219	0.126	0.148	0.0399	0.111	0.134	0.219
				2020	0.115	0.103	0.147	0.154	0.137	0.123	0.185	0.122	0.136	0.026	0.103	0.13	0.185
				2021	0.0863	0.137	0.142	0.0888	0.187	0.142	0.116	0.115	0.127	0.0328	0.0863	0.126	0.187
		Vanadium	mg/kg	2010	42.6	53.7	43.9	68.6	51.4	-	-	-	52	10.4	42.6	51.4	68.6
				2018	18	8.6	14.8	10.8	7.17	9.81	20.7	17.2	13.4	4.96	7.17	12.8	20.7
				2019	7.3	7.51	10.9	7.88	13	11.5	22	9.48	11.2	4.82	7.3	10.2	22
				2020	9.39	7.03	11.1	12.6	9.88	8.1	20.8	9.54	11.1	4.29	7.03	9.71	20.8
				2021	4.44	9.6	9.39	4.17	7.81	4.4	5.24	8.57	6.7	2.37	4.17	6.52	9.6
		Zinc	mg/kg	2010	55.2	77.1	56.6	88.9	78.9	-	-	-	71.3	14.8	55.2	77.1	88.9
				2018	18.4	15	22.4	18.8	12.2	20	23.9	25.8	19.6	4.52	12.2	19.4	25.8
				2019	<13	9.7	16.4	13.4	16.3	15.4	18.1	12	14	3.1	9.7	14.4	18.1
				2020	12.5	10.4	14.5	16.1	11.8	11.3	14.6	11.5	12.8	1.99	10.4	12.2	16.1
				2021	6.7	11.2	16.6	8.2	11.9	6.9	7.3	7.5	9.54	3.47	6.7	7.85	16.6
Lower Edney Creek	EDC-D (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2017	13.8	20.3	28.2	18.3	24.3	12.4	18.1	13.8	18.6	5.51	12.4	18.2	28.2
				2018	18.4	16.3	13.5	9.79	11.7	9.73	18	11.7	13.6	3.51	9.73	12.6	18.4
				2019	19	14.7	15.4	8.7	8.66	9.09	21.8	12.2	13.7	4.95	8.66	13.4	21.8
				2020	11.7	15.8	8.63	16.3	13	11.7	9.18	9.06	11.9	2.98	8.63	11.7	16.3
				2021	16.6	16.5	16.4	15.8	15.2	15.7	15.1	6.88	14.8	3.24	6.88	15.8	16.6
		Copper	mg/kg	2017	21.2	17.6	29	18.8	26	8.89	12.5	13.8	18.5	6.82	8.89	18.2	29
				2018	25.8	23.9	20.1	13.1	29.8	14.3	18.4	19.7	20.6	5.66	13.1	19.9	29.8
				2019	42.1	41.6	39.9	22.9	25.6	19	44.9	25.2	32.6	10.4	19	32.8	44.9
				2020	27.2	26	19.6	23.4	24.3	21.4	18.2	23.3	22.9	3.06	18.2	23.4	27.2
				2021	16.5	20.8	20.3	18	24.1	21.4	23.2	8.7	19.1	4.89	8.7	20.6	24.1
		Iron	mg/kg	2017	14,700	9,070	10,100	15,700	21,200	7,120	5,920	11,100	11,864	5,060	5,920	10,600	21,200
				2018	12,600	10,100	5,740	1,990	13,000	5,790	7,950	5,710	7,860	3,813	1,990	6,870	13,000
				2019	28,200	30,700	23,000	20,500	19,600	14,200	31,100	17,400	23,088	6,307	14,200	21,750	31,100
				2020	26,300	23,200	22,600	28,200	23,200	24,300	19,400	24,900	24,013	2,625	19,400	23,750	28,200
				2021	11,400	11,500	19,000	9,940	9,930	12,100	16,600	5,430	11,988	4,183	5,430	11,450	19,000
		Selenium	mg/kg	2017	0.94	2.07	3.71	1.51	1.24	0.88	1.7	0.876	1.62	0.948	0.876	1.38	3.71
				2018	3.51	2.65	2.44	2.15	1.86	1.75	2.17	1.95	2.31	0.569	1.75	2.16	3.51
				2019	1.19	4.82	2.37	0.54	0.54	0.71	1.1	0.7	1.5	1.47	0.54	0.905	4.82
				2020	0.655	0.95	0.387	0.55	0.84	0.609	0.544	0.454	0.624	0.189	0.387	0.58	0.95
				2021	2.99	1.88	1.15	1.76	2.24	1.82	1.4	0.68	1.74	0.7	0.68	1.79	2.99

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	EDC-D (Reference)	**Secondary Analytes**															
		Barium	mg/kg	2017	107	141	228	156	175	143	137	136	153	35.9	107	142	228
				2018	120	139	100	105	94.6	89.9	147	71	108	25.6	71	102	147
				2019	205	770	166	112	158	92.6	185	103	224	224	92.6	162	770
				2020	137	172	105	118	142	133	105	130	130	21.9	105	132	172
				2021	139	126	147	149	142	139	115	54.6	126	31.1	54.6	139	149
		Cadmium	mg/kg	2017	0.26	0.286	0.676	0.313	0.338	0.194	0.353	0.222	0.33	0.15	0.194	0.3	0.676
				2018	0.353	0.387	0.285	0.236	0.357	0.416	0.373	0.342	0.344	0.0577	0.236	0.355	0.416
				2019	0.677	0.373	0.451	0.225	0.348	0.482	0.656	0.299	0.439	0.162	0.225	0.412	0.677
				2020	0.274	0.557	0.185	0.224	0.516	0.468	0.214	0.21	0.331	0.155	0.185	0.249	0.557
				2021	0.37	0.366	0.318	0.335	0.435	0.431	0.301	0.132	0.336	0.0957	0.132	0.35	0.435
		Calcium	mg/kg	2017	22,800	88,700	146,000	58,000	23,600	96,400	73,100	142,000	81,325	47,079	22,800	80,900	146,000
				2018	34,200	61,800	106,000	107,000	55,600	19,800	48,500	12,400	55,663	35,611	12,400	52,050	107,000
				2019	17,000	10,000	10,700	9,530	15,000	8,870	12,000	10,300	11,675	2,869	8,870	10,500	17,000
				2020	9,520	12,600	8,080	8,390	9,060	9,830	10,200	9,060	9,592	1,403	8,080	9,290	12,600
				2021	35,600	30,500	27,400	49,300	49,800	27,500	14,300	15,300	31,213	13,416	14,300	29,000	49,800
		Cobalt	mg/kg	2017	9.01	4.82	6.26	7.59	10.7	4.08	4.3	5.17	6.49	2.4	4.08	5.72	10.7
				2018	9.48	7.51	3.36	1.56	7.46	4.51	7.38	4.04	5.66	2.68	1.56	5.94	9.48
				2019	15.7	13.1	13.7	10.2	9.6	7.36	15.8	9.35	11.9	3.15	7.36	11.6	15.8
				2020	12.8	16.7	10.1	12.6	15	14.2	9.4	11.8	12.8	2.45	9.4	12.7	16.7
				2021	8.09	7.21	10.8	5.91	7.73	7.97	8.54	2.92	7.4	2.27	2.92	7.85	10.8
		Manganese	mg/kg	2017	1,570	2,700	3,810	1,750	2,740	1,360	2,130	1,210	2,159	879	1,210	1,940	3,810
				2018	2,190	2,720	1,200	796	1,540	1,510	2,060	974	1,624	657	796	1,525	2,720
				2019	3,840	2,700	2,620	1,490	1,330	1,900	3,540	1,560	2,372	959	1,330	2,260	3,840
				2020	2,120	4,730	1,200	1,930	4,440	2,900	1,850	1,840	2,626	1,298	1,200	2,025	4,730
				2021	2,880	3,040	2,500	2,000	3,170	2,790	1,940	911	2,404	754	911	2,645	3,170
		Mercury	mg/kg	2017	0.0378	0.051	0.077	0.047	0.0835	0.036	0.056	0.034	0.0528	0.0187	0.034	0.049	0.0835
				2018	0.0838	0.0465	0.0355	0.0246	0.129	0.0375	0.0559	0.0555	0.0585	0.0336	0.0246	0.051	0.129
				2019	0.123	0.052	0.083	0.059	0.041	0.061	0.128	0.068	0.0769	0.0324	0.041	0.0645	0.128
				2020	0.0645	0.051	0.0325	0.0416	0.045	0.0356	0.0496	0.0554	0.0469	0.0105	0.0325	0.0473	0.0645
				2021	0.0402	0.0306	0.038	0.0336	0.034	0.0353	0.0701	0.0182	0.0375	0.0147	0.0182	0.0346	0.0701
		Molybdenum	mg/kg	2017	0.648	0.924	2.78	0.748	0.856	1.39	3.8	0.564	1.46	1.19	0.564	0.89	3.8
				2018	0.91	1.7	0.684	1.68	0.935	1.89	4.35	2.08	1.78	1.16	0.684	1.69	4.35
				2019	4.7	2.81	2.19	0.759	1.03	2.54	2.01	1.39	2.18	1.25	0.759	2.1	4.7
				2020	1.32	6.64	0.676	0.838	2.6	3.17	2.74	0.61	2.32	2.02	0.61	1.96	6.64
				2021	3.3	1.67	1.01	5.56	2.74	3.18	0.689	0.786	2.37	1.67	0.689	2.2	5.56
		Nickel	mg/kg	2017	21	12.1	21.6	17.3	22.9	7.93	11	10.6	15.6	5.84	7.93	14.7	22.9
				2018	20.8	18.6	11.5	7.18	15.3	11.1	15.5	14.4	14.3	4.34	7.18	14.8	20.8
				2019	32.3	28.7	31.6	24.2	25.2	16.6	36	22.9	27.2	6.2	16.6	27	36
				2020	30.5	39.1	23.9	27.5	34.4	28.1	20.8	26.4	28.8	5.81	20.8	27.8	39.1
				2021	16.8	17.7	21.4	15.1	24.6	20.6	21.2	7.06	18.1	5.37	7.06	19.2	24.6
		Phosphorus	mg/kg	2017	748	2,340	4,240	1,630	1,300	1,160	2,190	1,240	1,856	1,101	748	1,465	4,240
				2018	1,990	2,210	2,510	2,160	2,640	1,650	2,080	2,070	2,164	307	1,650	2,120	2,640
				2019	2,770	1,590	1,730	1,020	1,150	2,460	2,980	1,640	1,918	733	1,020	1,685	2,980
				2020	1,510	2,020	1,140	1,100	1,970	1,750	1,160	1,130	1,472	395	1,100	1,335	2,020
				2021	1,680	1,770	1,420	2,010	1,970	2,080	1,420	825	1,647	417	825	1,725	2,080
		Silver	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.113	0.118	0.101	0.082	0.111	0.0766	0.174	0.0907	0.108	0.0305	0.0766	0.106	0.174
				2020	0.102	0.0698	0.0738	0.0813	0.0576	0.0684	0.0659	0.088	0.0758	0.0141	0.0576	0.0718	0.102
				2021	0.0493	0.0773	0.0666	0.0682	0.071	0.0947	0.0743	0.0293	0.0663	0.0195	0.0293	0.0696	0.0947
		Sodium	mg/kg	2017	317	709	1,420	675	436	442	525	724	656	342	317	600	1,420
				2018	492	559	749	517	3,550	512	681	325	923	1,069	325	538	3,550
				2019	726	267	427	201	273	875	589	889	531	279	201	508	889
				2020	326	399	292	229	396	266	318	334	320	58.8	229	322	399
				2021	423	639	351	546	469	629	384	282	465	130	282	446	639
		Strontium	mg/kg	2017	88.9	301	529	236	137	328	328	435	298	145	88.9	314	529
				2018	144	230	339	381	179	135	256	96.8	220	101	96.8	204	381
				2019	142	94.1	88.3	72.8	83.4	68.3	95.2	77.7	90.2	23	68.3	85.8	142
				2020	83.1	116	69.4	64.4	76.2	95.9	85	73	82.9	16.6	64.4	79.7	116
				2021	200	153	129	252	200	166	82.7	76.7	157	60.4	76.7	160	252
		Tin	mg/kg	2017	<0.10	0.21	<0.20	0.16	0.15	<0.10	<0.10	<0.10	0.13	0.0241	<0.1	0.15	0.21
				2018	0.18	0.17	0.11	<0.10	0.41	0.12	0.14	<0.10	0.166	0.104	<0.1	0.13	0.41
				2019	1.83	0.67	1.58	0.19	1.18	2.87	6.68	0.41	1.93	2.11	0.19	1.38	6.68
				2020	0.24	0.32	0.19	0.17	0.3	0.22	0.18	0.21	0.229	0.0551	0.17	0.215	0.32
				2021	0.14	0.16	0.16	0.16	0.22	0.14	0.13	<0.10	0.151	0.0296	<0.1	0.15	0.22
		Titanium	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	808	335	399	465	329	290	590	362	447	174	290	380	808
				2020	652	597	704	575	620	638	636	787	651	66.9	575	637	787
				2021	141	231	318	212	181	270	305	113	221	74.4	113	222	318
		Uranium	mg/kg	2017	0.522	0.264	0.407	0.684	0.61	0.183	0.313	0.281	0.408	0.18	0.183	0.36	0.684
				2018	0.959	0.309	0.277	0.186	0.729	0.34	0.276	0.597	0.459	0.272	0.186	0.324	0.959
				2019	0.631	12.3	0.623	0.494	0.499	0.352	0.714	0.45	2.01	4.16	0.352	0.561	12.3
				2020	0.704	0.61	0.693	0.496	0.564	0.652	0.571	0.715	0.626	0.0786	0.496	0.631	0.715
				2021	0.366	0.284	0.335	0.323	0.311	0.386	0.367	0.126	0.312	0.0823	0.126	0.329	0.386
		Vanadium	mg/kg	2017	41.9	19.9	19.4	34.4	46.1	15.2	14.1	28.1	27.4	12.3	14.1	24	46.1
				2018	27.3	30.7	14.5	3.75	50.7	17.8	27.3	11	22.9	14.5	3.75	22.6	50.7
				2019	69.7	64.5	52.5	42	42.6	23.5	52.2	30.2	47.1	15.8	23.5	47.4	69.7
				2020	56.5	48.2	55.7	49.3	52.6	64	46.6	57.1	53.8	5.74	46.6	54.1	64
				2021	22.2	23.2	42.8	23.2	18.5	26.5	33	11.6	25.1	9.4	11.6	23.2	42.8
		Zinc	mg/kg	2017	32.9	38.9	75.1	48	56.8	30.7	58.7	30.9	46.5	16.1	30.7	43.5	75.1
				2018	41.8	39	21.4	12.7	42.4	35.5	62.8	64.2	40	17.8	12.7	40.4	64.2
				2019	118	78.8	72.8	49.8	58	45.7	88.9	56.5	71.1	24.1	45.7	65.4	118
				2020	59.8	88.6	46.8	53.5	57.6	88.5	54.2	49.4	62.3	16.7	46.8	55.9	88.6
				2021	55.8	39.4	54.2	65.5	47.2	59.5	42.7	17.6	47.7	14.9	17.6	50.7	65.5
Lower Hazeltine Creek	HAC-D (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	10.3	10.1	10.3	10.1	7.35	-	-	-	9.63	1.28	7.35	10.1	10.3
				2017	20.1	12.7	17.1	8.08	12.7	19.1	15.4	10.3	14.4	4.23	8.08	14	20.1
				2018	4.56	8.57	27.4	10.5	7.75	12.6	11	12.8	11.9	6.83	4.56	10.8	27.4
				2019	3.22	4.9	9.6	6.22	6.18	6.77	4.52	6.27	5.96	1.88	3.22	6.2	9.6
				2020	6.8	23.2	3.58	9.02	4.53	11.4	4.3	4.22	8.38	6.58	3.58	5.66	23.2
				2021	43.8	6.42	8.98	8.88	11	9.88	7.81	6.18	12.9	12.6	6.18	8.93	43.8
		Copper	mg/kg	2010	27.8	25	24.6	26.1	14.6	-	-	-	23.6	5.19	14.6	25	27.8
				2017	281	225	191	158	202	254	311	289	239	53.6	158	240	311
				2018	67.7	173	118	222	115	214	146	279	167	68.9	67.7	160	279
				2019	74.5	109	159	130	135	110	92.9	121	116	26.1	74.5	116	159
				2020	92.2	112	65.8	127	78	102	70.3	62.9	88.8	23.4	62.9	85.1	127
				2021	87.2	65.5	265	352	631	374	300	474	319	188	65.5	326	631
		Iron	mg/kg	2010	17,800	17,400	15,400	15,300	9,110	-	-	-	15,002	3,484	9,110	15,400	17,800
				2017	19,500	16,800	23,800	12,100	13,700	26,400	28,700	14,600	19,450	6,215	12,100	18,150	28,700
				2018	4,730	10,500	14,900	16,500	10,400	16,200	13,800	21,300	13,541	4,996	4,730	14,350	21,300
				2019	5,980	9,480	24,600	15,000	13,900	13,800	8,800	13,900	13,182	5,604	5,980	13,850	24,600
				2020	18,500	21,200	8,350	19,300	11,400	21,500	10,200	8,520	14,871	5,776	8,350	14,950	21,500
				2021	5,200	4,630	12,800	17,600	25,900	13,100	10,400	14,700	13,041	6,847	4,630	12,950	25,900

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Selenium	mg/kg	2010	1.32	1.21	1.54	1.71	1.31	-	-	-	1.42	0.203	1.21	1.32	1.71
				2017	1.26	0.79	1.67	0.94	1.43	1.29	1.72	1.88	1.37	0.381	0.79	1.36	1.88
				2018	1.1	1	1.15	0.98	1.1	0.8	1.1	1.24	1.06	0.132	0.8	1.1	1.24
				2019	0.7	0.97	0.54	0.75	0.89	0.59	0.99	0.87	0.788	0.169	0.54	0.81	0.99
				2020	1	0.76	1.01	0.82	0.958	0.726	1.22	1.13	0.953	0.175	0.726	0.979	1.22
				2021	1.45	1.55	1.55	1.49	1.12	2.26	2.05	0.54	1.5	0.528	0.54	1.52	2.26
		Secondary Analytes															
		Barium	mg/kg	2010	189	162	189	179	113	-	-	-	166	31.8	113	179	189
				2017	160	84.9	93.4	124	133	123	157	203	135	38.3	84.9	128	203
				2018	106	99.2	159	3,840	114	132	150	232	604	1,308	99.2	141	3,840
				2019	101	131	308	148	140	118	146	171	158	64.2	101	143	308
				2020	198	195	191	285	145	427	176	296	239	92.1	145	196	427
				2021	90.7	119	286	268	344	374	304	550	292	145	90.7	295	550
		Cadmium	mg/kg	2010	0.267	0.237	0.31	0.29	0.201	-	-	-	0.261	0.0432	0.201	0.267	0.31
				2017	0.572	0.332	0.536	0.412	0.678	0.415	0.546	0.875	0.546	0.172	0.332	0.541	0.875
				2018	0.31	0.41	0.599	0.493	0.57	0.29	0.49	0.764	0.491	0.157	0.29	0.492	0.764
				2019	0.538	0.664	0.28	0.49	0.448	0.356	0.874	0.714	0.546	0.196	0.28	0.514	0.874
				2020	0.485	0.194	0.908	0.499	0.729	0.424	1.03	1.24	0.689	0.351	0.194	0.614	1.24
				2021	0.261	0.306	0.46	0.376	0.399	0.331	0.398	0.167	0.337	0.0925	0.167	0.354	0.46
		Calcium	mg/kg	2010	23,400	23,400	26,700	20,600	21,900	-	-	-	23,200	2,279	20,600	23,400	26,700
				2017	36,900	28,100	35,000	54,500	60,200	35,700	59,100	71,600	47,638	15,628	28,100	45,700	71,600
				2018	283,000	211,000	175,000	149,000	232,000	112,000	210,000	129,000	187,625	57,221	112,000	192,500	283,000
				2019	150,000	193,000	58,900	141,000	140,000	101,000	210,000	146,000	142,488	47,652	58,900	143,500	210,000
				2020	188,000	93,600	234,000	129,000	182,000	120,000	210,000	242,000	174,825	55,006	93,600	185,000	242,000
				2021	185,000	238,000	33,300	28,000	32,100	26,900	28,000	17,700	73,625	86,395	17,700	30,050	238,000
		Cobalt	mg/kg	2010	10.8	9.43	8.36	9.12	5.65	-	-	-	8.67	1.91	5.65	9.12	10.8
				2017	14.8	9.69	9.21	6.17	8.48	9.98	11.7	8.19	9.78	2.58	6.17	9.45	14.8
				2018	2.28	4.43	5.53	7.41	4.73	8.01	6.75	10.9	6.26	2.62	2.28	6.14	10.9
				2019	3.3	4.73	10.3	6.5	6.23	6.6	4.88	7.45	6.25	2.1	3.3	6.36	10.3
				2020	6.34	9.27	7.01	6.96	4.91	8.55	5.2	6.15	6.8	1.51	4.91	6.65	9.27
				2021	3.18	2.66	9.15	7.63	13.5	6.03	4.87	8.37	6.92	3.55	2.66	6.83	13.5
		Manganese	mg/kg	2010	3,540	3,100	2,880	4,180	2,700	-	-	-	3,280	593	2,700	3,100	4,180
				2017	1,660	1,000	1,650	951	2,070	1,540	1,800	3,110	1,723	677	951	1,655	3,110
				2018	504	759	1,230	1,210	1,190	765	1,180	6,020	1,607	1,804	504	1,185	6,020
				2019	1,180	1,330	716	972	1,040	757	2,020	3,430	1,431	906	716	1,110	3,430
				2020	1,510	573	2,930	1,320	1,970	1,180	3,170	7,990	2,580	2,355	573	1,740	7,990
				2021	904	988	1,130	627	762	608	458	415	736	255	415	694	1,130
		Mercury	mg/kg	2010	0.0096	0.0088	0.0089	0.0102	0.0068	-	-	-	0.00886	0.00128	0.0068	0.0089	0.0102
				2017	0.0686	0.064	0.0416	0.0444	0.056	0.127	0.067	0.0626	0.0664	0.0265	0.0416	0.0633	0.127
				2018	0.0183	0.0346	0.0466	0.0606	0.0291	0.0567	0.0565	0.0546	0.0446	0.0155	0.0183	0.0506	0.0606
				2019	0.019	0.022	0.05	0.029	0.026	0.03	0.029	0.037	0.0302	0.00965	0.019	0.029	0.05
				2020	0.0226	0.0319	0.0136	0.0292	0.0149	0.0285	0.0135	0.0117	0.0207	0.00827	0.0117	0.0188	0.0319
				2021	0.0255	0.0157	0.0419	0.0532	0.0886	0.0647	0.227	0.0642	0.0726	0.0666	0.0157	0.0587	0.227
		Molybdenum	mg/kg	2010	0.76	0.74	1.44	0.83	0.68	-	-	-	0.89	0.312	0.68	0.76	1.44
				2017	3.33	1.35	7.76	1.4	3.17	2.5	3.4	4.95	3.48	2.08	1.35	3.25	7.76
				2018	0.58	0.74	0.72	1.28	1.04	1.16	0.87	2.4	1.1	0.577	0.58	0.955	2.4
				2019	0.83	1.29	0.97	1.7	0.94	0.79	0.94	1.1	1.07	0.299	0.79	0.955	1.7
				2020	0.934	0.753	0.943	0.805	0.747	0.847	0.932	1.11	0.884	0.121	0.747	0.89	1.11
				2021	0.634	1.4	1.92	2.2	3.07	1.51	1.33	0.879	1.62	0.774	0.634	1.46	3.07
		Nickel	mg/kg	2010	20.2	18	16.8	17	9.5	-	-	-	16.3	4.03	9.5	17	20.2
				2017	28.1	26.1	21	9.93	15	17.8	21.3	14.3	19.2	6.14	9.93	19.4	28.1
				2018	4.3	6.4	12.1	15.1	7.6	11.2	11.8	19.3	11	4.86	4.3	11.5	19.3
				2019	7.6	9.6	20.4	12.6	11.7	12.2	9	14.3	12.2	3.97	7.6	12	20.4
				2020	13.6	30.5	30	13.1	8.91	16.3	8.6	9.26	16.3	9.03	8.6	13.4	30.5
				2021	7.46	4.68	8.79	13.1	18.8	9.27	7.78	9.02	9.86	4.3	4.68	8.9	18.8
		Phosphorus	mg/kg	2010	1,070	1,070	1,140	1,200	1,100	-	-	-	1,116	55	1,070	1,100	1,200
				2017	825	826	738	676	655	986	1,150	869	841	165	655	826	1,150
				2018	580	730	779	960	780	838	930	1,170	846	177	580	809	1,170
				2019	550	800	1,340	990	960	830	680	1,040	899	242	550	895	1,340
				2020	1,300	1,310	645	1,120	747	1,040	742	692	950	276	645	894	1,310
				2021	930	1,430	2,220	2,010	1,490	2,530	2,190	983	1,723	599	930	1,750	2,530
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.035	0.047	0.111	0.07	0.0817	0.0626	0.0428	0.0627	0.0641	0.0243	0.035	0.0626	0.111
				2020	0.0443	0.0719	0.0236	0.0683	0.041	0.071	0.0332	0.0272	0.0476	0.0201	0.0236	0.0426	0.0719
				2021	0.0302	0.0369	0.0978	0.125	0.255	0.0828	0.0961	0.0852	0.101	0.0697	0.0302	0.0906	0.255
		Sodium	mg/kg	2010	520	510	650	560	490	-	-	-	546	63.5	490	520	650
				2017	450	473	284	328	438	462	646	621	463	125	284	456	646
				2018	290	320	410	460	330	343	970	430	444	221	290	376	970
				2019	240	310	330	290	280	220	310	330	289	40.5	220	300	330
				2020	278	421	314	253	235	354	252	253	295	64.3	235	266	421
				2021	266	514	1,070	679	1,010	912	853	280	698	316	266	766	1,070
		Strontium	mg/kg	2010	168	164	177	138	141	-	-	-	158	17.2	138	164	177
				2017	192	140	203	223	277	174	283	319	226	61.3	140	213	319
				2018	708	508	441	397	567	332	538	361	482	124	332	474	708
				2019	372	501	224	383	396	276	517	386	382	99.2	224	384	517
				2020	477	308	573	368	465	415	518	588	464	97.3	308	471	588
				2021	425	536	240	151	196	169	166	126	251	148	126	182	536
		Tin	mg/kg	2010	1.51	1.13	1.33	1.21	1.06	-	-	-	1.25	0.178	1.06	1.21	1.51
				2017	0.2	<0.20	<0.20	<0.20	<0.20	0.35	0.37	0.24	0.245	0.0783	0.2	0.2	0.37
				2018	<1.0	<1.0	<0.50	<0.50	<1.0	<0.20	<1.0	<0.50	<0.2	-	<0.2	<0.2	<0.2
				2019	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5	-	<0.5	<0.5	<0.5
				2020	0.24	0.25	0.29	0.21	0.14	0.24	0.11	<0.10	0.198	0.0701	<0.1	0.225	0.29
				2021	<0.12	<0.12	0.34	0.33	0.41	0.24	0.19	0.24	0.249	0.0857	<0.12	0.24	0.41
		Titanium	mg/kg	2010	590	651	513	497	272	-	-	-	505	144	272	513	651
				2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	209	301	750	473	494	443	341	514	441	164	209	458	750
				2020	648	723	520	566	378	658	356	252	513	168	252	543	723
				2021	14.2	93.8	419	588	888	601	461	513	447	282	14.2	487	888
		Uranium	mg/kg	2010	0.722	0.59	0.494	0.534	0.283	-	-	-	0.525	0.16	0.283	0.534	0.722
				2017	0.936	0.569	1.02	0.487	0.502	0.659	0.696	0.719	0.698	0.193	0.487	0.678	1.02
				2018	0.251	0.367	0.559	0.497	0.354	0.683	0.457	0.695	0.483	0.158	0.251	0.477	0.695
				2019	0.19	0.312	0.699	0.486	0.398	0.401	0.291	0.4	0.397	0.151	0.19	0.399	0.699
				2020	0.452	0.594	0.237	0.465	0.275	0.601	0.267	0.234	0.391	0.157	0.234	0.364	0.601
				2021	0.393	0.24	0.311	0.354	0.507	0.24	0.199	0.296	0.318	0.0996	0.199	0.304	0.507
		Vanadium	mg/kg	2010	57.7	55.2	43.8	43.7	26.6	-	-	-	45.4	12.3	26.6	43.8	57.7
				2017	66.2	48.4	37.1	35.7	39.9	77.8	84.3	45.6	54.4	19.1	35.7	47	84.3
				2018	14.8	35.3	38.2	56.6	35.9	55.6	41.3	68.4	43.3	16.6	14.8	39.8	68.4
				2019	18.3	29.3	71.4	43.9	42.5	40.7	27.2	42.6	39.5	15.9	18.3	41.6	71.4
				2020	59.2	62	24.9	67	43.5	72.8	36.1	34	49.9	17.6	24.9	51.4	72.8
				2021	10.5	13.8	40.8	58.2	79.9	42.6	35	44.9	40.7	22.5	10.5	41.7	79.9

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.2: Periphyton Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Zinc	mg/kg	2010	51.8	42.3	40.1	39.1	25.9	-	-	-	39.8	9.27	25.9	40.1	51.8
				2017	61	49.9	57.7	41.8	60	64.3	76.6	67.4	59.8	10.6	41.8	60.5	76.6
				2018	15	29	38.8	49.4	31	34	39	56.1	36.5	12.6	15	36.4	56.1
				2019	21.8	27.7	48	34.6	33.1	32.7	32.5	41.6	34	7.99	21.8	32.9	48
				2020	41.7	40.1	45.5	43.1	40.6	40.9	51.2	56.7	45	5.98	40.1	42.4	56.7
				2021	21.6	21.4	46	48.9	72.4	61.6	49.8	35.5	44.6	18	21.4	47.5	72.4
Lower Edney Creek	E1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2019	9.37	16.2	6.32	9.31	9.92	12.4	13.4	14.3	11.4	3.23	6.32	11.2	16.2
				2020	10.7	10.1	8.74	9.98	18	9.54	14	10.9	11.5	3.05	8.74	10.4	18
				2021	13.2	7.35	8.51	5.33	5.78	4.06	6.22	11.9	7.79	3.24	4.06	6.78	13.2
		Copper	mg/kg	2019	73.4	47.9	51.3	117	2,020	24.5	39.4	29.1	300	695	24.5	49.6	2,020
				2020	153	143	162	146	111	162	167	155	150	17.7	111	154	167
				2021	90.9	122	108	74.9	85.1	89.4	264	309	143	90.6	74.9	99.5	309
		Iron	mg/kg	2019	21,300	28,700	17,500	26,100	37,800	12,800	20,600	13,600	22,300	8,354	12,800	20,950	37,800
				2020	35,600	32,400	24,400	28,300	30,900	31,600	38,800	46,600	33,575	6,819	24,400	32,000	46,600
				2021	20,500	16,100	11,300	9,670	6,360	16,900	6,980	17,000	13,101	5,228	6,360	13,700	20,500
		Selenium	mg/kg	2019	0.77	1.17	0.46	0.59	1.51	0.62	0.9	0.62	0.83	0.352	0.46	0.695	1.51
				2020	0.917	0.82	0.59	0.74	0.76	0.682	0.906	0.865	0.785	0.114	0.59	0.79	0.917
				2021	0.83	0.81	0.71	0.76	1	0.96	1.39	0.87	0.916	0.214	0.71	0.85	1.39
		Secondary Analytes															
		Barium	mg/kg	2019	149	164	73.5	272	680	67.2	115	49.6	196	208	49.6	132	680
				2020	146	406	206	148	148	425	164	172	227	118	146	168	425
				2021	106	3,630	2,610	413	7,730	130	357	435	1,926	2,688	106	424	7,730
		Cadmium	mg/kg	2019	0.299	0.611	0.178	0.336	0.157	0.435	0.578	0.67	0.408	0.197	0.157	0.386	0.67
				2020	0.203	0.244	0.162	0.215	0.231	0.18	0.23	0.225	0.211	0.028	0.162	0.22	0.244
				2021	0.326	0.382	0.185	0.255	0.204	0.266	0.254	0.269	0.268	0.0629	0.185	0.26	0.382
		Calcium	mg/kg	2019	11,200	13,700	8,850	11,900	31,200	8,200	13,200	10,800	13,631	7,350	8,200	11,550	31,200
				2020	18,400	14,500	14,600	16,000	11,300	15,500	16,700	15,300	15,288	2,043	11,300	15,400	18,400
				2021	38,600	94,400	116,000	278,000	167,000	122,000	199,000	155,000	146,250	72,139	38,600	138,500	278,000
		Cobalt	mg/kg	2019	9.53	13.1	6.08	12.6	28.9	5.94	9.22	6.57	11.5	7.56	5.94	9.38	28.9
				2020	11.8	12	9.45	11.8	10.9	11	13.1	13.8	11.7	1.35	9.45	11.8	13.8
				2021	8.78	6.28	5.11	6.05	2.74	7.36	3.86	11.4	6.45	2.76	2.74	6.16	11.4
		Manganese	mg/kg	2019	1,560	2,680	808	1,630	1,610	1,250	1,740	1,100	1,547	556	808	1,585	2,680
				2020	1,700	1,650	988	1,540	1,230	1,190	1,800	1,690	1,474	297	988	1,595	1,800
				2021	965	889	930	473	310	488	1,850	1,280	898	500	310	910	1,850
		Mercury	mg/kg	2019	0.221	0.104	0.042	0.087	0.066	0.088	0.086	0.07	0.0955	0.054	0.042	0.0865	0.221
				2020	0.0624	0.0425	0.0482	0.0627	0.0632	0.0481	0.0532	0.0707	0.0564	0.00975	0.0425	0.0578	0.0707
				2021	0.039	0.027	0.033	0.022	0.0338	0.357	0.0384	0.0463	0.0746	0.114	0.022	0.0361	0.357
		Molybdenum	mg/kg	2019	1.24	1.94	0.9	0.851	2.54	2.41	2.56	4.63	2.13	1.23	0.851	2.17	4.63
				2020	1.62	1.06	0.872	0.969	1.82	1.16	1.25	1.24	1.25	0.322	0.872	1.2	1.82
				2021	1.61	2.14	0.64	0.857	0.655	0.625	0.875	0.78	1.02	0.553	0.625	0.818	2.14
		Nickel	mg/kg	2019	22.3	30.3	14.5	24.9	11.5	13.9	22.3	15.3	19.4	6.54	11.5	18.8	30.3
				2020	24.1	23	18.4	25.7	23.7	19.4	24.4	25.2	23	2.67	18.4	23.9	25.7
				2021	22.5	18.4	8.27	11.3	5.6	15.4	4.79	10	12	6.26	4.79	10.6	22.5
		Phosphorus	mg/kg	2019	1,820	2,480	1,360	1,200	1,310	2,700	2,870	3,840	2,198	934	1,200	2,150	3,840
				2020	1,380	1,550	1,160	1,200	1,830	1,270	1,490	1,610	1,436	228	1,160	1,435	1,830
				2021	1,310	1,620	1,110	1,060	1,260	1,580	1,830	1,170	1,368	277	1,060	1,285	1,830
		Silver	mg/kg	2019	0.104	0.17	0.06	0.121	0.314	0.0756	0.113	0.0631	0.128	0.0835	0.06	0.108	0.314
				2020	0.124	0.408	0.0988	0.149	0.0906	0.11	0.12	0.128	0.154	0.104	0.0906	0.122	0.408
				2021	<0.085	<0.115	<0.085	<0.095	0.0413	0.101	0.0623	0.128	0.0685	0.038	0.0413	0.0623	0.128
		Sodium	mg/kg	2019	929	806	519	385	420	665	366	381	559	217	366	470	929
				2020	416	382	410	357	842	539	449	580	497	159	357	432	842
				2021	835	885	802	575	797	2,570	687	600	969	656	575	800	2,570
		Strontium	mg/kg	2019	109	102	47.7	104	163	56.5	90.5	63.1	92	37.1	47.7	96.2	163
				2020	105	91.5	99.5	101	94.5	137	108	112	106	14.2	91.5	103	137
				2021	172	450	606	853	526	384	592	659	530	202	172	559	853
		Tin	mg/kg	2019	0.28	2.88	0.29	0.29	<0.50	0.94	0.6	1.33	0.862	0.911	0.28	0.445	2.88
				2020	0.43	0.35	0.33	0.35	0.32	0.44	0.52	0.51	0.406	0.0802	0.32	0.39	0.52
				2021	0.23	0.51	0.21	0.3	0.18	0.17	0.19	0.29	0.26	0.112	0.17	0.22	0.51
		Titanium	mg/kg	2019	456	491	447	710	374	276	434	271	432	139	271	440	710
				2020	956	893	744	1,170	805	1,020	1,110	1,320	1,002	193	744	988	1,320
				2021	498	469	630	409	327	707	253	910	525	215	253	484	910
		Uranium	mg/kg	2019	0.466	1.4	0.388	0.581	0.332	0.3	0.556	0.236	0.532	0.371	0.236	0.427	1.4
				2020	0.815	3.06	0.617	0.617	0.67	0.752	2.1	1.03	1.21	0.895	0.617	0.784	3.06
				2021	0.42	0.223	0.239	0.217	0.205	0.353	0.176	0.312	0.268	0.0847	0.176	0.231	0.42
		Vanadium	mg/kg	2019	41.8	46	50.9	65.1	84.5	22.5	37	27.3	46.9	20.2	22.5	43.9	84.5
				2020	107	108	74	75.5	103	104	132	158	108	27.6	74	106	158
				2021	54.4	35.5	41.1	20.1	22.6	58	22.2	52	38.2	15.5	20.1	38.3	58
		Zinc	mg/kg	2019	57.3	96.6	35.5	61	104	61.4	92.3	101	76.1	25.4	35.5	76.8	104
				2020	47.2	56	42.9	53.3	63	44.9	50.7	57.6	52	6.85	42.9	52	63
				2021	66.4	40.1	23.7	25.6	21.7	36.3	16	35.1	33.1	15.8	16	30.4	66.4

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All results are in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.3: Caddisfly Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Reference												
		Upper Edney Creek (EDC-U)												
		EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-6	EDC-U-7	EDC-U-8	Mean	Standard Deviation	Minimum	Median	Maximum
		8-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22					
Moisture	mg/kg dw	75.3	75.1	75.7	75.2	78.3	74.9	76.6	78.0	76.1	1.35	74.9	75.5	78.3
Aluminum	mg/kg dw	89.4	21.2	80.5	1,670	34.1	70.9	29.5	46.0	255	572	21.2	58.5	1,670
Antimony	mg/kg dw	0.0130	0.0120	0.0120	0.0360	<0.010	<0.010	<0.010	0.0110	0.0142	0.00906	<0.010	0.0115	0.0360
Arsenic	mg/kg dw	0.634	0.409	0.532	2.96	0.382	0.312	0.417	0.324	0.746	0.901	0.312	0.413	2.96
Barium	mg/kg dw	3.88	1.32	10.6	117	2.73	3.19	2.54	3.16	18.1	40.1	1.32	3.18	117
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	0.0600	<0.010	<0.010	<0.010	<0.010	0.0162	-	<0.010	0.0100	0.0600
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	0.0120	<0.010	<0.010	<0.010	<0.010	0.0102	-	<0.010	0.0100	0.0120
Boron	mg/kg dw	<1.0	<1.0	<1.0	2.60	<1.0	<1.0	<1.0	<1.0	1.20	-	<1.0	1.00	2.60
Cadmium	mg/kg dw	0.207	<0.017	0.116	1.09	0.0310	0.0400	0.0160	0.0290	0.193	0.372	0.0160	0.0355	1.09
Calcium	mg/kg dw	548	514	695	1,560	558	586	559	592	702	351	514	572	1,560
Cesium	mg/kg dw	0.00710	<0.0050	0.00610	0.0981	<0.0050	0.00510	<0.0050	<0.0050	0.0170	0.0354	<0.0050	0.00505	0.0981
Chromium	mg/kg dw	0.350	0.230	1.15	11.8	<0.20	0.800	0.370	1.84	2.09	4.00	<0.20	0.585	11.8
Cobalt	mg/kg dw	0.348	0.149	0.456	6.59	0.251	0.323	0.242	0.279	1.08	2.23	0.149	0.301	6.59
Copper	mg/kg dw	17.1	13.0	15.4	24.3	14.3	12.2	14.1	15.6	15.8	3.78	12.2	14.8	24.3
Iron	mg/kg dw	224	109	242	3,620	131	196	115	173	601	1,221	109	184	3,620
Lead	mg/kg dw	0.0570	<0.050	0.0660	0.626	<0.050	<0.050	<0.050	0.0500	0.125	0.219	<0.050	0.0500	0.626
Lithium	mg/kg dw	<0.50	<0.50	<0.50	1.22	<0.50	<0.50	<0.50	<0.50	0.590	-	<0.50	0.500	1.22
Magnesium	mg/kg dw	1,330	1,200	1,400	1,800	1,270	1,130	1,340	1,360	1,354	201	1,130	1,335	1,800
Manganese	mg/kg dw	205	107	400	4,330	154	227	120	185	716	1,463	107	195	4,330
Mercury	mg/kg dw	0.0418	0.0294	0.0392	0.0561	0.0370	0.0447	0.0309	0.0435	0.0403	0.00846	0.0294	0.0405	0.0561
Molybdenum	mg/kg dw	24.2	16.7	14.5	1.28	9.63	6.23	11.5	4.86	11.1	7.33	1.28	10.6	24.2
Nickel	mg/kg dw	0.320	<0.20	0.790	10.6	<0.20	0.370	0.240	0.440	1.64	3.71	<0.20	0.345	10.6
Phosphorus	mg/kg dw	7,850	7,520	9,190	7,710	8,060	7,580	8,040	8,100	8,006	527	7,520	7,945	9,190
Potassium	mg/kg dw	7,170	6,720	8,350	12,900	7,410	7,070	7,430	7,520	8,071	2,007	6,720	7,420	12,900
Rubidium	mg/kg dw	3.49	2.28	3.00	5.06	2.49	1.87	2.04	1.35	2.70	1.16	1.35	2.38	5.06
Selenium	mg/kg dw	0.740	0.680	0.680	0.590	0.720	0.590	0.740	0.770	0.689	0.0681	0.590	0.700	0.770
Silver	mg/kg dw	0.0830	0.0552	0.0374	0.0802	0.0351	0.0331	0.0228	0.0285	0.0469	0.0234	0.0228	0.0362	0.0830
Sodium	mg/kg dw	2,920	2,660	3,170	2,390	2,950	2,490	3,100	3,070	2,844	294	2,390	2,935	3,170
Strontium	mg/kg dw	3.52	3.36	4.92	13.7	4.19	3.99	3.81	4.20	5.21	3.46	3.36	4.09	13.7
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00340	<0.0020	<0.0020	0.0259	<0.0020	0.00220	<0.0020	<0.0020	0.00519	0.00954	<0.0020	0.00200	0.0259
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	4.01	0.960	3.71	73.8	1.44	2.76	1.24	1.87	11.2	25.3	0.960	2.32	73.8
Uranium	mg/kg dw	0.00660	0.00290	0.00920	0.218	0.00370	0.00590	0.00310	0.00420	0.0317	0.0753	0.00290	0.00505	0.218
Vanadium	mg/kg dw	0.620	0.280	0.470	7.52	0.210	0.310	0.300	0.250	1.25	2.54	0.210	0.305	7.52
Zinc	mg/kg dw	103	83.1	117	222	83.7	93.7	88.2	105	112	46	83.1	98.3	222
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	1.52	<0.20	<0.20	<0.20	<0.20	0.365	-	<0.20	0.200	1.52

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.3: Caddisfly Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 1 (HAC-R1)												
		HAC-R1-1	HAC-R1-2	HAC-R1-3	HAC-R1-4	HAC-R1-5	HAC-R1-6	HAC-R1-7	HAC-R1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22					
Moisture	mg/kg dw	68.2	78.3	73.1	68.8	67.6	73.2	71.0	73.6	71.7	3.57	67.6	72.0	78.3
Aluminum	mg/kg dw	18.0	34.3	80.8	14.7	126	69.1	64.4	56.3	58	36.5	14.7	60.4	126
Antimony	mg/kg dw	0.0140	0.0160	0.0180	0.0140	0.0220	0.0210	0.0210	0.0260	0.0190	0.00424	0.0140	0.0195	0.0260
Arsenic	mg/kg dw	0.220	0.192	0.361	0.279	0.389	0.334	0.317	0.338	0.304	0.0686	0.192	0.326	0.389
Barium	mg/kg dw	1.55	1.19	2.45	1.07	7.10	4.57	2.49	5.84	3.28	2.28	1.07	2.47	7.10
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0
Cadmium	mg/kg dw	<0.010	<0.010	0.0210	<0.010	0.125	0.0390	0.0350	0.0430	0.0366	0.0369	<0.010	0.0280	0.125
Calcium	mg/kg dw	497	512	568	397	850	803	664	701	624	158	397	616	850
Cesium	mg/kg dw	<0.0050	0.00650	0.00880	<0.0050	0.0140	0.00960	0.00820	0.00780	0.00811	0.00257	<0.0050	0.00800	0.0140
Chromium	mg/kg dw	<0.20	<0.20	0.230	<0.20	0.530	0.210	0.400	0.250	0.278	0.125	<0.20	0.220	0.530
Cobalt	mg/kg dw	0.0630	0.0640	0.157	0.0630	0.277	0.121	0.140	0.269	0.144	0.0875	0.0630	0.130	0.277
Copper	mg/kg dw	11.5	14.8	16.3	11.1	23.6	16.6	14.3	16.4	15.6	3.88	11.1	15.6	23.6
Iron	mg/kg dw	95.0	127	191	85.0	286	179	175	177	164	63.8	85.0	176	286
Lead	mg/kg dw	<0.050	<0.050	0.204	<0.050	0.0760	<0.050	0.0560	<0.050	0.0732	0.0593	<0.050	0.0500	0.204
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	987	1,470	1,040	894	876	1,060	999	1,020	1,043	185	876	1,010	1,470
Manganese	mg/kg dw	99.4	58.5	235	67.6	266	130	151	368	172	109	58.5	140	368
Mercury	mg/kg dw	0.0471	0.0603	0.0446	0.0444	0.0410	0.0325	0.0329	0.0429	0.0432	0.00875	0.0325	0.0436	0.0603
Molybdenum	mg/kg dw	3.87	2.63	5.09	6.85	9.55	9.88	8.77	5.49	6.52	2.70	2.63	6.17	9.88
Nickel	mg/kg dw	<0.20	<0.20	0.290	<0.20	0.820	<0.20	0.270	0.230	0.301	0.221	<0.20	0.215	0.820
Phosphorus	mg/kg dw	7,180	8,460	6,860	6,660	6,940	6,800	6,450	6,540	6,986	639	6,450	6,830	8,460
Potassium	mg/kg dw	5,670	7,880	6,290	5,670	6,920	6,370	6,130	5,850	6,348	746	5,670	6,210	7,880
Rubidium	mg/kg dw	0.707	0.983	1.06	0.716	1.26	1.20	1.01	1.14	1.01	0.206	0.707	1.03	1.26
Selenium	mg/kg dw	4.50	5.29	5.46	6.93	10.4	7.69	7.87	5.35	6.69	1.94	4.50	6.20	10.4
Silver	mg/kg dw	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050
Sodium	mg/kg dw	2,320	3,200	2,180	1,960	2,180	2,440	2,400	2,440	2,390	366	1,960	2,360	3,200
Strontium	mg/kg dw	3.50	3.32	3.63	2.37	5.24	5.59	3.95	4.80	4.05	1.08	2.37	3.79	5.59
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020	<0.0020
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	1.22	2.10	5.45	1.37	7.56	4.24	3.56	3.54	3.63	2.15	1.22	3.55	7.56
Uranium	mg/kg dw	<0.0020	0.00240	0.00770	<0.0020	0.0152	0.00700	0.00650	0.0116	0.00680	0.00478	<0.0020	0.00675	0.0152
Vanadium	mg/kg dw	0.120	0.150	0.500	0.150	0.750	0.470	0.400	0.420	0.370	0.218	0.120	0.410	0.750
Zinc	mg/kg dw	63.4	62.0	101	76.8	119	83.6	87.0	99.3	86.5	19.5	62.0	85.3	119
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.3: Caddisfly Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 2 (HAC-U)												
		HAC-U-1	HAC-U-2	HAC-U-3	HAC-U-4	HAC-U-5	HAC-U-6	HAC-U-7	HAC-U-8	Mean	Standard Deviation	Minimum	Median	Maximum
		6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	5-Aug-22	5-Aug-22	6-Aug-22	5-Aug-22					
Moisture	mg/kg dw	74.7	74.9	72.0	74.7	71.6	76.4	71.7	74.3	73.8	1.79	71.6	74.5	76.4
Aluminum	mg/kg dw	172	245	65.0	67.4	138	62.8	73.6	82.1	113	66.5	62.8	77.8	245
Antimony	mg/kg dw	0.0240	0.0190	0.0140	0.0150	0.0160	0.0210	0.0160	0.0210	0.0182	0.00354	0.0140	0.0175	0.0240
Arsenic	mg/kg dw	0.493	0.494	0.348	0.443	0.383	0.447	0.448	0.400	0.432	0.0516	0.348	0.445	0.494
Barium	mg/kg dw	11.0	5.29	3.26	3.60	4.62	4.32	6.74	2.97	5.22	2.63	2.97	4.47	11.0
Beryllium	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	1.60	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.08	-	<1.0	1.00	1.60
Cadmium	mg/kg dw	0.0940	0.0490	0.0290	0.0730	0.0580	0.110	0.0720	0.0330	0.0648	0.0283	0.0290	0.0650	0.110
Calcium	mg/kg dw	1,740	1,620	1,000	804	1,160	1,170	1,240	650	1,173	371	650	1,165	1,740
Cesium	mg/kg dw	0.0226	0.0138	0.00840	0.0108	0.0124	0.0107	0.0133	0.0112	0.0129	0.00427	0.00840	0.0118	0.0226
Chromium	mg/kg dw	1.10	0.460	0.270	0.260	0.260	0.210	0.320	0.240	0.390	0.297	0.210	0.265	1.10
Cobalt	mg/kg dw	0.324	0.221	0.0920	0.166	0.182	0.242	0.195	0.160	0.198	0.0679	0.0920	0.188	0.324
Copper	mg/kg dw	23.4	20.0	18.0	21.0	17.1	23.1	19.6	19.4	20.2	2.23	17.1	19.8	23.4
Iron	mg/kg dw	353	507	163	178	215	173	184	205	247	121	163	194	507
Lead	mg/kg dw	0.110	0.0940	<0.050	<0.050	0.0790	0.0540	0.0540	0.0550	0.0682	0.0229	<0.050	0.0545	0.110
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50
Magnesium	mg/kg dw	1,220	1,170	1,000	1,220	1,060	1,100	1,140	1,190	1,138	79.1	1,000	1,155	1,220
Manganese	mg/kg dw	516	246	158	292	297	329	512	242	324	128	158	294	516
Mercury	mg/kg dw	0.0380	0.0233	0.0303	0.0456	0.0433	0.0424	0.0398	0.0750	0.0422	0.0152	0.0233	0.0411	0.0750
Molybdenum	mg/kg dw	11.1	12.4	9.71	9.67	9.20	8.68	11.8	8.16	10.1	1.52	8.16	9.69	12.4
Nickel	mg/kg dw	0.770	0.370	0.210	0.270	0.260	0.330	0.360	0.270	0.355	0.176	0.210	0.300	0.770
Phosphorus	mg/kg dw	7,980	7,660	7,440	7,670	6,780	7,190	7,640	7,090	7,431	388	6,780	7,540	7,980
Potassium	mg/kg dw	6,560	6,160	6,040	7,120	6,180	6,700	6,150	6,770	6,460	385	6,040	6,370	7,120
Rubidium	mg/kg dw	1.43	1.12	1.02	1.22	1.24	1.34	1.17	1.17	1.21	0.127	1.02	1.20	1.43
Selenium	mg/kg dw	10.1	17.8	12.4	15.4	13.1	12.0	14.7	9.65	13.1	2.74	9.65	12.8	17.8
Silver	mg/kg dw	<0.0050	0.00510	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00501	-	<0.0050	0.00500	0.00510
Sodium	mg/kg dw	2,570	2,580	2,480	2,810	2,240	2,330	2,370	2,570	2,494	180	2,240	2,525	2,810
Strontium	mg/kg dw	13.3	12.5	6.87	5.60	5.99	6.45	8.13	4.17	7.88	3.30	4.17	6.66	13.3
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00210	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00201	-	<0.0020	0.00200	0.00210
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	9.92	27.2	5.09	4.08	5.22	3.33	4.18	4.90	7.99	8.02	3.33	5.00	27.2
Uranium	mg/kg dw	0.0266	0.0244	0.00810	0.0137	0.0160	0.0258	0.0198	0.0102	0.0181	0.00717	0.00810	0.0179	0.0266
Vanadium	mg/kg dw	0.930	1.87	0.440	0.480	0.680	0.520	0.550	0.470	0.742	0.483	0.440	0.535	1.87
Zinc	mg/kg dw	104	76.0	71.2	82.1	88.3	88.3	98.4	82.0	86.3	10.9	71.2	85.2	104
Zirconium	mg/kg dw	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20	<0.20

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Edney Creek	EDC-U (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	1.29	2.42	1.31	1.96	0.615	2.84	1.00	0.867	1.54	0.789	0.615	1.30	2.84
				2019	2.06	1.07	0.573	0.898	1.97	0.694	1.43	1.44	1.27	0.556	0.573	1.25	2.06
				2020	1.40	3.06	0.823	1.23	1.44	1.06	0.709	0.599	1.29	0.780	0.599	1.14	3.06
				2021	2.39	1.51	2.76	1.39	2.21	3.57	0.759	2.80	2.17	0.909	0.759	2.30	3.57
		Copper	mg/kg	2018	18.2	25.1	19.6	20.4	20.4	29.5	21.8	20.7	22.0	3.64	18.2	20.6	29.5
				2019	30.7	21.3	18.4	21.1	17.9	16.2	28.9	15.6	21.3	5.66	15.6	19.8	30.7
				2020	23.5	30.8	23.0	21.7	23.8	23.8	24.4	19.0	23.8	3.33	19.0	23.6	30.8
				2021	23.1	18.4	22.7	17.8	23.3	35.3	17.0	22.8	22.6	5.78	17.0	22.8	35.3
		Iron	mg/kg	2018	1,040	1,850	1,510	1,520	903	2,190	534	553	1,262	603	534	1,275	2,190
				2019	1,260	454	496	912	4,010	608	15,300	2,510	3,194	5,044	454	1,086	15,300
				2020	1,680	2,190	1,370	1,610	1,960	1,800	1,180	861	1,581	430	861	1,645	2,190
				2021	2,360	1,580	3,270	1,450	2,290	5,200	580	3,400	2,516	1,434	580	2,325	5,200
		Selenium	mg/kg	2018	0.360	0.480	0.590	0.580	0.690	0.840	0.680	0.600	0.602	0.144	0.360	0.595	0.840
				2019	0.470	0.600	0.630	0.390	0.520	0.420	0.790	0.590	0.551	0.130	0.390	0.555	0.790
				2020	0.520	0.460	0.450	0.630	0.720	0.480	0.410	0.800	0.559	0.142	0.410	0.500	0.800
				2021	0.550	0.640	0.580	0.900	0.600	0.800	0.640	0.790	0.688	0.126	0.550	0.640	0.900
		Secondary Analytes															
		Barium	mg/kg	2018	66.7	143	71.4	89.3	31.8	133	57.5	59.3	81.5	38.5	31.8	69.0	143
				2019	109	43.2	8.62	30.8	15.2	18.0	28.8	11.5	33.1	32.7	8.62	23.4	109
				2020	99.7	212	71.5	75.3	69.3	78.4	72.7	20.8	87.5	54.9	20.8	74.0	212
				2021	112	99.7	128	43.3	163	217	38.2	96.7	112	59.1	38.2	106	217
		Cadmium	mg/kg	2018	0.442	0.797	0.471	0.544	0.251	0.747	0.454	0.435	0.518	0.178	0.251	0.462	0.797
				2019	0.685	0.258	0.0430	0.177	0.0660	0.173	0.176	0.0440	0.203	0.210	0.0430	0.174	0.685
				2020	0.924	1.05	0.718	0.622	0.759	0.689	0.621	0.447	0.729	0.188	0.447	0.704	1.05
				2021	0.708	0.660	0.963	0.307	1.05	1.47	0.333	0.633	0.766	0.386	0.307	0.684	1.47
		Calcium	mg/kg	2018	790	2,020	872	968	1,160	1,680	879	894	1,158	450	790	931	2,020
				2019	1,490	731	1,620	1,850	3,950	1,550	3,740	2,080	2,126	1,131	731	1,735	3,950
				2020	3,120	2,730	3,490	2,310	2,370	3,350	3,520	1,960	2,856	599	1,960	2,925	3,520
				2021	1,670	1,580	2,250	1,260	2,440	3,190	1,210	1,940	1,942	666	1,210	1,805	3,190
		Cobalt	mg/kg	2018	2.39	5.27	2.16	4.73	1.68	5.15	2.25	2.90	3.32	1.48	1.68	2.64	5.27
				2019	4.63	1.74	0.375	1.43	1.60	0.939	5.70	1.09	2.19	1.91	0.375	1.52	5.70
				2020	4.92	4.99	3.11	3.07	3.44	3.55	3.07	1.14	3.41	1.21	1.14	3.28	4.99
				2021	4.57	4.04	7.12	3.27	9.60	10.0	2.37	5.30	5.78	2.85	2.37	4.93	10.0
		Manganese	mg/kg	2018	1,210	3,010	1,010	2,110	1,340	2,270	1,790	2,280	1,878	671	1,010	1,950	3,010
				2019	1,450	793	155	683	240	377	623	159	560	435	155	500	1,450
				2020	3,490	3,750	2,810	2,360	2,490	2,650	2,800	850	2,650	871	850	2,725	3,750
				2021	2,350	3,030	3,150	1,480	5,480	5,380	1,510	2,770	3,144	1,544	1,480	2,900	5,480
		Mercury	mg/kg	2018	0.0475	0.0752	0.0683	0.0910	0.0515	0.0964	0.0398	0.0579	0.0660	0.0205	0.0398	0.0631	0.0964
				2019	0.0530	0.0450	0.0280	0.140	0.0270	0.0330	0.0430	0.0200	0.0486	0.0385	0.0200	0.0380	0.140
				2020	0.0381	0.0333	0.0407	0.0420	0.0517	0.0362	0.0414	0.0309	0.0393	0.00638	0.0309	0.0394	0.0517
				2021	0.0334	0.0373	0.0480	0.0302	0.0381	0.0917	0.0226	0.0240	0.0407	0.0222	0.0226	0.0354	0.0917
		Molybdenum	mg/kg	2018	0.818	1.59	1.88	1.68	0.746	2.11	1.91	0.830	1.45	0.559	0.746	1.64	2.11
				2019	6.16	6.60	11.1	6.02	7.27	5.47	3.91	7.18	6.71	2.07	3.91	6.38	11.1
				2020	0.811	1.04	0.793	1.15	1.11	0.872	0.651	6.74	1.65	2.07	0.651	0.956	6.74
				2021	2.56	1.90	2.27	3.22	3.00	3.72	3.92	4.58	3.15	0.900	1.90	3.11	4.58
		Nickel	mg/kg	2018	3.84	6.99	5.71	6.04	2.34	6.35	3.97	2.59	4.73	1.78	2.34	4.84	6.99
				2019	4.79	1.71	0.640	1.77	3.34	1.61	6.98	2.39	2.90	2.07	0.640	2.08	6.98
				2020	7.37	10.6	4.98	4.76	5.80	6.17	5.37	1.73	5.85	2.51	1.73	5.58	10.6
				2021	7.31	5.35	8.55	2.87	8.70	11.5	1.64	5.81	6.47	3.24	1.64	6.56	11.5
		Phosphorus	mg/kg	2018	5,480	8,000	7,010	6,750	8,110	9,600	8,680	8,390	7,752	1,287	5,480	8,055	9,600
				2019	10,100	8,880	10,200	9,030	7,650	8,460	6,600	8,110	8,629	1,209	6,600	8,670	10,200
				2020	11,000	13,000	10,900	9,890	10,300	10,500	11,800	9,730	10,890	1,078	9,730	10,700	13,000
				2021	9,400	8,040	8,600	8,540	8,880	10,300	8,410	8,310	8,810	726	8,040	8,570	10,300
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0799	0.0641	0.0422	0.0428	0.0501	0.0299	0.0771	0.0399	0.0532	0.0184	0.0299	0.0464	0.0799
				2020	0.0685	0.0549	0.0506	0.0460	0.0753	0.0609	0.0500	0.0464	0.0566	0.0107	0.0460	0.0528	0.0753
				2021	0.0551	0.0452	0.0734	0.0480	0.0847	0.144	0.0355	0.0570	0.0679	0.0345	0.0355	0.0560	0.144
		Sodium	mg/kg	2018	2,010	4,900	3,030	2,870	3,400	4,900	4,550	3,540	3,650	1,048	2,010	3,470	4,900
				2019	4,950	4,370	3,880	4,030	2,590	3,330	2,810	2,660	3,578	868	2,590	3,605	4,950
				2020	5,160	6,560	5,160	5,230	4,980	5,660	6,710	4,040	5,438	869	4,040	5,195	6,710
				2021	4,430	3,460	3,920	3,120	4,730	5,470	3,790	4,030	4,119	745	3,120	3,975	5,470
		Strontium	mg/kg	2018	7.83	21.9	8.40	10.5	11.0	16.7	11.6	10.3	12.3	4.72	7.83	10.8	21.9
				2019	11.6	5.62	12.2	13.5	23.9	11.6	12.6	15.4	13.3	5.12	5.62	12.4	23.9
				2020	26.5	27.6	27.2	17.9	20.5	29.0	30.5	17.4	24.6	5.17	17.4	26.8	30.5
				2021	12.9	11.9	17.3	9.31	18.6	21.0	9.09	15.7	14.5	4.37	9.09	14.3	21.0
		Tin	mg/kg	2018	0.160	0.350	0.230	0.280	<0.10	0.110	<0.10	0.300	0.204	0.0990	<0.1	0.195	0.350
				2019	0.860	0.290	0.350	0.290	0.160	0.110	0.350	0.170	0.322	0.235	0.110	0.290	0.860
				2020	<0.10	<0.10	0.130	<0.10	<0.10	0.100	<0.10	<0.10	0.104	0.0140	<0.1	0.100	0.130
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	24.4	5.86	9.61	17.6	93.4	8.14	395	50.5	75.6	132	5.86	21.0	395
				2020	28.4	36.7	26.1	34.6	39.9	38.4	20.1	23.6	31.0	7.40	20.1	31.5	39.9
				2021	53.5	33.1	67.8	21.2	39.7	94.1	8.13	51.2	46.1	27.1	8.13	45.5	94.1
		Uranium	mg/kg	2018	0.124	0.182	0.106	0.162	0.0608	0.290	0.100	0.0708	0.137	0.0744	0.0608	0.115	0.290
				2019	0.148	0.0549	0.0249	0.0680	0.0889	0.0459	0.0808	0.124	0.0794	0.0407	0.0249	0.0744	0.148
				2020	0.186	0.236	0.142	0.139	0.184	0.163	0.164	0.0531	0.158	0.0524	0.0531	0.164	0.236
				2021	0.198	0.153	0.289	0.163	0.232	0.544	0.0560	0.208	0.230	0.144	0.0560	0.203	0.544
		Vanadium	mg/kg	2018	2.29	4.15	2.95	2.67	2.71	4.41	1.12	1.02	2.66	1.23	1.02	2.69	4.41
				2019	2.64	0.880	1.01	2.03	7.44	1.35	52.4	5.64	9.17	17.6	0.880	2.34	52.4
				2020	4.92	4.47	4.13	4.74	5.22	5.26	3.57	2.24	4.32	1.01	2.24	4.61	5.26
				2021	5.73	3.87	7.62	3.22	6.20	11.9	1.51	7.44	5.94	3.21	1.51	5.96	11.9
		Zinc	mg/kg	2018	203	231	161	145	291	228	302	260	228	56.7	145	230	302
				2019	253	276	98.7	163	91.7	121	140	83.4	153	73.7	83.4	130	276
				2020	350	530	478	251	314	404	428	366	390	89.6	251	385	530
				2021	207	182	196	153	206	258	173	180	194	31.3	153	189	258
Upper Hazeltine Reach 1	HAC-R1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2017	1.63	1.88	1.13	1.41	1.68	1.95	2.34	2.66	1.84	0.492	1.13	1.78	2.66
				2018	2.29	1.76	2.28	1.87	1.71	4.92	2.00	1.99	2.35	1.06	1.71	2.00	4.92
				2019	2.01	3.95	2.16	2.01	1.96	2.44	2.33	2.59	2.43	0.654	1.96	2.24	3.95
				2020	1.14	1.16	0.542	1.64	1.36	0.735	0.716	0.393	0.961	0.431	0.393	0.938	1.64
				2021	0.895	0.723	0.616	3.78	9.10	0.372	0.416	0.448	2.04	3.07	0.372	0.670	9.10
		Copper	mg/kg	2017	131	204	96.1	120	128	188	246	209	165	53.2	96.1	160	246
				2018	122	107	95.1	126	102	297	130	120	137	65.6	95.1	121	297
				2019	97.2	124	137	142	133	203	159	185	148	33.9	97.2	140	203
				2020	56.4	58.5	21.7	57.8	56.3	35.0	26.7	18.8	41.4	17.6	18.8	45.6	58.5
				2021	38.8	44.4	31.0	188	196	20.7	12.8	16.3	68.5	77.0	12.8	34.9	196

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Reach 1	HAC-R1 (Exposed)	Iron	mg/kg	2017	2,400	2,490	1,040	1,290	1,830	2,320	4,200	4,270	2,480	1,202	1,040	2,360	4,270
				2018	4,390	3,340	2,590	3,280	2,230	7,150	3,290	3,030	3,662	1,544	2,230	3,285	7,150
				2019	3,250	4,740	3,930	3,150	2,870	3,440	3,760	3,930	3,634	588	2,870	3,600	4,740
				2020	1,490	1,250	182	1,910	1,270	619	572	248	943	626	182	934	1,910
				2021	722	618	442	7,760	8,640	274	92.6	159	2,338	3,632	92.6	530	8,640
		Selenium	mg/kg	2017	3.04	3.64	3.04	3.06	3.50	3.95	3.33	3.81	3.42	0.361	3.04	3.42	3.95
				2018	3.06	2.28	4.02	3.02	2.62	6.66	2.44	2.88	3.37	1.43	2.28	2.95	6.66
				2019	3.56	4.18	3.99	3.90	4.13	3.03	2.96	3.82	3.70	0.474	2.96	3.86	4.18
				2020	3.48	4.33	3.84	4.49	3.19	4.11	5.01	2.91	3.92	0.704	2.91	3.98	5.01
				2021	7.79	9.68	8.64	5.00	5.38	7.03	6.74	8.06	7.29	1.59	5.00	7.41	9.68
		Secondary Analytes															
		Barium	mg/kg	2017	44.1	40.6	19.1	26.2	32.6	43.1	61.7	84.4	44	20.8	19.1	41.9	84.4
				2018	97.4	51.0	54.6	42.8	36.0	161	64.2	65.9	71.6	40.6	36.0	59.4	161
				2019	43.2	84.7	57.6	47.2	50.7	61.4	60.5	120	65.7	25.3	43.2	59.0	120
				2020	19.7	21.7	4.49	29.8	30.7	10.2	8.38	4.02	16.1	10.8	4.02	15.0	30.7
				2021	11.8	8.77	8.48	148	50.9	6.01	2.28	2.61	29.9	50.3	2.28	8.62	148
		Cadmium	mg/kg	2017	0.257	0.403	0.155	0.230	0.203	0.331	0.315	0.297	0.274	0.0789	0.155	0.277	0.403
				2018	0.131	0.265	0.266	0.352	0.262	0.824	0.355	0.338	0.349	0.205	0.131	0.302	0.824
				2019	0.214	0.303	0.441	0.297	0.301	0.439	0.524	0.493	0.376	0.112	0.214	0.371	0.524
				2020	0.274	0.176	<0.010	0.124	0.191	0.0930	0.0483	0.0820	0.125	0.0798	<0.01	0.108	0.274
				2021	0.0900	0.0560	0.149	0.371	0.336	0.0200	0.0490	0.0450	0.140	0.138	0.0200	0.0730	0.371
		Calcium	mg/kg	2017	8,520	3,660	1,290	1,600	2,670	4,280	3,740	5,210	3,871	2,296	1,290	3,700	8,520
				2018	8,630	5,080	4,420	4,690	3,070	8,970	3,560	5,050	5,434	2,193	3,070	4,870	8,970
				2019	9,770	24,400	12,200	6,900	6,440	4,950	10,700	5,590	10,119	6,323	4,950	8,335	24,400
				2020	4,820	2,740	930	4,090	2,330	915	1,080	506	2,176	1,609	506	1,705	4,820
				2021	1,090	1,440	1,640	9,800	8,660	696	547	590	3,058	3,842	547	1,265	9,800
		Cobalt	mg/kg	2017	2.30	2.42	1.18	1.40	1.82	2.56	3.50	3.45	2.33	0.856	1.18	2.36	3.50
				2018	3.61	2.87	2.46	2.89	2.27	7.57	3.07	2.82	3.44	1.71	2.27	2.88	7.57
				2019	3.11	4.17	4.19	3.02	2.93	3.45	3.81	4.04	3.59	0.529	2.93	3.63	4.19
				2020	1.31	1.17	0.197	1.49	1.20	0.588	0.435	0.288	0.835	0.511	0.197	0.879	1.49
				2021	0.632	0.517	0.449	6.09	4.88	0.224	0.116	0.130	1.63	2.41	0.116	0.483	6.09
		Manganese	mg/kg	2017	1,610	1,850	699	743	1,030	2,090	1,540	1,530	1,386	510	699	1,535	2,090
				2018	1,170	1,140	1,230	1,230	1,200	3,130	1,270	1,260	1,454	679	1,140	1,230	3,130
				2019	1,730	1,490	1,770	2,120	1,860	2,710	3,330	3,470	2,310	764	1,490	1,990	3,470
				2020	789	805	116	920	631	434	297	247	530	298	116	532	920
				2021	568	413	516	3,570	2,870	156	170	146	1,051	1,362	146	464	3,570
		Mercury	mg/kg	2017	0.0661	0.0855	0.0754	0.0715	0.0587	0.0675	0.174	0.0800	0.0848	0.0370	0.0587	0.0734	0.174
				2018	0.0658	0.0650	0.0592	0.0690	0.0707	0.169	0.0738	0.0745	0.0809	0.0360	0.0592	0.0698	0.169
				2019	0.0900	0.0850	0.104	0.110	0.119	0.116	0.0960	0.128	0.106	0.0150	0.0850	0.107	0.128
				2020	0.102	0.0916	0.0848	0.132	0.126	0.0954	0.0780	0.0847	0.0993	0.0198	0.0780	0.0935	0.132
				2021	0.0850	0.0652	0.0634	0.0847	0.117	0.0634	0.0241	0.0633	0.0708	0.0265	0.0241	0.0643	0.117
		Molybdenum	mg/kg	2017	6.16	6.09	4.07	5.08	4.95	5.99	8.11	8.13	6.07	1.45	4.07	6.04	8.13
				2018	28.0	4.49	8.30	5.05	4.93	18.6	6.31	7.01	10.3	8.48	4.49	6.66	28.0
				2019	4.02	4.22	4.25	5.34	5.27	5.05	6.08	6.46	5.09	0.891	4.02	5.16	6.46
				2020	4.28	4.77	5.33	5.08	3.75	6.87	7.91	6.12	5.51	1.38	3.75	5.20	7.91
				2021	10.7	13.0	15.6	6.17	6.63	12.5	11.2	12.4	11.0	3.21	6.17	11.8	15.6
		Nickel	mg/kg	2017	3.73	2.98	2.70	2.73	4.03	3.50	5.95	5.89	3.94	1.31	2.70	3.62	5.95
				2018	5.46	4.62	2.99	4.64	2.92	10.6	5.33	4.79	5.17	2.39	2.92	4.72	10.6
				2019	2.91	2.97	5.00	3.17	4.76	3.60	4.49	4.64	3.94	0.870	2.91	4.04	5.00
				2020	2.12	1.52	0.220	1.82	1.37	0.890	0.470	0.440	1.11	0.703	0.220	1.13	2.12
				2021	0.870	0.660	0.620	15.5	6.19	0.650	<0.20	0.220	3.11	5.44	<0.2	0.655	15.5
		Phosphorus	mg/kg	2017	5,470	6,880	6,230	5,270	6,510	7,160	6,080	8,000	6,450	897	5,270	6,370	8,000
				2018	6,040	5,800	5,870	6,540	6,260	14,700	5,680	4,900	6,974	3,159	4,900	5,955	14,700
				2019	7,360	8,290	8,230	7,300	8,170	8,120	8,470	7,820	7,970	435	7,300	8,145	8,470
				2020	6,740	8,620	8,020	8,060	7,540	7,380	8,110	4,660	7,391	1,241	4,660	7,780	8,620
				2021	9,200	8,740	7,760	9,690	8,860	6,900	7,120	7,690	8,245	1,017	6,900	8,250	9,690
		Silver	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0290	0.0300	0.0428	0.0377	0.0323	0.0342	0.0372	0.0438	0.0359	0.00552	0.0290	0.0357	0.0438
				2020	0.0164	0.0159	<0.0050	0.0136	0.0166	0.00870	<0.0050	<0.0050	0.0108	0.00399	<0.005	0.0112	0.0166
				2021	0.00860	0.00720	0.00540	0.0549	0.0558	0.00750	<0.0050	<0.0050	0.0187	0.0232	<0.005	0.00735	0.0558
		Sodium	mg/kg	2017	2,890	3,650	3,300	3,400	3,490	3,860	3,590	5,370	3,694	735	2,890	3,540	5,370
				2018	3,370	3,150	3,340	3,790	3,180	8,190	3,340	2,670	3,879	1,769	2,670	3,340	8,190
				2019	3,920	4,000	4,010	3,380	3,950	4,100	4,540	4,210	4,014	325	3,380	4,005	4,540
				2020	2,920	3,460	3,620	3,850	2,930	2,690	3,080	1,640	3,024	684	1,640	3,005	3,850
				2021	3,400	3,310	2,400	5,720	4,670	2,640	2,080	2,570	3,349	1,253	2,080	2,975	5,720
		Strontium	mg/kg	2017	37.3	25.1	11.1	12.8	17.3	21.5	24.8	28.3	22.3	8.59	11.1	23.2	37.3
				2018	48.1	31.7	29.5	31.0	22.9	65.3	28.6	30.0	35.9	13.9	22.9	30.5	65.3
				2019	40.0	73.0	49.9	33.4	36.3	27.9	42.2	43.1	43.2	13.7	27.9	41.1	73.0
				2020	19.5	14.2	4.99	14.0	12.2	6.68	6.55	3.69	10.2	5.56	3.69	9.44	19.5
				2021	8.20	7.05	6.78	54.2	36.6	5.09	3.18	3.92	15.6	19.0	3.18	6.92	54.2
		Tin	mg/kg	2017	0.260	0.270	0.240	0.170	0.340	0.110	0.210	0.270	0.234	0.0703	0.110	0.250	0.340
				2018	<0.20	0.270	0.180	0.350	0.370	0.750	0.230	0.240	0.321	0.189	0.180	0.255	0.750
				2019	0.480	0.540	0.350	0.290	0.730	0.740	1.32	0.680	0.641	0.322	0.290	0.610	1.32
				2020	0.110	0.120	<0.10	0.160	<0.10	<0.10	<0.10	<0.10	0.111	0.0201	<0.1	0.100	0.160
				2021	<0.10	<0.10	<0.10	0.140	0.150	<0.10	<0.10	<0.10	0.111	0.00468	<0.1	0.100	0.150
		Titanium	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	101	227	128	107	108	126	133	144	134	40.3	101	127	227
				2020	55.7	40.7	5.72	74.4	54.2	22.0	21.7	7.55	35.2	24.9	5.72	31.4	74.4
				2021	17.6	25.9	12.3	297	182	19.3	1.61	3.69	69.9	109	1.61	18.4	297
		Uranium	mg/kg	2017	0.122	0.100	0.0654	0.0718	0.0834	0.0961	0.135	0.176	0.106	0.0368	0.0654	0.0980	0.176
				2018	0.351	0.168	0.250	0.148	0.0978	0.358	0.145	0.307	0.228	0.102	0.0978	0.209	0.358
				2019	0.134	0.174	0.263	0.119	0.128	0.110	0.138	0.138	0.150	0.0492	0.110	0.136	0.263
				2020	0.0736	0.0588	0.00340	0.0609	0.0376	0.0250	0.0182	0.0124	0.0362	0.0257	0.00340	0.0313	0.0736
				2021	0.0362	0.0268	0.0271	0.266	0.263	0.0285	0.00820	0.0134	0.0836	0.112	0.00820	0.0278	0.266
		Vanadium	mg/kg	2017	7.90	9.22	3.41	4.20	5.95	8.33	13.9	14.8	8.46	4.15	3.41	8.12	14.8
				2018	16.1	12.0	9.48	11.1	7.68	22.4	11.4	11.0	12.6	4.61	7.68	11.2	22.4
				2019	9.55	16.3	13.1	10.6	8.79	12.4	11.6	12.2	11.8	2.33	8.79	11.9	16.3
				2020	4.96	4.16	0.300	7.46	4.15	1.76	1.71	0.640	3.14	2.46	0.300	2.96	7.46
				2021	2.38	2.25	1.52	25.7	31.2	0.920	0.260	0.460	8.09	12.7	0.260	1.88	31.2
		Zinc	mg/kg	2017	97.0	107	114	109	126	110	122	127	114	10.4	97.0	112	127
				2018	96.0	87.6	84.1	90.5	90.3	219	81.2	88.4	105	46.4	81.2	89.3	219
				2019	109	117	125	108	115	108	110	117	114	6.00	108	112	125
				2020	108	117	78.0	90.2	93.4	91.3	96.8	72.1	93.3	14.6	72.1	92.3	117
				2021	94.8	100	121	130	121	83.9	85.4	75.8	101	20.2	75.8	97.4	130

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Reach 2	HAC-U (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2016	2.44	-	2.61	-	2.54	-	-	-	2.53	0.0854	2.44	2.54	2.61
				2018	1.84	2.06	2.15	1.65	1.58	1.84	1.85	2.13	1.89	0.212	1.58	1.84	2.15
				2019	3.31	2.08	1.90	2.34	2.01	2.20	2.07	1.89	2.22	0.463	1.89	2.08	3.31
				2020	0.439	0.499	0.566	0.717	1.03	0.621	0.653	0.735	0.658	0.182	0.439	0.637	1.03
				2021	0.336	0.415	0.895	0.745	0.793	0.907	1.37	1.21	0.834	0.353	0.336	0.844	1.37
		Copper	mg/kg	2016	216	-	203	-	195	-	-	-	205	10.6	195	203	216
				2018	61.3	79.9	87.6	55.2	66.4	71.1	69.6	86.6	72.2	11.7	55.2	70.3	87.6
				2019	178	108	109	114	105	121	99.2	79.9	114	28.5	79.9	108	178
				2020	15.5	22.5	20.2	25.2	24.3	21.9	22.5	32.2	23.0	4.74	15.5	22.5	32.2
				2021	12.1	17.8	21.3	26.4	37.8	26.2	31.5	36.3	26.2	8.93	12.1	26.3	37.8
		Iron	mg/kg	2016	2,170	-	5,330	-	4,600	-	-	-	4,033	1,654	2,170	4,600	5,330
				2018	1,240	2,560	2,280	840	1,040	1,300	1,290	1,820	1,546	611	840	1,295	2,560
				2019	5,780	2,450	2,780	2,790	2,330	3,210	2,390	2,260	2,999	1,167	2,260	2,615	5,780
				2020	172	166	163	190	294	194	211	464	232	103	163	192	464
				2021	92.9	188	206	509	300	583	956	694	441	296	92.9	404	956
		Selenium	mg/kg	2016	10.5	-	10.3	-	9.70	-	-	-	10.2	0.416	9.70	10.3	10.5
				2018	2.17	1.73	1.95	1.85	1.86	2.13	2.25	1.78	1.96	0.194	1.73	1.90	2.25
				2019	3.59	3.46	3.06	3.17	3.33	3.88	3.41	3.94	3.48	0.313	3.06	3.44	3.94
				2020	3.59	5.12	4.71	5.55	5.89	5.22	5.03	5.79	5.11	0.732	3.59	5.17	5.89
				2021	5.85	7.64	7.19	9.43	8.86	8.49	7.65	8.00	7.89	1.10	5.85	7.82	9.43
		Secondary Analytes															
		Barium	mg/kg	2016	58.2	-	62.1	-	61.1	-	-	-	60.5	2.03	58.2	61.1	62.1
				2018	28.1	43.3	35.4	21.6	19.5	26.4	31.8	35.2	30.2	7.87	19.5	30.0	43.3
				2019	84.5	42.9	47.1	39.2	36.6	42.5	59.8	54.1	50.8	15.6	36.6	45.0	84.5
				2020	19.5	2.26	2.09	3.58	2.81	3.49	2.92	9.72	5.80	6.06	2.09	3.20	19.5
				2021	4.56	5.71	11.8	6.89	15.6	14.4	15.5	21.3	12.0	5.84	4.56	13.1	21.3
		Cadmium	mg/kg	2016	0.656	-	0.448	-	0.434	-	-	-	0.513	0.124	0.434	0.448	0.656
				2018	0.219	0.285	0.224	0.222	0.227	0.283	0.227	0.189	0.234	0.0329	0.189	0.226	0.285
				2019	0.631	0.409	0.352	0.365	0.341	0.367	0.489	0.287	0.405	0.108	0.287	0.366	0.631
				2020	0.0330	<0.010	<0.010	0.0407	0.0102	0.0228	0.0260	0.0941	0.0308	0.0286	<0.01	0.0244	0.0941
				2021	0.0710	0.132	0.134	0.140	0.117	0.139	0.161	0.207	0.138	0.0383	0.0710	0.136	0.207
		Calcium	mg/kg	2016	4,160	-	4,050	-	8,840	-	-	-	5,683	2,734	4,050	4,160	8,840
				2018	5,170	9,790	5,860	3,110	3,710	6,000	5,160	7,570	5,796	2,122	3,110	5,515	9,790
				2019	18,500	8,030	8,440	9,580	7,480	14,100	11,200	9,220	10,819	3,753	7,480	9,400	18,500
				2020	453	736	549	784	809	825	642	979	722	168	453	760	979
				2021	475	682	946	930	1,170	1,260	6,430	11,100	2,874	3,852	475	1,058	11,100
		Cobalt	mg/kg	2016	6.73	-	6.62	-	5.87	-	-	-	6.41	0.468	5.87	6.62	6.73
				2018	0.951	1.69	1.53	0.741	0.809	1.01	0.957	1.20	1.11	0.339	0.741	0.984	1.69
				2019	4.22	1.90	1.94	2.12	1.79	2.05	1.74	1.56	2.16	0.849	1.56	1.92	4.22
				2020	0.122	0.120	0.110	0.169	0.220	0.147	0.179	0.357	0.178	0.0810	0.110	0.158	0.357
				2021	0.166	0.211	0.285	0.455	0.358	0.478	0.716	0.860	0.441	0.243	0.166	0.406	0.860
		Manganese	mg/kg	2016	2,100	-	2,020	-	1,850	-	-	-	1,990	128	1,850	2,020	2,100
				2018	1,040	1,110	980	772	883	908	789	776	907	128	772	896	1,110
				2019	3,480	2,220	2,100	2,150	2,030	2,040	2,050	1,690	2,220	533	1,690	2,075	3,480
				2020	157	119	111	249	153	169	158	362	185	82.9	111	158	362
				2021	366	371	826	602	764	795	883	1,330	742	310	366	780	1,330
		Mercury	mg/kg	2016	0.0362	-	0.0442	-	0.0423	-	-	-	0.0409	0.00418	0.0362	0.0423	0.0442
				2018	0.0420	0.0629	0.0587	0.0461	0.0530	0.0521	0.0586	0.0475	0.0526	0.00717	0.0420	0.0526	0.0629
				2019	0.120	0.0900	0.0980	0.0910	0.0870	0.0840	0.0830	0.0940	0.0934	0.0119	0.0830	0.0905	0.120
				2020	0.0616	0.0471	0.0584	0.0728	0.0717	0.0576	0.0661	0.0989	0.0668	0.0154	0.0471	0.0638	0.0989
				2021	0.0236	0.0289	0.0443	0.0385	0.0512	0.0567	0.0446	0.0556	0.0429	0.0120	0.0236	0.0445	0.0567
		Molybdenum	mg/kg	2016	24.1	-	29.1	-	27.5	-	-	-	26.9	2.55	24.1	27.5	29.1
				2018	3.94	4.07	3.42	3.01	3.23	2.87	2.79	3.20	3.32	0.472	2.79	3.22	4.07
				2019	5.94	5.24	5.22	5.38	4.92	4.00	5.45	4.10	5.03	0.670	4.00	5.23	5.94
				2020	5.58	10.1	8.02	7.72	8.80	8.06	8.77	6.94	8.00	1.35	5.58	8.04	10.1
				2021	6.53	8.06	9.75	12.6	10.0	9.19	7.70	10.0	9.23	1.84	6.53	9.47	12.6
		Nickel	mg/kg	2016	10.5	-	10.1	-	9.19	-	-	-	9.93	0.671	9.19	10.1	10.5
				2018	2.21	3.33	3.62	1.52	2.20	1.80	1.57	3.13	2.42	0.826	1.52	2.20	3.62
				2019	6.32	2.88	3.33	2.93	2.94	3.38	2.69	2.44	3.36	1.23	2.44	2.94	6.32
				2020	<0.20	<0.20	<0.20	0.520	<0.20	<0.20	<0.20	0.320	0.255	0.0935	<0.2	0.200	0.520
				2021	0.250	0.220	0.380	0.410	0.330	0.690	1.44	0.770	0.561	0.406	0.220	0.395	1.44
		Phosphorus	mg/kg	2016	6,300	-	6,920	-	5,780	-	-	-	6,333	571	5,780	6,300	6,920
				2018	5,870	5,770	6,650	6,410	5,480	5,550	6,860	5,350	5,992	573	5,350	5,820	6,860
				2019	9,140	8,910	6,700	7,690	8,000	6,770	8,000	7,640	7,856	878	6,700	7,845	9,140
				2020	4,730	6,900	6,990	7,930	8,500	7,940	7,740	8,200	7,366	1,200	4,730	7,835	8,500
				2021	4,600	5,160	7,560	7,790	8,270	7,910	7,450	8,420	7,145	1,443	4,600	7,675	8,420
		Silver	mg/kg	2016	0.0344	-	0.0307	-	0.0384	-	-	-	0.0345	0.00385	0.0307	0.0344	0.0384
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0504	0.0287	0.0310	0.0276	0.0298	0.0373	0.0259	0.0232	0.0317	0.00859	0.0232	0.0292	0.0504
				2020	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00500	0.00500	-	<0.005	0.00500	0.00500
				2021	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00960	<0.0050	<0.0050	0.00558	-	<0.005	0.00500	0.00960
		Sodium	mg/kg	2016	4,940	-	4,560	-	4,200	-	-	-	4,567	370	4,200	4,560	4,940
				2018	2,490	2,580	3,020	2,670	2,890	2,950	2,980	3,030	2,826	214	2,490	2,920	3,030
				2019	5,030	4,260	3,360	4,130	4,180	3,480	4,180	3,660	4,035	534	3,360	4,155	5,030
				2020	1,700	3,000	2,410	3,140	3,300	2,760	2,810	3,230	2,794	528	1,700	2,905	3,300
				2021	1,670	1,600	2,320	2,640	3,310	2,290	2,410	2,440	2,335	541	1,600	2,365	3,310
		Strontium	mg/kg	2016	45.8	-	42.5	-	50.7	-	-	-	46.3	4.13	42.5	45.8	50.7
				2018	20.2	42.2	27.6	14.4	15.2	24.3	21.7	26.6	24.0	8.79	14.4	23.0	42.2
				2019	67.2	32.2	35.6	36.1	30.3	51.6	41.4	35.3	41.2	12.4	30.3	35.8	67.2
				2020	3.26	3.61	3.53	5.37	4.58	4.99	4.43	6.21	4.50	1.01	3.26	4.50	6.21
				2021	3.35	7.23	6.06	5.04	7.25	9.36	20.4	29.5	11.0	9.10	3.35	7.24	29.5
		Tin	mg/kg	2016	0.0130	-	0.0115	-	0.0102	-	-	-	0.0116	0.00140	0.0102	0.0115	0.0130
				2018	0.150	<0.10	0.420	<0.10	0.570	<0.10	<0.10	0.150	0.211	0.178	<0.1	0.125	0.570
				2019	0.590	0.260	0.320	1.04	0.390	0.580	0.330	0.280	0.474	0.262	0.260	0.360	1.04
				2020	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2016	46.5	-	46.7	-	50.1	-	-	-	47.8	2.02	46.5	46.7	50.1
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	215	83.4	93.3	91.6	77.5	110	74.9	72.8	102	47.1	72.8	87.5	215
				2020	4.71	3.87	4.39	4.50	6.69	4.75	6.09	15.4	6.30	3.79	3.87	4.73	15.4
				2021	1.40	5.10	4.74	5.17	9.96	14.2	11.8	26.9	9.91	8.07	1.40	7.56	26.9
		Uranium	mg/kg	2016	0.195	-	0.193	-	0.201	-	-	-	0.196	0.00416	0.193	0.195	0.201
				2018	0.0667	0.114	0.100	0.0487	0.0568	0.0721	0.0685	0.114	0.0801	0.0256	0.0487	0.0703	0.114
				2019	0.215	0.101	0.103	0.106	0.0876	0.214	0.115	0.0853	0.128	0.0540	0.0853	0.104	0.215
				2020	0.00560	0.00350	0.00420	0.00890	0.00480	0.00490	0.00800	0.0153	0.00690	0.00387	0.00350	0.00525	0.0153
				2021	0.0146	0.0187	0.0284	0.0306	0.0198	0.0343	0.0526	0.0607	0.0325	0.0165	0.0146	0.0295	0.0607

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Reach 2	HAC-U (Exposed)	Vanadium	mg/kg	2016	17.7	-	18.7	-	18.0	-	-	-	18.1	0.513	17.7	18.0	18.7
				2018	3.59	7.92	6.86	2.67	3.02	4.10	4.16	6.36	4.84	1.94	2.67	4.13	7.92
				2019	17.6	7.22	7.91	7.95	6.56	10.9	7.29	6.83	9.03	3.71	6.56	7.60	17.6
				2020	0.410	0.310	0.390	0.350	1.09	0.510	0.510	1.19	0.595	0.345	0.310	0.460	1.19
				2021	0.430	0.810	0.930	2.08	1.07	2.40	2.72	2.53	1.62	0.903	0.430	1.58	2.72
		Zinc	mg/kg	2016	153	-	146	-	137	-	-	-	145	8.02	137	146	153
				2018	90.0	79.2	90.8	86.1	66.4	74.8	91.7	82.2	82.7	8.88	66.4	84.2	91.7
				2019	124	111	107	113	105	92.0	110	97.2	107	9.81	92.0	108	124
				2020	61.0	75.6	81.5	98.8	94.1	80.6	85.2	104	85.1	13.8	61.0	83.3	104
				2021	64.6	80.7	126	112	116	131	109	140	110	25.5	64.6	114	140
Lower Edney Creek	EDC-D (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	14.5	18.7	19.9	11.7	10.2	8.57	12.0	8.37	13.0	4.37	8.37	11.8	19.9
				2019	3.41	1.26	2.54	2.96	1.64	1.62	4.06	1.29	2.35	1.06	1.26	2.09	4.06
				2020	5.07	9.47	6.49	5.85	8.09	9.57	2.54	1.48	6.07	2.99	1.48	6.17	9.57
				2021	17.6	3.72	11.8	3.43	1.18	1.62	1.35	2.02	5.34	6.05	1.18	2.72	17.6
		Copper	mg/kg	2018	23.4	27.7	45.6	21.7	26.5	21.2	26.6	24.6	27.2	7.81	21.2	25.6	45.6
				2019	20.2	15.2	29.1	19.0	12.9	18.3	24.6	15.9	19.4	5.28	12.9	18.6	29.1
				2020	25.0	35.0	26.9	25.8	33.0	27.4	21.0	23.6	27.2	4.67	21.0	26.4	35.0
				2021	26.4	14.1	24.9	14.4	13.4	14.8	12.6	13.2	16.7	5.57	12.6	14.2	26.4
		Iron	mg/kg	2018	3,910	3,530	7,990	3,310	3,040	2,770	1,900	5,710	4,020	1,942	1,900	3,420	7,990
				2019	1,440	296	2,540	1,530	1,490	344	2,020	207	1,233	866	207	1,465	2,540
				2020	6,350	11,800	9,270	8,230	9,690	13,000	6,210	300	8,106	3,948	300	8,750	13,000
				2021	6,030	632	3,600	960	110	165	1,700	290	1,686	2,102	110	796	6,030
		Selenium	mg/kg	2018	2.63	2.88	3.81	2.04	1.94	1.67	1.80	1.32	2.26	0.803	1.32	1.99	3.81
				2019	1.27	1.46	2.73	1.31	0.890	1.47	1.47	1.47	1.51	0.532	0.890	1.46	2.73
				2020	1.15	1.34	1.06	1.22	1.05	0.910	1.64	1.61	1.25	0.265	0.910	1.18	1.64
				2021	2.58	1.33	2.04	1.05	0.890	1.02	0.850	1.00	1.34	0.629	0.850	1.03	2.58
		Secondary Analytes															
		Barium	mg/kg	2018	138	163	321	118	110	104	155	110	152	71.6	104	128	321
				2019	47.9	4.55	19.1	24.4	18.1	4.49	43.9	4.12	20.8	17.3	4.12	18.6	47.9
				2020	126	173	131	133	132	163	26.2	6.46	111	61.2	6.46	132	173
				2021	135	23.4	147	27.6	4.47	6.08	5.26	12.6	45.2	59.8	4.47	18.0	147
		Cadmium	mg/kg	2018	0.375	0.432	0.927	0.448	0.369	0.366	0.592	0.472	0.498	0.189	0.366	0.440	0.927
				2019	0.159	0.0250	0.482	0.101	0.0310	0.0260	0.124	0.0390	0.123	0.154	0.0250	0.0700	0.482
				2020	0.470	0.600	0.425	0.313	0.311	0.392	0.282	0.0700	0.358	0.156	0.0700	0.352	0.600
				2021	0.559	0.0600	0.439	0.0880	0.0180	0.0290	0.0270	0.0330	0.157	0.215	0.0180	0.0465	0.559
		Calcium	mg/kg	2018	2,620	2,750	5,780	4,280	2,290	2,140	1,930	3,410	3,150	1,307	1,930	2,685	5,780
				2019	1,350	2,600	1,780	1,330	1,040	1,360	1,480	1,670	1,576	471	1,040	1,420	2,600
				2020	3,390	4,560	4,240	3,120	3,600	4,220	3,700	906	3,467	1,141	906	3,650	4,560
				2021	3,110	1,210	2,030	1,450	1,370	1,150	1,510	1,170	1,625	664	1,150	1,410	3,110
		Cobalt	mg/kg	2018	3.37	3.70	6.03	3.10	2.94	2.48	3.18	3.98	3.60	1.08	2.48	3.28	6.03
				2019	1.58	0.160	1.18	1.46	0.694	0.236	2.05	0.113	0.934	0.739	0.113	0.937	2.05
				2020	3.98	6.90	4.78	4.59	5.10	7.02	2.46	0.303	4.39	2.22	0.303	4.68	7.02
				2021	5.46	0.565	3.50	0.736	0.0760	0.211	0.878	0.214	1.46	1.96	0.0760	0.650	5.46
		Manganese	mg/kg	2018	1,270	1,490	2,670	1,030	940	796	1,220	559	1,247	644	559	1,125	2,670
				2019	956	42.9	286	525	270	80.3	644	35.9	355	330	35.9	278	956
				2020	1,900	2,540	1,630	1,340	1,610	1,900	276	141	1,417	823	141	1,620	2,540
				2021	2,350	440	1,970	312	55.0	121	113	230	699	916	55.0	271	2,350
		Mercury	mg/kg	2018	0.118	0.107	0.0739	0.0883	0.0733	0.0615	0.147	0.0935	0.0953	0.0279	0.0615	0.0909	0.147
				2019	0.0550	0.0420	0.125	0.0560	0.0370	0.0440	0.0930	0.0830	0.0669	0.0307	0.0370	0.0555	0.125
				2020	0.0768	0.0923	0.0656	0.0669	0.0662	0.0552	0.0860	0.0797	0.0736	0.0123	0.0552	0.0718	0.0923
				2021	0.0802	0.0292	0.0513	0.0194	0.0160	0.0207	0.0274	0.0232	0.0334	0.0218	0.0160	0.0253	0.0802
		Molybdenum	mg/kg	2018	2.25	3.08	4.55	2.11	1.61	1.77	2.40	1.58	2.42	0.992	1.58	2.18	4.55
				2019	4.40	5.66	5.66	3.31	2.51	5.28	4.54	5.84	4.65	1.21	2.51	4.91	5.84
				2020	5.72	2.45	6.96	3.41	3.76	2.15	6.17	8.78	4.92	2.35	2.15	4.74	8.78
				2021	2.07	7.86	2.70	8.88	8.86	8.22	6.32	4.54	6.18	2.76	2.07	7.09	8.88
		Nickel	mg/kg	2018	8.07	10.2	16.1	7.54	8.54	5.80	6.79	9.61	9.08	3.17	5.80	8.30	16.1
				2019	3.33	0.870	4.41	3.28	1.31	0.530	4.44	0.710	2.36	1.68	0.530	2.30	4.44
				2020	9.42	18.0	10.4	11.3	13.1	16.8	5.54	0.560	10.6	5.70	0.560	10.8	18.0
				2021	12.8	1.44	9.03	1.82	<0.20	0.260	2.46	0.470	3.56	4.76	<0.2	1.63	12.8
		Phosphorus	mg/kg	2018	5,910	8,280	10,200	5,840	6,250	6,170	8,090	4,710	6,931	1,775	4,710	6,210	10,200
				2019	9,770	9,320	10,500	7,980	7,410	8,980	9,370	9,950	9,160	1,025	7,410	9,345	10,500
				2020	8,100	7,980	8,950	7,840	7,810	5,670	7,340	9,160	7,856	1,070	5,670	7,910	9,160
				2021	8,690	8,420	8,720	9,310	9,200	9,380	8,080	8,540	8,792	464	8,080	8,705	9,380
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0306	0.00890	0.111	0.0214	0.00960	0.0230	0.0312	0.0115	0.0309	0.0336	0.00890	0.0222	0.111
				2020	0.0698	0.117	0.0845	0.0719	0.0698	0.0839	0.0700	0.0306	0.0747	0.0239	0.0306	0.0710	0.117
				2021	0.0574	0.0137	0.0370	0.0151	0.0100	0.0139	0.00950	0.00740	0.0205	0.0175	0.00740	0.0138	0.0574
		Sodium	mg/kg	2018	2,700	4,310	4,530	3,130	3,500	3,520	5,450	2,880	3,752	939	2,700	3,510	5,450
				2019	3,320	2,970	4,430	2,410	2,450	3,090	3,610	3,450	3,216	655	2,410	3,205	4,430
				2020	2,770	4,160	3,390	3,150	3,460	2,460	2,480	2,660	3,066	589	2,460	2,960	4,160
				2021	4,320	2,480	4,160	3,280	2,800	3,060	2,540	2,730	3,171	710	2,480	2,930	4,320
		Strontium	mg/kg	2018	25.4	24.4	51.9	34.2	20.9	21.5	17.7	34.4	28.8	11.1	17.7	24.9	51.9
				2019	10.7	14.6	13.3	9.14	7.90	9.40	12.4	12.7	11.3	2.34	7.90	11.6	14.6
				2020	28.9	37.3	34.6	26.7	29.2	38.2	27.4	6.26	28.6	10.1	6.26	29.0	38.2
				2021	23.4	9.78	15.7	11.7	11.2	8.82	8.85	8.69	12.3	5.07	8.69	10.5	23.4
		Tin	mg/kg	2018	<0.10	0.140	<0.20	0.130	0.300	<0.10	0.270	<0.20	0.159	0.0769	<0.1	0.130	0.300
				2019	0.260	<0.10	0.160	0.290	<0.10	0.170	0.250	0.300	0.204	0.0637	<0.1	0.210	0.300
				2020	<0.10	0.160	0.130	<0.10	<0.10	0.150	<0.10	<0.10	0.118	0.0136	<0.1	0.100	0.160
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	20.5	5.34	45.9	53.0	40.4	7.22	48.5	3.42	28.0	21.1	3.42	30.4	53.0
				2020	154	266	212	192	228	294	166	5.11	190	88.3	5.11	202	294
				2021	96.7	9.44	55.0	19.3	0.880	1.54	86.1	7.52	34.6	39.2	0.880	14.4	96.7
		Uranium	mg/kg	2018	0.259	0.261	0.658	0.403	0.252	0.252	0.193	0.560	0.355	0.170	0.193	0.260	0.658
				2019	0.0669	0.0127	0.112	0.0727	0.0183	0.00910	0.164	0.0436	0.0624	0.0541	0.00910	0.0552	0.164
				2020	0.240	0.460	0.276	0.262	0.320	0.438	0.143	0.0124	0.269	0.147	0.0124	0.269	0.460
				2021	0.265	0.0187	0.157	0.0359	0.00310	0.00540	0.0233	0.0134	0.0652	0.0950	0.00310	0.0210	0.265
		Vanadium	mg/kg	2018	7.84	7.72	18.6	7.08	6.74	7.34	4.21	14.7	9.28	4.80	4.21	7.53	18.6
				2019	2.42	0.490	4.56	3.25	2.86	0.540	3.75	0.590	2.31	1.59	0.490	2.64	4.56
				2020	13.0	24.3	21.9	17.6	20.1	25.9	18.4	0.520	17.7	8.04	0.520	19.2	25.9
				2021	10.4	1.12	6.28	1.78	0.150	0.330	8.90	0.690	3.71	4.17	0.150	1.45	10.4
		Zinc	mg/kg	2018	94.4	118	210	101	118	126	171	111	131	39.4	94.4	118	210
				2019	180	92.3	119	158	106	102	149	101	126	32.2	92.3	112	180
				2020	174	180	164	174	151	173	148	128	162	17.8	128	168	180
				2021	164	98.5	151	103	80.4	98.8	87.9	97.7	110	30.3	80.4	98.7	164

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2016	3.27	-	3.46	-	2.99	-	-	-	3.24	0.236	2.99	3.27	3.46
				2017	4.46	3.17	-	-	5.28	5.09	4.56	4.68	4.48	0.661	3.17	4.58	5.28
				2018	1.30	1.28	1.30	1.88	1.18	0.932	1.16	1.02	1.26	0.285	0.932	1.23	1.88
				2019	1.43	2.12	1.43	1.23	2.06	1.20	1.43	1.35	1.53	0.357	1.20	1.43	2.12
				2020	2.79	3.56	1.70	2.46	7.69	2.98	1.18	0.738	2.89	2.16	0.738	2.62	7.69
				2021	2.08	1.70	1.28	3.10	1.23	2.21	2.49	1.33	1.93	0.666	1.23	1.89	3.10
		Copper	mg/kg	2016	136	-	168	-	142	-	-	-	149	17.0	136	142	168
				2017	215	106	-	-	151	109	131	188	147	38.8	106	141	215
				2018	30.8	30.4	37.2	41.4	29.0	24.6	28.8	24.2	30.8	5.89	24.2	29.7	41.4
				2019	36.2	48.8	36.7	34.3	37.0	32.0	49.4	33.9	38.5	6.73	32.0	36.4	49.4
				2020	67.3	110	75.0	47.7	139	81.2	47.0	27.7	74.4	36.2	27.7	71.2	139
				2021	73.7	52.8	61.4	86.3	66.9	71.0	69.0	68.1	68.7	9.63	52.8	68.5	86.3
		Iron	mg/kg	2016	6,420	-	5,800	-	2,790	-	-	-	5,003	1,942	2,790	5,800	6,420
				2017	11,100	4,280	-	-	5,120	4,940	6,350	6,540	6,351	2,192	4,280	5,735	11,100
				2018	470	665	592	829	270	239	387	352	476	206	239	428	829
				2019	1,020	715	1,190	802	2,240	767	1,600	645	1,122	550	645	911	2,240
				2020	2,230	3,980	2,150	614	7,100	2,250	1,330	397	2,506	2,170	397	2,190	7,100
				2021	1,190	1,060	855	2,850	1,020	1,870	2,140	997	1,498	713	855	1,125	2,850
		Selenium	mg/kg	2016	9.11	-	11.8	-	10.1	-	-	-	10.3	1.36	9.11	10.1	11.8
				2017	3.40	2.85	-	-	4.69	3.50	3.96	3.97	3.62	0.579	2.85	3.50	4.69
				2018	3.87	3.61	3.88	3.99	4.51	3.75	3.57	3.87	3.88	0.292	3.57	3.87	4.51
				2019	2.95	2.87	3.05	2.87	2.94	3.10	4.11	2.76	3.08	0.429	2.76	2.94	4.11
				2020	4.45	3.16	2.44	3.99	3.44	3.44	3.20	3.14	3.41	0.602	2.44	3.32	4.45
				2021	4.15	4.80	5.13	5.18	5.20	5.24	4.10	5.51	4.91	0.524	4.10	5.16	5.51
		Secondary Analytes															
		Barium	mg/kg	2016	98.6	-	137	-	93.6	-	-	-	110	23.7	93.6	98.6	137
				2017	71.7	84.4	-	-	125	68.4	62.4	93.6	81.9	19.9	62.4	75.0	125
				2018	6.63	8.23	9.99	25.7	7.47	4.68	4.46	4.65	8.98	7.04	4.46	7.05	25.7
				2019	10.7	39.3	20.5	8.49	9.49	7.49	23.8	25.6	18.2	11.2	7.49	15.6	39.3
				2020	36.6	84.3	76.3	24.3	127	97.5	20.7	8.32	59.4	42.7	8.32	56.5	127
				2021	30.4	33.9	38.3	67.1	37.1	48.6	50.5	38.6	43.1	11.9	30.4	38.4	67.1
		Cadmium	mg/kg	2016	1.12	-	1.15	-	1.25	-	-	-	1.17	0.0681	1.12	1.15	1.25
				2017	0.480	0.545	-	-	2.54	0.820	0.891	1.03	0.943	0.673	0.480	0.766	2.54
				2018	0.0250	0.0590	0.163	0.275	0.218	<0.010	0.0370	<0.010	0.0996	0.103	<0.01	0.0480	0.275
				2019	0.0250	0.409	0.242	0.0240	0.0480	0.0200	0.249	0.127	0.143	0.144	0.0200	0.0875	0.409
				2020	0.896	1.57	1.00	0.797	2.29	1.44	0.378	0.402	1.10	0.644	0.378	0.948	2.29
				2021	0.707	0.767	0.835	1.30	0.909	1.08	0.974	0.913	0.936	0.188	0.707	0.911	1.30
		Calcium	mg/kg	2016	4,490	-	6,410	-	3,870	-	-	-	4,923	1,324	3,870	4,490	6,410
				2017	3,780	3,010	-	-	6,920	4,610	4,730	4,920	4,471	1,225	3,010	4,600	6,920
				2018	832	1,360	966	1,050	851	667	782	802	914	214	667	842	1,360
				2019	1,180	968	1,300	1,010	1,880	888	2,640	951	1,352	611	888	1,095	2,640
				2020	1,850	3,420	2,060	964	4,550	1,900	1,350	770	2,108	1,280	770	1,875	4,550
				2021	2,170	3,160	2,000	4,600	2,280	2,650	2,640	1,760	2,658	898	1,760	2,460	4,600
		Cobalt	mg/kg	2016	3.88	-	4.99	-	3.88	-	-	-	4.25	0.641	3.88	3.88	4.99
				2017	4.58	3.59	-	-	3.19	3.70	3.25	3.82	3.77	0.514	3.19	3.64	4.58
				2018	0.430	0.643	0.651	0.862	0.349	0.258	0.417	0.307	0.490	0.208	0.258	0.424	0.862
				2019	0.702	1.42	0.815	0.551	0.992	0.499	0.950	0.539	0.808	0.310	0.499	0.758	1.42
				2020	1.97	4.36	2.39	1.15	5.73	3.45	1.07	0.575	2.59	1.80	0.575	2.18	5.73
				2021	0.967	0.964	0.889	2.07	0.941	1.45	1.58	1.12	1.25	0.418	0.889	1.04	2.07
		Manganese	mg/kg	2016	2,130	-	2,460	-	2,210	-	-	-	2,267	172	2,130	2,210	2,460
				2017	4,390	5,120	-	-	2,080	1,380	1,670	2,620	3,115	1,370	1,380	3,135	5,120
				2018	113	157	185	419	124	101	126	127	169	104	101	126	419
				2019	117	633	276	115	150	124	211	330	244	176	115	180	633
				2020	676	1,320	693	571	1,700	1,190	370	201	840	513	201	684	1,700
				2021	650	744	872	1,150	770	926	930	863	863	151	650	868	1,150
		Mercury	mg/kg	2016	0.0540	-	0.0517	-	0.0538	-	-	-	0.0532	0.00127	0.0517	0.0538	0.0540
				2017	0.0647	0.0631	-	-	0.0567	0.0545	0.0542	0.0617	0.0594	0.00396	0.0542	0.0600	0.0647
				2018	0.0396	0.0398	<0.0050	0.0785	0.0368	0.0353	0.0367	0.0451	0.0396	0.0147	<0.005	0.0382	0.0785
				2019	0.0230	0.0270	0.0280	0.0260	0.0290	0.0320	0.0290	0.0310	0.0281	0.00285	0.0230	0.0285	0.0320
				2020	0.0655	0.0584	0.0426	0.0404	0.0737	0.0664	0.0779	0.0716	0.0621	0.0140	0.0404	0.0660	0.0779
				2021	0.0275	0.0227	0.0519	0.0391	0.0495	0.0395	0.0410	0.0451	0.0395	0.0101	0.0227	0.0402	0.0519
		Molybdenum	mg/kg	2016	18.4	-	20.8	-	13.9	-	-	-	17.7	3.50	13.9	18.4	20.8
				2017	10.5	12.5	-	-	12.8	8.03	7.16	11.9	10.5	2.10	7.16	11.0	12.8
				2018	6.19	6.36	5.40	7.72	7.40	5.62	4.77	6.20	6.21	0.985	4.77	6.20	7.72
				2019	6.17	7.77	7.14	5.99	6.92	5.32	4.11	6.93	6.29	1.17	4.11	6.54	7.77
				2020	3.12	3.27	2.58	4.27	3.65	4.89	3.91	4.09	3.72	0.728	2.58	3.78	4.89
				2021	2.58	2.60	1.53	1.86	1.61	1.72	1.61	1.62	1.89	0.442	1.53	1.67	2.60
		Nickel	mg/kg	2016	6.05	-	7.80	-	5.92	-	-	-	6.59	1.05	5.92	6.05	7.80
				2017	8.04	5.15	-	-	6.26	5.91	6.62	6.93	6.58	0.855	5.15	6.64	8.04
				2018	0.530	0.760	0.690	1.08	0.450	0.480	1.53	0.640	0.770	0.367	0.450	0.665	1.53
				2019	1.75	1.63	1.37	1.00	2.07	0.940	1.75	0.830	1.42	0.454	0.830	1.50	2.07
				2020	2.48	5.81	3.15	1.40	8.03	4.42	1.61	0.540	3.43	2.52	0.540	2.82	8.03
				2021	1.70	1.59	1.69	3.77	2.11	3.09	2.84	2.74	2.44	0.791	1.59	2.42	3.77
		Phosphorus	mg/kg	2016	7,270	-	6,500	-	6,830	-	-	-	6,867	386	6,500	6,830	7,270
				2017	6,330	5,750	-	-	5,280	4,700	5,840	5,870	5,729	518	4,700	5,855	6,330
				2018	7,000	7,170	6,830	6,270	6,820	6,290	6,530	6,190	6,638	369	6,190	6,675	7,170
				2019	7,540	7,620	6,880	7,050	6,930	7,110	6,810	6,900	7,105	309	6,810	6,990	7,620
				2020	8,710	7,600	7,480	8,480	9,600	8,480	7,930	7,560	8,230	730	7,480	8,205	9,600
				2021	8,300	9,270	7,980	9,000	7,930	9,210	7,400	8,780	8,484	683	7,400	8,540	9,270
		Silver	mg/kg	2016	0.0438	-	0.0452	-	0.0317	-	-	-	0.0402	0.00742	0.0317	0.0438	0.0452
				2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.00630	0.0134	0.00750	<0.0050	0.00880	<0.0050	0.0432	0.00530	0.0118	0.0133	<0.005	0.00690	0.0432
				2020	0.0270	0.0636	0.0382	0.0136	0.0716	0.0430	0.0234	<0.0050	0.0357	0.0220	<0.005	0.0326	0.0716
				2021	0.0231	0.0249	0.0304	0.0482	0.0304	0.0386	0.0360	0.0312	0.0328	0.00803	0.0231	0.0308	0.0482
		Sodium	mg/kg	2016	3,360	-	3,420	-	3,570	-	-	-	3,450	108	3,360	3,420	3,570
				2017	2,690	2,420	-	-	2,240	1,940	2,740	2,690	2,455	283	1,940	2,525	2,740
				2018	3,140	3,130	2,890	2,240	2,520	2,210	2,580	2,180	2,611	400	2,180	2,550	3,140
				2019	2,650	2,930	2,420	2,200	2,380	2,330	1,460	2,130	2,312	428	1,460	2,355	2,930
				2020	4,340	3,500	4,150	3,750	4,230	3,970	3,200	2,940	3,760	508	2,940	3,860	4,340
				2021	2,030	2,490	1,640	1,900	1,700	2,030	1,650	1,900	1,918	280	1,640	1,900	2,490

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Strontium	mg/kg	2016	60.8	-	77.6	-	49.5	-	-	-	62.6	14.1	49.5	60.8	77.6
				2017	39.2	41.7	-	-	67.5	41.4	42.3	44.7	43.5	10.4	31.7	41.5	67.5
				2018	6.65	9.57	5.90	6.48	5.66	4.71	4.70	5.72	6.17	1.55	4.70	5.81	9.57
				2019	8.01	7.27	9.48	7.25	9.95	6.52	14.3	6.63	8.68	2.60	6.52	7.64	14.3
				2020	15.2	22.1	36.7	7.64	35.5	14.6	9.84	5.20	18.3	12.1	5.20	14.9	36.7
				2021	13.6	15.6	10.2	22.4	11.2	15.3	15.2	9.46	14.1	4.13	9.46	14.4	22.4
		Tin	mg/kg	2016	0.0792	-	0.00960	-	0.0415	-	-	-	0.0434	0.0348	0.00960	0.0415	0.0792
				2017	0.210	0.280	-	-	0.150	0.230	0.330	0.250	0.218	0.0690	0.130	0.220	0.330
				2018	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.130	0.104	-	<0.1	0.100	0.130
				2019	0.210	0.500	0.170	0.280	0.410	0.300	0.170	0.200	0.280	0.120	0.170	0.245	0.500
				2020	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2016	83.2	-	21.2	-	43.1	-	-	-	49.2	31.4	21.2	43.1	83.2
				2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	36.8	24.0	37.0	21.8	41.7	25.7	39.0	21.0	30.9	8.53	21.0	31.2	41.7
				2020	61.6	92.6	57.7	14.5	131	57.1	31.2	10.6	57.0	40.3	10.6	57.4	131
				2021	20.6	13.7	21.7	55.4	21.9	29.2	49.0	18.4	28.7	15.2	13.7	21.8	55.4
		Uranium	mg/kg	2016	0.190	-	0.251	-	0.159	-	-	-	0.200	0.0468	0.159	0.190	0.251
				2017	0.204	0.168	-	-	0.306	0.232	0.232	0.272	0.222	0.0499	0.157	0.220	0.306
				2018	0.0217	0.0703	0.0169	0.0445	0.0110	0.00630	0.0120	0.0103	0.0241	0.0221	0.00630	0.0144	0.0703
				2019	0.0253	0.0331	0.0289	0.0177	0.0634	0.0190	0.0439	0.0176	0.0311	0.0158	0.0176	0.0271	0.0634
				2020	0.0844	0.187	0.152	0.0477	0.319	0.120	0.0564	0.0102	0.122	0.0983	0.0102	0.102	0.319
				2021	0.0650	0.0688	0.0791	0.158	0.0808	0.109	0.118	0.0814	0.0950	0.0314	0.0650	0.0811	0.158
		Vanadium	mg/kg	2016	23.5	-	30.9	-	12.7	-	-	-	22.4	9.15	12.7	23.5	30.9
				2017	45.2	15.4	-	-	16.6	17.0	21.1	23.9	23.2	9.85	15.4	19.7	45.2
				2018	1.13	2.15	1.72	2.51	0.860	0.460	0.970	0.810	1.33	0.721	0.460	1.05	2.51
				2019	2.61	1.99	2.95	1.91	6.86	1.92	4.14	1.68	3.01	1.75	1.68	2.30	6.86
				2020	6.06	12.6	6.96	1.48	19.9	6.81	3.94	0.840	7.32	6.28	0.840	6.44	19.9
				2021	3.58	3.60	2.68	8.78	3.03	5.51	6.43	2.75	4.54	2.18	2.68	3.59	8.78
		Zinc	mg/kg	2016	123	-	147	-	134	-	-	-	135	12.0	123	134	147
				2017	95.5	96.0	-	-	119	94.1	107	112	103	9.35	94.1	99.5	119
				2018	90.5	90.8	93.7	97.6	89.1	68.4	79.8	75.5	85.7	10.0	68.4	89.8	97.6
				2019	90.1	109	86.2	77.4	84.5	85.3	111	82.4	90.7	12.4	77.4	85.8	111
				2020	249	305	243	192	447	307	154	106	250	106	106	246	447
				2021	178	195	248	249	226	242	213	255	226	28.1	178	234	255
Lower Edney Creek	E1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2019	1.27	1.90	1.28	1.02	1.38	1.23	2.72	1.04	1.48	0.570	1.02	1.27	2.72
				2020	1.19	3.52	1.91	1.66	2.16	3.01	3.04	1.62	2.26	0.829	1.19	2.04	3.52
				2021	1.40	1.48	1.03	1.22	1.12	1.09	2.77	1.58	1.46	0.564	1.03	1.31	2.77
		Copper	mg/kg	2019	16.0	19.9	16.9	15.9	15.3	18.3	21.5	14.7	17.3	2.39	14.7	16.4	21.5
				2020	45.7	84.1	46.4	49.3	52.0	53.8	69.7	33.6	54.3	15.7	33.6	50.6	84.1
				2021	14.7	17.7	15.0	20.9	40.8	34.2	49.9	41.7	29.4	13.9	14.7	27.6	49.9
		Iron	mg/kg	2019	489	253	206	229	307	362	1,300	188	417	370	188	280	1,300
				2020	1,220	5,440	3,080	1,930	3,490	4,340	2,570	1,410	2,935	1,463	1,220	2,825	5,440
				2021	207	231	169	523	259	282	869	443	373	234	169	270	869
		Selenium	mg/kg	2019	1.34	1.47	1.88	1.40	1.57	1.22	1.01	1.16	1.38	0.269	1.01	1.37	1.88
				2020	2.21	2.44	3.75	2.98	3.01	2.05	2.13	2.25	2.60	0.593	2.05	2.35	3.75
				2021	1.00	1.23	1.77	1.58	1.76	1.45	1.50	1.82	1.51	0.286	1.00	1.54	1.82
		Secondary Analytes															
		Barium	mg/kg	2019	8.28	5.73	10.0	2.95	13.0	9.19	31.6	5.67	10.8	8.95	2.95	8.74	31.6
				2020	26.1	108	96.3	30.2	62.2	52.6	87.6	53.8	64.6	30.1	26.1	58.0	108
				2021	15.3	21.4	3.90	12.5	33.8	19.0	59.1	29.7	24.3	16.9	3.90	20.2	59.1
		Cadmium	mg/kg	2019	0.0890	0.0170	0.0440	0.0270	0.0590	0.0410	0.237	0.0240	0.0672	0.0723	0.0170	0.0425	0.237
				2020	0.290	0.936	1.31	0.574	0.896	0.310	0.521	0.290	0.641	0.373	0.290	0.548	1.31
				2021	0.216	0.196	0.0200	0.166	0.428	0.141	0.357	0.328	0.232	0.132	0.0200	0.206	0.428
		Calcium	mg/kg	2019	933	581	541	472	568	700	1,810	682	786	437	472	632	1,810
				2020	1,250	3,290	3,980	1,970	2,480	2,390	1,640	1,410	2,301	947	1,250	2,180	3,980
				2021	1,130	1,000	649	928	1,160	1,210	1,240	1,070	1,048	192	649	1,100	1,240
		Cobalt	mg/kg	2019	0.283	0.321	0.328	0.156	0.268	0.244	1.33	0.130	0.382	0.389	0.130	0.276	1.33
				2020	0.860	3.78	2.25	1.11	4.11	2.02	2.65	1.22	2.25	1.21	0.860	2.13	4.11
				2021	0.265	0.406	0.211	0.333	0.628	0.439	0.960	0.696	0.492	0.252	0.211	0.422	0.960
		Manganese	mg/kg	2019	101	145	171	89.9	225	132	483	76.9	178	132	76.9	138	483
				2020	352	1,390	1,290	527	1,060	742	1,160	694	902	376	352	901	1,390
				2021	239	326	107	139	249	122	1,260	624	383	392	107	244	1,260
		Mercury	mg/kg	2019	0.0550	0.0560	0.0700	0.0720	0.0760	0.0690	0.0510	0.0690	0.0648	0.00929	0.0510	0.0690	0.0760
				2020	0.134	0.0953	0.0768	0.0955	0.0895	0.0938	0.0910	0.0779	0.0942	0.0177	0.0768	0.0924	0.134
				2021	0.0269	0.0258	0.0301	0.0210	0.0264	0.0217	0.0294	0.0421	0.0279	0.00657	0.0210	0.0266	0.0421
		Molybdenum	mg/kg	2019	2.98	4.16	2.99	3.75	2.82	2.75	2.39	3.18	3.13	0.570	2.39	2.98	4.16
				2020	2.86	1.65	1.64	2.90	1.99	3.28	2.69	3.19	2.52	0.668	1.64	2.78	3.28
				2021	3.50	2.62	3.09	1.99	2.09	1.84	2.30	2.12	2.44	0.584	1.84	2.21	3.50
		Nickel	mg/kg	2019	0.760	0.380	0.340	0.380	0.510	0.680	2.99	0.390	0.804	0.897	0.340	0.450	2.99
				2020	2.84	7.35	5.18	2.78	4.50	3.78	5.08	2.44	4.24	1.64	2.44	4.14	7.35
				2021	0.460	0.610	<0.20	0.350	0.870	0.760	1.32	0.900	0.684	0.335	<0.2	0.685	1.32
		Phosphorus	mg/kg	2019	8,980	8,080	8,460	7,760	7,630	9,160	8,740	7,710	8,315	604	7,630	8,270	9,160
				2020	9,770	8,780	9,010	10,600	9,850	9,360	8,510	8,120	9,250	808	8,120	9,185	10,600
				2021	8,160	8,340	7,820	9,120	9,420	7,930	8,810	8,350	8,494	570	7,820	8,345	9,420
		Silver	mg/kg	2019	0.0138	0.00670	0.0105	<0.0050	0.00940	0.00820	0.0322	0.0103	0.0120	0.00848	<0.005	0.00985	0.0322
				2020	0.0620	0.0898	0.0454	0.0588	0.0451	0.0476	0.0558	0.0381	0.0553	0.0161	0.0381	0.0517	0.0898
				2021	0.0129	0.00870	0.0151	0.00960	0.0149	0.0178	0.0188	0.0161	0.0142	0.00363	0.00870	0.0150	0.0188
		Sodium	mg/kg	2019	3,180	1,970	3,240	2,470	2,620	3,990	3,090	2,680	2,905	609	1,970	2,885	3,990
				2020	3,950	2,940	2,650	4,060	3,220	3,160	2,900	2,550	3,179	558	2,550	3,050	4,060
				2021	2,480	2,640	2,380	3,490	2,830	2,710	2,640	3,000	2,771	348	2,380	2,675	3,490
		Strontium	mg/kg	2019	7.11	4.51	4.16	3.30	8.55	4.95	13.5	5.08	6.40	3.33	3.30	5.01	13.5
				2020	9.96	23.1	15.0	12.1	22.2	15.0	11.7	8.85	14.7	5.34	8.85	13.6	23.1
				2021	7.86	6.66	4.36	7.18	7.88	8.18	10.1	7.02	7.40	1.62	4.36	7.52	10.1
		Tin	mg/kg	2019	0.130	0.190	<0.10	0.310	<0.10	0.200	0.360	<0.10	0.186	0.0947	<0.1	0.160	0.360
				2020	0.400	<0.10	<0.10	<0.10	0.160	<0.10	<0.10	<0.10	0.145	0.112	<0.1	0.100	0.400
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.4: Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2016 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek (Remediated)	E1 (Exposed)	Titanium	mg/kg	2019	8.37	3.77	3.08	4.06	5.19	7.00	20.2	2.67	6.79	5.76	2.67	4.62	20.2
				2020	32.5	139	77.8	68.4	110	97.6	66.3	33.7	78.2	36.6	32.5	73.1	139
				2021	3.06	3.51	2.82	4.65	4.67	5.84	15.2	8.59	6.04	4.14	2.82	4.66	15.2
		Uranium	mg/kg	2019	0.0204	0.00580	0.00800	0.00500	0.0103	0.00820	0.0917	0.00400	0.0192	0.0298	0.00400	0.00810	0.0917
				2020	0.111	0.211	0.138	0.0950	0.116	0.106	0.116	0.0649	0.120	0.0424	0.0649	0.114	0.211
				2021	0.00890	0.0107	0.00400	0.0140	0.0207	0.0198	0.0328	0.0210	0.0165	0.00901	0.00400	0.0169	0.0328
		Vanadium	mg/kg	2019	0.970	0.350	0.300	0.310	0.450	0.510	2.35	0.210	0.681	0.714	0.210	0.400	2.35
				2020	2.58	15.5	9.18	9.18	9.20	11.2	6.56	3.70	8.39	4.13	2.58	9.18	15.5
				2021	0.340	0.410	0.270	1.03	0.720	0.650	2.47	1.09	0.872	0.713	0.270	0.685	2.47
		Zinc	mg/kg	2019	105	107	117	84.9	102	110	142	94.2	108	16.9	84.9	106	142
				2020	138	254	282	202	227	187	212	204	213	43.3	138	208	282
				2021	95.6	110	97.7	95.5	160	94.4	125	116	112	22.5	94.4	104	160

Notes: All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes.

Table D.5.5: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Reference												
		Upper Edney Creek (EDC-U)												
		EDC-U-1	EDC-U-2	EDC-U-3	EDC-U-4	EDC-U-5	EDC-U-6	EDC-U-7	EDC-U-8	Mean	Standard Deviation	Minimum	Median	Maximum
		8-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22					
Moisture	mg/kg dw	73.8	89.1	89.5	77.9	87.2	86.8	88.9	84.3	84.7	5.81	73.8	87.0	89.5
Aluminum	mg/kg dw	1,960	13,300	10,600	6,490	14,700	10,900	8,020	8,050	9,252	4,042	1,960	9,325	14,700
Antimony	mg/kg dw	0.0940	0.0860	0.0860	0.0930	0.0710	0.0670	0.0850	0.110	0.0865	0.0135	0.0670	0.0860	0.110
Arsenic	mg/kg dw	6.75	12.8	14.4	37.9	41.0	10.8	24.5	34.0	22.8	13.4	6.75	19.4	41.0
Barium	mg/kg dw	232	229	319	824	480	225	242	1,140	461	343	225	280	1,140
Beryllium	mg/kg dw	0.206	0.447	0.374	0.392	0.629	0.339	0.336	0.422	0.393	0.120	0.206	0.383	0.629
Bismuth	mg/kg dw	0.0140	0.111	0.0840	0.0560	0.123	0.0780	0.0530	0.0560	0.0719	0.0349	0.0140	0.0670	0.123
Boron	mg/kg dw	18.6	7.80	8.80	11.9	7.40	15.1	8.40	9.90	11.0	3.99	7.40	9.35	18.6
Cadmium	mg/kg dw	1.03	0.949	1.07	2.83	1.82	0.991	1.13	4.69	1.81	1.33	0.949	1.10	4.69
Calcium	mg/kg dw	7,430	11,700	11,000	10,100	13,100	9,420	8,310	12,000	10,382	1,932	7,430	10,550	13,100
Cesium	mg/kg dw	0.0886	1.01	0.783	0.306	1.02	0.848	0.440	0.419	0.614	0.347	0.0886	0.612	1.02
Chromium	mg/kg dw	23.9	127	79.1	119	68.6	145	233	46.6	105	66.2	23.9	99.0	233
Cobalt	mg/kg dw	14.4	21.9	22.8	47.6	35.9	20.6	22.0	65.9	31.4	17.4	14.4	22.4	65.9
Copper	mg/kg dw	24.7	44.1	39.1	34.8	43.0	35.3	36.4	39.7	37.1	6.06	24.7	37.8	44.1
Iron	mg/kg dw	4,460	26,400	22,600	22,700	45,500	21,800	26,000	19,800	23,658	11,206	4,460	22,650	45,500
Lead	mg/kg dw	0.742	5.27	3.99	2.96	6.26	3.94	3.71	3.33	3.78	1.63	0.742	3.82	6.26
Lithium	mg/kg dw	1.39	12.2	9.04	4.18	12.0	9.95	6.82	5.51	7.64	3.84	1.39	7.93	12.2
Magnesium	mg/kg dw	1,910	6,170	5,340	3,540	6,250	5,040	4,330	3,640	4,528	1,476	1,910	4,685	6,250
Manganese	mg/kg dw	6,970	8,460	11,300	26,900	18,300	8,900	9,480	38,600	16,114	11,264	6,970	10,390	38,600
Mercury	mg/kg dw	0.0486	0.157	0.188	0.0972	0.176	0.122	0.0730	0.0777	0.117	0.0517	0.0486	0.110	0.188
Molybdenum	mg/kg dw	2.38	2.24	2.42	2.87	2.74	2.17	3.78	4.41	2.88	0.806	2.17	2.58	4.41
Nickel	mg/kg dw	25.2	45.0	45.3	66.3	56.0	48.1	51.1	95.6	54.1	20.4	25.2	49.6	95.6
Phosphorus	mg/kg dw	2,760	3,290	3,900	3,030	3,600	2,630	2,630	2,670	3,064	487	2,630	2,895	3,900
Potassium	mg/kg dw	6,070	4,780	5,880	4,850	4,140	3,080	4,260	3,810	4,609	1,011	3,080	4,520	6,070
Rubidium	mg/kg dw	7.02	16.7	15.1	8.09	14.7	11.5	9.40	8.27	11.3	3.71	7.02	10.4	16.7
Selenium	mg/kg dw	0.390	0.980	0.820	0.700	1.13	0.770	0.600	0.770	0.770	0.225	0.390	0.770	1.13
Silver	mg/kg dw	0.0337	0.200	0.164	0.0811	0.193	0.129	0.0847	0.100	0.123	0.0589	0.0337	0.114	0.200
Sodium	mg/kg dw	159	291	289	147	291	214	224	151	221	64.0	147	219	291
Strontium	mg/kg dw	65.4	98.2	94.0	114	125	94.2	74.0	140	101	25.0	65.4	96.2	140
Tellurium	mg/kg dw	<0.026	<0.038	<0.025	0.0340	<0.060	<0.062	<0.050	<0.068	0.0280	-	<0.025	0.0500	0.0340
Thallium	mg/kg dw	0.0419	0.116	0.116	0.200	0.152	0.105	0.0929	0.404	0.153	0.111	0.0419	0.116	0.404
Tin	mg/kg dw	<0.13	0.270	0.190	<0.15	<0.30	<0.31	<0.25	<0.34	0.174	0.0572	<0.13	0.270	0.270
Titanium	mg/kg dw	116	458	353	200	487	385	417	289	338	129	116	369	487
Uranium	mg/kg dw	0.388	0.809	0.658	0.612	1.00	0.704	0.660	0.851	0.710	0.182	0.388	0.682	1.00
Vanadium	mg/kg dw	16.2	54.4	45.0	55.4	98.8	45.7	58.8	53.0	53.4	22.7	16.2	53.7	98.8
Zinc	mg/kg dw	154	152	143	241	202	135	113	337	185	73.7	113	153	337
Zirconium	mg/kg dw	1.56	7.61	5.87	4.70	8.94	6.12	6.87	5.40	5.88	2.19	1.56	6.00	8.94

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.5: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 1 (HAC-R1)												
		HAC-R1-1	HAC-R1-2	HAC-R1-3	HAC-R1-4	HAC-R1-5	HAC-R1-6	HAC-R1-7	HAC-R1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22					
Moisture	mg/kg dw	65.7	67.7	64.7	61.0	72.3	67.4	69.8	71.3	67.5	3.71	61.0	67.5	72.3
Aluminum	mg/kg dw	2,010	1,750	868	920	1,400	857	4,720	4,470	2,124	1,584	857	1,575	4,720
Antimony	mg/kg dw	0.0800	0.0680	0.0640	0.0850	0.0680	0.0570	0.0720	0.0780	0.0715	0.00917	0.0570	0.0700	0.0850
Arsenic	mg/kg dw	2.30	2.24	1.78	1.87	2.11	2.17	3.41	3.97	2.48	0.781	1.78	2.20	3.97
Barium	mg/kg dw	133	99.3	68.3	125	84.5	71.6	246	165	124	59.4	68.3	112	246
Beryllium	mg/kg dw	0.0570	0.0620	0.0330	0.0360	0.0500	0.0370	0.171	0.138	0.0730	0.0521	0.0330	0.0535	0.171
Bismuth	mg/kg dw	<0.012	<0.010	<0.012	<0.015	<0.010	<0.012	<0.012	0.0160	0.0107	-	<0.010	0.0120	0.0160
Boron	mg/kg dw	363	288	289	295	325	117	232	150	257	85.3	117	288	363
Cadmium	mg/kg dw	0.148	0.169	0.148	0.152	0.182	0.190	0.180	0.238	0.176	0.0300	0.148	0.174	0.238
Calcium	mg/kg dw	224,000	246,000	236,000	250,000	223,000	280,000	247,000	210,000	239,500	21,527	210,000	241,000	280,000
Cesium	mg/kg dw	0.216	0.172	0.116	0.146	0.175	0.0775	0.258	0.267	0.178	0.0663	0.0775	0.174	0.267
Chromium	mg/kg dw	2.64	3.23	2.34	1.88	2.90	5.79	19.3	88.5	15.8	29.9	1.88	3.06	88.5
Cobalt	mg/kg dw	2.00	1.96	1.20	1.48	1.70	1.23	3.01	3.47	2.01	0.826	1.20	1.83	3.47
Copper	mg/kg dw	42.1	116	36.4	42.6	60.4	41.0	57.5	160	69.5	44.7	36.4	50.0	160
Iron	mg/kg dw	2,840	3,100	1,630	1,830	2,520	1,510	4,450	7,680	3,195	2,051	1,510	2,680	7,680
Lead	mg/kg dw	0.644	0.498	0.298	0.315	0.484	0.280	0.747	1.17	0.554	0.300	0.280	0.491	1.17
Lithium	mg/kg dw	1.59	1.49	0.910	0.990	1.39	0.960	2.56	2.80	1.59	0.724	0.910	1.44	2.80
Magnesium	mg/kg dw	3,090	2,840	2,570	2,750	2,840	2,610	3,260	3,660	2,952	367	2,570	2,840	3,660
Manganese	mg/kg dw	1,240	1,150	774	1,580	1,360	852	1,780	2,100	1,354	452	774	1,300	2,100
Mercury	mg/kg dw	0.00960	0.00910	0.00910	0.00640	0.00880	0.00600	0.0160	0.0243	0.0112	0.00612	0.00600	0.00910	0.0243
Molybdenum	mg/kg dw	1.50	1.35	1.17	1.31	1.71	1.01	1.23	2.29	1.45	0.401	1.01	1.33	2.29
Nickel	mg/kg dw	3.13	3.77	3.10	3.12	3.30	3.98	4.68	11.1	4.52	2.71	3.10	3.54	11.1
Phosphorus	mg/kg dw	866	886	731	681	787	780	880	1,340	869	204	681	826	1,340
Potassium	mg/kg dw	4,980	3,870	3,720	3,790	4,480	1,610	3,410	3,370	3,654	988	1,610	3,755	4,980
Rubidium	mg/kg dw	5.14	3.90	3.54	3.65	4.42	1.64	4.05	4.55	3.86	1.04	1.64	3.98	5.14
Selenium	mg/kg dw	2.22	1.88	2.28	2.57	1.95	1.50	1.51	1.92	1.98	0.371	1.50	1.94	2.57
Silver	mg/kg dw	0.0138	0.0246	0.0115	0.0150	0.0189	0.00930	0.0259	0.0295	0.0186	0.00738	0.00930	0.0170	0.0295
Sodium	mg/kg dw	326	358	249	270	313	225	333	370	306	52.2	225	320	370
Strontium	mg/kg dw	513	535	509	544	512	543	571	439	521	39.1	439	524	571
Tellurium	mg/kg dw	<0.025	0.0250	0.0310	0.0320	0.0250	0.0350	0.0270	0.0210	0.0271	0.00519	0.0210	0.0260	0.0350
Thallium	mg/kg dw	0.00700	0.00610	0.00480	0.00630	0.00640	0.00360	0.00680	0.00870	0.00621	0.00151	0.00360	0.00635	0.00870
Tin	mg/kg dw	<0.12	<0.10	<0.12	<0.15	<0.10	<0.12	<0.12	0.220	0.115	-	<0.10	0.120	0.220
Titanium	mg/kg dw	132	124	72.3	80.9	112	69.3	228	365	148	101	69.3	118	365
Uranium	mg/kg dw	0.156	0.150	0.117	0.122	0.138	0.0956	0.215	0.195	0.149	0.0401	0.0956	0.144	0.215
Vanadium	mg/kg dw	10.7	12.3	6.18	7.06	10.1	5.61	18.2	25.7	12.0	6.87	5.61	10.4	25.7
Zinc	mg/kg dw	19.2	20.7	16.9	16.4	21.4	11.6	27.4	59.8	24.2	15.1	11.6	20.0	59.8
Zirconium	mg/kg dw	1.42	1.26	0.960	0.910	1.23	0.710	2.10	2.38	1.37	0.586	0.710	1.25	2.38

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.5: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data from Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2022

Analyte	Units	Exposed												
		Upper Hazeltine Creek Reach 2 (HAC-U)												
		HAC-U-1 6-Aug-22	HAC-U-2 6-Aug-22	HAC-U-3 6-Aug-22	HAC-U-4 6-Aug-22	HAC-U-5 5-Aug-22	HAC-U-6 5-Aug-22	HAC-U-7 6-Aug-22	HAC-U-8 5-Aug-22	Mean	Standard Deviation	Minimum	Median	Maximum
Moisture	mg/kg dw	59.8	57.2	70.5	74.3	76.4	71.7	87.3	71.0	71.0	9.43	57.2	71.3	87.3
Aluminum	mg/kg dw	1,370	3,010	1,170	3,900	2,610	595	3,730	11,600	3,498	3,490	595	2,810	11,600
Antimony	mg/kg dw	0.0820	0.0830	0.0600	0.0720	0.0540	0.0530	0.0610	0.0710	0.0670	0.0118	0.0530	0.0660	0.0830
Arsenic	mg/kg dw	2.31	2.97	1.95	2.92	3.12	1.93	4.70	5.27	3.15	1.23	1.93	2.94	5.27
Barium	mg/kg dw	113	238	96.1	272	136	84.0	114	823	235	247	84.0	125	823
Beryllium	mg/kg dw	0.0480	0.162	0.0400	0.131	0.0640	0.0230	0.0940	0.180	0.0928	0.0590	0.0230	0.0790	0.180
Bismuth	mg/kg dw	<0.010	0.0140	<0.010	<0.010	<0.010	<0.011	0.0110	<0.010	0.0106	0.00140	<0.010	0.0100	0.0140
Boron	mg/kg dw	239	228	323	197	114	201	115	90.4	188	78.4	90.4	199	323
Cadmium	mg/kg dw	0.242	0.234	0.197	0.237	0.152	0.162	0.209	0.127	0.195	0.0435	0.127	0.203	0.242
Calcium	mg/kg dw	212,000	176,000	203,000	196,000	188,000	238,000	145,000	185,000	192,875	27,195	145,000	192,000	238,000
Cesium	mg/kg dw	0.243	0.365	0.192	0.202	0.249	0.134	0.189	0.225	0.225	0.0673	0.134	0.214	0.365
Chromium	mg/kg dw	2.28	4.74	2.66	1.96	7.92	1.28	17.5	7.08	5.68	5.36	1.28	3.70	17.5
Cobalt	mg/kg dw	1.75	3.20	1.29	2.50	2.23	0.800	2.89	3.09	2.22	0.874	0.800	2.37	3.20
Copper	mg/kg dw	50.5	86.8	35.1	510	52.2	21.2	71.5	104	116	161	21.2	61.9	510
Iron	mg/kg dw	2,320	4,680	1,610	3,940	3,420	950	5,860	5,070	3,481	1,736	950	3,680	5,860
Lead	mg/kg dw	0.541	1.43	0.385	0.885	0.729	0.226	2.53	1.12	0.981	0.738	0.226	0.807	2.53
Lithium	mg/kg dw	1.27	2.51	0.920	1.53	1.76	0.600	2.31	2.72	1.70	0.766	0.600	1.64	2.72
Magnesium	mg/kg dw	3,020	4,110	2,740	3,420	3,270	2,650	3,780	4,460	3,431	646	2,650	3,345	4,460
Manganese	mg/kg dw	3,500	3,200	2,820	4,260	2,620	2,120	2,220	2,200	2,868	750	2,120	2,720	4,260
Mercury	mg/kg dw	0.0153	0.0195	0.00970	0.0129	0.0148	0.00640	0.0362	0.0202	0.0169	0.00906	0.00640	0.0150	0.0362
Molybdenum	mg/kg dw	1.37	1.49	1.35	1.56	1.20	0.900	1.96	0.745	1.32	0.382	0.745	1.36	1.96
Nickel	mg/kg dw	3.11	6.97	2.66	2.59	3.20	1.79	5.49	2.97	3.60	1.73	1.79	3.04	6.97
Phosphorus	mg/kg dw	1,050	1,360	861	1,280	1,670	896	4,480	1,650	1,656	1,182	861	1,320	4,480
Potassium	mg/kg dw	6,350	7,010	6,070	5,410	6,100	4,930	6,820	5,490	6,022	715	4,930	6,085	7,010
Rubidium	mg/kg dw	6.78	8.68	6.17	6.20	7.95	5.15	7.94	8.08	7.12	1.22	5.15	7.36	8.68
Selenium	mg/kg dw	5.00	3.83	4.05	12.2	1.97	1.94	2.30	1.62	4.11	3.49	1.62	3.06	12.2
Silver	mg/kg dw	0.0162	0.0616	0.0101	0.0631	0.0171	<0.0057	0.0477	0.0214	0.0304	0.0230	<0.0057	0.0192	0.0631
Sodium	mg/kg dw	317	375	307	345	420	246	269	306	323	56.1	246	312	420
Strontium	mg/kg dw	518	488	479	494	474	550	366	589	495	65.2	366	491	589
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	0.0270	<0.020	<0.023	0.0210	0.0230	0.0214	0.00245	<0.020	0.0210	0.0270
Thallium	mg/kg dw	0.00970	0.0168	0.00880	0.0134	0.0123	0.00780	0.00640	0.00860	0.0105	0.00343	0.00640	0.00925	0.0168
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.11	0.100	<0.10	0.100	-	<0.10	0.100	0.100
Titanium	mg/kg dw	98.0	304	73.2	188	207	39.6	296	255	183	102	39.6	198	304
Uranium	mg/kg dw	0.186	0.189	0.144	0.163	0.165	0.123	0.130	0.174	0.159	0.0247	0.123	0.164	0.189
Vanadium	mg/kg dw	9.34	17.0	7.29	20.8	13.2	4.24	18.1	22.1	14.0	6.55	4.24	15.1	22.1
Zinc	mg/kg dw	43.1	31.7	14.5	13.2	12.4	6.40	19.7	15.3	19.5	12.0	6.40	14.9	43.1
Zirconium	mg/kg dw	0.890	2.15	0.800	1.30	1.14	0.600	1.13	1.90	1.24	0.537	0.600	1.14	2.15

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Edney Creek (Reference)	EDC-U (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	1.25	1.99	1.87	3.01	1.55	2.29	0.601	1.15	1.71	0.747	0.601	1.71	3.01
				2019	3.76	2.81	2.85	3.53	1.52	2.45	2.96	4.54	3.05	0.907	1.52	2.90	4.54
				2020	1.08	2.84	3.27	2.12	2.62	0.951	0.906	1.80	1.95	0.916	0.906	1.96	3.27
				2021	1.78	2.74	3.29	3.67	3.82	3.82	2.84	3.81	3.22	0.729	1.78	3.48	3.82
		Copper	mg/kg	2018	19.2	22.5	22.7	29.5	21.5	23.9	20.3	17.9	22.2	3.55	17.9	22.0	29.5
				2019	26.1	18.5	37.1	22.5	24.6	32.5	31.1	25.5	27.2	5.98	18.5	25.8	37.1
				2020	27.0	24.1	20.9	26.9	27.3	21.2	25.2	27.3	25.0	2.68	20.9	26.0	27.3
				2021	18.8	25.0	21.6	27.8	26.0	25.6	27.0	26.8	24.8	3.08	18.8	25.8	27.8
		Iron	mg/kg	2018	1,530	3,170	2,130	4,100	1,420	3,690	652	977	2,209	1,294	652	1,830	4,100
				2019	6,790	2,680	3,030	5,260	3,000	2,650	3,800	3,940	3,894	1,456	2,650	3,415	6,790
				2020	1,450	4,780	3,180	2,480	3,010	1,580	1,340	1,440	2,408	1,211	1,340	2,030	4,780
				2021	1,570	3,360	3,240	4,490	4,940	4,510	3,060	4,480	3,706	1,115	1,570	3,920	4,940
		Selenium	mg/kg	2018	0.460	0.900	0.940	0.890	0.800	0.840	1.05	0.850	0.841	0.172	0.460	0.870	1.05
				2019	0.730	1.29	0.560	1.03	0.580	1.22	1.33	1.59	1.04	0.382	0.560	1.12	1.59
				2020	0.740	1.07	2.14	0.530	1.17	0.590	0.440	0.970	0.956	0.546	0.440	0.855	2.14
				2021	0.520	0.740	0.900	1.12	0.720	0.810	0.900	0.970	0.835	0.181	0.520	0.855	1.12
		Secondary Analytes															
		Barium	mg/kg	2018	45.0	46.7	24.0	117	46.2	107	18.7	36.5	55.1	36.7	18.7	45.6	117
				2019	33.8	25.4	21.6	31.3	17.3	23.9	34.4	57.0	30.6	12.3	17.3	28.4	57.0
				2020	60.6	130	67.2	127	33.6	37.6	43.1	35.5	66.8	39.9	33.6	51.9	130
				2021	52.3	110	69.9	108	163	92.8	72.7	36.4	88.1	39.7	36.4	82.8	163
		Cadmium	mg/kg	2018	2.11	3.39	2.56	2.26	2.53	2.90	1.18	1.43	2.30	0.729	1.18	2.40	3.39
				2019	2.29	1.55	1.22	1.83	2.76	4.32	4.57	3.82	2.80	1.30	1.22	2.52	4.57
				2020	1.87	1.30	1.83	1.41	3.12	2.15	1.10	3.27	2.01	0.809	1.10	1.85	3.27
				2021	2.42	3.13	5.04	4.06	3.87	3.16	6.41	8.35	4.56	1.98	2.42	3.96	8.35
		Calcium	mg/kg	2018	2,520	3,090	2,370	2,680	1,810	2,480	1,480	1,450	2,235	592	1,450	2,425	3,090
				2019	3,790	2,340	3,040	3,050	2,440	3,150	4,220	4,640	3,334	818	2,340	3,100	4,640
				2020	2,930	3,230	3,650	2,740	2,380	1,830	2,990	3,090	2,855	553	1,830	2,960	3,650
				2021	1,920	3,040	2,970	2,920	3,480	3,240	3,610	3,990	3,146	615	1,920	3,140	3,990
		Cobalt	mg/kg	2018	1.79	3.31	2.56	5.08	3.36	4.05	1.18	2.46	2.97	1.25	1.18	2.94	5.08
				2019	4.20	2.30	3.18	4.00	2.53	4.47	3.87	4.46	3.63	0.853	2.30	3.94	4.47
				2020	3.15	4.46	3.86	5.55	3.76	2.45	2.75	2.93	3.61	1.02	2.45	3.46	5.55
				2021	3.19	5.96	5.50	7.95	11.4	7.21	6.22	5.18	6.58	2.41	3.19	6.09	11.4
		Manganese	mg/kg	2018	1,100	1,100	620	2,040	1,700	1,390	624	1,430	1,250	495	620	1,245	2,040
				2019	672	485	854	767	291	684	868	988	701	225	291	726	988
				2020	1,730	2,410	2,410	4,140	1,230	1,250	1,960	1,490	2,078	953	1,230	1,845	4,140
				2021	1,130	3,360	1,920	2,860	5,330	2,860	2,680	1,260	2,675	1,339	1,130	2,770	5,330
		Mercury	mg/kg	2018	0.0716	0.172	0.125	0.121	0.0800	0.133	0.0770	0.0986	0.110	0.0345	0.0716	0.110	0.172
				2019	0.0750	0.0930	0.0590	0.109	0.0960	0.134	0.145	0.104	0.102	0.0283	0.0590	0.100	0.145
				2020	0.0446	0.0985	0.185	0.0391	0.0913	0.0658	0.0315	0.0490	0.0756	0.0504	0.0315	0.0574	0.185
				2021	0.0333	0.0674	0.0776	0.0758	0.0668	0.0686	0.0575	0.0707	0.0647	0.0141	0.0333	0.0680	0.0776
		Molybdenum	mg/kg	2018	0.925	1.43	1.62	1.49	1.10	1.55	1.15	1.00	1.28	0.270	0.925	1.29	1.62
				2019	0.846	0.519	0.874	0.677	0.798	1.47	1.39	1.40	0.997	0.368	0.519	0.860	1.47
				2020	1.10	0.958	0.960	0.852	1.26	0.869	0.878	1.08	0.995	0.142	0.852	0.959	1.26
				2021	0.817	1.24	1.48	1.66	2.09	2.72	1.70	1.72	1.68	0.564	0.817	1.68	2.72
		Nickel	mg/kg	2018	3.69	5.42	3.80	9.04	3.60	5.92	1.83	2.87	4.52	2.24	1.83	3.74	9.04
				2019	5.68	2.55	6.39	6.49	2.12	4.46	5.28	5.92	4.86	1.69	2.12	5.48	6.49
				2020	4.68	9.06	6.06	10.2	4.12	3.32	4.84	3.82	5.76	2.54	3.32	4.76	10.2
				2021	4.22	8.07	6.93	9.60	13.3	9.15	8.61	7.29	8.40	2.59	4.22	8.34	13.3
		Phosphorus	mg/kg	2018	6,670	8,170	8,190	7,580	8,010	6,610	6,970	6,800	7,375	689	6,610	7,275	8,190
				2019	6,490	7,740	6,440	6,560	8,710	10,100	9,080	8,020	7,892	1,355	6,440	7,880	10,100
				2020	10,700	9,550	9,880	11,000	9,770	7,500	9,090	10,300	9,724	1,090	7,500	9,825	11,000
				2021	9,000	10,200	11,000	9,480	8,920	10,100	11,200	11,900	10,225	1,078	8,920	10,150	11,900
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.185	0.164	0.192	0.156	0.168	0.291	0.252	0.163	0.196	0.0490	0.156	0.176	0.291
				2020	0.108	0.134	0.198	0.0736	0.272	0.148	0.0636	0.164	0.145	0.0682	0.0636	0.141	0.272
				2021	0.0730	0.105	0.116	0.118	0.131	0.122	0.212	0.102	0.122	0.0402	0.0730	0.117	0.212
		Sodium	mg/kg	2018	5,520	4,040	4,580	5,660	4,900	3,870	3,800	3,150	4,440	882	3,150	4,310	5,660
				2019	4,620	7,440	4,470	5,400	9,500	15,700	11,700	5,050	7,985	4,051	4,470	6,420	15,700
				2020	6,960	6,460	4,540	6,070	9,730	7,430	3,960	7,000	6,519	1,782	3,960	6,710	9,730
				2021	4,710	6,310	5,990	5,320	5,280	8,160	5,890	6,350	6,001	1,038	4,710	5,940	8,160
		Strontium	mg/kg	2018	16.9	23.0	13.4	18.3	13.4	19.1	7.63	8.97	15.1	5.22	7.63	15.2	23.0
				2019	26.2	11.5	25.0	20.0	7.49	12.5	21.0	25.6	18.7	7.24	7.49	20.5	26.2
				2020	21.5	25.4	24.6	23.6	13.9	11.7	21.4	21.7	20.5	5.00	11.7	21.6	25.4
				2021	13.0	20.4	20.7	20.7	25.5	21.7	24.8	24.8	21.4	4.01	13.0	21.2	25.5
		Tin	mg/kg	2018	<0.10	0.120	<0.10	0.130	<0.10	<0.10	<0.10	<0.10	0.106	0.00468	<0.1	0.100	0.130
				2019	0.490	0.150	0.340	0.420	0.880	0.770	1.07	1.23	0.669	0.378	0.150	0.630	1.23
				2020	<0.10	<0.10	0.120	0.100	<0.10	<0.10	<0.10	0.190	0.114	0.0362	<0.1	0.100	0.190
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	138	70.6	71.5	102	68.1	40.4	84.0	84.6	82.4	28.6	40.4	77.8	138
				2020	26.8	99.1	65.0	52.7	49.1	24.1	25.9	25.4	46.0	26.5	24.1	38.0	99.1
				2021	37.4	82.6	69.8	95.6	106	80.9	66.5	101	80	22.3	37.4	81.8	106
		Uranium	mg/kg	2018	0.152	0.245	0.181	0.385	0.161	0.352	0.0959	0.122	0.212	0.106	0.0959	0.171	0.385
				2019	0.245	0.120	0.150	0.248	0.0781	0.187	0.294	0.382	0.213	0.0992	0.0781	0.216	0.382
				2020	0.138	0.269	0.365	0.237	0.159	0.125	0.142	0.182	0.202	0.0829	0.125	0.170	0.365
				2021	0.143	0.288	0.284	0.593	0.420	0.415	0.329	0.315	0.348	0.131	0.143	0.322	0.593
		Vanadium	mg/kg	2018	3.74	7.25	5.13	9.59	3.15	11.3	1.38	2.02	5.44	3.61	1.38	4.43	11.3
				2019	17.2	6.33	7.48	11.5	11.1	6.43	9.57	9.18	9.85	3.56	6.33	9.38	17.2
				2020	3.85	9.73	7.44	6.80	6.94	3.33	4.05	3.72	5.73	2.32	3.33	5.42	9.73
				2021	3.88	8.28	7.81	11.4	13.1	10.9	8.26	10.6	9.28	2.85	3.88	9.44	13.1
		Zinc	mg/kg	2018	130	172	168	192	242	206	208	196	189	33.2	130	194	242
				2019	124	199	157	108	149	192	185	155	159	32.3	108	156	199
				2020	366	364	366	413	220	202	228	377	317	84.8	202	365	413
				2021	161	253	174	181	190	165	243	169	192	35.8	161	178	253
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2018	3.02	2.82	2.38	3.28	2.39	2.71	3.51	2.46	2.82	0.422	2.38	2.76	3.51
				2019	4.93	1.69	2.40	1.65	1.90	2.13	3.16	2.64	2.56	1.08	1.65	2.26	4.93
				2020	1.59	1.36	2.16	3.95	2.24	0.714	0.671	0.926	1.70	1.09	0.671	1.48	3.95
				2021	2.76	3.55	2.93	3.57	3.51	3.03	3.88	2.78	3.25	0.426	2.76	3.27	3.88
		Copper	mg/kg	2018	252	258	260	228	128	165	230	259	222	49.6	128	241	260
				2019	162	73.3	122	182	92.5	144	159	177	139	39.7	73.3	152	182
				2020	107	67.6	232	425	214	35.0	26.8	63.7	146	137	26.8	87.3	425
				2021	149	184	170	217	227	198	223	167	192	29.0	149	191	227
		Iron	mg/kg	2018	1,930	1,650	1,120	1,760	3,010	2,490	2,930	1,660	2,069	672	1,120	1,845	3,010
				2019	8,230	1,830	3,900	2,860	2,400	2,830	4,460	5,450	3,995	2,076	1,830	3,380	8,230
				2020	2,180	1,670	5,600	7,570	4,730	655	528	1,680	3,077	2,574	528	1,930	7,570
				2021	3,270	4,960	4,260	6,190	6,580	4,840	5,620	3,600	4,915	1,181	3,270	4,900	6,580
		Selenium	mg/kg	2018	2.06	2.06	2.06	3.60	3.13	2.58	2.29	1.95	2.47	0.601	1.95	2.17	3.60
				2019	3.18	3.63	4.13	3.64	4.09	3.40	3.23	2.92	3.53	0.430	2.92	3.52	4.13
				2020	5.06	5.18	6.51	8.92	4.57	6.09	4.27	4.94	5.69	1.50	4.27	5.12	8.92
				2021	6.70	6.45	6.34	8.14	7.34	6.83	7.05	6.79	6.96	0.574	6.34	6.81	8.14

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Secondary Analytes**															
		Barium	mg/kg	2018	42.0	37.2	31.4	34.4	58.7	57.1	384	57.1	87.7	120	31.4	49.5	384
				2019	169	31.2	55.1	28.7	23.2	44.0	259	367	122	130	23.2	49.5	367
				2020	28.6	29.6	69.5	97.2	106	8.46	5.82	21.4	45.8	39.6	5.82	29.1	106
				2021	48.3	134	60.3	70.2	81.8	79.0	78.3	57.2	76.1	26.2	48.3	74.2	134
		Cadmium	mg/kg	2018	0.772	0.746	0.585	1.62	1.85	1.28	1.26	0.618	1.09	0.481	0.585	1.02	1.85
				2019	0.438	0.797	1.17	0.488	1.11	1.78	1.76	0.609	1.02	0.534	0.438	0.954	1.78
				2020	0.527	0.860	0.306	0.494	0.387	0.218	0.0800	0.175	0.381	0.247	0.0800	0.346	0.860
				2021	0.756	1.36	1.28	1.02	1.26	0.826	1.95	2.08	1.32	0.483	0.756	1.27	2.08
		Calcium	mg/kg	2018	166,000	162,000	194,000	109,000	6,860	119,000	136,000	161,000	131,733	57,464	6,860	148,500	194,000
				2019	36,000	6,300	11,400	4,170	3,370	9,130	9,410	9,980	11,220	10,411	3,370	9,270	36,000
				2020	12,900	3,360	6,980	7,420	7,990	1,330	783	4,390	5,644	4,002	783	5,685	12,900
				2021	6,640	7,250	5,940	7,980	10,300	5,770	13,100	4,620	7,700	2,768	4,620	6,945	13,100
		Cobalt	mg/kg	2018	1.82	1.78	1.27	1.75	3.27	2.23	2.59	1.66	2.05	0.631	1.27	1.80	3.27
				2019	6.36	1.79	3.41	2.42	2.12	2.90	3.70	4.24	3.37	1.46	1.79	3.16	6.36
				2020	1.91	1.36	4.61	5.59	3.55	0.501	0.386	1.40	2.41	1.94	0.386	1.66	5.59
				2021	3.08	3.80	3.69	4.92	4.90	4.30	5.14	3.68	4.19	0.741	3.08	4.05	5.14
		Manganese	mg/kg	2018	394	481	330	545	1,260	816	927	627	672	312	330	586	1,260
				2019	1,490	931	1,320	1,410	1,070	1,810	2,200	2,540	1,596	553	931	1,450	2,540
				2020	1,070	875	2,280	2,140	2,000	241	192	788	1,198	838	192	972	2,280
				2021	2,490	2,700	2,490	3,430	3,310	3,720	3,780	2,860	3,098	529	2,490	3,085	3,780
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Secondary Analytes**															
		Mercury	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
		Molybdenum	mg/kg	2018	7.72	1.54	1.90	2.22	5.04	3.11	3.50	1.77	3.35	2.11	1.54	2.66	7.72
				2019	2.96	2.59	3.11	3.27	1.47	4.15	3.89	4.39	3.23	0.943	1.47	3.19	4.39
				2020	5.61	5.18	5.52	6.50	4.66	9.91	6.76	8.36	6.56	1.77	4.66	6.06	9.91
				2021	6.16	6.18	4.71	5.26	5.49	5.72	7.19	7.02	5.97	0.850	4.71	5.94	7.19
		Nickel	mg/kg	2018	3.47	4.33	2.64	3.07	21.2	3.39	5.88	2.39	5.80	6.32	2.39	3.43	21.2
				2019	3.59	1.91	3.21	3.83	3.88	3.14	4.24	3.78	3.45	0.718	1.91	3.68	4.24
				2020	2.56	2.08	6.28	8.25	4.36	0.860	0.580	2.10	3.38	2.71	0.580	2.33	8.25
				2021	4.37	5.91	5.41	9.41	8.09	6.51	8.30	6.03	6.75	1.69	4.37	6.27	9.41
		Phosphorus	mg/kg	2018	4,180	5,160	3,870	6,240	6,730	4,760	4,690	4,740	5,046	979	3,870	4,750	6,730
				2019	6,610	6,290	7,700	6,430	5,710	7,260	6,120	6,340	6,558	638	5,710	6,385	7,700
				2020	8,670	9,060	11,000	20,500	7,840	7,080	6,970	7,030	9,769	4,546	6,970	8,255	20,500
				2021	12,500	11,700	12,200	10,900	11,200	11,000	12,400	12,200	11,762	652	10,900	11,950	12,500
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0407	0.0188	0.0330	0.0370	0.0258	0.0334	0.0420	0.0426	0.0342	0.00838	0.0188	0.0352	0.0426
				2020	0.0280	0.0225	0.0981	0.220	0.117	0.0108	0.00560	0.0299	0.0665	0.0743	0.00560	0.0290	0.220
				2021	0.0421	0.0593	0.0582	0.0740	0.0877	0.0698	0.0718	0.0552	0.0648	0.0140	0.0421	0.0646	0.0877
		Sodium	mg/kg	2018	3,420	3,940	3,660	4,080	3,110	3,380	3,410	3,560	3,570	316	3,110	3,490	4,080
				2019	3,850	3,760	5,080	3,780	4,220	4,520	3,340	3,370	3,990	591	3,340	3,815	5,080
				2020	5,070	4,500	8,490	17,000	4,740	2,420	2,310	3,650	6,022	4,838	2,310	4,620	17,000
				2021	6,880	6,590	7,360	6,710	7,260	6,720	6,850	6,370	6,842	330	6,370	6,785	7,360
		Strontium	mg/kg	2018	341	324	348	203	33.1	244	290	310	262	105	33.1	300	348
				2019	111	25.8	38.7	21.3	18.5	34.5	50.4	36.4	42.1	29.7	18.5	35.4	111
				2020	38.8	17.5	57.7	76.6	55.0	8.52	4.94	17.6	34.6	26.4	4.94	28.2	76.6
				2021	35.2	43.3	40.7	45.1	65.0	46.4	55.6	34.7	45.8	10.2	34.7	44.2	65.0
		Tin	mg/kg	2018	<0.10	<0.10	<0.10	<0.10	0.150	<0.10	0.110	<0.10	0.108	0.0187	<0.1	0.100	0.150
				2019	0.220	0.160	0.420	0.150	0.160	0.280	0.180	0.290	0.232	0.0933	0.150	0.200	0.420
				2020	<0.10	0.270	0.210	0.330	0.120	<0.10	<0.10	0.120	0.169	0.0878	<0.1	0.120	0.330
				2021	<0.10	0.100	<0.10	0.120	0.120	<0.10	0.160	<0.10	0.112	0.0229	<0.1	0.100	0.160
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	446	62.3	247	93.8	124	119	177	258	191	125	62.3	150	446
				2020	77.6	54.2	223	287	155	25.0	17.0	70.9	114	98.3	17.0	74.2	287
				2021	97.0	148	133	197	178	146	175	115	149	33.7	97.0	147	197
		Uranium	mg/kg	2018	0.167	0.145	0.135	0.156	0.130	0.159	0.252	0.115	0.157	0.0418	0.115	0.150	0.252
				2019	0.180	0.0991	0.149	0.0925	0.0872	0.0950	0.136	0.129	0.121	0.0331	0.0872	0.114	0.180
				2020	0.128	0.0863	0.353	0.267	0.210	0.0204	0.0154	0.0617	0.143	0.123	0.0154	0.107	0.353
				2021	0.179	0.235	0.202	0.235	0.224	0.213	0.277	0.194	0.220	0.0303	0.179	0.218	0.277
		Vanadium	mg/kg	2018	7.19	5.69	4.17	6.42	10.5	9.06	10.8	5.78	7.45	2.42	4.17	6.80	10.8
				2019	28.7	6.03	13.4	9.06	8.44	9.25	14.5	20.2	13.7	7.52	6.03	11.3	28.7
				2020	7.13	5.13	18.4	25.4	14.8	2.03	1.97	5.28	10.0	8.56	1.97	6.20	25.4
				2021	10.7	16.2	13.6	19.6	21.0	15.2	18.1	11.5	15.7	3.71	10.7	15.7	21.0
		Zinc	mg/kg	2018	39.8	42.4	34.3	69.5	107	50.8	49.1	46.7	55	23.5	34.3	47.9	107
				2019	94.8	89.9	105	88.1	84.7	99.3	84.4	85.2	91.4	7.60	84.4	89.0	105
				2020	130	116	136	173	104	82.9	90.3	94.1	116	29.8	82.9	110	173
				2021	145	148	134	137	136	138	162	160	145	10.9	134	142	162
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	2.54	3.99	2.74	2.13	1.72	-	-	-	2.62	0.858	1.72	2.54	3.99
				2015	2.60	2.32	2.56	2.56	2.78	-	-	-	2.56	0.164	2.32	2.56	2.78
				2018	1.84	2.32	2.30	2.04	1.69	1.81	1.97	2.19	2.02	0.235	1.69	2.00	2.32
				2019	2.68	9.52	3.18	2.61	1.95	3.10	2.93	2.24	3.53	2.46	1.95	2.80	9.52
				2020	1.27	1.47	1.33	0.773	0.810	0.490	0.918	1.17	1.03	0.334	0.490	1.04	1.47
				2021	2.35	2.40	3.91	3.32	1.55	2.16	2.06	3.53	2.66	0.825	1.55	2.38	3.91
		Copper	mg/kg	2010	49.6	53.3	54.4	47.4	44.3	-	-	-	49.8	4.17	44.3	49.6	54.4
				2015	188	171	165	168	186	-	-	-	176	10.6	165	171	188
				2018	77.5	75.7	88.5	82.1	92.9	73.3	98.7	64.2	81.6	11.3	64.2	79.8	98.7
				2019	129	343	124	135	111	230	205	83.4	170	85.2	83.4	132	343
				2020	61.6	68.8	62.7	31.6	33.9	19.8	39.4	68.8	48.3	19.3	19.8	50.5	68.8
				2021	141	118	144	205	69.7	107	74.7	121	123	43.0	69.7	120	205
		Iron	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	9,770	3,540	6,790	7,240	5,170	-	-	-	6,502	2,337	3,540	6,790	9,770
				2018	1,220	3,260	1,960	1,320	1,140	1,480	1,690	1,470	1,692	686	1,140	1,475	3,260
				2019	3,040	8,170	2,900	4,550	2,560	4,850	2,940	2,460	3,934	1,930	2,460	2,990	8,170
				2020	1,080	1,530	1,500	650	568	232	779	1,370	964	480	232	930	1,530
				2021	6,550	4,730	6,440	7,220	1,170	2,810	1,760	3,490	4,271	2,314	1,170	4,110	7,220
		Selenium	mg/kg	2010	10.8	10.0	10.7	11.2	11.8	-	-	-	10.9	0.663	10.0	10.8	11.8
				2015	4.05	4.49	5.44	5.56	4.99	-	-	-	4.91	0.638	4.05	4.99	5.56
				2018	2.70	2.88	2.49	2.73	2.96	2.21	3.04	2.10	2.64	0.344	2.10	2.72	3.04
				2019	3.61	2.51	3.30	3.42	3.10	2.30	3.13	2.80	3.02	0.452	2.30	3.12	3.61
				2020	6.95	6.47	5.52	5.98	5.10	4.44	6.40	6.48	5.92	0.840	4.44	6.19	6.95
				2021	6.08	5.73	5.28	5.14	4.77	4.41	4.94	5.27	5.20	0.527	4.41	5.20	6.08
		Secondary Analytes			-	-	-	-	-	-	-	-	-	-	-	-	-
		Barium	mg/kg	2010	63.7	72.7	78.0	63.1	47.6	-	-	-	65.0	11.6	47.6	63.7	78.0
				2015	135	93.0	87.3	84.3	90.1	-	-	-	97.9	21.0	84.3	90.1	135
				2018	24.9	25.8	28.5	31.0	26.7	28.0	35.9	27.9	28.6	3.49	24.9	28.0	35.9
				2019	50.2	91.4	40.5	126	43.1	216	57.2	60.8	85.7	60	40.5	59.0	216
				2020	23.2	22.3	27.2	11.9	9.29	3.36	14.0	28.3	17.4	9.08	3.36	18.2	28.3
				2021	55.4	68.0	97.7	65.9	57.9	92.0	69.9	75.2	72.8	15.1	55.4	69	97.7

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	Cadmium	mg/kg	2010	0.502	0.355	0.381	0.344	0.248	-	-	-	0.366	0.0912	0.248	0.355	0.502
				2015	0.304	0.333	0.327	0.327	0.328	-	-	-	0.324	0.0113	0.304	0.327	0.333
				2018	1.07	1.34	1.37	1.09	1.04	0.918	0.701	0.345	0.984	0.336	0.345	1.06	1.37
				2019	3.11	0.532	1.12	0.933	0.433	0.442	0.740	0.524	0.979	0.896	0.433	0.636	3.11
				2020	0.311	0.781	0.371	0.0664	0.0948	0.0790	0.319	0.430	0.307	0.239	0.0664	0.315	0.781
				2021	0.674	1.06	0.691	0.737	0.516	0.553	0.926	1.32	0.810	0.274	0.516	0.714	1.32
		Calcium	mg/kg	2010	2,320	12,900	2,560	1,730	1,870	-	-	-	4,276	4,833	1,730	2,320	12,900
				2015	10,200	7,010	5,950	6,760	7,160	-	-	-	7,416	1,625	5,950	7,010	10,200
				2018	4,630	5,220	4,200	4,330	4,000	5,550	5,710	8,250	5,236	1,373	4,000	4,925	8,250
				2019	9,660	30,500	11,700	14,700	9,870	55,900	42,900	11,600	23,354	17,771	9,660	13,200	55,900
				2020	2,140	2,290	2,330	1,830	1,520	738	1,520	3,040	1,926	690	738	1,985	3,040
				2021	7,780	13,600	8,870	9,020	5,000	15,000	3,340	16,300	9,864	4,691	3,340	8,945	16,300
		Cobalt	mg/kg	2010	2.78	2.69	3.19	2.14	1.76	-	-	-	2.51	0.563	1.76	2.69	3.19
				2015	5.74	4.23	3.86	3.57	3.70	-	-	-	4.22	0.885	3.57	3.86	5.74
				2018	1.37	2.09	1.75	1.28	1.16	1.06	1.31	1.04	1.38	0.363	1.04	1.30	2.09
				2019	2.20	4.39	2.09	2.99	1.95	2.78	2.12	1.85	2.55	0.845	1.85	2.16	4.39
				2020	0.988	1.17	1.29	0.440	0.472	0.151	0.562	1.07	0.768	0.413	0.151	0.775	1.29
				2021	3.55	2.71	3.94	3.87	1.33	2.20	1.76	2.41	2.72	0.980	1.33	2.56	3.94
		Manganese	mg/kg	2010	1,970	2,040	2,320	2,060	1,700	-	-	-	2,018	222	1,700	2,040	2,320
				2015	681	577	554	550	586	-	-	-	590	53.3	550	577	681
				2018	888	736	812	781	660	712	567	789	743	98.7	567	758	888
				2019	1,970	1,940	2,170	1,910	2,240	1,820	1,560	1,800	1,926	214	1,560	1,925	2,240
				2020	992	1,110	1,190	413	516	166	507	1,000	737	380	166	754	1,190
				2021	3,410	1,960	3,400	3,010	2,750	2,630	2,530	2,060	2,719	545	1,960	2,690	3,410
		Mercury	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
		Molybdenum	mg/kg	2010	4.67	3.81	4.84	3.67	3.39	-	-	-	4.08	0.641	3.39	3.81	4.84
				2015	1.24	1.29	1.53	1.71	1.57	-	-	-	1.47	0.198	1.24	1.53	1.71
				2018	3.43	3.26	3.40	2.80	2.77	2.62	2.48	2.91	2.96	0.361	2.48	2.86	3.43
				2019	3.67	3.37	4.34	3.66	5.13	3.37	3.42	4.05	3.88	0.613	3.37	3.66	5.13
				2020	13.9	6.88	4.57	10.8	7.34	5.55	8.11	6.16	7.91	3.06	4.57	7.11	13.9
				2021	6.56	5.12	6.01	6.08	4.00	4.51	4.22	4.77	5.16	0.951	4.00	4.94	6.56
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Secondary Analytes**															
		Nickel	mg/kg	2010	20.8	13.1	19.6	7.97	6.25	-	-	-	13.5	6.59	6.25	13.1	20.8
				2015	9.25	8.80	11.1	7.05	6.00	-	-	-	8.44	1.98	6.00	8.80	11.1
				2018	2.42	2.54	2.56	1.82	1.74	2.37	2.12	1.87	2.18	0.336	1.74	2.24	2.56
				2019	3.35	4.04	2.98	4.87	3.07	2.86	3.49	3.86	3.56	0.671	2.86	3.42	4.87
				2020	1.46	1.84	2.02	0.640	0.650	0.280	1.04	1.72	1.21	0.645	0.280	1.25	2.02
				2021	6.59	5.97	5.99	4.41	2.03	6.09	2.51	6.56	5.02	1.83	2.03	5.98	6.59
		Phosphorus	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	3,280	2,880	5,340	4,840	3,360	-	-	-	3,940	1,080	2,880	3,360	5,340
				2018	7,610	7,520	8,300	8,010	7,820	6,360	7,800	5,880	7,412	842	5,880	7,705	8,300
				2019	6,640	5,620	7,480	6,540	7,660	5,970	6,830	6,490	6,654	687	5,620	6,590	7,660
				2020	7,760	7,960	9,210	7,740	8,260	6,950	8,230	7,710	7,978	643	6,950	7,860	9,210
				2021	9,380	8,670	9,140	7,990	8,820	8,360	9,300	8,180	8,730	523	7,990	8,745	9,380
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	0.0889	0.0681	0.0636	0.0685	0.109	-	-	-	0.0796	0.0191	0.0636	0.0685	0.109
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0429	0.0676	0.0403	0.0543	0.0325	0.0580	0.0323	0.0281	0.0445	0.0141	0.0281	0.0416	0.0676
				2020	0.0172	0.0287	0.0163	0.00610	0.00680	<0.0050	0.0100	0.0187	0.0136	0.00806	<0.005	0.0132	0.0287
				2021	0.0542	0.0435	0.0428	0.0586	0.0223	0.0272	0.0206	0.0328	0.0378	0.0143	0.0206	0.0378	0.0586
		Sodium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	2,980	3,320	4,260	2,960	3,640	-	-	-	3,432	540	2,960	3,320	4,260
				2018	3,450	2,590	3,140	3,170	3,380	2,790	3,840	2,850	3,151	406	2,590	3,155	3,840
				2019	3,460	2,860	4,260	3,830	3,800	3,540	3,950	3,440	3,642	420	2,860	3,670	4,260
				2020	3,200	2,610	4,000	3,500	4,100	4,500	3,550	3,340	3,600	590	2,610	3,525	4,500
				2021	5,150	4,200	4,890	3,730	3,660	3,680	3,870	3,120	4,038	679	3,120	3,800	5,150
		Strontium	mg/kg	2010	21.0	35.7	22.8	18.4	14.8	-	-	-	22.5	7.95	14.8	21.0	35.7
				2015	63.8	57.1	53.3	59.5	68.1	-	-	-	60.4	5.77	53.3	59.5	68.1
				2018	23.6	26.5	25.1	28.3	27.5	23.1	39.3	31.2	28.1	5.24	23.1	27.0	39.3
				2019	39.0	92.8	41.2	54.0	36.3	457	94.2	41.0	107	143	36.3	47.6	457
				2020	14.9	16.4	13.3	9.81	8.36	3.55	8.65	16.1	11.4	4.53	3.55	11.6	16.4
				2021	38.5	108	66.5	38.5	22.1	48.5	19.5	48.9	48.8	28.3	19.5	43.5	108
		Tin	mg/kg	2010	<0.20	<0.20	<0.20	<0.20	<0.20	-	-	-	<0.2	-	<0.2	<0.2	<0.2
				2015	0.0306	0.0271	0.0167	0.0503	0.0291	-	-	-	0.0308	0.0122	0.0167	0.0291	0.0503
				2018	<0.10	<0.10	<0.10	<0.10	0.140	<0.10	<0.10	<0.10	0.105	-	<0.1	0.100	0.140
				2019	0.130	0.300	0.170	0.230	0.510	0.360	0.230	0.310	0.280	0.120	0.130	0.265	0.510
				2020	<0.10	<0.10	0.120	0.120	<0.10	<0.10	<0.10	0.110	0.106	0.00530	<0.1	0.100	0.120
				2021	<0.10	<0.10	<0.10	0.150	<0.10	<0.10	<0.10	<0.10	0.106	-	<0.1	0.100	0.150
		Titanium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	67.2	28.9	27.3	58.5	74.8	-	-	-	51.3	22.0	27.3	58.5	74.8
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	113	292	111	310	84.5	144	90.5	79.0	153	93.7	79.0	112	310
				2020	40.4	46.6	41.0	24.7	21.1	5.42	24.4	44.2	31.0	14.4	5.42	32.6	46.6
				2021	333	133	193	213	42.3	115	57.8	134	153	93.4	42.3	134	333
		Uranium	mg/kg	2010	0.248	0.282	0.266	0.193	0.153	-	-	-	0.228	0.0539	0.153	0.248	0.282
				2015	0.230	0.180	0.166	0.175	0.198	-	-	-	0.190	0.0253	0.166	0.180	0.230
				2018	0.0595	0.0758	0.0725	0.0610	0.0610	0.0579	0.0831	0.0785	0.0687	0.00991	0.0579	0.0668	0.0831
				2019	0.156	0.178	0.116	0.163	0.112	0.141	0.117	0.0973	0.135	0.0286	0.0973	0.129	0.178
				2020	0.0455	0.0546	0.0526	0.0202	0.0215	0.00590	0.0279	0.0581	0.0358	0.0194	0.00590	0.0367	0.0581
				2021	0.187	0.128	0.149	0.195	0.0902	0.180	0.0919	0.243	0.158	0.0533	0.0902	0.164	0.243
		Vanadium	mg/kg	2010	7.89	7.78	9.04	4.58	3.72	-	-	-	6.60	2.31	3.72	7.78	9.04
				2015	40.0	23.3	22.6	25.1	33.4	-	-	-	28.9	7.57	22.6	25.1	40.0
				2018	3.35	11.1	6.30	3.80	3.68	4.91	5.37	4.77	5.41	2.50	3.35	4.84	11.1
				2019	9.51	32.8	8.96	16.0	7.58	18.1	9.50	7.19	13.7	8.68	7.19	9.51	32.8
				2020	3.48	4.67	4.04	1.95	1.46	0.540	2.12	3.99	2.78	1.46	0.540	2.80	4.67
				2021	24.1	15.9	21.8	24.6	4.18	10.5	6.01	14.0	15.1	7.94	4.18	15.0	24.6
		Zinc	mg/kg	2010	206	203	244	244	202	-	-	-	220	22.1	202	206	244
				2015	79.2	94.6	93.5	103	89.2	-	-	-	91.9	8.68	79.2	93.5	103
				2018	91.9	88.1	104	92.9	99.7	88.5	96.1	79.2	92.5	7.65	79.2	92.4	104
				2019	102	76.6	102	89.3	120	78.2	82.9	89.3	92.5	14.7	76.6	89.3	120
				2020	132	112	115	79.1	85.8	84.0	127	125	107	21.4	79.1	114	132
				2021	126	99.0	126	113	104	107	124	120	115	10.6	99.0	116	126

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	EDC-D (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2015	1.76	1.24	1.47	1.87	1.03	-	-	-	1.47	0.350	1.03	1.47	1.87
				2018	6.76	9.27	12.8	8.10	5.43	1.53	6.75	6.07	7.09	3.24	1.53	6.76	12.8
				2019	2.06	2.15	1.05	1.95	1.47	1.16	2.78	1.70	1.79	0.569	1.05	1.82	2.78
				2020	2.65	1.71	1.61	3.82	1.05	1.78	1.77	4.25	2.33	1.14	1.05	1.78	4.25
				2021	3.71	1.58	8.06	5.26	3.58	4.06	7.70	3.31	4.66	2.23	1.58	3.88	8.06
		Copper	mg/kg	2015	16.9	13.3	18.3	13.3	17.6	-	-	-	15.9	2.41	13.3	16.9	18.3
				2018	23.7	24.7	25.7	28.4	31.9	37.4	25.3	22.2	27.4	5.02	22.2	25.5	37.4
				2019	31.4	32.0	36.2	29.5	39.3	39.5	24.8	38.1	33.8	5.28	24.8	34.1	39.5
				2020	47.6	50.4	48.3	37.2	17.2	51.6	38.3	26.9	39.7	12.4	17.2	43	51.6
				2021	38.1	44.6	32.9	35.7	40.0	44.2	28.8	35.8	37.5	5.41	28.8	37.0	44.6
		Iron	mg/kg	2015	1,020	148	339	268	147	-	-	-	384	365	147	268	1,020
				2018	1,460	2,170	3,810	1,460	1,940	380	2,390	4,820	2,304	1,408	380	2,055	4,820
				2019	1,410	1,570	611	1,730	845	646	2,630	2,340	1,473	755	611	1,490	2,630
				2020	2,830	1,080	867	3,660	636	1,840	1,740	2,160	1,852	1,027	636	1,790	3,660
				2021	1,760	629	3,300	2,010	1,230	1,550	4,140	1,460	2,010	1,152	629	1,655	4,140
		Selenium	mg/kg	2015	1.24	1.12	2.70	1.36	1.12	-	-	-	1.51	0.674	1.12	1.24	2.70
				2018	1.48	3.14	2.92	3.59	2.28	1.61	2.80	2.12	2.49	0.745	1.48	2.54	3.59
				2019	2.44	1.04	1.30	2.23	1.71	0.680	3.34	0.720	1.68	0.934	0.680	1.50	3.34
				2020	1.38	1.61	1.47	1.86	1.32	0.618	1.70	1.37	1.42	0.372	0.618	1.42	1.86
				2021	2.21	1.39	3.21	1.95	2.34	2.42	3.47	1.62	2.33	0.720	1.39	2.28	3.47
		Secondary Analytes															
		Barium	mg/kg	2015	7.11	4.53	7.72	9.81	4.45	-	-	-	6.72	2.27	4.45	7.11	9.81
				2018	41.8	105	128	58.8	56.4	6.36	70.8	64.1	66.4	37.2	6.36	61.5	128
				2019	10.1	12.4	7.68	14.7	10.5	10.9	19.4	12.4	12.3	3.54	7.68	11.6	19.4
				2020	48.0	11.9	9.16	46.1	12.0	14.7	14.0	18.5	21.8	15.8	9.16	14.4	48.0
				2021	26.4	7.42	101	41.2	19.6	16.9	22.2	14.2	31.1	29.9	7.42	20.9	101
		Cadmium	mg/kg	2015	0.0427	0.0253	0.241	0.132	0.0996	-	-	-	0.108	0.0858	0.0253	0.0996	0.241
				2018	0.366	1.26	0.686	1.07	0.986	0.477	1.38	1.60	0.978	0.439	0.366	1.03	1.60
				2019	0.704	0.170	0.284	0.346	0.753	0.120	1.16	0.144	0.460	0.374	0.120	0.315	1.16
				2020	0.649	1.10	0.752	1.63	0.681	0.170	0.786	0.670	0.805	0.420	0.170	0.716	1.63
				2021	0.639	0.342	1.85	0.631	1.18	1.04	1.50	0.793	0.997	0.500	0.342	0.916	1.85
		Calcium	mg/kg	2015	1,600	1,620	1,420	764	1,980	-	-	-	1,477	447	764	1,600	1,980
				2018	2,500	2,680	2,940	2,310	3,620	2,820	2,730	3,030	2,829	394	2,310	2,775	3,620
				2019	2,080	4,740	3,380	5,490	3,250	5,860	2,380	4,890	4,009	1,428	2,080	4,060	5,860
				2020	3,110	3,080	3,830	3,050	1,610	5,250	2,900	2,180	3,126	1,086	1,610	3,065	5,250
				2021	2,300	2,170	2,960	2,450	2,880	2,830	2,780	3,440	2,726	409	2,170	2,805	3,440
		Cobalt	mg/kg	2015	0.301	0.0751	0.179	0.275	0.137	-	-	-	0.193	0.0944	0.0751	0.179	0.301
				2018	1.44	2.62	3.26	2.15	1.84	0.626	2.78	3.64	2.29	0.987	0.626	2.38	3.64
				2019	1.08	0.912	0.580	1.17	1.06	0.746	1.66	1.28	1.06	0.332	0.580	1.07	1.66
				2020	1.88	1.36	1.10	3.08	0.551	1.50	1.37	1.48	1.54	0.730	0.551	1.42	3.08
				2021	1.40	0.561	3.28	1.72	1.34	1.65	2.57	1.69	1.78	0.822	0.561	1.67	3.28
		Manganese	mg/kg	2015	58.6	32.0	79.1	127	72.2	-	-	-	73.8	34.8	32.0	72.2	127
				2018	643	1,430	1,170	789	633	154	695	294	726	419	154	669	1,430
				2019	190	183	155	228	202	195	264	188	201	32.7	155	192	264
				2020	769	342	286	906	192	468	333	236	442	260	192	338	906
				2021	524	269	1,420	704	441	524	395	423	588	359	269	482	1,420
		Mercury	mg/kg	2015	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
	EDC-D (Reference)	Molybdenum	mg/kg	2015	5.72	7.57	3.66	3.39	4.69	-	-	-	5.01	1.70	3.39	4.69	7.57
				2018	1.41	1.60	2.15	2.00	1.94	0.500	1.54	1.01	1.52	0.551	0.500	1.57	2.15
				2019	0.530	0.879	0.439	0.409	0.511	0.342	0.588	0.350	0.506	0.174	0.342	0.475	0.879
				2020	1.06	0.738	0.555	2.24	1.55	0.694	0.579	2.21	1.20	0.709	0.555	0.899	2.24
				2021	0.841	0.335	1.49	1.12	0.593	0.750	0.770	0.528	0.803	0.362	0.335	0.760	1.49
		Nickel	mg/kg	2015	0.612	0.166	0.525	0.513	0.275	-	-	-	0.418	0.188	0.166	0.513	0.612
				2018	4.63	6.15	8.50	7.03	4.81	2.31	5.89	7.20	5.82	1.91	2.31	6.02	8.50
				2019	3.09	3.68	1.89	3.90	2.06	3.80	3.68	5.34	3.43	1.10	1.89	3.68	5.34
				2020	4.79	3.30	3.16	7.00	1.66	8.37	3.67	2.77	4.34	2.27	1.66	3.48	8.37
				2021	4.23	2.02	7.25	4.52	3.22	3.82	7.09	5.96	4.76	1.86	2.02	4.38	7.25
		Phosphorus	mg/kg	2015	7,190	8,190	7,210	6,550	7,900	-	-	-	7,408	647	6,550	7,210	8,190
				2018	6,500	8,080	6,550	8,030	8,800	7,600	7,730	4,650	7,242	1,302	4,650	7,665	8,800
				2019	8,910	9,400	9,880	7,080	10,300	11,300	9,860	8,350	9,385	1,286	7,080	9,630	11,300
				2020	8,830	9,860	10,200	8,740	5,530	8,600	8,140	6,900	8,350	1,523	5,530	8,670	10,200
				2021	9,140	8,810	10,500	9,220	11,300	10,600	8,070	9,730	9,671	1,069	8,070	9,475	11,300
		Silver	mg/kg	2015	0.0258	0.00734	0.0158	0.0126	0.0514	-	-	-	0.0226	0.0175	0.00734	0.0158	0.0514
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.155	0.0987	0.130	0.121	0.147	0.0866	0.118	0.115	0.121	0.0228	0.0866	0.120	0.155
				2020	0.218	0.242	0.200	0.158	0.0862	0.113	0.224	0.134	0.172	0.0573	0.0862	0.179	0.242
				2021	0.161	0.175	0.111	0.140	0.164	0.141	0.148	0.142	0.148	0.0195	0.111	0.145	0.175
		Sodium	mg/kg	2015	2,080	2,070	1,840	1,790	2,080	-	-	-	1,972	144	1,790	2,070	2,080
				2018	2,230	3,660	3,090	3,360	3,120	3,500	4,290	2,390	3,205	669	2,230	3,240	4,290
				2019	3,910	4,040	3,670	4,680	4,070	5,150	4,080	5,510	4,389	653	3,670	4,075	5,510
				2020	3,060	4,260	5,180	4,490	2,230	4,130	4,630	3,830	3,976	938	2,230	4,195	5,180
				2021	3,360	3,980	4,150	3,560	5,950	4,550	3,810	3,660	4,128	824	3,360	3,895	5,950
		Strontium	mg/kg	2015	13.4	13.2	10.0	6.03	11.2	-	-	-	10.8	3.00	6.03	11.2	13.4
				2018	15.4	22.0	27.3	14.7	22.7	19.9	23.9	31.0	22.1	5.53	14.7	22.4	31.0
				2019	13.4	30.4	18.0	30.2	15.9	38.2	16.3	39.9	25.3	10.6	13.4	24.1	39.9
				2020	17.5	15.1	17.6	22.2	10.4	34.5	18.3	13.7	18.7	7.29	10.4	17.6	34.5
				2021	13.1	9.42	21.6	16.3	15.1	19.8	22.2	26.6	18.0	5.56	9.42	18.0	26.6
		Tin	mg/kg	2015	0.110	0.0814	0.180	0.243	0.125	-	-	-	0.148	0.0641	0.0814	0.125	0.243
				2018	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.440	0.110	0.144	0.154	<0.1	0.100	0.440
				2019	0.140	0.130	0.270	0.190	0.610	0.510	0.510	0.590	0.369	0.206	0.130	0.390	0.610
				2020	<0.10	0.100	<0.10	0.150	0.150	<0.10	0.100	<0.10	0.112	0.0250	<0.1	0.100	0.150
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2015	5.52	2.77	4.53	4.63	2.06	-	-	-	3.90	1.43	2.06	4.53	5.52
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	34.1	35.5	13.0	36.5	16.8	12.5	64.4	32.0	30.6	17.1	12.5	33.0	64.4
				2020	64.3	21.4	21.4	84.4	13.6	46.2	39.2	28.3	39.8	24.3	13.6	33.8	84.4
				2021	45.9	13.6	56.2	37.3	21.8	29.9	87.7	33.6	40.8	23.1	13.6	35.4	87.7
		Vanadium	mg/kg	2015	2.55	0.272	0.581	0.610	0.249	-	-	-	0.852	0.964	0.249	0.581	2.55
				2018	2.96	4.84	7.74	2.74	4.12	0.820	5.48	12.5	5.15	3.61	0.820	4.48	12.5
				2019	2.79	3.34	1.08	4.02	1.99	1.24	5.67	5.19	3.16	1.72	1.08	3.06	5.67
				2020	5.36	2.02	1.63	7.84	1.42	4.57	4.86	5.63	4.17	2.28	1.42	4.72	7.84
				2021	3.22	1.23	6.14	4.06	2.24	3.46	8.49	3.60	4.06	2.29	1.23	3.53	8.49
		Zinc	mg/kg	2015	72.0	68.8	74.6	80.1	78.8	-	-	-	74.9	4.69	68.8	74.6	80.1
				2018	141	142	103	125	164	162	182	90.1	139	31.4	90.1	142	182
				2019	155	169	140	154	181	189	190	185	170	18.9	140	175	190
				2020	236	213	183	179	97.5	155	202	136	175	44.6	97.5	181	236
				2021	174	168	193	177	183	192	132	175	174	19.2	132	176	193

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	7.33	1.46	3.63	3.97	3.32	-	-	-	3.94	2.13	1.46	3.63	7.33
				2015	2.43	2.51	2.72	1.97	1.84	-	-	-	2.29	0.373	1.84	2.43	2.72
				2018	2.07	1.35	1.85	1.42	1.51	1.30	1.07	1.44	1.50	0.317	1.07	1.43	2.07
				2019	2.48	11.7	1.15	2.93	1.23	1.40	2.02	1.48	3.05	3.55	1.15	1.75	11.7
				2020	1.41	2.48	2.87	1.36	1.81	4.36	2.06	2.15	2.31	0.971	1.36	2.10	4.36
				2021	2.64	2.64	3.61	2.37	3.59	2.32	2.38	4.56	3.01	0.815	2.32	2.64	4.56
		Copper	mg/kg	2010	31.8	19.2	23.6	33.9	22.6	-	-	-	26.2	6.31	19.2	23.6	33.9
				2015	251	254	184	174	158	-	-	-	204	45.1	158	184	254
				2018	41.7	36.1	71.2	43.5	58.4	40.8	36.5	76.1	50.5	15.9	36.1	42.6	76.1
				2019	72.2	135	36.4	91.1	39.2	63.4	99.8	53.1	73.8	33.5	36.4	67.8	135
				2020	88.2	43.9	107	41.8	81.3	87.2	94.3	65.7	76.2	23.6	41.8	84.2	107
				2021	75.4	76.8	150	117	192	394	144	399	194	131	75.4	147	399
		Iron	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	8,460	10,200	10,300	7,420	2,220	-	-	-	7,720	3,305	2,220	8,460	10,300
				2018	1,170	964	901	1,090	1,630	1,280	541	2,360	1,242	550	541	1,130	2,360
				2019	2,690	7,690	747	4,570	1,210	1,770	3,420	1,910	3,001	2,259	747	2,300	7,690
				2020	731	1,910	2,550	1,070	4,750	6,780	2,400	684	2,609	2,142	684	2,155	6,780
				2021	2,050	2,500	5,010	4,480	8,060	4,250	4,680	13,600	5,579	3,714	2,050	4,580	13,600
		Selenium	mg/kg	2010	3.49	3.55	3.67	3.19	3.64	-	-	-	3.51	0.192	3.19	3.55	3.67
				2015	2.55	2.76	3.02	2.49	2.77	-	-	-	2.72	0.210	2.49	2.76	3.02
				2018	3.53	3.76	4.30	2.79	3.36	3.49	4.11	2.79	3.52	0.549	2.79	3.51	4.30
				2019	2.85	2.39	2.36	2.35	2.66	2.93	2.32	2.95	2.60	0.278	2.32	2.52	2.95
				2020	3.58	3.98	4.22	2.88	3.04	3.10	3.91	2.60	3.41	0.589	2.60	3.34	4.22
				2021	4.31	4.89	4.34	3.89	4.72	4.11	6.04	4.04	4.54	0.692	3.89	4.32	6.04
		Secondary Analytes															
		Barium	mg/kg	2010	110	35.3	66.6	69.8	66.0	-	-	-	69.5	26.6	35.3	66.6	110
				2015	69.5	61.1	69.0	61.1	88.2	-	-	-	69.8	11.1	61.1	69.0	88.2
				2018	8.49	8.20	30.8	13.8	11.9	7.74	5.45	16.0	12.8	8.07	5.45	10.2	30.8
				2019	24.9	138	8.33	36.2	9.03	43.6	41.3	24.7	40.8	41.5	8.33	30.6	138
				2020	42.2	23.4	86.8	21.0	48.0	85.9	52.8	76.9	54.6	26.2	21.0	50.4	86.8
				2021	42.2	41.4	75.2	65.6	155	77.6	63.2	132	81.5	41	41.4	70.4	155
		Cadmium	mg/kg	2010	0.495	0.214	0.339	0.369	0.312	-	-	-	0.346	0.102	0.214	0.339	0.495
				2015	0.904	1.33	0.989	0.594	0.760	-	-	-	0.915	0.276	0.594	0.904	1.33
				2018	0.608	0.553	1.67	0.359	2.74	0.304	0.346	2.22	1.10	0.968	0.304	0.580	2.74
				2019	0.311	1.46	0.124	1.01	0.235	0.298	0.996	0.321	0.594	0.489	0.124	0.316	1.46
				2020	1.38	0.359	1.85	0.563	1.03	1.23	1.09	1.67	1.15	0.508	0.359	1.16	1.85
				2021	0.950	0.814	0.463	0.529	0.594	0.665	0.800	0.604	0.677	0.164	0.463	0.634	0.950
		Calcium	mg/kg	2010	3,260	1,360	2,180	3,780	2,260	-	-	-	2,568	956	1,360	2,260	3,780
				2015	3,840	5,720	4,530	4,070	2,850	-	-	-	4,202	1,047	2,850	4,070	5,720
				2018	1,130	1,350	1,390	1,430	2,730	1,360	890	4,980	1,908	1,356	890	1,375	4,980
				2019	3,530	8,910	1,060	4,580	1,240	2,480	3,420	1,680	3,362	2,555	1,060	2,950	8,910
				2020	1,360	2,210	3,080	1,780	2,740	4,180	7,290	1,440	3,010	1,968	1,360	2,475	7,290
				2021	4,670	3,980	5,780	5,030	9,360	4,880	4,400	11,400	6,188	2,694	3,980	4,955	11,400
		Cobalt	mg/kg	2010	5.68	0.980	2.96	4.70	3.01	-	-	-	3.47	1.81	0.980	3.01	5.68
				2015	3.45	6.98	3.95	2.92	2.46	-	-	-	3.95	1.78	2.46	3.45	6.98
				2018	0.924	0.925	1.76	0.901	1.39	0.775	0.675	2.43	1.22	0.604	0.675	0.924	2.43
				2019	1.72	4.93	0.551	2.71	0.789	1.23	2.43	1.21	1.95	1.42	0.551	1.48	4.93
				2020	2.37	1.29	3.06	1.02	3.85	4.41	2.31	1.69	2.50	1.20	1.02	2.34	4.41
				2021	1.50	1.74	2.87	2.44	4.20	2.60	2.70	6.21	3.03	1.52	1.50	2.65	6.21
		Manganese	mg/kg	2010	1,710	701	981	1,020	1,320	-	-	-	1,146	384	701	1,020	1,710
				2015	188	242	201	189	199	-	-	-	204	22.1	188	199	242
				2018	107	124	772	140	150	103	104	319	227	231	103	132	772
				2019	219	1,370	133	445	112	201	222	351	382	414	112	220	1,370
				2020	994	254	1,300	469	973	938	921	658	813	333	254	930	1,300
				2021	777	684	522	320	449	224	186	490	456	209	186	470	777
		Mercury	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-D (Exposed)	Molybdenum	mg/kg	2010	3.88	3.74	4.49	9.25	4.32	-	-	-	5.14	2.32	3.74	4.32	9.25
				2015	1.18	1.37	1.38	0.924	1.47	-	-	-	1.26	0.218	0.924	1.37	1.47
				2018	3.28	3.23	3.92	5.12	2.22	4.95	3.79	1.70	3.53	1.19	1.70	3.54	5.12
				2019	6.52	3.18	3.83	3.54	3.67	4.19	0.835	4.51	3.78	1.57	0.835	3.75	6.52
				2020	3.58	3.19	2.33	3.14	3.27	3.61	4.07	3.42	3.33	0.501	2.33	3.34	4.07
				2021	1.50	1.42	1.34	1.04	1.69	1.61	3.34	3.77	1.96	1.01	1.04	1.56	3.77
		Nickel	mg/kg	2010	27.8	5.17	15.8	69.3	16.1	-	-	-	26.8	25.1	5.17	16.1	69.3
				2015	2.66	4.43	3.41	2.81	2.40	-	-	-	3.14	0.810	2.40	2.81	4.43
				2018	1.73	0.980	6.56	2.56	9.66	7.28	1.03	28.5	7.29	9.17	0.980	4.56	28.5
				2019	3.36	8.52	0.870	4.59	1.29	2.06	3.86	2.24	3.35	2.44	0.870	2.80	8.52
				2020	2.45	2.39	4.13	1.51	9.91	6.94	2.60	1.69	3.95	2.98	1.51	2.52	9.91
				2021	3.28	3.12	5.04	4.67	5.53	3.29	4.47	5.06	4.31	0.945	3.12	4.57	5.53
		Phosphorus	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	2,840	1,940	2,990	2,650	4,150	-	-	-	2,914	800	1,940	2,840	4,150
				2018	7,140	7,220	8,900	6,450	7,900	6,380	6,600	8,370	7,370	935	6,380	7,180	8,900
				2019	7,610	6,510	6,590	6,870	6,660	5,970	8,840	6,580	6,954	888	5,970	6,625	8,840
				2020	7,590	8,610	9,740	7,500	6,570	8,790	9,170	6,690	8,082	1,166	6,570	8,100	9,740
				2021	7,750	8,870	13,300	11,300	11,800	9,470	6,870	6,830	9,524	2,405	6,830	9,170	13,300
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	0.214	0.125	0.126	0.0976	0.0684	-	-	-	0.126	0.0545	0.0684	0.125	0.214
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0238	0.0759	0.00750	0.0647	0.0145	0.125	0.193	0.0519	0.0695	0.0629	0.00750	0.0583	0.193
				2020	0.0311	0.0167	0.0694	0.0111	0.0441	0.0598	0.0327	0.0196	0.0356	0.0208	0.0111	0.0319	0.0694
				2021	0.0397	0.0382	<0.080	<0.060	<0.125	<0.14	<0.045	<0.065	0.0390	0.00212	0.0382	0.0390	0.0397
		Sodium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	1,300	834	1,050	1,410	1,400	-	-	-	1,199	250	834	1,300	1,410
				2018	3,050	2,330	6,370	2,570	8,090	2,320	3,570	9,370	4,709	2,826	2,320	3,310	9,370
				2019	2,730	4,450	2,160	5,030	2,390	2,320	5,190	3,240	3,439	1,262	2,160	2,985	5,190
				2020	3,280	3,730	3,540	4,350	3,050	4,640	4,010	3,370	3,746	550	3,050	3,635	4,640
				2021	1,640	2,550	5,560	4,530	4,550	3,390	2,890	3,000	3,514	1,276	1,640	3,195	5,560
		Strontium	mg/kg	2010	29.5	10.3	19.8	24.5	19.5	-	-	-	20.7	7.11	10.3	19.8	29.5
				2015	26.5	37.6	26.6	28.3	22.9	-	-	-	28.4	5.52	22.9	26.6	37.6
				2018	9.24	9.02	7.83	9.69	15.1	9.07	5.99	18.9	10.6	4.24	5.99	9.15	18.9
				2019	19.0	47.5	6.79	29.7	8.00	15.3	19.3	10.3	19.5	13.5	6.79	17.2	47.5
				2020	12.0	12.8	16.9	9.01	12.4	24.1	18.6	9.79	14.4	5.08	9.01	12.6	24.1
				2021	19.9	25.3	57.3	43.7	58.2	31.7	26.0	72.6	41.8	19.1	19.9	37.7	72.6

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2010 to 2021

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Tin	mg/kg	2010	0.360	<0.20	<0.20	0.250	<0.20	-	-	-	0.242	0.0622	<0.2	0.200	0.360
				2015	0.0145	0.0417	0.0426	0.0215	0.0111	-	-	-	0.0263	0.0150	0.0111	0.0215	0.0426
				2018	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.110	0.101	-	<0.1	0.100	0.110
				2019	0.330	0.450	0.180	0.200	0.710	0.230	1.19	0.140	0.429	0.360	0.140	0.280	1.19
				2020	<0.10	0.100	0.160	<0.10	<0.10	0.300	<0.10	<0.10	0.132	0.0812	<0.1	0.100	0.300
				2021	<0.10	<0.10	<0.10	<0.10	0.320	0.120	0.120	0.240	0.150	0.0833	<0.1	0.110	0.320
		Titanium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2015	50.0	60.4	62.8	56.0	11.8	-	-	-	48.2	20.9	11.8	56.0	62.8
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	64.0	138	21.3	113	35.9	60.2	114	60.8	75.9	41.2	21.3	62.4	138
				2020	17.4	51.4	63.8	29.8	112	170	52.4	18.6	64.4	52.4	17.4	51.9	170
				2021	46.8	82.2	155	157	322	168	185	575	211	168	46.8	162	575
		Uranium	mg/kg	2010	0.334	0.0550	0.172	0.272	0.183	-	-	-	0.203	0.106	0.0550	0.183	0.334
				2015	0.215	0.262	0.240	0.200	0.185	-	-	-	0.220	0.0309	0.185	0.215	0.262
				2018	0.0399	0.0436	0.0374	0.0329	0.0815	0.0328	0.0199	0.0610	0.0436	0.0192	0.0199	0.0386	0.0815
				2019	0.0993	0.303	0.0168	0.127	0.0279	0.0664	0.108	0.0475	0.0995	0.0910	0.0168	0.0828	0.303
				2020	0.0531	0.0826	0.123	0.0332	0.157	0.290	0.0844	0.0377	0.108	0.0849	0.0332	0.0835	0.290
				2021	0.123	0.124	0.127	0.0985	0.140	0.0883	0.0756	0.305	0.135	0.0720	0.0756	0.124	0.305
		Vanadium	mg/kg	2010	17.8	4.21	11.4	12.6	9.11	-	-	-	11.0	4.97	4.21	11.4	17.8
				2015	46.4	60.2	51.7	41.9	20.6	-	-	-	44.2	14.8	20.6	46.4	60.2
				2018	3.67	2.90	2.72	3.74	6.22	4.60	1.46	7.20	4.06	1.89	1.46	3.70	7.20
				2019	6.59	22.0	1.77	12.5	3.15	4.62	8.81	5.12	8.07	6.56	1.77	5.86	22.0
				2020	2.08	5.58	7.96	3.18	16.4	21.3	7.58	1.57	8.21	7.10	1.57	6.58	21.3
				2021	5.79	8.03	14.2	12.9	27.9	12.7	15.5	43.5	17.6	12.4	5.79	13.6	43.5
		Zinc	mg/kg	2010	112	91.1	95.5	113	92.1	-	-	-	101	10.9	91.1	95.5	113
				2015	110	120	111	101	110	-	-	-	110	6.73	101	110	120
				2018	124	131	199	113	133	86.2	95.7	142	128	34.4	86.2	128	199
				2019	101	182	85.2	116	83.9	84.8	145	97.3	112	35.0	83.9	99.2	182
				2020	326	168	450	125	199	261	349	329	276	108	125	294	450
				2021	208	190	151	126	144	148	110	110	148	35.4	110	146	208
Lower Edney Creek	E1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2019	1.01	0.727	2.59	1.21	6.13	1.59	2.06	1.64	2.12	1.72	0.727	1.62	6.13
				2020	1.01	1.19	1.45	1.47	1.19	2.07	1.57	1.25	1.40	0.327	1.01	1.35	2.07
				2021	1.77	4.49	2.10	3.56	4.32	4.30	3.40	4.82	3.60	1.13	1.77	3.93	4.82
		Copper	mg/kg	2019	33.6	26.2	27.7	30.6	60.3	26.2	32.6	29.4	33.3	11.2	26.2	30.0	60.3
				2020	36.7	33.1	50.3	74.2	53.1	62.2	65.9	45.4	52.6	14.3	33.1	51.7	74.2
				2021	23.1	62.5	36.6	95.9	82.0	123	132	182	92.1	52.7	23.1	89	182
		Iron	mg/kg	2019	482	703	3,810	2,610	5,380	1,570	1,240	1,410	2,151	1,690	482	1,490	5,380
				2020	1,340	2,490	2,740	2,110	1,980	3,880	1,970	1,970	2,310	756	1,340	2,045	3,880
				2021	1,100	2,320	1,040	2,740	2,370	4,040	2,920	5,470	2,750	1,467	1,040	2,555	5,470
		Selenium	mg/kg	2019	1.40	1.33	1.02	1.49	1.31	2.45	1.53	2.40	1.62	0.522	1.02	1.44	2.45
				2020	1.27	0.900	2.08	1.82	1.67	1.48	1.41	1.45	1.51	0.357	0.900	1.46	2.08
				2021	2.42	3.15	2.11	2.36	2.29	2.94	2.06	3.05	2.55	0.434	2.06	2.39	3.15
		Secondary Analytes															
		Barium	mg/kg	2019	6.38	5.62	36.2	9.87	33.3	14.7	18.9	6.49	16.4	12.2	5.62	12.3	36.2
				2020	10.9	12.0	105	14.3	13.0	23.3	15.4	13.1	25.9	32.2	10.9	13.7	105
				2021	14.3	23.3	11.5	21.4	25.2	44.3	41.6	46.3	28.5	13.7	11.5	24.2	46.3
		Cadmium	mg/kg	2019	0.668	1.30	0.521	1.02	0.546	1.35	0.754	0.897	0.882	0.320	0.521	0.826	1.35
				2020	0.798	0.723	1.38	1.33	1.49	0.775	0.785	0.821	1.01	0.325	0.723	0.810	1.49
				2021	1.50	2.93	0.983	2.72	1.52	2.30	1.94	3.72	2.20	0.896	0.983	2.12	3.72
		Calcium	mg/kg	2019	2,630	2,830	2,850	2,080	3,800	2,320	1,660	1,870	2,505	681	1,660	2,475	3,800
				2020	2,230	3,020	4,190	2,400	1,970	3,420	2,130	2,300	2,708	772	1,970	2,350	4,190
				2021	1,900	2,990	1,350	2,790	1,890	3,010	3,070	4,940	2,742	1,099	1,350	2,890	4,940
		Cobalt	mg/kg	2019	0.640	0.965	2.26	1.61	2.85	1.40	1.53	1.19	1.56	0.709	0.640	1.46	2.85
				2020	1.27	1.34	2.09	1.60	1.65	1.98	1.70	1.32	1.62	0.305	1.27	1.62	2.09
				2021	1.23	2.92	1.08	3.36	1.90	3.98	3.02	4.46	2.74	1.24	1.08	2.97	4.46
		Manganese	mg/kg	2019	119	126	380	169	546	234	310	107	249	155	107	202	546
				2020	268	190	244	386	325	553	283	348	325	111	190	304	553
				2021	225	351	216	258	186	299	1,130	818	435	347	186	278	1,130
		Mercury	mg/kg	2019	0.0810	0.0890	0.0940	0.0640	0.145	0.122	0.0910	0.0910	0.0971	0.0251	0.0640	0.0910	0.145
				2020	0.0753	0.119	0.108	0.0901	0.107	0.0609	0.0948	0.0656	0.0901	0.0212	0.0609	0.0924	0.119
				2021	0.0730	0.0648	0.0519	0.0622	0.0535	0.0669	0.0680	0.0990	0.0674	0.0146	0.0519	0.0659	0.0990
		Molybdenum	mg/kg	2019	0.517	0.765	1.42	0.348	0.732	0.784	0.905	0.604	0.759	0.319	0.348	0.748	1.42
				2020	0.683	0.582	0.660	0.550	0.556	1.87	0.627	0.935	0.808	0.446	0.550	0.644	1.87
				2021	0.646	0.846	2.06	1.01	1.88	0.974	1.48	0.914	1.23	0.518	0.646	0.992	2.06
		Nickel	mg/kg	2019	1.12	0.880	4.25	2.50	7.35	2.10	2.16	2.49	2.86	2.08	0.880	2.33	7.35
				2020	2.11	1.80	8.06	2.80	2.20	3.28	2.57	2.78	3.20	2.02	1.80	2.68	8.06
				2021	1.93	4.40	1.52	3.54	2.09	4.80	3.32	5.34	3.37	1.42	1.52	3.43	5.34
		Phosphorus	mg/kg	2019	9,150	8,570	5,920	7,380	7,820	7,980	9,350	8,300	8,059	1,087	5,920	8,140	9,350
				2020	7,340	4,610	9,180	7,510	6,420	7,210	6,860	9,070	7,275	1,460	4,610	7,275	9,180
				2021	10,100	10,000	8,770	9,080	9,210	8,830	8,940	9,600	9,316	522	8,770	9,145	10,100
		Silver	mg/kg	2019	0.0939	0.0425	0.0435	0.0775	0.146	0.0881	0.105	0.0949	0.0864	0.0335	0.0425	0.0910	0.146
				2020	0.0760	0.0663	0.104	0.102	0.0643	0.0836	0.0917	0.0684	0.0820	0.0159	0.0643	0.0798	0.104
				2021	0.139	0.0687	0.0328	0.0442	0.0473	0.0797	0.0655	0.0826	0.0700	0.0330	0.0328	0.0671	0.139
		Sodium	mg/kg	2019	5,670	10,600	3,710	8,260	4,730	10,200	4,860	4,980	6,626	2,675	3,710	5,325	10,600
				2020	9,060	4,830	11,600	5,370	7,270	3,100	5,000	9,340	6,946	2,866	3,100	6,320	11,600
				2021	9,530	4,840	2,910	3,860	3,450	3,450	3,510	4,080	4,454	2,128	2,910	3,685	9,530
		Strontium	mg/kg	2019	11.9	9.19	14.1	7.98	23.0	10.1	10.4	7.97	11.8	4.95	7.97	10.2	23.0
				2020	14.1	7.81	14.8	12.5	11.9	18.4	17.5	12.1	13.6	3.38	7.81	13.3	18.4
				2021	10.8	19.4	9.55	17.1	13.6	21.6	20.3	28.6	17.6	6.27	9.55	18.2	28.6
		Tin	mg/kg	2019	0.420	0.450	0.230	0.440	0.500	0.690	0.430	0.500	0.458	0.126	0.230	0.445	0.690
				2020	<0.10	<0.10	<0.10	0.120	0.130	0.110	0.120	0.100	0.110	0.0125	<0.1	0.105	0.130
				2021	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	-	<0.1	<0.1	<0.1
		Titanium	mg/kg	2019	8.15	18.2	102	107	146	38.9	29.4	38.3	61	50.2	8.15	38.6	146
				2020	30.2	69.4	146	57.5	53.0	101	67.3	39.9	70.5	37.2	30.2	62.4	146
				2021	32.5	51.1	22.2	71.9	81.8	110	65.4	149	73	41.4	22.2	68.7	149
		Uranium	mg/kg	2019	0.0216	0.0193	0.0915	0.0713	0.222	0.0582	0.0591	0.0484	0.0739	0.0645	0.0193	0.0586	0.222
				2020	0.120	0.0634	0.0924	0.0772	0.0790	0.0862	0.0935	0.0722	0.0855	0.0172	0.0634	0.0826	0.120
				2021	0.0501	0.108	0.0517	0.0827	0.0665	0.114	0.119	0.152	0.0930	0.0362	0.0501	0.0954	0.152
		Vanadium	mg/kg	2019	0.850	1.56	9.97	8.22	14.1	3.48	2.65	2.85	5.46	4.75	0.850	3.16	14.1
				2020	2.90	10.2	6.96	5.40	5.98	13.1	5.82	4.72	6.88	3.26	2.90	5.90	13.1
				2021	2.84	5.06	2.29	7.17	6.56	12.1	7.63	15.6	7.41	4.51	2.29	6.86	15.6
		Zinc	mg/kg	2019	137	130	140	112	165	134	202	121	143	28.5	112	136	202
				2020	124	91.9	181	154	133	174	122	164	143	30.4	91.9	144	181
				2021	141	135	107	110	118	140	142	146	130	15.7	107	138	146

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. "-" indicates no data available.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Edney Creek	EDC-U (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	0.141	0.169	0.164	0.194	0.0480	0.287	0.0763	0.0657	0.143	0.0792	0.0480	0.153	0.287
				2019	0.198	0.121	0.0638	0.101	0.227	0.130	0.139	0.0900	0.134	0.0547	0.0638	0.126	0.227
				2020	0.0833	0.0397	0.0275	0.0658	0.0558	0.100	0.0251	0.0109	0.0510	0.0308	0.0109	0.0478	0.100
				2021	0.327	0.0654	0.224	0.142	0.123	0.319	0.0477	0.141	0.174	0.106	0.0477	0.142	0.327
				2022	0.0939	0.0320	0.0369	0.0781	0.00932	0.0289	0.0170	0.00953	0.0382	0.0315	0.00932	0.0304	0.0939
		Copper	mg/kg	2018	0.480	0.812	0.797	0.734	0.425	0.688	0.586	0.404	0.616	0.165	0.404	0.637	0.812
				2019	1.03	0.780	0.601	0.851	0.725	0.959	0.960	0.370	0.784	0.218	0.370	0.816	1.03
				2020	0.770	0.842	1.10	0.854	0.516	0.665	0.862	0.725	0.791	0.169	0.516	0.806	1.10
				2021	0.875	0.451	0.822	0.496	0.393	0.989	0.247	0.608	0.610	0.261	0.247	0.552	0.989
				2022	0.692	0.295	0.394	0.698	0.333	0.346	0.387	0.393	0.442	0.160	0.295	0.390	0.698
		Iron	mg/kg	2018	0.0565	0.0768	0.104	0.0734	0.0351	0.0808	0.0305	0.0212	0.0598	0.0289	0.0212	0.0650	0.104
				2019	0.0621	0.0188	0.0301	0.0530	0.189	0.0479	0.757	0.120	0.160	0.248	0.0188	0.0575	0.757
				2020	0.0764	0.0303	0.105	0.118	0.0562	0.0645	0.0311	0.0202	0.0628	0.0359	0.0202	0.0603	0.118
				2021	0.165	0.0568	0.129	0.0628	0.0643	0.176	0.0267	0.173	0.107	0.0605	0.0267	0.0965	0.176
				2022	0.0502	0.00413	0.0107	0.159	0.00288	0.00899	0.00442	0.00874	0.0312	0.0541	0.00288	0.00886	0.159
		Selenium	mg/kg	2018	0.507	0.906	1.55	1.23	0.784	1.20	0.919	0.659	0.970	0.341	0.507	0.912	1.55
				2019	0.701	1.11	1.21	0.542	0.675	1.17	1.39	0.881	0.959	0.302	0.542	0.996	1.39
				2020	0.743	0.442	0.918	2.10	1.06	0.800	1.11	1.70	1.11	0.541	0.442	0.989	2.10
				2021	1.20	0.914	1.61	1.38	0.822	1.45	0.842	1.80	1.25	0.369	0.822	1.29	1.80
				2022	1.90	0.694	0.829	0.843	0.637	0.766	1.23	1.00	0.988	0.413	0.637	0.836	1.90
		Secondary Analytes															
		Barium	mg/kg	2018	0.377	0.650	0.338	0.444	0.131	0.682	0.264	0.244	0.391	0.194	0.131	0.358	0.682
				2019	0.606	0.273	0.0463	0.170	0.0993	0.188	0.135	0.0273	0.193	0.185	0.0273	0.153	0.606
				2020	0.127	0.872	0.0781	0.204	0.0881	0.316	0.0854	0.0547	0.228	0.274	0.0547	0.108	0.872
				2021	0.767	0.563	0.921	0.258	0.694	1.47	0.132	0.222	0.628	0.442	0.132	0.628	1.47
				2022	0.0167	0.00576	0.0332	0.142	0.00569	0.0142	0.0105	0.00277	0.0289	0.0467	0.00277	0.0123	0.142
		Cadmium	mg/kg	2018	0.601	1.54	1.04	1.05	0.286	1.16	0.395	0.466	0.816	0.442	0.286	0.819	1.54
				2019	0.940	0.518	0.0509	0.282	0.119	0.554	0.190	0.0306	0.336	0.314	0.0306	0.236	0.940
				2020	0.353	0.772	0.204	0.415	0.280	0.970	0.309	0.315	0.452	0.271	0.204	0.334	0.970
				2021	1.33	0.821	2.52	0.445	1.12	3.06	0.204	0.379	1.23	1.04	0.204	0.971	3.06
				2022	0.201	-	0.108	0.385	0.0170	0.0404	0.0142	0.00618	0.110	0.140	0.00618	0.0404	0.385
		Calcium	mg/kg	2018	0.0731	0.176	0.0727	0.0905	0.0951	0.108	0.0979	0.0704	0.0979	0.0342	0.0704	0.0928	0.176
				2019	0.159	0.0778	0.169	0.204	0.455	0.287	0.356	0.189	0.237	0.122	0.0778	0.197	0.455
				2020	0.256	0.210	0.381	0.282	0.212	0.299	0.303	0.233	0.272	0.0573	0.210	0.269	0.381
				2021	0.195	0.148	0.272	0.133	0.202	0.334	0.126	0.235	0.206	0.0725	0.126	0.198	0.334
				2022	0.0738	0.0439	0.0632	0.154	0.0426	0.0622	0.0673	0.0493	0.0696	0.0361	0.0426	0.0627	0.154
		Cobalt	mg/kg	2018	0.161	0.310	0.177	0.311	0.0781	0.249	0.124	0.116	0.191	0.0893	0.0781	0.169	0.311
				2019	0.253	0.114	0.0231	0.108	0.143	0.109	0.298	0.0368	0.136	0.0961	0.0231	0.111	0.298
				2020	0.111	0.181	0.0693	0.123	0.0662	0.176	0.0616	0.0400	0.103	0.0535	0.0400	0.0900	0.181
				2021	0.397	0.240	0.527	0.196	0.343	0.671	0.0856	0.184	0.331	0.195	0.0856	0.292	0.671
				2022	0.0242	0.00680	0.0200	0.138	0.00699	0.0157	0.0110	0.00423	0.0284	0.0450	0.00423	0.0133	0.138
		Manganese	mg/kg	2018	0.273	0.492	0.204	0.400	0.164	0.392	0.262	0.234	0.303	0.113	0.164	0.268	0.492
				2019	0.233	0.178	0.0204	0.119	0.0481	0.166	0.0772	0.0115	0.107	0.0807	0.0115	0.0981	0.233
				2020	0.167	0.455	0.0822	0.169	0.0922	0.454	0.130	0.0726	0.203	0.159	0.0726	0.149	0.455
				2021	0.505	0.454	1.01	0.271	0.517	2.01	0.110	0.195	0.635	0.622	0.110	0.480	2.01
				2022	0.0294	0.0126	0.0354	0.161	0.00842	0.0255	0.0127	0.00479	0.0362	0.0515	0.00479	0.0191	0.161
		Mercury	mg/kg	2018	0.481	0.745	1.35	1.16	0.436	0.759	0.459	0.391	0.722	0.360	0.391	0.613	1.35
				2019	0.552	0.577	0.389	0.628	0.129	0.287	0.430	0.167	0.395	0.188	0.129	0.409	0.628
				2020	0.350	0.198	0.841	0.808	0.763	0.508	0.599	0.412	0.560	0.234	0.198	0.553	0.841
				2021	0.574	0.772	0.698	0.342	0.0952	1.11	0.409	0.573	0.572	0.305	0.0952	0.573	1.11
				2022	0.860	0.187	0.209	0.577	0.210	0.366	0.423	0.560	0.424	0.234	0.187	0.395	0.860
		Molybdenum	mg/kg	2018	0.718	1.10	0.891	1.38	0.592	2.18	1.33	0.703	1.11	0.521	0.592	0.994	2.18
				2019	4.22	5.89	4.96	4.49	6.27	6.49	1.63	3.25	4.65	1.64	1.63	4.72	6.49
				2020	0.220	0.340	0.253	0.530	0.314	0.559	0.149	2.18	0.568	0.667	0.149	0.327	2.18
				2021	1.22	0.420	1.94	2.75	0.826	3.58	1.02	1.78	1.69	1.06	0.420	1.50	3.58
				2022	10.2	7.46	5.99	0.446	3.51	2.87	3.04	1.10	4.32	3.31	0.446	3.28	10.2
		Nickel	mg/kg	2018	0.132	0.251	0.209	0.234	0.0639	0.190	0.0873	0.0680	0.154	0.0761	0.0639	0.161	0.251
				2019	0.160	0.0629	0.0202	0.0708	0.124	0.105	0.190	0.0500	0.0979	0.0579	0.0202	0.0877	0.190
				2020	0.103	0.199	0.0713	0.136	0.0682	0.105	0.0865	0.0422	0.101	0.0484	0.0422	0.0948	0.199
				2021	0.250	0.153	0.346	0.0839	0.169	0.330	0.0197	0.117	0.184	0.116	0.0197	0.161	0.346
				2022	0.0127	-	0.0174	0.160	-	0.00769	0.00470	0.00460	0.0345	0.0616	0.00460	0.0102	0.160
		Phosphorus	mg/kg	2018	3.17	4.94	5.01	4.38	4.27	5.33	4.74	4.24	4.51	0.667	3.17	4.56	5.33
				2019	3.70	5.29	3.82	3.10	1.88	9.41	2.20	2.58	4.00	2.44	1.88	3.40	9.41
				2020	7.05	3.10	5.27	4.40	3.59	4.79	7.52	5.09	5.10	1.54	3.10	4.94	7.52
				2021	5.11	4.62	7.29	5.77	4.44	7.25	3.23	5.65	5.42	1.39	3.23	5.38	7.29
				2022	2.84	2.29	2.36	2.54	2.24	2.88	3.06	3.03	2.66	0.339	2.24	2.69	3.06
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.701	0.534	0.494	0.348	0.346	0.418	0.670	0.319	0.479	0.148	0.319	0.456	0.701
				2020	0.606	0.308	1.03	1.27	0.666	0.611	0.562	0.661	0.714	0.298	0.308	0.636	1.27
				2021	0.618	0.318	0.769	0.324	0.596	0.973	0.273	0.570	0.555	0.244	0.273	0.583	0.973
				2022	2.46	0.276	0.228	0.989	0.182	0.257	0.269	0.285	0.619	0.790	0.182	0.273	2.46
		Sodium	mg/kg	2018	4.74	12.2	6.63	5.34	8.79	5.99	13.2	10.3	8.39	3.21	4.74	7.71	13.2
				2019	11.5	7.61	3.40	8.82	3.33	15.3	4.07	4.09	7.27	4.42	3.33	5.85	15.3
				2020	24.3	18.5	-	6.63	10.7	16.3	10.6	18.0	15.0	6.03	6.63	16.3	24.3
				2021	17.4	10.1	8.15	13.7	15.5	10.6	9.48	13.2	12.3	3.21	8.15	11.9	17.4
				2022	18.4	9.14	11.0	16.3	10.1	11.6	13.8	20.3	13.8	4.09	9.14	12.7	20.3
		Strontium	mg/kg	2018	0.0924	0.243	0.0918	0.125	0.118	0.144	0.176	0.102	0.136	0.0514	0.0918	0.121	0.243
				2019	0.157	0.0750	0.165	0.185	0.331	0.262	0.150	0.141	0.183	0.0791	0.0750	0.161	0.331
				2020	0.221	0.244	0.241	0.235	0.193	0.290	0.324	0.221	0.246	0.0419	0.193	0.238	0.324
				2021	0.200	0.175	0.253	0.124	0.209	0.282	0.117	0.186	0.193	0.0568	0.117	0.193	0.282
				2022	0.0538	0.0342	0.0523	0.120	0.0335	0.0424	0.0515	0.0300	0.0522	0.0290	0.0300	0.0469	0.120
		Tin	mg/kg	2018	-	-	-	-	-	0.440	-	1.36	0.902	0.653	0.440	0.902	1.36
				2019	0.789	0.617	0.385	0.547	0.0737	0.0846	0.186	0.116	0.350	0.276	0.0737	0.285	0.789
				2020	-	-	-	-	-	0.333	-	-	0.333	-	0.333	0.333	0.333
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0755	0.0115	0.0164	0.0752	0.350	0.0308	0.842	0.128	0.191	0.285	0.0115	0.0754	0.842
				2020	0.0691	0.0722	0.0939	0.127	0.0541	0.0453	0.0264	0.0557	0.0679	0.0310	0.0264	0.0624	0.127
				2021	0.162	0.0813	0.117	0.0493	0.0511	0.147	0.0191	0.129	0.0944	0.0518	0.0191	0.0992	0.162
				2022	0.0346	0.00210	0.0105	0.369	0.00296	0.00717	0.00297	0.00647	0.0545	0.128	0.00210	0.00682	0.369
		Uranium	mg/kg	2018	0.139	0.347	0.267	0.304	0.0629	0.309	0.111	0.0566	0.200	0.119	0.0566	0.203	0.347
				2019	0.217	0.0750	0.0399	0.132	0.196	0.0948	0.118	0.159	0.129	0.0602	0.0399	0.125	0.217
				2020	0.304	0.254	0.421	0.388	0.302	0.223	0.252	0.0706	0.277	0.108	0.0706	0.278	0.421
				2021	0.437	0.238	0.385	0.191	0.205	0.477	0.0724	0.366	0.297	0.141	0.0724	0.302	0.477
				2022	0.0170	0.00358	0.0140	0.356	0.00370	0.00838	0.00470	0.00494	0.0516	0.123	0.00358	0.00666	0.356
		Vanadium	mg/kg	2018	0.0515	0.0801	0.101	0.0567	0.0455	0.0661	0.0244	0.0167	0.0552	0.0276	0.0167	0.0541	0.101
				2019	0.0633	0.0161	0.0261	0.0630	0.203	0.0458	1.13	0.111	0.207	0.376	0.0161	0.0632	1.13
				2020	0.0976	0.0248	0.117	0.114	0.0572	0.0874	0.0456	0.0239	0.0710	0.0381	0.0239	0.0723	0.117
				2021	0.172	0.0569	0.123	0.0617	0.0658	0.163	0.0292	0.148	0.102	0.0553	0.0292	0.0944	0.172
				2022	0.0383	0.00515	0.0104	0.136	0.00213	0.00678	0.00510	0.00472	0.0260	0.0458	0.00213	0.00597	0.136
		Zinc	mg/kg	2018	3.19	3.48	2.78	1.96	3.16	2.84	3.20	3.25	2.98	0.471	1.96	3.17	3.48
				2019	3.52	4.42	1.04	1.96	1.46	3.07	1.97	0.579	2.25	1.31	0.579	1.96	4.42
				2020	2.46	5.84	2.49	2.22	2.01	5.47	3.40	2.93	3.35	1.48	2.01	2.71	5.84
				2021	3.61	2.46	3.19	2.12	2.21	3.32	1.43	1.64	2.50	0.803	1.43	2.33	3.61
				2022	0.669	0.547	0.818	0.921	0.414	0.694	0.781	0.312	0.644	0.208	0.312	0.681	0.921

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2017	0.420	0.385	0.198	0.267	0.384	0.488	0.290	0.513	0.368	0.109	0.198	0.384	0.513
				2018	1.22	1.01	0.724	0.410	0.218	2.21	1.07	1.02	0.983	0.603	0.218	1.01	2.21
				2019	0.845	1.72	0.850	0.918	0.787	1.20	1.13	1.29	1.09	0.313	0.787	1.02	1.72
				2020	0.579	0.611	0.250	0.759	0.621	0.366	0.424	0.217	0.478	0.194	0.217	0.501	0.759
				2021	0.411	0.552	0.318	2.66	6.36	0.335	0.236	0.439	1.41	2.16	0.236	0.425	6.36
				2022	0.0957	0.0857	0.203	0.149	0.184	0.154	0.0930	0.0851	0.131	0.0474	0.0851	0.122	0.203
		Copper	mg/kg	2017	1.65	1.67	0.525	0.805	1.34	2.04	1.37	1.12	1.32	0.492	0.525	1.35	2.04
				2018	3.36	3.38	0.773	0.737	0.429	5.62	3.93	3.51	2.72	1.86	0.429	3.37	5.62
				2019	3.04	3.94	2.32	3.59	2.98	6.74	5.85	5.71	4.27	1.61	2.32	3.76	6.74
				2020	1.84	1.81	0.604	1.16	1.38	0.797	0.840	0.568	1.12	0.508	0.568	1.00	1.84
				2021	1.24	1.87	0.700	3.62	7.00	1.09	0.240	0.964	2.09	2.23	0.240	1.17	7.00
				2022	0.273	0.128	0.448	0.261	0.391	0.405	0.249	0.102	0.282	0.127	0.102	0.267	0.448
		Iron	mg/kg	2017	0.455	0.213	0.151	0.137	0.365	0.301	0.382	0.575	0.322	0.153	0.137	0.333	0.575
				2018	2.91	2.23	0.541	0.403	0.203	2.79	2.11	3.18	1.80	1.22	0.203	2.17	3.18
				2019	2.21	3.41	2.41	1.62	1.62	2.36	3.42	4.22	2.66	0.932	1.62	2.38	4.22
				2020	0.914	0.665	0.0958	0.677	0.531	0.261	0.335	0.146	0.453	0.290	0.0958	0.433	0.914
				2021	0.564	1.34	0.351	19.2	31.3	0.763	0.0791	0.537	6.76	11.9	0.0791	0.664	31.3
				2022	0.0335	0.0410	0.117	0.0464	0.113	0.119	0.0393	0.0230	0.0666	0.0418	0.0230	0.0437	0.119
		Selenium	mg/kg	2017	2.29	3.43	2.04	1.83	2.20	3.76	2.82	2.91	2.66	0.689	1.83	2.55	3.76
				2018	3.29	2.51	4.96	3.55	1.03	6.73	2.74	3.16	3.50	1.71	1.03	3.23	6.73
				2019	3.21	2.79	3.09	3.55	-	2.75	2.24	3.01	2.95	0.410	2.24	3.01	3.55
				2020	2.26	2.95	2.29	2.61	1.88	2.94	3.53	2.08	2.57	0.547	1.88	2.45	3.53
				2021	-	-	5.65	2.76	3.82	4.42	4.43	6.61	4.61	1.35	2.76	4.43	6.61
				2022	2.03	2.81	2.39	2.70	5.33	5.13	5.21	2.79	3.55	1.41	2.03	2.80	5.33
		Secondary Analytes															
		Barium	mg/kg	2017	0.181	0.317	0.0513	0.0759	0.320	0.0885	0.0880	0.169	0.161	0.107	0.0513	0.129	0.320
				2018	1.29	0.700	0.459	0.0408	0.202	1.59	0.765	0.898	0.744	0.523	0.0408	0.732	1.59
				2019	0.547	0.784	0.654	0.311	0.381	0.529	0.692	1.72	0.702	0.439	0.311	0.600	1.72
				2020	0.287	0.323	0.0416	0.371	0.379	0.124	0.117	0.0510	0.212	0.143	0.0416	0.206	0.379
				2021	0.0500	0.0851	0.0471	1.80	0.630	0.0737	0.0333	0.0166	0.342	0.623	0.0166	0.0618	1.80
				2022	0.0117	0.0120	0.0359	0.00856	0.0840	0.0638	0.0101	0.0354	0.0327	0.0282	0.00856	0.0237	0.0840
		Cadmium	mg/kg	2017	1.08	1.82	0.767	1.02	1.13	0.946	0.997	1.48	1.16	0.336	0.767	1.05	1.82
				2018	0.845	1.40	1.05	1.33	0.916	3.94	1.67	1.60	1.59	0.996	0.845	1.37	3.94
				2019	1.03	1.94	1.39	0.400	1.77	2.23	2.05	2.02	1.60	0.625	0.400	1.86	2.23
				2020	1.89	1.54	-	0.626	0.838	0.520	0.293	0.451	0.880	0.604	0.293	0.626	1.89
				2021	-	0.848	0.955	2.42	3.61	0.161	0.338	0.479	1.26	1.28	0.161	0.848	3.61
				2022	-	-	0.142	-	0.687	0.205	0.194	0.181	0.282	0.228	0.142	0.194	0.687
		Calcium	mg/kg	2017	0.0412	0.0261	0.00827	0.00762	0.0138	0.0266	0.0243	0.0326	0.0226	0.0118	0.00762	0.0252	0.0412
				2018	0.0436	0.0251	0.0257	0.0303	0.0136	0.0419	0.0200	0.0232	0.0279	0.0104	0.0136	0.0254	0.0436
				2019	0.0446	0.0795	0.0581	0.0342	0.0233	0.0251	0.0431	0.0252	0.0416	0.0195	0.0233	0.0387	0.0795
				2020	0.0209	0.0124	0.00410	0.0179	0.0108	0.00396	0.00430	0.00182	0.00952	0.00713	0.00182	0.00754	0.0209
				2021	0.00392	0.00652	0.00698	0.0415	0.0401	0.00308	0.00233	0.00259	0.0134	0.0170	0.00233	0.00522	0.0415
				2022	0.00222	0.00208	0.00241	0.00159	0.00381	0.00287	0.00269	0.00334	0.00263	0.000713	0.00159	0.00255	0.00381
		Cobalt	mg/kg	2017	0.567	0.257	0.285	0.270	0.619	0.391	0.569	0.665	0.453	0.170	0.257	0.479	0.665
				2018	1.81	2.02	0.734	0.407	0.269	3.71	2.40	3.82	1.90	1.39	0.269	1.92	3.82
				2019	2.12	3.42	2.12	1.60	1.90	2.33	3.34	3.71	2.57	0.799	1.60	2.22	3.71
				2020	0.942	0.929	0.125	0.753	0.600	0.372	0.348	0.230	0.537	0.315	0.125	0.486	0.942
				2021	0.381	0.546	0.226	5.86	4.44	0.289	0.0906	0.107	1.49	2.29	0.0906	0.335	5.86
				2022	0.0315	0.0327	0.131	0.0426	0.163	0.0984	0.0465	0.0775	0.0779	0.0491	0.0315	0.0620	0.163
		Manganese	mg/kg	2017	1.53	2.00	0.810	0.780	1.44	1.87	1.54	1.53	1.44	0.439	0.780	1.53	2.00
				2018	1.08	1.61	0.976	0.879	0.498	4.02	1.62	1.98	1.58	1.10	0.498	1.34	4.02
				2019	1.15	1.42	0.776	1.21	1.77	2.15	2.69	2.57	1.72	0.698	0.776	1.60	2.69
				2020	0.831	0.989	0.0983	0.590	0.363	0.347	0.268	0.240	0.466	0.310	0.0983	0.355	0.989
				2021	0.536	0.632	0.437	2.83	2.66	0.150	0.167	0.146	0.945	1.13	0.146	0.487	2.83
				2022	0.0802	0.0509	0.304	0.0428	0.196	0.153	0.0848	0.175	0.136	0.0887	0.0428	0.119	0.304
		Mercury	mg/kg	2017	3.44	3.72	2.41	2.08	2.50	3.29	3.08	2.22	2.84	0.616	2.08	2.79	3.72
				2018	5.93	5.42	2.51	2.48	1.06	7.90	5.16	7.38	4.73	2.47	1.06	5.29	7.90
				2019	-	5.00	-	7.33	2.43	5.52	-	-	5.07	2.03	2.43	5.26	7.33
				2020	17.9	12.1	12.1	13.5	14.7	12.6	13.2	9.74	13.2	2.36	9.74	12.9	17.9
				2021	12.5	-	10.1	-	-	-	3.54	11.5	9.40	4.03	3.54	10.8	12.5
				2022	4.91	6.63	4.90	6.94	4.66	5.42	2.06	1.77	4.66	1.89	1.77	4.90	6.94
		Molybdenum	mg/kg	2017	4.93	6.20	1.76	3.50	4.71	7.67	1.12	6.56	4.56	2.31	1.12	4.82	7.67
				2018	17.1	3.10	4.49	2.21	1.51	16.2	5.21	7.20	7.12	6.13	1.51	4.85	17.1
				2019	2.44	2.09	2.51	3.90	4.32	3.34	2.70	4.22	3.19	0.873	2.09	3.02	4.32
				2020	2.66	3.24	3.37	2.48	2.16	4.35	6.13	4.98	3.67	1.37	2.16	3.31	6.13
				2021	-	17.9	15.8	5.93	7.30	16.0	11.8	13.9	12.7	4.57	5.93	13.9	17.9
				2022	2.58	1.95	4.35	5.23	5.58	9.78	7.13	2.40	4.88	2.67	1.95	4.79	9.78
		Nickel	mg/kg	2017	0.483	0.0387	0.496	0.361	1.04	0.116	0.231	0.947	0.463	0.364	0.0387	0.422	1.04
				2018	2.95	2.64	0.773	1.02	0.316	3.56	3.35	4.13	2.34	1.44	0.316	2.80	4.13
				2019	1.27	1.24	2.38	1.76	-	0.973	1.95	2.32	1.70	0.555	0.973	1.76	2.38
				2020	0.741	0.553	0.0692	0.537	0.371	0.278	0.152	0.136	0.355	0.239	0.0692	0.325	0.741
				2021	-	0.363	0.249	6.83	2.75	0.367	-	0.0659	1.77	2.67	0.0659	0.365	6.83
				2022	-	-	0.0935	-	0.248	-	0.0577	0.0207	0.105	0.100	0.0207	0.0756	0.248
		Phosphorus	mg/kg	2017	6.15	6.49	5.72	4.54	7.07	8.57	7.02	7.08	6.58	1.18	4.54	6.76	8.57
				2018	12.7	11.0	8.12	11.3	4.93	26.9	12.3	8.25	11.9	6.59	4.93	11.2	26.9
				2019	8.56	11.2	10.8	8.49	9.50	11.0	12.8	10.7	10.4	1.47	8.49	10.8	12.8
				2020	9.41	11.8	9.89	9.63	9.07	9.21	12.5	6.97	9.81	1.70	6.97	9.52	12.5
				2021	11.4	17.1	9.59	18.9	15.6	14.7	8.49	23.0	14.8	4.89	8.49	15.2	23.0
				2022	8.29	9.55	9.38	9.78	8.82	8.72	7.33	4.88	8.34	1.60	4.88	8.77	9.78
		Silver	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	1.46	1.19	-	0.400	1.63	0.956	-	-	1.13	0.481	0.400	1.19	1.63
				2021	-	1.20	0.806	3.23	6.34	0.872	-	-	2.49	2.37	0.806	1.20	6.34
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Sodium	mg/kg	2017	6.61	10.8	6.86	7.02	8.57	11.2	10.5	13.3	9.36	2.46	6.61	9.54	13.3
				2018	8.96	8.38	6.20	5.33	4.75	23.9	10.7	9.11	9.67	6.10	4.75	8.67	23.9
				2019	11.9	11.1	15.4	9.66	13.6	12.8	13.8	12.4	12.6	1.77	9.66	12.6	15.4
				2020	9.67	9.75	10.7	11.1	8.67	8.73	11.4	5.73	9.47	1.82	5.73	9.71	11.4
				2021	-	15.5	9.80	25.7	22.7	15.4	9.77	15.3	16.3	5.99	9.77	15.4	25.7
				2022	7.12	8.94	8.76	7.26	6.96	10.8	7.21	6.59	7.96	1.44	6.59	7.23	10.8
		Strontium	mg/kg	2017	0.0635	0.0659	0.0245	0.0198	0.0345	0.0455	0.0549	0.0614	0.0462	0.0181	0.0198	0.0502	0.0659
				2018	0.0818	0.0527	0.0561	0.0242	0.0434	0.108	0.0513	0.0527	0.0588	0.0254	0.0242	0.0527	0.108
				2019	0.0765	0.0954	0.103	0.0625	0.0539	0.0514	0.0676	0.0837	0.0742	0.0188	0.0514	0.0721	0.103
				2020	0.0351	0.0283	0.00936	0.0267	0.0236	0.0121	0.0117	0.00607	0.0191	0.0106	0.00607	0.0178	0.0351
				2021	0.0138	0.0134	0.0124	0.0998	0.0729	0.0103	0.00630	0.00737	0.0295	0.0359	0.00630	0.0129	0.0998
				2022	0.00682	0.00621	0.00713	0.00436	0.0102	0.0103	0.00692	0.0109	0.00786	0.00235	0.00436	0.00702	0.0109
		Tin	mg/kg	2017	2.60	-	1.85	0.773	3.09	-	-	1.80	2.02	0.883	0.773	1.85	3.09
				2018	-	-	-	1.21	1.06	-	-	-	1.13	0.106	1.06	1.13	1.21
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	0.786	0.750	-	-	-	-	-	-	0.768	0.0253	0.750	0.768	0.786
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	Titanium	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	1.16	2.92	1.51	1.06	1.06	1.11	2.25	3.34	1.80	0.918	1.06	1.33	3.34
				2020	0.720	0.417	0.0638	0.641	0.488	0.177	0.230	0.0801	0.352	0.252	0.0638	0.323	0.720
				2021	0.301	2.68	0.530	33.1	55.2	7.42	0.0452	0.413	12.5	20.6	0.0452	1.61	55.2
				2022	0.00924	0.0169	0.0754	0.0169	0.0675	0.0612	0.0156	0.00970	0.0341	0.0285	0.00924	0.0169	0.0754
		Uranium	mg/kg	2017	0.792	0.224	0.291	0.291	0.471	0.334	0.330	0.893	0.453	0.252	0.224	0.332	0.893
				2018	1.86	1.02	0.825	0.454	0.220	1.98	0.890	2.13	1.17	0.726	0.220	0.954	2.13
				2019	1.61	1.78	2.96	1.13	1.08	1.22	1.48	1.64	1.61	0.600	1.08	1.55	2.96
				2020	0.852	0.626	0.0340	0.539	0.376	0.273	0.218	0.140	0.382	0.273	0.0340	0.324	0.852
				2021	0.437	0.531	0.423	4.77	5.47	1.19	0.120	0.398	1.67	2.16	0.120	0.484	5.47
				2022	-	0.0160	0.0658	-	0.110	0.0732	0.0302	0.0595	0.0591	0.0333	0.0160	0.0626	0.110
		Vanadium	mg/kg	2017	0.364	0.249	0.143	0.120	0.332	0.358	0.529	0.576	0.334	0.164	0.120	0.345	0.576
				2018	2.40	1.77	0.527	0.394	0.195	2.28	1.75	2.38	1.46	0.939	0.195	1.76	2.40
				2019	1.35	2.56	1.85	1.27	1.24	2.07	2.21	2.82	1.92	0.601	1.24	1.96	2.82
				2020	0.755	0.542	0.0367	0.678	0.426	0.183	0.247	0.0867	0.369	0.272	0.0367	0.337	0.755
				2021	0.582	1.13	0.388	10.3	15.7	0.860	0.0636	0.254	3.65	5.94	0.0636	0.721	15.7
				2022	0.0112	0.0122	0.0809	0.0212	0.0743	0.0838	0.0220	0.0163	0.0402	0.0330	0.0112	0.0216	0.0838
		Zinc	mg/kg	2017	3.44	3.68	5.76	4.11	7.41	3.97	5.04	5.75	4.89	1.36	3.44	4.58	7.41
				2018	12.2	11.2	4.16	3.07	3.01	23.8	12.7	17.3	10.9	7.38	3.01	11.7	23.8
				2019	13.0	15.4	12.8	11.9	-	12.9	14.3	15.8	13.7	1.48	11.9	13.0	15.8
				2020	9.23	12.1	6.61	6.58	6.14	8.78	11.2	7.07	8.46	2.25	6.14	7.92	12.1
				2021	-	17.2	13.4	18.3	20.5	15.8	12.0	14.0	15.9	2.98	12.0	15.8	20.5
				2022	3.30	3.00	5.98	4.68	5.56	7.21	3.18	1.66	4.32	1.85	1.66	3.99	7.21
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2018	0.483	0.671	0.468	0.604	0.575	0.719	0.523	0.539	0.573	0.0883	0.468	0.557	0.719
				2019	1.66	0.863	0.642	1.12	0.551	0.701	0.552	0.904	0.873	0.371	0.551	0.782	1.66
				2020	0.164	0.220	0.185	0.291	0.390	0.247	0.155	0.285	0.242	0.0790	0.155	0.234	0.390
				2021	0.154	0.134	0.321	0.339	0.282	0.405	0.561	0.508	0.338	0.152	0.134	0.330	0.561
				2022	0.213	0.166	0.178	0.152	0.123	0.232	0.0953	0.0759	0.154	0.0545	0.0759	0.159	0.232
		Copper	mg/kg	2018	0.552	0.866	0.859	0.803	1.37	0.931	0.700	0.390	0.809	0.290	0.390	0.831	1.37
				2019	3.92	2.17	1.75	2.30	1.41	1.33	0.794	1.27	1.87	0.965	0.794	1.58	3.92
				2020	0.369	0.714	0.403	0.369	0.570	0.549	0.268	0.747	0.499	0.174	0.268	0.476	0.747
				2021	0.423	0.236	0.0964	0.964	0.761	1.02	0.168	0.405	0.508	0.360	0.0964	0.414	1.02
				2022	0.463	0.230	0.513	0.0412	0.328	1.09	0.274	0.187	0.391	0.320	0.0412	0.301	1.09
		Iron	mg/kg	2018	0.234	1.03	0.504	0.268	0.667	0.428	0.214	0.364	0.463	0.274	0.214	0.396	1.03
				2019	2.83	1.18	0.906	1.26	0.577	0.973	0.377	0.850	1.12	0.751	0.377	0.939	2.83
				2020	0.0714	0.0982	0.0540	0.0541	0.131	0.107	0.0421	0.198	0.0945	0.0519	0.0421	0.0848	0.198
				2021	0.0794	0.0712	0.0892	1.21	0.140	0.572	0.741	0.354	0.407	0.409	0.0712	0.247	1.21
				2022	0.152	0.108	0.101	0.0452	0.0629	0.182	0.0314	0.0404	0.0905	0.0553	0.0314	0.0821	0.182
		Selenium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	1.36	1.33	1.29	1.26	1.39	1.32	1.79	1.25	1.37	0.173	1.25	1.33	1.79
				2019	2.76	2.31	1.85	2.10	1.84	1.93	2.17	2.49	2.18	0.326	1.84	2.14	2.76
				2020	1.80	2.65	1.53	2.89	2.17	2.42	2.91	3.33	2.46	0.605	1.53	2.53	3.33
				2021	2.81	3.20	2.95	4.65	2.74	3.30	2.97	4.28	3.36	0.710	2.74	3.08	4.65
				2022	2.02	4.65	3.06	1.26	6.65	6.19	6.39	5.96	4.52	2.13	1.26	5.30	6.65
		Secondary Analytes															
		Barium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0881	0.412	0.219	0.204	0.199	0.261	0.261	0.183	0.228	0.0920	0.0881	0.211	0.412
				2019	0.850	0.383	0.344	0.309	0.261	0.327	0.467	0.562	0.438	0.192	0.261	0.363	0.850
				2020	0.182	0.0260	0.0188	0.0370	0.0307	0.0349	0.0228	0.0900	0.0553	0.0560	0.0188	0.0328	0.182
				2021	0.0557	0.0484	0.0797	0.0779	0.0772	0.127	0.158	0.172	0.0995	0.0467	0.0484	0.0788	0.172
				2022	0.0973	0.0222	0.0339	0.0132	0.0340	0.0514	0.0591	0.00361	0.0394	0.0298	0.00361	0.0339	0.0973
		Cadmium	mg/kg	2018	1.08	1.50	0.933	1.02	0.974	1.20	1.12	0.750	1.07	0.220	0.750	1.05	1.50
				2019	2.34	1.70	0.780	1.23	0.972	1.02	2.03	1.15	1.40	0.557	0.780	1.19	2.34
				2020	0.137	-	-	0.164	0.0425	0.0887	0.112	0.361	0.151	0.111	0.0425	0.124	0.361
				2021	0.573	0.786	0.333	0.870	0.585	0.903	0.904	1.25	0.775	0.277	0.333	0.828	1.25
				2022	0.388	0.209	0.147	0.308	0.382	0.679	0.344	0.260	0.340	0.161	0.147	0.326	0.679
		Calcium	mg/kg	2018	0.0283	0.0363	0.0238	0.0113	0.0150	0.0197	0.0202	0.0280	0.0228	0.00801	0.0113	0.0220	0.0363
				2019	0.0740	0.0339	0.0307	0.0389	0.0262	0.0547	0.0432	0.0412	0.0428	0.0153	0.0262	0.0401	0.0740
				2020	0.00184	0.00335	0.00234	0.00366	0.00415	0.00368	0.00321	0.00445	0.00333	0.000877	0.00184	0.00350	0.00445
				2021	0.00226	0.00306	0.00380	0.00470	0.00480	0.00474	0.0256	0.0470	0.0120	0.0161	0.00226	0.00472	0.0470
				2022	0.00821	0.00920	0.00493	0.00410	0.00617	0.00492	0.00855	0.00351	0.00620	0.00219	0.00351	0.00555	0.00920
		Cobalt	mg/kg	2018	0.292	1.16	0.680	0.414	0.722	0.540	0.301	0.420	0.566	0.287	0.292	0.480	1.16
				2019	2.64	1.19	0.840	1.23	0.591	0.810	0.458	0.843	1.08	0.684	0.458	0.842	2.64
				2020	0.0642	0.0863	0.0505	0.0782	0.130	0.0987	0.0668	0.222	0.0996	0.0551	0.0505	0.0823	0.222
				2021	0.158	0.110	0.184	0.345	0.195	0.503	0.597	0.593	0.336	0.203	0.110	0.270	0.597
				2022	0.185	0.0691	0.0713	0.0664	0.0816	0.302	0.0675	0.0518	0.112	0.0876	0.0518	0.0702	0.302
		Manganese	mg/kg	2018	0.698	1.01	0.710	0.536	0.761	0.649	0.698	0.588	0.706	0.142	0.536	0.698	1.01
				2019	1.51	0.991	0.634	0.991	0.695	0.636	0.967	0.862	0.911	0.288	0.634	0.915	1.51
				2020	0.0595	0.0522	0.0374	0.0980	0.0665	0.0710	0.0712	0.155	0.0763	0.0362	0.0374	0.0688	0.155
				2021	0.195	0.156	0.401	0.254	0.236	0.366	0.348	0.541	0.312	0.126	0.156	0.301	0.541
				2022	0.147	0.0769	0.0560	0.0685	0.113	0.155	0.231	0.110	0.120	0.0573	0.0560	0.112	0.231
		Mercury	mg/kg	2018	1.19	3.96	3.04	2.00	2.93	2.34	1.42	1.90	2.35	0.921	1.19	2.17	3.96
				2019	8.57	5.62	4.90	4.79	3.78	3.23	2.59	5.53	4.88	1.84	2.59	4.84	8.57
				2020	3.67	3.46	3.72	4.79	5.69	5.94	4.50	10.8	5.31	2.38	3.46	4.64	10.8
				2021	2.57	1.93	1.78	4.38	2.80	7.66	4.42	8.97	4.31	2.68	1.78	3.59	8.97
				2022	2.48	1.19	3.12	3.53	2.93	6.62	1.10	3.71	3.09	1.73	1.10	3.02	6.62
		Molybdenum	mg/kg	2018	3.61	6.56	4.28	5.02	5.39	3.93	4.43	4.92	4.77	0.933	3.61	4.68	6.56
				2019	5.94	4.40	4.92	3.96	4.51	3.17	5.09	3.60	4.45	0.884	3.17	4.46	5.94
				2020	3.34	6.35	3.87	5.51	5.61	4.88	5.62	5.88	5.13	1.04	3.34	5.56	6.35
				2021	5.35	4.86	7.74	8.46	6.76	7.60	6.75	10.8	7.29	1.86	4.86	7.18	10.8
				2022	8.10	8.32	7.19	6.20	7.67	9.64	6.02	11.0	8.01	1.67	6.02	7.88	11.0
		Nickel	mg/kg	2018	0.453	1.33	0.905	0.563	1.61	0.621	0.334	0.824	0.830	0.441	0.334	0.722	1.61
				2019	2.43	1.20	0.925	1.13	0.795	0.719	0.456	0.871	1.07	0.599	0.456	0.898	2.43
				2020	-	-	-	0.138	-	-	-	0.117	0.127	0.0144	0.117	0.127	0.138
				2021	0.129	0.0620	0.129	0.149	0.112	0.347	0.655	0.317	0.237	0.196	0.0620	0.139	0.655
				2022	0.248	0.0531	0.0789	0.104	0.0812	0.184	0.0656	0.0909	0.113	0.0674	0.0531	0.0861	0.248
		Phosphorus	mg/kg	2018	9.19	10.1	7.94	10.3	13.2	9.25	8.09	6.09	9.27	2.09	6.09	9.22	13.2
				2019	17.9	12.4	7.20	10.7	8.79	7.44	9.76	15.3	11.2	3.81	7.20	10.2	17.9
				2020	4.94	6.76	7.18	10.6	9.25	9.41	7.95	8.12	8.03	1.77	4.94	8.03	10.6
				2021	4.90	4.45	4.37	21.9	6.56	7.46	6.65	9.15	8.18	5.77	4.37	6.61	21.9
				2022	7.60	5.63	8.64	5.99	4.06	8.02	1.71	4.30	5.74	2.34	1.71	5.81	8.64
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	0.439	-	0.439	-	0.439	0.439	0.439
				2020	-	-	-	-	-	-	-	0.455	0.455	-	0.455	0.455	0.455
				2021	-	-	-	-	-	0.681	-	-	0.681	-	0.681	0.681	0.681
				2022	-	0.0828	-	-	-	-	-	-	0.0828	-	0.0828	0.0828	0.0828
		Sodium	mg/kg	2018	4.51	6.00	4.72	4.94	9.97	7.97	3.97	5.83	5.99	2.03	3.97	5.39	9.97
				2019	17.3	12.2	8.40	15.3	8.04	6.96	7.46	11.8	10.9	3.87	6.96	10.1	17.3
				2020	4.79	7.09	8.20	9.81	7.91	7.67	7.08	8.73	7.66	1.47	4.79	7.79	9.81
				2021	5.14	3.56	3.55	8.71	8.23	6.09	7.33	9.80	6.55	2.36	3.55	6.71	9.80
				2022	8.11	6.88	8.08	8.14	5.33	9.47	8.81	8.40	7.90	1.27	5.33	8.13	9.47
		Strontium	mg/kg	2018	0.0363	0.0631	0.0462	0.0232	0.0242	0.0338	0.0356	0.0424	0.0381	0.0128	0.0232	0.0359	0.0631
				2019	0.112	0.0547	0.0559	0.0618	0.0439	0.0845	0.0647	0.0651	0.0678	0.0212	0.0439	0.0633	0.112
				2020	0.00560	0.00694	0.00654	0.0105	0.00909	0.00897	0.00904	0.0115	0.00852	0.00202	0.00560	0.00901	0.0115
				2021	0.00637	0.0130	0.00927	0.00923	0.0122	0.0145	0.0342	0.0524	0.0189	0.0160	0.00637	0.0126	0.0524
				2022	0.0257	0.0256	0.0143	0.0113	0.0126	0.0117	0.0222	0.00708	0.0163	0.00715	0.00708	0.0135	0.0257

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	Tin	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	2.20	0.878	0.635	0.961	0.438	0.797	0.281	0.687	0.860	0.587	0.281	0.742	2.20
				2020	0.0403	0.0466	0.0323	0.0273	0.0567	0.0535	0.0255	0.143	0.0531	0.0380	0.0255	0.0434	0.143
				2021	0.0377	0.0451	0.0484	0.424	0.113	0.449	0.312	0.341	0.221	0.178	0.0377	0.213	0.449
				2022	0.101	0.0895	0.0695	0.0217	0.0252	0.0841	0.0141	0.0192	0.0531	0.0365	0.0141	0.0474	0.101
		Uranium	mg/kg	2018	0.246	0.905	0.578	0.293	0.389	0.494	0.320	0.620	0.481	0.218	0.246	0.441	0.905
				2019	1.85	0.878	0.725	0.955	0.466	1.25	0.525	0.677	0.916	0.454	0.466	0.802	1.85
				2020	0.0487	0.0340	0.0286	0.0578	0.0350	0.0398	0.0432	0.125	0.0516	0.0312	0.0286	0.0415	0.125
				2021	0.169	0.136	0.200	0.345	0.106	0.242	0.453	0.528	0.272	0.154	0.106	0.221	0.528
				2022	0.143	0.129	0.0562	0.0840	0.0970	0.210	0.152	0.0586	0.116	0.0524	0.0562	0.113	0.210
		Vanadium	mg/kg	2018	0.199	0.921	0.464	0.247	0.421	0.418	0.201	0.370	0.405	0.233	0.199	0.394	0.921
				2019	2.41	0.961	0.726	1.01	0.505	0.948	0.331	0.720	0.951	0.635	0.331	0.837	2.41
				2020	0.0437	0.0441	0.0351	0.0278	0.110	0.0630	0.0245	0.125	0.0592	0.0381	0.0245	0.0439	0.125
				2021	0.0968	0.0844	0.0990	0.499	0.137	0.545	0.519	0.295	0.284	0.207	0.0844	0.216	0.545
				2022	0.0996	0.110	0.0604	0.0231	0.0515	0.123	0.0304	0.0213	0.0649	0.0407	0.0213	0.0559	0.123
		Zinc	mg/kg	2018	4.89	5.28	4.05	4.58	5.44	3.74	3.84	3.19	4.38	0.800	3.19	4.32	5.44
				2019	-	11.4	6.52	8.43	6.44	5.97	6.08	8.10	7.57	1.97	5.97	6.52	11.4
				2020	4.88	7.27	5.62	6.14	7.97	7.13	5.84	9.04	6.74	1.37	4.88	6.63	9.04
				2021	9.64	7.21	7.59	13.7	9.75	19.0	14.9	18.7	12.6	4.71	7.21	11.7	19.0
				2022	2.41	2.40	4.91	6.22	7.12	13.8	4.99	5.36	5.90	3.60	2.40	5.18	13.8
Lower Edney Creek	EDC-D (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	0.788	1.15	1.47	1.20	0.872	0.881	0.667	0.715	0.967	0.279	0.667	0.876	1.47
				2019	0.179	0.0857	0.165	0.340	0.189	0.178	0.186	0.106	0.179	0.0760	0.0857	0.179	0.340
				2020	0.433	0.599	0.752	0.359	0.622	0.818	0.277	0.163	0.503	0.232	0.163	0.516	0.818
				2021	1.06	0.225	0.720	0.217	0.0776	0.103	0.0894	0.294	0.348	0.355	0.0776	0.221	1.06
				2022	0.229	0.152	0.577	0.438	0.242	0.0456	0.416	0.0589	0.270	0.191	0.0456	0.235	0.577
		Copper	mg/kg	2018	0.907	1.16	2.27	1.66	0.889	1.48	1.45	1.25	1.38	0.449	0.889	1.35	2.27
				2019	0.480	0.365	0.729	0.830	0.504	0.963	0.548	0.631	0.631	0.199	0.365	0.589	0.963
				2020	0.919	1.35	1.37	1.10	1.36	1.28	1.15	1.01	1.19	0.172	0.919	1.22	1.37
				2021	1.60	0.678	1.23	0.800	0.556	0.692	0.543	1.52	0.952	0.432	0.543	0.746	1.60
				2022	0.630	0.917	0.749	1.08	0.959	0.734	0.804	0.418	0.787	0.207	0.418	0.776	1.08
		Iron	mg/kg	2018	0.310	0.350	1.39	1.66	0.234	0.478	0.239	1.00	0.708	0.567	0.234	0.414	1.66
				2019	0.0511	0.00964	0.110	0.0746	0.0760	0.0242	0.0650	0.0119	0.0529	0.0355	0.00964	0.0580	0.110
				2020	0.241	0.509	0.410	0.292	0.418	0.535	0.320	0.0120	0.342	0.168	0.0120	0.365	0.535
				2021	0.529	0.0550	0.189	0.0966	0.0111	0.0136	0.102	0.0534	0.131	0.171	0.0111	0.0758	0.529
				2022	0.0611	0.0463	0.206	0.465	0.203	0.0255	0.589	0.0327	0.204	0.215	0.0255	0.132	0.589
		Selenium	mg/kg	2018	0.749	1.09	1.56	0.949	1.04	0.954	0.829	0.677	0.981	0.273	0.677	0.952	1.56
				2019	1.07	0.303	1.15	2.43	1.65	2.07	1.34	2.10	1.51	0.690	0.303	1.49	2.43
				2020	1.76	1.41	2.74	2.22	1.25	1.49	3.01	3.55	2.18	0.844	1.25	1.99	3.55
				2021	0.863	0.707	1.77	0.597	0.397	0.560	0.607	1.47	0.872	0.488	0.397	0.657	1.77
				2022	1.38	1.64	1.72	1.28	1.26	1.07	1.75	0.779	1.36	0.337	0.779	1.33	1.75
		Secondary Analytes															
		Barium	mg/kg	2018	1.15	1.17	3.21	1.12	1.16	1.16	1.05	1.55	1.45	0.728	1.05	1.16	3.21
				2019	0.234	0.00591	0.115	0.218	0.115	0.0485	0.237	0.0400	0.127	0.0930	0.00591	0.115	0.237
				2020	0.920	1.01	1.25	1.13	0.930	1.23	0.250	0.0497	0.844	0.449	0.0497	0.968	1.25
				2021	0.971	0.186	1.00	0.185	0.0315	0.0437	0.0457	0.231	0.337	0.408	0.0315	0.185	1.00
				2022	0.238	0.101	0.606	0.201	0.372	0.130	0.941	0.0412	0.329	0.305	0.0412	0.220	0.941
		Cadmium	mg/kg	2018	1.06	1.12	3.25	1.90	1.03	0.880	1.59	1.38	1.53	0.773	0.880	1.25	3.25
				2019	0.235	0.0670	1.07	0.449	0.0891	0.0539	0.189	0.130	0.285	0.341	0.0539	0.160	1.07
				2020	1.72	1.08	2.30	1.40	0.603	0.838	1.32	0.333	1.20	0.630	0.333	1.20	2.30
				2021	1.51	0.164	1.38	0.263	0.0414	0.0673	0.0897	0.250	0.471	0.608	0.0414	0.207	1.51
				2022	0.944	1.26	0.899	1.56	1.03	0.179	0.907	0.162	0.867	0.483	0.162	0.925	1.56
		Calcium	mg/kg	2018	0.0766	0.0445	0.0545	0.0400	0.0412	0.108	0.0398	0.275	0.0850	0.0804	0.0398	0.0495	0.275
				2019	0.0794	0.260	0.166	0.140	0.0693	0.153	0.123	0.162	0.144	0.0592	0.0693	0.146	0.260
				2020	0.356	0.362	0.525	0.372	0.397	0.429	0.363	0.100	0.363	0.120	0.100	0.367	0.525
				2021	0.0874	0.0397	0.0741	0.0294	0.0275	0.0418	0.106	0.0765	0.0602	0.0294	0.0275	0.0580	0.106
				2022	0.208	0.0957	0.226	0.386	0.194	0.0502	0.323	0.139	0.203	0.112	0.0502	0.201	0.386
		Cobalt	mg/kg	2018	0.355	0.493	1.79	1.99	0.394	0.550	0.431	0.985	0.874	0.660	0.355	0.521	1.99
				2019	0.101	0.0122	0.0861	0.143	0.0723	0.0321	0.130	0.0121	0.0735	0.0509	0.0121	0.0792	0.143
				2020	0.311	0.413	0.473	0.364	0.340	0.494	0.262	0.0257	0.335	0.148	0.0257	0.352	0.494
				2021	0.675	0.0784	0.324	0.125	0.00983	0.0265	0.103	0.0733	0.177	0.223	0.00983	0.0906	0.675
				2022	0.107	0.0585	0.267	0.548	0.251	0.0500	0.481	0.0214	0.223	0.202	0.0214	0.179	0.548
		Manganese	mg/kg	2018	0.580	0.548	2.22	1.29	0.610	0.527	0.592	0.574	0.869	0.604	0.527	0.586	2.22
				2019	0.249	0.0159	0.109	0.352	0.203	0.0423	0.182	0.0230	0.147	0.121	0.0159	0.146	0.352
				2020	0.896	0.537	1.36	0.694	0.363	0.655	0.149	0.0766	0.591	0.416	0.0766	0.596	1.36
				2021	0.816	0.145	0.788	0.156	0.0174	0.0434	0.0582	0.252	0.285	0.328	0.0174	0.150	0.816
				2022	0.235	0.112	0.433	0.165	0.294	0.0781	0.333	0.0364	0.211	0.137	0.0364	0.200	0.433
		Mercury	mg/kg	2018	1.41	2.30	2.08	3.59	0.568	1.64	2.63	1.68	1.99	0.898	0.568	1.88	3.59
				2019	0.447	0.808	1.51	0.949	0.902	0.721	0.727	1.22	0.910	0.327	0.447	0.855	1.51
				2020	1.19	1.81	2.02	1.61	1.47	1.55	1.73	1.44	1.60	0.253	1.19	1.58	2.02
				2021	2.00	0.954	1.35	0.577	0.471	0.586	0.391	1.27	0.950	0.557	0.391	0.770	2.00
				2022	1.36	1.98	1.11	0.869	1.27	1.22	1.97	0.653	1.30	0.472	0.653	1.24	1.98
		Molybdenum	mg/kg	2018	2.47	1.81	6.65	1.26	1.72	0.937	0.552	0.760	2.02	1.97	0.552	1.49	6.65
				2019	0.936	2.01	2.58	4.36	2.44	2.08	2.26	4.20	2.61	1.15	0.936	2.35	4.36
				2020	4.33	0.369	10.3	4.07	1.45	0.678	2.25	14.4	4.73	5.03	0.369	3.16	14.4
				2021	0.627	4.71	2.67	1.60	3.23	2.58	9.17	5.78	3.80	2.71	0.627	2.95	9.17
				2022	5.33	1.56	3.62	2.73	0.797	1.50	2.73	3.48	2.72	1.45	0.797	2.73	5.33
		Nickel	mg/kg	2018	0.388	0.548	1.40	1.05	0.558	0.523	0.438	0.667	0.697	0.349	0.388	0.553	1.40
				2019	0.103	0.0303	0.140	0.136	0.0520	0.0319	0.123	0.0310	0.0808	0.0493	0.0303	0.0775	0.140
				2020	0.309	0.460	0.435	0.411	0.381	0.598	0.266	0.0212	0.360	0.170	0.0212	0.396	0.598
				2021	0.762	0.0814	0.422	0.121	-	0.0126	0.116	0.0666	0.226	0.271	0.0126	0.116	0.762
				2022	0.115	0.197	0.222	0.977	0.433	0.106	0.319	0.0440	0.302	0.300	0.0440	0.210	0.977
		Phosphorus	mg/kg	2018	2.97	3.75	4.06	2.70	2.37	3.74	3.89	2.28	3.22	0.723	2.28	3.35	4.06
				2019	3.53	5.86	6.07	7.82	6.44	3.65	3.14	6.07	5.32	1.68	3.14	5.96	7.82
				2020	5.36	3.95	7.85	7.13	3.96	3.24	6.33	8.11	5.74	1.89	3.24	5.85	8.11
				2021	5.17	4.76	6.14	4.63	4.67	4.51	5.69	10.4	5.74	1.95	4.51	4.96	10.4
				2022	6.67	4.07	4.42	5.53	3.06	4.45	4.54	5.86	4.83	1.14	3.06	4.50	6.67
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.271	0.0754	1.10	0.261	0.0865	0.300	0.179	0.127	0.300	0.334	0.0754	0.220	1.10
				2020	0.684	1.68	1.14	0.884	1.21	1.23	1.06	0.348	1.03	0.398	0.348	1.10	1.68
				2021	1.16	0.177	0.556	0.221	0.141	0.147	0.128	0.253	0.348	0.358	0.128	0.199	1.16
				2022	0.382	0.645	0.534	0.215	0.996	0.423	1.13	0.142	0.559	0.353	0.142	0.479	1.13
		Sodium	mg/kg	2018	5.49	7.71	6.05	6.05	0.986	6.88	8.00	8.86	6.25	2.41	0.986	6.46	8.86
				2019	4.57	11.1	10.4	12.0	8.97	3.53	6.13	3.88	7.57	3.44	3.53	7.55	12.0
				2020	8.50	10.4	11.6	13.8	8.74	9.25	7.80	7.96	9.75	2.06	7.80	8.99	13.8
				2021	10.2	3.88	11.9	6.01	5.97	4.86	6.61	9.68	7.39	2.84	3.88	6.31	11.9
				2022	12.3	8.99	8.72	7.96	10.9	7.69	15.1	5.11	9.60	3.10	5.11	8.85	15.1
		Strontium	mg/kg	2018	0.176	0.106	0.153	0.0898	0.117	0.159	0.0691	0.355	0.153	0.0895	0.0691	0.135	0.355
				2019	0.0754	0.155	0.151	0.126	0.0947	0.138	0.130	0.163	0.129	0.0304	0.0754	0.134	0.163
				2020	0.348	0.322	0.499	0.415	0.383	0.398	0.322	0.0858	0.347	0.120	0.0858	0.365	0.499
				2021	0.117	0.0639	0.122	0.0464	0.0560	0.0531	0.107	0.113	0.0848	0.0326	0.0464	0.0855	0.122
				2022	0.161	0.0613	0.280	0.251	0.156	0.0419	0.348	0.0985	0.175	0.109	0.0419	0.159	0.348

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	EDC-D (Reference)	Tin	mg/kg	2018	-	0.824	-	-	0.732	-	1.93	-	1.16	0.666	0.732	0.824	1.93
				2019	0.142	-	0.101	1.53	-	0.0592	0.0374	0.732	0.433	0.596	0.0374	0.122	1.53
				2020	-	0.500	0.684	-	-	0.682	-	-	0.622	0.106	0.500	0.682	0.684
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0254	0.0159	0.115	0.114	0.123	0.0249	0.0822	0.00945	0.0637	0.0496	0.00945	0.0538	0.123
				2020	0.236	0.446	0.301	0.334	0.368	0.461	0.261	0.00649	0.302	0.144	0.00649	0.318	0.461
				2021	0.686	0.0409	0.173	0.0910	0.00486	0.00570	0.282	0.0665	0.169	0.229	0.00486	0.0788	0.686
				2022	0.0630	0.0369	0.143	0.532	0.173	0.0217	0.476	0.0536	0.187	0.203	0.0217	0.103	0.532
		Uranium	mg/kg	2018	0.270	0.845	2.38	2.17	0.346	0.741	0.699	0.938	1.05	0.791	0.270	0.793	2.38
				2019	0.106	0.00103	0.180	0.147	0.0367	0.0259	0.230	0.0969	0.103	0.0799	0.00103	0.101	0.230
				2020	0.341	0.754	0.398	0.528	0.567	0.672	0.250	0.0173	0.441	0.240	0.0173	0.463	0.754
				2021	0.724	0.0658	0.469	0.111	0.00997	0.0140	0.0635	0.106	0.195	0.259	0.00997	0.0861	0.724
				2022	0.104	0.0620	0.286	0.483	0.466	0.0505	0.312	0.0336	0.225	0.187	0.0336	0.195	0.483
		Vanadium	mg/kg	2018	0.287	0.251	1.28	1.89	0.133	0.412	0.154	1.34	0.718	0.679	0.133	0.350	1.89
				2019	0.0347	0.00760	0.0869	0.0774	0.0671	0.0230	0.0718	0.0195	0.0485	0.0306	0.00760	0.0509	0.0869
				2020	0.230	0.504	0.393	0.357	0.382	0.405	0.395	0.00911	0.334	0.151	0.00911	0.388	0.504
				2021	0.468	0.0483	0.147	0.0767	0.00811	0.0125	0.270	0.0595	0.136	0.159	0.00811	0.0681	0.468
				2022	0.0518	0.0422	0.212	0.655	0.223	0.0284	0.742	0.0575	0.252	0.287	0.0284	0.135	0.742
		Zinc	mg/kg	2018	2.26	3.03	9.81	7.95	2.78	3.55	2.72	1.73	4.23	2.96	1.73	2.90	9.81
				2019	1.53	1.17	1.63	3.17	1.83	2.23	1.68	1.79	1.88	0.602	1.17	1.73	3.17
				2020	2.91	2.03	3.50	3.25	2.62	1.95	2.73	2.59	2.70	0.537	1.95	2.68	3.50
				2021	2.94	2.50	2.79	1.57	1.70	1.66	2.06	5.55	2.60	1.30	1.57	2.28	5.55
				2022	1.77	1.79	1.89	1.80	1.79	1.80	1.83	1.38	1.76	0.157	1.38	1.80	1.89
Lower Hazeltine Creek	HAC-D (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2017	-	-	-	-	0.416	0.266	0.296	0.454	0.358	0.0910	0.266	0.356	0.454
				2018	0.285	0.149	0.0474	0.179	0.152	0.0740	0.105	0.0797	0.134	0.0759	0.0474	0.127	0.285
				2019	0.444	0.433	0.149	0.198	0.333	0.177	0.316	0.215	0.283	0.115	0.149	0.266	0.444
				2020	0.410	0.153	0.475	0.273	1.70	0.261	0.274	0.175	0.465	0.510	0.153	0.274	1.70
				2021	0.0475	0.265	0.143	0.349	0.112	0.224	0.319	0.215	0.209	0.104	0.0475	0.219	0.349
				2022	0.0120	0.126	0.178	0.189	0.323	0.102	0.124	0.0674	0.140	0.0932	0.0120	0.125	0.323
		Copper	mg/kg	2017	-	-	-	-	0.748	0.429	0.421	0.651	0.562	0.163	0.421	0.540	0.748
				2018	0.455	0.176	0.315	0.186	0.252	0.115	0.197	0.0867	0.223	0.118	0.0867	0.192	0.455
				2019	0.486	0.448	0.231	0.264	0.274	0.291	0.532	0.280	0.351	0.118	0.231	0.286	0.532
				2020	0.730	0.982	1.14	0.376	1.78	0.796	0.669	0.440	0.864	0.449	0.376	0.763	1.78
				2021	0.845	0.806	0.232	0.245	0.106	0.190	0.230	0.144	0.350	0.298	0.106	0.231	0.845
				2022	0.0269	0.418	0.772	0.348	0.400	0.383	0.146	0.190	0.335	0.225	0.0269	0.366	0.772
		Iron	mg/kg	2017	-	-	-	-	0.374	0.187	0.221	0.448	0.308	0.124	0.187	0.297	0.448
				2018	0.0994	0.0633	0.0397	0.0502	0.0260	0.0148	0.0280	0.0165	0.0422	0.0284	0.0148	0.0339	0.0994
				2019	0.171	0.0754	0.0484	0.0535	0.161	0.0556	0.182	0.0464	0.0991	0.0606	0.0464	0.0655	0.182
				2020	0.121	0.188	0.257	0.0318	0.623	0.105	0.130	0.0466	0.188	0.190	0.0318	0.125	0.623
				2021	0.229	0.229	0.0668	0.162	0.0394	0.143	0.206	0.0678	0.143	0.0768	0.0394	0.152	0.229
				2022	0.00374	0.0620	0.169	0.175	0.456	0.0813	0.0835	0.0561	0.136	0.141	0.00374	0.0824	0.456
		Selenium	mg/kg	2017	-	-	-	-	3.28	2.71	2.30	2.11	2.60	0.517	2.11	2.51	3.28
				2018	3.52	3.61	3.37	4.07	4.10	4.69	3.25	3.12	3.72	0.529	3.12	3.56	4.69
				2019	4.21	2.96	5.65	3.83	3.30	5.25	4.15	3.17	4.07	0.972	2.96	3.99	5.65
				2020	4.45	4.16	2.42	4.87	3.59	4.74	2.62	2.78	3.70	0.991	2.42	3.87	4.87
				2021	2.86	3.10	3.31	3.48	4.64	2.32	2.00	10.2	3.99	2.63	2.00	3.20	10.2
				2022	0.609	2.65	3.42	2.59	2.42	2.34	1.27	1.98	2.16	0.873	0.609	2.38	3.42
		Secondary Analytes															
		Barium	mg/kg	2017	-	-	-	-	0.940	0.556	0.397	0.461	0.589	0.243	0.397	0.509	0.940
				2018	0.0625	0.0830	0.0628	0.00669	0.0655	0.0355	0.0297	0.0200	0.0457	0.0265	0.00669	0.0490	0.0830
				2019	0.106	0.300	0.0666	0.0574	0.0678	0.0635	0.163	0.150	0.122	0.0828	0.0574	0.0869	0.300
				2020	0.185	0.432	0.399	0.0853	0.876	0.228	0.118	0.0281	0.294	0.275	0.0281	0.207	0.876
				2021	0.335	0.285	0.134	0.250	0.108	0.130	0.166	0.0702	0.185	0.0941	0.0702	0.150	0.335
				2022	0.0179	0.157	0.133	0.330	0.0890	0.0348	0.0572	0.0113	0.104	0.106	0.0113	0.0731	0.330
		Cadmium	mg/kg	2017	-	-	-	-	3.75	1.98	1.63	1.18	2.13	1.12	1.18	1.80	3.75
				2018	0.0806	0.144	0.272	0.558	0.382	-	0.0755	-	0.252	0.191	0.0755	0.208	0.558
				2019	0.0465	0.616	0.864	0.0490	0.107	0.0562	0.285	0.178	0.275	0.305	0.0465	0.143	0.864
				2020	1.85	8.09	1.10	1.60	3.14	3.40	0.367	0.324	2.48	2.53	0.324	1.72	8.09
				2021	2.71	2.51	1.82	3.46	2.28	3.26	2.45	5.47	2.99	1.13	1.82	2.61	5.47
				2022	0.264	2.56	1.85	1.90	0.569	0.488	0.323	0.0680	1.00	0.949	0.0680	0.528	2.56
		Calcium	mg/kg	2017	-	-	-	-	0.115	0.129	0.0800	0.0687	0.0982	0.0285	0.0687	0.0975	0.129
				2018	0.00294	0.00645	0.00552	0.00705	0.00367	0.00596	0.00372	0.00622	0.00519	0.00153	0.00294	0.00574	0.00705
				2019	0.00787	0.00502	0.0221	0.00716	0.0134	0.00879	0.0126	0.00651	0.0104	0.00552	0.00502	0.00833	0.0221
				2020	0.00984	0.0365	0.00880	0.00747	0.0250	0.0158	0.00643	0.00318	0.0141	0.0113	0.00318	0.00932	0.0365
				2021	0.0117	0.0133	0.0601	0.164	0.0710	0.0985	0.0943	0.0994	0.0766	0.0500	0.0117	0.0827	0.164
				2022	0.00113	0.00707	0.00889	0.00413	0.0156	0.00289	0.00377	0.00233	0.00572	0.00472	0.00113	0.00395	0.0156
		Cobalt	mg/kg	2017	-	-	-	-	0.376	0.371	0.278	0.466	0.373	0.0770	0.278	0.373	0.466
				2018	0.189	0.145	0.118	0.116	0.0738	0.0322	0.0618	0.0282	0.0955	0.0563	0.0282	0.0951	0.189
				2019	0.213	0.300	0.0791	0.0848	0.159	0.0756	0.195	0.0723	0.147	0.0840	0.0723	0.122	0.300
				2020	0.311	0.470	0.341	0.165	1.17	0.404	0.206	0.0935	0.395	0.336	0.0935	0.326	1.17
				2021	0.304	0.362	0.0972	0.271	0.0697	0.240	0.324	0.134	0.225	0.111	0.0697	0.256	0.362
				2022	0.0112	0.167	0.444	0.479	0.369	0.224	0.124	0.0374	0.232	0.180	0.0112	0.196	0.479
		Manganese	mg/kg	2017	-	-	-	-	1.00	0.896	0.928	0.842	0.918	0.0679	0.842	0.912	1.00
				2018	0.224	0.207	0.150	0.346	0.104	0.132	0.107	0.0211	0.161	0.0979	0.0211	0.141	0.346
				2019	0.0992	0.476	0.385	0.118	0.144	0.164	0.104	0.0962	0.198	0.147	0.0962	0.131	0.476
				2020	0.448	2.30	0.237	0.433	0.863	1.01	0.117	0.0252	0.679	0.740	0.0252	0.440	2.30
				2021	0.719	0.753	0.772	1.83	1.01	1.52	2.03	2.08	1.34	0.593	0.719	1.27	2.08
				2022	0.116	0.632	0.844	0.462	0.164	0.133	0.0741	0.0186	0.305	0.303	0.0186	0.149	0.844
		Mercury	mg/kg	2017	-	-	-	-	1.01	0.429	0.809	0.986	0.809	0.269	0.429	0.897	1.01
				2018	2.16	1.15	-	1.30	1.26	0.623	0.650	0.826	1.14	0.532	0.623	1.15	2.16
				2019	1.21	1.23	0.560	0.897	1.12	1.07	1.00	0.838	0.989	0.221	0.560	1.03	1.23
				2020	2.90	1.83	3.13	1.38	4.95	2.33	5.77	6.12	3.55	1.82	1.38	3.02	6.12
				2021	1.08	1.45	1.24	0.735	0.559	0.611	0.181	0.702	0.819	0.410	0.181	0.719	1.45
				2022	0.207	1.32	3.56	3.64	1.77	2.25	1.67	2.16	2.07	1.13	0.207	1.97	3.64
		Molybdenum	mg/kg	2017	-	-	-	-	4.04	3.21	2.11	2.40	2.94	0.868	2.11	2.81	4.04
				2018	10.7	8.59	7.50	6.03	7.12	4.84	5.48	2.58	6.60	2.46	2.58	6.57	10.7
				2019	7.43	6.02	7.36	3.52	7.36	6.73	4.37	6.30	6.14	1.46	3.52	6.52	7.43
				2020	3.34	4.34	2.74	5.30	4.89	5.77	4.20	3.68	4.28	1.02	2.74	4.27	5.77
				2021	4.07	1.86	0.797	0.845	0.524	1.14	1.21	1.84	1.54	1.13	0.524	1.17	4.07
				2022	0.374	4.95	6.63	4.70	5.52	6.20	4.16	3.00	4.44	2.00	0.374	4.83	6.63
		Nickel	mg/kg	2017	-	-	-	-	0.417	0.332	0.311	0.485	0.386	0.0802	0.311	0.375	0.485
				2018	0.123	0.119	0.0570	0.0715	0.0592	0.0429	0.130	0.0332	0.0794	0.0386	0.0332	0.0654	0.130
				2019	0.230	0.170	0.0672	0.0794	0.177	0.0770	0.194	0.0580	0.132	0.0681	0.0580	0.125	0.230
				2020	0.182	0.190	0.105	0.107	0.901	0.271	0.187	0.0583	0.250	0.271	0.0583	0.185	0.901
				2021	0.228	0.340	0.192	0.288	0.112	0.333	0.365	0.304	0.270	0.0862	0.112	0.296	0.365
				2022	0.00724	0.136	0.327	0.311	0.344	0.105	0.139	0.0403	0.176	0.133	0.00724	0.138	0.344
		Phosphorus	mg/kg	2017	-	-	-	-	8.06	4.77	5.08	6.75	6.17	1.54	4.77	5.92	8.06
				2018	12.1	9.82	8.77	6.53	8.74	7.51	7.02	5.29	8.22	2.12	5.29	8.12	12.1
				2019	13.7	9.52	5.13	7.12	7.22	8.57	10.0	6.63	8.49	2.64	5.13	7.89	13.7
				2020	6.70	5.80	11.6	7.57	12.9	8.15	10.7	10.9	9.29	2.56	5.80	9.42	12.9
				2021	8.92	6.48	3.59	4.48	5.32	3.64	3.38	8.93	5.59	2.30	3.38	4.90	8.93
				2022	0.581	3.30	3.95	4.02	4.02	3.82	3.32	3.79	3.35	1.16	0.581	3.81	4.02

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Silver	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.180	0.285	0.0676	-	0.108	-	1.01	0.0845	0.289	0.362	0.0676	0.144	1.01
				2020	0.609	0.885	1.62	0.199	1.75	0.606	0.705	-	0.910	0.568	0.199	0.705	1.75
				2021	0.765	0.675	0.311	0.386	0.119	0.466	0.375	0.366	0.433	0.205	0.119	0.380	0.765
				2022	0.0200	0.329	1.07	0.861	1.24	0.228	0.245	-	0.571	0.478	0.0200	0.329	1.24
		Sodium	mg/kg	2017	-	-	-	-	5.11	4.20	4.24	4.33	4.47	0.432	4.20	4.29	5.11
				2018	10.8	9.78	7.05	4.87	7.64	6.44	2.66	5.07	6.79	2.67	2.66	6.75	10.8
				2019	11.0	9.45	7.33	7.59	8.50	10.6	4.71	6.45	8.21	2.13	4.71	8.04	11.0
				2020	15.6	8.31	13.2	14.8	18.0	11.2	12.7	11.6	13.2	2.98	8.31	13.0	18.0
				2021	7.63	4.84	1.53	2.80	1.68	2.23	1.93	6.79	3.68	2.42	1.53	2.51	7.63
				2022	0.880	7.41	6.33	5.94	9.02	9.55	6.36	7.18	6.59	2.64	0.880	6.77	9.55
		Strontium	mg/kg	2017	-	-	-	-	0.244	0.238	0.149	0.140	0.193	0.0556	0.140	0.194	0.244
				2018	0.00939	0.0188	0.0134	0.0163	0.00998	0.0142	0.00874	0.0158	0.0133	0.00367	0.00874	0.0138	0.0188
				2019	0.0215	0.0145	0.0423	0.0189	0.0251	0.0236	0.0277	0.0172	0.0239	0.00861	0.0145	0.0226	0.0423
				2020	0.0319	0.0718	0.0640	0.0208	0.0763	0.0352	0.0190	0.00884	0.0410	0.0261	0.00884	0.0335	0.0763
				2021	0.0320	0.0291	0.0425	0.148	0.0571	0.0905	0.0916	0.0751	0.0708	0.0398	0.0291	0.0661	0.148
				2022	0.00280	0.0194	0.0186	0.0110	0.0233	0.00840	0.0125	0.00718	0.0129	0.00700	0.00280	0.0117	0.0233
		Tin	mg/kg	2017	-	-	-	-	-	0.657	0.892	1.04	0.864	0.194	0.657	0.892	1.04
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	-	-	-	-	-	-	-	-	-	-
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2017	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.176	0.0797	0.0493	0.0461	0.0844	0.0580	0.114	0.0409	0.0811	0.0456	0.0409	0.0689	0.176
				2020	0.0951	0.128	0.111	0.0256	0.347	0.0868	0.0876	0.0421	0.115	0.0256	0.0256	0.0914	0.347
				2021	1.45	0.146	0.0518	0.0942	0.0247	0.0486	0.106	0.0359	0.245	0.489	0.0247	0.0730	1.45
				2022	0.00362	0.0643	0.143	0.159	0.815	0.0559	0.0775	0.0344	0.169	0.266	0.00362	0.0709	0.815
		Uranium	mg/kg	2017	-	-	-	-	0.610	0.352	0.333	0.378	0.418	0.129	0.333	0.365	0.610
				2018	0.0865	0.192	0.0302	0.0895	0.0311	0.00922	0.0263	0.0148	0.0599	0.0614	0.00922	0.0307	0.192
				2019	0.133	0.106	0.0413	0.0364	0.159	0.0474	0.151	0.0440	0.0898	0.0532	0.0364	0.0767	0.159
				2020	0.187	0.315	0.641	0.103	1.16	0.200	0.211	0.0436	0.357	0.371	0.0436	0.205	1.16
				2021	0.165	0.287	0.254	0.446	0.159	0.454	0.593	0.275	0.329	0.153	0.159	0.281	0.593
				2022	0.00734	0.105	0.362	0.235	0.349	0.136	0.0905	0.0465	0.166	0.134	0.00734	0.120	0.362
		Vanadium	mg/kg	2017	-	-	-	-	0.416	0.219	0.250	0.524	0.352	0.144	0.219	0.333	0.524
				2018	0.0764	0.0609	0.0450	0.0443	0.0240	0.00827	0.0235	0.0118	0.0368	0.0241	0.00827	0.0342	0.0764
				2019	0.143	0.0679	0.0413	0.0435	0.161	0.0472	0.152	0.0394	0.0869	0.0549	0.0394	0.0575	0.161
				2020	0.102	0.203	0.280	0.0221	0.457	0.0935	0.109	0.0247	0.162	0.147	0.0221	0.106	0.457
				2021	0.341	0.261	0.0657	0.151	0.0379	0.129	0.184	0.0612	0.154	0.105	0.0379	0.140	0.341
				2022	0.00266	0.0519	0.138	0.148	0.713	0.0652	0.0604	0.0296	0.151	0.233	0.00266	0.0628	0.713
		Zinc	mg/kg	2017	-	-	-	-	1.98	1.46	1.40	1.66	1.63	0.263	1.40	1.56	1.98
				2018	6.03	3.13	2.41	1.98	2.87	2.01	2.05	1.35	2.73	1.45	1.35	2.23	6.03
				2019	4.13	3.94	1.80	2.24	2.55	2.61	3.42	1.98	2.83	0.889	1.80	2.58	4.13
				2020	5.97	7.61	5.34	4.45	11.0	7.51	3.01	1.87	5.85	2.89	1.87	5.66	11.0
				2021	8.24	9.11	5.39	5.09	3.12	3.93	4.28	7.18	5.79	2.15	3.12	5.24	9.11
				2022	0.727	5.33	8.17	8.19	4.90	5.41	2.95	2.06	4.72	2.70	0.727	5.12	8.19
Lower Edney Creek	E1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2019	0.136	0.117	0.203	0.110	0.139	0.0992	0.203	0.0727	0.135	0.0468	0.0727	0.126	0.203
				2020	0.111	0.349	0.219	0.166	0.120	0.316	0.217	0.149	0.206	0.0877	0.111	0.192	0.349
				2021	0.106	0.201	0.121	0.229	0.194	0.268	0.445	0.133	0.212	0.110	0.106	0.198	0.445
				2022	0.212	1.76	0.366	2.50	0.531	0.411	0.658	0.208	0.831	0.840	0.208	0.471	2.50
		Copper	mg/kg	2019	0.218	0.415	0.329	0.136	0.00757	0.747	0.546	0.505	0.363	0.240	0.00757	0.372	0.747
				2020	0.299	0.588	0.286	0.338	0.468	0.332	0.417	0.217	0.368	0.118	0.217	0.335	0.588
				2021	0.162	0.145	0.139	0.279	0.479	0.383	0.189	0.135	0.239	0.130	0.135	0.175	0.479
				2022	0.818	2.00	1.64	1.25	0.551	0.399	0.884	0.0699	0.951	0.646	0.0699	0.851	2.00
		Iron	mg/kg	2019	0.0230	0.00882	0.0118	0.00877	0.00812	0.0283	0.0631	0.0138	0.0207	0.0186	0.00812	0.0128	0.0631
				2020	0.0343	0.168	0.126	0.0682	0.113	0.137	0.0662	0.0303	0.0929	0.0504	0.0303	0.0906	0.168
				2021	0.0101	0.0143	0.0150	0.0541	0.0407	0.0167	0.124	0.0261	0.0377	0.0382	0.0101	0.0214	0.124
				2022	0.0403	0.848	0.213	1.77	0.336	0.288	0.625	0.113	0.529	0.568	0.0403	0.312	1.77
		Selenium	mg/kg	2019	1.74	1.26	4.09	2.37	1.04	1.97	1.12	1.87	1.93	0.985	1.04	1.81	4.09
				2020	2.41	2.98	6.36	4.03	3.96	3.01	2.35	2.60	3.46	1.33	2.35	2.99	6.36
				2021	1.20	1.52	2.49	2.08	1.76	1.51	1.08	2.09	1.72	0.482	1.08	1.64	2.49
				2022	3.37	3.20	1.62	5.07	1.53	1.49	1.92	0.899	2.39	1.38	0.899	1.77	5.07
		Secondary Analytes															
		Barium	mg/kg	2019	0.0556	0.0349	0.136	0.0108	0.0191	0.137	0.275	0.114	0.0978	0.0879	0.0108	0.0849	0.275
				2020	0.179	0.266	0.467	0.204	0.420	0.124	0.534	0.313	0.313	0.147	0.124	0.289	0.534
				2021	0.144	0.00590	0.00149	0.0303	0.00437	0.146	0.166	0.0683	0.0708	0.0709	0.00149	0.0493	0.166
				2022	0.152	3.61	1.15	0.984	1.04	0.601	1.74	0.0767	1.17	1.13	0.0767	1.01	3.61
		Cadmium	mg/kg	2019	0.298	0.0278	0.247	0.0804	0.376	0.0943	0.410	0.0358	0.196	0.155	0.0278	0.171	0.410
				2020	1.43	3.84	8.09	2.67	3.88	1.72	2.27	1.29	3.15	2.23	1.29	2.47	8.09
				2021	0.663	0.513	0.108	0.651	2.10	0.530	1.41	1.22	0.898	0.635	0.108	0.657	2.10
				2022	1.30	3.26	3.04	11.9	3.28	4.37	3.72	1.91	4.10	3.29	1.30	3.27	11.9
		Calcium	mg/kg	2019	0.0833	0.0424	0.0611	0.0397	0.0182	0.0854	0.137	0.0631	0.0663	0.0364	0.0182	0.0621	0.137
				2020	0.0679	0.227	0.273	0.123	0.219	0.154	0.0982	0.0922	0.157	0.0745	0.0679	0.139	0.273
				2021	0.0293	0.0106	0.00559	0.00334	0.00695	0.00992	0.00623	0.00690	0.00985	0.00818	0.00334	0.00692	0.0293
				2022	0.488	0.964	0.251	1.16	0.335	0.238	0.210	0.105	0.469	0.385	0.105	0.293	1.16
		Cobalt	mg/kg	2019	0.0297	0.0245	0.0539	0.0124	0.00927	0.0411	0.144	0.0198	0.0419	0.0439	0.00927	0.0271	0.144
				2020	0.0729	0.315	0.238	0.0941	0.377	0.184	0.202	0.0884	0.196	0.111	0.0729	0.193	0.377
				2021	0.0302	0.0646	0.0413	0.0550	0.229	0.0596	0.249	0.0611	0.0987	0.0874	0.0302	0.0603	0.249
				2022	0.0622	1.46	0.448	2.38	0.540	0.518	0.882	0.136	0.803	0.775	0.0622	0.529	2.38
		Manganese	mg/kg	2019	0.0647	0.0541	0.212	0.0552	0.140	0.106	0.278	0.0699	0.122	0.0827	0.0541	0.0878	0.278
				2020	0.207	0.842	1.31	0.342	0.862	0.624	0.644	0.411	0.655	0.351	0.207	0.634	1.31
				2021	0.248	0.367	0.115	0.294	0.803	0.250	0.681	0.488	0.406	0.236	0.115	0.330	0.803
				2022	0.363	2.42	0.908	5.38	1.09	1.46	1.11	0.236	1.62	1.66	0.236	1.10	5.38
		Mercury	mg/kg	2019	0.249	0.538	1.67	0.828	1.15	0.784	0.593	0.986	0.849	0.432	0.249	0.806	1.67
				2020	2.15	2.24	1.59	1.52	1.42	1.95	1.71	1.10	1.71	0.385	1.10	1.65	2.24
				2021	0.690	0.956	0.912	0.955	0.781	0.0608	0.766	0.909	0.754	0.297	0.0608	0.845	0.956
				2022	0.936	1.19	1.75	1.16	0.754	0.995	1.09	1.29	1.14	0.294	0.754	1.12	1.75
		Molybdenum	mg/kg	2019	2.40	2.14	3.32	4.41	1.11	1.14	0.934	0.687	2.02	1.32	0.687	1.64	4.41
				2020	1.77	1.56	1.88	2.99	1.09	2.83	2.15	2.57	2.11	0.657	1.09	2.02	2.99
				2021	2.17	1.22	4.83	2.32	3.19	2.94	2.63	2.72	2.75	1.03	1.22	2.67	4.83
				2022	7.95	3.58	0.322	3.67	1.29	1.09	1.07	2.10	2.63	2.46	0.322	1.69	7.95
		Nickel	mg/kg	2019	0.0341	0.0125	0.0234	0.0153	0.0443	0.0489	0.134	0.0255	0.0423	0.0393	0.0125	0.0298	0.134
				2020	0.118	0.320	0.282	0.108	0.190	0.195	0.208	0.0968	0.190	0.0812	0.0968	0.192	0.320
				2021	0.0204	0.0332	-	0.0310	0.155	0.0494	0.276	0.0900	0.0936	0.0929	0.0204	0.0494	0.276
				2022	0.0630	0.962	0.423	2.13	0.661	0.430	0.726	0.243	0.705	0.641	0.0630	0.546	2.13
		Phosphorus	mg/kg	2019	4.93	3.26	6.22	6.47	5.82	3.39	3.05	2.01	4.39	1.68	2.01	4.16	6.47
				2020	7.08	5.66	7.77	8.83	5.38	7.37	5.71	5.04	6.61	1.35	5.04	6.40	8.83
				2021	6.23	5.15	7.05	8.60	7.48	5.02	4.81	7.14	6.43	1.36	4.81	6.64	8.60
				2022	11.8	9.26	4.73	10.1	3.70	4.80	2.34	5.10	6.47	3.41	2.34	4.95	11.8
		Silver	mg/kg	2019	0.133	0.0394	0.175	-	0.0299	0.108	0.285	0.163	0.133	0.0873	0.0299	0.133	0.285
				2020	0.500	0.220	0.460	0.395	0.498	0.433	0.465	0.298	0.408	0.100	0.220	0.446	0.500
				2021	-	-	-	-	0.361	0.176	0.302	0.126	0.241	0.109	0.126	0.239	0.361
				2022	1.13	1.87	0.977	4.91	0.684	0.842	1.30	0.472	1.52	1.43	0.472	1.06	4.91

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC) Areas, 2018 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	E1 (Exposed)	Sodium	mg/kg	2019	3.42	2.44	6.24	6.42	6.24	6.00	8.44	7.03	5.78	1.94	2.44	6.24	8.44
				2020	9.50	7.70	6.46	11.4	3.82	5.86	6.46	4.40	6.95	2.52	3.82	6.46	11.4
				2021	2.97	2.98	2.97	6.07	3.55	1.05	3.84	5.00	3.55	1.50	1.05	3.27	6.07
				2022	14.8	15.9	13.1	14.1	7.56	10.4	7.66	8.05	11.4	3.43	7.56	11.8	15.9
		Strontium	mg/kg	2019	0.0652	0.0442	0.0872	0.0317	0.0525	0.0876	0.149	0.0805	0.0748	0.0364	0.0317	0.0729	0.149
				2020	0.0949	0.252	0.151	0.120	0.235	0.109	0.108	0.0790	0.144	0.0652	0.0790	0.115	0.252
				2021	0.0457	0.0148	0.00719	0.00842	0.0150	0.0213	0.0171	0.0107	0.0175	0.0123	0.00719	0.0149	0.0457
				2022	0.371	1.01	0.245	0.539	0.310	0.110	0.302	0.0435	0.366	0.300	0.0435	0.306	1.01
		Tin	mg/kg	2019	0.464	0.0660	-	1.07	-	0.213	0.600	-	0.482	0.389	0.0660	0.464	1.07
				2020	0.930	-	-	-	0.500	-	-	-	0.715	0.304	0.500	0.715	0.930
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	1.33	0.429	-	0.500	-	0.754	0.503	0.429	0.500	1.33
		Titanium	mg/kg	2019	0.0184	0.00768	0.00689	0.00572	0.0139	0.0254	0.0465	0.00985	0.0168	0.0137	0.00572	0.0119	0.0465
				2020	0.0340	0.156	0.105	0.0585	0.137	0.0957	0.0597	0.0255	0.0838	0.0472	0.0255	0.0777	0.156
				2021	0.00614	0.00748	0.00448	0.0114	0.0143	0.00826	0.0601	0.00944	0.0152	0.0184	0.00448	0.00885	0.0601
				2022	0.0284	0.861	0.594	0.807	0.346	0.230	0.601	0.0978	0.446	0.316	0.0284	0.470	0.861
		Uranium	mg/kg	2019	0.0438	0.00414	0.0206	0.00861	0.0310	0.0273	0.165	0.0169	0.0397	0.0522	0.00414	0.0240	0.165
				2020	0.136	0.0690	0.224	0.154	0.173	0.141	0.0552	0.0630	0.127	0.0599	0.0552	0.139	0.224
				2021	0.0212	0.0480	0.0167	0.0645	0.101	0.0561	0.186	0.0673	0.0701	0.0540	0.0167	0.0603	0.186
				2022	0.0970	1.26	0.157	4.05	0.704	0.730	0.912	0.205	1.01	1.29	0.0970	0.717	4.05
		Vanadium	mg/kg	2019	0.0232	0.00761	0.00589	0.00476	0.00533	0.0227	0.0635	0.00769	0.0176	0.0201	0.00476	0.00765	0.0635
				2020	0.0241	0.144	0.124	0.122	0.0893	0.108	0.0497	0.0234	0.0854	0.0472	0.0234	0.0985	0.144
				2021	0.00625	0.0115	0.00657	0.0512	0.0319	0.0112	0.111	0.0210	0.0314	0.0357	0.00625	0.0163	0.111
				2022	0.0350	0.775	0.256	1.48	0.324	0.249	0.709	0.0918	0.490	0.480	0.0350	0.290	1.48
		Zinc	mg/kg	2019	1.83	1.11	3.30	1.39	0.981	1.79	1.54	0.933	1.61	0.764	0.933	1.47	3.30
				2020	2.92	4.54	6.57	3.79	3.60	4.16	4.18	3.54	4.16	1.09	2.92	3.98	6.57
				2021	1.44	2.74	4.12	3.73	7.37	2.60	7.81	3.30	4.14	2.28	1.44	3.52	7.81
				2022	5.86	8.24	1.88	9.14	2.49	3.08	3.46	2.39	4.57	2.82	1.88	3.27	9.14

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Edney Creek	EDC-U (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	0.137	0.139	0.234	0.298	0.121	0.232	0.0459	0.0871	0.162	0.0849	0.0459	0.138	0.298
				2019	0.362	0.319	0.317	0.397	0.175	0.461	0.287	0.284	0.325	0.0849	0.175	0.318	0.461
				2020	0.0643	0.0369	0.109	0.113	0.102	0.0897	0.0320	0.0326	0.0725	0.0353	0.0320	0.0770	0.113
				2021	0.244	0.119	0.267	0.375	0.212	0.341	0.179	0.192	0.241	0.0852	0.119	0.228	0.375
				2022	0.160	0.0550	0.105	0.0230	0.0217	0.113	0.0502	0.0182	0.0682	0.0521	0.0182	0.0526	0.160
		Copper	mg/kg	2018	0.507	0.728	0.923	1.06	0.448	0.557	0.546	0.350	0.640	0.245	0.350	0.551	1.06
				2019	0.873	0.678	1.21	0.907	0.996	1.92	1.03	0.604	1.03	0.410	0.604	0.952	1.92
				2020	0.885	0.658	0.995	1.06	0.592	0.592	0.890	1.04	0.839	0.198	0.592	0.888	1.06
				2021	0.712	0.613	0.783	0.774	0.438	0.717	0.392	0.715	0.643	0.150	0.392	0.713	0.783
				2022	0.984	0.501	0.650	0.675	0.495	0.853	0.659	0.443	0.658	0.186	0.443	0.654	0.984
		Iron	mg/kg	2018	0.0832	0.132	0.147	0.198	0.0553	0.136	0.0373	0.0374	0.103	0.0588	0.0373	0.107	0.198
				2019	0.334	0.111	0.184	0.306	0.142	0.209	0.188	0.188	0.208	0.0764	0.111	0.188	0.334
				2020	0.0659	0.0661	0.245	0.182	0.0862	0.0566	0.0353	0.0337	0.0964	0.0761	0.0337	0.0660	0.245
				2021	0.110	0.121	0.128	0.194	0.139	0.152	0.141	0.227	0.152	0.0399	0.110	0.140	0.227
				2022	0.224	0.0324	0.0805	0.0387	0.0203	0.0853	0.0762	0.0394	0.0745	0.0650	0.0203	0.0578	0.224
		Selenium	mg/kg	2018	0.648	1.70	2.47	1.89	0.909	1.20	1.42	0.934	1.40	0.603	0.648	1.31	2.47
				2019	1.09	2.39	1.08	1.43	0.753	3.39	2.33	2.37	1.85	0.904	0.753	1.88	3.39
				2020	1.06	1.03	4.37	1.77	1.72	0.983	1.19	2.06	1.77	1.12	0.983	1.45	4.37
				2021	1.13	1.06	2.50	1.72	0.986	1.47	1.18	2.20	1.53	0.565	0.986	1.33	2.50
				2022	3.05	0.888	1.05	1.29	0.841	1.32	1.68	1.32	1.43	0.709	0.841	1.31	3.05
		Secondary Analytes															
		Barium	mg/kg	2018	0.254	0.212	0.114	0.582	0.190	0.549	0.0858	0.150	0.267	0.192	0.0858	0.201	0.582
				2019	0.188	0.161	0.116	0.173	0.113	0.250	0.162	0.135	0.162	0.0444	0.113	0.161	0.250
				2020	0.0772	0.535	0.0734	0.343	0.0427	0.152	0.0506	0.0934	0.171	0.176	0.0427	0.0853	0.535
				2021	0.358	0.621	0.503	0.643	0.694	0.627	0.251	0.0835	0.473	0.220	0.0835	0.562	0.694
				2022	0.0343	0.0369	0.0339	0.00978	0.0161	0.0684	0.0839	0.00590	0.0361	0.0276	0.00590	0.0341	0.0839
		Cadmium	mg/kg	2018	2.87	6.54	5.64	4.35	2.88	4.50	1.03	1.53	3.67	1.93	1.03	3.61	6.54
				2019	3.14	3.11	1.45	2.92	4.97	13.8	4.95	2.65	4.63	3.90	1.45	3.13	13.8
				2020	0.714	0.956	0.520	0.940	1.15	3.03	0.547	2.30	1.27	0.908	0.520	0.948	3.03
				2021	4.55	3.89	13.2	5.88	4.13	6.57	3.93	5.00	5.89	3.10	3.89	4.77	13.2
				2022	1.13	0.855	1.59	0.431	0.577	1.08	1.14	0.0904	0.861	0.476	0.0904	0.967	1.59
		Calcium	mg/kg	2018	0.233	0.269	0.198	0.250	0.148	0.159	0.165	0.114	0.192	0.0546	0.114	0.181	0.269
				2019	0.405	0.249	0.316	0.337	0.281	0.582	0.402	0.422	0.374	0.104	0.249	0.369	0.582
				2020	0.240	0.248	0.398	0.335	0.212	0.163	0.258	0.367	0.278	0.0808	0.163	0.253	0.398
				2021	0.225	0.284	0.359	0.308	0.288	0.339	0.376	0.484	0.333	0.0777	0.225	0.324	0.484
				2022	0.167	0.123	0.167	0.141	0.0977	0.215	0.185	0.0842	0.148	0.0447	0.0842	0.154	0.215
		Cobalt	mg/kg	2018	0.121	0.195	0.210	0.334	0.156	0.196	0.0648	0.0988	0.172	0.0833	0.0648	0.175	0.334
				2019	0.230	0.150	0.196	0.303	0.226	0.520	0.203	0.151	0.247	0.120	0.150	0.214	0.520
				2020	0.0709	0.162	0.0860	0.222	0.0723	0.121	0.0552	0.103	0.112	0.0560	0.0552	0.0944	0.222
				2021	0.277	0.355	0.407	0.476	0.407	0.484	0.225	0.180	0.351	0.114	0.180	0.381	0.484
				2022	0.130	0.0717	0.116	0.0370	0.0435	0.187	0.143	0.0240	0.0940	0.0586	0.0240	0.0937	0.187
		Manganese	mg/kg	2018	0.248	0.180	0.125	0.386	0.208	0.240	0.0914	0.147	0.203	0.0920	0.0914	0.194	0.386
				2019	0.108	0.109	0.112	0.134	0.0583	0.301	0.108	0.0716	0.125	0.0751	0.0583	0.108	0.301
				2020	0.0828	0.292	0.0705	0.296	0.0456	0.214	0.0912	0.127	0.152	0.101	0.0456	0.109	0.296
				2021	0.243	0.504	0.615	0.524	0.503	1.07	0.196	0.0887	0.468	0.307	0.0887	0.503	1.07
				2022	0.0542	0.0446	0.0513	0.0180	0.0249	0.178	0.139	0.0174	0.0659	0.0597	0.0174	0.0479	0.178
		Mercury	mg/kg	2018	0.725	1.70	2.47	1.54	0.678	1.05	0.887	0.666	1.21	0.642	0.666	0.967	2.47
				2019	0.781	1.19	0.819	0.489	0.457	1.17	1.45	0.867	0.903	0.347	0.457	0.843	1.45
				2020	0.409	0.586	3.82	0.752	1.35	0.923	0.456	0.653	1.12	1.13	0.409	0.703	3.82
				2021	0.572	1.40	1.13	0.858	0.167	0.830	1.04	1.69	0.960	0.472	0.167	0.950	1.69
				2022	1.44	0.356	0.543	0.934	0.378	1.04	1.07	0.763	0.816	0.378	0.356	0.849	1.44
		Molybdenum	mg/kg	2018	0.811	0.986	0.768	1.22	0.873	1.60	0.799	0.847	0.989	0.288	0.768	0.860	1.60
				2019	0.579	0.463	0.390	0.505	0.688	1.74	0.579	0.633	0.698	0.433	0.390	0.579	1.74
				2020	0.299	0.313	0.307	0.393	0.357	0.557	0.201	0.350	0.347	0.102	0.201	0.331	0.557
				2021	0.389	0.274	1.26	1.42	0.576	2.62	0.440	0.669	0.956	0.788	0.274	0.623	2.62
				2022	10.8	2.33	1.31	0.787	1.59	0.288	0.231	1.02	2.29	3.49	0.231	1.16	10.8
		Nickel	mg/kg	2018	0.127	0.194	0.139	0.350	0.0984	0.177	0.0402	0.0753	0.150	0.0955	0.0402	0.133	0.350
				2019	0.190	0.0938	0.202	0.260	0.0788	0.290	0.144	0.124	0.173	0.0762	0.0788	0.167	0.290
				2020	0.0655	0.170	0.0868	0.291	0.0484	0.0563	0.0779	0.0932	0.111	0.0817	0.0484	0.0824	0.291
				2021	0.145	0.231	0.281	0.281	0.258	0.263	0.104	0.147	0.213	0.0707	0.104	0.244	0.281
				2022	0.0762	0.0333	0.0563	0.0229	0.0257	0.0611	0.0483	0.0120	0.0420	0.0220	0.0120	0.0408	0.0762
		Phosphorus	mg/kg	2018	3.86	5.04	5.85	4.92	4.22	3.67	3.81	3.43	4.35	0.838	3.43	4.04	5.85
				2019	2.38	4.61	2.41	2.25	2.14	11.2	3.03	2.55	3.83	3.10	2.14	2.48	11.2
				2020	6.86	2.27	4.77	4.89	3.40	3.42	5.79	5.39	4.60	1.49	2.27	4.83	6.86
				2021	4.89	5.86	9.32	6.41	4.46	7.11	4.31	8.10	6.31	1.80	4.31	6.13	9.32
				2022	3.04	2.64	2.01	2.71	2.26	3.38	3.01	3.03	2.76	0.451	2.01	2.86	3.38
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	1.62	1.37	2.25	1.27	1.16	4.07	2.19	1.30	1.90	0.970	1.16	1.49	4.07
				2020	0.956	0.753	4.02	2.03	2.41	1.48	0.715	2.34	1.84	1.11	0.715	1.76	4.02
				2021	0.819	0.739	1.22	0.797	0.923	0.824	1.63	1.02	0.996	0.298	0.739	0.873	1.63
				2022	4.69	0.950	1.55	3.38	0.637	2.49	2.22	1.04	2.12	1.38	0.637	1.88	4.69
		Sodium	mg/kg	2018	13.0	10.0	10.0	10.5	12.7	4.73	11.0	9.16	10.1	2.56	4.73	10.3	13.0
				2019	10.7	13.0	3.92	11.8	12.2	72.4	17.0	7.76	18.6	22.1	3.92	12.0	72.4
				2020	32.8	18.2	-	7.69	20.9	21.4	6.25	31.1	19.8	10.3	6.25	20.9	32.8
				2021	18.5	18.5	12.5	23.3	17.3	15.8	14.7	20.8	17.7	3.43	12.5	17.9	23.3
				2022	17.9	11.3	11.1	19.9	13.0	17.2	16.4	18.1	15.6	3.37	11.1	16.8	19.9
		Strontium	mg/kg	2018	0.200	0.255	0.146	0.218	0.143	0.165	0.116	0.0888	0.166	0.0548	0.0888	0.156	0.255
				2019	0.355	0.154	0.338	0.274	0.104	0.282	0.249	0.235	0.249	0.0856	0.104	0.262	0.355
				2020	0.179	0.225	0.218	0.310	0.131	0.117	0.228	0.276	0.210	0.0662	0.117	0.221	0.310
				2021	0.202	0.300	0.303	0.276	0.286	0.291	0.320	0.293	0.284	0.0358	0.202	0.292	0.320
				2022	0.113	0.0869	0.113	0.0682	0.0644	0.127	0.151	0.0623	0.0983	0.0329	0.0623	0.0998	0.151
		Tin	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.450	0.319	0.374	0.792	0.406	0.592	0.569	0.837	0.542	0.192	0.319	0.509	0.837
				2020	-	-	-	-	-	-	-	1.12	1.12	-	1.12	1.12	1.12
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.427	0.138	0.122	0.436	0.255	0.153	0.179	0.214	0.241	0.125	0.122	0.197	0.436
				2020	0.0652	0.195	0.234	0.193	0.0665	0.0285	0.0341	0.0599	0.110	0.0830	0.0285	0.0659	0.234
				2021	0.113	0.203	0.121	0.222	0.136	0.126	0.156	0.254	0.167	0.0531	0.113	0.146	0.254
				2022	0.263	0.0493	0.0972	0.0940	0.0409	0.0977	0.125	0.0526	0.102	0.0712	0.0409	0.0956	0.263
		Uranium	mg/kg	2018	0.170	0.468	0.456	0.722	0.166	0.375	0.106	0.0976	0.320	0.222	0.0976	0.273	0.722
				2019	0.359	0.164	0.240	0.482	0.172	0.386	0.429	0.491	0.341	0.132	0.164	0.373	0.491
				2020	0.226	0.289	1.08	0.662	0.261	0.171	0.218	0.242	0.394	0.318	0.171	0.251	1.08
				2021	0.316	0.448	0.379	0.694	0.372	0.364	0.425	0.555	0.444	0.124	0.316	0.402	0.694
				2022	0.144	0.0756	0.153	0.101	0.0535	0.203	0.136	0.0659	0.117	0.0513	0.0535	0.119	0.203
		Vanadium	mg/kg	2018	0.0840	0.140	0.175	0.204	0.0529	0.169	0.0301	0.0331	0.111	0.0693	0.0301	0.112	0.204
				2019	0.412	0.116	0.193	0.357	0.303	0.218	0.206	0.180	0.248	0.0998	0.116	0.212	0.412
				2020	0.0764	0.0541	0.211	0.163	0.0761	0.0553	0.0517	0.0396	0.0910	0.0621	0.0396	0.0657	0.211
				2021	0.116	0.122	0.126	0.218	0.139	0.149	0.160	0.211	0.155	0.0394	0.116	0.144	0.218
				2022	0.146	0.0360	0.0942	0.0334	0.0192	0.0803	0.0784	0.0323	0.0650	0.0429	0.0192	0.0572	0.146
		Zinc	mg/kg	2018	2.04	2.59	2.90	2.59	2.62	2.57	2.21	2.45	2.50	0.266	2.04	2.58	2.90
				2019	1.72	3.18	1.65	1.30	2.37	4.87	2.61	1.08	2.35	1.24	1.08	2.04	4.87
				2020	2.58	4.01	1.91	3.65	1.41	2.73	1.81	3.02	2.64	0.910	1.41	2.66	4.01
				2021	2.81	3.42	2.83	2.50	2.04	2.12	2.01	1.54	2.41	0.599	1.54	2.31	3.42
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	0.712	0.145	0.352	0.393	0.452	-	-	-	0.411	0.204	0.145	0.393	0.712
				2018	1.61	1.61	0.756	0.719	0.304	1.22	1.88	1.26	1.17	0.537	0.304	1.24	1.88
				2019	2.07	0.735	0.945	0.753	0.763	1.04	1.53	1.31	1.14	0.471	0.735	0.994	2.07
				2020	0.807	0.716	0.995	1.83	1.02	0.355	0.397	0.512	0.829	0.477	0.355	0.761	1.83
				2021	1.27	2.71	1.51	2.51	2.45	2.73	2.20	2.73	2.26	0.573	1.27	2.48	2.73
				2022	0.639	0.929	0.674	0.936	1.54	1.25	0.513	0.524	0.875	0.366	0.513	0.801	1.54
		Copper	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	5.06	2.33	2.07	4.60	2.07	4.78	5.85	5.46	4.03	1.60	2.07	4.69	5.85
				2020	3.49	2.09	6.46	8.55	5.25	0.797	0.843	1.92	3.67	2.83	0.797	2.79	8.55
				2021	4.78	7.76	3.84	4.18	8.11	10.4	4.18	9.88	6.64	2.72	3.84	6.27	10.4
				2022	2.12	0.879	2.50	3.50	1.58	3.71	2.33	0.862	2.18	1.07	0.862	2.23	3.71
		Iron	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	1.28	1.10	0.234	0.216	0.274	0.973	1.88	1.74	0.962	0.668	0.216	1.04	1.88
				2019	5.60	1.32	2.39	1.47	1.36	1.94	4.05	5.85	3.00	1.90	1.32	2.17	5.85
				2020	1.34	0.888	2.95	2.68	1.98	0.276	0.309	0.988	1.43	1.02	0.276	1.16	2.95
				2021	2.55	10.8	3.38	15.3	23.8	13.5	4.80	12.2	10.8	7.15	2.55	11.5	23.8
				2022	0.856	1.14	1.27	1.62	1.71	4.13	0.679	0.237	1.46	1.19	0.237	1.20	4.13
		Selenium	mg/kg	2010	2.64	2.93	2.38	1.87	2.78	-	-	-	2.52	0.419	1.87	2.64	2.93
				2018	2.22	2.26	2.54	4.24	1.23	2.61	2.57	2.14	2.48	0.837	1.23	2.40	4.24
				2019	2.86	2.42	3.20	3.31	-	3.09	2.45	2.30	2.80	0.414	2.30	2.86	3.31
				2020	3.29	3.52	3.88	5.19	2.69	4.35	3.01	3.53	3.68	0.792	2.69	3.53	5.19
				2021	-	-	4.14	4.50	5.21	4.30	4.64	5.57	4.72	0.551	4.14	4.57	5.57
				2022	1.90	2.48	3.20	2.00	2.18	2.75	3.25	2.69	2.56	0.514	1.90	2.58	3.25
		Secondary Analytes															
		Barium	mg/kg	2010	0.582	0.218	0.352	0.390	0.584	-	-	-	0.425	0.158	0.218	0.390	0.584
				2018	0.557	0.510	0.264	0.0328	0.330	0.565	4.58	0.778	0.952	1.48	0.0328	0.534	4.58
				2019	2.14	0.289	0.625	0.189	0.174	0.379	2.96	5.25	1.50	1.84	0.174	0.502	5.25
				2020	0.417	0.441	0.644	1.21	1.31	0.103	0.0813	0.271	0.560	0.470	0.0813	0.429	1.31
				2021	0.205	1.30	0.335	0.853	1.01	0.968	1.14	0.364	0.773	0.414	0.205	0.911	1.30
				2022	0.184	0.365	0.414	0.262	0.367	0.814	0.419	0.152	0.372	0.205	0.152	0.366	0.814
		Cadmium	mg/kg	2010	1.85	0.903	1.09	1.27	1.55	-	-	-	1.34	0.376	0.903	1.27	1.85
				2018	4.98	3.95	2.30	6.11	6.47	6.12	5.92	2.93	4.85	1.60	2.30	5.45	6.47
				2019	2.11	5.11	3.69	0.657	6.53	9.04	6.90	2.50	4.57	2.83	0.657	4.40	9.04
				2020	3.63	7.54	1.85	2.49	1.70	1.22	0.485	0.962	2.49	2.26	0.485	1.78	7.54
				2021	-	20.6	8.21	6.67	13.5	6.66	13.4	22.1	13.0	6.39	6.66	13.4	22.1
				2022	1.52	1.64	2.57	3.03	1.99	2.16	5.19	8.28	3.30	2.33	1.52	2.37	8.28
		Calcium	mg/kg	2010	0.139	0.0581	0.0816	0.183	0.103	-	-	-	0.113	0.0494	0.0581	0.103	0.183
				2018	0.838	0.802	1.13	0.703	0.0304	0.556	0.764	0.739	0.695	0.313	0.0304	0.751	1.13
				2019	0.164	0.0205	0.0543	0.0206	0.0122	0.0463	0.0379	0.0450	0.0502	0.0485	0.0122	0.0414	0.164
				2020	0.0558	0.0152	0.0307	0.0325	0.0370	0.00576	0.00312	0.0158	0.0245	0.0178	0.00312	0.0233	0.0558
				2021	0.0239	0.0328	0.0253	0.0338	0.0477	0.0255	0.0557	0.0203	0.0331	0.0125	0.0203	0.0292	0.0557
				2022	0.0374	0.0377	0.0178	0.0138	0.0713	0.0382	0.0165	0.0315	0.0330	0.0185	0.0138	0.0344	0.0713
		Cobalt	mg/kg	2010	0.526	0.104	0.354	0.515	0.533	-	-	-	0.406	0.185	0.104	0.515	0.533
				2018	0.915	1.25	0.379	0.246	0.387	1.09	2.02	2.25	1.07	0.754	0.246	1.00	2.25
				2019	4.33	1.47	1.72	1.28	1.38	1.96	3.25	3.89	2.41	1.22	1.28	1.84	4.33
				2020	1.37	1.08	2.92	2.82	1.78	0.317	0.309	1.12	1.46	0.999	0.309	1.25	2.92
				2021	1.86	4.01	1.85	4.73	4.45	5.55	4.02	3.02	3.69	1.34	1.85	4.01	5.55
				2022	0.900	1.24	1.29	1.44	1.69	3.07	0.694	0.484	1.35	0.799	0.484	1.27	3.07
		Manganese	mg/kg	2010	0.483	0.226	0.341	0.244	0.489	-	-	-	0.357	0.126	0.226	0.341	0.489
				2018	0.365	0.677	0.262	0.389	0.523	1.05	1.18	0.986	0.679	0.352	0.262	0.600	1.18
				2019	0.987	0.887	0.579	0.806	1.02	1.44	1.77	1.88	1.17	0.472	0.579	1.00	1.88
				2020	1.13	1.07	1.93	1.37	1.15	0.193	0.173	0.765	0.973	0.590	0.173	1.10	1.93
				2021	2.35	4.13	2.11	2.72	3.06	3.58	3.71	2.86	3.07	0.697	2.11	2.96	4.13
				2022	0.679	0.761	0.779	0.594	0.654	1.68	0.551	0.394	0.761	0.390	0.394	0.667	1.68
		Mercury	mg/kg	2010	5.47	3.94	4.84	5.86	5.43	-	-	-	5.11	0.746	3.94	5.43	5.86
				2018	5.67	5.90	2.46	2.64	1.20	3.85	5.59	7.03	4.29	2.05	1.20	4.72	7.03
				2019	-	5.59	-	7.73	2.00	5.57	-	-	5.22	2.38	2.00	5.58	7.73
				2020	26.3	14.6	29.1	24.1	19.3	11.2	14.5	12.5	19.0	6.80	11.2	17.0	29.1
				2021	10.8	-	11.5	-	-	-	12.0	16.9	12.8	2.78	10.8	11.7	16.9
				2022	5.73	5.93	4.04	11.0	7.02	11.7	4.76	3.47	6.70	3.07	3.47	5.83	11.7
		Molybdenum	mg/kg	2010	5.11	5.05	3.12	11.1	6.35	-	-	-	6.15	3.02	3.12	5.11	11.1
				2018	4.71	1.06	1.03	0.969	1.54	2.70	2.89	1.82	2.09	1.29	0.969	1.68	4.71
				2019	1.79	1.28	1.84	2.39	1.20	2.75	1.73	2.87	1.98	0.627	1.20	1.82	2.87
				2020	3.48	3.52	3.49	3.17	2.68	6.27	5.24	6.80	4.33	1.55	2.68	3.51	6.80
				2021	-	8.52	4.78	5.06	6.05	7.34	7.60	7.87	6.75	1.46	4.78	7.34	8.52
				2022	2.24	3.00	4.15	3.12	2.04	3.28	2.93	1.10	2.73	0.923	1.10	2.96	4.15
		Nickel	mg/kg	2010	1.38	0.287	0.940	4.08	1.69	-	-	-	1.68	1.44	0.287	1.38	4.08
				2018	1.88	2.47	0.682	0.672	2.29	1.14	3.70	2.06	1.86	1.02	0.672	1.97	3.70
				2019	1.56	0.796	1.53	2.13	-	0.849	1.84	1.89	1.51	0.514	0.796	1.56	2.13
				2020	0.895	0.756	1.97	2.43	1.18	0.269	0.188	0.650	1.04	0.794	0.188	0.826	2.43
				2021	-	3.25	2.17	4.15	3.60	3.68	2.96	1.81	3.09	0.841	1.81	3.25	4.15
				2022	0.990	1.16	1.15	1.10	0.809	1.44	0.692	0.227	0.947	0.370	0.227	1.04	1.44
		Phosphorus	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	8.78	9.83	5.35	10.8	5.30	8.72	10.1	7.98	8.36	2.07	5.30	8.75	10.8
				2019	7.69	8.50	10.1	7.48	6.64	9.81	9.27	8.68	8.53	1.21	6.64	8.59	10.1
				2020	12.1	12.4	13.6	24.5	9.43	8.84	10.7	10.5	12.8	4.99	8.84	11.4	24.5
				2021	15.5	22.9	15.1	21.2	19.8	23.5	14.8	36.4	21.1	7.10	14.8	20.5	36.4
				2022	9.68	9.98	9.85	11.4	8.98	9.76	9.07	7.91	9.58	0.994	7.91	9.72	11.4
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	2.50	1.68	11.7	6.47	11.5	1.19	0.718	2.93	4.83	4.52	0.718	2.72	11.7
				2021	-	9.88	8.69	4.35	9.97	8.12	5.32	9.52	7.98	2.26	4.35	8.69	9.97
				2022	2.02	1.37	2.19	2.61	1.50	4.76	1.37	1.13	2.12	1.18	1.13	1.76	4.76
		Sodium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	9.10	10.5	6.79	5.74	4.65	9.85	11.0	12.2	8.72	2.69	4.65	9.47	12.2
				2019	11.7	10.4	19.5	10.8	14.6	14.1	10.1	9.91	12.6	3.30	9.91	11.2	19.5
				2020	16.8	12.7	25.1	48.9	14.0	7.86	8.59	12.8	18.3	13.4	7.86	13.4	48.9
				2021	-	30.9	30.0	30.1	35.2	39.3	32.2	37.9	33.7	3.83	30.0	32.2	39.3
				2022	12.9	15.1	12.1	19.1	9.97	18.4	10.3	9.78	13.4	3.71	9.78	12.5	19.1
		Strontium	mg/kg	2010	0.176	0.0628	0.112	0.178	0.138	-	-	-	0.133	0.0480	0.0628	0.138	0.178
				2018	0.580	0.538	0.662	0.159	0.0627	0.404	0.521	0.545	0.434	0.213	0.0627	0.529	0.662
				2019	0.212	0.0337	0.0796	0.0399	0.0274	0.0635	0.0808	0.0707	0.0760	0.0588	0.0274	0.0671	0.212
				2020	0.0698	0.0349	0.108	0.146	0.106	0.0154	0.00885	0.0289	0.0648	0.0507	0.00885	0.0524	0.146
				2021	0.0594	0.0825	0.0743	0.0831	0.129	0.0939	0.110	0.0652	0.0872	0.0234	0.0594	0.0828	0.129
				2022	0.0478	0.0770	0.0371	0.0379	0.0762	0.0674	0.0695	0.0588	0.0590	0.0163	0.0371	0.0631	0.0770
		Tin	mg/kg	2010	0.238	-	-	0.207	-	-	-	-	0.223	0.0225	0.207	0.223	0.238
				2018	-	-	-	-	0.429	-	-	-	0.429	-	0.429	0.429	0.429
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	1.69	-	-	-	-	-	0.800	1.24	0.628	0.800	1.24	1.69
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	5.13	0.801	2.91	0.929	1.22	1.04	3.00	5.99	2.63	2.02	0.801	2.06	5.99
				2020	1.00	0.555	2.49	2.47	1.40	0.202	0.180	0.753	1.13	0.923	0.180	0.878	2.49
				2021	1.66	15.3	5.73	21.9	53.9	56.2	4.92	12.9	21.6	21.7	1.66	14.1	56.2
				2022	0.556	0.960	0.994	1.43	1.05	3.30	0.447	0.157	1.11	0.972	0.157	0.977	3.30

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 1	HAC-R1 (Exposed)	Uranium	mg/kg	2010	0.463	0.0932	0.348	0.509	0.647	-	-	-	0.412	0.208	0.0932	0.463	0.647
				2018	0.884	0.879	0.446	0.479	0.292	0.878	1.55	0.799	0.775	0.389	0.292	0.839	1.55
				2019	2.17	1.01	1.67	0.881	0.733	1.06	1.46	1.54	1.32	0.480	0.733	1.26	2.17
				2020	1.48	0.918	3.53	2.36	2.10	0.223	0.184	0.696	1.44	1.17	0.184	1.20	3.53
				2021	2.16	4.65	3.15	4.21	4.66	8.91	4.06	5.76	4.70	2.01	2.16	4.43	8.91
				2022	0.699	1.25	0.872	1.26	1.24	2.02	0.595	0.459	1.05	0.503	0.459	1.06	2.02
		Vanadium	mg/kg	2010	0.308	0.0763	0.260	0.288	0.342	-	-	-	0.255	0.104	0.0763	0.288	0.342
				2018	1.07	0.839	0.232	0.228	0.267	0.922	1.65	1.25	0.807	0.528	0.228	0.880	1.65
				2019	4.07	0.948	1.90	1.09	1.19	1.54	2.76	4.67	2.27	1.42	0.948	1.72	4.67
				2020	1.09	0.668	2.25	2.31	1.52	0.211	0.285	0.715	1.13	0.823	0.211	0.900	2.31
				2021	2.62	8.14	3.47	7.84	10.6	14.2	4.43	6.35	7.20	3.87	2.62	7.10	14.2
				2022	0.761	1.06	1.16	1.46	1.01	4.26	0.549	0.224	1.31	1.25	0.224	1.03	4.26
		Zinc	mg/kg	2010	2.16	2.15	2.38	2.89	3.56	-	-	-	2.63	0.598	2.15	2.38	3.56
				2018	5.04	5.44	1.70	2.36	3.57	5.52	7.67	9.16	5.06	2.53	1.70	5.24	9.16
				2019	11.3	11.8	10.7	9.68	-	11.8	11.0	11.5	11.1	0.757	9.68	11.3	11.8
				2020	11.1	12.0	11.5	12.6	6.84	7.97	10.5	9.23	10.2	2.03	6.84	10.8	12.6
				2021	-	25.5	14.9	19.3	23.1	26.0	22.8	29.6	23.0	4.81	14.9	23.1	29.6
				2022	5.36	5.60	6.51	7.26	5.19	8.79	4.34	2.19	5.66	1.97	2.19	5.48	8.79
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.483	0.756	0.501	0.747	0.615	0.707	0.556	0.554	0.615	0.109	0.483	0.586	0.756
				2019	1.34	3.95	1.07	1.25	0.534	0.987	0.781	1.07	1.37	1.07	0.534	1.07	3.95
				2020	0.474	0.648	0.435	0.314	0.307	0.195	0.218	0.453	0.380	0.151	0.195	0.374	0.648
				2021	1.08	0.774	1.40	1.51	0.552	0.964	0.844	1.48	1.08	0.357	0.552	1.02	1.51
				2022	1.62	1.05	1.89	0.702	1.00	1.00	0.915	0.478	1.08	0.462	0.478	1.00	1.89
		Copper	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.698	0.820	0.868	1.20	1.92	0.959	0.993	0.289	0.968	0.466	0.289	0.914	1.92
				2019	2.84	6.90	1.99	2.73	1.49	2.52	1.64	1.33	2.68	1.80	1.33	2.26	6.90
				2020	1.47	2.18	1.25	0.463	0.796	0.496	0.470	1.60	1.09	0.637	0.463	1.02	2.18
				2021	4.93	1.56	0.652	7.48	1.40	4.15	0.397	1.35	2.74	2.51	0.397	1.48	7.48
				2022	8.75	13.6	26.4	0.261	7.72	18.6	5.50	1.22	10.3	8.89	0.261	8.24	26.4
		Iron	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.230	1.31	0.434	0.422	0.731	0.487	0.280	0.294	0.523	0.354	0.230	0.428	1.31
				2019	1.49	3.95	0.945	2.05	0.634	1.47	0.464	0.925	1.49	1.12	0.464	1.21	3.95
				2020	0.448	0.905	0.497	0.185	0.254	0.127	0.155	0.585	0.395	0.268	0.127	0.351	0.905
				2021	5.60	1.79	2.79	17.1	0.544	2.75	1.36	1.78	4.22	5.42	0.544	2.27	17.1
				2022	1.60	0.194	1.43	0.180	0.281	1.47	0.725	0.0868	0.746	0.655	0.0868	0.503	1.60
		Selenium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	1.70	2.22	1.65	1.86	2.21	1.37	2.41	1.48	1.86	0.379	1.37	1.78	2.41
				2019	2.78	1.67	2.00	2.26	1.71	1.14	1.99	1.77	1.92	0.477	1.14	1.88	2.78
				2020	3.48	3.35	1.80	3.11	1.88	2.06	3.70	3.72	2.89	0.835	1.80	3.23	3.72
				2021	2.92	2.40	2.16	2.53	1.48	1.72	1.91	2.82	2.24	0.518	1.48	2.28	2.92
				2022	1.11	1.53	1.65	0.506	3.08	4.65	2.95	4.94	2.55	1.63	0.506	2.30	4.94
		Secondary Analytes															
		Barium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0781	0.246	0.176	0.292	0.273	0.277	0.294	0.145	0.223	0.0803	0.0781	0.259	0.294
				2019	0.505	0.816	0.296	0.992	0.308	1.66	0.447	0.632	0.707	0.455	0.296	0.569	1.66
				2020	0.217	0.257	0.245	0.123	0.102	0.0336	0.109	0.262	0.168	0.0870	0.0336	0.170	0.262
				2021	0.676	0.576	0.660	0.745	0.287	0.814	0.712	0.606	0.635	0.159	0.287	0.668	0.814
				2022	0.496	0.104	0.620	0.0893	0.262	0.226	0.659	0.0491	0.313	0.245	0.0491	0.244	0.659
		Cadmium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	5.27	7.05	5.71	5.02	4.46	3.91	3.45	1.37	4.53	1.69	1.37	4.74	7.05
				2019	11.5	2.22	2.48	3.15	1.23	1.22	3.07	2.10	3.37	3.37	1.22	2.35	11.5
				2020	1.29	4.20	1.24	0.268	0.395	0.307	1.38	1.65	1.34	1.28	0.268	1.27	4.20
				2021	5.44	6.31	1.71	4.58	2.58	3.59	5.20	7.95	4.67	2.02	1.71	4.89	7.95
				2022	1.89	4.25	3.02	1.29	4.74	3.33	1.75	5.25	3.19	1.47	1.29	3.17	5.25
		Calcium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0253	0.0193	0.0171	0.0157	0.0162	0.0183	0.0224	0.0306	0.0206	0.00518	0.0157	0.0188	0.0306
				2019	0.0386	0.129	0.0425	0.0598	0.0345	0.217	0.166	0.0518	0.0923	0.0692	0.0345	0.0558	0.217
				2020	0.00870	0.0104	0.00991	0.00855	0.00779	0.00329	0.00760	0.0138	0.00876	0.00297	0.00329	0.00863	0.0138
				2021	0.0370	0.0610	0.0356	0.0456	0.0205	0.0564	0.0133	0.0691	0.0423	0.0195	0.0133	0.0413	0.0691
				2022	0.176	0.293	0.139	0.0602	0.109	0.0306	0.139	0.156	0.138	0.0794	0.0306	0.139	0.293
		Cobalt	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.420	1.43	0.778	0.715	1.04	0.567	0.412	0.364	0.715	0.367	0.364	0.641	1.43
				2019	1.38	2.76	0.905	1.74	0.644	1.10	0.558	1.00	1.26	0.716	0.558	1.05	2.76
				2020	0.520	0.842	0.592	0.204	0.279	0.101	0.210	0.665	0.427	0.264	0.101	0.400	0.842
				2021	3.38	1.41	2.54	2.93	0.723	2.32	1.47	1.66	2.05	0.888	0.723	1.99	3.38
				2022	1.23	0.412	1.81	0.237	0.561	1.26	0.879	0.238	0.830	0.569	0.237	0.720	1.81
		Manganese	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.596	0.669	0.588	0.542	0.569	0.509	0.502	0.598	0.572	0.0545	0.502	0.579	0.669
				2019	0.857	0.866	0.656	0.880	0.767	0.567	0.736	0.918	0.781	0.123	0.567	0.812	0.918
				2020	0.376	0.487	0.401	0.163	0.224	0.0697	0.228	0.427	0.297	0.146	0.0697	0.302	0.487
				2021	1.81	0.824	1.65	1.27	0.849	1.21	0.996	0.837	1.18	0.382	0.824	1.10	1.81
				2022	0.306	0.138	0.465	0.188	0.325	0.271	0.554	0.736	0.373	0.200	0.138	0.315	0.736
		Mercury	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	1.67	3.48	3.52	2.79	3.79	2.60	1.72	1.97	2.69	0.850	1.67	2.69	3.79
				2019	9.79	6.75	5.25	5.00	5.09	3.42	2.72	5.41	5.43	2.15	2.72	5.17	9.79
				2020	5.02	6.24	5.68	4.28	6.30	9.70	6.15	13.7	7.13	3.09	4.28	6.20	13.7
				2021	12.5	8.87	4.14	10.8	4.77	9.80	7.55	10.4	8.60	2.93	4.14	9.33	12.5
				2022	5.25	5.23	10.4	6.62	7.23	14.0	2.87	3.74	6.92	3.68	2.87	5.93	14.0
		Molybdenum	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	3.15	5.26	4.25	4.67	4.62	3.59	3.94	4.48	4.24	0.669	3.15	4.36	5.26
				2019	3.67	2.83	4.09	2.69	4.71	2.67	3.20	3.55	3.43	0.724	2.67	3.37	4.71
				2020	8.32	4.33	2.21	7.71	4.68	3.36	5.20	5.22	5.13	2.05	2.21	4.94	8.32
				2021	5.38	3.08	4.77	4.08	2.70	3.73	3.70	5.15	4.07	0.961	2.70	3.90	5.38
				2022	1.85	0.906	1.36	2.58	1.47	7.31	1.12	2.26	2.36	2.08	0.906	1.66	7.31
		Nickel	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.496	1.02	0.640	0.674	1.27	0.817	0.451	0.492	0.732	0.288	0.451	0.657	1.27
				2019	1.29	1.68	0.828	1.87	0.830	0.609	0.592	1.38	1.14	0.491	0.592	1.06	1.87
				2020	0.400	0.786	0.496	0.169	0.209	0.106	0.333	0.630	0.391	0.237	0.106	0.367	0.786
				2021	3.40	1.68	2.03	1.60	0.688	3.06	1.14	2.70	2.04	0.947	0.688	1.86	3.40
				2022	1.20	0.377	1.70	0.359	1.03	1.30	0.754	0.330	0.882	0.510	0.330	0.894	1.70
		Phosphorus	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	11.9	13.2	9.90	12.8	18.8	10.6	9.20	6.70	11.6	3.59	6.70	11.3	18.8
				2019	13.0	7.81	8.04	9.08	8.42	6.56	8.33	13.0	9.28	2.40	6.56	8.37	13.0
				2020	8.11	7.80	9.46	10.4	8.99	8.23	8.45	7.63	8.63	0.921	7.63	8.34	10.4
				2021	9.99	7.47	5.28	22.4	7.00	7.89	8.30	8.89	9.66	5.35	5.28	8.10	22.4
				2022	8.47	7.79	11.8	6.88	6.89	7.19	2.63	6.73	7.30	2.53	2.63	7.04	11.8
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	0.547	-	0.547	-	0.547	0.547	0.547
				2020	1.26	-	0.896	0.330	0.507	-	0.317	1.70	0.834	0.558	0.317	0.702	1.70
				2021	6.53	1.75	0.548	4.92	0.974	1.93	0.595	3.04	2.54	2.17	0.548	1.84	6.53
				2022	9.81	6.15	46.6	0.572	5.15	-	5.20	2.96	10.9	16.0	0.572	5.20	46.6

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Upper Hazeltine Creek Reach 2	HAC-U (Exposed)	Sodium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	6.25	6.02	4.91	5.87	11.7	7.54	5.12	5.48	6.61	2.20	4.91	5.95	11.7
				2019	11.9	8.17	10.6	14.2	7.31	7.08	7.05	11.1	9.68	2.67	7.05	9.41	14.2
				2020	9.01	6.17	13.6	10.9	9.83	12.5	8.94	9.03	10.0	2.33	6.17	9.43	13.6
				2021	15.8	9.33	7.49	12.3	9.10	9.79	11.8	12.5	11.0	2.63	7.49	10.8	15.8
				2022	8.14	7.87	8.05	11.2	8.98	9.02	11.9	13.4	9.82	2.08	7.87	9.00	13.4
		Strontium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0424	0.0396	0.0420	0.0455	0.0438	0.0321	0.0645	0.0497	0.0449	0.00939	0.0321	0.0431	0.0645
				2019	0.0648	0.158	0.0647	0.0925	0.0526	0.748	0.147	0.0756	0.175	0.235	0.0526	0.0841	0.748
				2020	0.0256	0.0315	0.0246	0.0192	0.0166	0.00638	0.0177	0.0299	0.0214	0.00820	0.00638	0.0219	0.0315
				2021	0.0732	0.194	0.102	0.0705	0.0371	0.0752	0.0327	0.0869	0.0838	0.0500	0.0327	0.0742	0.194
				2022	0.175	0.213	0.196	0.0994	0.170	0.0493	0.229	0.125	0.157	0.0612	0.0493	0.173	0.229
		Tin	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	-	-	0.750	-	-	-	0.786	0.768	0.0253	0.750	0.768	0.786
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	1.16	3.07	0.755	3.25	0.477	1.04	0.339	0.745	1.36	1.15	0.339	0.899	3.25
				2020	0.345	0.561	0.301	0.150	0.179	0.0610	0.102	0.409	0.264	0.171	0.0610	0.240	0.561
				2021	8.98	1.18	1.97	17.5	0.482	3.64	1.53	1.70	4.62	5.84	0.482	1.83	17.5
				2022	1.10	0.0543	0.792	0.0920	0.0986	1.11	0.385	0.0174	0.457	0.475	0.0174	0.242	1.11
		Uranium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.220	0.602	0.419	0.367	0.418	0.397	0.388	0.427	0.405	0.104	0.220	0.407	0.602
				2019	1.34	1.55	0.817	1.47	0.596	0.825	0.534	0.772	0.988	0.402	0.534	0.821	1.55
				2020	0.396	0.530	0.358	0.131	0.157	0.0480	0.151	0.476	0.281	0.181	0.0480	0.257	0.530
				2021	2.17	0.934	1.05	2.20	0.482	1.27	0.792	2.11	1.38	0.686	0.482	1.16	2.20
				2022	1.37	1.06	1.44	0.250	0.691	0.685	1.54	0.181	0.903	0.532	0.181	0.877	1.54
		Vanadium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.186	1.29	0.426	0.352	0.513	0.501	0.259	0.277	0.476	0.349	0.186	0.389	1.29
				2019	1.30	4.37	0.822	2.03	0.583	1.57	0.432	0.758	1.48	1.28	0.432	1.06	4.37
				2020	0.371	0.664	0.364	0.155	0.148	0.0667	0.102	0.418	0.286	0.204	0.0667	0.259	0.664
				2021	5.43	1.66	2.32	5.90	0.535	2.39	1.15	1.63	2.63	1.97	0.535	1.99	5.90
				2022	1.45	0.166	1.09	0.0962	0.189	1.12	0.812	0.0602	0.623	0.557	0.0602	0.501	1.45
		Zinc	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	4.99	5.87	4.64	4.94	8.17	4.42	4.02	3.07	5.02	1.51	3.07	4.79	8.17
				2019	-	7.90	6.22	6.66	7.36	5.08	4.58	7.44	6.46	1.25	4.58	6.66	7.90
				2020	10.6	10.8	7.93	4.91	7.27	7.43	8.70	10.9	8.56	2.10	4.91	8.31	10.9
				2021	18.8	8.84	7.59	13.8	8.74	15.5	17.0	16.0	13.3	4.30	7.59	14.6	18.8
				2022	1.85	2.79	6.68	7.80	8.05	15.8	4.30	4.49	6.47	4.38	1.85	5.58	15.8
Lower Edney Creek	EDC-D (Reference)	**Primary Analytes**															
		Arsenic	mg/kg	2018	0.367	0.569	0.948	0.827	0.464	0.157	0.375	0.519	0.528	0.256	0.157	0.491	0.948
				2019	0.108	0.146	0.0682	0.224	0.170	0.128	0.128	0.139	0.139	0.0454	0.0682	0.133	0.224
				2020	0.226	0.108	0.187	0.234	0.0808	0.152	0.193	0.469	0.206	0.119	0.0808	0.190	0.469
				2021	0.223	0.0958	0.491	0.333	0.236	0.259	0.510	0.481	0.329	0.152	0.0958	0.296	0.510
				2022	0.154	0.0873	0.250	0.136	0.137	0.0705	0.194	0.0843	0.139	0.0609	0.0705	0.136	0.250
		Copper	mg/kg	2018	0.919	1.03	1.28	2.17	1.07	2.62	1.38	1.13	1.45	0.611	0.919	1.20	2.62
				2019	0.746	0.769	0.907	1.29	1.54	2.08	0.552	1.51	1.17	0.518	0.552	1.10	2.08
				2020	1.75	1.94	2.46	1.59	0.708	2.41	2.10	1.15	1.77	0.606	0.708	1.84	2.46
				2021	2.31	2.14	1.62	1.98	1.66	2.07	1.24	4.11	2.14	0.867	1.24	2.02	4.11
				2022	1.39	1.17	1.50	2.17	1.28	1.25	1.13	0.875	1.34	0.381	0.875	1.26	2.17
		Iron	mg/kg	2018	0.116	0.215	0.664	0.734	0.149	0.0656	0.301	0.844	0.386	0.311	0.0656	0.258	0.844
				2019	0.0500	0.0511	0.0266	0.0844	0.0431	0.0455	0.0846	0.134	0.0650	0.0345	0.0266	0.0506	0.134
				2020	0.108	0.0466	0.0384	0.130	0.0274	0.0757	0.0897	0.0867	0.0752	0.0355	0.0274	0.0812	0.130
				2021	0.154	0.0547	0.174	0.202	0.124	0.128	0.249	0.269	0.169	0.0703	0.0547	0.164	0.269
				2022	0.0393	0.0300	0.105	0.0297	0.106	0.0667	0.0896	0.0353	0.0627	0.0335	0.0297	0.0530	0.106
		Selenium	mg/kg	2018	0.422	1.18	1.20	1.67	1.23	0.920	1.29	1.09	1.12	0.355	0.422	1.19	1.67
				2019	2.05	0.216	0.549	4.13	3.17	0.958	3.04	1.03	1.89	1.42	0.216	1.54	4.13
				2020	2.11	1.69	3.80	3.38	1.57	1.01	3.12	3.02	2.46	0.999	1.01	2.56	3.80
				2021	0.739	0.739	2.79	1.11	1.04	1.33	2.48	2.38	1.58	0.837	0.739	1.22	2.79
				2022	2.00	1.67	2.25	1.92	1.30	0.988	2.28	1.77	1.77	0.448	0.988	1.84	2.28
		Secondary Analytes															
		Barium	mg/kg	2018	0.348	0.755	1.28	0.560	0.596	0.0707	0.482	0.903	0.624	0.365	0.0707	0.578	1.28
				2019	0.0493	0.0161	0.0463	0.131	0.0665	0.118	0.105	0.120	0.0815	0.0425	0.0161	0.0857	0.131
				2020	0.350	0.0692	0.0872	0.391	0.0845	0.111	0.133	0.142	0.171	0.126	0.0692	0.122	0.391
				2021	0.190	0.0589	0.687	0.277	0.138	0.122	0.193	0.260	0.241	0.194	0.0589	0.191	0.687
				2022	0.0654	0.0713	0.174	0.0463	0.140	0.125	0.245	0.0883	0.119	0.0661	0.0463	0.107	0.245
		Cadmium	mg/kg	2018	1.04	3.26	2.41	4.53	2.76	1.15	3.70	4.68	2.94	1.38	1.04	3.01	4.68
				2019	1.04	0.456	0.630	1.54	2.16	0.249	1.77	0.482	1.04	0.706	0.249	0.835	2.16
				2020	2.37	1.97	4.06	7.28	1.32	0.363	3.67	3.19	3.03	2.11	0.363	2.78	7.28
				2021	1.73	0.934	5.82	1.88	2.71	2.41	4.98	6.01	3.31	1.99	0.934	2.56	6.01
				2022	2.80	2.99	8.20	3.02	2.30	0.246	3.73	2.19	3.18	2.27	0.246	2.89	8.20
		Calcium	mg/kg	2018	0.0731	0.0434	0.0277	0.0216	0.0651	0.142	0.0563	0.244	0.0842	0.0747	0.0216	0.0607	0.244
				2019	0.122	0.474	0.316	0.576	0.217	0.661	0.198	0.475	0.380	0.195	0.122	0.395	0.661
				2020	0.327	0.244	0.474	0.364	0.178	0.534	0.284	0.241	0.331	0.122	0.178	0.305	0.534
				2021	0.0646	0.0711	0.108	0.0497	0.0578	0.103	0.194	0.225	0.109	0.0658	0.0497	0.0870	0.225
				2022	0.238	0.157	0.256	0.449	0.118	0.134	0.157	0.153	0.208	0.109	0.118	0.157	0.449
		Cobalt	mg/kg	2018	0.152	0.349	0.970	1.38	0.247	0.139	0.377	0.901	0.564	0.459	0.139	0.363	1.38
				2019	0.0688	0.0696	0.0423	0.115	0.110	0.101	0.105	0.137	0.0936	0.0307	0.0423	0.103	0.137
				2020	0.147	0.0814	0.109	0.244	0.0367	0.106	0.146	0.125	0.124	0.0604	0.0367	0.117	0.244
				2021	0.173	0.0778	0.304	0.291	0.173	0.207	0.301	0.579	0.263	0.150	0.0778	0.249	0.579
				2022	0.0830	0.0666	0.164	0.0896	0.128	0.0629	0.154	0.0610	0.101	0.0417	0.0610	0.0863	0.164
		Manganese	mg/kg	2018	0.294	0.526	0.975	0.991	0.411	0.102	0.337	0.302	0.492	0.326	0.102	0.374	0.991
				2019	0.0495	0.0678	0.0592	0.153	0.152	0.103	0.0746	0.121	0.0974	0.0410	0.0495	0.0886	0.153
				2020	0.363	0.0723	0.238	0.469	0.0432	0.161	0.180	0.128	0.207	0.145	0.0432	0.171	0.469
				2021	0.182	0.0885	0.568	0.352	0.139	0.188	0.204	0.464	0.273	0.170	0.0885	0.196	0.568
				2022	0.118	0.0778	0.198	0.115	0.117	0.0620	0.246	0.0921	0.128	0.0627	0.0620	0.116	0.246
		Mercury	mg/kg	2018	1.06	1.70	2.38	2.80	0.770	1.27	2.15	1.46	1.70	0.698	0.770	1.58	2.80
				2019	0.902	0.712	0.976	1.24	2.02	0.344	1.05	0.544	0.974	0.512	0.344	0.939	2.02
				2020	1.75	2.20	2.10	1.83	2.98	0.683	2.36	1.99	1.98	0.650	0.683	2.04	2.98
				2021	2.89	3.53	1.87	1.72	2.16	1.40	1.60	2.48	2.21	0.723	1.40	2.02	3.53
				2022	2.76	2.00	2.23	1.10	2.20	1.92	2.79	2.52	2.19	0.549	1.10	2.21	2.79
		Molybdenum	mg/kg	2018	1.55	0.941	3.14	1.19	2.07	0.265	0.354	0.486	1.25	0.986	0.265	1.07	3.14
				2019	0.113	0.313	0.200	0.539	0.496	0.135	0.293	0.252	0.292	0.156	0.113	0.272	0.539
				2020	0.803	0.111	0.821	2.67	0.596	0.219	0.211	3.62	1.13	1.30	0.111	0.700	3.62
				2021	0.255	0.201	1.48	0.201	0.216	0.236	1.12	0.672	0.547	0.498	0.201	0.245	1.48
				2022	0.638	0.388	0.644	0.751	0.332	0.408	0.713	0.578	0.557	0.160	0.332	0.608	0.751

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	EDC-D (Reference)	Nickel	mg/kg	2018	0.223	0.331	0.739	0.979	0.314	0.208	0.380	0.500	0.459	0.271	0.208	0.355	0.979
				2019	0.0957	0.128	0.0598	0.161	0.0817	0.229	0.102	0.233	0.136	0.0658	0.0598	0.115	0.233
				2020	0.157	0.0844	0.132	0.255	0.0483	0.298	0.176	0.105	0.157	0.0846	0.0483	0.145	0.298
				2021	0.252	0.114	0.339	0.299	0.131	0.185	0.334	0.844	0.312	0.232	0.114	0.276	0.844
				2022	0.0735	0.115	0.122	0.242	0.0845	0.0893	0.0884	0.201	0.127	0.0614	0.0735	0.102	0.242
		Phosphorus	mg/kg	2018	3.27	3.66	2.61	3.72	3.33	4.61	3.72	2.25	3.39	0.727	2.25	3.49	4.61
				2019	3.22	5.91	5.71	6.94	8.96	4.59	3.31	5.09	5.47	1.90	3.22	5.40	8.96
				2020	5.85	4.88	8.95	7.95	2.81	4.91	7.02	6.11	6.06	1.93	2.81	5.98	8.95
				2021	5.44	4.98	7.39	4.59	5.74	5.10	5.68	11.8	6.34	2.36	4.59	5.56	11.8
				2022	5.21	4.34	4.62	9.04	3.44	4.11	4.75	6.40	5.24	1.76	3.44	4.69	9.04
		Silver	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	1.37	0.836	1.29	1.48	1.32	1.13	0.678	1.27	1.17	0.277	0.678	1.28	1.48
				2020	2.14	3.47	2.71	1.94	1.50	1.65	3.40	1.52	2.29	0.807	1.50	2.04	3.47
				2021	3.27	2.26	1.67	2.05	2.31	1.49	1.99	4.85	2.49	1.09	1.49	2.16	4.85
				2022	1.83	1.64	2.28	0.700	2.82	1.74	1.46	1.63	1.76	0.614	0.700	1.69	2.82
		Sodium	mg/kg	2018	4.53	6.55	4.13	6.50	0.879	6.84	6.30	7.35	5.38	2.14	0.879	6.40	7.35
				2019	5.39	15.1	8.59	23.3	14.9	5.89	6.93	6.20	10.8	6.39	5.39	7.76	23.3
				2020	9.39	10.7	17.7	19.6	5.63	15.5	14.6	11.5	13.1	4.63	5.63	13.0	19.6
				2021	7.94	6.23	11.8	6.52	12.7	7.23	9.92	13.0	9.42	2.80	6.23	8.93	13.0
				2022	12.0	12.7	10.7	14.5	13.4	9.75	10.8	8.02	11.5	2.08	8.02	11.4	14.5
		Strontium	mg/kg	2018	0.107	0.0957	0.0805	0.0386	0.127	0.147	0.0934	0.320	0.126	0.0847	0.0386	0.101	0.320
				2019	0.0944	0.323	0.204	0.415	0.191	0.559	0.171	0.514	0.309	0.172	0.0944	0.263	0.559
				2020	0.211	0.130	0.254	0.345	0.136	0.360	0.215	0.188	0.230	0.0859	0.130	0.213	0.360
				2021	0.0655	0.0616	0.167	0.0647	0.0755	0.119	0.268	0.347	0.146	0.108	0.0616	0.0974	0.347
				2022	0.131	0.0964	0.175	0.202	0.0693	0.0873	0.133	0.154	0.131	0.0455	0.0693	0.132	0.202
		Tin	mg/kg	2018	-	-	-	-	-	-	3.14	-	3.14	-	3.14	3.14	3.14
				2019	0.0765	0.194	0.171	1.00	0.517	0.178	0.0763	1.44	0.456	0.504	0.0763	0.186	1.44
				2020	-	0.312	-	0.882	0.500	-	0.556	-	0.563	0.237	0.312	0.528	0.882
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.0422	0.106	0.0326	0.0785	0.0511	0.0431	0.109	0.0884	0.0689	0.0304	0.0326	0.0648	0.109
				2020	0.0986	0.0358	0.0304	0.147	0.0219	0.0724	0.0616	0.0360	0.0629	0.0424	0.0219	0.0488	0.147
				2021	0.326	0.0589	0.177	0.176	0.120	0.111	0.288	0.297	0.194	0.0985	0.0589	0.176	0.326
				2022	0.0421	0.0231	0.0894	0.0308	0.110	0.0272	0.0681	0.0262	0.0521	0.0331	0.0231	0.0365	0.110
		Uranium	mg/kg	2018	0.0978	0.744	0.982	0.699	0.158	0.114	0.678	0.546	0.502	0.337	0.0978	0.612	0.982
				2019	0.113	0.00504	0.0494	0.165	0.107	0.168	0.129	0.172	0.114	0.0600	0.00504	0.121	0.172
				2020	0.148	0.0916	0.0681	0.310	0.0798	0.121	0.139	0.0796	0.130	0.0788	0.0681	0.106	0.310
				2021	0.151	0.0669	0.519	0.274	0.185	0.167	0.406	0.484	0.282	0.168	0.0669	0.229	0.519
				2022	0.0821	0.0459	0.162	0.0700	0.157	0.0984	0.179	0.0787	0.109	0.0498	0.0459	0.0902	0.179
		Vanadium	mg/kg	2018	0.108	0.158	0.534	0.731	0.0813	0.0461	0.201	1.14	0.374	0.392	0.0461	0.179	1.14
				2019	0.0400	0.0518	0.0206	0.0957	0.0467	0.0528	0.109	0.172	0.0735	0.0492	0.0206	0.0523	0.172
				2020	0.0949	0.0419	0.0293	0.159	0.0270	0.0714	0.104	0.0986	0.0783	0.0452	0.0270	0.0831	0.159
				2021	0.145	0.0530	0.143	0.175	0.121	0.131	0.257	0.310	0.167	0.0813	0.0530	0.144	0.310
				2022	0.0328	0.0260	0.0935	0.0352	0.109	0.0944	0.0751	0.0296	0.0620	0.0345	0.0260	0.0552	0.109
		Zinc	mg/kg	2018	3.37	3.64	4.81	9.84	3.87	4.56	2.90	1.40	4.30	2.48	1.40	3.75	9.84
				2019	1.31	2.14	1.92	3.09	3.12	4.14	2.14	3.27	2.64	0.914	1.31	2.62	4.14
				2020	3.95	2.40	3.91	3.35	1.69	1.75	3.73	2.75	2.94	0.928	1.69	3.05	3.95
				2021	3.12	4.26	3.56	2.70	3.88	3.23	3.09	9.94	4.22	2.36	2.70	3.39	9.94
				2022	2.13	4.92	2.96	3.17	1.94	1.66	2.07	2.65	2.69	1.04	1.66	2.39	4.92
Lower Hazeltine Creek	HAC-D (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.454	0.158	0.0675	0.135	0.195	0.103	0.0973	0.112	0.165	0.123	0.0675	0.124	0.454
				2019	0.770	2.39	0.120	0.471	0.199	0.207	0.447	0.236	0.605	0.751	0.120	0.341	2.39
				2020	0.207	0.107	0.802	0.151	0.400	0.382	0.479	0.509	0.380	0.227	0.107	0.391	0.802
				2021	0.0603	0.411	0.402	0.267	0.326	0.235	0.305	0.738	0.343	0.194	0.0603	0.316	0.738
				2022	0.114	0.144	0.397	0.252	0.384	0.161	0.334	0.239	0.253	0.110	0.114	0.246	0.397
		Copper	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.616	0.209	0.603	0.196	0.508	0.191	0.250	0.273	0.356	0.187	0.191	0.261	0.616
				2019	0.969	1.24	0.229	0.701	0.290	0.576	1.07	0.439	0.690	0.373	0.229	0.639	1.24
				2020	0.957	0.392	1.63	0.329	1.04	0.855	1.34	1.04	0.948	0.437	0.329	0.999	1.63
				2021	0.865	1.17	0.566	0.332	0.304	1.05	0.480	0.842	0.702	0.328	0.304	0.704	1.17
				2022	0.0920	0.368	1.31	0.634	1.09	0.772	0.420	0.781	0.682	0.394	0.0920	0.703	1.31
		Iron	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.247	0.0918	0.0605	0.0661	0.157	0.0790	0.0392	0.111	0.106	0.0672	0.0392	0.0854	0.247
				2019	0.450	0.811	0.0304	0.305	0.0871	0.128	0.389	0.137	0.292	0.258	0.0304	0.221	0.811
				2020	0.0395	0.0901	0.305	0.0554	0.417	0.315	0.235	0.0803	0.192	0.144	0.0395	0.163	0.417
				2021	0.394	0.540	0.391	0.255	0.311	0.324	0.450	0.925	0.449	0.212	0.255	0.393	0.925
				2022	0.0591	0.0311	0.397	0.290	0.304	0.155	0.268	0.581	0.261	0.181	0.0311	0.279	0.581
		Selenium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	3.21	3.76	3.74	2.85	3.05	4.36	3.74	2.25	3.37	0.661	2.25	3.47	4.36
				2019	4.07	2.46	4.37	3.13	2.99	4.97	2.34	3.39	3.47	0.929	2.34	3.26	4.97
				2020	3.58	5.24	4.18	3.51	3.17	4.27	3.20	2.30	3.68	0.882	2.30	3.55	5.24
				2021	2.97	3.15	2.80	2.61	4.21	1.82	2.95	7.48	3.50	1.74	1.82	2.96	7.48
				2022	0.733	2.57	3.06	2.45	2.65	2.86	1.67	2.22	2.28	0.753	0.733	2.51	3.06
		Secondary Analytes															
		Barium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0801	0.0827	0.194	0.00359	0.104	0.0586	0.0363	0.0690	0.0785	0.0559	0.00359	0.0745	0.194
				2019	0.247	1.05	0.0270	0.245	0.0645	0.369	0.283	0.144	0.304	0.324	0.0270	0.246	1.05
				2020	0.213	0.120	0.454	0.0737	0.331	0.201	0.300	0.260	0.244	0.121	0.0737	0.236	0.454
				2021	0.465	0.348	0.263	0.245	0.451	0.207	0.208	0.240	0.303	0.105	0.207	0.254	0.465
				2022	0.0444	0.159	0.128	0.195	0.326	0.0849	0.143	0.148	0.153	0.0835	0.0444	0.146	0.326
		Cadmium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	1.96	1.35	2.79	0.728	4.81	1.05	0.706	2.91	2.04	1.41	0.706	1.66	4.81
				2019	0.578	2.20	0.443	2.06	0.525	0.837	1.14	0.450	1.03	0.719	0.443	0.708	2.20
				2020	2.85	1.85	2.04	1.13	1.41	2.90	1.06	1.35	1.82	0.729	1.06	1.63	2.90
				2021	3.64	2.66	1.01	1.41	1.49	2.01	2.01	3.62	2.23	0.994	1.01	2.01	3.64
				2022	0.757	2.20	3.36	3.25	4.81	2.41	3.87	0.872	2.69	1.41	0.757	2.83	4.81
		Calcium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.00399	0.00640	0.00794	0.00960	0.0118	0.0121	0.00424	0.0386	0.0118	0.0112	0.00399	0.00877	0.0386
				2019	0.0235	0.0462	0.0180	0.0325	0.00886	0.0246	0.0163	0.0115	0.0227	0.0121	0.00886	0.0208	0.0462
				2020	0.00723	0.0236	0.0132	0.0138	0.0151	0.0348	0.0347	0.00595	0.0185	0.0114	0.00595	0.0144	0.0348
				2021	0.0252	0.0167	0.174	0.180	0.292	0.181	0.157	0.644	0.209	0.197	0.0167	0.177	0.644
				2022	0.00889	0.00529	0.00937	0.0110	0.0155	0.00691	0.0186	0.0143	0.0112	0.00456	0.00529	0.0102	0.0186
		Cobalt	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.405	0.209	0.318	0.122	0.294	0.0968	0.100	0.223	0.221	0.113	0.0968	0.216	0.405
				2019	0.521	1.04	0.0535	0.417	0.127	0.186	0.498	0.162	0.376	0.323	0.0535	0.302	1.04
				2020	0.374	0.139	0.437	0.147	0.784	0.516	0.444	0.275	0.389	0.211	0.139	0.405	0.784
				2021	0.472	0.654	0.314	0.320	0.311	0.431	0.554	0.742	0.475	0.164	0.311	0.451	0.742
				2022	0.0800	0.332	0.787	0.620	0.585	0.316	0.410	0.285	0.427	0.225	0.0800	0.371	0.787

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Hazeltine Creek	HAC-D (Exposed)	Manganese	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.212	0.163	0.628	0.116	0.126	0.135	0.0881	0.0530	0.190	0.183	0.0530	0.130	0.628
				2019	0.186	1.03	0.186	0.458	0.108	0.266	0.110	0.102	0.306	0.316	0.102	0.186	1.03
				2020	0.658	0.443	0.444	0.355	0.494	0.795	0.291	0.0824	0.445	0.218	0.0824	0.443	0.795
				2021	0.860	0.692	0.462	0.510	0.589	0.368	0.406	1.18	0.634	0.273	0.368	0.550	1.18
				2022	0.141	0.691	0.493	0.442	0.375	0.232	0.193	0.0950	0.333	0.204	0.0950	0.303	0.691
		Mercury	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	3.52	1.97	1.43	0.741	2.90	0.907	0.754	1.28	1.69	1.04	0.741	1.36	3.52
				2019	2.47	3.36	0.840	2.28	2.00	2.27	4.10	2.19	2.44	0.963	0.840	2.27	4.10
				2020	3.22	1.54	6.38	1.16	3.33	2.71	6.40	11.5	4.52	3.42	1.16	3.28	11.5
				2021	1.86	1.92	1.69	0.977	0.779	0.788	0.207	1.29	1.19	0.609	0.207	1.14	1.92
				2022	0.403	1.82	3.35	5.15	3.05	2.91	3.97	3.70	3.04	1.43	0.403	3.20	5.15
		Molybdenum	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	5.66	4.36	5.44	4.00	2.13	4.27	4.36	0.708	3.87	1.66	0.708	4.31	5.66
				2019	7.86	2.47	3.95	2.08	3.90	5.30	0.888	4.10	3.82	2.14	0.888	3.93	7.86
				2020	3.83	4.24	2.47	3.90	4.38	4.26	4.37	3.08	3.82	0.692	2.47	4.07	4.38
				2021	2.37	1.01	0.698	0.473	0.550	1.07	2.51	4.29	1.62	1.33	0.473	1.04	4.29
				2022	0.130	6.81	3.39	1.87	2.36	3.56	1.79	1.68	2.70	1.98	0.130	2.11	6.81
		Nickel	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.402	0.153	0.542	0.170	1.27	0.650	0.0873	1.48	0.594	0.523	0.0873	0.472	1.48
				2019	0.442	0.888	0.0426	0.364	0.110	0.169	0.429	0.157	0.325	0.273	0.0426	0.267	0.888
				2020	0.180	0.0784	0.138	0.115	1.11	0.426	0.302	0.183	0.317	0.340	0.0784	0.181	1.11
				2021	0.440	0.667	0.573	0.356	0.294	0.355	0.575	0.561	0.478	0.134	0.294	0.500	0.667
				2022	0.0597	0.113	19.9	0.400	1.06	0.237	0.361	0.357	2.81	6.91	0.0597	0.359	19.9
		Phosphorus	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	12.3	9.89	11.4	6.72	10.1	7.61	7.10	7.15	9.04	2.17	6.72	8.75	12.3
				2019	13.8	8.14	4.92	6.94	6.94	7.19	13.0	6.33	8.41	3.23	4.92	7.07	13.8
				2020	5.84	6.57	15.1	6.70	8.80	8.45	12.4	9.67	9.19	3.17	5.84	8.62	15.1
				2021	8.33	6.20	5.99	5.62	7.92	3.74	3.14	6.95	5.99	1.83	3.14	6.10	8.33
				2022	0.527	2.55	4.65	4.45	5.11	3.90	4.87	4.21	3.78	1.53	0.527	4.33	5.11
		Silver	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.680	1.61	0.0676	0.924	0.177	2.00	4.51	0.828	1.35	1.43	0.0676	0.876	4.51
				2020	0.702	0.232	2.94	0.163	1.08	0.842	0.985	0.721	0.958	0.865	0.163	0.781	2.94
				2021	1.31	1.04	-	-	-	-	-	-	1.17	0.198	1.04	1.17	1.31
				2022	0.230	0.229	1.80	1.25	1.05	0.772	1.12	1.79	1.03	0.606	0.229	1.09	1.80
		Sodium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	10.5	7.28	15.5	5.59	24.5	6.76	3.68	21.8	12.0	7.81	3.68	8.90	24.5
				2019	11.4	14.4	6.55	17.3	8.54	10.5	16.7	9.82	11.9	3.88	6.55	11.0	17.3
				2020	11.8	8.86	11.3	17.2	13.0	13.1	15.9	13.3	13.1	2.61	8.86	13.0	17.2
				2021	6.17	4.96	5.20	6.67	4.50	3.72	3.39	10.7	5.66	2.32	3.39	5.08	10.7
				2022	0.891	6.70	9.42	9.20	9.61	12.3	24.2	17.6	11.2	7.04	0.891	9.51	24.2
		Strontium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.0131	0.0178	0.0178	0.0244	0.0266	0.0273	0.0111	0.0524	0.0238	0.0130	0.0111	0.0211	0.0524
				2019	0.0511	0.0948	0.0303	0.0775	0.0202	0.0554	0.0373	0.0267	0.0492	0.0261	0.0202	0.0442	0.0948
				2020	0.0252	0.0416	0.0295	0.0245	0.0267	0.0581	0.0359	0.0166	0.0322	0.0129	0.0166	0.0281	0.0581
				2021	0.0468	0.0472	0.239	0.289	0.297	0.188	0.157	0.576	0.230	0.170	0.0468	0.213	0.576
				2022	0.0190	0.0128	0.0243	0.0214	0.0366	0.0188	0.0311	0.0321	0.0245	0.00806	0.0128	0.0229	0.0366
		Tin	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	-	-	-	-	-	-	-	-	-	-	-	-	-
				2020	-	0.400	0.552	-	-	1.25	-	-	0.734	0.453	0.400	0.552	1.25
				2021	-	-	-	-	0.780	0.500	0.632	1.00	0.728	0.214	0.500	0.706	1.00
				2022	-	-	-	-	-	-	-	-	-	-	-	-	-
		Titanium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	-	-	-	-	-	-	-	-	-	-	-	-	-
				2019	0.306	0.458	0.0284	0.239	0.0727	0.136	0.334	0.118	0.212	0.148	0.0284	0.187	0.458
				2020	0.0269	0.0711	0.123	0.0527	0.296	0.258	0.147	0.0738	0.131	0.0984	0.0269	0.0983	0.296
				2021	3.30	0.876	0.370	0.267	0.363	0.280	0.401	1.12	0.872	1.03	0.267	0.386	3.30
				2022	0.0433	0.0271	0.336	0.236	0.199	0.150	0.242	0.663	0.237	0.201	0.0271	0.218	0.663
		Uranium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.159	0.119	0.0669	0.0662	0.230	0.0480	0.0435	0.0878	0.103	0.0644	0.0435	0.0773	0.230
				2019	0.523	0.971	0.0240	0.261	0.0701	0.166	0.371	0.119	0.313	0.313	0.0240	0.213	0.971
				2020	0.117	0.139	0.519	0.0714	0.571	0.483	0.316	0.161	0.297	0.202	0.0714	0.239	0.571
				2021	0.313	0.517	0.408	0.278	0.276	0.368	0.380	1.03	0.446	0.249	0.276	0.374	1.03
				2022	0.0620	0.0983	0.353	0.301	0.383	0.228	0.343	0.520	0.286	0.152	0.0620	0.322	0.520
		Vanadium	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	0.248	0.0822	0.0712	0.0661	0.173	0.0827	0.0354	0.105	0.108	0.0692	0.0354	0.0824	0.248
				2019	0.360	0.751	0.0248	0.285	0.0741	0.114	0.324	0.120	0.257	0.235	0.0248	0.202	0.751
				2020	0.0351	0.0900	0.320	0.0475	0.377	0.293	0.210	0.0462	0.177	0.140	0.0351	0.150	0.377
				2021	0.551	0.582	0.348	0.222	0.349	0.298	0.443	0.969	0.470	0.236	0.222	0.396	0.969
				2022	0.0505	0.0294	0.391	0.254	0.275	0.162	0.233	0.520	0.239	0.164	0.0294	0.244	0.520
		Zinc	mg/kg	2010	-	-	-	-	-	-	-	-	-	-	-	-	-
				2018	8.27	4.52	5.13	2.29	4.29	2.54	2.45	2.53	4.00	2.05	2.29	3.41	8.27
				2019	4.63	6.57	1.78	3.35	2.53	2.59	4.46	2.34	3.53	1.59	1.78	2.97	6.57
				2020	7.82	4.19	9.89	2.90	4.90	6.38	6.82	5.80	6.09	2.18	2.90	6.09	9.89
				2021	9.63	8.88	3.28	2.58	1.99	2.40	2.21	3.10	4.26	3.12	1.99	2.84	9.63
				2022	0.658	6.46	6.94	7.37	7.58	5.73	4.97	3.62	5.42	2.33	0.658	6.09	7.58
Lower Edney Creek	E1 (Exposed)	**Primary Analytes**															
		Arsenic	mg/kg	2019	0.108	0.0449	0.410	0.130	0.618	0.128	0.154	0.115	0.213	0.196	0.0449	0.129	0.618
				2020	0.0944	0.118	0.166	0.147	0.0661	0.217	0.112	0.115	0.129	0.0466	0.0661	0.116	0.217
				2021	0.134	0.611	0.247	0.668	0.747	1.06	0.547	0.405	0.552	0.293	0.134	0.579	1.06
				2022	0.839	0.727	0.0875	0.375	0.266	0.198	0.152	0.528	0.397	0.276	0.0875	0.321	0.839
		Copper	mg/kg	2019	0.458	0.547	0.540	0.262	0.0299	1.07	0.827	1.01	0.593	0.360	0.0299	0.543	1.07
				2020	0.240	0.231	0.310	0.508	0.478	0.384	0.395	0.293	0.355	0.104	0.231	0.347	0.508
				2021	0.254	0.512	0.339	1.28	0.964	1.38	0.500	0.589	0.727	0.427	0.254	0.551	1.38
				2022	1.99	1.62	0.460	0.551	0.362	0.254	0.237	0.156	0.704	0.699	0.156	0.411	1.99
		Iron	mg/kg	2019	0.0226	0.0245	0.218	0.100	0.142	0.123	0.0602	0.104	0.0992	0.0649	0.0226	0.102	0.218
				2020	0.0376	0.0769	0.112	0.0746	0.0641	0.123	0.0508	0.0423	0.0727	0.0312	0.0376	0.0693	0.123
				2021	0.0537	0.144	0.0920	0.283	0.373	0.239	0.418	0.322	0.241	0.133	0.0537	0.261	0.418
				2022	0.299	0.597	0.0204	0.0785	0.144	0.111	0.0447	0.232	0.191	0.189	0.0204	0.128	0.597
		Selenium	mg/kg	2019	1.82	1.14	2.22	2.53	0.868	3.95	1.70	3.87	2.26	1.15	0.868	2.02	3.95
				2020	1.38	1.10	3.53	2.46	2.20	2.17	1.56	1.68	2.01	0.765	1.10	1.92	3.53
				2021	2.92	3.89	2.97	3.11	2.29	3.06	1.48	3.51	2.90	0.737	1.48	3.02	3.89
				2022	4.44	4.83	2.02	5.70	2.03	1.90	2.10	1.29	3.04	1.67	1.29	2.06	5.70

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analytes Concentrations for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), Upper Edney Creek (EDC-U; Reference), Lower Hazeltine Creek (HAC-D; Exposed), and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2010 to 2022

Waterbody	Area	Parameter	Units	Year	Replicate								Mean	Standard Deviation	Minimum	Median	Maximum
					1	2	3	4	5	6	7	8					
Lower Edney Creek	E1 (Exposed)	**Secondary Analytes**															
		Barium	mg/kg	2019	0.0428	0.0343	0.493	0.0363	0.0490	0.219	0.164	0.131	0.146	0.156	0.0343	0.0899	0.493
				2020	0.0747	0.0296	0.510	0.0966	0.0878	0.0548	0.0939	0.0762	0.128	0.156	0.0296	0.0820	0.510
				2021	0.135	0.00642	0.00441	0.0518	0.00326	0.341	0.117	0.106	0.0956	0.113	0.00326	0.0791	0.341
				2022	0.348	0.656	0.0477	0.0291	0.558	0.199	0.114	0.0520	0.250	0.245	0.0291	0.156	0.656
		Cadmium	mg/kg	2019	2.23	2.13	2.93	3.04	3.48	3.10	1.30	1.34	2.44	0.824	1.30	2.58	3.48
				2020	3.93	2.96	8.52	6.19	6.45	4.31	3.41	3.65	4.93	1.93	2.96	4.12	8.52
				2021	4.60	7.67	5.31	10.7	7.45	8.65	7.64	13.8	8.23	2.94	4.60	7.65	13.8
				2022	14.8	24.0	2.11	9.79	8.07	5.56	3.17	9.81	9.66	7.07	2.11	8.93	24.0
		Calcium	mg/kg	2019	0.235	0.207	0.322	0.175	0.122	0.283	0.126	0.173	0.205	0.0715	0.122	0.191	0.322
				2020	0.121	0.208	0.287	0.150	0.174	0.221	0.128	0.150	0.180	0.0560	0.121	0.162	0.287
				2021	0.0492	0.0317	0.0116	0.0100	0.0113	0.0247	0.0154	0.0319	0.0232	0.0138	0.0100	0.0200	0.0492
				2022	0.967	1.11	0.119	0.376	0.253	0.179	0.0625	0.295	0.420	0.395	0.0625	0.274	1.11
		Cobalt	mg/kg	2019	0.0672	0.0737	0.372	0.128	0.0986	0.236	0.166	0.181	0.165	0.101	0.0672	0.147	0.372
				2020	0.108	0.112	0.221	0.136	0.151	0.180	0.130	0.0957	0.142	0.0418	0.0957	0.133	0.221
				2021	0.140	0.465	0.211	0.555	0.693	0.541	0.782	0.391	0.472	0.221	0.140	0.503	0.782
				2022	0.665	0.991	0.0746	0.319	0.259	0.220	0.147	0.336	0.377	0.304	0.0746	0.289	0.991
		Manganese	mg/kg	2019	0.0763	0.0470	0.470	0.104	0.339	0.187	0.178	0.0973	0.187	0.147	0.0470	0.141	0.470
				2020	0.158	0.115	0.247	0.251	0.264	0.465	0.157	0.206	0.233	0.108	0.115	0.226	0.465
				2021	0.233	0.395	0.232	0.545	0.600	0.613	0.611	0.639	0.484	0.172	0.232	0.573	0.639
				2022	1.33	0.706	0.0849	0.473	0.498	0.354	0.138	0.240	0.478	0.400	0.0849	0.414	1.33
		Mercury	mg/kg	2019	0.367	0.856	2.24	0.736	2.20	1.39	1.06	1.30	1.27	0.669	0.367	1.18	2.24
				2020	1.21	2.80	2.24	1.44	1.69	1.27	1.78	0.928	1.67	0.609	0.928	1.57	2.80
				2021	1.87	2.40	1.57	2.83	1.58	0.187	1.77	2.14	1.79	0.778	0.187	1.82	2.83
				2022	1.19	2.17	1.23	1.03	1.22	1.76	1.43	2.20	1.53	0.457	1.03	1.33	2.20
		Molybdenum	mg/kg	2019	0.417	0.394	1.58	0.409	0.288	0.325	0.354	0.130	0.487	0.450	0.130	0.374	1.58
				2020	0.422	0.549	0.757	0.568	0.305	1.61	0.502	0.754	0.684	0.405	0.305	0.558	1.61
				2021	0.401	0.395	3.22	1.18	2.87	1.56	1.69	1.17	1.56	1.03	0.395	1.37	3.22
				2022	1.03	0.920	0.0740	0.858	0.566	0.808	1.47	0.476	0.774	0.413	0.0740	0.833	1.47
		Nickel	mg/kg	2019	0.0502	0.0290	0.293	0.100	0.639	0.151	0.0969	0.163	0.190	0.199	0.0290	0.126	0.639
				2020	0.0876	0.0783	0.438	0.109	0.0928	0.169	0.105	0.110	0.149	0.120	0.0783	0.107	0.438
				2021	0.0858	0.239	0.184	0.313	0.373	0.312	0.693	0.534	0.342	0.194	0.0858	0.312	0.693
				2022	0.621	1.07	0.421	0.161	0.125	0.232	0.389	0.290	0.414	0.309	0.125	0.340	1.07
		Phosphorus	mg/kg	2019	5.03	3.46	4.35	6.15	5.97	2.96	3.26	2.16	4.17	1.45	2.16	3.90	6.15
				2020	5.32	2.97	7.91	6.26	3.51	5.68	4.60	5.63	5.24	1.56	2.97	5.48	7.91
				2021	7.71	6.17	7.90	8.57	7.31	5.59	4.89	8.21	7.04	1.33	4.89	7.51	8.57
				2022	13.6	11.1	5.57	13.5	5.15	5.98	2.76	4.56	7.77	4.27	2.76	5.77	13.6
		Silver	mg/kg	2019	0.903	0.250	0.725	0.640	0.465	1.17	0.929	1.50	0.823	0.396	0.250	0.814	1.50
				2020	0.613	0.162	1.05	0.685	0.710	0.760	0.764	0.534	0.660	0.252	0.162	0.697	1.05
				2021	-	-	-	-	1.15	0.789	1.05	0.645	0.908	0.231	0.645	0.920	1.15
				2022	4.64	8.19	0.420	3.40	0.837	1.61	0.511	0.522	2.52	2.76	0.420	1.22	8.19
		Sodium	mg/kg	2019	6.10	13.2	7.15	21.5	11.3	15.3	13.3	13.1	12.6	4.79	6.10	13.1	21.5
				2020	21.8	12.6	28.3	15.0	8.63	5.75	11.1	16.1	14.9	7.27	5.75	13.8	28.3
				2021	11.4	5.47	3.63	6.71	4.33	1.34	5.11	6.80	5.60	2.94	1.34	5.29	11.4
				2022	27.6	66.5	38.9	17.1	21.5	25.7	8.86	8.56	26.8	18.9	8.56	23.6	66.5
		Strontium	mg/kg	2019	0.109	0.0901	0.296	0.0767	0.141	0.179	0.115	0.126	0.142	0.0696	0.0767	0.121	0.296
				2020	0.134	0.0854	0.149	0.124	0.126	0.134	0.162	0.108	0.128	0.0236	0.0854	0.130	0.162
				2021	0.0628	0.0431	0.0158	0.0200	0.0259	0.0562	0.0343	0.0434	0.0377	0.0168	0.0158	0.0387	0.0628
				2022	0.720	0.797	0.0667	0.101	0.153	0.0690	0.0676	0.0651	0.255	0.313	0.0651	0.0852	0.797
		Tin	mg/kg	2019	1.50	0.156	0.793	1.52	-	0.734	0.717	0.376	0.828	0.517	0.156	0.734	1.52
				2020	-	-	-	0.343	0.406	0.250	0.231	0.196	0.285	0.0868	0.196	0.250	0.406
				2021	-	-	-	-	-	-	-	-	-	-	-	-	-
				2022	-	-	-	1.08	-	-	-	-	1.08	-	1.08	1.08	1.08
		Titanium	mg/kg	2019	0.0179	0.0371	0.228	0.151	0.390	0.141	0.0677	0.141	0.147	0.120	0.0179	0.141	0.390
				2020	0.0316	0.0777	0.196	0.0491	0.0658	0.0990	0.0606	0.0302	0.0763	0.0536	0.0302	0.0632	0.196
				2021	0.0653	0.109	0.0352	0.176	0.250	0.156	0.258	0.164	0.152	0.0799	0.0352	0.160	0.258
				2022	0.312	0.530	0.106	0.0356	0.162	0.116	0.0461	0.215	0.190	0.164	0.0356	0.139	0.530
		Uranium	mg/kg	2019	0.0464	0.0138	0.236	0.123	0.669	0.194	0.106	0.205	0.199	0.205	0.0138	0.158	0.669
				2020	0.147	0.0207	0.150	0.125	0.118	0.115	0.0445	0.0701	0.0987	0.0480	0.0207	0.116	0.150
				2021	0.119	0.484	0.216	0.381	0.324	0.323	0.676	0.487	0.376	0.174	0.119	0.353	0.676
				2022	0.449	0.950	0.00982	0.193	0.289	0.236	0.0832	0.356	0.321	0.291	0.00982	0.262	0.950
		Vanadium	mg/kg	2019	0.0203	0.0339	0.196	0.126	0.167	0.155	0.0716	0.104	0.109	0.0635	0.0203	0.115	0.196
				2020	0.0271	0.0944	0.0941	0.0715	0.0581	0.126	0.0441	0.0299	0.0681	0.0349	0.0271	0.0648	0.126
				2021	0.0522	0.143	0.0557	0.357	0.290	0.209	0.344	0.300	0.219	0.123	0.0522	0.249	0.357
				2022	0.337	0.675	0.0277	0.0632	0.165	0.112	0.0421	0.229	0.206	0.216	0.0277	0.138	0.675
		Zinc	mg/kg	2019	2.39	1.35	3.94	1.84	1.59	2.18	2.19	1.20	2.08	0.863	1.20	2.01	3.94
				2020	2.63	1.64	4.22	2.89	2.11	3.88	2.41	2.85	2.83	0.860	1.64	2.74	4.22
				2021	2.12	3.37	4.51	4.30	5.44	3.86	8.88	4.16	4.58	1.98	2.12	4.23	8.88
				2022	7.32	8.95	1.19	8.21	2.31	2.51	2.68	2.26	4.43	3.15	1.19	2.60	8.95

Notes: For 2010 data at HAC-D and HAC-U, historical station codes were W11 and W7, respectively. All values reported in dry weight. Summary statistics reported to 3 significant figures for display purposes. TTF calculated as Benthic Invertebrate Analyte Concentration/Periphyton Analyte Concentration. "-" = data were not available to calculate a TTF or TTF was not calculated because the concentration of an analyte was below the Laboratory Reporting Limit (LRL) for either the periphyton or benthic invertebrate tissue results.

Table D.5.9: Periphyton Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2022

Analyte	Units	Reference												
		Lower Edney Creek (EDC-D)												
		EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-6	EDC-D-7	EDC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		4-Aug-22	4-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22					
Moisture	mg/kg dw	66.6	83.8	82.2	79.0	88.3	71.0	80.1	83.1	79.3	7.12	66.6	81.2	88.3
Aluminum	mg/kg dw	10,500	9,850	11,400	7,600	6,060	13,300	9,740	11,700	10,019	2,310	6,060	10,175	13,300
Antimony	mg/kg dw	0.0400	0.0640	0.0530	0.0510	0.0800	0.219	0.0710	0.0950	0.0841	0.0572	0.0400	0.0675	0.219
Arsenic	mg/kg dw	12.7	14.2	12.9	9.58	13.9	32.9	12.6	15.3	15.5	7.22	9.58	13.4	32.9
Barium	mg/kg dw	130	138	149	114	174	205	119	154	148	30.2	114	144	205
Beryllium	mg/kg dw	0.323	0.292	0.310	0.260	0.212	0.500	0.318	0.326	0.318	0.0833	0.212	0.314	0.500
Bismuth	mg/kg dw	0.0690	0.0750	0.0830	0.0810	0.0620	0.0680	0.0570	0.110	0.0756	0.0165	0.0570	0.0720	0.110
Boron	mg/kg dw	6.60	10.5	9.40	5.30	17.8	27.9	10.1	10.0	12.2	7.34	5.30	10.0	27.9
Cadmium	mg/kg dw	0.338	0.294	0.328	0.197	0.461	2.12	0.311	0.328	0.547	0.640	0.197	0.328	2.12
Calcium	mg/kg dw	7,550	9,440	9,330	5,720	12,100	23,300	9,580	9,410	10,804	5,368	5,720	9,425	23,300
Cesium	mg/kg dw	1.27	1.21	1.24	1.29	0.815	1.55	1.22	1.53	1.27	0.227	0.815	1.25	1.55
Chromium	mg/kg dw	50.3	41.6	54.4	25.8	27.1	54.4	37.7	50.1	42.7	11.6	25.8	45.9	54.4
Cobalt	mg/kg dw	10.8	10.0	11.3	6.99	7.94	21.0	9.15	12.0	11.1	4.32	6.99	10.4	21.0
Copper	mg/kg dw	27.3	25.2	26.3	17.9	24.1	27.1	28.5	30.4	25.8	3.75	17.9	26.7	30.4
Iron	mg/kg dw	21,600	19,700	21,600	15,500	12,600	42,400	19,200	25,400	22,250	9,034	12,600	20,650	42,400
Lead	mg/kg dw	4.57	4.44	4.39	3.68	2.84	9.34	3.66	5.33	4.78	1.99	2.84	4.42	9.34
Lithium	mg/kg dw	10.8	10.3	11.2	9.34	6.56	10.1	15.8	12.3	10.8	2.63	6.56	10.6	15.8
Magnesium	mg/kg dw	6,370	5,710	5,980	4,300	4,250	8,000	5,670	6,000	5,785	1,190	4,250	5,845	8,000
Manganese	mg/kg dw	2,020	2,300	2,540	1,640	2,960	5,970	1,710	2,280	2,678	1,398	1,640	2,290	5,970
Mercury	mg/kg dw	0.0435	0.0516	0.0494	0.0666	0.0550	0.0630	0.0433	0.0452	0.0522	0.00882	0.0433	0.0505	0.0666
Molybdenum	mg/kg dw	1.05	1.70	1.26	0.776	2.86	1.94	1.43	1.06	1.51	0.662	0.776	1.34	2.86
Nickel	mg/kg dw	33.6	29.8	36.0	22.0	25.2	43.1	29.3	33.2	31.5	6.54	22.0	31.5	43.1
Phosphorus	mg/kg dw	1,370	1,960	1,680	1,030	2,560	1,950	1,870	1,400	1,728	469	1,030	1,775	2,560
Potassium	mg/kg dw	2,540	4,380	2,990	2,300	5,480	2,720	3,650	2,910	3,371	1,080	2,300	2,950	5,480
Rubidium	mg/kg dw	8.97	11.5	10.3	8.24	10.9	11.7	10.3	11.6	10.4	1.27	8.24	10.6	11.7
Selenium	mg/kg dw	0.880	1.08	0.880	0.860	1.56	1.73	0.930	0.860	1.10	0.348	0.860	0.905	1.73
Silver	mg/kg dw	0.0897	0.0744	0.0760	0.263	0.0504	0.0870	0.105	0.0824	0.103	0.0663	0.0504	0.0847	0.263
Sodium	mg/kg dw	266	316	289	240	274	403	381	505	334	89.1	240	302	505
Strontium	mg/kg dw	73.7	91.3	79.9	50.9	111	189	70.4	77.7	93	42.4	50.9	78.8	189
Tellurium	mg/kg dw	<0.033	<0.054	<0.053	<0.035	<0.032	<0.054	<0.070	<0.052	<0.032	#N/A	<0.032	<0.032	<0.032
Thallium	mg/kg dw	0.0812	0.0726	0.0752	0.0596	0.0626	0.109	0.100	0.108	0.0835	0.0197	0.0596	0.0782	0.109
Tin	mg/kg dw	<0.16	<0.27	<0.27	<0.18	<0.16	0.320	<0.35	<0.26	0.183	#N/A	<0.16	0.270	0.320
Titanium	mg/kg dw	432	485	566	301	252	1,020	529	580	521	234	252	507	1,020
Uranium	mg/kg dw	0.546	0.645	0.559	0.377	0.382	0.860	0.477	0.494	0.542	0.156	0.377	0.520	0.860
Vanadium	mg/kg dw	46.3	40.0	46.2	26.1	23.9	91.5	45.8	49.6	46.2	20.7	23.9	46.0	91.5
Zinc	mg/kg dw	55.8	59.2	58.2	40.7	76.9	89.1	62.3	58.5	62.6	14.5	40.7	58.9	89.1
Zirconium	mg/kg dw	6.12	6.44	6.96	4.27	2.00	16.2	6.41	7.08	6.94	4.11	2.00	6.42	16.2

Notes: "-" = no data or summary statistic could not be calculated. Mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.9: Periphyton Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2022

Analyte	Units	Exposed												
		Lower Hazeltine Creek (HAC-D)												
		HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5	HAC-D-6	HAC-D-7	HAC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22					
Moisture	mg/kg dw	93.5	73.3	63.4	64.5	64.0	62.0	61.9	65.7	68.5	10.7	61.9	64.2	93.5
Aluminum	mg/kg dw	53,800	4,190	2,400	1,900	2,580	2,130	2,320	1,760	8,885	18,164	1,760	2,360	53,800
Antimony	mg/kg dw	0.341	0.0610	0.0550	0.0500	0.0600	0.0580	0.0820	0.0820	0.0986	0.0987	0.0500	0.0605	0.341
Arsenic	mg/kg dw	63.0	6.96	5.32	5.19	5.89	6.33	6.29	7.60	13.3	20.1	5.19	6.31	63.0
Barium	mg/kg dw	987	127	177	130	164	232	222	304	293	287	127	200	987
Beryllium	mg/kg dw	1.85	0.155	0.0760	0.0720	0.104	0.0890	0.105	0.0750	0.316	0.621	0.0720	0.0965	1.85
Bismuth	mg/kg dw	0.376	0.0340	0.0160	0.0140	0.0170	0.0150	<0.024	<0.014	0.0626	0.130	0.0140	0.0160	0.376
Boron	mg/kg dw	181	36.8	43.0	41.5	38.0	25.5	88.8	71.3	65.7	51	25.5	42.2	181
Cadmium	mg/kg dw	1.73	0.249	0.285	0.311	0.318	0.320	0.597	0.853	0.583	0.507	0.249	0.319	1.73
Calcium	mg/kg dw	827,000	174,000	252,000	271,000	230,000	246,000	260,000	236,000	312,000	210,139	174,000	249,000	827,000
Cesium	mg/kg dw	5.30	0.570	0.301	0.271	0.325	0.255	0.315	0.265	0.950	1.76	0.255	0.308	5.30
Chromium	mg/kg dw	258	11.7	5.88	5.81	9.29	9.25	7.85	6.83	39.3	88.4	5.81	8.55	258
Cobalt	mg/kg dw	43.9	3.74	2.16	1.84	2.82	2.56	3.93	6.07	8.38	14.4	1.84	3.28	43.9
Copper	mg/kg dw	1,130	93.4	59.1	118	75.2	71.2	194	96.3	230	366	59.1	94.8	1,130
Iron	mg/kg dw	117,000	9,110	4,460	3,830	5,200	4,380	4,740	4,080	19,100	39,593	3,830	4,600	117,000
Lead	mg/kg dw	24.2	2.10	1.25	0.894	1.25	1.04	1.12	0.863	4.09	8.14	0.863	1.18	24.2
Lithium	mg/kg dw	48.5	4.52	2.37	2.08	2.80	2.47	2.65	1.82	8.40	16.2	1.82	2.56	48.5
Magnesium	mg/kg dw	34,100	4,000	3,480	3,540	3,740	3,510	4,170	3,280	7,478	10,761	3,280	3,640	34,100
Manganese	mg/kg dw	4,970	779	921	1,890	3,280	3,540	7,210	12,000	4,324	3,769	779	3,410	12,000
Mercury	mg/kg dw	0.225	0.0364	0.0189	0.0161	0.0266	0.0222	0.0212	0.0200	0.0483	0.0717	0.0161	0.0217	0.225
Molybdenum	mg/kg dw	11.1	0.620	0.490	0.755	0.703	0.626	0.998	1.33	2.08	3.66	0.490	0.729	11.1
Nickel	mg/kg dw	105	8.23	4.41	4.38	5.67	6.38	6.17	8.18	18.6	35.0	4.38	6.28	105
Phosphorus	mg/kg dw	13,300	2,530	1,820	1,850	1,690	1,890	1,910	1,700	3,336	4,035	1,690	1,870	13,300
Potassium	mg/kg dw	19,300	3,750	3,550	3,640	3,610	2,980	3,480	3,370	5,460	5,597	2,980	3,580	19,300
Rubidium	mg/kg dw	49.3	7.70	6.43	5.89	6.69	5.67	5.26	5.03	11.5	15.3	5.03	6.16	49.3
Selenium	mg/kg dw	9.13	2.11	1.59	1.98	1.67	1.65	2.53	1.94	2.82	2.57	1.59	1.96	9.13
Silver	mg/kg dw	0.470	0.0398	0.0188	0.0216	0.0226	0.0298	0.0265	0.0191	0.0810	0.157	0.0188	0.0246	0.470
Sodium	mg/kg dw	2,740	351	311	350	306	292	341	312	625	855	292	326	2,740
Strontium	mg/kg dw	2,510	478	596	659	604	617	618	574	832	680	478	610	2,510
Tellurium	mg/kg dw	0.185	0.0310	0.0310	0.0280	0.0330	0.0260	<0.048	0.0360	0.0501	0.0552	0.0260	0.0310	0.185
Thallium	mg/kg dw	0.390	0.0457	0.0239	0.0255	0.0256	0.0255	0.0344	0.0422	0.0766	0.127	0.0239	0.0300	0.390
Tin	mg/kg dw	1.66	0.140	<0.10	<0.12	<0.10	<0.10	<0.24	<0.14	0.301	0.711	<0.10	0.140	1.66
Titanium	mg/kg dw	3,120	244	141	111	178	135	142	99.1	521	1,051	99.1	142	3,120
Uranium	mg/kg dw	3.68	0.354	0.229	0.206	0.219	0.192	0.210	0.172	0.658	1.22	0.172	0.214	3.68
Vanadium	mg/kg dw	380	26.2	13.8	10.9	17.1	13.2	16.9	14.2	61.5	129	10.9	15.6	380
Zinc	mg/kg dw	231	27.4	18.0	17.1	17.8	18.5	28.6	34.3	49.1	73.8	17.1	23.0	231
Zirconium	mg/kg dw	33.5	2.75	1.30	1.06	1.75	1.24	1.22	1.06	5.48	11.3	1.06	1.27	33.5

Notes: "-" = no data or summary statistic could not be calculated. Mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.9: Periphyton Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D), 2022

Analyte	Units	Exposed												
		Lower Edney Creek (E1)												
		E1-1	E1-2	E1-3	E1-4	E1-5	E1-6	E1-7	E1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22					
Moisture	mg/kg dw	92.1	89.8	83.7	93.6	78.4	76.4	87.3	70.4	84	8.25	70.4	85.5	93.6
Aluminum	mg/kg dw	2,860	2,210	11,100	4,160	12,300	11,600	6,810	14,000	8,130	4,676	2,210	8,955	14,000
Antimony	mg/kg dw	0.0220	0.0230	0.0560	0.0260	0.0490	0.0960	0.0850	0.0960	0.0566	0.0321	0.0220	0.0525	0.0960
Arsenic	mg/kg dw	2.79	2.78	12.8	3.01	11.4	12.7	9.48	8.94	7.99	4.46	2.78	9.21	12.8
Barium	mg/kg dw	31.3	24.1	112	190	157	291	103	725	204	227	24.1	134	725
Beryllium	mg/kg dw	0.0780	0.0650	0.529	0.162	0.411	0.434	0.224	0.450	0.294	0.183	0.0650	0.318	0.529
Bismuth	mg/kg dw	0.0230	0.0170	0.0540	0.0150	0.0890	0.0840	0.0510	0.0850	0.0522	0.0314	0.0150	0.0525	0.0890
Boron	mg/kg dw	5.80	6.60	19.4	6.90	11.9	12.3	56.2	46.7	20.7	19.6	5.80	12.1	56.2
Cadmium	mg/kg dw	0.0730	0.0980	0.473	0.0810	0.275	0.284	0.248	0.363	0.237	0.144	0.0730	0.262	0.473
Calcium	mg/kg dw	2,110	1,960	13,400	3,910	9,300	11,800	16,800	16,900	9,522	6,225	1,960	10,550	16,900
Cesium	mg/kg dw	0.346	0.247	1.16	0.369	1.36	1.12	0.808	0.957	0.796	0.426	0.247	0.882	1.36
Chromium	mg/kg dw	30.9	40.1	416	9.94	32.0	34.3	23.2	20.4	75.9	138	9.94	31.4	416
Cobalt	mg/kg dw	2.54	2.19	12.2	3.26	11.7	10.3	6.87	11.9	7.62	4.44	2.19	8.59	12.2
Copper	mg/kg dw	17.6	17.0	49.6	102	214	293	147	823	208	267	17.0	124	823
Iron	mg/kg dw	5,880	4,790	30,300	6,840	25,000	22,800	15,000	18,200	16,101	9,632	4,790	16,600	30,300
Lead	mg/kg dw	1.33	1.01	3.58	1.41	5.97	6.19	3.28	6.13	3.61	2.25	1.01	3.43	6.19
Lithium	mg/kg dw	3.40	2.47	5.95	3.14	13.4	11.6	7.19	8.29	6.93	4.02	2.47	6.57	13.4
Magnesium	mg/kg dw	1,530	1,280	4,600	2,840	7,020	6,100	4,800	6,450	4,328	2,221	1,280	4,700	7,020
Manganese	mg/kg dw	284	296	1,190	264	1,200	1,150	1,490	2,500	1,047	767	264	1,170	2,500
Mercury	mg/kg dw	0.0450	0.0350	0.0377	0.0530	0.0637	0.0580	0.0450	0.0578	0.0494	0.0103	0.0350	0.0490	0.0637
Molybdenum	mg/kg dw	0.478	0.659	3.54	0.379	1.44	1.30	1.72	1.88	1.42	1.03	0.379	1.37	3.54
Nickel	mg/kg dw	10.0	9.82	47.7	10.2	25.4	24.2	16.8	16.6	20.1	12.7	9.82	16.7	47.7
Phosphorus	mg/kg dw	696	860	1,770	716	1,860	1,670	2,930	2,020	1,565	773	696	1,720	2,930
Potassium	mg/kg dw	1,300	1,520	3,470	1,200	2,420	2,430	6,040	3,690	2,759	1,624	1,200	2,425	6,040
Rubidium	mg/kg dw	3.42	2.98	8.10	3.12	10.4	8.75	11.4	8.97	7.14	3.44	2.98	8.43	11.4
Selenium	mg/kg dw	0.270	0.410	1.08	0.300	0.940	1.16	0.830	1.98	0.871	0.569	0.270	0.885	1.98
Silver	mg/kg dw	0.0224	0.0193	0.133	0.0267	0.129	0.115	0.0709	0.149	0.0832	0.0548	0.0193	0.0930	0.149
Sodium	mg/kg dw	206	194	293	249	447	372	351	430	318	97.5	194	322	447
Strontium	mg/kg dw	17.5	14.8	83.1	67.3	87.1	200	87.7	292	106	94.3	14.8	85.1	292
Tellurium	mg/kg dw	<0.020	<0.020	0.0210	<0.020	0.0320	0.0310	<0.020	0.0330	0.0246	0.00618	<0.020	0.0205	0.0330
Thallium	mg/kg dw	0.0265	0.0217	0.0737	0.0191	0.0766	0.0692	0.0649	0.0554	0.0509	0.0245	0.0191	0.0602	0.0766
Tin	mg/kg dw	<0.10	<0.10	0.230	0.120	0.280	0.330	0.220	0.420	0.225	0.113	<0.10	0.225	0.420
Titanium	mg/kg dw	147	112	266	405	647	662	386	554	397	213	112	396	662
Uranium	mg/kg dw	0.134	0.120	2.73	0.130	0.544	0.552	0.386	0.449	0.631	0.868	0.120	0.418	2.73
Vanadium	mg/kg dw	12.0	11.1	62.4	20.9	59.5	60.2	34.7	49.7	38.8	22.0	11.1	42.2	62.4
Zinc	mg/kg dw	15.3	15.3	88.9	15.1	61.8	50.9	39.6	53.5	42.5	26.6	15.1	45.2	88.9
Zirconium	mg/kg dw	1.64	1.36	7.22	3.25	7.58	7.31	4.68	6.10	4.89	2.56	1.36	5.39	7.58

Notes: "-" = no data or summary statistic could not be calculated. Mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.10: Caddisfly Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (E1; Exposed and EDC-D; Reference), 2022

Analyte	Units	Reference												
		Lower Edney Creek (EDC-D)												
		EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-6	EDC-D-7	EDC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		4-Aug-22	4-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22					
Moisture	mg/kg dw	81.5	83.9	78.7	66.6	83.0	85.8	74.9	73.5	78.5	6.45	66.6	80.1	85.8
Aluminum	mg/kg dw	650	497	1,610	3,400	1,120	565	6,900	344	1,886	2,258	344	885	6,900
Antimony	mg/kg dw	0.0190	0.0240	0.0600	0.0330	0.0380	0.0310	0.0300	<0.010	0.0306	0.0134	<0.010	0.0305	0.0600
Arsenic	mg/kg dw	2.91	2.16	7.44	4.20	3.36	1.50	5.24	0.901	3.46	2.14	0.901	3.14	7.44
Barium	mg/kg dw	31.0	13.9	90.3	22.9	64.8	26.7	112	6.34	46	38.6	6.34	28.8	112
Beryllium	mg/kg dw	0.0230	0.0140	0.0820	0.0900	0.0510	0.0180	0.132	0.0120	0.0528	0.0444	0.0120	0.0370	0.132
Bismuth	mg/kg dw	<0.010	0.124	0.0150	0.0320	0.0100	0.0360	0.0320	<0.010	0.0336	0.0391	<0.010	0.0235	0.124
Boron	mg/kg dw	<1.0	<1.0	1.50	1.00	2.40	<1.0	1.70	<1.0	1.32	0.556	<1.0	1.00	2.40
Cadmium	mg/kg dw	0.319	0.369	0.295	0.307	0.474	0.380	0.282	0.0530	0.310	0.121	0.0530	0.313	0.474
Calcium	mg/kg dw	1,570	903	2,110	2,210	2,350	1,170	3,090	1,310	1,839	728	903	1,840	3,090
Cesium	mg/kg dw	0.0789	0.0489	0.180	0.311	0.130	0.0979	0.388	0.0181	0.157	0.130	0.0181	0.114	0.388
Chromium	mg/kg dw	4.11	2.42	10.8	32.9	15.7	5.27	9.95	2.50	10.5	10.2	2.42	7.61	32.9
Cobalt	mg/kg dw	1.16	0.585	3.02	3.83	1.99	1.05	4.40	0.257	2.04	1.55	0.257	1.58	4.40
Copper	mg/kg dw	17.2	23.1	19.7	19.4	23.1	19.9	22.9	12.7	19.8	3.56	12.7	19.8	23.1
Iron	mg/kg dw	1,320	913	4,450	7,210	2,560	1,080	11,300	831	3,708	3,788	831	1,940	11,300
Lead	mg/kg dw	0.324	0.548	1.33	1.18	0.563	0.363	1.23	0.150	0.711	0.464	0.150	0.556	1.33
Lithium	mg/kg dw	0.620	<0.50	1.52	3.74	1.10	<0.50	5.41	<0.50	1.74	1.89	<0.50	0.860	5.41
Magnesium	mg/kg dw	1,490	1,280	1,760	3,950	1,700	1,440	4,030	1,440	2,136	1,154	1,280	1,595	4,030
Manganese	mg/kg dw	474	257	1,100	270	870	466	569	82.9	511	336	82.9	470	1,100
Mercury	mg/kg dw	0.0591	0.102	0.0548	0.0579	0.0698	0.0769	0.0853	0.0295	0.0669	0.0219	0.0295	0.0644	0.102
Molybdenum	mg/kg dw	5.60	2.65	4.56	2.12	2.28	2.91	3.90	3.69	3.46	1.21	2.12	3.30	5.60
Nickel	mg/kg dw	3.88	5.88	8.01	21.5	10.9	4.59	9.34	1.46	8.20	6.19	1.46	6.94	21.5
Phosphorus	mg/kg dw	9,140	7,970	7,430	5,700	7,840	8,680	8,490	8,210	7,932	1,045	5,700	8,090	9,140
Potassium	mg/kg dw	9,200	7,880	8,790	5,100	8,780	7,960	7,120	5,490	7,540	1,534	5,100	7,920	9,200
Rubidium	mg/kg dw	3.14	2.02	3.96	2.93	3.67	2.20	2.94	1.29	2.77	0.886	1.29	2.94	3.96
Selenium	mg/kg dw	1.21	1.77	1.51	1.10	1.97	1.85	1.63	0.670	1.46	0.440	0.670	1.57	1.97
Silver	mg/kg dw	0.0343	0.0480	0.0406	0.0566	0.0502	0.0368	0.119	0.0117	0.0496	0.0311	0.0117	0.0443	0.119
Sodium	mg/kg dw	3,280	2,840	2,520	1,910	2,980	3,100	5,760	2,580	3,121	1,147	1,910	2,910	5,760
Strontium	mg/kg dw	11.9	5.60	22.4	12.8	17.3	7.92	24.5	7.65	13.8	7.02	5.60	12.4	24.5
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0550	<0.020	0.0244	-	<0.020	0.0200	0.0550
Thallium	mg/kg dw	0.0111	0.00750	0.0193	0.0166	0.0188	0.00830	0.0140	0.00360	0.0124	0.00572	0.00360	0.0126	0.0193
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	27.2	17.9	80.7	160	43.6	22.1	252	31.1	79.3	84.3	17.9	37.4	252
Uranium	mg/kg dw	0.0567	0.0400	0.160	0.182	0.178	0.0434	0.149	0.0166	0.103	0.0701	0.0166	0.103	0.182
Vanadium	mg/kg dw	2.40	1.69	9.81	17.1	5.32	2.60	34.0	2.85	9.47	11.2	1.69	4.08	34.0
Zinc	mg/kg dw	98.8	106	110	73.2	138	160	114	80.6	110	28.4	73.2	108	160
Zirconium	mg/kg dw	0.530	0.330	1.47	2.30	0.920	0.520	2.52	0.200	1.10	0.902	0.200	0.725	2.52

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.10: Caddisfly Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (E1; Exposed and EDC-D; Reference), 2022

Analyte	Units	Exposed												
		Lower Hazeltine Creek (HAC-D)												
		HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5	HAC-D-6	HAC-D-7	HAC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22					
Moisture	mg/kg dw	75.7	71.6	74.0	72.6	76.2	73.6	70.1	75.0	73.6	2.09	70.1	73.8	76.2
Aluminum	mg/kg dw	222	311	357	339	2,040	130	186	56.9	455	649	56.9	266	2,040
Antimony	mg/kg dw	0.0290	0.0250	0.0350	0.0270	0.0490	0.0220	0.0190	0.0150	0.0276	0.0106	0.0150	0.0260	0.0490
Arsenic	mg/kg dw	0.758	0.874	0.946	0.982	1.90	0.644	0.782	0.512	0.925	0.423	0.512	0.828	1.90
Barium	mg/kg dw	17.7	20.0	23.5	42.9	14.6	8.07	12.7	3.44	17.9	12.0	3.44	16.2	42.9
Beryllium	mg/kg dw	<0.010	<0.010	0.0150	0.0110	0.0440	<0.010	<0.010	<0.010	0.0150	0.0132	<0.010	0.0100	0.0440
Bismuth	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010
Boron	mg/kg dw	<1.0	<1.0	1.40	<1.0	1.50	<1.0	<1.0	<1.0	1.11	0.0468	<1.0	1.00	1.50
Cadmium	mg/kg dw	0.457	0.638	0.528	0.592	0.181	0.156	0.193	0.0580	0.350	0.227	0.0580	0.325	0.638
Calcium	mg/kg dw	934	1,230	2,240	1,120	3,580	712	980	549	1,418	1,011	549	1,050	3,580
Cesium	mg/kg dw	0.0352	0.0375	0.0458	0.0498	0.0689	0.0220	0.0269	0.0130	0.0374	0.0176	0.0130	0.0364	0.0689
Chromium	mg/kg dw	0.510	1.18	1.22	1.29	2.59	0.500	0.860	<0.20	1.04	0.704	<0.20	1.02	2.59
Cobalt	mg/kg dw	0.493	0.626	0.960	0.882	1.04	0.573	0.488	0.227	0.661	0.277	0.227	0.600	1.04
Copper	mg/kg dw	30.4	39.0	45.6	41.1	30.1	27.3	28.3	18.3	32.5	8.82	18.3	30.2	45.6
Iron	mg/kg dw	437	565	754	672	2,370	356	396	229	722	687	229	501	2,370
Lead	mg/kg dw	0.178	0.202	0.250	0.238	3.94	0.122	0.130	0.0580	0.640	1.34	0.0580	0.190	3.94
Lithium	mg/kg dw	<0.50	<0.50	<0.50	<0.50	0.880	<0.50	<0.50	<0.50	0.548	-	<0.50	0.500	0.880
Magnesium	mg/kg dw	1,340	1,460	1,240	1,300	1,680	1,220	1,070	987	1,287	217	987	1,270	1,680
Manganese	mg/kg dw	575	492	777	873	539	472	534	223	561	197	223	536	873
Mercury	mg/kg dw	0.0466	0.0482	0.0673	0.0586	0.0472	0.0500	0.0353	0.0433	0.0496	0.00968	0.0353	0.0477	0.0673
Molybdenum	mg/kg dw	4.15	3.07	3.25	3.55	3.88	3.88	4.15	3.99	3.74	0.408	3.07	3.88	4.15
Nickel	mg/kg dw	0.760	1.12	1.44	1.36	1.95	0.670	0.860	0.330	1.06	0.513	0.330	0.990	1.95
Phosphorus	mg/kg dw	7,730	8,340	7,180	7,440	6,790	7,220	6,340	6,450	7,186	666	6,340	7,200	8,340
Potassium	mg/kg dw	7,000	7,790	7,040	7,460	6,790	7,220	6,210	6,480	6,999	511	6,210	7,020	7,790
Rubidium	mg/kg dw	1.33	1.60	1.42	1.41	1.47	1.14	1.38	1.08	1.35	0.171	1.08	1.40	1.60
Selenium	mg/kg dw	5.56	5.59	5.43	5.13	4.04	3.86	3.21	3.84	4.58	0.944	3.21	4.58	5.59
Silver	mg/kg dw	0.00940	0.0131	0.0201	0.0186	0.0281	0.00680	0.00650	<0.0050	0.0134	0.00803	<0.0050	0.0112	0.0281
Sodium	mg/kg dw	2,410	2,600	1,970	2,080	2,760	2,790	2,170	2,240	2,378	312	1,970	2,325	2,790
Strontium	mg/kg dw	7.03	9.27	11.1	7.22	14.1	5.18	7.72	4.12	8.22	3.22	4.12	7.47	14.1
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00480	0.00410	0.00460	0.00440	0.00550	0.00220	0.00400	<0.0020	0.00395	0.00120	<0.0020	0.00425	0.00550
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	0.110	<0.10	0.100	<0.10	0.101	0.00468	<0.10	0.100	0.110
Titanium	mg/kg dw	11.3	15.7	20.2	17.7	145	7.54	11.0	3.41	29.0	47.2	3.41	13.5	145
Uranium	mg/kg dw	0.0270	0.0371	0.0828	0.0485	0.0765	0.0261	0.0190	0.00800	0.0406	0.0269	0.00800	0.0320	0.0828
Vanadium	mg/kg dw	1.01	1.36	1.90	1.61	12.2	0.860	1.02	0.420	2.55	3.93	0.420	1.19	12.2
Zinc	mg/kg dw	168	146	147	140	87.3	100	84.3	70.7	118	36.3	70.7	120	168
Zirconium	mg/kg dw	<0.20	0.240	0.280	0.260	2.30	0.290	<0.20	<0.20	0.496	0.756	<0.20	0.250	2.30

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.10: Caddisfly Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (E1; Exposed and EDC-D; Reference), 2022

Analyte	Units	Exposed												
		Lower Edney Creek (E1)												
		E1-1	E1-2	E1-3	E1-4	E1-5	E1-6	E1-7	E1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22					
Moisture	mg/kg dw	77.6	81.3	82.2	78.5	80.4	83.0	76.8	78.4	79.8	2.27	76.8	79.5	83.0
Aluminum	mg/kg dw	89.5	2,030	2,900	5,990	4,140	2,980	4,520	980	2,954	1,929	89.5	2,940	5,990
Antimony	mg/kg dw	<0.010	0.0460	0.0850	0.0800	0.0730	0.0700	0.0760	0.0270	0.0584	0.0239	<0.010	0.0715	0.0850
Arsenic	mg/kg dw	0.592	4.88	4.69	7.54	6.05	5.22	6.24	1.86	4.63	2.31	0.592	5.05	7.54
Barium	mg/kg dw	4.75	86.9	129	187	163	175	179	55.6	123	67	4.75	146	187
Beryllium	mg/kg dw	<0.010	0.0630	0.116	0.202	0.148	0.121	0.164	0.0360	0.108	0.0617	<0.010	0.118	0.202
Bismuth	mg/kg dw	<0.010	0.0180	0.0270	0.0430	0.0320	0.0260	0.0330	<0.010	0.0249	0.00917	<0.010	0.0265	0.0430
Boron	mg/kg dw	<1.0	2.10	3.90	6.50	5.30	4.70	4.40	1.40	3.66	1.91	<1.0	4.15	6.50
Cadmium	mg/kg dw	0.0950	0.319	1.44	0.962	0.903	1.24	0.923	0.695	0.822	0.446	0.0950	0.913	1.44
Calcium	mg/kg dw	1,030	1,890	3,370	4,520	3,120	2,810	3,530	1,770	2,755	1,129	1,030	2,965	4,520
Cesium	mg/kg dw	0.0137	0.214	0.318	0.587	0.392	0.265	0.447	0.0956	0.292	0.187	0.0137	0.292	0.587
Chromium	mg/kg dw	0.460	12.1	26.4	30.0	23.2	9.81	13.8	4.60	15.0	10.5	0.460	13.0	30.0
Cobalt	mg/kg dw	0.158	3.19	5.47	7.77	6.32	5.34	6.06	1.62	4.49	2.59	0.158	5.40	7.77
Copper	mg/kg dw	14.4	34.0	81.4	127	118	117	130	57.5	84.9	45.1	14.4	99.2	130
Iron	mg/kg dw	237	4,060	6,440	12,100	8,410	6,570	9,370	2,050	6,155	3,915	237	6,505	12,100
Lead	mg/kg dw	0.0630	0.998	1.60	2.78	1.96	1.69	2.05	0.510	1.46	0.885	0.0630	1.64	2.78
Lithium	mg/kg dw	<0.50	2.18	2.78	5.71	4.09	2.72	4.20	0.940	2.89	1.67	<0.50	2.75	5.71
Magnesium	mg/kg dw	1,270	2,120	2,760	4,070	3,240	2,830	3,240	1,680	2,651	917	1,270	2,795	4,070
Manganese	mg/kg dw	103	717	1,080	1,420	1,310	1,680	1,650	591	1,069	558	103	1,195	1,680
Mercury	mg/kg dw	0.0421	0.0417	0.0658	0.0613	0.0480	0.0577	0.0489	0.0743	0.0550	0.0117	0.0417	0.0533	0.0743
Molybdenum	mg/kg dw	3.80	2.36	1.14	1.39	1.86	1.42	1.84	3.94	2.22	1.09	1.14	1.85	3.94
Nickel	mg/kg dw	0.630	9.45	20.2	21.7	16.8	10.4	12.2	4.03	11.9	7.43	0.630	11.3	21.7
Phosphorus	mg/kg dw	8,190	7,960	8,370	7,210	6,890	8,010	6,870	10,300	7,975	1,108	6,870	7,985	10,300
Potassium	mg/kg dw	6,810	10,500	15,600	15,100	13,700	17,000	13,200	10,500	12,801	3,342	6,810	13,450	17,000
Rubidium	mg/kg dw	2.20	4.78	7.33	9.39	6.10	6.25	6.40	4.37	5.85	2.13	2.20	6.18	9.39
Selenium	mg/kg dw	0.910	1.31	1.75	1.52	1.44	1.73	1.59	1.78	1.50	0.290	0.910	1.56	1.78
Silver	mg/kg dw	0.0254	0.0361	0.130	0.131	0.0882	0.0968	0.0919	0.0704	0.0837	0.0387	0.0254	0.0900	0.131
Sodium	mg/kg dw	3,040	3,080	3,840	3,510	3,380	3,870	2,690	3,460	3,359	406	2,690	3,420	3,870
Strontium	mg/kg dw	6.50	14.9	20.4	36.3	27.0	22.0	26.5	12.7	20.8	9.39	6.50	21.2	36.3
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.00290	0.0203	0.0358	0.0511	0.0351	0.0357	0.0306	0.0145	0.0282	0.0150	0.00290	0.0328	0.0511
Tin	mg/kg dw	<0.10	<0.10	<0.10	0.160	0.120	<0.10	0.110	<0.10	0.111	0.0201	<0.10	0.100	0.160
Titanium	mg/kg dw	4.17	96.4	158	327	224	152	232	54.2	156	105	4.17	155	327
Uranium	mg/kg dw	0.0130	0.151	0.428	0.527	0.383	0.403	0.352	0.0922	0.294	0.183	0.0130	0.368	0.527
Vanadium	mg/kg dw	0.420	8.60	16.0	30.9	19.3	15.0	24.6	4.56	14.9	10.2	0.420	15.5	30.9
Zinc	mg/kg dw	89.6	126	167	138	154	157	137	128	137	24.0	89.6	138	167
Zirconium	mg/kg dw	<0.20	1.54	2.47	4.09	3.12	2.57	3.45	0.850	2.29	1.21	<0.20	2.52	4.09

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.11: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2022

Analyte	Units	Reference												
		Lower Edney Creek (EDC-D)												
		EDC-D-1	EDC-D-2	EDC-D-3	EDC-D-4	EDC-D-5	EDC-D-6	EDC-D-7	EDC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		4-Aug-22	4-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22	3-Aug-22					
Moisture	mg/kg dw	73.2	78.5	80.1	73.8	80.3	79.0	80.1	80.9	78.2	3.02	73.2	79.5	80.9
Aluminum	mg/kg dw	424	274	1,180	221	658	2,140	880	396	772	641	221	541	2,140
Antimony	mg/kg dw	0.0200	0.0180	0.0390	0.0110	0.0210	0.0330	0.0290	0.0210	0.0240	0.00902	0.0110	0.0210	0.0390
Arsenic	mg/kg dw	1.96	1.24	3.23	1.30	1.90	2.32	2.44	1.29	1.96	0.695	1.24	1.93	3.23
Barium	mg/kg dw	8.50	9.84	25.9	5.28	24.3	25.6	29.1	13.6	17.8	9.42	5.28	19.0	29.1
Beryllium	mg/kg dw	0.0140	<0.010	0.0370	<0.010	0.0240	0.0450	0.0290	0.0120	0.0226	0.0132	<0.010	0.0190	0.0450
Bismuth	mg/kg dw	<0.010	<0.010	0.0150	<0.010	<0.010	0.0100	<0.010	0.0760	0.0189	0.0265	<0.010	0.0100	0.0760
Boron	mg/kg dw	<1.0	<1.0	1.20	<1.0	<1.0	2.00	1.80	<1.0	1.25	0.376	<1.0	1.00	2.00
Cadmium	mg/kg dw	0.946	0.878	2.69	0.595	1.06	0.522	1.16	0.717	1.07	0.690	0.522	0.912	2.69
Calcium	mg/kg dw	1,800	1,480	2,390	2,570	1,430	3,130	1,500	1,440	1,968	649	1,430	1,650	3,130
Cesium	mg/kg dw	0.0625	0.0439	0.170	0.0379	0.0892	0.0911	0.116	0.0520	0.0828	0.0442	0.0379	0.0758	0.170
Chromium	mg/kg dw	2.02	1.60	3.77	1.04	2.36	2.26	2.89	1.76	2.21	0.837	1.04	2.14	3.77
Cobalt	mg/kg dw	0.896	0.666	1.85	0.626	1.02	1.32	1.41	0.732	1.06	0.430	0.626	0.958	1.85
Copper	mg/kg dw	38.0	29.6	39.4	38.8	30.8	33.8	32.1	26.6	33.6	4.71	26.6	33.0	39.4
Iron	mg/kg dw	848	591	2,260	460	1,340	2,830	1,720	896	1,368	843	460	1,118	2,830
Lead	mg/kg dw	0.198	0.170	0.596	0.106	0.341	0.666	0.443	0.312	0.354	0.202	0.106	0.326	0.666
Lithium	mg/kg dw	<0.50	<0.50	1.16	<0.50	0.640	0.980	0.830	<0.50	0.701	0.218	<0.50	0.570	1.16
Magnesium	mg/kg dw	1,300	1,640	1,540	1,900	1,610	1,820	1,500	1,340	1,581	210	1,300	1,575	1,900
Manganese	mg/kg dw	238	179	504	188	345	370	421	210	307	121	179	292	504
Mercury	mg/kg dw	0.120	0.103	0.110	0.0730	0.121	0.121	0.121	0.114	0.110	0.0165	0.0730	0.117	0.121
Molybdenum	mg/kg dw	0.670	0.659	0.811	0.583	0.950	0.791	1.02	0.613	0.762	0.160	0.583	0.730	1.02
Nickel	mg/kg dw	2.47	3.44	4.41	5.32	2.13	3.85	2.59	6.67	3.86	1.56	2.13	3.64	6.67
Phosphorus	mg/kg dw	7,140	8,510	7,770	9,310	8,800	8,010	8,880	8,960	8,422	725	7,140	8,655	9,310
Potassium	mg/kg dw	7,040	8,000	6,720	7,080	8,830	8,910	9,750	8,600	8,116	1,085	6,720	8,300	9,750
Rubidium	mg/kg dw	2.88	3.49	5.23	2.74	3.49	1.90	3.93	2.44	3.26	1.03	1.90	3.18	5.23
Selenium	mg/kg dw	1.76	1.80	1.98	1.65	2.03	1.71	2.12	1.52	1.82	0.205	1.52	1.78	2.12
Silver	mg/kg dw	0.164	0.122	0.173	0.184	0.142	0.151	0.153	0.134	0.153	0.0205	0.122	0.152	0.184
Sodium	mg/kg dw	3,190	4,000	3,090	3,470	3,670	3,930	4,110	4,050	3,689	400	3,090	3,800	4,110
Strontium	mg/kg dw	9.63	8.80	14.0	10.3	7.69	16.5	9.36	12.0	11.0	2.95	7.69	9.96	16.5
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0143	0.00960	0.0260	0.00720	0.0155	0.0135	0.0166	0.00970	0.0140	0.00582	0.00720	0.0139	0.0260
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	18.2	11.2	50.6	9.28	27.7	27.7	36.0	15.2	24.5	14.0	9.28	23.0	50.6
Uranium	mg/kg dw	0.0448	0.0296	0.0908	0.0264	0.0598	0.0846	0.0856	0.0389	0.0576	0.0264	0.0264	0.0523	0.0908
Vanadium	mg/kg dw	1.52	1.04	4.32	0.920	2.61	8.64	3.44	1.47	3.00	2.58	0.920	2.06	8.64
Zinc	mg/kg dw	119	291	172	129	149	148	129	155	162	55.0	119	148	291
Zirconium	mg/kg dw	0.640	0.210	0.790	<0.20	0.460	0.760	0.610	0.280	0.494	0.242	<0.20	0.535	0.790

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.11: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2022

Analyte	Units	Exposed												
		Lower Hazeltine Creek (HAC-D)												
		HAC-D-1	HAC-D-2	HAC-D-3	HAC-D-4	HAC-D-5	HAC-D-6	HAC-D-7	HAC-D-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22	5-Aug-22					
Moisture	mg/kg dw	69.9	68.8	75.4	75.9	73.4	73.0	79.6	79.7	74.5	4.02	68.8	74.4	79.7
Aluminum	mg/kg dw	3,070	132	870	540	1,240	286	541	1,010	961	928	132	706	3,070
Antimony	mg/kg dw	0.0820	0.0230	0.0290	0.0280	0.0350	0.0180	0.0300	0.0390	0.0355	0.0199	0.0180	0.0295	0.0820
Arsenic	mg/kg dw	7.19	0.999	2.11	1.31	2.26	1.02	2.10	1.82	2.35	2.02	0.999	1.96	7.19
Barium	mg/kg dw	43.8	20.2	22.6	25.3	53.4	19.7	31.7	45.1	32.7	13.0	19.7	28.5	53.4
Beryllium	mg/kg dw	0.124	<0.010	0.0290	0.0220	0.0640	0.0110	0.0210	0.0360	0.0396	0.0384	<0.010	0.0255	0.124
Bismuth	mg/kg dw	0.0230	<0.010	0.0110	<0.010	<0.010	<0.010	<0.010	0.0100	0.0118	0.00522	<0.010	0.0100	0.0230
Boron	mg/kg dw	3.30	<1.0	1.40	2.60	1.80	<1.0	4.00	2.40	2.19	1.00	<1.0	2.10	4.00
Cadmium	mg/kg dw	1.31	0.548	0.958	1.01	1.53	0.772	2.31	0.744	1.15	0.566	0.548	0.984	2.31
Calcium	mg/kg dw	7,350	920	2,360	2,980	3,570	1,700	4,840	3,380	3,388	2,000	920	3,180	7,350
Cesium	mg/kg dw	0.362	0.0250	0.111	0.0879	0.121	0.0601	0.0860	0.122	0.122	0.102	0.0250	0.0994	0.362
Chromium	mg/kg dw	6.21	0.480	11.0	1.65	1.58	0.950	2.29	1.90	3.26	3.58	0.480	1.78	11.0
Cobalt	mg/kg dw	3.51	1.24	1.70	1.14	1.65	0.809	1.61	1.73	1.67	0.811	0.809	1.63	3.51
Copper	mg/kg dw	104	34.4	77.2	74.8	81.6	55.0	81.5	75.2	73	20.5	34.4	76.2	104
Iron	mg/kg dw	6,910	283	1,770	1,110	1,580	677	1,270	2,370	1,996	2,087	283	1,425	6,910
Lead	mg/kg dw	1.57	0.141	0.611	0.332	1.49	0.196	0.350	0.498	0.648	0.565	0.141	0.424	1.57
Lithium	mg/kg dw	2.64	<0.50	0.920	0.540	0.740	<0.50	0.560	1.05	0.931	0.731	<0.50	0.650	2.64
Magnesium	mg/kg dw	2,580	952	1,590	1,310	1,540	1,100	1,500	1,610	1,523	490	952	1,520	2,580
Manganese	mg/kg dw	702	538	454	836	1,230	820	1,390	1,140	889	335	454	828	1,390
Mercury	mg/kg dw	0.0906	0.0664	0.0633	0.0829	0.0810	0.0646	0.0842	0.0739	0.0759	0.0103	0.0633	0.0774	0.0906
Molybdenum	mg/kg dw	1.44	4.22	1.66	1.41	1.66	2.23	1.79	2.24	2.08	0.920	1.41	1.72	4.22
Nickel	mg/kg dw	6.27	0.930	87.8	1.75	6.03	1.51	2.23	2.92	13.7	30.0	0.930	2.58	87.8
Phosphorus	mg/kg dw	7,010	6,460	8,470	8,240	8,630	7,370	9,300	7,150	7,829	971	6,460	7,805	9,300
Potassium	mg/kg dw	6,770	4,500	6,390	7,050	7,440	6,130	8,210	6,450	6,618	1,084	4,500	6,610	8,210
Rubidium	mg/kg dw	4.08	1.07	2.92	2.78	3.49	2.24	3.35	2.04	2.75	0.948	1.07	2.85	4.08
Selenium	mg/kg dw	6.69	5.42	4.87	4.85	4.43	4.72	4.23	4.30	4.94	0.804	4.23	4.78	6.69
Silver	mg/kg dw	0.108	0.00910	0.0338	0.0271	0.0238	0.0230	0.0296	0.0341	0.0361	0.0301	0.00910	0.0284	0.108
Sodium	mg/kg dw	2,440	2,350	2,930	3,220	2,940	3,600	8,240	5,490	3,901	2,011	2,350	3,080	8,240
Strontium	mg/kg dw	47.8	6.12	14.5	14.1	22.1	11.6	19.2	18.4	19.2	12.6	6.12	16.4	47.8
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0507	0.00360	0.0115	0.00960	0.0122	0.00750	0.0120	0.0123	0.0149	0.0148	0.00360	0.0118	0.0507
Tin	mg/kg dw	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Titanium	mg/kg dw	135	6.62	47.4	26.2	35.5	20.3	34.4	65.7	46.4	39.9	6.62	35.0	135
Uranium	mg/kg dw	0.228	0.0348	0.0808	0.0621	0.0838	0.0438	0.0721	0.0894	0.0868	0.0602	0.0348	0.0764	0.228
Vanadium	mg/kg dw	19.2	0.770	5.40	2.77	4.70	2.14	3.94	7.38	5.79	5.79	0.770	4.32	19.2
Zinc	mg/kg dw	152	177	125	126	135	106	142	124	136	21.5	106	130	177
Zirconium	mg/kg dw	1.86	<0.20	0.510	0.460	0.400	0.250	0.420	0.680	0.598	0.532	<0.20	0.440	1.86

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

Table D.5.11: Composite-Taxa Benthic Invertebrate Tissue Chemistry Data for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek Exposed (E1) and Reference (EDC-D) Areas, 2022

Analyte	Units	Exposed												
		Lower Edney Creek (E1)												
		E1-1	E1-2	E1-3	E1-4	E1-5	E1-6	E1-7	E1-8	Mean	Standard Deviation	Minimum	Median	Maximum
		5-Aug-22	5-Aug-22	5-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22	4-Aug-22					
Moisture	mg/kg dw	79.5	84.4	84.8	75.0	84.3	82.4	77.4	79.5	80.9	3.63	75.0	81	84.8
Aluminum	mg/kg dw	1,000	1,360	360	271	1,730	1,380	356	2,280	1,092	730	271	1,180	2,280
Antimony	mg/kg dw	0.0230	0.0390	0.0140	0.0110	0.0440	0.0300	0.0160	0.0460	0.0279	0.0139	0.0110	0.0265	0.0460
Arsenic	mg/kg dw	2.34	2.02	1.12	1.13	3.03	2.52	1.44	4.72	2.29	1.20	1.12	2.18	4.72
Barium	mg/kg dw	10.9	15.8	5.34	5.53	87.6	57.9	11.7	37.7	29.1	29.9	5.34	13.8	87.6
Beryllium	mg/kg dw	0.0260	0.0440	0.0120	<0.010	0.0590	0.0500	0.0120	0.0680	0.0351	0.0230	<0.010	0.0350	0.0680
Bismuth	mg/kg dw	<0.010	0.0110	<0.010	<0.010	0.0140	0.0100	<0.010	0.0160	0.0114	0.00251	<0.010	0.0100	0.0160
Boron	mg/kg dw	1.60	1.00	<1.0	<1.0	1.70	1.50	<1.0	1.90	1.34	0.395	1.00	1.25	1.90
Cadmium	mg/kg dw	1.08	2.35	0.996	0.793	2.22	1.58	0.786	3.56	1.67	0.978	0.786	1.33	3.56
Calcium	mg/kg dw	2,040	2,170	1,600	1,470	2,350	2,110	1,050	4,990	2,222	1,198	1,050	2,075	4,990
Cesium	mg/kg dw	0.0966	0.141	0.0434	0.0433	0.210	0.117	0.0440	0.242	0.117	0.0769	0.0433	0.107	0.242
Chromium	mg/kg dw	3.84	3.51	0.770	1.04	5.06	5.41	1.14	4.74	3.19	1.93	0.770	3.68	5.41
Cobalt	mg/kg dw	1.69	2.17	0.910	1.04	3.03	2.27	1.01	4.00	2.02	1.09	0.910	1.93	4.00
Copper	mg/kg dw	35.0	27.6	22.8	56.2	77.4	74.5	34.8	128	57.0	35.4	22.8	45.6	128
Iron	mg/kg dw	1,760	2,860	618	537	3,610	2,540	671	4,220	2,102	1,431	537	2,150	4,220
Lead	mg/kg dw	0.373	0.709	0.139	0.135	0.881	0.751	0.190	0.911	0.511	0.337	0.135	0.541	0.911
Lithium	mg/kg dw	0.930	1.45	<0.50	<0.50	1.60	1.26	<0.50	2.04	1.10	0.432	<0.50	1.10	2.04
Magnesium	mg/kg dw	1,830	2,170	1,570	1,830	2,420	2,310	1,480	2,470	2,010	384	1,480	2,000	2,470
Manganese	mg/kg dw	378	209	101	125	597	407	206	600	328	199	101	294	600
Mercury	mg/kg dw	0.0537	0.0758	0.0463	0.0545	0.0780	0.102	0.0642	0.127	0.0752	0.0274	0.0463	0.0700	0.127
Molybdenum	mg/kg dw	0.491	0.606	0.262	0.325	0.815	1.05	2.52	0.895	0.870	0.721	0.262	0.710	2.52
Nickel	mg/kg dw	6.21	10.5	20.1	1.64	3.18	5.61	6.54	4.82	7.32	5.78	1.64	5.91	20.1
Phosphorus	mg/kg dw	9,460	9,510	9,860	9,640	9,580	9,980	8,080	9,210	9,415	589	8,080	9,545	9,980
Potassium	mg/kg dw	9,130	8,540	9,570	9,240	11,100	12,200	7,720	9,460	9,620	1,416	7,720	9,350	12,200
Rubidium	mg/kg dw	5.41	4.92	4.69	4.61	5.52	4.38	3.18	8.15	5.11	1.43	3.18	4.80	8.15
Selenium	mg/kg dw	1.20	1.98	2.18	1.71	1.91	2.20	1.74	2.55	1.93	0.404	1.20	1.94	2.55
Silver	mg/kg dw	0.104	0.158	0.0558	0.0907	0.108	0.185	0.0362	0.0778	0.102	0.0496	0.0362	0.0974	0.185
Sodium	mg/kg dw	5,690	12,900	11,400	4,260	9,590	9,570	3,110	3,680	7,525	3,792	3,110	7,630	12,900
Strontium	mg/kg dw	12.6	11.8	5.54	6.83	13.3	13.8	5.93	19.0	11.1	4.68	5.54	12.2	19.0
Tellurium	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020
Thallium	mg/kg dw	0.0176	0.0247	0.0135	0.00890	0.0240	0.0193	0.00630	0.0266	0.0176	0.00752	0.00630	0.0184	0.0266
Tin	mg/kg dw	<0.10	<0.10	<0.10	0.130	<0.10	<0.10	<0.10	<0.10	0.104	-	<0.10	0.100	0.130
Titanium	mg/kg dw	45.8	59.4	28.3	14.4	105	77.0	17.8	119	58.3	39.4	14.4	52.6	119
Uranium	mg/kg dw	0.0601	0.114	0.0268	0.0251	0.157	0.130	0.0321	0.160	0.0881	0.0585	0.0251	0.0870	0.160
Vanadium	mg/kg dw	4.04	7.49	1.73	1.32	9.79	6.75	1.46	11.4	5.50	3.94	1.32	5.40	11.4
Zinc	mg/kg dw	112	137	106	124	143	128	106	121	122	13.7	106	122	143
Zirconium	mg/kg dw	0.600	0.800	0.300	<0.20	1.34	1.12	0.280	1.43	0.759	0.485	<0.20	0.700	1.43

Value exceeds the British Columbia interim guideline for selenium in invertebrate tissue (4 mg/kg dw; BCMOE 2014).

Notes: "-" = no data or summary statistic could not be calculated. mg/kg dw = milligrams per kilogram dry weight. All summary statistics are reported to three significant digits for display purposes and were calculated using the Kaplan-Meier method.

APPENDIX E
STATISTICAL ANALYSES – LAKES

APPENDIX E.1
SEDIMENT QUALITY

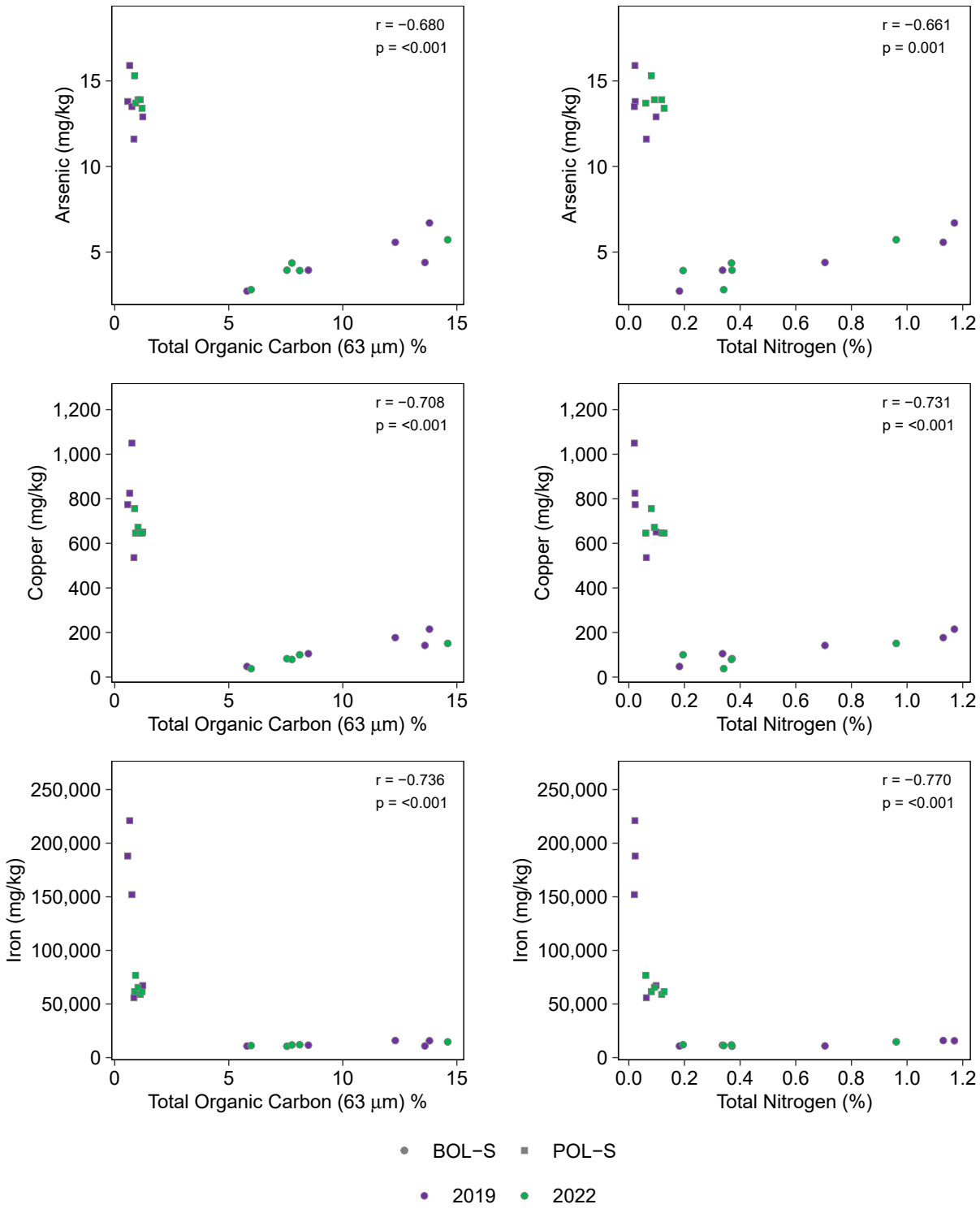

Figure E.1.1: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022

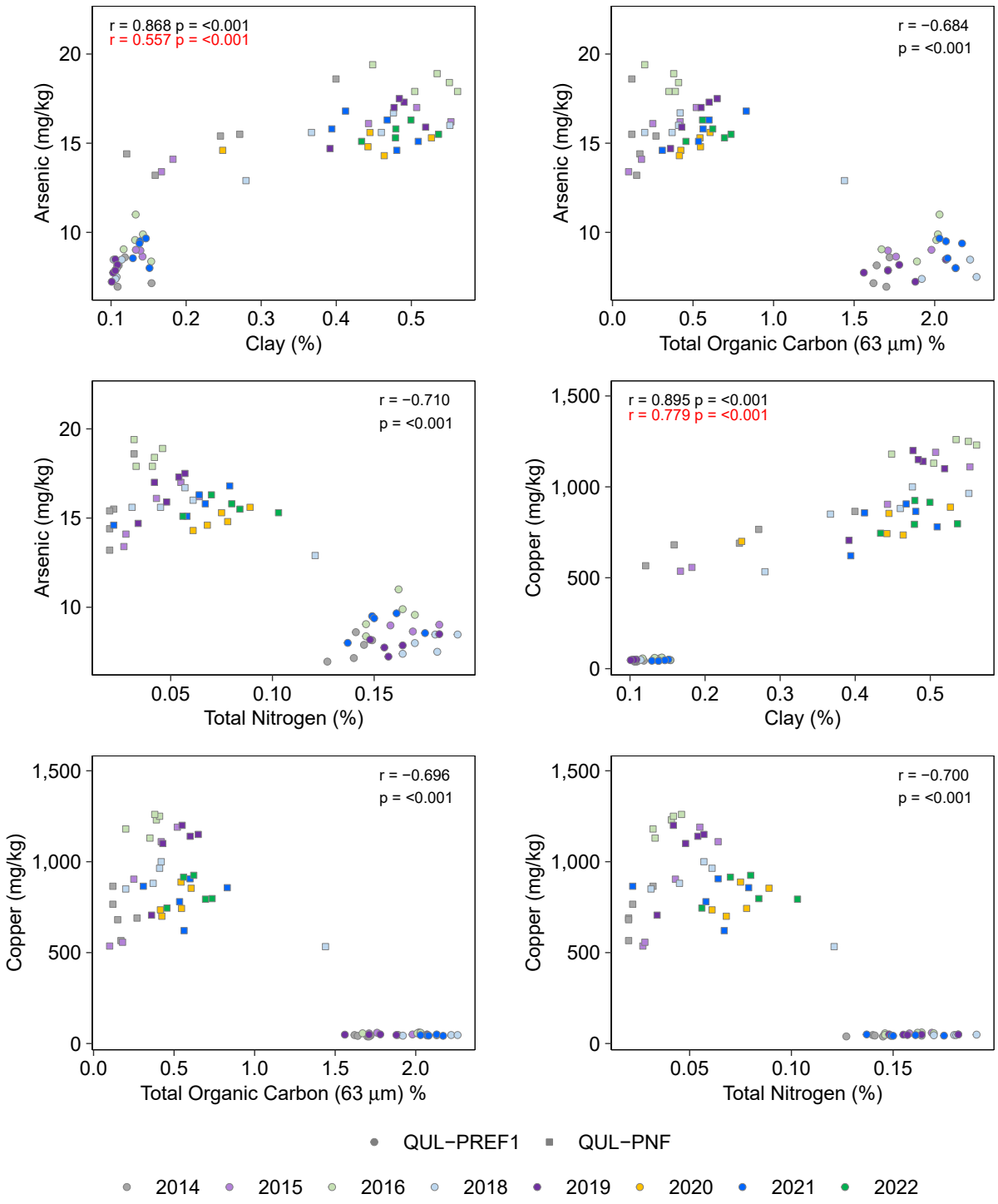

Figure E.1.2: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from deep exposed and reference sampling areas of Quesnel Lake (QUL−PNF, QUL-PREF1) are shown in black font on each plot. Results of correlations that only evaluated data from the deep exposed area of Quesnel Lake (QUL−PNF) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

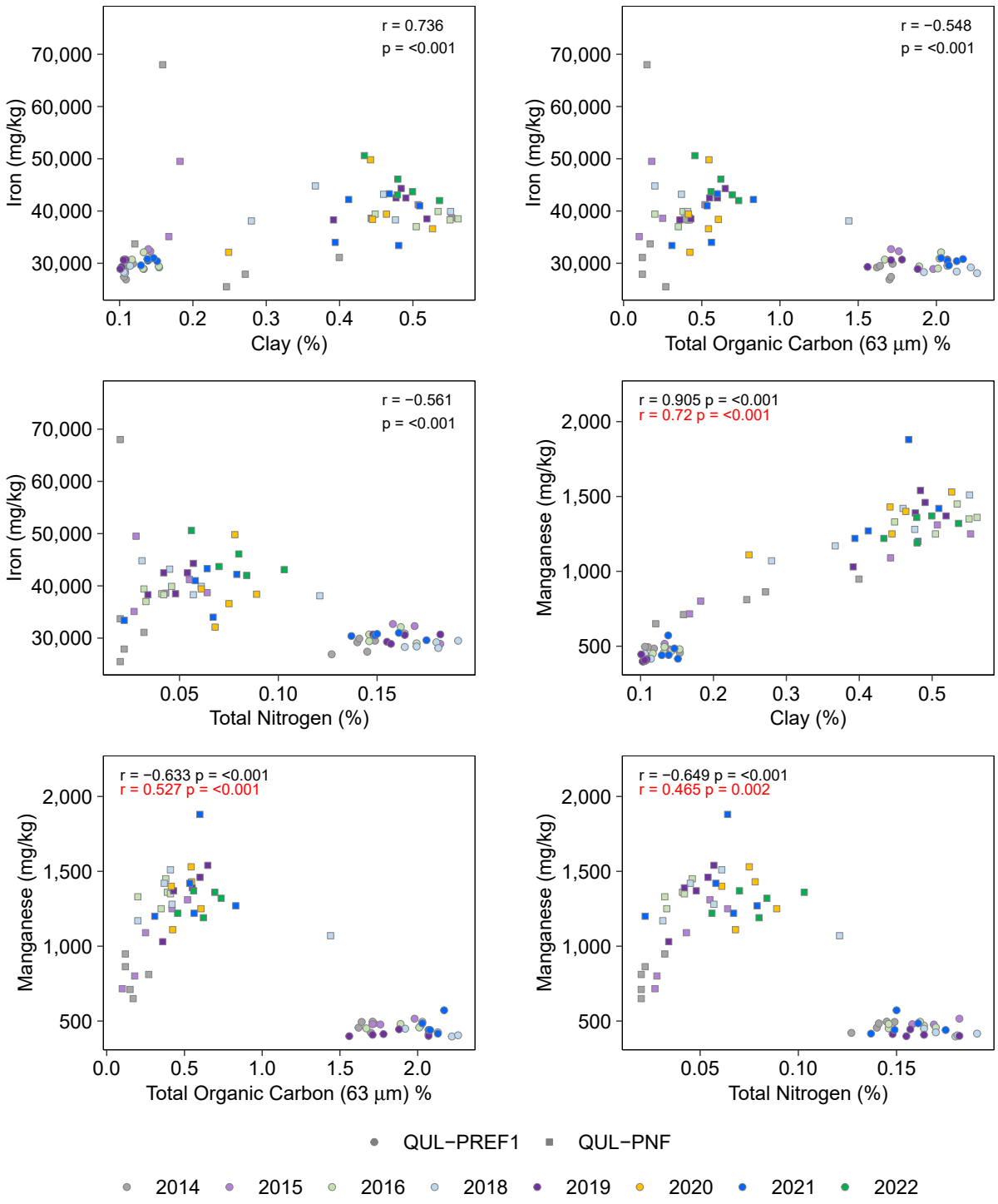

Figure E.1.2: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from deep exposed and reference sampling areas of Quesnel Lake (QUL−PNF, QUL-PREF1) are shown in black font on each plot. Results of correlations that only evaluated data from the deep exposed area of Quesnel Lake (QUL−PNF) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

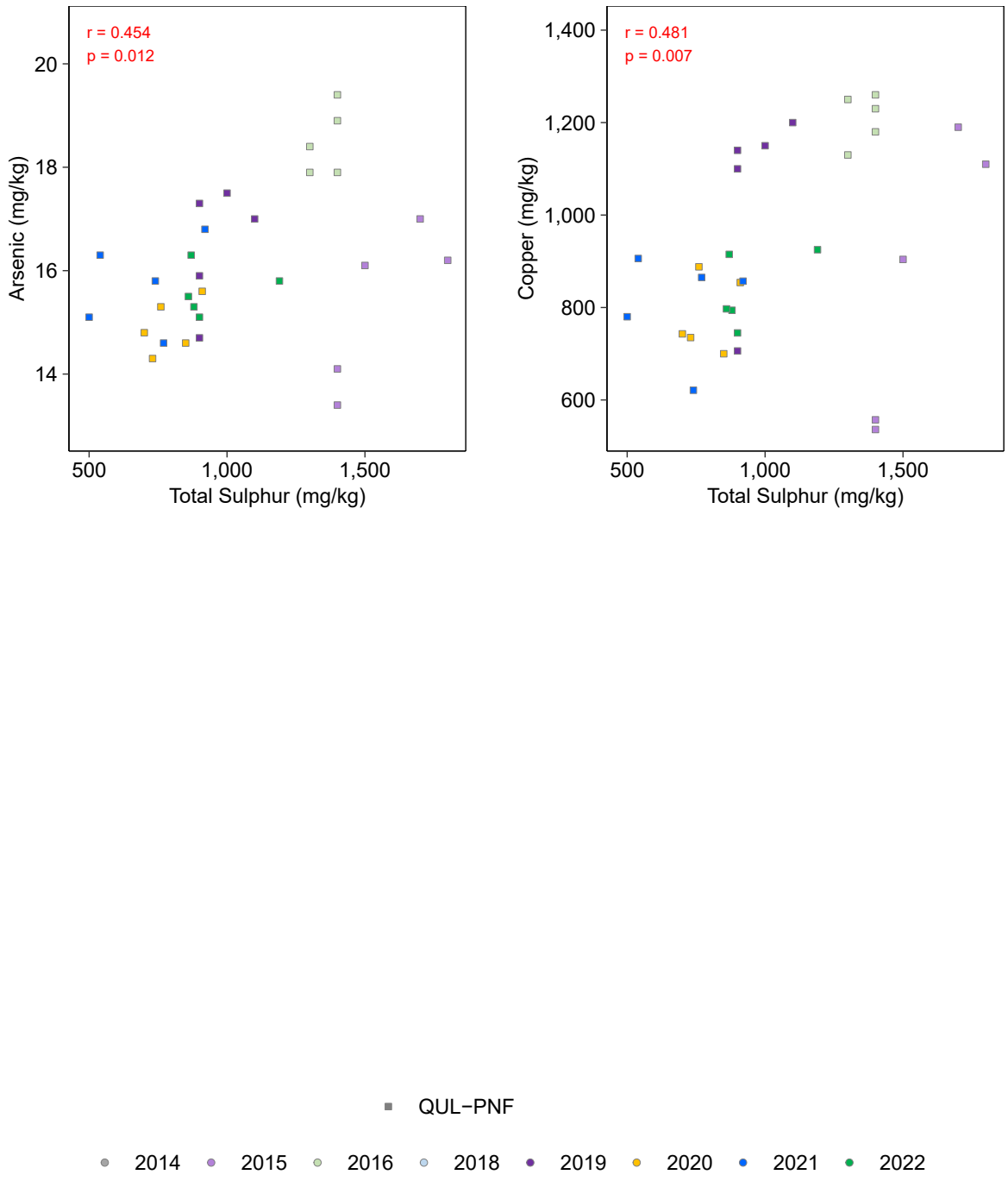

Figure E.1.2: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from deep exposed and reference sampling areas of Quesnel Lake (QUL−PNF, QUL-PREF1) are shown in black font on each plot. Results of correlations that only evaluated data from the deep exposed area of Quesnel Lake (QUL−PNF) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

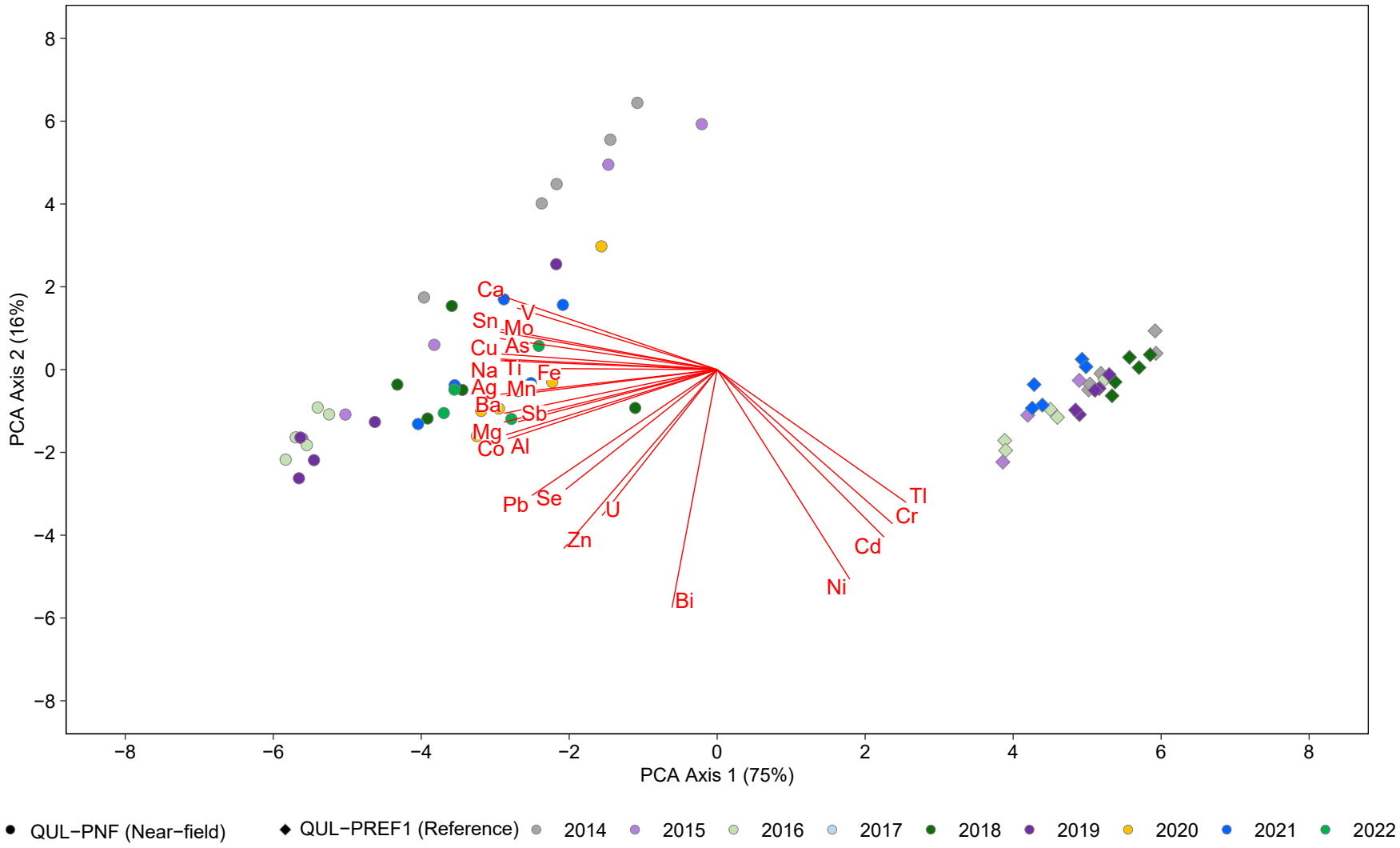

Figure E.1.3: Biplot of Principal Components Analysis (PCA) Axis Scores (PC-1, PC-2) for Metal Concentrations in Sediment (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: PCA conducted on correlation matrix with $\log_{10}$−transformed concentrations. Vectors represent the PC loadings for each parameter (scaled). Parameters that had more than 25% censored data were excluded from the analyses.

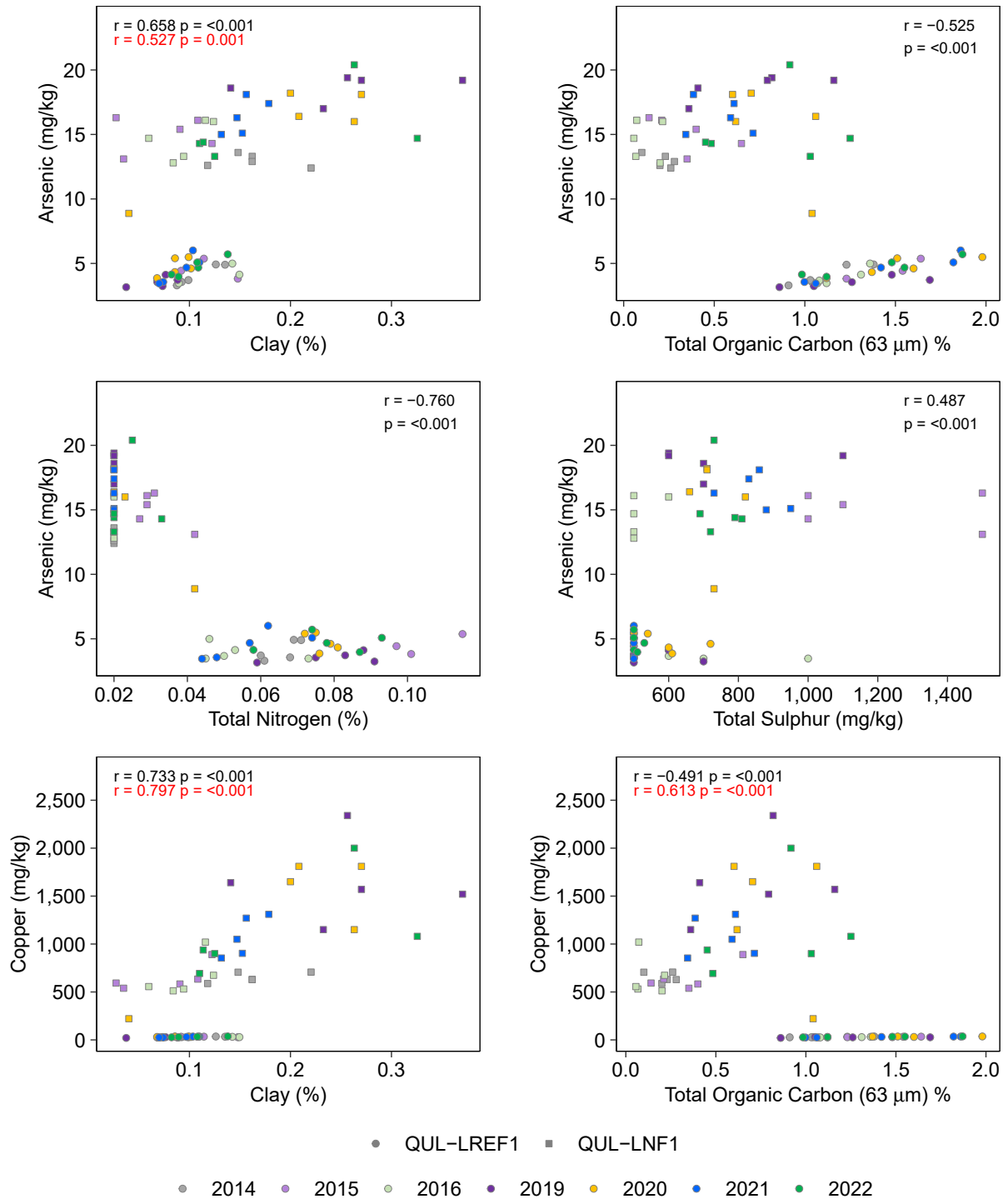

Figure E.1.4: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from shallow exposed and reference sampling areas of Quesnel Lake (QUL−LREF1, QUL−LNF1) are shown in black font on each plot. Results of correlations that only evaluated data from the shallow exposed area of Quesnel Lake (QUL−LNF1) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

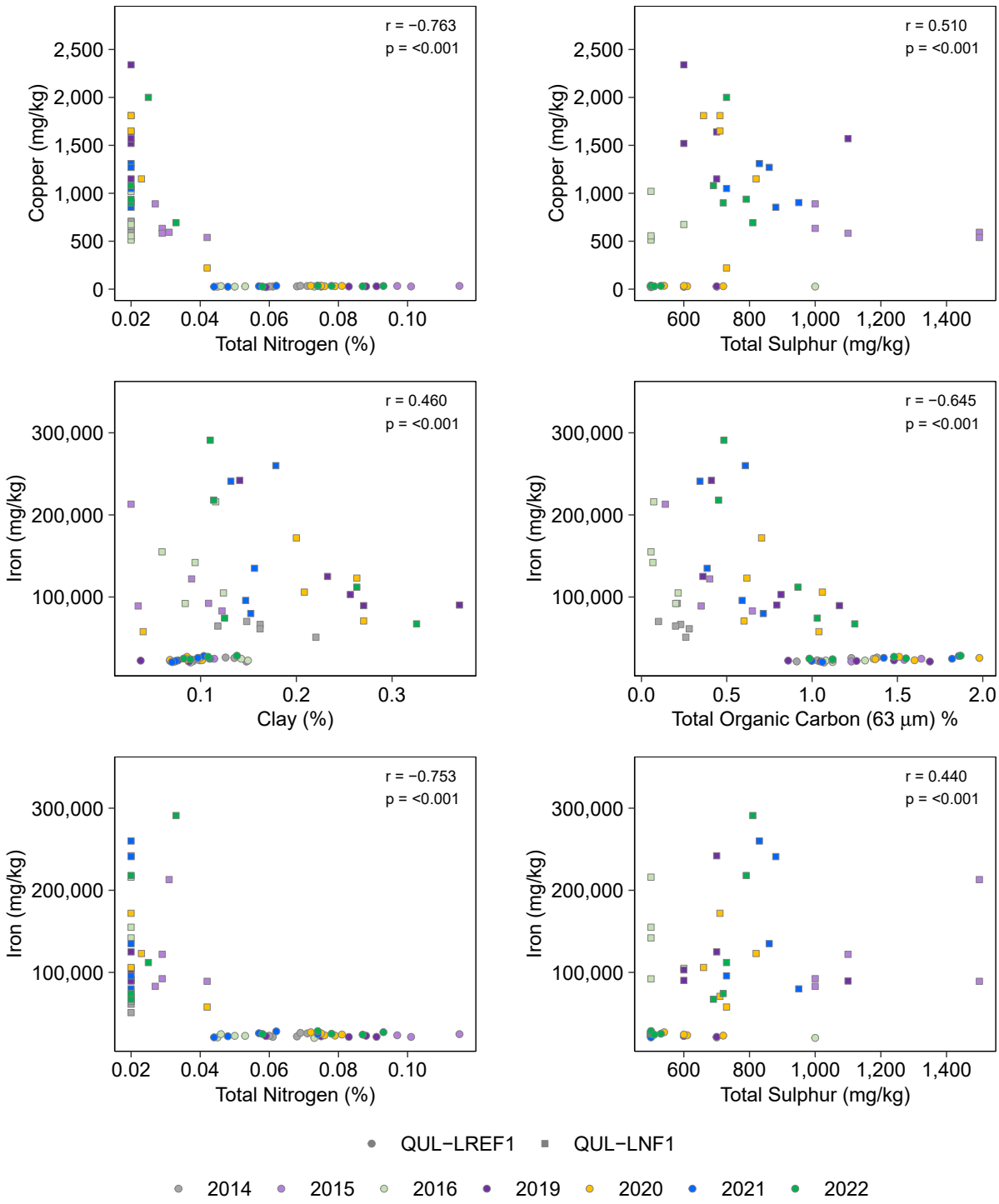

Figure E.1.4: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from shallow exposed and reference sampling areas of Quesnel Lake (QUL−LREF1, QUL−LNF1) are shown in black font on each plot. Results of correlations that only evaluated data from the shallow exposed area of Quesnel Lake (QUL−LNF1) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

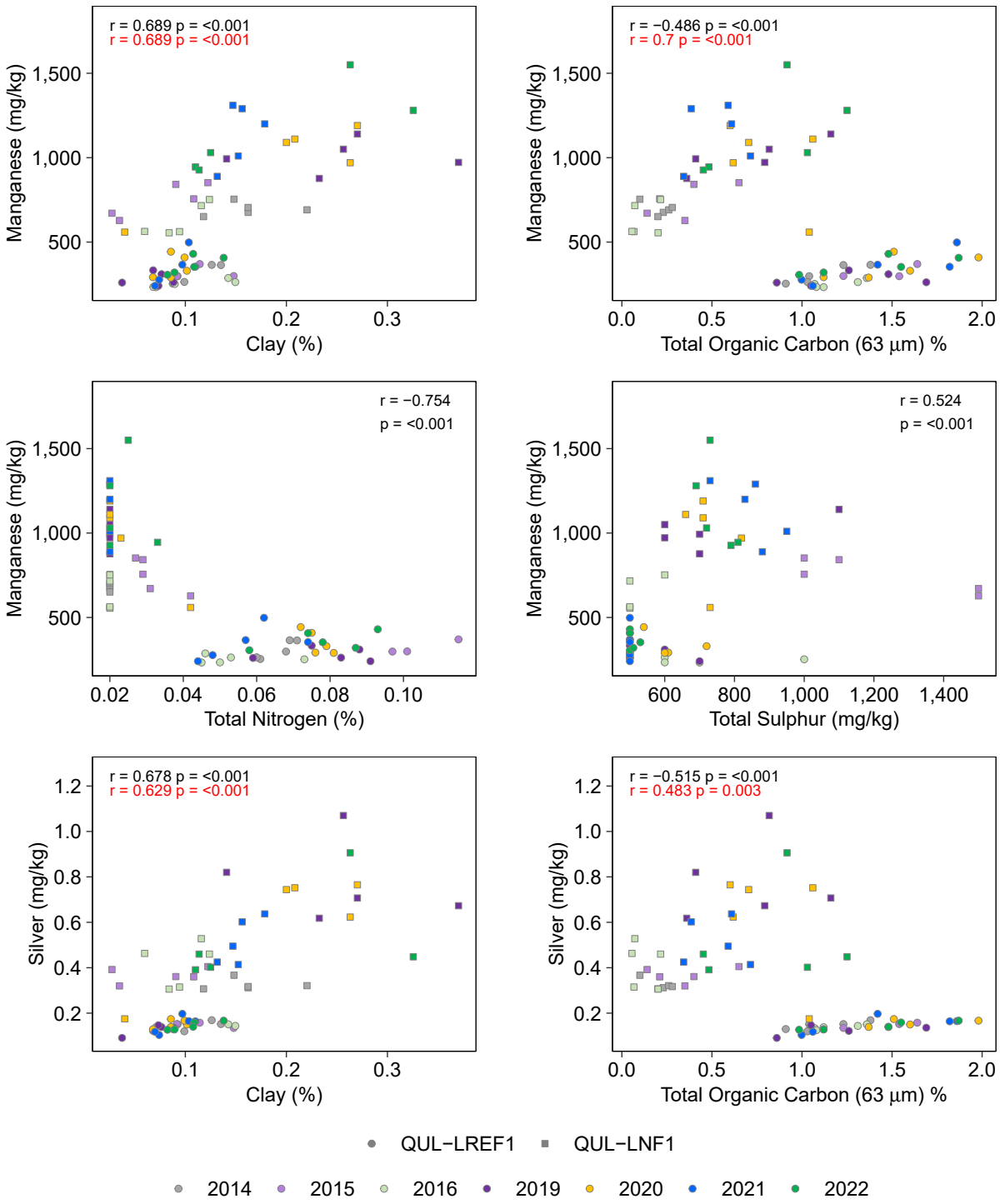

Figure E.1.4: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from shallow exposed and reference sampling areas of Quesnel Lake (QUL −LREF1, QUL−LNF1) are shown in black font on each plot. Results of correlations that only evaluated data from the shallow exposed area of Quesnel Lake (QUL−LNF1) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

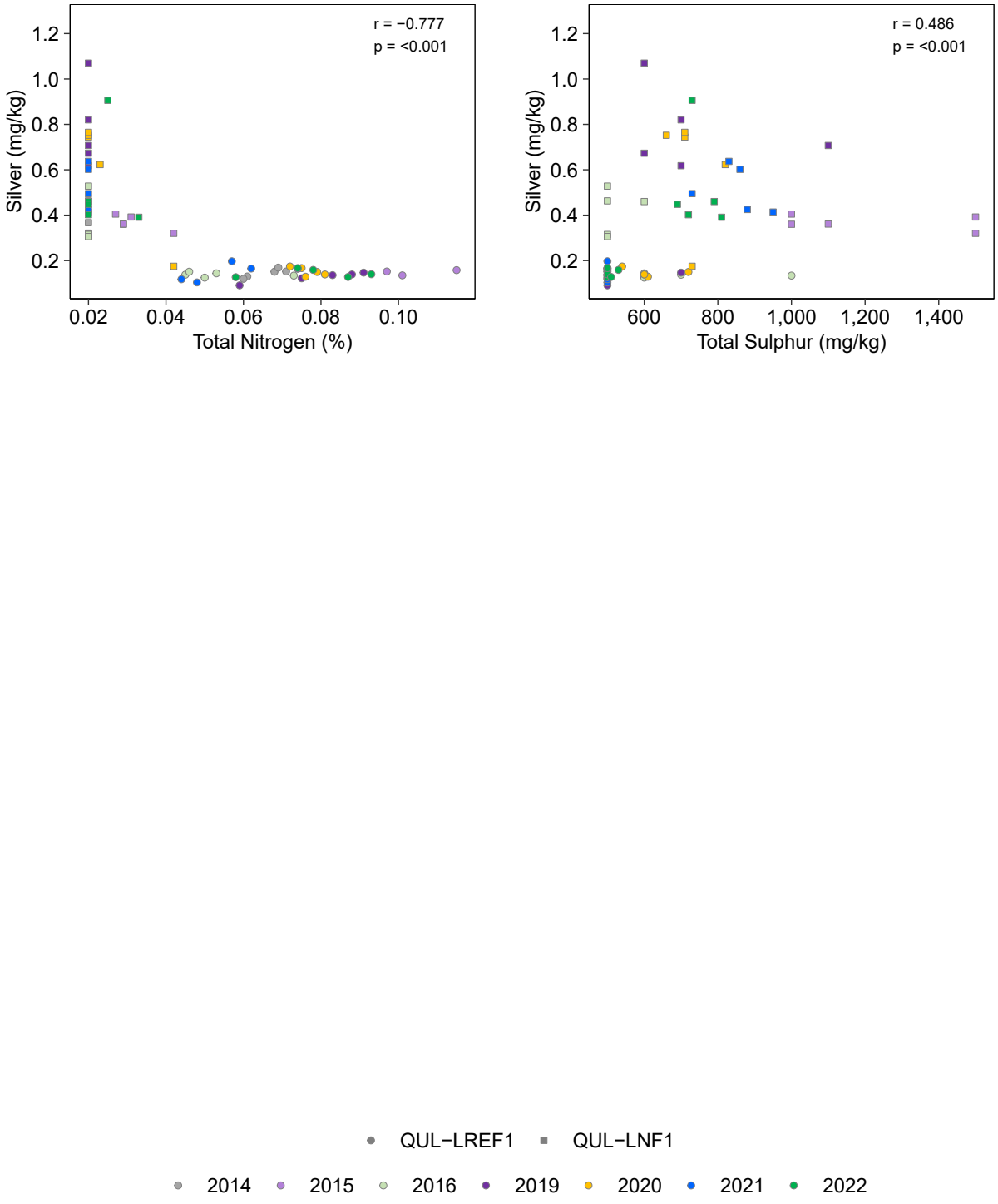

Figure E.1.4: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

Notes: Results of correlations that evaluated data from shallow exposed and reference sampling areas of Quesnel Lake (QUL−LREF1, QUL−LNF1) are shown in black font on each plot. Results of correlations that only evaluated data from the shallow exposed area of Quesnel Lake (QUL−LNF1) are shown in red font. An absence of results in red font on a plot indicates the displayed variables were not significantly correlated when only exposed sediment results were considered.

Table E.1.1: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022

ANOVA Model						(Exposed - Reference) Relative Differences Among Years[a]		Relative MOD for Exposed - Reference Over Time (%)[b]
Parameter	Units	Transformation	Area	Year	Area x Year	2019	2022	2022
Total Organic Carbon	%	none	<0.001	0.424	0.324	A	A	ns
Arsenic	mg/kg	log10	<0.001	0.779	0.500	A	A	ns
Copper	mg/kg	log10	<0.001	0.188	0.441	A	A	ns
Iron	mg/kg	log10	<0.001	0.039	0.088	A	A	ns

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates no data; "ns" indicates not significant; MOD = Magnitude of Difference; mg/kg = milligrams per kilogram.

[a] Years that share a letter are not significantly different among years.

[b] MOD calculated as $(Exp_{observed} - Exp_{predicted}) / (Exp_{predicted})x100\%$, where $Exp_{predicted} = Ref_{observed} + (Exp_{observed\ 2019} - Ref_{observed\ 2019})$. Exp = Exposed (POL-S); Ref = Reference (BOL-S).

Table E.1.2: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022

ANOVA Model						Area	Pairwise Differences Among Years for Each Area[a]		Do Concentrations Differ from 2019?	Do Concentrations Differ Between the Areas?
Parameter	Units	Transformation	Area	Year	Area x Year		2019	2022	Magnitude of Difference (MOD)[b]	Magnitude of Difference (MOD)[c]
Total Organic Carbon	%	none	<0.001	0.424	0.324	BOL-S	A	A	ns	-91
						POL-S				
Arsenic	mg/kg	log10	<0.001	0.779	0.500	BOL-S	A	A	ns	224
						POL-S				
Copper	mg/kg	log10	<0.001	0.188	0.441	BOL-S	A	A	ns	609
						POL-S				
Iron	mg/kg	log10	<0.001	0.039	0.088	BOL-S	A	A	ns	608
						POL-S				

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates no data; "ns" indicates not significant; MOD = Magnitude of Difference; mg/kg = milligrams per kilogram.

[a] Years that do not share a letter are significantly different for that area.

[b] MOD is calculated as $([year_{2022} - year_{2019}] / year_{2019})*100$.

[c] MOD calculated as ((POL-S - BOL-S) / BOL-S)*100.

Table E.1.3: Spearman's Correlation Relationships Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Polley Lake (POL-S; Exposed) and Bootjack Lake (BOL-B2; Reference) Shallow Areas, 2019 to 2022[a]

Analyte of Interest	Correlation Parameter	Data used in Correlation: POL-S and BOL-S				Data used in Correlation: POL-S			
		Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)	Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)
Arsenic (mg/kg)	Correlation Coefficient	0.158	-0.68	-0.661	-0.315	-0.097	-0.316	-0.188	0.141
	Sig. (2-tailed)	0.506	<0.001	0.001	0.176	0.789	0.374	0.602	0.698
Copper (mg/kg)	Correlation Coefficient	0.066	-0.708	-0.731	-0.425	-0.389	-0.559	-0.614	-0.495
	Sig. (2-tailed)	0.782	<0.001	<0.001	0.062	0.266	0.093	0.059	0.145
Iron (mg/kg)	Correlation Coefficient	-0.011	-0.736	-0.770	-0.481	-0.894	-0.529	-0.699	-0.563
	Sig. (2-tailed)	0.962	<0.001	<0.001	0.032	<0.001	0.116	0.024	0.09

Significant correlation; p-value < 0. 0125 (p<0.05, Bonferroni corrected for 4 independent variables).

Notes: n=20 for all correlations. Analyte of Interest was defined as an analyte at the exposed areas with a mean concentration that exceeded guidelines as well as reference/pre-breach 95th values. mg/kg = milligrams per kilogram. % = percent.

[a] Results below the Laboratory Reporting Limit (LRL) were used at the LRL for calculations.

[b] % clay represents the clay proportion of the < 63 µm (silt and clay) sediment fraction that was used for metals analysis. % clay was calculated as: [% clay] / [% silt and clay].

Table E.1.4: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

ANOVA Model						(Exposed - Reference) Relative Differences Among Years[a]						Relative MOD for Exposed - Reference Over Time (%)[b]				
Parameter	Units	Transformation	Area	Year	Area x Year	2014	2015	2016	2018	2019	2021	2015	2016	2018	2019	2021
Total Organic Carbon	%	none	<0.001	<0.001	0.509	A	A	A	A	A	A	ns	ns	ns	ns	ns
Arsenic	mg/kg	log10	<0.001	<0.001	0.078	A	A	A	A	A	A	ns	ns	ns	ns	ns
Copper	mg/kg	log10	<0.001	<0.001	0.132	A	A	A	A	A	A	ns	ns	ns	ns	ns
Iron	mg/kg	log10	<0.001	0.203	0.796	A	A	A	A	A	A	ns	ns	ns	ns	ns
Manganese	mg/kg	log10	<0.001	<0.001	<0.001	B	B	A	A	A	A	ns	70	82	94	75

P-value < 0.05
Indicates negative MOD
Indicates positive MOD

Notes: "-" indicates comparison not-relevant; "ns" indicates not significant; MOD = Magnitude of Difference; mg/kg = milligrams per kilogram. QUL-PREF1 was not sampled in 2022, therefore displayed data include to 2021 only.

[a] Years that share a letter are not significantly different among years.

[b] MOD calculated as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})x100\%$, where $Exp_{predicted} = Ref_{observed} + (Exp_{observed\ 2014} - Ref_{observed\ 2014})$. Exp = Exposed (QUL-PNF); Ref = Reference (QUL-PREF1)

Table E.1.5: **Statistical Comparisons of Spatial and Temporal Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022**

ANOVA Model						Area	Pairwise Differences Among Years for Each Area[a]								Do Concentrations Differ from 2014? MOD[b]							Do Concentrations Differ Between the Areas? QUL-PNF vs QUL-PREF1[c]							
Parameter	Units	Transformation	Area	Year	Area x Year		2014	2015	2016	2018	2019	2020	2021	2022	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	<0.001	0.509	QUL-PREF1	C	BC	ABC	A	ABC	AB[d]	A	AB[d]	ns	ns	46	ns	36[d]	44	48[d]	-77							
						QUL-PNF																							
Arsenic	mg/kg	log10	<0.001	<0.001	0.078	QUL-PREF1	B	B	A	B	B	B[d]	AB	B[d]	ns	22	ns	ns	ns[d]	ns	ns[d]	90							
						QUL-PNF																							
Copper	mg/kg	log10	<0.001	<0.001	0.132	QUL-PREF1	C	ABC	A	BC	AB	BC[d]	BC	ABC[d]	ns	51	ns	31	ns[d]	ns	ns[d]	1,735							
						QUL-PNF																							
Iron	mg/kg	log10	<0.001	0.203	0.796	QUL-PREF1	A								ns							30							
						QUL-PNF	A								ns														
Manganese	mg/kg	log10	<0.001	<0.001	<0.001	QUL-PREF1	A	A	A	A	A	-	A	-	ns	ns	ns	ns	-	ns	-	68	105	186	206	226	-	195	-
						QUL-PNF	C	BC	A	AB	A	A	A	AB	ns	71	62	70	69	75	63								

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates no data; "ns" indicates not significant; MOD = Magnitude of Difference; mg/kg = milligrams per kilogram.

[a] Years that do not share a letter are significantly different for that area.

[b] MOD is calculated as $((year_{recent} - year_{2014})/year_{2014})*100$.

[c] MOD calculated as ((QUL-PNF - QUL-PREF1)/QUL-PREF1)*100.

[d] No data available for QUL-PREF1 in 2020 and 2022; statistical comparisons and MOD values calculated based on QUL-PNF data only.

Table E.1.6: Spearman's Correlation Relationships Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022[a]

Analyte of Interest	Correlation Parameter	Data used in Correlation: QUL-PREF1, QUL-PNF				Data used in Correlation: QUL-PNF			
		Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)	Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)
Arsenic (mg/kg)	Correlation Coefficient	0.868	-0.684	-0.710	0.029	0.557	0.108	0.000	0.454
	Sig. (2-tailed)	<0.001	<0.001	<0.001	0.834	<0.001	0.506	1	0.012
Copper (mg/kg)	Correlation Coefficient	0.895	-0.696	-0.700	0.149	0.779	0.153	0.036	0.481
	Sig. (2-tailed)	<0.001	<0.001	<0.001	0.288	<0.001	0.344	0.827	0.007
Iron (mg/kg)	Correlation Coefficient	0.736	-0.548	-0.561	-0.083	0.132	0.338	0.254	-0.024
	Sig. (2-tailed)	<0.001	<0.001	<0.001	0.554	0.415	0.033	0.113	0.898
Manganese (mg/kg)	Correlation Coefficient	0.905	-0.633	-0.649	-0.290	0.720	0.527	0.465	-0.368
	Sig. (2-tailed)	<0.001	<0.001	<0.001	0.035	<0.001	<0.001	0.002	0.046

Significant correlation; p-value < 0.0125 (p<0.05, Bonferroni corrected for 4 independent variables).

Notes: n=70 for all correlations. Analyte of Interest was defined as an analyte at the exposed areas with a mean concentration that exceeded guidelines as well as reference 95th percentile values. mg/kg = milligrams per kilogram. % = percent.

[a] Results below the Laboratory Reporting Limit (LRL) were used at the LRL for calculations.

[b] % clay represents the clay proportion of the < 63 µm (silt and clay) sediment fraction that was used for metals analysis. % clay was calculated as: [% clay] / [% silt and clay].

Table E.1.7: Principal Components (PC) and Percentage of Variance Explained for the Principal Component Analysis (PCA) of Sediment Metal Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Year	Replicate Number	Reference		Exposed	
		QUL-PREF1		QUL-PNF	
		PC1 (75.2 %)	PC2 (15.6 %)	PC1 (75.2 %)	PC2 (15.6 %)
2014	1	5.02	-0.488	-2.37	4.02
	2	5.93	0.393	-3.96	1.74
	3	5.04	-0.352	-2.17	4.48
	4	5.19	-0.0945	-1.08	6.44
	5	5.92	0.935	-1.44	5.55
2015	1	3.86	-2.23	-5.02	-1.09
	2	nd	nd	-5.61	-1.67
	3	4.20	-1.10	-3.82	0.597
	4	nd	nd	-0.208	5.93
	5	4.89	-0.262	-1.47	4.95
2016	1	3.89	-1.71	-5.55	-1.82
	2	4.60	-1.15	-5.70	-1.64
	3	3.90	-1.95	-5.40	-0.916
	4	4.50	-0.960	-5.83	-2.17
	5	5.24	-0.232	-5.24	-1.08
2018	1	5.34	-0.632	-3.44	-0.491
	2	5.38	-0.300	-4.32	-0.363
	3	5.57	0.295	-3.59	1.54
	4	5.70	0.0492	-1.11	-0.927
	5	5.85	0.360	-3.91	-1.18
2019	1	4.90	-1.09	-5.63	-1.64
	2	4.84	-0.977	-5.45	-2.19
	3	5.16	-0.456	-2.18	2.55
	4	5.11	-0.501	-5.65	-2.63
	5	5.30	-0.123	-4.63	-1.27
2020	1	nd	nd	-1.56	2.98
	2	nd	nd	-3.19	-0.999
	3	nd	nd	-2.23	-0.301
	4	nd	nd	-2.95	-0.941
	5	nd	nd	-3.25	-1.61
2021	1	4.40	-0.858	-4.04	-1.31
	2	4.93	0.249	-3.55	-0.377
	3	4.26	-0.933	-2.88	1.70
	4	4.98	0.0689	-2.09	1.56
	5	4.28	-0.362	-2.52	-0.326
2022	1	nd	nd	-3.55	-0.484
	2	nd	nd	-2.69	-0.519
	3	nd	nd	-2.41	0.572
	4	nd	nd	-2.78	-1.19
	5	nd	nd	-3.69	-1.05

Note: "nd" indicates no data.

Table E.1.8: Pearson Correlations of Principal Components (PC) of Sediment Metal Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Variable	PC1 (75.2 %)		PC2 (15.6 %)	
	P-value	r_s	P-value	r_s
Aluminum	<0.001	-0.953	0.034	-0.257
Antimony	<0.001	-0.905	0.114	-0.193
Arsenic	<0.001	-0.980	0.640	0.0577
Barium	<0.001	-0.968	0.187	-0.162
Bismuth	0.093	-0.205	<0.001	-0.882
Cadmium	<0.001	0.759	<0.001	-0.620
Calcium	<0.001	-0.956	0.028	0.266
Chromium	<0.001	0.797	<0.001	-0.571
Cobalt	<0.001	-0.959	0.047	-0.242
Copper	<0.001	-0.987	0.351	0.115
Iron	<0.001	-0.732	0.978	0.00347
Lead	<0.001	-0.842	<0.001	-0.466
Magnesium	<0.001	-0.970	0.112	-0.195
Manganese	<0.001	-0.958	0.430	-0.0974
Molybdenum	<0.001	-0.987	0.258	0.139
Nickel	<0.001	0.603	<0.001	-0.776
Selenium	<0.001	-0.689	<0.001	-0.444
Silver	<0.001	-0.985	0.457	-0.0916
Sodium	<0.001	-0.984	0.752	0.0390
Thallium	<0.001	0.859	<0.001	-0.492
Tin	<0.001	-0.982	0.227	0.149
Titanium	<0.001	-0.984	0.790	0.0328
Uranium	<0.001	-0.523	<0.001	-0.541
Vanadium	<0.001	-0.910	0.061	0.228
Zinc	<0.001	-0.698	<0.001	-0.663

$r_s \geq 0.6$ or ≤ -0.6

significant correlation (p-value < 0.05).

Notes: PCA conducted on correlation matrix with log10 −transformed concentrations. Vectors represent the PC loadings for each parameter (scaled). Parameters that had more than 25% censored data were excluded from the analyses. Variables are in units of mg/kg dry weight.

Table E.1.9: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

ANOVA Model						(Exposed - Reference) Relative Differences Among Years[a]							Relative MOD for Exposed - Reference Over Time (%)[b]					
Parameter	Unit	Transformation	Area	Year	Area x Year	2014	2015	2016	2019	2020	2021	2022	2015	2016	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	<0.001	0.139	A	A	A	A	A	A	A	ns	ns	ns	ns	ns	ns
Arsenic	mg/kg	log10	<0.001	0.162	0.010	B	B	B	A	B	B	B	ns	ns	64	ns	ns	ns
Copper	mg/kg	log10	<0.001	0.008	0.004	B	B	B	A	B	AB	B	ns	ns	181	ns	ns	ns
Iron	mg/kg	log10	<0.001	0.074	0.071	A	A	A	A	A	A	A	ns	ns	ns	ns	ns	ns
Manganese	mg/kg	log10	<0.001	<0.001	0.031	C	C	BC	A	ABC	AB	ABC	ns	ns	58	ns	47	ns
Silver	mg/kg	log10	<0.001	0.023	0.002	C	BC	BC	A	B	BC	BC	ns	ns	169	59	ns	ns

P-value < 0.05
Indicates negative MOD
Indicates positive MOD

Notes: "-" indicates comparison not-relevant; "ns" indicates not significant; MOD = Magnitude of Difference; mg/kg = milligrams per kilogram.

[a] Years that share a letter are not significantly different among years.

[b] MOD calculated as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})x100\%$, where $Exp_{predicted} = Ref_{observed} + (Exp_{observed\ 2014} - Ref_{observed\ 2014})$. Exp = Exposed (QUL-LNF1); Ref = Reference (QUL-LREF1)

Table E.1.10: Statistical Comparisons of Spatial and Temporal Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022

ANOVA Model						Area	Pairwise Differences Among Years for Each Area[a]							Do Concentrations Differ from 2014? MOD[b]						Do Concentrations Differ Between the Areas? QUL-LNF1 vs QUL-LREF1[c]						
Parameter	Unit	Transformation	Area	Year	Area x Year		2014	2015	2016	2019	2020	2021	2022	2015	2016	2019	2020	2021	2022	2014	2015	2016	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	<0.001	0.139	QUL-LREF1	B	AB	B	AB	A	AB	A	ns	ns	ns	74	ns	67	-62						
						QUL-LNF1																				
Arsenic	mg/kg	log10	<0.001	0.162	0.010	QUL-LREF1	A	A	A	A	A	A	A	ns	ns	ns	ns	ns	ns	222	233	272	427	220	220	226
						QUL-LNF1	B	AB	AB	A	AB	AB	AB	ns	ns	44	ns	ns	ns							
Copper	mg/kg	log10	<0.001	0.008	0.004	QUL-LREF1	A	A	A	A	A	A	A	ns	ns	ns	ns	ns	ns	2,062	1,926	2,192	5,976	3,105	3,105	3,188
						QUL-LNF1	B	B	B	A	AB	AB	AB	ns	ns	146	ns	ns	ns							
Iron	mg/kg	log10	<0.001	0.074	0.071	QUL-LREF1	ns							ns						369						
						QUL-LNF1	ns							ns												
Manganese	mg/kg	log10	<0.001	<0.001	0.031	QUL-LREF1	AB	AB	B	AB	AB	AB	A	ns	ns	ns	ns	ns	ns	127	132	147	259	174	174	212
						QUL-LNF1	CD	BCD	D	AB	ABC	A	A	ns	ns	44	ns	62	62							
Silver	mg/kg	log10	<0.001	0.023	0.002	QUL-LREF1	A	A	A	A	A	A	A	ns	ns	ns	ns	ns	ns	126	148	193	509	259	259	245
						QUL-LNF1	C	BC	BC	A	AB	ABC	ABC	ns	ns	135	67	ns	ns							

P-value < 0.05
Indicates negative MOD
Indicates positive MOD

Notes: "-" indicates comparison not-relevant, "ns" indicates not significant, MOD = Magnitude of Difference, mg/kg = milligrams per kilogram.

[a] Years that do not share a letter are significantly different for that area.

[b] MOD is calculated as $((year_{recent} - year_{2014}) / year_{2014})*100$.

[c] MOD calculated as ((QUL-LNF1 - QUL-LREF1)/QUL-LREF1)*100.

Table E.1.11: Spearman's Correlation Relationships Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Quesnel Lake at QUL-LNF1 (Exposed) and QUL-LREF1 (Reference) Shallow Areas, 2014 to 2022[a]

Analyte of Interest	Correlation Parameter	Data used in Correlation: QUL-LREF1, QUL-LNF1				Data used in Correlation: QUL-LNF1			
		Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)	Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)
Arsenic (mg/kg)	Correlation Coefficient	0.658	-0.525	-0.760	0.487	0.527	0.377	-0.149	-0.039
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	0.001	0.025	0.393	0.837
Copper (mg/kg)	Correlation Coefficient	0.733	-0.491	-0.763	0.510	0.797	0.613	-0.347	-0.132
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.041	0.487
Iron (mg/kg)	Correlation Coefficient	0.460	-0.645	-0.753	0.440	-0.200	-0.149	0.040	-0.043
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	0.248	0.392	0.82	0.821
Manganese (mg/kg)	Correlation Coefficient	0.689	-0.486	-0.754	0.524	0.689	0.700	-0.232	0.105
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.18	0.581
Silver (mg/kg)	Correlation Coefficient	0.678	-0.515	-0.777	0.486	0.629	0.483	-0.289	-0.246
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.092	0.189

Significant correlation; p-value < 0.0125 (p<0.05, Bonferroni corrected for 4 independent variables).

Notes: n=68 for all correlations. Analyte of Interest was defined as an analyte at the exposed areas with a mean concentration that exceeded guidelines as well as reference 95th percentile values. mg/kg = milligrams per kilogram. % = percent.

[a] Results below the Laboratory Reporting Limit (LRL) were used at the LRL for calculations.

[b] % clay represents the clay proportion of the < 63 µm (silt and clay) sediment fraction that was used for metals analysis. % clay was calculated as: [% clay] / [% silt and clay].

APPENDIX E.2
PLANKTON COMMUNITY
& PRODUCTIVITY

APPENDIX E2 PLANKTON DATA COLLAPSING METHODS

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E2.1 Zooplankton 1
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E2 PLANKTON DATA COLLAPSING METHODS

E2.1 Zooplankton

Zooplankton community densities were calculated by the laboratory, Biologica Environmental Services (Biologica; Appendix G). Biologica used sampling information (haul depth, net diameter; provided by Minnow) and zooplankton abundances in each sample to calculate densities for taxa within each sample using the following formula:

$$Density(\frac{\#}{L}) = \frac{Abundance}{Haul\ Depth\ (m) \times \left(0.25\pi \times \left(Net\ mouth\ diameter\ (m)\right)^2\right) * 1000}$$

Zooplankton taxa identified in samples from the vicinity of the Mount Polley Mine typically are part of four major taxonomic groups: Cladocera, Rotifera, Calanoida, and Cyclopoida. Cladocera and Rotifera are easier to identify than Calanoida and Cyclopoida and have better developed taxonomic classifications. Therefore, decisions regarding taxonomic resolution of Cladocera and Rotifera taxa were made using a decision key, as described in Appendix E.4 (i.e., Resolving mixed-levels of taxonomic resolution for benthic invertebrates). Calanoida and Cyclopoida are less consistently identified to lower (i.e., higher resolution) taxonomic levels than Cladocera and Rotifera, making them unsuitable for the decision key described above for resolving inconsistent taxonomic resolution. Thus, inconsistent taxonomic resolution with within the Calanoida and Cyclopoida orders was resolved by pooling results within their respective major taxonomic group level (i.e., higher taxonomic resolution) for analysis, with the Copepod Nauplii stage remaining as a separate taxon group.

E2.2 Phytoplankton

Phytoplankton taxa are commonly identified to genus level but are occasionally identified to species level / species complex level (i.e., higher resolution) or phylum level (i.e., lower resolution). Due to the high proportion of ambiguously resolved taxa within phytoplankton data, phytoplankton taxonomy is not suited for the decision key described in Appendix E.4.

As such phytoplankton data were processed prior to analysis as follows. Phytoplankton taxa identified to species were rolled up to genus, and taxa identified to genus remained at genus. Two morphological groups, centric and pennate Diatoms, were considered as genera for the purpose of resolving taxonomic resolution. For each sample, taxa at a higher taxonomic level (e.g., phylum) were proportionally assigned to a lower taxonomic level (i.e., genera) if taxa at a lower taxonomic level were present in that sample. In cases where taxa at a lower taxonomic level were not observed in a sample, the taxon was assigned to the most common lower taxonomic level present in samples from that monitoring station (e.g., QUL-ZOO-1) in the present sampling year. If a lower taxonomic level was not observed at that station, the original taxonomic level was retained.

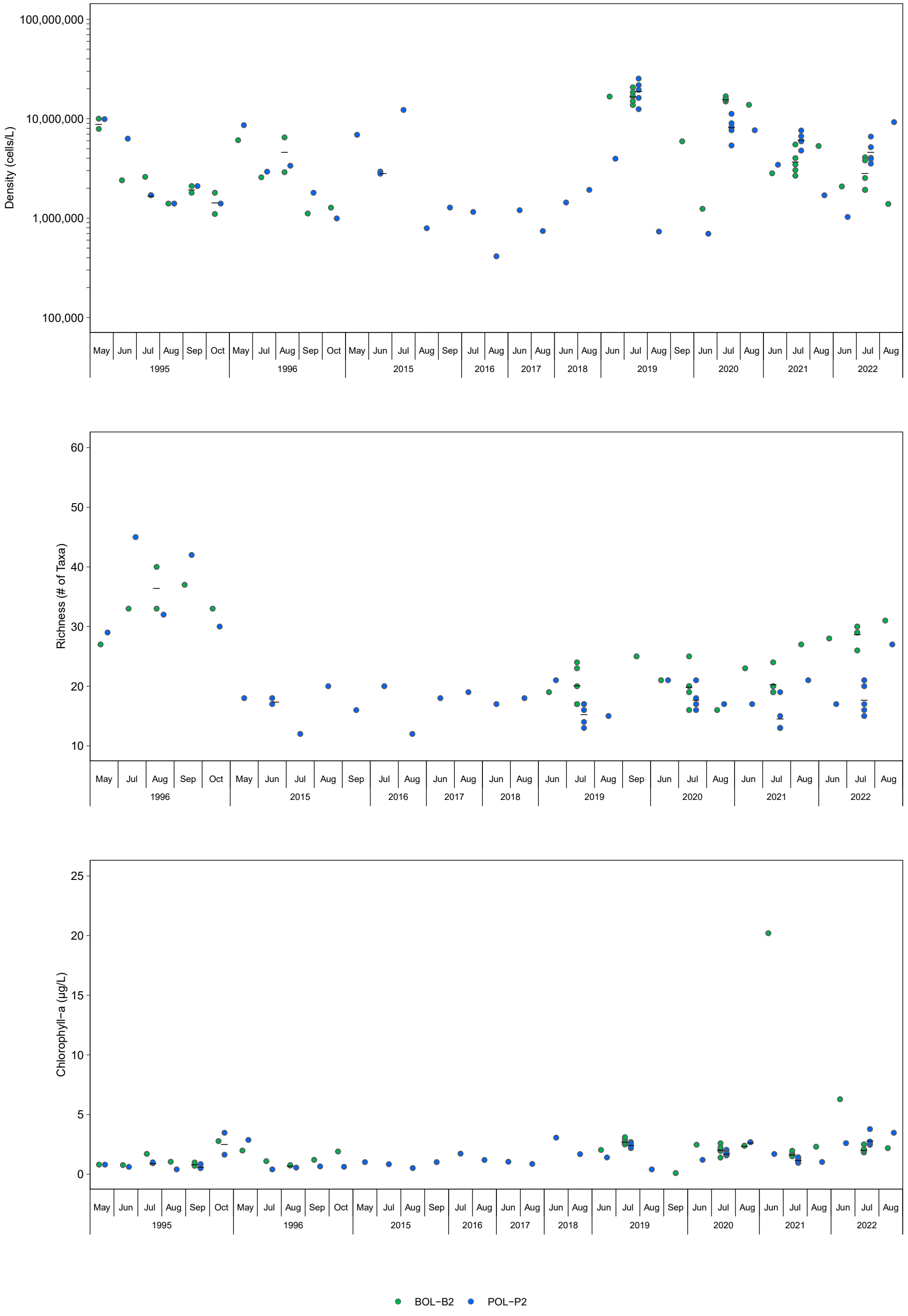

Figure E.2.1: Phytoplankton Community Endpoints for Polley Lake (POL–P2; Exposed) and Bootjack Lake (BOL–B2; Reference) Areas, 1995 to 2022

Notes: Black bars represent mean values.

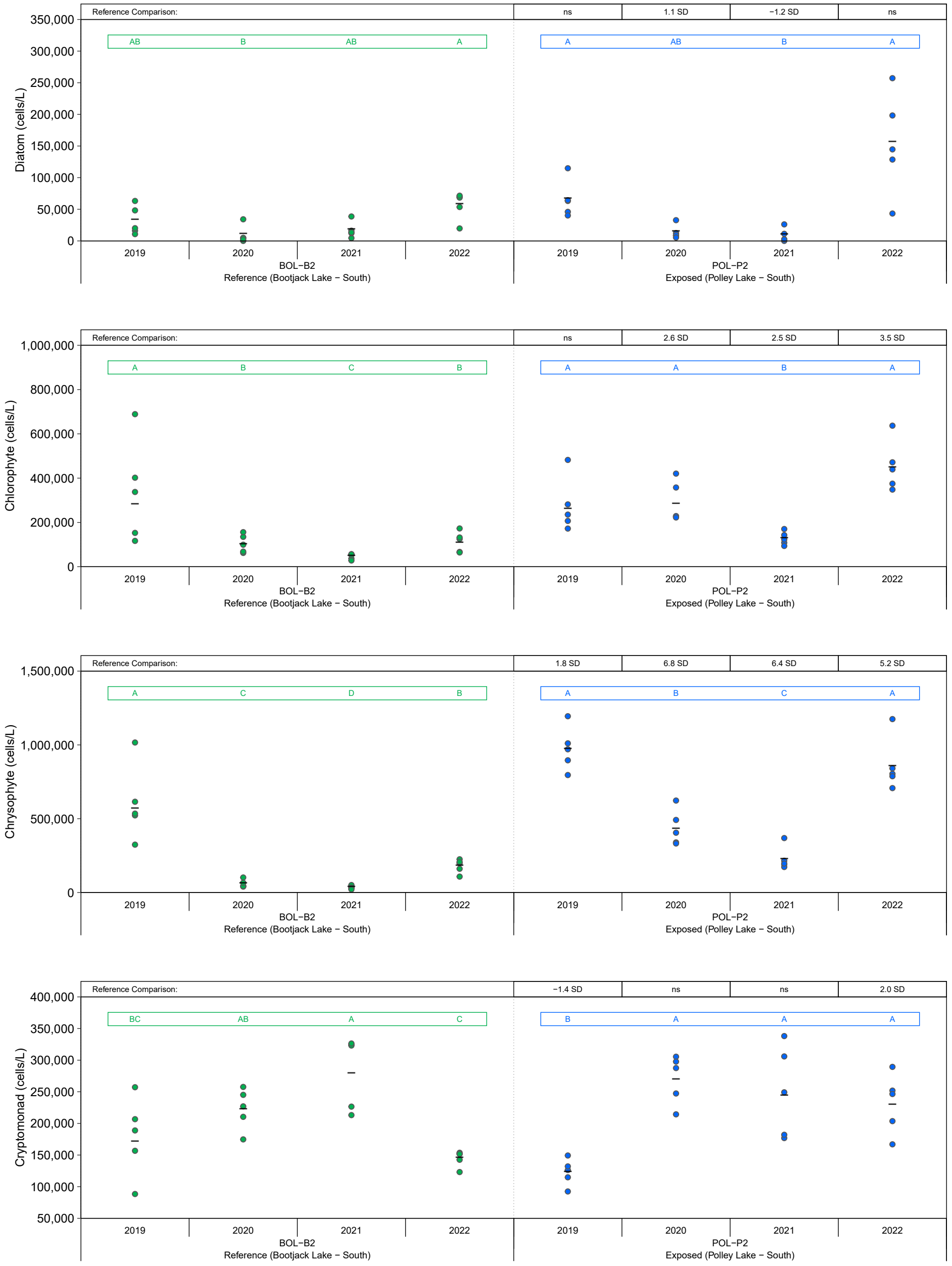

Figure E.2.2: Phytoplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

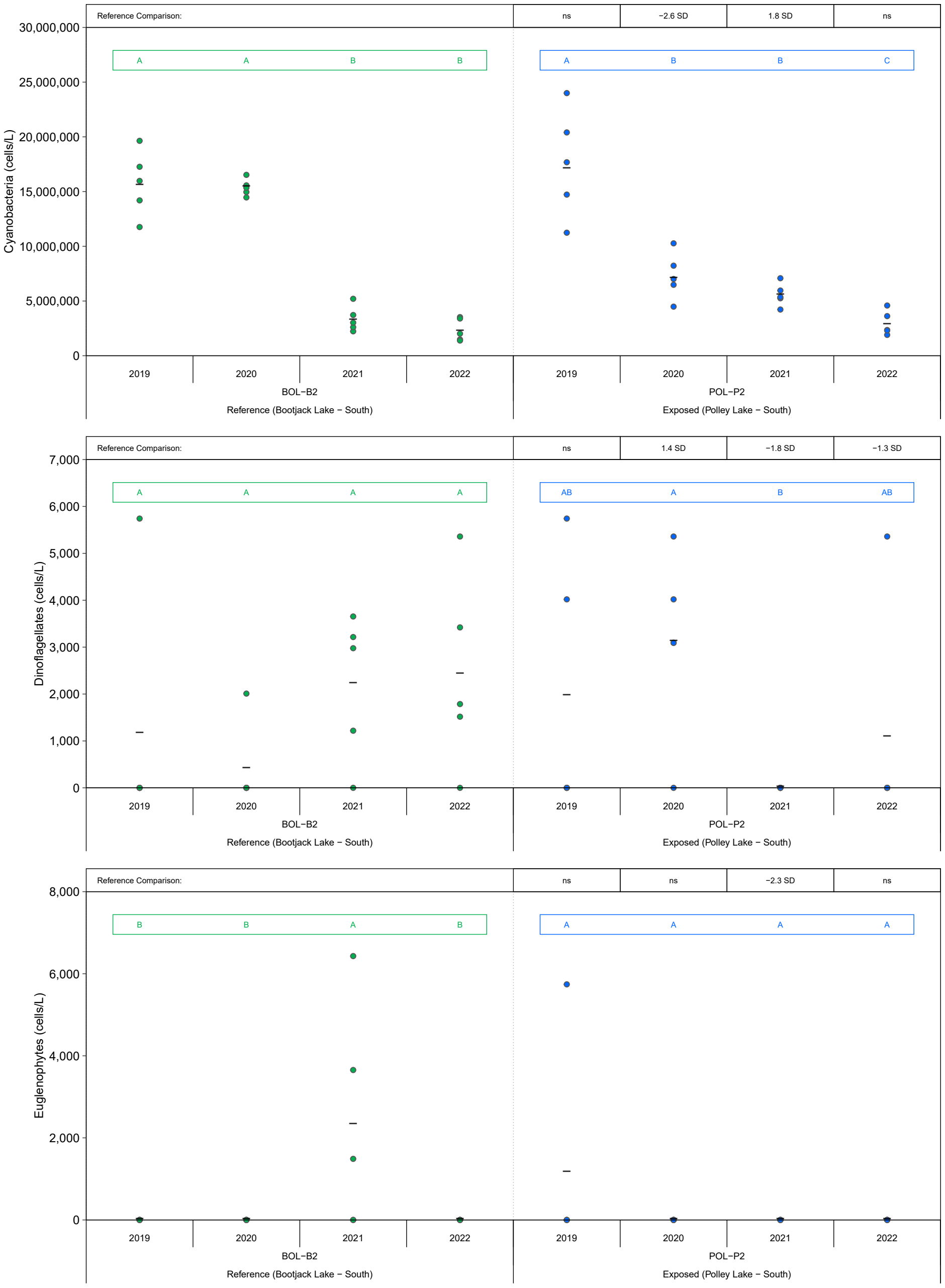

Figure E.2.2: Phytoplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

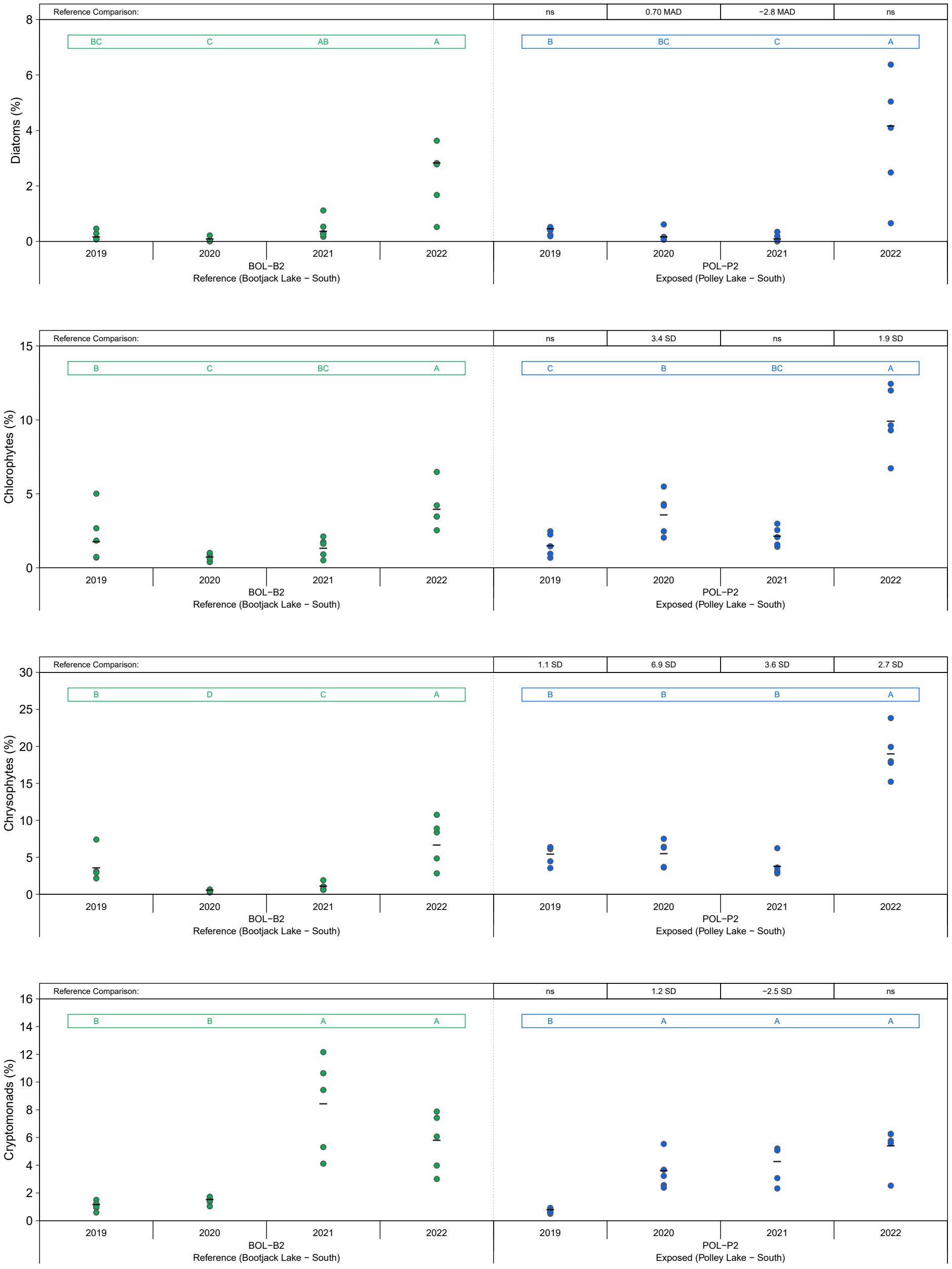

Figure E.2.2: Phytoplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

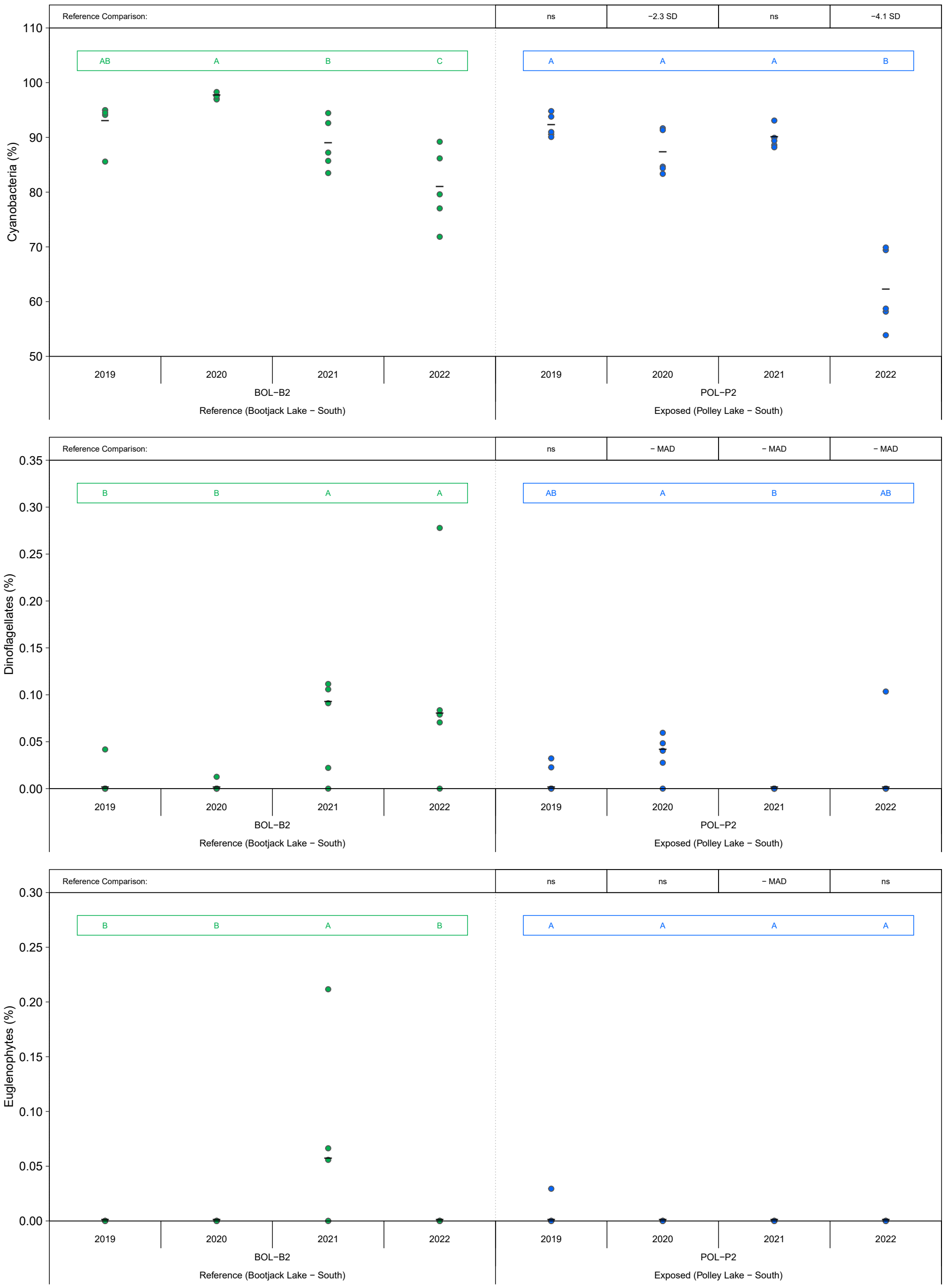

Figure E.2.2: Phytoplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.1.

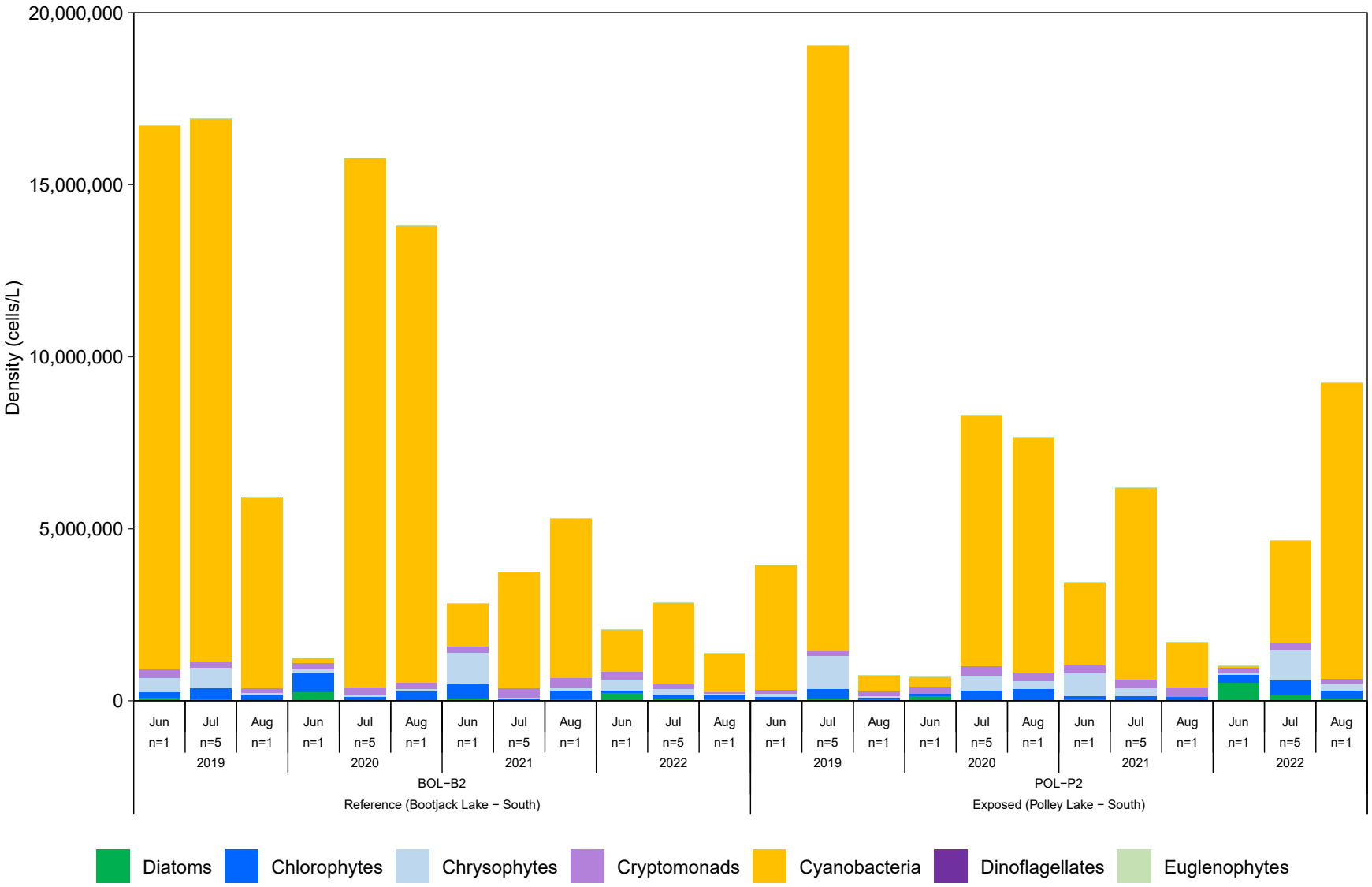

Figure E.2.3: Mean Densities of Major Phytoplankton Community Taxonomic Groups for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas, 2019 to 2022

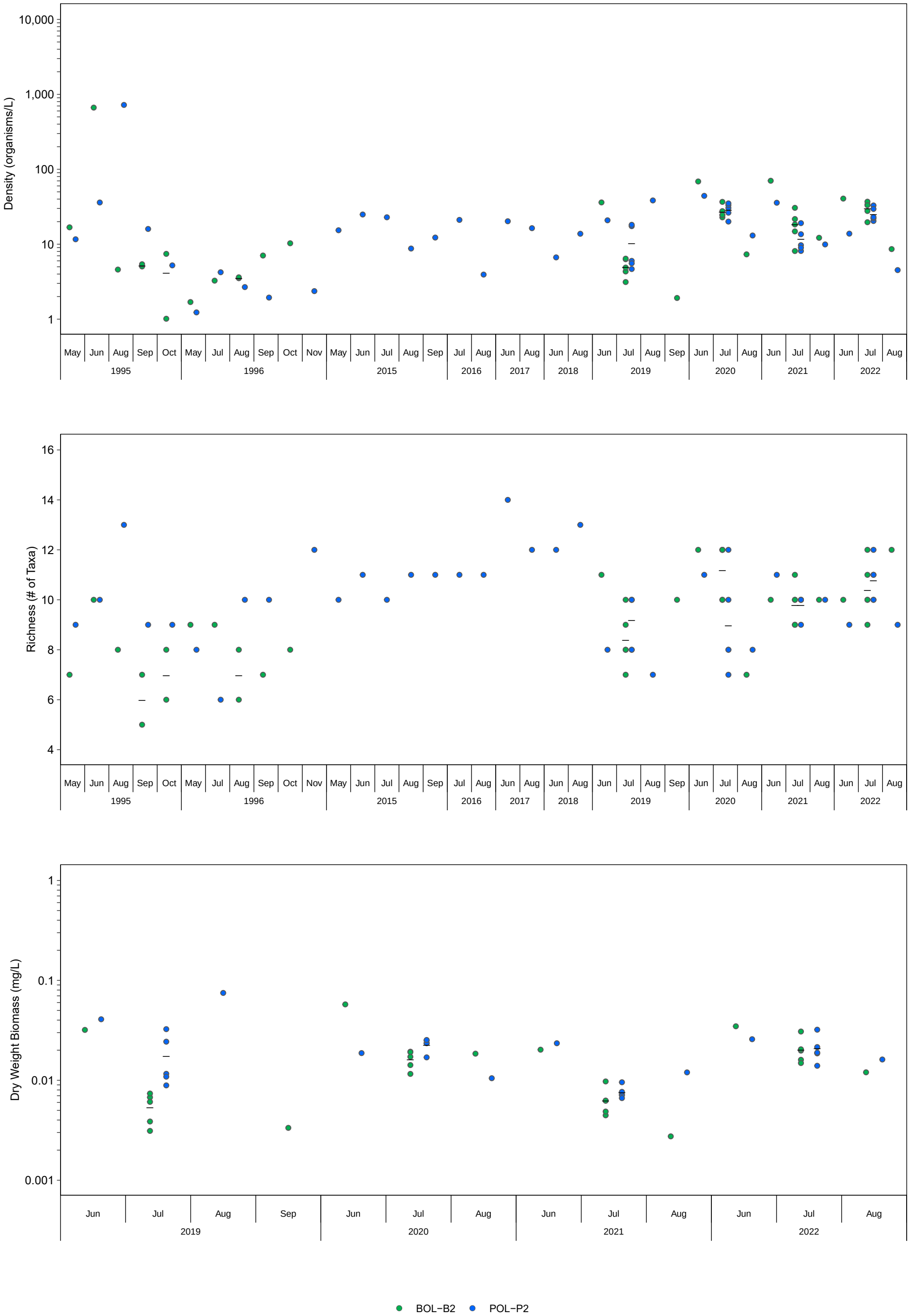

Figure E.2.4: Zooplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas, 1995 to 2022

Notes: Black bars represent mean values. Results displayed for POL-P2 (August 2019) in the current figure differ from those presented in previous reports (Minnow 2020a, 2021a, 2022a) for the same sampling area and date. This discrepancy is due to an incorrect calculation for these results in the prior reporting years.

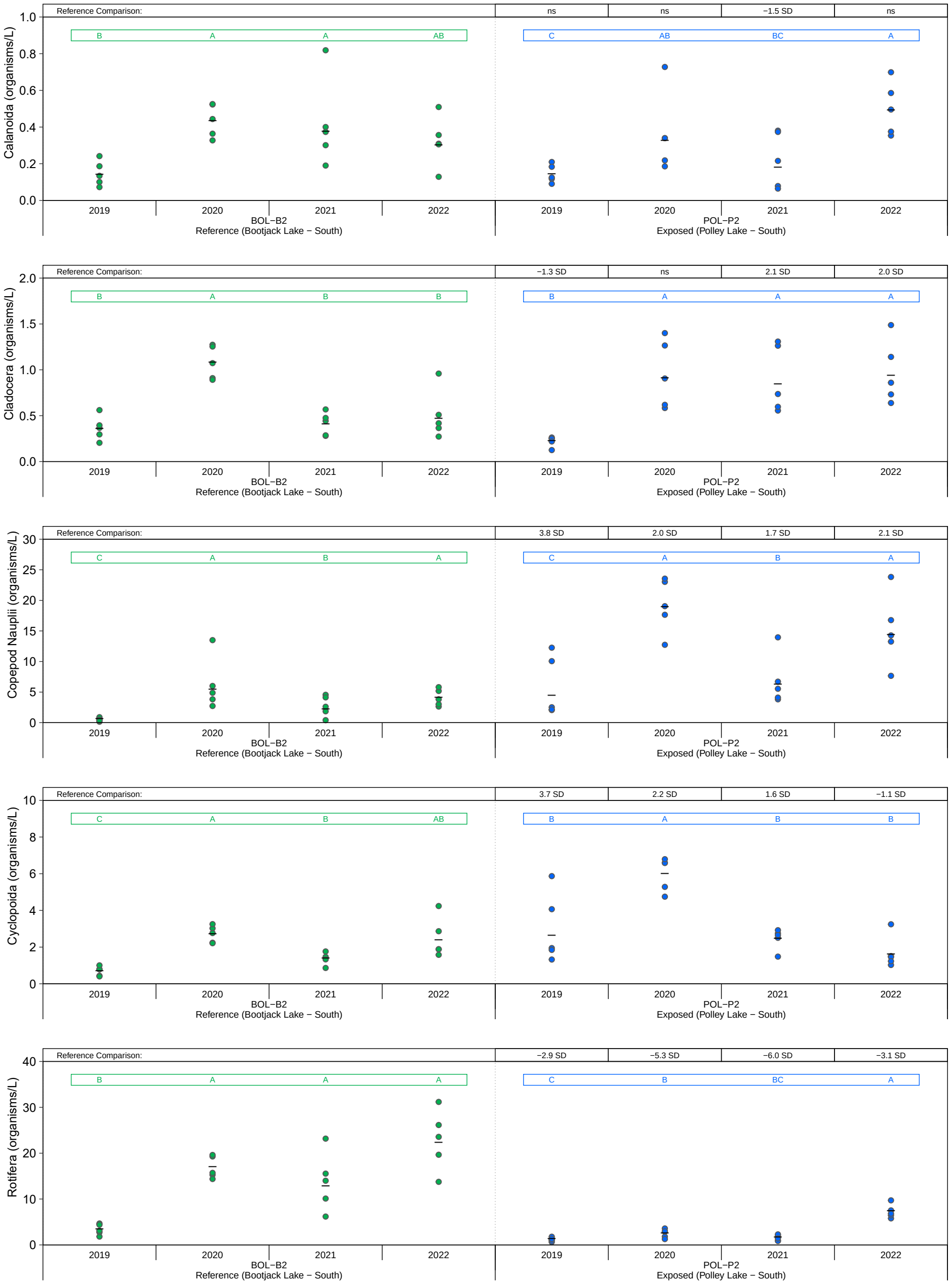

Figure E.2.5: Zooplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.3.

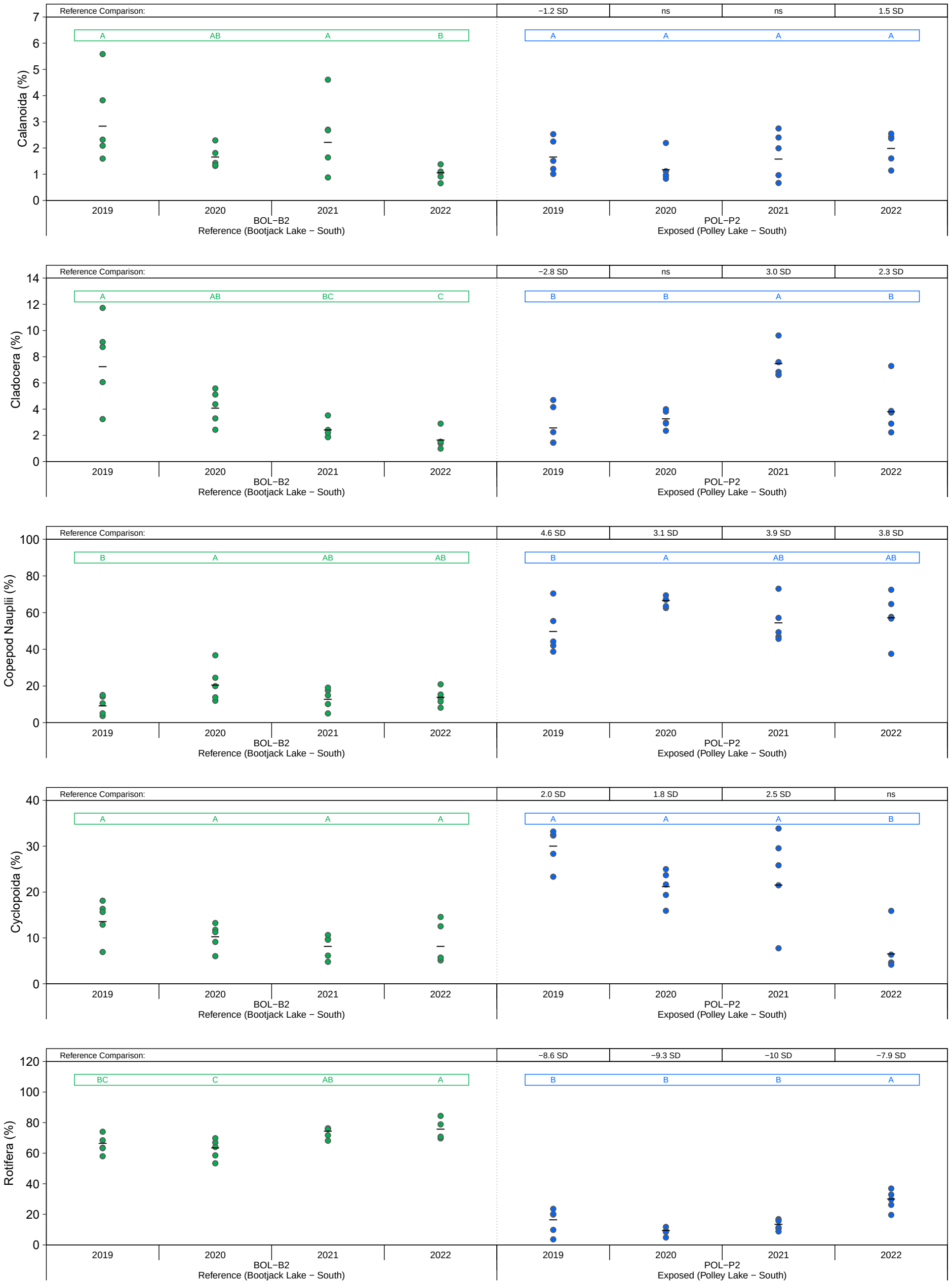

Figure E.2.5: Zooplankton Community Endpoints for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.3.

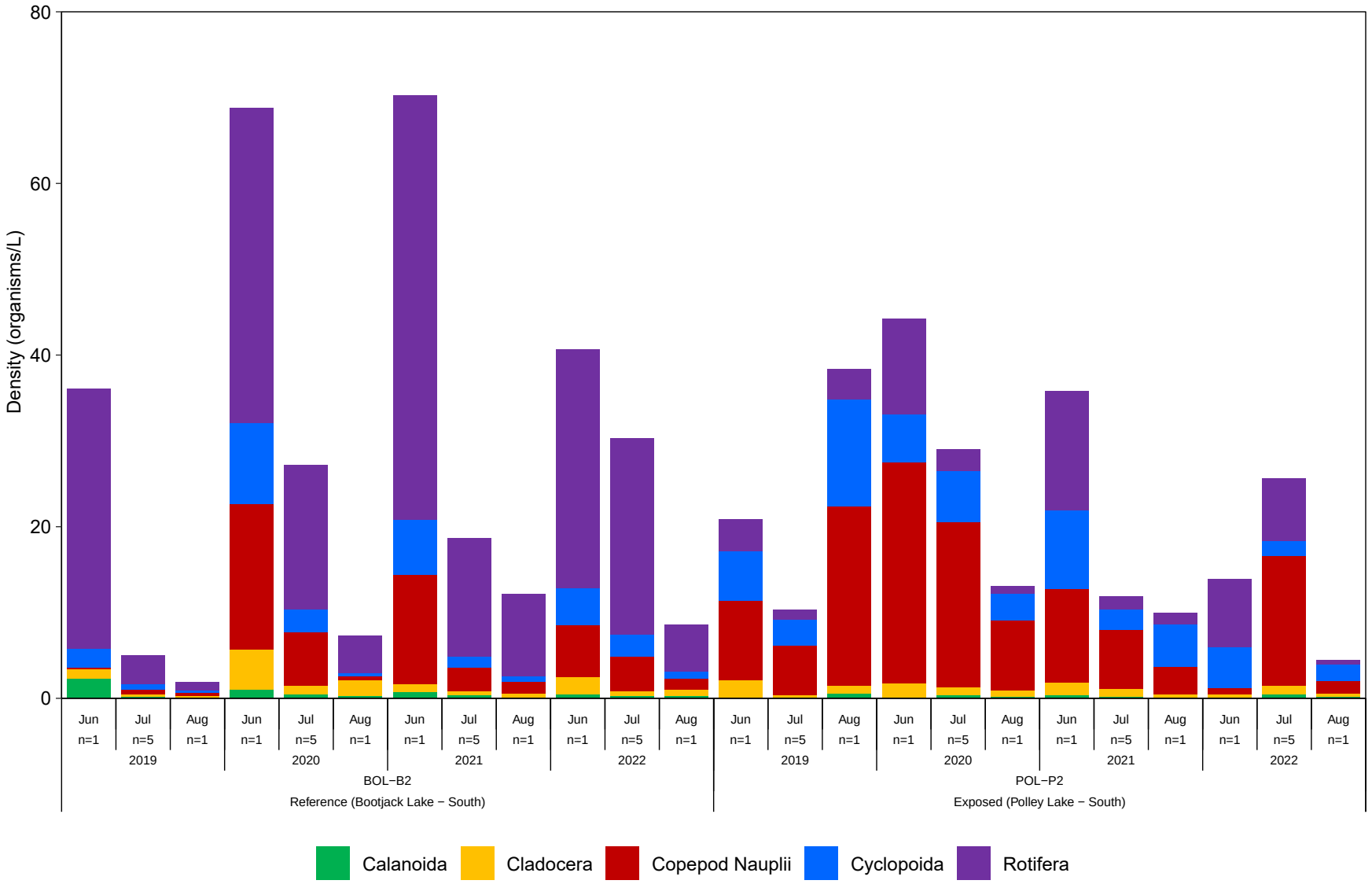

Figure E.2.6: Mean Densities of Major Zooplankton Community Taxonomic Groups for Polley Lake (POL−P2; Exposed) and Bootjack Lake (BOL−B2; Reference) Areas, 2019 to 2022

Notes: Results displayed for POL-P2 (August 2019) in the current figure differ from those presented in previous reports (Minnow 2020a, 2021a, 2022a) for the same sampling area and date. This discrepany is due to an incorrect calculation for these results in the prior reporting years.

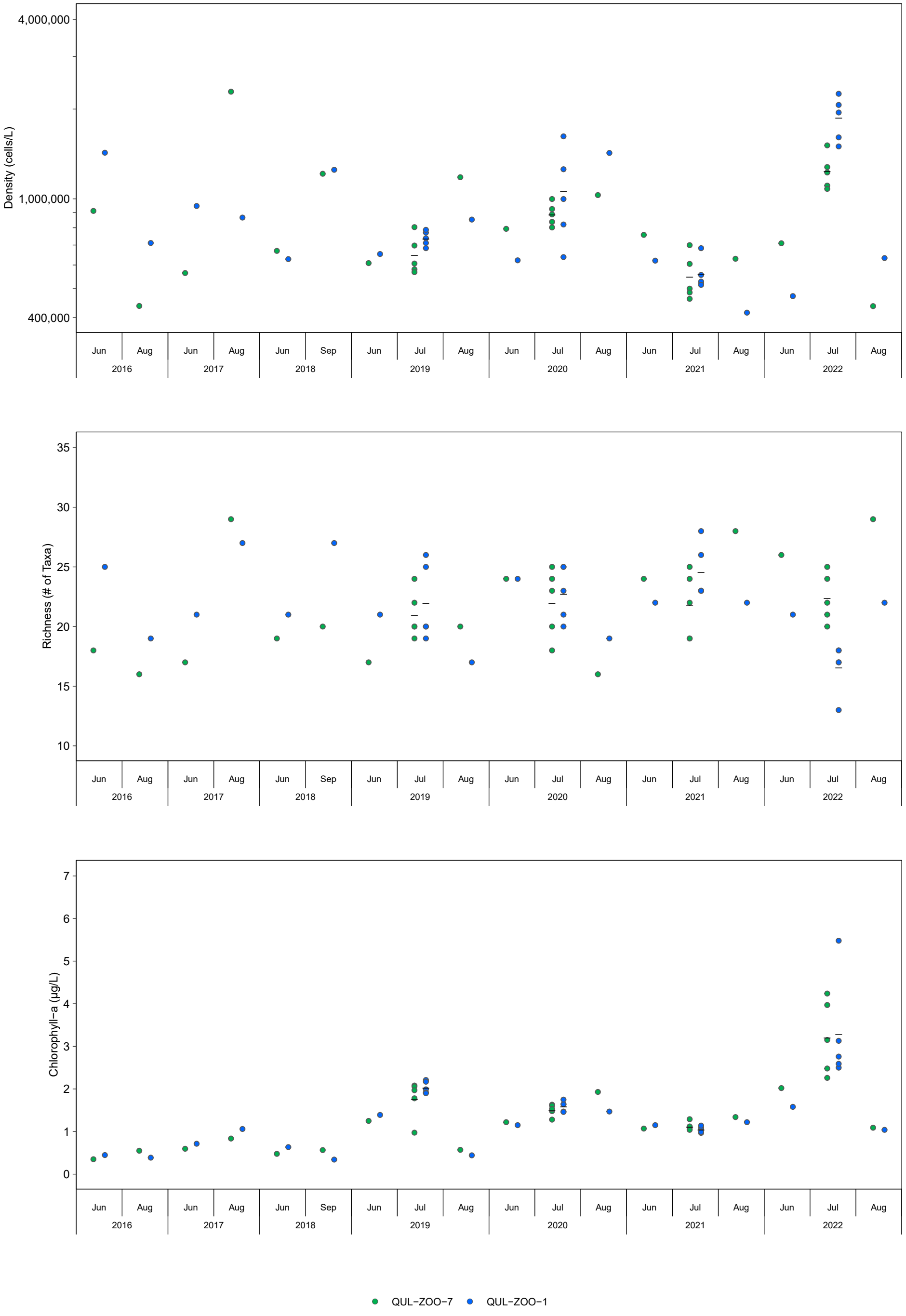

Figure E.2.7: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2016 to 2022

Notes: Black bars represent mean values.

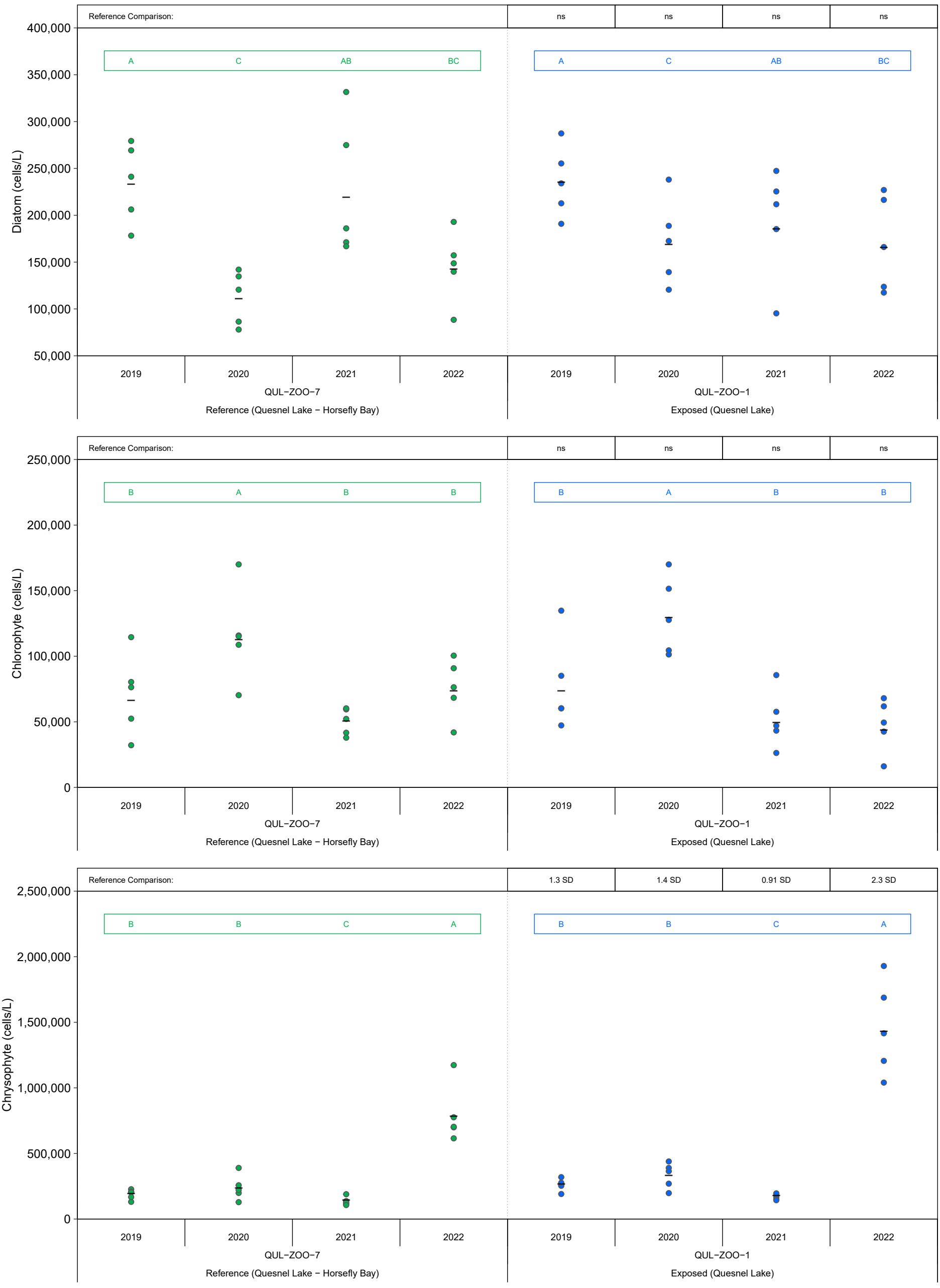

Figure E.2.8: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

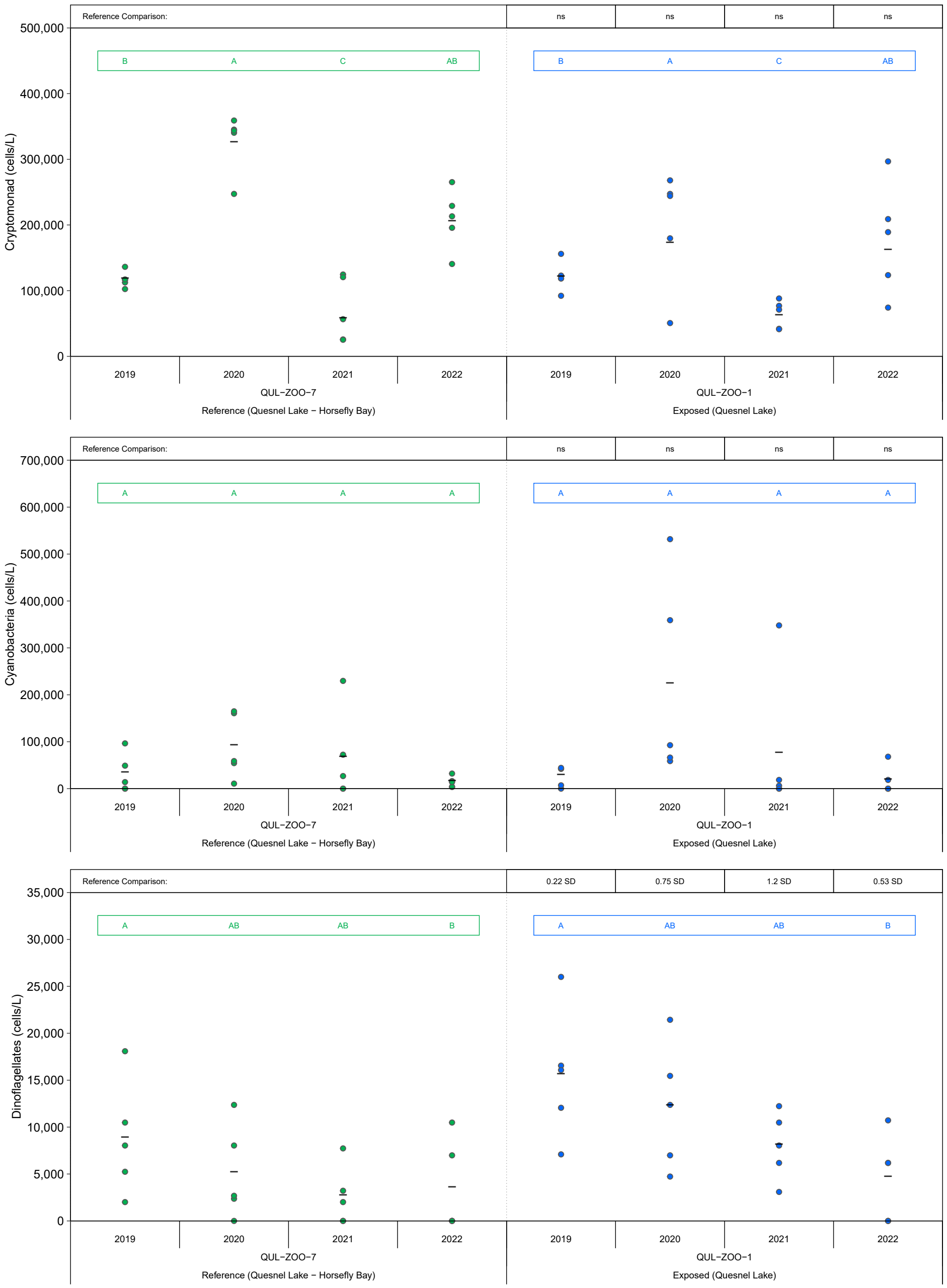

Figure E.2.8: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

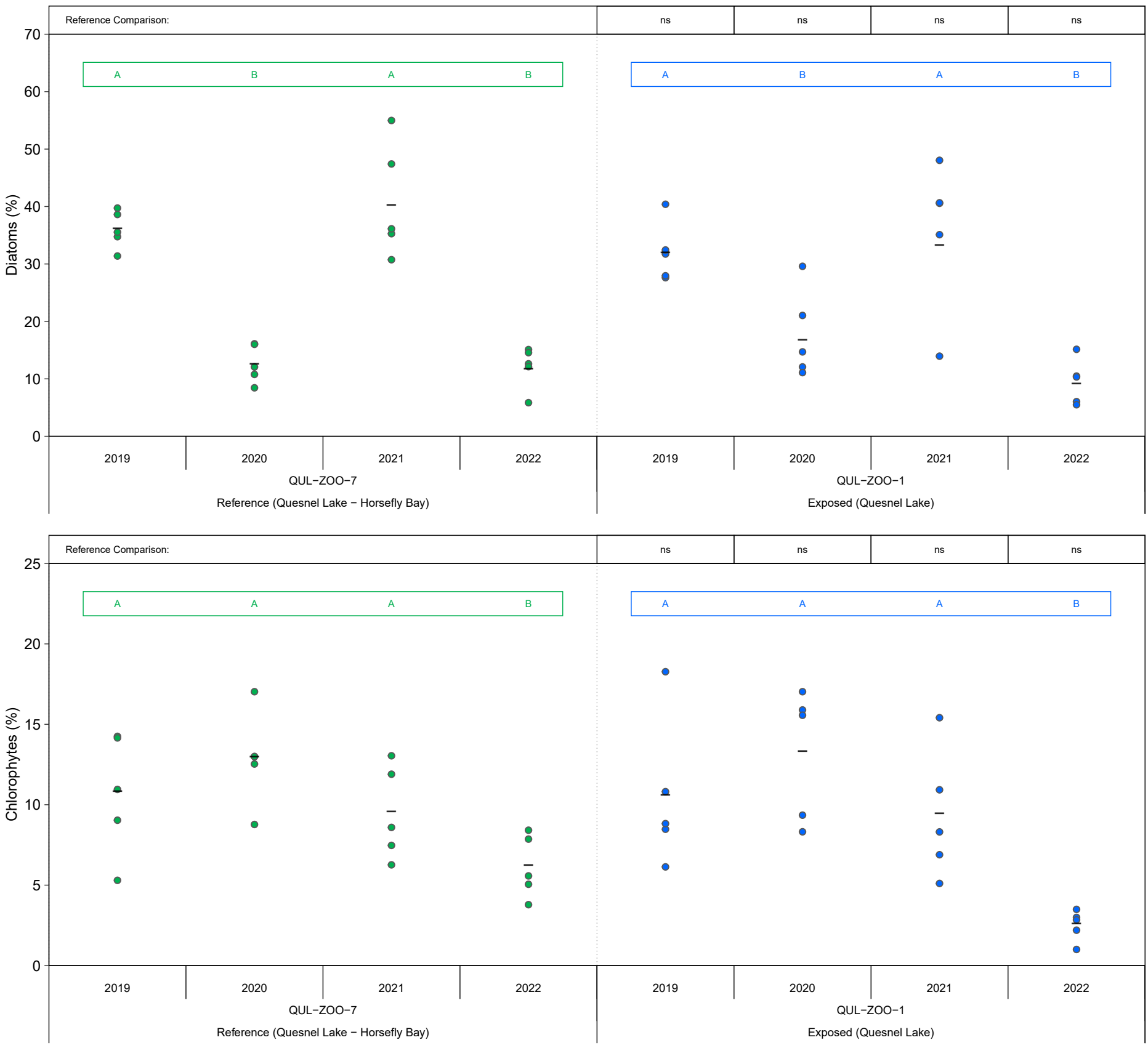

Figure E.2.8: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

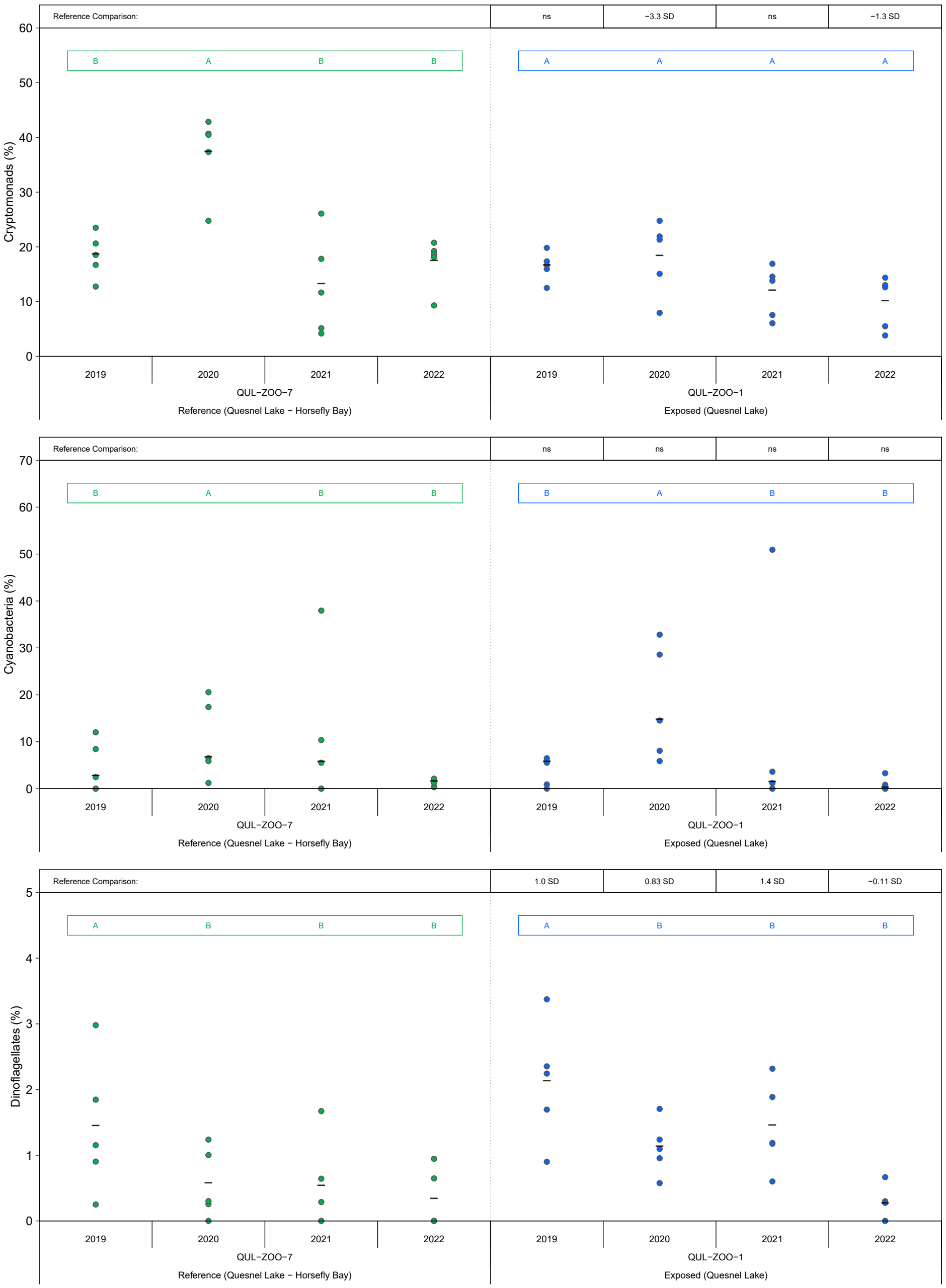

Figure E.2.8: Phytoplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of phytoplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated phytoplankton results collected in June and August 2022, see Appendix Table C.3.5.

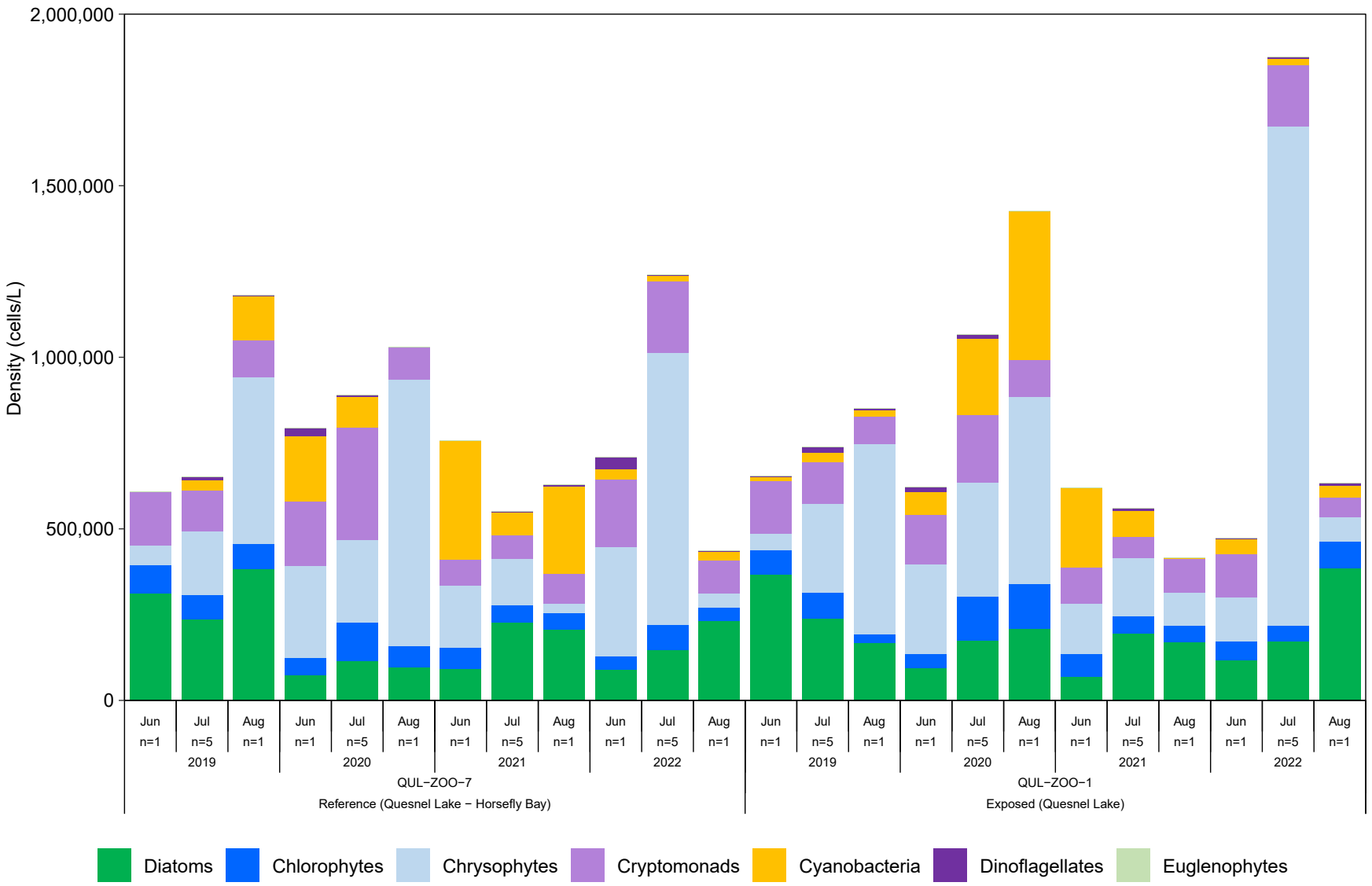

Figure E.2.9: Mean Densities of Major Phytoplankton Community Taxonomic Groups for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2019 to 2022

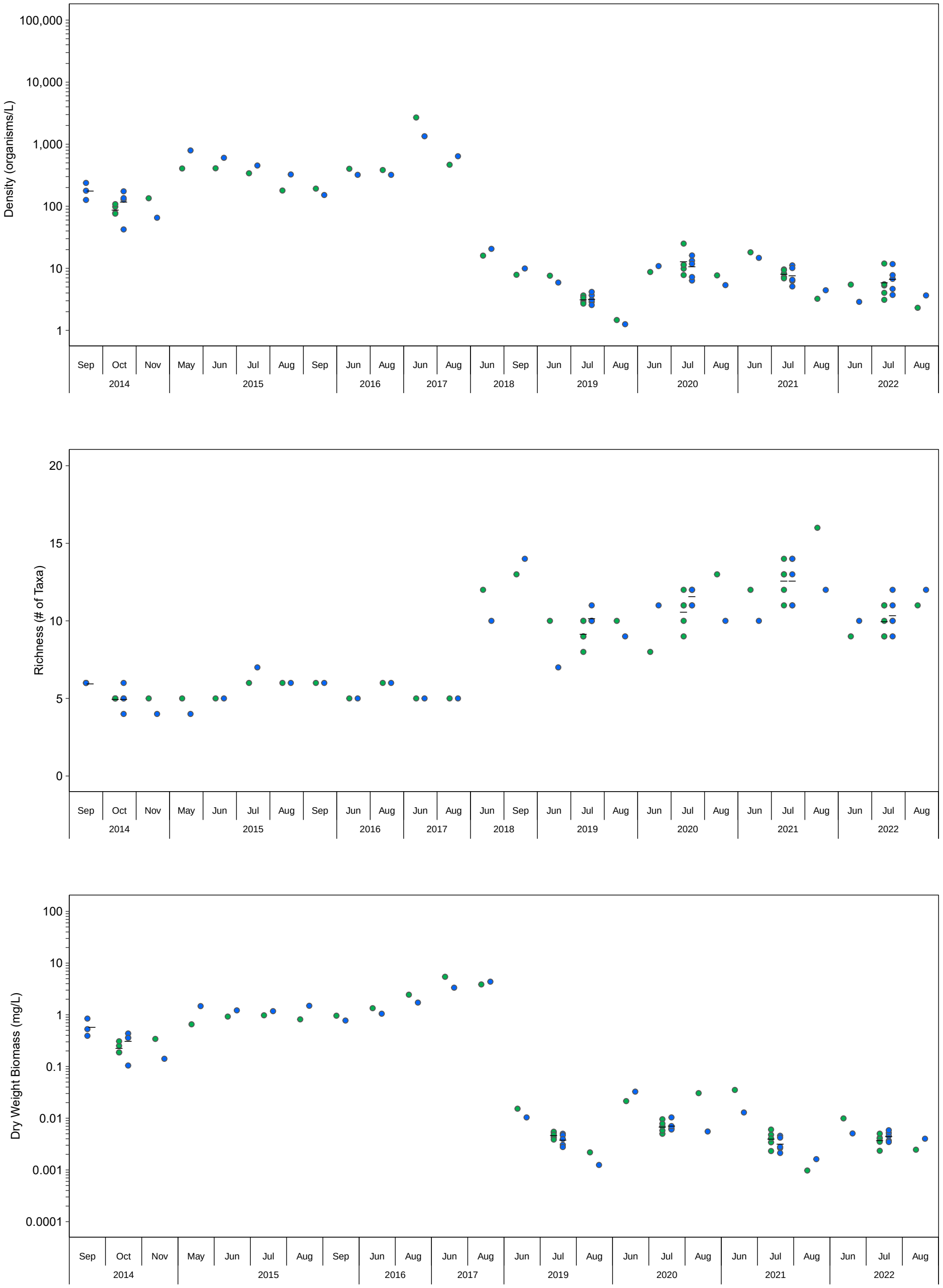

Figure E.2.10: Zooplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2014 to 2022

Notes: Black bars represent mean values.

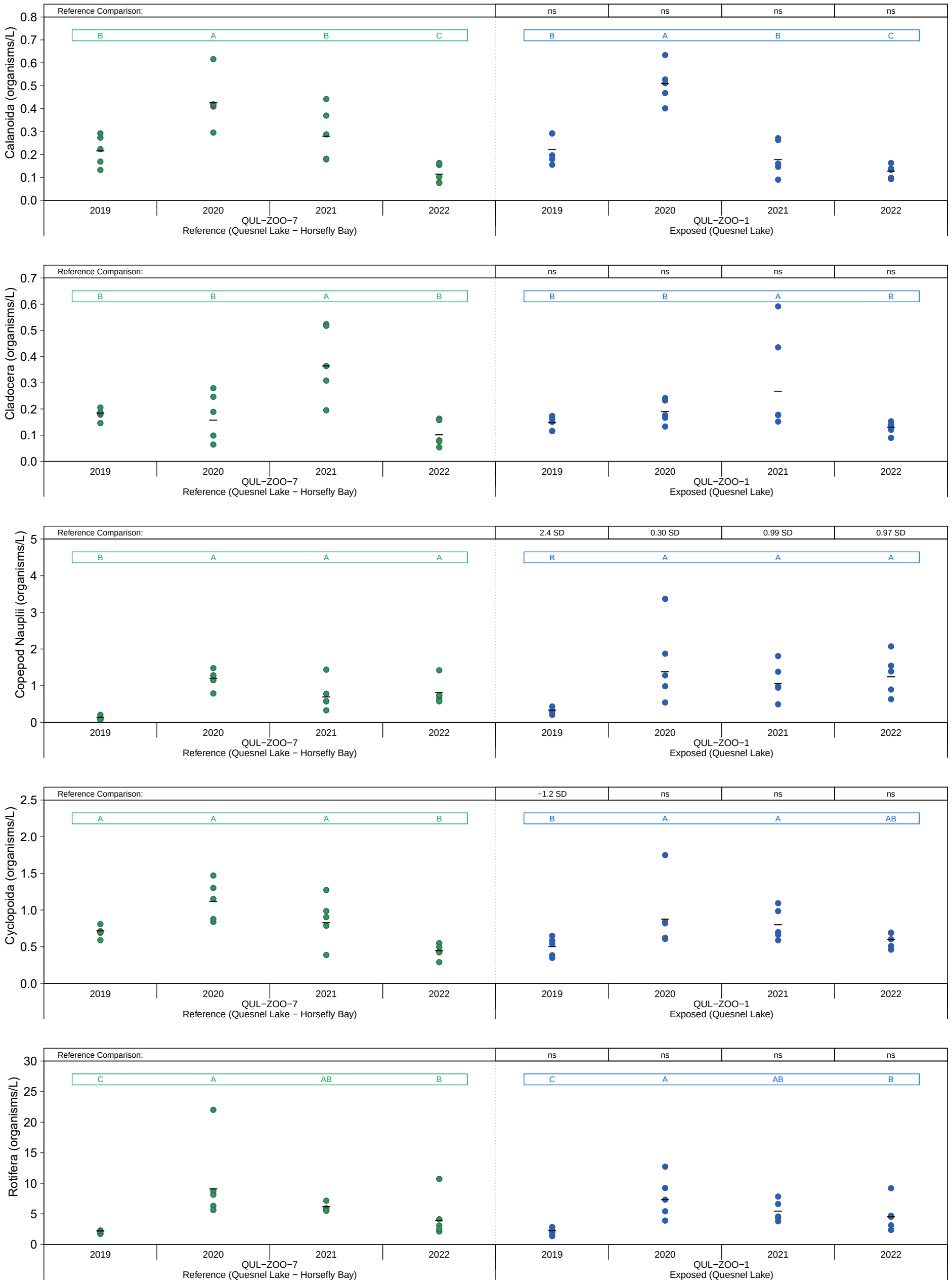

Figure E.2.11: Zooplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, seeAppendix Table C.3.7.

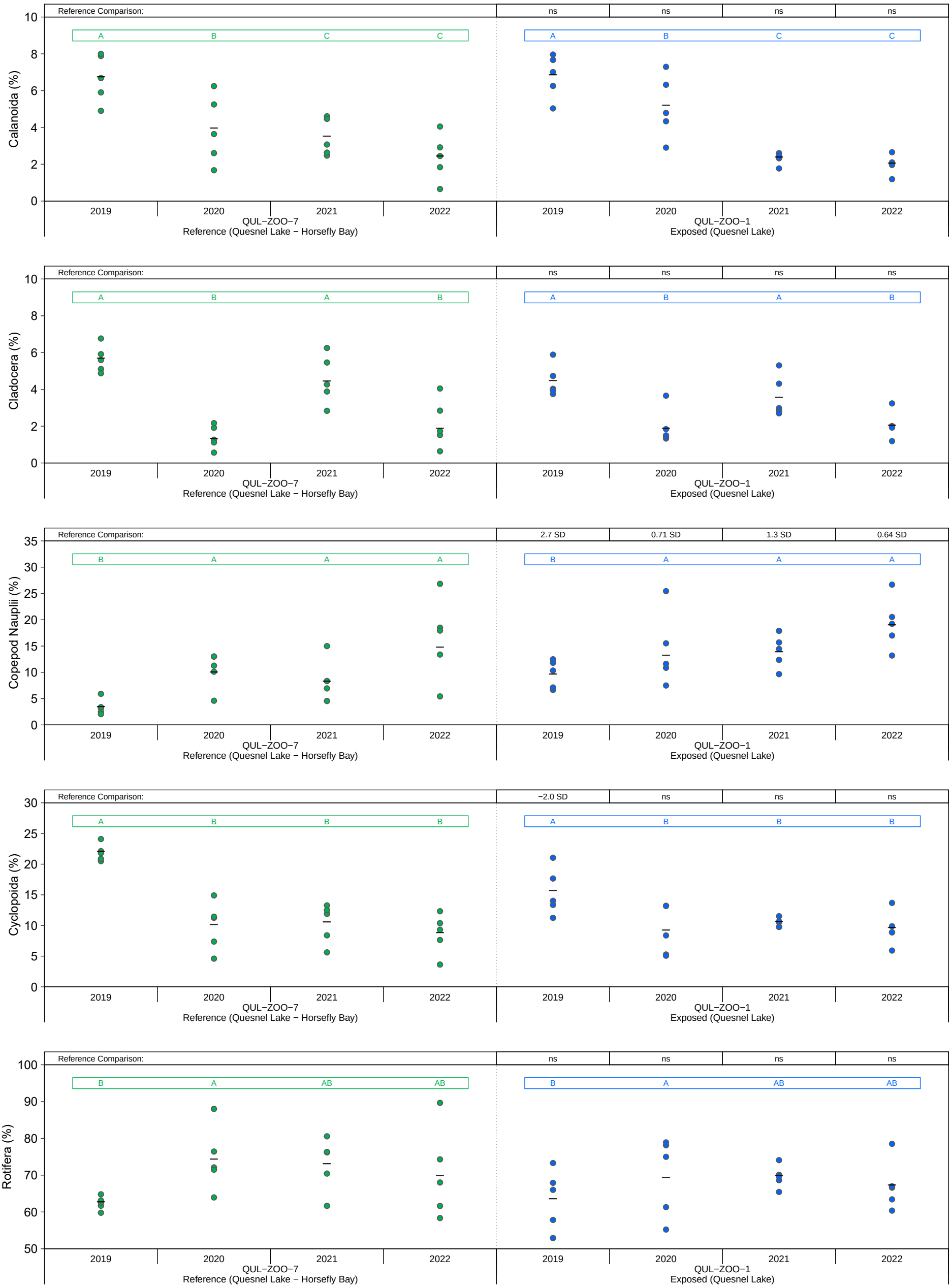

Figure E.2.11: Zooplankton Community Endpoints for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas in July, 2019 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. For plots of zooplankton results prior to 2019, see Minnow 2019a, 2020a, 2021a. For unreplicated zooplankton results collected in June and August 2022, see Appendix Table C.3.7.

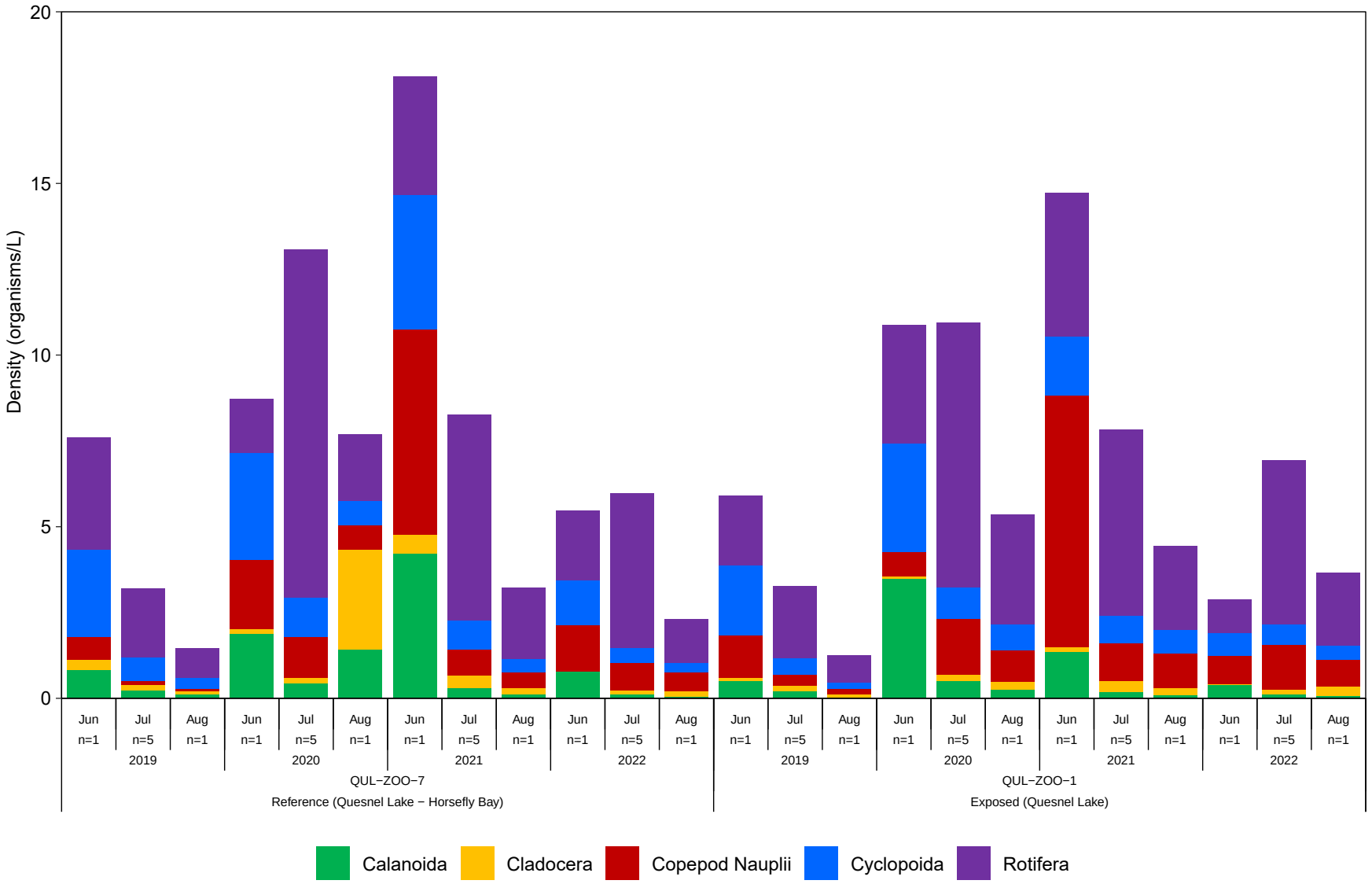

Figure E.2.12: Mean Densities of Major Zooplankton Community Taxonomic Groups for Quesnel Lake at QUL−ZOO−1 (Exposed) and QUL−ZOO−7 (Reference) Areas, 2019 to 2022

Table E.2.1: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Diatom (cells/L)	log10(x+1)	-	-	0.090	Reference	BOL-B2	2019	25,387	AB	B	AB	A	Baseline	ns	ns	ns	ns
							2020	1,125									1.1
							2021	13,521									-1.2
							2022	51,443									ns
					Exposed	POL-P2	2019	61,233	A	AB	B	A	Baseline	ns	-1.9	ns	
							2020	11,010									
							2021	1,102									
							2022	132,652									
Chlorophyte (cells/L)	log10	-	-	0.002	Reference	BOL-B2	2019	278,118	A	B	C	B	Baseline	-2.6	-4.5	-2.4	ns
							2020	280,330									2.6
							2021	44,413									2.5
							2022	104,106									3.5
					Exposed	POL-P2	2019	257,727	A	A	B	A	Baseline	ns	-1.8	ns	
							2020	280,330									
							2021	124,888									
							2022	443,934									
Chrysophyte (cells/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	563,030	A	C	D	B	Baseline	-7.7	-9.5	-3.9	1.8
							2020	54,989									6.8
							2021	32,094									6.4
							2022	174,143									5.2
					Exposed	POL-P2	2019	964,479	A	B	C	A	Baseline	-2.7	-4.9	ns	
							2020	425,720									
							2021	219,571									
							2022	849,603									
Cryptomonad (cells/L)	log10	-	-	0.003	Reference	BOL-B2	2019	169,322	BC	AB	A	C	Baseline	ns	2.1	ns	-1.4
							2020	220,998									ns
							2021	277,719									ns
							2022	144,083									2.0
					Exposed	POL-P2	2019	121,456	B	A	A	A	Baseline	3.4	3.0	2.7	
							2020	268,135									
							2021	241,972									
							2022	227,598									
Cyanobacteria (cells/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	15,531,745	A	A	B	B	Baseline	ns	-5.4	-6.7	ns
							2020	15,358,522									-2.6
							2021	3,205,966									1.8
							2022	2,182,678									ns
					Exposed	POL-P2	2019	17,030,989	A	B	B	C	Baseline	-3.0	-3.8	-6.1	
							2020	7,032,626									
							2021	5,494,837									
							2022	2,796,891									
Dinoflagellates (cells/L)	log10(x+1)	-	-	0.003	Reference	BOL-B2	2019	4.60	A	A	A	A	Baseline	ns	ns	ns	ns
							2020	3.60									1.4
							2021	531									-1.8
							2022	548									-1.3
					Exposed	POL-P2	2019	29.0	AB	A	B	AB	Baseline	ns	ns	ns	
							2020	728									
							2021	0									
							2022	4.60									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. Cells/L = cells per Litre

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.1: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Euglenophytes (cells/L)	log10(x+1)	-	-	0.009	Reference	BOL-B2	2019	0	B	B	A	B	Baseline	ns	2.3	ns	ns
							2020	0									ns
							2021	127									-2.3
							2022	0									ns
					Exposed	POL-P2	2019	4.60	A	A	A	A	Baseline	ns	ns	ns	
							2020	0									
							2021	0									
							2022	0									
Diatoms (%)	rank	-	-	0.004	Reference	BOL-B2	2019	0.110	BC	C	AB	A	Baseline	ns	ns	28	ns
							2020	0.0310									0.70
							2021	0.300									-2.8
							2022	2.80									ns
					Exposed	POL-P2	2019	0.390	B	BC	C	A	Baseline	ns	-3.7	39	
							2020	0.0970									
							2021	0.0400									
							2022	4.10									
Chlorophytes (%)	log10	-	-	0.002	Reference	BOL-B2	2019	1.70	B	C	BC	A	Baseline	-2.0	ns	1.7	ns
							2020	0.620									3.4
							2021	1.20									ns
							2022	3.80									1.9
					Exposed	POL-P2	2019	1.40	C	B	BC	A	Baseline	1.8	ns	3.9	
							2020	3.50									
							2021	2.00									
							2022	9.80									
Chrysophytes (%)	log10	-	-	<0.001	Reference	BOL-B2	2019	3.40	B	D	C	A	Baseline	-5.8	-3.4	1.7	1.1
							2020	0.350									6.9
							2021	0.890									3.6
							2022	6.40									2.7
					Exposed	POL-P2	2019	5.20	B	B	B	A	Baseline	ns	ns	3.3	
							2020	5.30									
							2021	3.60									
							2022	19.0									
Cryptomonads (%)	none	-	-	0.003	Reference	BOL-B2	2019	1.10	B	B	A	A	Baseline	ns	4.3	2.7	ns
							2020	1.40									1.2
							2021	8.30									-2.5
							2022	5.70									ns
					Exposed	POL-P2	2019	0.670	B	A	A	A	Baseline	1.7	2.1	2.7	
							2020	3.50									
							2021	4.20									
							2022	5.30									
Cyanobacteria (%)	none	-	-	<0.001	Reference	BOL-B2	2019	93.0	AB	A	B	C	Baseline	ns	ns	-2.7	ns
							2020	97.0									-2.3
							2021	89.0									ns
							2022	81.0									-4.1
					Exposed	POL-P2	2019	92.0	A	A	A	B	Baseline	ns	ns	-6.6	
							2020	87.0									
							2021	90.0									
							2022	62.0									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. Cells/L = cells per Litre

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.1: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Dinoflagellates (%)	rank	-	-	0.002	Reference	BOL-B2	2019	0	B	B	A	A	Baseline	ns	ns	ns	ns
							2020	0									nc
							2021	0.0910									nc
							2022	0.0790									nc
					Exposed	POL-P2	2019	0	AB	A	B	AB	Baseline	ns	ns	ns	
							2020	0.0400									
							2021	0									
							2022	0									
Euglenophytes (%)	rank	-	-	0.006	Reference	BOL-B2	2019	0	B	B	A	B	Baseline	ns	nm	nm	ns
							2020	0									nm
							2021	0.0560									nm
							2022	0									nm
					Exposed	POL-P2	2019	0	A	A	A	A	Baseline	ns	ns	ns	
							2020	0									
							2021	0									
							2022	0									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. Cells/L = cells per Litre

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.2: Results of Statistical Comparisons of Zooplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Calanoida (organisms/L)	log10	-	-	0.055	Reference	BOL-B2	2019	0.130	B	A	A	AB	Baseline	2.3	2.0	ns	ns
							2020	0.430									ns
							2021	0.370									-1.5
							2022	0.290									ns
					Exposed	POL-P2	2019	0.140	C	AB	BC	A	Baseline	1.7	ns	2.5	
							2020	0.320									
							2021	0.170									
							2022	0.490									
Cladocera (organisms/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	0.350	B	A	B	B	Baseline	3.1	ns	ns	-1.3
							2020	0.430									ns
							2021	0.390									2.1
							2022	0.460									2.0
					Exposed	POL-P2	2019	0.210	B	A	A	A	Baseline	4.0	3.8	4.1	
							2020	0.320									
							2021	0.830									
							2022	0.930									
Copepod Nauplii (organisms/L)	log10	<0.001	<0.001	0.118	Reference	BOL-B2	2019	0.410	C	A	B	A	Baseline	4.1	2.6	3.6	3.8
							2020	1.10									ns
							2021	2.10									1.7
							2022	3.90									2.1
					Exposed	POL-P2	2019	4.20	C	A	B	A	Baseline	2.4	0.57	1.9	
							2020	19.0									
							2021	6.10									
							2022	14.0									
Cyclopoida (organisms/L)	log10	-	-	<0.001	Reference	BOL-B2	2019	0.640	C	A	B	AB	Baseline	3.8	2.0	3.5	3.7
							2020	2.70									2.2
							2021	1.30									1.6
							2022	2.30									-1.1
					Exposed	POL-P2	2019	2.60	B	A	B	B	Baseline	2.3	ns	ns	
							2020	5.90									
							2021	2.40									
							2022	1.60									
Rotifera (organisms/L)	log10	-	-	0.002	Reference	BOL-B2	2019	3.20	B	A	A	A	Baseline	4.5	3.8	5.3	-2.9
							2020	17.0									-5.3
							2021	13.0									-6.0
							2022	22.0									-3.1
					Exposed	POL-P2	2019	1.10	C	B	BC	A	Baseline	2.0	ns	5.1	
							2020	2.30									
							2021	1.40									
							2022	7.10									
Calanoida (%)	log10	-	-	0.020	Reference	BOL-B2	2019	2.80	A	AB	A	B	Baseline	ns	ns	-2.3	-1.2
							2020	1.60									ns
							2021	2.20									ns
							2022	1.00									1.5
					Exposed	POL-P2	2019	1.60	A	A	A	A	Baseline	ns	ns	ns	
							2020	1.10									
							2021	1.50									
							2022	1.90									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. organisms/L = organisms per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.2: Results of Statistical Comparisons of Zooplankton Community Endpoints for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	POL-P2
Cladocera (%)	log10	-	-	<0.001	Reference	BOL-B2	2019	7.10	A	AB	BC	C	Baseline	ns	-2.9	-4.0	-2.8
							2020	4.00									ns
							2021	2.30									3.0
							2022	1.60									2.3
					Exposed	POL-P2	2019	2.50	B	B	A	B	Baseline	ns	2.9	ns	
							2020	3.10									
							2021	7.40									
							2022	3.70									
Copepod Nauplii (%)	log10	<0.001	0.018	0.467	Reference	BOL-B2	2019	8.40	B	A	AB	AB	Baseline	2.2	ns	ns	4.6
							2020	20.0									3.1
							2021	12.0									3.9
							2022	13.0									3.8
					Exposed	POL-P2	2019	49.0	B	A	AB	AB	Baseline	0.77	ns	ns	
							2020	66.0									
							2021	54.0									
							2022	56.0									
Cyclopoida (%)	log10	-	-	0.008	Reference	BOL-B2	2019	13.0	A	A	A	A	Baseline	ns	ns	ns	2.0
							2020	9.90									1.8
							2021	7.80									2.5
							2022	7.90									ns
					Exposed	POL-P2	2019	30.0	A	A	A	B	Baseline	ns	ns	-3.9	
							2020	21.0									
							2021	21.0									
							2022	6.20									
Rotifera (%)	none	-	-	0.039	Reference	BOL-B2	2019	65.0	BC	C	AB	A	Baseline	ns	ns	1.6	-8.6
							2020	63.0									-9.3
							2021	74.0									-10
							2022	75.0									-7.9
					Exposed	POL-P2	2019	15.0	B	B	B	A	Baseline	ns	ns	2.4	
							2020	8.50									
							2021	13.0									
							2022	29.0									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. organisms/L = organisms per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.3: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Diatoms (cells/L)	log10	0.265	<0.001	0.130	Reference	QUL-ZOO-7	2019	231,616	A	C	AB	BC	Baseline	-2.7	ns	-1.8	ns
							2020	109,236									ns
							2021	217,305									ns
							2022	141,016									ns
					Exposed	QUL-ZOO-1	2019	233,728	A	C	AB	BC	Baseline	-1.2	ns	-1.3	
							2020	167,090									
							2021	183,565									
							2022	163,971									
Chlorophyte (cells/L)	log10	0.545	<0.001	0.220	Reference	QUL-ZOO-7	2019	65,274	B	A	B	B	Baseline	1.4	ns	ns	ns
							2020	111,660									ns
							2021	49,457									ns
							2022	72,460									ns
					Exposed	QUL-ZOO-1	2019	72,265	B	A	B	B	Baseline	1.5	ns	ns	
							2020	128,345									
							2021	48,356									
							2022	42,721									
Chrysophyte (cells/L)	log10	<0.001	<0.001	0.435	Reference	QUL-ZOO-7	2019	184,147	B	B	C	A	Baseline	ns	-1.3	5.5	1.3
							2020	224,375									1.4
							2021	132,320									0.91
							2022	772,584									2.3
					Exposed	QUL-ZOO-1	2019	256,472	B	B	C	A	Baseline	ns	-1.6	6.6	
							2020	319,246									
							2021	167,672									
							2022	1,420,457									
Cryptomonad (cells/L)	log10	0.196	<0.001	0.283	Reference	QUL-ZOO-7	2019	116,488	B	A	C	AB	Baseline	2.3	-1.6	ns	ns
							2020	324,272									ns
							2021	56,028									ns
							2022	204,382									ns
					Exposed	QUL-ZOO-1	2019	119,978	B	A	C	AB	Baseline	0.79	-1.5	ns	
							2020	171,268									
							2021	60,862									
							2022	160,839									
Cyanobacteria (cells/L)	log10(x+1)	0.628	0.061	0.360	Reference	QUL-ZOO-7	2019	580	A	A	A	A	Baseline	ns	ns	ns	ns
							2020	61,874									ns
							2021	850									ns
							2022	10,030									ns
					Exposed	QUL-ZOO-1	2019	3,548	A	A	A	A	Baseline	ns	ns	ns	
							2020	147,047									
							2021	524									
							2022	65.0									
Dinoflagellates (cells/L)	log10(x+1)	0.035	0.015	0.730	Reference	QUL-ZOO-7	2019	6,937	A	AB	AB	B	Baseline	ns	ns	-1.6	0.22
							2020	-									nc
							2021	137									1.2
							2022	36.0									0.53
					Exposed	QUL-ZOO-1	2019	14,270	A	AB	AB	B	Baseline	ns	ns	-1.3	
							2020	-									
							2021	7,226									
							2022	209									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. Cells/L = Cells per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.3: Results of Statistical Comparisons of Phytoplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Diatoms (%)	log10	0.518	<0.001	0.271	Reference	QUL-ZOO-7	2019	36.0	A	B	A	B	Baseline	-3.2	ns	-3.4	ns
							2020	12.0									ns
							2021	40.0									ns
							2022	11.0									ns
					Exposed	QUL-ZOO-1	2019	32.0	A	B	A	B	Baseline	-1.9	ns	-3.8	
							2020	17.0									
							2021	33.0									
							2022	8.90									
Chlorophytes (%)	none	0.394	<0.001	0.531	Reference	QUL-ZOO-7	2019	11.0	A	A	A	B	Baseline	ns	ns	-1.4	ns
							2020	13.0									ns
							2021	9.50									ns
							2022	6.10									ns
					Exposed	QUL-ZOO-1	2019	11.0	A	A	A	B	Baseline	ns	ns	-2.4	
							2020	13.0									
							2021	9.30									
							2022	2.50									
Chrysophytes (%)	log10	0.003	<0.001	0.999	Reference	QUL-ZOO-7	2019	29.0	B	B	B	A	Baseline	ns	ns	3.7	0.94
							2020	25.0									1.0
							2021	24.0									1.0
							2022	63.0									0.95
					Exposed	QUL-ZOO-1	2019	35.0	B	B	B	A	Baseline	ns	ns	3.7	
							2020	32.0									
							2021	30.0									
							2022	77.0									
Cryptomonads (%)	none	-	-	0.006	Reference	QUL-ZOO-7	2019	18.0	B	A	B	B	Baseline	3.2	ns	ns	ns
							2020	37.0									-3.3
							2021	13.0									ns
							2022	17.0									-1.3
					Exposed	QUL-ZOO-1	2019	16.0	A	A	A	A	Baseline	ns	ns	ns	
							2020	18.0									
							2021	12.0									
							2022	9.90									
Cyanobacteria (%)	rank	0.780	0.003	0.716	Reference	QUL-ZOO-7	2019	2.50	B	A	B	B	Baseline	1.5	ns	ns	ns
							2020	6.50									ns
							2021	5.50									ns
							2022	1.30									ns
					Exposed	QUL-ZOO-1	2019	5.50	B	A	B	B	Baseline	3.4	ns	ns	
							2020	15.0									
							2021	1.20									
							2022	0									
Dinoflagellates (%)	log10(x+1)	0.018	<0.001	0.406	Reference	QUL-ZOO-7	2019	1.40	A	B	B	B	Baseline	-1.3	-1.4	-1.7	1.0
							2020	0.560									0.83
							2021	0.520									1.4
							2022	0.320									-0.11
					Exposed	QUL-ZOO-1	2019	2.10	A	B	B	B	Baseline	-1.5	-1.0	-2.8	
							2020	1.10									
							2021	1.40									
							2022	0.250									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. Cells/L = Cells per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table E.2.4: Results of Statistical Comparisons of Zooplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Calanoida (organisms/L)	log10	0.762	<0.001	0.133	Reference	QUL-ZOO-7	2019	0.210	B	A	B	C	Baseline	2.1	ns	-2.0	ns
							2020	0.420									ns
							2021	0.270									ns
							2022	0.110									ns
					Exposed	QUL-ZOO-1	2019	0.220	B	A	B	C	Baseline	2.6	ns	-1.7	
							2020	0.500									
							2021	0.170									
							2022	0.120									
Cladocera (organisms/L)	log10	0.866	<0.001	0.298	Reference	QUL-ZOO-7	2019	0.180	B	B	A	B	Baseline	ns	1.7	ns	ns
							2020	0.420									ns
							2021	0.360									ns
							2022	0.0970									ns
					Exposed	QUL-ZOO-1	2019	0.140	B	B	A	B	Baseline	ns	1.5	ns	
							2020	0.500									
							2021	0.260									
							2022	0.130									
Copepod Nauplii (organisms/L)	log10	0.001	<0.001	0.137	Reference	QUL-ZOO-7	2019	0.100	B	A	A	A	Baseline	5.4	4.1	4.5	2.4
							2020	1.20									0.30
							2021	0.660									0.99
							2022	0.780									0.97
					Exposed	QUL-ZOO-1	2019	0.300	B	A	A	A	Baseline	3.3	2.7	3.1	
							2020	1.30									
							2021	1.00									
							2022	1.20									
Cyclopoida (organisms/L)	log10	-	-	0.078	Reference	QUL-ZOO-7	2019	0.700	A	A	A	B	Baseline	ns	ns	-1.6	-1.2
							2020	1.10									ns
							2021	0.810									ns
							2022	0.430									ns
					Exposed	QUL-ZOO-1	2019	0.490	B	A	A	AB	Baseline	1.9	1.6	ns	
							2020	0.850									
							2021	0.780									
							2022	0.580									
Rotifera (organisms/L)	log10	0.705	<0.001	0.768	Reference	QUL-ZOO-7	2019	2.00	C	A	AB	B	Baseline	3.6	2.7	1.5	ns
							2020	8.90									ns
							2021	6.00									ns
							2022	3.70									ns
					Exposed	QUL-ZOO-1	2019	2.00	C	A	AB	B	Baseline	3.0	2.3	1.8	
							2020	7.10									
							2021	5.20									
							2022	4.30									
Calanoida (%)	none	0.911	<0.001	0.210	Reference	QUL-ZOO-7	2019	6.70	A	B	C	C	Baseline	-2.2	-2.6	-3.4	ns
							2020	3.90									ns
							2021	3.50									ns
							2022	2.40									ns
					Exposed	QUL-ZOO-1	2019	6.80	A	B	C	C	Baseline	-1.3	-3.6	-3.8	
							2020	5.10									
							2021	2.30									
							2022	2.00									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. organisms/L = organisms per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.
[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed

Table E.2.4: Results of Statistical Comparisons of Zooplankton Community Endpoints for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites								Spatial Comparison Within Years[b]
									Pairwise Comparisons Between Years				MOD Relative to Baseline[b]				
		Area	Year	Area x Year					2019	2020	2021	2022	2019	2020	2021	2022	QUL-ZOO-1
Cladocera (%)	log10	0.946	<0.001	0.321	Reference	QUL-ZOO-7	2019	5.60	A	B	A	B	Baseline	-3.7	ns	-2.8	ns
							2020	3.90									ns
							2021	4.40									ns
							2022	1.80									ns
					Exposed	QUL-ZOO-1	2019	4.40	A	B	A	B	Baseline	-2.2	ns	-2.0	
							2020	5.10									
							2021	3.50									
							2022	2.00									
Copepod Nauplii (%)	log10	<0.001	<0.001	0.106	Reference	QUL-ZOO-7	2019	3.20	B	A	A	A	Baseline	2.8	2.3	3.7	2.7
							2020	9.80									0.71
							2021	8.00									1.3
							2022	15.0									0.64
					Exposed	QUL-ZOO-1	2019	9.40	B	A	A	A	Baseline	0.81	0.94	1.7	
							2020	13.0									
							2021	14.0									
							2022	19.0									
Cyclopoida (%)	none	-	-	0.060	Reference	QUL-ZOO-7	2019	22.0	A	B	B	B	Baseline	-3.8	-3.7	-4.2	-2.0
							2020	9.90									ns
							2021	10.0									ns
							2022	8.70									ns
					Exposed	QUL-ZOO-1	2019	15.0	A	B	B	B	Baseline	-2.1	-1.6	-1.9	
							2020	9.00									
							2021	10.0									
							2022	9.50									
Rotifera (%)	log10	0.330	0.051	0.881	Reference	QUL-ZOO-7	2019	62.0	B	A	AB	AB	Baseline	1.5	ns	ns	ns
							2020	74.0									ns
							2021	73.0									ns
							2022	70.0									ns
					Exposed	QUL-ZOO-1	2019	63.0	B	A	AB	AB	Baseline	0.76	ns	ns	
							2020	69.0									
							2021	70.0									
							2022	67.0									

P-value < 0.05
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0. organisms/L = organisms per Litre.

[a] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

APPENDIX E.3
ZOOPLANKTON TISSUE QUALITY

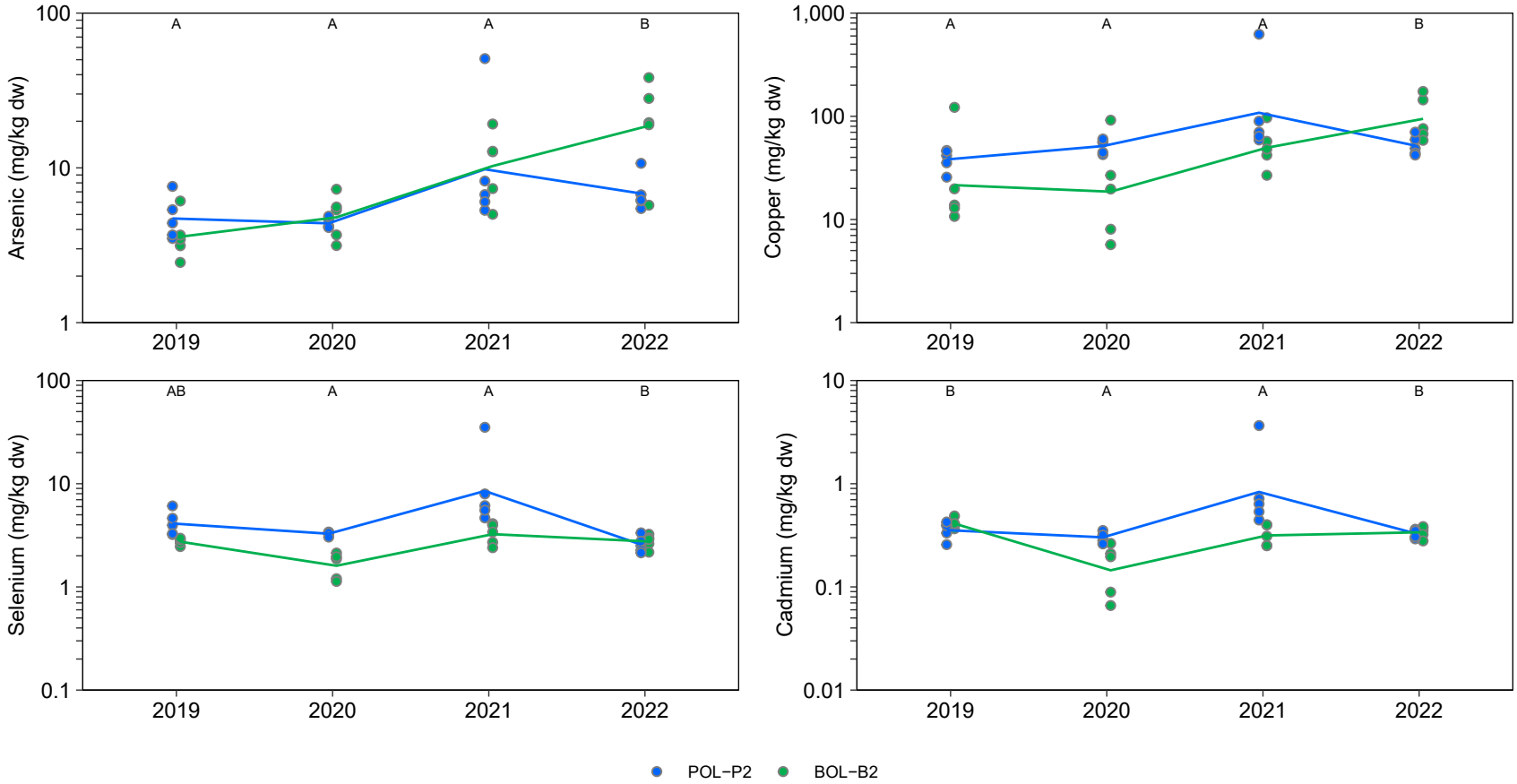

Figure E.3.1: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas for which a Significant Area x Year Effect was Detected in July, 2019 to 2022

Notes: dw = dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed : Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed : Reference). Only years with samples from both reference and exposed areas are plotted.

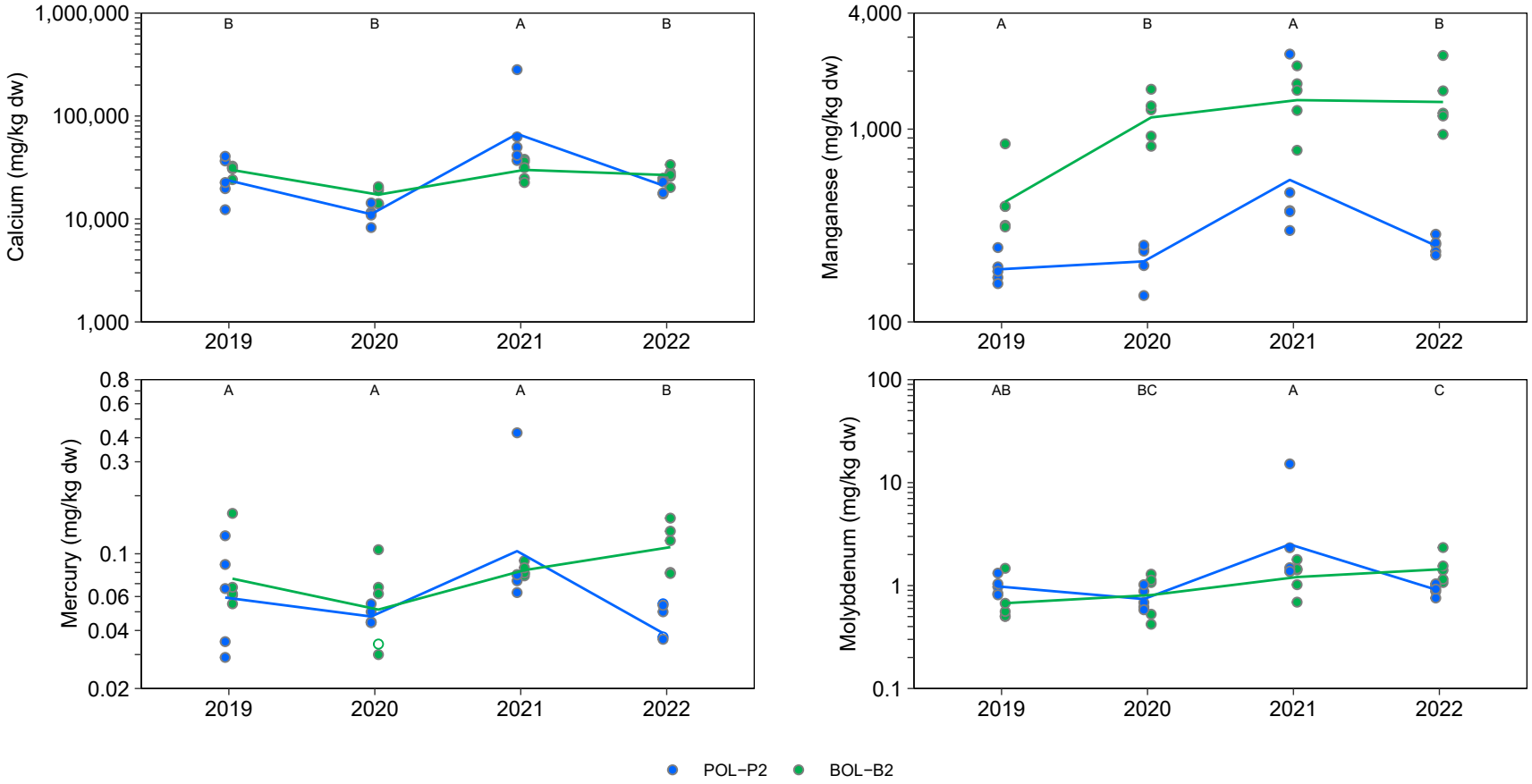

Figure E.3.1: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas for which a Significant Area x Year Effect was Detected in July, 2019 to 2022

Notes: dw = dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed : Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed : Reference). Only years with samples from both reference and exposed areas are plotted.

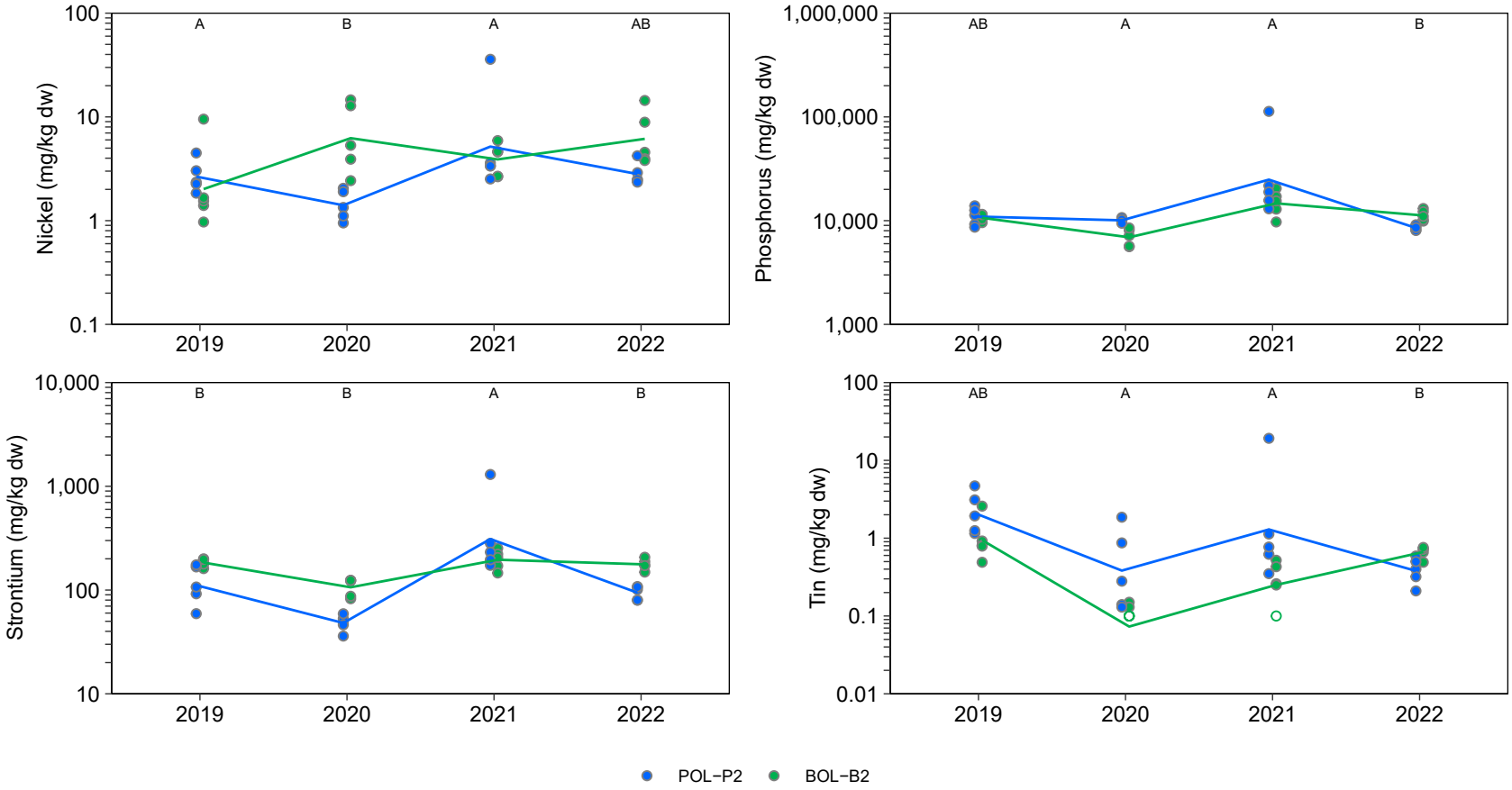

Figure E.3.1: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas for which a Significant Area x Year Effect was Detected in July, 2019 to 2022

Notes: dw = dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed : Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed : Reference). Only years with samples from both reference and exposed areas are plotted.

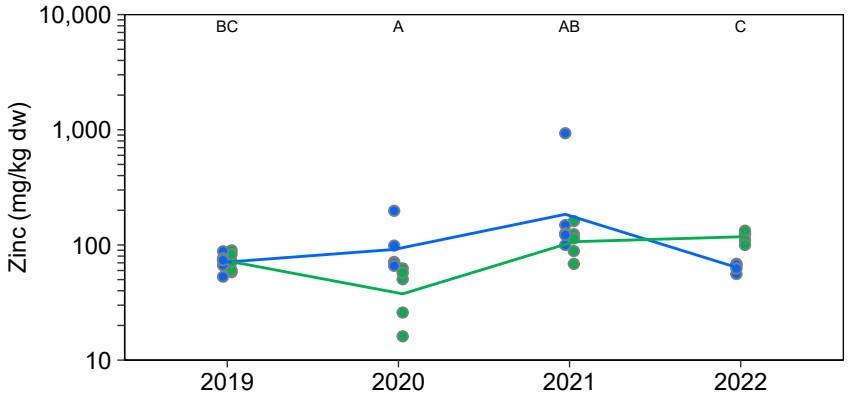

Figure E.3.1: Zooplankton Tissue Primary and Secondary Analyte Concentrations for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas for which a Significant Area x Year Effect was Detected in July, 2019 to 2022

Notes: dw = dry weight. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed : Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed : Reference). Only years with samples from both reference and exposed areas are plotted.

Table E.3.1: Statistical Comparisons of Exposed - Reference Relative Differences of Metal Concentrations in Zooplankton Tissue for Polley Lake (POL-P2; Exposed) and Bootjack Lake (BOL-B2; Reference) Areas in July, 2019 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for Polley Mean Relative to Bootjack (%)[c]			
					Post-Breach Period				Post-Breach Period				Post-Breach Period			
		Area	Year	Area × Year	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	MLE	0.328	<0.001	0.357	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Antimony	MLE	0.498	<0.001	0.004	BC	AB	A	C	baseline	ns	262	ns	ns	ns	194	-64
Arsenic	MLE	0.183	<0.001	0.021	A	A	A	B	baseline	ns	ns	-72	ns	ns	ns	-64
Barium	MLE	<0.001	<0.001	0.383	A	A	A	A	baseline	ns	ns	ns	-61			
Beryllium	MLE	0.093	<0.001	0.636	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Bismuth	MLE	0.099	0.770	0.062	<LRL	<LRL	A	A	<LRL	<LRL	baseline	ns	<LRL	<LRL	ns	ns
Boron	MLE	0.275	0.001	0.160	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cadmium	MLE	0.006	<0.001	0.002	B	A	A	B	baseline	141	205	ns	ns	109	164	ns
Calcium	MLE	0.883	<0.001	<0.001	B	B	A	B	baseline	ns	177	ns	ns	-35	124	ns
Cesium	MLE	0.014	<0.001	0.223	A	A	A	A	baseline	ns	ns	ns	-42			
Chromium	MLE	0.061	<0.001	0.055	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.165	<0.001	0.127	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.047	0.003	0.027	A	A	A	B	baseline	ns	ns	-69	ns	177	ns	ns
Iron	MLE	0.005	<0.001	0.258	A	A	A	A	baseline	ns	ns	ns	-46			
Lead	MLE	0.457	0.005	0.096	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lithium	MLE	0.279	0.651	0.028	<LRL	<LRL	A	B	<LRL	<LRL	baseline	-67	<LRL	<LRL	ns	-57
Magnesium	MLE	0.683	<0.001	0.026	AB	B	A	B	baseline	ns	ns	ns	ns	ns	80	ns
Manganese	MLE	<0.001	<0.001	0.010	A	B	A	B	baseline	-60	ns	-60	-55	-82	-61	-82
Mercury	MLE	0.085	0.048	0.016	A	A	A	B	baseline	ns	ns	-55	ns	ns	ns	-64
Molybdenum	MLE	0.367	0.002	0.022	AB	BC	A	C	baseline	ns	ns	-56	ns	ns	107	ns
Nickel	MLE	0.055	0.134	0.003	A	B	A	AB	baseline	-83	ns	ns	ns	-77	ns	-54
Phosphorus	MLE	0.137	<0.001	0.027	AB	A	A	B	baseline	ns	ns	ns	ns	ns	69	ns
Potassium	MLE	0.267	0.003	0.103	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.173	0.008	0.122	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	<0.001	<0.001	0.004	AB	A	A	B	baseline	ns	ns	ns	50	104	162	ns
Silver	MLE	<0.001	0.002	0.271	A	A	A	A	baseline	ns	ns	ns	-46			
Sodium	MLE	0.036	<0.001	0.058	A	A	A	A	baseline	ns	ns	ns	28			
Strontium	MLE	0.006	<0.001	<0.001	B	B	A	B	baseline	ns	162	ns	-39	-55	58	-47
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.007	0.013	C	AB	A	BC	baseline	178	285	ns	-87	-64	-49	-84
Tin	MLE	0.003	<0.001	0.009	AB	A	A	B	baseline	ns	ns	ns	ns	424	415	ns
Titanium	MLE	0.857	<0.001	0.347	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Uranium	MLE	<0.001	<0.001	0.192	A	A	A	A	baseline	ns	ns	ns	-66			
Vanadium	MLE	0.679	<0.001	0.529	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zinc	MLE	0.197	0.002	<0.001	BC	A	AB	C	baseline	146	ns	ns	ns	143	73	-46
Zirconium	MLE	0.094	<0.001	0.745	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05.
Contrast is significant (α = 0.05) and magnitude of difference is positive.
Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (POL-P2:BOL-B2) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (POL-P2:BOL-B2).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table E.3.2: Seasonal Kendall Trend Analysis of Primary and Secondary Analyte Concentrations in Post-Breach Surface Water for Polley Lake (POL-P1, POL-P2; Exposed) Monitoring Stations, 2015 to 2022

Analyte		Surface			
		POL-P1 (Exposed)		POL-P2 (Exposed)	
		P-Value	Slope	P-Value	Slope
Total Metals	Arsenic	<0.001	-10	<0.001	-9.7
	Barium	<0.001	-2.7	<0.001	-2.7
	Cadmium	-	-	-	-
	Calcium	<0.001	-2.2	<0.001	-2.3
	Cobalt	-	-	-	-
	Copper	0.047	1.6	0.030	2.0
	Iron	-	-	-	-
	Manganese	<0.001	-13	<0.001	-11
	Molybdenum	<0.001	-9.0	<0.001	-9.0
	Nickel	-	-	-	-
	Phosphorus	0.032	-5.0	0.013	-4.5
	Selenium	<0.001	-5.8	<0.001	-6.3
	Silver	-	-	-	-
	Sodium	<0.001	-3.9	<0.001	-3.8
	Strontium	<0.001	-3.6	<0.001	-4.0
	Tin	-	-	-	-
	Titanium	-	-	-	-
	Vanadium	<0.001	3.8	<0.001	4.0
	Uranium	<0.001	-5.7	<0.001	-6.4
	Zinc	-	-	-	-
Dissolved Metals	GEF Dissolved Copper Chronic	0.002	5.2	<0.001	6.2
	GEF Dissolved Copper Acute	0.002	4.7	<0.001	5.8
	Arsenic	<0.001	-9.0	<0.001	-8.9
	Barium	<0.001	-2.2	<0.001	-2.1
	Cadmium	-	-	-	-
	Calcium	<0.001	-2.4	<0.001	-2.2
	Cobalt	-	-	-	-
	Copper	<0.001	4.2	<0.001	3.4
	Iron	-	-	-	-
	Manganese	0.042	-15	0.020	-15
	Molybdenum	<0.001	-8.1	<0.001	-8.5
	Nickel	-	-	-	-
	Selenium	<0.001	-6.6	<0.001	-6.9
	Silver	-	-	-	-
	Sodium	<0.001	-3.6	<0.001	-3.6
	Strontium	<0.001	-3.7	<0.001	-3.4
	Tin	-	-	-	-
	Titanium	-	-	-	-
	Vanadium	<0.001	5.8	<0.001	5.6
	Uranium	<0.001	-4.4	<0.001	-4.6
	Zinc	-	-	-	-

P-Value < 0.05

Significant decreasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Significant increasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Notes: GEF = Guideline Exceedance Factor. NS = no significant temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). "-" not enough detected data to test for trend (> 75 % of values below laboratory reporting limit).

Table E.3.3: Statistical Comparisons of Exposed - Reference Relative Differences of Metal Concentrations in Zooplankton Tissue for Quesnel Lake at QUL-ZOO-1 (Exposed) and QUL-ZOO-7 (Reference) Areas in July, 2019 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed ─ Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed ─ Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for QUL-ZOO-1 Mean Relative to QUL-ZOO-7 (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	MLE	0.041	0.798	0.948	A	A	A	A	baseline	ns	ns	ns	-32			
Antimony	MLE	0.738	0.332	0.310	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	MLE	0.301	0.015	0.511	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Barium	MLE	0.299	0.114	0.797	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Beryllium	MLE	0.006	0.723	0.097	A	A	A	A	baseline	ns	ns	ns	-40			
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	0.098	<0.001	0.035	A	B	<LRL	AB	baseline	103	<LRL	ns	-44	ns	<LRL	ns
Cadmium	MLE	0.091	<0.001	0.385	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.709	0.002	0.265	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	0.026	0.911	0.952	A	A	A	A	baseline	ns	ns	ns	-29			
Chromium	MLE	0.042	0.093	0.954	A	A	A	A	baseline	ns	ns	ns	-31			
Cobalt	MLE	0.023	0.953	0.857	A	A	A	A	baseline	ns	ns	ns	-30			
Copper	MLE	0.202	0.139	0.713	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Iron	MLE	0.048	0.584	0.958	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	0.005	<0.001	0.100	A	A	A	A	baseline	ns	ns	ns	-41			
Lithium	MLE	0.034	0.293	0.763	A	A	A	A	baseline	ns	ns	ns	-35			
Magnesium	MLE	0.451	0.008	0.547	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.031	0.241	0.640	A	A	A	A	baseline	ns	ns	ns	-27			
Mercury	MLE	0.505	0.056	0.970	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	0.472	0.182	0.292	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Nickel	MLE	0.264	0.355	0.777	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Phosphorus	MLE	0.739	<0.001	0.139	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.869	<0.001	0.071	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.854	<0.001	0.066	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	0.397	<0.001	0.370	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Silver	MLE	0.334	<0.001	0.063	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Sodium	MLE	0.666	0.002	0.083	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.614	<0.001	0.423	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.265	<0.001	0.408	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	0.208	<0.001	0.868	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Titanium	MLE	0.026	0.606	0.959	A	A	A	A	baseline	ns	ns	ns	-38			
Uranium	MLE	0.082	0.555	0.879	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	0.087	0.135	0.947	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zinc	MLE	0.599	<0.001	0.434	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zirconium	MLE	0.129	0.895	0.974	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05.
Contrast is significant (α = 0.05) and magnitude of difference is positive.
Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (QUL-ZOO-1 [Exposed] : QUL-ZOO-7 [Reference]) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (QUL-ZOO-1 [Exposed]:QUL-ZOO-7 [Reference]).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table E.3.4: Seasonal Kendall Trend Analysis of Primary and Secondary Analyte Concentrations in Post-Breach Surface Water for Quesnel Lake at Exposed (QUL-18, QUL-2a) and Reference (QUL-120) Monitoring Stations, 2015 to 2022

	Analyte	Surface					
		QUL-18 (Exposed)		QUL-2a (Exposed)		QUL-120a (Reference)	
		P-Value	Slope	P-Value	Slope	P-Value	Slope
Total Metals	Arsenic	0.186	NS	NS	-	NS	-
	Barium	0.243	NS	0.307	NS	NS	-
	Cadmium	-	-	-	-	-	-
	Calcium	0.097	NS	0.040	-0.89	NS	-
	Cobalt	-	-	-	-	-	-
	Copper	0.384	NS	0.336	NS	NS	-
	Iron	-	-	-	-	-	-
	Manganese	0.032	5.2	0.303	NS	NS	-
	Molybdenum	0.559	NS	0.156	NS	NS	-
	Nickel	-	-	-	-	-	-
	Phosphorus	0.059	NS	<0.001	28	NS	-
	Selenium	0.080	NS	0.001	7.3	NS	-
	Silver	-	-	-	-	-	-
	Sodium	0.436	NS	0.307	NS	NS	-
	Strontium	0.023	-1.6	0.069	NS	NS	-
	Tin	-	-	-	-	-	-
	Titanium	-	-	-	-	-	-
	Vanadium	-	-	-	-	-	-
	Uranium	0.011	-2.2	0.149	NS	NS	-
	Zinc	-	-	-	-	-	-
Dissolved Metals	GEF Dissolved Copper Chronic	0.282	NS	0.223	NS	NS	-
	GEF Dissolved Copper Acute	0.208	NS	0.403	NS	NS	-
	Arsenic	0.387	NS	0.136	NS	NS	-
	Barium	0.146	NS	0.033	1.6	NS	-
	Cadmium	-	-	-	-	-	-
	Calcium	0.559	NS	0.060	NS	NS	-
	Cobalt	-	-	-	-	-	-
	Copper	0.256	NS	NS	-	NS	-
	Iron	-	-	-	-	-	-
	Manganese	0.771	NS	0.853	NS	NS	-
	Molybdenum	0.020	2.9	0.009	2.8	NS	-
	Nickel	-	-	-	-	-	-
	Selenium	0.002	7.3	0.009	6.8	NS	-
	Silver	-	-	-	-	-	-
	Sodium	0.173	NS	0.004	1.8	NS	-
	Strontium	0.777	NS	0.585	NS	NS	-
	Tin	-	-	-	-	-	-
	Titanium	-	-	-	-	-	-
	Vanadium	-	-	-	-	-	-
	Uranium	0.453	NS	0.174	NS	NS	-
	Zinc	-	-	-	-	-	-

P-Value < 0.05

Significant decreasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Significant increasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Notes: GEF = Guideline Exceedance Factor. NS = no significant temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). "-" not enough detected data to test for trend (> 75 % of values below laboratory reporting limit).

APPENDIX E.4
BENTHIC COMMUNITY

APPENDIX E4 RESOLVING MIXED-LEVELS OF TAXONOMIC RESOLUTION FOR BENTHIC INVERTEBRATES

E.4.1 INTRODUCTION 1
E.4.2 DECISION KEY 3
E.4.3 REFERENCES 4

E.4.1 INTRODUCTION

Processing of benthic invertebrate data for ecological assessment generally involves determining taxonomic richness (number of taxa present) as well as community composition, which is typically assessed using abundances (and/or density) of all taxa present and their relative proportion of the total community. Taxonomic richness and community composition can be informative metrics on their own, however they are also utilized in the calculation of diversity indices (e.g. Simpson's Evenness and Simpson's Diversity). Determination of taxonomic richness and community composition from taxonomic data can be complicated by inconsistencies in taxonomic data, relating to the taxonomic level to which organisms can practicably be identified by the laboratory ("resolution"). Taxonomists endeavour to classify organisms within the most specific taxon (a defined taxonomic identity of any rank) possible, generally Genus or Species, however specimens that are damaged or are in an early developmental stage may lack the morphological features necessary to confirm an identification to the same level that can be achieved for some adult specimens. Furthermore, the information needed to confirm the identification of specimens may not be available in taxonomic keys or other resources. When individuals of a single taxon are identified to different levels of resolution within a single sample they are considered redundant or "ambiguous" taxa. The presence of these ambiguous taxa may result in inflated estimates of richness or distorted patterns of diversity across sites. For example, some specimens may be identified to the genus level (e.g., *Baetis*) while others are identified to the species level (e.g., *Baetis tricaudatus*). If ambiguous taxa are not resolved, then the coarser-resolution taxon (i.e., the Genus-level, *Baetis*) is counted as a unique taxon when it may actually be the same species as the finer-level taxon (i.e., species-level, *B. tricaudatus*). Therefore, one consequence of the common practice of identifying organisms to the lowest practicable taxonomic level (LPL) is that the "species list" (complete list of taxa identified) from any site contains a mixture of taxa (or "mixed-level") wherein an individual taxon may have multiple specimens identified to several different levels of taxonomic resolution. As a result, benthic invertebrate data typically comprise a mixture of identification levels due to difficulties in achieving a uniform Species, Genus, or even Family-level identification for aquatic macroinvertebrates (Cranston 1990) and must undergo additional consolidation steps prior to data analysis.

At least four options are available for dealing with taxa identified to mixed-levels of taxonomic resolution:

1. remove data for any organisms identified to a level less-specific than the target resolution (i.e., anything not at the Genus or Species level);

2. group all data for any organisms identified to a level less-specific than the target resolution into an "Other" group, a standalone but undefined taxon;

3. proportionally distribute data for any organisms identified to a level less-specific than the target resolution into values for organisms positively identified to target resolution according to the ratios of those positively identified taxa (i.e. “rolling down” unidentified taxa to more specific taxonomic levels); or

4. combine all related taxa least-specific taxon to which consistent identification is possible (i.e. “rolling up” unidentified taxa to less-specific taxonomic levels – often family-level).

Option 1 (though sometimes used) is unsatisfactory because a bias is introduced into the sample (because difficult to identify taxa are not randomly distributed, but rather occur more frequently in particular Classes, Orders, and Families). The second option (also sometimes used) is unsatisfactory because organisms grouped as “Other” contribute no useful information (beyond increasing the total density estimate), and complicate further analyses. The third option assumes that the ratio of taxa among ambiguous taxa is the same as in specimens of identified decisively, which may or may not be accurate. The fourth option is most conservative but may lead to a significant loss of data. For example, specimens of the Genera *Baetis* and *Pseudocloeon* might be lumped together and analyzed as Baetidae. The preferred option for analysis depends on the distribution of the organisms among taxa. If identified specimens in the two genera above constitute only 10% of the total abundance, it may be most appropriate to lump them together with the other 90% in the less-specific taxon (Family: Baetidae). Conversely, if 90% of the identified organisms fall into the two Genera, it is more defensible to apportion the ambiguous taxa identified only to Baetidae (Family) into the values for specimens identified to Genus, and any resulting error may not seriously bias the analysis. In order to standardize the decision-making process, reduce subjectivity, and improve the efficiency of benthic community data processing, Minnow has developed and applied a decision key which is used in the processing of all benthic invertebrate community data.

E.4.2 DECISION KEY

Resolution of redundant or ambiguous taxa was achieved through implementation of a decision key that dictated criteria for data processing (Figure E.4.1). The first two options for dealing with taxa identified to mixed-levels of taxonomic resolution outlined in Section E.4.1 were considered unsatisfactory, therefore the decision key makes use of abundance and richness criteria to apply options 3 (roll-down) and 4 (roll-up) for each level of the taxonomic hierarchy. This method preserves as much detailed taxonomic information as possible, while addressing issues of taxonomic ambiguities. The decision key was modified from the Puget Sound Long-Term Marine Sediment Benthic Invertebrate Summary and is outlined below (Weakland et al. 2018).

The decision key rules are summarised as follows (see Figure E.4.1 for details).

- If identifications have not been taken to the same level consistently over multiple years of monitoring, data are rolled up to a less-specific taxonomic level. If identifications have been taken to the same level consistently over multiple years or only one year of data is available, they are kept at their respective taxonomic levels.
- If for a taxa identified to mixed-levels of resolution it is known that differentiating among specimens at more-specific levels of identification is notably challenging (e.g. due to inconsistencies in taxonomic keys or fragility of defining features) then all taxa are rolled up to a less-specific taxonomic level. If the difficulty of identifications are of mixed levels of difficulty, then easy-to-identify taxa are left at their respective level of identification, whereas difficult-to-identify taxa are rolled up to a less-specific level. If the identifications are easy, then they are kept at their respective taxonomic levels.
- For examples that have satisfied the above criteria, if there are no more-specific levels of identification or there are no organisms identified to a more-specific taxon, they are left at that level of identification.

E.4.3 REFERENCES

Cranston, P.S. 1990. Biomonitoring and invertebrate taxonomy. Environmental Monitoring and Assessment 14: 265-273

Weakland, S., V. Partridge, and M. Dutch. 2018. Sediment Quality in Puget Sound: Changes in chemistry, toxicity, and benthic invertebrates at multiple geographic scales, 1989–2015. Publication Number: 18-03-004.https://fortress.wa.gov/ecy/publications/SummaryPages/1803004.html

Identifications have NOT been taken to the same level consistently over multiple years

Identifications have been taken to the same level consistently over multiple years (or only 1 year of data available)

More specific identifications are not easily achievable

Mixed levels of difficulty to achieve identification at more specific levels

More specific identifications are easily achievable

Leave easy-to-identify levels separate and roll up levels that are difficult to identify into the less specific taxonomic level

Taxon is redundant (representatives of ≥1 more-specific taxon identified in samples)

Taxon is at most-specific identified level and there are no redundant more-specifically identified taxa

Roll Up to less-specific level

Taxon level contains only one more specific identification

Taxon level contains >1 more specific identification

Keep assigned identifications at their levels

Abundance at less-specifically identified level is ≤50% of the combined total abundance of that taxon and more specifically identified taxa (family/genus/species, etc.).

Abundance at less-specific level is >50% of the combined total abundance of that taxon and more-specifically identified taxa (family/genus/species, etc.)

Proportionally assign less-specifically identified abundance to more specifically identified taxa

Less-specifically identified taxon contains only 2 more specific identifications and ≥50% of the combined abundance of that taxon and more specifically identified taxa

Less-specifically identified taxon contains >2 more specific identifications and ≥50% of the combined abundance of that taxon and more specifically identified taxa

Roll to higher level

Leave the less AND more-specific levels of identification

Decision Key for Resolving Mixed Levels of Taxonomic Resolution

Date: March 2023
Project 2272202.0029

minnow environmental inc. A Tetra Tech Company

Figure E.4.1

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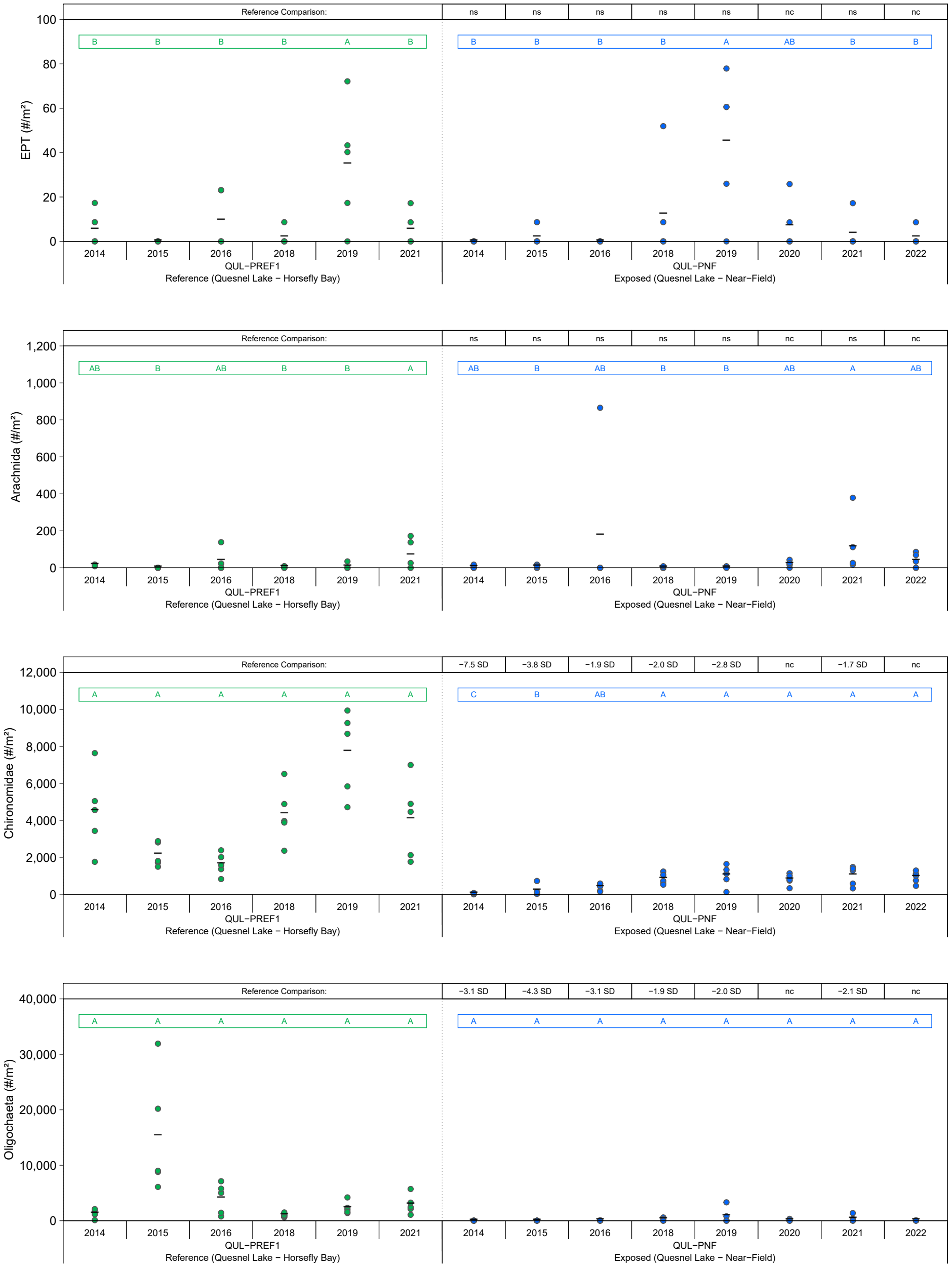

Figure E.4.2: Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL−PNF (Exposed) and QUL−PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

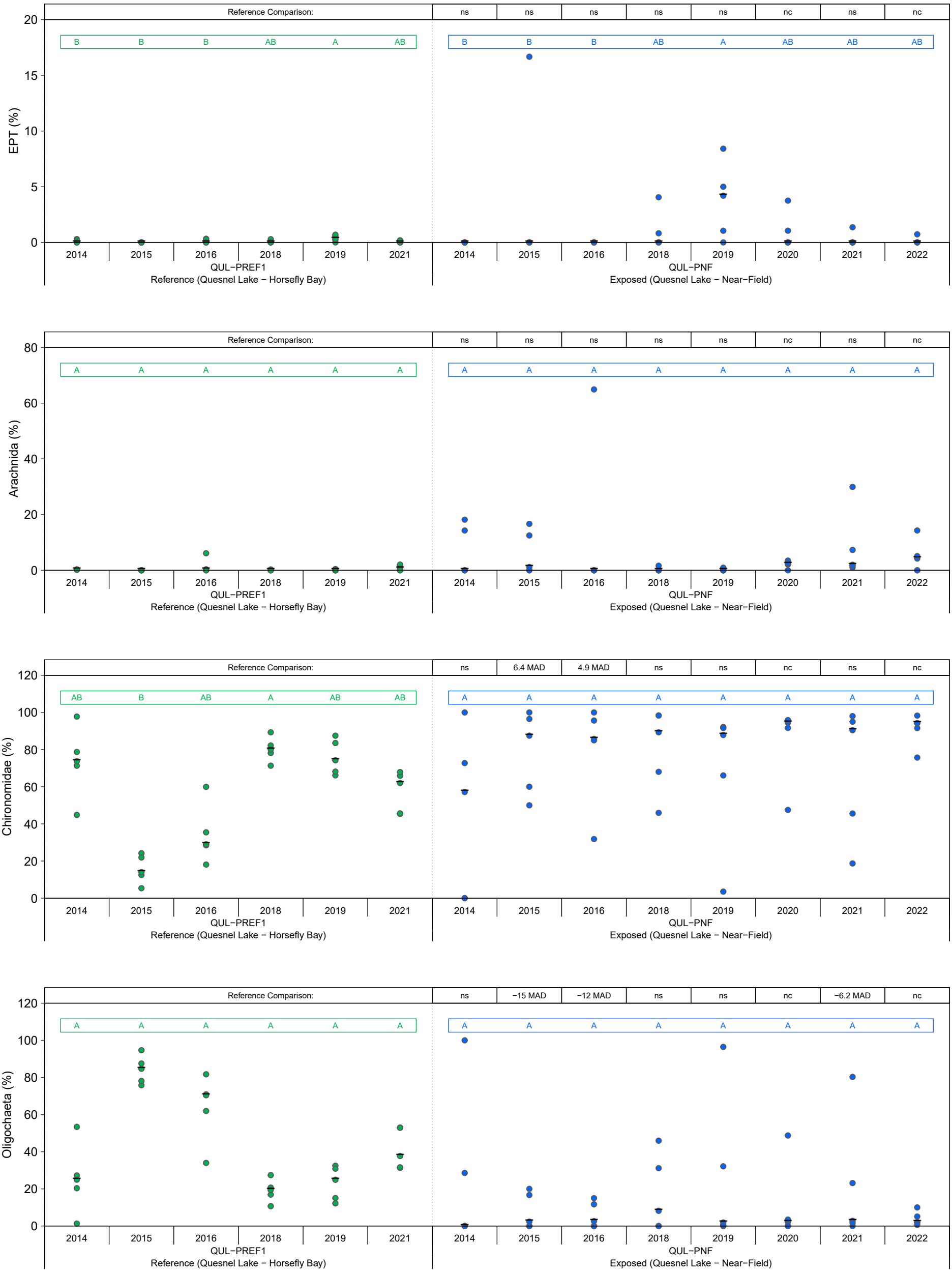

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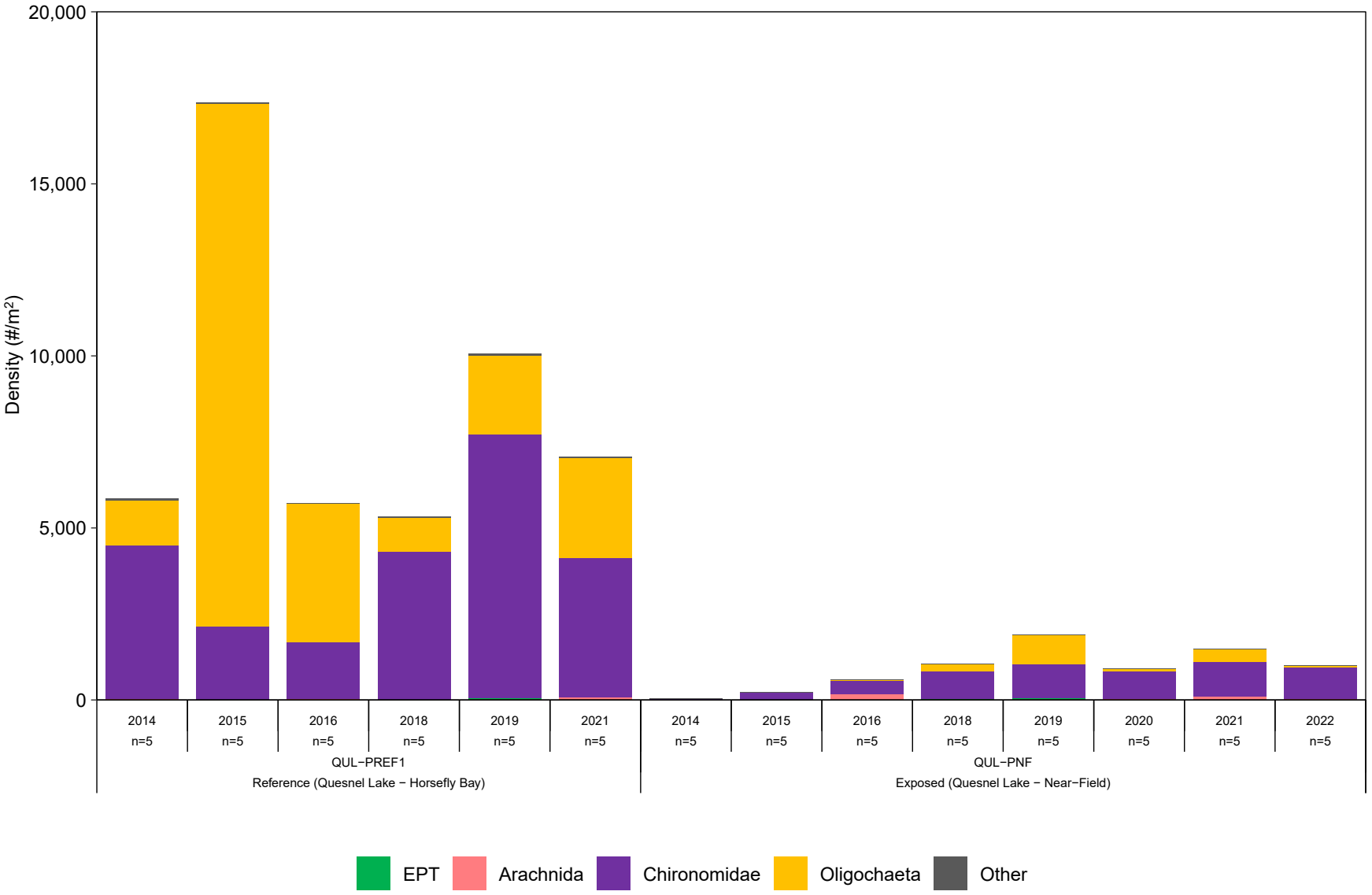

Figure E.4.3: Mean Densities of Major Benthic Invertebrate Community Taxonomic Groups for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

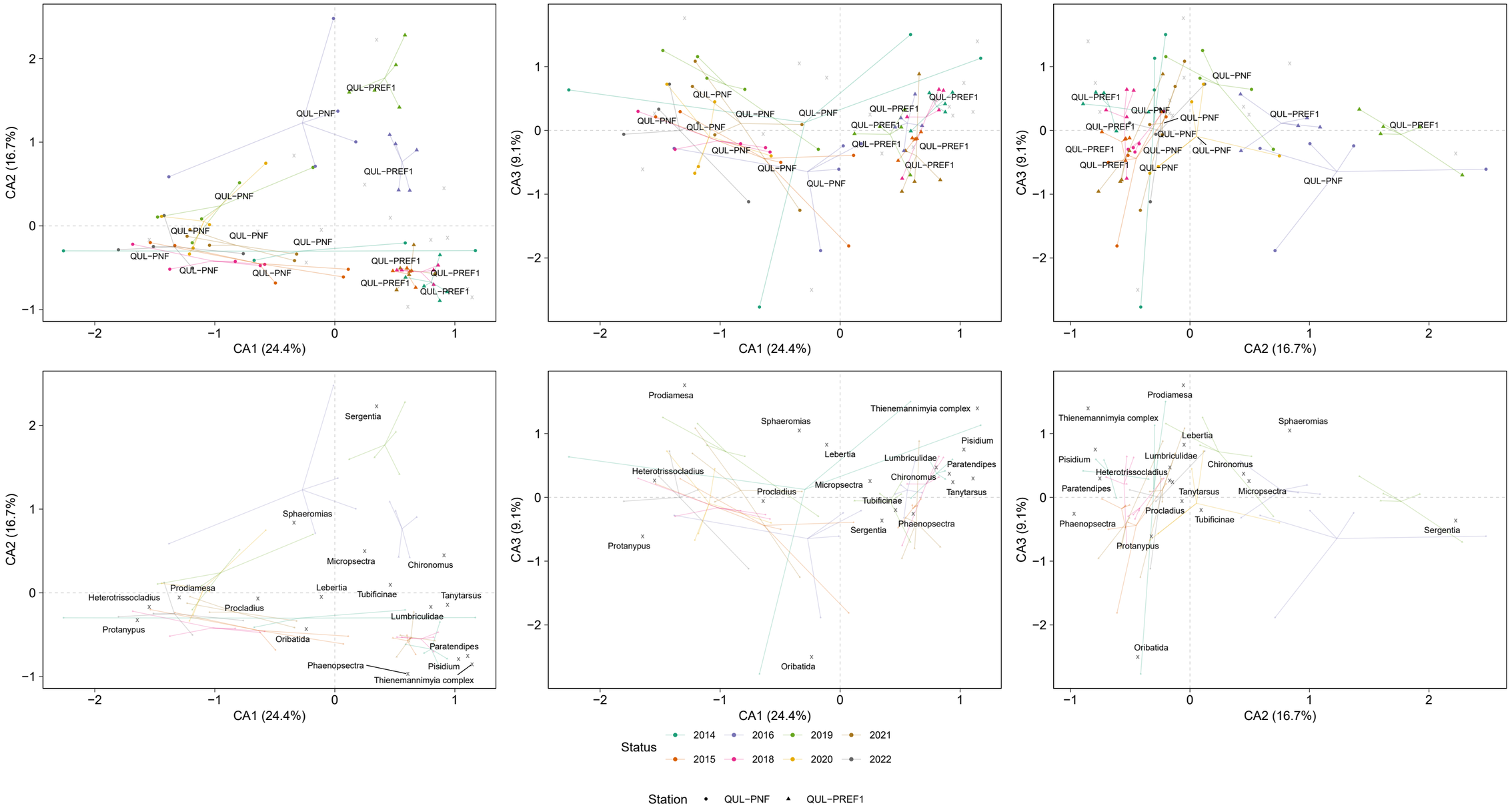

Figure E.4.4: Biplots of Correspondence Analysis Site and Taxa Scores of Benthic Invertebrate Community Data for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Analysis was completed using data at the Lowest Practicable Level (LPL). Taxa present at fewer than 1% of samples or less than 1% of total abundance were excluded from the analysis. Correspondence Analysis was conducted on ln(x+1)−transformed densities.

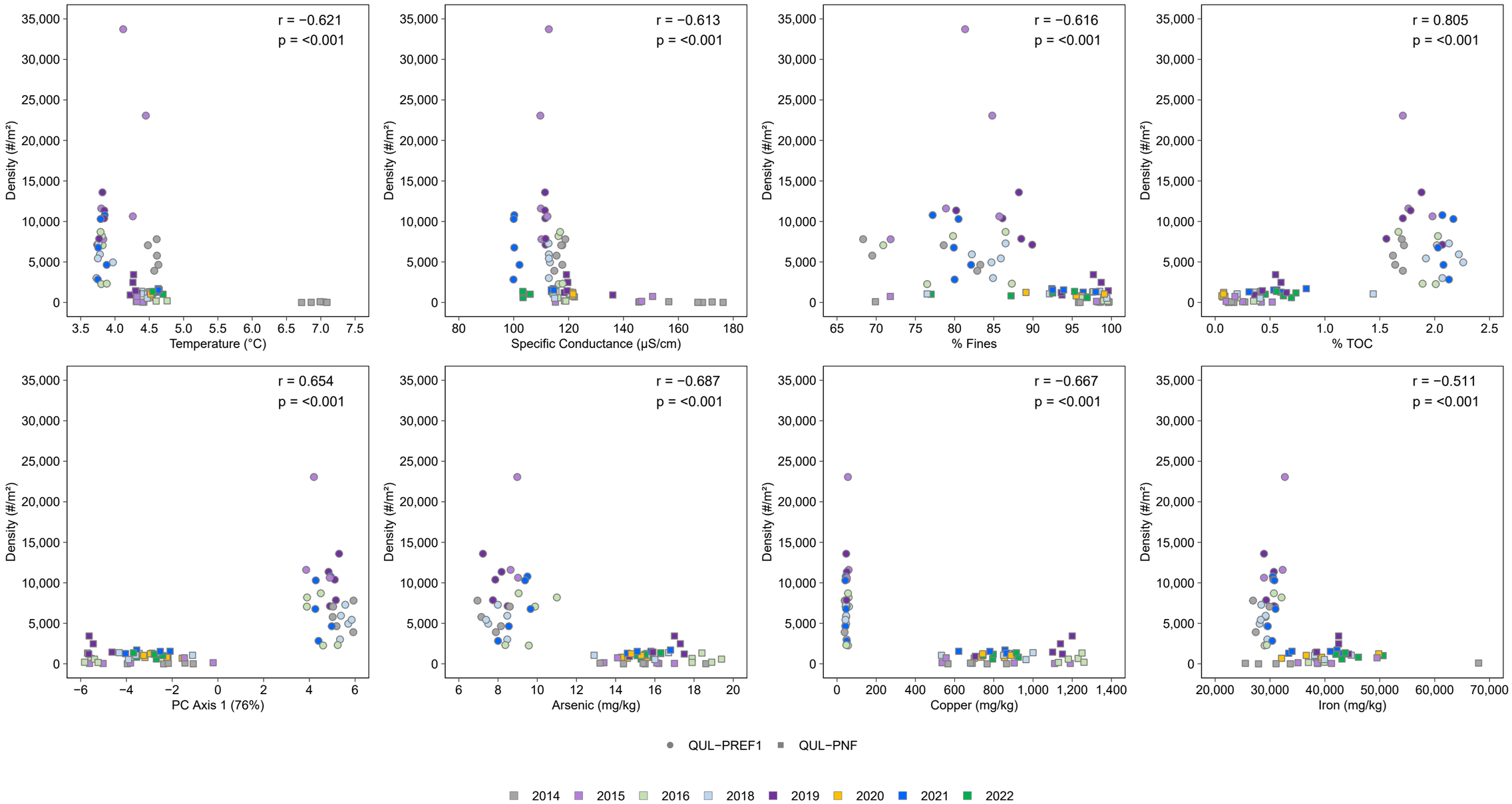

Figure E.4.5: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.00357, Bonferroni Corrected) Between Benthic Invertebrate Community Metrics and Chemical and Physical Sediment Quality Parameters for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Notes: Correlations were completed using data from 2014 to 2022.

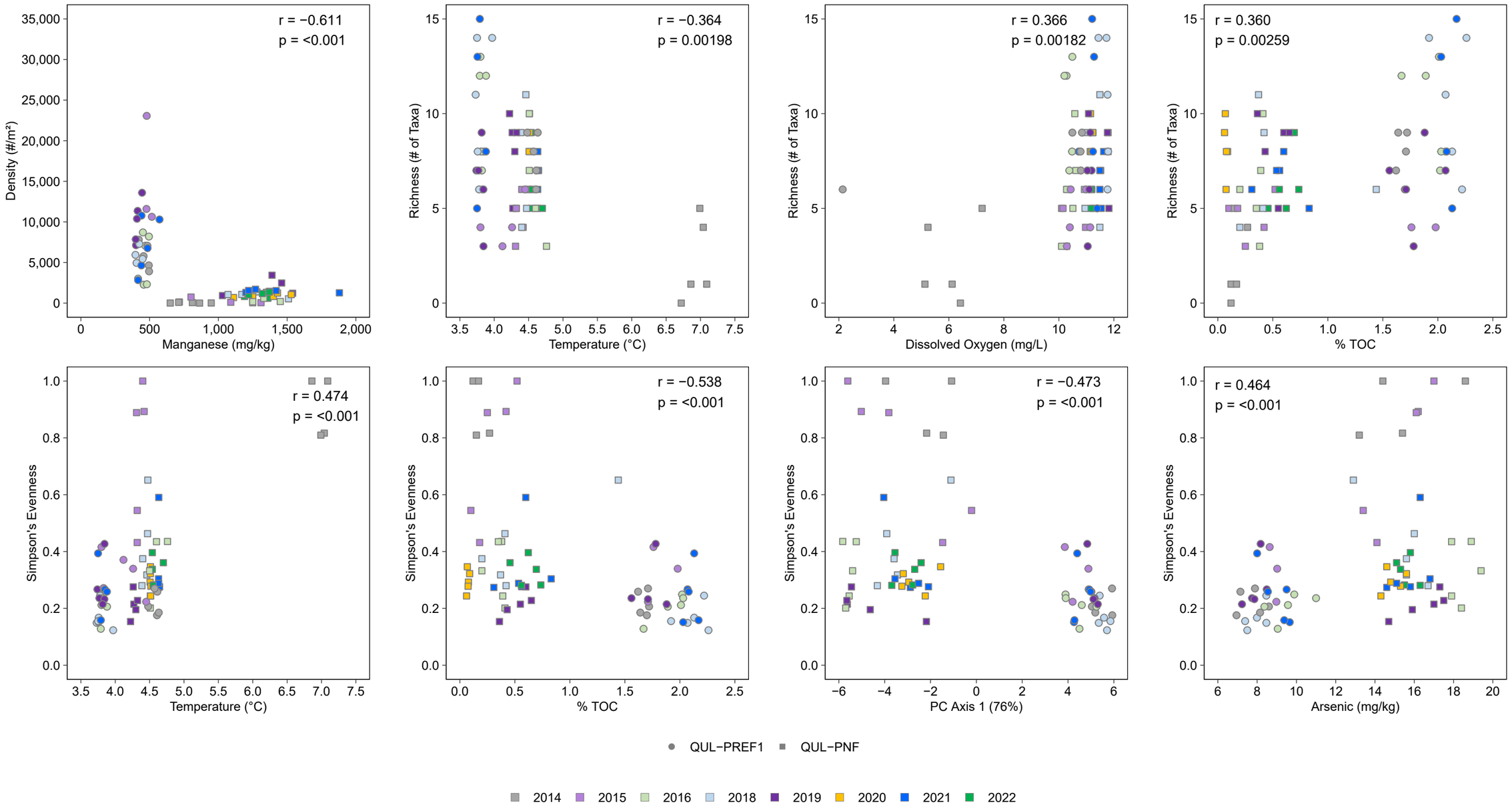

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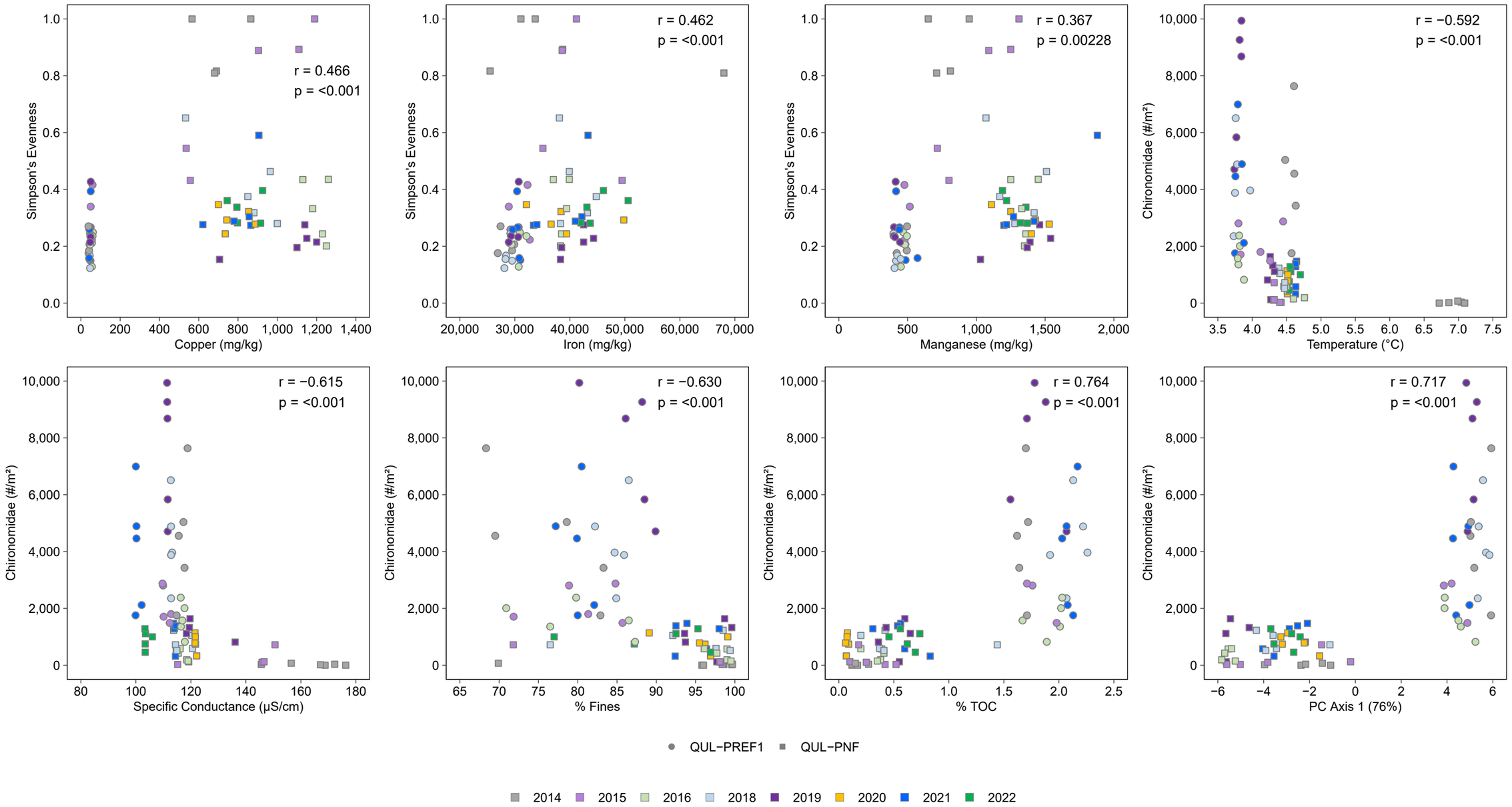

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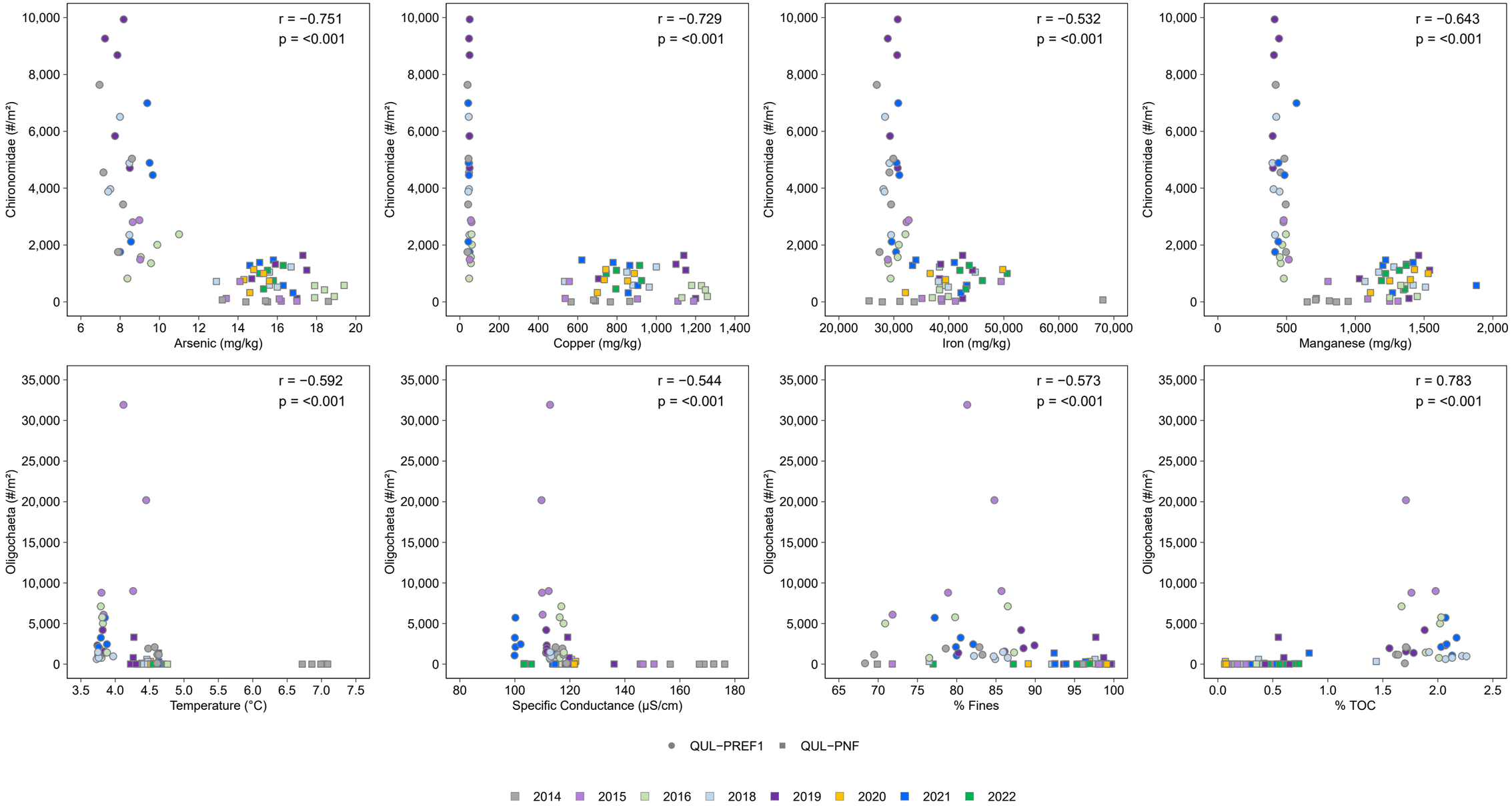

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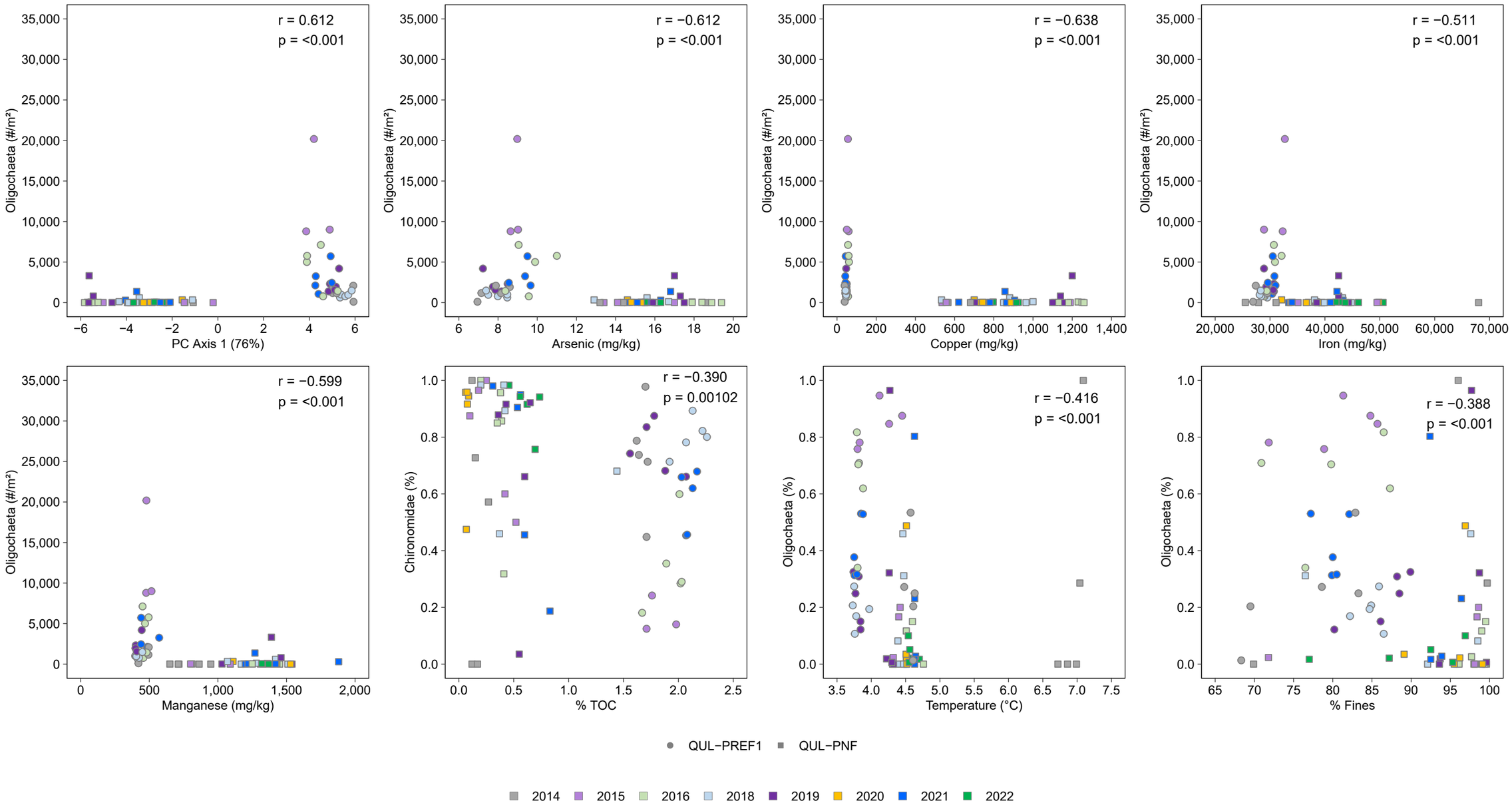

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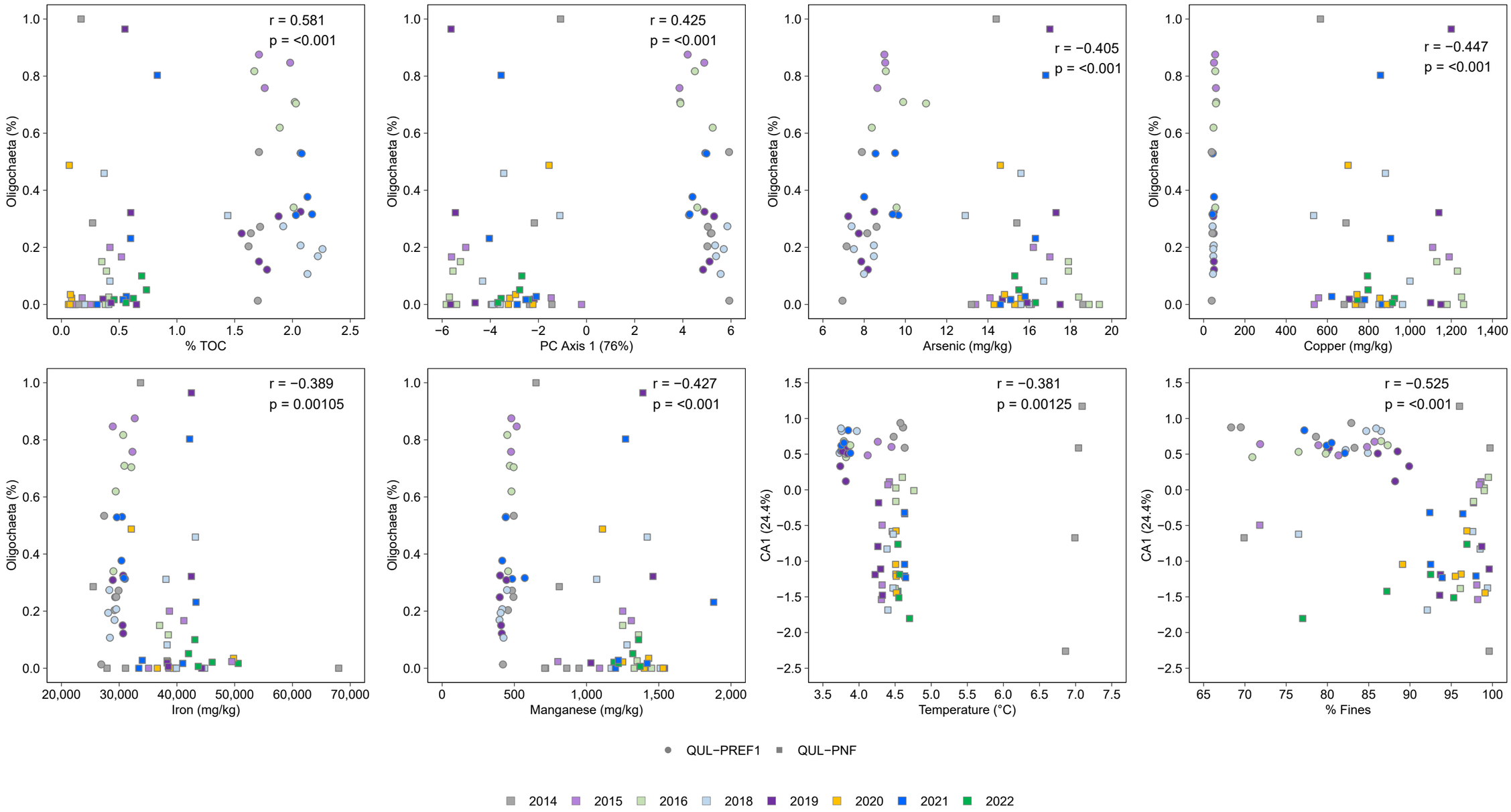

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Notes: Correlations were completed using data from 2014 to 2022.

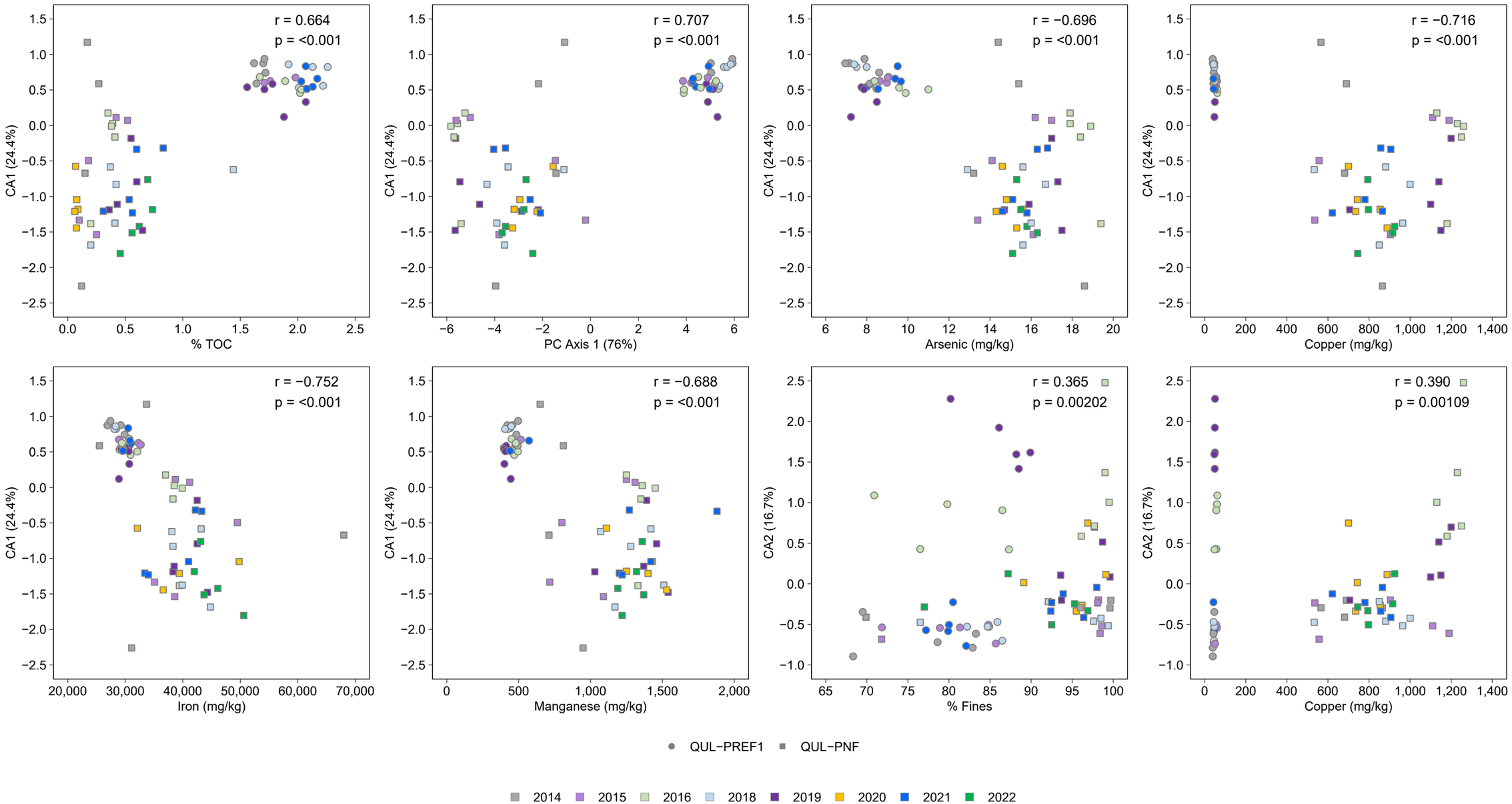

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Notes: Correlations were completed using data from 2014 to 2022.

Table E.4.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years								Temporal Contrasts Within Sites: MOD Relative to Baseline[b]								Spatial Comparison Within Years
		Area	Year	Area x Year					2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022	QUL-PNF
EPT (#/m²)	log10(x+1)	0.532	<0.001	0.409	Reference	QUL-PREF1	2014	1.82	B	B	B	B	A	nc	B	nc	Baseline	ns	ns	ns	1.5	nc	ns	nc	ns
							2015	0																	ns
							2016	2.57																	ns
							2018	0.574																	ns
							2019	18.0																	ns
							2021	1.81																	ns
					Exposed	QUL-PNF	2014	0	B	B	B	B	A	AB	B	B	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	0.574																	
							2016	0																	
							2018	2.48																	
							2019	23.1																	
							2020	2.04																	
							2021	0.787																	
							2022	0.572																	
Arachnida (#/m²)	log10(x+1)	0.866	0.005	0.240	Reference	QUL-PREF1	2014	13.9	AB	B	AB	B	B	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	0																	ns
							2016	8.59																	ns
							2018	1.48																	ns
							2019	1.04																	ns
							2021	13.5																	ns
					Exposed	QUL-PNF	2014	1.82	AB	B	AB	B	B	AB	A	AB	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	3.43																	
							2016	2.87																	
							2018	0.574																	
							2019	0.574																	
							2020	12.2																	
							2021	55.2																	
							2022	10.7																	
Chironomidae (#/m²)	log10(x+1)	-	-	<0.001	Reference	QUL-PREF1	2014	4,023	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	-7.5
							2015	2,058																	-3.8
							2016	1,531																	-1.9
							2018	4,094																	-2.0
							2019	7,385																	-2.8
							2021	3,555																	-1.7
					Exposed	QUL-PNF	2014	7.56	C	B	AB	A	A	A	A	A	Baseline	2.9	4.4	5.5	5.4	5.4	5.6	5.6	
							2015	91.3																	
							2016	331																	
							2018	777																	
							2019	752																	
							2020	736																	
							2021	864																	
							2022	866																	

Area x Year or Area P-value < 0.05.
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Note: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the MAD=0 (MAD = Median Absolute Deviation).

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

Table E.4.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years								Temporal Contrasts Within Sites: MOD Relative to Baseline[b]								Spatial Comparison Within Years
		Area	Year	Area x Year					2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022	QUL-PNF
Oligochaeta (#/m²)	log10(x+1)	-	-	0.060	Reference	QUL-PREF1	2014	895	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	-3.1
							2015	12,547																	-4.3
							2016	2,962																	-3.1
							2018	931																	-1.9
							2019	2,103																	-2.0
							2021	2,528																	-2.1
					Exposed	QUL-PNF	2014	1.82	A	A	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	3.43																	
							2016	8.46																	
							2018	28.4																	
							2019	53.2																	
							2020	11.2																	
							2021	53.4																	
							2022	25.0																	
EPT (%)	rank	0.957	0.015	0.372	Reference	QUL-PREF1	2014	0	B	B	B	AB	A	nc	AB	nc	Baseline	ns	ns	ns	nm	nc	ns	nc	ns
							2015	0																	ns
							2016	0																	ns
							2018	0																	ns
							2019	0.318																	ns
							2021	0																	ns
					Exposed	QUL-PNF	2014	0	B	B	B	AB	A	AB	AB	AB	Baseline	ns	ns	ns	nm	ns	ns	ns	
							2015	0																	
							2016	0																	
							2018	0																	
							2019	4.19																	
							2020	0																	
							2021	0																	
							2022	0																	
Arachnida (%)	rank	0.240	0.022	0.184	Reference	QUL-PREF1	2014	25	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	0																	ns
							2016	0.282																	ns
							2018	0																	ns
							2019	0																	ns
							2021	0.557																	ns
					Exposed	QUL-PNF	2014	0	A	A	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	1.16																	
							2016	0																	
							2018	0																	
							2019	0																	
							2020	2.20																	
							2021	1.97																	
							2022	4.21																	

Area x Year or Area P-value < 0.05.
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Note: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the MAD=0 (MAD = Median Absolute Deviation).

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

Table E.4.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years								Temporal Contrasts Within Sites: MOD Relative to Baseline[b]								Spatial Comparison Within Years
		Area	Year	Area x Year					2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022	QUL-PNF
Chironomidae (%)	rank	-	-	0.017	Reference	QUL-PREF1	2014	73.7	AB	B	AB	A	AB	nc	AB	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	14.0																	6.4
							2016	29.0																	4.9
							2018	80.1																	ns
							2019	74.2																	ns
							2021	62.0																	ns
					Exposed	QUL-PNF	2014	57.1	A	A	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	87.5																	
							2016	85.7																	
							2018	89.3																	
							2019	87.9																	
							2020	94.5																	
							2021	90.4																	
							2022	94.2																	
Oligochaeta (%)	rank	-	-	0.049	Reference	QUL-PREF1	2014	25.0	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	84.7																	-15
							2016	70.4																	-12
							2018	19.4																	ns
							2019	24.9																	ns
							2021	37.7																	-6.2
					Exposed	QUL-PNF	2014	0	A	A	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	2.33																	
							2016	2.60																	
							2018	8.18																	
							2019	1.87																	
							2020	2.20																	
							2021	2.78																	
							2022	2.11																	
CA1 (24.4%)	rank	<0.001	0.012	0.442	Reference	QUL-PREF1	2014	0.875	A	AB	AB	AB	B	nc	AB	nc	Baseline	ns	ns	ns	-1.7	nc	ns	nc	-4.3
							2015	0.625																	-5.3
							2016	0.532																	-2.6
							2018	0.823																	-7.8
							2019	0.509																	-7.7
							2021	0.620																	-7.9
					Exposed	QUL-PNF	2014	-0.0427	A	AB	AB	AB	B	AB	AB	B	Baseline	ns	ns	ns	-5.1	ns	ns	-6.5	
							2015	-0.495																	
							2016	-0.0111																	
							2018	-0.830																	
							2019	-1.11																	
							2020	-1.18																	
							2021	-1.04																	
							2022	-1.42																	

Area x Year or Area P-value < 0.05.
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Note: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the MAD=0 (MAD = Median Absolute Deviation).

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

Table E.4.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	Measures of Central Tendency[a]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years								Temporal Contrasts Within Sites: MOD Relative to Baseline[b]								Spatial Comparison Within Years
		Area	Year	Area x Year					2014	2015	2016	2018	2019	2020	2021	2022	2014	2015	2016	2018	2019	2020	2021	2022	QUL-PNF
CA2 (16.7%)	rank	-	-	<0.001	Reference	QUL-PREF1	2014	-0.720	B	B	A	B	A	nc	B	nc	Baseline	ns	11	ns	16	nc	ns	nc	2.9
							2015	-0.539																	0.14
							2016	0.906																	ns
							2018	-0.529																	0.47
							2019	1.62																	-10
							2021	-0.572																	2.3
					Exposed	QUL-PNF	2014	-0.297	BCD	D	A	CD	AB	ABC	BCD	BCD	Baseline	ns	8.9	ns	ns	ns	ns	ns	
							2015	-0.519																	
							2016	1.00																	
							2018	-0.460																	
							2019	0.106																	
							2020	0.0147																	
							2021	-0.231																	
							2022	-0.286																	
CA3 (9.1%)	rank	-	-	0.072	Reference	QUL-PREF1	2014	0.415	A	A	A	A	A	nc	A	nc	Baseline	ns	ns	ns	ns	nc	ns	nc	ns
							2015	-0.130																	ns
							2016	0.0737																	-1.3
							2018	0.319																	ns
							2019	0.0513																	2.9
							2021	-0.776																	ns
					Exposed	QUL-PNF	2014	0.883	AB	AB	B	AB	A	AB	AB	AB	Baseline	ns	ns	ns	ns	ns	ns	ns	
							2015	-0.391																	
							2016	-0.282																	
							2018	-0.270																	
							2019	0.818																	
							2020	-0.400																	
							2021	0.0915																	
							2022	0.117																	

Area x Year or Area P-value < 0.05.
Magnitude of Difference (MOD) < -2
Magnitude of Difference (MOD) > 2

Note: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the MAD=0 (MAD = Median Absolute Deviation).

[a] mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled Median Absolute Deviation.

Table E.4.2: Station Scores from Correspondence Analysis (CA) of Benthic Invertebrate Community Results for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Year	Area	Area Type	Replicate	CA1 (24.4%)	CA2 (16.7%)	CA3 (9.1%)
2014	QUL-PNF	Exposed	1	-	-	-
			2	-2.26	-0.298	0.635
			3	0.587	-0.204	1.50
			4	1.17	-0.295	1.13
			5	-0.672	-0.412	-2.77
	QUL-PREF1	Reference	1	0.876	-0.347	0.287
			2	0.875	-0.894	0.415
			3	0.743	-0.720	0.587
			4	0.589	-0.616	-0.0112
			5	0.936	-0.788	0.596
2015	QUL-PNF	Exposed	1	0.112	-0.519	-0.391
			2	0.0714	-0.611	-1.81
			3	-1.54	-0.200	0.213
			4	-1.33	-0.236	0.293
			5	-0.495	-0.683	-0.501
	QUL-PREF1	Reference	1	0.625	-0.543	-0.138
			2	0.640	-0.537	-0.130
			3	0.601	-0.505	-0.120
			4	0.483	-0.539	-0.474
			5	0.674	-0.737	-0.0237
2016	QUL-PNF	Exposed	1	0.0256	1.37	-0.242
			2	-0.163	0.712	-1.88
			3	-1.38	0.586	-0.282
			4	-0.0111	2.48	-0.609
			5	0.175	1.00	-0.208
	QUL-PREF1	Reference	1	0.457	1.09	0.0511
			2	0.532	0.427	-0.320
			3	0.506	0.980	0.195
			4	0.683	0.906	0.0737
			5	0.624	0.423	0.567
2018	QUL-PNF	Exposed	1	-0.584	-0.460	-0.339
			2	-0.830	-0.425	-0.209
			3	-1.68	-0.220	0.298
			4	-0.621	-0.474	-0.270
			5	-1.38	-0.517	-0.297
	QUL-PREF1	Reference	1	0.517	-0.529	-0.753
			2	0.558	-0.529	0.210
			3	0.823	-0.702	0.319
			4	0.823	-0.528	0.641
			5	0.861	-0.471	0.626
2019	QUL-PNF	Exposed	1	-0.182	0.698	-0.297
			2	-0.794	0.515	0.643
			3	-1.19	-0.202	1.16
			4	-1.48	0.106	1.25
			5	-1.11	0.0838	0.818
	QUL-PREF1	Reference	1	0.331	1.62	0.0585
			2	0.585	2.28	-0.700
			3	0.538	1.42	0.331
			4	0.509	1.92	0.0513
			5	0.120	1.60	-0.0528
2020	QUL-PNF	Exposed	1	-0.575	0.748	-0.400
			2	-1.18	-0.265	-0.567
			3	-1.21	-0.336	-0.672
			4	-1.04	0.0147	0.449
			5	-1.44	0.113	0.725
2021	QUL-PNF	Exposed	1	-0.336	-0.415	-1.25
			2	-0.318	-0.337	0.0915
			3	-1.21	-0.0452	1.08
			4	-1.23	-0.124	0.689
			5	-1.04	-0.231	-0.0697
	QUL-PREF1	Reference	1	0.545	-0.506	-0.320
			2	0.834	-0.572	-0.776
			3	0.620	-0.583	-0.802
			4	0.515	-0.765	-0.957
			5	0.658	-0.227	0.883
2022	QUL-PNF	Exposed	1	-1.42	0.123	0.725
			2	-0.763	-0.331	-1.12
			3	-1.80	-0.286	-0.0611
			4	-1.19	-0.504	0.117
			5	-1.51	-0.247	0.332

Notes: Correspondence Analysis was conducted using ln(x+1)-transformed density benthic invertebrate results at the Lowest Practicable Level (LPL).
A "-" indicates that no organisms were present in all replicate samples from QUL-PFF1-1 and QUL-PFF1-2 in 2014, therefore CA site scores could not be calculated.

Table E.4.3: Taxon Scores from Correspondence Analysis (CA) of Benthic Invertebrate Community Results for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022

Phylum	Class	Order	Family	Taxa	CA1 (24.4%)	CA2 (16.7%)	CA3 (9.1%)
Annelida	Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0.800	-0.167	0.471
		Tubificida	Naididae	Tubificinae	0.464	0.0935	-0.200
Arthropoda	Euchelicerata	Sarcoptiformes	-	Oribatida	-0.237	-0.437	-2.50
		Trombidiformes	Lebertiidae	*Lebertia*	-0.111	-0.0491	0.824
	Insecta	Diptera	Ceratopogonidae	*Sphaeromias*	-0.339	0.836	1.05
			Chironomidae	*Chironomus*	0.911	0.450	0.373
			Chironomidae	*Heterotrissocladius*	-1.55	-0.168	0.265
			Chironomidae	*Micropsectra*	0.250	0.494	0.251
			Chironomidae	*Paratendipes*	1.11	-0.753	0.292
			Chironomidae	*Phaenopsectra*	0.609	-0.969	-0.261
			Chironomidae	*Procladius*	-0.640	-0.0664	-0.0576
			Chironomidae	*Prodiamesa*	-1.30	-0.0547	1.75
			Chironomidae	*Protanypus*	-1.65	-0.324	-0.614
			Chironomidae	*Sergentia*	0.349	2.22	-0.364
			Chironomidae	*Tanytarsus*	0.940	-0.145	0.234
			Chironomidae	*Thienemannimyia complex*	1.14	-0.852	1.39
Mollusca	Bivalvia	Veneroida	Pisidiidae	*Pisidium*	1.03	-0.792	0.746

Notes: Correspondence Analysis was conducted using ln(x+1)-transformed density benthic invertebrate results at the Lowest Practicable Level (LPL). "-" no applicable data.

Table E.4.4: **Spearman's Rank Correlations Between Benthic Invertebrate Community Metrics and Supporting Environmental Measures for Quesnel Lake at QUL-PNF (Exposed) and QUL-PREF1 (Reference) Deep Areas, 2014 to 2022**

Benthic Invertebrate Community Metric	Correlation Parameter	Station Depth (m)	Physical/Chemical Parameter									Sediment Concentration of Analytes of Interest			
			Bottom *In Situ* Water Quality					Sediment Parameters							
			Temp (°C)	DO (mg/L)	DO (%)	Specific Conductance (µS/cm)	pH (pH Units)	Fines (%)	Total Organic Carbon (%)	PCA 1 (79%)	PCA 2 (13%)	Arsenic (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)
Density (#/m²)	Correlation Coefficient	-0.0472	-0.621	0.237	0.148	-0.613	-0.0661	-0.616	0.805	0.654	-0.169	-0.687	-0.667	-0.511	-0.611
	Sig. (2-tailed)	0.698	<0.001	0.0483	0.223	<0.001	0.586	<0.001	<0.001	<0.001	0.169	<0.001	<0.001	<0.001	<0.001
Richness (# of Taxa)	Correlation Coefficient	-0.00853	-0.364	0.366	0.328	-0.161	-0.281	-0.143	0.360	0.297	-0.114	-0.279	-0.316	-0.202	-0.0985
	Sig. (2-tailed)	0.944	0.00198	0.00182	0.00553	0.184	0.0186	0.237	0.00259	0.0138	0.357	0.0214	0.00874	0.0981	0.424
Simpson's Evenness	Correlation Coefficient	0.0635	0.474	-0.307	-0.242	0.270	0.0551	0.307	-0.538	-0.473	0.0832	0.464	0.466	0.462	0.367
	Sig. (2-tailed)	0.604	<0.001	0.0103	0.0454	0.0249	0.653	0.0103	<0.001	<0.001	0.503	<0.001	<0.001	<0.001	0.00228
Simpson's Diversity	Correlation Coefficient	0.0423	0.100	-0.0222	-0.00693	0.186	-0.227	0.161	-0.221	-0.212	-0.00647	0.212	0.174	0.249	0.312
	Sig. (2-tailed)	0.73	0.412	0.856	0.955	0.126	0.0606	0.188	0.0725	0.0851	0.959	0.085	0.159	0.0421	0.0102
EPT (#/m²)	Correlation Coefficient	0.0716	-0.229	0.223	0.211	0.0294	0.120	-0.0120	0.151	0.0612	-0.223	-0.127	-0.0700	-0.00142	-0.0248
	Sig. (2-tailed)	0.556	0.0564	0.063	0.0798	0.809	0.322	0.921	0.22	0.62	0.0677	0.303	0.571	0.991	0.841
Arachnida (#/m²)	Correlation Coefficient	0.193	0.195	0.0519	0.0681	-0.0500	-0.0238	-0.138	0.00152	0.0666	0.0146	-0.0438	-0.0943	0.0623	0.0763
	Sig. (2-tailed)	0.11	0.106	0.669	0.575	0.681	0.845	0.255	0.99	0.589	0.906	0.723	0.444	0.614	0.536
Chironomidae (#/m²)	Correlation Coefficient	-0.0225	-0.592	0.296	0.206	-0.615	0.00108	-0.630	0.764	0.717	-0.0640	-0.751	-0.729	-0.532	-0.643
	Sig. (2-tailed)	0.853	<0.001	0.013	0.0866	<0.001	0.993	<0.001	<0.001	<0.001	0.604	<0.001	<0.001	<0.001	<0.001
Oligochaeta (#/m²)	Correlation Coefficient	0.0260	-0.592	0.0934	-0.00300	-0.544	-0.143	-0.573	0.783	0.612	-0.172	-0.612	-0.638	-0.511	-0.599
	Sig. (2-tailed)	0.831	<0.001	0.442	0.98	<0.001	0.239	<0.001	<0.001	<0.001	0.162	<0.001	<0.001	<0.001	<0.001
EPT (%)	Correlation Coefficient	0.0896	-0.159	0.231	0.233	0.0785	0.102	0.0356	0.0789	-0.0188	-0.243	-0.0455	0.00935	0.0770	0.0736
	Sig. (2-tailed)	0.461	0.188	0.0549	0.0522	0.518	0.401	0.77	0.522	0.879	0.0463	0.712	0.94	0.532	0.551
Arachnida (%)	Correlation Coefficient	0.127	0.287	-0.0169	0.0205	0.115	0.0284	0.0156	-0.186	-0.0654	0.0570	0.0818	0.0532	0.180	0.201
	Sig. (2-tailed)	0.296	0.0162	0.89	0.866	0.342	0.816	0.898	0.129	0.596	0.644	0.507	0.667	0.141	0.101
Chironomidae (%)	Correlation Coefficient	0.00240	0.255	0.133	0.207	0.127	0.0762	0.251	-0.390	-0.255	0.134	0.239	0.268	0.336	0.287
	Sig. (2-tailed)	0.984	0.0333	0.272	0.0856	0.295	0.531	0.0359	0.00102	0.0361	0.276	0.0495	0.0274	0.00503	0.0177
Oligochaeta (%)	Correlation Coefficient	0.0264	-0.416	0.00139	-0.0801	-0.312	-0.125	-0.388	0.581	0.425	-0.145	-0.405	-0.447	-0.389	-0.427
	Sig. (2-tailed)	0.828	<0.001	0.991	0.51	0.00853	0.302	<0.001	<0.001	<0.001	0.238	<0.001	<0.001	0.00105	<0.001
CA1 (24.4%)	Correlation Coefficient	-0.0438	-0.381	-0.165	-0.280	-0.280	-0.0716	-0.525	0.664	0.707	0.0640	-0.696	-0.716	-0.752	-0.688
	Sig. (2-tailed)	0.721	0.00125	0.175	0.0198	0.02	0.559	<0.001	<0.001	<0.001	0.607	<0.001	<0.001	<0.001	<0.001
CA2 (16.7%)	Correlation Coefficient	-0.0320	0.000146	-0.00897	0.00212	0.185	0.0482	0.365	-0.243	-0.325	-0.301	0.283	0.390	0.169	0.175
	Sig. (2-tailed)	0.794	0.999	0.942	0.986	0.128	0.694	0.00202	0.0478	0.00726	0.0133	0.0201	0.00109	0.172	0.156
CA3 (9.1%)	Correlation Coefficient	-0.202	0.0822	0.102	0.122	0.152	0.314	0.118	-0.00313	0.133	0.258	-0.0998	-0.128	-0.208	-0.0544
	Sig. (2-tailed)	0.0955	0.502	0.405	0.318	0.211	0.00862	0.335	0.98	0.283	0.035	0.421	0.303	0.0917	0.662

Significant correlation; p-value <0.00357 (p <0.05, Bonferroni corrected for 14 independent variables).

Correlation p-value <0.01.

Note: EPT = Ephemeroptera, Plecoptera, Trichoptera.

APPENDIX E.5
FISH POPULATION HEALTH

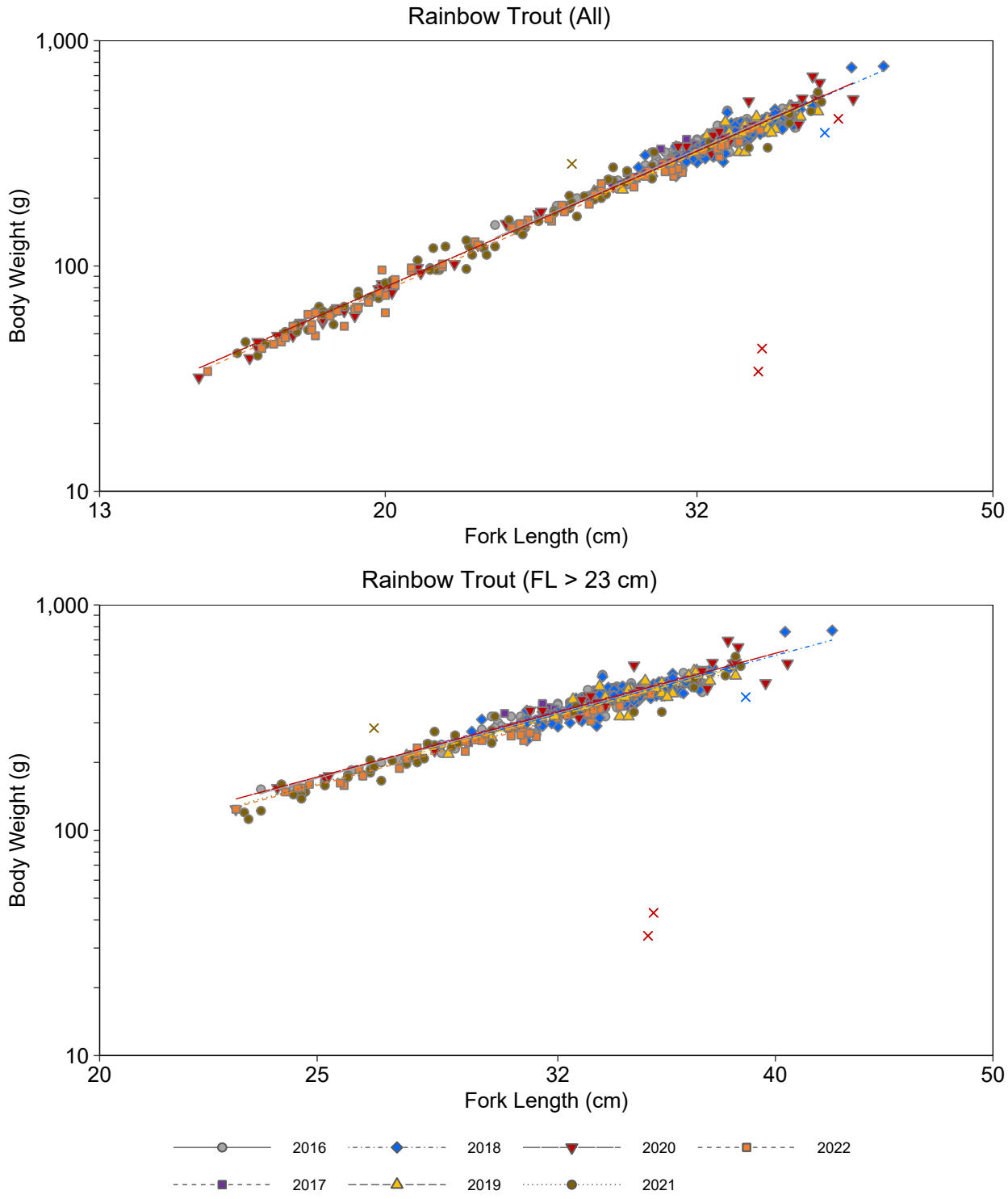

Figure E.5.1: Condition (Weight−at−Length) of a) All Rainbow Trout and b) Rainbow Trout With Fork Length Greater than 23 cm for Polley Lake in Spring, 2016 to 2022

Notes: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

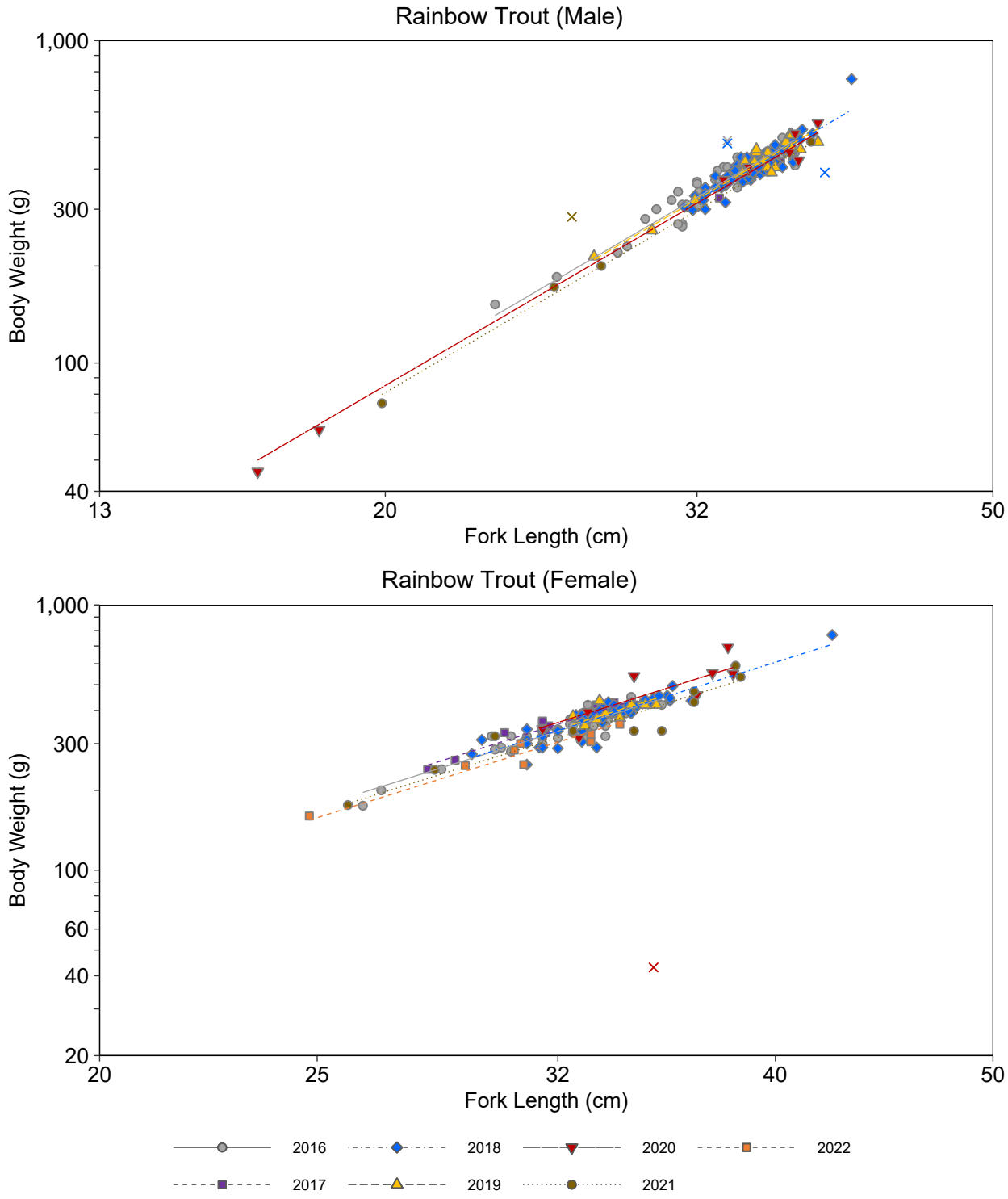

Figure E.5.1: Condition (Weight−at−Length) of a) Male Rainbow Trout and b) Female Rainbow Trout for Polley Lake in Spring, 2016 to 2022

Notes: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

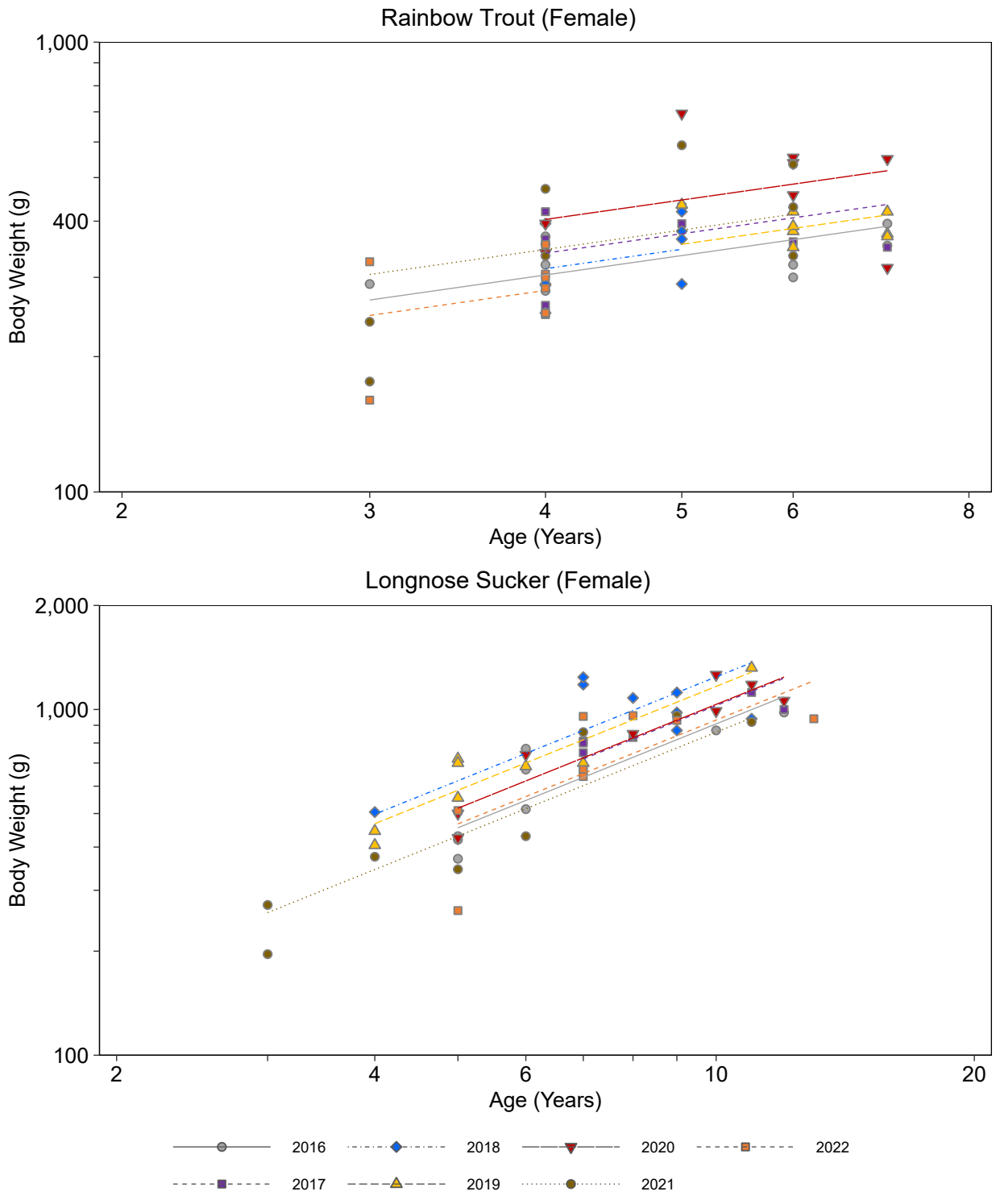

Figure E.5.2: Weight−at−Age of a) Female Rainbow Trout and b) Female Longnose Sucker for Polley Lake in Spring, 2016 to 2022

Note: Outliers removed from the statistical analyses are plotted with an x through them.

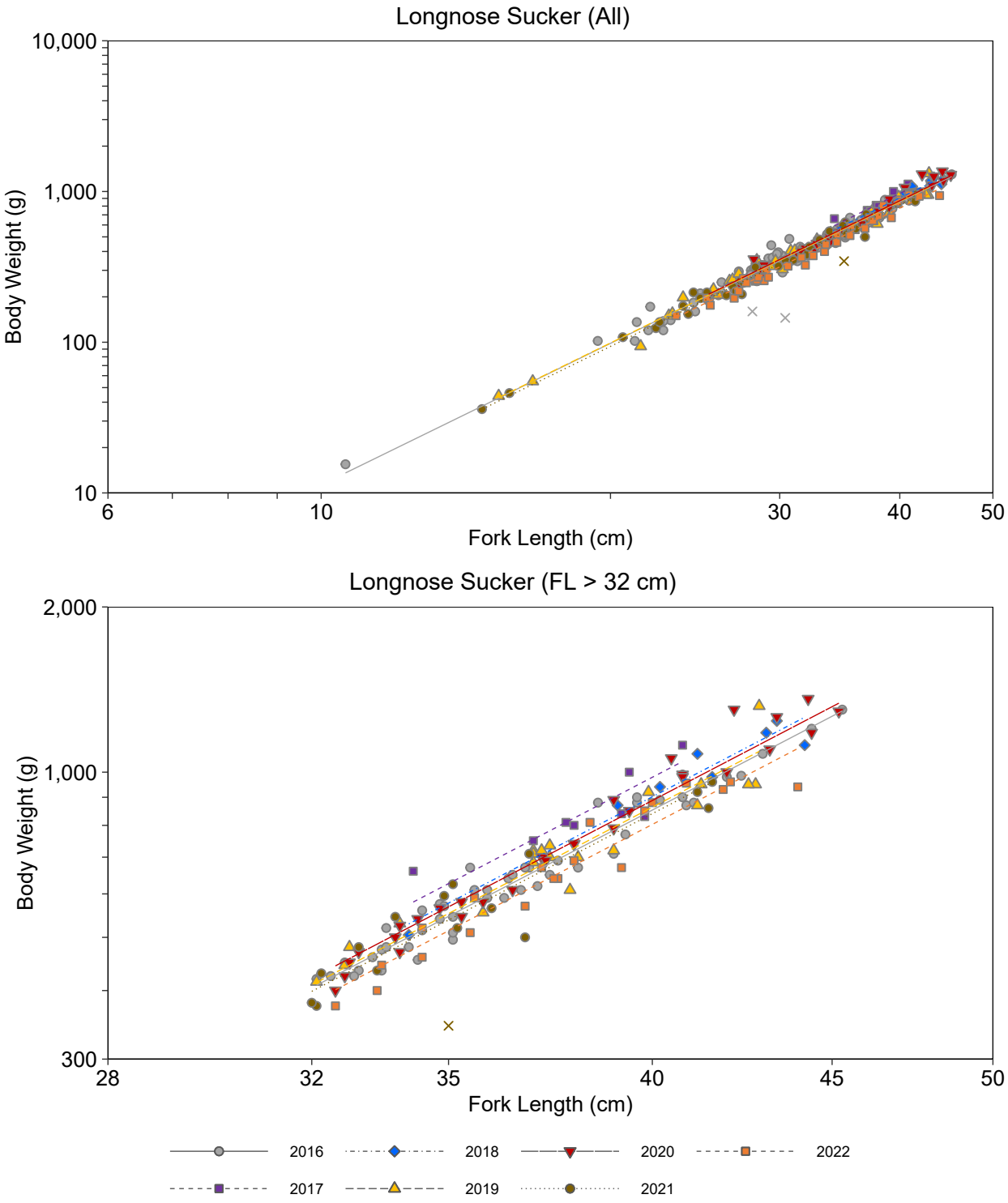

Figure E.5.3: Condition (Weight−at−Length) of a) All Longnose Sucker and b) Longnose Sucker With Fork Length Greater than 32 cm for Polley Lake in Spring, 2016 to 2022

Notes: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

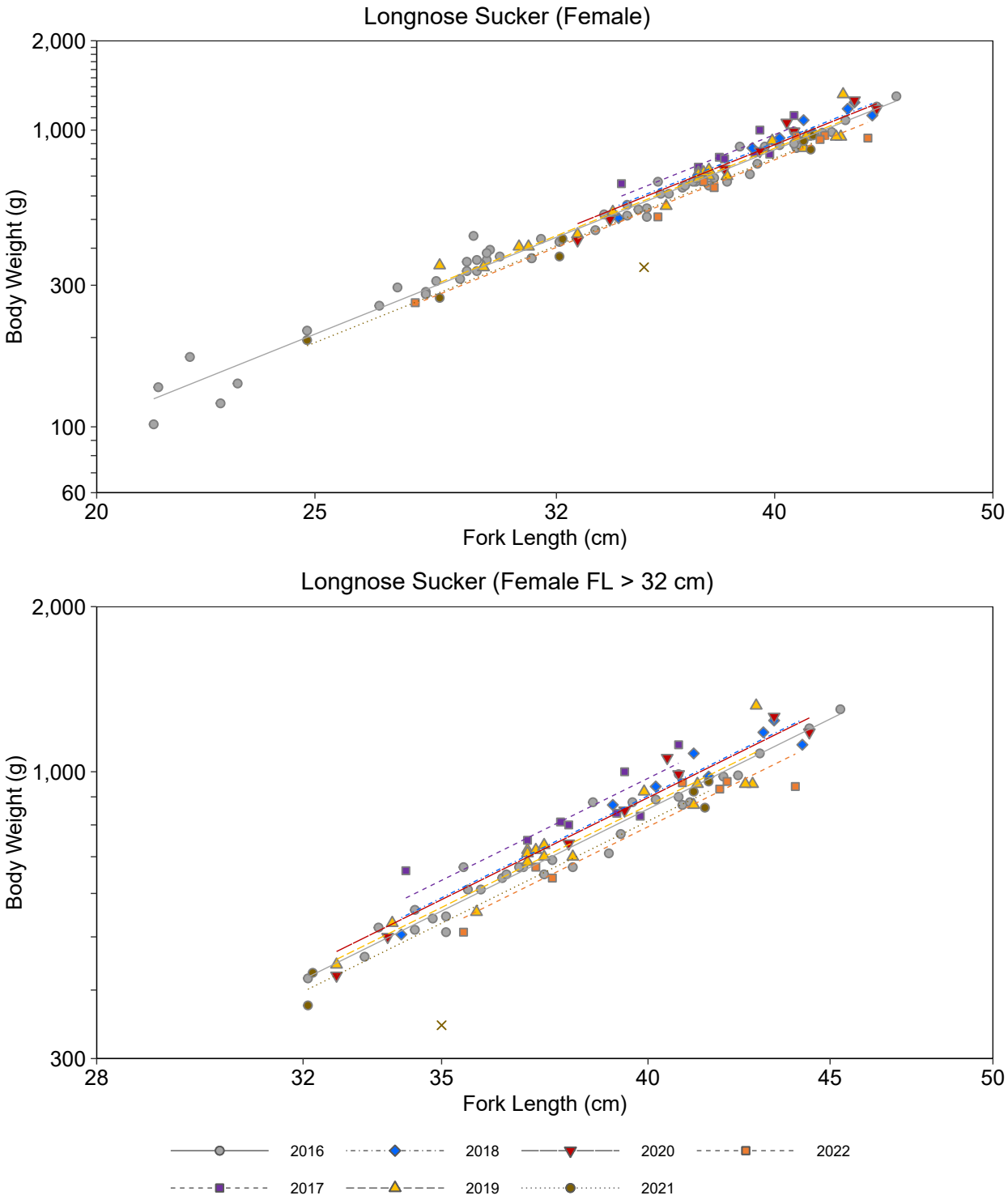

Figure E.5.3: Condition (Weight−at−Length) of a) Female Longnose Sucker and b) Female Longnose Sucker With Fork Length Greater than 32 cm for Polley Lake in Spring, 2016 to 2022

Notes: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

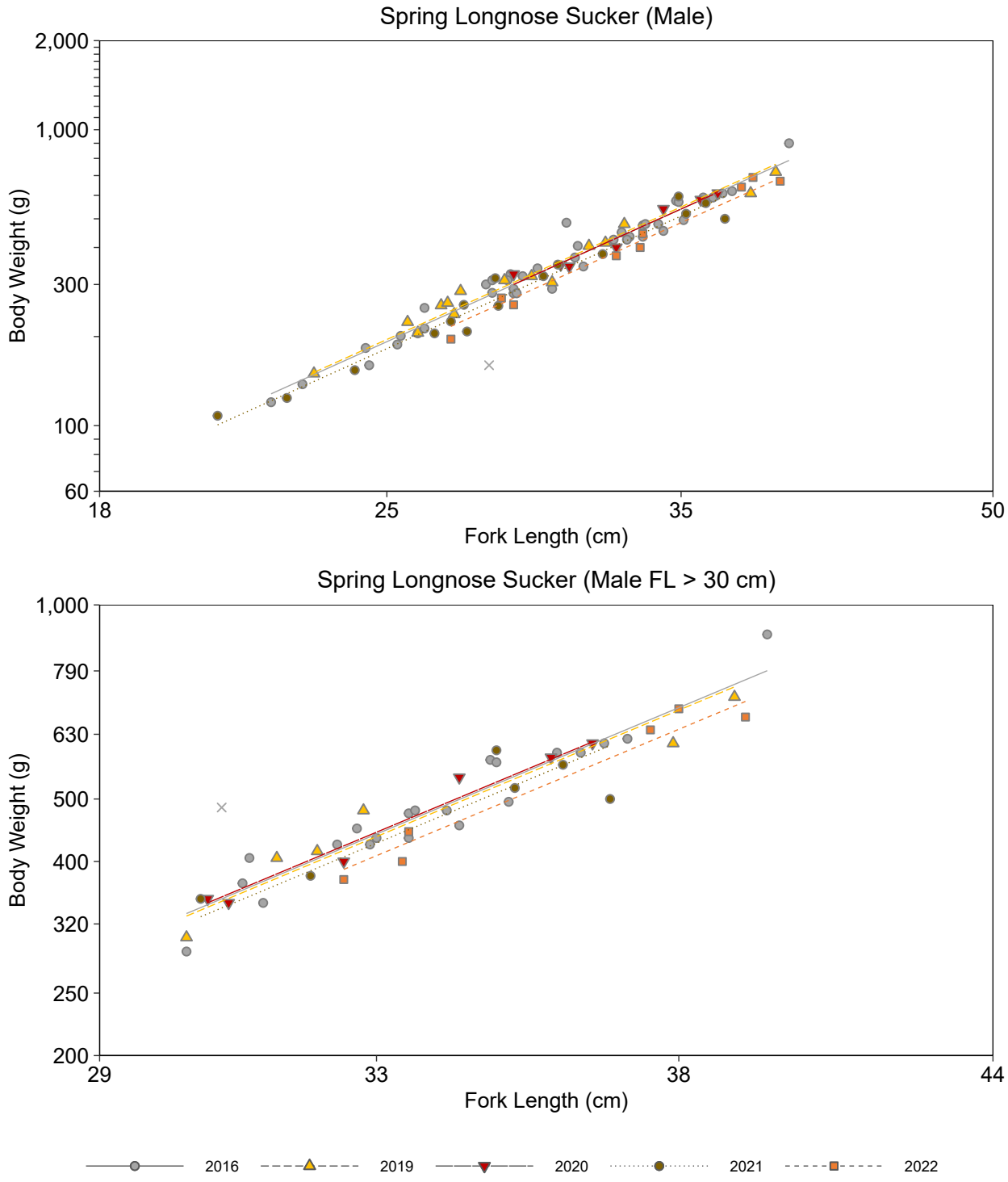

Figure E.5.3: Condition (Weight−at−Length) of a) Male Longnose Sucker and b) Male Longnose Sucker With Fork Length Greater than 30 cm for Polley Lake in Spring, 2016 to 2022

Notes: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

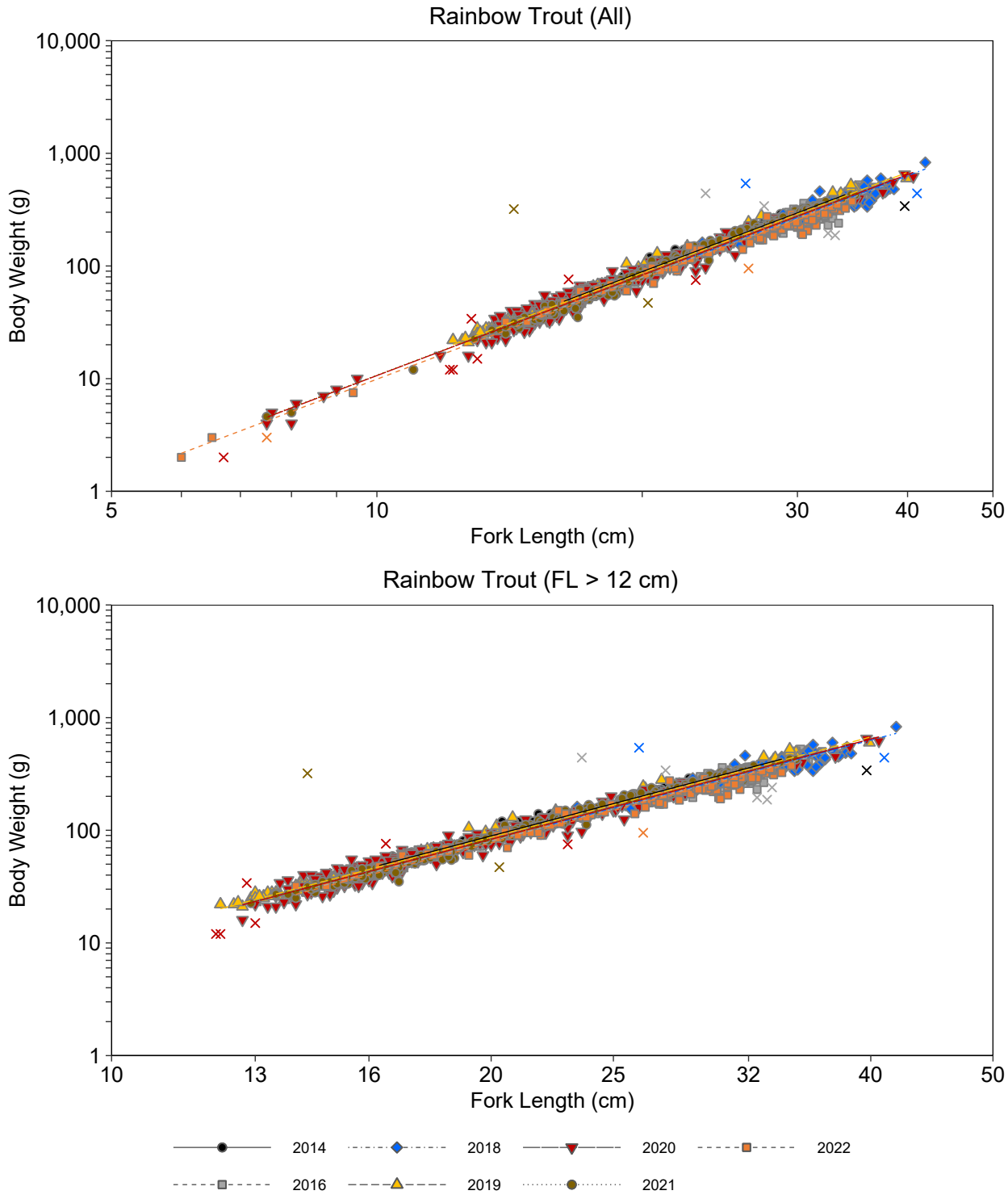

Figure E.5.4: Condition (Weight−at−Length) of a) All Rainbow Trout and b) Rainbow Trout With Fork Length Greater than 12 cm for Polley Lake in Fall, 2014 to 2022

Note: Note: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

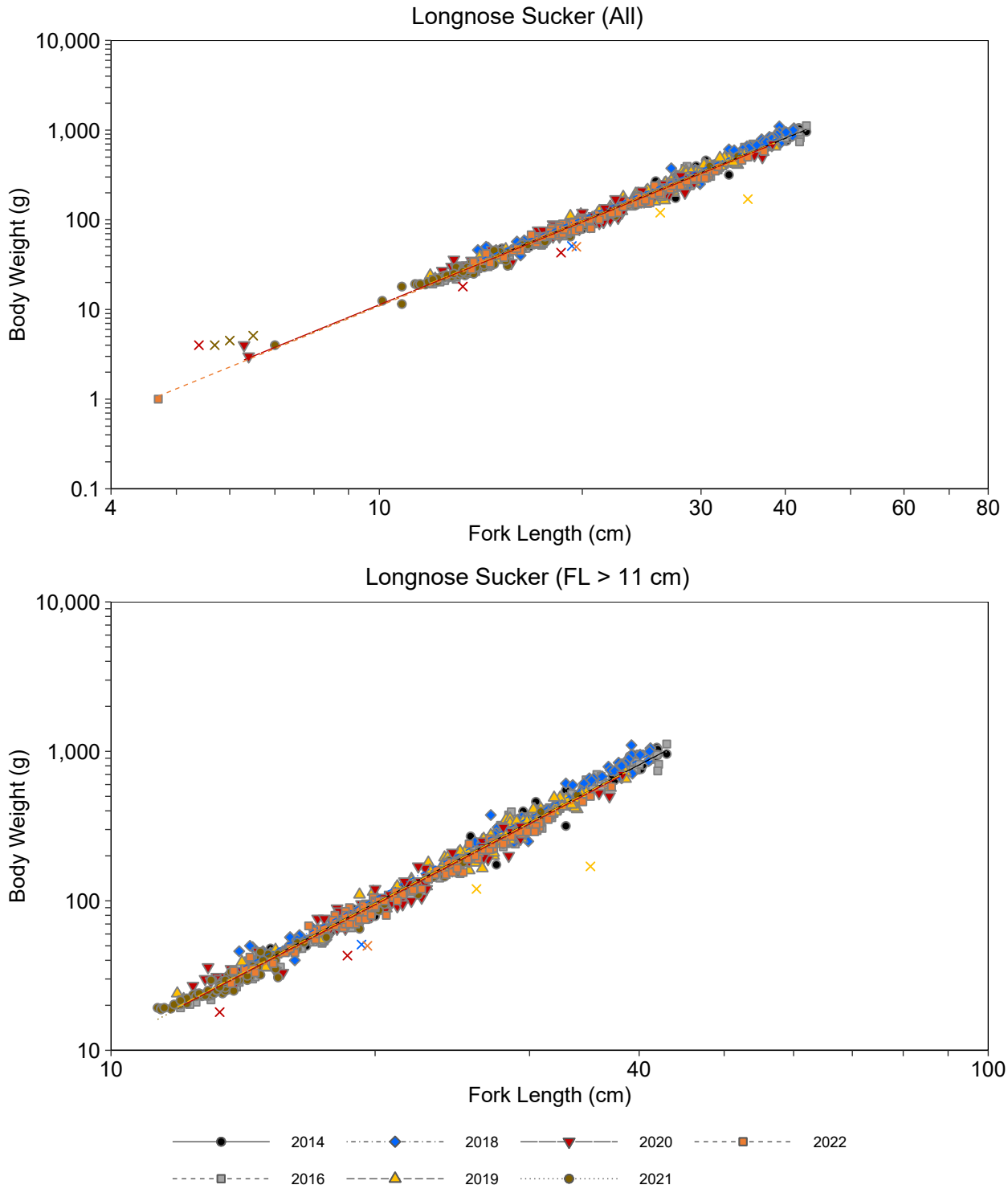

Figure E.5.4: Condition (Weight−at−Length) of a) All Longnose Sucker and b) Longnose Sucker With Fork Length Greater than 11 cm for Polley Lake in Fall, 2014 to 2022

Note: Note: FL = Fork Length. Outliers removed from the statistical analyses are plotted with an x through them.

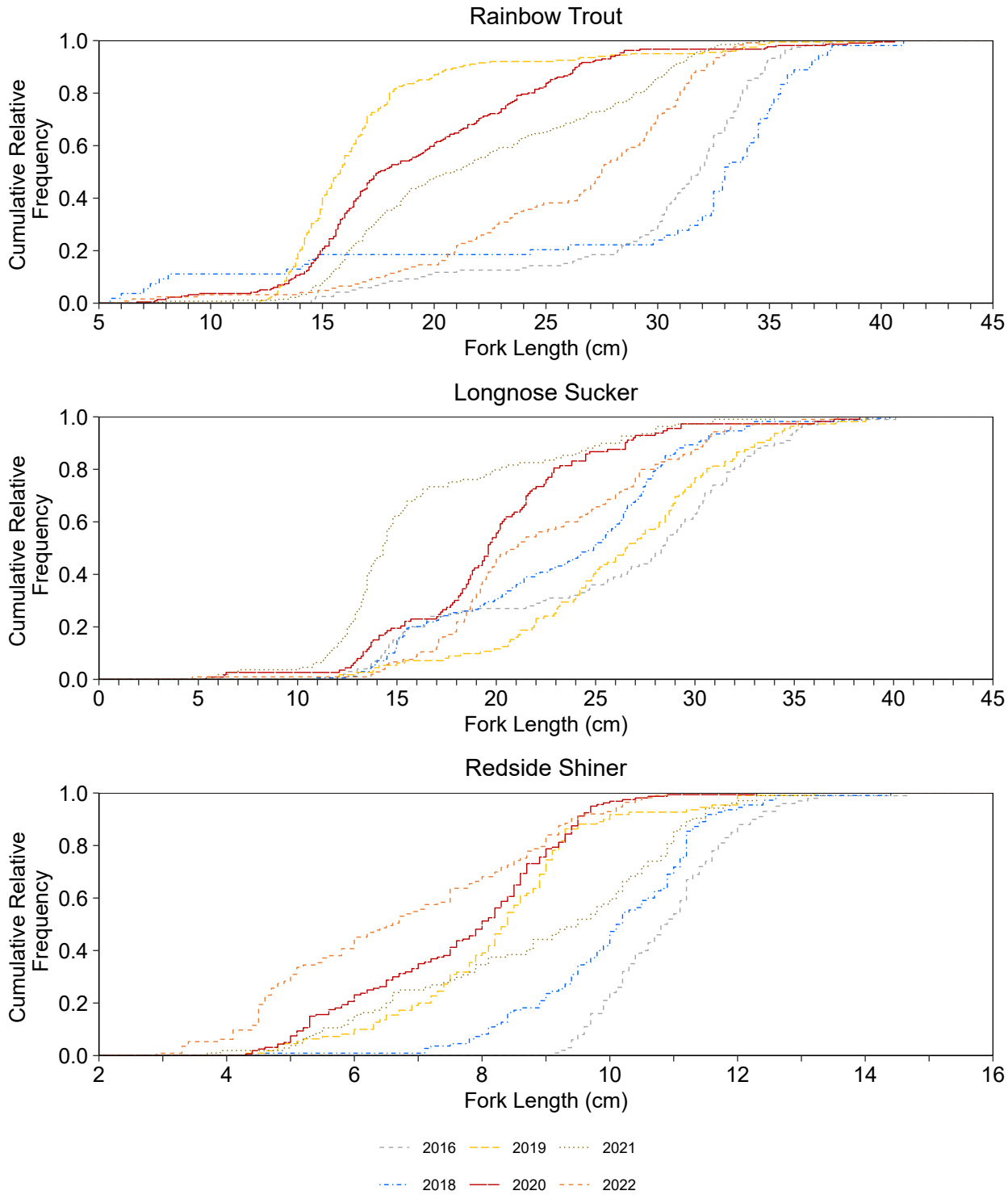

Figure E.5.5: Cumulative Relative Frequency Distributions of Rainbow Trout, Longnose Sucker, and Redside Shiner from Randomized Fall Hoop Netting in Polley Lake, 2016 to 2022

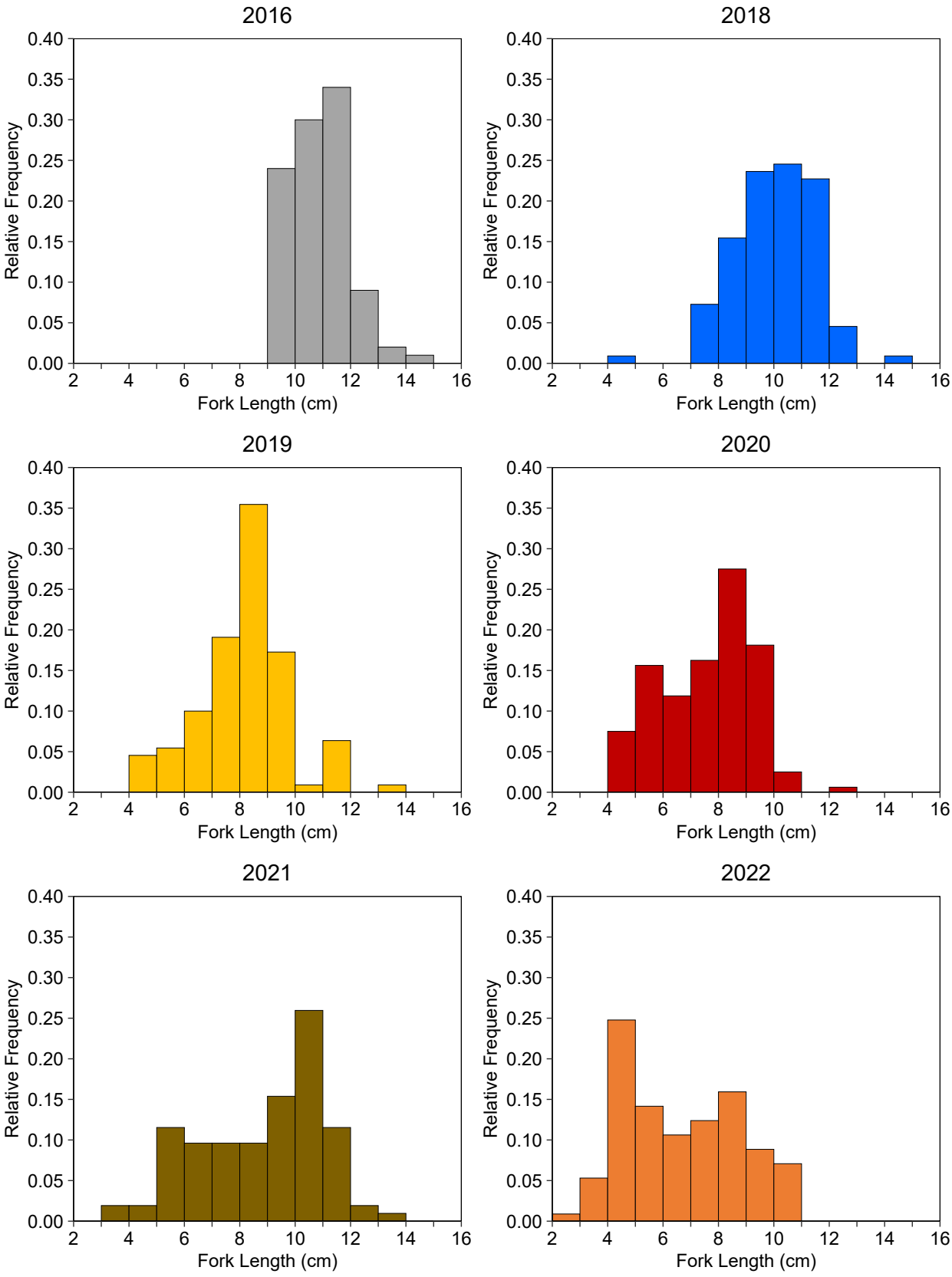

Figure E.5.6: Redside Shiner Length Frequency Distributions for Randomized Fall Hoop Netting in Polley Lake, 2016 to 2022

Table E.5.1: Statistical Comparisons of Condition and Weight-at-Age of Rainbow Trout and Longnose Sucker for Polley Lake in Spring and Fall, 2014 to 2022

Species	Indicator	Endpoint	Sex	Season	Variables		Sample Size								Test	ANCOVA Model Statistics[a]			
																Interaction Model	Parallel Slope Model	Covariate Value for Comparisons[b]	Test P-value (Year)
					Response	Covariate (Cov)	2014	2016	2017	2018	2019	2020	2021	2022		Cov×Year P-value	Cov P-value		
RBT	Energy Storage	Condition	All	Spring	log10[Body Weight (g)]	log10[Fork Length (cm)]	-	106	30	143[e]	34	54[e]	77[e]	68	ANCOVA	0.001[f]	0.001	29.6	0.001
	Energy Storage	Condition	All (FL > 23 cm)	Spring		log10[Fork Length (cm)]	-	106	30	143[e]	34	29[e]	41[e]	39	ANCOVA	0.401	0.001	32.6	0.001
	Energy Storage	Condition	All	Fall		log10[Fork Length (cm)]	82[e]	160[e]	-	94[e]	201	209[e]	266[e]	121[e]	ANCOVA	0.001[g]	0.001	22.3	0.001
	Energy Storage	Condition	All (FL > 12 cm)	Fall		log10[Fork Length (cm)]	82[e]	159[e]	-	94[e]	201	201[e]	263[e]	118[e]	ANCOVA	0.001[h]	0.001	22.5	0.001
	Energy Storage	Condition	Female	Spring		log10[Fork Length (cm)]	-	38	16	55	9	8[e]	10	8	ANCOVA	0.644	0.001	33.0	0.001
	Energy Usage	Weight-at-age	Female	Spring		log10[Age (years)]	-	9	8	8	8	8	8	8	ANCOVA	0.215	0.003	4.81	0.075
	Energy Storage	Condition	Male	Spring		log10[Fork Length (cm)]	-	62[e]	4	87[e]	21	9	4[e]	-	ANCOVA	0.192	0.001	34.0	0.054
LSU	Energy Storage	Condition	All	Spring	log10[Body Weight (g)]	log10[Fork Length (cm)]	-	100[e]	8	8	42	42	38[e]	38	ANCOVA	0.059[i]	0.001	32.0	0.001
	Energy Storage	Condition	All (FL > 32 cm)	Spring		log10[Fork Length (cm)]	-	49	8	8	20	30	15[e]	20	ANCOVA	0.230	0.001	37.3	0.001
	Energy Storage	Condition	All	Fall		log10[Fork Length (cm)]	78	157	-	91[e]	109[e]	110[e]	106[e]	104[e]	ANCOVA	0.001[j]	0.001	22.6	0.001
	Energy Storage	Condition	All (FL > 11 cm)	Fall		log10[Fork Length (cm)]	78	157	-	91[e]	109[e]	108[e]	102	103[e]	ANCOVA	0.001[k]	0.001	22.9	0.001
	Energy Storage	Condition	Female	Spring		log10[Fork Length (cm)]	-	56	8	8	21	8	7[e]	8	ANCOVA	0.509	0.001	35.2	0.001
	Energy Storage	Condition	Female (FL > 32 cm)	Spring		log10[Fork Length (cm)]	-	32	8	8	16	8	5[e]	7	ANCOVA	0.621	0.001	38.5	0.001
	Energy Usage	Weight-at-age	Female	Spring		log10[Age (years)]	-	8	8	8	8	8	8	8	ANCOVA	0.575	0.001	6.87	0.007
	Energy Storage	Condition	Male	Spring		log10[Fork Length (cm)]	-	41[e]	-	-	15	7	16	9	ANCOVA	0.378	0.001	30.3	0.002
	Energy Storage	Condition	Male (FL > 30 cm)	Spring		log10[Fork Length (cm)]	-	21[e]	-	-	6	6	6	6	ANCOVA	0.318	0.001	34.1	0.266

P-value < 0.1

Mean is significantly greater than baseline year

Mean is significantly lower than baseline year

Covariate was not significant therefore an ANOVA was conducted

Note: "-" = no data; RBT = rainbow trout; LSU = longnose sucker; ANCOVA = analysis of covariance; ANOVA = analysis of variance; nt = no test (not enough data to conduct comparisons); ns = not significant.

[a] Model: $Y = \beta_0 + \beta_1(Cov) + \beta_2(Year) + \beta_3(Cov \times Year) + \varepsilon$.

[b] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[c] The median, mean (geometric mean for log10-transformed variables), and adjusted mean are reported for ANCOVA, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

[d] Calculated as the difference in measure of central tendency (MCT) between years (i.e., 2022 minus baseline year), expressed as a percentage of the baseline year MCT.

[e] Outliers removed. See Table E.5.2 for details.

[f] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9877 and R^2 of parallel slope model = 0.9868; a difference < 0.02) following Environment Canada (2012b).

[g] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9893 and R^2 of parallel slope model = 0.9885; a difference < 0.02) following Environment Canada (2012b).

[h] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9889 and R^2 of parallel slope model = 0.9882; a difference < 0.02) following Environment Canada (2012b).

[i] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9845 and R^2 of parallel slope model = 0.9837; a difference < 0.02) following Environment Canada (2012b).

[j] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9909 and R^2 of parallel slope model = 0.99; a difference < 0.02) following Environment Canada (2012b).

[k] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9903 and R^2 of parallel slope model = 0.9894; a difference < 0.02) following Environment Canada (2012b).

Table E.5.1: Statistical Comparisons of Condition and Weight-at-Age of Rainbow Trout and Longnose Sucker for Polley Lake in Spring and Fall, 2014 to 2022

Species	Indicator	Endpoint	Sex	Season	Variables		Summary Statistics[c]								Multiple Comparisons Among Years								Magnitude of Difference[d]							
					Response	Covariate (Cov)	Statistic	2014	2016	2017	2018	2019	2020	2021	2022	2014	2016	2017	2018	2019	2020	2021	2022	Baseline Year	2016	2017	2018	2019	2020	2021	2022
RBT	Energy Storage	Condition	All	Spring	log10[Body Weight (g)]	log10[Fork Length (cm)]	Adjusted Mean	-	262	268	256	253	258	256	249	-	AB	A	BC	BC	ABC	ABC	C	2016	-	ns	ns	ns	ns	ns	-4.9
	Energy Storage	Condition	All (FL > 23 cm)	Spring		log10[Fork Length (cm)]		-	349	357	346	341	353	330	325	-	A	A	A	AB	A	B	B	2016	-	ns	ns	ns	ns	-5.5	-6.8
	Energy Storage	Condition	All	Fall		log10[Fork Length (cm)]		122	109	-	111	119	114	115	106	A	CD	-	BC	A	B	B	D	2014	-11	-	-8.8	ns	-6.5	-5.6	-13
	Energy Storage	Condition	All (FL > 12 cm)	Fall		log10[Fork Length (cm)]		127	114	-	116	123	118	119	110	A	CD	-	BC	A	B	B	D	2014	-10	-	-8.5	ns	-6.6	-5.6	-13
	Energy Storage	Condition	Female	Spring		log10[Fork Length (cm)]		-	361	384	363	368	390	342	329	-	AB	A	AB	AB	A	BC	C	2016	-	ns	ns	ns	ns	ns	-9.0
	Energy Usage	Weight-at-age	Female	Spring		log10[Age (years)]		-	330	369	341	349	438	376	305	-	AB	AB	AB	AB	A	AB	B	2016	-	ns	ns	ns	ns	ns	ns
	Energy Storage	Condition	Male	Spring		log10[Fork Length (cm)]		-	386	369	377	380	370	352	-	-	A	A	A	A	A	A	-	2016	-	ns	ns	ns	ns	ns	-
LSU	Energy Storage	Condition	All	Spring	log10[Body Weight (g)]	log10[Fork Length (cm)]	Adjusted Mean	-	427	485	453	430	434	408	388	-	B	A	AB	BC	B	CD	D	2016	-	14	ns	ns	ns	-4.5	-9.1
	Energy Storage	Condition	All (FL > 32 cm)	Spring		log10[Fork Length (cm)]		-	677	777	716	686	705	667	638	-	B	A	AB	B	B	BC	C	2016	-	15	ns	ns	ns	ns	-5.8
	Energy Storage	Condition	All	Fall		log10[Fork Length (cm)]		141	139	-	153	140	138	136	134	B	BC	-	A	B	BC	BC	C	2014	ns	-	8.5	ns	ns	ns	-5.3
	Energy Storage	Condition	All (FL > 11 cm)	Fall		log10[Fork Length (cm)]		145	143	-	158	145	142	140	138	B	BC	-	A	B	BC	BC	C	2014	ns	-	8.4	ns	ns	ns	-5.1
	Energy Storage	Condition	Female	Spring		log10[Fork Length (cm)]		-	580	652	612	587	603	543	536	-	BC	A	AB	BC	AB	BC	C	2016	-	12	ns	ns	ns	ns	ns
	Energy Storage	Condition	Female (FL > 32 cm)	Spring		log10[Fork Length (cm)]		-	755	859	799	767	793	718	701	-	BC	A	AB	BC	AB	BC	C	2016	-	14	ns	ns	ns	ns	ns
	Energy Usage	Weight-at-age	Female	Spring		log10[Age (years)]		-	624	705	854	801	711	591	641	-	BC	ABC	A	AB	ABC	C	BC	2016	-	ns	37	ns	ns	ns	ns
	Energy Storage	Condition	Male	Spring		log10[Fork Length (cm)]		-	346	-	-	352	346	328	311	-	A	-	-	A	A	AB	B	2016	-	-	-	ns	ns	ns	-10
	Energy Storage	Condition	Male (FL > 30 cm)	Spring		log10[Fork Length (cm)]		-	488	-	-	484	492	473	452	-	A	-	-	A	A	A	A	2016	-	-	-	ns	ns	ns	ns

P-value < 0.1

Mean is significantly greater than baseline year

Mean is significantly lower than baseline year

Covariate was not significant therefore an ANOVA was conducted

Note: "-" = no data; RBT = rainbow trout; LSU = longnose sucker; ANCOVA = analysis of covariance; ANOVA = analysis of variance; nt = no test (not enough data to conduct comparisons); ns = not significant.

[a] Model: $Y = \beta_0 + \beta_1(Cov) + \beta_2(Year) + \beta_3(Cov \times Year) + \varepsilon$.

[b] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[c] The median, mean (geometric mean for log10-transformed variables), and adjusted mean are reported for ANCOVA, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

[d] Calculated as the difference in measure of central tendency (MCT) between years (i.e., 2022 minus baseline year), expressed as a percentage of the baseline year MCT.

[e] Outliers removed. See Table E.5.2 for details.

[f] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9877 and R^2 of parallel slope model = 0.9868; a difference < 0.02) following Environment Canada (2012b).

[g] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9893 and R^2 of parallel slope model = 0.9885; a difference < 0.02) following Environment Canada (2012b).

[h] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9889 and R^2 of parallel slope model = 0.9882; a difference < 0.02) following Environment Canada (2012b).

[i] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9845 and R^2 of parallel slope model = 0.9837; a difference < 0.02) following Environment Canada (2012b).

[j] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9909 and R^2 of parallel slope model = 0.99; a difference < 0.02) following Environment Canada (2012b).

[k] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9903 and R^2 of parallel slope model = 0.9894; a difference < 0.02) following Environment Canada (2012b).

Table E.5.2: Outliers Excluded from Statistical Comparisons of Condition and Weight-at-Age of Rainbow Trout and Longnose Sucker for Polley Lake in Spring and Fall, 2014 to 2022

Taxa	Sex	Season	Year	Outliers (Student Residual)
RBT	All	Spring	2018	POL_RB_105_2018-05-15 (-4.14)
			2020	POL_RB_N41_2020-05-15(-15.755)); POL_RB_N42_2020-05-15 (-18.346)); POL_RB_N5_2020-05-15 (-4.025)
			2021	POL_RB_33_2021-05-15 (5.292)
	All (FL > 23 cm)	Spring	2018	POL_RB_105_2018-05-15 (-4.006)
			2020	POL_RB_N41_2020-05-15 (-14.743)); POL_RB_N42_2020-05-15 (-17.272)
			2021	POL_RB_33_2021-05-15 (5.149)
	All	Fall	2014	POL_RB_50_2014-09-15 (-4.03)
			2016	POL_RB_11L_2016-09-15 (-4.412); POL_RB_32L_2016-09-15 (8.551); POL_RB_11_2016-09-13 (-4.846); POL_RB_37L_2016-09-15 (4.54)
			2018	POL_RB_30_2018-09-15 (6.799); POL_RB_90_2018-09-15 (-4.09)
			2020	POL_RB_62_2020-10-05 (4.059); POL_RB_112_2020-10-05 (4.447); POL_RB_143_2020-10-06 (-4.084); POL_RB_151_2020-10-06 (-4.144); POL_RB_205_2020-10-07 (-4.688); POL_RB_12_2020-10-03 (-4.228); POL_RB_195_2020-10-07 (-4.128)
			2021	POL_RB_47_2021-09-24 (-4.406); POL_RB_173_2021-09-26 (18.823)
			2022	POL_RB-11_2022-09 (-4.245); POL_RB-6_2022-09 (-4.034)
	All (FL > 12 cm)	Fall	2014	POL_RB_50_2014-09-15 (-4.069)
			2016	POL_RB_11L_2016-09-15 (-4.455); POL_RB_32L_2016-09-15 (8.642); POL_RB_11_2016-09-13 (-4.952); POL_RB_37L_2016-09-15 (4.638); POL_RB_71_2016-09-16 (-4.002)
			2018	POL_RB_30_2018-09-15 (6.868); POL_RB_90_2018-09-15 (-4.109)
			2020	POL_RB_12_2020-10-03 (-4.15); POL_RB_112_2020-10-05 (4.467); POL_RB_143_2020-10-06 (-4.379); POL_RB_195_2020-10-07 (-4.036); POL_RB_205_2020-10-07 (-4.746); POL_RB_62_2020-10-05 (4.045)
			2021	POL_RB_47_2021-09-24 (-4.455); POL_RB_173_2021-09-26 (19.098)
			2022	POL_RB-11_2022-09 (-4.31)
	Female	Spring	2020	POL_RB_N41_2020-05-15 (-27.837)
	Male	Spring	2016	POL_RB_54_2016-04-15 (4.05);
			2018	POL_RB_105_2018-05-15 (-4.035); POL_RB_85_2018-05-15 (4.021)
			2021	POL_RB_33_2021-05-15 (5.671);
LSU	All	Spring	2016	POL_LSU_88_2016-04-15 (-9.341); POL_LSU_72_2016-04-15 (-5.315)
			2021	POL_LSU_36_2021-05-13 (-4.933)
	All (FL > 32 cm)	Spring	2021	POL_LSU_36_2021-05-13 (-5.724)
	All	Fall	2018	POL_LSU_32_2018-09-15 (-4.743)
			2019	POL_LSU_36_2019-09-25 (-4.616); POL_LSU_91_2019-09-26 (-9.42)
			2020	POL_LSU_10_2020-10-05 (4.642); POL_LSU_86_2020-10-05 (-4.561); POL_LSU_110_2020-10-05 (-4.335)
			2021	POL_LSU_45_2021-09-25 (4.558); POL_LSU_105_2021-09-26 (4.256); POL_LSU_106_2021-09-26 (4.3)
			2022	POL_LSU-7_2022-09 (-4.359)
	All (FL > 11 cm)	Fall	2018	POL_LSU_32_2018-09-15 (-4.986)
			2019	POL_LSU_36_2019-09-25 (-4.852); POL_LSU_91_2019-09-26 (-9.955)
			2020	POL_LSU_86_2020-10-05 (-4.725); POL_LSU_110_2020-10-05 (-4.547)
			2022	POL_LSU-7_2022-09 (-4.652)
	Male	Spring	2016	POL_LSU_72_2016-04-15 (-6.451)
	Male (FL > 30 cm)	Spring	2016	POL_LSU_91_2016-04-15 (4.41)
	Female	Spring	2021	POL_LSU_36_2021-05-13 (-4.935)
	Female (FL > 32 cm)	Spring	2021	POL_LSU_36_2021-05-13 (-5.253)

Notes: - = no outliers. RBT = rainbow trout. LSU = longnose sucker. FL = fork length.

Table E.5.3: Two-Sample Kolmogorov-Smirnov Test Results of Rainbow Trout, Longnose Sucker, and Redside Shiner Length Frequency Distributions for Polley Lake in Spring and Fall, 2016 to 2022

Species	Sample Size						P-Value					
	2016	2018	2019	2020	2021	2022	Baseline Year	2018	2019	2020	2021	2022
RBT	119	54	201	216	268	123	2016	0.008	<0.001	<0.001	<0.001	<0.001
LSU	100	169	112	113	109	105	2016	<0.001	0.088	<0.001	<0.001	<0.001
RSC	100	110	110	160	104	113	2016	0.001	<0.001	<0.001	<0.001	<0.001

P-Value < 0.1

Notes: RBT = rainbow trout; LSU = longnose sucker; RSC = redside shiner.

APPENDIX E.6
FISH TISSUE QUALITY

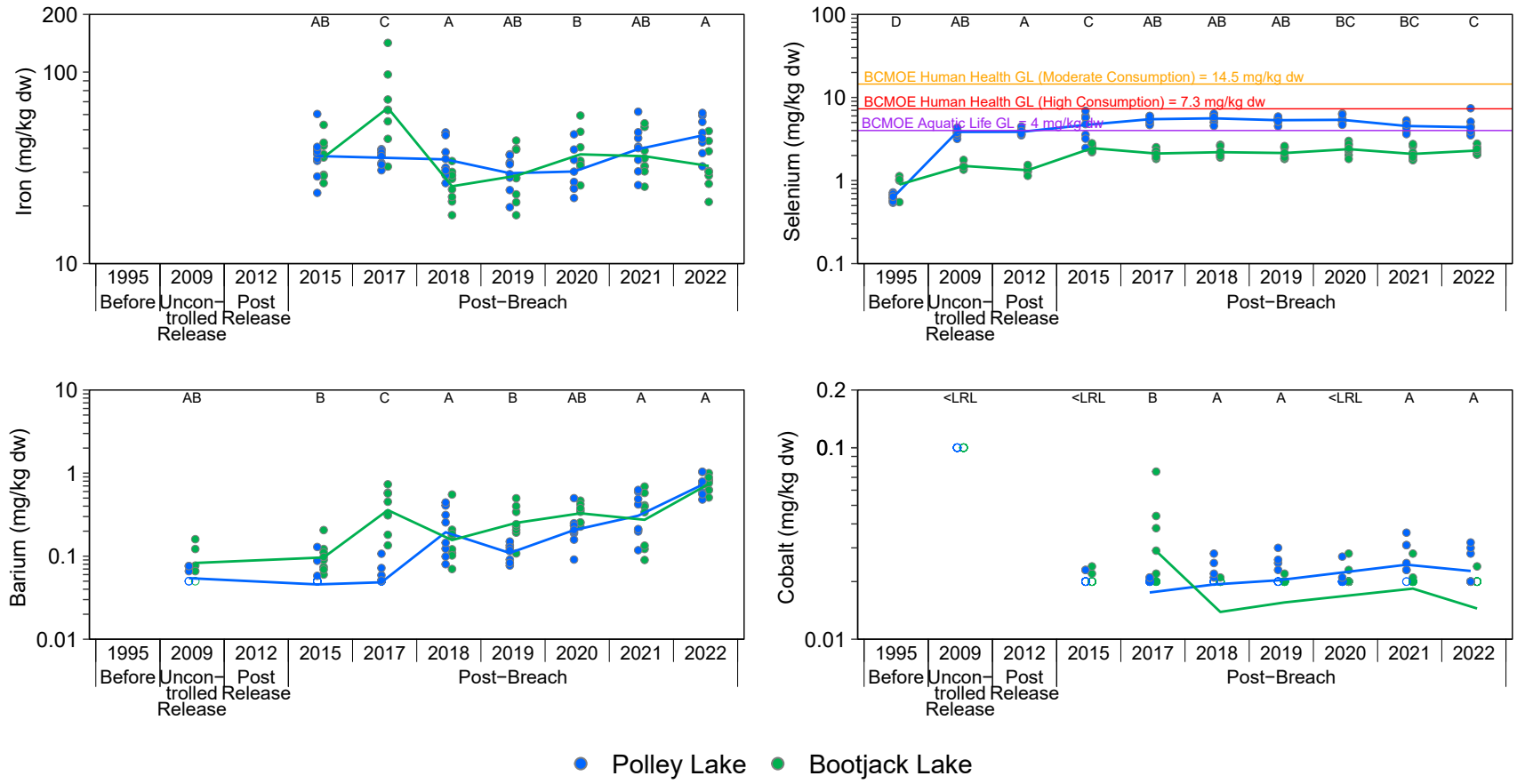

Figure E.6.1: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

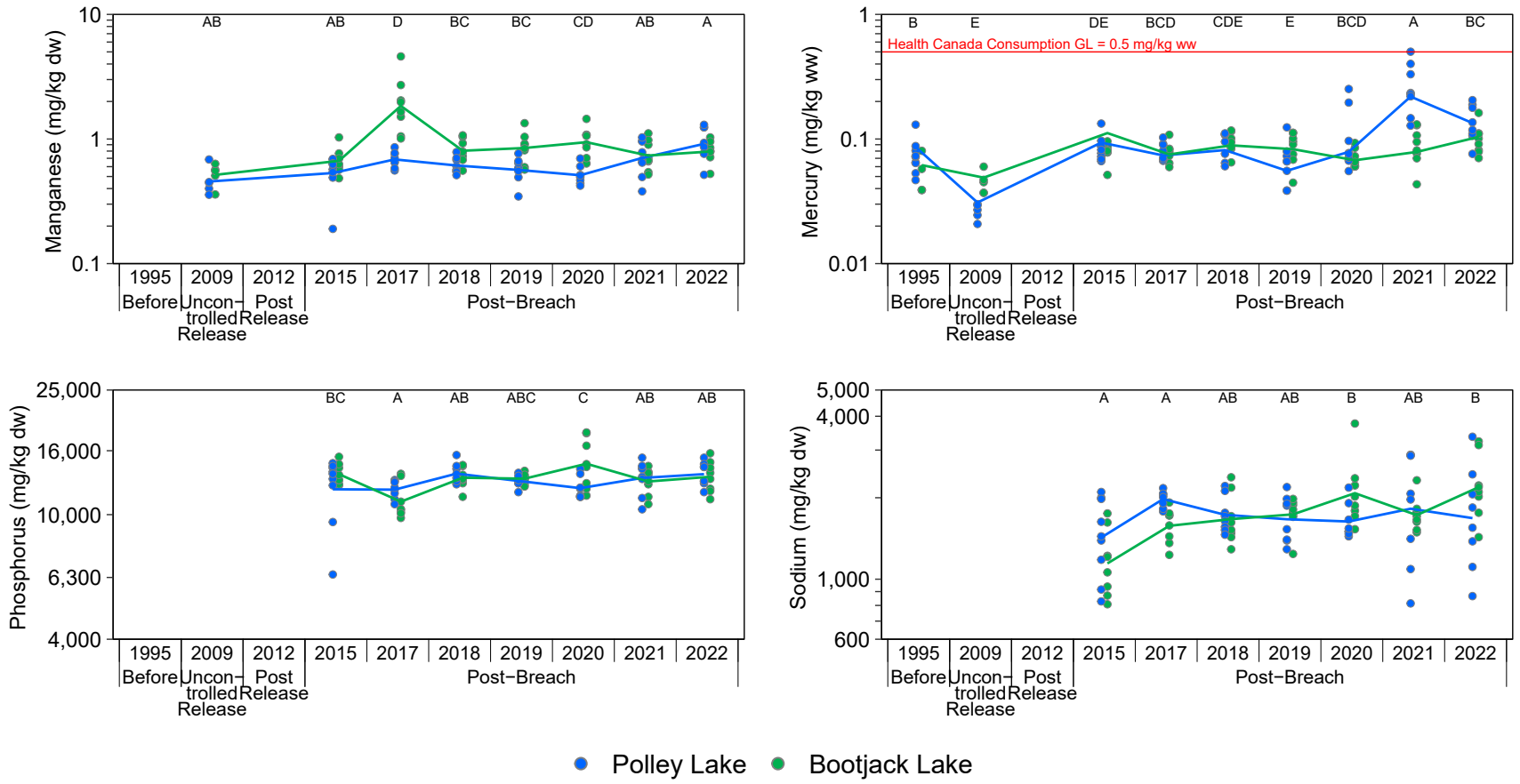

Figure E.6.1: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

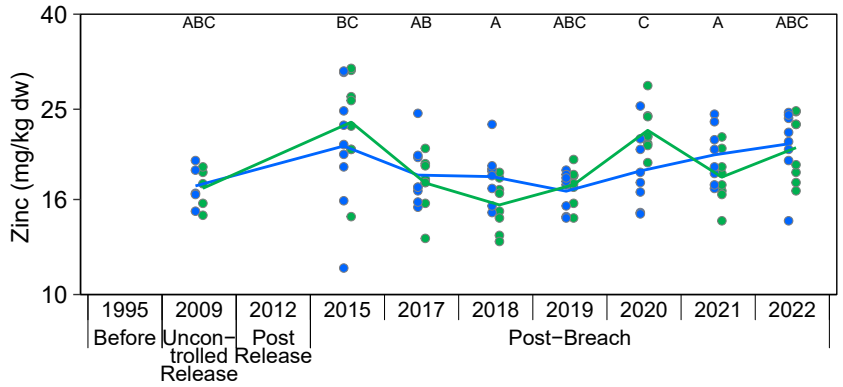

Figure E.6.1: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

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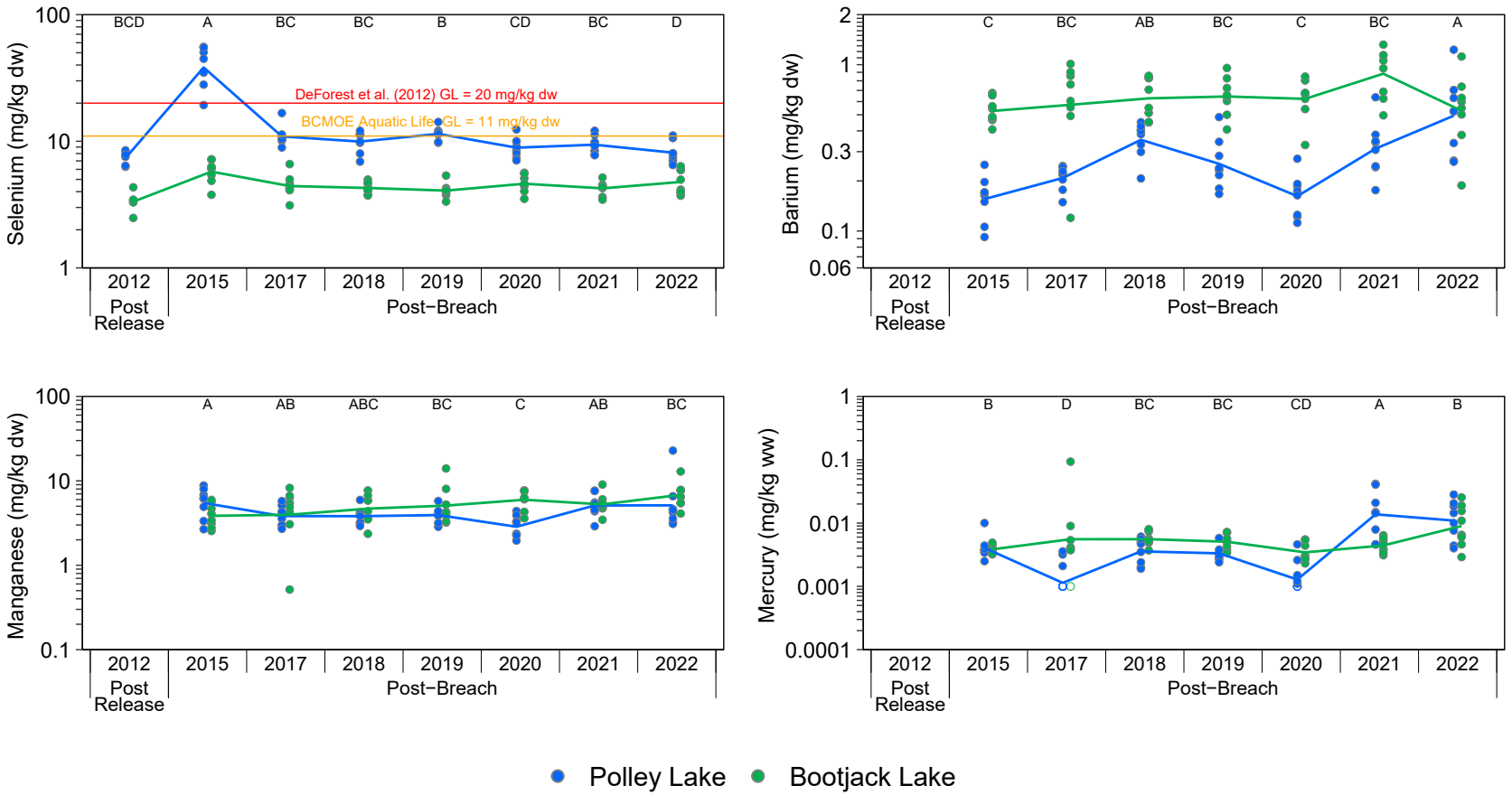

Figure E.6.2: Rainbow Trout Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

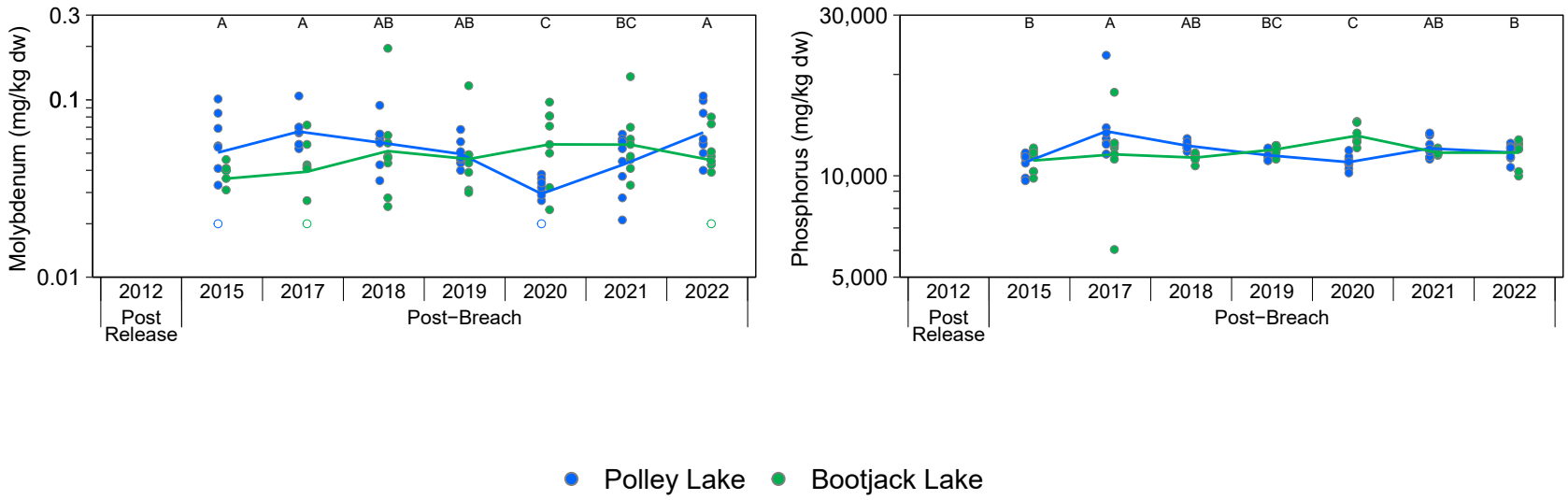

Figure E.6.2: Rainbow Trout Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

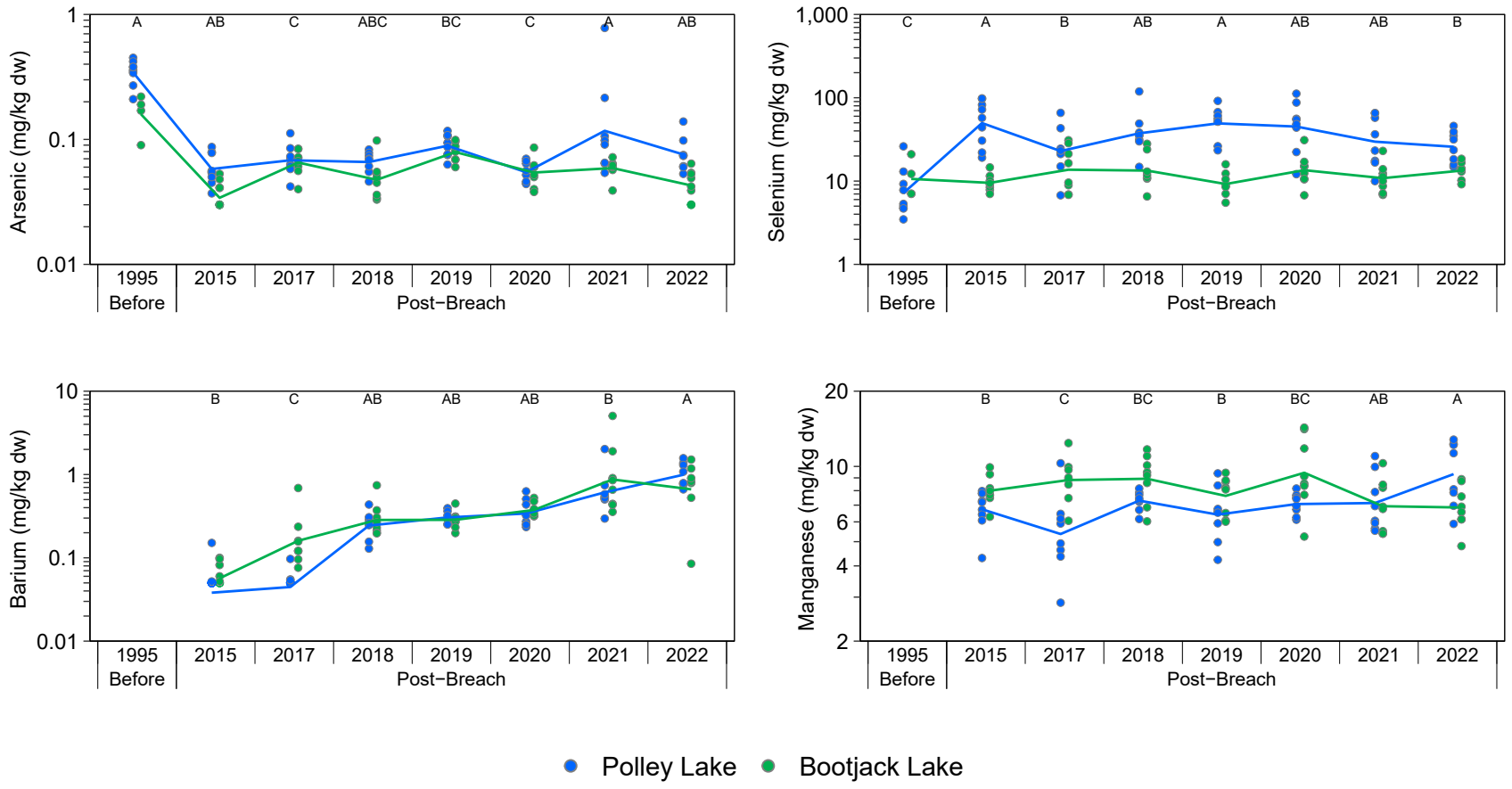

Figure E.6.3: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

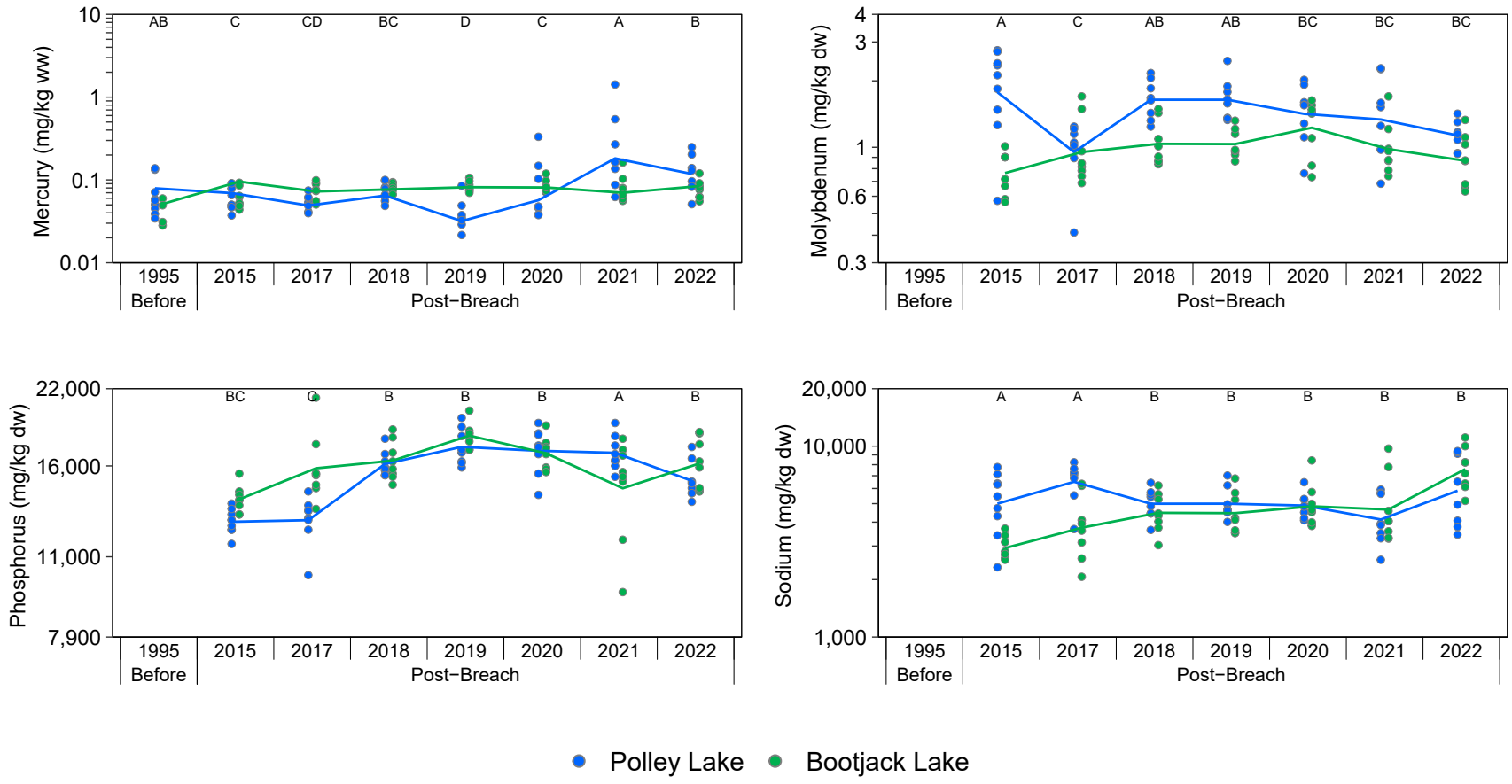

Figure E.6.3: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

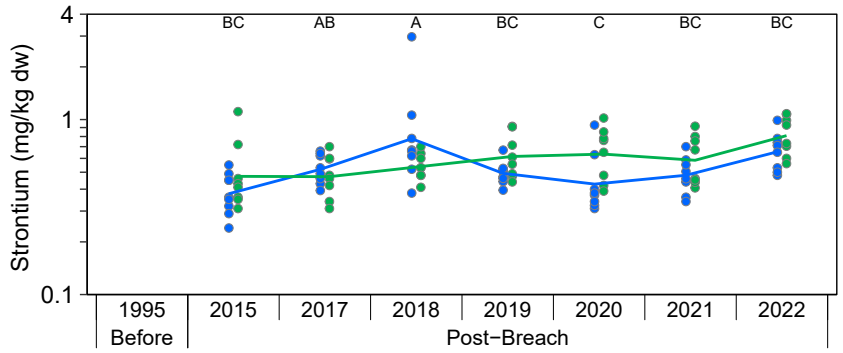

Figure E.6.3: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

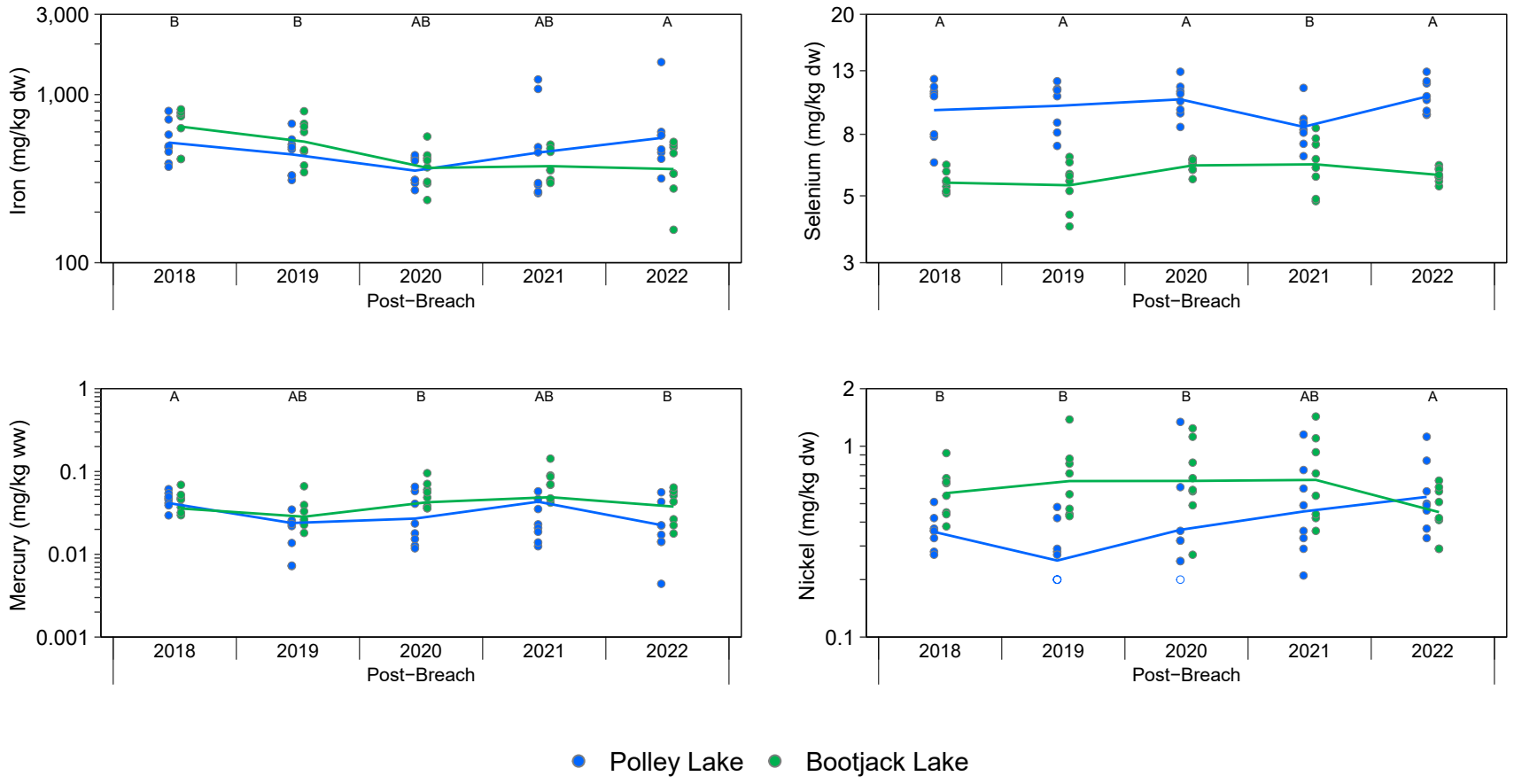

Figure E.6.4: Rainbow Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

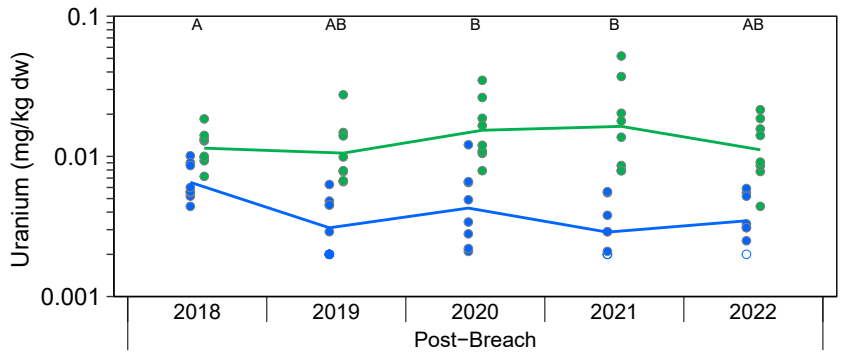

Figure E.6.4: Rainbow Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

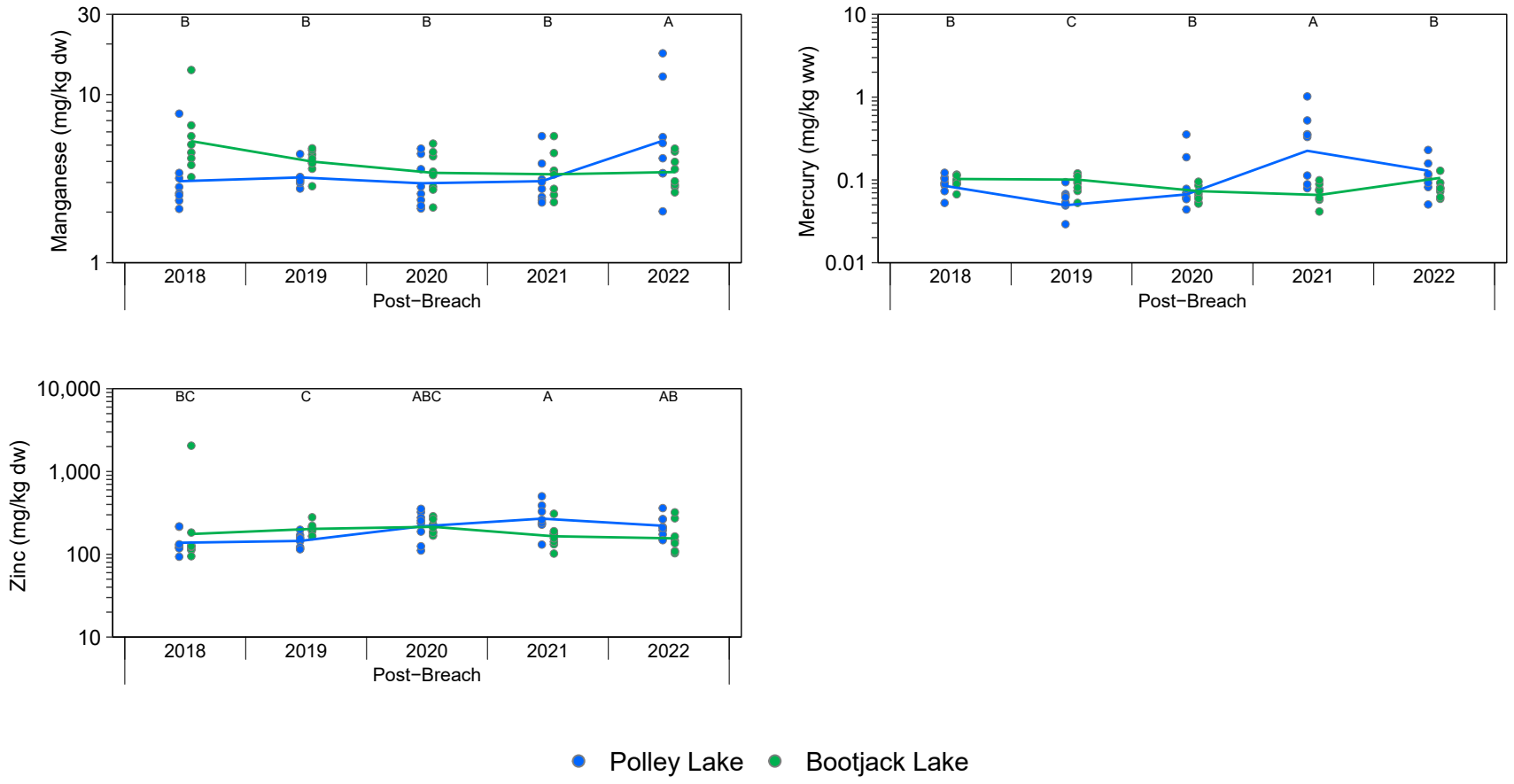

Figure E.6.5: Longnose Sucker Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

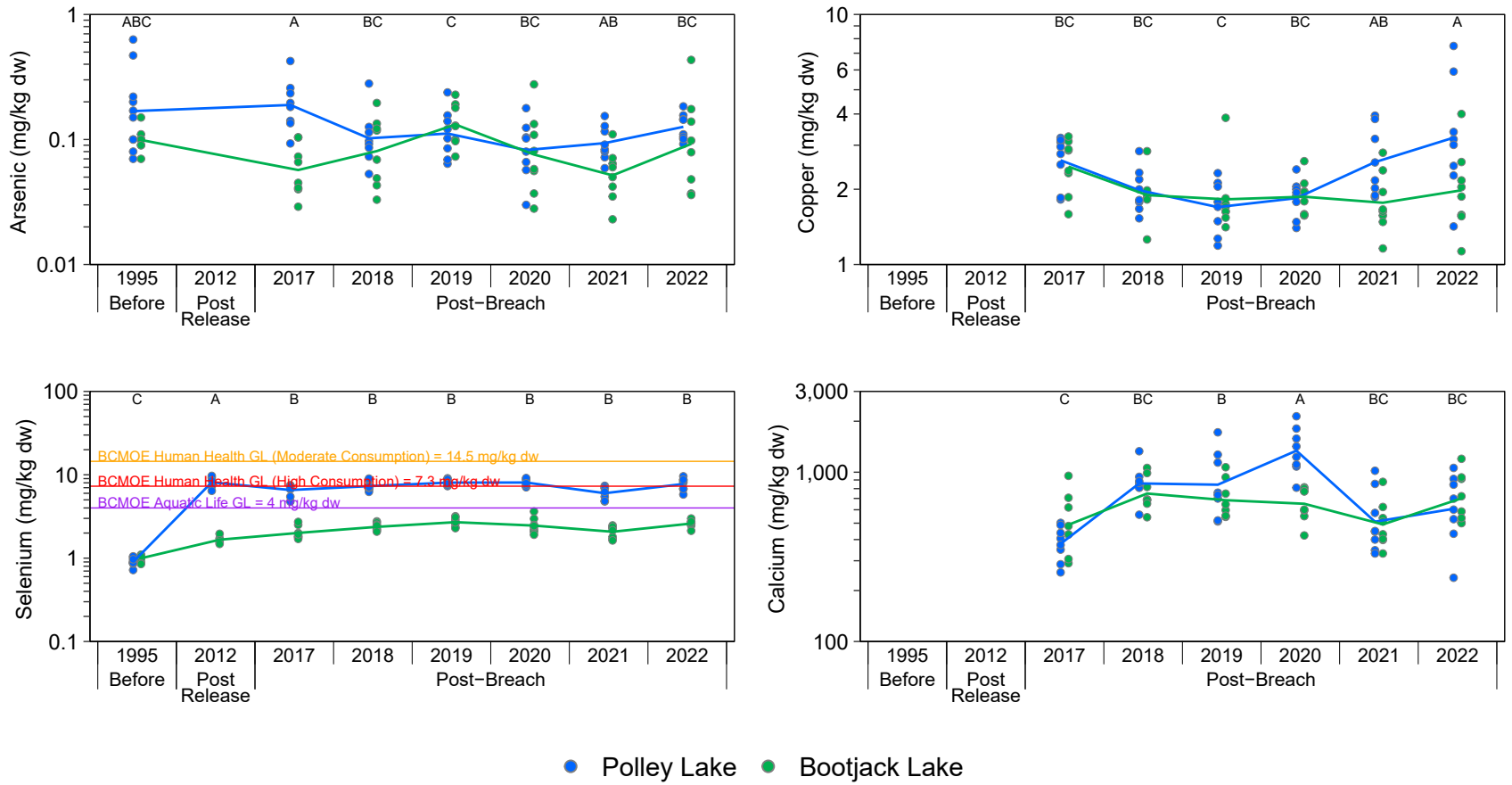

Figure E.6.6: Longnose Sucker Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

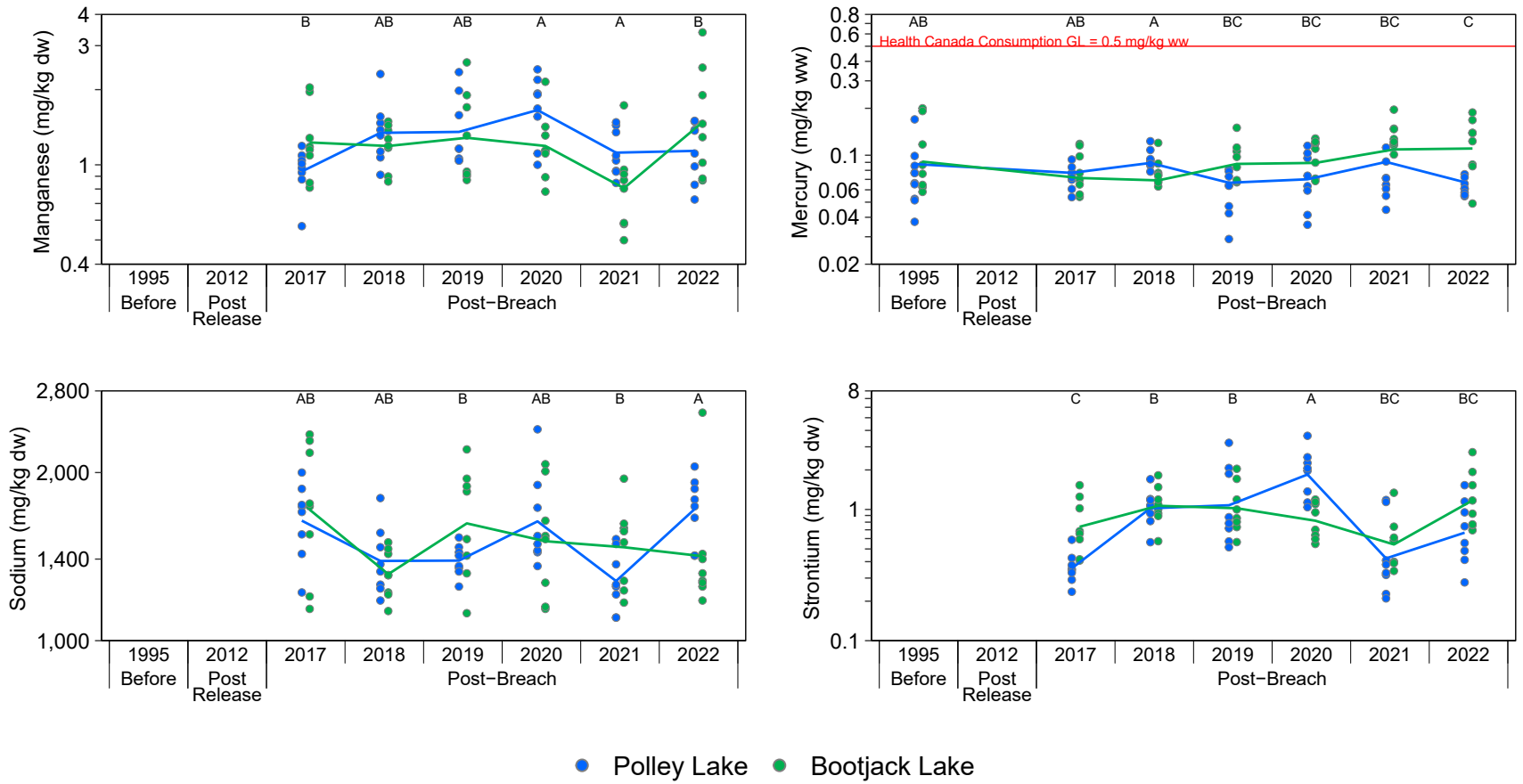

Figure E.6.6: Longnose Sucker Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

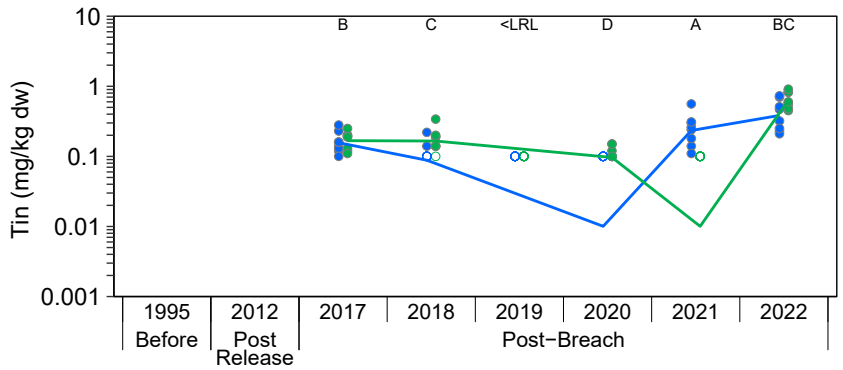

Figure E.6.6: Longnose Sucker Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

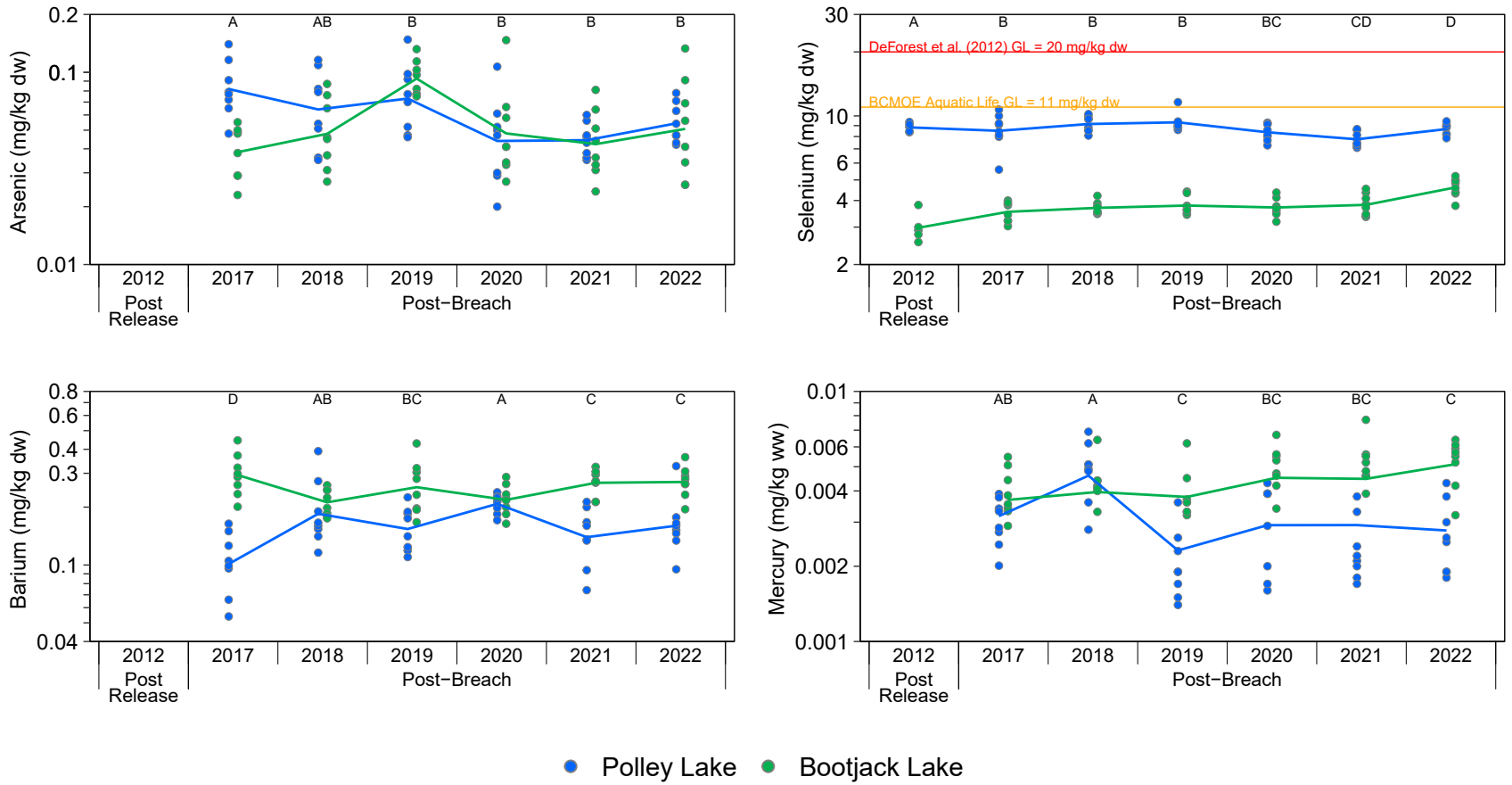

Figure E.6.7: Longnose Sucker Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

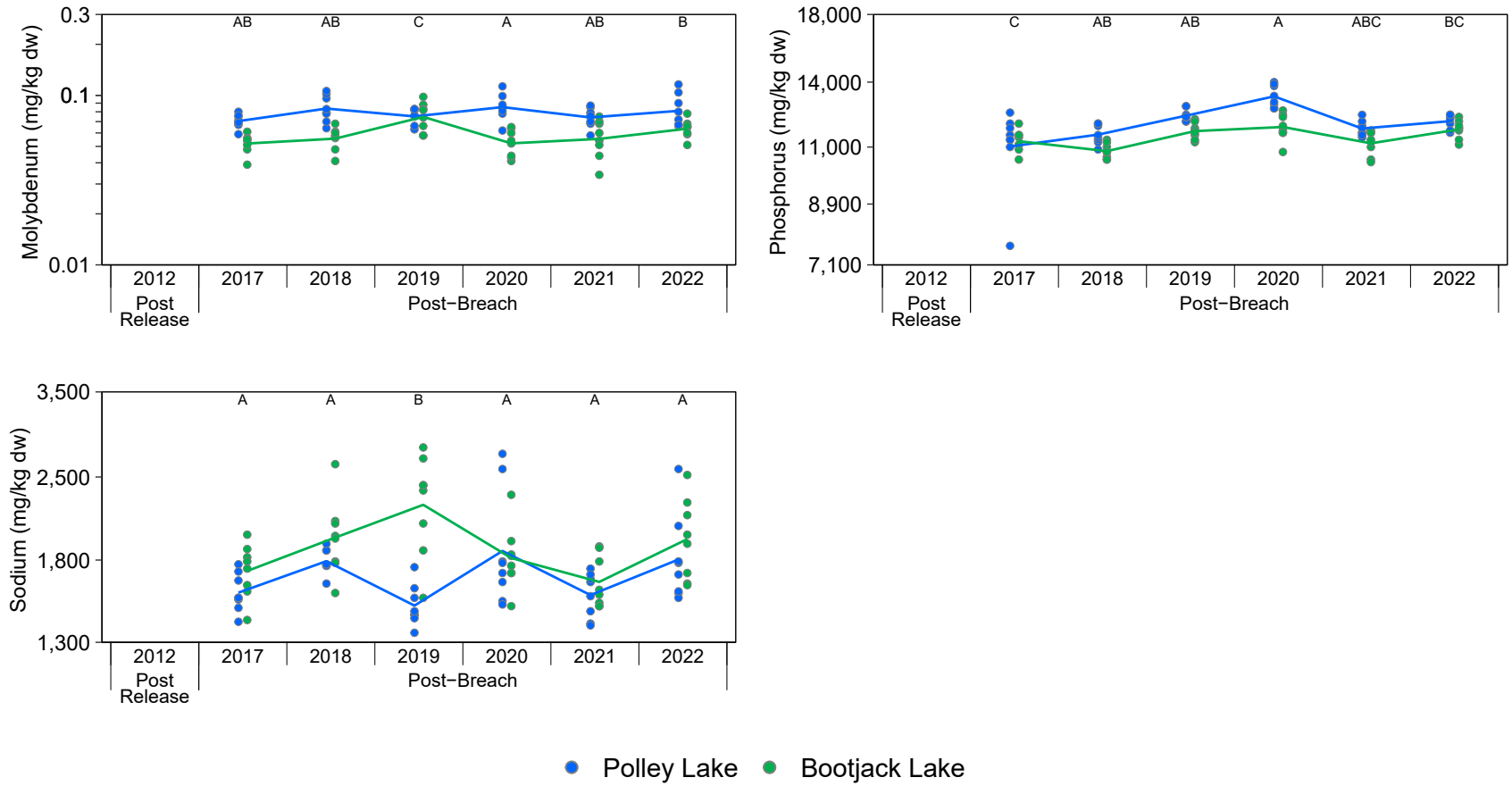

Figure E.6.7: Longnose Sucker Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

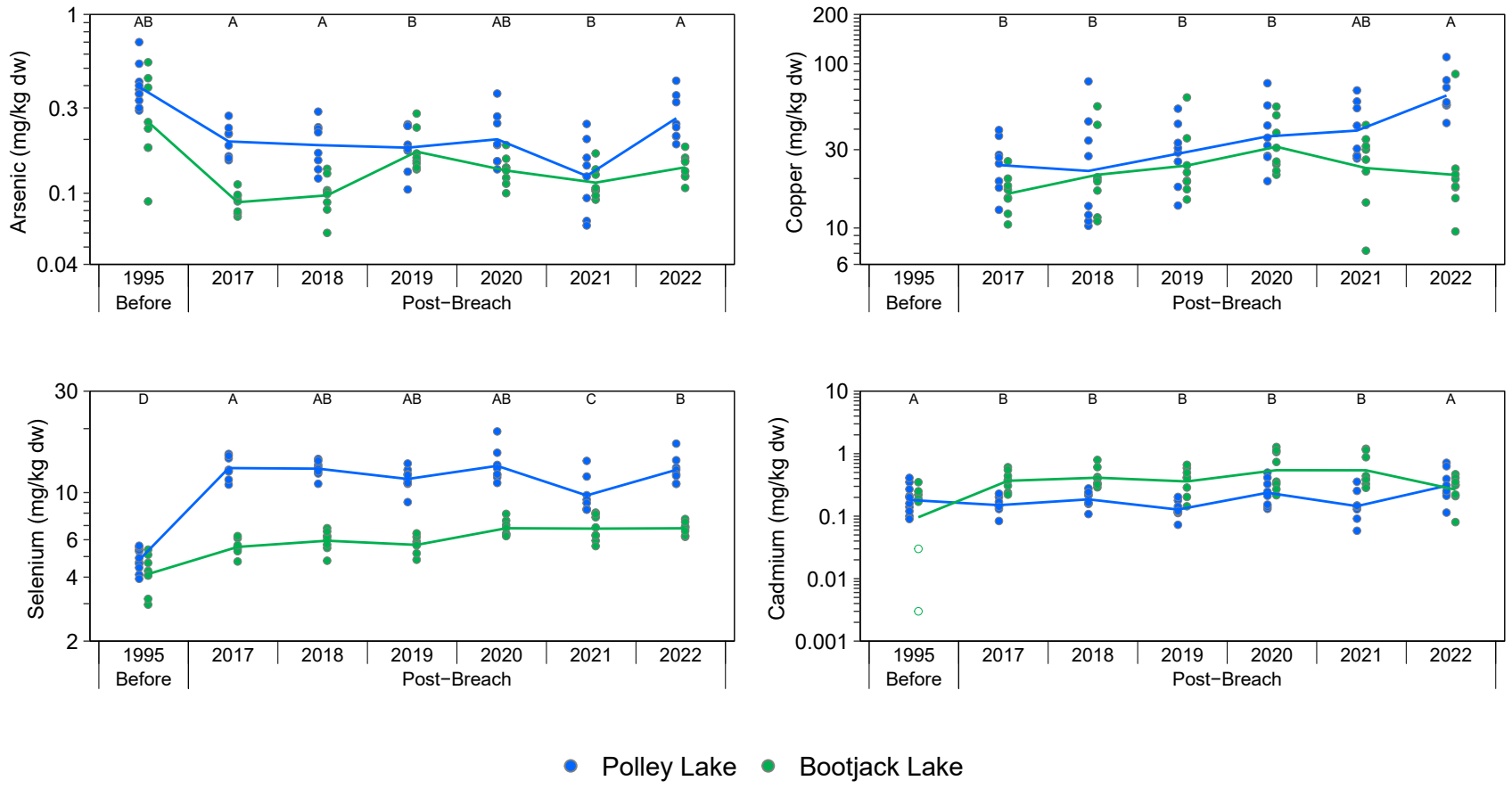

Figure E.6.8: Longnose Sucker Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

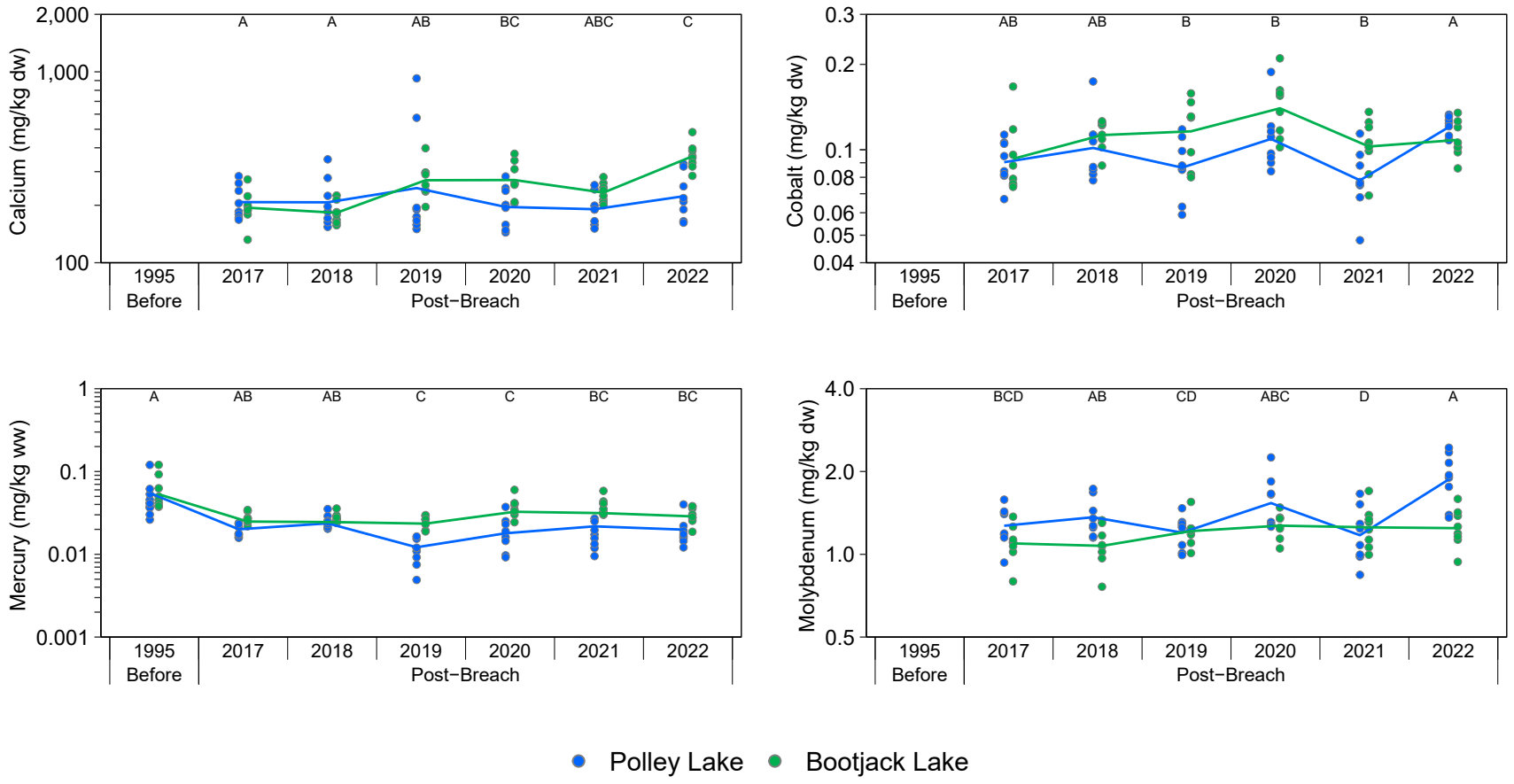

Figure E.6.8: Longnose Sucker Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

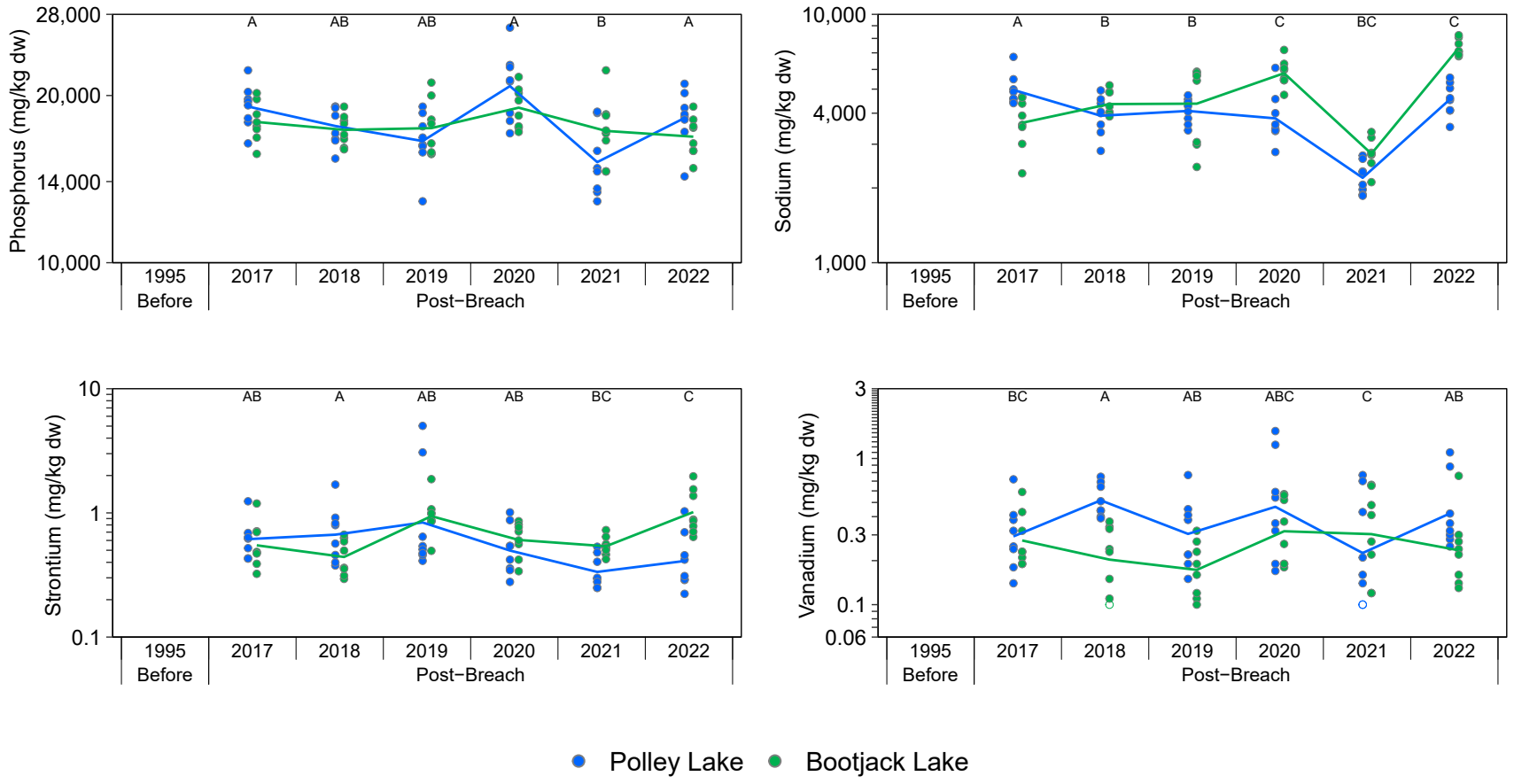

Figure E.6.8: Longnose Sucker Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

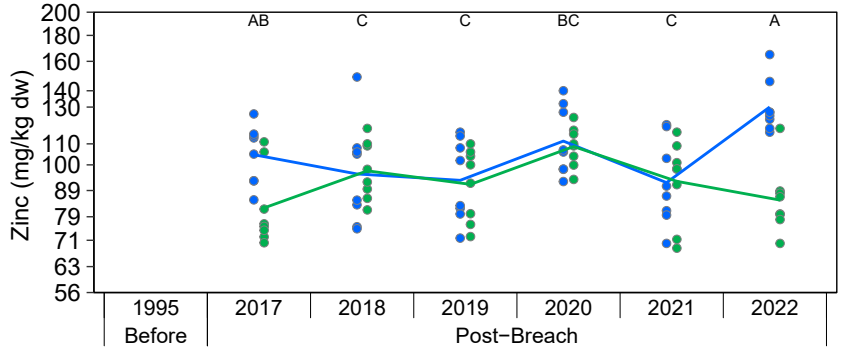

Figure E.6.8: Longnose Sucker Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). Only years with samples from both reference and exposed areas are plotted.

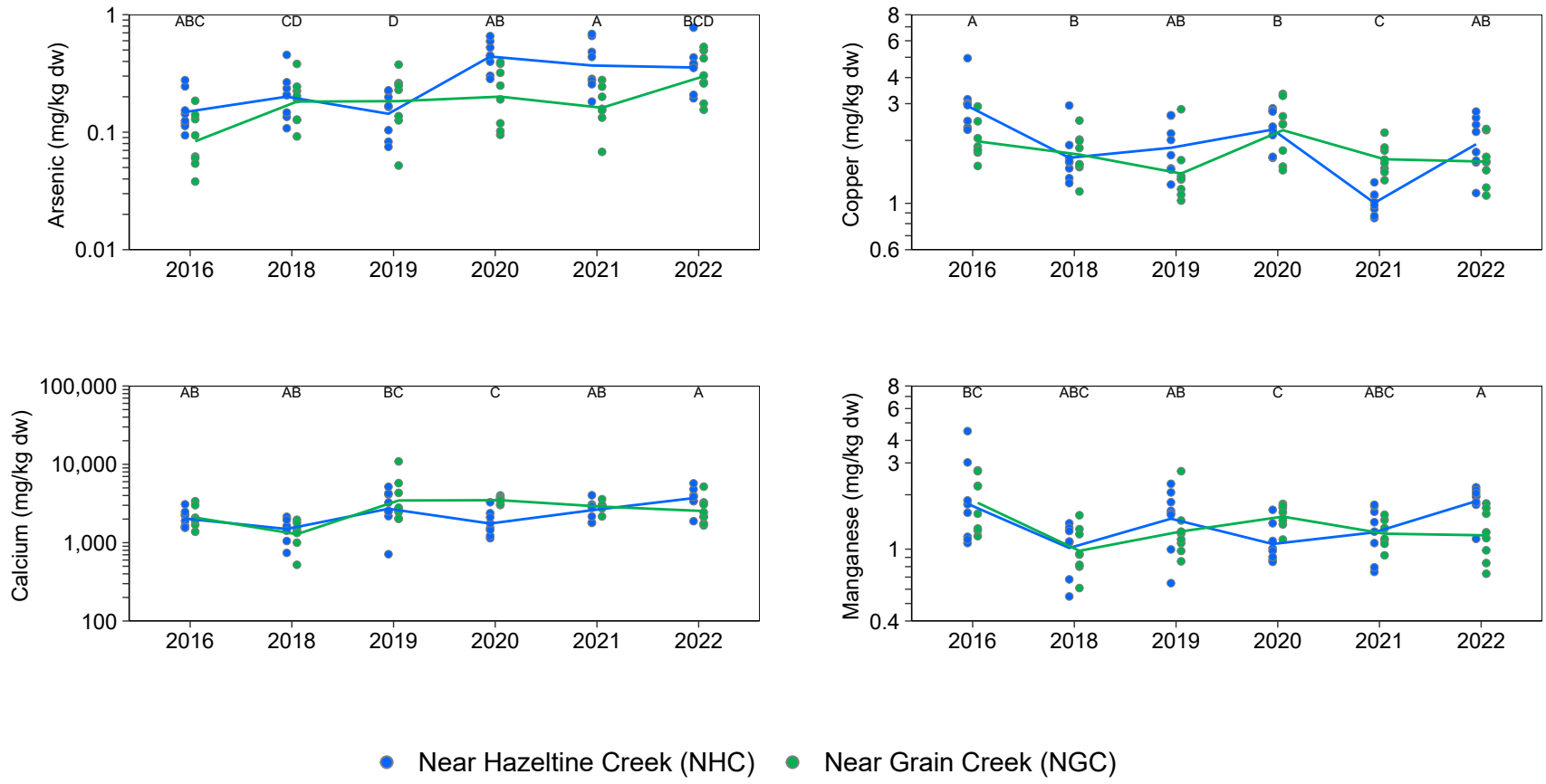

Figure E.6.9: Peamouth Chub Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

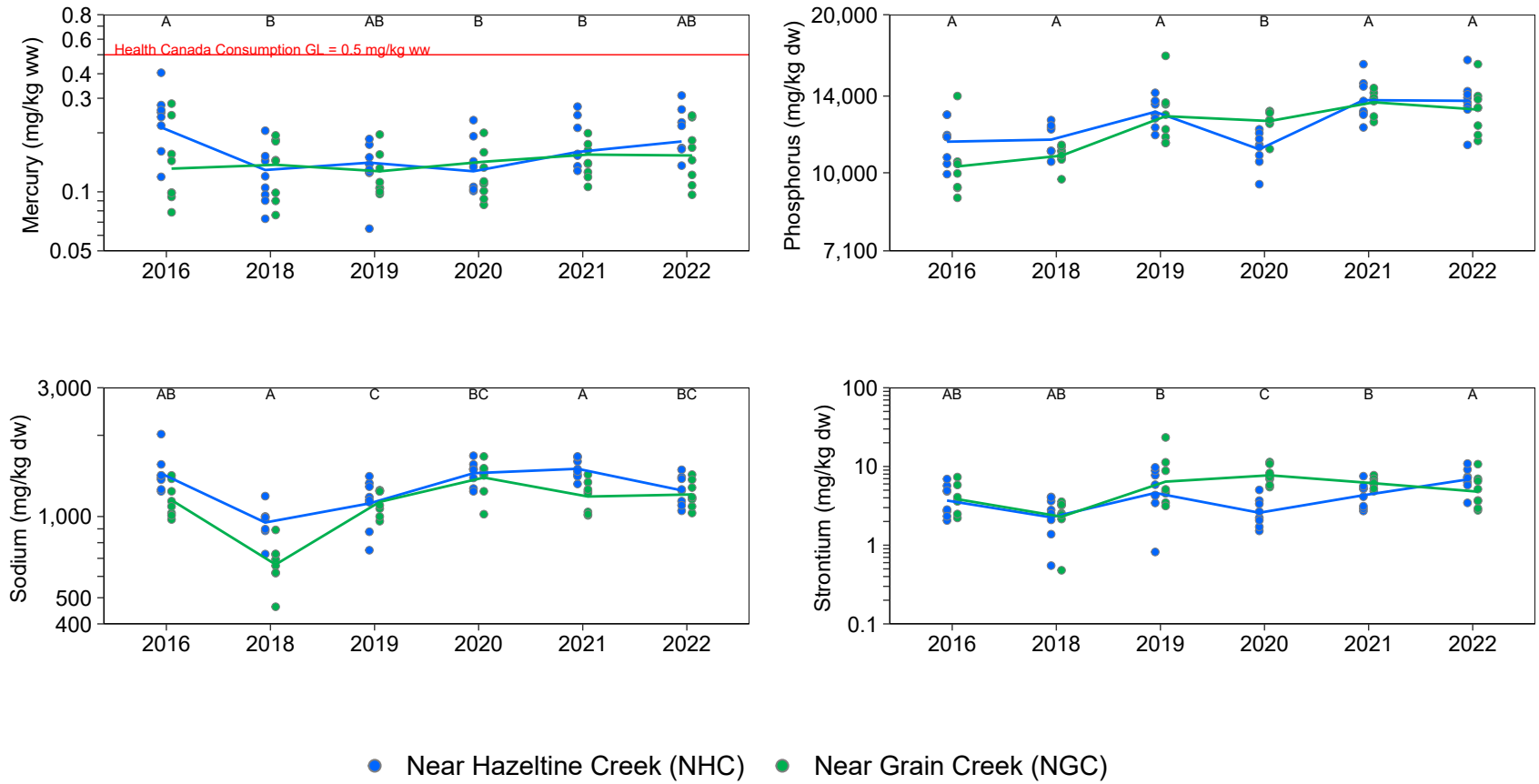

Figure E.6.9: Peamouth Chub Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

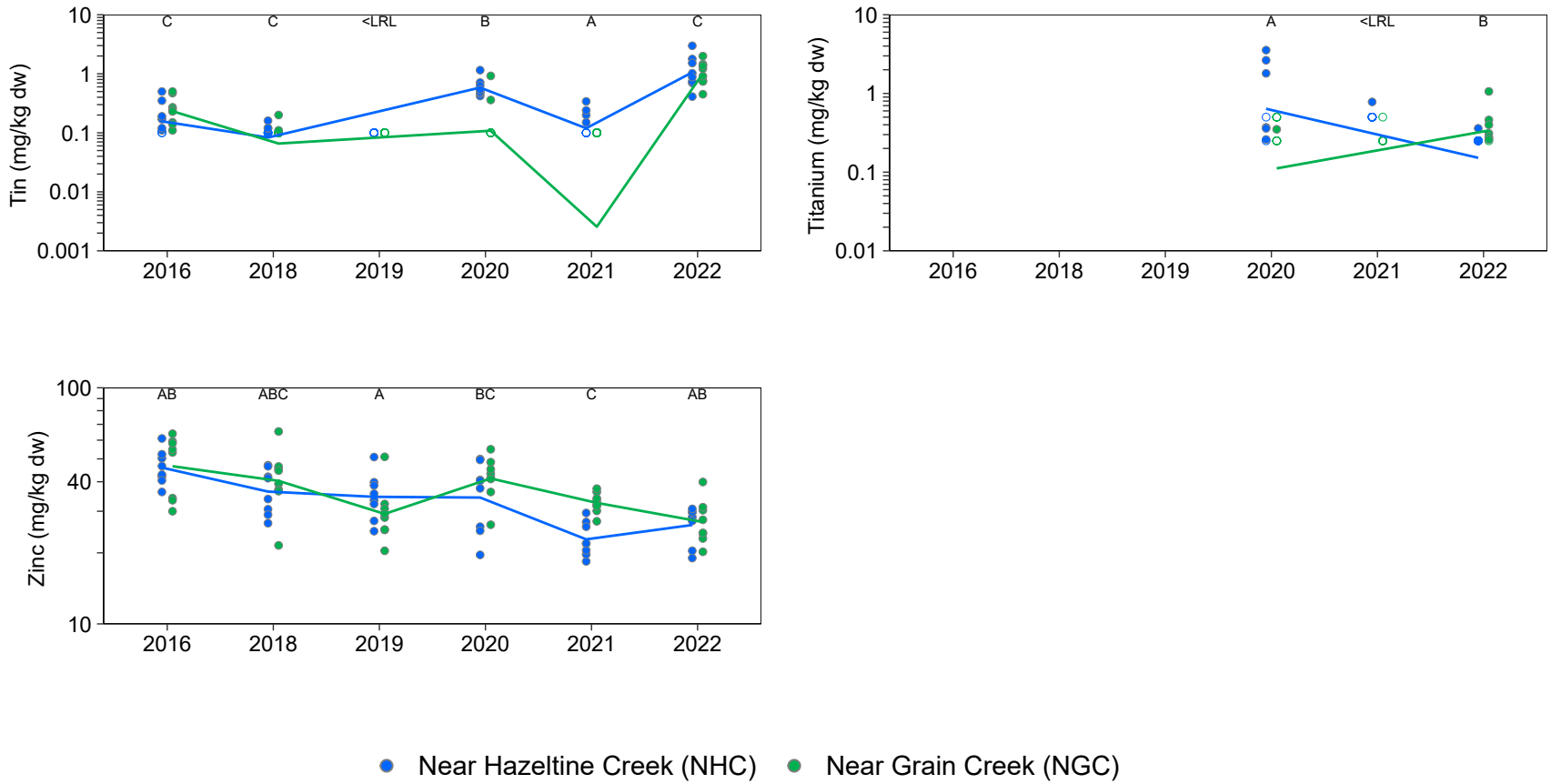

Figure E.6.9: Peamouth Chub Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two −way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

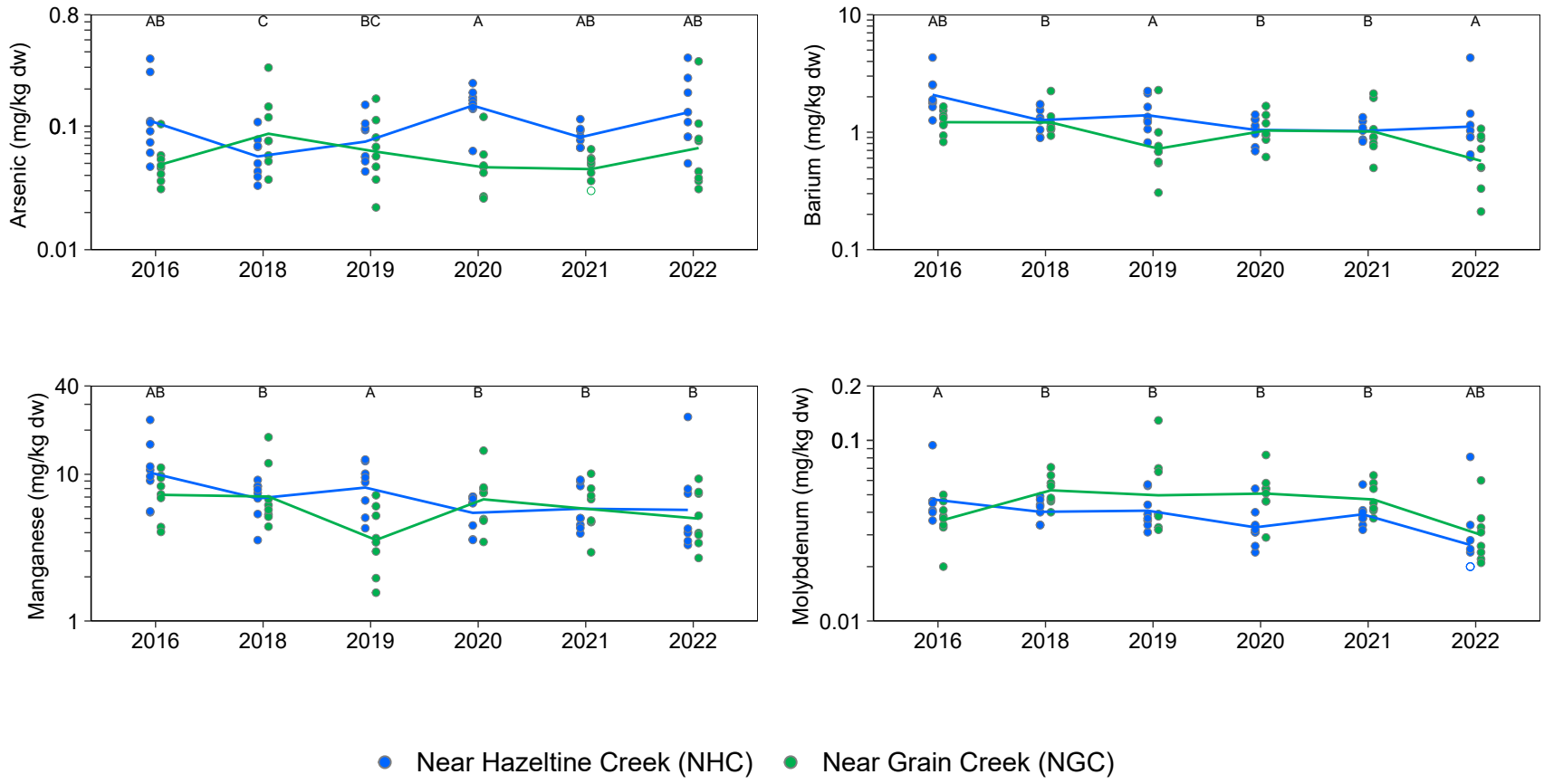

Figure E.6.10: Northern Pikeminnow Wholebody Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

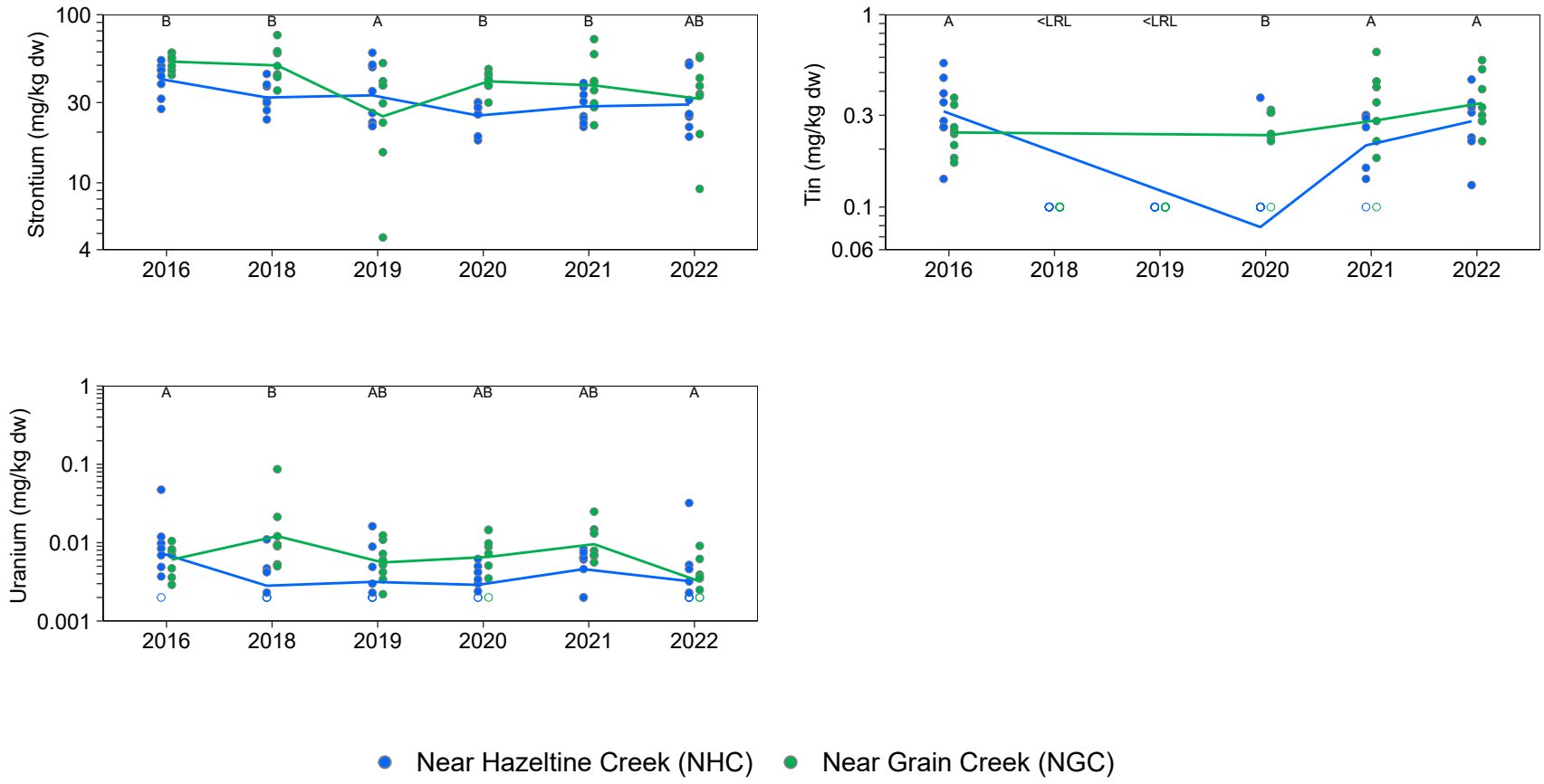

Figure E.6.10: Northern Pikeminnow Wholebody Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

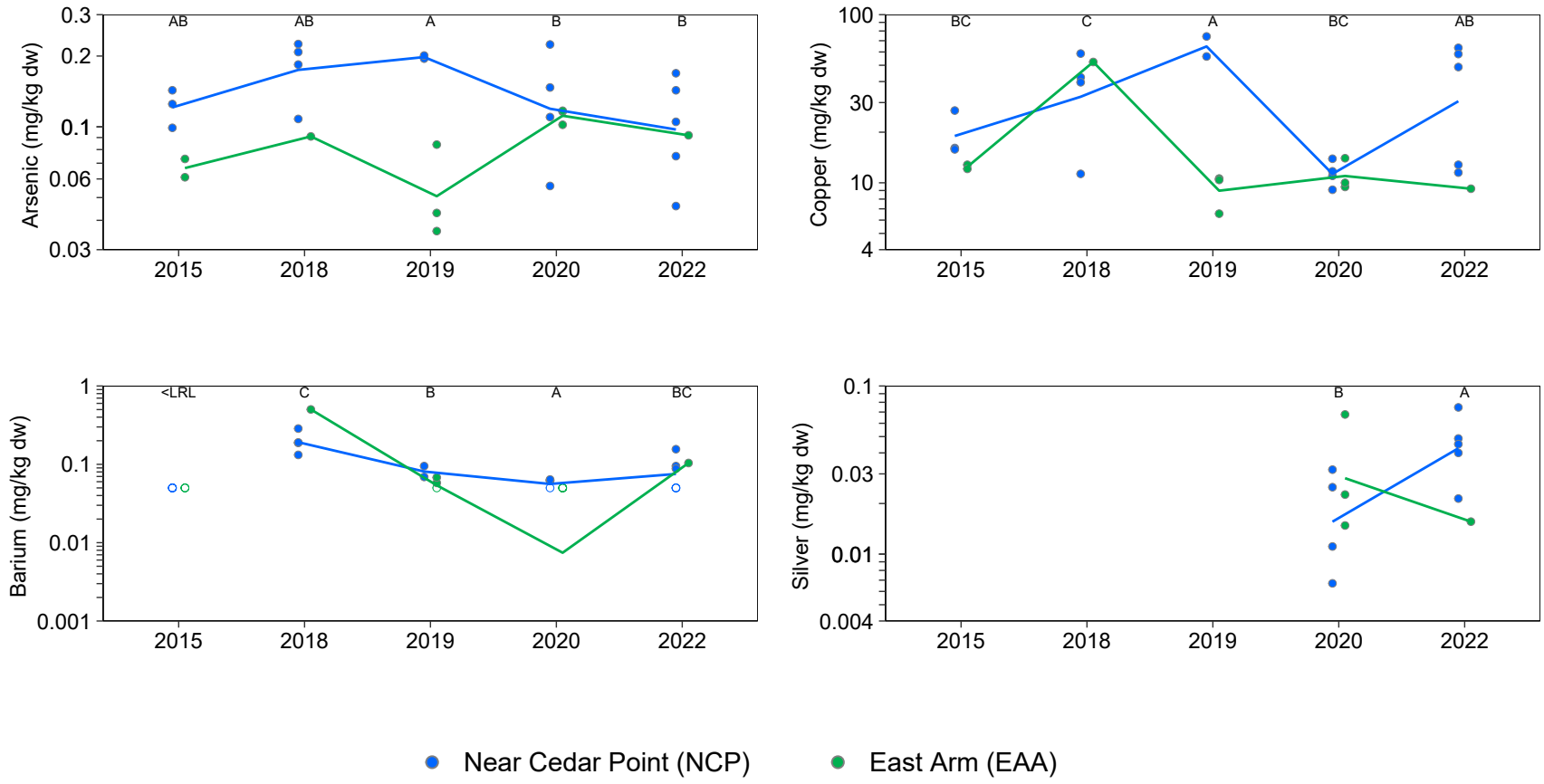

Figure E.6.11: Lake Trout Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

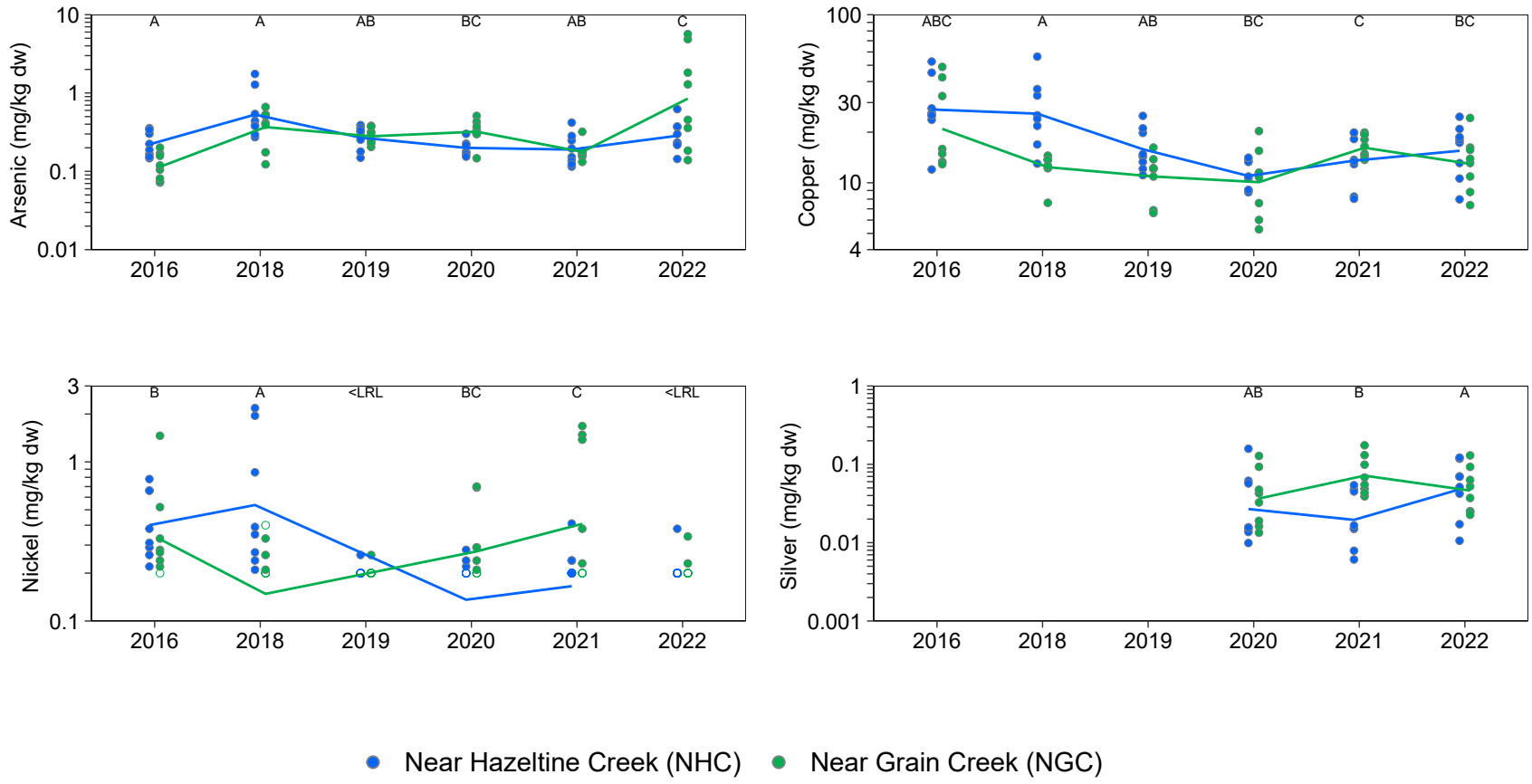

Figure E.6.12: Peamouth Chub Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

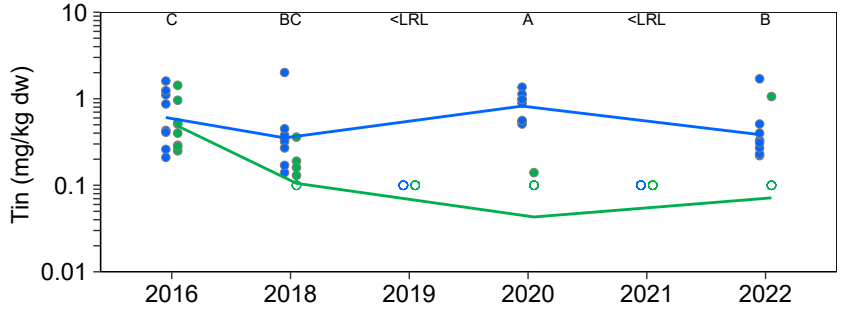

Figure E.6.12: Peamouth Chub Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

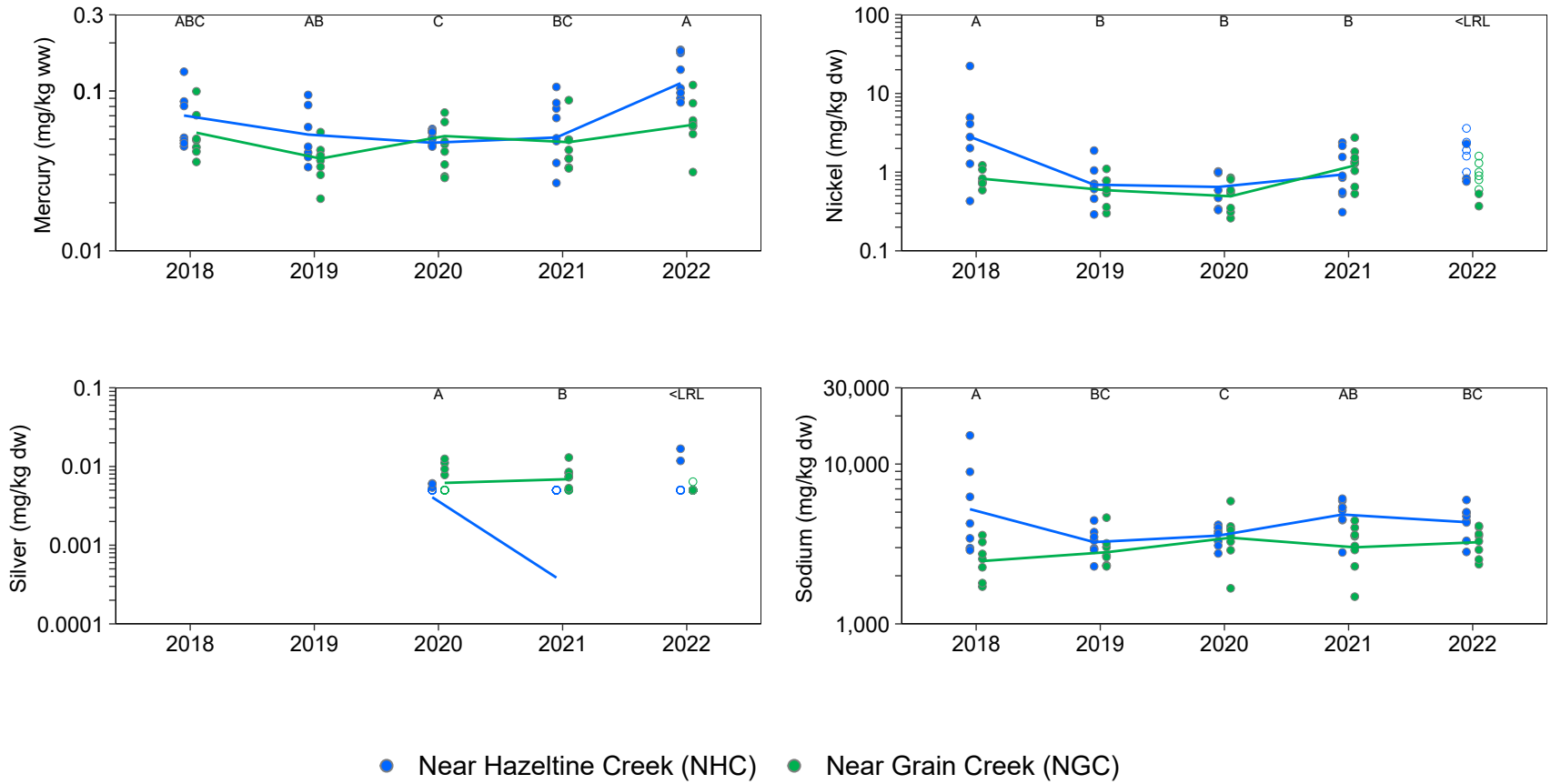

Figure E.6.13: Peamouth Chub Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

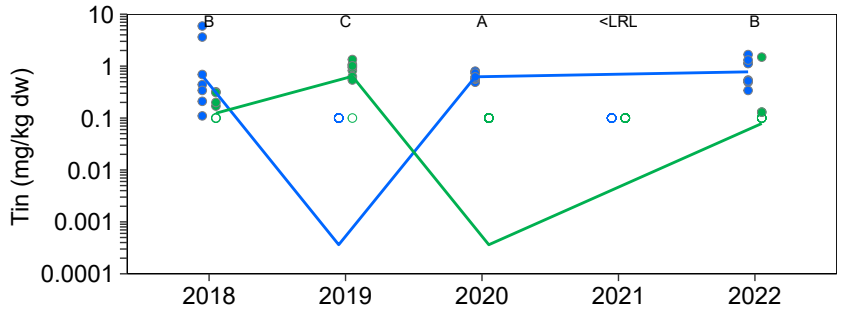

Figure E.6.13: Peamouth Chub Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2018 to 2022

Notes: GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

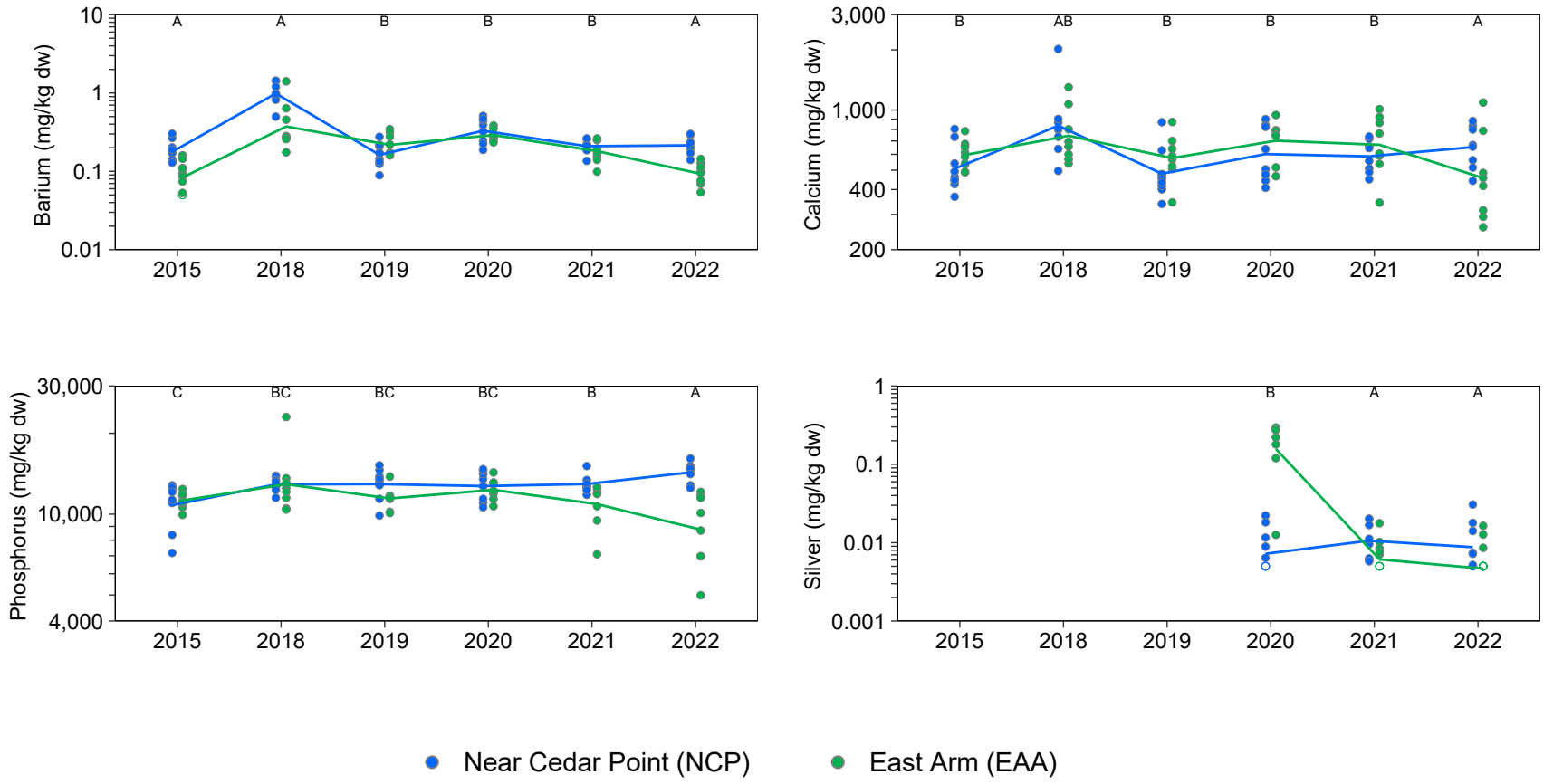

Figure E.6.14: Lake Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

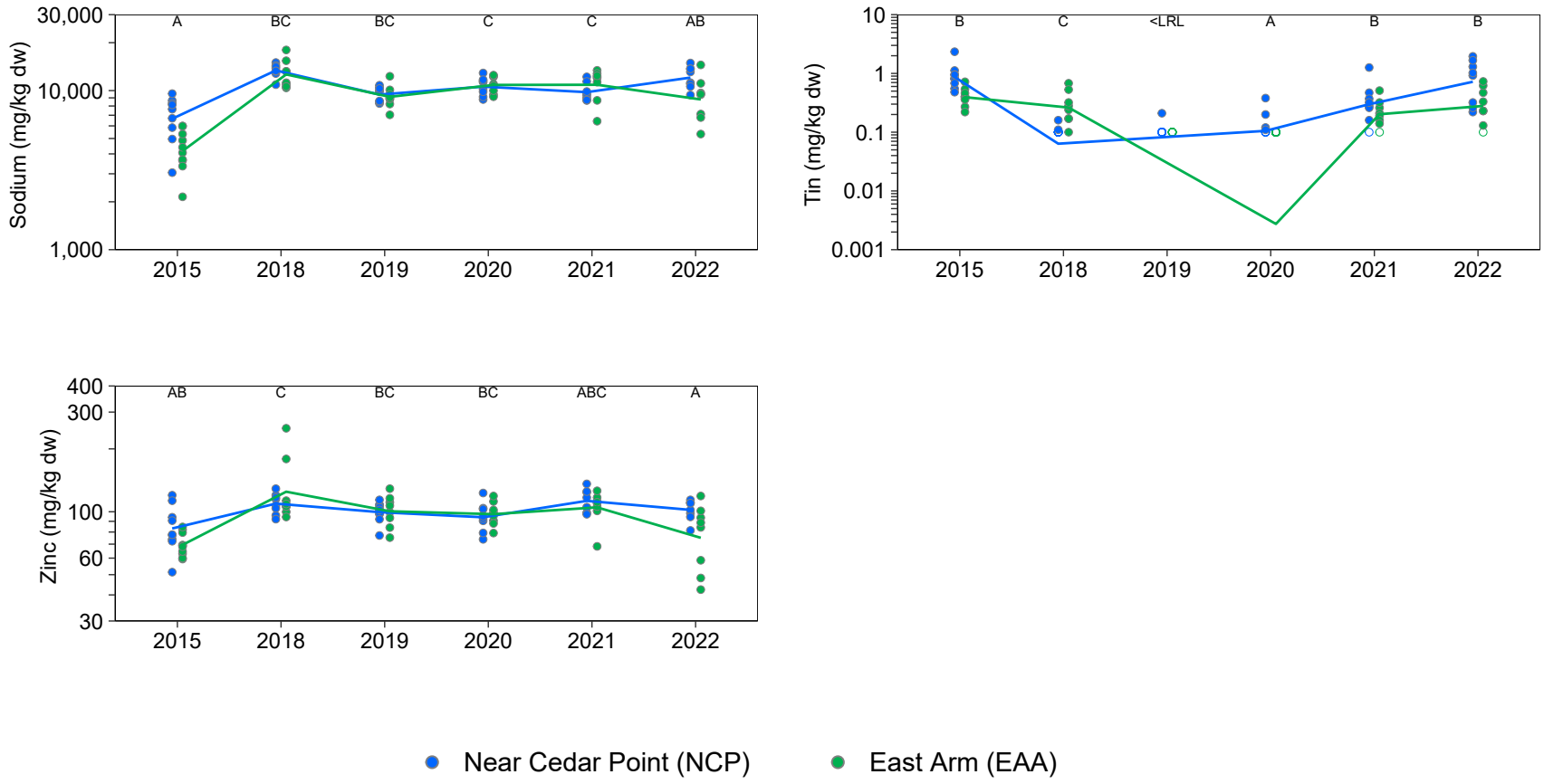

Figure E.6.14: Lake Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

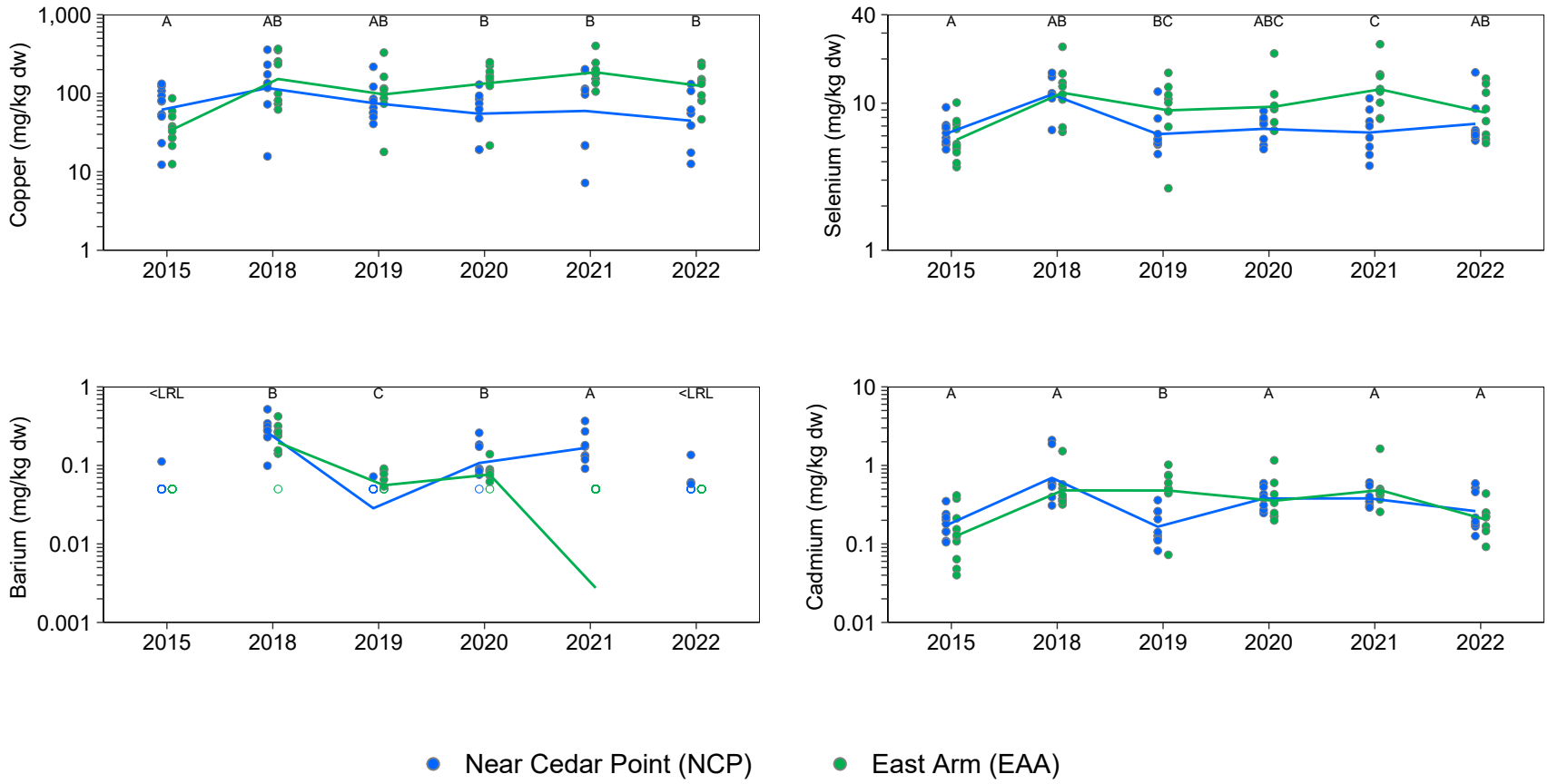

Figure E.6.15: Lake Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

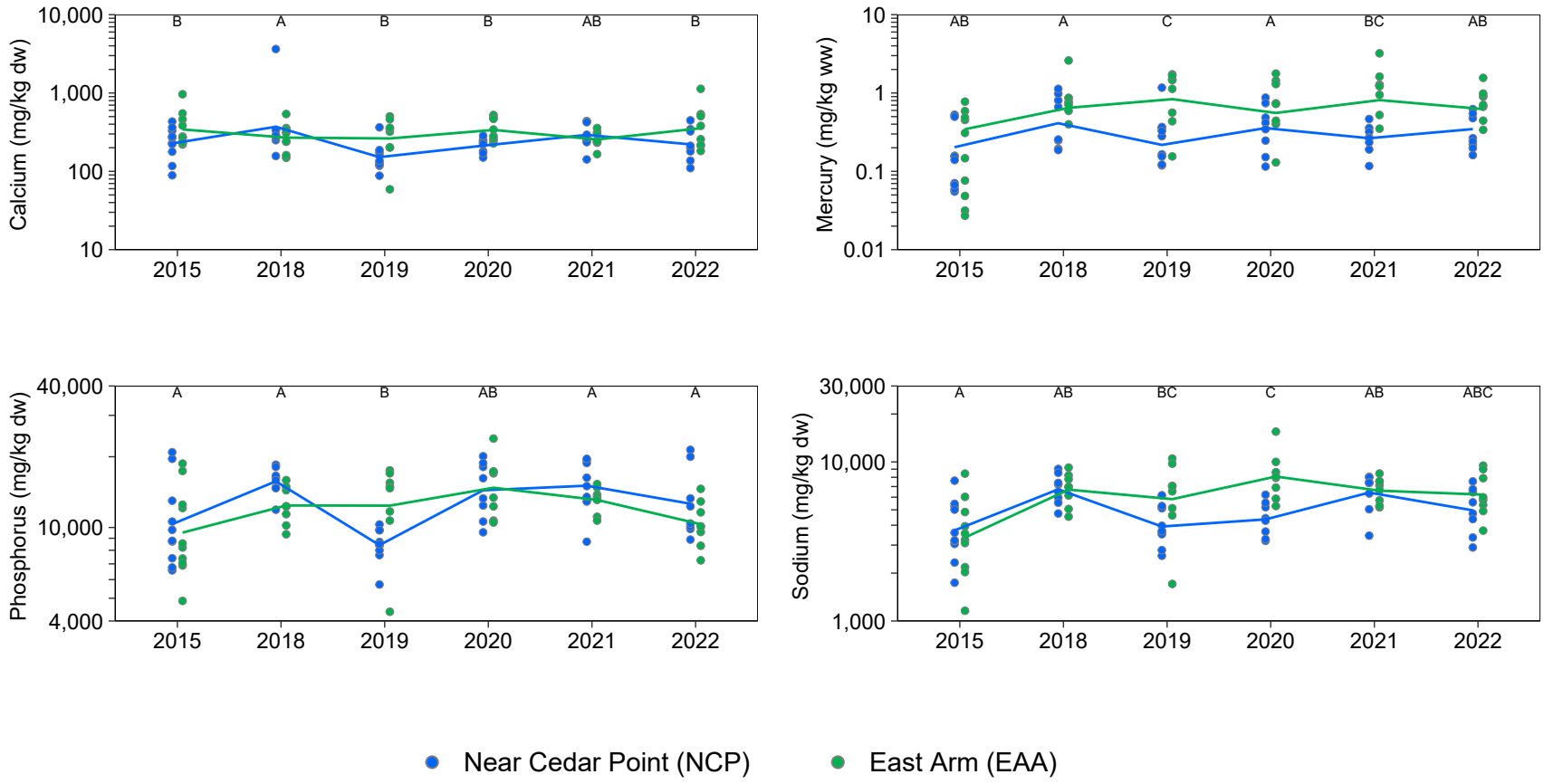

Figure E.6.15: Lake Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

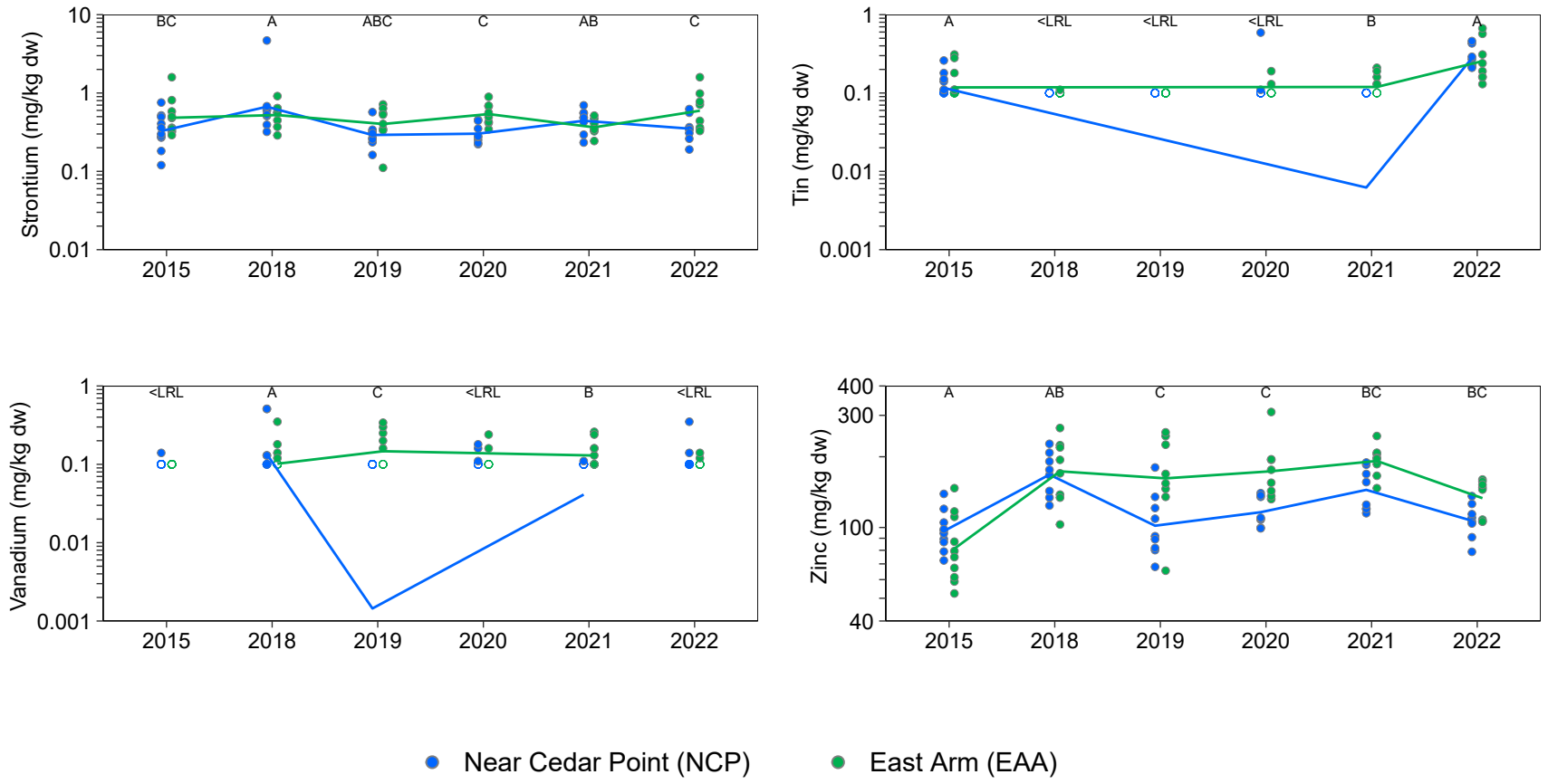

Figure E.6.15: Lake Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

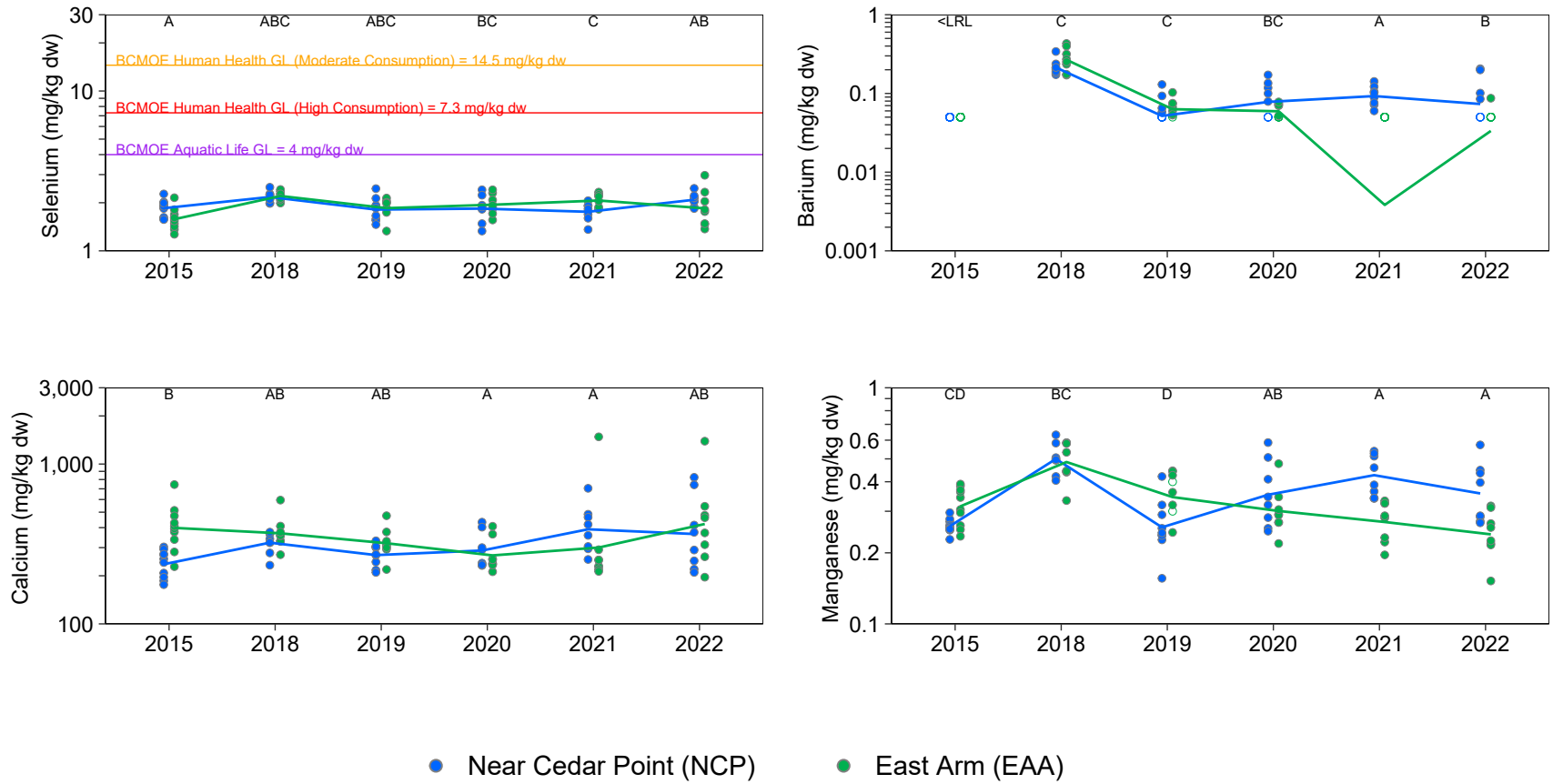

Figure E.6.16: Lake Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

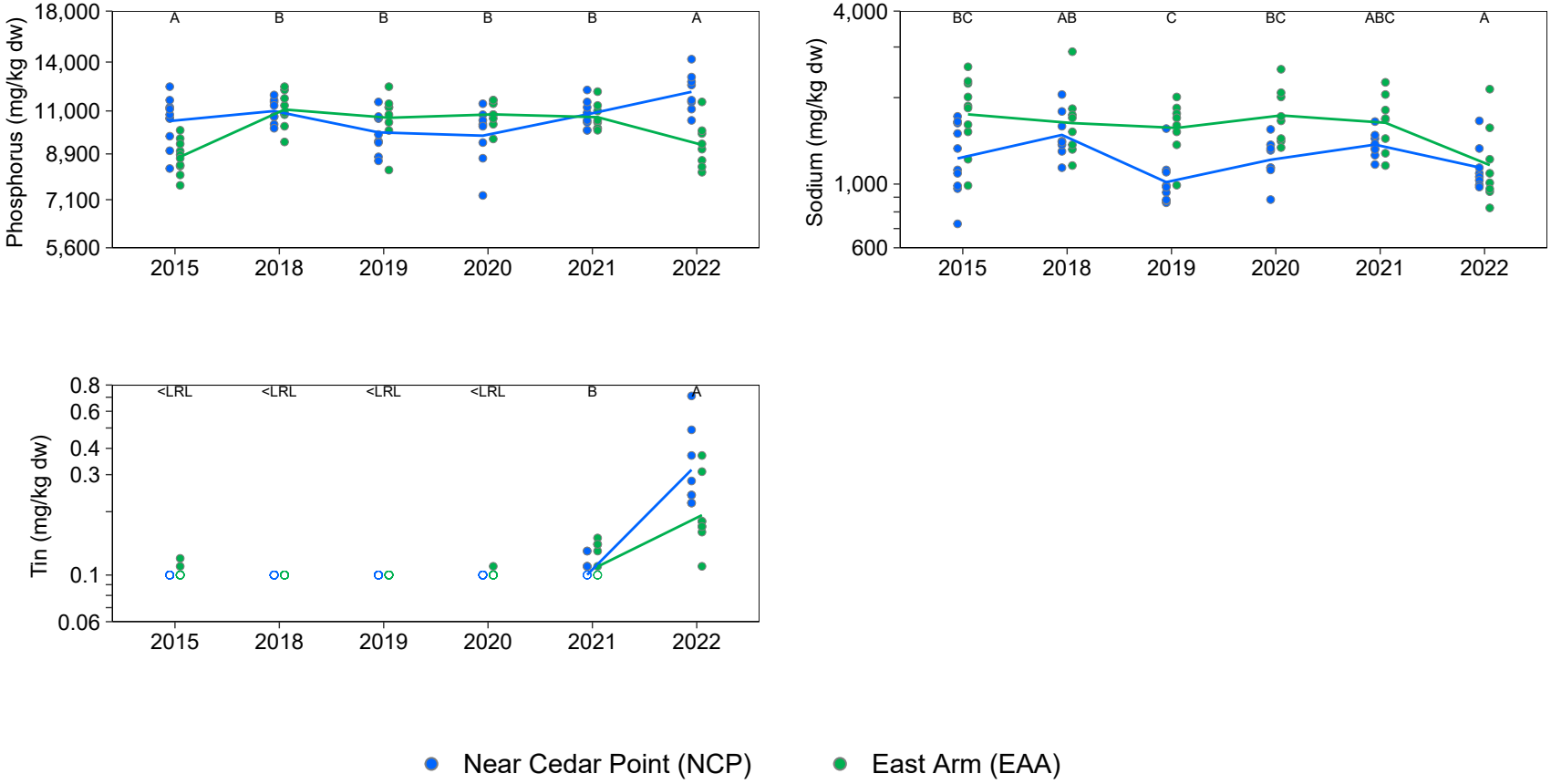

Figure E.6.16: Lake Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

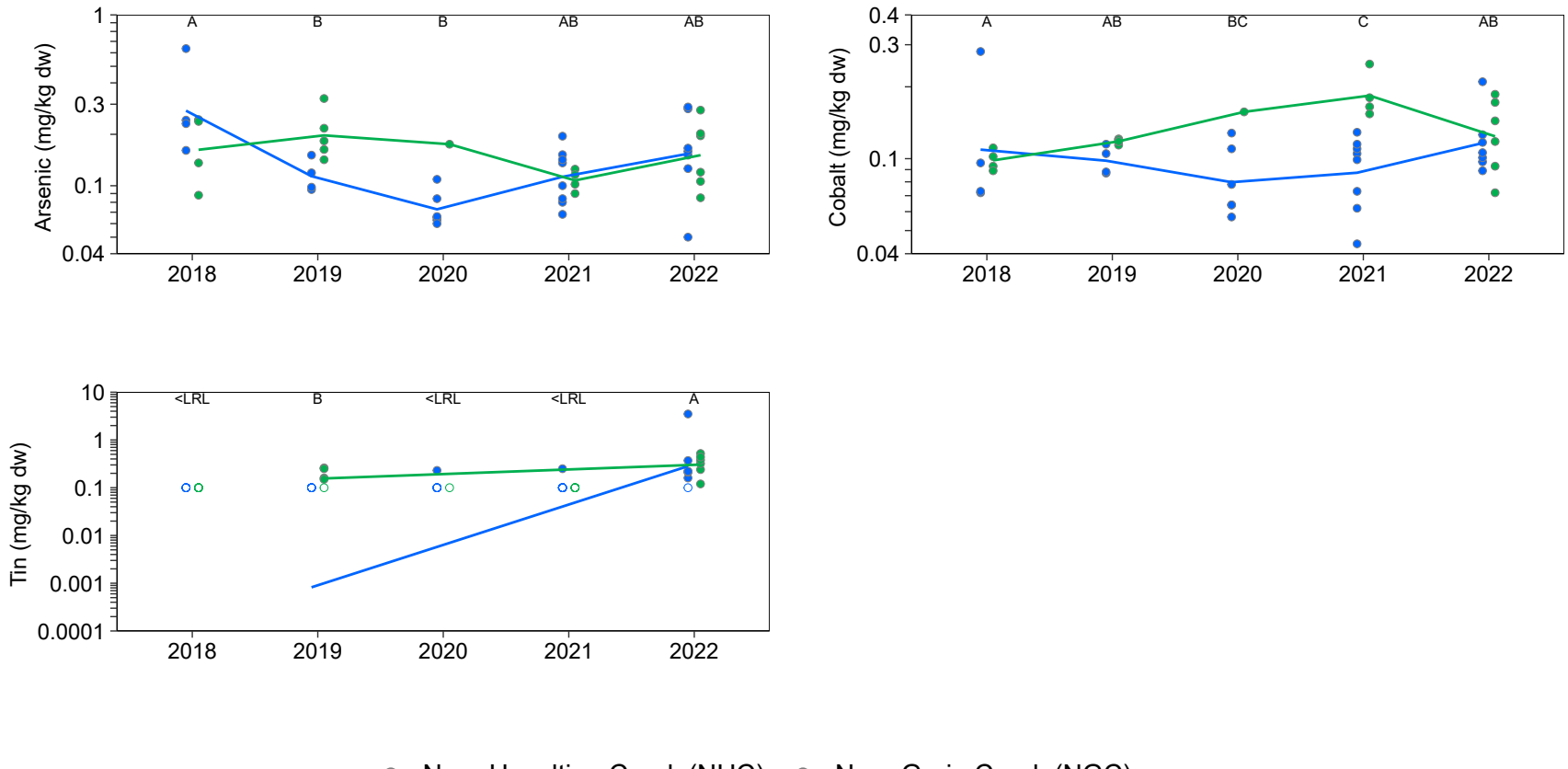

Figure E.6.17: Peamouth Chub Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2018 to 2022

Notes: dw = dry weight; ww = wet weight; <LRL = lower than the laboratory reporting limit. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

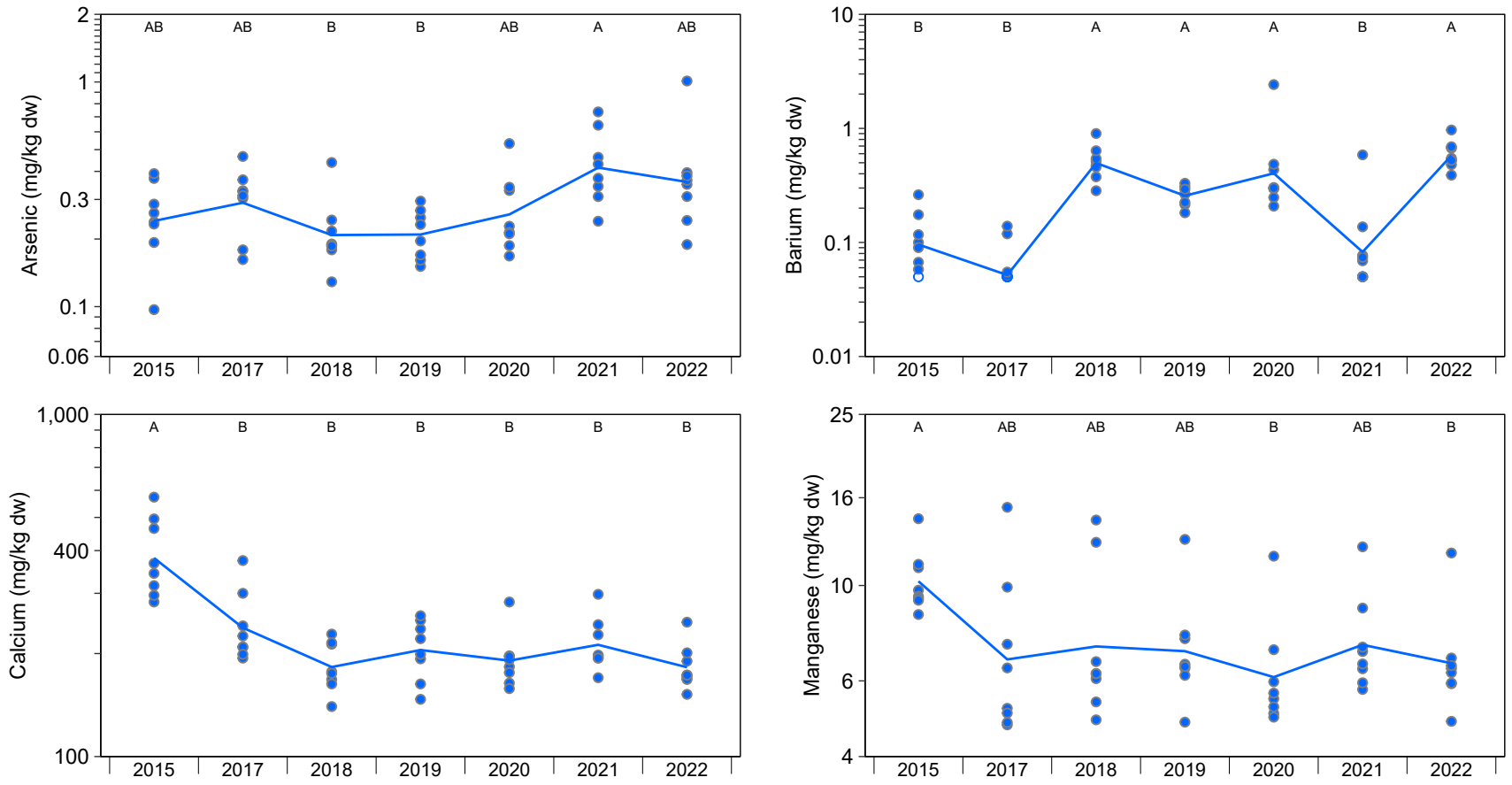

Figure E.6.18: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

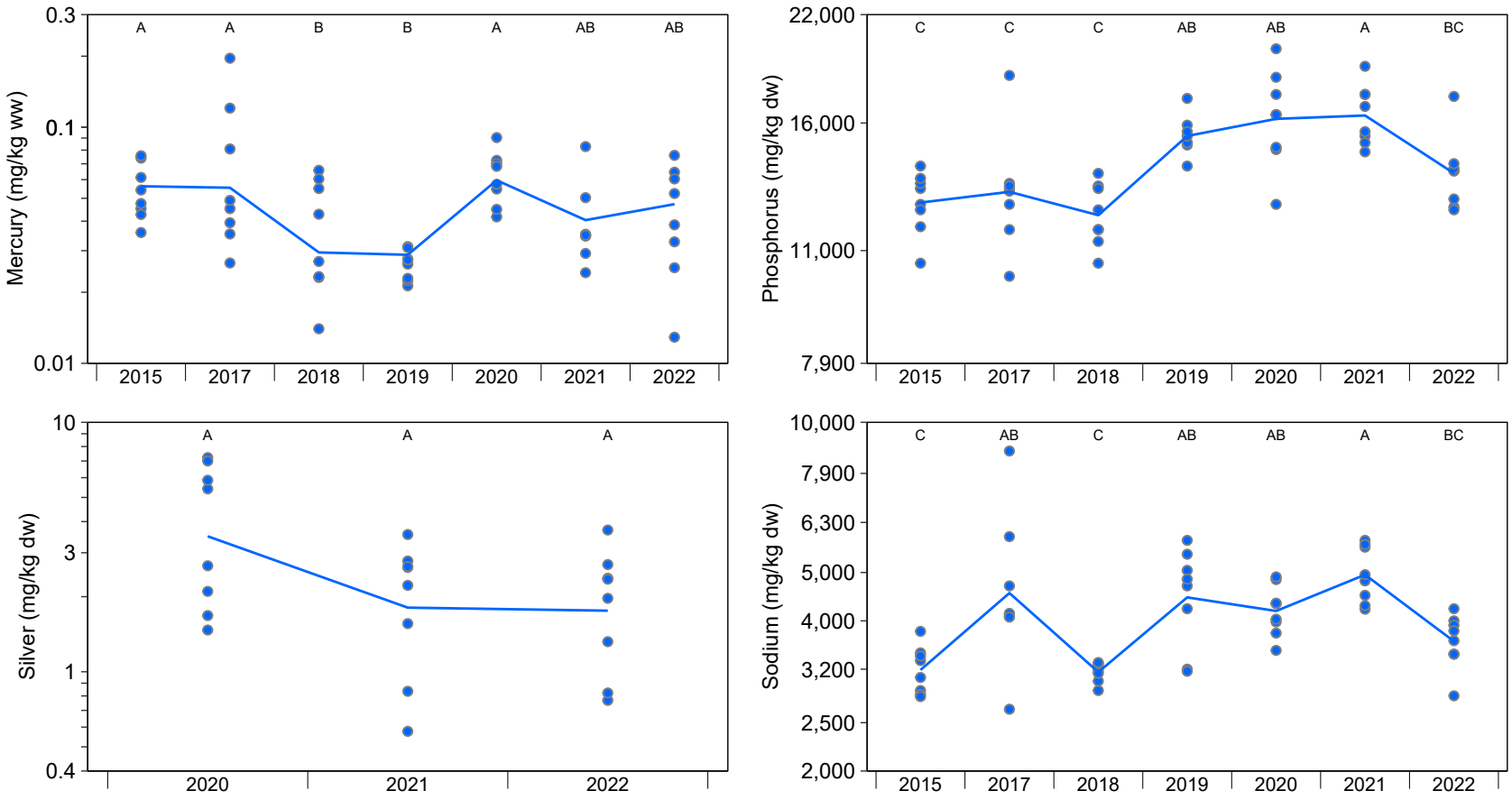

Figure E.6.18: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

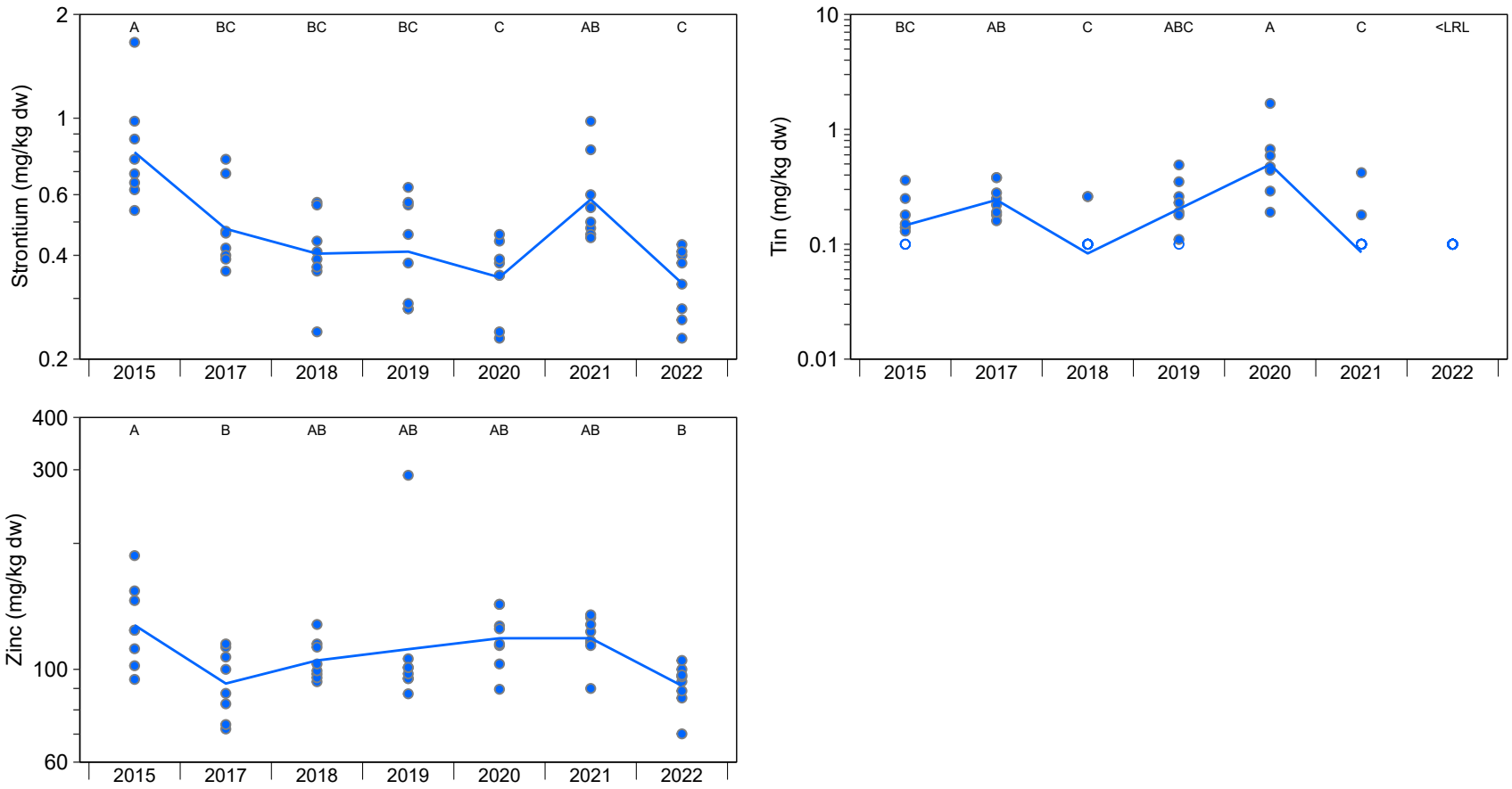

Figure E.6.18: Rainbow Trout Liver Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

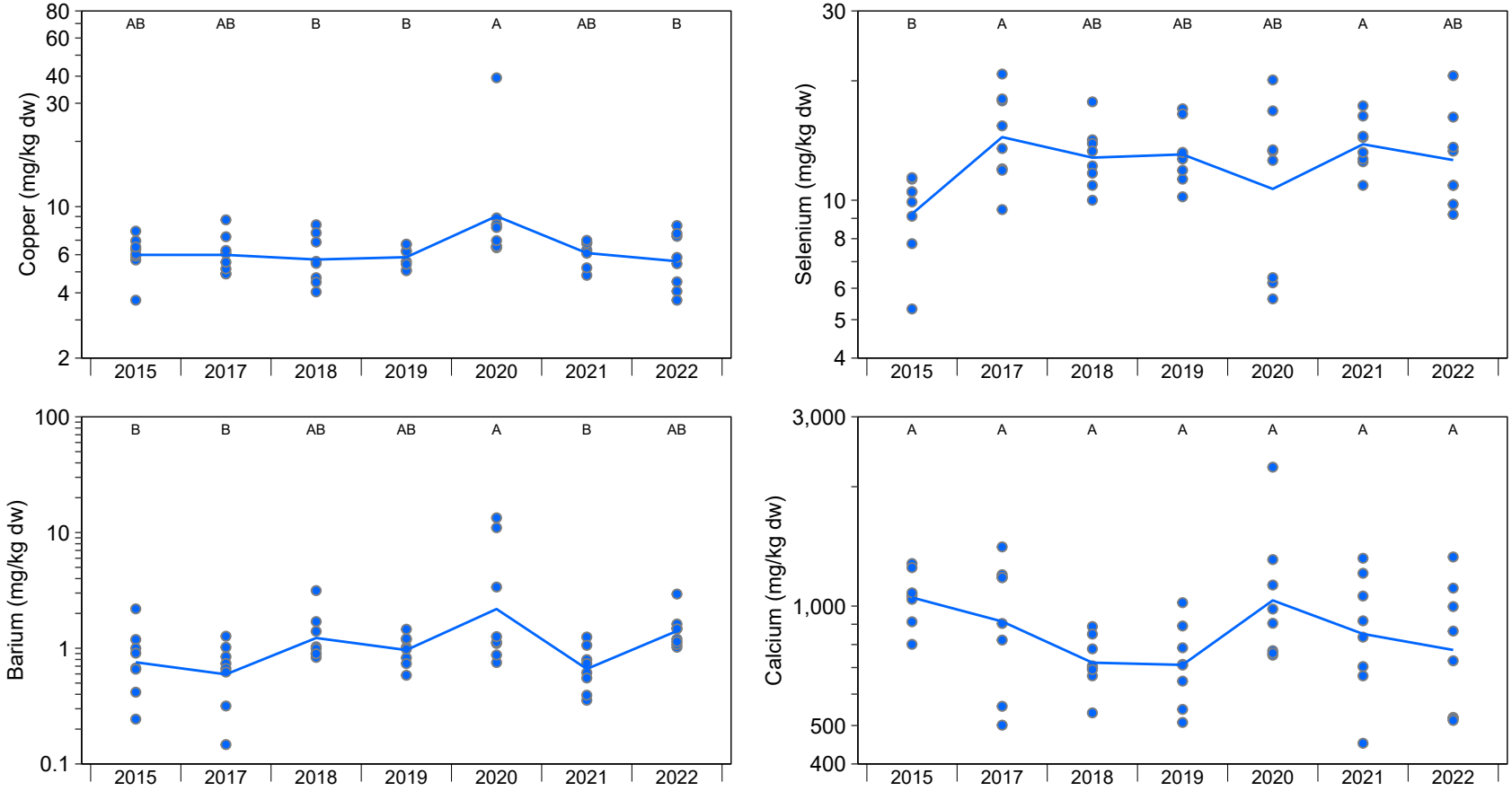

Figure E.6.19: Rainbow Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

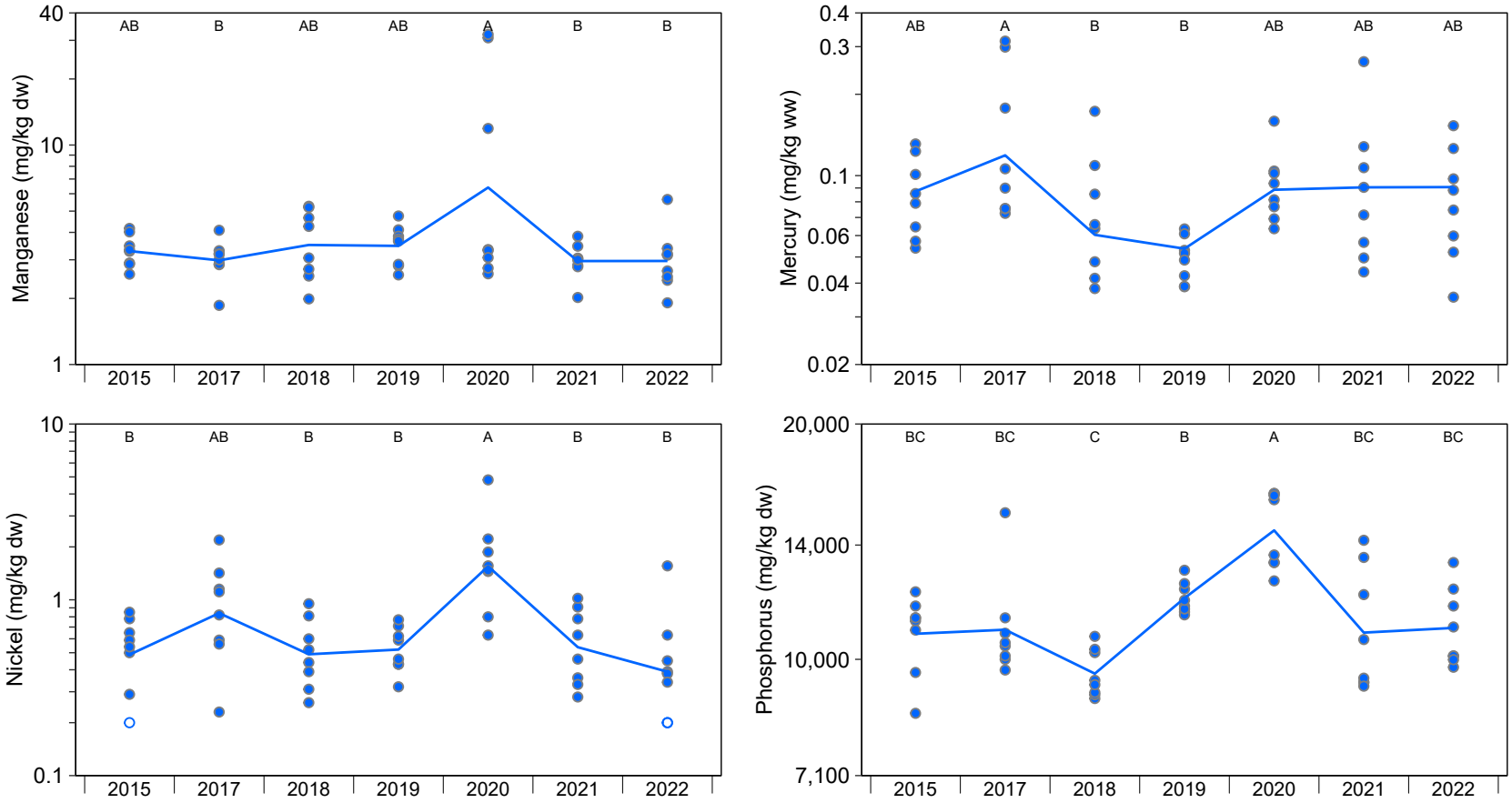

Figure E.6.19: Rainbow Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

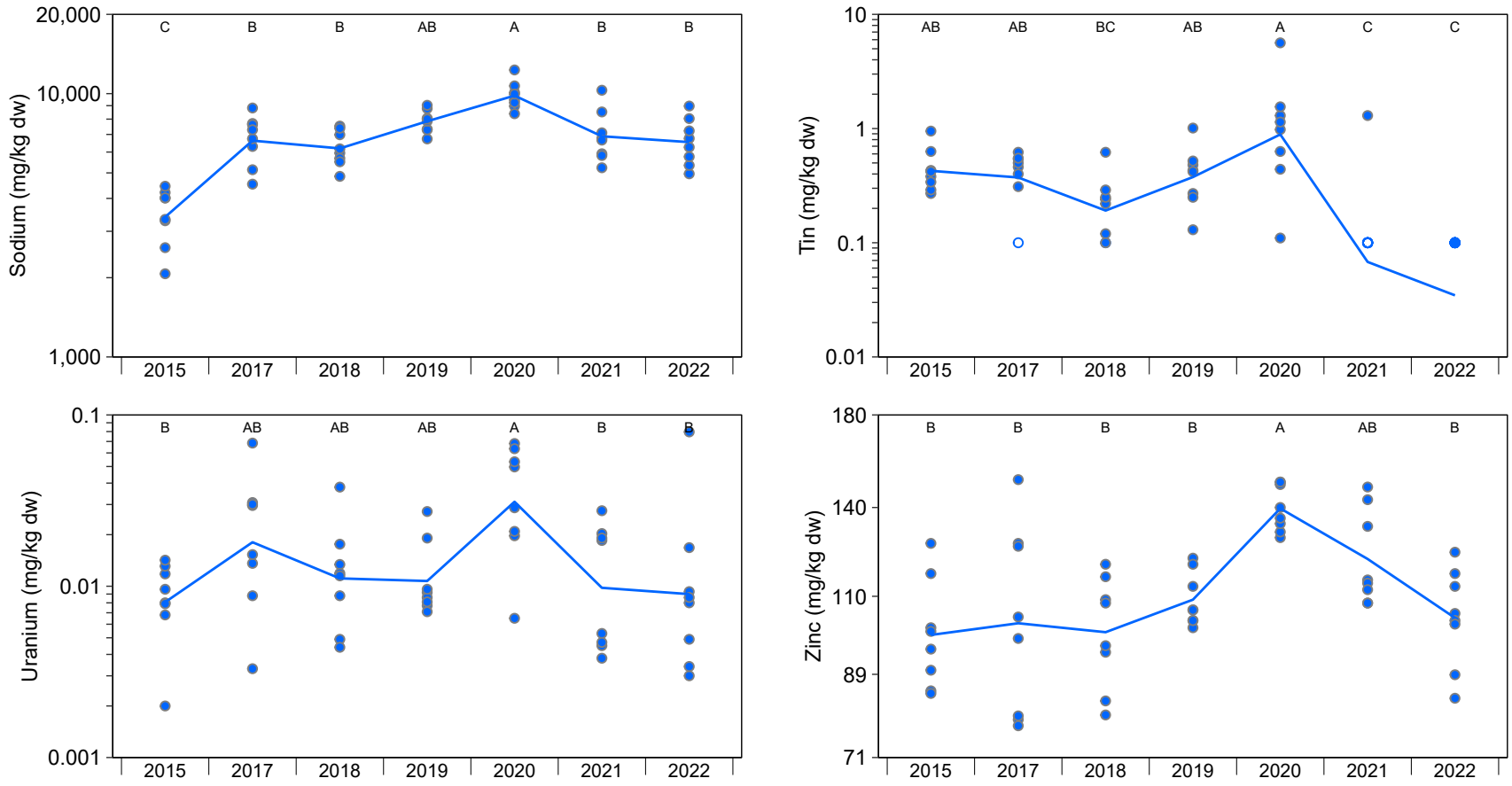

Figure E.6.19: Rainbow Trout Kidney Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

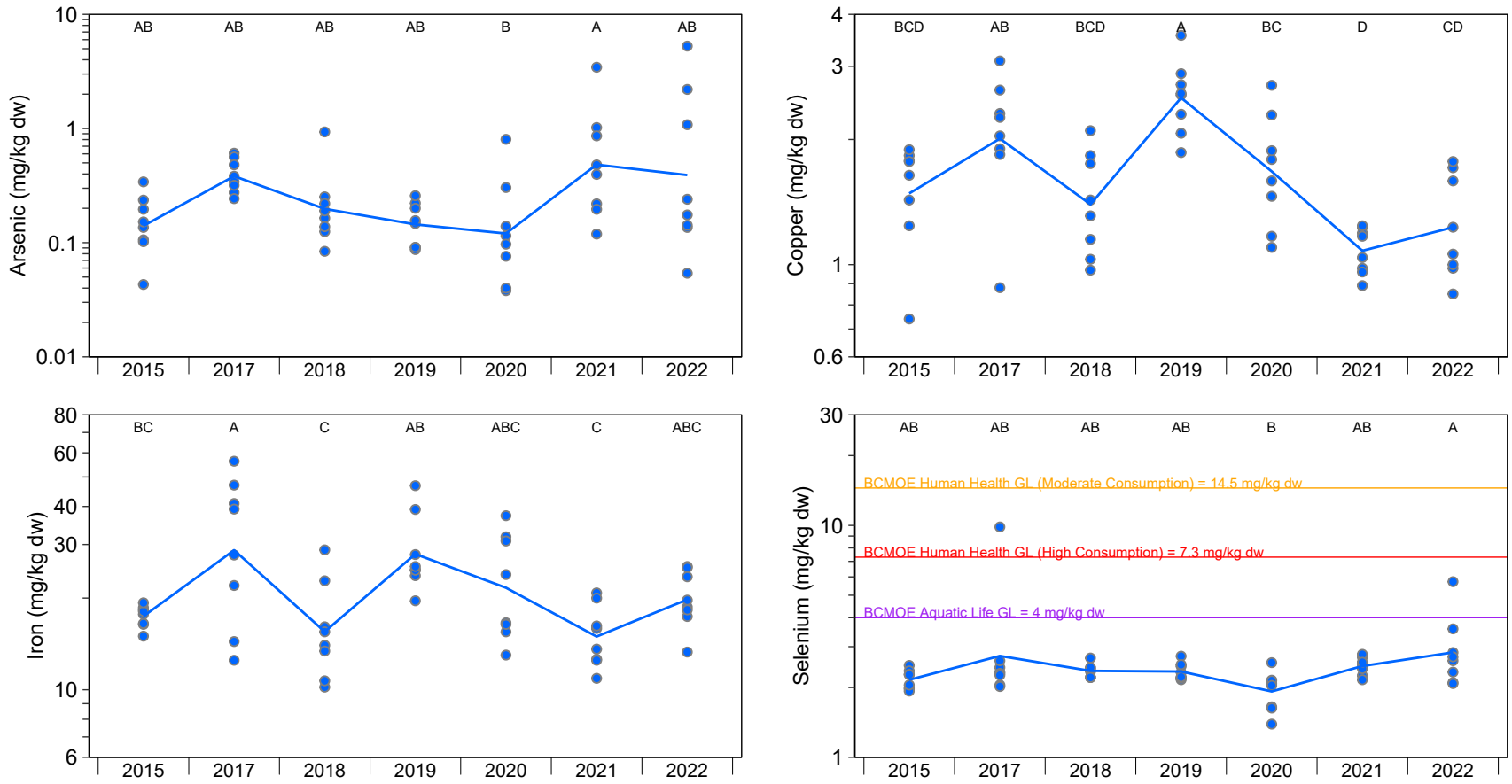

Figure E.6.20: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

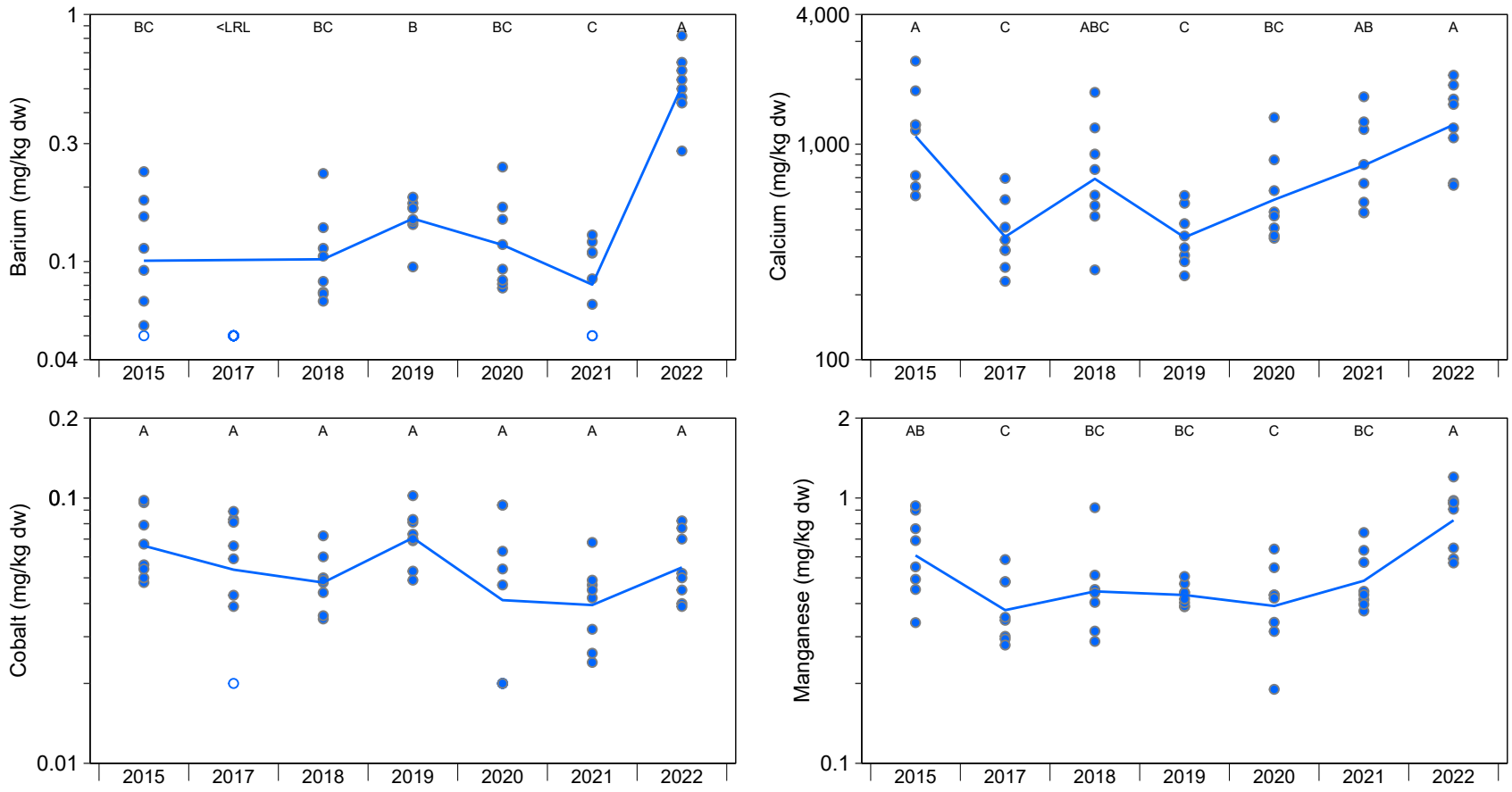

Figure E.6.20: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

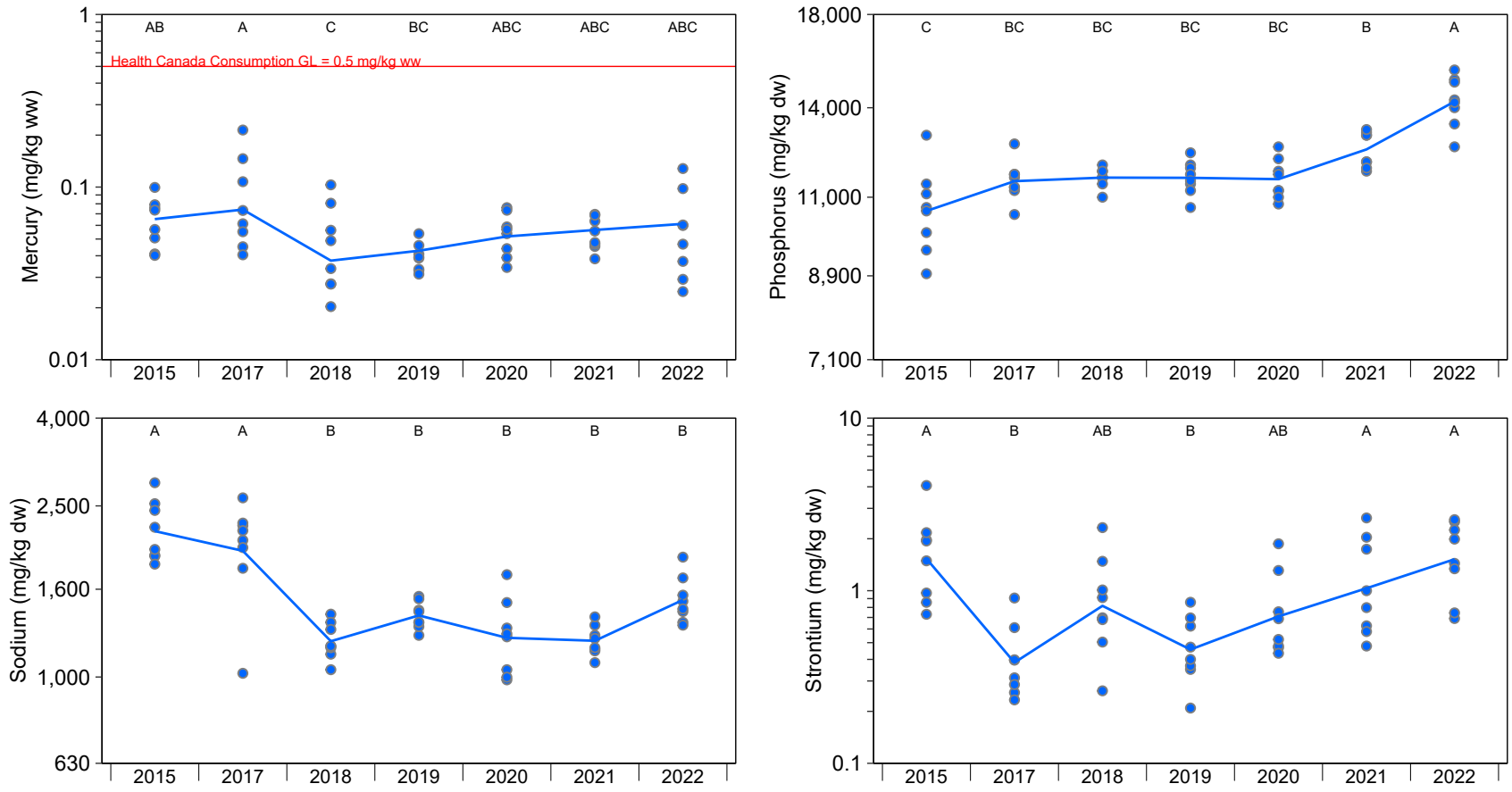

Figure E.6.20: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

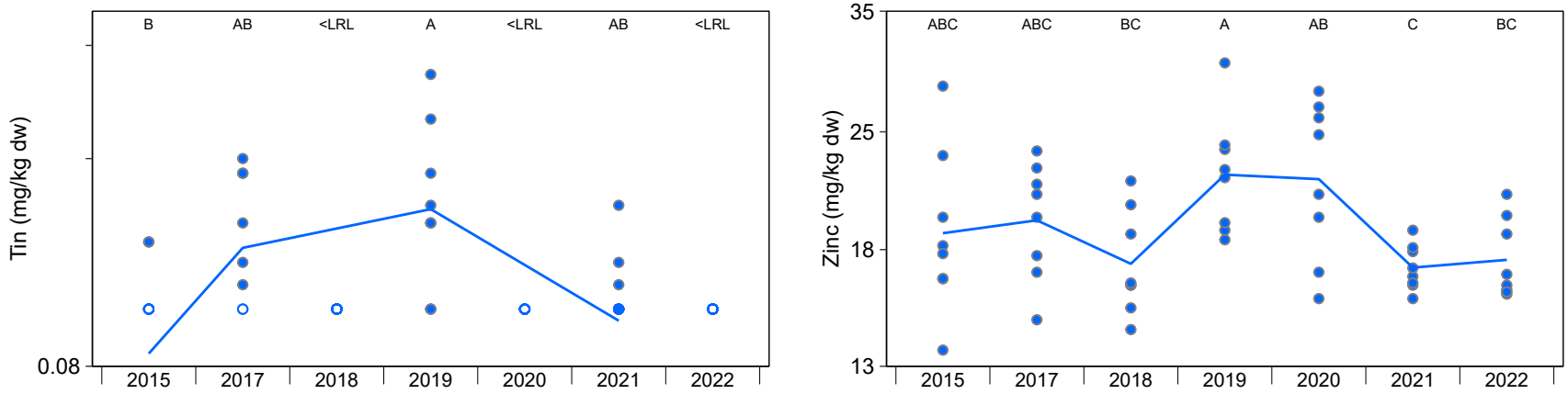

Figure E.6.20: Rainbow Trout Muscle Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

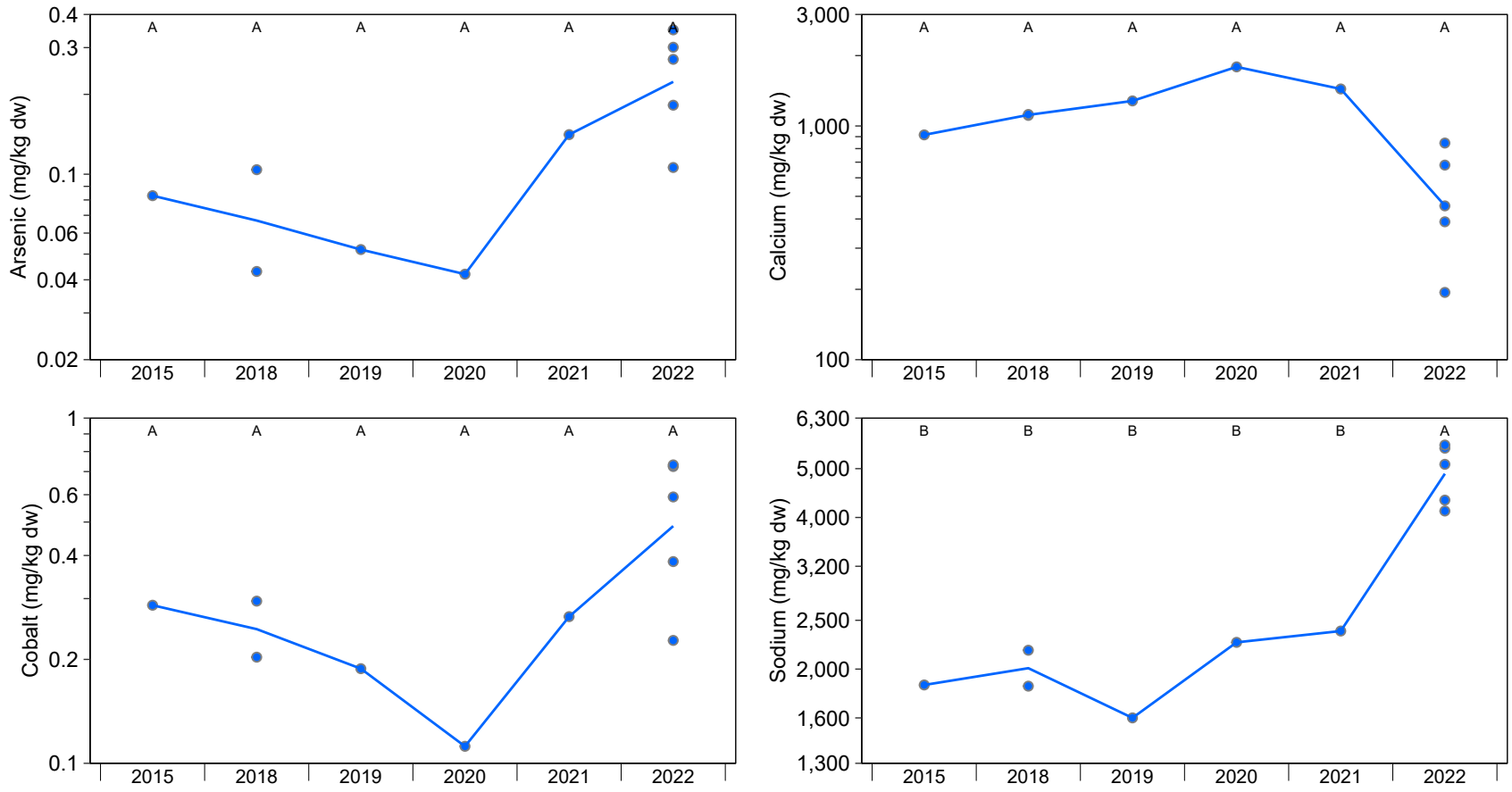

Figure E.6.21: Rainbow Trout Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

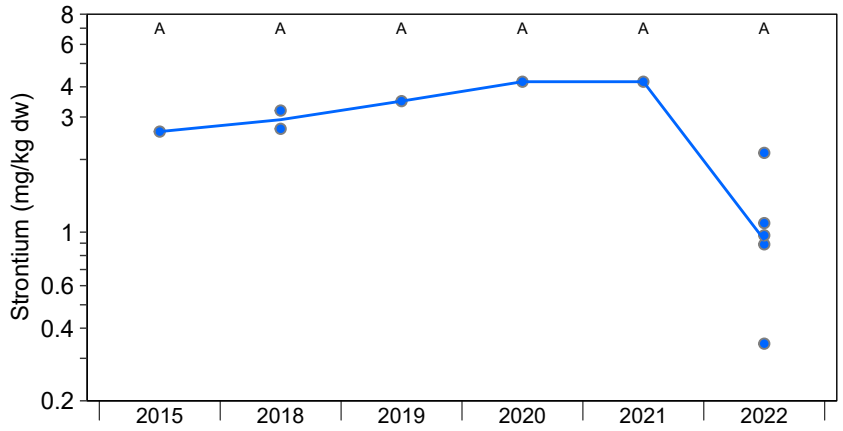

Figure E.6.21: Rainbow Trout Ovary Tissue Primary and Secondary Analyte Concentrations with a Significant Year Effect for Quesnel River, 2015 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a one−way ANOVA with factor Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations.

Table E.6.1: **Statistical Comparisons of Exposed - Reference Relative Differences of Rainbow Trout Muscle Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed ─ Reference) Contrasts Among Periods[a]										Magnitude of Difference in (Exposed ─ Reference) Relative to Baseline Period (%)[b]										Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]									
		Area	Year	Area × Year	Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period							Before Period	Uncontrolled Release Period	Post-Release Period	Post-Breach Period						
					1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2009	2012	2015	2017	2018	2019	2020	2021	2022	1995	2009	2012	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.012	0.013	0.006	-	<LRL	-	<LRL	B	<LRL	A	<LRL	A	<LRL	-	<LRL	-	<LRL	baseline	<LRL	312	<LRL	804	<LRL	-	<LRL	-	<LRL	-86	<LRL	ns	<LRL	ns	<LRL
Antimony	MLE	nt	nt	nt	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	<0.001	0.393	A	A	-	A	A	A	A	A	A	A	baseline	ns	-	ns	ns	ns	ns	ns	ns	ns	66		-	66						
Barium	MLE	0.002	<0.001	<0.001	-	AB	-	B	C	A	B	AB	A	A	-	baseline	-	ns	-79	ns	ns	ns	ns	ns	-	ns	-	-53	-86	ns	-57	ns	ns	ns
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	nt	nt	nt	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Calcium	MLE	0.755	<0.001	0.088	-	A	-	A	A	A	A	A	A	A	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	0.109	<0.001	-	-	-	C	A	A	AB	BC	BC	BC	-	-	-	baseline	79	65	41	ns	ns	ns	-	-	-	ns	78	65	41	ns	ns	ns
Chromium	MLE	0.092	<0.001	0.035	B	<LRL	-	<LRL	B	A	<LRL	AB	A	A	baseline	<LRL	-	<LRL	ns	217	<LRL	ns	180	305	-68	<LRL	-	<LRL	-64	ns	<LRL	ns	ns	ns
Cobalt	MLE	0.123	0.108	<0.001	-	<LRL	-	<LRL	B	A	A	<LRL	A	A	-	<LRL	-	<LRL	baseline	129	115	<LRL	120	159	-	<LRL	-	<LRL	-39	ns	ns	<LRL	ns	57
Copper	MLE	0.307	<0.001	0.437	-	A	-	A	A	A	A	A	A	A	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	ns	ns	ns
Iron	MLE	0.964	<0.001	<0.001	-	-	-	AB	C	A	AB	B	AB	A	-	-	-	baseline	-46	ns	ns	ns	ns	ns	-	-	-	ns	-45	38	ns	ns	ns	44
Lead	MLE	0.055	0.001	<0.001	A	<LRL	-	<LRL	C	<LRL	B	<LRL	<LRL	<LRL	baseline	<LRL	-	<LRL	-94	<LRL	-79	<LRL	<LRL	<LRL	ns	<LRL	-	<LRL	-88	<LRL	ns	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.052	0.100	<0.001	-	BCD	-	CD	A	AB	BCD	D	BC	AB	-	baseline	-	ns	22	ns	ns	ns	ns	ns	-	ns	-	-13	16	ns	-11	-18	ns	ns
Manganese	MLE	<0.001	<0.001	<0.001	-	AB	-	AB	D	BC	BC	CD	AB	A	-	baseline	-	ns	-58	ns	ns	-39	ns	ns	-	ns	-	ns	-63	-24	-33	-46	ns	ns
Mercury (ww)[d]	MLE	0.368	<0.001	<0.001	B	E	-	DE	BCD	CDE	E	BCD	A	BC	baseline	-55	-	-40	ns	-34	-52	ns	99	ns	40	-37	-	ns	ns	ns	-33	ns	178	ns
Molybdenum	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Nickel	MLE	nt	nt	nt	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.382	0.011	0.020	-	-	-	BC	A	AB	ABC	C	AB	AB	-	-	-	baseline	22	ns	ns	ns	ns	ns	-	-	-	-11	ns	ns	ns	-16	ns	ns
Potassium	MLE	0.171	0.005	0.028	-	-	-	BC	AB	AB	BC	C	AB	A	-	-	-	baseline	ns	ns	ns	ns	ns	20	-	-	-	-11	ns	ns	-12	-14	ns	ns
Rubidium	MLE	0.003	0.001	0.170	-	-	-	A	A	A	A	A	A	A	-	-	-	baseline	ns	ns	ns	ns	ns	ns	-	-	-	-12						
Selenium	MLE	<0.001	<0.001	<0.001	D	AB	A	C	AB	AB	AB	BC	BC	C	baseline	268	316	173	271	267	257	224	211	174	-30	157	190	90	159	156	149	125	117	91
Silver	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	0.941	<0.001	0.023	-	-	-	A	A	AB	AB	B	AB	B	-	-	-	baseline	ns	ns	ns	-37	ns	-38	-	-	-	ns	ns	ns	ns	ns	ns	-23
Strontium	MLE	0.165	<0.001	0.179	-	A	-	A	A	A	A	A	A	A	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.043	0.003	-	<LRL	-	C	BC	AB	BC	AB	BC	A	-	<LRL	-	baseline	ns	54	ns	52	ns	115	-	<LRL	-	-72	-61	-57	-68	-58	-67	-40
Tin	MLE	0.931	<0.001	0.246	-	<LRL	-	<LRL	A	A	<LRL	<LRL	A	A	-	<LRL	-	<LRL	baseline	ns	<LRL	<LRL	ns	ns	-	<LRL	-	<LRL	ns	ns	<LRL	<LRL	ns	ns
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.933	<0.001	0.048	-	ABC	-	BC	AB	A	ABC	C	A	ABC	-	baseline	-	ns	ns	ns	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns	-18	ns	ns
Zirconium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.918	<0.001	0.134	A	A	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.103	<0.001	0.006	BC	C	C	A	BC	BC	AB	AB	BC	BC	baseline	ns	ns	17	ns	ns	ns	ns	ns	ns	ns	ns	ns	17	ns	ns	8.0	12	ns	ns
Body Weight[e]	ANOVAlog	0.009	<0.001	0.045	ABCD	D	CD	AB	ABCD	BCD	ABC	A	BCD	ABCD	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	30	ns	ns	27	46	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.49.

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.2: **Statistical Comparisons of Exposed - Reference Relative Differences of Longnose Sucker Muscle Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed ─ Reference) Contrasts Among Periods[a]								Magnitude of Difference in (Exposed ─ Reference) Relative to Baseline Period (%)[b]								Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]							
		Area	Year	Area × Year	Before Period	Post-Release Period	Post-Breach Period						Before Period	Post-Release Period	Post-Breach Period						Before Period	Post-Release Period	Post-Breach Period					
					1995	2012	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022	1995	2012	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.098	0.800	0.264	-	-	A	<LRL	A	A	A	A	-	-	baseline	<LRL	ns	ns	ns	ns	-	-	ns	<LRL	ns	ns	ns	ns
Antimony	MLE	nt	nt	nt	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	0.013	0.010	ABC	-	A	BC	C	BC	AB	BC	baseline	-	ns	ns	ns	ns	ns	ns	70	-	231	ns	ns	ns	81	ns
Barium	MLE	0.400	<0.001	0.300	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	nt	nt	nt	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Calcium	MLE	0.194	<0.001	<0.001	-	-	C	BC	B	A	BC	BC	-	-	baseline	ns	60	167	ns	ns	-	-	ns	ns	ns	106	ns	ns
Cesium	MLE	0.678	0.006	0.238	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.977	0.652	0.183	A	-	<LRL	<LRL	<LRL	<LRL	A	A	baseline	-	<LRL	<LRL	<LRL	<LRL	ns	ns	ns	-	<LRL	<LRL	<LRL	<LRL	ns	ns
Cobalt	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Copper	MLE	0.029	<0.001	0.024	-	-	BC	BC	C	BC	AB	A	-	-	baseline	ns	ns	ns	ns	53	-	-	ns	ns	ns	ns	45	62
Iron	MLE	0.462	<0.001	0.080	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Lead	MLE	nt	nt	nt	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.209	<0.001	0.645	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.488	0.011	0.014	-	-	B	AB	AB	A	A	B	-	-	baseline	ns	ns	82	81	ns	-	-	ns	ns	ns	39	39	ns
Mercury (ww)[d]	MLE	0.031	0.042	0.001	AB	-	AB	A	BC	BC	BC	C	baseline	-	ns	ns	ns	ns	ns	-37	ns	-	ns	29	-24	ns	ns	-39
Molybdenum	MLE	<0.001	0.129	0.733	-	-	A	<LRL	<LRL	A	A	A	-	-	baseline	<LRL	<LRL	ns	ns	ns	-	-	120[e]	<LRL	<LRL	120[e]		
Nickel	MLE	nt	nt	nt	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.804	<0.001	0.262	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.858	<0.001	0.277	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
Rubidium	MLE	<0.001	<0.001	0.695	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	25					
Selenium	MLE	<0.001	<0.001	<0.001	C	A	B	B	B	B	B	B	baseline	440	261	240	230	263	221	229	ns	389	227	208	198	229	190	198
Silver	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	0.976	0.008	0.036	-	-	AB	AB	B	AB	B	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	21
Strontium	MLE	0.348	<0.001	<0.001	-	-	C	B	B	A	BC	BC	-	-	baseline	99	118	366	ns	ns	-	-	-52	ns	ns	125	ns	-43
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.921	0.268	-	-	<LRL	A	A	<LRL	A	<LRL	-	-	<LRL	baseline	ns	<LRL	ns	<LRL	-	-	<LRL	-50[e]		<LRL	-50	<LRL
Tin[e]	MLE	0.754	<0.001	<0.001	-	-	B	C	<LRL	D	A	BC	-	-	baseline	-43	<LRL	-89[e]	2,392[e]	ns	-	-	ns	-47	<LRL	ns	ns	-39
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	<0.001	0.005	0.073	-	-	A	A	A	A	A	A	-	-	baseline	ns	ns	ns	ns	ns	-	-	85					
Zirconium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	0.005	<0.001	0.070	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	-90						
Fork Length[f]	ANOVAlog	<0.001	0.002	0.025	AB	A	A	A	A	A	B	A	baseline	ns	ns	ns	ns	ns	ns	ns	-13	ns	ns	ns	-9.6	ns	-22	ns
Body Weight[f]	ANOVAlog	<0.001	0.001	0.014	A	A	A	A	A	A	B	A	baseline	ns	ns	ns	ns	ns	-41	ns	-30	ns	-26	ns	-33	ns	-59	-30

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.60.

[e] MOD may be inflated because data for one of the groups for two consecutive years in the comparison (2020, Polley Lake; 2021, Bootjack Lake) were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.3: **Statistical Comparisons of Exposed - Reference Relative Differences of Rainbow Trout Ovary Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]								Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]								Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]							
		Area	Year	Area × Year	Post-Release Period	Post-Breach Period							Post-Release Period	Post-Breach Period							Post-Release Period	Post-Breach Period						
					2012	2015	2017	2018	2019	2020	2021	2022	2012	2015	2017	2018	2019	2020	2021	2022	2012	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Antimony	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.034	<0.001	0.068	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	22						
Barium	MLE	<0.001	<0.001	<0.001	-	C	BC	AB	BC	C	BC	A	-	baseline	ns	91	ns	ns	ns	216	-	-70	-64	-44	-61	-74	-65	ns
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Calcium	MLE	0.692	0.124	0.167	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	<0.001	0.172	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	41						
Chromium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cobalt	MLE	<0.001	0.003	0.218	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	29						
Copper	MLE	0.036	0.608	0.527	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	11						
Iron	MLE	0.865	<0.001	0.474	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.419	0.013	0.169	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.043	0.103	0.016	-	A	AB	ABC	BC	C	AB	BC	-	baseline	ns	ns	-46	-66	ns	-47	-	ns	ns	ns	ns	-52	ns	ns
Mercury (ww)[d]	MLE	0.089	<0.001	<0.001	-	B	D	BC	BC	CD	A	B	-	baseline	-81	ns	ns	-65	195	ns	-	ns	-80	ns	ns	-63	210	ns
Molybdenum	MLE	0.401	0.353	<0.001	-	A	A	AB	AB	C	BC	A	-	baseline	ns	ns	ns	-62	-45	ns	-	ns	68	ns	ns	-47	ns	ns
Nickel	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.821	0.131	0.001	-	B	A	AB	BC	C	AB	B	-	baseline	19	ns	ns	-15	ns	ns	-	ns	17	ns	ns	-17	ns	ns
Potassium	MLE	0.619	<0.001	0.052	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.160	<0.001	0.112	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	<0.001	<0.001	<0.001	BCD	A	BC	BC	B	CD	BC	D	baseline	201	ns	ns	ns	ns	ns	ns	121	564	146	133	180	93	121	70
Silver	MLE	<0.001	0.068	0.316	-	-	-	-	-	A	A	A	-	-	-	-	-	baseline	ns	ns	-	-	-	-	-	-65[f]		
Sodium	MLE	0.563	<0.001	0.281	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.118	0.160	0.059	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.269	<0.001	0.541	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Zirconium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.367	<0.001	0.107	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.003	<0.001	0.019	C	A	BC	BC	AB	AB	BC	BC	baseline	22	ns	ns	13	17	ns	ns	ns	17	ns	ns	8.0	12	ns	ns
Body Weight[e]	ANOVAlog	<0.001	<0.001	0.059	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	15							

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted first as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate, but the covariate was not a significant predictor of mercury concentration. Analysis proceeded as a two-way ANOVA on Mercury in units of wet weight (ww).

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

[f] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Table E.6.4: **Statistical Comparisons of Exposed - Reference Relative Differences of Rainbow Trout Liver Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]								Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]								Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]							
		Area	Year	Area × Year	Before Period	Post-Breach Period							Before Period	Post-Breach Period							Before Period	Post-Breach Period						
					1995	2015	2017	2018	2019	2020	2021	2022	1995	2015	2017	2018	2019	2020	2021	2022	1995	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.991	0.016	0.026	-	<LRL	B	<LRL	A	<LRL	A	A	-	<LRL	baseline	<LRL	181	<LRL	151	221	-	<LRL	-57	<LRL	ns	<LRL	ns	ns
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	<0.001	0.003	A	AB	C	ABC	BC	C	A	AB	baseline	ns	-52	ns	-48	-53	ns	ns	116	70	ns	39	ns	ns	99	77
Barium	MLE	0.180	<0.001	<0.001	-	B	C	AB	AB	AB	B	A	-	baseline	-59	ns	ns	ns	ns	122	-	ns	-72	ns	ns	ns	ns	ns
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.043	<0.001	0.128	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.702	0.001	0.509	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	<0.001	0.169	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	48						
Chromium	MLE	0.204	<0.001	0.018	B	<LRL	<LRL	<LRL	AB	<LRL	A	A	baseline	<LRL	<LRL	<LRL	ns	<LRL	342	342	-71	<LRL	<LRL	<LRL	ns	<LRL	ns	ns
Cobalt	MLE	<0.001	<0.001	0.068	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	30						
Copper	MLE	0.035	0.028	0.148	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	45						
Iron	MLE	<0.001	0.012	0.234	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	42						
Lead	MLE	0.315	<0.001	0.014	A	<LRL	B	<LRL	A	<LRL	<LRL	<LRL	baseline	<LRL	-99[f]	<LRL	ns	<LRL	<LRL	<LRL	ns	<LRL	ns	<LRL	ns	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.116	<0.001	<0.001	-	DE	E	BCD	CDE	AB	A	BC	-	baseline	ns	ns	ns	24	45	20	-	-16	-20	ns	-13	ns	23	ns
Manganese	MLE	0.004	0.217	<0.001	-	B	C	BC	B	BC	AB	A	-	baseline	-28	ns	ns	ns	ns	61	-	ns	-39	ns	ns	-25	ns	36
Mercury (ww)[d]	MLE	0.547	<0.001	<0.001	AB	C	CD	BC	D	C	A	B	baseline	-53	-56	ns	-75	-55	ns	ns	ns	ns	-32	ns	-61	ns	160	ns
Molybdenum	MLE	<0.001	0.010	0.002	-	A	C	AB	AB	BC	BC	BC	-	baseline	-57	ns	ns	-50	-41	-44	-	132	ns	58	59	ns	36	ns
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.099	<0.001	<0.001	-	BC	C	B	B	B	A	B	-	baseline	ns	ns	ns	ns	27	ns	-	-8.9	-19	ns	ns	ns	16	ns
Potassium	MLE	0.481	<0.001	0.004	-	BC	C	BC	BC	AB	A	BC	-	baseline	ns	ns	ns	ns	25	ns	-	ns	-11	ns	ns	ns	19	ns
Rubidium	MLE	0.050	<0.001	0.001	-	C	BC	AB	AB	A	A	A	-	baseline	ns	38	38	64	80	59	-	-35	-23	ns	ns	ns	ns	ns
Selenium	MLE	<0.001	<0.001	<0.001	C	A	B	AB	A	AB	AB	B	baseline	672	148	314	690	394	306	186	ns	422	67	180	434	234	174	93
Silver	MLE	<0.001	0.649	0.442	-	-	-	-	-	A	A	A	-	-	-	-	-	baseline	ns	ns	-	-	-	-	-	-68		
Sodium	MLE	0.040	<0.001	<0.001	-	A	A	B	B	B	B	B	-	baseline	ns	-35	-34	-41	-48	-55	-	71	74	ns	ns	ns	ns	ns
Strontium	MLE	0.085	<0.001	0.013	-	BC	AB	A	BC	C	BC	BC	-	baseline	ns	81	ns	ns	ns	ns	-	ns	ns	44	ns	-33	ns	ns
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	<0.001	<0.001	-	BC	C	A	AB	A	A	A	-	baseline	ns	83	ns	92	124	85	-	-77	-84	-59	-68	-57	-49	-58
Tin	MLE	0.846	<0.001	0.082	-	<LRL	A	A	A	A	A	A	-	<LRL	baseline	ns	ns	ns	ns	ns	-	<LRL	ns	ns	ns	ns	ns	ns
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	0.892	<0.001	0.719	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	<0.001	0.048	0.206	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	164						
Zinc	MLE	0.045	<0.001	0.078	-	A	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	11						
Zirconium	MLE	0.001	0.345	0.077	-	<LRL	<LRL	<LRL	<LRL	<LRL	A	A	-	<LRL	<LRL	<LRL	<LRL	<LRL	baseline	ns	-	<LRL	<LRL	<LRL	<LRL	<LRL	75	
Age[e]	ANOVA	0.782	<0.001	0.094	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.018	<0.001	0.090	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	6.2							
Body Weight[e]	ANOVAlog	<0.001	<0.001	0.212	A	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	18							

Area x Year or Area P-value < 0.05
Contrast is significant (α = 0.05) and magnitude of difference is positive
Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted first as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate, but the covariate was not a significant predictor of mercury concentration. Analysis proceeded as a two-way ANOVA on Mercury in units of wet weight (ww).

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

[f] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

Table E.6.5: Statistical Comparisons of Exposed - Reference Relative Differences of Longnose Sucker Ovary Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 2012 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]							Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]							Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]						
		Area	Year	Area × Year	Post-Release Period	Post-Breach Period						Post-Release Period	Post-Breach Period						Post-Release Period	Post-Breach Period					
					2012	2017	2018	2019	2020	2021	2022	2012	2017	2018	2019	2020	2021	2022	2012	2017	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	0.162	0.524	-	A	<LRL	A	<LRL	<LRL	<LRL	-	baseline	<LRL	ns	<LRL	<LRL	<LRL	-	-64[d]	<LRL	-64	<LRL	<LRL	<LRL
Antimony	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.144	<0.001	0.008	-	A	AB	B	B	B	B	-	baseline	ns	-63	-57	-51	-50	-	113	ns	ns	ns	ns	ns
Barium	MLE	<0.001	0.482	<0.001	-	D	AB	BC	A	C	C	-	baseline	153	76	177	51	72	-	-66	ns	-39	ns	-48	-41
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Calcium	MLE	<0.001	<0.001	0.217	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-21	-21	-21	-21	-21	-21
Cesium	MLE	<0.001	0.394	0.129	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-23	-23	-23	-23	-23	-23
Chromium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cobalt	MLE	0.006	0.386	0.062	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	17	17	17	17	17	17
Copper	MLE	0.638	0.044	0.343	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Iron	MLE	<0.001	0.691	0.247	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-24	-24	-24	-24	-24	-24
Lead	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	<0.001	0.001	0.848	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-11	-11	-11	-11	-11	-11
Manganese	MLE	0.070	0.233	0.263	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Mercury (ww)[e]	MLE	<0.001	0.007	<0.001	-	AB	A	C	BC	BC	C	-	baseline	ns	-29	ns	ns	-37	-	ns	ns	-39	-35	-35	-46
Molybdenum	MLE	<0.001	0.015	0.001	-	AB	AB	C	A	AB	B	-	baseline	ns	-26	ns	ns	ns	-	36	50	ns	64	34	27
Nickel	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	<0.001	<0.001	0.024	-	C	AB	AB	A	ABC	BC	-	baseline	8.4	8.0	14	ns	ns	-	ns	6.3	5.9	12	5.7	ns
Potassium	MLE	<0.001	<0.001	0.100	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-10	-10	-10	-10	-10	-10
Rubidium	MLE	<0.001	0.012	0.961	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	16	16	16	16	16	16
Selenium	MLE	<0.001	<0.001	<0.001	A	B	B	B	BC	CD	D	baseline	-19	-16	-17	-24	-31	-37	197	140	148	146	126	103	88
Silver	MLE	<0.001	0.818	>0.999	-	-	-	-	<LRL	A	A	-	-	-	-	<LRL	baseline	ns	-	-	-	-	<LRL	ns	ns
Sodium	MLE	<0.001	0.006	<0.001	-	A	A	B	A	A	A	-	baseline	ns	-27	ns	ns	ns	-	ns	ns	-33	ns	ns	ns
Strontium	MLE	<0.001	0.039	0.186	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-32	-32	-32	-32	-32	-32
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	<0.001	0.009	0.463	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	9.4	9.4	9.4	9.4	9.4	9.4
Zirconium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	0.005	<0.001	0.070	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	-90	-90	-90	-90	-90	-90	-90
Fork Length[f]	ANOVAlog	<0.001	0.009	0.024	A	A	A	A	A	B	A	baseline	ns	ns	ns	ns	-16	ns	ns	ns	ns	-9.6	ns	-22	ns
Body Weight[f]	ANOVAlog	<0.001	0.003	0.011	A	A	A	A	A	B	A	baseline	ns	ns	ns	ns	-53	ns	ns	-26	ns	-33	ns	-59	-30

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake). <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[e] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.60.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.6: Statistical Comparisons of Exposed - Reference Relative Differences of Longnose Sucker Liver Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 1995 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]							Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]							Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]						
		Area	Year	Area × Year	Before Period	Post-Breach Period						Before Period	Post-Breach Period						Before Period	Post-Breach Period					
					1995	2017	2018	2019	2020	2021	2022	1995	2017	2018	2019	2020	2021	2022	1995	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.762	0.298	0.147	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Antimony	MLE	0.058	0.011	0.014	<LRL	B	A	B	AB	B	A	<LRL	baseline	155	ns	ns	ns	ns	148	<LRL	-44	ns	-42	ns	-37	ns
Arsenic	MLE	<0.001	<0.001	0.002	AB	A	A	B	AB	B	A	baseline	ns	ns	ns	ns	ns	ns	57	119	91	ns	50	ns	88
Barium	MLE	0.519	<0.001	0.235	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Beryllium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	<0.001	0.008	<0.001	A	B	B	B	B	B	A	baseline	-78	-76	-81	-77	-86	ns	89	-59	-55	-65	-56	-73	ns
Calcium	MLE	0.020	0.001	0.013	-	A	A	AB	BC	ABC	C	-	baseline	ns	ns	-32	ns	-42	-	ns	ns	ns	-28	ns	-38
Cesium	MLE	0.455	0.555	0.170	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.914	<0.001	0.029	B	<LRL	<LRL	A	AB	A	A	baseline	<LRL	<LRL	241	ns	237	305	-58	<LRL	<LRL	ns	ns	ns	ns
Cobalt	MLE	0.007	<0.001	0.049	-	AB	AB	B	B	B	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	-26	-22	-24	ns
Copper	MLE	<0.001	0.002	0.016	-	B	B	B	B	AB	A	-	baseline	ns	ns	ns	ns	104	-	ns	ns	ns	ns	69	204
Iron	MLE	0.045	0.021	0.181	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-19					
Lead	MLE	0.345	<0.001	0.012	A	BC	AB	C	<LRL	<LRL	<LRL	baseline	-67	ns	-74	<LRL	<LRL	<LRL	135	ns	ns	ns	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.205	<0.001	0.214	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.426	0.072	0.264	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Mercury (ww)[d]	MLE	<0.001	<0.001	<0.001	A	AB	AB	C	C	BC	BC	baseline	ns	ns	-50	-47	-33	-33	ns	ns	ns	-48	-45	-31	-31
Molybdenum	MLE	<0.001	<0.001	<0.001	-	BCD	AB	CD	ABC	D	A	-	baseline	ns	ns	ns	ns	30	-	ns	27	ns	21	ns	50
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.680	<0.001	0.019	-	A	AB	AB	A	B	A	-	baseline	ns	ns	ns	-18	ns	-	ns	ns	ns	ns	-12	ns
Potassium	MLE	0.161	<0.001	0.087	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Rubidium	MLE	<0.001	<0.001	0.849	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	25					
Selenium	MLE	<0.001	<0.001	<0.001	D	A	AB	AB	AB	C	B	baseline	102	87	75	69	23	62	17	135	118	104	97	43	88
Silver	MLE	0.030	0.871	0.078	-	-	-	-	A	A	A	-	-	-	-	baseline	ns	ns	-	-	-	-	-36		
Sodium	MLE	0.018	<0.001	<0.001	-	A	B	B	C	BC	C	-	baseline	-34	-31	-51	-41	-54	-	36	ns	ns	-34	-20	-38
Strontium	MLE	0.075	0.002	0.001	-	AB	A	AB	AB	BC	C	-	baseline	ns	ns	ns	ns	-64	-	ns	ns	ns	ns	-38	-60
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.194	0.662	-	A	A	A	<LRL	A	<LRL	-	baseline	ns	ns	<LRL	ns	<LRL	-	-64			<LRL	-64	<LRL
Tin	MLE	0.004	<0.001	0.068	-	A	A	<LRL	<LRL	<LRL	A	-	baseline	ns	<LRL	<LRL	<LRL	ns	-	76		<LRL	<LRL	<LRL	76
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	<0.001	0.706	0.125	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	-	-65					
Vanadium	MLE	0.003	0.197	0.041	-	BC	A	AB	ABC	C	AB	-	baseline	139	ns	ns	ns	ns	-	ns	154	76	ns	ns	79
Zinc	MLE	0.003	0.016	<0.001	-	AB	C	C	BC	C	A	-	baseline	-23	-20	ns	-22	ns	-	27	ns	ns	ns	ns	53
Zirconium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.012	0.044	0.056	-	A	A	A	A	A	A	-	baseline	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	<0.001	0.080	0.017	AB	A	A	A	A	B	A	baseline	ns	ns	ns	ns	ns	ns	-13	ns	ns	-9.6	ns	-22	ns
Body Weight[e]	ANOVAlog	<0.001	0.008	0.019	A	A	A	A	A	B	A	baseline	ns	ns	ns	ns	-41	ns	-30	-26	ns	-33	ns	-59	-30

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.60.

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.7: Statistical Comparisons of Exposed - Reference Relative Differences of Longnose Sucker Kidney Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.773	<0.001	0.105	<LRL	A	A	A	<LRL	<LRL	baseline	ns	ns	<LRL	<LRL	ns	ns	ns	<LRL
Antimony	MLE	0.038	0.004	0.015	A	B	<LRL	B	<LRL	baseline	-97[f]	<LRL	-97[f]	<LRL	ns	ns	<LRL	ns	<LRL
Arsenic	MLE	<0.001	0.005	0.300	A	A	A	A	A	baseline	ns	ns	ns	ns	36				
Barium	MLE	<0.001	<0.001	0.292	A	A	A	A	A	baseline	ns	ns	ns	ns	-37				
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL		<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.004	0.031	0.462	A	A	A	A	A	baseline	ns	ns	ns	ns	-32				
Calcium	MLE	<0.001	0.735	0.290	A	A	A	A	A	baseline	ns	ns	ns	ns	-50				
Cesium	MLE	0.005	0.844	0.987	A	A	A	A	A	baseline	ns	ns	ns	ns	-21				
Chromium	MLE	0.004	<0.001	0.021	<LRL	B	B	AB	A	<LRL	baseline	ns	ns	366	<LRL	ns	ns	152	417
Cobalt	MLE	0.358	0.736	0.069	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.070	0.004	0.339	A	A	A	A	A	baseline	ns	ns	ns	ns	8.0				
Iron	MLE	0.676	0.005	0.041	B	B	AB	AB	A	baseline	ns	ns	ns	91	ns	ns	ns	ns	53
Lead	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.260	<0.001	0.637	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	<0.001	0.846	0.062	A	A	A	A	A	baseline	ns	ns	ns	ns	-57				
Mercury (dw)	MLE	<0.001	<0.001	0.023	A	AB	AB	B	AB	baseline	ns	ns	-70	ns	ns	-55	-52	-74	-51
Mercury (ww)[d]	MLE	0.038	<0.001	0.038	A	AB	B	AB	B	baseline	ns	-45	ns	-49	ns	ns	-37	ns	-40
Molybdenum	MLE	<0.001	0.221	0.896	A	A	A	A	A	baseline	ns	ns	ns	ns	76				
Nickel	MLE	<0.001	0.445	0.006	B	B	B	AB	A	baseline	ns	ns	ns	92	-37	-62	-45	ns	ns
Phosphorus	MLE	0.293	<0.001	0.676	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.466	0.001	0.147	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	<0.001	0.138	0.097	A	A	A	A	A	baseline	ns	ns	ns	ns	27				
Selenium	MLE	<0.001	0.166	0.014	A	A	A	B	A	baseline	ns	ns	-23	ns	74	83	66	33	82
Silver	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	<0.001	<0.001	0.398	A	A	A	A	A	baseline	ns	ns	ns	ns	-25				
Strontium	MLE	<0.001	0.474	0.124	A	A	A	A	A	baseline	ns	ns	ns	ns	-54				
Tellurium	MLE	0.261	0.021	0.106	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Thallium	MLE	<0.001	0.231	0.103	A	A	A	A	A	baseline	ns	ns	ns	ns	-81				
Tin	MLE	0.705	<0.001	0.185	A	A	A	<LRL	A	baseline	ns	ns	<LRL	ns	ns	ns	ns	<LRL	ns
Titanium	MLE	0.687	0.815	0.187	-	-	A	A	<LRL	-	-	baseline	ns	<LRL	-	-	ns	ns	<LRL
Uranium	MLE	<0.001	0.136	0.024	A	AB	B	B	AB	baseline	ns	-51	-69	ns	-43	-71	-72	-82	-69
Vanadium	MLE	<0.001	0.068	0.269	A	A	A	A	A	baseline	ns	ns	ns	ns	99				
Zinc	MLE	<0.001	<0.001	0.735	A	A	A	A	A	baseline	ns	ns	ns	ns	42				
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.014	0.116	0.055	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	<0.001	0.160	0.017	A	A	A	B	A	baseline	ns	ns	-20	ns	ns	-9.6	ns	-22	ns
Body Weight[e]	ANOVAlog	<0.001	0.038	0.019	A	A	A	B	A	baseline	ns	ns	-52	ns	ns	-33	ns	-59	-30

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g.. A.B.C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant. all contrasts were conducted at a $\log_{10}$(fork length) of 1.60.

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretatio

[f] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups

Table E.6.8: **Statistical Comparisons of Exposed - Reference Relative Differences of Rainbow Trout Kidney Metal Concentrations for Polley Lake (Exposed) and Bootjack Lake (Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed ─ Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed ─ Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for Polley Lake Mean Relative to Bootjack Lake (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	0.016	0.641	A	A	A	A	A	baseline	ns	ns	ns	ns			62		
Antimony	MLE	0.441	0.258	0.454	A	A	<LRL	A	<LRL	baseline	ns	<LRL	ns	<LRL	ns	ns	<LRL	ns	<LRL
Arsenic	MLE	<0.001	0.011	0.820	A	A	A	A	A	baseline	ns	ns	ns	ns			68		
Barium	MLE	0.007	0.049	0.639	A	A	A	A	A	baseline	ns	ns	ns	ns			-27		
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.465	0.091	0.247	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.426	0.250	0.357	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	0.010	0.054	A	A	A	A	A	baseline	ns	ns	ns	ns			32		
Chromium	MLE	0.425	0.006	0.016	A	C	BC	AB	ABC	baseline	-73	-64	ns	ns	121	ns	ns	ns	ns
Cobalt	MLE	<0.001	0.830	0.056	A	A	A	A	A	baseline	ns	ns	ns	ns			171		
Copper	MLE	0.042	0.384	0.738	A	A	A	A	A	baseline	ns	ns	ns	ns			11		
Iron	MLE	<0.001	<0.001	0.088	A	A	A	A	A	baseline	ns	ns	ns	ns			21		
Lead	MLE	0.572	0.322	0.974	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	ns	ns	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.691	<0.001	0.361	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.197	0.110	0.004	B	B	B	B	A	baseline	ns	ns	ns	166	-42	ns	ns	ns	53
Mercury (ww)[d]	MLE	0.265	0.001	<0.001	B	C	B	A	B	baseline	-41	ns	313	ns	ns	-51	ns	242	ns
Molybdenum	MLE	0.419	0.402	0.625	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Nickel	MLE	<0.001	0.085	0.499	A	A	A	A	A	baseline	ns	ns	ns	ns			33		
Phosphorus	MLE	0.499	<0.001	0.502	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.239	<0.001	0.265	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.024	0.500	0.345	A	A	A	A	A	baseline	ns	ns	ns	ns			-10		
Selenium	MLE	<0.001	0.163	0.106	A	A	A	A	A	baseline	ns	ns	ns	ns			71		
Silver	MLE	0.015	0.041	0.723	-	-	A	A	A	-	-	baseline	ns	ns	-	-		-46	
Sodium	MLE	0.496	<0.001	0.052	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.656	0.195	0.248	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.002	0.018	0.488	A	A	A	A	A	baseline	ns	ns	ns	ns			-20		
Tin	MLE	0.594	<0.001	0.055	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Titanium	MLE	0.060	0.676	0.601	-	-	A	A	A	-	-	baseline	ns	ns	-	-	ns	ns	ns
Uranium	MLE	0.080	0.665	0.494	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	<0.001	0.440	0.737	A	A	A	A	A	baseline	ns	ns	ns	ns			97		
Zinc	MLE	0.590	0.193	0.021	BC	C	ABC	A	AB	baseline	ns	ns	108	ns	ns	ns	ns	63	ns
Zirconium	MLE	0.352	<0.001	0.058	A	<LRL	<LRL	A	A	baseline	<LRL	<LRL	ns	ns	ns	<LRL	<LRL	ns	ns
Age[e]	ANOVA	0.286	<0.001	0.071	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.005	0.005	0.479	A	A	A	A	A	baseline	ns	ns	ns	ns			5.8		
Body Weight[e]	ANOVAlog	0.005	<0.001	0.112	A	A	A	A	A	baseline	ns	ns	ns	ns			16		

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "<LRL" = greater than 50% LRL data for both stations so the time period was omitted from the analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Polley Lake:Bootjack Lake) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Polley Lake:Bootjack Lake).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.51.

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.9: **Statistical Comparisons of Exposed - Reference Relative Differences of Lake Trout Ovary Tissue Metal Concentrations for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022**

Parameter	Data Transfor-mation	Two-way ANOVA P-values			(Exposed ─ Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed ─ Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]				
					Post-Breach Period					Post-Breach Period					Post-Breach Period				
		Area	Year	Area × Year	2015	2018	2019	2020	2022	2015	2018	2019	2020	2022	2015	2018	2019	2020	2022
Aluminum	MLE	0.346	0.572	<0.001	<LRL	B	A	<LRL	<LRL	<LRL	baseline	229	<LRL	<LRL	<LRL	-66	ns	<LRL	<LRL
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.003	0.315	0.027	AB	AB	A	B	B	baseline	ns	ns	ns	ns	ns	ns	291	ns	ns
Barium	MLE	0.308	<0.001	0.008	<LRL	C	B	A	BC	<LRL	baseline	293	1,877[e]	ns	<LRL	-62	ns	ns	ns
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.924	0.112	0.281	A	A	A	<LRL	A	baseline	ns	ns	<LRL	ns	ns	ns	ns	<LRL	ns
Calcium	MLE	0.137	0.089	0.945	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	0.481	0.017	0.207	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.613	0.709	0.675	<LRL	A	A	<LRL	A	<LRL	baseline	ns	<LRL	ns	<LRL	ns	ns	<LRL	ns
Cobalt	MLE	0.083	0.001	0.279	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.011	0.061	0.002	BC	C	A	BC	AB	baseline	ns	373	ns	ns	ns	ns	621	ns	231
Iron	MLE	0.271	<0.001	0.139	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	0.751	0.970	<0.001	<LRL	B	A	<LRL	<LRL	<LRL	baseline	101,897[e]	<LRL	<LRL	<LRL	ns	ns	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.422	0.058	0.908	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.157	0.003	0.531	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Mercury (ww)[d]	MLE	0.897	0.006	0.054	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	0.921	0.937	0.330	<LRL	A	A	<LRL	A	<LRL	baseline	ns	<LRL	ns	<LRL	ns	ns	<LRL	ns
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.854	0.218	0.423	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.767	<0.001	0.377	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.817	0.005	0.192	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	0.012	0.018	0.081	A	A	A	A	A	baseline	ns	ns	ns	ns	45				
Silver	MLE	0.787	0.113	0.037	-	-	-	B	A	-	-	-	baseline	395	-	-	-	ns	ns
Sodium	MLE	0.667	<0.001	0.088	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.979	0.393	0.742	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.352	0.012	0.194	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.178	<0.001	0.099	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	0.611	0.010	0.003	AB	ABC	C	A	BC	baseline	ns	-62	ns	ns	ns	ns	-52	150	ns
Fork Length[f]	ANOVAlog	0.636	0.484	0.080	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Body Weight[f]	ANOVAlog	0.528	0.297	0.145	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. No female lake trout were collected from the Quesnel Lake reference area in 2021, so 2021 was excluded fron analyses.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.76.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.10: Statistical Comparisons of Exposed - Reference Relative Differences of Peamouth Chub Muscle Tissue Metal Concentrations for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
		Area	Year	Area × Year	Post-Breach Period						Post-Breach Period						Post-Breach Period					
					2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Aluminum	MLE	0.853	<0.001	<0.001	BC	B	<LRL	A	<LRL	C	baseline	ns	<LRL	43,815[e]	<LRL	ns	ns	ns	<LRL	ns	<LRL	-67
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.004	<0.001	0.004	ABC	CD	D	AB	A	BCD	baseline	ns	-56	ns	ns	ns	77	ns	ns	119	129	ns
Barium	MLE	0.097	<0.001	0.053	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	14					
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	<0.001	0.002	0.850	A	<LRL	<LRL	A	A	A	baseline	<LRL	<LRL	ns	ns	ns	128	<LRL	<LRL	128		
Calcium	MLE	0.366	<0.001	0.001	AB	AB	BC	C	AB	A	baseline	ns	ns	-48	ns	ns	ns	ns	ns	-50	ns	46
Cesium	MLE	<0.001	<0.001	0.025	AB	AB	A	BC	C	ABC	baseline	ns	ns	ns	-30	ns	-38	-38	-29	-56	-56	-47
Chromium	MLE	0.907	0.185	0.005	<LRL	A	<LRL	B	<LRL	A	<LRL	baseline	<LRL	-83	<LRL	ns	<LRL	ns	<LRL	-60	<LRL	ns
Cobalt	MLE	0.847	<0.001	0.413	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.405	<0.001	<0.001	A	B	AB	B	C	AB	baseline	-35	ns	-32	-58	ns	48	ns	33	ns	-38	ns
Iron	MLE	0.455	<0.001	0.580	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.173	<0.001	<0.001	BC	A	A	C	AB	BC	baseline	22	19	ns	ns	ns	ns	18	15	ns	ns	ns
Manganese	MLE	0.523	<0.001	0.020	BC	ABC	AB	C	ABC	A	baseline	ns	ns	ns	ns	57	ns	ns	ns	-29	ns	55
Mercury (ww)[d]	MLE	0.166	0.053	0.042	A	B	AB	B	B	AB	baseline	-42	ns	-45	-36	ns	62	ns	ns	ns	ns	ns
Molybdenum	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.440	<0.001	0.006	A	A	A	B	A	A	baseline	ns	ns	-21	ns	ns	11	ns	ns	-12	ns	ns
Potassium	MLE	0.411	<0.001	0.006	AB	A	AB	C	BC	BC	baseline	ns	ns	-16	ns	ns	8.7	11	ns	-8.4	ns	ns
Rubidium	MLE	0.046	<0.001	0.073	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-10					
Selenium	MLE	<0.001	<0.001	0.157	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	79					
Silver	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	0.004	<0.001	<0.001	AB	A	C	BC	A	BC	baseline	ns	-21	ns	ns	ns	26	43	ns	ns	27	ns
Strontium	MLE	0.050	<0.001	0.002	AB	AB	B	C	B	A	baseline	ns	ns	-65	ns	ns	ns	ns	ns	-67	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.074	<0.001	0.043	A	A	A	B	AB	A	baseline	ns	ns	-50	ns	ns	ns	ns	ns	-51	ns	ns
Tin	MLE	0.074	<0.001	<0.001	C	C	<LRL	B	A	C	baseline	ns	<LRL	700	6,823[e]	ns	ns	ns	<LRL	438	ns	ns
Titanium	MLE	0.351	0.512	<0.001	-	-	-	A	<LRL	B	-	-	-	baseline	<LRL	-92	-	-	-	472	<LRL	ns
Uranium	MLE	0.589	0.004	0.054	A	<LRL	A	A	<LRL	A	baseline	<LRL	ns	ns	<LRL	ns	ns	<LRL	ns	ns	<LRL	ns
Vanadium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.168	<0.001	0.037	AB	ABC	A	BC	C	AB	baseline	ns	ns	ns	-29	ns	ns	ns	ns	ns	-30	ns
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	0.278	0.027	0.094	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[f]	ANOVAlog	0.012	0.052	0.013	BC	C	C	A	AB	ABC	baseline	ns	ns	19	ns	ns	ns	ns	ns	23	15	ns
Body Weight[f]	ANOVAlog	0.009	0.066	0.009	BC	C	BC	A	AB	AB	baseline	ns	ns	89	ns	ns	ns	ns	ns	102	56	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.30.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.11: Statistical Comparisons of Exposed - Reference Relative Differences of Northern Pikeminnow Wholebody Metal Concentrations for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Parameter	Data Transfor-mation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
					Post-Breach Period						Post-Breach Period						Post-Breach Period					
		Area	Year	Area × Year	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Aluminum	MLE	0.317	<0.001	0.161	A	A	A	A	A	<LRL	baseline	ns	ns	ns	ns	<LRL	ns	ns	ns	ns	ns	<LRL
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	0.335	<0.001	AB	C	BC	A	AB	AB	baseline	-71	ns	ns	ns	ns	125	ns	ns	216	81	94
Barium	MLE	<0.001	<0.001	0.012	AB	B	A	B	B	A	baseline	ns	ns	ns	ns	ns	71	ns	93	ns	ns	96
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	<0.001	<0.001	0.546	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	119					
Calcium	MLE	0.805	<0.001	0.066	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	0.203	0.205	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-56					
Chromium	MLE	0.793	<0.001	0.047	AB	B	<LRL	B	<LRL	A	baseline	ns	<LRL	ns	<LRL	ns	ns	ns	<LRL	ns	<LRL	ns
Cobalt	MLE	0.323	0.015	0.136	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.865	0.004	0.462	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Iron	MLE	0.317	<0.001	0.374	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	0.006	0.645	0.030	<LRL	A	<LRL	B	<LRL	A	<LRL	baseline	<LRL	-71	<LRL	ns	<LRL	ns	<LRL	-75	<LRL	ns
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.026	0.029	0.904	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-7.5					
Manganese	MLE	0.068	0.027	0.013	AB	B	A	B	B	B	baseline	ns	ns	ns	ns	ns	ns	ns	128	ns	ns	ns
Mercury (ww)[d]	MLE	0.662	<0.001	0.249	-	A	A	A	A	A	-	baseline	ns	ns	ns	ns	-	ns	ns	ns	ns	ns
Molybdenum	MLE	0.027	<0.001	0.032	A	B	B	B	B	AB	baseline	-42	-37	-50	-36	ns	ns	ns	ns	-35	ns	ns
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.149	<0.001	0.212	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.105	<0.001	0.438	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.004	0.042	0.052	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-15					
Selenium	MLE	<0.001	0.084	0.083	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	70					
Silver	MLE	0.333	0.771	0.883	-	-	-	A	A	<LRL	-	-	-	baseline	ns	<LRL	-	-	-	ns	ns	<LRL
Sodium	MLE	0.487	<0.001	0.098	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.016	0.003	0.037	B	B	A	B	B	AB	baseline	ns	70	ns	ns	ns	ns	-36	ns	-37	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.785	<0.001	0.340	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	0.040	<0.001	0.002	A	<LRL	<LRL	B	A	A	baseline	<LRL	<LRL	-74	ns	ns	ns	<LRL	<LRL	-67	ns	ns
Titanium	MLE	0.885	0.823	0.436	-	-	-	A	A	<LRL	-	-	-	baseline	ns	<LRL	-	-	-	ns	ns	<LRL
Uranium	MLE	0.001	0.066	0.041	A	B	AB	AB	AB	A	baseline	-81	ns	ns	ns	ns	ns	-77	ns	-56	ns	ns
Vanadium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.038	<0.001	0.492	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-8.3					
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.580	<0.001	0.004	ABC	C	C	AB	BC	A	baseline	ns	ns	ns	ns	ns	ns	-27	-26	ns	ns	43
Fork Length[e]	ANOVAlog	0.372	<0.001	0.035	BC	ABC	C	A	ABC	AB	baseline	ns	ns	23	ns	ns	ns	ns	ns	21	ns	16
Body Weight[e]	ANOVAlog	0.219	<0.001	0.022	BC	BC	C	A	BC	AB	baseline	ns	ns	94	ns	ns	ns	ns	ns	95	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference). <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.20.

[e] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.12: Statistical Comparisons of Exposed - Reference Relative Differences of Peamouth Chub Liver Tissue Metal Concentrations for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2016 to 2022

Parameter	Data Transfor-mation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periodsa						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
		Area	Year	Area × Year	Post-Breach Period						Post-Breach Period						Post-Breach Period					
					2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022	2016	2018	2019	2020	2021	2022
Aluminum	MLE	0.726	<0.001	0.485	A	<LRL	A	A	A	A	baseline	<LRL	ns	ns	ns	ns	ns	<LRL	ns	ns	ns	ns
Antimony	MLE	0.014	0.175	0.089	A	<LRL	<LRL	<LRL	<LRL	A	baseline	<LRL	<LRL	<LRL	<LRL	ns	85[e]	<LRL	<LRL	<LRL	<LRL	85
Arsenic	MLE	0.570	<0.001	<0.001	A	A	AB	BC	AB	C	baseline	ns	ns	-68	ns	-83	94	ns	ns	ns	ns	-66
Barium	MLE	0.252	<0.001	0.370	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<0.001	<0.001	0.817	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-44					
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	<0.001	0.012	0.901	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	141					
Calcium	MLE	0.326	0.008	0.286	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	<0.001	0.101	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-36					
Chromium	MLE	0.816	0.044	<0.001	B	A	BC	C	BC	B	baseline	191	ns	-75	ns	ns	ns	268	ns	-68	ns	ns
Cobalt	MLE	0.225	0.003	0.526	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.010	<0.001	0.014	ABC	A	AB	BC	C	BC	baseline	ns	ns	ns	ns	ns	ns	108	45	ns	ns	ns
Iron	MLE	<0.001	<0.001	0.987	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	55					
Lead	MLE	0.299	0.550	0.001	A	<LRL	<LRL	B	<LRL	<LRL	baseline	<LRL	<LRL	-88	<LRL	<LRL	ns	<LRL	<LRL	-77	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.047	<0.001	0.569	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	15					
Manganese	MLE	0.045	<0.001	0.972	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	20					
Mercury (ww)[d]	MLE	<0.001	<0.001	0.055	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	59					
Molybdenum	MLE	<0.001	0.053	0.637	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	34					
Nickel	MLE	0.951	0.220	<0.001	B	A	<LRL	BC	C	<LRL	baseline	195	<LRL	ns	-67	<LRL	ns	262	<LRL	ns	-59	<LRL
Phosphorus	MLE	0.016	<0.001	0.734	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	17					
Potassium	MLE	0.083	<0.001	0.760	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	12					
Rubidium	MLE	0.637	0.019	0.799	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	<0.001	0.003	0.276	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	30					
Silver	MLE	0.030	0.360	0.040	-	-	-	AB	B	A	-	-	-	baseline	ns	ns	-	-	-	ns	-73	ns
Sodium	MLE	0.039	<0.001	0.163	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	20					
Strontium	MLE	0.235	0.007	0.379	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.458	0.020	0.647	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	<0.001	<0.001	<0.001	C	BC	<LRL	A	<LRL	B	baseline	ns	<LRL	1,424[e]	<LRL	329	ns	235	<LRL	1,811	<LRL	438
Titanium	MLE	0.506	0.360	0.099	-	-	-	A	A	<LRL	-	-	-	baseline	ns	<LRL	-	-	-	ns	ns	<LRL
Uranium	MLE	0.135	<0.001	0.663	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	<0.001	<0.001	0.081	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	136					
Zinc	MLE	0.002	<0.001	0.692	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	19					
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.278	0.027	0.094	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.012	0.052	0.013	BC	C	C	A	AB	ABC	baseline	ns	ns	19	ns	ns	ns	ns	ns	23	15	ns
Body Weight[e]	ANOVAlog	0.009	0.066	0.009	BC	C	BC	A	AB	AB	baseline	ns	ns	89	ns	ns	ns	ns	ns	102	56	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.30.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.13: Statistical Comparisons of Exposed - Reference Relative Differences of Peamouth Chub Kidney Tissue Metal Concentrations for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]				
					Post-Breach Period					Post-Breach Period					Post-Breach Period				
		Area	Year	Area × Year	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.090	0.094	0.096	A	<LRL	<LRL	A	A	baseline	<LRL	<LRL	ns	ns	ns	<LRL	<LRL	ns	ns
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	<0.001	0.964	A	A	A	A	A	baseline	ns	ns	ns	ns	32				
Barium	MLE	<0.001	<0.001	0.387	A	A	A	A	A	baseline	ns	ns	ns	ns	92				
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<0.001	<0.001	0.935	A	A	A	A	A	baseline	ns	ns	ns	ns	-40				
Boron	MLE	0.014	<0.001	0.019	A	B	<LRL	<LRL	B	baseline	-71	<LRL	<LRL	-78	439	ns	<LRL	<LRL	ns
Cadmium	MLE	<0.001	0.020	0.444	A	A	A	A	A	baseline	ns	ns	ns	ns	173				
Calcium	MLE	0.009	0.006	0.228	A	A	A	A	A	baseline	ns	ns	ns	ns	64				
Cesium	MLE	0.002	<0.001	0.018	A	AB	B	A	A	baseline	ns	-54	ns	ns	ns	-29	-53	ns	ns
Chromium	MLE	0.050	<0.001	<0.001	A	B	BC	C	BC	baseline	-69	-83	-90	-78	496	ns	ns	ns	ns
Cobalt	MLE	0.123	<0.001	0.535	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.007	<0.001	0.660	A	A	A	A	A	baseline	ns	ns	ns	ns	24				
Iron	MLE	0.029	<0.001	0.545	A	A	A	A	A	baseline	ns	ns	ns	ns	20				
Lead	MLE	0.001	0.002	0.047	B	A	<LRL	B	B	baseline	1,775[e]	<LRL	ns	ns	ns	ns	<LRL	ns	125
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.004	<0.001	0.197	A	A	A	A	A	baseline	ns	ns	ns	ns	21				
Manganese	MLE	<0.001	<0.001	0.806	A	A	A	A	A	baseline	ns	ns	ns	ns	45				
Mercury (ww)[d]	MLE	0.014	<0.001	0.016	ABC	AB	C	BC	A	baseline	ns	ns	ns	ns	ns	41	ns	ns	82
Molybdenum	MLE	<0.001	0.032	0.475	A	A	A	A	A	baseline	ns	ns	ns	ns	56				
Nickel	MLE	0.090	<0.001	0.010	A	B	B	B	<LRL	baseline	-66	-62	-78	<LRL	242	ns	ns	ns	<LRL
Phosphorus	MLE	<0.001	0.020	0.181	A	A	A	A	A	baseline	ns	ns	ns	ns	28				
Potassium	MLE	0.001	0.149	0.093	A	A	A	A	A	baseline	ns	ns	ns	ns	22				
Rubidium	MLE	0.425	0.005	0.191	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Selenium	MLE	<0.001	0.001	0.309	A	A	A	A	A	baseline	ns	ns	ns	ns	45				
Silver	MLE	<0.001	0.533	0.046	-	-	A	B	<LRL	-	-	baseline	-91[e]	<LRL	-	-	ns	ns	<LRL
Sodium	MLE	<0.001	0.307	0.012	A	BC	C	AB	BC	baseline	-45	-51	ns	-37	111	ns	ns	60	ns
Strontium	MLE	0.008	0.003	0.194	A	A	A	A	A	baseline	ns	ns	ns	ns	68				
Tellurium	MLE	0.015	0.044	0.563	<LRL	<LRL	A	A	A	<LRL	<LRL	baseline	ns	ns	<LRL	<LRL	49		
Thallium	MLE	0.052	0.225	0.815	A	A	A	A	A	baseline	ns	ns	ns	ns	20				
Tin	MLE	0.003	0.655	<0.001	B	C	A	<LRL	B	baseline	-100[e]	32,347[e]	<LRL	ns	428	ns	ns	<LRL	888
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	0.012	0.021	0.597	A	A	A	A	A	baseline	ns	ns	ns	ns	56				
Vanadium	MLE	<0.001	0.001	0.144	A	A	A	A	A	baseline	ns	ns	ns	ns	110				
Zinc	MLE	0.019	0.031	0.409	A	A	A	A	A	baseline	ns	ns	ns	ns	17				
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	0.231	0.744	0.128	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[f]	ANOVAlog	0.004	0.225	0.041	C	BC	A	AB	ABC	baseline	ns	28	19	ns	ns	ns	23	15	ns
Body Weight[f]	ANOVAlog	0.002	0.152	0.026	C	BC	A	AB	ABC	baseline	ns	142	86	ns	ns	ns	102	56	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.30.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.14: Statistical Comparisons of Exposed - Reference Relative Differences of Lake Trout Kidney Tissue Metal Concentrations for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
					Post-Breach Period						Post-Breach Period						Post-Breach Period					
		Area	Year	Area × Year	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022
Aluminum	MLE	0.776	0.002	0.005	BC	AB	C	AB	BC	A	baseline	ns	ns	ns	ns	190	ns	ns	-64	ns	ns	120
Antimony	MLE	0.277	0.786	0.004	<LRL	<LRL	B	A	<LRL	<LRL	<LRL	<LRL	baseline	418	<LRL	<LRL	<LRL	<LRL	ns	244	<LRL	<LRL
Arsenic	MLE	<0.001	0.002	0.522	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	40					
Barium	MLE	0.002	<0.001	<0.001	A	A	B	B	B	A	baseline	ns	-65	-47	-46	ns	113	164	ns	ns	ns	131
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.069	<0.001	0.259	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	29					
Calcium	MLE	0.629	0.002	0.046	B	AB	B	B	B	A	baseline	ns	ns	ns	ns	68	ns	ns	ns	ns	ns	43
Cesium	MLE	<0.001	<0.001	<0.001	C	B	B	AB	AB	A	baseline	45	57	91	68	136	-54	-34	-28	ns	-23	ns
Chromium	MLE	0.146	<0.001	0.493	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.673	0.005	0.081	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	0.685	0.061	0.454	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Iron	MLE	<0.001	<0.001	0.403	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-36					
Lead	MLE	0.850	0.001	<0.001	A	C	C	BC	B	B	baseline	-100	-100	-99	-99	-98	ns	-58	-62	ns	ns	ns
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.482	0.224	0.002	C	BC	AB	BC	AB	A	baseline	ns	38	ns	33	62	-18	ns	ns	ns	ns	33
Manganese	MLE	<0.001	<0.001	0.110	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	52					
Mercury (ww)[d]	MLE	<0.001	0.374	0.161	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-37					
Molybdenum	MLE	0.923	0.001	0.287	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Nickel	MLE	0.845	0.001	0.526	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Phosphorus	MLE	<0.001	0.079	<0.001	C	BC	BC	BC	B	A	baseline	ns	ns	ns	24	70	ns	ns	ns	ns	19	63
Potassium	MLE	0.437	0.071	<0.001	C	B	B	B	B	A	baseline	28	48	32	51	119	-27	ns	ns	ns	ns	60
Rubidium	MLE	0.119	<0.001	0.001	B	B	B	B	B	A	baseline	ns	ns	ns	ns	57	ns	ns	ns	ns	ns	53
Selenium	MLE	0.163	<0.001	0.092	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Silver	MLE	0.169	<0.001	<0.001	-	-	-	B	A	A	-	-	-	baseline	3,674	3,989	-	-	-	-95	ns	ns
Sodium	MLE	0.056	<0.001	<0.001	A	BC	BC	C	C	AB	baseline	-34	-35	-39	-44	ns	59	ns	ns	ns	ns	37
Strontium	MLE	0.062	<0.001	0.461	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-18					
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.089	<0.001	0.036	A	B	AB	AB	B	A	baseline	-35	ns	ns	-33	ns	32	ns	ns	ns	ns	41
Tin	MLE	0.238	<0.001	<0.001	B	C	<LRL	A	B	B	baseline	-89	<LRL	1,641[e]	ns	ns	120	-76	<LRL	ns	ns	158
Titanium	MLE	<0.001	0.285	0.500	-	-	-	A	A	A	-	-	-	baseline	ns	ns	-	-	-	235		
Uranium	MLE	0.984	0.072	0.183	<LRL	A	A	A	A	A	<LRL	baseline	ns	ns	ns	ns	<LRL	ns	ns	ns	ns	ns
Vanadium	MLE	0.704	0.612	0.086	<LRL	A	A	A	A	<LRL	<LRL	baseline	ns	ns	ns	<LRL	<LRL	ns	ns	ns	ns	<LRL
Zinc	MLE	0.149	<0.001	0.021	AB	C	BC	BC	ABC	A	baseline	-27	ns	ns	ns	ns	20	ns	ns	ns	ns	36
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	<0.001	<0.001	0.202	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-32					
Fork Length[f]	ANOVAlog	0.525	<0.001	0.666	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Body Weight[f]	ANOVAlog	0.635	<0.001	0.419	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.75.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.15: Statistical Comparisons of Exposed - Reference Relative Differences of Peamouth Chub Ovary Tissue Metal Concentrations for Quesnel Lake near Hazeltine Creek (NHC; Exposed) and near Grain Creek (NGC; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]				
					Post-Breach Period					Post-Breach Period					Post-Breach Period				
		Area	Year	Area × Year	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.164	0.002	0.018	A	B	B	AB	AB	baseline	-66	-75	ns	ns	ns	-42	-58	ns	ns
Barium	MLE	0.070	0.003	0.795	A	A	A	A	A	baseline	ns	ns	ns	ns	37				
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.169	<0.001	0.719	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.009	0.015	0.479	A	A	A	A	A	baseline	ns	ns	ns	ns	-21				
Cesium	MLE	<0.001	0.005	0.519	A	A	A	A	A	baseline	ns	ns	ns	ns	-51				
Chromium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cobalt	MLE	0.005	0.594	0.016	A	AB	BC	C	AB	baseline	ns	-54	-57	ns	ns	ns	-49	-52	ns
Copper	MLE	0.162	0.257	0.182	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Iron	MLE	0.925	0.030	0.430	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.114	<0.001	0.044	A	AB	AB	B	B	baseline	ns	ns	-38	-32	ns	ns	ns	-25	-18
Manganese	MLE	0.089	0.021	0.657	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Mercury (ww)[d]	MLE	0.800	0.003	0.306	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	0.027	0.034	0.517	A	A	A	A	A	baseline	ns	ns	ns	ns	-17				
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.456	0.066	0.170	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.107	0.020	0.473	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	<0.001	0.717	0.302	A	A	A	A	A	baseline	ns	ns	ns	ns	-25				
Selenium	MLE	0.190	0.003	0.394	A	A	A	A	A	baseline	ns	ns	ns	ns	24				
Silver	MLE	0.015	0.006	0.929	-	-	A	A	A	-	-	baseline	ns	ns	-	-	-27		
Sodium	MLE	0.628	0.003	0.267	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.005	<0.001	0.860	A	A	A	A	A	baseline	ns	ns	ns	ns	-22				
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.043	0.051	0.228	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	0.351	0.003	0.032	<LRL	B	<LRL	<LRL	A	<LRL	baseline	<LRL	<LRL	17,495[e]	<LRL	ns	<LRL	<LRL	ns
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	0.626	0.044	0.756	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.006	0.010	0.166	A	A	A	A	A	baseline	ns	ns	ns	ns	-17				
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[e]	ANOVA	0.974	0.789	0.526	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Fork Length[e]	ANOVAlog	0.003	0.427	0.948	A	A	A	A	A	baseline	ns	ns	ns	ns	6.5				
Body Weight[e]	ANOVAlog	0.003	0.377	0.962	A	A	A	A	A	baseline	ns	ns	ns	ns	26				

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.33.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.16: Statistical Comparisons of Exposed - Reference Relative Differences of Lake Trout Muscle Tissue Metal Concentrations for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
		Area	Year	Area × Year	Post-Breach Period						Post-Breach Period						Post-Breach Period					
					2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022
Aluminum	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	0.350	0.165	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	65					
Barium	MLE	0.112	<0.001	<0.001	<LRL	C	C	BC	A	B	<LRL	baseline	ns	ns	2,926[e]	175	<LRL	ns	ns	ns	ns	120
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Calcium	MLE	0.094	0.083	0.023	B	AB	AB	A	A	AB	baseline	ns	ns	81	119	ns	-41	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	0.002	0.247	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-27					
Chromium	MLE	0.791	0.733	0.342	<LRL	<LRL	A	A	<LRL	A	<LRL	<LRL	baseline	ns	<LRL	ns	<LRL	<LRL	ns	ns	<LRL	ns
Cobalt	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Copper	MLE	0.061	<0.001	0.101	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-12					
Iron	MLE	<0.001	0.083	0.604	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-35					
Lead	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.414	<0.001	0.002	B	B	B	B	B	A	baseline	ns	ns	ns	ns	18	ns	ns	ns	ns	ns	21
Manganese	MLE	0.204	<0.001	<0.001	CD	BC	D	AB	A	A	baseline	ns	ns	42	92	81	-18	ns	-26	ns	58	49
Mercury (ww)[d]	MLE	<0.001	0.129	0.142	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-36					
Molybdenum	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.049	0.007	<0.001	A	B	B	B	B	A	baseline	-17	-22	-25	-15	ns	19	ns	ns	-10	ns	30
Potassium	MLE	0.192	<0.001	<0.001	A	BC	C	C	AB	A	baseline	-15	-23	-21	ns	ns	15	ns	-12	ns	ns	24
Rubidium	MLE	0.363	<0.001	<0.001	A	BC	BC	C	AB	A	baseline	-16	-20	-27	ns	ns	15	ns	ns	-16	ns	23
Selenium	MLE	0.766	<0.001	0.011	A	ABC	ABC	BC	C	AB	baseline	ns	ns	-19	-27	ns	17	ns	ns	ns	-15	ns
Silver	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	<0.001	0.002	0.045	BC	AB	C	BC	ABC	A	baseline	ns	ns	ns	ns	40	-30	ns	-35	-30	ns	ns
Strontium	MLE	0.190	0.002	0.105	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.232	0.275	0.020	A	AB	AB	B	AB	A	baseline	ns	ns	-42	ns	ns	31	ns	ns	-24	ns	37
Tin	MLE	0.309	<0.001	0.022	<LRL	<LRL	<LRL	<LRL	B	A	<LRL	<LRL	<LRL	<LRL	baseline	80	<LRL	<LRL	<LRL	<LRL	ns	64
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.237	0.040	0.149	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	<0.001	<0.001	0.172	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-31					
Fork Length[f]	ANOVAlog	0.548	<0.001	0.560	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Body Weight[f]	ANOVAlog	0.645	<0.001	0.331	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.75.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.17: Statistical Comparisons of Exposed - Reference Relative Differences of Lake Trout Liver Tissue Metal Concentrations for Quesnel Lake near Cedar Point (NCP; Exposed) and East Arm (EAA; Reference), 2015 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for Exposed Mean Relative to Reference Mean (%)[c]					
					Post-Breach Period						Post-Breach Period						Post-Breach Period					
		Area	Year	Area × Year	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022
Aluminum	MLE	0.432	0.013	0.004	<LRL	A	B	A	AB	A	<LRL	baseline	-70	ns	ns	ns	<LRL	ns	-60	117	ns	ns
Antimony	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.476	0.022	0.211	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Barium	MLE	0.047	<0.001	<0.001	<LRL	B	C	B	A	<LRL	<LRL	baseline	-62	ns	4,402[e]	<LRL	<LRL	ns	-49	ns	ns	<LRL
Beryllium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.734	<0.001	0.001	A	A	B	A	A	A	baseline	ns	-74	ns	ns	ns	ns	ns	-65	ns	ns	ns
Calcium	MLE	0.017	0.178	0.045	B	A	B	B	AB	B	baseline	108	ns	ns	ns	ns	ns	ns	-42	ns	ns	ns
Cesium	MLE	0.010	0.012	0.603	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-23					
Chromium	MLE	<0.001	0.031	0.033	<LRL	A	B	A	AB	A	<LRL	baseline	-72	ns	ns	ns	<LRL	ns	-76	ns	-50	ns
Cobalt	MLE	<0.001	<0.001	0.168	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-27					
Copper	MLE	0.008	0.003	0.004	A	AB	AB	B	B	B	baseline	ns	ns	-77	-82	-80	ns	ns	ns	-59	-68	-64
Iron	MLE	<0.001	<0.001	0.648	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-57					
Lead	MLE	0.129	0.051	0.005	<LRL	B	B	<LRL	A	<LRL	<LRL	baseline	ns	<LRL	288	<LRL	<LRL	-52	ns	<LRL	ns	<LRL
Lithium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.721	0.003	0.048	AB	A	B	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	-31	ns	ns	ns
Manganese	MLE	0.440	<0.001	0.097	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Mercury (ww)[d]	MLE	<0.001	0.004	0.013	AB	A	C	A	BC	AB	baseline	ns	-56	ns	ns	ns	-41	-36	-74	ns	-67	-44
Molybdenum	MLE	0.164	<0.001	0.150	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Nickel	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.603	<0.001	0.026	A	A	B	AB	A	A	baseline	ns	-37	ns	ns	ns	ns	ns	-32	ns	ns	ns
Potassium	MLE	0.118	<0.001	0.015	A	A	B	A	A	A	baseline	ns	-42	ns	ns	ns	ns	ns	-32	ns	ns	42
Rubidium	MLE	0.002	<0.001	0.054	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	36					
Selenium	MLE	0.004	<0.001	0.018	A	AB	BC	ABC	C	AB	baseline	ns	-37	ns	-54	ns	ns	ns	-31	-29	-49	ns
Silver	MLE	<0.001	0.336	0.950	-	-	-	A	A	A	-	-	-	baseline	ns	ns	-	-	-	-64		
Sodium	MLE	0.033	<0.001	0.026	A	AB	BC	C	AB	ABC	baseline	ns	-39	-51	ns	ns	ns	ns	-33	-46	ns	ns
Strontium	MLE	0.017	0.035	0.029	BC	A	ABC	C	AB	C	baseline	89	ns	ns	ns	ns	ns	ns	ns	-44	ns	-41
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.610	0.003	0.723	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	0.408	<0.001	0.010	A	<LRL	<LRL	<LRL	B	A	baseline	<LRL	<LRL	<LRL	-95[e]	ns	ns	<LRL	<LRL	<LRL	ns	ns
Titanium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	0.011	0.275	0.002	<LRL	A	C	<LRL	B	<LRL	<LRL	baseline	-99[e]	<LRL	-76	<LRL	<LRL	ns	ns	<LRL	-68	<LRL
Zinc	MLE	0.007	<0.001	0.002	A	AB	C	C	BC	BC	baseline	ns	-47	-44	-37	-32	ns	ns	-37	-33	-25	ns
Zirconium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age[f]	ANOVA	<0.001	<0.001	0.172	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-31					
Fork Length[f]	ANOVAlog	0.548	<0.001	0.560	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Body Weight[f]	ANOVAlog	0.645	<0.001	0.331	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05

Contrast is significant (α = 0.05) and magnitude of difference is positive

Contrast is significant (α = 0.05) and magnitude of difference is negative

Notes: "-" = no data available; "nt" = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period; "ns" = not significant; "baseline" = first year of data included in analysis; "ww" = wet weight; "ANOVA" = two way analysis of variance; "MLE" = censored regression using maximum likelihood estimation; "ANCOVA" = two-way analysis of covariance, MOD = magnitude of difference. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (Exposed:Reference) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (Exposed:Reference).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

[d] Conducted as a two-way ANCOVA with $\log_{10}$(fork length) as a covariate. Because the covariate was significant, all contrasts were conducted at a $\log_{10}$(fork length) of 1.75.

[e] MOD is inflated because data for one of the groups in the comparison were entirely < LRL, leading to an underestimate of the mean for the <LRL result and a consequent increase in MOD between the two groups.

[f] Results of statistical contrasts for age, fork length, and body weight may differ among tissue types for a given species due to different sample sizes or sampling years among tissue types. Only the results associated with muscle and ovary tissue types were used in data interpretation.

Table E.6.18: Statistical Comparisons of Temporal Differences of Rainbow Trout Liver Metal Concentrations for Quesnel River, 2015 to 2022

Parameter	Test	One-way ANOVA Year P-values	Temporal Contrasts Among Periods[a]							Magnitude of Difference Relative to Baseline Period (%)[b]						
			2015	2017	2018	2019	2020	2021	2022	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.144	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Antimony	MLE	0.889	<LRL	A	<LRL	A	A	<LRL	A	<LRL	baseline	<LRL	ns	ns	<LRL	ns
Arsenic	MLE	0.002	AB	AB	B	B	AB	A	AB	baseline	ns	ns	ns	ns	ns	ns
Barium	MLE	<0.001	B	B	A	A	A	B	A	baseline	ns	418	168	321	ns	503
Beryllium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.723	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Calcium	MLE	<0.001	A	B	B	B	B	B	B	baseline	-37	-52	-46	-50	-44	-52
Cesium	MLE	0.013	A	AB	AB	AB	B	AB	AB	baseline	ns	ns	ns	-44	ns	ns
Chromium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cobalt	MLE	0.349	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Copper	MLE	0.057	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Iron	MLE	0.586	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Lead	MLE	0.141	<LRL	A	<LRL	<LRL	A	A	A	<LRL	baseline	<LRL	<LRL	ns	ns	ns
Lithium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.001	AB	AB	B	AB	AB	A	B	baseline	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.028	A	AB	AB	AB	B	AB	B	baseline	ns	ns	ns	-40	ns	-36
Mercury (dw)	MLE	0.001	ABC	A	BC	C	AB	ABC	ABC	baseline	ns	ns	ns	ns	ns	ns
Mercury (ww)[c]	MLE	<0.001	A	A	B	B	A	AB	AB	baseline	ns	-48	-49	ns	ns	ns
Molybdenum	MLE	0.510	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Nickel	MLE	0.533	A	<LRL	<LRL	<LRL	A	A	A	baseline	<LRL	<LRL	<LRL	ns	ns	ns
Phosphorus	MLE	<0.001	C	C	C	AB	AB	A	BC	baseline	ns	ns	22	28	29	ns
Potassium	MLE	<0.001	D	ABC	C	BC	AB	A	C	baseline	47	34	45	72	74	39
Rubidium	MLE	<0.001	B	A	A	A	AB	A	AB	baseline	61	78	77	ns	75	ns
Selenium	MLE	0.642	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Silver	MLE	0.046	-	-	-	-	A	A	A	-	-	-	-	-	ns	ns
Sodium	MLE	<0.001	C	AB	C	AB	AB	A	BC	baseline	43	ns	40	31	55	ns
Strontium	MLE	<0.001	A	BC	BC	BC	C	AB	C	baseline	-40	-49	-49	-57	ns	-58
Tellurium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.797	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Tin	MLE	<0.001	BC	AB	C	ABC	A	C	<LRL	baseline	ns	ns	ns	238	ns	<LRL
Titanium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	0.786	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Vanadium	MLE	0.529	A	A	A	<LRL	A	A	A	baseline	ns	ns	<LRL	ns	ns	ns
Zinc	MLE	0.008	A	B	AB	AB	AB	AB	B	baseline	-27	ns	ns	ns	ns	-28
Zirconium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age	ANOVA	0.019	AB	AB	A	AB	AB	B	AB	baseline	ns	ns	ns	ns	ns	ns
Fork Length	ANOVAlog	0.315	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Body Weight	ANOVAlog	0.345	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = all of the concentrations were reported as < LRL so the time period was omitted from the analysis, ww = wet weight, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight.

[a] Years that share a letter (e.g., A,B,C) had concentrations that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest concentrations. <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means as $(year - year_{baseline})/year_{baseline} \times 100\%$.

[c] Assessed as a one-way ANCOVA with log10(fork length) as a covariate. Post-hoc comparisons made at a log10 fork length of 1.48

Table E.6.19: Statistical Comparisons of Temporal Differences of Rainbow Trout Kidney Metal Concentrations for Quesnel River, 2015 to 2022

Parameter	Test	One-way ANOVA Year P-values	Temporal Contrasts Among Periods[a]							Magnitude of Difference Relative to Baseline Period (%)[b]						
			2015	2017	2018	2019	2020	2021	2022	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.018	B	AB	B	AB	A	AB	AB	baseline	ns	ns	ns	903	ns	ns
Antimony	MLE	0.032	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Arsenic	MLE	0.112	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Barium	MLE	<0.001	B	B	AB	AB	A	B	AB	baseline	ns	ns	ns	189	ns	ns
Beryllium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	0.016	<LRL	<LRL	A	A	A	<LRL	A	<LRL	<LRL	by	ns	ns	<LRL	ns
Cadmium	MLE	0.127	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.034	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Cesium	MLE	<0.001	A	AB	B	B	AB	B	B	baseline	ns	-51	-51	ns	-48	-52
Chromium	MLE	<0.001	C	BC	BC	BC	A	AB	BC	baseline	ns	ns	ns	649	240	ns
Cobalt	MLE	0.408	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Copper	MLE	0.025	AB	AB	B	B	A	AB	B	baseline	ns	ns	ns	ns	ns	ns
Iron	MLE	0.068	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Lead	MLE	0.058	A	A	A	<LRL	A	A	A	baseline	ns	ns	<LRL	ns	ns	ns
Lithium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	<0.001	AB	C	C	BC	A	C	C	baseline	-22	-30	ns	ns	-21	-25
Manganese	MLE	0.015	AB	B	AB	AB	A	B	B	baseline	ns	ns	ns	ns	ns	ns
Mercury (ww)[c]	MLE	<0.001	AB	A	B	B	AB	AB	AB	baseline	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	0.263	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Nickel	MLE	<0.001	B	AB	B	B	A	B	B	baseline	ns	ns	ns	218	ns	ns
Phosphorus	MLE	<0.001	BC	BC	C	B	A	BC	BC	baseline	ns	ns	ns	36	ns	ns
Potassium	MLE	<0.001	B	B	B	B	A	B	B	baseline	ns	ns	ns	23	ns	ns
Rubidium	MLE	0.234	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Selenium	MLE	0.018	B	A	AB	AB	AB	A	AB	baseline	56	ns	ns	ns	50	ns
Silver	MLE	0.126	-	-	-	-	A	A	A	-	-	-	-	baseline	ns	ns
Sodium	MLE	<0.001	C	B	B	AB	A	B	B	baseline	95	82	131	189	103	93
Strontium	MLE	0.055	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Tellurium	MLE	0.330	A	A	A	<LRL	A	A	A	baseline	ns	ns	<LRL	ns	ns	ns
Thallium	MLE	0.769	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Tin	MLE	<0.001	AB	AB	BC	AB	A	C	C	baseline	ns	ns	ns	ns	-84	-92
Titanium	MLE	0.065	-	-	-	-	A	A	A	-	-	-	-	baseline	ns	ns
Uranium	MLE	0.009	B	AB	AB	AB	A	B	B	baseline	ns	ns	ns	285	ns	ns
Vanadium	MLE	0.124	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Zinc	MLE	<0.001	B	B	B	B	A	AB	B	baseline	ns	ns	ns	41	ns	ns
Zirconium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age	ANOVA	0.019	AB	AB	A	AB	AB	B	AB	baseline	ns	ns	ns	ns	ns	ns
Fork Length	ANOVAlog	0.315	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Body Weight	ANOVAlog	0.345	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = all of the concentrations were reported as < LRL so the time period was omitted from the analysis, ww = wet weight, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight.

[a] Years that share a letter (e.g., A,B,C) had concentrations that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest concentrations. <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means as $(year_t\text{-}year_{baseline})/year_{baseline}$ x 100%.

[c] Assessed as a one-way ANCOVA with log10(fork length) as a covariate. Post-hoc comparisons made at a log10 fork length of 1.48

Table E.6.20: Statistical Comparisons of Temporal Differences of Rainbow Trout Muscle Metal Concentrations for Quesnel River, 2015 to 2022

Parameter	Test	One-way ANOVA Year P-values	Temporal Contrasts Among Periods[a]							Magnitude of Difference Relative to Baseline Period (%)[b]						
			2015	2017	2018	2019	2020	2021	2022	2015	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.011	<LRL	A	<LRL	A	A	<LRL	A	<LRL	baseline	<LRL	ns	ns	<LRL	ns
Antimony	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.006	AB	AB	AB	AB	B	A	AB	baseline	ns	ns	ns	ns	ns	ns
Barium	MLE	<0.001	BC	<LRL	BC	B	BC	C	A	baseline	<LRL	ns	ns	ns	ns	410
Beryllium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.971	A	A	<LRL	A	A	A	A	baseline	ns	<LRL	ns	ns	ns	ns
Calcium	MLE	<0.001	A	C	ABC	C	BC	AB	A	baseline	-66	ns	-66	-49	ns	ns
Cesium	MLE	0.112	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.007	<LRL	B	<LRL	AB	AB	<LRL	A	<LRL	baseline	<LRL	ns	ns	<LRL	714
Cobalt	MLE	0.038	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Copper	MLE	<0.001	BCD	AB	BCD	A	BC	D	CD	baseline	ns	ns	70	ns	ns	ns
Iron	MLE	<0.001	BC	A	C	AB	ABC	C	ABC	baseline	65	ns	ns	ns	ns	ns
Lead	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	<0.001	C	C	C	C	C	B	A	baseline	ns	ns	ns	ns	16	29
Manganese	MLE	<0.001	AB	C	BC	BC	C	BC	A	baseline	-38	ns	ns	-36	ns	ns
Mercury (ww)[c]	MLE	0.001	AB	A	C	BC	ABC	ABC	ABC	baseline	ns	-43	ns	ns	ns	ns
Molybdenum	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Nickel	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	<0.001	C	BC	BC	BC	BC	B	A	baseline	ns	ns	ns	ns	18	34
Potassium	MLE	<0.001	C	BC	BC	BC	B	B	A	baseline	ns	ns	ns	13	15	39
Rubidium	MLE	0.016	AB	AB	AB	AB	B	AB	A	baseline	ns	ns	ns	ns	ns	ns
Selenium	MLE	0.038	AB	AB	AB	AB	B	AB	A	baseline	ns	ns	ns	ns	ns	ns
Silver	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Sodium	MLE	<0.001	A	A	B	B	B	B	B	baseline	ns	-45	-36	-44	-44	-31
Strontium	MLE	<0.001	A	B	AB	B	AB	A	A	baseline	-75	ns	-70	ns	ns	ns
Tellurium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.045	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Tin	MLE	0.006	B	AB	<LRL	A	<LRL	AB	<LRL	baseline	ns	<LRL	76	<LRL	ns	<LRL
Titanium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Vanadium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.003	ABC	ABC	BC	A	AB	C	BC	baseline	ns	ns	ns	ns	ns	ns
Zirconium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age	ANOVA	0.019	AB	AB	A	AB	AB	B	AB	baseline	ns	ns	ns	ns	ns	ns
Fork Length	ANOVAlog	0.315	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns
Body Weight	ANOVAlog	0.345	A	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = all of the concentrations were reported as < LRL so the time period was omitted from the analysis, ww = wet weight, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight.

[a] Years that share a letter (e.g., A,B,C) had concentrations that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest concentrations. <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means as $(year_t - year_{baseline})/year_{baseline} \times 100\%$.

[c] Assessed as a one-way ANCOVA with log10(fork length) as a covariate. Post-hoc comparisons made at a log10 fork length of 1.48

Table E.6.21: Statistical Comparisons of Temporal Differences of Rainbow Trout Ovary Metal Concentrations for Quesnel River, 2015 to 2022

Parameter	Test	One-way ANOVA Year P-values	Temporal Contrasts Among Periods[a]						Magnitude of Difference Relative to Baseline Period (%)[b]					
			2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022
Aluminum	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Antimony	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.006	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Barium	MLE	0.086	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Beryllium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cadmium	MLE	0.555	A	A	<LRL	<LRL	<LRL	A	baseline	ns	<LRL	<LRL	<LRL	ns
Calcium	MLE	0.021	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Cesium	MLE	0.003	AB	B	AB	B	AB	A	baseline	ns	ns	ns	ns	ns
Chromium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Cobalt	MLE	0.023	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Copper	MLE	0.800	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Iron	MLE	0.754	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Lead	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Lithium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Magnesium	MLE	0.080	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Manganese	MLE	0.966	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Mercury (ww)[c]	MLE	0.134	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Molybdenum	MLE	0.064	<LRL	A	A	A	<LRL	A	<LRL	by	ns	ns	<LRL	ns
Nickel	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Phosphorus	MLE	0.119	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Potassium	MLE	0.001	AB	B	AB	AB	AB	A	baseline	ns	ns	ns	ns	ns
Rubidium	MLE	<0.001	AB	B	AB	B	B	A	baseline	ns	ns	ns	ns	ns
Selenium	MLE	0.654	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Silver	MLE	0.454	-	-	-	A	A	A	-	-	-	baseline	ns	ns
Sodium	MLE	<0.001	B	B	B	B	B	A	baseline	ns	ns	ns	ns	163
Strontium	MLE	0.013	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Tellurium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.014	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Tin	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Uranium	MLE	0.647	A	A	A	A	<LRL	A	baseline	ns	ns	ns	<LRL	ns
Vanadium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Zinc	MLE	0.728	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Zirconium	MLE	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Age	ANOVA	0.626	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Fork Length	ANOVAlog	0.764	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns
Body Weight	ANOVAlog	0.616	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the method detection limit (LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = all of the concentrations were reported as < LRL so the time period was omitted from the analysis, ww = wet weight, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, MLE = censored regression using maximum likelihood estimation. Data were analysed in units of mg/kg dry weight except mercury which was analysed in units of mg/kg wet weight.

[a] Years that share a letter (e.g., A,B,C) had concentrations that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest concentrations. <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means as $(year_i - year_{baseline})/year_{baseline} \times 100\%$.

[c] Assessed first as a one-way ANCOVA with log10(fork length) as a covariate, but the covariate was not a significant predictor of mercury concentration. Analysis proceeded as a one-way ANOVA on Mercury in units of wet weight (ww).

Table E.6.22: Tissue Accumulation of Focus Metals

Metal	Tissue Reported to Accumulate	Reference
Arsenic (non-essential)	liver, kidney	McIntyre, D.O., and T.K. Linton. 2012. Arsenic. In: C.M. Wood, A.P. Farrell and C.J. Brauner (eds.), pp. 297-349, Homeostasis and Toxicology of Non-Essential Metals. Elsevier/Academic Press, New York, NY.
		Kumari, B., V. Kumar, A.K. Sinha, J. Ahsan, A.K. Ghosh, H. Wang, and G. DeBoeck. 2016. Toxicology of Arsenic in Fish and Aquatic Systems. Environmental Chemistry Letters 15(1): 1–22.
Copper (essential)	liver, kidney	Miller, P.A., R.P. Lanno, M.E.McMaster and D.G. Dixon. 1993. Relative contributions of dietary and waterborne copper to tissue copper burdens and waterborne-copper tolerance in rainbow trout (Oncorhynchus mykiss). Canadian Journal of Fisheries and Aquatic Sciences. 50:1683-1689.
		Clearwater, S.J., S. Baskin, C.M. Wood, D.G. McDonald. 2000. Gastrointestinal uptake and distribution of copper in rainbow trout. Journal of Experimental Biology 203:2455-2466.
		Kamunde, C., M. Grosell, D. Higgs, C.M. Wood (2002). Copper metabolism in actively growing rainbow trout (*Oncorhynchus mykiss*): interactions between dietary and waterborne copper uptake. Journal of Experimental Biology 205:279-290.
		Grosell, M. 2012. Copper. In: C.M. Wood, A.P. Farrell and C.J. Brauner (eds.), pp. 53-133, Homeostasis and Toxicology of Essential Metals. Elsevier / Academic Press, New York, NY.
Iron (essential)	liver, kidney	Bury, N.R., D. Boyle and C.A. Cooper. 2012. Iron. In: C.M. Wood, A.P. Farrell and C.J. Brauner (eds.). Homeostasis and Toxicology of Essential Metals. Elsevier /Academic Press, New York. pp. 201-251.
		Desjardins, L. M., B.D. Hicks, and J.W. Hilton. 1987. Iron Catalyzed Oxidation of Trout Diets and its Effect on the Growth and Physiological Response of Rainbow Trout. Fish Physiol. Biochem. 3(4): 173–182.
Selenium (essential)	liver, kidney, ovary	Sato, T., Ose, Y., and Sakai, T. 1980. Toxicological effect of selenium on fish. Environmental Pollution Series A, Ecological and Biological 21(3): 217–224.
		Janz, D.M. 2012. Selenium. In: C.M. Wood, A.P. Farrell, and C.J. Brauner (Eds.), pp. 327-374, Homeostasis and Toxicology of Essential Metals. Elsevier/Academic Press, New York, NY.

APPENDIX F
STATISTICAL ANALYSES – CREEK HABITAT

APPENDIX F.1
SEDIMENT QUALITY

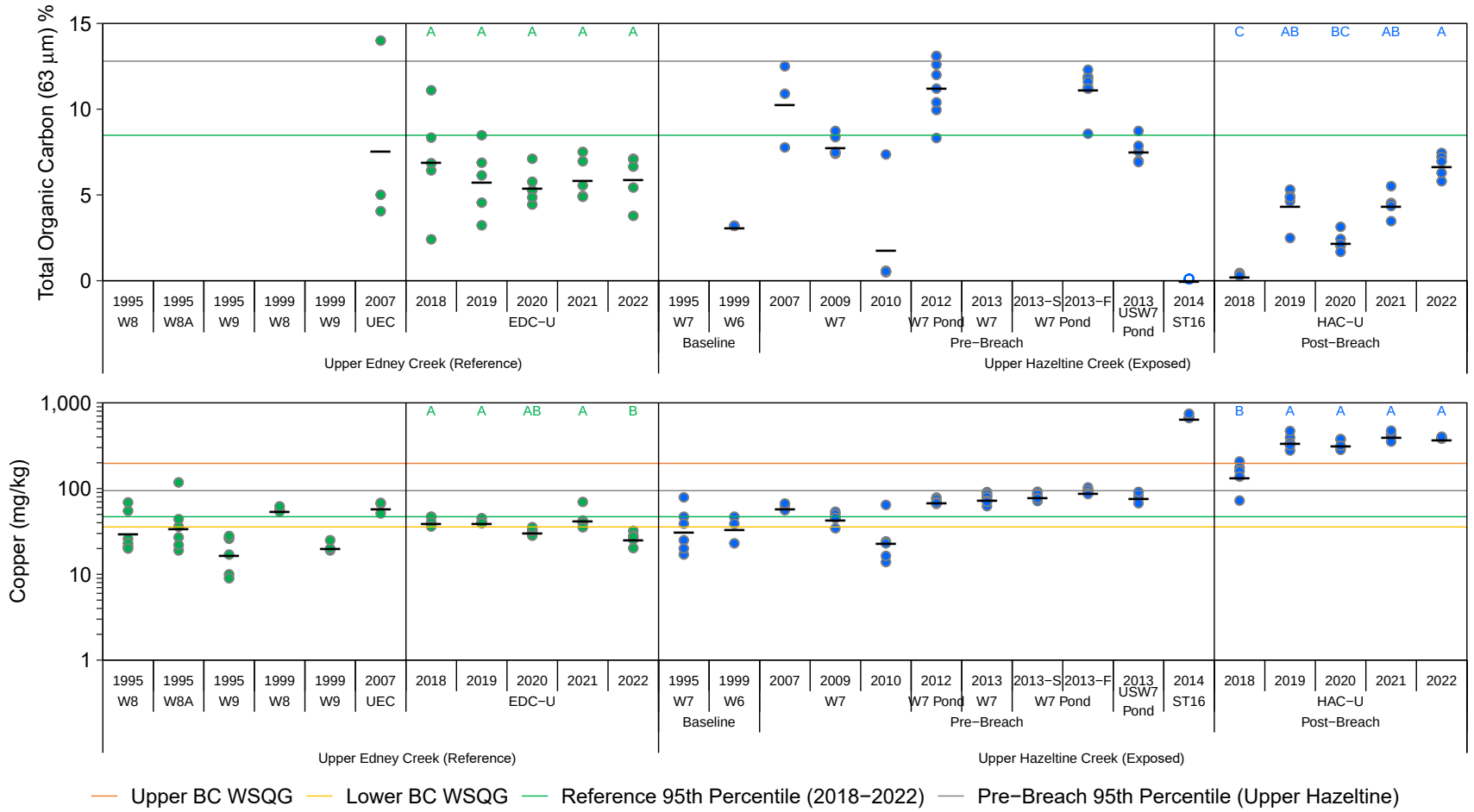

Figure F.1.1: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Notes: Data not available for all analytes in all years (particularly baseline). Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal bars. Years that share a letter within an area (i.e., EDC−U [green] and HAC−U [blue]) do not differ significantly. Statistical differences among years were evaluated from 2018 to 2022. Reference 95th Percentile was calculated with EDC−U data from 2018 to 2022. S and F following the sampling years = Spring and Fall, respectively. British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). Some sediment metal concentrations reported for 1996 (HKP 1997a) were unusually high and are suspected errors (see Appendix Table D.2.1 and D.2.2), data from 1996 were therefore not plotted, selenium was the only parameter measured in 2012 (Minnow 2013a), therefore concentrations of analytes of interest are not plotted for this year.

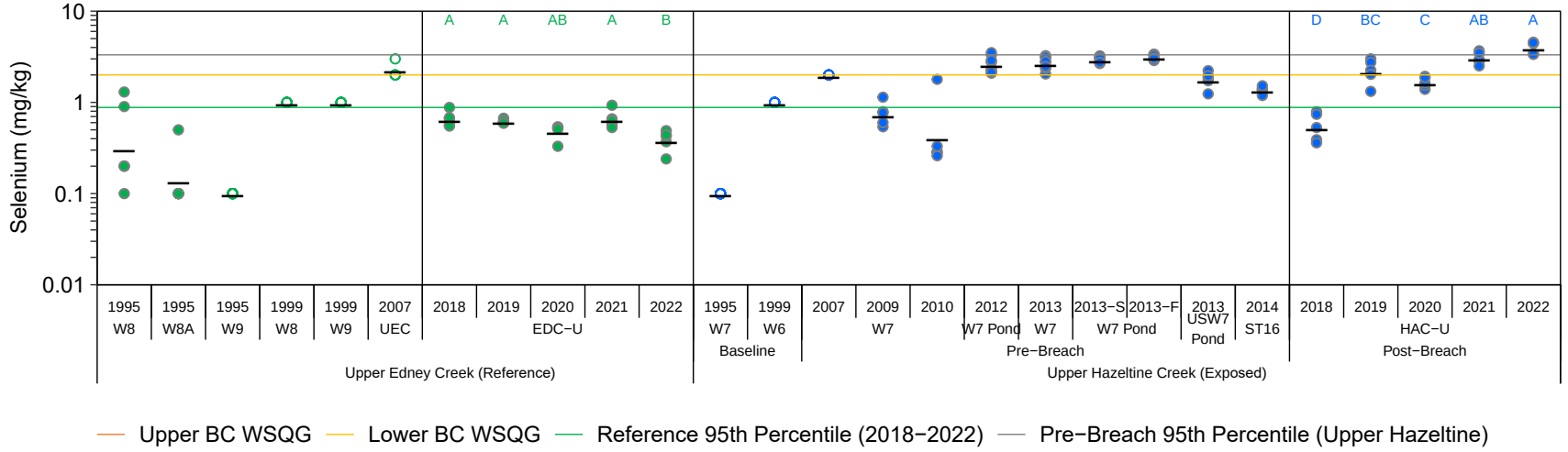

Figure F.1.1: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 1995 to 2022

Notes: Data not available for all analytes in all years (particularly baseline). Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal bars. Years that share a letter within an area (i.e., EDC−U [green] and HAC−U [blue]) do not differ significantly. Statistical differences among years were evaluated from 2018 to 2022. Reference 95th Percentile was calculated with EDC−U data from 2018 to 2022. S and F following the sampling years = Spring and Fall, respectively. British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). Some sediment metal concentrations reported for 1996 (HKP 1997a) were unusually high and are suspected errors (see Appendix Table D.2.1 and D.2.2), data from 1996 were therefore not plotted, selenium was the only parameter measured in 2012 (Minnow 2013a), therefore concentrations of analytes of interest are not plotted for this year.

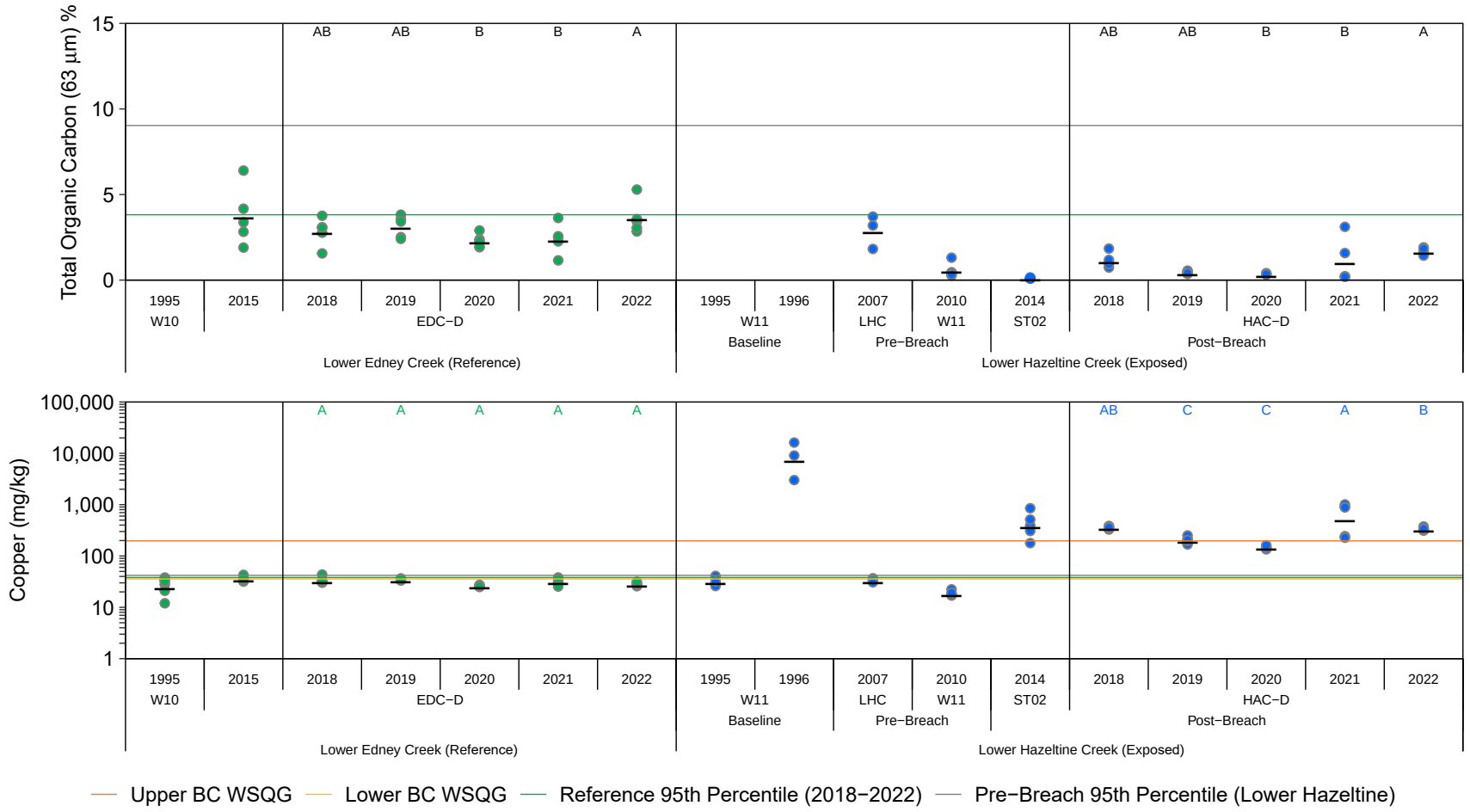

Figure F.1.2: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 1995 to 2022

Notes: Data not available for all analytes in all years (particularly baseline). Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal bars. Years that share a letter within an area (i.e., EDC−D [green] and HAC−D [blue]) do not differ significantly. Statistical differences among years were evaluated from 2018 to 2022. Reference 95th Percentile was calculated with EDC−D data from 2018 to 2022. British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). Some sediment metal concentrations reported for 1996 (HKP 1997a) were unusually high and are suspected errors (see Appendix Table D.2.1 and D.2.4), data from 1996 were therefore not plotted, selenium was the only parameter measured in 2012 (Minnow 2013a), therefore concentrations of analytes of interest are not plotted for this year.

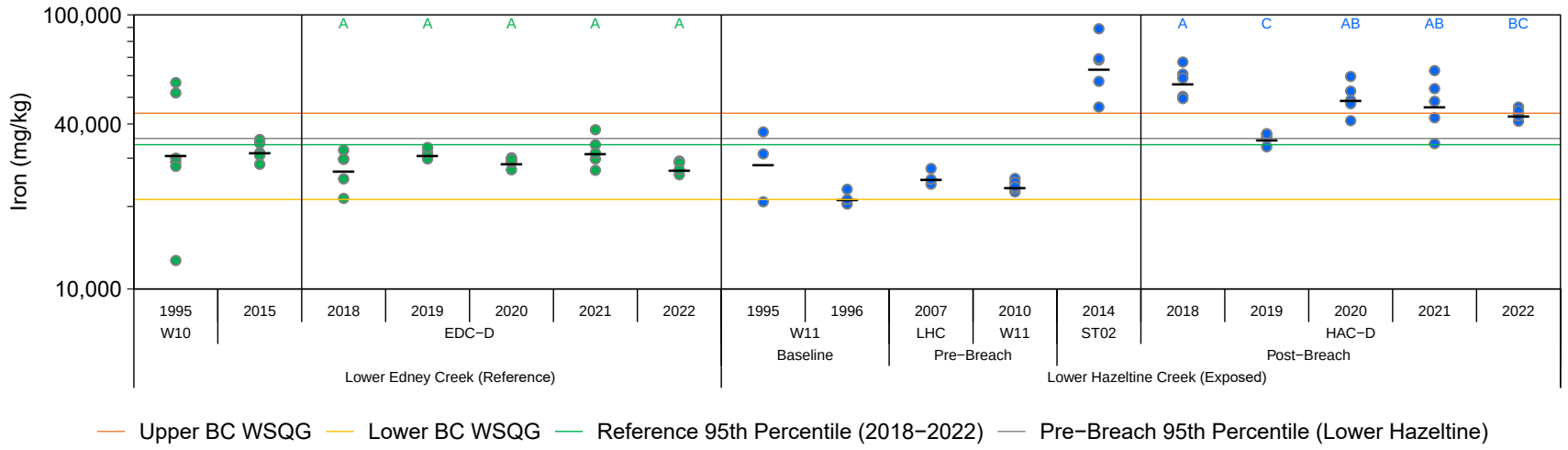

Figure F.1.2: Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 1995 to 2022

Notes: Data not available for all analytes in all years (particularly baseline). Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Means are plotted as horizontal bars. Years that share a letter within an area (i.e., EDC−D [green] and HAC−D [blue]) do not differ significantly. Statistical differences among years were evaluated from 2018 to 2022. Reference 95th Percentile was calculated with EDC−D data from 2018 to 2022. British Columbia Working Sediment Guidelines (BCMOECCS 2021a) and approved BC Sediment Quality Guideline for Selenium (BCMOECCS 2021b). Some sediment metal concentrations reported for 1996 (HKP 1997a) were unusually high and are suspected errors (see Appendix Table D.2.1 and D.2.4), data from 1996 were therefore not plotted, selenium was the only parameter measured in 2012 (Minnow 2013a), therefore concentrations of analytes of interest are not plotted for this year.

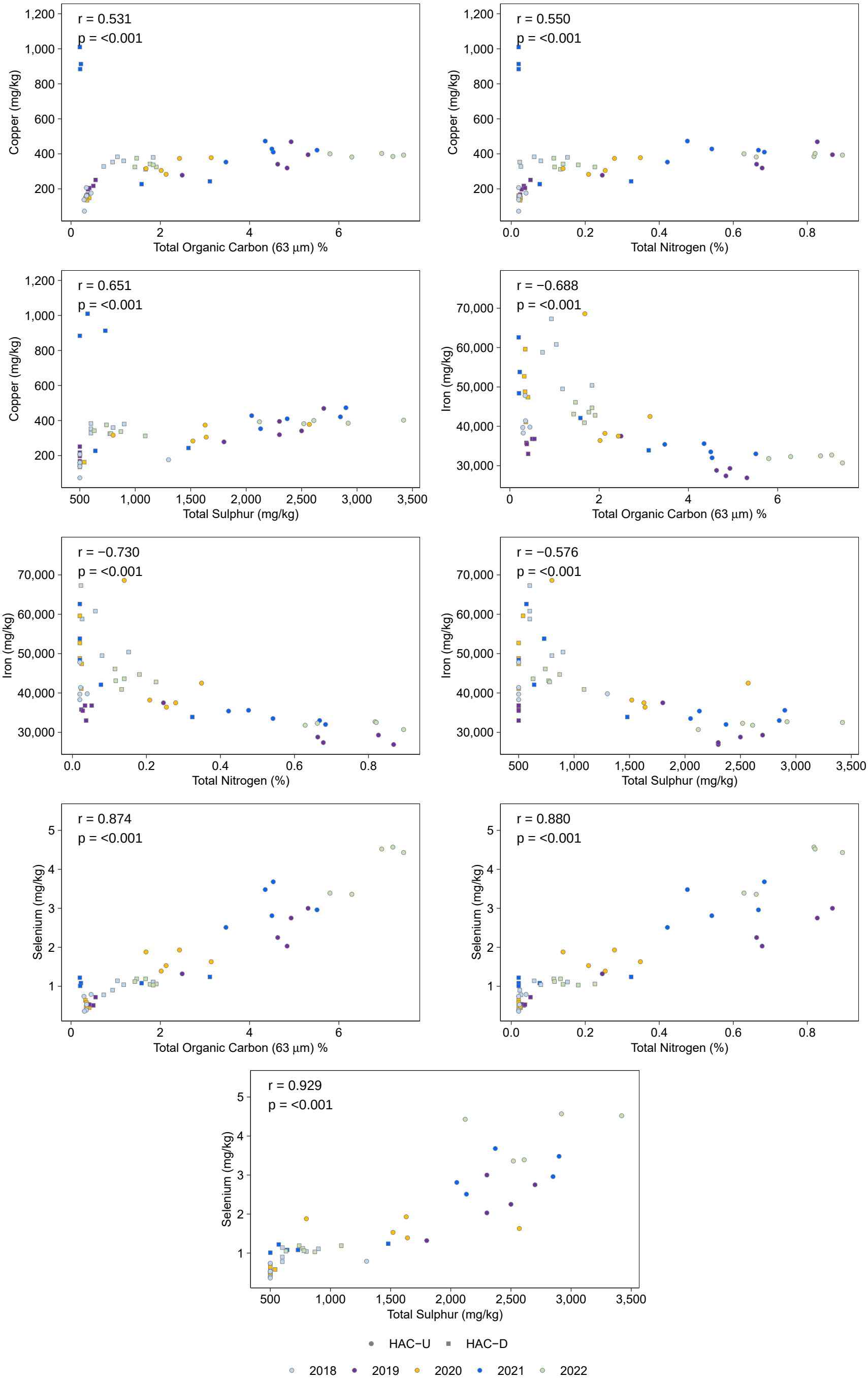

Figure F.1.3: Scatterplots of Significant Spearman's Correlation Relationships (p < 0.0125, Bonferroni Corrected) Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Upper (HAC−U; Exposed) and Lower (HAC−D; Exposed) Hazeltine Creek, 2018 to 2022

Table F.1.1: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

ANOVA Model						(Exposed - Reference) Relative Differences Among Years[a]					Relative MOD for Exposed - Reference Over Time (%)[b]			
Parameter	Units	Transformation	Area	Year	Area x Year	2018	2019	2020	2021	2022	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	<0.001	<0.001	C	AB	B	AB	A	639	292	730	1,107
Copper	mg/kg	log10	<0.001	<0.001	<0.001	C	B	B	B	A	151	196	172	331
Selenium	mg/kg	log10	<0.001	<0.001	<0.001	C	B	B	B	A	333	326	479	1,192

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates comparison not-relevant, "ns" indicates not significant, MOD = Magnitude of Difference, ANOVA = analysis of variance.

[a] Years that share a letter are not significantly different among years.

[b] MOD calculated as $((Observed_{HAC\text{-}U} - Predicted_{EDC\text{-}U})/Predicted_{EDC\text{-}U})*100$. $Predicted_{EDC\text{-}U} = Observed_{EDC\text{-}U} + (Observed_{HAC\text{-}U\ 2018} - Observed_{EDC\text{-}U\ 2018})$.

Table F.1.2: Statistical Comparisons of Spatial and Temporal Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

ANOVA Model						Area	Pairwise Differences Among Years for Each Area[a]					Do Concentrations Differ Over Time? MOD[b]				Do Concentrations Differ Between the Areas? HAC-U vs EDC-U[c]				
Parameter	Units	Transformation	Area	Year	Area x Year		2018	2019	2020	2021	2022	2019 vs 2018	2020 vs 2018	2021 vs 2018	2022 vs 2018	2018	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	<0.001	<0.001	EDC-U	A	A	A	A	A	ns	ns	ns	ns	-	-	-	-	-
						HAC-U	C	AB	BC	AB	A	1,181	ns	1,190	1,845	-95	ns	-58	ns	ns
Copper	mg/kg	log10	<0.001	<0.001	<0.001	EDC-U	A	A	AB	A	B	ns	ns	ns	ns	-	-	-	-	-
						HAC-U	B	A	A	A	A	149	131	192	176	244	765	921	838	1,384
Selenium	mg/kg	log10	<0.001	<0.001	<0.001	EDC-U	A	A	AB	A	B	ns	ns	ns	ns	-	-	-	-	-
						HAC-U	D	BC	C	AB	A	309	211	472	651	ns	252	246	370	948

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates comparison not-relevant, "ns" indicates not significant, MOD = Magnitude of Difference, ANOVA = analysis of variance.

[a] Years that do not share a letter are significantly different for that area.

[b] MOD is calculated as $((year_{recent} - year_{older})/year_{older})*100$.

[c] MOD calculated as ((HAC-U - EDC-U)/EDC-U)*100.

Table F.1.3: Statistical Comparisons of Exposed - Reference Relative Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference) Areas, 2018 to 2022

ANOVA Model						(Exposed - Reference) Relative Differences Among Years[a]					Relative MOD for Exposed - Reference Over Time (%)[b]			
Parameter	Units	Transformation	Area	Year	Area x Year	2018	2019	2020	2021	2022	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	0.001	0.288	A	A	A	A	A	ns	ns	ns	ns
Copper	mg/kg	log10	<0.001	<0.001	<0.001	A	B	B	A	A	-45	-46	ns	ns
Iron	mg/kg	log10	<0.001	0.009	<0.001	A	C	AB	B	B	-45	ns	-29	-25

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates comparison not-relevant, "ns" indicates not significant, MOD = Magnitude of Difference, ANOVA = analysis of variance.

[a] Years that share a letter are not significantly different among years.

[b] MOD calculated as $((Observed_{HAC\text{-}D} - Predicted_{EDC\text{-}D})/Predicted_{EDC\text{-}D})*100$. $Predicted_{EDC\text{-}D} = Observed_{EDC\text{-}D} + (Observed_{HAC\text{-}D\ 2018} - Observed_{EDC\text{-}D\ 2018})$.

Table F.1.4: Statistical Comparisons of Spatial and Temporal Differences of Sediment Analyte of Interest Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

ANOVA Model						Area	Pairwise Differences Among Years for Each Area[a]					Do Concentrations Differ Over Time? MOD[b]				Do Concentrations Differ Between Areas? HAC-D vs EDC-D[c]				
Parameter	Units	Transformation	Area	Year	Area x Year		2018	2019	2020	2021	2022	2019 vs 2018	2020 vs 2018	2021 vs 2018	2022 vs 2018	2018	2019	2020	2021	2022
Total Organic Carbon	%	none	<0.001	0.001	0.288	EDC-D	AB	AB	B	B	A	ns	ns	ns	ns	-	-	-	-	-
						HAC-D	AB	AB	B	B	A					-67				
Copper	mg/kg	log10	<0.001	<0.001	<0.001	EDC-D	A	A	A	A	A	ns	ns	ns	ns	-	-	-	-	-
						HAC-D	AB	C	C	A	B	-43	-59	ns	ns	966	489	471	1,580	1,089
Iron	mg/kg	log10	<0.001	0.009	<0.001	EDC-D	A	A	A	A	A	ns	ns	ns	ns	-	-	-	-	-
						HAC-D	A	C	AB	AB	BC	-38	ns	ns	-24	108	ns	71	48	57

P-value < 0.05

Indicates negative MOD

Indicates positive MOD

Notes: "-" indicates comparison not-relevant, "ns" indicates not significant, MOD = Magnitude of Difference, ANOVA = analysis of variance.

[a] Years that do not share a letter are significantly different for that area.

[b] MOD is calculated as $((year_{recent} - year_{older})/year_{older})*100$.

[c] MOD calculated as ((HAC-D - EDC-D)/EDC-D)*100.

Table F.1.5: Spearman's Correlation Relationships Between Analyte of Interest Concentrations (<63 µm Fraction) and Sediment Physical and Chemical Parameters for Upper (HAC-U; Exposed) and Lower (HAC-D; Exposed) Hazeltine Creek, 2018 to 2022

Analyte of Interest	Correlation Parameter	Clay (%)[b]	Total Organic Carbon (%)	Total Nitrogen (%)	Total Sulphur (mg/kg)
Copper (mg/kg)	Correlation Coefficient	0.02880	0.531	0.550	0.651
	Sig. (2-tailed)	0.841	<0.001	<0.001	<0.001
Iron (mg/kg)	Correlation Coefficient	0.0925	-0.688	-0.730	-0.576
	Sig. (2-tailed)	0.519	<0.001	<0.001	<0.001
Selenium (mg/kg)	Correlation Coefficient	-0.08310	0.874	0.880	0.929
	Sig. (2-tailed)	0.562	<0.001	<0.001	<0.001

Significant correlation; p-value < 0. 0125 (p<0.05, Bonferroni corrected for 4 independent variables).

Notes: n=51 for all correlations. Analyte of Interest was defined as an analyte at the exposed areas with a mean concentration that exceeded guidelines as well as reference 95th percentile values. Mg/kg = milligrams per kilogram.

[a] Results below the Laboratory Reporting Limit (LRL) were used at the LRL for calculations.

[b] % clay represents the clay proportion of the < 63 µm (silt and clay) sediment fraction that was used for metals analysis. % clay was calculated as: [% clay] / [% silt and clay].

APPENDIX F.2
PERIPHYTON COMMUNITY
& PRODUCTIVITY

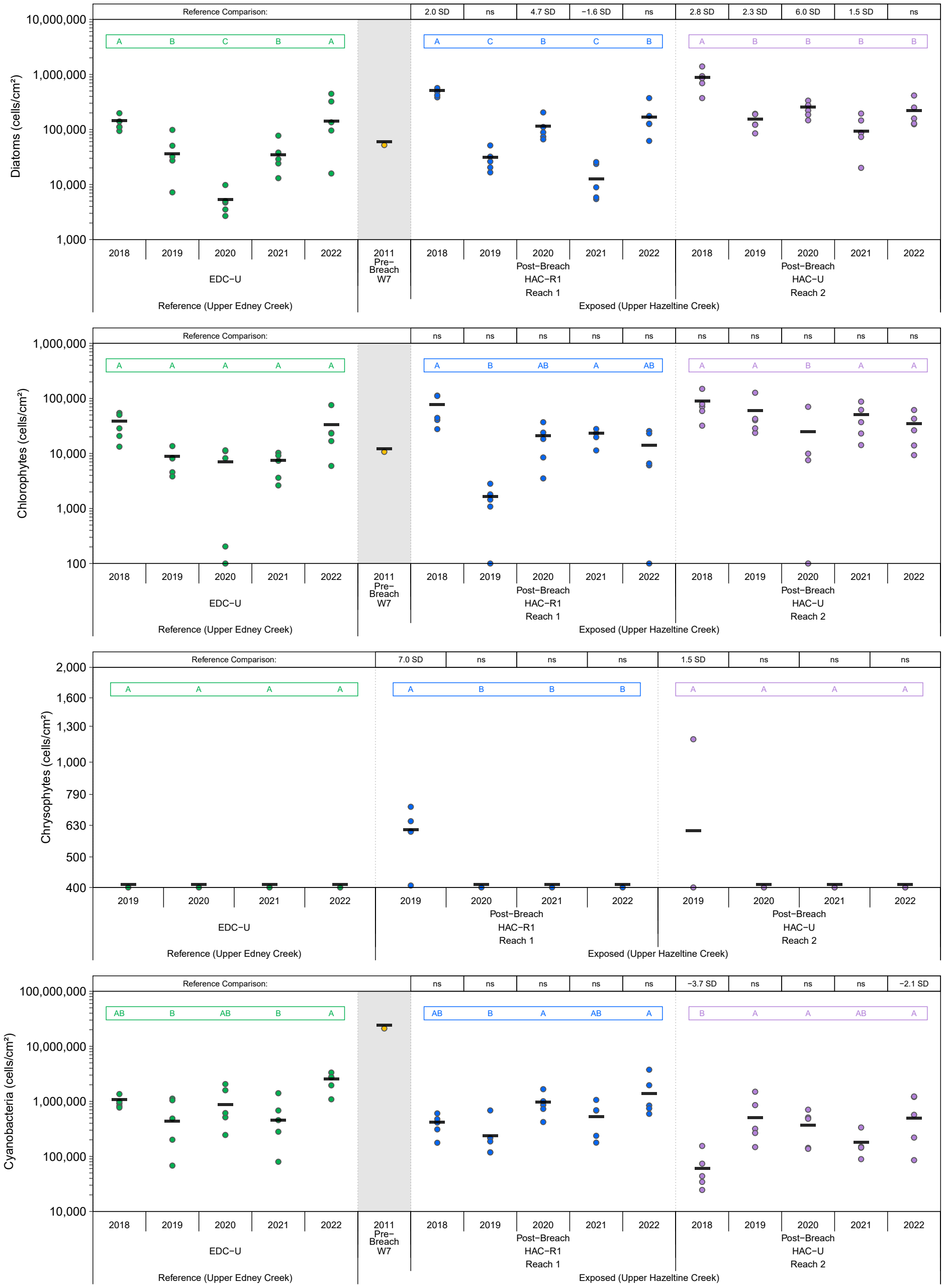

Figure F.2.1: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

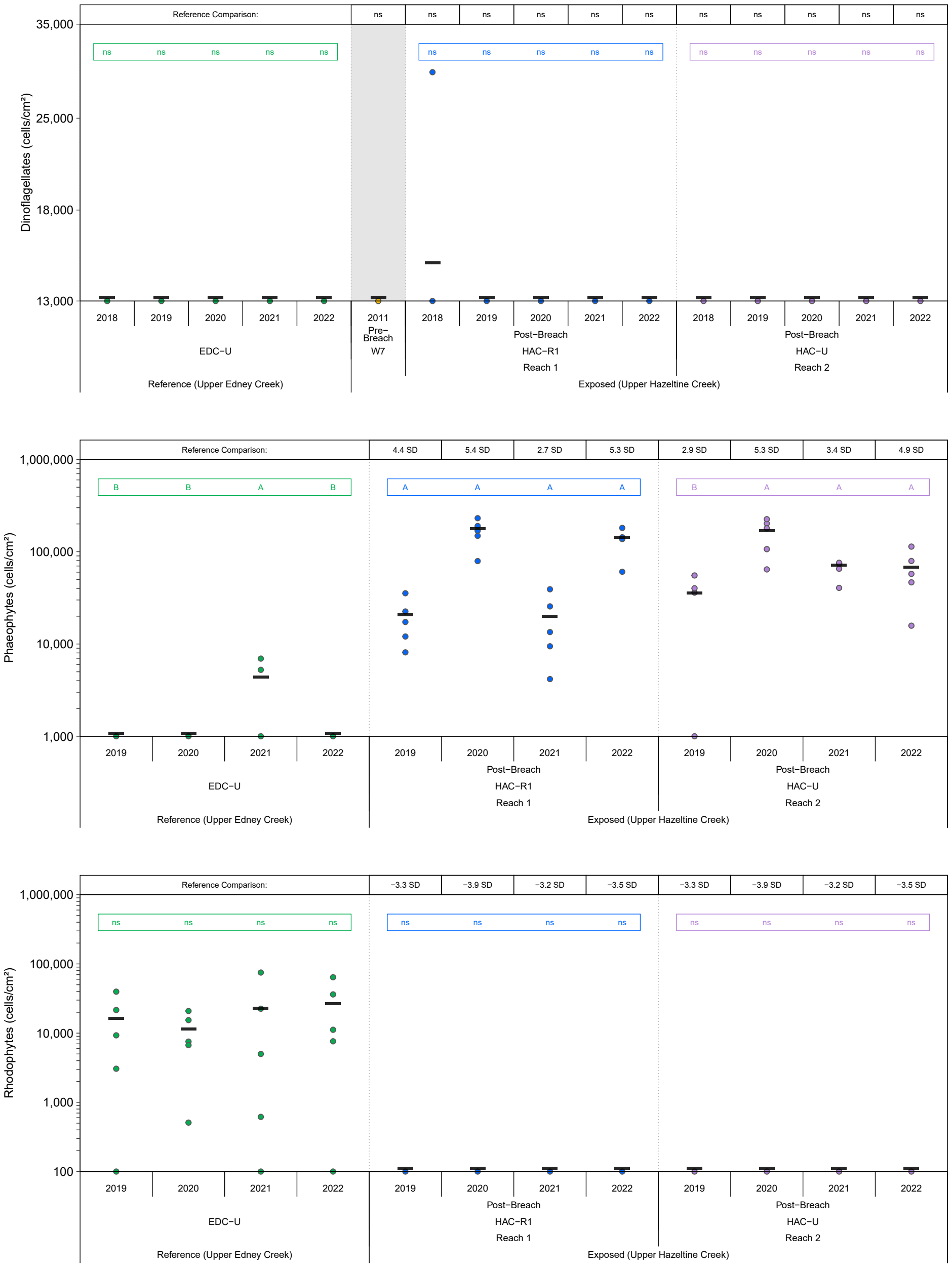

Figure F.2.1: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

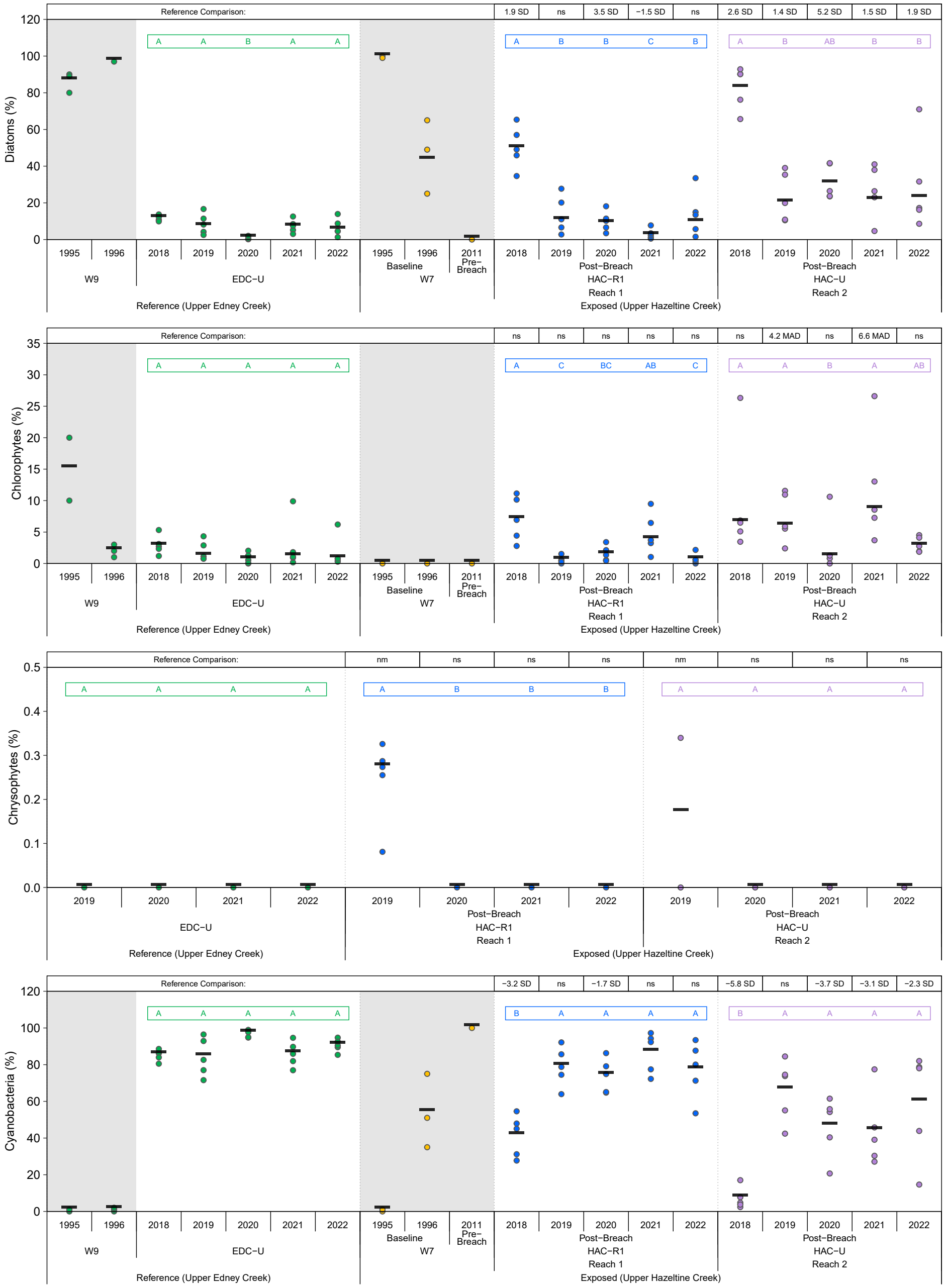

Figure F.2.1: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

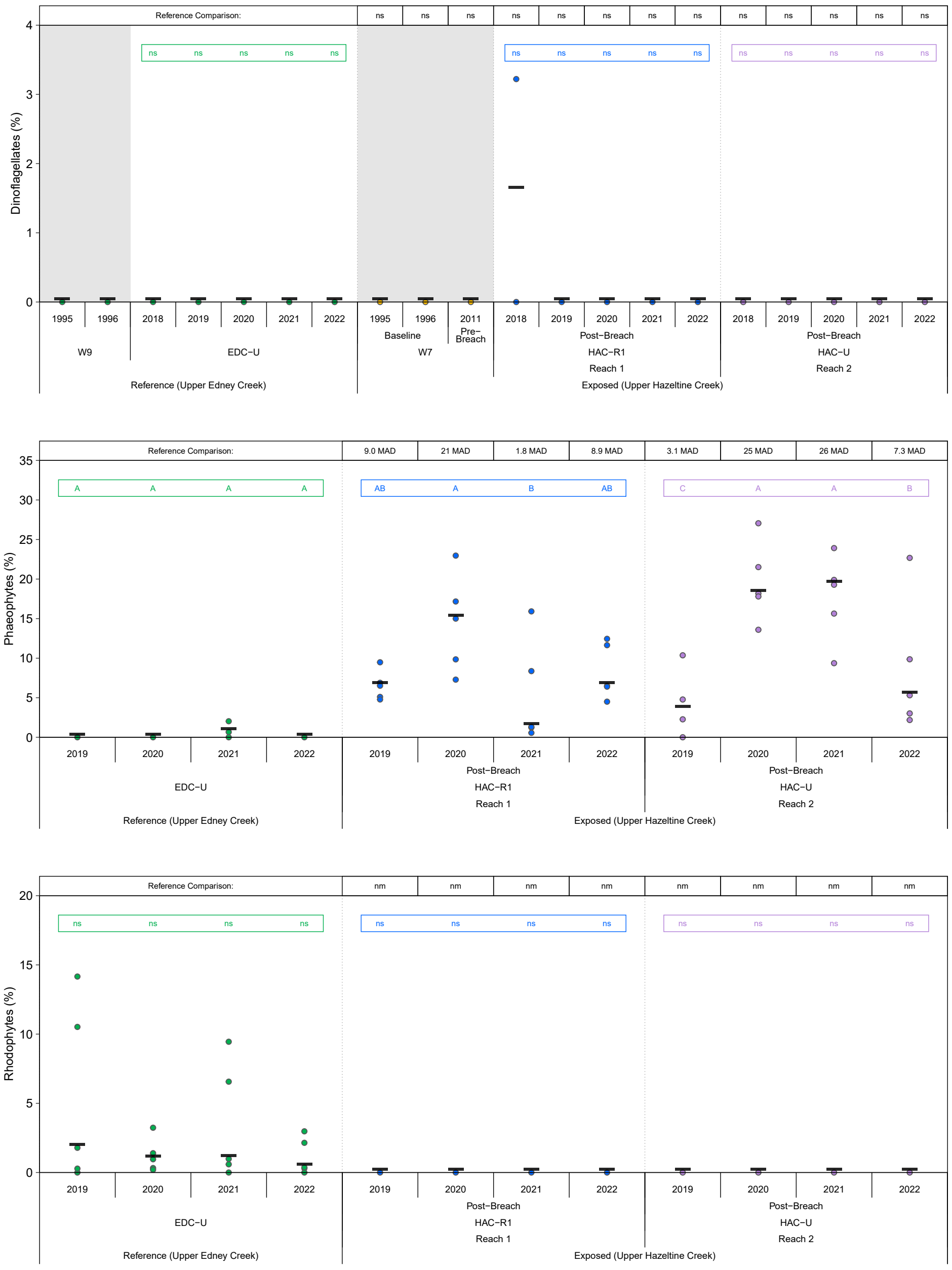

Figure F.2.1: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

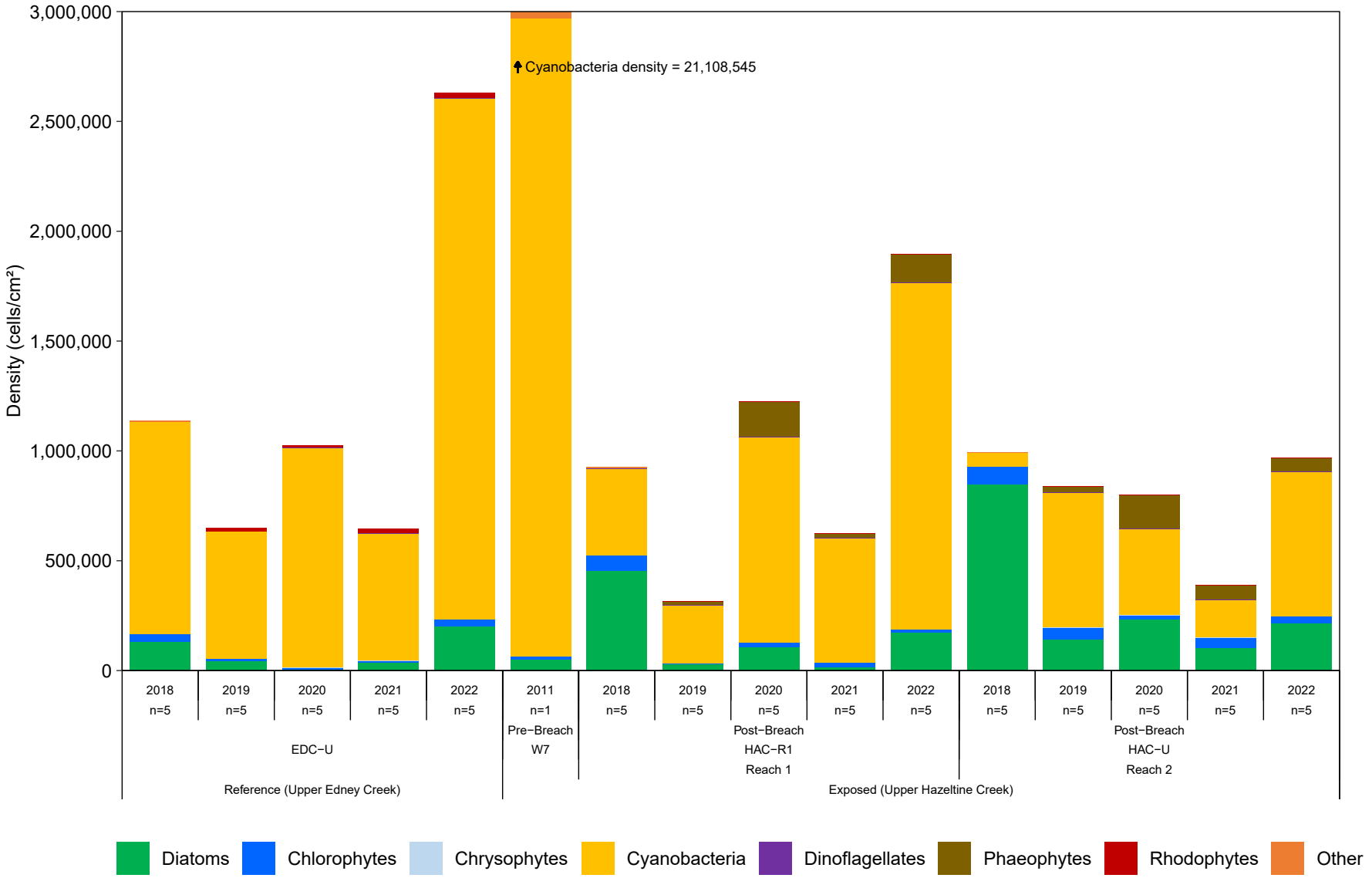

Figure F.2.2: Mean Densities of Major Periphyton Community Taxonomic Groups for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2011 to 2022

Notes: The sampling area W7 (2011) is the pre-breach equivalent of the post-breach sampling areas HAC-R1 and HAC-U (2018 to 2022). Densities of taxonomic groups are not displayed for baseline (1995 and 1996) results due to the qualitative nature of these data. In 2018 and earlier, Chrysophytes, Phaeophytes, and Rhodophytes are grouped into the 'Other' category. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. See Minnow 2019a for detailed laboratory results for 2018. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

Table F.2.1: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	MCT[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
									Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Area x Year					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Diatoms (cells/cm²)	log10	-	-	<0.001	Reference	EDC-U	2018	126,176	A	B	C	B	A	Baseline	-2.1	-5.1	-2.2	ns	2.0	2.8
							2019	31,531											ns	2.3
							2020	4,644											4.7	6.0
							2021	30,567											-1.6	1.5
							2022	123,963											ns	ns
					Exposed	HAC-R1	2018	450,027	A	C	B	C	B	Baseline	-4.3	-2.3	-5.7	-1.8			ns
							2019	27,089												2.5
							2020	99,548												ns
							2021	11,119												3.1
							2022	145,276												ns
					Exposed	HAC-U	2018	778,654	A	B	B	B	B	Baseline	-2.7	-1.9	-3.5	-2.2			
							2019	135,723												
							2020	223,317												
							2021	81,504												
							2022	192,176												
Chlorophytes (cells/cm²)	log10(x+1)	-	-	0.014	Reference	EDC-U	2018	29,250	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns
							2019	6,913											ns	ns
							2020	731											ns	ns
							2021	5,798											ns	ns
							2022	20,992											ns	ns
					Exposed	HAC-R1	2018	57,246	A	B	AB	A	AB	Baseline	-2.2	ns	ns	ns			ns
							2019	379												2.0
							2020	13,681												-1.6
							2021	20,221												ns
							2022	1,879												ns
					Exposed	HAC-U	2018	68,990	A	A	B	A	A	Baseline	ns	-2.3	ns	ns			
							2019	42,943												
							2020	349												
							2021	36,554												
							2022	24,563												
Chrysophytes (cells/cm²)	log10(x+1)	-	-	<0.001	Reference	EDC-U	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns	-		
							2019	0											7.0	1.5
							2020	0											ns	ns
							2021	0											ns	ns
							2022	0											ns	ns
					Exposed	HAC-R1	2018	-	-	A	B	B	B	-	Baseline	-7.0	-7.0	-7.0			-
							2019	586												-5.4
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns			
							2019	3.10												
							2020	0												
							2021	0												
							2022	0												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD)=0. Results are only displayed for periphyton community endpoints with sufficient data available to complete statistical analyses. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table F.2.1: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	MCT[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
									Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Area x Year					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Cyanobacteria (cells/cm²)	log10	-	-	0.004	Reference	EDC-U	2018	948,559	AB	B	AB	B	A	Baseline	ns	ns	ns	ns	ns	-3.7
							2019	378,869											ns	ns
							2020	758,872											ns	ns
							2021	396,551											ns	ns
							2022	2,217,139											ns	-2.1
					Exposed	HAC-R1	2018	364,886	AB	B	A	AB	A	Baseline	ns	ns	ns	ns		-2.5
							2019	207,639												ns
							2020	849,061												ns
							2021	461,427												-1.4
							2022	1,223,298												ns
					Exposed	HAC-U	2018	53,085	B	A	A	AB	A	Baseline	2.7	2.3	ns	2.7		
							2019	437,074												
							2020	320,667												
							2021	156,406												
							2022	436,124												
Dinoflagellates (cells/cm²)	log10(x+1)	0.373	0.414	0.446	Reference	EDC-U	2018	0	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns	ns	ns
							2019	0											ns	ns
							2020	0											ns	ns
							2021	0											ns	ns
							2022	0											ns	ns
					Exposed	HAC-R1	2018	6.80	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns		ns
							2019	0												ns
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	0	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns		
							2019	0												
							2020	0												
							2021	0												
							2022	0												
Phaeophytes (cells/cm²)	log10(x+1)	-	-	0.012	Reference	EDC-U	2018	-	-	B	B	A	B	-	Baseline	ns	1.6	ns	-	
							2019	0											4.4	2.9
							2020	0											5.4	5.3
							2021	32.0											2.7	3.4
							2022	0											5.3	4.9
					Exposed	HAC-R1	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns		-
							2019	16,835												-1.5
							2020	154,113												ns
							2021	13,960												ns
							2022	124,398												ns
					Exposed	HAC-U	2018	-	-	B	A	A	A	-	Baseline	2.5	2.1	2.0		
							2019	603												
							2020	141,111												
							2021	64,349												
							2022	52,018												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD)=0. Results are only displayed for periphyton community endpoints with sufficient data available to complete statistical analyses. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table F.2.1: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	MCT[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
									Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Area x Year					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Rhodophytes (cells/cm²)	log10(x+1)	<0.001	0.931	0.991	Reference	EDC-U	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns	-	
							2019	1,893											-3.3	-3.3
							2020	6,077											-3.9	-3.9
							2021	1,390											-3.2	-3.2
							2022	2,878											-3.5	-3.5
					Exposed	HAC-R1	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns		-
							2019	0												ns
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns		
							2019	0												
							2020	0												
							2021	0												
							2022	0												
Diatoms (%)	log10	-	-	<0.001	Reference	EDC-U	2018	0.110	A	A	B	A	A	Baseline	ns	-3.9	ns	ns	1.9	2.6
							2019	0.0700											ns	1.4
							2020	0.00590											3.5	5.2
							2021	0.0660											-1.5	1.5
							2022	0.0510											ns	1.9
					Exposed	HAC-R1	2018	0.490	A	B	B	C	B	Baseline	-2.1	-2.3	-4.2	-2.2		ns
							2019	0.100												ns
							2020	0.0860												1.7
							2021	0.0210												3.1
							2022	0.0900												ns
					Exposed	HAC-U	2018	0.820	A	B	AB	B	B	Baseline	-1.9	ns	-1.8	-1.7		
							2019	0.200												
							2020	0.300												
							2021	0.210												
							2022	0.220												
Chlorophytes (%)	rank	-	-	0.015	Reference	EDC-U	2018	0.0270	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns	ns
							2019	0.0110											ns	4.2
							2020	0.00550											ns	ns
							2021	0.0110											ns	6.6
							2022	0.00740											ns	ns
					Exposed	HAC-R1	2018	0.0690	A	C	BC	AB	C	Baseline	-5.7	-4.9	ns	-5.6		ns
							2019	0.00460												4.8
							2020	0.0140												ns
							2021	0.0370												ns
							2022	0.00570												1.9
					Exposed	HAC-U	2018	0.0650	A	A	B	A	AB	Baseline	ns	-5.0	ns	ns		
							2019	0.0590												
							2020	0.00800												
							2021	0.0850												
							2022	0.0280												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD)=0. Results are only displayed for periphyton community endpoints with sufficient data available to complete statistical analyses. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table F.2.1: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	MCT[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
									Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Area x Year					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Chrysophytes (%)	rank	-	-	<0.001	Reference	EDC-U	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns	-	
							2019	0											nm	nm
							2020	0											ns	ns
							2021	0											ns	ns
							2022	0											ns	ns
					Exposed	HAC-R1	2018	-	-	A	B	B	B	-	Baseline	nm	nm	nm		-
							2019	0.00270												nm
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns		
							2019	0												
							2020	0												
							2021	0												
							2022	0												
Cyanobacteria (%)	none	-	-	<0.001	Reference	EDC-U	2018	0.850	A	A	A	A	A	Baseline	ns	ns	ns	ns	-3.2	-5.8
							2019	0.840											ns	ns
							2020	0.970											-1.7	-3.7
							2021	0.860											ns	-3.1
							2022	0.910											ns	-2.3
					Exposed	HAC-R1	2018	0.410	B	A	A	A	A	Baseline	2.8	2.4	3.4	2.7		-2.5
							2019	0.790												ns
							2020	0.740												-2.0
							2021	0.870												-3.2
							2022	0.770												ns
					Exposed	HAC-U	2018	0.0710	B	A	A	A	A	Baseline	4.4	2.9	2.7	3.9		
							2019	0.660												
							2020	0.460												
							2021	0.440												
							2022	0.590												
Dinoflagellates (%)	rank	0.373	0.414	0.446	Reference	EDC-U	2018	0	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns	ns	ns
							2019	0											ns	ns
							2020	0											ns	ns
							2021	0											ns	ns
							2022	0											ns	ns
					Exposed	HAC-R1	2018	0	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns		ns
							2019	0												ns
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	0	ns	ns	ns	ns	ns	Baseline	ns	ns	ns	ns		
							2019	0												
							2020	0												
							2021	0												
							2022	0												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD)=0. Results are only displayed for periphyton community endpoints with sufficient data available to complete statistical analyses. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table F.2.1: Results of Statistical Comparisons of Periphyton Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year	MCT[a]	Temporal Contrasts Within Sites										Spatial Comparison Within Years	
									Pairwise Comparisons Between Years					MOD Relative to Baseline[b]						
		Area	Year	Area x Year					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Phaeophytes (%)	rank	-	-	<0.001	Reference	EDC-U	2018	-	-	A	A	A	A	-	Baseline	ns	ns	ns	-	
							2019	0											9.0	3.1
							2020	0											21	25
							2021	0											1.8	26
							2022	0											8.9	7.3
					Exposed	HAC-R1	2018	-	-	AB	A	B	AB	-	Baseline	ns	ns	ns		-
							2019	0.0650												ns
							2020	0.150												ns
							2021	0.0130												25
							2022	0.0650												ns
					Exposed	HAC-U	2018	-	-	C	A	A	B	-	Baseline	22	23	4.2		
							2019	0.0230												
							2020	0.180												
							2021	0.190												
							2022	0.0530												
Rhodophytes (%)	rank	<0.001	0.942	0.994	Reference	EDC-U	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns	-	
							2019	0.0180											nm	nm
							2020	0.00960											nm	nm
							2021	0.00980											nm	nm
							2022	0.00370											nm	nm
					Exposed	HAC-R1	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns		-
							2019	0												ns
							2020	0												ns
							2021	0												ns
							2022	0												ns
					Exposed	HAC-U	2018	-	-	ns	ns	ns	ns	-	Baseline	ns	ns	ns		
							2019	0												
							2020	0												
							2021	0												
							2022	0												

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD)=0. Results are only displayed for periphyton community endpoints with sufficient data available to complete statistical analyses. Periphyton data were classified as "Other" taxa in laboratory results issued in 2018 but the taxonomic groups contained in this category were unknown (i.e., unknown taxonomic idenification of these organisms), but suspected to include Phaeophytes, Chrysophytes, and Rhodophytes. Temporal statistical contrasts therefore excluded 2018 data for these taxon groups (Phaeophytes, Chrysophytes, and Rhodophytes) which were reported as absent from all samples in 2018 data. See Minnow 2019a for detailed laboratory results for 2018. Data reported in 2018 for this "Other" category has therefore excluded from data presentation and analyses in the present report. Periphyton taxonomy results have not been reported in an "Other" category by the laboratory since 2018. See report Section 4.2.3.1 for details.

[a] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[b] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

Table F.2.2: Results of Statistical Comparisons of Periphyton Productivity Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Endpoint	Transformation	2-Way ANOVA P-values			Area Type	Area	Year[a]	MCT[a]	Temporal Contrasts Within Sites: Pairwise Comparisons Between Years									Temporal Contrasts Within Sites: MOD Relative to Baseline[c,b]									Spatial Comparison Within Years[c]	
		Area	Year	Area x Year					1995 [d]	1996 [d]	2011 [d]	2017	2018	2019	2020	2021	2022	1995	1996	2011	2017	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Chlorophyll-a (mg/m²)	log10	-	-	<0.001	Reference	EDC-U	1995	9.30	BCD	ABC	nc	nc	BCD	AB	CD	D	A	Baseline	ns	nc	nc	ns	ns	ns	ns	2.8	ns	
							1996	16.0																			ns	
							2018	11.0																			ns	ns
							2019	20.0																			1.7	ns
							2020	7.00																			4.1	ns
							2021	5.00																			3.6	3.1
							2022	36.0																			1.7	ns
					Exposed	HAC-R1	1995	8.80	D	BCD	BCD	D	CD	AB	AB	BC	A	Baseline	ns	ns	ns	ns	3.4	3.7	2.5	4.6		nc[e]
							1996	19.0																				nc[e]
							2011	15.0																				nc[e]
							2018	16.0																				ns
							2019	46.0																				ns
							2020	52.0																				-3.0
							2021	29.0																				ns
							2022	82.0																				-2.4
					Exposed	HAC-U	1995	8.80	C	ABC	ABC	nc	BC	A	BC	AB	AB	Baseline	ns	ns	nc	ns	2.8	ns	ns	2.2		
							1996	19.0																				
							2011	15.0																				
							2018	12.0																				
							2019	35.0																				
							2020	12.0																				
							2021	22.0																				
							2022	26.0																				
Ash Free Dry Mass (g/m²)	log10	-	-	<0.001	Reference	EDC-U	1995	-	-	-	-	-	A	A	A	A	A	-	-	-	-	Baseline	ns	ns	ns	ns	-	-
							1996	-																			-	-
							2018	6.00																			ns	ns
							2019	7.90																			3.6	2.4
							2020	7.60																			5.1	3.7
							2021	4.40																			2.2	3.6
							2022	9.20																			4.2	2.3
					Exposed	HAC-R1	1995	-	-	-	-	C	BC	A	A	B	A	-	-	-	Baseline	ns	4.6	6.0	2.1	5.5		-
							1996	-																				-
							2011	-																				-
							2018	11.0																				ns
							2019	55.0																				ns
							2020	121																				-1.4
							2021	14.0																				1.4
							2022	91.0																				-1.9
					Exposed	HAC-U	1995	-	-	-	-	-	B	A	A	A	A	-	-	-	-	Baseline	2.0	3.2	2.1	2.2		
							1996	-																				
							2011	-																				
							2018	9.90																				
							2019	30.0																				
							2020	57.0																				
							2021	31.0																				
							2022	32.0																				

P-value < 0.1.
Magnitude of Difference (MOD) < -2.
Magnitude of Difference (MOD) > 2.

Notes: "-" = no data available. "nc" = no comparison. "ns" = no significance. "nm" = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) =0.

[a] 1995, 1996 and 2011 data from UHC (W7).

[b] MCT = Measure of Central Tendency, which is the mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the

[d] Pairwise contrasts of post-breach (2017 to 2022) data from HAC-R1 and HAC-U against baseline (1995 and 1996) and pre-breach (2011) data from W7 are indicated with an * for contrasts to 1995 data , † for contrasts to 1996 data, and ‡ for contrasts to 2011 data in Figure 6.5.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 1995, 1996, and 2011 were not calculated because W7 data from these years represents baseline or pre-breach conditions for both HAC-R1 and HAC-U.

APPENDIX F.3
BENTHIC COMMUNITY
AND PRODUCTIVITY

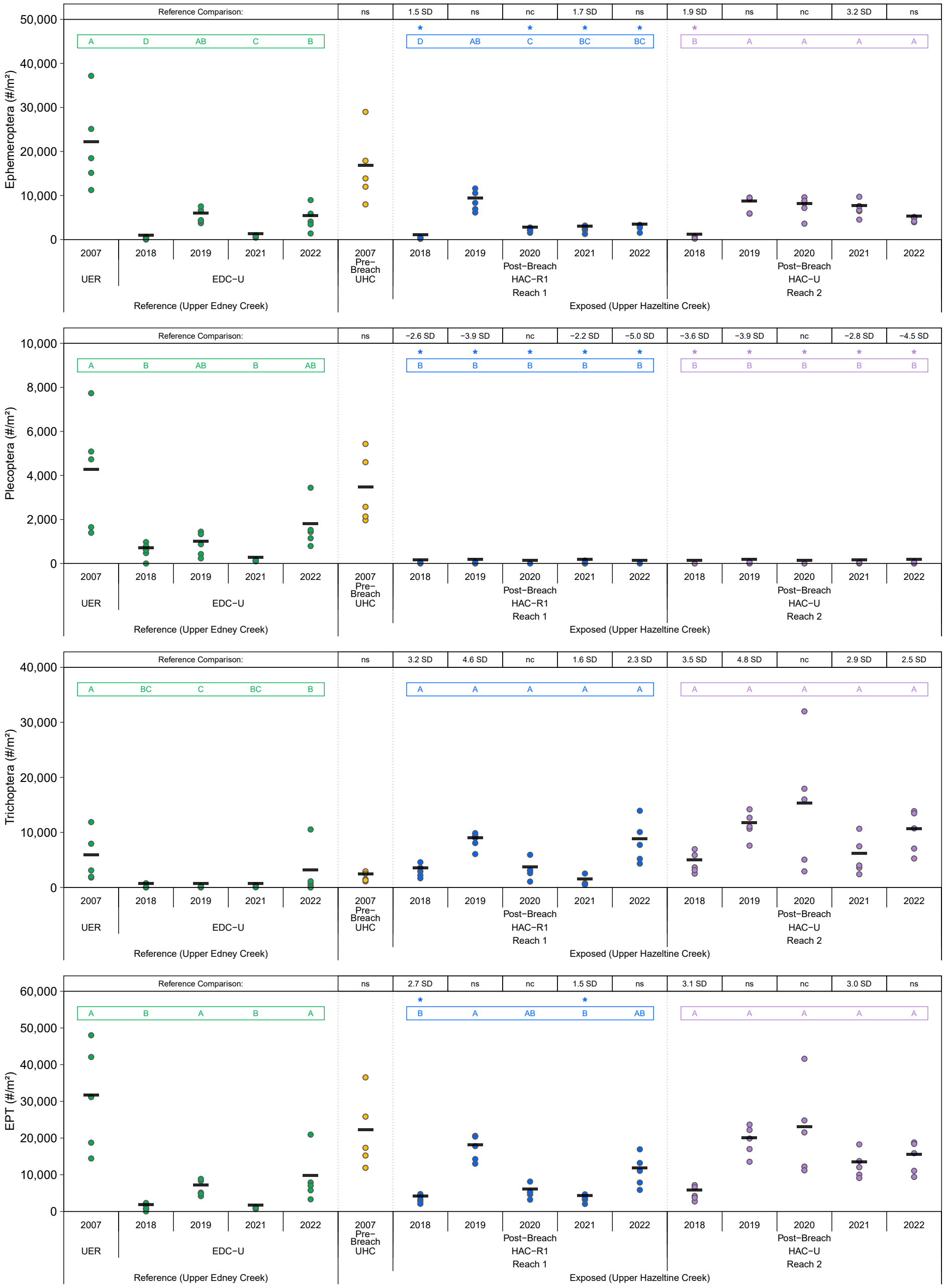

Figure F.3.1: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post −breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

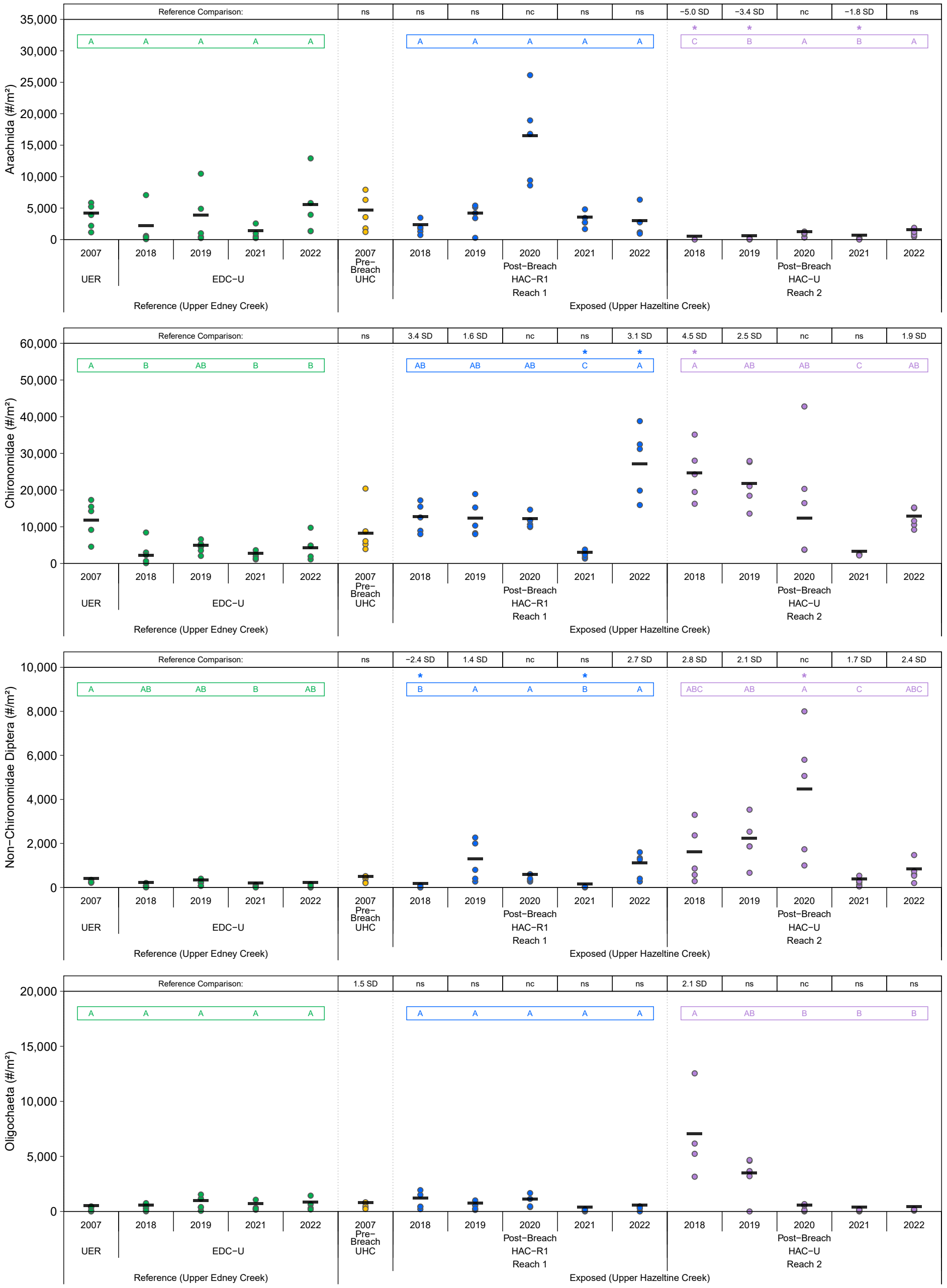

Figure F.3.1: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post −breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

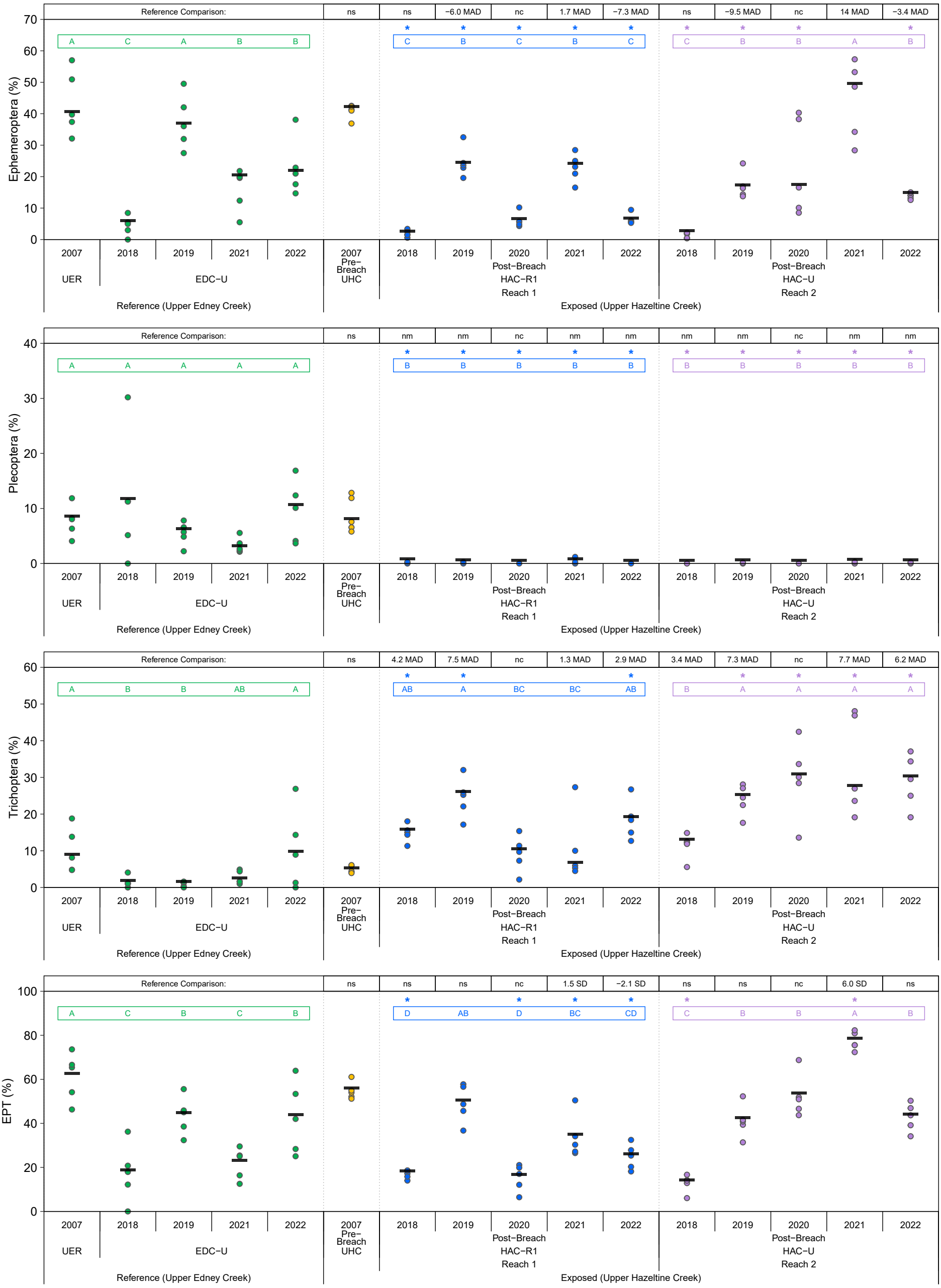

Figure F.3.1: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post −breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

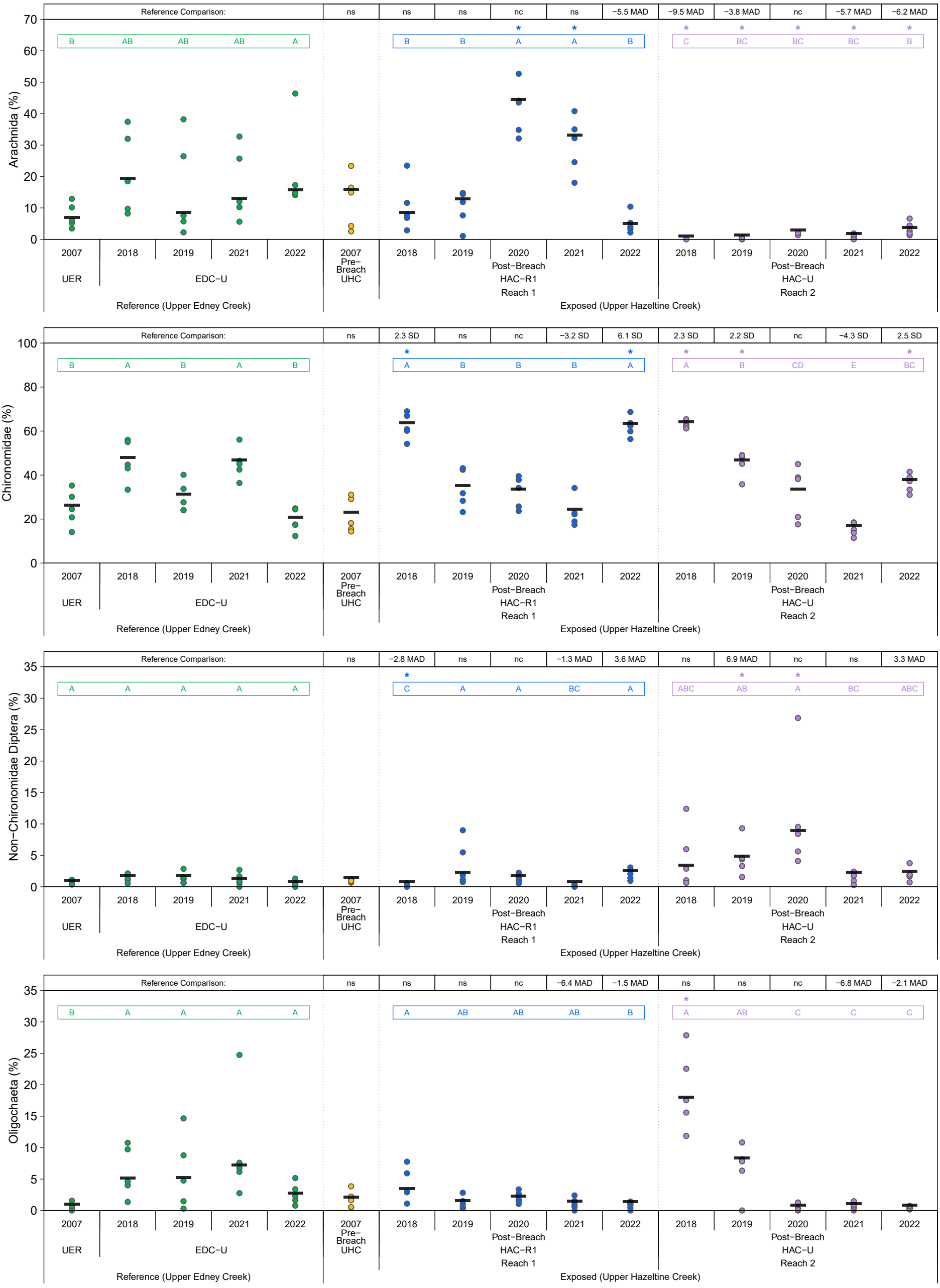

Figure F.3.1: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post −breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

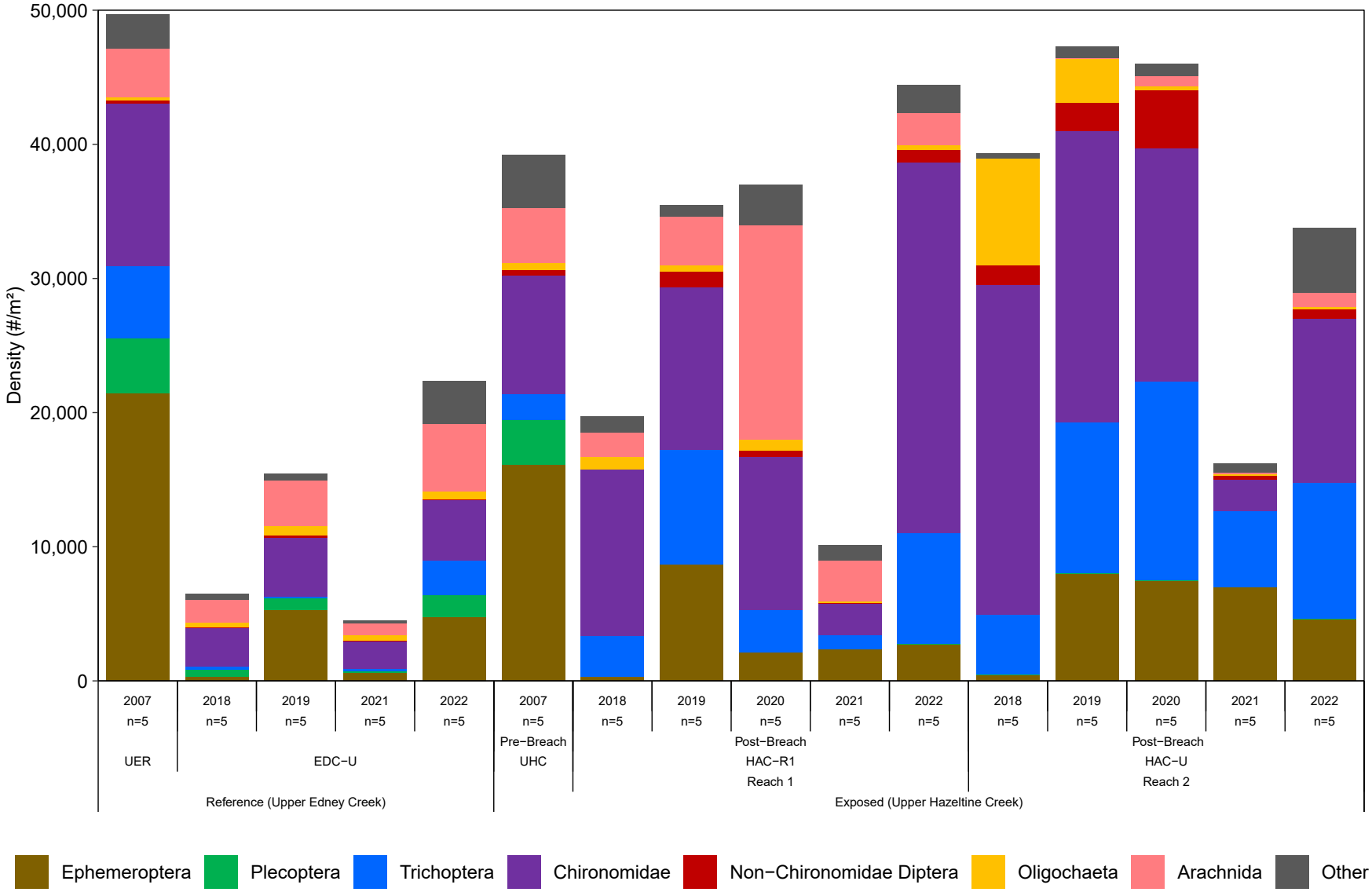

Figure F.3.2: Mean Densities of Major Benthic Invertebrate Community Taxonomic Groups for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Notes: The sampling area UHC (2007) is the pre-breach equivalent of the post-breach sampling areas HAC-R1 and HAC-U (2018 to 2022). The sampling area UER (2007) is the pre-breach equivalent of the post-breach sampling area EDC-U (2018 to 2022).

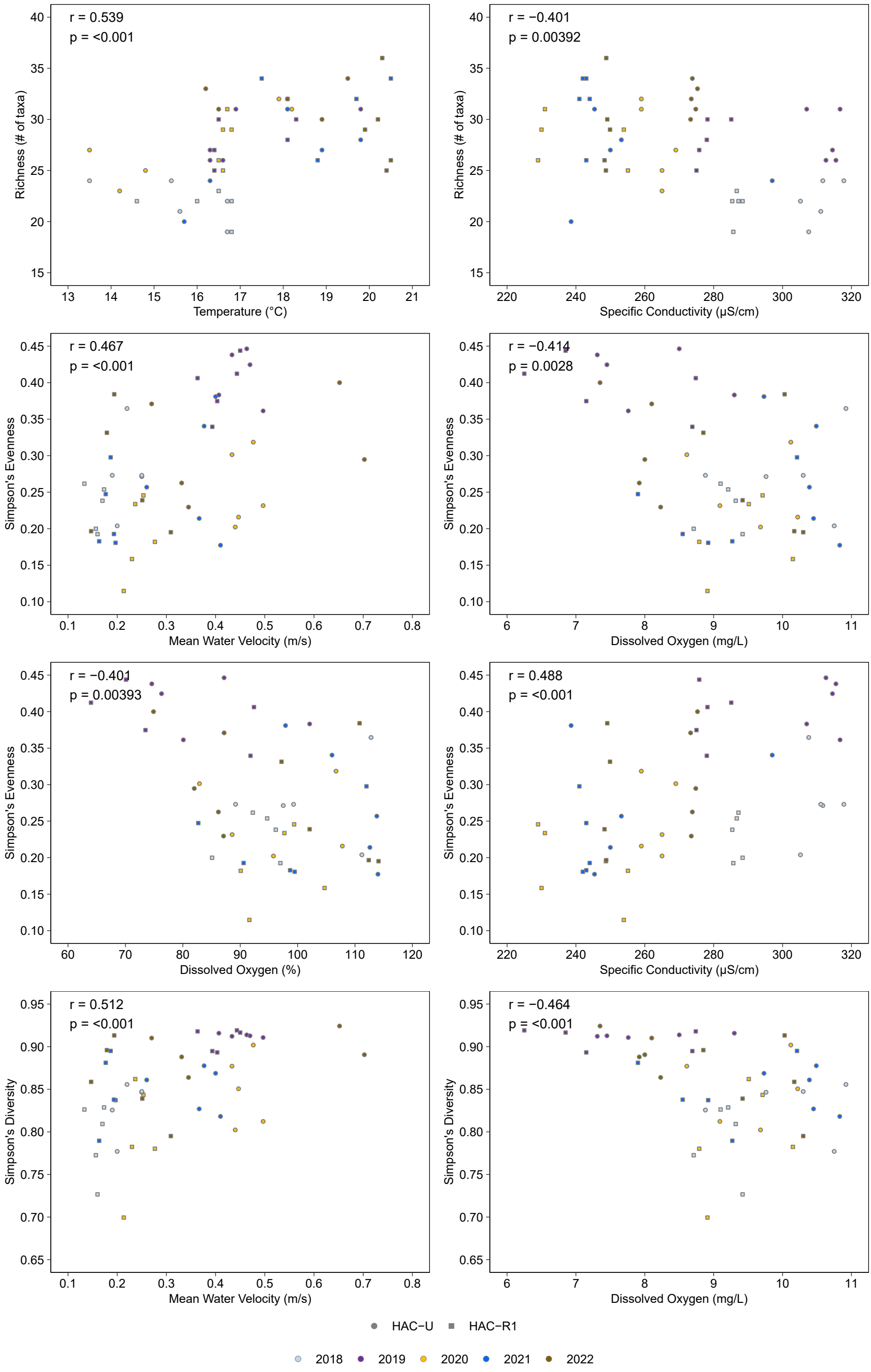

Figure F.3.3: Scatterplots of Spearman's Correlation Relationships (p < 0.05, Bonferroni Corrected) Between Benthic Invertebrate Community Metrics and Supporting In Situ Measures in Upper Hazeltine Creek (HAC−R1, HAC−U), 2018 to 2022

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight.

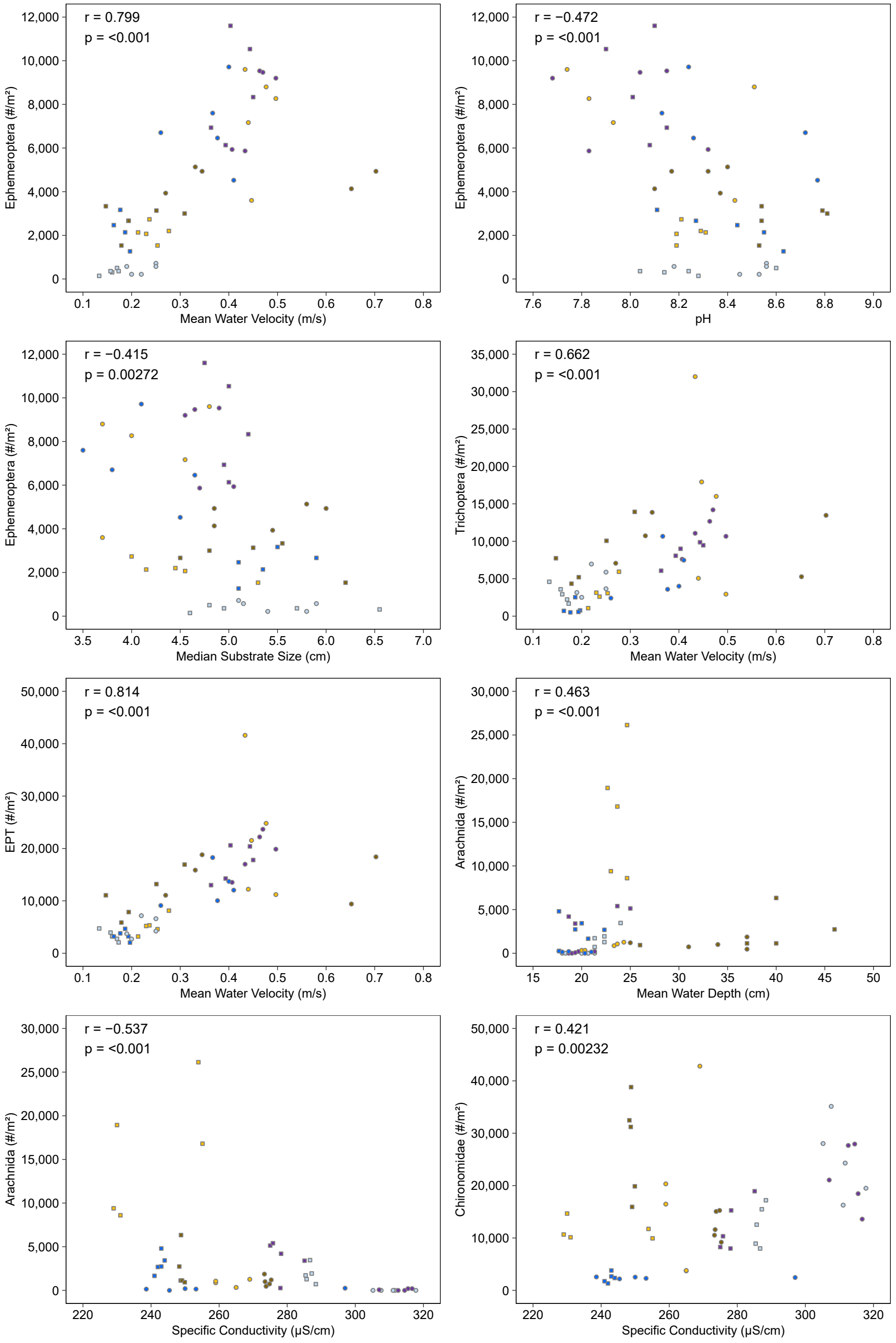

Figure F.3.3: Scatterplots of Spearman's Correlation Relationships (p < 0.05, Bonferroni Corrected) Between Benthic Invertebrate Community Metrics and Supporting In Situ Measures in Upper Hazeltine Creek (HAC−R1, HAC−U), 2018 to 2022

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight.

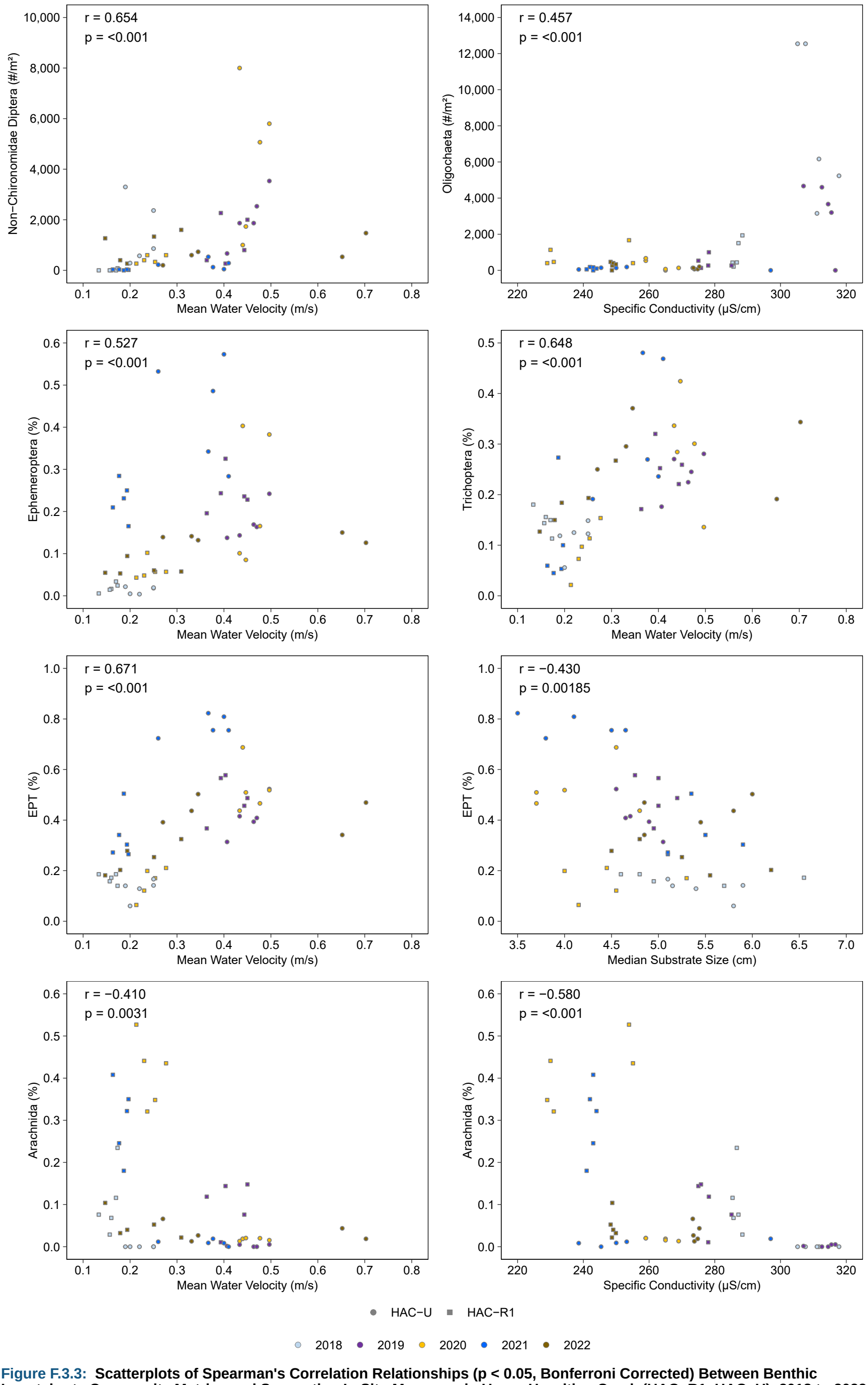

Figure F.3.3: Scatterplots of Spearman's Correlation Relationships (p < 0.05, Bonferroni Corrected) Between Benthic Invertebrate Community Metrics and Supporting In Situ Measures in Upper Hazeltine Creek (HAC−R1, HAC−U), 2018 to 2022

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight.

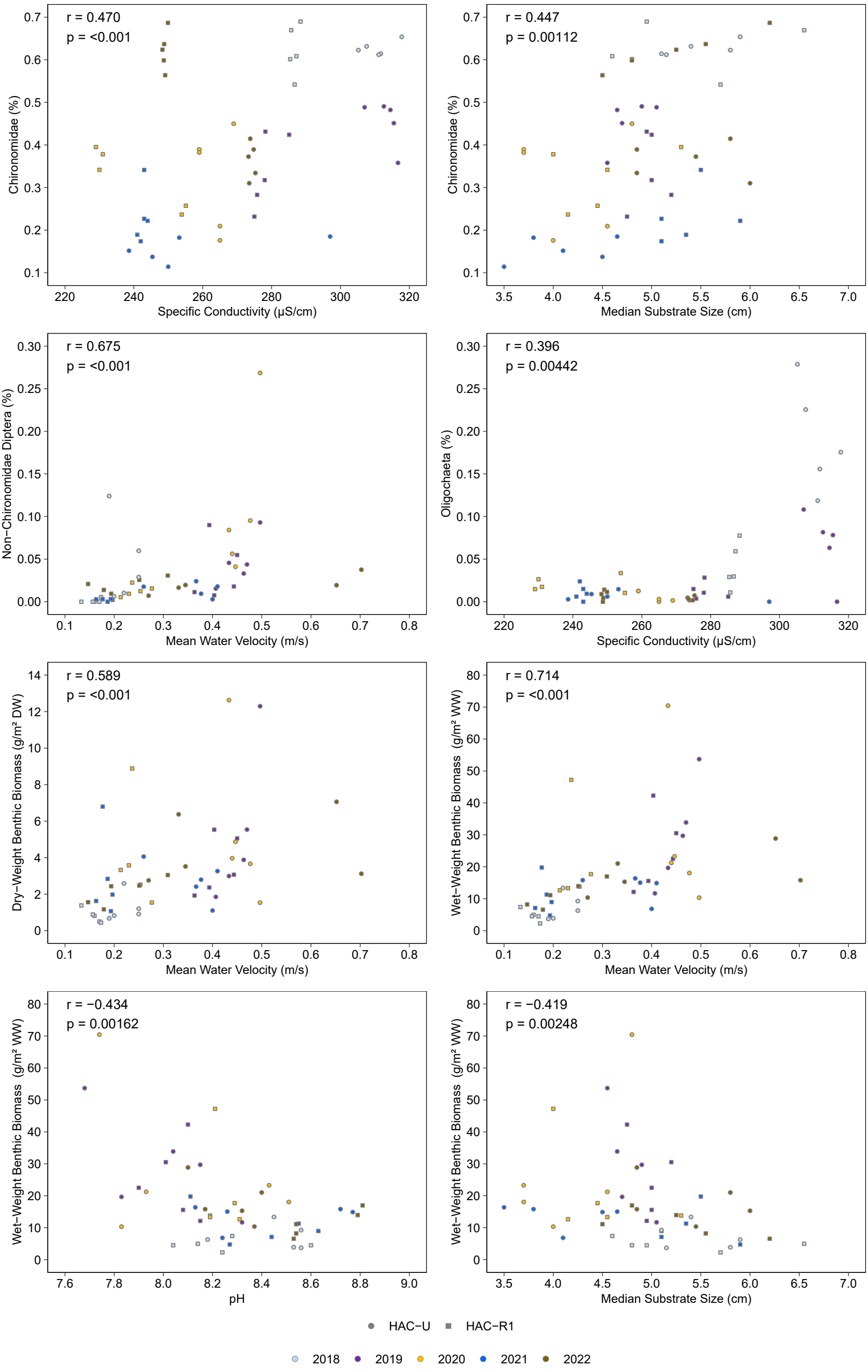

Figure F.3.3: Scatterplots of Spearman's Correlation Relationships (p < 0.05, Bonferroni Corrected) Between Benthic Invertebrate Community Metrics and Supporting In Situ Measures in Upper Hazeltine Creek (HAC−R1, HAC−U), 2018 to 2022

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Ephemeroptera (#/m²)	log10(x+1)	-	-	0.017	Reference	EDC-U	2007	19,658	A	D	AB	nc	C	B	Baseline	-7.0	-1.8	nc	-4.6	-2.1	ns	
							2018	94.0													1.5	1.9
							2019	5,111													ns	ns
							2020	-													nc	nc
							2021	599													1.7	3.2
							2022	4,000													ns	ns
					Exposed	HAC-R1	2007	14,712	A	D	AB	C	BC	BC	Baseline	-5.0	ns	-2.5	-2.5	-2.2		nc
							2018	310														ns
							2019	8,459														ns
							2020	2,098														1.6
							2021	2,240														1.5
							2022	2,640														ns
					Exposed	HAC-U	2007	14,712	A	B	A	A	A	A	Baseline	-4.7	ns	ns	ns	ns		
							2018	405														
							2019	7,802														
							2020	7,098														
							2021	6,793														
							2022	4,587														
Plecoptera (#/m²)	log10(x+1)	-	-	0.083	Reference	EDC-U	2007	3,361	A	B	AB	nc	B	AB	Baseline	-2.0	ns	nc	-2.2	ns	ns	
							2018	185													-2.6	-3.6
							2019	701													-3.9	-3.9
							2020	-													nc	nc
							2021	129													-2.2	-2.8
							2022	1,469													-5.0	-4.5
					Exposed	HAC-R1	2007	3,064	A	B	B	B	B	B	Baseline	-4.5	-5.0	-5.5	-4.4	-5.5		nc
							2018	3.30														ns
							2019	1.30														ns
							2020	0														ns
							2021	4.40														ns
							2022	0														ns
					Exposed	HAC-U	2007	3,064	A	B	B	B	B	B	Baseline	-5.5	-5.0	-5.5	-5.0	-5.0		
							2018	0														
							2019	1.30														
							2020	0														
							2021	1.20														
							2022	1.30														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Trichoptera (#/m²)	log10(x+1)	-	-	0.040	Reference	EDC-U	2007	4,005	A	BC	C	nc	BC	B	Baseline	-3.5	-4.1	nc	-2.8	-1.9	ns	
							2018	36.0													3.2	3.5
							2019	15.0													4.6	4.8
							2020	-													nc	nc
							2021	94.0													1.6	2.9
							2022	321													2.3	2.5
					Exposed	HAC-R1	2007	1,744	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns		nc
							2018	2,820														ns
							2019	8,372														ns
							2020	2,753														ns
							2021	826														ns
							2022	7,545														ns
					Exposed	HAC-U	2007	1,744	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns		
							2018	4,117														
							2019	11,004														
							2020	10,637														
							2021	4,875														
							2022	9,431														
EPT (#/m²)	log10(x+1)	-	-	0.041	Reference	EDC-U	2007	27,942	A	B	A	nc	B	A	Baseline	-5.2	ns	nc	-3.9	ns	ns	
							2018	283													2.7	3.1
							2019	5,968													ns	ns
							2020	-													nc	nc
							2021	877													1.5	3.0
							2022	7,394													ns	ns
					Exposed	HAC-R1	2007	19,692	A	B	A	AB	B	AB	Baseline	-2.1	ns	ns	-2.0	ns		nc
							2018	3,216														ns
							2019	16,921														ns
							2020	5,061														1.5
							2021	3,269														1.5
							2022	10,268														ns
					Exposed	HAC-U	2007	19,692	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns		
							2018	4,587														
							2019	18,884														
							2020	19,797														
							2021	12,252														
							2022	14,168														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Arachnida (#/m²)	log10(x+1)	-	-	<0.001	Reference	EDC-U	2007	3,126	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	ns	
							2018	514													ns	-5.0
							2019	1,387													ns	-3.4
							2020	-													nc	nc
							2021	600													ns	-1.8
							2022	3,509													ns	ns
					Exposed	HAC-R1	2007	3,282	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns		nc
							2018	1,603														-5.9
							2019	2,541														-3.9
							2020	14,638														-2.5
							2021	2,890														-3.0
							2022	1,834														ns
					Exposed	HAC-U	2007	3,282	A	C	B	A	B	A	Baseline	-6.5	-4.1	ns	-3.1	ns		
							2018	0														
							2019	18.0														
							2020	665														
							2021	63.0														
							2022	948														
Chironomidae (#/m²)	log10	-	-	<0.001	Reference	EDC-U	2007	10,998	A	B	AB	nc	B	B	Baseline	-3.3	ns	nc	-2.7	-1.8	ns	
							2018	1,319													3.4	4.5
							2019	4,090													1.6	2.5
							2020	-													nc	nc
							2021	1,893													ns	ns
							2022	3,458													3.1	1.9
					Exposed	HAC-R1	2007	7,409	B	AB	AB	AB	C	A	Baseline	ns	ns	ns	-1.8	2.0		nc
							2018	11,901														ns
							2019	11,458														ns
							2020	11,306														ns
							2021	2,237														ns
							2022	26,240														ns
					Exposed	HAC-U	2007	7,409	BC	A	AB	AB	C	AB	Baseline	1.8	ns	ns	ns	ns		
							2018	23,772														
							2019	21,005														
							2020	11,518														
							2021	2,406														
							2022	12,092														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Non-Chironomidae Diptera (#/m²)	log10(x+1)	-	-	<0.001	Reference	EDC-U	2007	251	A	AB	AB	nc	B	AB	Baseline	ns	ns	nc	-2.0	ns	ns		
							2018	38.0													-2.4	2.8
							2019	161													1.4	2.1
							2020	-													nc	nc
							2021	24.0													ns	1.7
							2022	32.0													2.7	2.4
					Exposed	HAC-R1	2007	338	A	B	A	A	B	A	Baseline	-4.2	ns	ns	-2.6	ns		nc
							2018	1.40														5.1
							2019	827														ns
							2020	418														1.8
							2021	14.0														2.1
							2022	780														ns
					Exposed	HAC-U	2007	338	BC	ABC	AB	A	C	ABC	Baseline	ns	ns	1.9	ns	ns		
							2018	1,020														
							2019	1,835														
							2020	3,327														
							2021	183														
							2022	586														
Oligochaeta (#/m²)	log10(x+1)	-	-	0.012	Reference	EDC-U	2007	27.0	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	1.5	
							2018	143													ns	2.1
							2019	428													ns	ns
							2020	-													nc	nc
							2021	310													ns	ns
							2022	405													ns	ns
					Exposed	HAC-R1	2007	468	A	A	A	A	A	A	Baseline	ns	ns	ns	ns	ns		nc
							2018	646														ns
							2019	348														ns
							2020	676														ns
							2021	44.0														ns
							2022	110														ns
					Exposed	HAC-U	2007	468	AB	A	AB	B	B	B	Baseline	ns	ns	ns	ns	ns		
							2018	6,933														
							2019	758														
							2020	79.0														
							2021	44.0														
							2022	110														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Ephemeroptera (%)	rank	-	-	<0.001	Reference	EDC-U	2007	40.0	A	C	A	nc	B	B	Baseline	-17	ns	nc	-9.7	-9.0	ns	
							2018	5.00													ns	ns
							2019	36.0													-6.0	-9.5
							2020	-													nc	nc
							2021	20.0													1.7	14
							2022	21.0													-7.3	-3.4
					Exposed	HAC-R1	2007	41.0	A	C	B	C	B	C	Baseline	-19	-8.5	-17	-8.8	-17		nc
							2018	1.60														ns
							2019	24.0														ns
							2020	5.70														5.2
							2021	23.0														12
							2022	5.80														ns
					Exposed	HAC-U	2007	41.0	A	C	B	B	A	B	Baseline	-19	-12	-12	ns	-13		
							2018	1.80														
							2019	16.0														
							2020	17.0														
							2021	49.0														
							2022	14.0														
Plecoptera (%)	rank	<0.001	0.689	0.312	Reference	EDC-U	2007	8.00	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	ns	
							2018	11.0													nm	nm
							2019	5.70													nm	nm
							2020	-													nc	nc
							2021	2.60													nm	nm
							2022	10.0													nm	nm
					Exposed	HAC-R1	2007	7.60	A	B	B	B	B	B	Baseline	nm	nm	nm	nm	nm		nc
							2018	0														ns
							2019	0														ns
							2020	0														ns
							2021	0														ns
							2022	0														ns
					Exposed	HAC-U	2007	7.60	A	B	B	B	B	B	Baseline	nm	nm	nm	nm	nm		
							2018	0														
							2019	0														
							2020	0														
							2021	0														
							2022	0														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites											Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Trichoptera (%)	rank	-	-	<0.001	Reference	EDC-U	2007	8.10	A	B	B	nc	AB	A	Baseline	-2.1	-2.4	nc	ns	ns	ns	ns
							2018	1.10													4.2	3.4
							2019	0.320													7.5	7.3
							2020	-													nc	nc
							2021	1.70													1.3	7.7
							2022	8.90													2.9	6.2
					Exposed	HAC-R1	2007	4.40	C	AB	A	BC	BC	AB	Baseline	3.2	6.3	ns	ns	4.2		nc
							2018	15.0														ns
							2019	25.0														ns
							2020	9.70														6.2
							2021	5.90														6.4
							2022	18.0														3.4
					Exposed	HAC-U	2007	4.40	B	B	A	A	A	A	Baseline	ns	6.1	7.8	6.8	7.6		
							2018	12.0														
							2019	25.0														
							2020	30.0														
							2021	27.0														
							2022	30.0														
EPT (%)	log10(x+1)	-	-	<0.001	Reference	EDC-U	2007	61.0	A	C	B	nc	C	B	Baseline	-5.1	-1.9	nc	-4.5	-2.0	ns	
							2018	17.0													ns	ns
							2019	43.0													ns	ns
							2020	-													nc	nc
							2021	22.0													1.5	6.0
							2022	42.0													-2.1	ns
					Exposed	HAC-R1	2007	55.0	A	D	AB	D	BC	CD	Baseline	-4.5	ns	-4.7	-2.4	-3.4		nc
							2018	17.0														ns
							2019	49.0														ns
							2020	15.0														4.5
							2021	33.0														4.5
							2022	25.0														2.2
					Exposed	HAC-U	2007	55.0	B	C	B	B	A	B	Baseline	-5.1	ns	ns	2.2	ns		
							2018	13.0														
							2019	41.0														
							2020	52.0														
							2021	77.0														
							2022	43.0														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Arachnida (%)	rank	-	-	<0.001	Reference	EDC-U	2007	6.00	B	AB	AB	nc	AB	A	Baseline	ns	ns	nc	ns	4.5	ns	
							2018	18.0													ns	-9.5
							2019	7.50													ns	-3.8
							2020	-													nc	nc
							2021	12.0													ns	-5.7
							2022	15.0													-5.5	-6.2
					Exposed	HAC-R1	2007	15.0	B	B	B	A	A	B	Baseline	ns	ns	15	8.9	ns		nc
							2018	7.60														-3.9
							2019	12.0														-6.0
							2020	44.0														-21
							2021	32.0														-16
							2022	4.00														ns
					Exposed	HAC-U	2007	15.0	A	C	BC	BC	BC	B	Baseline	-7.7	-7.6	-6.7	-7.2	-6.3		
							2018	0														
							2019	0.150														
							2020	1.90														
							2021	0.900														
							2022	2.70														
Chironomidae (%)	none	-	-	<0.001	Reference	EDC-U	2007	25.0	B	A	B	nc	A	B	Baseline	3.1	ns	nc	2.9	ns	ns	
							2018	46.0													2.3	2.3
							2019	30.0													ns	2.2
							2020	-													nc	nc
							2021	45.0													-3.2	-4.3
							2022	19.0													6.1	2.5
					Exposed	HAC-R1	2007	22.0	B	A	B	B	B	A	Baseline	5.8	ns	ns	ns	5.8		nc
							2018	62.0														ns
							2019	34.0														1.7
							2020	32.0														ns
							2021	23.0														ns
							2022	62.0														-3.7
					Exposed	HAC-U	2007	22.0	DE	A	B	CD	E	BC	Baseline	5.9	3.4	ns	ns	2.1		
							2018	63.0														
							2019	45.0														
							2020	32.0														
							2021	15.0														
							2022	36.0														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Non-Chironomidae Diptera (%)	rank	-	-	<0.001	Reference	EDC-U	2007	0.520	A	A	A	nc	A	A	Baseline	ns	ns	nc	ns	ns	ns	
							2018	1.30													-2.8	ns
							2019	1.20													ns	6.9
							2020	-													nc	nc
							2021	0.880													-1.3	ns
							2022	0.400													3.6	3.3
					Exposed	HAC-R1	2007	0.930	AB	C	A	A	BC	A	Baseline	-2.0	ns	ns	ns	ns		nc
							2018	0														6.2
							2019	1.80														ns
							2020	1.20														16
							2021	0.280														3.2
							2022	2.10														ns
					Exposed	HAC-U	2007	0.930	C	ABC	AB	A	BC	ABC	Baseline	ns	7.5	16	ns	ns		
							2018	2.90														
							2019	4.40														
							2020	8.40														
							2021	1.80														
							2022	1.90														
Oligochaeta (%)	rank	-	-	<0.001	Reference	EDC-U	2007	0.280	B	A	A	nc	A	A	Baseline	4.8	5.0	nc	7.1	2.2	ns	
							2018	4.60													ns	ns
							2019	4.80													ns	ns
							2020	-													nc	nc
							2021	6.70													-6.4	-6.8
							2022	2.30													-1.5	-2.1
					Exposed	HAC-R1	2007	1.60	AB	A	AB	AB	AB	B	Baseline	ns	ns	ns	ns	ns		nc
							2018	3.00														16
							2019	1.10														7.5
							2020	1.70														-1.6
							2021	0.940														ns
							2022	0.900														ns
					Exposed	HAC-U	2007	1.60	BC	A	AB	C	C	C	Baseline	18	ns	ns	ns	ns		
							2018	18.0														
							2019	7.80														
							2020	0.310														
							2021	0.600														
							2022	0.360														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.1: Results of Statistical Comparisons of Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2007 to 2022

Endpoint	Transformation	2-Way ANOVA p-values			Area Type	Area	Year[a]	Measures of Central Tendency[b]	Temporal Contrasts Within Sites												Spatial Comparison Within Years[c,e]	
									Pairwise Comparisons Between Years						MOD Relative to Baseline[c]							
		Area	Year	Interaction					2007 (pre-breach)[d]	2018	2019	2020	2021	2022	2007 (pre-breach)	2018	2019	2020	2021	2022	HAC-R1	HAC-U
Dry Weight Benthic Biomass (g/m² DW)	rank	<0.001	0.002	0.153	Reference	EDC-U	2007	-	-	B	A	A	AB	A	-	Baseline	0.43	nc	ns	1.4	-	
							2018	0.180													0.96	1.1
							2019	0.460													3.9	5.1
							2020	-													nc	nc
							2021	0.380													2.4	3.6
							2022	1.10													2.0	3.6
					Exposed	HAC-R1	2007	-	-	B	A	A	AB	A	-	Baseline	3.4	3.8	ns	2.4		-
							2018	0.810														ns
							2019	3.10														ns
							2020	3.30														ns
							2021	2.00														ns
							2022	2.40														ns
					Exposed	HAC-U	2007	-	-	B	A	A	AB	A	-	Baseline	4.5	4.6	ns	3.9		
							2018	0.910														
							2019	3.90														
							2020	4.00														
							2021	2.80														
							2022	3.50														
Wet Weight Benthic Biomass (g/m² WW)	rank	<0.001	<0.001	0.213	Reference	EDC-U	2007	-	-	C	A	AB	BC	AB	-	Baseline	0.32	nc	ns	0.96	-	
							2018	1.40													0.88	1.4
							2019	2.50													5.6	7.6
							2020	-													nc	nc
							2021	2.00													2.0	3.7
							2022	4.80													1.8	3.1
					Exposed	HAC-R1	2007	-	-	C	A	AB	BC	AB	-	Baseline	5.1	2.6	ns	1.9		-
							2018	4.50														ns
							2019	22.0														ns
							2020	14.0														ns
							2021	9.00														ns
							2022	11.0														ns
					Exposed	HAC-U	2007	-	-	C	A	AB	BC	AB	-	Baseline	6.6	4.2	ns	2.7		
							2018	6.30														
							2019	30.0														
							2020	21.0														
							2021	15.0														
							2022	16.0														

Magnitude of Difference (MOD) < -2

Magnitude of Difference (MOD) > 2

Notes: "-" = no data available. nc = no comparison. ns = no significance. nm = Contrast MODs could not be calculated because the Median Absolute Deviation (MAD) = 0. EPT = Ephemeroptera, Plecoptera, Trichoptera. DW = dry weight. WW = wet weight. Reference area EDC-U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U. See Section 4.3 for details

[a] Data from 2007 were used in the analyses to compare post-breach (2018 to 2022) to pre-breach conditions (2007). Post-breach data from HAC-R1 and HAC-U was compared to pre-breach data from UHC, and post-breach data from EDC-U was compared to pre-breach data from UER.

[b] Mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}-transformed, or rank-transformed data.

[c] Magnitude of difference (MOD) calculated for two-way ANOVA as (Exposed Mean - Reference Mean)/SD (or [Mean - Baseline Mean]/SD for temporal comparisons) on the transformed scale, where SD was the pooled standard deviation of the model residuals. MOD calculated for Kruskal-Wallis (i.e., rank-transformed data) as (Exposed Median - Reference Median)/MAD, where MAD was the pooled median absolute deviation.

[d] Pairwise contrasts of post-breach (2018 to 2022) data from HAC-R1 and HAC-U against pre-breach (2007) data from UHC are indicated with in Figure F.3.2.

[e] Spatial pairwise contrasts between HAC-R1 and HAC-U in 2007 were not calculated because UHC in 2007 represents pre-breach data for both HAC-R1 and HAC-U.

Table F.3.2: Spearman's Rank Correlation Relationships Between Benthic Invertebrate Community Metrics and Supporting Measures for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), 2018 to 2022

Benthic Invertebrate Community Endpoint	Correlation Parameter	Mean Water Depth (cm)	Mean Water Velocity (m/s)	Temperature (°C)	Dissolved Oxygen (mg/L)
Density (#/m²)	Correlation Coefficient	0.265	0.355	-0.0359	-0.100
	Sig. (2-tailed)	0.063	0.0113	0.805	0.488
Richness (# of taxa)	Correlation Coefficient	0.306	0.203	0.539	-0.242
	Sig. (2-tailed)	0.0304	0.157	<0.001	0.0905
Simpson's Evenness	Correlation Coefficient	-0.182	0.467	-0.208	-0.414
	Sig. (2-tailed)	0.207	<0.001	0.147	0.0028
Simpson's Diversity	Correlation Coefficient	-0.0248	0.512	0.0898	-0.464
	Sig. (2-tailed)	0.864	<0.001	0.535	<0.001
Ephemeroptera (#/m²)	Correlation Coefficient	-0.141	0.799	-0.0650	-0.368
	Sig. (2-tailed)	0.329	<0.001	0.654	0.00864
Plecoptera (#/m²)	Correlation Coefficient	-0.184	-0.151	0.100	-0.151
	Sig. (2-tailed)	0.201	0.296	0.489	0.294
Trichoptera (#/m²)	Correlation Coefficient	0.193	0.662	0.0230	-0.225
	Sig. (2-tailed)	0.180	<0.001	0.874	0.116
EPT (#/m²)	Correlation Coefficient	0.0495	0.814	-0.0302	-0.286
	Sig. (2-tailed)	0.733	<0.001	0.835	0.0438
Arachnida (#/m²)	Correlation Coefficient	0.463	-0.308	0.199	-0.234
	Sig. (2-tailed)	<0.001	0.0297	0.165	0.102
Chironomidae (#/m²)	Correlation Coefficient	0.216	0.0437	-0.0591	-0.0171
	Sig. (2-tailed)	0.132	0.763	0.684	0.906
Non-Chironomidae Diptera (#/m²)	Correlation Coefficient	0.0472	0.654	-0.212	-0.176
	Sig. (2-tailed)	0.745	<0.001	0.139	0.221
Oligochaeta (#/m²)	Correlation Coefficient	-0.0997	-0.177	-0.197	0.0760
	Sig. (2-tailed)	0.491	0.220	0.170	0.600
Ephemeroptera (%)	Correlation Coefficient	-0.341	0.527	0.0898	-0.191
	Sig. (2-tailed)	0.0152	<0.001	0.535	0.185
Plecoptera (%)	Correlation Coefficient	-0.198	-0.181	0.110	-0.111
	Sig. (2-tailed)	0.167	0.208	0.446	0.442
Trichoptera (%)	Correlation Coefficient	0.0714	0.648	0.0586	-0.0945
	Sig. (2-tailed)	0.622	<0.001	0.686	0.514
EPT (%)	Correlation Coefficient	-0.194	0.671	0.0528	-0.137
	Sig. (2-tailed)	0.177	<0.001	0.716	0.343
Arachnida (%)	Correlation Coefficient	0.360	-0.410	0.232	-0.177
	Sig. (2-tailed)	0.0103	0.0031	0.105	0.218
Chironomidae (%)	Correlation Coefficient	0.210	-0.366	-0.0556	0.0313
	Sig. (2-tailed)	0.144	0.00892	0.701	0.829
Non-Chironomidae Diptera (%)	Correlation Coefficient	0.0192	0.675	-0.207	-0.120
	Sig. (2-tailed)	0.895	<0.001	0.149	0.406
Oligochaeta (%)	Correlation Coefficient	-0.216	-0.331	-0.169	0.109
	Sig. (2-tailed)	0.132	0.0188	0.240	0.453
Dry Weight Benthic Biomass (g/m² DW)	Correlation Coefficient	0.198	0.589	0.0298	-0.295
	Sig. (2-tailed)	0.169	<0.001	0.837	0.0375
Wet Weight Benthic Biomass (g/m² WW)	Correlation Coefficient	-0.415	0.483	-0.314	-0.144
	Sig. (2-tailed)	0.00273	<0.001	0.0265	0.317

Significant correlation; p-value <0.00625 (p <0.05, Bonferroni corrected for 8 independent variables).

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight; #/m^2 = number per square metre; g/m^2 = grams per square metre

Table F.3.2: Spearman's Rank Correlation Relationships Between Benthic Invertebrate Community Metrics and Supporting Measures for Upper Hazeltine Creek (HAC-R1, HAC-U; Exposed), 2018 to 2022

Benthic Invertebrate Community Endpoint	Correlation Parameter	Dissolved Oxygen (%)	pH	Specific Conductivity (µS/cm)	Median Substrate Size (cm)
Density (#/m²)	Correlation Coefficient	-0.0941	-0.0616	0.302	-0.0469
	Sig. (2-tailed)	0.516	0.671	0.0332	0.746
Richness (# of taxa)	Correlation Coefficient	-0.0499	0.0733	-0.401	0.0312
	Sig. (2-tailed)	0.731	0.613	0.00392	0.829
Simpson's Evenness	Correlation Coefficient	-0.401	-0.342	0.488	0.0188
	Sig. (2-tailed)	0.00393	0.015	<0.001	0.897
Simpson's Diversity	Correlation Coefficient	-0.358	-0.279	0.225	0.0430
	Sig. (2-tailed)	0.0106	0.0494	0.117	0.767
Ephemeroptera (#/m²)	Correlation Coefficient	-0.339	-0.472	0.0174	-0.415
	Sig. (2-tailed)	0.0161	<0.001	0.905	0.00272
Plecoptera (#/m²)	Correlation Coefficient	-0.114	-0.00459	-0.00610	0.119
	Sig. (2-tailed)	0.429	0.975	0.966	0.411
Trichoptera (#/m²)	Correlation Coefficient	-0.193	-0.196	0.281	-0.196
	Sig. (2-tailed)	0.179	0.173	0.0478	0.172
EPT (#/m²)	Correlation Coefficient	-0.262	-0.353	0.169	-0.362
	Sig. (2-tailed)	0.0658	0.0119	0.241	0.0098
Arachnida (#/m²)	Correlation Coefficient	-0.141	-0.0402	-0.537	0.0658
	Sig. (2-tailed)	0.329	0.782	<0.001	0.650
Chironomidae (#/m²)	Correlation Coefficient	-0.0251	0.0438	0.421	0.192
	Sig. (2-tailed)	0.863	0.763	0.00232	0.181
Non-Chironomidae Diptera (#/m²)	Correlation Coefficient	-0.214	-0.259	0.308	-0.191
	Sig. (2-tailed)	0.136	0.0697	0.0296	0.184
Oligochaeta (#/m²)	Correlation Coefficient	0.0326	0.0904	0.457	0.0589
	Sig. (2-tailed)	0.822	0.533	<0.001	0.685
Ephemeroptera (%)	Correlation Coefficient	-0.134	-0.299	-0.261	-0.356
	Sig. (2-tailed)	0.352	0.0349	0.0668	0.0112
Plecoptera (%)	Correlation Coefficient	-0.0750	0.0324	-0.0403	0.117
	Sig. (2-tailed)	0.605	0.823	0.781	0.416
Trichoptera (%)	Correlation Coefficient	-0.0858	-0.164	0.123	-0.311
	Sig. (2-tailed)	0.553	0.255	0.395	0.0278
EPT (%)	Correlation Coefficient	-0.117	-0.277	-0.105	-0.430
	Sig. (2-tailed)	0.420	0.0517	0.470	0.00185
Arachnida (%)	Correlation Coefficient	-0.0806	0.0268	-0.580	0.0832
	Sig. (2-tailed)	0.578	0.853	<0.001	0.566
Chironomidae (%)	Correlation Coefficient	0.00615	0.139	0.470	0.447
	Sig. (2-tailed)	0.966	0.337	<0.001	0.00112
Non-Chironomidae Diptera (%)	Correlation Coefficient	-0.167	-0.249	0.264	-0.262
	Sig. (2-tailed)	0.245	0.0816	0.0641	0.0657
Oligochaeta (%)	Correlation Coefficient	0.0729	0.139	0.396	0.121
	Sig. (2-tailed)	0.615	0.337	0.00442	0.402
Dry Weight Benthic Biomass (g/m² DW)	Correlation Coefficient	-0.263	-0.302	-0.141	-0.347
	Sig. (2-tailed)	0.0645	0.0332	0.329	0.0134
Wet Weight Benthic Biomass (g/m² WW)	Correlation Coefficient	-0.213	-0.524	0.106	-0.505
	Sig. (2-tailed)	0.137	<0.001	0.465	<0.001

Significant correlation; p-value <0.00625 (p <0.05, Bonferroni corrected for 8 independent variables).

Notes: EPT = Ephemeroptera, Plecoptera, Trichoptera; DW = dry weight; WW = wet weight; #/m^2 = number per square metre; g/m^2 = grams per square metre

APPENDIX F.4
PERIPHYTON & BENTHOS
TISSUE QUALITY

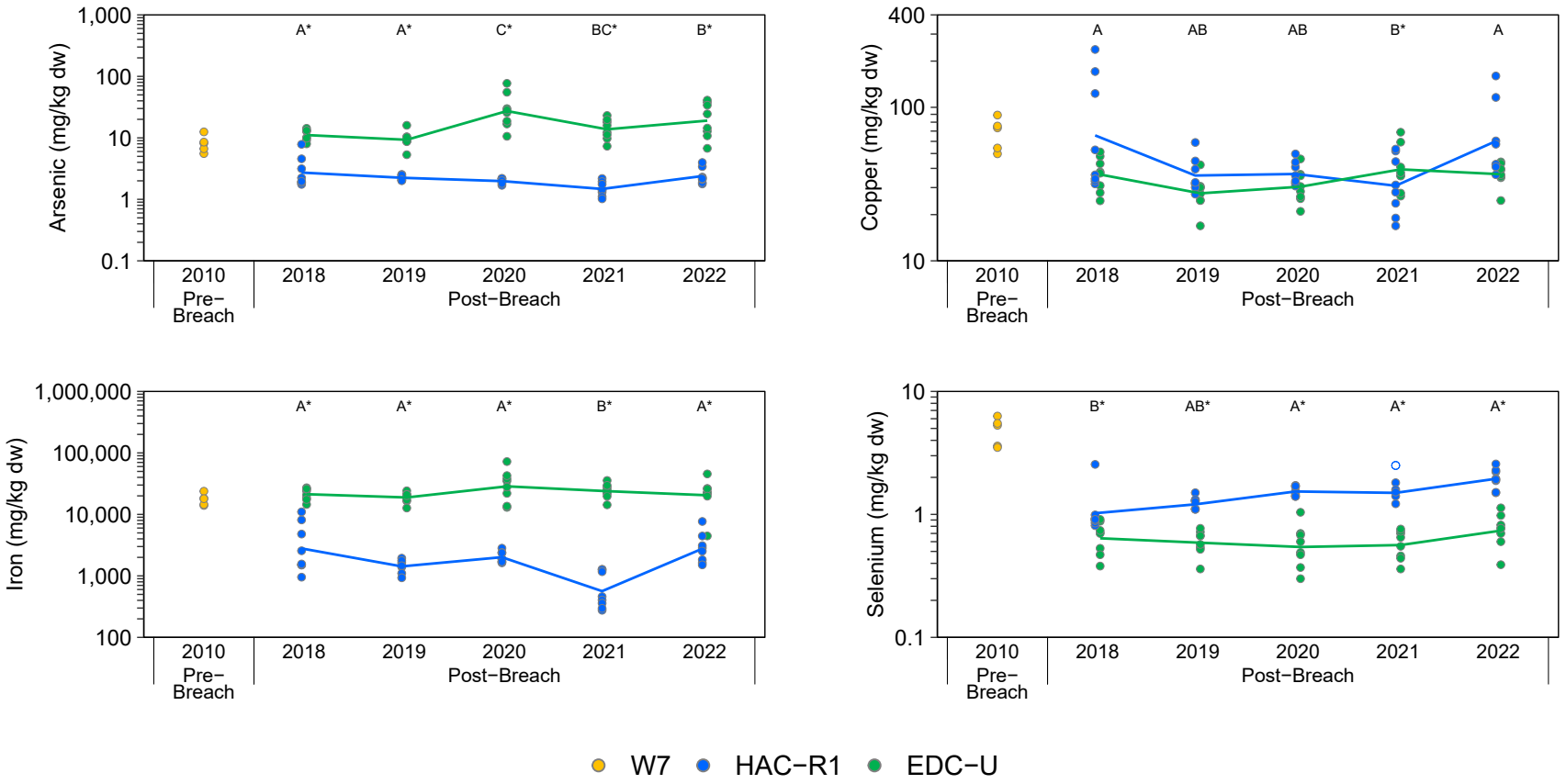

Figure F.4.1: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

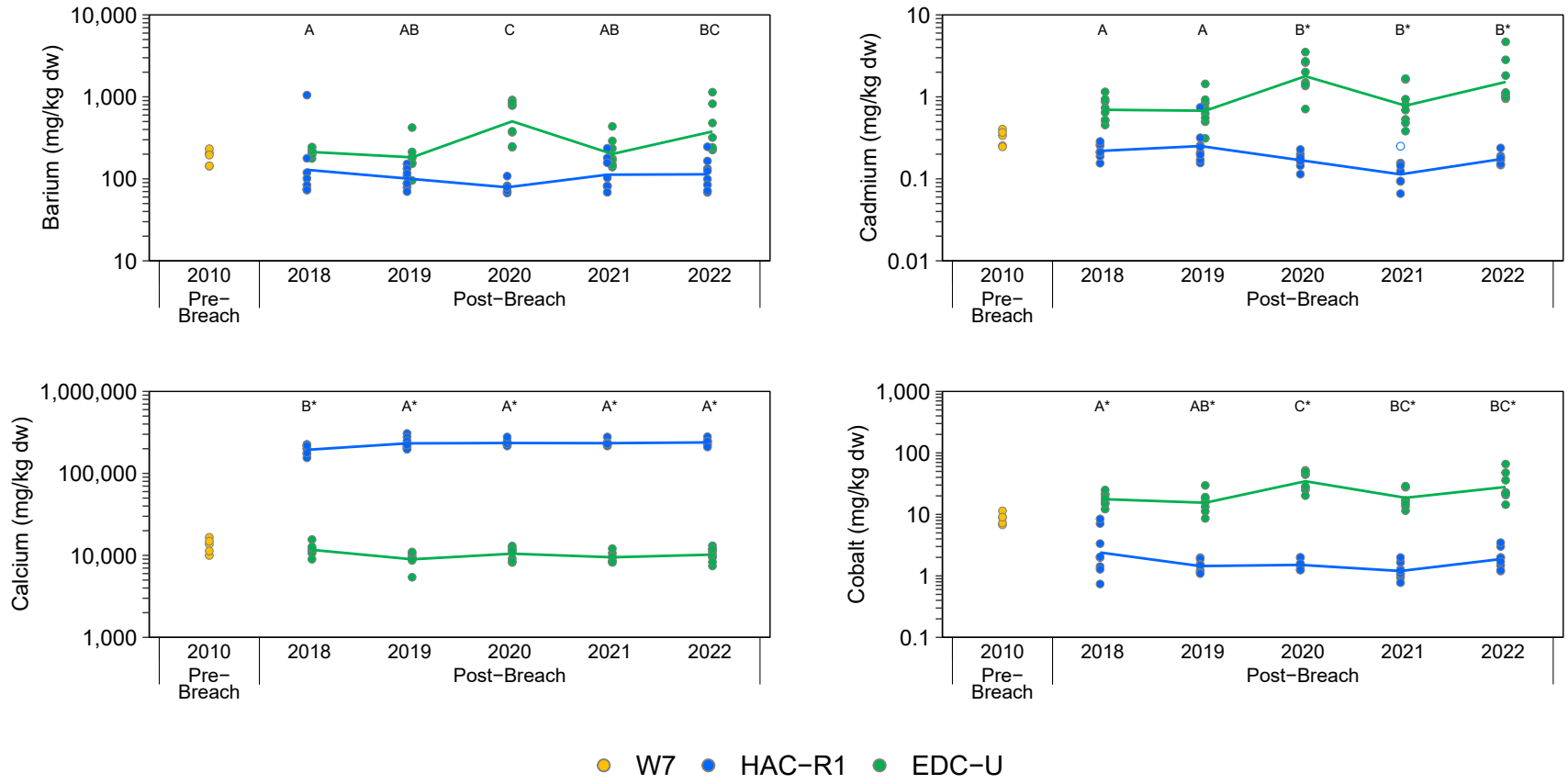

Figure F.4.1: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

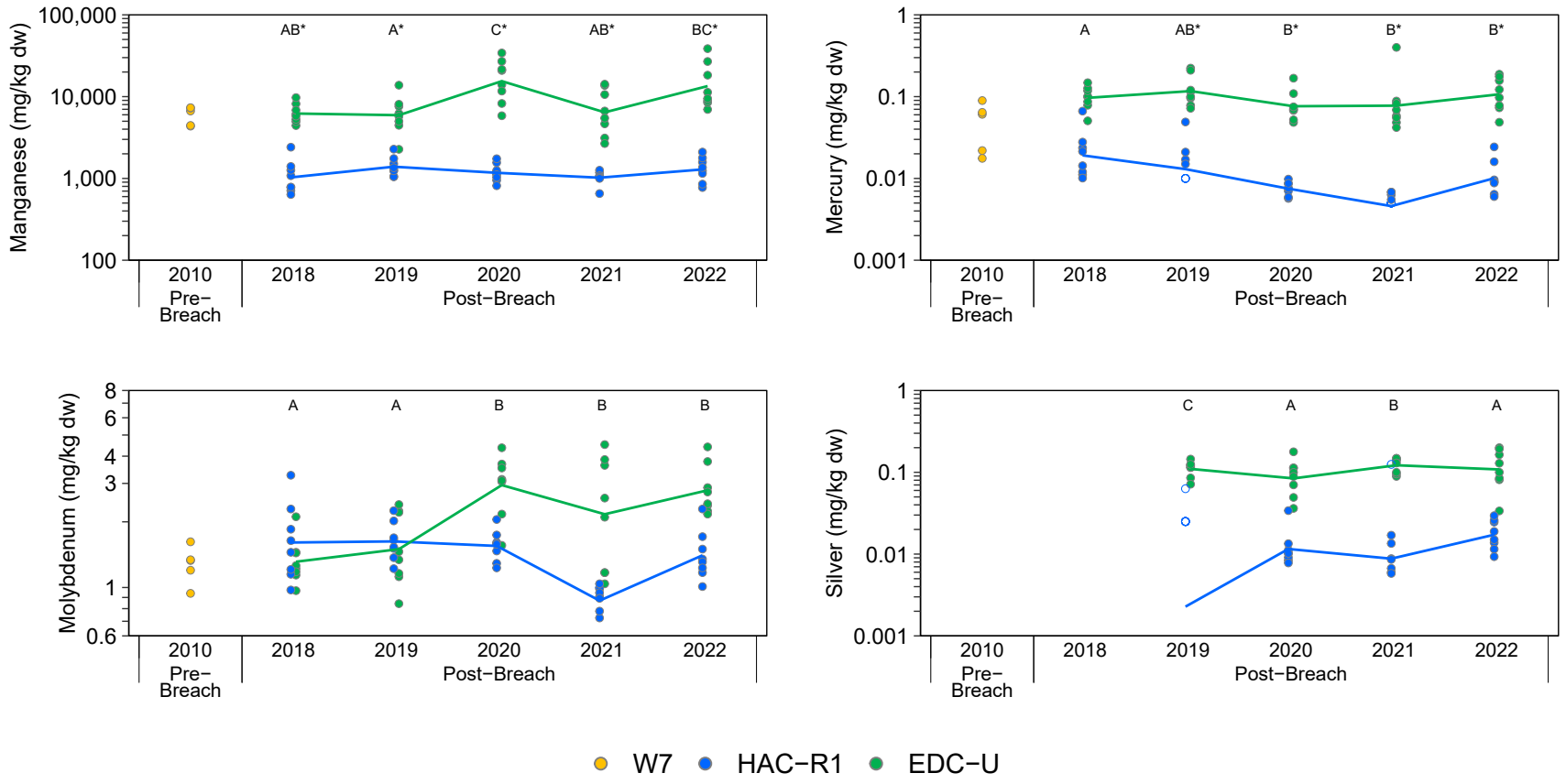

Figure F.4.1: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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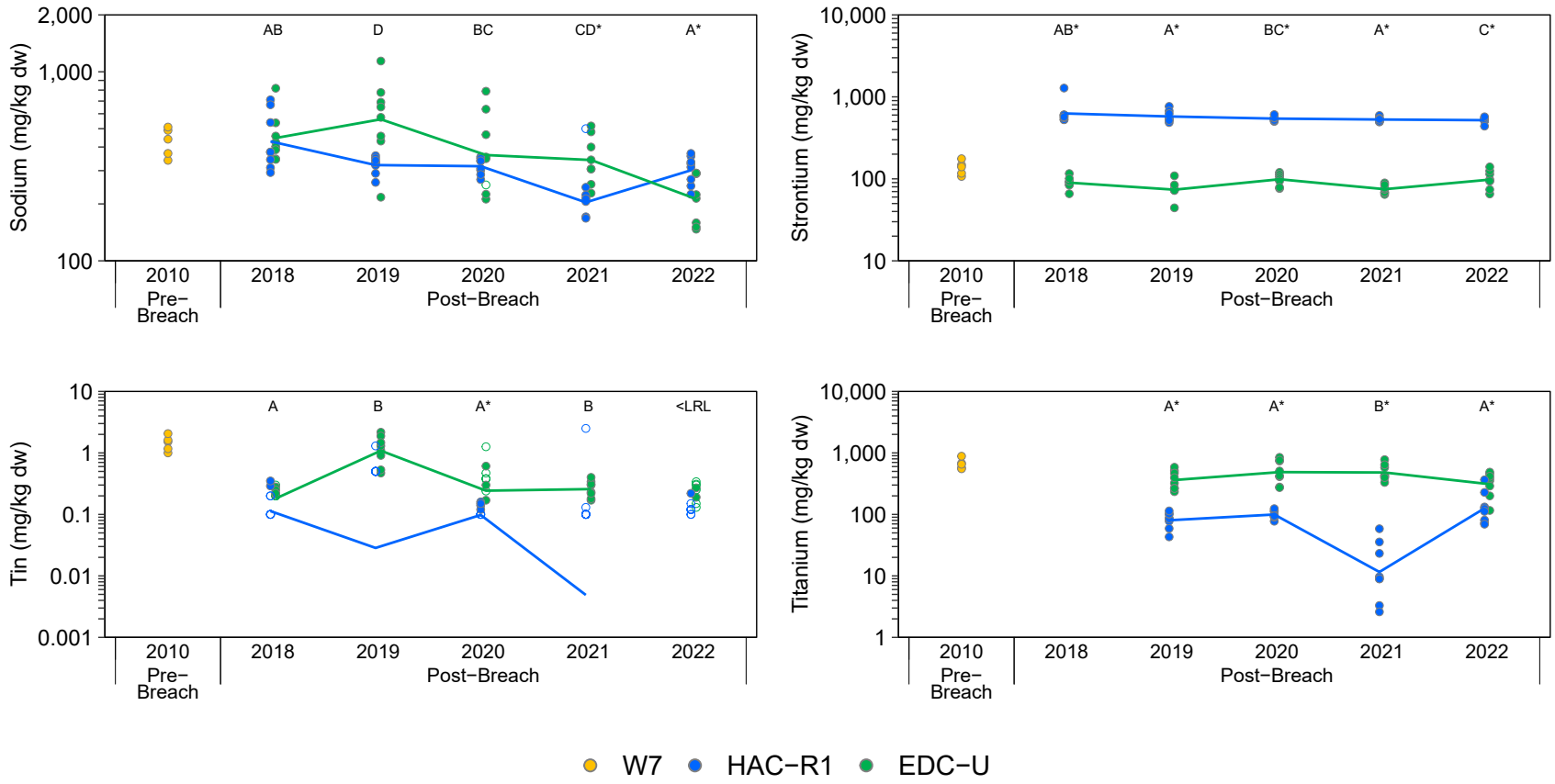

Figure F.4.1: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

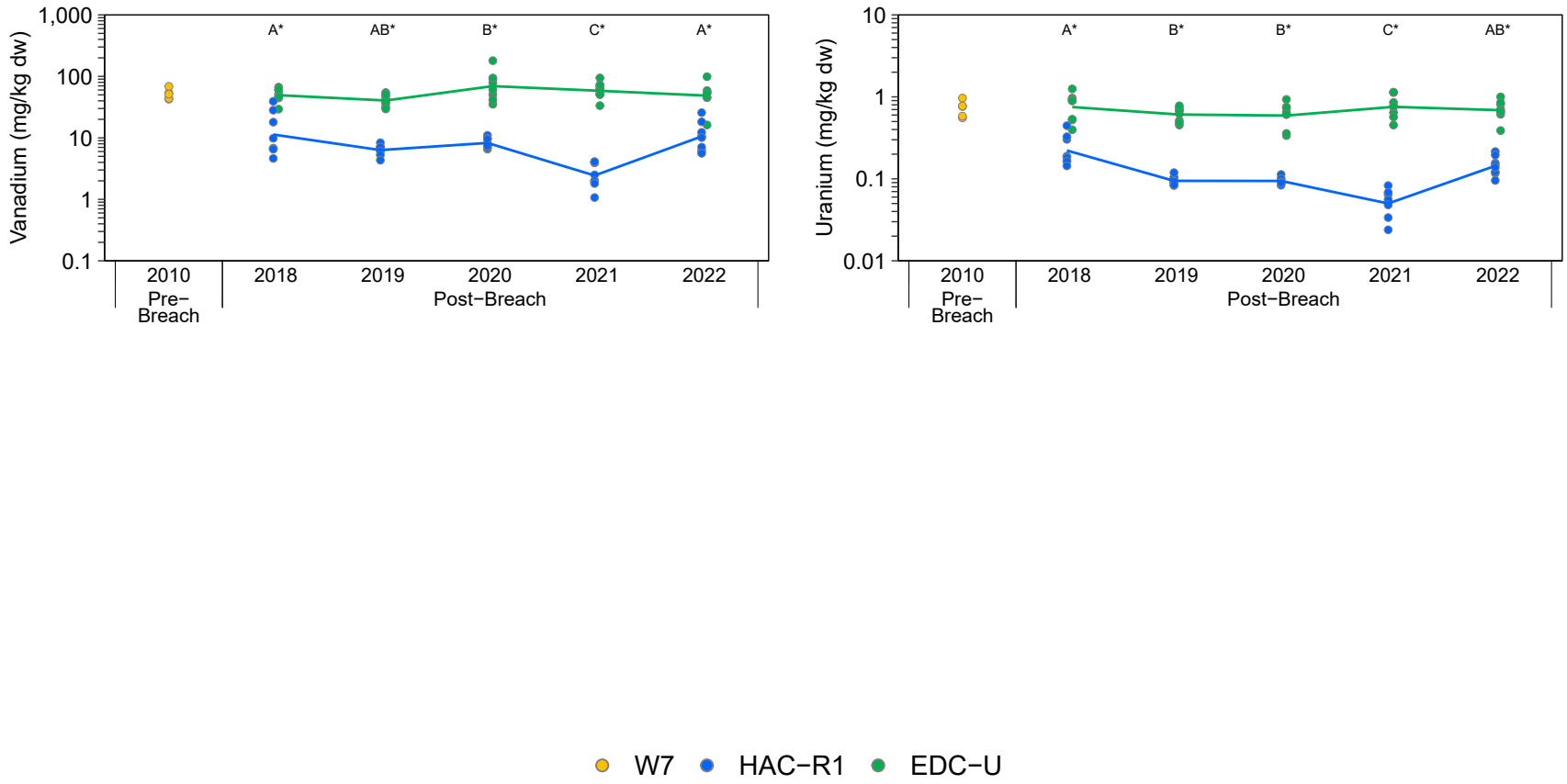

Figure F.4.1: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

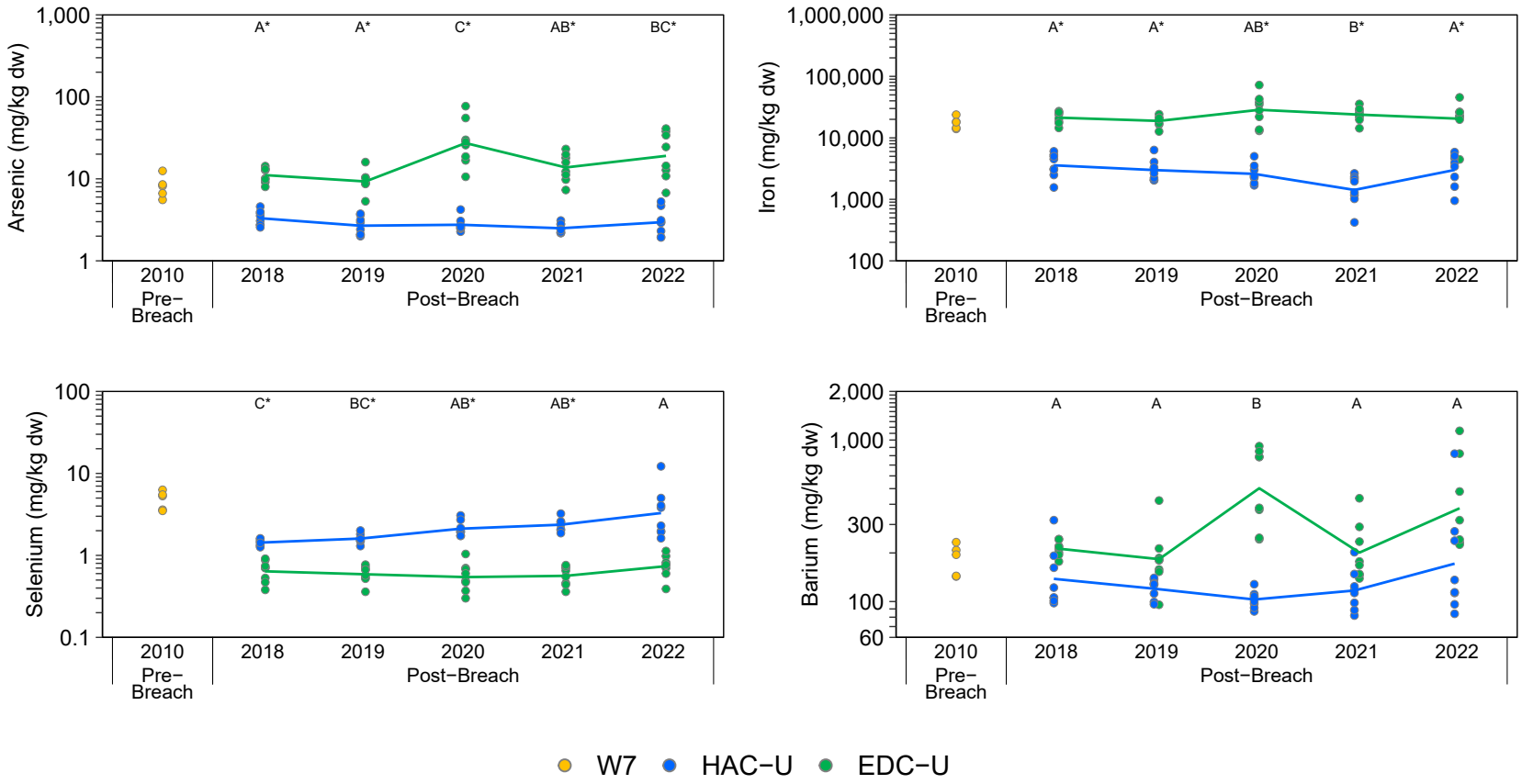

Figure F.4.2: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

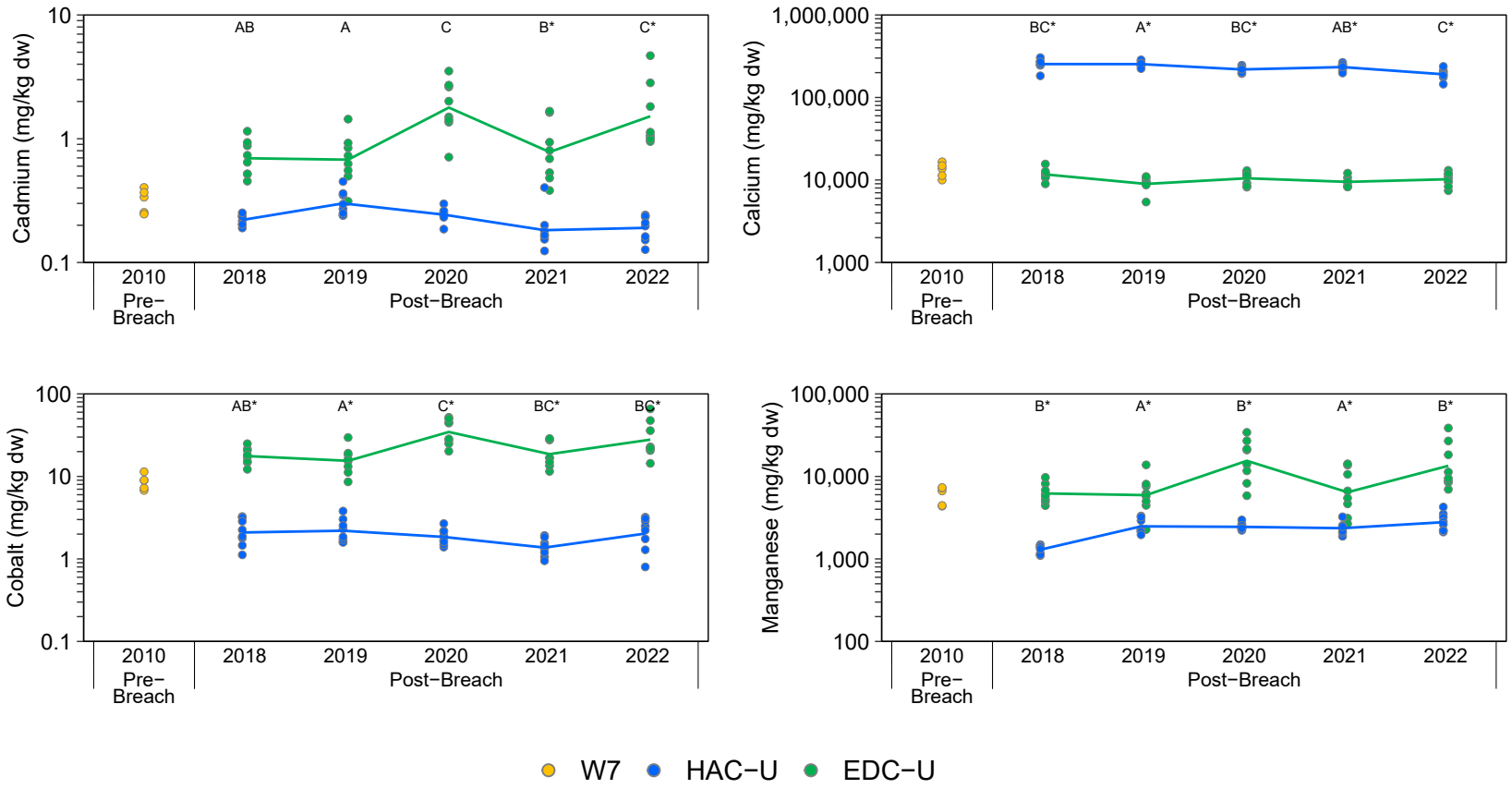

Figure F.4.2: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

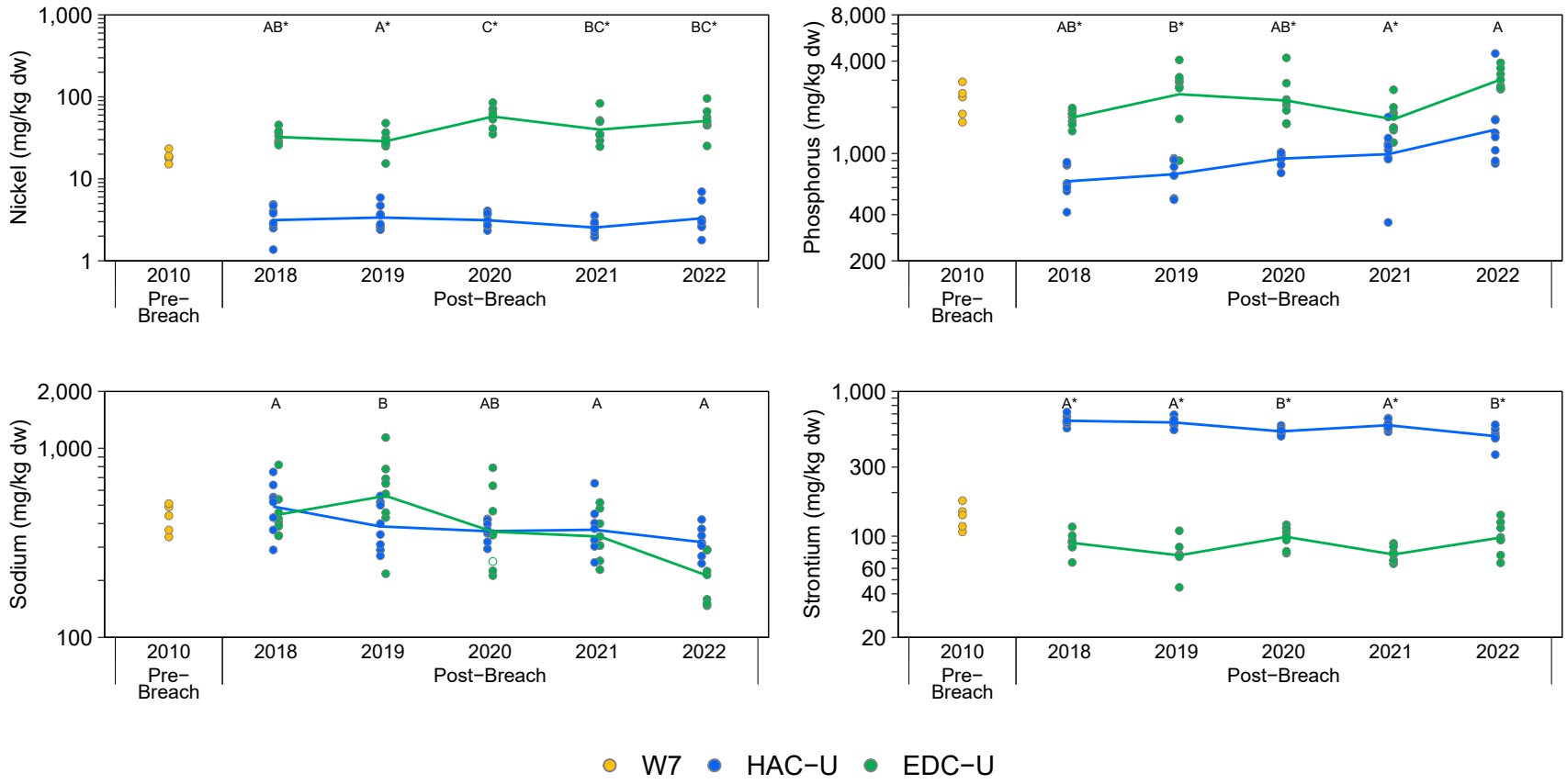

Figure F.4.2: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

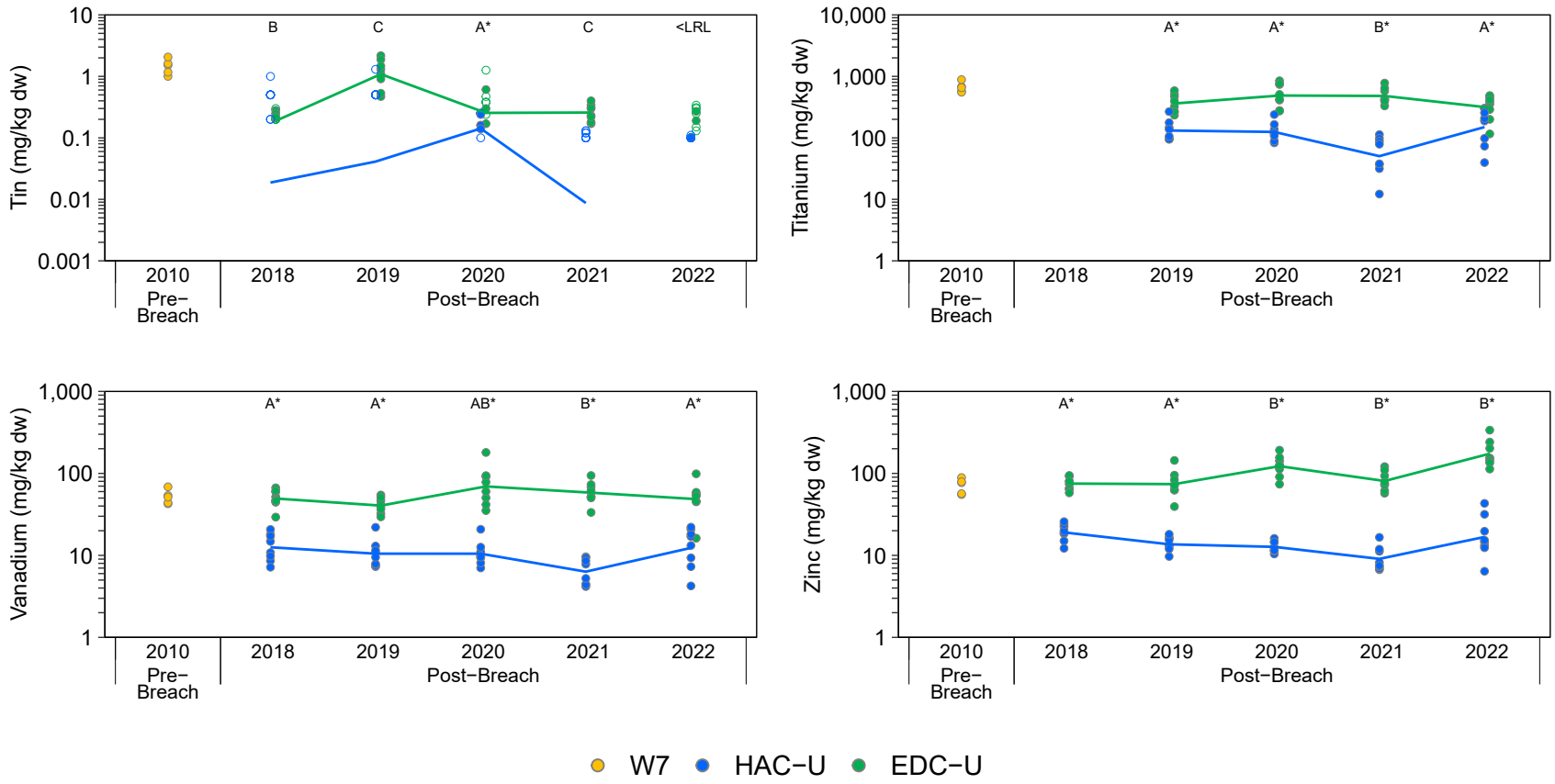

Figure F.4.2: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

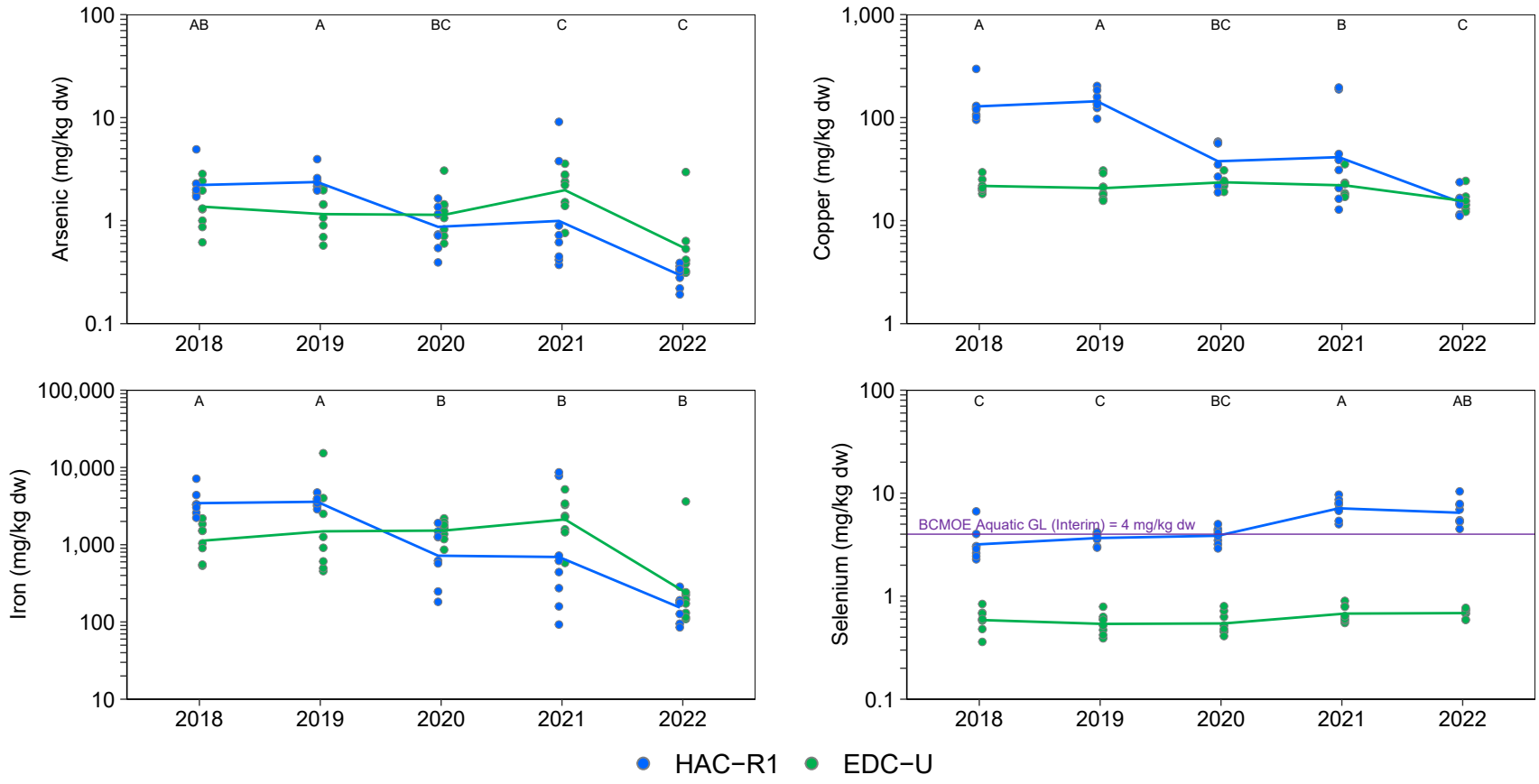

Figure F.4.3: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

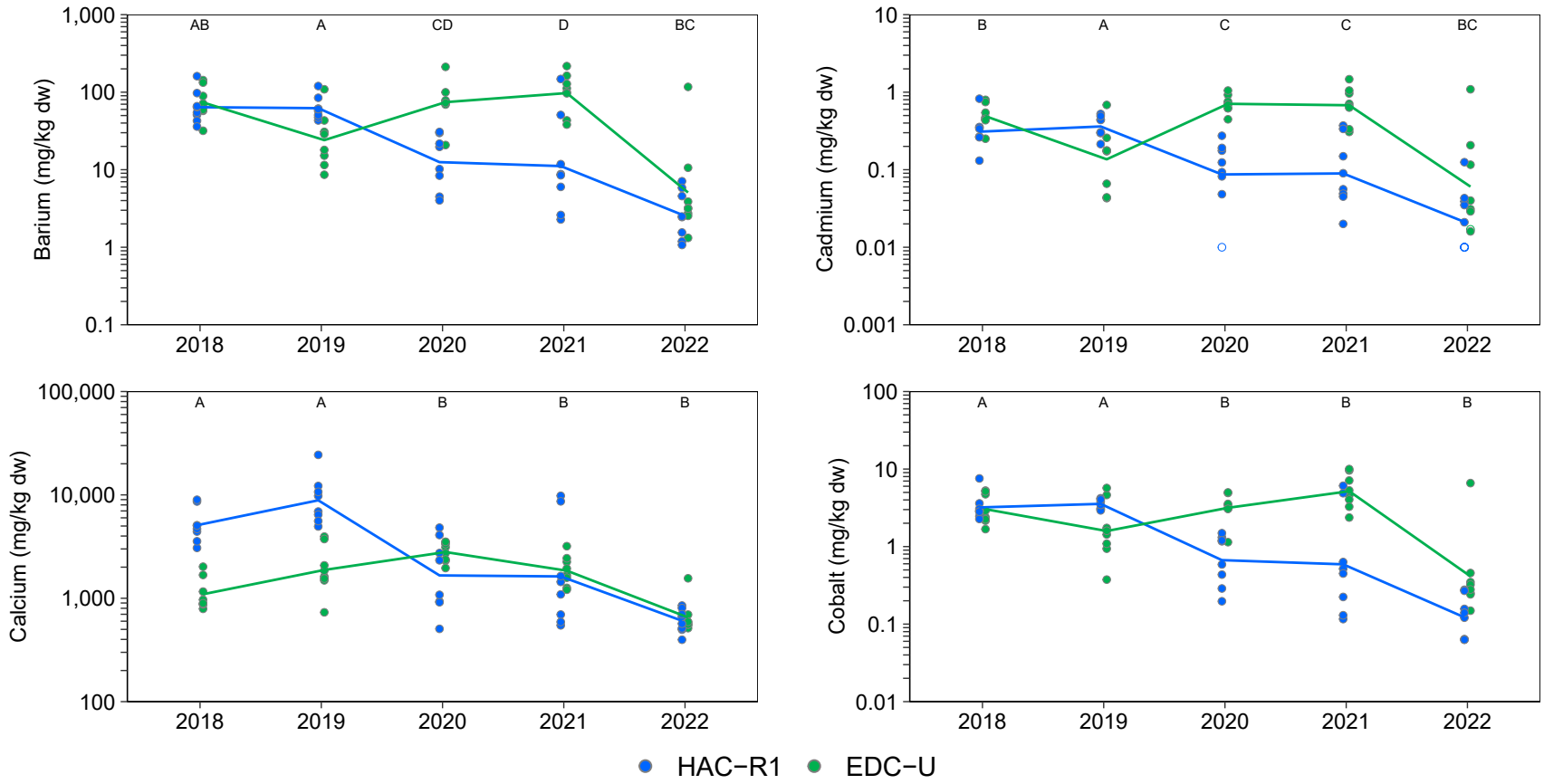

Figure F.4.3: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two-way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

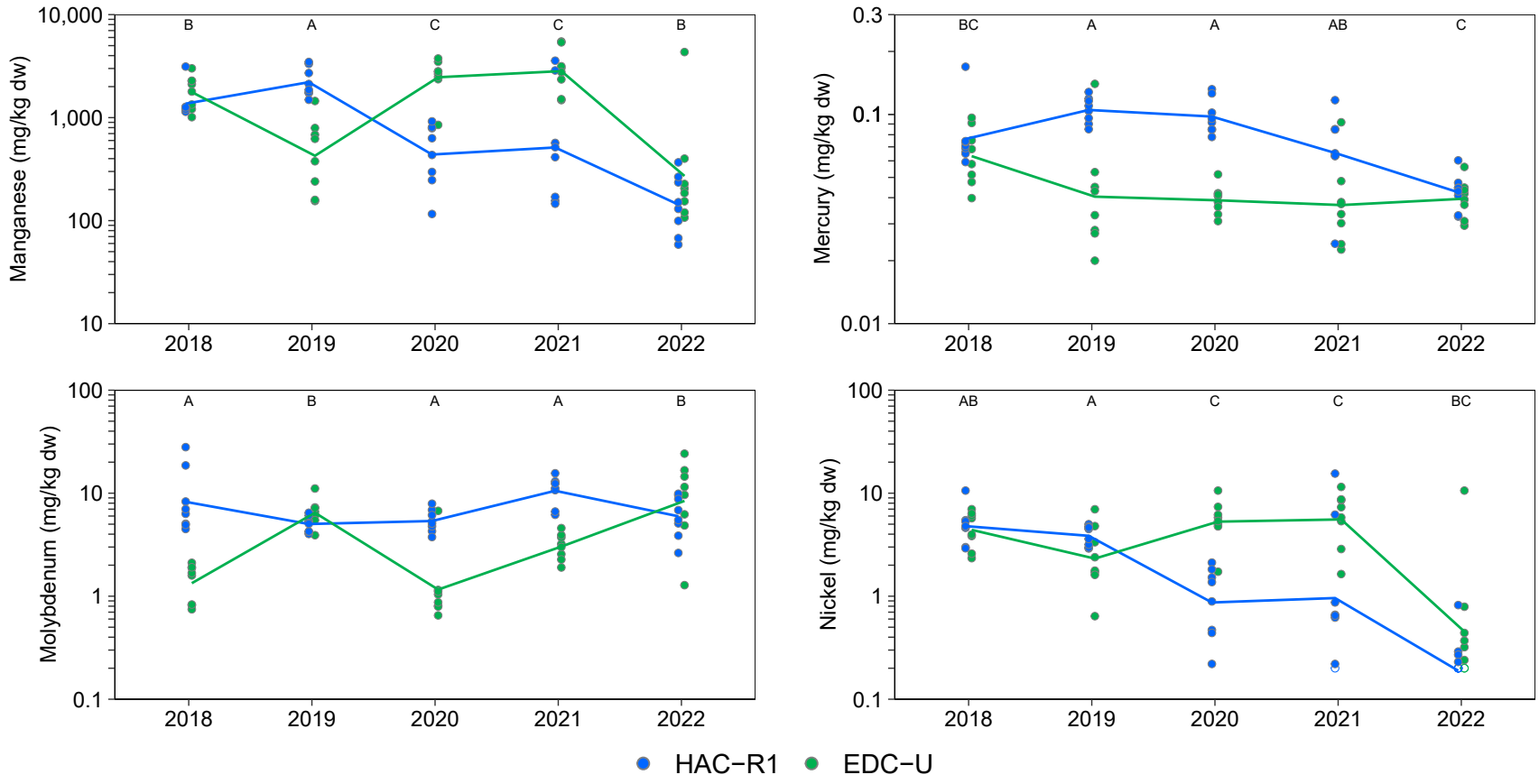

Figure F.4.3: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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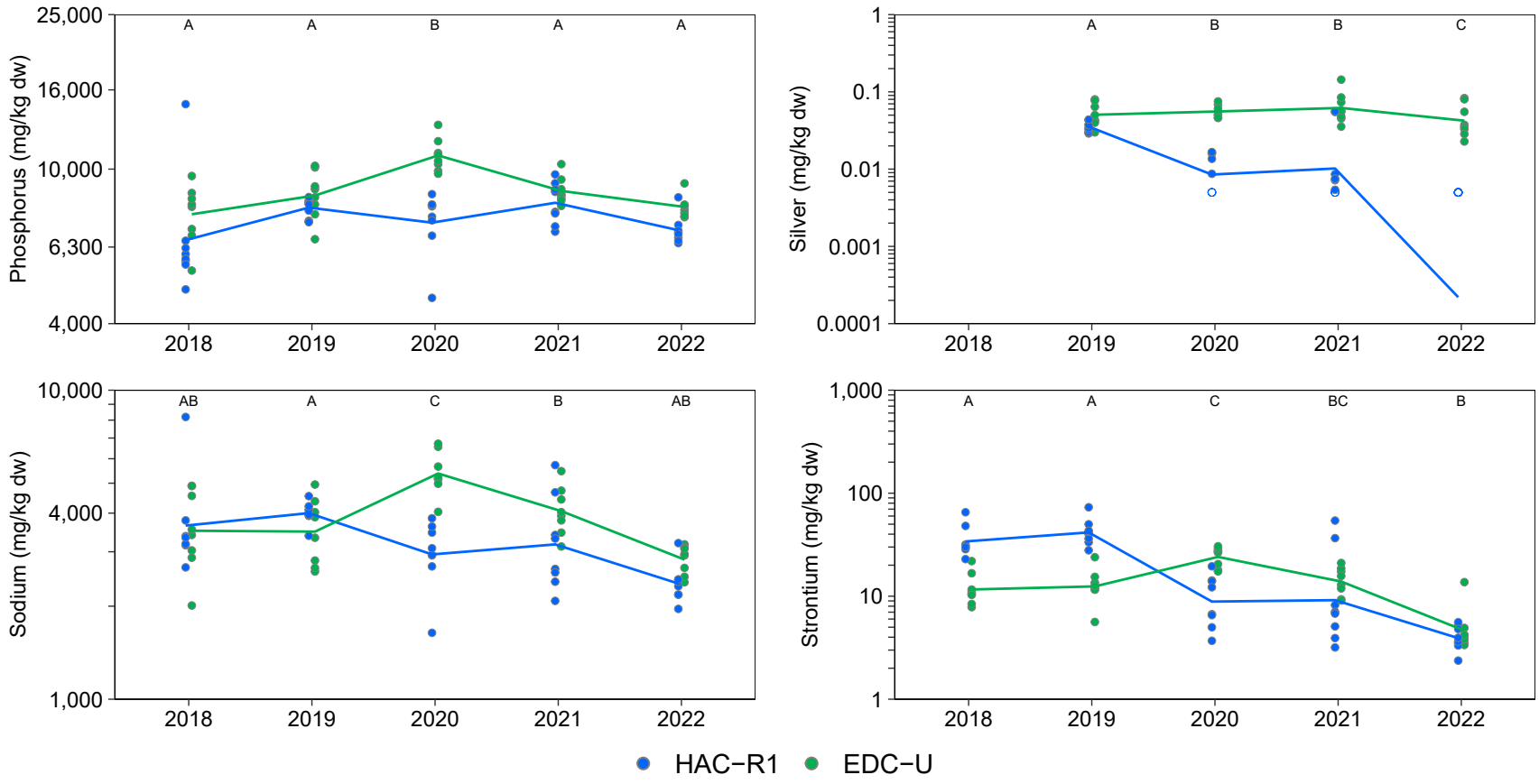

Figure F.4.3: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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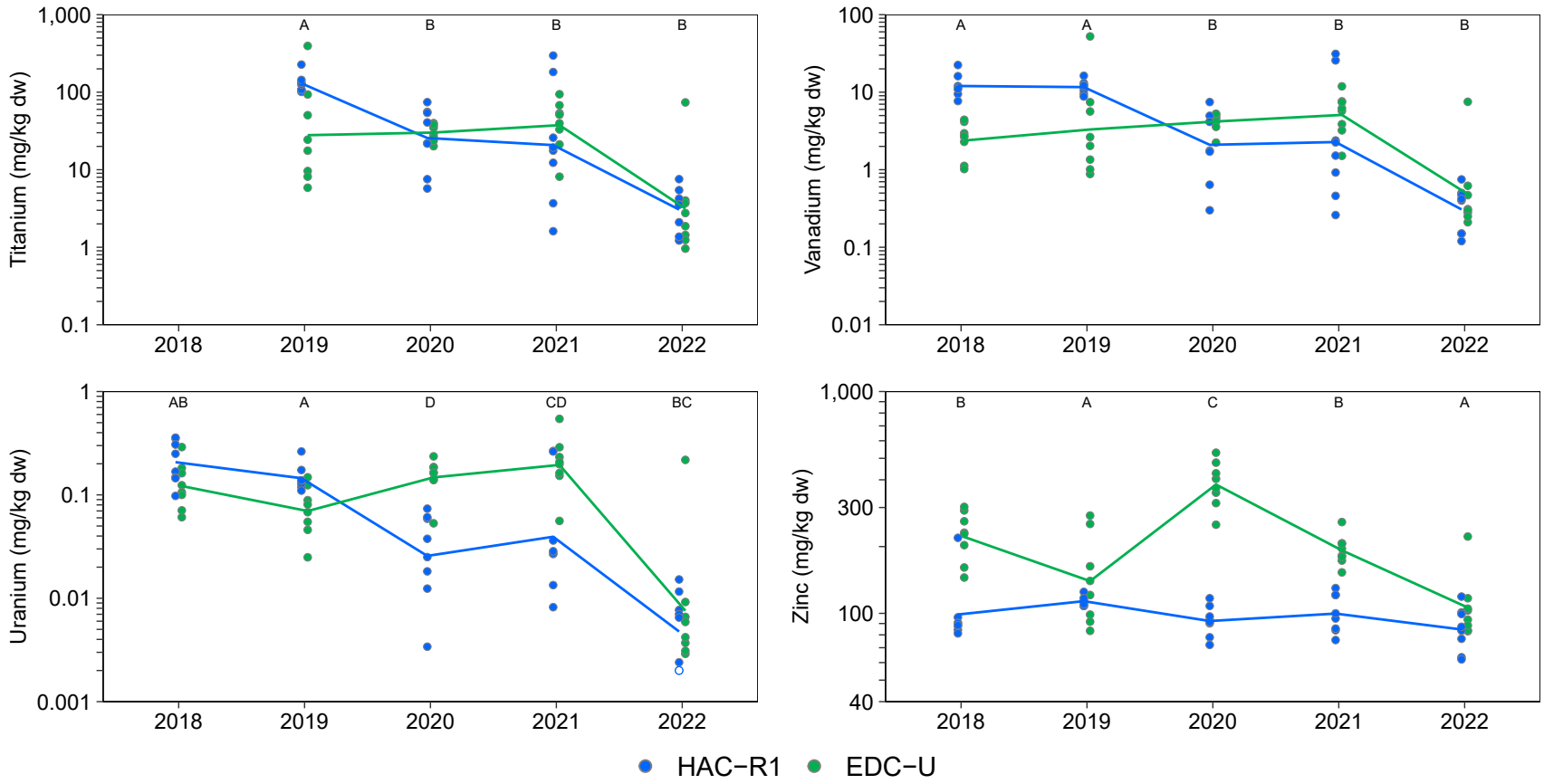

Figure F.4.3: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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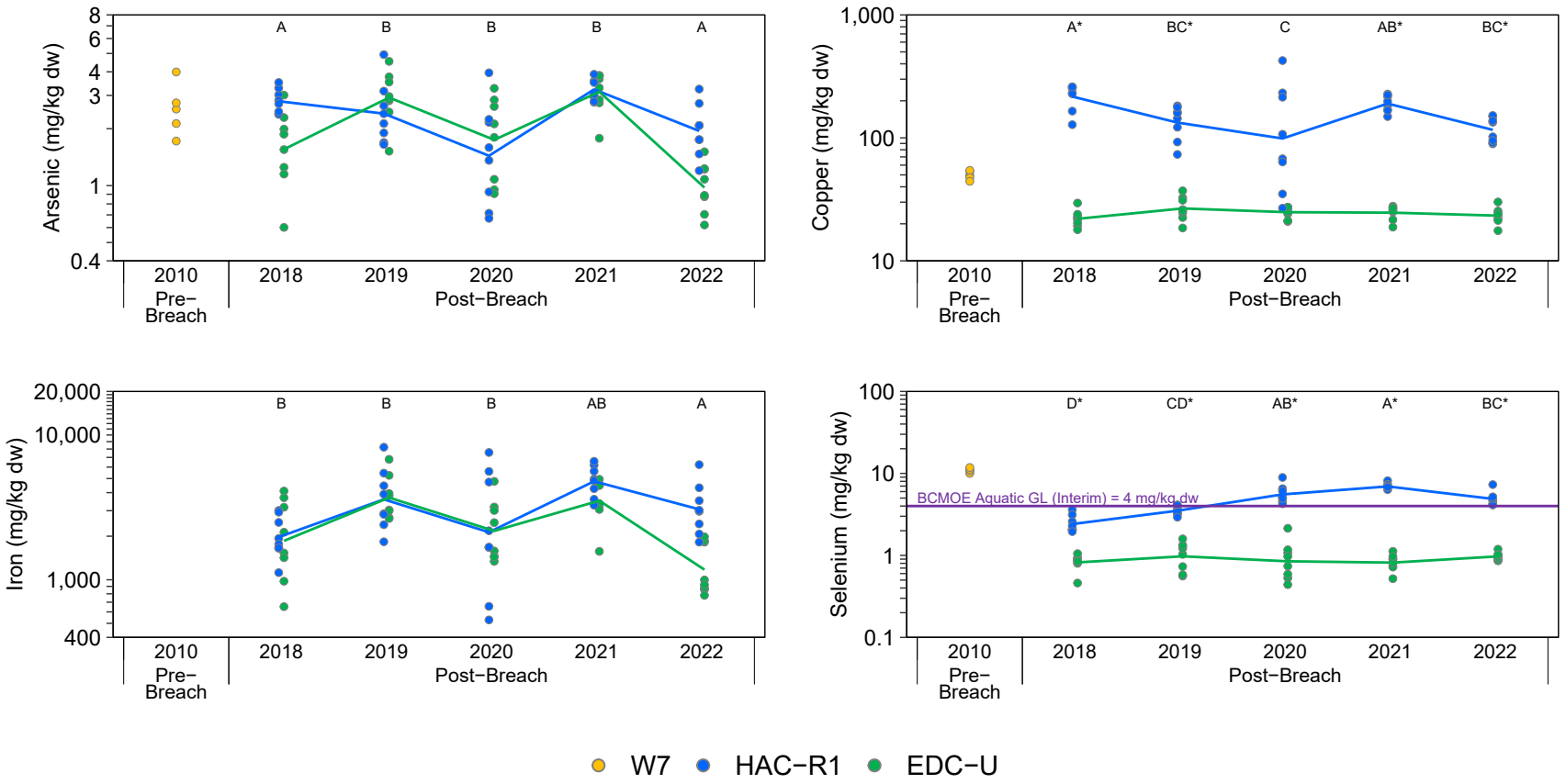

Figure F.4.4: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

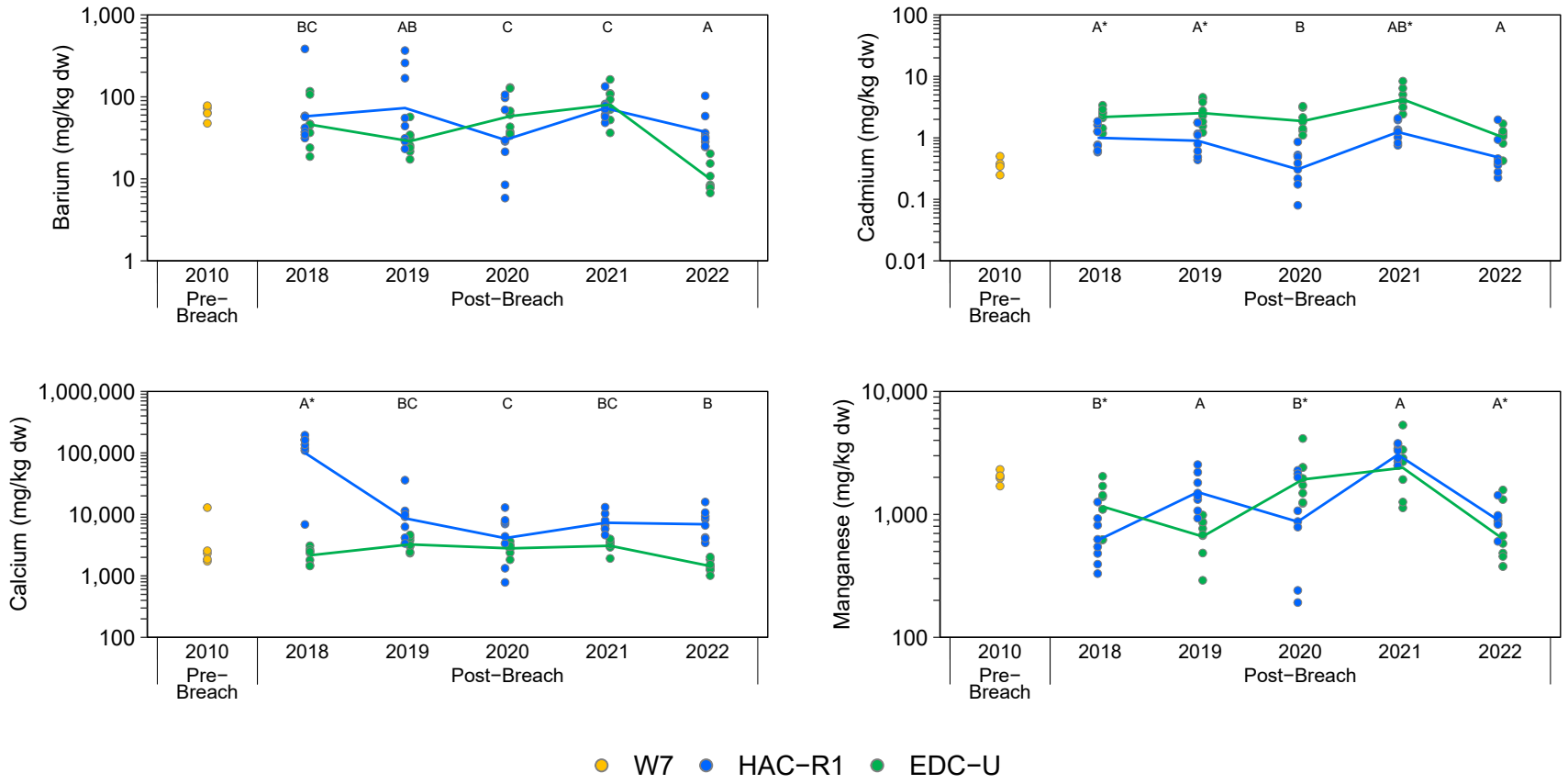

Figure F.4.4: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

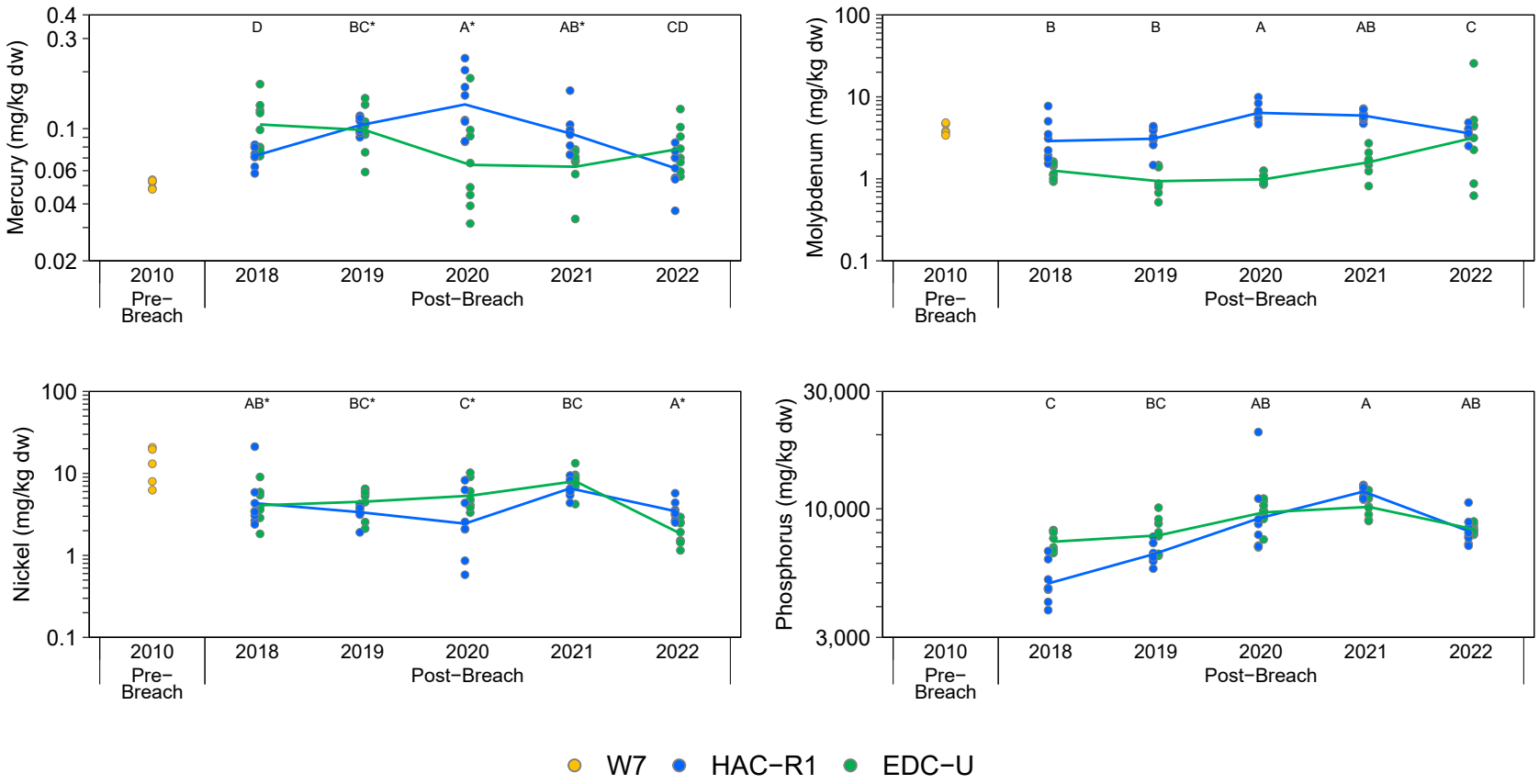

Figure F.4.4: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

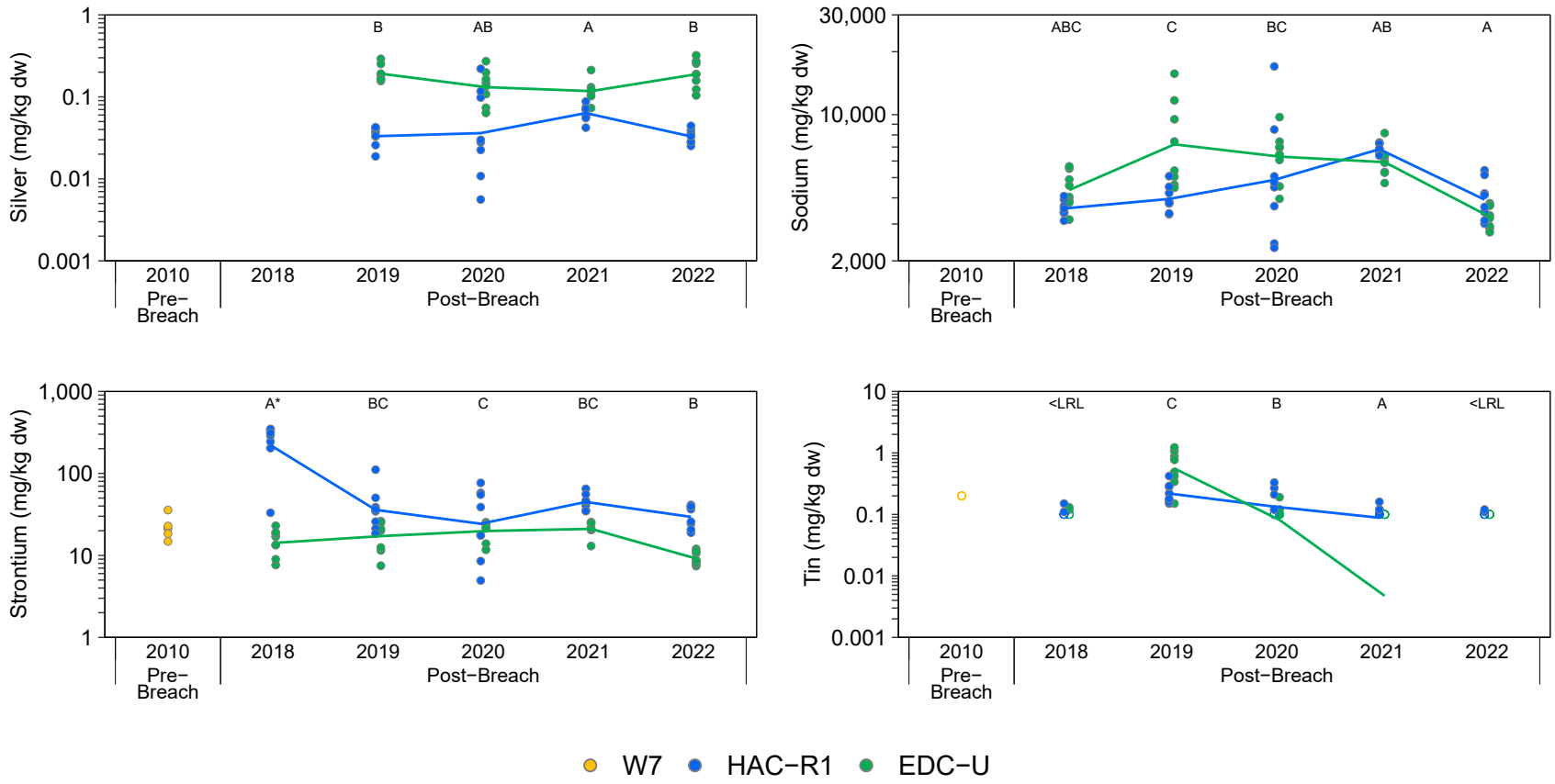

Figure F.4.4: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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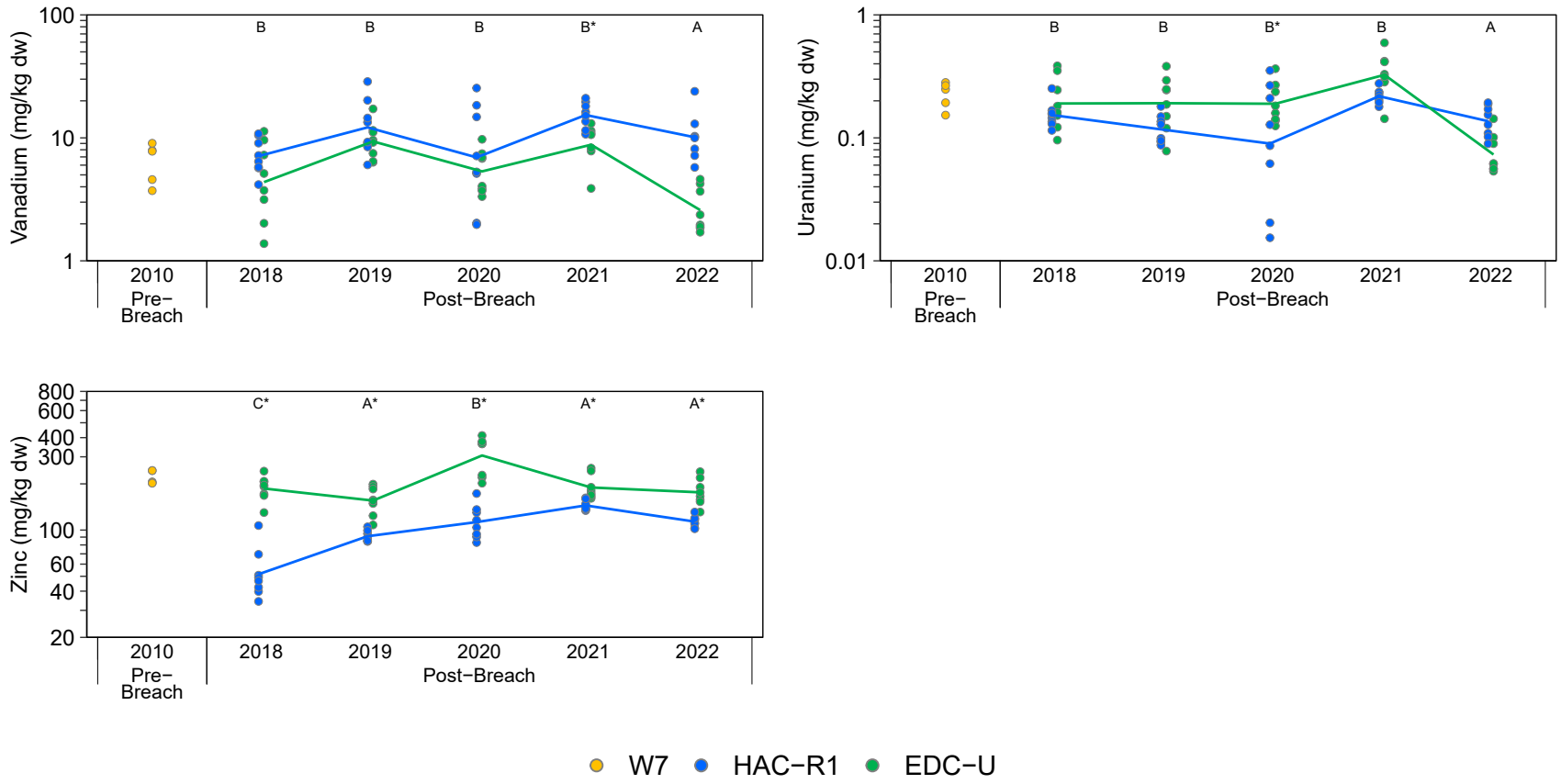

Figure F.4.4: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

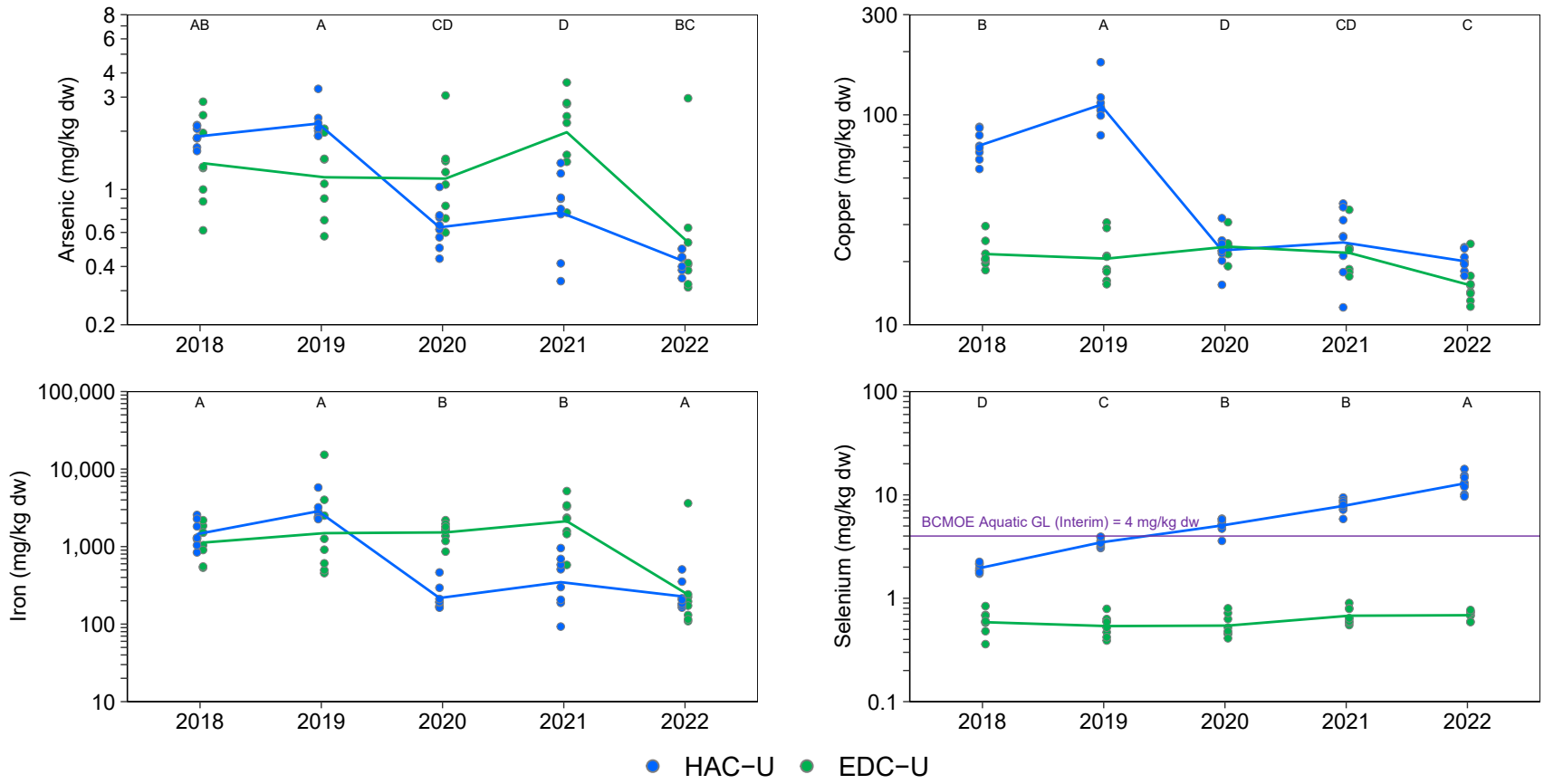

Figure F.4.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

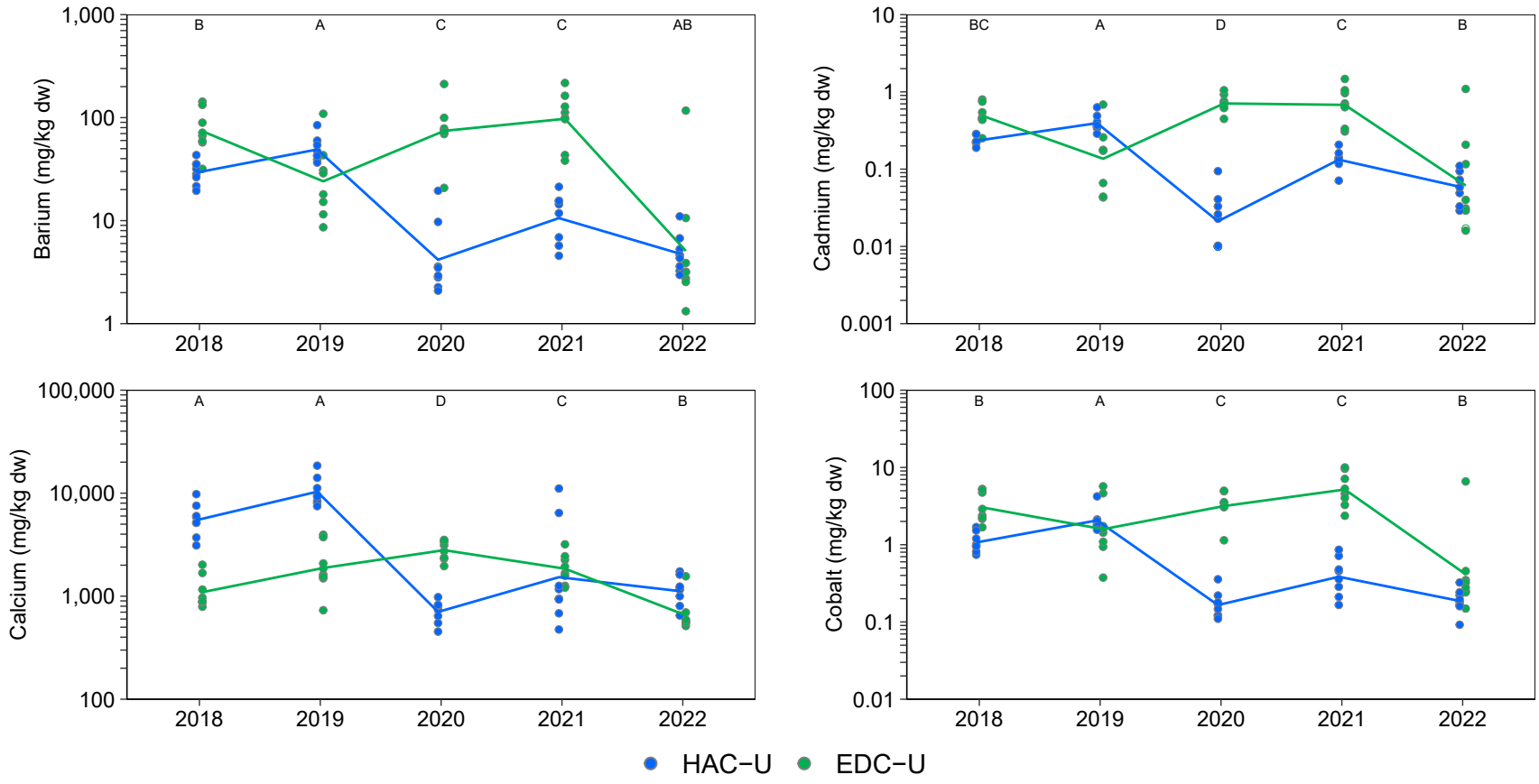

Figure F.4.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

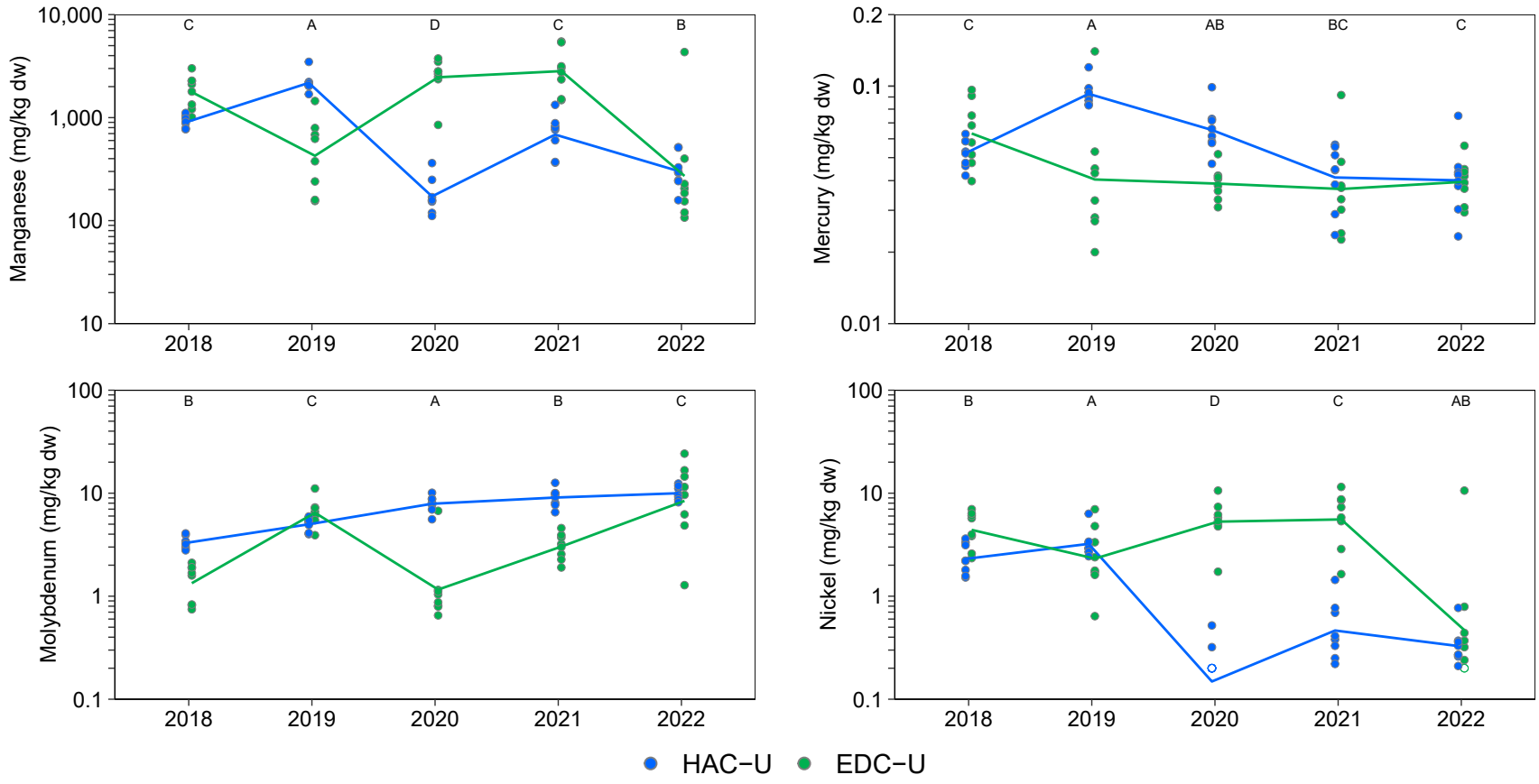

Figure F.4.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

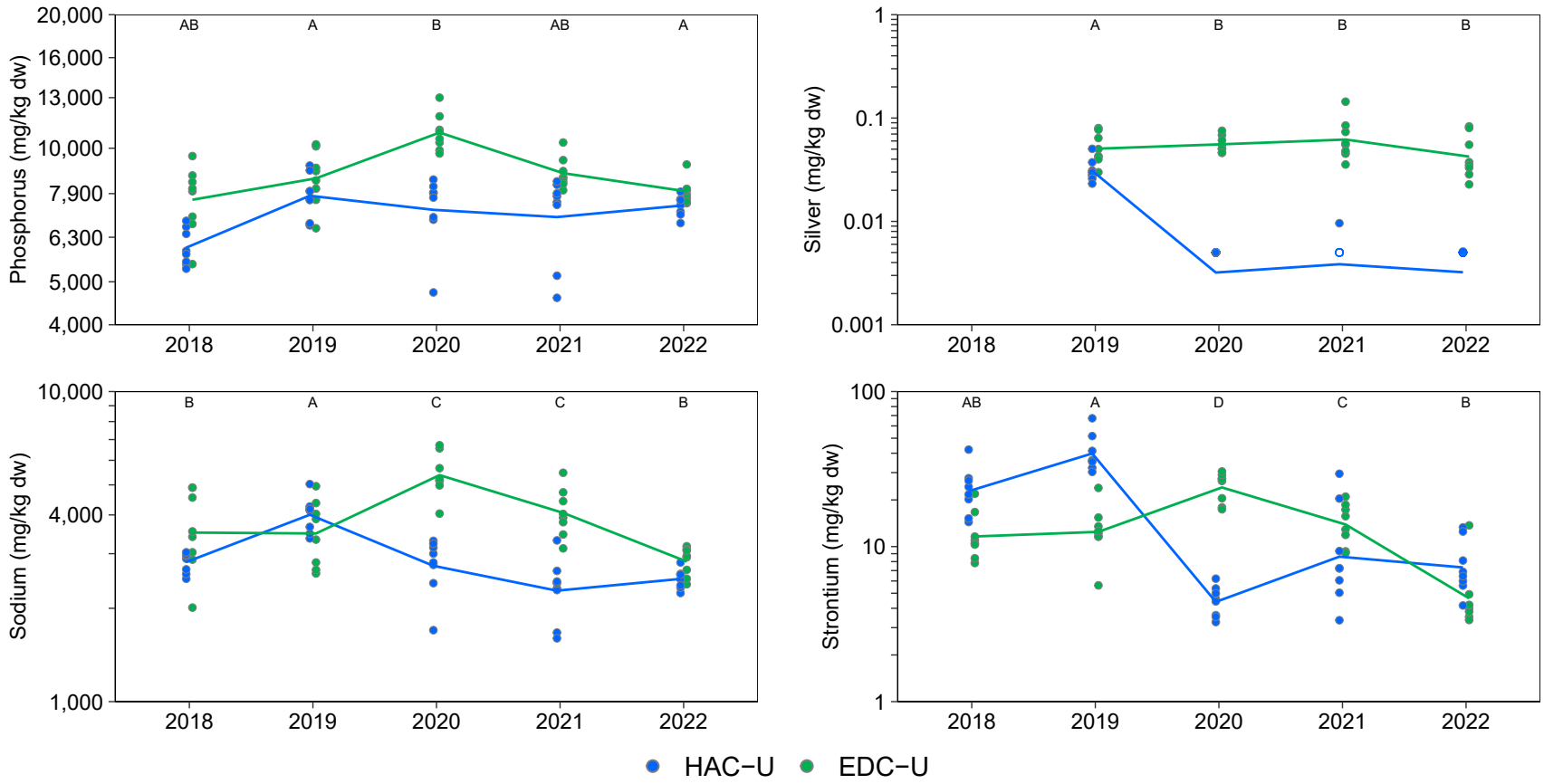

Figure F.4.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

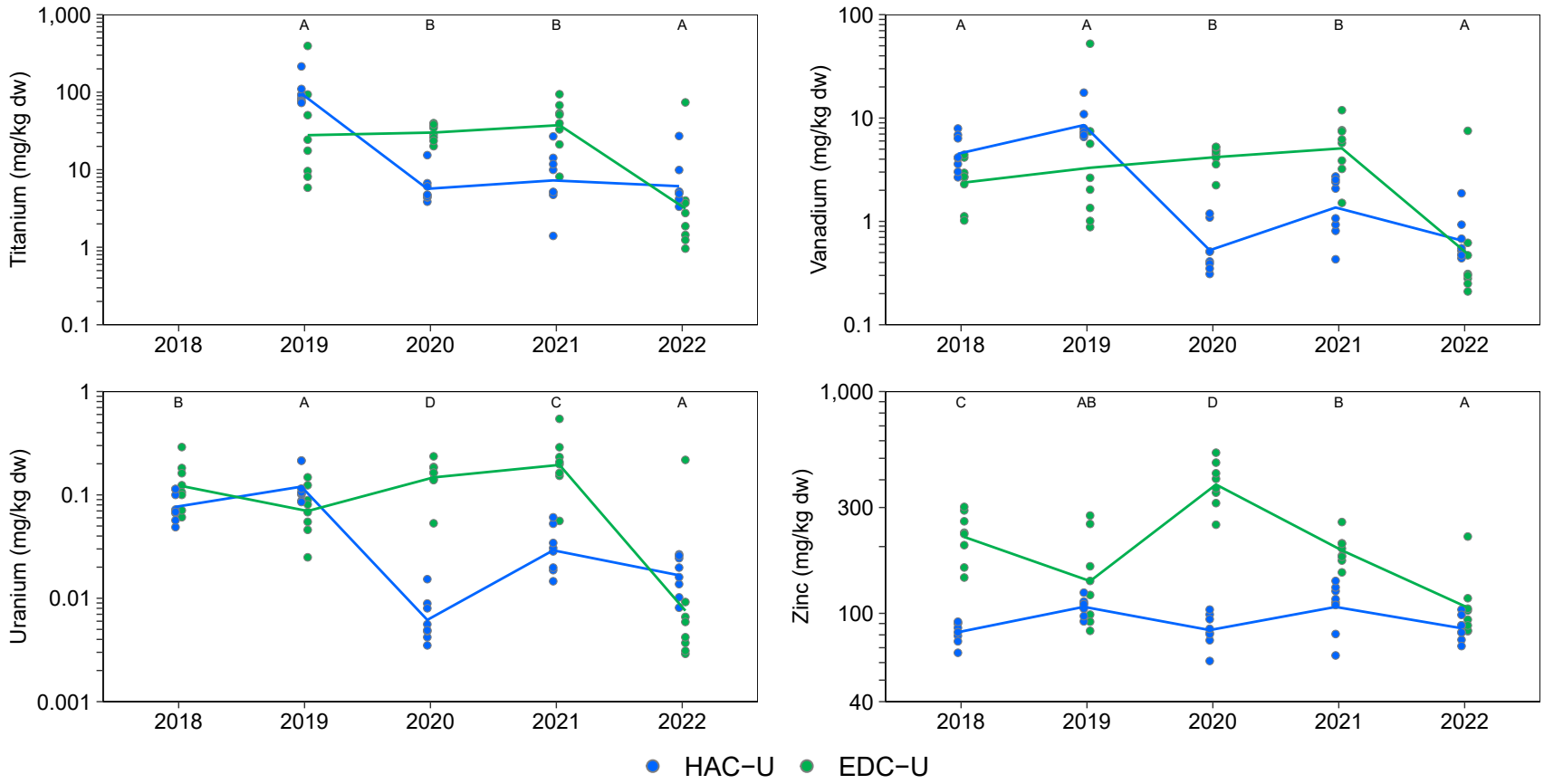

Figure F.4.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

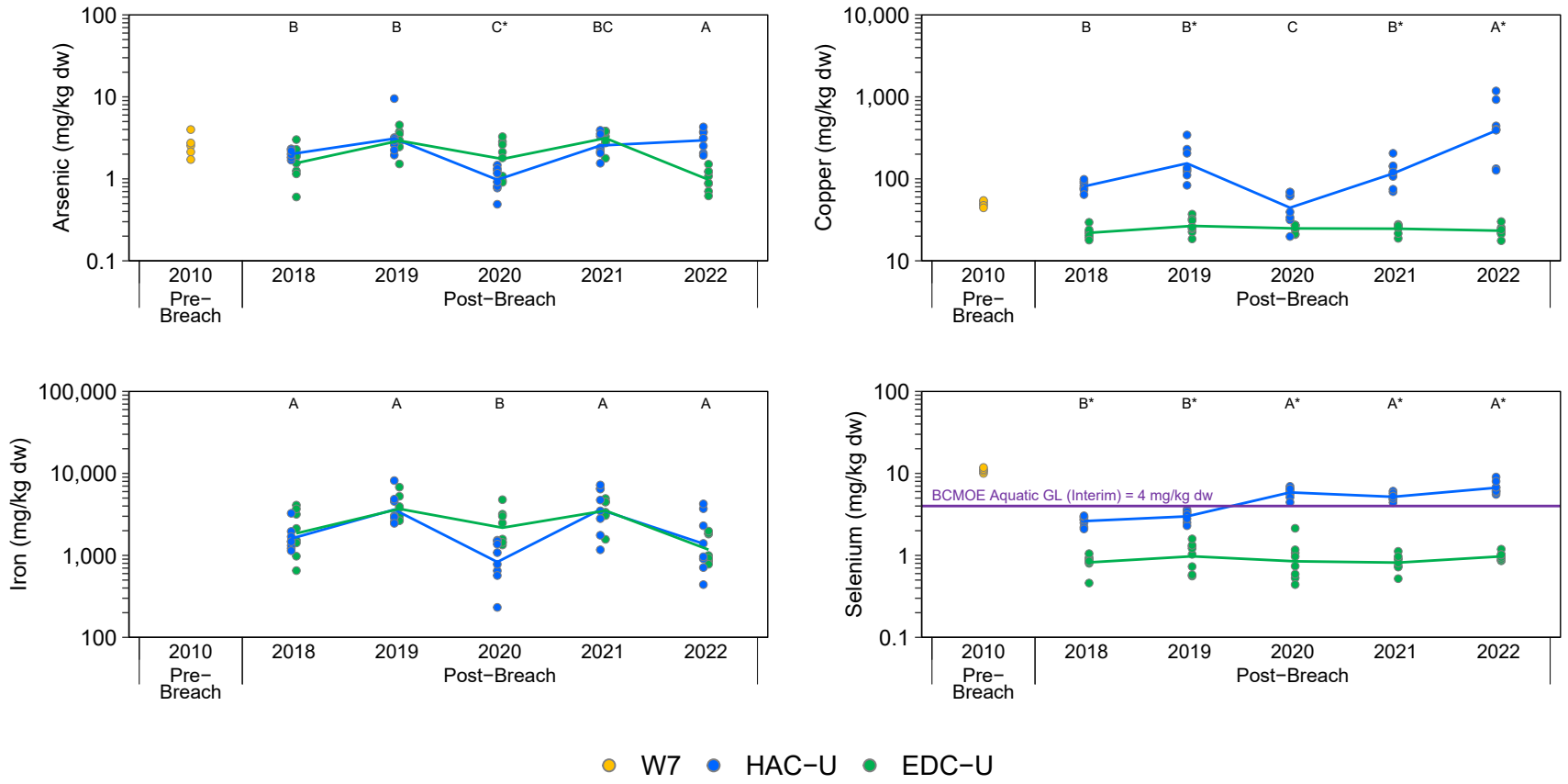

Figure F.4.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log −normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

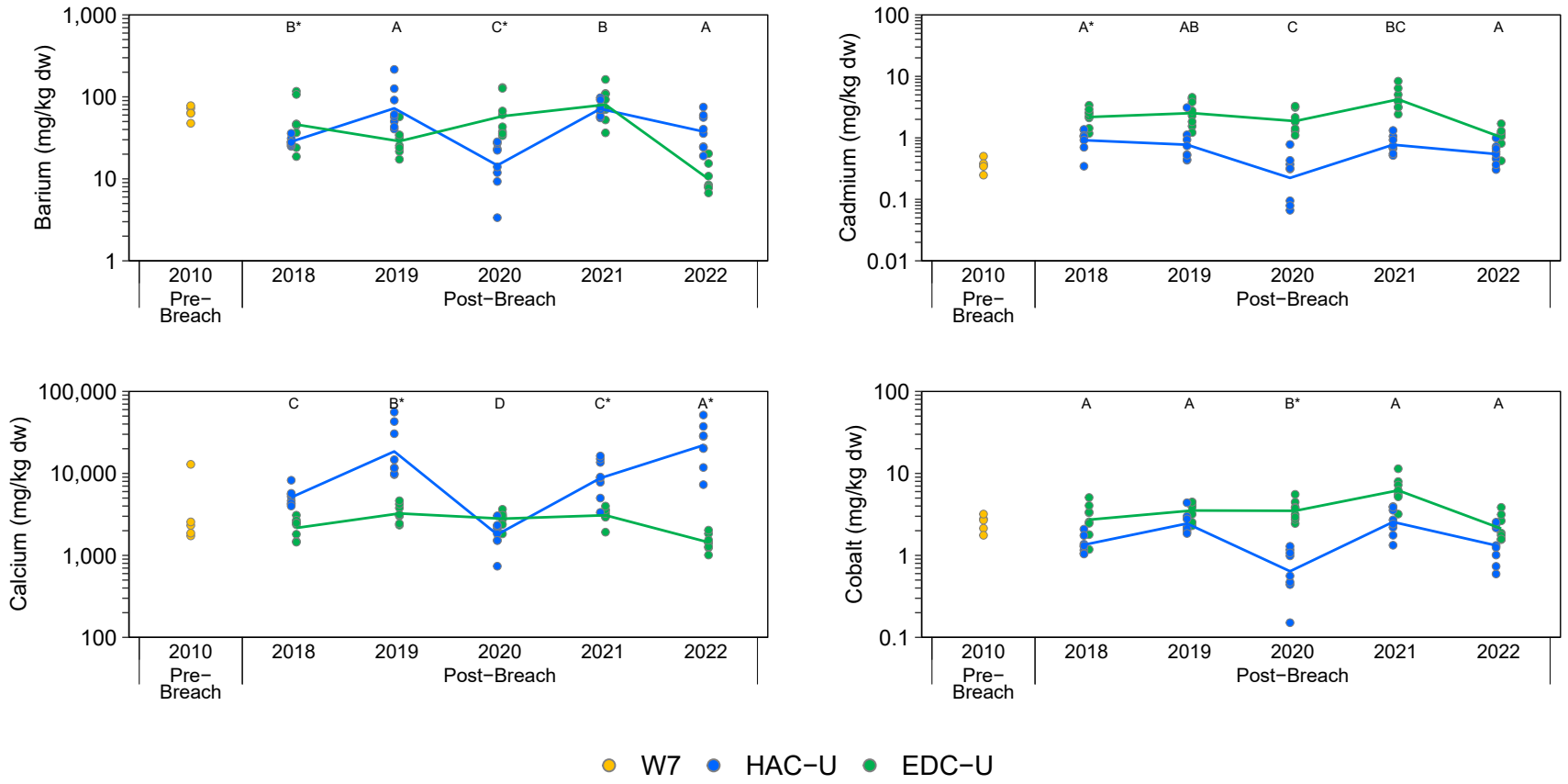

Figure F.4.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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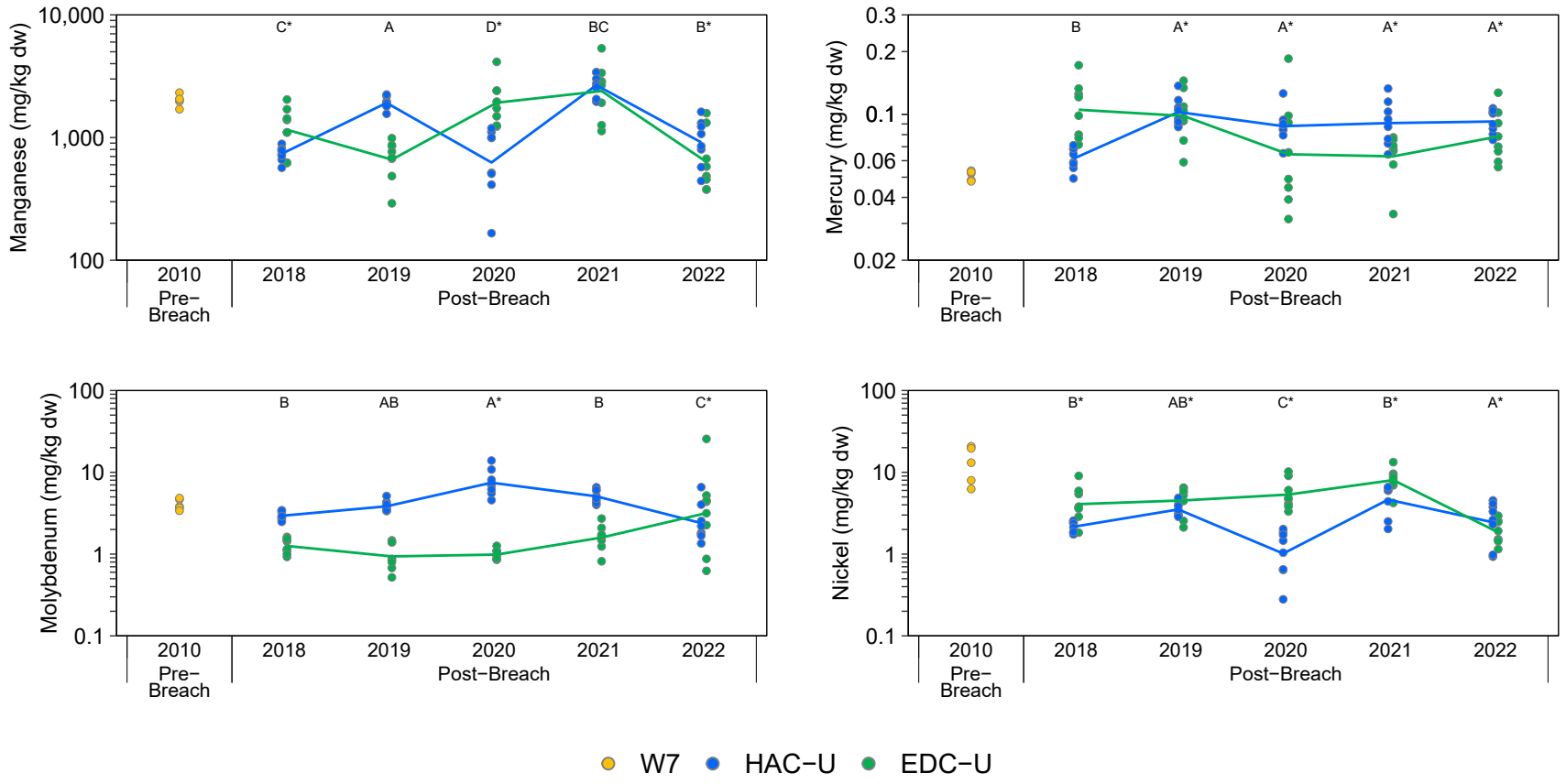

Figure F.4.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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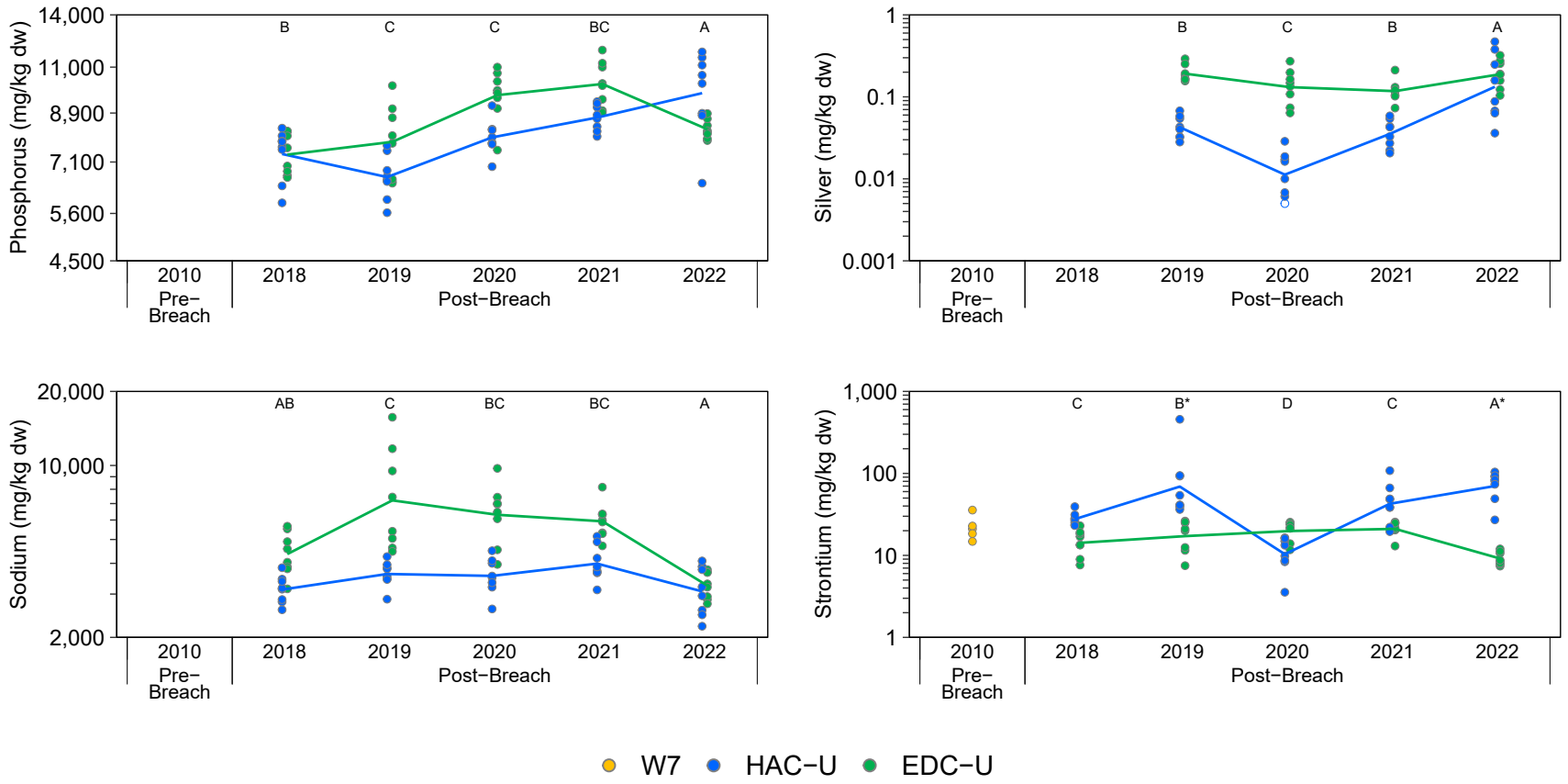

Figure F.4.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment; GL = Guideline; dw = dry weight; <LRL = lower than the laboratory reporting limit (LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log −normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

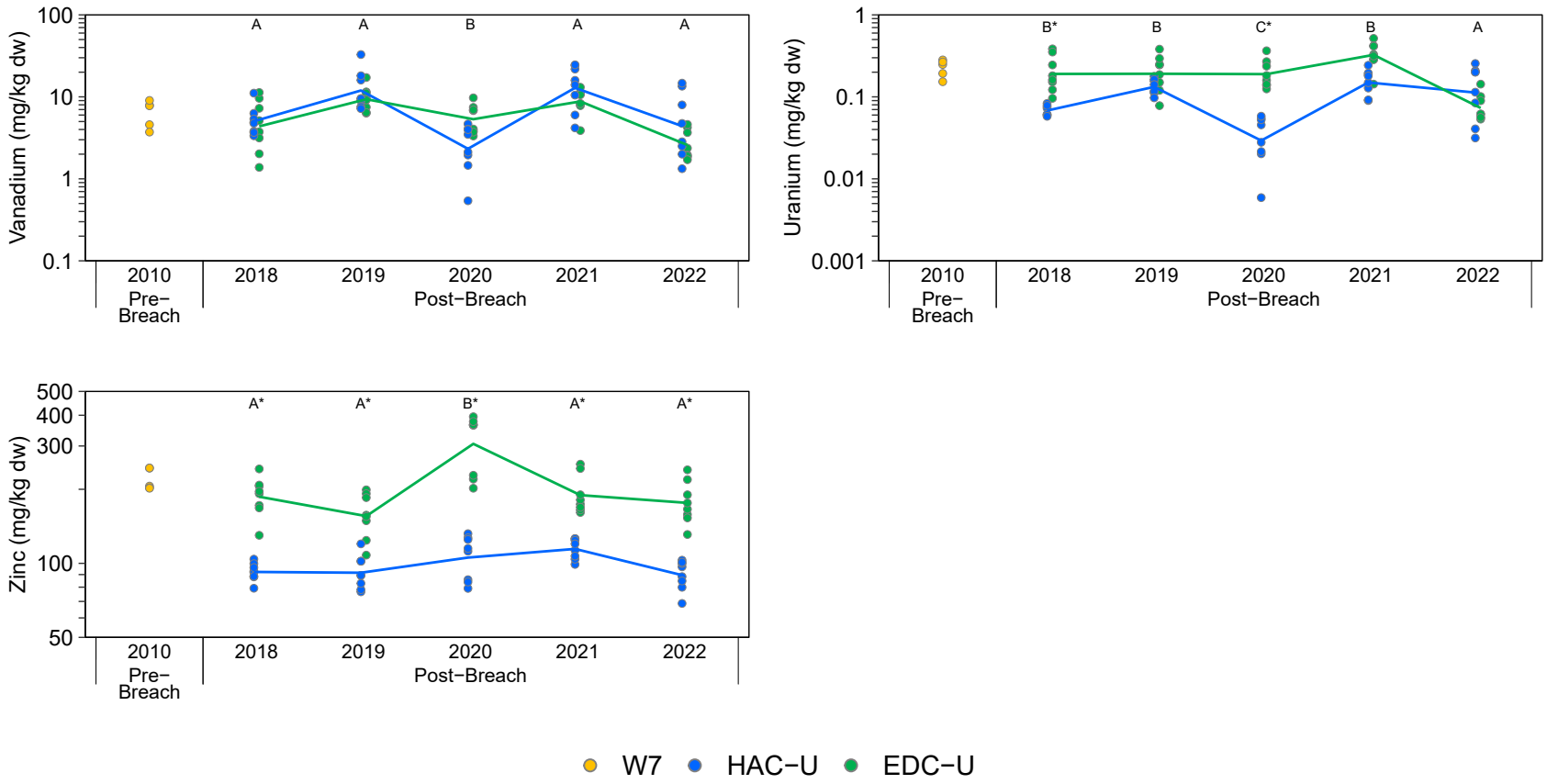

Figure F.4.6: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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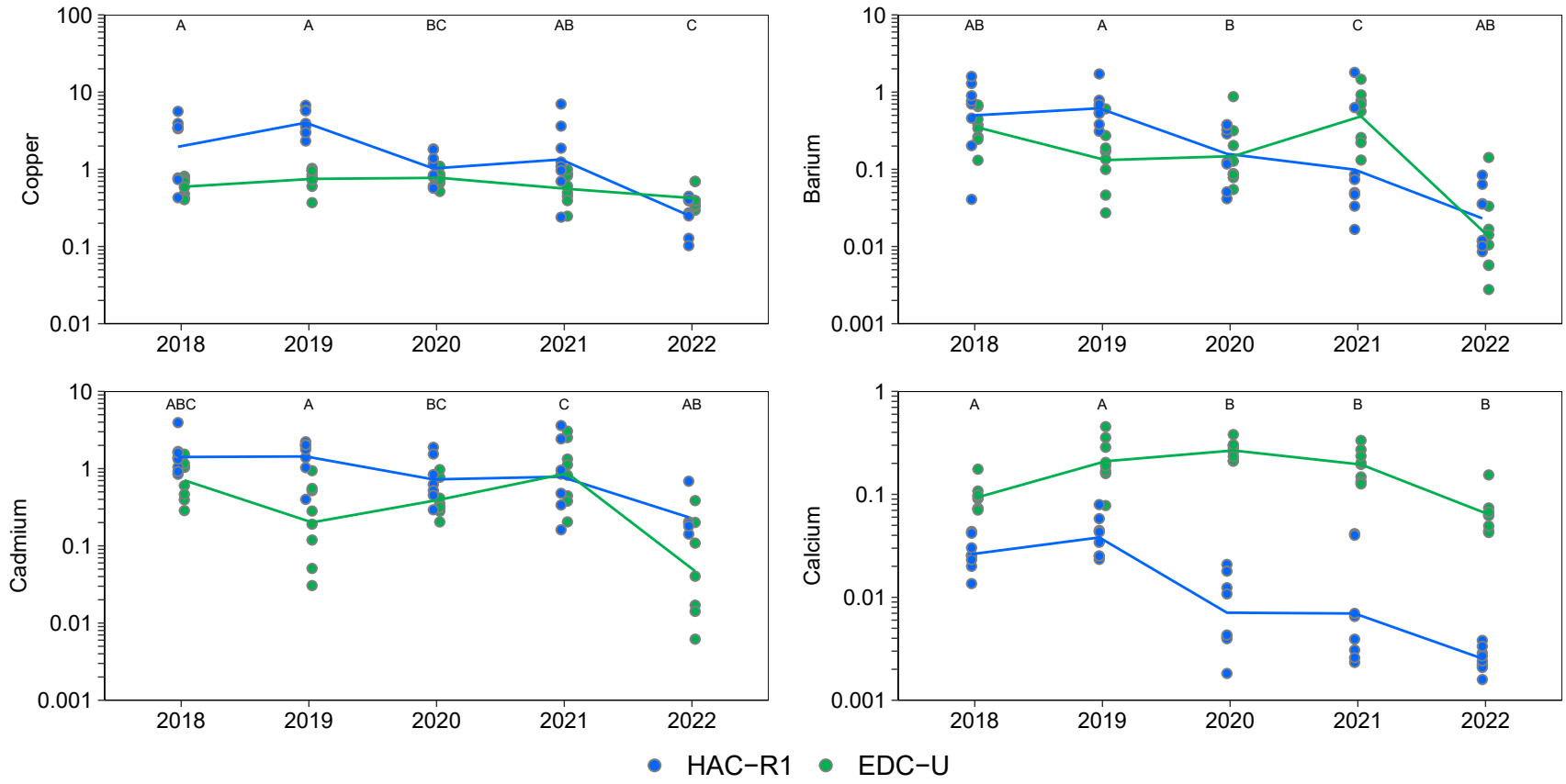

Figure F.4.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log-normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

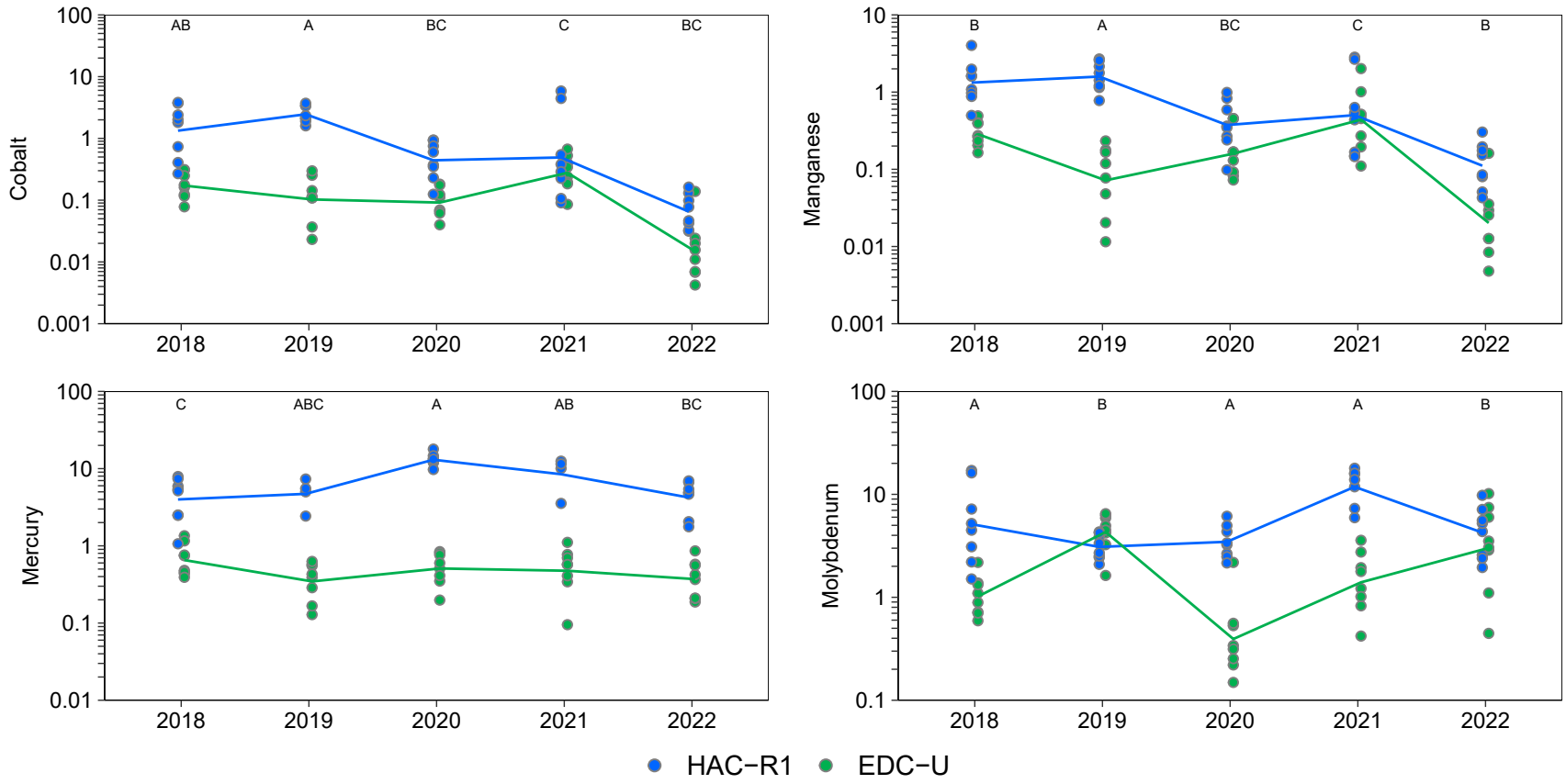

Figure F.4.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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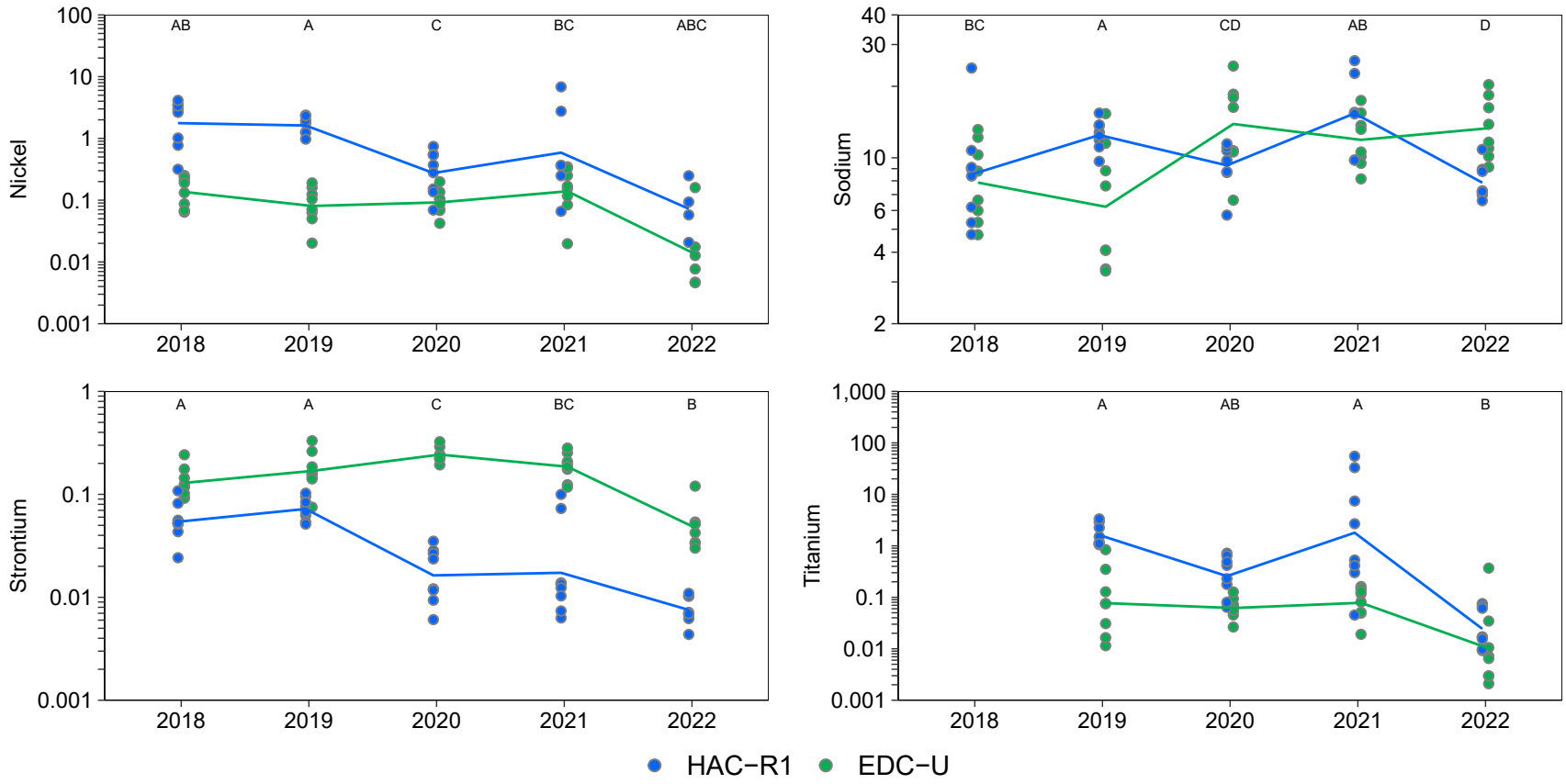

Figure F.4.7: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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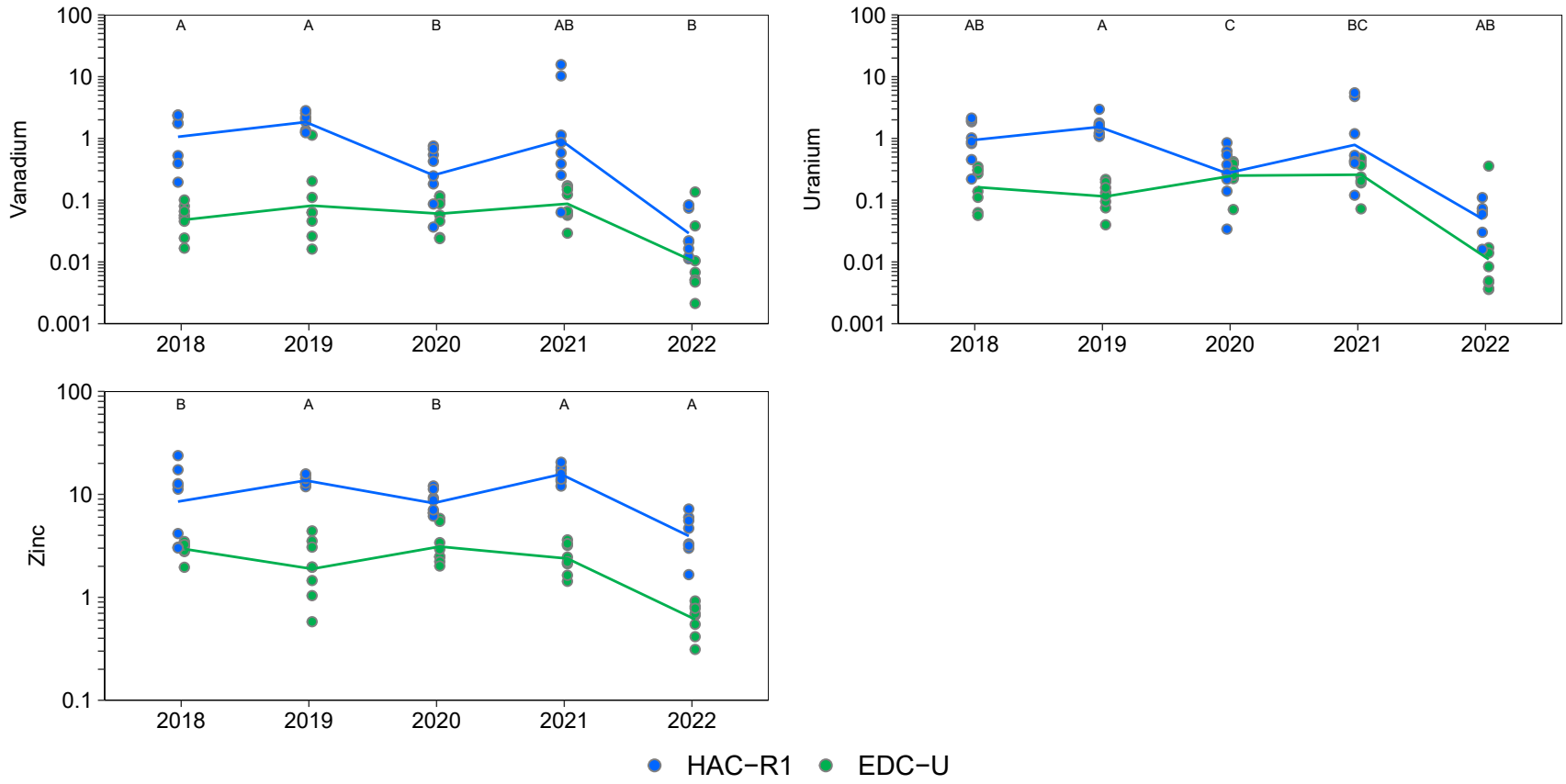

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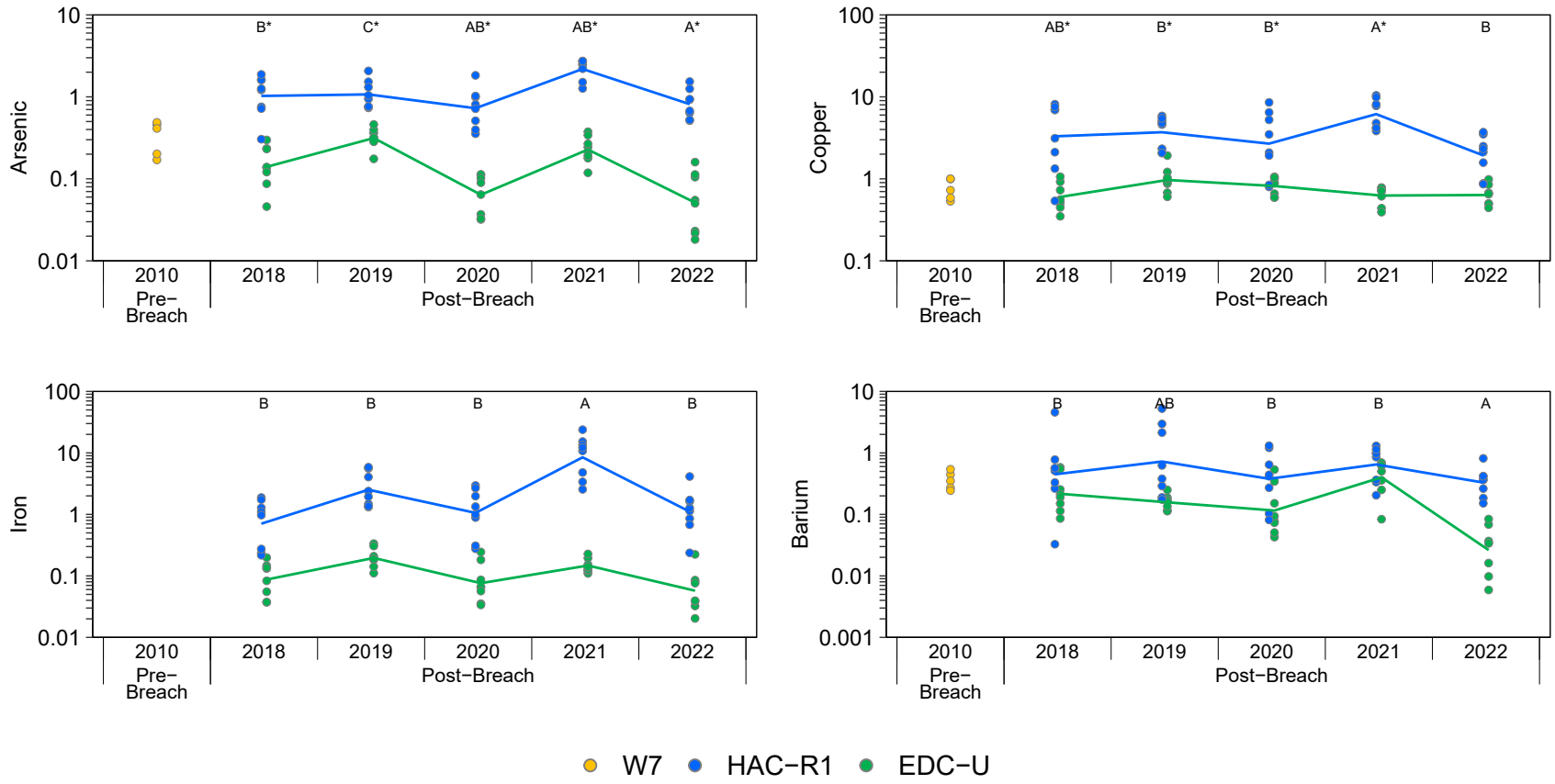

Figure F.4.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). W7 (2010) is the pre-breach equivalent of HAC-R1. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

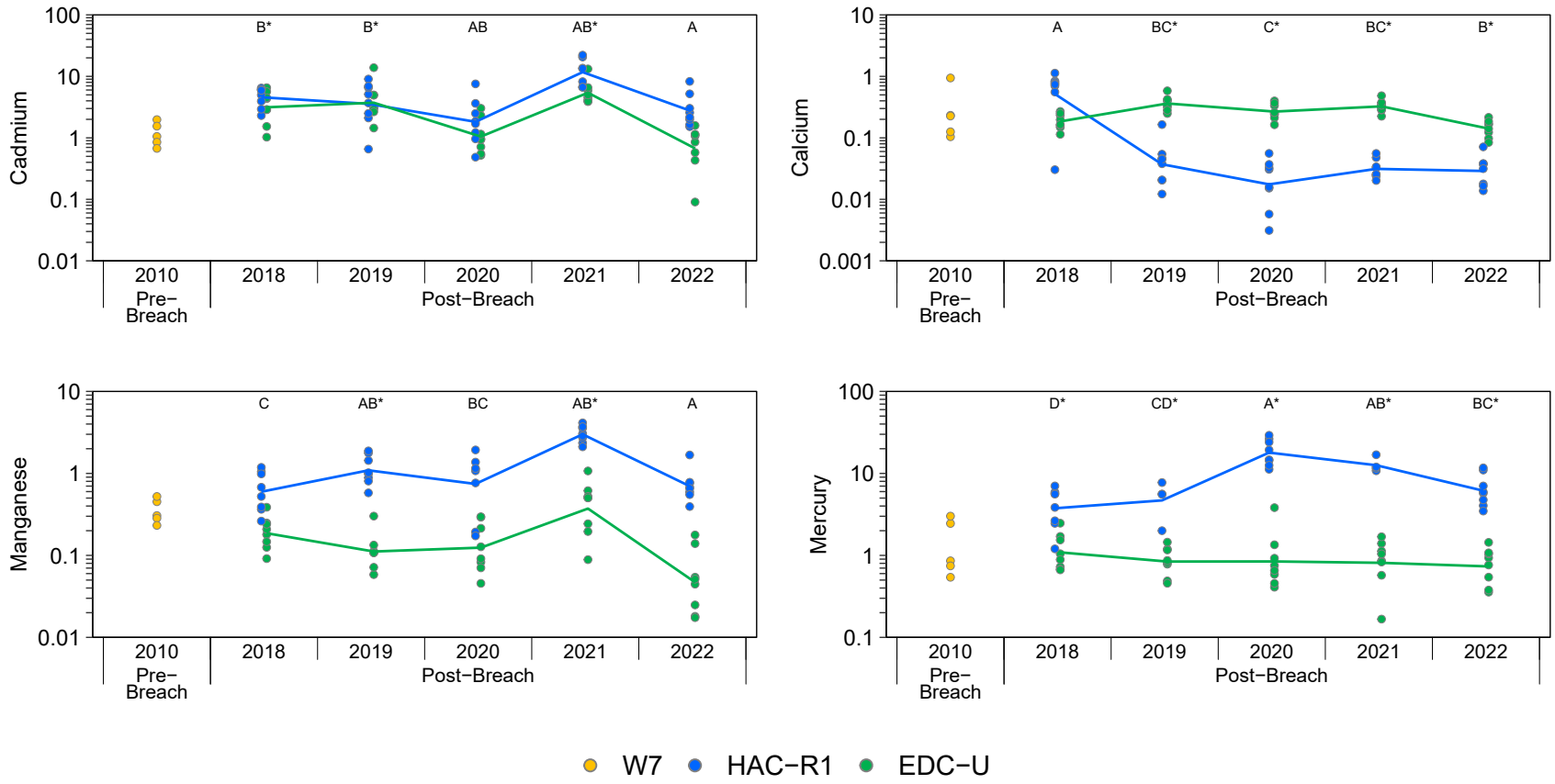

Figure F.4.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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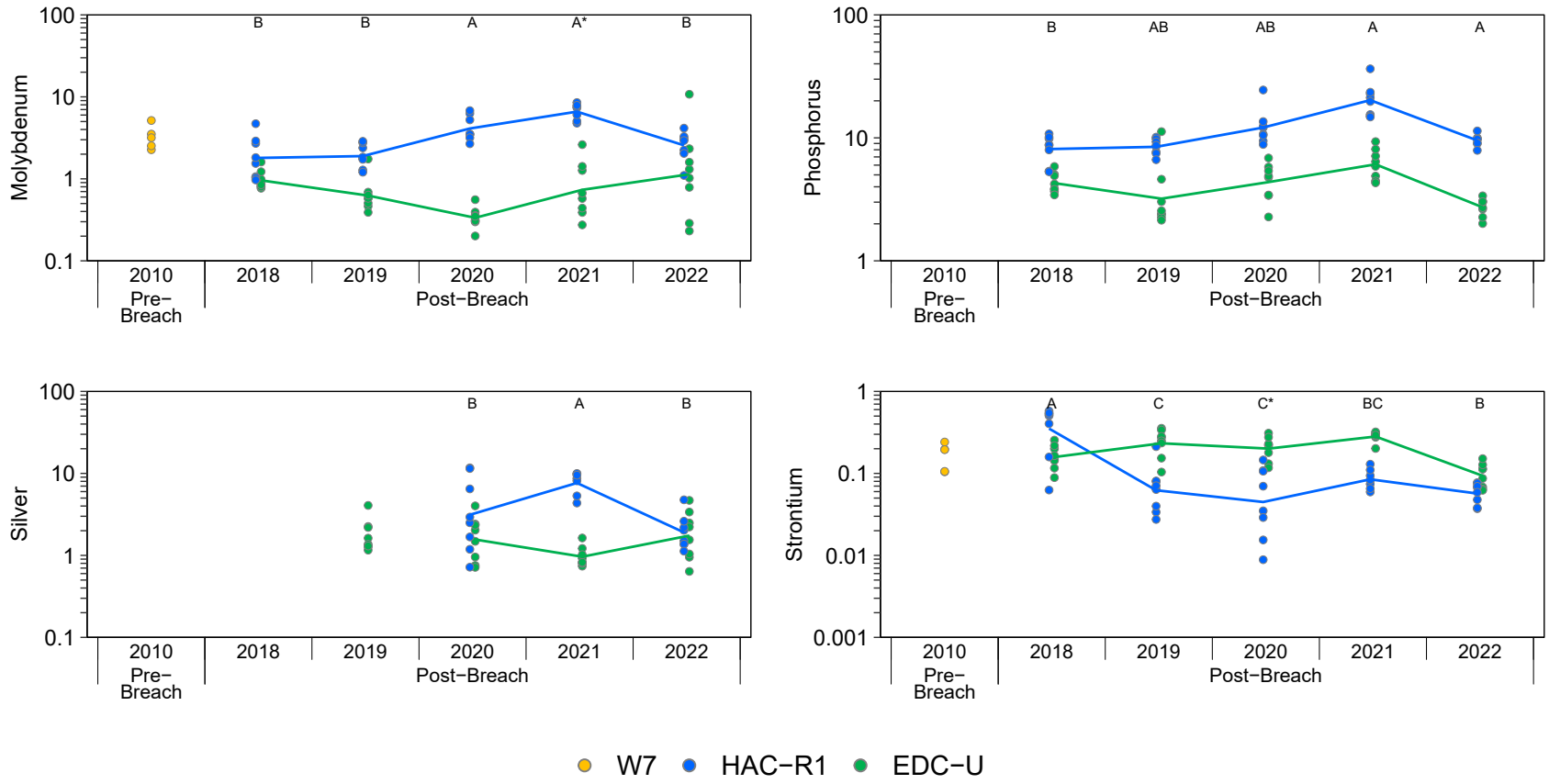

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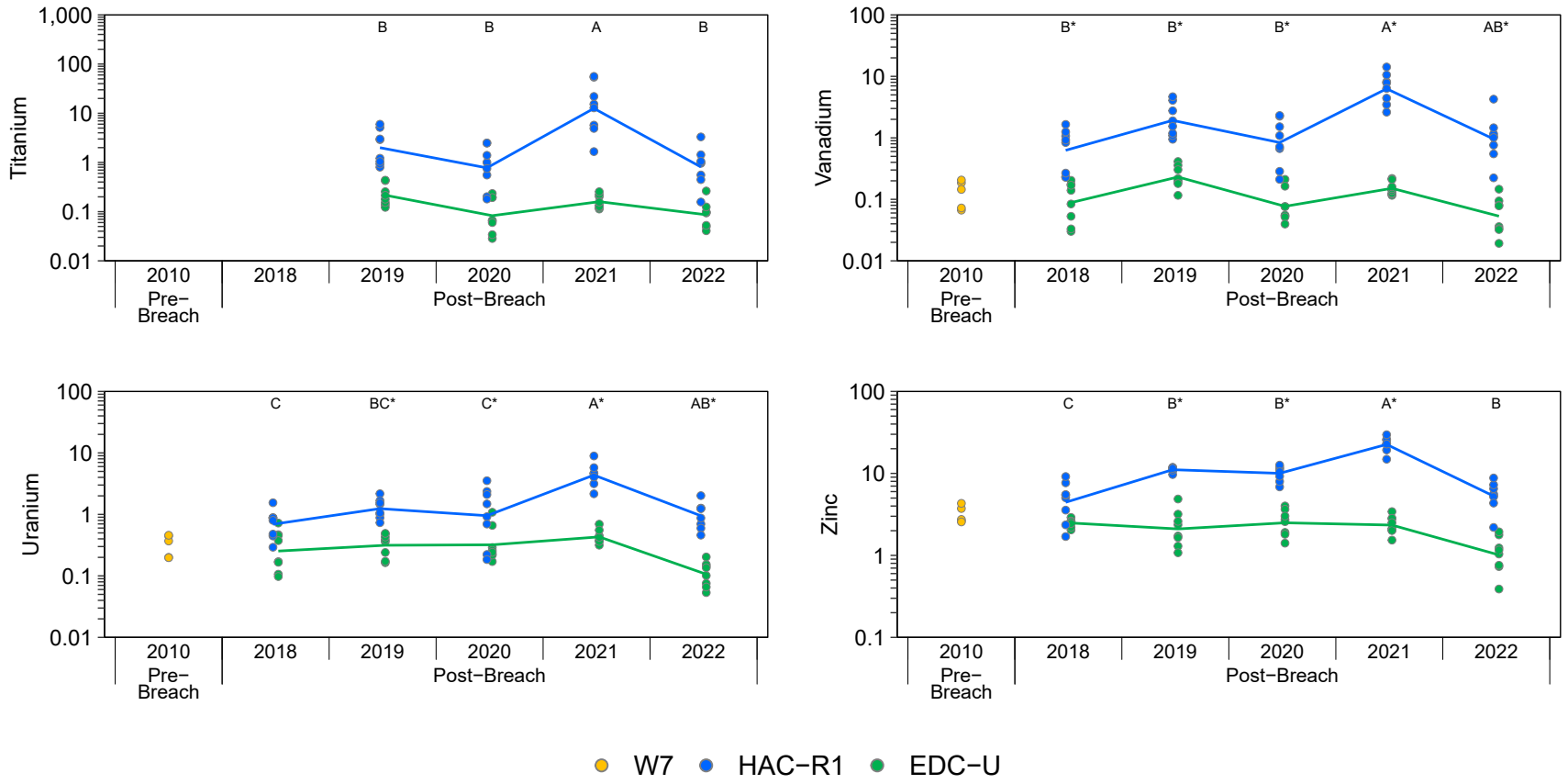

Figure F.4.8: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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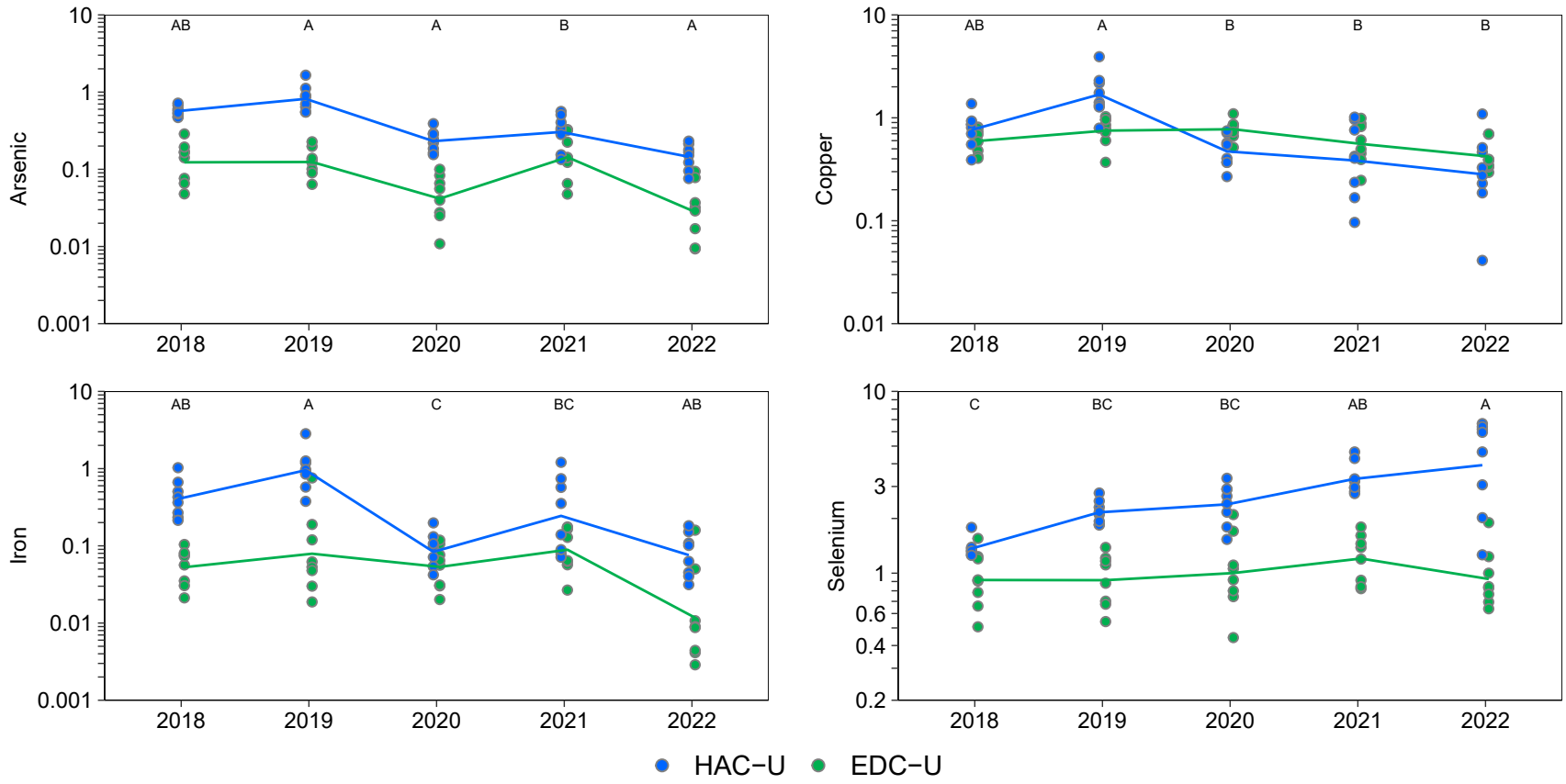

Figure F.4.9: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

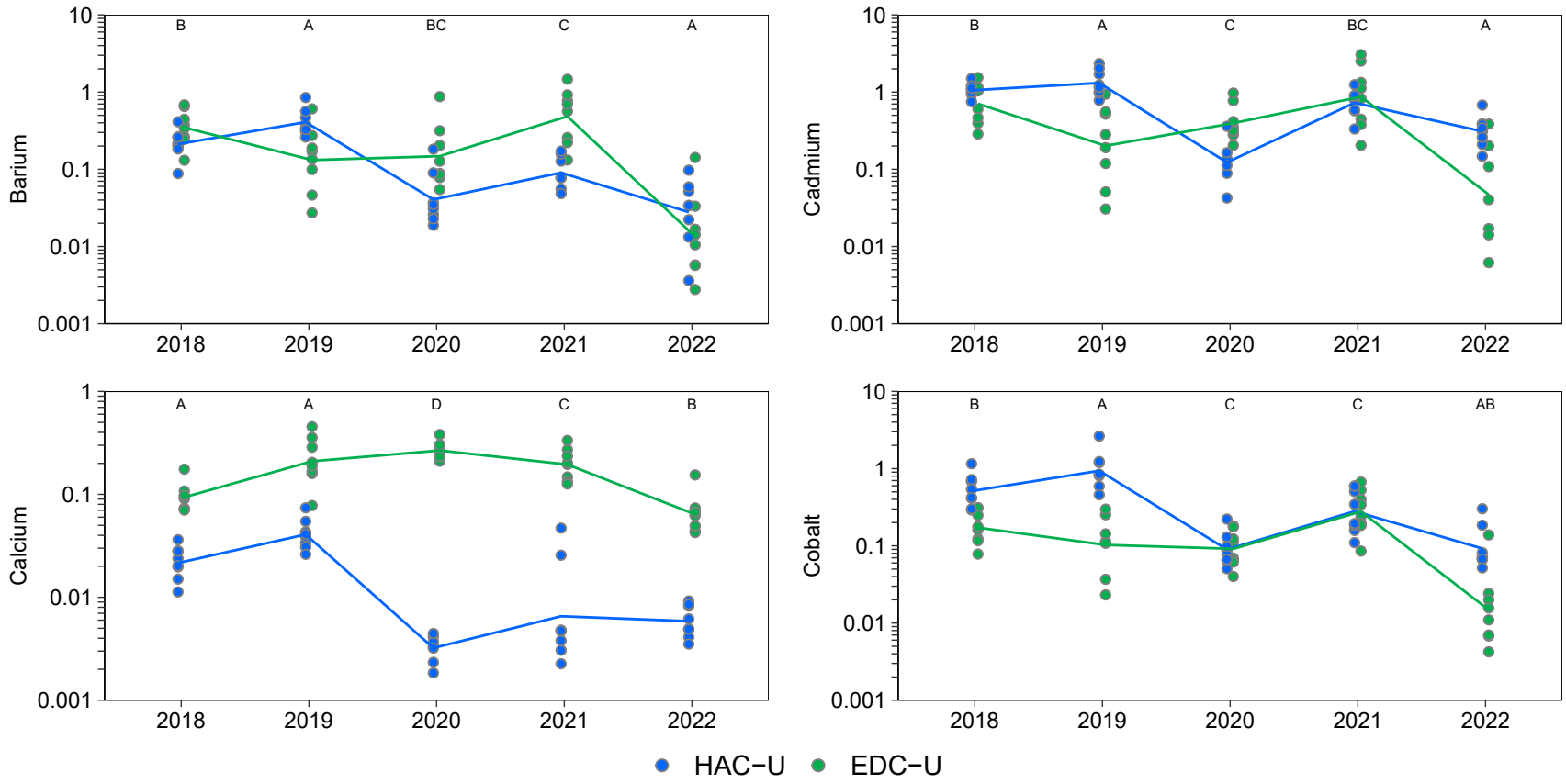

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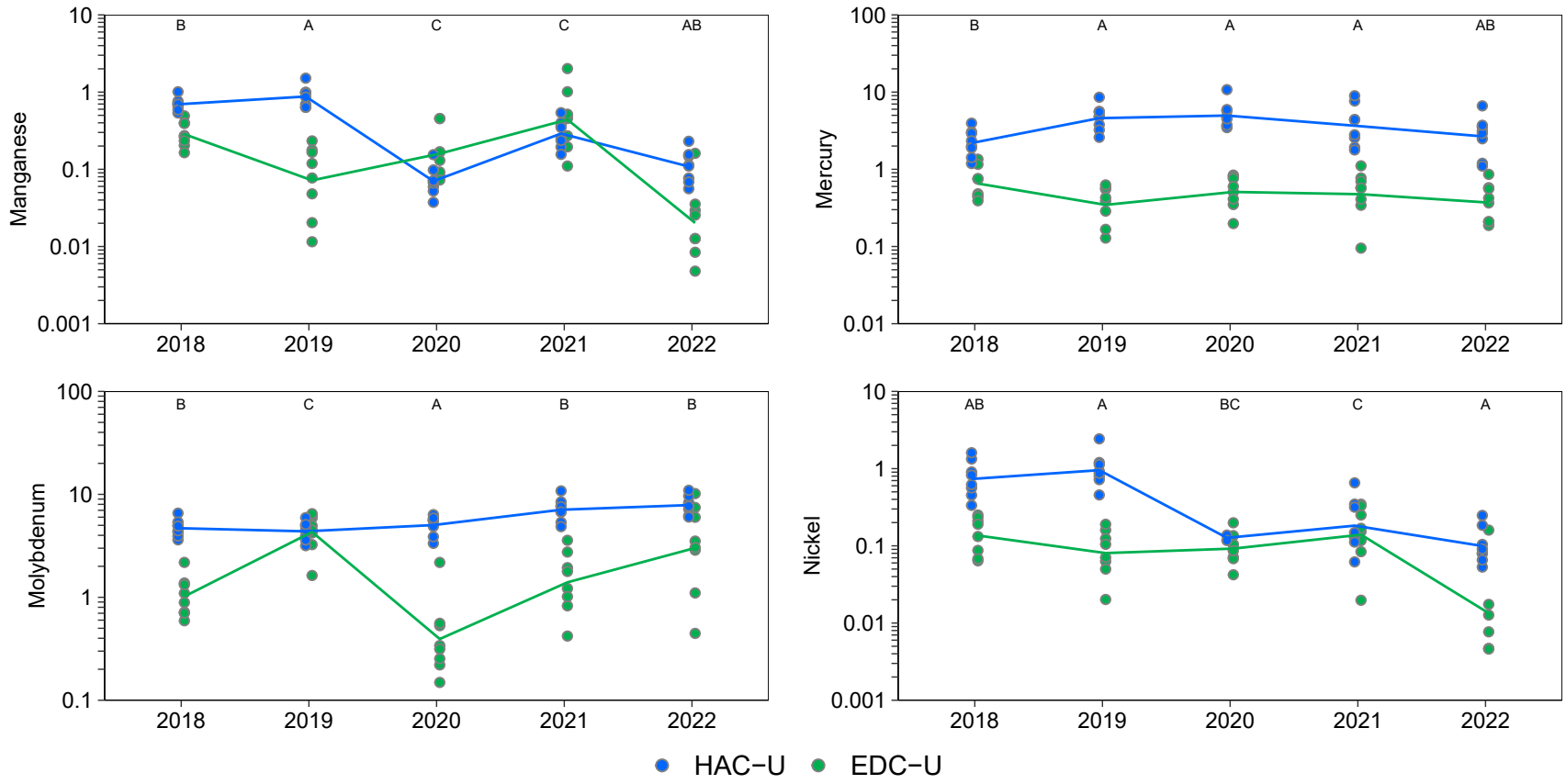

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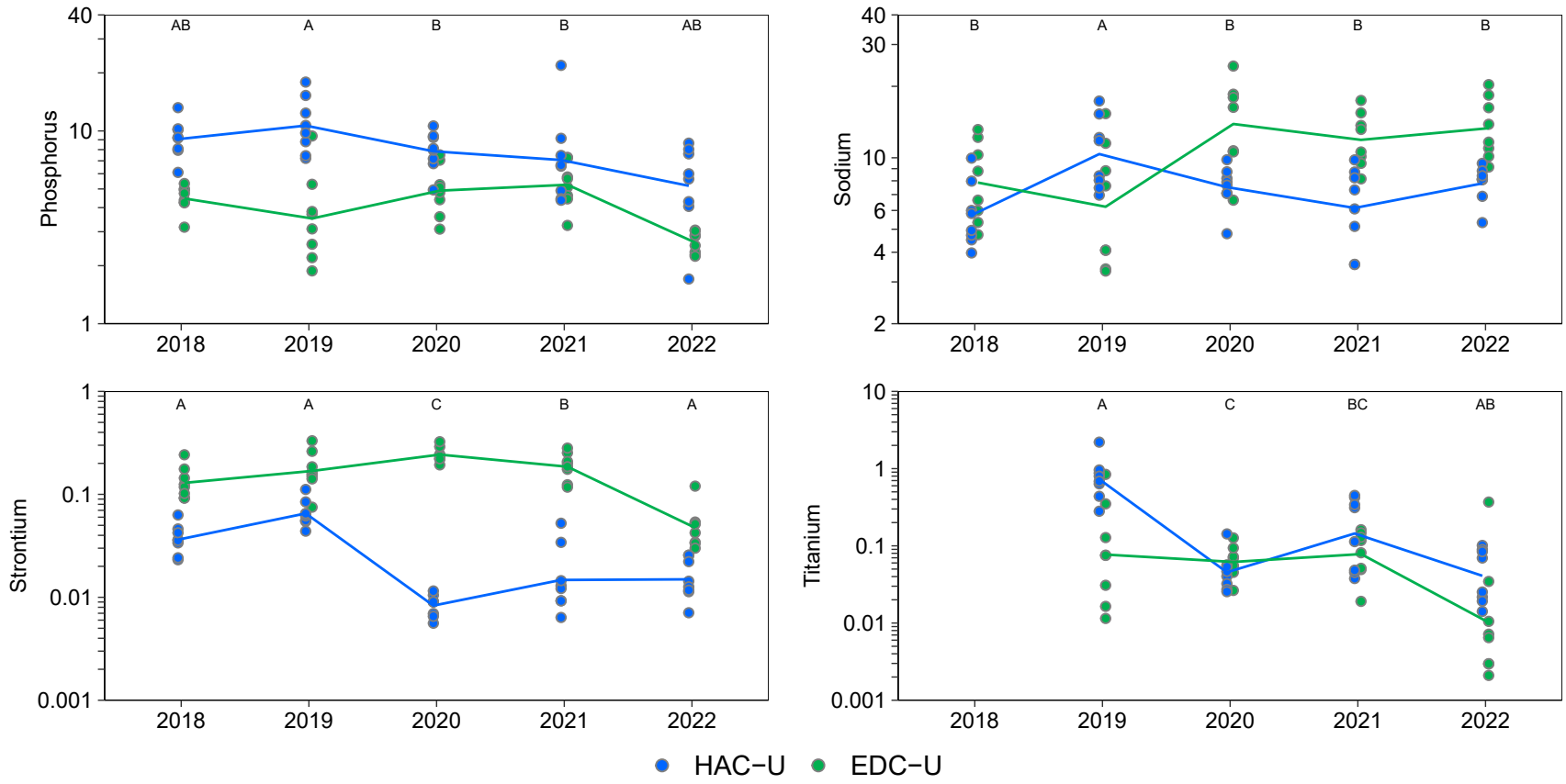

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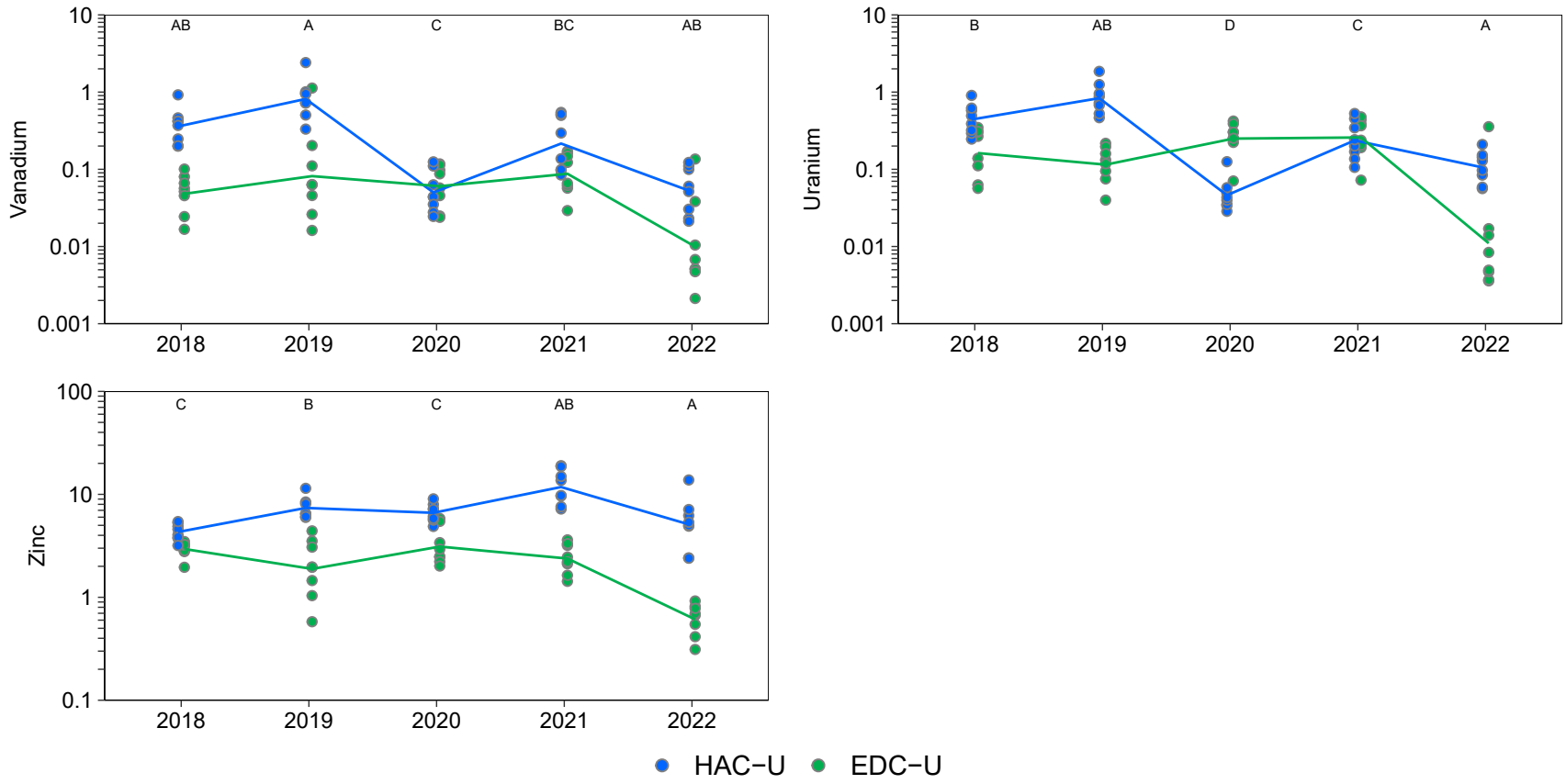

Figure F.4.9: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

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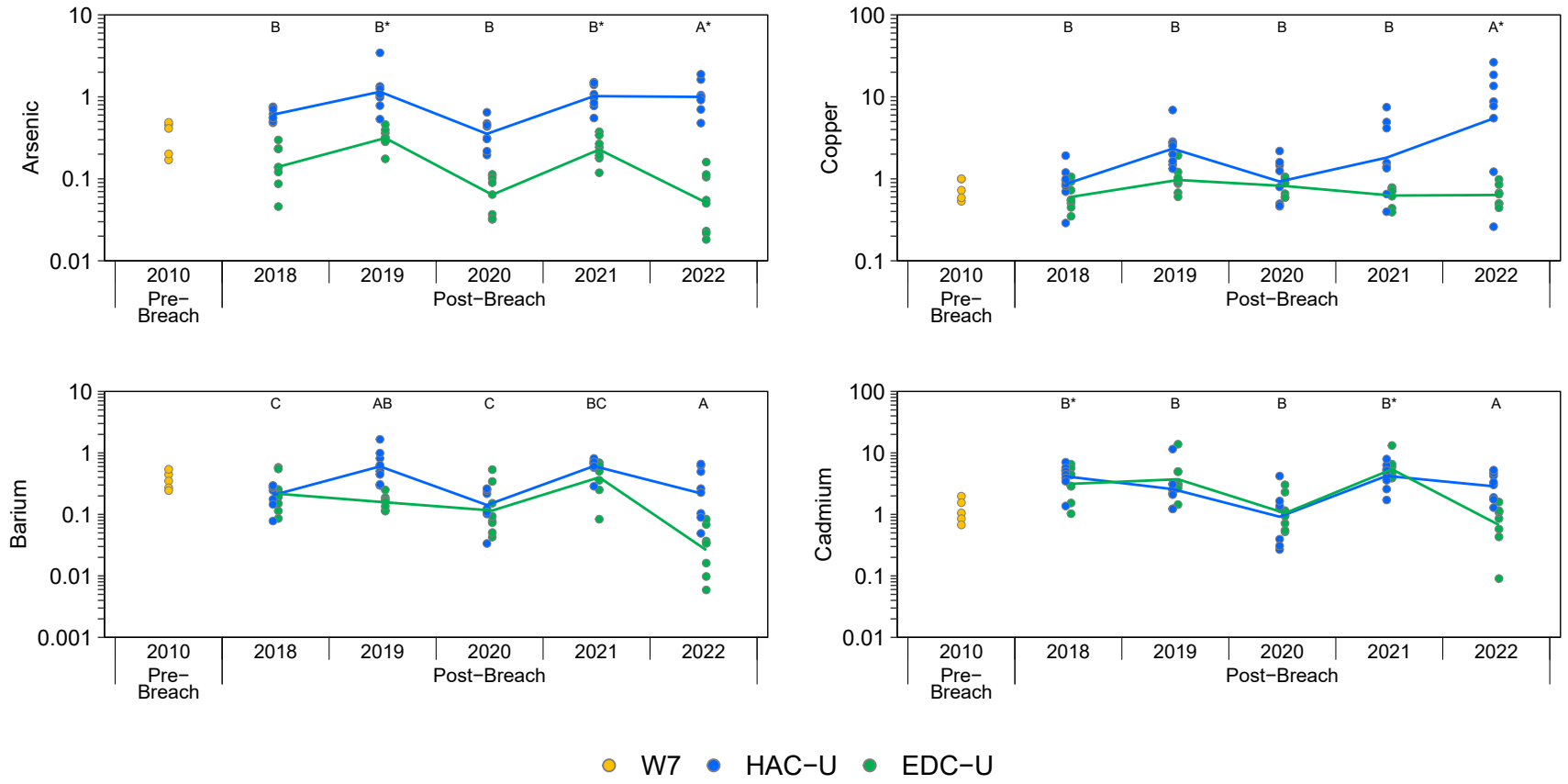

Figure F.4.10: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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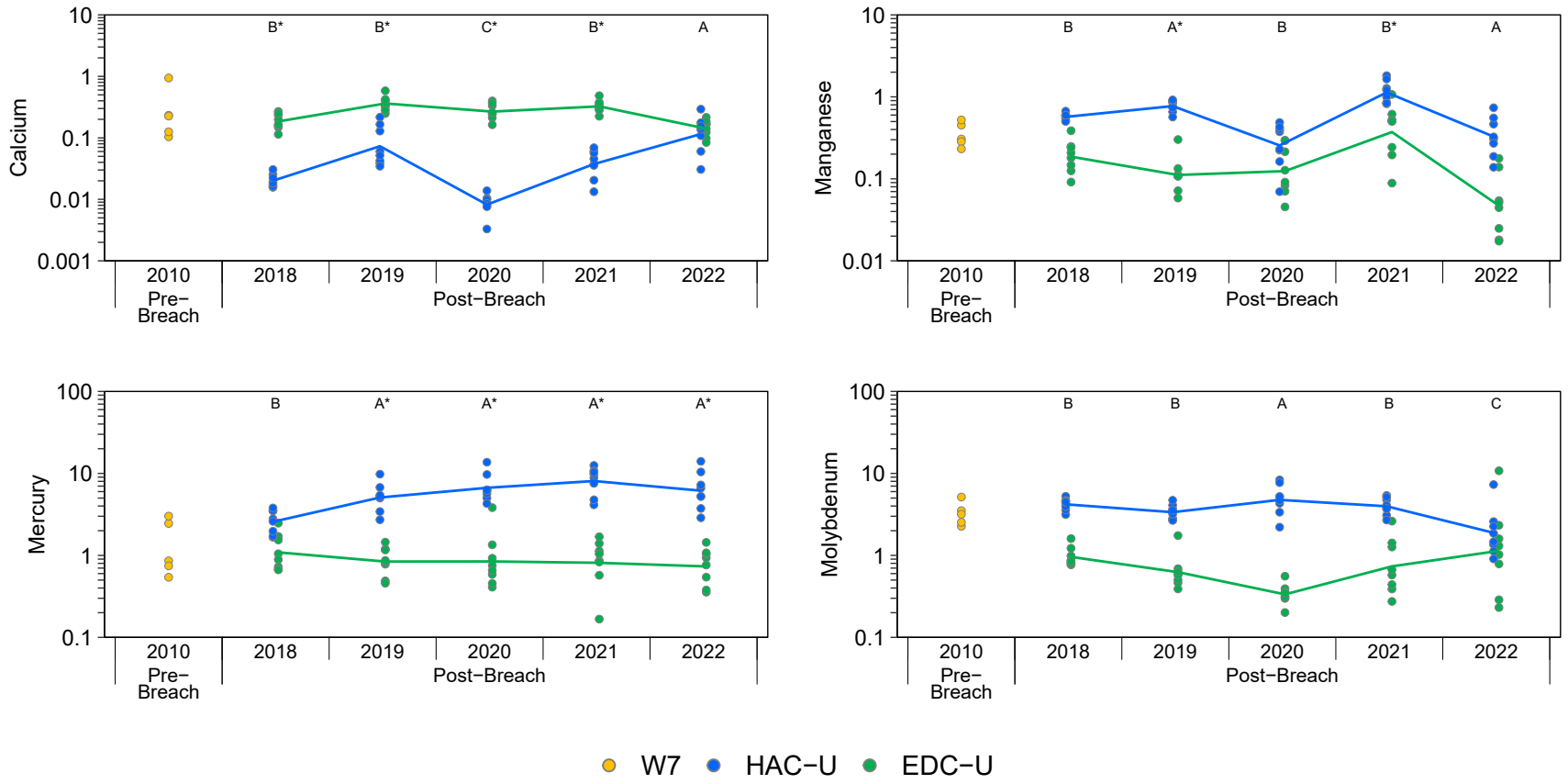

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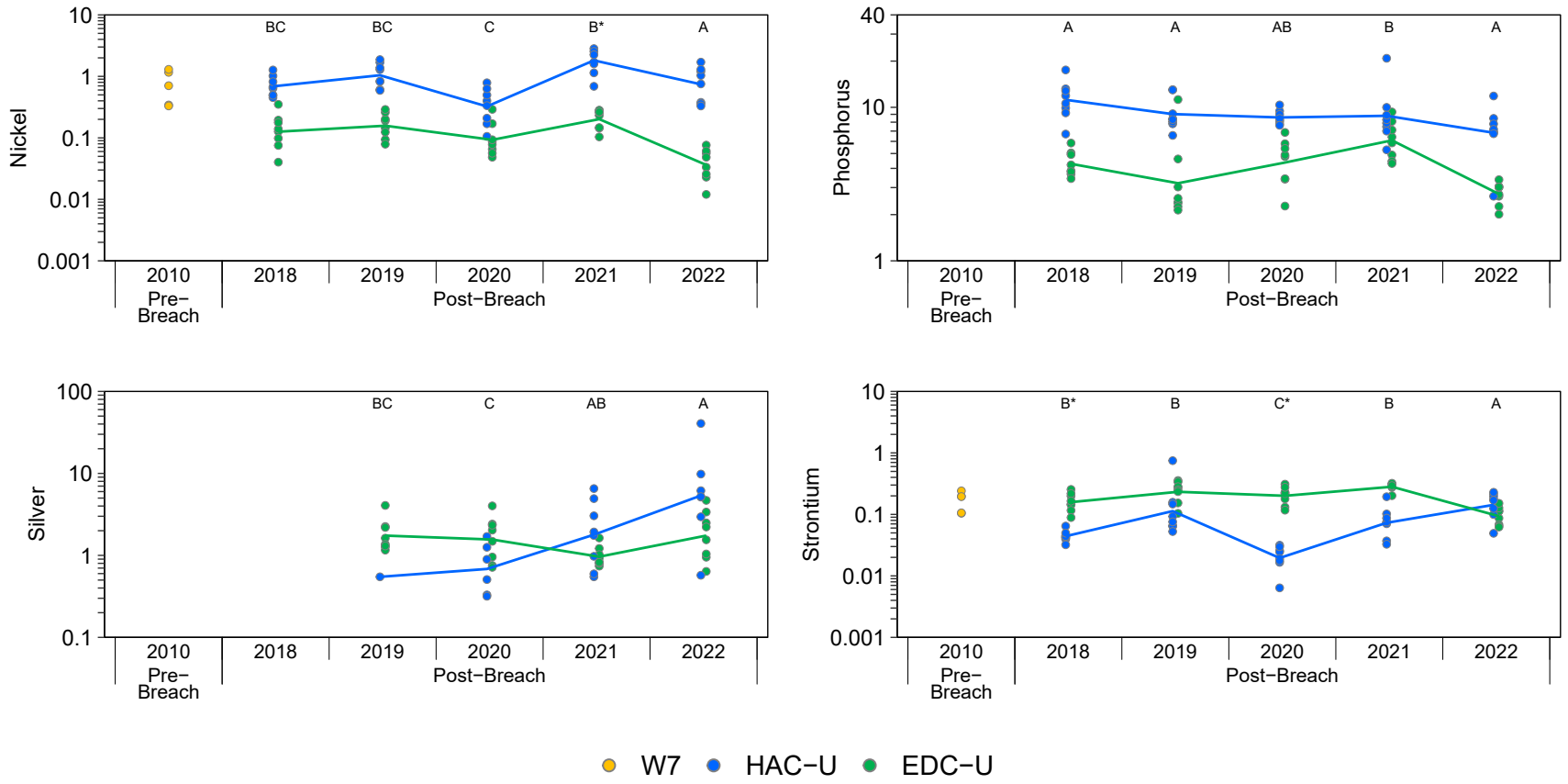

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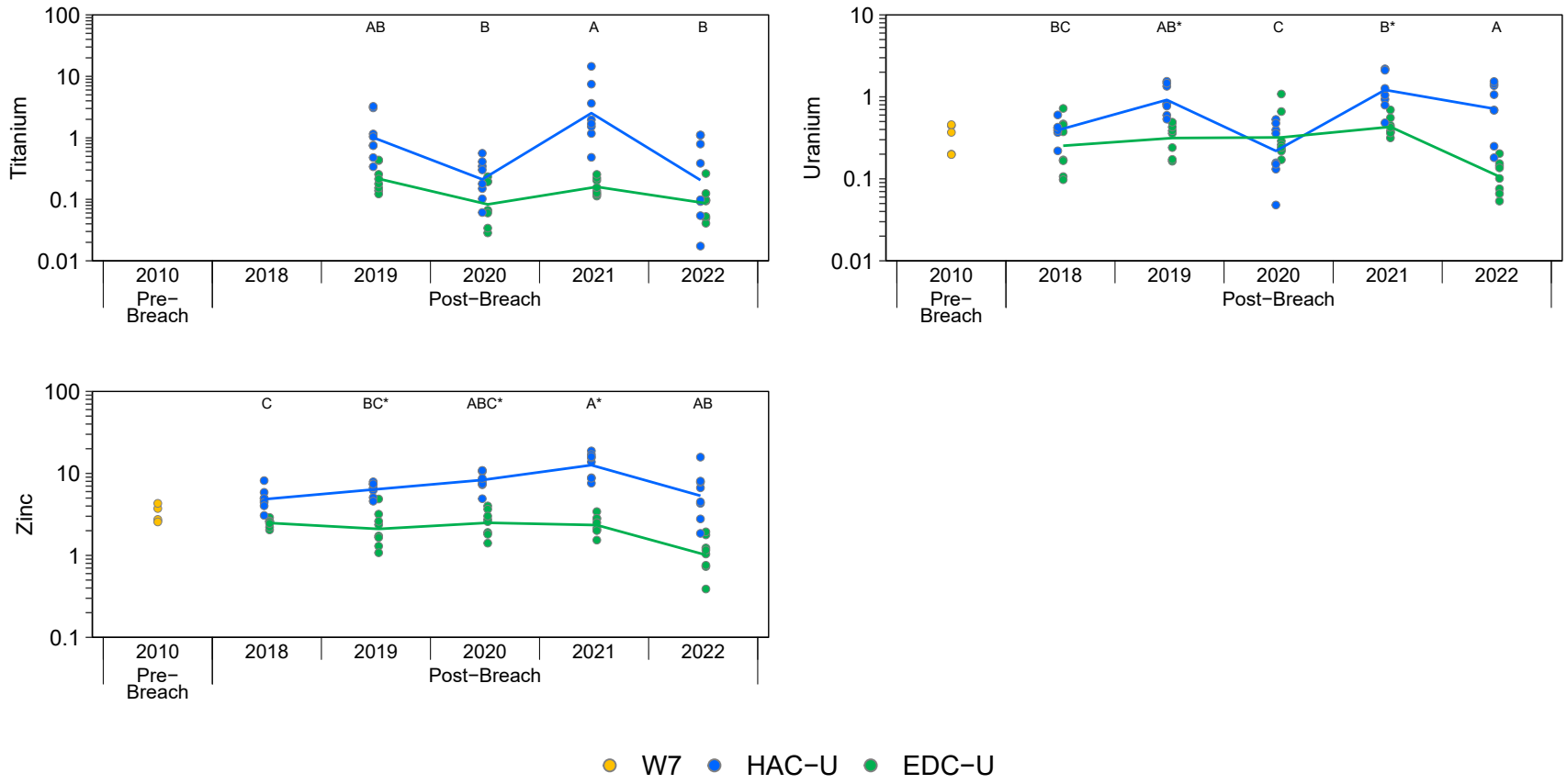

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Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). W7 (2010) is the pre-breach equivalent of HAC-U. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

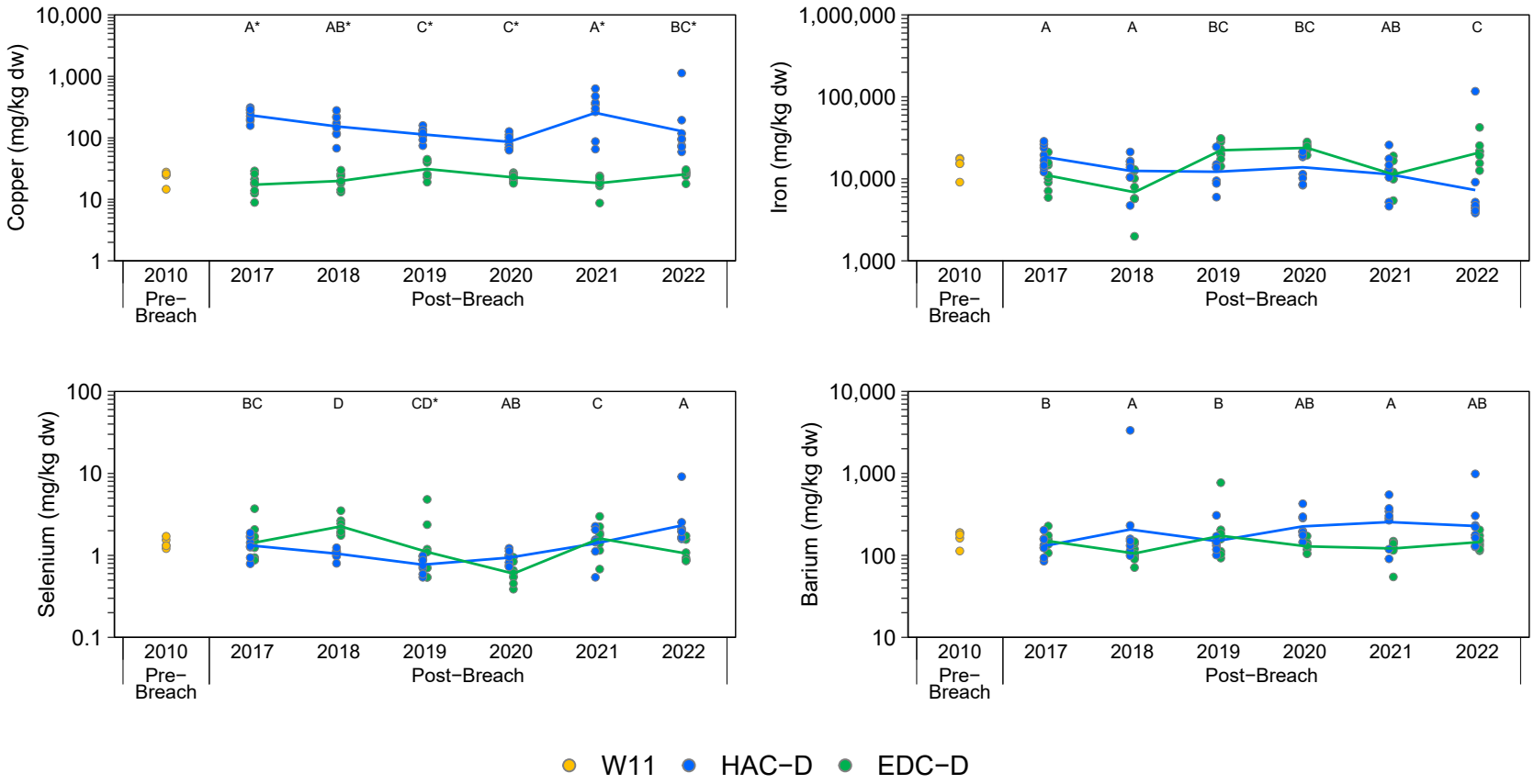

Figure F.4.11: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

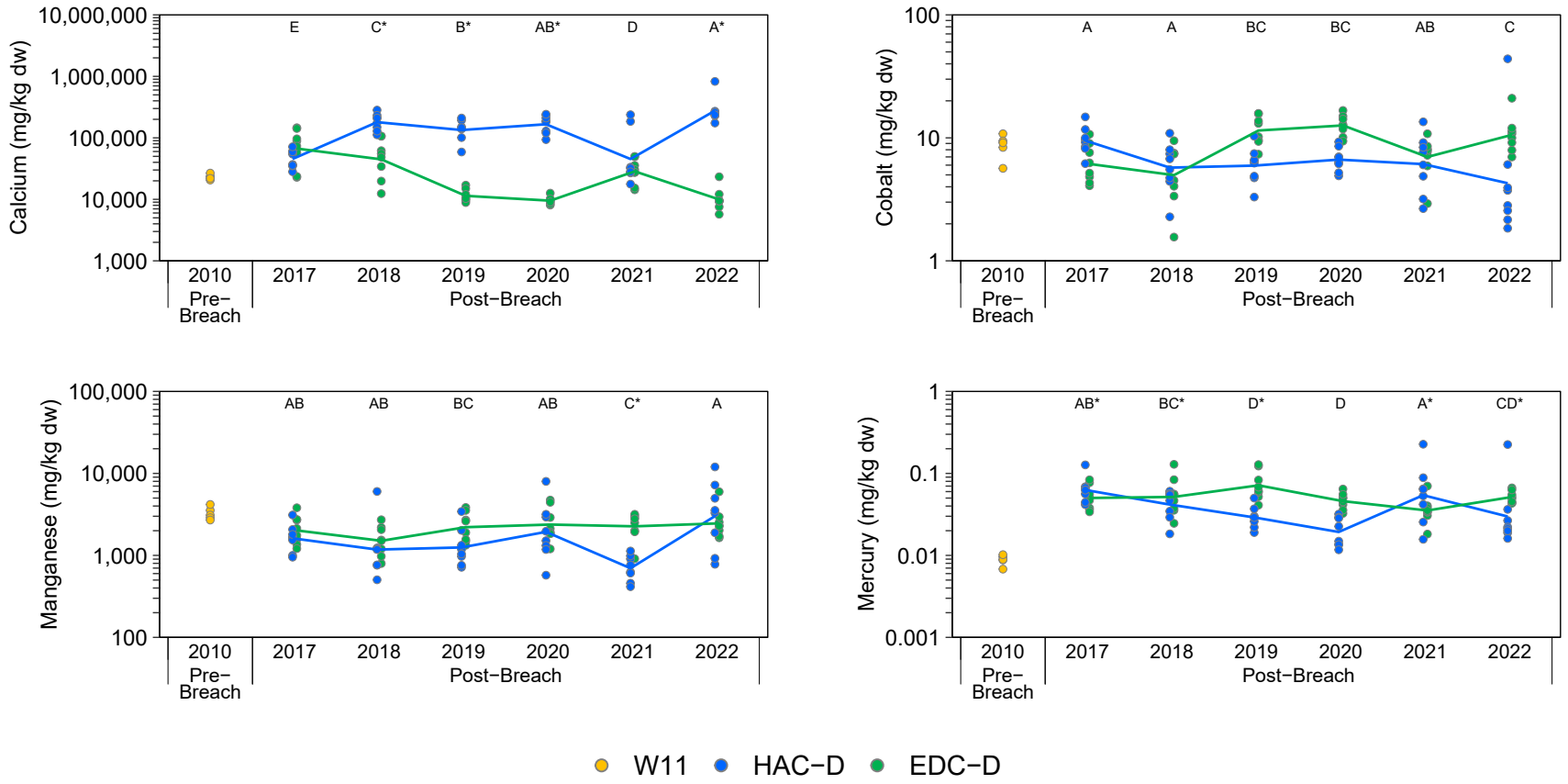

Figure F.4.11: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

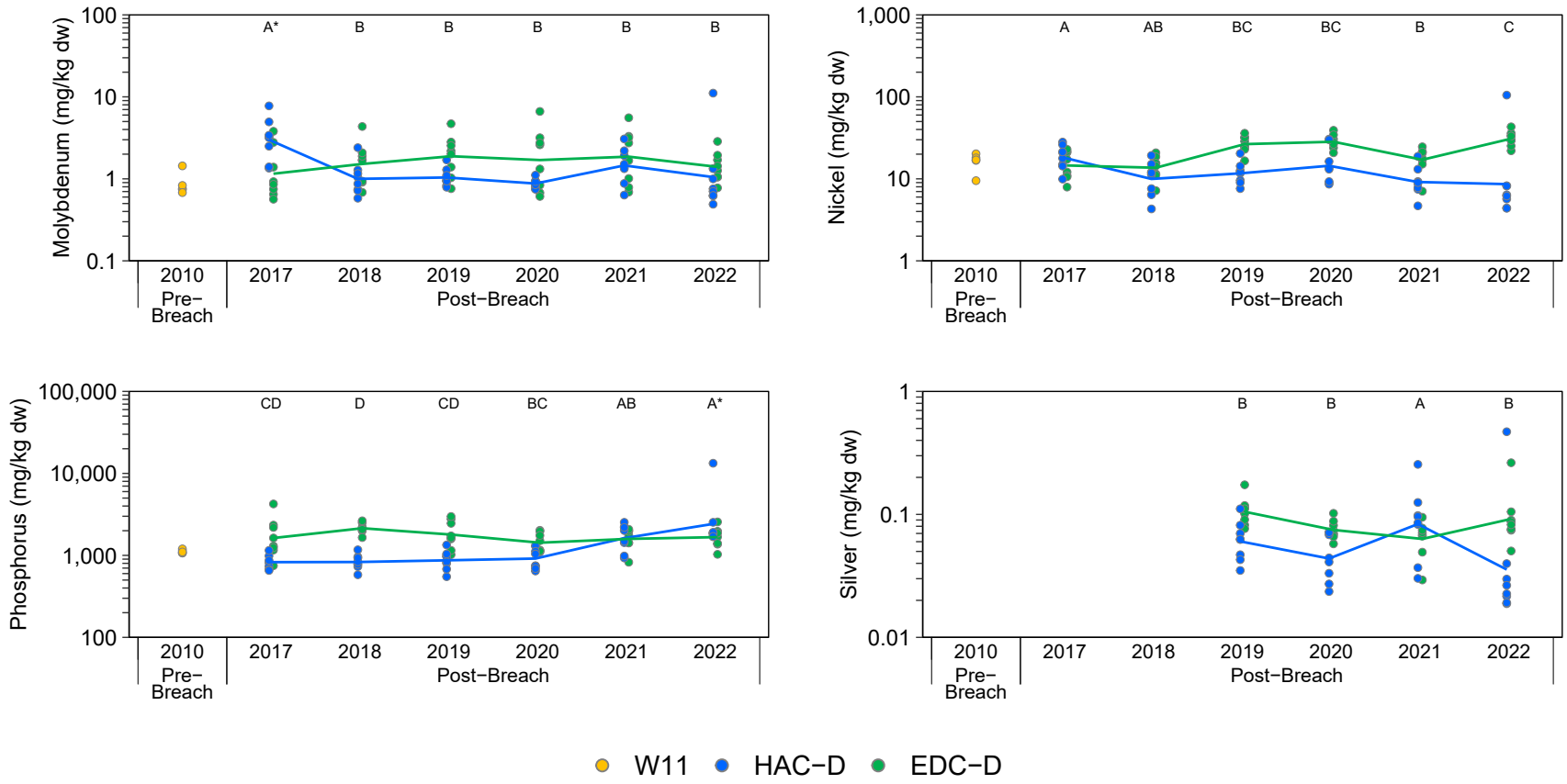

Figure F.4.11: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

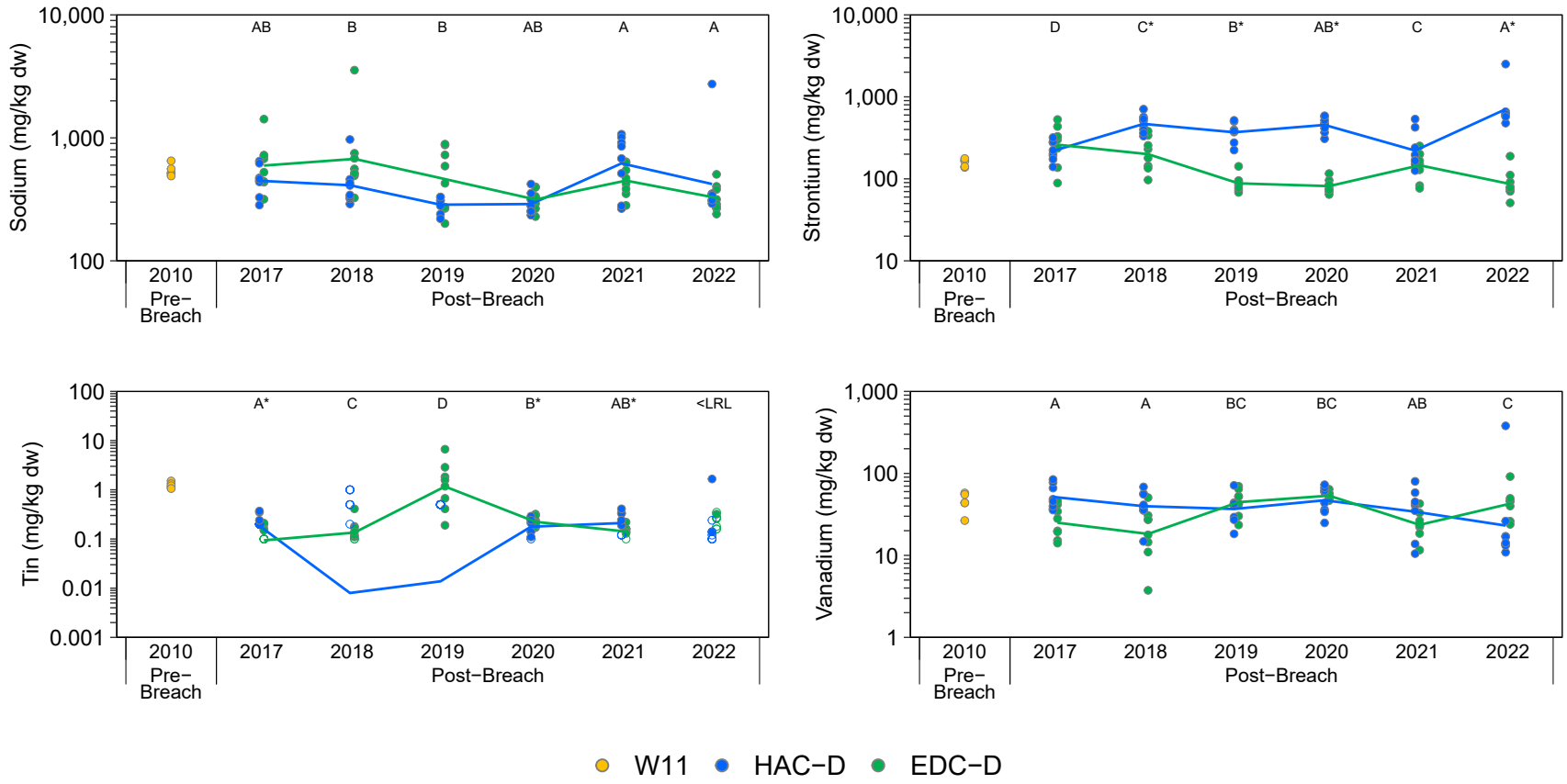

Figure F.4.11: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

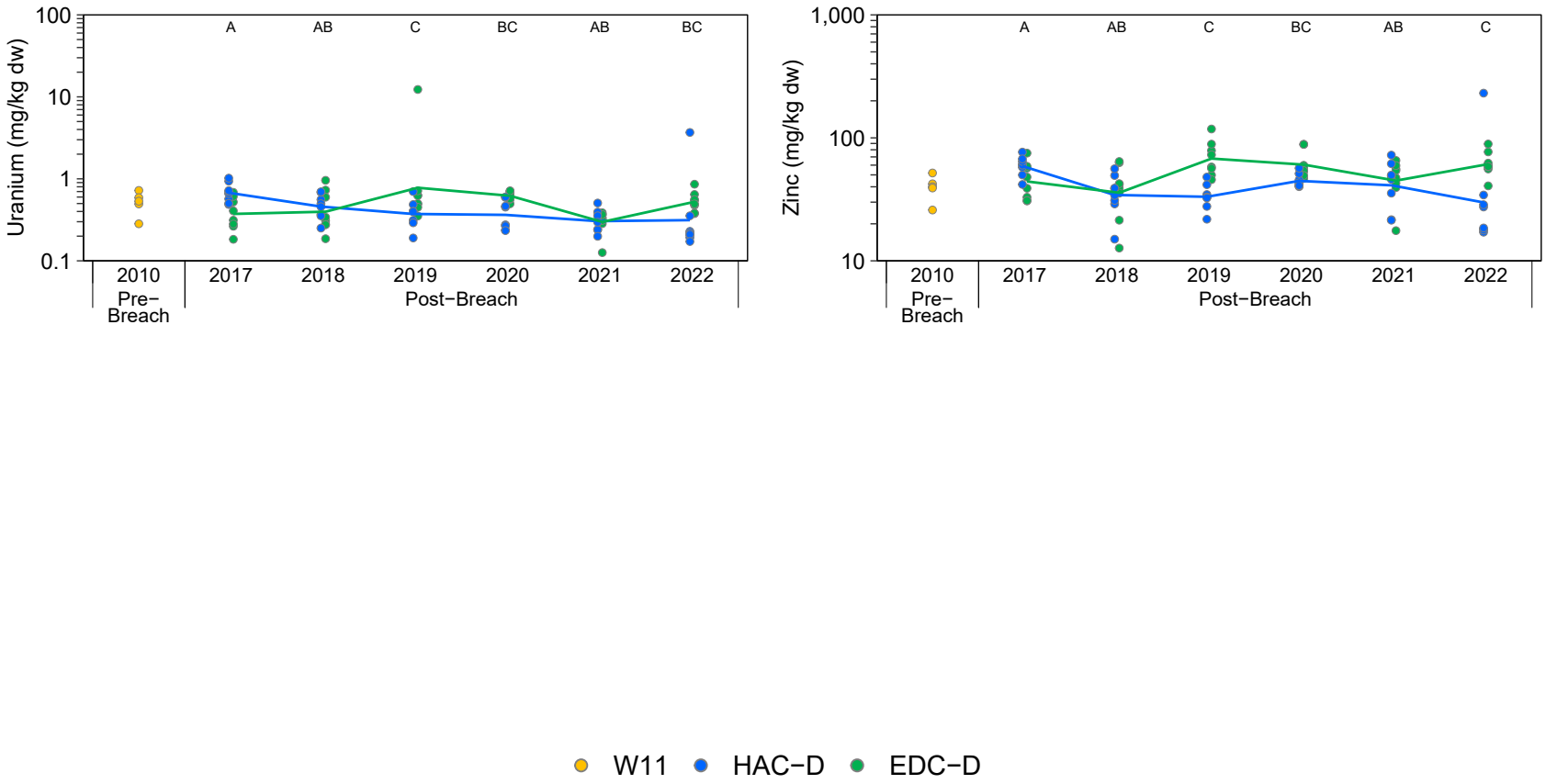

Figure F.4.11: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least-squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

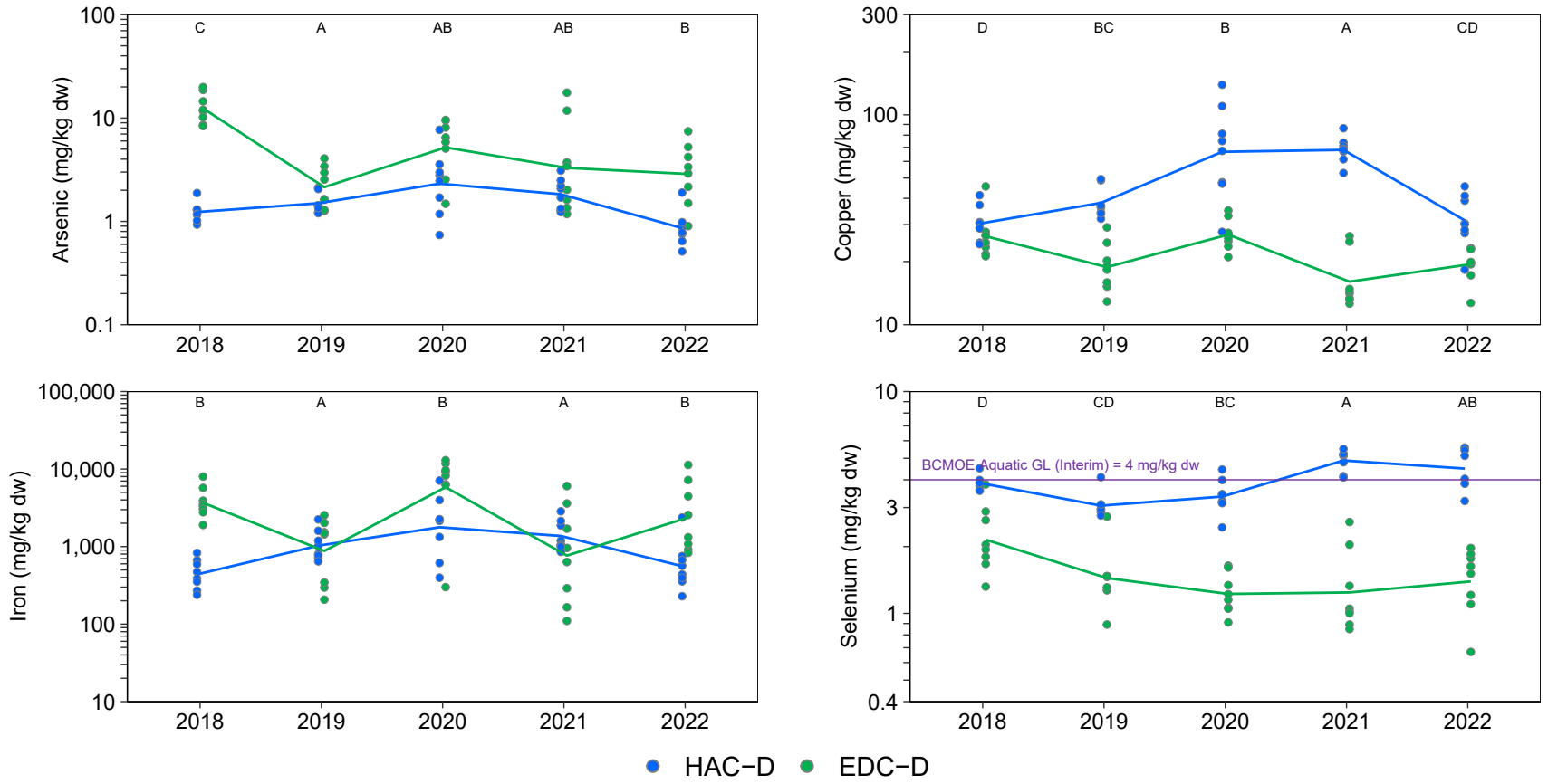

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

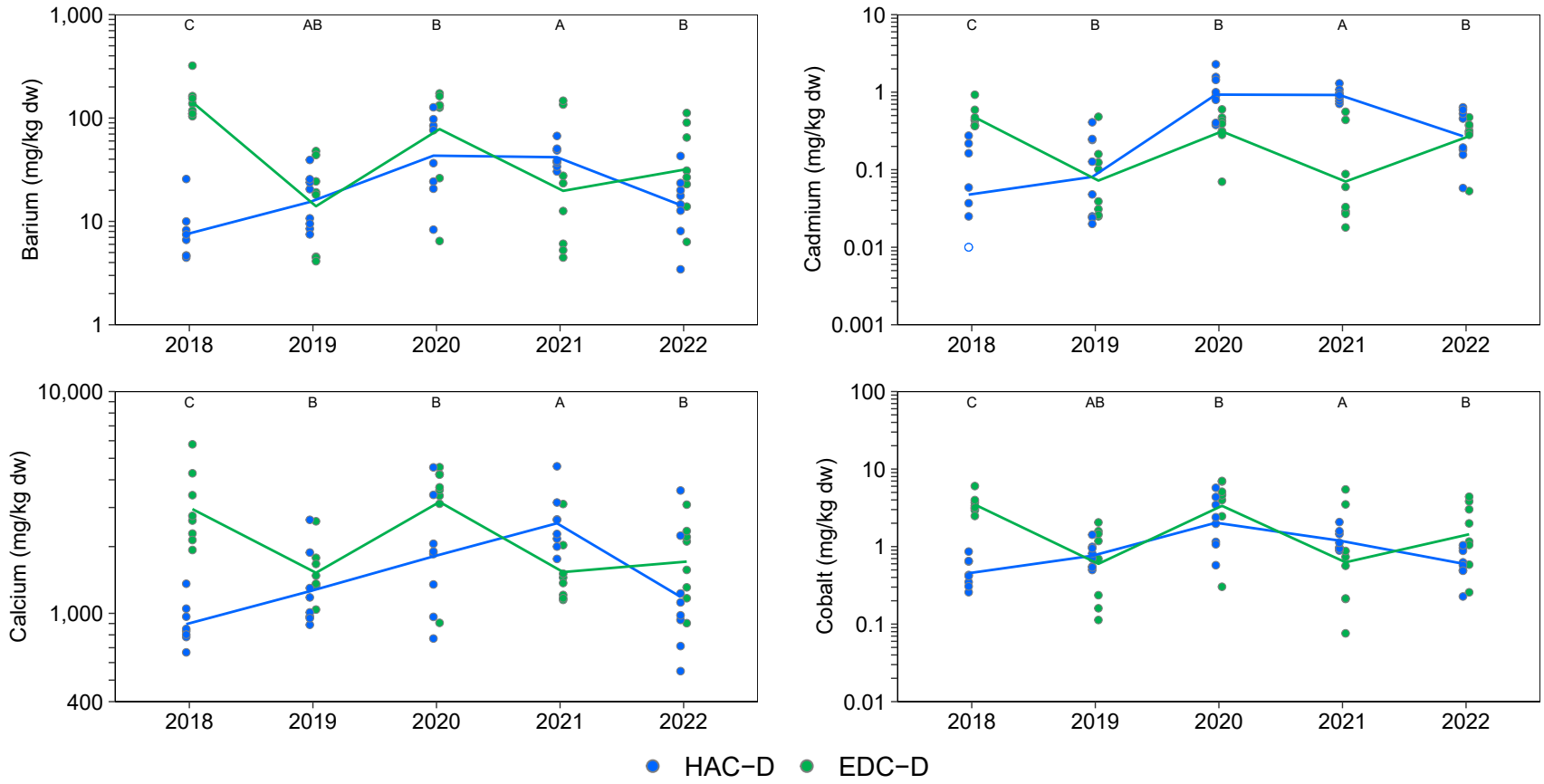

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

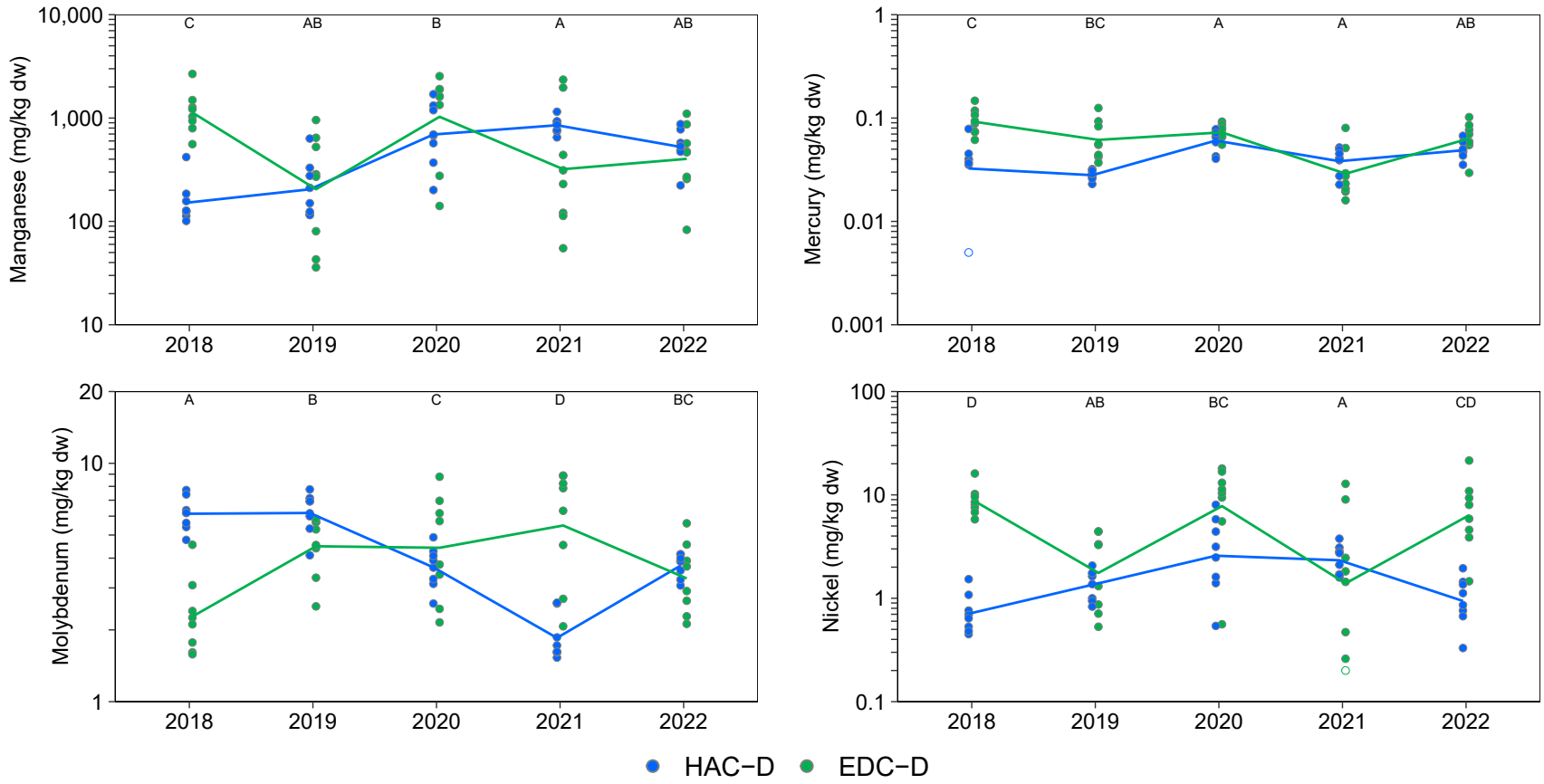

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

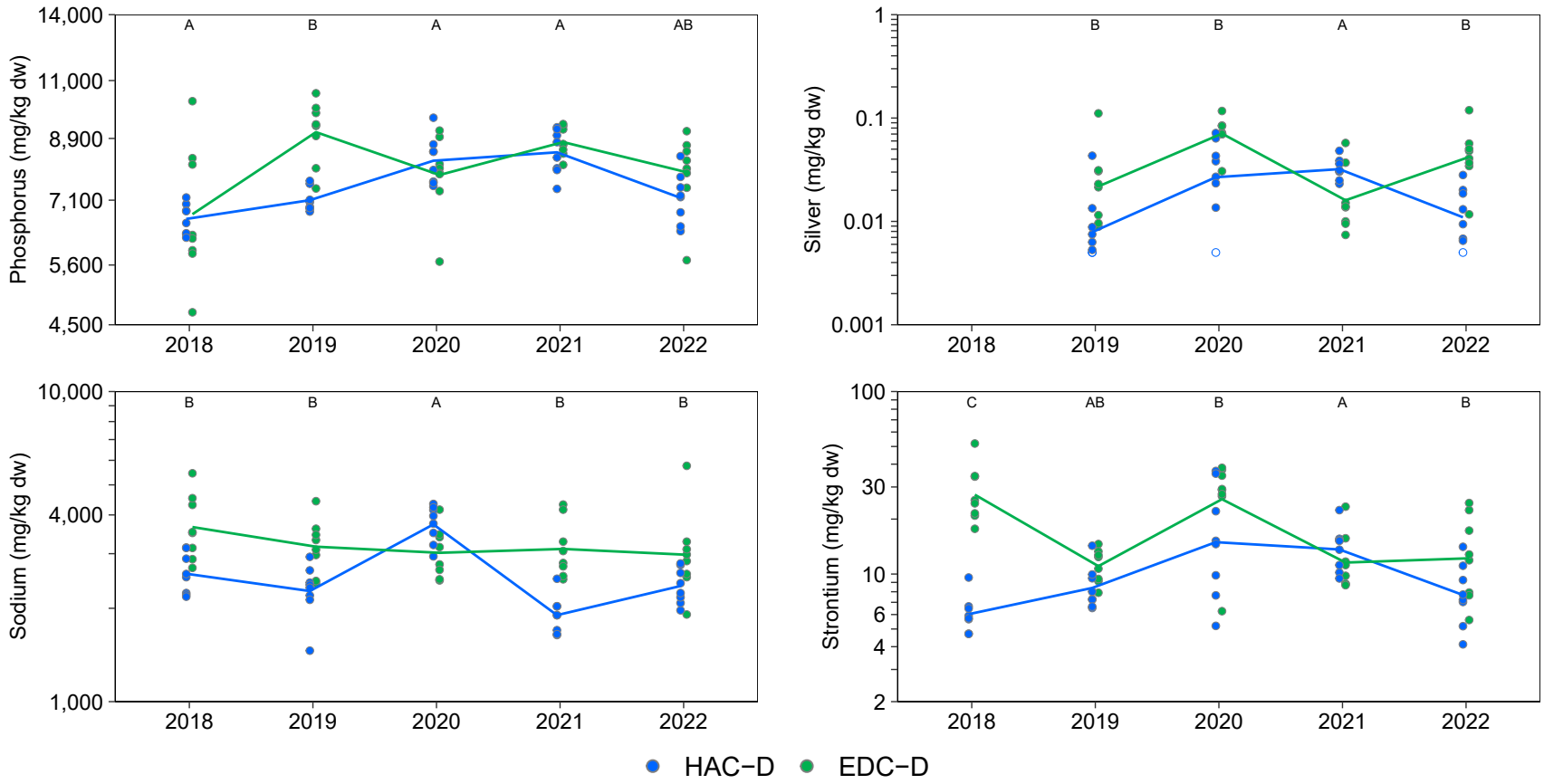

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

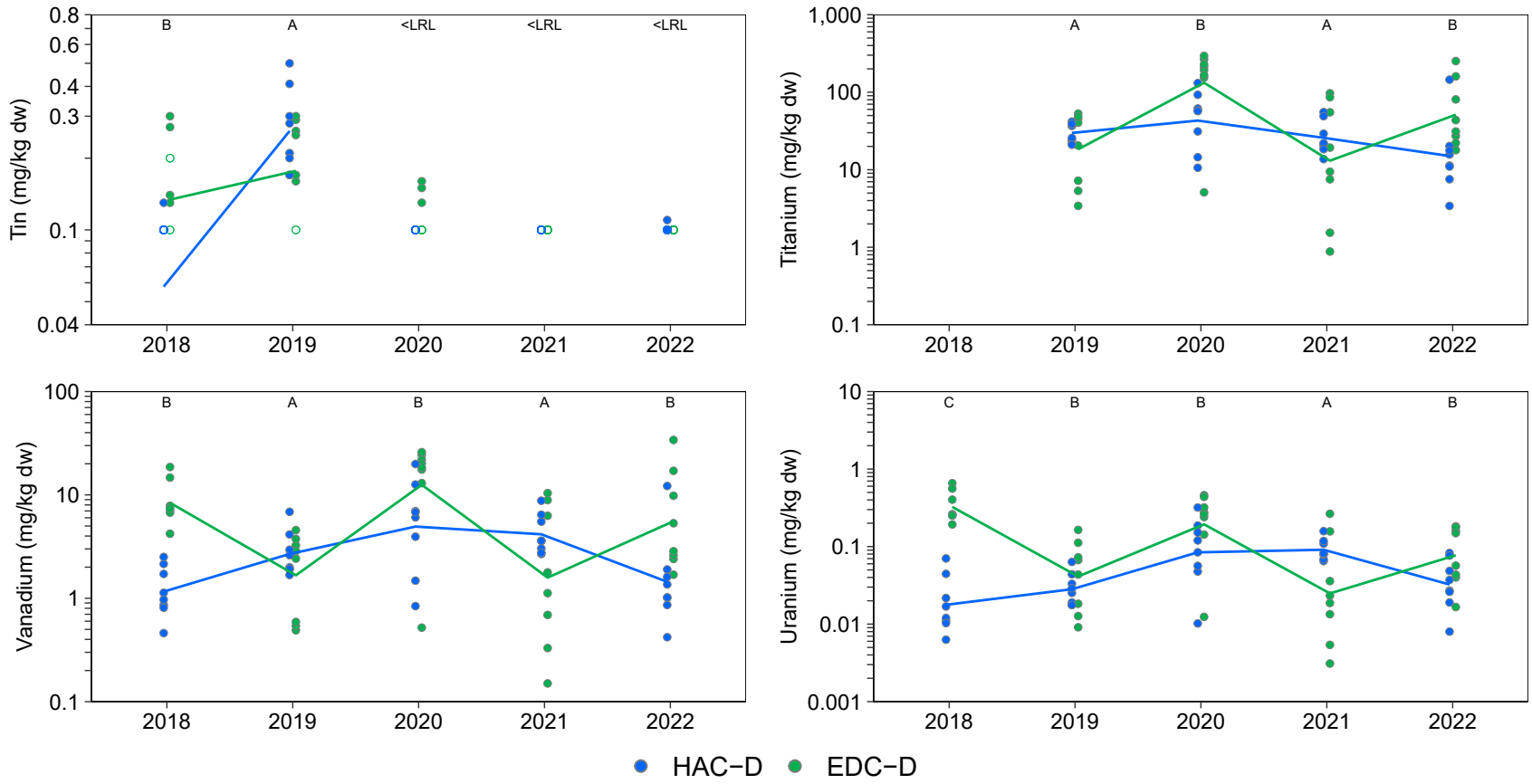

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

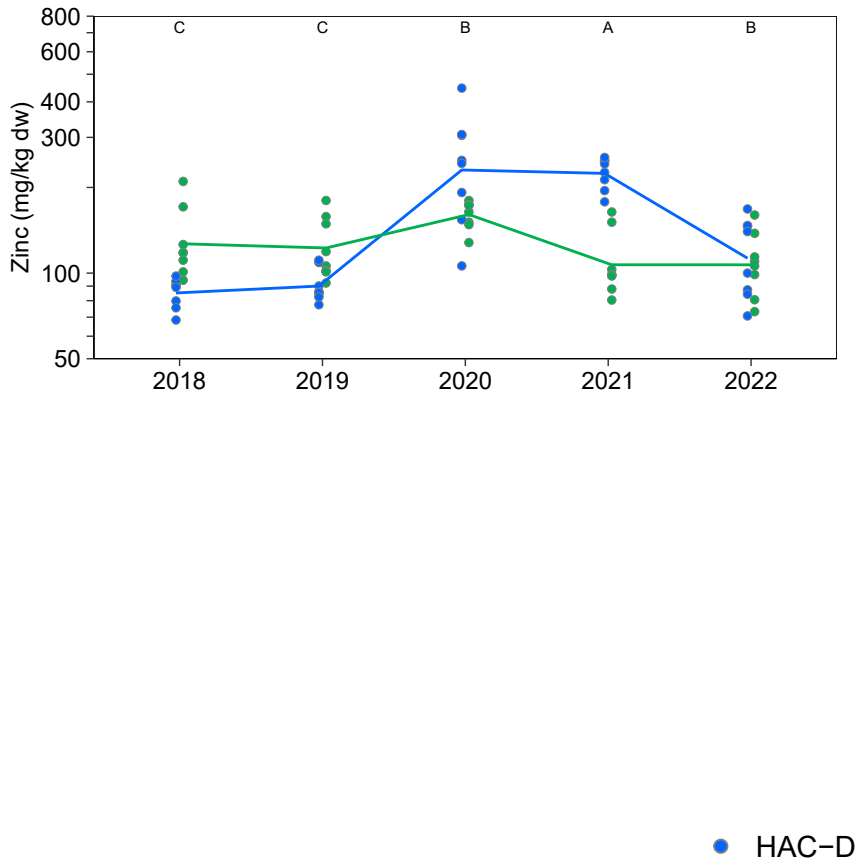

Figure F.4.12: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

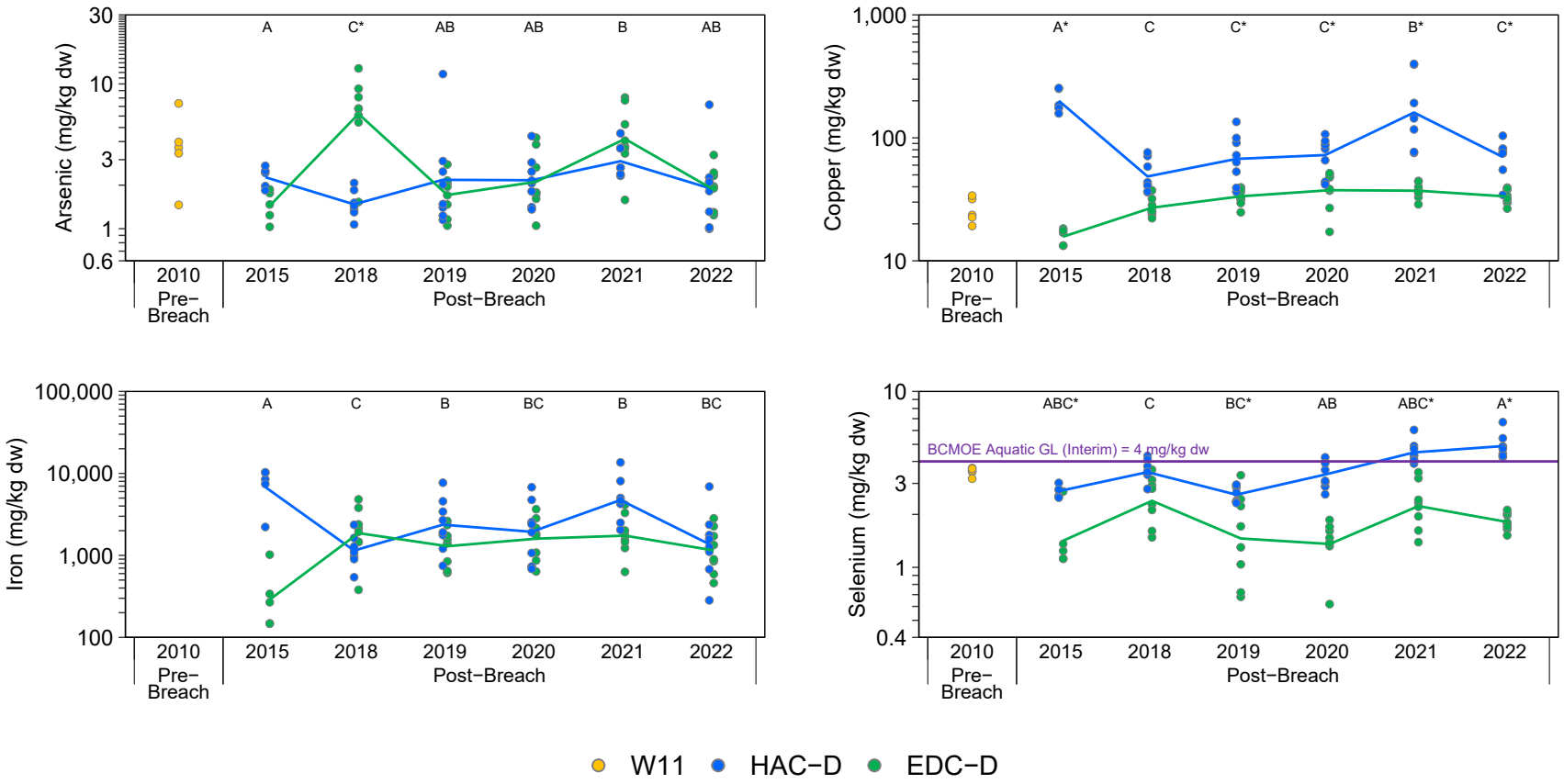

Figure F.4.13: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

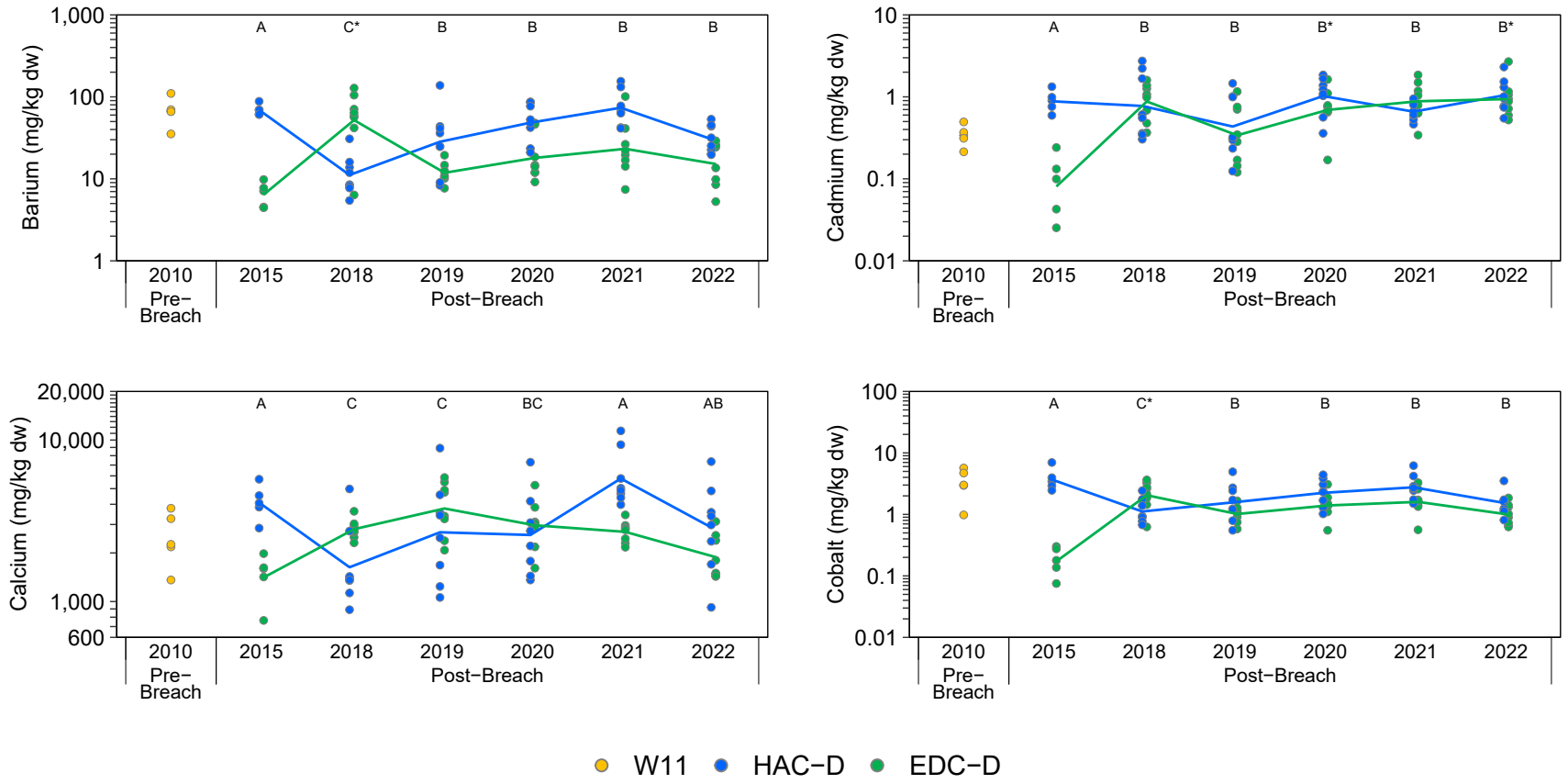

Figure F.4.13: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

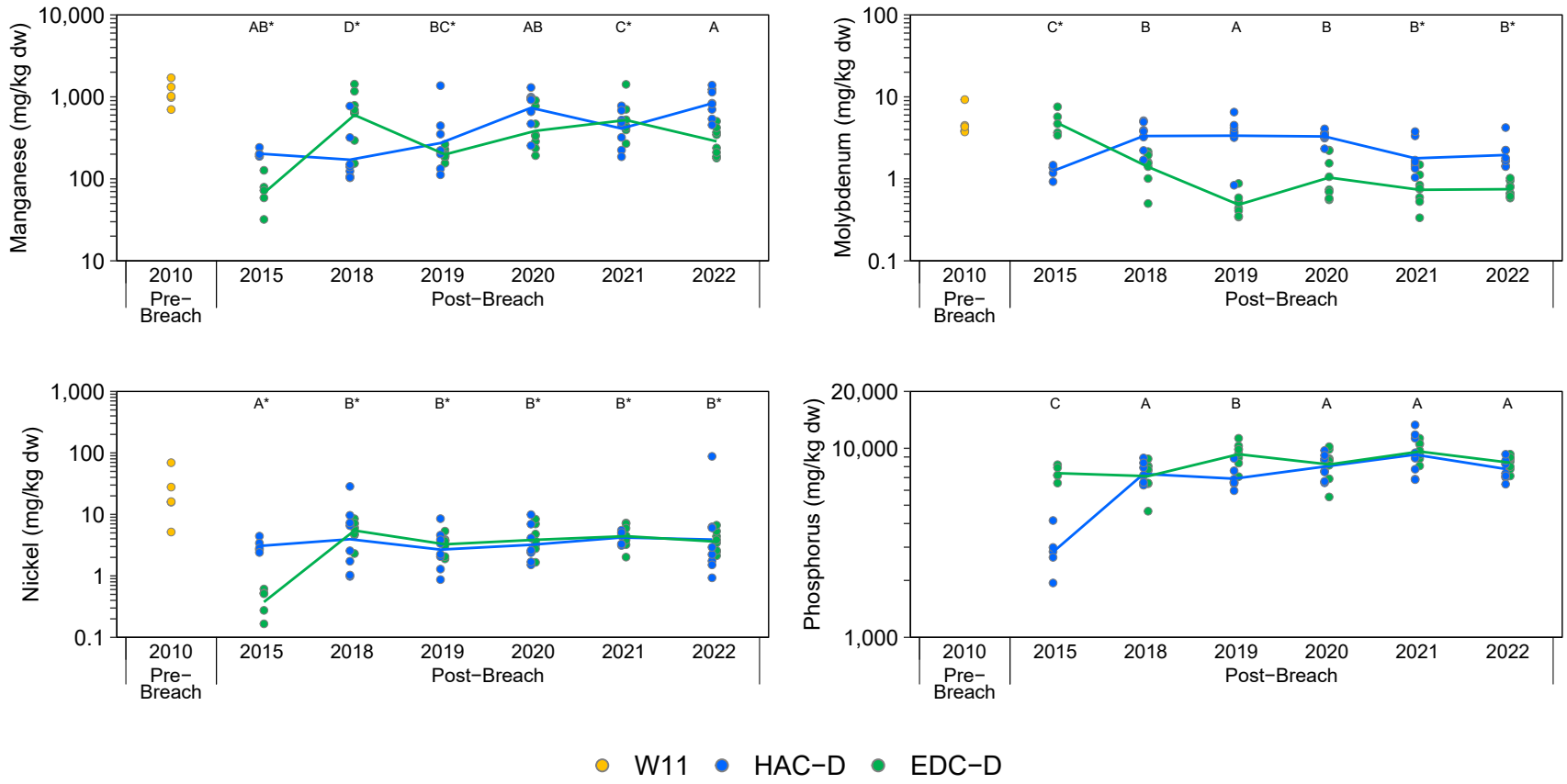

Figure F.4.13: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

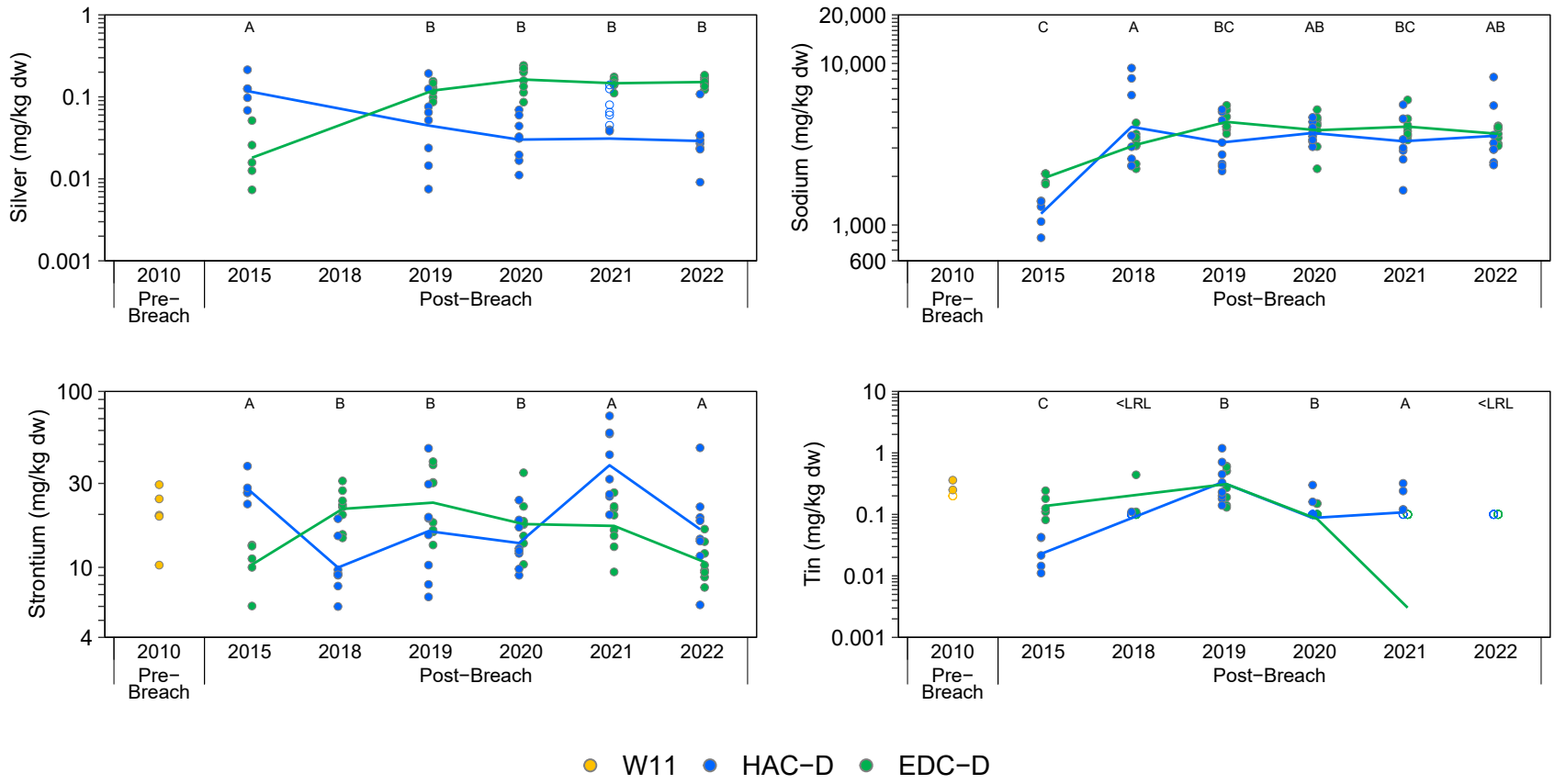

Figure F.4.13: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

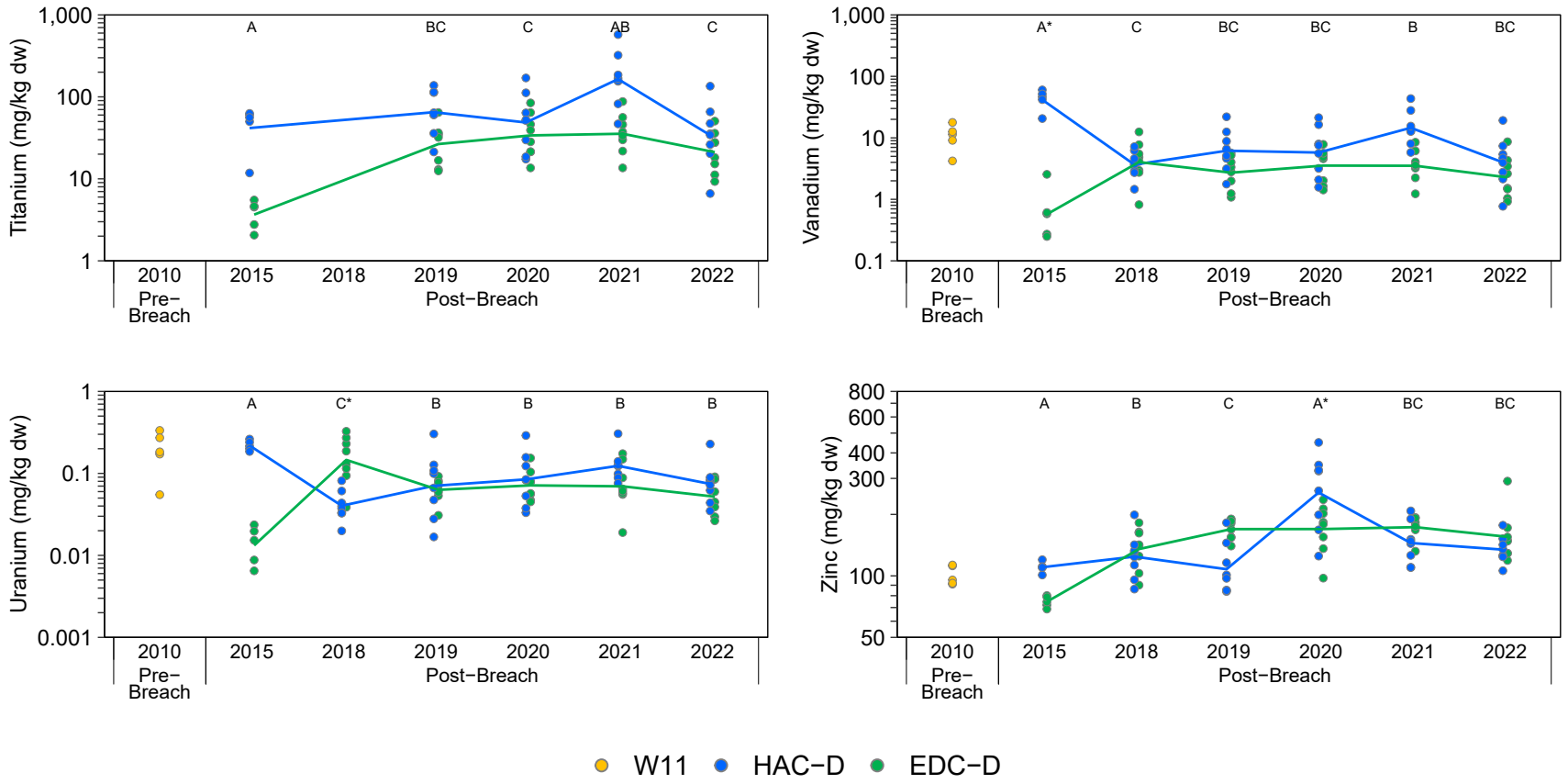

Figure F.4.13: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). W11 (2010) is the pre-breach equivalent of HAC-D. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

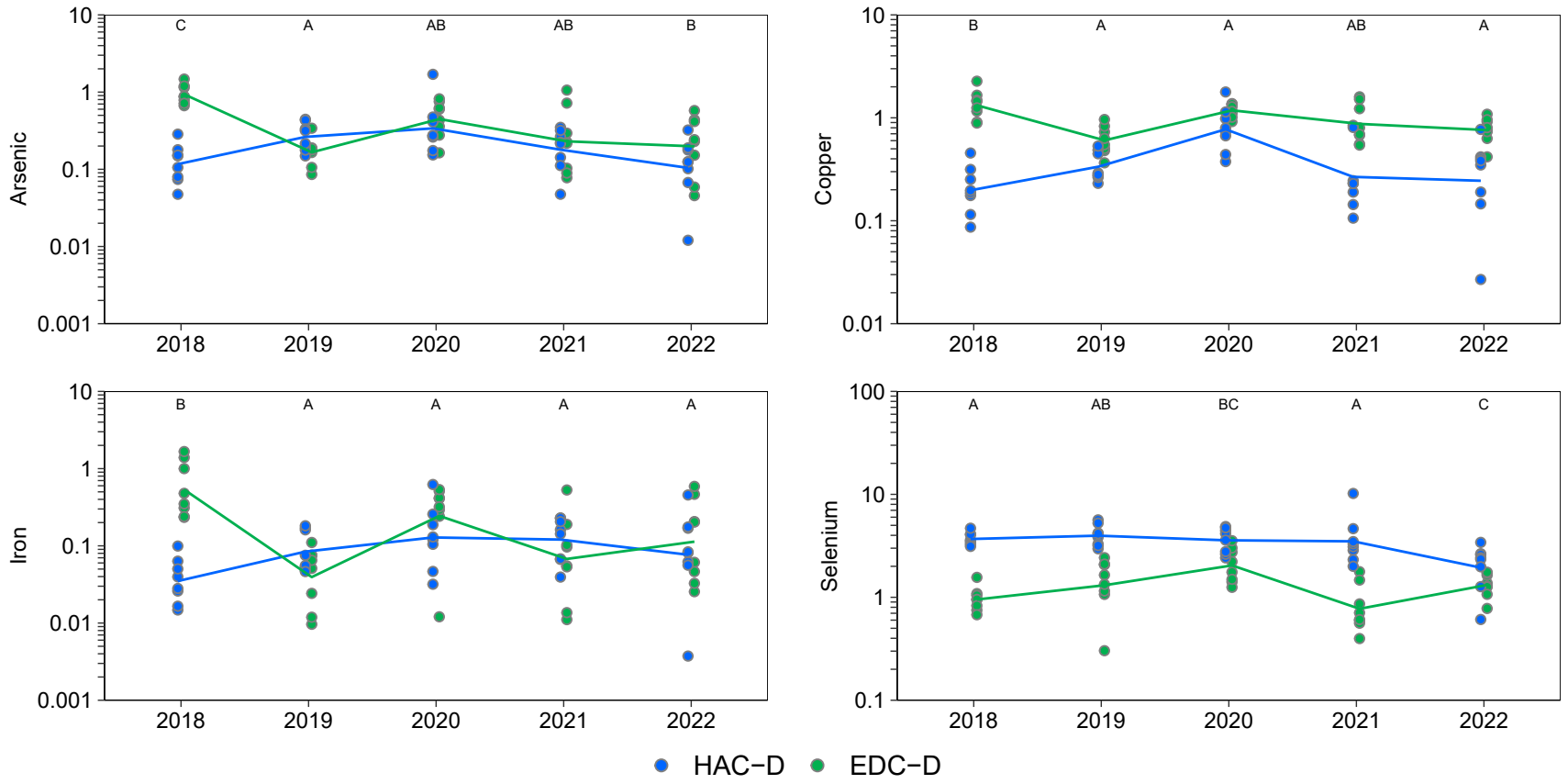

Figure F.4.14: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

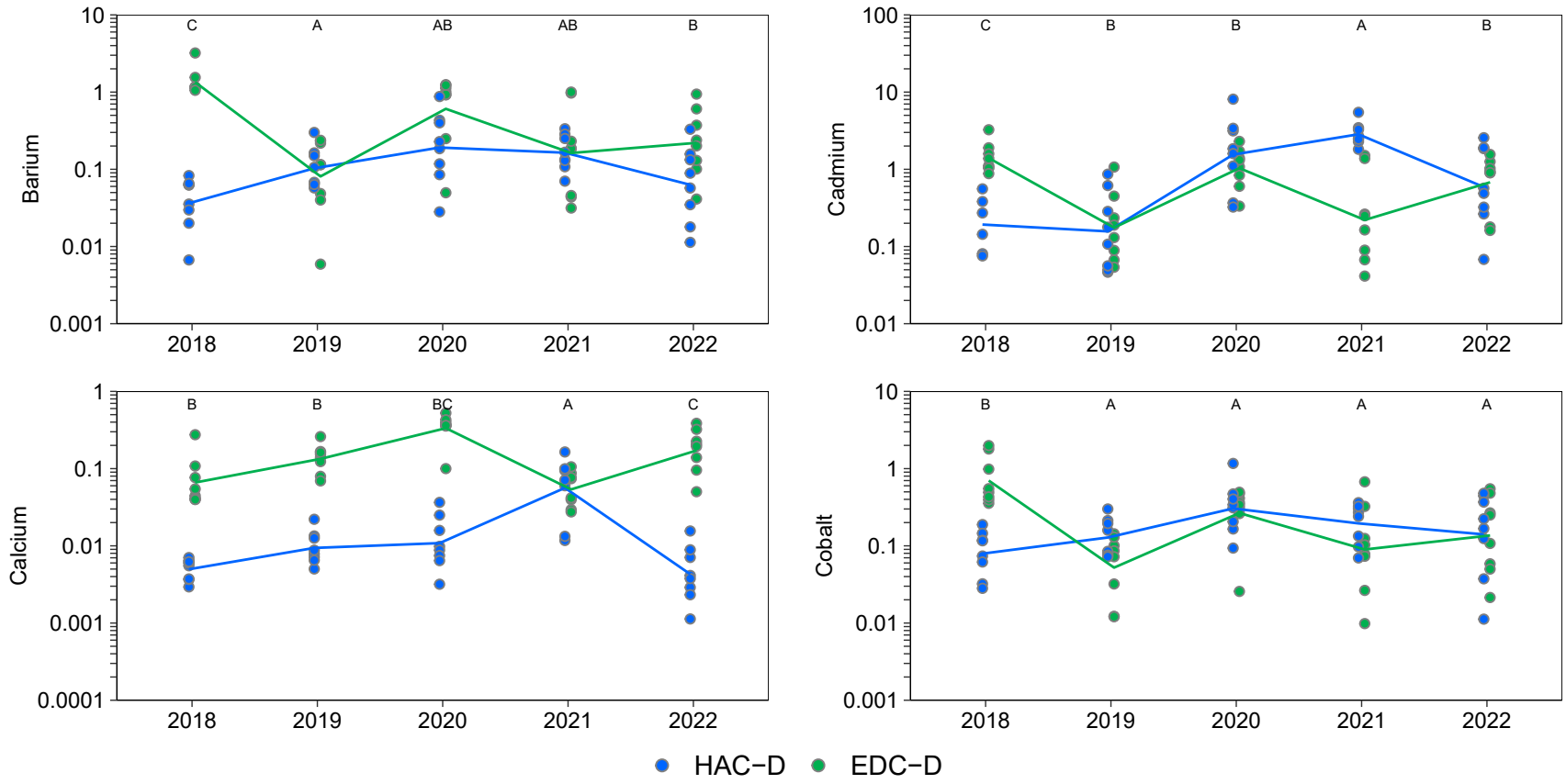

Figure F.4.14: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

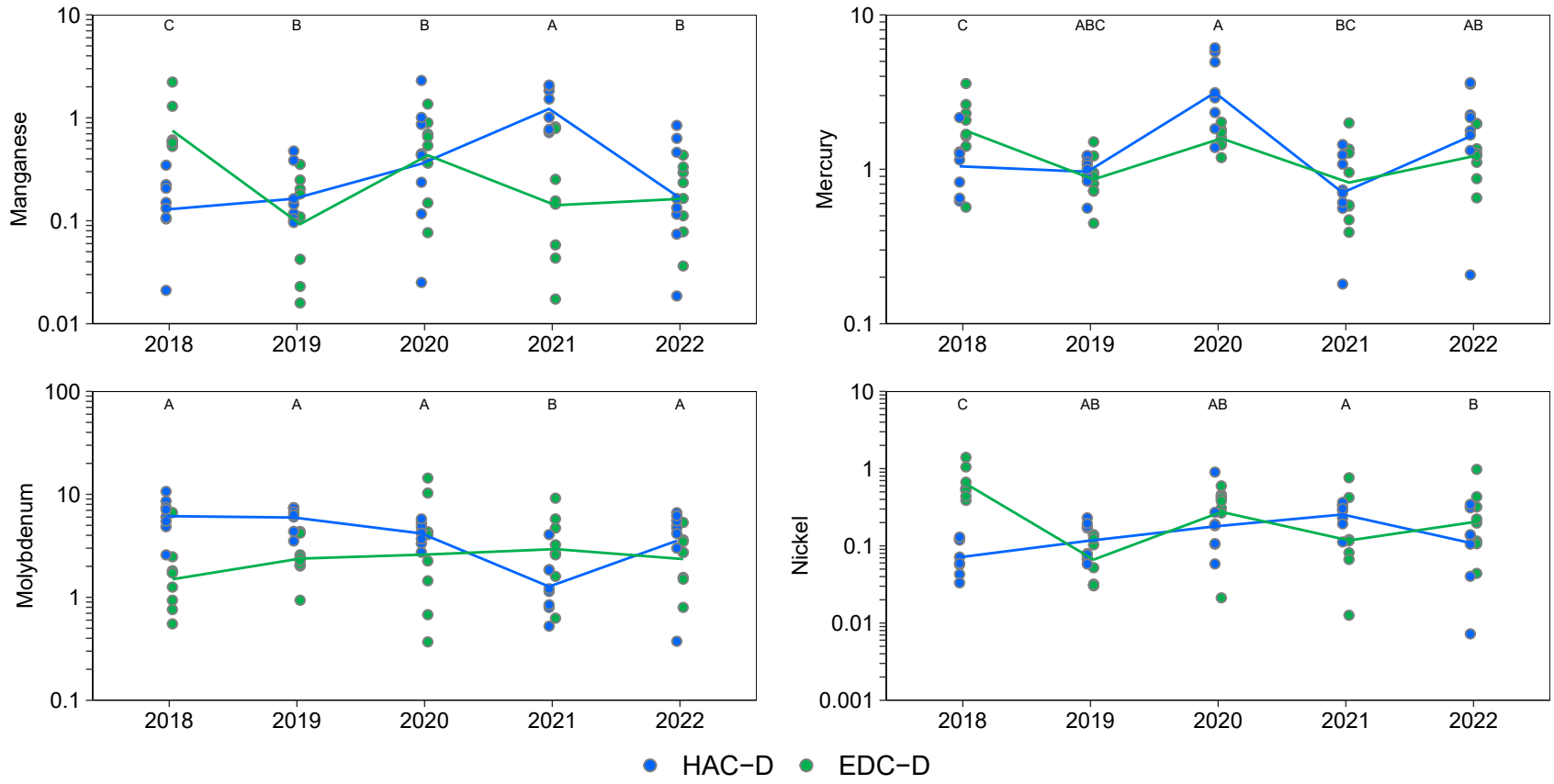

Figure F.4.14: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

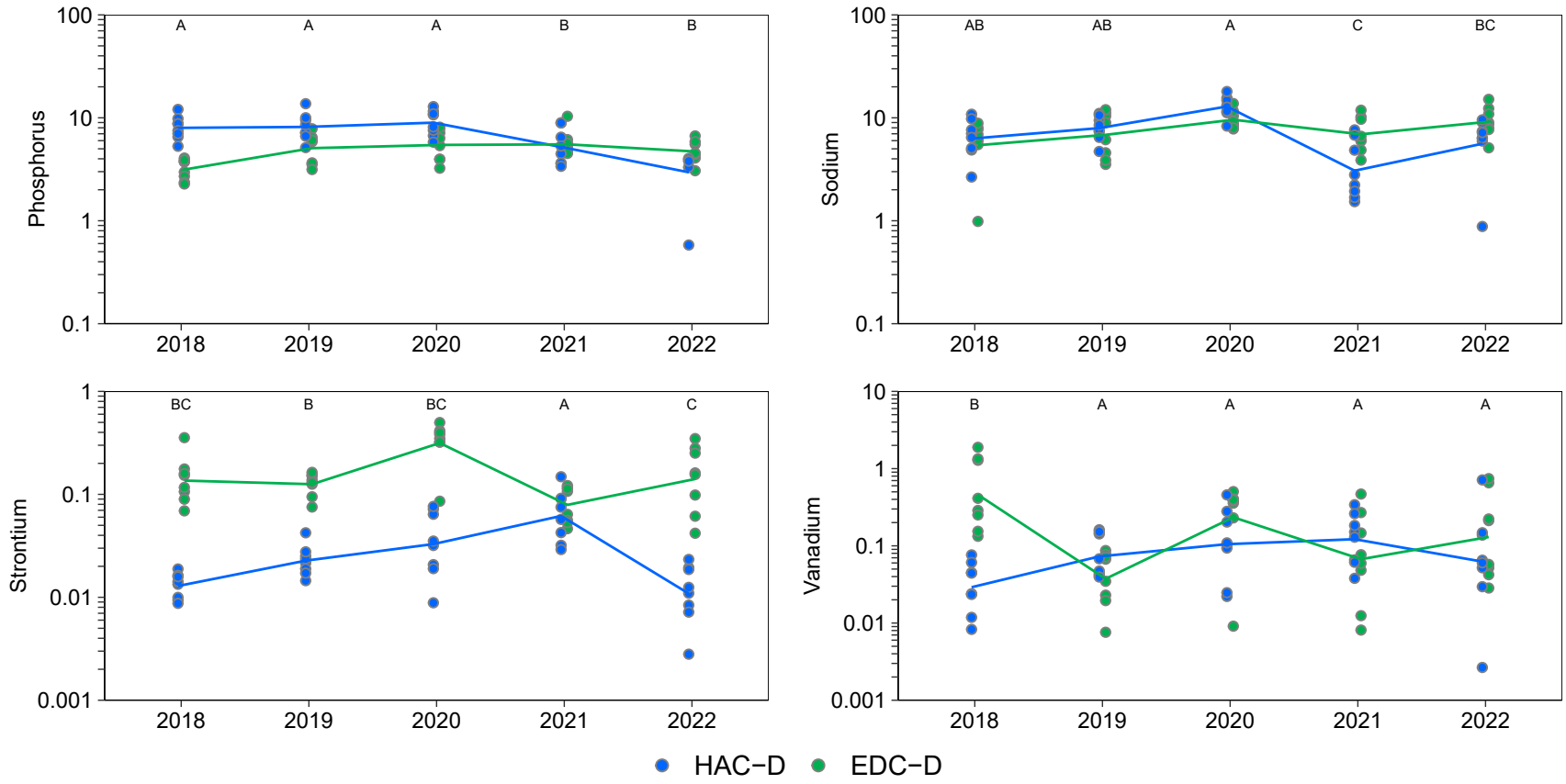

Figure F.4.14: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

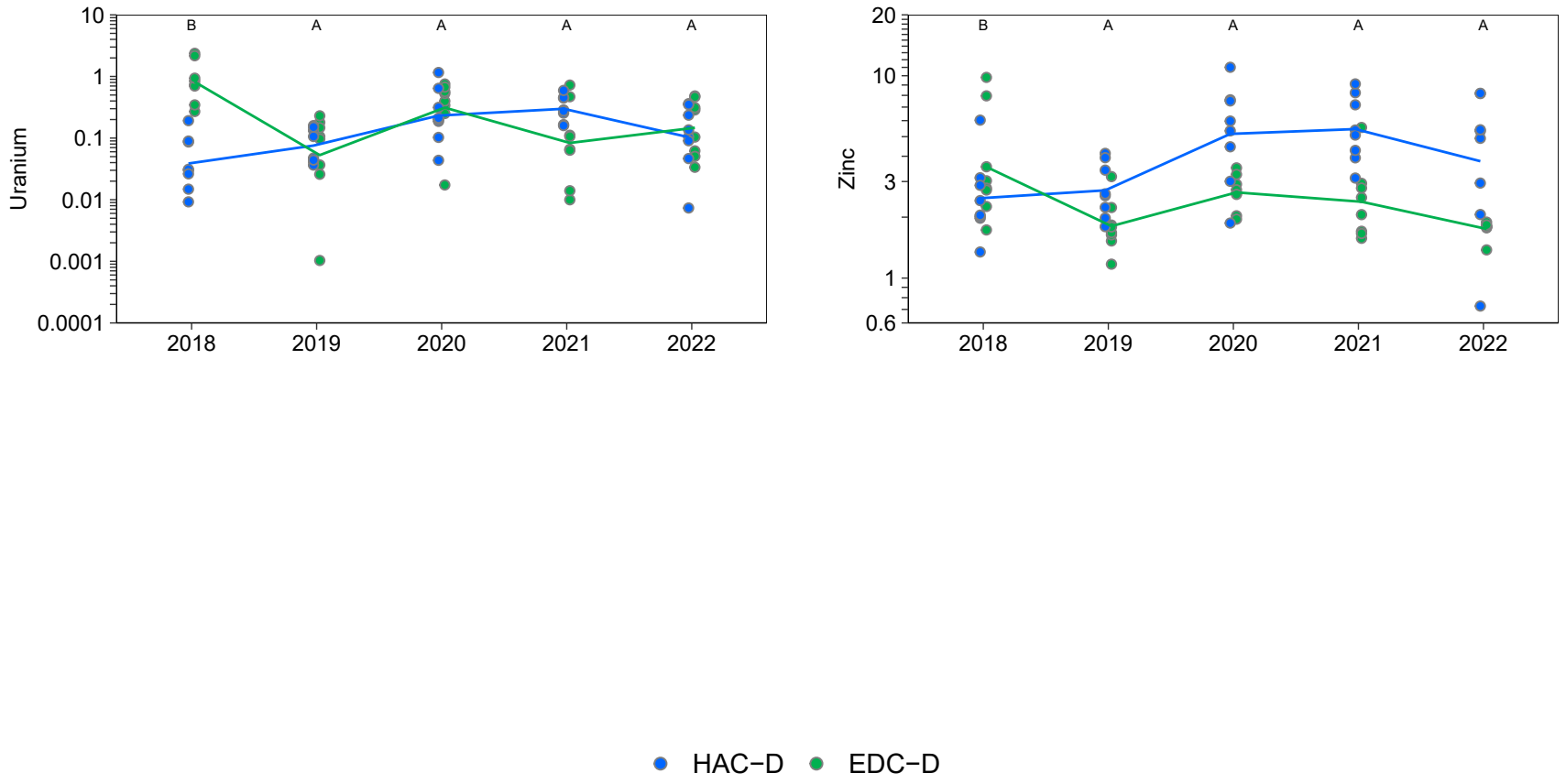

Figure F.4.14: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

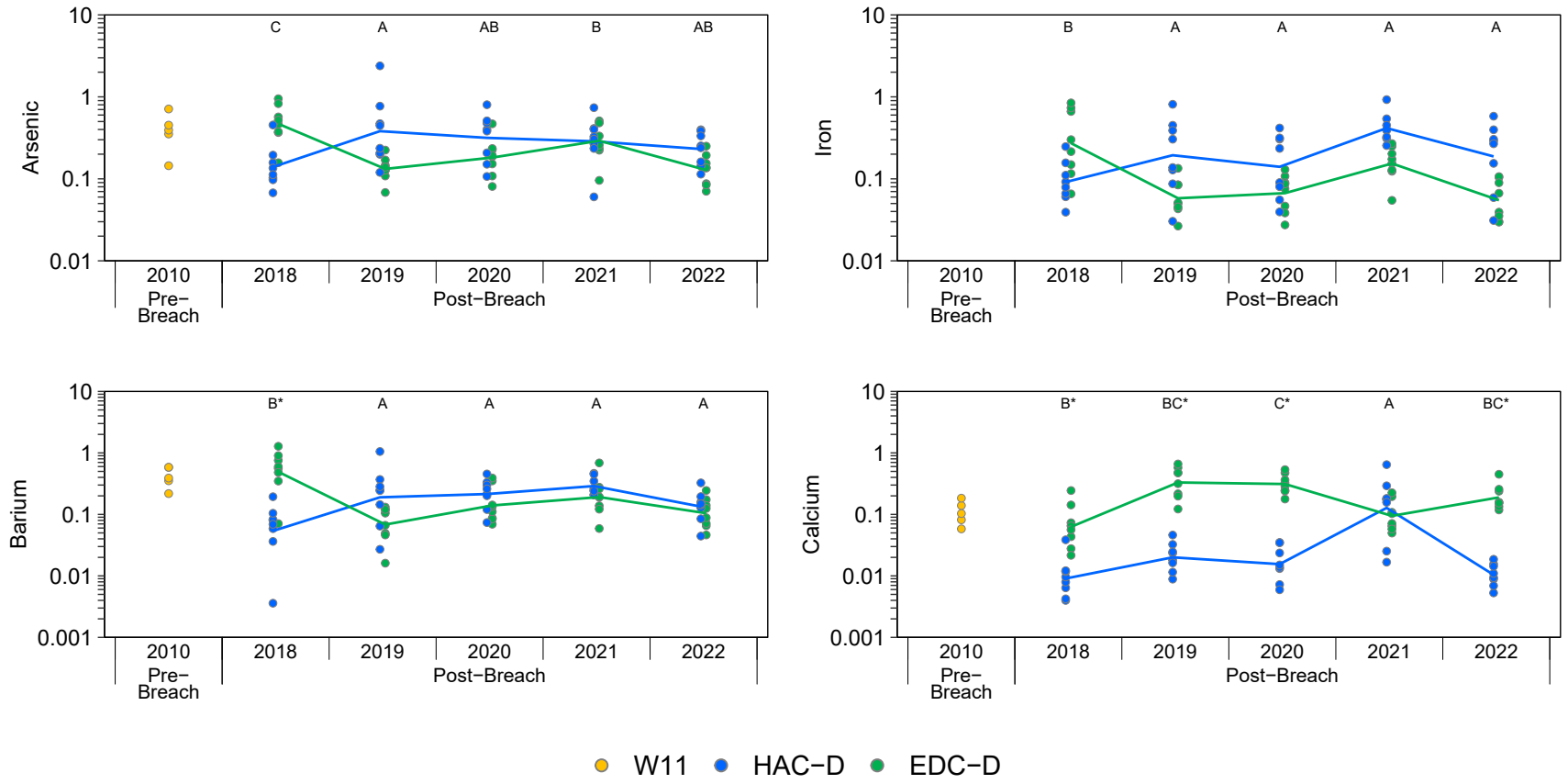

Figure F.4.15: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). W11 (2010) is the pre-breach equivalent of HAC-D.. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

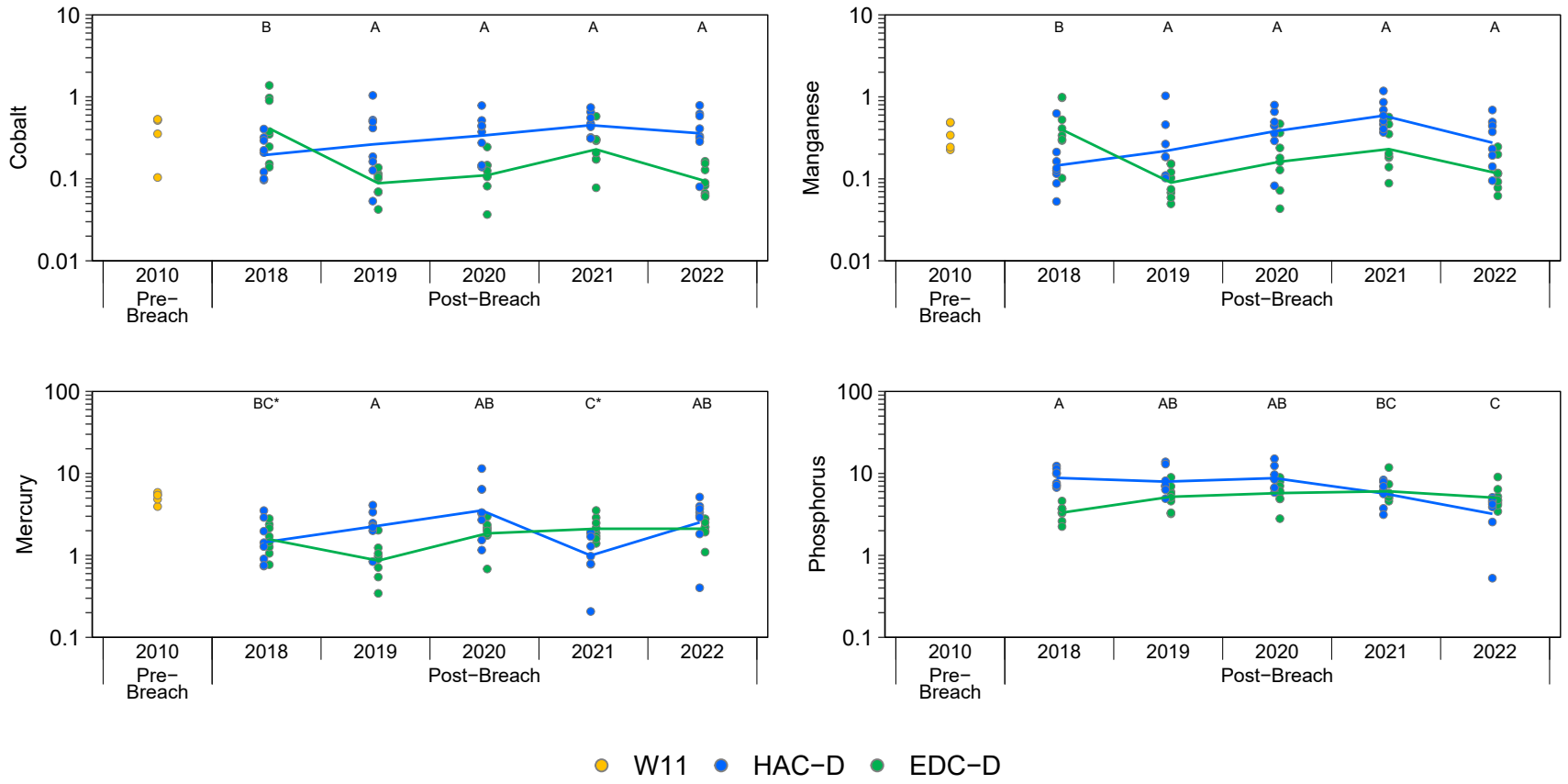

Figure F.4.15: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). W11 (2010) is the pre-breach equivalent of HAC-D.. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

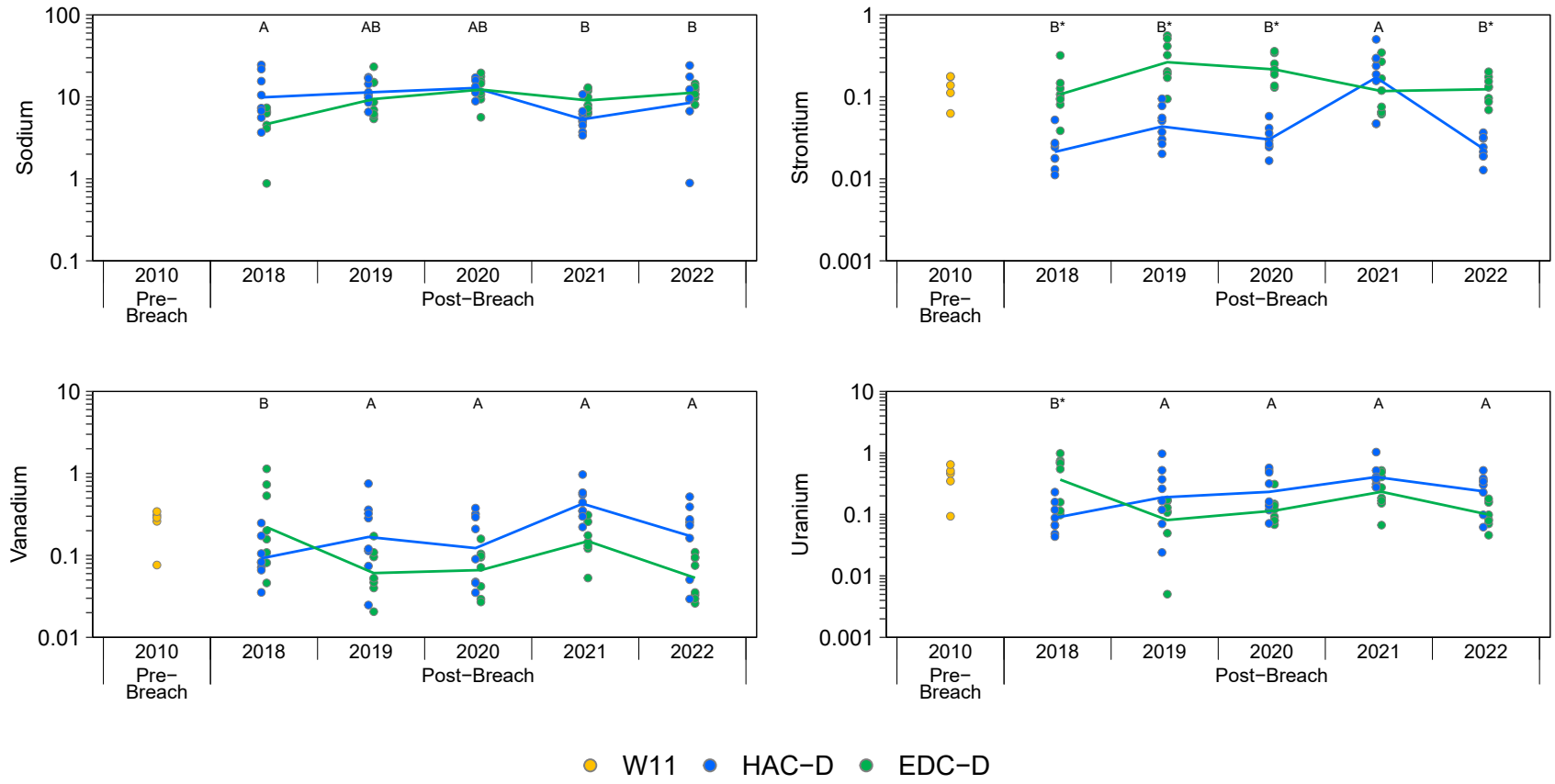

Figure F.4.15: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). W11 (2010) is the pre-breach equivalent of HAC-D.. Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p −value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

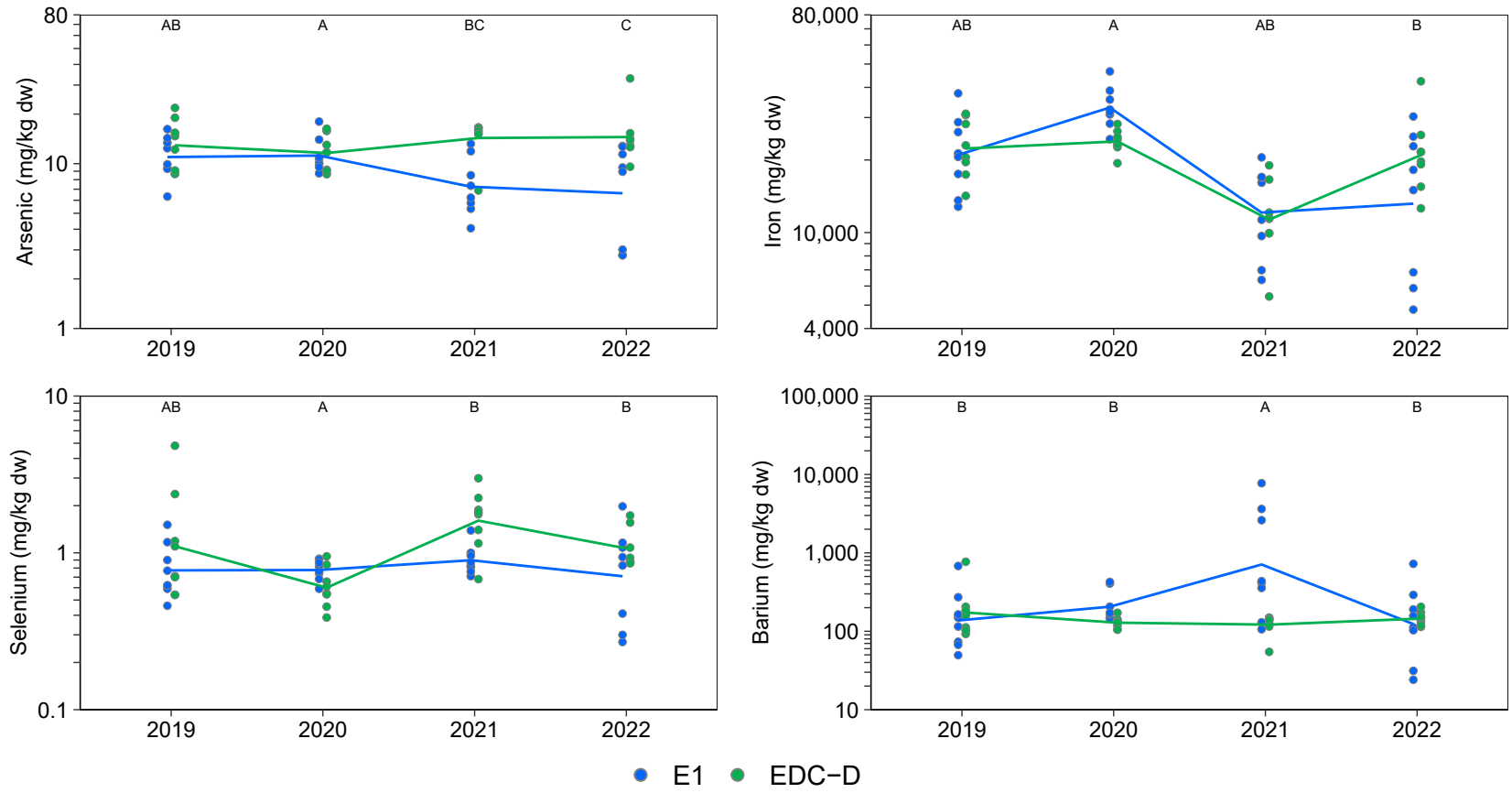

Figure F.4.16: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

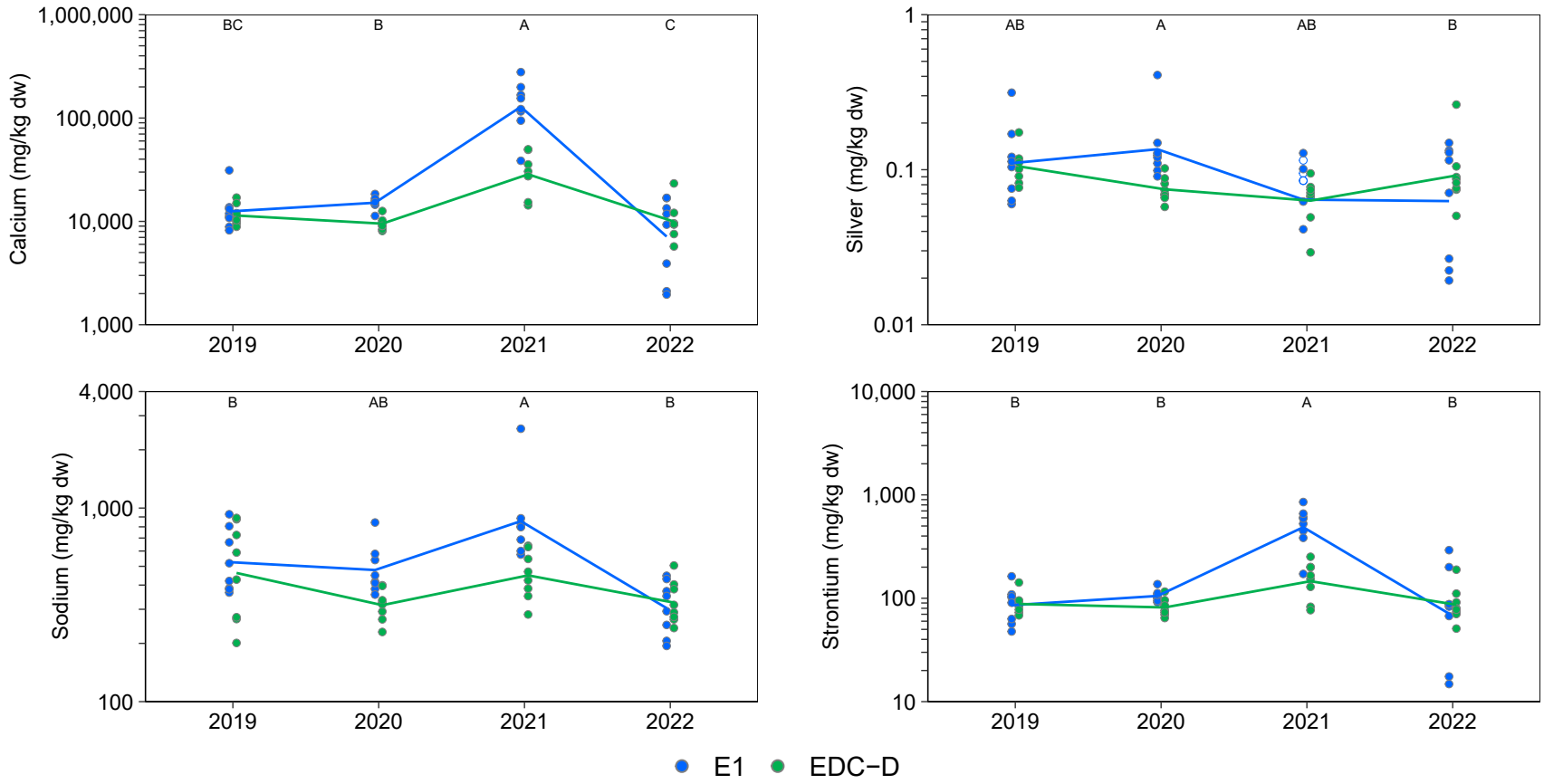

Figure F.4.16: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

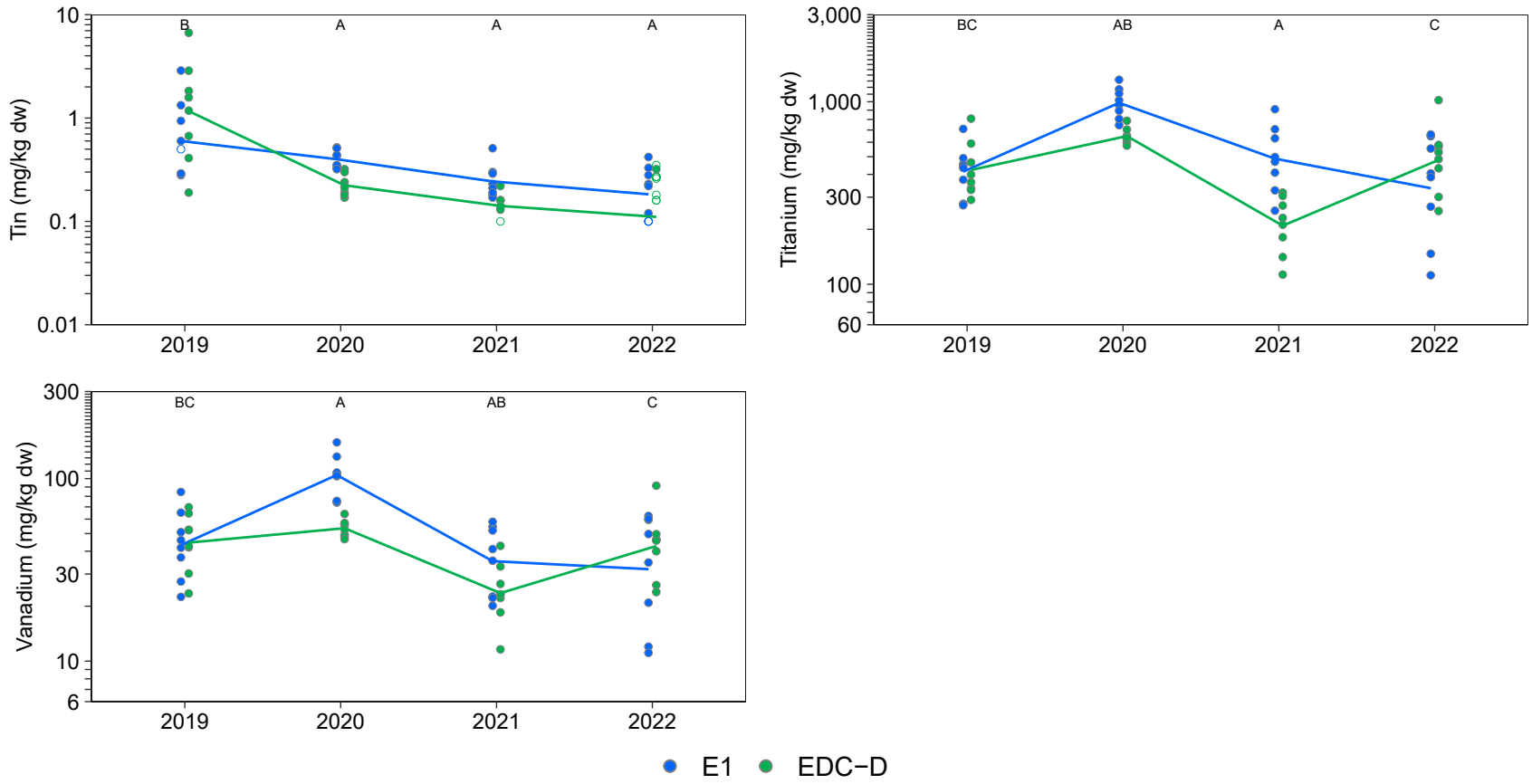

Figure F.4.16: Periphyton Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

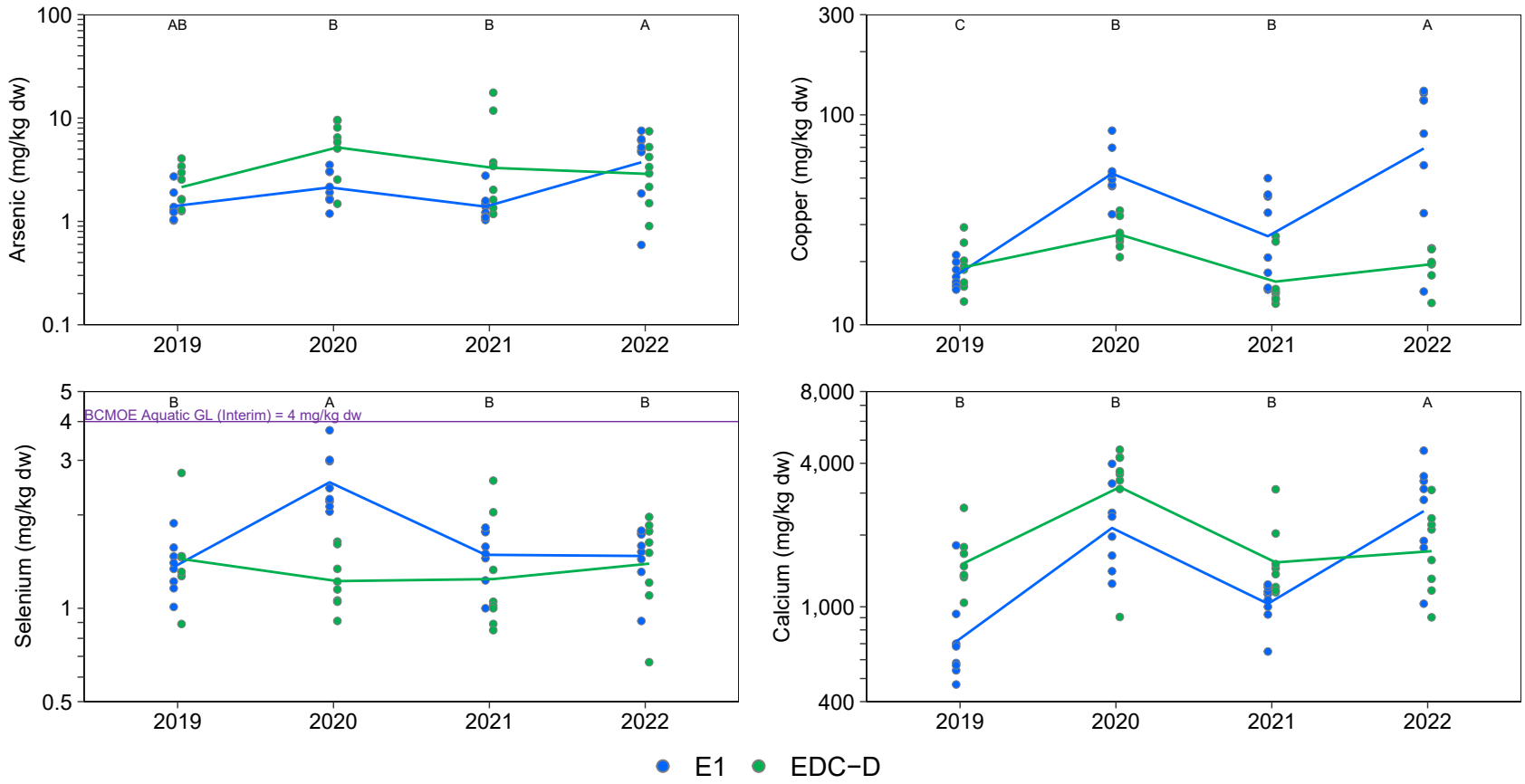

Figure F.4.17: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

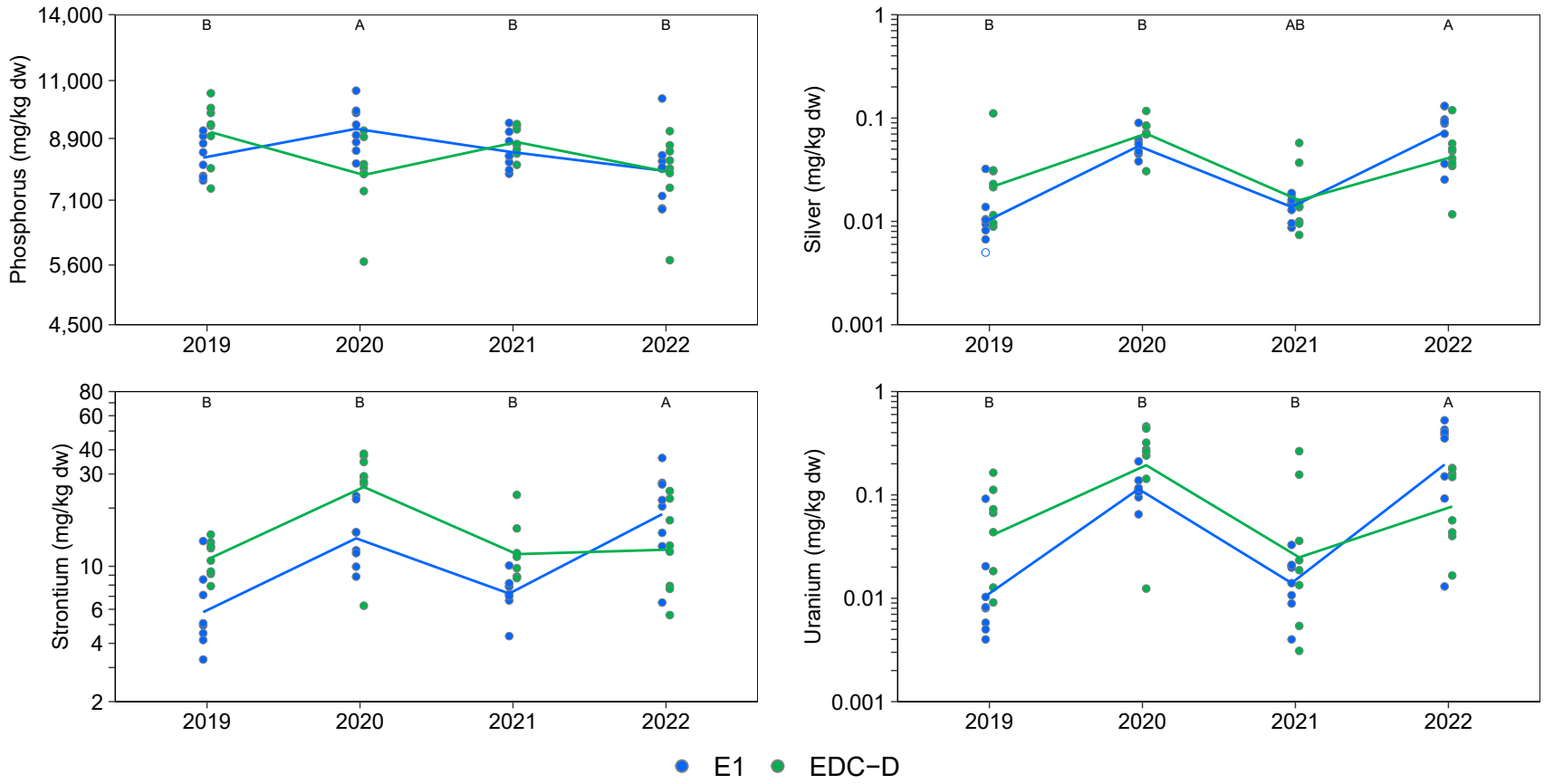

Figure F.4.17: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

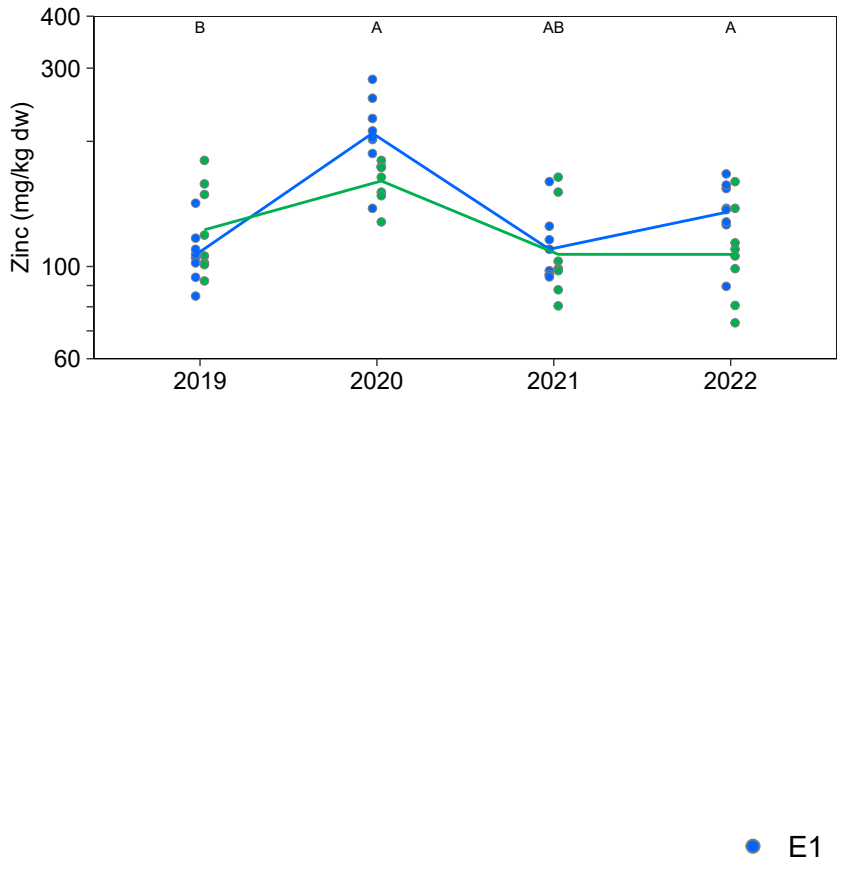

Figure F.4.17: Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

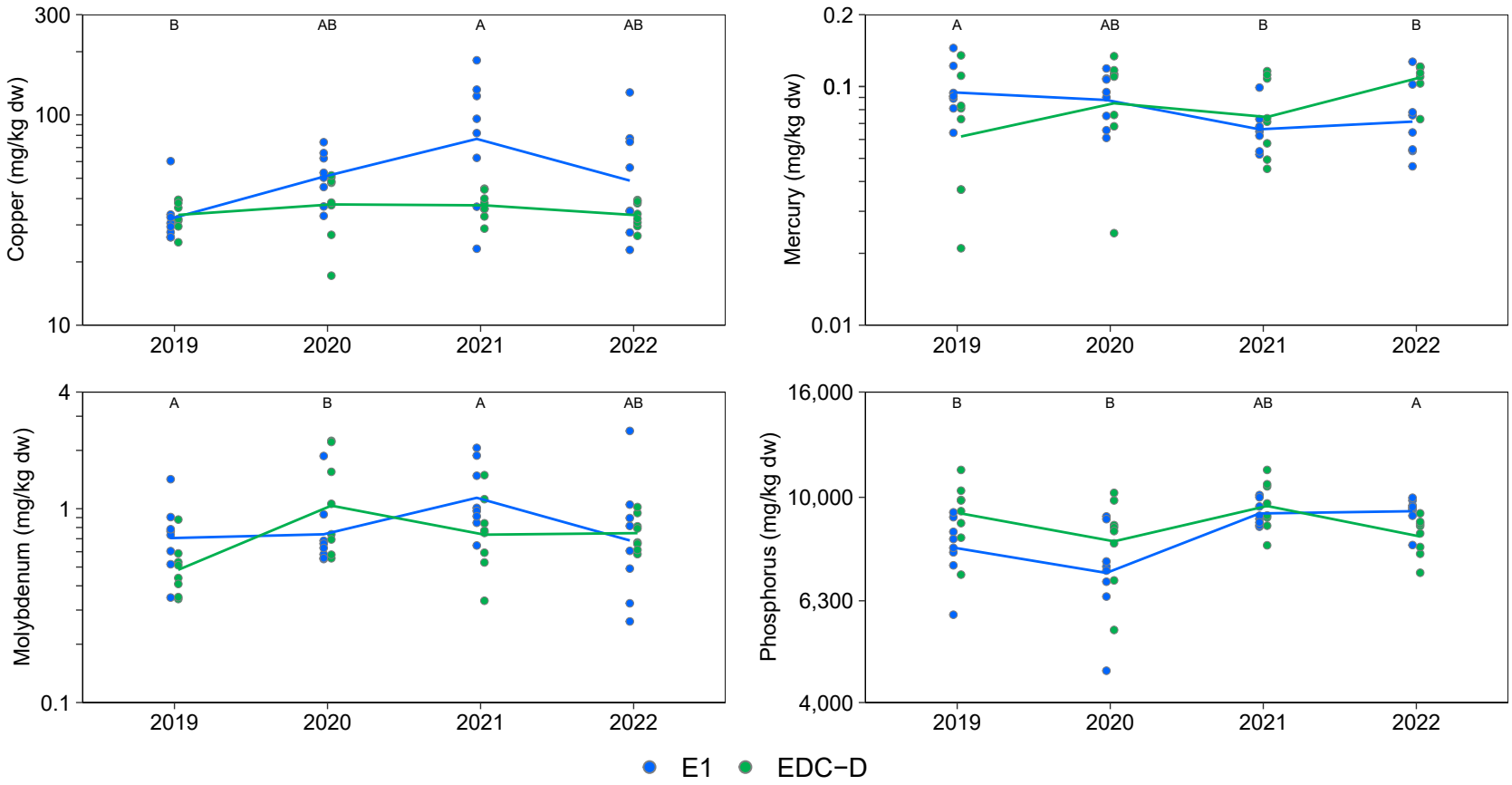

Figure F.4.18: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

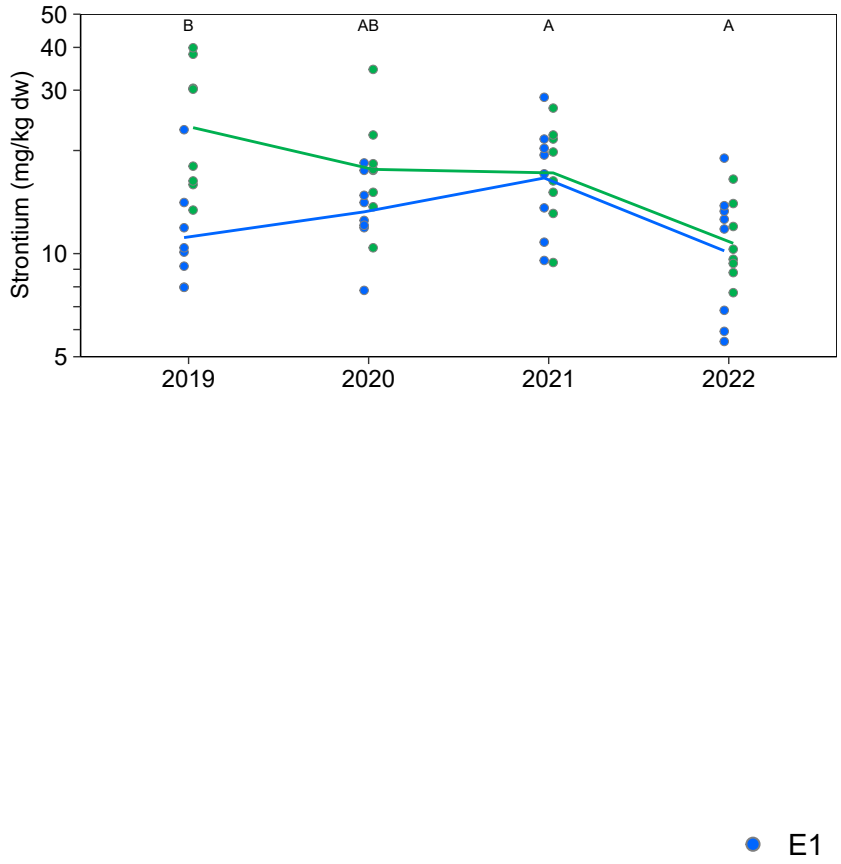

Figure F.4.18: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: BCMOE = British Columbia Ministry of the Environment, GL = Guideline, dw = dry weight, <LRL = lower than the laboratory reporting limit (LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

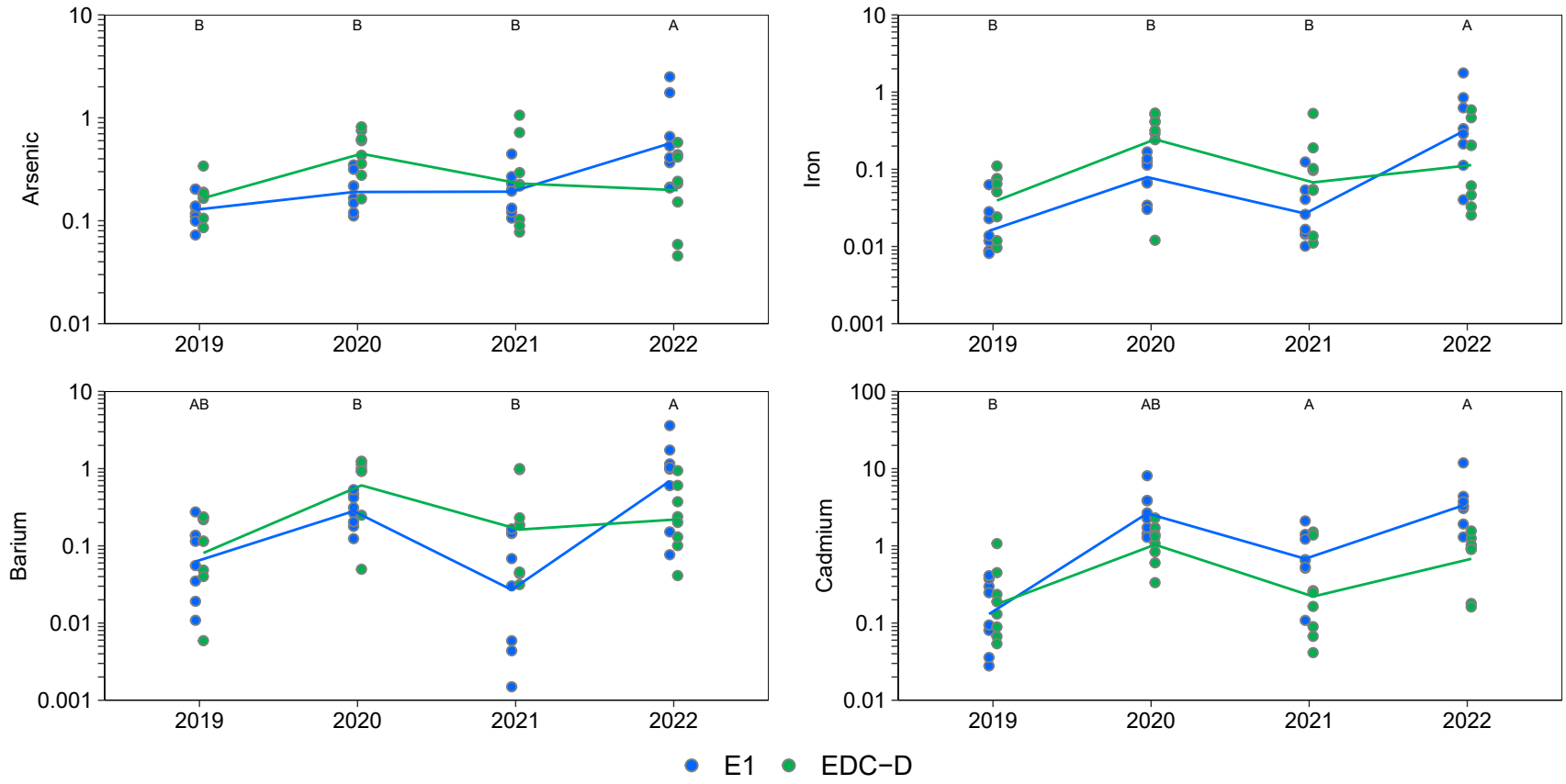

Figure F.4.19: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

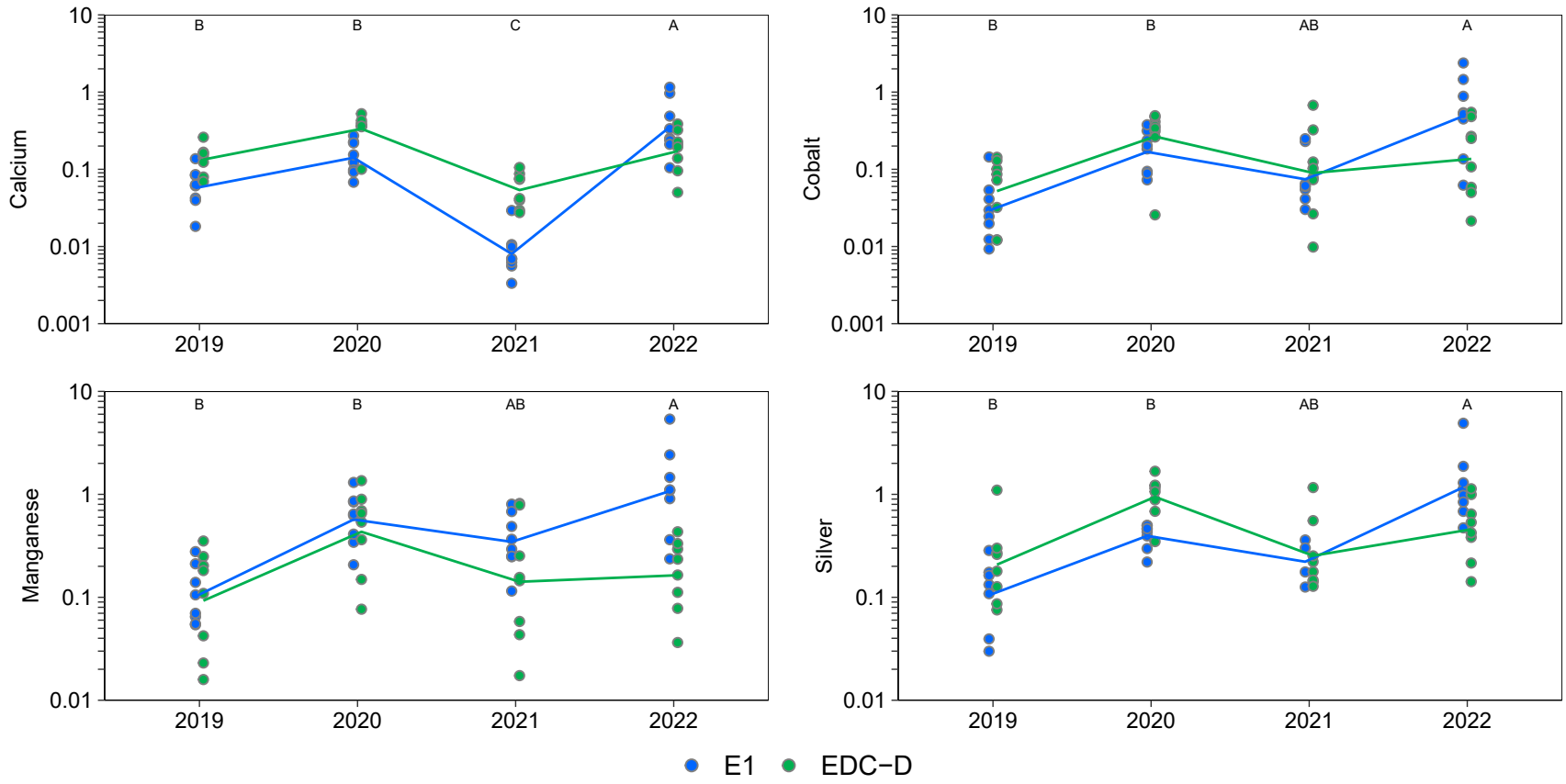

Figure F.4.19: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

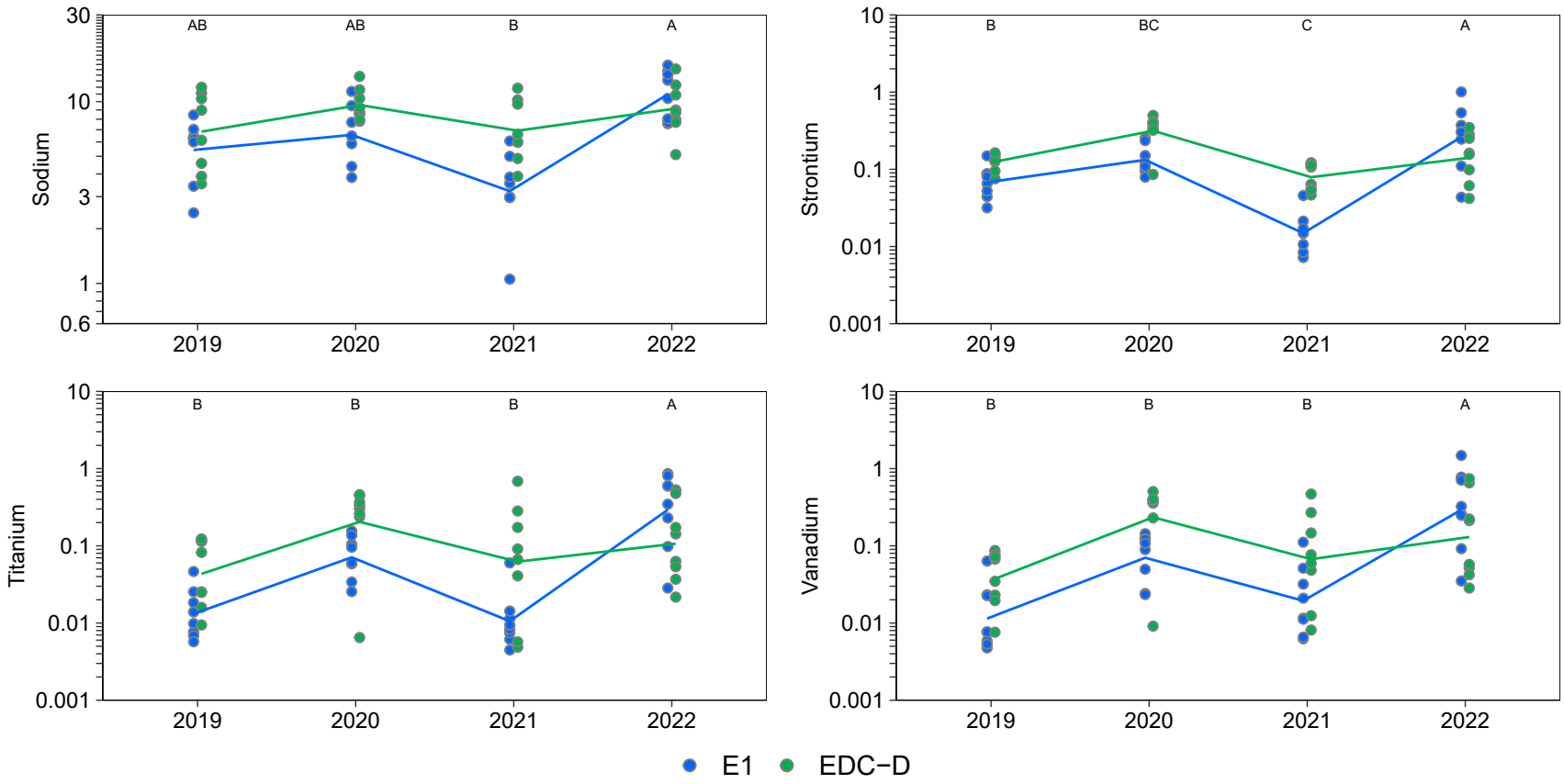

Figure F.4.19: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

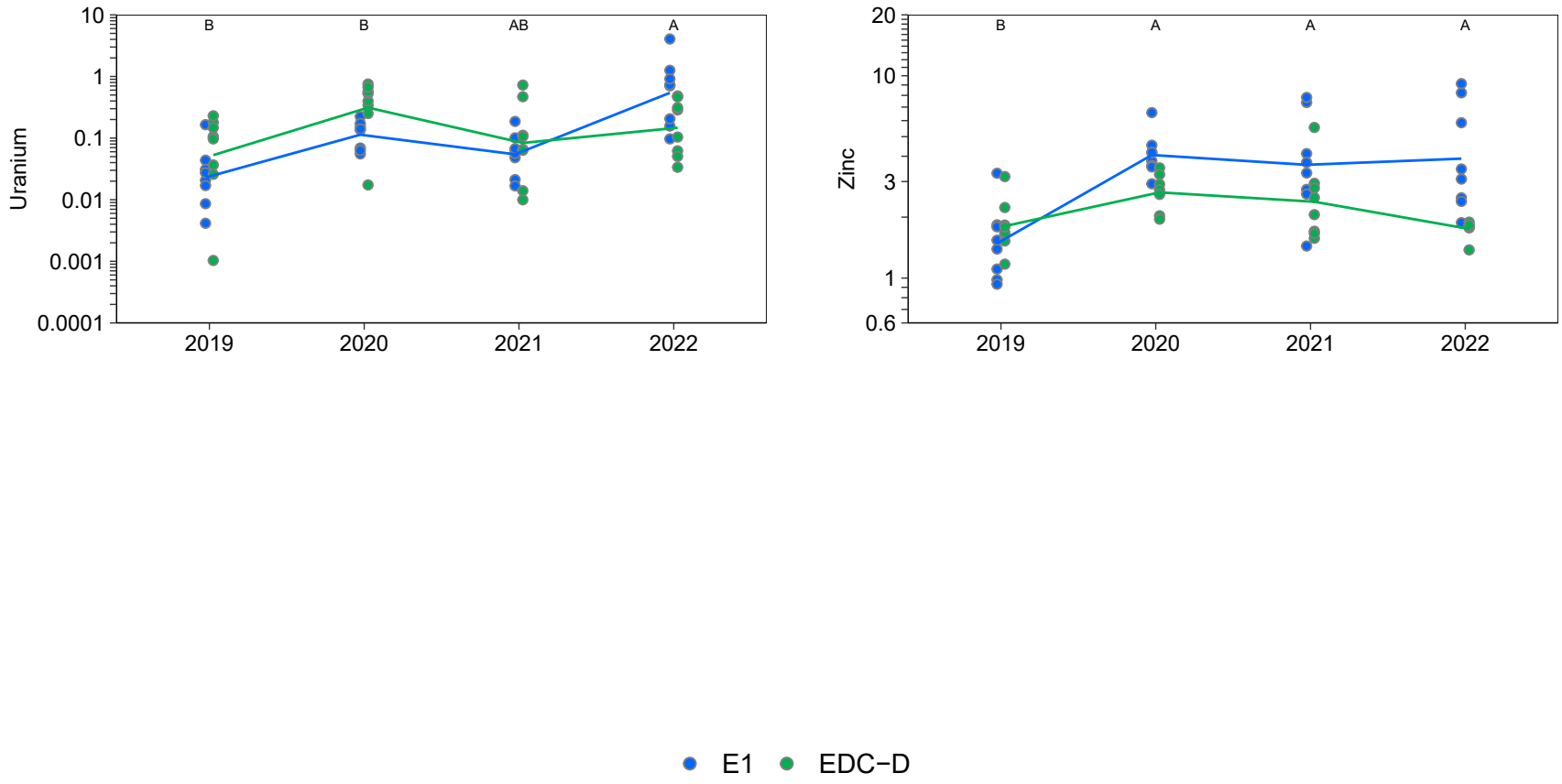

Figure F.4.19: Trophic Transfer Factors for Caddisfly Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

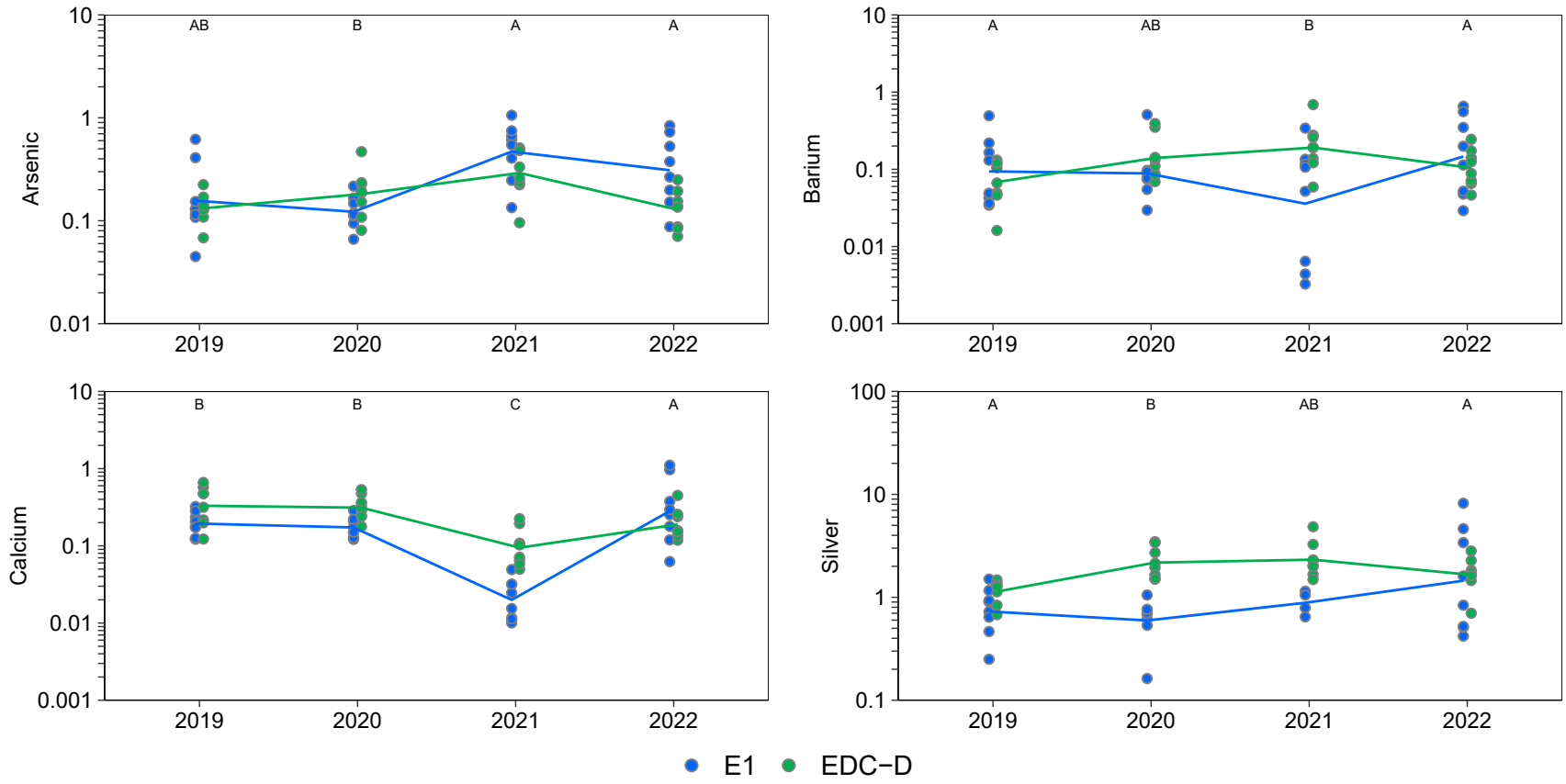

Figure F.4.20: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

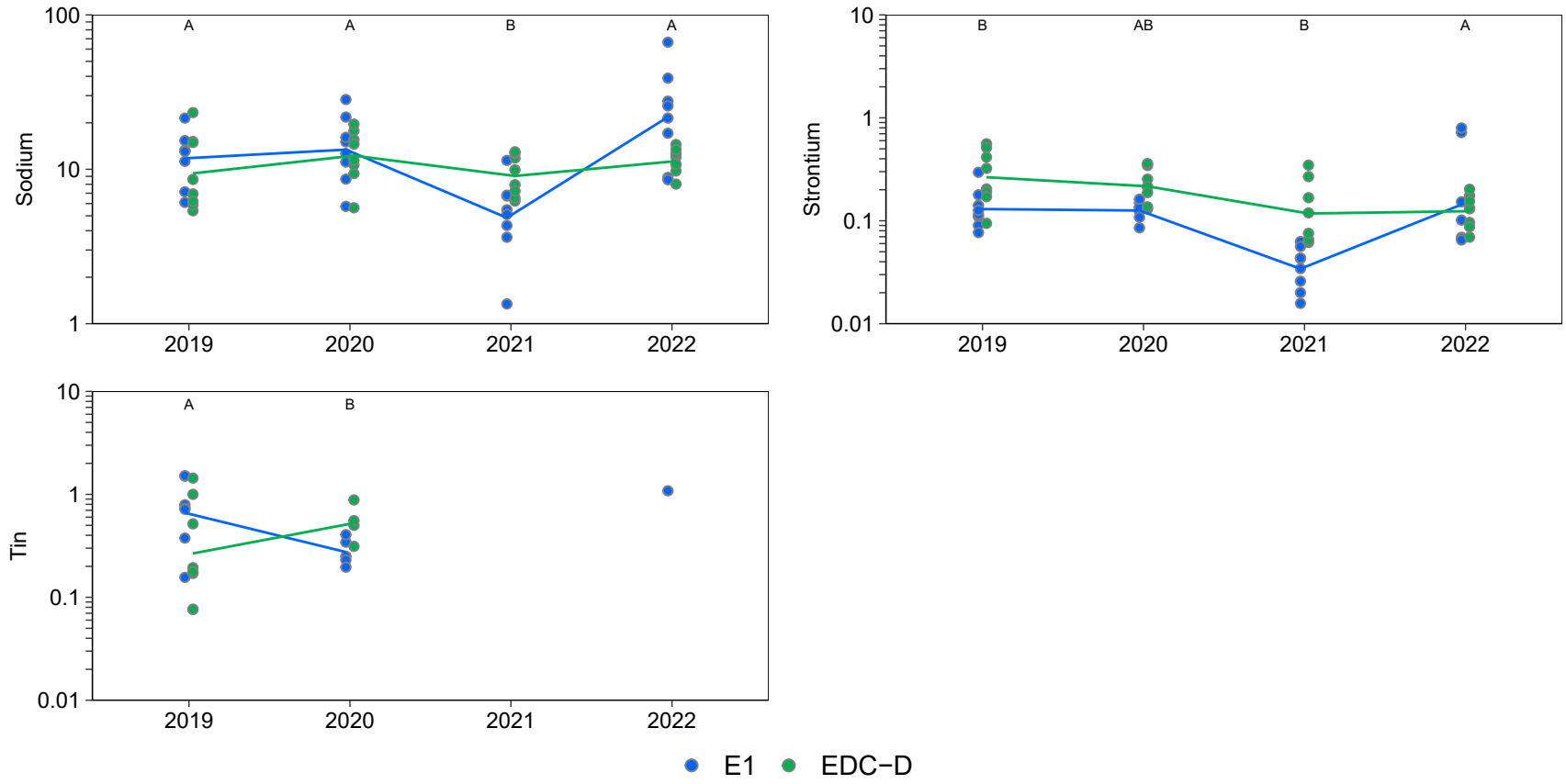

Figure F.4.20: Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations with a Significant Area x Year Effect for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Notes: Trophic Transfer Factors (TTFs) were not calculated for analytes with results reported below the laboratory reporting limit (<LRL). Concentrations <LRL are plotted as open symbols at the LRL and the open symbol represents one or more values reported <LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

Table F.4.1: Statistical Comparisons of Exposed - Reference Relative Differences of Periphyton Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-R1 Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	0.023	0.008	A	AB	AB	B	A	baseline	ns	ns	-72	ns	-80	-89	-88	-94	-79
Antimony	MLE	0.161	0.010	0.358	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Arsenic	MLE	<0.001	0.005	<0.001	A	A	C	BC	B	baseline	ns	-70	-56	-49	-75	-76	-93	-89	-87
Barium	MLE	<0.001	0.124	<0.001	A	AB	C	AB	BC	baseline	ns	-74	ns	-50	-39	-45	-84	-44	-70
Beryllium	MLE	<0.001	0.002	<0.001	A	BC	CD	D	AB	baseline	-51	-65	-74	ns	-75	-88	-91	-94	-84
Bismuth	MLE	<0.001	0.073	0.071	A	A	A	A	A	baseline	ns	ns	ns	ns			-91		
Boron	MLE	<0.001	0.073	<0.001	C	B	A	AB	AB	baseline	259	610	471	591	236	1,105	2,281	1,815	2,219
Cadmium	MLE	<0.001	0.005	<0.001	A	A	B	B	B	baseline	ns	-70	-54	-64	-68	-63	-91	-85	-89
Calcium	MLE	<0.001	0.563	<0.001	B	A	A	A	A	baseline	56	35	48	41	1,561	2,495	2,138	2,364	2,236
Cesium	MLE	<0.001	<0.001	<0.001	A	A	A	B	A	baseline	ns	ns	-80	ns	-51	-61	-54	-90	-66
Chromium	MLE	<0.001	<0.001	0.002	A	AB	A	B	A	baseline	ns	ns	-83	ns	-93	-97	-96	-99	-93
Cobalt	MLE	<0.001	0.006	0.002	A	AB	C	BC	BC	baseline	ns	-68	-53	-51	-86	-91	-96	-94	-93
Copper	MLE	0.010	0.005	0.024	A	AB	AB	B	A	baseline	ns	ns	-57	ns	80	ns	ns	ns	64
Iron	MLE	<0.001	<0.001	<0.001	A	A	A	B	A	baseline	ns	ns	-82	ns	-87	-92	-93	-98	-86
Lead	MLE	<0.001	0.004	<0.001	A	B	B	C	AB	baseline	-54	-66	-87	ns	-76	-89	-92	-97	-85
Lithium	MLE	<0.001	0.002	0.013	A	D	BC	C	AB	baseline	-93	-54	-67	ns	-72	ns	-87	-91	-77
Magnesium	MLE	<0.001	0.892	0.279	A	A	A	A	A	baseline	ns	ns	ns	ns			-43		
Manganese	MLE	<0.001	0.001	0.002	AB	A	C	AB	BC	baseline	ns	-54	ns	ns	-83	-77	-92	-84	-90
Mercury	MLE	<0.001	<0.001	0.015	A	AB	B	B	B	baseline	ns	-50	-70	-52	-80	-89	-90	-94	-91
Molybdenum	MLE	<0.001	0.004	<0.001	A	A	B	B	B	baseline	ns	-57	-67	-59	ns	ns	-47	-60	-50
Nickel	MLE	<0.001	<0.001	0.276	A	A	A	A	A	baseline	ns	ns	ns	ns			-93		
Phosphorus	MLE	<0.001	<0.001	0.665	A	A	A	A	A	baseline	ns	ns	ns	ns			-67		
Potassium	MLE	0.199	<0.001	<0.001	B	A	A	B	B	baseline	71	89	ns	ns	ns	60	77	ns	ns
Rubidium	MLE	<0.001	<0.001	<0.001	B	A	A	C	B	baseline	46	74	-48	ns	-61	-43	-32	-80	-66
Selenium	MLE	<0.001	0.001	0.011	B	AB	A	A	A	baseline	ns	77	66	65	60	105	183	166	164
Silver	MLE	<0.001	0.164	0.033	-	C	A	B	A	-	baseline	563	248	670	-	ns	-86	-93	-84
Sodium	MLE	0.064	<0.001	<0.001	AB	D	BC	CD	A	baseline	-40	ns	-38	ns	ns	-43	ns	-40	42
Strontium	MLE	<0.001	0.034	0.004	AB	A	BC	A	C	baseline	ns	ns	ns	-24	599	682	449	608	431
Tellurium	MLE	<0.001	0.208	0.061	<LRL	<LRL	A	A	A	<LRL	<LRL	baseline	ns	ns	<LRL	<LRL		40	
Thallium	MLE	<0.001	0.003	0.070	A	A	A	A	A	baseline	ns	ns	ns	ns			-95		
Tin	MLE	<0.001	<0.001	0.005	A	B	A	B	<LRL	baseline	-96	ns	-97	<LRL	ns	ns	-60	ns	<LRL
Titanium	MLE	<0.001	<0.001	<0.001	-	A	A	B	A	-	baseline	ns	-89	ns	-	-78	-80	-98	-59
Uranium	MLE	<0.001	<0.001	<0.001	A	B	B	C	AB	baseline	-47	-46	-78	ns	-70	-84	-84	-93	-79
Vanadium	MLE	<0.001	<0.001	<0.001	A	AB	B	C	A	baseline	ns	-48	-82	ns	-77	-84	-88	-96	-78
Zinc	MLE	<0.001	<0.001	0.067	A	A	A	A	A	baseline	ns	ns	ns	ns			-89		
Zirconium	MLE	<0.001	<0.001	<0.001	A	B	AB	C	A	baseline	-49	ns	-99	ns	-74	-87	-84	ns	-76

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ww = wet weight, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis,Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-R1:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-R1:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.2: Statistical Comparisons of Periphyton Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) in Post-Breach Years (2017 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]					
			Post-Breach Period					
			2017	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	-69	-87	-93	-93	-97	-89
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	ns	-66	-72	-75	-81	-70
Barium	MLE	<0.001	ns	ns	ns	ns	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-	-
Cadmium	MLE	<0.001	ns	ns	ns	-46	-64	-45
Calcium	MLE	<0.001	1,207	1,383	1,678	1,694	1,687	1,725
Cesium	MLE	-	-	-	-	-	-	-
Chromium	MLE	<0.001	-70	-93	-96	-95	-95	-83
Cobalt	MLE	<0.001	ns	-72	-83	-82	-86	-78
Copper	MLE	<0.001	ns	ns	ns	ns	-54	ns
Iron	MLE	<0.001	ns	-84	-92	-88	-97	-84
Lead	MLE	<0.001	-63	-79	-93	-94	-96	-90
Lithium	MLE	<0.001	ns	-75	<LRL	-91	-93	-87
Magnesium	MLE	<0.001	ns	-50	-49	-50	-54	-46
Manganese	MLE	<0.001	-84	-82	-76	-80	-83	-78
Mercury	MLE	<0.001	ns	ns	-69	-82	-89	-76
Molybdenum	MLE	0.007	ns	ns	ns	ns	ns	ns
Nickel	MLE	<0.001	ns	-85	-88	-83	-88	-78
Phosphorus	MLE	<0.001	-55	-72	-64	-65	-73	-61
Potassium	MLE	<0.001	-52	-46	ns	ns	-50	ns
Rubidium	MLE	-	-	-	-	-	-	-
Selenium	MLE	<0.001	-72	-78	-74	-67	-68	-59
Silver	MLE	-	-	-	-	-	-	-
Sodium	MLE	<0.001	ns	ns	ns	ns	-52	-29
Strontium	MLE	<0.001	261	363	326	301	291	283
Tellurium	MLE	-	-	-	-	-	-	-
Thallium	MLE	<0.001	-85	-92	<LRL	-94	-96	-94
Tin	MLE	<0.001	-91	<LRL	<LRL	-92	<LRL	<LRL
Titanium	MLE	<0.001	-	-	-88	-85	-98	-81
Uranium	MLE	<0.001	-65	-69	-87	-87	-93	-80
Vanadium	MLE	<0.001	ns	-78	-88	-84	-95	-79
Zinc	MLE	<0.001	-66	-83	-88	-84	-91	-69
Zirconium	MLE	-	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis, dw = dry weight, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.3: **Statistical Comparisons of Exposed - Reference Relative Differences of Periphyton Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periodsa					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)b					Magnitude of Difference for HAC-U Mean Relative to EDC-U (%)c				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	0.090	0.041	A	A	AB	B	A	baseline	ns	ns	-55	ns	-75	-77	-82	-89	-70
Antimony	MLE	0.307	0.017	0.044	B	C	A	A	AB	baseline	-64	68	76	ns	-32	ns	ns	ns	ns
Arsenic	MLE	<0.001	0.003	<0.001	A	A	C	AB	BC	baseline	ns	-66	ns	-48	-70	-71	-90	-82	-84
Barium	MLE	<0.001	0.004	<0.001	A	A	B	A	A	baseline	ns	-69	ns	ns	-35	-34	-80	-42	-55
Beryllium	MLE	<0.001	0.206	0.042	A	AB	BC	C	ABC	baseline	ns	-48	-51	ns	-75	-77	-87	-88	-80
Bismuth	MLE	<0.001	0.289	0.116	A	A	A	A	A	baseline	ns	ns	ns	ns	-89				
Boron	MLE	<0.001	0.431	<0.001	C	B	A	A	A	baseline	589	1,863	1,968	1,449	ns	640	2,007	2,120	1,563
Cadmium	MLE	<0.001	0.002	<0.001	AB	A	C	B	C	baseline	ns	-57	ns	-60	-68	-56	-86	-77	-87
Calcium	MLE	<0.001	0.008	<0.001	BC	A	BC	AB	C	baseline	30	ns	ns	ns	2,075	2,732	1,986	2,363	1,771
Cesium	MLE	<0.001	0.092	0.034	B	AB	A	B	B	baseline	ns	107	ns	ns	-61	-48	ns	-66	-56
Chromium	MLE	<0.001	<0.001	0.209	A	A	A	A	A	baseline	ns	ns	ns	ns	-94				
Cobalt	MLE	<0.001	0.007	<0.001	AB	A	C	BC	BC	baseline	ns	-55	ns	ns	-88	-86	-95	-93	-93
Copper	MLE	<0.001	0.102	0.449	A	A	A	A	A	baseline	ns	ns	ns	ns	98				
Iron	MLE	<0.001	0.134	0.005	A	A	AB	B	A	baseline	ns	ns	-65	ns	-83	-84	-91	-94	-85
Lead	MLE	<0.001	0.052	<0.001	AB	A	BC	C	AB	baseline	ns	ns	-64	ns	-77	-73	-86	-92	-77
Lithium	MLE	<0.001	0.055	0.125	A	A	A	A	A	baseline	ns	ns	ns	ns	-80				
Magnesium	MLE	<0.001	0.678	0.333	A	A	A	A	A	baseline	ns	ns	ns	ns	-29				
Manganese	MLE	<0.001	<0.001	0.002	B	A	B	A	B	baseline	101	ns	76	ns	-79	-58	-84	-63	-79
Mercury	MLE	<0.001	0.002	0.325	A	A	A	A	A	baseline	ns	ns	ns	ns	-83				
Molybdenum	MLE	<0.001	<0.001	0.148	A	A	A	A	A	baseline	ns	ns	ns	ns	-43				
Nickel	MLE	<0.001	0.018	0.003	AB	A	C	BC	BC	baseline	ns	-44	ns	ns	-90	-88	-95	-94	-94
Phosphorus	MLE	<0.001	<0.001	0.037	AB	B	AB	A	A	baseline	ns	ns	ns	ns	-62	-70	-58	-41	-53
Potassium	MLE	0.020	<0.001	<0.001	D	C	A	A	B	baseline	61	337	403	144	-46	ns	138	174	33
Rubidium	MLE	<0.001	<0.001	<0.001	D	C	A	AB	B	baseline	45	265	189	143	-73	-61	ns	-23	-35
Selenium	MLE	<0.001	<0.001	0.006	C	BC	AB	AB	A	baseline	ns	74	88	98	124	173	290	320	345
Silver	MLE	<0.001	0.281	0.907	-	A	A	A	A	-	baseline	ns	ns	ns	-	-83			
Sodium	MLE	0.605	<0.001	0.014	A	B	AB	A	A	baseline	-37	ns	ns	ns	ns	-31	ns	ns	50
Strontium	MLE	<0.001	0.227	<0.001	A	A	B	A	B	baseline	ns	-23	ns	-28	598	728	436	681	402
Tellurium	MLE	<0.001	0.194	0.448	<LRL	<LRL	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	92		<LRL
Thallium	MLE	<0.001	0.073	0.393	A	A	A	A	A	baseline	ns	ns	ns	ns	-92				
Tin	MLE	<0.001	<0.001	0.014	B	C	A	C	<LRL	baseline	-62	461	-66	<LRL	ns	ns	-44	ns	<LRL
Titanium	MLE	<0.001	0.117	<0.001	-	A	A	B	A	-	baseline	ns	-71	ns	-	-64	-74	-90	-52
Uranium	MLE	<0.001	0.086	0.223	A	A	A	A	A	baseline	ns	ns	ns	ns	-78				
Vanadium	MLE	<0.001	0.127	0.003	A	A	AB	B	A	baseline	ns	ns	-57	ns	-75	-74	-85	-89	-75
Zinc	MLE	<0.001	<0.001	<0.001	A	A	B	B	B	baseline	ns	-59	-56	-62	-75	-82	-90	-89	-90
Zirconium	MLE	<0.001	0.004	0.003	A	A	A	B	A	baseline	ns	ns	-66	ns	-75	-77	-81	-92	-79

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-U:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-U:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.4: Statistical Comparisons of Periphyton Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) in Post-Breach Years (2018 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]				
			Post-Breach Period				
			2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	-83	-87	-90	-93	-85
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	-58	-66	-65	-69	-63
Barium	MLE	0.050	ns	ns	ns	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-
Cadmium	MLE	<0.001	ns	ns	ns	-42	-40
Calcium	MLE	<0.001	1,842	1,840	1,572	1,686	1,362
Cesium	MLE	-	-	-	-	-	-
Chromium	MLE	<0.001	-91	-90	-92	-86	-88
Cobalt	MLE	<0.001	-75	-74	-78	-84	-76
Copper	MLE	0.372	ns	ns	ns	ns	ns
Iron	MLE	<0.001	-79	-83	-85	-92	-83
Lead	MLE	<0.001	-80	-82	-90	-89	-85
Lithium	MLE	<0.001	-78	<LRL	-88	-91	-86
Magnesium	MLE	<0.001	-38	-33	-39	-43	-38
Manganese	MLE	<0.001	-78	-58	-58	-60	-52
Mercury	MLE	<0.001	ns	-52	-69	-73	-64
Molybdenum	MLE	<0.001	-45	ns	ns	ns	ns
Nickel	MLE	<0.001	-83	-82	-83	-86	-82
Phosphorus	MLE	<0.001	-70	-66	-57	-55	ns
Potassium	MLE	<0.001	-68	ns	51	51	40
Rubidium	MLE	-	-	-	-	-	-
Selenium	MLE	<0.001	-70	-66	-55	-50	ns
Silver	MLE	-	-	-	-	-	-
Sodium	MLE	0.013	ns	ns	ns	ns	ns
Strontium	MLE	<0.001	363	351	291	331	262
Tellurium	MLE	-	-	-	-	-	-
Thallium	MLE	<0.001	-89	<LRL	-90	-91	-90
Tin	MLE	<0.001	<LRL	<LRL	-90	<LRL	<LRL
Titanium	MLE	<0.001	-	-80	-81	-92	-77
Uranium	MLE	<0.001	-76	-80	-81	-83	-78
Vanadium	MLE	<0.001	-75	-80	-80	-88	-76
Zinc	MLE	<0.001	-73	-81	-82	-87	-76
Zirconium	MLE	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.5: **Statistical Comparisons of Exposed - Reference Relative Differences of Caddisfly Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-R1 Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.615	<0.001	<0.001	A	A	B	B	B	baseline	ns	-87	-93	-87	389	231	ns	-65	ns
Antimony	MLE	0.003	<0.001	<0.001	A	AB	C	C	B	baseline	ns	-81	-84	-61	312	209	ns	ns	63
Arsenic	MLE	0.708	<0.001	<0.001	AB	A	BC	C	C	baseline	ns	ns	-69	-66	ns	105	ns	-50	-44
Barium	MLE	0.017	<0.001	<0.001	AB	A	CD	D	BC	baseline	ns	-81	-87	ns	ns	158	-83	-89	ns
Beryllium	MLE	0.074	0.162	<0.001	A	A	B	B	<LRL	baseline	ns	-85	-87	<LRL	300	306	ns	ns	<LRL
Bismuth	MLE	0.001	0.184	0.436	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	65		<LRL	<LRL	<LRL
Boron	MLE	0.615	<0.001	<0.001	B	A	C	C	<LRL	baseline	343	-90	-80	<LRL	108	822	-78	-58	<LRL
Cadmium	MLE	0.002	<0.001	<0.001	B	A	C	C	BC	baseline	320	-81	-79	ns	ns	165	-88	-87	-65
Calcium	MLE	0.024	<0.001	<0.001	A	A	B	B	B	baseline	ns	-87	-81	-80	365	372	ns	ns	ns
Cesium	MLE	0.025	<0.001	<0.001	A	A	B	B	B	baseline	ns	-91	-93	-87	784	552	ns	ns	ns
Chromium	MLE	0.017	<0.001	0.001	A	A	B	B	B	baseline	ns	-80	-81	-80	ns	ns	-73	-74	-72
Cobalt	MLE	0.006	<0.001	<0.001	A	A	B	B	B	baseline	ns	-80	-89	-72	ns	124	-79	-89	-70
Copper	MLE	<0.001	<0.001	<0.001	A	A	BC	B	C	baseline	ns	-73	-68	-83	491	598	60	88	ns
Iron	MLE	0.825	<0.001	<0.001	A	A	B	B	B	baseline	ns	-85	-89	-79	206	141	ns	-67	ns
Lead	MLE	0.628	<0.001	<0.001	A	A	B	B	B	baseline	ns	-88	-93	-82	329	266	ns	-69	ns
Lithium	MLE	<0.001	<0.001	0.022	A	AB	B	<LRL	<LRL	baseline	ns	-74	<LRL	<LRL	395	191	ns	<LRL	<LRL
Magnesium	MLE	0.085	<0.001	<0.001	A	AB	C	BC	BC	baseline	ns	-63	-47	-44	38	ns	-48	-27	ns
Manganese	MLE	0.044	<0.001	<0.001	B	A	C	C	B	baseline	571	-77	-76	ns	ns	418	-82	-82	ns
Mercury	MLE	<0.001	<0.001	<0.001	BC	A	A	AB	C	baseline	115	108	ns	ns	ns	160	151	77	ns
Molybdenum	MLE	<0.001	<0.001	<0.001	A	B	A	A	B	baseline	-87	ns	ns	-88	516	ns	363	248	ns
Nickel	MLE	0.013	<0.001	<0.001	AB	A	C	C	BC	baseline	ns	-85	-84	ns	ns	ns	-84	-83	-58
Phosphorus	MLE	<0.001	<0.001	0.014	A	A	B	A	A	baseline	ns	-22	ns	ns	-14	ns	-33	ns	ns
Potassium	MLE	<0.001	<0.001	<0.001	B	A	C	BC	B	baseline	55	-43	ns	ns	-21	ns	-55	-41	-20
Rubidium	MLE	<0.001	<0.001	<0.001	A	A	C	B	B	baseline	ns	-79	-61	-56	ns	ns	-81	-65	-60
Selenium	MLE	<0.001	<0.001	<0.001	C	C	BC	A	AB	baseline	ns	ns	94	74	442	581	610	952	842
Silver	MLE	<0.001	<0.001	<0.001	-	A	B	B	C	-	baseline	-78	-77	-99	-	ns	-85	-84	ns
Sodium	MLE	0.012	<0.001	<0.001	AB	A	C	B	AB	baseline	ns	-47	ns	ns	ns	ns	-45	-22	ns
Strontium	MLE	0.470	<0.001	<0.001	A	A	C	BC	B	baseline	ns	-87	-77	-71	193	234	-63	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.184	<0.001	A	A	B	B	<LRL	baseline	ns	-84	-84	<LRL	ns	ns	-86	-86	<LRL
Tin	MLE	0.006	0.003	0.480	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	90		<LRL	<LRL	<LRL
Titanium	MLE	0.623	<0.001	0.021	-	A	B	B	B	-	baseline	-82	-88	-79	-	366	ns	ns	ns
Uranium	MLE	0.125	<0.001	<0.001	AB	A	D	CD	BC	baseline	ns	-90	-88	ns	ns	ns	-83	-80	ns
Vanadium	MLE	0.561	<0.001	<0.001	A	A	B	B	B	baseline	ns	-90	-91	-87	406	252	ns	ns	ns
Zinc	MLE	<0.001	<0.001	<0.001	B	A	C	B	A	baseline	82	-46	ns	78	-55	ns	-76	-48	ns
Zirconium	MLE	0.432	0.048	<0.001	A	A	B	B	<LRL	baseline	ns	-87	-86	<LRL	104	185	-73	-71	<LRL

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-R1:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-R1:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.6: **Statistical Comparisons of Exposed - Reference Relative Differences of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-R1 Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.002	<0.001	0.025	B	B	B	B	A	baseline	ns	ns	ns	154	ns	ns	ns	ns	265
Antimony	MLE	<0.001	<0.001	0.021	B	B	AB	B	A	baseline	ns	ns	ns	110	ns	41	101	73	188
Arsenic	MLE	0.110	<0.001	<0.001	A	B	B	B	A	baseline	-54	-54	-43	ns	80	ns	ns	ns	99
Barium	MLE	0.073	<0.001	<0.001	BC	AB	C	C	A	baseline	ns	ns	ns	199	ns	154	-49	ns	276
Beryllium	MLE	<0.001	<0.001	0.019	B	B	B	B	A	baseline	ns	ns	ns	126	ns	ns	ns	ns	279
Bismuth	MLE	0.128	0.026	0.425	<LRL	A	<LRL	A	<LRL	<LRL	baseline	<LRL	ns	<LRL	<LRL	ns	<LRL	ns	<LRL
Boron	MLE	0.037	<0.001	<0.001	C	B	C	B	A	baseline	132	ns	155	760	ns	ns	ns	73	484
Cadmium	MLE	<0.001	<0.001	0.015	A	A	B	AB	A	baseline	ns	-64	ns	ns	-54	-64	-84	-71	-53
Calcium	MLE	<0.001	<0.001	<0.001	A	BC	C	BC	B	baseline	-94	-97	-95	-90	4,536	166	ns	137	379
Cesium	MLE	<0.001	<0.001	0.291	A	A	A	A	A	baseline	ns	ns	ns	ns	137				
Chromium	MLE	0.230	<0.001	0.390	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.011	<0.001	0.105	A	A	A	A	A	baseline	ns	ns	ns	ns	-27				
Copper	MLE	<0.001	0.045	0.002	A	BC	C	AB	BC	baseline	-49	-60	ns	-49	887	399	298	671	398
Iron	MLE	0.063	<0.001	0.022	B	B	B	AB	A	baseline	ns	ns	ns	146	ns	ns	ns	ns	161
Lead	MLE	0.012	<0.001	0.063	A	A	A	A	A	baseline	ns	ns	ns	ns	38				
Lithium	MLE	<0.001	<0.001	0.089	A	A	A	A	A	baseline	ns	ns	ns	ns	95				
Magnesium	MLE	0.061	<0.001	0.003	AB	BC	C	AB	A	baseline	ns	-35	ns	ns	ns	ns	-21	ns	48
Manganese	MLE	0.996	<0.001	<0.001	B	A	B	A	A	baseline	332	ns	141	168	-47	129	-55	ns	ns
Mercury	MLE	0.175	0.035	<0.001	D	BC	A	AB	CD	baseline	55	206	120	ns	-32	ns	109	50	ns
Molybdenum	MLE	<0.001	0.001	<0.001	B	B	A	AB	C	baseline	ns	181	ns	-51	130	229	546	271	ns
Nickel	MLE	0.387	<0.001	<0.001	AB	BC	C	BC	A	baseline	ns	-57	ns	ns	ns	ns	-54	ns	88
Phosphorus	MLE	0.103	<0.001	<0.001	C	BC	AB	A	AB	baseline	ns	40	71	45	-32	-16	ns	ns	ns
Potassium	MLE	0.049	<0.001	<0.001	C	AB	B	AB	A	baseline	92	52	104	136	-51	ns	-25	ns	ns
Rubidium	MLE	<0.001	<0.001	<0.001	A	A	C	BC	AB	baseline	ns	-52	-39	ns	-35	-32	-69	-61	-42
Selenium	MLE	<0.001	<0.001	<0.001	D	CD	AB	A	BC	baseline	ns	123	190	71	193	260	555	749	403
Silver	MLE	<0.001	0.709	0.005	-	B	AB	A	B	-	baseline	ns	213	ns	-	-83	-73	-46	-83
Sodium	MLE	0.091	<0.001	<0.001	ABC	C	BC	AB	A	baseline	ns	ns	ns	ns	ns	-45	ns	ns	ns
Strontium	MLE	<0.001	<0.001	<0.001	A	BC	C	BC	B	baseline	-87	-92	-86	-79	1,454	109	ns	113	222
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	<0.001	<0.001	A	B	B	B	A	baseline	-66	-67	-52	ns	ns	-76	-77	-67	ns
Tin	MLE	0.940	<0.001	<0.001	<LRL	C	B	A	<LRL	<LRL	baseline	320	4,648	<LRL	<LRL	-61	ns	ns	<LRL
Titanium	MLE	<0.001	<0.001	0.165	-	A	A	A	A	-	baseline	ns	ns	ns	-	130			
Uranium	MLE	0.078	<0.001	0.001	B	B	B	B	A	baseline	ns	ns	ns	132	ns	-39	-53	ns	87
Vanadium	MLE	<0.001	<0.001	0.011	B	B	B	B	A	baseline	ns	ns	ns	140	63	ns	ns	74	291
Zinc	MLE	<0.001	<0.001	<0.001	C	A	B	A	A	baseline	112	33	176	133	-72	-41	-63	-24	-36
Zirconium	MLE	0.128	<0.001	<0.001	C	BC	B	B	A	baseline	ns	136	272	792	-72	-44	ns	ns	150

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-R1:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-R1:EDC-U). <LRL = all of the concentrations were reported as <LRL for at least one area so the time period was omitted from the analysis.

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.7: Statistical Comparisons of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) in Post-Breach Years (2018 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]				
			Post-Breach Period				
			2018	2019	2020	2021	2022
Aluminum	MLE	0.101	ns	ns	ns	ns	ns
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	ns	ns	ns	ns	ns
Barium	MLE	0.091	ns	ns	ns	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-
Cadmium	MLE	<0.001	180	152	ns	248	ns
Calcium	MLE	<0.001	3,227	ns	ns	ns	ns
Cesium	MLE	-	-	-	-	-	-
Chromium	MLE	<0.001	-76	-85	-87	-71	-86
Cobalt	MLE	0.005	ns	ns	ns	ns	ns
Copper	MLE	<0.001	336	168	ns	282	134
Iron	MLE	-	-	-	-	-	-
Lead	MLE	0.109	ns	ns	ns	ns	ns
Lithium	MLE	0.016	ns	ns	ns	146	ns
Magnesium	MLE	0.125	ns	ns	ns	ns	ns
Manganese	MLE	<0.001	-69	ns	-57	ns	-55
Mercury	MLE	<0.001	ns	105	164	85	ns
Molybdenum	MLE	<0.001	ns	ns	ns	ns	ns
Nickel	MLE	<0.001	-64	-72	-80	ns	-72
Phosphorus	MLE	-	-	-	-	-	-
Potassium	MLE	-	-	-	-	-	-
Rubidium	MLE	-	-	-	-	-	-
Selenium	MLE	<0.001	-78	-68	-49	-36	-55
Silver	MLE	-	-	-	-	-	-
Sodium	MLE	-	-	-	-	-	-
Strontium	MLE	<0.001	925	ns	ns	ns	ns
Tellurium	MLE	-	-	-	-	-	-
Thallium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	-	-	-	-	-	-
Uranium	MLE	0.010	ns	ns	-60	ns	ns
Vanadium	MLE	0.008	ns	ns	ns	146	ns
Zinc	MLE	<0.001	-76	-58	-49	-34	-48
Zirconium	MLE	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis, dw = dry weight, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.8: Statistical Comparisons of Exposed - Reference Relative Differences of Caddisfly Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periodsa					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-U Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.288	<0.001	<0.001	A	A	B	B	A	baseline	ns	-93	-89	ns	ns	153	-86	-77	ns
Antimony	MLE	0.475	<0.001	<0.001	AB	A	C	D	B	baseline	ns	-67	-82	ns	83	165	-40	-67	52
Arsenic	MLE	0.294	<0.001	<0.001	AB	A	CD	D	BC	baseline	ns	-59	-72	ns	ns	89	-44	-62	ns
Barium	MLE	<0.001	<0.001	<0.001	B	A	C	C	AB	baseline	414	-86	-73	ns	-60	104	-94	-89	ns
Beryllium	MLE	0.232	0.015	<0.001	A	A	C	B	<LRL	baseline	ns	-99	-82	<LRL	ns	200	ns	-72	<LRL
Bismuth	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	0.221	0.010	<0.001	B	A	D	C	<LRL	baseline	409	-93	-59	<LRL	ns	472	-92	-54	<LRL
Cadmium	MLE	<0.001	<0.001	<0.001	BC	A	D	C	B	baseline	510	-94	ns	ns	-53	189	-97	-80	ns
Calcium	MLE	0.028	<0.001	<0.001	A	A	D	C	B	baseline	ns	-95	-83	-66	400	450	-75	ns	72
Cesium	MLE	0.267	<0.001	<0.001	AB	A	C	C	B	baseline	ns	-93	-88	ns	237	488	-75	-61	95
Chromium	MLE	<0.001	<0.001	<0.001	AB	A	C	C	B	baseline	ns	-90	-88	ns	ns	ns	-92	-90	-55
Cobalt	MLE	<0.001	<0.001	<0.001	B	A	C	C	B	baseline	269	-85	-79	ns	-65	ns	-95	-93	-55
Copper	MLE	<0.001	<0.001	<0.001	B	A	D	CD	C	baseline	64	-71	-66	-60	229	440	ns	ns	30
Iron	MLE	0.023	<0.001	<0.001	A	A	B	B	A	baseline	ns	-89	-87	ns	ns	92	-86	-84	ns
Lead	MLE	0.216	<0.001	<0.001	AB	A	C	C	B	baseline	ns	-91	-90	ns	92	223	-83	-80	ns
Lithium	MLE	0.018	0.038	0.347	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	94		<LRL	<LRL	<LRL
Magnesium	MLE	<0.001	<0.001	<0.001	AB	A	C	BC	A	baseline	ns	-39	ns	ns	-23	ns	-53	-44	ns
Manganese	MLE	0.013	<0.001	<0.001	C	A	D	C	B	baseline	904	-86	ns	120	-49	410	-93	-76	ns
Mercury	MLE	0.005	<0.001	<0.001	C	A	AB	BC	C	baseline	178	104	ns	ns	ns	129	68	ns	ns
Molybdenum	MLE	<0.001	<0.001	<0.001	B	C	A	B	C	baseline	-69	177	ns	-52	146	ns	581	199	ns
Nickel	MLE	<0.001	<0.001	<0.001	B	A	D	C	AB	baseline	166	-95	-84	ns	-48	ns	-97	-92	ns
Phosphorus	MLE	<0.001	<0.001	0.003	AB	A	B	AB	A	baseline	ns	ns	ns	ns	-22	ns	-33	-20	ns
Potassium	MLE	<0.001	<0.001	<0.001	B	A	C	C	B	baseline	84	-37	-25	ns	-32	26	-57	-49	-18
Rubidium	MLE	<0.001	0.001	<0.001	A	A	C	B	B	baseline	ns	-85	-61	-45	ns	ns	-87	-65	-52
Selenium	MLE	<0.001	<0.001	<0.001	D	C	B	B	A	baseline	93	179	246	464	234	544	830	1,053	1,781
Silver	MLE	<0.001	<0.001	<0.001	-	A	B	B	B	-	baseline	-91	-90	-88	-	-39	-94	-94	-92
Sodium	MLE	<0.001	<0.001	<0.001	B	A	C	C	B	baseline	43	-37	-30	ns	-20	ns	-49	-44	ns
Strontium	MLE	0.891	<0.001	<0.001	AB	A	D	C	B	baseline	ns	-91	-68	ns	96	220	-82	-38	58
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	0.058	<0.001	B	A	C	C	<LRL	baseline	78	-82	-86	<LRL	-40	ns	-89	-92	<LRL
Tin	MLE	0.636	0.001	0.154	A	A	<LRL	<LRL	<LRL	baseline	ns	<LRL	<LRL	<LRL	ns	ns	<LRL	<LRL	<LRL
Titanium	MLE	0.304	<0.001	<0.001	-	A	B	B	A	-	baseline	-95	-94	ns	-	244	-81	-81	ns
Uranium	MLE	0.004	<0.001	<0.001	B	A	D	C	A	baseline	174	-93	-76	250	ns	ns	-96	-85	120
Vanadium	MLE	0.258	<0.001	<0.001	A	A	B	B	A	baseline	ns	-93	-86	ns	ns	159	-87	-73	ns
Zinc	MLE	<0.001	<0.001	<0.001	C	AB	D	B	A	baseline	106	-41	49	117	-63	-23	-78	-44	ns
Zirconium	MLE	<0.001	0.006	<0.001	B	A	C	D	<LRL	baseline	136	-88	-98	<LRL	ns	111	-89	ns	<LRL

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-U:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-U:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.9: Statistical Comparisons of Exposed - Reference Relative Differences of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-U Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.892	<0.001	0.050	AB	A	B	A	A	baseline	ns	ns	ns	ns	ns	ns	-54	ns	ns
Antimony	MLE	0.100	<0.001	0.007	BC	AB	C	BC	A	baseline	ns	ns	ns	76	ns	34	ns	ns	76
Arsenic	MLE	0.305	<0.001	<0.001	B	B	C	BC	A	baseline	ns	-57	ns	134	ns	ns	-44	ns	202
Barium	MLE	0.758	<0.001	<0.001	B	A	C	B	A	baseline	307	-59	ns	514	-38	152	-75	ns	280
Beryllium	MLE	0.515	<0.001	0.007	A	A	B	A	A	baseline	ns	-64	ns	ns	ns	ns	-57	ns	ns
Bismuth	MLE	0.072	0.721	0.392	<LRL	A	<LRL	A	<LRL	<LRL	baseline	<LRL	ns	<LRL	<LRL	ns	<LRL	ns	<LRL
Boron	MLE	0.746	<0.001	<0.001	C	BC	D	B	A	baseline	ns	-62	117	333	ns	ns	-71	65	231
Cadmium	MLE	<0.001	<0.001	<0.001	A	AB	C	BC	A	baseline	ns	-72	-56	ns	-58	-69	-88	-82	-47
Calcium	MLE	<0.001	<0.001	<0.001	C	B	D	C	A	baseline	142	-73	ns	546	136	471	-36	184	1,426
Cesium	MLE	0.003	<0.001	0.008	A	A	B	AB	A	baseline	ns	-60	ns	ns	81	202	ns	ns	134
Chromium	MLE	<0.001	<0.001	0.033	A	A	B	A	A	baseline	ns	-54	ns	ns	-39	ns	-72	-38	-41
Cobalt	MLE	<0.001	<0.001	<0.001	A	A	B	A	A	baseline	ns	-63	ns	ns	-51	ns	-82	-59	-38
Copper	MLE	<0.001	<0.001	<0.001	B	B	C	B	A	baseline	ns	-51	ns	351	269	479	79	371	1,564
Iron	MLE	0.240	<0.001	0.018	A	A	B	A	A	baseline	ns	-56	ns	ns	ns	ns	-62	ns	ns
Lead	MLE	0.602	<0.001	0.046	A	A	B	A	A	baseline	ns	-49	ns	ns	ns	ns	-50	ns	ns
Lithium	MLE	0.202	<0.001	0.097	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Magnesium	MLE	0.796	0.006	<0.001	C	B	C	B	A	baseline	55	ns	37	195	-28	ns	-45	ns	111
Manganese	MLE	0.966	<0.001	<0.001	C	A	D	BC	B	baseline	355	-49	ns	127	-36	190	-67	ns	ns
Mercury	MLE	0.353	0.070	<0.001	B	A	A	A	A	baseline	79	134	148	102	-42	ns	36	44	ns
Molybdenum	MLE	<0.001	0.103	<0.001	B	AB	A	B	C	baseline	ns	224	ns	-68	134	310	657	219	ns
Nickel	MLE	<0.001	<0.001	<0.001	B	AB	C	B	A	baseline	ns	-64	ns	151	-47	ns	-81	-42	ns
Phosphorus	MLE	0.075	<0.001	<0.001	B	C	C	BC	A	baseline	-15	-18	ns	18	ns	-15	-18	-14	18
Potassium	MLE	<0.001	<0.001	<0.001	A	A	B	B	A	baseline	ns	-40	-33	ns	ns	ns	-43	-36	-19
Rubidium	MLE	<0.001	0.041	<0.001	AB	B	C	C	A	baseline	ns	-71	-64	ns	ns	-38	-76	-71	ns
Selenium	MLE	<0.001	<0.001	<0.001	B	B	A	A	A	baseline	ns	117	99	116	219	207	592	534	587
Silver	MLE	<0.001	<0.001	<0.001	-	B	C	B	A	-	baseline	-61	ns	216	-	-78	-91	-70	ns
Sodium	MLE	<0.001	<0.001	0.001	AB	C	BC	BC	A	baseline	-30	ns	ns	ns	-28	-50	-44	-33	ns
Strontium	MLE	<0.001	0.001	<0.001	C	B	D	C	A	baseline	106	-73	ns	293	95	302	-48	102	666
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	<0.001	<0.001	B	B	C	BC	A	baseline	ns	-60	ns	239	-66	-67	-86	-78	ns
Tin	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	0.380	<0.001	0.086	-	A	A	A	A	-	baseline	ns	ns	ns	-	ns	ns	ns	ns
Uranium	MLE	<0.001	<0.001	<0.001	B	B	C	B	A	baseline	ns	-57	ns	331	-64	ns	-85	-54	ns
Vanadium	MLE	0.591	<0.001	0.006	A	A	B	A	A	baseline	ns	-62	ns	ns	ns	ns	-56	ns	ns
Zinc	MLE	<0.001	<0.001	<0.001	A	A	B	A	A	baseline	ns	-30	ns	ns	-51	-41	-66	-40	-49
Zirconium	MLE	<0.001	<0.001	0.053	A	A	A	A	A	baseline	ns	ns	ns	ns			-47		

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-U:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-U:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.10: Statistical Comparisons of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) in Post-Breach Years (2015 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]					
			Post-Breach Period					
			2015	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	315	ns	ns	ns	ns	ns
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	<0.001	ns	ns	ns	-61	ns	ns
Barium	MLE	<0.001	ns	-56	ns	-77	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-	-
Cadmium	MLE	<0.001	ns	157	ns	ns	ns	ns
Calcium	MLE	<0.001	ns	ns	515	ns	191	631
Cesium	MLE	-	-	-	-	-	-	-
Chromium	MLE	<0.001	-65	-86	-82	-95	-74	-93
Cobalt	MLE	<0.001	ns	ns	ns	-74	ns	ns
Copper	MLE	<0.001	253	ns	211	ns	134	680
Iron	MLE	-	-	-	-	-	-	-
Lead	MLE	<0.001	225	ns	ns	-63	ns	-54
Lithium	MLE	<0.001	276	ns	148	<LRL	ns	ns
Magnesium	MLE	<0.001	78	-35	ns	ns	ns	ns
Manganese	MLE	<0.001	-71	-63	ns	-69	ns	-55
Mercury	MLE	<0.001	-	ns	101	72	78	81
Molybdenum	MLE	<0.001	-64	ns	ns	85	ns	-41
Nickel	MLE	<0.001	ns	-82	-71	-92	-62	-80
Phosphorus	MLE	-	-	-	-	-	-	-
Potassium	MLE	-	-	-	-	-	-	-
Rubidium	MLE	-	-	-	-	-	-	-
Selenium	MLE	<0.001	-55	-76	-73	-46	-52	-39
Silver	MLE	-	-	-	-	-	-	-
Sodium	MLE	-	-	-	-	-	-	-
Strontium	MLE	<0.001	179	ns	220	ns	ns	225
Tellurium	MLE	-	-	-	-	-	-	-
Thallium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	-	-	-	-	-	-	-
Uranium	MLE	<0.001	ns	-69	ns	-87	ns	ns
Vanadium	MLE	<0.001	351	ns	ns	ns	ns	ns
Zinc	MLE	<0.001	-58	-58	-58	-52	-48	-59
Zirconium	MLE	-	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.11: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Caddisfly Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-R1 Mean Relative to EDC-U (%)[c]				
					Post-Breach Period					Post-Breach Period					Post-Breach Period				
		Area	Year	Area × Year	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	<0.001	0.030	A	A	AB	AB	B	baseline	ns	ns	ns	-88	2,375	2,808	430	532	ns
Antimony	log_{10}	0.037	<0.001	<0.001	A	-	B	B	B	baseline	-	-87	-88	-71	468	-	ns	ns	ns
Arsenic	log_{10}	<0.001	<0.001	0.311	A	A	A	A	A	baseline	ns	ns	ns	ns	557				
Barium	log_{10}	0.409	<0.001	0.001	AB	A	B	C	AB	baseline	ns	ns	-86	ns	ns	368	ns	-80	ns
Beryllium	log_{10}	<0.001	0.246	0.994	A	A	A	A	-	baseline	ns	ns	ns	-	1,151				-
Bismuth	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	log_{10}	<0.001	0.427	<0.001	A	A	B	B	-	baseline	ns	-98	-93	-	ns	ns	-99	-96	-
Cadmium	log_{10}	<0.001	<0.001	0.017	ABC	A	BC	C	AB	baseline	ns	ns	ns	ns	ns	614	ns	ns	398
Calcium	log_{10}	<0.001	<0.001	<0.001	A	A	B	B	B	baseline	ns	-91	-87	-86	-72	-82	-97	-96	-96
Cesium	log_{10}	<0.001	<0.001	<0.001	A	A	B	AB	B	baseline	ns	-91	ns	-91	1,688	1,569	ns	446	ns
Chromium	log_{10}	<0.001	<0.001	0.023	AB	A	BC	AB	C	baseline	ns	ns	ns	-83	1,801	3,867	505	1,952	ns
Cobalt	log_{10}	<0.001	<0.001	0.002	AB	A	BC	C	BC	baseline	ns	ns	-77	ns	675	2,296	384	ns	341
Copper	log_{10}	<0.001	<0.001	<0.001	A	A	BC	AB	C	baseline	ns	-60	ns	-82	229	434	ns	140	ns
Iron	log_{10}	<0.001	<0.001	0.058	A	A	A	A	A	baseline	ns	ns	ns	ns	1,167				
Lead	log_{10}	<0.001	0.035	0.043	AB	A	B	AB	B	baseline	ns	ns	ns	ns	1,718	2,879	550	1,869	347
Lithium	log_{10}	<0.001	0.022	0.307	A	-	A	A	-	baseline	-	ns	ns	-	1,617	-	1,617		-
Magnesium	log_{10}	<0.001	0.004	0.002	A	AB	C	BC	BC	baseline	ns	-69	-46	-60	176	86	ns	ns	ns
Manganese	log_{10}	<0.001	<0.001	<0.001	B	A	BC	C	B	baseline	374	ns	-75	ns	366	2,107	135	ns	451
Mercury	log_{10}	<0.001	0.003	0.010	C	ABC	A	AB	BC	baseline	ns	320	192	ns	510	1,261	2,461	1,679	1,040
Molybdenum	log_{10}	<0.001	<0.001	<0.001	A	B	A	A	B	baseline	-86	ns	ns	-72	403	ns	780	746	ns
Nickel	log_{10}	<0.001	<0.001	0.031	AB	A	C	BC	ABC	baseline	ns	-77	ns	ns	1,200	1,907	199	321	440
Phosphorus	log_{10}	<0.001	<0.001	0.249	A	A	A	A	A	baseline	ns	ns	ns	ns	159				
Potassium	log_{10}	<0.001	<0.001	<0.001	A	A	B	A	A	baseline	ns	-70	ns	ns	ns	ns	-74	-35	ns
Rubidium	log_{10}	0.044	<0.001	<0.001	A	AB	C	AB	B	baseline	ns	-88	ns	-49	128	110	-72	73	ns
Selenium	log_{10}	<0.001	0.065	0.609	A	A	A	A	A	baseline	ns	ns	ns	ns	223				
Silver	log_{10}	0.002	0.825	0.090	-	-	A	A	-	-	-	baseline	ns	-	-	-	131		-
Sodium	log_{10}	0.825	0.003	<0.001	BC	A	CD	AB	D	baseline	85	ns	ns	-46	ns	100	-33	ns	-41
Strontium	log_{10}	<0.001	<0.001	<0.001	A	A	C	BC	B	baseline	ns	-84	-78	-62	-58	-57	-93	-91	-84
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	<0.001	0.001	0.191	A	-	A	A	-	baseline	-	ns	ns	-	736	-	736		-
Tin	log_{10}	0.282	0.213	0.579	A	-	A	-	-	baseline	-	ns	-	-	ns	-	ns	-	-
Titanium	log_{10}	<0.001	<0.001	0.037	-	A	AB	A	B	-	baseline	ns	ns	-89	-	2,004	317	2,196	ns
Uranium	log_{10}	<0.001	<0.001	0.004	AB	A	C	BC	AB	baseline	ns	-81	ns	ns	477	1,237	ns	204	352
Vanadium	log_{10}	<0.001	<0.001	0.019	A	A	B	AB	B	baseline	ns	-81	ns	-87	2,107	2,154	320	966	193
Zinc	log_{10}	<0.001	<0.001	0.002	B	A	B	A	A	baseline	150	ns	128	124	189	623	164	559	546
Zirconium	log_{10}	<0.001	0.652	0.013	A	A	B	-	-	baseline	ns	-70	-	-	687	1,133	132	-	-

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, "-" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-R1:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-R1:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.12: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-R1 Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	<0.001	0.345	A	A	A	A	A	baseline	ns	ns	ns	ns			1,176		
Antimony	log_{10}	<0.001	<0.001	0.176	A	-	A	A	A	baseline	-	ns	ns	ns	122	-		122	
Arsenic	log_{10}	<0.001	<0.001	0.001	B	C	AB	AB	A	baseline	-53	ns	ns	117	632	241	1,036	861	1,490
Barium	log_{10}	<0.001	<0.001	0.019	B	AB	B	B	A	baseline	ns	ns	ns	504	ns	360	228	ns	1,152
Beryllium	log_{10}	<0.001	<0.001	0.022	C	BC	ABC	A	AB	baseline	ns	ns	317	261	476	512	1,468	2,303	1,980
Bismuth	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	log_{10}	<0.001	0.161	0.007	A	AB	C	BC	ABC	baseline	ns	-76	-55	ns	-80	-87	-95	-91	-94
Cadmium	log_{10}	<0.001	<0.001	0.043	B	B	AB	AB	A	baseline	ns	ns	ns	184	ns	ns	ns	117	313
Calcium	log_{10}	<0.001	<0.001	<0.001	A	BC	C	BC	B	baseline	-96	-98	-97	-93	179	-90	-93	-90	-80
Cesium	log_{10}	<0.001	<0.001	0.011	BC	BC	C	A	AB	baseline	ns	ns	321	ns	408	511	265	2,041	989
Chromium	log_{10}	<0.001	<0.001	0.198	A	A	A	A	A	baseline	ns	ns	ns	ns			2,069		
Cobalt	log_{10}	<0.001	<0.001	0.155	A	A	A	A	A	baseline	ns	ns	ns	ns			876		
Copper	log_{10}	<0.001	0.025	0.019	AB	B	B	A	B	baseline	ns	ns	ns	ns	448	282	229	885	203
Iron	log_{10}	<0.001	<0.001	0.004	B	B	B	A	B	baseline	ns	ns	610	ns	710	1,186	1,290	5,652	1,832
Lead	log_{10}	<0.001	<0.001	0.002	C	BC	BC	A	AB	baseline	ns	ns	724	214	436	796	1,376	4,322	1,584
Lithium	log_{10}	<0.001	0.001	0.094	A	-	A	A	A	baseline	-	ns	ns	ns	1,000	-		1,000	
Magnesium	log_{10}	<0.001	0.011	0.104	A	A	A	A	A	baseline	ns	ns	ns	ns			98		
Manganese	log_{10}	<0.001	<0.001	0.012	C	AB	BC	AB	A	baseline	205	ns	151	364	220	878	499	705	1,386
Mercury	log_{10}	<0.001	0.005	<0.001	D	CD	A	AB	BC	baseline	ns	516	350	143	245	457	2,026	1,451	738
Molybdenum	log_{10}	<0.001	0.007	<0.001	B	B	A	A	B	baseline	ns	555	379	ns	88	203	1,128	798	126
Nickel	log_{10}	<0.001	<0.001	0.099	A	A	A	A	A	baseline	ns	ns	ns	ns			1,172		
Phosphorus	log_{10}	<0.001	<0.001	0.040	B	AB	AB	A	A	baseline	ns	ns	76	85	89	164	178	233	250
Potassium	log_{10}	0.001	<0.001	<0.001	B	B	B	A	A	baseline	ns	ns	109	185	-47	-41	-58	ns	51
Rhenium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rubidium	log_{10}	0.016	<0.001	<0.001	A	A	B	A	A	baseline	ns	-72	ns	ns	66	ns	-54	95	70
Selenium	log_{10}	<0.001	0.019	0.120	A	A	A	A	A	baseline	ns	ns	ns	ns			111		
Silver	log_{10}	<0.001	0.290	<0.001	-	-	B	A	B	-	-	baseline	296	ns	-	-	100	694	ns
Sodium	log_{10}	0.821	<0.001	0.056	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium	log_{10}	<0.001	<0.001	<0.001	A	C	C	BC	B	baseline	-88	-90	-86	-73	122	-73	-78	-70	ns
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	<0.001	<0.001	0.221	A	-	A	A	A	baseline	-	ns	ns	ns	857	-		857	
Tin	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	log_{10}	<0.001	<0.001	<0.001	-	B	B	A	B	-	baseline	ns	749	ns	-	825	836	7,760	838
Uranium	log_{10}	<0.001	<0.001	0.003	C	BC	C	A	AB	baseline	ns	ns	270	227	173	294	198	911	792
Vanadium	log_{10}	<0.001	<0.001	0.003	B	B	B	A	AB	baseline	ns	ns	486	ns	610	733	991	4,060	1,702
Zinc	log_{10}	<0.001	<0.001	<0.001	C	B	B	A	B	baseline	195	124	438	192	79	428	301	863	423
Zirconium	log_{10}	<0.001	<0.001	0.002	C	BC	AB	-	A	baseline	ns	247	-	640	ns	ns	391	-	949

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, "-" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-R1:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-R1:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.13: Statistical Comparisons of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) in Post-Breach Years (2018 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	One-way ANOVA Year P-values	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]				
			Post-Breach Period				
			2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	657	2,444	1,244	5,324	1,270
Antimony	log_{10}	-	-	-	-	-	-
Arsenic	log_{10}	<0.001	224	239	130	592	158
Barium	log_{10}	0.532	ns	ns	ns	ns	ns
Beryllium	log_{10}	-	-	-	-	-	-
Bismuth	log_{10}	-	-	-	-	-	-
Boron	log_{10}	-	-	-	-	-	-
Cadmium	log_{10}	<0.001	304	216	ns	936	ns
Calcium	log_{10}	<0.001	ns	-84	-92	-86	-87
Cesium	log_{10}	-	-	-	-	-	-
Chromium	log_{10}	0.002	ns	ns	ns	550	ns
Cobalt	log_{10}	<0.001	ns	649	286	1,092	307
Copper	log_{10}	<0.001	344	398	262	729	ns
Iron	log_{10}	-	-	-	-	-	-
Lead	log_{10}	<0.001	452	1,507	1,474	4,189	967
Lithium	log_{10}	<0.001	556	-	1,889	3,231	1,084
Magnesium	log_{10}	<0.001	123	120	100	200	ns
Manganese	log_{10}	<0.001	ns	218	ns	773	ns
Mercury	log_{10}	<0.001	211	288	1,386	943	410
Molybdenum	log_{10}	<0.001	ns	ns	ns	107	ns
Nickel	log_{10}	<0.001	ns	ns	ns	355	ns
Phosphorus	log_{10}	-	-	-	-	-	-
Potassium	log_{10}	-	-	-	-	-	-
Rubidium	log_{10}	-	-	-	-	-	-
Selenium	log_{10}	<0.001	ns	ns	56	103	ns
Silver	log_{10}	-	-	-	-	-	-
Sodium	log_{10}	-	-	-	-	-	-
Strontium	log_{10}	<0.001	ns	ns	-72	ns	ns
Tellurium	log_{10}	-	-	-	-	-	-
Thallium	log_{10}	-	-	-	-	-	-
Tin	log_{10}	-	-	-	-	-	-
Titanium	log_{10}	-	-	-	-	-	-
Uranium	log_{10}	<0.001	ns	297	205	1,293	204
Vanadium	log_{10}	<0.001	416	1,480	590	5,066	688
Zinc	log_{10}	<0.001	ns	255	221	622	ns
Zirconium	log_{10}	-	-	-	-	-	-

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.14: Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Caddisfly Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-U Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	<0.001	<0.001	A	A	C	BC	AB	baseline	ns	-91	-76	ns	709	1,011	ns	ns	351
Antimony	log_{10}	0.395	<0.001	<0.001	A	-	B	C	A	baseline	-	-74	-89	ns	158	-	ns	-73	70
Arsenic	log_{10}	<0.001	<0.001	0.045	AB	A	A	B	A	baseline	ns	ns	ns	ns	361	556	456	112	419
Barium	log_{10}	0.077	<0.001	<0.001	B	A	BC	C	A	baseline	409	ns	-69	240	ns	210	-73	-81	ns
Beryllium	log_{10}	<0.001	0.015	0.188	A	A	-	A	-	baseline	ns	-	ns	-	377		-	377	-
Bismuth	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	log_{10}	<0.001	0.005	<0.001	A	A	C	B	BC	baseline	ns	-99	-89	-97	ns	ns	-99	-88	-97
Cadmium	log_{10}	0.001	<0.001	<0.001	B	A	C	BC	A	baseline	337	-79	ns	342	ns	552	-69	ns	560
Calcium	log_{10}	<0.001	<0.001	<0.001	A	A	D	C	B	baseline	ns	-95	-85	-60	-77	-81	-99	-97	-91
Cesium	log_{10}	<0.001	<0.001	<0.001	A	A	C	B	B	baseline	ns	-96	-88	-80	772	1,027	-69	ns	ns
Chromium	log_{10}	<0.001	<0.001	0.001	A	A	C	BC	AB	baseline	ns	-85	-76	ns	743	1,476	ns	ns	691
Cobalt	log_{10}	<0.001	<0.001	<0.001	B	A	C	C	AB	baseline	208	-67	-66	ns	197	814	ns	ns	522
Copper	log_{10}	0.724	<0.001	0.002	AB	A	B	B	B	baseline	ns	ns	ns	ns	ns	124	ns	ns	ns
Iron	log_{10}	<0.001	<0.001	0.007	AB	A	C	BC	AB	baseline	ns	-80	ns	ns	666	1,107	ns	174	548
Lead	log_{10}	<0.001	<0.001	<0.001	AB	A	C	BC	C	baseline	ns	-83	ns	-77	731	1,085	ns	186	ns
Lithium	log_{10}	<0.001	<0.001	0.024	AB	B	-	A	-	baseline	ns	-	ns	-	203	ns	-	723	-
Magnesium	log_{10}	0.951	0.003	0.061	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	log_{10}	<0.001	<0.001	<0.001	B	A	C	C	AB	baseline	399	-82	-73	ns	144	1,119	-56	ns	438
Mercury	log_{10}	<0.001	0.180	0.009	B	A	A	A	AB	baseline	297	191	130	ns	235	1,228	876	671	621
Molybdenum	log_{10}	<0.001	<0.001	<0.001	B	C	A	B	B	baseline	-78	178	ns	ns	360	ns	1,179	407	161
Nickel	log_{10}	<0.001	<0.001	<0.001	AB	A	BC	C	A	baseline	ns	ns	-76	ns	440	1,085	ns	ns	641
Phosphorus	log_{10}	<0.001	<0.001	0.024	AB	A	B	B	AB	baseline	ns	ns	ns	ns	103	203	60	ns	97
Potassium	log_{10}	<0.001	<0.001	<0.001	A	A	C	C	B	baseline	ns	-86	-85	-51	ns	ns	-82	-81	-38
Rubidium	log_{10}	0.065	<0.001	<0.001	A	A	C	B	B	baseline	ns	-96	-86	-77	229	212	-87	-55	ns
Selenium	log_{10}	<0.001	<0.001	0.003	C	BC	BC	AB	A	baseline	ns	ns	84	184	49	136	139	174	323
Silver	log_{10}	0.174	0.118	0.175	-	A	A	A	A	-	baseline	ns	ns	ns	-	ns	ns	ns	ns
Sodium	log_{10}	<0.001	0.008	<0.001	B	A	B	B	B	baseline	129	ns	ns	ns	ns	67	-46	-48	-41
Strontium	log_{10}	<0.001	<0.001	<0.001	A	A	C	B	A	baseline	ns	-88	-72	ns	-72	-61	-97	-92	-68
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	<0.001	0.007	0.062	A	A	A	A	A	baseline	ns	ns	ns	ns			321		
Tin	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	log_{10}	<0.001	<0.001	0.006	-	A	C	BC	AB	-	baseline	-92	-80	ns	-	845	ns	ns	302
Uranium	log_{10}	<0.001	<0.001	<0.001	B	AB	D	C	A	baseline	ns	-93	-66	253	172	627	-82	ns	861
Vanadium	log_{10}	<0.001	<0.001	<0.001	AB	A	C	BC	AB	baseline	ns	-89	ns	ns	645	899	ns	146	432
Zinc	log_{10}	<0.001	<0.001	<0.001	C	B	C	AB	A	baseline	167	ns	238	472	ns	291	113	395	737
Zirconium	log_{10}	<0.001	0.193	0.002	A	A	B	-	-	baseline	ns	-71	-	-	214	527	ns	-	-

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-U:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-U:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.15: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-U Mean Relative to EDC-U (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	<0.001	0.186	A	A	A	A	A	baseline	ns	ns	ns	ns			376		
Antimony	log_{10}	0.020	<0.001	0.001	AB	-	C	BC	A	baseline	-	-46	ns	ns	ns	-	ns	ns	128
Arsenic	log_{10}	<0.001	<0.001	<0.001	B	B	B	B	A	baseline	ns	ns	ns	350	333	267	454	348	1,849
Barium	log_{10}	<0.001	<0.001	<0.001	C	AB	C	BC	A	baseline	303	ns	ns	780	ns	283	ns	ns	736
Beryllium	log_{10}	<0.001	<0.001	0.129	A	A	A	A	A	baseline	ns	ns	ns	ns			542		
Bismuth	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	log_{10}	<0.001	<0.001	<0.001	A	B	D	C	BCD	baseline	-75	-98	-90	-93	ns	-82	-98	-93	-95
Cadmium	log_{10}	0.193	<0.001	0.001	B	B	B	B	A	baseline	ns	ns	ns	222	ns	ns	ns	ns	325
Calcium	log_{10}	<0.001	<0.001	<0.001	B	B	C	B	A	baseline	ns	-72	ns	651	-89	-80	-97	-88	ns
Cesium	log_{10}	<0.001	<0.001	0.003	A	A	B	A	A	baseline	ns	-81	ns	ns	367	479	ns	339	431
Chromium	log_{10}	<0.001	<0.001	0.127	A	A	A	A	A	baseline	ns	ns	ns	ns			760		
Cobalt	log_{10}	<0.001	<0.001	0.215	A	A	A	A	A	baseline	ns	ns	ns	ns			407		
Copper	log_{10}	<0.001	0.001	0.001	B	B	B	B	A	baseline	ns	ns	ns	497	ns	141	ns	190	759
Iron	log_{10}	<0.001	<0.001	0.070	A	A	A	A	A	baseline	ns	ns	ns	ns			613		
Lead	log_{10}	<0.001	<0.001	0.053	A	A	A	A	A	baseline	ns	ns	ns	ns			424		
Lithium	log_{10}	<0.001	<0.001	0.019	B	B	AB	A	A	baseline	ns	ns	225	253	193	170	334	854	935
Magnesium	log_{10}	<0.001	0.002	<0.001	BC	B	C	B	A	baseline	ns	ns	ns	133	ns	39	ns	60	167
Manganese	log_{10}	<0.001	<0.001	0.007	B	A	B	B	A	baseline	126	ns	ns	128	206	592	106	204	597
Mercury	log_{10}	<0.001	0.171	0.001	B	A	A	A	A	baseline	156	235	321	255	136	504	691	895	739
Molybdenum	log_{10}	<0.001	0.182	<0.001	B	B	A	B	C	baseline	ns	225	ns	-62	338	438	1,321	441	ns
Nickel	log_{10}	<0.001	<0.001	<0.001	BC	BC	C	B	A	baseline	ns	ns	ns	275	446	561	249	803	1,948
Phosphorus	log_{10}	<0.001	<0.001	0.039	A	A	AB	B	A	baseline	ns	ns	-45	ns	161	182	97	45	151
Potassium	log_{10}	<0.001	<0.001	<0.001	A	B	D	D	C	baseline	-39	-86	-87	-65	76	ns	-76	-76	-39
Rubidium	log_{10}	0.259	<0.001	<0.001	A	B	C	C	B	baseline	-48	-92	-88	-54	205	60	-76	-62	ns
Selenium	log_{10}	<0.001	0.362	0.669	A	A	A	A	A	baseline	ns	ns	ns	ns			46		
Silver	log_{10}	0.271	0.006	0.003	-	BC	C	AB	A	-	baseline	ns	ns	879	-	ns	ns	ns	208
Sodium	log_{10}	<0.001	0.002	0.946	A	A	A	A	A	baseline	ns	ns	ns	ns			-36		
Strontium	log_{10}	<0.001	<0.001	<0.001	B	B	C	B	A	baseline	ns	-65	ns	448	-72	-51	-90	-74	ns
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	<0.001	<0.001	<0.001	B	B	B	B	A	baseline	ns	ns	ns	327	241	146	168	167	1,355
Tin	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	log_{10}	<0.001	<0.001	0.014	-	AB	B	A	B	-	baseline	ns	ns	ns	-	369	155	1,482	ns
Uranium	log_{10}	<0.001	<0.001	<0.001	BC	AB	C	B	A	baseline	ns	ns	ns	335	ns	192	ns	182	573
Vanadium	log_{10}	<0.001	<0.001	0.056	A	A	A	A	A	baseline	ns	ns	ns	ns			466		
Zinc	log_{10}	<0.001	<0.001	0.002	C	BC	ABC	A	AB	baseline	ns	ns	176	171	95	202	233	438	427
Zirconium	log_{10}	<0.001	<0.001	0.008	B	B	B	A	AB	baseline	ns	ns	191	ns	151	ns	92	630	243

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-U:EDC-U) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-U:EDC-U).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.16: Statistical Comparisons of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) in Post-Breach Years (2018 to 2022) Relative to Pre-Breach Conditions (2010; W7)

Parameter	Data Transformation	One-way ANOVA Year P-values	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]				
			Post-Breach Period				
			2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	ns	1,410	ns	2,247	ns
Antimony	log_{10}	-	-	-	-	-	-
Arsenic	log_{10}	<0.001	ns	265	ns	223	216
Barium	log_{10}	<0.001	ns	ns	ns	ns	ns
Beryllium	log_{10}	-	-	-	-	-	-
Bismuth	log_{10}	-	-	-	-	-	-
Boron	log_{10}	-	-	-	-	-	-
Cadmium	log_{10}	<0.001	267	ns	ns	274	ns
Calcium	log_{10}	<0.001	-91	-68	-96	-84	ns
Cesium	log_{10}	-	-	-	-	-	-
Chromium	log_{10}	0.027	ns	ns	ns	ns	ns
Cobalt	log_{10}	<0.001	ns	286	ns	546	ns
Copper	log_{10}	<0.001	ns	ns	ns	ns	635
Iron	log_{10}	-	-	-	-	-	-
Lead	log_{10}	<0.001	338	663	275	1,134	ns
Lithium	log_{10}	<0.001	310	557	515	1,793	770
Magnesium	log_{10}	<0.001	ns	76	ns	91	119
Manganese	log_{10}	<0.001	ns	125	ns	230	ns
Mercury	log_{10}	<0.001	ns	321	453	569	410
Molybdenum	log_{10}	<0.001	ns	ns	ns	ns	ns
Nickel	log_{10}	<0.001	ns	ns	ns	178	ns
Phosphorus	log_{10}	-	-	-	-	-	-
Potassium	log_{10}	-	-	-	-	-	-
Rubidium	log_{10}	-	-	-	-	-	-
Selenium	log_{10}	0.350	ns	ns	ns	ns	ns
Silver	log_{10}	-	-	-	-	-	-
Sodium	log_{10}	-	-	-	-	-	-
Strontium	log_{10}	<0.001	-72	ns	-88	ns	ns
Tellurium	log_{10}	-	-	-	-	-	-
Thallium	log_{10}	-	-	-	-	-	-
Tin	log_{10}	-	-	-	-	-	-
Titanium	log_{10}	-	-	-	-	-	-
Uranium	log_{10}	<0.001	ns	194	ns	289	ns
Vanadium	log_{10}	<0.001	ns	837	ns	1,572	ns
Zinc	log_{10}	<0.001	ns	103	166	304	ns
Zirconium	log_{10}	-	-	-	-	-	-

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: " -" = no data available or sample reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ns = not significant, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (LRL) or because there were only data for a single time period.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.17:Statistical Comparisons of Exposed - Reference Relative Differences of Periphyton Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2017 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for HAC-D Mean Relative to EDC-D (%)[c]					
		Area	Year	Area × Year	Post-Breach Period						Post-Breach Period						Post-Breach Period					
					2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.187	0.039	<0.001	A	A	B	B	A	B	baseline	ns	-55	-65	ns	-72	ns	93	-42	-55	ns	-64
Antimony	MLE	0.047	0.003	0.029	BC	C	D	A	BC	AB	baseline	ns	-80	158	ns	ns	-45	-56	ns	ns	ns	ns
Arsenic	MLE	<0.001	0.002	0.370	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	-37					
Barium	MLE	0.001	0.685	0.029	B	A	B	AB	A	AB	baseline	125	ns	ns	141	ns	ns	96	ns	76	110	ns
Beryllium	MLE	0.807	0.253	<0.001	A	A	B	B	A	B	baseline	ns	-69	-68	ns	-77	91	69	-40	-38	64	-56
Bismuth	MLE	0.117	0.238	<0.001	A	A	BC	BC	B	C	baseline	ns	-77	-77	-60	-85	120	118	-49	-50	ns	-67
Boron	MLE	<0.001	0.201	<0.001	E	D	AB	A	C	BC	baseline	430	5,735	11,307	1,448	3,260	-85	ns	777	1,614	132	405
Cadmium	MLE	<0.001	0.295	0.235	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	38					
Calcium	MLE	<0.001	0.026	<0.001	E	C	B	AB	D	A	baseline	494	1,635	2,483	134	3,997	ns	303	1,076	1,650	ns	2,676
Cesium	MLE	0.007	0.608	<0.001	A	AB	BCD	CD	ABC	D	baseline	ns	-70	-75	ns	-80	83	ns	-45	-54	ns	-64
Chromium	MLE	<0.001	<0.001	0.002	A	AB	BC	C	BC	BC	baseline	ns	-68	-81	-73	-78	ns	ns	-57	-75	-63	-70
Cobalt	MLE	0.008	0.049	<0.001	A	A	BC	BC	AB	C	baseline	ns	-67	-66	ns	-74	55	ns	-48	-47	ns	-60
Copper	MLE	<0.001	0.233	<0.001	A	AB	C	C	A	BC	baseline	ns	-73	-72	ns	-63	1,247	669	265	279	1,287	402
Iron	MLE	0.159	0.016	<0.001	A	A	BC	BC	AB	C	baseline	ns	-68	-66	ns	-79	70	82	-45	-42	ns	-65
Lead	MLE	0.274	0.072	<0.001	A	A	B	B	B	B	baseline	ns	-73	-78	-68	-84	138	82	ns	-48	ns	-62
Lithium	MLE	0.155	0.019	<0.001	A	A	BC	C	AB	C	baseline	ns	-68	-79	ns	-82	92	67	ns	-60	ns	-65
Magnesium	MLE	0.962	0.049	0.134	A	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	MLE	0.004	0.002	0.011	AB	AB	BC	AB	C	A	baseline	ns	ns	ns	-62	ns	ns	ns	-43	ns	-69	ns
Mercury	MLE	0.006	0.025	<0.001	AB	BC	D	D	A	CD	baseline	ns	-68	-66	ns	-54	ns	ns	-59	-58	ns	-42
Molybdenum	MLE	0.121	0.281	0.002	A	B	B	B	B	B	baseline	-75	-79	-80	-70	-71	159	ns	-45	-48	ns	ns
Nickel	MLE	<0.001	0.017	<0.001	A	AB	BC	BC	B	C	baseline	ns	-65	-59	-57	-78	ns	ns	-56	-49	-46	-72
Phosphorus	MLE	<0.001	<0.001	<0.001	CD	D	CD	BC	AB	A	baseline	ns	ns	ns	101	185	-49	-61	-52	-36	ns	45
Potassium	MLE	<0.001	0.005	<0.001	C	C	BC	AB	BC	A	baseline	ns	ns	173	ns	301	-67	-57	-51	ns	ns	ns
Rubidium	MLE	<0.001	0.007	0.005	A	AB	C	BC	AB	A	baseline	ns	-52	-42	ns	ns	ns	-29	-63	-54	-32	ns
Selenium	MLE	0.869	<0.001	<0.001	BC	D	CD	AB	C	A	baseline	-50	ns	ns	ns	137	ns	-53	ns	57	ns	119
Silver	MLE	0.003	0.237	0.011	-	-	B	B	A	B	-	-	baseline	ns	130	ns	-	-	-43	-41	ns	-61
Sodium	MLE	0.217	<0.001	0.019	AB	B	B	AB	A	A	baseline	ns	ns	ns	ns	ns	ns	-39	-38	ns	ns	ns
Strontium	MLE	<0.001	0.034	<0.001	D	C	B	AB	C	A	baseline	179	400	564	80	873	ns	134	320	457	51	717
Tellurium	MLE	<0.001	0.089	0.485	A	<LRL	<LRL	A	A	A	baseline	<LRL	<LRL	ns	ns	ns	116	<LRL	<LRL	116		
Thallium	MLE	0.187	0.109	<0.001	A	A	C	BC	AB	BC	baseline	ns	-80	-62	ns	-71	77	ns	-65	ns	ns	-48
Tin	MLE	0.164	<0.001	<0.001	A	C	D	B	AB	<LRL	baseline	-97	-99	-60	ns	<LRL	97	ns	ns	ns	ns	<LRL
Titanium	MLE	0.272	0.008	0.110	-	-	A	A	A	A	-	-	baseline	ns	ns	ns	-	-	ns	ns	ns	ns
Uranium	MLE	0.163	0.073	0.004	A	AB	C	BC	AB	BC	baseline	ns	-74	-68	ns	-67	81	ns	-52	-41	ns	-40
Vanadium	MLE	0.220	0.034	0.001	A	A	BC	BC	AB	C	baseline	ns	-60	-57	ns	-74	106	118	ns	ns	ns	-46
Zinc	MLE	0.005	0.108	0.002	A	AB	C	BC	AB	C	baseline	ns	-63	-45	ns	-63	ns	ns	-51	ns	ns	-51
Zirconium	MLE	0.131	0.075	<0.001	A	AB	BC	BC	AB	C	baseline	ns	-56	-59	ns	-78	ns	ns	ns	ns	ns	-65

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-D:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-D:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.18: Statistical Comparisons of Periphyton Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) in Post-Breach Years (2017 to 2022) Relative to Pre-Breach Conditions (2010; W11)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]					
			Post-Breach Period					
			2017	2018	2019	2020	2021	2022
Aluminum	MLE	0.068	ns	ns	ns	ns	ns	ns
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.029	ns	ns	ns	ns	ns	ns
Barium	MLE	0.237	ns	ns	ns	ns	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-	-
Cadmium	MLE	0.009	ns	ns	ns	133	ns	ns
Calcium	MLE	<0.001	ns	678	480	620	ns	1,096
Cesium	MLE	-	-	-	-	-	-	-
Chromium	MLE	0.060	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.072	ns	ns	ns	ns	ns	ns
Copper	MLE	<0.001	912	566	393	274	1,006	457
Iron	MLE	0.087	ns	ns	ns	ns	ns	ns
Lead	MLE	0.012	ns	ns	ns	ns	ns	ns
Lithium	MLE	0.039	ns	ns	ns	ns	ns	ns
Magnesium	MLE	0.737	ns	ns	ns	ns	ns	ns
Manganese	MLE	<0.001	ns	ns	ns	ns	-78	ns
Mercury	MLE	<0.001	615	375	231	ns	517	240
Molybdenum	MLE	<0.001	251	ns	ns	ns	ns	ns
Nickel	MLE	0.047	ns	ns	ns	ns	ns	ns
Phosphorus	MLE	<0.001	ns	ns	ns	ns	ns	117
Potassium	MLE	<0.001	-60	ns	ns	ns	ns	ns
Rubidium	MLE	-	-	-	-	-	-	-
Selenium	MLE	<0.001	ns	ns	-45	ns	ns	ns
Silver	MLE	-	-	-	-	-	-	-
Sodium	MLE	0.003	ns	ns	ns	ns	ns	ns
Strontium	MLE	<0.001	ns	198	136	190	ns	351
Tellurium	MLE	-	-	-	-	-	-	-
Thallium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	<0.001	-84	<LRL	<LRL	-85	-82	<LRL
Titanium	MLE	0.235	-	-	ns	ns	ns	ns
Uranium	MLE	0.024	ns	ns	ns	ns	ns	ns
Vanadium	MLE	0.168	ns	ns	ns	ns	ns	ns
Zinc	MLE	0.044	ns	ns	ns	ns	ns	ns
Zirconium	MLE	-	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.19: **Statistical Comparisons of Exposed - Reference Relative Differences of Caddisfly Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-D Mean Relative to EDC-D (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	MLE	0.007	0.007	<0.001	B	A	B	A	B	baseline	1,109	ns	1,774	ns	-87	ns	-73	ns	-77
Antimony	MLE	0.075	<0.001	<0.001	D	AB	BC	A	CD	baseline	247	114	382	ns	-44	93	ns	169	ns
Arsenic	MLE	<0.001	<0.001	<0.001	C	A	AB	AB	B	baseline	602	348	459	201	-90	ns	-55	-44	-70
Barium	MLE	0.007	0.006	<0.001	C	AB	B	A	B	baseline	1,978	947	3,903	751	-95	ns	ns	ns	ns
Beryllium	MLE	<0.001	0.005	<0.001	C	A	B	A	B	baseline	2,216	606	4,091	379	-95	ns	-67	ns	-78
Bismuth	MLE	<0.001	0.087	0.023	B	<LRL	A	<LRL	B	baseline	<LRL	6,408	<LRL	ns	ns	<LRL	-55	<LRL	ns
Boron	MLE	0.071	0.002	<0.001	C	<LRL	B	A	B	baseline	<LRL	2,223	11,486	1,885	-97	<LRL	ns	286	ns
Cadmium	MLE	0.340	<0.001	<0.001	C	B	B	A	B	baseline	1,007	2,860	12,883	894	-90	ns	198	1,207	ns
Calcium	MLE	0.003	0.009	<0.001	C	B	B	A	B	baseline	173	87	448	129	-70	ns	-43	66	ns
Cesium	MLE	0.020	<0.001	<0.001	B	A	B	A	B	baseline	1,480	ns	1,971	ns	-88	ns	-65	144	-69
Chromium	MLE	<0.001	0.018	<0.001	C	AB	BC	A	C	baseline	759	ns	1,320	ns	-89	ns	-70	ns	-89
Cobalt	MLE	0.028	<0.001	<0.001	C	AB	B	A	B	baseline	876	364	1,361	221	-87	ns	ns	ns	-58
Copper	MLE	<0.001	<0.001	<0.001	D	BC	B	A	CD	baseline	76	116	269	ns	ns	102	148	324	62
Iron	MLE	0.001	0.004	<0.001	B	A	B	A	B	baseline	881	ns	1,405	ns	-88	ns	-70	ns	-76
Lead	MLE	0.171	<0.001	<0.001	B	A	B	A	B	baseline	788	ns	1,505	ns	-81	ns	ns	207	-59
Lithium	MLE	<0.001	<0.001	<0.001	C	A	B	A	B	baseline	58,130	9,262	77,099	10,011	ns	ns	-79	ns	-77
Magnesium	MLE	<0.001	<0.001	0.005	B	A	B	A	B	baseline	69	ns	75	ns	-43	ns	-34	ns	-34
Manganese	MLE	0.309	0.001	<0.001	C	AB	B	A	AB	baseline	645	403	1,887	874	-87	ns	ns	166	ns
Mercury	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL
Molybdenum	MLE	0.767	0.034	<0.001	A	B	C	D	BC	baseline	-49	-69	-87	-58	170	38	ns	-66	ns
Nickel	MLE	<0.001	0.024	<0.001	D	AB	BC	A	CD	baseline	841	306	1,950	ns	-92	ns	-67	ns	-85
Phosphorus	MLE	0.043	<0.001	0.006	A	B	A	A	AB	baseline	-21	ns	ns	ns	ns	-22	ns	ns	ns
Potassium	MLE	<0.001	<0.001	<0.001	B	A	A	A	A	baseline	95	91	130	142	-61	-24	-25	ns	ns
Rubidium	MLE	<0.001	<0.001	<0.001	C	A	B	A	AB	baseline	221	81	223	159	-80	-37	-64	-36	-49
Selenium	MLE	<0.001	0.004	<0.001	D	CD	BC	A	AB	baseline	ns	52	118	79	80	112	175	293	223
Silver	MLE	0.003	<0.001	<0.001	-	B	B	A	B	-	baseline	ns	455	ns	-	-64	-62	100	-74
Sodium	MLE	<0.001	<0.001	<0.001	B	B	A	B	B	baseline	ns	75	ns	ns	-29	-28	23	-39	-21
Strontium	MLE	<0.001	<0.001	<0.001	C	AB	B	A	B	baseline	243	163	432	184	-78	ns	-42	ns	-37
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	<0.001	<0.001	<0.001	C	B	B	A	B	baseline	611	377	1,770	206	-89	ns	-49	100	-67
Tin	MLE	0.762	<0.001	0.003	B	A	<LRL	<LRL	<LRL	baseline	241	<LRL	<LRL	<LRL	-57	ns	<LRL	<LRL	<LRL
Titanium	MLE	0.336	0.003	0.011	-	A	B	A	B	-	baseline	-80	ns	-82	-	ns	-67	ns	-71
Uranium	MLE	0.006	0.012	<0.001	C	B	B	A	B	baseline	1,153	695	6,599	668	-95	ns	ns	266	-58
Vanadium	MLE	0.031	0.008	<0.001	B	A	B	A	B	baseline	1,063	ns	1,799	ns	-86	ns	-61	163	-74
Zinc	MLE	0.320	<0.001	<0.001	C	C	B	A	B	baseline	ns	114	212	57	-33	-27	43	110	ns
Zirconium	MLE	<0.001	<0.001	<0.001	B	A	A	A	A	baseline	2,296	671	1,145	621	-96	ns	-66	ns	-68

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-D:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-D:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.20: **Statistical Comparisons of Exposed - Reference Relative Differences of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2015 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]						Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]						Magnitude of Difference for HAC-D Mean Relative to EDC-D (%)[c]					
		Area	Year	Area × Year	Post-Breach Period						Post-Breach Period						Post-Breach Period					
					2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022	2015	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	0.041	<0.001	A	D	BC	CD	B	CD	baseline	-97	-90	-94	-82	-94	1,901	ns	100	ns	261	ns
Antimony	MLE	<0.001	<0.001	0.049	A	C	ABC	AB	ABC	BC	baseline	-60	ns	ns	ns	-50	186	ns	79	135	83	ns
Arsenic	MLE	0.083	0.002	<0.001	A	C	AB	AB	B	AB	baseline	-85	ns	ns	-56	ns	ns	-76	ns	ns	ns	ns
Barium	MLE	<0.001	0.078	<0.001	A	C	B	B	B	B	baseline	-98	-78	-75	-71	-81	978	-79	139	169	217	101
Beryllium	MLE	<0.001	0.056	<0.001	A	D	BC	C	B	BC	baseline	-98	-90	-94	-83	-93	2,041	-50	114	ns	258	ns
Bismuth	MLE	0.010	0.987	<0.001	A	C	B	<LRL	B	<LRL	baseline	-100	-74	<LRL	-80	<LRL	980	ns	182	<LRL	111	<LRL
Boron	MLE	0.038	<0.001	<0.001	A	C	B	B	A	B	baseline	-96	-81	-73	ns	-62	427	-79	ns	ns	428	100
Cadmium	MLE	0.069	<0.001	<0.001	A	B	B	B	B	B	baseline	-92	-88	-87	-93	-90	994	ns	ns	ns	ns	ns
Calcium	MLE	0.199	0.011	<0.001	A	C	C	BC	A	AB	baseline	-80	-75	-70	ns	ns	191	-42	ns	ns	114	53
Cesium	MLE	0.007	0.034	<0.001	A	C	B	B	B	B	baseline	-97	-89	-93	-88	-92	1,511	-54	79	ns	89	ns
Chromium	MLE	0.013	<0.001	<0.001	A	B	B	B	B	B	baseline	-90	-88	-92	-88	-92	1,139	ns	ns	ns	ns	ns
Cobalt	MLE	<0.001	0.012	<0.001	A	C	B	B	B	B	baseline	-97	-93	-93	-92	-93	2,039	-46	ns	60	73	ns
Copper	MLE	<0.001	<0.001	<0.001	A	C	C	C	B	C	baseline	-86	-84	-85	-66	-84	1,173	80	101	93	332	110
Iron	MLE	0.001	0.094	<0.001	A	C	B	BC	B	BC	baseline	-97	-92	-95	-88	-95	2,256	ns	ns	ns	172	ns
Lead	MLE	<0.001	0.411	<0.001	A	C	B	B	B	B	baseline	-97	-90	-93	-87	-93	2,076	ns	114	ns	185	ns
Lithium	MLE	0.005	0.091	<0.001	A	D	BC	C	B	BC	baseline	-98	-82	-90	-74	-89	1,164	-73	128	ns	232	ns
Magnesium	MLE	0.828	<0.001	0.003	AB	C	C	BC	A	BC	baseline	-47	-45	ns	ns	ns	41	-25	ns	ns	43	ns
Manganese	MLE	0.199	<0.001	<0.001	AB	D	BC	AB	C	A	baseline	-91	ns	ns	-74	ns	202	-72	ns	91	ns	190
Mercury	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Molybdenum	MLE	<0.001	0.001	<0.001	C	B	A	B	B	B	baseline	813	2,565	1,117	830	901	-74	138	594	217	143	161
Nickel	MLE	0.538	<0.001	<0.001	A	B	B	B	B	B	baseline	-91	-90	-90	-88	-87	715	ns	ns	ns	ns	ns
Phosphorus	MLE	0.004	<0.001	<0.001	C	A	B	A	A	A	baseline	168	94	155	151	142	-62	ns	-26	ns	ns	ns
Potassium	MLE	0.006	<0.001	0.032	B	B	AB	A	A	AB	baseline	ns	ns	51	40	ns	-31	-29	ns	ns	ns	-19
Rubidium	MLE	<0.001	0.001	<0.001	A	C	B	B	B	B	baseline	-86	-77	-76	-70	-67	150	-65	-43	-40	-25	ns
Selenium	MLE	<0.001	<0.001	0.015	ABC	C	BC	AB	ABC	A	baseline	ns	ns	ns	ns	ns	91	46	77	148	102	170
Silver	MLE	<0.001	0.669	<0.001	A	-	B	B	B	B	baseline	-	-94	-97	-97	-97	550	-	-63	-81	-79	-81
Sodium	MLE	0.196	<0.001	0.020	C	A	BC	AB	BC	AB	baseline	116	ns	61	ns	62	-40	ns	-25	ns	ns	ns
Strontium	MLE	0.478	0.006	<0.001	A	B	B	B	A	A	baseline	-83	-75	-71	ns	ns	170	-54	ns	ns	121	54
Tellurium	MLE	nt	nt	nt	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL	-	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.545	0.363	<0.001	A	C	B	BC	BC	BC	baseline	-94	-85	-91	-88	-90	732	-47	ns	ns	ns	ns
Tin	MLE	0.743	<0.001	<0.001	C	<LRL	B	B	A	<LRL	baseline	<LRL	543	525	21,287	<LRL	-83	<LRL	ns	ns	ns	<LRL
Titanium	MLE	<0.001	<0.001	<0.001	A	-	BC	C	AB	C	baseline	-	-78	-87	ns	-86	1,037	-	145	ns	364	ns
Uranium	MLE	0.072	0.528	<0.001	A	C	B	B	B	B	baseline	-98	-93	-93	-89	-91	1,553	-72	ns	ns	78	ns
Vanadium	MLE	<0.001	0.193	<0.001	A	C	BC	BC	B	BC	baseline	-99	-97	-98	-94	-98	7,174	ns	127	ns	314	ns
Zinc	MLE	0.625	<0.001	<0.001	A	B	C	A	BC	BC	baseline	-38	-57	ns	-43	-41	47	ns	-36	51	ns	ns
Zirconium	MLE	0.265	<0.001	<0.001	A	C	B	B	A	B	baseline	-94	-85	-86	ns	-83	557	-63	ns	ns	181	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-D:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-D:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.21: Statistical Comparisons of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) in Post-Breach Years (2015 to 2022) Relative to Pre-Breach Conditions (2010; W11)

Parameter	Data Transformation	Year	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]					
			Post-Breach Period					
			2015	2018	2019	2020	2021	2022
Aluminum	MLE	<0.001	ns	-71	ns	ns	ns	ns
Antimony	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Arsenic	MLE	0.032	ns	-58	ns	ns	ns	ns
Barium	MLE	<0.001	ns	-83	ns	ns	ns	ns
Beryllium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Bismuth	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Boron	MLE	-	-	-	-	-	-	-
Cadmium	MLE	0.004	ns	ns	ns	206	ns	213
Calcium	MLE	<0.001	ns	ns	ns	ns	ns	ns
Cesium	MLE	-	-	-	-	-	-	-
Chromium	MLE	<0.001	-83	-80	-90	-92	-84	-93
Cobalt	MLE	<0.001	ns	-63	ns	ns	ns	ns
Copper	MLE	<0.001	682	ns	163	183	527	173
Iron	MLE	-	-	-	-	-	-	-
Lead	MLE	<0.001	ns	-63	ns	ns	ns	ns
Lithium	MLE	0.013	ns	<LRL	ns	ns	ns	ns
Magnesium	MLE	<0.001	ns	ns	ns	ns	ns	ns
Manganese	MLE	<0.001	-81	-84	-75	ns	-63	ns
Mercury	MLE	0.031	-	ns	ns	ns	ns	69
Molybdenum	MLE	<0.001	-74	ns	ns	ns	-63	-60
Nickel	MLE	0.009	-84	-79	-86	-83	-78	-80
Phosphorus	MLE	-	-	-	-	-	-	-
Potassium	MLE	-	-	-	-	-	-	-
Rubidium	MLE	-	-	-	-	-	-	-
Selenium	MLE	<0.001	-23	ns	-26	ns	28	40
Silver	MLE	-	-	-	-	-	-	-
Sodium	MLE	-	-	-	-	-	-	-
Strontium	MLE	<0.001	ns	ns	ns	ns	ns	ns
Tellurium	MLE	-	-	-	-	-	-	-
Thallium	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Tin	MLE	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	-	-	-	-	-	-	-
Uranium	MLE	<0.001	ns	-77	ns	ns	ns	ns
Vanadium	MLE	<0.001	318	ns	ns	ns	ns	ns
Zinc	MLE	<0.001	ns	ns	ns	155	ns	ns
Zirconium	MLE	-	-	-	-	-	-	-

Year P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Data were analysed in units of mg/kg dry weight.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.22: Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Caddisfly Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-D Mean Relative to EDC-D (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	0.067	0.018	<0.001	B	A	A	A	A	baseline	3,901	813	2,335	900	-94	ns	ns	ns	ns
Antimony	log_{10}	0.855	<0.001	0.095	A	-	A	A	A	baseline	-	ns	ns	ns	ns	-	ns	ns	ns
Arsenic	log_{10}	<0.001	<0.001	<0.001	C	A	AB	AB	B	baseline	1,170	507	525	322	-88	ns	ns	ns	ns
Barium	log_{10}	<0.001	0.003	<0.001	C	A	AB	AB	B	baseline	4,622	1,068	3,638	960	-97	ns	-68	ns	-71
Beryllium	log_{10}	0.002	<0.001	0.011	C	AB	BC	AB	A	baseline	1,573	ns	780	2,520	-93	ns	-59	ns	ns
Bismuth	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	log_{10}	<0.001	0.001	0.078	A	A	A	A	A	baseline	ns	ns	ns	ns	-91				
Cadmium	log_{10}	0.343	<0.001	<0.001	C	B	B	A	B	baseline	550	988	9,251	531	-86	ns	ns	1,188	ns
Calcium	log_{10}	<0.001	<0.001	<0.001	B	B	BC	A	C	baseline	ns	ns	1,290	-67	-92	-93	-97	ns	-98
Cesium	log_{10}	0.763	0.002	<0.001	C	A	B	AB	AB	baseline	2,646	514	2,041	590	-88	240	ns	165	ns
Chromium	log_{10}	0.479	<0.001	<0.001	C	A	AB	A	BC	baseline	1,295	659	1,649	ns	-84	ns	ns	ns	ns
Cobalt	log_{10}	0.754	0.003	<0.001	B	A	A	A	A	baseline	2,068	913	1,823	812	-89	ns	ns	ns	ns
Copper	log_{10}	<0.001	<0.001	0.002	B	A	A	AB	A	baseline	271	338	ns	116	-85	-45	ns	-69	-68
Iron	log_{10}	0.036	0.028	<0.001	B	A	A	A	A	baseline	3,171	704	2,626	936	-93	ns	ns	ns	ns
Lead	log_{10}	0.476	<0.001	<0.001	B	A	A	A	A	baseline	2,400	800	1,954	922	-90	162	ns	ns	ns
Lithium	log_{10}	0.223	0.011	0.184	-	A	A	A	A	-	baseline	ns	ns	ns	-	ns	ns	ns	ns
Magnesium	log_{10}	0.009	0.005	0.070	A	A	A	A	A	baseline	ns	ns	ns	ns	-23				
Manganese	log_{10}	0.458	0.002	<0.001	C	B	B	A	B	baseline	928	382	4,937	521	-83	ns	ns	764	ns
Mercury	log_{10}	0.469	<0.001	0.026	C	ABC	A	BC	AB	baseline	ns	237	ns	127	ns	ns	98	ns	ns
Molybdenum	log_{10}	0.004	0.109	<0.001	A	A	A	B	A	baseline	ns	ns	-89	ns	310	151	ns	-57	ns
Nickel	log_{10}	0.044	0.023	<0.001	C	AB	AB	A	B	baseline	1,460	481	1,841	375	-89	ns	ns	ns	ns
Phosphorus	log_{10}	<0.001	<0.001	<0.001	A	A	A	B	B	baseline	ns	ns	-63	-75	154	61	64	ns	-37
Potassium	log_{10}	0.786	<0.001	0.179	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Rubidium	log_{10}	0.012	<0.001	<0.001	C	A	B	AB	B	baseline	506	181	238	142	-72	69	ns	ns	ns
Selenium	log_{10}	<0.001	0.002	<0.001	A	AB	BC	A	C	baseline	ns	-55	ns	-62	287	203	75	352	ns
Silver	log_{10}	0.826	<0.001	0.606	-	A	A	A	A	-	baseline	ns	ns	ns	-	ns	ns	ns	ns
Sodium	log_{10}	0.195	<0.001	0.006	AB	AB	A	C	BC	baseline	ns	ns	-62	ns	ns	ns	ns	-56	-39
Strontium	log_{10}	<0.001	<0.001	<0.001	BC	B	BC	A	C	baseline	ns	ns	724	ns	-91	-82	-90	ns	-92
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	0.039	<0.001	<0.001	B	A	A	A	A	baseline	2,848	917	1,731	874	-93	ns	ns	ns	ns
Tin	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	log_{10}	0.775	0.255	0.370	-	A	A	A	A	-	baseline	ns	ns	ns	-	ns	ns	ns	ns
Uranium	log_{10}	0.108	0.011	<0.001	B	A	A	A	A	baseline	2,918	1,467	7,465	1,384	-95	ns	ns	258	ns
Vanadium	log_{10}	0.018	0.091	<0.001	B	A	A	A	A	baseline	2,975	608	2,766	658	-94	ns	ns	ns	ns
Zinc	log_{10}	<0.001	0.009	0.003	B	A	A	A	A	baseline	115	178	226	209	ns	ns	95	129	116
Zirconium	log_{10}	<0.001	0.007	0.001	C	AB	B	BC	A	baseline	1,012	640	ns	2,794	-93	ns	ns	-72	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or samples reported bellow the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-D:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-D:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.23: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]					Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]					Magnitude of Difference for HAC-D Mean Relative to EDC-D (%)[c]				
		Area	Year	Area × Year	Post-Breach Period					Post-Breach Period					Post-Breach Period				
					2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Aluminum	log_{10}	<0.001	0.016	<0.001	B	A	A	A	A	baseline	1,005	746	684	908	-69	242	161	142	211
Antimony	log_{10}	0.006	0.001	0.655	A	-	A	A	A	baseline	-	ns	ns	ns	72	-	72		
Arsenic	log_{10}	0.153	0.174	<0.001	C	A	AB	B	AB	baseline	870	484	230	506	-70	189	ns	ns	ns
Barium	log_{10}	0.903	0.059	<0.001	B	A	A	A	A	baseline	2,438	1,301	1,282	1,072	-89	177	ns	ns	ns
Beryllium	log_{10}	0.008	0.033	<0.001	B	A	A	A	A	baseline	1,218	726	717	1,337	-77	203	ns	ns	230
Bismuth	log_{10}	0.017	0.803	0.264	-	A	A	A	A	-	baseline	ns	ns	ns	-	105			
Boron	log_{10}	<0.001	0.053	<0.001	B	BC	C	A	B	baseline	ns	-77	677	ns	-74	-88	-94	ns	-68
Cadmium	log_{10}	0.179	<0.001	0.859	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Calcium	log_{10}	<0.001	<0.001	<0.001	B	BC	C	A	BC	baseline	ns	-66	835	ns	-86	-94	-95	ns	-94
Cesium	log_{10}	<0.001	0.009	0.005	B	A	A	A	A	baseline	579	379	325	641	ns	227	131	ns	257
Chromium	log_{10}	<0.001	<0.001	0.729	A	A	A	A	A	baseline	ns	ns	ns	ns	218				
Cobalt	log_{10}	<0.001	0.006	<0.001	B	A	A	A	A	baseline	529	542	317	707	-53	198	204	97	282
Copper	log_{10}	<0.001	0.009	0.114	A	A	A	A	A	baseline	ns	ns	ns	ns	-61				
Iron	log_{10}	<0.001	0.001	<0.001	B	A	A	A	A	baseline	896	524	704	919	-66	235	110	170	242
Lead	log_{10}	<0.001	0.310	<0.001	B	A	A	A	A	baseline	860	775	1,001	1,093	-66	231	202	279	311
Lithium	log_{10}	0.003	0.004	0.043	B	A	A	A	A	baseline	1,155	1,511	910	1,178	ns	175	252	121	180
Magnesium	log_{10}	0.679	0.007	0.287	A	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns	ns	ns
Manganese	log_{10}	<0.001	0.001	<0.001	B	A	A	A	A	baseline	567	543	601	549	-64	143	134	156	137
Mercury	log_{10}	0.140	0.005	<0.001	BC	A	AB	C	AB	baseline	183	ns	ns	ns	ns	160	90	-53	ns
Molybdenum	log_{10}	<0.001	0.010	0.084	A	A	A	A	A	baseline	ns	ns	ns	ns	397				
Nickel	log_{10}	0.002	0.014	0.275	A	A	A	A	A	baseline	ns	ns	ns	ns	83				
Phosphorus	log_{10}	0.003	0.001	<0.001	A	AB	AB	BC	C	baseline	ns	ns	-64	-76	165	53	52	ns	-36
Potassium	log_{10}	0.047	0.009	0.028	A	A	AB	A	B	baseline	ns	ns	ns	-63	ns	82	ns	ns	ns
Rubidium	log_{10}	0.723	<0.001	0.008	B	A	A	A	A	baseline	206	166	123	118	-50	ns	ns	ns	ns
Selenium	log_{10}	<0.001	0.111	0.057	A	A	A	A	A	baseline	ns	ns	ns	ns	105				
Silver	log_{10}	<0.001	0.317	0.578	-	A	A	A	A	-	baseline	ns	ns	ns	-	-53			
Sodium	log_{10}	0.788	0.005	0.013	A	AB	AB	B	B	baseline	ns	ns	-72	-65	111	ns	ns	-41	ns
Strontium	log_{10}	<0.001	<0.001	<0.001	B	B	B	A	B	baseline	ns	ns	637	ns	-80	-84	-86	ns	-81
Tellurium	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	log_{10}	0.348	0.052	<0.001	C	A	B	B	AB	baseline	1,007	256	211	424	-68	252	ns	ns	ns
Tin	log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	log_{10}	<0.001	<0.001	0.618	-	A	A	A	A	-	baseline	ns	ns	ns	-	178			
Uranium	log_{10}	0.087	0.028	<0.001	B	A	A	A	A	baseline	877	746	627	902	-76	133	ns	ns	140
Vanadium	log_{10}	0.001	0.003	0.003	B	A	A	A	A	baseline	562	346	589	680	-58	176	ns	186	225
Zinc	log_{10}	0.012	0.358	0.086	A	A	A	A	A	baseline	ns	ns	ns	ns	33				
Zirconium	log_{10}	0.105	0.069	<0.001	B	A	A	A	A	baseline	590	599	993	1,619	-80	ns	ns	121	248

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or samples reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported <LRL or because there were only data for a single time period, ns = not significant, baseline = first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (HAC-D:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (HAC-D:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.24: Statistical Comparisons of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) in Post-Breach Years (2018 to 2022) Relative to Pre-Breach Conditions (2010; W11)

Parameter	Data Transformation	One-way ANOVA Year P-values	Magnitude of Difference in Relative to Pre-Breach Period (%)[a]				
			Post-Breach Period				
			2018	2019	2020	2021	2022
Aluminum	log_{10}	0.029	ns	ns	ns	ns	ns
Antimony	log_{10}	-	-	-	-	-	-
Arsenic	log_{10}	0.068	ns	ns	ns	ns	ns
Barium	log_{10}	<0.001	-87	ns	ns	ns	ns
Beryllium	log_{10}	-	-	-	-	-	-
Bismuth	log_{10}	-	-	-	-	-	-
Boron	log_{10}	-	-	-	-	-	-
Cadmium	log_{10}	0.019	ns	ns	ns	ns	ns
Calcium	log_{10}	<0.001	-91	-81	-85	ns	-90
Cesium	log_{10}	-	-	-	-	-	-
Chromium	log_{10}	<0.001	ns	-89	-90	ns	-85
Cobalt	log_{10}	0.209	ns	ns	ns	ns	ns
Copper	log_{10}	0.010	-72	ns	ns	ns	ns
Iron	log_{10}	-	-	-	-	-	-
Lead	log_{10}	0.303	ns	ns	ns	ns	ns
Lithium	log_{10}	0.381	ns	ns	ns	ns	ns
Magnesium	log_{10}	0.036	ns	ns	ns	ns	ns
Manganese	log_{10}	0.003	ns	ns	ns	ns	ns
Mercury	log_{10}	-	-	-	-	-	-
Molybdenum	log_{10}	0.008	ns	ns	ns	-78	ns
Nickel	log_{10}	0.097	ns	ns	ns	ns	ns
Phosphorus	log_{10}	-	-	-	-	-	-
Potassium	log_{10}	-	-	-	-	-	-
Rubidium	log_{10}	-	-	-	-	-	-
Selenium	log_{10}	0.018	ns	ns	ns	ns	ns
Silver	log_{10}	-	-	-	-	-	-
Sodium	log_{10}	-	-	-	-	-	-
Strontium	log_{10}	<0.001	-83	-65	-76	ns	-81
Tellurium	log_{10}	-	-	-	-	-	-
Thallium	log_{10}	0.271	ns	ns	ns	ns	ns
Tin	log_{10}	0.036	-	-	ns	217	-
Titanium	log_{10}	-	-	-	-	-	-
Uranium	log_{10}	0.009	-75	ns	ns	ns	ns
Vanadium	log_{10}	0.018	ns	ns	ns	ns	ns
Zinc	log_{10}	0.139	ns	ns	ns	ns	ns
Zirconium	log_{10}	-	-	-	-	-	-

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or samples reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = one way analysis of variance, MOD = Magnitude of Difference, nt = not tested because all data were reported <LRL or because there were only data for a single time period, ns = not significant.

[a] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Post-breach-Pre-breach)/Pre-breach x 100%.

Table F.4.25: Statistical Comparisons of Exposed - Reference Relative Differences of Periphyton Tissue Metal Concentrations for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for E1 Mean Relative to EDC-D (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	MLE	0.230	0.003	<0.001	B	B	A	B	baseline	ns	100	ns	ns	ns	123	ns
Antimony	MLE	0.627	0.033	0.177	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	MLE	<0.001	0.473	0.010	AB	A	BC	C	baseline	ns	ns	-46	ns	ns	-49	-54
Barium	MLE	0.047	0.062	0.001	B	B	A	B	baseline	ns	637	ns	ns	ns	484	ns
Beryllium	MLE	0.500	<0.001	0.156	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Bismuth	MLE	0.036	<0.001	0.150	A	A	A	A	baseline	ns	ns	ns	-23			
Boron	MLE	0.936	<0.001	0.160	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cadmium	MLE	0.006	0.074	0.272	A	A	A	A	baseline	ns	ns	ns	-30			
Calcium	MLE	0.072	<0.001	<0.001	BC	B	A	C	baseline	ns	311	ns	ns	59	350	ns
Cesium	MLE	0.057	<0.001	0.036	AB	A	AB	B	baseline	ns	ns	ns	ns	ns	-32	-46
Chromium	MLE	0.685	0.131	0.018	B	B	A	B	baseline	ns	313	ns	ns	ns	137	ns
Cobalt	MLE	0.056	<0.001	0.362	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	<0.001	0.871	0.145	A	A	A	A	baseline	ns	ns	ns	356			
Iron	MLE	0.794	<0.001	0.032	AB	A	AB	B	baseline	ns	ns	ns	ns	ns	ns	-37
Lead	MLE	0.237	0.321	0.380	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lithium	MLE	0.813	<0.001	0.024	A	A	A	B	baseline	ns	ns	-53	ns	ns	ns	-44
Magnesium	MLE	0.243	<0.001	0.002	A	A	A	B	baseline	ns	ns	-61	65	ns	49	-35
Manganese	MLE	<0.001	0.134	0.059	A	A	A	A	baseline	ns	ns	ns	-54			
Mercury	MLE	0.242	<0.001	0.703	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	0.039	0.237	0.406	A	A	A	A	baseline	ns	ns	ns	-27			
Nickel	MLE	<0.001	<0.001	0.474	A	A	A	A	baseline	ns	ns	ns	-34			
Phosphorus	MLE	0.499	0.055	0.486	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Potassium	MLE	0.071	0.002	0.719	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Rubidium	MLE	0.006	<0.001	0.162	A	A	A	A	baseline	ns	ns	ns	-27			
Selenium	MLE	0.035	0.011	0.044	AB	A	B	B	baseline	ns	ns	ns	ns	ns	-44	ns
Silver	MLE	0.542	0.015	0.038	AB	A	AB	B	baseline	ns	ns	ns	ns	81	ns	ns
Sodium	MLE	0.014	<0.001	0.024	B	AB	A	B	baseline	ns	68	ns	ns	52	91	ns
Strontium	MLE	0.093	<0.001	<0.001	B	B	A	B	baseline	ns	242	ns	ns	ns	233	ns
Tellurium	MLE	<0.001	0.054	0.074	<LRL	A	A	A	<LRL	baseline	ns	ns	<LRL	94		
Thallium	MLE	0.007	<0.001	0.171	A	A	A	A	baseline	ns	ns	ns	-34			
Tin	MLE	0.444	<0.001	0.012	B	A	A	A	baseline	248	236	222	-49	ns	ns	ns
Titanium	MLE	0.109	<0.001	<0.001	BC	AB	A	C	baseline	ns	138	ns	ns	52	133	ns
Uranium	MLE	0.448	<0.001	0.106	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	0.183	<0.001	0.005	BC	A	AB	C	baseline	102	ns	ns	ns	96	50	ns
Zinc	MLE	0.022	<0.001	0.104	A	A	A	A	baseline	ns	ns	ns	-23			
Zirconium	MLE	0.774	0.001	0.010	BC	AB	A	C	baseline	ns	90	ns	ns	ns	55	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (E1:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (E1:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.26: Statistical Comparisons of Exposed - Reference Relative Differences of Caddisfly Tissue Metal Concentrations for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for E1 Mean Relative to EDC-D (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	MLE	0.143	<0.001	0.125	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Antimony	MLE	0.999	<0.001	0.057	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	MLE	0.007	0.010	0.027	AB	B	B	A	baseline	ns	ns	ns	ns	-59	-58	ns
Barium	MLE	0.895	<0.001	0.140	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Beryllium	MLE	0.246	<0.001	0.023	B	B	B	A	baseline	ns	ns	564	ns	ns	-73	ns
Bismuth	MLE	0.117	0.294	0.104	<LRL	A	<LRL	A	<LRL	baseline	<LRL	ns	<LRL	ns	<LRL	ns
Boron	MLE	0.549	0.369	<0.001	<LRL	B	<LRL	A	<LRL	baseline	<LRL	546	<LRL	-53	<LRL	204
Cadmium	MLE	0.118	<0.001	0.097	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Calcium	MLE	0.042	<0.001	<0.001	B	B	B	A	baseline	ns	ns	214	-53	-33	-33	47
Cesium	MLE	0.189	<0.001	0.060	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.108	<0.001	0.227	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.496	<0.001	0.135	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Copper	MLE	<0.001	<0.001	<0.001	C	B	B	A	baseline	114	80	290	ns	95	65	256
Iron	MLE	0.134	<0.001	0.089	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	0.544	<0.001	0.164	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lithium	MLE	0.866	0.388	0.007	<LRL	B	<LRL	A	<LRL	baseline	<LRL	529	<LRL	-62	<LRL	ns
Magnesium	MLE	0.247	<0.001	0.010	AB	B	B	A	baseline	ns	ns	ns	ns	-34	ns	ns
Manganese	MLE	0.984	<0.001	0.324	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Mercury	MLE	0.887	<0.001	0.256	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Molybdenum	MLE	<0.001	0.026	0.326	A	A	A	A	baseline	ns	ns	ns	-44			
Nickel	MLE	0.085	<0.001	0.183	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Phosphorus	MLE	0.696	0.070	0.004	B	A	B	B	baseline	30	ns	ns	ns	18	ns	ns
Potassium	MLE	0.987	0.054	<0.001	B	B	B	A	baseline	ns	ns	73	ns	ns	-23	67
Rubidium	MLE	0.742	<0.001	0.002	B	B	B	A	baseline	ns	ns	98	ns	ns	ns	107
Selenium	MLE	0.005	0.066	<0.001	B	A	B	B	baseline	121	ns	ns	ns	108	ns	ns
Silver	MLE	0.467	<0.001	0.008	B	B	AB	A	baseline	ns	ns	284	-54	ns	ns	75
Sodium	MLE	0.716	0.728	0.238	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Strontium	MLE	0.027	<0.001	<0.001	B	B	B	A	baseline	ns	ns	191	-48	-46	-37	52
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.340	<0.001	0.023	B	B	AB	A	baseline	ns	ns	442	-63	ns	ns	ns
Tin	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Titanium	MLE	0.179	<0.001	0.072	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Uranium	MLE	0.287	<0.001	0.014	B	B	B	A	baseline	ns	ns	898	-75	ns	ns	ns
Vanadium	MLE	0.178	<0.001	0.110	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zinc	MLE	0.194	<0.001	0.015	B	A	AB	A	baseline	50	ns	45	ns	30	ns	26
Zirconium	MLE	0.134	<0.001	0.003	B	B	C	A	baseline	ns	-99	627	ns	ns	ns	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (E1:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (E1:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.27: **Statistical Comparisons of Exposed - Reference Relative Differences of Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for E1 Mean Relative to EDC-D (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	MLE	0.036	0.414	0.992	A	A	A	A	baseline	ns	ns	ns	44			
Antimony	MLE	0.587	<0.001	0.389	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	MLE	0.326	<0.001	0.292	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Barium	MLE	0.607	0.045	0.989	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Beryllium	MLE	0.030	0.243	0.943	A	A	A	A	baseline	ns	ns	ns	45			
Bismuth	MLE	0.756	0.424	0.351	<LRL	<LRL	A	A	<LRL	<LRL	baseline	ns	<LRL	<LRL	ns	ns
Boron	MLE	0.139	<0.001	0.008	B	B	A	A	baseline	ns	161	153	-51	-58	ns	ns
Cadmium	MLE	<0.001	<0.001	0.322	A	A	A	A	baseline	ns	ns	ns	87			
Calcium	MLE	0.138	0.002	0.140	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cesium	MLE	0.602	0.044	0.800	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Chromium	MLE	0.515	0.019	0.920	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cobalt	MLE	0.002	0.010	0.506	A	A	A	A	baseline	ns	ns	ns	45			
Copper	MLE	0.002	0.008	0.037	B	AB	A	AB	baseline	ns	116	ns	ns	ns	107	46
Iron	MLE	0.054	0.164	0.994	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lead	MLE	0.068	0.587	0.946	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lithium	MLE	0.018	0.738	0.979	A	A	A	A	baseline	ns	ns	ns	45			
Magnesium	MLE	0.521	0.231	0.021	B	AB	AB	A	baseline	ns	ns	66	-24	ns	ns	26
Manganese	MLE	0.282	<0.001	0.550	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Mercury	MLE	0.827	0.312	0.013	A	AB	B	B	baseline	ns	-42	-57	53	ns	ns	-35
Molybdenum	MLE	0.434	0.031	0.038	A	B	A	AB	baseline	-51	ns	ns	ns	ns	55	ns
Nickel	MLE	0.336	0.060	0.053	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Phosphorus	MLE	0.186	<0.001	0.019	B	B	AB	A	baseline	ns	ns	30	-14	-13	ns	ns
Potassium	MLE	0.463	0.001	0.006	A	B	AB	A	baseline	-21	ns	ns	ns	-22	ns	18
Rubidium	MLE	0.638	0.002	<0.001	B	C	AB	A	baseline	-40	ns	58	ns	-40	ns	58
Selenium	MLE	0.396	<0.001	0.985	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Silver	MLE	<0.001	0.215	0.232	A	A	A	A	baseline	ns	ns	ns	-46			
Sodium	MLE	<0.001	0.220	0.068	A	A	A	A	baseline	ns	ns	ns	45			
Strontium	MLE	0.009	0.001	0.014	B	AB	A	A	baseline	ns	102	99	-52	ns	ns	ns
Tellurium	MLE	nt	nt	nt	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL	<LRL
Thallium	MLE	0.457	0.211	0.692	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Tin	MLE	0.499	<0.001	0.321	A	A	<LRL	<LRL	baseline	ns	<LRL	<LRL	ns	ns	<LRL	<LRL
Titanium	MLE	<0.001	0.149	0.922	A	A	A	A	baseline	ns	ns	ns	83			
Uranium	MLE	0.317	0.273	0.727	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Vanadium	MLE	0.005	0.128	0.938	A	A	A	A	baseline	ns	ns	ns	67			
Zinc	MLE	<0.001	0.247	0.820	A	A	A	A	baseline	ns	ns	ns	-21			
Zirconium	MLE	0.073	<0.001	0.701	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were reported below the laboratory reporting limit (<LRL) or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis. Data were analysed in units of mg/kg dry weight.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (E1:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (E1:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.28: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Caddisfly Tissue Metal Concentrations for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for E1 Mean Relative to EDC-D (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	Log_{10}	0.013	<0.001	0.010	B	B	B	A	baseline	ns	ns	626	ns	ns	-83	ns
Antimony	Log_{10}	0.304	<0.001	0.108	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	Log_{10}	0.709	0.004	0.002	B	B	B	A	baseline	ns	ns	269	ns	-57	ns	185
Barium	Log_{10}	0.180	<0.001	0.013	AB	B	B	A	baseline	ns	ns	ns	ns	ns	-83	ns
Beryllium	Log_{10}	0.881	0.042	<0.001	AB	B	AB	A	baseline	ns	ns	ns	ns	-75	ns	233
Bismuth	Log_{10}	0.707	0.065	0.091	-	A	-	A	-	baseline	-	ns	-	ns	-	ns
Boron	Log_{10}	0.303	0.154	0.013	A	B	-	A	baseline	-84	-	ns	ns	-64	-	ns
Cadmium	Log_{10}	<0.001	<0.001	0.033	B	AB	A	A	baseline	ns	313	561	ns	154	208	393
Calcium	Log_{10}	<0.001	<0.001	<0.001	B	B	C	A	baseline	ns	-65	379	-57	-58	-85	105
Cesium	Log_{10}	0.412	<0.001	0.009	B	B	B	A	baseline	ns	ns	593	ns	-63	ns	238
Chromium	Log_{10}	0.068	<0.001	0.022	A	A	B	A	baseline	ns	-86	ns	ns	ns	-89	ns
Cobalt	Log_{10}	0.962	<0.001	0.044	B	B	AB	A	baseline	ns	ns	541	ns	ns	ns	259
Copper	Log_{10}	<0.001	0.029	0.061	A	A	A	A	baseline	ns	ns	ns	-61			
Iron	Log_{10}	0.065	<0.001	0.016	B	B	B	A	baseline	ns	ns	578	ns	-68	ns	ns
Lead	Log_{10}	0.272	<0.001	0.028	B	B	B	A	baseline	ns	ns	312	ns	ns	ns	173
Lithium	Log_{10}	0.251	0.073	<0.001	-	B	-	A	-	baseline	-	892	-	-75	-	151
Magnesium	Log_{10}	0.031	<0.001	<0.001	B	B	B	A	baseline	ns	ns	262	-45	-39	-46	100
Manganese	Log_{10}	0.001	<0.001	0.038	B	B	AB	A	baseline	ns	ns	497	ns	ns	ns	556
Mercury	Log_{10}	0.335	<0.001	0.798	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Molybdenum	Log_{10}	0.186	0.615	0.980	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Nickel	Log_{10}	0.340	<0.001	0.073	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Phosphorus	Log_{10}	0.417	0.101	0.296	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Potassium	Log_{10}	0.070	<0.001	0.200	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Rubidium	Log_{10}	0.010	<0.001	0.003	B	B	B	A	baseline	ns	ns	213	ns	ns	ns	243
Selenium	Log_{10}	<0.001	<0.001	0.531	A	A	A	A	baseline	ns	ns	ns	64			
Silver	Log_{10}	0.612	<0.001	0.002	B	B	AB	A	baseline	ns	ns	408	ns	-58	ns	156
Sodium	Log_{10}	0.003	<0.001	0.012	AB	AB	B	A	baseline	ns	ns	ns	ns	ns	-53	ns
Strontium	Log_{10}	<0.001	<0.001	<0.001	B	BC	C	A	baseline	ns	-65	244	-46	-58	-81	86
Tellurium	Log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	Log_{10}	0.074	<0.001	0.015	AB	B	B	A	baseline	ns	ns	ns	ns	ns	ns	271
Tin	Log_{10}	0.490	0.126	0.690	A	A	-	-	baseline	ns	-	-	ns	ns	-	-
Titanium	Log_{10}	0.011	<0.001	0.007	B	B	B	A	baseline	ns	ns	806	-70	ns	-83	ns
Uranium	Log_{10}	0.424	<0.001	0.034	B	B	AB	A	baseline	ns	ns	750	ns	ns	ns	268
Vanadium	Log_{10}	0.015	<0.001	0.028	B	B	B	A	baseline	ns	ns	636	-69	-70	-71	ns
Zinc	Log_{10}	<0.001	<0.001	0.006	B	A	A	A	baseline	86	85	171	ns	53	52	123
Zirconium	Log_{10}	0.499	0.240	0.003	AB	B	-	A	baseline	ns	-	ns	ns	-65	-	280

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or samples reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (E1:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (E1:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted})\times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

Table F.4.29: **Statistical Comparisons of Exposed - Reference Relative Differences of Trophic Transfer Factors for Composite-Taxa Benthic Invertebrate Tissue Metal Concentrations for Lower Edney Creek (E1 [Exposed]; EDC-D [Reference]), 2019 to 2022**

Parameter	Data Transformation	Two-way ANOVA P-values			(Exposed – Reference) Contrasts Among Periods[a]				Magnitude of Difference in (Exposed – Reference) Relative to Baseline Period (%)[b]				Magnitude of Difference for E1 Mean Relative to EDC-D (%)[c]			
		Area	Year	Area × Year	Post-Breach Period				Post-Breach Period				Post-Breach Period			
					2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Aluminum	Log_{10}	0.234	0.063	0.234	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Antimony	Log_{10}	0.634	0.318	0.178	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Arsenic	Log_{10}	0.060	<0.001	0.025	AB	B	A	A	baseline	ns	ns	ns	ns	ns	ns	142
Barium	Log_{10}	0.145	0.534	0.020	A	AB	B	A	baseline	ns	-86	ns	ns	ns	-81	ns
Beryllium	Log_{10}	0.166	0.002	0.480	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Bismuth	Log_{10}	0.247	0.158	0.290	A	-	A	A	baseline	-	ns	ns	ns	-	ns	ns
Boron	Log_{10}	0.235	<0.001	0.142	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cadmium	Log_{10}	<0.001	<0.001	0.813	A	A	A	A	baseline	ns	ns	ns	167			
Calcium	Log_{10}	<0.001	<0.001	<0.001	B	B	C	A	baseline	ns	-64	153	ns	-45	-79	ns
Cesium	Log_{10}	0.080	<0.001	0.192	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Chromium	Log_{10}	0.474	0.683	0.165	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Cobalt	Log_{10}	<0.001	<0.001	0.138	A	A	A	A	baseline	ns	ns	ns	82			
Copper	Log_{10}	<0.001	0.132	0.493	A	A	A	A	baseline	ns	ns	ns	-69			
Iron	Log_{10}	0.052	<0.001	0.417	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Lead	Log_{10}	0.025	0.924	0.634	A	A	A	A	baseline	ns	ns	ns	52			
Lithium	Log_{10}	0.084	<0.001	0.082	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Magnesium	Log_{10}	0.122	0.009	<0.001	B	B	B	A	baseline	ns	ns	324	-54	ns	ns	94
Manganese	Log_{10}	<0.001	<0.001	0.308	A	A	A	A	baseline	ns	ns	ns	88			
Mercury	Log_{10}	0.203	0.002	0.279	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Molybdenum	Log_{10}	0.036	0.025	0.168	A	A	A	A	baseline	ns	ns	ns	52			
Nickel	Log_{10}	0.092	0.003	0.061	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Phosphorus	Log_{10}	0.955	0.046	0.115	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Potassium	Log_{10}	0.116	0.006	0.529	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Rubidium	Log_{10}	0.008	<0.001	0.004	BC	C	AB	A	baseline	ns	ns	149	ns	ns	103	162
Selenium	Log_{10}	0.015	0.508	0.150	A	A	A	A	baseline	ns	ns	ns	41			
Silver	Log_{10}	<0.001	0.045	0.031	A	B	AB	A	baseline	-57	ns	ns	ns	-73	-62	ns
Sodium	Log_{10}	0.476	<0.001	0.005	A	A	B	A	baseline	ns	-57	ns	ns	ns	-46	93
Strontium	Log_{10}	<0.001	<0.001	0.014	B	AB	B	A	baseline	ns	ns	136	-51	ns	-71	ns
Tellurium	Log_{10}	nt	nt	nt	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	Log_{10}	0.001	<0.001	0.137	A	A	A	A	baseline	ns	ns	ns	63			
Tin	Log_{10}	0.353	0.701	0.036	A	B	-	-	baseline	-79	-	-	148	ns	-	-
Titanium	Log_{10}	0.035	0.004	0.052	A	A	A	A	baseline	ns	ns	ns	47			
Uranium	Log_{10}	0.220	0.005	0.470	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Vanadium	Log_{10}	0.081	0.003	0.294	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zinc	Log_{10}	0.744	0.002	0.315	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns
Zirconium	Log_{10}	0.099	0.035	0.348	A	A	A	A	baseline	ns	ns	ns	ns	ns	ns	ns

Area x Year or Area P-value < 0.05.

Contrast is significant (α = 0.05) and magnitude of difference is positive.

Contrast is significant (α = 0.05) and magnitude of difference is negative.

Notes: "-" = no data available or samples reported below the laboratory reporting limit (<LRL) so TTF ratio was not calculated, ANOVA = two way analysis of variance, MLE = censored regression using maximum likelihood estimation, MOD = Magnitude of Difference, nt = not tested because all data were <LRL or because there were only data for a single time period, ns = not significant, baseline= first year of data included in analysis, <LRL = greater than 50% LRL data for both stations so the time period was omitted from the analysis. Merged cells across years indicate that the Area × Time term was not significant, therefore MOD is for all years combined. Only years with samples from both reference and exposed were included in the analysis.

[a] Years that share a letter (e.g., A,B,C) had ratios of concentrations (E1:EDC-D) that do not differ significantly among years. Letters are assigned such that A is assigned to the year with the highest ratio of concentrations (E1:EDC-D).

[b] Magnitude of difference (MOD) calculated on backtransformed least-squares means for the observed time period as $(Exp_{observed} - Exp_{predicted})/(Exp_{predicted}) \times 100\%$ where $Exp_{predicted} = Ref_{observed} + (Exp_{baseline} - Ref_{baseline})$.

[c] Magnitude of difference (MOD) calculated on backtransformed least-squares means as (Exp-Ref)/Ref x 100%.

APPENDIX G
ANALYTICAL REPORTS

WATER CHEMISTRY

ALS Laboratory Report VA22B4117

(Finalized July 8, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B4117**	Page	: 1 of 6
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Jun-2022 10:55
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 23-Jun-2022
C-O-C number	: ----	Issue Date	: 08-Jul-2022 15:48
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Ann Joby	Lab Assistant	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-06	POL-P2_WS_DI-1_2022-06	----	----	----
					Client sampling date / time	21-Jun-2022 14:25	21-Jun-2022 12:05	----	----	----
						VA22B4117-001	VA22B4117-002	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		38.1	88.2	----	----	----
conductivity	----	E100	2.0	µS/cm		92.2	242	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		44.2	109	----	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		44.2	106	----	----	----
pH	----	E108	0.10	pH units		7.72	8.12	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L		79	162	----	----	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		3.0	3.0	----	----	----
turbidity	----	E121	0.10	NTU		1.27	1.44	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0052	<0.0050	----	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		0.62	1.03	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.057	0.074	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	----	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.314	0.367	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0130	0.0180	----	----	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0061	0.0072	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		7.16	33.8	----	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		7.43	6.77	----	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0586	0.103	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		0.00015	0.00012	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00058	0.00085	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.0181	0.0126	----	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L		0.045	0.020	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-06	POL-P2_WS_DI-1_2022-06	----	----	----
					Client sampling date / time	21-Jun-2022 14:25	21-Jun-2022 12:05	----	----	----
						VA22B4117-001	VA22B4117-002	--------	--------	--------
						Result	Result	----	----	----
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000120	0.0000070	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L		13.6	34.2	----	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	0.00053	----	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00554	0.00807	----	----	----
iron, total	7439-89-6	E420	0.030	mg/L		0.074	0.101	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		0.000098	0.000210	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L		0.0011	0.0014	----	----	----
magnesium, total	7439-95-4	E420	0.100	mg/L		2.50	4.97	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.0140	0.00857	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000788	0.00596	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.517	1.28	----	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000192	0.000509	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L		1.99	3.68	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	0.000016	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		2.43	7.00	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.126	0.233	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L		0.00023	0.00011	----	----	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000041	0.000192	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	0.00159	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		0.0045	0.0034	----	----	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0103	0.0056	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00029	0.00050	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.0173	0.0101	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-06	POL-P2_WS_DI-1_2022-06	----	----	----
					Client sampling date / time	21-Jun-2022 14:25	21-Jun-2022 12:05	----	----	----
						VA22B4117-001	VA22B4117-002	--------	--------	--------
						Result	Result	----	----	----
Dissolved Metals										
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.046	0.020	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		<0.0000050	<0.0000050	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		13.5	35.2	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00265	0.00435	----	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	0.0012	----	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.54	5.11	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00233	0.00155	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000765	0.00586	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.494	1.27	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000178	0.000469	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.99	3.44	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		2.62	7.35	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.135	0.235	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000038	0.000190	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	0.00136	----	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		0.0050	<0.0030	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	----	----	----
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg/L		6.60	2.30	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B4117**	Page	: 1 of 12
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Jun-2022 10:55
PO	: 5590008044 Q2 2022	Issue Date	: 08-Jul-2022 15:48
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) BOL-B2_WS_DI-1_2022-06	E298	21-Jun-2022	05-Jul-2022	----	----		07-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) POL-P2_WS_DI-1_2022-06	E298	21-Jun-2022	05-Jul-2022	----	----		07-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE BOL-B2_WS_DI-1_2022-06	E235.Cl	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE POL-P2_WS_DI-1_2022-06	E235.Cl	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-B2_WS_DI-1_2022-06	E378-U	21-Jun-2022	----	----	----		25-Jun-2022	3 days	4 days	× EHT
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-P2_WS_DI-1_2022-06	E378-U	21-Jun-2022	----	----	----		25-Jun-2022	3 days	4 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE BOL-B2_WS_DI-1_2022-06	E235.F	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-06	E235.F	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-B2_WS_DI-1_2022-06	E235.NO3-L	21-Jun-2022	----	----	----		24-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1_2022-06	E235.NO3-L	21-Jun-2022	----	----	----		24-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-B2_WS_DI-1_2022-06	E235.NO2-L	21-Jun-2022	----	----	----		24-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1_2022-06	E235.NO2-L	21-Jun-2022	----	----	----		24-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-B2_WS_DI-1_2022-06	E235.SO4	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-06	E235.SO4	21-Jun-2022	----	----	----		24-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
BOL-B2_WS_DI-1_2022-06	E375-T	21-Jun-2022	05-Jul-2022	----	----		06-Jul-2022	28 days	15 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-P2_WS_DI-1_2022-06	E375-T	21-Jun-2022	05-Jul-2022	----	----		06-Jul-2022	28 days	15 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-06	E366	21-Jun-2022	05-Jul-2022	----	----		07-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-06	E366	21-Jun-2022	05-Jul-2022	----	----		07-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-06	E372-U	21-Jun-2022	05-Jul-2022	----	----		06-Jul-2022	28 days	15 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-06	E372-U	21-Jun-2022	05-Jul-2022	----	----		06-Jul-2022	28 days	15 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BOL-B2_WS_DI-1_2022-06	E421	21-Jun-2022	01-Jul-2022	----	----		03-Jul-2022	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-P2_WS_DI-1_2022-06	E421	21-Jun-2022	01-Jul-2022	----	----		03-Jul-2022	180 days	12 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
BOL-B2_WS_DI-1_2022-06	E358-L	21-Jun-2022	05-Jul-2022	----	----		05-Jul-2022	28 days	14 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
POL-P2_WS_DI-1_2022-06	E358-L	21-Jun-2022	05-Jul-2022	----	----		05-Jul-2022	28 days	14 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
BOL-B2_WS_DI-1_2022-06	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE POL-P2_WS_DI-1_2022-06	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE BOL-B2_WS_DI-1_2022-06	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE POL-P2_WS_DI-1_2022-06	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓
Physical Tests : pH by Meter										
HDPE BOL-B2_WS_DI-1_2022-06	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-P2_WS_DI-1_2022-06	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	172 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE BOL-B2_WS_DI-1_2022-06	E162	21-Jun-2022	----	----	----		29-Jun-2022	7 days	8 days	× EHT
Physical Tests : TDS by Gravimetry										
HDPE POL-P2_WS_DI-1_2022-06	E162	21-Jun-2022	----	----	----		29-Jun-2022	7 days	8 days	× EHT
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-B2_WS_DI-1_2022-06	E164	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-P2_WS_DI-1_2022-06	E164	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
BOL-B2_WS_DI-1_2022-06	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
POL-P2_WS_DI-1_2022-06	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
BOL-B2_WS_DI-1_2022-06	E870	21-Jun-2022	23-Jun-2022	2 days	2 days	✓	23-Jun-2022	672 hrs	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
POL-P2_WS_DI-1_2022-06	E870	21-Jun-2022	23-Jun-2022	2 days	2 days	✓	23-Jun-2022	672 hrs	0 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
BOL-B2_WS_DI-1_2022-06	E420	21-Jun-2022	----	----	----		03-Jul-2022	180 days	12 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-P2_WS_DI-1_2022-06	E420	21-Jun-2022	----	----	----		03-Jul-2022	180 days	12 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	537369	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	549340	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	537373	1	16	6.2	5.0	✓
Conductivity in Water	E100	537370	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	545635	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	549332	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	537379	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	537372	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	537375	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	537376	1	19	5.2	5.0	✓
pH by Meter	E108	537368	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	537377	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	542739	1	20	5.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	549339	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	543730	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	549334	1	18	5.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	549338	1	18	5.5	5.0	✓
Turbidity by Nephelometry	E121	535695	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	537369	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	549340	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	537373	1	16	6.2	5.0	✓
Chlorophyll-a by Fluorometry	E870	535360	1	5	20.0	5.0	✓
Conductivity in Water	E100	537370	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	545635	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	549332	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	537379	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	537372	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	537375	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	537376	1	19	5.2	5.0	✓
pH by Meter	E108	537368	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	537377	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	542739	1	20	5.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	549339	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	543730	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	549334	1	18	5.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	549338	1	18	5.5	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
TSS by Gravimetry (Whole Bottle)	E164	542051	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	535695	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	537369	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	549340	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	537373	1	16	6.2	5.0	✓
Chlorophyll-a by Fluorometry	E870	535360	1	5	20.0	5.0	✓
Conductivity in Water	E100	537370	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	545635	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	549332	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	537379	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	537372	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	537375	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	537376	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	537377	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	542739	1	20	5.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	549339	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	543730	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	549334	1	18	5.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	549338	1	18	5.5	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	542051	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	535695	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	549340	1	18	5.5	5.0	✓
Chloride in Water by IC	E235.Cl	537373	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	545635	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	549332	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	537379	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	537372	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	537375	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	537376	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	537377	1	16	6.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	549339	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	543730	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	549334	1	18	5.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	549338	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Chlorophyll-a by Fluorometry	E870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Chlorophyll-a Extraction	EP870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22B4117**	Page	: 1 of 14
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Jun-2022 10:55
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 23-Jun-2022
C-O-C number	: ----	Issue Date	: 08-Jul-2022 15:48
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Ann Joby	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 535695)											
KS2202234-001	Anonymous	turbidity	----	E121	0.10	NTU	2010	2010	0.159%	15%	----
Physical Tests (QC Lot: 537368)											
FJ2201649-003	Anonymous	pH	----	E108	0.10	pH units	8.33	8.34	0.120%	4%	----
Physical Tests (QC Lot: 537369)											
FJ2201649-003	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	149	151	1.13%	20%	----
Physical Tests (QC Lot: 537370)											
FJ2201649-003	Anonymous	conductivity	----	E100	2.0	µS/cm	269	272	1.11%	10%	----
Physical Tests (QC Lot: 542739)											
KS2202298-002	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1120	1120	0.624%	20%	----
Anions and Nutrients (QC Lot: 537372)											
FJ2201649-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.022	0.021	0.001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 537373)											
FJ2201649-001	Anonymous	chloride	16887-00-6	E235.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 537375)											
FJ2201649-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.337	0.337	0.0632%	20%	----
Anions and Nutrients (QC Lot: 537376)											
FJ2201649-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 537377)											
FJ2201649-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	2.64	2.63	0.01	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 537379)											
FJ2201649-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0014	0.0012	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 549334)											
VA22B3826-001	Anonymous	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.899	0.821	9.06%	20%	----
Anions and Nutrients (QC Lot: 549338)											
VA22B3826-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0060	0.0057	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 549339)											
VA22B3826-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0020	<0.0020	0.00002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 549340)											
VA22B3826-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0054	<0.0050	0.0004	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 549332)											
VA22B3826-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	0.80	0.92	0.12	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 543730)											
KS2202300-001	Anonymous	aluminum, total	7429-90-5	E420	0.0060	mg/L	0.0075	0.0063	0.0012	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00020	mg/L	0.00025	0.00023	0.00002	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00020	mg/L	0.0972	0.0973	0.0937%	20%	----
		barium, total	7440-39-3	E420	0.00020	mg/L	0.0128	0.0128	0.397%	20%	----
		beryllium, total	7440-41-7	E420	0.000040	mg/L	<0.000040	<0.000040	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.020	mg/L	0.480	0.460	4.35%	20%	----
		cadmium, total	7440-43-9	E420	0.000110	mg/L	<0.000110	<0.000110	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.100	mg/L	21.4	20.9	1.98%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00020	mg/L	0.00023	0.00022	0.000009	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00100	mg/L	0.00164	0.00164	0.0000002	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.020	mg/L	0.067	0.077	0.010	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0020	mg/L	0.0102	0.0098	0.0004	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0100	mg/L	38.0	38.1	0.129%	20%	----
		manganese, total	7439-96-5	E420	0.00020	mg/L	0.0865	0.0862	0.295%	20%	----
		molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.468	0.436	7.13%	20%	----
		nickel, total	7440-02-0	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.100	mg/L	8.84	9.08	2.67%	20%	----
		selenium, total	7782-49-2	E420	0.000100	mg/L	0.000177	0.000224	0.000047	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.20	mg/L	3.50	3.51	0.322%	20%	----
		silver, total	7440-22-4	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.100	mg/L	457	455	0.403%	20%	----
		strontium, total	7440-24-6	E420	0.00040	mg/L	1.52	1.39	8.76%	20%	----
		thallium, total	7440-28-0	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000020	mg/L	0.00131	0.00115	12.9%	20%	----
		vanadium, total	7440-62-2	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0060	mg/L	<0.0060	<0.0060	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 545635)											
CG2208318-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00028	0.00028	0.000004	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 545635) - continued											
CG2208318-001	Anonymous	barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0160	0.0170	5.90%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.013	0.012	0.001	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.849 µg/L	0.000871	2.57%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	193	179	7.29%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00034	0.00034	0.000001	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0249	0.0226	9.94%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	132	135	1.85%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00121	0.00120	0.551%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00821	0.00859	4.45%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.64	2.66	0.625%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	186 µg/L	0.202	8.13%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.96	2.02	2.80%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	3.43	3.50	2.14%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.166	0.162	2.36%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000048	0.000045	0.000003	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00749	0.00726	3.12%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0089	0.0088	0.0001	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 535695)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 537369)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 537370)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 542051)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 542739)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 537372)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 537373)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 537375)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 537376)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 537377)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 537379)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 549334)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 549338)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 549339)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 549340)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 549332)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 543730)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 543730) - continued						
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 545635)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 545635) - continued						
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Plant Pigments (QCLot: 535360)						
chlorophyll a	479-61-8	E870	0.01	µg/L	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 535695)									
turbidity	----	E121	0.1	NTU	200 NTU	98.0	85.0	115	----
Physical Tests (QCLot: 537368)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 537369)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	100	85.0	115	----
Physical Tests (QCLot: 537370)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.6	90.0	110	----
Physical Tests (QCLot: 542051)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	88.3	85.0	115	----
Physical Tests (QCLot: 542739)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 537372)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	105	90.0	110	----
Anions and Nutrients (QCLot: 537373)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 537375)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 537376)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 537377)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 537379)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	95.7	80.0	120	----
Anions and Nutrients (QCLot: 549334)									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	96.0	75.0	125	----
Anions and Nutrients (QCLot: 549338)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	96.0	80.0	120	----
Anions and Nutrients (QCLot: 549339)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	96.2	80.0	120	----
Anions and Nutrients (QCLot: 549340)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	104	85.0	115	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Organic / Inorganic Carbon (QCLot: 549332)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	99.4	80.0	120	----
Total Metals (QCLot: 543730)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	108	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	112	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	114	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	109	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	99.6	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	99.3	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	109	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	91.8	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	89.6	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	95.9	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	110	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	106	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	97.0	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	89.7	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	109	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	90.6	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	96.0	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	98.8	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	113	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	108	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	105	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	102	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	89.3	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	99.1	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	93.5	80.0	120	----
Dissolved Metals (QCLot: 545635)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	105	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	110	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 545635) - continued									
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	106	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	103	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	98.5	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	106	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	105	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	107	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	104	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	105	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	108	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	107	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	107	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	103	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	110	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	109	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	102	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	105	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	107	80.0	120	----
Plant Pigments (QCLot: 535360)									
chlorophyll a	479-61-8	E870	0.01	µg/L	5 µg/L	93.3	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 537372)										
FJ2201649-002	Anonymous	fluoride	16984-48-8	E235.F	1.07 mg/L	1 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 537373)										
FJ2201649-002	Anonymous	chloride	16887-00-6	E235.Cl	106 mg/L	100 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 537375)										
FJ2201649-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.69 mg/L	2.5 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 537376)										
FJ2201649-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.523 mg/L	0.5 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 537377)										
FJ2201649-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	105 mg/L	100 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 537379)										
FJ2201649-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0302 mg/L	0.03 mg/L	101	70.0	130	----
Anions and Nutrients (QCLot: 549334)										
VA22B3826-002	Anonymous	nitrogen, total	7727-37-9	E366	ND mg/L	0.4 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 549338)										
VA22B3826-002	Anonymous	phosphorus, total	7723-14-0	E372-U	ND mg/L	0.05 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 549339)										
VA22B3826-002	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	ND mg/L	0.05 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 549340)										
VA22B3826-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	MS-B
Organic / Inorganic Carbon (QCLot: 549332)										
VA22B3826-002	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Total Metals (QCLot: 543730)										
KS2202213-022	Anonymous	aluminum, total	7429-90-5	E420	0.391 mg/L	0.4 mg/L	97.7	70.0	130	----
		antimony, total	7440-36-0	E420	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		arsenic, total	7440-38-2	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0811 mg/L	0.08 mg/L	101	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0180 mg/L	0.02 mg/L	90.1	70.0	130	----
		boron, total	7440-42-8	E420	0.214 mg/L	0.2 mg/L	107	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 543730) - continued										
KS2202213-022	Anonymous	cadmium, total	7440-43-9	E420	0.00784 mg/L	0.008 mg/L	98.0	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	8 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0763 mg/L	0.08 mg/L	95.4	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0378 mg/L	0.04 mg/L	94.5	70.0	130	----
		copper, total	7440-50-8	E420	0.0378 mg/L	0.04 mg/L	94.4	70.0	130	----
		iron, total	7439-89-6	E420	3.61 mg/L	4 mg/L	90.3	70.0	130	----
		lead, total	7439-92-1	E420	0.0358 mg/L	0.04 mg/L	89.5	70.0	130	----
		lithium, total	7439-93-2	E420	0.194 mg/L	0.2 mg/L	96.9	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0419 mg/L	0.04 mg/L	105	70.0	130	----
		nickel, total	7440-02-0	E420	0.0755 mg/L	0.08 mg/L	94.4	70.0	130	----
		potassium, total	7440-09-7	E420	8.08 mg/L	8 mg/L	101	70.0	130	----
		selenium, total	7782-49-2	E420	0.0797 mg/L	0.08 mg/L	99.7	70.0	130	----
		silicon, total	7440-21-3	E420	18.8 mg/L	20 mg/L	93.9	70.0	130	----
		silver, total	7440-22-4	E420	0.00779 mg/L	0.008 mg/L	97.4	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00702 mg/L	0.008 mg/L	87.8	70.0	130	----
		tin, total	7440-31-5	E420	0.0387 mg/L	0.04 mg/L	96.8	70.0	130	----
		titanium, total	7440-32-6	E420	ND mg/L	0.08 mg/L	ND	70.0	130	----
		uranium, total	7440-61-1	E420	0.00761 mg/L	0.008 mg/L	95.1	70.0	130	----
		vanadium, total	7440-62-2	E420	0.194 mg/L	0.2 mg/L	96.8	70.0	130	----
		zinc, total	7440-66-6	E420	0.784 mg/L	0.8 mg/L	98.0	70.0	130	----
Dissolved Metals (QCLot: 545635)										
FJ2201668-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.210 mg/L	0.2 mg/L	105	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0196 mg/L	0.02 mg/L	98.2	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0201 mg/L	0.02 mg/L	101	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0398 mg/L	0.04 mg/L	99.5	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00828 mg/L	0.01 mg/L	82.8	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.092 mg/L	0.1 mg/L	91.5	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00373 mg/L	0.004 mg/L	93.3	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0384 mg/L	0.04 mg/L	96.1	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0188 mg/L	0.02 mg/L	93.9	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 545635) - continued										
FJ2201668-001	Anonymous	copper, dissolved	7440-50-8	E421	0.0177 mg/L	0.02 mg/L	88.6	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.90 mg/L	2 mg/L	94.9	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0178 mg/L	0.02 mg/L	88.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	ND mg/L	0.1 mg/L	ND	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0361 mg/L	0.04 mg/L	90.2	70.0	130	----
		potassium, dissolved	7440-09-7	E421	3.93 mg/L	4 mg/L	98.2	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0419 mg/L	0.04 mg/L	105	70.0	130	----
		silicon, dissolved	7440-21-3	E421	10.2 mg/L	10 mg/L	102	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00799 mg/L	0.008 mg/L	99.9	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00343 mg/L	0.004 mg/L	85.7	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0195 mg/L	0.02 mg/L	97.6	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0393 mg/L	0.04 mg/L	98.3	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.372 mg/L	0.4 mg/L	93.1	70.0	130	----

Qualifiers

Qualifier	Description
MS-B	*Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.*

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.iveris@mountpolley.com, pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-006
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:**

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)		E87OB (Chl-a)					
	BOL-B2_WS_DI-1_2022-06	21-Jun-22	14:25	Water	R	R	R	R	R	R		R					67
	POL-P2_WS_DI-1_2022-06	21-Jun-22	12:05	Water	R	R	R	R	R	R		R					67
	~~QUL-ZOO-1_WS_DI-1_2022-06~~	~~Jun-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~							~~X~~ 7
	~~QUL-ZOO-7_WS_DI-1_2022-06~~	~~Jun-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~							~~X~~ 7
	~~WS_DI-1X_2022-06~~	~~Jun-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~							~~X~~

Environmental Division
Vancouver
Work Order Reference
VA22B4117

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Pls filter + freeze chlorophyll but HOLD for analysis *

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			5.6	8	

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: IT	Date: June 22/22	Time: ~~10:55~~ 10:55 am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WATER CHEMISTRY

ALS Laboratory Report VA22B4435

(Finalized July 11, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B4435**	Page	: 1 of 6
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 24-Jun-2022
C-O-C number	: ----	Issue Date	: 11-Jul-2022 14:23
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Erin Sanchez		Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kyle Chang	Lab Assistant	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DTC	*Dissolved concentration exceeds total. Results were confirmed by re-analysis.*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-06	QUL-ZOO-7_WS_DI-1_2022-06	QUL-ZOO-1_WS_DI-1X_2022-06	----	----
					Client sampling date / time	22-Jun-2022 11:00	22-Jun-2022 09:55	22-Jun-2022 11:00	----	----
						VA22B4435-001	VA22B4435-002	VA22B4435-003	--------	--------
						Result	Result	Result	----	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		48.1	46.2	46.3	----	----
conductivity	----	E100	2.0	µS/cm		113	107	116	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		49.4	46.0	50.5	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		44.6	41.0	49.0	----	----
pH	----	E108	0.10	pH units		7.89	7.87	7.87	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L		80	69	76	----	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		1.5	2.2	1.2	----	----
turbidity	----	E121	0.10	NTU		1.25	2.16	1.03	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	<0.50	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.033	0.031	0.033	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.100	0.0750 HTD	0.0992	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.100	0.0750	0.0992	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.232	0.210	0.247	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0064	0.0088	0.0090	----	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0030	0.0042	0.0025	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.92	5.03	8.08	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		2.92	3.60	3.40	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0285	0.0443	0.0445	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00014	0.00022	0.00019	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.00544	0.00605	0.00629	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-06	QUL-ZOO-7_WS_DI-1_2022-06	QUL-ZOO-1_WS_DI-1X_2022-06	----	----
					Client sampling date / time	22-Jun-2022 11:00	22-Jun-2022 09:55	22-Jun-2022 11:00	----	----
						VA22B4435-001	VA22B4435-002	VA22B4435-003	--------	--------
						Result	Result	Result	----	----
Total Metals										
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	<0.010	<0.010	----	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000072	0.0000115	0.0000067	----	----
calcium, total	7440-70-2	E420	0.050	mg/L		14.8	13.4	16.2	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00168	0.00166	0.00223	----	----
iron, total	7439-89-6	E420	0.030	mg/L		0.035	0.072	0.057	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		<0.000050	<0.000050	0.000052	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
magnesium, total	7439-95-4	E420	0.100	mg/L		1.85	1.83	2.07	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00224	0.00394	0.00327	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000396	0.000414	0.000419	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		0.00092	0.00062	0.00102	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.489	0.495	0.557	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000156	0.000170	0.000141	----	----
silicon, total	7440-21-3	E420	0.10	mg/L		2.05	2.19	2.04	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		0.943	0.930	1.02	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.110	0.0983	0.129	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000140	0.000120	0.000154	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	----	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0142	0.0190	0.0129	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00012	0.00018	0.00012	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00568	0.00624	0.00561	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-06	QUL-ZOO-7_WS_DI-1_2022-06	QUL-ZOO-1_WS_DI-1X_2022-06	----	----
					Client sampling date / time	22-Jun-2022 11:00	22-Jun-2022 09:55	22-Jun-2022 11:00	----	----
						VA22B4435-001	VA22B4435-002	VA22B4435-003	--------	--------
						Result	Result	Result	----	----
Dissolved Metals										
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	<0.010	<0.010	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000090	0.0000160	0.0000054	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		16.5	15.1	16.9	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00120	0.00107	0.00100	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.00	2.01	2.01	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00086	0.00147	0.00070	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000488	0.000453	0.000397	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00089	0.00055	0.00086	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.532	0.545	0.526	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000140	0.000160	0.000146	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		2.03	2.26	1.97	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		0.983	0.972	0.963	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.122	0.101	0.118	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		0.00064 DTC	<0.00010	<0.00010	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000144	0.000118	0.000138	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	----	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	----	----
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg/L		1.36	1.88	1.32	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B4435**	Page	: 1 of 14
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Issue Date	: 11-Jul-2022 14:22
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) QUL-ZOO-1_WS_DI-1_2022-06	E298	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) QUL-ZOO-1_WS_DI-1X_2022-06	E298	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) QUL-ZOO-7_WS_DI-1_2022-06	E298	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E235.Cl	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E235.Cl	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E235.Cl	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E378-U	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E378-U	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E378-U	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E235.F	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E235.F	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E235.F	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E235.NO3-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E235.NO3-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E235.NO3-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E235.NO2-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-06	E235.NO2-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-06	E235.NO2-L	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-06	E235.SO4	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-06	E235.SO4	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-06	E235.SO4	22-Jun-2022	----	----	----		25-Jun-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-06	E375-T	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-06	E375-T	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-06	E375-T	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-06	E366	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-06	E366	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-06	E366	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	16 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-06	E372-U	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-06	E372-U	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-06	E372-U	22-Jun-2022	07-Jul-2022	----	----		09-Jul-2022	28 days	17 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-06	E421	22-Jun-2022	03-Jul-2022	----	----		04-Jul-2022	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-1_WS_DI-1X_2022-06	E421	22-Jun-2022	03-Jul-2022	----	----		04-Jul-2022	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-06	E421	22-Jun-2022	03-Jul-2022	----	----		04-Jul-2022	180 days	12 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-06	E358-L	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	15 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-ZOO-1_WS_DI-1X_2022-06	E358-L	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-ZOO-7_WS_DI-1_2022-06	E358-L	22-Jun-2022	07-Jul-2022	----	----		08-Jul-2022	28 days	15 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E290	22-Jun-2022	----	----	----		01-Jul-2022	14 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E290	22-Jun-2022	----	----	----		01-Jul-2022	14 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E290	22-Jun-2022	----	----	----		01-Jul-2022	14 days	9 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E100	22-Jun-2022	----	----	----		01-Jul-2022	28 days	9 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E100	22-Jun-2022	----	----	----		01-Jul-2022	28 days	9 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E100	22-Jun-2022	----	----	----		01-Jul-2022	28 days	9 days	✓
Physical Tests : pH by Meter										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E108	22-Jun-2022	----	----	----		01-Jul-2022	0.25 hrs	213 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E108	22-Jun-2022	----	----	----		01-Jul-2022	0.25 hrs	213 hrs	✖ EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E108	22-Jun-2022	----	----	----		01-Jul-2022	0.25 hrs	214 hrs	✖ EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-7_WS_DI-1_2022-06	E162	22-Jun-2022	----	----	----		29-Jun-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E162	22-Jun-2022	----	----	----		30-Jun-2022	7 days	8 days	✖ EHT
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-1_WS_DI-1X_2022-06	E162	22-Jun-2022	----	----	----		30-Jun-2022	7 days	8 days	✖ EHT
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-7_WS_DI-1_2022-06	E164	22-Jun-2022	----	----	----		29-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-1_WS_DI-1_2022-06	E164	22-Jun-2022	----	----	----		30-Jun-2022	7 days	8 days	✖ EHT
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-1_WS_DI-1X_2022-06	E164	22-Jun-2022	----	----	----		30-Jun-2022	7 days	8 days	✖ EHT
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-ZOO-1_WS_DI-1_2022-06	E121	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-06	E121	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-06	E121	22-Jun-2022	----	----	----		25-Jun-2022	3 days	3 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
QUL-ZOO-1_WS_DI-1_2022-06	E870	22-Jun-2022	24-Jun-2022	2 days	2 days	× EHTL	26-Jun-2022	672 hrs	2 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
QUL-ZOO-1_WS_DI-1X_2022-06	E870	22-Jun-2022	24-Jun-2022	2 days	2 days	× EHTL	26-Jun-2022	672 hrs	2 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
QUL-ZOO-7_WS_DI-1_2022-06	E870	22-Jun-2022	24-Jun-2022	2 days	2 days	× EHTR	26-Jun-2022	672 hrs	2 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-06	E420	22-Jun-2022	----	----	----		04-Jul-2022	180 days	13 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-1_WS_DI-1X_2022-06	E420	22-Jun-2022	----	----	----		04-Jul-2022	180 days	13 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-06	E420	22-Jun-2022	----	----	----		04-Jul-2022	180 days	13 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	538163	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	553525	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	538166	1	19	5.2	5.0	✓
Conductivity in Water	E100	538164	1	10	10.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	546220	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	553520	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	538171	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	538165	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	538168	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	538169	1	19	5.2	5.0	✓
pH by Meter	E108	538162	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	538170	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	543633	2	34	5.8	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	553523	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	545623	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	553524	1	5	20.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	553522	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	538304	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	538163	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	553525	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	538166	1	19	5.2	5.0	✓
Chlorophyll-a by Fluorometry	E870	538063	1	3	33.3	5.0	✓
Conductivity in Water	E100	538164	1	10	10.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	546220	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	553520	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	538171	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	538165	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	538168	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	538169	1	19	5.2	5.0	✓
pH by Meter	E108	538162	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	538170	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	543633	2	34	5.8	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	553523	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	545623	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	553524	1	5	20.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	553522	1	17	5.8	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
TSS by Gravimetry (Whole Bottle)	E164	543611	2	28	7.1	5.0	✓
Turbidity by Nephelometry	E121	538304	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	538163	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	553525	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	538166	1	19	5.2	5.0	✓
Chlorophyll-a by Fluorometry	E870	538063	1	3	33.3	5.0	✓
Conductivity in Water	E100	538164	1	10	10.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	546220	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	553520	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	538171	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	538165	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	538168	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	538169	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	538170	1	19	5.2	5.0	✓
TDS by Gravimetry	E162	543633	2	34	5.8	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	553523	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	545623	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	553524	1	5	20.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	553522	1	17	5.8	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	543611	2	28	7.1	5.0	✓
Turbidity by Nephelometry	E121	538304	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	553525	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	538166	1	19	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	546220	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	553520	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	538171	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	538165	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	538168	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	538169	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	538170	1	19	5.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	553523	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	545623	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	553524	1	5	20.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	553522	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Chlorophyll-a by Fluorometry	E870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Chlorophyll-a Extraction	EP870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22B4435**	Page	: 1 of 15
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 24-Jun-2022
C-O-C number	: ----	Issue Date	: 11-Jul-2022 14:22
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Erin Sanchez		Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kyle Chang	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 538162)											
FJ2201667-001	Anonymous	pH	----	E108	0.10	pH units	8.19	8.20	0.146%	4%	----
Physical Tests (QC Lot: 538163)											
FJ2201667-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	106	106	0.565%	20%	----
Physical Tests (QC Lot: 538164)											
FJ2201667-001	Anonymous	conductivity	----	E100	2.0	µS/cm	525	527	0.380%	10%	----
Physical Tests (QC Lot: 538304)											
KS2202283-006	Anonymous	turbidity	----	E121	0.10	NTU	0.24	0.26	0.02	Diff <2x LOR	----
Physical Tests (QC Lot: 543633)											
KS2202224-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	5290	5280	0.189%	20%	----
Physical Tests (QC Lot: 545680)											
KS2202302-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	310	307	1.13%	20%	----
Anions and Nutrients (QC Lot: 538165)											
FJ2201667-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.188	0.184	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 538166)											
FJ2201667-001	Anonymous	chloride	16887-00-6	E235.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 538168)											
FJ2201667-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	1.87	1.86	0.722%	20%	----
Anions and Nutrients (QC Lot: 538169)											
FJ2201667-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0010	0.0011	0.00004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 538170)											
FJ2201667-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	141	140	1.02%	20%	----
Anions and Nutrients (QC Lot: 538171)											
FJ2201667-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0040	0.0038	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 553522)											
VA22B4435-001	QUL-ZOO-1_WS_DI-1_2022-06	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0064	0.0084	0.0020	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 553523)											
VA22B4435-001	QUL-ZOO-1_WS_DI-1_2022-06	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0030	0.0034	0.0004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 553524)											
VA22B4435-001	QUL-ZOO-1_WS_DI-1_2022-06	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.232	0.268	0.036	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 553525)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 553525) - continued											
VA22B4435-001	QUL-ZOO-1_WS_DI-1_2022-06	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0060	0.0010	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 553520)											
VA22B4435-001	QUL-ZOO-1_WS_DI-1_2022-06	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.92	2.98	0.05	Diff <2x LOR	----
Total Metals (QC Lot: 545623)											
VA22B4433-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.282	0.295	4.46%	20%	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00036	0.00037	0.000003	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00078	0.00080	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0438	0.0447	2.14%	20%	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.076	0.075	0.001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.000105	mg/L	<0.000105	<0.000105	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	113	113	0.157%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00211	0.00212	0.427%	20%	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.168	0.170	1.10%	20%	----
		iron, total	7439-89-6	E420	0.030	mg/L	0.180	0.181	0.001	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000125	0.000124	0.0000008	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0070	0.0070	0.00007	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.100	mg/L	21.6	21.1	2.41%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.193	0.191	0.726%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.121	0.117	3.79%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00236	0.00228	0.00008	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	4.38	4.38	0.0978%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.0256	0.0255	0.458%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	3.38	3.36	0.721%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	0.000010	0.000010	0.000000008	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	26.0	26.5	1.66%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	1.56	1.52	2.53%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000840	0.000849	0.999%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00090	0.00092	0.00002	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 545623) - continued											
VA22B4433-001	Anonymous	zinc, total	7440-66-6	E420	0.0030	mg/L	0.0050	0.0049	0.0002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 546220)											
VA22B4424-011	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0442	0.0447	1.18%	20%	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00014	0.00014	0.000002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00032	0.00028	0.00004	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00375	0.00377	0.622%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000102	0.0000113	0.0000011	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	21.3	21.3	0.342%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00140	0.00153	0.00013	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	0.034	0.036	0.001	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	2.81	2.84	0.993%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00132	0.00130	1.93%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000371	0.000383	0.000011	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00052	0.00054	0.00002	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.158	0.164	0.006	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000151	0.000180	0.000029	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.99	3.98	0.450%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.04	1.06	1.63%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.108	0.108	0.236%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00062	0.00070	0.00008	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000028	0.000028	0.0000009	Diff <2x LOR	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 538163)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 538164)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 538304)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 543611)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 543633)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 545195)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 545680)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 538165)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 538166)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 538168)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 538169)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 538170)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 538171)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 553522)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 553523)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 553524)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 553525)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic / Inorganic Carbon (QCLot: 553520)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 545623)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 546220)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 546220) - continued						
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Plant Pigments (QCLot: 538063)						
chlorophyll a	479-61-8	E870	0.01	µg/L	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 538162)									
pH	----	E108	----	pH units	7 pH units	99.8	98.0	102	----
Physical Tests (QCLot: 538163)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	99.9	85.0	115	----
Physical Tests (QCLot: 538164)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	106	90.0	110	----
Physical Tests (QCLot: 538304)									
turbidity	----	E121	0.1	NTU	200 NTU	99.5	85.0	115	----
Physical Tests (QCLot: 543611)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	98.8	85.0	115	----
Physical Tests (QCLot: 543633)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	103	85.0	115	----
Physical Tests (QCLot: 545195)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	108	85.0	115	----
Physical Tests (QCLot: 545680)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	105	85.0	115	----
Anions and Nutrients (QCLot: 538165)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	96.3	90.0	110	----
Anions and Nutrients (QCLot: 538166)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	97.2	90.0	110	----
Anions and Nutrients (QCLot: 538168)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	99.4	90.0	110	----
Anions and Nutrients (QCLot: 538169)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.0	90.0	110	----
Anions and Nutrients (QCLot: 538170)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.4	90.0	110	----
Anions and Nutrients (QCLot: 538171)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	97.4	80.0	120	----
Anions and Nutrients (QCLot: 553522)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	99.0	80.0	120	----
Anions and Nutrients (QCLot: 553523)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	98.3	80.0	120	----
Anions and Nutrients (QCLot: 553524)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 553524) - continued									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 553525)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	102	85.0	115	----
Organic / Inorganic Carbon (QCLot: 553520)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.8	80.0	120	----
Total Metals (QCLot: 545623)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	103	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	106	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	97.2	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	95.5	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	97.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	98.3	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	98.2	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	96.3	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	98.2	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	103	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	99.2	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	98.4	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	98.5	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	97.9	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	98.1	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	105	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	110	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	105	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	99.5	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	95.7	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	107	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	100	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 545623) - continued									
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	96.6	80.0	120	----
Dissolved Metals (QCLot: 546220)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	103	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	102	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	103	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	106	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.2	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	103	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.2	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	105	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.5	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.9	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	98.2	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	107	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	98.2	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	104	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	97.4	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.3	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	97.2	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	102	80.0	120	----
Plant Pigments (QCLot: 538063)									
chlorophyll a	479-61-8	E870	0.01	µg/L	5 µg/L	99.5	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 538165)										
VA22B4270-001	Anonymous	fluoride	16984-48-8	E235.F	16.6 mg/L	20 mg/L	82.9	75.0	125	----
Anions and Nutrients (QCLot: 538166)										
VA22B4270-001	Anonymous	chloride	16887-00-6	E235.Cl	1880 mg/L	2000 mg/L	94.1	75.0	125	----
Anions and Nutrients (QCLot: 538168)										
VA22B4270-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	47.8 mg/L	50 mg/L	95.6	75.0	125	----
Anions and Nutrients (QCLot: 538169)										
VA22B4270-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	9.37 mg/L	10 mg/L	93.7	75.0	125	----
Anions and Nutrients (QCLot: 538170)										
VA22B4270-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1870 mg/L	2000 mg/L	93.6	75.0	125	----
Anions and Nutrients (QCLot: 538171)										
VA22B4270-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	1.70 mg/L	1.5 mg/L	113	70.0	130	----
Anions and Nutrients (QCLot: 553522)										
VA22B4435-002	QUL-ZOO-7_WS_DI-1_2022-06	phosphorus, total	7723-14-0	E372-U	0.0520 mg/L	0.05 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 553523)										
VA22B4435-002	QUL-ZOO-7_WS_DI-1_2022-06	phosphorus, total dissolved	7723-14-0	E375-T	0.0513 mg/L	0.05 mg/L	102	70.0	130	----
Anions and Nutrients (QCLot: 553524)										
VA22B4435-002	QUL-ZOO-7_WS_DI-1_2022-06	nitrogen, total	7727-37-9	E366	0.356 mg/L	0.4 mg/L	89.1	70.0	130	----
Anions and Nutrients (QCLot: 553525)										
VA22B4435-002	QUL-ZOO-7_WS_DI-1_2022-06	ammonia, total (as N)	7664-41-7	E298	0.0966 mg/L	0.1 mg/L	96.6	75.0	125	----
Organic / Inorganic Carbon (QCLot: 553520)										
VA22B4435-002	QUL-ZOO-7_WS_DI-1_2022-06	carbon, dissolved organic [DOC]	----	E358-L	5.07 mg/L	5 mg/L	101	70.0	130	----
Total Metals (QCLot: 545623)										
VA22B4433-002	Anonymous	aluminum, total	7429-90-5	E420	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		antimony, total	7440-36-0	E420	0.0196 mg/L	0.02 mg/L	98.3	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0195 mg/L	0.02 mg/L	97.6	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0369 mg/L	0.04 mg/L	92.4	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 545623) - continued										
VA22B4433-002	Anonymous	bismuth, total	7440-69-9	E420	0.0101 mg/L	0.01 mg/L	101	70.0	130	----
		boron, total	7440-42-8	E420	ND mg/L	0.1 mg/L	ND	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00393 mg/L	0.004 mg/L	98.2	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0390 mg/L	0.04 mg/L	97.6	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0192 mg/L	0.02 mg/L	95.9	70.0	130	----
		copper, total	7440-50-8	E420	0.0187 mg/L	0.02 mg/L	93.5	70.0	130	----
		iron, total	7439-89-6	E420	1.85 mg/L	2 mg/L	92.4	70.0	130	----
		lead, total	7439-92-1	E420	0.0195 mg/L	0.02 mg/L	97.6	70.0	130	----
		lithium, total	7439-93-2	E420	0.0919 mg/L	0.1 mg/L	91.9	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		nickel, total	7440-02-0	E420	0.0390 mg/L	0.04 mg/L	97.6	70.0	130	----
		potassium, total	7440-09-7	E420	3.83 mg/L	4 mg/L	95.7	70.0	130	----
		selenium, total	7782-49-2	E420	0.0390 mg/L	0.04 mg/L	97.4	70.0	130	----
		silicon, total	7440-21-3	E420	8.71 mg/L	10 mg/L	87.1	70.0	130	----
		silver, total	7440-22-4	E420	0.00372 mg/L	0.004 mg/L	93.0	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00378 mg/L	0.004 mg/L	94.6	70.0	130	----
		tin, total	7440-31-5	E420	0.0194 mg/L	0.02 mg/L	97.1	70.0	130	----
		titanium, total	7440-32-6	E420	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.00399 mg/L	0.004 mg/L	99.7	70.0	130	----
		vanadium, total	7440-62-2	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		zinc, total	7440-66-6	E420	0.380 mg/L	0.4 mg/L	95.0	70.0	130	----
Dissolved Metals (QCLot: 546220)										
VA22B4424-012	Anonymous	aluminum, dissolved	7429-90-5	E421	0.194 mg/L	0.2 mg/L	97.1	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0198 mg/L	0.02 mg/L	99.2	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0200 mg/L	0.02 mg/L	100.0	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.0200 mg/L	0.02 mg/L	99.8	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0426 mg/L	0.04 mg/L	107	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00900 mg/L	0.01 mg/L	90.0	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.098 mg/L	0.1 mg/L	98.1	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00402 mg/L	0.004 mg/L	101	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 546220) - continued										
VA22B4424-012	Anonymous	chromium, dissolved	7440-47-3	E421	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0195 mg/L	0.02 mg/L	97.7	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0193 mg/L	0.02 mg/L	96.6	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.90 mg/L	2 mg/L	95.0	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0192 mg/L	0.02 mg/L	95.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.107 mg/L	0.1 mg/L	107	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0190 mg/L	0.02 mg/L	94.9	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0382 mg/L	0.04 mg/L	95.5	70.0	130	----
		potassium, dissolved	7440-09-7	E421	3.95 mg/L	4 mg/L	98.6	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0405 mg/L	0.04 mg/L	101	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.32 mg/L	10 mg/L	93.2	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00391 mg/L	0.004 mg/L	97.8	70.0	130	----
		sodium, dissolved	7440-23-5	E421	1.98 mg/L	2 mg/L	98.9	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00382 mg/L	0.004 mg/L	95.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0193 mg/L	0.02 mg/L	96.5	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00378 mg/L	0.004 mg/L	94.6	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.0990 mg/L	0.1 mg/L	99.0	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.411 mg/L	0.4 mg/L	103	70.0	130	----

ALS Environmental

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 1

COC # K0499

Page 1 of

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com; pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-006	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)	Chlorophyll-a (F&P)	Number of Containers
	~~BGL-D2_WS_DI-1_2022-06~~	~~-Jun-22~~		Water	R	R	R	R	R	R		6
	~~PGL-P2-WS_DI-1_2022-06~~	~~-Jun-22~~		Water	R	R	R	R	R	R		6
	QUL-ZOO-1_WS_DI-1_2022-06	22 -Jun-22	11:00	Water	R	R	R	R	R	R	R	7
	QUL-ZOO-7_WS_DI-1_2022-06	22 -Jun-22	09:55	Water	R	R	R	R	R	R	R	7
	Qul-Zoo-1_WS_DI-1X_2022-06	22 -Jun-22	11:00	Water	R	R	R	R	R	R	R	7

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Pls filter and freeze Chl-a but HOLD for analysis.

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☑ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	6.0 3.0

(client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
						June 24 2022	11:20 am

Environmental Division Vancouver
Work Order Reference
VA22B4435

Telephone : +1 604 253 4188

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Service Requested: (rush - subject to availability)

- (●) Regular (Default)
- ( ) Priority (2-3 Business Days) - 50% Surcharge
- ( ) Emergency (1 Business Day) - 100% Surcharge
- ( ) For Emergency < 1 Day, ASAP or Weekend - Contact ALS

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample Type	Nutrients-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	TN/NH3	DOC	TSS (Whole bottle)	Hardness	TN / NH3	Dissolved metals	Total Metals
			F	P	F/P				F/P	P
Water	X	X	X	X	X	X				
Water	X	X	X	X	X	X				

Fax

is Details

lease fill in this form LEGIBLY.
s specified on the back page of the white - report copy.

SHIPMENT VERIFICATION (lab use only)			
emperature:	Verified by:	Date & Time:	Observations Yes / No ? If Yes attach
6.3°		June 24/22 11:20 am	

PINK - FILE COPY, YELLOW - CLIENT COPY GENF 18.00 Fr

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-006	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)		Chlorophyll-a (F&P)						Number of Containers
	~~BOL-D2_WS_DI-1_2022-06~~	~~-Jun-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~								~~8~~
	~~POL-P2_WS_DI-1_2022-06~~	~~-Jun-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~								~~8~~
	QUL-ZOO-1_WS_DI-1_2022-06	22 -Jun-22	11:00	Water	R	R	R	R	R	R		R						7
	QUL-ZOO-7_WS_DI-1_2022-06	22 -Jun-22	09:55	Water	R	R	R	R	R	R		R						7
	QUL-ZOO-1_WS_DI-1X_2022-06	22 -Jun-22	11:00	Water	R	R	R	R	R	R		R						7

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Pls filter and freeze Chl-a but HOLD for analysis.

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6°	3°	

(client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
						June 24 2022	1120 am

Environmental Division Vancouver
Work Order Reference
VA22B4435

Telephone : +1 604 253 4188

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WATER CHEMISTRY

ALS Laboratory Report KS2202711

(Finalized August 11, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **KS2202711**	Page	: 1 of 5
Client	: **Mount Polley Mining Corporation**	Laboratory	: Kamloops - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 1445 McGill Road, Unit 2B Kamloops BC Canada V2C 6K7
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 250 372 3588
Project	: ----	Date Samples Received	: 27-Jul-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 28-Jul-2022
C-O-C number	: COC Number Provided	Issue Date	: 11-Aug-2022 09:00
Sampler	: Minnow		
Site	: ----		
Quote number	: Q77258 - WQ Analysis		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DTMF	*Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-07	POL-P2_WS_DI-1_2022-07	POL-P2_WS_DI-1X_2022-07	FIELD_WS-1_2022-07	TRAVEL_WS-1_2022-07
					Client sampling date / time	26-Jul-2022 08:45	25-Jul-2022 11:56	25-Jul-2022 11:56	26-Jul-2022 09:00	25-Jul-2022
						KS2202711-001	KS2202711-002	KS2202711-003	KS2202711-004	KS2202711-005
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		41.8	91.7	92.3	<1.0	<1.0
conductivity	----	E100	2.0	µS/cm		95.8	239	241	<2.0	<2.0
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		41.8	106	106	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		41.0	105	103	<0.50	<0.50
pH	----	E108	0.10	pH units		7.80	8.20	8.20	5.74	5.61
solids, total dissolved [TDS]	----	E162	10	mg/L		91	169	181	<10	<10
solids, total suspended [TSS]	----	E164	1.0	mg/L		2.0	1.3	1.4	<1.0	<1.1
turbidity	----	E121	0.10	NTU		0.81	0.59	0.52	<0.10	<0.10
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0052	0.0085	0.0054	<0.0050	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L		0.56	0.80	0.81	<0.50	<0.50
fluoride	16984-48-8	E235.F	0.020	mg/L		0.048	0.062	0.058	<0.020	<0.020
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.287	0.324	0.296	<0.030	<0.030
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	0.0037	0.0044	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0120	0.0145	0.0155	<0.0020	<0.0020
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0053	0.0126	0.0121	<0.0020	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		6.98	34.1	34.2	<0.30	<0.30
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		7.85	6.56	6.54	<0.50	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0354	0.0242	0.0146	<0.0030	<0.0030
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00036	0.00051	0.00051	<0.00010	<0.00010
barium, total	7440-39-3	E420	0.00010	mg/L		0.0167	0.0103	0.0101	<0.00010	<0.00010
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		0.046	0.021	0.021	<0.010	<0.010
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000222	0.0000379	0.0000872	<0.0000050	<0.0000050

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-07	POL-P2_WS_DI-1_2022-07	POL-P2_WS_DI-1X_2022-07	FIELD_WS-1_2022-07	TRAVEL_WS-1_2022-07
					Client sampling date / time	26-Jul-2022 08:45	25-Jul-2022 11:56	25-Jul-2022 11:56	26-Jul-2022 09:00	25-Jul-2022
						KS2202711-001	KS2202711-002	KS2202711-003	KS2202711-004	KS2202711-005
						Result	Result	Result	Result	Result
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		12.4	33.6	33.2	<0.050	<0.050
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00342	0.00543	0.00497	<0.00050	<0.00050
iron, total	7439-89-6	E420	0.030	mg/L		0.050	<0.030	<0.030	<0.030	<0.030
lead, total	7439-92-1	E420	0.000050	mg/L		0.000097	0.000117	0.000128	<0.000050	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		2.43	5.03	5.00	<0.100	<0.100
manganese, total	7439-96-5	E420	0.00010	mg/L		0.0212	0.00462	0.00404	<0.00010	<0.00010
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000824	0.00666	0.00654	<0.000050	<0.000050
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L		0.496	1.11	1.10	<0.050	<0.050
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000253	0.000565	0.000675	<0.000050	<0.000050
silicon, total	7440-21-3	E420	0.10	mg/L		1.89	3.11	3.10	<0.10	<0.10
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		2.45	7.27	7.46	<0.050	<0.050
strontium, total	7440-24-6	E420	0.00020	mg/L		0.127	0.242	0.235	<0.00020	<0.00020
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000039	0.000197	0.000192	<0.000010	<0.000010
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	0.00132	0.00129	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0069	0.0040	0.0049	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00028	0.00047	0.00042	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.0142	0.00946	0.00876	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.041	0.020	0.019	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000142	0.0000653 DTMF	0.0000504	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_WS_DI-1_2022-07	POL-P2_WS_DI-1_2022-07	POL-P2_WS_DI-1X_2022-07	FIELD_WS-1_2022-07	TRAVEL_WS-1_2022-07
					Client sampling date / time	26-Jul-2022 08:45	25-Jul-2022 11:56	25-Jul-2022 11:56	26-Jul-2022 09:00	25-Jul-2022
						KS2202711-001	KS2202711-002	KS2202711-003	KS2202711-004	KS2202711-005
						Result	Result	Result	Result	Result
Dissolved Metals										
calcium, dissolved	7440-70-2	E421	0.050	mg/L		12.9	34.2	34.9	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00232	0.00436	0.00419	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.33	4.90	4.56	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00279	0.00184	0.00194	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000794	0.00617	0.00634	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00050	0.00062	0.00059	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.495	1.05	0.995	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000180	0.000461	0.000476	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.83	3.10	2.94	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		2.38	7.71	7.42	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.136	0.252	0.256	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000037	0.000196	0.000196	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	0.00132	0.00122	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	----	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **KS2202711**	Page	: 1 of 18
Client	: **Mount Polley Mining Corporation**	Laboratory	: Kamloops - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 1445 McGill Road, Unit 2B Kamloops, British Columbia Canada V2C 6K7
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 250 372 3588
Project	: ----	Date Samples Received	: 27-Jul-2022 11:00
PO	: 5590008044 Q2 2022	Issue Date	: 11-Aug-2022 09:01
C-O-C number	: COC Number Provided		
Sampler	: Minnow		
Site	: ----		
Quote number	: Q77258 - WQ Analysis		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-07	E298	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
FIELD_WS-1_2022-07	E298	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-07	E298	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1X_2022-07	E298	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
TRAVEL_WS-1_2022-07	E298	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-B2_WS_DI-1_2022-07	E235.Cl	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
FIELD_WS-1_2022-07	E235.Cl	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE POL-P2_WS_DI-1_2022-07	E235.Cl	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE POL-P2_WS_DI-1X_2022-07	E235.Cl	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE TRAVEL_WS-1_2022-07	E235.Cl	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-B2_WS_DI-1_2022-07	E378-U	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE FIELD_WS-1_2022-07	E378-U	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-P2_WS_DI-1_2022-07	E378-U	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-P2_WS_DI-1X_2022-07	E378-U	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE TRAVEL_WS-1_2022-07	E378-U	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE BOL-B2_WS_DI-1_2022-07	E235.F	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE FIELD_WS-1_2022-07	E235.F	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE POL-P2_WS_DI-1_2022-07	E235.F	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE POL-P2_WS_DI-1X_2022-07	E235.F	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE TRAVEL_WS-1_2022-07	E235.F	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE BOL-B2_WS_DI-1_2022-07	E235.NO3-L	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE FIELD_WS-1_2022-07	E235.NO3-L	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-P2_WS_DI-1_2022-07	E235.NO3-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-P2_WS_DI-1X_2022-07	E235.NO3-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
TRAVEL_WS-1_2022-07	E235.NO3-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-B2_WS_DI-1_2022-07	E235.NO2-L	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
FIELD_WS-1_2022-07	E235.NO2-L	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1_2022-07	E235.NO2-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1X_2022-07	E235.NO2-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
TRAVEL_WS-1_2022-07	E235.NO2-L	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-B2_WS_DI-1_2022-07	E235.SO4	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
FIELD_WS-1_2022-07	E235.SO4	26-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-07	E235.SO4	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-P2_WS_DI-1X_2022-07	E235.SO4	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
TRAVEL_WS-1_2022-07	E235.SO4	25-Jul-2022	28-Jul-2022	----	----		28-Jul-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
BOL-B2_WS_DI-1_2022-07	E375-T	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
FIELD_WS-1_2022-07	E375-T	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-P2_WS_DI-1_2022-07	E375-T	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-P2_WS_DI-1X_2022-07	E375-T	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-07	E366	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
FIELD_WS-1_2022-07	E366	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-07	E366	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1X_2022-07	E366	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
TRAVEL_WS-1_2022-07	E366	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-07	E372-U	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
FIELD_WS-1_2022-07	E372-U	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-07	E372-U	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1X_2022-07	E372-U	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
TRAVEL_WS-1_2022-07	E372-U	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-P2_WS_DI-1_2022-07	E421	25-Jul-2022	01-Aug-2022	----	----		04-Aug-2022	180 days	10 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-P2_WS_DI-1X_2022-07	E421	25-Jul-2022	01-Aug-2022	----	----		04-Aug-2022	180 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) BOL-B2_WS_DI-1_2022-07	E421	26-Jul-2022	01-Aug-2022	----	----		04-Aug-2022	180 days	9 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-B2_WS_DI-1_2022-07	E358-L	26-Jul-2022	30-Jul-2022	----	----		02-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) FIELD_WS-1_2022-07	E358-L	26-Jul-2022	30-Jul-2022	----	----		02-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-P2_WS_DI-1_2022-07	E358-L	25-Jul-2022	30-Jul-2022	----	----		02-Aug-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-P2_WS_DI-1X_2022-07	E358-L	25-Jul-2022	30-Jul-2022	----	----		02-Aug-2022	28 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-B2_WS_DI-1_2022-07	E290	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE FIELD_WS-1_2022-07	E290	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-P2_WS_DI-1_2022-07	E290	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-P2_WS_DI-1X_2022-07	E290	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	14 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE TRAVEL_WS-1_2022-07	E290	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	14 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE BOL-B2_WS_DI-1_2022-07	E100	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE FIELD_WS-1_2022-07	E100	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE POL-P2_WS_DI-1_2022-07	E100	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE POL-P2_WS_DI-1X_2022-07	E100	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE TRAVEL_WS-1_2022-07	E100	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	28 days	4 days	✓
Physical Tests : pH by Meter										
HDPE BOL-B2_WS_DI-1_2022-07	E108	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	0.25 hrs	69 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE FIELD_WS-1_2022-07	E108	26-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	0.25 hrs	69 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE TRAVEL_WS-1_2022-07	E108	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	0.25 hrs	87 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE POL-P2_WS_DI-1_2022-07	E108	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	0.25 hrs	90 hrs	✖ EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-P2_WS_DI-1X_2022-07	E108	25-Jul-2022	28-Jul-2022	----	----		29-Jul-2022	0.25 hrs	90 hrs	✖ EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE BOL-B2_WS_DI-1_2022-07	E162	26-Jul-2022	----	----	----		30-Jul-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE FIELD_WS-1_2022-07	E162	26-Jul-2022	----	----	----		30-Jul-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-P2_WS_DI-1_2022-07	E162	25-Jul-2022	----	----	----		29-Jul-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-P2_WS_DI-1X_2022-07	E162	25-Jul-2022	----	----	----		29-Jul-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE TRAVEL_WS-1_2022-07	E162	25-Jul-2022	----	----	----		30-Jul-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-P2_WS_DI-1_2022-07	E164	25-Jul-2022	----	----	----		29-Jul-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-P2_WS_DI-1X_2022-07	E164	25-Jul-2022	----	----	----		29-Jul-2022	7 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] TRAVEL_WS-1_2022-07	E164	25-Jul-2022	----	----	----		29-Jul-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-B2_WS_DI-1_2022-07	E164	26-Jul-2022	----	----	----		02-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] FIELD_WS-1_2022-07	E164	26-Jul-2022	----	----	----		02-Aug-2022	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-B2_WS_DI-1_2022-07	E121	26-Jul-2022	----	----	----		28-Jul-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE FIELD_WS-1_2022-07	E121	26-Jul-2022	----	----	----		28-Jul-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-P2_WS_DI-1_2022-07	E121	25-Jul-2022	----	----	----		28-Jul-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-P2_WS_DI-1X_2022-07	E121	25-Jul-2022	----	----	----		28-Jul-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE TRAVEL_WS-1_2022-07	E121	25-Jul-2022	----	----	----		28-Jul-2022	3 days	3 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-B2_WS_DI-1_2022-07	E420	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	180 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
FIELD_WS-1_2022-07	E420	26-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	180 days	8 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-P2_WS_DI-1_2022-07	E420	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-P2_WS_DI-1X_2022-07	E420	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
TRAVEL_WS-1_2022-07	E420	25-Jul-2022	30-Jul-2022	----	----		03-Aug-2022	180 days	9 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	581670	1	16	6.2	5.0	✓
Ammonia by Fluorescence	E298	584151	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	581665	1	17	5.8	5.0	✓
Conductivity in Water	E100	581672	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	584057	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	584152	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	581674	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	581664	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	581662	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	581663	1	19	5.2	5.0	✓
pH by Meter	E108	581671	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	581666	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	583440	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	584155	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	583612	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	584153	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	584154	1	9	11.1	5.0	✓
Turbidity by Nephelometry	E121	581565	2	30	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	581670	1	16	6.2	5.0	✓
Ammonia by Fluorescence	E298	584151	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	581665	1	17	5.8	5.0	✓
Conductivity in Water	E100	581672	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	584057	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	584152	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	581674	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	581664	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	581662	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	581663	1	19	5.2	5.0	✓
pH by Meter	E108	581671	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	581666	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	583440	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	584155	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	583612	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	584153	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	584154	1	9	11.1	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	583456	2	27	7.4	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Turbidity by Nephelometry	E121	581565	2	30	6.6	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	581670	1	16	6.2	5.0	✓
Ammonia by Fluorescence	E298	584151	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	581665	1	17	5.8	5.0	✓
Conductivity in Water	E100	581672	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	584057	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	584152	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	581674	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	581664	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	581662	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	581663	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	581666	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	583440	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	584155	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	583612	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	584153	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	584154	1	9	11.1	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	583456	2	27	7.4	5.0	✓
Turbidity by Nephelometry	E121	581565	2	30	6.6	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	584151	1	16	6.2	5.0	✓
Chloride in Water by IC	E235.Cl	581665	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	584057	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	584152	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	581674	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	581664	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	581662	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	581663	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	581666	1	16	6.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	584155	1	8	12.5	5.0	✓
Total Metals in Water by CRC ICPMS	E420	583612	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	584153	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	584154	1	9	11.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

QUALITY CONTROL REPORT

Work Order	: **KS2202711**	Page	: 1 of 15
Client	: Mount Polley Mining Corporation	Laboratory	: Kamloops - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 1445 McGill Road, Unit 2B Kamloops, British Columbia Canada V2C 6K7
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 250 372 3588
Project	: ----	Date Samples Received	: 27-Jul-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 28-Jul-2022
C-O-C number	: COC Number Provided	Issue Date	: 11-Aug-2022 09:01
Sampler	: Minnow		
Site	: ----		
Quote number	: Q77258 - WQ Analysis		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Vancouver Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 581565)											
FJ2201981-009	Anonymous	turbidity	----	E121	0.10	NTU	0.75	0.69	0.06	Diff <2x LOR	----
Physical Tests (QC Lot: 581621)											
KS2202711-001	BOL-B2_WS_DI-1_2022-07	turbidity	----	E121	0.10	NTU	0.81	0.76	0.04	Diff <2x LOR	----
Physical Tests (QC Lot: 581670)											
KS2202706-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	244	244	0.123%	20%	----
Physical Tests (QC Lot: 581671)											
KS2202706-001	Anonymous	pH	----	E108	0.10	pH units	8.37	8.37	0.00%	4%	----
Physical Tests (QC Lot: 581672)											
KS2202706-001	Anonymous	conductivity	----	E100	2.0	µS/cm	477	477	0.00%	10%	----
Physical Tests (QC Lot: 583440)											
KS2202662-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	204	206	0.978%	20%	----
Physical Tests (QC Lot: 584049)											
KS2202706-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	306	310	1.14%	20%	----
Anions and Nutrients (QC Lot: 581662)											
KS2202700-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	0.127	0.128	0.0008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 581663)											
KS2202700-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 581664)											
KS2202700-001	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 581665)											
KS2202700-001	Anonymous	chloride	16887-00-6	E235.Cl	2.50	mg/L	32.8	33.0	0.839%	20%	----
Anions and Nutrients (QC Lot: 581666)											
KS2202700-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	28.0	28.6	1.74%	20%	----
Anions and Nutrients (QC Lot: 581674)											
KS2202703-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0105	0.0106	0.983%	20%	----
Anions and Nutrients (QC Lot: 584151)											
KS2202710-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0314	0.0308	0.0007	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 584153)											
KS2202710-001	Anonymous	nitrogen, total	7727-37-9	E366	0.150	mg/L	4.76	4.71	1.07%	20%	----
Anions and Nutrients (QC Lot: 584154)											
KS2202710-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0087	0.0080	0.0007	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 584155)											
KS2202710-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0026	0.0026	0.0001	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 584152)											
KS2202710-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.46	2.50	0.04	Diff <2x LOR	----
Total Metals (QC Lot: 583612)											
KS2202711-001	BOL-B2_WS_DI-1_2022-07	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0354	0.0367	3.75%	20%	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00036	0.00036	0.000007	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0167	0.0169	1.03%	20%	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.046	0.047	0.0006	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000222	0.0000214	0.0000008	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	12.4	12.8	3.22%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00342	0.00317	0.00025	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.030	mg/L	0.050	0.051	0.0006	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000097	0.000101	0.000004	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.100	mg/L	2.43	2.49	2.33%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.0212	0.0214	1.01%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000824	0.000802	2.60%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.496	0.506	1.96%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000253	0.000189	0.000064	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.89	1.95	2.99%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	2.45	2.56	4.48%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.127	0.126	0.670%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000039	0.000038	0.0000004	Diff <2x LOR	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 584057)											
KS2202708-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00602	0.00555	8.13%	20%	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0179	0.0164	8.86%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.059	0.058	0.001	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	194	190	2.20%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00066	0.00064	0.00002	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.030	mg/L	1.01	0.976	3.71%	20%	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0070	0.0069	0.0001	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.100	mg/L	25.5	23.3	9.12%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	1.98	1.90	4.30%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00771	0.00743	3.69%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00050	<0.00050	0.000002	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.899	0.833	7.59%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	11.6	11.1	4.17%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	7.52	7.35	2.22%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.534	0.521	2.32%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000646	0.000622	3.68%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0030	mg/L	0.0154	0.0151	0.0004	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 581565)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 581621)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 581670)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 581672)						
conductivity	----	E100	1	µS/cm	1.4	----
Physical Tests (QCLot: 583440)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 583456)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 584049)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 585196)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 581662)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 581663)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 581664)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 581665)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 581666)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 581674)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 584151)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 584153)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 584154)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 584155)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 584152)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 583612)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	MBRR
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	MBRR
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 584057)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 584057) - continued						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Qualifiers

Qualifier	Description
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 581565)									
turbidity	----	E121	0.1	NTU	200 NTU	101	85.0	115	----
Physical Tests (QCLot: 581621)									
turbidity	----	E121	0.1	NTU	200 NTU	101	85.0	115	----
Physical Tests (QCLot: 581670)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	110	85.0	115	----
Physical Tests (QCLot: 581671)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 581672)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	97.1	90.0	110	----
Physical Tests (QCLot: 583440)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	106	85.0	115	----
Physical Tests (QCLot: 583456)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	99.3	85.0	115	----
Physical Tests (QCLot: 584049)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	101	85.0	115	----
Physical Tests (QCLot: 585196)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	93.0	85.0	115	----
Anions and Nutrients (QCLot: 581662)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 581663)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.1	90.0	110	----
Anions and Nutrients (QCLot: 581664)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	99.2	90.0	110	----
Anions and Nutrients (QCLot: 581665)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 581666)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 581674)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	97.3	80.0	120	----
Anions and Nutrients (QCLot: 584151)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 584153)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 584153) - continued									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 584154)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	95.4	80.0	120	----
Anions and Nutrients (QCLot: 584155)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	92.3	80.0	120	----
Organic / Inorganic Carbon (QCLot: 584152)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.7	80.0	120	----
Total Metals (QCLot: 583612)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	112	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	110	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	107	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	111	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	107	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	106	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	99.2	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	108	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	105	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	103	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	105	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	108	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	105	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	110	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	110	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	114	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	102	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	98.7	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	114	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	108	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	105	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	105	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 583612) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	103	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	110	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	108	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	104	80.0	120	----
Dissolved Metals (QCLot: 584057)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	106	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	111	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	105	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	101	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	112	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	96.1	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	101	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	95.2	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	96.7	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	101	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	112	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.3	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	104	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	100	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	107	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	116	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	107	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	104	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	107	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	107	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	108	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 581662)										
KS2202701-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.52 mg/L	2.5 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 581663)										
KS2202701-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.476 mg/L	0.5 mg/L	95.2	75.0	125	----
Anions and Nutrients (QCLot: 581664)										
KS2202701-001	Anonymous	fluoride	16984-48-8	E235.F	0.994 mg/L	1 mg/L	99.4	75.0	125	----
Anions and Nutrients (QCLot: 581665)										
KS2202701-001	Anonymous	chloride	16887-00-6	E235.Cl	99.5 mg/L	100 mg/L	99.5	75.0	125	----
Anions and Nutrients (QCLot: 581666)										
KS2202701-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	100 mg/L	100 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 581674)										
KS2202711-001	BOL-B2_WS_DI-1_2022-07	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0310 mg/L	0.03 mg/L	103	70.0	130	----
Anions and Nutrients (QCLot: 584151)										
KS2202710-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.101 mg/L	0.1 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 584153)										
KS2202710-002	Anonymous	nitrogen, total	7727-37-9	E366	ND mg/L	10 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 584154)										
KS2202710-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.104 mg/L	0.1 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 584155)										
KS2202710-002	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0485 mg/L	0.05 mg/L	97.0	70.0	130	----
Organic / Inorganic Carbon (QCLot: 584152)										
KS2202710-002	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.31 mg/L	5 mg/L	106	70.0	130	----
Total Metals (QCLot: 583612)										
KS2202711-002	POL-P2_WS_DI-1_2022-07	aluminum, total	7429-90-5	E420	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		antimony, total	7440-36-0	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0195 mg/L	0.02 mg/L	97.4	70.0	130	----
		barium, total	7440-39-3	E420	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0411 mg/L	0.04 mg/L	103	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00999 mg/L	0.01 mg/L	99.9	70.0	130	----
		boron, total	7440-42-8	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 583612) - continued										
KS2202711-002	POL-P2_WS_DI-1_2022-07	cadmium, total	7440-43-9	E420	0.00394 mg/L	0.004 mg/L	98.5	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0397 mg/L	0.04 mg/L	99.2	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0196 mg/L	0.02 mg/L	98.0	70.0	130	----
		copper, total	7440-50-8	E420	0.0187 mg/L	0.02 mg/L	93.7	70.0	130	----
		iron, total	7439-89-6	E420	1.91 mg/L	2 mg/L	95.5	70.0	130	----
		lead, total	7439-92-1	E420	0.0195 mg/L	0.02 mg/L	97.5	70.0	130	----
		lithium, total	7439-93-2	E420	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0198 mg/L	0.02 mg/L	98.9	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0204 mg/L	0.02 mg/L	102	70.0	130	----
		nickel, total	7440-02-0	E420	0.0381 mg/L	0.04 mg/L	95.3	70.0	130	----
		potassium, total	7440-09-7	E420	4.14 mg/L	4 mg/L	103	70.0	130	----
		selenium, total	7782-49-2	E420	0.0395 mg/L	0.04 mg/L	98.9	70.0	130	----
		silicon, total	7440-21-3	E420	9.41 mg/L	10 mg/L	94.1	70.0	130	----
		silver, total	7440-22-4	E420	0.00393 mg/L	0.004 mg/L	98.2	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00384 mg/L	0.004 mg/L	96.1	70.0	130	----
		tin, total	7440-31-5	E420	0.0197 mg/L	0.02 mg/L	98.4	70.0	130	----
		titanium, total	7440-32-6	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		uranium, total	7440-61-1	E420	0.00402 mg/L	0.004 mg/L	100	70.0	130	----
		vanadium, total	7440-62-2	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		zinc, total	7440-66-6	E420	0.371 mg/L	0.4 mg/L	92.9	70.0	130	----
Dissolved Metals (QCLot: 584057)										
KS2202708-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.217 mg/L	0.2 mg/L	108	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0223 mg/L	0.02 mg/L	111	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0216 mg/L	0.02 mg/L	108	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0412 mg/L	0.04 mg/L	103	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0105 mg/L	0.01 mg/L	105	70.0	130	----
		boron, dissolved	7440-42-8	E421	ND mg/L	0.1 mg/L	ND	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00416 mg/L	0.004 mg/L	104	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0414 mg/L	0.04 mg/L	104	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0204 mg/L	0.02 mg/L	102	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 584057) - continued										
KS2202708-002	Anonymous	copper, dissolved	7440-50-8	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		iron, dissolved	7439-89-6	E421	2.04 mg/L	2 mg/L	102	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0990 mg/L	0.1 mg/L	99.0	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0396 mg/L	0.04 mg/L	99.1	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.03 mg/L	4 mg/L	101	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0417 mg/L	0.04 mg/L	104	70.0	130	----
		silicon, dissolved	7440-21-3	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00435 mg/L	0.004 mg/L	109	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00415 mg/L	0.004 mg/L	104	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0437 mg/L	0.04 mg/L	109	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00447 mg/L	0.004 mg/L	112	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.428 mg/L	0.4 mg/L	107	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here
(lab use only)

COC Number:

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level sel

Analysis Reque

Indicate Filtered (F), Preserved (P) or Filtered and Pres

Project Information

ALS Account # / Quote #: VA22-MPMC100-006
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang | Sampler: Minnow

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)	Hardness (F)	TN/NH3 (F/P)	
1	BOL-B2_WS_DI-1_2022-07	26-July-22	08:45	Water	R	R	R	R	R	R			6
2	POL-P2_WS_DI-1_2022-07	25-July-22	11:56	Water	R	R	R	R	R	R			6
3	POL-P2_WS_DI-1X_2022-07	25-July-22	11:56	Water	R	R	R	R	R	R			6
4	FIELD_WS-1_2022-07	26-July-22	09:00	Water	R	R		R	R	R	R		5
5	TRAVEL_WS-1_2022-07	25-Jul-22	—	Water	R	R		F		R	R	R	4

Environmental Division
Kamloops
Work Order Reference
KS2202711

Telephone : +1 250 372 3588

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
10					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date: JUL 27 2022	Time: 1500	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3	pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-006
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: Minnow

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level sel

Analysis Reque

Indicate Filtered (F), Preserved (P) or Filtered and Pres

Environmental Division Kamloops

Work Order Reference

KS2202711

Telephone : +1 250 372 3588

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)	Hardness	TN/NH3					
							F	P	F/P								
1	BOL-B2_WS_DI-1_2022-07	26-July-22	08:45	Water	R	R	R	R	R	R							6
2	POL-P2_WS_DI-1_2022-07	25-July-22	11:56	Water	R	R	R	R	R	R							6
3	POL-P2_WS_DI-1X_2022-07	25-July-22	11:56	Water	R	R	R	R	R	R							6
4	FIELD_WS-1_2022-07	26-July-22	09:00	Water	R	R		R	R	R	R						5
5	TRAVEL_WS-1_2022-07	25-Jul-22	—	Water	R	R		R		R	R	R	F. H				4

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
10	8°C (avg 4)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
				JUL 27 2022	1100	JC ice cube	JUL 28 2022	925am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WATER CHEMISTRY

ALS Laboratory Report VA22B7687

(Finalized August 11, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B7687**	Page	: 1 of 5
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Mr. Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 ext 2171	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 11:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 03-Aug-2022
C-O-C number	: ----	Issue Date	: 11-Aug-2022 14:19
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Ann Joby	Lab Assistant	Metals, Burnaby, British Columbia
David Stewart	Analyst - Chemistry	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-07	QUL-ZOO-7_WS_DI-1_2022-07	----	----	----
					Client sampling date / time	27-Jul-2022 13:40	27-Jul-2022 09:00	----	----	----
						VA22B7687-001	VA22B7687-002	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		44.8	44.1	----	----	----
conductivity	----	E100	2.0	µS/cm		98.1	94.4	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		46.2	46.6	----	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		45.6	47.7	----	----	----
pH	----	E108	0.10	pH units		7.94	7.90	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L		68	63	----	----	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	----	----	----
turbidity	----	E121	0.10	NTU		0.33	0.72	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0100	0.0073	----	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.031	0.030	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0690	0.0694	----	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0690	0.0694	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.209	0.156	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0075	0.0033	----	----	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		<0.0020	0.0022	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.38	5.36	----	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		2.42	2.69	----	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0237	0.0303	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00014	0.00034	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.00530	0.00606	----	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	<0.010	----	----	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000119	0.0000309	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-07	QUL-ZOO-7_WS_DI-1_2022-07	----	----	----
					Client sampling date / time	27-Jul-2022 13:40	27-Jul-2022 09:00	----	----	----
						VA22B7687-001	VA22B7687-002	--------	--------	--------
						Result	Result	----	----	----
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		15.3	16.1	----	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00102	0.00195	----	----	----
iron, total	7439-89-6	E420	0.030	mg/L		<0.030	0.049	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		0.000091	0.000093	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	----	----	----
magnesium, total	7439-95-4	E420	0.100	mg/L		1.80	1.83	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00168	0.00341	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000348	0.000432	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.486	0.541	----	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000101	0.000135	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L		1.76	1.86	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		0.856	0.879	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.117	0.116	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000146	0.000131	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	----	----	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0118	0.0125	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00011	0.00017	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00520	0.00557	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	<0.010	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000200	0.0000246	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	QUL-ZOO-1_WS_DI-1_2022-07	QUL-ZOO-7_WS_DI-1_2022-07	----	----	----
					Client sampling date / time	27-Jul-2022 13:40	27-Jul-2022 09:00	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B7687-001	VA22B7687-002	--------	--------	--------
						Result	Result	----	----	----
Dissolved Metals										
calcium, dissolved	7440-70-2	E421	0.050	mg/L		15.4	15.5	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00064	0.00138	----	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	0.000057	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	----	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		1.88	1.91	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00056	0.00118	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000346	0.000371	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	0.00052	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.541	0.598	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000112	0.000126	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.71	1.79	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		0.881	0.912	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.120	0.113	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000135	0.000123	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B7687**	Page	: 1 of 13
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Mr. Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 ext 2171	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 11:40
PO	: 5590008044 Q2 2022	Issue Date	: 11-Aug-2022 14:12
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Physical Tests	QC-MRG2-5865170 01	----	alkalinity, total (as CaCO3)	----	E290	1.5 mg/L [B]	1.5 mg/L	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) QUL-ZOO-7_WS_DI-1_2022-07	E298	27-Jul-2022	03-Aug-2022	----	----		06-Aug-2022	28 days	10 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) QUL-ZOO-1_WS_DI-1_2022-07	E298	27-Jul-2022	03-Aug-2022	----	----		06-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E235.Cl	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E235.Cl	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E378-U	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E378-U	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E235.F	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E235.F	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E235.NO3-L	27-Jul-2022	03-Aug-2022	3 days	7 days	× EHTR	03-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E235.NO3-L	27-Jul-2022	03-Aug-2022	3 days	7 days	× EHTR	03-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E235.NO2-L	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E235.NO2-L	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	3 days	7 days	× EHTR-FM
Anions and Nutrients : Sulfate in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E235.SO4	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E235.SO4	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-ZOO-1_WS_DI-1_2022-07	E375-T	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-ZOO-7_WS_DI-1_2022-07	E375-T	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-07	E366	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-07	E366	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-07	E372-U	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-07	E372-U	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-07	E421	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	180 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-07	E421	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	180 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-07	E358-L	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	9 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-07	E358-L	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	28 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-07	E290	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	14 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E290	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	14 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E100	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E100	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	28 days	7 days	✓
Physical Tests : pH by Meter										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E108	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E108	27-Jul-2022	03-Aug-2022	----	----		03-Aug-2022	0.25 hrs	3.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-1_WS_DI-1_2022-07	E162	27-Jul-2022	----	----	----		03-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-7_WS_DI-1_2022-07	E162	27-Jul-2022	----	----	----		03-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-1_WS_DI-1_2022-07	E164	27-Jul-2022	----	----	----		03-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-7_WS_DI-1_2022-07	E164	27-Jul-2022	----	----	----		03-Aug-2022	7 days	7 days	✓

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-07	E121	27-Jul-2022	----	----	----		03-Aug-2022	3 days	7 days	✖ EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-07	E121	27-Jul-2022	----	----	----		03-Aug-2022	3 days	7 days	✖ EHTR
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-07	E420	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-07	E420	27-Jul-2022	03-Aug-2022	----	----		04-Aug-2022	180 days	8 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	586517	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	586168	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	586511	1	17	5.8	5.0	✓
Conductivity in Water	E100	586518	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	586097	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	586163	1	16	6.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	586509	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	586510	1	17	5.8	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	586512	1	18	5.5	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	586513	1	18	5.5	5.0	✓
pH by Meter	E108	586516	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	586514	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	586171	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	586170	1	7	14.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	586158	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	586169	1	7	14.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	586165	1	18	5.5	5.0	✓
Turbidity by Nephelometry	E121	586961	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	586517	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	586168	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	586511	1	17	5.8	5.0	✓
Conductivity in Water	E100	586518	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	586097	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	586163	1	16	6.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	586509	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	586510	1	17	5.8	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	586512	1	18	5.5	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	586513	1	18	5.5	5.0	✓
pH by Meter	E108	586516	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	586514	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	586171	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	586170	1	7	14.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	586158	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	586169	1	7	14.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	586165	1	18	5.5	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	587170	1	19	5.2	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Turbidity by Nephelometry	E121	586961	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	586517	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	586168	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	586511	1	17	5.8	5.0	✓
Conductivity in Water	E100	586518	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	586097	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	586163	1	16	6.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	586509	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	586510	1	17	5.8	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	586512	1	18	5.5	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	586513	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	586514	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	586171	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	586170	1	7	14.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	586158	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	586169	1	7	14.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	586165	1	18	5.5	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	587170	1	19	5.2	5.0	✓
Turbidity by Nephelometry	E121	586961	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	586168	1	15	6.6	5.0	✓
Chloride in Water by IC	E235.Cl	586511	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	586097	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	586163	1	16	6.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	586509	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	586510	1	17	5.8	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	586512	1	18	5.5	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	586513	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	586514	1	17	5.8	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	586170	1	7	14.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	586158	1	19	5.2	5.0	✓
Total Nitrogen by Colourimetry	E366	586169	1	7	14.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	586165	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

QUALITY CONTROL REPORT

Work Order	: **VA22B7687**	Page	: 1 of 14
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Mr. Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 ext 2171	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 11:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 03-Aug-2022
C-O-C number	: ----	Issue Date	: 11-Aug-2022 14:11
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Ann Joby	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
David Stewart	Analyst - Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 586171)											
FJ2202041-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	318	326	2.48%	20%	----
Physical Tests (QC Lot: 586516)											
VA22B7752-003	Anonymous	pH	----	E108	0.10	pH units	8.32	8.30	0.241%	4%	----
Physical Tests (QC Lot: 586517)											
VA22B7752-003	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	171	171	0.292%	20%	----
Physical Tests (QC Lot: 586518)											
VA22B7752-003	Anonymous	conductivity	----	E100	2.0	µS/cm	464	463	0.216%	10%	----
Physical Tests (QC Lot: 586961)											
FJ2202040-001	Anonymous	turbidity	----	E121	0.10	NTU	10.6	10.4	1.90%	15%	----
Physical Tests (QC Lot: 587197)											
VA22B7532-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1470	1530	4.13%	20%	----
Anions and Nutrients (QC Lot: 586165)											
KS2202760-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0200	mg/L	0.253	0.250	0.870%	20%	----
Anions and Nutrients (QC Lot: 586168)											
KS2202760-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0098	0.0090	0.0008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586169)											
VA22B7505-001	Anonymous	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.224	0.228	0.003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586170)											
VA22B7505-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0045	0.0046	0.00006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586509)											
VA22B7687-001	QUL-ZOO-1_WS_DI-1_2022-07	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586510)											
VA22B7752-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586511)											
VA22B7752-001	Anonymous	chloride	16887-00-6	E235.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586512)											
VA22B7752-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586513)											
VA22B7752-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 586514)											
VA22B7752-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Organic / Inorganic Carbon (QC Lot: 586163)											
KS2202760-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	5.45	5.88	7.53%	20%	----
Total Metals (QC Lot: 586158)											
VA22B7660-004	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 586097)											
VA22B7687-001	QUL-ZOO-1_WS_DI-1_2022-07	aluminum, dissolved	7429-90-5	E421	0.0030	mg/L	0.0118	0.0122	0.0004	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 586097) - continued											
VA22B7687-001	QUL-ZOO-1_WS_DI-1_2022-07	antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00011	0.00012	0.000006	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00520	0.00506	2.70%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000200	0.0000209	0.0000008	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	15.4	15.5	0.997%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00050	mg/L	0.00064	0.00065	0.00001	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.100	mg/L	1.88	1.88	0.328%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00056	0.00057	0.000008	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000346	0.000372	0.000025	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.541	0.535	1.20%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000112	0.000080	0.000032	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.71	1.75	2.47%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	0.881	0.890	1.02%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.120	0.123	2.04%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000135	0.000135	0.229%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 586171)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 586517)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	# 1.5	B
Physical Tests (QCLot: 586518)						
conductivity	----	E100	1	µS/cm	1.4	----
Physical Tests (QCLot: 586961)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 587170)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 587197)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 586165)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 586168)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 586169)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 586170)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 586509)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 586510)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 586511)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 586512)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 586513)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 586514)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Organic / Inorganic Carbon (QCLot: 586163)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 586158)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 586097)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 586097) - continued						
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 586171)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	104	85.0	115	----
Physical Tests (QCLot: 586516)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 586517)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	110	85.0	115	----
Physical Tests (QCLot: 586518)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.0	90.0	110	----
Physical Tests (QCLot: 586961)									
turbidity	----	E121	0.1	NTU	200 NTU	98.0	85.0	115	----
Physical Tests (QCLot: 587170)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	104	85.0	115	----
Physical Tests (QCLot: 587197)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	96.2	85.0	115	----
Anions and Nutrients (QCLot: 586165)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	95.1	80.0	120	----
Anions and Nutrients (QCLot: 586168)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 586169)									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 586170)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	96.1	80.0	120	----
Anions and Nutrients (QCLot: 586509)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	91.2	80.0	120	----
Anions and Nutrients (QCLot: 586510)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 586511)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 586512)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 586513)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	98.8	90.0	110	----
Anions and Nutrients (QCLot: 586514)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 586514) - continued									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Organic / Inorganic Carbon (QCLot: 586163)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.3	80.0	120	----
Total Metals (QCLot: 586158)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	96.7	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	115	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	99.8	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	98.0	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	99.4	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	93.0	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	100	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	104	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	97.5	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	96.7	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	113	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	99.8	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	97.0	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	109	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	99.8	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	101	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	102	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	105	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	98.5	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	102	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	93.7	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	110	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	93.4	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 586097)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	99.6	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	98.4	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.9	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	97.5	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	103	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	97.1	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.1	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	96.7	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.7	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	99.8	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	97.6	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	99.1	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	98.7	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	99.6	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	96.8	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	107	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	101	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	100	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.7	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	99.8	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.8	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.3	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	99.7	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	94.8	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	97.9	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 586165)										
VA22B7505-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0492 mg/L	0.05 mg/L	98.5	70.0	130	----
Anions and Nutrients (QCLot: 586168)										
VA22B7505-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.105 mg/L	0.1 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 586169)										
VA22B7505-002	Anonymous	nitrogen, total	7727-37-9	E366	ND mg/L	0.4 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 586170)										
VA22B7505-002	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0486 mg/L	0.05 mg/L	97.3	70.0	130	----
Anions and Nutrients (QCLot: 586509)										
VA22B7687-002	QUL-ZOO-7_WS_DI-1_2022-07	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0286 mg/L	0.03 mg/L	95.3	70.0	130	----
Anions and Nutrients (QCLot: 586510)										
VA22B7752-002	Anonymous	fluoride	16984-48-8	E235.F	1.02 mg/L	1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 586511)										
VA22B7752-002	Anonymous	chloride	16887-00-6	E235.Cl	104 mg/L	100 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 586512)										
VA22B7752-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.62 mg/L	2.5 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 586513)										
VA22B7752-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.505 mg/L	0.5 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 586514)										
VA22B7752-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	103 mg/L	100 mg/L	103	75.0	125	----
Organic / Inorganic Carbon (QCLot: 586163)										
VA22B7505-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Total Metals (QCLot: 586158)										
VA22B7687-001	QUL-ZOO-1_WS_DI-1_2022-07	aluminum, total	7429-90-5	E420	0.183 mg/L	0.2 mg/L	91.6	70.0	130	----
		antimony, total	7440-36-0	E420	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0186 mg/L	0.02 mg/L	92.8	70.0	130	----
		barium, total	7440-39-3	E420	0.0188 mg/L	0.02 mg/L	94.1	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00930 mg/L	0.01 mg/L	93.0	70.0	130	----
		boron, total	7440-42-8	E420	0.092 mg/L	0.1 mg/L	91.7	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 586158) - continued										
VA22B7687-001	QUL-ZOO-1_WS_DI-1_2022-07	cadmium, total	7440-43-9	E420	0.00385 mg/L	0.004 mg/L	96.2	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0378 mg/L	0.04 mg/L	94.6	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0186 mg/L	0.02 mg/L	93.0	70.0	130	----
		copper, total	7440-50-8	E420	0.0186 mg/L	0.02 mg/L	93.0	70.0	130	----
		iron, total	7439-89-6	E420	1.90 mg/L	2 mg/L	94.8	70.0	130	----
		lead, total	7439-92-1	E420	0.0184 mg/L	0.02 mg/L	91.8	70.0	130	----
		lithium, total	7439-93-2	E420	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0195 mg/L	0.02 mg/L	97.4	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0210 mg/L	0.02 mg/L	105	70.0	130	----
		nickel, total	7440-02-0	E420	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		potassium, total	7440-09-7	E420	3.78 mg/L	4 mg/L	94.6	70.0	130	----
		selenium, total	7782-49-2	E420	0.0388 mg/L	0.04 mg/L	97.0	70.0	130	----
		silicon, total	7440-21-3	E420	9.16 mg/L	10 mg/L	91.6	70.0	130	----
		silver, total	7440-22-4	E420	0.00409 mg/L	0.004 mg/L	102	70.0	130	----
		sodium, total	7440-23-5	E420	1.85 mg/L	2 mg/L	92.6	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00361 mg/L	0.004 mg/L	90.3	70.0	130	----
		tin, total	7440-31-5	E420	0.0194 mg/L	0.02 mg/L	96.8	70.0	130	----
		titanium, total	7440-32-6	E420	0.0346 mg/L	0.04 mg/L	86.6	70.0	130	----
		uranium, total	7440-61-1	E420	0.00406 mg/L	0.004 mg/L	102	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0954 mg/L	0.1 mg/L	95.4	70.0	130	----
		zinc, total	7440-66-6	E420	0.358 mg/L	0.4 mg/L	89.6	70.0	130	----
Dissolved Metals (QCLot: 586097)										
VA22B7687-002	QUL-ZOO-7_WS_DI-1_2022-07	aluminum, dissolved	7429-90-5	E421	0.198 mg/L	0.2 mg/L	99.1	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0199 mg/L	0.02 mg/L	99.5	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.0187 mg/L	0.02 mg/L	93.5	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00934 mg/L	0.01 mg/L	93.4	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00393 mg/L	0.004 mg/L	98.3	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0200 mg/L	0.02 mg/L	100.0	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 586097) - continued										
VA22B7687-002	QUL-ZOO-7_WS_DI-1_2022-07	copper, dissolved	7440-50-8	E421	0.0198 mg/L	0.02 mg/L	99.3	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.91 mg/L	2 mg/L	95.4	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0190 mg/L	0.02 mg/L	94.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0961 mg/L	0.1 mg/L	96.1	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0200 mg/L	0.02 mg/L	100.0	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0396 mg/L	0.04 mg/L	98.9	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.26 mg/L	4 mg/L	107	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0418 mg/L	0.04 mg/L	104	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.36 mg/L	10 mg/L	93.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00402 mg/L	0.004 mg/L	100	70.0	130	----
		sodium, dissolved	7440-23-5	E421	1.96 mg/L	2 mg/L	98.2	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00372 mg/L	0.004 mg/L	93.1	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0197 mg/L	0.02 mg/L	98.4	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00376 mg/L	0.004 mg/L	94.1	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.417 mg/L	0.4 mg/L	104	70.0	130	----

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of

Environmental Division Vancouver
Work Order Reference
VA22B7687

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3	pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will ap

Regular [R] ☑ Standard TAT if received by 3 pm - business days - r

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] | Same Day, Weekend o | Statutory holiday [E0

Date and Time Required for all E&P TATs: dd-mmm-yy

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-006
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only): B7687

ALS Contact: Can Dang

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1 (F)	Total Metals (ICPMS) (P)	Dissolved Metals (ICPMS) (F)	Total Nitrogen Ammonia (P)	DOC (F/P)	TSS (Whole bottle)	Number of Containers
	QUL-ZOO-1_WS_DI-1_2022-07	27-July-22	13:40	Water	R	R	R	R	R	R	6
	QUL-ZOO-7_WS_DI-1_2022-07	27-July-22	09:00	Water	R	R	R	R	R	R	6
	~~TRAVEL_WS-1-2022-07~~	~~July-22~~		~~Water~~	~~R~~	~~R~~		~~R~~		~~R~~	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☑ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	2.3° 3 coolers

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lahmer	Date: 28-Jul-22	Time: 1300	Received by:	Date:	Time:	Received by: IT	Date: Aug 2/22	Time: 11:40 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WATER CHEMISTRY

ALS Laboratory Report VA22B8478

(Finalized August 18, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B8478**	Page	: 1 of 8
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 10-Aug-2022
C-O-C number	: ----	Issue Date	: 18-Aug-2022 16:44
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Kyle Chang	Lab Assistant	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
HTP	*Sample preparation or preservation hold time was exceeded.*
RRV	*Reported result verified by repeat analysis.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	FPC-R3_WS-1_2022-08	HAC-R1_WS-1_2022-08	HAC-U_WS-1_2022-08	HAC-D_WS-1_2022-08	EDC-U_WS-1_2022-08
					Client sampling date / time	08-Aug-2022 12:30	08-Aug-2022 10:30	08-Aug-2022 11:00	08-Aug-2022 12:35	08-Aug-2022 08:00
						VA22B8478-001	VA22B8478-002	VA22B8478-003	VA22B8478-004	VA22B8478-005
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		84.2	89.5	93.0	109	63.2
conductivity	----	E100	2.0	µS/cm		160	248	271	293	126
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		74.8	100	114	125	59.2
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		81.6	113	123	136	66.6
pH	----	E108	0.10	pH units		8.01	8.09	8.11	8.17	7.88
solids, total dissolved [TDS]	----	E162	10	mg/L		102	164	191	203	114
solids, total suspended [TSS]	----	E164	1.0	mg/L		2.5	1.8	1.6	1.6	<1.0
turbidity	----	E121	0.10	NTU		1.53	0.58	0.58	0.47	0.67
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0205	0.0094	0.0227	0.0122	0.0101
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	0.74	0.92	0.87	<0.50
fluoride	16984-48-8	E235.F	0.020	mg/L		0.044	0.058	0.062	0.071	0.037
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0915	0.0068	0.0343	0.0239	0.0234
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0915	0.0068	0.0343	0.0239	0.0234
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.809	0.294	0.318	0.268	0.509
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		0.0306	0.0010	0.0034	0.0046	0.0017
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0489	0.0127 RRV	0.0138	0.0090	0.0107
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0449	0.0069	0.0094	0.0121	0.0112
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		<0.30	35.4	44.1	44.3	0.48
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		17.4	6.40	5.83 HTP	5.65	16.9
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.397	0.0386	0.0297	0.0524	0.0593
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00084	0.00051	0.00061	0.00081	0.00052
barium, total	7440-39-3	E420	0.00010	mg/L		0.00566	0.0108	0.0116	0.0174	0.0108
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	0.021	0.021	0.022	<0.010

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	FPC-R3_WS-1_2022-08	HAC-R1_WS-1_2022-08	HAC-U_WS-1_2022-08	HAC-D_WS-1_2022-08	EDC-U_WS-1_2022-08
					Client sampling date / time	08-Aug-2022 12:30	08-Aug-2022 10:30	08-Aug-2022 11:00	08-Aug-2022 12:35	08-Aug-2022 08:00
						VA22B8478-001	VA22B8478-002	VA22B8478-003	VA22B8478-004	VA22B8478-005
						Result	Result	Result	Result	Result
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000064	<0.0000100 DLM	<0.0000050	<0.0000050	0.0000086
calcium, total	7440-70-2	E420	0.050	mg/L		24.9	36.2	38.9	42.4	17.4
chromium, total	7440-47-3	E420	0.00050	mg/L		0.00123	<0.00050	<0.00050	<0.00050	0.00069
cobalt, total	7440-48-4	E420	0.00010	mg/L		0.00032	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00270	0.00477	0.00506	0.00801	0.00221
iron, total	7439-89-6	E420	0.030	mg/L		0.719	0.043	0.036	0.060	0.140
lead, total	7439-92-1	E420	0.000050	mg/L		0.000097	<0.000050	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		4.71	5.48	6.28	7.21	5.63
manganese, total	7439-96-5	E420	0.00010	mg/L		0.0408	0.0147	0.0385	0.0195	0.0199
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000197	0.00685	0.00690	0.00718	0.000329
nickel, total	7440-02-0	E420	0.00050	mg/L		0.00107	<0.00050	<0.00050	<0.00050	0.00121
potassium, total	7440-09-7	E420	0.050	mg/L		0.305	0.987	1.00	1.12	0.510
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000109	0.000607	0.00120	0.00122	0.000129
silicon, total	7440-21-3	E420	0.10	mg/L		7.43	3.13	3.45	3.90	3.34
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		4.83	7.16	7.50	7.98	2.44
strontium, total	7440-24-6	E420	0.00020	mg/L		0.0936	0.251	0.271	0.302	0.113
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		0.0149	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000042	0.000189	0.000230	0.000305	0.000060
vanadium, total	7440-62-2	E420	0.00050	mg/L		0.00289	0.00148	0.00143	0.00148	0.00080
zinc, total	7440-66-6	E420	0.0030	mg/L		0.0050	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0392	0.0047	0.0041	0.0062	0.0333
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	0.00010	0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00078	0.00046	0.00046	0.00078	0.00041
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00274	0.00832	0.00932	0.0164	0.00842
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	FPC-R3_WS-1_2022-08	HAC-R1_WS-1_2022-08	HAC-U_WS-1_2022-08	HAC-D_WS-1_2022-08	EDC-U_WS-1_2022-08
					Client sampling date / time	08-Aug-2022 12:30	08-Aug-2022 10:30	08-Aug-2022 11:00	08-Aug-2022 12:35	08-Aug-2022 08:00
						VA22B8478-001	VA22B8478-002	VA22B8478-003	VA22B8478-004	VA22B8478-005
						Result	Result	Result	Result	Result
Dissolved Metals										
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	0.020	0.020	0.020	<0.010
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000092
calcium, dissolved	7440-70-2	E421	0.050	mg/L		22.9	33.0	37.4	38.6	16.2
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00177	0.00336	0.00367	0.00684	0.00181
iron, dissolved	7439-89-6	E421	0.030	mg/L		0.307	<0.030	<0.030	<0.030	0.106
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		4.28	4.28	5.11	6.90	4.55
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.0122	0.00504	0.0221	0.00766	0.0118
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000214	0.00673	0.00663	0.00691	0.000331
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00070	<0.00050	<0.00050	<0.00050	0.00100
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.247	0.782	0.821	1.05	0.402
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000090	0.000625	0.00126	0.00120	0.000130
silicon, dissolved	7440-21-3	E421	0.050	mg/L		6.64	2.83	3.11	3.76	3.11
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L		4.75	6.14	6.42	8.12	2.08
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.0903	0.242	0.252	0.289	0.110
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000030	0.000194	0.000224	0.000310	0.000061
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		0.00174	0.00114	0.00110	0.00128	0.00057
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	0.0050	<0.0030
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_WS-1_2022-08	E1_WS-1_2022-08	HAC-R3_WS-1_2022-08	HAC-U_WS-1X_2022-08	----
					Client sampling date / time	08-Aug-2022 12:12	08-Aug-2022 11:15	08-Aug-2022 13:39	08-Aug-2022 11:00	----
						VA22B8478-006	VA22B8478-007	VA22B8478-008	VA22B8478-009	--------
						Result	Result	Result	Result	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		125	125	99.4	91.8	----
conductivity	----	E100	2.0	µS/cm		242	239	280	274	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		114	116	119	114	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		122	118	123	122	----
pH	----	E108	0.10	pH units		8.24	8.24	8.14	8.11	----
solids, total dissolved [TDS]	----	E162	10	mg/L		158	176	187	167	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	1.2	<1.0	----
turbidity	----	E121	0.10	NTU		0.23	0.26	0.54	0.58	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0107	0.0200	0.0065	0.0147	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	0.90	0.92	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.060	0.059	0.065	0.062	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0066	0.0091	0.0351	0.0319	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0066	0.0091	0.0351	0.0319	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.380	0.371	0.277	0.314	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		0.0021	0.0023	0.0049	0.0033	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0068	0.0068	0.0122	0.0116	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0090	0.0057	0.0091	0.0092	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		4.08	4.06	44.2	44.0	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		13.2	13.2	5.91	6.54	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0231	0.0272	0.0319	0.0258	----
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00154	0.00133	0.00069	0.00060	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.0180	0.0193	0.0142	0.0116	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
boron, total	7440-42-8	E420	0.010	mg/L		0.014	0.014	0.023	0.023	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000072	<0.0000050	<0.0000100 DLM	<0.0000100 DLM	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_WS-1_2022-08	E1_WS-1_2022-08	HAC-R3_WS-1_2022-08	HAC-U_WS-1X_2022-08	----
					Client sampling date / time	08-Aug-2022 12:12	08-Aug-2022 11:15	08-Aug-2022 13:39	08-Aug-2022 11:00	----
						VA22B8478-006	VA22B8478-007	VA22B8478-008	VA22B8478-009	--------
						Result	Result	Result	Result	----
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		33.0	31.7	38.5	38.8	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00179	0.00306	0.00784	0.00518	----
iron, total	7439-89-6	E420	0.030	mg/L		0.083	0.068	0.042	0.033	----
lead, total	7439-92-1	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, total	7439-93-2	E420	0.0010	mg/L		0.0010	<0.0010	<0.0010	<0.0010	----
magnesium, total	7439-95-4	E420	0.100	mg/L		9.55	9.51	6.57	6.23	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00795	0.00466	0.0201	0.0371	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.00103	0.00105	0.00703	0.00710	----
nickel, total	7440-02-0	E420	0.00050	mg/L		0.00116	0.00090	<0.00050	<0.00050	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.909	0.907	1.07	1.01	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000128	0.000155	0.00126	0.00135	----
silicon, total	7440-21-3	E420	0.10	mg/L		5.42	5.18	3.82	3.60	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, total	7440-23-5	E420	0.050	mg/L		5.36	5.31	7.97	7.82	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.223	0.220	0.271	0.266	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000166	0.000185	0.000277	0.000247	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		0.00064	0.00077	0.00147	0.00142	----
zinc, total	7440-66-6	E420	0.0030	mg/L		0.0061	<0.0030	<0.0030	<0.0030	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0142	0.0150	0.0056	0.0034	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00150	0.00130	0.00070	0.00046	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.0168	0.0193	0.0130	0.00919	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.013	0.013	0.020	0.020	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	EDC-D_WS-1_2022-08	E1_WS-1_2022-08	HAC-R3_WS-1_2022-08	HAC-U_WS-1X_2022-08	----
					Client sampling date / time	08-Aug-2022 12:12	08-Aug-2022 11:15	08-Aug-2022 13:39	08-Aug-2022 11:00	----
Analyte	CAS Number	Method	LOR	Unit		VA22B8478-006	VA22B8478-007	VA22B8478-008	VA22B8478-009	--------
						Result	Result	Result	Result	----
Dissolved Metals										
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		<0.0000050	0.0000051	0.0000061	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		31.0	31.1	37.0	37.4	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00150	0.00287	0.00644	0.00371	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		0.074	0.053	<0.030	<0.030	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		8.97	9.33	6.43	5.04	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00605	0.00356	0.00537	0.0214	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.00102	0.00106	0.00694	0.00667	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00086	0.00088	<0.00050	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.862	0.906	1.02	0.815	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000148	0.000173	0.00129	0.00131	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		5.32	5.35	3.73	3.25	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		5.16	5.36	7.52	6.44	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.211	0.214	0.275	0.259	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000171	0.000188	0.000266	0.000245	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		0.00054	0.00062	0.00131	0.00110	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B8478**	Page	: 1 of 27
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Issue Date	: 18-Aug-2022 16:44
C-O-C number	: ----		
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
E1_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
EDC-D_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
EDC-U_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
FPC-R3_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
HAC-D_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
HAC-R1_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
HAC-R3_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
HAC-U_WS-1_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
HAC-U_WS-1X_2022-08	E298	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
E1_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
EDC-D_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
EDC-U_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
FPC-R3_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
HAC-D_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
HAC-R1_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
HAC-R3_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE HAC-U_WS-1_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE HAC-U_WS-1X_2022-08	E235.Cl	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE E1_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE EDC-D_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE EDC-U_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE FPC-R3_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE HAC-D_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE HAC-R1_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE HAC-R3_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE HAC-U_WS-1_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE HAC-U_WS-1X_2022-08	E378-U	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE E1_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE EDC-D_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE EDC-U_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE FPC-R3_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE HAC-D_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE HAC-R1_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
HAC-R3_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
HAC-U_WS-1_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
HAC-U_WS-1X_2022-08	E235.F	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
E1_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
EDC-D_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
EDC-U_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
FPC-R3_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
HAC-D_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
HAC-R1_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
HAC-R3_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
HAC-U_WS-1_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
HAC-U_WS-1X_2022-08	E235.NO3-L	08-Aug-2022	11-Aug-2022	3 days	3 days	✓	11-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
E1_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
EDC-D_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
EDC-U_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
FPC-R3_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
HAC-D_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
HAC-R1_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
HAC-R3_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
HAC-U_WS-1_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
HAC-U_WS-1X_2022-08	E235.NO2-L	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
E1_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
EDC-D_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
EDC-U_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
FPC-R3_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
HAC-D_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
HAC-R1_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
HAC-R3_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
HAC-U_WS-1_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
HAC-U_WS-1X_2022-08	E235.SO4	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
E1_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
EDC-D_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
EDC-U_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
FPC-R3_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
HAC-D_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
HAC-R1_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
HAC-R3_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
HAC-U_WS-1_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
HAC-U_WS-1X_2022-08	E375-T	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
E1_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
EDC-D_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
EDC-U_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
FPC-R3_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
HAC-D_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
HAC-R1_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
HAC-R3_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
HAC-U_WS-1_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
HAC-U_WS-1X_2022-08	E366	08-Aug-2022	15-Aug-2022	----	----		17-Aug-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
E1_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
EDC-D_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
EDC-U_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
FPC-R3_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
HAC-D_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
HAC-R1_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
HAC-R3_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
HAC-U_WS-1_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
HAC-U_WS-1X_2022-08	E372-U	08-Aug-2022	15-Aug-2022	----	----		16-Aug-2022	28 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
HAC-R3_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
E1_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
EDC-D_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
EDC-U_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
FPC-R3_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
HAC-D_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
HAC-R1_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
HAC-U_WS-1_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
HAC-U_WS-1X_2022-08	E421	08-Aug-2022	13-Aug-2022	----	----		13-Aug-2022	180 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
E1_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
EDC-D_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
EDC-U_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
FPC-R3_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
HAC-D_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
HAC-R1_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
HAC-R3_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
HAC-U_WS-1_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
HAC-U_WS-1X_2022-08	E358-L	08-Aug-2022	15-Aug-2022	----	----		15-Aug-2022	28 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
E1_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
EDC-D_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
EDC-U_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
FPC-R3_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
HAC-D_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
HAC-R1_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE										
HAC-R3_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
HAC-U_WS-1_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
HAC-U_WS-1X_2022-08	E290	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
E1_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
EDC-D_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
EDC-U_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
FPC-R3_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
HAC-D_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
HAC-R1_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE HAC-R3_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE HAC-U_WS-1_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE HAC-U_WS-1X_2022-08	E100	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	28 days	3 days	✓
Physical Tests : pH by Meter										
HDPE E1_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE EDC-D_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE EDC-U_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE FPC-R3_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE HAC-D_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE HAC-R1_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE HAC-R3_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE HAC-U_WS-1_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE HAC-U_WS-1X_2022-08	E108	08-Aug-2022	11-Aug-2022	----	----		11-Aug-2022	0.25 hrs	8.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE E1_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE EDC-U_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE FPC-R3_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE HAC-D_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE HAC-R1_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE HAC-R3_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE										
HAC-U_WS-1_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
HAC-U_WS-1X_2022-08	E162	08-Aug-2022	----	----	----		14-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
EDC-D_WS-1_2022-08	E162	08-Aug-2022	----	----	----		15-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
EDC-D_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
FPC-R3_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
HAC-D_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
HAC-R3_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
E1_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
EDC-U_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] HAC-R1_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] HAC-U_WS-1_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] HAC-U_WS-1X_2022-08	E164	08-Aug-2022	----	----	----		12-Aug-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE E1_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE EDC-D_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE FPC-R3_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE HAC-D_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE HAC-R1_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE HAC-R3_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
HAC-U_WS-1_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
HAC-U_WS-1X_2022-08	E121	08-Aug-2022	----	----	----		10-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
EDC-U_WS-1_2022-08	E121	08-Aug-2022	----	----	----		11-Aug-2022	3 days	3 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
HAC-R3_WS-1_2022-08	E420	08-Aug-2022	14-Aug-2022	----	----		15-Aug-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
HAC-U_WS-1X_2022-08	E420	08-Aug-2022	14-Aug-2022	----	----		15-Aug-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
E1_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
EDC-D_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
EDC-U_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
FPC-R3_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
HAC-D_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
HAC-R1_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
HAC-U_WS-1_2022-08	E420	08-Aug-2022	16-Aug-2022	----	----		17-Aug-2022	180 days	9 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	597435	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	603261	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	597438	1	17	5.8	5.0	✓
Conductivity in Water	E100	597436	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	599135	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	603262	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	597446	1	16	6.2	5.0	✓
Fluoride in Water by IC	E235.F	597437	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	597440	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	597441	1	17	5.8	5.0	✓
pH by Meter	E108	597434	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	597442	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	602167	3	31	9.6	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	603260	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	600764	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	603256	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	603263	1	12	8.3	5.0	✓
Turbidity by Nephelometry	E121	597268	2	29	6.9	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	597435	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	603261	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	597438	1	17	5.8	5.0	✓
Conductivity in Water	E100	597436	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	599135	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	603262	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	597446	1	16	6.2	5.0	✓
Fluoride in Water by IC	E235.F	597437	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	597440	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	597441	1	17	5.8	5.0	✓
pH by Meter	E108	597434	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	597442	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	602167	3	31	9.6	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	603260	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	600764	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	603256	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	603263	1	12	8.3	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	601035	2	27	7.4	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Turbidity by Nephelometry	E121	597268	2	29	6.9	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	597435	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	603261	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	597438	1	17	5.8	5.0	✓
Conductivity in Water	E100	597436	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	599135	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	603262	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	597446	1	16	6.2	5.0	✓
Fluoride in Water by IC	E235.F	597437	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	597440	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	597441	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	597442	1	17	5.8	5.0	✓
TDS by Gravimetry	E162	602167	3	31	9.6	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	603260	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	600764	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	603256	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	603263	1	12	8.3	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	601035	2	27	7.4	5.0	✓
Turbidity by Nephelometry	E121	597268	2	29	6.9	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	603261	1	19	5.2	5.0	✓
Chloride in Water by IC	E235.Cl	597438	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	599135	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	603262	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	597446	1	16	6.2	5.0	✓
Fluoride in Water by IC	E235.F	597437	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	597440	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	597441	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	597442	1	17	5.8	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	603260	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	600764	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	603256	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	603263	1	12	8.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

QUALITY CONTROL REPORT

Work Order	: **VA22B8478**	Page	: 1 of 18
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 10-Aug-2022
C-O-C number	: ----	Issue Date	: 18-Aug-2022 16:44
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Kyle Chang	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Vancouver Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 597268)											
VA22B8418-006	Anonymous	turbidity	----	E121	0.10	NTU	3.35	3.53	5.00%	15%	----
Physical Tests (QC Lot: 597434)											
FJ2202082-003	Anonymous	pH	----	E108	0.10	pH units	8.36	8.35	0.120%	4%	----
Physical Tests (QC Lot: 597435)											
FJ2202082-003	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	184	184	0.217%	20%	----
Physical Tests (QC Lot: 597436)											
FJ2202082-003	Anonymous	conductivity	----	E100	2.0	µS/cm	1370	1360	0.660%	10%	----
Physical Tests (QC Lot: 598950)											
VA22B8478-005	EDC-U_WS-1_2022-08	turbidity	----	E121	0.10	NTU	0.67	0.74	0.07	Diff <2x LOR	----
Physical Tests (QC Lot: 602167)											
KS2202865-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	963	945	1.94%	20%	----
Physical Tests (QC Lot: 602168)											
VA22B8478-008	HAC-R3_WS-1_2022-08	solids, total dissolved [TDS]	----	E162	20	mg/L	187	184	3	Diff <2x LOR	----
Physical Tests (QC Lot: 603288)											
KS2202952-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	182	180	2	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 597437)											
FJ2202082-003	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.239	0.232	0.006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 597438)											
FJ2202082-003	Anonymous	chloride	16887-00-6	E235.Cl	2.50	mg/L	<2.50	<2.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 597440)											
FJ2202082-003	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	17.4	17.5	0.236%	20%	----
Anions and Nutrients (QC Lot: 597441)											
FJ2202082-003	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	0.0056	0.0006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 597442)											
FJ2202082-003	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	560	560	0.0604%	20%	----
Anions and Nutrients (QC Lot: 597446)											
FJ2202082-003	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 603256)											
KS2202913-001	Anonymous	nitrogen, total	7727-37-9	E366	0.300	mg/L	8.52	8.39	1.47%	20%	----
Anions and Nutrients (QC Lot: 603260)											
KS2202913-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.200	mg/L	4.34	4.40	1.28%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 603261)											
KS2202913-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0250	mg/L	4.44	4.33	2.52%	20%	----
Anions and Nutrients (QC Lot: 603263)											
VA22B8478-001	FPC-R3_WS-1_2022-08	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0489	0.0485	0.944%	20%	----
Organic / Inorganic Carbon (QC Lot: 603262)											
VA22B8478-001	FPC-R3_WS-1_2022-08	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	17.4	18.6	6.72%	20%	----
Total Metals (QC Lot: 600764)											
VA22B8451-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0318	0.0346	8.17%	20%	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00025	0.00022	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0185	0.0184	0.485%	20%	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.024	0.024	0.0002	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	16.5	15.9	3.63%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00174	0.00171	0.00003	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.062	0.062	0.0004	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000892	0.000860	3.58%	20%	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	1.73	1.72	0.768%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.0304	0.0301	1.04%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000198	0.000208	0.000010	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.333	0.329	0.004	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000082	0.000075	0.000006	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.76	2.64	4.28%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	7.77	7.65	1.58%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.0493	0.0490	0.631%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	0.00059	0.00048	0.00010	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 600764) - continued											
VA22B8451-001	Anonymous	vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00064	0.00060	0.00003	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.0263	0.0254	0.0009	Diff <2x LOR	----
Total Metals (QC Lot: 600784)											
VA22B8488-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0120	0.0124	0.0004	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00032	0.00032	0.000006	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00193	0.00194	0.214%	20%	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0135	0.0136	1.02%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.587	0.595	1.38%	20%	----
		cadmium, total	7440-43-9	E420	0.0000200	mg/L	<0.0000200	<0.0000200	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	54.2	54.1	0.112%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00159	0.00155	0.00004	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.014	0.014	0.00006	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.00120	0.00121	0.948%	20%	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	60.7	61.3	1.01%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00355	0.00358	0.663%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.0350	0.0353	0.844%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00112	0.00106	0.00006	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	7.08	7.08	0.0888%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.00105	0.00109	3.15%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	5.98	6.01	0.515%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	255	254	0.425%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	1.73	1.77	1.90%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	0.00010	0.00011	0.000006	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00106	0.00109	2.29%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00319	0.00327	0.00008	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 599135)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 599135) - continued											
VA22B8488-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0060	0.0063	0.0003	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00027	0.00028	0.000010	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00215	0.00206	4.31%	20%	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0137	0.0131	4.50%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.501	0.489	2.36%	20%	----
		cadmium, dissolved	7440-43-9	E421	0.0000150	mg/L	<0.0000150	<0.0000150	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	51.0	52.8	3.41%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00104	0.00105	0.000008	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000263	0.000275	0.000012	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	59.7	61.6	3.17%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00388	0.00385	0.804%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.0344	0.0348	1.16%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00128	0.00127	0.00001	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	7.24	7.29	0.612%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.00110	0.00104	5.45%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	5.90	5.78	2.11%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	247	245	0.805%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	1.74	1.81	3.88%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00101	0.00106	3.89%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00307	0.00308	0.00001	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 597268)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 597435)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 597436)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 598950)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 601035)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 601036)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 602167)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 602168)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 603288)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 597437)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 597438)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 597440)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 597441)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 597442)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 597446)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 603256)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 603260)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 603261)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 603263)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 603262)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 600764)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	MBRR
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 600764) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 600784)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 599135)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 599135) - continued						
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Qualifiers

Qualifier	Description
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 597268)									
turbidity	----	E121	0.1	NTU	200 NTU	95.8	85.0	115	----
Physical Tests (QCLot: 597434)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 597435)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	113	85.0	115	----
Physical Tests (QCLot: 597436)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	97.5	90.0	110	----
Physical Tests (QCLot: 598950)									
turbidity	----	E121	0.1	NTU	200 NTU	97.9	85.0	115	----
Physical Tests (QCLot: 601035)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	88.5	85.0	115	----
Physical Tests (QCLot: 601036)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	96.2	85.0	115	----
Physical Tests (QCLot: 602167)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	96.2	85.0	115	----
Physical Tests (QCLot: 602168)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	104	85.0	115	----
Physical Tests (QCLot: 603288)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 597437)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	97.3	90.0	110	----
Anions and Nutrients (QCLot: 597438)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 597440)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 597441)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	95.6	90.0	110	----
Anions and Nutrients (QCLot: 597442)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 597446)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	97.6	80.0	120	----
Anions and Nutrients (QCLot: 603256)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 603256) - continued									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 603260)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	91.5	80.0	120	----
Anions and Nutrients (QCLot: 603261)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 603263)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	91.5	80.0	120	----
Organic / Inorganic Carbon (QCLot: 603262)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.2	80.0	120	----
Total Metals (QCLot: 600764)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	103	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	96.6	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	97.5	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	98.6	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	102	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	94.1	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	96.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	98.2	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	96.1	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	96.2	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	96.2	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	98.4	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	97.5	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	99.3	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	97.4	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	99.9	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	97.2	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	96.7	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	90.6	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 600764) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	102	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	95.6	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	94.3	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	99.0	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	97.4	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	95.4	80.0	120	----
Total Metals (QCLot: 600784)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	110	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	107	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	98.4	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	106	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	118	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	98.7	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	98.8	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	98.2	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	99.7	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	105	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	106	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	99.2	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	106	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	99.3	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	110	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	95.0	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	111	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	104	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	103	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	99.7	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	100	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 600784) - continued									
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	98.4	80.0	120	----
Dissolved Metals (QCLot: 599135)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	107	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	103	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	96.0	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	102	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	95.6	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.7	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.8	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.6	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	99.1	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	110	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	105	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	97.6	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	100	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	105	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	88.9	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	104	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	102	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	102	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	95.1	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	108	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	105	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 597437)										
FJ2202082-004	Anonymous	fluoride	16984-48-8	E235.F	9.42 mg/L	10 mg/L	94.2	75.0	125	----
Anions and Nutrients (QCLot: 597438)										
FJ2202082-004	Anonymous	chloride	16887-00-6	E235.Cl	1010 mg/L	1000 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 597440)										
FJ2202082-004	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	25.4 mg/L	25 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 597441)										
FJ2202082-004	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	4.67 mg/L	5 mg/L	93.4	75.0	125	----
Anions and Nutrients (QCLot: 597442)										
FJ2202082-004	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	981 mg/L	1000 mg/L	98.1	75.0	125	----
Anions and Nutrients (QCLot: 597446)										
FJ2202082-004	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0374 mg/L	0.03 mg/L	125	70.0	130	----
Anions and Nutrients (QCLot: 603256)										
KS2202913-002	Anonymous	nitrogen, total	7727-37-9	E366	ND mg/L	0.4 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 603260)										
KS2202913-002	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0502 mg/L	0.05 mg/L	100	70.0	130	----
Anions and Nutrients (QCLot: 603261)										
KS2202913-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.102 mg/L	0.1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 603263)										
VA22B8478-002	HAC-R1_WS-1_2022-08	phosphorus, total	7723-14-0	E372-U	0.0442 mg/L	0.05 mg/L	88.4	70.0	130	----
Organic / Inorganic Carbon (QCLot: 603262)										
VA22B8478-002	HAC-R1_WS-1_2022-08	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Total Metals (QCLot: 600764)										
VA22B8451-002	Anonymous	aluminum, total	7429-90-5	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		antimony, total	7440-36-0	E420	0.0196 mg/L	0.02 mg/L	98.1	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		barium, total	7440-39-3	E420	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0418 mg/L	0.04 mg/L	104	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00991 mg/L	0.01 mg/L	99.1	70.0	130	----
		boron, total	7440-42-8	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 600764) - continued										
VA22B8451-002	Anonymous	cadmium, total	7440-43-9	E420	0.00397 mg/L	0.004 mg/L	99.2	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0394 mg/L	0.04 mg/L	98.4	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0199 mg/L	0.02 mg/L	99.5	70.0	130	----
		copper, total	7440-50-8	E420	0.0198 mg/L	0.02 mg/L	98.8	70.0	130	----
		iron, total	7439-89-6	E420	1.93 mg/L	2 mg/L	96.5	70.0	130	----
		lead, total	7439-92-1	E420	0.0191 mg/L	0.02 mg/L	95.7	70.0	130	----
		lithium, total	7439-93-2	E420	0.0995 mg/L	0.1 mg/L	99.5	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0207 mg/L	0.02 mg/L	103	70.0	130	----
		nickel, total	7440-02-0	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		potassium, total	7440-09-7	E420	3.98 mg/L	4 mg/L	99.6	70.0	130	----
		selenium, total	7782-49-2	E420	0.0397 mg/L	0.04 mg/L	99.3	70.0	130	----
		silicon, total	7440-21-3	E420	9.62 mg/L	10 mg/L	96.2	70.0	130	----
		silver, total	7440-22-4	E420	0.00398 mg/L	0.004 mg/L	99.6	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00384 mg/L	0.004 mg/L	95.9	70.0	130	----
		tin, total	7440-31-5	E420	0.0196 mg/L	0.02 mg/L	98.2	70.0	130	----
		titanium, total	7440-32-6	E420	0.0402 mg/L	0.04 mg/L	101	70.0	130	----
		uranium, total	7440-61-1	E420	0.00384 mg/L	0.004 mg/L	96.0	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0989 mg/L	0.1 mg/L	98.9	70.0	130	----
		zinc, total	7440-66-6	E420	0.391 mg/L	0.4 mg/L	97.7	70.0	130	----
Total Metals (QCLot: 600784)										
VA22B8488-002	Anonymous	aluminum, total	7429-90-5	E420	0.214 mg/L	0.2 mg/L	107	70.0	130	----
		antimony, total	7440-36-0	E420	0.0201 mg/L	0.02 mg/L	101	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0196 mg/L	0.02 mg/L	98.0	70.0	130	----
		barium, total	7440-39-3	E420	0.0193 mg/L	0.02 mg/L	96.7	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0433 mg/L	0.04 mg/L	108	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00910 mg/L	0.01 mg/L	91.0	70.0	130	----
		boron, total	7440-42-8	E420	ND mg/L	0.1 mg/L	ND	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00370 mg/L	0.004 mg/L	92.6	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0389 mg/L	0.04 mg/L	97.3	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0187 mg/L	0.02 mg/L	93.6	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 600784) - continued										
VA22B8488-002	Anonymous	copper, total	7440-50-8	E420	0.0176 mg/L	0.02 mg/L	88.1	70.0	130	----
		iron, total	7439-89-6	E420	1.89 mg/L	2 mg/L	94.6	70.0	130	----
		lead, total	7439-92-1	E420	0.0186 mg/L	0.02 mg/L	93.2	70.0	130	----
		lithium, total	7439-93-2	E420	0.105 mg/L	0.1 mg/L	105	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0197 mg/L	0.02 mg/L	98.6	70.0	130	----
		molybdenum, total	7439-98-7	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		nickel, total	7440-02-0	E420	0.0368 mg/L	0.04 mg/L	92.1	70.0	130	----
		potassium, total	7440-09-7	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, total	7782-49-2	E420	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		silicon, total	7440-21-3	E420	10.4 mg/L	10 mg/L	104	70.0	130	----
		silver, total	7440-22-4	E420	0.00390 mg/L	0.004 mg/L	97.5	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00365 mg/L	0.004 mg/L	91.3	70.0	130	----
		tin, total	7440-31-5	E420	0.0193 mg/L	0.02 mg/L	96.7	70.0	130	----
		titanium, total	7440-32-6	E420	0.0425 mg/L	0.04 mg/L	106	70.0	130	----
		uranium, total	7440-61-1	E420	0.00377 mg/L	0.004 mg/L	94.3	70.0	130	----
		vanadium, total	7440-62-2	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		zinc, total	7440-66-6	E420	0.364 mg/L	0.4 mg/L	90.9	70.0	130	----
Dissolved Metals (QCLot: 599135)										
VA22B8461-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.254 mg/L	0.2 mg/L	127	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0248 mg/L	0.02 mg/L	124	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0251 mg/L	0.02 mg/L	125	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.0249 mg/L	0.02 mg/L	124	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0472 mg/L	0.04 mg/L	118	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0113 mg/L	0.01 mg/L	113	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.117 mg/L	0.1 mg/L	117	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00500 mg/L	0.004 mg/L	125	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0482 mg/L	0.04 mg/L	120	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0241 mg/L	0.02 mg/L	121	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0242 mg/L	0.02 mg/L	121	70.0	130	----
		iron, dissolved	7439-89-6	E421	2.40 mg/L	2 mg/L	120	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0240 mg/L	0.02 mg/L	120	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.119 mg/L	0.1 mg/L	119	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 599135) - continued										
VA22B8461-002	Anonymous	magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0254 mg/L	0.02 mg/L	127	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0256 mg/L	0.02 mg/L	128	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0487 mg/L	0.04 mg/L	122	70.0	130	----
		potassium, dissolved	7440-09-7	E421	5.00 mg/L	4 mg/L	125	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0822 mg/L	0.08 mg/L	103	70.0	130	----
		silicon, dissolved	7440-21-3	E421	12.4 mg/L	10 mg/L	124	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00466 mg/L	0.004 mg/L	116	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00462 mg/L	0.004 mg/L	116	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0247 mg/L	0.02 mg/L	123	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0471 mg/L	0.04 mg/L	118	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00495 mg/L	0.004 mg/L	124	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.126 mg/L	0.1 mg/L	126	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.506 mg/L	0.4 mg/L	126	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-006	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	8478	ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS) F	Total Nitrogen Ammonia P	DOC F/P	TSS (Whole bottle)							
1	FPC-R3_WS-1_2022-08	08-Aug-22	12:30	Water	R	R	R	R	R	R							6
2	HAC-R1_WS-1_2022-08	08-Aug-22	10:30	Water	R	R	R	R	R	R							6
3	HAC-U_WS-1_2022-08	08-Aug-22	11:00	Water	R	R	R	R	R	R							6
4	HAC-D_WS-1_2022-08	08-Aug-22	12:35	Water	R	R	R	R	R	R							6
5	EDC-U_WS-1_2022-08	08-Aug-22	08:00	Water	R	R	R	R	R	R							6
6	EDC-D_WS-1_2022-08	08-Aug-22	12:12	Water	R	R	R	R	R	R							6
7	E1_WS-1_2022-08	08-Aug-22	11:15	Water	R	R	R	R	R	R							6
8	HAC-R3_WS-1_2022-08	08-Aug-22	13:39	Water	R	R	R	R	R	R							6
9	HAC-U _WS-1X_2022-08	08-Aug-22	11:00	Water	R	R	R	R	R	R							6

Environmental Division Vancouver

Work Order Reference VA22B8478

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	10	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 9-Aug-22	Time: 08:00	Received by:	Date:	Time:	Received by:	Date: Aug 10/22	Time: 11 am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WATER CHEMISTRY

ALS Laboratory Report VA22C0064

(Finalized September 8, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0064**	Page	: 1 of 6
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 26-Aug-2022
C-O-C number	: ----	Issue Date	: 08-Sep-2022 09:05
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Inorganics, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_WS_DI -1_2022-08	----	----	----	----
					Client sampling date / time	25-Aug-2022 10:55	----	----	----	----
						VA22C0064-001	--------	--------	--------	--------
						Result	----	----	----	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		89.1	----	----	----	----
conductivity	----	E100	2.0	µS/cm		242	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		111	----	----	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		108	----	----	----	----
pH	----	E108	0.10	pH units		8.12	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L		174	----	----	----	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		2.8	----	----	----	----
turbidity	----	E121	0.10	NTU		1.73	----	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0107	----	----	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		0.87	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.080	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0078	----	----	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0078	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	----	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.388	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0134	----	----	----	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0059	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		34.9	----	----	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		7.40	----	----	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0399	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		0.00010	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00058	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.0111	----	----	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L		0.020	----	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_WS_DI-1_2022-08	----	----	----	----
					Client sampling date / time	25-Aug-2022 10:55	----	----	----	----
						VA22C0064-001	--------	--------	--------	--------
						Result	----	----	----	----
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000057	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L		34.6	----	----	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	----	----	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00623	----	----	----	----
iron, total	7439-89-6	E420	0.030	mg/L		0.036	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		0.000144	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	----	----	----	----
magnesium, total	7439-95-4	E420	0.100	mg/L		5.27	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00746	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.00658	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		1.07	----	----	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000658	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L		3.32	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		7.04	----	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.258	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000192	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		0.00141	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	----	----	----	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0037	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00052	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00958	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	POL-P2_WS_DI -1_2022-08	----	----	----	----
					Client sampling date / time	25-Aug-2022 10:55	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22C0064-001	--------	--------	--------	--------
						Result	----	----	----	----
Dissolved Metals										
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.020	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		<0.0000050	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		35.9	----	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00428	----	----	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000158	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		5.16	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00176	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.00629	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		1.02	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000634	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		3.23	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		7.22	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.229	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000191	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		0.00130	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	----	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	----	----	----	----
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg/L		3.47	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C0064**	Page	: 1 of 10
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Issue Date	: 08-Sep-2022 09:05
C-O-C number	: ----		
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-P2_WS_DI-1_2022-08	E298	25-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-08	E235.Cl	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE										
POL-P2_WS_DI-1_2022-08	E378-U	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-08	E235.F	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1_2022-08	E235.NO3-L	25-Aug-2022	28-Aug-2022	3 days	3 days	✓	28-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-P2_WS_DI-1_2022-08	E235.NO2-L	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-P2_WS_DI-1_2022-08	E235.SO4	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) POL-P2_WS_DI-1_2022-08	E375-T	25-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid) POL-P2_WS_DI-1_2022-08	E366	25-Aug-2022	02-Sep-2022	----	----		06-Sep-2022	28 days	12 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-P2_WS_DI-1_2022-08	E372-U	25-Aug-2022	02-Sep-2022	----	----		06-Sep-2022	28 days	12 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) POL-P2_WS_DI-1_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-P2_WS_DI-1_2022-08	E358-L	25-Aug-2022	02-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-P2_WS_DI-1_2022-08	E290	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE POL-P2_WS_DI-1_2022-08	E100	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	28 days	3 days	✓
Physical Tests : pH by Meter										
HDPE POL-P2_WS_DI-1_2022-08	E108	25-Aug-2022	28-Aug-2022	----	----		28-Aug-2022	0.25 hrs	2.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE POL-P2_WS_DI-1_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
POL-P2_WS_DI-1_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
POL-P2_WS_DI-1_2022-08	E121	25-Aug-2022	----	----	----		28-Aug-2022	3 days	3 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
POL-P2_WS_DI-1_2022-08	E870	25-Aug-2022	26-Aug-2022	2 days	1 days	✓	31-Aug-2022	672 hrs	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-P2_WS_DI-1_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		01-Sep-2022	180 days	7 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	622347	1	10	10.0	5.0	✓
Ammonia by Fluorescence	E298	630773	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	622341	1	18	5.5	5.0	✓
Conductivity in Water	E100	622346	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	630769	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	622344	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	622340	1	8	12.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	622338	1	13	7.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	622339	1	18	5.5	5.0	✓
pH by Meter	E108	622345	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	622337	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	628028	1	18	5.5	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	630772	1	1	100.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621231	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	630774	1	1	100.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	630770	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	622440	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	622347	1	10	10.0	5.0	✓
Ammonia by Fluorescence	E298	630773	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	622341	1	18	5.5	5.0	✓
Chlorophyll-a by Fluorometry	E870	620673	1	1	100.0	5.0	✓
Conductivity in Water	E100	622346	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	630769	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	622344	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	622340	1	8	12.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	622338	1	13	7.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	622339	1	18	5.5	5.0	✓
pH by Meter	E108	622345	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	622337	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	628028	1	18	5.5	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	630772	1	1	100.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621231	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	630774	1	1	100.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	630770	1	17	5.8	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
TSS by Gravimetry (Whole Bottle)	E164	627200	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	622440	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	622347	1	10	10.0	5.0	✓
Ammonia by Fluorescence	E298	630773	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	622341	1	18	5.5	5.0	✓
Chlorophyll-a by Fluorometry	E870	620673	1	1	100.0	5.0	✓
Conductivity in Water	E100	622346	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	630769	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	622344	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	622340	1	8	12.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	622338	1	13	7.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	622339	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	622337	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	628028	1	18	5.5	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	630772	1	1	100.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621231	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	630774	1	1	100.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	630770	1	17	5.8	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	627200	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	622440	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	630773	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	622341	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	630769	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	622344	1	13	7.6	5.0	✓
Fluoride in Water by IC	E235.F	622340	1	8	12.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	622338	1	13	7.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	622339	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	622337	1	18	5.5	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	630772	0	1	0.0	5.0	×
Total Metals in Water by CRC ICPMS	E420	621231	1	20	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	630774	0	1	0.0	5.0	×
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	630770	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Chlorophyll-a by Fluorometry	E870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Chlorophyll-a Extraction	EP870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22C0064**	Page	: 1 of 15
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 26-Aug-2022
C-O-C number	: ----	Issue Date	: 08-Sep-2022 09:06
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angelo Salandanan	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Inorganics, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 622345)											
KS2203176-001	Anonymous	pH	----	E108	0.10	pH units	8.10	8.10	0.00%	4%	----
Physical Tests (QC Lot: 622346)											
KS2203176-001	Anonymous	conductivity	----	E100	2.0	µS/cm	334	332	0.601%	10%	----
Physical Tests (QC Lot: 622347)											
KS2203176-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	89.3	89.2	0.112%	20%	----
Physical Tests (QC Lot: 622440)											
FJ2202342-001	Anonymous	turbidity	----	E121	0.10	NTU	0.60	0.57	0.03	Diff <2x LOR	----
Physical Tests (QC Lot: 628028)											
KS2203171-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1910	2000	4.56%	20%	----
Anions and Nutrients (QC Lot: 622337)											
FJ2202340-007	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	6.00	mg/L	73.8	72.2	2.23%	20%	----
Anions and Nutrients (QC Lot: 622338)											
FJ2202340-007	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 622339)											
FJ2202340-007	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0200	mg/L	<0.0200	<0.0200	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 622340)											
FJ2202340-007	Anonymous	fluoride	16984-48-8	E235.F	0.400	mg/L	<0.400	<0.400	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 622341)											
FJ2202340-007	Anonymous	chloride	16887-00-6	E235.Cl	10.0	mg/L	45.4	44.5	0.99	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 622344)											
VA22B9971-017	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 630770)											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0134	0.0134	0.00008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 630772)											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0059	0.0058	0.00008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 630773)											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0107	0.0105	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 630774)											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.388	0.354	9.01%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Organic / Inorganic Carbon (QC Lot: 630769)											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	7.40	7.74	4.55%	20%	----
Total Metals (QC Lot: 621231)											
KS2203144-002	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00020	0.00020	0.0000002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0555	0.0568	2.42%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000507	0.0000499	1.51%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	58.0	55.7	3.96%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.0188	0.0185	1.42%	20%	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.028	0.028	0.0003	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000142	0.000144	0.000001	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	12.3	12.0	2.02%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00122	0.00115	6.21%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00898	0.00927	3.20%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	2.88	2.79	3.37%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	5.94	5.81	2.16%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	11.0	10.4	4.73%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.590	0.606	2.62%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00556	0.00566	1.78%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.0042	0.0041	0.0001	Diff <2x LOR	----
Dissolved Metals (QC Lot: 623614)											

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 623614) - continued											
VA22C0064-001	POL-P2_WS_DI-1_2022-08	aluminum, dissolved	7429-90-5	E421	0.0030	mg/L	0.0037	0.0038	0.0001	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00052	0.00052	0.000004	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00958	0.00978	2.04%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.020	0.019	0.0008	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	0.0000054	0.0000004	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	35.9	35.0	2.39%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00050	mg/L	0.00428	0.00430	0.00002	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000158	0.000160	0.000002	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.100	mg/L	5.16	5.29	2.37%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00176	0.00173	1.42%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00629	0.00649	3.11%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.02	1.02	0.0908%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000634	0.000592	6.86%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.23	3.22	0.450%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	7.22	7.26	0.488%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.229	0.238	3.65%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000191	0.000183	3.99%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00130	0.00130	0.0000002	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 622346)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 622347)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	1.1	----
Physical Tests (QCLot: 622440)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 627200)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 628028)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 622337)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 622338)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 622339)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 622340)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 622341)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 622344)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 630770)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 630772)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 630773)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 630774)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Organic / Inorganic Carbon (QCLot: 630769)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 621231)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 621231) - continued						
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 623614)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 623614) - continued						
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Plant Pigments (QCLot: 620673)						
chlorophyll a	479-61-8	E870	0.01	µg/L	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 622345)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 622346)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.2	90.0	110	----
Physical Tests (QCLot: 622347)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	110	85.0	115	----
Physical Tests (QCLot: 622440)									
turbidity	----	E121	0.1	NTU	200 NTU	103	85.0	115	----
Physical Tests (QCLot: 627200)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	97.2	85.0	115	----
Physical Tests (QCLot: 628028)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	106	85.0	115	----
Anions and Nutrients (QCLot: 622337)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 622338)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 622339)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.7	90.0	110	----
Anions and Nutrients (QCLot: 622340)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	99.9	90.0	110	----
Anions and Nutrients (QCLot: 622341)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 622344)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	103	80.0	120	----
Anions and Nutrients (QCLot: 630770)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	93.7	80.0	120	----
Anions and Nutrients (QCLot: 630772)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	89.4	80.0	120	----
Anions and Nutrients (QCLot: 630773)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	89.2	85.0	115	----
Anions and Nutrients (QCLot: 630774)									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	102	75.0	125	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Organic / Inorganic Carbon (QCLot: 630769)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	101	80.0	120	----
Total Metals (QCLot: 621231)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	110	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	116	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	106	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	105	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	101	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	103	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	96.8	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	98.0	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	102	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	107	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	99.0	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	107	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	106	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	113	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	105	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	107	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	103	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	105	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	113	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	108	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	97.5	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	102	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	101	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	105	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	103	80.0	120	----
Dissolved Metals (QCLot: 623614)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	105	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 623614) - continued									
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	94.9	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	96.1	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	104	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	88.8	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.6	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	109	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	94.4	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	103	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	104	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.9	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.7	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	102	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	104	80.0	120	----
Plant Pigments (QCLot: 620673)									
chlorophyll a	479-61-8	E870	0.01	µg/L	5 µg/L	90.2	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 622337)										
VA22B9992-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	106 mg/L	100 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 622338)										
VA22B9992-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.64 mg/L	2.5 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 622339)										
VA22B9992-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.516 mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 622340)										
VA22B9992-001	Anonymous	fluoride	16984-48-8	E235.F	1.05 mg/L	1 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 622341)										
VA22B9992-001	Anonymous	chloride	16887-00-6	E235.Cl	105 mg/L	100 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 622344)										
VA22B9991-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0280 mg/L	0.03 mg/L	93.3	70.0	130	----
Anions and Nutrients (QCLot: 630770)										
VA22C0101-010	Anonymous	phosphorus, total	7723-14-0	E372-U	4.66 mg/L	5 mg/L	93.1	70.0	130	----
Anions and Nutrients (QCLot: 630773)										
VA22C0101-010	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0942 mg/L	0.1 mg/L	94.2	75.0	125	----
Organic / Inorganic Carbon (QCLot: 630769)										
WR2200953-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.01 mg/L	5 mg/L	100	70.0	130	----
Total Metals (QCLot: 621231)										
KS2203144-004	Anonymous	aluminum, total	7429-90-5	E420	0.182 mg/L	0.2 mg/L	91.2	70.0	130	----
		antimony, total	7440-36-0	E420	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0182 mg/L	0.02 mg/L	91.3	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0370 mg/L	0.04 mg/L	92.4	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00915 mg/L	0.01 mg/L	91.5	70.0	130	----
		boron, total	7440-42-8	E420	0.091 mg/L	0.1 mg/L	91.4	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00359 mg/L	0.004 mg/L	89.8	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0360 mg/L	0.04 mg/L	89.9	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0179 mg/L	0.02 mg/L	89.4	70.0	130	----
		copper, total	7440-50-8	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 621231) - continued										
KS2203144-004	Anonymous	iron, total	7439-89-6	E420	1.81 mg/L	2 mg/L	90.4	70.0	130	----
		lead, total	7439-92-1	E420	0.0190 mg/L	0.02 mg/L	95.1	70.0	130	----
		lithium, total	7439-93-2	E420	0.0892 mg/L	0.1 mg/L	89.2	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0180 mg/L	0.02 mg/L	90.2	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		nickel, total	7440-02-0	E420	0.0357 mg/L	0.04 mg/L	89.4	70.0	130	----
		potassium, total	7440-09-7	E420	3.64 mg/L	4 mg/L	90.9	70.0	130	----
		selenium, total	7782-49-2	E420	0.0371 mg/L	0.04 mg/L	92.8	70.0	130	----
		silicon, total	7440-21-3	E420	8.53 mg/L	10 mg/L	85.3	70.0	130	----
		silver, total	7440-22-4	E420	0.00390 mg/L	0.004 mg/L	97.6	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00368 mg/L	0.004 mg/L	92.1	70.0	130	----
		tin, total	7440-31-5	E420	0.0182 mg/L	0.02 mg/L	91.0	70.0	130	----
		titanium, total	7440-32-6	E420	0.0361 mg/L	0.04 mg/L	90.3	70.0	130	----
		uranium, total	7440-61-1	E420	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0920 mg/L	0.1 mg/L	92.0	70.0	130	----
		zinc, total	7440-66-6	E420	0.360 mg/L	0.4 mg/L	90.0	70.0	130	----
Dissolved Metals (QCLot: 623614)										
VA22C0053-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.203 mg/L	0.2 mg/L	101	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0196 mg/L	0.02 mg/L	98.3	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0216 mg/L	0.02 mg/L	108	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0384 mg/L	0.04 mg/L	95.9	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00872 mg/L	0.01 mg/L	87.2	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.085 mg/L	0.1 mg/L	85.5	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00377 mg/L	0.004 mg/L	94.3	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0185 mg/L	0.02 mg/L	92.6	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0176 mg/L	0.02 mg/L	88.2	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.83 mg/L	2 mg/L	91.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0184 mg/L	0.02 mg/L	91.8	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0933 mg/L	0.1 mg/L	93.3	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 623614) - continued										
VA22C0053-001	Anonymous	manganese, dissolved	7439-96-5	E421	0.0199 mg/L	0.02 mg/L	99.7	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0368 mg/L	0.04 mg/L	92.0	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0447 mg/L	0.04 mg/L	112	70.0	130	----
		silicon, dissolved	7440-21-3	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00364 mg/L	0.004 mg/L	91.0	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00366 mg/L	0.004 mg/L	91.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0192 mg/L	0.02 mg/L	96.1	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.383 mg/L	0.4 mg/L	95.7	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	238-317-4939	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:	Likely, BC	Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Distribution**	**Analysis Request**
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2:	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-006	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): VA22C0064

ALS Contact: Can Dang

Sampler: D Schnurr / S Lahmer

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)	Chlorophyll a (E8708)	Number of Containers
	~~POL-P2_WS_DI-1_2022-08~~	~~Aug-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	R		~~6~~
1	POL-P2_WS_DI-1_2022-08	25-Aug-22	10:55	Water	R	R	R	R	R	R	R	7
	~~WS_DI-1_2022-08~~	~~Aug-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	R		~~6~~

Environmental Division Vancouver
Work Order Reference
VA22C0064

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client u

Are samples taken from a Regulated DW System?
☐ NO

Are samples for human drinking water use?
☐ NO

dd on report by clicking on the drop-down list below
tronic COC only)

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6.5	10	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S.Lahmer	Date: 25 Aug 22	Time: 11:40	Received by:	Date:	Time:	Received by: JC	Date: AUG 26 2022	Time: 1015am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

WATER CHEMISTRY

ALS Laboratory Report VA22C0091

(Finalized September 6, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0091**	Page	: 1 of 17
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 26-Aug-2022
C-O-C number	: ----	Issue Date	: 06-Sep-2022 14:19
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 22		
No. of samples analysed	: 22		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Delson Resende	Lab Assistant	Metals, Burnaby, British Columbia
Greg Pokocky	Supervisor - Inorganic	Inorganics, Waterloo, Ontario
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Inorganics, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

For sample POL_WS_1X_2022_08 total nutrients bottle is received empty, analysis will be carried out from the sub sample.

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
DTC	*Dissolved concentration exceeds total. Results were confirmed by re-analysis.*
DTMF	*Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_WS-1_2022-08	QUL-LNF1_WS-2_2022-08	QUL-LNF1_WS-3_2022-08	QUL-LNF1_WS-4_2022-08	QUL-LNF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 07:05	24-Aug-2022 07:20	24-Aug-2022 07:40	24-Aug-2022 08:00	24-Aug-2022 08:20
						VA22C0091-001	VA22C0091-002	VA22C0091-003	VA22C0091-004	VA22C0091-005
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		43.5	43.4	43.7	43.8	43.7
conductivity	----	E100	2.0	µS/cm		101	99.7	99.4	99.9	100
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		46.9	47.6	48.3	48.2	47.7
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		48.8	49.2	48.4	48.4	48.8
pH	----	E108	0.10	pH units		7.96	7.97	7.98	7.98	7.97
solids, total dissolved [TDS]	----	E162	10	mg/L		68	68	69	67	72
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
turbidity	----	E121	0.10	NTU		0.25	0.22	0.24	0.19	0.29
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0107	0.0051	0.0076	0.0095	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
fluoride	16984-48-8	E235.F	0.020	mg/L		0.035	0.034	0.034	0.034	0.034
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0131	0.0127	0.0121	0.0125	0.0120
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0131	0.0127	0.0121	0.0125	0.0120
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.101	0.092	0.096	0.095	0.101
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0027	0.0027	0.0027	0.0037	0.0039
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.92	5.82	5.85	5.86	5.85
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		2.80	2.58	2.52	2.38	2.38
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0153	0.0141	0.0142	0.0152	0.0185
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00014	0.00014	0.00013	0.00014	0.00015
barium, total	7440-39-3	E420	0.00010	mg/L		0.00542	0.00557	0.00544	0.00544	0.00560
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_WS-1_2022-08	QUL-LNF1_WS-2_2022-08	QUL-LNF1_WS-3_2022-08	QUL-LNF1_WS-4_2022-08	QUL-LNF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 07:05	24-Aug-2022 07:20	24-Aug-2022 07:40	24-Aug-2022 08:00	24-Aug-2022 08:20
						VA22C0091-001	VA22C0091-002	VA22C0091-003	VA22C0091-004	VA22C0091-005
						Result	Result	Result	Result	Result
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000191	0.0000101	0.0000077	0.0000074	<0.0000050
calcium, total	7440-70-2	E420	0.050	mg/L		16.3	16.4	16.1	16.2	16.2
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00088	0.00069	0.00072	0.00066	0.00129
iron, total	7439-89-6	E420	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, total	7439-92-1	E420	0.000050	mg/L		0.000088	<0.000050	<0.000050	<0.000050	0.000992
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		1.96	2.01	1.98	1.94	2.02
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00174	0.00176	0.00175	0.00177	0.00187
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000366	0.000377	0.000364	0.000354	0.000376
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L		0.450	0.462	0.459	0.450	0.452
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000133	0.000101	0.000127	0.000117	0.000093
silicon, total	7440-21-3	E420	0.10	mg/L		1.59	1.61	1.60	1.66	1.62
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		0.878	0.894	0.886	0.868	0.900
strontium, total	7440-24-6	E420	0.00020	mg/L		0.117	0.119	0.119	0.119	0.118
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000135	0.000137	0.000135	0.000133	0.000134
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L		0.0071	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0097	0.0098	0.0106	0.0104	0.0105
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00012	<0.00010	0.00012	0.00014	0.00012
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00491	0.00474	0.00500	0.00479	0.00503
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_WS-1_2022-08	QUL-LNF1_WS-2_2022-08	QUL-LNF1_WS-3_2022-08	QUL-LNF1_WS-4_2022-08	QUL-LNF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 07:05	24-Aug-2022 07:20	24-Aug-2022 07:40	24-Aug-2022 08:00	24-Aug-2022 08:20
						VA22C0091-001	VA22C0091-002	VA22C0091-003	VA22C0091-004	VA22C0091-005
						Result	Result	Result	Result	Result
Dissolved Metals										
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000200	0.0000269 DTC	0.0000263 DTC	0.0000076	0.0000252 DTC
calcium, dissolved	7440-70-2	E421	0.050	mg/L		15.7	16.0	16.3	16.2	16.0
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00079	0.00068	0.00085	0.00063	0.00086
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000085	0.000066	0.000117 DTC	<0.000050	0.000174
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		1.88	1.87	1.85	1.88	1.88
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00048	0.00044	0.00068	0.00051	0.00058
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000374	0.000344	0.000368	0.000360	0.000373
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.475	0.466	0.474	0.471	0.483
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000117	0.000116	0.000103	0.000115	0.000124
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.53	1.53	1.53	1.53	1.58
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L		0.855	0.847	0.847	0.862	0.862
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.113	0.108	0.114	0.113	0.115
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000135	0.000136	0.000134	0.000136	0.000138
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		0.0109	0.0084 DTC	0.0076 DTC	<0.0030	0.0043
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_WS-1_2022-08	QUL-LREF1_WS-2_2022-08	QUL-LREF1_WS-3_2022-08	QUL-LREF1_WS-4_2022-08	QUL-LREF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 09:00	24-Aug-2022 09:15	24-Aug-2022 09:25	24-Aug-2022 09:45	24-Aug-2022 10:00
						VA22C0091-006	VA22C0091-007	VA22C0091-008	VA22C0091-009	VA22C0091-010
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		44.8	44.6	45.2	45.0	44.6
conductivity	----	E100	2.0	µS/cm		101	101	101	102	102
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		50.3	48.0	47.6	48.1	47.4
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		50.2	49.9	49.7	50.5	50.4
pH	----	E108	0.10	pH units		8.00	8.02	8.00	8.00	8.00
solids, total dissolved [TDS]	----	E162	10	mg/L		76	70	69	68	62
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.2	<1.3	<1.0	<1.0
turbidity	----	E121	0.10	NTU		0.46	0.48	0.45	0.48	0.61
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	0.0074	<0.0050	<0.0050	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
fluoride	16984-48-8	E235.F	0.020	mg/L		0.036	0.036	0.036	0.036	0.036
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.104	0.106	0.100	0.104	0.115
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0047	0.0109	0.0050	0.0055	0.0054
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0022	<0.0020	<0.0020	0.0024	0.0020
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.85	5.80	5.85	5.83	5.83
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		2.74	2.65	2.80	2.73	2.77
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0185	0.0208	0.0261	0.0217	0.0247
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00026	0.00027	0.00022	0.00026	0.00023
barium, total	7440-39-3	E420	0.00010	mg/L		0.00711	0.00710	0.00720	0.00709	0.00723
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000125	0.0000069	0.0000098	0.0000056	0.0000053

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_WS-1_2022-08	QUL-LREF1_WS-2_2022-08	QUL-LREF1_WS-3_2022-08	QUL-LREF1_WS-4_2022-08	QUL-LREF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 09:00	24-Aug-2022 09:15	24-Aug-2022 09:25	24-Aug-2022 09:45	24-Aug-2022 10:00
						VA22C0091-006	VA22C0091-007	VA22C0091-008	VA22C0091-009	VA22C0091-010
						Result	Result	Result	Result	Result
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		16.3	16.2	16.2	16.4	16.5
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00074	0.00102	0.00115	0.00096	0.00110
iron, total	7439-89-6	E420	0.030	mg/L		0.050	0.056	0.060	0.057	0.065
lead, total	7439-92-1	E420	0.000050	mg/L		0.000107	0.000780	0.000382	0.000348	0.000662
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		2.32	2.29	2.24	2.31	2.23
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00668	0.00626	0.00692	0.00844	0.00842
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000512	0.000498	0.000495	0.000515	0.000521
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L		0.502	0.464	0.478	0.496	0.473
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000208	0.000163	0.000183	0.000129	0.000179
silicon, total	7440-21-3	E420	0.10	mg/L		2.00	1.92	1.94	1.97	1.91
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		1.08	1.04	1.04	1.08	1.04
strontium, total	7440-24-6	E420	0.00020	mg/L		0.108	0.109	0.107	0.108	0.114
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000128	0.000127	0.000128	0.000120	0.000128
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	0.0043	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0113	0.0108	0.0103	0.0103	0.0097
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00023	0.00020	0.00023	0.00025	0.00021
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00634	0.00639	0.00606	0.00623	0.00645
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_WS-1_2022-08	QUL-LREF1_WS-2_2022-08	QUL-LREF1_WS-3_2022-08	QUL-LREF1_WS-4_2022-08	QUL-LREF1_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 09:00	24-Aug-2022 09:15	24-Aug-2022 09:25	24-Aug-2022 09:45	24-Aug-2022 10:00
						VA22C0091-006	VA22C0091-007	VA22C0091-008	VA22C0091-009	VA22C0091-010
						Result	Result	Result	Result	Result
Dissolved Metals										
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000205	0.0000091	0.0000193	0.0000118	<0.0000050
calcium, dissolved	7440-70-2	E421	0.050	mg/L		16.5	15.5	15.5	15.6	15.4
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00069	0.00088	0.00073	0.00094	0.00060
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000052	0.000128	0.000123	0.000188	0.000101
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.20	2.26	2.17	2.23	2.17
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00131	0.00124	0.00148	0.00222	0.00193
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000468	0.000460	0.000466	0.000492	0.000486
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.528	0.485	0.492	0.505	0.484
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000159	0.000159	0.000149	0.000197	0.000171
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.88	1.80	1.77	1.85	1.80
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L		1.04	1.00	0.993	1.04	0.991
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.101	0.103	0.0999	0.0986	0.0978
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000118	0.000125	0.000122	0.000120	0.000121
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-S_WS-1_2022-08	POL-S_WS-2_2022-08	POL-S_WS-3_2022-08	POL-S_WS-4_2022-08	POL-S_WS-5_2022-08
					Client sampling date / time	25-Aug-2022 08:50	25-Aug-2022 09:05	25-Aug-2022 09:25	25-Aug-2022 09:40	25-Aug-2022 09:55
						VA22C0091-011	VA22C0091-012	VA22C0091-013	VA22C0091-014	VA22C0091-015
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		87.9	88.3	88.8	89.9	88.9
conductivity	----	E100	2.0	µS/cm		246	244	247	247	245
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		108	109	110	109	115
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		112	112	116	114	114
pH	----	E108	0.10	pH units		8.34	8.36	8.36	8.36	8.36
solids, total dissolved [TDS]	----	E162	10	mg/L		203	196	196	185	199
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	2.2	1.7	<1.0
turbidity	----	E121	0.10	NTU		0.34	0.46	0.35	0.33	0.32
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L		0.80	0.81	0.82	0.82	0.83
fluoride	16984-48-8	E235.F	0.020	mg/L		0.080	0.082	0.082	0.081	0.080
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.272	0.275	0.259	0.250	0.262
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0091	0.0083	0.0297	0.0080	0.0097
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0036	0.0041	0.0037	0.0042	0.0031
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		36.1	36.2	36.6	36.6	36.7
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		6.60	6.20	6.92	6.87	7.08
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0085	0.0079	0.0120	0.0080	0.0208
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	0.00012	0.00012
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00055	0.00056	0.00057	0.00057	0.00064
barium, total	7440-39-3	E420	0.00010	mg/L		0.0106	0.0107	0.0107	0.0105	0.0108
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		0.020	0.020	0.020	0.020	0.020
cadmium, total	7440-43-9	E420	0.0000050	mg/L		<0.0000100 DLM	<0.0000100 DLM	<0.0000050	<0.0000050	<0.0000100 DLM

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-S_WS-1_2022-08	POL-S_WS-2_2022-08	POL-S_WS-3_2022-08	POL-S_WS-4_2022-08	POL-S_WS-5_2022-08
					Client sampling date / time	25-Aug-2022 08:50	25-Aug-2022 09:05	25-Aug-2022 09:25	25-Aug-2022 09:40	25-Aug-2022 09:55
						VA22C0091-011	VA22C0091-012	VA22C0091-013	VA22C0091-014	VA22C0091-015
						Result	Result	Result	Result	Result
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		36.1	35.9	37.5	36.5	36.8
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00419	0.00393	0.00420	0.00389	0.00488
iron, total	7439-89-6	E420	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, total	7439-92-1	E420	0.000050	mg/L		<0.000050	0.000171	0.000143	0.000158	0.000549
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		5.41	5.38	5.55	5.56	5.43
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00711	0.00734	0.00678	0.00524	0.00556
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.00691	0.00694	0.00713	0.00694	0.00707
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L		0.942	0.928	0.962	0.949	0.939
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000787	0.000749	0.000846	0.000873	0.000751
silicon, total	7440-21-3	E420	0.10	mg/L		2.87	2.83	3.02	3.02	2.98
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		7.51	7.48	7.57	7.58	7.45
strontium, total	7440-24-6	E420	0.00020	mg/L		0.252	0.252	0.255	0.254	0.256
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000183	0.000186	0.000194	0.000192	0.000191
vanadium, total	7440-62-2	E420	0.00050	mg/L		0.00144	0.00136	0.00141	0.00140	0.00144
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0032	<0.0030	0.0041	0.0040	0.0036
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00052	0.00055	0.00056	0.00054	0.00051
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00991	0.00962	0.00936	0.00946	0.00950
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.018	0.018	0.018	0.018	0.019

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-S_WS-1_2022-08	POL-S_WS-2_2022-08	POL-S_WS-3_2022-08	POL-S_WS-4_2022-08	POL-S_WS-5_2022-08
					Client sampling date / time	25-Aug-2022 08:50	25-Aug-2022 09:05	25-Aug-2022 09:25	25-Aug-2022 09:40	25-Aug-2022 09:55
						VA22C0091-011	VA22C0091-012	VA22C0091-013	VA22C0091-014	VA22C0091-015
						Result	Result	Result	Result	Result
Dissolved Metals										
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000188 DTMF	<0.0000050	<0.0000050	<0.0000050	0.0000058
calcium, dissolved	7440-70-2	E421	0.050	mg/L		34.6	34.7	35.4	34.5	37.0
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00372	0.00362	0.00370	0.00357	0.00355
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000070	0.000054	0.000898 DTC	0.000061	0.000187
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		5.25	5.43	5.38	5.52	5.46
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00096	0.00092	0.00112	0.00073	0.00094
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.00677	0.00691	0.00688	0.00698	0.00692
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.924	0.950	0.953	0.953	0.938
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000763	0.000763	0.000799	0.000755	0.000813
silicon, dissolved	7440-21-3	E421	0.050	mg/L		2.69	2.68	2.82	2.86	2.84
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L		6.99	7.26	7.13	7.14	7.18
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.235	0.236	0.241	0.237	0.231
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000189	0.000189	0.000196	0.000195	0.000184
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		0.00124	0.00131	0.00131	0.00132	0.00137
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		0.0059	<0.0030	0.0036	<0.0030	<0.0030
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S_WS-1_2022-08	BOL-S_WS-2_2022-08	BOL-S_WS-3_2022-08	BOL-S_WS-4_2022-08	BOL-S_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 14:30	24-Aug-2022 14:45	24-Aug-2022 14:50	24-Aug-2022 15:10	24-Aug-2022 15:25
						VA22C0091-016	VA22C0091-017	VA22C0091-018	VA22C0091-019	VA22C0091-020
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		40.2	39.9	39.3	39.2	39.5
conductivity	----	E100	2.0	µS/cm		98.0	97.7	98.8	97.1	97.4
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		43.4	44.6	42.7	43.3	43.8
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		45.0	44.8	45.0	44.6	44.8
pH	----	E108	0.10	pH units		7.91	7.91	7.95	7.92	7.93
solids, total dissolved [TDS]	----	E162	10	mg/L		91	91	90	88	94
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	1.2	1.0	1.3
turbidity	----	E121	0.10	NTU		0.41	0.42	0.34	0.33	0.41
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L		0.58	0.58	0.58	0.58	0.59
fluoride	16984-48-8	E235.F	0.020	mg/L		0.059	0.062	0.062	0.063	0.063
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.276	0.277	0.264	0.264	0.367
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		0.0011	<0.0010	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0160	0.0063	0.0070	0.0066	0.0088
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0029	0.0027	0.0029	0.0030	0.0029
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		7.57	7.56	7.58	7.53	7.54
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		7.51	7.54	7.90	7.55	7.56
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0107	0.0121	0.0070	0.0088	0.0071
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00034	0.00034	0.00034	0.00038	0.00035
barium, total	7440-39-3	E420	0.00010	mg/L		0.0156	0.0159	0.0156	0.0157	0.0160
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L		0.043	0.044	0.044	0.044	0.044
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000062	<0.0000050	<0.0000050	<0.0000050	0.0000071

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S_WS-1_2022-08	BOL-S_WS-2_2022-08	BOL-S_WS-3_2022-08	BOL-S_WS-4_2022-08	BOL-S_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 14:30	24-Aug-2022 14:45	24-Aug-2022 14:50	24-Aug-2022 15:10	24-Aug-2022 15:25
						VA22C0091-016	VA22C0091-017	VA22C0091-018	VA22C0091-019	VA22C0091-020
						Result	Result	Result	Result	Result
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		13.7	13.7	13.7	13.6	13.7
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L		0.00235	0.00248	0.00218	0.00279	0.00232
iron, total	7439-89-6	E420	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, total	7439-92-1	E420	0.000050	mg/L		0.000088	0.000258	0.000144	0.000564	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.100	mg/L		2.61	2.58	2.61	2.59	2.58
manganese, total	7439-96-5	E420	0.00010	mg/L		0.0122	0.0105	0.0113	0.0124	0.0140
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000916	0.000906	0.000878	0.000885	0.000873
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L		0.431	0.454	0.437	0.439	0.431
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000241	0.000235	0.000244	0.000189	0.000164
silicon, total	7440-21-3	E420	0.10	mg/L		1.55	1.58	1.54	1.56	1.53
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L		2.42	2.41	2.44	2.40	2.42
strontium, total	7440-24-6	E420	0.00020	mg/L		0.134	0.133	0.133	0.133	0.135
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000041	0.000044	0.000044	0.000045	0.000043
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0052	0.0045	0.0043	0.0044	0.0051
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00033	0.00030	0.00034	0.00031	0.00031
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.0145	0.0141	0.0139	0.0151	0.0148
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.040	0.042	0.040	0.042	0.042

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S_WS-1_2022-08	BOL-S_WS-2_2022-08	BOL-S_WS-3_2022-08	BOL-S_WS-4_2022-08	BOL-S_WS-5_2022-08
					Client sampling date / time	24-Aug-2022 14:30	24-Aug-2022 14:45	24-Aug-2022 14:50	24-Aug-2022 15:10	24-Aug-2022 15:25
						VA22C0091-016	VA22C0091-017	VA22C0091-018	VA22C0091-019	VA22C0091-020
						Result	Result	Result	Result	Result
Dissolved Metals										
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000089	<0.0000050	0.0000082	0.0000102 DTMF	0.0000117
calcium, dissolved	7440-70-2	E421	0.050	mg/L		13.2	13.7	13.0	13.2	13.4
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00218	0.00215	0.00199	0.00198	0.00209
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	<0.030	<0.030	<0.030
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	0.000358	0.000058	0.000091	0.000053
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.54	2.52	2.49	2.51	2.52
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00364	0.00224	0.00255	0.00421	0.00506
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000846	0.000822	0.000809	0.000840	0.000858
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.457	0.443	0.434	0.440	0.456
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000186	0.000158	0.000196	0.000246	0.000239
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.49	1.49	1.47	1.52	1.51
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L		2.42	2.43	2.42	2.35	2.47
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.121	0.122	0.121	0.125	0.123
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000045	0.000041	0.000044	0.000043	0.000042
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		0.0042	<0.0030	<0.0030	<0.0030	0.0030
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_WS-1X_2022-08	POL-S_WS-1X_2022-08	----	----	----
					Client sampling date / time	24-Aug-2022 09:00	25-Aug-2022 08:50	----	----	----
						VA22C0091-021	VA22C0091-022	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		47.5	90.9	----	----	----
conductivity	----	E100	2.0	µS/cm		98.9	236	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		48.7	111	----	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		50.1	113	----	----	----
pH	----	E108	0.10	pH units		7.75	8.15	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L		69	188	----	----	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		<1.0	<1.0	----	----	----
turbidity	----	E121	0.10	NTU		0.38	0.36	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	----	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	0.78	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.035	0.074	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	----	----	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		<0.0051	<0.0051	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.095	0.288	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0050	0.0061	----	----	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		<0.0020	0.0037	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.65	35.1	----	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		3.43	6.67	----	----	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0188	0.0068	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00024	0.00052	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.00715	0.0106	----	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	0.020	----	----	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.0000098	<0.0000100 DLM	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_WS-1X_2022-08	POL-S_WS-1X_2022-08	----	----	----
					Client sampling date / time	24-Aug-2022 09:00	25-Aug-2022 08:50	----	----	----
						VA22C0091-021	VA22C0091-022	--------	--------	--------
						Result	Result	----	----	----
Total Metals										
calcium, total	7440-70-2	E420	0.050	mg/L		16.3	36.5	----	----	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00084	0.00419	----	----	----
iron, total	7439-89-6	E420	0.030	mg/L		0.049	<0.030	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L		0.000120	0.000060	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	----	----	----
magnesium, total	7439-95-4	E420	0.100	mg/L		2.29	5.31	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00674	0.00682	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000498	0.00702	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.508	0.907	----	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000165	0.000732	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L		1.89	2.67	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L		1.07	7.40	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.111	0.256	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000125	0.000187	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	0.00135	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	----	----	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0107	<0.0030	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00021	0.00051	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00641	0.00939	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	0.019	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	QUL-LREF1_WS-1X_2022-08	POL-S_WS-1X_2022-08	----	----	----
					Client sampling date / time	24-Aug-2022 09:00	25-Aug-2022 08:50	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22C0091-021	VA22C0091-022	--------	--------	--------
						Result	Result	----	----	----
Dissolved Metals										
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000290 DTMF	0.0000100	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		16.0	35.6	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00080	0.00359	----	----	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		<0.030	<0.030	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000146	0.000293 DTC	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	----	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		2.13	5.42	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00117	0.00097	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000496	0.00675	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.501	0.919	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000155	0.000702	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.83	2.70	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		0.973	7.00	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.0978	0.240	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000122	0.000184	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	0.00124	----	----	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	0.0046	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C0091**	Page	: 1 of 56
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Issue Date	: 06-Sep-2022 14:19
C-O-C number	: ----		
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 22		
No. of samples analysed	: 22		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Total Metals	QC-621232-001	----	manganese, total	7439-96-5	E420	0.00012 [B] mg/L	0.0001 mg/L	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S_WS-1_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S_WS-2_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S_WS-3_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S_WS-4_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S_WS-5_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S_WS-1_2022-08	E298	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S_WS-2_2022-08	E298	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S_WS-3_2022-08	E298	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S_WS-4_2022-08	E298	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S_WS-5_2022-08	E298	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1X_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-1_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-2_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-3_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-4_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-5_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-2_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-3_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-4_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-5_2022-08	E298	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (lab preserved)										
POL-S_WS-1X_2022-08	E298	25-Aug-2022	26-Aug-2022	3 days	2 days	✓	27-Aug-2022	28 days	0 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-S_WS-1_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-S_WS-2_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-S_WS-3_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-S_WS-4_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BOL-S_WS-5_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-1_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-1X_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-2_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-3_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-4_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
POL-S_WS-5_2022-08	E235.Cl	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
QUL-LNF1_WS-1_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LNF1_WS-2_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LNF1_WS-3_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LNF1_WS-4_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LNF1_WS-5_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-1_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-1X_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-2_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-3_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-4_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE QUL-LREF1_WS-5_2022-08	E235.Cl	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-S_WS-1_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-S_WS-2_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-S_WS-3_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-S_WS-4_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-S_WS-5_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-1_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-1X_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-2_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-3_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-4_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE POL-S_WS-5_2022-08	E378-U	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LNF1_WS-1_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LNF1_WS-2_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LNF1_WS-3_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LNF1_WS-4_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LNF1_WS-5_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-1_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-1X_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-2_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-3_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-4_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-LREF1_WS-5_2022-08	E378-U	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE BOL-S_WS-1_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
BOL-S_WS-2_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
BOL-S_WS-3_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
BOL-S_WS-4_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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BOL-S_WS-5_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
POL-S_WS-1_2022-08	E235.F	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
POL-S_WS-1X_2022-08	E235.F	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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POL-S_WS-2_2022-08	E235.F	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
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POL-S_WS-4_2022-08	E235.F	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
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POL-S_WS-5_2022-08	E235.F	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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QUL-LNF1_WS-1_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LNF1_WS-2_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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QUL-LNF1_WS-3_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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QUL-LNF1_WS-4_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
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QUL-LNF1_WS-5_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-1_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-1X_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-2_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-3_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-4_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
QUL-LREF1_WS-5_2022-08	E235.F	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-S_WS-1_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-S_WS-2_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-S_WS-3_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-S_WS-4_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-S_WS-5_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
POL-S_WS-1_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-S_WS-1X_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-S_WS-2_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-S_WS-3_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-S_WS-4_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE POL-S_WS-5_2022-08	E235.NO3-L	25-Aug-2022	27-Aug-2022	3 days	2 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-1_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-2_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-3_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-4_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LNF1_WS-5_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-1_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-1X_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-2_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-3_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-4_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-5_2022-08	E235.NO3-L	24-Aug-2022	27-Aug-2022	3 days	3 days	✓	27-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-S_WS-1_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-S_WS-2_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-S_WS-3_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-S_WS-4_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-S_WS-5_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-1_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-1X_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-2_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-3_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-4_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
POL-S_WS-5_2022-08	E235.NO2-L	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-1_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-2_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-3_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-4_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LNF1_WS-5_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LREF1_WS-1_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LREF1_WS-1X_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LREF1_WS-2_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE QUL-LREF1_WS-3_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-4_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-LREF1_WS-5_2022-08	E235.NO2-L	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-S_WS-1_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-S_WS-2_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-S_WS-3_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-S_WS-4_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-S_WS-5_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-1_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-1X_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-2_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-3_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-4_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
POL-S_WS-5_2022-08	E235.SO4	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LNF1_WS-1_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LNF1_WS-2_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LNF1_WS-3_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LNF1_WS-4_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LNF1_WS-5_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-1_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-1X_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-2_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-3_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-4_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-LREF1_WS-5_2022-08	E235.SO4	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-S_WS-1_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-S_WS-1X_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
POL-S_WS-2_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) POL-S_WS-3_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) POL-S_WS-4_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) POL-S_WS-5_2022-08	E375-T	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-1_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-2_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-3_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-4_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-5_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-1_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-2_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-3_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-4_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-5_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-1_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-1X_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-2_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-3_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-4_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-LREF1_WS-5_2022-08	E375-T	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-S_WS-1_2022-08	E366	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-S_WS-2_2022-08	E366	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-S_WS-3_2022-08	E366	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-S_WS-4_2022-08	E366	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
POL-S_WS-5_2022-08	E366	25-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-S_WS-1_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-S_WS-2_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-S_WS-3_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-S_WS-4_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
BOL-S_WS-5_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-1_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-2_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-3_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-4_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-5_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1X_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-2_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-3_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-4_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-5_2022-08	E366	24-Aug-2022	01-Sep-2022	----	----		02-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Colourimetry										
Amber glass total (lab preserved)										
POL-S_WS-1X_2022-08	E366	25-Aug-2022	26-Aug-2022	3 days	2 days	✓	30-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-S_WS-1_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-S_WS-2_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-S_WS-3_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-S_WS-4_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-S_WS-5_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-1_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-2_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-3_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-4_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LNF1_WS-5_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-1X_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-LREF1_WS-2_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) QUL-LREF1_WS-3_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) QUL-LREF1_WS-4_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) QUL-LREF1_WS-5_2022-08	E372-U	24-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-S_WS-1_2022-08	E372-U	25-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-S_WS-2_2022-08	E372-U	25-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-S_WS-3_2022-08	E372-U	25-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-S_WS-4_2022-08	E372-U	25-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) POL-S_WS-5_2022-08	E372-U	25-Aug-2022	01-Sep-2022	----	----		03-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (lab preserved) POL-S_WS-1X_2022-08	E372-U	25-Aug-2022	26-Aug-2022	3 days	2 days	✓	28-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-1_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-1X_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-2_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-3_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-4_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
POL-S_WS-5_2022-08	E421	25-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BOL-S_WS-1_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BOL-S_WS-2_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BOL-S_WS-3_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) BOL-S_WS-4_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) BOL-S_WS-5_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LNF1_WS-1_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LNF1_WS-2_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LNF1_WS-3_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LNF1_WS-4_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LNF1_WS-5_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-1_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-1X_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-2_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-3_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-4_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) QUL-LREF1_WS-5_2022-08	E421	24-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-1_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-1X_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-2_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-3_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-4_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) POL-S_WS-5_2022-08	E358-L	25-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-1_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-2_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-3_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-4_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) BOL-S_WS-5_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-1_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-2_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-3_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-4_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LNF1_WS-5_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-1_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-1X_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-2_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-3_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-4_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) QUL-LREF1_WS-5_2022-08	E358-L	24-Aug-2022	31-Aug-2022	----	----		01-Sep-2022	28 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-S_WS-1_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-S_WS-2_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-S_WS-3_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-S_WS-4_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE BOL-S_WS-5_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-1_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-1X_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-2_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-3_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-4_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE POL-S_WS-5_2022-08	E290	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LNF1_WS-1_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LNF1_WS-2_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LNF1_WS-3_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LNF1_WS-4_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LNF1_WS-5_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LREF1_WS-1_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LREF1_WS-1X_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE QUL-LREF1_WS-2_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-LREF1_WS-3_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-LREF1_WS-4_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-LREF1_WS-5_2022-08	E290	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-S_WS-1_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-S_WS-2_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-S_WS-3_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-S_WS-4_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-S_WS-5_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-1_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-1X_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-2_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-3_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-4_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
POL-S_WS-5_2022-08	E100	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-LNF1_WS-1_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-LNF1_WS-2_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-LNF1_WS-3_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-LNF1_WS-4_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE QUL-LNF1_WS-5_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-1_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-1X_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-2_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-3_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-4_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE QUL-LREF1_WS-5_2022-08	E100	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	28 days	3 days	✓
Physical Tests : pH by Meter										
HDPE POL-S_WS-1X_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	1.11 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-1X_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	1.11 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE BOL-S_WS-1_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE BOL-S_WS-2_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE BOL-S_WS-3_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE BOL-S_WS-4_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE BOL-S_WS-5_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-S_WS-1_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-S_WS-2_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-S_WS-3_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE POL-S_WS-4_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE POL-S_WS-5_2022-08	E108	25-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LNF1_WS-1_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LNF1_WS-2_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LNF1_WS-3_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LNF1_WS-4_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LNF1_WS-5_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-1_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-2_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-3_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-4_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-LREF1_WS-5_2022-08	E108	24-Aug-2022	27-Aug-2022	----	----		27-Aug-2022	0.25 hrs	7.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-1_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-1X_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-2_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-3_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-4_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE POL-S_WS-5_2022-08	E162	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE BOL-S_WS-1_2022-08	E162	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE BOL-S_WS-2_2022-08	E162	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE BOL-S_WS-3_2022-08	E162	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE BOL-S_WS-4_2022-08	E162	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE BOL-S_WS-5_2022-08	E162	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-LNF1_WS-1_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-LNF1_WS-2_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-LNF1_WS-3_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-LNF1_WS-4_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-LNF1_WS-5_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-1_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-1X_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-2_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-3_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-4_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
QUL-LREF1_WS-5_2022-08	E162	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
POL-S_WS-1_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
POL-S_WS-1X_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB]										
POL-S_WS-2_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-S_WS-3_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-S_WS-4_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] POL-S_WS-5_2022-08	E164	25-Aug-2022	----	----	----		31-Aug-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-S_WS-1_2022-08	E164	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-S_WS-2_2022-08	E164	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-S_WS-3_2022-08	E164	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-S_WS-4_2022-08	E164	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-S_WS-5_2022-08	E164	24-Aug-2022	----	----	----		31-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LNF1_WS-1_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LNF1_WS-2_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LNF1_WS-3_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LNF1_WS-4_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LNF1_WS-5_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-1_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-1X_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-2_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-3_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-4_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-LREF1_WS-5_2022-08	E164	24-Aug-2022	----	----	----		30-Aug-2022	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-1_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-1X_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-2_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-3_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-4_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE POL-S_WS-5_2022-08	E121	25-Aug-2022	----	----	----		27-Aug-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-S_WS-1_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-S_WS-2_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-S_WS-3_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-S_WS-4_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
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Physical Tests : Turbidity by Nephelometry										
HDPE QUL-LNF1_WS-2_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-LNF1_WS-3_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-LNF1_WS-4_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-LNF1_WS-5_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-LREF1_WS-1_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-LREF1_WS-1X_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-LREF1_WS-2_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-LREF1_WS-3_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-LREF1_WS-4_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
QUL-LREF1_WS-5_2022-08	E121	24-Aug-2022	----	----	----		27-Aug-2022	3 days	3 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-S_WS-1_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-S_WS-2_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-S_WS-3_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
POL-S_WS-4_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) POL-S_WS-5_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-S_WS-1_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-S_WS-2_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-S_WS-3_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-S_WS-4_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) BOL-S_WS-5_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) POL-S_WS-1X_2022-08	E420	25-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LNF1_WS-1_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LNF1_WS-2_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LNF1_WS-3_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LNF1_WS-4_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LNF1_WS-5_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-1_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-2_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-3_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-4_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-5_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) QUL-LREF1_WS-1X_2022-08	E420	24-Aug-2022	29-Aug-2022	----	----		30-Aug-2022	180 days	7 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	621330	2	39	5.1	5.0	✓
Ammonia by Fluorescence	E298	621279	3	41	7.3	5.0	✓
Chloride in Water by IC	E235.Cl	621335	2	39	5.1	5.0	✓
Conductivity in Water	E100	621328	2	39	5.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	2	38	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	627354	2	40	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	621336	2	32	6.2	5.0	✓
Fluoride in Water by IC	E235.F	621334	2	39	5.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	621332	2	38	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	621333	2	39	5.1	5.0	✓
pH by Meter	E108	621329	2	38	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	621331	2	39	5.1	5.0	✓
TDS by Gravimetry	E162	626133	3	58	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	625825	2	31	6.4	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621232	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	621280	3	40	7.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	621278	3	37	8.1	5.0	✓
Turbidity by Nephelometry	E121	621561	2	40	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	621330	2	39	5.1	5.0	✓
Ammonia by Fluorescence	E298	621279	3	41	7.3	5.0	✓
Chloride in Water by IC	E235.Cl	621335	2	39	5.1	5.0	✓
Conductivity in Water	E100	621328	2	39	5.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	2	38	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	627354	2	40	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	621336	2	32	6.2	5.0	✓
Fluoride in Water by IC	E235.F	621334	2	39	5.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	621332	2	38	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	621333	2	39	5.1	5.0	✓
pH by Meter	E108	621329	2	38	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	621331	2	39	5.1	5.0	✓
TDS by Gravimetry	E162	626133	3	58	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	625825	2	31	6.4	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621232	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	621280	3	40	7.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	621278	3	37	8.1	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	626145	3	60	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Turbidity by Nephelometry	E121	621561	2	40	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	621330	2	39	5.1	5.0	✓
Ammonia by Fluorescence	E298	621279	3	41	7.3	5.0	✓
Chloride in Water by IC	E235.Cl	621335	2	39	5.1	5.0	✓
Conductivity in Water	E100	621328	2	39	5.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	2	38	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	627354	2	40	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	621336	2	32	6.2	5.0	✓
Fluoride in Water by IC	E235.F	621334	2	39	5.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	621332	2	38	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	621333	2	39	5.1	5.0	✓
Sulfate in Water by IC	E235.SO4	621331	2	39	5.1	5.0	✓
TDS by Gravimetry	E162	626133	3	58	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	625825	2	31	6.4	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621232	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	621280	3	40	7.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	621278	3	37	8.1	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	626145	3	60	5.0	5.0	✓
Turbidity by Nephelometry	E121	621561	2	40	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	621279	3	41	7.3	5.0	✓
Chloride in Water by IC	E235.Cl	621335	2	39	5.1	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	623614	2	38	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	627354	2	40	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	621336	2	32	6.2	5.0	✓
Fluoride in Water by IC	E235.F	621334	2	39	5.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	621332	2	38	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	621333	2	39	5.1	5.0	✓
Sulfate in Water by IC	E235.SO4	621331	2	39	5.1	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	625825	2	31	6.4	5.0	✓
Total Metals in Water by CRC ICPMS	E420	621232	2	40	5.0	5.0	✓
Total Nitrogen by Colourimetry	E366	621280	3	40	7.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	621278	2	37	5.4	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Waterloo - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Nitrogen by Colourimetry	E366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Total Nitrogen is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Waterloo - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Waterloo - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Nitrogen in water	EP366 Vancouver - Environmental	Water	APHA 4500-P J (mod)	Samples are heated with a persulfate digestion reagent.
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Waterloo - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

QUALITY CONTROL REPORT

Work Order	: **VA22C0091**	Page	: 1 of 26
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 26-Aug-2022 10:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 26-Aug-2022
C-O-C number	: ----	Issue Date	: 06-Sep-2022 14:19
Sampler	: D. Schnurr, S. Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 22		
No. of samples analysed	: 22		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
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Miles Gropen	Department Manager - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
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Sukhman Khosa	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 621328)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	conductivity	----	E100	2.0	µS/cm	101	101	0.298%	10%	----
Physical Tests (QC Lot: 621329)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	pH	----	E108	0.10	pH units	7.96	7.98	0.251%	4%	----
Physical Tests (QC Lot: 621330)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	43.5	43.5	0.00%	20%	----
Physical Tests (QC Lot: 621561)											
FJ2202341-001	Anonymous	turbidity	----	E121	0.10	NTU	2.98	2.99	0.603%	15%	----
Physical Tests (QC Lot: 621562)											
VA22C0091-015	POL-S_WS-5_2022-08	turbidity	----	E121	0.10	NTU	0.32	0.35	0.03	Diff <2x LOR	----
Physical Tests (QC Lot: 621831)											
VA22C0105-001	Anonymous	conductivity	----	E100	2.0	µS/cm	7220	7250	0.415%	10%	----
Physical Tests (QC Lot: 621832)											
VA22C0105-001	Anonymous	pH	----	E108	0.10	pH units	8.95	8.97	0.223%	4%	----
Physical Tests (QC Lot: 621833)											
VA22C0105-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	61.5	61.9	0.648%	20%	----
Physical Tests (QC Lot: 626133)											
FJ2202313-001	Anonymous	solids, total dissolved [TDS]	----	E162	13	mg/L	116	118	2	Diff <2x LOR	----
Physical Tests (QC Lot: 626134)											
VA22C0091-009	QUL-LREF1_WS-4_2022-08	solids, total dissolved [TDS]	----	E162	13	mg/L	68	66	2	Diff <2x LOR	----
Physical Tests (QC Lot: 627540)											
VA22C0002-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	376	379	0.795%	20%	----
Anions and Nutrients (QC Lot: 621278)											
VA22C0091-022	POL-S_WS-1X_2022-08	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0061	0.0095	0.0033	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621279)											
VA22C0019-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621280)											
VA22C0073-001	Anonymous	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.234	0.240	0.006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621331)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	5.92	5.90	0.339%	20%	----
Anions and Nutrients (QC Lot: 621332)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0131	0.0132	0.00006	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 621333)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621334)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	fluoride	16984-48-8	E235.F	0.020	mg/L	0.035	0.034	0.0008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621335)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	chloride	16887-00-6	E235.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621336)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621834)											
VA22C0105-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	15.0	mg/L	4170	4150	0.602%	20%	----
Anions and Nutrients (QC Lot: 621835)											
VA22C0105-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.250	mg/L	9.94	9.87	0.658%	20%	----
Anions and Nutrients (QC Lot: 621836)											
VA22C0105-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0500	mg/L	1.59	1.58	0.467%	20%	----
Anions and Nutrients (QC Lot: 621837)											
VA22C0105-001	Anonymous	fluoride	16984-48-8	E235.F	1.00	mg/L	1.43	1.45	0.016	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621838)											
VA22C0105-001	Anonymous	chloride	16887-00-6	E235.Cl	25.0	mg/L	74.0	73.6	0.42	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 621841)											
VA22C0091-021	QUL-LREF1_WS-1X_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 625825)											
VA22C0085-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0044	0.0047	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 625831)											
VA22C0091-012	POL-S_WS-2_2022-08	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0041	0.0043	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629498)											
KS2203163-001	Anonymous	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.133	0.148	0.015	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629499)											
KS2203163-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0071	0.0070	0.00004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629501)											
KS2203163-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629591)											
VA22C0085-001	Anonymous	nitrogen, total	7727-37-9	E366	0.030	mg/L	0.238	0.263	0.025	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629592)											
VA22C0085-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0035	0.0035	0.00008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 629593)											

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 629593) - continued											
VA22C0085-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 627354)											
VA22C0085-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	6.87	7.29	5.91%	20%	----
Organic / Inorganic Carbon (QC Lot: 627383)											
VA22C0091-012	POL-S_WS-2_2022-08	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	6.20	6.59	6.17%	20%	----
Total Metals (QC Lot: 621232)											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0153	0.0155	0.0002	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00014	0.00014	0.0000006	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.00542	0.00560	3.31%	20%	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000191	0.0000147	0.0000043	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	16.3	15.4	5.73%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00088	0.00090	0.00002	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.000088	0.000095	0.000007	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.100	mg/L	1.96	2.00	1.89%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00174	0.00175	0.632%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000366	0.000382	0.000015	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.450	0.460	0.010	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000133	0.000124	0.000008	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.59	1.58	0.765%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	0.878	0.890	1.41%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.117	0.112	4.29%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000135	0.000136	0.915%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 621232) - continued											
VA22C0091-001	QUL-LNF1_WS-1_2022-08	vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.0071	0.0068	0.0003	Diff <2x LOR	----
Total Metals (QC Lot: 623537)											
KS2203182-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0182	0.0176	0.0007	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00019	0.00019	0.000006	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.115	0.118	2.00%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	14.9	15.0	0.324%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.0118	0.0120	1.64%	20%	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.442	0.443	0.346%	20%	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	2.04	2.08	1.76%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.0559	0.0586	4.88%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00560	0.00553	1.28%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.484	0.512	0.027	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000059	0.000053	0.000006	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	5.74	5.70	0.594%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	1.99	2.01	0.835%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.170	0.173	1.93%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	0.00033	0.00040	0.00007	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000074	0.000074	0.0000002	Diff <2x LOR	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 623614)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 623614) - continued											
VA22C0064-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0030	mg/L	0.0037	0.0038	0.0001	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00052	0.00052	0.000004	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00958	0.00978	2.04%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.020	0.019	0.0008	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	0.0000054	0.0000004	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	35.9	35.0	2.39%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00050	mg/L	0.00428	0.00430	0.00002	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000158	0.000160	0.000002	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.100	mg/L	5.16	5.29	2.37%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00176	0.00173	1.42%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00629	0.00649	3.11%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.02	1.02	0.0908%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000634	0.000592	6.86%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.23	3.22	0.450%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	7.22	7.26	0.488%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.229	0.238	3.65%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000191	0.000183	3.99%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00130	0.00130	0.0000002	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 624084)											
VA22B9884-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0013	0.0015	0.0002	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00467	0.00458	2.02%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 624084) - continued											
VA22B9884-001	Anonymous	barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0529	0.0533	0.765%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000092	0.0000101	0.0000008	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	26.9	28.2	4.92%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	0.013	0.014	0.0007	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0027	0.0026	0.00002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	2.69	2.66	0.962%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.112	0.113	0.758%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00320	0.00315	1.57%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.15	3.18	0.916%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	5.27	5.32	0.826%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	6.21	6.22	0.148%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.232	0.231	0.335%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000494	0.000507	2.72%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 621328)						
conductivity	----	E100	1	µS/cm	1.1	----
Physical Tests (QCLot: 621330)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 621561)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 621562)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 621831)						
conductivity	----	E100	1	µS/cm	1.3	----
Physical Tests (QCLot: 621833)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 626133)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 626134)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 626145)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 627200)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 627201)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 627540)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 621278)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 621279)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 621280)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 621331)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 621332)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 621333)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 621334)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 621335)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 621336)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 621834)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 621835)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 621836)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 621837)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 621838)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 621841)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 625825)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 625831)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 629498)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 629499)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 629501)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 629591)						
nitrogen, total	7727-37-9	E366	0.03	mg/L	<0.030	----
Anions and Nutrients (QCLot: 629592)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 629593)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 627354)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic / Inorganic Carbon (QCLot: 627354) - continued						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 627383)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 621232)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	# 0.00012	B
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 623537)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 623537) - continued						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 623614)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 623614) - continued						
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 624084)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 624084) - continued						
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 621328)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	99.9	90.0	110	----
Physical Tests (QCLot: 621329)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 621330)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	110	85.0	115	----
Physical Tests (QCLot: 621561)									
turbidity	----	E121	0.1	NTU	200 NTU	102	85.0	115	----
Physical Tests (QCLot: 621562)									
turbidity	----	E121	0.1	NTU	200 NTU	103	85.0	115	----
Physical Tests (QCLot: 621831)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.5	90.0	110	----
Physical Tests (QCLot: 621832)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 621833)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	109	85.0	115	----
Physical Tests (QCLot: 626133)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	107	85.0	115	----
Physical Tests (QCLot: 626134)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	109	85.0	115	----
Physical Tests (QCLot: 626145)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	105	85.0	115	----
Physical Tests (QCLot: 627200)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	97.2	85.0	115	----
Physical Tests (QCLot: 627201)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	92.6	85.0	115	----
Physical Tests (QCLot: 627540)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 621278)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	94.3	80.0	120	----
Anions and Nutrients (QCLot: 621279)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 621280)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 621280) - continued									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	99.9	75.0	125	----
Anions and Nutrients (QCLot: 621331)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 621332)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 621333)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	98.0	90.0	110	----
Anions and Nutrients (QCLot: 621334)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 621335)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 621336)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 621834)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 621835)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 621836)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	98.8	90.0	110	----
Anions and Nutrients (QCLot: 621837)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	98.7	90.0	110	----
Anions and Nutrients (QCLot: 621838)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 621841)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	97.2	80.0	120	----
Anions and Nutrients (QCLot: 625825)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.53 mg/L	99.3	80.0	120	----
Anions and Nutrients (QCLot: 625831)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.53 mg/L	99.1	80.0	120	----
Anions and Nutrients (QCLot: 629498)									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	100.0	75.0	125	----
Anions and Nutrients (QCLot: 629499)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	89.9	80.0	120	----
Anions and Nutrients (QCLot: 629501)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	106	85.0	115	----
Anions and Nutrients (QCLot: 629591)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 629591) - continued									
nitrogen, total	7727-37-9	E366	0.03	mg/L	0.5 mg/L	97.9	75.0	125	----
Anions and Nutrients (QCLot: 629592)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	89.7	80.0	120	----
Anions and Nutrients (QCLot: 629593)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	104	85.0	115	----
Organic / Inorganic Carbon (QCLot: 627354)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.1	80.0	120	----
Organic / Inorganic Carbon (QCLot: 627383)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.3	80.0	120	----
Total Metals (QCLot: 621232)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	99.5	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	112	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	103	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	96.5	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	99.4	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	97.2	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	97.2	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	96.3	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	97.8	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	98.7	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	104	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	98.2	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 621232) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	98.4	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	99.8	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	102	80.0	120	----
Total Metals (QCLot: 623537)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	102	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	110	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	99.5	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	105	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	94.7	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	100	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	97.6	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	98.9	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	95.4	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	98.6	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	98.6	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	99.0	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	103	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	97.0	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	99.6	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	98.1	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	101	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	101	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 623537) - continued									
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	103	80.0	120	----
Dissolved Metals (QCLot: 623614)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	105	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	94.9	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	96.1	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	104	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	88.8	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.6	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	109	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	94.4	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	103	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	104	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.9	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.7	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	102	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	104	80.0	120	----
Dissolved Metals (QCLot: 624084)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	102	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 624084) - continued									
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	94.9	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	101	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	92.9	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	96.1	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.1	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.5	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	97.8	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.2	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	97.6	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	97.9	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	99.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	103	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	92.3	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	99.5	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	96.0	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.6	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	95.4	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	99.9	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	97.3	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	100	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 621279)										
VA22C0019-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.107 mg/L	0.1 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 621280)										
VA22C0075-001	Anonymous	nitrogen, total	7727-37-9	E366	0.390 mg/L	0.4 mg/L	97.5	70.0	130	----
Anions and Nutrients (QCLot: 621331)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	sulfate (as SO4)	14808-79-8	E235.SO4	104 mg/L	100 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 621332)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	nitrate (as N)	14797-55-8	E235.NO3-L	2.56 mg/L	2.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 621333)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	nitrite (as N)	14797-65-0	E235.NO2-L	0.492 mg/L	0.5 mg/L	98.4	75.0	125	----
Anions and Nutrients (QCLot: 621334)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	fluoride	16984-48-8	E235.F	1.03 mg/L	1 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 621335)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	chloride	16887-00-6	E235.Cl	102 mg/L	100 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 621336)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0300 mg/L	0.03 mg/L	100	70.0	130	----
Anions and Nutrients (QCLot: 621834)										
VA22C0105-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	5040 mg/L	5000 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 621835)										
VA22C0105-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	130 mg/L	125 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 621836)										
VA22C0105-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	25.5 mg/L	25 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 621837)										
VA22C0105-002	Anonymous	fluoride	16984-48-8	E235.F	51.3 mg/L	50 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 621838)										
VA22C0105-002	Anonymous	chloride	16887-00-6	E235.Cl	5210 mg/L	5000 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 621841)										
VA22C0091-022	POL-S_WS-1X_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0287 mg/L	0.03 mg/L	95.6	70.0	130	----
Anions and Nutrients (QCLot: 625825)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 625825) - continued										
VA22C0085-001	Anonymous	phosphorus, total dissolved	7723-14-0	E375-T	0.0874 mg/L	0.1 mg/L	87.4	70.0	130	----
Anions and Nutrients (QCLot: 625831)										
VA22C0091-012	POL-S_WS-2_2022-08	phosphorus, total dissolved	7723-14-0	E375-T	0.0914 mg/L	0.1 mg/L	91.4	70.0	130	----
Anions and Nutrients (QCLot: 629498)										
KS2203163-002	Anonymous	nitrogen, total	7727-37-9	E366	0.399 mg/L	0.4 mg/L	99.7	70.0	130	----
Anions and Nutrients (QCLot: 629499)										
KS2203163-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0526 mg/L	0.05 mg/L	105	70.0	130	----
Anions and Nutrients (QCLot: 629501)										
KS2203163-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.115 mg/L	0.1 mg/L	115	75.0	125	----
Anions and Nutrients (QCLot: 629591)										
VA22C0085-002	Anonymous	nitrogen, total	7727-37-9	E366	0.374 mg/L	0.4 mg/L	93.6	70.0	130	----
Anions and Nutrients (QCLot: 629592)										
VA22C0085-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0500 mg/L	0.05 mg/L	99.9	70.0	130	----
Anions and Nutrients (QCLot: 629593)										
VA22C0085-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.111 mg/L	0.1 mg/L	111	75.0	125	----
Organic / Inorganic Carbon (QCLot: 627354)										
VA22C0085-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Organic / Inorganic Carbon (QCLot: 627383)										
VA22C0091-012	POL-S_WS-2_2022-08	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Total Metals (QCLot: 621232)										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	aluminum, total	7429-90-5	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		antimony, total	7440-36-0	E420	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		barium, total	7440-39-3	E420	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00998 mg/L	0.01 mg/L	99.8	70.0	130	----
		boron, total	7440-42-8	E420	0.096 mg/L	0.1 mg/L	95.6	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00411 mg/L	0.004 mg/L	103	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0395 mg/L	0.04 mg/L	98.9	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0197 mg/L	0.02 mg/L	98.3	70.0	130	----
		copper, total	7440-50-8	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		iron, total	7439-89-6	E420	2.00 mg/L	2 mg/L	100	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 621232) - continued										
VA22C0091-002	QUL-LNF1_WS-2_2022-08	lead, total	7439-92-1	E420	0.0197 mg/L	0.02 mg/L	98.6	70.0	130	----
		lithium, total	7439-93-2	E420	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0192 mg/L	0.02 mg/L	96.0	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		nickel, total	7440-02-0	E420	0.0398 mg/L	0.04 mg/L	99.5	70.0	130	----
		potassium, total	7440-09-7	E420	3.92 mg/L	4 mg/L	98.0	70.0	130	----
		selenium, total	7782-49-2	E420	0.0418 mg/L	0.04 mg/L	105	70.0	130	----
		silicon, total	7440-21-3	E420	9.76 mg/L	10 mg/L	97.6	70.0	130	----
		silver, total	7440-22-4	E420	0.00396 mg/L	0.004 mg/L	98.9	70.0	130	----
		sodium, total	7440-23-5	E420	1.94 mg/L	2 mg/L	97.2	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00385 mg/L	0.004 mg/L	96.3	70.0	130	----
		tin, total	7440-31-5	E420	0.0199 mg/L	0.02 mg/L	99.5	70.0	130	----
		titanium, total	7440-32-6	E420	0.0397 mg/L	0.04 mg/L	99.3	70.0	130	----
		uranium, total	7440-61-1	E420	0.00397 mg/L	0.004 mg/L	99.2	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0994 mg/L	0.1 mg/L	99.4	70.0	130	----
		zinc, total	7440-66-6	E420	0.412 mg/L	0.4 mg/L	103	70.0	130	----
Total Metals (QCLot: 623537)										
KS2203182-002	Anonymous	aluminum, total	7429-90-5	E420	0.203 mg/L	0.2 mg/L	102	70.0	130	----
		antimony, total	7440-36-0	E420	0.0203 mg/L	0.02 mg/L	101	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0200 mg/L	0.02 mg/L	99.8	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0388 mg/L	0.04 mg/L	97.0	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00951 mg/L	0.01 mg/L	95.1	70.0	130	----
		boron, total	7440-42-8	E420	0.088 mg/L	0.1 mg/L	88.5	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00401 mg/L	0.004 mg/L	100	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0385 mg/L	0.04 mg/L	96.3	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0193 mg/L	0.02 mg/L	96.4	70.0	130	----
		copper, total	7440-50-8	E420	0.0191 mg/L	0.02 mg/L	95.7	70.0	130	----
		iron, total	7439-89-6	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		lead, total	7439-92-1	E420	0.0193 mg/L	0.02 mg/L	96.5	70.0	130	----
		lithium, total	7439-93-2	E420	0.0959 mg/L	0.1 mg/L	95.9	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 623537) - continued										
KS2203182-002	Anonymous	molybdenum, total	7439-98-7	E420	0.0207 mg/L	0.02 mg/L	103	70.0	130	----
		nickel, total	7440-02-0	E420	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		potassium, total	7440-09-7	E420	3.99 mg/L	4 mg/L	99.7	70.0	130	----
		selenium, total	7782-49-2	E420	0.0418 mg/L	0.04 mg/L	104	70.0	130	----
		silicon, total	7440-21-3	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, total	7440-22-4	E420	0.00397 mg/L	0.004 mg/L	99.4	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00377 mg/L	0.004 mg/L	94.4	70.0	130	----
		tin, total	7440-31-5	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		titanium, total	7440-32-6	E420	0.0394 mg/L	0.04 mg/L	98.6	70.0	130	----
		uranium, total	7440-61-1	E420	0.00382 mg/L	0.004 mg/L	95.4	70.0	130	----
		vanadium, total	7440-62-2	E420	0.1000 mg/L	0.1 mg/L	100.0	70.0	130	----
		zinc, total	7440-66-6	E420	0.401 mg/L	0.4 mg/L	100	70.0	130	----
Dissolved Metals (QCLot: 623614)										
VA22C0053-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.203 mg/L	0.2 mg/L	101	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0196 mg/L	0.02 mg/L	98.3	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0216 mg/L	0.02 mg/L	108	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0384 mg/L	0.04 mg/L	95.9	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00872 mg/L	0.01 mg/L	87.2	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.085 mg/L	0.1 mg/L	85.5	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00377 mg/L	0.004 mg/L	94.3	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0185 mg/L	0.02 mg/L	92.6	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0176 mg/L	0.02 mg/L	88.2	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.83 mg/L	2 mg/L	91.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0184 mg/L	0.02 mg/L	91.8	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0933 mg/L	0.1 mg/L	93.3	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0199 mg/L	0.02 mg/L	99.7	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0368 mg/L	0.04 mg/L	92.0	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0447 mg/L	0.04 mg/L	112	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 623614) - continued										
VA22C0053-001	Anonymous	silicon, dissolved	7440-21-3	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00364 mg/L	0.004 mg/L	91.0	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00366 mg/L	0.004 mg/L	91.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0192 mg/L	0.02 mg/L	96.1	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.383 mg/L	0.4 mg/L	95.7	70.0	130	----
Dissolved Metals (QCLot: 624084)										
VA22B9884-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0188 mg/L	0.02 mg/L	94.3	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0383 mg/L	0.04 mg/L	95.7	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00892 mg/L	0.01 mg/L	89.2	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.086 mg/L	0.1 mg/L	86.2	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00370 mg/L	0.004 mg/L	92.4	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0372 mg/L	0.04 mg/L	92.9	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0184 mg/L	0.02 mg/L	91.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0181 mg/L	0.02 mg/L	90.7	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.89 mg/L	2 mg/L	94.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0188 mg/L	0.02 mg/L	94.1	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0951 mg/L	0.1 mg/L	95.1	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0193 mg/L	0.02 mg/L	96.7	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0373 mg/L	0.04 mg/L	93.3	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0424 mg/L	0.04 mg/L	106	70.0	130	----
		silicon, dissolved	7440-21-3	E421	8.96 mg/L	10 mg/L	89.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00365 mg/L	0.004 mg/L	91.2	70.0	130	----
		sodium, dissolved	7440-23-5	E421	1.70 mg/L	2 mg/L	85.2	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 624084) - continued										
VA22B9884-002	Anonymous	thallium, dissolved	7440-28-0	E421	0.00380 mg/L	0.004 mg/L	94.9	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0183 mg/L	0.02 mg/L	91.6	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0381 mg/L	0.04 mg/L	95.4	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00378 mg/L	0.004 mg/L	94.5	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.0976 mg/L	0.1 mg/L	97.6	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.394 mg/L	0.4 mg/L	98.4	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

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Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 1 of 2

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-006
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and

Environmental Division Vancouver

Work Order Reference VA22C0091

Telephone : +1 604 253 4188

ALS Lab Work Order # (lab use only): 0091

ALS Contact: Can Dang

Sampler: P.Schnurr S.Lahmer

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS)	Total Nitrogen Ammonia	DOC	TSS (Whole bottle)							
					F			P		F/P							
1	QUL-LNF1_WS-1_2022-08	24-Aug-22	07:05	Water	R	R	R	R	R	R							6
2	QUL-LNF1_WS-2_2022-08	24-Aug-22	07:20	Water	R	R	R	R	R	R							6
3	QUL-LNF1_WS-3_2022-08	24-Aug-22	07:40	Water	R	R	R	R	R	R							6
4	QUL-LNF1_WS-4_2022-08	24-Aug-22	08:00	Water	R	R	R	R	R	R							6
5	QUL-LNF1_WS-5_2022-08	24-Aug-22	08:20	Water	R	R	R	R	R	R							6
6	QUL-LREF1_WS-1_2022-08	24-Aug-22	09:00	Water	R	R	R	R	R	R							6
7	QUL-LREF1_WS-2_2022-08	24-Aug-22	09:15	Water	R	R	R	R	R	R							6
8	QUL-LREF1_WS-3_2022-08	24-Aug-22	09:25	Water	R	R	R	R	R	R							6
9	QUL-LREF1_WS-4_2022-08	24-Aug-22	09:45	Water	R	R	R	R	R	R							6
10	QUL-LREF1_WS-5_2022-08	24-Aug-22	10:00	Water	R	R	R	R	R	R							6
11	POL-S_WS-1_2022-08	25-Aug-22	08:50	Water	R	R	R	R	R	R							6
12	POL-S_WS-2_2022-08	25-Aug-22	09:05	Water	R	R	R	R	R	R							6

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)
Are samples for human drinking water use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6.5	10	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
S.Lahmer	25 Aug 22	10:10				JC	AUG 26 2022	1015am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-006

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** P.Schnurr S.Lahmer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUTRIENTS-1	Total Metals (ICPMS)	Dissolved Metals (ICPMS) F	Total Nitrogen Ammonia P	DOC F/P	TSS (Whole bottle)	Number of Containers
12	POL-S_WS-3_2022-08	25-Aug-22	09:25	Water	R	R	R	R	R	R	6
13	POL-S_WS-4_2022-08	25-Aug-22	09:40	Water	R	R	R	R	R	R	6
14	POL-S_WS-5_2022-08	25-Aug-22	09:55	Water	R	R	R	R	R	R	6
15	BOL-S_WS-1_2022-08	24-Aug-22	14:30	Water	R	R	R	R	R	R	6
16	BOL-S_WS-2_2022-08	24-Aug-22	14:45	Water	R	R	R	R	R	R	6
17	BOL-S_WS-3_2022-08	24-Aug-22	14:50	Water	R	R	R	R	R	R	6
18	BOL-S_WS-4_2022-08	24-Aug-22	15:10	Water	R	R	R	R	R	R	6
19	BOL-S_WS-5_2022-08	24-Aug-22	15:25	Water	R	R	R	R	R	R	6
20	QUL-LREF1_WS-1X_2022-08 (no spaces)	24-Aug-22	09:00	Water	R	R	R	R	R	R	6
21	POL-S_WS-1X-2022-08	25-Aug-22	08:50	Water	R	R	R	R	R	R	6
	~~POL-P2_WS-DE-1-2022-08~~	~~Aug-22~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~6~~

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6,5	10	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
S.Lahmer	25Aug22	10:10				JL	26 Aug 22	10:15am

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

WATER CHEMISTRY

ALS Laboratory Report VA22C0362

(Finalized September 9, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0362**	Page	: 1 of 6
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 30-Aug-2022
C-O-C number	: ----	Issue Date	: 09-Sep-2022 14:41
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DTC	*Dissolved concentration exceeds total. Results were confirmed by re-analysis.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-08	QUL-ZOO-7_WS_DI-1_2022-08	QUL-ZOO-1_WS_DI-1X_2022-08	BOL-B2_WS_DI-1_2022-08	----
					Client sampling date / time	28-Aug-2022 11:10	28-Aug-2022 12:45	28-Aug-2022 11:10	28-Aug-2022 08:10	----
						VA22C0362-001	VA22C0362-002	VA22C0362-003	VA22C0362-004	--------
						Result	Result	Result	Result	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		46.8	46.8	46.1	42.5	----
conductivity	----	E100	2.0	µS/cm		103	103	101	98.7	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		46.3	49.1	49.3	45.0	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.50	mg/L		46.6	48.9	47.4	44.8	----
pH	----	E108	0.10	pH units		7.73	7.70	7.69	7.49	----
solids, total dissolved [TDS]	----	E162	10	mg/L		80	73	70	83	----
solids, total suspended [TSS]	----	E164	1.0	mg/L		2.5	2.7	1.9	3.6	----
turbidity	----	E121	0.10	NTU		1.67	1.83	1.54	2.47	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0072	0.0090	0.0107	0.0072	----
chloride	16887-00-6	E235.Cl	0.50	mg/L		<0.50	<0.50	<0.50	0.64	----
fluoride	16984-48-8	E235.F	0.020	mg/L		0.030	0.030	0.037	0.056	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0696	0.0712	0.0642	0.0064	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L		0.0696	0.0712	0.0642	0.0064	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	0.0016	<0.0010	0.0016	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0092	0.0083	0.0074	0.0170	----
phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L		0.0029	0.0032	0.0029	0.0072	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		5.58	5.63	6.01	6.78	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		2.62	2.62	3.00	7.81	----
Total Metals										
aluminum, total	7429-90-5	E420	0.0030	mg/L		0.0111	0.0808	0.0631	0.0551	----
antimony, total	7440-36-0	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	0.00012	----
arsenic, total	7440-38-2	E420	0.00010	mg/L		0.00012	0.00023	0.00021	0.00071	----
barium, total	7440-39-3	E420	0.00010	mg/L		0.00571	0.00648	0.00644	0.0168	----
beryllium, total	7440-41-7	E420	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	----
bismuth, total	7440-69-9	E420	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
boron, total	7440-42-8	E420	0.010	mg/L		<0.010	<0.010	<0.010	0.044	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-08	QUL-ZOO-7_WS_DI-1_2022-08	QUL-ZOO-1_WS_DI-1X_2022-08	BOL-B2_WS_DI-1_2022-08	----
					Client sampling date / time	28-Aug-2022 11:10	28-Aug-2022 12:45	28-Aug-2022 11:10	28-Aug-2022 08:10	----
						VA22C0362-001	VA22C0362-002	VA22C0362-003	VA22C0362-004	--------
						Result	Result	Result	Result	----
Total Metals										
cadmium, total	7440-43-9	E420	0.0000050	mg/L		0.000118	0.0000578	0.000261	0.0000075	----
calcium, total	7440-70-2	E420	0.050	mg/L		15.6	16.4	15.8	13.8	----
chromium, total	7440-47-3	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
cobalt, total	7440-48-4	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
copper, total	7440-50-8	E420	0.00050	mg/L		0.00091	0.00396	0.00328	0.00528	----
iron, total	7439-89-6	E420	0.030	mg/L		<0.030	0.072	0.059	0.089	----
lead, total	7439-92-1	E420	0.000050	mg/L		<0.000050	0.000183	0.000279	0.000107	----
lithium, total	7439-93-2	E420	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
magnesium, total	7439-95-4	E420	0.100	mg/L		1.86	1.94	1.92	2.52	----
manganese, total	7439-96-5	E420	0.00010	mg/L		0.00125	0.00422	0.00409	0.0431	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L		0.000363	0.000364	0.000362	0.000853	----
nickel, total	7440-02-0	E420	0.00050	mg/L		<0.00050	0.00052	<0.00050	<0.00050	----
potassium, total	7440-09-7	E420	0.050	mg/L		0.460	0.569	0.524	0.541	----
selenium, total	7782-49-2	E420	0.000050	mg/L		0.000160	0.000113	0.000163	0.000180	----
silicon, total	7440-21-3	E420	0.10	mg/L		1.71	1.97	1.86	2.40	----
silver, total	7440-22-4	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, total	7440-23-5	E420	0.050	mg/L		0.863	0.932	0.930	2.54	----
strontium, total	7440-24-6	E420	0.00020	mg/L		0.129	0.131	0.127	0.137	----
thallium, total	7440-28-0	E420	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
tin, total	7440-31-5	E420	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, total	7440-32-6	E420	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	----
uranium, total	7440-61-1	E420	0.000010	mg/L		0.000150	0.000147	0.000149	0.000041	----
vanadium, total	7440-62-2	E420	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, total	7440-66-6	E420	0.0030	mg/L		<0.0030	<0.0030	<0.0030	0.0037	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0030	mg/L		0.0439 DTC	0.0122	0.0110	0.0089	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00017	0.00012	0.00012	0.00034	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.00615	0.00582	0.00577	0.0160	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_WS_DI-1_2022-08	QUL-ZOO-7_WS_DI-1_2022-08	QUL-ZOO-1_WS_DI-1X_2022-08	BOL-B2_WS_DI-1_2022-08	----
					Client sampling date / time	28-Aug-2022 11:10	28-Aug-2022 12:45	28-Aug-2022 11:10	28-Aug-2022 08:10	----
						VA22C0362-001	VA22C0362-002	VA22C0362-003	VA22C0362-004	--------
						Result	Result	Result	Result	----
Dissolved Metals										
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L		<0.010	<0.010	<0.010	0.048	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.000178 DTC	0.0000561	0.000189	0.0000068	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L		15.4	16.4	16.5	13.8	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
copper, dissolved	7440-50-8	E421	0.00050	mg/L		0.00240 DTC	0.00107	0.00092	0.00282	----
iron, dissolved	7439-89-6	E421	0.030	mg/L		0.044	<0.030	<0.030	<0.030	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000167 DTC	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		1.91	1.99	1.96	2.56	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.00309 DTC	0.00087	0.00113	0.00646	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.000318	0.000328	0.000334	0.000777	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L		0.482	0.557	0.513	0.536	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000119	0.000096	0.000108	0.000185	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L		1.64	1.71	1.63	2.19	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		0.856	0.916	0.906	2.55	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.122	0.121	0.121	0.128	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0100	mg/L		<0.0100	<0.0100	<0.0100	<0.0100	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000148	0.000138	0.000142	0.000038	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	----
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	----
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg/L		1.04	1.09	1.01	2.18	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C0362**	Page	: 1 of 16
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Issue Date	: 09-Sep-2022 14:41
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-08	E298	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-08	E298	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-08	E298	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-08	E298	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E235.Cl	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E235.Cl	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E235.Cl	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE BOL-B2_WS_DI-1_2022-08	E235.Cl	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-1_WS_DI-1_2022-08	E378-U	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E378-U	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE QUL-ZOO-7_WS_DI-1_2022-08	E378-U	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE BOL-B2_WS_DI-1_2022-08	E378-U	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1_2022-08	E235.F	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E235.F	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE QUL-ZOO-7_WS_DI-1_2022-08	E235.F	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE BOL-B2_WS_DI-1_2022-08	E235.F	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E235.NO3-L	28-Aug-2022	30-Aug-2022	3 days	2 days	✓	31-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E235.NO3-L	28-Aug-2022	30-Aug-2022	3 days	2 days	✓	31-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E235.NO3-L	28-Aug-2022	30-Aug-2022	3 days	2 days	✓	31-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE										
BOL-B2_WS_DI-1_2022-08	E235.NO3-L	28-Aug-2022	30-Aug-2022	3 days	3 days	✓	31-Aug-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E235.NO2-L	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E235.NO2-L	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E235.NO2-L	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE										
BOL-B2_WS_DI-1_2022-08	E235.NO2-L	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E235.SO4	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E235.SO4	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E235.SO4	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BOL-B2_WS_DI-1_2022-08	E235.SO4	28-Aug-2022	30-Aug-2022	----	----		31-Aug-2022	28 days	3 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
BOL-B2_WS_DI-1_2022-08	E375-T	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-08	E375-T	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-08	E375-T	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-08	E375-T	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
BOL-B2_WS_DI-1_2022-08	E372-U	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-08	E372-U	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-08	E372-U	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-08	E372-U	28-Aug-2022	05-Sep-2022	----	----		07-Sep-2022	28 days	10 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BOL-B2_WS_DI-1_2022-08	E421	28-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-08	E421	28-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-1_WS_DI-1X_2022-08	E421	28-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-08	E421	28-Aug-2022	02-Sep-2022	----	----		03-Sep-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
BOL-B2_WS_DI-1_2022-08	E358-L	28-Aug-2022	05-Sep-2022	----	----		05-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1_2022-08	E358-L	28-Aug-2022	05-Sep-2022	----	----		05-Sep-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-1_WS_DI-1X_2022-08	E358-L	28-Aug-2022	05-Sep-2022	----	----		05-Sep-2022	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
QUL-ZOO-7_WS_DI-1_2022-08	E358-L	28-Aug-2022	05-Sep-2022	----	----		05-Sep-2022	28 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E290	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E290	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E290	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
BOL-B2_WS_DI-1_2022-08	E290	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-ZOO-1_WS_DI-1_2022-08	E100	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-ZOO-1_WS_DI-1X_2022-08	E100	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E100	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE										
BOL-B2_WS_DI-1_2022-08	E100	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE BOL-B2_WS_DI-1_2022-08	E108	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	0.25 hrs	1.71 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-ZOO-1_WS_DI-1_2022-08	E108	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	0.25 hrs	1.71 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E108	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	0.25 hrs	1.71 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE QUL-ZOO-7_WS_DI-1_2022-08	E108	28-Aug-2022	30-Aug-2022	----	----		30-Aug-2022	0.25 hrs	1.71 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE BOL-B2_WS_DI-1_2022-08	E162	28-Aug-2022	----	----	----		03-Sep-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-1_WS_DI-1_2022-08	E162	28-Aug-2022	----	----	----		03-Sep-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E162	28-Aug-2022	----	----	----		03-Sep-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE QUL-ZOO-7_WS_DI-1_2022-08	E162	28-Aug-2022	----	----	----		03-Sep-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] BOL-B2_WS_DI-1_2022-08	E164	28-Aug-2022	----	----	----		02-Sep-2022	7 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-1_WS_DI-1_2022-08	E164	28-Aug-2022	----	----	----		02-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-1_WS_DI-1X_2022-08	E164	28-Aug-2022	----	----	----		02-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Whole Bottle)										
HDPE [TSS-WB] QUL-ZOO-7_WS_DI-1_2022-08	E164	28-Aug-2022	----	----	----		02-Sep-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE BOL-B2_WS_DI-1_2022-08	E121	28-Aug-2022	----	----	----		31-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-ZOO-1_WS_DI-1_2022-08	E121	28-Aug-2022	----	----	----		31-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E121	28-Aug-2022	----	----	----		31-Aug-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE QUL-ZOO-7_WS_DI-1_2022-08	E121	28-Aug-2022	----	----	----		31-Aug-2022	3 days	3 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE QUL-ZOO-1_WS_DI-1_2022-08	E870	28-Aug-2022	31-Aug-2022	2 days	3 days	× EHTL	01-Sep-2022	672 hrs	1 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE QUL-ZOO-1_WS_DI-1X_2022-08	E870	28-Aug-2022	31-Aug-2022	2 days	3 days	× EHTL	01-Sep-2022	672 hrs	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
QUL-ZOO-7_WS_DI-1_2022-08	E870	28-Aug-2022	31-Aug-2022	2 days	3 days	× EHTL	01-Sep-2022	672 hrs	1 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE										
BOL-B2_WS_DI-1_2022-08	E870	28-Aug-2022	31-Aug-2022	2 days	3 days	× EHTR	01-Sep-2022	672 hrs	1 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
BOL-B2_WS_DI-1_2022-08	E420	28-Aug-2022	02-Sep-2022	----	----		02-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-1_WS_DI-1_2022-08	E420	28-Aug-2022	02-Sep-2022	----	----		02-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-1_WS_DI-1X_2022-08	E420	28-Aug-2022	02-Sep-2022	----	----		02-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
QUL-ZOO-7_WS_DI-1_2022-08	E420	28-Aug-2022	02-Sep-2022	----	----		02-Sep-2022	180 days	6 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	626009	1	18	5.5	5.0	✓
Ammonia by Fluorescence	E298	633180	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	626014	1	18	5.5	5.0	✓
Conductivity in Water	E100	626007	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	630246	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	633178	1	4	25.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	626017	1	10	10.0	5.0	✓
Fluoride in Water by IC	E235.F	626013	1	18	5.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	626011	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	626012	1	19	5.2	5.0	✓
pH by Meter	E108	626008	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	626010	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	632304	1	10	10.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	633179	1	4	25.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	630139	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	633177	1	18	5.5	5.0	✓
Turbidity by Nephelometry	E121	626473	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	626009	1	18	5.5	5.0	✓
Ammonia by Fluorescence	E298	633180	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	626014	1	18	5.5	5.0	✓
Chlorophyll-a by Fluorometry	E870	627043	1	19	5.2	5.0	✓
Conductivity in Water	E100	626007	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	630246	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	633178	1	4	25.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	626017	1	10	10.0	5.0	✓
Fluoride in Water by IC	E235.F	626013	1	18	5.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	626011	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	626012	1	19	5.2	5.0	✓
pH by Meter	E108	626008	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	626010	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	632304	1	10	10.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	633179	1	4	25.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	630139	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	633177	1	18	5.5	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	631391	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	626473	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB)							
Alkalinity Species by Titration	E290	626009	1	18	5.5	5.0	✓
Ammonia by Fluorescence	E298	633180	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	626014	1	18	5.5	5.0	✓
Chlorophyll-a by Fluorometry	E870	627043	1	19	5.2	5.0	✓
Conductivity in Water	E100	626007	1	12	8.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	630246	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	633178	1	4	25.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	626017	1	10	10.0	5.0	✓
Fluoride in Water by IC	E235.F	626013	1	18	5.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	626011	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	626012	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	626010	1	18	5.5	5.0	✓
TDS by Gravimetry	E162	632304	1	10	10.0	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	633179	1	4	25.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	630139	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	633177	1	18	5.5	5.0	✓
TSS by Gravimetry (Whole Bottle)	E164	631391	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	626473	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	633180	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	626014	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	630246	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	633178	1	4	25.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	626017	1	10	10.0	5.0	✓
Fluoride in Water by IC	E235.F	626013	1	18	5.5	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	626011	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	626012	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	626010	1	18	5.5	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	633179	1	4	25.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	630139	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	633177	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Vancouver - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TDS by Gravimetry	E162 Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
TSS by Gravimetry (Whole Bottle)	E164 Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Vancouver - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Chlorophyll-a by Fluorometry	E870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Vancouver - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Digestion for Dissolved Phosphorus in water	EP375 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Chlorophyll-a Extraction	EP870 Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22C0362**	Page	: 1 of 14
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 30-Aug-2022
C-O-C number	: ----	Issue Date	: 09-Sep-2022 14:41
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-006 - Minnow Env. - Water Quality		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Angelo Salandanan	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 626007)											
FJ2202360-004	Anonymous	conductivity	----	E100	2.0	µS/cm	183	184	0.328%	10%	----
Physical Tests (QC Lot: 626008)											
FJ2202360-004	Anonymous	pH	----	E108	0.10	pH units	7.98	7.99	0.125%	4%	----
Physical Tests (QC Lot: 626009)											
FJ2202360-004	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	82.1	82.3	0.243%	20%	----
Physical Tests (QC Lot: 626473)											
VA22C0350-005	Anonymous	turbidity	----	E121	0.10	NTU	425	418	1.71%	15%	----
Physical Tests (QC Lot: 632304)											
VA22C0296-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	2260	2280	0.550%	20%	----
Anions and Nutrients (QC Lot: 626010)											
FJ2202364-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	3.00	mg/L	469	471	0.384%	20%	----
Anions and Nutrients (QC Lot: 626011)											
FJ2202364-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0500	mg/L	0.487	0.490	0.0025	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 626012)											
FJ2202364-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 626013)											
FJ2202364-001	Anonymous	fluoride	16984-48-8	E235.F	0.200	mg/L	0.436	0.434	0.002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 626014)											
FJ2202364-001	Anonymous	chloride	16887-00-6	E235.Cl	5.00	mg/L	27.7	27.8	0.04	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 626017)											
VA22C0362-001	QUL-ZOO-1_WS_DI-1_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 633177)											
VA22C0324-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0884	0.0880	0.453%	20%	----
Anions and Nutrients (QC Lot: 633179)											
VA22C0362-001	QUL-ZOO-1_WS_DI-1_2022-08	phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0029	0.0032	0.0004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 633180)											
VA22C0352-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0250	mg/L	0.365	0.367	0.539%	20%	----
Organic / Inorganic Carbon (QC Lot: 633178)											
VA22C0362-001	QUL-ZOO-1_WS_DI-1_2022-08	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.62	2.40	0.22	Diff <2x LOR	----
Total Metals (QC Lot: 630139)											

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 630139) - continued											
VA22C0362-001	QUL-ZOO-1_WS_DI-1_2022-08	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0111	0.0116	0.0005	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00012	0.00012	0.000006	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.00571	0.00579	1.38%	20%	----
		beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.000118	0.000128	8.56%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	15.6	15.7	0.489%	20%	----
		chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00091	0.00091	0.000002	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.100	mg/L	1.86	1.85	0.540%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00125	0.00123	1.35%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000363	0.000362	0.000002	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.460	0.461	0.0004	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.000160	0.000136	0.000023	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.71	1.70	0.705%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	0.863	0.841	2.60%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.129	0.127	1.81%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.0100	mg/L	<0.0100	<0.0100	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000150	0.000150	0.207%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 630246)											
VA22C0357-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0314	0.0324	3.27%	20%	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00269	0.00264	1.71%	20%	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00172	0.00173	0.942%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 630246) - continued											
VA22C0357-002	Anonymous	barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00100	0.00102	2.61%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.000107	0.000107	0.176%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	11.0	10.8	1.38%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00150	0.00157	4.99%	20%	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00148	0.00152	0.00005	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	0.018	0.019	0.0002	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0019	0.0019	0.00002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	1.82	1.87	2.59%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.168	0.173	2.80%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00231	0.00243	0.00012	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.67	1.70	1.38%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.00171	0.00156	9.57%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	0.763	0.759	0.478%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	0.000015	0.000015	0.0000002	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	0.063	0.066	0.002	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0394	0.0396	0.498%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000071	0.000072	0.000001	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000108	0.000108	0.0314%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0531	0.0541	1.91%	20%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 626007)						
conductivity	----	E100	1	µS/cm	1.1	----
Physical Tests (QCLot: 626009)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	1.4	----
Physical Tests (QCLot: 626473)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 631391)						
solids, total suspended [TSS]	----	E164	1	mg/L	<1.0	----
Physical Tests (QCLot: 632304)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 626010)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 626011)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 626012)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 626013)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 626014)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 626017)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 633177)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 633179)						
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 633180)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 633178)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 630139)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 630139) - continued						
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 630246)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 630246) - continued						
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Plant Pigments (QCLot: 627043)						
chlorophyll a	479-61-8	E870	0.01	µg/L	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 626007)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	99.3	90.0	110	----
Physical Tests (QCLot: 626008)									
pH	----	E108	----	pH units	7 pH units	99.7	98.0	102	----
Physical Tests (QCLot: 626009)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	108	85.0	115	----
Physical Tests (QCLot: 626473)									
turbidity	----	E121	0.1	NTU	200 NTU	97.0	85.0	115	----
Physical Tests (QCLot: 631391)									
solids, total suspended [TSS]	----	E164	1	mg/L	150 mg/L	97.0	85.0	115	----
Physical Tests (QCLot: 632304)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 626010)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 626011)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	99.2	90.0	110	----
Anions and Nutrients (QCLot: 626012)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	97.6	90.0	110	----
Anions and Nutrients (QCLot: 626013)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	96.9	90.0	110	----
Anions and Nutrients (QCLot: 626014)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	98.8	90.0	110	----
Anions and Nutrients (QCLot: 626017)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	92.1	80.0	120	----
Anions and Nutrients (QCLot: 633177)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	99.1	80.0	120	----
Anions and Nutrients (QCLot: 633179)									
phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	100	80.0	120	----
Anions and Nutrients (QCLot: 633180)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	104	85.0	115	----
Organic / Inorganic Carbon (QCLot: 633178)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 630139)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	103	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	105	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	104	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	94.4	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	92.5	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	98.3	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	99.5	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	103	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	98.3	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	99.1	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	98.5	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	106	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	107	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	108	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	95.4	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	103	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	98.0	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	96.1	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	105	80.0	120	----
Dissolved Metals (QCLot: 630246)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	106	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	109	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	109	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	105	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 630246) - continued									
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.0	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	106	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	103	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	103	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	107	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	103	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	105	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	108	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	99.6	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	105	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.7	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.3	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	102	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	101	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	107	80.0	120	----
Plant Pigments (QCLot: 627043)									
chlorophyll a	479-61-8	E870	0.01	µg/L	5 µg/L	93.0	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 626010)										
FJ2202365-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	2020 mg/L	2000 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 626011)										
FJ2202365-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	51.0 mg/L	50 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 626012)										
FJ2202365-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	9.98 mg/L	10 mg/L	99.8	75.0	125	----
Anions and Nutrients (QCLot: 626013)										
FJ2202365-001	Anonymous	fluoride	16984-48-8	E235.F	20.4 mg/L	20 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 626014)										
FJ2202365-001	Anonymous	chloride	16887-00-6	E235.Cl	2040 mg/L	2000 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 626017)										
VA22C0362-002	QUL-ZOO-7_WS_DI-1_2022-08	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0260 mg/L	0.03 mg/L	86.8	70.0	130	----
Anions and Nutrients (QCLot: 633177)										
VA22C0325-001	Anonymous	phosphorus, total	7723-14-0	E372-U	ND mg/L	0.05 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 633179)										
VA22C0362-002	QUL-ZOO-7_WS_DI-1_2022-08	phosphorus, total dissolved	7723-14-0	E375-T	0.0519 mg/L	0.05 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 633180)										
VA22C0362-001	QUL-ZOO-1_WS_DI-1_2022-08	ammonia, total (as N)	7664-41-7	E298	0.108 mg/L	0.1 mg/L	108	75.0	125	----
Organic / Inorganic Carbon (QCLot: 633178)										
VA22C0362-002	QUL-ZOO-7_WS_DI-1_2022-08	carbon, dissolved organic [DOC]	----	E358-L	4.98 mg/L	5 mg/L	99.6	70.0	130	----
Total Metals (QCLot: 630139)										
VA22C0362-002	QUL-ZOO-7_WS_DI-1_2022-08	aluminum, total	7429-90-5	E420	0.190 mg/L	0.2 mg/L	95.3	70.0	130	----
		antimony, total	7440-36-0	E420	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		barium, total	7440-39-3	E420	0.0192 mg/L	0.02 mg/L	96.2	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00977 mg/L	0.01 mg/L	97.7	70.0	130	----
		boron, total	7440-42-8	E420	0.097 mg/L	0.1 mg/L	96.8	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00406 mg/L	0.004 mg/L	101	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 630139) - continued										
VA22C0362-002	QUL-ZOO-7_WS_DI-1_2022-08	calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		chromium, total	7440-47-3	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		copper, total	7440-50-8	E420	0.0201 mg/L	0.02 mg/L	101	70.0	130	----
		iron, total	7439-89-6	E420	1.94 mg/L	2 mg/L	96.8	70.0	130	----
		lead, total	7439-92-1	E420	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		lithium, total	7439-93-2	E420	0.0999 mg/L	0.1 mg/L	99.9	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0206 mg/L	0.02 mg/L	103	70.0	130	----
		nickel, total	7440-02-0	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		potassium, total	7440-09-7	E420	4.18 mg/L	4 mg/L	104	70.0	130	----
		selenium, total	7782-49-2	E420	0.0419 mg/L	0.04 mg/L	105	70.0	130	----
		silicon, total	7440-21-3	E420	10.2 mg/L	10 mg/L	102	70.0	130	----
		silver, total	7440-22-4	E420	0.00413 mg/L	0.004 mg/L	103	70.0	130	----
		sodium, total	7440-23-5	E420	2.01 mg/L	2 mg/L	101	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00386 mg/L	0.004 mg/L	96.4	70.0	130	----
		tin, total	7440-31-5	E420	0.0193 mg/L	0.02 mg/L	96.4	70.0	130	----
		titanium, total	7440-32-6	E420	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		uranium, total	7440-61-1	E420	0.00400 mg/L	0.004 mg/L	100	70.0	130	----
		vanadium, total	7440-62-2	E420	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		zinc, total	7440-66-6	E420	0.406 mg/L	0.4 mg/L	101	70.0	130	----
Dissolved Metals (QCLot: 630246)										
VA22C0357-003	Anonymous	aluminum, dissolved	7429-90-5	E421	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0194 mg/L	0.02 mg/L	96.8	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0210 mg/L	0.02 mg/L	105	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.0209 mg/L	0.02 mg/L	104	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0414 mg/L	0.04 mg/L	104	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00950 mg/L	0.01 mg/L	95.0	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00406 mg/L	0.004 mg/L	102	70.0	130	----
		calcium, dissolved	7440-70-2	E421	4.05 mg/L	4 mg/L	101	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0412 mg/L	0.04 mg/L	103	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0210 mg/L	0.02 mg/L	105	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 630246) - continued										
VA22C0357-003	Anonymous	iron, dissolved	7439-89-6	E421	1.99 mg/L	2 mg/L	99.6	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0196 mg/L	0.02 mg/L	98.2	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0991 mg/L	0.1 mg/L	99.1	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	1.00 mg/L	1 mg/L	100	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0210 mg/L	0.02 mg/L	105	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0417 mg/L	0.04 mg/L	104	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.26 mg/L	4 mg/L	106	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.78 mg/L	10 mg/L	97.8	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00410 mg/L	0.004 mg/L	103	70.0	130	----
		sodium, dissolved	7440-23-5	E421	2.04 mg/L	2 mg/L	102	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00390 mg/L	0.004 mg/L	97.5	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0197 mg/L	0.02 mg/L	98.3	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0414 mg/L	0.04 mg/L	103	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00392 mg/L	0.004 mg/L	98.0	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.420 mg/L	0.4 mg/L	105	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-m

For tests that can not be performed according to the service level selected, you will

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) b

Project Information

ALS Account # / Quote #: VA22-MPMC100-006

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): VA22C0362

ALS Contact: Can Dang

Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F NUTRIENTS-1	F Total Metals (ICPMS)	F Dissolved Metals (ICPMS)	P Total Nitrogen Ammonia	F/P DOC	F/P TSS (Whole bottle)	Chlorophyll-a (E8708)						
	QUL-ZOO-1_WS_DI-1_2022-08	28-Aug-22	11:10	Water	R	R	R	R	R	R	R						6 7
	QUL-ZOO-7_WS_DI-1_2022-08	28-Aug-22	12:45	Water	R	R	R	R	R	R	R						6 7
	QUL-ZOO1_WS_DI-1X_2022-08	28-Aug-22	11:10	Water	R	R	R	R	R	R	R						6 7
	BQL-B2_WS_DI-1_2022-08	28-Aug-22	08:10	water	R	R	R	R	R	R	R						7

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Regular analytes for Mount Polley Mine water sample package. Please also report ANIONS-N+N-CALC-VA (calculated nitrate and nitrite)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
				9	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lahmer	Date: 29 AUG 22	Time: 0830	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 10 50 am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Environmental Division
Vancouver
Work Order Reference
VA22C0362

Telephone : +1 604 253 4188

SEDIMENT CHEMISTRY

ALS Laboratory Report VA22B8489

(Finalized August 31, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B8489**	Page	: 1 of 12
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 15-Aug-2022
C-O-C number	: ----	Issue Date	: 31-Aug-2022 14:49
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 66		
No. of samples analysed	: 22		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
VA22B8489-045	HAC-U_SE-1_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22B8489-046	HAC-U_SE-2_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22B8489-047	HAC-U_SE-3_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22B8489-048	HAC-U_SE-4_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22B8489-049	HAC-U_SE-5_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22B8489-065	HAC-D_SE-5X_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_SE-1_2022-08	HAC-U_SE-2_2022-08	HAC-U_SE-3_2022-08	HAC-U_SE-4_2022-08	HAC-U_SE-5_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8489-045	VA22B8489-046	VA22B8489-047	VA22B8489-048	VA22B8489-049
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		88.4	85.0	87.1	85.8	90.3
pH (1:2 soil:water)	----	E108	0.10	pH units		7.03	7.19	7.27	7.18	7.22
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		15.1	16.2	14.7	17.3	17.3
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		72.0	69.2	70.7	70.1	73.7
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		12.9	14.6	14.6	12.6	9.0
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.895	0.629	0.662	0.818	0.821
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		7.45	5.80	6.29	7.21	6.96
Inorganic Parameters										
sulfur, total	7704-34-9	E399	500	mg/kg		2120	2610	2520	2920	3420
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		15700	16500	16400	15400	16600
antimony	7440-36-0	E440A	0.10	mg/kg		0.28	0.36	0.35	0.29	0.36
arsenic	7440-38-2	E440A	0.050	mg/kg		7.08	7.35	7.38	7.16	7.43
barium	7440-39-3	E440A	0.50	mg/kg		266	255	257	266	256
beryllium	7440-41-7	E440A	0.10	mg/kg		0.52	0.55	0.54	0.51	0.55
bismuth	7440-69-9	E440A	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
boron	7440-42-8	E440A	5.0	mg/kg		23.3	15.1	16.6	22.2	21.8
cadmium	7440-43-9	E440A	0.020	mg/kg		0.395	0.374	0.328	0.330	0.344
calcium	7440-70-2	E440A	50	mg/kg		23600	20700	22800	21800	19300
chromium	7440-47-3	E440A	0.50	mg/kg		26.7	29.4	25.9	23.9	27.6
cobalt	7440-48-4	E440A	0.10	mg/kg		13.2	13.6	13.6	12.8	13.4
copper	7440-50-8	E440A	0.50	mg/kg		393	400	382	385	402
iron	7439-89-6	E440A	50	mg/kg		30700	31800	32300	32700	32500
lead	7439-92-1	E440A	0.10	mg/kg		5.50	5.99	5.82	5.69	5.87
lithium	7439-93-2	E440A	2.0	mg/kg		12.4	14.0	13.4	12.6	13.0
magnesium	7439-95-4	E440A	10	mg/kg		8460	8620	8420	8480	8560
manganese	7439-96-5	E440A	0.20	mg/kg		1860	1430	1880	2250	1780

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_SE-1_2022-08	HAC-U_SE-2_2022-08	HAC-U_SE-3_2022-08	HAC-U_SE-4_2022-08	HAC-U_SE-5_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8489-045	VA22B8489-046	VA22B8489-047	VA22B8489-048	VA22B8489-049
						Result	Result	Result	Result	Result
Metals										
mercury	7439-97-6	E510A	0.0050	mg/kg		0.108	0.112	0.105	0.103	0.107
molybdenum	7439-98-7	E440A	0.10	mg/kg		4.06	3.67	4.16	3.40	3.92
nickel	7440-02-0	E440A	0.50	mg/kg		25.2	25.4	22.4	21.0	23.0
phosphorus	7723-14-0	E440A	50	mg/kg		1650	1340	1420	1580	1570
potassium	7440-09-7	E440A	100	mg/kg		1420	1610	1360	1340	1440
selenium	7782-49-2	E440A	0.10	mg/kg		4.43	3.39	3.36	4.57	4.52
silver	7440-22-4	E440A	0.050	mg/kg		0.185	0.198	0.193	0.178	0.181
sodium	7440-23-5	E440A	50	mg/kg		496	458	476	465	468
strontium	7440-24-6	E440A	0.10	mg/kg		147	143	151	143	134
thallium	7440-28-0	E440A	0.050	mg/kg		<0.050	0.063	0.053	<0.050	0.054
tin	7440-31-5	E440A	0.20	mg/kg		0.74	0.68	0.71	0.62	0.77
titanium	7440-32-6	E440A	1.0	mg/kg		707	727	737	678	871
uranium	7440-61-1	E440A	0.050	mg/kg		0.798	0.749	0.835	0.802	0.850
vanadium	7440-62-2	E440A	0.20	mg/kg		96.8	96.0	99.9	95.7	105
zinc	7440-66-6	E440A	1.0	mg/kg		68.3	71.1	69.8	67.8	70.6
zirconium	7440-67-7	E440A	1.0	mg/kg		1.9	2.1	2.0	1.9	2.2

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_SE-1_2022-08	HAC-D_SE-2_2022-08	HAC-D_SE-3_2022-08	HAC-D_SE-4_2022-08	HAC-D_SE-5_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8489-050	VA22B8489-051	VA22B8489-052	VA22B8489-053	VA22B8489-054
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		59.0	50.3	51.8	46.1	69.7
pH (1:2 soil:water)	----	E108	0.10	pH units		7.66	7.65	7.36	7.60	7.22
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		6.8	6.6	11.5	7.3	10.0
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		42.5	38.6	54.8	35.5	65.4
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		50.5	54.3	33.7	57.0	23.7
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.133	0.115	0.140	0.117	0.226
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		1.67	1.47	1.77	1.43	1.91
Inorganic Parameters										
sulfur, total	7704-34-9	E399	500	mg/kg		1090	740	630	770	780
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		14900	15600	16400	14200	14500
antimony	7440-36-0	E440A	0.10	mg/kg		0.48	0.53	0.50	0.49	0.49
arsenic	7440-38-2	E440A	0.050	mg/kg		13.3	15.9	15.4	15.5	15.5
barium	7440-39-3	E440A	0.50	mg/kg		239	268	220	227	244
beryllium	7440-41-7	E440A	0.10	mg/kg		0.53	0.59	0.58	0.55	0.57
bismuth	7440-69-9	E440A	0.10	mg/kg		0.13	0.12	0.14	0.12	0.13
boron	7440-42-8	E440A	5.0	mg/kg		11.5	13.6	11.1	11.2	11.3
cadmium	7440-43-9	E440A	0.020	mg/kg		0.280	0.293	0.312	0.267	0.272
calcium	7440-70-2	E440A	50	mg/kg		22900	24200	22200	24000	23400
chromium	7440-47-3	E440A	0.50	mg/kg		33.8	35.1	36.5	31.9	33.3
cobalt	7440-48-4	E440A	0.10	mg/kg		14.2	15.5	15.5	14.2	14.3
copper	7440-50-8	E440A	0.50	mg/kg		312	375	342	325	325
iron	7439-89-6	E440A	50	mg/kg		40900	46100	43600	43100	42800
lead	7439-92-1	E440A	0.10	mg/kg		8.52	8.45	8.96	8.29	8.61
lithium	7439-93-2	E440A	2.0	mg/kg		14.4	14.3	15.0	13.7	14.5
magnesium	7439-95-4	E440A	10	mg/kg		7900	8530	8680	8090	7710
manganese	7439-96-5	E440A	0.20	mg/kg		1030	1470	996	1310	1110
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0926	0.115	0.101	0.0956	0.108

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_SE-1_2022-08	HAC-D_SE-2_2022-08	HAC-D_SE-3_2022-08	HAC-D_SE-4_2022-08	HAC-D_SE-5_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8489-050	VA22B8489-051	VA22B8489-052	VA22B8489-053	VA22B8489-054
						Result	Result	Result	Result	Result
Metals										
molybdenum	7439-98-7	E440A	0.10	mg/kg		1.57	1.70	1.66	1.91	1.60
nickel	7440-02-0	E440A	0.50	mg/kg		25.8	24.9	26.5	24.4	24.4
phosphorus	7723-14-0	E440A	50	mg/kg		1220	1370	1200	1160	1220
potassium	7440-09-7	E440A	100	mg/kg		1290	1420	1500	1340	1360
selenium	7782-49-2	E440A	0.10	mg/kg		1.19	1.19	1.05	1.12	1.06
silver	7440-22-4	E440A	0.050	mg/kg		0.167	0.177	0.201	0.182	0.292
sodium	7440-23-5	E440A	50	mg/kg		340	417	412	371	357
strontium	7440-24-6	E440A	0.10	mg/kg		176	192	171	174	171
thallium	7440-28-0	E440A	0.050	mg/kg		0.106	0.108	0.123	0.113	0.116
tin	7440-31-5	E440A	0.20	mg/kg		0.61	0.73	0.66	0.66	0.63
titanium	7440-32-6	E440A	1.0	mg/kg		873	1090	1020	868	901
uranium	7440-61-1	E440A	0.050	mg/kg		0.979	1.02	1.02	0.966	0.992
vanadium	7440-62-2	E440A	0.20	mg/kg		125	152	133	130	129
zinc	7440-66-6	E440A	1.0	mg/kg		74.0	76.2	75.9	72.6	75.2
zirconium	7440-67-7	E440A	1.0	mg/kg		2.3	3.3	2.9	2.5	2.7

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_SE-1_2022-08	EDC-U_SE-2_2022-08	EDC-U_SE-3_2022-08	EDC-U_SE-4_2022-08	EDC-U_SE-5_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8489-055	VA22B8489-056	VA22B8489-057	VA22B8489-058	VA22B8489-059
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		63.9	70.8	64.9	64.5	45.5
pH (1:2 soil:water)	----	E108	0.10	pH units		6.67	6.64	6.44	7.03	6.97
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		8.2	14.3	6.3	8.1	5.2
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		44.9	47.4	32.7	36.1	17.6
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		44.9	37.7	60.7	55.8	76.2
gravel (>2mm)	----	EC184E	1.0	%		2.0	<1.0	<1.0	<1.0	1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.424	0.303	0.248	0.271	0.167
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		7.11	3.78	7.08	5.43	6.65
Inorganic Parameters										
sulfur, total	7704-34-9	E399	500	mg/kg		760	710	690	610	<500
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		16600	12300	14600	14800	15400
antimony	7440-36-0	E440A	0.10	mg/kg		0.34	0.24	0.31	0.30	0.31
arsenic	7440-38-2	E440A	0.050	mg/kg		8.78	5.80	9.52	8.03	8.23
barium	7440-39-3	E440A	0.50	mg/kg		129	79.3	116	105	111
beryllium	7440-41-7	E440A	0.10	mg/kg		0.39	0.29	0.38	0.38	0.42
bismuth	7440-69-9	E440A	0.10	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10
boron	7440-42-8	E440A	5.0	mg/kg		5.3	<5.0	<5.0	<5.0	<5.0
cadmium	7440-43-9	E440A	0.020	mg/kg		0.426	0.165	0.387	0.316	0.351
calcium	7440-70-2	E440A	50	mg/kg		8850	6170	7820	7950	8440
chromium	7440-47-3	E440A	0.50	mg/kg		49.5	37.2	47.4	47.3	53.2
cobalt	7440-48-4	E440A	0.10	mg/kg		13.0	8.18	12.5	11.9	12.2
copper	7440-50-8	E440A	0.50	mg/kg		32.2	20.2	28.2	25.5	27.6
iron	7439-89-6	E440A	50	mg/kg		26400	18400	26800	24700	27200
lead	7439-92-1	E440A	0.10	mg/kg		8.14	5.70	6.88	5.90	6.35
lithium	7439-93-2	E440A	2.0	mg/kg		12.8	10.4	12.2	11.8	12.8
magnesium	7439-95-4	E440A	10	mg/kg		6570	5210	6150	6150	6460
manganese	7439-96-5	E440A	0.20	mg/kg		560	541	852	1080	1010
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0820	0.0530	0.0794	0.0747	0.0866

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_SE-1_2022-08	EDC-U_SE-2_2022-08	EDC-U_SE-3_2022-08	EDC-U_SE-4_2022-08	EDC-U_SE-5_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8489-055	VA22B8489-056	VA22B8489-057	VA22B8489-058	VA22B8489-059
						Result	Result	Result	Result	Result
Metals										
molybdenum	7439-98-7	E440A	0.10	mg/kg		0.67	0.47	0.57	0.56	0.62
nickel	7440-02-0	E440A	0.50	mg/kg		28.2	19.0	26.2	25.6	27.2
phosphorus	7723-14-0	E440A	50	mg/kg		1060	954	1010	1020	1080
potassium	7440-09-7	E440A	100	mg/kg		1240	720	1030	1000	1100
selenium	7782-49-2	E440A	0.10	mg/kg		0.49	0.24	0.37	0.43	0.44
silver	7440-22-4	E440A	0.050	mg/kg		0.159	0.100	0.139	0.124	0.132
sodium	7440-23-5	E440A	50	mg/kg		289	200	255	262	269
strontium	7440-24-6	E440A	0.10	mg/kg		77.1	55.7	68.9	70.5	75.8
thallium	7440-28-0	E440A	0.050	mg/kg		0.128	0.084	0.107	0.103	0.114
tin	7440-31-5	E440A	0.20	mg/kg		0.46	0.25	0.33	0.34	0.43
titanium	7440-32-6	E440A	1.0	mg/kg		626	492	588	608	652
uranium	7440-61-1	E440A	0.050	mg/kg		1.48	1.15	1.23	1.19	1.33
vanadium	7440-62-2	E440A	0.20	mg/kg		67.1	48.4	64.7	63.6	68.2
zinc	7440-66-6	E440A	1.0	mg/kg		73.4	45.4	68.3	62.0	67.6
zirconium	7440-67-7	E440A	1.0	mg/kg		1.1	<1.0	1.0	<1.0	<1.0

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_SE-1_2022-08	EDC-D_SE-2_2022-08	EDC-D_SE-3_2022-08	EDC-D_SE-4_2022-08	EDC-D_SE-5_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8489-060	VA22B8489-061	VA22B8489-062	VA22B8489-063	VA22B8489-064
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		50.0	52.8	60.6	43.8	59.8
pH (1:2 soil:water)	----	E108	0.10	pH units		7.30	7.71	7.87	7.69	6.49
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		6.6	7.4	7.0	5.8	6.8
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		33.5	38.7	40.9	24.1	34.0
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		59.5	52.7	51.2	70.0	58.1
gravel (>2mm)	----	EC184E	1.0	%		<1.0	1.2	<1.0	<1.0	1.1
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.189	0.158	0.210	0.087	0.206
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		3.43	2.84	3.56	3.05	5.29
Inorganic Parameters										
sulfur, total	7704-34-9	E399	500	mg/kg		620	530	570	<500	520
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		13800	14600	14200	13100	13600
antimony	7440-36-0	E440A	0.10	mg/kg		0.34	0.33	0.36	0.35	0.32
arsenic	7440-38-2	E440A	0.050	mg/kg		9.30	8.39	10.5	11.3	9.49
barium	7440-39-3	E440A	0.50	mg/kg		110	111	118	126	122
beryllium	7440-41-7	E440A	0.10	mg/kg		0.35	0.40	0.36	0.37	0.35
bismuth	7440-69-9	E440A	0.10	mg/kg		0.11	0.11	0.11	0.12	0.12
boron	7440-42-8	E440A	5.0	mg/kg		<5.0	<5.0	5.0	<5.0	<5.0
cadmium	7440-43-9	E440A	0.020	mg/kg		0.264	0.213	0.265	0.278	0.288
calcium	7440-70-2	E440A	50	mg/kg		8300	8550	8940	8700	8480
chromium	7440-47-3	E440A	0.50	mg/kg		42.3	44.8	45.0	43.9	41.1
cobalt	7440-48-4	E440A	0.10	mg/kg		11.4	11.2	12.3	12.1	11.7
copper	7440-50-8	E440A	0.50	mg/kg		25.8	29.2	27.3	27.6	31.5
iron	7439-89-6	E440A	50	mg/kg		27100	26100	29300	28900	27200
lead	7439-92-1	E440A	0.10	mg/kg		6.44	7.26	6.73	6.87	6.77
lithium	7439-93-2	E440A	2.0	mg/kg		13.3	15.0	14.0	13.4	13.9
magnesium	7439-95-4	E440A	10	mg/kg		6450	6880	7100	6620	6760
manganese	7439-96-5	E440A	0.20	mg/kg		514	564	1000	904	541
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0530	0.0689	0.0578	0.0533	0.0661

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_SE-1_2022-08	EDC-D_SE-2_2022-08	EDC-D_SE-3_2022-08	EDC-D_SE-4_2022-08	EDC-D_SE-5_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8489-060	VA22B8489-061	VA22B8489-062	VA22B8489-063	VA22B8489-064
						Result	Result	Result	Result	Result
Metals										
molybdenum	7439-98-7	E440A	0.10	mg/kg		0.60	0.58	0.65	0.54	0.55
nickel	7440-02-0	E440A	0.50	mg/kg		26.9	28.0	28.7	27.9	28.2
phosphorus	7723-14-0	E440A	50	mg/kg		930	953	1050	960	968
potassium	7440-09-7	E440A	100	mg/kg		1120	1140	1240	1110	1080
selenium	7782-49-2	E440A	0.10	mg/kg		0.38	0.49	0.43	0.39	0.54
silver	7440-22-4	E440A	0.050	mg/kg		0.094	0.116	0.107	0.103	0.107
sodium	7440-23-5	E440A	50	mg/kg		280	267	290	257	226
strontium	7440-24-6	E440A	0.10	mg/kg		77.8	87.4	84.9	80.5	75.8
thallium	7440-28-0	E440A	0.050	mg/kg		0.093	0.106	0.097	0.092	0.090
tin	7440-31-5	E440A	0.20	mg/kg		0.34	0.35	0.41	0.37	0.35
titanium	7440-32-6	E440A	1.0	mg/kg		706	704	766	666	543
uranium	7440-61-1	E440A	0.050	mg/kg		1.06	1.06	1.03	0.965	0.894
vanadium	7440-62-2	E440A	0.20	mg/kg		63.1	62.3	67.2	68.5	59.2
zinc	7440-66-6	E440A	1.0	mg/kg		59.4	65.0	64.9	62.7	65.5
zirconium	7440-67-7	E440A	1.0	mg/kg		1.5	1.9	1.5	1.7	1.6

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_SE-5X_2022-08	EDC-D_SE-4X_2022-08	----	----	----
					Client sampling date / time	05-Aug-2022	03-Aug-2022	----	----	----
						VA22B8489-065	VA22B8489-066	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
moisture	----	E144	0.25	%		63.4	40.8	----	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units		7.39	7.47	----	----	----
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		9.8	5.4	----	----	----
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		55.0	27.7	----	----	----
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		35.2	66.5	----	----	----
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	----	----	----
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.181	0.098	----	----	----
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		1.84	2.59	----	----	----
Inorganic Parameters										
sulfur, total	7704-34-9	E399	500	mg/kg		870	580	----	----	----
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		15300	14600	----	----	----
antimony	7440-36-0	E440A	0.10	mg/kg		0.82	0.38	----	----	----
arsenic	7440-38-2	E440A	0.050	mg/kg		17.8	12.0	----	----	----
barium	7440-39-3	E440A	0.50	mg/kg		229	115	----	----	----
beryllium	7440-41-7	E440A	0.10	mg/kg		0.53	0.38	----	----	----
bismuth	7440-69-9	E440A	0.10	mg/kg		0.12	0.12	----	----	----
boron	7440-42-8	E440A	5.0	mg/kg		10.8	<5.0	----	----	----
cadmium	7440-43-9	E440A	0.020	mg/kg		0.385	0.283	----	----	----
calcium	7440-70-2	E440A	50	mg/kg		21900	8670	----	----	----
chromium	7440-47-3	E440A	0.50	mg/kg		32.9	45.0	----	----	----
cobalt	7440-48-4	E440A	0.10	mg/kg		14.7	13.2	----	----	----
copper	7440-50-8	E440A	0.50	mg/kg		337	28.1	----	----	----
iron	7439-89-6	E440A	50	mg/kg		44700	30400	----	----	----
lead	7439-92-1	E440A	0.10	mg/kg		18.9	7.56	----	----	----
lithium	7439-93-2	E440A	2.0	mg/kg		14.8	14.6	----	----	----
magnesium	7439-95-4	E440A	10	mg/kg		8020	6790	----	----	----
manganese	7439-96-5	E440A	0.20	mg/kg		1050	839	----	----	----
mercury	7439-97-6	E510A	0.0050	mg/kg		0.106	0.0531	----	----	----

Analytical Results

Sub-Matrix: Soil (Matrix: Soil/Solid)					Client sample ID	HAC-D_SE-5X_2022-08	EDC-D_SE-4X_2022-08	----	----	----
					Client sampling date / time	05-Aug-2022	03-Aug-2022	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B8489-065	VA22B8489-066	--------	--------	--------
						Result	Result	----	----	----
Metals										
molybdenum	7439-98-7	E440A	0.10	mg/kg		1.78	0.57	----	----	----
nickel	7440-02-0	E440A	0.50	mg/kg		24.9	29.1	----	----	----
phosphorus	7723-14-0	E440A	50	mg/kg		1580	1240	----	----	----
potassium	7440-09-7	E440A	100	mg/kg		1260	1040	----	----	----
selenium	7782-49-2	E440A	0.10	mg/kg		1.03	0.45	----	----	----
silver	7440-22-4	E440A	0.050	mg/kg		0.314	0.105	----	----	----
sodium	7440-23-5	E440A	50	mg/kg		360	244	----	----	----
strontium	7440-24-6	E440A	0.10	mg/kg		149	67.7	----	----	----
thallium	7440-28-0	E440A	0.050	mg/kg		0.109	0.090	----	----	----
tin	7440-31-5	E440A	0.20	mg/kg		0.69	0.45	----	----	----
titanium	7440-32-6	E440A	1.0	mg/kg		953	683	----	----	----
uranium	7440-61-1	E440A	0.050	mg/kg		0.960	0.919	----	----	----
vanadium	7440-62-2	E440A	0.20	mg/kg		140	70.0	----	----	----
zinc	7440-66-6	E440A	1.0	mg/kg		86.9	65.0	----	----	----
zirconium	7440-67-7	E440A	1.0	mg/kg		2.9	1.8	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B8489**	Page	: 1 of 21
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Issue Date	: 31-Aug-2022 14:50
C-O-C number	: ----		
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 66		
No. of samples analysed	: 22		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22B8489-065	HAC-D_SE-5X_2022-08	antimony	7440-36-0	E440A	40.3 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8489-065	HAC-D_SE-5X_2022-08	lead	7439-92-1	E440A	52.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG2-604968002	----	zirconium	7440-67-7	E440A	123 % MES	80.0-120%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E366	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	23 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E366	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	23 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E366	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	23 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E366	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	23 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E366	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	23 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-1_2022-08	E366	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	24 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E366	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	24 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-3_2022-08	E366	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	24 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-4_2022-08	E366	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	24 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-5_2022-08	E366	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	24 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-1_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-2_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-3_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-4_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5X_2022-08	E366	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	25 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-1_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-2_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-3_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4X_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E366	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	28 days	27 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E399	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	23 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E399	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	23 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E399	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	23 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E399	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	23 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E399	07-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	23 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-1_2022-08	E399	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	24 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E399	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	24 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-3_2022-08	E399	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	24 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-4_2022-08	E399	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	24 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-U_SE-5_2022-08	E399	06-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	24 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-1_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
HAC-D_SE-2_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap HAC-D_SE-3_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap HAC-D_SE-4_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap HAC-D_SE-5_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap HAC-D_SE-5X_2022-08	E399	05-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	25 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap EDC-D_SE-1_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap EDC-D_SE-2_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap EDC-D_SE-3_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap EDC-D_SE-4_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap EDC-D_SE-4X_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganic Parameters : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E399	03-Aug-2022	29-Aug-2022	----	----		29-Aug-2022	365 days	27 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E510A	07-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	12 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E510A	07-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	12 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E510A	07-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	12 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E510A	07-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	12 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E510A	07-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	12 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5X_2022-08	E510A	05-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	28 days	13 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-1_2022-08	E510A	06-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	13 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E510A	06-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	13 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-3_2022-08	E510A	06-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	13 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-4_2022-08	E510A	06-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	13 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-5_2022-08	E510A	06-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	13 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-1_2022-08	E510A	05-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-2_2022-08	E510A	05-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-3_2022-08	E510A	05-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-4_2022-08	E510A	05-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5_2022-08	E510A	05-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4X_2022-08	E510A	03-Aug-2022	17-Aug-2022	----	----		18-Aug-2022	28 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-1_2022-08	E510A	03-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-2_2022-08	E510A	03-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-3_2022-08	E510A	03-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4_2022-08	E510A	03-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E510A	03-Aug-2022	18-Aug-2022	----	----		19-Aug-2022	28 days	16 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E440A	07-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	11 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E440A	07-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	11 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E440A	07-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	11 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E440A	07-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E440A	07-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	11 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
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Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E440A	06-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	12 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
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HAC-U_SE-5_2022-08	E440A	06-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	12 days	✓
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Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-4_2022-08	E440A	05-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	13 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5_2022-08	E440A	05-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	13 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5X_2022-08	E440A	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	180 days	13 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-1_2022-08	E440A	03-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	15 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-2_2022-08	E440A	03-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	15 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-3_2022-08	E440A	03-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	15 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4_2022-08	E440A	03-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	15 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4X_2022-08	E440A	03-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	180 days	15 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E440A	03-Aug-2022	18-Aug-2022	----	----		18-Aug-2022	180 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-1_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-2_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-3_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4X_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E144	03-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E144	07-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E144	07-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E144	07-Aug-2022	----	----	----		15-Aug-2022	----	----	

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E144	07-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E144	07-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-1_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-2_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-3_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-4_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5X_2022-08	E144	05-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-U_SE-1_2022-08	E144	06-Aug-2022	----	----	----		15-Aug-2022	----	----	

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E144	06-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-U_SE-3_2022-08	E144	06-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-U_SE-4_2022-08	E144	06-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
HAC-U_SE-5_2022-08	E144	06-Aug-2022	----	----	----		15-Aug-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-1_2022-08	E108	07-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-2_2022-08	E108	07-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-3_2022-08	E108	07-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-4_2022-08	E108	07-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-U_SE-5_2022-08	E108	07-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	11 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-1_2022-08	E108	06-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-2_2022-08	E108	06-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-3_2022-08	E108	06-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-4_2022-08	E108	06-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-U_SE-5_2022-08	E108	06-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-1_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-2_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-3_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-4_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
HAC-D_SE-5X_2022-08	E108	05-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-1_2022-08	E108	03-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	15 days	✓
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Glass soil jar/Teflon lined cap										
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Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-4X_2022-08	E108	03-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	15 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
EDC-D_SE-5_2022-08	E108	03-Aug-2022	17-Aug-2022	----	----		17-Aug-2022	30 days	15 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	604968	2	22	9.0	5.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	604969	2	22	9.0	5.0	✓
Moisture Content by Gravimetry	E144	602878	2	38	5.2	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	604970	2	22	9.0	5.0	✓
Total Nitrogen by Combustion	E366	623543	2	22	9.0	5.0	✓
Total Sulfur by high temperature combustion	E399	623544	2	22	9.0	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	604968	4	22	18.1	10.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	604969	4	22	18.1	10.0	✓
Moisture Content by Gravimetry	E144	602878	2	38	5.2	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	604970	2	22	9.0	5.0	✓
Total Nitrogen by Combustion	E366	623543	4	22	18.1	10.0	✓
Total Sulfur by high temperature combustion	E399	623544	4	22	18.1	10.0	✓
Method Blanks (MB)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	604968	2	22	9.0	5.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	604969	2	22	9.0	5.0	✓
Moisture Content by Gravimetry	E144	602878	2	38	5.2	5.0	✓
Total Nitrogen by Combustion	E366	623543	2	22	9.0	5.0	✓
Total Sulfur by high temperature combustion	E399	623544	2	22	9.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.
Total Sulfur by high temperature combustion	E399 Saskatoon - Environmental	Soil/Solid	ISO 15178:2000	Air-dried sample is ignited in a combustion analyzer where sulfur in the reduced SO_2 gas is determined using a thermal conductivity detector.
Metals in Sediment by CRC ICPMS (<63 µm)	E440A Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are sieved through a 63 um sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Elemental Sulfur may be poorly recovered by this method. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Sediment by CVAAS (<63 µm)	E510A Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are sieved through a 63 µm sieve, and digested with HNO_3 and HCl, followed by CVAAS analysis.
Particle Size Analysis (Pipette) - MMER Classification	EC184E Saskatoon - Environmental	Soil/Solid	Metal Mining Technical Guidance for Environmental Effects Monitoring (2012)	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Metal Mining Effluent Regulations (MMER) classification system for Environmental Effects Monitoring.
Total Organic Carbon (Calculated) in soil (<63 µm)	EC356A Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC) analyzed on material passing a 63 µm sieve.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury (63 µm Sieve)	EP440A Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are sieved through a 63 µm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **VA22B8489**	Page	: 1 of 14
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 10-Aug-2022 11:00
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 15-Aug-2022
C-O-C number	: ----	Issue Date	: 31-Aug-2022 14:51
Sampler	: KBA		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 66		
No. of samples analysed	: 22		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Vancouver Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Vancouver Organics, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 602878)											
VA22B7144-003	Anonymous	moisture	----	E144	0.25	%	48.5	48.3	0.358%	20%	----
Physical Tests (QC Lot: 602973)											
VA22B8489-049	HAC-U_SE-5_2022-08	moisture	----	E144	0.25	%	90.3	88.3	2.26%	20%	----
Physical Tests (QC Lot: 604817)											
VA22B8489-045	HAC-U_SE-1_2022-08	pH (1:2 soil:water)	----	E108	0.10	pH units	7.03	7.10	1.0%	5%	----
Physical Tests (QC Lot: 604970)											
VA22B8489-066	EDC-D_SE-4X_2022-08	pH (1:2 soil:water)	----	E108	0.10	pH units	7.47	7.44	0.4%	5%	----
Anions and Nutrients (QC Lot: 619438)											
VA22B8489-047	HAC-U_SE-3_2022-08	nitrogen, total	7727-37-9	E366	0.020	%	0.662	0.688	3.85%	20%	----
Anions and Nutrients (QC Lot: 623543)											
VA22B8489-065	HAC-D_SE-5X_2022-08	nitrogen, total	7727-37-9	E366	0.020	%	0.181	0.202	0.021	Diff <2x LOR	----
Inorganic Parameters (QC Lot: 619439)											
VA22B8489-047	HAC-U_SE-3_2022-08	sulfur, total	7704-34-9	E399	0.050	%	2520 mg/kg	0.202	0.050	Diff <2x LOR	----
Inorganic Parameters (QC Lot: 623544)											
VA22B8489-065	HAC-D_SE-5X_2022-08	sulfur, total	7704-34-9	E399	0.050	%	870 mg/kg	0.076	0.011	Diff <2x LOR	----
Metals (QC Lot: 604815)											
VA22B8489-045	HAC-U_SE-1_2022-08	mercury	7439-97-6	E510A	0.0050	mg/kg	0.108	0.0936	13.8%	40%	----
Metals (QC Lot: 604816)											
VA22B8489-045	HAC-U_SE-1_2022-08	aluminum	7429-90-5	E440A	50	mg/kg	15700	13600	14.7%	40%	----
		antimony	7440-36-0	E440A	0.10	mg/kg	0.28	0.19	0.09	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.050	mg/kg	7.08	6.02	16.3%	30%	----
		barium	7440-39-3	E440A	0.50	mg/kg	266	234	12.8%	40%	----
		beryllium	7440-41-7	E440A	0.10	mg/kg	0.52	0.48	0.04	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	5.0	mg/kg	23.3	18.8	4.5	Diff <2x LOR	----
		cadmium	7440-43-9	E440A	0.020	mg/kg	0.395	0.326	19.1%	30%	----
		calcium	7440-70-2	E440A	50	mg/kg	23600	19900	16.9%	30%	----
		chromium	7440-47-3	E440A	0.50	mg/kg	26.7	22.8	15.6%	30%	----
		cobalt	7440-48-4	E440A	0.10	mg/kg	13.2	12.0	9.77%	30%	----
		copper	7440-50-8	E440A	0.50	mg/kg	393	336	15.5%	30%	----
		iron	7439-89-6	E440A	50	mg/kg	30700	27900	9.57%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 604816) - continued											
VA22B8489-045	HAC-U_SE-1_2022-08	lead	7439-92-1	E440A	0.10	mg/kg	5.50	5.05	8.64%	40%	----
		lithium	7439-93-2	E440A	2.0	mg/kg	12.4	11.2	1.1	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	10	mg/kg	8460	7500	11.9%	30%	----
		manganese	7439-96-5	E440A	0.20	mg/kg	1860	1670	11.2%	30%	----
		molybdenum	7439-98-7	E440A	0.10	mg/kg	4.06	3.95	2.73%	40%	----
		nickel	7440-02-0	E440A	0.50	mg/kg	25.2	24.4	3.12%	30%	----
		phosphorus	7723-14-0	E440A	50	mg/kg	1650	1420	15.3%	30%	----
		potassium	7440-09-7	E440A	100	mg/kg	1420	1200	16.7%	40%	----
		selenium	7782-49-2	E440A	0.10	mg/kg	4.43	3.95	11.4%	30%	----
		silver	7440-22-4	E440A	0.050	mg/kg	0.185	0.181	0.003	Diff <2x LOR	----
		sodium	7440-23-5	E440A	50	mg/kg	496	435	13.1%	40%	----
		strontium	7440-24-6	E440A	0.10	mg/kg	147	132	10.7%	40%	----
		thallium	7440-28-0	E440A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.20	mg/kg	0.74	0.58	0.15	Diff <2x LOR	----
		titanium	7440-32-6	E440A	1.0	mg/kg	707	484	37.4%	40%	----
		uranium	7440-61-1	E440A	0.050	mg/kg	0.798	0.686	15.0%	30%	----
		vanadium	7440-62-2	E440A	0.20	mg/kg	96.8	77.7	21.9%	30%	----
		zinc	7440-66-6	E440A	1.0	mg/kg	68.3	62.2	9.38%	30%	----
		zirconium	7440-67-7	E440A	1.0	mg/kg	1.9	1.6	0.2	Diff <2x LOR	----
Metals (QC Lot: 604968)											
VA22B8489-065	HAC-D_SE-5X_2022-08	mercury	7439-97-6	E510A	0.0050	mg/kg	0.106	0.101	4.93%	40%	----
Metals (QC Lot: 604969)											
VA22B8489-065	HAC-D_SE-5X_2022-08	aluminum	7429-90-5	E440A	50	mg/kg	15300	16300	6.50%	40%	----
		antimony	7440-36-0	E440A	0.10	mg/kg	0.82	0.55	40.3%	30%	DUP-H
		arsenic	7440-38-2	E440A	0.050	mg/kg	17.8	16.9	5.16%	30%	----
		barium	7440-39-3	E440A	0.50	mg/kg	229	242	5.47%	40%	----
		beryllium	7440-41-7	E440A	0.10	mg/kg	0.53	0.55	0.02	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.10	mg/kg	0.12	0.12	0.0005	Diff <2x LOR	----
		boron	7440-42-8	E440A	5.0	mg/kg	10.8	10.4	0.3	Diff <2x LOR	----
		cadmium	7440-43-9	E440A	0.020	mg/kg	0.385	0.328	16.2%	30%	----
		calcium	7440-70-2	E440A	50	mg/kg	21900	21000	3.90%	30%	----
		chromium	7440-47-3	E440A	0.50	mg/kg	32.9	33.1	0.566%	30%	----
		cobalt	7440-48-4	E440A	0.10	mg/kg	14.7	15.3	3.77%	30%	----
		copper	7440-50-8	E440A	0.50	mg/kg	337	347	2.93%	30%	----
		iron	7439-89-6	E440A	50	mg/kg	44700	43400	2.93%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 604969) - continued											
VA22B8489-065	HAC-D_SE-5X_2022-08	lead	7439-92-1	E440A	0.10	mg/kg	18.9	11.0	52.9%	40%	DUP-H
		lithium	7439-93-2	E440A	2.0	mg/kg	14.8	15.4	3.61%	30%	----
		magnesium	7439-95-4	E440A	10	mg/kg	8020	8320	3.66%	30%	----
		manganese	7439-96-5	E440A	0.20	mg/kg	1050	1200	13.7%	30%	----
		molybdenum	7439-98-7	E440A	0.10	mg/kg	1.78	1.55	13.6%	40%	----
		nickel	7440-02-0	E440A	0.50	mg/kg	24.9	26.4	5.80%	30%	----
		phosphorus	7723-14-0	E440A	50	mg/kg	1580	1450	8.63%	30%	----
		potassium	7440-09-7	E440A	100	mg/kg	1260	1280	2.04%	40%	----
		selenium	7782-49-2	E440A	0.10	mg/kg	1.03	1.17	12.1%	30%	----
		silver	7440-22-4	E440A	0.050	mg/kg	0.314	0.223	34.0%	40%	----
		sodium	7440-23-5	E440A	50	mg/kg	360	362	0.411%	40%	----
		strontium	7440-24-6	E440A	0.10	mg/kg	149	134	9.99%	40%	----
		thallium	7440-28-0	E440A	0.050	mg/kg	0.109	0.111	0.001	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.20	mg/kg	0.69	0.63	0.07	Diff <2x LOR	----
		titanium	7440-32-6	E440A	1.0	mg/kg	953	882	7.78%	40%	----
		uranium	7440-61-1	E440A	0.050	mg/kg	0.960	0.894	7.22%	30%	----
		vanadium	7440-62-2	E440A	0.20	mg/kg	140	130	7.67%	30%	----
		zinc	7440-66-6	E440A	1.0	mg/kg	86.9	80.8	7.35%	30%	----
		zirconium	7440-67-7	E440A	1.0	mg/kg	2.9	2.6	0.3	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 602878)						
moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 602973)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 619438)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Anions and Nutrients (QCLot: 623543)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Inorganic Parameters (QCLot: 619439)						
sulfur, total	7704-34-9	E399	0.05	%	<0.050	----
Inorganic Parameters (QCLot: 623544)						
sulfur, total	7704-34-9	E399	0.05	%	<0.050	----
Metals (QCLot: 604815)						
mercury	7439-97-6	E510A	0.005	mg/kg	<0.0050	----
Metals (QCLot: 604816)						
aluminum	7429-90-5	E440A	50	mg/kg	<50	----
antimony	7440-36-0	E440A	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440A	0.05	mg/kg	<0.050	----
barium	7440-39-3	E440A	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440A	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440A	0.1	mg/kg	<0.10	----
boron	7440-42-8	E440A	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440A	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440A	50	mg/kg	<50	----
chromium	7440-47-3	E440A	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440A	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440A	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440A	50	mg/kg	<50	----
lead	7439-92-1	E440A	0.1	mg/kg	<0.10	----
lithium	7439-93-2	E440A	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440A	10	mg/kg	<10	----
manganese	7439-96-5	E440A	0.2	mg/kg	<0.20	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440A	0.5	mg/kg	<0.50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 604816) - continued						
phosphorus	7723-14-0	E440A	50	mg/kg	<50	----
potassium	7440-09-7	E440A	100	mg/kg	<100	----
selenium	7782-49-2	E440A	0.1	mg/kg	<0.10	----
silver	7440-22-4	E440A	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440A	50	mg/kg	<50	----
strontium	7440-24-6	E440A	0.1	mg/kg	<0.10	----
thallium	7440-28-0	E440A	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440A	0.2	mg/kg	<0.20	----
titanium	7440-32-6	E440A	1	mg/kg	<1.0	----
uranium	7440-61-1	E440A	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440A	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440A	1	mg/kg	<1.0	----
zirconium	7440-67-7	E440A	1	mg/kg	<1.0	----
Metals (QCLot: 604968)						
mercury	7439-97-6	E510A	0.005	mg/kg	<0.0050	----
Metals (QCLot: 604969)						
aluminum	7429-90-5	E440A	50	mg/kg	<50	----
antimony	7440-36-0	E440A	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440A	0.05	mg/kg	<0.050	----
barium	7440-39-3	E440A	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440A	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440A	0.1	mg/kg	<0.10	----
boron	7440-42-8	E440A	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440A	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440A	50	mg/kg	<50	----
chromium	7440-47-3	E440A	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440A	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440A	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440A	50	mg/kg	<50	----
lead	7439-92-1	E440A	0.1	mg/kg	<0.10	----
lithium	7439-93-2	E440A	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440A	10	mg/kg	<10	----
manganese	7439-96-5	E440A	0.2	mg/kg	<0.20	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440A	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440A	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 604969) - continued						
potassium	7440-09-7	E440A	100	mg/kg	<100	----
selenium	7782-49-2	E440A	0.1	mg/kg	<0.10	----
silver	7440-22-4	E440A	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440A	50	mg/kg	<50	----
strontium	7440-24-6	E440A	0.1	mg/kg	<0.10	----
thallium	7440-28-0	E440A	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440A	0.2	mg/kg	<0.20	----
titanium	7440-32-6	E440A	1	mg/kg	<1.0	----
uranium	7440-61-1	E440A	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440A	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440A	1	mg/kg	<1.0	----
zirconium	7440-67-7	E440A	1	mg/kg	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 602878)									
moisture	----	E144	0.25	%	50 %	98.6	90.0	110	----
Physical Tests (QCLot: 602973)									
moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 604817)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 604970)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.2	95.0	105	----
Anions and Nutrients (QCLot: 619438)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	98.3	90.0	110	----
Anions and Nutrients (QCLot: 623543)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Inorganic Parameters (QCLot: 619439)									
sulfur, total	7704-34-9	E399	0.05	%	12.81 %	96.5	90.0	110	----
Inorganic Parameters (QCLot: 623544)									
sulfur, total	7704-34-9	E399	0.05	%	12.81 %	99.5	90.0	110	----
Metals (QCLot: 604815)									
mercury	7439-97-6	E510A	0.005	mg/kg	0.1 mg/kg	103	80.0	120	----
Metals (QCLot: 604816)									
aluminum	7429-90-5	E440A	50	mg/kg	200 mg/kg	108	80.0	120	----
antimony	7440-36-0	E440A	0.1	mg/kg	100 mg/kg	119	80.0	120	----
arsenic	7440-38-2	E440A	0.05	mg/kg	100 mg/kg	108	80.0	120	----
barium	7440-39-3	E440A	0.5	mg/kg	25 mg/kg	107	80.0	120	----
beryllium	7440-41-7	E440A	0.1	mg/kg	10 mg/kg	103	80.0	120	----
bismuth	7440-69-9	E440A	0.1	mg/kg	100 mg/kg	102	80.0	120	----
boron	7440-42-8	E440A	5	mg/kg	100 mg/kg	103	80.0	120	----
cadmium	7440-43-9	E440A	0.02	mg/kg	10 mg/kg	108	80.0	120	----
calcium	7440-70-2	E440A	50	mg/kg	5000 mg/kg	106	80.0	120	----
chromium	7440-47-3	E440A	0.5	mg/kg	25 mg/kg	105	80.0	120	----
cobalt	7440-48-4	E440A	0.1	mg/kg	25 mg/kg	103	80.0	120	----
copper	7440-50-8	E440A	0.5	mg/kg	25 mg/kg	103	80.0	120	----
iron	7439-89-6	E440A	50	mg/kg	100 mg/kg	109	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 604816) - continued									
lead	7439-92-1	E440A	0.1	mg/kg	50 mg/kg	110	80.0	120	----
lithium	7439-93-2	E440A	2	mg/kg	25 mg/kg	96.2	80.0	120	----
magnesium	7439-95-4	E440A	10	mg/kg	5000 mg/kg	111	80.0	120	----
manganese	7439-96-5	E440A	0.2	mg/kg	25 mg/kg	106	80.0	120	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	25 mg/kg	114	80.0	120	----
nickel	7440-02-0	E440A	0.5	mg/kg	50 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440A	50	mg/kg	1000 mg/kg	108	80.0	120	----
potassium	7440-09-7	E440A	100	mg/kg	5000 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440A	0.1	mg/kg	100 mg/kg	110	80.0	120	----
silver	7440-22-4	E440A	0.05	mg/kg	10 mg/kg	96.5	80.0	120	----
sodium	7440-23-5	E440A	50	mg/kg	5000 mg/kg	107	80.0	120	----
strontium	7440-24-6	E440A	0.1	mg/kg	25 mg/kg	110	80.0	120	----
thallium	7440-28-0	E440A	0.05	mg/kg	100 mg/kg	107	80.0	120	----
tin	7440-31-5	E440A	0.2	mg/kg	50 mg/kg	105	80.0	120	----
titanium	7440-32-6	E440A	1	mg/kg	25 mg/kg	100	80.0	120	----
uranium	7440-61-1	E440A	0.05	mg/kg	0.5 mg/kg	105	80.0	120	----
vanadium	7440-62-2	E440A	0.2	mg/kg	50 mg/kg	107	80.0	120	----
zinc	7440-66-6	E440A	1	mg/kg	50 mg/kg	104	80.0	120	----
zirconium	7440-67-7	E440A	1	mg/kg	10 mg/kg	106	80.0	120	----
Metals (QCLot: 604968)									
mercury	7439-97-6	E510A	0.005	mg/kg	0.1 mg/kg	100	80.0	120	----
Metals (QCLot: 604969)									
aluminum	7429-90-5	E440A	50	mg/kg	200 mg/kg	102	80.0	120	----
antimony	7440-36-0	E440A	0.1	mg/kg	100 mg/kg	114	80.0	120	----
arsenic	7440-38-2	E440A	0.05	mg/kg	100 mg/kg	102	80.0	120	----
barium	7440-39-3	E440A	0.5	mg/kg	25 mg/kg	99.7	80.0	120	----
beryllium	7440-41-7	E440A	0.1	mg/kg	10 mg/kg	101	80.0	120	----
bismuth	7440-69-9	E440A	0.1	mg/kg	100 mg/kg	101	80.0	120	----
boron	7440-42-8	E440A	5	mg/kg	100 mg/kg	104	80.0	120	----
cadmium	7440-43-9	E440A	0.02	mg/kg	10 mg/kg	99.3	80.0	120	----
calcium	7440-70-2	E440A	50	mg/kg	5000 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440A	0.5	mg/kg	25 mg/kg	96.7	80.0	120	----
cobalt	7440-48-4	E440A	0.1	mg/kg	25 mg/kg	100.0	80.0	120	----
copper	7440-50-8	E440A	0.5	mg/kg	25 mg/kg	99.1	80.0	120	----
iron	7439-89-6	E440A	50	mg/kg	100 mg/kg	99.5	80.0	120	----
lead	7439-92-1	E440A	0.1	mg/kg	50 mg/kg	105	80.0	120	----
lithium	7439-93-2	E440A	2	mg/kg	25 mg/kg	100	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 604969) - continued									
magnesium	7439-95-4	E440A	10	mg/kg	5000 mg/kg	103	80.0	120	----
manganese	7439-96-5	E440A	0.2	mg/kg	25 mg/kg	99.4	80.0	120	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	25 mg/kg	107	80.0	120	----
nickel	7440-02-0	E440A	0.5	mg/kg	50 mg/kg	95.3	80.0	120	----
phosphorus	7723-14-0	E440A	50	mg/kg	1000 mg/kg	117	80.0	120	----
potassium	7440-09-7	E440A	100	mg/kg	5000 mg/kg	102	80.0	120	----
selenium	7782-49-2	E440A	0.1	mg/kg	100 mg/kg	101	80.0	120	----
silver	7440-22-4	E440A	0.05	mg/kg	10 mg/kg	93.6	80.0	120	----
sodium	7440-23-5	E440A	50	mg/kg	5000 mg/kg	106	80.0	120	----
strontium	7440-24-6	E440A	0.1	mg/kg	25 mg/kg	103	80.0	120	----
thallium	7440-28-0	E440A	0.05	mg/kg	100 mg/kg	110	80.0	120	----
tin	7440-31-5	E440A	0.2	mg/kg	50 mg/kg	103	80.0	120	----
titanium	7440-32-6	E440A	1	mg/kg	25 mg/kg	100	80.0	120	----
uranium	7440-61-1	E440A	0.05	mg/kg	0.5 mg/kg	108	80.0	120	----
vanadium	7440-62-2	E440A	0.2	mg/kg	50 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440A	1	mg/kg	50 mg/kg	102	80.0	120	----
zirconium	7440-67-7	E440A	1	mg/kg	10 mg/kg	# 123	80.0	120	MES

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Anions and Nutrients (QCLot: 619438)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	116	80.0	120	----
Anions and Nutrients (QCLot: 623543)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	110	80.0	120	----
Inorganic Parameters (QCLot: 619439)									
	RM	sulfur, total	7704-34-9	E399	0.352 %	80.1	70.0	130	----
Inorganic Parameters (QCLot: 623544)									
	RM	sulfur, total	7704-34-9	E399	0.352 %	71.6	70.0	130	----
Metals (QCLot: 604815)									
	SCP SS-2	mercury	7439-97-6	E510A	0.059 mg/kg	104	70.0	130	----
Metals (QCLot: 604816)									
	SCP SS-2	aluminum	7429-90-5	E440A	9817 mg/kg	111	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440A	3.99 mg/kg	106	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440A	3.73 mg/kg	105	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440A	105 mg/kg	107	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440A	0.349 mg/kg	119	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440A	8.5 mg/kg	135	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440A	0.91 mg/kg	105	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440A	31082 mg/kg	115	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440A	101 mg/kg	116	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440A	6.9 mg/kg	108	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440A	123 mg/kg	105	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440A	23558 mg/kg	108	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440A	267 mg/kg	109	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440A	9.5 mg/kg	106	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440A	5509 mg/kg	113	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440A	269 mg/kg	111	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440A	1.03 mg/kg	113	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440A	26.7 mg/kg	107	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440A	752 mg/kg	96.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 604816) - continued									
	SCP SS-2	potassium	7440-09-7	E440A	1587 mg/kg	118	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440A	797 mg/kg	112	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440A	86.1 mg/kg	116	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440A	0.0786 mg/kg	104	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440A	10.6 mg/kg	100	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440A	839 mg/kg	119	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440A	0.52 mg/kg	111	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440A	32.7 mg/kg	112	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440A	297 mg/kg	125	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440A	5.73 mg/kg	103	70.0	130	----
Metals (QCLot: 604968)									
	SCP SS-2	mercury	7439-97-6	E510A	0.059 mg/kg	104	70.0	130	----
Metals (QCLot: 604969)									
	SCP SS-2	aluminum	7429-90-5	E440A	9817 mg/kg	106	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440A	3.99 mg/kg	114	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440A	3.73 mg/kg	101	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440A	105 mg/kg	99.8	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440A	0.349 mg/kg	104	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440A	8.5 mg/kg	127	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440A	0.91 mg/kg	105	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440A	31082 mg/kg	115	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440A	101 mg/kg	107	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440A	6.9 mg/kg	104	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440A	123 mg/kg	98.5	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440A	23558 mg/kg	99.4	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440A	267 mg/kg	110	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440A	9.5 mg/kg	104	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440A	5509 mg/kg	101	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440A	269 mg/kg	103	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440A	1.03 mg/kg	102	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440A	26.7 mg/kg	97.5	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440A	752 mg/kg	110	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440A	1587 mg/kg	107	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 604969) - continued									
	SCP SS-2	sodium	7440-23-5	E440A	797 mg/kg	107	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440A	86.1 mg/kg	101	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440A	0.0786 mg/kg	108	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440A	10.6 mg/kg	100	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440A	839 mg/kg	114	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440A	0.52 mg/kg	116	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440A	32.7 mg/kg	106	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440A	297 mg/kg	102	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440A	5.73 mg/kg	92.4	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 1 of 4

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Requ

Indicate Filtered (F), Preserved (P) or Filtered and Pre

Environmental Division Vancouver

Work Order Reference

VA22B8489

Telephone : +1 604 253 4188

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	
	HAC-U_SE-1_2022-08 A	6-Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-U_SE-1_2022-08 B	6-Aug-22		Sediment									1
	HAC-U_SE-2_2022-08 A	6-Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-U_SE-2_2022-08 B	6-Aug-22		Sediment									1
	HAC-U_SE-3_2022-08 A	6-Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-U_SE-3_2022-08 B	6-Aug-22		Sediment									1
	HAC-U_SE-4_2022-08 A	6-Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-U_SE-4_2022-08 B	6-Aug-22		Sediment									1
	HAC-U_SE-5_2022-08 A	6-Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-U_SE-5_2022-08 B	6-Aug-22		Sediment									1
	HAC-D_SE-1_2022-08 A	5 -Aug-22		Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-1_2022-08 B	5 -Aug-22		Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8.10.6°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 9-Aug-22	Time: 08:00	Received by:	Date:	Time:	Received by:	Date: Aug 10 '22	Time: 11am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 3 of 4

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca, kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-005	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
	EDC-U_SE-3_2022-08 A	7-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-U_SE-3_2022-08 B	7-Aug-22	—	Sediment									1
	EDC-U_SE-4_2022-08 A	7-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-U_SE-4_2022-08 B	7-Aug-22	—	Sediment									1
	EDC-U_SE-5_2022-08 A	7-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-U_SE-5_2022-08 B	7-Aug-22	—	Sediment									1
	EDC-D_SE-1_2022-08 A	3-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-1_2022-08 B	3-Aug-22	—	Sediment									1
	EDC-D_SE-2_2022-08 A	3-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-2_2022-08 B	3-Aug-22	—	Sediment									1
	EDC-D_SE-3_2022-08 A	3-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-3_2022-08 B	3-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8.1	10.6	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 9-Aug-22	Time: 08:00	Received by:	Date:	Time:	Received by: JW	Date: Aug. 10 2022	Time: 11am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 2 of 4

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-005	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
	HAC-D_SE-2_2022-08 A	5 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-2_2022-08 B	5 -Aug-22	—	Sediment									1
	HAC-D_SE-3_2022-08 A	5 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-3_2022-08 B	5 -Aug-22	—	Sediment									1
	HAC-D_SE-4_2022-08 A	5 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-4_2022-08 B	5 -Aug-22	—	Sediment									1
	HAC-D_SE-5_2022-08 A	5 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-5_2022-08 B	5 -Aug-22	—	Sediment									1
	EDC-U_SE-1_2022-08 A	7 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-U_SE-1_2022-08 B	7 -Aug-22	—	Sediment									1
	EDC-U_SE-2_2022-08 A	7 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-U_SE-2_2022-08 B	7 -Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	10	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katmarina Batchelar	Date: 9-Aug-22	Time: 08:10	Received by:	Date:	Time:	Received by:	Date: Aug. 10 2022	Time: 11am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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ALS Environmental

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COC Number: 15 -

Page 4 of 4

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Project Information

ALS Account # / Quote #: VA22-MPMC100-005
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

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Date and Time Required for all E&P TATs: dd-mmm-y, hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
	EDC-D_SE-4_2022-08 A	3 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-4_2022-08 B	3 -Aug-22	—	Sediment									1
	EDC-D_SE-5_2022-08 A	2 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-5_2022-08 B	3 -Aug-22	—	Sediment									1
	HAC-D_SE-5X_2022-08 A	5-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	HAC-D_SE-5X_2022-08 B	5-Aug-22	—	Sediment									1
	EDC-D_SE-4X_2022-08 A	3-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
	EDC-D_SE-4X_2022-08 B	3-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☑ ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8.1	10.5	6.4

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katherine Batchelar	9-Aug-22	08:00					Aug. 10 2022	11am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

SEDIMENT CHEMISTRY

ALS Laboratory Report VA22C0370

(Finalized November 23, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0370**	Page	: 1 of 14
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 08-Sep-2022
C-O-C number	: ----	Issue Date	: 23-Nov-2022 22:09
Sampler	: P. Rosette, Sarah Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 84		
No. of samples analysed	: 28		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Justin Kuzek	Team Leader - Organics	Organics, Saskatoon, Saskatchewan
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Owen Cheng		Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (23/11/2022): This report has been amended as a result of a request to correct the sample collection date. All analysis results are as per the previous report.

Sample Comments

Sample	Client Id	*Comment*
VA22C0370-079	BOL-S_SE-3_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
VA22C0370-080	BOL-S_SE-4_2022-08	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_SE-1_2022-08	QUL-LNF1_SE-2_2022-08	QUL-LNF1_SE-3_2022-08	QUL-LNF1_SE-4_2022-08	QUL-LNF1_SE-5_2022-08
					Client sampling date / time	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022
						VA22C0370-057	VA22C0370-058	VA22C0370-059	VA22C0370-060	VA22C0370-061
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		22.2	25.8	24.7	23.5	23.1
pH (1:2 soil:water)	----	E108	0.10	pH units		8.38	8.19	8.54	8.06	8.56
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		1.1	1.1	<1.0	1.4	<1.0
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		8.9	7.7	7.8	2.9	2.8
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		90.0	90.6	92.2	94.5	96.7
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	1.2	<1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.033	<0.020	<0.020	<0.020	0.025
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		0.483	1.03	0.452	1.25	0.917
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		810	720	790	690	730
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		10400	15800	11400	16500	15800
antimony	7440-36-0	E440A	0.10	mg/kg		0.48	0.45	0.43	0.47	0.56
arsenic	7440-38-2	E440A	0.050	mg/kg		14.3	13.3	14.4	14.7	20.4
barium	7440-39-3	E440A	0.50	mg/kg		83.2	104	85.6	138	146
beryllium	7440-41-7	E440A	0.10	mg/kg		0.41	0.53	0.43	0.55	0.56
bismuth	7440-69-9	E440A	0.10	mg/kg		0.12	0.11	0.12	0.14	0.16
boron	7440-42-8	E440A	5.0	mg/kg		6.4	7.8	6.5	7.0	8.8
cadmium	7440-43-9	E440A	0.020	mg/kg		0.183	0.349	0.248	0.477	0.456
calcium	7440-70-2	E440A	50	mg/kg		15800	16700	17900	14000	19500
chromium	7440-47-3	E440A	0.50	mg/kg		68.6	38.0	57.0	46.0	47.3
cobalt	7440-48-4	E440A	0.10	mg/kg		40.8	18.5	34.1	19.8	26.7
copper	7440-50-8	E440A	0.50	mg/kg		693	900	938	1080	2000
iron	7439-89-6	E440A	50	mg/kg		291000	74300	218000	67300	112000
lead	7439-92-1	E440A	0.10	mg/kg		6.46	7.48	6.97	9.56	10.3
lithium	7439-93-2	E440A	2.0	mg/kg		11.8	14.2	12.2	15.6	15.8
magnesium	7439-95-4	E440A	10	mg/kg		5690	8370	6610	9020	9330

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_SE-1_2022-08	QUL-LNF1_SE-2_2022-08	QUL-LNF1_SE-3_2022-08	QUL-LNF1_SE-4_2022-08	QUL-LNF1_SE-5_2022-08
					Client sampling date / time	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022
						VA22C0370-057	VA22C0370-058	VA22C0370-059	VA22C0370-060	VA22C0370-061
						Result	Result	Result	Result	Result
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		945	1030	927	1280	1550
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0842	0.126	0.109	0.143	0.184
molybdenum	7439-98-7	E440A	0.10	mg/kg		2.23	2.50	2.47	2.37	3.82
nickel	7440-02-0	E440A	0.50	mg/kg		25.6	23.3	23.5	29.6	25.8
phosphorus	7723-14-0	E440A	50	mg/kg		1500	1470	1770	1410	1560
potassium	7440-09-7	E440A	100	mg/kg		710	1180	740	1210	1110
selenium	7782-49-2	E440A	0.10	mg/kg		1.18	1.20	1.31	1.22	2.15
silver	7440-22-4	E440A	0.050	mg/kg		0.391	0.402	0.460	0.448	0.906
sodium	7440-23-5	E440A	50	mg/kg		365	540	389	517	530
strontium	7440-24-6	E440A	0.10	mg/kg		78.1	116	83.3	112	113
thallium	7440-28-0	E440A	0.050	mg/kg		<0.050	0.066	<0.050	0.080	0.064
tin	7440-31-5	E440A	0.20	mg/kg		1.83	1.20	1.42	1.17	1.58
titanium	7440-32-6	E440A	1.0	mg/kg		1870	1380	1510	1110	1480
uranium	7440-61-1	E440A	0.050	mg/kg		1.45	1.18	1.04	1.00	1.02
vanadium	7440-62-2	E440A	0.20	mg/kg		1140	266	831	227	409
zinc	7440-66-6	E440A	1.0	mg/kg		94.2	64.5	86.1	77.4	85.3
zirconium	7440-67-7	E440A	1.0	mg/kg		5.6	5.1	5.1	4.0	4.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_SE-1_2022-08	QUL-LREF1_SE-2_2022-08	QUL-LREF1_SE-3_2022-08	QUL-LREF1_SE-4_2022-08	QUL-LREF1_SE-5_2022-08
					Client sampling date / time	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022
						VA22C0370-062	VA22C0370-063	VA22C0370-064	VA22C0370-065	VA22C0370-066
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		30.6	26.6	30.6	34.9	29.6
pH (1:2 soil:water)	----	E108	0.10	pH units		6.19	5.97	6.07	6.38	6.01
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		4.1	2.6	3.9	3.6	4.4
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		33.6	29.0	32.3	22.5	44.9
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		60.3	64.4	60.4	73.3	48.6
gravel (>2mm)	----	EC184E	1.0	%		2.0	4.0	3.4	<1.0	2.1
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.078	0.058	0.093	0.074	0.087
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		1.55	0.984	1.48	1.87	1.12
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		530	<500	<500	<500	510
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		15600	14200	16300	17800	15100
antimony	7440-36-0	E440A	0.10	mg/kg		0.29	0.25	0.34	0.30	0.26
arsenic	7440-38-2	E440A	0.050	mg/kg		4.68	4.14	5.08	5.71	3.97
barium	7440-39-3	E440A	0.50	mg/kg		128	108	130	138	124
beryllium	7440-41-7	E440A	0.10	mg/kg		0.43	0.38	0.41	0.45	0.39
bismuth	7440-69-9	E440A	0.10	mg/kg		0.11	<0.10	0.10	0.13	<0.10
boron	7440-42-8	E440A	5.0	mg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
cadmium	7440-43-9	E440A	0.020	mg/kg		0.358	0.268	0.328	0.388	0.289
calcium	7440-70-2	E440A	50	mg/kg		7790	7970	8230	8680	7680
chromium	7440-47-3	E440A	0.50	mg/kg		53.9	58.0	55.6	59.0	52.6
cobalt	7440-48-4	E440A	0.10	mg/kg		11.8	10.1	12.2	12.9	10.5
copper	7440-50-8	E440A	0.50	mg/kg		34.1	26.9	33.0	36.6	29.7
iron	7439-89-6	E440A	50	mg/kg		25300	25000	27200	28500	24200
lead	7439-92-1	E440A	0.10	mg/kg		5.96	4.88	5.69	6.47	5.14
lithium	7439-93-2	E440A	2.0	mg/kg		12.6	10.0	12.1	13.7	10.9
magnesium	7439-95-4	E440A	10	mg/kg		7570	6770	7670	8320	7350

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1_SE-1_2022-08	QUL-LREF1_SE-2_2022-08	QUL-LREF1_SE-3_2022-08	QUL-LREF1_SE-4_2022-08	QUL-LREF1_SE-5_2022-08
					Client sampling date / time	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022	23-Aug-2022
						VA22C0370-062	VA22C0370-063	VA22C0370-064	VA22C0370-065	VA22C0370-066
						Result	Result	Result	Result	Result
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		353	306	430	407	320
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0370	0.0292	0.0357	0.0439	0.0310
molybdenum	7439-98-7	E440A	0.10	mg/kg		0.86	0.61	0.85	0.94	0.62
nickel	7440-02-0	E440A	0.50	mg/kg		32.7	28.2	32.3	34.8	29.6
phosphorus	7723-14-0	E440A	50	mg/kg		1090	1160	1210	1110	1120
potassium	7440-09-7	E440A	100	mg/kg		1360	1150	1510	1630	1300
selenium	7782-49-2	E440A	0.10	mg/kg		0.71	0.52	0.70	0.88	0.58
silver	7440-22-4	E440A	0.050	mg/kg		0.159	0.127	0.140	0.167	0.128
sodium	7440-23-5	E440A	50	mg/kg		463	496	546	560	515
strontium	7440-24-6	E440A	0.10	mg/kg		74.3	70.2	77.2	83.7	72.0
thallium	7440-28-0	E440A	0.050	mg/kg		0.130	0.105	0.129	0.147	0.112
tin	7440-31-5	E440A	0.20	mg/kg		0.49	0.51	0.49	0.57	0.45
titanium	7440-32-6	E440A	1.0	mg/kg		991	1090	1140	1080	1080
uranium	7440-61-1	E440A	0.050	mg/kg		1.20	1.19	1.30	1.39	1.06
vanadium	7440-62-2	E440A	0.20	mg/kg		61.6	65.5	65.1	67.8	61.8
zinc	7440-66-6	E440A	1.0	mg/kg		66.4	56.2	65.0	70.3	61.2
zirconium	7440-67-7	E440A	1.0	mg/kg		3.2	3.6	3.4	3.0	3.5

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-PNF_SE-1_2022-08	QUL-PNF_SE-2_2022-08	QUL-PNF_SE-3_2022-08	QUL-PNF_SE-4_2022-08	QUL-PNF_SE-5_2022-08
					Client sampling date / time	26-Aug-2022	26-Aug-2022	27-Aug-2022	27-Aug-2022	27-Aug-2022
						VA22C0370-067	VA22C0370-068	VA22C0370-069	VA22C0370-070	VA22C0370-071
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		60.1	63.0	49.4	61.0	61.2
pH (1:2 soil:water)	----	E108	0.10	pH units		8.01	8.02	8.22	8.07	8.16
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		41.8	46.4	33.4	49.6	47.6
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		45.4	50.5	43.6	42.9	47.7
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		12.8	3.1	23.0	7.5	4.7
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.080	0.103	0.056	0.084	0.070
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		0.622	0.695	0.456	0.736	0.559
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		1190	880	900	860	870
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		31900	29900	26800	31700	32500
antimony	7440-36-0	E440A	0.10	mg/kg		0.50	0.50	0.50	0.50	0.53
arsenic	7440-38-2	E440A	0.050	mg/kg		15.8	15.3	15.1	15.5	16.3
barium	7440-39-3	E440A	0.50	mg/kg		279	265	244	280	286
beryllium	7440-41-7	E440A	0.10	mg/kg		1.04	0.97	0.88	1.05	1.08
bismuth	7440-69-9	E440A	0.10	mg/kg		0.15	0.16	0.15	0.17	0.16
boron	7440-42-8	E440A	5.0	mg/kg		11.1	9.8	9.3	9.9	11.3
cadmium	7440-43-9	E440A	0.020	mg/kg		0.246	0.242	0.241	0.251	0.250
calcium	7440-70-2	E440A	50	mg/kg		24800	20300	21200	19700	24200
chromium	7440-47-3	E440A	0.50	mg/kg		27.1	30.5	28.7	32.0	28.9
cobalt	7440-48-4	E440A	0.10	mg/kg		27.8	24.9	23.4	25.5	27.6
copper	7440-50-8	E440A	0.50	mg/kg		925	794	745	797	915
iron	7439-89-6	E440A	50	mg/kg		46100	43100	50600	42000	43700
lead	7439-92-1	E440A	0.10	mg/kg		11.8	12.0	11.2	12.6	12.4
lithium	7439-93-2	E440A	2.0	mg/kg		32.6	29.0	26.6	30.3	32.1
magnesium	7439-95-4	E440A	10	mg/kg		20100	17600	15300	18100	19800

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-PNF_SE-1_2022-08	QUL-PNF_SE-2_2022-08	QUL-PNF_SE-3_2022-08	QUL-PNF_SE-4_2022-08	QUL-PNF_SE-5_2022-08
					Client sampling date / time	26-Aug-2022	26-Aug-2022	27-Aug-2022	27-Aug-2022	27-Aug-2022
						VA22C0370-067	VA22C0370-068	VA22C0370-069	VA22C0370-070	VA22C0370-071
						Result	Result	Result	Result	Result
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		1190	1360	1220	1320	1370
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0997	0.100	0.0922	0.0999	0.103
molybdenum	7439-98-7	E440A	0.10	mg/kg		3.61	3.35	3.19	3.24	3.66
nickel	7440-02-0	E440A	0.50	mg/kg		25.7	28.3	25.9	29.6	27.2
phosphorus	7723-14-0	E440A	50	mg/kg		1280	1200	1310	1180	1330
potassium	7440-09-7	E440A	100	mg/kg		2780	2620	2420	2910	2950
selenium	7782-49-2	E440A	0.10	mg/kg		1.23	1.08	1.02	1.10	1.22
silver	7440-22-4	E440A	0.050	mg/kg		0.363	0.351	0.334	0.343	0.372
sodium	7440-23-5	E440A	50	mg/kg		1150	1110	1030	1190	1230
strontium	7440-24-6	E440A	0.10	mg/kg		211	207	195	224	228
thallium	7440-28-0	E440A	0.050	mg/kg		0.077	0.085	0.076	0.096	0.084
tin	7440-31-5	E440A	0.20	mg/kg		1.86	1.68	1.62	1.66	1.87
titanium	7440-32-6	E440A	1.0	mg/kg		1920	1690	1660	1720	1940
uranium	7440-61-1	E440A	0.050	mg/kg		1.53	1.44	1.32	1.52	1.59
vanadium	7440-62-2	E440A	0.20	mg/kg		142	130	166	125	137
zinc	7440-66-6	E440A	1.0	mg/kg		106	99.6	90.4	103	107
zirconium	7440-67-7	E440A	1.0	mg/kg		5.6	4.8	5.3	4.7	5.5

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-S_SE-1_2022-08	POL-S_SE-2_2022-08	POL-S_SE-3_2022-08	POL-S_SE-4_2022-08	POL-S_SE-5_2022-08
					Client sampling date / time	25-Aug-2022	25-Aug-2022	25-Aug-2022	25-Aug-2022	25-Aug-2022
						VA22C0370-072	VA22C0370-073	VA22C0370-074	VA22C0370-075	VA22C0370-076
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		40.6	37.6	38.9	48.9	46.6
pH (1:2 soil:water)	----	E108	0.10	pH units		7.63	7.57	7.55	7.51	7.44
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		10.3	7.0	4.2	9.1	7.5
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		55.8	47.8	45.8	60.7	58.3
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		33.9	45.0	49.1	30.2	34.2
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.081	0.092	0.061	0.118	0.127
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		0.872	1.02	0.914	1.12	1.20
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		1740	2270	1550	2140	2280
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		22900	20900	19200	22100	21200
antimony	7440-36-0	E440A	0.10	mg/kg		0.50	0.45	0.45	0.45	0.42
arsenic	7440-38-2	E440A	0.050	mg/kg		15.3	13.9	13.7	13.9	13.4
barium	7440-39-3	E440A	0.50	mg/kg		192	180	169	189	179
beryllium	7440-41-7	E440A	0.10	mg/kg		0.86	0.80	0.71	0.78	0.77
bismuth	7440-69-9	E440A	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
boron	7440-42-8	E440A	5.0	mg/kg		11.5	10.5	10.6	10.6	10.5
cadmium	7440-43-9	E440A	0.020	mg/kg		0.146	0.119	0.128	0.124	0.143
calcium	7440-70-2	E440A	50	mg/kg		29900	28900	24200	29100	27300
chromium	7440-47-3	E440A	0.50	mg/kg		13.0	13.2	13.3	12.6	13.2
cobalt	7440-48-4	E440A	0.10	mg/kg		21.2	20.8	19.7	20.7	20.2
copper	7440-50-8	E440A	0.50	mg/kg		756	672	646	647	646
iron	7439-89-6	E440A	50	mg/kg		61500	65500	76700	58900	61500
lead	7439-92-1	E440A	0.10	mg/kg		5.78	4.77	4.27	4.50	4.69
lithium	7439-93-2	E440A	2.0	mg/kg		20.5	18.3	15.6	19.1	18.4
magnesium	7439-95-4	E440A	10	mg/kg		13600	12500	10900	13400	12500

Analytical Results

Sub-Matrix: Sediment (Matrix: Soil/Solid)					Client sample ID	POL-S_SE-1_2022-08	POL-S_SE-2_2022-08	POL-S_SE-3_2022-08	POL-S_SE-4_2022-08	POL-S_SE-5_2022-08
					Client sampling date / time	25-Aug-2022	25-Aug-2022	25-Aug-2022	25-Aug-2022	25-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22C0370-072	VA22C0370-073	VA22C0370-074	VA22C0370-075	VA22C0370-076
						Result	Result	Result	Result	Result
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		862	764	735	730	730
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0735	0.0676	0.0695	0.0669	0.0689
molybdenum	7439-98-7	E440A	0.10	mg/kg		5.05	4.96	4.35	5.18	4.80
nickel	7440-02-0	E440A	0.50	mg/kg		10.9	10.6	10.1	10.7	10.7
phosphorus	7723-14-0	E440A	50	mg/kg		1910	1860	1980	1820	1930
potassium	7440-09-7	E440A	100	mg/kg		1780	1690	1480	1780	1670
selenium	7782-49-2	E440A	0.10	mg/kg		1.43	1.43	1.23	1.50	1.59
silver	7440-22-4	E440A	0.050	mg/kg		0.337	0.292	0.312	0.274	0.288
sodium	7440-23-5	E440A	50	mg/kg		956	936	849	994	928
strontium	7440-24-6	E440A	0.10	mg/kg		204	217	195	230	221
thallium	7440-28-0	E440A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
tin	7440-31-5	E440A	0.20	mg/kg		2.35	2.16	2.06	2.19	1.95
titanium	7440-32-6	E440A	1.0	mg/kg		2120	1820	1790	1930	1780
uranium	7440-61-1	E440A	0.050	mg/kg		1.46	1.36	1.29	1.31	1.28
vanadium	7440-62-2	E440A	0.20	mg/kg		238	268	300	234	243
zinc	7440-66-6	E440A	1.0	mg/kg		70.9	63.1	58.1	61.6	61.0
zirconium	7440-67-7	E440A	1.0	mg/kg		8.3	5.1	5.5	5.4	5.4

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S_SE-1_2022-08	BOL-S_SE-2_2022-08	BOL-S_SE-3_2022-08	BOL-S_SE-4_2022-08	BOL-S_SE-5_2022-08
					Client sampling date / time	24-Aug-2022	24-Aug-2022	24-Aug-2022	24-Aug-2022	24-Aug-2022
						VA22C0370-077	VA22C0370-078	VA22C0370-079	VA22C0370-080	VA22C0370-081
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		51.5	68.8	83.7	69.3	65.1
pH (1:2 soil:water)	----	E108	0.10	pH units		6.34	7.67	6.37	7.67	7.69
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		1.9	5.9	7.2	5.3	5.3
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		18.2	63.0	50.8	39.1	38.3
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		79.3	30.5	40.8	52.1	50.6
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	1.2	3.5	5.8
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.195	0.341	0.961	0.371	0.369
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		8.11	5.98	14.6	7.55	7.77
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		910	2810	4730	1130	1470
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		9710	6470	10200	6380	6630
antimony	7440-36-0	E440A	0.10	mg/kg		0.41	0.35	0.52	0.14	0.34
arsenic	7440-38-2	E440A	0.050	mg/kg		3.92	2.80	5.72	3.94	4.36
barium	7440-39-3	E440A	0.50	mg/kg		124	143	123	132	123
beryllium	7440-41-7	E440A	0.10	mg/kg		0.36	0.19	0.41	0.26	0.24
bismuth	7440-69-9	E440A	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
boron	7440-42-8	E440A	5.0	mg/kg		9.1	7.5	10.2	5.3	7.5
cadmium	7440-43-9	E440A	0.020	mg/kg		0.136	0.172	0.228	0.175	0.172
calcium	7440-70-2	E440A	50	mg/kg		7850	183000	8840	168000	158000
chromium	7440-47-3	E440A	0.50	mg/kg		19.9	16.2	19.6	11.9	13.6
cobalt	7440-48-4	E440A	0.10	mg/kg		4.60	4.59	6.58	4.03	3.95
copper	7440-50-8	E440A	0.50	mg/kg		100	37.8	151	82.5	79.1
iron	7439-89-6	E440A	50	mg/kg		12000	11200	14700	10600	11800
lead	7439-92-1	E440A	0.10	mg/kg		2.83	2.20	3.17	2.30	2.25
lithium	7439-93-2	E440A	2.0	mg/kg		5.7	4.6	6.4	4.2	4.4
magnesium	7439-95-4	E440A	10	mg/kg		2810	5600	3070	4850	4570

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S_SE-1_2022-08	BOL-S_SE-2_2022-08	BOL-S_SE-3_2022-08	BOL-S_SE-4_2022-08	BOL-S_SE-5_2022-08
					Client sampling date / time	24-Aug-2022	24-Aug-2022	24-Aug-2022	24-Aug-2022	24-Aug-2022
						VA22C0370-077	VA22C0370-078	VA22C0370-079	VA22C0370-080	VA22C0370-081
						Result	Result	Result	Result	Result
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		384	635	904	775	747
mercury	7439-97-6	E510A	0.0050	mg/kg		0.0906	0.0321	0.119	0.0521	0.0549
molybdenum	7439-98-7	E440A	0.10	mg/kg		1.27	1.87	2.68	3.35	3.74
nickel	7440-02-0	E440A	0.50	mg/kg		11.5	9.77	15.5	10.3	10.1
phosphorus	7723-14-0	E440A	50	mg/kg		694	528	549	488	547
potassium	7440-09-7	E440A	100	mg/kg		750	590	790	460	510
selenium	7782-49-2	E440A	0.10	mg/kg		1.11	2.21	1.81	2.08	2.68
silver	7440-22-4	E440A	0.050	mg/kg		0.100	0.051	0.143	0.068	0.079
sodium	7440-23-5	E440A	50	mg/kg		248	230	227	175	186
strontium	7440-24-6	E440A	0.10	mg/kg		78.8	1030	88.6	768	694
thallium	7440-28-0	E440A	0.050	mg/kg		<0.050	<0.050	0.068	<0.050	<0.050
tin	7440-31-5	E440A	0.20	mg/kg		0.33	<0.20	0.22	<0.20	0.23
titanium	7440-32-6	E440A	1.0	mg/kg		578	455	419	187	284
uranium	7440-61-1	E440A	0.050	mg/kg		1.13	0.958	1.36	2.10	2.15
vanadium	7440-62-2	E440A	0.20	mg/kg		35.3	28.3	36.8	22.3	24.9
zinc	7440-66-6	E440A	1.0	mg/kg		29.8	28.5	39.4	25.7	25.8
zirconium	7440-67-7	E440A	1.0	mg/kg		3.7	2.8	4.1	1.4	1.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1_SE-2X_2022-08	POL-S_SE-1X_2022-08	QUL-PNF_SE-2X_2022-08	----	----
					Client sampling date / time	23-Aug-2022	25-Aug-2022	26-Aug-2022	----	----
						VA22C0370-082	VA22C0370-083	VA22C0370-084	--------	--------
						Result	Result	Result	----	----
Physical Tests										
moisture	----	E144	0.25	%		25.4	42.2	63.5	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units		8.21	7.63	8.03	----	----
Particle Size										
clay (<0.004mm)	----	EC184E	1.0	%		1.2	10.6	44.5	----	----
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		7.4	58.2	51.8	----	----
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		91.3	31.2	3.7	----	----
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	----	----
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.033	0.095	0.090	----	----
Organic / Inorganic Carbon										
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%		1.02	1.00	0.752	----	----
Inorganics										
sulfur, total	7704-34-9	E399	500	mg/kg		850	2090	1080	----	----
Metals										
aluminum	7429-90-5	E440A	50	mg/kg		15500	21800	31300	----	----
antimony	7440-36-0	E440A	0.10	mg/kg		0.35	0.50	0.54	----	----
arsenic	7440-38-2	E440A	0.050	mg/kg		10.4	14.3	15.2	----	----
barium	7440-39-3	E440A	0.50	mg/kg		109	189	272	----	----
beryllium	7440-41-7	E440A	0.10	mg/kg		0.53	0.82	1.03	----	----
bismuth	7440-69-9	E440A	0.10	mg/kg		0.10	<0.10	0.16	----	----
boron	7440-42-8	E440A	5.0	mg/kg		6.6	11.4	11.4	----	----
cadmium	7440-43-9	E440A	0.020	mg/kg		0.374	0.151	0.237	----	----
calcium	7440-70-2	E440A	50	mg/kg		16300	29600	21600	----	----
chromium	7440-47-3	E440A	0.50	mg/kg		34.3	12.4	30.6	----	----
cobalt	7440-48-4	E440A	0.10	mg/kg		17.6	20.6	24.8	----	----
copper	7440-50-8	E440A	0.50	mg/kg		864	739	793	----	----
iron	7439-89-6	E440A	50	mg/kg		66000	59900	42900	----	----
lead	7439-92-1	E440A	0.10	mg/kg		7.07	5.43	12.0	----	----
lithium	7439-93-2	E440A	2.0	mg/kg		14.0	20.0	29.6	----	----
magnesium	7439-95-4	E440A	10	mg/kg		8330	13400	17500	----	----

Analytical Results

Sub-Matrix: Sediment (Matrix: Soil/Solid)					Client sample ID	QUL-LNF1_SE-2X_2022-08	POL-S_SE-1X_2022-08	QUL-PNF_SE-2X_2022-08	----	----
					Client sampling date / time	23-Aug-2022	25-Aug-2022	26-Aug-2022	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22C0370-082	VA22C0370-083	VA22C0370-084	--------	--------
						Result	Result	Result	----	----
Metals										
manganese	7439-96-5	E440A	0.20	mg/kg		959	843	1350	----	----
mercury	7439-97-6	E510A	0.0050	mg/kg		0.131	0.0784	0.106	----	----
molybdenum	7439-98-7	E440A	0.10	mg/kg		2.87	5.22	3.44	----	----
nickel	7440-02-0	E440A	0.50	mg/kg		22.0	10.3	27.9	----	----
phosphorus	7723-14-0	E440A	50	mg/kg		1150	1870	1170	----	----
potassium	7440-09-7	E440A	100	mg/kg		1150	1760	2980	----	----
selenium	7782-49-2	E440A	0.10	mg/kg		0.99	1.48	1.20	----	----
silver	7440-22-4	E440A	0.050	mg/kg		0.406	0.320	0.358	----	----
sodium	7440-23-5	E440A	50	mg/kg		537	950	1160	----	----
strontium	7440-24-6	E440A	0.10	mg/kg		115	201	223	----	----
thallium	7440-28-0	E440A	0.050	mg/kg		0.063	<0.050	0.091	----	----
tin	7440-31-5	E440A	0.20	mg/kg		1.06	2.16	1.67	----	----
titanium	7440-32-6	E440A	1.0	mg/kg		692	1970	1870	----	----
uranium	7440-61-1	E440A	0.050	mg/kg		0.934	1.36	1.48	----	----
vanadium	7440-62-2	E440A	0.20	mg/kg		230	229	129	----	----
zinc	7440-66-6	E440A	1.0	mg/kg		63.2	66.5	98.4	----	----
zirconium	7440-67-7	E440A	1.0	mg/kg		2.2	7.9	5.3	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C0370**	Page	: 1 of 24
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Issue Date	: 23-Nov-2022 22:09
C-O-C number	: ----		
Sampler	: P. Rosette, Sarah Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 84		
No. of samples analysed	: 28		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-3_2022-08	E366	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	18 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-4_2022-08	E366	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	18 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-5_2022-08	E366	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	18 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-1_2022-08	E366	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	19 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2_2022-08	E366	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	19 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2X_2022-08	E366	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	19 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-1_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-1X_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-2_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-3_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-4_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-5_2022-08	E366	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	20 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-1_2022-08	E366	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	21 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-2_2022-08	E366	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	21 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-3_2022-08	E366	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	21 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-4_2022-08	E366	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	21 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-5_2022-08	E366	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	21 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-1_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2X_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-3_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-4_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-5_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-1_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-2_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-3_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-4_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-5_2022-08	E366	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-3_2022-08	E399	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	18 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-4_2022-08	E399	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	18 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-5_2022-08	E399	27-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	18 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-1_2022-08	E399	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	19 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2_2022-08	E399	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	19 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2X_2022-08	E399	26-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	19 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-1_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-1X_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-2_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-3_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-4_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
POL-S_SE-5_2022-08	E399	25-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	20 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-1_2022-08	E399	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	21 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-2_2022-08	E399	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	21 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-3_2022-08	E399	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	21 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-4_2022-08	E399	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	21 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
BOL-S_SE-5_2022-08	E399	24-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	21 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-1_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2X_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-3_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-4_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-5_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-1_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-2_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-3_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-4_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Inorganics : Total Sulfur by high temperature combustion										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-5_2022-08	E399	23-Aug-2022	13-Sep-2022	----	----		13-Sep-2022	365 days	22 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-3_2022-08	E510A	27-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-4_2022-08	E510A	27-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-5_2022-08	E510A	27-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	14 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-1_2022-08	E510A	26-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	15 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-2_2022-08	E510A	26-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-1_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-2_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-3_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-4_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-5_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2X_2022-08	E510A	26-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	28 days	16 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-1X_2022-08	E510A	25-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	28 days	17 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-1_2022-08	E510A	24-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-2_2022-08	E510A	24-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	28 days	18 days	✓

Matrix: **Soil/Solid**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
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Glass soil jar/Teflon lined cap										
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Glass soil jar/Teflon lined cap										
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Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-1_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
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QUL-LNF1_SE-3_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-4_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-5_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-1_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-2_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-3_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-4_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-5_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		10-Sep-2022	28 days	18 days	✓
Metals : Mercury in Sediment by CVAAS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-2X_2022-08	E510A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	28 days	19 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-3_2022-08	E440A	27-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	16 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-4_2022-08	E440A	27-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	16 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
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Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
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POL-S_SE-1_2022-08	E440A	25-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	18 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
POL-S_SE-1X_2022-08	E440A	25-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	18 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
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Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
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Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-5_2022-08	E440A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	20 days	✓
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Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-2_2022-08	E440A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	20 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-3_2022-08	E440A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	20 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-4_2022-08	E440A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	20 days	✓
Metals : Metals in Sediment by CRC ICPMS (<63 µm)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-5_2022-08	E440A	23-Aug-2022	09-Sep-2022	----	----		11-Sep-2022	180 days	20 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BOL-S_SE-1_2022-08	E144	24-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BOL-S_SE-2_2022-08	E144	24-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BOL-S_SE-3_2022-08	E144	24-Aug-2022	----	----	----		09-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BOL-S_SE-4_2022-08	E144	24-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BOL-S_SE-5_2022-08	E144	24-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-1_2022-08	E144	25-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-1X_2022-08	E144	25-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-2_2022-08	E144	25-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-3_2022-08	E144	25-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-4_2022-08	E144	25-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
POL-S_SE-5_2022-08	E144	25-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-1_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2X_2022-08	E144	23-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-3_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-4_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-5_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-1_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-2_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-3_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-4_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-5_2022-08	E144	23-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-1_2022-08	E144	26-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2_2022-08	E144	26-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-2X_2022-08	E144	26-Aug-2022	----	----	----		09-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-3_2022-08	E144	27-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-4_2022-08	E144	27-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-5_2022-08	E144	27-Aug-2022	----	----	----		08-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-3_2022-08	E108	27-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
QUL-PNF_SE-4_2022-08	E108	27-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	16 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-5_2022-08	E108	27-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-1_2022-08	E108	26-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	17 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-2_2022-08	E108	26-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	17 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-1_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	18 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-PNF_SE-2X_2022-08	E108	26-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	19 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-1X_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-2_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-3_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-4_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	20 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap POL-S_SE-5_2022-08	E108	25-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-1_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-2_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-3_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-4_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LNF1_SE-5_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-1_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-2_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap QUL-LREF1_SE-3_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-4_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
QUL-LREF1_SE-5_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		12-Sep-2022	30 days	20 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-1_2022-08	E108	24-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	21 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-2_2022-08	E108	24-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	21 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-3_2022-08	E108	24-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	21 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-4_2022-08	E108	24-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	21 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
BOL-S_SE-5_2022-08	E108	24-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	21 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
QUL-LNF1_SE-2X_2022-08	E108	23-Aug-2022	12-Sep-2022	----	----		13-Sep-2022	30 days	22 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	635467	2	28	7.1	5.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	636186	2	28	7.1	5.0	✓
Moisture Content by Gravimetry	E144	639723	2	36	5.5	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	640209	2	40	5.0	5.0	✓
Total Nitrogen by Combustion	E366	644811	2	34	5.8	5.0	✓
Total Sulfur by high temperature combustion	E399	644812	2	28	7.1	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	635467	4	28	14.2	10.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	636186	4	28	14.2	10.0	✓
Moisture Content by Gravimetry	E144	639723	2	36	5.5	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	640209	4	40	10.0	10.0	✓
Total Nitrogen by Combustion	E366	644811	4	34	11.7	10.0	✓
Total Sulfur by high temperature combustion	E399	644812	4	28	14.2	10.0	✓
Method Blanks (MB)							
Mercury in Sediment by CVAAS (<63 µm)	E510A	635467	2	28	7.1	5.0	✓
Metals in Sediment by CRC ICPMS (<63 µm)	E440A	636186	2	28	7.1	5.0	✓
Moisture Content by Gravimetry	E144	639723	2	36	5.5	5.0	✓
Total Nitrogen by Combustion	E366	644811	2	34	5.8	5.0	✓
Total Sulfur by high temperature combustion	E399	644812	2	28	7.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Saskatoon - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Saskatoon - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.
Total Sulfur by high temperature combustion	E399 Saskatoon - Environmental	Soil/Solid	ISO 15178:2000	Air-dried sample is ignited in a combustion analyzer where sulfur in the reduced SO_2 gas is determined using a thermal conductivity detector.
Metals in Sediment by CRC ICPMS (<63 µm)	E440A Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are sieved through a 63 um sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Elemental Sulfur may be poorly recovered by this method. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Sediment by CVAAS (<63 µm)	E510A Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are sieved through a 63 µm sieve, and digested with HNO_3 and HCl, followed by CVAAS analysis.
Particle Size Analysis (Pipette) - MMER Classification	EC184E Saskatoon - Environmental	Soil/Solid	Metal Mining Technical Guidance for Environmental Effects Monitoring (2012)	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Metal Mining Effluent Regulations (MMER) classification system for Environmental Effects Monitoring.
Total Organic Carbon (Calculated) in soil (<63 µm)	EC356A Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC) analyzed on material passing a 63 µm sieve.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Saskatoon - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury (63 µm Sieve)	EP440A Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are sieved through a 63 µm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22C0370**	Page	: 1 of 14
Amendment	: **1**		
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 08-Sep-2022
C-O-C number	: ----	Issue Date	: 23-Nov-2022 22:09
Sampler	: P. Rosette, Sarah Latimer 250-790-2215 Ext 2112		
Site	: ----		
Quote number	: VA22-MPMC100-005 - Minnow Environmental-Sediment Quality		
No. of samples received	: 84		
No. of samples analysed	: 28		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Sask Soils, Saskatoon, Saskatchewan
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Nancy Cruse	Laboratory Assistant	Saskatoon Inorganics, Saskatoon, Saskatchewan
Owen Cheng		Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 638498)											
VA22C0370-057	QUL-LNF1_SE-1_2022-08	moisture	----	E144	0.25	%	22.2	22.4	0.966%	20%	----
Physical Tests (QC Lot: 639723)											
RG2201202-076	Anonymous	moisture	----	E144	0.25	%	20.1	24.2	18.3%	20%	----
Physical Tests (QC Lot: 640203)											
VA22C0370-057	QUL-LNF1_SE-1_2022-08	pH (1:2 soil:water)	----	E108	0.10	pH units	8.38	8.43	0.595%	10%	----
Physical Tests (QC Lot: 640209)											
VA22C0370-073	POL-S_SE-2_2022-08	pH (1:2 soil:water)	----	E108	0.10	pH units	7.57	7.57	0.00%	10%	----
Anions and Nutrients (QC Lot: 639719)											
VA22C0370-062	QUL-LREF1_SE-1_2022-08	nitrogen, total	7727-37-9	E366	0.020	%	0.078	0.102	0.024	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 644811)											
VA22C0370-078	BOL-S_SE-2_2022-08	nitrogen, total	7727-37-9	E366	0.020	%	0.341	0.338	0.884%	20%	----
Inorganics (QC Lot: 639720)											
VA22C0370-062	QUL-LREF1_SE-1_2022-08	sulfur, total	7704-34-9	E399	0.050	%	530 mg/kg	0.054	0.001	Diff <2x LOR	----
Inorganics (QC Lot: 644812)											
VA22C0370-078	BOL-S_SE-2_2022-08	sulfur, total	7704-34-9	E399	0.050	%	2810 mg/kg	0.359	0.078	Diff <2x LOR	----
Metals (<63 µm) (QC Lot: 635467)											
VA22C0370-057	QUL-LNF1_SE-1_2022-08	mercury	7439-97-6	E510A	0.0050	mg/kg	0.0842	0.0860	2.19%	40%	----
Metals (<63 µm) (QC Lot: 635468)											
VA22C0370-057	QUL-LNF1_SE-1_2022-08	aluminum	7429-90-5	E440A	50	mg/kg	10400	10800	3.01%	40%	----
		antimony	7440-36-0	E440A	0.10	mg/kg	0.48	0.46	0.02	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.050	mg/kg	14.3	13.7	4.07%	30%	----
		barium	7440-39-3	E440A	0.50	mg/kg	83.2	84.6	1.66%	40%	----
		beryllium	7440-41-7	E440A	0.10	mg/kg	0.41	0.44	0.02	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.10	mg/kg	0.12	0.12	0.007	Diff <2x LOR	----
		boron	7440-42-8	E440A	5.0	mg/kg	6.4	6.0	0.4	Diff <2x LOR	----
		cadmium	7440-43-9	E440A	0.020	mg/kg	0.183	0.223	19.9%	30%	----
		calcium	7440-70-2	E440A	50	mg/kg	15800	16000	1.34%	30%	----
		chromium	7440-47-3	E440A	0.50	mg/kg	68.6	61.2	11.4%	30%	----
		cobalt	7440-48-4	E440A	0.10	mg/kg	40.8	38.0	7.10%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (<63 µm) (QC Lot: 635468) - continued											
VA22C0370-057	QUL-LNF1_SE-1_2022-08	copper	7440-50-8	E440A	0.50	mg/kg	693	725	4.58%	30%	----
		iron	7439-89-6	E440A	50	mg/kg	291000	264000	9.81%	30%	----
		lead	7439-92-1	E440A	0.10	mg/kg	6.46	6.73	4.19%	40%	----
		lithium	7439-93-2	E440A	2.0	mg/kg	11.8	12.3	0.5	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	10	mg/kg	5690	5980	4.89%	30%	----
		manganese	7439-96-5	E440A	0.20	mg/kg	945	918	2.84%	30%	----
		molybdenum	7439-98-7	E440A	0.10	mg/kg	2.23	2.16	3.53%	40%	----
		nickel	7440-02-0	E440A	0.50	mg/kg	25.6	24.7	3.49%	30%	----
		phosphorus	7723-14-0	E440A	50	mg/kg	1500	1520	0.810%	30%	----
		potassium	7440-09-7	E440A	100	mg/kg	710	750	4.74%	40%	----
		selenium	7782-49-2	E440A	0.10	mg/kg	1.18	1.20	1.12%	30%	----
		silver	7440-22-4	E440A	0.050	mg/kg	0.391	0.434	10.4%	40%	----
		sodium	7440-23-5	E440A	50	mg/kg	365	358	1.94%	40%	----
		strontium	7440-24-6	E440A	0.10	mg/kg	78.1	77.8	0.366%	40%	----
		thallium	7440-28-0	E440A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.20	mg/kg	1.83	1.59	13.9%	40%	----
		titanium	7440-32-6	E440A	1.0	mg/kg	1870	1710	9.14%	40%	----
		uranium	7440-61-1	E440A	0.050	mg/kg	1.45	1.08	29.3%	30%	----
		vanadium	7440-62-2	E440A	0.20	mg/kg	1140	1030	10.5%	30%	----
		zinc	7440-66-6	E440A	1.0	mg/kg	94.2	91.2	3.21%	30%	----
		zirconium	7440-67-7	E440A	1.0	mg/kg	5.6	5.2	0.4	Diff <2x LOR	----
Metals (<63 µm) (QC Lot: 636186)											
VA22C0370-077	BOL-S_SE-1_2022-08	aluminum	7429-90-5	E440A	50	mg/kg	9710	9690	0.258%	40%	----
		antimony	7440-36-0	E440A	0.10	mg/kg	0.41	0.40	0.006	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.050	mg/kg	3.92	3.92	0.0775%	30%	----
		barium	7440-39-3	E440A	0.50	mg/kg	124	126	2.08%	40%	----
		beryllium	7440-41-7	E440A	0.10	mg/kg	0.36	0.36	0.002	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	5.0	mg/kg	9.1	8.9	0.2	Diff <2x LOR	----
		cadmium	7440-43-9	E440A	0.020	mg/kg	0.136	0.133	2.21%	30%	----
		calcium	7440-70-2	E440A	50	mg/kg	7850	8120	3.32%	30%	----
		chromium	7440-47-3	E440A	0.50	mg/kg	19.9	19.9	0.00269%	30%	----
		cobalt	7440-48-4	E440A	0.10	mg/kg	4.60	4.63	0.829%	30%	----
		copper	7440-50-8	E440A	0.50	mg/kg	100	98.5	1.90%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (<63 µm) (QC Lot: 636186) - continued											
VA22C0370-077	BOL-S_SE-1_2022-08	iron	7439-89-6	E440A	50	mg/kg	12000	12000	0.721%	30%	----
		lead	7439-92-1	E440A	0.10	mg/kg	2.83	2.80	1.25%	40%	----
		lithium	7439-93-2	E440A	2.0	mg/kg	5.7	5.6	0.08	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	10	mg/kg	2810	2820	0.450%	30%	----
		manganese	7439-96-5	E440A	0.20	mg/kg	384	403	4.64%	30%	----
		molybdenum	7439-98-7	E440A	0.10	mg/kg	1.27	1.21	4.53%	40%	----
		nickel	7440-02-0	E440A	0.50	mg/kg	11.5	11.4	1.27%	30%	----
		phosphorus	7723-14-0	E440A	50	mg/kg	694	751	7.79%	30%	----
		potassium	7440-09-7	E440A	100	mg/kg	750	730	2.46%	40%	----
		selenium	7782-49-2	E440A	0.10	mg/kg	1.11	0.93	18.0%	30%	----
		silver	7440-22-4	E440A	0.050	mg/kg	0.100	0.094	0.006	Diff <2x LOR	----
		sodium	7440-23-5	E440A	50	mg/kg	248	248	0.2	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.10	mg/kg	78.8	83.3	5.58%	40%	----
		thallium	7440-28-0	E440A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.20	mg/kg	0.33	0.31	0.02	Diff <2x LOR	----
		titanium	7440-32-6	E440A	1.0	mg/kg	578	561	3.07%	40%	----
		uranium	7440-61-1	E440A	0.050	mg/kg	1.13	1.12	0.977%	30%	----
		vanadium	7440-62-2	E440A	0.20	mg/kg	35.3	35.6	0.718%	30%	----
		zinc	7440-66-6	E440A	1.0	mg/kg	29.8	29.2	1.84%	30%	----
		zirconium	7440-67-7	E440A	1.0	mg/kg	3.7	3.8	0.1	Diff <2x LOR	----
Metals (<63 µm) (QC Lot: 636187)											
VA22C0370-077	BOL-S_SE-1_2022-08	mercury	7439-97-6	E510A	0.0050	mg/kg	0.0906	0.0834	8.33%	40%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 638498)						
moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 639723)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 639719)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Anions and Nutrients (QCLot: 644811)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Inorganics (QCLot: 639720)						
sulfur, total	7704-34-9	E399	0.05	%	<0.050	----
Inorganics (QCLot: 644812)						
sulfur, total	7704-34-9	E399	0.05	%	<0.050	----
Metals (<63 µm) (QCLot: 635467)						
mercury	7439-97-6	E510A	0.005	mg/kg	<0.0050	----
Metals (<63 µm) (QCLot: 635468)						
aluminum	7429-90-5	E440A	50	mg/kg	<50	----
antimony	7440-36-0	E440A	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440A	0.05	mg/kg	<0.050	----
barium	7440-39-3	E440A	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440A	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440A	0.1	mg/kg	<0.10	----
boron	7440-42-8	E440A	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440A	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440A	50	mg/kg	<50	----
chromium	7440-47-3	E440A	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440A	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440A	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440A	50	mg/kg	<50	----
lead	7439-92-1	E440A	0.1	mg/kg	<0.10	----
lithium	7439-93-2	E440A	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440A	10	mg/kg	<10	----
manganese	7439-96-5	E440A	0.2	mg/kg	<0.20	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	<0.10	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (<63 µm) (QCLot: 635468) - continued						
nickel	7440-02-0	E440A	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440A	50	mg/kg	<50	----
potassium	7440-09-7	E440A	100	mg/kg	<100	----
selenium	7782-49-2	E440A	0.1	mg/kg	<0.10	----
silver	7440-22-4	E440A	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440A	50	mg/kg	<50	----
strontium	7440-24-6	E440A	0.1	mg/kg	<0.10	----
thallium	7440-28-0	E440A	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440A	0.2	mg/kg	<0.20	----
titanium	7440-32-6	E440A	1	mg/kg	<1.0	----
uranium	7440-61-1	E440A	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440A	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440A	1	mg/kg	<1.0	----
zirconium	7440-67-7	E440A	1	mg/kg	<1.0	----
Metals (<63 µm) (QCLot: 636186)						
aluminum	7429-90-5	E440A	50	mg/kg	<50	----
antimony	7440-36-0	E440A	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440A	0.05	mg/kg	<0.050	----
barium	7440-39-3	E440A	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440A	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440A	0.1	mg/kg	<0.10	----
boron	7440-42-8	E440A	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440A	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440A	50	mg/kg	<50	----
chromium	7440-47-3	E440A	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440A	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440A	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440A	50	mg/kg	<50	----
lead	7439-92-1	E440A	0.1	mg/kg	<0.10	----
lithium	7439-93-2	E440A	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440A	10	mg/kg	<10	----
manganese	7439-96-5	E440A	0.2	mg/kg	<0.20	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440A	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440A	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (<63 µm) (QCLot: 636186) - continued						
potassium	7440-09-7	E440A	100	mg/kg	<100	----
selenium	7782-49-2	E440A	0.1	mg/kg	<0.10	----
silver	7440-22-4	E440A	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440A	50	mg/kg	<50	----
strontium	7440-24-6	E440A	0.1	mg/kg	<0.10	----
thallium	7440-28-0	E440A	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440A	0.2	mg/kg	<0.20	----
titanium	7440-32-6	E440A	1	mg/kg	<1.0	----
uranium	7440-61-1	E440A	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440A	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440A	1	mg/kg	<1.0	----
zirconium	7440-67-7	E440A	1	mg/kg	<1.0	----
Metals (<63 µm) (QCLot: 636187)						
mercury	7439-97-6	E510A	0.005	mg/kg	<0.0050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 638498)									
moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 639723)									
moisture	----	E144	0.25	%	50 %	97.4	90.0	110	----
Physical Tests (QCLot: 640203)									
pH (1:2 soil:water)	----	E108	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 640209)									
pH (1:2 soil:water)	----	E108	----	pH units	6.86 pH units	101	97.0	103	----
Anions and Nutrients (QCLot: 639719)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Anions and Nutrients (QCLot: 644811)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	99.5	90.0	110	----
Inorganics (QCLot: 639720)									
sulfur, total	7704-34-9	E399	0.05	%	12.81 %	101	90.0	110	----
Inorganics (QCLot: 644812)									
sulfur, total	7704-34-9	E399	0.05	%	12.81 %	97.8	90.0	110	----
Metals (<63 µm) (QCLot: 635467)									
mercury	7439-97-6	E510A	0.005	mg/kg	0.1 mg/kg	104	80.0	120	----
Metals (<63 µm) (QCLot: 635468)									
aluminum	7429-90-5	E440A	50	mg/kg	200 mg/kg	109	80.0	120	----
antimony	7440-36-0	E440A	0.1	mg/kg	100 mg/kg	109	80.0	120	----
arsenic	7440-38-2	E440A	0.05	mg/kg	100 mg/kg	105	80.0	120	----
barium	7440-39-3	E440A	0.5	mg/kg	25 mg/kg	100	80.0	120	----
beryllium	7440-41-7	E440A	0.1	mg/kg	10 mg/kg	101	80.0	120	----
bismuth	7440-69-9	E440A	0.1	mg/kg	100 mg/kg	101	80.0	120	----
boron	7440-42-8	E440A	5	mg/kg	100 mg/kg	97.5	80.0	120	----
cadmium	7440-43-9	E440A	0.02	mg/kg	10 mg/kg	102	80.0	120	----
calcium	7440-70-2	E440A	50	mg/kg	5000 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440A	0.5	mg/kg	25 mg/kg	100	80.0	120	----
cobalt	7440-48-4	E440A	0.1	mg/kg	25 mg/kg	101	80.0	120	----
copper	7440-50-8	E440A	0.5	mg/kg	25 mg/kg	100	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (<63 µm) (QCLot: 635468) - continued									
iron	7439-89-6	E440A	50	mg/kg	100 mg/kg	109	80.0	120	----
lead	7439-92-1	E440A	0.1	mg/kg	50 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440A	2	mg/kg	25 mg/kg	99.1	80.0	120	----
magnesium	7439-95-4	E440A	10	mg/kg	5000 mg/kg	107	80.0	120	----
manganese	7439-96-5	E440A	0.2	mg/kg	25 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	25 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440A	0.5	mg/kg	50 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440A	50	mg/kg	1000 mg/kg	101	80.0	120	----
potassium	7440-09-7	E440A	100	mg/kg	5000 mg/kg	107	80.0	120	----
selenium	7782-49-2	E440A	0.1	mg/kg	100 mg/kg	97.9	80.0	120	----
silver	7440-22-4	E440A	0.05	mg/kg	10 mg/kg	93.6	80.0	120	----
sodium	7440-23-5	E440A	50	mg/kg	5000 mg/kg	107	80.0	120	----
strontium	7440-24-6	E440A	0.1	mg/kg	25 mg/kg	107	80.0	120	----
thallium	7440-28-0	E440A	0.05	mg/kg	100 mg/kg	103	80.0	120	----
tin	7440-31-5	E440A	0.2	mg/kg	50 mg/kg	103	80.0	120	----
titanium	7440-32-6	E440A	1	mg/kg	25 mg/kg	98.4	80.0	120	----
uranium	7440-61-1	E440A	0.05	mg/kg	0.5 mg/kg	105	80.0	120	----
vanadium	7440-62-2	E440A	0.2	mg/kg	50 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440A	1	mg/kg	50 mg/kg	99.4	80.0	120	----
zirconium	7440-67-7	E440A	1	mg/kg	10 mg/kg	100	80.0	120	----
Metals (<63 µm) (QCLot: 636186)									
aluminum	7429-90-5	E440A	50	mg/kg	200 mg/kg	103	80.0	120	----
antimony	7440-36-0	E440A	0.1	mg/kg	100 mg/kg	101	80.0	120	----
arsenic	7440-38-2	E440A	0.05	mg/kg	100 mg/kg	99.3	80.0	120	----
barium	7440-39-3	E440A	0.5	mg/kg	25 mg/kg	95.7	80.0	120	----
beryllium	7440-41-7	E440A	0.1	mg/kg	10 mg/kg	97.8	80.0	120	----
bismuth	7440-69-9	E440A	0.1	mg/kg	100 mg/kg	96.9	80.0	120	----
boron	7440-42-8	E440A	5	mg/kg	100 mg/kg	92.0	80.0	120	----
cadmium	7440-43-9	E440A	0.02	mg/kg	10 mg/kg	99.2	80.0	120	----
calcium	7440-70-2	E440A	50	mg/kg	5000 mg/kg	98.2	80.0	120	----
chromium	7440-47-3	E440A	0.5	mg/kg	25 mg/kg	96.2	80.0	120	----
cobalt	7440-48-4	E440A	0.1	mg/kg	25 mg/kg	97.3	80.0	120	----
copper	7440-50-8	E440A	0.5	mg/kg	25 mg/kg	96.0	80.0	120	----
iron	7439-89-6	E440A	50	mg/kg	100 mg/kg	99.3	80.0	120	----
lead	7439-92-1	E440A	0.1	mg/kg	50 mg/kg	100	80.0	120	----
lithium	7439-93-2	E440A	2	mg/kg	25 mg/kg	95.0	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (<63 µm) (QCLot: 636186) - continued									
magnesium	7439-95-4	E440A	10	mg/kg	5000 mg/kg	106	80.0	120	----
manganese	7439-96-5	E440A	0.2	mg/kg	25 mg/kg	97.1	80.0	120	----
molybdenum	7439-98-7	E440A	0.1	mg/kg	25 mg/kg	101	80.0	120	----
nickel	7440-02-0	E440A	0.5	mg/kg	50 mg/kg	97.3	80.0	120	----
phosphorus	7723-14-0	E440A	50	mg/kg	1000 mg/kg	100	80.0	120	----
potassium	7440-09-7	E440A	100	mg/kg	5000 mg/kg	100.0	80.0	120	----
selenium	7782-49-2	E440A	0.1	mg/kg	100 mg/kg	97.6	80.0	120	----
silver	7440-22-4	E440A	0.05	mg/kg	10 mg/kg	89.0	80.0	120	----
sodium	7440-23-5	E440A	50	mg/kg	5000 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440A	0.1	mg/kg	25 mg/kg	105	80.0	120	----
thallium	7440-28-0	E440A	0.05	mg/kg	100 mg/kg	98.7	80.0	120	----
tin	7440-31-5	E440A	0.2	mg/kg	50 mg/kg	97.8	80.0	120	----
titanium	7440-32-6	E440A	1	mg/kg	25 mg/kg	92.1	80.0	120	----
uranium	7440-61-1	E440A	0.05	mg/kg	0.5 mg/kg	99.8	80.0	120	----
vanadium	7440-62-2	E440A	0.2	mg/kg	50 mg/kg	99.5	80.0	120	----
zinc	7440-66-6	E440A	1	mg/kg	50 mg/kg	98.1	80.0	120	----
zirconium	7440-67-7	E440A	1	mg/kg	10 mg/kg	98.7	80.0	120	----
Metals (<63 µm) (QCLot: 636187)									
mercury	7439-97-6	E510A	0.005	mg/kg	0.1 mg/kg	105	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 640203)									
	RM	pH (1:2 soil:water)	----	E108	8.13 pH units	99.9	96.0	104	----
Physical Tests (QCLot: 640209)									
	RM	pH (1:2 soil:water)	----	E108	8.13 pH units	99.9	96.0	104	----
Anions and Nutrients (QCLot: 639719)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	97.3	80.0	120	----
Anions and Nutrients (QCLot: 644811)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	98.2	80.0	120	----
Inorganics (QCLot: 639720)									
	RM	sulfur, total	7704-34-9	E399	0.352 %	105	70.0	130	----
Inorganics (QCLot: 644812)									
	RM	sulfur, total	7704-34-9	E399	0.352 %	90.0	70.0	130	----
Metals (<63 µm) (QCLot: 635467)									
	SCP SS-2	mercury	7439-97-6	E510A	0.059 mg/kg	103	70.0	130	----
Metals (<63 µm) (QCLot: 635468)									
	SCP SS-2	aluminum	7429-90-5	E440A	9817 mg/kg	113	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440A	3.99 mg/kg	96.3	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440A	3.73 mg/kg	102	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440A	105 mg/kg	101	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440A	0.349 mg/kg	113	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440A	8.5 mg/kg	126	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440A	0.91 mg/kg	96.4	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440A	31082 mg/kg	102	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440A	101 mg/kg	115	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440A	6.9 mg/kg	103	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440A	123 mg/kg	99.5	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440A	23558 mg/kg	107	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440A	267 mg/kg	102	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440A	9.5 mg/kg	106	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (<63 µm) (QCLot: 635468) - continued									
	SCP SS-2	magnesium	7439-95-4	E440A	5509 mg/kg	110	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440A	269 mg/kg	110	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440A	1.03 mg/kg	106	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440A	26.7 mg/kg	103	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440A	752 mg/kg	95.0	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440A	1587 mg/kg	125	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440A	797 mg/kg	110	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440A	86.1 mg/kg	106	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440A	0.0786 mg/kg	103	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440A	10.6 mg/kg	101	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440A	839 mg/kg	120	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440A	0.52 mg/kg	119	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440A	32.7 mg/kg	110	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440A	297 mg/kg	98.7	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440A	5.73 mg/kg	102	70.0	130	----
Metals (<63 µm) (QCLot: 636186)									
	SCP SS-2	aluminum	7429-90-5	E440A	9817 mg/kg	108	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440A	3.99 mg/kg	94.3	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440A	3.73 mg/kg	96.3	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440A	105 mg/kg	95.9	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440A	0.349 mg/kg	102	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440A	8.5 mg/kg	117	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440A	0.91 mg/kg	101	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440A	31082 mg/kg	99.5	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440A	101 mg/kg	114	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440A	6.9 mg/kg	100	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440A	123 mg/kg	96.4	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440A	23558 mg/kg	99.7	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440A	267 mg/kg	105	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440A	9.5 mg/kg	103	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440A	5509 mg/kg	108	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Reference Material (RM) Report: Recovery (%) RM	Reference Material (RM) Report: Recovery Limits (%) Low	Reference Material (RM) Report: Recovery Limits (%) High	Reference Material (RM) Report: Qualifier
Metals (<63 µm) (QCLot: 636186) - continued									
	SCP SS-2	manganese	7439-96-5	E440A	269 mg/kg	105	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440A	1.03 mg/kg	108	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440A	26.7 mg/kg	99.0	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440A	752 mg/kg	91.7	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440A	1587 mg/kg	120	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440A	797 mg/kg	107	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440A	86.1 mg/kg	104	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440A	0.0786 mg/kg	97.0	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440A	10.6 mg/kg	85.6	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440A	839 mg/kg	103	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440A	0.52 mg/kg	105	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440A	32.7 mg/kg	104	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440A	297 mg/kg	96.8	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440A	5.73 mg/kg	85.4	70.0	130	----
Metals (<63 µm) (QCLot: 636187)									
	SCP SS-2	mercury	7439-97-6	E510A	0.059 mg/kg	104	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Numb

Environmental Division Vancouver
Work Order Reference
VA22C0370

Telephone : + 1 604 253 4188

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with you
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 B / Sa / St
Phone:	236-317-4939	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs:
Street:	PO Box 12	Email 1 or Fax kala.ivens@mountpolley.com	For tests that can not be performed according to the service level
City/Province:	Likely, BC	Email 2 gabriel.holmes@mountpolley.com	
Postal Code:	V0L 1N0	Email 3 pstecko@minnow.ca; kbatchelar@minnow.ca	Analysis Reque
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-005	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: P. Schnurr S. Latimer

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
1	QUL-LNF1_SE-1_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
2	QUL-LNF1_SE-1_2022-08 B	23-Aug-22	—	Sediment									1
3	QUL-LNF1_SE-2_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
4	QUL-LNF1_SE-2_2022-08 B	23-Aug-22	—	Sediment									1
5	QUL-LNF1_SE-3_2022-08 A →	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
6	QUL-LNF1_SE-3_2022-08 B →	23-Aug-22	—	Sediment									1
7	QUL-LNF1_SE-4_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
8	QUL-LNF1_SE-4_2022-08 B	23-Aug-22	—	Sediment									1
9	QUL-LNF1_SE-5_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
10	QUL-LNF1_SE-5_2022-08 B	23-Aug-22	—	Sediment									1
11	QUL-LREF1_SE-1_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
12	QUL-LREF1_SE-1_2022-08 B	23-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ NO	Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 29 Aug 22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1050am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-005	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: P. Schnurr S. Lahmer

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
13	QUL-LREF1_SE-2_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
14	QUL-LREF1_SE-2_2022-08 B	23-Aug-22	—	Sediment									1
15	QUL-LREF1_SE-3_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
16	QUL-LREF1_SE-3_2022-08 B	23-Aug-22	—	Sediment									1
17	QUL-LREF1_SE-4_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
18	QUL-LREF1_SE-4_2022-08 B	23-Aug-22	—	Sediment									1
19	QUL-LREF1_SE-5_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
20	QUL-LREF1_SE-5_2022-08 B	23-Aug-22	—	Sediment									1
21	QUL-PNF_SE-1_2022-08 A	26-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
22	QUL-PNF_SE-1_2022-08 B	26-Aug-22	—	Sediment									1
23	QUL-PNF_SE-2_2022-08 A	26-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
24	QUL-PNF_SE-2_2022-08 B	26-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lahmer	Date: 29-Aug-22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 10:50am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#:

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: P.Schnurr S.Lahmer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E386)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette-gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
37	POL-S_SE-4_2022-08 A	25 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
38	POL-S_SE-4_2022-08 B	25 -Aug-22	—	Sediment									1
39	POL-S_SE-5_2022-08 A	25 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
40	POL-S_SE-5_2022-08 B	25 -Aug-22	—	Sediment									1
41	BOL-S_SE-1_2022-08 A	24 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
42	BOL-S_SE-1_2022-08 B	24 -Aug-22	—	Sediment									1
43	BOL-S_SE-2_2022-08 A	24 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
44	BOL-S_SE-2_2022-08 B	24 -Aug-22	—	Sediment									1
45	BOL-S_SE-3_2022-08 A	24 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
46	BOL-S_SE-3_2022-08 B	24 -Aug-22	—	Sediment									1
47	BOL-S_SE-4_2022-08 A	24 -Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
48	BOL-S_SE-4_2022-08 B	24 -Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)

Released by: S.Lahmer Date: 29 Aug 22 Time: 0810

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Date: Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by: JC Date: AUG 30 2022 Time: 1055am

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COC Number: 15 -

Page 5 of 5

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Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

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Email 2:

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Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

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3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-005
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: P.Schnurr S.Latimer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E386)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
49	BOL-S_SE-5_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
50	BOL-S_SE-5_2022-08 B	24-Aug-22	—	Sediment									1
51	QUL-LNF1_SE-2X_2022-08 A ← (no spaces)	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
52	QUL-LNF1_SE-2X_2022-08 B ← (no spaces)	23-Aug-22	—	Sediment									1
53	POL-S_SE-1X_2022-08 A ← (no spaces)	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
54	POL-S_SE-1X_2022-08 B ← (no spaces)	25-Aug-22	—	Sediment									1
55	QUL-PNF_SE-2X_2022-08 A ← (no spaces)	26-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
56	QUL-PNF_SE-2X_2022-08 B ← (no spaces)	26-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
				12	12

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S.Latimer	Date: 29-Aug-22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1055a

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Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Numb

Environmental Division Vancouver

Work Order Reference VA22C0370

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with you

Regular [R] ☑ Standard TAT if received by

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 B | Sa | St

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level s

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: P. Schnurr S. Latimer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
1	QUL-LNF1_SE-1_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
2	QUL-LNF1_SE-1_2022-08 B	23-Aug-22	—	Sediment									1
3	QUL-LNF1_SE-2_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
4	QUL-LNF1_SE-2_2022-08 B	23-Aug-22	—	Sediment									1
5	QUL-LNF1_SE-3_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
6	QUL-LNF1_SE-3_2022-08 B	23-Aug-22	—	Sediment									1
7	QUL-LNF1_SE-4_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
8	QUL-LNF1_SE-4_2022-08 B	23-Aug-22	—	Sediment									1
9	QUL-LNF1_SE-5_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
10	QUL-LNF1_SE-5_2022-08 B	23-Aug-22	—	Sediment									1
11	QUL-LREF1_SE-1_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
12	QUL-LREF1_SE-1_2022-08 B	23-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 29 Aug 22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1050am

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ALS Environmental

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Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

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Contact:	Gabriel Holmes
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Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
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Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-005	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: P. Schnurr, S. Lahmer

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
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16	QUL-LREF1_SE-3_2022-08 B	23-Aug-22	—	Sediment									1
17	QUL-LREF1_SE-4_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
18	QUL-LREF1_SE-4_2022-08 B	23-Aug-22	—	Sediment									1
19	QUL-LREF1_SE-5_2022-08 A	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
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21	QUL-PNF_SE-1_2022-08 A	26-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
22	QUL-PNF_SE-1_2022-08 B	26-Aug-22	—	Sediment									1
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Drinking Water (DW) Samples[1] (client use)

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Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			12	12

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
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Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

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Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#:

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: P.Schnurr S.Lahmer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)						Number of Containers
25	QUL-PNF_SE-3_2022-08 A	27-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
26	QUL-PNF_SE-3_2022-08 B	27-Aug-22	—	Sediment														1
27	QUL-PNF_SE-4_2022-08 A	27-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
28	QUL-PNF_SE-4_2022-08 B	27-Aug-22	—	Sediment														1
29	QUL-PNF_SE-5_2022-08 A	27-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
30	QUL-PNF_SE-5_2022-08 B	27-Aug-22	—	Sediment														1
31	POL-S_SE-1_2022-08 A	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
32	POL-S_SE-1_2022-08 B	25-Aug-22	—	Sediment														1
33	POL-S_SE-2_2022-08 A	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
34	POL-S_SE-2_2022-08 B	25-Aug-22	—	Sediment														1
35	POL-S_SE-3_2022-08 A	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
36	POL-S_SE-3_2022-08 B	25-Aug-22	—	Sediment														1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
S.Lahmer	29-Aug-22	0810

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
JC	AUG 30 2022	10 50 am

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 4 of 5

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#:

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: P.Schnurr S.Lahmer

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S3514)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)						Number of Containers
37	POL-S_SE-4_2022-08 A	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
38	POL-S_SE-4_2022-08 B	25-Aug-22	—	Sediment														1
39	POL-S_SE-5_2022-08 A	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
40	POL-S_SE-5_2022-08 B	25-Aug-22	—	Sediment														1
41	BOL-S_SE-1_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
42	BOL-S_SE-1_2022-08 B	24-Aug-22	—	Sediment														1
43	BOL-S_SE-2_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
44	BOL-S_SE-2_2022-08 B	24-Aug-22	—	Sediment														1
45	BOL-S_SE-3_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
46	BOL-S_SE-3_2022-08 B	24-Aug-22	—	Sediment														1
47	BOL-S_SE-4_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R						1
48	BOL-S_SE-4_2022-08 B	24-Aug-22	—	Sediment														1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Samples consist of 2 jars (denoted -A and -B). Please combine and homogenize the 2 jars before running analyses. Analyses are intended for the homogenized samples so are only listed for once for each A&B pairing.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			12	12	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S.Lahmer	Date: 29 Aug 22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1055am

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Page 5 of 5

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Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Project Information

ALS Account # / Quote #: VA22-MPMC100-005

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: P.Schnurr S.Latimer

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals in Sediment by CRC ICPMS (<63µm) (E440A)	TC, TOC, TIC in Soil (<63 µm) (S351A)	pH by Meter (1:2 Soil:Water Extraction) (E108)	Total Nitrogen by combustion method (0.02 %) (E366)	Total Sulfur by high temperature combustion (E399)	Particle Size Analysis (Pipette+gravel) (S184EA)	Moisture Content by Gravimetry (E144)	Mercury in Sediment by CVAAS (<63µm) (E510A)	Number of Containers
49	BOL-S_SE-5_2022-08 A	24-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
50	BOL-S_SE-5_2022-08 B	24-Aug-22	—	Sediment									1
51	QUL-LNF1_SE-2_X_2022-08 A ← (no spaces)	23-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
52	QUL-LNF1_SE-2_X_2022-08 B ← (no spaces)	23-Aug-22	—	Sediment									1
53	POL-S_SE-1_X_2022-08 A ← (no spaces)	25-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
54	POL-S_SE-1_X_2022-08 B ← (no spaces)	25-Aug-22	—	Sediment									1
55	QUL-PNF_SE-2_X_2022-08 A ← (no spaces)	26-Aug-22	—	Sediment	R	R	R	R	R	R	R	R	1
56	QUL-PNF_SE-2_X_2022-08 B ← (no spaces)	26-Aug-22	—	Sediment									1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

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Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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SAMPLE CONDITION AS RECEIVED (lab use only)

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Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
				12	12

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S.Latimer	Date: 24-Aug-22	Time: 0810	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1055a

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SEDIMENT TOXICITY

Nautilus Environmental Laboratory Report WO221769

(Finalized November 10, 2022)

Toxicity testing using *Hyalella azteca*

Sample collected August 2022

Final Report

November 10, 2022

Submitted to: **Minnow Environmental Inc**
Victoria, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

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APPENDIX B – Analytical Chemistry

APPENDIX C – Chain-of-Custody Forms

SIGNATURE PAGE

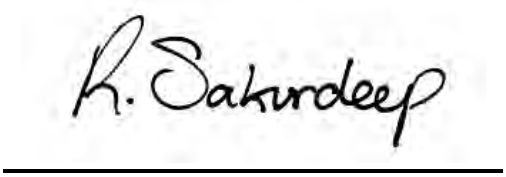

Report By:
Rachel Sakurdeep, B. Sc.
Laboratory Biologist



Reviewed By:
Mimi Tran, Dipl. T.
Biologist



Report By:
Carley Winter, B. Sc.
Laboratory Biologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample and Test Type Information

Sample ID	QUL-LNF1, QUL-LREF1, POL-S, BOL-S
Sample collection date	August 23-25, 2022
Sample receipt date	August 30, 2022
Sample receipt temperature	11.2°C
Test types	14-d *Hyalella azteca* survival and growth

Results

Endpoint	Sample ID				
(mean + SD)	Control Sediment	QUL-LNF1	QUL-LREF1	POL-S	BOL-S
H. azteca survival (%)	96.0 ± 5.5	54.0 ± 23.0*β	84.0 ± 5.5	94.0 ± 8.9	90.0 ± 7.1
H. azteca growth (mg)	0.19 ± 0.03	0.04 ± 0.01*β	0.23 ± 0.04	0.24 ± 0.03	0.21 ± 0.01

SD = Standard Deviation

(*) Indicates a statistically significant effect relative to control sediment

(β) Indicates a statistically significant effect relative to the reference sediment QUL-LREF1

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted freshwater sediment toxicity tests for Minnow Environmental Inc. Samples QUL-LNF1, QUL-LREF1, POL-S, BOL-S were collected between August 23-25, 2022, and delivered to the Nautilus Environmental Laboratory in Burnaby, BC on August 30, 2022. Each sample was transported in five 500-mL containers, and each was received at a temperature of 11.2°C. The samples were stored in the dark at 4 ± 2°C prior to testing. The 14-d *Hyalella azteca* survival and growth sediment toxicity test was conducted on these samples.

This report describes the results of these toxicity tests. Copies of raw laboratory data sheets and statistical analyses for each sample are provided in Appendix A, analytical chemistry is provided in Appendix B and the chain-of-custody forms are provided in Appendix C.

2.0 METHODS

Methods for the toxicity test are summarized in Table 1. Testing was conducted according to procedures described by Environment Canada (2017). Statistical analyses for all tests were performed using CETIS (Tidepool Scientific Software, 2021).

Ammonia concentrations were measured in-house three times per week on the reference sediment samples QUL-LREF1 and BOL-S to ensure that un-ionized ammonia was below 0.2 mg/L N. Subsamples of dissolved copper were collected at test termination as requested by the client, and sent to ALS Environmental (Burnaby, BC) for analysis. Samples of overlying water were collected at test initiation and termination, and then analyzed by ALS Environmental for total ammonia concentration. Analytical results are provided in Appendix B.

Table 1. Summary of test conditions: *Hyalella azteca* survival and growth test.

Test species	*Hyalella azteca*
Organism source	Aquatic BioSystems, Fort Collins, CO
Organism age	7- to 9-days old
Test type	Static
Test duration	14 days
Test vessel	375-mL glass container
Test volume	100 mL sediment; 175 mL overlying water
Test replicates	5 per sample
Number of organisms	10 per replicate
Control water	Reconstituted water; recipe from Borgmann (1996)
Test solution renewal	None
Test temperature	23 ± 1°C
Feeding	0.75 mL of YCT and 1.35 mg of Tetramin per replicate daily
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity of overlying water measured daily; total ammonia of overlying water measured at test initiation and termination; unionized ammonia measured three times weekly in overlying water of reference sample
Test protocol	Environment Canada (2017), EPS 1/RM/33
Statistical software	CETIS Version 2.1.1
Test endpoints	Survival and dry weight
Test acceptability criteria for controls	≥80% survival and ≥0.1 mg/amphipod dry weight
Reference toxicant	Sodium chloride (NaCl)

3.0 RESULTS

Results of the toxicity tests are summarized in Table 2. Adverse effects were observed on the survival and growth of *H. azteca* in sample QUL-LNF1 compared to the control sediment and the reference sediment, QUL-LREF1. No significant effects were observed on survival or growth in the remaining samples.

Measured total overlying ammonia concentrations in the *H. azteca* tests are summarized in Table 3. These concentrations were at levels that are not expected to cause adverse effects to the species. Unionized ammonia measurements on the reference samples were below 0.2 mg/L throughout the test.

Table 2. Results: *Hyalella azteca* survival and growth test.

Sample ID	Mean ± SD	
	Survival (%)	Average Dry Weight (mg/org)
Control Sediment	96.0 ± 5.5	0.19 ± 0.03
QUL-LNF1	54.0 ± 23.0*β	0.04 ± 0.01*β
QUL-LREF1	84.0 ± 5.5	0.23 ± 0.04
POL-S	94.0 ± 8.9	0.24 ± 0.03
BOL-S	90.0 ± 7.1	0.21 ± 0.01

SD = Standard Deviation

(*) Indicates a statistically significant effect relative to control sediment

(β) Indicates a statistically significant effect relative to the reference sediment QUL-LREF1

Table 3. Summary of total overlying ammonia concentrations (mg/L N) measured in the *Hyalella azteca* toxicity tests.

Sample ID	Day 0	Day 14
Control	0.0195	0.145
QUL-LNF1	0.0891	0.0232
QUL-LREF1	0.419	0.0699
POL-S	0.0899	0.0322
BOL-S	0.380	0.0545

Table 4. Summary of dissolved copper (mg/L Cu) measured in the *Hyalella azteca* toxicity tests at Day 14.

Replicate	Control	QUL-LNF1	QUL-LREF1	POL-S	BOL-S
A	0.00436	0.0936	0.00343	0.0361	0.00518
B	0.00396	0.00281	0.0775	0.0289	0.00434
C	0.00410	0.105	0.00297	0.0277	0.00494
D	0.00379	0.0728	0.00413	0.0233	0.00588
E	0.00424	0.0939	0.00240	0.0231	0.00439

4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirement of the Environment Canada protocol. *H. azteca* organisms were not received from the supplier on the date requested and therefore were not held for the required one-day holding period before test initiation. The delay did not appear to affect the test results as water quality was within the acceptable ranges and there were no mortalities upon arrival. During the test, pH measurements exceeded 8.0 in both reference sites, QUL_LREF1 and BOL-S; the client requested the test remain static, unless the unionized ammonia was greater than 0.2mg/L. There were no other deviations from the test methodology. Uncertainties associated with the test are best described by the standard deviations around the mean.

Results of the reference toxicant test conducted during the testing program are summarized in Table 5. Results for the test fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in the test was appropriate.

Table 5. Reference toxicant test result.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
H. azteca	Survival (LC50): 6.1 g/L NaCl	6.5 (5.1 – 8.3)	12	September 8, 2022

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration

5.0 REFERENCES

Borgmann, U. 1996. Systematic Analysis of Aqueous Ion Requirements of *Hyalella azteca*: A Standard Artificial Medium Including the Essential Bromide Ion, Arch. Environ. Contam. Toxicol. 30: 356- 363 pp.

Environment Canada. 2017. Biological test method: test for survival and growth in sediment and water using the freshwater amphipod, *Hyalella azteca*. EPS 1/RM/33, Second Edition, September 2017.

Tidepool Scientific Software. 2021. CETIS comprehensive environmental toxicity information system, version 2.1.1 Tidepool Scientific Software, McKinleyville, CA. 303 pp.

APPENDIX A – *Hyalella azteca* Toxicity Test Data

Hyalella azteca Sediment Test Summary Sheet

Client: Minnow Environmental Inc
Work Order No.: 221769

Start Date: Sept 8/22
Set up by: CZW / RZS

Sample Information:

Sample ID: various - see below
Sample Date: August 23-25, 2022
Date Received: August 30, 2022
Sample Volume: 5x500mL per sample

Test Organism Information:

Species: *Hyalella azteca*
Supplier: Aquatic Biosystems
Date received: Sept 8, 2022
Age or size (Day 0): 7-9 days
% Mortality in 24 h prior to testing 0%

NaCl Reference Toxicant Results:

Reference Toxicant ID: HA232
Stock Solution ID: n/a
Date Initiated: sept 8/22

96-h LC50 (95% CL): 6.1 (4.9-7.5) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.5 (5.1-8.3) g/L NaCl CV (%): 12 % ~~13%~~ CZW

Test Results:

Sample ID	Survival ± SD (%)	Average Dry Wt. ± SD (mg)
control sediment	96.0 ± 5.5	0.19 ± 0.03
QUL-LNF1	54.0 ± 23.0 (*)(B)	0.04 ± 0.01 (*)(B)
QUL-LREF1	84.0 ± 5.5	0.23 ± 0.04
POL-S	94.0 ± 8.9	0.24 ± 0.03
BOL-S	90.0 ± 7.1	0.21 ± 0.01
	±	±
	±	±
	±	±

(*) indicates a significant effect compared to control sediment
(B) indicates a significant effect compared to reference sediment, QUL-LREF1

Reviewed by: [signature] Date reviewed: ~~Sept 30~~, 22

Chronic *H. azteca* Sediment Toxicity Test Data Sheet

Freshwater Sediment Water Quality

Client: Minnow Environmental Inc.
Work Order No.: 221769

Start Date: Sept 8/22 ~~@ 1150h~~ CZW
Termination Date: Sept 22/22
CER #: 10
Test Organism: *Hyalella azteca*

Temperature (°C)

Sample ID	Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control Sediment	22.0	22.0	22.0	22.0	22.0	22.0	22.0	23.0	22.5	22.5	23.0	22.0	23.0	23.0	23.0
QUL-LNF1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	22.5	↓	22.5	22.5	22.5
QUL-LREF1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
POL-S	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	23.0	↓	↓	↓	↓
BOL-S	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
Technician Initials	CZW	CZW	GM	KML	CZW	CZW	RZS	CZW	CZW	MML	KML	RZS	CZW	CZW	CZW

Thermometer: CER #6

Conductivity (µS)

Sample ID	Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
control sediment	394	421	423	438	446	451	489	489	494	499	504	516	513	522	531
QUL-LNF1	413	437	448	462	468	480	556	560	568	575	585	598	586	597	6016
QUL-LREF1	440	470	495	523	530	543	562	581	6004	620	631	637	612	624	6033
POL-S	441	476	492	516	518	528	536	544	560	579	595	623	622	644	662
BOL-S	407	439	449	467	472	480	488	494	504	515	525	535	528	539	549
Technician Initials	CZW	CZW	GM	KML	CZW	CZW	RZS	CZW	CZW	MML	KML	RZS	CZW	CZW	CZW

Conductivity meter/probe: 3 / 3

Comments:

Reviewed by:

Date Reviewed: Sept 30, 2022

Chronic *H. azteca* Sediment Toxicity Test Data Sheet
Freshwater Sediment Water Quality

Client: Minnow Environmental
Work Order No.: 221769

Start Date: Sept 8/22 @1150h ow
Termination Date: Sept 22/22
CER #: 6
Test Organism: *Hyalella azteca*

Dissolved oxygen (mg/L)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
control sediment	8.2	8.1	8.3	8.2	8.2	8.1	8.3	8.1	7.9	7.9	8.2	8.1	8.0	8.1	8.0
QUL-LNF1	8.3	8.2	8.4	8.3	8.3	8.2	8.4	8.2	7.9	7.8	8.3	8.3	8.1	8.1	8.0
QUL-LREF1	8.3	8.2	8.3	8.2	8.3	8.2	8.3	8.1	8.0	7.9	8.3	8.3	8.2	8.2	8.1
POL-S	8.3	8.2	8.3	8.3	8.3	8.2	8.4	8.2	8.0	7.9	8.3	8.3	8.2	8.2	8.1
BOL-S	8.3	8.3	8.3	8.3	8.3	8.2	8.4	8.2	8.1	7.9	8.3	8.3	8.2	8.2	8.1
Technician Initials	CZW	CZW	CZW	KUL	CZW	CZW	RZS	CZW	CZW	UW	KUL	RZS	CZW	CZW	CZW

DO meter/probe: 3 / 3

pH

Sample ID	Day														
	0	1	2	② 3	① 4	5 ⑧	6	7	8	9	10	11	12	13	14
control sediment	7.8	7.8	7.8	7.6	7.6	7.8	7.9	7.9	7.8	8.0	7.8	7.9	7.8	7.8	7.8
QUL-LNF1	7.9	8.0	7.8	7.9	7.9	8.2	8.2	8.2	8.2	8.3	8.2	8.3	8.2	8.2	8.2
QUL-LREF1	7.7	7.8	7.9	7.9	8.0	8.4	8.3	8.4	8.4	8.4	8.4	8.4	8.3	8.4	8.4
POL-S	8.0	7.9	8.0	8.0	7.9	8.4	8.3	8.3	8.3	8.4	8.3	8.4	8.4	8.4	8.4
BOL-S	8.0	8.0	7.9	7.9	7.9	8.4	8.3	8.3	8.3	8.3	8.2	8.3	8.3	8.3	8.3
Technician Initials	CZW	CZW	CZW	KUL	RZS	CZW	RZS	CZW	CZW	UW	KUL	RZS	CZW	CZW	CZW

pH meter/probe: 3 / 3

Light meter: Lit-1

Light intensity (Lux): 500-910

Comments: ① pH meter/probe: 6/6 used ⑧ pH on day 5 confirmed w/ pH meter/probe 1/1

Reviewed by: [signature]

Date Reviewed: Sept. 30, 2022

H. azteca Sediment Toxicity Test Data Sheet

Freshwater Sediment 14-d Survival and Weight

Client: Minnow Environmental
Work Order No: 221769
Sample ID: various - see below

Start Date: Sept 8/22
Termination Date: sept 22/22
Test Organism: *Hyalella azteca*
Balance: 6

Sample ID	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control Sediment	1	A	9	1	0	CZW	991.47	992.92	9	CZW/CZW
	2	B	9	0	1		1000.92	1002.36	9	
	3	C	10		0		995.06	997.14	10	
	4	D					995.16	996.98		
	5	E	↓	↓	↓	↓	998.84	1000.98	↓	
QUL-LWF1	6	A	8	0	2	KV	1014 55	1014.92	8	
	7	B	5		5		1013.84	1014.10	5	
	8	C	5		5		1008.79	1008.98	5	
	9	D	7		3		1011 28	1011 60	7	
	10	E	2	↓	8	↓	1013.64	1013.70	2	
QUL-LREF	11	A	8 ⊛	0	2	CZW	1004.67	1006.95	8	
	12	B	8		2	KYL	1035.80	1037.48	8	
	13	C	9		1	↓	1035.90	1038.16	9	
	14	D	9		1	CZW	1036.62	1038.68	9	
	15	E	8	↓	2	KYL	1028.06	1029.51	8	
	16	A	8	0	2	KYL	1027.81	1029.57	8	
POL-S	17	B	10		0		1027.02	1029.10	10	
	18	C	9		1		1036.97	1038.92	9	
	19	D	10		0		999.00	1001.63	10	
	20	E	10	↓	0	↓	1004.75	1007.48	10	↓

Date/time pan placed in oven: sept 8/22 @ 1430h
Date/time pan removed from oven: sept 9/22 @ 1430h

Date/time pan + organisms placed in oven: sept 22/22 @ 1230h
Date/time pan + organisms removed from oven: sept 23/22 @ 1230h

Comments: ⊛ live leech-like organism found in test jar
10% reweigh: pan 10: 1013.67mg; pan 20: 1007.45mg; pan 24: 1018.73mg

Reviewed by: [signature]

Date Reviewed: Sept. 30, 2022

H. azteca Sediment Toxicity Test Data Sheet

Freshwater Sediment 14-d Survival and Weight

Client: Minnow Environmental
Work Order No: 221769
Sample ID: various - see below

Start Date: Sept 8/22
Termination Date: Sept 22/22
Test Organism: *Hyalella azteca*
Balance: 6

Sample ID	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
~~Control Sediment~~	21	A	9	0	1	CZW	1005.04	1006.99	9	CZW/CZW
BOL-S	22	B	10	↓	0	↓	1010.75	1012.80	10	↓
	23	C	9①	↓	1	↓	1021.48	1023.40	9	↓
	24	D	9	↓	1	↓	1017.16	1018.82	9	↓
	25	E	8	↓	2	↓	993.35	995.05	8	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 8/22 @ 1430h
Date/time pan removed from oven: Sept 9/22 @ 1430h

Date/time pan + organisms placed in oven: Sept 22/22 @ 1230h
Date/time pan + organisms removed from oven: Sept 23/22 @ 1230h

Comments: ① one organism smaller than others

Reviewed by: [signature]

Date Reviewed: Sept 30, 2022

CETIS Summary Report

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (~~10d~~) 14 CW	**Analyst:**	Carley Winter		
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water		
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**			
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO	**Age:**	7-9d

Sample ID:	10-7042-0697	**Code:**	Control Sed	**Project:**	
Sample Date:	08 Sep-22	**Material:**	Sediment Sample	**Source:**	Minnow Environmental
Receipt Date:	08 Sep-22	**CAS (PC):**		**Station:**	Control Sediment
Sample Age:	---	**Client:**	Minnow Environmental		

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control Sed	10-7042-0697	08 Sep-22	08 Sep-22	---	Minnow Environmental	
QUL-LNF1	00-4438-3904	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
QUL-LREF1	13-7106-0450	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
POL-S	05-8645-7879	25 Aug-22	30 Aug-22 10:40	14d 0h (11.2 °C)		
BOL-S	15-1832-2783	24 Aug-22	30 Aug-22 10:40	15d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control Sed	Sediment Sample	Minnow Environmental	Control Sediment	
QUL-LNF1	Sediment Sample	Minnow Environmental	QUL-LNF1	
QUL-LREF1	Sediment Sample	Minnow Environmental	QUL-LREF1	
POL-S	Sediment Sample	Minnow Environmental	POL-S	
BOL-S	Sediment Sample	Minnow Environmental	BOL-S	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
05-5596-9208	10d Survival Rate	Fisher Exact/Bonferroni-Holm Test	<1.0E-05	QUL-LNF1 failed 10d survival rate	1
05-5596-9208	10d Survival Rate	Fisher Exact/Bonferroni-Holm Test	0.1375	QUL-LREF1 passed 10d survival rate	1
05-5596-9208	10d Survival Rate	Fisher Exact/Bonferroni-Holm Test	0.5000	POL-S passed 10d survival rate	1
05-5596-9208	10d Survival Rate	Fisher Exact/Bonferroni-Holm Test	0.4360	BOL-S passed 10d survival rate	1
11-8864-9223	Mean Dry Weight-mg	Dunnett Multiple Comparison Test	<1.0E-05	QUL-LNF1 failed mean dry weight-mg	1
11-8864-9223	Mean Dry Weight-mg	Dunnett Multiple Comparison Test	0.9999	QUL-LREF1 passed mean dry weight-mg	1
11-8864-9223	Mean Dry Weight-mg	Dunnett Multiple Comparison Test	1.0000	POL-S passed mean dry weight-mg	1
11-8864-9223	Mean Dry Weight-mg	Dunnett Multiple Comparison Test	0.9895	BOL-S passed mean dry weight-mg	1

14 ~~10d~~ Survival Rate Summary CW

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Sed	N	5	0.9600	0.8920	1.0280	0.9000	1.0000	0.0245	0.0548	5.71%	0.00%
QUL-LNF1		5	0.5400	0.2541	0.8259	0.2000	0.8000	0.1030	0.2302	42.63%	43.75%
QUL-LREF1		5	0.8400	0.7720	0.9080	0.8000	0.9000	0.0245	0.0548	6.52%	12.50%
POL-S		5	0.9400	0.8289	1.0510	0.8000	1.0000	0.0400	0.0894	9.52%	2.08%
BOL-S		5	0.9000	0.8122	0.9878	0.8000	1.0000	0.0316	0.0707	7.86%	6.25%

Mean Dry Weight-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Sed	N	5	0.185	0.1535	0.2165	0.16	0.214	0.01135	0.02537	13.71%	0.00%
QUL-LNF1		5	0.04239	0.0318	0.05298	0.03	0.05199	0.003814	0.008527	20.12%	77.09%
QUL-LREF1		5	0.2312	0.1822	0.2803	0.1812	0.285	0.01767	0.0395	17.08%	-24.98%
POL-S		5	0.2361	0.1993	0.2729	0.208	0.273	0.01325	0.02963	12.55%	-27.62%
BOL-S		5	0.2064	0.1903	0.2225	0.1844	0.2167	0.005808	0.01299	6.29%	-11.55%

Analyst: CW QA: DB 10/3/22

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

14d Survival Rate Detail CZW — MD5: F45C656FE4287E678399DA15D9403CE8

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	0.9000	0.9000	1.0000	1.0000	1.0000
QUL-LNF1		0.8000	0.5000	0.5000	0.7000	0.2000
QUL-LREF1		0.8000	0.8000	0.9000	0.9000	0.8000
POL-S		0.8000	1.0000	0.9000	1.0000	1.0000
BOL-S		0.9000	1.0000	0.9000	0.9000	0.8000

Mean Dry Weight-mg Detail — MD5: E59EEFE7DCCA2AAF916BE721E9D935DE

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	0.1611	0.16	0.208	0.182	0.214
QUL-LNF1		0.04625	0.05199	0.038	0.04571	0.03
QUL-LREF1		0.285	0.21	0.2511	0.2289	0.1812
POL-S		0.22	0.208	0.2167	0.263	0.273
BOL-S		0.2167	0.205	0.2133	0.1844	0.2125

14d Survival Rate Binomials CZW

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	9/10	9/10	10/10	10/10	10/10
QUL-LNF1		8/10	5/10	5/10	7/10	2/10
QUL-LREF1		8/10	8/10	9/10	9/10	8/10
POL-S		8/10	10/10	9/10	10/10	10/10
BOL-S		9/10	10/10	9/10	9/10	8/10

Analyst: CZW QA: Oct. 3/22

Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	05-5596-9208	**Endpoint:**	14d Survival Rate	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:05	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	F45C656FE4287E678399DA15D9403CE8	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (14d)	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control Sed	10-7042-0697	08 Sep-22	08 Sep-22	---	Minnow Environmental	
QUL-LNF1	00-4438-3904	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
QUL-LREF1	13-7106-0450	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
POL-S	05-8645-7879	25 Aug-22	30 Aug-22 10:40	14d 0h (11.2 °C)		
BOL-S	15-1832-2783	24 Aug-22	30 Aug-22 10:40	15d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control Sed	Sediment Sample	Minnow Environmental	Control Sediment	
QUL-LNF1	Sediment Sample	Minnow Environmental	QUL-LNF1	
QUL-LREF1	Sediment Sample	Minnow Environmental	QUL-LREF1	
POL-S	Sediment Sample	Minnow Environmental	POL-S	
BOL-S	Sediment Sample	Minnow Environmental	BOL-S	

Fisher Exact/Bonferroni-Holm Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		QUL-LNF1*	0.0000	Exact	<1.0E-05	Significant Effect
		QUL-LREF1	0.0458	Exact	0.1375	Non-Significant Effect
		POL-S	0.5000	Exact	0.5000	Non-Significant Effect
		BOL-S	0.2180	Exact	0.4360	Non-Significant Effect

14d Survival Rate Frequencies

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
Control Sed	N	48	2	50	0.9600	0.0400	0.00%
QUL-LNF1		27	23	50	0.5400	0.4600	43.75%
QUL-LREF1		42	8	50	0.8400	0.1600	12.50%
POL-S		47	3	50	0.9400	0.0600	2.08%
BOL-S		45	5	50	0.9000	0.1000	6.25%

14d Survival Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Sed	N	5	0.9600	0.8920	1.0000	1.0000	0.9000	1.0000	0.0245	5.71%	0.00%
QUL-LNF1		5	0.5400	0.2541	0.8259	0.5000	0.2000	0.8000	0.1030	42.63%	43.75%
QUL-LREF1		5	0.8400	0.7720	0.9080	0.8000	0.8000	0.9000	0.0245	6.52%	12.50%
POL-S		5	0.9400	0.8289	1.0000	1.0000	0.8000	1.0000	0.0400	9.52%	2.08%
BOL-S		5	0.9000	0.8122	0.9878	0.9000	0.8000	1.0000	0.0316	7.86%	6.25%

14d Survival Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	0.9000	0.9000	1.0000	1.0000	1.0000
QUL-LNF1		0.8000	0.5000	0.5000	0.7000	0.2000
QUL-LREF1		0.8000	0.8000	0.9000	0.9000	0.8000
POL-S		0.8000	1.0000	0.9000	1.0000	1.0000
BOL-S		0.9000	1.0000	0.9000	0.9000	0.8000

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	05-5596-9208	**Endpoint:**	14d Survival Rate	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:05	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	F45C656FE4287E678399DA15D9403CE8	**Editor ID:**	007-585-424-0

14d Survival Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	9/10	9/10	10/10	10/10	10/10
QUL-LNF1		8/10	5/10	5/10	7/10	2/10
QUL-LREF1		8/10	8/10	9/10	9/10	8/10
POL-S		8/10	10/10	9/10	10/10	10/10
BOL-S		9/10	10/10	9/10	9/10	8/10

Graphics

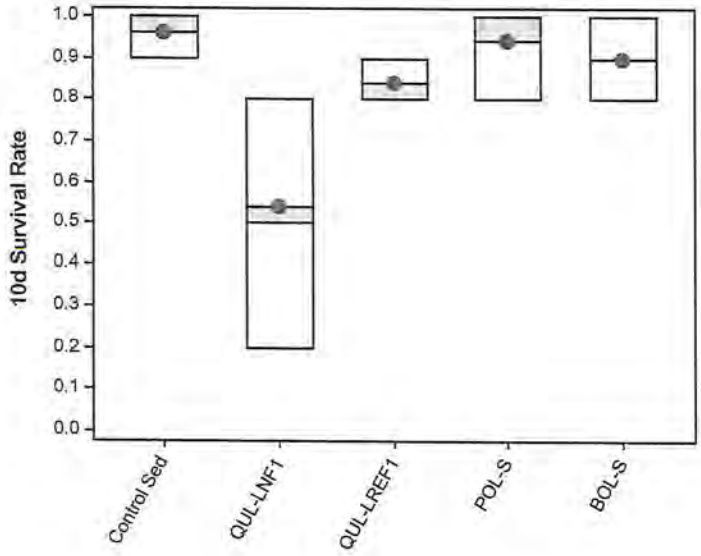

CETIS Analytical Report

Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	11-8864-9223	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:05	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	E59EEFE7DCCA2AAF916BE721E9D935D	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (~~10d~~) 14 CZW	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
Control Sed	10-7042-0697	08 Sep-22	08 Sep-22	---	Minnow Environmental	
QUL-LNF1	00-4438-3904	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
QUL-LREF1	13-7106-0450	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		
POL-S	05-8645-7879	25 Aug-22	30 Aug-22 10:40	14d 0h (11.2 °C)		
BOL-S	15-1832-2783	24 Aug-22	30 Aug-22 10:40	15d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
Control Sed	Sediment Sample	Minnow Environmental	Control Sediment	
QUL-LNF1	Sediment Sample	Minnow Environmental	QUL-LNF1	
QUL-LREF1	Sediment Sample	Minnow Environmental	QUL-LREF1	
POL-S	Sediment Sample	Minnow Environmental	POL-S	
BOL-S	Sediment Sample	Minnow Environmental	BOL-S	

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	QUL-LNF1 failed mean dry weight-mg endpoint	20.31%
		QUL-LREF1 passed mean dry weight-mg endpoint	20.31%
		POL-S passed mean dry weight-mg endpoint	20.31%
		BOL-S passed mean dry weight-mg endpoint	20.31%

Dunnett Multiple Comparison Test

Sample I	vs	Sample II	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Negative Control		QUL-LNF1*	8	8.747	2.305	0.03758	CDF	<1.0E-05	Significant Effect
		QUL-LREF1	8	-2.835	2.305	0.03758	CDF	0.9999	Non-Significant Effect
		POL-S	8	-3.134	2.305	0.03758	CDF	1.0000	Non-Significant Effect
		BOL-S	8	-1.311	2.305	0.03758	CDF	0.9895	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.127177	0.0317942	4	47.83	<1.0E-05	Significant Effect
Error	0.0132939	0.0006647	20			
Total	0.140471		24			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	9.035	13.28	0.0602	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9844	0.8877	0.9565	Normal Distribution

Mean Dry Weight-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Sed	N	5	0.185	0.1535	0.2165	0.182	0.16	0.214	0.01135	13.71%	0.00%
QUL-LNF1		5	0.04239	0.0318	0.05298	0.04571	0.03	0.05199	0.003814	20.12%	77.09%
QUL-LREF1		5	0.2312	0.1822	0.2803	0.2289	0.1812	0.285	0.01767	17.08%	-24.98%
POL-S		5	0.2361	0.1993	0.2729	0.22	0.208	0.273	0.01325	12.55%	-27.62%
BOL-S		5	0.2064	0.1903	0.2225	0.2125	0.1844	0.2167	0.005808	6.29%	-11.55%

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	11-8864-9223	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:05	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	E59EEFE7DCCA2AAF916BE721E9D935D	**Editor ID:**	007-585-424-0

Mean Dry Weight-mg Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control Sed	N	0.1611	0.16	0.208	0.182	0.214
QUL-LNF1		0.04625	0.05199	0.038	0.04571	0.03
QUL-LREF1		0.285	0.21	0.2511	0.2289	0.1812
POL-S		0.22	0.208	0.2167	0.263	0.273
BOL-S		0.2167	0.205	0.2133	0.1844	0.2125

Graphics

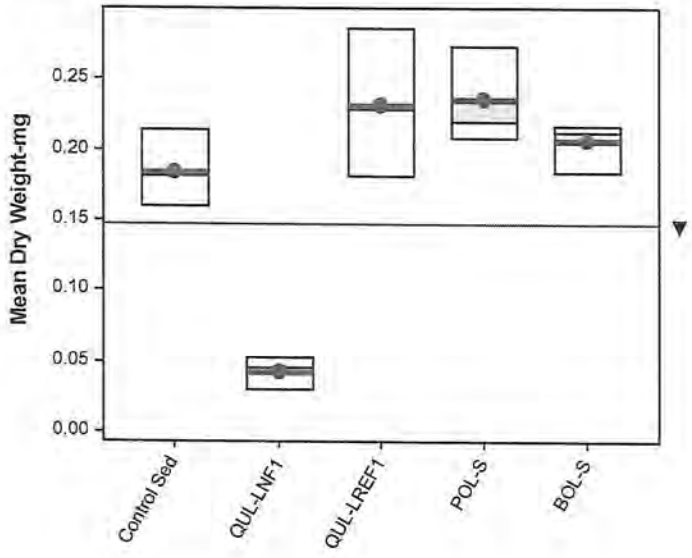

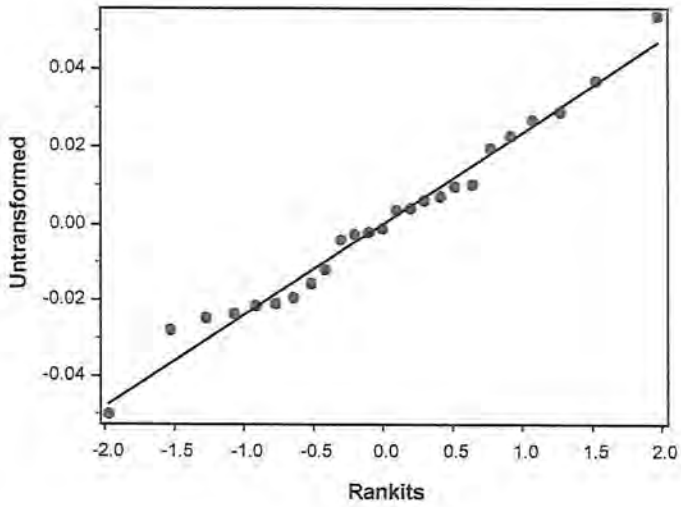

CETIS Analytical Report

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	15-0634-4916	**Endpoint:**	14d Survival Rate	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:00	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	BAE583E9A02959B6AB8ED16F74D3A12A	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (14d)	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
QUL-LNF1	00-4438-3904	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)	Minnow Environmental	
QUL-LREF1	13-7106-0450	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
QUL-LNF1	Sediment Sample	Minnow Environmental	QUL-LNF1	
QUL-LREF1	Sediment Sample	Minnow Environmental	QUL-LREF1	

Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Reference Sed		QUL-LNF1*	0.0011	Exact	0.0011	Significant Effect

14d Survival Rate Frequencies

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
QUL-LNF1		27	23	50	0.5400	0.4600	35.71%
QUL-LREF1	RS	42	8	50	0.8400	0.1600	0.00%

14d Survival Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
QUL-LNF1		5	0.5400	0.2541	0.8259	0.5000	0.2000	0.8000	0.1030	42.63%	35.71%
QUL-LREF1	RS	5	0.8400	0.7720	0.9080	0.8000	0.8000	0.9000	0.0245	6.52%	0.00%

14d Survival Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
QUL-LNF1		0.8000	0.5000	0.5000	0.7000	0.2000
QUL-LREF1	RS	0.8000	0.8000	0.9000	0.9000	0.8000

14d Survival Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
QUL-LNF1		8/10	5/10	5/10	7/10	2/10
QUL-LREF1	RS	8/10	8/10	9/10	9/10	8/10

Reference Sediment (RS): QUL-LREF1

Analyst: CJW QA: 10-27-22

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	15-0634-4916	**Endpoint:**	10d Survival Rate	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:00	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	BAE583E9A02959B6AB8ED16F74D3A12A	**Editor ID:**	007-585-424-0

Graphics

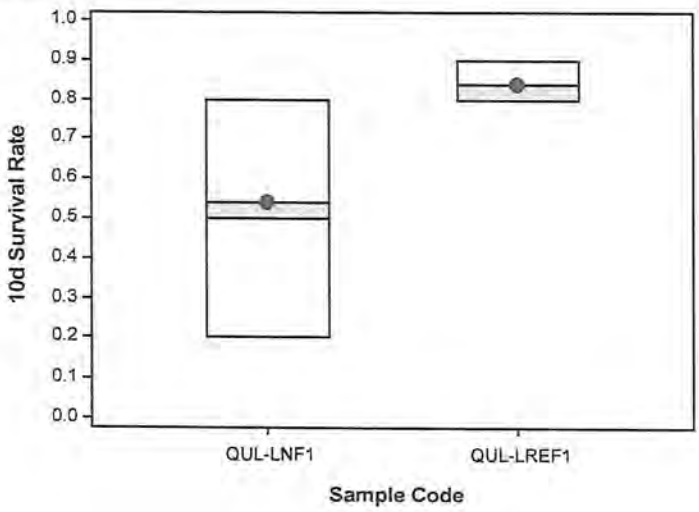

CETIS Analytical Report

Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	08-1695-6629	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	A067BF58C73E5E70F7450C588BD75926	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (~~10d~~) 14 CAW	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
QUL-LNF1	00-4438-3904	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)	Minnow Environmental	
QUL-LREF1	13-7106-0450	23 Aug-22	30 Aug-22 10:40	16d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
QUL-LNF1	Sediment Sample	Minnow Environmental	QUL-LNF1	
QUL-LREF1	Sediment Sample	Minnow Environmental	QUL-LREF1	

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	QUL-LNF1 failed mean dry weight-mg endpoint	14.53%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Reference Sed		QUL-LNF1*	8	10.45	1.86	0.03361	CDF	<1.0E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0891706	0.0891706	1	109.2	<1.0E-05	Significant Effect
Error	0.0065329	0.0008166	8			
Total	0.0957035		9			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Variance Ratio F Test	21.46	23.15	0.0115	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9556	0.7411	0.7343	Normal Distribution

Mean Dry Weight-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
QUL-LNF1		5	0.04239	0.0318	0.05298	0.04571	0.03	0.05199	0.003814	20.12%	81.67%
QUL-LREF1	RS	5	0.2312	0.1822	0.2803	0.2289	0.1812	0.285	0.01767	17.08%	0.00%

Mean Dry Weight-mg Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
QUL-LNF1		0.04625	0.05199	0.038	0.04571	0.03
QUL-LREF1	RS	0.285	0.21	0.2511	0.2289	0.1812

Reference sediment (RS): QUL-LREF1

Hyalella 14-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	08-1695-6629	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	03 Oct-22 10:00	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	A067BF58C73E5E70F7450C588BD75926	**Editor ID:**	007-585-424-0

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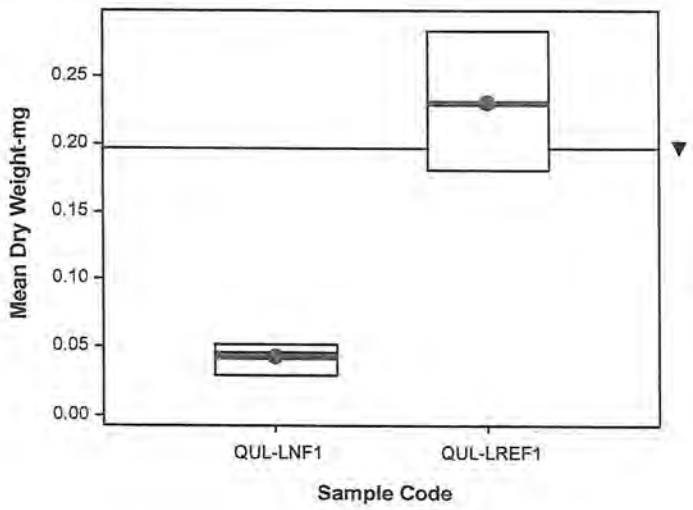

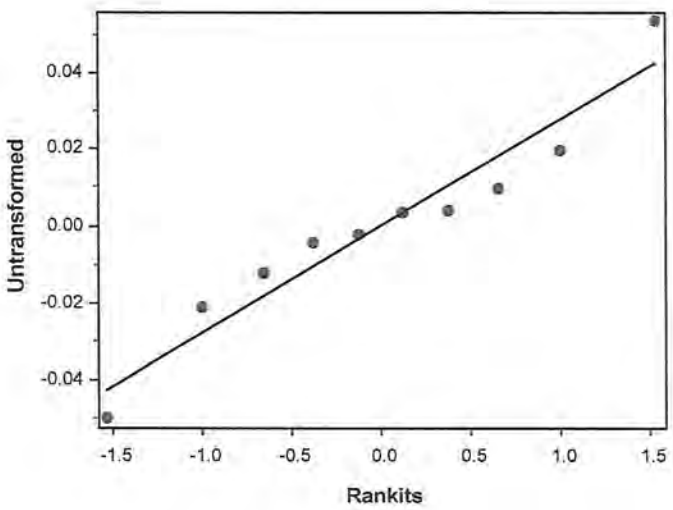

Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	17-4782-4649	**Endpoint:**	14/10d Survival Rate (CZW)	**CETIS Version:**	CETISv2.1.1
Analyzed:	28 Sep-22 11:43	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	EE5EA727D356F7C8270D6BA39481FFFE	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (10d)/14 (CZW)	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
POL-S	05-8645-7879	25 Aug-22	30 Aug-22 10:40	14d 0h (11.2 °C)	Minnow Environmental	
BOL-S	15-1832-2783	24 Aug-22	30 Aug-22 10:40	15d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
POL-S	Sediment Sample	Minnow Environmental	POL-S	
BOL-S	Sediment Sample	Minnow Environmental	BOL-S	

Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Reference Sed		POL-S	0.8657	Exact	0.8657	Non-Significant Effect

14/10d (CZW) Survival Rate Frequencies

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
POL-S		47	3	50	0.9400	0.0600	-4.44%
BOL-S	RS	45	5	50	0.9000	0.1000	0.00%

14/10d (CZW) Survival Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
POL-S		5	0.9400	0.8289	1.0000	1.0000	0.8000	1.0000	0.0400	9.52%	-4.44%
BOL-S	RS	5	0.9000	0.8122	0.9878	0.9000	0.8000	1.0000	0.0316	7.86%	0.00%

14/10d (CZW) Survival Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
POL-S		0.8000	1.0000	0.9000	1.0000	1.0000
BOL-S	RS	0.9000	1.0000	0.9000	0.9000	0.8000

14/10d (CZW) Survival Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
POL-S		8/10	10/10	9/10	10/10	10/10
BOL-S	RS	9/10	10/10	9/10	9/10	8/10

Reference Sediment (RS): BOL-S

Hyalella 14-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	17-4782-4649	**Endpoint:**	10d Survival Rate	**CETIS Version:**	CETISv2.1.1
Analyzed:	28 Sep-22 11:43	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	EE5EA727D356F7C8270D6BA39481FFFE	**Editor ID:**	007-585-424-0

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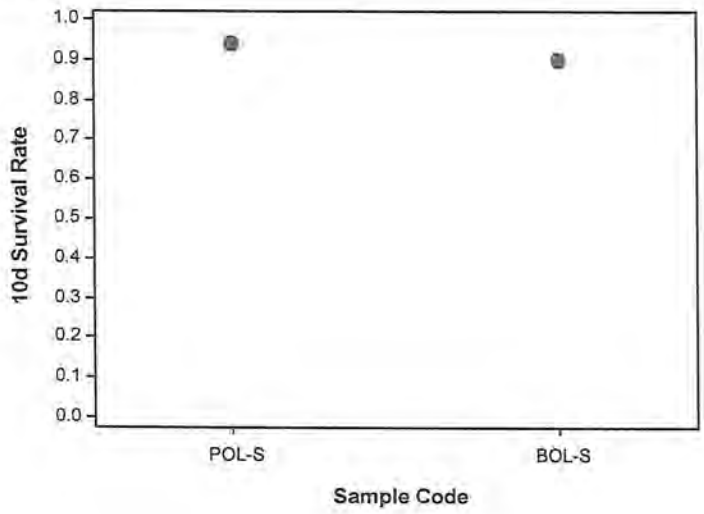

CETIS Analytical Report

Hyalella 14-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	11-3304-6217	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	28 Sep-22 11:44	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	F2D0F2A689BFCB4C2103C5CB4A930C5	**Editor ID:**	007-585-424-0
Batch ID:	04-8223-2973	**Test Type:**	Growth-Survival (10d) 14 CAW	**Analyst:**	Carley Winter
Start Date:	08 Sep-22	**Protocol:**	EC/EPS 1/RM/32	**Diluent:**	Reconstituted Water
Ending Date:	22 Sep-22	**Species:**	Hyalella azteca	**Brine:**	
Test Length:	14d 0h	**Taxon:**	Malacostraca	**Source:**	Aquatic Biosystems, CO **Age:** 7-9d

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
POL-S	05-8645-7879	25 Aug-22	30 Aug-22 10:40	14d 0h (11.2 °C)	Minnow Environmental	
BOL-S	15-1832-2783	24 Aug-22	30 Aug-22 10:40	15d 0h (11.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
POL-S	Sediment Sample	Minnow Environmental	POL-S	
BOL-S	Sediment Sample	Minnow Environmental	BOL-S	

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	POL-S passed mean dry weight-mg endpoint	13.04%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Reference Sed		POL-S	8	-2.056	1.86	0.0269	CDF	0.9631	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0022112	0.0022112	1	4.225	0.0739	Non-Significant Effect
Error	0.0041866	0.0005233	8			
Total	0.0063978		9			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Variance Ratio F Test	5.206	23.15	0.1391	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9438	0.7411	0.5963	Normal Distribution

Mean Dry Weight-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
POL-S		5	0.2361	0.1993	0.2729	0.22	0.208	0.273	0.01325	12.55%	-14.41%
BOL-S	RS	5	0.2064	0.1903	0.2225	0.2125	0.1844	0.2167	0.005808	6.29%	0.00%

Mean Dry Weight-mg Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
POL-S		0.22	0.208	0.2167	0.263	0.273
BOL-S	RS	0.2167	0.205	0.2133	0.1844	0.2125

Reference sediment (RS): BOL-S

Hyalella 14-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	11-3304-6217	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv2.1.1
Analyzed:	28 Sep-22 11:44	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	28 Sep-22 11:14	**MD5 Hash:**	F2D0F2A689BFCB4C2103C5CB4A930C5	**Editor ID:**	007-585-424-0

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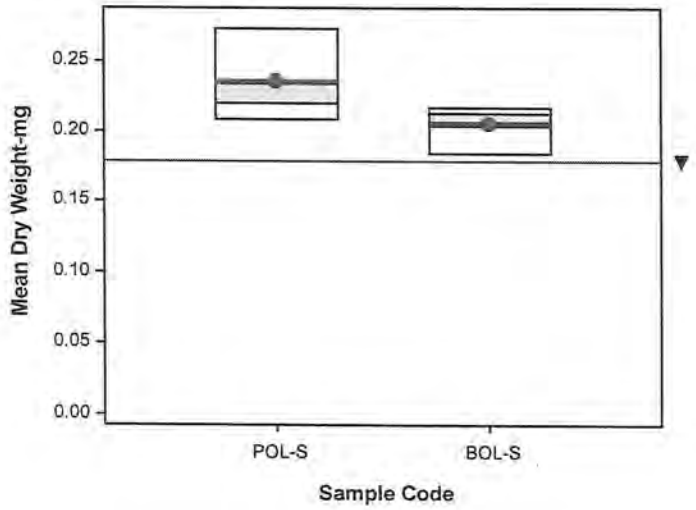

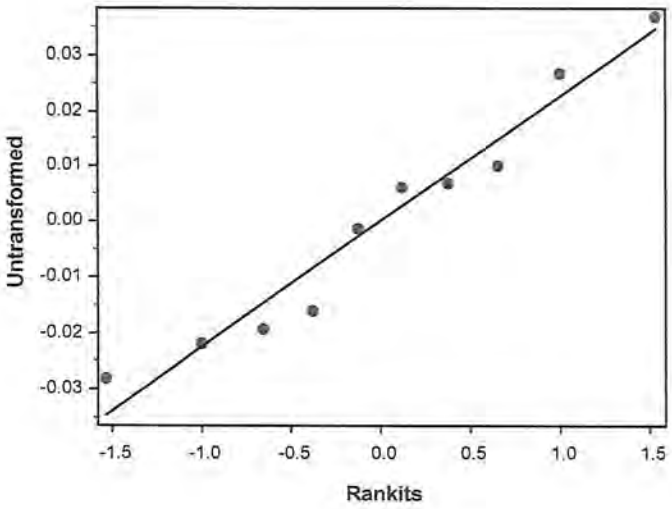

Analyst: CAN QA: Sept 30/22

Client : Minnow Environmental
W.O.: 221769
Date see below

Table of PKa values

	TDS (mg/L)			Salinity (g/kg)		
Temperature (°C)	*0*	*250*	*2000*	*10*	*20*	*30*
12	9.662	9.699	9.754	9.788	9.819	9.837
15	9.564	9.601	9.655	9.688	9.719	9.737
18	9.465	9.502	9.557	9.588	9.619	9.636
20	9.401	9.438	9.492	9.523	9.554	9.571
22		9.391				
23	9.307	9.344	9.398	9.426	9.459	9.476
24		9.314				
25	9.246	9.283	9.337	9.366	9.397	9.414

Date	Sample ID	Temperature (C)	pH	Salinity (ppt)	Total Ammonia as N (mg/L)	pKa	Unionized Ammonia (mg/L N)
Sept. 9/22	QUL-LREF1	22	7.8		0.04	9.391	0.001000
Sept. 9/22	BOL-S	22	8		0.54	9.391	0.021091
Sept 12/22	QUL-LREF1	22	8		1.50	9.391	0.058585
Sept 12/22	BOL-S	22	7.9		0.41	9.391	0.012823
Sept 14/22	QUL-LREF1	22	8.3		0.30	9.391	0.022504
Sept 14/22	BOL-S	22	8.3		0.10	9.391	0.007501
Sept 16/22	QUL-LREF1	22.5	8.4		2.00	9.391	0.185273
Sept 16/22	BOL-S	22.5	8.3		0.06	9.391	0.004501
Sept 19/22	QUL-LREF1	22	8.4		0.20	9.391	0.018527
Sept 19/22	BOL-S	22	8.3		0.05	9.391	0.003751
Sept 21/22	QUL-LREF1	22.5	8.4		0.08	9.391	0.007411
Sept 21/22	BOL-S	22.5	8.3		0.05	9.391	0.003751

Sept. 30, 2022

Nautilus Environmental
Water Quality Data For Ammonia

Client: Minnow Environmental Inc **Species:** H. azteca

Work Order No: 221769 **Sample Type:** overlying water

Date Measured: see below

Date	Sample ID	Temperature (°C)	pH	Total Ammonia as N (mg/L)	Unionized Ammonia as N (mg/L)	Tech. Init.
Sept 9/22	QUL-LREF1	22.0	7.8	0.04	0.001	CZW
↓	BOL-S	22.0	8.0	0.54	0.021	CZW
Sept 12/22	QUL-LREF1	22.0	8.0	0.15 x10	0.059	CZW
↓	BOLS	22.0	7.9	0.41	0.013	CZW
Sept 14/22	QUL-LREF1	22.0	8.3	0.03 x10	0.023	CZW
↓	BOL-S	22.0	8.3	0.01 x10	0.008	CZW
Sept 16/22	QUL-LREF1	22.5	8.4	0.20x10	0.185	CZW
↓	BOLS	22.5	8.3	0.06	0.005	CZW
Sept 19/22	QUL-LREF1	22.0	8.4	0.02 x10	0.0189	CZW
↓	BOL-S	22.0	8.3	0.05	0.004	CZW

Ammonia Salicylate Lot #: A20408

Ammonia Cyanurate Lot #: A2005

Comments: _____

Reviewed by: _____ **Date Reviewed:** Sept 30, 2022

Nautilus Environmental
Water Quality Data For Ammonia

Client: Minnow Environmental Inc. **Species:** H. azteca

Work Order No: 221769 **Sample Type:** overlying water

Date Measured: see below

Date	Sample ID	Temperature (°C)	pH	Total Ammonia as N (mg/L)	Unionized Ammonia as N (mg/L)	Tech. Init.
sept 21/22	QUL-LREF1	22.5	8.4	0.08	0.007	CZW
↓	BOL-S	22.5	8.3	0.05	0.004	↓

Ammonia Salicylate Lot #: A20408

Ammonia Cyanurate Lot #: A2005

Comments:

Reviewed by: **Date Reviewed:** Sept. 30, 2022

Sediment Description Data Sheet

Client: Minnow Environmental Inc. Date: Sept 7/22

Work Order No.: 221769 Test Organism: *Hyalella azteca*

Sample ID	Grain Size	Colour	Odour	Debris	Other	Initials
Control Sediment	sand	grey	none	none	none	RZS
QUL-LNF1-1	sand	grey/brown	none	none	none	CZW
-2	sand	↓	faint sulphide	roots	none	↓
-3	sand	brown	none	none	none	
-4	sand	↓	sulphide	grass	none	
-5	sand	reddish brown	faint sulphide	none	none	↓
QUL-LREF1-1	sand/silt	brown	strong sulphide	roots	none	CZW
-2	↓	brown/grey	strong sulphide	grass, roots	↓	↓
-3		↓	↓	↓		
-4						
-5	↓	↓	↓	↓	↓	↓
POL-S-1	silt/clay	brown	strong sulphide	roots	none	RZS
-2	↓	↓	↓	↓	↓	↓
-3						
-4						
-5	↓	↓	↓	↓	↓	↓

Reviewed by: Date Reviewed: Sept. 30, 2022

Sediment Description Data Sheet

Client: Minnow Environmental Inc.
Work Order No.: 221769

Date: Sept 7/22
Test Organism: *Hyalella azteca*

Sample ID	Grain Size	Colour	Odour	Debris	Other	Initials
~~Control Sediment~~ CZW						
BOL-S-1	silt / clay	brown	sulfide	none		CZW/EZS
-2	↓	grey / brown	strong sulfide	roots / twigs		↓
-3	↓	brown	sulfide	none		↓
-4	sand / silt	light grey	sulfide	pebbles		↓
-5	silt / clay	dark brown	sulfide	none		↓

Reviewed by: [signature]

Date Reviewed: Sept. 30, 2022

APPENDIX B – Analytical Chemistry

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2841**	Page	: 1 of 3
Client	: **Nautilus Environmental Company Inc.**	Laboratory	: Vancouver - Environmental
Contact	: C Winter	Account Manager	: Emmanuel Mariano
Address	: 8664 Commerce Court Imperial Square Lake City Burnaby BC Canada V5A 4N7	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Sep-2022 15:20
PO	: 2223-027BC	Date Analysis Commenced	: 25-Sep-2022
C-O-C number	: ----	Issue Date	: 26-Sep-2022 11:33
Sampler	: ----		
Site	: Tissue, Water and Sediment Testing		
Quote number	: Q69439 (Vancouver Blanket Quote)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Control Day 0	QUL-LNF1 Day 0	QUL-LREF1 Day 0	POL-S Day 0	BOL-S Day 0
					Client sampling date / time	08-Sep-2022	08-Sep-2022	08-Sep-2022	08-Sep-2022	08-Sep-2022
						VA22C2841-001	VA22C2841-002	VA22C2841-003	VA22C2841-004	VA22C2841-005
						Result	Result	Result	Result	Result
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0195	0.0891	0.419	0.0899	0.380

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Control Day 14	QUL-LNF1 Day 14	QUL-LREF1 Day 14	POL-S Day 14	BOL-S Day 14
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2841-006	VA22C2841-007	VA22C2841-008	VA22C2841-009	VA22C2841-010
						Result	Result	Result	Result	Result
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.145	0.0232	0.0699	0.0322	0.0545

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2841**	Page	: 1 of 6
Client	: **Nautilus Environmental Company Inc.**	Laboratory	: Vancouver - Environmental
Contact	: C Winter	Account Manager	: Emmanuel Mariano
Address	: 8664 Commerce Court Imperial Square Lake City Burnaby BC Canada V5A 4N7	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Sep-2022 15:20
PO	: 2223-027BC	Issue Date	: 26-Sep-2022 11:34
C-O-C number	: ----		
Sampler	: ----		
Site	: Tissue, Water and Sediment Testing		
Quote number	: Q69439 (Vancouver Blanket Quote)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S Day 0	E298	08-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	17 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Control Day 0	E298	08-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	17 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S Day 0	E298	08-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	17 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1 Day 0	E298	08-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	17 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1 Day 0	E298	08-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	17 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BOL-S Day 14	E298	22-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Control Day 14	E298	22-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
POL-S Day 14	E298	22-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LNF1 Day 14	E298	22-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
QUL-LREF1 Day 14	E298	22-Sep-2022	25-Sep-2022	----	----		25-Sep-2022	28 days	3 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	664879	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	664879	1	20	5.0	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	664879	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	664879	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.

NAUTILUS ENVIRONMENTAL

TESTING LOCATION (Please Circle)

Burnaby (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

Point Edward ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

Chain of Custody

Date_____Page___of___

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/Prov/PC	Burnaby,BC	**City/Prov/PC**	Burnaby,BC
Contact	Carley Winter	**Contact**	Nair
Phone	6044208773	**Phone**	6044208773
Email	cwinter@nautilusenvironmental.ca	**Email**	nair@nautilusenvironmental.ca
	rachel@nautilusenvironmental.ca	**PO No.**	cnb 2022-2223-027BC

Sample Collection By: **Sample Type:** Grab ( ) OR Composite ( )

ANALYSES REQUIRED

	SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	Overlying Ammonia
1	Control	08/09/22			1 x 125 mL	Day 0	✓
2	QUL-LNF1	08/09/22			1 x 125 mL	Day 0	✓
3	QUL-LREF1	08/09/22			1 x 125 mL	Day 0	✓
4	POL-S	08/09/22			1 x 125 mL	Day 0	✓
5	BOL-S	08/09/22			1 x 125 mL	Day 0	✓
6	Control	22/09/22			1 x 125 mL	Day 14	✓
7	QUL-LNF1	22/09/22			1 x 125 mL	Day 14	✓
8	QUL-LREF1	22/09/22			1 x 125 mL	Day 14	✓
9	POL-S	22/09/22			1 x 125 mL	Day 14	✓
10	BOL-S	22/09/22			1 x 125 mL	Day 14	✓

Receipt Temperature (°C) 22

Environmental Division
Vancouver
Work Order Reference
VA22C2841

Telephone : +1 604 253 4188

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

-Preserved with Sulphuric acid

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

CARLEY WINTER (Printed Name) (Signature)

Nautilus Environmental (Company) 22/09/22 (Date DD/MM/YY and Time)

RECEIVED BY (LABORATORY)

HPA (Printed Name) (Signature)

3120P (Company) 9/22 (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2842**	Page	: 1 of 4
Client	: **Nautilus Environmental Company Inc.**	Laboratory	: Vancouver - Environmental
Contact	: Rachel Sakurdeep	Account Manager	: Emmanuel Mariano
Address	: 8664 Commerce Court Imperial Square Lake City Burnaby BC Canada V5A 4N7	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Sep-2022 15:20
PO	: 2223-028BC	Date Analysis Commenced	: 27-Sep-2022
C-O-C number	: ----	Issue Date	: 29-Sep-2022 16:46
Sampler	: ----		
Site	: Tissue, Water and Sediment Testing		
Quote number	: Q69439 (Vancouver Blanket Quote)		
No. of samples received	: 25		
No. of samples analysed	: 25		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Ann Joby	Lab Assistant	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Kyle Chang	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

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Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

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UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LREF1 Day 14 - Rep A	QUL-LREF1 Day 14 - Rep B	QUL-LREF1 Day 14 - Rep C	QUL-LREF1 Day 14 - Rep D	QUL-LREF1 Day 14 - Rep E
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2842-001	VA22C2842-002	VA22C2842-003	VA22C2842-004	VA22C2842-005
						Result	Result	Result	Result	Result
Dissolved Metals										
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.00343	0.0775	0.00297	0.00413	0.00240
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-S Day 14 - Rep A	POL-S Day 14 - Rep B	POL-S Day 14 - Rep C	POL-S Day 14 - Rep D	POL-S Day 14 - Rep E
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2842-006	VA22C2842-007	VA22C2842-008	VA22C2842-009	VA22C2842-010
						Result	Result	Result	Result	Result
Dissolved Metals										
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.0361	0.0289	0.0277	0.0233	0.0231
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Control Sediment Day 14 - Rep A	Control Sediment Day 14 - Rep B	Control Sediment Day 14 - Rep C	Control Sediment Day 14 - Rep D	Control Sediment Day 14 - Rep E
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2842-011	VA22C2842-012	VA22C2842-013	VA22C2842-014	VA22C2842-015
						Result	Result	Result	Result	Result
Dissolved Metals										
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.00436	0.00396	0.00410	0.00379	0.00424
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-LNF1 Day 14 - Rep A	QUL-LNF1 Day 14 - Rep B	QUL-LNF1 Day 14 - Rep C	QUL-LNF1 Day 14 - Rep D	QUL-LNF1 Day 14 - Rep E
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2842-016	VA22C2842-017	VA22C2842-018	VA22C2842-019	VA22C2842-020
						Result	Result	Result	Result	Result
Dissolved Metals										
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.0936	0.00281	0.105	0.0728	0.0939
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-S Day 14 - Rep A	BOL-S Day 14 - Rep B	BOL-S Day 14 - Rep C	BOL-S Day 14 - Rep D	BOL-S Day 14 - Rep E
					Client sampling date / time	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
						VA22C2842-021	VA22C2842-022	VA22C2842-023	VA22C2842-024	VA22C2842-025
						Result	Result	Result	Result	Result
Dissolved Metals										
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.00518	0.00434	0.00494	0.00588	0.00439
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2842**	Page	: 1 of 7
Client	: **Nautilus Environmental Company Inc.**	Laboratory	: Vancouver - Environmental
Contact	: Rachel Sakurdeep	Account Manager	: Emmanuel Mariano
Address	: 8664 Commerce Court Imperial Square Lake City Burnaby BC Canada V5A 4N7	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 22-Sep-2022 15:20
PO	: 2223-028BC	Issue Date	: 29-Sep-2022 16:46
C-O-C number	: ----		
Sampler	: ----		
Site	: Tissue, Water and Sediment Testing		
Quote number	: Q69439 (Vancouver Blanket Quote)		
No. of samples received	: 25		
No. of samples analysed	: 25		

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Key

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CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
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LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

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Summary of Outliers

Outliers : Quality Control Samples

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- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
Control Sediment Day 14 - Rep A	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
Control Sediment Day 14 - Rep B	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
Control Sediment Day 14 - Rep C	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
Control Sediment Day 14 - Rep D	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
Control Sediment Day 14 - Rep E	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
POL-S Day 14 - Rep A	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
POL-S Day 14 - Rep B	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) POL-S Day 14 - Rep C	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) POL-S Day 14 - Rep D	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) POL-S Day 14 - Rep E	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LNF1 Day 14 - Rep A	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LNF1 Day 14 - Rep B	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LNF1 Day 14 - Rep C	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LNF1 Day 14 - Rep D	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LNF1 Day 14 - Rep E	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LREF1 Day 14 - Rep A	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LREF1 Day 14 - Rep B	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LREF1 Day 14 - Rep C	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LREF1 Day 14 - Rep D	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) QUL-LREF1 Day 14 - Rep E	E421	22-Sep-2022	27-Sep-2022	----	----		27-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) BOL-S Day 14 - Rep A	E421	22-Sep-2022	28-Sep-2022	----	----		28-Sep-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) BOL-S Day 14 - Rep B	E421	22-Sep-2022	28-Sep-2022	----	----		28-Sep-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) BOL-S Day 14 - Rep C	E421	22-Sep-2022	28-Sep-2022	----	----		28-Sep-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) BOL-S Day 14 - Rep D	E421	22-Sep-2022	28-Sep-2022	----	----		28-Sep-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) BOL-S Day 14 - Rep E	E421	22-Sep-2022	28-Sep-2022	----	----		28-Sep-2022	180 days	7 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Dissolved Metals in Water by CRC ICPMS	E421	667395	2	39	5.1	5.0	✓
Laboratory Control Samples (LCS)							
Dissolved Metals in Water by CRC ICPMS	E421	667395	2	39	5.1	5.0	✓
Method Blanks (MB)							
Dissolved Metals in Water by CRC ICPMS	E421	667395	2	39	5.1	5.0	✓
Matrix Spikes (MS)							
Dissolved Metals in Water by CRC ICPMS	E421	667395	2	39	5.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

NAUTILUS ENVIRONMENTAL

TESTING LOCATION (Please Circle)

Burnaby (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

Point Edward ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

Chain of Custody

Date_____Page___of___

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/Prov/PC	Burnaby,BC	**City/Prov/PC**	Burnaby,BC
Contact	Rachel Sakurdeep	**Contact**	Nair
Phone	6044208773	**Phone**	6044208773
Email	rachel@nautilusenvironmental.ca	**Email**	nair@nautilusenvironmental.ca
	cwinter@nautilusenvironmental.ca	**PO No.**	2223-028BC

Sample Collection By: **Sample Type:** Grab ( ) OR Composite ( )

	SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	Dissolved Copper
1	QUL-LREF1	22/09/22			1 x 125 mL	Day 14 - Rep A	✓
2	QUL-LREF1	22/09/22			1 x 125 mL	Day 14 - Rep B	✓
3	QUL-LREF1	22/09/22			1 x 125 mL	Day 14 - Rep C	✓
4	QUL-LREF1	22/09/22			1 x 125 mL	Day 14 - Rep D	✓
5	QUL-LREF1	22/09/22			1 x 125 mL	Day 14 - Rep E	✓
6	POL-S	22/09/22			1 x 125 mL	Day 14 - Rep A	✓
7	POL-S	22/09/22			1 x 125 mL	Day 14 - Rep B	✓
8	POL-S	22/09/22			1 x 125 mL	Day 14 - Rep C	✓
9	POL-S	22/09/22			1 x 125 mL	Day 14 - Rep D	✓
10	POL-S	22/09/22			1 x 125 mL	Day 14 - Rep E	✓

ANALYSES REQUIRED

Receipt Temperature (°C) 22

Environmental Division
Vancouver
Work Order Reference
VA22C2842

Telephone : +1 604 253 4188

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

-Preserved with nitric acid

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

RELINQUISHED BY (CLIENT)

CARLEY WINTER (Printed Name) (Signature)

Nautilus Environmental (Company) 22/09/22 (Date DD/MM/YY and Time)

RECEIVED BY (LABORATORY)

(Printed Name) (Signature)

(Company) 9/22 (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

NAUTILUS ENVIRONMENTAL

TESTING LOCATION (Please Circle)

Burnaby (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

Point Edward ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

Chain of Custody

Date_____Page__of__

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/Prov/PC	Burnaby,BC	**City/Prov/PC**	Burnaby,BC
Contact	Rachel Sakurdeep	**Contact**	Nair
Phone	6044208773	**Phone**	6044208773
Email	rachel@nautilusenvironmental.ca	**Email**	nair@nautilusenvironmental.ca
	cwinter@nautilusenvironmental.ca	**PO No.**	2223-028BC

Sample Collection By: **Sample Type:** Grab ( ) OR Composite ( )

	SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: Dissolved Copper	Receipt Temperature (°C)
1	Control Sediment	22/09/22			1 x 125 mL	Day 14 - Rep A	✓	22
2	Control Sediment	22/09/22			1 x 125 mL	Day 14 - Rep B	✓	
3	Control Sediment	22/09/22			1 x 125 mL	Day 14 - Rep C	✓	
4	Control Sediment	22/09/22			1 x 125 mL	Day 14 - Rep D	✓	
5	Control Sediment	22/09/22			1 x 125 mL	Day 14 - Rep E	✓	
6	QUL-LNF1	22/09/22			1 x 125 mL	Day 14 - Rep A	✓	
7	QUL-LNF1	22/09/22			1 x 125 mL	Day 14 - Rep B	✓	
8	QUL-LNF1	22/09/22			1 x 125 mL	Day 14 - Rep C	✓	
9	QUL-LNF1	22/09/22			1 x 125 mL	Day 14 - Rep D	✓	
10	QUL-LNF1	22/09/22			1 x 125 mL	Day 14 - Rep E	✓	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

-Preserved with nitric acid

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

CARLEY WINTER (Printed Name) (Signature)

Nautilus Environmental (Company) 22/09/22 (Date DD/MM/YY and Time)

RECEIVED BY (LABORATORY)

HM (Printed Name) (Signature)

3:20P (Company) 9/22 (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Form 020; Revised by TP 2021/11/17

NAUTILUS ENVIRONMENTAL

TESTING LOCATION (Please Circle)

Burnaby (●)
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary ( )
10823 27 Street SE
Calgary, Alberta, Canada
T2Z 3V9
Phone 403.253.7121

Point Edward ( )
704 Mara Street, Suite 122
Point Edward, Ontario, Canada
N7V 1X4
Phone 519.339.8787

Chain of Custody

Date_____Page__of__

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/Prov/PC	Burnaby,BC	**City/Prov/PC**	Burnaby,BC
Contact	Rachel Sakurdeep	**Contact**	Nair
Phone	6044208773	**Phone**	6044208773
Email	rachel@nautilusenvironmental.ca	**Email**	nair@nautilusenvironmental.ca
	cwinter@nautilusenvironmental.ca	**PO No.**	2223-028BC

Sample Collection By: **Sample Type:** Grab ( ) OR Composite ( )

	SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: Dissolved Copper	Receipt Temperature (°C)
1	BOL-S	22/09/22			1 x 125 mL	Day 14 - Rep A	✓	
2	BOL-S	22/09/22			1 x 125 mL	Day 14 - Rep B	✓	
3	BOL-S	22/09/22			1 x 125 mL	Day 14 - Rep C	✓	
4	BOL-S	22/09/22			1 x 125 mL	Day 14 - Rep D	✓	
5	BOL-S	22/09/22			1 x 125 mL	Day 14 - Rep E	✓	
6								
7								
8								
9								
10								

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

-Preserved with nitric acid

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers		4. Ice Present in Cooler?	Y / N
2. Courier		5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

CARLEY WINTER (Printed Name) (Signature)

Nautilus Environmental 22/09/22
(Company) (Date DD/MM/YY and Time)

RECEIVED BY (LABORATORY)

(Printed Name) (Signature)

(Company) (Date DD/MM/YY and Time)

Our liability is limited to the cost of the test requested. The test results only relate to the sample as received. No liability in whole or in part is assumed for the collection, handling, or transport of the sample, application or interpretation of the test data or results in part or in whole.

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

APPENDIX C – Chain-of-Custody Forms

TESTING LOCATION (Please Circle)

NAUTILUS ENVIRONMENTAL

Burnaby
8664 Commerce Court
Burnaby, British Columbia, Canada
4N7
604.420.8773

Calgary
#4 6125 12th St S.E.
V5A Calgary, Alberta, Canada
Phone T2H 2K1
Phone 403.253.7121

Ch[illegible] of Custody

Date_____Page__1_of_2__

Report to:		**Invoice To:**	
Company	Minnow Environmental	**Company**	Mount Polley Mining Corporation
Address	204-1006 Fort Street	**Address**	PO Box 12
City/State/Zip	Victoria, BC, V8V 3K4	**City/State/Zip**	Likely, BC, V0L 1N0
Contact	Katharina Batchelar	**Contact**	Gabriel Holmes
Phone	250-595-1627 ext. 22	**Phone**	236-317-4939
Email	katchelar@minnow.ca pstecko@minnow.ca	**Email**	gabriel.holmes@mountpolley.com
		PO No.	22-29-7

Sample Collection By: P.Schnurr, S.Lahmer **Sample Type:** **Grab** ○ **OR** **Composite** ○

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 14 day *Hyallela azteca* test	221769	Receipt Temperature (°C)
1	QUL-LNF1_TOX-1_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 1	✓		11.2
2	QUL-LNF1_TOX-2_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 2	✓		
3	QUL-LNF1_TOX-3_2022-08	23 Aug-22	—	sediment	1 x 500 mL glass	rep 3	✓		
4	QUL-LNF1_TOX-4_2022-08	24- Aug-22	—	sediment	1 x 500 mL glass	rep 4	✓		
5	QUL-LNF1_TOX-5_2022-08	24- Aug-22	—	sediment	1 x 500 mL glass	rep 5	✓		
6	QUL-LREF1_TOX-1_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 1	✓		
7	QUL-LREF1_TOX-2_2022-08	23-Aug-22	—	sediment	1 x 500 mL glass	rep 2	✓		
8	QUL-LREF1_TOX-3_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 3	✓		
9	QUL-LREF1_TOX-4_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 4	✓		
10	QUL-LREF1_TOX-5_2022-08	23- Aug-22	—	sediment	1 x 500 mL glass	rep 5	✓		

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Overlying water must be measured for dissolved copper concentrations in each toxicity replicate for all samples. Please contact Katharina Batchelar (kbatchelar@minnow.ca) to discuss.

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	20	4. Ice Present in Cooler?	(Y) N
2. Courier	Vantem	5. Seal Present on Cooler?	Y / (N)
3. Good Condition?	(Y) / N	6. Initials Present on Seal?	Y / (N)

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Printed Name) (Signature)

(Company) (Date and Time)

RECEIVED BY (LABORATORY)

Tyson (Printed Name) TH (Signature)

NautRes (Company) Aug. 30/22 @10:40 (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

TESTING LOCATION (Please Circle)

NAUTILUS ENVIRONMENTAL

Burnaby
8664 Commerce Court
Burnaby, British Columbia, Canada
4N7
604.420.8773

Calgary
#4 6125 12th St S.E.
V5A Calgary, Alberta, Canada
Phone T2H 2K1
Phone 403.253.7121

Ch of Custody

Date_____Page__2_of_2__

Report to:		**Invoice To:**	
Company	Minnow Environmental	**Company**	Mount Polley Mining Corporation
Address	204-1006 Fort Street	**Address**	PO Box 12
City/State/Zip	Victoria, BC, V8V 3K4	**City/State/Zip**	Likely, BC, V0L 1N0
Contact	Katharina Batchelar	**Contact**	Gabriel Holmes
Phone	250-595-1627 ext. 22	**Phone**	236-317-4939
Email	katchelar@minnow.ca pstecko@minnow.ca	**Email**	gabriel.holmes@mountpolley.com
		PO No.	22-29-7

Sample Collection By: P.Schnurr, S.Latimer **Sample Type:** Grab ○ **OR** Composite ○

	SAMPLE ID	DATE	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 14 day *Hyallela azteca* test	22/769	Receipt Temperature (°C)
11	POL-S_TOX-1_2022-08	25-Aug-22	—	sediment	1 x 500 mL glass	rep 1	✓		11.2
12	POL-S_TOX-2_2022-08	25-Aug-22	—	sediment	1 x 500 mL glass	rep 2	✓		
13	POL-S_TOX-3_2022-08	25-Aug-22	—	sediment	1 x 500 mL glass	rep 3	✓		
14	POL-S_TOX-4_2022-08	25-Aug-22	—	sediment	1 x 500 mL glass	rep 4	✓		
15	POL-S_TOX-5_2022-08	25-Aug-22	—	sediment	1 x 500 mL glass	rep 5	✓		
16	BOL-S_TOX-1_2022-08	24-Aug-22	—	sediment	1 x 500 mL glass	rep 1	✓		
17	BOL-S_TOX-2_2022-08	24-Aug-22	—	sediment	1 x 500 mL glass	rep 2	✓		
18	BOL-S_TOX-3_2022-08	24-Aug-22	—	sediment	1 x 500 mL glass	rep 3	✓		
19	BOL-S_TOX-4_2022-08	24-Aug-22	—	sediment	1 x 500 mL glass	rep 4	✓		
20	BOL-S_TOX-5_2022-08	24-Aug-22	—	sediment	1 x 500 mL glass	rep 5	✓		

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Overlying water must be measured for dissolved copper concentrations in each toxicity replicate for all samples. Please contact Katharina Batchelar (kbatchelar@minnow.ca) to discuss.

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	20	4. Ice Present in Cooler?	(Y) / N
2. Courier	Van Kam	5. Seal Present on Cooler?	Y / (N)
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / (N)

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Printed Name) (Signature)

(Company) (Date and Time)

RECEIVED BY (LABORATORY)

Tyrone (Printed Name) TN (Signature)

Nautilus (Company) Aug. 30/22 @ 10:40 (Date and Time)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

PLANKTON COMMUNITY AND PRODUCTIVITY

Biologica Laboratory Reports fp22-078 Freshwater Phytoplankton

(Finalized November 16, 2022)

Freshwater Phytoplankton Enumeration and Identification Methods
Client: Minnow Environmental
Project: Mount Polley 2022

Sample Inventory

Sample arrival: 29-Jun-22; 15-Aug-22; 1-Sept-22
Number of samples: 28 (4, 20, 4)
Number of jars: 28
Biologica project number: fp22-078

Upon arrival, samples were examined, and Lugol's preservative was added to ensure adequate preservation of samples. An inventory form was created and verified with the chain of custody (COC) to ensure (1) all samples are accounted for, (2) each sample has the appropriate number of jars as indicated on the COC. Any discrepancies were reported to the client and were resolved before further sample handling.

Sample Processing

Samples were thoroughly mixed by shaking, and sub-samples (25-50 mL) were dispensed into Utermohl settling chambers and allowed to settle for 24-36 hours (depending on sub-sample volume). Sub-samples were then systematically scanned using a Zeiss Axio Vert A.1 inverted phase-contrast microscope at 400x magnification. All algal units were counted in a series of randomly located fields of view (FOV) until a minimum of 300 units were enumerated. Algal units represent single cells of all algal groups, as well as colonies or filaments of blue-green algae. Given that blue-green algal colonies/filaments may contain hundreds of cells, enumerating units rather than individual cells allows for a more equal representation of algal groups. The mean number of cells per unit (= 1 for single cells, >1 for all other algal forms) was estimated for all taxa and used to calculate total densities. Only "viable" cells (those that appeared to be alive at the time of collection) were identified and enumerated. Chrysophyte loricas were also counted (EPA, 2003).

Algae were identified to genus, where possible, following the most up-to-date taxonomic references and collaborations with international and local algal taxonomic experts. Species-level identifications were only given to identifiable taxa for which there are reliable taxonomic references available that encompass the species-level morphological diversity in North America. This approach ensures the long-term consistency of data sets and is in accordance with the trend in algal taxonomic practice to be more conservative with the delineation of species. Species-level identifications for some taxa are problematic due to widespread phenotypic plasticity that can artificially inflate species richness (Wehr *et al.* 2015). When applicable, the terms "cf." (*confertim*, possibly for species) and "sp.1" (a single undetermined species) were employed to distinguish between different species in the same genus.

Table 1. Summary of phytoplankton samples processed for Minnow Environmental Mount Polley, 2022.

Client Sample ID	Date Sampled	Biologica Sample ID	Subsample Volume (mL)	Fields of View Counted	Sum of Units Counted*
POL-P2_PHYTO-1_2022-06	21-Jun-22	fp22-078-001	50	13	316
BOL-B2_PHYTO-1_2022-06	21-Jun-22	fp22-078-002	25	30	323

Client Sample ID	Date Sampled	Biologica Sample ID	Subsample Volume (mL)	Fields of View Counted	Sum of Units Counted*
QUL-ZOO-7_PHYTO-1_2022-06	22-Jun-22	fp22-078-003	25	35	305
QUL-ZOO-1_PHYTO-1_2022-06	22-Jun-22	fp22-078-004	50	27	317
BOL-B2_PHYTO-1_2022-07	26-Jul-22	fp22-078-029	25	53	314
BOL-B2_PHYTO-2_2022-07	26-Jul-22	fp22-078-030	25	47	313
BOL-B2_PHYTO-3_2022-07	26-Jul-22	fp22-078-031	25	45	305
BOL-B2_PHYTO-4_2022-07	26-Jul-22	fp22-078-032	25	45	311
BOL-B2_PHYTO-5_2022-07	26-Jul-22	fp22-078-033	25	53	299
POL-P2_PHYTO-1_2022-07	25-Jul-22	fp22-078-034	25	15	323
POL-P2_PHYTO-2_2022-07	25-Jul-22	fp22-078-035	25	15	312
POL-P2_PHYTO-3_2022-07	25-Jul-22	fp22-078-036	25	15	312
POL-P2_PHYTO-4_2022-07	25-Jul-22	fp22-078-037	25	13	353
POL-P2_PHYTO-5_2022-07	25-Jul-22	fp22-078-038	25	15	301
QUL-ZOO-1_PHYTO-1_2022-07	27-Jul-22	fp22-078-039	25	13	325
QUL-ZOO-1_PHYTO-2_2022-07	27-Jul-22	fp22-078-040	25	17	317
QUL-ZOO-1_PHYTO-3_2022-07*	28-Jul-22	fp22-078-041	25	13	315
QUL-ZOO-1_PHYTO-4_2022-07	28-Jul-22	fp22-078-042	25	13	362
QUL-ZOO-1_PHYTO-5_2022-07	28-Jul-22	fp22-078-043	25	15	300
QUL-ZOO-7_PHYTO-1_2022-07	27-Jul-22	fp22-078-044	25	20	369
QUL-ZOO-7_PHYTO-2_2022-07	27-Jul-22	fp22-078-045	25	23	317
QUL-ZOO-7_PHYTO-3_2022-07	27-Jul-22	fp22-078-046	25	20	305
QUL-ZOO-7_PHYTO-4_2022-07	27-Jul-22	fp22-078-047	25	20	315
QUL-ZOO-7_PHYTO-5_2022-07	27-Jul-22	fp22-078-048	25	23	309
POL-P2_PHYTO-1_2022-08	25-Aug-22	fp22-078-049	25	30	300
BOL-B2_PHYTO-1_2022-08	28-Aug-22	fp22-078-050	25	80	279
QUL-ZOO-1_PHYTO-1_2022-08*	28-Aug-22	fp22-078-051	25	40	303
QUL-ZOO-7_PHYTO-1_2022-08	28-Aug-22	fp22-078-052	25	60	314

*Algal units represent single cells, colonies, coenobia or filaments.
*QUL-ZOO-1_PHYTO-3_2022-07 labelled as zooplankton but preserved in formalin. Processed as algae.
*QUL-ZOO-1_PHYTO-1_2022-08 algae sample preserved in formalin.

Data

Algal densities expressed as the number of cells per litre (cells/L) were derived for each sample from the sub-sample volume, number of FOV assessed, number of units counted, and number of cells per unit.

QA/QC

Three samples (10% of samples) were reanalyzed to assess sub-sampling and enumeration precision (Table 2). Samples were randomly selected and processed at different times to reduce counting and identification bias.

Table 2. Summary of enumeration QA/QC results for Minnow Environmental Mount Polley, 2022.

Client Sample ID	Biologica Sample ID	Original Density (cells/L)	QA Density (cells/L)	% Agreement
BOL-B2_PHYTO-1_2022-06	fp22-078-002	2,644,518	1,677,273	**84.43**

Client Sample ID	Biologica Sample ID	Original Density (cells/L)	QA Density (cells/L)	% Agreement
POL-P2_PHYTO-5_2022-07	fp22-078-038	5,177,576	6,607,277	**82.53**
QUL-ZOO-7_PHYTO-3_2022-07	fp22-078-046	1,225,803	1,225,803	**100.00**
			Average:	**88.99**

* Percent Agreement: [100- (difference in abundance between samples) / total abundance of the original sample)] %

Results were provided to the Minnow Environmental project manager in Excel spreadsheets via email.

Methodological and Taxonomic References

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-001	fp22-078-002	fp22-078-003	fp22-078-004	fp22-078-029	fp22-078-030	fp22-078-031	fp22-078-032
Client Sample ID							POL-P2_PHYTO-1_2022-06	BOL-B2_PHYTO-1_2022-06	QUL-ZOO-7_PHYTO-1_2022-06	QUL-ZOO-1_PHYTO-1_2022-06	BOL-B2_PHYTO-1_2022-07	BOL-B2_PHYTO-2_2022-07	BOL-B2_PHYTO-3_2022-07	BOL-B2_PHYTO-4_2022-07
Date Sampled							21-Jun-22	21-Jun-22	22-Jun-22	22-Jun-22	26-Jul-22	26-Jul-22	26-Jul-22	26-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	224,892	18,549	32,152			50,048		8,931	23,221
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	68,146	9,275	5,359	20,669	4,466	1,517			1,786
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	1	18,143			2,297	1,489				
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	1,340								
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Didymosphenia geminata	1	4,019								
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	1,489				1,489				
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	0								
Diatoms	Bacillariophyta	Eunotiales	Eunotiaceae	Eunotia sp.	1	20,186	12,366		4,593		1,517	1,710		
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	1	75,022								
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	149,523				1,489				
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		105,171		10,717	6,890					
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	19,831						3,420		
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	18,755		18,755						
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria ulna	1	6,183	6,183							
Diatoms	Bacillariophyta	Naviculales	Sellaphoraceae	Sellaphora sp.	1	1,517								
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	1	682,648		109,853				10,261	21,435	3,572
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	2,344								
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Tabellaria fenestrata	1	168,933					6,066	34,204	32,152	19,649
Diatoms	Bacillariophyta	Rhizosoleniales	Rhizosoleniaceae	Urosolenia eriensis	1	21,779			4,593	1,489				
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	2,679								
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.		623,465		13,397	4,593	14,885	3,033	15,392	3,572	3,572
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella cf. atomus	1	357,092	21,641			2,977				
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Lindavia sp.	1	6,606					3,033		3,572	
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	1	16,811		10,717					1,786	1,786
Diatoms	Bacillariophyta			Centric diatom		1,662,793	442,093	10,717	43,635	86,335	4,550	3,420		
				Total Diatoms		**4,259,368**	**510,107**	**211,669**	**87,270**	**114,617**	**69,764**	**68,409**	**71,449**	**53,587**
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	1	9,532								
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Staurastrum sp.	1	3,303					1,517			1,786
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix gelatinosa	1	34,468						3,420		3,572
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix sp.		85,448		24,114				1,710	3,572	
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix viridis	1	53,848	12,366							
Green Algae	Chlorophyta	Chlamydomonadales	Sphaerocystidaceae	Sphaerocystis sp.	1	1,941,671		21,435			13,650	13,682	28,580	33,938
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Nephrocytium sp.	1	168,331								
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	713,404	34,007	10,717	4,593	4,466	30,332	37,625	16,076	39,297
Green Algae	Chlorophyta	Prasiolales	Prasiolaceae	Stichococcus sp.	1	65,036				2,977				
Green Algae	Chlorophyta	Pyramimonadales	Pyramimonadaceae	Pyramimonas sp.	1	15,360		8,038			1,517			1,786
Green Algae	Chlorophyta	Sphaeropleales	Characiaceae	Ankyra sp.	1	312,705		5,359			10,616	20,523	14,290	21,435
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediastrum boryanum	1	7,583					7,583			
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetraedron sp.	1	8,676				1,489				
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Coelastrum sp.	1	0								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	16,076								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus arcuatus	1	169,359								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.		72,683			22,966	41,679				
Green Algae	Chlorophyta	Sphaeropleales	Schizochlamydaceae	Planktosphaeria sp.	1	39,378		5,359				5,131	1,786	
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	1	195,318	185,493	5,359		4,466				
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.		62,583	21,641		4,593	1,489		5,131		1,786
Green Algae	Chlorophyta	Trebouxiales	Botryococcaceae	Botryococcus sp.	1	93,264						71,829		21,435
Green Algae	Chlorophyta	Trebouxiophyceae ordo incertae sedis	Trebouxiophyceae incertae sedis	Crucigenia sp.	1	261,974			9,186			6,841		
Green Algae	Chlorophyta			Chlorophyte		49,742					1,517	6,841		
				Total Green Algae		**4,379,742**	**253,508**	**80,381**	**41,339**	**56,564**	**66,731**	**172,733**	**64,304**	**125,036**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-001	fp22-078-002	fp22-078-003	fp22-078-004	fp22-078-029	fp22-078-030	fp22-078-031	fp22-078-032
Client Sample ID							POL-P2_PHYTO-1_2022-06	BOL-B2_PHYTO-1_2022-06	QUL-ZOO-7_PHYTO-1_2022-06	QUL-ZOO-1_PHYTO-1_2022-06	BOL-B2_PHYTO-1_2022-07	BOL-B2_PHYTO-2_2022-07	BOL-B2_PHYTO-3_2022-07	BOL-B2_PHYTO-4_2022-07
Date Sampled							21-Jun-22	21-Jun-22	22-Jun-22	22-Jun-22	26-Jul-22	26-Jul-22	26-Jul-22	26-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Golden Algae	Haptophyta	Prymnesiales	Chrysochromulinaceae	Chrysochromulina sp.	1	271,359	12,366	26,794	13,780	35,725	7,583	3,420	1,786	10,717
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Chromulina sp.	1	14,210			9,186					
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Uroglena sp.	1	10,121,266	9,275	5,359	6,890		40,949	13,682	28,580	23,221
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Chrysolykos sp.	1	55,379			6,890					
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon borgei	1	49,426			13,780	8,931				
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon crenulatum	1	226,800			25,262	11,908				
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon divergens	1	3,260,808			6,890	8,931		17,102		
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon sp.		1,124,947		2,679	34,449	14,885	1,517			3,572
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Epipyxis sp.	1	16,700							1,786	
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Kephyrion/Pseudokephyrion sp.	1	250,778			2,297	20,839				
Golden Algae	Ochrophyta	Hibberdinales	Stylococcaceae	Bitrichia sp.	1	6,029								
Golden Algae	Ochrophyta	Pedinellales	Pedinellaceae	Pseudopedinella sp.	1	168,125	12,366	13,397	2,297	5,954		1,710	1,786	1,786
Golden Algae	Ochrophyta	Phaeothamniales	Phaeothamniaceae	Stichogloea sp.	1	1,362,752		32,152			100,096	148,789	171,478	153,616
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas akrokomos	1	8,762						1,710		
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas sp.		374,542	3,092	238,462	22,966	13,397	10,616	10,261	16,076	14,290
Golden Algae	Ochrophyta	Synurales	Synuraceae	Spiniferomonas sp.	1	1,517								
Golden Algae	Ochrophyta	Synurales	Synuraceae	Synura sp.	1	153,207			142,388			1,710	3,572	
Golden Algae	Ochrophyta			Chrysophyte		139,201			32,152	7,443				
				Total Golden Algae		**17,605,807**	**37,099**	**318,843**	**319,225**	**128,013**	**160,761**	**198,386**	**225,065**	**207,203**
Cryptomonads	Cryptophyta	Cryptomonadales	Cryptomonadaceae	Cryptomonas sp.	1	523,654	6,183	42,870	13,780	7,443	19,716	20,523	21,435	23,221
Cryptomonads	Cryptophyta	Pyrenomonadales	Geminigeraceae	Plagioselmis nanoplanctica	1	4,338,590	160,761	174,158	183,727	120,571	119,812	102,613	130,395	128,609
Cryptomonads	Katablepharidophyta	Katablepharidales	Katablepharidaceae	Katablepharis ovalis	1	31,089		10,717			3,033		1,786	
				Total Cryptomonads		**4,893,333**	**166,944**	**227,745**	**197,506**	**128,013**	**142,562**	**123,136**	**153,616**	**151,830**
Euglenoids	Euglenozoa	Euglenida	Euglenidae	Trachelomonas sp.	1	2,010								
				Total Euglenoids		**2,010**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	1	13,380,249		160,761			932,717	1,559,724	1,157,479	1,196,379
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	165,117					18,199			25,007
Blue-green Algae	Cyanophyta	Chroococcales	Gomphosphaeriaceae	Gomphosphaeria sp.	1	310,835						34,204		
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Aphanizomenon sp.	1	522,780						129,977		
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Dolichospermum sp.	1	5,643,629	52,556		11,483		74,314	128,267	144,685	55,373
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelomoron sp.	1	11,139,030								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelosphaerium sp.	1	1,140,291					197,160			
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Snowella sp.	1	50,908								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Woronichinia sp.	1	180,856								
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	1	2,202,527		1,071,740			84,930		176,837	107,174
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	77,869								
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Cyanodictyon sp.	1	2,918,502					166,827	1,668,038	535,870	1,786
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Synechococcus sp.	1	101,608			18,373	43,167				
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		28,983					6,066	6,841		
				Total Blue-green Algae		**37,863,183**	**52,556**	**1,232,501**	**29,856**	**43,167**	**1,480,215**	**3,527,051**	**2,014,871**	**1,385,720**
Dinoflagellates	Miozoa	Gonyaulacales	Ceratiaceae	Ceratium hirundinella	1	18,557					1,517	3,420		3,572
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium fuscum	1	5,771	3,092	2,679						
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium sp.		82,818	3,092	5,359	29,856	1,489			1,786	1,786
Dinoflagellates	Miozoa	Peridiniales	Peridiniaceae	Peridinium sp.	1	19,097		2,679	4,593					
				Total Dinoflagellates		**126,242**	**6,183**	**10,717**	**34,449**	**1,489**	**1,517**	**3,420**	**1,786**	**5,359**
				Total Phytoplankton		**69,129,685**	**1,026,397**	**2,081,855**	**709,645**	**471,863**	**1,921,549**	**4,093,135**	**2,531,093**	**1,928,735**
				Total Unique Taxa	**76**		**16**	**27**	**27**	**22**	**27**	**28**	**26**	**29**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-033	fp22-078-034	fp22-078-035	fp22-078-036	fp22-078-037	fp22-078-038	fp22-078-039	fp22-078-040
Client Sample ID							BOL-B2_PHYTO-5_2022-07	POL-P2_PHYTO-1_2022-07	POL-P2_PHYTO-2_2022-07	POL-P2_PHYTO-3_2022-07	POL-P2_PHYTO-4_2022-07	POL-P2_PHYTO-5_2022-07	QUL-ZOO-1_PHYTO-1_2022-07	QUL-ZOO-1_PHYTO-2_2022-07
Date Sampled							26-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	27-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	224,892	4,550							18,913
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	68,146		5,359						
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	1	18,143								
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	1,340								
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Didymosphenia geminata	1	4,019								
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	1,489								
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	0								
Diatoms	Bacillariophyta	Eunotiales	Eunotiaceae	Eunotia sp.	1	20,186								
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	1	75,022			75,022					
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	149,523								
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		105,171		42,870	5,359	10,717		10,717		4,728
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	19,831								
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	18,755								
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria ulna	1	6,183								
Diatoms	Bacillariophyta	Naviculales	Sellaphoraceae	Sellaphora sp.	1	1,517	1,517							
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	1	682,648	1,517	155,402	37,511	123,250	6,183	64,304	18,549	66,196
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	2,344								
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Tabellaria fenestrata	1	168,933	3,033			5,359				
Diatoms	Bacillariophyta	Rhizosoleniales	Rhizosoleniaceae	Urosolenia eriensis	1	21,779								
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	2,679								
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.		623,465	6,066	32,152	21,435	48,228	30,916	37,511	24,732	23,641
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella cf. atomus	1	357,092							61,831	14,185
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Lindavia sp.	1	6,606								
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	1	16,811	1,517							
Diatoms	Bacillariophyta			Centric diatom		1,662,793	1,517	21,435	5,359	10,717	6,183	16,076	111,296	99,294
				Total Diatoms		**4,259,368**	**19,716**	**257,218**	**144,685**	**198,272**	**43,282**	**128,609**	**216,409**	**226,957**
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	1	9,532							6,183	
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Staurastrum sp.	1	3,303								
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix gelatinosa	1	34,468	6,066					5,359	12,366	
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix sp.		85,448		10,717	5,359	5,359				
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix viridis	1	53,848							12,366	18,913
Green Algae	Chlorophyta	Chlamydomonadales	Sphaerocystidaceae	Sphaerocystis sp.	1	1,941,671	15,166	294,728	316,163	348,315	408,086	187,554		4,728
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Nephrocytium sp.	1	168,331	1,517			42,870	24,732			9,457
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	713,404	65,214	21,435	53,587	32,152	80,380	107,174	12,366	4,728
Green Algae	Chlorophyta	Prasiolales	Prasiolaceae	Stichococcus sp.	1	65,036							18,549	4,728
Green Algae	Chlorophyta	Pyramimonadales	Pyramimonadaceae	Pyramimonas sp.	1	15,360								
Green Algae	Chlorophyta	Sphaeropleales	Characiaceae	Ankyra sp.	1	312,705	18,199	48,228	42,870	37,511	49,465	32,152		
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediastrum boryanum	1	7,583								
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetraedron sp.	1	8,676								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Coelastrum sp.	1	0								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	16,076								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus arcuatus	1	169,359	3,033				61,831			
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.		72,683								
Green Algae	Chlorophyta	Sphaeropleales	Schizochlamydaceae	Planktosphaeria sp.	1	39,378			10,717					
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	1	195,318								
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.		62,583			5,359	5,359				
Green Algae	Chlorophyta	Trebouxiales	Botryococcaceae	Botryococcus sp.	1	93,264								
Green Algae	Chlorophyta	Trebouxiophyceae ordo incertae sedis	Trebouxiophyceae incertae sedis	Crucigenia sp.	1	261,974	15,166							
Green Algae	Chlorophyta			Chlorophyte		49,742	7,583		5,359		12,366	16,076		
				Total Green Algae		**4,379,742**	**131,945**	**375,109**	**439,413**	**471,566**	**636,861**	**348,315**	**61,831**	**42,554**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-033	fp22-078-034	fp22-078-035	fp22-078-036	fp22-078-037	fp22-078-038	fp22-078-039	fp22-078-040
Client Sample ID							BOL-B2_PHYTO-5_2022-07	POL-P2_PHYTO-1_2022-07	POL-P2_PHYTO-2_2022-07	POL-P2_PHYTO-3_2022-07	POL-P2_PHYTO-4_2022-07	POL-P2_PHYTO-5_2022-07	QUL-ZOO-1_PHYTO-1_2022-07	QUL-ZOO-1_PHYTO-2_2022-07
Date Sampled							26-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	27-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Golden Algae	Haptophyta	Prymnesiales	Chrysochromulinaceae	Chrysochromulina sp.	1	271,359	13,650		5,359					9,457
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Chromulina sp.	1	14,210								
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Uroglena sp.	1	10,121,266	31,849		42,870	5,359	6,183	5,359	1,255,172	955,109
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Chrysolykos sp.	1	55,379								4,728
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon borgei	1	49,426							6,183	
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon crenulatum	1	226,800							12,366	23,641
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon divergens	1	3,260,808		637,685	476,924	530,511	809,988	530,511	18,549	18,913
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon sp.		1,124,947		96,457	155,402	64,304	352,438	128,609	24,732	23,641
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Epipyxis sp.	1	16,700	1,517							
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Kephyrion/Pseudokephyrion sp.	1	250,778							18,549	4,728
Golden Algae	Ochrophyta	Hibberdinales	Stylococcaceae	Bitrichia sp.	1	6,029								
Golden Algae	Ochrophyta	Pedinellales	Pedinellaceae	Pseudopedinella sp.	1	168,125	1,517						24,732	
Golden Algae	Ochrophyta	Phaeothamniales	Phaeothamniaceae	Stichogloea sp.	1	1,362,752	43,982	69,663	160,761	107,174	6,183	123,250	6,183	
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas akrokomos	1	8,762	3,033							
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas sp.		374,542	9,100						6,183	
Golden Algae	Ochrophyta	Synurales	Synuraceae	Spiniferomonas sp.	1	1,517	1,517							
Golden Algae	Ochrophyta	Synurales	Synuraceae	Synura sp.	1	153,207	1,517							
Golden Algae	Ochrophyta			Chrysophyte		139,201							43,282	
				Total Golden Algae		**17,605,807**	**107,680**	**803,805**	**841,316**	**707,348**	**1,174,792**	**787,729**	**1,415,933**	**1,040,218**
Cryptomonads	Cryptophyta	Cryptomonadales	Cryptomonadaceae	Cryptomonas sp.	1	523,654	16,683	21,435	26,793	16,076	18,549	42,870	49,465	18,913
Cryptomonads	Cryptophyta	Pyrenomonadales	Geminigeraceae	Plagioselmis nanoplanctica	1	4,338,590	134,979	230,424	176,837	230,424	148,395	246,500	247,325	170,218
Cryptomonads	Katablepharidophyta	Katablepharidales	Katablepharidaceae	Katablepharis ovalis	1	31,089								
				Total Cryptomonads		**4,893,333**	**151,661**	**251,859**	**203,631**	**246,500**	**166,944**	**289,370**	**296,790**	**189,131**
Euglenoids	Euglenozoa	Euglenida	Euglenidae	Trachelomonas sp.	1	2,010								
				Total Euglenoids		**2,010**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	1	13,380,249	2,476,413			1,270,012	1,706,540	1,067,453		
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	165,117			42,870					
Blue-green Algae	Cyanophyta	Chroococcales	Gomphosphaeriaceae	Gomphosphaeria sp.	1	310,835	131,945							
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Aphanizomenon sp.	1	522,780	71,281		96,457	166,120				
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Dolichospermum sp.	1	5,643,629	27,299	1,328,958	852,033	573,381	1,693,290	300,087	61,831	
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelomoron sp.	1	11,139,030		1,018,153			1,187,158	2,250,654		
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelosphaerium sp.	1	1,140,291			482,283	300,087				
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Snowella sp.	1	50,908								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Woronichinia sp.	1	180,856								
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	1	2,202,527	145,595		428,696					
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	77,869								
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Cyanodictyon sp.	1	2,918,502	545,981							
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Synechococcus sp.	1	101,608							6,183	
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		28,983								
				Total Blue-green Algae		**37,863,183**	**3,398,514**	**2,347,111**	**1,902,338**	**2,309,600**	**4,586,988**	**3,618,194**	**68,014**	**0**
Dinoflagellates	Miozoa	Gonyaulacales	Ceratiaceae	Ceratium hirundinella	1	18,557						5,359		
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium fuscum	1	5,771								
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium sp.		82,818							6,183	
Dinoflagellates	Miozoa	Peridiniales	Peridiniaceae	Peridinium sp.	1	19,097								
				Total Dinoflagellates		**126,242**	**0**	**0**	**0**	**0**	**0**	**5,359**	**6,183**	**0**
				Total Phytoplankton		**69,129,685**	**3,809,516**	**4,035,101**	**3,531,383**	**3,933,286**	**6,608,867**	**5,177,576**	**2,065,161**	**1,498,860**
				Total Unique Taxa	**76**		**29**	**14**	**20**	**19**	**15**	**16**	**20**	**17**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-041	fp22-078-042	fp22-078-043	fp22-078-044	fp22-078-045	fp22-078-046	fp22-078-047	fp22-078-048
Client Sample ID							QUL-ZOO-1_PHYTO-3_2022-07	QUL-ZOO-1_PHYTO-4_2022-07	QUL-ZOO-1_PHYTO-5_2022-07	QUL-ZOO-7_PHYTO-1_2022-07	QUL-ZOO-7_PHYTO-2_2022-07	QUL-ZOO-7_PHYTO-3_2022-07	QUL-ZOO-7_PHYTO-4_2022-07	QUL-ZOO-7_PHYTO-5_2022-07
Date Sampled							28-Jul-22	28-Jul-22	28-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	224,892			21,435		13,979	8,038		6,990
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	68,146				4,019	3,495			3,495
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	1	18,143					6,990			
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	1,340								
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Didymosphenia geminata	1	4,019							4,019	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	1,489								
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	0								
Diatoms	Bacillariophyta	Eunotiales	Eunotiaceae	Eunotia sp.	1	20,186								
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	1	75,022								
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	149,523			5,359			4,019	8,038	
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		105,171		6,183			6,990			
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	19,831								
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	18,755								
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria ulna	1	6,183								
Diatoms	Bacillariophyta	Naviculales	Sellaphoraceae	Sellaphora sp.	1	1,517								
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	1	682,648		12,366		12,057		8,038		
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	2,344								
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Tabellaria fenestrata	1	168,933				20,095	3,495		8,038	
Diatoms	Bacillariophyta	Rhizosoleniales	Rhizosoleniaceae	Urosolenia eriensis	1	21,779			5,359					6,990
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	2,679								
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.		623,465	24,732	37,099	26,793	8,038	27,958	28,133	52,247	48,927
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella cf. atomus	1	357,092		18,549	26,793	16,076	24,464	12,057	20,095	10,484
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Lindavia sp.	1	6,606								
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	1	16,811								
Diatoms	Bacillariophyta			Centric diatom		1,662,793	92,747	49,465	80,380	28,133	52,422	88,419	100,476	80,380
				Total Diatoms		**4,259,368**	**117,479**	**123,662**	**166,120**	**88,419**	**139,792**	**148,704**	**192,913**	**157,266**
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	1	9,532								
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Staurastrum sp.	1	3,303								
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix gelatinosa	1	34,468								
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix sp.		85,448	6,183	6,183				16,076		3,495
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix viridis	1	53,848	6,183			4,019				
Green Algae	Chlorophyta	Chlamydomonadales	Sphaerocystidaceae	Sphaerocystis sp.	1	1,941,671				4,019	6,990			3,495
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Nephrocytium sp.	1	168,331	6,183	12,366	10,717	24,114	6,990	12,057		13,979
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	713,404	24,732		5,359	12,057	6,990	24,114	8,038	38,443
Green Algae	Chlorophyta	Prasiolales	Prasiolaceae	Stichococcus sp.	1	65,036	12,366				3,495	4,019	12,057	3,495
Green Algae	Chlorophyta	Pyramimonadales	Pyramimonadaceae	Pyramimonas sp.	1	15,360							4,019	
Green Algae	Chlorophyta	Sphaeropleales	Characiaceae	Ankyra sp.	1	312,705						4,019		
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediastrum boryanum	1	7,583								
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetraedron sp.	1	8,676		6,183						
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Coelastrum sp.	1	0								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	16,076								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus arcuatus	1	169,359								
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.		72,683						8,038		
Green Algae	Chlorophyta	Sphaeropleales	Schizochlamydaceae	Planktosphaeria sp.	1	39,378	12,366						4,019	
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	1	195,318								
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.		62,583					3,495		8,038	
Green Algae	Chlorophyta	Trebouxiales	Botryococcaceae	Botryococcus sp.	1	93,264								
Green Algae	Chlorophyta	Trebouxiophyceae ordo incertae sedis	Trebouxiophyceae incertae sedis	Crucigenia sp.	1	261,974		24,732		32,152	13,979		64,304	27,958
Green Algae	Chlorophyta			Chlorophyte		49,742								
				Total Green Algae		**4,379,742**	**68,014**	**49,465**	**16,076**	**76,361**	**41,938**	**68,323**	**100,476**	**90,865**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-041	fp22-078-042	fp22-078-043	fp22-078-044	fp22-078-045	fp22-078-046	fp22-078-047	fp22-078-048
Client Sample ID							QUL-ZOO-1_PHYTO-3_2022-07	QUL-ZOO-1_PHYTO-4_2022-07	QUL-ZOO-1_PHYTO-5_2022-07	QUL-ZOO-7_PHYTO-1_2022-07	QUL-ZOO-7_PHYTO-2_2022-07	QUL-ZOO-7_PHYTO-3_2022-07	QUL-ZOO-7_PHYTO-4_2022-07	QUL-ZOO-7_PHYTO-5_2022-07
Date Sampled							28-Jul-22	28-Jul-22	28-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Golden Algae	Haptophyta	Prymnesiales	Chrysochromulinaceae	Chrysochromulina sp.	1	271,359		12,366	32,152	4,019	38,443	12,057	8,038	20,969
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Chromulina sp.	1	14,210						4,019		
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Uroglena sp.	1	10,121,266	1,601,427	1,756,005	1,018,153	1,077,099	548,684	643,044	558,644	475,293
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Chrysolykos sp.	1	55,379	6,183	6,183	5,359	8,038	3,495	4,019		10,484
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon borgei	1	49,426				4,019	3,495		4,019	6,990
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon crenulatum	1	226,800	6,183	30,916	37,511	8,038	10,484	16,076	12,057	20,969
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon divergens	1	3,260,808		24,732	21,435	24,114	17,474	36,171	44,209	27,958
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon sp.		1,124,947	24,732	49,465	26,793	12,057	27,958	28,133	12,057	20,969
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Epipyxis sp.	1	16,700								
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Kephyrion/Pseudokephyrion sp.	1	250,778	43,282	30,916	26,793	16,076	27,958	4,019	20,095	17,474
Golden Algae	Ochrophyta	Hibberdinales	Stylococcaceae	Bitrichia sp.	1	6,029								
Golden Algae	Ochrophyta	Pedinellales	Pedinellaceae	Pseudopedinella sp.	1	168,125	6,183	18,549	32,152	16,076		8,038	12,057	3,495
Golden Algae	Ochrophyta	Phaeothamniales	Phaeothamniaceae	Stichogloea sp.	1	1,362,752					6,990		8,038	
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas akrokomos	1	8,762								
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas sp.		374,542			5,359		3,495	4,019	4,019	3,495
Golden Algae	Ochrophyta	Synurales	Synuraceae	Spiniferomonas sp.	1	1,517								
Golden Algae	Ochrophyta	Synurales	Synuraceae	Synura sp.	1	153,207				4,019				
Golden Algae	Ochrophyta			Chrysophyte		139,201					10,484	16,076	20,095	6,990
				Total Golden Algae		**17,605,807**	**1,687,990**	**1,929,132**	**1,205,707**	**1,173,555**	**698,961**	**775,672**	**703,329**	**615,086**
Cryptomonads	Cryptophyta	Cryptomonadales	Cryptomonadaceae	Cryptomonas sp.	1	523,654		18,549	10,717	4,019	6,990		28,133	20,969
Cryptomonads	Cryptophyta	Pyrenomonadales	Geminigeraceae	Plagioselmis nanoplanctica	1	4,338,590	74,197	105,113	198,272	136,647	206,193	217,027	237,122	171,245
Cryptomonads	Katablepharidophyta	Katablepharidales	Katablepharidaceae	Katablepharis ovalis	1	31,089						12,057		3,495
				Total Cryptomonads		**4,893,333**	**74,197**	**123,662**	**208,989**	**140,666**	**213,183**	**229,084**	**265,256**	**195,709**
Euglenoids	Euglenozoa	Euglenida	Euglenidae	Trachelomonas sp.	1	2,010								
				Total Euglenoids		**2,010**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	1	13,380,249								
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	165,117								
Blue-green Algae	Cyanophyta	Chroococcales	Gomphosphaeriaceae	Gomphosphaeria sp.	1	310,835								
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Aphanizomenon sp.	1	522,780								
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Dolichospermum sp.	1	5,643,629		18,549						
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelomoron sp.	1	11,139,030								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelosphaerium sp.	1	1,140,291								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Snowella sp.	1	50,908								
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Woronichinia sp.	1	180,856								
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	1	2,202,527								
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	77,869				32,152				
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Cyanodictyon sp.	1	2,918,502								
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Synechococcus sp.	1	101,608					3,495	4,019		13,979
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		28,983							16,076	
				Total Blue-green Algae		**37,863,183**	**0**	**18,549**	**0**	**32,152**	**3,495**	**4,019**	**16,076**	**13,979**
Dinoflagellates	Miozoa	Gonyaulacales	Ceratiaceae	Ceratium hirundinella	1	18,557								
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium fuscum	1	5,771								
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium sp.		82,818		6,183	10,717		3,495			3,495
Dinoflagellates	Miozoa	Peridiniales	Peridiniaceae	Peridinium sp.	1	19,097					6,990			3,495
				Total Dinoflagellates		**126,242**	**0**	**6,183**	**10,717**	**0**	**10,484**	**0**	**0**	**6,990**
				Total Phytoplankton		**69,129,685**	**1,947,681**	**2,250,654**	**1,607,610**	**1,511,153**	**1,107,853**	**1,225,803**	**1,278,050**	**1,079,895**
				Total Unique Taxa	**76**		**12**	**18**	**17**	**21**	**26**	**22**	**21**	**25**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-049	fp22-078-050	fp22-078-051	fp22-078-052	fp22-078-002-QA	fp22-078-038-QA	fp22-078-046-QA
Client Sample ID							POL-P2_PHYTO-1_2022-08	BOL-B2_PHYTO-1_2022-08	QUL-ZOO-1_PHYTO-1_2022-08	QUL-ZOO-7_PHYTO-1_2022-08	BOL-B2_PHYTO-1_2022-06-QA	POL-P2_PHYTO-5_2022-07-QA	QUL-ZOO-7_PHYTO-3_2022-07-QA
Date Sampled							25-Aug-22	28-Aug-22	28-Aug-22	28-Aug-22	21-Jun-22	25-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	224,892	5,359	2,010		10,717	58,946		
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	68,146		4,019	2,010	2,679	5,359		8,038
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	1	18,143		6,029		1,340	5,359		
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	1,340				1,340			
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Didymosphenia geminata	1	4,019							
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	1,489							
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	0							4,019
Diatoms	Bacillariophyta	Eunotiales	Eunotiaceae	Eunotia sp.	1	20,186							
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	1	75,022							
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	149,523			78,371	52,247			
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		105,171					10,717	5,359	
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	19,831	13,397	3,014					
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	18,755					2,679		
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria ulna	1	6,183							
Diatoms	Bacillariophyta	Naviculales	Sellaphoraceae	Sellaphora sp.	1	1,517							
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	1	682,648	8,038	8,038	16,076		42,870	42,870	
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	2,344		1,005		1,340			
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Tabellaria fenestrata	1	168,933		2,010	4,019	30,813	8,038		
Diatoms	Bacillariophyta	Rhizosoleniales	Rhizosoleniaceae	Urosolenia eriensis	1	21,779			2,010	1,340			
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	2,679	2,679						
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.		623,465	21,435		46,219	18,755	16,076	32,152	24,114
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella cf. atomus	1	357,092			78,371	49,568	10,717		28,133
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Lindavia sp.	1	6,606							
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	1	16,811		1,005			13,397		
Diatoms	Bacillariophyta			Centric diatom		1,662,793	2,679	8,038	156,742	60,285	18,755	32,152	44,209
				Total Diatoms		**4,259,368**	**53,587**	**35,166**	**383,817**	**230,424**	**192,913**	**112,533**	**108,514**
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	1	9,532			2,010	1,340			
Green Algae	Charophyta	Desmidiales	Desmidiaceae	Staurastrum sp.	1	3,303							
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix gelatinosa	1	34,468		1,005		2,679			
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix sp.		85,448				2,679	16,076		4,019
Green Algae	Charophyta	Klebsormidiales	Elakatotrichaceae	Elakatothrix viridis	1	53,848					21,435		
Green Algae	Chlorophyta	Chlamydomonadales	Sphaerocystidaceae	Sphaerocystis sp.	1	1,941,671	158,082	76,361		6,698	32,152	434,055	
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Nephrocytium sp.	1	168,331		2,010		1,340			4,019
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	713,404	10,717	16,076	10,048	2,679	10,717	21,435	8,038
Green Algae	Chlorophyta	Prasiolales	Prasiolaceae	Stichococcus sp.	1	65,036			2,010	1,340			
Green Algae	Chlorophyta	Pyramimonadales	Pyramimonadaceae	Pyramimonas sp.	1	15,360					2,679		
Green Algae	Chlorophyta	Sphaeropleales	Characiaceae	Ankyra sp.	1	312,705	8,038				8,038	48,228	
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediastrum boryanum	1	7,583							
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetraedron sp.	1	8,676		1,005					4,019
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Coelastrum sp.	1	0					21,435		
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	16,076			16,076				
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus arcuatus	1	169,359	72,342	32,152					
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.		72,683							
Green Algae	Chlorophyta	Sphaeropleales	Schizochlamydaceae	Planktosphaeria sp.	1	39,378					2,679		
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	1	195,318					5,359		
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.		62,583	2,679	1,005	2,010		13,397	10,717	
Green Algae	Chlorophyta	Trebouxiales	Botryococcaceae	Botryococcus sp.	1	93,264							
Green Algae	Chlorophyta	Trebouxiophyceae ordo incertae sedis	Trebouxiophyceae incertae sedis	Crucigenia sp.	1	261,974			46,219	21,435			
Green Algae	Chlorophyta			Chlorophyte		49,742					2,679		
				Total Green Algae		**4,379,742**	**251,859**	**129,614**	**78,371**	**40,190**	**136,647**	**514,435**	**20,095**

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Total phytoplankton density (cells/L) for Minnow Environmental Mount Polley Phytoplankton, 2022

Biologica Sample ID							fp22-078-049	fp22-078-050	fp22-078-051	fp22-078-052	fp22-078-002-QA	fp22-078-038-QA	fp22-078-046-QA
Client Sample ID							POL-P2_PHYTO-1_2022-08	BOL-B2_PHYTO-1_2022-08	QUL-ZOO-1_PHYTO-1_2022-08	QUL-ZOO-7_PHYTO-1_2022-08	BOL-B2_PHYTO-1_2022-06-QA	POL-P2_PHYTO-5_2022-07-QA	QUL-ZOO-7_PHYTO-3_2022-07-QA
Date Sampled							25-Aug-22	28-Aug-22	28-Aug-22	28-Aug-22	21-Jun-22	25-Jul-22	27-Jul-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)	(cells/L)
Golden Algae	Haptophyta	Prymnesiales	Chrysochromulinaceae	Chrysochromulina sp.	1	271,359				2,679	13,397	10,717	32,152
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Chromulina sp.	1	14,210		1,005					
Golden Algae	Ochrophyta	Chromulinales	Chromulinaceae	Uroglena sp.	1	10,121,266		13,062				5,359	590,797
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Chrysolykos sp.	1	55,379							8,038
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon borgei	1	49,426			2,010				
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon crenulatum	1	226,800			2,010	9,378			12,057
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon divergens	1	3,260,808			6,029	2,679		455,489	60,285
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Dinobryon sp.		1,124,947	2,679	8,038	8,038	1,340		101,815	8,038
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Epipyxis sp.	1	16,700	13,397						
Golden Algae	Ochrophyta	Chromulinales	Dinobryaceae	Kephyrion/Pseudokephyrion sp.	1	250,778		7,033	4,019	6,698			12,057
Golden Algae	Ochrophyta	Hibberdinales	Stylococcaceae	Bitrichia sp.	1	6,029	2,679	2,010		1,340			
Golden Algae	Ochrophyta	Pedinellales	Pedinellaceae	Pseudopedinella sp.	1	168,125			6,029		10,717		4,019
Golden Algae	Ochrophyta	Phaeothamniales	Phaeothamniaceae	Stichogloea sp.	1	1,362,752	174,158		38,181	12,057	53,587	150,044	
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas akrokomos	1	8,762		4,019					
Golden Algae	Ochrophyta	Synurales	Mallomonadaceae	Mallomonas sp.		374,542		1,005	6,029	2,679	243,821		4,019
Golden Algae	Ochrophyta	Synurales	Synuraceae	Spiniferomonas sp.	1	1,517							
Golden Algae	Ochrophyta	Synurales	Synuraceae	Synura sp.	1	153,207							
Golden Algae	Ochrophyta			Chrysophyte		139,201				2,679			24,114
				Total Golden Algae		**17,605,807**	**192,913**	**36,171**	**72,342**	**41,530**	**321,522**	**723,424**	**755,577**
Cryptomonads	Cryptophyta	Cryptomonadales	Cryptomonadaceae	Cryptomonas sp.	1	523,654	10,717	10,048	26,124	21,435	34,832	26,793	8,038
Cryptomonads	Cryptophyta	Pyrenomonadales	Geminigeraceae	Plagioselmis nanoplanctica	1	4,338,590	144,685	35,166	32,152	75,022	198,272	203,631	261,237
Cryptomonads	Katablepharidophyta	Katablepharidales	Katablepharidaceae	Katablepharis ovalis	1	31,089					5,359		4,019
				Total Cryptomonads		**4,893,333**	**155,402**	**45,214**	**58,276**	**96,457**	**238,462**	**230,424**	**273,294**
Euglenoids	Euglenozoa	Euglenida	Euglenidae	Trachelomonas sp.	1	2,010		2,010					
				Total Euglenoids		**2,010**	**0**	**2,010**	**0**	**0**	**0**	**0**	**0**
Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	1	13,380,249	1,028,870	823,900			187,555	2,625,763	
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	165,117	26,794		32,152	20,095			
Blue-green Algae	Cyanophyta	Chroococcales	Gomphosphaeriaceae	Gomphosphaeria sp.	1	310,835	144,685						
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Aphanizomenon sp.	1	522,780	58,946						
Blue-green Algae	Cyanophyta	Nostocales	Aphanizomenonaceae	Dolichospermum sp.	1	5,643,629	321,522				8,038	235,783	68,323
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelomoron sp.	1	11,139,030	6,683,064					1,607,610	
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Coelosphaerium sp.	1	1,140,291	160,761						
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Snowella sp.	1	50,908	50,908						
Blue-green Algae	Cyanophyta	Synechococcales	Coelosphaeriaceae	Woronichinia sp.	1	180,856		180,856					
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	1	2,202,527	107,174	80,381			669,838		
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	77,869		45,716					
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Cyanodictyon sp.	1	2,918,502							
Blue-green Algae	Cyanophyta	Synechococcales	Synechococcaceae	Synechococcus sp.	1	101,608		7,033		5,359		10,717	
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		28,983						21,435	
				Total Blue-green Algae		**37,863,183**	**8,582,724**	**1,137,886**	**32,152**	**25,454**	**865,430**	**4,501,308**	**68,323**
Dinoflagellates	Miozoa	Gonyaulacales	Ceratiaceae	Ceratium hirundinella	1	18,557	2,679	2,010					
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium fuscum	1	5,771							
Dinoflagellates	Miozoa	Gymnodiniales	Gymnodiniaceae	Gymnodinium sp.		82,818			8,038	1,340	2,679		
Dinoflagellates	Miozoa	Peridiniales	Peridiniaceae	Peridinium sp.	1	19,097				1,340			
				Total Dinoflagellates		**126,242**	**2,679**	**2,010**	**8,038**	**2,679**	**2,679**	**0**	**0**
				Total Phytoplankton		**69,129,685**	**9,239,164**	**1,388,071**	**632,996**	**436,734**	**1,757,654**	**6,082,124**	**1,225,803**
				Total Unique Taxa	**76**		**26**	**30**	**23**	**29**	**28**	**17**	**19**

PLANKTON COMMUNITY AND PRODUCTIVITY

Biologica Laboratory Reports fz22-078 Freshwater Zooplankton

(Finalized November 16, 2022)

Freshwater Zooplankton Enumeration and Identification Methods
Client: Minnow Environmental
Project: Mount Polley 2022

Sample Inventory

Sample arrival: 29-Jun-22; 15-Aug-22; 1-Sept-22
Number of samples: 28 (4, 20, 4)
Number of jars: 28
Screen size: 45 µm
Biologica project number: fz22-078

Upon arrival, the samples were examined and double-checked against the chain of custody to ensure that (1) all samples were accounted for, and (2) each sample had the appropriate number of jars as indicated on the COC. Any discrepancies were reported to the client and were resolved before further sample handling. Samples were transferred from formalin into 70% ethanol and assigned a unique identification number.

Sample Processing

Freshwater zooplankton samples were analyzed in 2-3 fractions as follows:

(1) A "URL" fraction (Unique, Large, and Rare) or "Whole" fraction comprised of unique, large, and rare organisms. These tend to have low abundance. The whole sample was scanned, and these organisms were removed for identification.

(2) A "Coarse" fraction comprised of cladocerans, adult copepods, and copepodids, in which a minimum count of 200 organisms was obtained, and

(3) A "Fine" or "Micro" fraction, in which only copepod nauplii and rotifers were identified and enumerated. Processing of the micro fraction was completed to either a 100-count or a minimum of three sub-samples. The Micro fraction was analyzed using a 1-mL Sedgewick-Rafter counting chamber.

The Coarse fraction was analyzed in a Bogorov tray through a stereo microscope at 10-40x magnification. All organisms were identified by taxonomic experts to the lowest taxonomic level using a compound microscope (100–400x magnification), appropriate dissection tools, and standard taxonomic references. For copepods, the stage of development was also recorded (copepodite stages I-V) as is the sex for mature individuals (copepod stage VI).

Sub-sampling for all fractions was performed using Hensen-Stempel pipettes. Generally sub-samples are 1/10 of total sample volume for the "Coarse" fraction and 1/100 for the "Micro" fraction.

Zooplankton were identified to species wherever possible, although immature copepods lack differentiating features required for identification beyond order (e.g., Calanoida, Cyclopoida, or

Harpacticoida). All identifications were performed using taxonomic references and collaborations with external experts, where necessary.

Table 1. Summary of zooplankton samples processed for Minnow Environmental Mount Polley, 2022.

Client Sample ID	Lake	Date Sampled	Biologica Sample ID	Fraction	Split	Specimens Counted
POL-P2_ZOO-1_2022-06	Polley	21-Jun-22	fz22-078-005	Coarse	2/220	240
				Fine	1/220	201
BOL-B2_ZOO-1_2022-06	Bootjack	21-Jun-22	fz22-078-006	Coarse	2/200	203
				Fine	1/200	497
QUL-ZOO-1_ZOO-1_2022-06	Quesnel	22-Jun-22	fz22-078-007	Coarse	10/220	322
				Fine	3/220	158
QUL-ZOO-7_ZOO-1_2022-06	Quesnel	22-Jun-22	fz22-078-008	Coarse	4/200	272
				Fine	2/200	218
BOL-B2_ZOO-1_2022-07	Bootjack	26-Jul-22	fz22-078-009	Coarse	4/180	228
				Fine	1/180	286
BOL-B2_ZOO-2_2022-07	Bootjack	26-Jul-22	fz22-078-010	Coarse	5/250	278
				Fine	1/250	316
BOL-B2_ZOO-3_2022-07	Bootjack	26-Jul-22	fz22-078-011	Coarse	8/200	249
				Fine	1/200	386
BOL-B2_ZOO-4_2022-07	Bootjack	26-Jul-22	fz22-078-012	Coarse	10/200	226
				Fine	1/200	250
				Whole	Whole	1
BOL-B2_ZOO-5_2022-07	Bootjack	26-Jul-22	fz22-078-013	Coarse	10/200	377
				Fine	1/200	353
POL-P2_ZOO-1_2022-07	Polley	25-Jul-22	fz22-078-014	Coarse	2/230	232
				Fine	1/230	337
				Whole	Whole	6
POL-P2_ZOO-2_2022-07	Polley	25-Jul-22	fz22-078-015	Coarse	6/250	228
				Fine	1/250	378
				Whole	Whole	9
POL-P2_ZOO-3_2022-07	Polley	25-Jul-22	fz22-078-016	Coarse	5/220	286
				Fine	1/220	662
				Whole	Whole	3
POL-P2_ZOO-4_2022-07	Polley	25-Jul-22	fz22-078-017	Coarse	4/230	233
				Fine	1/230	403
POL-P2_ZOO-5_2022-07	Polley	25-Jul-22	fz22-078-018	Coarse	4/200	259
				Fine	1/200	559
				Whole	Whole	16
QUL-ZOO-1_ZOO-1_2022-07	Quesnel	27-Jul-22	fz22-078-019	Coarse	10/200	282
				Fine	1/200	191
QUL-ZOO-1_ZOO-2_2022-07	Quesnel	27-Jul-22	fz22-078-020	Coarse	10/220	296
				Fine	1/220	199
QUL-ZOO-1_ZOO-3_2022-07*	Quesnel	28-Jul-22	fz22-078-021	Coarse	15/250	377
				Fine	1/250	278
QUL-ZOO-1_ZOO-4_2022-07	Quesnel	28-Jul-22	fz22-078-022	Coarse	10/200	236
				Fine	2/200	194
				Whole	Whole	1

Client Sample ID	Lake	Date Sampled	Biologica Sample ID	Fraction	Split	Specimens Counted
QUL-ZOO-1_ZOO-5_2022-07	Quesnel	28-Jul-22	fz22-078-023	Coarse	10/200	208
				Fine	1/200	130
QUL-ZOO-7_ZOO-1_2022-07	Quesnel	27-Jul-22	fz22-078-024	Coarse	10/200	254
				Fine	1/200	146
QUL-ZOO-7_ZOO-2_2022-07	Quesnel	27-Jul-22	fz22-078-025	Coarse	15/200	286
				Fine	1/200	368
QUL-ZOO-7_ZOO-3_2022-07	Quesnel	27-Jul-22	fz22-078-026	Coarse	20/240	226
				Fine	2/240	145
QUL-ZOO-7_ZOO-4_2022-07	Quesnel	27-Jul-22	fz22-078-027	Coarse	10/240	222
				Fine	2/240	173
QUL-ZOO-7_ZOO-5_2022-07	Quesnel	27-Jul-22	fz22-078-028	Coarse	12/240	221
				Fine	1/240	131
POL-P2_ZOO-1_2022-08	Polley	25-Aug-22	fz22-078-053	Coarse	4/200	257
				Fine	3/200	153
BOL-B2_ZOO-1_2022-08	Bootjack	28-Aug-22	fz22-078-054	Coarse	12/230	269
				Fine	2/230	161
				Whole	Whole	53
QUL-ZOO-1_ZOO-1_2022-08	Quesnel	28-Aug-22	fz22-078-055	Coarse	10/200	244
				Fine	2/200	188
				Whole	Whole	1
QUL-ZOO-7_ZOO-1_2022-08	Quesnel	28-Aug-22	fz22-078-056	Coarse	15/200	243
				Fine	3/200	176
				Whole	Whole	1

*QUL-ZOO-1_ZOO-3_2022-07 labelled as phytoplankton but preserved in lugols. Processed as zooplankton.

QA/QC

Ten percent (10%) of samples were reanalyzed to assess sub-sampling accuracy and taxonomic consistency. The sample(s) were chosen at random and processed at different times to reduce counting and identification bias. The percent agreement between QA samples is reported in Table 2.

Table 2. Summary of enumeration QA/QC results for Minnow Environmental Mount Polley, 2022.

Client Sample ID	Biologica Sample ID	Original Total Abundance	QA Total Abundance	Percent Agreement
BOL-B2_ZOO-3_2022-07	fz22-078-011	83,425	87,875	94.67
POL-P2_ZOO-5_2022-07	fz22-078-018	124,766	118,666	95.11
QUL-ZOO-7_ZOO-1_2022-08	fz22-078-056	14,974	14,534	97.06
			Average:	**95.61**

Percent Agreement:
100 – [(difference in abundance between samples/total abundance of original sample) x 100]

Data

Biomass calculations were also performed for the 7 dominant zooplankton taxa by measuring at least 5-10 specimens of each taxon and applying length/weight regression formulae (EPA, 2003).

Biomass estimates were presented as total per-sample wet-weight and dry-weight values derived from per-sample abundances.

Taxonomic data were recorded in Biologica's custom database. Results were provided to the Minnow Environmental project manager in Excel spreadsheets via email.

Methodological and Taxonomic References

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-005	fz22-078-006	fz22-078-007	fz22-078-008	fz22-078-009
Lake							Polley	Bootjack	Quesnel	Quesnel	Bootjack
Client Sample ID							POL-P2_ZOO-1_2022-06	BOL-B2_ZOO-1_2022-06	QUL-ZOO-1_ZOO-1_2022-06	QUL-ZOO-7_ZOO-1_2022-06	BOL-B2_ZOO-1_2022-07
Date Sampled							21-Jun-22	21-Jun-22	22-Jun-22	22-Jun-22	26-Jul-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953			154		
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	1,760	2,300	44	50	540
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367					
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411	110	3,700	22	50	270
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36					
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45					45
			Total Cladocera			**51,450**	**1,870**	**6,000**	**220**	**100**	**855**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12					
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	220	1,300	2,486	5,000	405
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274	110	100			
			Total Calanoida			**35,124**	**330**	**1,400**	**2,486**	**5,000**	**405**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20					
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	5,390	900	880	1,350	270
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	330	100	154	650	45
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	18,480	11,900	3,344	6,500	8,685
			Total Cyclopoida			**173,197**	**24,200**	**12,900**	**4,378**	**8,500**	**9,000**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083		1,600	1,393	1,500	
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	3,960	16,000	3,887	7,200	8,280
			Total Copepoda Nauplii			**526,638**	**3,960**	**17,600**	**5,280**	**8,700**	**8,280**
			Total Crustacean Zooplankton			**786,409**	**30,360**	**37,900**	**12,364**	**22,300**	**18,540**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55					
			Total Diptera			**55**	**0**	**0**	**0**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365					900
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	37,840	78,400	2,053	5,600	38,160
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283			3,593	6,700	2,520
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110	1,320	2,200		100	
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	440				
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212		200			540
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467					
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600					
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200					
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	660	1,000	660	700	1,080
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500					
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415					
			Total Rotifera			**929,317**	**40,260**	**81,800**	**6,307**	**13,100**	**43,200**
			Total Zooplankton			**1,715,781**	**70,620**	**119,700**	**18,671**	**35,400**	**61,740**
			Total Unique Taxa		**24**		**8**	**8**	**8**	**8**	**10**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-010	fz22-078-011	fz22-078-012	fz22-078-013	fz22-078-014
Lake							Bootjack	Bootjack	Bootjack	Bootjack	Polley
Client Sample ID							BOL-B2_ZOO-2_2022-07	BOL-B2_ZOO-3_2022-07	BOL-B2_ZOO-4_2022-07	BOL-B2_ZOO-5_2022-07	POL-P2_ZOO-1_2022-07
Date Sampled							26-Jul-22	26-Jul-22	26-Jul-22	26-Jul-22	25-Jul-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953					
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	1,100	575	700	1,720	7,360
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367					
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411	300	250	120	540	230
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36					6
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45					
			Total Cladocera			**51,450**	**1,400**	**825**	**820**	**2,260**	**7,596**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747	100	25	20	20	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299	50	25			
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12					
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	700	1,100	580	820	2,530
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274					
			Total Calanoida			**35,124**	**850**	**1,150**	**600**	**840**	**2,530**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20				20	
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	600	400	160	140	3,105
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290		25		40	
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	11,050	3,825	2,940	4,240	13,455
			Total Cyclopoida			**173,197**	**11,650**	**4,250**	**3,100**	**4,440**	**16,560**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083	250				
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	14,000	6,800	11,400	9,000	39,100
			Total Copepoda Nauplii			**526,638**	**14,250**	**6,800**	**11,400**	**9,000**	**39,100**
			Total Crustacean Zooplankton			**786,409**	**28,150**	**13,025**	**15,920**	**16,540**	**65,786**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55			1		
			Total Diptera			**55**	**0**	**0**	**1**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365	1,750	1,200	1,000	400	
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	55,500	64,200	33,800	53,200	32,200
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	5,000	4,800	2,600	6,000	690
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110					920
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	500		600	1,400	
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212	250	200			1,610
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467					
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600					
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200					
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	1,750		600	600	2,990
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500					
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415					
			Total Rotifera			**929,317**	**64,750**	**70,400**	**38,600**	**61,600**	**38,410**
			Total Zooplankton			**1,715,781**	**92,900**	**83,425**	**54,521**	**78,140**	**104,196**
			Total Unique Taxa		**24**		**10**	**8**	**10**	**10**	**10**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-015	fz22-078-016	fz22-078-017	fz22-078-018	fz22-078-019
Lake							Polley	Polley	Polley	Polley	Quesnel
Client Sample ID							POL-P2_ZOO-2_2022-07	POL-P2_ZOO-3_2022-07	POL-P2_ZOO-4_2022-07	POL-P2_ZOO-5_2022-07	QUL-ZOO-1_ZOO-1_2022-07
Date Sampled							25-Jul-22	25-Jul-22	25-Jul-22	25-Jul-22	27-Jul-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953					620
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	2,917	3,344	3,738	4,700	260
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367					
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411	83	176	230	100	
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36	9	3		16	
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45					
			Total Cladocera			**51,450**	**3,009**	**3,523**	**3,968**	**4,816**	**880**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747	83	88	58	100	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299	42	44			
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0					
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20					
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12					
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	1,542	1,672	2,645	2,850	860
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274					
			Total Calanoida			**35,124**	**1,667**	**1,804**	**2,703**	**2,950**	**860**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20					
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	667	880	978	600	660
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	42	44			80
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	4,125	6,336	5,750	4,600	3,160
			Total Cyclopoida			**173,197**	**4,833**	**7,260**	**6,728**	**5,200**	**3,900**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083	750		230	400	
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	66,500	114,620	60,950	70,400	9,000
			Total Copepoda Nauplii			**526,638**	**67,250**	**114,620**	**61,180**	**70,800**	**9,000**
			Total Crustacean Zooplankton			**786,409**	**76,759**	**127,207**	**74,578**	**83,766**	**14,640**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55					
			Total Diptera			**55**	**0**	**0**	**0**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365					
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	20,250	22,440	24,380	27,800	10,400
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	250	880	1,150	400	11,200
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110	500	220	920	1,400	
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	250		690	2,000	2,400
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212		440	230	800	
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467					
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600					
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200					
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	6,000	7,040	4,140	8,600	5,200
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500					
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415					
			Total Rotifera			**929,317**	**27,250**	**31,020**	**31,510**	**41,000**	**29,200**
			Total Zooplankton			**1,715,781**	**104,009**	**158,227**	**106,088**	**124,766**	**43,840**
			Total Unique Taxa		**24**		**10**	**10**	**10**	**11**	**8**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-020	fz22-078-021	fz22-078-022	fz22-078-023
Lake							Quesnel	Quesnel	Quesnel	Quesnel
Client Sample ID							QUL-ZOO-1_ZOO-2_2022-07	QUL-ZOO-1_ZOO-3_2022-07	QUL-ZOO-1_ZOO-4_2022-07	QUL-ZOO-1_ZOO-5_2022-07
Date Sampled							27-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953	572	383	480	300
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	418	517	300	280
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367				
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411				
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36			1	
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45				
			Total Cladocera			**51,450**	**990**	**900**	**781**	**580**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12				
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	1,012	900	620	600
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274	44		20	
			Total Calanoida			**35,124**	**1,056**	**900**	**640**	**600**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20				
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	880	833	500	380
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	264	267	100	240
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	3,322	3,383	2,700	2,360
			Total Cyclopoida			**173,197**	**4,466**	**4,483**	**3,300**	**2,980**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083	220	500		
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	13,200	9,500	4,100	5,800
			Total Copepoda Nauplii			**526,638**	**13,420**	**10,000**	**4,100**	**5,800**
			Total Crustacean Zooplankton			**786,409**	**19,932**	**16,283**	**8,821**	**9,960**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55				
			Total Diptera			**55**	**0**	**0**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365				
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	9,460	17,750	5,800	6,800
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	12,760	27,750	5,000	7,800
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110		250	200	200
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	1,760	750	600	1,000
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212				
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467				
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600		4,000		200
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200				200
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	6,380	8,500	3,700	4,000
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500		500		
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415				
			Total Rotifera			**929,317**	**30,360**	**59,500**	**15,300**	**20,200**
			Total Zooplankton			**1,715,781**	**50,292**	**75,783**	**24,121**	**30,160**
			Total Unique Taxa		**24**		**8**	**9**	**11**	**10**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-024	fz22-078-025	fz22-078-026	fz22-078-027
Lake							Quesnel	Quesnel	Quesnel	Quesnel
Client Sample ID							QUL-ZOO-7_ZOO-1_2022-07	QUL-ZOO-7_ZOO-2_2022-07	QUL-ZOO-7_ZOO-3_2022-07	QUL-ZOO-7_ZOO-4_2022-07
Date Sampled							27-Jul-22	27-Jul-22	27-Jul-22	27-Jul-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953	220	307	180	624
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	300	187	168	432
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367				
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411				
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36				
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45				
			Total Cladocera			**51,450**	**520**	**493**	**348**	**1,056**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216	60	13	12	24
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59	20	13	12	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12			12	
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	920	480	456	1,032
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274				
			Total Calanoida			**35,124**	**1,000**	**507**	**492**	**1,056**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20				
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	600	387	324	432
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	160	93	72	192
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	2,800	2,333	1,476	2,592
			Total Cyclopoida			**173,197**	**3,560**	**2,813**	**1,872**	**3,216**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083				
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	9,200	4,200	3,720	4,680
			Total Copepoda Nauplii			**526,638**	**9,200**	**4,200**	**3,720**	**4,680**
			Total Crustacean Zooplankton			**786,409**	**14,280**	**8,013**	**6,432**	**10,008**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55				
			Total Diptera			**55**	**0**	**0**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365				
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	8,400	9,800	4,320	7,440
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	7,800	54,600	8,640	4,440
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110				240
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	600	200	240	360
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212	200			
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467		200		
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600	200	600		
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200				
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	2,800	4,000	480	3,600
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500				
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415				
			Total Rotifera			**929,317**	**20,000**	**69,400**	**13,680**	**16,080**
			Total Zooplankton			**1,715,781**	**34,280**	**77,413**	**20,112**	**26,088**
			Total Unique Taxa		**24**		**11**	**10**	**10**	**9**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-028	fz22-078-053	fz22-078-054	fz22-078-055
Lake							Quesnel	Polley	Bootjack	Quesnel
Client Sample ID							QUL-ZOO-7_ZOO-5_2022-07	POL-P2_ZOO-1_2022-08	BOL-B2_ZOO-1_2022-08	QUL-ZOO-1_ZOO-1_2022-08
Date Sampled							27-Jul-22	25-Aug-22	28-Aug-22	28-Aug-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953	660			240
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	360	2,050	1,706	1,280
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367				180
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411			230	
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36				
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45				
			Total Cladocera			**51,450**	**1,020**	**2,050**	**1,936**	**1,700**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747		100	153	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299		100	38	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216	60			20
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20				20
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12				
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	600	650	671	500
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274				
			Total Calanoida			**35,124**	**660**	**850**	**863**	**540**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20				
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	480	150	38	640
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	180		19	140
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	2,080	9,800	2,300	1,860
			Total Cyclopoida			**173,197**	**2,740**	**9,950**	**2,358**	**2,640**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083	240			
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	4,560	7,400	3,565	5,000
			Total Copepoda Nauplii			**526,638**	**4,800**	**7,400**	**3,565**	**5,000**
			Total Crustacean Zooplankton			**786,409**	**9,220**	**20,250**	**8,721**	**9,880**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55			53	1
			Total Diptera			**55**	**0**	**0**	**53**	**1**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365			115	
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	7,680	1,267	8,970	8,100
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	13,200	1,000	1,610	1,100
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110	240	267		
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	960	67	3,105	300
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212		67	575	100
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467				
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600				600
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200				
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	4,560	133	460	3,300
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500				
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415			115	300
			Total Rotifera			**929,317**	**26,640**	**2,800**	**14,950**	**13,800**
			Total Zooplankton			**1,715,781**	**35,860**	**23,050**	**23,724**	**23,681**
			Total Unique Taxa		**24**		**9**	**9**	**12**	**13**

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Zooplankton total abundance data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-056	fz22-078-011_QA	fz22-078-018_QA	fz22-078-056_QA
Lake							Quesnel	Bootjack	Polley	Quesnel
Client Sample ID							QUL-ZOO-7_ZOO-1_2022-08	BOL-B2_ZOO-3_2022-07_QA	POL-P2_ZOO-5_2022-07_QA	QUL-ZOO-7_ZOO-1_2022-08_QA
Date Sampled							28-Aug-22	26-Jul-22	25-Jul-22	28-Aug-22
					Grand Total		Total Abundance	Total Abundance	Total Abundance	Total Abundance
Groupcode	Major Group	Family	Taxon	Stage	Unique Taxa	Total Abundance (#/sample)	(#/sample)	(#/sample)	(#/sample)	(#/sample)
CRCL	Crustacea Cladocera	Bosminidae	Eubosmina sp.	F	1	4,953	213			213
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	1	39,638	533	675	4,950	693
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	M		367	187			120
CRCL	Crustacea Cladocera	Daphniidae	Daphnia pulicaria	F	1	6,411		275	100	
CRCL	Crustacea Cladocera	Leptodoridae	Leptodora kindtii	F	1	36	1		16	1
CRCL	Crustacea Cladocera	Polyphemidae	Polyphemus pediculus	F	1	45				
			Total Cladocera			**51,450**	**934**	**950**	**5,066**	**1,028**
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIf	1	747			50	
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Aglaodiaptomus leptopus	VIm		299				
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIf	1	216	27			27
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Leptodiaptomus ashlandi	VIm		59	13			13
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIf	1	0		25		
CRCO	Crustacea Copepoda Calanoida	Diaptomidae	Skistodiaptomus pallidus	VIm		0		25		
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIf	1	20				
CRCO	Crustacea Copepoda Calanoida	Temoridae	Epischura sp.	VIm		12				
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V		33,497	347	1,300	3,100	427
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	VIf		274				
			Total Calanoida			**35,124**	**387**	**1,350**	**3,150**	**467**
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	VIm	1	20				
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIf	1	23,064	440	275	800	480
CRCO	Crustacea Copepoda Cyclopoida	Cyclopidae	Diacyclops thomasi	VIm		3,290	53	25		80
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V		146,823	1,427	3,675	4,250	1,480
			Total Cyclopoida			**173,197**	**1,920**	**3,975**	**5,050**	**2,040**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	Nauplius		7,083			200	
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius		519,555	3,533	5,800	64,400	2,600
			Total Copepoda Nauplii			**526,638**	**3,533**	**5,800**	**64,600**	**2,600**
			Total Crustacean Zooplankton			**786,409**	**6,774**	**12,075**	**77,866**	**6,134**
INDI	Insecta Diptera	Chaoboridae	Chaoborus sp.	L	1	55				
			Total Diptera			**55**	**0**	**0**	**0**	**0**
ROTI	Rotifera	Asplanchnidae	Asplanchna sp.	----	1	5,365		1,800		
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	1	607,010	5,000	69,800	26,600	4,467
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	1	193,283	1,800	3,800	800	2,333
ROTI	Rotifera	Brachionidae	Keratella sp. 2	----	1	9,110	133		1,000	200
ROTI	Rotifera	Conochilidae	Conochilus sp.	Individual	1	18,355	133		1,600	133
ROTI	Rotifera	Filiniidae	Filinia sp.	----	1	5,212		400	1,000	
ROTI	Rotifera	Gastropodidae	Ascomorpha sp.	----	1	467	267			333
ROTI	Rotifera	Gastropodidae	Gastropus sp.	----	1	5,600				
ROTI	Rotifera	Lecanidae	Monostyla sp.	----	1	200				
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	1	83,800	867		9,800	933
ROTI	Rotifera	Synchaetidae	Synchaeta sp.	----	1	500				
ROTI	Rotifera	Trichocercidae	Trichocerca sp.	----	1	415				
			Total Rotifera			**929,317**	**8,200**	**75,800**	**40,800**	**8,400**
			Total Zooplankton			**1,715,781**	**14,974**	**87,875**	**118,666**	**14,534**
			Total Unique Taxa		**24**		**11**	**8**	**11**	**11**

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Zooplankton total wet (WW) and dry (DW) weight biomass data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID					fz22-078-005		fz22-078-006		fz22-078-007		fz22-078-008		fz22-078-009		fz22-078-010		fz22-078-011	
Lake					Polley		Bootjack		Quesnel		Quesnel		Bootjack		Bootjack		Bootjack	
Client Sample ID					POL-P2_ZOO-1_2022-06		BOL-B2_ZOO-1_2022-06		QUL-ZOO-1_ZOO-1_2022-06		QUL-ZOO-7_ZOO-1_2022-06		BOL-B2_ZOO-1_2022-07		BOL-B2_ZOO-2_2022-07		BOL-B2_ZOO-3_2022-07	
Date Sampled					21-Jun-22		21-Jun-22		22-Jun-22		22-Jun-22		26-Jul-22		26-Jul-22		26-Jul-22	
Groupcode	Major Group	Family	Taxon	Stage	Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)	
					DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	350	1,749	15.5	77.6	20.3	101	0.388	1.94	0.441	2.21	4.76	23.8	9.71	48.5	5.07	25.4
			Total Cladocera		**350**	**1,749**	**15.5**	**77.6**	**20.3**	**101**	**0.388**	**1.94**	**0.441**	**2.21**	**4.76**	**23.8**	**9.71**	**48.5**	**5.07**	**25.4**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V	141	707	0.928	4.64	5.48	27.4	10.5	52.4	21.1	105	1.71	8.54	2.95	14.8	4.64	23.2
			Total Calanoida		**141**	**707**	**0.928**	**4.64**	**5.48**	**27.4**	**10.5**	**52.4**	**21.1**	**105**	**1.71**	**8.54**	**2.95**	**14.8**	**4.64**	**23.2**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V	906	4,532	114	570	73.5	367	20.6	103	40.1	201	53.6	268	68.2	341	23.6	118
			Total Cyclopoida		**906**	**4,532**	**114**	**570**	**73.5**	**367**	**20.6**	**103**	**40.1**	**201**	**53.6**	**268**	**68.2**	**341**	**23.6**	**118**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius	58.5	293	0.446	2.23	1.80	9.02	0.438	2.19	0.811	4.06	0.933	4.67	1.58	7.89	0.766	3.83
			Total Copepoda Nauplii		**58.5**	**293**	**0.446**	**2.23**	**1.80**	**9.02**	**0.438**	**2.19**	**0.811**	**4.06**	**0.933**	**4.67**	**1.58**	**7.89**	**0.766**	**3.83**
			Total Crustacean Zooplankton		**1,456**	**7,280**	**131**	**655**	**101**	**505**	**32.0**	**160**	**62.5**	**312**	**61.0**	**305**	**82.5**	**412**	**34.1**	**170**
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	8.63	86.3	0.538	5.38	1.11	11.1	0.0292	0.292	0.0796	0.796	0.542	5.42	0.789	7.89	0.912	9.12
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	48.5	485					0.902	9.02	1.68	16.8	0.633	6.33	1.26	12.6	1.21	12.1
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	3.98	39.8	0.0313	0.313	0.0474	0.474	0.0313	0.313	0.0332	0.332	0.0512	0.512	0.0830	0.830		
			Total Rotifera		**61.1**	**611**	**0.569**	**5.69**	**1.16**	**11.6**	**0.963**	**9.63**	**1.80**	**18.0**	**1.23**	**12.3**	**2.13**	**21.3**	**2.12**	**21.2**
			Total Zooplankton		**1,517**	**7,891**	**132**	**661**	**102**	**517**	**32.9**	**169**	**64.3**	**330**	**62.2**	**317**	**84.6**	**434**	**36.2**	**192**

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Zooplankton total wet (WW) and dry (DW) weight biomass data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID					fz22-078-012		fz22-078-013		fz22-078-014		fz22-078-015		fz22-078-016		fz22-078-017		fz22-078-018	
Lake					Bootjack		Bootjack		Polley		Polley		Polley		Polley		Polley	
Client Sample ID					BOL-B2_ZOO-4_2022-07		BOL-B2_ZOO-5_2022-07		POL-P2_ZOO-1_2022-07		POL-P2_ZOO-2_2022-07		POL-P2_ZOO-3_2022-07		POL-P2_ZOO-4_2022-07		POL-P2_ZOO-5_2022-07	
Date Sampled					26-Jul-22		26-Jul-22		25-Jul-22		25-Jul-22		25-Jul-22		25-Jul-22		25-Jul-22	
Groupcode	Major Group	Family	Taxon	Stage	Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)	
					DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	350	1,749	6.18	30.9	15.2	75.9	64.9	325	25.7	129	29.5	148	33.0	165	41.5	207
			Total Cladocera		**350**	**1,749**	**6.18**	**30.9**	**15.2**	**75.9**	**64.9**	**325**	**25.7**	**129**	**29.5**	**148**	**33.0**	**165**	**41.5**	**207**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V	141	707	2.45	12.2	3.46	17.3	10.7	53.4	6.50	32.5	7.05	35.3	11.2	55.8	12.0	60.1
			Total Calanoida		**141**	**707**	**2.45**	**12.2**	**3.46**	**17.3**	**10.7**	**53.4**	**6.50**	**32.5**	**7.05**	**35.3**	**11.2**	**55.8**	**12.0**	**60.1**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V	906	4,532	18.1	90.7	26.2	131	83.1	415	25.5	127	39.1	196	35.5	177	28.4	142
			Total Cyclopoida		**906**	**4,532**	**18.1**	**90.7**	**26.2**	**131**	**83.1**	**415**	**25.5**	**127**	**39.1**	**196**	**35.5**	**177**	**28.4**	**142**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius	58.5	293	1.28	6.42	1.01	5.07	4.41	22.0	7.49	37.5	12.9	64.6	6.87	34.3	7.93	39.7
			Total Copepoda Nauplii		**58.5**	**293**	**1.28**	**6.42**	**1.01**	**5.07**	**4.41**	**22.0**	**7.49**	**37.5**	**12.9**	**64.6**	**6.87**	**34.3**	**7.93**	**39.7**
			Total Crustacean Zooplankton		**1,456**	**7,280**	**28.1**	**140**	**45.8**	**229**	**163**	**815**	**65.2**	**326**	**88.6**	**443**	**86.5**	**433**	**89.8**	**449**
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	8.63	86.3	0.480	4.80	0.756	7.56	0.458	4.58	0.288	2.88	0.319	3.19	0.346	3.46	0.395	3.95
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	48.5	485	0.653	6.53	1.51	15.1	0.173	1.73	0.0628	0.628	0.221	2.21	0.289	2.89	0.100	1.00
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	3.98	39.8	0.0285	0.285	0.0285	0.285	0.142	1.42	0.285	2.85	0.334	3.34	0.196	1.96	0.408	4.08
			Total Rotifera		**61.1**	**611**	**1.16**	**11.6**	**2.29**	**22.9**	**0.773**	**7.73**	**0.635**	**6.35**	**0.874**	**8.74**	**0.832**	**8.32**	**0.904**	**9.04**
			Total Zooplankton		**1,517**	**7,891**	**29.2**	**152**	**48.1**	**252**	**164**	**823**	**65.8**	**332**	**89.5**	**452**	**87.3**	**441**	**90.7**	**458**

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Zooplankton total wet (WW) and dry (DW) weight biomass data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID					fz22-078-019		fz22-078-020		fz22-078-021		fz22-078-022		fz22-078-023		fz22-078-024		fz22-078-025	
Lake					Quesnel		Quesnel		Quesnel		Quesnel		Quesnel		Quesnel		Quesnel	
Client Sample ID					QUL-ZOO-1_ZOO-1_2022-07		QUL-ZOO-1_ZOO-2_2022-07		QUL-ZOO-1_ZOO-3_2022-07		QUL-ZOO-1_ZOO-4_2022-07		QUL-ZOO-1_ZOO-5_2022-07		QUL-ZOO-7_ZOO-1_2022-07		QUL-ZOO-7_ZOO-2_2022-07	
Date Sampled					27-Jul-22		27-Jul-22		28-Jul-22		28-Jul-22		28-Jul-22		27-Jul-22		27-Jul-22	
Groupcode	Major Group	Family	Taxon	Stage	Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)	
					DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	350	1,749	2.29	11.5	3.69	18.4	4.56	22.8	2.65	13.2	2.47	12.4	2.65	13.2	1.65	8.24
			Total Cladocera		**350**	**1,749**	**2.29**	**11.5**	**3.69**	**18.4**	**4.56**	**22.8**	**2.65**	**13.2**	**2.47**	**12.4**	**2.65**	**13.2**	**1.65**	**8.24**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V	141	707	3.63	18.1	4.27	21.3	3.80	19.0	2.62	13.1	2.53	12.7	3.88	19.4	2.03	10.1
			Total Calanoida		**141**	**707**	**3.63**	**18.1**	**4.27**	**21.3**	**3.80**	**19.0**	**2.62**	**13.1**	**2.53**	**12.7**	**3.88**	**19.4**	**2.03**	**10.1**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V	906	4,532	19.5	97.5	20.5	103	20.9	104	16.7	83.3	14.6	72.8	17.3	86.4	14.4	72.0
			Total Cyclopoida		**906**	**4,532**	**19.5**	**97.5**	**20.5**	**103**	**20.9**	**104**	**16.7**	**83.3**	**14.6**	**72.8**	**17.3**	**86.4**	**14.4**	**72.0**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius	58.5	293	1.01	5.07	1.49	7.44	1.07	5.35	0.462	2.31	0.654	3.27	1.04	5.18	0.473	2.37
			Total Copepoda Nauplii		**58.5**	**293**	**1.01**	**5.07**	**1.49**	**7.44**	**1.07**	**5.35**	**0.462**	**2.31**	**0.654**	**3.27**	**1.04**	**5.18**	**0.473**	**2.37**
			Total Crustacean Zooplankton		**1,456**	**7,280**	**26.4**	**132**	**30.0**	**150**	**30.3**	**152**	**22.4**	**112**	**20.2**	**101**	**24.9**	**124**	**18.5**	**92.7**
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	8.63	86.3	0.148	1.48	0.134	1.34	0.252	2.52	0.0824	0.824	0.097	0.966	0.119	1.19	0.139	1.39
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	48.5	485	2.81	28.1	3.20	32.0	6.97	69.7	1.26	12.6	1.96	19.6	1.96	19.6	13.7	137
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	3.98	39.8	0.247	2.47	0.303	3.03	0.216	2.16	0.403	4.03	0.176	1.76	0.190	1.90	0.133	1.33
			Total Rotifera		**61.1**	**611**	**3.21**	**32.1**	**3.64**	**36.4**	**7.44**	**74.4**	**1.74**	**17.4**	**2.23**	**22.3**	**2.27**	**22.7**	**14.0**	**140**
			Total Zooplankton		**1,517**	**7,891**	**29.7**	**164**	**33.6**	**186**	**37.8**	**226**	**24.1**	**129**	**22.5**	**123**	**27.1**	**147**	**32.5**	**233**

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Zooplankton total wet (WW) and dry (DW) weight biomass data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID					fz22-078-026		fz22-078-027		fz22-078-028		fz22-078-053		fz22-078-054		fz22-078-055		fz22-078-056	
Lake					Quesnel		Quesnel		Quesnel		Polley		Bootjack		Quesnel		Quesnel	
Client Sample ID					QUL-ZOO-7_ZOO-3_2022-07		QUL-ZOO-7_ZOO-4_2022-07		QUL-ZOO-7_ZOO-5_2022-07		POL-P2_ZOO-1_2022-08		BOL-B2_ZOO-1_2022-08		QUL-ZOO-1_ZOO-1_2022-08		QUL-ZOO-7_ZOO-1_2022-08	
Date Sampled					27-Jul-22		27-Jul-22		27-Jul-22		25-Aug-22		28-Aug-22		28-Aug-22		28-Aug-22	
Groupcode	Major Group	Family	Taxon	Stage	Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)	
					DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW	DW	WW
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	350	1,749	1.48	7.41	3.81	19.1	3.18	15.9	18.1	90.4	15.1	75.3	11.3	56.5	4.71	23.5
			Total Cladocera		**350**	**1,749**	**1.48**	**7.41**	**3.81**	**19.1**	**3.18**	**15.9**	**18.1**	**90.4**	**15.1**	**75.3**	**11.3**	**56.5**	**4.71**	**23.5**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V	141	707	1.92	9.62	4.35	21.8	2.53	12.7	2.74	13.7	2.83	14.2	2.11	10.5	1.46	7.31
			Total Calanoida		**141**	**707**	**1.92**	**9.62**	**4.35**	**21.8**	**2.53**	**12.7**	**2.74**	**13.7**	**2.83**	**14.2**	**2.11**	**10.5**	**1.46**	**7.31**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V	906	4,532	9.11	45.6	16.0	80.0	12.8	64.2	60.5	302	14.2	71.0	11.5	57.4	8.81	44.0
			Total Cyclopoida		**906**	**4,532**	**9.11**	**45.6**	**16.0**	**80.0**	**12.8**	**64.2**	**60.5**	**302**	**14.2**	**71.0**	**11.5**	**57.4**	**8.81**	**44.0**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius	58.5	293	0.419	2.10	0.527	2.64	0.514	2.57	0.834	4.17	0.402	2.01	0.563	2.82	0.398	1.99
			Total Copepoda Nauplii		**58.5**	**293**	**0.419**	**2.10**	**0.527**	**2.64**	**0.514**	**2.57**	**0.834**	**4.17**	**0.402**	**2.01**	**0.563**	**2.82**	**0.398**	**1.99**
			Total Crustacean Zooplankton		**1,456**	**7,280**	**12.9**	**64.7**	**24.7**	**123**	**19.1**	**95.3**	**82.2**	**411**	**32.5**	**162**	**25.4**	**127**	**15.4**	**76.9**
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	8.63	86.3	0.0614	0.614	0.106	1.06	0.109	1.09	0.0180	0.180	0.127	1.27	0.115	1.15	0.0710	0.710
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	48.5	485	2.17	21.7	1.12	11.2	3.32	33.2	0.251	2.51	0.404	4.04	0.276	2.76	0.452	4.52
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	3.98	39.8	0.190	1.90	0.0228	0.228	0.171	1.71	0.0063	0.0633	0.0218	0.218	0.157	1.57	0.0411	0.411
			Total Rotifera		**61.1**	**611**	**2.42**	**24.2**	**1.24**	**12.4**	**3.60**	**36.0**	**0.275**	**2.75**	**0.554**	**5.54**	**0.548**	**5.48**	**0.564**	**5.64**
			Total Zooplankton		**1,517**	**7,891**	**15.4**	**88.9**	**25.9**	**136**	**22.7**	**131**	**82.4**	**414**	**33.0**	**168**	**26.0**	**133**	**15.9**	**82.5**

biologica

Zooplankton total wet (WW) and dry (DW) weight biomass data matrix for Minnow Environmental Mount Polley, 2022

Biologica Sample ID							fz22-078-011_QA		fz22-078-018_QA		fz22-078-056_QA	
Lake							Bootjack		Polley		Quesnel	
Client Sample ID							BOL-B2_ZOO-3_2022-07_QA		POL-P2_ZOO-5_2022-07_QA		QUL-ZOO-7_ZOO-1_2022-08_QA	
Date Sampled							26-Jul-22		25-Jul-22		28-Aug-22	
Groupcode	Major Group	Family	Taxon	Stage	Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)		Total Biomass (mg/sample)	
					DW	WW	DW	WW	DW	WW	DW	WW
CRCL	Crustacea Cladocera	Daphniidae	Daphnia mendotae complex	F	350	1,749	5.96	29.8	43.7	218	6.12	30.6
			Total Cladocera		**350**	**1,749**	**5.96**	**29.8**	**43.7**	**218**	**6.12**	**30.6**
CRCO	Crustacea Copepoda Calanoida		Calanoida indet.	I-V	141	707	5.48	27.4	13.1	65.4	1.80	9.00
			Total Calanoida		**141**	**707**	**5.48**	**27.4**	**13.1**	**65.4**	**1.80**	**9.00**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	I-V	906	4,532	22.7	113	26.2	131	9.14	45.7
			Total Cyclopoida		**906**	**4,532**	**22.7**	**113**	**26.2**	**131**	**9.14**	**45.7**
CRCO	Crustacea Copepoda Cyclopoida		Cyclopoida indet.	Nauplius	58.5	293	0.654	3.27	7.26	36.3	0.293	1.46
			Total Copepoda Nauplii		**58.5**	**293**	**0.654**	**3.27**	**7.26**	**36.3**	**0.293**	**1.46**
			Total Crustacean Zooplankton		**1,456**	**7,280**	**34.8**	**174**	**90.2**	**451**	**17.3**	**86.7**
ROTI	Rotifera	Brachionidae	Kellicottia sp.	----	8.63	86.3	0.992	9.92	0.378	3.78	0.0635	0.635
ROTI	Rotifera	Brachionidae	Keratella sp. 1	----	48.5	485	0.954	9.54	0.201	2.01	0.586	5.86
ROTI	Rotifera	Synchaetidae	Polyarthra sp.	----	3.98	39.8			0.465	4.65	0.0443	0.443
			Total Rotifera		**61.1**	**611**	**1.95**	**19.5**	**1.04**	**10.4**	**0.694**	**6.94**
			Total Zooplankton		**1,517**	**7,891**	**36.7**	**193**	**91.3**	**462**	**18.0**	**93.7**

PLANKTON COMMUNITY AND PRODUCTIVITY

ALS Laboratory Report VA22B4431
(Finalized July 7, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B4431**	Page	: 1 of 2
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 28-Jun-2022
C-O-C number	: ----	Issue Date	: 07-Jul-2022 14:43
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA2021-MPMC100-004-Minnow Water Quality		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Janice Pearson	Account Manager Assistant	Administration, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µg/L	micrograms per litre
µg/sample	micrograms per sample
L	litres

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Client sample ID*	**POL-P2_CHLA-1_2022-06**	**BOL-B2_CHLA-1_2022-06**	**QUL-ZOO-7_CHLA-1_2022-06**	**QUL-ZOO-1_CHLA-1_2022-06**	**QUL-ZOO-1_CHLA-1X_2022-06**
					Client sampling date / time	21-Jun-2022 12:05	21-Jun-2022 14:25	22-Jun-2022 09:55	22-Jun-2022 11:00	22-Jun-2022 11:00
						VA22B4431-001	**VA22B4431-002**	**VA22B4431-003**	**VA22B4431-004**	**VA22B4431-005**
						Result	Result	Result	Result	Result
Field Tests										
sampling volume, field	----	EF003	0.010	L		0.250	0.250	0.250	0.240	0.245
Plant Pigments										
chlorophyll a	479-61-8	EC870A	0.010	µg/L		2.60	6.28	2.02	1.58	1.63
chlorophyll a	479-61-8	E870A	0.0020	µg/sample		0.651	1.57	0.506	0.380	0.400

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B4431**	Page	: 1 of 5
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Issue Date	: 07-Jul-2022 14:42
C-O-C number	: ----		
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA2021-MPMC100-004-Minnow Water Quality		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-1_2022-06	EF003	21-Jun-2022	----	----	----		29-Jun-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
POL-P2_CHLA-1_2022-06	EF003	21-Jun-2022	----	----	----		29-Jun-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
QUL-ZOO-1_CHLA-1_2022-06	EF003	22-Jun-2022	----	----	----		29-Jun-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
QUL-ZOO-1_CHLA-1X_2022-06	EF003	22-Jun-2022	----	----	----		29-Jun-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
QUL-ZOO-7_CHLA-1_2022-06	EF003	22-Jun-2022	----	----	----		29-Jun-2022	----	----	
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
QUL-ZOO-1_CHLA-1_2022-06	E870A	22-Jun-2022	28-Jun-2022	28 days	6 days	✓	28-Jun-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
QUL-ZOO-1_CHLA-1X_2022-06	E870A	22-Jun-2022	28-Jun-2022	28 days	6 days	✓	28-Jun-2022	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
QUL-ZOO-7_CHLA-1_2022-06	E870A	22-Jun-2022	28-Jun-2022	28 days	6 days	✓	28-Jun-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
BOL-B2_CHLA-1_2022-06	E870A	21-Jun-2022	28-Jun-2022	28 days	7 days	✓	28-Jun-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
POL-P2_CHLA-1_2022-06	E870A	21-Jun-2022	28-Jun-2022	28 days	7 days	✓	28-Jun-2022	28 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	541174	1	16	6.2	5.0	✓
Method Blanks (MB)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	541174	1	16	6.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. Sampling volume not provided by client.
Chlorophyll-a by Fluorometry (Field Filtered µg/L)	EC870A Vancouver - Environmental	Water	CALC	Convert results to sample concentration based on field information.
Field Volume (L)	EF003 Vancouver - Environmental	Water		Field measurement of sampling volume provided by client and recorded on ALS report may affect the validity of results.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a Extraction (Field Filtered)	EP870A Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22B4431**	Page	: 1 of 3
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 11:20
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 28-Jun-2022
C-O-C number	: ----	Issue Date	: 07-Jul-2022 14:43
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA2021-MPMC100-004-Minnow Water Quality		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Janice Pearson	Account Manager Assistant	Vancouver Administration, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Plant Pigments (QCLot: 541174)						
chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Plant Pigments (QCLot: 541174)									
chlorophyll a	479-61-8	E870A	0.002	µg/sample	1 µg/sample	92.2	80.0	120	----

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	VA2021-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:**

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F	Chlorophyll-a by Fluorometry (E870A)	Number of Containers
	POL-P2_CHLA-1_2022-06	21-JUN-22	12:05	Tissue	R		1
	BOL-B2_CHLA-1_2022-06	21-JUN-22	14:25	Tissue	R		1
	QUL-ZOO-7_CHLA-1_2022-06	22-JUN-22	09:55	Tissue	R		1
	QUL-ZOO-1_CHLA-1_2022-06	22-JUN-22	11:00	Tissue	R		1
	QUL-ZOO-1_CHLA-1X_2022-06	22-JUN-22	11:00	Tissue	R		1

Environmental Division
Vancouver
Work Order Reference
VA22B4431

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
		6°	5°

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
							June 24/22	11:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2019 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

PLANKTON COMMUNITY AND PRODUCTIVITY

ALS Laboratory Report VA22B7705
(Finalized August 18, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B7705**	Page	: 1 of 5
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 11:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 04-Aug-2022
C-O-C number	: ----	Issue Date	: 18-Aug-2022 16:23
Sampler	: SLA/NZI		
Site	: ----		
Quote number	: VA2021-MPMC100-004-Minnow Water Quality		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Janice Pearson	Account Manager Assistant	Administration, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µg/L	micrograms per litre
µg/sample	micrograms per sample
L	litres

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (18/08/2022): This report has been amended as a result of a request to change sample identification numbers (IDs). The id for the sample ALS identify as VA22B7705-021 has been modified. All analysis results are as per the previous report.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_CHLA-1_2022-07	POL-P2_CHLA-2_2022-07	POL-P2_CHLA-3_2022-07	POL-P2_CHLA-4_2022-07	POL-P2_CHLA-5_2022-07
					Client sampling date / time	25-Jul-2022 11:56	25-Jul-2022 13:30	25-Jul-2022 14:25	25-Jul-2022 15:00	25-Jul-2022 15:45
						VA22B7705-001	VA22B7705-002	VA22B7705-003	VA22B7705-004	VA22B7705-005
						Result	Result	Result	Result	Result
Field Tests										
sampling volume, field	----	EF003	0.010	L		0.225	0.250	0.250	0.250	0.250
Plant Pigments										
chlorophyll a	479-61-8	EC870A	0.010	µg/L		2.57	2.46	2.55	3.78	2.73
chlorophyll a	479-61-8	E870A	0.0020	µg/sample		0.579	0.616	0.638	0.946	0.682

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_CHLA-1_2022-07	BOL-B2_CHLA-2_2022-07	BOL-B2_CHLA-3_2022-07	BOL-B2_CHLA-4_2022-07	BOL-B2_CHLA-5_2022-07
					Client sampling date / time	26-Jul-2022 08:45	26-Jul-2022 10:50	26-Jul-2022 11:45	26-Jul-2022 13:40	26-Jul-2022 14:15
						VA22B7705-006	VA22B7705-007	VA22B7705-008	VA22B7705-009	VA22B7705-010
						Result	Result	Result	Result	Result
Field Tests										
sampling volume, field	----	EF003	0.010	L		0.225	0.225	0.225	0.225	0.225
Plant Pigments										
chlorophyll a	479-61-8	EC870A	0.010	µg/L		1.82	2.07	1.94	2.50	2.09
chlorophyll a	479-61-8	E870A	0.0020	µg/sample		0.409	0.465	0.436	0.562	0.470

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-7_CHLA-1_2022-07	QUL-ZOO-7_CHLA-2_2022-07	QUL-ZOO-7_CHLA-3_2022-07	QUL-ZOO-7_CHLA-4_2022-07	QUL-ZOO-7_CHLA-5_2022-07
					Client sampling date / time	27-Jul-2022 09:00	27-Jul-2022 10:30	27-Jul-2022 11:15	27-Jul-2022 11:50	27-Jul-2022 12:40
						VA22B7705-011	VA22B7705-012	VA22B7705-013	VA22B7705-014	VA22B7705-015
						Result	Result	Result	Result	Result
Field Tests										
sampling volume, field	----	EF003	0.010	L		0.250	0.225	0.225	0.250	0.225
Plant Pigments										
chlorophyll a	479-61-8	EC870A	0.010	µg/L		3.97	2.26	2.48	4.24	3.15
chlorophyll a	479-61-8	E870A	0.0020	µg/sample		0.992	0.508	0.557	1.06	0.708

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_CHLA-1_2022-07	QUL-ZOO-1_CHLA-2_2022-07	QUL-ZOO-1_CHLA-3_2022-07	QUL-ZOO-1_CHLA-4_2022-07	QUL-ZOO-1_CHLA-5_2022-07
					Client sampling date / time	27-Jul-2022 13:40	27-Jul-2022 14:50	28-Jul-2022 07:30	28-Jul-2022 08:10	28-Jul-2022 08:50
						VA22B7705-016	VA22B7705-017	VA22B7705-018	VA22B7705-019	VA22B7705-020
						Result	Result	Result	Result	Result
Field Tests										
sampling volume, field	----	EF003	0.010	L		0.250	0.250	0.250	0.250	0.250
Plant Pigments										
chlorophyll a	479-61-8	EC870A	0.010	µg/L		2.76	2.50	3.13	5.48	2.59
chlorophyll a	479-61-8	E870A	0.0020	µg/sample		0.690	0.626	0.782	1.37	0.647

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)				Client sample ID	POL-P2_CHLA-1X_2022-07	----	----	----	----
				Client sampling date / time	25-Jul-2022 11:56	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA22B7705-021**	--------	--------	--------	--------
					Result	----	----	----	----
Field Tests									
sampling volume, field	----	EF003	0.010	L	0.188	----	----	----	----
Plant Pigments									
chlorophyll a	479-61-8	EC870A	0.010	µg/L	2.56	----	----	----	----
chlorophyll a	479-61-8	E870A	0.0020	µg/sample	0.482	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B7705**	Page	: 1 of 9
Amendment	: 1		
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Quote number	: VA2021-MPMC100-004-Minnow Water Quality		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-1_2022-07	EF003	26-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-2_2022-07	EF003	26-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-3_2022-07	EF003	26-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-4_2022-07	EF003	26-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
BOL-B2_CHLA-5_2022-07	EF003	26-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
POL-P2_CHLA-1_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube										
POL-P2_CHLA-1X_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Field Volume (L)										
Opaque HDPE tube POL-P2_CHLA-2_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube POL-P2_CHLA-3_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube POL-P2_CHLA-4_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube POL-P2_CHLA-5_2022-07	EF003	25-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-1_CHLA-1_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-1_CHLA-2_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-1_CHLA-3_2022-07	EF003	28-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-1_CHLA-4_2022-07	EF003	28-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-1_CHLA-5_2022-07	EF003	28-Jul-2022	----	----	----		04-Aug-2022	----	----	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-7_CHLA-1_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-7_CHLA-2_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-7_CHLA-3_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-7_CHLA-4_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Field Tests : Field Volume (L)										
Opaque HDPE tube QUL-ZOO-7_CHLA-5_2022-07	EF003	27-Jul-2022	----	----	----		04-Aug-2022	----	----	
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-1_CHLA-3_2022-07	E870A	28-Jul-2022	09-Aug-2022	28 days	12 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-1_CHLA-4_2022-07	E870A	28-Jul-2022	09-Aug-2022	28 days	12 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-1_CHLA-5_2022-07	E870A	28-Jul-2022	09-Aug-2022	28 days	12 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-1_CHLA-1_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-1_CHLA-2_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-7_CHLA-1_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-7_CHLA-2_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-7_CHLA-3_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-7_CHLA-4_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube QUL-ZOO-7_CHLA-5_2022-07	E870A	27-Jul-2022	09-Aug-2022	28 days	13 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube BOL-B2_CHLA-1_2022-07	E870A	26-Jul-2022	09-Aug-2022	28 days	14 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube BOL-B2_CHLA-2_2022-07	E870A	26-Jul-2022	09-Aug-2022	28 days	14 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube BOL-B2_CHLA-3_2022-07	E870A	26-Jul-2022	09-Aug-2022	28 days	14 days	✓	09-Aug-2022	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube BOL-B2_CHLA-4_2022-07	E870A	26-Jul-2022	09-Aug-2022	28 days	14 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube BOL-B2_CHLA-5_2022-07	E870A	26-Jul-2022	09-Aug-2022	28 days	14 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-1_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-1X_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-2_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-3_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-4_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube POL-P2_CHLA-5_2022-07	E870A	25-Jul-2022	09-Aug-2022	28 days	15 days	✓	09-Aug-2022	28 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	594074	2	21	9.5	5.0	✓
Method Blanks (MB)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	594074	2	21	9.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. Sampling volume not provided by client.
Chlorophyll-a by Fluorometry (Field Filtered µg/L)	EC870A Vancouver - Environmental	Water	CALC	Convert results to sample concentration based on field information.
Field Volume (L)	EF003 Vancouver - Environmental	Water		Field measurement of sampling volume provided by client and recorded on ALS report may affect the validity of results.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a Extraction (Field Filtered)	EP870A Vancouver - Environmental	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22B7705**	Page	: 1 of 3
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This Quality Control Report contains the following information:

- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Janice Pearson	Account Manager Assistant	Vancouver Administration, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Plant Pigments (QCLot: 594074)						
chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----
Plant Pigments (QCLot: 594075)						
chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Plant Pigments (QCLot: 594074)									
chlorophyll a	479-61-8	E870A	0.002	µg/sample	1 µg/sample	96.9	80.0	120	----
Plant Pigments (QCLot: 594075)									
chlorophyll a	479-61-8	E870A	0.002	µg/sample	1 µg/sample	93.7	80.0	120	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Num

Environmental Division Vancouver

Work Order Reference

VA22B7705

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To |✓| YES | | NO
	Copy of Invoice with Report | | YES | | NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	|✓| PDF |✓| EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report	|✓| | | NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	|✓| EMAIL | | MAIL | | FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com; pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with

Regular [R] ☑ Standard TAT if received by

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service le

Project Information	
ALS Account # / Quote #:	VA2021-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only): B7705

ALS Contact: Can Dang

Sampler: SLA/NZI

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (E870A)	Number of Containers
1	POL-P2_CHLA-1_2022-07	225 mL	25-JUL-22	11:56	Tissue	R	1
2	POL-P2_CHLA-2_2022-07	250 mL	25-JUL-22	13:30	Tissue	R	1
3	POL-P2_CHLA-3_2022-07	250 mL	25-JUL-22	14:25	Tissue	R	1
4	POL-P2_CHLA-4_2022-07	250 mL	25-JUL-22	15:00	Tissue	R	1
5	POL-P2_CHLA-5_2022-07	250 mL	25-JUL-22	15:45	Tissue	R	1
6	BOL-B2_CHLA-1_2022-07	225 mL	26-JUL-22	08:45	Tissue	R	1
7	BOL-B2_CHLA-2_2022-07	225 mL	26-JUL-22	10:50	Tissue	R	1
8	BOL-B2_CHLA-3_2022-07	225 mL	26-JUL-22	11:45	Tissue	R	1
9	BOL-B2_CHLA-4_2022-07	225 mL	26-JUL-22	13:40	Tissue	R	1
10	BOL-B2_CHLA-5_2022-07	225mL	26-JUL-22	14:15	Tissue	R	1
11	QUL-ZOO-7_CHLA-1_2022-07	250 mL	27-JUL-22	09:00	Tissue	R	1
12	QUL-ZOO-7_CHLA-2_2022-07	225mL	27-JUL-22	10:30	Tissue	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? \| \| \| \|

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Volume filtered indicated beside Sample ID is

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2.3		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lajoie	Date: 28-JUL-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2/22	Time: 1124

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To |✓| YES | | NO
	Copy of Invoice with Report | | YES | | NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	|✓| PDF ☑ EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report	|✓| | | NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	|✓| EMAIL | MAIL | | FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com; pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA2021-MPMC100-004	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA/NZi

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F	Chlorophyll-a by Fluorometry (E870A)	Number of Containers
13	QUL-ZOO-7_CHLA-3_2022-07 225mL	27-JUL-22	11:15	Tissue	R		1
14	QUL-ZOO-7_CHLA-4_2022-07 250mL	27-JUL-22	11:50	Tissue	R		1
15	QUL-ZOO-7_CHLA-5_2022-07 225mL	27-JUL-22	12:40	Tissue	R		1
16	QUL-ZOO-1_CHLA-1_2022-07 250mL	27-JUL-22	13:40	Tissue	R		1
17	QUL-ZOO-1_CHLA-2_2022-07 250mL	27-JUL-22	14:50	Tissue	R		1
18	QUL-ZOO-1_CHLA-3_2022-07 250mL	28-JUL-22	07:30	Tissue	R		1
19	QUL-ZOO-1_CHLA-4_2022-07 250mL	28-JUL-22	08:10	Tissue	R		1
20	QUL-ZOO-1_CHLA-5_2022-07 250mL	28-JUL-22	08:50	Tissue	R		1
21	QUL-POL-PZ_CHLA-1X_2022-07 187.5	25-JUL-22	11:56	Tissue	R		1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ ☐	Volume filtered is indicated beside the Sample ID.
Are samples for human drinking water use? | | | |	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-July-2022	Time: 1241	Received by:	Date:	Time:	Received by: BIT	Date: Aug 2/22	Time: 11:40 am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Num

Environmental Division
Vancouver
Work Order Reference
VA22B7705

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To |✓| YES | | NO
	Copy of Invoice with Report | | YES | | NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	|✓| PDF |✓| EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report	|✓| | | NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	|✓| EMAIL | | MAIL | | FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com; pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with

Regular [R] ☑ Standard TAT if received by

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service le

Project Information	
ALS Account # / Quote #:	VA2021-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order #. (lab use only): B7705 **ALS Contact:** Can Dang **Sampler:** SLA/NZI

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F	Chlorophyll-a by Fluorometry (E870A)	Number of Containers
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2	POL-P2_CHLA-2_2022-07 250 mL	25 -JUL-22	13:30	Tissue	R		1
3	POL-P2_CHLA-3_2022-07 250 mL	25 -JUL-22	14:25	Tissue	R		1
4	POL-P2_CHLA-4_2022-07 250 mL	25 -JUL-22	15:00	Tissue	R		1
5	POL-P2_CHLA-5_2022-07 250 mL	25 -JUL-22	15:45	Tissue	R		1
6	BOL-B2_CHLA-1_2022-07 225 mL	26 -JUL-22	08:45	Tissue	R		1
7	BOL-B2_CHLA-2_2022-07 225 mL	26 -JUL-22	10:50	Tissue	R		1
8	BOL-B2_CHLA-3_2022-07 225 mL	26 -JUL-22	11:45	Tissue	R		1
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10	BOL-B2_CHLA-5_2022-07 225mL	26 -JUL-22	14:15	Tissue	R		1
11	QUL-ZOO-7_CHLA-1_2022-07 250mL	27 -JUL-22	09:00	Tissue	R		1
12	QUL-ZOO-7_CHLA-2_2022-07 225mL	27 -JUL-22	10:30	Tissue	R		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? \| \| \| \|

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Volume filtered indicated beside Sample ID is

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23.0		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-JUL-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2/22	Time: 1124

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Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
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Contact:	Gabriel Holmes
Phone:	236-317-4939
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Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To |✓| YES | | NO
	Copy of Invoice with Report | | YES | | NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	|✓| PDF ☑ EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report	|✓| | | NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	|✓| EMAIL | | MAIL | | FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kela.ivens@mountpolley.com; pschnurr@minnow.ca
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4]		1 Business day [E1]
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2]		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA2021-MPMC100-004	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA/NZi

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17	QUL-ZOO-1_CHLA-2_2022-07 250mL	27-JUL-22	14:50	Tissue	R		1
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20	QUL-ZOO-1_CHLA-5_2022-07 250mL	28-JUL-22	08:50	Tissue	R		1
21	QUL-POL-P2_CHLA-1X_2022-07 187.5	25-JUL-22	11:56	Tissue	R		1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ ☐	Volume filtered is indicated beside the Sample ID.
Are samples for human drinking water use? | | | |	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-July-2022	Time: 1241	Received by:	Date:	Time:	Received by: EIT	Date: Aug 2/22	Time: 11:40 am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ZOOPLANKTON TISSUE CHEMISTRY

ALS Laboratory Report VA22B4432

(Finalized August 25, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B4432**	Page	: 1 of 4
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 16:40
PO	: 550008044 Q2 2022	Date Analysis Commenced	: 29-Jul-2022
C-O-C number	: ----	Issue Date	: 25-Aug-2022 09:56
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Ragini Saini	Lab Assistant	Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-06	BOL-B2_ZOOT-1_2022-06	QUL-ZOO-7_ZOOT-1_2022-06	QUL-ZOO-1_ZOOT-1_2022-06	QUL-ZOO-1_ZOOT-1X_2022-06
					Client sampling date / time	21-Jun-2022 12:05	21-Jun-2022 14:25	22-Jun-2022 09:55	22-Jun-2022 11:00	22-Jun-2022 11:00
						VA22B4432-001	VA22B4432-002	VA22B4432-003	VA22B4432-004	VA22B4432-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		94.8	99.1	94.0	94.6	94.7
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		895	5240	2290	1220	1210
antimony	7440-36-0	E475	0.020	mg/kg		0.167	0.603	0.049	0.079	0.171
arsenic	7440-38-2	E475	0.050	mg/kg		23.0	26.3	3.50	2.62	2.63
barium	7440-39-3	E475	0.050	mg/kg		15.7	132	15.1	20.0	19.6
beryllium	7440-41-7	E475	0.010	mg/kg		0.036	0.202	0.162	0.056	0.058
bismuth	7440-69-9	E475	0.010	mg/kg		0.011	0.041	<0.010	<0.010	<0.010
boron	7440-42-8	E475	1.0	mg/kg		3.4	12.9	<1.0	1.2	<1.0
cadmium	7440-43-9	E475	0.010	mg/kg		0.404	0.450	0.927	0.940	0.926
calcium	7440-70-2	E475	20	mg/kg		6430	26300	3650	3360	3440
cesium	7440-46-2	E475	0.0050	mg/kg		0.0982	0.579	0.0870	0.103	0.0927
chromium	7440-47-3	E475	0.20	mg/kg		27.9	49.9	4.11	2.69	3.37
cobalt	7440-48-4	E475	0.020	mg/kg		0.836	3.80	0.912	0.983	0.983
copper	7440-50-8	E475	0.20	mg/kg		71.2	182	24.3	16.5	18.1
iron	7439-89-6	E475	5.0	mg/kg		1380	10200	1410	1180	1190
lead	7439-92-1	E475	0.050	mg/kg		1.44	4.27	0.580	0.464	0.514
lithium	7439-93-2	E475	0.50	mg/kg		0.76	3.54	0.72	0.90	0.92
magnesium	7439-95-4	E475	2.0	mg/kg		1340	2960	1470	1300	1330
manganese	7439-96-5	E475	0.050	mg/kg		210	1180	84.9	97.7	97.3
mercury	7439-97-6	E512	0.010	mg/kg		0.027	0.090	0.035	0.037	0.036
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0021	<0.0020	<0.0020
molybdenum	7439-98-7	E475	0.040	mg/kg		0.827	1.82	0.566	0.308	0.318
nickel	7440-02-0	E475	0.20	mg/kg		3.21	11.8	2.70	2.50	2.81
phosphorus	7723-14-0	E475	20	mg/kg		8820	8300	9130	11300	11500
potassium	7440-09-7	E475	20	mg/kg		6660	6570	7590	9280	9500
rubidium	7440-17-7	E475	0.050	mg/kg		6.77	8.70	12.1	15.4	15.9
selenium	7782-49-2	E475	0.10	mg/kg		2.68	2.35	2.33	2.88	2.87
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0429	0.121	0.0472	0.0547	0.0506
sodium	7440-23-5	E475	20	mg/kg		3020	3380	2420	3300	3350

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-06	BOL-B2_ZOOT-1_2022-06	QUL-ZOO-7_ZOOT-1_2022-06	QUL-ZOO-1_ZOOT-1_2022-06	QUL-ZOO-1_ZOOT-1X_2022-06
					Client sampling date / time	21-Jun-2022 12:05	21-Jun-2022 14:25	22-Jun-2022 09:55	22-Jun-2022 11:00	22-Jun-2022 11:00
						VA22B4432-001	VA22B4432-002	VA22B4432-003	VA22B4432-004	VA22B4432-005
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		30.2	186	22.2	20.4	20.8
tellurium	13494-80-9	E475	0.020	mg/kg		<0.020	0.023	<0.020	<0.020	<0.020
thallium	7440-28-0	E475	0.0020	mg/kg		0.0069	0.0283	0.0269	0.0307	0.0304
tin	7440-31-5	E475	0.10	mg/kg		0.71	1.92	0.24	0.30	0.22
titanium	7440-32-6	E475.Ti	0.50	mg/kg		56.8	317	41.1	35.1	36.3
uranium	7440-61-1	E475	0.0020	mg/kg		0.0622	0.427	0.150	0.0901	0.0883
vanadium	7440-62-2	E475	0.10	mg/kg		4.80	30.6	3.11	2.48	2.56
zinc	7440-66-6	E475	1.0	mg/kg		85.6	79.5	79.8	84.6	81.5
zirconium	7440-67-7	E475	0.20	mg/kg		0.97	2.74	0.77	0.61	0.57

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B4432**	Page	: 1 of 9
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 16:40
PO	: 550008044 Q2 2022	Issue Date	: 25-Aug-2022 09:56
C-O-C number	: ----		
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Reference Material (RM) Sample								
Metals	QC-MRG4-594928003	----	lead	7439-92-1	E475	133 % MES	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-06	E512	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-06	E512	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-06	E512	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-06	E512	21-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-06	E512	21-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-06	E512A	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-06	E512A	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-06	E512A	22-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-06	E512A	21-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-06	E512A	21-Jun-2022	09-Aug-2022	----	----		10-Aug-2022	365 days	49 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-06	E475	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-06	E475	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-06	E475	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-06	E475	21-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	49 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-06	E475	21-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-06	E475.Ag	22-Jun-2022	19-Aug-2022	----	----		19-Aug-2022	730 days	58 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-06	E475.Ag	22-Jun-2022	19-Aug-2022	----	----		19-Aug-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-06	E475.Ag	22-Jun-2022	19-Aug-2022	----	----		19-Aug-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-06	E475.Ag	21-Jun-2022	19-Aug-2022	----	----		19-Aug-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-06	E475.Ag	21-Jun-2022	19-Aug-2022	----	----		19-Aug-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-06	E475.Ti	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-06	E475.Ti	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-06	E475.Ti	22-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-06	E475.Ti	21-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	49 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-06	E475.Ti	21-Jun-2022	09-Aug-2022	----	----		09-Aug-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
BOL-B2_ZOOT-1_2022-06	E144A	21-Jun-2022	----	----	----		09-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
POL-P2_ZOOT-1_2022-06	E144A	21-Jun-2022	----	----	----		09-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
QUL-ZOO-1_ZOOT-1_2022-06	E144A	22-Jun-2022	----	----	----		09-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
QUL-ZOO-1_ZOOT-1X_2022-06	E144A	22-Jun-2022	----	----	----		09-Aug-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
QUL-ZOO-7_ZOOT-1_2022-06	E144A	22-Jun-2022	----	----	----		09-Aug-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	594929	2	5	40.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	594930	2	5	40.0	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	594931	2	5	40.0	10.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	595007	1	5	20.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	610686	2	5	40.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	594928	2	5	40.0	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	594929	1	5	20.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	594930	1	5	20.0	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	594931	1	5	20.0	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	595007	1	5	20.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	610686	1	5	20.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	594928	1	5	20.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

QUALITY CONTROL REPORT

Work Order	: **VA22B4432**	Page	: 1 of 8
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 24-Jun-2022 16:40
PO	: 550008044 Q2 2022	Date Analysis Commenced	: 29-Jul-2022
C-O-C number	: ----	Issue Date	: 25-Aug-2022 09:56
Sampler	: Latimer, Schnurr		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Ragini Saini	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 595007)						
moisture	----	E144A	2	%	<2.0	----
Metals (QCLot: 594928)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 594929)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 594930)						
mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 594931)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 594931) - continued						
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 610686)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 595007)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Metals (QCLot: 594928)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	102	80.0	120	----
Metals (QCLot: 594929)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	95.4	80.0	120	----
Metals (QCLot: 594930)									
mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	95.4	80.0	120	----
Metals (QCLot: 594931)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	105	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	101	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	101	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	99.1	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	92.8	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	100	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	104	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	103	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	100	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	99.3	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	100	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	101	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	103	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	98.6	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	109	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	100	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	105	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	102	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	101	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	102	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 594931) - continued									
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	101	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	101	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	104	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	105	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	106	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	97.5	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	106	80.0	120	----
Metals (QCLot: 610686)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	86.7	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 594928)									
	RM	titanium	7440-32-6	E475.Ti	1.05 mg/kg	86.2	70.0	130	----
Metals (QCLot: 594929)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	109	70.0	130	----
Metals (QCLot: 594930)									
	RM	mercury	7439-97-6	E512A	0.331 mg/kg wwt	109	70.0	130	----
Metals (QCLot: 594931)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	95.7	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	102	70.0	130	----
	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	94.3	60.0	140	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	95.7	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	100	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	97.4	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	107	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	94.6	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	99.4	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	99.9	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	# 133	70.0	130	MES
	RM	magnesium	7439-95-4	E475	940 mg/kg	99.2	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	99.5	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	101	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	94.0	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	103	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	104	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	98.9	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	106	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	98.2	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	96.7	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	93.6	70.0	130	----
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	99.9	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 594931) - continued									
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	99.8	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	99.4	70.0	130	----
Metals (QCLot: 610686)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	88.3	70.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4939	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca	
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2:	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SCHNURR/ LATIMER

Environmental Division Vancouver
Work Order Reference
VA22B4432

Telephone : +1 604 253 4188

Analysis Request — Indicate Filtered (F), Preserved (P) or

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	
	POL-P2_ZOOT-1_2022-06	21-June-22	12:05	Tissue	R	R	R	R	R	R	1
	BOL-B2_ZOOT-1_2022-06	21-June-22	14:25	Tissue	R	R	R	R	R	R	1
	QUL-ZOO-7_ZOOT-1_2022-06	22-June-22	09:55	Tissue	R	R	R	R	R	R	1
	QUL-ZOO-1_ZOOT-1_2022-06	22-June-22	11:00	Tissue	R	R	R	R	R	R	1
	QUL-ZOOL ZOOT- X_2022-06	22-June-22	11:00	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	
Are samples for human drinking water use? ☐ YES ☑ NO	If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6°	3°	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
							June 24/22	11:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ZOOPLANKTON TISSUE CHEMISTRY

ALS Laboratory Report VA22B7702

(Finalized November 7, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B7702**	Page	: 1 of 13
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 14:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 07-Sep-2022
C-O-C number	: ----	Issue Date	: 07-Nov-2022 16:16
Sampler	: Sarah Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.
Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (07/11/2022): This report has been amended and re-released to remove extra wet weight basis analysis data as requested.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLHM	*Detection Limit Adjusted: Sample has high moisture content.*
DLIS	*Detection Limit Adjusted due to insufficient sample.*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-07	POL-P2_ZOOT-2_2022-07	POL-P2_ZOOT-3_2022-07	POL-P2_ZOOT-4_2022-07	POL-P2_ZOOT-5_2022-07
					Client sampling date / time	25-Jul-2022	25-Jul-2022	25-Jul-2022	25-Jul-2022	25-Jul-2022
						VA22B7702-001	VA22B7702-002	VA22B7702-003	VA22B7702-004	VA22B7702-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		97.6	97.9	98.2	98.0	98.4
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		1150	1450	948	1200	888
antimony	7440-36-0	E475	0.020	mg/kg		0.108	0.074	0.065	0.033	0.078
arsenic	7440-38-2	E475	0.050	mg/kg		6.70	5.46	10.7	6.12	6.20
barium	7440-39-3	E475	0.050	mg/kg		22.3	37.2	23.5	23.1	20.8
beryllium	7440-41-7	E475	0.010	mg/kg		0.049	0.071	0.049	0.054	0.044
bismuth	7440-69-9	E475	0.010	mg/kg		0.017	<0.012 DLIS	<0.011 DLIS	<0.010	<0.012 DLIS
boron	7440-42-8	E475	1.0	mg/kg		5.5	5.6	5.2	4.8	5.1
cadmium	7440-43-9	E475	0.010	mg/kg		0.349	0.362	0.349	0.292	0.306
calcium	7440-70-2	E475	20	mg/kg		17500	24900	23600	17900	23000
cesium	7440-46-2	E475	0.0050	mg/kg		0.119	0.128	0.0962	0.124	0.0880
chromium	7440-47-3	E475	0.20	mg/kg		7.21	3.23	9.71	3.54	3.96
cobalt	7440-48-4	E475	0.020	mg/kg		0.989	1.12	0.740	0.919	0.703
copper	7440-50-8	E475	0.20	mg/kg		59.5	70.2	48.8	44.1	42.1
iron	7439-89-6	E475	5.0	mg/kg		1760	2290	1390	1720	1320
lead	7439-92-1	E475	0.050	mg/kg		1.18	0.982	0.981	2.72	0.820
lithium	7439-93-2	E475	0.50	mg/kg		0.92	1.13	0.75	0.97	0.70
magnesium	7439-95-4	E475	2.0	mg/kg		1560	1870	1570	1630	1560
manganese	7439-96-5	E475	0.050	mg/kg		285	252	257	232	222
mercury	7439-97-6	E512	0.010	mg/kg		<0.055 DLA	0.050	<0.037 DLA	0.036	0.054
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
molybdenum	7439-98-7	E475	0.040	mg/kg		1.00	1.04	0.878	0.757	0.924
nickel	7440-02-0	E475	0.20	mg/kg		4.22	2.90	2.46	2.50	2.35
phosphorus	7723-14-0	E475	20	mg/kg		8120	8730	9120	8040	8560
potassium	7440-09-7	E475	20	mg/kg		6220	6860	6360	7060	6640
rubidium	7440-17-7	E475	0.050	mg/kg		5.86	6.34	6.07	7.30	6.36
selenium	7782-49-2	E475	0.10	mg/kg		2.50	3.34	2.27	2.14	2.77
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0648	0.0478	0.0409	0.0333	0.0291
sodium	7440-23-5	E475	20	mg/kg		4800	5600	5460	5650	5460

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-07	POL-P2_ZOOT-2_2022-07	POL-P2_ZOOT-3_2022-07	POL-P2_ZOOT-4_2022-07	POL-P2_ZOOT-5_2022-07
					Client sampling date / time	25-Jul-2022	25-Jul-2022	25-Jul-2022	25-Jul-2022	25-Jul-2022
						VA22B7702-001	VA22B7702-002	VA22B7702-003	VA22B7702-004	VA22B7702-005
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		79.8	108	101	80.1	107
tellurium	13494-80-9	E475	0.020	mg/kg		<0.033 DLIS	<0.024 DLIS	<0.022 DLIS	<0.020	<0.024 DLIS
thallium	7440-28-0	E475	0.0020	mg/kg		0.0078	0.0076	0.0059	0.0064	0.0074
tin	7440-31-5	E475	0.10	mg/kg		0.59	0.40	0.32	0.21	0.50
titanium	7440-32-6	E475.Ti	0.50	mg/kg		73.3	94.6	54.6	64.4	50.7
uranium	7440-61-1	E475	0.0020	mg/kg		0.0789	0.0761	0.0661	0.0773	0.0638
vanadium	7440-62-2	E475	0.10	mg/kg		8.18	11.6	7.47	8.73	6.90
zinc	7440-66-6	E475	1.0	mg/kg		68.6	66.0	67.5	55.9	62.4
zirconium	7440-67-7	E475	0.20	mg/kg		1.70	1.41	1.24	1.15	0.98

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_ZOOT-1_2022-07	BOL-B2_ZOOT-2_2022-07	BOL-B2_ZOOT-3_2022-07	BOL-B2_ZOOT-4_2022-07	BOL-B2_ZOOT-5_2022-07
					Client sampling date / time	26-Jul-2022	26-Jul-2022	26-Jul-2022	26-Jul-2022	26-Jul-2022
						VA22B7702-006	VA22B7702-007	VA22B7702-008	VA22B7702-009	VA22B7702-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		95.9	97.7	97.4	97.7	97.8
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		7530	2100	5430	1920	1520
antimony	7440-36-0	E475	0.020	mg/kg		0.194	0.176	0.237	0.162	0.180
arsenic	7440-38-2	E475	0.050	mg/kg		5.74	19.6	38.3	28.1	19.0
barium	7440-39-3	E475	0.050	mg/kg		177	93.6	109	65.5	68.6
beryllium	7440-41-7	E475	0.010	mg/kg		0.293	0.080	0.196	0.074	0.064
bismuth	7440-69-9	E475	0.010	mg/kg		0.050	0.017	0.037	0.016	0.013
boron	7440-42-8	E475	1.0	mg/kg		11.0	6.9	10.2	6.9	6.1
cadmium	7440-43-9	E475	0.010	mg/kg		0.371	0.349	0.384	0.322	0.279
calcium	7440-70-2	E475	20	mg/kg		20200	28300	25900	33700	26800
cesium	7440-46-2	E475	0.0050	mg/kg		0.904	0.280	0.664	0.257	0.199
chromium	7440-47-3	E475	0.20	mg/kg		23.6	23.8	52.8	35.8	21.7
cobalt	7440-48-4	E475	0.020	mg/kg		4.68	1.66	3.64	1.47	1.33
copper	7440-50-8	E475	0.20	mg/kg		144	76.1	174	67.3	58.5
iron	7439-89-6	E475	5.0	mg/kg		12200	3960	9390	3550	3160
lead	7439-92-1	E475	0.050	mg/kg		4.33	3.13	4.45	2.44	2.19
lithium	7439-93-2	E475	0.50	mg/kg		4.97	1.40	3.68	1.36	1.08
magnesium	7439-95-4	E475	2.0	mg/kg		2960	2240	2920	2150	1870
manganese	7439-96-5	E475	0.050	mg/kg		2410	1580	1210	939	1170
mercury	7439-97-6	E512	0.010	mg/kg		0.153	0.080	0.131	0.079	0.117
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.0062	<0.0020	0.0034	<0.0020	0.0025
molybdenum	7439-98-7	E475	0.040	mg/kg		2.34	1.41	1.55	1.07	1.15
nickel	7440-02-0	E475	0.20	mg/kg		14.4	4.56	8.89	3.95	3.80
phosphorus	7723-14-0	E475	20	mg/kg		9900	13100	10200	12200	11000
potassium	7440-09-7	E475	20	mg/kg		6360	9410	6860	8090	7430
rubidium	7440-17-7	E475	0.050	mg/kg		10.0	10.8	10.0	9.23	8.15
selenium	7782-49-2	E475	0.10	mg/kg		2.62	3.24	2.99	2.88	2.17
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.185	0.0960	0.170	0.0898	0.0858
sodium	7440-23-5	E475	20	mg/kg		3730	6370	3870	5470	4940

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL-B2_ZOOT-1_2022-07	BOL-B2_ZOOT-2_2022-07	BOL-B2_ZOOT-3_2022-07	BOL-B2_ZOOT-4_2022-07	BOL-B2_ZOOT-5_2022-07
					Client sampling date / time	26-Jul-2022	26-Jul-2022	26-Jul-2022	26-Jul-2022	26-Jul-2022
						VA22B7702-006	VA22B7702-007	VA22B7702-008	VA22B7702-009	VA22B7702-010
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		149	188	173	207	172
tellurium	13494-80-9	E475	0.020	mg/kg		<0.023 DLIS	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E475	0.0020	mg/kg		0.0726	0.0328	0.0641	0.0352	0.0275
tin	7440-31-5	E475	0.10	mg/kg		0.49	0.66	0.73	0.72	0.76
titanium	7440-32-6	E475.Ti	0.50	mg/kg		258	95.2	232	90.9	75.4
uranium	7440-61-1	E475	0.0020	mg/kg		0.938	0.322	0.701	0.297	0.272
vanadium	7440-62-2	E475	0.10	mg/kg		29.8	11.1	21.8	10.5	9.36
zinc	7440-66-6	E475	1.0	mg/kg		125	125	133	110	100
zirconium	7440-67-7	E475	0.20	mg/kg		5.71	2.58	4.98	2.38	2.09

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-7_ZOOT-1_2022-07	QUL-ZOO-7_ZOOT-2_2022-07	QUL-ZOO-7_ZOOT-3_2022-07	QUL-ZOO-7_ZOOT-4_2022-07	QUL-ZOO-7_ZOOT-5_2022-07
					Client sampling date / time	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
						VA22B7702-011	VA22B7702-012	VA22B7702-013	VA22B7702-014	VA22B7702-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		----	97.8	98.3	98.7	95.6
moisture	----	E144-H	2.0	%		97.1	----	----	----	----
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		----	1250	911	671	584
aluminum	7429-90-5	E472	5.0	mg/kg		618	----	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg		0.023	----	----	----	----
antimony	7440-36-0	E475	0.020	mg/kg		----	0.043	0.054	0.043	0.046
arsenic	7440-38-2	E472	0.030	mg/kg		2.40	----	----	----	----
arsenic	7440-38-2	E475	0.050	mg/kg		----	3.09	2.69	2.25	2.07
barium	7440-39-3	E475	0.050	mg/kg		----	16.4	14.9	15.1	10.9
barium	7440-39-3	E472	0.050	mg/kg		9.50	----	----	----	----
beryllium	7440-41-7	E475	0.010	mg/kg		----	0.053	0.036	0.033	0.023
beryllium	7440-41-7	E472	0.010	mg/kg		0.033	----	----	----	----
bismuth	7440-69-9	E475	0.010	mg/kg		----	0.013	0.012	0.013	0.014
bismuth	7440-69-9	E472	0.010	mg/kg		<0.013 DLHM	----	----	----	----
boron	7440-42-8	E475	1.0	mg/kg		----	1.9	1.4	1.1	<1.8 DLIS
boron	7440-42-8	E472	1.0	mg/kg		<1.3 DLHM	----	----	----	----
cadmium	7440-43-9	E475	0.010	mg/kg		----	1.88	2.43	2.81	2.06
cadmium	7440-43-9	E472	0.010	mg/kg		1.66	----	----	----	----
calcium	7440-70-2	E475	20	mg/kg		----	13400	8160	11000	14200
calcium	7440-70-2	E472	20	mg/kg		11000	----	----	----	----
cesium	7440-46-2	E475	0.0050	mg/kg		----	0.141	0.114	0.0929	0.0971
cesium	7440-46-2	E472	0.0050	mg/kg		0.0789	----	----	----	----
chromium	7440-47-3	E475	0.20	mg/kg		----	5.26	2.60	2.02	4.39
chromium	7440-47-3	E472	0.20	mg/kg		2.08	----	----	----	----
cobalt	7440-48-4	E475	0.020	mg/kg		----	1.22	1.10	1.00	0.893
cobalt	7440-48-4	E472	0.020	mg/kg		0.685	----	----	----	----
copper	7440-50-8	E475	0.20	mg/kg		----	39.3	28.0	19.4	16.8
copper	7440-50-8	E472	0.20	mg/kg		17.3	----	----	----	----
iron	7439-89-6	E475	5.0	mg/kg		----	2250	1770	1540	1380

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-7_ZOOT-1_2022-07	QUL-ZOO-7_ZOOT-2_2022-07	QUL-ZOO-7_ZOOT-3_2022-07	QUL-ZOO-7_ZOOT-4_2022-07	QUL-ZOO-7_ZOOT-5_2022-07
					Client sampling date / time	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
						VA22B7702-011	VA22B7702-012	VA22B7702-013	VA22B7702-014	VA22B7702-015
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		1100	----	----	----	----
lead	7439-92-1	E475	0.050	mg/kg		----	0.846	0.928	0.945	0.579
lead	7439-92-1	E472	0.050	mg/kg		0.635	----	----	----	----
lithium	7439-93-2	E475	0.50	mg/kg		----	0.97	0.80	0.70	<0.68 DLIS
lithium	7439-93-2	E472	0.50	mg/kg		<0.65 DLHM	----	----	----	----
magnesium	7439-95-4	E475	2.0	mg/kg		----	1650	1420	1330	1210
magnesium	7439-95-4	E472	2.0	mg/kg		1130	----	----	----	----
manganese	7439-96-5	E475	0.050	mg/kg		----	128	126	141	109
manganese	7439-96-5	E472	0.050	mg/kg		78.8	----	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		0.0366	----	----	----	----
mercury	7439-97-6	E512	0.010	mg/kg		----	0.041	0.045	0.059	0.046
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0011	----	----	----	----
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	<0.0020	<0.0020	<0.0020	<0.0020
molybdenum	7439-98-7	E475	0.040	mg/kg		----	0.604	0.431	0.392	0.494
molybdenum	7439-98-7	E472	0.040	mg/kg		0.364	----	----	----	----
nickel	7440-02-0	E475	0.20	mg/kg		----	4.48	3.66	4.12	3.60
nickel	7440-02-0	E472	0.20	mg/kg		2.54	----	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg		10500	----	----	----	----
phosphorus	7723-14-0	E475	20	mg/kg		----	12400	10200	10000	11800
potassium	7440-09-7	E475	20	mg/kg		----	8360	6970	7340	7350
potassium	7440-09-7	E472	20	mg/kg		7150	----	----	----	----
rubidium	7440-17-7	E475	0.050	mg/kg		----	13.0	11.6	11.9	11.5
rubidium	7440-17-7	E472	0.050	mg/kg		11.8	----	----	----	----
selenium	7782-49-2	E475	0.10	mg/kg		----	2.42	2.46	2.69	2.56
selenium	7782-49-2	E472	0.10	mg/kg		2.10	----	----	----	----
silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	0.0779	0.0754	0.0843	0.0607
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0547	----	----	----	----
sodium	7440-23-5	E475	20	mg/kg		----	4370	3180	3810	4310
sodium	7440-23-5	E472	20	mg/kg		3570	----	----	----	----
strontium	7440-24-6	E475	0.10	mg/kg		----	66.9	46.7	57.2	72.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-7_ZOOT-1_2022-07	QUL-ZOO-7_ZOOT-2_2022-07	QUL-ZOO-7_ZOOT-3_2022-07	QUL-ZOO-7_ZOOT-4_2022-07	QUL-ZOO-7_ZOOT-5_2022-07
					Client sampling date / time	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
						VA22B7702-011	VA22B7702-012	VA22B7702-013	VA22B7702-014	VA22B7702-015
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		54.1	----	----	----	----
tellurium	13494-80-9	E475	0.020	mg/kg		----	<0.020	<0.020	<0.020	<0.027 DLIS
tellurium	13494-80-9	E472	0.020	mg/kg		<0.026 DLHM	----	----	----	----
thallium	7440-28-0	E475	0.0020	mg/kg		----	0.0308	0.0221	0.0263	0.0252
thallium	7440-28-0	E472	0.0020	mg/kg		0.0288	----	----	----	----
tin	7440-31-5	E475	0.10	mg/kg		----	0.32	0.25	0.33	0.18
tin	7440-31-5	E472	0.10	mg/kg		0.13	----	----	----	----
titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	64.2	51.1	36.5	30.9
titanium	7440-32-6	E472.Ti	0.50	mg/kg		24.5	----	----	----	----
uranium	7440-61-1	E475	0.0020	mg/kg		----	0.118	0.106	0.0820	0.0761
uranium	7440-61-1	E472	0.0020	mg/kg		0.0766	----	----	----	----
vanadium	7440-62-2	E475	0.10	mg/kg		----	7.04	4.94	3.51	2.81
vanadium	7440-62-2	E472	0.10	mg/kg		2.98	----	----	----	----
zinc	7440-66-6	E475	1.0	mg/kg		----	100	114	88.1	99.9
zinc	7440-66-6	E472	1.0	mg/kg		79.2	----	----	----	----
zirconium	7440-67-7	E475	0.20	mg/kg		----	1.07	0.95	0.75	0.60
zirconium	7440-67-7	E472	0.20	mg/kg		0.54	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_ZOOT-1_2022-07	QUL-ZOO-1_ZOOT-2_2022-07	QUL-ZOO-1_ZOOT-3_2022-07	QUL-ZOO-1_ZOOT-4_2022-07	QUL-ZOO-1_ZOOT-5_2022-07
					Client sampling date / time	27-Jul-2022	27-Jul-2022	28-Jul-2022	28-Jul-2022	28-Jul-2022
						VA22B7702-016	VA22B7702-017	VA22B7702-018	VA22B7702-019	VA22B7702-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		99.2	98.3	98.5	98.6	98.9
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		604	530	512	602	631
antimony	7440-36-0	E475	0.020	mg/kg		0.060	0.048	0.436	0.037	0.044
arsenic	7440-38-2	E475	0.050	mg/kg		2.37	2.49	2.58	2.30	2.44
barium	7440-39-3	E475	0.050	mg/kg		10.8	9.44	7.93	8.40	9.33
beryllium	7440-41-7	E475	0.010	mg/kg		0.026	0.024	0.026	0.032	0.033
bismuth	7440-69-9	E475	0.010	mg/kg		0.012	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E475	1.0	mg/kg		1.4	1.2	<1.0	1.2	1.2
cadmium	7440-43-9	E475	0.010	mg/kg		4.90	2.60	2.77	2.92	3.32
calcium	7440-70-2	E475	20	mg/kg		8760	8000	9200	8420	9180
cesium	7440-46-2	E475	0.0050	mg/kg		0.0808	0.0788	0.0631	0.0656	0.0703
chromium	7440-47-3	E475	0.20	mg/kg		2.67	2.02	1.84	1.68	1.31
cobalt	7440-48-4	E475	0.020	mg/kg		1.13	0.701	0.652	0.715	0.806
copper	7440-50-8	E475	0.20	mg/kg		29.2	18.1	16.0	23.9	27.5
iron	7439-89-6	E475	5.0	mg/kg		1720	1060	1030	1130	1220
lead	7439-92-1	E475	0.050	mg/kg		0.966	0.662	0.559	0.545	0.612
lithium	7439-93-2	E475	0.50	mg/kg		0.66	0.59	<0.50	0.55	0.55
magnesium	7439-95-4	E475	2.0	mg/kg		1530	1270	1220	1260	1350
manganese	7439-96-5	E475	0.050	mg/kg		184	77.2	98.2	112	117
mercury	7439-97-6	E512	0.010	mg/kg		0.065	0.045	0.044	0.043	0.045
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
molybdenum	7439-98-7	E475	0.040	mg/kg		0.512	0.405	0.334	1.86	0.426
nickel	7440-02-0	E475	0.20	mg/kg		6.59	3.17	3.21	3.45	3.80
phosphorus	7723-14-0	E475	20	mg/kg		9350	10700	10200	9710	10300
potassium	7440-09-7	E475	20	mg/kg		7760	7770	7410	7420	7850
rubidium	7440-17-7	E475	0.050	mg/kg		13.4	13.1	12.4	12.7	13.4
selenium	7782-49-2	E475	0.10	mg/kg		3.68	2.63	2.64	2.64	2.84
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.131	0.0723	0.0720	0.0813	0.0900
sodium	7440-23-5	E475	20	mg/kg		3320	3680	3480	3560	3700

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-ZOO-1_ZOOT-1_2022-07	QUL-ZOO-1_ZOOT-2_2022-07	QUL-ZOO-1_ZOOT-3_2022-07	QUL-ZOO-1_ZOOT-4_2022-07	QUL-ZOO-1_ZOOT-5_2022-07
					Client sampling date / time	27-Jul-2022	27-Jul-2022	28-Jul-2022	28-Jul-2022	28-Jul-2022
						VA22B7702-016	VA22B7702-017	VA22B7702-018	VA22B7702-019	VA22B7702-020
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		53.2	46.8	50.9	47.0	50.9
tellurium	13494-80-9	E475	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E475	0.0020	mg/kg		0.0198	0.0192	0.0229	0.0204	0.0195
tin	7440-31-5	E475	0.10	mg/kg		0.27	0.27	0.16	0.16	0.18
titanium	7440-32-6	E475.Ti	0.50	mg/kg		32.3	25.7	18.2	22.0	21.2
uranium	7440-61-1	E475	0.0020	mg/kg		0.0824	0.0708	0.0600	0.0706	0.0788
vanadium	7440-62-2	E475	0.10	mg/kg		3.79	3.15	2.93	3.19	3.10
zinc	7440-66-6	E475	1.0	mg/kg		108	96.0	87.3	89.5	100
zirconium	7440-67-7	E475	0.20	mg/kg		0.63	0.86	0.38	0.55	0.72

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	BOL-B2_ZOOT-3X_2022-07	----	----	----	----
					Client sampling date / time	26-Jul-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B7702-021	--------	--------	--------	--------
						Result	----	----	----	----
Physical Tests										
moisture	----	E144A	2.0	%		96.9	----	----	----	----
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		5590	----	----	----	----
antimony	7440-36-0	E475	0.020	mg/kg		0.493	----	----	----	----
arsenic	7440-38-2	E475	0.050	mg/kg		63.1	----	----	----	----
barium	7440-39-3	E475	0.050	mg/kg		108	----	----	----	----
beryllium	7440-41-7	E475	0.010	mg/kg		0.218	----	----	----	----
bismuth	7440-69-9	E475	0.010	mg/kg		0.042	----	----	----	----
boron	7440-42-8	E475	1.0	mg/kg		10.3	----	----	----	----
cadmium	7440-43-9	E475	0.010	mg/kg		0.393	----	----	----	----
calcium	7440-70-2	E475	20	mg/kg		27000	----	----	----	----
cesium	7440-46-2	E475	0.0050	mg/kg		0.717	----	----	----	----
chromium	7440-47-3	E475	0.20	mg/kg		98.5	----	----	----	----
cobalt	7440-48-4	E475	0.020	mg/kg		3.81	----	----	----	----
copper	7440-50-8	E475	0.20	mg/kg		178	----	----	----	----
iron	7439-89-6	E475	5.0	mg/kg		9760	----	----	----	----
lead	7439-92-1	E475	0.050	mg/kg		6.65	----	----	----	----
lithium	7439-93-2	E475	0.50	mg/kg		4.09	----	----	----	----
magnesium	7439-95-4	E475	2.0	mg/kg		2800	----	----	----	----
manganese	7439-96-5	E475	0.050	mg/kg		1210	----	----	----	----
mercury	7439-97-6	E512	0.010	mg/kg		0.133	----	----	----	----
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.0041	----	----	----	----
molybdenum	7439-98-7	E475	0.040	mg/kg		2.03	----	----	----	----
nickel	7440-02-0	E475	0.20	mg/kg		14.3	----	----	----	----
phosphorus	7723-14-0	E475	20	mg/kg		10100	----	----	----	----
potassium	7440-09-7	E475	20	mg/kg		5640	----	----	----	----
rubidium	7440-17-7	E475	0.050	mg/kg		8.92	----	----	----	----
selenium	7782-49-2	E475	0.10	mg/kg		2.70	----	----	----	----
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.174	----	----	----	----
sodium	7440-23-5	E475	20	mg/kg		3230	----	----	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	BOL-B2_ZOOT-3X_2022-07	----	----	----	----
					Client sampling date / time	26-Jul-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B7702-021	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		183	----	----	----	----
tellurium	13494-80-9	E475	0.020	mg/kg		<0.029 DLIS	----	----	----	----
thallium	7440-28-0	E475	0.0020	mg/kg		0.0727	----	----	----	----
tin	7440-31-5	E475	0.10	mg/kg		0.88	----	----	----	----
titanium	7440-32-6	E475.Ti	0.50	mg/kg		235	----	----	----	----
uranium	7440-61-1	E475	0.0020	mg/kg		0.770	----	----	----	----
vanadium	7440-62-2	E475	0.10	mg/kg		21.8	----	----	----	----
zinc	7440-66-6	E475	1.0	mg/kg		142	----	----	----	----
zirconium	7440-67-7	E475	0.20	mg/kg		5.43	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B7702**	Page	: 1 of 21
Amendment	: 1		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 14:15
PO	: 5590008044 Q2 2022	Issue Date	: 07-Nov-2022 16:16
C-O-C number	: ----		
Sampler	: Sarah Latimer		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG8-635554002	----	silver	7440-22-4	E472.Ag	79.0 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG8-648756002	----	silver	7440-22-4	E475.Ag	79.0 % MES	80.0-120%	Recovery less than lower control limit

Result Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E512	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E512	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E512	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-5_2022-07	E512	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E512	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E512	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E512	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E512	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E512	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E512	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-07	E511	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E512A	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E512A	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E512A	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-5_2022-07	E512A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E512A	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E512A	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E512A	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E512A	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E512A	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E512A	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-07	E511A	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	365 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E475	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E475	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E475	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-5_2022-07	E475	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E475	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E475	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E475	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E475	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E475	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E475	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-07	E472	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E475.Ag	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E475.Ag	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E475.Ag	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-5_2022-07	E475.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E475.Ag	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E475.Ag	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E475.Ag	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E475.Ag	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E475.Ag	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E475.Ag	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-07	E472.Ag	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E475.Ti	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E475.Ti	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E475.Ti	28-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-5_2022-07	E475.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E475.Ti	26-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E475.Ti	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E475.Ti	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E475.Ti	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E475.Ti	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E475.Ti	25-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-07	E472.Ti	27-Jul-2022	16-Sep-2022	----	----		16-Sep-2022	730 days	51 days	✓
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-2_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-3_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-3X_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-4_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-5_2022-07	E144A	26-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-07	E144A	25-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-2_2022-07	E144A	25-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-3_2022-07	E144A	25-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-4_2022-07	E144A	25-Jul-2022	----	----	----		15-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-5_2022-07	E144A	25-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-2_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-3_2022-07	E144A	28-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-4_2022-07	E144A	28-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-5_2022-07	E144A	28-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-2_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-3_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-4_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag										
QUL-ZOO-7_ZOOT-5_2022-07	E144A	27-Jul-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag										
QUL-ZOO-7_ZOOT-1_2022-07	E144-H	27-Jul-2022	----	----	----		07-Sep-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✘ = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	635559	0	1	0.0	5.0	✘
Mercury in Biota by CVAAS (WET units, Micro)	E511A	635560	0	1	0.0	5.0	✘
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	635561	0	1	0.0	5.0	✘
Moisture Content by Gravimetry (Micro)	E144-H	635498	1	1	100.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	635557	0	1	0.0	5.0	✘
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	635558	0	1	0.0	5.0	✘
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	648734	4	20	20.0	10.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	635559	2	1	200.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	648735	4	20	20.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	635560	2	1	200.0	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	648741	4	20	20.0	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	635561	2	1	200.0	10.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	648732	2	20	10.0	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	635498	1	1	100.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	648736	4	20	20.0	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	635557	2	1	200.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	648737	2	20	10.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	635558	1	1	100.0	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	648734	2	20	10.0	5.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	635559	1	1	100.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	648735	2	20	10.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	635560	1	1	100.0	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	648741	2	20	10.0	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	635561	1	1	100.0	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	648732	2	20	10.0	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	635498	1	1	100.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	648736	2	20	10.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	635557	1	1	100.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	648737	2	20	10.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	635558	1	1	100.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at < 60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Micro)	E511A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22B7702**	Page	: 1 of 15
Amendment	: **1**		
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Aug-2022 14:15
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 07-Sep-2022
C-O-C number	: ----	Issue Date	: 07-Nov-2022 16:16
Sampler	: Sarah Latimer---		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 635498)											
VA22B7702-015	QUL-ZOO-7_ZOOT-5_2022-07	moisture	----	E144-H	2.0	%	95.6	95.7	0.0885%	20%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 635498)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 648732)						
moisture	----	E144A	2	%	<2.0	----
Physical Tests (QCLot: 648743)						
moisture	----	E144A	2	%	<2.0	----
Metals (QCLot: 635557)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 635558)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 635559)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 635560)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 635561)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 635561) - continued						
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 648734)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 648735)						
mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 648736)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 648737)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 648741)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 648741) - continued						
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 648756)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 648757)						
mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 648758)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 648759)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 648763)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 648763) - continued						
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 635498)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 648732)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 648743)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Metals (QCLot: 635557)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	# 79.0	80.0	120	MES
Metals (QCLot: 635558)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	87.0	80.0	120	----
Metals (QCLot: 635559)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	88.8	80.0	120	----
Metals (QCLot: 635560)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	88.8	80.0	120	----
Metals (QCLot: 635561)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	89.3	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	89.8	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	91.0	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	86.6	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	89.0	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	87.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	89.0	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	86.0	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	86.4	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	91.6	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	87.4	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	86.1	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	84.0	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	89.6	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	89.4	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	91.9	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	86.9	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 635561) - continued									
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	88.5	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	93.0	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	84.0	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	90.0	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	86.6	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	90.8	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	86.9	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	92.3	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	91.3	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	86.0	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	87.3	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	87.3	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	91.9	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	90.2	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	83.6	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	90.1	80.0	120	----
Metals (QCLot: 648734)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	91.0	80.0	120	----
Metals (QCLot: 648735)									
mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	91.0	80.0	120	----
Metals (QCLot: 648736)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	83.4	80.0	120	----
Metals (QCLot: 648737)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	91.4	80.0	120	----
Metals (QCLot: 648741)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	94.0	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	93.6	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	93.7	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	86.9	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	95.4	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	90.2	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	97.5	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	88.3	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	91.7	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	96.9	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	90.6	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 648741) - continued									
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	88.5	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	86.8	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	93.5	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	92.8	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	98.4	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	89.8	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	91.5	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	99.4	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	87.1	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	94.6	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	90.0	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	94.3	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	88.3	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	94.9	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	96.9	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	91.7	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	89.2	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	90.6	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	94.9	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	93.8	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	87.3	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	97.1	80.0	120	----
Metals (QCLot: 648756)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	86.8	80.0	120	----
Metals (QCLot: 648757)									
mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	86.8	80.0	120	----
Metals (QCLot: 648758)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	# 79.0	80.0	120	MES
Metals (QCLot: 648759)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	87.0	80.0	120	----
Metals (QCLot: 648763)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	89.3	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	89.8	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	91.0	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	86.6	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	89.0	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 648763) - continued									
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	87.6	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	89.0	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	86.0	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	86.4	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	91.6	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	87.4	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	86.1	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	84.0	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	89.6	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	89.4	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	91.9	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	86.9	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	88.5	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	93.0	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	84.0	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	90.0	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	86.6	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	90.8	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	86.9	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	92.3	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	91.3	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	86.0	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	87.3	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	87.3	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	91.9	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	90.2	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	83.6	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	90.1	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 635557)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	83.5	70.0	130	----
Metals (QCLot: 635559)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	97.6	70.0	130	----
Metals (QCLot: 635560)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	97.6	70.0	130	----
Metals (QCLot: 635561)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	84.0	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	87.8	70.0	130	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	81.9	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	87.9	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	91.5	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	91.4	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	80.8	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	83.4	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	85.0	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	86.6	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	83.3	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	86.0	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	93.0	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	116	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	88.0	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	87.2	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	84.4	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	94.0	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	90.0	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	87.9	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	87.4	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	90.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 635561) - continued									
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	83.9	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	88.0	70.0	130	----
Metals (QCLot: 648734)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	99.8	70.0	130	----
Metals (QCLot: 648735)									
	RM	mercury	7439-97-6	E512A	0.331 mg/kg wwt	99.8	70.0	130	----
Metals (QCLot: 648736)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	84.2	70.0	130	----
Metals (QCLot: 648741)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	92.0	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	89.0	70.0	130	----
	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	73.7	60.0	140	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	83.5	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	90.5	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	92.6	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	106	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	81.8	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	84.5	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	87.9	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	109	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	85.8	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	87.5	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	92.1	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	83.3	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	91.8	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	90.6	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	86.7	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	92.4	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	91.7	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	89.9	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	86.5	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 648741) - continued									
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	95.4	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	87.9	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	86.9	70.0	130	----
Metals (QCLot: 648756)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	94.9	70.0	130	----
Metals (QCLot: 648757)									
	RM	mercury	7439-97-6	E512A	0.331 mg/kg wwt	94.9	70.0	130	----
Metals (QCLot: 648758)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	83.5	70.0	130	----
Metals (QCLot: 648763)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	84.0	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	87.8	70.0	130	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	81.9	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	87.9	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	91.5	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	91.4	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	80.8	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	83.4	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	85.0	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	86.6	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	83.3	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	86.0	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	93.0	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	116	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	88.0	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	87.2	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	84.4	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	94.0	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	90.0	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	87.9	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	87.4	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 648763) - continued									
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	90.2	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	83.9	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	88.0	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

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Affix ALS barcode label here
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COC Nu

Environmental Division
Vancouver
Work Order Reference
VA22B7702

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if receive
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1
Phone:	236-317-4939	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs:
Street:	PO Box 12	Email 1 or Fax gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service le
City/Province:	Likely, BC	Email 2 kala.ivens@mountpolley.com, pschnurr@minnow.ca	
Postal Code:	V0L 1N0	Email 3 pstecko@minnow.ca, kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Distribution**	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)	B7702	ALS Contact: Can Dang	Sampler: ~~SCHNURR~~ LATIMER

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
1	POL-P2_ZOOT-1_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
2	POL-P2_ZOOT-2_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
3	POL-P2_ZOOT-3_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
4	POL-P2_ZOOT-4_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
5	POL-P2_ZOOT-5_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
6	BOL-B2_ZOOT-1_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
7	BOL-B2_ZOOT-2_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
8	BOL-B2_ZOOT-3_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
9	BOL-B2_ZOOT-4_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
10	BOL-B2_ZOOT-5_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
~~11~~											
~~12~~											

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human drinking water use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7.8°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-Jul-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2 22	Time: 11:40 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3: pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: ~~SCHERR~~ LATIMER

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
11	QUL-ZOO-7_ZOOT-1_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
12	QUL-ZOO-7_ZOOT-2_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
13	QUL-ZOO-7_ZOOT-3_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
14	QUL-ZOO-7_ZOOT-4_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
15	QUL-ZOO-7_ZOOT-5_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
16	QUL-ZOO-1_ZOOT-1_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
17	QUL-ZOO-1_ZOOT-2_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
18	QUL-ZOO-1_ZOOT-3_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
19	QUL-ZOO-1_ZOOT-4_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
20	QUL-ZOO-1_ZOOT-5_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
21	BBOL-B2_ZOOT-3 X_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
22											

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human drinking water use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-Jul-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2 2	Time: 11:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here
(lab use only)

COC Nu

Environmental Division
Vancouver
Work Order Reference
VA22B7702

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3	pstecko@minnow.ca, kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with

Regular [R] ☑ Standard TAT if receive

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service le

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): B7702 **ALS Contact:** Can Dang **Sampler:** ~~SCHNURR~~ LATIMER

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
1	POL-P2_ZOOT-1_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
2	POL-P2_ZOOT-2_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
3	POL-P2_ZOOT-3_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
4	POL-P2_ZOOT-4_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
5	POL-P2_ZOOT-5_2022-07	25-July-22	—	Tissue	R	R	R	R	R	R	1
6	BOL-B2_ZOOT-1_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
7	BOL-B2_ZOOT-2_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
8	BOL-B2_ZOOT-3_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
9	BOL-B2_ZOOT-4_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
10	BOL-B2_ZOOT-5_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
~~11~~											
~~12~~											

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human drinking water use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			28°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-Jul-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2/22	Time: 11:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com, pschnurr@minnow.ca
Email 3	pstecko@minnow.ca, kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: ~~SCHNURR~~ LATIMER

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
11 ~~13~~	QUL-ZOO-7_ZOOT-1_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
12 ~~14~~	QUL-ZOO-7_ZOOT-2_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
13 ~~15~~	QUL-ZOO-7_ZOOT-3_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
14 ~~16~~	QUL-ZOO-7_ZOOT-4_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
15 ~~17~~	QUL-ZOO-7_ZOOT-5_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
16 ~~18~~	QUL-ZOO-1_ZOOT-1_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
17 ~~19~~	QUL-ZOO-1_ZOOT-2_2022-07	27-July-22	—	Tissue	R	R	R	R	R	R	1
18 ~~20~~	QUL-ZOO-1_ZOOT-3_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
19 ~~21~~	QUL-ZOO-1_ZOOT-4_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
20 ~~22~~	QUL-ZOO-1_ZOOT-5_2022-07	28-July-22	—	Tissue	R	R	R	R	R	R	1
21 ~~23~~	BBOL-B2 _ZOOT-3 X_2022-07	26-July-22	—	Tissue	R	R	R	R	R	R	1
~~24~~											

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human drinking water use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			23°		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: 28-Jul-2022	Time: 1241	Received by:	Date:	Time:	Received by: IT	Date: Aug 2 22	Time: 11:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ZOOPLANKTON TISSUE CHEMISTRY

ALS Laboratory Report VA22C0442

(Finalized October 19, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0442**	Page	: 1 of 4
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: ----	Issue Date	: 19-Oct-2022 12:38
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-08	BOL-B2_ZOOT-1_2022-08	QUL-ZOO-7_ZOOT-1_2022-08	QUL-ZOO-1_ZOOT-1_2022-08	QUL-ZOO-1_ZOOT-1X_2022-08
					Client sampling date / time	25-Aug-2022	28-Aug-2022	28-Aug-2022	28-Aug-2022	28-Aug-2022
						VA22C0442-001	VA22C0442-002	VA22C0442-003	VA22C0442-004	VA22C0442-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		96.5	98.4	97.8	97.9	98.0
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		576	1150	1190	1450	1240
antimony	7440-36-0	E475	0.020	mg/kg		0.086	0.249	0.053	0.170	0.071
arsenic	7440-38-2	E475	0.050	mg/kg		7.85	8.24	3.48	4.24	3.70
barium	7440-39-3	E475	0.050	mg/kg		14.2	86.0	19.4	26.0	25.0
beryllium	7440-41-7	E475	0.010	mg/kg		0.019	0.044	0.044	0.052	0.045
bismuth	7440-69-9	E475	0.010	mg/kg		<0.014 DLA	0.010	0.020	0.014	0.012
boron	7440-42-8	E475	1.0	mg/kg		4.5	9.5	4.6	3.3	3.8
cadmium	7440-43-9	E475	0.010	mg/kg		0.303	0.368	1.49	1.50	1.51
calcium	7440-70-2	E475	20	mg/kg		11700	25600	37100	34500	36900
cesium	7440-46-2	E475	0.0050	mg/kg		0.0789	0.149	0.147	0.177	0.166
chromium	7440-47-3	E475	0.20	mg/kg		19.0	16.2	7.31	21.3	12.8
cobalt	7440-48-4	E475	0.020	mg/kg		0.725	1.29	1.55	1.97	1.59
copper	7440-50-8	E475	0.20	mg/kg		53.3	57.0	41.3	36.3	31.6
iron	7439-89-6	E475	5.0	mg/kg		964	3000	2130	3110	2090
lead	7439-92-1	E475	0.050	mg/kg		0.649	5.72	0.892	0.933	0.750
lithium	7439-93-2	E475	0.50	mg/kg		<0.71 DLA	0.84	1.17	1.63	1.13
magnesium	7439-95-4	E475	2.0	mg/kg		1160	2090	1770	2330	1770
manganese	7439-96-5	E475	0.050	mg/kg		187	3060	132	164	145
mercury	7439-97-6	E512	0.010	mg/kg		0.030	0.058	0.068	0.082	0.075
mercury	7439-97-6	E512A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
molybdenum	7439-98-7	E475	0.040	mg/kg		0.867	2.26	0.554	0.744	0.552
nickel	7440-02-0	E475	0.20	mg/kg		7.71	8.16	5.52	10.0	6.01
phosphorus	7723-14-0	E475	20	mg/kg		8000	11400	11600	11200	11500
potassium	7440-09-7	E475	20	mg/kg		6360	9800	8690	8840	9130
rubidium	7440-17-7	E475	0.050	mg/kg		5.67	9.11	13.5	13.7	13.4
selenium	7782-49-2	E475	0.10	mg/kg		2.83	3.01	2.75	2.65	2.67
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0255	0.0664	0.0622	0.0587	0.0560
sodium	7440-23-5	E475	20	mg/kg		4730	9580	6970	7070	7490

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL-P2_ZOOT-1_2022-08	BOL-B2_ZOOT-1_2022-08	QUL-ZOO-7_ZOOT-1_2022-08	QUL-ZOO-1_ZOOT-1_2022-08	QUL-ZOO-1_ZOOT-1X_2022-08
					Client sampling date / time	25-Aug-2022	28-Aug-2022	28-Aug-2022	28-Aug-2022	28-Aug-2022
						VA22C0442-001	VA22C0442-002	VA22C0442-003	VA22C0442-004	VA22C0442-005
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E475	0.10	mg/kg		53.4	153	177	167	186
tellurium	13494-80-9	E475	0.020	mg/kg		<0.028 DLA	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E475	0.0020	mg/kg		0.0075	0.0475	0.0209	0.0192	0.0189
tin	7440-31-5	E475	0.10	mg/kg		0.21	0.29	0.43	0.21	0.22
titanium	7440-32-6	E475.Ti	0.50	mg/kg		36.9	65.5	66.2	85.7	59.7
uranium	7440-61-1	E475	0.0020	mg/kg		0.0827	0.209	0.126	0.143	0.131
vanadium	7440-62-2	E475	0.10	mg/kg		3.42	7.22	6.83	10.4	6.85
zinc	7440-66-6	E475	1.0	mg/kg		77.3	89.1	77.2	71.0	74.7
zirconium	7440-67-7	E475	0.20	mg/kg		1.04	1.92	1.43	1.50	1.13

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C0442**	Page	: 1 of 9
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Issue Date	: 19-Oct-2022 12:36
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG6-699714002	----	silver	7440-22-4	E475.Ag	78.4 % MES	80.0-120%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E512	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E512	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E512	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E512	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E512	25-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E512A	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E512A	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E512A	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E512A	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E512A	25-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	365 days	55 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E475	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E475	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E475	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E475	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E475	25-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E475.Ag	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E475.Ag	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E475.Ag	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E475.Ag	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E475.Ag	25-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E475.Ti	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E475.Ti	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E475.Ti	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E475.Ti	28-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E475.Ti	25-Aug-2022	17-Oct-2022	----	----		18-Oct-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag BOL-B2_ZOOT-1_2022-08	E144A	28-Aug-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag POL-P2_ZOOT-1_2022-08	E144A	25-Aug-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1_2022-08	E144A	28-Aug-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-1_ZOOT-1X_2022-08	E144A	28-Aug-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-ZOO-7_ZOOT-1_2022-08	E144A	28-Aug-2022	----	----	----		17-Oct-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	699714	2	6	33.3	10.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	699715	2	6	33.3	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	699717	2	6	33.3	10.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	699722	1	6	16.6	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	699718	2	5	40.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	699719	1	5	20.0	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	699714	1	6	16.6	5.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	699715	1	6	16.6	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	699717	1	6	16.6	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	699722	1	6	16.6	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	699718	1	5	20.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	699719	1	5	20.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

QUALITY CONTROL REPORT

Work Order	: **VA22C0442**	Page	: 1 of 8
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 30-Aug-2022 10:50
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: ----	Issue Date	: 19-Oct-2022 12:36
Sampler	: ---- 250-790-2215 Ext 2112		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 699722)						
moisture	----	E144A	2	%	<2.0	----
Metals (QCLot: 699714)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 699715)						
mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 699717)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 699717) - continued						
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 699718)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 699719)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 699722)									
moisture	----	E144A	2	%	100 %	99.9	90.0	110	----
Metals (QCLot: 699714)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	95.8	80.0	120	----
Metals (QCLot: 699715)									
mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	95.8	80.0	120	----
Metals (QCLot: 699717)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	95.5	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	95.4	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	99.5	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	95.7	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	85.9	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	92.3	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	85.0	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	91.3	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	89.2	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	100	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	96.0	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	97.6	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	94.0	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	95.1	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	93.5	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	88.1	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	93.0	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	95.4	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	104	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	93.6	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	95.1	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	93.7	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	99.3	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	92.4	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	93.5	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	98.1	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 699717) - continued									
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	93.9	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	94.9	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	95.7	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	94.5	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	99.7	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	90.8	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	101	80.0	120	----
Metals (QCLot: 699718)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	# 78.4	80.0	120	MES
Metals (QCLot: 699719)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	94.2	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 699714)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	99.4	70.0	130	----
Metals (QCLot: 699715)									
	RM	mercury	7439-97-6	E512A	0.331 mg/kg wwt	99.4	70.0	130	----
Metals (QCLot: 699717)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	85.4	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	93.6	70.0	130	----
	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	110	60.0	140	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	85.1	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	88.8	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	89.1	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	92.1	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	88.3	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	91.8	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	91.6	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	83.4	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	93.5	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	92.2	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	91.1	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	106	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	94.7	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	99.4	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	93.6	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	93.8	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	91.1	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	90.6	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	88.1	70.0	130	----
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	96.0	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	91.9	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 699717) - continued									
	RM	zinc	7440-66-6	E475	105.3 mg/kg	90.4	70.0	130	----
Metals (QCLot: 699718)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	83.0	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4939	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2 kala.ivens@mountpolley.com, pschnurr@minnow.ca	
Postal Code:	V0L 1N0	Email 3 pstecko@minnow.ca, kbatchelar@minnow.ca	

Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	VA22C0442	ALS Contact: Can Dang	Sampler: SCHNURR/ LATIMER

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	POL-P2_ZOOT-1_2022-08	25-Aug-22		Tissue	R	R	R	R	R	R	1
	BOL-B2_ZOOT-1_2022-08	28-Aug-22		Tissue	R	R	R	R	R	R	1
	QUL-ZOO-7_ZOOT-1_2022-08	29-Aug-22		Tissue	R	R	R	R	R	R	1
	QUL-ZOO-1_ZOOT-1_2022-08	28-Aug-22		Tissue	R	R	R	R	R	R	1
	QUL-ZOO-1_ZOOT-1X_2022-08	28-Aug-22		Tissue	R	R	R	R	R	R	1

Environmental Division Vancouver
Work Order Reference
VA22C0442

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human drinking water use? ☐ YES ☑ NO

dd on report by clicking on the drop-down list below
ronic COC only)

If sample is insufficient for regular digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., use of microdigestion and HR-ICPMS)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
				9	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lohmar	Date: 29 Aug 22	Time: 0915	Received by:	Date:	Time:	Received by: JC	Date: AUG 30 2022	Time: 1050 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

PERIPHYTON COMMUNITY AND PRODUCTIVITY

Biologica Laboratory Reports pp22-078
Freshwater Periphyton

(Finalized November 1, 2022)

Freshwater Periphyton Enumeration and Identification Methods
Client: Minnow Environmental
Project: Mount Polley 2022

Sample Inventory

Sample arrival: 15-Aug-2022
Number of samples: 15
Number of jars: 15
Biologica project number: pp22-078

Upon arrival, samples were examined, and Lugols preservative was added to ensure adequate preservation of samples. An inventory form was created and verified with the chain of custody (COC) to ensure all samples were accounted for. Any discrepancies were reported to the client and were resolved before further sample handling.

Sample Processing

Distilled water was added to the samples as needed to make their volumes uniform (27.8 mL). Samples were sonicated for seven minutes using a CO-Z Digital Ultrasonic Cleaner (40 kHz), and sub-samples (0.1 – 0.2 mL) were dispensed into Utermohl settling chambers and allowed to settle for 24 hours. Sub-samples were then systematically scanned using a Zeiss Axio Vert A.1 inverted phase-contrast microscope at 400x magnification. All algal cells were counted in a series of randomly located fields of view (FOV) until a minimum of 300 algal units were enumerated or until 80 FOV were scanned. Algal units represent single cells of all algal groups, as well as colonies or filaments of blue-green algae. Given that blue-green algal colonies/filaments may contain hundreds of cells, enumerating units rather than individual cells allows for a more equal representation of algal groups. The mean number of cells per unit (= 1 for single cells, >1 for all other algal forms) was estimated for all taxa and used to calculate total densities. Only “viable” cells (those that appeared to be alive at the time of collection) were identified and enumerated. Chrysophyte loricas were also counted (EPA, 2003).

Algae were identified to genus, where possible, following the most up-to-date taxonomic references and collaborations with international and local algal taxonomic experts. Species-level identifications were only given to identifiable taxa for which there are reliable taxonomic references available that encompass the species-level morphological diversity in North America. This approach ensures long-term consistency of data sets and is in accordance with the trend in algal taxonomic practice to be more conservative with the delineation of species. Species-level identifications for some taxa are problematic due to widespread phenotypic plasticity that can artificially inflate species richness (Wehr *et al.* 2015). When applicable, terms “cf.” (*confertim*, possibly for species) and “sp.1” (a single undetermined species) were employed to distinguish between different species in the same genus.

Table 1. Summary of phytoplankton samples processed for Minnow Environmental Mount Polley Periphyton, 2022.

Client Sample ID	Rep	Date Sampled	Biologica Sample ID	Sub-sample Volume (mL)	Fields of View Scanned	Total Units Counted*
EDC-U_PERI-1_2022-08	1	10-Aug-22	pp22-078-049	0.1	37	304
EDC-U_PERI-2_2022-08	2	10-Aug-22	pp22-078-050	0.1	15	324
EDC-U_PERI-3_2022-08	3	10-Aug-22	pp22-078-051	0.1	13	310
EDC-U_PERI-4_2022-08	4	10-Aug-22	pp22-078-052	0.1	33	312
EDC-U_PERI-5_2022-08	5	10-Aug-22	pp22-078-053	0.1	17	307
HAC-R1_PERI-1_2022-08	1	10-Aug-22	pp22-078-054	0.1	23	319
HAC-R1_PERI-2_2022-08	2	10-Aug-22	pp22-078-055	0.1	35	318
HAC-R1_PERI-3_2022-08	3	10-Aug-22	pp22-078-056	0.1	23	357
HAC-R1_PERI-4_2022-08	4	10-Aug-22	pp22-078-057	0.1	23	312
HAC-R1_PERI-5_2022-08	5	10-Aug-22	pp22-078-058	0.1	17	341
HAC-U_PERI-1_2022-08	1	10-Aug-22	pp22-078-059	0.2	23	325
HAC-U_PERI-2_2022-08	2	10-Aug-22	pp22-078-060	0.2	15	314
HAC-U_PERI-3_2022-08	3	10-Aug-22	pp22-078-061	0.1	17	306
HAC-U_PERI-4_2022-08	4	10-Aug-22	pp22-078-062	0.1	21	311
HAC-U_PERI-5_2022-08	5	10-Aug-22	pp22-078-063	0.1	25	321

*Algal units represent single cells, colonies, coenobia or filaments.

Data

A calculation involving the sub-sample volume, number of FOV assessed, number of units counted, and number of cells per unit enabled cell densities, expressed as the number of cells per centimetre squared (cells/cm^2), to be determined.

QA/QC

Two samples were re-analyzed to assess the precision of enumeration (Table 2). Replicate samples are chosen at random and processed at different times to reduce counting and identification bias.

Table 2. Summary of enumeration QA/QC results for Minnow Environmental Mount Polley Periphyton, 2022.

Client Sample ID	Rep	Biologica Sample ID	Original Density (cells/cm^2)	QA Density (cells/cm^2)	Percent Agreement (%)
EDC-U_PERI-2_2022-08	2	pp22-078-050	3,685,304	3,174,032	**86.13**
HAC-R1_PERI-4_2022-08	4	pp22-078-057	2,239,208	1,876,189	**83.79**
				Average:	**84.96**

* Percent Agreement: [100- (difference in abundance between samples) / total abundance of the original sample)] %

Results were provided to the Minnow Environmental project manager in Excel spreadsheets via email.

Methodological and Taxonomic References

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Total Periphyton Density (cells/cm²) for Minnow Environmental Mount Polley, 2022

						Biologica Sample ID	pp22-078-049	pp22-078-050	pp22-078-051	pp22-078-052	pp22-078-053
						Client Sample ID	EDC-U_PERI-1_2022-08	EDC-U_PERI-2_2022-08	EDC-U_PERI-3_2022-08	EDC-U_PERI-4_2022-08	EDC-U_PERI-5_2022-08
						Date Sampled	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	2,429					
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	466,390		94,970	158,999	30,472	42,720
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium minutissimum	1	202,711	1,510	42,829	53,716	846	8,215
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.		316,591	3,020	44,692	75,202	6,771	21,360
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	58,136	755	5,586	2,149	2,539	3,286
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp.	1	139,172				1,693	
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp. (< 55 µm in length)		1,643					
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	65,148		3,724			
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis cf. microcephala	1	10,561					
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	295,836	9,814	35,381	42,973	22,007	27,932
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	1	7,866		1,862		2,539	
Diatoms	Bacillariophyta	Cymbellales	Rhoicospheniaceae	Rhoicosphenia sp.	1	6,482	755				1,643
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	7,287					
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		84,416		16,759	32,229	16,082	9,858
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	358,870				1,693	4,929
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	141,260					
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	1	16,354			6,446	1,693	4,929
Diatoms	Bacillariophyta	Mastogloiales	Achnanthaceae	Platessa sp.	1	2,760					
Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	1	33,949		9,311			
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	1	30,967		11,173	10,743	1,693	1,643
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Frustulia sp.	1	2,149			2,149		
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. cryptocephala	1	45,219					
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	1	11,095					1,643
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.		286,631		20,484	36,527	2,539	4,929
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	12,404					1,643
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Meridion circulare	1	2,995			2,149	846	
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia adnata	1	2,429					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sp.		13,054					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia turgida	1	5,286					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	180,632					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	1	24,386					
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.	1	1,643					
Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	1	1,862		1,862			
Diatoms	Bacillariophyta	Thalassiophysales	Catenulaceae	Amphora sp.	1	1,117					
Diatoms	Bacillariophyta			Pennate diatom		110,963		33,519	21,486	4,232	
				Total Diatoms		**2,950,694**	**15,853**	**322,152**	**444,767**	**95,647**	**134,732**
Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	1	1,862		1,862			
Green Algae	Chlorophyta	Chaetophorales	Chaetophoraceae	Chaetophora sp.	1	76,861					
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	4,858					
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	1	7,287					
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	11,430					
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	1	41,051			8,595		
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	1	13,621		3,724	4,297		
Green Algae	Chlorophyta			Chlorophyte		202,648	75,492	11,173	10,743	5,925	23,003
				Total Green Algae		**359,617**	**75,492**	**16,759**	**23,635**	**5,925**	**23,003**
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	2,429					
Blue-green Algae	Cyanophyta	Chroococcales	Stichosiphonaceae	Stichosiphon sp.	1	11,279	5,284	1,862		846	3,286
Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	1	30,373					
Blue-green Algae	Cyanophyta	Nostocales	Rivulariaceae	Calothrix sp.	1	7,933,883					29,575
Blue-green Algae	Cyanophyta	Oscillatoriales	Oscillatoriaceae	Phormidium sp.	1	4,514,213	36,236	2,041,535	655,333	686,117	756,319
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (colony)	1	2,341,633	415,406	426,855	573,346	227,521	449,928
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (single cell)		108,356	8,304	18,621	25,784	17,775	36,148
Blue-green Algae	Cyanophyta	Synechococcales	Heteroleibleiniaceae	Heteroleibeinia sp.	1	6,182,261	556,612	685,271	914,458	858,958	1,046,637
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Leptolyngbya sp.	1	825,740		75,417	292,214	110,036	213,599
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Tapinothrix sp.	1	224,457					123,230
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	1	56,736					
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	526,364		65,175	127,076	33,011	42,720
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		175,559	67,943	20,484		20,314	63,094
Blue-green Algae	Cyanophyta			Cyanophyte (filament)		139,661			139,661		
				Total Blue-green Algae		**23,072,947**	**1,089,786**	**3,335,220**	**2,727,872**	**1,954,579**	**2,764,536**
Red Algae	Rhodophyta	Acrochaetiales	Acrochaetiaceae	Audouinella sp.	1	119,107	36,236	11,173		7,618	64,080
				Total Red Algae		**119,107**	**36,236**	**11,173**	**0**	**7,618**	**64,080**
Brown Algae	Ochrophyta	Sphacelariales	Lithodermataceae	Bodanella sp.	1	972,927					
				Total Brown Algae		**972,927**	**0**	**0**	**0**	**0**	**0**
				Total Periphyton		**27,475,292**	**1,217,368**	**3,685,304**	**3,196,274**	**2,063,768**	**2,986,351**
				Total Unique Taxa	**49**		**10**	**20**	**2**	**20**	**21**

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Total Periphyton Density (cells/cm²) for Minnow Environmental Mount Polley, 2022

						Biologica Sample ID	pp22-078-054	pp22-078-055	pp22-078-056	pp22-078-057	pp22-078-058
						Client Sample ID	HAC-R1_PERI-1_2022-08	HAC-R1_PERI-2_2022-08	HAC-R1_PERI-3_2022-08	HAC-R1_PERI-4_2022-08	HAC-R1_PERI-5_2022-08
						Date Sampled	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	2,429	2,429				
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	466,390	7,287	5,586	1,214	7,287	19,717
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium minutissimum	1	202,711			3,643		3,286
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.		316,591	7,287	2,394	4,858	9,716	11,502
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	58,136	1,214	798	2,429	1,214	6,572
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp.	1	139,172	19,431	3,192	2,429	8,501	19,717
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp. (< 55 µm in length)		1,643					1,643
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	65,148	13,359	20,750		3,643	9,858
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis cf. microcephala	1	10,561				1,214	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	295,836		3,990	4,858	3,643	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	1	7,866	1,214				
Diatoms	Bacillariophyta	Cymbellales	Rhoicospheniaceae	Rhoicosphenia sp.	1	6,482		798			
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	7,287	4,858				
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		84,416		798			4,929
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	358,870	34,004	26,336	3,643	17,002	126,517
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	141,260	8,501	12,769	10,930	20,646	27,932
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	1	16,354					3,286
Diatoms	Bacillariophyta	Mastogloiales	Achnanthaceae	Platessa sp.	1	2,760					
Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	1	33,949	1,214	1,596			3,286
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	1	30,967	2,429				1,643
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Frustulia sp.	1	2,149					
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. cryptocephala	1	45,219		3,990	3,643	4,858	8,215
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	1	11,095	2,429	798		1,214	1,643
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.		286,631	29,147	21,548	8,501	17,002	19,717
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	12,404					
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Meridion circulare	1	2,995					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia adnata	1	2,429	2,429				
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sp.		13,054	1,214	798		3,643	3,286
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia turgida	1	5,286	1,214		1,214	1,214	1,643
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	180,632	25,503	11,173	8,501	19,431	80,511
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	1	24,386	8,501	3,192	1,214	1,214	4,929
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.	1	1,643					
Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	1	1,862					
Diatoms	Bacillariophyta	Thalassiophysales	Catenulaceae	Amphora sp.	1	1,117					
Diatoms	Bacillariophyta			Pennate diatom		110,963	2,429	4,788	4,858	6,072	11,502
				Total Diatoms		**2,950,694**	**176,094**	**125,296**	**61,937**	**127,517**	**371,334**
Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	1	1,862					
Green Algae	Chlorophyta	Chaetophorales	Chaetophoraceae	Chaetophora sp.	1	76,861					
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	4,858	4,858				
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	1	7,287			7,287		
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	11,430				4,858	
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	1	41,051	10,930		4,858		
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	1	13,621					
Green Algae	Chlorophyta			Chlorophyte		202,648	9,716		10,930	1,214	6,572
				Total Green Algae		**359,617**	**25,503**	**0**	**23,074**	**6,072**	**6,572**
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	2,429	2,429				
Blue-green Algae	Cyanophyta	Chroococcales	Stichosiphonaceae	Stichosiphon sp.	1	11,279					
Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	1	30,373		798			
Blue-green Algae	Cyanophyta	Nostocales	Rivulariaceae	Calothrix sp.	1	7,933,883	669,159	242,611	3,604,543	1,948,956	478,838
Blue-green Algae	Cyanophyta	Oscillatoriales	Oscillatoriaceae	Phormidium sp.	1	4,514,213	18,217	249,634	9,716		
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (colony)	1	2,341,633		47,884	8,501		
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (single cell)		108,356					
Blue-green Algae	Cyanophyta	Synechococcales	Heteroleibleiniaceae	Heteroleibeinia sp.	1	6,182,261	85,821	132,279	47,363		
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Leptolyngbya sp.	1	825,740		25,538	1,214		
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Tapinothrix sp.	1	224,457		20,750	65,580		
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	1	56,736	31,576		9,716		9,858
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	526,364	32,790	26,602	8,501	13,359	104,499
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		175,559					
Blue-green Algae	Cyanophyta			Cyanophyte (filament)		139,661					
				Total Blue-green Algae		**23,072,947**	**839,991**	**746,096**	**3,755,134**	**1,962,315**	**593,196**
Red Algae	Rhodophyta	Acrochaetiales	Acrochaetiaceae	Audouinella sp.	1	119,107					
				Total Red Algae		**119,107**	**0**	**0**	**0**	**0**	**0**
Brown Algae	Ochrophyta	Sphacelariales	Lithodermataceae	Bodanella sp.	1	972,927	137,232	60,653	180,952	143,304	138,018
				Total Brown Algae		**972,927**	**137,232**	**60,653**	**180,952**	**143,304**	**138,018**
				Total Periphyton		**27,475,292**	**1,178,821**	**932,045**	**4,021,097**	**2,239,208**	**1,109,121**
				Total Unique Taxa	**49**		**26**	**24**	**22**	**18**	**21**

Total Periphyton Density (cells/cm²) for Minnow Environmental Mount Polley, 2022

						Biologica Sample ID	pp22-078-059	pp22-078-060	pp22-078-061	pp22-078-062	pp22-078-063
						Client Sample ID	HAC-U_PERI-1_2022-08	HAC-U_PERI-2_2022-08	HAC-U_PERI-3_2022-08	HAC-U_PERI-4_2022-08	HAC-U_PERI-5_2022-08
						Date Sampled	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	Total Density	Total Density	Total Density
					Unique Taxa	Density (cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)	(cells/cm²)
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	2,429					
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	466,390	24,896	3,724	4,929	54,534	10,056
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium minutissimum	1	202,711	10,323	13,035	49,292	9,311	6,704
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.		316,591	13,966	25,139	49,292	21,282	20,111
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	58,136	4,251	10,242	8,215	6,651	2,235
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp.	1	139,172	4,251	12,104	50,935	7,981	8,938
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp. (< 55 µm in length)		1,643					
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	65,148	3,643	2,793	4,929	1,330	1,117
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis cf. microcephala	1	10,561	607	2,793	3,286	2,660	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	295,836	5,465	15,828	47,649	43,893	32,401
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	1	7,866	607		1,643		
Diatoms	Bacillariophyta	Cymbellales	Rhoicospheniaceae	Rhoicosphenia sp.	1	6,482			3,286		
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	7,287	2,429				
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		84,416	2,429			1,330	
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	358,870	12,144	35,381	37,791	57,195	2,235
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	141,260	14,573	7,449	29,575	6,651	2,235
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	1	16,354					
Diatoms	Bacillariophyta	Mastogloiales	Achnanthaceae	Platessa sp.	1	2,760			1,643		1,117
Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	1	33,949	1,822	2,793	3,286	10,641	
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	1	30,967			1,643		
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Frustulia sp.	1	2,149					
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. cryptocephala	1	45,219	4,858	1,862	8,215	3,990	5,586
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	1	11,095	607		1,643		1,117
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.		286,631	12,144	15,828	70,652	11,971	15,642
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	12,404		2,793	3,286	1,330	3,352
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Meridion circulare	1	2,995					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia adnata	1	2,429					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sp.		13,054	607	1,862	1,643		
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia turgida	1	5,286					
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	180,632	2,429	3,724	16,431	3,990	8,938
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	1	24,386		931	3,286		1,117
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.	1	1,643			1,643		
Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	1	1,862					
Diatoms	Bacillariophyta	Thalassiophysales	Catenulaceae	Amphora sp.	1	1,117					1,117
Diatoms	Bacillariophyta			Pennate diatom		110,963	2,429		9,858	5,320	4,469
				Total Diatoms		**2,950,694**	**124,481**	**158,283**	**414,054**	**250,060**	**128,488**
Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	1	1,862					
Green Algae	Chlorophyta	Chaetophorales	Chaetophoraceae	Chaetophora sp.	1	76,861			4,929	30,592	41,340
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	4,858					
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	1	7,287					
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	11,430			6,572		
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	1	41,051	2,429	9,311	4,929		
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	1	13,621	1,822			2,660	1,117
Green Algae	Chlorophyta			Chlorophyte		202,648	9,716		9,858	9,311	18,994
				Total Green Algae		**359,617**	**13,966**	**9,311**	**26,289**	**42,563**	**61,451**
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	2,429					
Blue-green Algae	Cyanophyta	Chroococcales	Stichosiphonaceae	Stichosiphon sp.	1	11,279					
Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	1	30,373			29,575		
Blue-green Algae	Cyanophyta	Nostocales	Rivulariaceae	Calothrix sp.	1	7,933,883	23,074			726,238	210,888
Blue-green Algae	Cyanophyta	Oscillatoriales	Oscillatoriaceae	Phormidium sp.	1	4,514,213			34,505	26,602	
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (colony)	1	2,341,633	72,138	67,968		25,272	26,815
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (single cell)		108,356	607				1,117
Blue-green Algae	Cyanophyta	Synechococcales	Heteroleibleiniaceae	Heteroleibeinia sp.	1	6,182,261	371,165	60,520	21,360	421,496	980,322
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Leptolyngbya sp.	1	825,740	40,684	67,037			
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Tapinothrix sp.	1	224,457		14,897			
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	1	56,736		5,586			
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	526,364	61,937			3,990	6,704
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		175,559		3,724			
Blue-green Algae	Cyanophyta			Cyanophyte (filament)		139,661					
				Total Blue-green Algae		**23,072,947**	**569,605**	**219,733**	**85,440**	**1,203,598**	**1,225,847**
Red Algae	Rhodophyta	Acrochaetiales	Acrochaetiaceae	Audouinella sp.	1	119,107					
				Total Red Algae		**119,107**	**0**	**0**	**0**	**0**	**0**
Brown Algae	Ochrophyta	Sphacelariales	Lithodermataceae	Bodanella sp.	1	972,927	15,788	113,591	57,508	46,554	79,328
				Total Brown Algae		**972,927**	**15,788**	**113,591**	**57,508**	**46,554**	**79,328**
				Total Periphyton		**27,475,292**	**723,839**	**500,918**	**583,291**	**1,542,775**	**1,495,113**
				Total Unique Taxa	**49**		**23**	**21**	**27**	**22**	**22**

biologica

Total Periphyton Density (cells/cm²) for Minnow Environmental Mount Polley, 2022

							Biologica Sample ID	pp22-078-050_QA	pp22-078-057_QA
							Client Sample ID	EDC-U_PERI-2_2022-08-QA	HAC-R1_PERI-4_2022-08-QA
							Date Sampled	10-Aug-22	10-Aug-22
Common Name	Phylum	Order	Family	Taxon	Grand Total		Total Density	Total Density	
					Unique Taxa	Density (cells/cm²)	(cells/cm²)	(cells/cm²)	
Diatoms	Bacillariophyta	Aulacoseirales	Aulacoseiraceae	Aulacoseira sp.	1	2,429			
Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	1	466,390	121,040	4,858	
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium minutissimum	1	202,711	13,035		
Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.		316,591	44,692	4,858	
Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	1	58,136	11,173	1,214	
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp.	1	139,172	3,724	1,214	
Diatoms	Bacillariophyta	Cymbellales	Cymbellaceae	Cymbella sp. (< 55 µm in length)		1,643			
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	1	65,148	1,862	1,214	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis cf. microcephala	1	10,561			
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	1	295,836	7,449	2,429	
Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	1	7,866	5,586		
Diatoms	Bacillariophyta	Cymbellales	Rhoicospheniaceae	Rhoicosphenia sp.	1	6,482			
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	1	7,287			
Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.		84,416	18,621	2,429	
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	1	358,870	5,586	23,074	
Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	1	141,260		29,147	
Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	1	16,354			
Diatoms	Bacillariophyta	Mastogloiales	Achnanthaceae	Platessa sp.	1	2,760			
Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	1	33,949	3,724		
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	1	30,967	11,173		
Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Frustulia sp.	1	2,149	1,862		
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. cryptocephala	1	45,219		4,858	
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	1	11,095			
Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.		286,631	29,794	7,287	
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	1	12,404			
Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Meridion circulare	1	2,995			
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia adnata	1	2,429		1,214	
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sp.		13,054		2,429	
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia turgida	1	5,286			
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	1	180,632		14,573	
Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	1	24,386			
Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Cyclotella sp.	1	1,643			
Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	1	1,862	1,862		
Diatoms	Bacillariophyta	Thalassiophysales	Catenulaceae	Amphora sp.	1	1,117			
Diatoms	Bacillariophyta			Pennate diatom		110,963	20,484	1,214	
				Total Diatoms		**2,950,694**	**301,668**	**102,013**	
Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	1	1,862	1,862		
Green Algae	Chlorophyta	Chaetophorales	Chaetophoraceae	Chaetophora sp.	1	76,861			
Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	1	4,858			
Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	1	7,287			
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	1	11,430			
Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	1	41,051		3,643	
Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	1	13,621	1,862		
Green Algae	Chlorophyta			Chlorophyte		202,648	14,897		
				Total Green Algae		**359,617**	**18,621**	**3,643**	
Blue-green Algae	Cyanophyta	Chroococcales	Chroococcaceae	Chroococcus sp.	1	2,429			
Blue-green Algae	Cyanophyta	Chroococcales	Stichosiphonaceae	Stichosiphon sp.	1	11,279			
Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	1	30,373			
Blue-green Algae	Cyanophyta	Nostocales	Rivulariaceae	Calothrix sp.	1	7,933,883		1,600,510	
Blue-green Algae	Cyanophyta	Oscillatoriales	Oscillatoriaceae	Phormidium sp.	1	4,514,213	1,612,620	4,858	
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (colony)	1	2,341,633	655,476		
Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp. (single cell)		108,356	7,449		
Blue-green Algae	Cyanophyta	Synechococcales	Heteroleibleiniaceae	Heteroleibeinia sp.	1	6,182,261	414,328		
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Leptolyngbya sp.	1	825,740	42,829		
Blue-green Algae	Cyanophyta	Synechococcales	Leptolyngbyaceae	Tapinothrix sp.	1	224,457			
Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	1	56,736			
Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	1	526,364	46,554		
Blue-green Algae	Cyanophyta			Cyanophyte (colony)		175,559			
Blue-green Algae	Cyanophyta			Cyanophyte (filament)		139,661			
				Total Blue-green Algae		**23,072,947**	**2,779,256**	**1,605,368**	
Red Algae	Rhodophyta	Acrochaetiales	Acrochaetiaceae	Audouinella sp.	1	119,107	74,486		
				Total Red Algae		**119,107**	**74,486**	**0**	
Brown Algae	Ochrophyta	Sphacelariales	Lithodermataceae	Bodanella sp.	1	972,927		165,164	
				Total Brown Algae		**972,927**	**0**	**165,164**	
				Total Periphyton		**27,475,292**	**3,174,032**	**1,876,189**	
				Total Unique Taxa	**49**		**21**	**16**	

PERIPHYTON COMMUNITY AND PRODUCTIVITY

ALS Laboratory Report VA22B8786

(Finalized August 24, 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B8786**	Page	: 1 of 6
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Mount Polley Periphyton Quality Analysis	Date Samples Received	: 12-Aug-2022 12:00
PO	: 5500052166	Date Analysis Commenced	: 16-Aug-2022
C-O-C number	: ----	Issue Date	: 24-Aug-2022 15:41
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-004-Minnow Environmental-Periphyton Analysis		
No. of samples received	: 50		
No. of samples analysed	: 50		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µg	micrograms
g/sample	grams per sample

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: Biota (Matrix: Biota)					Client sample ID	FPC-R3_CHLA-1_2022-08	FPC-R3_CHLA-2_2022-08	FPC-R3_CHLA-3_2022-08	FPC-R3_CHLA-4_2022-08	FPC-R3_CHLA-5_2022-08
					Client sampling date / time	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8786-001	VA22B8786-002	VA22B8786-003	VA22B8786-004	VA22B8786-005
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		42.7	223	93.5	102	30.4

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Biota (Matrix: Biota)					Client sample ID	HAC-R1_CHLA-1_2022-08	HAC-R1_CHLA-2_2022-08	HAC-R1_CHLA-3_2022-08	HAC-R1_CHLA-4_2022-08	HAC-R1_CHLA-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8786-006	VA22B8786-007	VA22B8786-008	VA22B8786-009	VA22B8786-010
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		107	143	212	287	125

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Biota (Matrix: Biota)					Client sample ID	HAC-U_CHLA-1_2022-08	HAC-U_CHLA-2_2022-08	HAC-U_CHLA-3_2022-08	HAC-U_CHLA-4_2022-08	HAC-U_CHLA-5_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8786-011	VA22B8786-012	VA22B8786-013	VA22B8786-014	VA22B8786-015
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		64.8	28.9	62.5	56.3	55.3

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_CHLA-1_2022-08	EDC-U_CHLA-2_2022-08	EDC-U_CHLA-3_2022-08	EDC-U_CHLA-4_2022-08	EDC-U_CHLA-5_2022-08
					Client sampling date / time	08-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8786-016	VA22B8786-017	VA22B8786-018	VA22B8786-019	VA22B8786-020
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		36.7	52.7	127	110	68.6

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R3_CHLA-1_2022-08	HAC-R3_CHLA-2_2022-08	HAC-R3_CHLA-3_2022-08	HAC-R3_CHLA-4_2022-08	HAC-R3_CHLA-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8786-021	VA22B8786-022	VA22B8786-023	VA22B8786-024	VA22B8786-025
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		7.07	24.4	4.86	1.48	1.86

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	FPC-R3_AFDM-1_2022-08	FPC-R3_AFDM-2_2022-08	FPC-R3_AFDM-3_2022-08	FPC-R3_AFDM-4_2022-08	FPC-R3_AFDM-5_2022-08
					Client sampling date / time	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022	09-Aug-2022
						VA22B8786-026	VA22B8786-027	VA22B8786-028	VA22B8786-029	VA22B8786-030
						Result	Result	Result	Result	Result
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample		0.0080	0.0224	0.0088	0.0163	0.0132
ash weight	----	E137	0.0010	g/sample		0.0703	0.121	0.0290	0.0605	0.182
weight, dry	----	E137	0.0010	g/sample		0.0783	0.143	0.0378	0.0768	0.195

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_AFDM-1_2022-08	HAC-R1_AFDM-2_2022-08	HAC-R1_AFDM-3_2022-08	HAC-R1_AFDM-4_2022-08	HAC-R1_AFDM-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8786-031	VA22B8786-032	VA22B8786-033	VA22B8786-034	VA22B8786-035
						Result	Result	Result	Result	Result
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample		0.171	0.0997	0.278	0.258	0.160
ash weight	----	E137	0.0010	g/sample		0.259	0.213	0.527	0.432	0.256
weight, dry	----	E137	0.0010	g/sample		0.430	0.312	0.805	0.689	0.415

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_AFDM-1_2022-08	HAC-U_AFDM-2_2022-08	HAC-U_AFDM-3_2022-08	HAC-U_AFDM-4_2022-08	HAC-U_AFDM-5_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8786-036	VA22B8786-037	VA22B8786-038	VA22B8786-039	VA22B8786-040
						Result	Result	Result	Result	Result
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample		0.0656	0.0775	0.149	0.0251	0.0605
ash weight	----	E137	0.0010	g/sample		0.138	0.133	0.226	0.0441	0.0989
weight, dry	----	E137	0.0010	g/sample		0.203	0.211	0.375	0.0692	0.159

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_AFDM-1_2022-08	EDC-U_AFDM-2_2022-08	EDC-U_AFDM-3_2022-08	EDC-U_AFDM-4_2022-08	EDC-U_AFDM-5_2022-08
					Client sampling date / time	08-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8786-041	VA22B8786-042	VA22B8786-043	VA22B8786-044	VA22B8786-045
						Result	Result	Result	Result	Result
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample		0.0281	0.0130	0.0243	0.0337	0.0071
ash weight	----	E137	0.0010	g/sample		0.0050	0.0170	0.0150	0.0172	0.0101
weight, dry	----	E137	0.0010	g/sample		0.0332	0.0301	0.0393	0.0509	0.0172

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Biota**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R3_AFDM-1_2022-08	HAC-R3_AFDM-2_2022-08	HAC-R3_AFDM-3_2022-08	HAC-R3_AFDM-4_2022-08	HAC-R3_AFDM-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	08-Aug-2022	08-Aug-2022	08-Aug-2022
						VA22B8786-046	VA22B8786-047	VA22B8786-048	VA22B8786-049	VA22B8786-050
						Result	Result	Result	Result	Result
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample		0.0038	0.0069	0.0011	0.0074	<0.0010
ash weight	----	E137	0.0010	g/sample		0.0138	0.0262	0.0066	0.0830	0.0017
weight, dry	----	E137	0.0010	g/sample		0.0176	0.0331	0.0076	0.0904	0.0021

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B8786**	Page	: 1 of 9
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Mount Polley Periphyton Quality Analysis	Date Samples Received	: 12-Aug-2022 12:00
PO	: 5500052166	Issue Date	: 24-Aug-2022 15:41
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-004-Minnow Environmental-Periphyton Analysis		
No. of samples received	: 50		
No. of samples analysed	: 50		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube EDC-U_AFDM-1_2022-08	E137	08-Aug-2022	----	----	----		18-Aug-2022	180 days	10 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R3_AFDM-3_2022-08	E137	08-Aug-2022	----	----	----		18-Aug-2022	180 days	10 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R3_AFDM-4_2022-08	E137	08-Aug-2022	----	----	----		18-Aug-2022	180 days	10 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R3_AFDM-5_2022-08	E137	08-Aug-2022	----	----	----		18-Aug-2022	180 days	10 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube EDC-U_AFDM-2_2022-08	E137	07-Aug-2022	----	----	----		18-Aug-2022	180 days	11 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube EDC-U_AFDM-3_2022-08	E137	07-Aug-2022	----	----	----		18-Aug-2022	180 days	11 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube EDC-U_AFDM-4_2022-08	E137	07-Aug-2022	----	----	----		18-Aug-2022	180 days	11 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube EDC-U_AFDM-5_2022-08	E137	07-Aug-2022	----	----	----		18-Aug-2022	180 days	11 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-U_AFDM-1_2022-08	E137	06-Aug-2022	----	----	----		18-Aug-2022	180 days	12 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-U_AFDM-2_2022-08	E137	06-Aug-2022	----	----	----		18-Aug-2022	180 days	12 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-U_AFDM-3_2022-08	E137	06-Aug-2022	----	----	----		18-Aug-2022	180 days	12 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-U_AFDM-4_2022-08	E137	06-Aug-2022	----	----	----		18-Aug-2022	180 days	12 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-U_AFDM-5_2022-08	E137	06-Aug-2022	----	----	----		18-Aug-2022	180 days	12 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R1_AFDM-1_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R1_AFDM-2_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R1_AFDM-3_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R1_AFDM-4_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R1_AFDM-5_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R3_AFDM-1_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube HAC-R3_AFDM-2_2022-08	E137	10-Aug-2022	----	----	----		18-Aug-2022	180 days	8 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube FPC-R3_AFDM-1_2022-08	E137	09-Aug-2022	----	----	----		18-Aug-2022	180 days	9 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube FPC-R3_AFDM-2_2022-08	E137	09-Aug-2022	----	----	----		18-Aug-2022	180 days	9 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube FPC-R3_AFDM-3_2022-08	E137	09-Aug-2022	----	----	----		18-Aug-2022	180 days	9 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube FPC-R3_AFDM-4_2022-08	E137	09-Aug-2022	----	----	----		18-Aug-2022	180 days	9 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Tube FPC-R3_AFDM-5_2022-08	E137	09-Aug-2022	----	----	----		18-Aug-2022	180 days	9 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-U_CHLA-1_2022-08	E870	06-Aug-2022	16-Aug-2022	28 days	10 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-U_CHLA-2_2022-08	E870	06-Aug-2022	16-Aug-2022	28 days	10 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-U_CHLA-3_2022-08	E870	06-Aug-2022	16-Aug-2022	28 days	10 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-U_CHLA-4_2022-08	E870	06-Aug-2022	16-Aug-2022	28 days	10 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-U_CHLA-5_2022-08	E870	06-Aug-2022	16-Aug-2022	28 days	10 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R1_CHLA-1_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R1_CHLA-2_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R1_CHLA-3_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R1_CHLA-4_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R1_CHLA-5_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R3_CHLA-1_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R3_CHLA-2_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R3_CHLA-3_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R3_CHLA-4_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube HAC-R3_CHLA-5_2022-08	E870	10-Aug-2022	16-Aug-2022	28 days	6 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube FPC-R3_CHLA-1_2022-08	E870	09-Aug-2022	16-Aug-2022	28 days	7 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube FPC-R3_CHLA-2_2022-08	E870	09-Aug-2022	16-Aug-2022	28 days	7 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube FPC-R3_CHLA-3_2022-08	E870	09-Aug-2022	16-Aug-2022	28 days	7 days	✓	16-Aug-2022	28 days	0 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube FPC-R3_CHLA-4_2022-08	E870	09-Aug-2022	16-Aug-2022	28 days	7 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube FPC-R3_CHLA-5_2022-08	E870	09-Aug-2022	16-Aug-2022	28 days	7 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube EDC-U_CHLA-1_2022-08	E870	08-Aug-2022	16-Aug-2022	28 days	8 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube EDC-U_CHLA-2_2022-08	E870	07-Aug-2022	16-Aug-2022	28 days	9 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube EDC-U_CHLA-3_2022-08	E870	07-Aug-2022	16-Aug-2022	28 days	9 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube EDC-U_CHLA-4_2022-08	E870	07-Aug-2022	16-Aug-2022	28 days	9 days	✓	16-Aug-2022	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube EDC-U_CHLA-5_2022-08	E870	07-Aug-2022	16-Aug-2022	28 days	9 days	✓	16-Aug-2022	28 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS)							
Ash-free Dry Weight by Gravimetry	E137	608144	2	25	8.0	5.0	✓
Chlorophyll-a by Fluorometry	E870	604651	2	25	8.0	5.0	✓
Method Blanks (MB)							
Ash-free Dry Weight by Gravimetry	E137	608144	2	25	8.0	5.0	✓
Chlorophyll-a by Fluorometry	E870	604651	2	25	8.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Ash-free Dry Weight by Gravimetry	E137 Vancouver - Environmental	Biota	APHA 10200 I (mod)	"Ash-free dry weight is determined gravimetrically after drying the submitted sample at 105°C. The residue is then ignited at 500°C and the ash rewetted to restore water of hydration to clays and other minerals. The ash weight is determined gravimetrically after bringing the rewetted ash to constant weight at 104°. The ash-free dry weight is the difference between the dry weight and the ash weight.
Chlorophyll-a by Fluorometry	E870 Vancouver - Environmental	Biota	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a Extraction	EP870 Vancouver - Environmental	Biota	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA22B8786**	Page	: 1 of 3
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: Mount Polley Periphyton Quality Analysis	Date Samples Received	: 12-Aug-2022 12:00
PO	: 5500052166	Date Analysis Commenced	: 16-Aug-2022
C-O-C number	: ----	Issue Date	: 24-Aug-2022 15:41
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-004-Minnow Environmental-Periphyton Analysis		
No. of samples received	: 50		
No. of samples analysed	: 50		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 608144)						
ash free dry weight	----	E137	0.001	g/sample	<0.0010	----
ash weight	----	E137	0.001	g/sample	<0.0010	----
weight, dry	----	E137	0.001	g/sample	<0.0010	----
Physical Tests (QCLot: 608145)						
ash free dry weight	----	E137	0.001	g/sample	<0.0010	----
ash weight	----	E137	0.001	g/sample	<0.0010	----
weight, dry	----	E137	0.001	g/sample	<0.0010	----
Plant Pigments (QCLot: 604651)						
chlorophyll a	479-61-8	E870	0.01	µg	<0.010	----
Plant Pigments (QCLot: 604652)						
chlorophyll a	479-61-8	E870	0.01	µg	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 608144)									
ash free dry weight	----	E137	0.001	g/sample	0.0405 g/sample	85.2	70.0	130	----
ash weight	----	E137	0.001	g/sample	0.0745 g/sample	104	70.0	130	----
weight, dry	----	E137	0.001	g/sample	0.115 g/sample	97.4	70.0	130	----
Physical Tests (QCLot: 608145)									
ash free dry weight	----	E137	0.001	g/sample	0.0405 g/sample	91.8	70.0	130	----
ash weight	----	E137	0.001	g/sample	0.0745 g/sample	102	70.0	130	----
weight, dry	----	E137	0.001	g/sample	0.115 g/sample	98.6	70.0	130	----
Plant Pigments (QCLot: 604651)									
chlorophyll a	479-61-8	E870	0.01	µg	1 µg	88.1	80.0	120	----
Plant Pigments (QCLot: 604652)									
chlorophyll a	479-61-8	E870	0.01	µg	1 µg	88.9	80.0	120	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Environmental Division Vancouver
Work Order Reference
VA22B8786

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Project Information

ALS Account # / Quote #: VA22-MPMC100-004
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang | Sampler: KBa

Select Service Level Below - Please confirm all E&P TATs with your

Regular [R] ☑ Standard TAT if received by 3 pr

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Bu | San | Sta

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level sel

Analysis Requ

Indicate Filtered (F), Preserved (P) or Filtered and Pr

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (E870)	Ash-free Dry Weight by Gravimetry (E137)	Number of Containers
1	FPC-R3_CHLA-1_2022-08	09-Aug-22		Tissue	R		1
2	FPC-R3_CHLA-2_2022-08	09-Aug-22		Tissue	R		1
3	FPC-R3_CHLA-3_2022-08	09-Aug-22		Tissue	R		1
4	FPC-R3_CHLA-4_2022-08	09-Aug-22		Tissue	R		1
5	FPC-R3_CHLA-5_2022-08	09-Aug-22		Tissue	R		1
6	HAC-R1_CHLA-1_2022-08	10-Aug-22		Tissue	R		1
7	HAC-R1_CHLA-2_2022-08	10-Aug-22		Tissue	R		1
8	HAC-R1_CHLA-3_2022-08	10-Aug-22		Tissue	R		1
9	HAC-R1_CHLA-4_2022-08	10-Aug-22		Tissue	R		1
10	HAC-R1_CHLA-5_2022-08	10-Aug-22		Tissue	R		1
11	HAC-U_CHLA-1_2022-08	06-Aug-22		Tissue	R		1
12	HAC-U_CHLA-2_2022-08	06-Aug-22		Tissue	R		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? | |

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2,4	6,6	10

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Kathrina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KB

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (E870)	Ash-free Dry Weight by Gravimetry (E137)	Number of Containers
13	HAC-U_CHLA-3_2022-08	06-Aug-22		Tissue	R		1
14	HAC-U_CHLA-4_2022-08	06-Aug-22		Tissue	R		1
15	HAC-U_CHLA-5_2022-08	06-Aug-22		Tissue	R		1
16	EDC-U_CHLA-1_2022-08	08-Aug-22		Tissue	R		1
17	EDC-U_CHLA-2_2022-08	07-Aug-22		Tissue	R		1
18	EDC-U_CHLA-3_2022-08	07-Aug-22		Tissue	R		1
19	EDC-U_CHLA-4_2022-08	07-Aug-22		Tissue	R		1
20	EDC-U_CHLA-5_2022-08	07-Aug-22		Tissue	R		1
21	HAC-R3_CHLA-1_2022-08	10-Aug-22		Tissue	R		1
22	HAC-R3_CHLA-2_2022-08	10-Aug-22		Tissue	R		1
23	HAC-R3_CHLA-3_2022-08	10-Aug-22		Tissue	R		1
24	HAC-R3_CHLA-4_2022-08	10-Aug-22		Tissue	R		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2,4	6,6	10

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-AUG-22	12:00				JC	AUG 12 2022	12pm

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
	☐ Compare Results to Criteria on Report - provide details below if box
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (E870)	Ash-free Dry Weight by Gravimetry (E137)	Number of Containers
25	HAC-R3_CHLA-5_2022-08	10-Aug-22		Tissue	R		1
26	FPC-R3_AFDM-1_2022-08	09-Aug-22		Tissue		R	1
27	FPC-R3_AFDM-2_2022-08	09-Aug-22		Tissue		R	1
28	FPC-R3_AFDM-3_2022-08	09-Aug-22		Tissue		R	1
29	FPC-R3_AFDM-4_2022-08	09-Aug-22		Tissue		R	1
30	FPC-R3_AFDM-5_2022-08	09-Aug-22		Tissue		R	1
31	HAC-R1_AFDM-1_2022-08 ✓	10-Aug-22		Tissue		R	1
32	HAC-R1_AFDM-2_2022-08 ✓	10-Aug-22		Tissue		R	1
33	HAC-R1_AFDM-3_2022-08 ✓	10-Aug-22		Tissue		R	1
34	HAC-R1_AFDM-4_2022-08 ✓	10-Aug-22		Tissue		R	1
35	HAC-R1_AFDM-5_2022-08 ✓	10-Aug-22		Tissue		R	1
36	HAC-U_AFDM-1_2022-08	06-Aug-22		Tissue		R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? | | | |

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2, 4	6, 6	10 -

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-Aug-22	12:00				JC	AUG 12 2022	12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-004
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: KBa

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (E870)	Ash-free Dry Weight by Gravimetry (E137)	Number of Containers
37	HAC-U_AFDM-2_2022-08	06-Aug-22		Tissue		R	1
38	HAC-U_AFDM-3_2022-08	06-Aug-22		Tissue		R	1
39	HAC-U_AFDM-4_2022-08	06-Aug-22		Tissue		R	1
40	HAC-U_AFDM-5_2022-08	06-Aug-22		Tissue		R	1
41	EDC-U_AFDM-1_2022-08	08-Aug-22		Tissue		R	1
42	EDC-U_AFDM-2_2022-08	07-Aug-22		Tissue		R	1
43	EDC-U_AFDM-3_2022-08	07-Aug-22		Tissue		R	1
44	EDC-U_AFDM-4_2022-08	07-Aug-22		Tissue		R	1
45	EDC-U_AFDM-5_2022-08	07-Aug-22		Tissue		R	1
46	HAC-R3_AFDM-1_2022-08	10-Aug-22		Tissue		R	1
47	HAC-R3_AFDM-2_2022-08	10-Aug-22		Tissue		R	1
48	HAC-R3_AFDM-3_2022-08	08-Aug-22		Tissue		R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? | | | |

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2.4	6.6	10

SHIPMENT RELEASE (client use)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: JC	Date: AUG 12 2022	Time: 12pm

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Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 5 of 5

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

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For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-004	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll-a by Fluorometry (EB70)	Ash-free Dry Weight by Gravimetry (E137)	Number of Containers
49	HAC-R3_AFDM-4_2022-08	08-Aug-22		Tissue		R	1
50	HAC-R3_AFDM-5_2022-08	08-Aug-22		Tissue		R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? | | | |

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☑ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			2, 4	6, 6	10

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12pm

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BENTHIC INVERTEBRATE COMMUNITY

Cordillera Methods, QC Report, and Results 22-29-1

(Finalized October 7, 2022)

Methods and QC Report 2022

Project ID: MPMC Hazeltine (22-29)

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC
© 2022

Unit 1, 13216 Henry Ave B1202
Summerland, BC, V0H 1Z0
www.cordilleraconsulting.ca

P: 250.494.7553
F: 250.494.7562

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Sorting Quality Control - Sub-Sampling QC **5**
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Error Summary **10**
Error Rationale **10**
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Taxonomic Keys **12**

Sample Reception

On August 15, 2022, Cordillera Consulting received 10 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
FPC-R3_BIC-1_2022-08	CC230204	8/9/2022	250µM	1
FPC-R3_BIC-2_2022-08	CC230205	8/9/2022	250µM	1
FPC-R3_BIC-3_2022-08	CC230206	8/9/2022	250µM	1
FPC-R3_BIC-4_2022-08	CC230207	8/9/2022	250µM	1
FPC-R3_BIC-5_2022-08	CC230208	8/9/2022	250µM	1
HAC-R3_BIC-1_2022-08	CC230209	8/10/2022	250µM	1
HAC-R3_BIC-2_2022-08	CC230210	8/10/2022	250µM	1
HAC-R3_BIC-3_2022-08	CC230211	8/8/2022	250µM	1
HAC-R3_BIC-4_2022-08	CC230212	8/8/2022	250µM	1
HAC-R3_BIC-5_2022-08	CC230213	8/8/2022	250µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.

- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	250 micron fraction	
			% Sampled	# Invertebrates
FPC-R3_BIC-1_2022-08	09-Aug-22	CC230204	7%	377
FPC-R3_BIC-2_2022-08	09-Aug-22	CC230205	5%	371
FPC-R3_BIC-3_2022-08	09-Aug-22	CC230206	10%	403
FPC-R3_BIC-4_2022-08	09-Aug-22	CC230207	6%	308
FPC-R3_BIC-5_2022-08	09-Aug-22	CC230208	9%	411
HAC-R3_BIC-1_2022-08	10-Aug-22	CC230209	6%	329
HAC-R3_BIC-2_2022-08	10-Aug-22	CC230210	6%	333
HAC-R3_BIC-3_2022-08	08-Aug-22	CC230211	5%	342
HAC-R3_BIC-4_2022-08	08-Aug-22	CC230212	6%	376
HAC-R3_BIC-5_2022-08	08-Aug-22	CC230213	10%	328

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

			Total from Sample	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC230211, Percent sampled = 5%, Sieve size = 250				
Coleoptera		1		
Trichoptera		5		
	Total:	**6**	**342**	**98%**

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																			Sorter		Actual Total	Precision		Accuracy	
CC#	Sample Name	1	2	3	4	5	6	7	8	9	10										By	Time		Percent Range		Min	Max
230213	HAC-R3_BIC-5_2022-08	328	335	401	403	382	404	333	392	350	332										MP	625	3660	0.25	18.81	4.37	10.38

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - FPC-R3, Sample - FPC-R3_BIC-4_2022-08, CC# - CC230207, Percent sampled = 6%, Sieve size = 250	312	0.00	0.64516129	1.6025641	0.00967742

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - FPC-R3, Sample - FPC-R3_BIC-4_2022-08, CC# - CC230207, Percent sampled = 6%, Sieve size = 250	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Atractides	1	1						
Aturus	2	2						
Baetidae	28	27	No			X		
Baetis	1	2	No			X		
Bezzia/ Palpomyia	1	1						
Capniidae	33	33						
Chloroperlidae	11	11						

Collembola	9	9						
Elmidae	3	3						
Enchytraeus	2	2						
Eukiefferiella	7	7						
Heptageniidae	87	88	No			X		
Heterlimnius	1	1						
Hygrobates	2	5	No			X		
Leptophlebiidae	41	41						
Leuctridae	1	1						
Micropsectra	3	3						
Mideopsis	1	1						
Nemouridae	5	5						
Oribatida	1	1						
Orthocladiinae	2	2						
Orthocladius lignicola	1	1						
Perlodidae	8	8						
Pisidiidae	5	5						
Plecoptera	1	1						
Polypedilum	3	3						
Rheocricotopus	6	6						
Rhyacophila	1	1						
Sminthuridae	1	1						
Sweltsa	13	13						
Tanypodinae	2	2						
Tanytarsini	10	10						
Trichoptera	7	7						
Tubificinae with hair chaetae	1	1						
Tvetenia	3	3						
Wormaldia	4	4						
Total:	**308**	**312**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

References

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[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
| Order: Collembola	14	0	0	150	78	0	0	0	0	0
| Family: Sminthuridae	0	0	0	17	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	0	0	80	33	50
| Family: Baetidae	29	500	270	467	356	1,033	817	240	317	90
Baetis	0	20	50	17	33	350	1,767	260	367	20
Fallceon	0	0	0	0	0	283	0	320	250	50
| Family: Ephemerellidae	0	0	0	0	22	300	0	0	0	0
Drunella	0	20	0	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0	0	0	10
Ephemerella excrucians complex	0	0	0	0	22	0	0	0	0	0
| Family: Heptageniidae	57	640	1,210	1,450	556	683	117	360	517	160
Epeorus	0	0	0	0	0	0	0	0	33	0
| Family: Leptophlebiidae	2,043	3,440	910	683	600	633	0	220	117	180
Neoleptophlebia	0	0	10	0	0	0	0	0	0	0
Paraleptophlebia	0	0	0	0	0	83	0	60	17	10
| Order: Plecoptera	29	0	40	17	22	0	0	0	0	0
| Family: Capniidae	343	600	460	550	778	0	0	0	0	0
| Family: Chloroperlidae	0	60	70	183	67	0	0	0	0	0
Sweltsa	0	40	180	217	478	0	0	0	0	0
| Family: Leuctridae	0	0	10	17	0	0	0	0	0	0
| Family: Nemouridae	14	40	50	83	56	0	0	0	0	0
Malenka	29	40	0	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	0	0	33	83	40	0	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| **Family: Perlodidae**	0	660	130	133	233	0	17	0	0	10
Isoperla	71	100	10	0	11	0	0	0	0	0
| **Order: Trichoptera**	29	180	70	117	56	183	233	2,100	1,017	870
| **Family: Apataniidae**	0	0	0	0	0	0	0	0	0	0
Apatania	0	20	0	0	0	0	0	0	0	0
| **Family: Hydropsychidae**	0	120	0	0	0	133	983	480	817	230
Cheumatopsyche	0	0	0	0	0	33	50	160	150	110
Hydropsyche	0	0	0	0	0	0	167	80	50	0
| **Family: Lepidostomatidae**	0	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	433	367	2,260	2,350	1,300
| **Family: Limnephilidae**	0	0	0	0	0	33	0	0	0	0
Dicosmoecus	0	0	10	0	11	0	0	0	0	0
| **Family: Philopotamidae**	0	0	0	0	0	0	0	0	0	0
Chimarra	0	0	10	0	0	0	0	0	0	0
Wormaldia	0	20	10	67	33	0	0	0	0	0
| **Family: Polycentropodidae**	0	0	20	0	0	0	0	0	0	0
| **Family: Rhyacophilidae**	0	0	0	0	0	0	0	0	0	0
Rhyacophila	0	0	20	17	33	0	0	0	0	0
Rhyacophila brunnea/vemna group	0	0	0	0	11	0	0	0	0	0
Rhyacophila arnaudi	0	0	0	0	0	0	33	0	0	0
| **Order: Coleoptera**	14	0	0	0	0	0	0	0	0	0
| **Family: Dytiscidae**	29	0	0	0	0	0	0	0	0	0
| **Family: Elmidae**	0	80	50	50	78	233	233	0	0	60
Heterlimnius	0	0	40	17	44	0	0	0	0	0
Optioservus	0	0	0	0	0	84	17	0	0	0
| **Family: Staphylinidae**	0	0	0	0	11	0	0	0	0	0
| **Order: Diptera**	0	0	0	0	0	0	0	0	0	0
| **Family: Ceratopogonidae**	0	0	0	0	0	0	0	20	0	0
Bezzia/ Palpomyia	0	0	20	17	11	0	0	0	0	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
Culicoides	0	0	0	0	11	0	0	0	0	0
Forcipomyia	0	0	0	0	11	0	0	0	0	0
| Family: Chironomidae	0	0	0	0	22	0	0	0	0	0
| Subfamily: Chironominae	0	0	10	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Polypedilum	43	0	10	50	11	17	50	0	50	0
| Tribe: Tanytarsini	57	20	10	167	111	33	67	20	0	0
Micropsectra	14	20	30	50	178	150	150	0	17	10
Rheotanytarsus	0	0	0	0	11	50	50	0	0	0
Stempellinella	14	0	0	0	0	0	0	0	0	0
Tanytarsus	14	0	0	0	11	17	0	0	17	10
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Pagastia	0	0	0	0	11	17	50	20	0	0
| Subfamily: Orthocladiinae	86	20	0	33	0	0	17	0	0	0
Brillia	0	20	0	0	0	0	0	0	0	0
Corynoneura	14	20	10	0	22	0	0	0	0	0
Eukiefferiella	43	20	0	117	44	33	50	20	0	0
Heterotrissocladius	0	0	0	0	0	17	0	0	0	0
Limnophyes	14	0	0	0	0	0	0	0	0	0
Orthocladius complex	114	80	0	0	0	0	0	0	0	0
Orthocladius lignicola	0	0	0	17	0	0	0	0	0	0
Parakiefferiella	0	0	10	0	0	0	0	0	0	0
Parametriocnemus	29	20	0	0	11	17	0	0	0	0
Rheocricotopus	0	0	20	100	111	17	17	0	0	0
Synorthocladius	43	60	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	17	0
Tvetenia	14	100	20	50	44	0	0	20	17	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Subfamily: Prodiamesinae	0	0	0	0	0	0	0	0	0	0
Monodiamesa	0	0	10	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	14	0	0	33	0	0	0	0	0	0
Ablabesmyia	0	0	0	0	0	17	17	0	0	0
| Tribe: Natarsiini	0	0	0	0	0	0	0	0	0	0
Natarsia	57	0	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0	0	0
Pentaneura	0	0	0	0	0	83	100	40	33	30
Thienemannimyia group	186	0	0	0	0	150	33	20	50	50
| Family: Empididae	57	0	0	0	0	0	0	0	0	0
| Family: Simuliidae	0	20	0	0	33	0	0	20	0	10
Simulium	0	0	10	0	33	0	17	0	0	0
| Family: Tipulidae	0	0	0	0	0	0	0	0	0	10
Antocha	0	0	0	0	0	117	17	0	0	0
Dicranota	0	0	0	0	11	0	0	0	0	0
| Order: Lepidoptera	14	0	20	0	0	0	0	0	0	0
| Order: Megaloptera	0	20	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0	0	0
Sialis	0	0	10	0	0	0	0	0	0	0
| Order: Thysanoptera	14	0	0	0	0	0	17	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0	0	0
Aturus	0	0	30	33	67	0	0	0	0	0
| Family: Halacaridae	14	0	0	0	0	0	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0	0	0
Albertathyas	14	0	0	0	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| **Family: Hygrobatidae**	29	40	0	0	0	0	0	0	0	0
Atractides	0	40	30	17	22	0	0	0	0	0
Hygrobates	0	0	10	33	0	0	0	0	0	10
| **Family: Lebertiidae**	0	0	0	0	0	0	0	0	0	0
Lebertia	14	0	0	0	0	0	0	0	0	0
| **Family: Limnesiidae**	0	20	0	0	0	0	0	0	0	0
| **Family: Mideopsidae**	0	0	0	0	0	0	0	0	0	0
Mideopsis	0	0	10	17	0	0	0	0	0	0
| **Family: Sperchontidae**	0	0	0	0	0	0	0	0	0	0
Sperchon	43	120	0	0	0	0	0	0	0	0
| **Order: Sarcoptiformes**	0	0	0	0	0	0	0	0	0	0
| **Order: Oribatida**	0	0	30	17	0	0	0	0	0	0
| **Family: Hydrozetidae**	0	0	10	0	11	0	0	0	0	0
| **Class: Malacostraca**	0	0	0	0	0	0	0	0	0	0
| **Order: Amphipoda**	14	0	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0	0	0
| **Class: Bivalvia**	0	0	0	0	0	0	0	0	0	0
| **Order: Veneroida**	0	0	0	0	0	0	0	0	0	0
| **Family: Pisidiidae**	1,457	160	40	83	111	0	0	0	0	0
Pisidium	86	0	0	0	0	0	0	0	0	0
| **Class: Gastropoda**	29	0	0	0	0	100	0	0	0	0
| **Order: Basommatophora**	0	0	0	0	0	0	0	0	0	0
| **Family: Lymnaeidae**	0	0	0	0	0	0	0	0	0	0
Fossaria	0	0	0	0	0	50	0	0	0	0
| **Family: Physidae**	0	0	0	0	0	0	0	0	0	0
Physa	0	0	0	0	0	17	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| **Class: Oligochaeta**	0	0	0	0	0	0	0	0	0	0
| **Order: Lumbriculida**	0	0	0	0	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Family: Lumbriculidae	0	0	0	0	11	17	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0	0	0
Enchytraeus	29	0	0	33	56	0	0	0	0	0
| Family: Naididae	114	0	50	0	0	0	0	0	17	0
Nais	0	40	0	0	0	33	0	0	0	0
Pristina	0	0	0	0	0	0	17	0	17	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	17	0	0	0	0	0	0
Totals:	**5,385**	**7,420**	**4,030**	**5,136**	**4,564**	**5,482**	**5,553**	**6,840**	**6,270**	**3,280**
Taxa present but not included:										
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	14	20	10	17	11	17	17	20	17	10
| Class: Branchiopoda	0	0	0	0	0	0	0	0	0	0
| Order: Cladocera	14	20	10	17	11	0	17	20	0	10
| Class: Maxillipoda	0	0	0	0	0	0	0	0	0	0
| Class: Copepoda	14	20	0	17	11	0	0	20	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	14	0	60	17	11	0	0	0	0	0
Phylum: Nemata	14	0	10	0	11	0	0	0	0	10
Totals:	**70**	**60**	**90**	**68**	**55**	**17**	**34**	**60**	**17**	**30**

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Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
| Order: Collembola	3.91	0	0	41.9	21.8	0	0	0	0	0
| Family: Sminthuridae	0	0	0	4.74	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	0	0	24.0	9.90	15.0
| Family: Baetidae	8.09	140	75.3	130	99.3	310	245	72.0	95.1	27.0
Baetis	0	5.58	14.0	4.74	9.21	105	530	78.0	110	6.00
Fallceon	0	0	0	0	0	84.9	0	96.0	75.0	15.0
| Family: Ephemerellidae	0	0	0	0	6.14	90.0	0	0	0	0
Drunella	0	5.58	0	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0	0	0	3.00
Ephemerella excrucians complex	0	0	0	0	6.14	0	0	0	0	0
| Family: Heptageniidae	15.9	179	338	405	155	205	35.1	108	155	48.0
Epeorus	0	0	0	0	0	0	0	0	9.90	0
| Family: Leptophlebiidae	570	960	254	191	167	190	0	66.0	35.1	54.0
Neoleptophlebia	0	0	2.79	0	0	0	0	0	0	0
Paraleptophlebia	0	0	0	0	0	24.9	0	18.0	5.10	3.00
| Order: Plecoptera	8.09	0	11.2	4.74	6.14	0	0	0	0	0
| Family: Capniidae	95.7	167	128	153	217	0	0	0	0	0
| Family: Chloroperlidae	0	16.7	19.5	51.1	18.7	0	0	0	0	0
Sweltsa	0	11.2	50.2	60.5	133	0	0	0	0	0
| Family: Leuctridae	0	0	2.79	4.74	0	0	0	0	0	0
| Family: Nemouridae	3.91	11.2	14.0	23.2	15.6	0	0	0	0	0
Malenka	8.09	11.2	0	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	0	0	9.90	24.9	12.0	0	0
| Family: Perlodidae	0	184	36.3	37.1	65.0	0	5.10	0	0	3.00
Isoperla	19.8	27.9	2.79	0	3.07	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Order: Trichoptera	8.09	50.2	19.5	32.6	15.6	54.9	69.9	630	305	261
| Family: Apataniidae	0	0	0	0	0	0	0	0	0	0
Apatania	0	5.58	0	0	0	0	0	0	0	0
| Family: Hydropsychidae	0	33.5	0	0	0	39.9	295	144	245	69.0
Cheumatopsyche	0	0	0	0	0	9.90	15.0	48.0	45.0	33.0
Hydropsyche	0	0	0	0	0	0	50.1	24.0	15.0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	130	110	678	705	390
| Family: Limnephilidae	0	0	0	0	0	9.90	0	0	0	0
Dicosmoecus	0	0	2.79	0	3.07	0	0	0	0	0
| Family: Philopotamidae	0	0	0	0	0	0	0	0	0	0
Chimarra	0	0	2.79	0	0	0	0	0	0	0
Wormaldia	0	5.58	2.79	18.7	9.21	0	0	0	0	0
| Family: Polycentropodidae	0	0	5.58	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0	0
Rhyacophila	0	0	5.58	4.74	9.21	0	0	0	0	0
Rhyacophila brunnea/vemna group	0	0	0	0	3.07	0	0	0	0	0
Rhyacophila arnaudi	0	0	0	0	0	0	9.90	0	0	0
| Order: Coleoptera	3.91	0	0	0	0	0	0	0	0	0
| Family: Dytiscidae	8.09	0	0	0	0	0	0	0	0	0
| Family: Elmidae	0	22.3	14.0	14.0	21.8	69.9	69.9	0	0	18.0
Heterlimnius	0	0	11.2	4.74	12.3	0	0	0	0	0
Optioservus	0	0	0	0	0	25.2	5.10	0	0	0
| Family: Staphylinidae	0	0	0	0	3.07	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	6.00	0	0
Bezzia/ Palpomyia	0	0	5.58	4.74	3.07	0	0	0	0	0
Culicoides	0	0	0	0	3.07	0	0	0	0	0
Forcipomyia	0	0	0	0	3.07	0	0	0	0	0
| Family: Chironomidae	0	0	0	0	6.14	0	0	0	0	0

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Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Subfamily: Chironominae	0	0	2.79	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Polypedilum	12.0	0	2.79	14.0	3.07	5.10	15.0	0	15.0	0
| Tribe: Tanytarsini	15.9	5.58	2.79	46.6	31.0	9.90	20.1	6.00	0	0
Micropsectra	3.91	5.58	8.37	14.0	49.7	45.0	45.0	0	5.10	3.00
Rheotanytarsus	0	0	0	0	3.07	15.0	15.0	0	0	0
Stempellinella	3.91	0	0	0	0	0	0	0	0	0
Tanytarsus	3.91	0	0	0	3.07	5.10	0	0	5.10	3.00
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Pagastia	0	0	0	0	3.07	5.10	15.0	6.00	0	0
| Subfamily: Orthocladiinae	24.0	5.58	0	9.21	0	0	5.10	0	0	0
Brillia	0	5.58	0	0	0	0	0	0	0	0
Corynoneura	3.91	5.58	2.79	0	6.14	0	0	0	0	0
Eukiefferiella	12.0	5.58	0	32.6	12.3	9.90	15.0	6.00	0	0
Heterotrissocladius	0	0	0	0	0	5.10	0	0	0	0
Limnophyes	3.91	0	0	0	0	0	0	0	0	0
Orthocladius complex	31.8	22.3	0	0	0	0	0	0	0	0
Orthocladius lignicola	0	0	0	4.74	0	0	0	0	0	0
Parakiefferiella	0	0	2.79	0	0	0	0	0	0	0
Parametriocnemus	8.09	5.58	0	0	3.07	5.10	0	0	0	0
Rheocricotopus	0	0	5.58	27.9	31.0	5.10	5.10	0	0	0
Synorthocladius	12.0	16.7	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0	5.10	0
Tvetenia	3.91	27.9	5.58	14.0	12.3	0	0	6.00	5.10	0
| Subfamily: Prodiamesinae	0	0	0	0	0	0	0	0	0	0
Monodiamesa	0	0	2.79	0	0	0	0	0	0	0
| Subfamily: Tanypodinae	3.91	0	0	9.21	0	0	0	0	0	0
Ablabesmyia	0	0	0	0	0	5.10	5.10	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| **Tribe: Natarsiini**	0	0	0	0	0	0	0	0	0	0
Natarsia	15.9	0	0	0	0	0	0	0	0	0
| **Tribe: Pentaneurini**	0	0	0	0	0	0	0	0	0	0
Pentaneura	0	0	0	0	0	24.9	30.0	12.0	9.90	9.00
Thienemannimyia group	51.9	0	0	0	0	45.0	9.90	6.00	15.0	15.0
| **Family: Empididae**	15.9	0	0	0	0	0	0	0	0	0
| **Family: Simuliidae**	0	5.58	0	0	9.21	0	0	6.00	0	3.00
Simulium	0	0	2.79	0	9.21	0	5.10	0	0	0
| **Family: Tipulidae**	0	0	0	0	0	0	0	0	0	3.00
Antocha	0	0	0	0	0	35.1	5.10	0	0	0
Dicranota	0	0	0	0	3.07	0	0	0	0	0
| **Order: Lepidoptera**	3.91	0	5.58	0	0	0	0	0	0	0
| **Order: Megaloptera**	0	5.58	0	0	0	0	0	0	0	0
| **Family: Sialidae**	0	0	0	0	0	0	0	0	0	0
Sialis	0	0	2.79	0	0	0	0	0	0	0
| **Order: Thysanoptera**	3.91	0	0	0	0	0	5.10	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0	0	0	0
| **Order: Trombidiformes**	0	0	0	0	0	0	0	0	0	0
| **Family: Aturidae**	0	0	0	0	0	0	0	0	0	0
Aturus	0	0	8.37	9.21	18.7	0	0	0	0	0
| **Family: Halacaridae**	3.91	0	0	0	0	0	0	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0	0	0	0
Albertathyas	3.91	0	0	0	0	0	0	0	0	0
| **Family: Hygrobatidae**	8.09	11.2	0	0	0	0	0	0	0	0
Atractides	0	11.2	8.37	4.74	6.14	0	0	0	0	0
Hygrobates	0	0	2.79	9.21	0	0	0	0	0	3.00
| **Family: Lebertiidae**	0	0	0	0	0	0	0	0	0	0
Lebertia	3.91	0	0	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Family: Limnesiidae	0	5.58	0	0	0	0	0	0	0	0
| Family: Mideopsidae	0	0	0	0	0	0	0	0	0	0
Mideopsis	0	0	2.79	4.74	0	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0	0
Sperchon	12.0	33.5	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	8.37	4.74	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	2.79	0	3.07	0	0	0	0	0
| Class: Malacostraca	0	0	0	0	0	0	0	0	0	0
| Order: Amphipoda	3.91	0	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0	0	0
| Family: Pisidiidae	407	44.6	11.2	23.2	31.0	0	0	0	0	0
Pisidium	24.0	0	0	0	0	0	0	0	0	0
| Class: Gastropoda	8.09	0	0	0	0	30.0	0	0	0	0
| Order: Basommatophora	0	0	0	0	0	0	0	0	0	0
| Family: Lymnaeidae	0	0	0	0	0	0	0	0	0	0
Fossaria	0	0	0	0	0	15.0	0	0	0	0
| Family: Physidae	0	0	0	0	0	0	0	0	0	0
Physa	0	0	0	0	0	5.10	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	3.07	5.10	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0	0	0
Enchytraeus	8.09	0	0	9.21	15.6	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-1 (MPMC Hazeltine)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	09-Aug-22	10-Aug-22	10-Aug-22	08-Aug-22	08-Aug-22	08-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
| Family: Naididae	31.8	0	14.0	0	0	0	0	0	5.10	0
Nais	0	11.2	0	0	0	9.90	0	0	0	0
Pristina	0	0	0	0	0	0	5.10	0	5.10	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	4.74	0	0	0	0	0	0
Totals:	**1,502**	**2,070**	**1,124**	**1,433**	**1,273**	**1,645**	**1,666**	**2,052**	**1,881**	**984**
Taxa present but not included:										
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	3.91	5.58	2.79	4.74	3.07	5.10	5.10	6.00	5.10	3.00
| Class: Branchiopoda	0	0	0	0	0	0	0	0	0	0
| Order: Cladocera	3.91	5.58	2.79	4.74	3.07	0	5.10	6.00	0	3.00
| Class: Maxillipoda	0	0	0	0	0	0	0	0	0	0
| Class: Copepoda	3.91	5.58	0	4.74	3.07	0	0	6.00	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	3.91	0	16.7	4.74	3.07	0	0	0	0	0
Phylum: Nemata	3.91	0	2.79	0	3.07	0	0	0	0	3.00
Totals:	**19.5**	**16.7**	**25.1**	**19.0**	**15.3**	**5.10**	**10.2**	**18.0**	**5.10**	**9.00**

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

BENTHIC COMMUNITY

Cordillera Biomass Creek Data 22-29-1

(Finalized October 7, 2022)

Raw Benthic Invertebrate Biomass Results (g), Mount Polley Mine

Project: Mt. Polley 2022
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	FPC-R3	FPC-R3	FPC-R3	FPC-R3	FPC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3	HAC-R3
Sample:	BIC_2022-08	BIC-2_2022-08	BIC-3_2-22-08	BIC-4_2022-08	BIC-5_2022-08	BIC-1_2022-08	BIC-2_2022-08	BIC-3_2022-08	BIC-4_2022-08	BIC-5_2022-08
Sample Collection Date:	9-Aug-22	9-Aug-23	9-Aug-22	9-Aug-22	9-Aug-22	10-Aug-22	10-Aug-22	8-Aug-22	8-Aug-22	8-Aug-22
CC#:	CC230204	CC230205	CC230206	CC230207	CC230208	CC230209	CC230210	CC230211	CC230212	CC230213
Mesh	250	250	250	250	250	250	250	250	250	250
Sub-sample %	7	5	10	6	9	6	6	5	6	10
Dry Biomass analysis (g)										
Sample Total Dry Weight										
All organisms	1.4929	0.1780	1.1750	0.4683	0.7356	0.8083	0.4033	0.5120	0.4600	0.1400
Raw Dry Weight										
All organisms	0.1045	0.0089	0.1175	0.0281	0.0662	0.0485	0.0242	0.0256	0.0276	0.0140
Measured Weight										
All organisms	0.2388	0.144	0.2521	0.1618	0.1996	0.1826	0.1585	0.1588	0.1613	0.1473
Mesh Weight	0									
All organisms	0.1343	0.1351	0.1346	0.1337	0.1334	0.1341	0.1343	0.1332	0.1337	0.1333
Wet Biomass Analysis (g)										
Sample Total Wet Weight (g)										
All organisms	0.4804	0.0615	0.5496	0.1721	0.3870	0.1866	0.1480	0.1096	0.1111	0.0462
Mesh Weight	0.4586	0.4586	0.4586	0.46	0.46	0.4621	0.4621	0.4532	0.4532	0.4532
Corrected Wet Weight										
All organisms	6.8629	1.2300	5.4960	2.8683	4.3000	3.1100	2.4667	2.1920	1.8517	0.4620
Raw Wet Weight										
All organisms	0.939	0.5201	1.0082	0.6321	0.847	0.6487	0.6101	0.5628	0.5643	0.4994

BENTHIC COMMUNITY

Cordillera Methods, QC Report, and Results 22-29-6

(Finalized October 19, 2022)

Methods and QC Report 2022

Project ID: 22-29-6 (MPMC Creek CEMP)

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC
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Sample Reception

On August 16, 2022, Cordillera Consulting received 15 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
HAC-R1_BIC-1_2022-08	CC230214	8/10/2022	250µM	1
HAC-R1_BIC-2_2022-08	CC230215	8/10/2022	250µM	1
HAC-R1_BIC-3_2022-08	CC230216	8/10/2022	250µM	1
HAC-R1_BIC-4_2022-08	CC230217	8/10/2022	250µM	1
HAC-R1_BIC-5_2022-08	CC230218	8/10/2022	250µM	1
HAC-U_BIC-1_2022-08	CC230219	8/6/2022	250µM	1
HAC-U_BIC-2_2022-08	CC230220	8/6/2022	250µM	1
HAC-U_BIC-3_2022-08	CC230221	8/6/2022	250µM	1
HAC-U_BIC-4_2022-08	CC230222	8/6/2022	250µM	1
HAC-U_BIC-5_2022-08	CC230223	8/6/2022	250µM	1
EDC-U_BIC-1_2022-08	CC230224	8/8/2022	250µM	1
EDC-U_BIC-2_2022-08	CC230225	8/7/2022	250µM	1
EDC-U_BIC-3_2022-08	CC230226	8/7/2022	250µM	1
EDC-U_BIC-4_2022-08	CC230227	8/7/2022	250µM	1
EDC-U_BIC-5_2022-08	CC230228	8/7/2022	250µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence

(given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.

- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	250 micron fraction	
			% Sampled	# Invertebrates
HAC-R1_BIC-1_2022-08	10-Aug-22	CC230214	5%	781
HAC-R1_BIC-2_2022-08	10-Aug-22	CC230215	5%	782
HAC-R1_BIC-3_2022-08	10-Aug-22	CC230216	5%	914
HAC-R1_BIC-4_2022-08	10-Aug-22	CC230217	5%	424
HAC-R1_BIC-5_2022-08	10-Aug-22	CC230218	5%	434
HAC-U_BIC-1_2022-08	06-Aug-22	CC230219	5%	545
HAC-U_BIC-2_2022-08	06-Aug-22	CC230220	5%	424
HAC-U_BIC-3_2022-08	06-Aug-22	CC230221	5%	561
HAC-U_BIC-4_2022-08	06-Aug-22	CC230222	5%	588
HAC-U_BIC-5_2022-08	06-Aug-22	CC230223	5%	413
EDC-U_BIC-1_2022-08	08-Aug-22	CC230224	5%	388
EDC-U_BIC-2_2022-08	07-Aug-22	CC230225	5%	391
EDC-U_BIC-3_2022-08	07-Aug-22	CC230226	5%	547
EDC-U_BIC-4_2022-08	07-Aug-22	CC230227	20%	504
EDC-U_BIC-5_2022-08	07-Aug-22	CC230228	14%	307

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

			Total from Sample	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC230214, Percent sampled = 5%, Sieve size = 250				
Chironomidae		3		
Trichoptera		2		
	Total:	**5**	**781**	**99%**
Site - QC, Sample - QC 2, CC# - CC230224, Percent sampled = 5%, Sieve size = 250				
Oligochaeta		2		
Chironomidae		1		
Plecoptera		2		
	Total:	**5**	**388**	**99%**

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate

representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Sorter		Actual Total	Precision		Accuracy	
CC#	Sample Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	By	Time		Percent Range		Min	Max
230227	EDC-U_BIC-4_2022-08	532	491	525	564	488																MP	540	2600	0.61	13.48	0.96	8.46
230223	HAC-U_BIC-5_2022-08	413	402	385	420	348																AR	315	1968	1.67	17.14	2.13	11.59

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - HAC-R1, Sample - HAC-R1_BIC-1_2022-08, CC# - CC230214, Percent sampled = 5%, Sieve size = 250	780	0.00	0.0640615	0.51216389	0.0044843
Site - HAC-U, Sample - HAC-U_BIC-4_2022-08, CC# - CC230222, Percent sampled = 5%, Sieve size = 250	588	0.00	0	0.68027211	0.00680272

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - HAC-R1, Sample - HAC-R1_BIC-1_2022-08, CC# - CC230214, Percent sampled = 5%, Sieve size = 250	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Antocha	1	1						
Atractides	2	2						
Baetidae	7	7						
Cardiocladius	1	1						
Cheumatopsyche	32	33	No			X		
Chironomidae	13	13						

Diphetor hageni	1	1						
Elmidae	2	2						
Eukiefferiella	2	2						
Gastropoda	20	20						
Gyraulus	3	3						
Hyalella	3	3						
Hydropsyche	1	2	No			X		
Hydropsychidae	86	84	No			X		
Hydrozetidae	7	7						
Lepidostoma	1	1						
Leptoceridae	3	3						
Leptophlebiidae	38	38						
Micropsectra	9	9						
Nais	7	7						
Oribatida	30	30						
Orthocladius complex	61	61						
Paraleptophlebia	1	1						
Parametriocnemus	9	9						
Pentaneura	10	10						
Rheotanytarsus	251	249	No			X		
Simuliidae	9	9						
Simulium	8	8						
Sperchon	2	2						
Synorthocladius	98	98						
Tanypodinae	6	6						
Thienemannimyia group	11	11						
Tipula	2	2						
Trichoptera	28	29	No			X		
Tvetenia	16	16						
Total:	**781**	**780**						
					0	5	0	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				
Site - HAC-U, Sample - HAC-U_BIC-4_2022-08, CC# - CC230222, Percent sampled = 5%, Sieve size = 250	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficient Taxonomic Resolution**	**Comments**

Ablabesmyia	2	2						
Antocha	8	8						
Atractides	3	3						
Aturus	1	1						
Baetidae	22	24	No			X		
Baetis	12	10	No			X		
Cheumatopsyche	26	26						
Chironomidae	3	3						
Cryptochironomus	3	3						
Diphetor hageni	10	10						
Diptera	1	1						
Drunella	2	2						
Drunella spinifera	1	1						
Elmidae	23	23						
Ephemerellidae	1	1						
Eukiefferiella	2	2						
Fossaria	14	14						
Gastropoda	2	2						
Gyraulus	1	1						
Heterotrissocladius	1	1						
Hydropsyche	14	16	No			X		
Hydropsychidae	144	142	No			X		
Hydrozetidae	2	2						
Hygrobatidae	2	2						
Lepidostoma	13	13						
Leptophlebiidae	26	26						
Lymnaeidae	1	1						
Micropsectra	60	60						
Microtendipes	1	1						
Nais	1	1						
Optioservus	2	2						
Optioservus	4	4						
Oribatida	2	2						
Orthocladius complex	8	8						
Parametriocnemus	3	3						
Pentaneura	16	16						
Planorbidae	2	2						
Polypedilum	1	1						
Rheotanytarsus	54	54						
Rhyacophila arnaudi	3	3						
Simulium	13	13						

Synorthocladius	21	21						
Tanytarsini	34	34						
Thienemannimyia group	16	16						
Tipula	1	1						
Trichoptera	2	2						
Trombidiformes	1	1						
Tvetenia	3	3						
Total:	**588**	**588**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

References

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[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	0	0
| Family: Baetidae	140	120	60	60	80	260	60
Baetis	0	0	0	0	0	100	80
Diphetor hageni	20	40	140	40	20	140	20
| Family: Caenidae	0	0	0	0	0	0	0
Caenis	0	0	20	0	0	0	0
| Family: Ephemerellidae	0	0	0	0	0	0	0
Drunella	0	0	0	0	0	0	0
Drunella doddsii	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	20	20
Ephemerella	0	0	0	0	0	0	0
| Family: Heptageniidae	0	0	0	0	0	0	0
Rhithrogena	0	0	0	0	0	0	0
| Family: Leptophlebiidae	760	600	680	580	320	980	900
Neoleptophlebia	0	0	0	0	0	0	0
Paraleptophlebia	20	140	100	120	40	40	100
| Order: Plecoptera	0	0	0	0	0	0	0
| Family: Capniidae	0	0	0	0	0	0	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Family: Chloroperlidae	0	0	0	0	0	0	0
Sweltsa	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	0	0	0	0
| Family: Perlodidae	0	0	0	0	0	0	20
Isoperla	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0
| Order: Trichoptera	560	60	800	260	340	440	380
| Family: Hydropsychidae	1,720	2,860	880	780	700	2,320	1,380
Cheumatopsyche	640	1,080	380	260	180	100	120
Hydropsyche	20	100	40	20	20	100	80
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	120	60	20	0	40
| Family: Lepidostomatidae	0	0	0	0	0	0	0
Lepidostoma	20	0	60	20	20	260	120
| Family: Leptoceridae	60	80	40	140	0	0	0
| Family: Limnephilidae	0	0	0	20	20	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila arnaudi	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Elmidae	40	0	140	80	40	300	400
Heterlimnius	0	0	0	0	0	0	0
Narpus	0	0	0	0	0	0	0
Optioservus	0	0	40	40	0	40	20

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Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Family: Staphylinidae	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0
| Family: Chironomidae	260	560	520	220	100	140	80
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Cryptochironomus	0	0	0	0	0	20	20
Microtendipes	0	0	0	0	0	0	0
Paralauterborniella nigrohalterale	0	0	0	20	20	0	0
Paratendipes	0	0	20	0	0	0	0
Phaenopsectra	0	40	0	0	0	0	0
Polypedilum	0	0	40	0	0	40	40
| Tribe: Tanytarsini	0	0	0	0	0	0	160
Micropsectra	180	380	380	780	1,080	1,560	900
Rheotanytarsus	5,020	5,720	5,160	1,420	1,500	680	400
Stempellinella	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Pagastia	0	40	0	0	0	60	60
| Subfamily: Orthocladiinae	0	0	0	0	0	180	0
Brillia	0	0	0	0	0	0	0
Cardiocladius	20	0	20	0	0	0	0

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Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
Corynoneura	0	0	0	0	0	20	0
Eukiefferiella	40	20	60	0	0	0	0
Heterotrissocladius	0	0	0	40	0	20	0
Metriocnemus	0	0	20	0	0	0	0
Nanocladius	0	0	20	0	0	20	0
Orthocladius complex	1,220	320	1,400	600	820	100	480
Parametriocnemus	180	60	80	0	140	80	40
Pseudosmittia	0	0	0	0	0	0	0
Rheocricotopus	0	0	0	0	0	20	0
Synorthocladius	1,960	1,400	2,800	980	1,340	320	340
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	320	240	340	120	60	60	60
| Subfamily: Tanypodinae	120	160	260	80	540	340	40
Ablabesmyia	0	0	20	40	40	40	80
Guttipelopia	0	0	0	20	20	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0
Pentaneura	200	200	280	240	40	660	240
Thienemannimyia group	220	220	220	220	260	160	220
| Family: Dixidae	0	0	20	0	0	0	20
| Family: Simuliidae	180	120	60	0	0	20	0
Simulium	160	240	260	60	60	40	0
| Family: Tabanidae	0	0	20	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0	0
Antocha	20	120	20	20	60	100	40
Dicranota	0	0	0	0	0	20	0
Tipula	40	0	0	0	0	0	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Lepidoptera	0	0	0	0	0	0	0
| Order: Odonata	0	0	0	0	0	0	0
| Family: Aeshnidae	0	0	0	0	0	0	0
Boyeria	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	20	0	20	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0
| Family: Halacaridae	0	0	20	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	40	60	60	0	0	0	20
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	0	0	0	0	0	0	0
| Family: Mideopsidae	0	0	0	0	0	0	0
Mideopsis	0	0	0	0	0	0	0
| Family: Pionidae	0	0	0	0	0	0	0
Piona	0	0	0	0	0	20	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	40	60	20	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	600	140	1,460	220	120	100	320
| Family: Hydrozetidae	140	80	340	100	160	0	220
| Class: Malacostraca	0	0	0	0	0	0	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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Taxonomist: Scott Finlayson
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250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Amphipoda	0	20	240	180	0	0	0
| Family: Hyalellidae	0	0	0	0	0	0	0
Hyalella	60	80	100	140	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Gastropoda	400	80	260	260	240	200	440
| Order: Basommatophora	0	0	0	0	0	0	0
| Family: Lymnaeidae	0	0	0	0	0	0	80
Fossaria	0	20	0	0	40	480	220
| Family: Planorbidae	0	0	0	0	0	0	100
Gyraulus	60	140	80	80	120	220	80
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Order: Hirudinida	0	0	0	0	0	0	0
| Order: Arhynchobdellida	0	0	0	0	0	0	0
| Family: Erpobdellidae	0	0	0	0	0	0	0
Erpobdella	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	20	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	20	0
| Family: Naididae	0	0	0	0	0	0	0
Nais	140	0	60	40	60	0	40
Pristina	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	20	80	20	0	0
Phylum: Cnidaria	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0

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Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Anthoathecatae	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0
Hydra	0	40	100	20	20	40	0
Totals:	**15,620**	**15,640**	**18,280**	**8,480**	**8,680**	**10,900**	**8,480**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	20	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	20	20	20	20	20	20	20
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	20	20	20	20	20	20	20
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	20	0	20	20	20
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	0	0
Phylum: Nemata	0	0	0	0	0	0	0
Totals:	**60**	**40**	**60**	**40**	**60**	**60**	**60**

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

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Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	60	20	3200	20	20	214
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	20	5	0
| Family: Baetidae	660	440	280	20	20	100	20	0
Baetis	260	240	0	20	0	40	30	14
Diphetor hageni	120	200	180	20	0	0	0	7
| Family: Caenidae	0	0	0	0	0	0	0	0
Caenis	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	20	20	0	0	40	60	20	0
Drunella	0	40	0	20	0	20	30	14
Drunella doddsii	0	0	0	20	60	120	30	14
Drunella spinifera	20	20	0	280	140	140	105	36
Ephemerella	0	0	0	0	0	20	0	0
| Family: Heptageniidae	0	0	0	460	600	940	365	93
Rhithrogena	0	0	0	0	60	0	0	7
| Family: Leptophlebiidae	380	520	720	280	600	1,020	355	200
Neoleptophlebia	0	0	0	0	0	20	0	0
Paraleptophlebia	20	0	60	20	120	0	0	0
| Order: Plecoptera	0	0	0	40	40	0	5	0
| Family: Capniidae	0	0	0	160	20	180	165	86

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Family: Chloroperlidae	0	0	0	240	40	0	70	7
Sweltsa	0	0	0	360	20	100	100	71
| Family: Nemouridae	0	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	20	20	0	0	7
| Family: Perlodidae	0	0	0	60	100	0	50	36
Isoperla	0	0	0	0	20	20	15	14
Skwala	0	0	0	80	60	100	20	0
| Order: Trichoptera	400	40	140	40	0	2,940	220	314
| Family: Hydropsychidae	3,240	2,880	1,040	0	0	0	0	0
Cheumatopsyche	240	520	160	0	0	0	0	0
Hydropsyche	160	280	120	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	20	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	120	260	100	0	0	0	0	0
| Family: Leptoceridae	0	0	0	60	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0	5	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila arnaudi	0	60	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	260	0	0
| Family: Elmidae	280	460	360	20	120	160	45	57
Heterlimnius	0	0	0	0	0	0	15	0
Narpus	0	0	0	20	0	0	10	0
Optioservus	160	120	280	100	0	100	30	0

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Family: Staphylinidae	0	0	20	0	0	0	5	0
| Order: Diptera	0	20	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	40	0	0	0	0
Mallochohelea	0	0	0	0	20	0	0	0
| Family: Chironomidae	120	60	40	0	40	40	15	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Cryptochironomus	0	60	20	0	0	0	0	0
Microtendipes	0	20	20	0	0	0	0	0
Paralauterborniella nigrohalterale	0	0	0	0	0	0	0	0
Paratendipes	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	40	20	60	0	40	0	0	0
| Tribe: Tanytarsini	0	680	0	340	180	480	0	50
Micropsectra	1,360	1,200	1,040	220	300	500	75	93
Rheotanytarsus	540	1,080	200	0	0	20	0	7
Stempellinella	0	0	0	0	0	20	0	7
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Pagastia	60	0	40	60	0	80	10	0
| Subfamily: Orthocladiinae	80	0	340	480	260	440	55	43
Brillia	0	0	0	0	120	0	20	50
Cardiocladius	0	0	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
Corynoneura	0	0	0	60	40	80	10	7
Eukiefferiella	20	40	0	0	20	40	10	0
Heterotrissocladius	80	20	20	0	0	0	25	0
Metriocnemus	0	0	0	0	0	0	0	0
Nanocladius	0	0	0	0	0	0	0	0
Orthocladius complex	60	160	120	100	20	400	30	7
Parametriocnemus	20	60	220	0	0	0	0	0
Pseudosmittia	0	0	0	0	0	0	5	0
Rheocricotopus	0	0	0	60	100	260	5	79
Synorthocladius	340	420	160	0	0	0	0	0
Thienemanniella	0	0	0	0	0	20	0	0
Tvetenia	140	60	80	40	120	240	35	179
| Subfamily: Tanypodinae	0	0	20	0	0	40	0	0
Ablabesmyia	100	40	80	0	0	0	0	0
Guttipelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Pentaneura	260	320	120	0	0	20	0	7
Thienemannimyia group	260	320	180	0	120	40	15	7
| Family: Dixidae	0	0	20	0	0	0	0	7
| Family: Simuliidae	40	0	0	0	0	0	0	14
Simulium	40	260	120	0	0	0	5	7
| Family: Tabanidae	0	0	20	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0	5	0
Antocha	120	160	0	0	0	0	0	0
Dicranota	20	0	0	0	0	0	0	0
Tipula	0	20	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Lepidoptera	0	0	0	0	0	0	5	7
| Order: Odonata	0	0	0	0	0	0	0	0
| Family: Aeshnidae	0	0	0	0	0	0	0	0
Boyeria	20	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	40	20	0	20	40	40	10	29
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	20	0	60	60	80	25	64
| Family: Halacaridae	0	0	0	100	0	20	0	0
| Family: Hygrobatidae	0	40	0	0	0	0	0	0
Atractides	40	60	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	0	0	0	0	0	0	10	7
| Family: Mideopsidae	0	0	0	0	0	0	0	0
Mideopsis	0	0	0	20	20	80	15	14
| Family: Pionidae	0	0	0	0	0	0	0	0
Piona	0	0	20	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	0	20	0	0	100	5	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	7
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	100	40	200	3,380	980	1,280	300	250
| Family: Hydrozetidae	120	40	120	20	0	20	5	7
| Class: Malacostraca	0	0	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Amphipoda	160	0	40	0	0	0	5	0
| Family: Hyalellidae	0	0	0	0	0	0	0	0
Hyalella	100	0	20	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Gastropoda	200	40	380	0	0	40	0	0
| Order: Basommatophora	0	0	0	0	0	0	0	0
| Family: Lymnaeidae	20	20	0	0	0	0	0	0
Fossaria	400	280	680	0	0	0	0	0
| Family: Planorbidae	100	40	60	0	0	0	0	0
Gyraulus	100	20	200	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Order: Hirudinida	0	0	0	0	0	0	0	0
| Order: Arhynchobdellida	0	0	0	0	0	0	0	0
| Family: Erpobdellidae	0	0	0	0	0	0	0	0
Erpobdella	0	0	0	20	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	20	5	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0
| Family: Naididae	20	0	0	120	40	20	10	21
Nais	20	20	60	180	0	20	5	21
Pristina	0	0	0	80	20	120	65	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	7
Phylum: Cnidaria	0	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0	0

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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Anthoathecatae	0	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0	0
Hydra	0	0	0	0	0	0	0	0
Totals:	**11,220**	**11,760**	**8,260**	**7,760**	**7,820**	**10,940**	**2,520**	**2,189**
Taxa present but not included:								
Phylum: Arthropoda	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	0	0	5	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0
| Class: Ostracoda	20	20	20	20	20	20	5	0
| Class: Branchiopoda	0	0	0	0	0	0	0	0
| Order: Cladocera	20	20	20	0	20	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0	0
| Class: Copepoda	20	0	20	0	0	20	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	20	0	0	0	0	0
Phylum: Nemata	0	0	20	20	20	20	5	0
Totals:	**60**	**40**	**100**	**40**	**60**	**60**	**15**	**0**

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	0	0
| Family: Baetidae	42.0	36.0	18.0	18.0	24.0	78.0	18.0
Baetis	0	0	0	0	0	30.0	24.0
Diphetor hageni	6.00	12.0	42.0	12.0	6.00	42.0	6.00
| Family: Caenidae	0	0	0	0	0	0	0
Caenis	0	0	6.00	0	0	0	0
| Family: Ephemerellidae	0	0	0	0	0	0	0
Drunella	0	0	0	0	0	0	0
Drunella doddsii	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	6.00	6.00
Ephemerella	0	0	0	0	0	0	0
| Family: Heptageniidae	0	0	0	0	0	0	0
Rhithrogena	0	0	0	0	0	0	0
| Family: Leptophlebiidae	228	180	204	174	96.0	294	270
Neoleptophlebia	0	0	0	0	0	0	0
Paraleptophlebia	6.00	42.0	30.0	36.0	12.0	12.0	30.0
| Order: Plecoptera	0	0	0	0	0	0	0
| Family: Capniidae	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Family: Chloroperlidae	0	0	0	0	0	0	0
Sweltsa	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	0	0	0	0
| Family: Perlodidae	0	0	0	0	0	0	6.00
Isoperla	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0
| Order: Trichoptera	168	18.0	240	78.0	102	132	114
| Family: Hydropsychidae	516	858	264	234	210	696	414
Cheumatopsyche	192	324	114	78.0	54.0	30.0	36.0
Hydropsyche	6.00	30.0	12.0	6.00	6.00	30.0	24.0
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	36.0	18.0	6.00	0	12.0
| Family: Lepidostomatidae	0	0	0	0	0	0	0
Lepidostoma	6.00	0	18.0	6.00	6.00	78.0	36.0
| Family: Leptoceridae	18.0	24.0	12.0	42.0	0	0	0
| Family: Limnephilidae	0	0	0	6.00	6.00	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila arnaudi	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Elmidae	12.0	0	42.0	24.0	12.0	90.0	120
Heterlimnius	0	0	0	0	0	0	0
Narpus	0	0	0	0	0	0	0
Optioservus	0	0	12.0	12.0	0	12.0	6.00

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Family: Staphylinidae	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0
| Family: Chironomidae	78.0	168	156	66.0	30.0	42.0	24.0
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Cryptochironomus	0	0	0	0	0	6.00	6.00
Microtendipes	0	0	0	0	0	0	0
Paralauterborniella nigrohalterale	0	0	0	6.00	6.00	0	0
Paratendipes	0	0	6.00	0	0	0	0
Phaenopsectra	0	12.0	0	0	0	0	0
Polypedilum	0	0	12.0	0	0	12.0	12.0
| Tribe: Tanytarsini	0	0	0	0	0	0	48.0
Micropsectra	54.0	114	114	234	324	468	270
Rheotanytarsus	1,506	1,716	1,548	426	450	204	120
Stempellinella	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Pagastia	0	12.0	0	0	0	18.0	18.0
| Subfamily: Orthocladiinae	0	0	0	0	0	54.0	0
Brillia	0	0	0	0	0	0	0
Cardiocladius	6.00	0	6.00	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
Corynoneura	0	0	0	0	0	6.00	0
Eukiefferiella	12.0	6.00	18.0	0	0	0	0
Heterotrissocladius	0	0	0	12.0	0	6.00	0
Metriocnemus	0	0	6.00	0	0	0	0
Nanocladius	0	0	6.00	0	0	6.00	0
Orthocladius complex	366	96.0	420	180	246	30.0	144
Parametriocnemus	54.0	18.0	24.0	0	42.0	24.0	12.0
Pseudosmittia	0	0	0	0	0	0	0
Rheocricotopus	0	0	0	0	0	6.00	0
Synorthocladius	588	420	840	294	402	96.0	102
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	96.0	72.0	102	36.0	18.0	18.0	18.0
| Subfamily: Tanypodinae	36.0	48.0	78.0	24.0	162	102	12.0
Ablabesmyia	0	0	6.00	12.0	12.0	12.0	24.0
Guttipelopia	0	0	0	6.00	6.00	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0
Pentaneura	60.0	60.0	84.0	72.0	12.0	198	72.0
Thienemannimyia group	66.0	66.0	66.0	66.0	78.0	48.0	66.0
| Family: Dixidae	0	0	6.00	0	0	0	6.00
| Family: Simuliidae	54.0	36.0	18.0	0	0	6.00	0
Simulium	48.0	72.0	78.0	18.0	18.0	12.0	0
| Family: Tabanidae	0	0	6.00	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0	0
Antocha	6.00	36.0	6.00	6.00	18.0	30.0	12.0
Dicranota	0	0	0	0	0	6.00	0
Tipula	12.0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Lepidoptera	0	0	0	0	0	0	0
| Order: Odonata	0	0	0	0	0	0	0
| Family: Aeshnidae	0	0	0	0	0	0	0
Boyeria	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	6.00	0	6.00	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0
| Family: Halacaridae	0	0	6.00	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	12.0	18.0	18.0	0	0	0	6.00
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	0	0	0	0	0	0	0
| Family: Mideopsidae	0	0	0	0	0	0	0
Mideopsis	0	0	0	0	0	0	0
| Family: Pionidae	0	0	0	0	0	0	0
Piona	0	0	0	0	0	6.00	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	12.0	18.0	6.00	0	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	180	42.0	438	66.0	36.0	30.0	96.0
| Family: Hydrozetidae	42.0	24.0	102	30.0	48.0	0	66.0
| Class: Malacostraca	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Amphipoda	0	6.00	72.0	54.0	0	0	0
| Family: Hyalellidae	0	0	0	0	0	0	0
Hyalella	18.0	24.0	30.0	42.0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0
| Class: Gastropoda	120	24.0	78.0	78.0	72.0	60.0	132
| Order: Basommatophora	0	0	0	0	0	0	0
| Family: Lymnaeidae	0	0	0	0	0	0	24.0
Fossaria	0	6.00	0	0	12.0	144	66.0
| Family: Planorbidae	0	0	0	0	0	0	30.0
Gyraulus	18.0	42.0	24.0	24.0	36.0	66.0	24.0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Order: Hirudinida	0	0	0	0	0	0	0
| Order: Arhynchobdellida	0	0	0	0	0	0	0
| Family: Erpobdellidae	0	0	0	0	0	0	0
Erpobdella	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	6.00	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	6.00	0
| Family: Naididae	0	0	0	0	0	0	0
Nais	42.0	0	18.0	12.0	18.0	0	12.0
Pristina	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	6.00	24.0	6.00	0	0
Phylum: Cnidaria	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0

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Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	06-Aug-22	06-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220
| Order: Anthoathecatae	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0
Hydra	0	12.0	30.0	6.00	6.00	12.0	0
Totals:	**4,686**	**4,692**	**5,484**	**2,544**	**2,604**	**3,270**	**2,544**
Taxa present but not included:	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Cecidomyiidae	6.00	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	6.00	6.00	6.00	6.00	6.00	6.00	6.00
| Class: Branchiopoda	0	0	0	0	0	0	0
| Order: Cladocera	6.00	6.00	6.00	6.00	6.00	6.00	6.00
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	6.00	0	6.00	6.00	6.00
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	0	0
Phylum: Nemata	0	0	0	0	0	0	0
Totals:	**18.0**	**12.0**	**18.0**	**12.0**	**18.0**	**18.0**	**18.0**

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	18.0	5.57	892	5.57	5.57	59.6
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	5.57	1.39	0
| Family: Baetidae	198	132	84.0	5.57	5.57	27.9	5.57	0
Baetis	78.0	72.0	0	5.57	0	11.1	8.36	3.90
Diphetor hageni	36.0	60.0	54.0	5.57	0	0	0	1.95
| Family: Caenidae	0	0	0	0	0	0	0	0
Caenis	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	6.00	6.00	0	0	11.1	16.7	5.57	0
Drunella	0	12.0	0	5.57	0	5.57	8.36	3.90
Drunella doddsii	0	0	0	5.57	16.7	33.4	8.36	3.90
Drunella spinifera	6.00	6.00	0	78.0	39.0	39.0	29.3	10.0
Ephemerella	0	0	0	0	0	5.57	0	0
| Family: Heptageniidae	0	0	0	128	167	262	102	25.9
Rhithrogena	0	0	0	0	16.7	0	0	1.95
| Family: Leptophlebiidae	114	156	216	78.0	167	284	98.9	55.7
Neoleptophlebia	0	0	0	0	0	5.57	0	0
Paraleptophlebia	6.00	0	18.0	5.57	33.4	0	0	0
| Order: Plecoptera	0	0	0	11.1	11.1	0	1.39	0
| Family: Capniidae	0	0	0	44.6	5.57	50.2	46.0	24.0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Family: Chloroperlidae	0	0	0	66.9	11.1	0	19.5	1.95
Sweltsa	0	0	0	100	5.57	27.9	27.9	19.8
| Family: Nemouridae	0	0	0	0	0	0	0	0
Zapada cinctipes	0	0	0	5.57	5.57	0	0	1.95
| Family: Perlodidae	0	0	0	16.7	27.9	0	13.9	10.0
Isoperla	0	0	0	0	5.57	5.57	4.18	3.90
Skwala	0	0	0	22.3	16.7	27.9	5.57	0
| Order: Trichoptera	120	12.0	42.0	11.1	0	819	61.3	87.5
| Family: Hydropsychidae	972	864	312	0	0	0	0	0
Cheumatopsyche	72.0	156	48.0	0	0	0	0	0
Hydropsyche	48.0	84.0	36.0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	6.00	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	36.0	78.0	30.0	0	0	0	0	0
| Family: Leptoceridae	0	0	0	16.7	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0	1.39	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila arnaudi	0	18.0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	72.5	0	0
| Family: Elmidae	84.0	138	108	5.57	33.4	44.6	12.5	15.9
Heterlimnius	0	0	0	0	0	0	4.18	0
Narpus	0	0	0	5.57	0	0	2.79	0
Optioservus	48.0	36.0	84.0	27.9	0	27.9	8.36	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Family: Staphylinidae	0	0	6.00	0	0	0	1.39	0
| Order: Diptera	0	6.00	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	11.1	0	0	0	0
Mallochohelea	0	0	0	0	5.57	0	0	0
| Family: Chironomidae	36.0	18.0	12.0	0	11.1	11.1	4.18	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Cryptochironomus	0	18.0	6.00	0	0	0	0	0
Microtendipes	0	6.00	6.00	0	0	0	0	0
Paralauterborniella nigrohalterale	0	0	0	0	0	0	0	0
Paratendipes	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	12.0	6.00	18.0	0	11.1	0	0	0
| Tribe: Tanytarsini	0	204	0	94.8	50.2	134	0	13.9
Micropsectra	408	360	312	61.3	83.6	139	20.9	25.9
Rheotanytarsus	162	324	60.0	0	0	5.57	0	1.95
Stempellinella	0	0	0	0	0	5.57	0	1.95
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Pagastia	18.0	0	12.0	16.7	0	22.3	2.79	0
| Subfamily: Orthocladiinae	24.0	0	102	134	72.5	123	15.3	12.0
Brillia	0	0	0	0	33.4	0	5.57	13.9
Cardiocladius	0	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
Corynoneura	0	0	0	16.7	11.1	22.3	2.79	1.95
Eukiefferiella	6.00	12.0	0	0	5.57	11.1	2.79	0
Heterotrissocladius	24.0	6.00	6.00	0	0	0	6.97	0
Metriocnemus	0	0	0	0	0	0	0	0
Nanocladius	0	0	0	0	0	0	0	0
Orthocladius complex	18.0	48.0	36.0	27.9	5.57	111	8.36	1.95
Parametriocnemus	6.00	18.0	66.0	0	0	0	0	0
Pseudosmittia	0	0	0	0	0	0	1.39	0
Rheocricotopus	0	0	0	16.7	27.9	72.5	1.39	22.0
Synorthocladius	102	126	48.0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	5.57	0	0
Tvetenia	42.0	18.0	24.0	11.1	33.4	66.9	9.75	49.9
| Subfamily: Tanypodinae	0	0	6.00	0	0	11.1	0	0
Ablabesmyia	30.0	12.0	24.0	0	0	0	0	0
Guttipelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Pentaneura	78.0	96.0	36.0	0	0	5.57	0	1.95
Thienemannimyia group	78.0	96.0	54.0	0	33.4	11.1	4.18	1.95
| Family: Dixidae	0	0	6.00	0	0	0	0	1.95
| Family: Simuliidae	12.0	0	0	0	0	0	0	3.90
Simulium	12.0	78.0	36.0	0	0	0	1.39	1.95
| Family: Tabanidae	0	0	6.00	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0	1.39	0
Antocha	36.0	48.0	0	0	0	0	0	0
Dicranota	6.00	0	0	0	0	0	0	0
Tipula	0	6.00	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Lepidoptera	0	0	0	0	0	0	1.39	1.95
| Order: Odonata	0	0	0	0	0	0	0	0
| Family: Aeshnidae	0	0	0	0	0	0	0	0
Boyeria	6.00	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	12.0	6.00	0	5.57	11.1	11.1	2.79	8.08
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	6.00	0	16.7	16.7	22.3	6.97	17.8
| Family: Halacaridae	0	0	0	27.9	0	5.57	0	0
| Family: Hygrobatidae	0	12.0	0	0	0	0	0	0
Atractides	12.0	18.0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	0	0	0	0	0	0	2.79	1.95
| Family: Mideopsidae	0	0	0	0	0	0	0	0
Mideopsis	0	0	0	5.57	5.57	22.3	4.18	3.90
| Family: Pionidae	0	0	0	0	0	0	0	0
Piona	0	0	6.00	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	0	6.00	0	0	27.9	1.39	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	1.95
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	30.0	12.0	60.0	942	273	357	83.6	69.7
| Family: Hydrozetidae	36.0	12.0	36.0	5.57	0	5.57	1.39	1.95
| Class: Malacostraca	0	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Amphipoda	48.0	0	12.0	0	0	0	1.39	0
| Family: Hyalellidae	0	0	0	0	0	0	0	0
Hyalella	30.0	0	6.00	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Gastropoda	60.0	12.0	114	0	0	11.1	0	0
| Order: Basommatophora	0	0	0	0	0	0	0	0
| Family: Lymnaeidae	6.00	6.00	0	0	0	0	0	0
Fossaria	120	84.0	204	0	0	0	0	0
| Family: Planorbidae	30.0	12.0	18.0	0	0	0	0	0
Gyraulus	30.0	6.00	60.0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Order: Hirudinida	0	0	0	0	0	0	0	0
| Order: Arhynchobdellida	0	0	0	0	0	0	0	0
| Family: Erpobdellidae	0	0	0	0	0	0	0	0
Erpobdella	0	0	0	5.57	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	5.57	1.39	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0
| Family: Naididae	6.00	0	0	33.4	11.1	5.57	2.79	5.85
Nais	6.00	6.00	18.0	50.2	0	5.57	1.39	5.85
Pristina	0	0	0	22.3	5.57	33.4	18.1	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	1.95
Phylum: Cnidaria	0	0	0	0	0	0	0	0
| Class: Hydrozoa	0	0	0	0	0	0	0	0

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-6 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample:	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	06-Aug-22	06-Aug-22	06-Aug-22	08-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22	07-Aug-22
CC#:	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
| Order: Anthoathecatae	0	0	0	0	0	0	0	0
| Family: Hydridae	0	0	0	0	0	0	0	0
Hydra	0	0	0	0	0	0	0	0
Totals:	**3,366**	**3,528**	**2,478**	**2,163**	**2,180**	**3,049**	**702**	**610**
Taxa present but not included:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Phylum: Arthropoda	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0	0	0	1.39	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0
| Class: Ostracoda	6.00	6.00	6.00	5.57	5.57	5.57	1.39	0
| Class: Branchiopoda	0	0	0	0	0	0	0	0
| Order: Cladocera	6.00	6.00	6.00	0	5.57	0	0	0
| Class: Maxillipoda	0	0	0	0	0	0	0	0
| Class: Copepoda	6.00	0	6.00	0	0	5.57	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	6.00	0	0	0	0	0
Phylum: Nemata	0	0	6.00	5.57	5.57	5.57	1.39	0
Totals:	**18.0**	**12.0**	**30.0**	**11.1**	**16.7**	**16.7**	**4.18**	**0**

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

BENTHIC COMMUNITY

Cordillera Biomass Creek Data 22-29-6

(Finalized October 18, 2022)

Raw Benthic Invertebrate Biomass Results (g), Mount Polley Mine

Project: Mt. Polley 2022 (MPMC Creek CEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-R1	HAC-U	HAC-U	HAC-U	HAC-U	HAC-U	EDC-U	EDC-U	EDC-U	EDC-U	EDC-U
Sample Collection Date:	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	10-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	6-Aug-22	8-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22	7-Aug-22
CC#:	CC230214	CC230215	CC230216	CC230217	CC230218	CC230219	CC230220	CC230221	CC230222	CC230223	CC230224	CC230225	CC230226	CC230227	CC230228
Mesh	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Sub-sample %	5	5	5	5	5	5	5	5	5	5	5	5	5	20	14
Dry Biomass analysis (g)															
Sample Total Dry Weight															
All organisms	0.740	0.914	0.468	0.730	0.350	1.912	0.826	1.056	0.936	2.118	6.066	0.312	0.432	0.223	0.074
Raw Dry Weight															
All organisms	0.037	0.046	0.023	0.037	0.018	0.096	0.041	0.053	0.047	0.106	0.303	0.016	0.022	0.045	0.010
Measured Weight															
All organisms	0.1693	0.1783	0.1579	0.1711	0.1536	0.2309	0.1775	0.1877	0.1817	0.2401	0.4397	0.1499	0.1556	0.1789	0.1444
Mesh Weight															
All organisms	0.1323	0.1326	0.1345	0.1346	0.1361	0.1353	0.1362	0.1349	0.1349	0.1342	0.1364	0.1343	0.134	0.1344	0.1341
Wet Biomass Analysis (g)															
Sample Total Wet Weight (g)															
All organisms	0.2093	0.2546	0.1231	0.1666	0.0984	0.3153	0.1555	0.2295	0.2369	0.4328	1.0770	0.0668	0.1002	0.2204	0.0526
Mesh Weight	0.4494	0.4494	0.4513	0.4513	0.4517	0.4527	0.4525	0.4526	0.4511	0.4507	0.4542	0.4527	0.4522	0.4528	0.4538
Corrected Wet Weight															
All organisms	4.1860	5.0920	2.4620	3.3320	1.9680	6.3060	3.1100	4.5900	4.7380	8.6560	21.5400	1.3360	2.0040	1.1020	0.3757
Raw Wet Weight															
All organisms	0.6587	0.704	0.5744	0.6179	0.5501	0.768	0.608	0.6821	0.688	0.8835	1.5312	0.5195	0.5524	0.6732	0.5064

BENTHIC COMMUNITY

Cordillera Methods, QC Report, and Results 22-29-7

(Finalized October 19, 2022)

Methods and QC Report 2022

Project ID: 22-29-7 (MPMC CEMP Lake Sediment and BIC)

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC
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Sample Reception

On September 1, 2022, Cordillera Consulting received 5 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
QUL-PNF_BIC-1_2022-08	CC230336	8/26/2022	250µM	1
QUL-PNF_BIC-2_2022-08	CC230337	8/27/2022	250µM	1
QUL-PNF_BIC-3_2022-08	CC230338	8/27/2022	250µM	1
QUL-PNF_BIC-4_2022-08	CC230339	8/27/2022	250µM	1
QUL-PNF_BIC-5_2022-08	CC230340	8/27/2022	250µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.

- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	250 micron fraction	
			% Sampled	# Invertebrates
QUL-PNF_BIC-1_2022-08	26-Aug-22	CC230336	100%	95
QUL-PNF_BIC-2_2022-08	27-Aug-22	CC230337	100%	70
QUL-PNF_BIC-3_2022-08	27-Aug-22	CC230338	100%	118
QUL-PNF_BIC-4_2022-08	27-Aug-22	CC230339	100%	137
QUL-PNF_BIC-5_2022-08	27-Aug-22	CC230340	100%	158

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

		Total from Sample	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC230336, Percent sampled = 100%, Sieve size = 250			
No Invertebrates Found	0		
Total:	**0**	**95**	**100%**

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

All samples fully processed.

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - 2022, Sample - QUL-PNF_BIC-2_2022-08, CC# - CC230337, Percent sampled = 100%, Sieve size = 250	70	0.00	0	0	0

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - 2022, Sample - QUL-PNF_BIC-2_2022-08, CC# - CC230337, Percent sampled = 100%, Sieve size = 250	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Aturidae	1	1						
Chironomidae	5	5						
Heterotrissocladius	33	33						
Hydrozetidae	9	9						
Micropsectra	1	1						
Naididae	5	5						
Phaenopsectra	1	1						
Pristina	1	1						

Procladius	12	12						
Protanypus	1	1						
Tubificinae with hair chaetae	1	1						
Total:	**70**	**70**						
					0	**0**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-7 (MPMC CEMP Lake Sediment and BIC)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	26-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22
CC#:	CC230336	CC230337	CC230338	CC230339	CC230340
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0
| Class: Insecta	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0
| Family: Baetidae	0	0	0	0	0
Baetis	0	0	0	1	0
| Order: Diptera	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0
Sphaeromias	2	0	0	0	0
| Family: Chironomidae	33	5	60	62	58
| Subfamily: Chironominae	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0
Dicrotendipes	0	0	1	0	0
Phaenopsectra	0	1	0	1	0
| Tribe: Tanytarsini	0	0	0	0	0
Micropsectra	0	1	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0
Protanypus	0	1	1	0	1
| Subfamily: Orthocladiinae	0	0	0	0	0
Heterotrissocladius	39	33	40	53	72
| Subfamily: Tanypodinae	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0
Procladius	15	12	14	13	18
Subphylum: Chelicerata	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0
| Family: Aturidae	4	1	0	0	5
| Family: Lebertiidae	0	0	0	0	0
Lebertia	0	0	0	0	3

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Raw Benthic Invertebrate Density Results (# individuals/sample), Mount Polley Mine

Project: 22-29-7 (MPMC CEMP Lake Sediment and BIC)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	26-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22
CC#:	CC230336	CC230337	CC230338	CC230339	CC230340
| Order: Sarcoptiformes	0	0	0	0	0
| Family: Hydrozetidae	0	9	0	0	0
Phylum: Annelida	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0
Enchytraeus	0	0	0	2	1
| Family: Naididae	1	5	0	2	0
Nais	1	0	0	0	0
Pristina	0	1	2	3	0
| Subfamily: Tubificinae with hair chaetae	0	1	0	0	0
Totals:	**95**	**70**	**118**	**137**	**158**
Taxa present but not included:					
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0
| Class: Ostracoda	0	1	1	0	0
| Class: Branchiopoda	0	0	0	0	0
| Order: Cladocera	0	1	1	1	1
| Class: Maxillipoda	0	0	0	0	0
| Class: Copepoda	1	1	0	1	1
Phylum: Nemata	1	1	1	0	1
Phylum: Platyhelminthes	0	0	0	0	0
| Class: Turbellaria	0	1	0	0	0
Totals:	**2**	**5**	**3**	**2**	**3**

Note: A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-7 (MPMC CEMP Lake Sediment and BIC)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	26-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22
CC#:	CC230336	CC230337	CC230338	CC230339	CC230340
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0
| Class: Insecta	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0
| Family: Baetidae	0	0	0	0	0
Baetis	0	0	0	0.116	0
| Order: Diptera	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0
Sphaeromias	0.232	0	0	0	0
| Family: Chironomidae	3.83	0.581	6.97	7.20	6.74
| Subfamily: Chironominae	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0
Dicrotendipes	0	0	0.116	0	0
Phaenopsectra	0	0.116	0	0.116	0
| Tribe: Tanytarsini	0	0	0	0	0
Micropsectra	0	0.116	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0
Protanypus	0	0.116	0.116	0	0.116
| Subfamily: Orthocladiinae	0	0	0	0	0
Heterotrissocladius	4.53	3.83	4.65	6.15	8.36
| Subfamily: Tanypodinae	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0
Procladius	1.74	1.39	1.63	1.51	2.09
Subphylum: Chelicerata	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0
| Family: Aturidae	0.465	0.116	0	0	0.581

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

Area-Based Benthic Invertebrate Density Results (# individuals/m^2), Mount Polley Mine

Project: 22-29-7 (MPMC CEMP Lake Sediment and BIC)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF
Sample:	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Sample Collection Date:	26-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22	27-Aug-22
CC#:	CC230336	CC230337	CC230338	CC230339	CC230340
| Family: Lebertiidae	0	0	0	0	0
Lebertia	0	0	0	0	0.348
| Order: Sarcoptiformes	0	0	0	0	0
| Family: Hydrozetidae	0	1.05	0	0	0
Phylum: Annelida	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0
Enchytraeus	0	0	0	0.232	0.116
| Family: Naididae	0.116	0.581	0	0.232	0
Nais	0.116	0	0	0	0
Pristina	0	0.116	0.232	0.348	0
| Subfamily: Tubificinae with hair chaetae	0	0.116	0	0	0
Totals:	**11.0**	**8.13**	**13.7**	**15.9**	**18.3**
Taxa present but not included:					
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0
| Class: Ostracoda	0	0.116	0.116	0	0
| Class: Branchiopoda	0	0	0	0	0
| Order: Cladocera	0	0.116	0.116	0.116	0.116
| Class: Maxillipoda	0	0	0	0	0
| Class: Copepoda	0.116	0.116	0	0.116	0.116
Phylum: Nemata	0.116	0.116	0.116	0	0.116
Phylum: Platyhelminthes	0	0	0	0	0
| Class: Turbellaria	0	0.116	0	0	0
Totals:	**0.232**	**0.581**	**0.348**	**0.232**	**0.348**

Notes: All results displayed are area-based densities (#/m^2). A value of zero reported at a less specific level of taxonomy does not indicate an absence of organisms at a more specific level of taxonomy.

BENTHIC & PERIPHYTON TISSUE

ALS Laboratory Report VA22B8779

(Finalized November 7, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B8779**	Page	: 1 of 70
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Aug-2022 12:25
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: ----	Issue Date	: 07-Nov-2022 09:07
Sampler	: KBa		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 159		
No. of samples analysed	: 159		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Benjamin Oke	Lab Assistant	Metals, Burnaby, British Columbia
Hamideh Moradi	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-1_2022-08	HAC-R1_PERT-2_2022-08	HAC-R1_PERT-3_2022-08	HAC-R1_PERT-4_2022-08	HAC-R1_PERT-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-001	VA22B8779-002	VA22B8779-003	VA22B8779-004	VA22B8779-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		65.7	67.7	64.7	61.0	72.3
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		2010	1750	868	920	1400
antimony	7440-36-0	E472	0.010	mg/kg		0.080	0.068	0.064	0.085	0.068
arsenic	7440-38-2	E472	0.030	mg/kg		2.30	2.24	1.78	1.87	2.11
barium	7440-39-3	E472	0.050	mg/kg		133	99.3	68.3	125	84.5
beryllium	7440-41-7	E472	0.010	mg/kg		0.057	0.062	0.033	0.036	0.050
bismuth	7440-69-9	E472	0.010	mg/kg		<0.012 DLA	<0.010	<0.012 DLA	<0.015 DLA	<0.010
boron	7440-42-8	E472	1.0	mg/kg		363	288	289	295	325
cadmium	7440-43-9	E472	0.010	mg/kg		0.148	0.169	0.148	0.152	0.182
calcium	7440-70-2	E472	20	mg/kg		224000	246000	236000	250000	223000
cesium	7440-46-2	E472	0.0050	mg/kg		0.216	0.172	0.116	0.146	0.175
chromium	7440-47-3	E472	0.20	mg/kg		2.64	3.23	2.34	1.88	2.90
cobalt	7440-48-4	E472	0.020	mg/kg		2.00	1.96	1.20	1.48	1.70
copper	7440-50-8	E472	0.20	mg/kg		42.1	116	36.4	42.6	60.4
iron	7439-89-6	E472	5.0	mg/kg		2840	3100	1630	1830	2520
lead	7439-92-1	E472	0.050	mg/kg		0.644	0.498	0.298	0.315	0.484
lithium	7439-93-2	E472	0.50	mg/kg		1.59	1.49	0.91	0.99	1.39
magnesium	7439-95-4	E472	2.0	mg/kg		3090	2840	2570	2750	2840
manganese	7439-96-5	E472	0.050	mg/kg		1240	1150	774	1580	1360
mercury	7439-97-6	E511	0.0050	mg/kg		0.0096	0.0091	0.0091	0.0064	0.0088
molybdenum	7439-98-7	E472	0.040	mg/kg		1.50	1.35	1.17	1.31	1.71
nickel	7440-02-0	E472	0.20	mg/kg		3.13	3.77	3.10	3.12	3.30
phosphorus	7723-14-0	E472	10	mg/kg		866	886	731	681	787
potassium	7440-09-7	E472	20	mg/kg		4980	3870	3720	3790	4480
rubidium	7440-17-7	E472	0.050	mg/kg		5.14	3.90	3.54	3.65	4.42
selenium	7782-49-2	E472	0.10	mg/kg		2.22	1.88	2.28	2.57	1.95
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0138	0.0246	0.0115	0.0150	0.0189
sodium	7440-23-5	E472	20	mg/kg		326	358	249	270	313
strontium	7440-24-6	E472	0.10	mg/kg		513	535	509	544	512

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-1_2022-08	HAC-R1_PERT-2_2022-08	HAC-R1_PERT-3_2022-08	HAC-R1_PERT-4_2022-08	HAC-R1_PERT-5_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-001	VA22B8779-002	VA22B8779-003	VA22B8779-004	VA22B8779-005
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.025 DLA	0.025	0.031	0.032	0.025
thallium	7440-28-0	E472	0.0020	mg/kg		0.0070	0.0061	0.0048	0.0063	0.0064
tin	7440-31-5	E472	0.10	mg/kg		<0.12 DLA	<0.10	<0.12 DLA	<0.15 DLA	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		132	124	72.3	80.9	112
uranium	7440-61-1	E472	0.0020	mg/kg		0.156	0.150	0.117	0.122	0.138
vanadium	7440-62-2	E472	0.10	mg/kg		10.7	12.3	6.18	7.06	10.1
zinc	7440-66-6	E472	1.0	mg/kg		19.2	20.7	16.9	16.4	21.4
zirconium	7440-67-7	E472	0.20	mg/kg		1.42	1.26	0.96	0.91	1.23

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-6_2022-08	HAC-R1_PERT-7_2022-08	HAC-R1_PERT-8_2022-08	HAC-U_PERT-1_2022-08	HAC-U_PERT-2_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8779-006	VA22B8779-007	VA22B8779-008	VA22B8779-009	VA22B8779-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		67.4	69.8	71.3	59.8	57.2
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		857	4720	4470	1370	3010
antimony	7440-36-0	E472	0.010	mg/kg		0.057	0.072	0.078	0.082	0.083
arsenic	7440-38-2	E472	0.030	mg/kg		2.17	3.41	3.97	2.31	2.97
barium	7440-39-3	E472	0.050	mg/kg		71.6	246	165	113	238
beryllium	7440-41-7	E472	0.010	mg/kg		0.037	0.171	0.138	0.048	0.162
bismuth	7440-69-9	E472	0.010	mg/kg		<0.012 DLA	<0.012 DLA	0.016	<0.010	0.014
boron	7440-42-8	E472	1.0	mg/kg		117	232	150	239	228
cadmium	7440-43-9	E472	0.010	mg/kg		0.190	0.180	0.238	0.242	0.234
calcium	7440-70-2	E472	20	mg/kg		280000	247000	210000	212000	176000
cesium	7440-46-2	E472	0.0050	mg/kg		0.0775	0.258	0.267	0.243	0.365
chromium	7440-47-3	E472	0.20	mg/kg		5.79	19.3	88.5	2.28	4.74
cobalt	7440-48-4	E472	0.020	mg/kg		1.23	3.01	3.47	1.75	3.20
copper	7440-50-8	E472	0.20	mg/kg		41.0	57.5	160	50.5	86.8
iron	7439-89-6	E472	5.0	mg/kg		1510	4450	7680	2320	4680
lead	7439-92-1	E472	0.050	mg/kg		0.280	0.747	1.17	0.541	1.43
lithium	7439-93-2	E472	0.50	mg/kg		0.96	2.56	2.80	1.27	2.51
magnesium	7439-95-4	E472	2.0	mg/kg		2610	3260	3660	3020	4110
manganese	7439-96-5	E472	0.050	mg/kg		852	1780	2100	3500	3200
mercury	7439-97-6	E511	0.0050	mg/kg		0.0060	0.0160	0.0243	0.0153	0.0195
molybdenum	7439-98-7	E472	0.040	mg/kg		1.01	1.23	2.29	1.37	1.49
nickel	7440-02-0	E472	0.20	mg/kg		3.98	4.68	11.1	3.11	6.97
phosphorus	7723-14-0	E472	10	mg/kg		780	880	1340	1050	1360
potassium	7440-09-7	E472	20	mg/kg		1610	3410	3370	6350	7010
rubidium	7440-17-7	E472	0.050	mg/kg		1.64	4.05	4.55	6.78	8.68
selenium	7782-49-2	E472	0.10	mg/kg		1.50	1.51	1.92	5.00	3.83
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0093	0.0259	0.0295	0.0162	0.0616
sodium	7440-23-5	E472	20	mg/kg		225	333	370	317	375
strontium	7440-24-6	E472	0.10	mg/kg		543	571	439	518	488

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-6_2022-08	HAC-R1_PERT-7_2022-08	HAC-R1_PERT-8_2022-08	HAC-U_PERT-1_2022-08	HAC-U_PERT-2_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8779-006	VA22B8779-007	VA22B8779-008	VA22B8779-009	VA22B8779-010
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		0.035	0.027	0.021	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0036	0.0068	0.0087	0.0097	0.0168
tin	7440-31-5	E472	0.10	mg/kg		<0.12 DLA	<0.12 DLA	0.22	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		69.3	228	365	98.0	304
uranium	7440-61-1	E472	0.0020	mg/kg		0.0956	0.215	0.195	0.186	0.189
vanadium	7440-62-2	E472	0.10	mg/kg		5.61	18.2	25.7	9.34	17.0
zinc	7440-66-6	E472	1.0	mg/kg		11.6	27.4	59.8	43.1	31.7
zirconium	7440-67-7	E472	0.20	mg/kg		0.71	2.10	2.38	0.89	2.15

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_PERT-3_2022-08	HAC-U_PERT-4_2022-08	HAC-U_PERT-5_2022-08	HAC-U_PERT-6_2022-08	HAC-U_PERT-7_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022	06-Aug-2022
						VA22B8779-011	VA22B8779-012	VA22B8779-013	VA22B8779-014	VA22B8779-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		70.5	74.3	76.4	71.7	87.3
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		1170	3900	2610	595	3730
antimony	7440-36-0	E472	0.010	mg/kg		0.060	0.072	0.054	0.053	0.061
arsenic	7440-38-2	E472	0.030	mg/kg		1.95	2.92	3.12	1.93	4.70
barium	7440-39-3	E472	0.050	mg/kg		96.1	272	136	84.0	114
beryllium	7440-41-7	E472	0.010	mg/kg		0.040	0.131	0.064	0.023	0.094
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.011 DLA	0.011
boron	7440-42-8	E472	1.0	mg/kg		323	197	114	201	115
cadmium	7440-43-9	E472	0.010	mg/kg		0.197	0.237	0.152	0.162	0.209
calcium	7440-70-2	E472	20	mg/kg		203000	196000	188000	238000	145000
cesium	7440-46-2	E472	0.0050	mg/kg		0.192	0.202	0.249	0.134	0.189
chromium	7440-47-3	E472	0.20	mg/kg		2.66	1.96	7.92	1.28	17.5
cobalt	7440-48-4	E472	0.020	mg/kg		1.29	2.50	2.23	0.800	2.89
copper	7440-50-8	E472	0.20	mg/kg		35.1	510	52.2	21.2	71.5
iron	7439-89-6	E472	5.0	mg/kg		1610	3940	3420	950	5860
lead	7439-92-1	E472	0.050	mg/kg		0.385	0.885	0.729	0.226	2.53
lithium	7439-93-2	E472	0.50	mg/kg		0.92	1.53	1.76	0.60	2.31
magnesium	7439-95-4	E472	2.0	mg/kg		2740	3420	3270	2650	3780
manganese	7439-96-5	E472	0.050	mg/kg		2820	4260	2620	2120	2220
mercury	7439-97-6	E511	0.0050	mg/kg		0.0097	0.0129	0.0148	0.0064	0.0362
molybdenum	7439-98-7	E472	0.040	mg/kg		1.35	1.56	1.20	0.900	1.96
nickel	7440-02-0	E472	0.20	mg/kg		2.66	2.59	3.20	1.79	5.49
phosphorus	7723-14-0	E472	10	mg/kg		861	1280	1670	896	4480
potassium	7440-09-7	E472	20	mg/kg		6070	5410	6100	4930	6820
rubidium	7440-17-7	E472	0.050	mg/kg		6.17	6.20	7.95	5.15	7.94
selenium	7782-49-2	E472	0.10	mg/kg		4.05	12.2	1.97	1.94	2.30
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0101	0.0631	0.0171	<0.0057 DLA	0.0477
sodium	7440-23-5	E472	20	mg/kg		307	345	420	246	269
strontium	7440-24-6	E472	0.10	mg/kg		479	494	474	550	366

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_PERT-3_2022-08	HAC-U_PERT-4_2022-08	HAC-U_PERT-5_2022-08	HAC-U_PERT-6_2022-08	HAC-U_PERT-7_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022	06-Aug-2022
						VA22B8779-011	VA22B8779-012	VA22B8779-013	VA22B8779-014	VA22B8779-015
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.027	<0.020	<0.023 DLA	0.021
thallium	7440-28-0	E472	0.0020	mg/kg		0.0088	0.0134	0.0123	0.0078	0.0064
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.11 DLA	0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		73.2	188	207	39.6	296
uranium	7440-61-1	E472	0.0020	mg/kg		0.144	0.163	0.165	0.123	0.130
vanadium	7440-62-2	E472	0.10	mg/kg		7.29	20.8	13.2	4.24	18.1
zinc	7440-66-6	E472	1.0	mg/kg		14.5	13.2	12.4	6.4	19.7
zirconium	7440-67-7	E472	0.20	mg/kg		0.80	1.30	1.14	0.60	1.13

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_PERT-8_2022-08	HAC-D_PERT-1_2022-08	HAC-D_PERT-2_2022-08	HAC-D_PERT-3_2022-08	HAC-D_PERT-4_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-016	VA22B8779-017	VA22B8779-018	VA22B8779-019	VA22B8779-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		----	93.5	----	----	----
moisture	----	E144-H	2.0	%		71.0	----	73.3	63.4	64.5
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		----	53800	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		11600	----	4190	2400	1900
antimony	7440-36-0	E472	0.010	mg/kg		0.071	----	0.061	0.055	0.050
antimony	7440-36-0	E475	0.020	mg/kg		----	0.341	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		5.27	----	6.96	5.32	5.19
arsenic	7440-38-2	E475	0.050	mg/kg		----	63.0	----	----	----
barium	7440-39-3	E475	0.050	mg/kg		----	987	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		823	----	127	177	130
beryllium	7440-41-7	E475	0.010	mg/kg		----	1.85	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		0.180	----	0.155	0.076	0.072
bismuth	7440-69-9	E475	0.010	mg/kg		----	0.376	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	----	0.034	0.016	0.014
boron	7440-42-8	E475	1.0	mg/kg		----	181	----	----	----
boron	7440-42-8	E472	1.0	mg/kg		90.4	----	36.8	43.0	41.5
cadmium	7440-43-9	E475	0.010	mg/kg		----	1.73	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		0.127	----	0.249	0.285	0.311
calcium	7440-70-2	E475	20	mg/kg		----	827000	----	----	----
calcium	7440-70-2	E472	20	mg/kg		185000	----	174000	252000	271000
cesium	7440-46-2	E475	0.0050	mg/kg		----	5.30	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		0.225	----	0.570	0.301	0.271
chromium	7440-47-3	E475	0.20	mg/kg		----	258	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg		7.08	----	11.7	5.88	5.81
cobalt	7440-48-4	E475	0.020	mg/kg		----	43.9	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		3.09	----	3.74	2.16	1.84
copper	7440-50-8	E475	0.20	mg/kg		----	1130	----	----	----
copper	7440-50-8	E472	0.20	mg/kg		104	----	93.4	59.1	118
iron	7439-89-6	E475	5.0	mg/kg		----	117000	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_PERT-8_2022-08	HAC-D_PERT-1_2022-08	HAC-D_PERT-2_2022-08	HAC-D_PERT-3_2022-08	HAC-D_PERT-4_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-016	VA22B8779-017	VA22B8779-018	VA22B8779-019	VA22B8779-020
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		5070	----	9110	4460	3830
lead	7439-92-1	E475	0.050	mg/kg		----	24.2	----	----	----
lead	7439-92-1	E472	0.050	mg/kg		1.12	----	2.10	1.25	0.894
lithium	7439-93-2	E475	0.50	mg/kg		----	48.5	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		2.72	----	4.52	2.37	2.08
magnesium	7439-95-4	E475	2.0	mg/kg		----	34100	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		4460	----	4000	3480	3540
manganese	7439-96-5	E475	0.050	mg/kg		----	4970	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg		2200	----	779	921	1890
mercury	7439-97-6	E511	0.0050	mg/kg		0.0202	----	0.0364	0.0189	0.0161
mercury	7439-97-6	E512	0.010	mg/kg		----	0.225	----	----	----
molybdenum	7439-98-7	E475	0.040	mg/kg		----	11.1	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		0.745	----	0.620	0.490	0.755
nickel	7440-02-0	E475	0.20	mg/kg		----	105	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		2.97	----	8.23	4.41	4.38
phosphorus	7723-14-0	E472	10	mg/kg		1650	----	2530	1820	1850
phosphorus	7723-14-0	E475	20	mg/kg		----	13300	----	----	----
potassium	7440-09-7	E475	20	mg/kg		----	19300	----	----	----
potassium	7440-09-7	E472	20	mg/kg		5490	----	3750	3550	3640
rubidium	7440-17-7	E475	0.050	mg/kg		----	49.3	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		8.08	----	7.70	6.43	5.89
selenium	7782-49-2	E475	0.10	mg/kg		----	9.13	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg		1.62	----	2.11	1.59	1.98
silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	0.470	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0214	----	0.0398	0.0188	0.0216
sodium	7440-23-5	E475	20	mg/kg		----	2740	----	----	----
sodium	7440-23-5	E472	20	mg/kg		306	----	351	311	350
strontium	7440-24-6	E475	0.10	mg/kg		----	2510	----	----	----
strontium	7440-24-6	E472	0.10	mg/kg		589	----	478	596	659
tellurium	13494-80-9	E475	0.020	mg/kg		----	0.185	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_PERT-8_2022-08	HAC-D_PERT-1_2022-08	HAC-D_PERT-2_2022-08	HAC-D_PERT-3_2022-08	HAC-D_PERT-4_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-016	VA22B8779-017	VA22B8779-018	VA22B8779-019	VA22B8779-020
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		0.023	----	0.031	0.031	0.028
thallium	7440-28-0	E475	0.0020	mg/kg		----	0.390	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.0086	----	0.0457	0.0239	0.0255
tin	7440-31-5	E475	0.10	mg/kg		----	1.66	----	----	----
tin	7440-31-5	E472	0.10	mg/kg		<0.10	----	0.14	<0.10	<0.12 DLA
titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	3120	----	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		255	----	244	141	111
uranium	7440-61-1	E475	0.0020	mg/kg		----	3.68	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.174	----	0.354	0.229	0.206
vanadium	7440-62-2	E475	0.10	mg/kg		----	380	----	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		22.1	----	26.2	13.8	10.9
zinc	7440-66-6	E475	1.0	mg/kg		----	231	----	----	----
zinc	7440-66-6	E472	1.0	mg/kg		15.3	----	27.4	18.0	17.1
zirconium	7440-67-7	E475	0.20	mg/kg		----	33.5	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		1.90	----	2.75	1.30	1.06

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_PERT-5_2022-08	HAC-D_PERT-6_2022-08	HAC-D_PERT-7_2022-08	HAC-D_PERT-8_2022-08	EDC-U_PERT-1_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	08-Aug-2022
						VA22B8779-021	VA22B8779-022	VA22B8779-023	VA22B8779-024	VA22B8779-025
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		64.0	62.0	61.9	65.7	73.8
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		2580	2130	2320	1760	1960
antimony	7440-36-0	E472	0.010	mg/kg		0.060	0.058	0.082	0.082	0.094
arsenic	7440-38-2	E472	0.030	mg/kg		5.89	6.33	6.29	7.60	6.75
barium	7440-39-3	E472	0.050	mg/kg		164	232	222	304	232
beryllium	7440-41-7	E472	0.010	mg/kg		0.104	0.089	0.105	0.075	0.206
bismuth	7440-69-9	E472	0.010	mg/kg		0.017	0.015	<0.024 DLA	<0.014 DLA	0.014
boron	7440-42-8	E472	1.0	mg/kg		38.0	25.5	88.8	71.3	18.6
cadmium	7440-43-9	E472	0.010	mg/kg		0.318	0.320	0.597	0.853	1.03
calcium	7440-70-2	E472	20	mg/kg		230000	246000	260000	236000	7430
cesium	7440-46-2	E472	0.0050	mg/kg		0.325	0.255	0.315	0.265	0.0886
chromium	7440-47-3	E472	0.20	mg/kg		9.29	9.25	7.85	6.83	23.9
cobalt	7440-48-4	E472	0.020	mg/kg		2.82	2.56	3.93	6.07	14.4
copper	7440-50-8	E472	0.20	mg/kg		75.2	71.2	194	96.3	24.7
iron	7439-89-6	E472	5.0	mg/kg		5200	4380	4740	4080	4460
lead	7439-92-1	E472	0.050	mg/kg		1.25	1.04	1.12	0.863	0.742
lithium	7439-93-2	E472	0.50	mg/kg		2.80	2.47	2.65	1.82	1.39
magnesium	7439-95-4	E472	2.0	mg/kg		3740	3510	4170	3280	1910
manganese	7439-96-5	E472	0.050	mg/kg		3280	3540	7210	12000	6970
mercury	7439-97-6	E511	0.0050	mg/kg		0.0266	0.0222	0.0212	0.0200	0.0486
molybdenum	7439-98-7	E472	0.040	mg/kg		0.703	0.626	0.998	1.33	2.38
nickel	7440-02-0	E472	0.20	mg/kg		5.67	6.38	6.17	8.18	25.2
phosphorus	7723-14-0	E472	10	mg/kg		1690	1890	1910	1700	2760
potassium	7440-09-7	E472	20	mg/kg		3610	2980	3480	3370	6070
rubidium	7440-17-7	E472	0.050	mg/kg		6.69	5.67	5.26	5.03	7.02
selenium	7782-49-2	E472	0.10	mg/kg		1.67	1.65	2.53	1.94	0.39
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0226	0.0298	0.0265	0.0191	0.0337
sodium	7440-23-5	E472	20	mg/kg		306	292	341	312	159
strontium	7440-24-6	E472	0.10	mg/kg		604	617	618	574	65.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_PERT-5_2022-08	HAC-D_PERT-6_2022-08	HAC-D_PERT-7_2022-08	HAC-D_PERT-8_2022-08	EDC-U_PERT-1_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	08-Aug-2022
						VA22B8779-021	VA22B8779-022	VA22B8779-023	VA22B8779-024	VA22B8779-025
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		0.033	0.026	<0.048 DLA	0.036	<0.026 DLA
thallium	7440-28-0	E472	0.0020	mg/kg		0.0256	0.0255	0.0344	0.0422	0.0419
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.24 DLA	<0.14 DLA	<0.13 DLA
titanium	7440-32-6	E472.Ti	0.50	mg/kg		178	135	142	99.1	116
uranium	7440-61-1	E472	0.0020	mg/kg		0.219	0.192	0.210	0.172	0.388
vanadium	7440-62-2	E472	0.10	mg/kg		17.1	13.2	16.9	14.2	16.2
zinc	7440-66-6	E472	1.0	mg/kg		17.8	18.5	28.6	34.3	154
zirconium	7440-67-7	E472	0.20	mg/kg		1.75	1.24	1.22	1.06	1.56

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_PERT-2_ 2022-08	EDC-U_PERT-3_ 2022-08	EDC-U_PERT-4_ 2022-08	EDC-U_PERT-5_ 2022-08	EDC-U_PERT-6_ 2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-026	VA22B8779-027	VA22B8779-028	VA22B8779-029	VA22B8779-030
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		----	89.5	----	----	----
moisture	----	E144-H	2.0	%		89.1	----	77.9	87.2	86.8
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		----	10600	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		13300	----	6490	14700	10900
antimony	7440-36-0	E472	0.010	mg/kg		0.086	----	0.093	0.071	0.067
antimony	7440-36-0	E475	0.020	mg/kg		----	0.086	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		12.8	----	37.9	41.0	10.8
arsenic	7440-38-2	E475	0.050	mg/kg		----	14.4	----	----	----
barium	7440-39-3	E475	0.050	mg/kg		----	319	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		229	----	824	480	225
beryllium	7440-41-7	E475	0.010	mg/kg		----	0.374	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		0.447	----	0.392	0.629	0.339
bismuth	7440-69-9	E475	0.010	mg/kg		----	0.084	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		0.111	----	0.056	0.123	0.078
boron	7440-42-8	E475	1.0	mg/kg		----	8.8	----	----	----
boron	7440-42-8	E472	1.0	mg/kg		7.8	----	11.9	7.4	15.1
cadmium	7440-43-9	E475	0.010	mg/kg		----	1.07	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		0.949	----	2.83	1.82	0.991
calcium	7440-70-2	E475	20	mg/kg		----	11000	----	----	----
calcium	7440-70-2	E472	20	mg/kg		11700	----	10100	13100	9420
cesium	7440-46-2	E475	0.0050	mg/kg		----	0.783	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		1.01	----	0.306	1.02	0.848
chromium	7440-47-3	E475	0.20	mg/kg		----	79.1	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg		127	----	119	68.6	145
cobalt	7440-48-4	E475	0.020	mg/kg		----	22.8	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		21.9	----	47.6	35.9	20.6
copper	7440-50-8	E475	0.20	mg/kg		----	39.1	----	----	----
copper	7440-50-8	E472	0.20	mg/kg		44.1	----	34.8	43.0	35.3
iron	7439-89-6	E475	5.0	mg/kg		----	22600	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_PERT-2_ 2022-08	EDC-U_PERT-3_ 2022-08	EDC-U_PERT-4_ 2022-08	EDC-U_PERT-5_ 2022-08	EDC-U_PERT-6_ 2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-026	VA22B8779-027	VA22B8779-028	VA22B8779-029	VA22B8779-030
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		26400	----	22700	45500	21800
lead	7439-92-1	E475	0.050	mg/kg		----	3.99	----	----	----
lead	7439-92-1	E472	0.050	mg/kg		5.27	----	2.96	6.26	3.94
lithium	7439-93-2	E475	0.50	mg/kg		----	9.04	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		12.2	----	4.18	12.0	9.95
magnesium	7439-95-4	E475	2.0	mg/kg		----	5340	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		6170	----	3540	6250	5040
manganese	7439-96-5	E475	0.050	mg/kg		----	11300	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg		8460	----	26900	18300	8900
mercury	7439-97-6	E511	0.0050	mg/kg		0.157	----	0.0972	0.176	0.122
mercury	7439-97-6	E512	0.010	mg/kg		----	0.188	----	----	----
molybdenum	7439-98-7	E475	0.040	mg/kg		----	2.42	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		2.24	----	2.87	2.74	2.17
nickel	7440-02-0	E475	0.20	mg/kg		----	45.3	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		45.0	----	66.3	56.0	48.1
phosphorus	7723-14-0	E472	10	mg/kg		3290	----	3030	3600	2630
phosphorus	7723-14-0	E475	20	mg/kg		----	3900	----	----	----
potassium	7440-09-7	E475	20	mg/kg		----	5880	----	----	----
potassium	7440-09-7	E472	20	mg/kg		4780	----	4850	4140	3080
rubidium	7440-17-7	E475	0.050	mg/kg		----	15.1	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		16.7	----	8.09	14.7	11.5
selenium	7782-49-2	E475	0.10	mg/kg		----	0.82	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg		0.98	----	0.70	1.13	0.77
silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	0.164	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.200	----	0.0811	0.193	0.129
sodium	7440-23-5	E475	20	mg/kg		----	289	----	----	----
sodium	7440-23-5	E472	20	mg/kg		291	----	147	291	214
strontium	7440-24-6	E475	0.10	mg/kg		----	94.0	----	----	----
strontium	7440-24-6	E472	0.10	mg/kg		98.2	----	114	125	94.2
tellurium	13494-80-9	E475	0.020	mg/kg		----	<0.025 DLA	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_PERT-2_ 2022-08	EDC-U_PERT-3_ 2022-08	EDC-U_PERT-4_ 2022-08	EDC-U_PERT-5_ 2022-08	EDC-U_PERT-6_ 2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-026	VA22B8779-027	VA22B8779-028	VA22B8779-029	VA22B8779-030
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.038 DLA	----	0.034	<0.060 DLA	<0.062 DLA
thallium	7440-28-0	E475	0.0020	mg/kg		----	0.116	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.116	----	0.200	0.152	0.105
tin	7440-31-5	E475	0.10	mg/kg		----	0.19	----	----	----
tin	7440-31-5	E472	0.10	mg/kg		0.27	----	<0.15 DLA	<0.30 DLA	<0.31 DLA
titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	353	----	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		458	----	200	487	385
uranium	7440-61-1	E475	0.0020	mg/kg		----	0.658	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.809	----	0.612	1.00	0.704
vanadium	7440-62-2	E475	0.10	mg/kg		----	45.0	----	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		54.4	----	55.4	98.8	45.7
zinc	7440-66-6	E475	1.0	mg/kg		----	143	----	----	----
zinc	7440-66-6	E472	1.0	mg/kg		152	----	241	202	135
zirconium	7440-67-7	E475	0.20	mg/kg		----	5.87	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		7.61	----	4.70	8.94	6.12

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_PERT-7_2022-08	EDC-U_PERT-8_2022-08	EDC-D_PERT-1_2022-08	EDC-D_PERT-2_2022-08	EDC-D_PERT-3_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	04-Aug-2022	04-Aug-2022	03-Aug-2022
						VA22B8779-031	VA22B8779-032	VA22B8779-033	VA22B8779-034	VA22B8779-035
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		88.9	84.3	66.6	83.8	82.2
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		8020	8050	10500	9850	11400
antimony	7440-36-0	E472	0.010	mg/kg		0.085	0.110	0.040	0.064	0.053
arsenic	7440-38-2	E472	0.030	mg/kg		24.5	34.0	12.7	14.2	12.9
barium	7440-39-3	E472	0.050	mg/kg		242	1140	130	138	149
beryllium	7440-41-7	E472	0.010	mg/kg		0.336	0.422	0.323	0.292	0.310
bismuth	7440-69-9	E472	0.010	mg/kg		0.053	0.056	0.069	0.075	0.083
boron	7440-42-8	E472	1.0	mg/kg		8.4	9.9	6.6	10.5	9.4
cadmium	7440-43-9	E472	0.010	mg/kg		1.13	4.69	0.338	0.294	0.328
calcium	7440-70-2	E472	20	mg/kg		8310	12000	7550	9440	9330
cesium	7440-46-2	E472	0.0050	mg/kg		0.440	0.419	1.27	1.21	1.24
chromium	7440-47-3	E472	0.20	mg/kg		233	46.6	50.3	41.6	54.4
cobalt	7440-48-4	E472	0.020	mg/kg		22.0	65.9	10.8	10.0	11.3
copper	7440-50-8	E472	0.20	mg/kg		36.4	39.7	27.3	25.2	26.3
iron	7439-89-6	E472	5.0	mg/kg		26000	19800	21600	19700	21600
lead	7439-92-1	E472	0.050	mg/kg		3.71	3.33	4.57	4.44	4.39
lithium	7439-93-2	E472	0.50	mg/kg		6.82	5.51	10.8	10.3	11.2
magnesium	7439-95-4	E472	2.0	mg/kg		4330	3640	6370	5710	5980
manganese	7439-96-5	E472	0.050	mg/kg		9480	38600	2020	2300	2540
mercury	7439-97-6	E511	0.0050	mg/kg		0.0730	0.0777	0.0435	0.0516	0.0494
molybdenum	7439-98-7	E472	0.040	mg/kg		3.78	4.41	1.05	1.70	1.26
nickel	7440-02-0	E472	0.20	mg/kg		51.1	95.6	33.6	29.8	36.0
phosphorus	7723-14-0	E472	10	mg/kg		2630	2670	1370	1960	1680
potassium	7440-09-7	E472	20	mg/kg		4260	3810	2540	4380	2990
rubidium	7440-17-7	E472	0.050	mg/kg		9.40	8.27	8.97	11.5	10.3
selenium	7782-49-2	E472	0.10	mg/kg		0.60	0.77	0.88	1.08	0.88
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0847	0.100	0.0897	0.0744	0.0760
sodium	7440-23-5	E472	20	mg/kg		224	151	266	316	289
strontium	7440-24-6	E472	0.10	mg/kg		74.0	140	73.7	91.3	79.9

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_PERT-7_2022-08	EDC-U_PERT-8_2022-08	EDC-D_PERT-1_2022-08	EDC-D_PERT-2_2022-08	EDC-D_PERT-3_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	04-Aug-2022	04-Aug-2022	03-Aug-2022
						VA22B8779-031	VA22B8779-032	VA22B8779-033	VA22B8779-034	VA22B8779-035
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.050 DLA	<0.068 DLA	<0.033 DLA	<0.054 DLA	<0.053 DLA
thallium	7440-28-0	E472	0.0020	mg/kg		0.0929	0.404	0.0812	0.0726	0.0752
tin	7440-31-5	E472	0.10	mg/kg		<0.25 DLA	<0.34 DLA	<0.16 DLA	<0.27 DLA	<0.27 DLA
titanium	7440-32-6	E472.Ti	0.50	mg/kg		417	289	432	485	566
uranium	7440-61-1	E472	0.0020	mg/kg		0.660	0.851	0.546	0.645	0.559
vanadium	7440-62-2	E472	0.10	mg/kg		58.8	53.0	46.3	40.0	46.2
zinc	7440-66-6	E472	1.0	mg/kg		113	337	55.8	59.2	58.2
zirconium	7440-67-7	E472	0.20	mg/kg		6.87	5.40	6.12	6.44	6.96

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_PERT-4_ 2022-08	EDC-D_PERT-5_ 2022-08	EDC-D_PERT-6_ 2022-08	EDC-D_PERT-7_ 2022-08	EDC-D_PERT-8_ 2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-036	VA22B8779-037	VA22B8779-038	VA22B8779-039	VA22B8779-040
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		----	88.3	71.0	----	----
moisture	----	E144-H	2.0	%		79.0	----	----	80.1	83.1
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		----	6060	13300	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		7600	----	----	9740	11700
antimony	7440-36-0	E472	0.010	mg/kg		0.051	----	----	0.071	0.095
antimony	7440-36-0	E475	0.020	mg/kg		----	0.080	0.219	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		9.58	----	----	12.6	15.3
arsenic	7440-38-2	E475	0.050	mg/kg		----	13.9	32.9	----	----
barium	7440-39-3	E475	0.050	mg/kg		----	174	205	----	----
barium	7440-39-3	E472	0.050	mg/kg		114	----	----	119	154
beryllium	7440-41-7	E475	0.010	mg/kg		----	0.212	0.500	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		0.260	----	----	0.318	0.326
bismuth	7440-69-9	E475	0.010	mg/kg		----	0.062	0.068	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		0.081	----	----	0.057	0.110
boron	7440-42-8	E475	1.0	mg/kg		----	17.8	27.9	----	----
boron	7440-42-8	E472	1.0	mg/kg		5.3	----	----	10.1	10.0
cadmium	7440-43-9	E475	0.010	mg/kg		----	0.461	2.12	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		0.197	----	----	0.311	0.328
calcium	7440-70-2	E475	20	mg/kg		----	12100	23300	----	----
calcium	7440-70-2	E472	20	mg/kg		5720	----	----	9580	9410
cesium	7440-46-2	E475	0.0050	mg/kg		----	0.815	1.55	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		1.29	----	----	1.22	1.53
chromium	7440-47-3	E475	0.20	mg/kg		----	27.1	54.4	----	----
chromium	7440-47-3	E472	0.20	mg/kg		25.8	----	----	37.7	50.1
cobalt	7440-48-4	E475	0.020	mg/kg		----	7.94	21.0	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		6.99	----	----	9.15	12.0
copper	7440-50-8	E475	0.20	mg/kg		----	24.1	27.1	----	----
copper	7440-50-8	E472	0.20	mg/kg		17.9	----	----	28.5	30.4
iron	7439-89-6	E475	5.0	mg/kg		----	12600	42400	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_PERT-4_ 2022-08	EDC-D_PERT-5_ 2022-08	EDC-D_PERT-6_ 2022-08	EDC-D_PERT-7_ 2022-08	EDC-D_PERT-8_ 2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-036	VA22B8779-037	VA22B8779-038	VA22B8779-039	VA22B8779-040
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		15500	----	----	19200	25400
lead	7439-92-1	E475	0.050	mg/kg		----	2.84	9.34	----	----
lead	7439-92-1	E472	0.050	mg/kg		3.68	----	----	3.66	5.33
lithium	7439-93-2	E475	0.50	mg/kg		----	6.56	10.1	----	----
lithium	7439-93-2	E472	0.50	mg/kg		9.34	----	----	15.8	12.3
magnesium	7439-95-4	E475	2.0	mg/kg		----	4250	8000	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		4300	----	----	5670	6000
manganese	7439-96-5	E475	0.050	mg/kg		----	2960	5970	----	----
manganese	7439-96-5	E472	0.050	mg/kg		1640	----	----	1710	2280
mercury	7439-97-6	E511	0.0050	mg/kg		0.0666	----	----	0.0433	0.0452
mercury	7439-97-6	E512	0.010	mg/kg		----	0.055	0.063	----	----
molybdenum	7439-98-7	E475	0.040	mg/kg		----	2.86	1.94	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		0.776	----	----	1.43	1.06
nickel	7440-02-0	E475	0.20	mg/kg		----	25.2	43.1	----	----
nickel	7440-02-0	E472	0.20	mg/kg		22.0	----	----	29.3	33.2
phosphorus	7723-14-0	E472	10	mg/kg		1030	----	----	1870	1400
phosphorus	7723-14-0	E475	20	mg/kg		----	2560	1950	----	----
potassium	7440-09-7	E475	20	mg/kg		----	5480	2720	----	----
potassium	7440-09-7	E472	20	mg/kg		2300	----	----	3650	2910
rubidium	7440-17-7	E475	0.050	mg/kg		----	10.9	11.7	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		8.24	----	----	10.3	11.6
selenium	7782-49-2	E475	0.10	mg/kg		----	1.56	1.73	----	----
selenium	7782-49-2	E472	0.10	mg/kg		0.86	----	----	0.93	0.86
silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	0.0504	0.0870	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.263	----	----	0.105	0.0824
sodium	7440-23-5	E475	20	mg/kg		----	274	403	----	----
sodium	7440-23-5	E472	20	mg/kg		240	----	----	381	505
strontium	7440-24-6	E475	0.10	mg/kg		----	111	189	----	----
strontium	7440-24-6	E472	0.10	mg/kg		50.9	----	----	70.4	77.7
tellurium	13494-80-9	E475	0.020	mg/kg		----	<0.032 DLA	<0.054 DLA	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_PERT-4_2022-08	EDC-D_PERT-5_2022-08	EDC-D_PERT-6_2022-08	EDC-D_PERT-7_2022-08	EDC-D_PERT-8_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-036	VA22B8779-037	VA22B8779-038	VA22B8779-039	VA22B8779-040
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.035 DLA	----	----	<0.070 DLA	<0.052 DLA
thallium	7440-28-0	E475	0.0020	mg/kg		----	0.0626	0.109	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.0596	----	----	0.100	0.108
tin	7440-31-5	E475	0.10	mg/kg		----	<0.16 DLA	0.32	----	----
tin	7440-31-5	E472	0.10	mg/kg		<0.18 DLA	----	----	<0.35 DLA	<0.26 DLA
titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	252	1020	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		301	----	----	529	580
uranium	7440-61-1	E475	0.0020	mg/kg		----	0.382	0.860	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.377	----	----	0.477	0.494
vanadium	7440-62-2	E475	0.10	mg/kg		----	23.9	91.5	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		26.1	----	----	45.8	49.6
zinc	7440-66-6	E475	1.0	mg/kg		----	76.9	89.1	----	----
zinc	7440-66-6	E472	1.0	mg/kg		40.7	----	----	62.3	58.5
zirconium	7440-67-7	E475	0.20	mg/kg		----	2.00	16.2	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		4.27	----	----	6.41	7.08

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_PERT-1_2022-08	E1_PERT-2_2022-08	E1_PERT-3_2022-08	E1_PERT-4_2022-08	E1_PERT-5_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-041	VA22B8779-042	VA22B8779-043	VA22B8779-044	VA22B8779-045
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144A	2.0	%		92.1	89.8	----	93.6	----
moisture	----	E144-H	2.0	%		----	----	83.7	----	78.4
Metals										
aluminum	7429-90-5	E475	5.0	mg/kg		2860	2210	----	4160	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	11100	----	12300
antimony	7440-36-0	E472	0.010	mg/kg		----	----	0.056	----	0.049
antimony	7440-36-0	E475	0.020	mg/kg		0.022	0.023	----	0.026	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	12.8	----	11.4
arsenic	7440-38-2	E475	0.050	mg/kg		2.79	2.78	----	3.01	----
barium	7440-39-3	E475	0.050	mg/kg		31.3	24.1	----	190	----
barium	7440-39-3	E472	0.050	mg/kg		----	----	112	----	157
beryllium	7440-41-7	E475	0.010	mg/kg		0.078	0.065	----	0.162	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	0.529	----	0.411
bismuth	7440-69-9	E475	0.010	mg/kg		0.023	0.017	----	0.015	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	0.054	----	0.089
boron	7440-42-8	E475	1.0	mg/kg		5.8	6.6	----	6.9	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	19.4	----	11.9
cadmium	7440-43-9	E475	0.010	mg/kg		0.073	0.098	----	0.081	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	0.473	----	0.275
calcium	7440-70-2	E475	20	mg/kg		2110	1960	----	3910	----
calcium	7440-70-2	E472	20	mg/kg		----	----	13400	----	9300
cesium	7440-46-2	E475	0.0050	mg/kg		0.346	0.247	----	0.369	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	1.16	----	1.36
chromium	7440-47-3	E475	0.20	mg/kg		30.9	40.1	----	9.94	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	416	----	32.0
cobalt	7440-48-4	E475	0.020	mg/kg		2.54	2.19	----	3.26	----
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	12.2	----	11.7
copper	7440-50-8	E475	0.20	mg/kg		17.6	17.0	----	102	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	49.6	----	214
iron	7439-89-6	E475	5.0	mg/kg		5880	4790	----	6840	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_PERT-1_2022-08	E1_PERT-2_2022-08	E1_PERT-3_2022-08	E1_PERT-4_2022-08	E1_PERT-5_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-041	VA22B8779-042	VA22B8779-043	VA22B8779-044	VA22B8779-045
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	30300	----	25000
lead	7439-92-1	E475	0.050	mg/kg		1.33	1.01	----	1.41	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	3.58	----	5.97
lithium	7439-93-2	E475	0.50	mg/kg		3.40	2.47	----	3.14	----
lithium	7439-93-2	E472	0.50	mg/kg		----	----	5.95	----	13.4
magnesium	7439-95-4	E475	2.0	mg/kg		1530	1280	----	2840	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	4600	----	7020
manganese	7439-96-5	E475	0.050	mg/kg		284	296	----	264	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	1190	----	1200
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	0.0377	----	0.0637
mercury	7439-97-6	E512	0.010	mg/kg		0.045	0.035	----	0.053	----
molybdenum	7439-98-7	E475	0.040	mg/kg		0.478	0.659	----	0.379	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	3.54	----	1.44
nickel	7440-02-0	E475	0.20	mg/kg		10.0	9.82	----	10.2	----
nickel	7440-02-0	E472	0.20	mg/kg		----	----	47.7	----	25.4
phosphorus	7723-14-0	E472	10	mg/kg		----	----	1770	----	1860
phosphorus	7723-14-0	E475	20	mg/kg		696	860	----	716	----
potassium	7440-09-7	E475	20	mg/kg		1300	1520	----	1200	----
potassium	7440-09-7	E472	20	mg/kg		----	----	3470	----	2420
rubidium	7440-17-7	E475	0.050	mg/kg		3.42	2.98	----	3.12	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	8.10	----	10.4
selenium	7782-49-2	E475	0.10	mg/kg		0.27	0.41	----	0.30	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	1.08	----	0.94
silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0224	0.0193	----	0.0267	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	0.133	----	0.129
sodium	7440-23-5	E475	20	mg/kg		206	194	----	249	----
sodium	7440-23-5	E472	20	mg/kg		----	----	293	----	447
strontium	7440-24-6	E475	0.10	mg/kg		17.5	14.8	----	67.3	----
strontium	7440-24-6	E472	0.10	mg/kg		----	----	83.1	----	87.1
tellurium	13494-80-9	E475	0.020	mg/kg		<0.020	<0.020	----	<0.020	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_PERT-1_2022-08	E1_PERT-2_2022-08	E1_PERT-3_2022-08	E1_PERT-4_2022-08	E1_PERT-5_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-041	VA22B8779-042	VA22B8779-043	VA22B8779-044	VA22B8779-045
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	0.021	----	0.032
thallium	7440-28-0	E475	0.0020	mg/kg		0.0265	0.0217	----	0.0191	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	0.0737	----	0.0766
tin	7440-31-5	E475	0.10	mg/kg		<0.10	<0.10	----	0.12	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	0.23	----	0.28
titanium	7440-32-6	E475.Ti	0.50	mg/kg		147	112	----	405	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	266	----	647
uranium	7440-61-1	E475	0.0020	mg/kg		0.134	0.120	----	0.130	----
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	2.73	----	0.544
vanadium	7440-62-2	E475	0.10	mg/kg		12.0	11.1	----	20.9	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	62.4	----	59.5
zinc	7440-66-6	E475	1.0	mg/kg		15.3	15.3	----	15.1	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	88.9	----	61.8
zirconium	7440-67-7	E475	0.20	mg/kg		1.64	1.36	----	3.25	----
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	7.22	----	7.58

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_PERT-6_2022-08	E1_PERT-7_2022-08	E1_PERT-8_2022-08	HAC-R1_INV-1_2022-08	HAC-R1_INV-2_2022-08
					Client sampling date / time	12-Aug-2022	12-Aug-2022	12-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-046	VA22B8779-047	VA22B8779-048	VA22B8779-049	VA22B8779-050
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		76.4	87.3	70.4	74.6	82.7
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		11600	6810	14000	1210	2160
antimony	7440-36-0	E472	0.010	mg/kg		0.096	0.085	0.096	0.038	0.055
arsenic	7440-38-2	E472	0.030	mg/kg		12.7	9.48	8.94	1.47	2.08
barium	7440-39-3	E472	0.050	mg/kg		291	103	725	24.5	36.2
beryllium	7440-41-7	E472	0.010	mg/kg		0.434	0.224	0.450	0.043	0.072
bismuth	7440-69-9	E472	0.010	mg/kg		0.084	0.051	0.085	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		12.3	56.2	46.7	4.4	4.6
cadmium	7440-43-9	E472	0.010	mg/kg		0.284	0.248	0.363	0.225	0.278
calcium	7440-70-2	E472	20	mg/kg		11800	16800	16900	8370	9280
cesium	7440-46-2	E472	0.0050	mg/kg		1.12	0.808	0.957	0.121	0.174
chromium	7440-47-3	E472	0.20	mg/kg		34.3	23.2	20.4	2.54	3.76
cobalt	7440-48-4	E472	0.020	mg/kg		10.3	6.87	11.9	1.80	2.43
copper	7440-50-8	E472	0.20	mg/kg		293	147	823	89.4	102
iron	7439-89-6	E472	5.0	mg/kg		22800	15000	18200	2430	3520
lead	7439-92-1	E472	0.050	mg/kg		6.19	3.28	6.13	0.522	0.718
lithium	7439-93-2	E472	0.50	mg/kg		11.6	7.19	8.29	1.11	1.69
magnesium	7439-95-4	E472	2.0	mg/kg		6100	4800	6450	1450	2040
manganese	7439-96-5	E472	0.050	mg/kg		1150	1490	2500	842	875
mercury	7439-97-6	E511	0.0050	mg/kg		0.0580	0.0450	0.0578	0.0550	0.0540
molybdenum	7439-98-7	E472	0.040	mg/kg		1.30	1.72	1.88	3.36	4.05
nickel	7440-02-0	E472	0.20	mg/kg		24.2	16.8	16.6	3.10	4.39
phosphorus	7723-14-0	E472	10	mg/kg		1670	2930	2020	8380	8840
potassium	7440-09-7	E472	20	mg/kg		2430	6040	3690	9100	9400
rubidium	7440-17-7	E472	0.050	mg/kg		8.75	11.4	8.97	1.94	2.56
selenium	7782-49-2	E472	0.10	mg/kg		1.16	0.83	1.98	4.21	4.66
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.115	0.0709	0.149	0.0279	0.0336
sodium	7440-23-5	E472	20	mg/kg		372	351	430	4200	5420
strontium	7440-24-6	E472	0.10	mg/kg		200	87.7	292	24.5	41.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_PERT-6_2022-08	E1_PERT-7_2022-08	E1_PERT-8_2022-08	HAC-R1_INV-1_2022-08	HAC-R1_INV-2_2022-08
					Client sampling date / time	12-Aug-2022	12-Aug-2022	12-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-046	VA22B8779-047	VA22B8779-048	VA22B8779-049	VA22B8779-050
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		0.031	<0.020	0.033	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0692	0.0649	0.0554	0.0058	0.0091
tin	7440-31-5	E472	0.10	mg/kg		0.33	0.22	0.42	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		662	386	554	73.4	119
uranium	7440-61-1	E472	0.0020	mg/kg		0.552	0.386	0.449	0.109	0.188
vanadium	7440-62-2	E472	0.10	mg/kg		60.2	34.7	49.7	8.14	13.0
zinc	7440-66-6	E472	1.0	mg/kg		50.9	39.6	53.5	103	116
zirconium	7440-67-7	E472	0.20	mg/kg		7.31	4.68	6.10	0.92	1.37

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-3_ 2022-08	HAC-R1_INV-4_ 2022-08	HAC-R1_INV-5_ 2022-08	HAC-R1_INV-6_ 2022-08	HAC-R1_INV-7_ 2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-051	VA22B8779-052	VA22B8779-053	VA22B8779-054	VA22B8779-055
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		75.8	83.2	78.2	72.5	81.8
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		1060	1580	5370	4200	2360
antimony	7440-36-0	E472	0.010	mg/kg		0.059	0.052	0.057	0.064	0.047
arsenic	7440-38-2	E472	0.030	mg/kg		1.20	1.75	3.24	2.72	1.75
barium	7440-39-3	E472	0.050	mg/kg		28.3	32.8	31.0	58.3	103
beryllium	7440-41-7	E472	0.010	mg/kg		0.037	0.055	0.144	0.129	0.058
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	0.017	<0.010
boron	7440-42-8	E472	1.0	mg/kg		3.1	3.9	7.0	5.1	3.4
cadmium	7440-43-9	E472	0.010	mg/kg		0.381	0.460	0.362	0.411	0.935
calcium	7440-70-2	E472	20	mg/kg		4210	3450	15900	10700	4080
cesium	7440-46-2	E472	0.0050	mg/kg		0.0980	0.146	0.163	0.244	0.152
chromium	7440-47-3	E472	0.20	mg/kg		2.74	2.60	1.84	5.15	2.67
cobalt	7440-48-4	E472	0.020	mg/kg		1.55	2.13	2.88	3.77	2.09
copper	7440-50-8	E472	0.20	mg/kg		91.0	149	95.2	152	134
iron	7439-89-6	E472	5.0	mg/kg		2070	2970	4320	6240	3020
lead	7439-92-1	E472	0.050	mg/kg		0.434	0.606	0.564	0.933	0.693
lithium	7439-93-2	E472	0.50	mg/kg		0.97	1.42	2.43	3.26	1.31
magnesium	7439-95-4	E472	2.0	mg/kg		1700	1900	1890	3250	1800
manganese	7439-96-5	E472	0.050	mg/kg		603	938	890	1430	981
mercury	7439-97-6	E511	0.0050	mg/kg		0.0368	0.0703	0.0618	0.0701	0.0761
molybdenum	7439-98-7	E472	0.040	mg/kg		4.86	4.09	3.49	3.31	3.60
nickel	7440-02-0	E472	0.20	mg/kg		3.58	3.42	2.67	5.73	3.24
phosphorus	7723-14-0	E472	10	mg/kg		7200	7750	7070	7610	7980
potassium	7440-09-7	E472	20	mg/kg		7350	9400	7400	9000	8380
rubidium	7440-17-7	E472	0.050	mg/kg		2.23	2.45	2.36	3.14	3.09
selenium	7782-49-2	E472	0.10	mg/kg		7.30	5.14	4.25	4.12	4.91
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0252	0.0392	0.0284	0.0443	0.0356
sodium	7440-23-5	E472	20	mg/kg		3010	5150	3120	4130	3420
strontium	7440-24-6	E472	0.10	mg/kg		18.9	20.6	39.0	36.6	39.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-3_ 2022-08	HAC-R1_INV-4_ 2022-08	HAC-R1_INV-5_ 2022-08	HAC-R1_INV-6_ 2022-08	HAC-R1_INV-7_ 2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-051	VA22B8779-052	VA22B8779-053	VA22B8779-054	VA22B8779-055
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0054	0.0109	0.0058	0.0088	0.0070
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	0.11	0.12	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		71.9	116	118	229	102
uranium	7440-61-1	E472	0.0020	mg/kg		0.102	0.154	0.171	0.193	0.128
vanadium	7440-62-2	E472	0.10	mg/kg		7.17	10.3	10.2	23.9	9.99
zinc	7440-66-6	E472	1.0	mg/kg		110	119	111	102	119
zirconium	7440-67-7	E472	0.20	mg/kg		0.76	1.13	1.70	1.91	1.11

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-8_2022-08	HAC-U_INV-1_2022-08	HAC-U_INV-2_2022-08	HAC-U_INV-3_2022-08	HAC-U_INV-4_2022-08
					Client sampling date / time	10-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8779-056	VA22B8779-057	VA22B8779-058	VA22B8779-059	VA22B8779-060
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		82.6	79.9	80.2	84.4	80.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		898	2180	496	1300	303
antimony	7440-36-0	E472	0.010	mg/kg		0.036	0.049	0.020	0.038	0.023
arsenic	7440-38-2	E472	0.030	mg/kg		2.08	3.75	3.12	3.68	2.05
barium	7440-39-3	E472	0.050	mg/kg		25.0	56.0	24.7	59.6	24.3
beryllium	7440-41-7	E472	0.010	mg/kg		0.029	0.086	0.017	0.050	0.011
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		2.3	3.7	1.0	9.2	1.9
cadmium	7440-43-9	E472	0.010	mg/kg		1.97	0.458	0.995	0.594	0.305
calcium	7440-70-2	E472	20	mg/kg		6620	37400	51500	28300	11800
cesium	7440-46-2	E472	0.0050	mg/kg		0.0978	0.180	0.0701	0.137	0.0491
chromium	7440-47-3	E472	0.20	mg/kg		1.88	3.46	0.96	2.12	0.64
cobalt	7440-48-4	E472	0.020	mg/kg		1.68	2.16	1.32	2.34	0.593
copper	7440-50-8	E472	0.20	mg/kg		138	442	1180	926	133
iron	7439-89-6	E472	5.0	mg/kg		1820	3710	907	2300	710
lead	7439-92-1	E472	0.050	mg/kg		0.386	0.611	0.199	0.467	0.142
lithium	7439-93-2	E472	0.50	mg/kg		0.81	1.68	0.52	1.00	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1740	2750	3050	2940	2800
manganese	7439-96-5	E472	0.050	mg/kg		828	1070	443	1310	801
mercury	7439-97-6	E511	0.0050	mg/kg		0.0844	0.0803	0.102	0.101	0.0854
molybdenum	7439-98-7	E472	0.040	mg/kg		2.52	2.54	1.35	1.83	4.03
nickel	7440-02-0	E472	0.20	mg/kg		2.52	3.74	2.63	4.53	0.93
phosphorus	7723-14-0	E472	10	mg/kg		10600	8890	10600	10200	8800
potassium	7440-09-7	E472	20	mg/kg		8350	4950	5080	4930	5710
rubidium	7440-17-7	E472	0.050	mg/kg		3.95	4.13	4.40	4.08	3.58
selenium	7782-49-2	E472	0.10	mg/kg		5.16	5.54	5.86	6.68	6.17
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0332	0.159	0.379	0.471	0.0361
sodium	7440-23-5	E472	20	mg/kg		3620	2580	2950	2470	3880
strontium	7440-24-6	E472	0.10	mg/kg		25.8	90.9	104	93.7	49.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-8_2022-08	HAC-U_INV-1_2022-08	HAC-U_INV-2_2022-08	HAC-U_INV-3_2022-08	HAC-U_INV-4_2022-08
					Client sampling date / time	10-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022	06-Aug-2022
						VA22B8779-056	VA22B8779-057	VA22B8779-058	VA22B8779-059	VA22B8779-060
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0067	0.0148	0.0251	0.0230	0.0056
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		57.4	108	16.5	58.0	17.3
uranium	7440-61-1	E472	0.0020	mg/kg		0.0896	0.255	0.201	0.208	0.0407
vanadium	7440-62-2	E472	0.10	mg/kg		5.75	13.5	2.83	7.98	2.00
zinc	7440-66-6	E472	1.0	mg/kg		131	79.9	88.3	96.8	103
zirconium	7440-67-7	E472	0.20	mg/kg		0.62	0.24	<0.20	<0.20	0.23

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INV-5_2022-08	HAC-U_INV-6_2022-08	HAC-U_INV-7_2022-08	HAC-U_INV-8_2022-08	HAC-D_INV-1_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-061	VA22B8779-062	VA22B8779-063	VA22B8779-064	VA22B8779-065
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		85.5	76.9	79.4	85.3	69.9
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		373	700	2360	94.1	3070
antimony	7440-36-0	E472	0.010	mg/kg		0.022	0.026	0.048	0.032	0.082
arsenic	7440-38-2	E472	0.030	mg/kg		3.12	1.93	4.30	2.52	7.19
barium	7440-39-3	E472	0.050	mg/kg		35.7	19.0	75.1	40.4	43.8
beryllium	7440-41-7	E472	0.010	mg/kg		0.012	0.024	0.096	<0.010	0.124
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	0.010	<0.010	0.023
boron	7440-42-8	E472	1.0	mg/kg		2.9	1.6	4.1	<1.0	3.3
cadmium	7440-43-9	E472	0.010	mg/kg		0.720	0.540	0.366	0.667	1.31
calcium	7440-70-2	E472	20	mg/kg		20400	7290	20100	28800	7350
cesium	7440-46-2	E472	0.0050	mg/kg		0.0713	0.0797	0.289	0.0337	0.362
chromium	7440-47-3	E472	0.20	mg/kg		1.06	1.19	3.81	0.35	6.21
cobalt	7440-48-4	E472	0.020	mg/kg		1.25	1.01	2.54	0.735	3.51
copper	7440-50-8	E472	0.20	mg/kg		403	394	393	127	104
iron	7439-89-6	E472	5.0	mg/kg		962	1400	4250	440	6910
lead	7439-92-1	E472	0.050	mg/kg		0.187	0.248	0.676	0.094	1.57
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	0.56	1.85	<0.50	2.64
magnesium	7439-95-4	E472	2.0	mg/kg		3320	1570	3420	2590	2580
manganese	7439-96-5	E472	0.050	mg/kg		851	574	1230	1620	702
mercury	7439-97-6	E511	0.0050	mg/kg		0.107	0.0897	0.104	0.0755	0.0906
molybdenum	7439-98-7	E472	0.040	mg/kg		1.76	6.58	2.20	1.68	1.44
nickel	7440-02-0	E472	0.20	mg/kg		3.31	2.32	4.14	0.98	6.27
phosphorus	7723-14-0	E472	10	mg/kg		11500	6440	11800	11100	7010
potassium	7440-09-7	E472	20	mg/kg		6750	4990	7320	8770	6770
rubidium	7440-17-7	E472	0.050	mg/kg		4.97	3.14	4.59	4.53	4.08
selenium	7782-49-2	E472	0.10	mg/kg		6.06	9.03	6.78	8.01	6.69
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0880	0.0674	0.248	0.0633	0.108
sodium	7440-23-5	E472	20	mg/kg		3770	2220	3210	4090	2440
strontium	7440-24-6	E472	0.10	mg/kg		80.5	27.1	83.7	73.6	47.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INV-5_2022-08	HAC-U_INV-6_2022-08	HAC-U_INV-7_2022-08	HAC-U_INV-8_2022-08	HAC-D_INV-1_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-061	VA22B8779-062	VA22B8779-063	VA22B8779-064	VA22B8779-065
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0070	0.0106	0.0142	0.0078	0.0507
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		20.4	44.1	114	4.43	135
uranium	7440-61-1	E472	0.0020	mg/kg		0.114	0.0843	0.200	0.0315	0.228
vanadium	7440-62-2	E472	0.10	mg/kg		2.50	4.74	14.7	1.33	19.2
zinc	7440-66-6	E472	1.0	mg/kg		99.8	101	84.8	68.7	152
zirconium	7440-67-7	E472	0.20	mg/kg		0.27	0.36	<0.20	<0.20	1.86

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_INV-2_2022-08	HAC-D_INV-3_2022-08	HAC-D_INV-4_2022-08	HAC-D_INV-5_2022-08	HAC-D_INV-6_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-066	VA22B8779-067	VA22B8779-068	VA22B8779-069	VA22B8779-070
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		68.8	75.4	75.9	73.4	73.0
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		132	870	540	1240	286
antimony	7440-36-0	E472	0.010	mg/kg		0.023	0.029	0.028	0.035	0.018
arsenic	7440-38-2	E472	0.030	mg/kg		0.999	2.11	1.31	2.26	1.02
barium	7440-39-3	E472	0.050	mg/kg		20.2	22.6	25.3	53.4	19.7
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	0.029	0.022	0.064	0.011
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	0.011	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	1.4	2.6	1.8	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.548	0.958	1.01	1.53	0.772
calcium	7440-70-2	E472	20	mg/kg		920	2360	2980	3570	1700
cesium	7440-46-2	E472	0.0050	mg/kg		0.0250	0.111	0.0879	0.121	0.0601
chromium	7440-47-3	E472	0.20	mg/kg		0.48	11.0	1.65	1.58	0.95
cobalt	7440-48-4	E472	0.020	mg/kg		1.24	1.70	1.14	1.65	0.809
copper	7440-50-8	E472	0.20	mg/kg		34.4	77.2	74.8	81.6	55.0
iron	7439-89-6	E472	5.0	mg/kg		283	1770	1110	1580	677
lead	7439-92-1	E472	0.050	mg/kg		0.141	0.611	0.332	1.49	0.196
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	0.92	0.54	0.74	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		952	1590	1310	1540	1100
manganese	7439-96-5	E472	0.050	mg/kg		538	454	836	1230	820
mercury	7439-97-6	E511	0.0050	mg/kg		0.0664	0.0633	0.0829	0.0810	0.0646
molybdenum	7439-98-7	E472	0.040	mg/kg		4.22	1.66	1.41	1.66	2.23
nickel	7440-02-0	E472	0.20	mg/kg		0.93	87.8	1.75	6.03	1.51
phosphorus	7723-14-0	E472	10	mg/kg		6460	8470	8240	8630	7370
potassium	7440-09-7	E472	20	mg/kg		4500	6390	7050	7440	6130
rubidium	7440-17-7	E472	0.050	mg/kg		1.07	2.92	2.78	3.49	2.24
selenium	7782-49-2	E472	0.10	mg/kg		5.42	4.87	4.85	4.43	4.72
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0091	0.0338	0.0271	0.0238	0.0230
sodium	7440-23-5	E472	20	mg/kg		2350	2930	3220	2940	3600
strontium	7440-24-6	E472	0.10	mg/kg		6.12	14.5	14.1	22.1	11.6

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	HAC-D_INV-2_2022-08	HAC-D_INV-3_2022-08	HAC-D_INV-4_2022-08	HAC-D_INV-5_2022-08	HAC-D_INV-6_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8779-066	VA22B8779-067	VA22B8779-068	VA22B8779-069	VA22B8779-070
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0036	0.0115	0.0096	0.0122	0.0075
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		6.62	47.4	26.2	35.5	20.3
uranium	7440-61-1	E472	0.0020	mg/kg		0.0348	0.0808	0.0621	0.0838	0.0438
vanadium	7440-62-2	E472	0.10	mg/kg		0.77	5.40	2.77	4.70	2.14
zinc	7440-66-6	E472	1.0	mg/kg		177	125	126	135	106
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	0.51	0.46	0.40	0.25

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_INV-7_2022-08	HAC-D_INV-8_2022-08	EDC-U_INV-1_2022-08	EDC-U_INV-2_2022-08	EDC-U_INV-3_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	08-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-071	VA22B8779-072	VA22B8779-073	VA22B8779-074	VA22B8779-075
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		79.6	79.7	82.1	82.2	81.7
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		541	1010	527	439	783
antimony	7440-36-0	E472	0.010	mg/kg		0.030	0.039	0.022	0.016	0.023
arsenic	7440-38-2	E472	0.030	mg/kg		2.10	1.82	1.08	0.704	1.51
barium	7440-39-3	E472	0.050	mg/kg		31.7	45.1	7.95	8.44	10.8
beryllium	7440-41-7	E472	0.010	mg/kg		0.021	0.036	0.015	0.012	0.026
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		4.0	2.4	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		2.31	0.744	1.16	0.811	1.70
calcium	7440-70-2	E472	20	mg/kg		4840	3380	1240	1440	1840
cesium	7440-46-2	E472	0.0050	mg/kg		0.0860	0.122	0.0404	0.0318	0.0518
chromium	7440-47-3	E472	0.20	mg/kg		2.29	1.90	2.80	2.22	2.71
cobalt	7440-48-4	E472	0.020	mg/kg		1.61	1.73	1.87	1.57	2.64
copper	7440-50-8	E472	0.20	mg/kg		81.5	75.2	24.3	22.1	25.4
iron	7439-89-6	E472	5.0	mg/kg		1270	2370	997	855	1820
lead	7439-92-1	E472	0.050	mg/kg		0.350	0.498	0.226	0.164	0.343
lithium	7439-93-2	E472	0.50	mg/kg		0.56	1.05	<0.50	<0.50	0.66
magnesium	7439-95-4	E472	2.0	mg/kg		1500	1610	1380	1210	1340
manganese	7439-96-5	E472	0.050	mg/kg		1390	1140	378	377	580
mercury	7439-97-6	E511	0.0050	mg/kg		0.0842	0.0739	0.0700	0.0559	0.102
molybdenum	7439-98-7	E472	0.040	mg/kg		1.79	2.24	25.6	5.22	3.16
nickel	7440-02-0	E472	0.20	mg/kg		2.23	2.92	1.92	1.50	2.55
phosphorus	7723-14-0	E472	10	mg/kg		9300	7150	8400	8670	7840
potassium	7440-09-7	E472	20	mg/kg		8210	6450	6790	7270	7200
rubidium	7440-17-7	E472	0.050	mg/kg		3.35	2.04	5.42	4.68	5.48
selenium	7782-49-2	E472	0.10	mg/kg		4.23	4.30	1.19	0.87	0.86
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0296	0.0341	0.158	0.190	0.254
sodium	7440-23-5	E472	20	mg/kg		8240	5490	2850	3300	3200
strontium	7440-24-6	E472	0.10	mg/kg		19.2	18.4	7.40	8.53	10.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_INV-7_2022-08	HAC-D_INV-8_2022-08	EDC-U_INV-1_2022-08	EDC-U_INV-2_2022-08	EDC-U_INV-3_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	08-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-071	VA22B8779-072	VA22B8779-073	VA22B8779-074	VA22B8779-075
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0120	0.0123	0.0104	0.0096	0.0118
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		34.4	65.7	30.5	22.6	34.3
uranium	7440-61-1	E472	0.0020	mg/kg		0.0721	0.0894	0.0558	0.0612	0.101
vanadium	7440-62-2	E472	0.10	mg/kg		3.94	7.38	2.37	1.96	4.24
zinc	7440-66-6	E472	1.0	mg/kg		142	124	190	158	166
zirconium	7440-67-7	E472	0.20	mg/kg		0.42	0.68	0.42	0.38	0.55

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INV-4_2022-08	EDC-U_INV-5_2022-08	EDC-U_INV-6_2022-08	EDC-U_INV-7_2022-08	EDC-U_INV-8_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-076	VA22B8779-077	VA22B8779-078	VA22B8779-079	VA22B8779-080
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		82.6	81.0	86.3	83.0	77.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		416	470	886	647	324
antimony	7440-36-0	E472	0.010	mg/kg		0.010	0.017	0.022	0.021	0.013
arsenic	7440-38-2	E472	0.030	mg/kg		0.873	0.888	1.22	1.23	0.619
barium	7440-39-3	E472	0.050	mg/kg		8.06	7.75	15.4	20.3	6.73
beryllium	7440-41-7	E472	0.010	mg/kg		0.012	0.013	0.027	0.031	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	2.3	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		1.22	1.05	1.07	1.29	0.424
calcium	7440-70-2	E472	20	mg/kg		1420	1280	2030	1540	1010
cesium	7440-46-2	E472	0.0050	mg/kg		0.0303	0.0347	0.0636	0.0462	0.0254
chromium	7440-47-3	E472	0.20	mg/kg		1.48	1.80	3.15	2.64	1.45
cobalt	7440-48-4	E472	0.020	mg/kg		1.76	1.56	3.85	3.15	1.58
copper	7440-50-8	E472	0.20	mg/kg		23.5	21.3	30.1	24.0	17.6
iron	7439-89-6	E472	5.0	mg/kg		879	925	1860	1980	780
lead	7439-92-1	E472	0.050	mg/kg		0.160	0.178	0.352	0.401	0.166
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	0.68	0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1120	1380	1380	1390	1220
manganese	7439-96-5	E472	0.050	mg/kg		485	455	1580	1320	672
mercury	7439-97-6	E511	0.0050	mg/kg		0.0908	0.0665	0.127	0.0784	0.0593
molybdenum	7439-98-7	E472	0.040	mg/kg		2.26	4.37	0.624	0.874	4.51
nickel	7440-02-0	E472	0.20	mg/kg		1.52	1.44	2.94	2.47	1.15
phosphorus	7723-14-0	E472	10	mg/kg		8200	8140	8880	7910	8080
potassium	7440-09-7	E472	20	mg/kg		6910	6960	8500	8940	6110
rubidium	7440-17-7	E472	0.050	mg/kg		4.06	3.49	5.43	5.36	3.39
selenium	7782-49-2	E472	0.10	mg/kg		0.90	0.95	1.02	1.01	1.02
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.274	0.123	0.321	0.188	0.104
sodium	7440-23-5	E472	20	mg/kg		2930	3770	3690	3670	2740
strontium	7440-24-6	E472	0.10	mg/kg		7.78	8.05	12.0	11.2	8.72

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INV-4_2022-08	EDC-U_INV-5_2022-08	EDC-U_INV-6_2022-08	EDC-U_INV-7_2022-08	EDC-U_INV-8_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-076	VA22B8779-077	VA22B8779-078	VA22B8779-079	VA22B8779-080
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0095	0.0082	0.0157	0.0133	0.0068
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		18.8	19.9	37.6	52.0	15.2
uranium	7440-61-1	E472	0.0020	mg/kg		0.0619	0.0535	0.143	0.0897	0.0561
vanadium	7440-62-2	E472	0.10	mg/kg		1.85	1.90	3.67	4.61	1.71
zinc	7440-66-6	E472	1.0	mg/kg		176	153	240	219	131
zirconium	7440-67-7	E472	0.20	mg/kg		0.36	0.38	0.75	0.66	0.27

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INV-1_2022-08	EDC-D_INV-2_2022-08	EDC-D_INV-3_2022-08	EDC-D_INV-4_2022-08	EDC-D_INV-5_2022-08
					Client sampling date / time	04-Aug-2022	04-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-081	VA22B8779-082	VA22B8779-083	VA22B8779-084	VA22B8779-085
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		73.2	78.5	80.1	73.8	80.3
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		424	274	1180	221	658
antimony	7440-36-0	E472	0.010	mg/kg		0.020	0.018	0.039	0.011	0.021
arsenic	7440-38-2	E472	0.030	mg/kg		1.96	1.24	3.23	1.30	1.90
barium	7440-39-3	E472	0.050	mg/kg		8.50	9.84	25.9	5.28	24.3
beryllium	7440-41-7	E472	0.010	mg/kg		0.014	<0.010	0.037	<0.010	0.024
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	0.015	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	1.2	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.946	0.878	2.69	0.595	1.06
calcium	7440-70-2	E472	20	mg/kg		1800	1480	2390	2570	1430
cesium	7440-46-2	E472	0.0050	mg/kg		0.0625	0.0439	0.170	0.0379	0.0892
chromium	7440-47-3	E472	0.20	mg/kg		2.02	1.60	3.77	1.04	2.36
cobalt	7440-48-4	E472	0.020	mg/kg		0.896	0.666	1.85	0.626	1.02
copper	7440-50-8	E472	0.20	mg/kg		38.0	29.6	39.4	38.8	30.8
iron	7439-89-6	E472	5.0	mg/kg		848	591	2260	460	1340
lead	7439-92-1	E472	0.050	mg/kg		0.198	0.170	0.596	0.106	0.341
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	1.16	<0.50	0.64
magnesium	7439-95-4	E472	2.0	mg/kg		1300	1640	1540	1900	1610
manganese	7439-96-5	E472	0.050	mg/kg		238	179	504	188	345
mercury	7439-97-6	E511	0.0050	mg/kg		0.120	0.103	0.110	0.0730	0.121
molybdenum	7439-98-7	E472	0.040	mg/kg		0.670	0.659	0.811	0.583	0.950
nickel	7440-02-0	E472	0.20	mg/kg		2.47	3.44	4.41	5.32	2.13
phosphorus	7723-14-0	E472	10	mg/kg		7140	8510	7770	9310	8800
potassium	7440-09-7	E472	20	mg/kg		7040	8000	6720	7080	8830
rubidium	7440-17-7	E472	0.050	mg/kg		2.88	3.49	5.23	2.74	3.49
selenium	7782-49-2	E472	0.10	mg/kg		1.76	1.80	1.98	1.65	2.03
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.164	0.122	0.173	0.184	0.142
sodium	7440-23-5	E472	20	mg/kg		3190	4000	3090	3470	3670
strontium	7440-24-6	E472	0.10	mg/kg		9.63	8.80	14.0	10.3	7.69

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INV-1_2022-08	EDC-D_INV-2_2022-08	EDC-D_INV-3_2022-08	EDC-D_INV-4_2022-08	EDC-D_INV-5_2022-08
					Client sampling date / time	04-Aug-2022	04-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-081	VA22B8779-082	VA22B8779-083	VA22B8779-084	VA22B8779-085
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0143	0.0096	0.0260	0.0072	0.0155
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		18.2	11.2	50.6	9.28	27.7
uranium	7440-61-1	E472	0.0020	mg/kg		0.0448	0.0296	0.0908	0.0264	0.0598
vanadium	7440-62-2	E472	0.10	mg/kg		1.52	1.04	4.32	0.92	2.61
zinc	7440-66-6	E472	1.0	mg/kg		119	291	172	129	149
zirconium	7440-67-7	E472	0.20	mg/kg		0.64	0.21	0.79	<0.20	0.46

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INV-6_2022-08	EDC-D_INV-7_2022-08	EDC-D_INV-8_2022-08	E1_INV-1_2022-08	E2_INV-2_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-086	VA22B8779-087	VA22B8779-088	VA22B8779-089	VA22B8779-090
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		79.0	80.1	80.9	79.5	84.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		2140	880	396	1000	1360
antimony	7440-36-0	E472	0.010	mg/kg		0.033	0.029	0.021	0.023	0.039
arsenic	7440-38-2	E472	0.030	mg/kg		2.32	2.44	1.29	2.34	2.02
barium	7440-39-3	E472	0.050	mg/kg		25.6	29.1	13.6	10.9	15.8
beryllium	7440-41-7	E472	0.010	mg/kg		0.045	0.029	0.012	0.026	0.044
bismuth	7440-69-9	E472	0.010	mg/kg		0.010	<0.010	0.076	<0.010	0.011
boron	7440-42-8	E472	1.0	mg/kg		2.0	1.8	<1.0	1.6	1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.522	1.16	0.717	1.08	2.35
calcium	7440-70-2	E472	20	mg/kg		3130	1500	1440	2040	2170
cesium	7440-46-2	E472	0.0050	mg/kg		0.0911	0.116	0.0520	0.0966	0.141
chromium	7440-47-3	E472	0.20	mg/kg		2.26	2.89	1.76	3.84	3.51
cobalt	7440-48-4	E472	0.020	mg/kg		1.32	1.41	0.732	1.69	2.17
copper	7440-50-8	E472	0.20	mg/kg		33.8	32.1	26.6	35.0	27.6
iron	7439-89-6	E472	5.0	mg/kg		2830	1720	896	1760	2860
lead	7439-92-1	E472	0.050	mg/kg		0.666	0.443	0.312	0.373	0.709
lithium	7439-93-2	E472	0.50	mg/kg		0.98	0.83	<0.50	0.93	1.45
magnesium	7439-95-4	E472	2.0	mg/kg		1820	1500	1340	1830	2170
manganese	7439-96-5	E472	0.050	mg/kg		370	421	210	378	209
mercury	7439-97-6	E511	0.0050	mg/kg		0.121	0.121	0.114	0.0537	0.0758
molybdenum	7439-98-7	E472	0.040	mg/kg		0.791	1.02	0.613	0.491	0.606
nickel	7440-02-0	E472	0.20	mg/kg		3.85	2.59	6.67	6.21	10.5
phosphorus	7723-14-0	E472	10	mg/kg		8010	8880	8960	9460	9510
potassium	7440-09-7	E472	20	mg/kg		8910	9750	8600	9130	8540
rubidium	7440-17-7	E472	0.050	mg/kg		1.90	3.93	2.44	5.41	4.92
selenium	7782-49-2	E472	0.10	mg/kg		1.71	2.12	1.52	1.20	1.98
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.151	0.153	0.134	0.104	0.158
sodium	7440-23-5	E472	20	mg/kg		3930	4110	4050	5690	12900
strontium	7440-24-6	E472	0.10	mg/kg		16.5	9.36	12.0	12.6	11.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INV-6_2022-08	EDC-D_INV-7_2022-08	EDC-D_INV-8_2022-08	E1_INV-1_2022-08	E2_INV-2_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-086	VA22B8779-087	VA22B8779-088	VA22B8779-089	VA22B8779-090
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0135	0.0166	0.0097	0.0176	0.0247
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		27.7	36.0	15.2	45.8	59.4
uranium	7440-61-1	E472	0.0020	mg/kg		0.0846	0.0856	0.0389	0.0601	0.114
vanadium	7440-62-2	E472	0.10	mg/kg		8.64	3.44	1.47	4.04	7.49
zinc	7440-66-6	E472	1.0	mg/kg		148	129	155	112	137
zirconium	7440-67-7	E472	0.20	mg/kg		0.76	0.61	0.28	0.60	0.80

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E3_INV-3_2022-08	E4_INV-4_2022-08	E5_INV-5_2022-08	E6_INV-6_2022-08	E7_INV-7_2022-08
					Client sampling date / time	05-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-091	VA22B8779-092	VA22B8779-093	VA22B8779-094	VA22B8779-095
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		84.8	75.0	84.3	82.4	77.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		360	271	1730	1380	356
antimony	7440-36-0	E472	0.010	mg/kg		0.014	0.011	0.044	0.030	0.016
arsenic	7440-38-2	E472	0.030	mg/kg		1.12	1.13	3.03	2.52	1.44
barium	7440-39-3	E472	0.050	mg/kg		5.34	5.53	87.6	57.9	11.7
beryllium	7440-41-7	E472	0.010	mg/kg		0.012	<0.010	0.059	0.050	0.012
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	0.014	0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	1.7	1.5	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.996	0.793	2.22	1.58	0.786
calcium	7440-70-2	E472	20	mg/kg		1600	1470	2350	2110	1050
cesium	7440-46-2	E472	0.0050	mg/kg		0.0434	0.0433	0.210	0.117	0.0440
chromium	7440-47-3	E472	0.20	mg/kg		0.77	1.04	5.06	5.41	1.14
cobalt	7440-48-4	E472	0.020	mg/kg		0.910	1.04	3.03	2.27	1.01
copper	7440-50-8	E472	0.20	mg/kg		22.8	56.2	77.4	74.5	34.8
iron	7439-89-6	E472	5.0	mg/kg		618	537	3610	2540	671
lead	7439-92-1	E472	0.050	mg/kg		0.139	0.135	0.881	0.751	0.190
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	1.60	1.26	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1570	1830	2420	2310	1480
manganese	7439-96-5	E472	0.050	mg/kg		101	125	597	407	206
mercury	7439-97-6	E511	0.0050	mg/kg		0.0463	0.0545	0.0780	0.102	0.0642
molybdenum	7439-98-7	E472	0.040	mg/kg		0.262	0.325	0.815	1.05	2.52
nickel	7440-02-0	E472	0.20	mg/kg		20.1	1.64	3.18	5.61	6.54
phosphorus	7723-14-0	E472	10	mg/kg		9860	9640	9580	9980	8080
potassium	7440-09-7	E472	20	mg/kg		9570	9240	11100	12200	7720
rubidium	7440-17-7	E472	0.050	mg/kg		4.69	4.61	5.52	4.38	3.18
selenium	7782-49-2	E472	0.10	mg/kg		2.18	1.71	1.91	2.20	1.74
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0558	0.0907	0.108	0.185	0.0362
sodium	7440-23-5	E472	20	mg/kg		11400	4260	9590	9570	3110
strontium	7440-24-6	E472	0.10	mg/kg		5.54	6.83	13.3	13.8	5.93

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E3_INV-3_2022-08	E4_INV-4_2022-08	E5_INV-5_2022-08	E6_INV-6_2022-08	E7_INV-7_2022-08
					Client sampling date / time	05-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-091	VA22B8779-092	VA22B8779-093	VA22B8779-094	VA22B8779-095
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0135	0.0089	0.0240	0.0193	0.0063
tin	7440-31-5	E472	0.10	mg/kg		<0.10	0.13	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		28.3	14.4	105	77.0	17.8
uranium	7440-61-1	E472	0.0020	mg/kg		0.0268	0.0251	0.157	0.130	0.0321
vanadium	7440-62-2	E472	0.10	mg/kg		1.73	1.32	9.79	6.75	1.46
zinc	7440-66-6	E472	1.0	mg/kg		106	124	143	128	106
zirconium	7440-67-7	E472	0.20	mg/kg		0.30	<0.20	1.34	1.12	0.28

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E8_INV-8_2022-08	HAC-R1_INVCAD-1_2022-08	HAC-R1_INVCAD-2_2022-08	HAC-R1_INVCAD-3_2022-08	HAC-R1_INVCAD-4_2022-08
					Client sampling date / time	04-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
						VA22B8779-096	VA22B8779-097	VA22B8779-098	VA22B8779-099	VA22B8779-100
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		79.5	68.2	78.3	73.1	68.8
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		2280	18.0	34.3	80.8	14.7
antimony	7440-36-0	E472	0.010	mg/kg		0.046	0.014	0.016	0.018	0.014
arsenic	7440-38-2	E472	0.030	mg/kg		4.72	0.220	0.192	0.361	0.279
barium	7440-39-3	E472	0.050	mg/kg		37.7	1.55	1.19	2.45	1.07
beryllium	7440-41-7	E472	0.010	mg/kg		0.068	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		0.016	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		1.9	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		3.56	<0.010	<0.010	0.021	<0.010
calcium	7440-70-2	E472	20	mg/kg		4990	497	512	568	397
cesium	7440-46-2	E472	0.0050	mg/kg		0.242	<0.0050	0.0065	0.0088	<0.0050
chromium	7440-47-3	E472	0.20	mg/kg		4.74	<0.20	<0.20	0.23	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		4.00	0.063	0.064	0.157	0.063
copper	7440-50-8	E472	0.20	mg/kg		128	11.5	14.8	16.3	11.1
iron	7439-89-6	E472	5.0	mg/kg		4220	95.0	127	191	85.0
lead	7439-92-1	E472	0.050	mg/kg		0.911	<0.050	<0.050	0.204	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		2.04	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		2470	987	1470	1040	894
manganese	7439-96-5	E472	0.050	mg/kg		600	99.4	58.5	235	67.6
mercury	7439-97-6	E511	0.0050	mg/kg		0.127	0.0471	0.0603	0.0446	0.0444
molybdenum	7439-98-7	E472	0.040	mg/kg		0.895	3.87	2.63	5.09	6.85
nickel	7440-02-0	E472	0.20	mg/kg		4.82	<0.20	<0.20	0.29	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		9210	7180	8460	6860	6660
potassium	7440-09-7	E472	20	mg/kg		9460	5670	7880	6290	5670
rubidium	7440-17-7	E472	0.050	mg/kg		8.15	0.707	0.983	1.06	0.716
selenium	7782-49-2	E472	0.10	mg/kg		2.55	4.50	5.29	5.46	6.93
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0778	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		3680	2320	3200	2180	1960
strontium	7440-24-6	E472	0.10	mg/kg		19.0	3.50	3.32	3.63	2.37

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	E8_INV-8_2022-08	HAC-R1_INVCAD-1_2022-08	HAC-R1_INVCAD-2_2022-08	HAC-R1_INVCAD-3_2022-08	HAC-R1_INVCAD-4_2022-08
					Client sampling date / time	04-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8779-096	VA22B8779-097	VA22B8779-098	VA22B8779-099	VA22B8779-100
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0266	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		119	1.22	2.10	5.45	1.37
uranium	7440-61-1	E472	0.0020	mg/kg		0.160	<0.0020	0.0024	0.0077	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		11.4	0.12	0.15	0.50	0.15
zinc	7440-66-6	E472	1.0	mg/kg		121	63.4	62.0	101	76.8
zirconium	7440-67-7	E472	0.20	mg/kg		1.43	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INVCAD-5_2022-08	HAC-R1_INVCAD-6_2022-08	HAC-R1_INVCAD-7_2022-08	HAC-R1_INVCAD-8_2022-08	HAC-U_INVCAD-1_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	06-Aug-2022
						VA22B8779-101	VA22B8779-102	VA22B8779-103	VA22B8779-104	VA22B8779-105
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		67.6	73.2	71.0	73.6	74.7
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		126	69.1	64.4	56.3	172
antimony	7440-36-0	E472	0.010	mg/kg		0.022	0.021	0.021	0.026	0.024
arsenic	7440-38-2	E472	0.030	mg/kg		0.389	0.334	0.317	0.338	0.493
barium	7440-39-3	E472	0.050	mg/kg		7.10	4.57	2.49	5.84	11.0
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	1.6
cadmium	7440-43-9	E472	0.010	mg/kg		0.125	0.039	0.035	0.043	0.094
calcium	7440-70-2	E472	20	mg/kg		850	803	664	701	1740
cesium	7440-46-2	E472	0.0050	mg/kg		0.0140	0.0096	0.0082	0.0078	0.0226
chromium	7440-47-3	E472	0.20	mg/kg		0.53	0.21	0.40	0.25	1.10
cobalt	7440-48-4	E472	0.020	mg/kg		0.277	0.121	0.140	0.269	0.324
copper	7440-50-8	E472	0.20	mg/kg		23.6	16.6	14.3	16.4	23.4
iron	7439-89-6	E472	5.0	mg/kg		286	179	175	177	353
lead	7439-92-1	E472	0.050	mg/kg		0.076	<0.050	0.056	<0.050	0.110
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		876	1060	999	1020	1220
manganese	7439-96-5	E472	0.050	mg/kg		266	130	151	368	516
mercury	7439-97-6	E511	0.0050	mg/kg		0.0410	0.0325	0.0329	0.0429	0.0380
molybdenum	7439-98-7	E472	0.040	mg/kg		9.55	9.88	8.77	5.49	11.1
nickel	7440-02-0	E472	0.20	mg/kg		0.82	<0.20	0.27	0.23	0.77
phosphorus	7723-14-0	E472	10	mg/kg		6940	6800	6450	6540	7980
potassium	7440-09-7	E472	20	mg/kg		6920	6370	6130	5850	6560
rubidium	7440-17-7	E472	0.050	mg/kg		1.26	1.20	1.01	1.14	1.43
selenium	7782-49-2	E472	0.10	mg/kg		10.4	7.69	7.87	5.35	10.1
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		2180	2440	2400	2440	2570
strontium	7440-24-6	E472	0.10	mg/kg		5.24	5.59	3.95	4.80	13.3

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INVCAD-5_2022-08	HAC-R1_INVCAD-6_2022-08	HAC-R1_INVCAD-7_2022-08	HAC-R1_INVCAD-8_2022-08	HAC-U_INVCAD-1_2022-08
					Client sampling date / time	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	06-Aug-2022
						VA22B8779-101	VA22B8779-102	VA22B8779-103	VA22B8779-104	VA22B8779-105
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0021
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		7.56	4.24	3.56	3.54	9.92
uranium	7440-61-1	E472	0.0020	mg/kg		0.0152	0.0070	0.0065	0.0116	0.0266
vanadium	7440-62-2	E472	0.10	mg/kg		0.75	0.47	0.40	0.42	0.93
zinc	7440-66-6	E472	1.0	mg/kg		119	83.6	87.0	99.3	104
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INVCAD-2_2022-08	HAC-U_INVCAD-3_2022-08	HAC-U_INVCAD-4_2022-08	HAC-U_INVCAD-5_2022-08	HAC-U_INVCAD-6_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-106	VA22B8779-107	VA22B8779-108	VA22B8779-109	VA22B8779-110
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		74.9	72.0	74.7	71.6	76.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		245	65.0	67.4	138	62.8
antimony	7440-36-0	E472	0.010	mg/kg		0.019	0.014	0.015	0.016	0.021
arsenic	7440-38-2	E472	0.030	mg/kg		0.494	0.348	0.443	0.383	0.447
barium	7440-39-3	E472	0.050	mg/kg		5.29	3.26	3.60	4.62	4.32
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.049	0.029	0.073	0.058	0.110
calcium	7440-70-2	E472	20	mg/kg		1620	1000	804	1160	1170
cesium	7440-46-2	E472	0.0050	mg/kg		0.0138	0.0084	0.0108	0.0124	0.0107
chromium	7440-47-3	E472	0.20	mg/kg		0.46	0.27	0.26	0.26	0.21
cobalt	7440-48-4	E472	0.020	mg/kg		0.221	0.092	0.166	0.182	0.242
copper	7440-50-8	E472	0.20	mg/kg		20.0	18.0	21.0	17.1	23.1
iron	7439-89-6	E472	5.0	mg/kg		507	163	178	215	173
lead	7439-92-1	E472	0.050	mg/kg		0.094	<0.050	<0.050	0.079	0.054
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1170	1000	1220	1060	1100
manganese	7439-96-5	E472	0.050	mg/kg		246	158	292	297	329
mercury	7439-97-6	E511	0.0050	mg/kg		0.0233	0.0303	0.0456	0.0433	0.0424
molybdenum	7439-98-7	E472	0.040	mg/kg		12.4	9.71	9.67	9.20	8.68
nickel	7440-02-0	E472	0.20	mg/kg		0.37	0.21	0.27	0.26	0.33
phosphorus	7723-14-0	E472	10	mg/kg		7660	7440	7670	6780	7190
potassium	7440-09-7	E472	20	mg/kg		6160	6040	7120	6180	6700
rubidium	7440-17-7	E472	0.050	mg/kg		1.12	1.02	1.22	1.24	1.34
selenium	7782-49-2	E472	0.10	mg/kg		17.8	12.4	15.4	13.1	12.0
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0051	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		2580	2480	2810	2240	2330
strontium	7440-24-6	E472	0.10	mg/kg		12.5	6.87	5.60	5.99	6.45

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INVCAD-2_2022-08	HAC-U_INVCAD-3_2022-08	HAC-U_INVCAD-4_2022-08	HAC-U_INVCAD-5_2022-08	HAC-U_INVCAD-6_2022-08
					Client sampling date / time	06-Aug-2022	06-Aug-2022	06-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-106	VA22B8779-107	VA22B8779-108	VA22B8779-109	VA22B8779-110
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		27.2	5.09	4.08	5.22	3.33
uranium	7440-61-1	E472	0.0020	mg/kg		0.0244	0.0081	0.0137	0.0160	0.0258
vanadium	7440-62-2	E472	0.10	mg/kg		1.87	0.44	0.48	0.68	0.52
zinc	7440-66-6	E472	1.0	mg/kg		76.0	71.2	82.1	88.3	88.3
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INVCAD-7_2022-08	HAC-U_INVCAD-8_2022-08	HAC-D_INVCAD-1_2022-08	HAC-D_INVCAD-2_2022-08	HAC-D_INVCAD-3_2022-08
					Client sampling date / time	06-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-111	VA22B8779-112	VA22B8779-113	VA22B8779-114	VA22B8779-115
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		71.7	74.3	75.7	71.6	74.0
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		73.6	82.1	222	311	357
antimony	7440-36-0	E472	0.010	mg/kg		0.016	0.021	0.029	0.025	0.035
arsenic	7440-38-2	E472	0.030	mg/kg		0.448	0.400	0.758	0.874	0.946
barium	7440-39-3	E472	0.050	mg/kg		6.74	2.97	17.7	20.0	23.5
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.015
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	1.4
cadmium	7440-43-9	E472	0.010	mg/kg		0.072	0.033	0.457	0.638	0.528
calcium	7440-70-2	E472	20	mg/kg		1240	650	934	1230	2240
cesium	7440-46-2	E472	0.0050	mg/kg		0.0133	0.0112	0.0352	0.0375	0.0458
chromium	7440-47-3	E472	0.20	mg/kg		0.32	0.24	0.51	1.18	1.22
cobalt	7440-48-4	E472	0.020	mg/kg		0.195	0.160	0.493	0.626	0.960
copper	7440-50-8	E472	0.20	mg/kg		19.6	19.4	30.4	39.0	45.6
iron	7439-89-6	E472	5.0	mg/kg		184	205	437	565	754
lead	7439-92-1	E472	0.050	mg/kg		0.054	0.055	0.178	0.202	0.250
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1140	1190	1340	1460	1240
manganese	7439-96-5	E472	0.050	mg/kg		512	242	575	492	777
mercury	7439-97-6	E511	0.0050	mg/kg		0.0398	0.0750	0.0466	0.0482	0.0673
molybdenum	7439-98-7	E472	0.040	mg/kg		11.8	8.16	4.15	3.07	3.25
nickel	7440-02-0	E472	0.20	mg/kg		0.36	0.27	0.76	1.12	1.44
phosphorus	7723-14-0	E472	10	mg/kg		7640	7090	7730	8340	7180
potassium	7440-09-7	E472	20	mg/kg		6150	6770	7000	7790	7040
rubidium	7440-17-7	E472	0.050	mg/kg		1.17	1.17	1.33	1.60	1.42
selenium	7782-49-2	E472	0.10	mg/kg		14.7	9.65	5.56	5.59	5.43
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0094	0.0131	0.0201
sodium	7440-23-5	E472	20	mg/kg		2370	2570	2410	2600	1970
strontium	7440-24-6	E472	0.10	mg/kg		8.13	4.17	7.03	9.27	11.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-U_INVCAD-7_2022-08	HAC-U_INVCAD-8_2022-08	HAC-D_INVCAD-1_2022-08	HAC-D_INVCAD-2_2022-08	HAC-D_INVCAD-3_2022-08
					Client sampling date / time	06-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-111	VA22B8779-112	VA22B8779-113	VA22B8779-114	VA22B8779-115
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		<0.0020	<0.0020	0.0048	0.0041	0.0046
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		4.18	4.90	11.3	15.7	20.2
uranium	7440-61-1	E472	0.0020	mg/kg		0.0198	0.0102	0.0270	0.0371	0.0828
vanadium	7440-62-2	E472	0.10	mg/kg		0.55	0.47	1.01	1.36	1.90
zinc	7440-66-6	E472	1.0	mg/kg		98.4	82.0	168	146	147
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	0.24	0.28

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_INVCAD-4_2022-08	HAC-D_INVCAD-5_2022-08	HAC-D_INVCAD-6_2022-08	HAC-D_INVCAD-7_2022-08	HAC-D_INVCAD-8_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-116	VA22B8779-117	VA22B8779-118	VA22B8779-119	VA22B8779-120
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		72.6	76.2	73.6	70.1	75.0
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		339	2040	130	186	56.9
antimony	7440-36-0	E472	0.010	mg/kg		0.027	0.049	0.022	0.019	0.015
arsenic	7440-38-2	E472	0.030	mg/kg		0.982	1.90	0.644	0.782	0.512
barium	7440-39-3	E472	0.050	mg/kg		42.9	14.6	8.07	12.7	3.44
beryllium	7440-41-7	E472	0.010	mg/kg		0.011	0.044	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	1.5	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.592	0.181	0.156	0.193	0.058
calcium	7440-70-2	E472	20	mg/kg		1120	3580	712	980	549
cesium	7440-46-2	E472	0.0050	mg/kg		0.0498	0.0689	0.0220	0.0269	0.0130
chromium	7440-47-3	E472	0.20	mg/kg		1.29	2.59	0.50	0.86	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		0.882	1.04	0.573	0.488	0.227
copper	7440-50-8	E472	0.20	mg/kg		41.1	30.1	27.3	28.3	18.3
iron	7439-89-6	E472	5.0	mg/kg		672	2370	356	396	229
lead	7439-92-1	E472	0.050	mg/kg		0.238	3.94	0.122	0.130	0.058
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	0.88	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1300	1680	1220	1070	987
manganese	7439-96-5	E472	0.050	mg/kg		873	539	472	534	223
mercury	7439-97-6	E511	0.0050	mg/kg		0.0586	0.0472	0.0500	0.0353	0.0433
molybdenum	7439-98-7	E472	0.040	mg/kg		3.55	3.88	3.88	4.15	3.99
nickel	7440-02-0	E472	0.20	mg/kg		1.36	1.95	0.67	0.86	0.33
phosphorus	7723-14-0	E472	10	mg/kg		7440	6790	7220	6340	6450
potassium	7440-09-7	E472	20	mg/kg		7460	6790	7220	6210	6480
rubidium	7440-17-7	E472	0.050	mg/kg		1.41	1.47	1.14	1.38	1.08
selenium	7782-49-2	E472	0.10	mg/kg		5.13	4.04	3.86	3.21	3.84
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0186	0.0281	0.0068	0.0065	<0.0050
sodium	7440-23-5	E472	20	mg/kg		2080	2760	2790	2170	2240
strontium	7440-24-6	E472	0.10	mg/kg		7.22	14.1	5.18	7.72	4.12

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-D_INVCAD-4_2022-08	HAC-D_INVCAD-5_2022-08	HAC-D_INVCAD-6_2022-08	HAC-D_INVCAD-7_2022-08	HAC-D_INVCAD-8_2022-08
					Client sampling date / time	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
						VA22B8779-116	VA22B8779-117	VA22B8779-118	VA22B8779-119	VA22B8779-120
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0044	0.0055	0.0022	0.0040	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	0.11	<0.10	0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		17.7	145	7.54	11.0	3.41
uranium	7440-61-1	E472	0.0020	mg/kg		0.0485	0.0765	0.0261	0.0190	0.0080
vanadium	7440-62-2	E472	0.10	mg/kg		1.61	12.2	0.86	1.02	0.42
zinc	7440-66-6	E472	1.0	mg/kg		140	87.3	100	84.3	70.7
zirconium	7440-67-7	E472	0.20	mg/kg		0.26	2.30	0.29	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INVCAD-1_2022-08	EDC-U_INVCAD-2_2022-08	EDC-U_INVCAD-3_2022-08	EDC-U_INVCAD-4_2022-08	EDC-U_INVCAD-5_2022-08
					Client sampling date / time	08-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-121	VA22B8779-122	VA22B8779-123	VA22B8779-124	VA22B8779-125
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		75.3	75.1	75.7	75.2	78.3
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		89.4	21.2	80.5	1670	34.1
antimony	7440-36-0	E472	0.010	mg/kg		0.013	0.012	0.012	0.036	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		0.634	0.409	0.532	2.96	0.382
barium	7440-39-3	E472	0.050	mg/kg		3.88	1.32	10.6	117	2.73
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	0.060	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	2.6	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.207	<0.017 DLM	0.116	1.09	0.031
calcium	7440-70-2	E472	20	mg/kg		548	514	695	1560	558
cesium	7440-46-2	E472	0.0050	mg/kg		0.0071	<0.0050	0.0061	0.0981	<0.0050
chromium	7440-47-3	E472	0.20	mg/kg		0.35	0.23	1.15	11.8	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		0.348	0.149	0.456	6.59	0.251
copper	7440-50-8	E472	0.20	mg/kg		17.1	13.0	15.4	24.3	14.3
iron	7439-89-6	E472	5.0	mg/kg		224	109	242	3620	131
lead	7439-92-1	E472	0.050	mg/kg		0.057	<0.050	0.066	0.626	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	1.22	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1330	1200	1400	1800	1270
manganese	7439-96-5	E472	0.050	mg/kg		205	107	400	4330	154
mercury	7439-97-6	E511	0.0050	mg/kg		0.0418	0.0294	0.0392	0.0561	0.0370
molybdenum	7439-98-7	E472	0.040	mg/kg		24.2	16.7	14.5	1.28	9.63
nickel	7440-02-0	E472	0.20	mg/kg		0.32	<0.20	0.79	10.6	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		7850	7520	9190	7710	8060
potassium	7440-09-7	E472	20	mg/kg		7170	6720	8350	12900	7410
rubidium	7440-17-7	E472	0.050	mg/kg		3.49	2.28	3.00	5.06	2.49
selenium	7782-49-2	E472	0.10	mg/kg		0.74	0.68	0.68	0.59	0.72
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0830	0.0552	0.0374	0.0802	0.0351
sodium	7440-23-5	E472	20	mg/kg		2920	2660	3170	2390	2950
strontium	7440-24-6	E472	0.10	mg/kg		3.52	3.36	4.92	13.7	4.19

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INVCAD-1_2022-08	EDC-U_INVCAD-2_2022-08	EDC-U_INVCAD-3_2022-08	EDC-U_INVCAD-4_2022-08	EDC-U_INVCAD-5_2022-08
					Client sampling date / time	08-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022	07-Aug-2022
						VA22B8779-121	VA22B8779-122	VA22B8779-123	VA22B8779-124	VA22B8779-125
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0034	<0.0020	<0.0020	0.0259	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		4.01	0.96	3.71	73.8	1.44
uranium	7440-61-1	E472	0.0020	mg/kg		0.0066	0.0029	0.0092	0.218	0.0037
vanadium	7440-62-2	E472	0.10	mg/kg		0.62	0.28	0.47	7.52	0.21
zinc	7440-66-6	E472	1.0	mg/kg		103	83.1	117	222	83.7
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	1.52	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INVCAD-6_2022-08	EDC-U_INVCAD-7_2022-08	EDC-U_INVCAD-8_2022-08	EDC-D_INVCAD-1_2022-08	EDC-D_INVCAD-2_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-126	VA22B8779-127	VA22B8779-128	VA22B8779-129	VA22B8779-130
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		74.9	76.6	78.0	81.5	83.9
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		70.9	29.5	46.0	650	497
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	0.011	0.019	0.024
arsenic	7440-38-2	E472	0.030	mg/kg		0.312	0.417	0.324	2.91	2.16
barium	7440-39-3	E472	0.050	mg/kg		3.19	2.54	3.16	31.0	13.9
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	0.023	0.014
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.124
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.040	0.016	0.029	0.319	0.369
calcium	7440-70-2	E472	20	mg/kg		586	559	592	1570	903
cesium	7440-46-2	E472	0.0050	mg/kg		0.0051	<0.0050	<0.0050	0.0789	0.0489
chromium	7440-47-3	E472	0.20	mg/kg		0.80	0.37	1.84	4.11	2.42
cobalt	7440-48-4	E472	0.020	mg/kg		0.323	0.242	0.279	1.16	0.585
copper	7440-50-8	E472	0.20	mg/kg		12.2	14.1	15.6	17.2	23.1
iron	7439-89-6	E472	5.0	mg/kg		196	115	173	1320	913
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	0.050	0.324	0.548
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	0.62	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1130	1340	1360	1490	1280
manganese	7439-96-5	E472	0.050	mg/kg		227	120	185	474	257
mercury	7439-97-6	E511	0.0050	mg/kg		0.0447	0.0309	0.0435	0.0591	0.102
molybdenum	7439-98-7	E472	0.040	mg/kg		6.23	11.5	4.86	5.60	2.65
nickel	7440-02-0	E472	0.20	mg/kg		0.37	0.24	0.44	3.88	5.88
phosphorus	7723-14-0	E472	10	mg/kg		7580	8040	8100	9140	7970
potassium	7440-09-7	E472	20	mg/kg		7070	7430	7520	9200	7880
rubidium	7440-17-7	E472	0.050	mg/kg		1.87	2.04	1.35	3.14	2.02
selenium	7782-49-2	E472	0.10	mg/kg		0.59	0.74	0.77	1.21	1.77
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0331	0.0228	0.0285	0.0343	0.0480
sodium	7440-23-5	E472	20	mg/kg		2490	3100	3070	3280	2840
strontium	7440-24-6	E472	0.10	mg/kg		3.99	3.81	4.20	11.9	5.60

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-U_INVCAD-6_2022-08	EDC-U_INVCAD-7_2022-08	EDC-U_INVCAD-8_2022-08	EDC-D_INVCAD-1_2022-08	EDC-D_INVCAD-2_2022-08
					Client sampling date / time	07-Aug-2022	07-Aug-2022	07-Aug-2022	04-Aug-2022	04-Aug-2022
						VA22B8779-126	VA22B8779-127	VA22B8779-128	VA22B8779-129	VA22B8779-130
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0022	<0.0020	<0.0020	0.0111	0.0075
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		2.76	1.24	1.87	27.2	17.9
uranium	7440-61-1	E472	0.0020	mg/kg		0.0059	0.0031	0.0042	0.0567	0.0400
vanadium	7440-62-2	E472	0.10	mg/kg		0.31	0.30	0.25	2.40	1.69
zinc	7440-66-6	E472	1.0	mg/kg		93.7	88.2	105	98.8	106
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	0.53	0.33

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INVCAD-3_2022-08	EDC-D_INVCAD-4_2022-08	EDC-D_INVCAD-5_2022-08	EDC-D_INVCAD-6_2022-08	EDC-D_INVCAD-7_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-131	VA22B8779-132	VA22B8779-133	VA22B8779-134	VA22B8779-135
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		78.7	66.6	83.0	85.8	74.9
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		1610	3400	1120	565	6900
antimony	7440-36-0	E472	0.010	mg/kg		0.060	0.033	0.038	0.031	0.030
arsenic	7440-38-2	E472	0.030	mg/kg		7.44	4.20	3.36	1.50	5.24
barium	7440-39-3	E472	0.050	mg/kg		90.3	22.9	64.8	26.7	112
beryllium	7440-41-7	E472	0.010	mg/kg		0.082	0.090	0.051	0.018	0.132
bismuth	7440-69-9	E472	0.010	mg/kg		0.015	0.032	0.010	0.036	0.032
boron	7440-42-8	E472	1.0	mg/kg		1.5	1.0	2.4	<1.0	1.7
cadmium	7440-43-9	E472	0.010	mg/kg		0.295	0.307	0.474	0.380	0.282
calcium	7440-70-2	E472	20	mg/kg		2110	2210	2350	1170	3090
cesium	7440-46-2	E472	0.0050	mg/kg		0.180	0.311	0.130	0.0979	0.388
chromium	7440-47-3	E472	0.20	mg/kg		10.8	32.9	15.7	5.27	9.95
cobalt	7440-48-4	E472	0.020	mg/kg		3.02	3.83	1.99	1.05	4.40
copper	7440-50-8	E472	0.20	mg/kg		19.7	19.4	23.1	19.9	22.9
iron	7439-89-6	E472	5.0	mg/kg		4450	7210	2560	1080	11300
lead	7439-92-1	E472	0.050	mg/kg		1.33	1.18	0.563	0.363	1.23
lithium	7439-93-2	E472	0.50	mg/kg		1.52	3.74	1.10	<0.50	5.41
magnesium	7439-95-4	E472	2.0	mg/kg		1760	3950	1700	1440	4030
manganese	7439-96-5	E472	0.050	mg/kg		1100	270	870	466	569
mercury	7439-97-6	E511	0.0050	mg/kg		0.0548	0.0579	0.0698	0.0769	0.0853
molybdenum	7439-98-7	E472	0.040	mg/kg		4.56	2.12	2.28	2.91	3.90
nickel	7440-02-0	E472	0.20	mg/kg		8.01	21.5	10.9	4.59	9.34
phosphorus	7723-14-0	E472	10	mg/kg		7430	5700	7840	8680	8490
potassium	7440-09-7	E472	20	mg/kg		8790	5100	8780	7960	7120
rubidium	7440-17-7	E472	0.050	mg/kg		3.96	2.93	3.67	2.20	2.94
selenium	7782-49-2	E472	0.10	mg/kg		1.51	1.10	1.97	1.85	1.63
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0406	0.0566	0.0502	0.0368	0.119
sodium	7440-23-5	E472	20	mg/kg		2520	1910	2980	3100	5760
strontium	7440-24-6	E472	0.10	mg/kg		22.4	12.8	17.3	7.92	24.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INVCAD-3_2022-08	EDC-D_INVCAD-4_2022-08	EDC-D_INVCAD-5_2022-08	EDC-D_INVCAD-6_2022-08	EDC-D_INVCAD-7_2022-08
					Client sampling date / time	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022	03-Aug-2022
						VA22B8779-131	VA22B8779-132	VA22B8779-133	VA22B8779-134	VA22B8779-135
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	0.055
thallium	7440-28-0	E472	0.0020	mg/kg		0.0193	0.0166	0.0188	0.0083	0.0140
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		80.7	160	43.6	22.1	252
uranium	7440-61-1	E472	0.0020	mg/kg		0.160	0.182	0.178	0.0434	0.149
vanadium	7440-62-2	E472	0.10	mg/kg		9.81	17.1	5.32	2.60	34.0
zinc	7440-66-6	E472	1.0	mg/kg		110	73.2	138	160	114
zirconium	7440-67-7	E472	0.20	mg/kg		1.47	2.30	0.92	0.52	2.52

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	EDC-D_INVCAD-8_2022-08	E1_INVCAD-1_2022-08	E1_INVCAD-2_2022-08	E1_INVCAD-3_2022-08	E1_INVCAD-4_2022-08
					Client sampling date / time	03-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	04-Aug-2022
						VA22B8779-136	VA22B8779-137	VA22B8779-138	VA22B8779-139	VA22B8779-140
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		73.5	77.6	81.3	82.2	78.5
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		344	89.5	2030	2900	5990
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	0.046	0.085	0.080
arsenic	7440-38-2	E472	0.030	mg/kg		0.901	0.592	4.88	4.69	7.54
barium	7440-39-3	E472	0.050	mg/kg		6.34	4.75	86.9	129	187
beryllium	7440-41-7	E472	0.010	mg/kg		0.012	<0.010	0.063	0.116	0.202
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	0.018	0.027	0.043
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	2.1	3.9	6.5
cadmium	7440-43-9	E472	0.010	mg/kg		0.053	0.095	0.319	1.44	0.962
calcium	7440-70-2	E472	20	mg/kg		1310	1030	1890	3370	4520
cesium	7440-46-2	E472	0.0050	mg/kg		0.0181	0.0137	0.214	0.318	0.587
chromium	7440-47-3	E472	0.20	mg/kg		2.50	0.46	12.1	26.4	30.0
cobalt	7440-48-4	E472	0.020	mg/kg		0.257	0.158	3.19	5.47	7.77
copper	7440-50-8	E472	0.20	mg/kg		12.7	14.4	34.0	81.4	127
iron	7439-89-6	E472	5.0	mg/kg		831	237	4060	6440	12100
lead	7439-92-1	E472	0.050	mg/kg		0.150	0.063	0.998	1.60	2.78
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	2.18	2.78	5.71
magnesium	7439-95-4	E472	2.0	mg/kg		1440	1270	2120	2760	4070
manganese	7439-96-5	E472	0.050	mg/kg		82.9	103	717	1080	1420
mercury	7439-97-6	E511	0.0050	mg/kg		0.0295	0.0421	0.0417	0.0658	0.0613
molybdenum	7439-98-7	E472	0.040	mg/kg		3.69	3.80	2.36	1.14	1.39
nickel	7440-02-0	E472	0.20	mg/kg		1.46	0.63	9.45	20.2	21.7
phosphorus	7723-14-0	E472	10	mg/kg		8210	8190	7960	8370	7210
potassium	7440-09-7	E472	20	mg/kg		5490	6810	10500	15600	15100
rubidium	7440-17-7	E472	0.050	mg/kg		1.29	2.20	4.78	7.33	9.39
selenium	7782-49-2	E472	0.10	mg/kg		0.67	0.91	1.31	1.75	1.52
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0117	0.0254	0.0361	0.130	0.131
sodium	7440-23-5	E472	20	mg/kg		2580	3040	3080	3840	3510
strontium	7440-24-6	E472	0.10	mg/kg		7.65	6.50	14.9	20.4	36.3

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	EDC-D_INVCAD-8_2022-08	E1_INVCAD-1_2022-08	E1_INVCAD-2_2022-08	E1_INVCAD-3_2022-08	E1_INVCAD-4_2022-08
					Client sampling date / time	03-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	04-Aug-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B8779-136	VA22B8779-137	VA22B8779-138	VA22B8779-139	VA22B8779-140
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0036	0.0029	0.0203	0.0358	0.0511
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	0.16
titanium	7440-32-6	E472.Ti	0.50	mg/kg		31.1	4.17	96.4	158	327
uranium	7440-61-1	E472	0.0020	mg/kg		0.0166	0.0130	0.151	0.428	0.527
vanadium	7440-62-2	E472	0.10	mg/kg		2.85	0.42	8.60	16.0	30.9
zinc	7440-66-6	E472	1.0	mg/kg		80.6	89.6	126	167	138
zirconium	7440-67-7	E472	0.20	mg/kg		0.20	<0.20	1.54	2.47	4.09

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_INVCAD-5_2022-08	E1_INVCAD-6_2022-08	E1_INVCAD-7_2022-08	E1_INVCAD-8_2022-08	HAC-R1_PERT-7X_2022-08
					Client sampling date / time	04-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-141	VA22B8779-142	VA22B8779-143	VA22B8779-144	VA22B8779-145
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		80.4	83.0	76.8	78.4	72.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		4140	2980	4520	980	1650
antimony	7440-36-0	E472	0.010	mg/kg		0.073	0.070	0.076	0.027	0.069
arsenic	7440-38-2	E472	0.030	mg/kg		6.05	5.22	6.24	1.86	2.16
barium	7440-39-3	E472	0.050	mg/kg		163	175	179	55.6	96.1
beryllium	7440-41-7	E472	0.010	mg/kg		0.148	0.121	0.164	0.036	0.056
bismuth	7440-69-9	E472	0.010	mg/kg		0.032	0.026	0.033	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		5.3	4.7	4.4	1.4	284
cadmium	7440-43-9	E472	0.010	mg/kg		0.903	1.24	0.923	0.695	0.218
calcium	7440-70-2	E472	20	mg/kg		3120	2810	3530	1770	196000
cesium	7440-46-2	E472	0.0050	mg/kg		0.392	0.265	0.447	0.0956	0.176
chromium	7440-47-3	E472	0.20	mg/kg		23.2	9.81	13.8	4.60	11.2
cobalt	7440-48-4	E472	0.020	mg/kg		6.32	5.34	6.06	1.62	2.99
copper	7440-50-8	E472	0.20	mg/kg		118	117	130	57.5	56.8
iron	7439-89-6	E472	5.0	mg/kg		8410	6570	9370	2050	3850
lead	7439-92-1	E472	0.050	mg/kg		1.96	1.69	2.05	0.510	0.512
lithium	7439-93-2	E472	0.50	mg/kg		4.09	2.72	4.20	0.94	1.47
magnesium	7439-95-4	E472	2.0	mg/kg		3240	2830	3240	1680	3220
manganese	7439-96-5	E472	0.050	mg/kg		1310	1680	1650	591	2410
mercury	7439-97-6	E511	0.0050	mg/kg		0.0480	0.0577	0.0489	0.0743	0.0088
molybdenum	7439-98-7	E472	0.040	mg/kg		1.86	1.42	1.84	3.94	1.67
nickel	7440-02-0	E472	0.20	mg/kg		16.8	10.4	12.2	4.03	6.42
phosphorus	7723-14-0	E472	10	mg/kg		6890	8010	6870	10300	879
potassium	7440-09-7	E472	20	mg/kg		13700	17000	13200	10500	4280
rubidium	7440-17-7	E472	0.050	mg/kg		6.10	6.25	6.40	4.37	4.52
selenium	7782-49-2	E472	0.10	mg/kg		1.44	1.73	1.59	1.78	1.82
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0882	0.0968	0.0919	0.0704	0.0195
sodium	7440-23-5	E472	20	mg/kg		3380	3870	2690	3460	306
strontium	7440-24-6	E472	0.10	mg/kg		27.0	22.0	26.5	12.7	432

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	E1_INVCAD-5_2022-08	E1_INVCAD-6_2022-08	E1_INVCAD-7_2022-08	E1_INVCAD-8_2022-08	HAC-R1_PERT-7X_2022-08
					Client sampling date / time	04-Aug-2022	04-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-141	VA22B8779-142	VA22B8779-143	VA22B8779-144	VA22B8779-145
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	0.022
thallium	7440-28-0	E472	0.0020	mg/kg		0.0351	0.0357	0.0306	0.0145	0.0066
tin	7440-31-5	E472	0.10	mg/kg		0.12	<0.10	0.11	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		224	152	232	54.2	304
uranium	7440-61-1	E472	0.0020	mg/kg		0.383	0.403	0.352	0.0922	0.132
vanadium	7440-62-2	E472	0.10	mg/kg		19.3	15.0	24.6	4.56	11.8
zinc	7440-66-6	E472	1.0	mg/kg		154	157	137	128	19.7
zirconium	7440-67-7	E472	0.20	mg/kg		3.12	2.57	3.45	0.85	2.67

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-8X_2022-08	HAC-D_PERT-7X_2022-08	E1_PERT-5X_2022-08	E1_PERT-7X_2022-08	HAC-R1_INV-7X_2022-08
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-146	VA22B8779-147	VA22B8779-148	VA22B8779-149	VA22B8779-150
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		60.2	56.8	91.2	79.9	77.0
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		1880	2700	19300	14500	838
antimony	7440-36-0	E472	0.010	mg/kg		0.084	0.065	0.057	0.070	0.036
arsenic	7440-38-2	E472	0.030	mg/kg		2.78	5.47	9.62	11.9	1.60
barium	7440-39-3	E472	0.050	mg/kg		90.7	163	550	573	26.0
beryllium	7440-41-7	E472	0.010	mg/kg		0.064	0.096	0.417	0.447	0.029
bismuth	7440-69-9	E472	0.010	mg/kg		0.014	0.019	0.073	0.084	<0.010
boron	7440-42-8	E472	1.0	mg/kg		179	39.9	14.8	24.8	2.6
cadmium	7440-43-9	E472	0.010	mg/kg		0.218	0.317	0.256	0.342	0.873
calcium	7440-70-2	E472	20	mg/kg		204000	202000	13200	12600	2600
cesium	7440-46-2	E472	0.0050	mg/kg		0.173	0.325	1.18	1.28	0.0752
chromium	7440-47-3	E472	0.20	mg/kg		123	8.89	65.6	33.1	2.63
cobalt	7440-48-4	E472	0.020	mg/kg		2.14	3.39	14.6	11.1	1.46
copper	7440-50-8	E472	0.20	mg/kg		56.0	102	164	520	107
iron	7439-89-6	E472	5.0	mg/kg		4250	6470	35700	27100	1530
lead	7439-92-1	E472	0.050	mg/kg		0.828	1.47	5.78	5.25	0.344
lithium	7439-93-2	E472	0.50	mg/kg		1.60	2.70	14.7	13.0	0.67
magnesium	7439-95-4	E472	2.0	mg/kg		2730	3540	11000	7290	1440
manganese	7439-96-5	E472	0.050	mg/kg		1580	3820	1300	1600	780
mercury	7439-97-6	E511	0.0050	mg/kg		0.0102	0.0245	0.0451	0.0602	0.0460
molybdenum	7439-98-7	E472	0.040	mg/kg		1.05	1.19	1.85	1.77	4.54
nickel	7440-02-0	E472	0.20	mg/kg		8.33	5.67	40.6	25.0	2.82
phosphorus	7723-14-0	E472	10	mg/kg		1040	1440	2580	2300	8290
potassium	7440-09-7	E472	20	mg/kg		2680	2920	3510	3170	7940
rubidium	7440-17-7	E472	0.050	mg/kg		2.98	5.07	9.43	10.4	2.82
selenium	7782-49-2	E472	0.10	mg/kg		1.62	1.78	0.97	2.03	4.48
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0228	0.0285	0.109	0.150	0.0219
sodium	7440-23-5	E472	20	mg/kg		295	267	1560	441	3040
strontium	7440-24-6	E472	0.10	mg/kg		429	522	148	117	14.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_PERT-8X_2022-08	HAC-D_PERT-7X_2022-08	E1_PERT-5X_2022-08	E1_PERT-7X_2022-08	HAC-R1_INV-7X_2022-08
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-146	VA22B8779-147	VA22B8779-148	VA22B8779-149	VA22B8779-150
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.024 DLA	<0.024 DLA	0.021	0.028	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0066	0.0285	0.0498	0.0737	0.0044
tin	7440-31-5	E472	0.10	mg/kg		<0.12 DLA	0.12	0.31	0.38	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		162	190	1260	786	45.8
uranium	7440-61-1	E472	0.0020	mg/kg		0.152	0.215	0.652	0.613	0.0908
vanadium	7440-62-2	E472	0.10	mg/kg		12.8	19.4	121	71.7	5.12
zinc	7440-66-6	E472	1.0	mg/kg		40.8	21.1	62.6	57.5	108
zirconium	7440-67-7	E472	0.20	mg/kg		1.35	1.65	13.0	7.97	0.57

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-8X_2022-08	HAC-D_INV-7X_2022-08	E1_INV-5X_2022-08	E1_INV-7X_2022-08	HAC-R1_INVCAD-7X_2022-08
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-151	VA22B8779-152	VA22B8779-153	VA22B8779-154	VA22B8779-155
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		85.3	80.3	79.6	78.2	72.9
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		2200	1820	1930	1910	84.8
antimony	7440-36-0	E472	0.010	mg/kg		0.080	0.089	0.045	0.048	0.019
arsenic	7440-38-2	E472	0.030	mg/kg		3.48	3.39	3.91	3.38	0.321
barium	7440-39-3	E472	0.050	mg/kg		50.9	35.9	68.1	70.0	2.93
beryllium	7440-41-7	E472	0.010	mg/kg		0.078	0.084	0.058	0.067	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		0.013	0.010	0.015	0.016	<0.010
boron	7440-42-8	E472	1.0	mg/kg		4.0	3.1	2.3	2.4	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		1.15	1.31	1.84	1.50	0.020
calcium	7440-70-2	E472	20	mg/kg		5560	4640	2240	2540	643
cesium	7440-46-2	E472	0.0050	mg/kg		0.210	0.399	0.226	0.214	0.0100
chromium	7440-47-3	E472	0.20	mg/kg		5.04	5.17	6.49	6.16	0.31
cobalt	7440-48-4	E472	0.020	mg/kg		2.83	2.51	3.76	3.42	0.128
copper	7440-50-8	E472	0.20	mg/kg		223	68.0	87.9	90.0	16.5
iron	7439-89-6	E472	5.0	mg/kg		4080	4730	3950	4040	210
lead	7439-92-1	E472	0.050	mg/kg		0.832	1.62	0.914	0.985	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		1.76	1.86	1.77	1.82	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		2440	2160	2090	2260	1010
manganese	7439-96-5	E472	0.050	mg/kg		1140	983	481	848	125
mercury	7439-97-6	E511	0.0050	mg/kg		0.0637	0.0656	0.0554	0.0700	0.0366
molybdenum	7439-98-7	E472	0.040	mg/kg		5.68	1.74	0.874	1.06	7.37
nickel	7440-02-0	E472	0.20	mg/kg		4.96	3.53	5.91	5.91	0.23
phosphorus	7723-14-0	E472	10	mg/kg		8220	8190	8550	7780	6400
potassium	7440-09-7	E472	20	mg/kg		10300	7820	9940	9830	5520
rubidium	7440-17-7	E472	0.050	mg/kg		4.04	2.66	6.66	5.63	1.24
selenium	7782-49-2	E472	0.10	mg/kg		6.07	3.59	2.04	2.03	6.17
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0557	0.0337	0.0970	0.0955	<0.0050
sodium	7440-23-5	E472	20	mg/kg		5710	6690	3820	3010	2200
strontium	7440-24-6	E472	0.10	mg/kg		28.1	21.4	17.1	16.5	3.95

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INV-8X_2022-08	HAC-D_INV-7X_2022-08	E1_INV-5X_2022-08	E1_INV-7X_2022-08	HAC-R1_INVCAD-7X_2022-08
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	10-Aug-2022
						VA22B8779-151	VA22B8779-152	VA22B8779-153	VA22B8779-154	VA22B8779-155
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0167	0.0229	0.0226	0.0226	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		128	204	109	100	5.59
uranium	7440-61-1	E472	0.0020	mg/kg		0.237	0.118	0.159	0.183	0.0072
vanadium	7440-62-2	E472	0.10	mg/kg		14.2	13.2	10.1	9.34	0.52
zinc	7440-66-6	E472	1.0	mg/kg		122	116	139	132	79.0
zirconium	7440-67-7	E472	0.20	mg/kg		1.30	1.98	1.52	1.65	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INVCAD-8X_2022-08	HAC-D_INVCAD-7X_2022-08	E1_INVCAD-5X_2022-08	E1_INVCAD-7X_2022-08	----
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	----
						VA22B8779-156	VA22B8779-157	VA22B8779-158	VA22B8779-159	--------
						Result	Result	Result	Result	----
Physical Tests										
moisture	----	E144-H	2.0	%		73.1	70.6	82.4	78.0	----
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		33.7	166	4750	3900	----
antimony	7440-36-0	E472	0.010	mg/kg		0.018	0.019	0.076	0.067	----
arsenic	7440-38-2	E472	0.030	mg/kg		0.272	0.547	6.66	6.20	----
barium	7440-39-3	E472	0.050	mg/kg		3.80	6.08	215	171	----
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	0.161	0.135	----
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	0.038	0.030	----
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	4.9	4.3	----
cadmium	7440-43-9	E472	0.010	mg/kg		0.013	0.079	1.10	0.895	----
calcium	7440-70-2	E472	20	mg/kg		748	790	3920	3130	----
cesium	7440-46-2	E472	0.0050	mg/kg		0.0060	0.0261	0.453	0.407	----
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.47	16.1	10.4	----
cobalt	7440-48-4	E472	0.020	mg/kg		0.079	0.243	6.80	5.61	----
copper	7440-50-8	E472	0.20	mg/kg		13.7	20.6	137	121	----
iron	7439-89-6	E472	5.0	mg/kg		119	376	9940	8180	----
lead	7439-92-1	E472	0.050	mg/kg		<0.050	0.113	2.34	1.87	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	4.26	3.51	----
magnesium	7439-95-4	E472	2.0	mg/kg		1070	1090	3590	2960	----
manganese	7439-96-5	E472	0.050	mg/kg		170	354	1640	1630	----
mercury	7439-97-6	E511	0.0050	mg/kg		0.0364	0.0480	0.0578	0.0531	----
molybdenum	7439-98-7	E472	0.040	mg/kg		9.03	5.68	1.53	1.54	----
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	0.42	14.5	10.5	----
phosphorus	7723-14-0	E472	10	mg/kg		6880	6480	7430	7020	----
potassium	7440-09-7	E472	20	mg/kg		5680	5850	15300	14100	----
rubidium	7440-17-7	E472	0.050	mg/kg		1.09	1.14	7.21	7.09	----
selenium	7782-49-2	E472	0.10	mg/kg		7.35	4.18	1.65	1.69	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0993	0.0882	----
sodium	7440-23-5	E472	20	mg/kg		2160	2070	3520	2710	----
strontium	7440-24-6	E472	0.10	mg/kg		5.48	5.90	31.6	24.2	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	HAC-R1_INVCAD-8X_2022-08	HAC-D_INVCAD-7X_2022-08	E1_INVCAD-5X_2022-08	E1_INVCAD-7X_2022-08	----
					Client sampling date / time	10-Aug-2022	05-Aug-2022	04-Aug-2022	04-Aug-2022	----
						VA22B8779-156	VA22B8779-157	VA22B8779-158	VA22B8779-159	--------
						Result	Result	Result	Result	----
Metals										
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
thallium	7440-28-0	E472	0.0020	mg/kg		<0.0020	0.0022	0.0416	0.0327	----
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	0.16	0.12	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		2.17	9.79	262	213	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.0035	0.0131	0.451	0.319	----
vanadium	7440-62-2	E472	0.10	mg/kg		0.21	0.97	23.8	20.8	----
zinc	7440-66-6	E472	1.0	mg/kg		92.3	81.4	171	138	----
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	3.49	3.10	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B8779**	Page	: 1 of 97
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Aug-2022 12:25
PO	: 5590008044 Q2 2022	Issue Date	: 07-Nov-2022 09:07
C-O-C number	: ----		
Sampler	: KBa		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 159		
No. of samples analysed	: 159		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	aluminum	7429-90-5	E472	51.1 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	aluminum	7429-90-5	E472	156 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	antimony	7440-36-0	E472	0.037 % DUP-H, J	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	arsenic	7440-38-2	E472	52.0 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	barium	7440-39-3	E472	98.5 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	beryllium	7440-41-7	E472	160 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	boron	7440-42-8	E472	102 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	cesium	7440-46-2	E472	51.0 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	cesium	7440-46-2	E472	121 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	chromium	7440-47-3	E472	52.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	chromium	7440-47-3	E472	107 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-141	E1_INVCAD-5_2022-08	chromium	7440-47-3	E472	41.5 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	cobalt	7440-48-4	E472	98.8 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	copper	7440-50-8	E472	82.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	iron	7439-89-6	E472	48.8 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	iron	7439-89-6	E472	131 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-001	HAC-R1_PERT-1_2022-08	lead	7439-92-1	E472	59.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	lead	7439-92-1	E472	129 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs - Continued								
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	lithium	7439-93-2	E472	1.58 % DUP-H, J	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	nickel	7440-02-0	E472	73.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	thallium	7440-28-0	E472	136 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	uranium	7440-61-1	E472	98.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	vanadium	7440-62-2	E472	43.8 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	vanadium	7440-62-2	E472	146 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	zirconium	7440-67-7	E472	0.44 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Metals	VA22B8779-021	HAC-D_PERT-5_2022-08	silver	7440-22-4	E472.Ag	51.1 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	silver	7440-22-4	E472.Ag	132 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-081	EDC-D_INV-1_2022-08	titanium	7440-32-6	E472.Ti	53.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22B8779-061	HAC-U_INV-5_2022-08	titanium	7440-32-6	E472.Ti	140 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*
J	*Duplicate results and limits are expressed in terms of absolute difference.*

Reference Material (RM) Sample								
Metals	QC-MRG4-676933003	----	titanium	7440-32-6	E472.Ti	64.4 % MES	70.0-130%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag EDC-U_PERT-3_2022-08	E512	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag E1_PERT-1_2022-08	E512	05-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag E1_PERT-2_2022-08	E512	05-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag E1_PERT-4_2022-08	E512	04-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-5_2022-08	E512	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-6_2022-08	E512	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag HAC-D_PERT-1_2022-08	E512	05-Aug-2022	23-Sep-2022	----	----		30-Sep-2022	365 days	57 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-1_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-2_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-3_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-4_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-5_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-6_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8_2022-08	E511	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-6_2022-08	E511	12-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-7_2022-08	E511	12-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-8_2022-08	E511	12-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-1_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-2_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-3_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-4_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-5_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-6_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8_2022-08	E511	10-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-1_2022-08	E511	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-2_2022-08	E511	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-3_2022-08	E511	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-4_2022-08	E511	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-7_2022-08	E511	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-2_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-3_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-4_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-5_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-6_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_PERT-8_2022-08	E511	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-1_2022-08	E511	08-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-1_2022-08	E511	08-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-2_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-3_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-4_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-5_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-6_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-7_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INV-8_2022-08	E511	07-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-2_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-4_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-5_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-6_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-7_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_PERT-8_2022-08	E511	07-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-1_2022-08	E511	06-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-2_2022-08	E511	06-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-3_2022-08	E511	06-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-4_2022-08	E511	06-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-7_2022-08	E511	06-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-3_2022-08	E511	05-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-1_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-2_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-3_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-4_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-5_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-6_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-7_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-8_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-5_2022-08	E511	05-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-6_2022-08	E511	05-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7_2022-08	E511	05-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-8_2022-08	E511	05-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-5_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-6_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INV-8_2022-08	E511	05-Aug-2022	28-Sep-2022	----	----		29-Sep-2022	365 days	55 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-5_2022-08	E511	04-Aug-2022	29-Sep-2022	----	----		29-Sep-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-1_2022-08	E511	04-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-2_2022-08	E511	04-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-1_2022-08	E511	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-2_2022-08	E511	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-3_2022-08	E511	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	56 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-4_2022-08	E511	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	56 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-3_2022-08	E511	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-4_2022-08	E511	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-7_2022-08	E511	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_PERT-8_2022-08	E511	03-Aug-2022	27-Sep-2022	----	----		28-Sep-2022	365 days	57 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-1_2022-08	E511	08-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	58 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-5_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	58 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-6_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	58 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	58 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	58 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-2_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-3_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-4_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-5_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-6_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-7_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-8_2022-08	E511	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8X_2022-08	E511	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	59 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INV-1_2022-08	E511	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	61 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-1_2022-08	E511	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	61 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-2_2022-08	E511	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	61 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-3_2022-08	E511	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	61 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E2_INV-2_2022-08	E511	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	61 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E3_INV-3_2022-08	E511	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	61 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-4_2022-08	E511	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E4_INV-4_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E5_INV-5_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E6_INV-6_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E7_INV-7_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E8_INV-8_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-1_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-2_2022-08	E511	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-1_2022-08	E511	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-2_2022-08	E511	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-1_2022-08	E511	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-2_2022-08	E511	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-3_2022-08	E511	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-4_2022-08	E511	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-7_2022-08	E511	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	62 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-3_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-4_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-5_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-6_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-7_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INV-8_2022-08	E511	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-3_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-4_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-5_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-6_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-7_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-8_2022-08	E511	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-1_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-2_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-3_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-4_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-5_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-6_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-8_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-5_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-6_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-8_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	365 days	63 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INV-7X_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	64 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7X_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	64 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7X_2022-08	E511	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	64 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INV-5X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INV-7X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-5_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-5X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-6_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-7_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-7X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_INVCAD-8_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-5X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag E1_PERT-7X_2022-08	E511	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	365 days	65 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag HAC-D_PERT-1_2022-08	E475	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-U_PERT-3_2022-08	E475	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-1_2022-08	E475	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-2_2022-08	E475	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-5_2022-08	E475	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-6_2022-08	E475	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-4_2022-08	E475	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-1_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-2_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-3_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-4_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-5_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-6_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8_2022-08	E472	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-6_2022-08	E472	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7_2022-08	E472	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-8_2022-08	E472	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-1_2022-08	E472	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-2_2022-08	E472	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-3_2022-08	E472	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-4_2022-08	E472	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-7_2022-08	E472	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-1_2022-08	E472	08-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-2_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-3_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-4_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-1_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-2_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-3_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-4_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-5_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-6_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8_2022-08	E472	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-5_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-6_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-8_2022-08	E472	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-1_2022-08	E472	08-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-2_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-4_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-5_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-6_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-7_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-8_2022-08	E472	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-2_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-3_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-4_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-5_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-6_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-7_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-8_2022-08	E472	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-5_2022-08	E472	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-6_2022-08	E472	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7_2022-08	E472	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-8_2022-08	E472	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-7_2022-08	E472	06-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-1_2022-08	E472	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-2_2022-08	E472	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-1_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-2_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-3_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-4_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-5_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-6_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-8_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-1_2022-08	E472	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-2_2022-08	E472	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-3_2022-08	E472	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-4_2022-08	E472	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-5_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-6_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-8_2022-08	E472	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-3_2022-08	E472	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-3_2022-08	E472	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-4_2022-08	E472	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-7_2022-08	E472	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-8_2022-08	E472	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-1_2022-08	E472	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-2_2022-08	E472	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-3_2022-08	E472	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-4_2022-08	E472	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5_2022-08	E472	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-1_2022-08	E472	08-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	58 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-5_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-6_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-2_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-3_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-4_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-5_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-6_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-7_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-8_2022-08	E472	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8X_2022-08	E472	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-1_2022-08	E472	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-1_2022-08	E472	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-2_2022-08	E472	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-3_2022-08	E472	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E2_INV-2_2022-08	E472	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E3_INV-3_2022-08	E472	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-4_2022-08	E472	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E4_INV-4_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E5_INV-5_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E6_INV-6_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E7_INV-7_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E8_INV-8_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-1_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-2_2022-08	E472	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-1_2022-08	E472	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-2_2022-08	E472	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-1_2022-08	E472	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-2_2022-08	E472	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-3_2022-08	E472	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-4_2022-08	E472	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-7_2022-08	E472	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-3_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-4_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-5_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-6_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-7_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-8_2022-08	E472	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-3_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-4_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-5_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-6_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-7_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-8_2022-08	E472	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-1_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-2_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-3_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-4_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-5_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-6_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-8_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-5_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-6_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-8_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7X_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7X_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7X_2022-08	E472	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-5X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-7X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-6_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-8_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7X_2022-08	E472	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag HAC-D_PERT-1_2022-08	E475.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-U_PERT-3_2022-08	E475.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-1_2022-08	E475.Ag	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-2_2022-08	E475.Ag	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-5_2022-08	E475.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-6_2022-08	E475.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-4_2022-08	E475.Ag	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-1_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-2_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-3_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-4_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-5_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-6_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8_2022-08	E472.Ag	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-6_2022-08	E472.Ag	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7_2022-08	E472.Ag	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-8_2022-08	E472.Ag	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-1_2022-08	E472.Ag	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-2_2022-08	E472.Ag	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-3_2022-08	E472.Ag	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-4_2022-08	E472.Ag	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-7_2022-08	E472.Ag	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-1_2022-08	E472.Ag	08-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-2_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-3_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-4_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-1_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-2_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-3_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-4_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-5_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-6_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8_2022-08	E472.Ag	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-5_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-6_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-8_2022-08	E472.Ag	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-1_2022-08	E472.Ag	08-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-2_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-4_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-5_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-6_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-7_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-8_2022-08	E472.Ag	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-2_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-3_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-4_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-5_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-6_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-7_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-8_2022-08	E472.Ag	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-5_2022-08	E472.Ag	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-6_2022-08	E472.Ag	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7_2022-08	E472.Ag	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-8_2022-08	E472.Ag	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-7_2022-08	E472.Ag	06-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-1_2022-08	E472.Ag	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-2_2022-08	E472.Ag	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-1_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-2_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-3_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-4_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-5_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-6_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-8_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-1_2022-08	E472.Ag	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-2_2022-08	E472.Ag	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-3_2022-08	E472.Ag	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-4_2022-08	E472.Ag	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-5_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-6_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-8_2022-08	E472.Ag	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-3_2022-08	E472.Ag	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-3_2022-08	E472.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-4_2022-08	E472.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-7_2022-08	E472.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-8_2022-08	E472.Ag	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-1_2022-08	E472.Ag	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-2_2022-08	E472.Ag	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-3_2022-08	E472.Ag	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-4_2022-08	E472.Ag	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5_2022-08	E472.Ag	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-1_2022-08	E472.Ag	08-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	58 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-5_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-6_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-2_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-3_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-4_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-5_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-6_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-7_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-8_2022-08	E472.Ag	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8X_2022-08	E472.Ag	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-1_2022-08	E472.Ag	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-1_2022-08	E472.Ag	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-2_2022-08	E472.Ag	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-3_2022-08	E472.Ag	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E2_INV-2_2022-08	E472.Ag	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E3_INV-3_2022-08	E472.Ag	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-4_2022-08	E472.Ag	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E4_INV-4_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E5_INV-5_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E6_INV-6_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E7_INV-7_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E8_INV-8_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-1_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-2_2022-08	E472.Ag	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-1_2022-08	E472.Ag	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-2_2022-08	E472.Ag	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-1_2022-08	E472.Ag	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-2_2022-08	E472.Ag	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-3_2022-08	E472.Ag	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-4_2022-08	E472.Ag	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-7_2022-08	E472.Ag	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-3_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-4_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-5_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-6_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-7_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-8_2022-08	E472.Ag	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-3_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-4_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-5_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-6_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-7_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-8_2022-08	E472.Ag	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-1_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-2_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-3_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-4_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-5_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-6_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-8_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-5_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-6_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-8_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7X_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7X_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7X_2022-08	E472.Ag	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-5X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-7X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-6_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-8_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7X_2022-08	E472.Ag	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag HAC-D_PERT-1_2022-08	E475.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-U_PERT-3_2022-08	E475.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-1_2022-08	E475.Ti	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-2_2022-08	E475.Ti	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-5_2022-08	E475.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag EDC-D_PERT-6_2022-08	E475.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag E1_PERT-4_2022-08	E475.Ti	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-1_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-2_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-3_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-4_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-5_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-6_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8_2022-08	E472.Ti	10-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-6_2022-08	E472.Ti	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7_2022-08	E472.Ti	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-8_2022-08	E472.Ti	12-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	49 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-1_2022-08	E472.Ti	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-2_2022-08	E472.Ti	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-3_2022-08	E472.Ti	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-4_2022-08	E472.Ti	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-7_2022-08	E472.Ti	06-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-1_2022-08	E472.Ti	08-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-2_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-3_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-4_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-1_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-2_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-3_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-4_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-5_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-6_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8_2022-08	E472.Ti	10-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-5_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-6_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_PERT-8_2022-08	E472.Ti	05-Aug-2022	23-Sep-2022	----	----		24-Sep-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-1_2022-08	E472.Ti	08-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-2_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-4_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-5_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-6_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-7_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_PERT-8_2022-08	E472.Ti	07-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-2_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-3_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-4_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-5_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-6_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-7_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INV-8_2022-08	E472.Ti	07-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-5_2022-08	E472.Ti	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-6_2022-08	E472.Ti	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7_2022-08	E472.Ti	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-8_2022-08	E472.Ti	05-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-7_2022-08	E472.Ti	06-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-1_2022-08	E472.Ti	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-2_2022-08	E472.Ti	04-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-1_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-2_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-3_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-4_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-5_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-6_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-8_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-1_2022-08	E472.Ti	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-2_2022-08	E472.Ti	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-3_2022-08	E472.Ti	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-4_2022-08	E472.Ti	06-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-5_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-6_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INV-8_2022-08	E472.Ti	05-Aug-2022	28-Sep-2022	----	----		28-Sep-2022	730 days	55 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-3_2022-08	E472.Ti	05-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-3_2022-08	E472.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-4_2022-08	E472.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-7_2022-08	E472.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_PERT-8_2022-08	E472.Ti	03-Aug-2022	27-Sep-2022	----	----		27-Sep-2022	730 days	56 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-1_2022-08	E472.Ti	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-2_2022-08	E472.Ti	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-3_2022-08	E472.Ti	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-4_2022-08	E472.Ti	10-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	56 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5_2022-08	E472.Ti	04-Aug-2022	29-Sep-2022	----	----		30-Sep-2022	730 days	57 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-1_2022-08	E472.Ti	08-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	58 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-5_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-6_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	58 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-2_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-3_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-4_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-5_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-6_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-7_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-U_INVCAD-8_2022-08	E472.Ti	07-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-7X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INV-8X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-7X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_INVCAD-8X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-7X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-R1_PERT-8X_2022-08	E472.Ti	10-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	59 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-1_2022-08	E472.Ti	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-1_2022-08	E472.Ti	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-2_2022-08	E472.Ti	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-3_2022-08	E472.Ti	05-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	61 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E2_INV-2_2022-08	E472.Ti	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E3_INV-3_2022-08	E472.Ti	05-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	61 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-4_2022-08	E472.Ti	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E4_INV-4_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E5_INV-5_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E6_INV-6_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E7_INV-7_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E8_INV-8_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-1_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-2_2022-08	E472.Ti	04-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-1_2022-08	E472.Ti	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-2_2022-08	E472.Ti	04-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-1_2022-08	E472.Ti	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-2_2022-08	E472.Ti	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-3_2022-08	E472.Ti	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-4_2022-08	E472.Ti	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-7_2022-08	E472.Ti	06-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	62 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-3_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-4_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-5_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-6_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-7_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INV-8_2022-08	E472.Ti	03-Aug-2022	05-Oct-2022	----	----		05-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-3_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-4_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-5_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-6_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-7_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag EDC-D_INVCAD-8_2022-08	E472.Ti	03-Aug-2022	04-Oct-2022	----	----		04-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-1_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-2_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-3_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-4_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-5_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-6_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-8_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-5_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-6_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-U_INVCAD-8_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		06-Oct-2022	730 days	63 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INV-7X_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_INVCAD-7X_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag HAC-D_PERT-7X_2022-08	E472.Ti	05-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	64 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-5X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INV-7X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-5X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-6_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-7X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_INVCAD-8_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-5X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag E1_PERT-7X_2022-08	E472.Ti	04-Aug-2022	06-Oct-2022	----	----		07-Oct-2022	730 days	65 days	✓
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag E1_PERT-1_2022-08	E144A	05-Aug-2022	----	----	----		28-Sep-2022	----	----	

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag E1_PERT-2_2022-08	E144A	05-Aug-2022	----	----	----		28-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag E1_PERT-4_2022-08	E144A	04-Aug-2022	----	----	----		28-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag EDC-D_PERT-5_2022-08	E144A	03-Aug-2022	----	----	----		27-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag EDC-D_PERT-6_2022-08	E144A	03-Aug-2022	----	----	----		27-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag EDC-U_PERT-3_2022-08	E144A	07-Aug-2022	----	----	----		27-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag HAC-D_PERT-1_2022-08	E144A	05-Aug-2022	----	----	----		23-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INV-1_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INV-5X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INV-7X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-1_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-2_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-4_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-5_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-5X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-6_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-7_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-7X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_INVCAD-8_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-5_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-5X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-6_2022-08	E144-H	12-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-7_2022-08	E144-H	12-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-7X_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E1_PERT-8_2022-08	E144-H	12-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E2_INV-2_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E3_INV-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E4_INV-4_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E5_INV-5_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E6_INV-6_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E7_INV-7_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag E8_INV-8_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-1_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-2_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-3_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-4_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-5_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-6_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-7_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INV-8_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-1_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-2_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-3_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-4_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-5_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-6_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-7_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_INVCAD-8_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-1_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-2_2022-08	E144-H	04-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-3_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-4_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-7_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-D_PERT-8_2022-08	E144-H	03-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-1_2022-08	E144-H	08-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-2_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-3_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-4_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-5_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-6_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-7_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INV-8_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-1_2022-08	E144-H	08-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-2_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-3_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-4_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-5_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-6_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-7_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_INVCAD-8_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-1_2022-08	E144-H	08-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-2_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-4_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-5_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-6_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-7_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag EDC-U_PERT-8_2022-08	E144-H	07-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-1_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-2_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-4_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-7_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-7X_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INV-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-1_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-2_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-4_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-7_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-7X_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_INVCAD-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-2_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-3_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-4_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-7_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-7X_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-D_PERT-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-1_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-2_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-3_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-4_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-5_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-6_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-7_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-7X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-8_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INV-8X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-1_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-2_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-3_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times* Rec	*Holding Times* Actual	*Eval*	*Analysis Date*	*Holding Times* Rec	*Holding Times* Actual	*Eval*
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-4_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-5_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-6_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-7_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-7X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-8_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_INVCAD-8X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-1_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-2_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-3_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-4_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-5_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-6_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-7_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-7X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-8_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-R1_PERT-8X_2022-08	E144-H	10-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-1_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-2_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-3_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-4_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-7_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INV-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-1_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-2_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-3_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-4_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-7_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_INVCAD-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-1_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-2_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-3_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-4_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-5_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-6_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-7_2022-08	E144-H	06-Aug-2022	----	----	----		16-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag HAC-U_PERT-8_2022-08	E144-H	05-Aug-2022	----	----	----		16-Sep-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✘ = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	660770	6	152	3.9	5.0	✘
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	660771	7	152	4.6	5.0	✘
Moisture Content by Gravimetry (Micro)	E144-H	650126	8	152	5.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	660768	7	152	4.6	5.0	✘
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	660769	7	152	4.6	5.0	✘
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	661601	6	7	85.7	10.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	660770	16	152	10.5	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	661604	6	7	85.7	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	660771	17	152	11.1	10.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	661600	3	7	42.8	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	650126	8	152	5.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	661602	6	7	85.7	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	660768	16	152	10.5	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	661603	3	7	42.8	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	660769	9	152	5.9	10.0	✘
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	661601	3	7	42.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	660770	8	152	5.2	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	661604	3	7	42.8	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	660771	8	152	5.2	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	661600	3	7	42.8	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	650126	8	152	5.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	661602	3	7	42.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	660768	8	152	5.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	661603	3	7	42.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	660769	8	152	5.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at < 60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22B8779**	Page	: 1 of 51
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Aug-2022 12:25
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: ----	Issue Date	: 07-Nov-2022 09:07
Sampler	: KBa ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 159		
No. of samples analysed	: 159		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Benjamin Oke	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Hamideh Moradi	Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 650126)											
VA22B8779-001	HAC-R1_PERT-1_2022-08	moisture	----	E144-H	2.0	%	65.7	64.4	1.98%	20%	----
Physical Tests (QC Lot: 650129)											
VA22B8779-021	HAC-D_PERT-5_2022-08	moisture	----	E144-H	2.0	%	64.0	63.8	0.293%	20%	----
Physical Tests (QC Lot: 650130)											
VA22B8779-041	E1_PERT-1_2022-08	moisture	----	E144-H	2.0	%	92.1	91.9	0.264%	20%	----
Physical Tests (QC Lot: 650207)											
VA22B8779-061	HAC-U_INV-5_2022-08	moisture	----	E144-H	2.0	%	85.5	81.0	5.38%	20%	----
Physical Tests (QC Lot: 650212)											
VA22B8779-081	EDC-D_INV-1_2022-08	moisture	----	E144-H	2.0	%	73.2	73.0	0.338%	20%	----
Physical Tests (QC Lot: 650220)											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	moisture	----	E144-H	2.0	%	74.3	74.8	0.635%	20%	----
Physical Tests (QC Lot: 650226)											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	moisture	----	E144-H	2.0	%	75.3	76.3	1.33%	20%	----
Physical Tests (QC Lot: 650234)											
VA22B8779-141	E1_INVCAD-5_2022-08	moisture	----	E144-H	2.0	%	80.4	81.2	1.03%	20%	----
Metals (QC Lot: 660768)											
VA22B8779-001	HAC-R1_PERT-1_2022-08	silver	7440-22-4	E472.Ag	0.0062	mg/kg	0.0138	0.0094	0.0044	Diff <2x LOR	----
Metals (QC Lot: 660769)											
VA22B8779-001	HAC-R1_PERT-1_2022-08	titanium	7440-32-6	E472.Ti	0.62	mg/kg	132	115	13.9%	40%	----
Metals (QC Lot: 660770)											
VA22B8779-001	HAC-R1_PERT-1_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.0096	0.0073	0.0023	Diff <2x LOR	----
Metals (QC Lot: 660771)											
VA22B8779-001	HAC-R1_PERT-1_2022-08	aluminum	7429-90-5	E472	6.2	mg/kg	2010	1490	29.6%	40%	----
		antimony	7440-36-0	E472	0.012	mg/kg	0.080	0.070	14.1%	40%	----
		arsenic	7440-38-2	E472	0.037	mg/kg	2.30	2.00	14.0%	40%	----
		barium	7440-39-3	E472	0.062	mg/kg	133	111	18.4%	40%	----
		beryllium	7440-41-7	E472	0.012	mg/kg	0.057	0.050	0.006	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.012	mg/kg	<0.012	<0.012	0.000005	Diff <2x LOR	----
		boron	7440-42-8	E472	1.2	mg/kg	363	333	8.61%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 660771) - continued											
VA22B8779-001	HAC-R1_PERT-1_2022-08	cadmium	7440-43-9	E472	0.012	mg/kg	0.148	0.150	1.88%	40%	----
		calcium	7440-70-2	E472	25	mg/kg	224000	228000	1.85%	60%	----
		cesium	7440-46-2	E472	0.0062	mg/kg	0.216	0.205	4.83%	40%	----
		chromium	7440-47-3	E472	0.25	mg/kg	2.64	3.18	18.7%	40%	----
		cobalt	7440-48-4	E472	0.025	mg/kg	2.00	1.72	15.2%	40%	----
		copper	7440-50-8	E472	0.25	mg/kg	42.1	40.8	3.06%	40%	----
		iron	7439-89-6	E472	6.2	mg/kg	2840	2180	26.0%	40%	----
		lead	7439-92-1	E472	0.062	mg/kg	0.644	0.349	59.6%	40%	DUP-H
		lithium	7439-93-2	E472	0.62	mg/kg	1.59	1.23	0.36	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.5	mg/kg	3090	3080	0.285%	40%	----
		manganese	7439-96-5	E472	0.062	mg/kg	1240	1170	5.69%	40%	----
		molybdenum	7439-98-7	E472	0.049	mg/kg	1.50	1.39	7.32%	40%	----
		nickel	7440-02-0	E472	0.25	mg/kg	3.13	3.54	12.2%	40%	----
		phosphorus	7723-14-0	E472	12	mg/kg	866	808	6.88%	40%	----
		potassium	7440-09-7	E472	25	mg/kg	4980	4740	4.90%	40%	----
		rubidium	7440-17-7	E472	0.062	mg/kg	5.14	4.48	13.6%	40%	----
		selenium	7782-49-2	E472	0.12	mg/kg	2.22	2.39	7.48%	40%	----
		sodium	7440-23-5	E472	25	mg/kg	326	331	1.54%	40%	----
		strontium	7440-24-6	E472	0.12	mg/kg	513	500	2.60%	60%	----
		tellurium	13494-80-9	E472	0.025	mg/kg	<0.025	0.026	0.026	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0025	mg/kg	0.0070	0.0060	0.0010	Diff <2x LOR	----
		tin	7440-31-5	E472	0.12	mg/kg	<0.12	<0.12	0.00005	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0025	mg/kg	0.156	0.125	22.0%	40%	----
		vanadium	7440-62-2	E472	0.12	mg/kg	10.7	8.59	22.2%	40%	----
		zinc	7440-66-6	E472	1.2	mg/kg	19.2	18.5	3.76%	40%	----
		zirconium	7440-67-7	E472	0.25	mg/kg	1.42	1.20	16.3%	40%	----
Metals (QC Lot: 667415)											
VA22B8779-021	HAC-D_PERT-5_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0226	0.0381	51.1%	40%	DUP-H
Metals (QC Lot: 667416)											
VA22B8779-021	HAC-D_PERT-5_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	178	189	6.03%	40%	----
Metals (QC Lot: 667417)											
VA22B8779-021	HAC-D_PERT-5_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.0266	0.0196	0.0070	Diff <2x LOR	----
Metals (QC Lot: 667418)											
VA22B8779-021	HAC-D_PERT-5_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	2580	2770	6.97%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 667418) - continued											
VA22B8779-021	HAC-D_PERT-5_2022-08	antimony	7440-36-0	E472	0.010	mg/kg	0.060	0.058	3.10%	40%	----
		arsenic	7440-38-2	E472	0.030	mg/kg	5.89	6.27	6.33%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	164	163	0.749%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	0.104	0.128	21.4%	40%	----
		bismuth	7440-69-9	E472	0.010	mg/kg	0.017	0.016	0.0004	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	38.0	34.0	11.0%	40%	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.318	0.305	4.29%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	230000	231000	0.793%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.325	0.336	3.41%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	9.29	12.4	28.6%	40%	----
		cobalt	7440-48-4	E472	0.020	mg/kg	2.82	2.95	4.61%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	75.2	76.2	1.29%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	5200	5590	7.16%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	1.25	1.21	3.34%	40%	----
		lithium	7439-93-2	E472	0.50	mg/kg	2.80	2.95	5.45%	40%	----
		magnesium	7439-95-4	E472	2.0	mg/kg	3740	3800	1.74%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	3280	3120	4.86%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.703	0.789	11.5%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	5.67	7.95	33.5%	40%	----
		phosphorus	7723-14-0	E472	10	mg/kg	1690	1720	1.68%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	3610	3460	4.30%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	6.69	6.72	0.438%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	1.67	1.66	1.18%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	306	305	0.288%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	604	588	2.59%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	0.033	0.026	0.007	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0256	0.0263	2.72%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.219	0.232	5.80%	40%	----
		vanadium	7440-62-2	E472	0.10	mg/kg	17.1	18.0	5.08%	40%	----
		zinc	7440-66-6	E472	1.0	mg/kg	17.8	19.3	8.13%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	1.75	1.89	7.84%	40%	----
Metals (QC Lot: 669491)											
VA22B8779-061	HAC-U_INV-5_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0880	0.429	132%	40%	DUP-H

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 669492)											
VA22B8779-061	HAC-U_INV-5_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	20.4	117	140%	40%	DUP-H
Metals (QC Lot: 669493)											
VA22B8779-061	HAC-U_INV-5_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.107	0.140	27.1%	40%	----
Metals (QC Lot: 669494)											
VA22B8779-061	HAC-U_INV-5_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	373	3030	156%	40%	DUP-H
		antimony	7440-36-0	E472	0.010	mg/kg	0.022	# 0.059	0.037	Diff <2x LOR	DUP-H,J
		arsenic	7440-38-2	E472	0.030	mg/kg	3.12	5.32	52.0%	40%	DUP-H
		barium	7440-39-3	E472	0.050	mg/kg	35.7	105	98.5%	40%	DUP-H
		beryllium	7440-41-7	E472	0.010	mg/kg	0.012	0.110	160%	40%	DUP-H
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	0.012	0.002	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	2.9	8.9	102%	40%	DUP-H
		cadmium	7440-43-9	E472	0.010	mg/kg	0.720	0.804	11.0%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	20400	35400	54.0%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0713	0.290	121%	40%	DUP-H
		chromium	7440-47-3	E472	0.20	mg/kg	1.06	3.50	107%	40%	DUP-H
		cobalt	7440-48-4	E472	0.020	mg/kg	1.25	3.70	98.8%	40%	DUP-H
		copper	7440-50-8	E472	0.20	mg/kg	403	975	82.9%	40%	DUP-H
		iron	7439-89-6	E472	5.0	mg/kg	962	4640	131%	40%	DUP-H
		lead	7439-92-1	E472	0.050	mg/kg	0.187	0.871	129%	40%	DUP-H
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	# 2.08	1.58	Diff <2x LOR	DUP-H,J
		magnesium	7439-95-4	E472	2.0	mg/kg	3320	4810	36.6%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	851	1060	21.8%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	1.76	1.92	8.96%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	3.31	7.17	73.6%	40%	DUP-H
		phosphorus	7723-14-0	E472	10	mg/kg	11500	15300	28.9%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	6750	7280	7.53%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	4.97	6.12	20.7%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	6.06	8.98	38.8%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	3770	3900	3.50%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	80.5	139	53.4%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0070	0.0372	136%	40%	DUP-H
		tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.114	0.337	98.9%	40%	DUP-H

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 669494) - continued											
VA22B8779-061	HAC-U_INV-5_2022-08	vanadium	7440-62-2	E472	0.10	mg/kg	2.50	16.2	146%	40%	DUP-H
		zinc	7440-66-6	E472	1.0	mg/kg	99.8	120	18.6%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.27	0.23	0.04	Diff <2x LOR	----
Metals (QC Lot: 676929)											
VA22B8779-081	EDC-D_INV-1_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.164	0.184	11.7%	40%	----
Metals (QC Lot: 676930)											
VA22B8779-081	EDC-D_INV-1_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	18.2	10.5	53.9%	40%	DUP-H
Metals (QC Lot: 676932)											
VA22B8779-081	EDC-D_INV-1_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	424	252	51.1%	40%	DUP-H
		antimony	7440-36-0	E472	0.010	mg/kg	0.020	0.014	0.007	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	1.96	1.56	22.5%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	8.50	6.59	25.3%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	0.014	<0.010	0.004	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	1.2	0.2	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.946	0.702	29.5%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	1800	1460	20.8%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0625	0.0371	51.0%	40%	DUP-H
		chromium	7440-47-3	E472	0.20	mg/kg	2.02	1.18	52.6%	40%	DUP-H
		cobalt	7440-48-4	E472	0.020	mg/kg	0.896	0.628	35.2%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	38.0	40.0	5.26%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	848	516	48.8%	40%	DUP-H
		lead	7439-92-1	E472	0.050	mg/kg	0.198	0.128	0.070	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1300	1290	0.597%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	238	196	19.2%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.670	0.626	6.89%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	2.47	1.84	29.6%	40%	----
		phosphorus	7723-14-0	E472	10	mg/kg	7140	7480	4.61%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	7040	6880	2.30%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	2.88	2.43	16.9%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	1.76	1.36	25.9%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	3190	3290	3.16%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	9.63	9.58	0.545%	60%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 676932) - continued											
VA22B8779-081	EDC-D_INV-1_2022-08	tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0143	0.0124	13.9%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0448	0.0406	9.79%	40%	----
		vanadium	7440-62-2	E472	0.10	mg/kg	1.52	0.98	43.8%	40%	DUP-H
		zinc	7440-66-6	E472	1.0	mg/kg	119	147	20.7%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.64	# 1.08	0.44	Diff <2x LOR	DUP-H
Metals (QC Lot: 676933)											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0830	0.0644	25.2%	40%	----
Metals (QC Lot: 676934)											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	4.01	5.77	36.1%	40%	DUP-H
Metals (QC Lot: 676935)											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.0418	0.0363	14.2%	40%	----
Metals (QC Lot: 676936)											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	89.4	93.3	4.23%	40%	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.013	0.014	0.0002	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.634	0.557	13.0%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	3.88	4.55	16.0%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.207	0.207	0.0453%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	548	573	4.49%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0071	0.0072	0.00008	Diff <2x LOR	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.35	0.41	0.06	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.348	0.278	22.5%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	17.1	13.6	22.9%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	224	212	5.24%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	0.057	0.057	0.0001	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1330	1260	5.74%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	205	238	15.1%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 676936) - continued											
VA22B8779-121	EDC-U_INVCAD-1_2022-08	molybdenum	7439-98-7	E472	0.040	mg/kg	24.2	21.8	10.3%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	0.32	0.29	0.03	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	7850	7040	11.0%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	7170	6180	14.8%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	3.49	3.10	12.0%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	0.74	0.60	20.8%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	2920	2570	12.7%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	3.52	3.60	2.17%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0034	0.0030	0.0004	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0066	0.0090	0.0024	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.62	0.57	7.49%	40%	----
		zinc	7440-66-6	E472	1.0	mg/kg	103	107	3.70%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 678979)											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 678980)											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	4.90	4.30	13.1%	40%	----
Metals (QC Lot: 678981)											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.0750	0.0709	5.68%	40%	----
Metals (QC Lot: 678982)											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	82.1	73.1	11.6%	40%	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.021	0.018	0.003	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.400	0.392	2.22%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	2.97	2.68	10.2%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.033	0.030	0.002	Diff <2x LOR	----
		calcium	7440-70-2	E472	20	mg/kg	650	588	10.0%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0112	0.0099	0.0013	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 678982) - continued											
VA22B8779-112	HAC-U_INVCAD-8_2022-08	chromium	7440-47-3	E472	0.20	mg/kg	0.24	0.23	0.009	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.160	0.149	7.17%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	19.4	17.9	8.03%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	205	192	6.62%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	0.055	0.051	0.003	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1190	1120	6.58%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	242	240	0.900%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	8.16	7.58	7.41%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	0.27	0.26	0.008	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	7090	6780	4.37%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	6770	6620	2.15%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	1.17	1.13	3.90%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	9.65	9.17	5.18%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	2570	2510	2.68%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	4.17	3.88	7.32%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0102	0.0088	0.0014	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.47	0.42	0.05	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	82.0	74.8	9.26%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 678986)											
VA22B8779-141	E1_INVCAD-5_2022-08	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0882	0.0865	1.98%	40%	----
Metals (QC Lot: 678987)											
VA22B8779-141	E1_INVCAD-5_2022-08	titanium	7440-32-6	E472.Ti	0.50	mg/kg	224	205	8.74%	40%	----
Metals (QC Lot: 678988)											
VA22B8779-141	E1_INVCAD-5_2022-08	mercury	7439-97-6	E511	0.0050	mg/kg	0.0480	0.0481	0.246%	40%	----
Metals (QC Lot: 678989)											
VA22B8779-141	E1_INVCAD-5_2022-08	aluminum	7429-90-5	E472	5.0	mg/kg	4140	3900	6.12%	40%	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.073	0.072	1.20%	40%	----
		arsenic	7440-38-2	E472	0.030	mg/kg	6.05	6.07	0.364%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 678989) - continued											
VA22B8779-141	E1_INVCAD-5_2022-08	barium	7440-39-3	E472	0.050	mg/kg	163	159	2.89%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	0.148	0.139	6.11%	40%	----
		bismuth	7440-69-9	E472	0.010	mg/kg	0.032	0.031	0.0003	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	5.3	5.2	1.41%	40%	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.903	0.882	2.30%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	3120	2870	8.30%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.392	0.400	2.08%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	23.2	15.2	41.5%	40%	DUP-H
		cobalt	7440-48-4	E472	0.020	mg/kg	6.32	6.15	2.74%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	118	119	0.580%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	8410	8130	3.43%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	1.96	1.88	4.03%	40%	----
		lithium	7439-93-2	E472	0.50	mg/kg	4.09	3.77	8.23%	40%	----
		magnesium	7439-95-4	E472	2.0	mg/kg	3240	3120	3.73%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	1310	1330	2.13%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	1.86	1.44	25.6%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	16.8	13.4	21.9%	40%	----
		phosphorus	7723-14-0	E472	10	mg/kg	6890	7020	1.86%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	13700	14000	2.03%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	6.10	6.14	0.683%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	1.44	1.47	2.28%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	3380	3410	0.773%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	27.0	25.6	5.43%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0351	0.0341	2.97%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	0.12	0.10	0.02	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.383	0.359	6.35%	40%	----
		vanadium	7440-62-2	E472	0.10	mg/kg	19.3	18.8	2.83%	40%	----
		zinc	7440-66-6	E472	1.0	mg/kg	154	152	1.14%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	3.12	3.00	4.03%	40%	----

Qualifiers

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 650126)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650129)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650130)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650207)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650212)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650220)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650226)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 650234)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 661600)						
moisture	----	E144A	2	%	<2.0	----
Physical Tests (QCLot: 667445)						
moisture	----	E144A	2	%	<2.0	----
Physical Tests (QCLot: 670357)						
moisture	----	E144A	2	%	<2.0	----
Metals (QCLot: 660768)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 660769)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 660770)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 660771)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 660771) - continued						
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 661601)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 661602)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 661603)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 661604)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 667415)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 667416)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 667417)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 667418)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 667418) - continued						
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 667450)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 667451)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 667452)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 667453)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 667453) - continued						
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 669485)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 669486)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 669487)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 669488)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 669488) - continued						
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 669491)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 669492)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 669493)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 669494)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 669494) - continued						
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 670360)						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 670361)						
silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 670362)						
titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 670363)						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 670363) - continued						
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----
zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 676929)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 676930)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 676931)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 676932)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 676932) - continued						
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 676933)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 676934)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 676935)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 676936)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 676936) - continued						
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 678979)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 678980)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 678980) - continued						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 678981)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 678982)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 678982) - continued						
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 678986)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 678987)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 678988)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 678989)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 678989) - continued						
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 650126)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650129)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650130)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650207)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650212)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650220)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650226)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 650234)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 661600)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 667445)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 670357)									
moisture	----	E144A	2	%	100 %	100	90.0	110	----
Metals (QCLot: 660768)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	92.6	80.0	120	----
Metals (QCLot: 660769)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	98.5	80.0	120	----
Metals (QCLot: 660770)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	93.0	80.0	120	----
Metals (QCLot: 660771)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	97.1	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	102	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	106	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 660771) - continued									
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	89.4	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	98.5	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	86.4	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	100	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.1	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	103	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	101	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	101	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	101	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	98.7	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	91.2	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	94.2	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	108	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	98.1	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	94.5	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	106	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	100	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	96.2	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	98.1	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	99.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	104	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	101	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	96.6	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	102	80.0	120	----
Metals (QCLot: 661601)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	93.0	80.0	120	----
Metals (QCLot: 661602)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	92.6	80.0	120	----
Metals (QCLot: 661603)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	98.5	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 661604)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	97.1	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	102	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	106	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	89.4	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	98.5	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	86.4	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	100	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	94.1	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	103	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	101	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	103	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	101	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	101	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	98.7	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	91.2	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	94.2	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	108	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	98.1	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	94.5	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	106	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	100	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	96.2	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	102	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	98.1	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	99.6	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	104	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	101	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	96.6	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	102	80.0	120	----
Metals (QCLot: 667415)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	95.4	80.0	120	----
Metals (QCLot: 667416)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 667416) - continued									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	103	80.0	120	----
Metals (QCLot: 667417)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	102	80.0	120	----
Metals (QCLot: 667418)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	107	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	105	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	109	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	107	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	108	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	100.0	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	102	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	104	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	107	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	98.6	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	103	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	111	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	112	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	100	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	111	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	108	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	97.2	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	106	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	101	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	107	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	98.3	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 667418) - continued									
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	111	80.0	120	----
Metals (QCLot: 667450)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	102	80.0	120	----
Metals (QCLot: 667451)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	95.4	80.0	120	----
Metals (QCLot: 667452)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	103	80.0	120	----
Metals (QCLot: 667453)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	107	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	105	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	109	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	107	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	108	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	100.0	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	102	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	104	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	107	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	103	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	98.6	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	104	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	103	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	111	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	105	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	112	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	100	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	111	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	97.2	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	106	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	101	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 667453) - continued									
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	107	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	98.3	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	111	80.0	120	----
Metals (QCLot: 669485)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	89.5	80.0	120	----
Metals (QCLot: 669486)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	90.6	80.0	120	----
Metals (QCLot: 669487)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	90.2	80.0	120	----
Metals (QCLot: 669488)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	92.3	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	98.8	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	94.2	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	94.2	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	93.9	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	86.8	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	93.4	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.7	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	94.2	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	94.8	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	93.6	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	90.8	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	92.9	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	94.7	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	98.0	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	91.5	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	92.9	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	99.5	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	92.0	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	101	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	93.9	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	97.6	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	93.4	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 669488) - continued									
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	97.1	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	95.6	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	92.7	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	95.0	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	95.5	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	98.8	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	96.8	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	90.5	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	95.1	80.0	120	----
Metals (QCLot: 669491)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	93.9	80.0	120	----
Metals (QCLot: 669492)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	101	80.0	120	----
Metals (QCLot: 669493)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	98.6	80.0	120	----
Metals (QCLot: 669494)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	101	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	98.3	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	103	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	97.9	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	96.9	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	99.8	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	101	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	100	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	98.2	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	102	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	100	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	101	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	105	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	99.7	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 669494) - continued									
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	105	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	99.3	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	105	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	98.9	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	105	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	97.1	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	100	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	101	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	97.4	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	100	80.0	120	----
Metals (QCLot: 670360)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	90.1	80.0	120	----
Metals (QCLot: 670361)									
silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	89.5	80.0	120	----
Metals (QCLot: 670362)									
titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	90.6	80.0	120	----
Metals (QCLot: 670363)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	92.3	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	98.8	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	94.2	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	94.2	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	93.9	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	86.8	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	93.4	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	94.7	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	94.2	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	94.8	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	93.6	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	90.8	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	92.9	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	94.7	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	98.0	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 670363) - continued									
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	91.5	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	92.9	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	99.5	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	92.0	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	101	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	93.9	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	97.6	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	93.4	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	97.1	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	95.6	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	92.7	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	95.0	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	95.5	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	98.8	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	96.8	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	90.5	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	95.1	80.0	120	----
Metals (QCLot: 676929)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	82.9	80.0	120	----
Metals (QCLot: 676930)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	101	80.0	120	----
Metals (QCLot: 676931)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	95.6	80.0	120	----
Metals (QCLot: 676932)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	108	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	96.3	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	109	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	98.9	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	95.0	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	94.7	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	91.1	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	97.6	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	95.9	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 676932) - continued									
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	100	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	95.4	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	97.3	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	104	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	95.2	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	113	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	109	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	97.1	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	110	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	93.5	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	90.8	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	96.8	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	98.5	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	109	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	99.2	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	96.3	80.0	120	----
Metals (QCLot: 676933)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	83.4	80.0	120	----
Metals (QCLot: 676934)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	102	80.0	120	----
Metals (QCLot: 676935)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	91.4	80.0	120	----
Metals (QCLot: 676936)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	101	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	97.9	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	105	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	95.4	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	96.5	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	95.9	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	97.6	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	90.4	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 676936) - continued									
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.6	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	92.0	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	97.6	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	96.7	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	94.8	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	94.4	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	97.0	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	98.4	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	99.0	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	98.4	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	97.5	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	94.4	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	111	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	100	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	95.1	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	103	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	92.8	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	91.6	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	94.2	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	97.2	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	99.8	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	93.2	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	94.8	80.0	120	----
Metals (QCLot: 678979)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	91.0	80.0	120	----
Metals (QCLot: 678980)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	102	80.0	120	----
Metals (QCLot: 678981)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	98.8	80.0	120	----
Metals (QCLot: 678982)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	110	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	110	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	106	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 678982) - continued									
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	103	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	97.7	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	101	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	106	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	100	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	103	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	104	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	103	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	106	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	106	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	107	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	99.8	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	107	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	104	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	99.3	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	102	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	106	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	107	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	108	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	98.7	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	104	80.0	120	----
Metals (QCLot: 678986)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	84.3	80.0	120	----
Metals (QCLot: 678987)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	97.4	80.0	120	----
Metals (QCLot: 678988)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	85.9	80.0	120	----
Metals (QCLot: 678989)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 678989) - continued									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	106	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	95.9	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	99.5	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	97.1	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	97.6	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	96.4	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	92.0	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	94.2	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	91.4	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	96.8	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	97.8	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	95.4	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	92.6	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	96.6	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	97.3	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	98.5	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	98.1	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	97.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	99.2	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	94.1	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	107	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	99.0	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	98.2	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	92.3	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	97.5	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	98.6	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	91.8	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	93.7	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	98.4	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	98.7	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	99.9	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	92.9	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	96.6	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 660768)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	87.0	70.0	130	----
Metals (QCLot: 660770)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	94.4	70.0	130	----
Metals (QCLot: 660771)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	101	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	97.0	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	85.1	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	90.7	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	93.6	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.5	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	99.8	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	92.3	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	93.6	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	94.2	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	95.4	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	98.6	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	96.9	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	104	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	106	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	104	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	96.8	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	97.0	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	98.6	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	93.8	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	91.0	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	102	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	95.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 660771) - continued									
	RM	zinc	7440-66-6	E472	105.3 mg/kg	94.3	70.0	130	----
Metals (QCLot: 661601)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	94.4	70.0	130	----
Metals (QCLot: 661602)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	87.0	70.0	130	----
Metals (QCLot: 661604)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	101	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	97.0	70.0	130	----
	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	85.1	60.0	140	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	90.7	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	93.6	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	93.5	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	99.8	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	92.3	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	93.6	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	94.2	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	95.4	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	98.6	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	96.9	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	104	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	106	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	104	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	96.8	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	97.0	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	98.6	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	93.8	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	91.0	70.0	130	----
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	102	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	95.9	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	94.3	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 667415)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	95.7	70.0	130	----
Metals (QCLot: 667417)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	108	70.0	130	----
Metals (QCLot: 667418)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	103	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	105	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	82.6	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	97.3	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	112	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	102	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	91.0	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	94.9	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	97.3	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	101	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	91.7	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	103	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	101	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	106	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	95.7	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	111	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	107	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	102	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	102	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	103	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	105	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	87.9	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	103	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	99.6	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	101	70.0	130	----
Metals (QCLot: 667450)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	109	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 667451)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	95.7	70.0	130	----
Metals (QCLot: 667453)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	103	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	105	70.0	130	----
	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	82.6	60.0	140	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	97.3	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	112	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	102	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	91.0	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	94.9	70.0	130	----
	RM	copper	7440-50-8	E475	35 mg/kg	97.3	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	101	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	91.7	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	103	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	101	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	106	70.0	130	----
	RM	nickel	7440-02-0	E475	1.57 mg/kg	95.7	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	111	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	107	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	102	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	102	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	103	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	105	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	87.9	70.0	130	----
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	103	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	99.6	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	101	70.0	130	----
Metals (QCLot: 669485)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	93.7	70.0	130	----
Metals (QCLot: 669487)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	104	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 669488)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	84.7	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	100	70.0	130	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	93.1	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	96.3	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	95.4	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	103	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	93.0	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	95.2	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	95.7	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	101	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	94.1	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	94.6	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	106	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.3	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	96.3	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	100	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	97.2	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	95.0	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	94.5	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	106	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	91.8	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	96.8	70.0	130	----
Metals (QCLot: 669491)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	90.6	70.0	130	----
Metals (QCLot: 669493)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	102	70.0	130	----
Metals (QCLot: 669494)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	84.3	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	95.1	70.0	130	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	90.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 669494) - continued									
	RM	calcium	7440-70-2	E472	550 mg/kg	95.6	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.0	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	89.8	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	91.4	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	93.1	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	98.9	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	95.4	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	93.4	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	115	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	95.9	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	95.3	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	92.2	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	96.3	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	95.5	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	90.2	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	91.0	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	104	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	90.2	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	92.3	70.0	130	----
Metals (QCLot: 670360)									
	RM	mercury	7439-97-6	E512	0.331 mg/kg	105	70.0	130	----
Metals (QCLot: 670361)									
	RM	silver	7440-22-4	E475.Ag	2.05 mg/kg	93.7	70.0	130	----
Metals (QCLot: 670363)									
	RM	aluminum	7429-90-5	E475	11.2 mg/kg	84.7	70.0	130	----
	RM	arsenic	7440-38-2	E475	34.6 mg/kg	100	70.0	130	----
	RM	cadmium	7440-43-9	E475	14.5 mg/kg	93.1	70.0	130	----
	RM	calcium	7440-70-2	E475	550 mg/kg	96.3	70.0	130	----
	RM	cesium	7440-46-2	E475	0.0712 mg/kg	95.4	70.0	130	----
	RM	chromium	7440-47-3	E475	1.96 mg/kg	103	70.0	130	----
	RM	cobalt	7440-48-4	E475	0.267 mg/kg	93.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 670363) - continued									
	RM	copper	7440-50-8	E475	35 mg/kg	95.2	70.0	130	----
	RM	iron	7439-89-6	E475	1070 mg/kg	95.7	70.0	130	----
	RM	lead	7439-92-1	E475	0.162 mg/kg	101	70.0	130	----
	RM	magnesium	7439-95-4	E475	940 mg/kg	94.1	70.0	130	----
	RM	manganese	7439-96-5	E475	8.91 mg/kg	94.6	70.0	130	----
	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	106	70.0	130	----
	RM	phosphorus	7723-14-0	E475	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E475	14400 mg/kg	97.3	70.0	130	----
	RM	rubidium	7440-17-7	E475	5.11 mg/kg	96.3	70.0	130	----
	RM	selenium	7782-49-2	E475	8 mg/kg	100	70.0	130	----
	RM	sodium	7440-23-5	E475	10673 mg/kg	97.2	70.0	130	----
	RM	strontium	7440-24-6	E475	3.92 mg/kg	95.0	70.0	130	----
	RM	thallium	7440-28-0	E475	0.013 mg/kg	94.5	70.0	130	----
	RM	uranium	7440-61-1	E475	0.0786 mg/kg	106	70.0	130	----
	RM	vanadium	7440-62-2	E475	0.51 mg/kg	91.8	70.0	130	----
	RM	zinc	7440-66-6	E475	105.3 mg/kg	96.8	70.0	130	----
Metals (QCLot: 676929)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	79.8	70.0	130	----
Metals (QCLot: 676931)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	95.7	70.0	130	----
Metals (QCLot: 676932)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	89.4	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	95.5	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	102	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	88.3	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	95.4	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	87.5	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	85.3	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	88.2	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	93.3	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	89.4	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 676932) - continued									
	RM	lead	7439-92-1	E472	0.162 mg/kg	74.2	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	98.0	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	93.2	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	88.0	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	87.9	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	102	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	99.7	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	93.7	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	91.9	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	99.3	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	89.8	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	79.6	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	95.1	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	90.4	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	92.4	70.0	130	----
Metals (QCLot: 676933)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	83.5	70.0	130	----
Metals (QCLot: 676934)									
	RM	titanium	7440-32-6	E472.Ti	1.05 mg/kg	# 64.4	70.0	130	MES
Metals (QCLot: 676935)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	101	70.0	130	----
Metals (QCLot: 676936)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	104	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	101	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	81.7	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	90.1	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	93.9	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	90.5	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	98.1	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	95.0	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	97.3	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 676936) - continued									
	RM	iron	7439-89-6	E472	1070 mg/kg	96.0	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	103	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	102	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	99.3	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	90.7	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	87.6	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	110	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	107	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	101	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	97.6	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	104	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	86.7	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	87.1	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	105	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	96.6	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	97.8	70.0	130	----
Metals (QCLot: 678979)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	84.7	70.0	130	----
Metals (QCLot: 678981)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	98.3	70.0	130	----
Metals (QCLot: 678982)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	103	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	95.9	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	89.2	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	88.8	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	91.0	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	91.6	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	87.5	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	87.0	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	89.3	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	91.9	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 678982) - continued									
	RM	lead	7439-92-1	E472	0.162 mg/kg	129	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	92.9	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	91.9	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	93.4	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	85.5	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	98.4	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.0	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	91.8	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	94.4	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	92.5	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	90.4	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	81.1	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	97.2	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	90.4	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	93.0	70.0	130	----
Metals (QCLot: 678986)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	82.3	70.0	130	----
Metals (QCLot: 678988)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	88.0	70.0	130	----
Metals (QCLot: 678989)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	114	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	89.8	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	78.3	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	87.4	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	97.8	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	88.6	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	91.7	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	86.6	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	87.1	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	93.4	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	95.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 678989) - continued									
	RM	magnesium	7439-95-4	E472	940 mg/kg	90.4	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	90.9	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	90.1	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	91.6	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	98.1	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.4	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	87.2	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	90.9	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	89.7	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	91.2	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	78.4	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	92.5	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	88.9	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	89.7	70.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Page 1 of 2 of 4

Environmental Division
Vancouver
Work Order Reference
VA22B8779

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
Company address below will appear on the final report	
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with you

Regular [R] ☑ Standard TAT if received by

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 B	
3 day [P3]	☐	Sa	
2 day [P2]	☐	S	

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level

Analysis Re

Indicate Filtered (F), Preserved (P) or Filtered and

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): B8779 **ALS Contact:** Can Dang **Sampler:** KBa

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
1	HAC-R1_PERT-1_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
2	HAC-R1_PERT-2_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
3	HAC-R1_PERT-3_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
4	HAC-R1_PERT-4_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
5	HAC-R1_PERT-5_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
6	HAC-R1_PERT-6_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
7	HAC-R1_PERT-7_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
8	HAC-R1_PERT-8_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
9	HAC-U_PERT-1_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
10	HAC-U_PERT-2_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
11	HAC-U_PERT-3_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
12	HAC-U_PERT-4_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KBox

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
13	HAC-U_PERT-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
14	HAC-U_PERT-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
15	HAC-U_PERT-7_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
16	HAC-U_PERT-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
17	HAC-D_PERT-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
18	HAC-D_PERT-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
19	HAC-D_PERT-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
20	HAC-D_PERT-4_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
21	HAC-D_PERT-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
22	HAC-D_PERT-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
23	HAC-D_PERT-7_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
24	HAC-D_PERT-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katherina Batchelar	11-Aug-22	1200				JC	AUG 12 2022	12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
Company address below will appear on the final report	
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-002
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
25	EDC-U_PERT-1_2022-08	08-Aug-22		Tissue	R	R	R	R	R	1
26	EDC-U_PERT-2_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
27	EDC-U_PERT-3_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
28	EDC-U_PERT-4_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
29	EDC-U_PERT-5_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
30	EDC-U_PERT-6_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
31	EDC-U_PERT-7_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
32	EDC-U_PERT-8_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
33	EDC-D_PERT-1_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
34	EDC-D_PERT-2_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
35	EDC-D_PERT-3_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
36	EDC-D_PERT-4_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6.8 (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Kathrina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
37	EDC-D_PERT-5_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
38	EDC-D_PERT-6_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
39	EDC-D_PERT-7_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
40	EDC-D_PERT-8_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
41	E1_PERT-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
42	E1_PERT-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
43	E1_PERT-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
44	E1_PERT-4_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
45	E1_PERT-5_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
46	E1_PERT-6_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
47	E1_PERT-7_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
48	E1_PERT-8_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-Aug-22	12:00				JC	AUG 17 2022	12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 5 of #14

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
49	HAC-R1_INV-1_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
50	HAC-R1_INV-2_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
51	HAC-R1_INV-3_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
52	HAC-R1_INV-4_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
53	HAC-R1_INV-5_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
54	HAC-R1_INV-6_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
55	HAC-R1_INV-7_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
56	HAC-R1_INV-8_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
57	HAC-U_INV-1_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
58	HAC-U_INV-2_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
59	HAC-U_INV-3_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
60	HAC-U_INV-4_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (Aug 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using **an Authorized DW COC form**.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-002
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
C1	HAC-U_INV-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C2	HAC-U_INV-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C3	HAC-U_INV-7_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
C4	HAC-U_INV-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C5	HAC-D_INV-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C6	HAC-D_INV-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C7	HAC-D_INV-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C8	HAC-D_INV-4_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
C9	HAC-D_INV-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
70	HAC-D_INV-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
71	HAC-D_INV-7_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
72	HAC-D_INV-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C	(avg 5)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JR	Date: AUG 12 2022	Time: 12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
73	EDC-U_INV-1_2022-08	08-Aug-22		Tissue	R	R	R	R	R	1
74	EDC-U_INV-2_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
75	EDC-U_INV-3_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
76	EDC-U_INV-4_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
77	EDC-U_INV-5_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
78	EDC-U_INV-6_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
79	EDC-U_INV-7_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
80	EDC-U_INV-8_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
81	EDC-D_INV-1_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
82	EDC-D_INV-2_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
83	EDC-D_INV-3_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
84	EDC-D_INV-4_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Page 8 of 14

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
85	EDC-D_INV-5_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
86	EDC-D_INV-6_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
87	EDC-D_INV-7_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
88	EDC-D_INV-8_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
89	E1_INV-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
90	E1_INV-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
91	E1_INV-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
92	E1_INV-4_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
93	E1_INV-5_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
94	E1_INV-6_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
95	E1_INV-7_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
96	E1_INV-8_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C
			6°C (avg5)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-Aug-22	1200				JZ	AUG 12 2022	12 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
97	HAC-R1_INVCAD-1_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
98	HAC-R1_INVCAD-2_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
99	HAC-R1_INVCAD-3_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
100	HAC-R1_INVCAD-4_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
101	HAC-R1_INVCAD-5_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
102	HAC-R1_INVCAD-6_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
103	HAC-R1_INVCAD-7_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
104	HAC-R1_INVCAD-8_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
105	HAC-U_INVCAD-1_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
106	HAC-U_INVCAD-2_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
107	HAC-U_INVCAD-3_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
108	HAC-U_INVCAD-4_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (Avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-Aug-22	12:00				JC	AUG 12 2022	12pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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ALS Environmental

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Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Page 10 of #14

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:** KBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)			EMERGENCY	
	4 day [P4]	☐	1 Business day [E1]	☐
	3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
	2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
107	HAC-U_INVCAD-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
110	HAC-U_INVCAD-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
111	HAC-U_INVCAD-7_2022-08	06-Aug-22		Tissue	R	R	R	R	R	1
112	HAC-U_INVCAD-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
113	HAC-D_INVCAD-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
114	HAC-D_INVCAD-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
115	HAC-D_INVCAD-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
116	HAC-D_INVCAD-4_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
117	HAC-D_INVCAD-5_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
118	HAC-D_INVCAD-6_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
119	HAC-D_INVCAD-7_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
120	HAC-D_INVCAD-8_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C
			6°C (avg 5)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	11-Aug-22	12:00				JC	AUG 12 2022	12pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

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COC Number: 15 -

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Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)			EMERGENCY	
	4 day [P4]	☐	1 Business day [E1]	☐
	3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
	2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
121	EDC-U_INVCAD-1_2022-08	08-Aug-22		Tissue	R	R	R	R	R	1
122	EDC-U_INVCAD-2_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
123	EDC-U_INVCAD-3_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
124	EDC-U_INVCAD-4_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
125	EDC-U_INVCAD-5_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
126	EDC-U_INVCAD-6_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
127	EDC-U_INVCAD-7_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
128	EDC-U_INVCAD-8_2022-08	07-Aug-22		Tissue	R	R	R	R	R	1
129	EDC-D_INVCAD-1_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
130	EDC-D_INVCAD-2_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
131	EDC-D_INVCAD-3_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
132	EDC-D_INVCAD-4_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			6°C (avg 5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JC	Date: AUG 12 2022	Time: 12 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

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PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

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Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KBa

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
133	EDC-D_INVCAD-5_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
134	EDC-D_INVCAD-6_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
135	EDC-D_INVCAD-7_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
136	EDC-D_INVCAD-8_2022-08	03-Aug-22		Tissue	R	R	R	R	R	1
137	E1_INVCAD-1_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
138	E1_INVCAD-2_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
139	E1_INVCAD-3_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
140	E1_INVCAD-4_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
141	E1_INVCAD-5_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
142	E1_INVCAD-6_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
143	E1_INVCAD-7_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
144	E1_INVCAD-8_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C
			6°C (avg 5)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JU	Date: AUG 12 2022	Time: 12 pm

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ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Page 13 of 14

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: KTBa

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
145	HAC-RI_PERT-7X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
146	HAC-RI_PERT-8X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
147	HAC-D_PERT-7X_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
148	EI_PERT-5X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
149	EI-PERT-7X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
150	HAC-RI_INV-7X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
151	HAC-RI_INV-8X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
152	HAC-D_INV-7X_2022-08	05-Aug-22		Tissue	R	R	R	R	R	1
153	EI_INV-5X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
154	EI_INV-7X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
155	HAC-RI_INVCAD-7X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1
156	HAC-RI_INVCAD-8X_2022-08	10-Aug-22		Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			6°C (avg	5)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 11-Aug-22	Time: 12:00	Received by:	Date:	Time:	Received by: JV	Date: AUG 12 2022	Time: 12pm

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Contact:	Gabriel Holmes
Phone:	236-317-4939
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang **Sampler:**

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

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158	EI_INVCAD-5X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
159	EI_INVCAD-7X_2022-08	04-Aug-22		Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1
				Tissue	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

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Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katherina Batchelar	11-Aug-22	12:00				JZ	AUG 12 2022	12pm

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FISH TISSUE CHEMISTRY

ALS Laboratory Report VA22B2820

(Finalized December 5, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B2820**	Page	: 1 of 40
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 08-Jul-2022
C-O-C number	: ----	Issue Date	: 05-Dec-2022 22:21
Sampler	: LBO		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 72		
No. of samples analysed	: 72		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (05/12/2023): This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The mercury data for the following samples has been modified: VA22B2820-051, -052, -058 and -064.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-M-1_2022-05	POL_RB-M-2_2022-05	POL_RB-M-3_2022-05	POL_RB-M-4_2022-05	POL_RB-M-5_2022-05
					Client sampling date / time	28-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-001	VA22B2820-002	VA22B2820-003	VA22B2820-004	VA22B2820-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		79.7	81.1	82.4	82.0	77.4
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	<5.0	<5.0	5.7	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		0.040	<0.030	0.044	0.069	0.039
barium	7440-39-3	E472	0.050	mg/kg		0.787	0.582	0.729	1.03	0.790
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
calcium	7440-70-2	E472	20	mg/kg		835	1470	459	628	1020
cesium	7440-46-2	E472	0.0050	mg/kg		0.0698	0.112	0.0654	0.0593	0.0531
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	<0.20	0.32	0.43	0.29
cobalt	7440-48-4	E472	0.020	mg/kg		0.020	0.020	0.028	0.030	<0.020
copper	7440-50-8	E472	0.20	mg/kg		2.64	1.84	3.71	3.48	1.30
iron	7439-89-6	E472	5.0	mg/kg		37.7	48.2	59.3	61.2	32.2
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	0.060
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1410	1300	1270	1430	1290
manganese	7439-96-5	E472	0.050	mg/kg		0.516	1.24	0.771	0.931	0.863
mercury	7439-97-6	E511	0.0050	mg/kg		0.523	0.991	1.01	0.759	0.335
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.106	0.188	0.178	0.136	0.0760
molybdenum	7439-98-7	E472	0.040	mg/kg		<0.040	<0.040	<0.040	<0.040	<0.040
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	<0.20	0.21	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		12600	15200	14500	14200	12800
potassium	7440-09-7	E472	20	mg/kg		21300	26700	26100	23900	21000
rubidium	7440-17-7	E472	0.050	mg/kg		10.2	18.5	12.1	8.97	8.86
selenium	7782-49-2	E472	0.10	mg/kg		3.65	7.41	4.52	3.72	3.50
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		1840	1550	3360	1380	866

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-M-1_2022-05	POL_RB-M-2_2022-05	POL_RB-M-3_2022-05	POL_RB-M-4_2022-05	POL_RB-M-5_2022-05
					Client sampling date / time	28-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-001	VA22B2820-002	VA22B2820-003	VA22B2820-004	VA22B2820-005
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.04	1.71	0.40	0.76	1.43
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0103	0.0036	0.0078	0.0059	0.0063
tin	7440-31-5	E472	0.10	mg/kg		0.75	0.95	0.67	1.66	0.65
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
zinc	7440-66-6	E472	1.0	mg/kg		14.4	21.3	24.6	23.9	20.5
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	0.24	0.43	0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-M-6_2022-05	POL_RB-M-7_2022-05	POL_RB-M-8_2022-05	POL_RB-O-1_2022-05	POL_RB-O-2_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	28-May-2022	29-May-2022
						VA22B2820-006	VA22B2820-007	VA22B2820-008	VA22B2820-009	VA22B2820-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	----	----	72.1	----
moisture	----	E144-H	2.0	%		80.6	79.5	76.9	----	71.1
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	----	----	<2.0	----
aluminum	7429-90-5	E472	5.0	mg/kg		8.5	<5.0	<5.0	----	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		----	----	----	<0.010	----
arsenic	7440-38-2	E440	0.020	mg/kg		----	----	----	0.035	----
arsenic	7440-38-2	E472	0.030	mg/kg		0.053	0.065	0.032	----	<0.030
barium	7440-39-3	E472	0.050	mg/kg		1.04	0.480	0.557	----	0.704
barium	7440-39-3	E440	0.050	mg/kg		----	----	----	0.524	----
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		----	----	----	<0.010	----
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		----	----	----	<0.010	----
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	----	<1.0
boron	7440-42-8	E440	1.0	mg/kg		----	----	----	<1.0	----
cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	----	0.0055	----
cadmium	7440-43-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	<0.010
calcium	7440-70-2	E472	20	mg/kg		432	711	1870	----	886
calcium	7440-70-2	E440	20	mg/kg		----	----	----	1120	----
cesium	7440-46-2	E472	0.0050	mg/kg		0.0715	0.0619	0.0620	----	0.0470
cesium	7440-46-2	E440	0.0050	mg/kg		----	----	----	0.0258	----
chromium	7440-47-3	E440	0.050	mg/kg		----	----	----	<0.050	----
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.52	0.23	----	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		0.020	0.032	0.020	----	0.124
cobalt	7440-48-4	E440	0.020	mg/kg		----	----	----	0.118	----
copper	7440-50-8	E440	0.10	mg/kg		----	----	----	7.25	----
copper	7440-50-8	E472	0.20	mg/kg		1.63	2.67	1.96	----	8.44
iron	7439-89-6	E440	3.0	mg/kg		----	----	----	111	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-M-6_2022-05	POL_RB-M-7_2022-05	POL_RB-M-8_2022-05	POL_RB-O-1_2022-05	POL_RB-O-2_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	28-May-2022	29-May-2022
						VA22B2820-006	VA22B2820-007	VA22B2820-008	VA22B2820-009	VA22B2820-010
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		42.9	54.9	44.9	----	101
lead	7439-92-1	E440	0.020	mg/kg		----	----	----	0.030	----
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	----	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	----	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		----	----	----	<0.50	----
magnesium	7439-95-4	E472	2.0	mg/kg		1580	1350	874	----	1680
magnesium	7439-95-4	E440	2.0	mg/kg		----	----	----	1480	----
manganese	7439-96-5	E472	0.050	mg/kg		1.24	0.761	1.30	----	6.57
manganese	7439-96-5	E440	0.050	mg/kg		----	----	----	3.23	----
mercury	7439-97-6	E511	0.0050	mg/kg		1.05	0.537	0.512	----	0.0499
mercury	7439-97-6	E510	0.0050	mg/kg		----	----	----	0.0358	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.205	0.110	0.118	----	0.0144
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	----	0.0100	----
molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	----	0.057	----
molybdenum	7439-98-7	E472	0.040	mg/kg		<0.040	<0.040	<0.040	----	0.099
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	0.26	<0.20	----	<0.20
nickel	7440-02-0	E440	0.20	mg/kg		----	----	----	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg		14200	12800	11800	----	11800
phosphorus	7723-14-0	E440	10	mg/kg		----	----	----	12000	----
potassium	7440-09-7	E472	20	mg/kg		24700	20900	19600	----	8080
potassium	7440-09-7	E440	20	mg/kg		----	----	----	8670	----
rubidium	7440-17-7	E472	0.050	mg/kg		11.2	10.6	9.43	----	7.14
rubidium	7440-17-7	E440	0.050	mg/kg		----	----	----	4.95	----
selenium	7782-49-2	E440	0.050	mg/kg		----	----	----	7.30	----
selenium	7782-49-2	E472	0.10	mg/kg		5.10	3.89	4.33	----	10.6
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	----	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	----	<0.0050	----
sodium	7440-23-5	E472	20	mg/kg		1110	2060	2440	----	3300
sodium	7440-23-5	E440	20	mg/kg		----	----	----	5030	----
strontium	7440-24-6	E440	0.050	mg/kg		----	----	----	3.27	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-M-6_2022-05	POL_RB-M-7_2022-05	POL_RB-M-8_2022-05	POL_RB-O-1_2022-05	POL_RB-O-2_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	28-May-2022	29-May-2022
						VA22B2820-006	VA22B2820-007	VA22B2820-008	VA22B2820-009	VA22B2820-010
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		0.56	0.82	2.36	----	2.45
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	----	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		----	----	----	<0.020	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.0056	0.0068	0.0036	----	<0.0020
thallium	7440-28-0	E440	0.0020	mg/kg		----	----	----	0.0027	----
tin	7440-31-5	E472	0.10	mg/kg		1.07	0.93	0.59	----	0.48
tin	7440-31-5	E440	0.10	mg/kg		----	----	----	0.32	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	----	<0.25	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		0.55	<0.50	<0.50	----	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	----	0.0044
uranium	7440-61-1	E440	0.0020	mg/kg		----	----	----	<0.0020	----
vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	<0.10	<0.10	----	0.23
vanadium	7440-62-2	E440	0.10	mg/kg		----	----	----	<0.10	----
zinc	7440-66-6	E440	0.50	mg/kg		----	----	----	103	----
zinc	7440-66-6	E472	1.0	mg/kg		22.3	24.3	19.4	----	82.5
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	0.38	<0.20	----	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		----	----	----	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-3_2022-05	POL_RB-O-4_2022-05	POL_RB-O-5_2022-05	POL_RB-O-6_2022-05	POL_RB-O-7_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-011	VA22B2820-012	VA22B2820-013	VA22B2820-014	VA22B2820-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		88.6	----	----	68.6	66.5
moisture	----	E144-H	2.0	%		----	65.9	73.0	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		18.1	----	----	<2.0	<2.0
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	12.8	----	----
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	<0.010	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	----	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.078	----	----	0.060	0.042
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.034	0.092	----	----
barium	7440-39-3	E472	0.050	mg/kg		----	0.631	0.338	----	----
barium	7440-39-3	E440	0.050	mg/kg		1.23	----	----	0.525	0.265
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	<0.010	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	----	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	<0.010	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	----	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	<1.0	----	----
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	----	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0106	----	----	0.0076	<0.0050
cadmium	7440-43-9	E472	0.010	mg/kg		----	<0.010	0.024	----	----
calcium	7440-70-2	E472	20	mg/kg		----	1210	756	----	----
calcium	7440-70-2	E440	20	mg/kg		1070	----	----	1270	1150
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0143	0.0429	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.0317	----	----	0.0191	0.0228
chromium	7440-47-3	E440	0.050	mg/kg		0.629	----	----	<0.050	0.055
chromium	7440-47-3	E472	0.20	mg/kg		----	<0.20	<0.20	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.073	0.168	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.175	----	----	0.115	0.110
copper	7440-50-8	E440	0.10	mg/kg		8.47	----	----	8.25	8.28
copper	7440-50-8	E472	0.20	mg/kg		----	6.62	17.5	----	----
iron	7439-89-6	E440	3.0	mg/kg		305	----	----	86.1	64.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-3_2022-05	POL_RB-O-4_2022-05	POL_RB-O-5_2022-05	POL_RB-O-6_2022-05	POL_RB-O-7_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-011	VA22B2820-012	VA22B2820-013	VA22B2820-014	VA22B2820-015
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	76.2	303	----	----
lead	7439-92-1	E440	0.020	mg/kg		0.032	----	----	<0.020	<0.020
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	<0.050	----	----
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	<0.50	----	----
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	----	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		----	1400	735	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		1030	----	----	1720	1520
manganese	7439-96-5	E472	0.050	mg/kg		----	4.23	22.8	----	----
manganese	7439-96-5	E440	0.050	mg/kg		4.63	----	----	4.54	3.09
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.0224	0.0685	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.247	----	----	0.0654	0.0130
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0076	0.0185	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0282	----	----	0.0205	0.0044
molybdenum	7439-98-7	E440	0.020	mg/kg		0.105	----	----	0.060	0.050
molybdenum	7439-98-7	E472	0.040	mg/kg		----	0.056	0.084	----	----
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	<0.20	----	----
nickel	7440-02-0	E440	0.20	mg/kg		0.30	----	----	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		----	11300	11400	----	----
phosphorus	7723-14-0	E440	10	mg/kg		10600	----	----	12500	12200
potassium	7440-09-7	E472	20	mg/kg		----	7560	13700	----	----
potassium	7440-09-7	E440	20	mg/kg		10400	----	----	8170	7660
rubidium	7440-17-7	E472	0.050	mg/kg		----	3.28	8.15	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		5.45	----	----	4.54	4.60
selenium	7782-49-2	E440	0.050	mg/kg		6.95	----	----	8.05	7.64
selenium	7782-49-2	E472	0.10	mg/kg		----	6.49	11.1	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	<0.0050	<0.0050	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0051	----	----	0.0064	<0.0050
sodium	7440-23-5	E472	20	mg/kg		----	2350	3120	----	----
sodium	7440-23-5	E440	20	mg/kg		23700	----	----	3270	3150
strontium	7440-24-6	E440	0.050	mg/kg		2.36	----	----	3.27	3.10

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-3_2022-05	POL_RB-O-4_2022-05	POL_RB-O-5_2022-05	POL_RB-O-6_2022-05	POL_RB-O-7_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-011	VA22B2820-012	VA22B2820-013	VA22B2820-014	VA22B2820-015
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	3.50	1.28	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	<0.020	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	----	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		----	<0.0020	0.0111	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		0.0040	----	----	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		----	0.37	0.10	----	----
tin	7440-31-5	E440	0.10	mg/kg		1.33	----	----	0.28	0.12
titanium	7440-32-6	E440.Ti	0.25	mg/kg		1.48	----	----	<0.25	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	1.01	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		----	<0.0020	0.0025	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		0.0048	----	----	0.0026	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		----	<0.10	0.16	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		0.32	----	----	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		184	----	----	77.1	66.2
zinc	7440-66-6	E472	1.0	mg/kg		----	85.9	250	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		----	<0.20	<0.20	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		0.55	----	----	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-8_2022-05	POL_RB-Li-1_2022-05	POL_RB-Li-2_2022-05	POL_RB-Li-3_2022-05	POL_RB-Li-4_2022-05
					Client sampling date / time	29-May-2022	28-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-016	VA22B2820-017	VA22B2820-018	VA22B2820-019	VA22B2820-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		64.2	----	----	----	----
moisture	----	E144-H	2.0	%		----	80.7	78.7	77.6	75.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	----	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	8.8	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.028	----	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.061	0.053	0.074	0.075
barium	7440-39-3	E472	0.050	mg/kg		----	0.663	0.762	0.785	0.786
barium	7440-39-3	E440	0.050	mg/kg		0.261	----	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	----	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	<1.0	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	----	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	0.181	0.212	0.131	0.109
calcium	7440-70-2	E472	20	mg/kg		----	410	335	290	337
calcium	7440-70-2	E440	20	mg/kg		1140	----	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0561	0.0828	0.0549	0.0432
cesium	7440-46-2	E440	0.0050	mg/kg		0.0170	----	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	----	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	0.28	0.27	<0.20	0.32
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.137	0.181	0.104	0.120
cobalt	7440-48-4	E440	0.020	mg/kg		0.066	----	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		8.29	----	----	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	31.7	198	132	18.2
iron	7439-89-6	E440	3.0	mg/kg		56.6	----	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-8_2022-05	POL_RB-Li-1_2022-05	POL_RB-Li-2_2022-05	POL_RB-Li-3_2022-05	POL_RB-Li-4_2022-05
					Client sampling date / time	29-May-2022	28-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-016	VA22B2820-017	VA22B2820-018	VA22B2820-019	VA22B2820-020
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	2200	2200	2030	1880
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	----	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	0.053	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	660	1050	868	859
magnesium	7439-95-4	E440	2.0	mg/kg		1710	----	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	5.89	8.10	11.3	12.3
manganese	7439-96-5	E440	0.050	mg/kg		3.57	----	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.498	0.653	0.909	0.536
mercury	7439-97-6	E510	0.0050	mg/kg		0.0113	----	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0963	0.139	0.203	0.130
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0040	----	----	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		0.040	----	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	0.941	1.14	1.42	0.934
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	<0.20	<0.20	0.39
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	----	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	14300	17300	15000	14600
phosphorus	7723-14-0	E440	10	mg/kg		12100	----	----	----	----
potassium	7440-09-7	E472	20	mg/kg		----	12400	14100	13300	11600
potassium	7440-09-7	E440	20	mg/kg		7780	----	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	7.69	14.7	11.2	7.21
rubidium	7440-17-7	E440	0.050	mg/kg		4.31	----	----	----	----
selenium	7782-49-2	E440	0.050	mg/kg		8.03	----	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	14.8	34.8	31.6	15.6
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	0.0725	0.184	0.623	0.0492
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	----	----	----	----
sodium	7440-23-5	E472	20	mg/kg		----	9130	4070	6510	3780
sodium	7440-23-5	E440	20	mg/kg		2630	----	----	----	----
strontium	7440-24-6	E440	0.050	mg/kg		3.59	----	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-8_2022-05	POL_RB-Li-1_2022-05	POL_RB-Li-2_2022-05	POL_RB-Li-3_2022-05	POL_RB-Li-4_2022-05
					Client sampling date / time	29-May-2022	28-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-016	VA22B2820-017	VA22B2820-018	VA22B2820-019	VA22B2820-020
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	0.78	0.53	0.48	0.50
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	0.142	0.0494	0.0851	0.0751
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	----	----	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	1.18	1.08	1.60	1.89
tin	7440-31-5	E440	0.10	mg/kg		<0.10	----	----	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	----	----	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	0.0024	0.0189	0.0084	0.0027
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	----	----	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	0.36	1.76	0.97	0.40
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	----	----	----	----
zinc	7440-66-6	E440	0.50	mg/kg		67.8	----	----	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	189	263	202	178
zirconium	7440-67-7	E472	0.20	mg/kg		----	0.28	0.30	0.24	0.30
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Li-5_2022-05	POL_RB-Li-6_2022-05	POL_RB-Li-7_2022-05	POL_RB-Li-8_2022-05	POL_RB-Ki-1_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	28-May-2022
						VA22B2820-021	VA22B2820-022	VA22B2820-023	VA22B2820-024	VA22B2820-025
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		74.3	76.7	81.0	80.8	79.8
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		6.7	25.4	<5.0	<5.0	10.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		0.098	0.139	0.074	0.060	0.662
barium	7440-39-3	E472	0.050	mg/kg		1.37	1.57	1.30	1.08	0.320
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		1.2	1.4	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.200	0.248	0.204	0.193	0.847
calcium	7440-70-2	E472	20	mg/kg		528	469	424	394	638
cesium	7440-46-2	E472	0.0050	mg/kg		0.0292	0.0574	0.0618	0.0396	0.0438
chromium	7440-47-3	E472	0.20	mg/kg		0.37	0.24	0.24	<0.20	0.29
cobalt	7440-48-4	E472	0.020	mg/kg		0.126	0.145	0.218	0.183	2.35
copper	7440-50-8	E472	0.20	mg/kg		115	153	59.8	28.2	8.16
iron	7439-89-6	E472	5.0	mg/kg		1470	1990	2300	2040	788
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	0.078
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		892	856	690	705	661
manganese	7439-96-5	E472	0.050	mg/kg		7.86	12.2	12.8	6.96	3.40
mercury	7439-97-6	E511	0.0050	mg/kg		0.198	1.07	0.435	0.435	0.405
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0509	0.249	0.0826	0.0836	0.0818
molybdenum	7439-98-7	E472	0.040	mg/kg		1.17	1.30	1.08	1.15	0.499
nickel	7440-02-0	E472	0.20	mg/kg		0.21	<0.20	<0.20	<0.20	0.45
phosphorus	7723-14-0	E472	10	mg/kg		16500	14900	13800	14300	10900
potassium	7440-09-7	E472	20	mg/kg		13300	12000	13300	12500	10800
rubidium	7440-17-7	E472	0.050	mg/kg		10.7	8.54	9.18	6.95	6.24
selenium	7782-49-2	E472	0.10	mg/kg		45.9	38.9	23.6	18.3	13.8
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.360	0.599	0.263	0.168	<0.0050
sodium	7440-23-5	E472	20	mg/kg		3440	4940	9300	9420	8850

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	POL_RB-Li-5_2022-05	POL_RB-Li-6_2022-05	POL_RB-Li-7_2022-05	POL_RB-Li-8_2022-05	POL_RB-Ki-1_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	28-May-2022
Analyte	CAS Number	Method	LOR	Unit		VA22B2820-021	VA22B2820-022	VA22B2820-023	VA22B2820-024	VA22B2820-025
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		0.99	0.74	0.71	0.65	2.26
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0391	0.0337	0.105	0.0916	0.0780
tin	7440-31-5	E472	0.10	mg/kg		1.58	1.29	1.46	1.69	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	1.67	<0.50	<0.50	0.68
uranium	7440-61-1	E472	0.0020	mg/kg		0.0034	0.0127	0.0062	0.0101	0.0042
vanadium	7440-62-2	E472	0.10	mg/kg		0.19	0.98	0.36	0.77	0.50
zinc	7440-66-6	E472	1.0	mg/kg		124	183	205	151	195
zirconium	7440-67-7	E472	0.20	mg/kg		0.25	0.25	0.31	0.34	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Ki-2_2022-05	POL_RB-Ki-3_2022-05	POL_RB-Ki-4_2022-05	POL_RB-Ki-5_2022-05	POL_RB-Ki-6_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-026	VA22B2820-027	VA22B2820-028	VA22B2820-029	VA22B2820-030
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		80.2	81.8	81.1	77.9	80.8
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		41.4	6.2	6.5	5.0	12.3
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		0.288	0.460	0.405	0.320	0.762
barium	7440-39-3	E472	0.050	mg/kg		2.55	1.35	0.253	1.46	2.22
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	1.5	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.307	0.894	0.819	0.588	0.761
calcium	7440-70-2	E472	20	mg/kg		20500	542	490	587	638
cesium	7440-46-2	E472	0.0050	mg/kg		0.0963	0.0417	0.0384	0.0349	0.0548
chromium	7440-47-3	E472	0.20	mg/kg		1.13	0.27	0.58	0.21	0.26
cobalt	7440-48-4	E472	0.020	mg/kg		1.80	1.82	0.999	2.76	1.34
copper	7440-50-8	E472	0.20	mg/kg		15.3	8.92	9.23	6.07	9.49
iron	7439-89-6	E472	5.0	mg/kg		742	1010	786	866	1030
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1160	765	864	817	718
manganese	7439-96-5	E472	0.050	mg/kg		17.6	5.59	5.14	3.41	12.8
mercury	7439-97-6	E511	0.0050	mg/kg		0.517	0.871	0.609	0.229	1.19
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.102	0.158	0.115	0.0505	0.230
molybdenum	7439-98-7	E472	0.040	mg/kg		0.538	0.432	0.445	0.434	0.586
nickel	7440-02-0	E472	0.20	mg/kg		0.97	0.33	0.45	0.64	0.47
phosphorus	7723-14-0	E472	10	mg/kg		27100	14100	14300	12300	13900
potassium	7440-09-7	E472	20	mg/kg		15200	13600	12800	12600	13200
rubidium	7440-17-7	E472	0.050	mg/kg		13.2	7.17	6.13	7.18	8.03
selenium	7782-49-2	E472	0.10	mg/kg		15.5	13.3	10.3	10.2	16.1
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0053	0.0143	0.0059	<0.0050	0.0074
sodium	7440-23-5	E472	20	mg/kg		6530	9050	6980	4530	7130

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Ki-2_2022-05	POL_RB-Ki-3_2022-05	POL_RB-Ki-4_2022-05	POL_RB-Ki-5_2022-05	POL_RB-Ki-6_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	29-May-2022	29-May-2022	29-May-2022
						VA22B2820-026	VA22B2820-027	VA22B2820-028	VA22B2820-029	VA22B2820-030
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		42.2	1.51	1.21	1.84	1.80
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0210	0.0385	0.0464	0.0556	0.0378
tin	7440-31-5	E472	0.10	mg/kg		<0.10	2.69	<0.10	2.65	1.43
titanium	7440-32-6	E472.Ti	0.50	mg/kg		3.46	<0.50	0.58	<0.50	0.97
uranium	7440-61-1	E472	0.0020	mg/kg		0.0328	0.0101	0.0036	0.0050	0.0174
vanadium	7440-62-2	E472	0.10	mg/kg		2.47	0.84	0.45	0.33	0.92
zinc	7440-66-6	E472	1.0	mg/kg		361	266	265	174	214
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	0.30	<0.20	0.20	0.24

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Ki-7_2022-05	POL_RB-Ki-8_2022-05	BOL_RB-M-1_2022-05	BOL_RB-M-2_2022-05	BOL_RB-M-3_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-031	VA22B2820-032	VA22B2820-033	VA22B2820-034	VA22B2820-035
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		83.3	78.3	82.7	77.9	77.3
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		6.6	7.8	<5.0	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		0.400	0.555	<0.030	<0.030	<0.030
barium	7440-39-3	E472	0.050	mg/kg		1.21	0.375	1.00	0.508	0.630
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.496	0.824	<0.010	<0.010	<0.010
calcium	7440-70-2	E472	20	mg/kg		623	926	564	477	988
cesium	7440-46-2	E472	0.0050	mg/kg		0.0568	0.0452	0.0665	0.0413	0.0624
chromium	7440-47-3	E472	0.20	mg/kg		0.31	0.20	0.25	<0.20	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		1.97	0.754	<0.020	<0.020	<0.020
copper	7440-50-8	E472	0.20	mg/kg		4.75	7.45	1.97	1.53	2.39
iron	7439-89-6	E472	5.0	mg/kg		1250	962	49.2	43.7	21.0
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		611	688	1400	958	1310
manganese	7439-96-5	E472	0.050	mg/kg		2.02	4.18	0.799	0.525	0.798
mercury	7439-97-6	E511	0.0050	mg/kg		0.553	0.545	0.584	0.734	0.359
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0921	0.118	0.101	0.162	0.0814
molybdenum	7439-98-7	E472	0.040	mg/kg		0.272	0.517	<0.040	<0.040	<0.040
nickel	7440-02-0	E472	0.20	mg/kg		0.39	0.33	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		11700	11600	14700	11200	12100
potassium	7440-09-7	E472	20	mg/kg		13800	11800	23200	18500	20000
rubidium	7440-17-7	E472	0.050	mg/kg		8.72	7.30	12.8	8.15	11.8
selenium	7782-49-2	E472	0.10	mg/kg		11.8	14.4	2.05	2.11	2.53
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		13800	7970	3230	2020	1430

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Ki-7_2022-05	POL_RB-Ki-8_2022-05	BOL_RB-M-1_2022-05	BOL_RB-M-2_2022-05	BOL_RB-M-3_2022-05
					Client sampling date / time	29-May-2022	29-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-031	VA22B2820-032	VA22B2820-033	VA22B2820-034	VA22B2820-035
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.72	2.48	0.66	0.63	1.50
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0348	0.0488	0.0075	0.0077	0.0109
tin	7440-31-5	E472	0.10	mg/kg		2.63	<0.10	1.24	0.61	0.61
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	0.58	<0.50	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		0.0057	0.0128	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		0.32	0.97	<0.10	<0.10	<0.10
zinc	7440-66-6	E472	1.0	mg/kg		148	209	23.2	23.2	16.7
zirconium	7440-67-7	E472	0.20	mg/kg		0.34	<0.20	0.63	0.35	0.38

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-M-4_2022-05	BOL_RB-M-5_2022-05	BOL_RB-M-6_2022-05	BOL_RB-M-7_2022-05	BOL_RB-M-8_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-036	VA22B2820-037	VA22B2820-038	VA22B2820-039	VA22B2820-040
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	----	----	----	80.8
moisture	----	E144-H	2.0	%		79.7	76.6	80.6	79.5	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	----	----	----	<2.0
aluminum	7429-90-5	E472	5.0	mg/kg		5.7	<5.0	<5.0	<5.0	----
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
antimony	7440-36-0	E440	0.010	mg/kg		----	----	----	----	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		----	----	----	----	0.025
arsenic	7440-38-2	E472	0.030	mg/kg		0.032	<0.030	0.034	0.031	----
barium	7440-39-3	E472	0.050	mg/kg		0.826	0.816	0.758	0.622	----
barium	7440-39-3	E440	0.050	mg/kg		----	----	----	----	0.890
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
beryllium	7440-41-7	E440	0.010	mg/kg		----	----	----	----	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
bismuth	7440-69-9	E440	0.010	mg/kg		----	----	----	----	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	1.3	<1.0	<1.0	----
boron	7440-42-8	E440	1.0	mg/kg		----	----	----	----	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	----	----	<0.0050
cadmium	7440-43-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
calcium	7440-70-2	E472	20	mg/kg		845	836	1310	516	----
calcium	7440-70-2	E440	20	mg/kg		----	----	----	----	1790
cesium	7440-46-2	E472	0.0050	mg/kg		0.0875	0.0594	0.0624	0.0611	----
cesium	7440-46-2	E440	0.0050	mg/kg		----	----	----	----	0.0721
chromium	7440-47-3	E440	0.050	mg/kg		----	----	----	----	0.150
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.30	0.57	<0.20	----
cobalt	7440-48-4	E472	0.020	mg/kg		<0.020	<0.020	0.024	<0.020	----
cobalt	7440-48-4	E440	0.020	mg/kg		----	----	----	----	<0.020
copper	7440-50-8	E440	0.10	mg/kg		----	----	----	----	1.19
copper	7440-50-8	E472	0.20	mg/kg		2.53	2.12	2.86	2.14	----
iron	7439-89-6	E440	3.0	mg/kg		----	----	----	----	30.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-M-4_2022-05	BOL_RB-M-5_2022-05	BOL_RB-M-6_2022-05	BOL_RB-M-7_2022-05	BOL_RB-M-8_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-036	VA22B2820-037	VA22B2820-038	VA22B2820-039	VA22B2820-040
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		26.1	28.8	38.6	30.4	----
lead	7439-92-1	E440	0.020	mg/kg		----	----	----	----	<0.020
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
lithium	7439-93-2	E440	0.50	mg/kg		----	----	----	----	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1300	1420	1160	1390	----
magnesium	7439-95-4	E440	2.0	mg/kg		----	----	----	----	1390
manganese	7439-96-5	E472	0.050	mg/kg		1.03	0.850	0.954	0.714	----
manganese	7439-96-5	E440	0.050	mg/kg		----	----	----	----	0.789
mercury	7439-97-6	E511	0.0050	mg/kg		0.389	0.474	0.471	0.343	----
mercury	7439-97-6	E510	0.0050	mg/kg		----	----	----	----	0.574
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0790	0.111	0.0911	0.0703	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	----	----	0.110
molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	----	----	<0.020
molybdenum	7439-98-7	E472	0.040	mg/kg		<0.040	<0.040	<0.040	<0.040	----
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
nickel	7440-02-0	E440	0.20	mg/kg		----	----	----	----	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		11900	13600	13000	14100	----
phosphorus	7723-14-0	E440	10	mg/kg		----	----	----	----	15700
potassium	7440-09-7	E472	20	mg/kg		18700	21600	21500	23700	----
potassium	7440-09-7	E440	20	mg/kg		----	----	----	----	25500
rubidium	7440-17-7	E472	0.050	mg/kg		13.1	9.70	11.0	11.9	----
rubidium	7440-17-7	E440	0.050	mg/kg		----	----	----	----	13.6
selenium	7782-49-2	E440	0.050	mg/kg		----	----	----	----	2.41
selenium	7782-49-2	E472	0.10	mg/kg		2.78	2.24	2.06	2.28	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	----	----	<0.0050
sodium	7440-23-5	E472	20	mg/kg		2100	2220	3130	2190	----
sodium	7440-23-5	E440	20	mg/kg		----	----	----	----	1760
strontium	7440-24-6	E440	0.050	mg/kg		----	----	----	----	2.74

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-M-4_2022-05	BOL_RB-M-5_2022-05	BOL_RB-M-6_2022-05	BOL_RB-M-7_2022-05	BOL_RB-M-8_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-036	VA22B2820-037	VA22B2820-038	VA22B2820-039	VA22B2820-040
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.09	1.23	2.11	0.67	----
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
tellurium	13494-80-9	E440	0.020	mg/kg		----	----	----	----	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0065	0.0106	0.0102	0.0129	----
thallium	7440-28-0	E440	0.0020	mg/kg		----	----	----	----	0.0155
tin	7440-31-5	E472	0.10	mg/kg		0.73	1.08	1.11	1.34	----
tin	7440-31-5	E440	0.10	mg/kg		----	----	----	----	1.14
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	----	----	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	----
uranium	7440-61-1	E440	0.0020	mg/kg		----	----	----	----	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	----
vanadium	7440-62-2	E440	0.10	mg/kg		----	----	----	----	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		----	----	----	----	19.0
zinc	7440-66-6	E472	1.0	mg/kg		24.7	17.4	24.8	18.3	----
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	0.33	0.25	----
zirconium	7440-67-7	E440	0.20	mg/kg		----	----	----	----	0.43

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-1_2022-05	BOL_RB-O-2_2022-05	BOL_RB-O-3_2022-05	BOL_RB-O-4_2022-05	BOL_RB-O-5_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-041	VA22B2820-042	VA22B2820-043	VA22B2820-044	VA22B2820-045
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		67.7	68.4	64.0	63.4	----
moisture	----	E144-H	2.0	%		----	----	----	----	83.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	----	----	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	----	----	----	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
arsenic	7440-38-2	E440	0.020	mg/kg		<0.020	0.032	0.021	<0.020	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	----	----	0.043
barium	7440-39-3	E472	0.050	mg/kg		----	----	----	----	0.188
barium	7440-39-3	E440	0.050	mg/kg		0.548	0.599	0.502	0.738	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	----	----	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	----	----	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	----	----	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	----	----	0.018
calcium	7440-70-2	E472	20	mg/kg		----	----	----	----	581
calcium	7440-70-2	E440	20	mg/kg		1360	1490	1460	1190	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	----	----	0.0319
cesium	7440-46-2	E440	0.0050	mg/kg		0.0186	0.0150	0.0161	0.0258	----
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	----	----	0.22
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	----	----	0.113
cobalt	7440-48-4	E440	0.020	mg/kg		0.084	0.101	0.055	0.071	----
copper	7440-50-8	E440	0.10	mg/kg		7.06	10.1	11.3	7.20	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	----	----	4.68
iron	7439-89-6	E440	3.0	mg/kg		55.4	96.3	55.2	57.6	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-1_2022-05	BOL_RB-O-2_2022-05	BOL_RB-O-3_2022-05	BOL_RB-O-4_2022-05	BOL_RB-O-5_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-041	VA22B2820-042	VA22B2820-043	VA22B2820-044	VA22B2820-045
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	----	----	283
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	----	----	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	----	----	----	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	----	----	638
magnesium	7439-95-4	E440	2.0	mg/kg		1880	1550	1690	1690	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	----	----	6.45
manganese	7439-96-5	E440	0.050	mg/kg		7.70	7.67	4.10	7.82	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	----	----	0.154
mercury	7439-97-6	E510	0.0050	mg/kg		0.0201	0.0345	0.0080	0.0124	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	----	----	0.0254
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0065	0.0109	0.0029	0.0046	----
molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	0.039	0.043	0.048	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	----	----	0.080
nickel	7440-02-0	E472	0.20	mg/kg		----	----	----	----	<0.20
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg		----	----	----	----	9980
phosphorus	7723-14-0	E440	10	mg/kg		12500	12000	12400	12100	----
potassium	7440-09-7	E472	20	mg/kg		----	----	----	----	11000
potassium	7440-09-7	E440	20	mg/kg		8170	8320	7330	7290	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	----	----	6.15
rubidium	7440-17-7	E440	0.050	mg/kg		5.05	3.99	4.63	6.24	----
selenium	7782-49-2	E440	0.050	mg/kg		3.92	5.97	5.92	4.98	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	----	----	3.72
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	----	----	0.0070
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0125	0.0105	0.0062	----
sodium	7440-23-5	E472	20	mg/kg		----	----	----	----	11000
sodium	7440-23-5	E440	20	mg/kg		3280	3490	2790	2200	----
strontium	7440-24-6	E440	0.050	mg/kg		3.58	3.97	4.75	3.57	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-1_2022-05	BOL_RB-O-2_2022-05	BOL_RB-O-3_2022-05	BOL_RB-O-4_2022-05	BOL_RB-O-5_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-041	VA22B2820-042	VA22B2820-043	VA22B2820-044	VA22B2820-045
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	----	----	----	1.53
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	----	----	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	----	----	0.0097
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	----	----	<0.10
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.13	0.19	<0.10	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	----	----	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	----	----	0.0022
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	----	----	<0.10
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	----
zinc	7440-66-6	E440	0.50	mg/kg		88.3	95.5	70.5	65.6	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	----	----	190
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	----	----	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-6_2022-05	BOL_RB-O-7_2022-05	BOL_RB-O-8_2022-05	BOL_RB-Li-1_2022-05	BOL_RB-Li-2_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-046	VA22B2820-047	VA22B2820-048	VA22B2820-049	VA22B2820-050
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		74.0	----	68.5	82.8	82.5
moisture	----	E144-H	2.0	%		----	82.6	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	----	<2.0	5.4	2.6
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.034	----	0.024	0.030	0.054
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.035	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		----	0.378	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		0.632	----	1.12	0.526	0.804
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0128	----	<0.0050	0.158	0.232
cadmium	7440-43-9	E472	0.010	mg/kg		----	0.012	----	----	----
calcium	7440-70-2	E472	20	mg/kg		----	637	----	----	----
calcium	7440-70-2	E440	20	mg/kg		1110	----	1440	418	596
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0444	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.0211	----	0.0174	0.0483	0.0350
chromium	7440-47-3	E440	0.050	mg/kg		0.078	----	<0.050	0.257	0.087
chromium	7440-47-3	E472	0.20	mg/kg		----	<0.20	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.143	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.097	----	0.080	0.094	0.130
copper	7440-50-8	E440	0.10	mg/kg		6.50	----	10.3	175	111
copper	7440-50-8	E472	0.20	mg/kg		----	6.32	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		142	----	61.9	1710	2490

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-6_2022-05	BOL_RB-O-7_2022-05	BOL_RB-O-8_2022-05	BOL_RB-Li-1_2022-05	BOL_RB-Li-2_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-046	VA22B2820-047	VA22B2820-048	VA22B2820-049	VA22B2820-050
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	291	----	----	----
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	<0.020
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	----	----	----
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		----	668	----	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		1550	----	1650	966	901
manganese	7439-96-5	E472	0.050	mg/kg		----	5.44	----	----	----
manganese	7439-96-5	E440	0.050	mg/kg		5.48	----	12.9	8.89	6.90
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.108	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.0597	----	0.0192	0.485	0.686
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0189	----	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0155	----	0.0060	0.0834	0.120
molybdenum	7439-98-7	E440	0.020	mg/kg		0.051	----	0.045	1.11	1.33
molybdenum	7439-98-7	E472	0.040	mg/kg		----	0.073	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	----	----	----
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	----	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		----	10300	----	----	----
phosphorus	7723-14-0	E440	10	mg/kg		12000	----	12800	18300	18400
potassium	7440-09-7	E472	20	mg/kg		----	11700	----	----	----
potassium	7440-09-7	E440	20	mg/kg		9470	----	8440	16000	15400
rubidium	7440-17-7	E472	0.050	mg/kg		----	7.82	----	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		5.91	----	5.12	10.2	7.35
selenium	7782-49-2	E440	0.050	mg/kg		4.15	----	6.35	10.2	13.9
selenium	7782-49-2	E472	0.10	mg/kg		----	3.99	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	<0.0050	----	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0135	----	0.0059	1.57	1.17
sodium	7440-23-5	E472	20	mg/kg		----	9200	----	----	----
sodium	7440-23-5	E440	20	mg/kg		5820	----	3860	10000	11100
strontium	7440-24-6	E440	0.050	mg/kg		3.66	----	4.16	0.704	1.07

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-O-6_2022-05	BOL_RB-O-7_2022-05	BOL_RB-O-8_2022-05	BOL_RB-Li-1_2022-05	BOL_RB-Li-2_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-046	VA22B2820-047	VA22B2820-048	VA22B2820-049	VA22B2820-050
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	1.70	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	----	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		----	0.0108	----	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		0.0032	----	<0.0020	0.124	0.321
tin	7440-31-5	E472	0.10	mg/kg		----	0.12	----	----	----
tin	7440-31-5	E440	0.10	mg/kg		0.36	----	<0.10	0.57	0.71
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	----	<0.25	<0.25	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		----	0.0020	----	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	----	<0.0020	0.0063	0.0085
vanadium	7440-62-2	E472	0.10	mg/kg		----	<0.10	----	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	----	<0.10	0.25	0.34
zinc	7440-66-6	E440	0.50	mg/kg		79.1	----	104	224	158
zinc	7440-66-6	E472	1.0	mg/kg		----	182	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		----	<0.20	----	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	----	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Li-3_2022-05	BOL_RB-Li-4_2022-05	BOL_RB-Li-5_2022-05	BOL_RB-Li-6_2022-05	BOL_RB-Li-7_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-051	VA22B2820-052	VA22B2820-053	VA22B2820-054	VA22B2820-055
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144-H	2.0	%		76.9	78.8	79.6	79.1	74.5
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	6.4	<5.0	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E472	0.030	mg/kg		<0.030	0.039	0.064	0.042	0.049
barium	7440-39-3	E472	0.050	mg/kg		1.18	1.51	0.791	0.822	0.085
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	1.5	<1.0	<1.0	<1.0
cadmium	7440-43-9	E472	0.010	mg/kg		0.123	0.317	0.118	0.142	0.135
calcium	7440-70-2	E472	20	mg/kg		446	368	365	322	279
cesium	7440-46-2	E472	0.0050	mg/kg		0.0299	0.0666	0.0292	0.0295	0.0336
chromium	7440-47-3	E472	0.20	mg/kg		0.32	0.28	<0.20	0.22	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		0.075	0.161	0.107	0.112	0.112
copper	7440-50-8	E472	0.20	mg/kg		66.9	69.7	86.9	22.1	137
iron	7439-89-6	E472	5.0	mg/kg		900	477	1250	1820	1290
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		704	721	749	834	706
manganese	7439-96-5	E472	0.050	mg/kg		4.80	6.57	8.74	6.15	6.14
mercury	7439-97-6	E511	0.0050	mg/kg		0.329	0.380	0.308	0.264	0.242
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0761	0.0805	0.0627	0.0552	0.0616
molybdenum	7439-98-7	E472	0.040	mg/kg		0.657	0.631	0.680	0.866	0.871
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		14400	14500	14600	16300	15900
potassium	7440-09-7	E472	20	mg/kg		12700	13600	13300	14400	11800
rubidium	7440-17-7	E472	0.050	mg/kg		8.53	11.5	7.47	9.74	7.75
selenium	7782-49-2	E472	0.10	mg/kg		13.0	14.1	13.8	9.16	16.6
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.793	0.969	0.941	0.283	1.16
sodium	7440-23-5	E472	20	mg/kg		6370	6120	8230	7200	5170

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Li-3_2022-05	BOL_RB-Li-4_2022-05	BOL_RB-Li-5_2022-05	BOL_RB-Li-6_2022-05	BOL_RB-Li-7_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-051	VA22B2820-052	VA22B2820-053	VA22B2820-054	VA22B2820-055
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		0.99	0.93	0.73	0.60	0.56
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.124	0.169	0.175	0.149	0.127
tin	7440-31-5	E472	0.10	mg/kg		0.90	0.95	0.79	1.18	<0.10
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	0.0064	0.0036	0.0052	0.0040
vanadium	7440-62-2	E472	0.10	mg/kg		0.11	0.21	0.14	0.20	0.20
zinc	7440-66-6	E472	1.0	mg/kg		152	133	226	186	188
zirconium	7440-67-7	E472	0.20	mg/kg		0.29	0.31	0.25	0.47	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Li-8_2022-05	BOL_RB-Ki-1_2022-05	BOL_RB-Ki-2_2022-05	BOL_RB-Ki-3_2022-05	BOL_RB-Ki-4_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-056	VA22B2820-057	VA22B2820-058	VA22B2820-059	VA22B2820-060
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		82.5	83.7	----	----	----
moisture	----	E144-H	2.0	%		----	----	81.5	80.6	81.1
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		7.1	4.0	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	7.3	<5.0	5.7
antimony	7440-36-0	E472	0.010	mg/kg		----	----	0.022	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	0.012	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.053	0.189	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	0.457	0.152	0.288
barium	7440-39-3	E472	0.050	mg/kg		----	----	2.16	0.388	1.21
barium	7440-39-3	E440	0.050	mg/kg		0.905	1.22	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	<1.0	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		0.233	0.268	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	0.717	0.470	0.710
calcium	7440-70-2	E472	20	mg/kg		----	----	904	723	931
calcium	7440-70-2	E440	20	mg/kg		543	533	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	0.0344	0.0412	0.0747
cesium	7440-46-2	E440	0.0050	mg/kg		0.0412	0.0568	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.175	0.297	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	0.30	<0.20	0.48
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	0.664	0.448	0.508
cobalt	7440-48-4	E440	0.020	mg/kg		0.134	0.411	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		148	7.20	----	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	7.83	6.16	5.54
iron	7439-89-6	E440	3.0	mg/kg		2270	682	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Li-8_2022-05	BOL_RB-Ki-1_2022-05	BOL_RB-Ki-2_2022-05	BOL_RB-Ki-3_2022-05	BOL_RB-Ki-4_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-056	VA22B2820-057	VA22B2820-058	VA22B2820-059	VA22B2820-060
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	763	613	537
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	----	<0.50	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	726	641	771
magnesium	7439-95-4	E440	2.0	mg/kg		868	894	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	2.83	2.62	2.91
manganese	7439-96-5	E440	0.050	mg/kg		7.58	3.60	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	0.695	0.304	0.328
mercury	7439-97-6	E510	0.0050	mg/kg		0.520	0.445	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	0.129	0.0591	0.0619
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0910	0.0726	----	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		1.03	0.522	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	0.641	0.367	0.454
nickel	7440-02-0	E472	0.20	mg/kg		----	----	0.38	0.29	0.45
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.25	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	----	11500	13300	13600
phosphorus	7723-14-0	E440	10	mg/kg		17500	16700	----	----	----
potassium	7440-09-7	E472	20	mg/kg		----	----	11500	12000	14000
potassium	7440-09-7	E440	20	mg/kg		14700	15900	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	6.04	9.04	12.2
rubidium	7440-17-7	E440	0.050	mg/kg		9.77	10.0	----	----	----
selenium	7782-49-2	E440	0.050	mg/kg		18.5	9.95	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	12.9	7.60	10.1
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	0.0146	0.0056	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		1.26	0.0092	----	----	----
sodium	7440-23-5	E472	20	mg/kg		----	----	12700	9520	8880
sodium	7440-23-5	E440	20	mg/kg		8220	12300	----	----	----
strontium	7440-24-6	E440	0.050	mg/kg		1.08	1.56	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Li-8_2022-05	BOL_RB-Ki-1_2022-05	BOL_RB-Ki-2_2022-05	BOL_RB-Ki-3_2022-05	BOL_RB-Ki-4_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2820-056	VA22B2820-057	VA22B2820-058	VA22B2820-059	VA22B2820-060
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	----	3.76	2.03	3.10
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	0.0556	0.0434	0.0356
thallium	7440-28-0	E440	0.0020	mg/kg		0.224	0.0226	----	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	1.50	<0.10	<0.10
tin	7440-31-5	E440	0.10	mg/kg		1.04	1.06	----	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.25	----	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	<0.50	<0.50	0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	0.0116	0.0048	0.0135
uranium	7440-61-1	E440	0.0020	mg/kg		0.0117	0.0078	----	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	0.41	0.21	0.32
vanadium	7440-62-2	E440	0.10	mg/kg		0.50	0.31	----	----	----
zinc	7440-66-6	E440	0.50	mg/kg		176	109	----	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	103	146	108
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	0.21	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Ki-5_2022-05	BOL_RB-Ki-6_2022-05	BOL_RB-Ki-7_2022-05	BOL_RB-Ki-8_2022-05	POL_LSU-M-1_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	28-May-2022
						VA22B2820-061	VA22B2820-062	VA22B2820-063	VA22B2820-064	VA22B2820-065
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	----	----	----	78.7
moisture	----	E144-H	2.0	%		80.2	81.4	78.2	82.3	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	----	----	----	<2.0
aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	6.5	<5.0	11.1	----
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	----
antimony	7440-36-0	E440	0.010	mg/kg		----	----	----	----	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		----	----	----	----	0.156
arsenic	7440-38-2	E472	0.030	mg/kg		0.237	0.208	0.211	0.283	----
barium	7440-39-3	E472	0.050	mg/kg		0.488	0.683	0.911	1.88	----
barium	7440-39-3	E440	0.050	mg/kg		----	----	----	----	0.804
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
beryllium	7440-41-7	E440	0.010	mg/kg		----	----	----	----	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
bismuth	7440-69-9	E440	0.010	mg/kg		----	----	----	----	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
boron	7440-42-8	E440	1.0	mg/kg		----	----	----	----	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	----	----	<0.0050
cadmium	7440-43-9	E472	0.010	mg/kg		0.618	0.643	0.587	0.729	----
calcium	7440-70-2	E472	20	mg/kg		611	490	510	604	----
calcium	7440-70-2	E440	20	mg/kg		----	----	----	----	601
cesium	7440-46-2	E472	0.0050	mg/kg		0.0359	0.0402	0.0394	0.0420	----
cesium	7440-46-2	E440	0.0050	mg/kg		----	----	----	----	0.161
chromium	7440-47-3	E440	0.050	mg/kg		----	----	----	----	0.058
chromium	7440-47-3	E472	0.20	mg/kg		0.25	0.34	<0.20	0.53	----
cobalt	7440-48-4	E472	0.020	mg/kg		0.423	1.69	0.818	0.709	----
cobalt	7440-48-4	E440	0.020	mg/kg		----	----	----	----	<0.020
copper	7440-50-8	E440	0.10	mg/kg		----	----	----	----	1.42
copper	7440-50-8	E472	0.20	mg/kg		8.08	8.02	7.24	7.54	----
iron	7439-89-6	E440	3.0	mg/kg		----	----	----	----	17.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Ki-5_2022-05	BOL_RB-Ki-6_2022-05	BOL_RB-Ki-7_2022-05	BOL_RB-Ki-8_2022-05	POL_LSU-M-1_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	28-May-2022
						VA22B2820-061	VA22B2820-062	VA22B2820-063	VA22B2820-064	VA22B2820-065
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		721	689	749	634	----
lead	7439-92-1	E440	0.020	mg/kg		----	----	----	----	<0.020
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
lithium	7439-93-2	E440	0.50	mg/kg		----	----	----	----	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		776	839	689	752	----
magnesium	7439-95-4	E440	2.0	mg/kg		----	----	----	----	1800
manganese	7439-96-5	E472	0.050	mg/kg		4.58	3.98	4.77	3.05	----
manganese	7439-96-5	E440	0.050	mg/kg		----	----	----	----	0.726
mercury	7439-97-6	E511	0.0050	mg/kg		0.466	0.422	0.370	0.445	----
mercury	7439-97-6	E510	0.0050	mg/kg		----	----	----	----	0.286
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0923	0.0785	0.0806	0.0787	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	----	----	0.0610
molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	----	----	<0.020
molybdenum	7439-98-7	E472	0.040	mg/kg		0.390	0.500	0.400	0.680	----
nickel	7440-02-0	E472	0.20	mg/kg		0.22	0.41	0.22	0.51	----
nickel	7440-02-0	E440	0.20	mg/kg		----	----	----	----	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		13600	14700	12700	12900	----
phosphorus	7723-14-0	E440	10	mg/kg		----	----	----	----	13400
potassium	7440-09-7	E472	20	mg/kg		14200	14600	12600	13100	----
potassium	7440-09-7	E440	20	mg/kg		----	----	----	----	23800
rubidium	7440-17-7	E472	0.050	mg/kg		7.91	9.45	8.05	8.99	----
rubidium	7440-17-7	E440	0.050	mg/kg		----	----	----	----	15.8
selenium	7782-49-2	E440	0.050	mg/kg		----	----	----	----	6.79
selenium	7782-49-2	E472	0.10	mg/kg		7.82	8.88	8.29	10.8	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0279	0.0184	0.0066	0.0066	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	----	----	<0.0050
sodium	7440-23-5	E472	20	mg/kg		9500	9790	6940	10200	----
sodium	7440-23-5	E440	20	mg/kg		----	----	----	----	1420
strontium	7440-24-6	E440	0.050	mg/kg		----	----	----	----	0.484

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_RB-Ki-5_2022-05	BOL_RB-Ki-6_2022-05	BOL_RB-Ki-7_2022-05	BOL_RB-Ki-8_2022-05	POL_LSU-M-1_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	28-May-2022
						VA22B2820-061	VA22B2820-062	VA22B2820-063	VA22B2820-064	VA22B2820-065
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		2.11	1.74	1.69	2.26	----
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
tellurium	13494-80-9	E440	0.020	mg/kg		----	----	----	----	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0636	0.0710	0.0628	0.0578	----
thallium	7440-28-0	E440	0.0020	mg/kg		----	----	----	----	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	0.87	----
tin	7440-31-5	E440	0.10	mg/kg		----	----	----	----	0.23
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	----	----	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	0.64	<0.50	0.57	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.0064	0.0083	0.0074	0.0156	----
uranium	7440-61-1	E440	0.0020	mg/kg		----	----	----	----	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		0.16	0.26	0.28	0.63	----
vanadium	7440-62-2	E440	0.10	mg/kg		----	----	----	----	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		----	----	----	----	38.5
zinc	7440-66-6	E472	1.0	mg/kg		272	321	164	136	----
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
zirconium	7440-67-7	E440	0.20	mg/kg		----	----	----	----	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-M-2_ 2022-05	POL_LSU-M-3_ 2022-05	POL_LSU-M-4_ 2022-05	POL_LSU-M-5_ 2022-05	POL_LSU-M-6_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2820-066	VA22B2820-067	VA22B2820-068	VA22B2820-069	VA22B2820-070
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		74.1	79.2	77.9	78.5	77.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		2.4	<2.0	<2.0	3.5	4.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.145	0.092	0.110	0.144	0.184
barium	7440-39-3	E440	0.050	mg/kg		0.976	0.922	0.804	1.01	0.725
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
calcium	7440-70-2	E440	20	mg/kg		238	433	913	844	698
cesium	7440-46-2	E440	0.0050	mg/kg		0.0446	0.162	0.148	0.0937	0.136
chromium	7440-47-3	E440	0.050	mg/kg		0.095	0.075	<0.050	0.116	0.210
cobalt	7440-48-4	E440	0.020	mg/kg		0.046	0.022	<0.020	<0.020	<0.020
copper	7440-50-8	E440	0.10	mg/kg		7.48	5.91	2.48	2.27	3.17
iron	7439-89-6	E440	3.0	mg/kg		90.4	64.7	31.5	22.2	30.5
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E440	2.0	mg/kg		775	1240	1500	1550	1430
manganese	7439-96-5	E440	0.050	mg/kg		1.11	0.832	1.38	1.49	1.37
mercury	7439-97-6	E510	0.0050	mg/kg		0.291	0.315	0.327	0.283	0.237
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0755	0.0656	0.0723	0.0610	0.0546
molybdenum	7439-98-7	E440	0.020	mg/kg		0.073	0.045	0.046	0.022	0.020
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E440	10	mg/kg		9630	12200	12700	12800	11600
potassium	7440-09-7	E440	20	mg/kg		11800	19700	22600	21600	20200
rubidium	7440-17-7	E440	0.050	mg/kg		10.0	14.0	16.9	11.9	13.0
selenium	7782-49-2	E440	0.050	mg/kg		5.80	9.59	8.68	8.02	8.33
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E440	20	mg/kg		2050	1920	1660	1790	1420

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-M-2_ 2022-05	POL_LSU-M-3_ 2022-05	POL_LSU-M-4_ 2022-05	POL_LSU-M-5_ 2022-05	POL_LSU-M-6_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2820-066	VA22B2820-067	VA22B2820-068	VA22B2820-069	VA22B2820-070
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E440	0.050	mg/kg		0.278	0.413	1.15	0.950	0.744
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E440	0.10	mg/kg		0.47	0.32	0.21	0.51	0.70
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	0.27
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		123	71.2	40.3	52.3	51.8
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	0.28

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-M-7_ 2022-05	POL_LSU-M-8_ 2022-05	----	----	----
					Client sampling date / time	28-May-2022	28-May-2022	----	----	----
						VA22B2820-071	VA22B2820-072	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
moisture	----	E144	0.50	%		77.7	76.0	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	7.2	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.105	0.101	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		0.836	0.654	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
calcium	7440-70-2	E440	20	mg/kg		1060	528	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.100	0.0821	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.068	0.234	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		3.39	3.01	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		33.9	37.7	----	----	----
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	----	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		1370	1350	----	----	----
manganese	7439-96-5	E440	0.050	mg/kg		1.50	0.985	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.258	0.231	----	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0576	0.0556	----	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		0.027	0.023	----	----	----
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	----	----	----
phosphorus	7723-14-0	E440	10	mg/kg		12700	11200	----	----	----
potassium	7440-09-7	E440	20	mg/kg		22700	19200	----	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		16.1	13.8	----	----	----
selenium	7782-49-2	E440	0.050	mg/kg		6.78	8.74	----	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
sodium	7440-23-5	E440	20	mg/kg		1870	1740	----	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	POL_LSU-M-7_2022-05	POL_LSU-M-8_2022-05	----	----	----
					Client sampling date / time	28-May-2022	28-May-2022	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B2820-071	VA22B2820-072	--------	--------	--------
						Result	Result	----	----	----
Metals										
strontium	7440-24-6	E440	0.050	mg/kg		1.53	0.555	----	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	----	----	----
tin	7440-31-5	E440	0.10	mg/kg		0.25	0.73	----	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	----	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	----	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	----	----	----
zinc	7440-66-6	E440	0.50	mg/kg		47.3	34.4	----	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	0.26	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B2820**	Page	: 1 of 56
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Issue Date	: 05-Dec-2022 22:21
C-O-C number	: ----		
Sampler	: LBO		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 72		
No. of samples analysed	: 72		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	chromium	7440-47-3	E472	0.41 % DUP-H, J	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*
J	*Duplicate results and limits are expressed in terms of absolute difference.*

Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG8-562335002	----	boron	7440-42-8	E472	72.6 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG8-562335002	----	lithium	7439-93-2	E472	76.0 % MES	80.0-120%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Sample								
Metals	QC-MRG8-562335003	----	lead	7439-92-1	E472	69.9 % MES	70.0-130%	Recovery less than lower control limit
Metals	QC-MRG8-562256003	----	nickel	7440-02-0	E472	136 % MES	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-1_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-2_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-3_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-4_2022-05	E511	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-5_2022-05	E511	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-6_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-7_2022-05	E511	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-O-5_2022-05	E511	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-O-7_2022-05	E511	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-2_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-3_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-4_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-5_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-6_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-7_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-8_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-2_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-3_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-4_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-5_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-6_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-7_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-8_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-O-2_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-O-4_2022-05	E511	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-O-5_2022-05	E511	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E511	28-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-1_2022-05	E511	28-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-1_2022-05	E511	28-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-1_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-Ki-1_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-Li-1_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-Li-2_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-Li-8_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-M-8_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-2_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-3_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-4_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-6_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-8_2022-05	E510	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-6_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-7_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-8_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-3_2022-05	E510	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-6_2022-05	E510	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-7_2022-05	E510	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-8_2022-05	E510	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-1_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-2_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-3_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-4_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-5_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-1_2022-05	E510	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E511A	30-May-2022	18-Oct-2022	----	----		18-Oct-2022	365 days	142 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-4_2022-05	E511A	30-May-2022	18-Oct-2022	----	----		18-Oct-2022	365 days	142 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-1_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-2_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-3_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-5_2022-05	E511A	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-6_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-7_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-O-5_2022-05	E511A	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-O-7_2022-05	E511A	30-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-2_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-3_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-4_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-5_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-6_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-7_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-8_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-2_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-3_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-4_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-5_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-6_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-7_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-8_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-O-2_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-O-4_2022-05	E511A	29-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-O-5_2022-05	E511A	29-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E511A	28-May-2022	20-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-1_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-1_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		21-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-1_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-Ki-1_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-Li-1_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-Li-2_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-Li-8_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-M-8_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-2_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-3_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-4_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-6_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-8_2022-05	E510A	30-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-6_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-7_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-8_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-3_2022-05	E510A	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-6_2022-05	E510A	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-7_2022-05	E510A	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-8_2022-05	E510A	29-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-1_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-2_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-3_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-4_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-5_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-1_2022-05	E510A	28-May-2022	18-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-1_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-2_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-3_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-4_2022-05	E472	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-5_2022-05	E472	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-6_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-5_2022-05	E472	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-7_2022-05	E472	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-2_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-3_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-4_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-5_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-7_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-8_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-3_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-4_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-5_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-6_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-7_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-8_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-2_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4_2022-05	E472	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-5_2022-05	E472	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E472	28-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-1_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-1_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-1_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-6_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-7_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Ki-1_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-1_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-2_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-8_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-M-8_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-2_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-3_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-4_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-6_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8_2022-05	E440	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-3_2022-05	E440	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-6_2022-05	E440	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7_2022-05	E440	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-8_2022-05	E440	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-1_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-2_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-3_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-4_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-5_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-1_2022-05	E440	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-1_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-2_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-3_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-4_2022-05	E472.Ag	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-5_2022-05	E472.Ag	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-6_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-5_2022-05	E472.Ag	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-7_2022-05	E472.Ag	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-2_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-3_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-4_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-5_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-7_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-8_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-3_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-4_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-5_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-6_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-7_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-8_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-2_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4_2022-05	E472.Ag	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-5_2022-05	E472.Ag	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E472.Ag	28-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-1_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-1_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-1_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-6_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-7_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Ki-1_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-1_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-2_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-8_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-M-8_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-2_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-3_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-4_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-6_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8_2022-05	E440.Ag	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-3_2022-05	E440.Ag	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-6_2022-05	E440.Ag	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7_2022-05	E440.Ag	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-8_2022-05	E440.Ag	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-1_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-2_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-3_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-4_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-5_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-1_2022-05	E440.Ag	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-1_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-2_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-3_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-4_2022-05	E472.Ti	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-5_2022-05	E472.Ti	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-6_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-5_2022-05	E472.Ti	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-O-7_2022-05	E472.Ti	30-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-2_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-3_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-4_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-5_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-7_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-8_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-3_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-4_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-5_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-6_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-7_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-8_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-2_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4_2022-05	E472.Ti	29-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-5_2022-05	E472.Ti	29-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E472.Ti	28-May-2022	20-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-1_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-1_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	54 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-1_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-6_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-7_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Ki-1_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-1_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-2_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-Li-8_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-M-8_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-2_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-3_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-4_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-6_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8_2022-05	E440.Ti	30-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	50 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-3_2022-05	E440.Ti	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-6_2022-05	E440.Ti	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7_2022-05	E440.Ti	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-8_2022-05	E440.Ti	29-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-1_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-2_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-3_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-4_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-5_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-1_2022-05	E440.Ti	28-May-2022	18-Jul-2022	----	----		18-Jul-2022	730 days	52 days	✓
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-2_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-3_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-4_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-5_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-6_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-7_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Ki-8_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Li-3_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Li-4_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Li-5_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Li-6_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-Li-7_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-1_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-2_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-3_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-4_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-5_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-6_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-7_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-O-5_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-O-7_2022-05	E144-H	30-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-1_2022-05	E144-H	28-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-2_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-3_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-4_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-5_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-6_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-7_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-8_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-1_2022-05	E144-H	28-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-2_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-3_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-4_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-5_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-6_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-7_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-8_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-1_2022-05	E144-H	28-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-2_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-3_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-4_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-5_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-6_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-7_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-8_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-O-2_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-O-4_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-O-5_2022-05	E144-H	29-May-2022	----	----	----		14-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-Ki-1_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-Li-1_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-Li-2_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-Li-8_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-M-8_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-1_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-2_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-3_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-4_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-6_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-8_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-1_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-2_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-3_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-4_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-5_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-6_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-7_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-8_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-1_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-3_2022-05	E144	29-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-6_2022-05	E144	29-May-2022	----	----	----		08-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-7_2022-05	E144	29-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-8_2022-05	E144	29-May-2022	----	----	----		08-Jul-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✗ = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562251	4	68	5.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554213	2	40	5.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562252	4	68	5.8	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554211	2	40	5.0	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562253	6	68	8.8	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554210	2	40	5.0	5.0	✓
Moisture Content by Gravimetry	E144	554200	3	28	10.7	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	4	68	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562249	4	68	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554212	2	40	5.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562250	4	68	5.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554214	2	40	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562251	8	68	11.7	10.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554213	4	40	10.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562252	10	68	14.7	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554211	4	40	10.0	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562253	8	68	11.7	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554210	4	40	10.0	10.0	✓
Moisture Content by Gravimetry	E144	554200	3	28	10.7	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	4	68	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562249	8	68	11.7	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554212	4	40	10.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562250	4	68	5.8	10.0	✗
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554214	2	40	5.0	10.0	✗
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562251	4	68	5.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554213	2	40	5.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562252	5	68	7.3	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554211	2	40	5.0	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562253	5	68	7.3	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554210	2	40	5.0	5.0	✓
Moisture Content by Gravimetry	E144	554200	3	28	10.7	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	4	68	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562249	4	68	5.8	5.0	✓

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554212	2	40	5.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562250	4	68	5.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554214	2	40	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at <60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Micro)	E511A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22B2820**	Page	: 1 of 34
Amendment	: **1**		
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 08-Jul-2022
C-O-C number	: ----	Issue Date	: 05-Dec-2022 22:21
Sampler	: LBO ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 72		
No. of samples analysed	: 72		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 554200)											
VA22B2820-015	POL_RB-O-7_2022-05	moisture	----	E144	0.50	%	66.5	67.1	0.898%	20%	----
Physical Tests (QC Lot: 554201)											
VA22B2820-071	POL_LSU-M-7_2022-05	moisture	----	E144	0.50	%	77.7	77.5	0.265%	20%	----
Physical Tests (QC Lot: 554262)											
VA22B2821-061	Anonymous	moisture	----	E144	0.50	%	61.8	62.1	0.420%	20%	----
Physical Tests (QC Lot: 559468)											
VA22B2821-013	Anonymous	moisture	----	E144-H	2.0	%	78.4	78.0	0.409%	20%	----
Physical Tests (QC Lot: 559474)											
VA22B2820-054	BOL_RB-Li-6_2022-05	moisture	----	E144-H	2.0	%	79.1	79.4	0.391%	20%	----
Physical Tests (QC Lot: 562243)											
VA22B2820-002	POL_RB-M-2_2022-05	moisture	----	E144-H	2.0	%	81.1	81.2	0.228%	20%	----
Physical Tests (QC Lot: 562254)											
VA22B2820-020	POL_RB-Li-4_2022-05	moisture	----	E144-H	2.0	%	75.6	76.0	0.454%	20%	----
Metals (QC Lot: 554210)											
VA22B2820-015	POL_RB-O-7_2022-05	aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.042	0.038	0.005	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	0.265	0.267	1.02%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	1150	1140	0.478%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0228	0.0230	0.0002	Diff <2x LOR	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.055	0.075	0.020	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.110	0.115	4.23%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	8.28	8.54	3.01%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	64.1	64.1	0.00703%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554210) - continued											
VA22B2820-015	POL_RB-O-7_2022-05	magnesium	7439-95-4	E440	2.0	mg/kg	1520	1500	1.39%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	3.09	3.06	1.22%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.050	0.061	0.011	Diff <2x LOR	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	12200	11800	3.79%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	7660	7870	2.82%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	4.60	4.72	2.68%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	7.64	7.66	0.320%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	3150	3260	3.25%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	3.10	3.11	0.530%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	0.12	0.13	0.005	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	66.2	75.6	13.2%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 554211)											
VA22B2820-015	POL_RB-O-7_2022-05	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0044	0.0053	0.0010	Diff <2x LOR	----
Metals (QC Lot: 554212)											
VA22B2820-015	POL_RB-O-7_2022-05	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 554213)											
VA22B2820-015	POL_RB-O-7_2022-05	mercury	7439-97-6	E510	0.0050	mg/kg	0.0130	0.0160	0.0029	Diff <2x LOR	----
Metals (QC Lot: 554214)											
VA22B2820-015	POL_RB-O-7_2022-05	titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 554356)											
VA22B2821-044	Anonymous	aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E440	0.010	mg/kg	0.020	0.021	0.001	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.125	0.132	5.15%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	0.119	0.106	0.013	Diff <2x LOR	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.411	0.430	4.66%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554356) - continued											
VA22B2821-044	Anonymous	calcium	7440-70-2	E440	20	mg/kg	354	366	3.48%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0164	0.0166	0.0003	Diff <2x LOR	----
		chromium	7440-47-3	E440	0.050	mg/kg	<0.050	0.055	0.005	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.102	0.108	6.56%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	9.52	9.63	1.14%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	147	150	2.17%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	930	948	1.98%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	9.72	9.83	1.10%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.939	0.951	1.25%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	14800	15200	2.91%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	12800	12900	0.616%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	7.77	7.88	1.44%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	6.92	7.17	3.50%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	8080	8290	2.59%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	0.864	0.855	1.03%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	0.39	0.42	0.03	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0040	0.0043	0.0003	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.22	0.22	0.006	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	70.0	72.4	3.30%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 554357)											
VA22B2821-044	Anonymous	mercury	7439-97-6	E510A	0.0011	mg/kg wwt	0.0358	0.0363	1.56%	40%	----
Metals (QC Lot: 554358)											
VA22B2821-044	Anonymous	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0091	0.0088	0.0003	Diff <2x LOR	----
Metals (QC Lot: 554359)											
VA22B2821-044	Anonymous	mercury	7439-97-6	E510	0.0054	mg/kg	0.200	0.203	1.56%	40%	----
Metals (QC Lot: 554360)											
VA22B2821-044	Anonymous	titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 562249)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562249) - continued											
VA22B2820-002	POL_RB-M-2_2022-05	silver	7440-22-4	E472.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 562250)											
VA22B2820-002	POL_RB-M-2_2022-05	titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 562251)											
VA22B2820-002	POL_RB-M-2_2022-05	mercury	7439-97-6	E511	0.0050	mg/kg	0.991	0.977	1.42%	40%	----
Metals (QC Lot: 562252)											
VA22B2820-002	POL_RB-M-2_2022-05	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.188	0.185	1.42%	40%	----
Metals (QC Lot: 562253)											
VA22B2820-002	POL_RB-M-2_2022-05	aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		barium	7440-39-3	E472	0.050	mg/kg	0.582	0.701	18.6%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		calcium	7440-70-2	E472	20	mg/kg	1470	1260	15.5%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.112	0.107	4.30%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.020	<0.020	0.0005	Diff <2x LOR	----
		copper	7440-50-8	E472	0.20	mg/kg	1.84	2.02	9.70%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	48.2	47.8	0.919%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1300	1150	12.2%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	1.24	1.10	11.3%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	<0.040	<0.040	0	Diff <2x LOR	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	15200	14300	5.66%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	26700	25200	5.75%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	18.5	17.4	5.92%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	7.41	7.29	1.54%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	1550	1480	4.68%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	1.71	1.48	14.4%	60%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562253) - continued											
VA22B2820-002	POL_RB-M-2_2022-05	tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0036	0.0034	0.0001	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	0.95	1.29	30.3%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	21.3	20.2	5.29%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 562259)											
VA22B2820-020	POL_RB-Li-4_2022-05	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0492	0.0493	0.195%	40%	----
Metals (QC Lot: 562260)											
VA22B2820-020	POL_RB-Li-4_2022-05	titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 562261)											
VA22B2820-020	POL_RB-Li-4_2022-05	mercury	7439-97-6	E511	0.0050	mg/kg	0.536	0.498	7.15%	40%	----
Metals (QC Lot: 562262)											
VA22B2820-020	POL_RB-Li-4_2022-05	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.130	0.121	7.15%	40%	----
Metals (QC Lot: 562263)											
VA22B2820-020	POL_RB-Li-4_2022-05	arsenic	7440-38-2	E472	0.030	mg/kg	0.075	0.068	0.007	Diff <2x LOR	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.32	0.27	0.04	Diff <2x LOR	----
VA22B2820-020	POL_RB-Li-4_2022-05	aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		barium	7440-39-3	E472	0.050	mg/kg	0.786	0.686	13.6%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.109	0.101	7.91%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	337	287	16.2%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0432	0.0397	8.42%	40%	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.120	0.098	20.6%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	18.2	17.4	4.88%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	1880	1860	1.22%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	859	797	7.41%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	12.3	10.7	14.2%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562263) - continued											
VA22B2820-020	POL_RB-Li-4_2022-05	molybdenum	7439-98-7	E472	0.040	mg/kg	0.934	0.897	4.07%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	0.39	<0.20	0.19	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	14600	13800	5.38%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	11600	10900	6.44%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	7.21	6.47	10.8%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	15.6	14.8	4.59%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	3780	3420	10.0%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	0.50	0.44	13.4%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0751	0.0692	8.12%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	1.89	1.75	7.70%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0027	0.0025	0.0001	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.40	0.38	0.02	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	178	160	10.8%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.30	0.28	0.02	Diff <2x LOR	----
Metals (QC Lot: 562338)											
VA22B2821-013	Anonymous	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0209	0.0205	0.0004	Diff <2x LOR	----
Metals (QC Lot: 562339)											
VA22B2821-013	Anonymous	titanium	7440-32-6	E472.Ti	0.50	mg/kg	0.89	0.84	0.05	Diff <2x LOR	----
Metals (QC Lot: 562340)											
VA22B2821-013	Anonymous	mercury	7439-97-6	E511	0.0050	mg/kg	0.0728	0.0708	2.79%	40%	----
Metals (QC Lot: 562341)											
VA22B2821-013	Anonymous	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0157	0.0156	1.01%	40%	----
Metals (QC Lot: 562342)											
VA22B2821-013	Anonymous	barium	7440-39-3	E472	0.050	mg/kg	1.25	1.12	10.4%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	319	289	9.93%	60%	----
		magnesium	7439-95-4	E472	2.0	mg/kg	920	899	2.24%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	12.0	10.7	11.3%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	1.03	0.72	35.3%	60%	----
VA22B2821-013	Anonymous	aluminum	7429-90-5	E472	5.0	mg/kg	14.9	18.9	4.0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.016	0.012	0.003	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.188	0.186	1.07%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562342) - continued											
VA22B2821-013	Anonymous	boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.114	0.115	0.912%	40%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0223	0.0222	0.00004	Diff <2x LOR	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.62	# 1.03	0.41	Diff <2x LOR	DUP-H,J
		cobalt	7440-48-4	E472	0.020	mg/kg	0.108	0.108	0.362%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	56.0	51.6	8.11%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	160	165	2.72%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	1.39	1.36	2.13%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	17200	13900	21.2%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	13400	13200	1.92%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	9.41	9.35	0.582%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	11.0	10.9	0.626%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	5320	5210	2.15%	40%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	0.59	0.62	5.19%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.30	0.29	0.009	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	116	114	0.826%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 562350)											
VA22B2820-054	BOL_RB-Li-6_2022-05	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.283	0.285	0.457%	40%	----
Metals (QC Lot: 562351)											
VA22B2820-054	BOL_RB-Li-6_2022-05	titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 562352)											
VA22B2820-054	BOL_RB-Li-6_2022-05	mercury	7439-97-6	E511	0.0050	mg/kg	0.264	0.261	1.31%	40%	----
Metals (QC Lot: 562353)											
VA22B2820-054	BOL_RB-Li-6_2022-05	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0552	0.0544	1.31%	40%	----
Metals (QC Lot: 562354)											
VA22B2820-054	BOL_RB-Li-6_2022-05	aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562354) - continued											
VA22B2820-054	BOL_RB-Li-6_2022-05	arsenic	7440-38-2	E472	0.030	mg/kg	0.042	0.041	0.001	Diff <2x LOR	----
		barium	7440-39-3	E472	0.050	mg/kg	0.822	0.857	4.19%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.142	0.143	0.416%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	322	333	3.49%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0295	0.0305	3.37%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.22	<0.20	0.02	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.112	0.106	5.16%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	22.1	22.7	3.04%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	1820	1780	2.10%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	834	821	1.56%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	6.15	6.26	1.77%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.866	0.870	0.386%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	16300	16400	0.242%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	14400	14600	0.785%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	9.74	9.86	1.24%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	9.16	8.89	3.08%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	7200	7230	0.502%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	0.60	0.64	7.00%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.149	0.138	7.30%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	1.18	1.40	17.2%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0052	0.0052	0.00005	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.20	0.20	0.002	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	186	183	1.38%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.47	0.50	0.03	Diff <2x LOR	----

Qualifiers

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 554200)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 554201)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 554262)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 559468)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 559474)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 562243)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 562254)						
moisture	----	E144-H	2	%	<2.0	----
Metals (QCLot: 554210)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554210) - continued						
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 554211)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 554212)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554213)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554214)						
titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 554356)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554356) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 554357)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 554358)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554359)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554360)						
titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 562249)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562250)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562251)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562251) - continued						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562252)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562253)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562253) - continued						
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 562259)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562260)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562261)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562262)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562263)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562263) - continued						
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 562338)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562339)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562340)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562341)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562342)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562342) - continued						
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 562350)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562351)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562352)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562353)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562354)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562354) - continued						
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 701598)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 554200)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 554201)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 554262)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 559468)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 559474)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 562243)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 562254)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Metals (QCLot: 554210)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	108	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	103	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	106	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	104	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	99.8	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	106	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	100.0	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	99.1	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	99.6	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	108	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 554210) - continued									
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	99.9	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	105	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	99.0	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	107	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	108	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	106	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	108	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	108	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.6	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 554211)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.0	80.0	120	----
Metals (QCLot: 554212)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	91.8	80.0	120	----
Metals (QCLot: 554213)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.0	80.0	120	----
Metals (QCLot: 554214)									
titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	101	80.0	120	----
Metals (QCLot: 554356)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	107	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	104	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	96.6	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	101	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 554356) - continued									
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	101	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	101	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	102	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	105	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	103	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	103	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	97.7	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	104	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	96.8	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	105	80.0	120	----
Metals (QCLot: 554357)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.1	80.0	120	----
Metals (QCLot: 554358)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	96.2	80.0	120	----
Metals (QCLot: 554359)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.1	80.0	120	----
Metals (QCLot: 554360)									
titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	103	80.0	120	----
Metals (QCLot: 562249)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	90.8	80.0	120	----
Metals (QCLot: 562250)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	103	80.0	120	----
Metals (QCLot: 562251)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	100	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562252)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	100	80.0	120	----
Metals (QCLot: 562253)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	99.6	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	96.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	105	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	98.7	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	99.7	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	98.7	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	98.5	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	102	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	96.7	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	98.4	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	101	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	108	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	99.5	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	101	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	104	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	101	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	100	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	101	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	101	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	96.8	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	105	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	95.2	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	104	80.0	120	----
Metals (QCLot: 562259)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562259) - continued									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	89.9	80.0	120	----
Metals (QCLot: 562260)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	101	80.0	120	----
Metals (QCLot: 562261)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	91.7	80.0	120	----
Metals (QCLot: 562262)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	91.7	80.0	120	----
Metals (QCLot: 562263)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	101	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	104	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	98.4	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	95.9	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	95.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	99.5	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	98.6	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	97.2	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	100	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	99.0	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	97.0	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	96.5	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	97.3	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	97.3	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	96.2	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	95.8	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	98.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	105	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	97.3	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	107	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	98.1	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	100	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	97.9	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	99.0	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	99.4	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	95.3	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562263) - continued									
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	99.3	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	96.7	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 562338)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	80.4	80.0	120	----
Metals (QCLot: 562339)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	89.2	80.0	120	----
Metals (QCLot: 562340)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	85.2	80.0	120	----
Metals (QCLot: 562341)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	85.2	80.0	120	----
Metals (QCLot: 562342)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	92.7	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	93.1	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	95.1	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	91.1	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	85.8	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	91.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	# 72.6	80.0	120	MES
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	88.4	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	87.2	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	92.0	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	89.5	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	87.9	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	87.0	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	88.5	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	90.3	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	# 76.0	80.0	120	MES
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	89.9	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	89.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	93.7	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	87.8	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	82.0	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	90.3	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562342) - continued									
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	92.1	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	88.5	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	89.6	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	91.8	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	88.6	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	92.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	92.9	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	94.4	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	91.8	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	87.1	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	95.2	80.0	120	----
Metals (QCLot: 562350)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	85.1	80.0	120	----
Metals (QCLot: 562351)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	94.9	80.0	120	----
Metals (QCLot: 562352)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	89.8	80.0	120	----
Metals (QCLot: 562353)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	89.8	80.0	120	----
Metals (QCLot: 562354)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	96.0	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	97.4	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	93.4	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	93.4	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	89.3	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	95.1	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	92.1	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.1	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	95.3	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	93.0	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	90.3	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	89.4	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	93.2	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	91.5	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	93.7	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562354) - continued									
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	92.6	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	93.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	99.6	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	90.2	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	101	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	94.1	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	95.8	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	91.6	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	93.7	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	95.4	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	94.7	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	90.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	98.1	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	92.6	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	95.8	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	89.1	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	96.2	80.0	120	----
Metals (QCLot: 701598)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	91.7	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554210)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	100	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	104	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	131	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	99.0	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	107	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	103	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	104	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	95.6	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	103	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	102	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	104	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	104	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	102	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	101	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	105	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	106	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	108	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	100	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	109	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	104	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	101	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	103	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	110	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	99.6	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	104	70.0	130	----
Metals (QCLot: 554211)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	114	70.0	130	----
Metals (QCLot: 554212)									

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554212) - continued									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	99.0	70.0	130	----
Metals (QCLot: 554213)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	114	70.0	130	----
Metals (QCLot: 554356)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	102	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	102	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	85.2	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	95.5	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	101	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	104	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	110	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	97.1	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	101	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	101	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	97.8	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	100	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	100	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	102	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	97.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	101	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	102	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	98.7	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	103	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	99.8	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	100	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	86.7	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	108	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	99.2	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	98.9	70.0	130	----
Metals (QCLot: 554357)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	114	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554358)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	102	70.0	130	----
Metals (QCLot: 554359)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	114	70.0	130	----
Metals (QCLot: 562249)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	87.0	70.0	130	----
Metals (QCLot: 562251)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	102	70.0	130	----
Metals (QCLot: 562252)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	102	70.0	130	----
Metals (QCLot: 562253)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	86.2	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	98.3	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	70.4	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	91.5	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	93.3	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	91.7	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	88.9	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	90.3	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	93.6	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	93.8	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	78.8	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	96.7	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	96.2	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	92.9	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	73.8	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	99.0	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	93.4	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	94.9	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	94.7	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	89.1	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	85.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 562253) - continued									
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	96.7	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	94.8	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	93.2	70.0	130	----
Metals (QCLot: 562259)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	88.8	70.0	130	----
Metals (QCLot: 562261)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	106	70.0	130	----
Metals (QCLot: 562262)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	106	70.0	130	----
Metals (QCLot: 562263)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	93.8	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	95.9	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	73.8	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	90.2	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	101	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.3	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	108	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	90.1	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	90.8	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	92.8	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	119	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	95.1	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	93.2	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	99.3	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	# 136	70.0	130	MES
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	98.4	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	96.6	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	89.5	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	96.2	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	93.8	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	96.7	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562263) - continued									
	RM	thallium	7440-28-0	E472	0.013 mg/kg	92.7	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	95.5	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	92.6	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	94.6	70.0	130	----
Metals (QCLot: 562338)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	80.1	70.0	130	----
Metals (QCLot: 562340)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	94.9	70.0	130	----
Metals (QCLot: 562341)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	94.9	70.0	130	----
Metals (QCLot: 562342)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	125	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	89.3	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	64.1	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	81.8	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	81.1	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	85.8	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	85.0	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	82.0	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	83.8	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	86.8	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	# 69.9	70.0	130	MES
	RM	magnesium	7439-95-4	E472	940 mg/kg	86.3	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	85.3	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	85.4	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	73.9	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	76.8	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	90.3	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	84.1	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	87.1	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	84.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562342) - continued									
	RM	strontium	7440-24-6	E472	3.92 mg/kg	83.6	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	80.1	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	90.1	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	85.2	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	86.7	70.0	130	----
Metals (QCLot: 562350)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	88.6	70.0	130	----
Metals (QCLot: 562352)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	102	70.0	130	----
Metals (QCLot: 562353)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	102	70.0	130	----
Metals (QCLot: 562354)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	88.3	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	97.0	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	84.2	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	89.0	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	98.8	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.4	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	84.7	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	84.9	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	90.7	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	93.1	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	78.8	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	92.9	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	93.2	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	95.1	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	84.0	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	99.4	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.9	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	91.9	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	93.3	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562354) - continued									
	RM	sodium	7440-23-5	E472	10673 mg/kg	93.6	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	93.0	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	82.8	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	94.1	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	91.9	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	91.6	70.0	130	----
Metals (QCLot: 701598)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	106	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 1 of 12

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2: kivens@mountpolley.com	
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2: kala.ivens@mountpolley.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	2820	ALS Contact: Can Dang	Sampler: LBO

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
1	POL_RB-M-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
2	POL_RB-M-2_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
3	POL_RB-M-3_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
4	POL_RB-M-4_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
5	POL_RB-M-5_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
6	POL_RB-M-6_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
7	POL_RB-M-7_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
8	POL_RB-M-8_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
9	POL_RB-O-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
10	POL_RB-O-2_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
11	POL_RB-O-3_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
12	POL_RB-O-4_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1

Environmental Division
Vancouver
Work Order Reference
VA22B2820

Telephone : +1 604 253 4188

Charge to ground
X1 cooler

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ ☐	If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3
Are samples for human drinking water use? ☐ ☐	

SAMPLE CONDITION AS REC

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☑ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
0.4			8	5	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	7-June-22	12:00				IT	Jun 8/22	10:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: LBo

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
13	POL_RB-O-5_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
14	POL_RB-O-6_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
15	POL_RB-O-7_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
16	POL_RB-O-8_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
17	POL_RB-Li-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
18	POL_RB-Li-2_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
19	POL_RB-Li-3_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
20	POL_RB-Li-4_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
21	POL_RB-Li-5_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
22	POL_RB-Li-6_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
23	POL_RB-Li-7_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
24	POL_RB-Li-8_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	7-June-22	12:00				IT	Jun 8/22	10:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 3 of 12

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2: kivens@mountpolley.com	
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2: kala.ivens@mountpolley.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: LBo

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
25	POL_RB-Ki-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
26	POL_RB-Ki-2_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
27	POL_RB-Ki-3_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
28	POL_RB-Ki-4_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
29	POL_RB-Ki-5_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
30	POL_RB-Ki-6_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
31	POL_RB-Ki-7_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
32	POL_RB-Ki-8_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
33	BOL_RB-M-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
34	BOL_RB-M-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
35	BOL_RB-M-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
36	BOL_RB-M-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ ☐		Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human drinking water use? ☐ ☐	If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3	Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: IT	Date: Jun 8/22	Time: 10:30AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 4 of 12

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kivens@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: VA22-MPMC100-002

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang | Sampler: LBo

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
37	BOL_RB-M-5_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
38	BOL_RB-M-6_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
39	BOL_RB-M-7_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
40	BOL_RB-M-8_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
41	BOL_RB-O-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
42	BOL_RB-O-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
43	BOL_RB-O-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
44	BOL_RB-O-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
45	BOL_RB-O-5_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
46	BOL_RB-O-6_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
47	BOL_RB-O-7_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
48	BOL_RB-O-8_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: JT	Date: Jun 8/22	Time: 10:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 5 of 12

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: LBo

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
49	BOL_RB-Li-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
50	BOL_RB-Li-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
51	BOL_RB-Li-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
52	BOL_RB-Li-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
53	BOL_RB-Li-5_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
54	BOL_RB-Li-6_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
55	BOL_RB-Li-7_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
56	BOL_RB-Li-8_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
57	BOL_RB-Ki-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
58	BOL_RB-Ki-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
59	BOL_RB-Ki-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
60	BOL_RB-Ki-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	7-June-22	12:00				IT	Jun 8/22	10:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 6 of 12

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: LBO

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
61	BOL_RB-Ki-5_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
62	BOL_RB-Ki-6_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
63	BOL_RB-Ki-7_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
64	BOL_RB-Ki-8_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
65	POL_LSU-M-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
66	POL_LSU-M-2_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
67	POL_LSU-M-3_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
68	POL_LSU-M-4_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
69	POL_LSU-M-5_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
70	POL_LSU-M-6_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
71	POL_LSU-M-7_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
72	POL_LSU-M-8_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
		8	8

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: IT	Date: Jun 8/22	Time: 10:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

FISH TISSUE CHEMISTRY

ALS Laboratory Report VA22B2821

(Finalized December 5, 2022)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B2821**	Page	: 1 of 40
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 06-Jul-2022
C-O-C number	: ----	Issue Date	: 05-Dec-2022 14:06
Sampler	: LBO		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 68		
No. of samples analysed	: 68		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (05/12/2022): This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The mercury data for the following samples has been modified: VA22B2821-013, -027, -031, -057, -059, -060 and -064.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-O-1_ 2022-05	POL_LSU-O-2_ 2022-05	POL_LSU-O-3_ 2022-05	POL_LSU-O-4_ 2022-05	POL_LSU-O-5_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-001	VA22B2821-002	VA22B2821-003	VA22B2821-004	VA22B2821-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		64.3	68.3	62.5	63.8	63.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.078	0.063	0.042	0.047	0.047
barium	7440-39-3	E440	0.050	mg/kg		0.152	0.095	0.146	0.177	0.160
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	0.0058	<0.0050	<0.0050
calcium	7440-70-2	E440	20	mg/kg		537	546	421	525	414
cesium	7440-46-2	E440	0.0050	mg/kg		0.0162	0.0126	0.0145	0.0168	0.0115
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
cobalt	7440-48-4	E440	0.020	mg/kg		0.047	0.057	0.046	0.045	0.081
copper	7440-50-8	E440	0.10	mg/kg		3.07	3.22	3.54	3.45	4.12
iron	7439-89-6	E440	3.0	mg/kg		44.4	38.5	31.2	39.4	36.2
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E440	2.0	mg/kg		660	770	672	668	755
manganese	7439-96-5	E440	0.050	mg/kg		12.2	10.0	12.2	16.6	24.2
mercury	7439-97-6	E510	0.0050	mg/kg		0.0052	0.0119	0.0079	0.0070	0.0118
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0018	0.0038	0.0030	0.0025	0.0043
molybdenum	7439-98-7	E440	0.020	mg/kg		0.067	0.104	0.080	0.116	0.066
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E440	10	mg/kg		11600	12000	12400	12300	11700
potassium	7440-09-7	E440	20	mg/kg		6400	7190	6360	6590	5980
rubidium	7440-17-7	E440	0.050	mg/kg		5.53	6.37	6.06	6.34	4.61
selenium	7782-49-2	E440	0.050	mg/kg		8.25	8.14	8.83	8.96	8.90
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E440	20	mg/kg		2060	2580	1580	1780	1550

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-O-1_ 2022-05	POL_LSU-O-2_ 2022-05	POL_LSU-O-3_ 2022-05	POL_LSU-O-4_ 2022-05	POL_LSU-O-5_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-001	VA22B2821-002	VA22B2821-003	VA22B2821-004	VA22B2821-005
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E440	0.050	mg/kg		0.603	0.402	0.351	0.551	0.477
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.10	<0.10
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	0.14	0.14	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		96.4	91.9	90.1	86.8	83.3
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-O-6_ 2022-05	POL_LSU-O-7_ 2022-05	POL_LSU-O-8_ 2022-05	POL_LSU-Li-1_ 2022-05	POL_LSU-Li-2_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-006	VA22B2821-007	VA22B2821-008	VA22B2821-009	VA22B2821-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		63.0	63.0	63.7	76.7	76.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	3.0	2.3
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.032	0.045
arsenic	7440-38-2	E440	0.020	mg/kg		0.071	0.054	0.043	0.353	0.426
barium	7440-39-3	E440	0.050	mg/kg		0.165	0.327	0.134	0.311	0.152
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.394	0.715
calcium	7440-70-2	E440	20	mg/kg		442	464	445	190	165
cesium	7440-46-2	E440	0.0050	mg/kg		0.0206	0.0103	0.0113	0.0327	0.0234
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	0.115	0.092
cobalt	7440-48-4	E440	0.020	mg/kg		0.128	0.049	0.057	0.124	0.133
copper	7440-50-8	E440	0.10	mg/kg		4.02	3.50	4.00	71.8	79.5
iron	7439-89-6	E440	3.0	mg/kg		40.1	47.2	53.3	232	430
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E440	2.0	mg/kg		693	679	756	1230	1010
manganese	7439-96-5	E440	0.050	mg/kg		18.4	14.1	23.4	15.0	9.90
mercury	7439-97-6	E510	0.0050	mg/kg		0.0052	0.0070	0.0052	0.0708	0.172
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0019	0.0026	0.0019	0.0165	0.0400
molybdenum	7439-98-7	E440	0.020	mg/kg		0.072	0.067	0.090	2.35	2.44
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E440	10	mg/kg		12300	12200	12400	21000	18300
potassium	7440-09-7	E440	20	mg/kg		6400	5990	6400	17800	13900
rubidium	7440-17-7	E440	0.050	mg/kg		5.33	5.66	6.08	14.2	11.4
selenium	7782-49-2	E440	0.050	mg/kg		9.11	7.86	9.43	13.1	17.0
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0223	0.0851
sodium	7440-23-5	E440	20	mg/kg		1790	1700	1590	4100	3520

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-O-6_ 2022-05	POL_LSU-O-7_ 2022-05	POL_LSU-O-8_ 2022-05	POL_LSU-Li-1_ 2022-05	POL_LSU-Li-2_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-006	VA22B2821-007	VA22B2821-008	VA22B2821-009	VA22B2821-010
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E440	0.050	mg/kg		0.505	0.616	0.559	0.288	0.223
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.13	0.13	0.77	0.52
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0029
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.28	1.10
zinc	7440-66-6	E440	0.50	mg/kg		82.2	80.4	91.0	165	127
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-3_ 2022-05	POL_LSU-Li-4_ 2022-05	POL_LSU-Li-5_ 2022-05	POL_LSU-Li-6_ 2022-05	POL_LSU-Li-7_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-011	VA22B2821-012	VA22B2821-013	VA22B2821-014	VA22B2821-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.4	77.3	----	77.1	----
moisture	----	E144-H	2.0	%		----	----	78.4	----	77.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	7.7	----	<2.0	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	14.9	----	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	----	0.016	----	0.017
antimony	7440-36-0	E440	0.010	mg/kg		0.035	0.030	----	0.012	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.244	0.323	----	0.208	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	0.188	----	0.234
barium	7440-39-3	E472	0.050	mg/kg		----	----	1.25	----	0.659
barium	7440-39-3	E440	0.050	mg/kg		0.427	0.624	----	0.654	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	<0.010	----	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	----	<0.010	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	<0.010	----	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	----	0.015	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	<1.0	----	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	----	<1.0	----
cadmium	7440-43-9	E440	0.0050	mg/kg		0.630	0.233	----	0.212	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	0.114	----	0.253
calcium	7440-70-2	E472	20	mg/kg		----	----	319	----	218
calcium	7440-70-2	E440	20	mg/kg		209	329	----	162	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	0.0223	----	0.0226
cesium	7440-46-2	E440	0.0050	mg/kg		0.0309	0.0356	----	0.0216	----
chromium	7440-47-3	E440	0.050	mg/kg		0.073	0.129	----	0.255	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	0.62	----	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	0.108	----	0.112
cobalt	7440-48-4	E440	0.020	mg/kg		0.109	0.127	----	0.121	----
copper	7440-50-8	E440	0.10	mg/kg		56.0	43.6	----	110	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	56.0	----	56.9
iron	7439-89-6	E440	3.0	mg/kg		230	221	----	503	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-3_2022-05	POL_LSU-Li-4_2022-05	POL_LSU-Li-5_2022-05	POL_LSU-Li-6_2022-05	POL_LSU-Li-7_2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-011	VA22B2821-012	VA22B2821-013	VA22B2821-014	VA22B2821-015
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	160	----	389
lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.028	----	<0.020	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	<0.050	----	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	----	<0.50	----	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	----	<0.50	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	920	----	1040
magnesium	7439-95-4	E440	2.0	mg/kg		1270	1170	----	873	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	12.0	----	10.8
manganese	7439-96-5	E440	0.050	mg/kg		11.1	15.1	----	11.5	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	0.0728	----	0.0762
mercury	7439-97-6	E510	0.0050	mg/kg		0.0971	0.0848	----	0.0633	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	0.0157	----	0.0175
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0220	0.0192	----	0.0145	----
molybdenum	7439-98-7	E440	0.020	mg/kg		1.90	1.94	----	1.36	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	1.39	----	2.15
nickel	7440-02-0	E472	0.20	mg/kg		----	----	<0.20	----	<0.20
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	----	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg		----	----	17200	----	18500
phosphorus	7723-14-0	E440	10	mg/kg		20200	19000	----	14300	----
potassium	7440-09-7	E472	20	mg/kg		----	----	13400	----	14200
potassium	7440-09-7	E440	20	mg/kg		16400	14000	----	12900	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	9.41	----	12.7
rubidium	7440-17-7	E440	0.050	mg/kg		15.0	12.6	----	9.72	----
selenium	7782-49-2	E440	0.050	mg/kg		14.2	12.8	----	11.0	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	11.0	----	12.2
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	0.0209	----	0.0226
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0224	0.0172	----	0.0359	----
sodium	7440-23-5	E472	20	mg/kg		----	----	5320	----	4110
sodium	7440-23-5	E440	20	mg/kg		4520	5040	----	4600	----
strontium	7440-24-6	E440	0.050	mg/kg		0.291	0.698	----	0.310	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-3_ 2022-05	POL_LSU-Li-4_ 2022-05	POL_LSU-Li-5_ 2022-05	POL_LSU-Li-6_ 2022-05	POL_LSU-Li-7_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-011	VA22B2821-012	VA22B2821-013	VA22B2821-014	VA22B2821-015
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	----	1.03	----	0.42
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	<0.020	----	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	----	<0.020	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	<0.0020	----	<0.0020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	----	<0.0020	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	0.59	----	1.10
tin	7440-31-5	E440	0.10	mg/kg		0.59	0.49	----	0.57	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.48	----	<0.25	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	0.89	----	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	<0.0020	----	<0.0020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0024	----	<0.0020	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	0.30	----	0.32
vanadium	7440-62-2	E440	0.10	mg/kg		0.88	0.36	----	0.25	----
zinc	7440-66-6	E440	0.50	mg/kg		123	146	----	125	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	116	----	127
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	<0.20	----	0.29
zirconium	7440-67-7	E440	0.20	mg/kg		0.26	<0.20	----	0.21	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-8_ 2022-05	POL_LSU-Ki-1_ 2022-05	POL_LSU-Ki-2_ 2022-05	POL_LSU-Ki-3_ 2022-05	POL_LSU-Ki-4_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-016	VA22B2821-017	VA22B2821-018	VA22B2821-019	VA22B2821-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		78.8	----	----	----	----
moisture	----	E144-H	2.0	%		----	79.9	78.9	78.2	78.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	----	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	<5.0	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		0.015	----	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.209	----	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.210	0.146	0.156	0.144
barium	7440-39-3	E472	0.050	mg/kg		----	2.48	0.968	1.38	2.04
barium	7440-39-3	E440	0.050	mg/kg		0.455	----	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	----	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	<1.0	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		0.311	----	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	1.89	2.80	4.61	1.02
calcium	7440-70-2	E472	20	mg/kg		----	386	417	534	361
calcium	7440-70-2	E440	20	mg/kg		251	----	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0409	0.0250	0.0423	0.0337
cesium	7440-46-2	E440	0.0050	mg/kg		0.0251	----	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.072	----	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	0.23	<0.20	<0.20	0.84
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.530	0.374	0.520	0.272
cobalt	7440-48-4	E440	0.020	mg/kg		0.131	----	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		58.3	----	----	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	6.59	5.93	7.70	5.53
iron	7439-89-6	E440	3.0	mg/kg		308	----	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-8_2022-05	POL_LSU-Ki-1_2022-05	POL_LSU-Ki-2_2022-05	POL_LSU-Ki-3_2022-05	POL_LSU-Ki-4_2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-016	VA22B2821-017	VA22B2821-018	VA22B2821-019	VA22B2821-020
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	600	453	317	571
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	----	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	<0.050	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	639	571	642	527
magnesium	7439-95-4	E440	2.0	mg/kg		1050	----	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	3.94	3.44	4.30	3.93
manganese	7439-96-5	E440	0.050	mg/kg		13.5	----	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.0701	0.265	0.197	0.104
mercury	7439-97-6	E510	0.0050	mg/kg		0.0571	----	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0141	0.0561	0.0430	0.0222
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0121	----	----	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		1.76	----	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	1.36	1.46	1.86	1.29
nickel	7440-02-0	E472	0.20	mg/kg		----	0.50	0.37	0.58	0.46
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	----	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	12900	12300	14000	11300
phosphorus	7723-14-0	E440	10	mg/kg		18100	----	----	----	----
potassium	7440-09-7	E472	20	mg/kg		----	12300	10500	11600	10100
potassium	7440-09-7	E440	20	mg/kg		14800	----	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	11.1	9.68	12.0	10.5
rubidium	7440-17-7	E440	0.050	mg/kg		12.3	----	----	----	----
selenium	7782-49-2	E440	0.050	mg/kg		12.0	----	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	10.4	10.7	12.9	9.28
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	<0.0050	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0262	----	----	----	----
sodium	7440-23-5	E472	20	mg/kg		----	6900	6010	6560	6960
sodium	7440-23-5	E440	20	mg/kg		5560	----	----	----	----
strontium	7440-24-6	E440	0.050	mg/kg		0.456	----	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Li-8_ 2022-05	POL_LSU-Ki-1_ 2022-05	POL_LSU-Ki-2_ 2022-05	POL_LSU-Ki-3_ 2022-05	POL_LSU-Ki-4_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	28-May-2022
						VA22B2821-016	VA22B2821-017	VA22B2821-018	VA22B2821-019	VA22B2821-020
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	0.71	0.63	0.77	0.60
tellurium	13494-80-9	E472	0.020	mg/kg		----	0.021	0.069	0.057	0.029
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	0.0078	0.0028	0.0025	0.0059
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	----	----	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	1.31	0.70	0.77	1.30
tin	7440-31-5	E440	0.10	mg/kg		0.53	----	----	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	----	----	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	0.0033	0.0055	0.0059	0.0031
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	----	----	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	1.23	3.53	4.24	1.48
vanadium	7440-62-2	E440	0.10	mg/kg		0.42	----	----	----	----
zinc	7440-66-6	E440	0.50	mg/kg		118	----	----	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	258	148	220	167
zirconium	7440-67-7	E472	0.20	mg/kg		----	0.26	<0.20	0.26	0.32
zirconium	7440-67-7	E440	0.20	mg/kg		0.28	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Ki-5_ 2022-05	POL_LSU-Ki-6_ 2022-05	POL_LSU-Ki-7_ 2022-05	POL_LSU-Ki-8_ 2022-05	BOL_LSU-M-1_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	30-May-2022
						VA22B2821-021	VA22B2821-022	VA22B2821-023	VA22B2821-024	VA22B2821-025
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	----	----	----	75.5
moisture	----	E144-H	2.0	%		81.5	78.8	79.3	80.3	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	----	----	----	<2.0
aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	<5.0	<5.0	<5.0	----
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
antimony	7440-36-0	E440	0.010	mg/kg		----	----	----	----	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		----	----	----	----	0.175
arsenic	7440-38-2	E472	0.030	mg/kg		0.156	0.318	0.126	0.137	----
barium	7440-39-3	E472	0.050	mg/kg		0.634	0.270	1.02	0.753	----
barium	7440-39-3	E440	0.050	mg/kg		----	----	----	----	0.682
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
beryllium	7440-41-7	E440	0.010	mg/kg		----	----	----	----	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
bismuth	7440-69-9	E440	0.010	mg/kg		----	----	----	----	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
boron	7440-42-8	E440	1.0	mg/kg		----	----	----	----	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	----	----	<0.0050
cadmium	7440-43-9	E472	0.010	mg/kg		1.37	0.133	2.00	2.52	----
calcium	7440-70-2	E472	20	mg/kg		481	411	352	530	----
calcium	7440-70-2	E440	20	mg/kg		----	----	----	----	586
cesium	7440-46-2	E472	0.0050	mg/kg		0.0441	0.0202	0.0358	0.0309	----
cesium	7440-46-2	E440	0.0050	mg/kg		----	----	----	----	0.123
chromium	7440-47-3	E440	0.050	mg/kg		----	----	----	----	0.090
chromium	7440-47-3	E472	0.20	mg/kg		1.15	2.16	<0.20	<0.20	----
cobalt	7440-48-4	E472	0.020	mg/kg		0.650	0.165	0.308	0.416	----
cobalt	7440-48-4	E440	0.020	mg/kg		----	----	----	----	<0.020
copper	7440-50-8	E440	0.10	mg/kg		----	----	----	----	2.04
copper	7440-50-8	E472	0.20	mg/kg		7.27	3.72	6.57	6.36	----
iron	7439-89-6	E440	3.0	mg/kg		----	----	----	----	26.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Ki-5_ 2022-05	POL_LSU-Ki-6_ 2022-05	POL_LSU-Ki-7_ 2022-05	POL_LSU-Ki-8_ 2022-05	BOL_LSU-M-1_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	30-May-2022
						VA22B2821-021	VA22B2821-022	VA22B2821-023	VA22B2821-024	VA22B2821-025
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		415	1560	472	574	----
lead	7439-92-1	E440	0.020	mg/kg		----	----	----	----	<0.020
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
lithium	7439-93-2	E440	0.50	mg/kg		----	----	----	----	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		750	377	638	669	----
magnesium	7439-95-4	E440	2.0	mg/kg		----	----	----	----	1200
manganese	7439-96-5	E472	0.050	mg/kg		9.00	1.66	4.47	7.18	----
manganese	7439-96-5	E440	0.050	mg/kg		----	----	----	----	1.02
mercury	7439-97-6	E511	0.0050	mg/kg		0.0930	0.0210	0.109	0.0721	----
mercury	7439-97-6	E510	0.0050	mg/kg		----	----	----	----	0.355
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0172	0.0044	0.0224	0.0142	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	----	----	0.0871
molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	----	----	<0.020
molybdenum	7439-98-7	E472	0.040	mg/kg		1.36	0.242	1.52	1.10	----
nickel	7440-02-0	E472	0.20	mg/kg		0.84	1.12	0.33	0.49	----
nickel	7440-02-0	E440	0.20	mg/kg		----	----	----	----	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		16900	7880	13600	14700	----
phosphorus	7723-14-0	E440	10	mg/kg		----	----	----	----	9980
potassium	7440-09-7	E472	20	mg/kg		14700	12100	12300	14000	----
potassium	7440-09-7	E440	20	mg/kg		----	----	----	----	16800
rubidium	7440-17-7	E472	0.050	mg/kg		12.0	8.34	13.9	14.5	----
rubidium	7440-17-7	E440	0.050	mg/kg		----	----	----	----	11.0
selenium	7782-49-2	E440	0.050	mg/kg		----	----	----	----	2.74
selenium	7782-49-2	E472	0.10	mg/kg		11.8	9.33	9.57	12.0	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	----	----	<0.0050
sodium	7440-23-5	E472	20	mg/kg		8360	8510	5790	7040	----
sodium	7440-23-5	E440	20	mg/kg		----	----	----	----	1250
strontium	7440-24-6	E440	0.050	mg/kg		----	----	----	----	0.928

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_LSU-Ki-5_ 2022-05	POL_LSU-Ki-6_ 2022-05	POL_LSU-Ki-7_ 2022-05	POL_LSU-Ki-8_ 2022-05	BOL_LSU-M-1_ 2022-05
					Client sampling date / time	28-May-2022	28-May-2022	28-May-2022	28-May-2022	30-May-2022
						VA22B2821-021	VA22B2821-022	VA22B2821-023	VA22B2821-024	VA22B2821-025
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		0.96	0.77	0.71	0.98	----
tellurium	13494-80-9	E472	0.020	mg/kg		0.022	<0.020	0.023	<0.020	----
tellurium	13494-80-9	E440	0.020	mg/kg		----	----	----	----	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		0.0034	<0.0020	0.0043	0.0048	----
thallium	7440-28-0	E440	0.0020	mg/kg		----	----	----	----	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		<0.10	0.16	<0.10	<0.10	----
tin	7440-31-5	E440	0.10	mg/kg		----	----	----	----	0.55
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	----	----	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	0.71	<0.50	<0.50	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.0025	<0.0020	0.0052	0.0031	----
uranium	7440-61-1	E440	0.0020	mg/kg		----	----	----	----	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		1.15	0.12	1.88	1.68	----
vanadium	7440-62-2	E440	0.10	mg/kg		----	----	----	----	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		----	----	----	----	23.1
zinc	7440-66-6	E472	1.0	mg/kg		170	56.2	156	158	----
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
zirconium	7440-67-7	E440	0.20	mg/kg		----	----	----	----	0.40

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-2_2022-05	BOL_LSU-M-3_2022-05	BOL_LSU-M-4_2022-05	BOL_LSU-M-5_2022-05	BOL_LSU-M-6_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	31-May-2022	31-May-2022
						VA22B2821-026	VA22B2821-027	VA22B2821-028	VA22B2821-029	VA22B2821-030
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.4	----	75.4	79.3	73.1
moisture	----	E144-H	2.0	%		----	74.2	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		3.2	----	<2.0	4.0	6.3
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.037	----	0.048	0.036	0.079
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.433	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		----	0.558	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		1.34	----	0.887	0.948	1.22
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	----	<0.0050	<0.0050	<0.0050
cadmium	7440-43-9	E472	0.010	mg/kg		----	<0.010	----	----	----
calcium	7440-70-2	E472	20	mg/kg		----	500	----	----	----
calcium	7440-70-2	E440	20	mg/kg		503	----	536	721	1200
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.226	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.115	----	0.108	0.137	0.0863
chromium	7440-47-3	E440	0.050	mg/kg		0.206	----	0.103	0.094	0.165
chromium	7440-47-3	E472	0.20	mg/kg		----	<0.20	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		----	<0.020	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.022	----	<0.020	<0.020	<0.020
copper	7440-50-8	E440	0.10	mg/kg		2.57	----	1.58	1.87	2.17
copper	7440-50-8	E472	0.20	mg/kg		----	1.13	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		46.0	----	19.7	40.0	38.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-2_2022-05	BOL_LSU-M-3_2022-05	BOL_LSU-M-4_2022-05	BOL_LSU-M-5_2022-05	BOL_LSU-M-6_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	31-May-2022	31-May-2022
						VA22B2821-026	VA22B2821-027	VA22B2821-028	VA22B2821-029	VA22B2821-030
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	15.1	----	----	----
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	<0.020
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	----	----	----
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		----	1310	----	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		1390	----	1410	1370	1260
manganese	7439-96-5	E472	0.050	mg/kg		----	0.866	----	----	----
manganese	7439-96-5	E440	0.050	mg/kg		1.46	----	0.881	1.29	3.39
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.330	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.614	----	0.764	0.595	0.623
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0850	----	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.139	----	0.188	0.123	0.168
molybdenum	7439-98-7	E440	0.020	mg/kg		0.022	----	<0.020	<0.020	<0.020
molybdenum	7439-98-7	E472	0.040	mg/kg		----	<0.040	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	----	----	----
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	----	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		----	10700	----	----	----
phosphorus	7723-14-0	E440	10	mg/kg		11800	----	12400	11400	10400
potassium	7440-09-7	E472	20	mg/kg		----	19000	----	----	----
potassium	7440-09-7	E440	20	mg/kg		20800	----	20200	19100	15000
rubidium	7440-17-7	E472	0.050	mg/kg		----	14.3	----	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		9.79	----	9.36	7.77	6.64
selenium	7782-49-2	E440	0.050	mg/kg		2.62	----	2.46	2.13	2.59
selenium	7782-49-2	E472	0.10	mg/kg		----	2.99	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	<0.0050	----	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	----	<0.0050	<0.0050	<0.0050
sodium	7440-23-5	E472	20	mg/kg		----	1180	----	----	----
sodium	7440-23-5	E440	20	mg/kg		1430	----	1280	2560	1270
strontium	7440-24-6	E440	0.050	mg/kg		0.694	----	0.770	1.17	2.73

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-2_2022-05	BOL_LSU-M-3_2022-05	BOL_LSU-M-4_2022-05	BOL_LSU-M-5_2022-05	BOL_LSU-M-6_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	31-May-2022	31-May-2022
						VA22B2821-026	VA22B2821-027	VA22B2821-028	VA22B2821-029	VA22B2821-030
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	0.76	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	----	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		----	<0.0020	----	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	----	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		----	0.45	----	----	----
tin	7440-31-5	E440	0.10	mg/kg		0.82	----	0.58	0.83	0.48
titanium	7440-32-6	E440.Ti	0.25	mg/kg		0.26	----	<0.25	0.36	0.64
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		----	<0.0020	----	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	----	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		----	<0.10	----	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	----	<0.10	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		34.5	----	29.4	23.8	26.8
zinc	7440-66-6	E472	1.0	mg/kg		----	22.1	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		----	0.23	----	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		0.43	----	0.36	0.37	0.33

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-7_2022-05	BOL_LSU-M-8_2022-05	BOL_LSU-O-1_2022-05	BOL_LSU-O-2_2022-05	BOL_LSU-O-3_2022-05
					Client sampling date / time	31-May-2022	31-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2821-031	VA22B2821-032	VA22B2821-033	VA22B2821-034	VA22B2821-035
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	77.1	63.2	65.9	67.2
moisture	----	E144-H	2.0	%		71.3	----	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	<2.0	<2.0	<2.0	<2.0
aluminum	7429-90-5	E472	5.0	mg/kg		7.3	----	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	----	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		----	0.098	0.091	0.026	0.133
arsenic	7440-38-2	E472	0.030	mg/kg		0.139	----	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		1.16	----	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		----	0.862	0.364	0.232	0.290
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	----	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	----	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		<1.0	----	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		----	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		----	<0.0050	<0.0050	<0.0050	0.0072
cadmium	7440-43-9	E472	0.010	mg/kg		<0.010	----	----	----	----
calcium	7440-70-2	E472	20	mg/kg		913	----	----	----	----
calcium	7440-70-2	E440	20	mg/kg		----	932	511	606	590
cesium	7440-46-2	E472	0.0050	mg/kg		0.0910	----	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		----	0.235	0.0191	0.0164	0.0395
chromium	7440-47-3	E440	0.050	mg/kg		----	0.111	<0.050	0.068	<0.050
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	----	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		<0.020	----	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		----	<0.020	0.044	0.053	0.063
copper	7440-50-8	E440	0.10	mg/kg		----	1.56	4.07	3.80	5.31
copper	7440-50-8	E472	0.20	mg/kg		4.00	----	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		----	19.4	54.8	57.3	29.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-7_2022-05	BOL_LSU-M-8_2022-05	BOL_LSU-O-1_2022-05	BOL_LSU-O-2_2022-05	BOL_LSU-O-3_2022-05
					Client sampling date / time	31-May-2022	31-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2821-031	VA22B2821-032	VA22B2821-033	VA22B2821-034	VA22B2821-035
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		30.2	----	----	----	----
lead	7439-92-1	E440	0.020	mg/kg		----	<0.020	<0.020	<0.020	<0.020
lead	7439-92-1	E472	0.050	mg/kg		<0.050	----	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	----	----	----	----
lithium	7439-93-2	E440	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		1010	----	----	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		----	1520	726	747	913
manganese	7439-96-5	E472	0.050	mg/kg		2.45	----	----	----	----
manganese	7439-96-5	E440	0.050	mg/kg		----	1.90	16.3	12.6	12.2
mercury	7439-97-6	E511	0.0050	mg/kg		0.170	----	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		----	0.608	0.0142	0.0160	0.0128
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0490	----	----	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	0.139	0.0052	0.0055	0.0042
molybdenum	7439-98-7	E440	0.020	mg/kg		----	<0.020	0.065	0.068	0.078
molybdenum	7439-98-7	E472	0.040	mg/kg		<0.040	----	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		<0.20	----	----	----	----
nickel	7440-02-0	E440	0.20	mg/kg		----	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		8220	----	----	----	----
phosphorus	7723-14-0	E440	10	mg/kg		----	12800	11800	11100	12300
potassium	7440-09-7	E472	20	mg/kg		12400	----	----	----	----
potassium	7440-09-7	E440	20	mg/kg		----	21600	6290	6770	7760
rubidium	7440-17-7	E472	0.050	mg/kg		8.21	----	----	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		----	11.9	5.28	3.97	8.20
selenium	7782-49-2	E440	0.050	mg/kg		----	2.74	4.83	5.00	4.94
selenium	7782-49-2	E472	0.10	mg/kg		2.63	----	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	----	----	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	<0.0050	<0.0050	0.0057	<0.0050
sodium	7440-23-5	E472	20	mg/kg		1320	----	----	----	----
sodium	7440-23-5	E440	20	mg/kg		----	1400	1640	2520	1990
strontium	7440-24-6	E440	0.050	mg/kg		----	1.53	0.687	0.632	0.924

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-M-7_2022-05	BOL_LSU-M-8_2022-05	BOL_LSU-O-1_2022-05	BOL_LSU-O-2_2022-05	BOL_LSU-O-3_2022-05
					Client sampling date / time	31-May-2022	31-May-2022	30-May-2022	30-May-2022	30-May-2022
						VA22B2821-031	VA22B2821-032	VA22B2821-033	VA22B2821-034	VA22B2821-035
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.93	----	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	----	----	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		----	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		<0.0020	----	----	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		----	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		0.60	----	----	----	----
tin	7440-31-5	E440	0.10	mg/kg		----	0.91	<0.10	<0.10	0.16
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	<0.25	<0.25	<0.25	<0.25
titanium	7440-32-6	E472.Ti	0.50	mg/kg		1.47	----	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	----	----	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		----	<0.0020	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	----	----	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		----	<0.10	<0.10	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		----	17.4	67.2	84.1	86.8
zinc	7440-66-6	E472	1.0	mg/kg		20.2	----	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		0.25	----	----	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		----	0.33	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-O-4_ 2022-05	BOL_LSU-O-5_ 2022-05	BOL_LSU-O-6_ 2022-05	BOL_LSU-O-7_ 2022-05	BOL_LSU-O-8_ 2022-05
					Client sampling date / time	30-May-2022	31-May-2022	31-May-2022	31-May-2022	31-May-2022
						VA22B2821-036	VA22B2821-037	VA22B2821-038	VA22B2821-039	VA22B2821-040
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		65.4	67.0	66.7	64.6	64.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	2.6	<2.0	<2.0	<2.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
arsenic	7440-38-2	E440	0.020	mg/kg		0.034	0.026	0.041	0.069	0.056
barium	7440-39-3	E440	0.050	mg/kg		0.307	0.280	0.264	0.195	0.264
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	0.0054	<0.0050	<0.0050	0.0051
calcium	7440-70-2	E440	20	mg/kg		508	510	532	448	574
cesium	7440-46-2	E440	0.0050	mg/kg		0.0113	0.0182	0.0179	0.0314	0.0311
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
cobalt	7440-48-4	E440	0.020	mg/kg		0.048	0.040	0.050	0.032	0.036
copper	7440-50-8	E440	0.10	mg/kg		3.54	3.74	3.98	3.49	3.70
iron	7439-89-6	E440	3.0	mg/kg		55.9	79.0	64.8	45.0	48.8
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
magnesium	7439-95-4	E440	2.0	mg/kg		761	758	792	726	780
manganese	7439-96-5	E440	0.050	mg/kg		5.48	6.11	16.5	13.6	16.0
mercury	7439-97-6	E510	0.0050	mg/kg		0.0184	0.0178	0.0170	0.0091	0.0170
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0064	0.0059	0.0057	0.0032	0.0061
molybdenum	7439-98-7	E440	0.020	mg/kg		0.059	0.065	0.066	0.051	0.060
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E440	10	mg/kg		11700	11800	12100	11300	11900
potassium	7440-09-7	E440	20	mg/kg		7000	6940	7100	6760	6870
rubidium	7440-17-7	E440	0.050	mg/kg		4.26	3.43	4.07	5.98	5.19
selenium	7782-49-2	E440	0.050	mg/kg		4.32	3.78	4.38	5.21	4.58
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0064	0.0064	0.0081	<0.0050	<0.0050
sodium	7440-23-5	E440	20	mg/kg		1920	2260	2150	1710	1630

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-O-4_ 2022-05	BOL_LSU-O-5_ 2022-05	BOL_LSU-O-6_ 2022-05	BOL_LSU-O-7_ 2022-05	BOL_LSU-O-8_ 2022-05
					Client sampling date / time	30-May-2022	31-May-2022	31-May-2022	31-May-2022	31-May-2022
						VA22B2821-036	VA22B2821-037	VA22B2821-038	VA22B2821-039	VA22B2821-040
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E440	0.050	mg/kg		0.672	0.733	0.757	0.537	0.691
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.10	<0.10	0.13	0.13
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
zinc	7440-66-6	E440	0.50	mg/kg		75.2	76.8	75.2	73.1	77.4
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-1_2022-05	BOL_LSU-Li-2_2022-05	BOL_LSU-Li-3_2022-05	BOL_LSU-Li-4_2022-05	BOL_LSU-Li-5_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	31-May-2022
						VA22B2821-041	VA22B2821-042	VA22B2821-043	VA22B2821-044	VA22B2821-045
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		80.3	----	81.5	82.1	82.3
moisture	----	E144-H	2.0	%		----	80.4	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		2.5	----	5.9	<2.0	14.6
aluminum	7429-90-5	E472	5.0	mg/kg		----	<5.0	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg		----	0.022	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		0.012	----	0.010	0.020	0.041
arsenic	7440-38-2	E440	0.020	mg/kg		0.158	----	0.150	0.125	0.182
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.152	----	----	----
barium	7440-39-3	E472	0.050	mg/kg		----	0.454	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		0.300	----	0.678	0.119	0.439
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	<0.010	<0.010	<0.010
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	<1.0	<1.0	<1.0
cadmium	7440-43-9	E440	0.0050	mg/kg		0.209	----	0.221	0.411	0.313
cadmium	7440-43-9	E472	0.010	mg/kg		----	0.469	----	----	----
calcium	7440-70-2	E472	20	mg/kg		----	285	----	----	----
calcium	7440-70-2	E440	20	mg/kg		362	----	386	354	396
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0216	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.0246	----	0.0449	0.0164	0.0353
chromium	7440-47-3	E440	0.050	mg/kg		0.073	----	0.098	<0.050	0.144
chromium	7440-47-3	E472	0.20	mg/kg		----	<0.20	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.120	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.086	----	0.098	0.102	0.135
copper	7440-50-8	E440	0.10	mg/kg		15.2	----	86.7	9.52	17.7
copper	7440-50-8	E472	0.20	mg/kg		----	23.0	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		158	----	84.5	147	503

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-1_ 2022-05	BOL_LSU-Li-2_ 2022-05	BOL_LSU-Li-3_ 2022-05	BOL_LSU-Li-4_ 2022-05	BOL_LSU-Li-5_ 2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	31-May-2022
						VA22B2821-041	VA22B2821-042	VA22B2821-043	VA22B2821-044	VA22B2821-045
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	424	----	----	----
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	0.027
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	----	----	----
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	----	----	----
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	<0.50	<0.50	<0.50
magnesium	7439-95-4	E472	2.0	mg/kg		----	1030	----	----	----
magnesium	7439-95-4	E440	2.0	mg/kg		1040	----	1220	930	1260
manganese	7439-96-5	E472	0.050	mg/kg		----	14.2	----	----	----
manganese	7439-96-5	E440	0.050	mg/kg		11.4	----	21.2	9.72	30.8
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.192	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.138	----	0.137	0.200	0.215
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.0376	----	----	----
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0272	----	0.0254	0.0358	0.0381
molybdenum	7439-98-7	E440	0.020	mg/kg		1.26	----	1.59	0.939	1.38
molybdenum	7439-98-7	E472	0.040	mg/kg		----	1.13	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	----	----	----
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	----	<0.20	<0.20	<0.20
phosphorus	7723-14-0	E472	10	mg/kg		----	15900	----	----	----
phosphorus	7723-14-0	E440	10	mg/kg		16400	----	17500	14800	19100
potassium	7440-09-7	E472	20	mg/kg		----	11300	----	----	----
potassium	7440-09-7	E440	20	mg/kg		13600	----	15600	12800	13800
rubidium	7440-17-7	E472	0.050	mg/kg		----	6.43	----	----	----
rubidium	7440-17-7	E440	0.050	mg/kg		10.5	----	15.5	7.77	7.93
selenium	7782-49-2	E440	0.050	mg/kg		6.19	----	6.79	6.92	7.51
selenium	7782-49-2	E472	0.10	mg/kg		----	6.89	----	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	0.0284	----	----	----
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0181	----	0.110	0.0091	0.0184
sodium	7440-23-5	E472	20	mg/kg		----	6940	----	----	----
sodium	7440-23-5	E440	20	mg/kg		6780	----	7090	8080	8240
strontium	7440-24-6	E440	0.050	mg/kg		0.883	----	1.37	0.864	1.55

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-1_2022-05	BOL_LSU-Li-2_2022-05	BOL_LSU-Li-3_2022-05	BOL_LSU-Li-4_2022-05	BOL_LSU-Li-5_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	30-May-2022	30-May-2022	31-May-2022
						VA22B2821-041	VA22B2821-042	VA22B2821-043	VA22B2821-044	VA22B2821-045
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	0.64	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	----	----	----
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	----	<0.020	<0.020	<0.020
thallium	7440-28-0	E472	0.0020	mg/kg		----	0.0021	----	----	----
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	----	<0.0020	<0.0020	<0.0020
tin	7440-31-5	E472	0.10	mg/kg		----	0.50	----	----	----
tin	7440-31-5	E440	0.10	mg/kg		0.31	----	0.54	0.39	0.44
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	----	0.31	<0.25	0.75
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	<0.50	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		----	0.0051	----	----	----
uranium	7440-61-1	E440	0.0020	mg/kg		0.0029	----	0.0032	0.0040	0.0102
vanadium	7440-62-2	E472	0.10	mg/kg		----	0.30	----	----	----
vanadium	7440-62-2	E440	0.10	mg/kg		0.24	----	0.14	0.22	0.76
zinc	7440-66-6	E440	0.50	mg/kg		80.0	----	118	70.0	88.8
zinc	7440-66-6	E472	1.0	mg/kg		----	79.9	----	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		----	0.24	----	----	----
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	----	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-6_2022-05	BOL_LSU-Li-7_2022-05	BOL_LSU-Li-8_2022-05	BOL_LSU-Ki-1_2022-05	BOL_LSU-Ki-2_2022-05
					Client sampling date / time	31-May-2022	31-May-2022	31-May-2022	30-May-2022	30-May-2022
						VA22B2821-046	VA22B2821-047	VA22B2821-048	VA22B2821-049	VA22B2821-050
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		81.7	80.7	79.7	----	----
moisture	----	E144-H	2.0	%		----	----	----	79.3	81.4
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		3.7	2.3	3.2	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	----	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		0.017	0.010	0.015	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.124	0.107	0.133	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	----	0.148	0.094
barium	7440-39-3	E472	0.050	mg/kg		----	----	----	1.06	2.82
barium	7440-39-3	E440	0.050	mg/kg		0.195	0.343	0.311	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	----	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		0.318	0.0803	0.352	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	----	1.11	1.89
calcium	7440-70-2	E472	20	mg/kg		----	----	----	670	856
calcium	7440-70-2	E440	20	mg/kg		334	319	483	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	----	0.0281	0.0350
cesium	7440-46-2	E440	0.0050	mg/kg		0.0361	0.0397	0.0575	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.090	0.109	0.070	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	----	0.134	0.283
cobalt	7440-48-4	E440	0.020	mg/kg		0.126	0.102	0.106	----	----
copper	7440-50-8	E440	0.10	mg/kg		19.9	17.9	21.2	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	----	4.55	5.97
iron	7439-89-6	E440	3.0	mg/kg		584	261	313	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-6_ 2022-05	BOL_LSU-Li-7_ 2022-05	BOL_LSU-Li-8_ 2022-05	BOL_LSU-Ki-1_ 2022-05	BOL_LSU-Ki-2_ 2022-05
					Client sampling date / time	31-May-2022	31-May-2022	31-May-2022	30-May-2022	30-May-2022
						VA22B2821-046	VA22B2821-047	VA22B2821-048	VA22B2821-049	VA22B2821-050
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	----	486	276
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	----	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	----	----	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	----	516	612
magnesium	7439-95-4	E440	2.0	mg/kg		1200	994	1150	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	----	11.7	20.4
manganese	7439-96-5	E440	0.050	mg/kg		12.6	9.69	16.8	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	----	0.128	0.277
mercury	7439-97-6	E510	0.0050	mg/kg		0.166	0.0966	0.139	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	----	0.0265	0.0514
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0303	0.0187	0.0283	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		1.19	1.42	1.16	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	----	0.575	0.719
nickel	7440-02-0	E472	0.20	mg/kg		----	----	----	0.29	0.58
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	----	----	11600	13600
phosphorus	7723-14-0	E440	10	mg/kg		18100	15900	17600	----	----
potassium	7440-09-7	E472	20	mg/kg		----	----	----	9540	10800
potassium	7440-09-7	E440	20	mg/kg		14900	13500	14200	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	----	7.70	7.06
rubidium	7440-17-7	E440	0.050	mg/kg		8.39	10.2	10.6	----	----
selenium	7782-49-2	E440	0.050	mg/kg		6.26	7.28	6.60	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	----	5.38	6.32
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	----	<0.0050	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0261	0.0230	0.0280	----	----
sodium	7440-23-5	E472	20	mg/kg		----	----	----	8280	9340
sodium	7440-23-5	E440	20	mg/kg		7610	7100	6870	----	----
strontium	7440-24-6	E440	0.050	mg/kg		0.782	0.705	1.97	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Li-6_ 2022-05	BOL_LSU-Li-7_ 2022-05	BOL_LSU-Li-8_ 2022-05	BOL_LSU-Ki-1_ 2022-05	BOL_LSU-Ki-2_ 2022-05
					Client sampling date / time	31-May-2022	31-May-2022	31-May-2022	30-May-2022	30-May-2022
						VA22B2821-046	VA22B2821-047	VA22B2821-048	VA22B2821-049	VA22B2821-050
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	----	----	1.55	1.72
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	----	<0.020	0.044
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	----	0.0174	0.0161
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	----	<0.10	<0.10
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	----	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	----	0.0078	0.0157
uranium	7440-61-1	E440	0.0020	mg/kg		0.0049	<0.0020	0.0032	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	----	0.63	1.05
vanadium	7440-62-2	E440	0.10	mg/kg		0.27	0.13	0.16	----	----
zinc	7440-66-6	E440	0.50	mg/kg		87.9	86.5	78.0	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	----	95.8	156
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-3_2022-05	BOL_LSU-Ki-4_2022-05	BOL_LSU-Ki-5_2022-05	BOL_LSU-Ki-6_2022-05	BOL_LSU-Ki-7_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	31-May-2022	31-May-2022	31-May-2022
						VA22B2821-051	VA22B2821-052	VA22B2821-053	VA22B2821-054	VA22B2821-055
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		----	----	83.1	----	----
moisture	----	E144-H	2.0	%		79.2	78.4	----	79.0	78.4
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		----	----	7.8	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		6.3	<5.0	----	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	----	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		----	----	0.012	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		----	----	0.092	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		0.230	0.092	----	0.093	0.122
barium	7440-39-3	E472	0.050	mg/kg		1.61	2.17	----	3.15	1.70
barium	7440-39-3	E440	0.050	mg/kg		----	----	3.27	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	----	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		----	----	<0.010	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	----	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		----	----	<0.010	----	----
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	----	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		----	----	<1.0	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	1.76	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		1.08	2.49	----	1.75	0.448
calcium	7440-70-2	E472	20	mg/kg		633	968	----	2520	794
calcium	7440-70-2	E440	20	mg/kg		----	----	1380	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		0.0734	0.0188	----	0.0459	0.0481
cesium	7440-46-2	E440	0.0050	mg/kg		----	----	0.0553	----	----
chromium	7440-47-3	E440	0.050	mg/kg		----	----	0.099	----	----
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	<0.20	----	<0.20	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		0.266	0.294	----	0.452	0.299
cobalt	7440-48-4	E440	0.020	mg/kg		----	----	0.181	----	----
copper	7440-50-8	E440	0.10	mg/kg		----	----	6.10	----	----
copper	7440-50-8	E472	0.20	mg/kg		6.08	4.38	----	4.24	4.26
iron	7439-89-6	E440	3.0	mg/kg		----	----	502	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-3_2022-05	BOL_LSU-Ki-4_2022-05	BOL_LSU-Ki-5_2022-05	BOL_LSU-Ki-6_2022-05	BOL_LSU-Ki-7_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	31-May-2022	31-May-2022	31-May-2022
						VA22B2821-051	VA22B2821-052	VA22B2821-053	VA22B2821-054	VA22B2821-055
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		157	340	----	338	448
lead	7439-92-1	E440	0.020	mg/kg		----	----	<0.020	----	----
lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	----	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	----	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		----	----	<0.50	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		609	448	----	692	556
magnesium	7439-95-4	E440	2.0	mg/kg		----	----	680	----	----
manganese	7439-96-5	E472	0.050	mg/kg		22.7	12.2	----	66.1	10.0
manganese	7439-96-5	E440	0.050	mg/kg		----	----	25.2	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		0.108	0.266	----	0.306	0.0822
mercury	7439-97-6	E510	0.0050	mg/kg		----	----	0.340	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0224	0.0572	----	0.0641	0.0178
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	0.0575	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	0.777	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		0.913	0.706	----	0.595	0.610
nickel	7440-02-0	E472	0.20	mg/kg		0.41	0.66	----	0.61	0.29
nickel	7440-02-0	E440	0.20	mg/kg		----	----	0.51	----	----
phosphorus	7723-14-0	E472	10	mg/kg		13200	10000	----	14500	11900
phosphorus	7723-14-0	E440	10	mg/kg		----	----	14500	----	----
potassium	7440-09-7	E472	20	mg/kg		10200	8230	----	12600	10700
potassium	7440-09-7	E440	20	mg/kg		----	----	13800	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		11.4	5.50	----	6.44	8.31
rubidium	7440-17-7	E440	0.050	mg/kg		----	----	6.82	----	----
selenium	7782-49-2	E440	0.050	mg/kg		----	----	6.17	----	----
selenium	7782-49-2	E472	0.10	mg/kg		5.59	5.75	----	6.11	5.79
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	----	<0.0050	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	<0.0050	----	----
sodium	7440-23-5	E472	20	mg/kg		7870	7290	----	6460	7020
sodium	7440-23-5	E440	20	mg/kg		----	----	11400	----	----
strontium	7440-24-6	E440	0.050	mg/kg		----	----	3.09	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-3_2022-05	BOL_LSU-Ki-4_2022-05	BOL_LSU-Ki-5_2022-05	BOL_LSU-Ki-6_2022-05	BOL_LSU-Ki-7_2022-05
					Client sampling date / time	30-May-2022	30-May-2022	31-May-2022	31-May-2022	31-May-2022
						VA22B2821-051	VA22B2821-052	VA22B2821-053	VA22B2821-054	VA22B2821-055
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.59	2.26	----	6.84	1.46
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.030	----	0.024	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		----	----	0.060	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.0143	0.0158	----	0.0125	0.0063
thallium	7440-28-0	E440	0.0020	mg/kg		----	----	0.0063	----	----
tin	7440-31-5	E472	0.10	mg/kg		0.91	0.63	----	0.66	0.65
tin	7440-31-5	E440	0.10	mg/kg		----	----	0.66	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	0.63	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		0.67	<0.50	----	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		0.0086	0.0141	----	0.0186	0.0044
uranium	7440-61-1	E440	0.0020	mg/kg		----	----	0.0215	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		0.30	0.97	----	0.97	0.40
vanadium	7440-62-2	E440	0.10	mg/kg		----	----	2.06	----	----
zinc	7440-66-6	E440	0.50	mg/kg		----	----	104	----	----
zinc	7440-66-6	E472	1.0	mg/kg		122	106	----	105	113
zirconium	7440-67-7	E472	0.20	mg/kg		0.23	0.22	----	0.20	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		----	----	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-8_2022-05	POL_RB-M-2X_2022-05	POL_LSU-M-8X_2022-05	BOL_RB-M-7X_2022-05	POL_RB-O-4X_2022-05
					Client sampling date / time	31-May-2022	29-May-2022	28-May-2022	30-May-2022	29-May-2022
						VA22B2821-056	VA22B2821-057	VA22B2821-058	VA22B2821-059	VA22B2821-060
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		80.1	----	74.8	----	----
moisture	----	E144-H	2.0	%		----	82.5	----	79.4	70.4
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	----	<2.0	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	27.0	----	<5.0	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	<0.010	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.111	----	0.077	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	0.031	----	0.031	0.032
barium	7440-39-3	E472	0.050	mg/kg		----	1.24	----	1.26	0.866
barium	7440-39-3	E440	0.050	mg/kg		2.20	----	0.905	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	<0.010	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	<0.010	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	<1.0	----	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	----	<1.0	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		2.23	----	<0.0050	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
calcium	7440-70-2	E472	20	mg/kg		----	1500	----	828	1540
calcium	7440-70-2	E440	20	mg/kg		1300	----	394	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	0.0976	----	0.0614	0.0157
cesium	7440-46-2	E440	0.0050	mg/kg		0.100	----	0.0707	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.063	----	0.065	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	<0.20	----	<0.20	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		----	0.032	----	<0.020	0.078
cobalt	7440-48-4	E440	0.020	mg/kg		0.214	----	<0.020	----	----
copper	7440-50-8	E440	0.10	mg/kg		5.15	----	4.15	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	1.87	----	1.94	6.01
iron	7439-89-6	E440	3.0	mg/kg		523	----	45.4	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-8_2022-05	POL_RB-M-2X_2022-05	POL_LSU-M-8X_2022-05	BOL_RB-M-7X_2022-05	POL_RB-O-4X_2022-05
					Client sampling date / time	31-May-2022	29-May-2022	28-May-2022	30-May-2022	29-May-2022
						VA22B2821-056	VA22B2821-057	VA22B2821-058	VA22B2821-059	VA22B2821-060
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	87.2	----	26.8	90.6
lead	7439-92-1	E440	0.020	mg/kg		<0.020	----	<0.020	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	<0.050	----	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	<0.50	----	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	----	<0.50	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	1190	----	1170	1400
magnesium	7439-95-4	E440	2.0	mg/kg		698	----	1080	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	1.80	----	0.843	4.02
manganese	7439-96-5	E440	0.050	mg/kg		12.0	----	0.890	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	0.842	----	0.320	0.0252
mercury	7439-97-6	E510	0.0050	mg/kg		0.217	----	0.199	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	0.147	----	0.0659	0.0072
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0431	----	0.0502	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		0.751	----	0.029	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	<0.040	----	<0.040	0.062
nickel	7440-02-0	E472	0.20	mg/kg		----	<0.20	----	<0.20	<0.20
nickel	7440-02-0	E440	0.20	mg/kg		0.42	----	0.34	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	15000	----	14400	12100
phosphorus	7723-14-0	E440	10	mg/kg		13900	----	10100	----	----
potassium	7440-09-7	E472	20	mg/kg		----	25100	----	23600	8120
potassium	7440-09-7	E440	20	mg/kg		14200	----	16200	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	17.1	----	11.9	3.39
rubidium	7440-17-7	E440	0.050	mg/kg		9.39	----	12.3	----	----
selenium	7782-49-2	E440	0.050	mg/kg		5.87	----	7.44	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	6.60	----	2.20	6.61
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	<0.0050	----	<0.0050	<0.0050
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	----	<0.0050	----	----
sodium	7440-23-5	E472	20	mg/kg		----	1080	----	1820	3130
sodium	7440-23-5	E440	20	mg/kg		7900	----	1790	----	----
strontium	7440-24-6	E440	0.050	mg/kg		2.83	----	0.459	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BOL_LSU-Ki-8_2022-05	POL_RB-M-2X_2022-05	POL_LSU-M-8X_2022-05	BOL_RB-M-7X_2022-05	POL_RB-O-4X_2022-05
					Client sampling date / time	31-May-2022	29-May-2022	28-May-2022	30-May-2022	29-May-2022
						VA22B2821-056	VA22B2821-057	VA22B2821-058	VA22B2821-059	VA22B2821-060
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	2.04	----	1.30	3.81
tellurium	13494-80-9	E472	0.020	mg/kg		----	<0.020	----	<0.020	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		0.025	----	<0.020	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	0.0032	----	0.0142	<0.0020
thallium	7440-28-0	E440	0.0020	mg/kg		0.0092	----	<0.0020	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	0.78	----	0.89	0.20
tin	7440-31-5	E440	0.10	mg/kg		0.53	----	0.50	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	----	<0.25	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	4.59	----	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	<0.0020	----	<0.0020	<0.0020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0091	----	<0.0020	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	0.23	----	<0.10	<0.10
vanadium	7440-62-2	E440	0.10	mg/kg		0.48	----	<0.10	----	----
zinc	7440-66-6	E440	0.50	mg/kg		87.8	----	42.7	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	18.0	----	17.6	98.4
zirconium	7440-67-7	E472	0.20	mg/kg		----	0.29	----	<0.20	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	----	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-7X_2022-05	BOL_RB-O-8X_2022-05	POL_LSU-Li-3X_2022-05	POL_RB-Li-6X_2022-05	BOL_LSU-Li-2X_2022-05
					Client sampling date / time	29-May-2022	30-May-2022	28-May-2022	29-May-2022	30-May-2022
						VA22B2821-061	VA22B2821-062	VA22B2821-063	VA22B2821-064	VA22B2821-065
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		61.8	68.5	78.0	----	----
moisture	----	E144-H	2.0	%		----	----	----	77.0	80.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	3.1	----	----
aluminum	7429-90-5	E472	5.0	mg/kg		----	----	----	11.9	<5.0
antimony	7440-36-0	E472	0.010	mg/kg		----	----	----	<0.010	0.022
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.032	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.040	0.021	0.278	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		----	----	----	0.122	0.153
barium	7440-39-3	E472	0.050	mg/kg		----	----	----	1.12	0.708
barium	7440-39-3	E440	0.050	mg/kg		0.148	1.04	0.663	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
boron	7440-42-8	E472	1.0	mg/kg		----	----	----	<1.0	<1.0
boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	0.627	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		----	----	----	0.218	0.459
calcium	7440-70-2	E472	20	mg/kg		----	----	----	310	293
calcium	7440-70-2	E440	20	mg/kg		1190	1410	243	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		----	----	----	0.0453	0.0201
cesium	7440-46-2	E440	0.0050	mg/kg		0.0195	0.0168	0.0350	----	----
chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	0.105	----	----
chromium	7440-47-3	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
cobalt	7440-48-4	E472	0.020	mg/kg		----	----	----	0.108	0.112
cobalt	7440-48-4	E440	0.020	mg/kg		0.096	0.078	0.128	----	----
copper	7440-50-8	E440	0.10	mg/kg		8.90	10.5	67.1	----	----
copper	7440-50-8	E472	0.20	mg/kg		----	----	----	134	26.0
iron	7439-89-6	E440	3.0	mg/kg		48.5	67.4	256	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-7X_2022-05	BOL_RB-O-8X_2022-05	POL_LSU-Li-3X_2022-05	POL_RB-Li-6X_2022-05	BOL_LSU-Li-2X_2022-05
					Client sampling date / time	29-May-2022	30-May-2022	28-May-2022	29-May-2022	30-May-2022
						VA22B2821-061	VA22B2821-062	VA22B2821-063	VA22B2821-064	VA22B2821-065
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E472	5.0	mg/kg		----	----	----	2060	449
lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
lead	7439-92-1	E472	0.050	mg/kg		----	----	----	<0.050	<0.050
lithium	7439-93-2	E472	0.50	mg/kg		----	----	----	<0.50	<0.50
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		----	----	----	562	959
magnesium	7439-95-4	E440	2.0	mg/kg		1580	1610	1300	----	----
manganese	7439-96-5	E472	0.050	mg/kg		----	----	----	13.7	12.7
manganese	7439-96-5	E440	0.050	mg/kg		3.00	12.0	11.7	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		----	----	----	1.22	0.186
mercury	7439-97-6	E510	0.0050	mg/kg		0.0056	0.0209	0.104	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	----	0.280	0.0362
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0021	0.0066	0.0230	----	----
molybdenum	7439-98-7	E440	0.020	mg/kg		0.056	0.047	2.10	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	----	1.35	1.08
nickel	7440-02-0	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
phosphorus	7723-14-0	E472	10	mg/kg		----	----	----	13500	15100
phosphorus	7723-14-0	E440	10	mg/kg		12100	12100	21400	----	----
potassium	7440-09-7	E472	20	mg/kg		----	----	----	10300	10600
potassium	7440-09-7	E440	20	mg/kg		7280	7920	17100	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		----	----	----	7.39	6.21
rubidium	7440-17-7	E440	0.050	mg/kg		4.34	5.11	15.6	----	----
selenium	7782-49-2	E440	0.050	mg/kg		7.26	6.22	15.4	----	----
selenium	7782-49-2	E472	0.10	mg/kg		----	----	----	36.2	6.37
silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	----	0.475	0.0316
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0050	0.0072	0.0302	----	----
sodium	7440-23-5	E472	20	mg/kg		----	----	----	4170	6690
sodium	7440-23-5	E440	20	mg/kg		2090	3860	5050	----	----
strontium	7440-24-6	E440	0.050	mg/kg		3.28	4.07	0.373	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-O-7X_ 2022-05	BOL_RB-O-8X_ 2022-05	POL_LSU-Li-3X _2022-05	POL_RB-Li-6X_ 2022-05	BOL_LSU-Li-2X _2022-05
					Client sampling date / time	29-May-2022	30-May-2022	28-May-2022	29-May-2022	30-May-2022
						VA22B2821-061	VA22B2821-062	VA22B2821-063	VA22B2821-064	VA22B2821-065
						Result	Result	Result	Result	Result
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		----	----	----	0.53	0.64
tellurium	13494-80-9	E472	0.020	mg/kg		----	----	----	<0.020	<0.020
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		----	----	----	0.0342	<0.0020
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	----	----
tin	7440-31-5	E472	0.10	mg/kg		----	----	----	0.53	0.50
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.14	0.62	----	----
titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	----	<0.50	<0.50
uranium	7440-61-1	E472	0.0020	mg/kg		----	----	----	0.0162	0.0048
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		----	----	----	0.98	0.31
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	0.93	----	----
zinc	7440-66-6	E440	0.50	mg/kg		64.1	106	138	----	----
zinc	7440-66-6	E472	1.0	mg/kg		----	----	----	186	77.5
zirconium	7440-67-7	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	POL_RB-Ki-1X_2022-05	POL_LSU-Ki-3X_2022-05	BOL_LSU-Ki-6X_2022-05	----	----
					Client sampling date / time	28-May-2022	28-May-2022	31-May-2022	----	----
						VA22B2821-066	VA22B2821-067	VA22B2821-068	--------	--------
						Result	Result	Result	----	----
Physical Tests										
moisture	----	E144-H	2.0	%		75.4	78.7	79.0	----	----
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg		10.0	<5.0	<5.0	----	----
antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
arsenic	7440-38-2	E472	0.030	mg/kg		0.421	0.115	0.091	----	----
barium	7440-39-3	E472	0.050	mg/kg		0.113	0.606	2.28	----	----
beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
cadmium	7440-43-9	E472	0.010	mg/kg		0.510	3.42	1.70	----	----
calcium	7440-70-2	E472	20	mg/kg		411	491	1040	----	----
cesium	7440-46-2	E472	0.0050	mg/kg		0.0318	0.0382	0.0483	----	----
chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.23	<0.20	----	----
cobalt	7440-48-4	E472	0.020	mg/kg		1.78	0.398	0.423	----	----
copper	7440-50-8	E472	0.20	mg/kg		6.64	6.00	4.30	----	----
iron	7439-89-6	E472	5.0	mg/kg		1100	385	513	----	----
lead	7439-92-1	E472	0.050	mg/kg		0.075	<0.050	<0.050	----	----
lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
magnesium	7439-95-4	E472	2.0	mg/kg		558	654	646	----	----
manganese	7439-96-5	E472	0.050	mg/kg		2.70	4.61	14.3	----	----
mercury	7439-97-6	E511	0.0050	mg/kg		0.418	0.148	0.282	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.103	0.0315	0.0592	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg		0.347	1.30	0.566	----	----
nickel	7440-02-0	E472	0.20	mg/kg		0.34	0.55	0.52	----	----
phosphorus	7723-14-0	E472	10	mg/kg		10800	14200	12800	----	----
potassium	7440-09-7	E472	20	mg/kg		9990	12400	13100	----	----
rubidium	7440-17-7	E472	0.050	mg/kg		5.59	11.7	6.39	----	----
selenium	7782-49-2	E472	0.10	mg/kg		11.5	11.7	5.93	----	----
silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	----	----
sodium	7440-23-5	E472	20	mg/kg		6210	6380	6110	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	POL_RB-Ki-1X_ 2022-05	POL_LSU-Ki-3X _2022-05	BOL_LSU-Ki-6X _2022-05	----	----
					Client sampling date / time	28-May-2022	28-May-2022	31-May-2022	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22B2821-066	VA22B2821-067	VA22B2821-068	--------	--------
						Result	Result	Result	----	----
Metals										
strontium	7440-24-6	E472	0.10	mg/kg		1.11	0.71	2.16	----	----
tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.042	0.021	----	----
thallium	7440-28-0	E472	0.0020	mg/kg		0.0694	<0.0020	0.0138	----	----
tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	0.74	----	----
titanium	7440-32-6	E472.Ti	0.50	mg/kg		0.68	<0.50	<0.50	----	----
uranium	7440-61-1	E472	0.0020	mg/kg		0.0041	0.0049	0.0153	----	----
vanadium	7440-62-2	E472	0.10	mg/kg		0.47	3.53	0.86	----	----
zinc	7440-66-6	E472	1.0	mg/kg		186	172	107	----	----
zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B2821**	Page	: 1 of 53
Amendment	: 1		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Issue Date	: 05-Dec-2022 14:10
C-O-C number	: ----		
Sampler	: LBO		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 68		
No. of samples analysed	: 68		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22B2821-013	POL_LSU-Li-5_2022-05	chromium	7440-47-3	E472	0.41 % DUP-H, J	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Metals	VA22B2821-042	BOL_LSU-Li-2_2022-05	chromium	7440-47-3	E472	0.46 % DUP-H, J	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*
J	*Duplicate results and limits are expressed in terms of absolute difference.*

Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG8-562335002	----	boron	7440-42-8	E472	72.6 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG8-562335002	----	lithium	7439-93-2	E472	76.0 % MES	80.0-120%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Sample								
Metals	QC-MRG8-562335003	----	lead	7439-92-1	E472	69.9 % MES	70.0-130%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E511	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	178 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E511	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E511	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E511	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E511	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E511	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-M-2X_2022-05	E511	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-O-4X_2022-05	E511	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E511	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E511	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E511	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E511	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E511	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-5_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-8_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-5_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-6_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-7_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-8_2022-05	E510	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-5_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-6_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-8_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-5_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-6_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-7_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-8_2022-05	E510	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-1_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-3_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-4_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-1_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-2_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-M-4_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-1_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-2_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-3_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_LSU-O-4_2022-05	E510	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag BOL_RB-O-8X_2022-05	E510	30-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_RB-O-7X_2022-05	E510	29-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-1_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-2_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-4_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-6_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-8_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-1_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-2_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-3_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-4_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-5_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-6_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-7_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-O-8_2022-05	E510	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3X_2022-05	E510	28-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag POL_LSU-M-8X_2022-05	E510	28-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E511A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E511A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E511A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E511A	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E511A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E511A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-M-2X_2022-05	E511A	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-O-4X_2022-05	E511A	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E511A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E511A	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E511A	29-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E511A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E511A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Ki-5_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Ki-8_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-5_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-6_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-7_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-8_2022-05	E510A	31-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-5_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-6_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-8_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-5_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-6_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-7_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-8_2022-05	E510A	31-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	50 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-1_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-3_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-Li-4_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-1_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-2_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-M-4_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-1_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-2_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-3_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_LSU-O-4_2022-05	E510A	30-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BOL_RB-O-8X_2022-05	E510A	30-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	51 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_RB-O-7X_2022-05	E510A	29-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	52 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-1_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-2_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-3_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-4_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-6_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-8_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-1_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-2_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-3_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-4_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-5_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-6_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-7_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-O-8_2022-05	E510A	28-May-2022	15-Jul-2022	----	----		20-Jul-2022	365 days	53 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-Li-3X_2022-05	E510A	28-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag POL_LSU-M-8X_2022-05	E510A	28-May-2022	14-Jul-2022	----	----		20-Jul-2022	365 days	54 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E472	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E472	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E472	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E472	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E472	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2X_2022-05	E472	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4X_2022-05	E472	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E472	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E472	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E472	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E472	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E472	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E472	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-5_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-8_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-5_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-6_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-7_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-8_2022-05	E440	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-5_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-6_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-8_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-5_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-6_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-7_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-8_2022-05	E440	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8X_2022-05	E440	30-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	45 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-1_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-3_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-4_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-1_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-2_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-4_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-1_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-2_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-3_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-4_2022-05	E440	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7X_2022-05	E440	29-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-1_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-2_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3X_2022-05	E440	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-4_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-6_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-8_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8X_2022-05	E440	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-1_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-2_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-3_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-4_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-5_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-6_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-7_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-8_2022-05	E440	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E472.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E472.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E472.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E472.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E472.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2X_2022-05	E472.Ag	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4X_2022-05	E472.Ag	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E472.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E472.Ag	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E472.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E472.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E472.Ag	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E472.Ag	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-5_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-8_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-5_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-6_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-7_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-8_2022-05	E440.Ag	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-5_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-6_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-8_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-5_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-6_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-7_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-8_2022-05	E440.Ag	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8X_2022-05	E440.Ag	30-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	45 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-1_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-3_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-4_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-1_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-2_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-4_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-1_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-2_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-3_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-4_2022-05	E440.Ag	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7X_2022-05	E440.Ag	29-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-1_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-2_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3X_2022-05	E440.Ag	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-4_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-6_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-8_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8X_2022-05	E440.Ag	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-1_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-2_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-3_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-4_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-5_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-6_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-7_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-8_2022-05	E440.Ag	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E472.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E472.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E472.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E472.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E472.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-M-2X_2022-05	E472.Ti	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-O-4X_2022-05	E472.Ti	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	47 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E472.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E472.Ti	29-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E472.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E472.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E472.Ti	30-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	51 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E472.Ti	28-May-2022	19-Jul-2022	----	----		20-Jul-2022	730 days	53 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-5_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Ki-8_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-5_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-6_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-7_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-8_2022-05	E440.Ti	31-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	44 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-5_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-6_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-8_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-5_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-6_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-7_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-8_2022-05	E440.Ti	31-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	45 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_RB-O-8X_2022-05	E440.Ti	30-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	45 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-1_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-3_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-Li-4_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-1_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-2_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-M-4_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-1_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-2_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-3_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag BOL_LSU-O-4_2022-05	E440.Ti	30-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_RB-O-7X_2022-05	E440.Ti	29-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	46 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-1_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-2_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-3X_2022-05	E440.Ti	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-4_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-6_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-Li-8_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-M-8X_2022-05	E440.Ti	28-May-2022	14-Jul-2022	----	----		14-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-1_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-2_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-3_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-4_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-5_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-6_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-7_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag POL_LSU-O-8_2022-05	E440.Ti	28-May-2022	15-Jul-2022	----	----		15-Jul-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-1_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-2_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-3_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-4_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-6_2022-05	E144-H	31-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-6X_2022-05	E144-H	31-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Ki-7_2022-05	E144-H	31-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Li-2_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-Li-2X_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-M-3_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_LSU-M-7_2022-05	E144-H	31-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag BOL_RB-M-7X_2022-05	E144-H	30-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-1_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-2_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-3_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-3X_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-4_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-5_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-6_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-7_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Ki-8_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Li-5_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_LSU-Li-7_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Ki-1X_2022-05	E144-H	28-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-Li-6X_2022-05	E144-H	29-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-M-2X_2022-05	E144-H	29-May-2022	----	----	----		12-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag POL_RB-O-4X_2022-05	E144-H	29-May-2022	----	----	----		12-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Ki-5_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Ki-8_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-1_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-3_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-4_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-5_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-6_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-7_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-Li-8_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-1_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-2_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-4_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-5_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-6_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-M-8_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-1_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-2_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-3_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-4_2022-05	E144	30-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-5_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-6_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-7_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_LSU-O-8_2022-05	E144	31-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BOL_RB-O-8X_2022-05	E144	30-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-1_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-2_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-3_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-3X_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-4_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-6_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-Li-8_2022-05	E144	28-May-2022	----	----	----		08-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-M-8X_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-1_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-2_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-3_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-4_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-5_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-6_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-7_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_LSU-O-8_2022-05	E144	28-May-2022	----	----	----		06-Jul-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag POL_RB-O-7X_2022-05	E144	29-May-2022	----	----	----		08-Jul-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✗ = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562340	3	38	7.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554359	3	45	6.6	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562341	3	37	8.1	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554357	3	45	6.6	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562342	5	38	13.1	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554356	3	45	6.6	5.0	✓
Moisture Content by Gravimetry	E144	551571	4	42	9.5	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	3	38	7.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562338	3	38	7.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554358	3	45	6.6	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562339	3	38	7.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554360	3	45	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562340	6	38	15.7	10.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554359	6	45	13.3	10.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562341	6	37	16.2	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554357	6	45	13.3	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562342	6	38	15.7	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554356	6	45	13.3	10.0	✓
Moisture Content by Gravimetry	E144	551571	4	42	9.5	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	3	38	7.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562338	6	38	15.7	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554358	6	45	13.3	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562339	3	38	7.8	10.0	✗
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554360	3	45	6.6	10.0	✗
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	562340	3	38	7.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	554359	3	45	6.6	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	562341	3	37	8.1	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	554357	3	45	6.6	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	562342	5	38	13.1	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	554356	3	45	6.6	5.0	✓
Moisture Content by Gravimetry	E144	551571	4	42	9.5	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	559468	3	38	7.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	562338	3	38	7.8	5.0	✓

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	554358	3	45	6.6	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	562339	3	38	7.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	554360	3	45	6.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at <60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Micro)	E511A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.

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QUALITY CONTROL REPORT

Work Order	: **VA22B2821**	Page	: 1 of 34
Amendment	: **1**		
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Gabriel Holmes	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Jun-2022 10:30
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 06-Jul-2022
C-O-C number	: ----	Issue Date	: 05-Dec-2022 14:14
Sampler	: LBO ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 68		
No. of samples analysed	: 68		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
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Kinny Wu	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 551571)											
VA22B2821-004	POL_LSU-O-4_2022-05	moisture	----	E144	0.50	%	63.8	63.4	0.629%	20%	----
Physical Tests (QC Lot: 551572)											
VA22B2821-048	BOL_LSU-Li-8_2022-05	moisture	----	E144	0.50	%	79.7	79.6	0.126%	20%	----
Physical Tests (QC Lot: 551583)											
VA22B2821-035	BOL_LSU-O-3_2022-05	moisture	----	E144	0.50	%	67.2	67.3	0.149%	20%	----
Physical Tests (QC Lot: 554262)											
VA22B2821-061	POL_RB-O-7X_2022-05	moisture	----	E144	0.50	%	61.8	62.1	0.420%	20%	----
Physical Tests (QC Lot: 559468)											
VA22B2821-013	POL_LSU-Li-5_2022-05	moisture	----	E144-H	2.0	%	78.4	78.0	0.409%	20%	----
Physical Tests (QC Lot: 559474)											
VA22B2820-054	Anonymous	moisture	----	E144-H	2.0	%	79.1	79.4	0.391%	20%	----
Physical Tests (QC Lot: 559475)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	moisture	----	E144-H	2.0	%	80.4	80.2	0.201%	20%	----
Metals (QC Lot: 554356)											
VA22B2821-044	BOL_LSU-Li-4_2022-05	aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E440	0.010	mg/kg	0.020	0.021	0.001	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.125	0.132	5.15%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	0.119	0.106	0.013	Diff <2x LOR	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.411	0.430	4.66%	40%	----
		calcium	7440-70-2	E440	20	mg/kg	354	366	3.48%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0164	0.0166	0.0003	Diff <2x LOR	----
		chromium	7440-47-3	E440	0.050	mg/kg	<0.050	0.055	0.005	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.102	0.108	6.56%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	9.52	9.63	1.14%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	147	150	2.17%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554356) - continued											
VA22B2821-044	BOL_LSU-Li-4_2022-05	magnesium	7439-95-4	E440	2.0	mg/kg	930	948	1.98%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	9.72	9.83	1.10%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.939	0.951	1.25%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	14800	15200	2.91%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	12800	12900	0.616%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	7.77	7.88	1.44%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	6.92	7.17	3.50%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	8080	8290	2.59%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	0.864	0.855	1.03%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	0.39	0.42	0.03	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0040	0.0043	0.0003	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.22	0.22	0.006	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	70.0	72.4	3.30%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 554357)											
VA22B2821-044	BOL_LSU-Li-4_2022-05	mercury	7439-97-6	E510A	0.0011	mg/kg wwt	0.0358	0.0363	1.56%	40%	----
Metals (QC Lot: 554358)											
VA22B2821-044	BOL_LSU-Li-4_2022-05	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0091	0.0088	0.0003	Diff <2x LOR	----
Metals (QC Lot: 554359)											
VA22B2821-044	BOL_LSU-Li-4_2022-05	mercury	7439-97-6	E510	0.0054	mg/kg	0.200	0.203	1.56%	40%	----
Metals (QC Lot: 554360)											
VA22B2821-044	BOL_LSU-Li-4_2022-05	titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 554382)											
VA22B2821-040	BOL_LSU-O-8_2022-05	aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.056	0.054	0.001	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	0.264	0.263	0.428%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.0051	0.0063	0.0012	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554382) - continued											
VA22B2821-040	BOL_LSU-O-8_2022-05	calcium	7440-70-2	E440	20	mg/kg	574	571	0.543%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0311	0.0322	3.35%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.036	0.036	0.0005	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	3.70	3.64	1.63%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	48.8	48.0	1.67%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	780	761	2.35%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	16.0	15.8	0.689%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.060	0.064	0.004	Diff <2x LOR	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	11900	11800	0.539%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	6870	6820	0.702%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	5.19	5.09	2.01%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	4.58	4.37	4.74%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	1630	1650	1.12%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	0.691	0.705	1.98%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	0.13	0.12	0.01	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	77.4	78.0	0.769%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 554383)											
VA22B2821-040	BOL_LSU-O-8_2022-05	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0061	0.0061	0.445%	40%	----
Metals (QC Lot: 554384)											
VA22B2821-040	BOL_LSU-O-8_2022-05	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 554385)											
VA22B2821-040	BOL_LSU-O-8_2022-05	mercury	7439-97-6	E510	0.0050	mg/kg	0.0170	0.0171	0.00008	Diff <2x LOR	----
Metals (QC Lot: 554386)											
VA22B2821-040	BOL_LSU-O-8_2022-05	titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 554395)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554395) - continued											
VA22B2821-046	BOL_LSU-Li-6_2022-05	aluminum	7429-90-5	E440	2.0	mg/kg	3.7	3.2	0.5	Diff <2x LOR	----
		antimony	7440-36-0	E440	0.010	mg/kg	0.017	0.018	0.0006	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.124	0.131	5.78%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	0.195	0.184	0.011	Diff <2x LOR	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.318	0.328	2.92%	40%	----
		calcium	7440-70-2	E440	20	mg/kg	334	337	0.828%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0361	0.0364	0.840%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.090	0.068	0.021	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.126	0.124	1.56%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	19.9	20.2	1.45%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	584	584	0.0778%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	1200	1180	1.32%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	12.6	12.6	0.426%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	1.19	1.27	6.46%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	18100	18500	2.08%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	14900	14900	0.131%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	8.39	8.57	2.20%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	6.26	6.44	2.83%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	7610	7730	1.54%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	0.782	0.806	2.94%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0049	0.0042	0.0007	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.27	0.27	0.0007	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	87.9	88.9	1.10%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 554396)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 554396) - continued											
VA22B2821-046	BOL_LSU-Li-6_2022-05	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0303	0.0312	2.98%	40%	----
Metals (QC Lot: 554397)											
VA22B2821-046	BOL_LSU-Li-6_2022-05	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0261	0.0264	1.15%	40%	----
Metals (QC Lot: 554398)											
VA22B2821-046	BOL_LSU-Li-6_2022-05	mercury	7439-97-6	E510	0.0050	mg/kg	0.166	0.170	2.98%	40%	----
Metals (QC Lot: 554399)											
VA22B2821-046	BOL_LSU-Li-6_2022-05	titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 562338)											
VA22B2821-013	POL_LSU-Li-5_2022-05	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0209	0.0205	0.0004	Diff <2x LOR	----
Metals (QC Lot: 562339)											
VA22B2821-013	POL_LSU-Li-5_2022-05	titanium	7440-32-6	E472.Ti	0.50	mg/kg	0.89	0.84	0.05	Diff <2x LOR	----
Metals (QC Lot: 562340)											
VA22B2821-013	POL_LSU-Li-5_2022-05	mercury	7439-97-6	E511	0.0050	mg/kg	0.0728	0.0708	2.79%	40%	----
Metals (QC Lot: 562341)											
VA22B2821-013	POL_LSU-Li-5_2022-05	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0157	0.0156	1.01%	40%	----
Metals (QC Lot: 562342)											
VA22B2821-013	POL_LSU-Li-5_2022-05	barium	7440-39-3	E472	0.050	mg/kg	1.25	1.12	10.4%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	319	289	9.93%	60%	----
		magnesium	7439-95-4	E472	2.0	mg/kg	920	899	2.24%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	12.0	10.7	11.3%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	1.03	0.72	35.3%	60%	----
VA22B2821-013	POL_LSU-Li-5_2022-05	aluminum	7429-90-5	E472	5.0	mg/kg	14.9	18.9	4.0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.016	0.012	0.003	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.188	0.186	1.07%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.114	0.115	0.912%	40%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0223	0.0222	0.00004	Diff <2x LOR	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.62	# 1.03	0.41	Diff <2x LOR	DUP-H,J
		cobalt	7440-48-4	E472	0.020	mg/kg	0.108	0.108	0.362%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	56.0	51.6	8.11%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	160	165	2.72%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562342) - continued											
VA22B2821-013	POL_LSU-Li-5_2022-05	lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	1.39	1.36	2.13%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	17200	13900	21.2%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	13400	13200	1.92%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	9.41	9.35	0.582%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	11.0	10.9	0.626%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	5320	5210	2.15%	40%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	0.59	0.62	5.19%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.30	0.29	0.009	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	116	114	0.826%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 562350)											
VA22B2820-054	Anonymous	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.283	0.285	0.457%	40%	----
Metals (QC Lot: 562351)											
VA22B2820-054	Anonymous	titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 562352)											
VA22B2820-054	Anonymous	mercury	7439-97-6	E511	0.0050	mg/kg	0.264	0.261	1.31%	40%	----
Metals (QC Lot: 562353)											
VA22B2820-054	Anonymous	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0552	0.0544	1.31%	40%	----
Metals (QC Lot: 562354)											
VA22B2820-054	Anonymous	aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.042	0.041	0.001	Diff <2x LOR	----
		barium	7440-39-3	E472	0.050	mg/kg	0.822	0.857	4.19%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.142	0.143	0.416%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	322	333	3.49%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0295	0.0305	3.37%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562354) - continued											
VA22B2820-054	Anonymous	chromium	7440-47-3	E472	0.20	mg/kg	0.22	<0.20	0.02	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.112	0.106	5.16%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	22.1	22.7	3.04%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	1820	1780	2.10%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	834	821	1.56%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	6.15	6.26	1.77%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.866	0.870	0.386%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	16300	16400	0.242%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	14400	14600	0.785%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	9.74	9.86	1.24%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	9.16	8.89	3.08%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	7200	7230	0.502%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	0.60	0.64	7.00%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.149	0.138	7.30%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	1.18	1.40	17.2%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0052	0.0052	0.00005	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.20	0.20	0.002	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	186	183	1.38%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.47	0.50	0.03	Diff <2x LOR	----
Metals (QC Lot: 562361)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0284	0.0280	1.62%	40%	----
Metals (QC Lot: 562362)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 562363)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	mercury	7439-97-6	E511	0.0050	mg/kg	0.192	0.183	4.69%	40%	----
Metals (QC Lot: 562364)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0376	0.0359	4.69%	40%	----
Metals (QC Lot: 562365)											
VA22B2821-042	BOL_LSU-Li-2_2022-05	barium	7440-39-3	E472	0.050	mg/kg	0.454	0.523	14.0%	40%	----
VA22B2821-042	BOL_LSU-Li-2_2022-05	aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 562365) - continued											
VA22B2821-042	BOL_LSU-Li-2_2022-05	antimony	7440-36-0	E472	0.010	mg/kg	0.022	0.021	0.001	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.152	0.145	0.006	Diff <2x LOR	----
		beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.469	0.451	3.92%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	285	274	3.77%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0216	0.0209	0.0007	Diff <2x LOR	----
		chromium	7440-47-3	E472	0.20	mg/kg	<0.20	# 0.66	0.46	Diff <2x LOR	DUP-H,J
		cobalt	7440-48-4	E472	0.020	mg/kg	0.120	0.119	1.10%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	23.0	23.4	1.65%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	424	415	2.15%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1030	1010	2.18%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	14.2	13.7	4.13%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	1.13	1.10	2.85%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	<0.20	0.35	0.15	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	15900	15300	3.93%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	11300	11000	3.07%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	6.43	6.24	2.90%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	6.89	6.67	3.34%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	6940	6700	3.50%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	0.64	0.61	4.68%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0021	<0.0020	0.0001	Diff <2x LOR	----
		tin	7440-31-5	E472	0.10	mg/kg	0.50	0.46	0.04	Diff <2x LOR	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0051	0.0048	0.0003	Diff <2x LOR	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.30	0.29	0.01	Diff <2x LOR	----
		zinc	7440-66-6	E472	1.0	mg/kg	79.9	75.8	5.28%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.24	<0.20	0.04	Diff <2x LOR	----

Qualifiers

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 551571)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 551572)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 551583)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 554262)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 559468)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 559474)						
moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 559475)						
moisture	----	E144-H	2	%	<2.0	----
Metals (QCLot: 554356)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554356) - continued						
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 554357)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 554358)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554359)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554360)						
titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 554382)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554382) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 554383)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 554384)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554385)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554386)						
titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 554395)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554395) - continued						
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 554396)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 554397)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 554398)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 554399)						
titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 562338)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562339)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562340)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562341)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562342)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562342) - continued						
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 562350)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562351)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562352)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562353)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562354)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562354) - continued						
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 562361)						
silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562362)						
titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 562363)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 562364)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 562365)						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	MBRR
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 562365) - continued						
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----

Qualifiers

Qualifier	Description
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 551571)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 551572)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 551583)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 554262)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 559468)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 559474)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 559475)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Metals (QCLot: 554356)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	107	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	104	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	96.6	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	101	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	101	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	101	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	102	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 554356) - continued									
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	105	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	103	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	103	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	97.7	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	104	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	96.8	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	105	80.0	120	----
Metals (QCLot: 554357)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.1	80.0	120	----
Metals (QCLot: 554358)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	96.2	80.0	120	----
Metals (QCLot: 554359)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.1	80.0	120	----
Metals (QCLot: 554360)									
titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	103	80.0	120	----
Metals (QCLot: 554382)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	109	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	108	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	105	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	106	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	100	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	108	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 554382) - continued									
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	101	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	106	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	105	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	108	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	108	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	103	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	105	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	102	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	102	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	106	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	107	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	106	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	107	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	98.6	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	104	80.0	120	----
Metals (QCLot: 554383)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.0	80.0	120	----
Metals (QCLot: 554384)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	99.8	80.0	120	----
Metals (QCLot: 554385)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.0	80.0	120	----
Metals (QCLot: 554386)									
titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	104	80.0	120	----
Metals (QCLot: 554395)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	108	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	109	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	105	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	106	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	107	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 554395) - continued									
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	101	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	104	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	103	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	107	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	107	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	106	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	109	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	105	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	102	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	105	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	110	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	104	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	103	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	108	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	105	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.5	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	104	80.0	120	----
Metals (QCLot: 554396)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	95.7	80.0	120	----
Metals (QCLot: 554397)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	99.4	80.0	120	----
Metals (QCLot: 554398)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	95.7	80.0	120	----
Metals (QCLot: 554399)									
titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	104	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562338)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	80.4	80.0	120	----
Metals (QCLot: 562339)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	89.2	80.0	120	----
Metals (QCLot: 562340)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	85.2	80.0	120	----
Metals (QCLot: 562341)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	85.2	80.0	120	----
Metals (QCLot: 562342)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	92.7	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	93.1	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	95.1	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	91.1	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	85.8	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	91.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	# 72.6	80.0	120	MES
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	88.4	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	87.2	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	92.0	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	89.5	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	87.9	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	87.0	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	88.5	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	90.3	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	# 76.0	80.0	120	MES
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	89.9	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	89.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	93.7	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	87.8	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	82.0	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	90.3	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	92.1	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	88.5	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	89.6	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	91.8	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	88.6	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	92.6	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562342) - continued									
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	92.9	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	94.4	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	91.8	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	87.1	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	95.2	80.0	120	----
Metals (QCLot: 562350)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	85.1	80.0	120	----
Metals (QCLot: 562351)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	94.9	80.0	120	----
Metals (QCLot: 562352)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	89.8	80.0	120	----
Metals (QCLot: 562353)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	89.8	80.0	120	----
Metals (QCLot: 562354)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	96.0	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	97.4	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	93.4	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	93.4	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	89.3	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	95.1	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	92.1	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.1	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	95.3	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	93.0	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	90.3	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	89.4	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	93.2	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	91.5	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	93.7	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	92.6	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	93.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	99.6	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	90.2	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	101	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	94.1	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562354) - continued									
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	95.8	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	91.6	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	93.7	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	95.4	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	94.7	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	90.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	98.1	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	92.6	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	95.8	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	89.1	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	96.2	80.0	120	----
Metals (QCLot: 562361)									
silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	86.6	80.0	120	----
Metals (QCLot: 562362)									
titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	99.7	80.0	120	----
Metals (QCLot: 562363)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	89.8	80.0	120	----
Metals (QCLot: 562364)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	89.8	80.0	120	----
Metals (QCLot: 562365)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	107	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	98.5	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	102	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	98.7	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	96.0	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	98.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	98.1	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	94.6	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	94.2	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	98.1	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	99.6	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	97.6	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	95.5	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	99.8	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	98.5	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	97.1	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 562365) - continued									
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	101	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	100	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	99.6	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	96.8	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	101	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	98.2	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	102	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	98.0	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	93.8	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	98.0	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	102	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	97.0	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	98.9	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554356)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	102	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	102	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	85.2	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	95.5	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	101	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	104	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	110	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	97.1	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	101	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	101	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	97.8	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	100	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	100	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	102	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	97.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	101	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	102	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	98.7	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	103	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	99.8	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	100	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	86.7	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	108	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	99.2	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	98.9	70.0	130	----
Metals (QCLot: 554357)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	114	70.0	130	----
Metals (QCLot: 554358)									

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554358) - continued									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	102	70.0	130	----
Metals (QCLot: 554359)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	114	70.0	130	----
Metals (QCLot: 554382)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	90.8	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.4	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	83.2	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	92.7	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	98.8	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	95.4	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	105	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	95.6	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	97.3	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.8	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	99.9	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.3	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	95.9	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	101	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	94.4	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	97.6	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	101	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	97.2	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	73.0	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	103	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	97.0	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	96.8	70.0	130	----
Metals (QCLot: 554383)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	116	70.0	130	----
Metals (QCLot: 554384)									

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554384) - continued									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	99.3	70.0	130	----
Metals (QCLot: 554385)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	116	70.0	130	----
Metals (QCLot: 554395)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	89.6	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.5	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	88.8	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	94.9	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	106	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	98.8	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	99.3	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	98.7	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	99.3	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	98.3	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	95.3	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	100	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.7	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	92.0	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	102	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	100	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	99.5	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	98.4	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	98.0	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	101	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	75.3	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	102	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	99.3	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	97.2	70.0	130	----
Metals (QCLot: 554396)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	114	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 554397)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	100	70.0	130	----
Metals (QCLot: 554398)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	114	70.0	130	----
Metals (QCLot: 562338)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	80.1	70.0	130	----
Metals (QCLot: 562340)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	94.9	70.0	130	----
Metals (QCLot: 562341)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	94.9	70.0	130	----
Metals (QCLot: 562342)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	125	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	89.3	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	64.1	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	81.8	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	81.1	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	85.8	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	85.0	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	82.0	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	83.8	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	86.8	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	# 69.9	70.0	130	MES
	RM	magnesium	7439-95-4	E472	940 mg/kg	86.3	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	85.3	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	85.4	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	73.9	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	76.8	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	90.3	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	84.1	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	87.1	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	84.0	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	83.6	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	80.1	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562342) - continued									
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	90.1	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	85.2	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	86.7	70.0	130	----
Metals (QCLot: 562350)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	88.6	70.0	130	----
Metals (QCLot: 562352)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	102	70.0	130	----
Metals (QCLot: 562353)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	102	70.0	130	----
Metals (QCLot: 562354)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	88.3	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	97.0	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	84.2	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	89.0	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	98.8	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.4	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	84.7	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	84.9	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	90.7	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	93.1	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	78.8	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	92.9	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	93.2	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	95.1	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	84.0	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	99.4	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.9	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	91.9	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	93.3	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	93.6	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	93.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562354) - continued									
	RM	thallium	7440-28-0	E472	0.013 mg/kg	82.8	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	94.1	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	91.9	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	91.6	70.0	130	----
Metals (QCLot: 562361)									
	RM	silver	7440-22-4	E472.Ag	2.05 mg/kg	83.4	70.0	130	----
Metals (QCLot: 562363)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	96.7	70.0	130	----
Metals (QCLot: 562364)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	96.7	70.0	130	----
Metals (QCLot: 562365)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	84.7	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	95.4	70.0	130	----
	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	82.7	60.0	140	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	87.0	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	86.0	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	88.1	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	105	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	87.5	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	90.0	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	91.0	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	78.2	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	93.3	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	91.6	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	88.5	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	94.7	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	102	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	97.9	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	91.1	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	96.0	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	94.6	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 562365) - continued									
	RM	strontium	7440-24-6	E472	3.92 mg/kg	85.9	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	81.6	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	92.5	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	89.5	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	92.3	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

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Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): 2821

ALS Contact: Can Dang

Sampler: LBo

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
1	POL_LSU-O-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
2	POL_LSU-O-2_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
3	POL_LSU-O-3_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
4	POL_LSU-O-4_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
5	POL_LSU-O-5_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
6	POL_LSU-O-6_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
7	POL_LSU-O-7_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
8	POL_LSU-O-8_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
9	POL_LSU-Li-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
10	POL_LSU-Li-2_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
11	POL_LSU-Li-3_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
12	POL_LSU-Li-4_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1

Environmental Division
Vancouver
Work Order Reference
VA22B2821

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: IT	Date: Jun 8/22	Time: 10:30 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: LBo

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
13	POL_LSU-Li-5_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
14	POL_LSU-Li-6_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
15	POL_LSU-Li-7_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
16	POL_LSU-Li-8_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
17	POL_LSU-Ki-1_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
18	POL_LSU-Ki-2_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
19	POL_LSU-Ki-3_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
20	POL_LSU-Ki-4_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
21	POL_LSU-Ki-5_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
22	POL_LSU-Ki-6_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
23	POL_LSU-Ki-7_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
24	POL_LSU-Ki-8_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
		9	8

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: IT	Date: Jun 8/22	Time: 10:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 9 of 12

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2: kala.ivens@mountpolley.com	
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2: kivens@mountpolley.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: LBo

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units) Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
28	BOL_LSU-M-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
26	BOL_LSU-M-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
~~29~~	BOL_LSU-M-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
28	BOL_LSU-M-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
29	BOL_LSU-M-5_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
30	BOL_LSU-M-6_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
31	BOL_LSU-M-7_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
32	BOL_LSU-M-8_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
33	BOL_LSU-O-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
34	BOL_LSU-O-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
35	BOL_LSU-O-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
36	BOL_LSU-O-4_2022-05	30 May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Kathrine Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: IT	Date: Jun 8/22	Time: 10:32 AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 10 of 12

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: LBo

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
37	BOL_LSU-O-5_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
38	BOL_LSU-O-6_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
39	BOL_LSU-O-7_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
40	BOL_LSU-O-8_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
41	BOL_LSU-Li-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
42	BOL_LSU-Li-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
43	BOL_LSU-Li-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
44	BOL_LSU-Li-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
45	BOL_LSU-Li-5_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
46	BOL_LSU-Li-6_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
47	BOL_LSU-Li-7_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
48	BOL_LSU-Li-8_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			9	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	7-June-22	12:00				JT	Jun 8/22	10:32AM

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 11 of 12

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Gabriel Holmes	Quality Control (QC) Report with Report ☑ ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	PO Box 12	Email 1 or Fax: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Likely, BC	Email 2: kala.ivens@mountpolley.com	
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2: kivens@mountpolley.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: LBO

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
49	BOL_LSU-Ki-1_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
50	BOL_LSU-Ki-2_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
51	BOL_LSU-Ki-3_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
52	BOL_LSU-Ki-4_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
53	BOL_LSU-Ki-5_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
54	BOL_LSU-Ki-6_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
55	BOL_LSU-Ki-7_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
56	BOL_LSU-Ki-8_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1
57	POL_RB-M-2 X_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
58	POL_LSU-M-5 X_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
59	BOL_RB-M-7 X_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
60	POL_RB-O-4 X_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ ☐	
Are samples for human drinking water use? ☐ ☐	If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
			8	8

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Katharina Batchelar	Date: 7-June-22	Time: 12:00	Received by:	Date:	Time:	Received by: TT	Date: Jun 8/22	Time: 10:30 AM

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number:

Page 12 of 12

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Gabriel Holmes
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kivens@mountpolley.com

Project Information

ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: LBo

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: ____

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
61	POL_BB-07 X_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
62	BOL_BB-08 X_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
63	POL_ISL-Li3 X_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
64	POL_BB-Li6 X_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
65	BOL_ISL-Li2 X_2022-05	30-May-22	—	Tissue	R	R	R	R	R	R	1
66	POL_BB-Ki4 X_2022-05	28-May-22	—	Tissue	R	R	R	R	R	R	1
67	POL_ISL-Ki3 X_2022-05	29-May-22	—	Tissue	R	R	R	R	R	R	1
68	BOL_ISL-Ki6 X_2022-05	31-May-22	—	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ ☐

Are samples for human drinking water use? ☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample insufficient for routine digestion and analysis, contact kbatchelar@minnow.ca to discuss analysis options (e.g., microdigestion and HR-ICPMS). Internal PO 22-29 Task 3

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			8	8	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Katharina Batchelar	7-June-22	12:00				JT	Jun 8 22	10:30AM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

FISH TISSUE CHEMISTRY

ALS Laboratory Report VA22C4917

(Finalized January 30, 2023)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C4917**	Page	: 1 of 74
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 04-Jan-2023
C-O-C number	: ----	Issue Date	: 30-Jan-2023 17:53
Sampler	: ABA, HQA, PLE, SLA		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 147		
No. of samples analysed	: 147		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia
Sam Silveira	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLB	*Detection Limit Raised. Analyte detected at comparable level in Method Blank.*
DLIS	*Detection Limit Adjusted due to insufficient sample.*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_NSC-WB-1_2022-10	QUL-NHC_NSC-WB-2_2022-10	QUL-NHC_NSC-WB-3_2022-10	QUL-NHC_NSC-WB-4_2022-10	QUL-NHC_NSC-WB-5_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-001	VA22C4917-002	VA22C4917-003	VA22C4917-004	VA22C4917-005
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		72.8	69.6	75.3	71.3	70.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.108	0.130	0.050	0.246	0.187
Barium	7440-39-3	E440	0.050	mg/kg		0.610	1.15	1.44	1.03	0.646
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0487	0.0940	0.0545	0.0583	0.0388
Calcium	7440-70-2	E440	20	mg/kg		13700	15400	41800	22400	18400
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0866	0.0770	0.103	0.0366	0.0806
Chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	0.064
Cobalt	7440-48-4	E440	0.020	mg/kg		0.038	0.024	0.049	<0.020	<0.020
Copper	7440-50-8	E440	0.10	mg/kg		2.19	2.14	2.47	2.34	1.90
Iron	7439-89-6	E440	3.0	mg/kg		29.2	19.4	20.7	27.1	17.3
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1650	1290	2050	1340	1310
Manganese	7439-96-5	E440	0.050	mg/kg		3.30	3.51	7.39	4.04	3.98
Mercury	7439-97-6	E510	0.0050	mg/kg		0.509	0.282	0.398	0.376	0.308
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.138	0.0856	0.0980	0.108	0.0927
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.028	<0.020	0.034	0.024	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		17500	16800	35200	21600	18600
Potassium	7440-09-7	E440	20	mg/kg		14100	13800	15700	14800	12600
Rubidium	7440-17-7	E440	0.050	mg/kg		29.2	18.0	27.7	16.3	26.7
Selenium	7782-49-2	E440	0.050	mg/kg		3.30	5.37	3.38	5.99	2.37
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		2060	1980	2310	2190	1770

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_NSC-WB-1_2022-10	QUL-NHC_NSC-WB-2_2022-10	QUL-NHC_NSC-WB-3_2022-10	QUL-NHC_NSC-WB-4_2022-10	QUL-NHC_NSC-WB-5_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-001	VA22C4917-002	VA22C4917-003	VA22C4917-004	VA22C4917-005
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		18.8	21.5	51.9	24.7	25.6
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0044	0.0040	0.0126	0.0048	0.0058
Tin	7440-31-5	E440	0.10	mg/kg		0.23	0.13	0.31	0.33	0.22
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0023	<0.0020	0.0032	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		70.2	82.9	98.2	80.3	72.2
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_NSC-WB-6_2022-10	QUL-NHC_NSC-WB-7_2022-10	QUL-NHC_NSC-WB-8_2022-10	QUL-NGC_NSC-WB-1_2022-10	QUL-NGC_NSC-WB-2_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-006	VA22C4917-007	VA22C4917-008	VA22C4917-009	VA22C4917-010
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		74.6	77.0	74.0	68.3	70.1
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	333	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.082	0.358	0.082	0.036	0.043
Barium	7440-39-3	E440	0.050	mg/kg		0.918	4.30	0.905	0.497	1.07
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0321	0.200	0.0307	0.0173	0.0312
Calcium	7440-70-2	E440	20	mg/kg		20600	25200	20800	18800	30700
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0668	0.102	0.0761	0.190	0.0770
Chromium	7440-47-3	E440	0.050	mg/kg		0.059	0.714	0.052	<0.050	<0.050
Cobalt	7440-48-4	E440	0.020	mg/kg		0.037	0.474	0.022	0.046	0.134
Copper	7440-50-8	E440	0.10	mg/kg		2.03	7.11	2.42	2.23	2.45
Iron	7439-89-6	E440	3.0	mg/kg		37.4	567	20.8	21.7	24.3
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.164	<0.020	0.025	0.024
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1400	1800	1390	1420	2290
Manganese	7439-96-5	E440	0.050	mg/kg		7.95	24.6	4.26	5.23	7.39
Mercury	7439-97-6	E510	0.0050	mg/kg		0.272	0.423	0.352	0.372	0.202
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0691	0.0972	0.0915	0.118	0.0606
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.025	0.081	<0.020	0.033	0.022
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.81	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		20900	23600	19600	19000	25300
Potassium	7440-09-7	E440	20	mg/kg		15300	14500	11900	12100	11400
Rubidium	7440-17-7	E440	0.050	mg/kg		22.4	21.1	20.6	32.0	16.7
Selenium	7782-49-2	E440	0.050	mg/kg		3.05	3.09	2.41	1.41	2.31
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0114	<0.0050	<0.0050	0.0093
Sodium	7440-23-5	E440	20	mg/kg		1970	2070	1480	1620	2040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_NSC-WB-6_2022-10	QUL-NHC_NSC-WB-7_2022-10	QUL-NHC_NSC-WB-8_2022-10	QUL-NGC_NSC-WB-1_2022-10	QUL-NGC_NSC-WB-2_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-006	VA22C4917-007	VA22C4917-008	VA22C4917-009	VA22C4917-010
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		25.6	50.1	31.1	33.8	56.6
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0031	0.0199	0.0064	0.0077	0.0063
Tin	7440-31-5	E440	0.10	mg/kg		0.34	0.35	0.46	0.28	0.52
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	17.6	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0052	0.0321	0.0046	<0.0020	0.0039
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	1.12	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		70.7	97.7	96.4	88.7	111
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	0.21	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_NSC-WB-3_2022-10	QUL-NGC_NSC-WB-4_2022-10	QUL-NGC_NSC-WB-5_2022-10	QUL-NGC_NSC-WB-6_2022-10	QUL-NGC_NSC-WB-7_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-011	VA22C4917-012	VA22C4917-013	VA22C4917-014	VA22C4917-015
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		73.0	77.3	73.1	74.3	74.2
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.031	0.335	0.105	0.076	0.079
Barium	7440-39-3	E440	0.050	mg/kg		0.211	0.882	0.723	0.504	0.925
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0098	0.0314	0.0441	0.0217	0.0240
Calcium	7440-70-2	E440	20	mg/kg		5620	22800	27300	18200	32900
Cesium	7440-46-2	E440	0.0050	mg/kg		0.118	0.0867	0.271	0.163	0.158
Chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
Cobalt	7440-48-4	E440	0.020	mg/kg		0.146	0.049	0.045	0.043	0.055
Copper	7440-50-8	E440	0.10	mg/kg		2.67	2.26	2.20	2.23	2.14
Iron	7439-89-6	E440	3.0	mg/kg		27.1	43.1	18.2	25.0	28.1
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.021	0.027	<0.020	0.021
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1990	1590	1640	1370	1770
Manganese	7439-96-5	E440	0.050	mg/kg		3.40	7.57	3.98	3.87	9.32
Mercury	7439-97-6	E510	0.0050	mg/kg		0.380	0.594	0.517	0.606	0.299
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.103	0.135	0.139	0.156	0.0770
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.026	0.037	0.021	0.024	0.031
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		11000	22400	25200	19600	29400
Potassium	7440-09-7	E440	20	mg/kg		13000	16800	14100	15600	15100
Rubidium	7440-17-7	E440	0.050	mg/kg		26.7	21.0	38.0	30.8	29.8
Selenium	7782-49-2	E440	0.050	mg/kg		1.52	2.33	1.64	1.78	1.86
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		2350	2610	2280	2360	2450

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_NSC-WB-3_2022-10	QUL-NGC_NSC-WB-4_2022-10	QUL-NGC_NSC-WB-5_2022-10	QUL-NGC_NSC-WB-6_2022-10	QUL-NGC_NSC-WB-7_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-011	VA22C4917-012	VA22C4917-013	VA22C4917-014	VA22C4917-015
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		9.20	37.7	42.0	32.9	55.3
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0067	0.0053	0.0067	0.0038	0.0075
Tin	7440-31-5	E440	0.10	mg/kg		0.58	0.30	0.33	0.28	0.22
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0091	0.0035	0.0025	0.0062
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		64.8	103	86.0	67.4	80.5
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_NSC-WB-8_2022-10	QUL-NHC_PCC-M-1_2022-10	QUL-NHC_PCC-M-2_2022-10	QUL-NHC_PCC-M-3_2022-10	QUL-NHC_PCC-M-4_2022-10
					Client sampling date / time	06-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-016	VA22C4917-017	VA22C4917-018	VA22C4917-019	VA22C4917-020
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		74.7	76.5	76.7	75.7	73.5
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		2.6	4.5	2.3	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.038	0.433	0.379	0.194	0.208
Barium	7440-39-3	E440	0.050	mg/kg		0.331	0.935	0.888	0.583	0.686
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0170	0.0124	0.0176	0.0322	0.0125
Calcium	7440-70-2	E440	20	mg/kg		12800	3390	4000	4800	1880
Cesium	7440-46-2	E440	0.0050	mg/kg		0.148	0.0881	0.0860	0.108	0.0825
Chromium	7440-47-3	E440	0.050	mg/kg		0.070	0.914	0.182	0.087	0.055
Cobalt	7440-48-4	E440	0.020	mg/kg		0.096	0.033	0.027	0.030	0.032
Copper	7440-50-8	E440	0.10	mg/kg		3.39	2.38	1.57	1.12	1.60
Iron	7439-89-6	E440	3.0	mg/kg		70.7	33.6	23.4	13.5	15.9
Lead	7439-92-1	E440	0.020	mg/kg		0.024	0.022	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1050	1790	1570	1670	1480
Manganese	7439-96-5	E440	0.050	mg/kg		2.69	2.20	1.95	1.96	1.14
Mercury	7439-97-6	E510	0.0050	mg/kg		0.342	0.963	1.33	0.893	0.515
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0865	0.226	0.310	0.217	0.136
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.060	<0.020	<0.020	<0.020	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		15500	13900	13600	13400	11300
Potassium	7440-09-7	E440	20	mg/kg		15700	21800	21900	19700	18500
Rubidium	7440-17-7	E440	0.050	mg/kg		26.4	28.0	35.2	22.2	22.8
Selenium	7782-49-2	E440	0.050	mg/kg		1.82	4.06	3.23	3.36	2.94
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0067	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		2520	1140	1490	1250	1050

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_NSC-WB-8_2022-10	QUL-NHC_PCC-M-1_2022-10	QUL-NHC_PCC-M-2_2022-10	QUL-NHC_PCC-M-3_2022-10	QUL-NHC_PCC-M-4_2022-10
					Client sampling date / time	06-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-016	VA22C4917-017	VA22C4917-018	VA22C4917-019	VA22C4917-020
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		19.5	6.26	7.40	9.15	3.45
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0056	0.0133	0.0101	<0.0020	0.0049
Tin	7440-31-5	E440	0.10	mg/kg		0.41	0.70	1.02	1.78	0.74
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.36	0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0036	0.0060	0.0052	0.0043	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		63.1	19.0	29.7	20.4	27.5
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-M-5_2022-10	QUL-NHC_PCC-M-6_2022-10	QUL-NHC_PCC-M-7_2022-10	QUL-NHC_PCC-M-8_2022-10	QUL-NHC_PCC-Li-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-021	VA22C4917-022	VA22C4917-023	VA22C4917-024	VA22C4917-025
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		77.2	80.5	78.2	77.2	----
Moisture	----	E144-H	2.0	%		----	----	----	----	53.3
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	----
Aluminum	7429-90-5	E472	5.0	mg/kg		----	----	----	----	11.0
Antimony	7440-36-0	E472	0.010	mg/kg		----	----	----	----	<0.010
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Arsenic	7440-38-2	E440	0.020	mg/kg		0.365	0.384	0.775	0.352	----
Arsenic	7440-38-2	E472	0.030	mg/kg		----	----	----	----	0.367
Barium	7440-39-3	E472	0.050	mg/kg		----	----	----	----	0.577
Barium	7440-39-3	E440	0.050	mg/kg		1.49	1.06	0.622	0.979	----
Beryllium	7440-41-7	E472	0.010	mg/kg		----	----	----	----	<0.010
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Bismuth	7440-69-9	E472	0.010	mg/kg		----	----	----	----	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Boron	7440-42-8	E472	1.0	mg/kg		----	----	----	----	<1.0
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0091	0.0210	0.0062	0.0119	----
Cadmium	7440-43-9	E472	0.010	mg/kg		----	----	----	----	0.722
Calcium	7440-70-2	E472	20	mg/kg		----	----	----	----	148
Calcium	7440-70-2	E440	20	mg/kg		5720	3400	3880	3860	----
Cesium	7440-46-2	E472	0.0050	mg/kg		----	----	----	----	0.0159
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0821	0.103	0.0932	0.0794	----
Chromium	7440-47-3	E440	0.050	mg/kg		0.486	0.129	0.074	0.087	----
Chromium	7440-47-3	E472	0.20	mg/kg		----	----	----	----	0.24
Cobalt	7440-48-4	E472	0.020	mg/kg		----	----	----	----	0.152
Cobalt	7440-48-4	E440	0.020	mg/kg		0.030	0.046	0.030	0.026	----
Copper	7440-50-8	E440	0.10	mg/kg		2.57	2.75	1.76	2.20	----
Copper	7440-50-8	E472	0.20	mg/kg		----	----	----	----	7.97
Iron	7439-89-6	E440	3.0	mg/kg		30.4	31.5	19.2	23.3	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-M-5_2022-10	QUL-NHC_PCC-M-6_2022-10	QUL-NHC_PCC-M-7_2022-10	QUL-NHC_PCC-M-8_2022-10	QUL-NHC_PCC-Li-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-021	VA22C4917-022	VA22C4917-023	VA22C4917-024	VA22C4917-025
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E472	5.0	mg/kg		----	----	----	----	558
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.024	0.022	<0.020	----
Lead	7439-92-1	E472	0.050	mg/kg		----	----	----	----	<0.050
Lithium	7439-93-2	E472	0.50	mg/kg		----	----	----	----	<0.50
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
Magnesium	7439-95-4	E472	2.0	mg/kg		----	----	----	----	432
Magnesium	7439-95-4	E440	2.0	mg/kg		1610	2100	1420	1640	----
Manganese	7439-96-5	E472	0.050	mg/kg		----	----	----	----	2.77
Manganese	7439-96-5	E440	0.050	mg/kg		2.12	1.76	2.04	1.82	----
Mercury	7439-97-6	E511	0.0050	mg/kg		----	----	----	----	0.286
Mercury	7439-97-6	E510	0.0050	mg/kg		0.730	0.856	0.758	1.15	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	----	----	0.133
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.167	0.167	0.165	0.263	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	----	----	0.403
Nickel	7440-02-0	E472	0.20	mg/kg		----	----	----	----	<0.20
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
Phosphorus	7723-14-0	E472	10	mg/kg		----	----	----	----	6950
Phosphorus	7723-14-0	E440	10	mg/kg		13200	16400	14300	14100	----
Potassium	7440-09-7	E472	20	mg/kg		----	----	----	----	5530
Potassium	7440-09-7	E440	20	mg/kg		21400	25600	22500	21100	----
Rubidium	7440-17-7	E472	0.050	mg/kg		----	----	----	----	7.63
Rubidium	7440-17-7	E440	0.050	mg/kg		18.3	28.7	29.4	24.9	----
Selenium	7782-49-2	E440	0.050	mg/kg		5.00	5.24	4.73	5.88	----
Selenium	7782-49-2	E472	0.10	mg/kg		----	----	----	----	6.35
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	----	----	0.0172
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	----
Sodium	7440-23-5	E472	20	mg/kg		----	----	----	----	2600
Sodium	7440-23-5	E440	20	mg/kg		1260	1400	1100	1380	----
Strontium	7440-24-6	E440	0.050	mg/kg		10.9	5.79	7.25	7.14	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-M-5_2022-10	QUL-NHC_PCC-M-6_2022-10	QUL-NHC_PCC-M-7_2022-10	QUL-NHC_PCC-M-8_2022-10	QUL-NHC_PCC-Li-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-021	VA22C4917-022	VA22C4917-023	VA22C4917-024	VA22C4917-025
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		----	----	----	----	0.37
Tellurium	13494-80-9	E472	0.020	mg/kg		----	----	----	----	<0.020
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
Thallium	7440-28-0	E472	0.0020	mg/kg		----	----	----	----	0.0190
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0040	0.0104	0.0086	0.0164	----
Tin	7440-31-5	E472	0.10	mg/kg		----	----	----	----	0.22
Tin	7440-31-5	E440	0.10	mg/kg		2.98	1.52	0.41	0.88	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.25	<0.25	<0.25	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	----	----	<0.50
Uranium	7440-61-1	E472	0.0020	mg/kg		----	----	----	----	0.0240
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0054	0.0024	0.0036	----
Vanadium	7440-62-2	E472	0.10	mg/kg		----	----	----	----	0.49
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	----
Zinc	7440-66-6	E440	0.50	mg/kg		28.4	29.8	30.7	27.3	----
Zinc	7440-66-6	E472	1.0	mg/kg		----	----	----	----	47.9
Zirconium	7440-67-7	E472	0.20	mg/kg		----	----	----	----	<0.20
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-2_2022-10	QUL-NHC_PCC-Li-3_2022-10	QUL-NHC_PCC-Li-4_2022-10	QUL-NHC_PCC-Li-5_2022-10	QUL-NHC_PCC-Li-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-026	VA22C4917-027	VA22C4917-028	VA22C4917-029	VA22C4917-030
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144-H	2.0	%		69.9	61.2	55.8	62.6	61.0
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		29.5	11.3	7.7	<5.0	15.4
Antimony	7440-36-0	E472	0.010	mg/kg		0.019	0.011	<0.010	0.016	0.016
Arsenic	7440-38-2	E472	0.030	mg/kg		0.374	0.231	0.232	0.144	0.299
Barium	7440-39-3	E472	0.050	mg/kg		0.379	0.155	0.349	0.149	0.212
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		0.012	0.055	0.029	0.030	0.033
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E472	0.010	mg/kg		1.06	1.29	0.939	0.519	1.59
Calcium	7440-70-2	E472	20	mg/kg		223	170	210	156	170
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0307	0.0411	0.0232	0.0266	0.0224
Chromium	7440-47-3	E472	0.20	mg/kg		0.49	0.26	<0.20	<0.20	0.37
Cobalt	7440-48-4	E472	0.020	mg/kg		0.297	0.217	0.232	0.136	0.250
Copper	7440-50-8	E472	0.20	mg/kg		17.3	18.0	13.1	10.6	24.7
Iron	7439-89-6	E472	5.0	mg/kg		2770	1050	823	793	1240
Lead	7439-92-1	E472	0.050	mg/kg		0.066	<0.050	<0.050	<0.050	0.060
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		649	698	593	615	585
Manganese	7439-96-5	E472	0.050	mg/kg		5.44	4.25	4.66	3.85	5.15
Mercury	7439-97-6	E511	0.0050	mg/kg		0.804	0.436	0.265	0.346	0.407
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.242	0.169	0.117	0.129	0.159
Molybdenum	7439-98-7	E472	0.040	mg/kg		1.05	0.690	0.829	0.488	1.04
Nickel	7440-02-0	E472	0.20	mg/kg		0.38	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		11800	12300	10700	10700	11000
Potassium	7440-09-7	E472	20	mg/kg		11400	9620	7430	8900	8390
Rubidium	7440-17-7	E472	0.050	mg/kg		18.6	12.2	10.2	8.56	9.62
Selenium	7782-49-2	E472	0.10	mg/kg		12.8	9.61	6.45	11.6	9.62
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0703	0.0422	0.0694	0.0106	0.118
Sodium	7440-23-5	E472	20	mg/kg		4550	3080	2720	3310	3290

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-2_2022-10	QUL-NHC_PCC-Li-3_2022-10	QUL-NHC_PCC-Li-4_2022-10	QUL-NHC_PCC-Li-5_2022-10	QUL-NHC_PCC-Li-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-026	VA22C4917-027	VA22C4917-028	VA22C4917-029	VA22C4917-030
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.57	0.46	0.49	0.38	0.45
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0673	0.0124	0.0201	0.0111	0.0276
Tin	7440-31-5	E472	0.10	mg/kg		1.70	0.33	0.40	0.23	0.27
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	7440-61-1	E472	0.0020	mg/kg		0.104	0.0264	0.0174	0.0263	0.0605
Vanadium	7440-62-2	E472	0.10	mg/kg		1.64	0.48	0.44	0.45	1.13
Zinc	7440-66-6	E472	1.0	mg/kg		88.2	84.6	67.8	72.1	85.0
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-7_2022-10	QUL-NHC_PCC-Li-8_2022-10	QUL-NHC_PCC-O-1_2022-10	QUL-NHC_PCC-O-2_2022-10	QUL-NHC_PCC-O-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-031	VA22C4917-032	VA22C4917-033	VA22C4917-034	VA22C4917-035
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	----	62.1	76.3	66.4
Moisture	----	E144-H	2.0	%		57.3	60.0	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	----	3.0	9.1	<2.0
Aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	15.6	----	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	0.018	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		----	----	0.282	0.289	0.151
Arsenic	7440-38-2	E472	0.030	mg/kg		0.217	0.622	----	----	----
Barium	7440-39-3	E472	0.050	mg/kg		0.174	0.292	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	----	1.05	1.58	0.445
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		0.020	0.013	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	----	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	0.140	0.176	0.0553
Cadmium	7440-43-9	E472	0.010	mg/kg		0.870	0.872	----	----	----
Calcium	7440-70-2	E472	20	mg/kg		138	166	----	----	----
Calcium	7440-70-2	E440	20	mg/kg		----	----	384	616	372
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0305	0.0205	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	----	0.0303	0.0502	0.0508
Chromium	7440-47-3	E440	0.050	mg/kg		----	----	0.210	0.263	<0.050
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.28	----	----	----
Cobalt	7440-48-4	E472	0.020	mg/kg		0.168	0.169	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	----	0.117	0.210	0.126
Copper	7440-50-8	E440	0.10	mg/kg		----	----	5.02	6.80	5.35
Copper	7440-50-8	E472	0.20	mg/kg		20.9	18.7	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	----	84.6	250	67.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-7_2022-10	QUL-NHC_PCC-Li-8_2022-10	QUL-NHC_PCC-O-1_2022-10	QUL-NHC_PCC-O-2_2022-10	QUL-NHC_PCC-O-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-031	VA22C4917-032	VA22C4917-033	VA22C4917-034	VA22C4917-035
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E472	5.0	mg/kg		599	546	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	----	<0.020	0.038	<0.020
Lead	7439-92-1	E472	0.050	mg/kg		<0.050	0.067	----	----	----
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	----	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		616	525	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	----	635	864	715
Manganese	7439-96-5	E472	0.050	mg/kg		4.08	4.05	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	----	9.57	5.64	11.0
Mercury	7439-97-6	E511	0.0050	mg/kg		0.282	0.556	----	----	----
Mercury	7439-97-6	E510	0.0050	mg/kg		----	----	0.0548	0.168	0.0448
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.120	0.222	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	0.0207	0.0398	0.0150
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	0.122	0.230	0.126
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.620	0.889	----	----	----
Nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	----	<0.20	0.30	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		10600	8320	----	----	----
Phosphorus	7723-14-0	E440	10	mg/kg		----	----	10000	12600	13200
Potassium	7440-09-7	E472	20	mg/kg		7580	7290	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	----	8020	14100	9530
Rubidium	7440-17-7	E472	0.050	mg/kg		10.5	8.94	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	----	12.3	26.2	13.4
Selenium	7782-49-2	E440	0.050	mg/kg		----	----	19.7	11.1	20.4
Selenium	7782-49-2	E472	0.10	mg/kg		11.7	17.6	----	----	----
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0514	0.122	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	0.0154	0.0176	0.0138
Sodium	7440-23-5	E472	20	mg/kg		2650	3280	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	----	1750	6580	1720
Strontium	7440-24-6	E440	0.050	mg/kg		----	----	0.514	0.972	0.492

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-7_2022-10	QUL-NHC_PCC-Li-8_2022-10	QUL-NHC_PCC-O-1_2022-10	QUL-NHC_PCC-O-2_2022-10	QUL-NHC_PCC-O-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-031	VA22C4917-032	VA22C4917-033	VA22C4917-034	VA22C4917-035
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.38	0.42	----	----	----
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0150	0.0367	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	----	0.0104	0.0215	0.0035
Tin	7440-31-5	E472	0.10	mg/kg		0.51	0.31	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	----	0.16	3.50	<0.10
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	<0.25	0.52	<0.25
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	----	----	----
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0104	0.0145	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	----	0.0112	0.0182	0.0048
Vanadium	7440-62-2	E472	0.10	mg/kg		0.32	0.66	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	----	<0.10	0.21	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	----	93.3	220	116
Zinc	7440-66-6	E472	1.0	mg/kg		71.8	64.4	----	----	----
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	----	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-O-4_2022-10	QUL-NHC_PCC-O-5_2022-10	QUL-NHC_PCC-O-6_2022-10	QUL-NHC_PCC-O-7_2022-10	QUL-NHC_PCC-Ki-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-036	VA22C4917-037	VA22C4917-038	VA22C4917-039	VA22C4917-040
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		62.5	64.9	61.0	59.3	----
Moisture	----	E144A	2.0	%		----	----	----	----	31.6
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	----
Aluminum	7429-90-5	E475	5.0	mg/kg		----	----	----	----	6.6
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Antimony	7440-36-0	E475	0.020	mg/kg		----	----	----	----	<0.020
Arsenic	7440-38-2	E440	0.020	mg/kg		0.159	0.050	0.166	0.126	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	----	----	----	0.458
Barium	7440-39-3	E475	0.050	mg/kg		----	----	----	----	2.71
Barium	7440-39-3	E440	0.050	mg/kg		0.362	0.158	0.511	0.321	----
Beryllium	7440-41-7	E475	0.010	mg/kg		----	----	----	----	<0.010
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Bismuth	7440-69-9	E475	0.010	mg/kg		----	----	----	----	0.011
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Boron	7440-42-8	E475	1.0	mg/kg		----	----	----	----	<1.0
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0175	0.0237	0.0270	0.0151	----
Cadmium	7440-43-9	E475	0.010	mg/kg		----	----	----	----	8.14
Calcium	7440-70-2	E475	20	mg/kg		----	----	----	----	256
Calcium	7440-70-2	E440	20	mg/kg		277	470	272	305	----
Cesium	7440-46-2	E475	0.0050	mg/kg		----	----	----	----	0.0276
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0290	0.0363	0.0298	0.0394	----
Chromium	7440-47-3	E440	0.050	mg/kg		<0.050	0.071	0.082	<0.050	----
Chromium	7440-47-3	E475	0.20	mg/kg		----	----	----	----	0.36
Cobalt	7440-48-4	E475	0.020	mg/kg		----	----	----	----	0.941
Cobalt	7440-48-4	E440	0.020	mg/kg		0.097	0.101	0.106	0.089	----
Copper	7440-50-8	E440	0.10	mg/kg		4.11	4.52	4.33	3.74	----
Copper	7440-50-8	E475	0.20	mg/kg		----	----	----	----	3.88
Iron	7439-89-6	E440	3.0	mg/kg		60.5	78.3	47.1	41.6	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-O-4_2022-10	QUL-NHC_PCC-O-5_2022-10	QUL-NHC_PCC-O-6_2022-10	QUL-NHC_PCC-O-7_2022-10	QUL-NHC_PCC-Ki-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-036	VA22C4917-037	VA22C4917-038	VA22C4917-039	VA22C4917-040
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E475	5.0	mg/kg		----	----	----	----	324
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
Lead	7439-92-1	E475	0.050	mg/kg		----	----	----	----	0.066
Lithium	7439-93-2	E475	0.50	mg/kg		----	----	----	----	<0.50
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
Magnesium	7439-95-4	E475	2.0	mg/kg		----	----	----	----	412
Magnesium	7439-95-4	E440	2.0	mg/kg		547	706	641	540	----
Manganese	7439-96-5	E475	0.050	mg/kg		----	----	----	----	1.85
Manganese	7439-96-5	E440	0.050	mg/kg		9.67	13.2	10.1	9.76	----
Mercury	7439-97-6	E510	0.0050	mg/kg		0.0230	0.0398	0.0249	0.0281	----
Mercury	7439-97-6	E512	0.010	mg/kg		----	----	----	----	0.265
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0086	0.0140	0.0097	0.0114	----
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	----	----	----	0.181
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.106	0.125	0.088	0.086	----
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	----	----	----	0.337
Nickel	7440-02-0	E475	0.20	mg/kg		----	----	----	----	<1.00 DLB
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg		9790	10800	10600	9610	----
Phosphorus	7723-14-0	E475	20	mg/kg		----	----	----	----	6310
Potassium	7440-09-7	E475	20	mg/kg		----	----	----	----	6360
Potassium	7440-09-7	E440	20	mg/kg		6770	8670	7940	7470	----
Rubidium	7440-17-7	E475	0.050	mg/kg		----	----	----	----	9.48
Rubidium	7440-17-7	E440	0.050	mg/kg		10.5	8.88	10.4	12.6	----
Selenium	7782-49-2	E440	0.050	mg/kg		7.47	28.3	16.6	20.3	----
Selenium	7782-49-2	E475	0.10	mg/kg		----	----	----	----	5.52
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	----	----	----	<0.0050
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0152	0.0165	0.0180	0.0097	----
Sodium	7440-23-5	E475	20	mg/kg		----	----	----	----	2820
Sodium	7440-23-5	E440	20	mg/kg		1340	1770	1580	1500	----
Strontium	7440-24-6	E440	0.050	mg/kg		0.326	0.528	0.317	0.459	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-O-4_2022-10	QUL-NHC_PCC-O-5_2022-10	QUL-NHC_PCC-O-6_2022-10	QUL-NHC_PCC-O-7_2022-10	QUL-NHC_PCC-Ki-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-036	VA22C4917-037	VA22C4917-038	VA22C4917-039	VA22C4917-040
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		----	----	----	----	0.59
Tellurium	13494-80-9	E475	0.020	mg/kg		----	----	----	----	<0.020
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
Thallium	7440-28-0	E475	0.0020	mg/kg		----	----	----	----	0.0207
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0045	0.0032	0.0054	0.0053	----
Tin	7440-31-5	E475	0.10	mg/kg		----	----	----	----	0.49
Tin	7440-31-5	E440	0.10	mg/kg		0.21	0.22	0.22	0.37	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	----
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	----	----	----	<0.50
Uranium	7440-61-1	E475	0.0020	mg/kg		----	----	----	----	0.0429
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0034	0.0061	0.0103	0.0026	----
Vanadium	7440-62-2	E475	0.10	mg/kg		----	----	----	----	0.43
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	----
Zinc	7440-66-6	E440	0.50	mg/kg		82.8	98.0	93.0	88.2	----
Zinc	7440-66-6	E475	1.0	mg/kg		----	----	----	----	73.5
Zirconium	7440-67-7	E475	0.20	mg/kg		----	----	----	----	<0.20
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Ki-2_2022-10	QUL-NHC_PCC-Ki-3_2022-10	QUL-NHC_PCC-Ki-4_2022-10	QUL-NHC_PCC-Ki-5_2022-10	QUL-NHC_PCC-Ki-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-041	VA22C4917-042	VA22C4917-043	VA22C4917-044	VA22C4917-045
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144A	2.0	%		69.0	48.2	53.9	57.0	50.0
Metals										
Aluminum	7429-90-5	E475	5.0	mg/kg		6.8	<5.0	<5.0	<5.0	7.1
Antimony	7440-36-0	E475	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Arsenic	7440-38-2	E475	0.050	mg/kg		0.416	0.282	0.276	0.199	0.419
Barium	7440-39-3	E475	0.050	mg/kg		1.96	1.40	1.31	1.29	2.29
Beryllium	7440-41-7	E475	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		0.013	0.037	0.021	0.024	0.038
Boron	7440-42-8	E475	1.0	mg/kg		1.5	<1.0	2.0	<1.0	1.2
Cadmium	7440-43-9	E475	0.010	mg/kg		19.0	12.9	8.14	6.12	24.6
Calcium	7440-70-2	E475	20	mg/kg		434	277	363	310	958
Cesium	7440-46-2	E475	0.0050	mg/kg		0.0508	0.0529	0.0470	0.0470	0.0462
Chromium	7440-47-3	E475	0.20	mg/kg		0.36	0.24	<0.20	0.28	0.48
Cobalt	7440-48-4	E475	0.020	mg/kg		1.17	2.88	2.90	1.64	4.00
Copper	7440-50-8	E475	0.20	mg/kg		8.54	5.42	5.01	4.29	7.00
Iron	7439-89-6	E475	5.0	mg/kg		534	250	477	286	336
Lead	7439-92-1	E475	0.050	mg/kg		0.052	0.107	0.065	<0.050	0.181
Lithium	7439-93-2	E475	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		615	488	563	515	673
Manganese	7439-96-5	E475	0.050	mg/kg		3.25	3.14	4.22	3.18	6.54
Mercury	7439-97-6	E512	0.010	mg/kg		0.336	0.263	0.196	0.197	0.347
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.104	0.136	0.0901	0.0848	0.173
Molybdenum	7439-98-7	E475	0.040	mg/kg		0.741	1.38	0.483	0.311	0.742
Nickel	7440-02-0	E475	0.20	mg/kg		2.29	<1.90 DLB	0.83	0.76	<2.40 DLB
Phosphorus	7723-14-0	E475	20	mg/kg		11100	9730	10900	10100	12800
Potassium	7440-09-7	E475	20	mg/kg		11300	8740	10100	10000	10800
Rubidium	7440-17-7	E475	0.050	mg/kg		21.3	12.2	15.2	10.6	14.9
Selenium	7782-49-2	E475	0.10	mg/kg		7.22	7.49	5.77	7.23	8.99
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0168	<0.0050	<0.0050	<0.0050	0.0118
Sodium	7440-23-5	E475	20	mg/kg		5960	3310	4420	4310	4950

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Ki-2_2022-10	QUL-NHC_PCC-Ki-3_2022-10	QUL-NHC_PCC-Ki-4_2022-10	QUL-NHC_PCC-Ki-5_2022-10	QUL-NHC_PCC-Ki-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-041	VA22C4917-042	VA22C4917-043	VA22C4917-044	VA22C4917-045
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		0.98	0.65	0.73	0.64	2.16
Tellurium	13494-80-9	E475	0.020	mg/kg		0.021	0.036	<0.020	0.031	0.045
Thallium	7440-28-0	E475	0.0020	mg/kg		0.0365	0.0325	0.0284	0.0167	0.0488
Tin	7440-31-5	E475	0.10	mg/kg		1.67	0.34	1.14	0.54	0.52
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		0.53	<0.50	<0.50	<0.50	0.55
Uranium	7440-61-1	E475	0.0020	mg/kg		0.119	0.0597	0.0241	0.0290	0.144
Vanadium	7440-62-2	E475	0.10	mg/kg		0.80	0.53	0.30	0.37	1.23
Zinc	7440-66-6	E475	1.0	mg/kg		160	147	120	97.7	156
Zirconium	7440-67-7	E475	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Ki-7_2022-10	QUL-NHC_PCC-Ki-8_2022-10	QUL-NGC_PCC-M-1_2022-10	QUL-NGC_PCC-M-2_2022-10	QUL-NGC_PCC-M-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-046	VA22C4917-047	VA22C4917-048	VA22C4917-049	VA22C4917-050
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	----	77.4	76.5	75.9
Moisture	----	E144A	2.0	%		50.0	56.0	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	----	7.5	3.3	3.0
Aluminum	7429-90-5	E475	5.0	mg/kg		9.6	6.1	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Antimony	7440-36-0	E475	0.020	mg/kg		<0.020	<0.020	----	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		----	----	0.175	0.266	0.425
Arsenic	7440-38-2	E475	0.050	mg/kg		0.313	0.477	----	----	----
Barium	7440-39-3	E475	0.050	mg/kg		1.39	2.34	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	----	0.340	0.501	0.558
Beryllium	7440-41-7	E475	0.010	mg/kg		<0.010	<0.010	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		0.018	0.018	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Boron	7440-42-8	E475	1.0	mg/kg		1.9	2.1	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	----	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	<0.0050	0.0078	0.0058
Cadmium	7440-43-9	E475	0.010	mg/kg		8.61	15.5	----	----	----
Calcium	7440-70-2	E475	20	mg/kg		412	340	----	----	----
Calcium	7440-70-2	E440	20	mg/kg		----	----	1660	1760	3270
Cesium	7440-46-2	E475	0.0050	mg/kg		0.0572	0.0401	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	----	0.158	0.154	0.148
Chromium	7440-47-3	E440	0.050	mg/kg		----	----	0.079	0.103	<0.050
Chromium	7440-47-3	E475	0.20	mg/kg		<0.20	0.31	----	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		2.16	2.13	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	----	0.033	<0.020	0.032
Copper	7440-50-8	E440	0.10	mg/kg		----	----	1.57	2.24	1.59
Copper	7440-50-8	E475	0.20	mg/kg		5.61	5.78	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	----	20.2	27.2	18.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Ki-7_2022-10	QUL-NHC_PCC-Ki-8_2022-10	QUL-NGC_PCC-M-1_2022-10	QUL-NGC_PCC-M-2_2022-10	QUL-NGC_PCC-M-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-046	VA22C4917-047	VA22C4917-048	VA22C4917-049	VA22C4917-050
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E475	5.0	mg/kg		353	455	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Lead	7439-92-1	E475	0.050	mg/kg		0.088	0.078	----	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		<0.50	<0.50	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	----	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		556	569	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	----	1750	1240	1480
Manganese	7439-96-5	E475	0.050	mg/kg		3.25	3.52	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	----	0.985	0.731	1.57
Mercury	7439-97-6	E510	0.0050	mg/kg		----	----	0.428	0.716	0.508
Mercury	7439-97-6	E512	0.010	mg/kg		0.195	0.405	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	0.0966	0.168	0.122
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.0974	0.178	----	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Molybdenum	7439-98-7	E475	0.040	mg/kg		0.576	0.828	----	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		<1.60 DLB	<3.60 DLB	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	----	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		----	----	11500	11800	13300
Phosphorus	7723-14-0	E475	20	mg/kg		10800	10700	----	----	----
Potassium	7440-09-7	E475	20	mg/kg		9100	9990	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	----	18400	20200	20200
Rubidium	7440-17-7	E475	0.050	mg/kg		15.0	14.4	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	----	22.2	23.8	26.4
Selenium	7782-49-2	E440	0.050	mg/kg		----	----	2.14	2.80	2.94
Selenium	7782-49-2	E475	0.10	mg/kg		9.04	13.0	----	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E475	20	mg/kg		4710	5000	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	----	1030	1170	1090
Strontium	7440-24-6	E440	0.050	mg/kg		----	----	2.77	2.93	6.98

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Ki-7_2022-10	QUL-NHC_PCC-Ki-8_2022-10	QUL-NGC_PCC-M-1_2022-10	QUL-NGC_PCC-M-2_2022-10	QUL-NGC_PCC-M-3_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-046	VA22C4917-047	VA22C4917-048	VA22C4917-049	VA22C4917-050
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		0.92	0.70	----	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		<0.020	0.052	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Thallium	7440-28-0	E475	0.0020	mg/kg		0.0319	0.0395	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	----	0.0075	0.0041	0.0042
Tin	7440-31-5	E475	0.10	mg/kg		1.12	1.31	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	----	1.45	0.76	0.45
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	0.46	0.27	<0.25
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		0.69	<0.50	----	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		0.0224	0.0431	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	----	<0.0020	0.0024	0.0027
Vanadium	7440-62-2	E475	0.10	mg/kg		0.42	1.01	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	----	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	----	24.1	27.6	23.0
Zinc	7440-66-6	E475	1.0	mg/kg		155	138	----	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		<0.20	<0.20	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	----	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-M-4_2022-10	QUL-NGC_PCC-M-5_2022-10	QUL-NGC_PCC-M-6_2022-10	QUL-NGC_PCC-M-7_2022-10	QUL-NGC_PCC-M-8_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-051	VA22C4917-052	VA22C4917-053	VA22C4917-054	VA22C4917-055
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		78.0	76.7	78.2	78.8	76.9
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		3.0	2.7	2.8	2.8	4.4
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.304	0.260	0.496	0.532	0.155
Barium	7440-39-3	E440	0.050	mg/kg		0.832	0.918	0.245	0.625	0.670
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.014	0.012
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0110	0.0108	<0.0050	0.0076	<0.0050
Calcium	7440-70-2	E440	20	mg/kg		2120	2160	2440	5190	3060
Cesium	7440-46-2	E440	0.0050	mg/kg		0.155	0.136	0.212	0.230	0.179
Chromium	7440-47-3	E440	0.050	mg/kg		0.164	0.194	<0.050	0.081	0.090
Cobalt	7440-48-4	E440	0.020	mg/kg		0.023	0.030	<0.020	0.026	0.038
Copper	7440-50-8	E440	0.10	mg/kg		2.27	1.09	1.19	1.44	1.67
Iron	7439-89-6	E440	3.0	mg/kg		23.8	14.0	12.4	17.8	19.2
Lead	7439-92-1	E440	0.020	mg/kg		0.020	<0.020	<0.020	<0.020	0.023
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1850	1630	1800	2270	1790
Manganese	7439-96-5	E440	0.050	mg/kg		1.15	0.837	1.24	1.79	1.69
Mercury	7439-97-6	E510	0.0050	mg/kg		0.492	1.03	0.838	1.15	0.629
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.108	0.240	0.183	0.245	0.145
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		14000	12300	13800	16100	13300
Potassium	7440-09-7	E440	20	mg/kg		23600	22200	24000	24000	21800
Rubidium	7440-17-7	E440	0.050	mg/kg		25.8	32.5	37.2	34.0	31.9
Selenium	7782-49-2	E440	0.050	mg/kg		3.72	1.66	1.88	2.14	1.58
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		1280	1160	1180	1430	1370

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-M-4_2022-10	QUL-NGC_PCC-M-5_2022-10	QUL-NGC_PCC-M-6_2022-10	QUL-NGC_PCC-M-7_2022-10	QUL-NGC_PCC-M-8_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-051	VA22C4917-052	VA22C4917-053	VA22C4917-054	VA22C4917-055
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		3.70	3.66	5.16	10.7	6.55
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0064	0.0049	0.0044	0.0106	0.0087
Tin	7440-31-5	E440	0.10	mg/kg		1.99	0.74	0.91	1.22	1.36
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		0.31	1.06	0.28	0.26	0.40
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0035	0.0023	0.0035	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		39.9	20.2	24.3	30.3	31.2
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-1_2022-10	QUL-NGC_PCC-Li-2_2022-10	QUL-NGC_PCC-Li-3_2022-10	QUL-NGC_PCC-Li-4_2022-10	QUL-NGC_PCC-Li-5_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-056	VA22C4917-057	VA22C4917-058	VA22C4917-059	VA22C4917-060
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144-H	2.0	%		57.0	68.2	56.0	59.0	62.2
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		29.2	18.0	5.2	67.2	13.5
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	0.016	<0.010	<0.010	0.011
Arsenic	7440-38-2	E472	0.030	mg/kg		0.184	1.82	0.455	0.358	1.29
Barium	7440-39-3	E472	0.050	mg/kg		0.462	0.201	0.136	0.308	0.099
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		0.033	0.112	0.020	0.029	0.031
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E472	0.010	mg/kg		0.226	0.441	0.271	0.442	1.19
Calcium	7440-70-2	E472	20	mg/kg		530	233	118	154	121
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0416	0.0418	0.0180	0.0326	0.0259
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.30	<0.20	<0.20	0.28
Cobalt	7440-48-4	E472	0.020	mg/kg		0.194	0.202	0.182	0.117	0.236
Copper	7440-50-8	E472	0.20	mg/kg		16.2	10.9	13.1	8.81	13.9
Iron	7439-89-6	E472	5.0	mg/kg		258	914	410	483	421
Lead	7439-92-1	E472	0.050	mg/kg		0.050	<0.050	<0.050	0.092	<0.050
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		408	811	446	438	532
Manganese	7439-96-5	E472	0.050	mg/kg		3.37	5.26	2.55	2.88	3.40
Mercury	7439-97-6	E511	0.0050	mg/kg		0.156	0.469	0.153	0.178	0.317
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0672	0.149	0.0673	0.0730	0.120
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.406	0.686	0.410	0.406	0.715
Nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	<0.20	0.34	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		6470	12500	6940	6750	9360
Potassium	7440-09-7	E472	20	mg/kg		4880	10100	5060	6000	7090
Rubidium	7440-17-7	E472	0.050	mg/kg		6.60	12.4	6.85	6.51	11.5
Selenium	7782-49-2	E472	0.10	mg/kg		4.65	7.45	6.06	8.83	6.01
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0928	0.0252	0.0524	0.0248	0.0372
Sodium	7440-23-5	E472	20	mg/kg		2160	3790	1920	2210	2450

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-1_2022-10	QUL-NGC_PCC-Li-2_2022-10	QUL-NGC_PCC-Li-3_2022-10	QUL-NGC_PCC-Li-4_2022-10	QUL-NGC_PCC-Li-5_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-056	VA22C4917-057	VA22C4917-058	VA22C4917-059	VA22C4917-060
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		1.79	0.66	0.32	0.50	0.31
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0138	0.0151	0.0128	0.0153	0.0165
Tin	7440-31-5	E472	0.10	mg/kg		<0.10	1.06	<0.10	<0.10	<0.10
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		1.48	<0.50	<0.50	0.75	<0.50
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0055	0.0781	0.0104	0.0260	0.0511
Vanadium	7440-62-2	E472	0.10	mg/kg		0.10	0.43	0.18	0.34	0.31
Zinc	7440-66-6	E472	1.0	mg/kg		57.5	79.6	58.2	54.6	70.7
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-6_2022-10	QUL-NGC_PCC-Li-7_2022-10	QUL-NGC_PCC-Li-8_2022-10	QUL-NGC_PCC-O-2_2022-10	QUL-NGC_PCC-O-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-061	VA22C4917-062	VA22C4917-063	VA22C4917-064	VA22C4917-065
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	----	----	66.2	65.1
Moisture	----	E144A	2.0	%		----	----	64.9	----	----
Moisture	----	E144-H	2.0	%		64.4	72.3	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	----	----	<2.0	<2.0
Aluminum	7429-90-5	E475	5.0	mg/kg		----	----	5.2	----	----
Aluminum	7429-90-5	E472	5.0	mg/kg		5.6	9.0	----	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	0.011	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	----	----	<0.010	<0.010
Antimony	7440-36-0	E475	0.020	mg/kg		----	----	<0.020	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		----	----	----	0.085	0.196
Arsenic	7440-38-2	E472	0.030	mg/kg		4.86	5.64	----	----	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	----	0.139	----	----
Barium	7440-39-3	E475	0.050	mg/kg		----	----	0.073	----	----
Barium	7440-39-3	E472	0.050	mg/kg		0.247	0.160	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	----	----	0.323	0.331
Beryllium	7440-41-7	E475	0.010	mg/kg		----	----	<0.010	----	----
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	----	----	<0.010	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		----	----	0.067	----	----
Bismuth	7440-69-9	E472	0.010	mg/kg		0.017	0.082	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	----	----	<0.010	<0.010
Boron	7440-42-8	E475	1.0	mg/kg		----	----	<1.0	----	----
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	<1.0	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	----	----	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	----	0.0121	0.0292
Cadmium	7440-43-9	E475	0.010	mg/kg		----	----	0.233	----	----
Cadmium	7440-43-9	E472	0.010	mg/kg		0.351	1.03	----	----	----
Calcium	7440-70-2	E475	20	mg/kg		----	----	131	----	----
Calcium	7440-70-2	E472	20	mg/kg		321	186	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-6_2022-10	QUL-NGC_PCC-Li-7_2022-10	QUL-NGC_PCC-Li-8_2022-10	QUL-NGC_PCC-O-2_2022-10	QUL-NGC_PCC-O-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-061	VA22C4917-062	VA22C4917-063	VA22C4917-064	VA22C4917-065
						Result	Result	Result	Result	Result
Metals										
Calcium	7440-70-2	E440	20	mg/kg		----	----	----	412	386
Cesium	7440-46-2	E475	0.0050	mg/kg		----	----	0.0483	----	----
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0446	0.0482	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	----	----	0.0562	0.0504
Chromium	7440-47-3	E440	0.050	mg/kg		----	----	----	<0.050	0.050
Chromium	7440-47-3	E475	0.20	mg/kg		----	----	<0.20	----	----
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.37	----	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		----	----	0.204	----	----
Cobalt	7440-48-4	E472	0.020	mg/kg		0.149	0.293	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	----	----	0.072	0.144
Copper	7440-50-8	E440	0.10	mg/kg		----	----	----	4.26	5.15
Copper	7440-50-8	E475	0.20	mg/kg		----	----	15.7	----	----
Copper	7440-50-8	E472	0.20	mg/kg		7.36	24.3	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	----	----	57.5	61.2
Iron	7439-89-6	E475	5.0	mg/kg		----	----	572	----	----
Iron	7439-89-6	E472	5.0	mg/kg		650	947	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	----	----	<0.020	<0.020
Lead	7439-92-1	E475	0.050	mg/kg		----	----	<0.050	----	----
Lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	----	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		----	----	<0.50	----	----
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	----	----	<0.50	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		----	----	454	----	----
Magnesium	7439-95-4	E472	2.0	mg/kg		534	887	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	----	----	694	761
Manganese	7439-96-5	E475	0.050	mg/kg		----	----	3.35	----	----
Manganese	7439-96-5	E472	0.050	mg/kg		3.56	6.29	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	----	----	8.87	8.72
Mercury	7439-97-6	E511	0.0050	mg/kg		0.184	0.572	----	----	----
Mercury	7439-97-6	E510	0.0050	mg/kg		----	----	----	0.0454	0.0252

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-6_2022-10	QUL-NGC_PCC-Li-7_2022-10	QUL-NGC_PCC-Li-8_2022-10	QUL-NGC_PCC-O-2_2022-10	QUL-NGC_PCC-O-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-061	VA22C4917-062	VA22C4917-063	VA22C4917-064	VA22C4917-065
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E512	0.010	mg/kg		----	----	0.232	----	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0654	0.159	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	----	0.0154	0.0088
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	----	0.0815	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	----	0.120	0.108
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	----	0.492	----	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.545	0.858	----	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		----	----	<0.20	----	----
Nickel	7440-02-0	E472	0.20	mg/kg		<0.20	0.23	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	----	----	<0.20	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		9050	14100	----	----	----
Phosphorus	7723-14-0	E440	10	mg/kg		----	----	----	10800	12600
Phosphorus	7723-14-0	E475	20	mg/kg		----	----	8560	----	----
Potassium	7440-09-7	E475	20	mg/kg		----	----	7260	----	----
Potassium	7440-09-7	E472	20	mg/kg		7360	11300	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	----	----	8890	9400
Rubidium	7440-17-7	E475	0.050	mg/kg		----	----	12.3	----	----
Rubidium	7440-17-7	E472	0.050	mg/kg		12.6	16.4	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	----	----	12.5	14.4
Selenium	7782-49-2	E440	0.050	mg/kg		----	----	----	12.8	14.8
Selenium	7782-49-2	E475	0.10	mg/kg		----	----	5.79	----	----
Selenium	7782-49-2	E472	0.10	mg/kg		4.41	8.79	----	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	----	0.0632	----	----
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0227	0.130	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	----	0.0171	0.0164
Sodium	7440-23-5	E475	20	mg/kg		----	----	2070	----	----
Sodium	7440-23-5	E472	20	mg/kg		2400	3720	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	----	----	1950	1610
Strontium	7440-24-6	E440	0.050	mg/kg		----	----	----	0.461	0.579
Strontium	7440-24-6	E475	0.10	mg/kg		----	----	0.29	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Li-6_2022-10	QUL-NGC_PCC-Li-7_2022-10	QUL-NGC_PCC-Li-8_2022-10	QUL-NGC_PCC-O-2_2022-10	QUL-NGC_PCC-O-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-061	VA22C4917-062	VA22C4917-063	VA22C4917-064	VA22C4917-065
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.96	0.50	----	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		----	----	<0.020	----	----
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	<0.020	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	----	----	<0.020	<0.020
Thallium	7440-28-0	E475	0.0020	mg/kg		----	----	0.0233	----	----
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0210	0.0264	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	----	----	0.0036	0.0044
Tin	7440-31-5	E475	0.10	mg/kg		----	----	<0.10	----	----
Tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	----	----	0.24	0.32
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	----	<0.25	0.32
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	----	0.52	----	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	----	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		----	----	0.0050	----	----
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0199	0.0217	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	----	----	0.0082	0.0079
Vanadium	7440-62-2	E475	0.10	mg/kg		----	----	<0.10	----	----
Vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	0.42	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	----	----	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	----	----	111	114
Zinc	7440-66-6	E475	1.0	mg/kg		----	----	74.7	----	----
Zinc	7440-66-6	E472	1.0	mg/kg		68.4	92.7	----	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		----	----	<0.20	----	----
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	<0.20	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	----	----	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-O-5_2022-10	QUL-NGC_PCC-O-6_2022-10	QUL-NGC_PCC-O-7_2022-10	QUL-NGC_PCC-O-8_2022-10	QUL-NGC_PCC-Ki-1_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-066	VA22C4917-067	VA22C4917-068	VA22C4917-069	VA22C4917-070
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		69.0	68.8	65.8	65.8	----
Moisture	----	E144A	2.0	%		----	----	----	----	60.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	3.5	<2.0	<2.0	----
Aluminum	7429-90-5	E475	5.0	mg/kg		----	----	----	----	8.3
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Antimony	7440-36-0	E475	0.020	mg/kg		----	----	----	----	<0.026 DLIS
Arsenic	7440-38-2	E440	0.020	mg/kg		0.106	0.277	0.202	0.120	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	----	----	----	0.201
Barium	7440-39-3	E475	0.050	mg/kg		----	----	----	----	1.42
Barium	7440-39-3	E440	0.050	mg/kg		0.415	0.320	0.311	0.249	----
Beryllium	7440-41-7	E475	0.010	mg/kg		----	----	----	----	<0.013 DLIS
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Bismuth	7440-69-9	E475	0.010	mg/kg		----	----	----	----	0.029
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	----
Boron	7440-42-8	E475	1.0	mg/kg		----	----	----	----	2.9
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0310	0.0354	0.0315	0.0451	----
Cadmium	7440-43-9	E475	0.010	mg/kg		----	----	----	----	2.84
Calcium	7440-70-2	E475	20	mg/kg		----	----	----	----	290
Calcium	7440-70-2	E440	20	mg/kg		662	622	365	507	----
Cesium	7440-46-2	E475	0.0050	mg/kg		----	----	----	----	0.0678
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0670	0.0879	0.0626	0.0993	----
Chromium	7440-47-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	0.148	----
Chromium	7440-47-3	E475	0.20	mg/kg		----	----	----	----	0.26
Cobalt	7440-48-4	E475	0.020	mg/kg		----	----	----	----	3.55
Cobalt	7440-48-4	E440	0.020	mg/kg		0.186	0.093	0.118	0.172	----
Copper	7440-50-8	E440	0.10	mg/kg		4.61	5.04	4.96	5.18	----
Copper	7440-50-8	E475	0.20	mg/kg		----	----	----	----	4.35
Iron	7439-89-6	E440	3.0	mg/kg		70.4	67.2	56.0	86.1	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-O-5_2022-10	QUL-NGC_PCC-O-6_2022-10	QUL-NGC_PCC-O-7_2022-10	QUL-NGC_PCC-O-8_2022-10	QUL-NGC_PCC-Ki-1_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-066	VA22C4917-067	VA22C4917-068	VA22C4917-069	VA22C4917-070
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E475	5.0	mg/kg		----	----	----	----	238
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	0.021	----
Lead	7439-92-1	E475	0.050	mg/kg		----	----	----	----	<0.064 DLIS
Lithium	7439-93-2	E475	0.50	mg/kg		----	----	----	----	<0.64 DLIS
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
Magnesium	7439-95-4	E475	2.0	mg/kg		----	----	----	----	478
Magnesium	7439-95-4	E440	2.0	mg/kg		927	854	681	929	----
Manganese	7439-96-5	E475	0.050	mg/kg		----	----	----	----	3.33
Manganese	7439-96-5	E440	0.050	mg/kg		15.1	15.8	10.2	17.3	----
Mercury	7439-97-6	E510	0.0050	mg/kg		0.0512	0.0417	0.0568	0.0284	----
Mercury	7439-97-6	E512	0.010	mg/kg		----	----	----	----	0.157
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0158	0.0130	0.0194	0.0097	----
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	----	----	----	0.0630
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.154	0.193	0.123	0.180	----
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	----	----	----	0.407
Nickel	7440-02-0	E475	0.20	mg/kg		----	----	----	----	<0.80 DLB
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg		10700	10300	12000	11100	----
Phosphorus	7723-14-0	E475	20	mg/kg		----	----	----	----	8710
Potassium	7440-09-7	E475	20	mg/kg		----	----	----	----	7800
Potassium	7440-09-7	E440	20	mg/kg		10900	10600	8920	10700	----
Rubidium	7440-17-7	E475	0.050	mg/kg		----	----	----	----	10.4
Rubidium	7440-17-7	E440	0.050	mg/kg		19.4	19.4	14.4	18.9	----
Selenium	7782-49-2	E440	0.050	mg/kg		9.08	7.62	10.5	12.7	----
Selenium	7782-49-2	E475	0.10	mg/kg		----	----	----	----	4.06
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	----	----	----	<0.0064 DLIS
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0205	0.0267	0.0191	0.0250	----
Sodium	7440-23-5	E475	20	mg/kg		----	----	----	----	2360
Sodium	7440-23-5	E440	20	mg/kg		2240	1880	1700	1640	----
Strontium	7440-24-6	E440	0.050	mg/kg		0.716	0.697	0.474	0.677	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-O-5_2022-10	QUL-NGC_PCC-O-6_2022-10	QUL-NGC_PCC-O-7_2022-10	QUL-NGC_PCC-O-8_2022-10	QUL-NGC_PCC-Ki-1_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-066	VA22C4917-067	VA22C4917-068	VA22C4917-069	VA22C4917-070
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		----	----	----	----	0.64
Tellurium	13494-80-9	E475	0.020	mg/kg		----	----	----	----	<0.026 DLIS
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	----
Thallium	7440-28-0	E475	0.0020	mg/kg		----	----	----	----	0.0496
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0059	0.0060	0.0047	0.0108	----
Tin	7440-31-5	E475	0.10	mg/kg		----	----	----	----	<0.13 DLIS
Tin	7440-31-5	E440	0.10	mg/kg		0.52	0.38	0.12	0.44	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.30	<0.25	<0.25	----
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	----	----	----	0.96
Uranium	7440-61-1	E475	0.0020	mg/kg		----	----	----	----	0.0149
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0104	0.0084	0.0119	<0.0020	----
Vanadium	7440-62-2	E475	0.10	mg/kg		----	----	----	----	0.21
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	----
Zinc	7440-66-6	E440	0.50	mg/kg		140	139	116	148	----
Zinc	7440-66-6	E475	1.0	mg/kg		----	----	----	----	164
Zirconium	7440-67-7	E475	0.20	mg/kg		----	----	----	----	<0.26 DLIS
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-2_2022-10	QUL-NGC_PCC-Ki-3_2022-10	QUL-NGC_PCC-Ki-4_2022-10	QUL-NGC_PCC-Ki-5_2022-10	QUL-NGC_PCC-Ki-6_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-071	VA22C4917-072	VA22C4917-073	VA22C4917-074	VA22C4917-075
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144A	2.0	%		----	64.7	60.2	56.0	69.6
Moisture	----	E144-H	2.0	%		66.9	----	----	----	----
Metals										
Aluminum	7429-90-5	E475	5.0	mg/kg		----	<5.0	<5.0	6.0	5.2
Aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	----	----	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	----	----	----	----
Antimony	7440-36-0	E475	0.020	mg/kg		----	<0.020	<0.020	<0.020	<0.020
Arsenic	7440-38-2	E472	0.030	mg/kg		0.229	----	----	----	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	0.357	0.303	0.208	0.638
Barium	7440-39-3	E475	0.050	mg/kg		----	1.41	1.08	0.899	1.21
Barium	7440-39-3	E472	0.050	mg/kg		0.805	----	----	----	----
Beryllium	7440-41-7	E475	0.010	mg/kg		----	<0.010	<0.010	<0.010	<0.010
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	----	----	----	----
Bismuth	7440-69-9	E475	0.010	mg/kg		----	0.022	0.015	0.025	0.032
Bismuth	7440-69-9	E472	0.010	mg/kg		0.033	----	----	----	----
Boron	7440-42-8	E475	1.0	mg/kg		----	<1.0	<1.0	1.9	1.2
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	----	----	----	----
Cadmium	7440-43-9	E475	0.010	mg/kg		----	9.26	3.63	6.82	4.56
Cadmium	7440-43-9	E472	0.010	mg/kg		4.29	----	----	----	----
Calcium	7440-70-2	E475	20	mg/kg		----	290	225	275	404
Calcium	7440-70-2	E472	20	mg/kg		412	----	----	----	----
Cesium	7440-46-2	E475	0.0050	mg/kg		----	0.0480	0.0362	0.0436	0.0698
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0473	----	----	----	----
Chromium	7440-47-3	E475	0.20	mg/kg		----	0.22	<0.20	0.26	0.22
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	----	----	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		----	1.86	0.754	1.36	1.42
Cobalt	7440-48-4	E472	0.020	mg/kg		1.25	----	----	----	----
Copper	7440-50-8	E475	0.20	mg/kg		----	4.46	2.70	3.49	4.74
Copper	7440-50-8	E472	0.20	mg/kg		3.34	----	----	----	----
Iron	7439-89-6	E475	5.0	mg/kg		----	444	269	262	207

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-2_2022-10	QUL-NGC_PCC-Ki-3_2022-10	QUL-NGC_PCC-Ki-4_2022-10	QUL-NGC_PCC-Ki-5_2022-10	QUL-NGC_PCC-Ki-6_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-071	VA22C4917-072	VA22C4917-073	VA22C4917-074	VA22C4917-075
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E472	5.0	mg/kg		390	----	----	----	----
Lead	7439-92-1	E475	0.050	mg/kg		----	<0.050	<0.050	<0.050	0.059
Lead	7439-92-1	E472	0.050	mg/kg		<0.050	----	----	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		----	<0.50	<0.50	<0.50	<0.50
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	----	----	----	----
Magnesium	7439-95-4	E475	2.0	mg/kg		----	459	352	407	519
Magnesium	7439-95-4	E472	2.0	mg/kg		422	----	----	----	----
Manganese	7439-96-5	E475	0.050	mg/kg		----	2.56	1.53	2.43	4.84
Manganese	7439-96-5	E472	0.050	mg/kg		1.95	----	----	----	----
Mercury	7439-97-6	E511	0.0050	mg/kg		0.162	----	----	----	----
Mercury	7439-97-6	E512	0.010	mg/kg		----	0.170	0.078	0.191	0.215
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0538	----	----	----	----
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	0.0599	0.0311	0.0839	0.0654
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	0.391	0.234	0.337	0.488
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.266	----	----	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		----	<0.90 DLB	0.37	<1.60 DLB	<1.30 DLB
Nickel	7440-02-0	E472	0.20	mg/kg		0.53	----	----	----	----
Phosphorus	7723-14-0	E472	10	mg/kg		7420	----	----	----	----
Phosphorus	7723-14-0	E475	20	mg/kg		----	8960	6530	7400	10000
Potassium	7440-09-7	E475	20	mg/kg		----	8180	6540	7220	9150
Potassium	7440-09-7	E472	20	mg/kg		7050	----	----	----	----
Rubidium	7440-17-7	E475	0.050	mg/kg		----	12.6	8.11	12.5	16.3
Rubidium	7440-17-7	E472	0.050	mg/kg		9.79	----	----	----	----
Selenium	7782-49-2	E475	0.10	mg/kg		----	6.29	4.86	3.36	4.21
Selenium	7782-49-2	E472	0.10	mg/kg		4.41	----	----	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	<0.0050	<0.0050	<0.0050	<0.0050
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		<0.0050	----	----	----	----
Sodium	7440-23-5	E475	20	mg/kg		----	3650	2530	3290	4040
Sodium	7440-23-5	E472	20	mg/kg		3560	----	----	----	----
Strontium	7440-24-6	E475	0.10	mg/kg		----	0.64	0.49	0.73	1.03

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-2_2022-10	QUL-NGC_PCC-Ki-3_2022-10	QUL-NGC_PCC-Ki-4_2022-10	QUL-NGC_PCC-Ki-5_2022-10	QUL-NGC_PCC-Ki-6_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-071	VA22C4917-072	VA22C4917-073	VA22C4917-074	VA22C4917-075
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		1.08	----	----	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		----	0.025	<0.020	<0.020	0.035
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	----	----	----	----
Thallium	7440-28-0	E475	0.0020	mg/kg		----	0.0237	0.0136	0.0218	0.0334
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0118	----	----	----	----
Tin	7440-31-5	E475	0.10	mg/kg		----	<0.10	<0.10	1.49	<0.10
Tin	7440-31-5	E472	0.10	mg/kg		0.13	----	----	----	----
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	<0.50	0.56	0.63	0.71
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	----	----	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		----	0.0274	0.0108	0.0677	0.0423
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0514	----	----	----	----
Vanadium	7440-62-2	E475	0.10	mg/kg		----	0.28	0.15	0.26	0.17
Vanadium	7440-62-2	E472	0.10	mg/kg		0.17	----	----	----	----
Zinc	7440-66-6	E475	1.0	mg/kg		----	113	86.9	103	182
Zinc	7440-66-6	E472	1.0	mg/kg		87.0	----	----	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		----	<0.20	<0.20	<0.20	<0.20
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-7_2022-10	QUL-NGC_PCC-Ki-8_2022-10	QUL-NCP_LT-M-1_2022-10	QUL-NCP_LT-M-2_2022-10	QUL-NCP_LT-M-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-076	VA22C4917-077	VA22C4917-078	VA22C4917-079	VA22C4917-080
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	----	76.9	76.4	76.4
Moisture	----	E144A	2.0	%		60.8	70.6	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	----	<2.0	3.2	<2.0
Aluminum	7429-90-5	E475	5.0	mg/kg		<5.0	5.1	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Antimony	7440-36-0	E475	0.020	mg/kg		<0.020	<0.020	----	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		----	----	0.090	0.589	0.108
Arsenic	7440-38-2	E475	0.050	mg/kg		0.351	0.186	----	----	----
Barium	7440-39-3	E475	0.050	mg/kg		0.927	1.02	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	----	<0.050	0.101	<0.050
Beryllium	7440-41-7	E475	0.010	mg/kg		<0.010	<0.010	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		0.059	0.055	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	----	<0.010	<0.010	<0.010
Boron	7440-42-8	E475	1.0	mg/kg		<1.0	1.2	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	----	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	----	<0.0050	<0.0050	<0.0050
Cadmium	7440-43-9	E475	0.010	mg/kg		6.21	2.97	----	----	----
Calcium	7440-70-2	E475	20	mg/kg		269	627	----	----	----
Calcium	7440-70-2	E440	20	mg/kg		----	----	826	415	220
Cesium	7440-46-2	E475	0.0050	mg/kg		0.0443	0.0972	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	----	0.309	0.182	0.270
Chromium	7440-47-3	E440	0.050	mg/kg		----	----	<0.050	0.053	0.053
Chromium	7440-47-3	E475	0.20	mg/kg		0.25	0.22	----	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		1.49	2.98	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Copper	7440-50-8	E440	0.10	mg/kg		----	----	0.71	2.92	1.14
Copper	7440-50-8	E475	0.20	mg/kg		3.70	7.44	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	----	8.6	32.4	8.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-7_2022-10	QUL-NGC_PCC-Ki-8_2022-10	QUL-NCP_LT-M-1_2022-10	QUL-NCP_LT-M-2_2022-10	QUL-NCP_LT-M-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-076	VA22C4917-077	VA22C4917-078	VA22C4917-079	VA22C4917-080
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E475	5.0	mg/kg		314	265	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	----	<0.020	0.022	<0.020
Lead	7439-92-1	E475	0.050	mg/kg		<0.050	0.059	----	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		<0.50	<0.50	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	----	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		342	624	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	----	1110	1080	1110
Manganese	7439-96-5	E475	0.050	mg/kg		1.73	5.92	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	----	0.272	0.448	0.284
Mercury	7439-97-6	E510	0.0050	mg/kg		----	----	2.23	0.672	2.40
Mercury	7439-97-6	E512	0.010	mg/kg		0.279	0.207	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	----	0.515	0.159	0.568
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.109	0.0609	----	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Molybdenum	7439-98-7	E475	0.040	mg/kg		0.500	0.395	----	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		<1.00 DLB	<0.60 DLB	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	----	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		----	----	11100	11500	11600
Phosphorus	7723-14-0	E475	20	mg/kg		6930	11900	----	----	----
Potassium	7440-09-7	E475	20	mg/kg		6160	10800	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	----	19600	17200	19900
Rubidium	7440-17-7	E475	0.050	mg/kg		9.61	19.6	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	----	40.5	33.1	36.0
Selenium	7782-49-2	E440	0.050	mg/kg		----	----	1.88	2.04	2.04
Selenium	7782-49-2	E475	0.10	mg/kg		4.33	5.30	----	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		<0.0050	0.0050	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	----	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E475	20	mg/kg		2910	4100	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	----	1090	1060	1030
Strontium	7440-24-6	E440	0.050	mg/kg		----	----	1.02	0.461	0.153

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NGC_PCC-Ki-7_2022-10	QUL-NGC_PCC-Ki-8_2022-10	QUL-NCP_LT-M-1_2022-10	QUL-NCP_LT-M-2_2022-10	QUL-NCP_LT-M-3_2022-10
					Client sampling date / time	06-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-076	VA22C4917-077	VA22C4917-078	VA22C4917-079	VA22C4917-080
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		0.60	1.54	----	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		0.040	0.024	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	----	<0.020	<0.020	<0.020
Thallium	7440-28-0	E475	0.0020	mg/kg		0.0268	0.0472	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	----	0.0254	0.0493	0.0293
Tin	7440-31-5	E475	0.10	mg/kg		<0.10	<0.10	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	----	0.22	0.22	0.49
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	----	<0.25	<0.25	<0.25
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		0.65	0.91	----	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		0.0303	0.0120	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	----	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E475	0.10	mg/kg		0.28	0.19	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	----	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	----	11.5	20.9	11.8
Zinc	7440-66-6	E475	1.0	mg/kg		103	172	----	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		<0.20	<0.20	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	----	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-M-4_2022-10	QUL-NCP_LT-M-5_2022-10	QUL-NCP_LT-M-6_2022-10	QUL-NCP_LT-M-7_2022-10	QUL-NCP_LT-M-8_2022-10
					Client sampling date / time	03-Oct-2022	04-Oct-2022	05-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-081	VA22C4917-082	VA22C4917-083	VA22C4917-084	VA22C4917-085
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		79.8	75.0	78.4	74.9	76.4
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	9.0	<2.0	<2.0	2.3
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.144	0.120	0.074	0.054	0.431
Barium	7440-39-3	E440	0.050	mg/kg		0.206	0.199	<0.050	<0.050	0.085
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0051	<0.0050
Calcium	7440-70-2	E440	20	mg/kg		741	374	248	210	290
Cesium	7440-46-2	E440	0.0050	mg/kg		0.257	0.198	0.314	0.281	0.217
Chromium	7440-47-3	E440	0.050	mg/kg		0.264	0.066	<0.050	<0.050	0.057
Cobalt	7440-48-4	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Copper	7440-50-8	E440	0.10	mg/kg		0.95	1.67	1.06	1.23	1.41
Iron	7439-89-6	E440	3.0	mg/kg		11.3	30.4	11.6	10.6	12.5
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1690	1320	1240	1160	1420
Manganese	7439-96-5	E440	0.050	mg/kg		0.435	0.573	0.287	0.268	0.397
Mercury	7439-97-6	E510	0.0050	mg/kg		0.987	0.734	1.82	1.17	0.929
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.199	0.183	0.394	0.293	0.219
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		14200	12500	12700	10500	13000
Potassium	7440-09-7	E440	20	mg/kg		24900	21600	24000	18900	22500
Rubidium	7440-17-7	E440	0.050	mg/kg		46.5	40.8	39.3	33.7	41.2
Selenium	7782-49-2	E440	0.050	mg/kg		2.46	2.14	2.15	1.84	2.21
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		1660	1140	1330	992	976

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-M-4_2022-10	QUL-NCP_LT-M-5_2022-10	QUL-NCP_LT-M-6_2022-10	QUL-NCP_LT-M-7_2022-10	QUL-NCP_LT-M-8_2022-10
					Client sampling date / time	03-Oct-2022	04-Oct-2022	05-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-081	VA22C4917-082	VA22C4917-083	VA22C4917-084	VA22C4917-085
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.855	0.354	0.150	0.141	0.194
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0436	0.0403	0.0283	0.0288	0.0270
Tin	7440-31-5	E440	0.10	mg/kg		0.71	0.24	0.24	0.37	0.28
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.91	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		14.7	13.6	13.4	11.9	13.2
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Li-1_2022-10	QUL-NCP_LT-Li-2_2022-10	QUL-NCP_LT-Li-3_2022-10	QUL-NCP_LT-Li-4_2022-10	QUL-NCP_LT-Li-5_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022	04-Oct-2022
						VA22C4917-086	VA22C4917-087	VA22C4917-088	VA22C4917-089	VA22C4917-090
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		79.7	68.1	80.1	74.8	67.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		3.3	<2.0	3.6	<2.0	5.6
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.265	0.630	0.452	0.298	0.329
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	0.061	0.058	<0.050	0.136
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.519	0.167	0.459	0.179	0.216
Calcium	7440-70-2	E440	20	mg/kg		345	198	448	324	180
Cesium	7440-46-2	E440	0.0050	mg/kg		0.296	0.0526	0.195	0.0873	0.0440
Chromium	7440-47-3	E440	0.050	mg/kg		0.280	0.078	0.325	0.106	0.097
Cobalt	7440-48-4	E440	0.020	mg/kg		0.098	0.098	0.121	0.117	0.220
Copper	7440-50-8	E440	0.10	mg/kg		12.6	107	17.5	55.2	38.8
Iron	7439-89-6	E440	3.0	mg/kg		354	569	369	409	209
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1070	434	981	550	435
Manganese	7439-96-5	E440	0.050	mg/kg		6.53	3.41	9.00	4.48	3.48
Mercury	7439-97-6	E510	0.0050	mg/kg		3.08	0.689	2.39	1.05	0.488
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.624	0.220	0.477	0.265	0.161
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.336	0.463	0.360	0.550	0.376
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		21400	9860	20000	12300	10100
Potassium	7440-09-7	E440	20	mg/kg		21300	8320	19200	10300	8670
Rubidium	7440-17-7	E440	0.050	mg/kg		89.8	19.8	62.6	22.8	21.0
Selenium	7782-49-2	E440	0.050	mg/kg		6.12	6.56	6.33	9.21	5.57
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0718	0.791	0.0912	0.331	0.274
Sodium	7440-23-5	E440	20	mg/kg		5570	4740	7540	6450	4370

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Li-1_2022-10	QUL-NCP_LT-Li-2_2022-10	QUL-NCP_LT-Li-3_2022-10	QUL-NCP_LT-Li-4_2022-10	QUL-NCP_LT-Li-5_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022	04-Oct-2022
						VA22C4917-086	VA22C4917-087	VA22C4917-088	VA22C4917-089	VA22C4917-090
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.366	0.345	0.560	0.624	0.341
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.695	0.234	0.327	0.205	0.116
Tin	7440-31-5	E440	0.10	mg/kg		0.22	0.27	0.43	0.46	0.29
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	0.48
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		0.10	<0.10	0.35	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		110	114	106	126	78.8
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Li-6_2022-10	QUL-NCP_LT-Li-7_2022-10	QUL-NCP_LT-Li-8_2022-10	QUL-NCP_LT-O-1_2022-10	QUL-NCP_LT-O-3_2022-10
					Client sampling date / time	05-Oct-2022	06-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-091	VA22C4917-092	VA22C4917-093	VA22C4917-094	VA22C4917-095
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		76.7	63.6	65.8	64.8	70.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		4.0	<2.0	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.485	0.233	0.281	0.046	0.075
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.589	0.126	0.193	<0.0050	<0.0050
Calcium	7440-70-2	E440	20	mg/kg		212	137	110	1060	958
Cesium	7440-46-2	E440	0.0050	mg/kg		0.193	0.0736	0.0589	0.0725	0.0805
Chromium	7440-47-3	E440	0.050	mg/kg		0.223	0.053	0.082	0.053	<0.050
Cobalt	7440-48-4	E440	0.020	mg/kg		0.140	0.207	0.194	0.045	0.064
Copper	7440-50-8	E440	0.10	mg/kg		131	61.6	38.9	12.8	11.5
Iron	7439-89-6	E440	3.0	mg/kg		1010	379	210	53.7	81.7
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		597	398	452	1330	1260
Manganese	7439-96-5	E440	0.050	mg/kg		5.62	3.60	3.53	0.799	2.39
Mercury	7439-97-6	E510	0.0050	mg/kg		2.34	0.661	0.580	0.271	0.247
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.546	0.241	0.198	0.0955	0.0742
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.650	0.382	0.485	<0.020	0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		13300	8880	10400	11200	11300
Potassium	7440-09-7	E440	20	mg/kg		12300	7310	8440	6430	6830
Rubidium	7440-17-7	E440	0.050	mg/kg		35.3	15.4	19.3	11.9	13.7
Selenium	7782-49-2	E440	0.050	mg/kg		16.2	5.89	6.09	4.21	4.57
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		1.21	0.347	0.232	0.0400	0.0214
Sodium	7440-23-5	E440	20	mg/kg		6730	3350	2900	3320	5230

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Li-6_2022-10	QUL-NCP_LT-Li-7_2022-10	QUL-NCP_LT-Li-8_2022-10	QUL-NCP_LT-O-1_2022-10	QUL-NCP_LT-O-3_2022-10
					Client sampling date / time	05-Oct-2022	06-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-091	VA22C4917-092	VA22C4917-093	VA22C4917-094	VA22C4917-095
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.308	0.261	0.190	2.56	1.95
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.204	0.138	0.151	0.0202	0.0194
Tin	7440-31-5	E440	0.10	mg/kg		0.23	0.22	0.21	0.11	0.10
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		0.14	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		136	90.9	104	75.4	98.7
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-O-4_2022-10	QUL-NCP_LT-O-5_2022-10	QUL-NCP_LT-O-8_2022-10	QUL-NCP_LT-Ki-1_2022-10	QUL-NCP_LT-Ki-2_2022-10
					Client sampling date / time	03-Oct-2022	04-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-096	VA22C4917-097	VA22C4917-098	VA22C4917-099	VA22C4917-100
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		78.5	79.4	79.4	84.1	81.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	2.7	3.2	15.9	13.6
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.105	0.143	0.169	0.239	0.339
Barium	7440-39-3	E440	0.050	mg/kg		0.095	0.156	0.088	0.195	0.291
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0108	0.0116	0.0118	3.54	0.964
Calcium	7440-70-2	E440	20	mg/kg		1150	1480	1410	830	881
Cesium	7440-46-2	E440	0.0050	mg/kg		0.192	0.195	0.206	0.246	0.142
Chromium	7440-47-3	E440	0.050	mg/kg		0.085	0.194	0.072	1.16	0.363
Cobalt	7440-48-4	E440	0.020	mg/kg		0.341	0.518	0.321	0.217	0.739
Copper	7440-50-8	E440	0.10	mg/kg		48.8	63.5	58.3	3.56	5.34
Iron	7439-89-6	E440	3.0	mg/kg		321	375	264	718	787
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	0.032	0.043
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		543	645	718	719	679
Manganese	7439-96-5	E440	0.050	mg/kg		7.66	9.72	10.3	1.39	2.40
Mercury	7439-97-6	E510	0.0050	mg/kg		0.243	0.256	0.225	7.89	1.95
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0523	0.0529	0.0462	1.26	0.369
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.068	0.087	0.089	0.276	0.203
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	0.70	0.36
Phosphorus	7723-14-0	E440	10	mg/kg		8660	11300	12000	15100	14800
Potassium	7440-09-7	E440	20	mg/kg		12800	15100	15400	14200	14200
Rubidium	7440-17-7	E440	0.050	mg/kg		33.4	39.8	43.3	36.9	34.9
Selenium	7782-49-2	E440	0.050	mg/kg		5.91	9.38	8.06	13.1	7.07
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0487	0.0746	0.0451	0.0179	0.0074
Sodium	7440-23-5	E440	20	mg/kg		9160	8060	8400	14900	11200

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-O-4_2022-10	QUL-NCP_LT-O-5_2022-10	QUL-NCP_LT-O-8_2022-10	QUL-NCP_LT-Ki-1_2022-10	QUL-NCP_LT-Ki-2_2022-10
					Client sampling date / time	03-Oct-2022	04-Oct-2022	06-Oct-2022	03-Oct-2022	03-Oct-2022
						VA22C4917-096	VA22C4917-097	VA22C4917-098	VA22C4917-099	VA22C4917-100
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		1.44	1.20	1.26	1.90	1.55
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0494	0.0995	0.0574	0.120	0.136
Tin	7440-31-5	E440	0.10	mg/kg		0.40	0.58	0.70	1.30	0.92
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.27	<0.25	0.84	0.92
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0105	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.22	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		183	215	225	98.4	102
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Ki-3_2022-10	QUL-NCP_LT-Ki-4_2022-10	QUL-NCP_LT-Ki-5_2022-10	QUL-NCP_LT-Ki-6_2022-10	QUL-NCP_LT-Ki-7_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	04-Oct-2022	05-Oct-2022	06-Oct-2022
						VA22C4917-101	VA22C4917-102	VA22C4917-103	VA22C4917-104	VA22C4917-105
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		82.5	84.2	80.4	83.5	79.2
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		31.2	7.9	14.0	55.6	4.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.294	0.198	0.381	0.260	0.130
Barium	7440-39-3	E440	0.050	mg/kg		0.203	0.171	0.236	0.300	0.231
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		2.10	0.624	1.36	2.22	0.512
Calcium	7440-70-2	E440	20	mg/kg		668	799	561	655	442
Cesium	7440-46-2	E440	0.0050	mg/kg		0.142	0.164	0.141	0.175	0.164
Chromium	7440-47-3	E440	0.050	mg/kg		0.966	0.490	0.371	0.620	0.135
Cobalt	7440-48-4	E440	0.020	mg/kg		0.202	0.309	0.349	0.447	0.358
Copper	7440-50-8	E440	0.10	mg/kg		3.75	4.65	5.13	4.89	3.00
Iron	7439-89-6	E440	3.0	mg/kg		1000	829	537	1380	693
Lead	7439-92-1	E440	0.020	mg/kg		0.022	0.024	0.031	0.027	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		648	744	556	745	611
Manganese	7439-96-5	E440	0.050	mg/kg		1.75	1.91	1.68	1.70	1.19
Mercury	7439-97-6	E510	0.0050	mg/kg		6.27	1.58	1.72	5.39	1.94
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		1.10	0.249	0.338	0.889	0.403
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.171	0.158	0.252	0.223	0.129
Nickel	7440-02-0	E440	0.20	mg/kg		0.51	0.42	0.25	0.64	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		12800	14600	14800	14100	12500
Potassium	7440-09-7	E440	20	mg/kg		12600	15100	14900	13500	12200
Rubidium	7440-17-7	E440	0.050	mg/kg		28.5	33.0	35.3	27.1	28.0
Selenium	7782-49-2	E440	0.050	mg/kg		10.6	7.63	7.71	14.1	5.36
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0307	0.0072	0.0051	0.0141	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		13100	13700	9380	13700	11000

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Ki-3_2022-10	QUL-NCP_LT-Ki-4_2022-10	QUL-NCP_LT-Ki-5_2022-10	QUL-NCP_LT-Ki-6_2022-10	QUL-NCP_LT-Ki-7_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	04-Oct-2022	05-Oct-2022	06-Oct-2022
						VA22C4917-101	VA22C4917-102	VA22C4917-103	VA22C4917-104	VA22C4917-105
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		1.26	2.15	1.08	1.91	1.01
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0866	0.0833	0.149	0.0967	0.0792
Tin	7440-31-5	E440	0.10	mg/kg		0.22	1.02	1.95	0.26	0.32
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		1.64	0.49	0.83	2.47	0.34
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0124	0.0021	0.0021	0.0080	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		0.50	<0.10	<0.10	0.20	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		81.4	111	110	114	94.5
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Ki-8_2022-10	QUL-EAA_LT-M-1_2022-10	QUL-EAA_LT-M-2_2022-10	QUL-EAA_LT-M-3_2022-10	QUL-EAA_LT-M-4_2022-10
					Client sampling date / time	06-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-106	VA22C4917-107	VA22C4917-108	VA22C4917-109	VA22C4917-110
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		81.1	70.9	76.1	74.5	72.2
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		4.3	<2.0	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.185	0.121	0.093	0.225	0.168
Barium	7440-39-3	E440	0.050	mg/kg		0.140	<0.050	<0.050	<0.050	<0.050
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		1.19	<0.0050	<0.0050	<0.0050	<0.0050
Calcium	7440-70-2	E440	20	mg/kg		515	371	478	544	462
Cesium	7440-46-2	E440	0.0050	mg/kg		0.156	0.295	0.283	0.317	0.289
Chromium	7440-47-3	E440	0.050	mg/kg		0.247	<0.050	<0.050	<0.050	0.058
Cobalt	7440-48-4	E440	0.020	mg/kg		0.558	<0.020	<0.020	<0.020	<0.020
Copper	7440-50-8	E440	0.10	mg/kg		3.86	0.87	0.97	0.86	1.13
Iron	7439-89-6	E440	3.0	mg/kg		550	13.7	11.0	9.3	16.5
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		762	957	1080	1120	902
Manganese	7439-96-5	E440	0.050	mg/kg		1.96	0.266	0.219	0.316	0.311
Mercury	7439-97-6	E510	0.0050	mg/kg		1.75	1.66	2.62	1.29	1.24
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.330	0.483	0.628	0.329	0.346
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.216	<0.020	<0.020	<0.020	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		0.24	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		16100	8620	9110	9350	8130
Potassium	7440-09-7	E440	20	mg/kg		15000	16000	16600	17300	14900
Rubidium	7440-17-7	E440	0.050	mg/kg		37.4	32.1	30.2	33.8	35.0
Selenium	7782-49-2	E440	0.050	mg/kg		7.13	1.47	2.04	1.76	1.37
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0052	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		10600	941	1010	962	1090

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-Ki-8_2022-10	QUL-EAA_LT-M-1_2022-10	QUL-EAA_LT-M-2_2022-10	QUL-EAA_LT-M-3_2022-10	QUL-EAA_LT-M-4_2022-10
					Client sampling date / time	06-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-106	VA22C4917-107	VA22C4917-108	VA22C4917-109	VA22C4917-110
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.994	0.254	0.526	0.550	0.448
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.110	0.0233	0.0229	0.0203	0.0288
Tin	7440-31-5	E440	0.10	mg/kg		1.67	0.11	0.17	0.18	0.16
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		110	9.30	12.2	10.6	9.88
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-M-5_2022-10	QUL-EAA_LT-M-6_2022-10	QUL-EAA_LT-M-7_2022-10	QUL-EAA_LT-M-8_2022-10	QUL-EAA_LT-Li-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-111	VA22C4917-112	VA22C4917-113	VA22C4917-114	VA22C4917-115
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		76.1	76.5	72.4	79.5	70.7
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.063	0.297	0.155	0.286	0.384
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	0.087	<0.050	<0.050	<0.050
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	0.219
Calcium	7440-70-2	E440	20	mg/kg		196	1390	313	263	213
Cesium	7440-46-2	E440	0.0050	mg/kg		0.276	0.273	0.249	0.264	0.120
Chromium	7440-47-3	E440	0.050	mg/kg		0.073	0.071	<0.050	<0.050	0.165
Cobalt	7440-48-4	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	0.165
Copper	7440-50-8	E440	0.10	mg/kg		1.18	2.62	0.88	0.68	244
Iron	7439-89-6	E440	3.0	mg/kg		14.9	43.8	9.0	21.9	947
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1080	1030	1000	1160	483
Manganese	7439-96-5	E440	0.050	mg/kg		0.216	0.256	0.225	0.152	4.41
Mercury	7439-97-6	E510	0.0050	mg/kg		2.05	2.12	1.04	4.35	3.07
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.490	0.498	0.289	0.893	0.898
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	0.423
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		9840	9980	8350	11500	10100
Potassium	7440-09-7	E440	20	mg/kg		18100	16900	15400	20100	7540
Rubidium	7440-17-7	E440	0.050	mg/kg		31.9	32.5	30.9	25.7	18.3
Selenium	7782-49-2	E440	0.050	mg/kg		1.81	2.33	1.48	2.97	14.7
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	1.43
Sodium	7440-23-5	E440	20	mg/kg		1220	1570	826	2140	5370

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-M-5_2022-10	QUL-EAA_LT-M-6_2022-10	QUL-EAA_LT-M-7_2022-10	QUL-EAA_LT-M-8_2022-10	QUL-EAA_LT-Li-1_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-111	VA22C4917-112	VA22C4917-113	VA22C4917-114	VA22C4917-115
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.115	1.68	0.196	0.148	0.346
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0221	0.0275	0.0235	0.0263	0.307
Tin	7440-31-5	E440	0.10	mg/kg		0.31	0.18	0.17	0.37	0.31
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		11.3	17.9	9.17	17.7	160
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Li-2_2022-10	QUL-EAA_LT-Li-3_2022-10	QUL-EAA_LT-Li-4_2022-10	QUL-EAA_LT-Li-5_2022-10	QUL-EAA_LT-Li-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-116	VA22C4917-117	VA22C4917-118	VA22C4917-119	VA22C4917-120
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		74.3	71.6	80.2	68.2	79.9
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	3.6
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.387	0.955	0.360	0.352	0.663
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.245	0.168	0.251	0.146	0.438
Calcium	7440-70-2	E440	20	mg/kg		381	257	537	217	506
Cesium	7440-46-2	E440	0.0050	mg/kg		0.100	0.118	0.203	0.0866	0.148
Chromium	7440-47-3	E440	0.050	mg/kg		0.266	0.119	0.291	0.127	0.429
Cobalt	7440-48-4	E440	0.020	mg/kg		0.158	0.130	0.132	0.124	0.134
Copper	7440-50-8	E440	0.10	mg/kg		223	151	144	80.2	93.9
Iron	7439-89-6	E440	3.0	mg/kg		978	760	609	860	1860
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		491	562	795	403	581
Manganese	7439-96-5	E440	0.050	mg/kg		3.48	5.84	3.51	3.84	4.55
Mercury	7439-97-6	E510	0.0050	mg/kg		3.55	1.56	3.37	2.22	4.90
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.912	0.444	0.668	0.707	0.984
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.570	0.403	0.276	0.472	0.568
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		9570	12900	14600	8360	11600
Potassium	7440-09-7	E440	20	mg/kg		7470	7750	12100	6150	8770
Rubidium	7440-17-7	E440	0.050	mg/kg		15.3	18.4	30.8	13.1	20.5
Selenium	7782-49-2	E440	0.050	mg/kg		7.56	9.16	6.12	5.70	11.8
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		1.16	1.33	1.36	0.504	0.950
Sodium	7440-23-5	E440	20	mg/kg		7900	5750	9480	4910	9000

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Li-2_2022-10	QUL-EAA_LT-Li-3_2022-10	QUL-EAA_LT-Li-4_2022-10	QUL-EAA_LT-Li-5_2022-10	QUL-EAA_LT-Li-6_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-116	VA22C4917-117	VA22C4917-118	VA22C4917-119	VA22C4917-120
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.710	0.441	0.774	0.362	0.985
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.168	0.316	0.401	0.212	0.326
Tin	7440-31-5	E440	0.10	mg/kg		0.24	0.57	0.67	0.13	0.19
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	0.12
Zinc	7440-66-6	E440	0.50	mg/kg		148	145	157	106	152
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Li-7_2022-10	QUL-EAA_LT-Li-8_2022-10	QUL-EAA_LT-O-4_2022-10	QUL-EAA_LT-Ki-1_2022-10	QUL-EAA_LT-Ki-2_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-121	VA22C4917-122	VA22C4917-123	VA22C4917-124	VA22C4917-125
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		63.4	75.4	87.2	77.0	67.0
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	2.4	<2.0	6.6	3.1
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.242	0.220	0.092	0.250	0.214
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	<0.050	0.104	0.100	0.054
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0920	0.223	0.0132	0.706	0.346
Calcium	7440-70-2	E440	20	mg/kg		182	1130	1130	484	259
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0819	0.0663	0.381	0.209	0.0764
Chromium	7440-47-3	E440	0.050	mg/kg		0.075	0.316	0.084	0.240	0.175
Cobalt	7440-48-4	E440	0.020	mg/kg		0.085	0.234	0.096	0.385	0.155
Copper	7440-50-8	E440	0.10	mg/kg		132	46.5	9.22	3.07	1.44
Iron	7439-89-6	E440	3.0	mg/kg		312	2270	276	994	722
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		350	511	835	516	272
Manganese	7439-96-5	E440	0.050	mg/kg		3.27	2.82	5.04	0.772	0.412
Mercury	7439-97-6	E510	0.0050	mg/kg		0.928	6.35	1.44	4.26	2.65
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.339	1.56	0.184	0.980	0.874
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.297	0.665	0.083	0.202	0.083
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	0.41	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		7250	10100	12500	8690	4990
Potassium	7440-09-7	E440	20	mg/kg		5310	9250	15300	8560	5310
Rubidium	7440-17-7	E440	0.050	mg/kg		13.8	14.5	47.1	26.5	12.3
Selenium	7782-49-2	E440	0.050	mg/kg		5.36	13.6	4.16	10.4	4.05
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.749	0.373	0.0156	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		3700	5990	16300	9660	5330

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Li-7_2022-10	QUL-EAA_LT-Li-8_2022-10	QUL-EAA_LT-O-4_2022-10	QUL-EAA_LT-Ki-1_2022-10	QUL-EAA_LT-Ki-2_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-121	VA22C4917-122	VA22C4917-123	VA22C4917-124	VA22C4917-125
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.328	1.59	1.36	1.80	0.745
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.187	0.102	0.0966	0.101	0.0341
Tin	7440-31-5	E440	0.10	mg/kg		0.16	0.16	0.32	0.23	<0.10
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0021	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	0.14	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		108	106	152	93.7	42.4
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Ki-3_2022-10	QUL-EAA_LT-Ki-4_2022-10	QUL-EAA_LT-Ki-5_2022-10	QUL-EAA_LT-Ki-6_2022-10	QUL-EAA_LT-Ki-7_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-126	VA22C4917-127	VA22C4917-128	VA22C4917-129	VA22C4917-130
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		77.1	71.5	69.6	82.2	78.3
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		6.5	3.7	3.7	12.5	3.5
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.014	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.370	0.168	0.181	0.207	0.124
Barium	7440-39-3	E440	0.050	mg/kg		0.127	0.069	0.076	0.144	0.096
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.685	0.398	0.424	1.56	0.605
Calcium	7440-70-2	E440	20	mg/kg		457	417	292	787	315
Cesium	7440-46-2	E440	0.0050	mg/kg		0.198	0.137	0.111	0.208	0.206
Chromium	7440-47-3	E440	0.050	mg/kg		0.174	0.193	0.205	0.739	0.147
Cobalt	7440-48-4	E440	0.020	mg/kg		0.529	0.074	0.267	0.370	0.553
Copper	7440-50-8	E440	0.10	mg/kg		3.26	4.56	2.05	3.94	3.26
Iron	7439-89-6	E440	3.0	mg/kg		542	513	751	1230	611
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	0.043	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		561	469	389	703	649
Manganese	7439-96-5	E440	0.050	mg/kg		1.03	0.906	0.584	0.946	1.20
Mercury	7439-97-6	E510	0.0050	mg/kg		1.77	2.45	2.31	5.23	1.78
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.405	0.698	0.703	0.928	0.385
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.157	0.097	0.115	0.214	0.208
Nickel	7440-02-0	E440	0.20	mg/kg		0.25	<0.20	<0.20	0.68	0.23
Phosphorus	7723-14-0	E440	10	mg/kg		10100	6970	6970	12100	11700
Potassium	7440-09-7	E440	20	mg/kg		9270	6390	7080	12300	11500
Rubidium	7440-17-7	E440	0.050	mg/kg		23.9	18.3	16.7	29.6	32.0
Selenium	7782-49-2	E440	0.050	mg/kg		7.13	3.95	5.78	14.1	5.40
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0164	<0.0050	0.0086	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		9440	7120	6770	11100	9500

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Ki-3_2022-10	QUL-EAA_LT-Ki-4_2022-10	QUL-EAA_LT-Ki-5_2022-10	QUL-EAA_LT-Ki-6_2022-10	QUL-EAA_LT-Ki-7_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-126	VA22C4917-127	VA22C4917-128	VA22C4917-129	VA22C4917-130
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		1.51	1.13	1.15	1.90	0.844
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0803	0.0617	0.0572	0.106	0.0925
Tin	7440-31-5	E440	0.10	mg/kg		0.47	0.33	0.13	0.62	0.73
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		0.46	0.38	<0.25	0.50	0.28
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0033	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		84.2	48.2	58.6	119	88.7
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Ki-8_2022-10	QUL-NGC_PCC-M-5X_2022-10	QUL-NGC_PCC-Li-5X_2022-10	QUL-NGC_PCC-O-5X_2022-10	QUL-NGC_PCC-Ki-7X_2022-10
					Client sampling date / time	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-131	VA22C4917-132	VA22C4917-133	VA22C4917-134	VA22C4917-135
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		83.8	78.3	----	68.4	----
Moisture	----	E144A	2.0	%		----	----	57.0	----	69.9
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		16.4	<2.0	----	<2.0	----
Aluminum	7429-90-5	E475	5.0	mg/kg		----	----	15.6	----	<5.0
Antimony	7440-36-0	E440	0.010	mg/kg		0.014	<0.010	----	<0.010	----
Antimony	7440-36-0	E475	0.020	mg/kg		----	----	<0.020	----	<0.020
Arsenic	7440-38-2	E440	0.020	mg/kg		0.217	0.274	----	0.114	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	----	1.11	----	0.505
Barium	7440-39-3	E475	0.050	mg/kg		----	----	0.149	----	0.931
Barium	7440-39-3	E440	0.050	mg/kg		0.112	0.336	----	0.483	----
Beryllium	7440-41-7	E475	0.010	mg/kg		----	----	<0.010	----	<0.010
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	----	<0.010	----
Bismuth	7440-69-9	E475	0.010	mg/kg		----	----	0.032	----	0.094
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	----	<0.010	----
Boron	7440-42-8	E475	1.0	mg/kg		----	----	<1.0	----	1.3
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	----	<1.0	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		1.59	<0.0050	----	0.0298	----
Cadmium	7440-43-9	E475	0.010	mg/kg		----	----	1.11	----	10.9
Calcium	7440-70-2	E475	20	mg/kg		----	----	126	----	275
Calcium	7440-70-2	E440	20	mg/kg		1090	2190	----	687	----
Cesium	7440-46-2	E475	0.0050	mg/kg		----	----	0.0199	----	0.0746
Cesium	7440-46-2	E440	0.0050	mg/kg		0.139	0.143	----	0.0675	----
Chromium	7440-47-3	E440	0.050	mg/kg		1.25	<0.050	----	<0.050	----
Chromium	7440-47-3	E475	0.20	mg/kg		----	----	0.33	----	0.42
Cobalt	7440-48-4	E475	0.020	mg/kg		----	----	0.228	----	2.47
Cobalt	7440-48-4	E440	0.020	mg/kg		0.394	0.037	----	0.185	----
Copper	7440-50-8	E440	0.10	mg/kg		3.92	1.85	----	4.62	----
Copper	7440-50-8	E475	0.20	mg/kg		----	----	11.2	----	5.60
Iron	7439-89-6	E440	3.0	mg/kg		2650	19.4	----	70.7	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Ki-8_2022-10	QUL-NGC_PCC-M-5X_2022-10	QUL-NGC_PCC-Li-5X_2022-10	QUL-NGC_PCC-O-5X_2022-10	QUL-NGC_PCC-Ki-7X_2022-10
					Client sampling date / time	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-131	VA22C4917-132	VA22C4917-133	VA22C4917-134	VA22C4917-135
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E475	5.0	mg/kg		----	----	518	----	334
Lead	7439-92-1	E440	0.020	mg/kg		0.025	<0.020	----	<0.020	----
Lead	7439-92-1	E475	0.050	mg/kg		----	----	<0.050	----	<0.050
Lithium	7439-93-2	E475	0.50	mg/kg		----	----	<0.50	----	<0.50
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	----	<0.50	----
Magnesium	7439-95-4	E475	2.0	mg/kg		----	----	425	----	603
Magnesium	7439-95-4	E440	2.0	mg/kg		728	1660	----	960	----
Manganese	7439-96-5	E475	0.050	mg/kg		----	----	3.03	----	3.18
Manganese	7439-96-5	E440	0.050	mg/kg		1.41	0.917	----	14.2	----
Mercury	7439-97-6	E510	0.0050	mg/kg		10.9	1.09	----	0.0532	----
Mercury	7439-97-6	E512	0.010	mg/kg		----	----	0.315	----	0.517
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		1.76	0.237	----	0.0168	----
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	----	0.135	----	0.156
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.464	<0.020	----	0.155	----
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	----	0.579	----	0.845
Nickel	7440-02-0	E475	0.20	mg/kg		----	----	<0.20	----	<3.50 DLB
Nickel	7440-02-0	E440	0.20	mg/kg		0.67	<0.20	----	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg		11500	12400	----	9500	----
Phosphorus	7723-14-0	E475	20	mg/kg		----	----	8340	----	11700
Potassium	7440-09-7	E475	20	mg/kg		----	----	6180	----	10700
Potassium	7440-09-7	E440	20	mg/kg		12100	21100	----	9450	----
Rubidium	7440-17-7	E475	0.050	mg/kg		----	----	10.2	----	16.8
Rubidium	7440-17-7	E440	0.050	mg/kg		17.5	31.9	----	17.1	----
Selenium	7782-49-2	E440	0.050	mg/kg		21.8	1.74	----	8.98	----
Selenium	7782-49-2	E475	0.10	mg/kg		----	----	5.90	----	6.71
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	----	0.0234	----	0.0060
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0127	<0.0050	----	0.0205	----
Sodium	7440-23-5	E475	20	mg/kg		----	----	2110	----	4260
Sodium	7440-23-5	E440	20	mg/kg		14500	1230	----	2120	----
Strontium	7440-24-6	E440	0.050	mg/kg		4.06	4.01	----	0.753	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-Ki-8_2022-10	QUL-NGC_PCC-M-5X_2022-10	QUL-NGC_PCC-Li-5X_2022-10	QUL-NGC_PCC-O-5X_2022-10	QUL-NGC_PCC-Ki-7X_2022-10
					Client sampling date / time	04-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022	06-Oct-2022
						VA22C4917-131	VA22C4917-132	VA22C4917-133	VA22C4917-134	VA22C4917-135
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E475	0.10	mg/kg		----	----	0.29	----	0.63
Tellurium	13494-80-9	E475	0.020	mg/kg		----	----	<0.020	----	0.070
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	----	<0.020	----
Thallium	7440-28-0	E475	0.0020	mg/kg		----	----	0.0165	----	0.0393
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0965	0.0069	----	0.0058	----
Tin	7440-31-5	E475	0.10	mg/kg		----	----	<0.10	----	<0.10
Tin	7440-31-5	E440	0.10	mg/kg		0.23	0.26	----	0.53	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		0.39	0.29	----	0.27	----
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	----	<0.50	----	1.04
Uranium	7440-61-1	E475	0.0020	mg/kg		----	----	0.0580	----	0.0513
Uranium	7440-61-1	E440	0.0020	mg/kg		0.0103	0.0030	----	0.0100	----
Vanadium	7440-62-2	E475	0.10	mg/kg		----	----	0.36	----	0.48
Vanadium	7440-62-2	E440	0.10	mg/kg		0.17	<0.10	----	<0.10	----
Zinc	7440-66-6	E440	0.50	mg/kg		101	28.1	----	151	----
Zinc	7440-66-6	E475	1.0	mg/kg		----	----	69.9	----	135
Zirconium	7440-67-7	E475	0.20	mg/kg		----	----	<0.20	----	<0.20
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	----	<0.20	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-M-1X_2022-10	QUL-NCP_LT-Li-1X_2022-10	QUL-NCP_LT-O-1X_2022-10	QUL-NCP_LT-Ki-1X_2022-10	QUL-NHC_PCC-M-6X_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022	04-Oct-2022
						VA22C4917-136	VA22C4917-137	VA22C4917-138	VA22C4917-139	VA22C4917-140
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		76.2	78.8	64.4	82.3	77.6
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	3.1	<2.0	11.8	<2.0
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		0.092	0.222	0.042	0.190	0.276
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	0.052	<0.050	0.161	0.730
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	0.422	<0.0050	2.52	0.0417
Calcium	7440-70-2	E440	20	mg/kg		428	337	978	729	4350
Cesium	7440-46-2	E440	0.0050	mg/kg		0.297	0.308	0.0694	0.224	0.0852
Chromium	7440-47-3	E440	0.050	mg/kg		<0.050	0.228	<0.050	0.859	<0.050
Cobalt	7440-48-4	E440	0.020	mg/kg		<0.020	0.090	0.042	0.174	0.038
Copper	7440-50-8	E440	0.10	mg/kg		0.74	11.1	12.4	3.18	1.42
Iron	7439-89-6	E440	3.0	mg/kg		8.6	347	47.7	635	17.6
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	0.028	0.027
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1060	1070	1350	632	1730
Manganese	7439-96-5	E440	0.050	mg/kg		0.280	5.94	0.747	0.901	1.62
Mercury	7439-97-6	E510	0.0050	mg/kg		2.09	2.58	0.269	6.57	0.760
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.498	0.547	0.0957	1.16	0.170
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	0.338	<0.020	0.227	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	0.51	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		10300	18200	9800	11400	12600
Potassium	7440-09-7	E440	20	mg/kg		18700	17300	5250	10100	18800
Rubidium	7440-17-7	E440	0.050	mg/kg		38.7	83.7	10.1	27.0	20.7
Selenium	7782-49-2	E440	0.050	mg/kg		1.58	5.35	3.96	10.2	4.23
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0569	0.0355	0.0151	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		1050	5270	3040	12800	1150

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NCP_LT-M-1X_2022-10	QUL-NCP_LT-Li-1X_2022-10	QUL-NCP_LT-O-1X_2022-10	QUL-NCP_LT-Ki-1X_2022-10	QUL-NHC_PCC-M-6X_2022-10
					Client sampling date / time	03-Oct-2022	03-Oct-2022	03-Oct-2022	03-Oct-2022	04-Oct-2022
						VA22C4917-136	VA22C4917-137	VA22C4917-138	VA22C4917-139	VA22C4917-140
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.385	0.387	2.53	1.76	7.48
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0246	0.646	0.0183	0.0929	0.0062
Tin	7440-31-5	E440	0.10	mg/kg		0.26	0.21	0.10	0.73	1.47
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	0.29	<0.25	0.84	0.28
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0074	0.0056
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.14	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		9.99	97.2	69.7	71.1	21.0
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-6X_2022-10	QUL-NHC_PCC-O-6X_2022-10	QUL-NHC_PCC-Ki-6X_2022-10	QUL-EAA_LT-M-4X_2022-10	QUL-EAA_LT-Li-4X_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-141	VA22C4917-142	VA22C4917-143	VA22C4917-144	VA22C4917-145
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	64.2	----	71.0	80.2
Moisture	----	E144A	2.0	%		----	----	59.1	----	----
Moisture	----	E144-H	2.0	%		71.0	----	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	<2.0	----	<2.0	<2.0
Aluminum	7429-90-5	E475	5.0	mg/kg		----	----	8.2	----	----
Aluminum	7429-90-5	E472	5.0	mg/kg		16.7	----	----	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		0.016	----	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
Antimony	7440-36-0	E475	0.020	mg/kg		----	----	<0.020	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		----	0.159	----	0.207	0.348
Arsenic	7440-38-2	E472	0.030	mg/kg		0.340	----	----	----	----
Arsenic	7440-38-2	E475	0.050	mg/kg		----	----	0.289	----	----
Barium	7440-39-3	E475	0.050	mg/kg		----	----	1.57	----	----
Barium	7440-39-3	E472	0.050	mg/kg		0.199	----	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	0.367	----	0.056	<0.050
Beryllium	7440-41-7	E475	0.010	mg/kg		----	----	<0.010	----	----
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	----	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		----	----	0.029	----	----
Bismuth	7440-69-9	E472	0.010	mg/kg		0.037	----	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	<0.010	----	<0.010	<0.010
Boron	7440-42-8	E475	1.0	mg/kg		----	----	<1.0	----	----
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	----	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	<1.0	----	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	0.0544	----	<0.0050	0.226
Cadmium	7440-43-9	E475	0.010	mg/kg		----	----	18.9	----	----
Cadmium	7440-43-9	E472	0.010	mg/kg		2.02	----	----	----	----
Calcium	7440-70-2	E475	20	mg/kg		----	----	2720	----	----
Calcium	7440-70-2	E472	20	mg/kg		199	----	----	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-6X_2022-10	QUL-NHC_PCC-O-6X_2022-10	QUL-NHC_PCC-Ki-6X_2022-10	QUL-EAA_LT-M-4X_2022-10	QUL-EAA_LT-Li-4X_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-141	VA22C4917-142	VA22C4917-143	VA22C4917-144	VA22C4917-145
						Result	Result	Result	Result	Result
Metals										
Calcium	7440-70-2	E440	20	mg/kg		----	270	----	4670	629
Cesium	7440-46-2	E475	0.0050	mg/kg		----	----	0.0315	----	----
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0331	----	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	0.0330	----	0.262	0.207
Chromium	7440-47-3	E440	0.050	mg/kg		----	<0.050	----	0.055	0.257
Chromium	7440-47-3	E475	0.20	mg/kg		----	----	0.41	----	----
Chromium	7440-47-3	E472	0.20	mg/kg		0.40	----	----	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		----	----	3.14	----	----
Cobalt	7440-48-4	E472	0.020	mg/kg		0.330	----	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	0.124	----	<0.020	0.134
Copper	7440-50-8	E440	0.10	mg/kg		----	5.54	----	1.19	135
Copper	7440-50-8	E475	0.20	mg/kg		----	----	4.69	----	----
Copper	7440-50-8	E472	0.20	mg/kg		26.6	----	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	74.8	----	20.8	799
Iron	7439-89-6	E475	5.0	mg/kg		----	----	236	----	----
Iron	7439-89-6	E472	5.0	mg/kg		1380	----	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	<0.020	----	<0.020	<0.020
Lead	7439-92-1	E475	0.050	mg/kg		----	----	0.149	----	----
Lead	7439-92-1	E472	0.050	mg/kg		0.054	----	----	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		----	----	<0.50	----	----
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	----	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	<0.50	----	<0.50	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		----	----	498	----	----
Magnesium	7439-95-4	E472	2.0	mg/kg		850	----	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	670	----	916	782
Manganese	7439-96-5	E475	0.050	mg/kg		----	----	5.42	----	----
Manganese	7439-96-5	E472	0.050	mg/kg		6.36	----	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	9.91	----	0.482	3.25
Mercury	7439-97-6	E511	0.0050	mg/kg		0.432	----	----	----	----
Mercury	7439-97-6	E510	0.0050	mg/kg		----	0.0340	----	1.10	3.38

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-6X_2022-10	QUL-NHC_PCC-O-6X_2022-10	QUL-NHC_PCC-Ki-6X_2022-10	QUL-EAA_LT-M-4X_2022-10	QUL-EAA_LT-Li-4X_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-141	VA22C4917-142	VA22C4917-143	VA22C4917-144	VA22C4917-145
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E512	0.010	mg/kg		----	----	0.266	----	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.125	----	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	0.0122	----	0.318	0.669
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		----	----	0.109	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	0.108	----	<0.020	0.268
Molybdenum	7439-98-7	E475	0.040	mg/kg		----	----	0.569	----	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		1.10	----	----	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		----	----	<1.80 DLB	----	----
Nickel	7440-02-0	E472	0.20	mg/kg		0.39	----	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	<0.20	----	<0.20	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		14000	----	----	----	----
Phosphorus	7723-14-0	E440	10	mg/kg		----	10600	----	9290	14600
Phosphorus	7723-14-0	E475	20	mg/kg		----	----	9900	----	----
Potassium	7440-09-7	E475	20	mg/kg		----	----	7630	----	----
Potassium	7440-09-7	E472	20	mg/kg		10900	----	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	7650	----	11200	12100
Rubidium	7440-17-7	E475	0.050	mg/kg		----	----	10.6	----	----
Rubidium	7440-17-7	E472	0.050	mg/kg		13.0	----	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	9.92	----	25.2	31.6
Selenium	7782-49-2	E440	0.050	mg/kg		----	18.6	----	1.22	5.96
Selenium	7782-49-2	E475	0.10	mg/kg		----	----	6.60	----	----
Selenium	7782-49-2	E472	0.10	mg/kg		10.9	----	----	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		----	----	0.0073	----	----
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.101	----	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	0.0238	----	<0.0050	1.16
Sodium	7440-23-5	E475	20	mg/kg		----	----	3270	----	----
Sodium	7440-23-5	E472	20	mg/kg		3920	----	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	1700	----	1060	9600
Strontium	7440-24-6	E440	0.050	mg/kg		----	0.378	----	6.85	2.15
Strontium	7440-24-6	E475	0.10	mg/kg		----	----	7.12	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-NHC_PCC-Li-6X_2022-10	QUL-NHC_PCC-O-6X_2022-10	QUL-NHC_PCC-Ki-6X_2022-10	QUL-EAA_LT-M-4X_2022-10	QUL-EAA_LT-Li-4X_2022-10
					Client sampling date / time	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
						VA22C4917-141	VA22C4917-142	VA22C4917-143	VA22C4917-144	VA22C4917-145
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.50	----	----	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		----	----	0.036	----	----
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	----	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	<0.020	----	<0.020	<0.020
Thallium	7440-28-0	E475	0.0020	mg/kg		----	----	0.0352	----	----
Thallium	7440-28-0	E472	0.0020	mg/kg		0.0282	----	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	0.0058	----	0.0325	0.368
Tin	7440-31-5	E475	0.10	mg/kg		----	----	<0.10	----	----
Tin	7440-31-5	E472	0.10	mg/kg		1.91	----	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	0.31	----	0.16	0.66
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	<0.25	----	0.26	<0.25
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		----	----	0.87	----	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	----	----	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		----	----	0.112	----	----
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0770	----	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	0.0126	----	<0.0020	<0.0020
Vanadium	7440-62-2	E475	0.10	mg/kg		----	----	0.92	----	----
Vanadium	7440-62-2	E472	0.10	mg/kg		1.30	----	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	<0.10	----	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	101	----	11.9	151
Zinc	7440-66-6	E475	1.0	mg/kg		----	----	102	----	----
Zinc	7440-66-6	E472	1.0	mg/kg		105	----	----	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		----	----	<0.20	----	----
Zirconium	7440-67-7	E472	0.20	mg/kg		<0.20	----	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	<0.20	----	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUL-EAA_LT-O-4X_2022-10	QUL-EAA_LT-Ki-4X_2022-10	----	----	----
					Client sampling date / time	04-Oct-2022	04-Oct-2022	----	----	----
						VA22C4917-146	VA22C4917-147	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
Moisture	----	E144	0.50	%		84.4	77.3	----	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	6.2	----	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		0.059	0.314	----	----	----
Barium	7440-39-3	E440	0.050	mg/kg		<0.050	0.181	----	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	----	----	----
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	----	----	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		0.0169	0.553	----	----	----
Calcium	7440-70-2	E440	20	mg/kg		985	545	----	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		0.296	0.170	----	----	----
Chromium	7440-47-3	E440	0.050	mg/kg		0.057	0.503	----	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		0.082	0.095	----	----	----
Copper	7440-50-8	E440	0.10	mg/kg		9.38	5.73	----	----	----
Iron	7439-89-6	E440	3.0	mg/kg		216	446	----	----	----
Lead	7439-92-1	E440	0.020	mg/kg		0.020	0.023	----	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	----	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		896	457	----	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		3.90	1.07	----	----	----
Mercury	7439-97-6	E510	0.0050	mg/kg		1.09	2.90	----	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.170	0.658	----	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		0.063	0.140	----	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.24	----	----	----
Phosphorus	7723-14-0	E440	10	mg/kg		11600	8060	----	----	----
Potassium	7440-09-7	E440	20	mg/kg		12600	7120	----	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		35.8	20.5	----	----	----
Selenium	7782-49-2	E440	0.050	mg/kg		3.80	6.67	----	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0164	0.0206	----	----	----
Sodium	7440-23-5	E440	20	mg/kg		13000	8240	----	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	QUL-EAA_LT-O-4X_2022-10	QUL-EAA_LT-Ki-4X_2022-10	----	----	----
					Client sampling date / time	04-Oct-2022	04-Oct-2022	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22C4917-146	VA22C4917-147	--------	--------	--------
						Result	Result	----	----	----
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		1.68	1.31	----	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	----	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0838	0.0768	----	----	----
Tin	7440-31-5	E440	0.10	mg/kg		0.28	0.70	----	----	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		0.29	0.51	----	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0024	----	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	----	----	----
Zinc	7440-66-6	E440	0.50	mg/kg		122	66.0	----	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C4917**	Page	: 1 of 107
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Issue Date	: 30-Jan-2023 17:53
C-O-C number	: ----		
Sampler	: ABA, HQA, PLE, SLA		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 147		
No. of samples analysed	: 147		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Barium	7440-39-3	E440	60.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Calcium	7440-70-2	E440	71.3 % DUP-H	60%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Chromium	7440-47-3	E440	55.9 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Manganese	7439-96-5	E440	53.2 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Phosphorus	7723-14-0	E440	43.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Strontium	7440-24-6	E440	69.9 % DUP-H	60%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG5-7976180 02	----	Iron	7439-89-6	E440	122 % MES	80.0-120%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E512	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E512	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E511	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E511	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E510	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-1X_2022-10	E510	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-1X_2022-10	E510	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E510	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E510	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
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LDPE bag QUL-NCP_LT-M-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E510	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E510	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-6_2022-10	E510	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-6_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-3_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E510	06-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	97 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-6_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-7_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-8_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-2_2022-10	E510	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E510	06-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-1_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-2_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-3_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-4_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-6_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-7_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-1_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-3_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-5_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-6_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
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Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-8_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-1_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-2_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓

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Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-3_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-4_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-4X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-5_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-6_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-7_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-8_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-4X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-8_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-2_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-3_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-1_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-2_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-3_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-4_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-2_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-3_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-4_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-1_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-3_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-4_2022-10	E510	03-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-1_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-2_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-3_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-4_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-6_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-7_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-8_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-1_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-2_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-3_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-7_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-2_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-3_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E510	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E510	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E512A	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	106 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E512A	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	365 days	108 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E511A	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	105 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E511A	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E510A	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Li-1X_2022-10	E510A	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-O-1X_2022-10	E510A	03-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	100 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E510A	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	365 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E510A	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	365 days	107 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Li-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-M-7_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-M-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-O-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E510A	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E510A	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-M-6_2022-10	E510A	05-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
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LDPE bag QUL-NGC_NSC-WB-6_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
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LDPE bag QUL-NGC_NSC-WB-7_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
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LDPE bag QUL-NGC_PCC-M-3_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓

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Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-5_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E510A	06-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-M-6_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
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LDPE bag QUL-NGC_PCC-O-2_2022-10	E510A	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E510A	06-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-1_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓

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Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-2_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-3_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-4_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-5_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-6_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-M-7_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NCP_LT-Ki-5_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	98 days	✓
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LDPE bag QUL-EAA_LT-Ki-1_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-3_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4X_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-5_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-6_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-EAA_LT-Ki-7_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓

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LDPE bag QUL-NHC_PCC-M-2_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-3_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-5_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-6_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-7_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-2_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-3_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-6_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E510A	04-Oct-2022	10-Jan-2023	----	----		11-Jan-2023	365 days	99 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E510A	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	365 days	99 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E475	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E475	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E472	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E472	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E440	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E440	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E440	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E440	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E440	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E440	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-6_2022-10	E440	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-6_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-3_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-6_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-7_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-8_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-2_2022-10	E440	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-1_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-3_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-5_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-6_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-7_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-8_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-1_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
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LDPE bag QUL-EAA_LT-Li-2_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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LDPE bag QUL-EAA_LT-Li-3_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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LDPE bag QUL-EAA_LT-Li-4_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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LDPE bag QUL-EAA_LT-Li-4X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-5_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-6_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-7_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-8_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-1_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-2_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-3_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-4_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-4X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
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LDPE bag QUL-EAA_LT-M-6_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-7_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-8_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E440	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E440	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-2_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-3_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-1_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NCP_LT-Li-1X_2022-10	E440	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NCP_LT-Li-3_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-4_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-2_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓

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LDPE bag QUL-NCP_LT-M-3_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NCP_LT-M-4_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-1_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NCP_LT-O-3_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-4_2022-10	E440	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-1_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-2_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-3_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-4_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-6_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-7_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-8_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-1_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NHC_PCC-M-2_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NHC_PCC-M-3_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

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LDPE bag QUL-NHC_PCC-M-7_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
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LDPE bag QUL-NHC_PCC-O-3_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

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LDPE bag QUL-NHC_PCC-O-6_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E440	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E475.Ag	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E475.Ag	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E472.Ag	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E472.Ag	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E440.Ag	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E440.Ag	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
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LDPE bag QUL-NCP_LT-Li-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E440.Ag	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E440.Ag	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E440.Ag	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E440.Ag	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-6_2022-10	E440.Ag	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-6_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
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LDPE bag QUL-NGC_NSC-WB-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-3_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
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LDPE bag QUL-NGC_PCC-M-6_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-7_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-8_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-2_2022-10	E440.Ag	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-1_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-4X_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-5_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-6_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓

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Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-8_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-1_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-M-8_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-O-4X_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E440.Ag	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E440.Ag	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-2_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-3_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-1_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-1X_2022-10	E440.Ag	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-2_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-3_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-4_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-2_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-3_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-4_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-1_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-1X_2022-10	E440.Ag	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-3_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-4_2022-10	E440.Ag	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-1_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-2_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-3_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-4_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-6_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-7_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-8_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-1_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-2_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-3_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-7_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-2_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-3_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E440.Ag	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E475.Ti	06-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	106 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E475.Ti	04-Oct-2022	19-Jan-2023	----	----		20-Jan-2023	730 days	108 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E472.Ti	06-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	105 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E472.Ti	04-Oct-2022	18-Jan-2023	----	----		19-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E440.Ti	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E440.Ti	03-Oct-2022	17-Jan-2023	----	----		17-Jan-2023	730 days	107 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-7_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E440.Ti	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E440.Ti	06-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	96 days	✓

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Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E440.Ti	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E440.Ti	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-M-6_2022-10	E440.Ti	05-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-6_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-7_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-3_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓

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LDPE bag QUL-NGC_PCC-M-8_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NGC_PCC-O-2_2022-10	E440.Ti	06-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	97 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-1_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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LDPE bag QUL-EAA_LT-Ki-6_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-7_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Ki-8_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-EAA_LT-Li-1_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
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Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E440.Ti	04-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	98 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1_2022-10	E440.Ti	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E440.Ti	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Ki-2_2022-10	E440.Ti	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-Li-4_2022-10	E440.Ti	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
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LDPE bag QUL-NCP_LT-O-1X_2022-10	E440.Ti	03-Oct-2022	10-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-3_2022-10	E440.Ti	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NCP_LT-O-4_2022-10	E440.Ti	03-Oct-2022	09-Jan-2023	----	----		09-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-1_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-2_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-3_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-4_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-5_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-6_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-7_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_NSC-WB-8_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-1_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-2_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-3_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-5_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-6_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-7_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-2_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-3_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-6_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E440.Ti	04-Oct-2022	09-Jan-2023	----	----		10-Jan-2023	730 days	99 days	✓
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-1_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-3_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-4_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-5_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-6_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-7X_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Ki-8_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Li-5X_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NGC_PCC-Li-8_2022-10	E144A	06-Oct-2022	----	----	----		19-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-1_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-2_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-3_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-4_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-5_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-6X_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-7_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUL-NHC_PCC-Ki-8_2022-10	E144A	04-Oct-2022	----	----	----		19-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Ki-2_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-1_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-2_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-3_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-4_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-5_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-6_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NGC_PCC-Li-7_2022-10	E144-H	06-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-1_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-2_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-3_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-4_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-5_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-6_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-6X_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-7_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUL-NHC_PCC-Li-8_2022-10	E144-H	04-Oct-2022	----	----	----		18-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-1_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-2_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-3_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-4_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-4X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-5_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-6_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-7_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Ki-8_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-1_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-2_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-3_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-4_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-4X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-5_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-6_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-7_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-Li-8_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-1_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-2_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-3_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-4_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-4X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-6_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-7_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-M-8_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-O-4_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-EAA_LT-O-4X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-1_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-1X_2022-10	E144	03-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-2_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-3_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-4_2022-10	E144	03-Oct-2022	----	----	----		16-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-6_2022-10	E144	05-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Ki-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-1_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-1X_2022-10	E144	03-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-2_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-3_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-4_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-6_2022-10	E144	05-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-Li-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-1_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-1X_2022-10	E144	03-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-2_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-3_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-4_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-6_2022-10	E144	05-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-M-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-1_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-1X_2022-10	E144	03-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-3_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-4_2022-10	E144	03-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NCP_LT-O-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-1_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-2_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-3_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-4_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-5_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-6_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_NSC-WB-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-1_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-2_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-3_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-4_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-5_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-5X_2022-10	E144	06-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-6_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-M-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-2_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-3_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-5_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-5X_2022-10	E144	06-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-6_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-7_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NGC_PCC-O-8_2022-10	E144	06-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-1_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-2_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-3_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-4_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-6_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-7_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_NSC-WB-8_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-1_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-2_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-3_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-4_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-6_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-6X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-7_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-M-8_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-1_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-2_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-3_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-4_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-5_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-6_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-6X_2022-10	E144	04-Oct-2022	----	----	----		05-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUL-NHC_PCC-O-7_2022-10	E144	04-Oct-2022	----	----	----		04-Jan-2023	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	805879	1	17	5.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	794597	8	111	7.2	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	805880	1	17	5.8	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	794596	8	112	7.1	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	805881	1	17	5.8	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	794595	10	111	9.0	5.0	✓
Moisture Content by Gravimetry	E144	794064	8	120	6.6	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	806037	1	17	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	805877	1	17	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	794599	8	111	7.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	805878	1	17	5.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	794598	8	111	7.2	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	807455	2	19	10.5	10.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	805879	2	17	11.7	10.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	794597	16	111	14.4	10.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	807456	2	19	10.5	10.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	805880	2	17	11.7	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	794596	16	112	14.2	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	807459	2	19	10.5	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	805881	2	17	11.7	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	794595	16	111	14.4	10.0	✓
Moisture Content by Gravimetry	E144	794064	8	120	6.6	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	807452	1	19	5.2	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	806037	1	17	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	807457	2	19	10.5	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	805877	2	17	11.7	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	794599	16	111	14.4	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	807458	2	19	10.5	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	805878	2	17	11.7	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	794598	16	111	14.4	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	807455	1	19	5.2	5.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	805879	1	17	5.8	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	794597	8	111	7.2	5.0	✓

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	807456	1	19	5.2	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	805880	1	17	5.8	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	794596	8	112	7.1	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	807459	2	19	10.5	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	805881	1	17	5.8	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	794595	8	111	7.2	5.0	✓
Moisture Content by Gravimetry	E144	794064	8	120	6.6	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	807452	1	19	5.2	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	806037	1	17	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	807457	1	19	5.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	805877	1	17	5.8	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	794599	8	111	7.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	807458	1	19	5.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	805878	1	17	5.8	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	794598	8	111	7.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at < 60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Mercury in Biota by CVAAS (WET units, Micro)	E511A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22C4917**	Page	: 1 of 52
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 04-Jan-2023
C-O-C number	: ----	Issue Date	: 30-Jan-2023 17:53
Sampler	: ABA, HQA, PLE, SLA 250-790-2215 Ext 2112		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 147		
No. of samples analysed	: 147		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Sam Silveira	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 794064)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Moisture	----	E144	0.50	%	72.8	72.4	0.552%	20%	----
Physical Tests (QC Lot: 794065)											
VA22C4917-023	QUL-NHC_PCC-M-7_2022-10	Moisture	----	E144	0.50	%	78.2	76.5	2.13%	20%	----
Physical Tests (QC Lot: 794066)											
VA22C4917-079	QUL-NCP_LT-M-2_2022-10	Moisture	----	E144	0.50	%	76.4	75.5	1.12%	20%	----
Physical Tests (QC Lot: 794067)											
VA22C4917-094	QUL-NCP_LT-O-1_2022-10	Moisture	----	E144	0.50	%	64.8	65.4	0.914%	20%	----
Physical Tests (QC Lot: 794068)											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Moisture	----	E144	0.50	%	79.5	79.6	0.182%	20%	----
Physical Tests (QC Lot: 794797)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Moisture	----	E144	0.50	%	70.7	71.2	0.642%	20%	----
Physical Tests (QC Lot: 794802)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Moisture	----	E144	0.50	%	78.8	79.0	0.255%	20%	----
Physical Tests (QC Lot: 803992)											
VA22C4917-102	QUL-NCP_LT-Ki-4_2022-10	Moisture	----	E144	0.50	%	84.2	84.7	0.497%	20%	----
Physical Tests (QC Lot: 806037)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Moisture	----	E144-H	2.0	%	62.6	58.0	7.61%	20%	----
Metals (QC Lot: 794595)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.108	0.119	9.16%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	0.610	1.14	60.9%	40%	DUP-H
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.0487	0.0438	10.7%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	13700	28900	71.3%	60%	DUP-H

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 794595) - continued											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Cesium	7440-46-2	E440	0.0050	mg/kg	0.0866	0.0928	6.89%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.038	0.038	0.0003	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	2.19	2.12	3.26%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	29.2	33.5	13.8%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1650	2090	23.6%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	3.30	5.69	53.2%	40%	DUP-H
		Molybdenum	7439-98-7	E440	0.020	mg/kg	0.028	0.032	0.004	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	17500	27300	43.6%	40%	DUP-H
		Potassium	7440-09-7	E440	20	mg/kg	14100	14600	3.44%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	29.2	30.5	4.38%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	3.30	3.21	2.96%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	2060	2320	11.5%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	18.8	38.9	69.9%	60%	DUP-H
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0044	0.0048	0.0004	Diff <2x LOR	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.23	0.12	0.11	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	0.0023	0.0035	0.0012	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	70.2	93.8	28.8%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 794596)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Mercury	7439-97-6	E510A	0.0017	mg/kg wwt	0.138	0.129	6.94%	40%	----
Metals (QC Lot: 794597)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Mercury	7439-97-6	E510	0.0050	mg/kg	0.509	0.475	6.94%	40%	----
Metals (QC Lot: 794598)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 794599)											
VA22C4917-001	QUL-NHC_NSC-WB-1_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 794602)											
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Barium	7440-39-3	E440	0.050	mg/kg	1.49	0.996	39.5%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	5720	5550	3.15%	60%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.486	0.273	55.9%	40%	DUP-H
		Manganese	7439-96-5	E440	0.050	mg/kg	2.12	1.63	26.2%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	10.9	8.95	20.1%	60%	----
		Tin	7440-31-5	E440	0.10	mg/kg	2.98	3.54	17.3%	40%	----
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.365	0.363	0.586%	40%	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.0091	0.0101	0.0010	Diff <2x LOR	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.0821	0.0786	4.41%	40%	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.030	0.028	0.001	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	2.57	2.62	1.66%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	30.4	30.6	0.768%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1610	1470	8.94%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	13200	13800	3.84%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	21400	20800	2.90%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	18.3	17.6	3.69%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	5.00	5.05	0.985%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	1260	1240	1.91%	40%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0040	0.0058	0.0018	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	0.0032	0.0012	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	28.4	29.4	3.21%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 794603)											
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Mercury	7439-97-6	E510A	0.0017	mg/kg wwt	0.167	0.152	9.27%	40%	----
Metals (QC Lot: 794604)											
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 794605)											
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Mercury	7439-97-6	E510	0.0050	mg/kg	0.730	0.666	9.27%	40%	----
Metals (QC Lot: 794606)											
VA22C4917-021	QUL-NHC_PCC-M-5_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 794612)											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Barium	7440-39-3	E440	0.050	mg/kg	0.331	0.347	4.65%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.050	0.075	0.025	Diff <2x LOR	----
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.196	0.192	2.12%	40%	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.0292	0.0243	18.4%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	386	424	9.57%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.0504	0.0500	0.772%	40%	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.144	0.130	9.76%	40%	----
		Copper	7440-50-8	E440	0.10	mg/kg	5.15	4.86	5.64%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	61.2	53.0	14.2%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	761	666	13.4%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	8.72	7.38	16.6%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	0.108	0.088	0.020	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	12600	11800	6.77%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	9400	9030	4.02%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	14.4	14.0	2.65%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 794612) - continued											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Selenium	7782-49-2	E440	0.050	mg/kg	14.8	14.2	3.66%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	1610	1550	3.79%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.579	0.595	2.78%	60%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0044	0.0043	0.0001	Diff <2x LOR	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.32	0.32	0.008	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	0.0079	0.0071	0.0008	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	114	106	7.11%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 794613)											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0088	0.0081	7.71%	40%	----
Metals (QC Lot: 794614)											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0164	0.0165	0.00006	Diff <2x LOR	----
Metals (QC Lot: 794615)											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Mercury	7439-97-6	E510	0.0050	mg/kg	0.0252	0.0234	0.0019	Diff <2x LOR	----
Metals (QC Lot: 794616)											
VA22C4917-065	QUL-NGC_PCC-O-3_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	0.32	<0.25	0.06	Diff <2x LOR	----
Metals (QC Lot: 794623)											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.281	0.268	4.76%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	<0.050	0.051	0.001	Diff <2x LOR	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.193	0.218	11.7%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	110	108	1.91%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.0589	0.0578	1.89%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.082	0.079	0.003	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.194	0.193	0.466%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 794623) - continued											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Copper	7440-50-8	E440	0.10	mg/kg	38.9	43.6	11.4%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	210	213	1.59%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	452	441	2.40%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	3.53	3.53	0.0246%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	0.485	0.528	8.53%	40%	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	10400	10100	2.89%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	8440	8010	5.21%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	19.3	18.7	3.05%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	6.09	6.04	0.694%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	2900	2800	3.55%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.190	0.189	0.277%	60%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.151	0.145	4.13%	40%	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.21	0.19	0.02	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	104	106	2.59%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 794624)											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Mercury	7439-97-6	E510A	0.0020	mg/kg wwt	0.198	0.191	3.94%	40%	----
Metals (QC Lot: 794625)											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.232	0.258	10.9%	40%	----
Metals (QC Lot: 794626)											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Mercury	7439-97-6	E510	0.0050	mg/kg	0.580	0.557	3.94%	40%	----
Metals (QC Lot: 794627)											
VA22C4917-093	QUL-NCP_LT-Li-8_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 795376)											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 795376) - continued											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Arsenic	7440-38-2	E440	0.020	mg/kg	0.286	0.312	8.66%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Calcium	7440-70-2	E440	20	mg/kg	263	268	1.82%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.264	0.286	8.08%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	0.68	0.78	13.6%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	21.9	26.2	18.0%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1160	1180	2.16%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	0.152	0.160	0.008	Diff <2x LOR	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	11500	13100	12.7%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	20100	22100	9.54%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	25.7	28.4	10.0%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	2.97	2.92	1.67%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	2140	2410	11.9%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.148	0.149	0.001	Diff <2x LOR	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0263	0.0277	5.08%	40%	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.37	0.38	0.01	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	17.7	17.9	1.07%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 795377)											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Mercury	7439-97-6	E510A	0.0088	mg/kg wwt	0.893	0.892	0.138%	40%	----
Metals (QC Lot: 795378)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 795378) - continued											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 795379)											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Mercury	7439-97-6	E510	0.0220	mg/kg	4.35	4.35	0.138%	40%	----
Metals (QC Lot: 795380)											
VA22C4917-114	QUL-EAA_LT-M-8_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 797610)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.384	0.419	8.68%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.219	0.222	1.50%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	213	224	4.64%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.120	0.124	3.35%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.165	0.167	0.002	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.165	0.163	1.52%	40%	----
		Copper	7440-50-8	E440	0.10	mg/kg	244	233	4.38%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	947	932	1.53%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	483	497	2.87%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	4.41	4.49	1.81%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	0.423	0.420	0.695%	40%	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	10100	10400	2.41%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	7540	7890	4.50%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	18.3	18.8	2.64%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	14.7	15.1	2.47%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	5370	5450	1.52%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.346	0.356	2.86%	60%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.307	0.308	0.232%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 797610) - continued											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Tin	7440-31-5	E440	0.10	mg/kg	0.31	0.32	0.009	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	160	161	0.291%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 797611)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Mercury	7439-97-6	E510A	0.0116	mg/kg wwt	0.898	0.896	0.254%	40%	----
Metals (QC Lot: 797612)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	1.43	1.34	6.39%	40%	----
Metals (QC Lot: 797613)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Mercury	7439-97-6	E510	0.0233	mg/kg	3.07	3.06	0.254%	40%	----
Metals (QC Lot: 797614)											
VA22C4917-115	QUL-EAA_LT-Li-1_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 797618)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	3.1	3.2	0.07	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.222	0.238	6.53%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	0.052	<0.050	0.002	Diff <2x LOR	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	0.422	0.440	4.18%	40%	----
		Calcium	7440-70-2	E440	20	mg/kg	337	346	2.54%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.308	0.316	2.60%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.228	0.244	0.016	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.090	0.097	0.007	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	11.1	12.0	8.28%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	347	375	7.87%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	0.020	0.0003	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1070	1130	5.82%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	5.94	6.34	6.51%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	0.338	0.345	2.13%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 797618) - continued											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	18200	19800	8.24%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	17300	18500	6.80%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	83.7	87.4	4.31%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	5.35	5.80	8.05%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	5270	5480	3.80%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.387	0.401	3.39%	60%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.646	0.672	3.91%	40%	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.21	0.21	0.0006	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	0.13	0.03	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	97.2	106	9.07%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 797619)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Mercury	7439-97-6	E510A	0.0017	mg/kg wwt	0.547	0.551	0.603%	40%	----
Metals (QC Lot: 797620)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0569	0.0583	2.32%	40%	----
Metals (QC Lot: 797621)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Mercury	7439-97-6	E510	0.0050	mg/kg	2.58	2.59	0.603%	40%	----
Metals (QC Lot: 797622)											
VA22C4917-137	QUL-NCP_LT-Li-1X_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	0.29	<0.25	0.04	Diff <2x LOR	----
Metals (QC Lot: 803962)											
KS2204160-001	Anonymous	Mercury	7439-97-6	E510A	0.0014	mg/kg wwt	0.0495	0.0477	3.79%	40%	----
Metals (QC Lot: 803963)											
VA22C4917-136	QUL-NCP_LT-M-1X_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.092	0.087	0.006	Diff <2x LOR	----
		Barium	7440-39-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 803963) - continued											
VA22C4917-136	QUL-NCP_LT-M-1X_2022-10	Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Calcium	7440-70-2	E440	20	mg/kg	428	286	39.8%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.297	0.278	6.54%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	0.74	0.88	17.7%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	8.6	9.2	0.6	Diff <2x LOR	----
		Lead	7439-92-1	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1060	1130	6.09%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	0.280	0.272	2.72%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	10300	9930	3.38%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	18700	18200	3.13%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	38.7	37.1	4.25%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	1.58	1.57	0.538%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	1050	1010	3.62%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	0.385	0.217	55.7%	60%	----
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0246	0.0223	9.72%	40%	----
		Tin	7440-31-5	E440	0.10	mg/kg	0.26	0.25	0.01	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	9.99	9.89	1.05%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 803964)											
VA22C4917-136	QUL-NCP_LT-M-1X_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 803965)											
VA22C4917-136	QUL-NCP_LT-M-1X_2022-10	Mercury	7439-97-6	E510	0.0141	mg/kg	2.09	1.96	6.50%	40%	----
Metals (QC Lot: 803966)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 803966) - continued											
VA22C4917-136	QUL-NCP_LT-M-1X_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 805877)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0106	0.0103	0.0003	Diff <2x LOR	----
Metals (QC Lot: 805878)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 805879)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Mercury	7439-97-6	E511	0.0050	mg/kg	0.346	0.387	11.4%	40%	----
Metals (QC Lot: 805880)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.129	0.145	11.4%	40%	----
Metals (QC Lot: 805881)											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Aluminum	7429-90-5	E472	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		Antimony	7440-36-0	E472	0.010	mg/kg	0.016	0.014	0.002	Diff <2x LOR	----
		Arsenic	7440-38-2	E472	0.030	mg/kg	0.144	0.164	13.0%	40%	----
		Barium	7440-39-3	E472	0.050	mg/kg	0.149	0.188	0.039	Diff <2x LOR	----
		Beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E472	0.010	mg/kg	0.030	0.036	0.006	Diff <2x LOR	----
		Boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E472	0.010	mg/kg	0.519	0.628	19.0%	40%	----
		Calcium	7440-70-2	E472	20	mg/kg	156	187	17.6%	60%	----
		Cesium	7440-46-2	E472	0.0050	mg/kg	0.0266	0.0313	16.1%	40%	----
		Chromium	7440-47-3	E472	0.20	mg/kg	<0.20	0.20	0.003	Diff <2x LOR	----
		Cobalt	7440-48-4	E472	0.020	mg/kg	0.136	0.176	26.2%	40%	----
		Copper	7440-50-8	E472	0.20	mg/kg	10.6	11.6	9.07%	40%	----
		Iron	7439-89-6	E472	5.0	mg/kg	793	941	17.0%	40%	----
		Lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E472	2.0	mg/kg	615	761	21.2%	40%	----
		Manganese	7439-96-5	E472	0.050	mg/kg	3.85	4.78	21.3%	40%	----
		Molybdenum	7439-98-7	E472	0.040	mg/kg	0.488	0.621	24.0%	40%	----
		Nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E472	10	mg/kg	10700	13100	20.6%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 805881) - continued											
VA22C4917-029	QUL-NHC_PCC-Li-5_2022-10	Potassium	7440-09-7	E472	20	mg/kg	8900	10300	14.9%	40%	----
		Rubidium	7440-17-7	E472	0.050	mg/kg	8.56	9.86	14.2%	40%	----
		Selenium	7782-49-2	E472	0.10	mg/kg	11.6	14.0	18.9%	40%	----
		Sodium	7440-23-5	E472	20	mg/kg	3310	3820	14.1%	40%	----
		Strontium	7440-24-6	E472	0.10	mg/kg	0.38	0.45	17.8%	60%	----
		Tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E472	0.0020	mg/kg	0.0111	0.0128	14.7%	40%	----
		Tin	7440-31-5	E472	0.10	mg/kg	0.23	0.22	0.007	Diff <2x LOR	----
		Uranium	7440-61-1	E472	0.0020	mg/kg	0.0263	0.0293	10.8%	40%	----
		Vanadium	7440-62-2	E472	0.10	mg/kg	0.45	0.55	19.0%	40%	----
		Zinc	7440-66-6	E472	1.0	mg/kg	72.1	84.0	15.2%	40%	----
		Zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 794064)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794065)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794066)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794067)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794068)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794797)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 794802)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 803992)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 806037)						
Moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 807452)						
Moisture	----	E144A	2	%	<2.0	----
Metals (QCLot: 794595)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 794595) - continued						
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 794596)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 794597)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794598)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 794599)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794602)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 794602) - continued						
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 794603)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 794604)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794605)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794606)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 794606) - continued						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 794612)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 794613)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 794614)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794615)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794616)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 794623)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 794623) - continued						
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 794624)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 794625)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794626)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 794627)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 795376)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 795376) - continued						
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 795377)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 795378)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 795379)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 795380)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 797610)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 797610) - continued						
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 797611)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 797612)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 797613)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 797614)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 797618)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 797618) - continued						
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 797619)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 797620)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 797621)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 797622)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 803962)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 803963)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 803964)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 803965)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 803966)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 805877)						
Silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 805878)						
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 805879)						
Mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 805880)						
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 805881)						
Aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
Antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
Barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E472	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E472	20	mg/kg	<20	----
Cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E472	5	mg/kg	<5.0	----
Lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
Manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E472	10	mg/kg	<10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 805881) - continued						
Potassium	7440-09-7	E472	20	mg/kg	<20	----
Rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E472	20	mg/kg	<20	----
Strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E472	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 807455)						
Mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 807456)						
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 807457)						
Silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 807458)						
Titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 807459)						
Aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
Antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
Arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
Barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E475	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E475	20	mg/kg	<20	----
Cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E475	5	mg/kg	<5.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 807459) - continued						
Lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
Manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E475	0.2	mg/kg	<0.20	MBRR
Phosphorus	7723-14-0	E475	20	mg/kg	<20	----
Potassium	7440-09-7	E475	20	mg/kg	<20	----
Rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E475	20	mg/kg	<20	----
Strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E475	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----

Qualifiers

Qualifier	Description
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 794064)									
Moisture	----	E144	0.5	%	50 %	100.0	90.0	110	----
Physical Tests (QCLot: 794065)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 794066)									
Moisture	----	E144	0.5	%	50 %	100.0	90.0	110	----
Physical Tests (QCLot: 794067)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 794068)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 794797)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 794802)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 803992)									
Moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 806037)									
Moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 807452)									
Moisture	----	E144A	2	%	100 %	100	90.0	110	----
Metals (QCLot: 794595)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	103	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	111	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	110	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	107	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	100	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	99.6	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 794595) - continued									
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	103	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	106	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	103	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	104	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	99.6	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	107	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	101	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	111	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	109	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	106	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	100	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	102	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	104	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	105	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	101	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 794596)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.3	80.0	120	----
Metals (QCLot: 794597)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.3	80.0	120	----
Metals (QCLot: 794598)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	97.9	80.0	120	----
Metals (QCLot: 794599)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	93.3	80.0	120	----
Metals (QCLot: 794602)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	101	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	111	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	106	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 794602) - continued									
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	102	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	97.6	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	103	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	102	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	101	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	96.3	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	106	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	99.8	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	117	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	115	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	99.8	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	99.7	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	104	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	105	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	102	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	102	80.0	120	----
Metals (QCLot: 794603)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.0	80.0	120	----
Metals (QCLot: 794604)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	92.4	80.0	120	----
Metals (QCLot: 794605)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	93.0	80.0	120	----
Metals (QCLot: 794606)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	98.4	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 794612)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	101	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	97.6	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	96.1	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	94.8	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	86.3	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	98.4	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	93.3	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	97.7	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	97.7	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	98.8	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	96.6	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	97.7	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	93.0	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	95.0	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	98.5	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	97.1	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	111	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	105	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	108	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	99.7	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	98.7	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	99.1	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	93.5	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	97.1	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	94.3	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	98.2	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	101	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	96.1	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	93.9	80.0	120	----
Metals (QCLot: 794613)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.7	80.0	120	----
Metals (QCLot: 794614)									

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 794614) - continued									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	85.0	80.0	120	----
Metals (QCLot: 794615)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	93.7	80.0	120	----
Metals (QCLot: 794616)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	94.4	80.0	120	----
Metals (QCLot: 794623)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	108	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	111	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	111	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	110	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	98.8	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	103	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	106	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	104	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	102	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	108	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	107	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	108	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	103	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	116	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	109	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	108	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	109	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	97.6	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	100	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 794623) - continued									
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	107	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	104	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 794624)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	96.8	80.0	120	----
Metals (QCLot: 794625)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	92.7	80.0	120	----
Metals (QCLot: 794626)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	96.8	80.0	120	----
Metals (QCLot: 794627)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	99.0	80.0	120	----
Metals (QCLot: 795376)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	102	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	109	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	107	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	105	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	95.3	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	98.2	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	99.9	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	102	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	100	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	100	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	104	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	103	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	104	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	100	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	114	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	105	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 795376) - continued									
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	105	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	96.3	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	98.4	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	102	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	100	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	99.0	80.0	120	----
Metals (QCLot: 795377)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	96.9	80.0	120	----
Metals (QCLot: 795378)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	88.7	80.0	120	----
Metals (QCLot: 795379)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	96.9	80.0	120	----
Metals (QCLot: 795380)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	96.3	80.0	120	----
Metals (QCLot: 797610)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	111	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	113	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	114	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	108	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	102	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	106	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	105	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	108	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	110	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	110	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	110	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	116	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	105	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	104	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	114	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	109	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 797610) - continued									
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	112	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	110	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	111	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	109	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	109	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	112	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	107	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	105	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	106	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	112	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	104	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	107	80.0	120	----
Metals (QCLot: 797611)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	91.9	80.0	120	----
Metals (QCLot: 797612)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	97.0	80.0	120	----
Metals (QCLot: 797613)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	91.9	80.0	120	----
Metals (QCLot: 797614)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	105	80.0	120	----
Metals (QCLot: 797618)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	113	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	113	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	116	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	110	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	112	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	103	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	108	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	108	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	109	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	110	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	114	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	113	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 797618) - continued									
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	114	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	# 122	80.0	120	MES
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	105	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	109	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	117	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	111	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	114	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	114	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	115	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	109	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	107	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	110	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	114	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	116	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	110	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	104	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	107	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	116	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	108	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	110	80.0	120	----
Metals (QCLot: 797619)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	95.4	80.0	120	----
Metals (QCLot: 797620)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	98.1	80.0	120	----
Metals (QCLot: 797621)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	95.4	80.0	120	----
Metals (QCLot: 797622)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	109	80.0	120	----
Metals (QCLot: 803962)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	96.0	80.0	120	----
Metals (QCLot: 803963)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	97.5	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	111	80.0	120	----
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	98.8	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 803963) - continued									
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	91.0	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	93.9	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	81.4	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	107	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	91.7	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	96.1	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	108	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	109	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	111	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	98.2	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	90.3	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	106	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	96.6	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	106	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	107	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	103	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	104	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	99.7	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	93.2	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	98.5	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	95.2	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	100	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	109	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	104	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	96.2	80.0	120	----
Metals (QCLot: 803964)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	89.2	80.0	120	----
Metals (QCLot: 803965)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	96.0	80.0	120	----
Metals (QCLot: 803966)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	100	80.0	120	----
Metals (QCLot: 805877)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 805877) - continued									
Silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	91.3	80.0	120	----
Metals (QCLot: 805878)									
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	95.7	80.0	120	----
Metals (QCLot: 805879)									
Mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	88.8	80.0	120	----
Metals (QCLot: 805880)									
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	88.8	80.0	120	----
Metals (QCLot: 805881)									
Aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	101	80.0	120	----
Antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	100.0	80.0	120	----
Arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	102	80.0	120	----
Barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	88.2	80.0	120	----
Beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	89.3	80.0	120	----
Bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	92.3	80.0	120	----
Boron	7440-42-8	E472	1	mg/kg	10 mg/kg	83.3	80.0	120	----
Cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	100	80.0	120	----
Calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	85.8	80.0	120	----
Cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	102	80.0	120	----
Chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	102	80.0	120	----
Cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
Copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	103	80.0	120	----
Iron	7439-89-6	E472	5	mg/kg	10 mg/kg	103	80.0	120	----
Lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	94.3	80.0	120	----
Lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	86.5	80.0	120	----
Magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	101	80.0	120	----
Manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	98.9	80.0	120	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	102	80.0	120	----
Nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	102	80.0	120	----
Phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	100	80.0	120	----
Potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	93.7	80.0	120	----
Rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	94.2	80.0	120	----
Selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	97.0	80.0	120	----
Sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	103	80.0	120	----
Strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	100	80.0	120	----
Tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	98.8	80.0	120	----
Thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	92.2	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 805881) - continued									
Tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	100	80.0	120	----
Uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	100	80.0	120	----
Vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	103	80.0	120	----
Zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	95.9	80.0	120	----
Zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	102	80.0	120	----
Metals (QCLot: 807455)									
Mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	94.6	80.0	120	----
Metals (QCLot: 807456)									
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	94.6	80.0	120	----
Metals (QCLot: 807457)									
Silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	88.7	80.0	120	----
Metals (QCLot: 807458)									
Titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	101	80.0	120	----
Metals (QCLot: 807459)									
Aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	104	80.0	120	----
Antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	99.2	80.0	120	----
Arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	104	80.0	120	----
Barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	105	80.0	120	----
Beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	97.2	80.0	120	----
Bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	92.2	80.0	120	----
Boron	7440-42-8	E475	1	mg/kg	25 mg/kg	91.4	80.0	120	----
Cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	97.5	80.0	120	----
Calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	93.8	80.0	120	----
Cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	99.3	80.0	120	----
Chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	100	80.0	120	----
Cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	96.2	80.0	120	----
Copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	94.7	80.0	120	----
Iron	7439-89-6	E475	5	mg/kg	25 mg/kg	105	80.0	120	----
Lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	96.5	80.0	120	----
Lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	96.7	80.0	120	----
Magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	96.0	80.0	120	----
Manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	103	80.0	120	----
Molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	106	80.0	120	----
Nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	95.2	80.0	120	----
Phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	110	80.0	120	----
Potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 807459) - continued									
Rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
Selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	96.7	80.0	120	----
Sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	104	80.0	120	----
Strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	102	80.0	120	----
Tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	97.5	80.0	120	----
Thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	93.9	80.0	120	----
Tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	100	80.0	120	----
Uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	100	80.0	120	----
Vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	103	80.0	120	----
Zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	94.6	80.0	120	----
Zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	102	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 794595)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	94.6	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	102	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	102	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	110	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	98.5	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	97.9	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	98.9	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	123	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	101	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	100	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	101	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	104	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	95.2	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	99.7	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	98.7	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	103	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	102	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	103	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	101	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	102	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	101	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	96.2	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	96.0	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	99.9	70.0	130	----
Metals (QCLot: 794596)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	95.0	70.0	130	----
Metals (QCLot: 794597)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	95.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 794598)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	83.5	70.0	130	----
Metals (QCLot: 794599)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	99.7	70.0	130	----
Metals (QCLot: 794602)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	94.2	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	101	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	102	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	105	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	102	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	96.8	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	95.0	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	91.8	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	99.5	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	100	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	96.0	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	102	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	94.9	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	97.2	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	92.6	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	90.1	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	102	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	98.9	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	98.7	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	100.0	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	100	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	96.5	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	97.8	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	101	70.0	130	----
Metals (QCLot: 794603)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	96.9	70.0	130	----
Metals (QCLot: 794604)									

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 794604) - continued									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	94.9	70.0	130	----
Metals (QCLot: 794605)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	96.9	70.0	130	----
Metals (QCLot: 794606)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	86.1	70.0	130	----
Metals (QCLot: 794612)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	97.2	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	99.2	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	97.8	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	92.7	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	102	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	100	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	95.7	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	91.5	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	104	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	95.9	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	96.3	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	102	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	93.1	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	94.6	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	101	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	89.4	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	104	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	102	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	95.1	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	97.4	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	99.4	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	93.3	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	87.6	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	96.8	70.0	130	----
Metals (QCLot: 794613)									

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 794613) - continued									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	94.9	70.0	130	----
Metals (QCLot: 794614)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	95.5	70.0	130	----
Metals (QCLot: 794615)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	94.9	70.0	130	----
Metals (QCLot: 794616)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	79.5	70.0	130	----
Metals (QCLot: 794623)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	88.7	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	100	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	96.2	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	110	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	95.5	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	99.4	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	94.4	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	90.4	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	109	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	99.7	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	99.2	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	98.6	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	94.2	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	105	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	95.8	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	88.4	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	102	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	104	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	101	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	107	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	102	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	92.8	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	91.5	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 794623) - continued									
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	102	70.0	130	----
Metals (QCLot: 794624)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	96.9	70.0	130	----
Metals (QCLot: 794625)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	97.1	70.0	130	----
Metals (QCLot: 794626)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	96.9	70.0	130	----
Metals (QCLot: 794627)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	82.0	70.0	130	----
Metals (QCLot: 795376)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	96.1	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	103	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	102	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	99.4	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	100	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	104	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	98.4	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	93.8	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	106	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	102	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	101	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	103	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	98.4	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	98.2	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	95.9	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	89.8	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	103	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	103	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	101	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	105	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	102	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	93.7	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 795376) - continued									
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	100	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	102	70.0	130	----
Metals (QCLot: 795377)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	99.6	70.0	130	----
Metals (QCLot: 795378)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	97.9	70.0	130	----
Metals (QCLot: 795379)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	99.6	70.0	130	----
Metals (QCLot: 795380)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	92.1	70.0	130	----
Metals (QCLot: 797610)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	96.7	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	94.8	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	88.9	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	107	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	95.1	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	95.1	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	96.3	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	94.2	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	97.9	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	99.6	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	102	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	96.8	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	100	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	96.6	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	92.0	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	86.4	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	91.2	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	90.8	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	90.9	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	99.8	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	96.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 797610) - continued									
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	95.3	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	97.6	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	96.2	70.0	130	----
Metals (QCLot: 797611)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	95.0	70.0	130	----
Metals (QCLot: 797612)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	96.0	70.0	130	----
Metals (QCLot: 797613)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	95.0	70.0	130	----
Metals (QCLot: 797614)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	101	70.0	130	----
Metals (QCLot: 797618)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	98.6	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	96.7	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	94.3	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	119	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	93.6	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	103	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	99.2	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	103	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	99.4	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	101	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	102	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	100	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	100	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	97.1	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	102	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	92.4	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	92.3	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	90.3	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	91.2	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	97.6	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 797618) - continued									
	RM	Sodium	7440-23-5	E440	9620 mg/kg	96.5	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	102	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	102	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	97.6	70.0	130	----
Metals (QCLot: 797619)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	98.5	70.0	130	----
Metals (QCLot: 797620)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	98.7	70.0	130	----
Metals (QCLot: 797621)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	98.5	70.0	130	----
Metals (QCLot: 797622)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	112	70.0	130	----
Metals (QCLot: 803962)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	97.1	70.0	130	----
Metals (QCLot: 803963)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	75.5	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	100	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	95.0	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	97.0	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	102	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	103	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	97.5	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	98.2	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	104	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	101	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	92.5	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	109	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	92.7	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	98.0	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	95.4	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	101	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	99.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 803963) - continued									
	RM	Potassium	7440-09-7	E440	11600 mg/kg	102	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	99.0	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	98.8	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	99.9	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	99.4	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	85.9	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	102	70.0	130	----
Metals (QCLot: 803964)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	101	70.0	130	----
Metals (QCLot: 803965)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	97.1	70.0	130	----
Metals (QCLot: 803966)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	79.7	70.0	130	----
Metals (QCLot: 805877)									
	RM	Silver	7440-22-4	E472.Ag	0.139 mg/kg	100	70.0	130	----
Metals (QCLot: 805878)									
	RM	Titanium	7440-32-6	E472.Ti	1.15 mg/kg	85.7	70.0	130	----
Metals (QCLot: 805879)									
	RM	Mercury	7439-97-6	E511	0.281 mg/kg	96.7	70.0	130	----
Metals (QCLot: 805880)									
	RM	Mercury	7439-97-6	E511A	0.281 mg/kg wwt	96.7	70.0	130	----
Metals (QCLot: 805881)									
	RM	Aluminum	7429-90-5	E472	147 mg/kg	112	70.0	130	----
	RM	Arsenic	7440-38-2	E472	14.5 mg/kg	96.7	70.0	130	----
	RM	Barium	7440-39-3	E472	0.352 mg/kg	85.1	70.0	130	----
	RM	Boron	7440-42-8	E472	3.47 mg/kg	87.6	70.0	130	----
	RM	Cadmium	7440-43-9	E472	0.153 mg/kg	97.6	70.0	130	----
	RM	Calcium	7440-70-2	E472	2010 mg/kg	94.2	70.0	130	----
	RM	Cesium	7440-46-2	E472	0.0889 mg/kg	101	70.0	130	----
	RM	Chromium	7440-47-3	E472	0.453 mg/kg	98.3	50.0	150	----
	RM	Cobalt	7440-48-4	E472	0.0567 mg/kg	97.6	65.0	135	----
	RM	Copper	7440-50-8	E472	3.3 mg/kg	109	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 805881) - continued									
	RM	Iron	7439-89-6	E472	102 mg/kg	102	70.0	130	----
	RM	Lead	7439-92-1	E472	0.058 mg/kg	97.5	15.0	185	----
	RM	Magnesium	7439-95-4	E472	899 mg/kg	100	70.0	130	----
	RM	Manganese	7439-96-5	E472	0.948 mg/kg	99.7	70.0	130	----
	RM	Molybdenum	7439-98-7	E472	0.134 mg/kg	100	70.0	130	----
	RM	Nickel	7440-02-0	E472	0.33 mg/kg	102	40.0	160	----
	RM	Phosphorus	7723-14-0	E472	6700 mg/kg	97.6	70.0	130	----
	RM	Potassium	7440-09-7	E472	11600 mg/kg	93.8	70.0	130	----
	RM	Rubidium	7440-17-7	E472	2.53 mg/kg	93.8	70.0	130	----
	RM	Selenium	7782-49-2	E472	2.48 mg/kg	101	70.0	130	----
	RM	Sodium	7440-23-5	E472	9620 mg/kg	101	70.0	130	----
	RM	Strontium	7440-24-6	E472	10.6 mg/kg	96.7	70.0	130	----
	RM	Vanadium	7440-62-2	E472	0.269 mg/kg	103	70.0	130	----
	RM	Zinc	7440-66-6	E472	28.7 mg/kg	97.2	70.0	130	----
Metals (QCLot: 807455)									
	RM	Mercury	7439-97-6	E512	0.281 mg/kg	97.7	70.0	130	----
Metals (QCLot: 807456)									
	RM	Mercury	7439-97-6	E512A	0.281 mg/kg wwt	97.7	70.0	130	----
Metals (QCLot: 807457)									
	RM	Silver	7440-22-4	E475.Ag	0.139 mg/kg	101	70.0	130	----
Metals (QCLot: 807458)									
	RM	Titanium	7440-32-6	E475.Ti	1.15 mg/kg	87.8	70.0	130	----
Metals (QCLot: 807459)									
	RM	Aluminum	7429-90-5	E475	147 mg/kg	110	70.0	130	----
	RM	Arsenic	7440-38-2	E475	14.5 mg/kg	101	70.0	130	----
	RM	Barium	7440-39-3	E475	0.352 mg/kg	108	70.0	130	----
	RM	Boron	7440-42-8	E475	3.47 mg/kg	95.6	70.0	130	----
	RM	Cadmium	7440-43-9	E475	0.153 mg/kg	94.6	70.0	130	----
	RM	Calcium	7440-70-2	E475	2010 mg/kg	124	70.0	130	----
	RM	Cesium	7440-46-2	E475	0.0889 mg/kg	102	70.0	130	----
	RM	Chromium	7440-47-3	E475	0.453 mg/kg	117	50.0	150	----
	RM	Cobalt	7440-48-4	E475	0.0567 mg/kg	94.9	65.0	135	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 807459) - continued									
	RM	Copper	7440-50-8	E475	3.3 mg/kg	94.1	70.0	130	----
	RM	Iron	7439-89-6	E475	102 mg/kg	100	70.0	130	----
	RM	Lead	7439-92-1	E475	0.058 mg/kg	104	15.0	185	----
	RM	Magnesium	7439-95-4	E475	899 mg/kg	96.3	70.0	130	----
	RM	Manganese	7439-96-5	E475	0.948 mg/kg	106	70.0	130	----
	RM	Molybdenum	7439-98-7	E475	0.134 mg/kg	114	70.0	130	----
	RM	Nickel	7440-02-0	E475	0.33 mg/kg	106	40.0	160	----
	RM	Phosphorus	7723-14-0	E475	6700 mg/kg	106	70.0	130	----
	RM	Potassium	7440-09-7	E475	11600 mg/kg	102	70.0	130	----
	RM	Rubidium	7440-17-7	E475	2.53 mg/kg	103	70.0	130	----
	RM	Selenium	7782-49-2	E475	2.48 mg/kg	99.6	70.0	130	----
	RM	Sodium	7440-23-5	E475	9620 mg/kg	97.0	70.0	130	----
	RM	Strontium	7440-24-6	E475	10.6 mg/kg	101	70.0	130	----
	RM	Vanadium	7440-62-2	E475	0.269 mg/kg	106	70.0	130	----
	RM	Zinc	7440-66-6	E475	28.7 mg/kg	100	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ *Compare Results to Criteria on Report - provide details below if box checked*
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Project Information

ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the servic

Analysis

Indicate Filtered (F), Preserved (P) or Filtere

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: SLA, HQA, PLE, ABA

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)							
	QUL-NHC_NSC-WB-1_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-2_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-3_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NHC_NSC-WB-8_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NGC_NSC-WB-1_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NGC_NSC-WB-2_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NGC_NSC-WB-3_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R							1
	QUL-NGC_NSC-WB-4_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R							1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
				3	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by: JC	Date: 120ct 22	Time: 1040am

Environmental Division
Vancouver
Work Order Reference
VA22C4917

Telephone : +1 604 253 4188

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply			
Regular [R]	☑ Standard TAT if received by 3 pm - business days - no surcharges apply		
PRIORITY (Business Days)	4 day [P4] ☐	EMERGENCY	1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		
Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
For tests that can not be performed according to the service level selected, you will be contacted.			

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA, HQA, PLE, ABA

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NGC_NSC-WB-5_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_NSC-WB-6_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_NSC-WB-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_NSC-WB-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-1_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-2_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-3_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-8_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
Released by: S. Latimer	Date: Oct-8-2022	Time: 0815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Project Information

ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NHC_PCC-Li-1_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-2_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-3_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-4_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-5_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-6_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-7_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-8_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-1_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-2_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-3_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-4_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

12Oct22 10:40am 3'C
ice pack, JC

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NHC_PCC-O-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
~~✓~~	~~QUL-NHC_PCC-O-8_2022-10~~	~~4-Oct-22~~	~~-~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
	QUL-NHC_PCC-Ki-1_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-2_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-3_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-8_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C
ice pack, JC

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the w

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NGC_PCC-M-1_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-2_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-3_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-4_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-5_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-6_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-M-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
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	QUL-NGC_PCC-Li-2_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-3_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-4_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

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SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
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Chain of Custody (COC) / Analytical Request Form

ALS Environmental

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Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kivens@mountpolley.com

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler: SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

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Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NGC_PCC-Li-5_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-6_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
~~X~~	~~QUL-NGC_PCC-O-1_2022-10~~	~~1-Oct-22~~	-	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~X~~
	QUL-NGC_PCC-O-2_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-O-3_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
~~X~~	~~QUL-NGC_PCC-O-4_2022-10~~	~~1-Oct-22~~	-	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~X~~
	QUL-NGC_PCC-O-5_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-O-6_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-O-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-O-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - r

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

12Oct22 10:40am 3'C

ice pack, JC

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report	Report Format / Distribution		Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply	
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	Kala Ivens	Quality Control (QC) Report with Report ☑ YES ☐ NO		PRIORITY (Business Days) 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐	EMERGENCY 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box checked		Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX		For tests that can not be performed according to the service level selected, you will be contacted.	
Street:	PO Box 12	Email 1 or Fax	kala.ivens@mountpolley.com	Analysis Request	
City/Province:	Likely, BC	Email 2	gabriel.holmes@mountpolley.com		
Postal Code:	V0L 1N0	Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca		
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution			
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX			
Company:		Email 1 or Fax	gabriel.holmes@mountpolley.com		
Contact:		Email 2	kivens@mountpolley.com		

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA, HQA, PLE, ABA

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NGC_PCC-Ki-1_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-2_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-3_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-4_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-5_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-6_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-1_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-2_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-3_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-4_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)	
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

12Oct22 10:40am 3'C

ice pack, JC

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Mount Polley Mining Corporation	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Kala Ivens	Quality Control (QC) Report with Report ☑ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	236-317-4946	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:	PO Box 12	Email 1 or Fax: kala.ivens@mountpolley.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:	Likely, BC	Email 2: gabriel.holmes@mountpolley.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	V0L 1N0	Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca	
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax: gabriel.holmes@mountpolley.com	
Contact:		Email 2: kivens@mountpolley.com	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA, HQA, PLE, ABA

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NCP_LT-M-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-6_2022-10	5-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-1_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-2_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-3_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-4_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-6_2022-10	5-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐	No ☐	
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐	
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - re

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

12Oct22 10:40am 3'C
ice pack, JC

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang | Sampler: SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NCP_LT-O-1_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
~~	~~QUL-NCP_LT-O-2_2022-10~~	~~-Oct-22~~	~~-~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
	QUL-NCP_LT-O-3_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-O-4_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-O-5_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
~~	~~QUL-NCP_LT-O-6_2022-10~~	~~-Oct-22~~	~~-~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
~~	~~QUL-NCP_LT-O-7_2022-10~~	~~-Oct-22~~	~~-~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
	QUL-NCP_LT-O-8_2022-10	6 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-1_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-2_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-3_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-4_2022-10	3 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☐ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL
Released by: S. Latimer	Date: Oct 8 -2022	Time: 815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

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Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUL-NCP_LT-Ki-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-6_2022-10	5-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-7_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-8_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-1_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-2_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-3_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-M-8_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL
Released by: S. Latimer	Date: Oct-8-2022	Time: 915	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: kala.ivens@mountpolley.com

Email 2: gabriel.holmes@mountpolley.com

Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX

Email 1 or Fax: gabriel.holmes@mountpolley.com

Email 2: kala.ivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only)

ALS Contact: Can Dang **Sampler:** SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

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Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

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	QUL-EAA_LT-Li-1_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-2_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-3_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-5_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-6_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-7_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Li-8_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
~~[illegible]~~	~~QUL-EAA_LT-O-1_2022-10~~	~~Oct-22~~	~~[illegible]~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~[illegible]~~
~~[illegible]~~	~~QUL-EAA_LT-O-2_2022-10~~	~~Oct-22~~	~~[illegible]~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~[illegible]~~
~~[illegible]~~	~~QUL-EAA_LT-O-3_2022-10~~	~~Oct-22~~	~~[illegible]~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~[illegible]~~
	QUL-EAA_LT-O-4_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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Affix ALS barcode label here (lab use only)

COC Number: 15 -

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Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kala.ivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang Sampler: SLA, HQA, PLE, ABA

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

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PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

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Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

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Analysis Request

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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
~~QUL-EAA_LT-O-5_2022-10~~		~~-Oct-22~~		~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
~~QUL-EAA_LT-O-6_2022-10~~		~~-Oct-22~~		~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
~~QUL-EAA_LT-O-7_2022-10~~		~~-Oct-22~~		~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
~~QUL-EAA_LT-O-8_2022-10~~		~~-Oct-22~~		~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~1~~
	QUL-EAA_LT-Ki-1_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-2_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-3_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-4_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-5_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-6_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-7_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT-Ki-8_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

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SAMPLE CONDITION AS RECEIVED (lab use only)

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Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SH
Released by: S. Latimer	Date: Oct-8-2022	Time: 815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C
ice pack, JC

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Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
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Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

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Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
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LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler: SLA, HQA, PLE, ABA

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	QUL-NGC_PCC-M-5X_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Li-5X_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-O-5X_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NGC_PCC-Ki-7X_2022-10	6-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-M-1X_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Li-1X_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-O-1X_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NCP_LT-Ki-1X_2022-10	3-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-M-6X_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Li-6X_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-O-6X_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-NHC_PCC-Ki-6X_2022-10	4-Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

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Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C

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Released by: S. Latimer	Date: Oct-6-2022	Time: 815	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

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Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
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Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
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	QUL-EAA_LT -M-4X_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT -Li-4X_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT -O-4X_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUL-EAA_LT -Ki-4X_2022-10	4 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

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Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

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SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)	
Released by: S. Latimer	Date: Oct 8 2022	Time: 815	Received by:	Date:	Time:	Received by:	

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12Oct22 10:40am 3'C

ice pack, JC

FISH TISSUE CHEMISTRY

ALS Laboratory Report VA22C5005

(Finalized February 16, 2023)

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C5005**	Page	: 1 of 19
Amendment	: **1**		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 29-Dec-2022
C-O-C number	: ----	Issue Date	: 16-Feb-2023 16:18
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 33		
No. of samples analysed	: 33		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (16/02/2023): This report has been amended and re-released to allow the reporting of additional analytical data. Includes the analysis data for the sample ALS indentify as VA22C5005-027.

Amendment (16/02/2023): This report has been amended to correct the sample collection date.

Amendment (16/02/2023): This report has been amended following changes to the analytical data reported. The quality system is being utilised to resolve this issue. The mercury data, for the sample ALS identify as VA22C5005-032, has been modified.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-M-1_2022-10	QUR_RB-M-2_2022-10	QUR_RB-M-3_2022-10	QUR_RB-M-4_2022-10	QUR_RB-M-5_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022	02-Oct-2022
						VA22C5005-001	VA22C5005-002	VA22C5005-003	VA22C5005-004	VA22C5005-005
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		75.8	75.6	76.9	77.5	78.1
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		6.1	2.2	5.4	3.9	3.4
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E440	0.020	mg/kg		1.08	0.054	0.240	2.20	5.27
Barium	7440-39-3	E440	0.050	mg/kg		0.280	0.640	0.500	0.593	0.820
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	1.0	<1.0	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0057	<0.0050
Calcium	7440-70-2	E440	20	mg/kg		660	1620	1880	2090	644
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0538	0.0875	0.0956	0.0359	0.117
Chromium	7440-47-3	E440	0.050	mg/kg		0.089	0.189	0.184	0.092	0.110
Cobalt	7440-48-4	E440	0.020	mg/kg		0.082	0.045	0.052	0.040	0.077
Copper	7440-50-8	E440	0.10	mg/kg		1.06	0.98	1.71	1.00	1.59
Iron	7439-89-6	E440	3.0	mg/kg		25.4	17.4	25.2	18.7	23.5
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	<0.020	<0.020	0.033	<0.020
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E440	2.0	mg/kg		1360	1560	1590	1580	1520
Manganese	7439-96-5	E440	0.050	mg/kg		0.590	0.951	1.20	0.979	0.648
Mercury	7439-97-6	E510	0.0050	mg/kg		0.248	0.248	0.161	0.130	0.583
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0599	0.0603	0.0371	0.0292	0.128
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E440	10	mg/kg		12600	13400	15500	14300	14000
Potassium	7440-09-7	E440	20	mg/kg		20900	22000	26000	25800	25000
Rubidium	7440-17-7	E440	0.050	mg/kg		12.8	24.8	27.4	13.9	26.4
Selenium	7782-49-2	E440	0.050	mg/kg		3.58	2.10	2.61	5.72	2.83
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	7440-23-5	E440	20	mg/kg		1500	1340	1900	1320	1700

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-M-1_2022-10	QUR_RB-M-2_2022-10	QUR_RB-M-3_2022-10	QUR_RB-M-4_2022-10	QUR_RB-M-5_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022	02-Oct-2022
						VA22C5005-001	VA22C5005-002	VA22C5005-003	VA22C5005-004	VA22C5005-005
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E440	0.050	mg/kg		0.690	2.51	2.58	2.25	0.744
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0150	0.0243	0.0214	0.0190	0.0276
Tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	0.51	0.35	<0.25
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		16.1	16.3	21.0	15.9	16.0
Zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-M-6_2022-10	QUR_RB-M-7_2022-10	QUR_RB-M-8_2022-10	QUR_RB-Li-1_2022-10	QUR_RB-Li-2_2022-10
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	01-Oct-2022	01-Oct-2022
						VA22C5005-006	VA22C5005-007	VA22C5005-008	VA22C5005-009	VA22C5005-010
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		75.7	79.5	78.3	----	----
Moisture	----	E144-H	2.0	%		----	----	----	71.6	68.4
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		<2.0	2.5	2.1	----	----
Aluminum	7429-90-5	E472	5.0	mg/kg		----	----	----	7.2	6.6
Antimony	7440-36-0	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
Antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
Arsenic	7440-38-2	E440	0.020	mg/kg		0.136	0.175	0.142	----	----
Arsenic	7440-38-2	E472	0.030	mg/kg		----	----	----	0.395	0.189
Barium	7440-39-3	E472	0.050	mg/kg		----	----	----	0.547	0.671
Barium	7440-39-3	E440	0.050	mg/kg		0.462	0.544	0.438	----	----
Beryllium	7440-41-7	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
Beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
Bismuth	7440-69-9	E472	0.010	mg/kg		----	----	----	<0.010	<0.010
Bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
Boron	7440-42-8	E472	1.0	mg/kg		----	----	----	1.2	1.8
Boron	7440-42-8	E440	1.0	mg/kg		<1.0	<1.0	<1.0	----	----
Cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	<0.0050	0.0068	----	----
Cadmium	7440-43-9	E472	0.010	mg/kg		----	----	----	0.658	0.510
Calcium	7440-70-2	E472	20	mg/kg		----	----	----	173	190
Calcium	7440-70-2	E440	20	mg/kg		1070	1190	1530	----	----
Cesium	7440-46-2	E472	0.0050	mg/kg		----	----	----	0.0164	0.0229
Cesium	7440-46-2	E440	0.0050	mg/kg		0.0882	0.155	0.113	----	----
Chromium	7440-47-3	E440	0.050	mg/kg		0.093	0.086	0.188	----	----
Chromium	7440-47-3	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
Cobalt	7440-48-4	E472	0.020	mg/kg		----	----	----	0.340	0.160
Cobalt	7440-48-4	E440	0.020	mg/kg		0.070	0.039	0.050	----	----
Copper	7440-50-8	E440	0.10	mg/kg		1.77	0.85	1.23	----	----
Copper	7440-50-8	E472	0.20	mg/kg		----	----	----	91.8	56.9
Iron	7439-89-6	E440	3.0	mg/kg		18.3	19.7	13.3	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-M-6_2022-10	QUR_RB-M-7_2022-10	QUR_RB-M-8_2022-10	QUR_RB-Li-1_2022-10	QUR_RB-Li-2_2022-10
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	01-Oct-2022	01-Oct-2022
						VA22C5005-006	VA22C5005-007	VA22C5005-008	VA22C5005-009	VA22C5005-010
						Result	Result	Result	Result	Result
Metals										
Iron	7439-89-6	E472	5.0	mg/kg		----	----	----	1440	982
Lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.032	<0.020	----	----
Lead	7439-92-1	E472	0.050	mg/kg		----	----	----	<0.050	<0.050
Lithium	7439-93-2	E472	0.50	mg/kg		----	----	----	<0.50	<0.50
Lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
Magnesium	7439-95-4	E472	2.0	mg/kg		----	----	----	582	639
Magnesium	7439-95-4	E440	2.0	mg/kg		1820	1620	1710	----	----
Manganese	7439-96-5	E472	0.050	mg/kg		----	----	----	4.83	6.41
Manganese	7439-96-5	E440	0.050	mg/kg		0.907	0.569	0.963	----	----
Mercury	7439-97-6	E511	0.0050	mg/kg		----	----	----	0.184	0.204
Mercury	7439-97-6	E510	0.0050	mg/kg		0.192	0.477	0.114	----	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	----	0.0524	0.0645
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0467	0.0980	0.0248	----	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	----	0.894	1.00
Nickel	7440-02-0	E472	0.20	mg/kg		----	----	----	<0.20	<0.20
Nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
Phosphorus	7723-14-0	E472	10	mg/kg		----	----	----	12500	13900
Phosphorus	7723-14-0	E440	10	mg/kg		14200	15100	15000	----	----
Potassium	7440-09-7	E472	20	mg/kg		----	----	----	9810	11100
Potassium	7440-09-7	E440	20	mg/kg		23400	27400	24500	----	----
Rubidium	7440-17-7	E472	0.050	mg/kg		----	----	----	6.84	15.6
Rubidium	7440-17-7	E440	0.050	mg/kg		24.4	32.8	33.4	----	----
Selenium	7782-49-2	E440	0.050	mg/kg		2.08	2.71	2.33	----	----
Selenium	7782-49-2	E472	0.10	mg/kg		----	----	----	34.9	20.2
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	----	2.37	1.32
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	----	----
Sodium	7440-23-5	E472	20	mg/kg		----	----	----	4000	3920
Sodium	7440-23-5	E440	20	mg/kg		1420	1550	1440	----	----
Strontium	7440-24-6	E440	0.050	mg/kg		1.44	1.34	1.99	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-M-6_2022-10	QUR_RB-M-7_2022-10	QUR_RB-M-8_2022-10	QUR_RB-Li-1_2022-10	QUR_RB-Li-2_2022-10
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	01-Oct-2022	01-Oct-2022
						VA22C5005-006	VA22C5005-007	VA22C5005-008	VA22C5005-009	VA22C5005-010
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		----	----	----	0.43	0.40
Tellurium	13494-80-9	E472	0.020	mg/kg		----	----	----	<0.020	<0.020
Tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	----	----
Thallium	7440-28-0	E472	0.0020	mg/kg		----	----	----	0.0504	0.0801
Thallium	7440-28-0	E440	0.0020	mg/kg		0.0232	0.0400	0.0190	----	----
Tin	7440-31-5	E472	0.10	mg/kg		----	----	----	<0.10	<0.10
Tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	----	----
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		<0.25	<0.25	<0.25	----	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	----	<0.50	<0.50
Uranium	7440-61-1	E472	0.0020	mg/kg		----	----	----	0.0056	0.0036
Uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	----	----
Vanadium	7440-62-2	E472	0.10	mg/kg		----	----	----	0.16	<0.10
Vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	<0.10	<0.10	----	----
Zinc	7440-66-6	E440	0.50	mg/kg		18.8	16.8	19.8	----	----
Zinc	7440-66-6	E472	1.0	mg/kg		----	----	----	85.4	100
Zirconium	7440-67-7	E472	0.20	mg/kg		----	----	----	<0.20	0.29
Zirconium	7440-67-7	E440	0.20	mg/kg		0.38	0.52	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Li-3_2022-10	QUR_RB-Li-4_2022-10	QUR_RB-Li-5_2022-10	QUR_RB-Li-6_2022-10	QUR_RB-Li-7_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-011	VA22C5005-012	VA22C5005-013	VA22C5005-014	VA22C5005-015
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144-H	2.0	%		74.8	73.8	69.7	68.7	74.5
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	6.7	50.2	<5.0	8.0
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	0.055	<0.010	<0.010
Arsenic	7440-38-2	E472	0.030	mg/kg		0.309	0.350	1.01	0.365	0.242
Barium	7440-39-3	E472	0.050	mg/kg		0.968	0.520	0.690	0.389	0.481
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E472	1.0	mg/kg		2.3	1.0	1.0	<1.0	<1.0
Cadmium	7440-43-9	E472	0.010	mg/kg		0.361	1.48	1.82	0.309	0.655
Calcium	7440-70-2	E472	20	mg/kg		201	170	247	168	152
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0462	0.0109	0.0631	0.0336	0.0217
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Cobalt	7440-48-4	E472	0.020	mg/kg		0.127	0.180	0.264	0.210	0.113
Copper	7440-50-8	E472	0.20	mg/kg		135	143	46.8	266	26.7
Iron	7439-89-6	E472	5.0	mg/kg		374	750	2960	476	1070
Lead	7439-92-1	E472	0.050	mg/kg		<0.050	<0.050	0.082	<0.050	<0.050
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		662	642	776	556	617
Manganese	7439-96-5	E472	0.050	mg/kg		6.78	5.91	11.9	5.93	6.27
Mercury	7439-97-6	E511	0.0050	mg/kg		0.101	0.125	0.251	0.124	0.237
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0254	0.0327	0.0760	0.0386	0.0604
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.785	1.18	1.40	0.817	0.768
Nickel	7440-02-0	E472	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
Phosphorus	7723-14-0	E472	10	mg/kg		13900	14000	17300	12400	12800
Potassium	7440-09-7	E472	20	mg/kg		11600	13400	14100	9610	11500
Rubidium	7440-17-7	E472	0.050	mg/kg		16.8	8.28	18.3	11.0	14.5
Selenium	7782-49-2	E472	0.10	mg/kg		37.6	63.3	17.0	60.0	12.6
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		1.97	3.70	2.35	2.69	0.768
Sodium	7440-23-5	E472	20	mg/kg		3430	3430	3650	3820	4230

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Li-3_2022-10	QUR_RB-Li-4_2022-10	QUR_RB-Li-5_2022-10	QUR_RB-Li-6_2022-10	QUR_RB-Li-7_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-011	VA22C5005-012	VA22C5005-013	VA22C5005-014	VA22C5005-015
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.41	0.26	0.38	0.33	0.23
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.022	<0.020	<0.020	<0.020
Thallium	7440-28-0	E472	0.0020	mg/kg		0.108	0.128	0.143	0.101	0.0835
Tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	0.0032	0.0740	0.0026	0.0057
Vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	0.16	0.67	<0.10	0.12
Zinc	7440-66-6	E472	1.0	mg/kg		93.5	88.8	105	96.0	96.9
Zirconium	7440-67-7	E472	0.20	mg/kg		0.44	0.70	0.68	<0.20	0.24

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Li-8_2022-10	QUR_RB-Ki-1_2022-10	QUR_RB-Ki-2_2022-10	QUR_RB-Ki-3_2022-10	QUR_RB-Ki-4_2022-10
					Client sampling date / time	02-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022
						VA22C5005-016	VA22C5005-017	VA22C5005-018	VA22C5005-019	VA22C5005-020
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144-H	2.0	%		68.9	77.0	74.4	74.6	80.3
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		<5.0	7.7	5.8	<5.0	32.3
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E472	0.030	mg/kg		0.382	0.783	0.324	0.364	0.517
Barium	7440-39-3	E472	0.050	mg/kg		0.525	1.02	1.49	1.08	1.20
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E472	1.0	mg/kg		1.7	<1.0	1.4	1.7	1.5
Cadmium	7440-43-9	E472	0.010	mg/kg		0.210	1.46	0.596	0.526	2.53
Calcium	7440-70-2	E472	20	mg/kg		173	524	997	728	521
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0531	0.0280	0.0377	0.0493	0.0237
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.48	<0.20	<0.20	0.33
Cobalt	7440-48-4	E472	0.020	mg/kg		0.110	1.67	0.842	0.561	1.45
Copper	7440-50-8	E472	0.20	mg/kg		61.9	4.07	3.70	5.45	4.50
Iron	7439-89-6	E472	5.0	mg/kg		245	760	770	409	513
Lead	7439-92-1	E472	0.050	mg/kg		<0.050	0.052	<0.050	<0.050	0.087
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		596	574	564	641	698
Manganese	7439-96-5	E472	0.050	mg/kg		6.51	1.91	2.42	2.67	2.51
Mercury	7439-97-6	E511	0.0050	mg/kg		0.0414	0.324	0.345	0.235	0.264
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0129	0.0746	0.0883	0.0598	0.0521
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.480	0.234	0.268	0.325	0.237
Nickel	7440-02-0	E472	0.20	mg/kg		0.23	0.45	0.39	<0.20	0.38
Phosphorus	7723-14-0	E472	10	mg/kg		14200	9770	10100	10100	12300
Potassium	7440-09-7	E472	20	mg/kg		10600	11800	11400	11200	14200
Rubidium	7440-17-7	E472	0.050	mg/kg		17.1	8.76	14.6	13.8	9.96
Selenium	7782-49-2	E472	0.10	mg/kg		18.6	10.9	9.21	13.3	9.77
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.822	0.0053	0.0055	0.0068	0.0089
Sodium	7440-23-5	E472	20	mg/kg		2830	6760	4960	5340	7220

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Li-8_2022-10	QUR_RB-Ki-1_2022-10	QUR_RB-Ki-2_2022-10	QUR_RB-Ki-3_2022-10	QUR_RB-Ki-4_2022-10
					Client sampling date / time	02-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022	01-Oct-2022
						VA22C5005-016	VA22C5005-017	VA22C5005-018	VA22C5005-019	VA22C5005-020
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.28	1.77	2.15	1.54	1.08
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.025	<0.020	<0.020	0.033
Thallium	7440-28-0	E472	0.0020	mg/kg		0.118	0.0458	0.0533	0.0463	0.0556
Tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	1.82
Uranium	7440-61-1	E472	0.0020	mg/kg		<0.0020	0.0093	0.0080	0.0030	0.0086
Vanadium	7440-62-2	E472	0.10	mg/kg		<0.10	0.27	<0.10	<0.10	0.31
Zinc	7440-66-6	E472	1.0	mg/kg		70.1	83.4	88.9	113	105
Zirconium	7440-67-7	E472	0.20	mg/kg		0.96	<0.20	0.21	<0.20	0.46

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Ki-5_2022-10	QUR_RB-Ki-6_2022-10	QUR_RB-Ki-7_2022-10	QUR_RB-Ki-8_2022-10	QUR_RB-O-1_2022-10
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022	01-Oct-2022
						VA22C5005-021	VA22C5005-022	VA22C5005-023	VA22C5005-024	VA22C5005-025
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144-H	2.0	%		78.4	75.1	79.4	75.8	81.6
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		19.2	<5.0	7.8	10.4	20.6
Antimony	7440-36-0	E472	0.010	mg/kg		0.022	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	E472	0.030	mg/kg		3.25	0.500	0.918	0.362	0.271
Barium	7440-39-3	E472	0.050	mg/kg		1.62	1.47	2.94	1.14	1.37
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
Boron	7440-42-8	E472	1.0	mg/kg		1.7	2.0	1.1	1.6	3.1
Cadmium	7440-43-9	E472	0.010	mg/kg		3.32	0.644	1.45	0.473	0.039
Calcium	7440-70-2	E472	20	mg/kg		1330	515	1110	865	389
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0773	0.0380	0.0606	0.0618	0.0440
Chromium	7440-47-3	E472	0.20	mg/kg		0.44	0.32	0.24	<0.20	0.55
Cobalt	7440-48-4	E472	0.020	mg/kg		1.57	1.18	1.71	0.794	0.724
Copper	7440-50-8	E472	0.20	mg/kg		8.18	7.29	5.83	7.51	12.2
Iron	7439-89-6	E472	5.0	mg/kg		956	656	1070	375	479
Lead	7439-92-1	E472	0.050	mg/kg		0.081	<0.050	<0.050	<0.050	0.074
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	7439-95-4	E472	2.0	mg/kg		806	549	789	663	928
Manganese	7439-96-5	E472	0.050	mg/kg		3.38	3.15	3.19	5.65	5.68
Mercury	7439-97-6	E511	0.0050	mg/kg		0.708	0.391	0.609	0.147	0.101
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.153	0.0973	0.126	0.0355	0.0187
Molybdenum	7439-98-7	E472	0.040	mg/kg		0.684	0.348	0.461	0.379	0.059
Nickel	7440-02-0	E472	0.20	mg/kg		1.56	0.34	0.63	<0.20	0.21
Phosphorus	7723-14-0	E472	10	mg/kg		11000	9990	13300	11700	16000
Potassium	7440-09-7	E472	20	mg/kg		13800	10200	15000	10900	21300
Rubidium	7440-17-7	E472	0.050	mg/kg		16.4	12.0	18.4	16.9	16.9
Selenium	7782-49-2	E472	0.10	mg/kg		16.2	10.9	20.6	13.6	11.2
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		0.0639	0.0140	0.0118	0.0133	0.0209
Sodium	7440-23-5	E472	20	mg/kg		8970	6260	8040	5760	5100

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	QUR_RB-Ki-5_2022-10	QUR_RB-Ki-6_2022-10	QUR_RB-Ki-7_2022-10	QUR_RB-Ki-8_2022-10	QUR_RB-O-1_2022-10
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022	01-Oct-2022
Analyte	CAS Number	Method	LOR	Unit		VA22C5005-021	VA22C5005-022	VA22C5005-023	VA22C5005-024	VA22C5005-025
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		5.43	1.38	2.49	1.76	0.89
Tellurium	13494-80-9	E472	0.020	mg/kg		0.038	<0.020	0.026	<0.020	<0.020
Thallium	7440-28-0	E472	0.0020	mg/kg		0.109	0.0609	0.0931	0.0464	0.0132
Tin	7440-31-5	E472	0.10	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		0.52	<0.50	<0.50	1.96	1.26
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0796	0.0049	0.0168	0.0034	0.0024
Vanadium	7440-62-2	E472	0.10	mg/kg		0.78	<0.10	0.27	0.13	0.16
Zinc	7440-66-6	E472	1.0	mg/kg		117	103	124	102	268
Zirconium	7440-67-7	E472	0.20	mg/kg		0.31	0.55	0.29	0.87	1.09

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-O-2_2022-10	QUR_RB-O-4_2022-10	QUR_RB-O-5_2022-10	QUR_RB-O-6_2022-10	QUR_RB-M-5X_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-026	VA22C5005-027	VA22C5005-028	VA22C5005-029	VA22C5005-030
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144	0.50	%		----	83.0	----	----	77.5
Moisture	----	E144A	2.0	%		78.1	----	----	84.0	----
Moisture	----	E144-H	2.0	%		----	----	72.7	----	----
Metals										
Aluminum	7429-90-5	E440	2.0	mg/kg		----	10.4	----	----	3.1
Aluminum	7429-90-5	E475	5.0	mg/kg		14.3	----	----	23.4	----
Aluminum	7429-90-5	E472	5.0	mg/kg		----	----	12.7	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		----	----	<0.010	----	----
Antimony	7440-36-0	E440	0.010	mg/kg		----	0.015	----	----	<0.010
Antimony	7440-36-0	E475	0.020	mg/kg		<0.020	----	----	<0.020	----
Arsenic	7440-38-2	E440	0.020	mg/kg		----	0.182	----	----	4.98
Arsenic	7440-38-2	E472	0.030	mg/kg		----	----	0.350	----	----
Arsenic	7440-38-2	E475	0.050	mg/kg		0.106	----	----	0.301	----
Barium	7440-39-3	E475	0.050	mg/kg		1.25	----	----	3.63	----
Barium	7440-39-3	E472	0.050	mg/kg		----	----	0.704	----	----
Barium	7440-39-3	E440	0.050	mg/kg		----	0.374	----	----	0.491
Beryllium	7440-41-7	E475	0.010	mg/kg		<0.010	----	----	<0.010	----
Beryllium	7440-41-7	E472	0.010	mg/kg		----	----	<0.010	----	----
Beryllium	7440-41-7	E440	0.010	mg/kg		----	<0.010	----	----	<0.010
Bismuth	7440-69-9	E475	0.010	mg/kg		<0.010	----	----	<0.010	----
Bismuth	7440-69-9	E472	0.010	mg/kg		----	----	<0.010	----	----
Bismuth	7440-69-9	E440	0.010	mg/kg		----	<0.010	----	----	<0.010
Boron	7440-42-8	E475	1.0	mg/kg		3.2	----	----	10.4	----
Boron	7440-42-8	E472	1.0	mg/kg		----	----	1.2	----	----
Boron	7440-42-8	E440	1.0	mg/kg		----	<1.0	----	----	<1.0
Cadmium	7440-43-9	E440	0.0050	mg/kg		----	<0.0050	----	----	0.0084
Cadmium	7440-43-9	E475	0.010	mg/kg		0.026	----	----	0.094	----
Cadmium	7440-43-9	E472	0.010	mg/kg		----	----	0.040	----	----
Calcium	7440-70-2	E475	20	mg/kg		455	----	----	680	----
Calcium	7440-70-2	E472	20	mg/kg		----	----	845	----	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-O-2_2022-10	QUR_RB-O-4_2022-10	QUR_RB-O-5_2022-10	QUR_RB-O-6_2022-10	QUR_RB-M-5X_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-026	VA22C5005-027	VA22C5005-028	VA22C5005-029	VA22C5005-030
						Result	Result	Result	Result	Result
Metals										
Calcium	7440-70-2	E440	20	mg/kg		----	194	----	----	870
Cesium	7440-46-2	E475	0.0050	mg/kg		0.0974	----	----	0.0920	----
Cesium	7440-46-2	E472	0.0050	mg/kg		----	----	0.0519	----	----
Cesium	7440-46-2	E440	0.0050	mg/kg		----	0.0301	----	----	0.106
Chromium	7440-47-3	E440	0.050	mg/kg		----	0.195	----	----	0.054
Chromium	7440-47-3	E475	0.20	mg/kg		0.41	----	----	0.51	----
Chromium	7440-47-3	E472	0.20	mg/kg		----	----	<0.20	----	----
Cobalt	7440-48-4	E475	0.020	mg/kg		0.384	----	----	0.591	----
Cobalt	7440-48-4	E472	0.020	mg/kg		----	----	0.732	----	----
Cobalt	7440-48-4	E440	0.020	mg/kg		----	0.227	----	----	0.079
Copper	7440-50-8	E440	0.10	mg/kg		----	1.68	----	----	1.69
Copper	7440-50-8	E475	0.20	mg/kg		14.9	----	----	29.1	----
Copper	7440-50-8	E472	0.20	mg/kg		----	----	45.3	----	----
Iron	7439-89-6	E440	3.0	mg/kg		----	45.3	----	----	23.3
Iron	7439-89-6	E475	5.0	mg/kg		290	----	----	297	----
Iron	7439-89-6	E472	5.0	mg/kg		----	----	335	----	----
Lead	7439-92-1	E440	0.020	mg/kg		----	<0.020	----	----	0.028
Lead	7439-92-1	E475	0.050	mg/kg		0.053	----	----	<0.050	----
Lead	7439-92-1	E472	0.050	mg/kg		----	----	<0.050	----	----
Lithium	7439-93-2	E475	0.50	mg/kg		<0.50	----	----	<0.50	----
Lithium	7439-93-2	E472	0.50	mg/kg		----	----	<0.50	----	----
Lithium	7439-93-2	E440	0.50	mg/kg		----	<0.50	----	----	<0.50
Magnesium	7439-95-4	E475	2.0	mg/kg		1160	----	----	1290	----
Magnesium	7439-95-4	E472	2.0	mg/kg		----	----	1220	----	----
Magnesium	7439-95-4	E440	2.0	mg/kg		----	1530	----	----	1370
Manganese	7439-96-5	E475	0.050	mg/kg		16.6	----	----	25.9	----
Manganese	7439-96-5	E472	0.050	mg/kg		----	----	19.1	----	----
Manganese	7439-96-5	E440	0.050	mg/kg		----	2.10	----	----	0.647
Mercury	7439-97-6	E511	0.0050	mg/kg		----	----	0.0869	----	----
Mercury	7439-97-6	E510	0.0050	mg/kg		----	0.0256	----	----	0.574

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-O-2_2022-10	QUR_RB-O-4_2022-10	QUR_RB-O-5_2022-10	QUR_RB-O-6_2022-10	QUR_RB-M-5X_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-026	VA22C5005-027	VA22C5005-028	VA22C5005-029	VA22C5005-030
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E512	0.010	mg/kg		0.114	----	----	0.142	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		----	----	0.0237	----	----
Mercury	7439-97-6	E510A	0.0010	mg/kg wwt		----	0.0043	----	----	0.129
Mercury	7439-97-6	E512A	0.0020	mg/kg wwt		0.0249	----	----	0.0227	----
Molybdenum	7439-98-7	E440	0.020	mg/kg		----	0.024	----	----	<0.020
Molybdenum	7439-98-7	E475	0.040	mg/kg		0.068	----	----	0.075	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		----	----	0.043	----	----
Nickel	7440-02-0	E475	0.20	mg/kg		0.36	----	----	0.62	----
Nickel	7440-02-0	E472	0.20	mg/kg		----	----	<0.20	----	----
Nickel	7440-02-0	E440	0.20	mg/kg		----	<0.20	----	----	0.51
Phosphorus	7723-14-0	E472	10	mg/kg		----	----	9860	----	----
Phosphorus	7723-14-0	E440	10	mg/kg		----	31600	----	----	13400
Phosphorus	7723-14-0	E475	20	mg/kg		18200	----	----	17100	----
Potassium	7440-09-7	E475	20	mg/kg		24400	----	----	24300	----
Potassium	7440-09-7	E472	20	mg/kg		----	----	8480	----	----
Potassium	7440-09-7	E440	20	mg/kg		----	31200	----	----	23500
Rubidium	7440-17-7	E475	0.050	mg/kg		37.2	----	----	34.5	----
Rubidium	7440-17-7	E472	0.050	mg/kg		----	----	11.3	----	----
Rubidium	7440-17-7	E440	0.050	mg/kg		----	20.9	----	----	24.9
Selenium	7782-49-2	E440	0.050	mg/kg		----	2.70	----	----	2.71
Selenium	7782-49-2	E475	0.10	mg/kg		12.4	----	----	16.5	----
Selenium	7782-49-2	E472	0.10	mg/kg		----	----	14.7	----	----
Silver	7440-22-4	E475.Ag	0.0050	mg/kg		0.0269	----	----	0.0388	----
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		----	----	0.120	----	----
Silver	7440-22-4	E440.Ag	0.0050	mg/kg		----	<0.0050	----	----	<0.0050
Sodium	7440-23-5	E475	20	mg/kg		4330	----	----	5570	----
Sodium	7440-23-5	E472	20	mg/kg		----	----	5490	----	----
Sodium	7440-23-5	E440	20	mg/kg		----	4120	----	----	1830
Strontium	7440-24-6	E440	0.050	mg/kg		----	0.345	----	----	1.07
Strontium	7440-24-6	E475	0.10	mg/kg		0.97	----	----	1.09	----

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-O-2_2022-10	QUR_RB-O-4_2022-10	QUR_RB-O-5_2022-10	QUR_RB-O-6_2022-10	QUR_RB-M-5X_2022-10
					Client sampling date / time	01-Oct-2022	01-Oct-2022	02-Oct-2022	02-Oct-2022	02-Oct-2022
						VA22C5005-026	VA22C5005-027	VA22C5005-028	VA22C5005-029	VA22C5005-030
						Result	Result	Result	Result	Result
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		----	----	2.13	----	----
Tellurium	13494-80-9	E475	0.020	mg/kg		<0.020	----	----	<0.020	----
Tellurium	13494-80-9	E472	0.020	mg/kg		----	----	<0.020	----	----
Tellurium	13494-80-9	E440	0.020	mg/kg		----	<0.020	----	----	<0.020
Thallium	7440-28-0	E475	0.0020	mg/kg		0.0293	----	----	0.0177	----
Thallium	7440-28-0	E472	0.0020	mg/kg		----	----	0.0114	----	----
Thallium	7440-28-0	E440	0.0020	mg/kg		----	0.0632	----	----	0.0258
Tin	7440-31-5	E475	0.10	mg/kg		0.17	----	----	0.22	----
Tin	7440-31-5	E472	0.10	mg/kg		----	----	<0.10	----	----
Tin	7440-31-5	E440	0.10	mg/kg		----	<0.10	----	----	<0.10
Titanium	7440-32-6	E440.Ti	0.25	mg/kg		----	0.66	----	----	<0.25
Titanium	7440-32-6	E475.Ti	0.50	mg/kg		1.18	----	----	1.92	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		----	----	<0.50	----	----
Uranium	7440-61-1	E475	0.0020	mg/kg		0.0034	----	----	0.0078	----
Uranium	7440-61-1	E472	0.0020	mg/kg		----	----	0.0123	----	----
Uranium	7440-61-1	E440	0.0020	mg/kg		----	<0.0020	----	----	<0.0020
Vanadium	7440-62-2	E475	0.10	mg/kg		<0.10	----	----	0.13	----
Vanadium	7440-62-2	E472	0.10	mg/kg		----	----	0.15	----	----
Vanadium	7440-62-2	E440	0.10	mg/kg		----	<0.10	----	----	<0.10
Zinc	7440-66-6	E440	0.50	mg/kg		----	65.3	----	----	16.7
Zinc	7440-66-6	E475	1.0	mg/kg		368	----	----	348	----
Zinc	7440-66-6	E472	1.0	mg/kg		----	----	168	----	----
Zirconium	7440-67-7	E475	0.20	mg/kg		1.04	----	----	1.26	----
Zirconium	7440-67-7	E472	0.20	mg/kg		----	----	0.23	----	----
Zirconium	7440-67-7	E440	0.20	mg/kg		----	0.31	----	----	<0.20

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	QUR_RB-Li-5X_2022-10	QUR_RB-Ki-5X_2022-10	QUR_RB-O-5X_2022-10	----	----
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	----	----
						VA22C5005-031	VA22C5005-032	VA22C5005-033	--------	--------
						Result	Result	Result	----	----
Physical Tests										
Moisture	----	E144-H	2.0	%		70.4	77.6	69.5	----	----
Metals										
Aluminum	7429-90-5	E472	5.0	mg/kg		34.7	21.4	9.3	----	----
Antimony	7440-36-0	E472	0.010	mg/kg		<0.010	0.016	<0.010	----	----
Arsenic	7440-38-2	E472	0.030	mg/kg		0.769	2.34	0.288	----	----
Barium	7440-39-3	E472	0.050	mg/kg		0.343	1.16	0.524	----	----
Beryllium	7440-41-7	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
Bismuth	7440-69-9	E472	0.010	mg/kg		<0.010	<0.010	<0.010	----	----
Boron	7440-42-8	E472	1.0	mg/kg		<1.0	2.0	1.0	----	----
Cadmium	7440-43-9	E472	0.010	mg/kg		1.38	1.85	0.032	----	----
Calcium	7440-70-2	E472	20	mg/kg		238	754	835	----	----
Cesium	7440-46-2	E472	0.0050	mg/kg		0.0467	0.0507	0.0486	----	----
Chromium	7440-47-3	E472	0.20	mg/kg		<0.20	0.50	<0.20	----	----
Cobalt	7440-48-4	E472	0.020	mg/kg		0.218	1.35	0.612	----	----
Copper	7440-50-8	E472	0.20	mg/kg		39.6	5.60	38.7	----	----
Iron	7439-89-6	E472	5.0	mg/kg		2150	1170	271	----	----
Lead	7439-92-1	E472	0.050	mg/kg		0.064	0.093	<0.050	----	----
Lithium	7439-93-2	E472	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
Magnesium	7439-95-4	E472	2.0	mg/kg		640	740	1060	----	----
Manganese	7439-96-5	E472	0.050	mg/kg		9.49	2.76	16.5	----	----
Mercury	7439-97-6	E511	0.0050	mg/kg		0.211	0.899	0.0740	----	----
Mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0625	0.202	0.0226	----	----
Molybdenum	7439-98-7	E472	0.040	mg/kg		1.04	0.410	<0.040	----	----
Nickel	7440-02-0	E472	0.20	mg/kg		<0.20	1.77	<0.20	----	----
Phosphorus	7723-14-0	E472	10	mg/kg		13500	10400	8470	----	----
Potassium	7440-09-7	E472	20	mg/kg		10500	12500	7140	----	----
Rubidium	7440-17-7	E472	0.050	mg/kg		13.9	13.8	9.81	----	----
Selenium	7782-49-2	E472	0.10	mg/kg		13.8	15.1	13.0	----	----
Silver	7440-22-4	E472.Ag	0.0050	mg/kg		1.92	0.0335	0.114	----	----
Sodium	7440-23-5	E472	20	mg/kg		3150	6180	4280	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	QUR_RB-Li-5X_ 2022-10	QUR_RB-Ki-5X_ 2022-10	QUR_RB-O-5X_ 2022-10	----	----
					Client sampling date / time	02-Oct-2022	02-Oct-2022	02-Oct-2022	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22C5005-031	VA22C5005-032	VA22C5005-033	--------	--------
						Result	Result	Result	----	----
Metals										
Strontium	7440-24-6	E472	0.10	mg/kg		0.38	2.76	2.00	----	----
Tellurium	13494-80-9	E472	0.020	mg/kg		<0.020	0.054	<0.020	----	----
Thallium	7440-28-0	E472	0.0020	mg/kg		0.109	0.0747	0.0104	----	----
Tin	7440-31-5	E472	0.10	mg/kg		<0.10	<0.10	<0.10	----	----
Titanium	7440-32-6	E472.Ti	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
Uranium	7440-61-1	E472	0.0020	mg/kg		0.0486	0.102	0.0107	----	----
Vanadium	7440-62-2	E472	0.10	mg/kg		0.50	1.13	0.12	----	----
Zinc	7440-66-6	E472	1.0	mg/kg		87.2	120	147	----	----
Zirconium	7440-67-7	E472	0.20	mg/kg		0.23	0.53	<0.20	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C5005**	Page	: 1 of 31
Amendment	: 1		
Client	: **Mount Polley Mining Corporation**	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250-790-2215 Ext 2112	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Issue Date	: 16-Feb-2023 16:22
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 33		
No. of samples analysed	: 33		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22C5005-007	QUR_RB-M-7_2022-10	Barium	7440-39-3	E440	41.0 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22C5005-007	QUR_RB-M-7_2022-10	Strontium	7440-24-6	E440	75.3 % DUP-H	60%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Laboratory Control Sample (LCS) Recoveries								
Metals	QC-MRG5-7995420 02	----	Boron	7440-42-8	E472	73.7 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG5-7905170 02	----	Silver	7440-22-4	E472.Ag	77.3 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG5-7995420 02	----	Silver	7440-22-4	E472.Ag	79.6 % MES	80.0-120%	Recovery less than lower control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E512	02-Oct-2022	29-Dec-2022	----	----		03-Jan-2023	365 days	94 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E512	01-Oct-2022	29-Dec-2022	----	----		03-Jan-2023	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E511	02-Oct-2022	11-Jan-2023	----	----		12-Jan-2023	365 days	103 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E511	01-Oct-2022	11-Jan-2023	----	----		12-Jan-2023	365 days	104 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-O-5_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E511	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag QUR_RB-O-1_2022-10	E511	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-5_2022-10	E510	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-5X_2022-10	E510	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-6_2022-10	E510	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-7_2022-10	E510	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-8_2022-10	E510	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-1_2022-10	E510	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-2_2022-10	E510	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-3_2022-10	E510	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-M-4_2022-10	E510	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag QUR_RB-O-4_2022-10	E510	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E512A	02-Oct-2022	29-Dec-2022	----	----		03-Jan-2023	365 days	94 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E512A	01-Oct-2022	29-Dec-2022	----	----		03-Jan-2023	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E511A	02-Oct-2022	11-Jan-2023	----	----		12-Jan-2023	365 days	103 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E511A	01-Oct-2022	11-Jan-2023	----	----		12-Jan-2023	365 days	104 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-O-5_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E511A	02-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	90 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag QUR_RB-O-1_2022-10	E511A	01-Oct-2022	29-Dec-2022	----	----		30-Dec-2022	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-5_2022-10	E510A	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-5X_2022-10	E510A	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-6_2022-10	E510A	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-7_2022-10	E510A	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-8_2022-10	E510A	02-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-1_2022-10	E510A	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-2_2022-10	E510A	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-3_2022-10	E510A	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-M-4_2022-10	E510A	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag QUR_RB-O-4_2022-10	E510A	01-Oct-2022	04-Jan-2023	----	----		05-Jan-2023	365 days	97 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E475	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E475	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E472	02-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	102 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E472	01-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	103 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E472	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-1_2022-10	E472	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5_2022-10	E440	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5X_2022-10	E440	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-6_2022-10	E440	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-7_2022-10	E440	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-8_2022-10	E440	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-1_2022-10	E440	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-2_2022-10	E440	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-3_2022-10	E440	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-4_2022-10	E440	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-O-4_2022-10	E440	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E475.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E475.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E472.Ag	02-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	102 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E472.Ag	01-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	103 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E472.Ag	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-1_2022-10	E472.Ag	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5_2022-10	E440.Ag	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5X_2022-10	E440.Ag	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-6_2022-10	E440.Ag	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-7_2022-10	E440.Ag	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-8_2022-10	E440.Ag	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-1_2022-10	E440.Ag	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-2_2022-10	E440.Ag	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-3_2022-10	E440.Ag	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-4_2022-10	E440.Ag	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-O-4_2022-10	E440.Ag	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E475.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E475.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E472.Ti	02-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	102 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E472.Ti	01-Oct-2022	11-Jan-2023	----	----		11-Jan-2023	730 days	103 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E472.Ti	02-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	89 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag QUR_RB-O-1_2022-10	E472.Ti	01-Oct-2022	29-Dec-2022	----	----		29-Dec-2022	730 days	90 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5_2022-10	E440.Ti	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-5X_2022-10	E440.Ti	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-6_2022-10	E440.Ti	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-7_2022-10	E440.Ti	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-8_2022-10	E440.Ti	02-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	95 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-1_2022-10	E440.Ti	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-2_2022-10	E440.Ti	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-3_2022-10	E440.Ti	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-M-4_2022-10	E440.Ti	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Metals : Titanium in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag QUR_RB-O-4_2022-10	E440.Ti	01-Oct-2022	04-Jan-2023	----	----		04-Jan-2023	730 days	96 days	✓
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUR_RB-O-2_2022-10	E144A	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag QUR_RB-O-6_2022-10	E144A	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-1_2022-10	E144-H	01-Oct-2022	----	----	----		11-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-2_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-3_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-4_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-5_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-5X_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-6_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-7_2022-10	E144-H	02-Oct-2022	----	----	----		11-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Ki-8_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-1_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-2_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-3_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-4_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-5_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-5X_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-6_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-7_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-Li-8_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-O-1_2022-10	E144-H	01-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-O-5_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag QUR_RB-O-5X_2022-10	E144-H	02-Oct-2022	----	----	----		29-Dec-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-1_2022-10	E144	01-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-2_2022-10	E144	01-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-3_2022-10	E144	01-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-4_2022-10	E144	01-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-5_2022-10	E144	02-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-5X_2022-10	E144	02-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-6_2022-10	E144	02-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-7_2022-10	E144	02-Oct-2022	----	----	----		03-Jan-2023	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-M-8_2022-10	E144	02-Oct-2022	----	----	----		03-Jan-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag QUR_RB-O-4_2022-10	E144	01-Oct-2022	----	----	----		03-Jan-2023	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	790519	3	21	14.2	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	792543	1	10	10.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	790520	3	21	14.2	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	792542	1	10	10.0	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	790521	3	21	14.2	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	792541	1	10	10.0	5.0	✓
Moisture Content by Gravimetry	E144	792546	1	10	10.0	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	790370	3	21	14.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	790517	3	21	14.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	792545	1	10	10.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	790518	3	21	14.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	792544	1	10	10.0	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	790558	2	2	100.0	10.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	790519	6	21	28.5	10.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	792543	2	10	20.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	790559	2	2	100.0	10.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	790520	6	21	28.5	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	792542	2	10	20.0	10.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	790562	2	2	100.0	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	790521	6	21	28.5	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	792541	2	10	20.0	10.0	✓
Moisture Content by Gravimetry	E144	792546	1	10	10.0	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	790556	1	2	50.0	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	790370	3	21	14.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	790560	2	2	100.0	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	790517	6	21	28.5	10.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	792545	2	10	20.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	790561	2	2	100.0	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	790518	6	21	28.5	10.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	792544	2	10	20.0	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	790558	1	2	50.0	5.0	✓
Mercury in Biota by CVAAS (DRY units, Micro)	E511	790519	3	21	14.2	5.0	✓
Mercury in Biota by CVAAS (DRY units, Routine)	E510	792543	1	10	10.0	5.0	✓

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	790559	1	2	50.0	5.0	✓
Mercury in Biota by CVAAS (WET units, Micro)	E511A	790520	3	21	14.2	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	792542	1	10	10.0	5.0	✓
Metals by CRC ICPMS (DRY units, Biopsy)	E475	790562	1	2	50.0	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	790521	3	21	14.2	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	792541	1	10	10.0	5.0	✓
Moisture Content by Gravimetry	E144	792546	1	10	10.0	5.0	✓
Moisture Content by Gravimetry (Biopsy)	E144A	790556	1	2	50.0	5.0	✓
Moisture Content by Gravimetry (Micro)	E144-H	790370	3	21	14.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag	790560	1	2	50.0	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag	790517	3	21	14.2	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	792545	1	10	10.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti	790561	1	2	50.0	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti	790518	3	21	14.2	5.0	✓
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti	792544	1	10	10.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Moisture Content by Gravimetry (Biopsy)	E144A Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at < 60 deg. C for a minimum of three days.
Moisture Content by Gravimetry (Micro)	E144-H Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at < 60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Routine)	E440.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Silver in Biota by CRC ICPMS (DRY units, Micro)	E472.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Micro)	E472.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals by CRC ICPMS (DRY units, Biopsy)	E475 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Titanium in Biota by CRC ICPMS (DRY units, Biopsy)	E475.Ti Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Micro)	E511 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Mercury in Biota by CVAAS (WET units, Micro)	E511A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512 Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Micro)	EP472 Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475 Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22C5005**	Page	: 1 of 28
Amendment	: **1**		
Client	: Mount Polley Mining Corporation	Laboratory	: Vancouver - Environmental
Contact	: Kala Ivens	Account Manager	: Can Dang
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Oct-2022 10:40
PO	: 5590008044 Q2 2022	Date Analysis Commenced	: 29-Dec-2022
C-O-C number	: ----	Issue Date	: 16-Feb-2023 16:18
Sampler	: ---- 250-790-2215 Ext 2112		
Site	: ----		
Quote number	: VA22-MPMC100-002		
No. of samples received	: 33		
No. of samples analysed	: 33		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 790370)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Moisture	----	E144-H	2.0	%	69.5	69.2	0.418%	20%	----
Physical Tests (QC Lot: 790566)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Moisture	----	E144-H	2.0	%	71.6	71.9	0.422%	20%	----
Physical Tests (QC Lot: 792546)											
VA22C5005-027	QUR_RB-O-4_2022-10	Moisture	----	E144	0.50	%	83.0	82.6	0.480%	20%	----
Physical Tests (QC Lot: 799547)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Moisture	----	E144-H	2.0	%	77.0	77.1	0.0764%	20%	----
Metals (QC Lot: 790517)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.114	0.117	2.90%	40%	----
Metals (QC Lot: 790518)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 790519)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Mercury	7439-97-6	E511	0.0050	mg/kg	0.0740	0.0807	8.63%	40%	----
Metals (QC Lot: 790520)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0226	0.0246	8.63%	40%	----
Metals (QC Lot: 790521)											
VA22C5005-033	QUR_RB-O-5X_2022-10	Aluminum	7429-90-5	E472	5.0	mg/kg	9.3	10.4	1.1	Diff <2x LOR	----
		Antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E472	0.030	mg/kg	0.288	0.291	0.980%	40%	----
		Barium	7440-39-3	E472	0.050	mg/kg	0.524	0.613	15.5%	40%	----
		Beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E472	1.0	mg/kg	1.0	1.1	0.1	Diff <2x LOR	----
		Cadmium	7440-43-9	E472	0.010	mg/kg	0.032	0.033	0.0006	Diff <2x LOR	----
		Calcium	7440-70-2	E472	20	mg/kg	835	910	8.62%	60%	----
		Cesium	7440-46-2	E472	0.0050	mg/kg	0.0486	0.0504	3.54%	40%	----
		Chromium	7440-47-3	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Cobalt	7440-48-4	E472	0.020	mg/kg	0.612	0.627	2.42%	40%	----
		Copper	7440-50-8	E472	0.20	mg/kg	38.7	39.8	2.61%	40%	----
		Iron	7439-89-6	E472	5.0	mg/kg	271	307	12.6%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 790521) - continued											
VA22C5005-033	QUR_RB-O-5X_2022-10	Lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E472	2.0	mg/kg	1060	1080	2.41%	40%	----
		Manganese	7439-96-5	E472	0.050	mg/kg	16.5	17.4	5.39%	40%	----
		Molybdenum	7439-98-7	E472	0.040	mg/kg	<0.040	<0.040	0	Diff <2x LOR	----
		Nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E472	10	mg/kg	8470	8640	1.92%	40%	----
		Potassium	7440-09-7	E472	20	mg/kg	7140	7290	2.10%	40%	----
		Rubidium	7440-17-7	E472	0.050	mg/kg	9.81	9.78	0.312%	40%	----
		Selenium	7782-49-2	E472	0.10	mg/kg	13.0	13.7	5.50%	40%	----
		Sodium	7440-23-5	E472	20	mg/kg	4280	4300	0.564%	40%	----
		Strontium	7440-24-6	E472	0.10	mg/kg	2.00	2.15	7.02%	60%	----
		Tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E472	0.0020	mg/kg	0.0104	0.0112	7.53%	40%	----
		Tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Uranium	7440-61-1	E472	0.0020	mg/kg	0.0107	0.0120	10.8%	40%	----
		Vanadium	7440-62-2	E472	0.10	mg/kg	0.12	0.13	0.02	Diff <2x LOR	----
		Zinc	7440-66-6	E472	1.0	mg/kg	147	152	3.73%	40%	----
		Zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 790571)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Silver	7440-22-4	E472.Ag	0.0050	mg/kg	2.37	2.28	4.22%	40%	----
Metals (QC Lot: 790572)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
Metals (QC Lot: 790573)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Mercury	7439-97-6	E511	0.0050	mg/kg	0.184	0.184	0.118%	40%	----
Metals (QC Lot: 790574)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0524	0.0523	0.118%	40%	----
Metals (QC Lot: 790575)											
VA22C5005-009	QUR_RB-Li-1_2022-10	Aluminum	7429-90-5	E472	5.0	mg/kg	7.2	7.5	0.2	Diff <2x LOR	----
		Antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E472	0.030	mg/kg	0.395	0.414	4.84%	40%	----
		Barium	7440-39-3	E472	0.050	mg/kg	0.547	0.534	2.41%	40%	----
		Beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 790575) - continued											
VA22C5005-009	QUR_RB-Li-1_2022-10	Boron	7440-42-8	E472	1.0	mg/kg	1.2	1.4	0.1	Diff <2x LOR	----
		Cadmium	7440-43-9	E472	0.010	mg/kg	0.658	0.721	9.10%	40%	----
		Calcium	7440-70-2	E472	20	mg/kg	173	200	14.4%	60%	----
		Cesium	7440-46-2	E472	0.0050	mg/kg	0.0164	0.0172	0.0008	Diff <2x LOR	----
		Chromium	7440-47-3	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Cobalt	7440-48-4	E472	0.020	mg/kg	0.340	0.371	8.69%	40%	----
		Copper	7440-50-8	E472	0.20	mg/kg	91.8	88.4	3.78%	40%	----
		Iron	7439-89-6	E472	5.0	mg/kg	1440	1400	2.14%	40%	----
		Lead	7439-92-1	E472	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E472	2.0	mg/kg	582	586	0.717%	40%	----
		Manganese	7439-96-5	E472	0.050	mg/kg	4.83	5.17	6.89%	40%	----
		Molybdenum	7439-98-7	E472	0.040	mg/kg	0.894	0.935	4.51%	40%	----
		Nickel	7440-02-0	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E472	10	mg/kg	12500	12100	3.13%	40%	----
		Potassium	7440-09-7	E472	20	mg/kg	9810	9700	1.16%	40%	----
		Rubidium	7440-17-7	E472	0.050	mg/kg	6.84	7.19	5.00%	40%	----
		Selenium	7782-49-2	E472	0.10	mg/kg	34.9	32.5	7.00%	40%	----
		Sodium	7440-23-5	E472	20	mg/kg	4000	3980	0.570%	40%	----
		Strontium	7440-24-6	E472	0.10	mg/kg	0.43	0.65	41.6%	60%	----
		Tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E472	0.0020	mg/kg	0.0504	0.0579	13.8%	40%	----
		Tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Uranium	7440-61-1	E472	0.0020	mg/kg	0.0056	0.0054	0.0002	Diff <2x LOR	----
		Vanadium	7440-62-2	E472	0.10	mg/kg	0.16	0.18	0.02	Diff <2x LOR	----
		Zinc	7440-66-6	E472	1.0	mg/kg	85.4	88.6	3.65%	40%	----
		Zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 792541)											
VA22C5005-007	QUR_RB-M-7_2022-10	Aluminum	7429-90-5	E440	2.0	mg/kg	2.5	2.1	0.4	Diff <2x LOR	----
		Antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.020	mg/kg	0.175	0.172	1.80%	40%	----
		Barium	7440-39-3	E440	0.050	mg/kg	0.544	0.359	41.0%	40%	DUP-H
		Beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 792541) - continued											
VA22C5005-007	QUR_RB-M-7_2022-10	Boron	7440-42-8	E440	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Calcium	7440-70-2	E440	20	mg/kg	1190	697	52.5%	60%	----
		Cesium	7440-46-2	E440	0.0050	mg/kg	0.155	0.160	3.23%	40%	----
		Chromium	7440-47-3	E440	0.050	mg/kg	0.086	0.092	0.005	Diff <2x LOR	----
		Cobalt	7440-48-4	E440	0.020	mg/kg	0.039	0.039	0.0002	Diff <2x LOR	----
		Copper	7440-50-8	E440	0.10	mg/kg	0.85	1.10	25.3%	40%	----
		Iron	7439-89-6	E440	3.0	mg/kg	19.7	19.5	0.932%	40%	----
		Lead	7439-92-1	E440	0.020	mg/kg	0.032	<0.020	0.012	Diff <2x LOR	----
		Lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	2.0	mg/kg	1620	1750	7.61%	40%	----
		Manganese	7439-96-5	E440	0.050	mg/kg	0.569	0.398	35.3%	40%	----
		Molybdenum	7439-98-7	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Phosphorus	7723-14-0	E440	10	mg/kg	15100	15700	3.54%	40%	----
		Potassium	7440-09-7	E440	20	mg/kg	27400	28700	4.72%	40%	----
		Rubidium	7440-17-7	E440	0.050	mg/kg	32.8	31.5	3.93%	40%	----
		Selenium	7782-49-2	E440	0.050	mg/kg	2.71	2.87	5.92%	40%	----
		Sodium	7440-23-5	E440	20	mg/kg	1550	1660	7.12%	40%	----
		Strontium	7440-24-6	E440	0.050	mg/kg	1.34	0.605	75.3%	60%	DUP-H
		Tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.0020	mg/kg	0.0400	0.0446	11.0%	40%	----
		Tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		Vanadium	7440-62-2	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Zinc	7440-66-6	E440	0.50	mg/kg	16.8	17.3	3.41%	40%	----
		Zirconium	7440-67-7	E440	0.20	mg/kg	0.52	0.33	0.19	Diff <2x LOR	----
Metals (QC Lot: 792542)											
VA22C5005-007	QUR_RB-M-7_2022-10	Mercury	7439-97-6	E510A	0.0025	mg/kg wwt	0.0980	0.100	2.49%	40%	----
Metals (QC Lot: 792543)											
VA22C5005-007	QUR_RB-M-7_2022-10	Mercury	7439-97-6	E510	0.0062	mg/kg	0.477	0.489	2.49%	40%	----
Metals (QC Lot: 792544)											
VA22C5005-007	QUR_RB-M-7_2022-10	Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	<0.25	0	Diff <2x LOR	----
Metals (QC Lot: 792545)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 792545) - continued											
VA22C5005-007	QUR_RB-M-7_2022-10	Silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 799542)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Silver	7440-22-4	E472.Ag	0.0050	mg/kg	0.0053	0.0059	0.0006	Diff <2x LOR	----
Metals (QC Lot: 799543)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Titanium	7440-32-6	E472.Ti	0.50	mg/kg	<0.50	0.54	0.04	Diff <2x LOR	----
Metals (QC Lot: 799544)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Mercury	7439-97-6	E511	0.0050	mg/kg	0.324	0.400	21.0%	40%	----
Metals (QC Lot: 799545)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0746	0.0921	21.0%	40%	----
Metals (QC Lot: 799546)											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Aluminum	7429-90-5	E472	5.0	mg/kg	7.7	10.1	2.3	Diff <2x LOR	----
		Antimony	7440-36-0	E472	0.010	mg/kg	<0.010	0.011	0.001	Diff <2x LOR	----
		Arsenic	7440-38-2	E472	0.030	mg/kg	0.783	1.07	31.0%	40%	----
		Barium	7440-39-3	E472	0.050	mg/kg	1.02	1.00	1.79%	40%	----
		Beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E472	0.010	mg/kg	1.46	1.93	27.7%	40%	----
		Calcium	7440-70-2	E472	20	mg/kg	524	722	31.9%	60%	----
		Cesium	7440-46-2	E472	0.0050	mg/kg	0.0280	0.0303	7.82%	40%	----
		Chromium	7440-47-3	E472	0.20	mg/kg	0.48	0.58	0.11	Diff <2x LOR	----
		Cobalt	7440-48-4	E472	0.020	mg/kg	1.67	1.98	16.9%	40%	----
		Copper	7440-50-8	E472	0.20	mg/kg	4.07	5.12	22.9%	40%	----
		Iron	7439-89-6	E472	5.0	mg/kg	760	942	21.4%	40%	----
		Lead	7439-92-1	E472	0.050	mg/kg	0.052	0.067	0.014	Diff <2x LOR	----
		Lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Magnesium	7439-95-4	E472	2.0	mg/kg	574	639	10.7%	40%	----
		Manganese	7439-96-5	E472	0.050	mg/kg	1.91	2.61	31.0%	40%	----
		Molybdenum	7439-98-7	E472	0.040	mg/kg	0.234	0.318	30.7%	40%	----
		Nickel	7440-02-0	E472	0.20	mg/kg	0.45	0.56	0.10	Diff <2x LOR	----
		Phosphorus	7723-14-0	E472	10	mg/kg	9770	11000	11.4%	40%	----
		Potassium	7440-09-7	E472	20	mg/kg	11800	13400	12.2%	40%	----
		Rubidium	7440-17-7	E472	0.050	mg/kg	8.76	9.84	11.6%	40%	----
		Selenium	7782-49-2	E472	0.10	mg/kg	10.9	13.3	19.6%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 799546) - continued											
VA22C5005-017	QUR_RB-Ki-1_2022-10	Sodium	7440-23-5	E472	20	mg/kg	6760	7670	12.6%	40%	----
		Strontium	7440-24-6	E472	0.10	mg/kg	1.77	2.34	27.7%	60%	----
		Tellurium	13494-80-9	E472	0.020	mg/kg	0.025	0.030	0.004	Diff <2x LOR	----
		Thallium	7440-28-0	E472	0.0020	mg/kg	0.0458	0.0625	30.9%	40%	----
		Tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Uranium	7440-61-1	E472	0.0020	mg/kg	0.0093	0.0126	29.7%	40%	----
		Vanadium	7440-62-2	E472	0.10	mg/kg	0.27	0.36	0.09	Diff <2x LOR	----
		Zinc	7440-66-6	E472	1.0	mg/kg	83.4	111	28.7%	40%	----
		Zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 790370)						
Moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 790556)						
Moisture	----	E144A	2	%	<2.0	----
Physical Tests (QCLot: 790566)						
Moisture	----	E144-H	2	%	<2.0	----
Physical Tests (QCLot: 792546)						
Moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 799547)						
Moisture	----	E144-H	2	%	<2.0	----
Metals (QCLot: 790517)						
Silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 790518)						
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 790519)						
Mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 790520)						
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 790521)						
Aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
Antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
Barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E472	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E472	20	mg/kg	<20	----
Cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E472	5	mg/kg	<5.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 790521) - continued						
Lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
Manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E472	10	mg/kg	<10	----
Potassium	7440-09-7	E472	20	mg/kg	<20	----
Rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E472	20	mg/kg	<20	----
Strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E472	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 790558)						
Mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
Metals (QCLot: 790559)						
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
Metals (QCLot: 790560)						
Silver	7440-22-4	E475.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 790561)						
Titanium	7440-32-6	E475.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 790562)						
Aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
Antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
Arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
Barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E475	1	mg/kg	<1.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 790562) - continued						
Cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E475	20	mg/kg	<20	----
Cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E475	5	mg/kg	<5.0	----
Lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
Manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E475	20	mg/kg	<20	----
Potassium	7440-09-7	E475	20	mg/kg	<20	----
Rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E475	20	mg/kg	<20	----
Strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E475	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----
Metals (QCLot: 790571)						
Silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 790572)						
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 790573)						
Mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 790574)						
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 790575)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 790575) - continued						
Aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
Antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
Barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E472	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E472	20	mg/kg	<20	----
Cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E472	5	mg/kg	<5.0	----
Lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
Manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E472	10	mg/kg	<10	----
Potassium	7440-09-7	E472	20	mg/kg	<20	----
Rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E472	20	mg/kg	<20	----
Strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E472	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
Metals (QCLot: 792541)						
Aluminum	7429-90-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 792541) - continued						
Antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
Barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E440	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
Calcium	7440-70-2	E440	20	mg/kg	<20	----
Cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
Cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
Iron	7439-89-6	E440	3	mg/kg	<3.0	----
Lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
Lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
Manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
Nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E440	10	mg/kg	<10	----
Potassium	7440-09-7	E440	20	mg/kg	<20	----
Rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
Sodium	7440-23-5	E440	20	mg/kg	<20	----
Strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
Tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
Zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 792542)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 792543)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 792543) - continued						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 792544)						
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	<0.25	----
Metals (QCLot: 792545)						
Silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 799542)						
Silver	7440-22-4	E472.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 799543)						
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	<0.50	----
Metals (QCLot: 799544)						
Mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
Metals (QCLot: 799545)						
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 799546)						
Aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
Antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
Arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
Barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
Beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
Bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
Boron	7440-42-8	E472	1	mg/kg	<1.0	----
Cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
Calcium	7440-70-2	E472	20	mg/kg	<20	----
Cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
Chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
Cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
Copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
Iron	7439-89-6	E472	5	mg/kg	<5.0	----
Lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
Lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
Magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
Manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
Nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
Phosphorus	7723-14-0	E472	10	mg/kg	<10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 799546) - continued						
Potassium	7440-09-7	E472	20	mg/kg	<20	----
Rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
Selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E472	20	mg/kg	<20	----
Strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
Tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
Thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
Tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
Uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
Vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
Zinc	7440-66-6	E472	1	mg/kg	<1.0	----
Zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 790370)									
Moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 790556)									
Moisture	----	E144A	2	%	100 %	101	90.0	110	----
Physical Tests (QCLot: 790566)									
Moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Physical Tests (QCLot: 792546)									
Moisture	----	E144	0.5	%	50 %	99.8	90.0	110	----
Physical Tests (QCLot: 799547)									
Moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Metals (QCLot: 790517)									
Silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	# 77.3	80.0	120	MES
Metals (QCLot: 790518)									
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	93.2	80.0	120	----
Metals (QCLot: 790519)									
Mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	93.8	80.0	120	----
Metals (QCLot: 790520)									
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.8	80.0	120	----
Metals (QCLot: 790521)									
Aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	94.0	80.0	120	----
Antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	86.4	80.0	120	----
Arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	96.5	80.0	120	----
Barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	93.3	80.0	120	----
Beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	91.6	80.0	120	----
Bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	84.1	80.0	120	----
Boron	7440-42-8	E472	1	mg/kg	10 mg/kg	89.9	80.0	120	----
Cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	86.5	80.0	120	----
Calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	84.0	80.0	120	----
Cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	89.0	80.0	120	----
Chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	91.5	80.0	120	----
Cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	89.7	80.0	120	----
Copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	87.6	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 790521) - continued									
Iron	7439-89-6	E472	5	mg/kg	10 mg/kg	94.2	80.0	120	----
Lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	88.5	80.0	120	----
Lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	92.2	80.0	120	----
Magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	86.5	80.0	120	----
Manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	94.0	80.0	120	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	90.1	80.0	120	----
Nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	88.6	80.0	120	----
Phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	98.1	80.0	120	----
Potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	95.3	80.0	120	----
Rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	96.0	80.0	120	----
Selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	87.2	80.0	120	----
Sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	92.3	80.0	120	----
Strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	88.2	80.0	120	----
Tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	86.4	80.0	120	----
Thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	86.6	80.0	120	----
Tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	87.3	80.0	120	----
Uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	89.8	80.0	120	----
Vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	94.5	80.0	120	----
Zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	88.4	80.0	120	----
Zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	88.8	80.0	120	----
Metals (QCLot: 790558)									
Mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	95.7	80.0	120	----
Metals (QCLot: 790559)									
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	95.7	80.0	120	----
Metals (QCLot: 790560)									
Silver	7440-22-4	E475.Ag	0.005	mg/kg	2.5 mg/kg	81.1	80.0	120	----
Metals (QCLot: 790561)									
Titanium	7440-32-6	E475.Ti	0.5	mg/kg	6.25 mg/kg	98.0	80.0	120	----
Metals (QCLot: 790562)									
Aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	101	80.0	120	----
Antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	91.2	80.0	120	----
Arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	104	80.0	120	----
Barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	97.8	80.0	120	----
Beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	89.9	80.0	120	----
Bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	86.9	80.0	120	----
Boron	7440-42-8	E475	1	mg/kg	25 mg/kg	85.3	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 790562) - continued									
Cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	90.7	80.0	120	----
Calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	86.8	80.0	120	----
Cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	93.0	80.0	120	----
Chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	99.9	80.0	120	----
Cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	99.6	80.0	120	----
Copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	99.3	80.0	120	----
Iron	7439-89-6	E475	5	mg/kg	25 mg/kg	98.3	80.0	120	----
Lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	90.5	80.0	120	----
Lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	90.6	80.0	120	----
Magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	98.4	80.0	120	----
Manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	99.3	80.0	120	----
Molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	96.6	80.0	120	----
Nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	99.5	80.0	120	----
Phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	104	80.0	120	----
Potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	99.1	80.0	120	----
Rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	99.3	80.0	120	----
Selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	93.8	80.0	120	----
Sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	103	80.0	120	----
Strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	95.2	80.0	120	----
Tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	92.9	80.0	120	----
Thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	87.6	80.0	120	----
Tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	93.6	80.0	120	----
Uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	91.9	80.0	120	----
Vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	103	80.0	120	----
Zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	96.1	80.0	120	----
Zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	92.0	80.0	120	----
Metals (QCLot: 790571)									
Silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	83.9	80.0	120	----
Metals (QCLot: 790572)									
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	93.8	80.0	120	----
Metals (QCLot: 790573)									
Mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	91.4	80.0	120	----
Metals (QCLot: 790574)									
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	91.4	80.0	120	----
Metals (QCLot: 790575)									
Aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	94.0	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 790575) - continued									
Antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	93.5	80.0	120	----
Arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	96.0	80.0	120	----
Barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	92.1	80.0	120	----
Beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	91.4	80.0	120	----
Bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	90.3	80.0	120	----
Boron	7440-42-8	E472	1	mg/kg	10 mg/kg	88.2	80.0	120	----
Cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	92.4	80.0	120	----
Calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	88.2	80.0	120	----
Cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	95.9	80.0	120	----
Chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	93.2	80.0	120	----
Cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	92.7	80.0	120	----
Copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	90.4	80.0	120	----
Iron	7439-89-6	E472	5	mg/kg	10 mg/kg	93.4	80.0	120	----
Lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	94.8	80.0	120	----
Lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	91.6	80.0	120	----
Magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	92.8	80.0	120	----
Manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	93.8	80.0	120	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	97.1	80.0	120	----
Nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	91.4	80.0	120	----
Phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	95.1	80.0	120	----
Potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	95.1	80.0	120	----
Rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	93.0	80.0	120	----
Selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	89.3	80.0	120	----
Sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	98.8	80.0	120	----
Strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	96.9	80.0	120	----
Tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	90.8	80.0	120	----
Thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	92.0	80.0	120	----
Tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	93.1	80.0	120	----
Uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	95.0	80.0	120	----
Vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	96.3	80.0	120	----
Zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	89.7	80.0	120	----
Zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	93.6	80.0	120	----
Metals (QCLot: 792541)									
Aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
Antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	94.6	80.0	120	----
Arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 792541) - continued									
Barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
Beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	97.7	80.0	120	----
Bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	93.1	80.0	120	----
Boron	7440-42-8	E440	1	mg/kg	10 mg/kg	84.7	80.0	120	----
Cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	99.4	80.0	120	----
Calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	97.1	80.0	120	----
Cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	96.6	80.0	120	----
Chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
Cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	99.9	80.0	120	----
Copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	97.4	80.0	120	----
Iron	7439-89-6	E440	3	mg/kg	10 mg/kg	102	80.0	120	----
Lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	95.2	80.0	120	----
Lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	101	80.0	120	----
Magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	102	80.0	120	----
Manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
Molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	98.4	80.0	120	----
Nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	97.9	80.0	120	----
Phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	108	80.0	120	----
Potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
Rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	107	80.0	120	----
Selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	97.2	80.0	120	----
Sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	98.3	80.0	120	----
Strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	97.5	80.0	120	----
Tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	95.9	80.0	120	----
Thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	94.0	80.0	120	----
Tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	97.9	80.0	120	----
Uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	97.8	80.0	120	----
Vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	105	80.0	120	----
Zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	92.9	80.0	120	----
Zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	92.6	80.0	120	----
Metals (QCLot: 792542)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	90.8	80.0	120	----
Metals (QCLot: 792543)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	90.8	80.0	120	----
Metals (QCLot: 792544)									
Titanium	7440-32-6	E440.Ti	0.25	mg/kg	2.5 mg/kg	97.9	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 792545)									
Silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	85.2	80.0	120	----
Metals (QCLot: 799542)									
Silver	7440-22-4	E472.Ag	0.005	mg/kg	1 mg/kg	# 79.6	80.0	120	MES
Metals (QCLot: 799543)									
Titanium	7440-32-6	E472.Ti	0.5	mg/kg	2.5 mg/kg	85.7	80.0	120	----
Metals (QCLot: 799544)									
Mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	83.0	80.0	120	----
Metals (QCLot: 799545)									
Mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	83.0	80.0	120	----
Metals (QCLot: 799546)									
Aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	90.1	80.0	120	----
Antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	86.8	80.0	120	----
Arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	96.3	80.0	120	----
Barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	88.7	80.0	120	----
Beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	82.5	80.0	120	----
Bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	85.8	80.0	120	----
Boron	7440-42-8	E472	1	mg/kg	10 mg/kg	# 73.7	80.0	120	MES
Cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	87.5	80.0	120	----
Calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	82.7	80.0	120	----
Cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	92.4	80.0	120	----
Chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	89.2	80.0	120	----
Cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	88.1	80.0	120	----
Copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	85.9	80.0	120	----
Iron	7439-89-6	E472	5	mg/kg	10 mg/kg	87.3	80.0	120	----
Lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	87.1	80.0	120	----
Lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	82.3	80.0	120	----
Magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	85.8	80.0	120	----
Manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	90.3	80.0	120	----
Molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	90.5	80.0	120	----
Nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	86.5	80.0	120	----
Phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	94.9	80.0	120	----
Potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	90.6	80.0	120	----
Rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	92.7	80.0	120	----
Selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	81.7	80.0	120	----
Sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	90.9	80.0	120	----
Strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	86.5	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 799546) - continued									
Tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	84.9	80.0	120	----
Thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	86.1	80.0	120	----
Tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	88.7	80.0	120	----
Uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	94.2	80.0	120	----
Vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	91.6	80.0	120	----
Zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	85.0	80.0	120	----
Zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	84.8	80.0	120	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 790517)									
	RM	Silver	7440-22-4	E472.Ag	0.139 mg/kg	88.2	70.0	130	----
Metals (QCLot: 790518)									
	RM	Titanium	7440-32-6	E472.Ti	1.15 mg/kg	88.6	70.0	130	----
Metals (QCLot: 790519)									
	RM	Mercury	7439-97-6	E511	0.281 mg/kg	95.9	70.0	130	----
Metals (QCLot: 790520)									
	RM	Mercury	7439-97-6	E511A	0.281 mg/kg wwt	95.9	70.0	130	----
Metals (QCLot: 790521)									
	RM	Aluminum	7429-90-5	E472	147 mg/kg	106	70.0	130	----
	RM	Arsenic	7440-38-2	E472	14.5 mg/kg	92.6	70.0	130	----
	RM	Barium	7440-39-3	E472	0.352 mg/kg	90.8	70.0	130	----
	RM	Boron	7440-42-8	E472	3.47 mg/kg	92.0	70.0	130	----
	RM	Cadmium	7440-43-9	E472	0.153 mg/kg	89.8	70.0	130	----
	RM	Calcium	7440-70-2	E472	2010 mg/kg	93.4	70.0	130	----
	RM	Cesium	7440-46-2	E472	0.0889 mg/kg	92.0	70.0	130	----
	RM	Chromium	7440-47-3	E472	0.453 mg/kg	91.7	50.0	150	----
	RM	Cobalt	7440-48-4	E472	0.0567 mg/kg	95.2	65.0	135	----
	RM	Copper	7440-50-8	E472	3.3 mg/kg	88.2	70.0	130	----
	RM	Iron	7439-89-6	E472	102 mg/kg	90.3	70.0	130	----
	RM	Lead	7439-92-1	E472	0.058 mg/kg	90.7	15.0	185	----
	RM	Magnesium	7439-95-4	E472	899 mg/kg	92.2	70.0	130	----
	RM	Manganese	7439-96-5	E472	0.948 mg/kg	90.8	70.0	130	----
	RM	Molybdenum	7439-98-7	E472	0.134 mg/kg	89.2	70.0	130	----
	RM	Nickel	7440-02-0	E472	0.33 mg/kg	83.4	40.0	160	----
	RM	Phosphorus	7723-14-0	E472	6700 mg/kg	93.0	70.0	130	----
	RM	Potassium	7440-09-7	E472	11600 mg/kg	93.6	70.0	130	----
	RM	Rubidium	7440-17-7	E472	2.53 mg/kg	92.0	70.0	130	----
	RM	Selenium	7782-49-2	E472	2.48 mg/kg	91.6	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 790521) - continued									
	RM	Sodium	7440-23-5	E472	9620 mg/kg	90.6	70.0	130	----
	RM	Strontium	7440-24-6	E472	10.6 mg/kg	88.6	70.0	130	----
	RM	Vanadium	7440-62-2	E472	0.269 mg/kg	99.1	70.0	130	----
	RM	Zinc	7440-66-6	E472	28.7 mg/kg	90.6	70.0	130	----
Metals (QCLot: 790558)									
	RM	Mercury	7439-97-6	E512	0.281 mg/kg	109	70.0	130	----
Metals (QCLot: 790559)									
	RM	Mercury	7439-97-6	E512A	0.281 mg/kg wwt	109	70.0	130	----
Metals (QCLot: 790560)									
	RM	Silver	7440-22-4	E475.Ag	0.139 mg/kg	99.7	70.0	130	----
Metals (QCLot: 790561)									
	RM	Titanium	7440-32-6	E475.Ti	1.15 mg/kg	103	70.0	130	----
Metals (QCLot: 790562)									
	RM	Aluminum	7429-90-5	E475	147 mg/kg	117	70.0	130	----
	RM	Arsenic	7440-38-2	E475	14.5 mg/kg	104	70.0	130	----
	RM	Barium	7440-39-3	E475	0.352 mg/kg	108	70.0	130	----
	RM	Boron	7440-42-8	E475	3.47 mg/kg	98.3	70.0	130	----
	RM	Cadmium	7440-43-9	E475	0.153 mg/kg	98.7	70.0	130	----
	RM	Calcium	7440-70-2	E475	2010 mg/kg	100.0	70.0	130	----
	RM	Cesium	7440-46-2	E475	0.0889 mg/kg	103	70.0	130	----
	RM	Chromium	7440-47-3	E475	0.453 mg/kg	101	50.0	150	----
	RM	Cobalt	7440-48-4	E475	0.0567 mg/kg	104	65.0	135	----
	RM	Copper	7440-50-8	E475	3.3 mg/kg	96.2	70.0	130	----
	RM	Iron	7439-89-6	E475	102 mg/kg	101	70.0	130	----
	RM	Lead	7439-92-1	E475	0.058 mg/kg	102	15.0	185	----
	RM	Magnesium	7439-95-4	E475	899 mg/kg	102	70.0	130	----
	RM	Manganese	7439-96-5	E475	0.948 mg/kg	107	70.0	130	----
	RM	Molybdenum	7439-98-7	E475	0.134 mg/kg	110	70.0	130	----
	RM	Nickel	7440-02-0	E475	0.33 mg/kg	99.7	40.0	160	----
	RM	Phosphorus	7723-14-0	E475	6700 mg/kg	108	70.0	130	----
	RM	Potassium	7440-09-7	E475	11600 mg/kg	109	70.0	130	----
	RM	Rubidium	7440-17-7	E475	2.53 mg/kg	107	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 790562) - continued									
	RM	Selenium	7782-49-2	E475	2.48 mg/kg	103	70.0	130	----
	RM	Sodium	7440-23-5	E475	9620 mg/kg	103	70.0	130	----
	RM	Strontium	7440-24-6	E475	10.6 mg/kg	101	70.0	130	----
	RM	Vanadium	7440-62-2	E475	0.269 mg/kg	109	70.0	130	----
	RM	Zinc	7440-66-6	E475	28.7 mg/kg	102	70.0	130	----
Metals (QCLot: 790571)									
	RM	Silver	7440-22-4	E472.Ag	0.139 mg/kg	86.2	70.0	130	----
Metals (QCLot: 790572)									
	RM	Titanium	7440-32-6	E472.Ti	1.15 mg/kg	81.4	70.0	130	----
Metals (QCLot: 790573)									
	RM	Mercury	7439-97-6	E511	0.281 mg/kg	91.0	70.0	130	----
Metals (QCLot: 790574)									
	RM	Mercury	7439-97-6	E511A	0.281 mg/kg wwt	91.0	70.0	130	----
Metals (QCLot: 790575)									
	RM	Aluminum	7429-90-5	E472	147 mg/kg	96.2	70.0	130	----
	RM	Arsenic	7440-38-2	E472	14.5 mg/kg	85.3	70.0	130	----
	RM	Barium	7440-39-3	E472	0.352 mg/kg	101	70.0	130	----
	RM	Boron	7440-42-8	E472	3.47 mg/kg	94.1	70.0	130	----
	RM	Cadmium	7440-43-9	E472	0.153 mg/kg	85.5	70.0	130	----
	RM	Calcium	7440-70-2	E472	2010 mg/kg	95.8	70.0	130	----
	RM	Cesium	7440-46-2	E472	0.0889 mg/kg	89.6	70.0	130	----
	RM	Chromium	7440-47-3	E472	0.453 mg/kg	85.5	50.0	150	----
	RM	Cobalt	7440-48-4	E472	0.0567 mg/kg	82.8	65.0	135	----
	RM	Copper	7440-50-8	E472	3.3 mg/kg	82.0	70.0	130	----
	RM	Iron	7439-89-6	E472	102 mg/kg	84.2	70.0	130	----
	RM	Lead	7439-92-1	E472	0.058 mg/kg	87.1	15.0	185	----
	RM	Magnesium	7439-95-4	E472	899 mg/kg	87.5	70.0	130	----
	RM	Manganese	7439-96-5	E472	0.948 mg/kg	90.1	70.0	130	----
	RM	Molybdenum	7439-98-7	E472	0.134 mg/kg	90.0	70.0	130	----
	RM	Nickel	7440-02-0	E472	0.33 mg/kg	83.3	40.0	160	----
	RM	Phosphorus	7723-14-0	E472	6700 mg/kg	87.9	70.0	130	----
	RM	Potassium	7440-09-7	E472	11600 mg/kg	87.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 790575) - continued									
	RM	Rubidium	7440-17-7	E472	2.53 mg/kg	84.1	70.0	130	----
	RM	Selenium	7782-49-2	E472	2.48 mg/kg	89.6	70.0	130	----
	RM	Sodium	7440-23-5	E472	9620 mg/kg	86.9	70.0	130	----
	RM	Strontium	7440-24-6	E472	10.6 mg/kg	89.3	70.0	130	----
	RM	Vanadium	7440-62-2	E472	0.269 mg/kg	89.6	70.0	130	----
	RM	Zinc	7440-66-6	E472	28.7 mg/kg	86.6	70.0	130	----
Metals (QCLot: 792541)									
	RM	Aluminum	7429-90-5	E440	147 mg/kg	105	70.0	130	----
	RM	Arsenic	7440-38-2	E440	14.5 mg/kg	102	70.0	130	----
	RM	Barium	7440-39-3	E440	0.352 mg/kg	101	70.0	130	----
	RM	Boron	7440-42-8	E440	3.47 mg/kg	99.8	70.0	130	----
	RM	Cadmium	7440-43-9	E440	0.153 mg/kg	102	70.0	130	----
	RM	Calcium	7440-70-2	E440	2010 mg/kg	105	70.0	130	----
	RM	Cesium	7440-46-2	E440	0.0889 mg/kg	98.1	70.0	130	----
	RM	Chromium	7440-47-3	E440	0.453 mg/kg	102	70.0	130	----
	RM	Cobalt	7440-48-4	E440	0.0567 mg/kg	110	65.0	135	----
	RM	Copper	7440-50-8	E440	3.3 mg/kg	102	70.0	130	----
	RM	Iron	7439-89-6	E440	102 mg/kg	102	70.0	130	----
	RM	Lead	7439-92-1	E440	0.058 mg/kg	99.4	70.0	130	----
	RM	Magnesium	7439-95-4	E440	899 mg/kg	103	70.0	130	----
	RM	Manganese	7439-96-5	E440	0.948 mg/kg	97.8	70.0	130	----
	RM	Molybdenum	7439-98-7	E440	0.134 mg/kg	95.9	70.0	130	----
	RM	Nickel	7440-02-0	E440	0.33 mg/kg	100	40.0	160	----
	RM	Phosphorus	7723-14-0	E440	6700 mg/kg	103	70.0	130	----
	RM	Potassium	7440-09-7	E440	11600 mg/kg	105	70.0	130	----
	RM	Rubidium	7440-17-7	E440	2.53 mg/kg	98.0	70.0	130	----
	RM	Selenium	7782-49-2	E440	2.48 mg/kg	101	70.0	130	----
	RM	Sodium	7440-23-5	E440	9620 mg/kg	105	70.0	130	----
	RM	Strontium	7440-24-6	E440	10.6 mg/kg	95.1	70.0	130	----
	RM	Vanadium	7440-62-2	E440	0.269 mg/kg	101	70.0	130	----
	RM	Zinc	7440-66-6	E440	28.7 mg/kg	98.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 792542)									
	RM	Mercury	7439-97-6	E510A	0.281 mg/kg wwt	100.0	70.0	130	----
Metals (QCLot: 792543)									
	RM	Mercury	7439-97-6	E510	0.281 mg/kg	100.0	70.0	130	----
Metals (QCLot: 792544)									
	RM	Titanium	7440-32-6	E440.Ti	1.15 mg/kg	93.8	70.0	130	----
Metals (QCLot: 792545)									
	RM	Silver	7440-22-4	E440.Ag	0.139 mg/kg	93.9	70.0	130	----
Metals (QCLot: 799542)									
	RM	Silver	7440-22-4	E472.Ag	0.139 mg/kg	91.4	70.0	130	----
Metals (QCLot: 799543)									
	RM	Titanium	7440-32-6	E472.Ti	1.15 mg/kg	82.4	70.0	130	----
Metals (QCLot: 799544)									
	RM	Mercury	7439-97-6	E511	0.281 mg/kg	92.7	70.0	130	----
Metals (QCLot: 799545)									
	RM	Mercury	7439-97-6	E511A	0.281 mg/kg wwt	92.7	70.0	130	----
Metals (QCLot: 799546)									
	RM	Aluminum	7429-90-5	E472	147 mg/kg	96.0	70.0	130	----
	RM	Arsenic	7440-38-2	E472	14.5 mg/kg	96.1	70.0	130	----
	RM	Barium	7440-39-3	E472	0.352 mg/kg	93.0	70.0	130	----
	RM	Boron	7440-42-8	E472	3.47 mg/kg	80.8	70.0	130	----
	RM	Cadmium	7440-43-9	E472	0.153 mg/kg	90.5	70.0	130	----
	RM	Calcium	7440-70-2	E472	2010 mg/kg	93.3	70.0	130	----
	RM	Cesium	7440-46-2	E472	0.0889 mg/kg	92.1	70.0	130	----
	RM	Chromium	7440-47-3	E472	0.453 mg/kg	86.8	50.0	150	----
	RM	Cobalt	7440-48-4	E472	0.0567 mg/kg	110	65.0	135	----
	RM	Copper	7440-50-8	E472	3.3 mg/kg	89.6	70.0	130	----
	RM	Iron	7439-89-6	E472	102 mg/kg	88.0	70.0	130	----
	RM	Lead	7439-92-1	E472	0.058 mg/kg	109	15.0	185	----
	RM	Magnesium	7439-95-4	E472	899 mg/kg	93.7	70.0	130	----
	RM	Manganese	7439-96-5	E472	0.948 mg/kg	89.4	70.0	130	----
	RM	Molybdenum	7439-98-7	E472	0.134 mg/kg	87.8	70.0	130	----
	RM	Nickel	7440-02-0	E472	0.33 mg/kg	89.1	40.0	160	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 799546) - continued									
	RM	Phosphorus	7723-14-0	E472	6700 mg/kg	96.6	70.0	130	----
	RM	Potassium	7440-09-7	E472	11600 mg/kg	94.8	70.0	130	----
	RM	Rubidium	7440-17-7	E472	2.53 mg/kg	92.7	70.0	130	----
	RM	Selenium	7782-49-2	E472	2.48 mg/kg	88.3	70.0	130	----
	RM	Sodium	7440-23-5	E472	9620 mg/kg	95.0	70.0	130	----
	RM	Strontium	7440-24-6	E472	10.6 mg/kg	85.2	70.0	130	----
	RM	Vanadium	7440-62-2	E472	0.269 mg/kg	92.3	70.0	130	----
	RM	Zinc	7440-66-6	E472	28.7 mg/kg	90.5	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

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(lab use only)

COC Number: 15 -

Report To	Contact and company name below will appear on the final report
Company:	Mount Polley Mining Corporation
Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: kala.ivens@mountpolley.com
Email 2: gabriel.holmes@mountpolley.com
Email 3: pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2: kala.ivens@mountpolley.com

Project Information

ALS Account # / Quote #: VA22-MPMC100-002
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):
ALS Contact: Can Dang Sampler:

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PRIORITY (Business days)		EMERGENCY	
	4 day [P4] ☐		1 Business day [E1] ☐
	3 day [P3] ☐		Same Day, Weekend or Statutory holiday [E0] ☐
	2 day [P2] ☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

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Analysis Request

Indicate Filtered (F), Preserved (P) or Filte

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)								
	QUR_RB-M-1_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-2_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-3_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-4_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-5_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-6_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-7_2022-10	2 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-M-8_2022-10	2 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-Li-1_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-Li-2_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-Li-3_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1
	QUR_RB-Li-4_2022-10	1 -Oct-22	-	Tissue	R	R	R	R	R	R								1

Environmental Division
Vancouver
Work Order Reference
VA22C5005

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			F
Released by: Stahmer	Date: Oct-8-2022	Time: 830	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C
Ice pack, JC

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental
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Chain of Custody (COC) / Analytical Request Form

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(lab use only)

COC Number: 15 -

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Contact:	Kala Ivens
Phone:	236-317-4946
	Company address below will appear on the final report
Street:	PO Box 12
City/Province:	Likely, BC
Postal Code:	V0L 1N0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Project Information	
ALS Account # / Quote #:	VA22-MPMC100-002
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Can Dang

Sampler:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

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2 day [P2]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440 Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440 Ti)	Number of Containers
	QUR_RB-Li-5_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Li-6_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Li-7_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Li-8_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-1_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-2_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-3_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-4_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-5_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-6_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-7_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-8_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human drinking water use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)	
Released by: S. Latimer	Date: Oct-[illegible]2022	Time: 830	Received by:	Date:	Time:	Received by:	Date: Time:

12Oct22 10:40am 3°C
ice pack, JC

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Chain of Custody (COC) / Analytical Request Form

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Canada Toll Free: 1 800 668 9878

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Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	kala.ivens@mountpolley.com
Email 2	gabriel.holmes@mountpolley.com
Email 3	pstecko@minnow.ca; kbatchelar@minnow.ca

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☑ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	kala.ivens@mountpolley.com

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	VA22-MPMC100-002	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact: Can Dang	Sampler:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4]	☐	1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		

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Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture Content by Gravimetry (E144)	Mercury in Biota by CVAAS (DRY units, Routine) (E510)	Mercury in Biota by CVAAS (WET units, Routine) (E510A)	Metals in Biota by CRC ICPMS (DRY units, Routine) (E440)	Silver in Biota by CRC ICPMS (DRY units, Routine) (E440.Ag)	Titanium in Biota by CRC ICPMS (DRY units, Routine) (E440.Ti)	Number of Containers
	QUR_RB-O-1_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-O-2_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	~~QUR_RB-O-3_2022-10-~~	~~-Oct-22~~	~~-~~	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	X
	QUR_RB-O-4_2022-10-	1 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-O-5_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-O-6_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	~~QUR_RB-O-7_2022-10-~~	~~-Oct-22~~	X	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	X
	~~QUR_RB-O-8_2022-10-~~	~~-Oct-22~~	X	~~Tissue~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	X
	QUR_RB-M-5X_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Li-5X_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-Ki-5X_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1
	QUR_RB-O-5X_2022-10-	2 -Oct-22	-	Tissue	R	R	R	R	R	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human drinking water use? ☐ YES ☐ NO	If sample is insufficient for regular digestion and analysis, please contact kbatchelar@minnow.ca or pstecko@minnow.ca to discuss analysis options.

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHI
Released by: S. Lahmer	Date: Oct-8-2022	Time: 830	Received by:	Date:	Time:	Received by:

12Oct22 10:40am 3'C

ice pack, JC

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FISH AGING

AAE Laboratory Report 22-29-3

(Finalized July 5, 2022)

1. SAMPLE SET

AAE Tech Services Inc. (AAE) was contracted by Minnow Environmental to provide ageing structure processing and age estimation services for samples collected under Project 22-29, received June 13, 2022. This included 16 pairs of Rainbow Trout otoliths and 16 Longnose Sucker fin ray clips. A full data spreadsheet, including sample ID, structure type, ageing process used, and age estimation results, is provided in the PDF data sheets accompanying this report.

2. AGEING METHOD: OTOLITHS

Sagittal otolith pairs were provided for Rainbow Trout samples in individual enumerated sample envelopes, along with sets of scales as the secondary ageing structure.

All otoliths in this sample set were analyzed using the "Sectioning" method. This method is used primarily for larger otoliths with a deep sulcus or irregular shape. This method was selected only after the "Read Whole" method (non-destructive, often used in smaller otoliths) was found to be inaccurate.

OTOLITH PREPARATION

Otolith pairs were examined under magnification and evaluated for any issues related to structural integrity (e.g. cracks, fractures, chips, pieces missing) and deformation (crystallization, misshapen lobes). One otolith is selected for processing and is embedded in Cold Cure epoxy resin. Samples are allowed to cure for 48 hours before sectioning. Samples are marked for sectioning under magnification using a fine tip marker to identify the nucleus (centre) and section plane (cut edge to be examined) for each otolith. Using the marks as a guide, a Buehler Isomet low speed dual-blade saw is used to cut a single section, with the section plane passing through the nucleus. This surface is then polished with a series of lapping film (30, 12, and 0.3 microns) to improve clarity of the section plane.

To carry out age estimation, an otolith section is submerged in water under magnification with the polished surface facing up.

AGE ESTIMATION

Annuli are counted outward from the nucleus. Checking (false-annuli) is common in many species, including Rainbow Trout in particular within the first 1-3 years of growth. Annuli are assessed for density (contrast between summer and winter growth), clarity (ability to differentiate individual annuli) and continuity (e.g. segmentation, merging, fading). Photographs under magnification are taken of each sample for reference and revision. Ages are recorded with a Confidence Index (CI) based on the condition of the otolith, annuli assessment, and the confidence of the reader in the age recorded, as described in Table 1.

Table 1. Confidence Index (CI) table; applied to each age estimate, reflecting the reader's confidence in the age recorded.

Confidence Index (CI)	Abbreviation	Qualitative Meaning	Quantitative Meaning
Good	G	Pattern very clear with no interpretational problems	Reader would always get the same age
Fairly Good	FG	Pattern is clear with few easy interpretational problems	Reader would get the same age most of the time for fish <20 years
Fair	F	Pattern is fairly clear with some areas presenting easy and moderate interpretational problems	Reader would be within one year most of the time for fish <20 years
Fairly Poor	FP	Pattern is fairly unclear, presenting a number of difficult interpretational problems	Reader would be within 2-3 years for fish <20 years
Poor	P	Pattern is very unclear, presenting significant interpretational problems	Reader has little confidence in repeatability of age

3. AGEING METHOD: FIN RAYS

Fin ray clips for Longnose Sucker samples were provided in individual enumerated sample envelopes, along with sets of scales as the secondary ageing structure.

Fin rays are often used instead of otoliths for age estimation (e.g. non-lethal sampling). Fin rays are the preferred ageing structure in instances where otolith samples are not available; the accuracy and precision of age estimation from fin clips or dorsal spines is much higher than scales. When sampling fish species known to have a consistently low-quality otolith (e.g. Northern Pike, Catostomidae spp.), fin rays are the preferred structure with which to derive age estimates. When possible, AAE should be consulted prior to sample collection or shipment to determine the ideal ageing structure for a particular fish species.

All fin ray clips in this sample set were processed and analyzed using the "Sectioning" method, similar to that used for the otoliths.

FIN RAY PREPARATION

Fin rays are embedded in Cold Cure epoxy resin to increase the structural integrity of the sample and prevent damage or degradation of the sample during processing. Samples are cured for 48 hours before sectioning. A fine-tip marker is used to mark a cut line on the sample, following the base of the fin rays and perpendicular to the primary (1st) ray. A Buehler Isomet low speed single-blade saw is used to cut three successive sections beginning at the marked base of the rays. Three sections (minimum) are taken to compensate for misalignment or staggering of the rays or spines, due to shifting during the embedding process, or the inherent shape of the structure; the first section may not pass through the base of all three (or more) rays. Each section is enumerated by the order of cut (I, II, III, etc.) directly onto the sample using a fine-tip pencil. The analysis of multiple spines enables age verification and improves the reliability of the age estimate, especially in the case of heavy checking or faint/thin annuli.

The three sections are submerged in a dish of water under magnification with the ageing surface facing up. Orientation is matched across all three sections to ensure accurate comparison.

AGE ESTIMATION

Annuli are counted out from the nucleus (center ring) in the first cut section, followed by the second and third; age estimation is based on analysis of all available sections. Photographs under magnification are taken of each sample for reference and revision. Ages are recorded with a Confidence Index (CI) based on the condition of the fin ray section, and the confidence of the reader in the age recorded (Table 1).

4. AGEING RESULTS

Age estimates were provided in July 2022 based on the otolith, fin ray, and scale samples provided.

Rainbow Trout age estimates ranged from 3 to 6 years of age, with a modal age of 4 years. CI values were fairly high, with the majority of samples recorded as either F or FG.

Longnose Sucker age estimates ranged from 5 to 13 years of age, with a modal age of 7 years. CI values were also fairly high, with the majority of samples recorded as either F or FG. Noted difficulties included checking, as well as the outer annuli of older fish becoming faint.

Samples were photographed under magnification for reference and revision. Representative photographs of each species are presented in Section 6.

5. QA/QC PROTOCOL

AAE's QA/QC protocols have been developed in consultation with Fisheries and Oceans Canada ageing experts to ensure accurate age estimations while addressing potential issues related to confidence index, reader bias, and human error. For this project, due to the low number of samples to be aged, 50% of each species were aged for QA/QC.

6. REPRESENTATIVE SAMPLE PHOTOGRAPHS

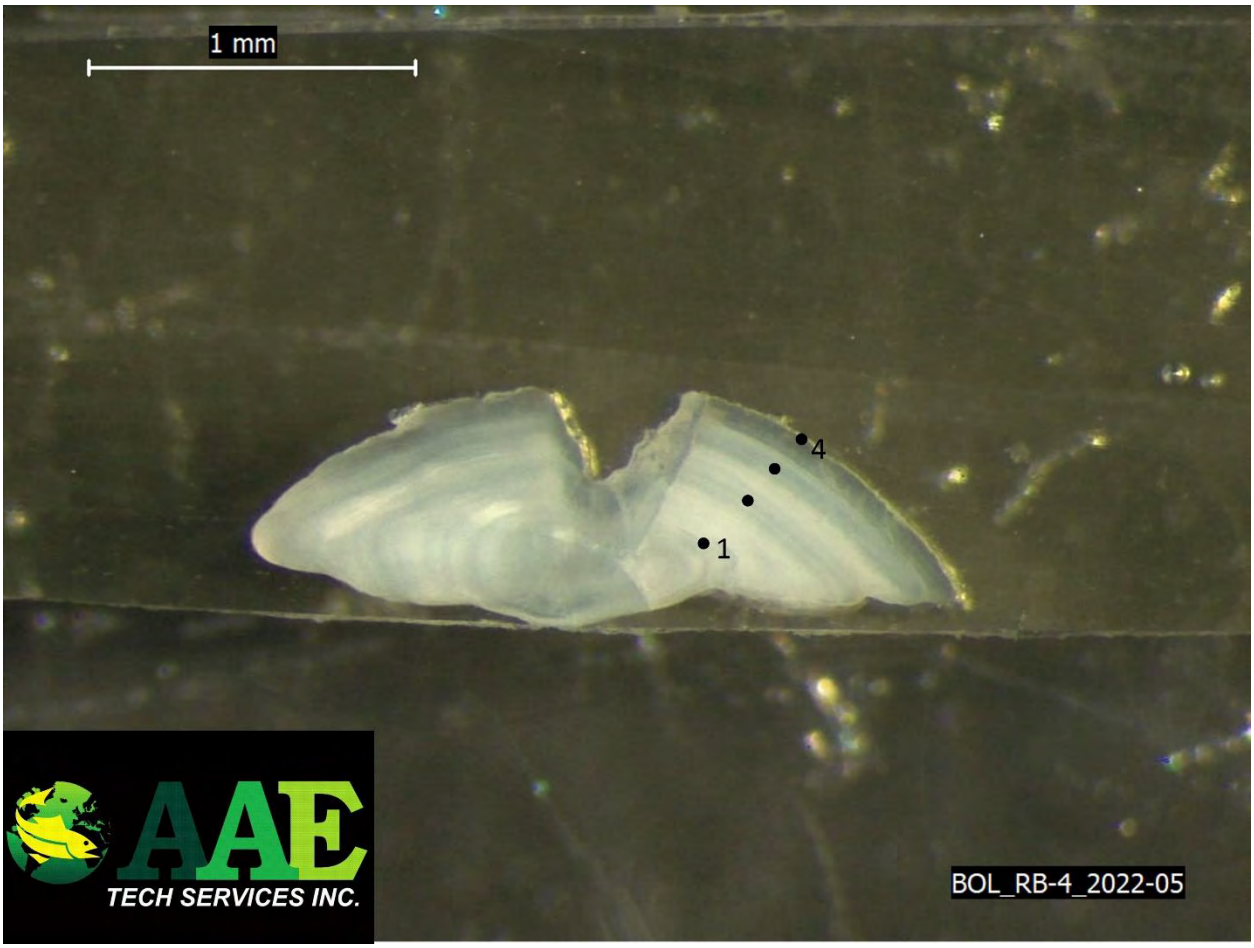

Figure 1. Rainbow Trout (sagittal otolith), showing counted annuli for age estimate.



Figure 2. Longnose Sucker (fin rays), showing counted annuli for age estimate.

57 First Ave
La Salle, Manitoba
R0G 0A2

AAE Fish Aging, Polley and BootJack Lake, May 2022

Sample ID	Species	Date Sampled	Plus Growth	Ageing Structure	Ageing Method	Primary Ager	Age Estimate	CI	QA/QC Ager	Age Estimate	CI	Final Age
POL_RB-1_2022-05	Rainbow Trout	28-May-22	-	Otolith	Section	JL	4	F	NF	4	F	**4**
POL_RB-2_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	4	F				**4**
POL_RB-3_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	4	F	NF	5	F	**4**
POL_RB-4_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	4	F				**4**
POL_RB-5_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	3	FG	NF	3	FG	**3**
POL_RB-6_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	4	F				**4**
POL_RB-7_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	3	F	NF	3	F	**3**
POL_RB-8_2022-05	Rainbow Trout	29-May-22	-	Otolith	Section	JL	4	F				**4**
BOL_RB-1_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	5	FP	NF	5	F	**5**
BOL_RB-2_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	6	FP				**6**
BOL_RB-3_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	3	FG	NF	3	F	**3**
BOL_RB-4_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	4	FG				**4**
BOL_RB-5_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	4	F	NF	4	FG	**4**
BOL_RB-6_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	3	F				**3**
BOL_RB-7_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	3	F	NF	3	F	**3**
BOL_RB-8_2022-05	Rainbow Trout	30-May-22	-	Otolith	Section	JL	5	F				**5**
POL_LSU-1_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	7	FG	NF	7	FG	**7**
POL_LSU-2_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	13	FP				**13**
POL_LSU-3_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	8	F	NF	8	F	**8**
POL_LSU-4_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	9	F				**9**
POL_LSU-5_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	5	FG	NF	5	F	**5**
POL_LSU-6_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	5	FG				**5**
POL_LSU-7_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	7	FG	NF	7	F	**7**
POL_LSU-8_2022-05	Longnose Sucker	28-May-22	-	Pectoral Fin	Section	JL	7	F				**7**
BOL_LSU-1_2022-05	Longnose Sucker	30-May-22	-	Pectoral Fin	Section	JL	7	F	NF	7	F	**7**
BOL_LSU-2_2022-05	Longnose Sucker	30-May-22	-	Pectoral Fin	Section	JL	12	FP				**12**
BOL_LSU-3_2022-05	Longnose Sucker	30-May-22	-	Pectoral Fin	Section	JL	6	F	NF	6	FG	**6**
BOL_LSU-4_2022-05	Longnose Sucker	30-May-22	-	Pectoral Fin	Section	JL	10	F				**10**
BOL_LSU-5_2022-05	Longnose Sucker	31-May-22	-	Pectoral Fin	Section	JL	12	FP	NF	12	FP	**12**
BOL_LSU-6_2022-05	Longnose Sucker	31-May-22	-	Pectoral Fin	Section	JL	9	F				**9**
BOL_LSU-7_2022-05	Longnose Sucker	31-May-22	-	Pectoral Fin	Section	JL	6	F	NF	6	F	**6**
BOL_LSU-8_2022-05	Longnose Sucker	31-May-22	-	Pectoral Fin	Section	JL	9	FP				**9**

FISH AGING

AAE Laboratory Report 22-29-8

(Finalized November 10, 2022)

1. SAMPLE SET

AAE Tech Services Inc. (AAE) was contracted by Minnow Environmental to provide ageing structure processing and age estimation services for samples collected under Project 22-29, received October 18, 2022. This included 16 Northern Pikeminnow heads, 13 pairs of Peamouth Chub otoliths, 3 sets of Peamouth Chub scales, 14 pairs of Lake Trout otoliths, 2 sets of Lake Trout scales, and 8 pairs of Rainbow Trout otoliths. A full data spreadsheet, including sample ID, structure type, ageing process used, and age estimation results, is provided in the data sheets accompanying this report.

2. AGEING METHOD: OTOLITHS

Lapillus otolith pairs were provided for Peamouth Chub, and sagittal otolith pairs were provided for Lake Trout and Rainbow Trout in individual enumerated sample envelopes, along with sets of scales as the secondary ageing structure, for a total of 51 samples. Along with scales as the secondary ageing structure, frozen heads were provided for Northern Pikeminnow samples. The lapillus otoliths were extracted and placed in individual enumerated sample envelopes.

All otoliths in this sample set were analyzed using the "Sectioning" method. This method is used primarily for larger otoliths with a deep sulcus or irregular shape. This method was selected only after the "Read Whole" method (non-destructive, often used in smaller otoliths) was found to be inaccurate.

OTOLITH PREPARATION

Otolith pairs were examined under magnification and evaluated for any issues related to structural integrity (e.g. cracks, fractures, chips, pieces missing) and deformation (crystallization, misshapen lobes). One otolith is selected for processing and is embedded in Cold Cure epoxy resin. Samples are allowed to cure for 48 hours before sectioning. Samples are marked for sectioning under magnification using a fine tip marker to identify the nucleus (centre) and section plane (cut edge to be examined) for each otolith. Using the marks as a guide, a Buehler Isomet low speed dual-blade saw is used to cut a single section, with the section plane passing through the nucleus. This surface is then polished with a series of lapping film (30, 12, and 0.3 microns) to improve clarity of the section plane.

To carry out age estimation, an otolith section is submerged in water under magnification with the polished surface facing up.

AGE ESTIMATION

Annuli are counted outward from the nucleus. Checking (false-annuli) is common in many species, including Rainbow Trout, particularly within the first 1-3 years of growth. Annuli are assessed for density (contrast between summer and winter growth), clarity (ability to differentiate individual annuli) and continuity (e.g. segmentation, merging, fading). Photographs under magnification are taken of each sample for reference and revision. Ages are recorded with a Confidence Index (CI) based on the condition of the otolith, annuli assessment, and the confidence of the reader in the age recorded, as described in Table 1.

Table 1. Confidence Index (CI) table; applied to each age estimate, reflecting the reader's confidence in the age recorded.

Confidence Index (CI)	Abbreviation	Qualitative Meaning	Quantitative Meaning
Good	G	Pattern very clear with no interpretational problems	Reader would always get the same age
Fairly Good	FG	Pattern is clear with few easy interpretational problems	Reader would get the same age most of the time for fish <20 years
Fair	F	Pattern is fairly clear with some areas presenting easy and moderate interpretational problems	Reader would be within one year most of the time for fish <20 years
Fairly Poor	FP	Pattern is fairly unclear, presenting a number of difficult interpretational problems	Reader would be within 2-3 years for fish <20 years
Poor	P	Pattern is very unclear, presenting significant interpretational problems	Reader has little confidence in repeatability of age

3. AGEING METHOD: SCALES

Scales were used to age 3 Peamouth Chub samples. One, QUL-NGC_PCC-1, where the wrong otolith was provided, and the remaining two, QUL-NGC_PCC-2 and QUL-NGC_PCC-3, where no otoliths were found within the sample envelope.

Scales were also used to age 2 Lake Trout samples. QUL-NCP_LT-5, where scales were indicated as the only structure provided, and QUL-NCP_LT-8, where no otoliths were found within the sample envelope.

SCALE PREPARATION

Scales were submerged in water and examined under magnification. Individual scales were isolated, examined for completeness and placed on a standard microscope slide. Scales were cleaned of excess tissue as much as possible without damaging the structure. Between six and twelve scales were mounted and pressed between two microscope slides and examined under magnification.

AGE ESTIMATION

Annuli were identified as a zone of crowded circuli, particularly around the central part of the scale, and were associated with crossovers of circuli.

4. AGEING RESULTS

Age estimates were provided in November 2022 based on the otolith and scale samples provided.

Northern Pikeminnow age estimates ranged from 2 to 6 years of age, with a modal age of 2 years. CI values were fair, with a few samples recorded as FP, but most of the samples recorded as F.

Peamouth Chub age estimates ranged from 3 to 14 years of age, with a bimodal age of 8 and 9 years. CI values were fair, with a few samples recorded as FP, but most of the samples recorded as F.

Lake Trout age estimates ranged from 2 to 9 years of age, with a multimodal age of 3, 10, and 11 years. CI values were fair, with a few samples recorded as FP, but most of the samples recorded as F.

Rainbow Trout age estimates ranged from 2 to 5 years of age, with a bimodal age of 2 and 5 years. CI values were fairly high, with one sample recorded as FG and the remainder recorded as F.

Samples were photographed under magnification for reference and revision. Representative photographs of each species are presented in Section 6.

5. QA/QC PROTOCOL

AAE's QA/QC protocols have been developed in consultation with Fisheries and Oceans Canada ageing experts to ensure accurate age estimations while addressing potential issues related to confidence index, reader bias, and human error. For this project 25% of samples were aged for QA/QC.

6. REPRESENTATIVE SAMPLE PHOTOGRAPHS



Figure 1. Northern Pikeminnow (lapillus otolith), showing counted annuli for age estimate.



Figure 2. Peamouth Chub (lapillus otolith), showing counted annuli for age estimate.



Figure 3. Lake Trout (sagittal otolith), showing counted annuli for age estimate.

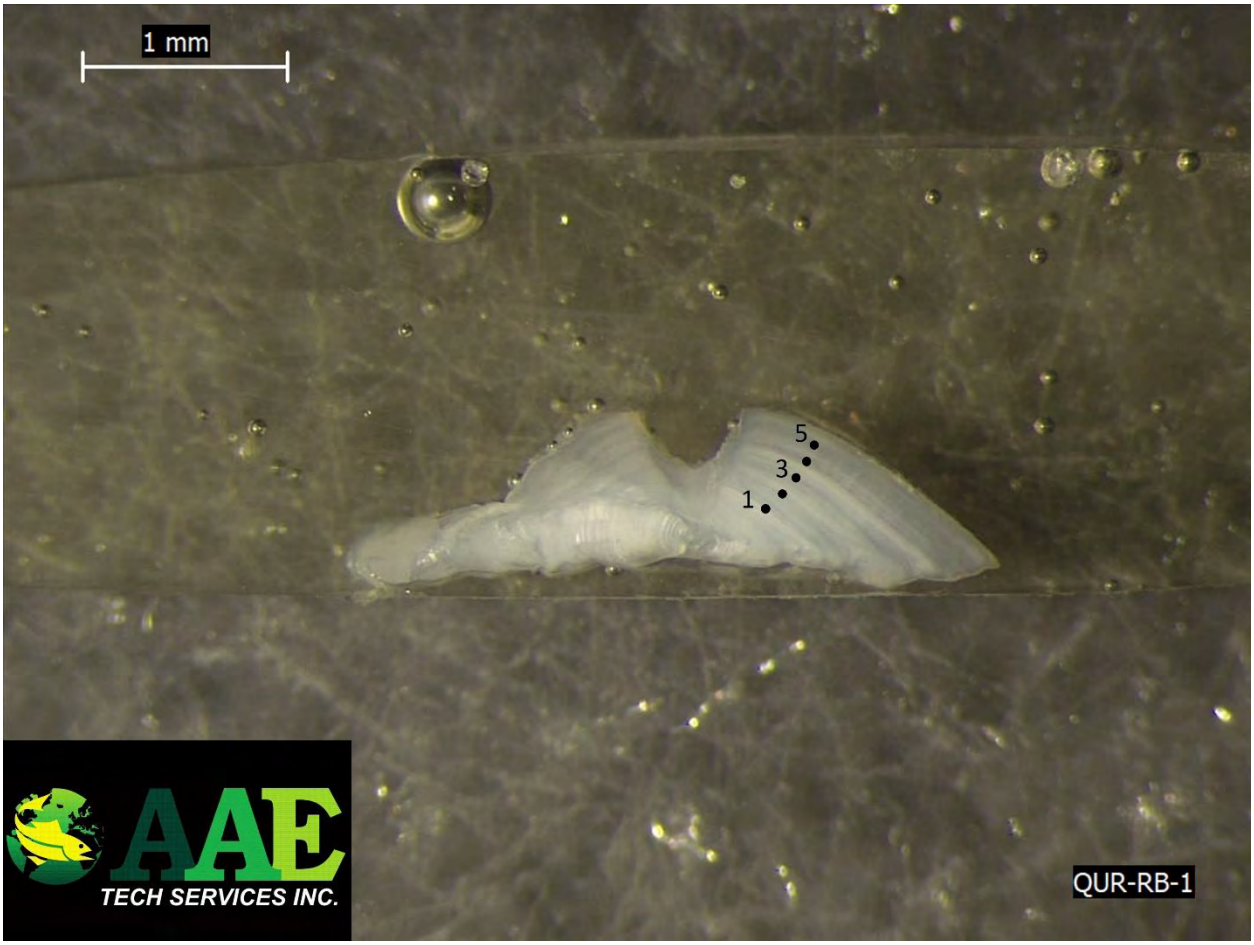

Figure 4. Rainbow Trout (sagittal otolith), showing counted annuli for age estimate.

57 First Ave
La Salle, Manitoba
R0G 0A2

AAE Fish Aging, Quesnel Lake and Quesnel River, October 2022

Sample ID	Date	Species	Plus Growth	Ageing Structure	Ageing Method	Primary Ager	Age Estimate	CI	QA/QC Ager	Age Estimate	CI	Final Age	Notes
QUL-NHC_NSC-1	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	6	F	JL	6	F	**6**	-
QUL-NHC_NSC-2	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	5	F				**5**	-
QUL-NHC_NSC-3	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	4	FP				**4**	-
QUL-NHC_NSC-4	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	3	F				**3**	-
QUL-NHC_NSC-5	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	3	F	JL	3	F	**3**	-
QUL-NHC_NSC-6	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	5	F				**5**	-
QUL-NHC_NSC-7	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	F				**2**	-
QUL-NHC_NSC-8	04-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	F				**2**	-
QUL-NGC_NSC-1	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	3	F	JL	3	F	**3**	-
QUL-NGC_NSC-2	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	F				**2**	-
QUL-NGC_NSC-3	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	3	F				**3**	-
QUL-NGC_NSC-4	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	FP				**2**	-
QUL-NGC_NSC-5	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	F	JL	2	F	**2**	-
QUL-NGC_NSC-6	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	3	FP				**3**	-
QUL-NGC_NSC-7	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	4	FP				**4**	-
QUL-NGC_NSC-8	06-Oct-22	Northern Pikeminnow	+	Otolith	Section	NC	2	F				**2**	-
QUL-NHC_PCC-1	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	9	F	JL	9	F	**9**	-
QUL-NHC_PCC-2	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	8	FP				**8**	-
QUL-NHC_PCC-3	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	9	FP				**9**	-
QUL-NHC_PCC-4	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	7	F				**7**	-
QUL-NHC_PCC-5	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	8	F	JL	8	F	**8**	-
QUL-NHC_PCC-6	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	10	F				**10**	-
QUL-NHC_PCC-7	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	6	F				**6**	-
QUL-NHC_PCC-8	04-Oct-22	Peamouth Chub	+	Otolith	Section	NC	8	F				**8**	-
QUL-NGC_PCC-1	06-Oct-22	Peamouth Chub	+	Scales	Whole	NC	3	F	JL	3	F	**3**	Wrong otolith
QUL-NGC_PCC-2	06-Oct-22	Peamouth Chub	+	Scales	Whole	NC	4	FP				**4**	No otoliths
QUL-NGC_PCC-3	06-Oct-22	Peamouth Chub	+	Scales	Whole	NC	4	F				**4**	No otoliths
QUL-NGC_PCC-4	06-Oct-22	Peamouth Chub	+	Otolith	Section	NC	6	F				**6**	-
QUL-NGC_PCC-5	06-Oct-22	Peamouth Chub	+	Otolith	Section	NC	14	FP	JL	13	FP	**14**	-

57 First Ave
La Salle, Manitoba
R0G 0A2

AAE Fish Aging, Quesnel Lake and Quesnel River, October 2022

Sample ID	Date	Species	Plus Growth	Ageing Structure	Ageing Method	Primary Ager	Age Estimate	CI	QA/QC Ager	Age Estimate	CI	Final Age	Notes
QUL-NGC_PCC-6	06-Oct-22	Peamouth Chub	+	Otolith	Section	NC	5	F				**5**	-
QUL-NGC_PCC-7	06-Oct-22	Peamouth Chub	+	Otolith	Section	NC	9	F				**9**	-
QUL-NGC_PCC-8	06-Oct-22	Peamouth Chub	+	Otolith	Section	NC	5	F				**5**	-
QUL-NCP_LT-1	03-Oct-22	Lake Trout	+	Otolith	Section	NC	10	F	JL	10	F	**10**	-
QUL-NCP_LT-2	03-Oct-22	Lake Trout	+	Otolith	Section	NC	3	F				**3**	-
QUL-NCP_LT-3	03-Oct-22	Lake Trout	+	Otolith	Section	NC	11	F				**11**	-
QUL-NCP_LT-4	03-Oct-22	Lake Trout	+	Otolith	Section	NC	4	F				**4**	-
QUL-NCP_LT-5	04-Oct-22	Lake Trout	+	Scales	Whole	NC	3	F	JL	3	F	**3**	-
QUL-NCP_LT-6	05-Oct-22	Lake Trout	+	Otolith	Section	NC	15	FP				**15**	-
QUL-NCP_LT-7	06-Oct-22	Lake Trout	+	Otolith	Section	NC	5	F				**5**	-
QUL-NCP_LT-8	06-Oct-22	Lake Trout	+	Scales	Whole	NC	2	F				**2**	No otoliths
QUL-EAA_LT-1	04-Oct-22	Lake Trout	+	Otolith	Section	NC	11	FP	JL	11	FP	**11**	-
QUL-EAA_LT-2	04-Oct-22	Lake Trout	+	Otolith	Section	NC	19	F				**19**	-
QUL-EAA_LT-3	04-Oct-22	Lake Trout	+	Otolith	Section	NC	10	F				**10**	-
QUL-EAA_LT-4	04-Oct-22	Lake Trout	+	Otolith	Section	NC	8	F				**8**	-
QUL-EAA_LT-5	04-Oct-22	Lake Trout	+	Otolith	Section	NC	12	F	JL	12	F	**12**	-
QUL-EAA_LT-6	04-Oct-22	Lake Trout	+	Otolith	Section	NC	18	FP				**18**	-
QUL-EAA_LT-7	04-Oct-22	Lake Trout	+	Otolith	Section	NC	7	F				**7**	-
QUL-EAA_LT-8	04-Oct-22	Lake Trout	+	Otolith	Section	NC	14	FP				**14**	-
QUR_RB-1	01-Oct-22	Rainbow Trout	+	Otolith	Section	NC	5	F	JL	5	F	**5**	-
QUR_RB-2	01-Oct-22	Rainbow Trout	+	Otolith	Section	NC	3	F				**3**	-
QUR_RB-3	01-Oct-22	Rainbow Trout	+	Otolith	Section	NC	2	F				**2**	-
QUR_RB-4	01-Oct-22	Rainbow Trout	+	Otolith	Section	NC	3	FG				**3**	-
QUR_RB-5	02-Oct-22	Rainbow Trout	+	Otolith	Section	NC	5	F	JL	5	F	**5**	-
QUR_RB-6	02-Oct-22	Rainbow Trout	+	Otolith	Section	NC	2	F				**2**	-
QUR_RB-7	02-Oct-22	Rainbow Trout	+	Otolith	Section	NC	5	F				**5**	-
QUR_RB-8	02-Oct-22	Rainbow Trout	+	Otolith	Section	NC	2	F				**2**	-

APPENDIX 2-6: Hazeltine Creek Monitoring Technical Memorandum

minnow environmental inc.
A Trinity Consultants Company
210-1175 Cook Street
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Tel: (250) 595-1627

Technical Memorandum

Date: October 20, 2023

To: Gabriel Holmes and Don Parsons, Mount Polley Mining Corporation

From: Katharina Batchelar and Pierre Stecko, Minnow Environmental Inc.

CC: Lee Nikl, Drew Kaiser, and Samantha Lundquist, WSP

RE: Summary of Hazeltine Creek Water Quality, Sediment Quality, and Aquatic Life Data, 2015 to present

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The purpose of this memorandum is to satisfy part of the data request outlined in the Information Request Table (IRT) provided by the British Columbia Ministry of Environment and Climate Change Strategy (ENV) as part of the Springer Pit Expansion Application process for the Mount Polley Mining Corporation (MPMC). The IRT outlined a request for a summary of relevant water quality, sediment quality, and periphyton and benthic invertebrate data (community and productivity, tissue quality) from the receiving environment, including Hazeltine Creek, as detailed below:

1. "*Summarize all receiving environment data including Hazeltine Creek since 2015 to present, and compare it with reference, pre-breach/baseline data. For parameters that require other parameters to calculate guideline, please provide those parameters used to calculate the guideline in the table foot note. For example (e.g., Dissolved copper) provide the pH, DO, and Hardness used to calculate this guideline. When presenting graphs, please indicate the applicable water quality guideline on the graph itself. If the chronic water quality guideline is not applicable to any sampling locations due to monthly sampling, the results still need to be compared with the chronic guideline. The raw data should be provided in an appendix.*"
2. *"Summarize all relevant receiving environment sediment quality data including Hazeltine Creek since 2015 to present, and compare it with reference, pre-breach/baseline data. Also provide all sediment toxicity data available to present in comparison with reference condition."*

3. *"Summarize all relevant periphyton and benthic invertebrate, plankton community measures from the receiving environment including Hazeltine Creek since 2015 to present, and compare it with reference, pre-breach/baseline data. Include all available tissue quality data to present from the applicable receiving environment locations."*

This memorandum serves to specifically address the request for Hazeltine Creek data within the IRT by providing a summary of compiled water, sediment, periphyton, and benthic invertebrate monitoring results from Hazeltine Creek, from 2015 to present. The data are presented both in graphical format, with comparison to British Columbia guidelines, reference, and pre-breach/baseline data where applicable, and in tabular format as raw data. The results compiled within this memorandum summarize those originally presented within the 2021 and 2022 Mount Polley Mine Comprehensive Environmental Monitoring Program – Sediment and Aquatic Life reports (Minnow 2022, 2023), except for water quality data. Routine water quality data summarized herein were originally presented within the Annual Environmental Reports for the Mount Polley Mine from 2015 to present MPMC (2016, 2017, 2018, 2019a, 2020, 2021, 2022, 2023). Data are only presented in this memorandum for monitoring stations and areas that have been monitored routinely from 2015 to present (i.e., routine monitoring areas identified within the Comprehensive Environmental Monitoring Plan [CEMP]; MPMC 2019b).

Water Quality

Water quality data collected routinely by MPMC from 2015 to present (i.e., over the period requested within the IRT) are presented in this memorandum. The plots provided herein for dissolved and total water quality analytes (Appendix Figures A.1 and A.2, respectively) include available data from Hazeltine Creek (and Edney Creek reference) for 2015 to present with graphical comparisons to British Columbia Water Quality Guidelines (BCWQG; BCMOECCS 2021, 2023). Graphical results are presented for dissolved and total concentrations of primary and secondary analytes only, which are constituents that have been previously identified as being indicative of a mine influence on the receiving environment (Minnow 2020). Appendix Table A.1 presents the tabulated raw data associated with the plots for all analytes reported by the laboratory. For short-term and long-term BCWQG guidelines that are condition specific, guideline values were calculated for each monitoring station and event. Appendix Table A.2 presents the modifying factors used in calculation of the condition-specific guidelines (i.e., hardness dependent or based on the Biotic Ligand Model[1]) and the resulting guideline value calculated for each monitoring station and event. Where data exist for multiple monitoring stations

[1] Dissolved copper guidelines were calculated using concurrent field pH, hardness and dissolved organic carbon and looked up using the calculation provided here: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/copper/cu_look-up_table.xlsm

on a given date (i.e., multiple guideline values were calculated), the plots display the most conservative (i.e., lowest) guideline values calculated for a given date. Graphical and tabular results are focused on exposed areas of Hazeltine Creek that have been monitored routinely as part of the CEMP: HAC-05a, HAC-08, HAC-13, HAC-14, with comparison to an associated reference area (lower Edney Creek; W10).

Interpretation and discussion of the water quality results for each monitoring year from 2015 to present are contained in the Annual Environmental Reports for the Mount Polley Mine (MPMC 2016, 2017, 2018, 2019a, 2020, 2021, 2022, 2023), and, therefore, are not detailed here.

Sediment Quality

Sediment quality has been monitored consistently in Hazeltine Creek (and reference) since the initiation of the CEMP in 2018. Upper Hazeltine Creek (and associated reference; upper Edney Creek) and lower Hazeltine Creek (and associated reference; lower Edney Creek) have been monitored annually since 2018 (MPMC 2019b), with select pre-breach monitoring completed prior to 2014. The most recent results available for upper and lower Hazeltine Creek (and associated reference areas) are from 2022 (Minnow 2023). The plots provided herein for sediment quality (Appendix Figures B.1 and B.2) include available data from 2015 to 2022[2] with graphical comparisons to the Working Sediment Quality Guideline (WSQG; BCMOECCS 2021), and reference/pre-breach 95th percentile values and statistical comparisons to reference among years. Appendix Table B.1 presents the tabulated raw data associated with the plots and includes results for all analytes reported by the laboratory. Appendix Table B.2 presents tabulated raw baseline and pre-breach data from upper and lower Hazeltine Creek that were used in calculation of the pre-breach 95th percentile values used for data screening. Graphical results are presented for primary and secondary analytes only, which are constituents that have been previously identified as being indicative of a mine influence on the receiving environment (Minnow 2020). Statistical comparisons within the plots are limited to constituents identified as Analytes of Interest in Minnow (2023) to maintain consistency with the interpretation presented in the most recent report (Minnow 2023). Analytes of interest were identified for each monitoring area as primary or secondary analytes with mean concentrations in sediment in 2023 that exceeded all the following criteria: 1) the WSQG, 2) the associated reference 95th percentile value, and 3) the associated pre-breach 95th percentile value. See Minnow (2022, 2023) for detailed statistical methods and outputs. Graphical and tabular results are focused on sampling areas Hazeltine Creek that have been monitored routinely as part of the CEMP over this period: upper Hazeltine Creek (HAC-U) and an associated reference area (upper Edney Creek; EDC-U),

[2] Although the IRT request was for inclusion of data from 2015 to present, finalized data from 2023 are not yet available. Therefore, data from 2015 to 2022 are presented (the most recent finalized data available).

and lower Hazeltine Creek (HAC-D) and an associated reference area (lower Edney Creek; EDC-D).

Brief summaries of sediment quality results for upper and lower Hazeltine Creek are provided below and are focused on the most recent year of monitoring. See Minnow (2023) for detailed results and interpretation.

Sediment quality monitoring completed in upper and lower Hazeltine Creek in 2022 continued to document the physical and chemical characteristics of sediments from this erosional habitat. Sediments were characterized by concentrations of several analytes that were greater than reference/pre-breach concentrations and WSQG values: copper and selenium in upper Hazeltine Creek, and copper and iron in lower Hazeltine Creek. In both upper and lower Hazeltine Creek in 2022, copper was the most substantially elevated analyte with concentrations higher than the upper WSQG, and higher than reference/pre-breach concentrations.

In upper Hazeltine Creek, mean concentrations of copper and selenium in sediments were significantly higher in 2022 than previously observed (2018 to 2021), when evaluated relative to reference. For both analytes, this change was driven in part by a significant decrease in sediment copper and selenium concentrations at the reference area in 2022 compared to prior years (except 2020 which was similar to 2022). When temporal changes in copper and selenium concentrations from upper Hazeltine Creek sediments were evaluated within the exposed area only (i.e., not evaluated relative to temporal changes at the reference area), copper concentrations were unchanged from 2019 to 2022, and selenium concentrations in 2022 were significantly higher than 2018 to 2020 results (Minnow 2023). The observed increase in selenium in upper Hazeltine Creek sediments in 2022 compared to 2020 when evaluated within the upper Hazeltine Creek area only (i.e., not relative to reference) was associated with higher total organic carbon (TOC) content and lower sand content of these sediments, with TOC significantly higher in 2022 than in 2018 and 2020, relative to reference. Sediment sampling in these erosional habitats is opportunistic due to the limited availability of fine sediments in some monitoring years. This often results in the relocation of sampling locations among years in both exposed and reference areas which can be unavoidable (i.e., sediment is collected where it is present rather than prescribed locations where sediment may be unavailable). The necessity for opportunistic sampling can also result in temporal variability in the sediment physical characteristics to some extent, with sediments having higher TOC content and lower sand content in some years compared to others, depending on sediment availability. This has been illustrated in the sediment quality results for upper Hazeltine Creek which have showed temporal variability in physical characteristics (i.e., TOC content and particle size) that are associated with changes

in sediment chemistry results. The variability in sediment physical characteristics may stabilize as sediment accumulation continues to occur in this remediated system.

In lower Hazeltine Creek, mean sediment concentrations of copper and iron in 2022 were similar to or lower than those observed in 2018, when evaluated relative to reference, indicating sediment concentrations of these analytes have not increased significantly from 2018 to 2022. Similarly, the TOC content of lower Hazeltine Creek sediments has remained unchanged relative to reference from 2018 to 2022. Overall, the results from sediment quality monitoring in 2022 continued to indicate that changes in concentrations of sediment quality parameters (e.g., selenium) are related to variability in sediment physical characteristics (i.e., TOC and sand content) that are driven by the necessity for opportunistic sampling due to limited availability of fine sediments in some monitoring years.

Periphyton Community and Productivity

Periphyton community and productivity (chlorophyll-a and Ash-Free Dry Mass) have been monitored consistently in Hazeltine Creek since the initiation of the CEMP in 2018. Upper Hazeltine Creek (and associated reference; upper Edney Creek) has been monitored annually since 2018 while lower Hazeltine Creek (and associated reference; lower Edney Creek) has been monitored biennially (i.e., every second year) since 2019 (MPMC 2019b). The most recent results available for upper Hazeltine Creek areas are from 2022, and the most recent results available for lower Hazeltine Creek are from 2021 (Minnow 2022, 2023). The plots provided herein for periphyton productivity (Appendix Figures C.1 and C.2) and periphyton community (Appendix Figures C.3 and C.4) include available data from 2015 to 2022[3] with graphical and statistical comparisons to reference and pre-breach (where applicable) and among years. See Minnow (2022, 2023) for detailed statistical methods and outputs. Appendix Table C.1 presents the tabulated raw data associated with the plots. Graphical and tabular results are focused on sampling areas Hazeltine Creek that have been monitored routinely as part of the CEMP over this period: upper Hazeltine Creek (HAC-R1, HAC-U) and an associated upper Edney Creek reference area (EDC-U), and lower Hazeltine Creek (HAC-D) and an associated lower Edney Creek reference area (EDC-D).

Brief summaries of periphyton community and productivity results for upper and lower Hazeltine Creek areas are provided below and are focused on the most recent year of monitoring. See Minnow (2022, 2023) for detailed results and interpretation.

[3] Although the IRT request was for inclusion of data from 2015 to present, finalized data from 2023 are not yet available. Therefore, data from 2015 to 2022 are presented (the most recent finalized data available).

Mean periphyton productivity (measured as chlorophyll-a; mg/m²) in upper Hazeltine Creek in 2022 was below the BCWQG and above the threshold for moderately enriched streams. Primary productivity as measured by both chlorophyll-a and AFDM at both upper Hazeltine Creek areas (HAC-R1 [Reach 1], HAC-U [Reach 2]) has been similar to or significantly higher than reference since 2018, and higher than pre-breach since 2019 at HAC-R1 and since 2021 at HAC-U. The periphyton community of upper Hazeltine Creek in 2022 was characterized by taxon richness, Simpson's Evenness and Diversity, and diatom richness that were similar to or higher than the reference area. Periphyton densities in 2022 at HAC-R1 and HAC-U were similar to and lower than reference, respectively, but were temporally stable at HAC-U despite being lower than reference in 2022. The similarity (or exceedance) of the primary periphyton community metrics (density, richness, Simpson's Evenness, and Simpson's Diversity) in upper Hazeltine Creek compared to the reference area in most years and/or temporal stability of these metrics are indicative of relatively stable periphyton communities at the remediated upper Hazeltine Creek areas and good periphyton community health.

Mean periphyton productivity (measured as chlorophyll-a; mg/m²) in lower Hazeltine Creek in 2021 was below the BCWQG and below the threshold indicative of moderate enriched streams. Primary productivity as measured by both chlorophyll-a and AFDM in lower Hazeltine Creek decreased significantly between 2019 and 2021, to values that were lower than and similar to reference in 2021, respectively, but that remained higher than in 2017. The periphyton community at HAC-D was characterized in 2019 and 2021 by total density higher than reference, Simpson's Evenness and Diversity similar to reference, and significantly lower total and diatom richness than the reference area. The decrease in productivity between 2019 and 2021, lower taxonomic richness compared to reference in 2019 and 2021, and lower diatom richness in 2021 compared to reference is indicative of ongoing periphyton community recovery. This is consistent with the disturbance of this area for channel remediation works just weeks prior to conducting periphyton monitoring in 2021.

Benthic Invertebrate Community and Productivity

Benthic invertebrate community and productivity (biomass) have been monitored consistently in Hazeltine Creek (and reference) since the initiation of the CEMP in 2018. Upper Hazeltine Creek (and associated reference; upper Edney Creek) has been monitored annually since 2018 while lower Hazeltine Creek (and associated reference; lower Edney Creek) has been monitored biennially (i.e., every second year) since 2017 (prior to CEMP inception; MPMC 2019b). The most recent results available for upper Hazeltine Creek areas are from 2022, and the most recent results available for lower Hazeltine Creek are from 2021 (Minnow 2022, 2023). The plots provided herein for benthic invertebrate productivity

(Appendix Figures D.1 and D.2) and benthic invertebrate community (Appendix Figures D.3 and D.4) include available data from 2015 to 2022[4] with graphical and statistical comparisons to reference and pre-breach (where applicable) and among years. See Minnow (2022, 2023) for detailed statistical methods and outputs. Appendix Table D.1 presents the tabulated raw data associated with the plots[5]. Graphical and tabular results are focused on sampling areas Hazeltine Creek that have been monitored routinely as part of the CEMP over this period: upper Hazeltine Creek (HAC-R1, HAC-U) and an associated upper Edney Creek reference area (EDC-U), and lower Hazeltine Creek (HAC-D) and an associated lower Edney Creek reference area (EDC-D).

Brief summaries of benthic invertebrate community and productivity results for upper and lower Hazeltine Creek areas are provided below and are focused on the most recent year of monitoring. See Minnow (2022, 2023) for detailed results and interpretation.

The benthic invertebrate community of upper Hazeltine Creek in 2022 was characterized by total density, taxon richness, and Simpson's Evenness and Diversity that were similar between the two areas (HAC-R1 and HAC-U) and that were similar to reference and/or pre-breach conditions. Taxon richness at HAC-R1 in 2022 remained significantly lower than pre-breach conditions but was similar to reference conditions. Benthic invertebrate productivity (dry weight biomass) at both upper Hazeltine Creek areas in 2022 was unchanged since 2019 and was either similar to or higher than reference in each year from 2018 to 2022. Some key differences remained in the benthic community structure at both areas of upper Hazeltine Creek in 2022, compared to pre-breach conditions, which indicated the community composition had not fully recovered to pre-breach conditions. Overall, the results from 2022 indicated that the benthic invertebrate community of both areas of upper Hazeltine Creek had recovered substantially following remediation to a condition that was similar to reference and/or pre-breach conditions based on primary metrics (density, taxon richness, Simpson's Evenness and Diversity), but with some remaining differences in community composition compared to reference and pre-breach.

The benthic invertebrate community of lower Hazeltine Creek in 2021 was characterized by lower density, taxon richness, and productivity (dry weight biomass) compared to the reference area and to pre-breach conditions, and lower Simpson's Diversity compared reference conditions. The key differences in community structure in lower Hazeltine Creek in 2021 compared to reference and to pre-breach conditions included lower relative abundances of sensitive

[4] Although the IRT request was for inclusion of data from 2015 to present, finalized data from 2023 are not yet available. Therefore, data from 2015 to 2022 are presented (the most recent finalized data available).
[5] Only monitoring data with consistent collection methodologies and paired exposed vs. reference results each year were included in plots, and therefore in the tabulated raw data associated with the plots. Data excluded from plots and statistical analyses in Minnow (2023) due to a lack of reference data or inconsistent sampling methods were excluded from Appendix Table D.1.

Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa and Arachnida and higher relative abundance of Chironomidae in 2021. These differences in primary metrics and community composition in lower Hazeltine Creek compared to reference and pre-breach conditions was consistent with effects expected from recent completion of remediation works at HAC-D in 2021 and suggested that the benthic invertebrate community at this area remained in a state of recovery at the time of sampling.

Periphyton and Benthic Invertebrate Tissue Quality

Periphyton and benthic invertebrate tissue quality have been monitored consistently in Hazeltine Creek (and reference) since the initiation of the CEMP in 2018. Upper Hazeltine Creek (and associated reference; upper Edney Creek) and lower Hazeltine Creek (and associated reference; lower Edney Creek) have been monitored annually since 2018 (MPMC 2019b), with select monitoring completed prior to 2018, including pre-breach. The most recent results available for upper and lower Hazeltine Creek (and associated reference areas) are from 2022 (Minnow 2023). Benthic invertebrate tissue quality monitoring since 2018 has included two sample types: composite-taxa samples (a mixture of benthic invertebrate taxa representative of the sampling area) and single taxon (caddisfly) samples. The plots provided herein for periphyton (Appendix Figures E.1 to E.3), composite-taxa benthic invertebrate (Appendix Figures F.1 to F.3), and single taxon (caddisfly) benthic invertebrate tissue quality (Appendix Figures F.4 to F.6) include available data from 2015 to 2022[6] with graphical and statistical comparisons to reference and pre-breach (where applicable) and among years. See Minnow (2022, 2023) for detailed statistical methods and outputs. Tabulated raw data associated with the plots[7] are presented in Appendix Table E.1 for periphyton tissue quality, Appendix Table F.1 for composite-taxa benthic invertebrate tissue quality, and Appendix Table F.2 for single taxon (caddisfly) benthic invertebrate tissue quality and include results for all analytes reported by the laboratory. Graphical results are presented for primary and secondary analytes only, which are constituents that have been previously identified as being indicative of a mine influence on the receiving environment (Minnow 2020). Graphical and tabular results are focused on sampling areas Hazeltine Creek that have been monitored routinely as part of the CEMP over this period: upper Hazeltine Creek (HAC-R1, HAC-U) and an associated upper Edney Creek reference area

[6] Although the IRT request was for inclusion of data from 2015 to present, finalized data from 2023 are not yet available. Therefore, data from 2015 to 2022 are presented (the most recent finalized data available).
[7] Only monitoring data with consistent collection and analytical methodologies and paired exposed vs. reference results each year were included in plots, and therefore in the tabulated raw data associated with the plots. Data excluded from plots and statistical analyses in Minnow (2023) due to a lack of reference data or inconsistent sampling or analytical methods were excluded from Appendix Tables E.1, F.1, and F.2.

(EDC-U), and lower Hazeltine Creek (HAC-D) and an associated lower Edney Creek reference area (EDC-D).

Brief summaries of periphyton and benthic invertebrate tissue quality results for upper and lower Hazeltine Creek areas are provided below and are focused on the most recent year of monitoring. See Minnow (2023) for detailed results and interpretation.

Periphyton and benthic invertebrate tissue quality monitoring in upper and lower Hazeltine Creek indicated that the primary analytes arsenic, copper, iron, and selenium had higher tissue concentrations compared to reference in 2022 for which the exposed-reference difference also increased significantly over time. Concentrations of copper and selenium were higher than reference and increased over time and showed some evidence of moderately higher bioavailability and/or trophic transfer of selenium and copper in upper Hazeltine Creek, and selenium in lower Hazeltine Creek. Selenium concentrations in most tissues in Hazeltine Creek (upper and lower) have increased since 2018 compared to reference (except composite-taxa benthic invertebrate samples from lower Hazeltine Creek), suggesting a mine influence on tissue concentrations. In upper Hazeltine Creek, tissue selenium concentrations in 2022 were similar to or lower than pre-breach results in comparable tissues, while those in composite-taxa benthic invertebrate samples from lower Hazeltine Creek in 2022 exceeded pre-breach results. Results indicate that the bioavailability and trophic transfer of selenium has been typically stable over time compared to reference and has not increased due to mine influence, except for increased trophic transfer in caddisflies from Reach 2 of upper Hazeltine Creek. Mean selenium concentrations in benthic invertebrate tissue have exceeded the BC interim guideline since 2020 and 2022 in upper (HAC-R1 and HAC-U) and lower (HAC-D) Hazeltine Creek, suggesting potential selenium-associated risks to aquatic life. Copper was elevated relative to reference in 2022, and higher than pre-breach in most tissues and sampling years; however, the difference relative to reference has been similar to reference over monitoring years except at HAC-U where concentrations in composite taxa-benthic invertebrate tissue samples were higher in 2022 than 2018 to 2021 (relative to reference). Mean trophic transfer of copper was stable or decreasing over time and lower than pre-breach, except for in composite taxa-benthic invertebrates from HAC-U which had mean trophic transfer that increased over time and was higher than pre-breach. The temporal increase in trophic transfer and concentrations of copper in benthic invertebrates in 2022 was limited to composite-taxa benthic invertebrate tissues from Reach 2 (HAC-U) and was not observed in caddisfly tissues from HAC-U nor in benthic invertebrate tissues (caddisfly or composite-taxa) from Reach 1 (HAC-R1) of upper Hazeltine Creek, indicating a potentially localized increase.

In composite-taxa benthic invertebrate samples from upper Hazeltine Creek, mean arsenic, and iron concentrations in tissues from Reach 2 (HAC-U) and Reach 1 (HAC-R1), respectively, were higher in 2022 than previous monitoring years compared to reference, but this was due to a temporal decrease at the reference area rather than an increase in tissues from upper Hazeltine Creek. Elevated concentrations of some secondary analytes in periphyton and/or benthic invertebrate tissues over time were also observed, relative to reference, but evidence was equivocal as to whether these observed increases in tissue concentrations were mine-related, and there was little or no evidence of increased metal bioavailability relative to reference and pre-breach. Comparison of the two benthic invertebrate tissue types (caddisfly and composite-taxa) indicated that although variability exists between the tissues, potential changes in analyte concentrations and trophic transfer in caddisfly tissues would largely be detected if sampling were limited to composite-taxa tissue samples only.

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Senior Advisor/Technical Reviewer





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APPENDIX A
WATER QUALITY

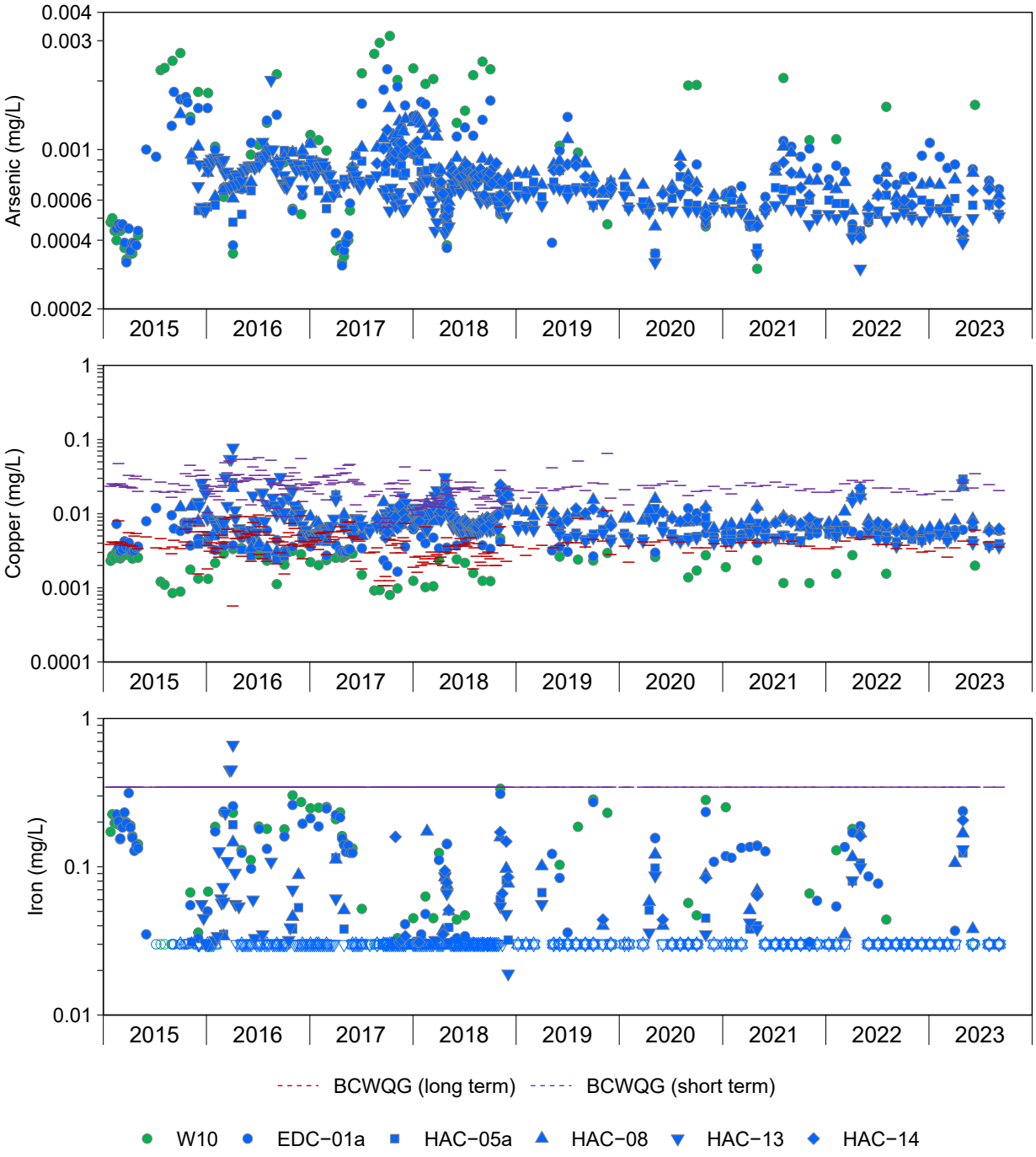

Figure A.1: Dissolved Aqueous Concentrations of Primary and Secondary Analytes in Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Notes: Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Monitoring station EDC−01 was relocated in Q4 2020 and renamed as EDC−01a for the new monitoring location.

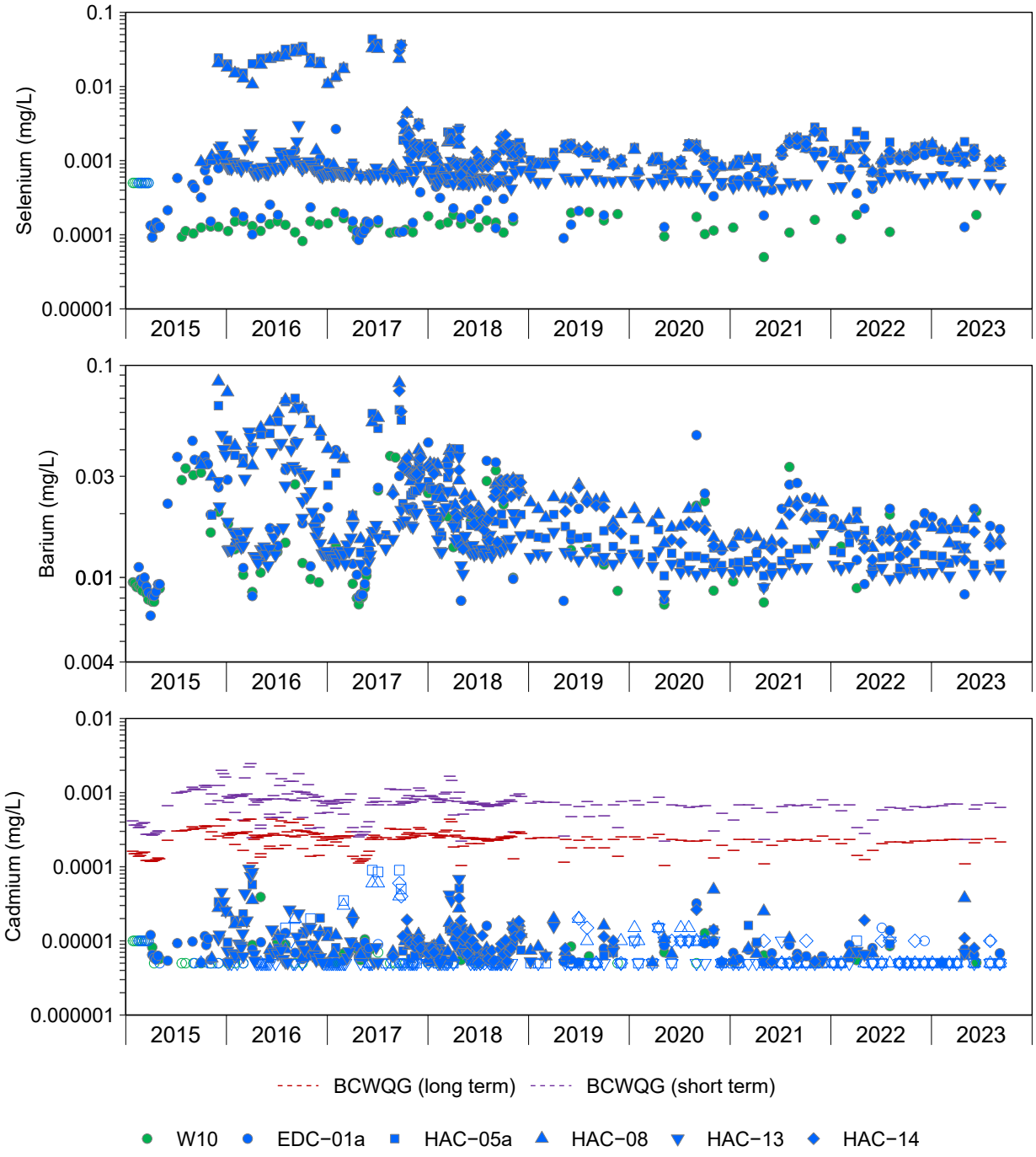

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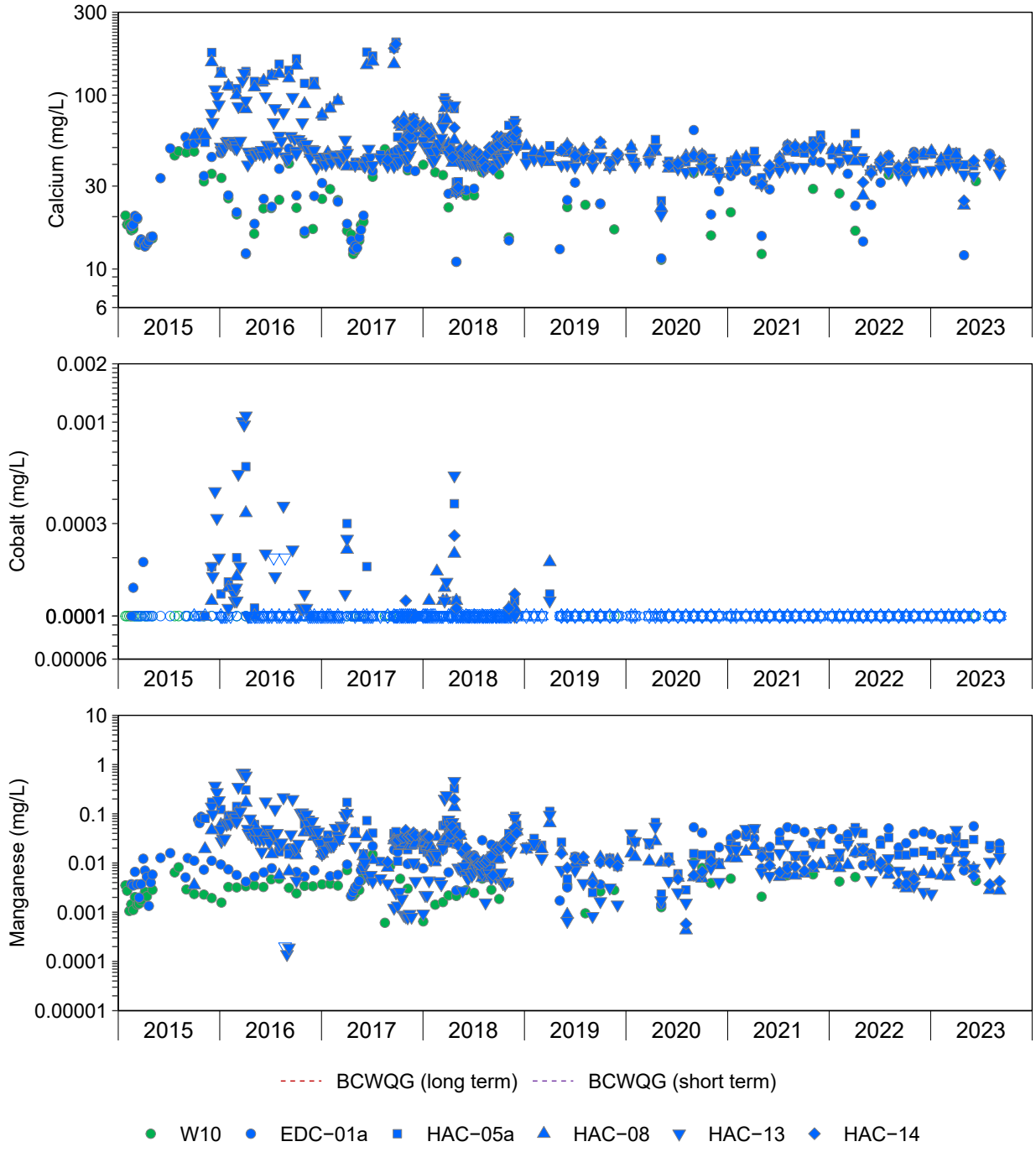

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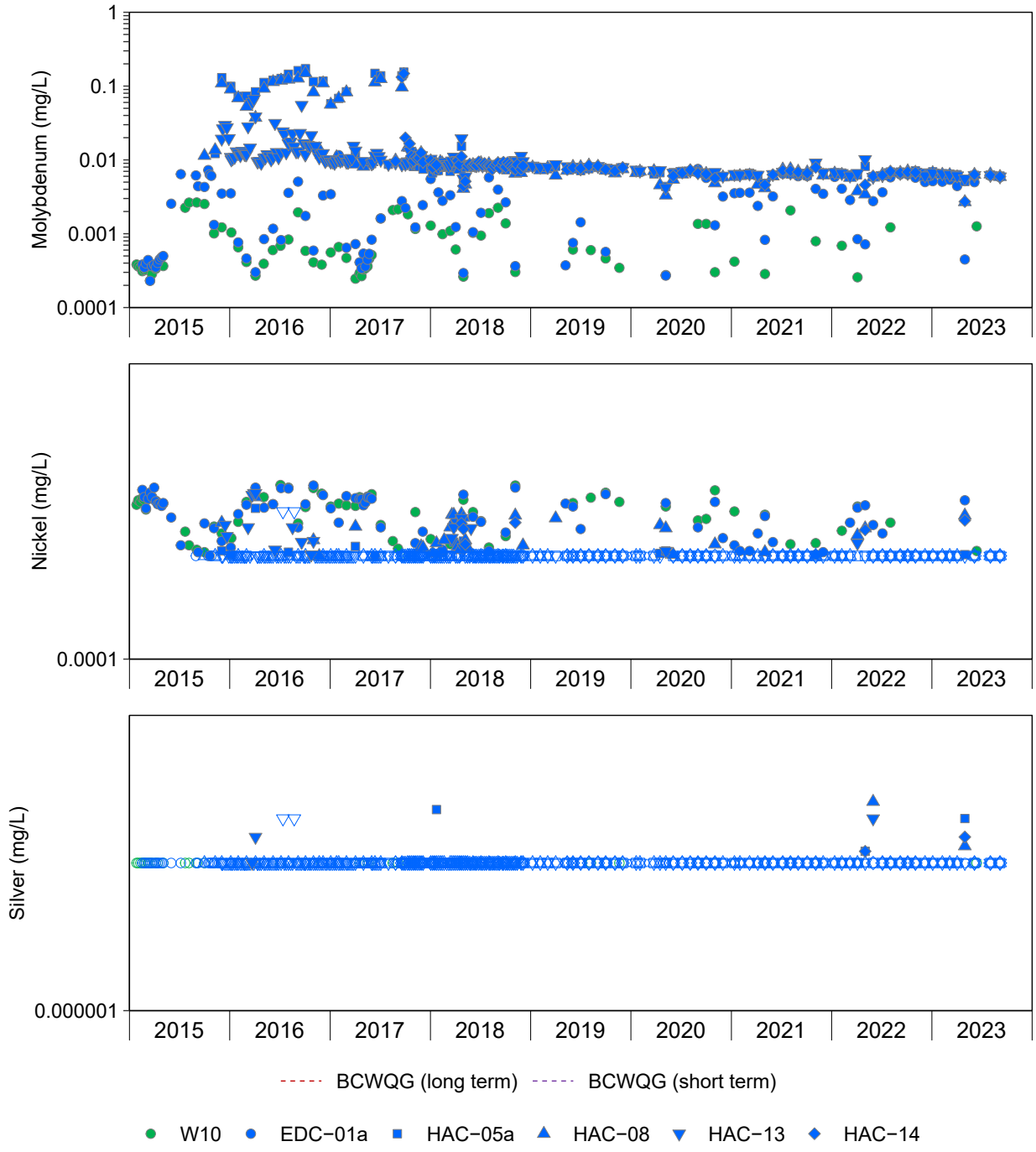

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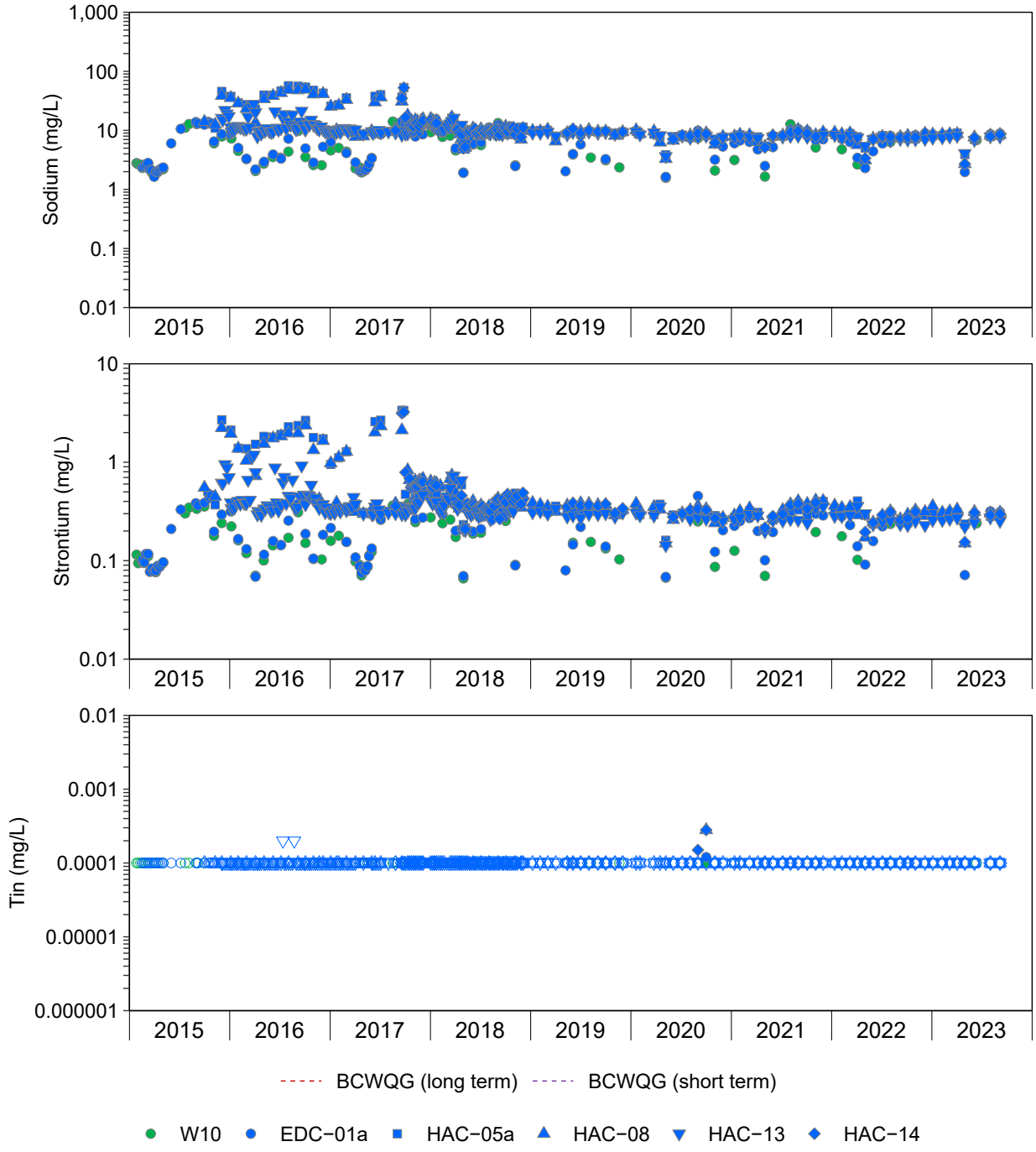

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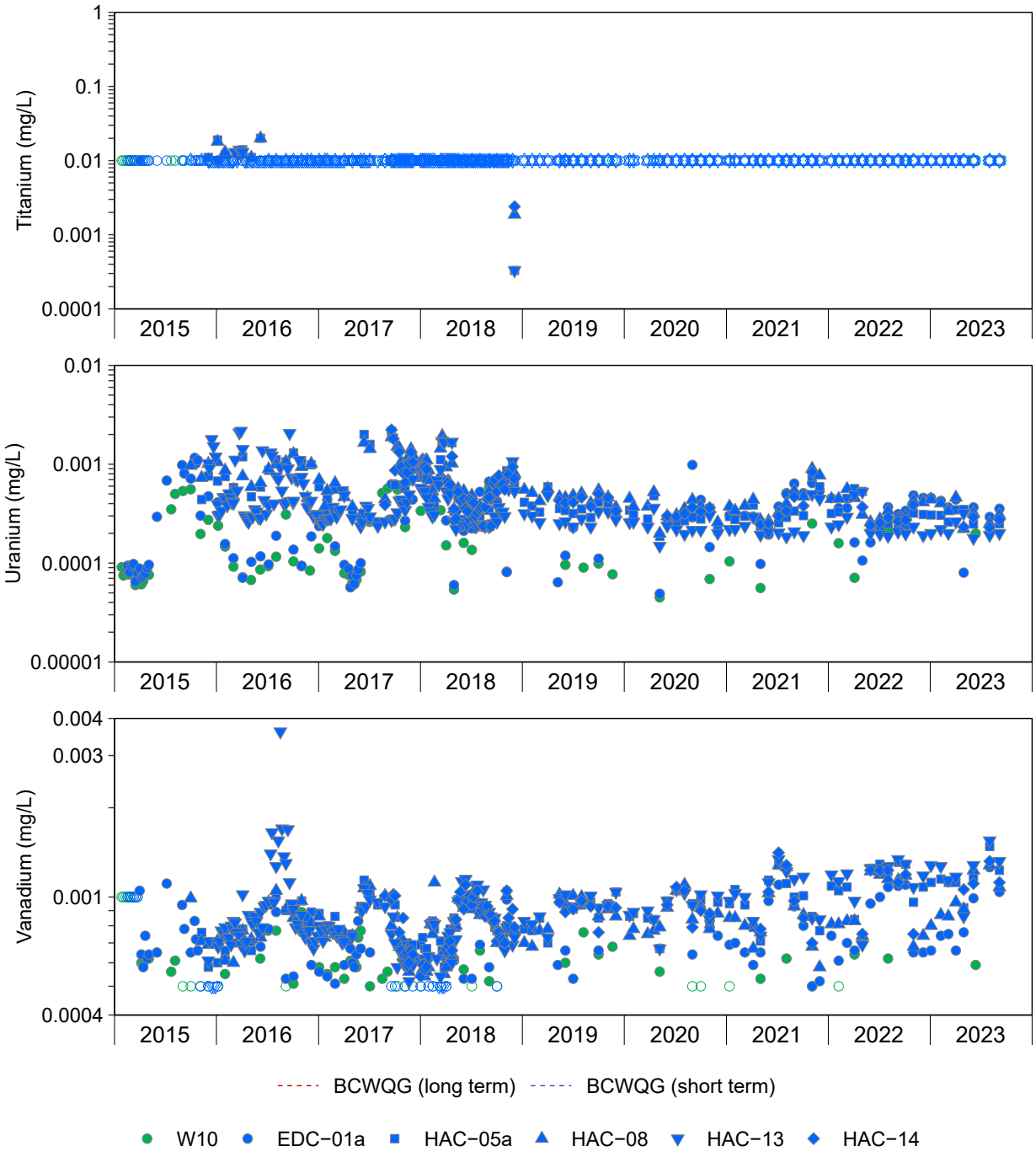

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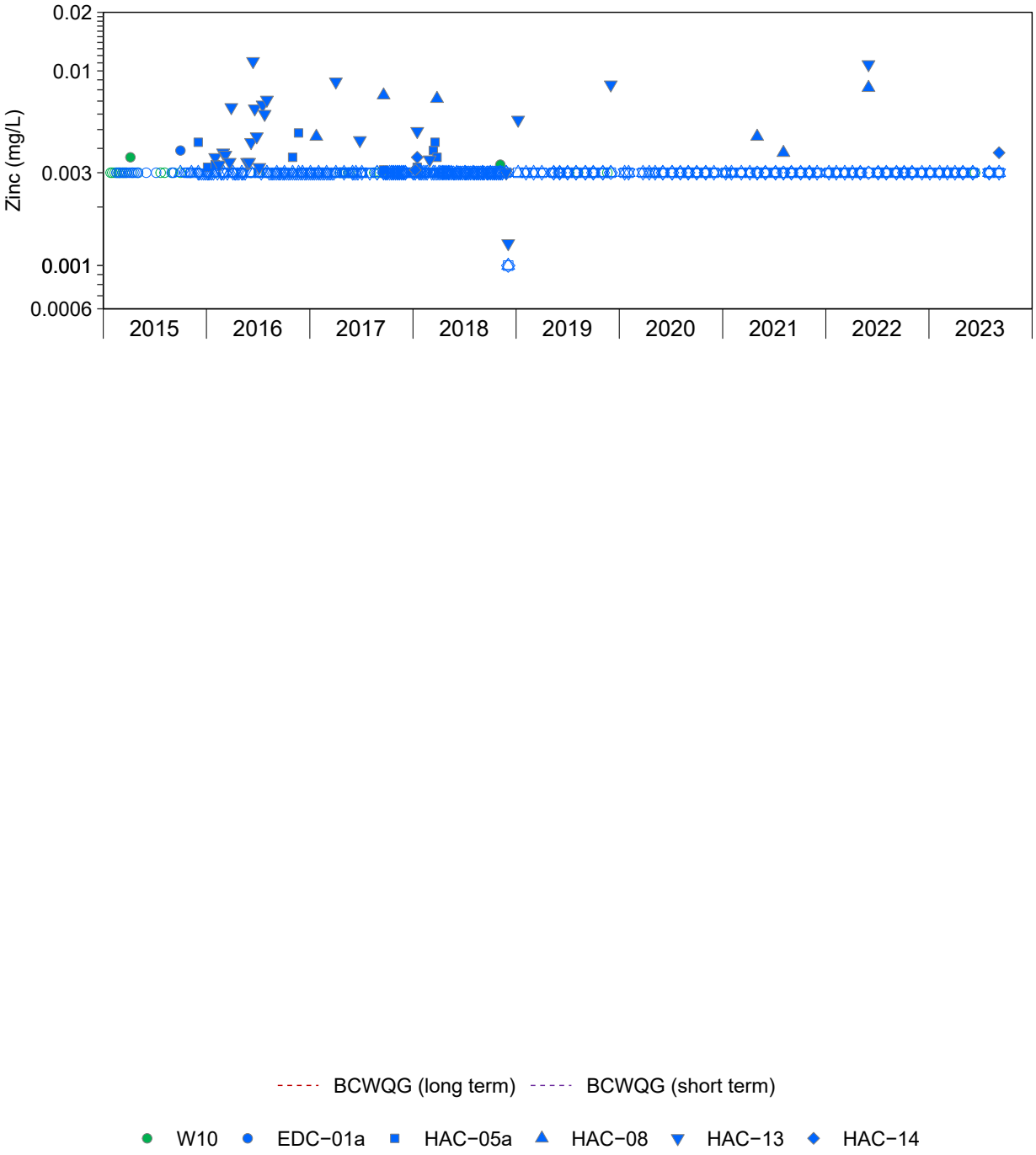

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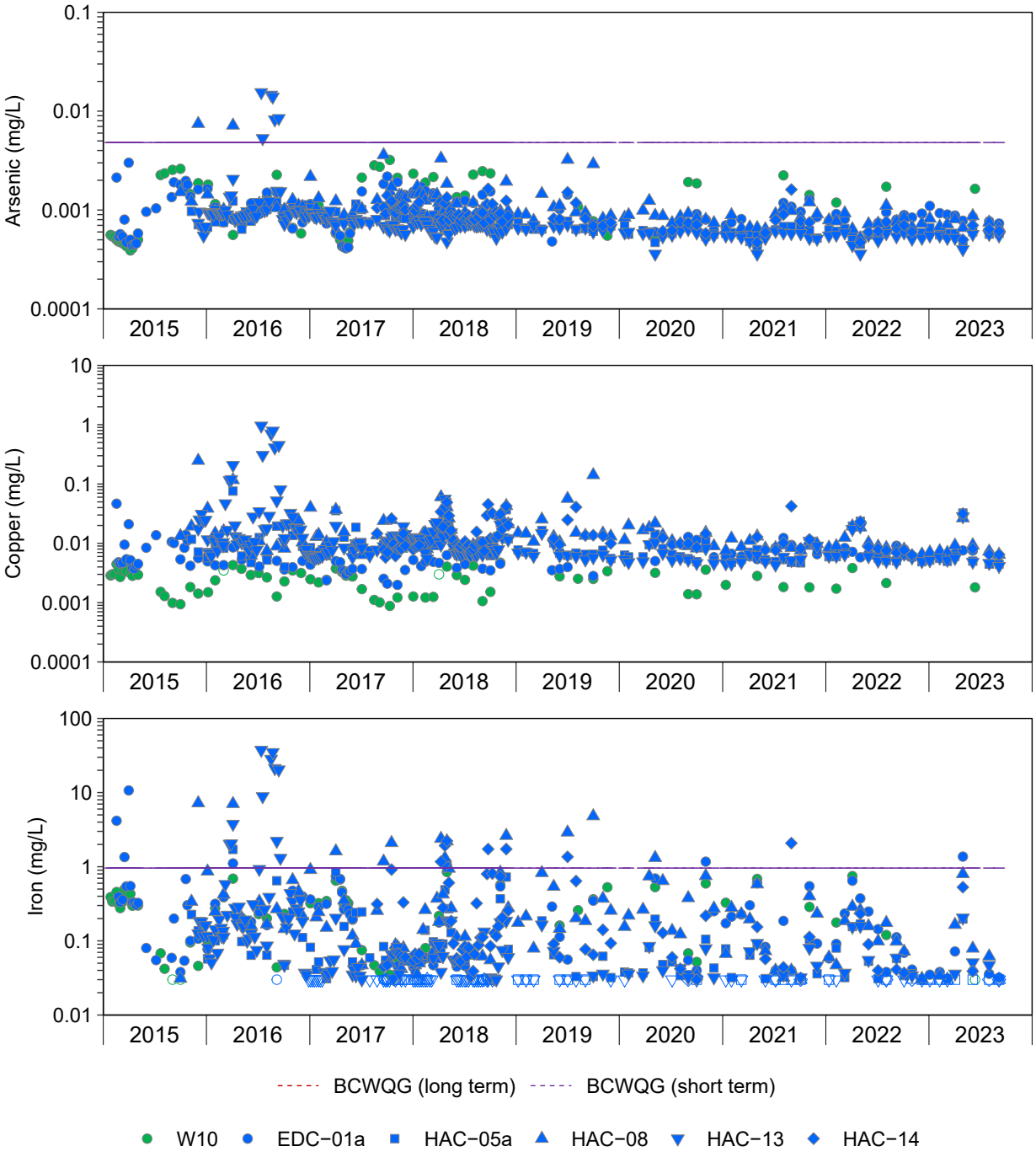

Figure A.2: Total Aqueous Concentrations of Primary and Secondary Analytes in Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

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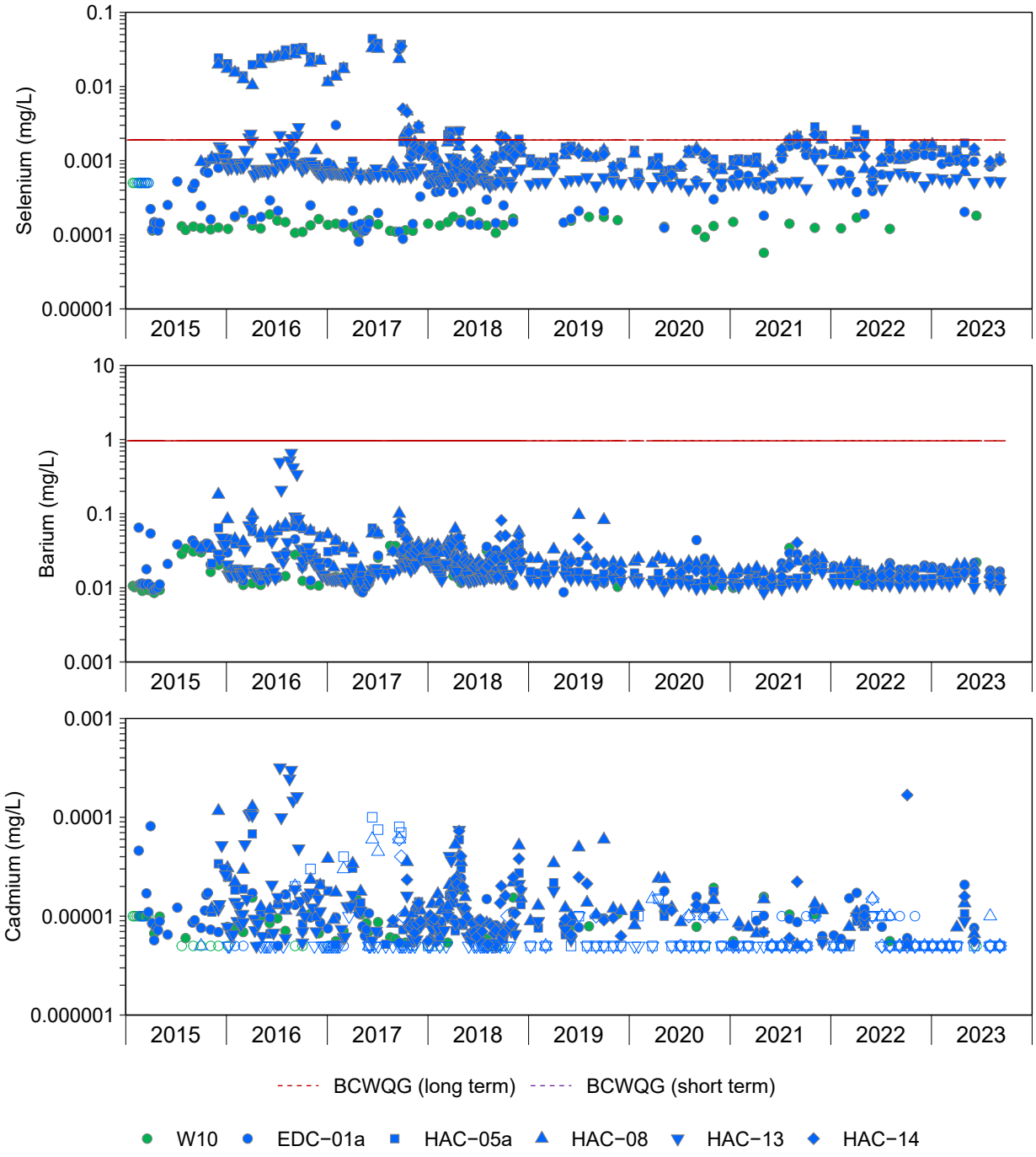

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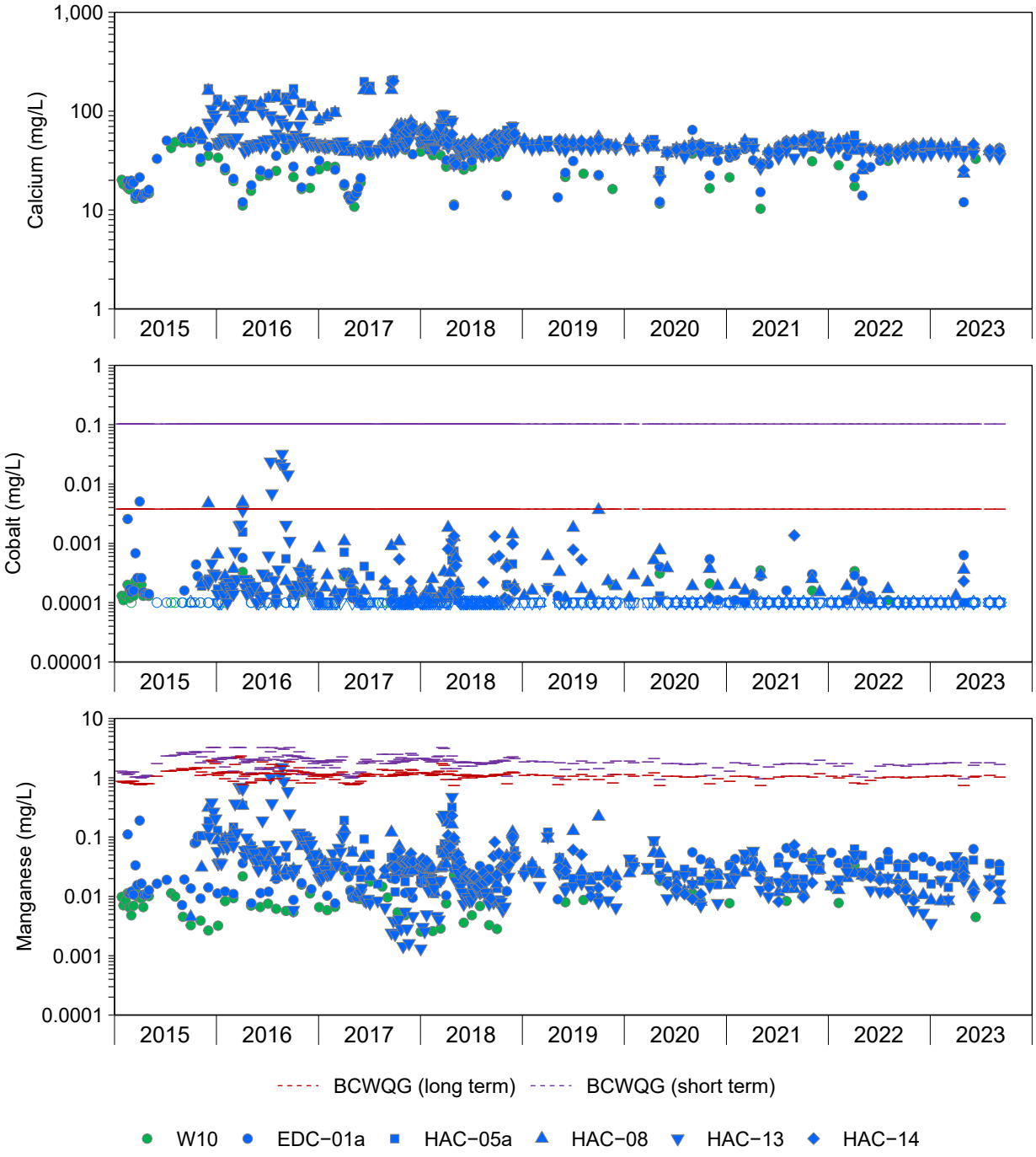

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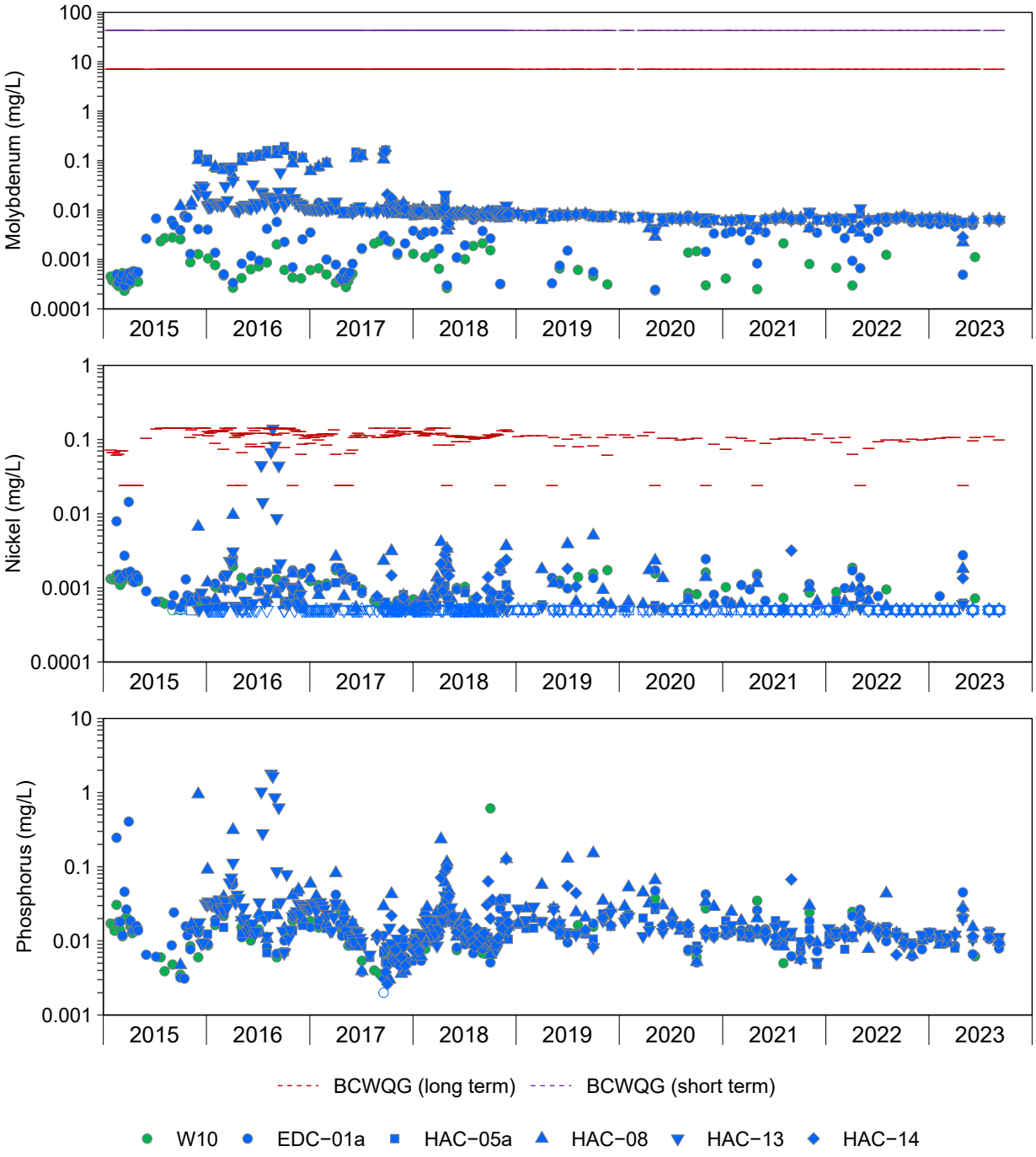

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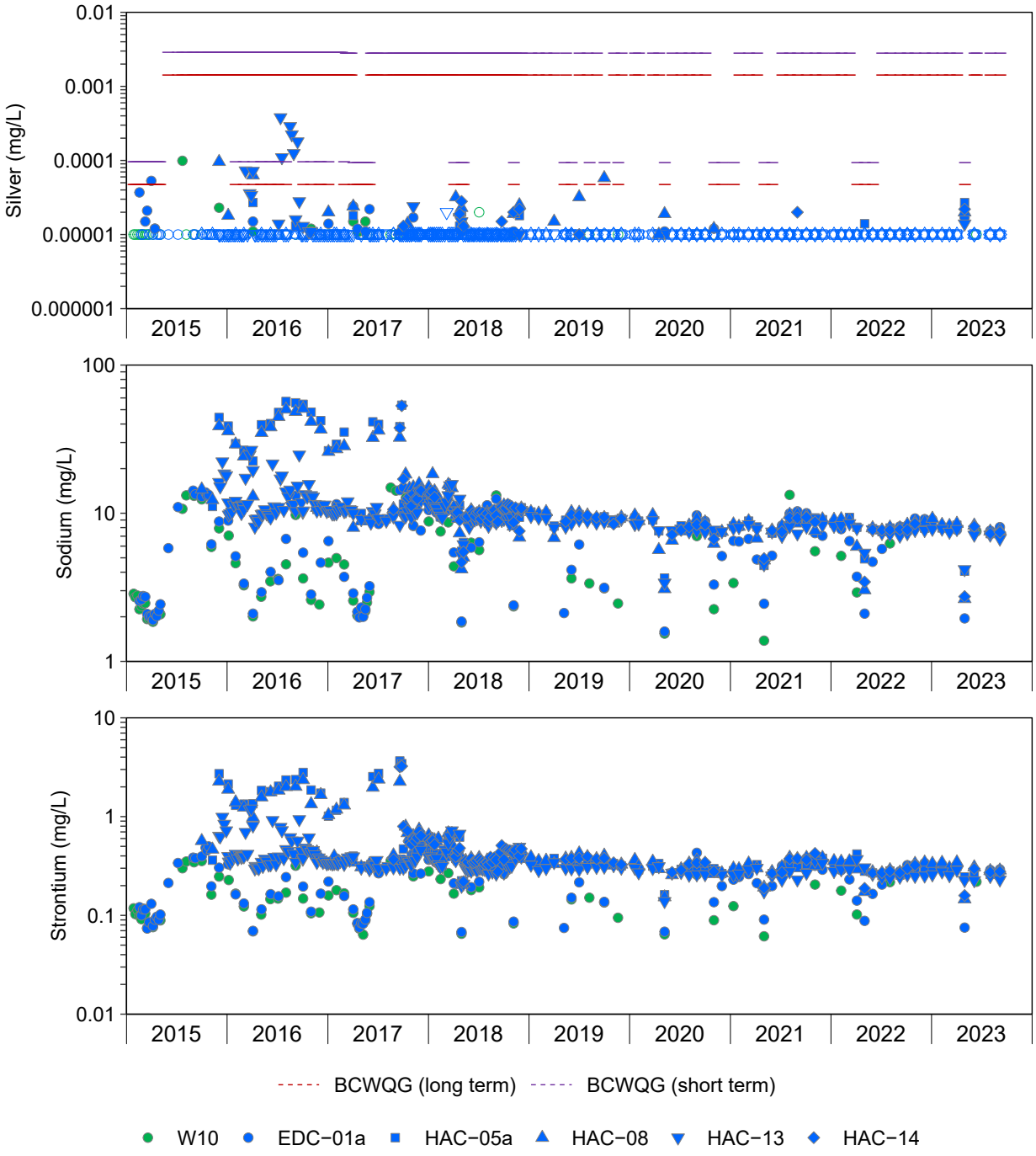

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Notes: Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Monitoring station EDC−01 was relocated in Q4 2020 and renamed as EDC−01a for the new monitoring location.

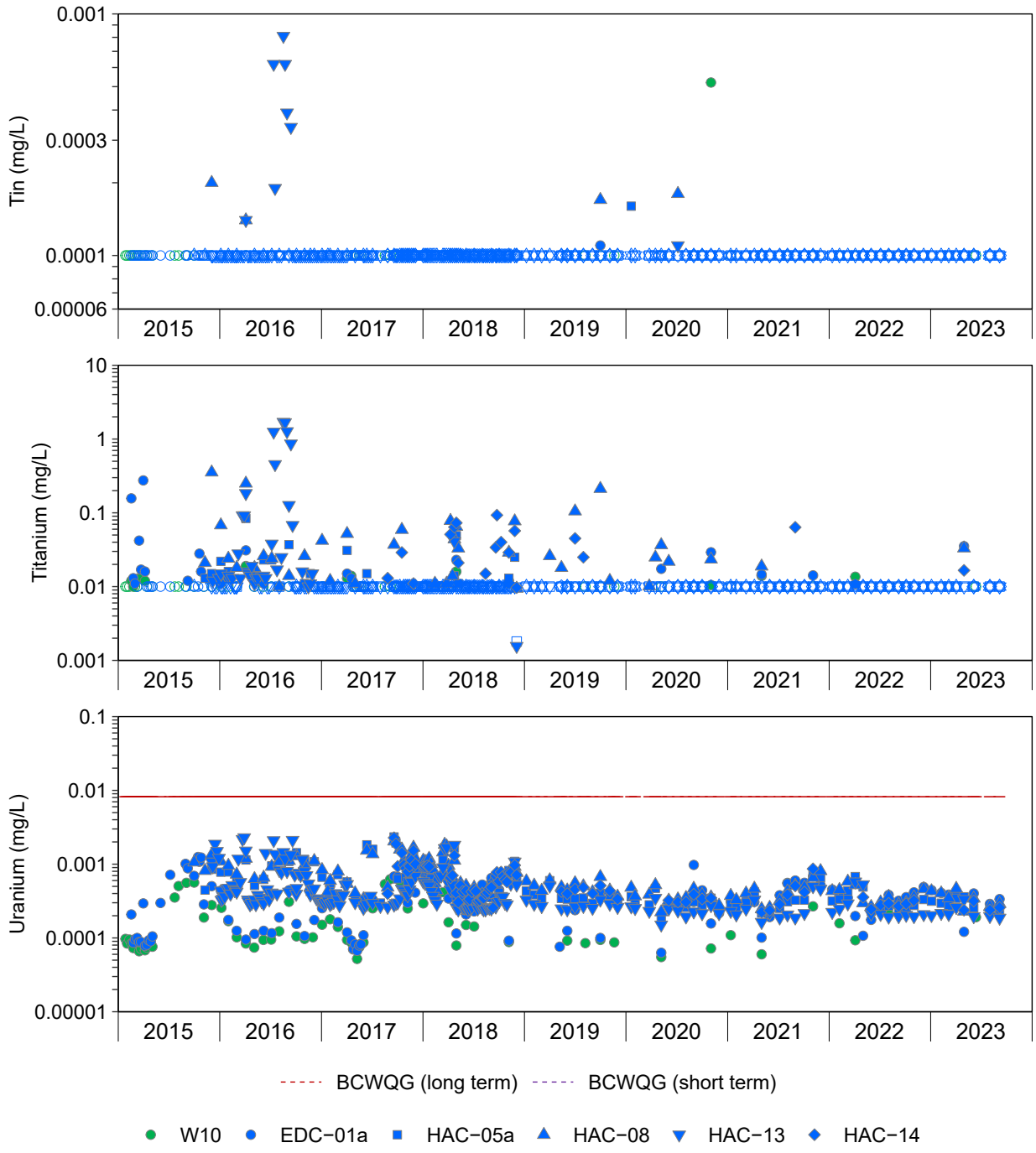

Figure A.2: Total Aqueous Concentrations of Primary and Secondary Analytes in Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Notes: Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Monitoring station EDC−01 was relocated in Q4 2020 and renamed as EDC−01a for the new monitoring location.

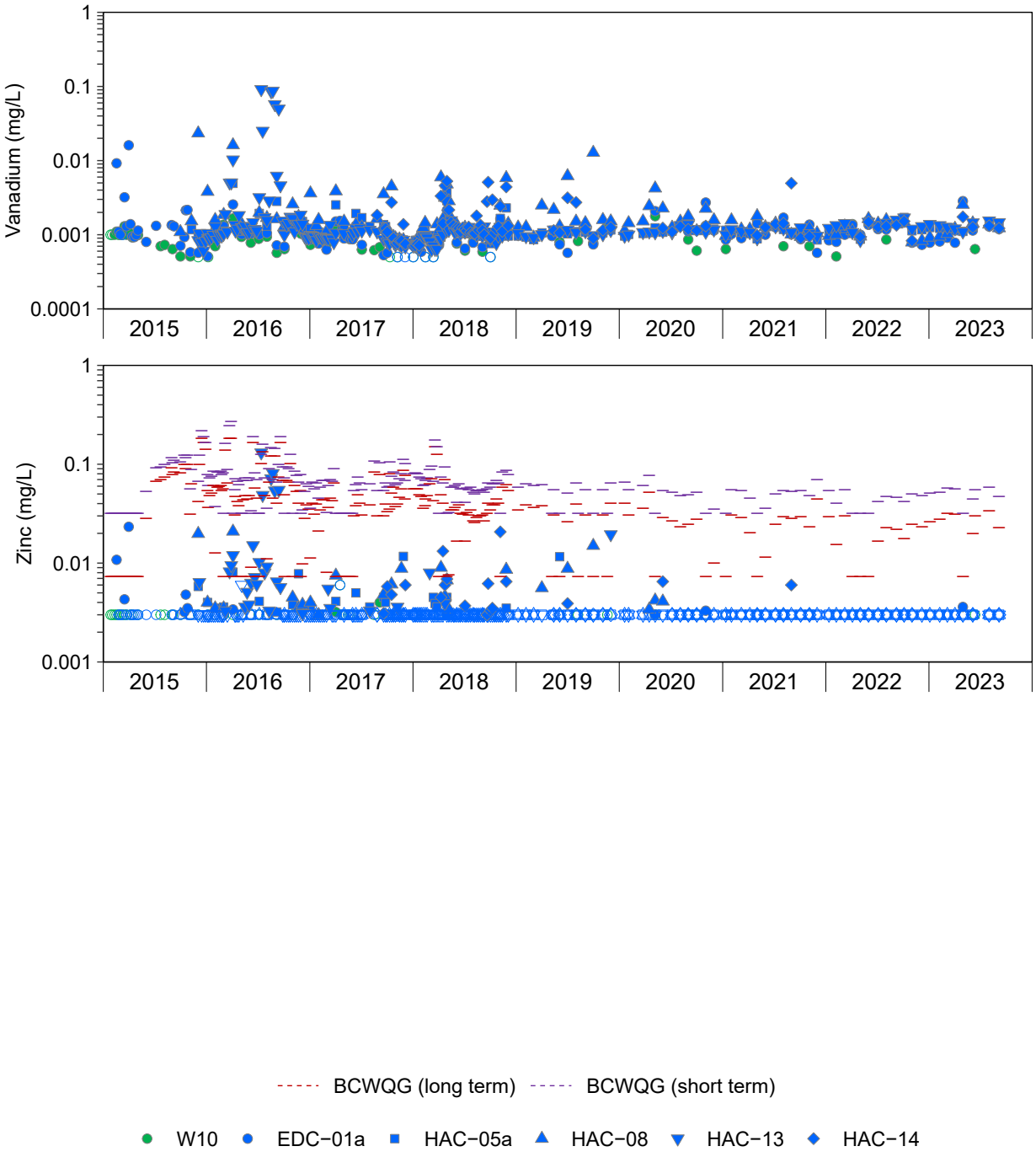

Figure A.2: Total Aqueous Concentrations of Primary and Secondary Analytes in Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Notes: Green represents reference stations and blue represents exposed stations. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.Values displayed for BCWQG that are condition specific (i.e., hardness dependent or based on the Biotic Ligand Model) are the most conservative (i.e., lowest) of those calculated for the multiple monitoring stations displayed. Monitoring station EDC−01 was relocated in Q4 2020 and renamed as EDC−01a for the new monitoring location.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2015	HAC-13	3-Dec-2015	544	102	14.0	8.30	1.50	0.940	493	245	8.30	336	<3.0	1.70	142	<0.0050	2.60	0.120	0.230
		7-Dec-2015	490	-	-	8.60	2.60	2.60	470	216	8.40	312	4.10	2.30	121	<0.0050	2.40	0.120	0.320
		15-Dec-2015	711	-	-	8.00	-0.100	1.60	721	345	8.20	470	<3.0	1.60	198	<0.0050	3.90	0.170	0.480
		22-Dec-2015	671	-	-	8.00	-0.220	1.10	-	-	-	-	-	-	-	-	-	-	-
		22-Dec-2015	-	-	-	-	-	-	653	309	8.10	415	<3.0	0.920	174	0.0140	3.60	0.160	0.380
		29-Dec-2015	561	-	-	8.10	0.500	2.70	561	276	7.90	376	15.0	3.10	169	-	3.00	0.130	0.340
	HAC-05a	31-May-2015	797	104	10.0	8.00	13.0	1.40	-	-	-	-	-	-	-	-	-	-	-
		2-Nov-2015	667	-	-	8.20	4.40	8.30	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	358	-	-	8.30	4.80	2.70	358	167	8.20	244	4.50	3.40	124	0.00820	1.70	0.110	0.170
		1-Dec-2015	340	-	-	8.40	0.700	0.330	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	1,008	-	-	8.00	1.10	16.0	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	1,258	89.0	12.0	7.80	2.00	2.60	1,200	564	7.80	865	9.70	3.80	82.0	0.0440	30.0	0.220	6.50
		7-Dec-2015	1,080	-	-	8.00	3.50	4.00	-	-	-	-	-	-	-	-	-	-	-
		15-Dec-2015	1,114	-	-	7.90	2.90	1.30	-	-	-	-	-	-	-	-	-	-	-
		29-Dec-2015	1,194	-	-	8.10	0.900	0.250	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	24-Feb-2015	326	-	-	8.30	0.100	84.0	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	450	-	-	8.40	8.80	0.690	414	200	8.40	263	<3.0	0.570	169	<0.0050	1.60	0.150	0.0110
		2-Nov-2015	629	-	-	8.70	4.70	9.50	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	399	-	-	8.40	3.10	3.50	398	191	8.30	275	10.0	4.00	132	<0.0050	1.70	0.120	0.220
		1-Dec-2015	365	-	-	8.40	0	25.0	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	372	-	-	8.40	0	4.40	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	1,118	90.0	13.0	8.00	0.620	34.0	1,070	500	8.00	772	499	24.0	92.0	0.0250	24.0	0.180	5.50
	W10	27-Jan-2015	-	-	-	-	-	-	141	74.0	8.00	120	<3.0	2.60	72.0	<0.0050	<0.50	0.0390	0.140
		2-Feb-2015	-	-	-	-	-	-	128	66.0	8.00	114	<3.0	1.90	63.0	0.00650	<0.50	0.0350	0.180
		10-Feb-2015	-	-	-	-	-	-	131	66.0	7.90	108	14.0	2.30	65.0	<0.0050	<0.50	0.0380	0.0940
		17-Feb-2015	-	-	-	-	-	-	114	60.0	8.00	113	10.0	3.50	54.0	0.00540	<0.50	0.0500	0.150
		24-Feb-2015	118	-	-	7.80	0.200	1.70	118	62.0	8.00	104	3.40	1.40	58.0	0.00540	<0.50	0.0400	0.0690
		2-Mar-2015	-	-	-	-	-	-	126	70.0	7.90	102	<3.0	1.50	61.0	0.00530	<0.50	0.0450	0.0570
		10-Mar-2015	-	-	-	-	-	-	142	70.0	8.10	123	12.0	1.80	69.0	0.00560	<0.50	0.0420	0.0560
		17-Mar-2015	-	-	-	-	-	-	96.0	50.0	7.80	131	10.0	4.80	46.0	<0.0050	<0.50	0.0310	0.0930
		24-Mar-2015	-	-	-	-	-	-	93.0	50.0	7.50	94.0	5.10	3.50	46.0	<0.0050	<0.50	0.0360	0.0410
		7-Apr-2015	-	-	-	-	-	-	93.0	48.0	7.80	84.0	12.0	5.30	48.0	<0.0050	<0.50	0.0360	0.0190
		14-Apr-2015	-	-	-	-	-	-	97.0	50.0	7.80	94.0	<3.0	2.30	49.0	0.00550	<0.50	0.0370	0.0130
		4-May-2015	-	-	-	-	-	-	104	55.0	8.00	94.0	4.00	1.80	56.0	0.00590	<0.50	0.0380	0.00870
		20-May-2015	-	-	-	-	-	-	-	-	-	-	4.20	0.490	-	-	-	-	-
		9-Jun-2015	270	-	-	8.10	13.0	3.00	-	-	-	-	-	-	-	-	-	-	-
		23-Jul-2015	344	-	-	8.10	13.0	0.190	341	176	8.30	202	<3.0	0.210	176	0.00730	1.20	0.100	0.0230
		2-Aug-2015	360	-	-	7.90	16.0	0.180	-	-	-	-	-	-	-	-	-	-	-
		6-Aug-2015	378	-	-	7.90	13.0	0.170	383	183	8.30	235	<3.0	0.270	199	<0.0050	1.30	0.110	0.0300
		3-Sep-2015	398	-	-	8.20	8.40	0.200	386	189	8.30	251	<3.0	0.780	196	<0.0050	2.20	0.120	0.0120
		6-Sep-2015	411	-	-	8.20	7.20	2.40	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	422	-	-	8.00	6.00	0.310	387	192	8.30	236	<3.0	0.220	207	<0.0050	1.90	0.110	0.00980
		5-Nov-2015	242	-	-	8.30	2.50	0.570	243	123	8.20	164	<3.0	0.590	122	<0.0050	0.880	0.0760	0.550
		3-Dec-2015	306	-	-	8.00	0	0.120	285	138	8.10	188	<3.0	0.280	141	<0.0050	1.00	0.0820	0.0960
	EDC-01a	17-Feb-2015	-	-	-	-	-	-	118	62.0	8.00	107	165	49.0	55.0	0.00880	<0.50	0.0490	0.150
		24-Feb-2015	121	-	-	7.90	0.400	2.50	119	65.0	7.90	112	11.0	2.30	58.0	0.00530	<0.50	0.0400	0.0690
		2-Mar-2015	-	-	-	-	-	-	132	72.0	8.00	108	5.70	2.60	64.0	0.00570	<0.50	0.0560	0.0590
		10-Mar-2015	-	-	-	-	-	-	141	72.0	8.00	121	12.0	3.00	69.0	0.00550	<0.50	0.0440	0.0550
		17-Mar-2015	-	-	-	-	-	-	97.0	51.0	7.70	104	42.0	12.0	53.0	0.00520	<0.50	0.0340	0.0960
		24-Mar-2015	-	-	-	-	-	-	96.0	52.0	7.70	81.0	9.20	5.10	50.0	<0.0050	<0.50	0.0370	0.0410
		1-Apr-2015	-	-	-	-	-	-	89.0	49.0	7.90	114	391	126	46.0	0.0570	<0.50	0.0370	0.0240
		7-Apr-2015	-	-	-	-	-	-	95.0	48.0	7.80	89.0	9.50	5.10	46.0	0.00560	<0.50	0.0370	0.0180
		14-Apr-2015	-	-	-	-	-	-	99.0	50.0	7.80	93.0	14.0	2.70	51.0	0.00590	<0.50	0.0410	0.0140
		21-Apr-2015	-	-	-	-	-	-	100	52.0	8.00	93.0	48.0	2.70	50.0	0.00590	<0.50	0.0390	0.0140
		28-Apr-2015	-	-	-	-	-	-	108	55.0	7.90	101	4.00	2.80	56.0	0.00610	<0.50	0.0420	0.0110
		4-May-2015	-	-	-	-	-	-	113	56.0	8.00	97.0	51.0	2.30	52.0	<0.0050	<0.50	0.0400	0.00930
		20-May-2015	-	-	-	-	-	-	-	-	-	-	12.0	0.780	-	-	-	-	-
		2-Jun-2015	260	-	-	7.70	15.0	1.40	225	119	8.20	162	5.40	0.860	110	0.00840	0.620	0.0780	0.0180
		7-Jul-2015	339	-	-	7.70	19.0	1.10	352	173	8.30	242	<3.0	0.880	162	<0.0050	1.30	0.120	0.0280
		31-Aug-2015	414	-	-	7.90	16.0	2.40	413	208	8.20	247	<3.0	1.60	203	<0.0050	1.70	0.130	0.00940
		8-Sep-2015	412	-	-	8.10	12.0	4.30	390	196	8.30	261	<3.0	2.60	191	<0.0050	2.00	0.130	<0.0050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2015	EDC-01a	1-Oct-2015	436	-	-	8.10	9.60	1.90	393	200	8.30	239	<3.0	0.510	196	<0.0050	2.00	0.120	<0.0050
		15-Oct-2015	429	-	-	8.40	7.00	0.710	426	217	8.40	292	<3.0	0.630	199	<0.0050	1.70	0.130	0.0120
		20-Oct-2015	441	-	-	9.10	6.00	9.10	392	205	8.30	266	10.0	10.0	190	<0.0050	1.70	0.130	0.0320
		26-Oct-2015	438	-	-	8.40	2.40	3.60	436	217	8.30	262	6.20	2.50	201	<0.0050	1.60	0.130	0.00820
		5-Nov-2015	266	-	-	8.40	3.50	1.00	262	128	8.20	178	<3.0	0.950	125	<0.0050	0.940	0.0800	0.510
		3-Dec-2015	365	90.0	13.0	8.10	0.430	2.50	323	163	8.10	213	<3.0	1.50	134	<0.0050	1.70	0.0870	0.200
	HAC-13	5-Jan-2016	364	82.0	12.0	8.00	-0.210	1.50	338	154	8.10	212	<3.0	0.980	113	0.00850	1.60	0.0950	0.170
		7-Jan-2016	310	-	-	8.00	0.0330	1.20	318	147	8.00	196	<3.0	0.830	100	0.00710	1.40	0.0940	0.160
		12-Jan-2016	330	-	-	7.80	0.250	0.810	325	147	8.20	206	<3.0	0.610	107	0.00710	1.50	0.0990	0.160
		19-Jan-2016	314	-	-	8.10	0.790	0.570	323	151	8.10	208	<3.0	0.780	100	<0.0050	1.50	0.0960	0.150
		26-Jan-2016	346	-	-	7.80	0.160	1.40	350	164	8.10	219	<3.0	1.10	107	0.00680	1.70	0.0960	0.230
		1-Feb-2016	354	89.0	13.0	7.70	0.710	1.80	357	167	8.10	226	4.70	1.20	111	0.00600	1.70	0.0970	0.180
		9-Feb-2016	330	-	-	7.70	0.570	1.00	345	161	8.10	234	<3.0	0.670	107	<0.0050	1.60	0.0970	0.240
		15-Feb-2016	166	-	-	7.40	0.00300	6.70	364	162	8.00	223	3.70	2.50	108	<0.0050	1.70	0.100	0.240
		22-Feb-2016	338	-	-	8.10	2.10	1.80	346	164	8.10	237	<3.0	1.60	105	0.00500	1.60	0.0980	0.170
		24-Feb-2016	361	-	-	7.80	2.30	0.540	344	154	8.10	230	2.20	0.870	105	<0.0050	1.60	0.0960	0.170
		29-Feb-2016	332	99.0	14.0	8.10	2.10	1.40	342	158	8.20	200	1.80	1.60	106	<0.0050	1.60	0.0980	0.180
		2-Mar-2016	308	82.0	-	8.30	2.70	0.460	333	152	8.20	224	1.50	0.800	105	<0.0050	1.60	0.0980	0.170
		8-Mar-2016	511	-	-	8.10	3.60	6.30	552	270	8.10	398	7.10	6.80	130	0.0150	2.70	0.140	0.260
		15-Mar-2016	338	96.0	13.0	8.00	2.40	2.30	368	169	8.10	234	2.50	1.80	106	0.00800	1.70	0.100	0.180
		23-Mar-2016	786	-	-	8.00	2.70	17.0	785	383	8.00	558	31.0	26.0	145	0.0360	4.00	0.170	0.180
		29-Mar-2016	812	-	-	8.00	7.40	18.0	827	420	7.90	615	38.0	29.0	147	0.0420	4.10	0.180	0.150
		4-Apr-2016	604	-	10.0	7.90	5.70	34.0	625	293	8.00	464	71.0	82.0	127	0.0410	2.70	0.160	0.0970
		11-Apr-2016	262	-	-	8.30	5.40	3.40	266	122	8.20	151	8.10	4.00	84.0	0.0120	1.20	0.0800	<0.0050
		13-Apr-2016	301	-	-	8.20	5.30	3.00	303	145	8.00	203	6.00	3.00	98.0	0.00720	1.40	0.0950	0.0710
		19-Apr-2016	300	-	-	8.20	6.80	1.90	295	138	8.10	182	5.90	1.70	100	0.00860	1.40	0.0920	0.0680
		25-Apr-2016	277	-	-	8.30	8.20	3.60	280	132	8.10	173	10.0	4.10	96.0	<0.0050	1.20	0.0860	<0.0050
		5-May-2016	301	106	10.0	8.20	12.0	2.90	302	141	8.20	224	3.40	3.20	104	0.00580	1.40	0.100	<0.0050
		10-May-2016	302	-	-	8.40	11.0	2.70	297	140	8.20	217	4.50	3.70	96.0	0.00590	1.40	0.0910	0.00700
		17-May-2016	306	-	-	8.40	16.0	2.80	320	146	8.30	219	4.90	2.80	107	<0.0050	1.40	0.0980	<0.0050
		24-May-2016	307	113	9.90	8.60	16.0	1.40	297	141	8.30	225	2.50	1.40	101	<0.0050	1.40	0.0900	<0.0050
		31-May-2016	298	107	10.0	8.50	13.0	0.780	286	146	8.20	199	3.00	1.70	100	<0.0050	1.40	0.0950	<0.0050
		7-Jun-2016	301	113	9.10	8.30	20.0	1.50	298	137	8.20	186	3.30	1.90	103	0.00840	1.40	0.0930	<0.0050
		14-Jun-2016	643	-	-	8.20	14.0	2.60	628	308	8.30	446	3.30	3.80	148	0.00990	3.10	0.180	0.0400
		18-Jun-2016	504	-	-	8.20	21.0	120	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	341	-	-	8.50	20.0	1.30	334	159	8.30	236	2.00	1.50	108	<0.0050	1.50	0.100	<0.0050
		27-Jun-2016	304	-	-	8.50	19.0	2.10	290	143	8.30	216	1.70	1.00	89.0	<0.0050	1.30	0.0930	<0.0050
		6-Jul-2016	329	109	8.80	8.40	20.0	13.0	325	155	8.20	224	18.0	20.0	103	0.00540	1.40	0.0870	0.0490
		13-Jul-2016	486	-	-	8.00	18.0	1,725	473	219	8.00	365	769	1,050	134	0.0450	2.20	0.150	0.120
		18-Jul-2016	-	-	-	-	-	-	523	264	8.20	367	233	249	150	0.0430	2.60	0.160	0.250
		25-Jul-2016	317	-	-	8.20	20.0	3.90	312	146	8.20	220	6.50	3.70	106	0.00500	1.40	0.100	0.0120
		2-Aug-2016	396	103	8.20	8.20	21.0	1.20	385	183	8.20	281	1.60	1.50	119	0.0110	1.80	0.140	0.0590
		10-Aug-2016	369	-	-	8.30	24.0	6.70	361	170	8.30	245	7.90	6.10	119	0.0110	1.70	0.130	0.110
		17-Aug-2016	747	-	-	8.00	20.0	-	450	248	8.00	369	1,040	593	177	0.0210	2.40	0.160	0.00600
		23-Aug-2016	334	-	-	8.10	19.0	-	324	142	8.20	262	1,310	830	122	0.0190	1.50	0.130	0.130
		30-Aug-2016	310	-	-	8.20	17.0	68.0	302	247	8.20	213	428	301	108	0.0100	1.40	0.110	0.0420
		6-Sep-2016	312	111	9.20	8.40	19.0	25.0	306	136	8.40	231	53.0	46.0	106	<0.0050	1.50	0.100	0.0420
		13-Sep-2016	436	-	-	8.10	16.0	1,094	-	-	-	-	-	-	-	-	-	-	-
		13-Sep-2016	-	-	-	-	-	-	420	182	8.20	329	448	453	126	0.0120	2.20	0.150	1.20
		19-Sep-2016	-	-	-	-	-	-	663	307	8.10	506	14.0	29.0	148	0.00950	3.90	0.180	1.20
		27-Sep-2016	384	-	-	8.00	12.0	3.60	350	175	8.20	262	4.30	4.30	118	<0.0050	1.60	0.100	0.100
		2-Oct-2016	304	-	-	8.10	10.0	2.70	314	147	8.10	194	1.60	0.920	106	<0.0050	1.40	0.0920	0.0110
		3-Oct-2016	326	88.0	9.50	8.20	12.0	1.10	324	142	8.10	211	<1.0	1.00	108	0.0300	1.40	0.0960	0.0250
		11-Oct-2016	397	-	-	8.10	7.50	3.90	379	175	8.00	252	14.0	3.20	121	0.00560	1.80	0.110	0.100
		18-Oct-2016	401	-	-	8.10	8.30	3.40	373	170	8.10	264	1.90	3.30	119	0.0200	1.80	0.110	0.0530
		24-Oct-2016	494	-	-	8.20	7.00	7.20	442	220	8.20	322	5.50	7.40	133	0.00920	2.10	0.130	0.0860
		1-Nov-2016	383	102	11.0	8.10	5.80	4.80	365	164	8.20	270	2.80	5.20	117	0.0250	1.70	0.120	0.240
		8-Nov-2016	393	-	-	8.90	7.10	2.90	370	164	8.20	263	2.20	2.50	120	0.0250	<2.5	0.100	0.200
		15-Nov-2016	348	-	-	8.20	4.90	4.80	333	153	8.20	228	4.50	5.10	116	0.0100	1.50	0.0960	0.120
		22-Nov-2016	314	92.0	10.0	7.90	4.80	4.90	303	136	8.10	180	6.00	3.10	106	0.00630	1.40	0.0950	0.110
		29-Nov-2016	339	-	-	8.10	3.10	2.60	330	154	8.10	237	2.40	3.00	111	0.00940	1.40	0.100	0.110
		6-Dec-2016	338	93.0	12.0	8.20	0	4.30	330	148	8.20	214	4.60	5.60	111	0.00880	1.50	0.0970	0.120
		14-Dec-2016	316	-	-	8.10	0.300	0.820	309	119	8.00	209	1.20	0.970	108	0.00770	1.30	0.0900	0.120
		20-Dec-2016	326	-	-	8.10	0.300	0.720	318	133	8.20	218	<1.0	0.920	113	0.0110	1.40	0.0910	0.120
		28-Dec-2016	316	-	-	8.10	0.300	0.600	306	128	8.00	209	<1.0	0.610	107	0.0110	1.30	0.0910	0.120

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2016	HAC-05a	5-Jan-2016	968	89.0	13.0	7.80	0.360	1.80	965	444	7.90	644	6.20	0.790	85.0	0.0400	16.0	0.260	5.20
		7-Jan-2016	945	-	-	7.70	1.20	1.20	-	-	-	-	-	-	-	-	-	-	-
		12-Jan-2016	1,000	-	-	7.50	1.40	1.00	-	-	-	-	-	-	-	-	-	-	-
		26-Jan-2016	902	-	-	7.70	1.50	1.90	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	802	93.0	13.0	8.00	1.70	1.80	806	366	8.00	546	4.50	1.10	92.0	0.0300	10.0	0.240	4.50
		9-Feb-2016	802	-	-	8.00	2.40	1.10	-	-	-	-	-	-	-	-	-	-	-
		15-Feb-2016	732	-	-	7.80	1.80	1.60	-	-	-	-	-	-	-	-	-	-	-
		22-Feb-2016	746	-	-	8.00	2.90	2.10	-	-	-	-	-	-	-	-	-	-	-
		29-Feb-2016	773	105	14.0	7.90	2.50	1.60	-	-	-	-	-	-	-	-	-	-	-
		2-Mar-2016	721	90.0	-	8.20	3.20	0.610	766	352	8.10	531	3.00	0.830	90.0	0.00940	12.0	0.190	3.90
		8-Mar-2016	916	-	-	7.90	3.90	6.60	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	761	101	13.0	7.90	3.30	3.00	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	1,008	-	-	7.90	3.80	14.0	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	971	-	-	7.80	5.60	10.0	-	-	-	-	-	-	-	-	-	-	-
		30-Mar-2016	833	-	-	7.80	8.80	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	869	-	11.0	7.80	6.50	11.0	892	437	8.00	623	43.0	27.0	104	0.0390	9.30	0.180	4.30
		11-Apr-2016	583	105	11.0	8.00	6.80	2.80	-	-	-	-	-	-	-	-	-	-	-
		13-Apr-2016	657	-	-	8.00	6.90	3.80	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	669	-	-	8.00	8.50	2.30	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	290	-	-	8.40	9.20	3.50	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	904	106	10.0	7.90	12.0	2.50	909	389	7.90	644	4.00	1.70	66.0	0.0960	14.0	0.320	5.70
		10-May-2016	927	-	-	8.00	11.0	1.60	-	-	-	-	-	-	-	-	-	-	-
		17-May-2016	900	-	-	8.00	14.0	0.780	-	-	-	-	-	-	-	-	-	-	-
		24-May-2016	930	107	10.0	8.10	14.0	1.10	-	-	-	-	-	-	-	-	-	-	-
		7-Jun-2016	933	108	9.30	7.90	17.0	0.570	915	389	7.90	642	3.10	1.00	69.0	0.0590	13.0	0.390	5.80
		14-Jun-2016	1,160	-	-	7.70	12.0	0.280	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2016	1,104	-	-	8.40	19.0	3.40	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	1,040	-	-	8.20	17.0	1.50	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2016	969	-	-	8.30	17.0	2.90	-	-	-	-	-	-	-	-	-	-	-
		6-Jul-2016	989	107	9.10	8.30	18.0	4.60	985	429	8.10	734	6.90	4.10	65.0	0.0810	9.20	0.500	6.40
		13-Jul-2016	1,104	-	-	8.20	17.0	13.0	-	-	-	-	-	-	-	-	-	-	-
		25-Jul-2016	957	-	-	8.40	19.0	1.80	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	1,151	110	9.10	8.30	19.0	0.860	1,120	501	8.10	849	1.80	0.810	59.0	0.0760	11.0	0.610	8.10
		10-Aug-2016	1,115	-	-	8.40	20.0	14.0	-	-	-	-	-	-	-	-	-	-	-
		17-Aug-2016	1,134	-	-	8.30	20.0	58.0	-	-	-	-	-	-	-	-	-	-	-
		23-Aug-2016	1,148	-	-	8.40	18.0	4.40	-	-	-	-	-	-	-	-	-	-	-
		30-Aug-2016	1,133	-	-	8.30	17.0	5.30	-	-	-	-	-	-	-	-	-	-	-
		6-Sep-2016	1,148	106	9.50	8.20	15.0	16.0	1,130	459	7.90	889	16.0	9.80	57.0	0.110	12.0	0.600	8.60
		13-Sep-2016	1,149	-	-	8.20	16.0	14.0	-	-	-	-	-	-	-	-	-	-	-
		27-Sep-2016	1,173	-	-	8.10	13.0	4.00	-	-	-	-	-	-	-	-	-	-	-
		3-Oct-2016	1,136	92.0	9.60	8.00	13.0	0.830	1,140	515	7.90	853	2.00	0.530	60.0	0.0210	14.0	0.590	8.40
		11-Oct-2016	1,154	-	-	8.30	11.0	4.80	-	-	-	-	-	-	-	-	-	-	-
		18-Oct-2016	1,006	-	-	8.20	10.0	1.70	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2016	1,124	-	-	8.30	10.0	2.50	-	-	-	-	-	-	-	-	-	-	-
		1-Nov-2016	994	105	11.0	8.20	8.60	3.10	941	391	8.00	705	5.40	3.40	76.0	0.0210	9.30	0.480	6.20
		8-Nov-2016	958	-	-	8.30	9.00	1.80	-	-	-	-	-	-	-	-	-	-	-
		15-Nov-2016	949	-	-	8.10	6.90	2.30	-	-	-	-	-	-	-	-	-	-	-
		22-Nov-2016	333	97.0	11.0	8.00	4.50	6.70	316	145	8.20	210	13.0	6.80	108	0.0100	1.40	0.100	0.140
		29-Nov-2016	866	-	-	8.10	4.90	1.70	-	-	-	-	-	-	-	-	-	-	-
		6-Dec-2016	942	98.0	12.0	8.00	2.40	2.40	921	389	8.10	659	3.70	2.50	76.0	0.0130	8.80	0.450	5.80
		14-Dec-2016	874	-	-	8.10	1.30	1.00	-	-	-	-	-	-	-	-	-	-	-
		20-Dec-2016	916	-	-	8.10	2.10	0.830	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2016	833	-	-	8.10	1.60	0.780	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	5-Jan-2016	933	92.0	13.0	8.00	-0.240	13.0	923	429	8.10	616	65.0	2.10	95.0	0.0240	14.0	0.250	4.80
		19-Jan-2016	874	-	-	8.00	1.30	2.80	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	791	93.0	13.0	8.10	1.70	2.10	791	365	8.10	542	12.0	2.10	96.0	0.0160	9.60	0.230	4.20
		2-Mar-2016	663	91.0	-	8.00	2.80	2.80	704	323	8.10	480	24.0	2.00	93.0	0.00600	11.0	0.190	3.50
		4-Apr-2016	545	-	11.0	8.20	5.70	34.0	561	267	8.00	411	245	68.0	81.0	0.0130	5.00	0.130	2.40
		5-May-2016	818	102	10.0	8.30	12.0	3.00	820	360	8.10	583	7.10	1.40	86.0	0.0350	12.0	0.290	4.80
		7-Jun-2016	937	103	9.40	8.20	16.0	0.940	918	399	8.00	622	4.70	1.00	76.0	0.0540	13.0	0.350	5.70
		6-Jul-2016	981	102	8.50	8.30	20.0	4.30	958	421	8.10	698	12.0	3.60	71.0	0.0330	9.00	0.480	6.20
		2-Aug-2016	1,032	102	8.60	8.30	19.0	1.90	1,010	437	8.10	744	7.30	1.60	70.0	0.0220	9.70	0.500	6.80
		6-Sep-2016	1,016	102	9.60	8.10	14.0	1.70	1,020	414	8.00	783	8.70	1.80	71.0	0.0480	10.0	0.490	6.90
		3-Oct-2016	764	91.0	10.0	8.10	10.0	2.50	1,070	473	8.00	782	8.90	1.10	69.0	0.00940	10.0	0.530	7.30
		1-Nov-2016	872	102	11.0	8.30	7.30	6.00	834	312	8.00	601	16.0	8.00	79.0	0.00850	7.70	0.400	5.00
		22-Nov-2016	338	103	12.0	8.40	4.10	10.0	317	146	8.20	222	27.0	8.90	107	<0.0050	1.50	0.120	0.310
		6-Dec-2016	912	101	14.0	8.20	-0.100	3.70	882	375	8.10	635	8.40	3.20	83.0	0.00750	7.80	0.390	5.30
		14-Dec-2016	868	-	-	8.20	-0.100	9.60	-	-	-	-	-	-	-	-	-	-	-

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Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2016	W10	7-Jan-2016	255	88.0	13.0	7.80	0.0400	0.330	249	130	8.00	172	<3.0	0.370	127	0.00880	0.750	0.0800	0.120
		1-Feb-2016	198	-	-	8.10	0.0230	1.10	201	97.0	8.00	134	<3.0	1.80	91.0	0.00530	<0.50	0.0580	0.620
		2-Mar-2016	139	-	-	8.10	0.500	1.80	149	76.0	7.90	135	<1.0	2.00	65.0	0.00680	<0.50	0.0480	0.340
		15-Mar-2016	109	90.0	13.0	8.20	0.400	3.30	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	81.0	-	-	7.60	1.90	2.90	84.0	45.0	7.70	102	13.0	7.40	40.0	0.00620	<0.50	0.0360	0.0900
		4-May-2016	110	-	-	8.00	12.0	1.30	111	59.0	7.90	110	1.90	1.00	56.0	0.00880	<0.50	0.0470	<0.0050
		4-May-2016	-	-	-	-	-	-	111	59.0	7.90	106	1.60	1.30	56.0	0.0130	<0.50	0.0470	<0.0050
		6-Jun-2016	162	-	-	8.10	14.0	-	161	82.0	8.00	128	<1.0	0.740	84.0	0.00970	<0.50	0.0550	0.0130
		4-Jul-2016	-	-	-	-	-	-	156	83.0	8.10	134	<1.0	1.00	81.0	0.00790	<0.50	0.0570	0.0190
		4-Jul-2016	158	-	-	8.00	12.0	0.410	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	189	100	9.60	8.10	13.0	0.180	185	95.0	8.00	148	<1.0	0.480	96.0	0.00690	<0.50	0.0620	0.0170
		6-Sep-2016	330	-	-	8.00	9.20	0.150	321	163	8.10	228	<1.0	0.290	172	<0.0050	1.30	0.0980	0.00860
		3-Oct-2016	166	-	-	7.60	4.50	1.20	169	82.0	8.00	132	<1.0	0.680	87.0	0.00760	<0.50	0.0480	<0.0050
		1-Nov-2016	115	-	-	8.00	4.40	2.40	112	59.0	7.80	124	2.90	3.00	59.0	0.00970	<0.50	0.0400	0.0510
		1-Dec-2016	120	-	-	8.00	1.10	2.10	115	61.0	7.80	106	1.90	2.40	60.0	0.00560	<0.50	0.0410	0.0580
	EDC-01a	5-Jan-2016	325	86.0	13.0	7.60	-0.0620	0.570	342	171	8.20	225	<3.0	1.10	141	0.00770	2.00	0.0870	0.370
		1-Feb-2016	205	92.0	13.0	8.10	0.110	2.80	210	101	8.00	146	<3.0	2.30	92.0	0.00670	0.520	0.0600	0.610
		2-Mar-2016	140	91.0	-	8.00	0.780	2.20	154	78.0	7.90	84.0	1.90	2.60	67.0	0.00660	<0.50	0.0460	0.350
		10-Mar-2016	135	-	-	8.00	0.800	3.80	-	-	-	-	8.20	5.80	-	-	-	-	-
		15-Mar-2016	112	90.0	13.0	8.30	0.540	4.30	-	-	-	-	3.70	3.50	-	-	-	-	-
		23-Mar-2016	111	-	-	7.80	1.20	4.30	-	-	-	-	9.10	4.80	-	-	-	-	-
		29-Mar-2016	98.0	-	-	7.80	1.00	3.30	-	-	-	-	5.40	3.80	-	-	-	-	-
		4-Apr-2016	82.0	-	13.0	7.60	2.00	4.60	85.0	45.0	7.70	115	25.0	11.0	40.0	0.00600	<0.50	0.0370	0.0890
		11-Apr-2016	76.0	-	-	8.10	4.10	4.50	-	-	-	-	7.90	4.30	-	-	-	-	-
		19-Apr-2016	85.0	-	-	7.80	7.60	2.40	-	-	-	-	3.30	2.30	-	-	-	-	-
		25-Apr-2016	94.0	-	-	7.90	9.60	1.70	-	-	-	-	2.60	2.30	-	-	-	-	-
		5-May-2016	126	102	10.0	8.00	10.0	1.80	128	66.0	7.90	114	1.40	1.10	62.0	0.0120	<0.50	0.0540	<0.0050
		7-Jun-2016	180	103	9.30	7.90	16.0	0.980	175	92.0	8.00	132	1.80	1.10	87.0	0.0170	<0.50	0.0620	0.0200
		6-Jul-2016	160	104	9.60	8.20	15.0	0.590	157	83.0	8.00	136	2.10	1.00	77.0	0.00890	<0.50	0.0530	0.00860
		2-Aug-2016	271	100	8.70	8.10	18.0	0.310	250	133	8.00	199	<1.0	0.560	100	0.00780	0.870	0.0730	0.100
		6-Sep-2016	400	102	10.0	8.10	12.0	0.210	394	185	8.20	276	<1.0	0.410	163	<0.0050	2.20	0.100	0.170
		3-Oct-2016	200	92.0	11.0	8.10	6.50	0.740	201	97.0	8.00	157	<1.0	0.800	88.0	<0.0050	0.540	0.0560	0.0810
		1-Nov-2016	123	103	12.0	8.00	4.80	2.80	119	62.0	7.90	126	2.70	3.00	59.0	0.00810	<0.50	0.0410	0.0660
		6-Dec-2016	193	100	13.0	7.90	-0.100	2.10	194	93.0	8.00	166	2.00	2.80	74.0	0.00590	0.830	0.0540	0.290
2017	HAC-13	3-Jan-2017	270	96.0	13.0	8.20	0.100	0.440	296	126	8.10	195	<3.0	0.600	106	0.00540	1.30	0.0840	0.110
		10-Jan-2017	300	-	-	8.20	0.200	0.480	303	136	8.20	184	<1.0	0.550	107	<0.0050	1.30	0.0860	0.110
		17-Jan-2017	306	-	-	8.30	0.900	0.380	296	123	8.00	197	<1.0	0.600	105	0.00790	1.30	0.0890	0.110
		24-Jan-2017	310	100	13.0	8.20	0.900	0.0700	301	134	7.30	215	<1.0	0.490	113	0.00630	1.40	0.0910	0.110
		1-Feb-2017	608	100	13.0	8.20	0.700	0.400	296	134	8.20	212	<1.0	0.510	107	<0.0050	1.30	0.0870	0.0900
		7-Feb-2017	247	-	-	8.40	0	0.620	302	127	8.20	214	<1.0	0.680	110	0.00540	1.30	0.0820	0.0860
		14-Feb-2017	310	-	-	8.50	1.40	0.470	305	140	8.20	202	1.20	0.630	108	0.00520	1.30	0.0920	0.0760
		21-Feb-2017	326	-	-	8.50	1.50	2.90	314	140	8.20	207	1.50	0.830	112	0.00730	1.40	0.0940	0.0810
		1-Mar-2017	314	106	14.0	8.30	0.700	0.620	300	131	8.30	217	1.00	0.820	108	0.00740	1.40	0.0900	0.0630
		7-Mar-2017	313	-	-	8.50	0.600	0.580	298	130	8.30	209	1.50	0.780	109	0.00840	1.40	0.0890	0.0450
		14-Mar-2017	328	-	-	8.10	1.10	0.700	326	142	8.10	222	<1.0	0.870	111	0.00910	1.40	0.0890	0.0600
		21-Mar-2017	325	-	-	8.30	1.50	0.490	313	139	8.20	215	1.10	0.730	111	0.00750	1.40	0.0900	0.0450
		27-Mar-2017	361	-	-	8.20	2.20	0.760	389	169	8.20	240	5.00	1.10	113	<0.0050	1.50	0.0990	0.0630
		30-Mar-2017	-	-	-	-	-	17.0	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	329	100	12.0	8.00	2.40	2.70	331	147	8.10	217	2.70	3.20	105	0.0110	1.20	0.0860	0.120
		11-Apr-2017	256	-	-	8.20	3.80	2.30	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	279	106	12.0	8.30	7.00	2.50	281	123	8.20	218	2.70	1.90	99.0	0.00600	1.20	0.0870	0.0110
		1-Jun-2017	283	110	9.80	8.50	16.0	0.920	283	125	8.30	169	1.30	0.760	99.0	<0.0050	1.20	0.0840	0.0120
		6-Jun-2017	288	110	9.50	8.40	17.0	1.20	284	121	8.20	211	1.30	1.20	105	0.00610	1.20	0.0880	0.0240
		13-Jun-2017	299	125	11.0	8.60	17.0	0.650	288	132	8.40	183	<1.0	0.690	100	0.00640	1.20	0.0920	0.0630
		20-Jun-2017	311	-	-	8.40	16.0	1.40	304	147	8.20	211	<1.0	0.760	106	<0.0050	1.30	0.0920	0.0460
		27-Jun-2017	318	115	9.80	8.40	18.0	1.50	307	135	8.20	211	<1.0	0.750	105	0.00600	1.30	0.0980	0.0440
		4-Jul-2017	292	127	12.0	8.50	20.0	0.520	278	122	8.20	216	2.00	0.760	104	0.00570	1.20	0.0850	0.0220
		1-Aug-2017	288	101	8.60	8.30	18.0	0.410	278	133	8.20	187	1.80	0.540	99.0	<0.0050	1.20	0.0870	0.0150
		27-Aug-2017	288	95.0	8.20	8.10	17.0	0.870	285	121	8.20	171	30.0	0.520	105	<0.0050	1.20	0.0870	0.0220
		19-Sep-2017	338	108	10.0	-	11.0	0.120	284	121	8.20	204	<1.0	0.410	109	0.00610	1.20	0.0970	0.0690
		26-Sep-2017	303	-	-	8.00	15.0	0.420	292	134	8.20	181	<1.0	0.280	111	0.00600	1.30	0.110	0.0830
		2-Oct-2017	320	112	11.0	-	8.00	0.660	287	126	8.20	221	<1.0	0.280	109	<0.0050	1.30	0.110	0.0580
		10-Oct-2017	289	84.0	10.0	7.40	7.40	0.450	299	128	8.20	216	<1.0	0.280	112	0.00620	1.20	0.0910	0.0880
		17-Oct-2017	343	84.0	10.0	8.00	6.00	1.20	330	150	8.20	230	<1.0	1.50	105	<0.0050	1.10	0.100	0.130
		24-Oct-2017	369	87.0	11.0	8.00	5.90	0.390	332	161	8.20	250	<1.0	0.520	111	<0.0050	1.40	0.0940	0.0920
		31-Oct-2017	322	87.0	11.0	7.90	4.20	0.330	324	131	8.20	216	<1.0	0.340	112	<0.0050	1.40	0.0950	0.0430

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2017	HAC-13	7-Nov-2017	335	96.0	13.0	8.30	0.400	2.00	316	134	8.20	215	4.60	1.10	114	<0.0050	1.50	0.0940	0.0600
		14-Nov-2017	336	84.0	11.0	8.00	2.70	0.540	310	144	8.20	216	<1.0	0.500	107	<0.0050	1.50	0.0990	0.100
		21-Nov-2017	343	96.0	12.0	8.00	1.00	0.320	322	157	8.10	244	<1.0	0.330	113	<0.0050	1.40	0.0870	0.0920
		28-Nov-2017	242	86.0	12.0	7.80	1.40	0.350	437	200	8.20	307	<1.0	1.40	128	<0.0050	1.90	0.110	0.280
		5-Dec-2017	418	97.0	13.0	7.90	0.500	0.320	395	186	8.10	280	<1.0	0.440	126	<0.0050	1.70	0.0880	0.170
		12-Dec-2017	418	84.0	12.0	7.60	0.310	0.220	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	385	81.0	12.0	7.80	0.100	0.140	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	371	78.0	11.0	7.90	0.0630	0	-	-	-	-	-	-	-	-	-	-	-
	HAC-05a	3-Jan-2017	611	99.0	13.0	8.10	0.800	1.30	593	245	8.00	420	3.90	1.40	91.0	0.0100	4.60	0.260	2.70
		10-Jan-2017	483	-	-	8.30	0	0.650	-	-	-	-	-	-	-	-	-	-	-
		17-Jan-2017	487	-	-	8.10	1.30	1.10	-	-	-	-	-	-	-	-	-	-	-
		24-Jan-2017	318	102	13.0	8.30	0.900	0.240	311	134	7.40	205	<1.0	0.590	120	0.00560	1.40	0.0950	0.120
		1-Feb-2017	676	102	13.0	8.00	1.10	0.940	648	269	8.00	457	2.80	0.730	86.0	0.0140	7.40	0.260	3.20
		7-Feb-2017	744	-	-	8.30	1.30	1.10	-	-	-	-	-	-	-	-	-	-	-
		14-Feb-2017	777	-	-	8.00	2.10	0.500	-	-	-	-	-	-	-	-	-	-	-
		21-Feb-2017	811	-	-	8.10	2.60	3.30	-	-	-	-	-	-	-	-	-	-	-
		1-Mar-2017	806	110	14.0	8.10	1.90	1.70	770	306	8.10	557	3.70	1.20	81.0	0.0120	10.0	0.310	4.50
		7-Mar-2017	830	-	-	8.20	2.20	0.990	-	-	-	-	-	-	-	-	-	-	-
		14-Mar-2017	881	-	-	7.90	2.00	1.20	-	-	-	-	-	-	-	-	-	-	-
		21-Mar-2017	867	-	-	8.00	2.30	0.750	-	-	-	-	-	-	-	-	-	-	-
		27-Mar-2017	827	-	-	8.00	3.00	1.10	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	344	100	12.0	7.90	2.70	7.40	342	153	8.20	224	26.0	11.0	110	0.0180	1.20	0.0870	0.140
		6-Apr-2017	-	-	-	-	-	10.0	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	272	-	-	8.10	4.30	4.50	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	251	-	-	8.30	5.70	6.20	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2017	265	-	-	8.20	7.10	2.50	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	290	105	11.0	8.20	8.20	2.80	291	130	8.20	199	5.90	2.50	107	0.00960	1.20	0.0890	0.0290
		9-May-2017	296	-	-	8.30	9.00	3.10	-	-	-	-	-	-	-	-	-	-	-
		17-May-2017	301	-	-	8.30	11.0	2.90	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	290	-	-	8.50	16.0	1.00	-	-	-	-	-	-	-	-	-	-	-
		1-Jun-2017	291	110	9.60	8.40	16.0	0.770	296	127	8.30	169	2.60	1.10	106	<0.0050	1.20	0.0870	0.0180
		6-Jun-2017	893	110	9.50	8.10	18.0	1.60	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	1,251	108	9.30	7.90	17.0	2.50	1,200	584	8.10	927	8.80	3.20	94.0	0.0980	14.0	0.440	9.20
		20-Jun-2017	1,246	-	-	7.80	16.0	1.80	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2017	1,189	105	9.00	7.80	18.0	1.50	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2017	1,250	105	8.70	7.80	19.0	2.50	1,180	542	8.00	1,040	11.0	2.80	85.0	0.0510	16.0	0.440	8.10
		1-Aug-2017	303	103	8.90	8.30	18.0	0.450	292	141	8.20	197	1.70	1.00	108	<0.0050	1.30	0.0880	0.0150
		19-Sep-2017	734	104	10.0	8.00	11.0	1.80	1,300	592	8.00	1,130	6.80	1.00	111	0.0970	14.0	0.510	7.50
		26-Sep-2017	1,396	107	-	7.60	12.0	0.970	1,300	636	8.10	1,030	4.70	0.760	92.0	0.0560	18.0	0.600	7.50
		2-Oct-2017	455	112	12.0	-	5.40	0.410	414	192	8.30	301	<1.0	0.500	151	<0.0050	2.40	0.160	0.350
		10-Oct-2017	438	93.0	11.0	7.80	6.50	9.70	-	-	-	-	-	-	-	-	-	-	-
		17-Oct-2017	451	87.0	11.0	8.00	5.50	5.40	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2017	465	94.0	12.0	8.10	5.40	0.410	-	-	-	-	-	-	-	-	-	-	-
		31-Oct-2017	412	89.0	12.0	8.00	3.30	0.390	399	172	8.30	270	<1.0	0.390	142	0.00640	1.90	0.100	0.190
		7-Nov-2017	437	106	14.0	8.40	0.200	0.220	415	196	8.30	277	<1.0	0.380	148	<0.0050	2.10	0.100	0.280
		14-Nov-2017	415	95.0	13.0	8.20	1.00	0.860	384	191	8.20	270	<1.0	0.390	131	0.00930	2.00	0.110	0.280
		21-Nov-2017	437	102	13.0	8.10	0.500	0.190	414	205	8.20	325	<1.0	0.300	145	<0.0050	2.00	0.0970	0.310
		28-Nov-2017	276	95.0	13.0	8.00	1.10	0.0500	-	-	-	-	-	-	-	-	-	-	-
		28-Nov-2017	-	-	-	-	-	-	502	242	8.30	358	<1.0	0.840	151	<0.0050	2.20	0.120	0.660
		5-Dec-2017	494	106	14.0	8.20	0.300	0.310	467	225	8.30	331	<1.0	0.330	155	<0.0050	2.20	0.0960	0.380
		12-Dec-2017	501	92.0	13.0	7.80	0.230	0.260	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	475	86.0	12.0	8.00	0.0520	0.240	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	463	82.0	12.0	7.80	0.0170	0.0900	-	-	-	-	-	-	-	-	-	-	-
	HAC-14	27-Aug-2017	330	102	9.20	8.30	16.0	10.0	325	138	8.20	194	27.0	2.20	119	0.00510	1.30	0.100	0.0390
		19-Sep-2017	783	103	10.0	8.40	9.80	0.520	1,200	588	8.20	1,030	2.50	0.560	115	0.0430	12.0	0.440	6.70
		26-Sep-2017	1,312	-	-	7.90	15.0	0.520	1,290	626	8.10	1,050	1.60	0.480	100	0.0240	18.0	0.570	7.20
		2-Oct-2017	563	111	11.0	-	6.60	0.420	497	241	8.40	360	<1.0	0.450	161	<0.0050	3.20	0.240	0.470
		17-Oct-2017	503	93.0	12.0	8.30	6.10	17.0	495	232	8.30	332	11.0	20.0	135	<0.0050	1.50	0.130	0.280
		24-Oct-2017	511	95.0	12.0	8.30	6.00	0.790	464	235	8.30	341	1.00	0.850	150	<0.0050	1.80	0.130	0.140
		31-Oct-2017	444	92.0	12.0	8.30	3.30	3.40	431	187	8.40	295	5.10	2.70	155	<0.0050	1.90	0.120	0.110
		7-Nov-2017	477	101	13.0	8.50	0.400	0.510	451	204	8.40	300	1.00	0.470	166	<0.0050	2.00	0.130	0.200
		14-Nov-2017	451	92.0	13.0	8.30	1.70	0.810	422	206	8.40	281	<1.0	0.710	149	<0.0050	1.90	0.130	0.190
		21-Nov-2017	471	105	13.0	8.40	1.10	0.230	442	224	8.30	350	<1.0	0.400	165	0.00520	1.90	0.120	0.230
		28-Nov-2017	303	91.0	12.0	8.20	2.60	3.60	523	249	8.30	369	6.50	5.70	171	0.00590	2.00	0.130	0.500
		5-Dec-2017	518	103	14.0	8.40	0.800	0.490	487	238	8.30	343	<1.0	0.620	168	0.00670	2.00	0.110	0.290
		12-Dec-2017	518	93.0	13.0	8.10	0.660	0.480	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	504	90.0	13.0	8.20	0.0730	0.380	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	493	83.0	12.0	8.00	0.0830	0.130	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2017	HAC-08	3-Jan-2017	-	102	14.0	8.20	-	11.0	605	250	8.10	412	34.0	14.0	97.0	0.00980	4.50	0.250	2.60
		24-Jan-2017	337	104	14.0	8.30	2.30	1.40	325	146	7.50	216	8.70	1.80	127	0.00650	1.50	0.110	0.160
		1-Feb-2017	686	101	14.0	8.20	0	3.60	660	268	8.10	462	14.0	3.50	92.0	0.00860	7.60	0.250	3.30
		1-Mar-2017	784	101	13.0	8.20	2.30	1.50	757	303	8.10	539	28.0	0.810	85.0	0.00940	9.60	0.300	4.20
		3-Apr-2017	278	102	13.0	8.20	2.10	15.0	279	128	8.10	201	45.0	24.0	94.0	0.0120	0.850	0.0740	0.180
		2-May-2017	274	104	11.0	8.30	8.80	5.60	273	124	8.20	205	14.0	4.60	100	<0.0050	1.00	0.0860	0.0200
		1-Jun-2017	302	104	9.40	8.50	15.0	2.70	298	133	8.30	184	8.60	1.50	110	<0.0050	1.20	0.0910	<0.0050
		6-Jun-2017	806	102	8.50	8.50	19.0	2.30	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	1,047	101	9.10	8.40	16.0	2.20	994	489	8.30	777	4.20	0.930	105	0.0320	11.0	0.320	7.10
		4-Jul-2017	1,122	101	8.10	8.40	22.0	0.620	1,070	501	8.20	893	2.30	0.650	91.0	0.0140	14.0	0.360	6.80
		27-Aug-2017	-	-	-	-	-	-	336	146	8.30	217	6.20	3.20	121	<0.0050	1.40	0.100	0.0220
		27-Aug-2017	340	102	9.30	8.40	16.0	4.50	-	-	-	-	-	-	-	-	-	-	-
		19-Sep-2017	927	102	11.0	8.60	7.00	13.0	1,050	492	8.20	895	56.0	13.0	128	0.00830	11.0	0.310	5.00
		10-Oct-2017	490	92.0	11.0	8.60	7.80	0.980	519	243	8.50	348	2.10	0.850	184	0.00510	2.30	0.170	0.170
		17-Oct-2017	483	93.0	12.0	8.40	5.70	32.0	470	225	8.30	327	33.0	38.0	132	<0.0050	1.30	0.140	0.190
		24-Oct-2017	522	96.0	12.0	8.40	5.80	1.60	468	255	8.40	345	1.60	1.10	155	<0.0050	1.80	0.130	0.100
		31-Oct-2017	445	93.0	13.0	8.40	2.30	1.70	428	190	8.40	310	3.10	1.30	160	<0.0050	1.80	0.120	0.0880
		7-Nov-2017	498	100	14.0	8.60	-0.100	1.10	472	226	8.40	316	2.40	0.950	173	<0.0050	2.00	0.140	0.190
		14-Nov-2017	458	92.0	13.0	8.30	0.910	1.60	426	203	8.30	294	2.40	0.880	151	<0.0050	1.90	0.140	0.190
		21-Nov-2017	480	104	14.0	8.50	0.600	0.610	450	226	8.40	325	<1.0	0.390	171	0.00650	1.90	0.120	0.230
		28-Nov-2017	537	91.0	13.0	8.10	1.50	1.20	525	247	8.40	359	1.80	1.60	173	0.00520	1.90	0.140	0.420
		5-Dec-2017	522	103	14.0	8.50	-0.100	0.830	492	235	8.40	337	1.70	0.940	175	0.00530	2.00	0.120	0.270
		12-Dec-2017	539	94.0	14.0	8.20	-0.00700	0.870	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	518	92.0	13.0	8.20	-0.0130	0.400	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	503	86.0	13.0	8.00	-0.00600	0.250	-	-	-	-	-	-	-	-	-	-	-
	W10	3-Jan-2017	188	100	14.0	8.10	-0.100	1.10	187	95.0	8.00	154	<1.0	1.50	98.0	0.0130	<0.50	0.0520	0.110
		1-Feb-2017	204	98.0	14.0	8.00	0.100	1.00	199	109	8.10	156	<1.0	1.10	106	0.00670	<0.50	0.0500	0.130
		1-Mar-2017	185	102	14.0	8.00	0.100	1.10	177	93.0	8.10	144	<1.0	1.70	93.0	0.00920	<0.50	0.0460	0.190
		3-Apr-2017	122	101	14.0	7.70	-0.100	4.00	124	61.0	7.80	115	9.50	5.50	61.0	0.00760	<0.50	0.0310	0.250
		6-Apr-2017	100	-	-	7.60	0.500	2.70	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	97.0	-	-	7.80	1.50	5.50	95.0	57.0	7.80	102	12.0	6.40	49.0	<0.0050	<0.50	0.0340	0.0590
		25-Apr-2017	88.0	-	-	7.80	3.50	3.40	90.0	46.0	7.80	101	7.10	4.00	44.0	<0.0050	<0.50	0.0340	0.0530
		2-May-2017	92.0	103	12.0	7.80	5.50	2.40	93.0	48.0	7.80	92.0	3.50	2.40	46.0	0.00570	<0.50	0.0380	0.0340
		9-May-2017	97.0	-	-	7.70	8.20	2.60	95.0	52.0	7.80	88.0	6.10	3.90	48.0	<0.0050	<0.50	0.0360	0.0170
		17-May-2017	103	-	-	7.80	8.10	1.50	98.0	53.0	7.70	101	6.00	3.40	51.0	0.00640	<0.50	0.0380	0.0120
		23-May-2017	118	-	-	7.80	14.0	1.30	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	-	-	-	-	-	-	114	65.0	7.90	109	2.90	1.80	60.0	0.00670	<0.50	0.0380	0.0120
		1-Jun-2017	141	101	9.40	8.00	14.0	1.00	141	73.0	8.10	114	1.80	1.20	75.0	0.00610	<0.50	0.0500	0.0110
		4-Jul-2017	294	98.0	9.10	7.70	15.0	0.150	285	133	8.20	207	<1.0	0.380	149	0.00910	0.740	0.0850	0.0380
		17-Aug-2017	401	-	-	7.90	11.0	0.470	383	194	8.40	267	<1.0	0.280	205	<0.0050	1.70	0.120	0.0200
		4-Sep-2017	236	-	-	7.60	14.0	1.30	-	-	-	-	-	-	-	-	-	-	-
		5-Sep-2017	-	-	-	-	-	-	394	189	8.30	255	<1.0	0.210	218	<0.0050	1.70	0.120	0.0190
		11-Oct-2017	406	-	-	8.40	4.20	0.150	377	190	8.40	223	<1.0	0.330	205	<0.0050	2.90	0.130	0.00570
		7-Nov-2017	310	96.0	13.0	8.20	0	0	296	145	8.30	194	<1.0	0.390	162	<0.0050	<0.50	0.0930	0.0230
		4-Dec-2017	251	101	13.0	8.20	0.200	0.430	-	-	-	-	-	-	-	-	-	-	-
	EDC-01a	3-Jan-2017	-	92.0	12.0	8.50	-	0.990	228	114	8.00	170	12.0	1.40	104	0.0120	0.690	0.0590	0.260
		1-Feb-2017	242	96.0	13.0	8.00	0.200	1.60	335	148	8.10	245	2.70	2.40	109	<0.0050	1.60	0.0950	0.760
		1-Mar-2017	199	100	14.0	8.00	0.100	1.40	184	91.0	8.10	148	<1.0	1.60	96.0	0.00810	<0.50	0.0470	0.200
		31-Mar-2017	-	-	-	-	-	5.60	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	129	100	14.0	7.80	0.100	4.40	130	67.0	7.90	121	12.0	6.80	63.0	0.00700	<0.50	0.0350	0.260
		6-Apr-2017	-	-	-	-	-	9.50	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	101	-	-	7.70	1.20	4.60	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	99.0	-	-	7.90	1.80	10.0	97.0	53.0	7.80	98.0	13.0	7.20	49.0	0.00980	<0.50	0.0340	0.0580
		25-Apr-2017	90.0	-	-	7.70	4.40	3.60	91.0	48.0	7.80	63.0	6.00	4.20	45.0	<0.0050	<0.50	0.0350	0.0530
		2-May-2017	95.0	104	11.0	7.80	5.80	2.80	96.0	50.0	7.80	87.0	4.90	2.50	48.0	0.00610	<0.50	0.0410	0.0350
		9-May-2017	98.0	-	-	7.80	8.30	2.30	98.0	50.0	7.80	90.0	4.80	2.60	48.0	0.00620	<0.50	0.0370	0.0160
		17-May-2017	105	-	-	8.00	8.70	2.90	100	55.0	7.80	99.0	4.70	1.70	50.0	0.00610	<0.50	0.0390	0.0100
		23-May-2017	122	-	-	7.90	15.0	1.40	119	63.0	7.90	112	2.50	1.00	62.0	0.00680	<0.50	0.0390	0.00900
		1-Jun-2017	150	103	9.50	8.00	15.0	1.40	153	76.0	8.10	117	1.50	1.30	76.0	0.00840	<0.50	0.0520	0.00890
		4-Jul-2017	308	109	8.70	8.00	22.0	0.170	296	140	8.30	211	<1.0	0.460	154	0.0110	0.790	0.0850	0.0210
		19-Sep-2017	420	106	12.0	8.50	6.40	0	398	189	8.40	273	<1.0	0.200	212	<0.0050	1.80	0.130	<0.0050
		2-Oct-2017	458	111	12.0	-	5.50	0.130	389	197	8.40	263	<1.0	0.380	215	<0.0050	2.60	0.130	<0.0050
		7-Nov-2017	314	107	14.0	8.50	-0.100	0.290	298	146	8.30	196	<1.0	0.430	162	<0.0050	0.540	0.0910	<0.0050
		4-Dec-2017	286	104	14.0	8.30	0.300	0.210	282	141	8.20	187	<1.0	0.440	130	<0.0050	0.860	0.0780	0.100

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2018	HAC-13	2-Jan-2018	369	75.0	11.0	8.00	0.670	0.340	361	172	8.30	232	<1.0	0.280	127	<0.0050	1.50	0.0970	0.130
		9-Jan-2018	354	73.0	11.0	7.70	0.230	0	350	158	8.10	225	<1.0	0.320	121	<0.0050	1.50	0.0980	0.120
		16-Jan-2018	349	78.0	11.0	7.20	0.0670	1.20	340	157	8.20	229	<1.0	0.300	120	<0.0050	1.40	0.0890	0.110
		23-Jan-2018	357	79.0	11.0	7.90	0.390	1.90	337	147	8.10	201	<1.0	0.220	118	<0.0050	1.40	0.0930	0.100
		30-Jan-2018	329	80.0	12.0	7.40	0.0150	0.280	318	145	8.10	207	<1.0	0.260	109	<0.0050	1.40	0.0870	0.0970
		6-Feb-2018	311	81.0	11.0	7.60	-0.00400	0.300	300	129	8.20	185	1.10	0.360	111	<0.0050	1.30	0.0910	0.0910
		13-Feb-2018	303	84.0	12.0	7.60	0.00100	1.70	294	132	8.00	206	<1.0	0.280	105	<0.0050	1.20	0.0820	0.0890
		20-Feb-2018	286	94.0	13.0	8.00	0.530	0.860	294	146	8.20	192	<1.0	0.270	109	<0.0050	1.30	0.0940	0.0860
		1-Mar-2018	361	77.0	11.0	7.60	0.100	0	372	167	8.00	250	<1.0	0.260	127	<0.0050	1.60	0.0930	0.100
		8-Mar-2018	397	89.0	12.0	7.80	-0.100	0.280	381	178	8.20	257	<1.0	0.260	129	0.00660	1.50	0.0930	0.120
		14-Mar-2018	436	76.0	11.0	7.50	0.0670	0.220	452	206	8.30	281	<1.0	0.410	142	0.0110	1.70	0.0920	0.140
		20-Mar-2018	560	73.0	11.0	7.10	0.200	0.770	554	288	8.10	391	<1.0	0.720	165	0.0250	2.20	0.100	0.200
		27-Mar-2018	585	76.0	11.0	7.30	0.350	0.440	574	285	8.30	405	<1.0	0.930	157	0.0260	2.00	0.110	0.300
		3-Apr-2018	348	84.0	12.0	7.50	0.430	0.790	340	146	8.30	248	<1.0	0.380	120	0.00950	1.30	0.0880	0.100
		10-Apr-2018	330	83.0	12.0	7.60	0.760	0.610	326	147	8.30	203	1.00	0.430	113	0.00930	1.30	0.0860	0.140
		17-Apr-2018	344	89.0	13.0	7.30	1.30	1.40	332	145	8.30	232	<1.0	0.660	115	0.00890	1.30	0.0940	0.160
		24-Apr-2018	554	78.0	11.0	7.30	1.80	13.0	544	275	8.20	368	24.0	16.0	126	0.0690	1.20	0.150	0.470
		1-May-2018	176	92.0	12.0	7.70	3.90	1.70	179	88.0	7.90	154	3.90	2.50	59.0	0.00770	0.550	0.0630	0.0660
		8-May-2018	197	94.0	11.0	7.90	-	0.0600	196	90.0	8.10	100	3.90	2.60	71.0	0.00690	0.710	0.0650	<0.0050
		16-May-2018	285	78.0	8.00	7.70	14.0	2.40	275	127	8.30	194	5.70	1.90	100	0.0240	1.10	0.0880	0.0460
		24-May-2018	279	86.0	8.50	7.40	16.0	0.410	283	127	8.20	179	2.00	1.20	104	0.0240	1.10	0.0870	0.0740
		29-May-2018	279	89.0	9.50	8.00	12.0	0.690	272	130	8.20	192	1.20	1.30	100	0.0120	1.10	0.0830	0.0400
		5-Jun-2018	283	94.0	10.0	8.10	13.0	0	270	124	8.20	181	1.20	0.660	103	0.00610	1.10	0.0870	0.0260
		12-Jun-2018	278	104	9.60	8.40	14.0	1.10	269	133	8.20	190	<1.0	1.30	104	0.00740	1.10	0.0820	0.0160
		18-Jun-2018	279	105	8.90	8.40	18.0	0.280	272	124	8.20	188	<1.0	0.650	97.0	0.00880	1.10	0.0880	0.0240
		26-Jun-2018	286	99.0	9.50	8.30	17.0	0.430	274	123	8.10	190	<1.0	0.400	104	0.00600	1.10	0.0890	0.0190
		4-Jul-2018	293	106	9.10	8.40	18.0	0.0600	291	125	8.30	204	2.00	0.510	100	<0.0050	1.10	0.0850	0.0140
		10-Jul-2018	276	101	9.40	8.30	19.0	0.680	269	125	8.20	178	<1.0	0.450	97.0	0.00540	1.10	0.0800	0.0130
		17-Jul-2018	261	-	-	8.60	23.0	1.10	266	122	8.40	200	1.20	0.460	102	<0.0050	1.10	0.0820	0.00960
		24-Jul-2018	276	-	-	8.70	19.0	0.480	278	127	8.30	189	<1.0	0.690	106	<0.0050	1.10	0.0800	0.00720
		2-Aug-2018	268	94.0	8.90	8.00	18.0	0.340	266	117	8.20	174	1.10	0.740	96.0	<0.0050	1.10	0.0850	0.0180
		7-Aug-2018	273	-	-	8.20	18.0	1.10	272	115	8.30	181	<1.0	0.620	100	0.00880	1.10	0.0870	0.0140
		14-Aug-2018	270	75.0	7.40	7.80	16.0	0.350	286	122	8.20	195	1.20	0.800	105	0.00640	1.10	0.0830	0.0230
		21-Aug-2018	270	-	-	8.30	17.0	0.450	287	121	8.20	192	<1.0	0.660	105	<0.0050	1.10	0.0840	0.0170
		28-Aug-2018	275	88.0	8.70	7.70	16.0	0.110	277	121	8.20	195	<1.0	0.510	106	0.00590	1.10	0.0820	0.0280
		4-Sep-2018	265	88.0	9.30	7.60	13.0	0.360	280	122	8.30	180	<1.0	0.470	106	0.00510	1.10	0.0860	0.0210
		10-Sep-2018	268	94.0	9.70	8.00	14.0	0.770	270	157	8.20	189	<1.0	0.440	90.0	<0.0050	1.20	0.0880	0.0200
		20-Sep-2018	282	-	-	7.80	12.0	0.760	270	124	8.20	182	<1.0	0.480	76.0	<0.0050	1.10	0.0860	0.0160
		24-Sep-2018	280	10.0	97.0	8.00	13.0	0.800	281	135	8.20	162	<1.0	0.500	106	<0.0050	1.10	0.0890	0.0130
		2-Oct-2018	301	87.0	11.0	7.70	6.80	0.660	277	127	8.20	200	<1.0	0.710	108	0.00530	1.10	0.0880	0.0120
		9-Oct-2018	320	90.0	11.0	7.90	7.80	0	316	133	8.20	196	<1.0	0.670	107	<0.0050	1.20	0.0930	0.0160
		16-Oct-2018	298	85.0	11.0	7.50	5.70	0	291	133	8.20	214	1.20	0.520	109	0.00700	1.20	0.0900	0.0160
		23-Oct-2018	293	88.0	11.0	7.50	5.90	0.110	307	141	8.20	204	<1.0	0.470	111	<0.0050	1.20	0.0890	0.0180
		30-Oct-2018	300	91.0	11.0	8.00	6.90	1.10	299	135	8.20	194	1.00	1.20	108	<0.0050	1.20	0.0840	0.0460
		6-Nov-2018	371	88.0	11.0	7.90	4.40	3.00	371	179	8.00	281	1.60	3.00	107	0.00530	1.10	0.0980	0.0810
		13-Nov-2018	333	88.0	12.0	7.90	3.00	1.40	353	160	8.00	233	1.50	1.50	115	<0.0050	1.20	0.0970	0.0430
		27-Nov-2018	415	84.0	11.0	7.10	2.60	1.80	454	220	8.10	301	2.30	3.20	122	0.00780	1.00	0.100	0.140
		4-Dec-2018	350	94.0	14.0	7.90	0.530	0.890	350	154	8.20	232	<1.0	1.10	114	<0.0050	1.20	0.0960	0.0690
	HAC-05a	2-Jan-2018	457	78.0	11.0	7.90	0.0180	0.440	444	221	8.40	277	<1.0	0.290	163	0.0120	2.30	0.100	0.460
		9-Jan-2018	436	81.0	12.0	7.90	0.170	0.940	431	204	8.20	247	1.40	0.480	151	0.00760	2.10	0.110	0.420
		16-Jan-2018	432	82.0	12.0	7.50	0.0160	1.90	421	198	8.30	268	<1.0	0.450	147	<0.0050	2.00	0.0960	0.380
		23-Jan-2018	438	82.0	12.0	7.80	0.150	1.60	416	191	8.20	275	<1.0	0.390	147	0.00930	2.10	0.100	0.360
		30-Jan-2018	388	82.0	12.0	7.60	-0.00400	1.30	388	182	8.20	250	1.70	0.750	131	<0.0050	1.80	0.0960	0.280
		6-Feb-2018	333	83.0	12.0	7.60	-0.00600	0.310	319	139	8.20	206	1.40	0.480	118	<0.0050	1.40	0.0940	0.140
		13-Feb-2018	318	86.0	13.0	7.90	-0.00300	3.70	309	144	8.00	224	6.50	1.70	111	<0.0050	1.30	0.0840	0.130
		20-Feb-2018	297	92.0	14.0	7.80	0.110	2.60	315	154	8.20	144	1.40	0.470	116	<0.0050	1.30	0.0880	0.120
		14-Mar-2018	490	81.0	12.0	7.70	0.120	2.20	486	245	8.40	319	2.50	1.80	156	0.0120	2.20	0.0960	0.440
		20-Mar-2018	573	83.0	12.0	7.60	0.400	0.770	555	314	8.30	394	<1.0	0.770	173	0.00650	2.40	0.100	0.510
		27-Mar-2018	604	82.0	12.0	7.70	0.470	1.20	591	295	8.30	422	<1.0	0.780	177	0.0100	2.30	0.110	0.580
		3-Apr-2018	386	89.0	13.0	7.80	0.600	1.30	389	164	8.40	259	<1.0	0.450	131	<0.0050	1.50	0.0930	0.180
		10-Apr-2018	350	89.0	13.0	7.80	1.20	0.310	341	156	8.30	230	1.60	1.00	118	0.00690	1.30	0.0870	0.160
		17-Apr-2018	371	98.0	14.0	7.80	1.70	1.40	361	144	8.30	254	<1.0	1.20	120	0.00930	1.30	0.0960	0.200
		24-Apr-2018	546	101	14.0	7.60	2.90	6.70	545	266	8.20	381	7.30	6.40	130	0.0330	1.20	0.130	0.500
		1-May-2018	205	98.0	12.0	7.60	5.20	19.0	207	101	8.00	168	35.0	20.0	67.0	0.00690	0.580	0.0690	0.0900
		8-May-2018	212	98.0	11.0	8.00	9.90	2.10	214	101	8.10	125	8.20	4.30	75.0	0.00890	0.710	0.0680	0.0170
		16-May-2018	326	86.0	8.90	7.80	13.0	2.50	319	151	8.30	226	3.70	1.50	115	0.0320	1.30	0.0930	0.140
		24-May-2018	316	87.0	8.70	7.60	15.0	0.580	-	-	-	-	-	-	-	-	-	-	-
		29-May-2018	307	91.0	10.0	7.90	11.0	1.00	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2018	HAC-05a	5-Jun-2018	231	100	11.0	8.20	12.0	0	309	146	8.30	217	<1.0	0.510	111	0.0120	1.40	0.0920	0.120
		12-Jun-2018	300	108	10.0	8.40	14.0	3.00	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2018	306	106	9.10	8.30	18.0	0.420	-	-	-	-	-	-	-	-	-	-	-
		26-Jun-2018	335	98.0	9.60	8.20	14.0	0.590	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2018	333	108	9.60	8.20	16.0	0.350	327	140	8.30	238	<1.0	0.630	112	0.00620	1.30	0.0880	0.110
		10-Jul-2018	307	112	10.0	8.20	18.0	0.120	-	-	-	-	-	-	-	-	-	-	-
		17-Jul-2018	281	-	-	8.60	23.0	1.80	-	-	-	-	-	-	-	-	-	-	-
		24-Jul-2018	295	-	-	9.00	19.0	0.400	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2018	291	116	11.0	8.20	17.0	0.220	295	128	8.40	194	1.40	0.740	107	<0.0050	1.30	0.0880	0.0410
		7-Aug-2018	297	-	-	8.50	17.0	0.710	-	-	-	-	-	-	-	-	-	-	-
		21-Aug-2018	331	-	-	8.40	15.0	0.270	-	-	-	-	-	-	-	-	-	-	-
		28-Aug-2018	327	108	11.0	7.90	15.0	0.0500	-	-	-	-	-	-	-	-	-	-	-
		4-Sep-2018	234	108	12.0	8.10	11.0	0.350	336	147	8.40	216	<1.0	0.370	119	0.00620	1.50	0.0920	0.160
		10-Sep-2018	322	116	12.0	8.30	12.0	0.650	-	-	-	-	-	-	-	-	-	-	-
		20-Sep-2018	351	-	-	7.90	10.0	1.10	-	-	-	-	-	-	-	-	-	-	-
		24-Sep-2018	352	106	12.0	8.00	11.0	1.40	354	171	8.30	232	1.50	0.470	122	0.00520	1.40	0.0920	0.160
		2-Oct-2018	356	99.0	12.0	7.80	5.60	0.370	336	157	8.20	225	<1.0	0.390	122	0.00540	1.50	0.0920	0.180
		9-Oct-2018	361	100	12.0	8.00	6.80	0.190	-	-	-	-	-	-	-	-	-	-	-
		16-Oct-2018	375	94.0	12.0	7.70	4.70	0	-	-	-	-	-	-	-	-	-	-	-
		23-Oct-2018	371	104	13.0	7.80	4.60	0.290	-	-	-	-	-	-	-	-	-	-	-
		30-Oct-2018	355	110	14.0	8.50	5.80	0.770	-	-	-	-	-	-	-	-	-	-	-
		6-Nov-2018	435	96.0	12.0	8.10	4.20	6.60	436	214	8.10	325	2.80	5.40	115	0.00650	1.20	0.100	0.170
		13-Nov-2018	393	96.0	13.0	8.10	2.30	0.970	-	-	-	-	-	-	-	-	-	-	-
		27-Nov-2018	414	86.0	12.0	7.40	2.30	12.0	455	228	8.20	327	16.0	12.0	119	0.00780	0.870	0.110	0.200
		4-Dec-2018	406	95.0	14.0	8.00	0.120	1.10	402	199	8.20	251	<1.0	1.00	126	<0.0050	1.50	0.0980	0.250
	HAC-14	2-Jan-2018	498	86.0	12.0	8.00	0.0550	0.520	475	236	8.40	310	<1.0	0.430	184	0.0170	2.10	0.120	0.360
		9-Jan-2018	465	83.0	12.0	7.90	0.390	0.740	468	220	8.30	297	<1.0	0.580	168	0.0160	2.00	0.120	0.330
		16-Jan-2018	464	89.0	13.0	7.80	0.640	1.90	456	218	8.40	304	<1.0	0.420	167	0.0130	1.90	0.110	0.300
		23-Jan-2018	478	88.0	13.0	8.00	0.930	2.20	440	208	8.40	301	1.10	0.380	167	0.00900	1.90	0.120	0.270
		10-Apr-2018	348	90.0	13.0	8.00	0.510	11.0	339	154	8.30	219	39.0	18.0	118	0.00750	1.20	0.0890	0.160
		17-Apr-2018	355	94.0	13.0	7.80	2.10	4.20	348	142	8.30	246	6.70	3.80	117	0.00710	1.10	0.0930	0.180
		24-Apr-2018	426	90.0	13.0	7.90	1.70	25.0	428	207	8.20	307	52.0	26.0	108	0.0140	0.840	0.100	0.330
		1-May-2018	180	93.0	11.0	7.80	6.50	24.0	189	92.0	8.00	149	60.0	24.0	62.0	0.00680	<0.50	0.0660	0.0580
		8-May-2018	193	92.0	10.0	8.10	11.0	5.90	195	94.0	8.10	100	17.0	8.50	70.0	0.00770	0.590	0.0650	0.00610
		16-May-2018	325	84.0	8.40	8.00	16.0	1.60	318	157	8.30	241	2.50	1.90	116	0.0190	1.20	0.0930	0.130
		24-May-2018	326	92.0	8.50	8.20	19.0	1.10	322	148	8.30	219	2.80	1.60	120	0.0190	1.30	0.0930	0.170
		29-May-2018	324	92.0	9.90	8.10	12.0	0.810	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	330	91.0	9.60	8.20	13.0	0	327	157	8.30	212	1.70	0.770	120	0.0110	1.30	0.0980	0.0810
		12-Jun-2018	310	101	9.30	8.10	14.0	0.740	300	156	8.30	196	2.40	1.10	114	0.00810	1.30	0.0880	0.0580
		18-Jun-2018	317	107	9.00	8.50	18.0	0.620	304	142	8.20	212	2.20	1.20	111	0.00820	1.20	0.0950	0.0780
		26-Jun-2018	326	90.0	8.70	8.20	17.0	1.30	325	147	8.10	211	2.50	1.50	118	0.00820	1.20	0.100	0.0980
		4-Jul-2018	348	102	9.00	8.40	16.0	0.310	341	151	8.30	228	2.20	1.10	118	<0.0050	1.30	0.0940	0.0960
		10-Jul-2018	326	97.0	9.00	8.20	19.0	0.650	319	151	8.30	223	2.20	0.600	115	0.00670	1.30	0.0910	0.0870
		17-Jul-2018	292	-	-	8.40	24.0	1.20	300	137	8.40	211	2.10	0.550	115	0.00750	1.20	0.0900	0.0390
		24-Jul-2018	362	-	-	8.70	21.0	0.240	308	142	8.30	212	1.30	0.590	113	<0.0050	1.20	0.0880	0.0110
		2-Aug-2018	308	92.0	8.80	8.00	17.0	0.140	313	138	8.30	195	1.50	0.640	112	<0.0050	1.30	0.0940	0.0360
		7-Aug-2018	316	-	-	8.20	18.0	0.610	317	133	8.30	203	1.40	0.700	118	0.00720	1.30	0.0950	0.0150
		14-Aug-2018	320	89.0	9.00	8.10	15.0	7.10	342	120	8.30	226	5.20	5.00	121	0.00750	1.30	0.0940	0.100
		21-Aug-2018	329	-	-	8.50	16.0	0.700	344	149	8.40	236	1.90	1.30	125	<0.0050	1.40	0.0990	0.0400
		28-Aug-2018	348	93.0	9.20	8.30	16.0	1.80	351	163	8.40	225	2.60	2.20	128	<0.0050	1.40	0.0990	0.0880
		4-Sep-2018	338	93.0	9.70	8.20	13.0	1.60	357	161	8.40	224	2.40	1.70	131	<0.0050	1.50	0.100	0.0990
		10-Sep-2018	349	94.0	9.80	8.30	14.0	3.30	353	117	8.40	226	1.30	1.90	126	0.00520	1.50	0.100	0.0840
		20-Sep-2018	376	-	-	8.00	10.0	19.0	362	170	8.30	239	16.0	8.60	125	<0.0050	1.40	0.100	0.130
		24-Sep-2018	389	92.0	10.0	7.90	11.0	25.0	392	191	8.30	254	40.0	30.0	138	0.00530	1.40	0.100	0.170
		2-Oct-2018	380	94.0	12.0	8.10	5.60	1.20	362	173	8.30	247	1.60	1.00	135	<0.0050	1.50	0.100	0.130
		9-Oct-2018	392	92.0	11.0	8.10	6.80	14.0	414	183	8.30	282	17.0	11.0	135	<0.0050	1.50	0.110	0.220
		16-Oct-2018	399	94.0	12.0	7.90	4.60	0.710	391	186	8.30	254	2.10	1.60	138	<0.0050	1.60	0.110	0.170
		23-Oct-2018	396	92.0	11.0	8.00	5.30	1.70	416	186	8.30	264	2.70	1.30	144	0.00530	1.70	0.110	0.190
		30-Oct-2018	380	92.0	11.0	8.40	6.80	2.70	393	175	8.30	259	3.50	2.40	133	<0.0050	1.50	0.0980	0.160
		6-Nov-2018	371	91.0	12.0	8.10	4.00	11.0	371	184	8.10	294	8.30	9.40	106	0.00700	0.970	0.0920	0.140
		13-Nov-2018	394	92.0	13.0	8.20	2.30	2.50	416	191	8.10	288	2.30	2.40	130	<0.0050	1.30	0.100	0.140
		27-Nov-2018	336	88.0	12.0	7.70	2.40	37.0	371	185	8.20	262	81.0	37.0	104	0.00800	0.660	0.0950	0.150
		4-Dec-2018	403	93.0	14.0	8.20	0.00400	3.30	400	205	8.20	262	2.20	3.40	131	0.00650	1.30	0.100	0.200

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2018	HAC-08	2-Jan-2018	510	93.0	14.0	7.70	-0.0110	0.880	484	240	8.50	322	1.10	0.400	186	0.0210	2.10	0.130	0.330
		9-Jan-2018	471	88.0	13.0	8.10	0.00300	1.20	471	222	8.40	319	1.40	0.560	175	0.0130	1.90	0.130	0.300
		16-Jan-2018	470	91.0	13.0	8.00	0.0430	1.70	461	212	8.40	290	<1.0	0.430	172	0.0130	1.80	0.120	0.280
		23-Jan-2018	489	91.0	13.0	7.80	0.500	2.20	456	218	8.40	309	1.60	0.440	171	0.0110	1.90	0.120	0.270
		30-Jan-2018	434	92.0	13.0	8.00	0.00200	2.00	428	213	8.30	277	2.20	0.850	151	0.00840	1.70	0.110	0.240
		6-Feb-2018	375	92.0	14.0	7.70	-0.00900	0.240	365	162	8.30	236	4.30	2.90	130	0.00630	1.50	0.120	0.150
		13-Feb-2018	338	93.0	14.0	8.10	-0.00700	5.10	330	157	8.20	222	11.0	3.10	117	<0.0050	1.30	0.0950	0.130
		20-Feb-2018	317	102	15.0	7.50	-0.00800	2.70	327	157	8.30	199	13.0	3.20	121	<0.0050	1.30	0.0910	0.130
		14-Mar-2018	500	90.0	13.0	8.00	0.430	1.50	487	250	8.40	328	1.40	1.10	174	0.0110	1.60	0.110	0.280
		20-Mar-2018	528	91.0	13.0	8.10	0.940	1.10	521	291	8.40	341	1.00	0.620	177	0.00620	1.70	0.110	0.290
		27-Mar-2018	516	91.0	13.0	7.80	0.150	4.30	516	254	8.40	355	16.0	5.70	169	0.00690	1.60	0.110	0.350
		3-Apr-2018	397	91.0	13.0	8.10	1.10	3.20	393	176	8.40	264	6.10	2.50	140	<0.0050	1.40	0.0960	0.150
		10-Apr-2018	334	90.0	13.0	8.10	0.460	28.0	323	156	8.20	228	182	33.0	116	0.00860	1.10	0.0860	0.150
		17-Apr-2018	330	95.0	13.0	8.00	2.40	6.20	322	135	8.30	232	15.0	4.30	112	0.00660	1.00	0.0880	0.160
		24-Apr-2018	366	91.0	13.0	8.00	1.50	16.0	360	176	8.10	263	45.0	15.0	97.0	0.00940	0.680	0.0860	0.270
		1-May-2018	171	93.0	11.0	7.80	7.20	25.0	180	88.0	8.00	152	50.0	27.0	62.0	0.00850	<0.50	0.0640	0.0410
		8-May-2018	189	92.0	9.90	8.00	12.0	12.0	192	94.0	8.10	103	29.0	12.0	71.0	0.00700	0.540	0.0660	<0.0050
		16-May-2018	318	87.0	8.80	8.10	15.0	4.70	315	152	8.30	226	13.0	2.60	118	0.0120	1.10	0.0930	0.100
		29-May-2018	330	91.0	9.80	8.20	12.0	0.540	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	335	92.0	9.70	8.40	13.0	0.0500	331	162	8.40	215	3.00	0.920	124	0.00800	1.30	0.100	0.0390
		4-Jul-2018	354	101	9.50	8.50	15.0	0.860	350	155	8.30	236	5.20	1.70	120	<0.0050	1.30	0.0970	0.0970
		2-Aug-2018	312	92.0	9.00	8.00	16.0	0.230	315	138	8.30	197	1.50	0.580	113	<0.0050	1.30	0.0970	0.0310
		4-Sep-2018	344	93.0	9.80	8.30	13.0	0.740	364	164	8.40	226	2.00	0.860	133	<0.0050	1.40	0.110	0.0760
		2-Oct-2018	384	93.0	12.0	8.30	5.30	0.550	366	173	8.40	243	1.10	0.800	139	0.00530	1.50	0.110	0.100
		6-Nov-2018	344	92.0	12.0	8.20	3.90	12.0	347	176	8.20	278	13.0	9.90	106	0.00590	0.920	0.0870	0.120
		27-Nov-2018	304	90.0	12.0	7.80	3.00	43.0	337	166	8.20	254	105	46.0	99.0	0.00700	0.610	0.0880	0.140
		4-Dec-2018	396	94.0	14.0	8.30	-0.0110	3.30	397	180	8.20	278	2.30	3.90	127	<0.0050	1.20	0.0990	0.180
	W10	2-Jan-2018	512	-	-	7.20	0.710	1.10	292	157	8.30	186	<1.0	0.280	158	0.00900	0.770	0.0920	0.100
		14-Feb-2018	292	100	13.0	8.20	0	0.290	281	141	8.30	190	1.90	0.320	147	0.00600	0.720	0.0790	0.110
		14-Mar-2018	296	87.0	13.0	7.90	0.0190	0.810	302	139	8.40	188	<1.0	0.370	155	0.00550	0.960	0.0810	0.160
		3-Apr-2018	197	88.0	13.0	7.70	0.0230	0.160	193	90.0	8.20	142	1.10	1.20	92.0	<0.0050	<0.50	0.0540	0.440
		1-May-2018	68.0	93.0	12.0	7.50	3.10	7.70	70.0	41.0	7.60	86.0	27.0	6.80	34.0	0.00690	<0.50	0.0360	0.0120
		5-Jun-2018	196	88.0	10.0	8.00	9.00	0	198	103	8.30	147	<1.0	0.360	104	0.00870	0.680	0.0690	<0.0050
		4-Jul-2018	206	94.0	9.90	8.10	9.30	0.170	212	103	8.20	160	1.40	0.450	109	0.00750	0.540	0.0730	0.320
		2-Aug-2018	324	77.0	7.90	7.30	14.0	0.0700	333	146	8.30	230	<1.0	0.220	177	<0.0050	0.990	0.110	0.0280
		4-Sep-2018	371	84.0	9.70	7.80	8.90	0.0200	368	187	8.40	231	<1.0	0.100	202	<0.0050	2.00	0.130	0.0180
		2-Oct-2018	308	88.0	12.0	8.00	3.60	0.140	288	146	8.40	191	<1.0	0.180	161	<0.0050	1.30	0.100	<0.0050
		6-Nov-2018	92.0	92.0	12.0	7.70	3.60	4.30	91.0	56.0	7.70	118	3.90	3.70	45.0	0.00820	<0.50	0.0360	0.160
	EDC-01a	2-Jan-2018	394	78.0	11.0	7.80	0.640	0.940	392	195	8.40	239	<1.0	0.260	177	0.00800	1.20	0.110	0.150
		30-Jan-2018	351	88.0	12.0	7.80	0.860	0.790	353	172	8.20	223	<1.0	0.380	153	<0.0050	1.20	0.0990	0.130
		14-Feb-2018	324	97.0	14.0	8.70	0.200	0.210	315	166	8.30	205	<1.0	0.320	151	0.00520	0.930	0.0980	0.110
		14-Mar-2018	343	84.0	12.0	7.80	0.410	0.770	359	187	8.20	221	<1.0	0.370	163	<0.0050	1.10	0.0970	0.150
		3-Apr-2018	228	87.0	13.0	7.90	0.360	0.420	221	102	8.20	166	<1.0	1.20	102	<0.0050	0.510	0.0620	0.420
		1-May-2018	68.0	94.0	12.0	7.50	3.60	12.0	71.0	40.0	7.60	90.0	34.0	8.90	35.0	0.00870	<0.50	0.0360	0.00990
		5-Jun-2018	215	91.0	10.0	8.00	11.0	0	215	108	8.30	155	<1.0	0.420	108	0.00870	0.680	0.0710	<0.0050
		4-Jul-2018	239	97.0	9.60	8.10	12.0	0.0100	237	112	8.30	168	<1.0	0.420	115	<0.0050	0.580	0.0810	<0.0050
		2-Aug-2018	342	81.0	7.90	7.50	16.0	0.350	338	161	8.20	213	<1.0	0.290	160	<0.0050	1.10	0.130	<0.0050
		4-Sep-2018	376	96.0	9.50	8.10	16.0	0.160	394	180	8.40	248	1.20	0.180	196	<0.0050	1.80	0.130	<0.0050
		2-Oct-2018	332	90.0	11.0	8.00	5.50	0.330	318	156	8.40	218	<1.0	0.170	163	<0.0050	1.30	0.110	<0.0050
		6-Nov-2018	101	92.0	12.0	7.80	3.90	3.70	94.0	54.0	7.80	114	3.50	3.90	46.0	0.00870	<0.50	0.0450	0.160
	HAC-13	8-Jan-2019	294	89.0	13.0	8.00	0.150	0.540	295	127	8.10	194	<1.0	0.340	109	0.00510	1.20	0.0880	0.0600
		5-Feb-2019	298	89.0	13.0	7.80	0.0570	0.350	303	133	8.10	201	<1.0	0.290	106	<0.0050	1.20	0.0860	0.0650
		4-Mar-2019	289	87.0	13.0	8.00	0.100	0.680	289	130	8.10	184	<1.0	0.260	105	0.00600	1.20	0.0850	0.0690
		2-Apr-2019	304	83.0	11.0	7.60	2.20	1.70	305	140	8.00	207	1.20	1.80	105	0.0110	0.910	0.0870	0.110
		14-May-2019	283	83.0	8.80	7.90	13.0	1.80	288	122	8.20	204	2.00	1.20	106	0.0350	1.10	0.0860	0.0820
		4-Jun-2019	276	97.0	9.60	8.20	16.0	0.890	276	125	8.30	190	<1.0	0.530	105	0.0110	1.10	0.0900	<0.0050
		2-Jul-2019	275	105	9.90	8.60	18.0	0.380	268	118	8.30	176	1.00	0.390	100	0.00690	1.00	0.0840	<0.0050
		1-Aug-2019	288	93.0	9.10	8.10	16.0	0.800	291	134	8.30	189	1.50	0.560	106	0.00520	1.00	0.0840	<0.0050
		3-Sep-2019	272	103	10.0	8.30	17.0	0.610	273	122	8.20	212	1.10	0.500	100	0.00770	1.00	0.0790	<0.0050
		1-Oct-2019	305	100	12.0	8.60	11.0	0.570	311	140	8.20	172	<1.0	0.450	108	0.00540	0.990	0.0880	<0.0050
		4-Nov-2019	288	93.0	12.0	8.20	5.90	0.560	268	122	8.20	186	<1.0	0.670	109	0.0100	1.10	0.0930	<0.0050
		2-Dec-2019	290	90.0	12.0	7.90	2.10	0.730	285	135	7.90	184	1.70	0.560	112	0.00800	1.20	0.0910	0.0170

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2019	HAC-05a	8-Jan-2019	331	87.0	13.0	8.00	0.00400	0.680	327	143	8.10	221	<1.0	0.380	116	0.00560	1.40	0.0900	0.170
		5-Feb-2019	334	85.0	12.0	7.90	0	0.690	342	143	8.00	219	<1.0	0.350	113	0.00660	1.30	0.0860	0.160
		4-Mar-2019	323	87.0	13.0	7.90	0.0170	0.470	322	144	8.10	189	<1.0	0.250	114	0.00750	1.40	0.0860	0.170
		2-Apr-2019	331	88.0	12.0	7.70	2.50	2.20	331	159	8.00	231	1.80	2.30	108	0.0120	0.920	0.0900	0.140
		18-Apr-2019	232	-	-	8.10	7.00	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	305	-	-	8.00	7.20	5.20	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	292	-	-	8.00	9.00	1.80	-	-	-	-	-	-	-	-	-	-	-
		29-Apr-2019	3.80	-	-	8.20	7.20	-	-	-	-	-	-	-	-	-	-	-	-
		14-May-2019	341	95.0	10.0	8.10	12.0	1.20	344	151	8.30	228	<1.0	0.960	120	0.0240	1.40	0.0900	0.260
		4-Jun-2019	326	114	12.0	8.30	14.0	0.530	329	150	8.40	222	<1.0	0.550	114	0.0100	1.40	0.0910	0.0930
		2-Jul-2019	315	115	11.0	8.60	17.0	0.330	309	138	8.30	193	<1.0	0.300	112	0.00890	1.30	0.0910	0.0580
		1-Aug-2019	319	105	10.0	8.20	16.0	1.10	321	144	8.30	203	1.10	0.920	112	0.00830	1.20	0.0850	0.0490
		3-Sep-2019	301	-	-	8.40	16.0	0.670	300	135	8.30	213	1.50	0.640	112	0.00840	1.20	0.0800	0.0540
		1-Oct-2019	346	105	12.0	8.60	10.0	0.700	352	167	8.30	212	<1.0	0.630	116	0.00940	1.20	0.0920	0.0660
		4-Nov-2019	308	97.0	12.0	8.30	6.00	0.830	285	135	8.20	244	1.70	1.10	113	0.0100	1.10	0.0960	0.0310
		2-Dec-2019	307	93.0	13.0	8.00	1.80	0.910	300	143	7.90	187	1.00	0.750	115	0.0110	1.20	0.0930	0.0580
	HAC-14	14-May-2019	346	92.0	9.90	8.40	12.0	1.50	351	157	8.30	244	2.30	0.980	126	0.0130	1.30	0.0930	0.200
		4-Jun-2019	348	93.0	9.10	8.20	16.0	0.870	349	169	8.30	226	<1.0	0.950	127	0.0110	1.30	0.0980	0.0740
		2-Jul-2019	339	92.0	8.60	8.40	18.0	18.0	330	145	8.40	216	40.0	11.0	119	0.0110	1.20	0.0990	0.0390
		1-Aug-2019	337	92.0	8.80	8.20	17.0	11.0	338	157	8.30	230	34.0	12.0	122	0.00730	1.20	0.0980	0.0330
		3-Sep-2019	320	92.0	8.90	8.20	17.0	2.00	319	141	8.30	237	2.40	1.00	119	0.00790	1.20	0.0870	0.0580
		1-Oct-2019	356	101	11.0	8.20	8.80	0.900	359	174	8.30	227	<1.0	0.790	125	0.00630	1.10	0.0930	0.0750
		4-Nov-2019	-	-	-	-	-	-	279	132	8.20	187	2.50	2.40	113	0.0110	1.00	0.0960	0.0280
		4-Nov-2019	302	91.0	11.0	8.20	5.70	2.40	-	-	-	-	-	-	-	-	-	-	-
		2-Dec-2019	314	90.0	13.0	7.90	0.990	1.50	305	147	7.90	195	1.40	1.20	116	0.00970	1.20	0.0960	0.0680
	HAC-08	8-Jan-2019	349	93.0	14.0	8.20	-0.00900	2.90	346	165	8.20	228	4.60	1.60	128	0.00610	1.30	0.0960	0.160
		5-Feb-2019	348	95.0	14.0	8.00	0.0600	3.00	355	155	8.20	236	8.70	1.60	123	0.00620	1.30	0.0890	0.150
		4-Mar-2019	337	94.0	14.0	8.20	0.0360	1.50	335	150	8.20	234	2.70	0.510	123	0.00830	1.30	0.0910	0.160
		2-Apr-2019	278	90.0	12.0	8.10	3.20	8.00	277	132	8.10	205	29.0	11.0	95.0	0.00880	0.660	0.0780	0.160
		14-May-2019	342	91.0	9.70	8.60	12.0	9.90	349	156	8.40	288	18.0	5.20	129	0.00810	1.20	0.0930	0.0700
		4-Jun-2019	351	93.0	9.30	8.30	16.0	2.80	356	166	8.40	239	5.80	1.40	130	0.00890	1.30	0.100	0.0420
		2-Jul-2019	346	91.0	8.10	8.50	21.0	63.0	339	150	8.40	228	58.0	48.0	124	0.0130	1.20	0.100	0.0140
		1-Aug-2019	340	93.0	8.80	8.40	18.0	8.30	343	159	8.40	243	13.0	6.20	125	0.00650	1.10	0.0980	0.0120
		3-Sep-2019	323	93.0	8.90	8.40	18.0	4.10	321	145	8.30	228	6.80	2.20	125	0.00660	1.20	0.0890	0.0330
		1-Oct-2019	348	102	11.0	8.30	8.40	80.0	355	168	8.30	236	122	89.0	127	0.00840	1.10	0.0960	0.0450
		4-Nov-2019	243	92.0	12.0	8.20	5.90	10.0	269	126	8.20	208	9.40	12.0	113	0.00970	0.970	0.0910	0.0120
		2-Dec-2019	314	93.0	14.0	7.70	0	5.00	303	143	8.00	194	6.50	3.90	119	0.0110	1.20	0.0940	0.0650
	W10	4-Jun-2019	158	88.0	9.40	7.80	12.0	0.870	159	85.0	8.10	132	2.10	0.730	81.0	0.0140	<0.50	0.0610	<0.0050
		8-Aug-2019	169	-	-	7.80	17.0	0.770	162	85.0	8.10	146	1.70	0.830	86.0	0.0130	<0.50	0.0620	0.00620
		1-Oct-2019	152	100	11.0	8.00	6.40	1.30	155	87.0	8.10	123	1.40	1.50	78.0	0.0120	<0.50	0.0450	0.00950
		20-Nov-2019	109	-	-	8.30	1.10	3.80	109	60.0	7.80	124	4.30	3.10	54.0	0.0180	<0.50	0.0420	0.0500
	EDC-01a	8-May-2019	94.0	92.0	11.0	7.90	9.30	1.70	82.0	47.0	7.70	130	4.70	2.00	47.0	0.0110	<0.50	0.0420	<0.0050
		4-Jun-2019	171	93.0	9.50	7.90	15.0	0.510	172	90.0	8.20	140	1.40	0.650	84.0	0.0140	<0.50	0.0610	<0.0050
		2-Jul-2019	250	93.0	8.90	8.10	18.0	0.250	237	116	8.30	167	<1.0	0.270	122	0.00940	0.670	0.0830	<0.0050
		1-Oct-2019	155	104	12.0	8.20	7.10	1.40	159	87.0	8.10	128	2.00	1.50	80.0	0.0140	<0.50	0.0520	0.00760
	HAC-13	20-Jan-2020	290	82.0	12.0	8.00	0.420	0.490	288	136	8.10	196	<1.0	0.360	112	0.0210	1.10	0.0840	0.0490
		3-Feb-2020	280	82.0	12.0	7.60	0.850	0.860	289	122	8.20	191	<1.0	0.520	107	0.0140	1.10	0.0830	0.0520
		25-Mar-2020	284	84.0	12.0	8.20	1.90	0.930	250	129	8.10	183	<1.0	0.210	105	0.00690	1.00	0.0770	0.0340
		16-Apr-2020	299	87.0	12.0	7.70	1.60	0.990	310	153	8.10	210	1.50	0.520	119	0.00890	0.940	0.0810	0.0490
		7-May-2020	146	90.0	12.0	7.60	4.00	3.30	142	66.0	7.80	105	2.10	2.10	49.0	0.0140	<0.50	0.0640	0.0220
		3-Jun-2020	263	95.0	10.0	8.10	12.0	0.630	266	123	8.10	164	1.20	0.620	92.0	<0.0050	<0.50	0.300	<0.0050
		6-Jul-2020	270	95.0	9.00	8.20	18.0	0.450	259	117	8.20	183	<1.0	0.470	93.0	0.0130	0.860	0.0820	<0.0050
		4-Aug-2020	250	100	8.70	8.30	22.0	0.410	253	112	8.20	155	1.50	0.560	91.0	0.0120	0.880	0.0780	0.0370
		1-Sep-2020	255	102	10.0	8.40	15.0	1.40	264	114	8.20	190	1.20	0.520	97.0	0.0100	0.870	0.0750	0.0110
		1-Oct-2020	252	106	11.0	8.30	15.0	1.10	257	118	8.20	187	<1.0	0.400	92.0	0.00670	0.880	0.0810	<0.0050
		2-Nov-2020	275	84.0	11.0	7.80	5.00	2.00	279	127	8.10	170	1.70	0.920	96.0	<0.0050	0.880	0.0840	0.0240
		1-Dec-2020	268	90.0	12.0	8.10	2.00	0.570	264	107	8.10	177	1.50	0.550	94.0	0.00920	0.910	0.0760	0.0350
	HAC-05a	20-Jan-2020	330	84.0	12.0	8.00	0.0110	0.700	326	158	8.10	220	1.00	0.590	116	0.0220	1.30	0.0870	0.170
		3-Feb-2020	294	89.0	13.0	7.60	0.390	1.10	302	128	8.20	199	2.00	1.10	110	0.0150	1.10	0.0860	0.0760
		25-Mar-2020	309	92.0	13.0	8.20	0.530	2.10	265	132	8.10	186	2.20	0.500	108	0.0120	1.20	0.0800	0.0640
		16-Apr-2020	306	95.0	13.0	7.70	1.50	1.70	345	174	8.10	231	5.30	0.890	128	0.0100	1.00	0.0860	0.0820
		7-May-2020	172	94.0	12.0	7.70	5.00	4.20	169	79.0	7.80	109	3.20	2.40	56.0	0.0150	<0.50	0.0700	0.0400
		3-Jun-2020	277	97.0	10.0	8.20	12.0	1.30	280	129	8.20	168	1.20	0.690	100	0.00710	<0.50	0.130	<0.0050
		6-Jul-2020	288	99.0	9.40	8.30	18.0	0.580	274	126	8.20	185	2.00	0.540	99.0	0.0150	0.960	0.0840	0.0350
		4-Aug-2020	283	115	10.0	8.40	22.0	0.360	290	129	8.40	192	1.60	0.540	97.0	0.0120	1.10	0.0810	0.0480
		1-Sep-2020	299	109	11.0	8.50	14.0	1.30	309	138	8.30	199	<1.0	0.490	107	0.0110	1.20	0.0720	0.0720
		1-Oct-2020	286	109	11.0	8.20	14.0	1.60	287	137	8.20	200	<1.0	0.360	99.0	0.00680	1.10	0.0810	0.0400
		2-Nov-2020	287	90.0	12.0	7.90	4.70	1.90	292	133	8.10	193	2.20	1.00	100	<0.0050	0.880	0.0870	0.0350
		1-Dec-2020	279	96.0	13.0	8.20	1.70	0.830	277	114	8.20	172	1.70	0.560	96.0	<0.0050	0.970	0.0760	0.0440

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2020	HAC-14	3-Jun-2020	261	90.0	10.0	8.00	11.0	2.20	266	124	8.10	181	2.20	1.50	93.0	0.00530	0.910	0.0840	0.0180
		6-Jul-2020	286	89.0	8.50	8.20	18.0	0.190	275	128	8.20	178	<1.0	0.620	104	0.0130	0.880	0.0860	0.0300
		4-Aug-2020	303	98.0	8.70	8.30	21.0	0.500	306	138	8.30	190	<1.0	0.540	110	0.00690	1.10	0.0860	0.0360
		1-Sep-2020	319	93.0	9.60	8.30	14.0	0.810	329	145	8.30	220	<1.0	0.350	115	0.00560	1.20	0.0800	0.0690
		1-Oct-2020	302	95.0	9.80	8.00	14.0	1.80	303	142	8.20	225	1.10	0.330	112	0.00680	1.10	0.0900	0.0410
		2-Nov-2020	264	91.0	12.0	8.00	4.40	4.30	270	121	8.10	153	2.50	2.60	91.0	<0.0050	0.760	0.0740	0.0380
	HAC-08	20-Jan-2020	342	93.0	13.0	8.10	0.620	2.70	332	165	8.20	217	8.60	2.30	131	0.0210	1.20	0.0910	0.160
		3-Feb-2020	300	94.0	14.0	7.80	0.360	11.0	305	132	8.20	196	21.0	15.0	115	0.0190	1.10	0.0880	0.0820
		25-Mar-2020	326	86.0	12.0	8.20	0.0240	4.90	282	152	8.20	212	21.0	3.40	120	0.00690	1.10	0.0830	0.0620
		16-Apr-2020	269	94.0	13.0	8.20	2.60	6.90	280	152	8.10	192	28.0	4.60	115	0.00640	0.580	0.0660	0.0930
		7-May-2020	155	93.0	12.0	7.90	5.60	21.0	153	73.0	7.90	116	39.0	23.0	55.0	0.0150	<0.50	0.0660	0.0250
		3-Jun-2020	249	92.0	10.0	8.20	12.0	8.90	256	120	8.10	163	21.0	6.40	92.0	<0.0050	0.780	0.0810	0.00990
		6-Jul-2020	284	93.0	8.80	8.30	18.0	0.940	273	129	8.20	185	3.70	1.30	105	0.0130	0.840	0.0830	0.0240
		4-Aug-2020	308	94.0	8.30	8.40	21.0	1.80	311	143	8.40	181	3.30	1.20	115	0.00710	1.10	0.0900	0.0260
		1-Sep-2020	321	94.0	9.50	8.40	15.0	10.0	332	149	8.30	217	9.50	5.90	116	0.00690	1.10	0.0880	0.0330
		1-Oct-2020	305	96.0	10.0	8.20	13.0	1.40	308	146	8.30	204	1.50	0.260	113	0.00560	1.10	0.0930	0.00620
		2-Nov-2020	252	93.0	12.0	8.10	4.40	13.0	254	113	8.10	170	17.0	8.60	89.0	<0.0050	0.700	0.0720	0.0410
		1-Dec-2020	278	94.0	14.0	8.20	0.340	5.30	273	113	8.20	183	80.0	1.50	98.0	0.00760	0.910	0.0750	0.0260
	W10	7-May-2020	79.0	93.0	12.0	7.60	3.10	7.30	77.0	41.0	7.60	84.0	17.0	4.90	38.0	0.0120	<0.50	0.0360	<0.0050
		31-Aug-2020	277	-	-	8.10	11.0	1.20	-	-	-	-	-	-	-	-	-	-	-
		1-Sep-2020	276	92.0	10.0	8.10	11.0	0.450	285	138	8.30	188	<1.1	0.230	148	0.00600	1.20	0.0760	<0.0050
		1-Oct-2020	290	92.0	11.0	7.80	8.90	1.00	291	155	8.30	210	<1.0	0.270	148	0.00680	1.40	0.0930	<0.0050
		2-Nov-2020	102	93.0	13.0	7.80	2.00	5.90	102	55.0	7.70	112	6.60	2.80	49.0	0.00680	<0.50	0.0360	0.0500
	EDC-01a	7-May-2020	79.0	93.0	12.0	7.60	3.30	8.30	78.0	42.0	7.60	88.0	24.0	6.00	38.0	0.0130	<0.50	0.0430	0.00800
		1-Sep-2020	434	64.0	6.30	7.50	16.0	1.20	441	207	7.90	307	1.10	0.670	173	0.00650	0.850	0.120	<0.0050
		1-Oct-2020	316	97.0	10.0	8.00	14.0	1.80	315	152	8.20	213	<1.0	0.490	124	0.00640	1.10	0.0960	<0.0050
		2-Nov-2020	140	92.0	13.0	7.80	2.70	14.0	141	70.0	7.90	127	18.0	14.0	60.0	0.00820	<0.50	0.0460	0.0460
		1-Dec-2020	216	94.0	14.0	8.00	0.340	1.90	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2020	-	-	-	-	-	-	213	94.0	8.10	164	1.90	1.80	86.0	<0.0050	0.540	0.0600	0.0160
	HAC-13	12-Jan-2021	268	87.0	12.0	8.00	1.10	0.260	263	114	8.00	168	<1.0	0.320	99.0	0.00660	0.900	0.0740	0.0560
		1-Feb-2021	280	92.0	13.0	7.80	1.40	0.620	264	123	8.20	202	<1.0	0.360	97.0	<0.0050	0.920	0.0780	0.0520
		8-Mar-2021	282	95.0	13.0	8.10	1.50	0.320	280	120	8.20	179	<1.0	0.230	100	0.00580	0.930	0.0770	0.0310
		7-Apr-2021	298	91.0	13.0	8.00	1.50	0.160	297	133	8.20	191	1.10	0.490	107	0.0110	0.870	0.0830	0.00700
		3-May-2021	194	93.0	12.0	8.10	6.20	1.30	188	93.0	8.00	137	1.40	0.910	73.0	0.00800	0.600	0.0600	0.0210
		1-Jun-2021	246	99.0	10.0	8.40	14.0	0.210	264	113	8.20	167	2.80	0.600	92.0	0.00600	0.860	0.0740	<0.0050
		7-Jul-2021	260	96.0	8.40	8.70	22.0	0.350	250	114	8.20	148	1.20	0.360	93.0	0.0110	0.820	0.0690	0.0110
		4-Aug-2021	256	97.0	8.90	8.10	20.0	0.220	257	120	8.30	179	1.60	0.840	93.0	0.0120	0.860	0.0760	0.0130
		1-Sep-2021	259	104	10.0	8.40	15.0	0.680	259	119	8.30	174	<1.0	0.340	96.0	0.00860	0.860	0.0720	0.00980
		4-Oct-2021	261	96.0	11.0	8.40	10.0	0.860	262	120	8.30	169	1.40	0.510	99.0	0.00920	0.880	0.0820	<0.0050
		4-Nov-2021	342	84.0	11.0	7.80	5.60	1.20	342	148	8.10	228	1.50	1.20	112	0.00760	0.940	0.0920	0.0190
		1-Dec-2021	341	80.0	11.0	7.80	0.820	1.00	301	155	7.90	160	<1.0	1.70	113	0.00520	0.740	0.0640	0.0220
	HAC-05a	12-Jan-2021	290	95.0	13.0	8.30	1.30	1.10	282	129	8.10	176	1.90	0.980	107	<0.0050	1.00	0.0820	0.0810
		1-Feb-2021	305	95.0	13.0	8.00	1.60	0.680	286	133	8.30	199	6.80	0.450	104	<0.0050	1.10	0.0800	0.0760
		8-Mar-2021	310	100	14.0	8.20	1.70	0.580	305	136	8.30	188	<1.0	0.310	108	0.00670	1.10	0.0800	0.0460
		7-Apr-2021	325	96.0	13.0	8.20	1.70	0.260	327	148	8.20	220	<1.0	0.500	114	0.00660	1.00	0.0870	0.0360
		3-May-2021	216	96.0	12.0	8.30	6.80	1.40	209	105	8.10	153	2.30	0.880	80.0	0.00990	0.670	0.0640	0.0410
		1-Jun-2021	258	99.0	10.0	9.10	13.0	0.340	273	119	8.20	184	1.20	0.590	94.0	0.0100	0.940	0.0760	0.0200
		7-Jul-2021	273	104	9.20	8.80	21.0	0.370	281	126	8.20	195	<1.0	0.450	98.0	0.0130	1.10	0.0730	0.0480
		4-Aug-2021	314	114	11.0	8.40	18.0	0.250	320	154	8.50	244	<1.0	0.450	109	0.00840	1.40	0.0810	0.0340
		1-Sep-2021	330	108	11.0	8.60	13.0	0.420	329	153	8.40	236	<1.0	0.270	112	0.0150	1.60	0.0760	0.0680
		4-Oct-2021	325	98.0	11.0	8.40	9.10	0.950	326	150	8.30	214	1.00	0.320	116	0.00590	1.40	0.0850	0.0520
		4-Nov-2021	389	88.0	11.0	8.00	5.30	1.90	392	176	8.20	260	2.10	1.60	118	0.00720	1.40	0.0960	0.0940
		1-Dec-2021	213	84.0	12.0	8.00	0.540	0.830	359	186	8.00	187	<1.0	1.30	123	0.00530	1.10	0.0650	0.0880
	HAC-14	3-May-2021	204	92.0	11.0	8.30	6.90	2.00	196	96.0	8.00	123	2.10	1.50	79.0	0.0100	0.570	0.0630	0.0410
		1-Jun-2021	261	94.0	10.0	8.10	12.0	0.550	281	125	8.20	194	3.00	1.00	97.0	0.0100	0.910	0.0780	0.0330
		7-Jul-2021	302	96.0	8.30	9.20	22.0	0.320	291	133	8.40	202	<1.0	0.380	108	0.00570	1.10	0.0780	<0.0050
		4-Aug-2021	336	94.0	8.40	8.30	21.0	0.120	339	159	8.40	230	1.40	0.770	118	0.00630	1.40	0.0920	0.0840
		1-Sep-2021	357	92.0	9.40	8.70	14.0	31.0	353	168	8.30	252	32.0	43.0	124	0.00730	1.50	0.0900	0.100
		4-Oct-2021	342	90.0	10.0	8.60	9.40	0.560	347	165	8.30	226	1.60	0.250	126	0.00520	1.30	0.0970	0.0380
		4-Nov-2021	395	88.0	11.0	8.10	4.80	2.50	394	171	8.20	252	1.80	1.40	122	0.00600	1.20	0.0960	0.110

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2021	HAC-08	12-Jan-2021	292	91.0	13.0	8.30	1.60	1.00	285	130	8.10	176	<1.0	0.670	113	<0.0050	0.950	0.0850	0.0710
		1-Feb-2021	315	92.0	13.0	7.90	0.580	2.50	296	140	8.20	191	22.0	1.40	111	<0.0050	1.00	0.0820	0.0990
		8-Mar-2021	323	93.0	13.0	8.20	1.30	2.20	315	141	8.30	178	6.50	2.30	113	0.00600	1.00	0.0810	0.0810
		7-Apr-2021	288	91.0	12.0	8.30	2.20	2.00	295	132	8.20	188	5.40	1.60	110	<0.0050	0.720	0.0790	0.0700
		3-May-2021	202	94.0	11.0	8.40	7.60	6.60	197	98.0	8.10	146	14.0	5.40	82.0	0.00770	0.560	0.0630	0.0310
		1-Jun-2021	265	93.0	9.70	8.20	14.0	1.10	279	123	8.20	167	3.20	1.10	99.0	0.00530	0.890	0.0790	0.0120
		7-Jul-2021	314	90.0	8.00	8.80	22.0	1.30	303	139	8.30	207	3.00	0.310	117	0.00680	1.00	0.0820	<0.0050
		4-Aug-2021	340	96.0	8.60	8.50	21.0	0.200	347	165	8.50	236	1.80	0.830	125	0.00780	1.30	0.0970	0.0360
		1-Sep-2021	360	93.0	9.70	8.70	14.0	0.680	361	170	8.40	246	2.30	0.260	129	0.00720	1.40	0.0920	0.0550
		4-Oct-2021	345	89.0	10.0	8.80	8.30	0.600	350	162	8.40	215	1.80	0.300	131	<0.0050	1.30	0.100	<0.0050
		4-Nov-2021	387	90.0	11.0	8.30	5.50	17.0	395	173	8.20	246	26.0	13.0	125	0.00640	1.10	0.0990	0.0950
		1-Dec-2021	382	92.0	13.0	8.20	-0.0140	4.60	344	177	8.10	178	8.00	4.80	128	0.00590	0.900	0.0600	0.0770
	W10	12-Jan-2021	152	89.0	13.0	8.00	0.380	1.10	151	76.0	7.90	114	<1.0	1.40	78.0	<0.0050	<0.50	0.0450	0.0580
		3-May-2021	84.0	99.0	12.0	7.90	6.80	4.20	79.0	43.0	7.80	90.0	17.0	6.10	46.0	0.00570	<0.50	0.0360	0.0130
		4-Aug-2021	372	83.0	8.40	8.00	15.0	0.100	381	190	8.30	254	<1.0	0.230	199	0.00560	1.60	0.110	0.0160
		4-Nov-2021	237	89.0	12.0	8.10	2.30	2.80	239	112	8.10	154	7.20	2.20	116	0.00630	1.10	0.0640	0.00790
	EDC-01a	12-Jan-2021	244	92.0	13.0	8.10	1.80	1.10	237	114	8.00	151	<1.0	1.00	105	<0.0050	0.670	0.0650	0.0660
		1-Feb-2021	272	92.0	13.0	7.70	0.780	1.80	256	122	8.20	179	2.90	1.50	108	<0.0050	0.730	0.0700	0.0880
		8-Mar-2021	273	91.0	13.0	8.00	0.920	1.50	265	123	8.20	170	1.30	1.40	112	0.00770	0.730	0.0670	0.0840
		7-Apr-2021	221	90.0	13.0	8.10	1.70	2.00	224	108	8.20	169	3.00	2.10	93.0	<0.0050	<0.50	0.0570	0.0760
		3-May-2021	103	97.0	12.0	7.80	6.90	4.30	100	54.0	7.80	102	12.0	4.70	51.0	0.00660	<0.50	0.0400	0.0160
		1-Jun-2021	196	95.0	9.70	8.40	14.0	1.00	207	96.0	8.10	142	3.60	1.50	82.0	0.0120	<0.50	0.0620	0.00660
		7-Jul-2021	326	92.0	8.40	8.50	20.0	0.840	314	143	8.20	218	1.50	0.470	126	<0.0050	0.970	0.0810	<0.0050
		4-Aug-2021	354	104	9.30	8.30	21.0	2.50	356	172	8.40	252	3.70	3.20	135	0.00580	1.30	0.100	0.00720
		1-Sep-2021	376	103	11.0	8.40	14.0	0.800	378	175	8.30	258	<1.0	0.410	149	0.00680	1.50	0.0940	0.0400
		4-Oct-2021	361	94.0	11.0	8.30	8.20	1.10	360	170	8.40	230	1.40	0.300	145	0.00540	1.30	0.100	<0.0050
		4-Nov-2021	314	91.0	12.0	8.10	4.50	6.50	325	148	8.10	212	11.0	5.60	125	0.00650	1.10	0.0830	0.0510
		1-Dec-2021	301	91.0	13.0	8.10	0.0230	1.80	275	141	8.00	165	1.80	2.40	116	0.00530	0.720	0.0580	0.0540
	HAC-13	12-Jan-2022	286	88.0	13.0	8.00	0.270	0.200	283	120	8.00	174	3.30	0.410	105	0.00770	0.940	0.0840	0.0520
		7-Feb-2022	273	92.0	13.0	8.00	1.50	0.370	277	126	8.10	176	<1.0	0.410	104	<0.0050	0.920	0.0850	0.0360
		9-Mar-2022	281	91.0	12.0	8.00	2.90	0.800	291	134	8.10	182	<1.0	0.410	106	0.00590	0.880	0.0770	0.0210
		5-Apr-2022	313	90.0	12.0	7.40	1.60	1.40	315	154	7.90	213	<1.0	1.00	99.0	0.00720	0.560	0.0920	0.0560
		3-May-2022	268	88.0	11.0	7.60	4.90	2.10	275	129	8.10	131	1.40	1.50	84.0	0.00800	<0.50	0.110	0.00980
		1-Jun-2022	246	93.0	10.0	8.30	11.0	0.630	252	110	8.20	171	2.50	0.660	90.0	0.00960	0.800	0.0710	<0.0050
		5-Jul-2022	252	92.0	9.00	8.10	16.0	2.00	246	118	8.20	171	1.60	0.300	88.0	0.00680	0.750	0.0670	0.00620
		3-Aug-2022	288	87.0	8.00	8.10	20.0	0.900	254	111	8.20	160	1.00	0.510	90.0	0.0180	0.770	0.0690	0.0170
		8-Sep-2022	247	90.0	8.90	8.30	16.0	0.820	249	110	8.20	160	1.80	1.30	90.0	0.00840	0.800	0.0730	<0.0050
		5-Oct-2022	249	98.0	9.70	8.40	16.0	1.00	247	104	8.00	169	1.50	0.530	95.0	0.0150	0.850	0.0780	<0.0050
		2-Nov-2022	255	91.0	12.0	7.90	4.20	0.780	256	114	8.20	175	1.10	0.730	87.0	0.00760	0.810	0.0720	<0.0050
		7-Dec-2022	265	82.0	12.0	7.90	0.0820	1.00	260	112	8.20	156	1.90	0.440	90.0	0.00800	0.840	0.0780	0.0380
	HAC-05a	12-Jan-2022	315	83.0	12.0	7.90	1.00	0.0500	325	144	8.00	210	<1.0	0.280	110	0.00860	1.30	0.0900	0.130
		7-Feb-2022	310	91.0	13.0	8.00	1.20	0.230	316	146	8.10	201	<1.0	0.240	109	0.00650	1.30	0.0910	0.0920
		9-Mar-2022	341	88.0	13.0	8.00	0.580	0.390	355	165	8.20	222	<1.0	0.320	116	0.00670	1.20	0.0810	0.0640
		5-Apr-2022	372	92.0	13.0	7.70	1.60	1.50	373	194	8.10	257	1.10	1.20	112	0.00880	0.820	0.0970	0.0850
		3-May-2022	287	93.0	12.0	7.60	4.60	1.40	294	136	8.20	171	<1.0	1.60	88.0	0.00810	0.520	0.110	0.0410
		1-Jun-2022	257	100	11.0	8.50	11.0	0.830	262	116	8.20	167	1.20	0.750	90.0	0.0100	0.870	0.0720	<0.0050
		5-Jul-2022	265	94.0	9.20	8.10	16.0	0.190	266	126	8.20	174	1.10	0.390	93.0	0.0110	0.880	0.0730	0.0240
		3-Aug-2022	342	91.0	8.60	8.10	18.0	0.760	301	132	8.20	193	<1.0	0.490	4.90	0.0180	1.10	0.0750	0.0700
		8-Sep-2022	265	96.0	9.70	8.30	15.0	0.560	268	118	8.20	193	2.50	1.20	94.0	0.0220	0.940	0.0740	0.0180
		5-Oct-2022	274	99.0	9.90	8.50	16.0	1.40	271	115	8.10	188	1.80	0.580	98.0	0.00740	1.10	0.0810	0.0190
		2-Nov-2022	305	97.0	13.0	8.10	3.20	1.60	302	134	8.20	205	<1.0	0.820	94.0	0.00760	1.20	0.0740	0.0520
		7-Dec-2022	324	84.0	12.0	7.80	0.0250	1.40	321	143	8.20	208	<1.0	0.530	98.0	0.00940	1.30	0.0790	0.110
	HAC-14	3-May-2022	197	91.0	12.0	7.70	4.00	3.30	202	98.0	8.00	137	<1.0	3.90	67.0	0.00720	<0.50	0.0800	0.0190
		1-Jun-2022	261	95.0	9.70	8.30	13.0	0.930	262	112	8.20	189	2.30	0.720	92.0	0.00840	0.840	0.0740	0.0120
		5-Jul-2022	272	94.0	9.00	8.20	17.0	1.10	273	132	8.20	180	<1.0	0.420	100	0.00880	0.850	0.0770	0.0430
		3-Aug-2022	349	91.0	8.60	8.20	18.0	1.00	305	141	8.30	206	<1.0	0.560	108	0.0120	1.00	0.0790	0.0720
		8-Sep-2022	273	92.0	9.20	8.20	15.0	0.210	276	122	8.20	170	<1.0	0.580	104	0.00880	0.930	0.0780	0.0200
		5-Oct-2022	287	98.0	9.30	8.20	17.0	1.30	283	123	8.20	188	<1.0	0.450	106	0.00640	1.00	0.0830	0.0190
		2-Nov-2022	319	92.0	12.0	8.00	2.90	0.440	316	144	8.20	212	<1.0	0.270	107	0.00750	1.20	0.0790	0.0670

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Conductivity (*in situ*; µs/cm)	Dissolved Oxygen (*in situ*; %)	Dissolved Oxygen (*in situ*; mg/L)	pH (*in situ*; pH units)	Temperature (*in situ*; °C)	Turbidity (*in situ*; NTU)	Conductivity (µs/cm)	Hardness (as $CaCO_3$; mg/L)	pH (pH units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Alkalinity ($CaCO_3$; mg/L)	Ammonia (as N; mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (as N; mg/L)
2022	HAC-08	12-Jan-2022	344	90.0	13.0	8.20	0.400	0.680	340	158	8.10	230	1.20	0.430	118	<0.0050	1.20	0.0940	0.130
		7-Feb-2022	318	92.0	13.0	8.20	0.840	0.520	326	153	8.20	220	<1.0	0.330	116	<0.0050	1.10	0.0910	0.0910
		9-Mar-2022	337	96.0	14.0	8.10	1.10	1.20	347	163	8.20	222	8.30	3.20	124	<0.0050	1.00	0.0840	0.0530
		5-Apr-2022	265	93.0	13.0	8.00	1.70	3.00	270	136	8.10	185	<1.0	2.40	88.0	0.00910	<0.50	0.0770	0.0210
		3-May-2022	174	92.0	12.0	7.80	4.60	6.80	180	85.0	8.00	111	5.60	6.10	64.0	0.00500	<0.50	0.0730	0.00680
		1-Jun-2022	259	93.0	9.50	8.30	14.0	1.90	265	114	8.20	184	5.00	0.810	94.0	0.00680	0.820	0.0710	0.00500
		5-Jul-2022	269	95.0	9.20	8.50	17.0	1.70	275	134	8.20	178	3.20	0.650	105	0.00680	0.830	0.0770	0.0120
		3-Aug-2022	340	93.0	8.90	8.40	18.0	6.60	298	136	8.30	200	23.0	5.80	108	0.00920	0.970	0.0780	0.0430
		8-Sep-2022	275	94.0	9.50	8.40	15.0	1.30	279	123	8.30	162	2.40	1.00	105	0.00780	0.920	0.0790	0.00510
		5-Oct-2022	292	92.0	9.00	8.30	16.0	1.50	290	128	8.20	197	1.90	0.590	108	0.00970	1.00	0.0860	0.00660
		2-Nov-2022	326	89.0	13.0	8.20	0.920	0.380	319	146	8.30	216	<1.0	0.280	110	0.00520	1.10	0.0810	0.0370
		7-Dec-2022	345	91.0	13.0	8.20	0.170	1.30	341	150	8.30	205	1.20	0.340	113	0.00720	1.20	0.0880	0.130
	W10	7-Feb-2022	199	89.0	13.0	7.90	0.0290	0.460	203	101	8.10	145	<1.0	0.640	104	0.00770	0.500	0.0640	0.0990
		5-Apr-2022	111	92.0	13.0	7.90	0.550	4.20	113	61.0	7.80	97.0	7.50	7.00	52.0	0.00760	<0.50	0.0380	0.0470
		3-Aug-2022	296	88.0	9.00	8.10	14.0	0.760	260	126	8.40	180	1.50	1.70	136	0.0350	0.600	0.0750	0.0250
	EDC-01a	12-Jan-2022	343	87.0	13.0	8.00	0.320	0.750	341	157	8.10	212	<1.0	0.510	124	0.00600	1.10	0.0920	0.120
		7-Feb-2022	281	92.0	13.0	8.00	0.970	0.820	288	135	8.10	186	<1.0	0.420	113	<0.0050	0.850	0.0800	0.0880
		9-Mar-2022	241	95.0	13.0	7.70	1.60	1.40	241	121	8.00	178	1.90	1.50	98.0	0.00690	0.580	0.0620	0.0920
		5-Apr-2022	146	93.0	13.0	7.70	1.20	4.40	146	82.0	7.90	116	6.30	5.90	61.0	0.00720	<0.50	0.0450	0.0430
		3-May-2022	97.0	93.0	13.0	7.50	2.60	6.90	99.0	52.0	7.80	69.0	9.80	7.00	44.0	0.00810	<0.50	0.0450	0.00920
		1-Jun-2022	168	90.0	9.40	8.10	13.0	2.00	172	77.0	8.00	130	6.40	1.50	68.0	0.00700	<0.50	0.0560	<0.0050
		5-Jul-2022	219	97.0	9.10	8.20	17.0	0.980	221	103	8.20	162	2.20	0.840	88.0	0.00820	<0.50	0.0640	0.0110
		3-Aug-2022	357	96.0	9.20	8.20	17.0	0.780	313	146	8.30	183	<1.0	0.500	122	0.00920	0.870	0.0790	0.0330
		8-Sep-2022	283	99.0	10.0	8.40	15.0	1.40	287	126	8.30	190	3.30	1.40	112	0.0120	0.920	0.0780	<0.0050
		5-Oct-2022	299	101	9.60	8.40	18.0	1.10	295	130	8.20	192	<1.0	0.590	116	0.0250	1.10	0.0890	0.0100
		2-Nov-2022	342	92.0	13.0	8.00	2.20	0.630	333	157	8.30	219	1.20	0.380	121	0.0130	1.20	0.0840	0.0260
		7-Dec-2022	347	88.0	13.0	8.00	0.0950	1.00	347	157	8.30	203	<1.0	0.250	128	0.00740	1.20	0.0880	0.130
2023	HAC-13	4-Jan-2023	273	82.0	12.0	7.80	0.0540	1.10	269	116	8.20	195	<1.0	0.530	98.0	0.00710	0.870	0.0740	0.0470
		8-Feb-2023	274	-	-	7.80	0.820	1.00	300	118	8.10	198	<1.0	0.670	100	0.00910	0.890	0.0790	0.0460
		7-Mar-2023	265	88.0	13.0	7.60	0.130	0.890	267	124	8.10	154	<1.0	1.00	98.0	<0.0050	0.870	0.0780	0.0420
		3-Apr-2023	290	91.0	12.0	7.80	2.10	0.930	287	123	8.20	188	<1.0	0.480	107	0.0100	0.850	0.0800	0.0220
		1-May-2023	228	89.0	10.0	7.30	8.70	1.50	224	107	8.00	128	<1.0	1.80	72.0	0.0150	<0.50	0.0930	0.0230
		5-Jun-2023	240	106	11.0	8.20	15.0	0.760	244	107	8.20	177	<1.0	0.520	88.0	0.00720	0.770	0.0760	0.00720
		6-Jul-2023	240	95.0	9.00	8.10	18.0	0.200	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	243	88.0	8.60	8.20	17.0	0.410	251	126	8.20	175	<1.0	0.740	92.0	0.0100	0.750	0.0650	0.00760
		6-Sep-2023	244	88.0	9.10	8.10	13.0	0.660	247	111	8.20	178	1.40	0.700	94.0	0.00790	0.780	0.0750	<0.0050
	HAC-05a	4-Jan-2023	327	85.0	12.0	7.80	0.00300	0.850	322	146	8.20	217	<1.0	0.250	108	0.00820	1.30	0.0780	0.110
		8-Feb-2023	310	-	-	7.90	0.320	1.10	319	131	8.10	224	<1.0	0.240	108	0.00700	1.20	0.0830	0.0780
		7-Mar-2023	294	92.0	13.0	7.80	0.0490	0.460	298	139	8.20	211	<1.0	0.230	106	0.00650	1.10	0.0780	0.0670
		3-Apr-2023	328	98.0	14.0	8.00	1.60	0.560	329	151	8.30	208	<1.0	0.390	113	0.00600	1.20	0.0820	0.0270
		1-May-2023	261	94.0	11.0	7.70	9.20	2.10	258	123	8.00	182	<1.0	2.30	77.0	0.0120	0.540	0.0960	0.0360
		5-Jun-2023	284	106	11.0	8.20	14.0	0.580	285	125	8.30	199	<1.0	0.500	96.0	0.00910	1.10	0.0790	0.0280
		6-Jul-2023	274	100	9.60	8.20	17.0	0.450	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	260	93.0	9.10	8.20	16.0	0.0600	266	134	8.20	202	<1.0	0.560	98.0	0.00790	0.940	0.0690	0.0280
		6-Sep-2023	272	93.0	9.80	8.00	13.0	0.420	277	122	8.20	192	1.50	0.520	99.0	0.00710	0.980	0.0750	0.0170
	HAC-14	1-May-2023	165	94.0	11.0	7.70	7.30	5.60	165	79.0	7.90	133	1.50	5.70	56.0	0.00610	<0.50	0.0690	0.0110
		5-Jun-2023	299	101	9.80	8.10	17.0	0.180	298	135	8.30	221	<1.0	0.360	106	0.00550	1.00	0.0860	0.0560
		6-Jul-2023	288	94.0	8.80	8.20	18.0	0.210	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	269	92.0	9.00	8.20	17.0	0	275	142	8.30	194	<1.0	0.480	99.0	<0.0050	1.20	0.0700	0.0120
		6-Sep-2023	282	91.0	9.50	8.10	14.0	0.490	287	128	8.20	195	1.00	0.360	107	0.00520	0.950	0.0750	0.0150
	HAC-08	4-Jan-2023	329	82.0	12.0	8.20	0.00500	1.00	346	154	8.30	239	<1.0	0.320	119	0.00520	1.20	0.0860	0.120
		8-Feb-2023	324	-	-	8.10	0.630	0.860	324	140	8.20	234	1.30	0.270	116	0.00540	1.10	0.0860	0.0920
		7-Mar-2023	306	98.0	14.0	8.10	0.120	0.420	311	151	8.30	194	<1.0	0.330	113	0.0140	1.00	0.0790	0.0740
		3-Apr-2023	340	94.0	13.0	8.10	1.10	1.80	338	151	8.30	214	6.10	0.580	121	0.00600	0.990	0.0840	0.0470
		1-May-2023	151	96.0	11.0	7.80	8.20	7.50	156	75.0	7.90	112	9.20	8.90	55.0	0.00560	<0.50	0.0640	<0.0050
		5-Jun-2023	303	99.0	9.60	8.50	17.0	1.50	302	133	8.40	216	2.80	0.510	110	0.00640	1.00	0.0860	<0.0050
		6-Jul-2023	292	93.0	8.60	8.30	19.0	0.440	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	272	93.0	9.10	8.30	17.0	0.0900	279	140	8.30	192	1.40	0.650	101	<0.0050	1.20	0.0730	<0.0050
		6-Sep-2023	286	92.0	9.60	8.30	14.0	0.780	291	132	8.30	196	1.70	0.340	109	0.00550	0.960	0.0780	<0.0050
	W10	13-Jun-2023	269	-	-	8.10	13.0	0.310	266	121	8.20	189	<1.0	0.230	136	0.00740	0.590	0.0830	0.0220
	EDC-01a	4-Jan-2023	326	80.0	12.0	8.00	0.0260	0.850	342	155	8.30	236	<1.1	0.290	132	0.00810	1.20	0.0810	0.130
		8-Feb-2023	321	-	-	8.10	0.770	0.900	321	143	8.10	221	<1.0	0.230	125	0.00730	0.990	0.0810	0.110
		7-Mar-2023	308	91.0	13.0	8.00	0.180	0.460	315	145	8.30	211	<1.0	0.260	121	0.0110	0.990	0.0820	0.0900
		3-Apr-2023	319	94.0	13.0	8.00	1.70	1.10	320	147	8.30	202	1.30	0.460	128	0.00620	0.890	0.0780	0.130
		1-May-2023	83.0	96.0	12.0	7.60	5.00	9.80	84.0	43.0	7.70	86.0	26.0	13.0	38.0	0.00720	<0.50	0.0430	0.0520
		5-Jun-2023	305	107	11.0	8.20	16.0	0.620	304	136	8.30	216	<1.0	0.360	120	0.00550	0.830	0.0840	<0.0050
		6-Jul-2023	304	101	9.40	8.20	18.0	0.420	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	281	97.0	9.40	8.20	17.0	0.400	288	148	8.30	197	<1.0	0.530	110	0.00690	0.860	0.0780	<0.0050
		6-Sep-2023	297	98.0	10.0	8.20	14.0	0.520	302	135	8.30	205	1.30	0.270	115	0.00560	0.970	0.0820	<0.0050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2015	HAC-13	3-Dec-2015	0.230	<0.0010	0.00260	0.00590	0.0140	106	0.490	6.50	0.0510	0.000230	0.000740	0.0290	<0.00010	<0.000050	0.0390	0.0000120	76.0	<0.00050	0.000210	0.0180
		7-Dec-2015	0.320	<0.0010	0.00530	0.00930	0.0180	118	0.630	6.30	0.130	0.000220	0.000960	0.0240	<0.00010	<0.000050	0.0330	0.0000130	71.0	<0.00050	0.000240	0.0250
		15-Dec-2015	0.480	<0.0050	0.00140	0.00410	0.00910	190	0.770	8.10	0.0430	0.000260	0.000680	0.0480	<0.00010	<0.000050	0.0430	0.0000520	105	<0.00050	0.000460	0.0310
		22-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Dec-2015	0.380	<0.0010	0.00140	0.00470	0.00950	161	0.670	8.00	0.0190	0.000180	0.000550	0.0380	<0.00010	<0.000050	0.0380	0.0000310	92.0	<0.00050	0.000310	0.0240
		29-Dec-2015	0.340	0.00130	0.00360	0.00490	0.0320	123	-	6.70	0.0930	0.000220	0.000680	0.0380	<0.00010	<0.000050	0.0370	0.0000260	86.0	<0.00050	0.000290	0.0250
	HAC-05a	31-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.170	0.00130	0.00440	0.00720	0.0140	62.0	0.490	6.80	0.150	0.000130	0.000970	0.0220	<0.00010	<0.000050	0.0290	0.0000110	51.0	<0.00050	0.000190	0.0120
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	6.60	0.0340	0.00150	0.00330	0.0160	490	6.50	2.80	0.780	0.000710	0.000710	0.0640	<0.00010	<0.000050	0.140	0.0000340	169	<0.00050	0.000250	0.00720
		7-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	24-Feb-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	0.0110	<0.0010	0.00340	0.00470	0.00470	55.0	0.160	3.80	0.0280	0.000180	0.00150	0.0340	<0.00010	<0.000050	0.0400	<0.0000050	59.0	<0.00050	<0.00010	0.0130
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.220	<0.0010	<0.0010	0.00280	0.0170	72.0	0.460	6.40	0.270	0.000140	0.00120	0.0340	<0.00010	<0.000050	0.0330	0.0000120	57.0	<0.00050	0.000210	0.0190
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	5.50	0.0270	0.00280	0.00470	0.950	415	5.50	2.80	5.60	0.000600	0.00750	0.180	0.000210	<0.000050	0.120	0.000120	161	0.00520	0.00470	0.250
	W10	27-Jan-2015	0.140	<0.0010	0.00230	0.00950	0.0170	3.60	0.590	18.0	0.220	<0.00010	0.000560	0.0110	<0.00010	<0.00050	<0.010	<0.000010	20.0	0.000940	0.000130	0.00290
		2-Feb-2015	0.180	<0.0010	0.00240	0.0120	0.0160	2.70	0.680	20.0	0.200	<0.00010	0.000540	0.0100	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.00100	0.000110	0.00300
		10-Feb-2015	0.0940	<0.0010	0.00130	0.00880	0.0140	3.10	0.620	19.0	0.210	<0.00010	0.000540	0.0100	<0.00010	<0.00050	0.0110	<0.000010	19.0	0.000970	0.000130	0.00300
		17-Feb-2015	0.150	<0.0010	0.00210	0.0120	0.0310	2.50	0.760	22.0	0.300	<0.00010	0.000500	0.0110	<0.00010	<0.00050	<0.010	0.0000100	17.0	0.00110	0.000200	0.00450
		24-Feb-2015	0.0690	<0.0010	0.00120	0.00910	0.0150	2.80	0.590	21.0	0.230	<0.00010	0.000480	0.0100	<0.00010	<0.00050	<0.010	<0.000010	16.0	0.000990	0.000120	0.00360
		2-Mar-2015	-	<0.0010	0.00180	0.0100	0.0140	3.00	0.560	20.0	0.190	<0.00010	0.000480	0.00910	<0.00010	<0.00050	<0.010	<0.000010	19.0	0.000840	<0.00010	0.00270
		10-Mar-2015	-	<0.0010	<0.0010	0.00900	0.0120	3.80	0.510	19.0	0.200	<0.00010	0.000460	0.00960	<0.00010	<0.00050	<0.010	<0.000010	19.0	0.000810	0.000130	0.00350
		17-Mar-2015	-	<0.0010	0.00200	0.0130	0.0190	1.80	0.690	23.0	0.390	<0.00010	0.000460	0.00990	<0.00010	<0.00050	<0.010	0.0000100	13.0	0.00130	0.000230	0.00390
		24-Mar-2015	0.0410	<0.0010	<0.0010	0.00990	0.0210	1.70	0.600	20.0	0.330	<0.00010	0.000430	0.00930	<0.00010	<0.00050	<0.010	<0.000010	14.0	0.00120	0.000190	0.00330
		7-Apr-2015	0.0190	<0.0010	<0.0010	0.00770	0.0160	1.50	0.490	21.0	0.330	<0.00010	0.000390	0.00900	<0.00010	<0.000050	<0.010	0.00000840	13.0	0.00120	0.000200	0.00320
		14-Apr-2015	0.0130	<0.0010	<0.0010	0.00750	0.0130	1.50	0.480	20.0	0.240	<0.00010	0.000410	0.00850	<0.00010	0.0000920	<0.010	0.00000670	14.0	0.000980	0.000130	0.00280
		4-May-2015	0.00870	<0.0010	0.00220	0.00680	0.0140	1.20	0.480	18.0	0.190	<0.00010	0.000500	0.00930	<0.00010	<0.000050	<0.010	0.00000990	15.0	0.000990	0.000130	0.00300
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Jun-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Jul-2015	0.0230	<0.0010	0.00270	0.00450	0.00600	9.60	0.220	6.60	0.0340	<0.00010	0.00230	0.0280	<0.00010	<0.000050	0.0260	<0.0000050	42.0	<0.00050	<0.00010	0.00150
		2-Aug-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Aug-2015	0.0300	<0.0010	0.00380	0.00420	0.00390	12.0	0.180	5.40	0.0140	<0.00010	0.00240	0.0340	<0.00010	<0.000050	0.0270	0.00000600	49.0	<0.00050	<0.00010	0.00130
		3-Sep-2015	0.0120	<0.0010	0.00170	0.00470	0.00480	14.0	0.150	4.70	0.0110	<0.00010	0.00260	0.0310	<0.00010	<0.000050	0.0280	<0.0000050	48.0	<0.00050	<0.00010	0.000990
		6-Sep-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	0.00980	<0.0010	0.00220	0.00380	0.00350	13.0	0.250	5.00	0.00670	<0.00010	0.00260	0.0300	<0.00010	<0.000050	0.0320	<0.0000050	48.0	<0.00050	<0.00010	0.000940
		5-Nov-2015	0.550	<0.0010	0.00240	0.00810	0.00850	9.40	0.950	11.0	0.0260	<0.00010	0.00140	0.0160	<0.00010	<0.000050	0.0130	<0.0000050	31.0	<0.00050	<0.00010	0.00180
		3-Dec-2015	0.0960	<0.0010	0.00310	0.00540	0.00600	9.40	0.340	8.70	0.0100	<0.00010	0.00190	0.0200	<0.00010	<0.000050	0.0190	<0.0000050	36.0	<0.00050	<0.00010	0.00140
	EDC-01a	17-Feb-2015	-	<0.0010	0.00240	0.0120	0.250	2.70	0.790	22.0	3.20	0.000110	0.00210	0.0650	0.000110	<0.00050	<0.010	0.0000460	20.0	0.00600	0.00260	0.0470
		24-Feb-2015	0.0690	<0.0010	0.00110	0.00890	0.0180	3.00	0.560	22.0	0.290	<0.00010	0.000540	0.0110	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.00120	0.000170	0.00480
		2-Mar-2015	-	<0.0010	<0.0010	0.0100	0.0180	3.50	0.550	21.0	0.230	<0.00010	0.000570	0.0110	<0.00010	<0.00050	<0.010	<0.000010	20.0	0.000960	0.000150	0.00460
		10-Mar-2015	-	<0.0010	0.00120	0.00860	0.0120	4.10	0.510	18.0	0.230	<0.00010	0.000540	0.0110	<0.00010	<0.00050	<0.010	<0.000010	19.0	0.000910	0.000160	0.00470
		17-Mar-2015	-	<0.0010	0.00240	0.0140	0.0460	1.90	0.710	23.0	1.00	<0.00010	0.000800	0.0180	<0.00010	<0.00050	<0.010	0.0000170	14.0	0.00250	0.000680	0.00950
		24-Mar-2015	0.0410	<0.0010	0.00100	0.00960	0.0260	2.20	0.600	21.0	0.430	<0.00010	0.000470	0.0110	<0.00010	<0.00050	<0.010	0.0000110	14.0	0.00140	0.000260	0.00540
		1-Apr-2015	0.0240	<0.0010	0.00170	0.0110	0.410	1.30	0.700	27.0	6.40	0.000170	0.00300	0.0540	0.000200	0.0000720	<0.010	0.0000810	21.0	0.0150	0.00510	0.0210
		7-Apr-2015	0.0180	<0.0010	<0.0010	0.00790	0.0190	1.80	0.500	20.0	0.440	<0.00010	0.000500	0.0100	<0.00010	<0.000050	<0.010	0.00000850	13.0	0.00140	0.000260	0.00520
		14-Apr-2015	0.0140	<0.0010	<0.0010	0.00720	0.0140	1.80	0.470	20.0	0.270	<0.00010	0.000440	0.00930	<0.00010	<0.000050	<0.010	0.00000570	14.0	0.00100	0.000150	0.00380
		21-Apr-2015	0.0140	<0.0010	<0.0010	0.00790	0.0140	1.90	0.470	18.0	0.240	<0.00010	0.000450	0.00970	<0.00010	<0.000050	<0.010	0.00000760	15.0	<0.0010	0.000140	0.00370
		28-Apr-2015	0.0110	<0.0010	<0.0010	0.00800	0.0160	2.10	0.490	19.0	0.200	<0.00010	0.000460	0.0100	<0.00010	<0.000050	<0.010	0.00000720	15.0	0.00130	0.000140	0.00420
		4-May-2015	0.00930	<0.0010	<0.0010	0.00660	0.0140	2.40	0.480	17.0	0.230	<0.00010	0.000580	0.0110	<0.00010	<0.000050	<0.010	0.00000890	16.0	0.00100	0.000140	0.00450
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Jun-2015	0.0180	<0.0010	0.00100	0.00510	0.00650	12.0	0.370	11.0	0.0510	<0.00010	0.000960	0.0210	<0.00010	<0.000050	0.0170	0.00000650	33.0	<0.00050	<0.00010	0.00840
		7-Jul-2015	0.0280	<0.0010	0.00120	0.00430	0.00610	32.0	0.240	6.80	0.0540	0.000320	0.00100	0.0380	<0.00010	<0.000050	0.0300	0.0000120	50.0	<0.00050	<0.00010	0.0140
		31-Aug-2015	0.00940	<0.0010	0.00340	0.00630	0.00870	27.0	0.160	4.70	0.0550	0.000130	0.00140	0.0440	<0.00010	<0.000050	0.0330	0.00000860	55.0	<0.00050	<0.00010	0.0110
		8-Sep-2015	<0.0051	0.00100	0.0140	0.0180	0.0240	25.0	0.210	6.20	0.170	0.000100	0.00190	0.0390	<0.00010	<0.000050	0.0340	0.00000910	52.0	<0.00050	0.000160	0.0100

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2015	EDC-01a	1-Oct-2015	<0.0051	<0.0010	0.00130	0.00240	0.00320	23.0	0.160	5.00	0.0290	0.000110	0.00180	0.0330	<0.00010	<0.000050	0.0300	0.00000760	52.0	<0.00050	<0.00010	0.00540
		15-Oct-2015	0.0120	<0.0010	<0.0010	0.00380	0.00310	45.0	0.150	4.50	0.0420	<0.00010	0.00170	0.0380	<0.00010	<0.000050	0.0320	0.0000110	59.0	<0.00050	<0.00010	0.00840
		20-Oct-2015	0.0320	<0.0010	0.00140	0.00350	0.0160	42.0	0.180	5.00	0.520	<0.00010	0.00200	0.0400	<0.00010	<0.000050	0.0300	0.0000160	55.0	0.000960	0.000440	0.0140
		26-Oct-2015	0.00820	<0.0010	0.00270	0.00290	0.0120	41.0	0.130	4.10	0.270	<0.00010	0.00180	0.0390	<0.00010	<0.000050	0.0350	0.0000170	62.0	0.000620	0.000280	0.0110
		5-Nov-2015	0.510	<0.0010	0.00110	0.00700	0.00770	15.0	0.900	12.0	0.0450	<0.00010	0.00140	0.0210	<0.00010	<0.000050	0.0160	0.00000730	33.0	<0.00050	<0.00010	0.00420
		3-Dec-2015	0.200	<0.0010	0.00700	0.00990	0.0130	27.0	0.460	8.40	0.0670	<0.00010	0.00160	0.0280	<0.00010	<0.000050	0.0240	0.00000690	44.0	<0.00050	<0.00010	0.00560
	HAC-13	5-Jan-2016	0.170	<0.0010	0.0140	0.0180	0.0310	58.0	0.450	5.60	0.0920	0.000140	0.000950	0.0210	<0.00010	<0.000050	0.0330	0.00000780	48.0	<0.00050	0.000140	0.0120
		7-Jan-2016	0.160	<0.0010	0.0200	0.0200	0.0340	53.0	0.440	6.00	0.0530	0.000120	0.000940	0.0150	<0.00010	<0.000050	0.0330	<0.0000050	48.0	<0.00050	<0.00010	0.00710
		12-Jan-2016	0.160	<0.0010	0.0200	0.0260	0.0330	55.0	0.450	5.80	0.0370	0.000130	0.000920	0.0150	<0.00010	<0.000050	0.0280	<0.0000050	48.0	<0.00050	<0.00010	0.00670
		19-Jan-2016	0.150	<0.0010	0.0200	0.0270	0.0310	56.0	0.410	6.10	0.0270	0.000140	0.000930	0.0140	<0.00010	<0.000050	0.0290	0.00000630	49.0	<0.00050	<0.00010	0.00620
		26-Jan-2016	0.230	0.00110	0.0190	0.0240	0.0300	66.0	0.510	6.40	0.0680	0.000140	0.000910	0.0170	<0.00010	<0.000050	0.0290	0.00000660	53.0	<0.00050	0.000140	0.0110
		1-Feb-2016	0.180	0.00360	0.0190	0.0240	0.0330	67.0	0.500	6.30	0.120	0.000150	0.00100	0.0180	<0.00010	<0.000050	0.0330	0.0000140	54.0	<0.00050	0.000190	0.0110
		9-Feb-2016	0.240	0.00120	0.0190	0.0230	0.0270	62.0	0.530	6.80	0.0310	0.000160	0.000950	0.0150	<0.00010	<0.000050	0.0300	0.00000890	51.0	<0.00050	0.000100	0.00750
		15-Feb-2016	0.240	<0.0010	0.0140	0.0200	0.0360	70.0	0.550	7.30	0.110	0.000150	0.000920	0.0170	<0.00010	<0.000050	0.0280	0.0000130	50.0	<0.00050	0.000220	0.0130
		22-Feb-2016	0.170	0.00100	0.0160	0.0230	0.0280	65.0	0.530	7.50	0.0830	0.000130	0.000920	0.0160	<0.00010	<0.000050	0.0280	0.0000100	52.0	<0.00050	0.000170	0.0100
		24-Feb-2016	0.170	0.00120	0.0160	0.0210	0.0280	63.0	0.480	7.50	0.0520	0.000130	0.000920	0.0140	<0.00010	<0.000050	0.0250	0.00000810	49.0	<0.00050	0.000150	0.00950
		29-Feb-2016	0.180	0.00130	0.0130	0.0150	0.0260	63.0	0.540	7.00	0.0450	0.000130	0.000920	0.0160	<0.00010	<0.000050	0.0280	0.0000100	51.0	<0.00050	0.000190	0.0100
		2-Mar-2016	0.180	0.00110	0.0140	0.0200	0.0350	61.0	0.520	6.90	0.0520	0.000170	0.000930	0.0150	<0.00010	<0.000050	0.0300	0.00000870	48.0	<0.00050	0.000140	0.00920
		8-Mar-2016	0.260	0.00250	0.00650	0.0140	0.0350	149	0.630	11.0	0.360	0.000220	0.00100	0.0320	<0.00010	<0.000050	0.0300	0.0000530	84.0	<0.00050	0.000730	0.0470
		15-Mar-2016	0.180	0.00110	0.00890	0.0140	0.0280	76.0	0.560	9.60	0.120	0.000140	0.000900	0.0180	<0.00010	<0.000050	0.0280	0.0000150	54.0	<0.00050	0.000250	0.0170
		23-Mar-2016	0.180	<0.0050	0.00480	0.0140	0.0610	268	0.570	12.0	1.60	0.000330	0.00140	0.0700	<0.00010	<0.000050	0.0320	0.000110	119	0.00140	0.00200	0.120
		29-Mar-2016	0.150	<0.0050	0.00190	0.00660	0.0710	288	0.620	12.0	1.60	0.000300	0.00140	0.0640	<0.00010	<0.000050	0.0340	0.000110	130	0.00130	0.00210	0.120
		4-Apr-2016	0.0990	0.00250	0.00480	0.0100	0.110	184	0.620	18.0	3.80	0.000320	0.00210	0.0820	0.000110	<0.000050	0.0240	0.000100	91.0	0.00220	0.00360	0.210
		11-Apr-2016	<0.0051	<0.0010	0.00140	0.00850	0.0340	48.0	0.410	7.90	0.240	0.000130	0.000790	0.0160	<0.00010	<0.000050	0.0210	0.00000940	39.0	<0.00050	0.000250	0.0200
		13-Apr-2016	0.0710	<0.0010	0.00740	0.0130	0.0330	54.0	0.390	6.70	0.190	0.000120	0.000810	0.0140	<0.00010	<0.000050	0.0220	0.00000720	44.0	<0.00050	0.000180	0.0130
		19-Apr-2016	0.0690	0.00140	0.0130	0.0220	0.0420	51.0	0.390	6.40	0.150	0.000130	0.000850	0.0140	<0.00010	<0.000050	0.0240	0.00000500	44.0	<0.00050	0.000140	0.00960
		25-Apr-2016	<0.0051	<0.0010	0.00100	0.00880	0.0380	45.0	0.480	8.20	0.290	0.000120	0.000840	0.0160	<0.00010	<0.000050	0.0270	0.00000840	41.0	<0.00050	0.000220	0.0120
		5-May-2016	<0.0051	<0.0010	0.00190	0.00800	0.0190	55.0	0.370	6.40	0.140	0.000150	0.000880	0.0160	<0.00010	<0.000050	0.0270	<0.0000050	46.0	<0.00050	0.000150	0.0100
		10-May-2016	0.00700	<0.0010	0.00140	0.00640	0.0280	51.0	0.360	5.80	0.150	0.000160	0.000860	0.0160	<0.00010	<0.000050	0.0310	0.00000630	44.0	<0.00050	0.000160	0.0110
		17-May-2016	<0.0051	<0.0010	0.00170	0.00570	0.0200	58.0	0.340	6.00	0.190	0.000140	0.000890	0.0160	<0.00010	<0.000050	0.0300	<0.0000050	46.0	<0.00050	0.000190	0.0120
		24-May-2016	<0.0051	<0.0010	<0.0010	0.00630	0.0130	55.0	0.330	6.10	0.0790	0.000150	0.000970	0.0140	<0.00010	<0.000050	0.0290	<0.0000050	46.0	<0.00050	0.000100	0.00820
		31-May-2016	<0.0051	<0.0010	<0.0010	0.00520	0.0150	50.0	0.320	5.80	0.100	0.000130	0.000910	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	47.0	<0.00050	<0.00010	0.00750
		7-Jun-2016	<0.0051	<0.0010	0.00170	0.00730	0.0170	50.0	0.370	5.80	0.110	0.000150	0.000940	0.0160	<0.00010	<0.000050	0.0300	<0.0000050	43.0	<0.00050	0.000120	0.00940
		14-Jun-2016	0.0400	<0.0010	0.00120	0.00590	0.0170	190	0.420	8.90	0.160	0.000240	0.00100	0.0420	<0.00010	<0.000050	0.0420	0.0000210	96.0	<0.00050	0.000310	0.0280
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	<0.0051	<0.0010	0.00120	0.00720	0.0120	65.0	0.310	6.30	0.0640	0.000120	0.000850	0.0160	<0.00010	<0.000050	0.0290	0.00000680	51.0	<0.00050	0.000130	0.0110
		27-Jun-2016	<0.0051	<0.0010	0.00120	0.00680	0.0140	53.0	0.310	6.10	0.0550	0.000120	0.000870	0.0130	<0.00010	<0.000050	0.0280	<0.0000050	44.0	<0.00050	<0.00010	0.00780
		6-Jul-2016	0.0530	0.00440	<0.0010	0.00600	0.0330	60.0	0.380	6.30	0.880	0.000190	0.00120	0.0270	<0.00010	<0.000050	0.0330	0.0000160	52.0	0.00110	0.000620	0.0340
		13-Jul-2016	0.130	0.00460	0.00230	0.00760	1.00	113	0.470	9.40	33.0	0.000600	0.0160	0.500	0.000980	0.000160	0.0440	0.000320	91.0	0.0430	0.0240	0.960
		18-Jul-2016	0.260	0.00680	0.00120	0.00590	0.280	127	0.900	9.30	9.70	0.000370	0.00530	0.210	0.000300	<0.000050	0.0400	0.000100	83.0	0.00910	0.00690	0.310
		25-Jul-2016	0.0120	<0.0010	0.00100	0.00590	0.0200	56.0	0.330	8.10	0.260	0.000160	0.000990	0.0220	<0.00010	<0.000050	0.0290	<0.0000050	48.0	<0.00050	0.000240	0.0170
		2-Aug-2016	0.0640	0.00540	<0.0010	0.00330	0.0120	79.0	0.380	7.00	0.0860	0.000230	0.00100	0.0280	<0.00010	<0.000050	0.0340	0.00000600	59.0	<0.00050	0.000100	0.0180
		10-Aug-2016	0.120	0.00260	0.00180	0.00520	0.0220	76.0	0.400	6.60	0.440	0.000400	0.00120	0.0410	<0.00010	<0.000050	0.0350	0.0000130	55.0	0.000520	0.000360	0.0290
		17-Aug-2016	0.00600	<0.0010	0.0150	0.0280	1.80	76.0	0.660	13.0	28.0	0.000560	0.0150	0.520	0.000900	0.000100	0.0420	0.000250	83.0	0.0380	0.0220	0.710
		23-Aug-2016	0.140	0.00240	0.00340	0.00700	1.70	60.0	0.670	6.30	32.0	0.000550	0.0140	0.660	0.00100	<0.00010	0.0380	0.000300	76.0	0.0840	0.0320	0.790
		30-Aug-2016	0.0430	0.00150	0.00300	0.00680	0.860	54.0	0.490	5.60	22.0	0.000410	0.00820	0.420	0.000550	0.0000510	0.0300	0.000150	54.0	0.0420	0.0200	0.410
		6-Sep-2016	0.0460	0.00330	0.00120	0.00450	0.0870	59.0	0.290	5.60	2.20	0.000270	0.00160	0.0910	<0.00010	<0.000050	0.0300	0.0000190	43.0	0.00520	0.00200	0.0520
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Sep-2016	1.20	0.00550	0.00240	0.00490	0.630	96.0	1.70	6.10	20.0	0.000610	0.00850	0.340	0.000570	0.0000910	0.0420	0.000160	72.0	0.0300	0.0140	0.450
		19-Sep-2016	1.20	0.00540	0.00250	0.00620	0.0330	225	1.40	11.0	1.40	0.000440	0.00150	0.0860	<0.00010	<0.000050	0.0510	0.0000480	105	0.00150	0.00110	0.0810
		27-Sep-2016	0.100	<0.0010	0.00230	0.00740	0.0140	75.0	0.400	6.50	0.190	0.000220	0.000810	0.0340	<0.00010	<0.000050	0.0320	0.0000140	53.0	<0.00050	0.000170	0.0200
		2-Oct-2016	0.0110	<0.0010	<0.0010	0.00510	0.00690	55.0	0.290	5.60	0.0550	0.000150	0.000850	0.0190	<0.00010	<0.000050	0.0270	0.00000540	46.0	<0.00050	<0.00010	0.0110
		3-Oct-2016	0.0250	<0.0010	<0.0010	0.00440	0.00700	59.0	0.290	5.50	0.0600	0.000200	0.000720	0.0230	<0.00010	<0.000050	0.0280	0.00000700	47.0	<0.00050	<0.00010	0.0120
		11-Oct-2016	0.100	<0.0010	0.00130	0.00570	0.0790	83.0	0.440	7.20	0.150	0.000180	0.000790	0.0330	<0.00010	<0.000050	0.0320	0.0000100	58.0	<0.00050	0.000140	0.0220
		18-Oct-2016	0.0550	0.00170	0.00140	0.00670	0.0110	84.0	0.370	7.80	0.160	0.000170	0.000890	0.0260	<0.00010	<0.000050	0.0310	0.0000160	54.0	0.000810	0.000200	0.0220
		24-Oct-2016	0.0880	0.00140	0.00170	0.00830	0.0140	118	0.500	9.10	0.380	0.000160	0.000900	0.0350	<0.00010	<0.000050	0.0320	0.0000160	72.0	0.000650	0.000340	0.0320
		1-Nov-2016	0.250	0.00530	0.00330	0.00940	0.0210	79.0	0.590	9.10	0.290	0.000160	0.00100	0.0300	<0.00010	<0.000050	0.0280	0.0000170	53.0	0.000560	0.000290	0.0280
		8-Nov-2016	0.200	<0.0050	0.0120	0.0170	0.0230	83.0	0.530	5.80	0.130	0.000170	0.000980	0.0240	<0.00010	<0.000050	0.0330	0.0000120	55.0	<0.00050	0.000190	0.0180
		15-Nov-2016	0.130	0.00150	0.0120	0.0190	0.0250	63.0	0.490	6.90	0.260	0.000400	0.000950	0.0210	<0.00010	<0.000050	0.0300	<0.0000050	50.0	<0.00050	0.000220	0.0180
		22-Nov-2016	0.110	0.00170	0.0190	0.0240	0.0320	54.0	0.440	6.70	0.280	0.000180	0.00100	0.0210	<0.00010	<0.000050	0.0300	0.00000700	44.0	<0.00050	0.000230	0.0150
		29-Nov-2016	0.120	0.00130	0.0190	0.0240	0.0230	62.0	0.420	6.60	0.380	0.000180	0.000980	0.0220	<0.00010	<0.000050	0.0310	0.0000150	50.0	0.000580	0.000320	0.0170
		6-Dec-2016	0.120	0.00200	0.0130	0.0200	0.0300	61.0	0.440	6.70	0.190	0.000160	0.000890	0.0190	<0.00010	<0.000050	0.0270	0.0000110	46.0	<0.00050	0.000190	0.0120
		14-Dec-2016	0.120	0.00120	0.0220	0.0280	0.0280	52.0	0.410	5.80	0.0570	0.000150	0.000850	0.0140	<0.00010	<0.000050	0.0260	<0.0000050	46.0	<0.00050	<0.00010	0.00720
		20-Dec-2016	0.120	0.00160	0.0220	0.0260	0.0270	55.0	0.420	6.30	0.0360	0.000140	0.000940	0.0150	<0.00010	<0.000050	0.0270	<0.0000050	48.0	<0.00050	<0.00010	0.00790
		28-Dec-2016	0.120	<0.0010	0.0260	0.0300	0.0270	51.0	0.390	6.00	0.0230	0.000110	0.000870	0.0140	<0.00010	<0.000050	0.0280	<0.0000050	45.0	<0.00050	<0.00010	0.00640

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2016	HAC-05a	5-Jan-2016	5.30	0.0260	0.00190	0.00450	0.0120	385	5.30	3.20	0.470	0.00100	0.000670	0.0460	<0.00010	<0.000050	0.140	0.0000250	132	<0.00050	0.000170	0.00570
		7-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		12-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	4.60	0.0220	0.00420	0.00780	0.0180	318	4.40	4.50	0.430	0.000640	0.000760	0.0390	<0.00010	<0.000050	0.0860	0.0000180	112	<0.00050	0.000200	0.00830
		9-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Mar-2016	3.90	0.0150	0.00170	0.00560	0.0150	281	4.00	5.00	0.340	0.000550	0.000750	0.0360	<0.00010	<0.000050	0.0830	0.0000190	104	<0.00050	0.000240	0.00830
		8-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	4.40	0.00710	0.00280	0.00730	0.0610	331	4.60	11.0	1.80	0.000340	0.00120	0.0570	<0.00010	<0.000050	0.0530	0.0000680	131	0.00140	0.00160	0.0760
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	5.80	0.0410	0.00100	0.00280	0.0130	375	6.00	3.80	0.390	0.00110	0.000640	0.0470	<0.00010	<0.000050	0.110	0.0000110	118	<0.00050	0.000180	0.00610
		10-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7-Jun-2016	5.90	0.0470	<0.0010	0.00310	0.0120	383	6.10	3.40	0.400	0.00120	0.000770	0.0490	<0.00010	<0.000050	0.110	0.00000660	117	<0.00050	0.000110	0.00470
		14-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Jul-2016	6.50	0.0640	<0.0010	0.00440	0.0210	417	6.80	3.10	0.330	0.00130	0.00100	0.0590	<0.00010	<0.000050	0.120	0.0000130	137	<0.00050	0.000270	0.0120
		13-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	8.20	0.0640	<0.0010	<0.0020	0.00690	510	8.00	2.60	0.0930	0.00170	0.00100	0.0660	<0.00010	<0.000050	0.130	<0.000015	150	<0.00050	0.000120	0.00520
		10-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Sep-2016	8.70	0.0630	<0.0010	0.00250	0.0310	535	8.40	2.40	0.690	0.00150	0.00120	0.0800	<0.00010	<0.000050	0.140	<0.000020	139	0.000820	0.000550	0.0200
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Oct-2016	8.40	0.0480	<0.0010	0.00310	0.00710	519	8.30	2.20	0.0620	0.00190	0.00100	0.0630	<0.00010	<0.000050	0.150	0.00000830	169	<0.00050	<0.00010	0.00400
		11-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Nov-2016	6.20	0.0320	0.00220	0.00560	0.0140	410	6.30	4.30	0.220	0.00130	0.00110	0.0580	<0.00010	<0.000050	0.100	<0.000030	121	<0.00050	0.000230	0.0140
		8-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Nov-2016	0.140	0.00260	0.0180	0.0240	0.0460	58.0	0.420	7.30	0.350	0.000140	0.00110	0.0250	<0.00010	<0.000050	0.0240	0.00000990	48.0	<0.00050	0.000360	0.0210
		29-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Dec-2016	5.90	0.0200	0.00580	0.00980	0.0160	386	5.80	3.40	0.120	0.00120	0.00110	0.0500	<0.00010	<0.000050	0.100	0.0000210	114	<0.00050	0.000140	0.00890
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	5-Jan-2016	4.80	0.0220	0.00250	0.00450	0.0920	364	4.80	3.30	0.850	0.000830	0.00140	0.0840	<0.00010	<0.000050	0.120	0.0000310	122	0.000720	0.000650	0.0390
		19-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	4.20	0.0170	0.00340	0.00670	0.0320	297	4.10	4.50	0.470	0.000660	0.000970	0.0450	<0.00010	<0.000050	0.0920	0.0000220	111	<0.00050	0.000280	0.0150
		2-Mar-2016	3.50	0.0150	<0.0010	0.00420	0.0390	261	3.50	6.30	0.540	0.000520	0.00100	0.0420	<0.00010	<0.000050	0.0750	0.0000300	96.0	0.000510	0.000370	0.0160
		4-Apr-2016	2.40	0.00440	0.00170	0.00790	0.310	182	2.80	14.0	5.20	0.000340	0.00720	0.0970	0.000180	<0.000050	0.0370	0.000130	84.0	0.00770	0.00490	0.120
		5-May-2016	4.80	0.0320	0.00120	0.00360	0.0210	324	5.10	4.20	0.300	0.000890	0.000860	0.0530	<0.00010	<0.000050	0.0920	0.0000120	110	<0.00050	0.000220	0.00980
		7-Jun-2016	5.80	0.0450	0.00120	0.00350	0.0150	380	6.00	3.70	0.310	0.00110	0.000830	0.0560	<0.00010	<0.000050	0.100	0.0000120	120	<0.00050	0.000150	0.00620
		6-Jul-2016	6.30	0.0540	<0.0010	0.00410	0.0230	407	6.70	3.40	0.320	0.00110	0.00120	0.0650	<0.00010	<0.000050	0.110	0.0000130	134	<0.00050	0.000260	0.0110
		2-Aug-2016	6.80	0.0400	<0.0010	<0.0020	0.0110	437	6.90	3.00	0.180	0.00140	0.00120	0.0720	<0.00010	<0.000050	0.120	0.0000110	136	<0.00050	0.000160	0.00740
		6-Sep-2016	7.00	0.0380	<0.0010	<0.0020	0.0220	440	6.80	3.00	0.260	0.00130	0.00100	0.0660	<0.00010	<0.000050	0.120	<0.000020	127	<0.00050	0.000230	0.00890
		3-Oct-2016	7.40	0.0320	<0.0010	0.00300	0.0150	468	7.60	2.60	0.150	0.00160	0.00100	0.0650	<0.00010	<0.000050	0.120	0.0000110	144	<0.00050	0.000140	0.00820
		1-Nov-2016	5.00	0.0150	0.00180	0.00540	0.0410	339	5.30	7.00	0.600	0.000920	0.00130	0.0590	<0.00010	<0.000050	0.0750	0.0000230	89.0	0.00100	0.000420	0.0210
		22-Nov-2016	0.310	<0.0010	0.0110	0.0170	0.0490	63.0	0.650	9.20	0.300	0.000200	0.00110	0.0250	<0.00010	<0.000050	0.0250	0.0000170	47.0	0.000640	0.000330	0.0240
		6-Dec-2016	5.30	0.0120	0.00430	0.00820	0.0200	350	5.60	4.20	0.210	0.00110	0.00110	0.0470	<0.00010	<0.000050	0.0970	0.0000200	110	<0.00050	0.000190	0.0100
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2016	W10	7-Jan-2016	0.120	<0.0010	0.00550	0.00810	0.00870	8.60	0.420	9.50	0.0140	<0.00010	0.00180	0.0190	<0.00010	<0.000050	0.0140	<0.0000050	34.0	<0.00050	<0.00010	0.00150
		1-Feb-2016	0.620	0.00140	0.00430	0.0140	0.0160	9.60	1.10	15.0	0.120	<0.00010	0.00120	0.0140	<0.00010	<0.000050	0.0100	0.00000770	25.0	0.000660	<0.00010	0.00240
		2-Mar-2016	0.340	<0.0010	0.00190	0.0150	0.0220	7.40	0.930	19.0	0.200	<0.00010	0.000750	0.0110	<0.00010	<0.000050	0.0110	0.00000690	20.0	0.000980	0.000150	<0.0035
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.0900	<0.0010	0.00240	0.0170	0.0360	2.00	0.660	2.20	0.520	<0.00010	0.000560	0.0120	<0.00010	<0.000050	<0.010	0.0000150	11.0	0.00150	0.000330	0.00430
		4-May-2016	<0.0051	<0.0010	0.00190	0.0110	0.0140	1.80	0.560	20.0	0.120	<0.00010	0.000660	0.0110	<0.00010	<0.000050	0.0100	0.00000740	16.0	0.000940	<0.00010	0.00380
		4-May-2016	<0.0051	<0.0010	0.00180	0.0100	0.0160	1.80	0.580	20.0	0.130	<0.00010	0.000760	0.0110	<0.00010	<0.000050	<0.010	0.0000120	16.0	0.00100	<0.00010	0.00360
		6-Jun-2016	0.0130	<0.0010	0.00280	0.00940	0.0100	2.50	0.550	17.0	0.0580	<0.00010	0.00100	0.0140	<0.00010	<0.000050	0.0110	0.00000850	22.0	0.000630	<0.00010	0.00290
		4-Jul-2016	0.0190	<0.0010	0.00380	0.0120	0.0140	1.70	0.640	19.0	0.0660	<0.00010	0.00110	0.0140	<0.00010	<0.000050	0.0110	0.00000950	22.0	0.000780	<0.00010	0.00320
		4-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	0.0170	<0.0010	0.00350	0.00870	0.0100	2.60	0.570	18.0	0.0370	<0.00010	0.00140	0.0140	<0.00010	<0.000050	0.0110	0.00000710	25.0	0.000680	<0.00010	0.00270
		6-Sep-2016	0.00860	<0.0010	0.00190	0.00480	0.00600	9.70	0.240	7.80	0.0130	<0.00010	0.00230	0.0280	<0.00010	<0.000050	0.0240	<0.0000050	41.0	<0.00050	<0.00010	0.00130
		3-Oct-2016	<0.0051	<0.0010	0.00130	0.00980	0.0130	2.60	0.640	18.0	0.0570	<0.00010	0.000980	0.0120	<0.00010	<0.000050	<0.010	<0.0000050	22.0	0.000700	<0.00010	0.00230
		1-Nov-2016	0.0510	<0.0010	0.00190	0.0150	0.0190	1.80	0.800	24.0	0.260	<0.00010	0.000660	0.0110	<0.00010	<0.000050	<0.010	0.0000110	16.0	0.00120	0.000150	0.00350
		1-Dec-2016	0.0580	<0.0010	0.00290	0.0150	0.0190	2.00	0.710	23.0	0.260	<0.00010	0.000580	0.0110	<0.00010	<0.000050	<0.010	0.00000670	17.0	0.00110	0.000140	0.00320
	EDC-01a	5-Jan-2016	0.370	<0.0010	0.00350	0.00570	0.00910	38.0	0.640	8.70	0.0270	<0.00010	0.00160	0.0300	<0.00010	<0.000050	0.0200	0.00000780	45.0	<0.00050	<0.00010	0.00500
		1-Feb-2016	0.610	0.00250	0.00370	0.0140	0.0190	12.0	1.00	15.0	0.170	<0.00010	0.00110	0.0160	<0.00010	<0.000050	0.0120	<0.0000050	26.0	0.000760	0.000130	0.00430
		2-Mar-2016	0.350	<0.0010	0.00260	0.0150	0.0230	7.90	0.920	18.0	0.220	<0.00010	0.000800	0.0120	<0.00010	<0.000050	<0.010	<0.0000050	21.0	0.000940	0.000150	0.00430
		10-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.0890	<0.0010	0.00230	0.0160	0.0580	2.00	0.750	22.0	0.860	0.000110	0.000800	0.0160	<0.00010	<0.000050	<0.010	0.0000170	12.0	0.00200	0.000570	0.00850
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	<0.0051	<0.0010	0.00140	0.00990	0.0110	4.60	0.590	18.0	0.110	<0.00010	0.000700	0.0120	<0.00010	<0.000050	0.0100	0.0000110	18.0	<0.00090	<0.00010	0.00530
		7-Jun-2016	0.0200	<0.0010	0.00330	0.00940	0.0130	7.00	0.550	15.0	0.100	<0.00010	0.00120	0.0180	<0.00010	<0.000050	0.0140	0.00000960	25.0	0.000670	<0.00010	0.00530
		6-Jul-2016	0.00860	<0.0010	0.00200	0.00920	0.0130	3.80	0.630	19.0	0.0860	<0.00010	0.000910	0.0140	<0.00010	<0.000050	0.0100	0.00000500	23.0	0.000840	<0.00010	0.00400
		2-Aug-2016	0.100	0.00140	0.00210	0.00640	0.00830	30.0	0.590	16.0	0.0420	<0.00010	0.00150	0.0300	<0.00010	<0.000050	0.0180	0.0000170	35.0	0.000610	<0.00010	0.00600
		6-Sep-2016	0.170	<0.0010	<0.0010	0.00220	0.00670	52.0	0.380	7.50	0.0130	<0.00010	0.00150	0.0450	<0.00010	<0.000050	0.0310	0.0000130	52.0	<0.00050	<0.00010	0.00510
		3-Oct-2016	0.0810	<0.0010	0.00110	0.00900	0.0100	16.0	0.680	17.0	0.0450	<0.00010	0.00100	0.0190	<0.00010	<0.000050	0.0120	0.00000710	28.0	0.000640	<0.00010	0.00360
		1-Nov-2016	0.0660	<0.0010	0.00200	0.0130	0.0210	4.40	0.800	22.0	0.270	<0.00010	0.000650	0.0120	<0.00010	<0.000050	<0.010	0.00000970	17.0	0.00120	0.000160	0.00400
		6-Dec-2016	0.290	<0.0010	0.00230	0.0140	0.0170	25.0	0.840	22.0	0.240	0.000110	0.000750	0.0180	<0.00010	<0.000050	<0.010	0.00000860	25.0	0.00120	0.000140	0.00510
2017	HAC-13	3-Jan-2017	0.110	<0.0010	0.0270	0.0310	0.0270	48.0	0.390	5.60	0.0340	0.000150	0.000930	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	45.0	<0.00050	<0.00010	0.00620
		10-Jan-2017	0.110	<0.0010	0.0230	0.0280	0.0320	49.0	0.370	6.00	0.0340	0.000160	0.000910	0.0140	<0.00010	<0.000050	0.0290	<0.0000050	46.0	<0.00050	<0.00010	0.00590
		17-Jan-2017	0.110	<0.0010	0.0230	0.0260	0.0300	49.0	0.370	6.30	0.0280	0.000120	0.000860	0.0130	<0.00010	<0.000050	0.0290	<0.0000050	45.0	<0.00050	<0.00010	0.00550
		24-Jan-2017	0.110	<0.0010	0.0210	0.0270	0.0260	52.0	0.370	6.40	0.0190	0.000130	0.000840	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	43.0	<0.00050	<0.00010	0.00570
		1-Feb-2017	0.0900	<0.0010	0.0210	0.0260	0.0320	49.0	0.360	6.50	0.0200	0.000110	0.000930	0.0130	<0.00010	<0.000050	0.0320	<0.0000050	44.0	<0.00050	<0.00010	0.00570
		7-Feb-2017	0.0860	<0.0010	0.0210	0.0260	0.0330	50.0	0.390	6.80	<0.027	0.000100	0.000850	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00600
		14-Feb-2017	0.0760	<0.0010	0.0190	0.0270	0.0300	50.0	0.360	6.70	0.0220	0.000150	0.000890	0.0130	<0.00010	<0.000050	0.0280	<0.0000050	47.0	<0.00050	<0.00010	0.00610
		21-Feb-2017	0.0830	0.00130	0.0160	0.0210	0.0270	55.0	0.360	6.60	0.0290	0.000120	0.000860	0.0140	<0.00010	<0.000050	0.0270	0.00000740	46.0	<0.00050	<0.00010	0.00790
		1-Mar-2017	0.0630	<0.0010	0.0130	0.0180	0.0210	52.0	0.380	5.80	0.0230	0.000120	0.000810	0.0140	<0.00010	<0.000050	0.0250	0.00000610	43.0	<0.00050	<0.00010	0.00680
		7-Mar-2017	0.0450	<0.0010	0.0160	0.0160	0.0230	51.0	0.400	6.90	0.0230	0.000140	0.000850	0.0120	<0.00010	<0.000050	0.0280	0.00000620	43.0	<0.00050	<0.00010	0.00720
		14-Mar-2017	0.0600	<0.0010	0.0100	0.0160	0.0140	55.0	0.390	6.70	0.0360	0.000120	0.000980	0.0160	<0.00010	<0.000050	0.0330	0.0000130	49.0	<0.00050	0.000120	0.00910
		21-Mar-2017	0.0450	<0.0010	0.00870	0.0140	0.0140	54.0	0.380	6.60	0.0200	0.000140	0.000770	0.0140	<0.00010	<0.000050	0.0270	<0.000010	46.0	<0.00050	<0.00010	0.00760
		27-Mar-2017	0.0630	<0.0010	0.00680	0.0120	0.0210	70.0	0.330	6.20	0.0410	0.000120	0.000740	0.0160	<0.00010	<0.000050	0.0280	0.0000130	50.0	<0.00050	0.000150	0.0110
		30-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.120	<0.0010	0.00560	0.0170	0.0320	65.0	0.510	9.40	0.190	0.000140	0.000700	0.0190	<0.00010	<0.000050	0.0240	0.0000160	45.0	<0.00050	0.000310	0.0200
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.0110	<0.0010	0.00140	0.00760	0.0190	46.0	0.370	6.40	0.0720	0.000140	0.000730	0.0120	<0.00010	<0.000050	0.0260	0.0000110	40.0	<0.00050	<0.00010	0.00840
		1-Jun-2017	0.0120	<0.0010	0.00190	0.00830	0.0110	45.0	0.320	6.00	0.0390	0.000110	0.000760	0.0110	<0.00010	<0.000050	0.0240	<0.0000050	38.0	<0.00050	<0.00010	0.00580
		6-Jun-2017	0.0240	<0.0010	0.00330	0.00830	0.00970	46.0	0.330	6.70	0.0550	0.000130	0.000720	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	40.0	<0.00050	<0.00010	0.00770
		13-Jun-2017	0.0630	<0.0010	0.00750	0.0120	0.0140	50.0	0.340	5.30	0.0480	0.000150	0.000810	0.0180	<0.00010	<0.000050	0.0280	0.00000570	45.0	<0.00050	<0.00010	0.0100
		20-Jun-2017	0.0460	<0.0010	0.00560	0.0120	0.0130	55.0	0.330	5.30	0.0540	0.000200	0.000770	0.0170	<0.00010	<0.000050	0.0250	<0.0000050	42.0	<0.00050	<0.00010	0.00960
		27-Jun-2017	0.0440	<0.0010	0.00420	0.00920	0.0110	55.0	0.300	5.60	0.0440	0.000170	0.000780	0.0180	<0.00010	<0.000050	0.0300	0.00000710	46.0	<0.00050	<0.00010	0.0100
		4-Jul-2017	0.0220	<0.0010	0.00310	0.00710	0.00990	46.0	0.320	5.90	0.0470	0.000130	0.000760	0.0160	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00840
		1-Aug-2017	0.0150	<0.0010	0.00160	0.00620	0.00650	45.0	0.280	3.90	0.0340	0.000110	0.000740	0.0140	<0.00010	<0.000050	0.0230	<0.0000050	39.0	<0.00050	<0.00010	0.00620
		27-Aug-2017	0.0230	0.00110	0.00120	0.00600	0.0110	46.0	0.290	5.60	0.0280	0.000120	0.000810	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	42.0	<0.00050	<0.00010	0.00780
		19-Sep-2017	0.0690	<0.0010	0.00410	0.00650	0.0120	47.0	0.320	4.80	0.0160	0.000140	0.000680	0.0180	<0.00010	<0.000050	0.0260	<0.0000050	40.0	<0.00050	<0.00010	0.00890
		26-Sep-2017	0.0830	<0.0010	0.00450	0.00710	0.00750	46.0	0.310	6.00	0.0170	0.000150	0.000690	0.0210	<0.00010	<0.000050	0.0330	<0.0000050	45.0	<0.00050	<0.00010	0.0110
		2-Oct-2017	0.0580	<0.0010	0.00410	0.00690	0.00840	46.0	0.270	4.90	0.0110	0.000130	0.000650	0.0200	<0.00010	<0.000050	0.0280	<0.0000050	40.0	<0.00050	<0.00010	0.0110
		10-Oct-2017	0.0900	0.00240	0.00670	0.00890	0.0150	50.0	0.320	4.60	0.0160	0.000120	0.000620	0.0200	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.0110
		17-Oct-2017	0.130	<0.0010	0.00450	0.00520	0.00930	68.0	0.380	6.00	0.0550	0.000170	0.000710	0.0220	<0.00010	<0.000050	0.0240	0.0000160	50.0	<0.00050	<0.00010	0.0130
		24-Oct-2017	0.0920	<0.0010	0.00390	0.00820	0.00740	70.0	0.360	6.90	0.0300	0.000130	0.000710	0.0220	<0.00010	<0.000050	0.0270	<0.0000050	53.0	<0.00050	<0.00010	0.0140
		31-Oct-2017	0.0430	<0.0010	0.00280	0.00610	0.00670	58.0	0.300	5.70	0.0120	0.000110	0.000640	0.0170	<0.00010	<0.000050	0.0260	<0.0000050	45.0	<0.00050	<0.00010	0.00950

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2017	HAC-13	7-Nov-2017	0.0600	<0.0010	0.00380	0.00650	0.0110	57.0	0.320	5.90	0.0770	0.000130	0.000650	0.0210	<0.00010	<0.000050	0.0290	0.00000590	49.0	<0.00050	<0.00010	0.0140
		14-Nov-2017	0.100	<0.0010	0.00350	0.00670	0.00600	62.0	0.350	6.00	0.0360	0.000120	0.000640	0.0190	<0.00010	<0.000050	0.0280	<0.0000050	49.0	<0.00050	<0.00010	0.0120
		21-Nov-2017	0.0920	<0.0010	0.00300	0.00560	0.00720	66.0	0.330	5.40	0.0240	0.000180	0.000590	0.0210	<0.00010	<0.000050	0.0300	0.00000580	51.0	0.00200	<0.00010	0.0120
		28-Nov-2017	0.280	<0.0010	0.00220	0.00700	0.00830	109	0.580	8.50	0.0640	0.000150	0.000640	0.0280	<0.00010	<0.000050	0.0260	0.0000130	64.0	<0.00050	<0.00010	0.0190
		5-Dec-2017	0.170	<0.0010	0.00190	0.00570	0.00510	86.0	0.450	7.10	0.0200	0.000140	0.000570	0.0250	<0.00010	<0.000050	0.0270	0.00000790	62.0	<0.00050	<0.00010	0.0140
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-05a	3-Jan-2017	2.70	0.00950	0.0200	0.0220	0.0280	196	3.00	4.30	0.0940	0.000680	0.00100	0.0310	<0.00010	<0.000050	0.0650	0.0000180	80.0	<0.00050	0.000100	0.00840
		10-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jan-2017	0.120	<0.0010	0.0220	0.0260	0.0330	53.0	0.380	6.10	0.0300	0.000130	0.000860	0.0140	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00620
		1-Feb-2017	3.20	0.00630	0.00710	0.0110	0.0190	228	3.40	4.70	0.410	0.000710	0.000920	0.0320	<0.00010	<0.000050	0.0820	0.00000520	88.0	<0.00050	<0.00010	0.00610
		7-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Mar-2017	4.50	0.0110	0.00160	0.00500	0.0150	307	4.60	3.70	0.670	0.000910	0.000810	0.0360	<0.00010	<0.000050	0.0930	<0.000040	98.0	<0.00050	<0.00010	0.00620
		7-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.140	<0.0010	0.00640	0.0160	0.0290	65.0	0.600	10.0	0.720	0.000140	0.000960	0.0300	<0.00010	<0.000050	0.0230	0.0000310	47.0	0.000970	0.000710	0.0360
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.0290	<0.0010	0.00240	0.00830	0.0240	47.0	0.370	6.80	0.140	0.000140	0.000830	0.0140	<0.00010	<0.000050	0.0250	0.0000140	42.0	<0.00050	0.000150	0.0130
		9-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Jun-2017	0.0180	<0.0010	0.00320	0.00940	0.0170	46.0	0.310	6.30	0.0600	0.000110	0.000790	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	40.0	<0.00050	<0.00010	0.00660
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	9.30	0.0760	<0.0010	0.00260	0.0130	529	10.0	3.40	0.550	0.00130	0.00120	0.0640	<0.00010	<0.000050	0.180	<0.00010	199	<0.00050	0.000410	0.0190
		20-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2017	8.20	0.0390	<0.0010	<0.0020	0.00850	547	8.20	3.20	0.600	0.00120	0.00100	0.0530	<0.00010	<0.000050	0.160	<0.000075	179	<0.00050	0.000280	0.0100
		1-Aug-2017	0.0150	<0.0010	<0.0010	0.00520	0.00600	48.0	0.280	5.50	0.0710	0.000110	0.000760	0.0170	<0.00010	<0.000050	0.0240	0.00000520	41.0	<0.00050	<0.00010	0.00750
		19-Sep-2017	7.60	0.0640	<0.0010	<0.0020	0.00690	613	7.80	3.00	0.380	0.000940	0.00110	0.0630	<0.00010	<0.000050	0.210	<0.000080	203	<0.00050	0.000150	0.00950
		26-Sep-2017	7.60	0.0790	<0.0010	<0.0020	0.00520	586	7.90	2.80	0.400	0.00100	0.000880	0.0550	<0.00010	<0.000050	0.230	<0.000070	207	<0.00050	0.000150	0.00790
		2-Oct-2017	0.350	0.00270	0.00230	0.00430	0.00500	75.0	0.520	3.60	0.0620	0.000140	0.000980	0.0230	<0.00010	<0.000050	0.0370	0.00000730	54.0	<0.00050	<0.00010	0.00890
		10-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		31-Oct-2017	0.190	<0.0010	0.00150	0.00400	0.00510	79.0	0.420	5.10	0.0320	0.000110	0.000800	0.0240	<0.00010	<0.000050	0.0270	0.00000540	58.0	<0.00050	<0.00010	0.00860
		7-Nov-2017	0.280	<0.0010	0.00260	0.00440	0.00510	77.0	0.470	4.60	0.0230	<0.00010	0.000880	0.0240	<0.00010	<0.000050	0.0310	0.00000570	61.0	<0.00050	<0.00010	0.00850
		14-Nov-2017	0.280	<0.0010	0.00250	0.00430	0.00760	78.0	0.440	4.70	0.0300	0.000100	0.000850	0.0250	<0.00010	<0.000050	0.0270	0.00000580	57.0	<0.00050	<0.00010	0.00960
		21-Nov-2017	0.310	<0.0010	0.00270	0.00510	0.00610	83.0	0.480	4.20	0.0170	0.000150	0.000850	0.0270	<0.00010	<0.000050	0.0310	0.00000760	64.0	<0.00050	<0.00010	0.00920
		28-Nov-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Nov-2017	0.660	0.00190	0.00270	0.00670	0.0100	127	0.930	7.90	0.0550	0.000140	0.000820	0.0340	<0.00010	<0.000050	0.0280	0.0000140	75.0	0.000670	<0.00010	0.0150
		5-Dec-2017	0.380	<0.0010	0.00360	0.00660	0.00570	99.0	0.620	5.70	0.0140	0.000120	0.000820	0.0310	<0.00010	<0.000050	0.0270	0.00000860	72.0	<0.00050	<0.00010	0.0100
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-14	27-Aug-2017	0.0390	<0.0010	0.00130	0.00550	0.0120	53.0	0.290	5.00	0.310	0.000130	0.00100	0.0310	<0.00010	<0.000050	0.0280	0.00000910	49.0	0.000510	0.000230	0.0150
		19-Sep-2017	6.70	0.0580	<0.0010	<0.0020	0.00310	550	6.80	3.20	0.210	0.000770	0.00110	0.0760	<0.00010	<0.000050	0.190	<0.000060	190	<0.00050	0.000110	0.00780
		26-Sep-2017	7.30	0.0710	<0.0010	<0.0020	0.00380	565	7.50	2.70	0.270	0.000990	0.000910	0.0610	<0.00010	<0.000050	0.220	<0.000040	202	<0.00050	<0.00010	0.00580
		2-Oct-2017	0.470	0.00130	<0.0010	0.00250	0.00260	112	0.660	3.60	0.0500	0.000230	0.00140	0.0330	<0.00010	<0.000050	0.0590	<0.000010	64.0	<0.00050	<0.00010	0.00700
		17-Oct-2017	0.280	<0.0010	0.00130	0.00410	0.0220	127	0.500	5.90	0.730	0.000200	0.00120	0.0460	<0.00010	<0.000050	0.0270	0.0000230	70.0	0.00130	0.000540	0.0260
		24-Oct-2017	0.140	<0.0010	<0.0010	0.00400	0.00540	109	0.340	5.70	0.0500	0.000100	0.000950	0.0340	<0.00010	<0.000050	0.0340	0.00000770	71.0	<0.00050	<0.00010	0.00970
		31-Oct-2017	0.110	<0.0010	<0.0010	0.00270	0.00760	85.0	0.310	4.60	0.0120	0.000110	0.000930	0.0280	<0.00010	<0.000050	0.0310	0.00000760	60.0	<0.00050	<0.00010	0.00610
		7-Nov-2017	0.200	<0.0010	0.00110	0.00260	0.00540	86.0	0.360	4.20	0.0410	0.000110	0.00100	0.0310	<0.00010	<0.000050	0.0370	0.00000840	64.0	<0.00050	<0.00010	0.00810
		14-Nov-2017	0.190	<0.0010	0.00110	0.00270	0.00460	83.0	0.350	4.20	0.0380	0.000110	0.00110	0.0290	<0.00010	<0.000050	0.0320	0.00000680	62.0	<0.00050	<0.00010	0.00830
		21-Nov-2017	0.230	<0.0010	0.00200	0.00330	0.00600	88.0	0.390	3.70	0.0290	0.000140	0.00110	0.0330	<0.00010	<0.000050	0.0370	0.00000840	67.0	<0.00050	<0.00010	0.00810
		28-Nov-2017	0.500	0.00100	0.00220	0.00620	0.0140	126	0.730	6.80	0.250	0.000170	0.00110	0.0380	<0.00010	<0.000050	0.0300	0.0000140	78.0	0.000590	0.000230	0.0150
		5-Dec-2017	0.290	<0.0010	0.00210	0.00470	0.00460	100	0.480	4.90	0.0250	0.000130	0.00100	0.0350	<0.00010	<0.000050	0.0300	0.00000890	69.0	<0.00050	<0.00010	0.00900
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2017	HAC-08	3-Jan-2017	2.60	0.00700	0.0160	0.0180	0.0590	195	3.00	5.30	0.720	0.000690	0.00220	0.0520	<0.00010	<0.000050	0.0650	0.0000380	82.0	0.000850	0.000830	0.0400
		24-Jan-2017	0.160	<0.0010	0.0200	0.0240	0.0400	58.0	0.390	6.00	0.190	0.000170	0.00100	0.0190	<0.00010	<0.000050	0.0280	0.00000920	45.0	<0.00050	0.000180	0.0130
		1-Feb-2017	3.30	0.00980	0.00590	0.0110	0.0300	236	3.40	4.90	0.260	0.000740	0.00130	0.0430	<0.00010	<0.000050	0.0780	0.0000170	90.0	<0.00050	0.000290	0.0140
		1-Mar-2017	4.30	0.0110	0.00200	0.00500	0.0170	293	4.40	3.50	0.490	0.000930	0.000860	0.0340	<0.00010	<0.000050	0.0850	<0.000030	96.0	<0.00050	0.000150	0.0100
		3-Apr-2017	0.180	<0.0010	0.00800	0.0200	0.0820	48.0	0.800	13.0	1.30	0.000150	0.00120	0.0330	<0.00010	<0.000050	0.0190	0.0000340	39.0	0.00220	0.00110	0.0370
		2-May-2017	0.0220	0.00110	0.00180	0.00790	0.0290	42.0	0.370	8.30	0.290	0.000140	0.000890	0.0190	<0.00010	<0.000050	0.0220	0.0000180	39.0	0.000530	0.000240	0.0160
		1-Jun-2017	<0.0051	<0.0010	0.00190	0.00730	0.0180	48.0	0.320	5.90	0.110	0.000130	0.000900	0.0150	<0.00010	<0.000050	0.0260	<0.0000050	42.0	<0.00050	0.000110	0.00870
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	7.20	0.0550	<0.0010	0.00340	0.00840	416	7.30	3.70	0.230	0.000960	0.00100	0.0540	<0.00010	<0.000050	0.140	<0.000060	163	<0.00050	0.000160	0.00960
		4-Jul-2017	6.90	0.0280	<0.0010	<0.0020	0.00390	469	6.90	3.10	0.230	0.00100	0.00100	0.0540	<0.00010	<0.000050	0.140	<0.000045	161	<0.00050	<0.00010	0.00640
		27-Aug-2017	0.0220	<0.0010	<0.0010	0.00480	0.0120	56.0	0.270	5.00	0.240	0.000150	0.00130	0.0310	<0.00010	<0.000050	0.0300	0.00000840	50.0	<0.00050	0.000190	0.0140
		27-Aug-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Sep-2017	5.10	0.0470	<0.0010	0.00220	0.0290	439	5.30	3.20	0.910	0.000550	0.00360	0.100	<0.00010	<0.000050	0.150	<0.000060	164	0.00130	0.000900	0.0240
		10-Oct-2017	0.170	<0.0010	<0.0010	<0.0020	0.00300	109	0.320	3.20	0.0500	0.000160	0.00150	0.0370	<0.00010	<0.000050	0.0490	0.0000110	71.0	<0.00050	<0.00010	0.00680
		17-Oct-2017	0.190	<0.0010	0.00120	0.00440	0.0430	118	0.420	5.30	1.40	0.000220	0.00170	0.0500	<0.00010	<0.000050	0.0280	0.0000350	68.0	0.00280	0.00110	0.0250
		24-Oct-2017	0.100	<0.0010	<0.0010	0.00370	0.00650	112	0.300	5.50	0.0630	0.000120	0.00110	0.0370	<0.00010	<0.000050	0.0360	0.00000880	73.0	<0.00050	<0.00010	0.00990
		31-Oct-2017	0.0880	<0.0010	<0.0010	0.00250	0.00610	84.0	0.290	4.40	0.0740	0.000110	0.00120	0.0290	<0.00010	<0.000050	0.0330	0.00000800	60.0	<0.00050	<0.00010	0.00840
		7-Nov-2017	0.190	<0.0010	<0.0010	0.00210	0.00550	91.0	0.350	4.00	0.0680	0.000120	0.00120	0.0340	<0.00010	<0.000050	0.0400	0.0000110	72.0	<0.00050	<0.00010	0.00920
		14-Nov-2017	0.190	<0.0010	<0.0010	0.00210	0.00610	84.0	0.340	4.00	0.0540	0.000120	0.00140	0.0310	<0.00010	<0.000050	0.0340	0.00000620	62.0	<0.00050	0.000120	0.00870
		21-Nov-2017	0.230	<0.0010	0.00150	0.00250	0.00360	89.0	0.390	3.50	0.0340	0.000140	0.00140	0.0310	<0.00010	<0.000050	0.0370	0.0000130	66.0	<0.00050	0.000100	0.00810
		28-Nov-2017	0.420	<0.0010	0.00160	0.00580	0.00520	125	0.650	6.40	0.0620	0.000150	0.00130	0.0400	<0.00010	<0.000050	0.0320	0.0000120	78.0	<0.00050	0.000170	0.0120
		5-Dec-2017	0.270	<0.0010	0.00150	0.00260	0.00390	100	0.440	4.90	0.0380	0.000110	0.00130	0.0350	<0.00010	<0.000050	0.0300	0.0000110	68.0	<0.00050	0.000130	0.00910
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	W10	3-Jan-2017	0.110	<0.0010	0.00550	0.0150	0.0180	4.10	0.620	16.0	0.0910	<0.00010	0.00120	0.0140	<0.00010	<0.000050	<0.010	<0.0000050	26.0	0.000750	<0.00010	0.00250
		1-Feb-2017	0.130	<0.0010	0.00580	0.0120	0.0150	4.60	0.580	16.0	0.0760	<0.00010	0.00110	0.0140	<0.00010	<0.000050	0.0110	0.00000560	28.0	0.000640	<0.00010	0.00220
		1-Mar-2017	0.190	<0.0010	0.00520	0.0140	0.0160	4.00	0.680	15.0	0.0980	<0.00010	0.000960	0.0140	<0.00010	<0.000050	<0.010	0.00000710	27.0	0.000770	<0.00010	0.00240
		3-Apr-2017	0.250	<0.0010	0.00370	0.0210	0.0310	2.40	0.790	21.0	0.390	<0.00010	0.000580	0.0130	<0.00010	<0.000050	<0.010	0.0000130	18.0	0.00130	0.000280	0.00380
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.0590	<0.0010	0.00210	0.0140	0.0260	1.40	-	17.0	0.480	<0.00010	0.000500	0.0110	<0.00010	<0.000050	<0.010	0.0000150	14.0	0.00140	0.000310	0.00360
		25-Apr-2017	0.0530	<0.0010	0.00260	0.0130	0.0140	1.10	0.610	17.0	0.350	<0.00010	0.000450	0.00970	<0.00010	<0.000050	<0.010	0.0000110	13.0	0.00120	0.000210	0.00330
		2-May-2017	0.0340	<0.0010	<0.0010	0.0100	0.0150	1.20	0.560	18.0	0.200	<0.00010	0.000430	0.00890	<0.00010	<0.000050	<0.010	0.0000100	14.0	0.000880	0.000140	0.00320
		9-May-2017	0.0170	<0.0010	<0.0010	0.0100	0.0150	1.10	0.560	18.0	0.280	<0.00010	0.000440	0.00900	<0.00010	<0.000050	<0.010	0.00000770	11.0	0.000950	0.000160	0.00280
		17-May-2017	0.0120	<0.0010	0.00120	0.00910	0.00860	1.00	0.560	20.0	0.240	<0.00010	0.000490	0.0100	<0.00010	<0.000050	<0.010	0.00000740	15.0	0.000960	0.000140	0.00330
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	0.0120	<0.0010	0.00120	0.00840	0.00970	1.30	0.550	19.0	0.130	0.000130	0.000600	0.0110	<0.00010	<0.000050	<0.010	0.00000850	17.0	0.000780	0.000110	0.00290
		1-Jun-2017	0.0110	<0.0010	0.00290	0.00900	0.0120	1.80	0.530	17.0	0.0810	<0.00010	0.000770	0.0120	<0.00010	<0.000050	<0.010	0.00000700	19.0	0.000780	<0.00010	0.00280
		4-Jul-2017	0.0380	<0.0010	0.00280	0.00560	0.00540	8.40	0.330	9.00	0.0230	<0.00010	0.00210	0.0250	<0.00010	<0.000050	0.0190	0.00000870	36.0	0.000670	<0.00010	0.00170
		17-Aug-2017	0.0200	<0.0010	0.00310	0.00420	0.00400	15.0	0.170	5.20	0.0100	<0.00010	0.00280	0.0370	<0.00010	<0.000050	0.0300	0.00000610	46.0	<0.00050	<0.00010	0.00110
		4-Sep-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Sep-2017	0.0190	<0.0010	0.00140	0.00400	0.00360	14.0	0.150	4.60	0.00930	<0.00010	0.00270	0.0370	<0.00010	<0.000050	0.0300	0.00000590	46.0	<0.00050	<0.00010	0.00100
		11-Oct-2017	0.00570	<0.0010	0.00270	0.00380	0.00640	15.0	0.150	4.90	0.0100	<0.00010	0.00320	0.0300	<0.00010	<0.000050	0.0310	0.00000540	44.0	<0.00050	<0.00010	0.000880
		7-Nov-2017	0.0230	<0.0010	0.00260	0.00540	0.00820	8.70	0.430	12.0	0.0150	<0.00010	0.00210	0.0210	<0.00010	<0.000050	0.0180	<0.0000050	41.0	<0.00050	<0.00010	0.00120
		4-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EDC-01a	3-Jan-2017	0.260	0.00120	0.00560	0.0130	0.0150	20.0	0.790	16.0	0.120	0.000110	0.00110	0.0220	<0.00010	<0.000050	0.0130	0.00000750	32.0	0.000750	0.000130	0.00440
		1-Feb-2017	0.760	<0.0010	0.00490	0.0100	0.0160	65.0	1.00	12.0	0.0920	0.000150	0.000980	0.0440	<0.00010	<0.000050	0.0250	0.00000970	45.0	0.000570	<0.00010	0.00710
		1-Mar-2017	0.200	<0.0010	0.00510	0.0130	0.0160	5.00	0.670	14.0	0.0920	<0.00010	0.000730	0.0120	<0.00010	<0.000050	<0.010	<0.0000050	26.0	0.000650	<0.00010	0.00240
		31-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.260	<0.0010	0.00360	0.0230	0.0420	4.70	0.950	20.0	0.480	<0.00010	0.000600	0.0160	<0.00010	<0.000050	<0.010	0.0000130	18.0	0.00150	0.000320	0.00500
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.0580	<0.0010	0.00190	0.0100	0.0170	2.00	0.650	17.0	0.520	<0.00010	0.000550	0.0120	<0.00010	<0.000050	<0.010	0.0000130	14.0	0.00140	0.000320	0.00480
		25-Apr-2017	0.0530	<0.0010	0.00180	0.0120	0.0120	1.40	0.620	17.0	0.340	<0.00010	0.000430	0.00950	<0.00010	<0.000050	<0.010	0.0000110	13.0	0.00120	0.000210	0.00360
		2-May-2017	0.0350	<0.0010	<0.0010	0.0100	0.0160	1.80	0.540	17.0	0.180	<0.00010	0.000420	0.00920	<0.00010	<0.000050	<0.010	0.0000120	14.0	0.000830	0.000120	0.00340
		9-May-2017	0.0160	<0.0010	0.00100	0.0100	0.0140	1.30	0.560	17.0	0.220	<0.00010	0.000410	0.00870	<0.00010	<0.000050	<0.010	0.00000790	14.0	0.000860	0.000150	0.00300
		17-May-2017	0.0100	<0.0010	<0.0010	0.00910	0.0120	1.60	0.530	19.0	0.200	<0.00010	0.000420	0.0100	<0.00010	<0.000050	<0.010	0.00000630	15.0	0.000900	0.000120	0.00340
		23-May-2017	0.00900	<0.0010	<0.0010	0.00760	0.00900	2.10	0.540	19.0	0.120	<0.00010	0.000580	0.0110	<0.00010	<0.000050	<0.010	0.00000730	17.0	0.000770	<0.00010	0.00340
		1-Jun-2017	0.00890	<0.0010	0.00180	0.00850	0.00960	3.50	0.490	16.0	0.0950	<0.00010	0.000740	0.0130	<0.00010	<0.000050	<0.010	0.0000110	21.0	0.000630	0.000100	0.00370
		4-Jul-2017	0.0210	<0.0010	0.00210	0.00460	0.00380	13.0	0.340	9.10	0.0250	<0.00010	0.00150	0.0270	<0.00010	<0.000050	0.0180	0.00000680	38.0	<0.00050	<0.00010	0.00370
		19-Sep-2017	<0.0051	<0.0010	0.00130	0.00220	<0.0020	20.0	0.130	4.30	0.00620	0.000110	0.00180	0.0300	<0.00010	<0.000050	0.0300	0.00000540	48.0	<0.00050	<0.00010	0.00250
		2-Oct-2017	<0.0051	<0.0010	0.00130	0.00280	0.00470	17.0	0.140	4.30	0.00620	<0.00010	0.00220	0.0330	<0.00010	<0.000050	0.0280	<0.0000050	50.0	<0.00050	<0.00010	0.00210
		7-Nov-2017	<0.0051	<0.0010	<0.0010	0.00350	0.00710	10.0	0.400	12.0	0.0130	<0.00010	0.00190	0.0220	<0.00010	<0.000050	0.0180	<0.0000050	42.0	<0.00050	<0.00010	0.00200
		4-Dec-2017	0.100	<0.0010	0.00120	0.00380	0.00600	26.0	0.420	10.0	0.0180	<0.00010	0.00140	0.0230	<0.00010	<0.000050	0.0150	0.00000800	37.0	0.00140	<0.00010	0.00360

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2018	HAC-13	2-Jan-2018	0.130	<0.0010	0.00630	0.0100	0.00970	66.0	0.370	6.20	0.0120	0.000140	0.000680	0.0230	<0.00010	<0.000050	0.0270	<0.0000050	50.0	<0.00050	<0.00010	0.0120
		9-Jan-2018	0.120	<0.0010	0.00710	0.0120	0.0110	62.0	0.350	5.80	0.0120	0.000110	0.000750	0.0200	<0.00010	<0.000050	0.0310	<0.0000050	50.0	<0.00050	<0.00010	0.0130
		16-Jan-2018	0.110	<0.0010	0.00790	0.0100	0.0100	59.0	0.350	6.20	0.0110	<0.00010	0.000750	0.0200	<0.00010	<0.000050	0.0300	0.00000740	52.0	<0.00050	<0.00010	0.0120
		23-Jan-2018	0.100	<0.0010	0.00820	0.00930	0.0100	60.0	0.350	6.10	0.0110	0.000110	0.000790	0.0190	<0.00010	<0.000050	0.0270	0.00000930	47.0	<0.00050	<0.00010	0.0120
		30-Jan-2018	0.0970	<0.0010	0.00900	0.0130	0.0120	54.0	0.330	5.80	0.0110	0.000120	0.000720	0.0180	<0.00010	<0.000050	0.0250	0.00000790	47.0	<0.00050	<0.00010	0.0110
		6-Feb-2018	0.0910	<0.0010	0.0130	0.0170	0.0180	49.0	0.340	5.40	0.0260	0.000110	0.000790	0.0150	<0.00010	<0.000050	0.0250	0.00000760	43.0	<0.00050	<0.00010	0.00890
		13-Feb-2018	0.0890	<0.0010	0.0140	0.0190	0.0170	48.0	0.330	5.90	0.0190	0.000120	0.000770	0.0140	<0.00010	<0.000050	0.0240	<0.0000050	42.0	<0.00050	<0.00010	0.00690
		20-Feb-2018	0.0860	<0.0010	0.0150	0.0180	0.0190	48.0	0.340	5.80	0.00340	0.000100	0.000710	0.0130	<0.00010	<0.000050	0.0260	0.00000900	41.0	<0.00050	<0.00010	0.00550
		1-Mar-2018	0.100	<0.0010	0.00830	0.0120	0.0130	70.0	0.330	6.10	0.00620	0.000140	0.000640	0.0220	<0.00010	<0.000050	0.0290	0.00000720	57.0	<0.00050	<0.00010	0.0110
		8-Mar-2018	0.120	<0.0010	0.00660	0.0100	0.0120	72.0	0.380	5.60	0.0150	0.000120	0.000590	0.0210	<0.00010	<0.000050	0.0300	<0.0000050	59.0	<0.00050	<0.00010	0.0120
		14-Mar-2018	0.140	<0.0010	0.00760	0.0120	0.0150	86.0	0.410	6.40	0.0300	<0.00010	0.000610	0.0290	<0.00010	<0.000050	0.0280	0.0000100	69.0	<0.00050	<0.00010	0.0160
		20-Mar-2018	0.210	0.00220	0.00410	0.00760	0.0120	133	0.510	7.90	0.0100	0.000130	0.000540	0.0340	<0.00010	<0.000050	0.0280	0.0000410	91.0	<0.00050	0.000130	0.0210
		27-Mar-2018	0.310	0.00400	0.00320	0.00650	0.00860	150	0.580	8.00	0.0130	0.000120	0.000530	0.0380	<0.00010	<0.000050	0.0270	0.0000370	92.0	<0.00050	0.000160	0.0230
		3-Apr-2018	0.100	<0.0010	0.00990	0.0130	0.0140	63.0	0.350	6.00	0.00840	0.000130	0.000740	0.0180	<0.00010	<0.000050	0.0250	0.0000170	51.0	0.000910	<0.00010	0.0110
		10-Apr-2018	0.140	<0.0010	0.0110	0.0150	0.0190	56.0	0.400	6.20	0.0190	0.000160	0.000690	0.0150	<0.00010	<0.000050	0.0240	0.00000850	44.0	<0.00050	<0.00010	0.00940
		17-Apr-2018	0.160	<0.0010	0.00880	0.0140	0.0190	65.0	0.490	7.00	0.0330	0.000140	0.000720	0.0170	<0.00010	<0.000050	0.0250	0.0000190	53.0	<0.00050	<0.00010	0.0130
		24-Apr-2018	0.470	0.00410	0.00240	0.00760	0.0410	161	0.770	9.20	0.860	0.000230	0.000760	0.0460	<0.00010	<0.000050	0.0180	0.0000740	78.0	0.00160	0.00100	0.0560
		1-May-2018	0.0660	<0.0010	0.00100	0.0120	0.0330	31.0	0.560	12.0	0.200	0.000110	0.000480	0.0120	<0.00010	<0.000050	0.0130	0.0000120	29.0	0.000540	0.000150	0.0160
		8-May-2018	<0.0051	<0.0010	0.00120	0.00630	0.0190	31.0	0.340	7.70	0.210	<0.00010	0.000570	0.0130	<0.00010	<0.000050	0.0160	0.00000870	30.0	<0.00050	0.000140	0.0130
		16-May-2018	0.0460	<0.0010	0.00740	0.0130	0.0280	48.0	0.360	6.70	0.180	0.000150	0.000750	0.0190	<0.00010	<0.000050	0.0230	0.0000110	40.0	<0.00050	0.000150	0.0150
		24-May-2018	0.0740	<0.0010	0.00740	0.0150	0.0170	43.0	0.350	6.00	0.0580	0.000140	0.000720	0.0150	<0.00010	<0.000050	0.0230	0.00000620	38.0	<0.00050	<0.00010	0.00860
		29-May-2018	0.0410	0.00100	0.00620	0.0120	0.0220	42.0	0.320	5.90	0.0510	0.000140	0.000650	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	38.0	<0.00050	<0.00010	0.00700
		5-Jun-2018	0.0260	<0.0010	0.00570	0.0130	0.0130	44.0	0.290	5.80	0.0130	0.000100	0.000670	0.0120	<0.00010	<0.000050	0.0230	0.00000570	37.0	<0.00050	<0.00010	0.00660
		12-Jun-2018	0.0160	<0.0010	0.00400	0.00790	0.0140	44.0	0.280	5.60	0.0290	0.000140	0.000760	0.0130	<0.00010	<0.000050	0.0230	0.00000680	40.0	<0.00050	<0.00010	0.00680
		18-Jun-2018	0.0240	<0.0010	<0.0010	0.00530	0.0140	42.0	0.300	5.80	0.0190	0.000130	0.000690	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00640
		26-Jun-2018	0.0190	<0.0010	0.00320	0.0100	0.0110	42.0	0.290	5.50	0.0190	0.000130	0.000740	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	40.0	<0.00050	<0.00010	0.00660
		4-Jul-2018	0.0140	<0.0010	0.00180	0.00580	0.0110	48.0	0.270	5.60	0.0250	0.000120	0.000690	0.0140	<0.00010	<0.000050	0.0250	0.00000570	42.0	<0.00050	<0.00010	0.00720
		10-Jul-2018	0.0130	<0.0010	<0.0010	0.00550	0.0130	44.0	0.300	5.70	0.0220	0.000110	0.000780	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	40.0	<0.00050	<0.00010	0.00690
		17-Jul-2018	0.00960	<0.0010	0.00220	0.00680	0.0120	41.0	0.290	5.60	0.0230	0.000130	0.000800	0.0140	<0.00010	<0.000050	0.0270	<0.0000050	40.0	<0.00050	<0.00010	0.00680
		24-Jul-2018	0.00720	<0.0010	0.00250	0.00790	0.0140	41.0	0.270	5.90	0.0390	0.000110	0.000730	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00630
		2-Aug-2018	0.0180	<0.0010	0.00410	0.00740	0.0120	43.0	0.380	5.40	0.0390	0.000120	0.000730	0.0140	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00690
		7-Aug-2018	0.0140	<0.0010	0.00420	0.00810	0.0120	42.0	0.290	5.40	0.0310	<0.00010	0.000700	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	36.0	<0.00050	<0.00010	0.00640
		14-Aug-2018	0.0230	<0.0010	0.00390	0.00780	0.0130	42.0	0.320	5.60	0.0310	0.000110	0.000690	0.0140	<0.00010	<0.000050	0.0250	0.00000540	36.0	<0.00050	<0.00010	0.00630
		21-Aug-2018	0.0170	<0.0010	0.00300	0.00730	0.0120	42.0	0.290	5.60	0.0290	0.000100	0.000700	0.0140	<0.00010	<0.000050	0.0230	<0.0000050	38.0	<0.00050	<0.00010	0.00700
		28-Aug-2018	0.0280	<0.0010	0.00480	0.00870	0.0130	41.0	0.290	5.10	0.0200	0.000100	0.000700	0.0150	<0.00010	<0.000050	0.0260	<0.0000050	42.0	<0.00050	<0.00010	0.00740
		4-Sep-2018	0.0210	<0.0010	0.00200	0.00610	0.00980	42.0	0.280	5.20	0.0220	0.000110	0.000700	0.0140	<0.00010	<0.000050	0.0230	0.00000500	36.0	<0.00050	<0.00010	0.00640
		10-Sep-2018	0.0200	<0.0010	0.00220	0.00610	0.0130	43.0	0.290	4.40	0.120	0.000120	0.00100	0.0270	<0.00010	<0.000050	0.0250	0.00000770	46.0	<0.00050	0.000100	0.0110
		20-Sep-2018	0.0160	<0.0010	0.00340	0.00690	0.00950	44.0	0.290	5.30	0.0200	0.000120	0.000640	0.0150	<0.00010	<0.000050	0.0260	<0.0000050	41.0	<0.00050	<0.00010	0.00690
		24-Sep-2018	0.0130	<0.0010	0.00340	0.00700	0.0100	47.0	0.290	5.40	0.0220	0.000120	0.000710	0.0140	<0.00010	<0.000050	0.0240	0.00000600	41.0	<0.00050	<0.00010	0.00710
		2-Oct-2018	0.0120	<0.0010	0.00150	0.00610	0.00940	47.0	0.250	5.40	0.0350	<0.00010	0.000620	0.0140	<0.00010	<0.000050	0.0250	0.00000730	41.0	<0.00050	<0.00010	0.00700
		9-Oct-2018	0.0160	<0.0010	0.00270	0.00560	0.0100	55.0	0.280	5.30	0.0240	0.000110	0.000630	0.0150	<0.00010	<0.000050	0.0260	0.00000680	45.0	<0.00050	<0.00010	0.00850
		16-Oct-2018	0.0160	<0.0010	0.00220	0.00610	0.00770	51.0	0.260	5.50	0.0300	0.000110	0.000600	0.0150	<0.00010	<0.000050	0.0250	<0.0000050	44.0	<0.00050	<0.00010	0.00760
		23-Oct-2018	0.0180	<0.0010	0.00220	0.00630	0.00760	48.0	0.290	5.60	0.0310	<0.00010	0.000520	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00680
		30-Oct-2018	0.0460	<0.0010	0.00310	0.00660	0.00890	48.0	0.290	4.60	0.0660	<0.00010	0.000610	0.0140	<0.00010	<0.000050	0.0260	0.00000710	43.0	<0.00050	<0.00010	0.00790
		6-Nov-2018	0.0820	0.00120	0.00290	0.0100	0.0160	90.0	0.460	11.0	0.180	0.000110	0.000670	0.0220	<0.00010	<0.000050	0.0220	0.00000770	56.0	<0.00050	0.000110	0.0210
		13-Nov-2018	0.0430	<0.0010	0.00380	0.00750	0.0130	68.0	0.300	6.50	0.0820	0.000110	0.000600	0.0190	<0.00010	<0.000050	0.0260	0.00000660	53.0	<0.00050	<0.00010	0.0130
		27-Nov-2018	0.140	0.00110	0.00720	0.0120	0.0220	114	0.450	9.10	0.150	0.000170	0.000650	0.0300	<0.00010	<0.000050	0.0200	0.0000210	70.0	<0.00050	0.000180	0.0230
		4-Dec-2018	0.0690	<0.0010	0.00570	0.00950	0.0140	67.0	0.370	6.60	0.0580	0.000110	0.000760	0.0180	<0.00010	<0.000050	0.0240	0.0000180	51.0	0.000210	<0.00010	0.0120
	HAC-05a	2-Jan-2018	0.460	0.00140	0.00690	0.00950	0.00950	85.0	0.620	4.70	0.0190	0.000120	0.000890	0.0290	<0.00010	<0.000050	0.0290	<0.0000050	64.0	<0.00050	<0.00010	0.00940
		9-Jan-2018	0.420	0.00120	0.00820	0.0120	0.0130	81.0	0.590	4.40	0.0350	0.000150	0.000940	0.0280	<0.00010	<0.000050	0.0310	0.00000570	62.0	<0.00050	<0.00010	0.0100
		16-Jan-2018	0.380	<0.0010	0.00800	0.00930	0.0110	76.0	0.620	5.10	0.0220	<0.00010	0.00100	0.0260	<0.00010	<0.000050	0.0310	<0.0000050	63.0	<0.00050	<0.00010	0.0100
		23-Jan-2018	0.360	<0.0010	0.00730	0.0100	0.0110	79.0	0.570	5.30	0.0220	0.000110	0.000930	0.0260	<0.00010	<0.000050	0.0280	0.00000740	59.0	<0.00050	<0.00010	0.00980
		30-Jan-2018	0.280	<0.0010	0.00780	0.0110	0.0120	68.0	0.470	5.20	0.0540	0.000110	0.000920	0.0230	<0.00010	<0.000050	0.0240	0.00000730	53.0	<0.00050	<0.00010	0.0110
		6-Feb-2018	0.140	0.00150	0.0110	0.0140	0.0120	54.0	0.360	5.40	0.0370	0.000120	0.000870	0.0210	<0.00010	<0.000050	0.0260	0.00000710	47.0	<0.00050	<0.00010	0.0100
		13-Feb-2018	0.130	<0.0010	0.0130	0.0160	0.0240	51.0	0.370	5.80	0.140	0.000120	0.000820	0.0190	<0.00010	<0.000050	0.0250	0.00000620	47.0	<0.00050	0.000120	0.0110
		20-Feb-2018	0.120	<0.0010	0.0130	0.0170	0.0200	51.0	0.380	5.60	0.00400	0.000110	0.000720	0.0150	<0.00010	<0.000050	0.0260	0.00000880	42.0	<0.00050	<0.00010	0.00670
		14-Mar-2018	0.440	0.00330	0.0110	0.0140	0.0190	99.0	0.630	4.60	0.0720	0.000100	0.000890	0.0340	<0.00010	<0.000050	0.0280	0.0000110	75.0	<0.00050	0.000120	0.0110
		20-Mar-2018	0.510	0.00120	0.00800	0.0120	0.0140	135	0.710	6.10	0.0310	0.000120	0.000750	0.0350	<0.00010	<0.000050	0.0270	0.0000160	92.0	<0.00050	<0.00010	0.0120
		27-Mar-2018	0.580	0.00210	0.00610	0.00900	0.0140	152	0.790	6.60	0.0250	0.000110	0.000770	0.0420	<0.00010	<0.000050	0.0270	0.0000140	92.0	<0.00050	<0.00010	0.0150
		3-Apr-2018	0.180	0.00110	0.00690	0.0100	0.0130	74.0	0.440	5.90	0.0580	0.000120	0.000820	0.0220	<0.00010	<0.000050	0.0260	0.0000140	59.0	<0.00050	<0.00010	0.0120
		10-Apr-2018	0.160	<0.0010	0.00850	0.0120	0.0210	62.0	0.430	6.20	0.0610	0.000140	0.000710	0.0190	<0.00010	<0.000050	0.0240	0.00000710	46.0	<0.00050	0.000120	0.0110
		17-Apr-2018	0.200	<0.0010	0.00730	0.0140	0.0180	73.0	0.490	7.20	0.0650	0.000140	0.000750	0.0210	<0.00010	<0.000050	0.0240	0.0000190	57.0	<0.00050	0.000130	0.0150
		24-Apr-2018	0.500	0.00390	0.00330	0.00980	0.0230	156	0.760	9.60	0.340	0.000190	0.000670	0.0410	<0.00010	<0.000050	0.0160	0.0000600	81.0	0.000590	0.000520	0.0390
		1-May-2018	0.0900	<0.0010	0.00170	0.0110	0.0460	39.0	0.600	13.0	1.20	0.000120	0.00110	0.0370	<0.00010	<0.000050	0.0130	0.0000310	33.0	0.00150	0.000740	0.0480
		8-May-2018	0.0170	<0.0010	0.00140	0.00720	0.0230	35.0	0.390	8.70	0.290	0.000100	0.000700	0.0170	<0.00010	<0.000050	0.0150	0.00000810	32.0	0.000570	0.000190	0.0190
		16-May-2018	0.150	0.00320	0.00740	0.0120	0.0230	58.0	0.460	6.90	0.120	0.000150	0.000830	0.0210	<0.00010	<0.000050	0.0240	0.0000110	46.0	<0.00050	0.000110	0.0140
		24-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2018	HAC-05a	5-Jun-2018	0.120	0.00200	0.00670	0.0120	0.0170	54.0	0.420	5.40	0.0210	0.000100	0.000790	0.0160	<0.00010	<0.000050	0.0260	0.00000610	45.0	<0.00050	<0.00010	0.00750
		12-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2018	0.110	<0.0010	0.00290	0.0120	0.0130	57.0	0.360	5.40	0.0380	0.000120	0.000680	0.0180	<0.00010	<0.000050	0.0250	<0.0000050	48.0	<0.00050	<0.00010	0.00790
		10-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2018	0.0410	<0.0010	0.00120	0.00490	0.0110	50.0	0.300	5.10	0.0270	0.000130	0.000770	0.0160	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.00690
		7-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Sep-2018	0.160	0.00140	0.00150	0.00600	0.0130	56.0	0.390	4.70	0.0260	<0.00010	0.000780	0.0170	<0.00010	<0.000050	0.0250	<0.0000050	44.0	<0.00050	<0.00010	0.00780
		10-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Sep-2018	0.160	<0.0010	0.00340	0.00660	0.0110	69.0	0.410	4.90	0.0180	0.000120	0.000800	0.0200	<0.00010	<0.000050	0.0270	<0.0000050	52.0	<0.00050	<0.00010	0.00760
		2-Oct-2018	0.180	0.00110	0.00250	0.00620	0.00780	64.0	0.400	4.80	0.0140	<0.00010	0.000690	0.0180	<0.00010	<0.000050	0.0250	0.00000590	50.0	<0.00050	<0.00010	0.00620
		9-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		16-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Nov-2018	0.180	0.00150	0.00290	0.0100	0.0180	116	0.540	12.0	0.360	0.000120	0.000750	0.0310	<0.00010	<0.000050	0.0230	0.0000110	64.0	0.000690	0.000200	0.0220
		13-Nov-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Nov-2018	0.200	0.00150	0.00920	0.0140	0.0370	116	0.510	9.30	0.620	0.000150	0.000810	0.0390	<0.00010	<0.000050	0.0170	0.0000270	70.0	0.000990	0.000450	0.0370
		4-Dec-2018	0.250	<0.0010	0.00510	0.00790	0.0100	83.0	0.540	7.00	0.0540	<0.00010	0.000710	0.0220	<0.00010	<0.000050	0.0240	0.0000130	59.0	0.000180	<0.00010	0.0120
	HAC-14	2-Jan-2018	0.360	0.00120	0.00610	0.00780	0.00750	87.0	0.500	4.00	0.0200	0.000110	0.00100	0.0360	<0.00010	<0.000050	0.0320	0.00000560	65.0	<0.00050	<0.00010	0.00790
		9-Jan-2018	0.330	0.00100	0.00600	0.00740	0.00970	82.0	0.490	3.90	0.0310	0.000100	0.000980	0.0320	<0.00010	<0.000050	0.0370	0.0000100	65.0	<0.00050	<0.00010	0.00870
		16-Jan-2018	0.300	<0.0010	0.00570	0.00670	0.00810	78.0	0.480	5.00	0.0220	<0.00010	0.00110	0.0310	<0.00010	<0.000050	0.0350	0.00000890	66.0	<0.00050	<0.00010	0.00890
		23-Jan-2018	0.270	0.00100	0.00530	0.00760	0.00730	81.0	0.450	4.60	0.0270	0.000100	0.00120	0.0310	<0.00010	<0.000050	0.0320	0.00000940	61.0	<0.00050	<0.00010	0.00930
		10-Apr-2018	0.160	<0.0010	0.00820	0.0110	0.0710	62.0	0.460	6.20	1.10	0.000140	0.00120	0.0450	<0.00010	<0.000050	0.0240	0.0000240	46.0	0.00140	0.000800	0.0340
		17-Apr-2018	0.180	<0.0010	0.00660	0.0130	0.0260	70.0	0.530	8.30	0.240	0.000140	0.000790	0.0250	<0.00010	<0.000050	0.0220	0.0000210	54.0	0.000560	0.000210	0.0190
		24-Apr-2018	0.340	0.00220	0.00490	0.0130	0.0860	111	0.650	12.0	1.60	0.000160	0.00120	0.0480	<0.00010	<0.000050	0.0130	0.0000730	59.0	0.00270	0.00110	0.0410
		1-May-2018	0.0580	<0.0010	0.00220	0.0130	0.0960	32.0	0.660	14.0	1.90	0.000130	0.00130	0.0360	<0.00010	<0.000050	0.0120	0.0000400	31.0	0.00300	0.00130	0.0490
		8-May-2018	0.00610	<0.0010	<0.0010	0.00760	0.0400	30.0	0.340	11.0	0.620	0.000110	0.000800	0.0220	<0.00010	<0.000050	0.0130	0.0000200	29.0	0.00120	0.000420	0.0290
		16-May-2018	0.130	0.00200	0.00640	0.0100	0.0210	56.0	0.430	8.30	0.160	0.000160	0.000880	0.0240	<0.00010	<0.000050	0.0240	0.0000120	46.0	<0.00050	0.000150	0.0160
		24-May-2018	0.170	0.00350	0.00860	0.0140	0.0210	53.0	0.420	6.20	0.0830	0.000160	0.000850	0.0210	<0.00010	<0.000050	0.0240	0.00000990	43.0	<0.00050	<0.00010	0.0110
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	0.0830	0.00180	0.00510	0.00960	0.0130	57.0	0.340	5.30	0.0380	0.000120	0.000860	0.0210	<0.00010	<0.000050	0.0270	0.00000670	48.0	<0.00050	<0.00010	0.00940
		12-Jun-2018	0.0580	<0.0010	0.00430	0.00540	0.0160	50.0	0.330	5.30	0.0460	0.000150	0.000900	0.0190	<0.00010	<0.000050	0.0260	0.00000850	45.0	<0.00050	<0.00010	0.00890
		18-Jun-2018	0.0790	0.00130	0.00380	0.00810	0.0170	50.0	0.320	5.30	0.0450	0.000140	0.000780	0.0190	<0.00010	<0.000050	0.0250	0.00000690	46.0	<0.00050	<0.00010	0.00880
		26-Jun-2018	0.0980	<0.0010	0.00500	0.0110	0.0150	56.0	0.360	5.20	0.0650	0.000140	0.000850	0.0210	<0.00010	<0.000050	0.0260	0.00000620	48.0	<0.00050	<0.00010	0.00970
		4-Jul-2018	0.0960	<0.0010	0.00330	0.00690	0.0170	59.0	0.360	5.20	0.0780	0.000130	0.000800	0.0230	<0.00010	<0.000050	0.0280	0.00000910	51.0	<0.00050	<0.00010	0.0110
		10-Jul-2018	0.0870	<0.0010	0.00480	0.00780	0.0170	54.0	0.380	5.00	0.0520	0.000150	0.000830	0.0200	<0.00010	<0.000050	0.0260	0.00000920	46.0	<0.00050	<0.00010	0.00890
		17-Jul-2018	0.0390	<0.0010	0.00280	0.00660	0.0130	48.0	0.370	5.20	0.0550	0.000140	0.000880	0.0200	<0.00010	<0.000050	0.0290	0.00000700	44.0	<0.00050	<0.00010	0.00920
		24-Jul-2018	0.0110	<0.0010	0.00110	0.00710	0.0120	47.0	0.260	5.10	0.0300	0.000120	0.000790	0.0170	<0.00010	<0.000050	0.0260	<0.0000050	43.0	<0.00050	<0.00010	0.00770
		2-Aug-2018	0.0360	<0.0010	0.00210	0.00580	0.00980	51.0	0.280	4.90	0.0340	0.000140	0.000810	0.0200	<0.00010	<0.000050	0.0260	<0.0000050	44.0	<0.00050	<0.00010	0.00790
		7-Aug-2018	0.0150	<0.0010	0.00160	0.00500	0.00840	50.0	0.250	5.00	0.0630	0.000110	0.000800	0.0200	<0.00010	<0.000050	0.0250	0.00000520	43.0	<0.00050	<0.00010	0.00930
		14-Aug-2018	0.100	<0.0010	0.00180	0.00490	0.0140	53.0	0.320	5.00	0.350	0.000130	0.000930	0.0270	<0.00010	<0.000050	0.0290	0.00000840	41.0	<0.00050	0.000220	0.0160
		21-Aug-2018	0.0420	0.00120	0.00190	0.00310	0.00940	54.0	0.240	4.70	0.0820	0.000100	0.000850	0.0230	<0.00010	<0.000050	0.0260	0.00000790	46.0	<0.00050	<0.00010	0.0100
		28-Aug-2018	0.0890	0.00110	0.00220	0.00560	0.0120	57.0	0.330	4.50	0.110	0.000110	0.000950	0.0260	<0.00010	<0.000050	0.0290	0.00000670	51.0	<0.00050	<0.00010	0.0100
		4-Sep-2018	0.0990	<0.0010	0.00260	0.00360	0.0110	58.0	0.300	4.60	0.0990	0.000110	0.000940	0.0250	<0.00010	<0.000050	0.0260	0.00000720	45.0	<0.00050	<0.00010	0.0100
		10-Sep-2018	0.0840	<0.0010	<0.0010	0.00340	0.0130	62.0	0.290	5.30	0.0230	0.000110	0.000740	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	37.0	<0.00050	<0.00010	0.00740
		20-Sep-2018	0.130	<0.0010	0.00240	0.00440	0.0300	68.0	0.370	4.90	0.830	0.000140	0.00120	0.0500	<0.00010	<0.000050	0.0290	0.0000140	53.0	0.000820	0.000540	0.0300
		24-Sep-2018	0.170	0.00150	0.00250	0.00500	0.0640	77.0	0.420	4.90	1.80	0.000150	0.00160	0.0810	<0.00010	<0.000050	0.0310	0.0000200	58.0	0.00120	0.00130	0.0460
		2-Oct-2018	0.130	<0.0010	<0.0010	0.00410	0.0200	67.0	0.320	4.60	0.0780	<0.00010	0.000800	0.0260	<0.00010	<0.000050	0.0270	0.00000680	52.0	<0.00050	<0.00010	0.0120
		9-Oct-2018	0.220	<0.0010	0.00230	0.00450	0.0360	79.0	0.430	4.80	0.850	0.000130	0.00120	0.0510	<0.00010	<0.000050	0.0280	0.0000160	57.0	0.000660	0.000610	0.0320
		16-Oct-2018	0.180	0.00110	0.00160	0.00400	0.00980	75.0	0.350	4.60	0.110	<0.00010	0.000880	0.0310	<0.00010	<0.000050	0.0280	<0.000010	56.0	<0.00050	<0.00010	0.0120
		23-Oct-2018	0.190	0.00100	0.00180	0.00400	0.00890	73.0	0.420	4.30	0.0980	0.000100	0.000960	0.0290	<0.00010	<0.000050	0.0310	0.00000770	57.0	<0.00050	<0.00010	0.0120
		30-Oct-2018	0.160	<0.0010	0.00190	0.00310	0.0110	68.0	0.370	4.50	0.150	<0.00010	0.000910	0.0280	<0.00010	<0.000050	0.0290	0.00000830	52.0	<0.00050	0.000120	0.0140
		6-Nov-2018	0.140	0.00190	0.00380	0.0160	0.0360	92.0	0.680	17.0	0.790	0.000120	0.000930	0.0370	<0.00010	<0.000050	0.0190	0.0000250	58.0	0.00140	0.000400	0.0310
		13-Nov-2018	0.140	<0.0010	0.00420	0.00810	0.0150	85.0	0.410	7.80	0.200	0.000110	0.000760	0.0290	<0.00010	<0.000050	0.0250	0.0000110	58.0	<0.00050	0.000110	0.0170
		27-Nov-2018	0.150	<0.0010	0.00850	0.0180	0.130	87.0	0.570	12.0	1.40	0.000150	0.00120	0.0500	<0.00010	<0.000050	0.0150	0.0000380	58.0	0.00230	0.000980	0.0430
		4-Dec-2018	0.200	<0.0010	0.00450	0.00790	0.0180	80.0	0.510	8.30	0.260	<0.00010	0.000870	0.0300	<0.00010	<0.000050	0.0230	0.0000190	60.0	0.000530	0.000160	0.0200

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2018	HAC-08	2-Jan-2018	0.330	<0.0010	0.00470	0.00630	0.00880	88.0	0.470	3.70	0.0300	0.000120	0.00150	0.0370	<0.00010	<0.000050	0.0340	0.00000840	64.0	<0.00050	0.000110	0.00880
		9-Jan-2018	0.300	<0.0010	0.00460	0.00680	0.00890	83.0	0.450	3.70	0.0320	<0.00010	0.00140	0.0330	<0.00010	<0.000050	0.0370	0.00000580	62.0	<0.00050	0.000120	0.00860
		16-Jan-2018	0.280	<0.0010	0.00460	0.00650	0.00620	78.0	0.490	4.00	0.0250	<0.00010	0.00170	0.0380	<0.00010	<0.000050	0.0370	0.0000130	66.0	<0.00050	0.000130	0.0100
		23-Jan-2018	0.270	0.00120	0.00480	0.00640	0.00850	83.0	0.440	4.30	0.0360	0.000120	0.00150	0.0330	<0.00010	<0.000050	0.0340	0.00000890	62.0	<0.00050	0.000150	0.00920
		30-Jan-2018	0.240	<0.0010	0.00470	0.00690	0.00620	74.0	0.400	4.50	0.0440	0.000130	0.00130	0.0340	<0.00010	<0.000050	0.0300	0.00000760	60.0	<0.00050	0.000110	0.0100
		6-Feb-2018	0.150	0.00120	0.00630	0.00910	0.0110	63.0	0.350	5.20	0.130	0.000150	0.00140	0.0370	<0.00010	<0.000050	0.0280	0.0000170	53.0	<0.00050	0.000170	0.0150
		13-Feb-2018	0.130	<0.0010	0.00850	0.0120	0.0240	55.0	0.350	5.50	0.230	0.000140	0.00120	0.0300	<0.00010	<0.000050	0.0270	0.0000140	51.0	<0.00050	0.000250	0.0150
		20-Feb-2018	0.130	<0.0010	0.0120	0.0140	0.0280	54.0	0.380	5.40	0.00510	0.000110	0.000850	0.0190	<0.00010	<0.000050	0.0280	0.0000110	43.0	<0.00050	<0.00010	0.00800
		14-Mar-2018	0.280	0.00180	0.00710	0.00910	0.0120	93.0	0.450	3.90	0.0460	0.000120	0.00140	0.0410	<0.00010	<0.000050	0.0320	0.0000130	70.0	<0.00050	0.000140	0.00900
		20-Mar-2018	0.290	<0.0010	0.00660	0.00910	0.00980	112	0.440	4.80	0.0340	0.000120	0.00130	0.0380	<0.00010	<0.000050	0.0300	0.0000210	78.0	<0.00050	0.000140	0.0100
		27-Mar-2018	0.350	<0.0010	0.00390	0.00690	0.0240	116	0.540	6.00	0.260	0.000120	0.00140	0.0440	<0.00010	<0.000050	0.0270	0.0000180	77.0	0.000610	0.000330	0.0160
		3-Apr-2018	0.150	<0.0010	0.00370	0.00740	0.0140	74.0	0.380	5.80	0.140	0.000130	0.00120	0.0280	<0.00010	<0.000050	0.0270	0.0000200	59.0	<0.00050	0.000180	0.0140
		10-Apr-2018	0.150	<0.0010	0.00680	0.0100	0.240	58.0	0.480	6.30	1.90	0.000160	0.00330	0.0620	<0.00010	<0.000050	0.0230	0.0000530	45.0	0.00230	0.00180	0.0600
		17-Apr-2018	0.160	<0.0010	0.00510	0.0120	0.0310	63.0	0.530	9.30	0.360	0.000130	0.000970	0.0260	<0.00010	<0.000050	0.0200	0.0000250	50.0	0.000810	0.000320	0.0180
		24-Apr-2018	0.270	0.00150	0.00370	0.0120	0.0610	91.0	0.610	12.0	1.00	0.000140	0.00100	0.0370	<0.00010	<0.000050	0.0130	0.0000410	50.0	0.00180	0.000770	0.0310
		1-May-2018	0.0410	<0.0010	0.00200	0.0110	0.120	28.0	0.550	14.0	1.80	0.000120	0.00180	0.0380	<0.00010	<0.000050	0.0100	0.0000350	28.0	0.00280	0.00130	0.0410
		8-May-2018	<0.0051	<0.0010	0.00110	0.00800	0.0480	29.0	0.410	11.0	0.840	0.000120	0.000950	0.0260	<0.00010	<0.000050	0.0130	0.0000190	28.0	0.00160	0.000570	0.0260
		16-May-2018	0.100	0.00110	0.00190	0.00690	0.0240	54.0	0.390	8.00	0.220	0.000160	0.00100	0.0270	<0.00010	<0.000050	0.0230	0.0000160	45.0	<0.00050	0.000210	0.0170
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	0.0410	0.00160	0.00250	0.00710	0.0110	58.0	0.320	5.50	0.0880	0.000120	0.00120	0.0230	<0.00010	<0.000050	0.0280	0.00000880	48.0	<0.00050	<0.00010	0.0100
		4-Jul-2018	0.0970	<0.0010	0.00330	0.00730	0.0220	59.0	0.340	5.40	0.100	0.000130	0.000950	0.0230	<0.00010	<0.000050	0.0270	0.00000610	50.0	<0.00050	<0.00010	0.00990
		2-Aug-2018	0.0310	<0.0010	0.00180	0.00420	0.00900	52.0	0.250	5.20	0.0670	0.000140	0.00120	0.0220	<0.00010	<0.000050	0.0280	0.00000850	45.0	<0.00050	<0.00010	0.00940
		4-Sep-2018	0.0760	<0.0010	0.00220	0.00290	0.00960	59.0	0.280	4.30	0.0600	0.000110	0.00100	0.0250	<0.00010	<0.000050	0.0270	<0.0000050	45.0	<0.00050	<0.00010	0.00910
		2-Oct-2018	0.100	<0.0010	0.00110	0.00350	0.00650	67.0	0.280	4.40	0.0500	<0.00010	0.000890	0.0260	<0.00010	<0.000050	0.0260	0.00000760	49.0	<0.00050	<0.00010	0.00880
		6-Nov-2018	0.120	0.00290	0.00270	0.0150	0.0340	82.0	0.710	17.0	0.820	0.000110	0.000970	0.0350	<0.00010	<0.000050	0.0180	0.0000220	54.0	0.00150	0.000430	0.0290
		27-Nov-2018	0.140	<0.0010	0.00760	0.0160	0.130	75.0	0.590	12.0	2.00	0.000160	0.00190	0.0560	<0.00010	<0.000050	0.0140	0.0000520	51.0	0.00330	0.00140	0.0430
		4-Dec-2018	0.180	0.00120	0.00340	0.00800	0.0160	77.0	0.520	9.40	0.280	<0.00010	0.000970	0.0320	<0.00010	<0.000050	0.0220	0.0000150	59.0	0.000560	0.000190	0.0210
	W10	2-Jan-2018	0.100	<0.0010	0.00640	0.00830	0.0100	10.0	0.380	9.60	0.0100	<0.00010	0.00230	0.0220	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00130
		14-Feb-2018	0.110	<0.0010	0.00650	0.00990	0.00780	9.40	0.380	9.40	0.0110	<0.00010	0.00190	0.0190	<0.00010	<0.000050	0.0140	<0.0000050	36.0	<0.00050	<0.00010	0.00120
		14-Mar-2018	0.160	<0.0010	0.00730	0.0100	0.0120	11.0	0.390	7.60	0.0150	<0.00010	0.00220	0.0200	<0.00010	<0.000050	0.0170	0.00000540	36.0	<0.00050	<0.00010	0.00120
		3-Apr-2018	0.440	<0.0010	0.00280	0.0110	0.0130	11.0	0.910	14.0	0.0910	<0.00010	0.00100	0.0140	<0.00010	<0.000050	0.0100	0.00000910	28.0	0.000870	<0.00010	<0.0030
		1-May-2018	0.0120	<0.0010	0.00290	0.0140	0.0340	1.90	0.620	18.0	0.580	<0.00010	0.000610	0.0120	<0.00010	<0.000050	<0.010	0.0000190	11.0	0.00160	0.000390	0.00400
		5-Jun-2018	<0.0051	<0.0010	0.00170	0.00650	0.00750	6.70	0.340	12.0	0.0240	<0.00010	0.00140	0.0170	<0.00010	<0.000050	0.0140	0.00000610	26.0	<0.00050	<0.00010	0.00290
		4-Jul-2018	0.320	<0.0010	0.00290	0.00630	0.0120	8.60	0.370	11.0	0.0420	<0.00010	0.00140	0.0180	<0.00010	<0.000050	0.0150	0.00000660	28.0	<0.00050	<0.00010	0.00240
		2-Aug-2018	0.0280	<0.0010	0.00330	0.00550	0.00870	12.0	0.230	6.00	0.0690	<0.00010	0.00230	0.0320	<0.00010	<0.000050	0.0280	0.00000590	40.0	<0.00050	<0.00010	0.00420
		4-Sep-2018	0.0180	<0.0010	0.00390	0.00440	0.00680	15.0	0.140	3.90	0.00820	<0.00010	0.00250	0.0310	<0.00010	<0.000050	0.0280	<0.0000050	42.0	<0.00050	<0.00010	0.00110
		2-Oct-2018	<0.0051	<0.0010	0.00120	0.00410	0.610	12.0	0.230	6.50	0.0130	<0.00010	0.00240	0.0240	<0.00010	<0.000050	0.0210	<0.0000050	35.0	<0.00050	<0.00010	0.00150
		6-Nov-2018	0.160	<0.0010	0.00250	0.0200	0.0280	3.00	0.980	27.0	0.360	<0.00010	0.000640	0.0110	<0.00010	<0.000050	<0.010	0.0000150	14.0	0.00140	0.000190	0.00470
	EDC-01a	2-Jan-2018	0.150	<0.0010	0.00310	0.00580	0.00540	47.0	0.360	7.50	0.00950	<0.00010	0.00150	0.0360	<0.00010	<0.000050	0.0220	0.00000960	47.0	0.000550	<0.00010	0.00520
		30-Jan-2018	0.130	<0.0010	0.00420	0.00630	0.00540	34.0	0.330	7.20	0.0120	<0.00010	0.00170	0.0300	<0.00010	<0.000050	0.0170	0.00000550	41.0	<0.00050	<0.00010	0.00410
		14-Feb-2018	0.110	<0.0010	0.00480	0.00790	0.00950	25.0	0.340	8.30	0.0120	<0.00010	0.00160	0.0320	<0.00010	<0.000050	0.0200	0.00000680	48.0	<0.00050	<0.00010	0.00490
		14-Mar-2018	0.150	0.00420	0.00500	0.00710	0.00970	35.0	0.370	6.20	0.0130	<0.00010	0.00150	0.0360	<0.00010	<0.000050	0.0220	0.0000120	49.0	<0.00050	<0.00010	0.00490
		3-Apr-2018	0.420	<0.0010	0.00250	0.00930	0.0120	19.0	0.820	13.0	0.0730	<0.00010	0.00100	0.0190	<0.00010	<0.000050	0.0120	0.00000930	32.0	0.000540	<0.00010	0.00470
		1-May-2018	0.00990	<0.0010	0.00300	0.0150	0.110	2.10	0.660	18.0	0.710	<0.00010	0.000690	0.0140	<0.00010	<0.000050	<0.010	0.0000240	11.0	0.00180	0.000520	0.00630
		5-Jun-2018	<0.0051	<0.0010	0.00180	0.00630	0.00810	11.0	0.390	11.0	0.0260	<0.00010	0.00120	0.0190	<0.00010	<0.000050	0.0140	0.00000630	28.0	<0.00050	<0.00010	0.00390
		4-Jul-2018	<0.0051	<0.0010	0.00130	0.00420	0.00900	12.0	0.360	10.0	0.0190	<0.00010	0.00120	0.0220	<0.00010	<0.000050	0.0170	0.00000770	32.0	<0.00050	<0.00010	0.00440
		2-Aug-2018	<0.0051	<0.0010	0.00180	0.00360	0.00680	29.0	0.200	6.00	0.0120	0.000120	0.00120	0.0360	<0.00010	<0.000050	0.0290	0.0000150	45.0	<0.00050	<0.00010	0.00790
		4-Sep-2018	<0.0051	<0.0010	0.00240	0.00230	0.00780	25.0	0.160	4.40	0.0110	<0.00010	0.00140	0.0320	<0.00010	<0.000050	0.0270	0.00000810	44.0	<0.00050	<0.00010	0.00370
		2-Oct-2018	<0.0051	<0.0010	<0.0010	0.00320	0.00510	24.0	0.170	6.10	0.00640	<0.00010	0.00150	0.0270	<0.00010	<0.000050	0.0210	0.00000630	38.0	<0.00050	<0.00010	0.00350
		6-Nov-2018	0.160	<0.0010	0.00250	0.0200	0.0270	3.50	0.970	26.0	0.340	<0.00010	0.000640	0.0110	<0.00010	<0.000050	<0.010	0.0000110	14.0	0.00120	0.000200	0.00450
	HAC-13	8-Jan-2019	0.0600	<0.0010	0.00810	0.0120	0.0270	49.0	0.320	5.90	0.0180	<0.00010	0.000660	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	44.0	<0.00050	<0.00010	0.00700
		5-Feb-2019	0.0650	<0.0010	0.00850	0.0120	0.0190	47.0	0.330	5.60	0.0120	<0.00010	0.000640	0.0120	<0.00010	<0.000050	0.0240	0.00000890	42.0	<0.00050	<0.00010	0.00710
		4-Mar-2019	0.0690	<0.0010	0.00910	0.0130	0.0290	44.0	0.330	6.50	0.0170	<0.00010	0.000700	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	42.0	<0.00050	<0.00010	0.00610
		2-Apr-2019	0.110	<0.0010	0.00370	0.0110	0.0180	56.0	0.450	9.00	0.120	0.000110	0.000630	0.0170	<0.00010	<0.000050	0.0210	0.0000180	46.0	<0.00050	0.000170	0.0150
		14-May-2019	0.0840	0.00170	0.00850	0.0150	0.0260	44.0	0.410	6.40	0.0800	0.000110	0.000690	0.0150	<0.00010	<0.000050	0.0220	0.00000730	42.0	<0.00050	<0.00010	0.00990
		4-Jun-2019	<0.0051	<0.0010	0.00370	0.00990	0.0170	41.0	0.300	5.80	0.0200	0.000110	0.000660	0.0130	<0.00010	<0.000050	0.0220	0.00000580	40.0	<0.00060	<0.00010	0.00620
		2-Jul-2019	<0.0051	<0.0010	0.00150	0.00680	0.0120	41.0	0.290	5.60	0.0690	<0.00010	0.000710	0.0130	<0.00010	<0.000050	0.0330	<0.000010	45.0	<0.00050	<0.00010	0.00630
		1-Aug-2019	<0.0051	<0.0010	0.00180	0.00930	0.0120	45.0	0.320	6.30	0.0200	0.000100	0.000640	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	42.0	<0.00050	<0.00010	0.00600
		3-Sep-2019	<0.0051	<0.0010	0.00120	0.00550	0.0130	38.0	0.280	5.60	0.0220	0.000100	0.000660	0.0110	<0.00010	<0.000050	0.0260	<0.0000050	41.0	<0.00050	<0.00010	0.00530
		1-Oct-2019	<0.0051	<0.0010	<0.0010	0.00460	0.00820	51.0	0.340	5.70	0.0240	<0.00010	0.000600	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	43.0	<0.00050	<0.00010	0.00580
		4-Nov-2019	<0.0051	<0.0010	<0.0010	0.00590	0.0190	46.0	0.300	6.30	0.0330	<0.00010	0.000620	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00640
		2-Dec-2019	0.0190	0.00240	0.00280	0.00780	0.0240	45.0	0.290	6.20	0.0270	0.000110	0.000660	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	42.0	<0.00050	<0.00010	0.00520

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2019	HAC-05a	8-Jan-2019	0.170	<0.0010	0.00790	0.0100	0.0170	59.0	0.430	5.80	0.0200	<0.00010	0.000740	0.0170	<0.00010	<0.000050	0.0260	<0.0000050	48.0	<0.00050	<0.00010	0.00770
		5-Feb-2019	0.160	<0.0010	0.00750	0.0100	0.0150	57.0	0.410	5.40	0.0190	<0.00010	0.000660	0.0160	<0.00010	<0.000050	0.0240	0.00000760	46.0	<0.00050	<0.00010	0.00710
		4-Mar-2019	0.170	<0.0010	0.00860	0.0130	0.0150	53.0	0.420	6.20	0.0170	0.000110	0.000640	0.0150	<0.00010	<0.000050	0.0270	<0.0000050	47.0	<0.00050	<0.00010	0.00680
		2-Apr-2019	0.140	<0.0010	0.00370	0.0100	0.0180	64.0	0.470	9.00	0.130	0.000120	0.000640	0.0200	<0.00010	<0.000050	0.0200	0.0000220	51.0	<0.00050	0.000180	0.0160
		18-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-May-2019	0.260	0.00300	0.00840	0.0140	0.0280	61.0	0.530	6.20	0.0590	0.000140	0.000760	0.0190	<0.00010	<0.000050	0.0240	0.00000650	49.0	<0.00050	<0.00010	0.0100
		4-Jun-2019	0.0950	0.00150	<0.0010	0.00680	0.0120	56.0	0.380	5.50	0.0120	0.000100	0.000780	0.0160	<0.00010	<0.000050	0.0230	<0.0000050	48.0	<0.00060	<0.00010	0.00680
		2-Jul-2019	0.0580	<0.0010	<0.0010	0.00620	0.0130	54.0	0.380	5.60	0.0120	0.000110	0.000770	0.0160	<0.00010	<0.000050	0.0230	<0.000010	44.0	<0.00050	<0.00010	0.00630
		1-Aug-2019	0.0490	<0.0010	0.00150	0.00870	0.0130	54.0	0.370	6.00	0.0380	0.000100	0.000640	0.0150	<0.00010	<0.000050	0.0250	<0.0000050	47.0	<0.00050	<0.00010	0.00690
		3-Sep-2019	0.0540	<0.0010	<0.0010	0.00540	0.0120	46.0	0.330	5.40	0.0260	0.000120	0.000650	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	46.0	<0.00050	<0.00010	0.00650
		1-Oct-2019	0.0660	<0.0010	<0.0010	0.00520	0.0110	63.0	0.360	5.40	0.0260	0.000100	0.000610	0.0150	<0.00010	<0.000050	0.0240	<0.0000050	51.0	<0.00050	<0.00010	0.00660
		4-Nov-2019	0.0310	0.00170	0.00100	0.00650	0.0230	53.0	0.330	6.40	0.0530	<0.00010	0.000680	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	47.0	<0.00050	<0.00010	0.00760
		2-Dec-2019	0.0600	0.00160	0.00310	0.00810	0.0160	50.0	0.330	6.10	0.0320	0.000100	0.000690	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	44.0	<0.00050	<0.00010	0.00550
	HAC-14	14-May-2019	0.200	0.00290	0.00290	0.00920	0.0170	60.0	0.450	6.70	0.0830	0.000130	0.000820	0.0220	<0.00010	<0.000050	0.0240	0.00000930	51.0	<0.00050	<0.00010	0.0120
		4-Jun-2019	0.0760	0.00110	<0.0010	0.00700	0.0130	57.0	0.350	5.20	0.0440	<0.00010	0.000810	0.0220	<0.00010	<0.000050	0.0250	0.00000650	49.0	<0.00050	<0.00010	0.00960
		2-Jul-2019	0.0390	<0.0010	0.00310	0.00610	0.0550	57.0	0.330	5.00	0.920	0.000130	0.00150	0.0450	<0.00010	<0.000050	0.0250	0.0000250	48.0	0.00140	0.000780	0.0250
		1-Aug-2019	0.0330	<0.0010	0.00200	0.00790	0.0440	56.0	0.350	5.60	0.620	0.000130	0.00120	0.0350	<0.00010	<0.000050	0.0270	0.0000210	50.0	0.000630	0.000530	0.0410
		3-Sep-2019	0.0580	<0.0010	0.00190	0.00570	0.0140	47.0	0.280	4.90	0.0770	0.000120	0.000820	0.0210	<0.00010	<0.000050	0.0280	<0.000010	49.0	<0.00050	<0.00010	0.0140
		1-Oct-2019	0.0750	<0.0010	<0.0010	0.00530	0.00820	62.0	0.370	6.10	0.0490	<0.00010	0.000690	0.0220	<0.00010	<0.000050	0.0260	0.00000910	52.0	<0.00050	<0.00010	0.0140
		4-Nov-2019	0.0280	<0.0010	0.00120	0.00620	0.0200	50.0	0.340	7.60	0.150	<0.00010	0.000690	0.0180	<0.00010	<0.000050	0.0210	0.00000960	46.0	<0.00050	<0.00010	0.0130
		4-Nov-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Dec-2019	0.0690	0.00130	0.00260	0.00680	0.0160	51.0	0.320	6.10	0.0870	0.000110	0.000750	0.0160	<0.00010	<0.000050	0.0250	0.00000630	44.0	<0.00050	<0.00010	0.0100
	HAC-08	8-Jan-2019	0.160	<0.0010	0.00590	0.00880	0.0170	60.0	0.380	5.90	0.150	<0.00010	0.000910	0.0240	<0.00010	<0.000050	0.0270	0.00000890	51.0	<0.00050	0.000130	0.0150
		5-Feb-2019	0.150	<0.0010	0.00560	0.00940	0.0280	58.0	0.400	5.10	0.190	<0.00010	0.000900	0.0250	<0.00010	<0.000050	0.0240	0.0000130	46.0	<0.00050	0.000160	0.0150
		4-Mar-2019	0.160	<0.0010	0.00730	0.0100	0.0200	54.0	0.410	5.90	0.0570	<0.00010	0.000780	0.0200	<0.00010	<0.000050	0.0280	<0.0000050	49.0	<0.00050	<0.00010	0.0110
		2-Apr-2019	0.160	<0.0010	0.00260	0.0110	0.0570	49.0	0.540	10.0	0.740	0.000110	0.00150	0.0330	<0.00010	<0.000050	0.0170	0.0000340	43.0	0.00120	0.000610	0.0250
		14-May-2019	0.0720	0.00180	<0.0010	0.00610	0.0270	58.0	0.400	6.90	0.430	0.000140	0.00110	0.0260	<0.00010	<0.000050	0.0240	0.0000120	50.0	0.000950	0.000330	0.0130
		4-Jun-2019	0.0420	<0.0010	<0.0010	0.00520	0.0180	57.0	0.310	5.40	0.110	0.000110	0.00110	0.0240	<0.00010	<0.000050	0.0260	0.0000100	50.0	<0.00070	0.000120	0.0100
		2-Jul-2019	0.0140	<0.0010	<0.0010	0.00570	0.130	57.0	0.340	5.10	2.20	0.000160	0.00320	0.0960	<0.00010	<0.000050	0.0280	0.0000500	50.0	0.00270	0.00180	0.0570
		1-Aug-2019	0.0120	<0.0010	0.00110	0.00660	0.0240	56.0	0.310	5.80	0.170	0.000120	0.000950	0.0270	<0.00010	<0.000050	0.0270	0.0000140	49.0	<0.00050	0.000170	0.0150
		3-Sep-2019	0.0330	<0.0010	0.00110	0.00300	0.0210	48.0	0.260	4.80	0.160	0.000110	0.000940	0.0230	<0.00010	<0.000050	0.0280	0.0000100	48.0	<0.00050	0.000130	0.0140
		1-Oct-2019	0.0450	<0.0010	<0.0010	0.00470	0.150	58.0	0.410	6.60	4.40	0.000170	0.00290	0.0820	0.000130	<0.000050	0.0270	0.0000600	55.0	0.00420	0.00360	0.140
		4-Nov-2019	0.0120	<0.0010	<0.0010	0.00500	0.0350	47.0	0.320	8.10	0.320	<0.00010	0.000820	0.0220	<0.00010	<0.000050	0.0190	0.0000120	44.0	0.000640	0.000230	0.0150
		2-Dec-2019	0.0670	0.00210	0.00220	0.00660	0.0270	50.0	0.330	6.20	0.220	0.000100	0.000880	0.0210	<0.00010	<0.000050	0.0250	0.0000110	45.0	<0.00050	0.000190	0.0130
	W10	4-Jun-2019	<0.0051	<0.0010	0.00110	0.00860	0.0160	2.50	0.520	16.0	0.0660	<0.00010	0.00110	0.0140	<0.00010	<0.000050	<0.010	0.00000790	22.0	<0.00090	<0.00010	0.00280
		8-Aug-2019	0.00620	<0.0010	0.00150	0.00900	0.0160	1.60	0.680	20.0	0.0540	<0.00010	0.00110	0.0140	<0.00010	<0.000050	<0.010	0.00000790	23.0	0.000610	<0.00010	0.00250
		1-Oct-2019	0.00950	<0.0010	0.00100	0.0100	0.0160	1.20	0.690	20.0	0.0980	<0.00010	0.000770	0.0120	<0.00010	<0.000050	<0.010	0.00000940	22.0	0.000820	<0.00010	0.00250
		20-Nov-2019	0.0510	0.00120	<0.0010	0.00910	0.0220	1.40	0.720	24.0	0.370	<0.00010	0.000550	0.0100	<0.00010	<0.000050	<0.010	0.0000100	16.0	0.00130	0.000200	0.00340
	EDC-01a	8-May-2019	<0.0051	<0.0010	<0.0010	0.00880	0.0160	1.50	0.500	17.0	0.220	<0.00010	0.000480	0.00870	<0.00010	<0.000050	<0.010	0.00000820	13.0	0.00100	0.000130	0.00350
		4-Jun-2019	<0.0051	0.00110	<0.0010	0.00710	0.0150	5.30	0.480	16.0	0.0470	<0.00010	0.00100	0.0150	<0.00010	<0.000050	0.0100	0.00000880	24.0	0.000560	<0.00010	0.00370
		2-Jul-2019	<0.0051	<0.0010	0.00100	0.00520	0.00950	9.20	0.400	11.0	0.0230	<0.00010	0.00140	0.0220	<0.00010	<0.000050	0.0150	0.00000770	31.0	<0.00050	<0.00010	0.00400
		1-Oct-2019	0.00760	<0.0010	0.00110	0.0100	0.0170	2.00	1.50	20.0	0.0960	<0.00010	0.000730	0.0120	<0.00010	<0.000050	<0.010	0.00000950	23.0	0.000790	<0.00010	0.00280
	HAC-13	20-Jan-2020	<0.50	0.00200	0.00610	0.0100	0.0180	45.0	0.330	6.10	0.0140	<0.00010	0.000590	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00540
		3-Feb-2020	0.0500	<0.0010	0.00370	0.0110	0.0210	42.0	0.330	6.60	0.0190	<0.00010	0.000600	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	41.0	<0.00050	<0.00010	0.00480
		25-Mar-2020	<0.050	<0.0010	0.00550	0.00810	0.0120	42.0	0.280	5.80	0.0130	<0.00010	0.000580	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00490
		16-Apr-2020	<0.050	<0.0010	0.00490	0.00780	0.0140	45.0	0.340	7.90	0.0260	<0.00010	0.000590	0.0130	<0.00010	<0.000050	0.0200	<0.000015	47.0	<0.00050	<0.00010	0.00960
		7-May-2020	<0.050	<0.0010	0.00120	0.0120	0.0290	21.0	0.430	12.0	0.160	<0.00010	0.000360	0.00940	<0.00010	<0.000050	<0.010	0.0000120	21.0	0.000510	0.000110	0.0100
		3-Jun-2020	<0.050	<0.0010	0.00160	0.00620	0.0130	215	0.290	6.90	0.0400	<0.00010	0.000540	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	38.0	<0.00050	<0.00010	0.00680
		6-Jul-2020	<0.050	<0.0010	0.00240	0.00650	0.0190	40.0	0.290	6.80	0.0200	<0.00010	0.000560	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00520
		4-Aug-2020	0.0400	0.00250	0.00460	0.00810	0.0160	37.0	0.320	6.30	0.0360	<0.00010	0.000610	0.0110	<0.00010	<0.000050	0.0190	<0.0000050	34.0	<0.00050	<0.00010	0.00560
		1-Sep-2020	0.0110	<0.0010	0.00500	0.00880	0.0140	36.0	0.300	6.50	0.0270	<0.00010	0.000640	0.00980	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00530
		1-Oct-2020	<0.0051	<0.0010	0.00150	0.00450	0.00770	37.0	0.260	5.90	0.0150	<0.00010	0.000590	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00460
		2-Nov-2020	0.0250	0.00100	0.00410	0.00600	0.0120	44.0	0.310	7.20	0.0740	<0.00010	0.000510	0.0130	<0.00010	<0.000050	0.0210	<0.000010	42.0	<0.00050	<0.00010	0.00820
		1-Dec-2020	0.0360	0.00120	0.00720	0.0120	0.0120	38.0	0.260	6.50	0.0380	<0.00010	0.000550	0.0100	<0.00010	<0.000050	0.0210	<0.0000050	40.0	<0.00050	<0.00010	0.00460
	HAC-05a	20-Jan-2020	<0.50	0.00230	0.00690	0.0130	0.0200	58.0	0.440	6.20	0.0250	<0.00010	0.000710	0.0160	<0.00010	<0.000050	0.0230	0.0000100	49.0	<0.00050	<0.00010	0.00630
		3-Feb-2020	0.0800	<0.0010	0.00330	0.0110	0.0220	47.0	0.340	5.40	0.0240	0.000100	0.000570	0.0140	<0.00010	<0.000050	0.0230	<0.000010	43.0	<0.00050	<0.00010	0.00590
		25-Mar-2020	0.0650	<0.0010	0.00440	0.00710	0.0200	50.0	0.320	6.50	0.0240	<0.00010	0.000620	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	47.0	<0.00050	<0.00010	0.00590
		16-Apr-2020	0.0830	0.00130	0.00440	0.00850	0.0160	55.0	0.370	8.30	0.0290	<0.00010	0.000600	0.0160	<0.00010	<0.000050	0.0190	<0.000015	52.0	<0.00050	<0.00010	0.00950
		7-May-2020	<0.050	0.00110	0.00160	0.0110	0.0260	26.0	0.430	12.0	0.190	<0.00010	0.000470	0.0120	<0.00010	<0.000050	<0.010	0.0000100	25.0	0.000650	0.000130	0.0140
		3-Jun-2020	<0.050	<0.0010	0.00280	0.00860	0.0140	27.0	0.320	7.40	0.0340	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0210	<0.0000050	40.0	<0.00050	<0.00010	0.00810
		6-Jul-2020	<0.050	<0.0010	0.00220	0.00670	0.0180	45.0	0.340	7.10	0.0470	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00650
		4-Aug-2020	0.0490	0.00130	0.00500	0.00900	0.0140	49.0	0.350	6.00	0.0280	<0.00010	0.000660	0.0130	<0.00010	<0.000050	0.0190	<0.0000050	41.0	<0.00050	<0.00010	0.00590
		1-Sep-2020	0.0730	<0.0010	0.00480	0.00940	0.0130	51.0	0.350	6.10	0.0270	<0.00010	0.000680	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	46.0	<0.00050	<0.00010	0.00550
		1-Oct-2020	0.0410	0.00110	0.00200	0.00480	0.00850	48.0	0.280	5.50	0.0120	<0.00010	0.000660	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00490
		2-Nov-2020	0.0370	0.00200	0.00380	0.00680	0.0120	48.0	0.330	8.20	0.0940	<0.00010	0.000540	0.0150	<0.00010	<0.000050	0.0190	0.0000180	44.0	<0.00050	<0.00010	0.0110
		1-Dec-2020	0.0450	<0.0010	0.00650	0.0120	0.0130	42.0	0.260	6.30	0.0400	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	41.0	<0.00050	<0.00010	0.00520

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2020	HAC-14	3-Jun-2020	<0.050	0.00100	0.00370	0.0100	0.0160	42.0	0.370	9.60	0.120	<0.00010	0.000610	0.0150	<0.00010	<0.000050	0.0200	0.0000110	38.0	<0.00050	<0.00010	0.0120
		6-Jul-2020	<0.050	<0.0010	0.00400	0.00850	0.0170	43.0	0.380	7.90	0.0540	<0.00010	0.000620	0.0160	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00950
		4-Aug-2020	0.0370	0.00130	0.00470	0.00740	0.0160	48.0	0.300	5.60	0.0390	<0.00010	0.000760	0.0180	<0.00010	<0.000050	0.0210	<0.000010	43.0	<0.00050	<0.00010	0.00990
		1-Sep-2020	0.0690	<0.0010	0.00310	0.00420	0.0170	52.0	0.240	5.40	0.0190	<0.00010	0.000740	0.0170	<0.00010	<0.000050	0.0230	0.0000130	44.0	<0.00050	<0.00010	0.00990
		1-Oct-2020	0.0420	0.00160	0.00350	0.00560	0.00730	49.0	0.260	5.30	0.0210	<0.00010	0.000710	0.0160	<0.00010	<0.000050	0.0230	<0.000010	46.0	<0.00050	<0.00010	0.00850
		2-Nov-2020	0.0390	<0.0010	0.00370	0.00810	0.0140	42.0	0.350	10.0	0.230	<0.00010	0.000580	0.0170	<0.00010	<0.000050	0.0170	0.00000970	40.0	0.000510	0.000120	0.0150
	HAC-08	20-Jan-2020	<0.50	0.00110	0.00540	0.0100	0.0290	56.0	0.410	5.70	0.130	<0.00010	0.000840	0.0220	<0.00010	<0.000050	0.0230	0.00000810	51.0	<0.00050	0.000120	0.0110
		3-Feb-2020	0.0800	<0.0010	0.00500	0.0100	0.0530	46.0	0.360	6.40	0.200	<0.00010	0.000890	0.0250	<0.00010	<0.000050	0.0230	0.0000120	43.0	<0.00050	0.000290	0.0200
		25-Mar-2020	0.0620	<0.0010	0.00300	0.00510	0.0450	50.0	0.300	6.00	0.190	<0.00010	0.000990	0.0210	<0.00010	<0.000050	0.0240	<0.000015	49.0	<0.00050	0.000220	0.0170
		16-Apr-2020	0.0940	<0.0010	0.00320	0.00860	0.0320	36.0	0.400	10.0	0.570	<0.00010	0.00120	0.0260	<0.00010	<0.000050	0.0140	0.0000240	43.0	0.00110	0.000520	0.0180
		7-May-2020	<0.050	0.00140	0.00240	0.0110	0.0660	20.0	0.440	15.0	0.960	<0.00010	0.000880	0.0240	<0.00010	<0.000050	<0.010	0.0000240	23.0	0.00200	0.000760	0.0220
		3-Jun-2020	<0.050	0.00110	0.00280	0.00790	0.0300	38.0	0.330	9.60	0.540	<0.00010	0.000870	0.0220	<0.00010	<0.000050	0.0190	0.0000120	37.0	0.00130	0.000380	0.0140
		6-Jul-2020	<0.050	<0.0010	0.00340	0.00770	0.0230	41.0	0.340	8.20	0.110	<0.00010	0.000740	0.0200	<0.00010	<0.000050	0.0210	0.00000870	42.0	<0.00050	<0.00010	0.0110
		4-Aug-2020	0.0270	0.00100	0.00340	0.00550	0.0140	48.0	0.280	5.60	0.0980	<0.00010	0.000860	0.0220	<0.00010	<0.000050	0.0210	<0.000010	43.0	<0.00050	<0.00010	0.00970
		1-Sep-2020	0.0330	<0.0010	0.00110	0.00620	0.0150	51.0	0.280	5.50	0.250	<0.00010	0.000920	0.0210	<0.00010	<0.000050	0.0240	0.0000120	46.0	0.000590	0.000190	0.00900
		1-Oct-2020	0.00680	<0.0010	0.00120	0.00380	0.00520	49.0	0.220	5.40	0.0280	0.000100	0.000830	0.0190	<0.00010	<0.000050	0.0230	<0.000010	45.0	<0.00050	<0.00010	0.00820
		2-Nov-2020	0.0430	0.00140	0.00310	0.00680	0.0330	38.0	0.400	10.0	0.600	0.000110	0.000800	0.0220	<0.00010	<0.000050	0.0160	0.0000150	38.0	0.00140	0.000370	0.0150
		1-Dec-2020	0.0270	0.00130	0.00450	0.00790	0.0290	40.0	0.260	6.80	0.220	<0.00010	0.000740	0.0150	<0.00010	<0.000050	0.0200	<0.000010	41.0	<0.00050	0.000190	0.00900
	W10	7-May-2020	<0.050	<0.0010	0.00220	0.0120	0.0370	0.820	0.500	19.0	0.390	<0.00010	0.000500	0.00990	<0.00010	<0.000050	<0.010	0.0000110	12.0	0.00120	0.000310	0.00320
		31-Aug-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Sep-2020	<0.0051	<0.0010	0.00290	0.00500	0.00730	6.50	0.280	10.0	0.0170	<0.00010	0.00190	0.0200	<0.00010	<0.000050	0.0160	0.00000780	37.0	<0.00050	<0.00010	0.00140
		1-Oct-2020	<0.0051	<0.0010	0.00240	0.00370	0.00600	7.70	0.260	9.00	0.0100	<0.00010	0.00190	0.0220	<0.00010	<0.000050	0.0170	<0.0000050	38.0	<0.00050	<0.00010	0.00140
		2-Nov-2020	0.0510	0.00120	0.00270	0.0130	0.0270	1.40	0.680	22.0	0.360	<0.00010	0.000540	0.0110	<0.00010	<0.000050	<0.010	0.0000190	17.0	0.00120	0.000210	0.00360
	EDC-01a	7-May-2020	<0.050	0.00110	0.00180	0.0130	0.0470	0.950	0.500	20.0	0.540	<0.00010	0.000600	0.0120	<0.00010	<0.000050	<0.010	0.0000180	12.0	0.00140	0.000400	0.00500
		1-Sep-2020	<0.0051	<0.0010	0.00240	0.00310	0.00760	57.0	0.240	7.10	0.0400	<0.00010	0.000730	0.0440	<0.00010	<0.000050	0.0250	0.0000160	65.0	<0.00050	<0.00010	0.0130
		1-Oct-2020	<0.0051	<0.0010	0.00140	0.00220	0.00510	43.0	0.230	5.60	0.0360	<0.00010	0.000910	0.0250	<0.00010	<0.000050	0.0220	0.0000120	47.0	<0.00050	<0.00010	0.0110
		2-Nov-2020	0.0480	0.00100	0.00280	0.0110	0.0420	10.0	0.640	20.0	0.800	<0.00010	0.000800	0.0180	<0.00010	<0.000050	<0.010	0.0000170	22.0	0.00220	0.000540	0.00870
		1-Dec-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2020	0.0170	0.00140	0.00300	0.00850	0.0110	23.0	0.340	12.0	0.160	<0.00010	0.000630	0.0130	<0.00010	<0.000050	0.0140	<0.0000050	32.0	0.000580	0.000110	0.00580
	HAC-13	12-Jan-2021	0.0560	<0.0010	0.00780	0.0140	0.0140	38.0	0.330	6.40	0.0160	<0.00010	0.000550	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00460
		1-Feb-2021	0.0540	0.00140	0.00800	0.0120	0.0160	38.0	0.300	6.40	0.0170	0.000110	0.000550	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00450
		8-Mar-2021	0.0310	<0.0010	0.00660	0.00790	0.0130	41.0	0.270	6.30	0.00960	<0.00010	0.000530	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	45.0	<0.00050	<0.00010	0.00480
		7-Apr-2021	0.00700	<0.0010	<0.0010	0.00470	0.0120	45.0	0.310	7.60	0.0250	<0.00010	0.000480	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	42.0	<0.00050	<0.00010	0.00660
		3-May-2021	0.0210	<0.0010	0.00270	0.00510	0.0130	28.0	0.300	6.80	0.0830	<0.00010	0.000360	0.00860	<0.00010	<0.000050	0.0150	<0.0000050	26.0	<0.00050	<0.00010	0.00630
		1-Jun-2021	<0.0051	<0.0010	<0.0010	0.00530	0.0110	37.0	0.280	6.60	0.0230	<0.00010	0.000520	0.0100	<0.00010	<0.000050	0.0210	<0.0000050	36.0	<0.00050	<0.00010	0.00490
		7-Jul-2021	0.0110	<0.0010	0.00680	0.00980	0.0150	36.0	0.300	6.10	0.00930	<0.00010	0.000610	0.00970	<0.00010	<0.000050	0.0230	<0.0000050	34.0	<0.00050	<0.00010	0.00430
		4-Aug-2021	0.0130	<0.0010	0.00790	0.0140	0.0160	37.0	0.300	6.60	0.0260	<0.00010	0.000590	0.0120	<0.00010	<0.000050	0.0240	<0.0000050	40.0	<0.00050	<0.00010	0.00590
		1-Sep-2021	0.00980	<0.0010	0.00520	0.00970	0.0130	36.0	0.290	6.40	0.0100	<0.00010	0.000580	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	34.0	<0.00050	<0.00010	0.00520
		4-Oct-2021	<0.0051	<0.0010	0.00190	0.00700	0.00990	36.0	0.260	5.90	0.0260	<0.00010	0.000580	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00540
		4-Nov-2021	0.0190	<0.0010	0.00140	0.00730	0.00970	63.0	0.270	6.80	0.0520	0.000100	0.000520	0.0180	<0.00010	<0.000050	0.0190	<0.000010	51.0	<0.00050	<0.00010	0.0110
		1-Dec-2021	0.0230	0.00110	0.00320	0.00420	0.00520	61.0	0.230	6.40	0.0360	0.000110	0.000510	0.0160	<0.00010	<0.000050	0.0200	0.00000540	49.0	<0.00050	<0.00010	0.00910
	HAC-05a	12-Jan-2021	0.0810	<0.0010	0.00700	0.0150	0.0190	46.0	0.370	6.40	0.0560	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00580
		1-Feb-2021	0.0770	0.00150	0.00720	0.0100	0.0140	46.0	0.340	6.20	0.0220	<0.00010	0.000590	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	39.0	<0.00050	<0.00010	0.00480
		8-Mar-2021	0.0460	<0.0010	0.00530	0.00660	0.0110	48.0	0.280	6.20	0.0130	<0.00010	0.000560	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	49.0	<0.00050	<0.00010	0.00530
		7-Apr-2021	0.0380	0.00200	0.00160	0.00420	0.0110	54.0	0.310	7.40	0.0230	<0.00010	0.000480	0.0140	<0.00010	<0.000050	0.0200	<0.000010	48.0	<0.00050	<0.00010	0.00710
		3-May-2021	0.0410	<0.0010	0.00140	0.00520	0.0120	34.0	0.300	7.20	0.0790	<0.00010	0.000390	0.00960	<0.00010	<0.000050	0.0140	0.00000690	30.0	<0.00050	<0.00010	0.00780
		1-Jun-2021	0.0200	<0.0010	0.00220	0.00520	0.0130	40.0	0.300	6.30	0.0220	<0.00010	0.000560	0.0110	<0.00010	<0.000050	0.0220	<0.0000050	39.0	<0.00050	<0.00010	0.00530
		7-Jul-2021	0.0500	0.00130	0.00870	0.0130	0.0190	47.0	0.360	5.90	0.0110	<0.00010	0.000630	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	39.0	<0.00050	<0.00010	0.00490
		4-Aug-2021	0.0360	0.00220	0.00420	0.0100	0.00980	59.0	0.300	6.20	0.0120	<0.00010	0.000680	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	45.0	<0.00050	<0.00010	0.00530
		1-Sep-2021	0.0700	0.00130	0.00500	0.00960	0.0120	61.0	0.320	6.40	0.00720	<0.00010	0.000680	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	45.0	<0.00050	<0.00010	0.00480
		4-Oct-2021	0.0530	0.00130	0.00270	0.0140	0.00820	57.0	0.280	5.90	0.0100	<0.00010	0.000680	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	49.0	<0.00050	<0.00010	0.00470
		4-Nov-2021	0.0940	<0.0010	0.00150	0.00670	0.0140	82.0	0.300	5.90	0.120	<0.00010	0.000620	0.0220	<0.00010	<0.000050	0.0180	<0.000010	57.0	<0.00050	<0.00010	0.00930
		1-Dec-2021	0.0890	0.00130	0.00240	0.00330	0.00480	82.0	0.290	5.60	0.0270	<0.00010	0.000520	0.0190	<0.00010	<0.000050	0.0200	0.00000560	56.0	<0.00050	<0.00010	0.00740
	HAC-14	3-May-2021	0.0420	0.00100	0.00300	0.00680	0.0140	30.0	0.310	9.10	0.150	<0.00010	0.000470	0.0120	<0.00010	<0.000050	0.0130	0.00000690	29.0	<0.00050	<0.00010	0.0130
		1-Jun-2021	0.0330	<0.0010	0.00430	0.00650	0.0130	40.0	0.300	6.50	0.0500	<0.00010	0.000590	0.0140	<0.00010	<0.000050	0.0270	<0.0000050	39.0	<0.00050	<0.00010	0.00770
		7-Jul-2021	<0.0051	<0.0010	0.00450	0.00710	0.0110	47.0	0.260	5.50	0.0130	<0.00010	0.000790	0.0140	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00760
		4-Aug-2021	0.0850	0.00100	0.00660	0.0110	0.0120	59.0	0.300	5.20	0.0300	0.000100	0.000900	0.0200	<0.00010	<0.000050	0.0260	0.00000600	48.0	<0.00050	<0.00010	0.0100
		1-Sep-2021	0.100	<0.0010	0.00580	0.00920	0.0670	63.0	0.270	5.20	1.50	0.000120	0.00160	0.0410	<0.00010	<0.000050	0.0260	0.0000220	50.0	0.00260	0.00140	0.0420
		4-Oct-2021	0.0380	<0.0010	0.00270	0.0160	0.00560	57.0	0.210	5.10	0.0110	<0.00010	0.000770	0.0180	<0.00010	<0.000050	0.0240	<0.0000050	51.0	<0.00050	<0.00010	0.00820
		4-Nov-2021	0.110	<0.0010	0.00280	0.00620	0.0100	80.0	0.290	5.70	0.0810	<0.00010	0.000750	0.0230	<0.00010	<0.000050	0.0180	<0.000010	57.0	<0.00050	<0.00010	0.0120

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2021	HAC-08	12-Jan-2021	0.0710	<0.0010	0.00510	0.0110	0.0130	43.0	0.320	6.50	0.0510	<0.00010	0.000630	0.0150	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00750
		1-Feb-2021	0.0990	<0.0010	0.00580	0.00820	0.0250	44.0	0.320	6.30	0.230	<0.00010	0.000890	0.0180	<0.00010	<0.000050	0.0200	0.00000850	40.0	<0.00050	0.000200	0.0120
		8-Mar-2021	0.0810	<0.0010	0.00570	0.00730	0.0190	47.0	0.280	5.90	0.150	<0.00010	0.000660	0.0170	<0.00010	<0.000050	0.0220	0.00000770	50.0	<0.00050	0.000160	0.00870
		7-Apr-2021	0.0700	<0.0010	0.00310	0.00600	0.0130	42.0	0.310	8.20	0.140	<0.00010	0.000670	0.0190	<0.00010	<0.000050	0.0160	0.00000670	43.0	<0.00050	0.000130	0.0110
		3-May-2021	0.0320	0.00160	0.00320	0.00500	0.0200	28.0	0.300	9.20	0.420	<0.00010	0.000660	0.0160	<0.00010	<0.000050	0.0120	0.0000150	29.0	0.00100	0.000300	0.0130
		1-Jun-2021	0.0120	<0.0010	0.00210	0.00490	0.0130	40.0	0.270	6.40	0.0560	<0.00010	0.000640	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00820
		7-Jul-2021	<0.0051	<0.0010	0.00300	0.00480	0.00980	47.0	0.260	5.50	0.0250	0.000100	0.000910	0.0180	<0.00010	<0.000050	0.0230	<0.0000050	43.0	<0.00050	<0.00010	0.00840
		4-Aug-2021	0.0370	0.00110	0.00380	0.00990	0.00840	60.0	0.270	5.10	0.0240	0.000120	0.00100	0.0220	<0.00010	<0.000050	0.0260	<0.0000050	48.0	<0.00050	<0.00010	0.00920
		1-Sep-2021	0.0550	<0.0010	0.00320	0.00710	0.0110	63.0	0.230	5.00	0.0270	<0.00010	0.000980	0.0230	<0.00010	<0.000050	0.0240	0.00000510	49.0	<0.00050	<0.00010	0.00840
		4-Oct-2021	<0.0051	<0.0010	0.00120	0.00390	0.00560	57.0	0.180	4.70	0.0170	<0.00010	0.000840	0.0190	<0.00010	<0.000050	0.0230	<0.0000050	51.0	<0.00050	<0.00010	0.00760
		4-Nov-2021	0.0950	<0.0010	0.00180	0.00640	0.0300	75.0	0.260	5.40	0.250	<0.00010	0.00120	0.0270	<0.00010	<0.000050	0.0150	0.0000130	43.0	0.000600	0.000250	0.0110
		1-Dec-2021	0.0770	<0.0010	0.00220	0.00360	0.00950	69.0	0.280	5.20	0.180	0.000120	0.000910	0.0240	<0.00010	<0.000050	0.0200	0.0000120	52.0	<0.00050	0.000150	0.00980
	W10	12-Jan-2021	0.0580	<0.0010	0.00470	0.0120	0.0120	2.70	0.490	15.0	0.110	<0.00010	0.000660	0.0100	<0.00010	<0.000050	<0.010	0.00000560	21.0	0.000700	<0.00010	0.00200
		3-May-2021	0.0140	0.00110	0.00160	0.00800	0.0350	0.800	0.500	17.0	0.450	<0.00010	0.000440	0.00940	<0.00010	<0.000050	<0.010	0.0000160	10.0	0.00120	0.000350	0.00280
		4-Aug-2021	0.0160	<0.0010	0.00270	0.00470	0.00500	14.0	0.190	5.80	0.0190	<0.00010	0.00220	0.0340	<0.00010	<0.000050	0.0270	0.0000100	45.0	<0.00050	<0.00010	0.00180
		4-Nov-2021	0.00790	<0.0010	0.00370	0.00940	0.0240	9.90	0.400	11.0	0.120	<0.00010	0.00140	0.0180	<0.00010	<0.000050	0.0100	0.0000100	31.0	<0.00050	0.000160	0.00180
	EDC-01a	12-Jan-2021	0.0660	<0.0010	0.00420	0.00950	0.0120	29.0	0.390	10.0	0.0930	<0.00010	0.000700	0.0150	<0.00010	<0.000050	0.0140	0.00000520	34.0	<0.00050	<0.00010	0.00590
		1-Feb-2021	0.0880	<0.0010	0.00480	0.00830	0.0130	29.0	0.360	9.00	0.0990	<0.00010	0.000750	0.0160	<0.00010	<0.000050	0.0150	0.00000800	36.0	<0.00050	0.000110	0.00670
		8-Mar-2021	0.0840	<0.0010	0.00550	0.00760	0.0140	28.0	0.350	8.50	0.0880	<0.00010	0.000810	0.0170	<0.00010	<0.000050	0.0170	<0.0000050	41.0	<0.00050	0.000100	0.00600
		7-Apr-2021	0.0760	<0.0010	0.00300	0.00650	0.0140	22.0	0.390	12.0	0.180	<0.00010	0.000580	0.0150	<0.00010	<0.000050	0.0110	0.00000900	32.0	0.000560	0.000140	0.00600
		3-May-2021	0.0170	0.00120	0.00200	0.00790	0.0260	5.00	0.450	16.0	0.420	<0.00010	0.000550	0.0110	<0.00010	<0.000050	<0.010	0.0000100	15.0	0.00210	0.000280	0.00540
		1-Jun-2021	0.00660	<0.0010	0.00120	0.00590	0.0140	21.0	0.370	11.0	0.0330	<0.00010	0.000570	0.0130	<0.00010	<0.000050	0.0150	<0.0000050	29.0	<0.00050	<0.00010	0.00520
		7-Jul-2021	<0.0051	<0.0010	0.00200	0.00410	0.00870	43.0	0.240	5.60	0.0280	0.000110	0.000850	0.0210	<0.00010	<0.000050	0.0230	<0.000010	44.0	<0.00050	<0.00010	0.00840
		4-Aug-2021	0.00720	<0.0010	0.00100	0.00460	0.0100	54.0	0.210	5.50	0.170	0.000100	0.00120	0.0290	<0.00010	<0.000050	0.0260	0.00000940	50.0	<0.00050	0.000160	0.0120
		1-Sep-2021	0.0400	<0.0010	0.00140	0.00460	0.00620	54.0	0.210	4.90	0.0240	<0.00010	0.00110	0.0280	<0.00010	<0.000050	0.0250	0.00000870	50.0	<0.00050	<0.00010	0.00940
		4-Oct-2021	<0.0051	<0.0010	0.00160	0.00440	0.00710	51.0	0.170	4.60	0.0180	<0.00010	0.000960	0.0240	<0.00010	<0.000050	0.0240	<0.000010	53.0	<0.00050	<0.00010	0.00770
		4-Nov-2021	0.0510	<0.0010	0.00180	0.00590	0.0190	41.0	0.280	7.90	0.370	<0.00010	0.00130	0.0280	<0.00010	<0.000050	0.0150	0.0000120	44.0	0.000730	0.000300	0.0110
		1-Dec-2021	0.0540	<0.0010	0.00170	0.00320	0.00730	39.0	0.350	8.30	0.0420	<0.00010	0.000850	0.0200	<0.00010	<0.000050	0.0160	0.00000630	42.0	<0.00050	<0.00010	0.00660
	HAC-13	12-Jan-2022	0.0520	<0.0010	0.00820	0.0110	0.0150	42.0	0.290	6.60	0.0160	<0.00010	0.000550	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00610
		7-Feb-2022	0.0360	<0.0010	0.00720	0.0120	0.0130	44.0	0.300	6.00	0.0150	0.000100	0.000560	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	43.0	<0.00050	<0.00010	0.00610
		9-Mar-2022	0.0210	<0.0010	0.00260	0.00840	0.0120	45.0	0.310	7.90	0.0200	<0.00010	0.000590	0.0120	<0.00010	<0.000050	0.0210	0.00000530	43.0	<0.00050	<0.00010	0.00650
		5-Apr-2022	0.0560	<0.0010	0.00120	0.00610	0.0120	62.0	0.480	14.0	0.100	<0.00010	0.000440	0.0170	<0.00010	<0.000050	0.0160	0.00000990	47.0	<0.00050	<0.00010	0.0170
		3-May-2022	0.00980	<0.0010	<0.0010	0.00800	0.0150	53.0	0.360	11.0	0.120	0.000100	0.000360	0.0160	<0.00010	<0.000050	0.0120	0.00000890	40.0	<0.00050	<0.00010	0.0190
		1-Jun-2022	<0.0051	<0.0010	0.00180	0.00800	0.0160	35.0	0.290	6.90	0.0520	<0.00010	0.000560	0.0110	<0.00010	<0.000050	0.0190	<0.000010	41.0	<0.00050	<0.00010	0.00600
		5-Jul-2022	0.00620	<0.0010	0.00140	0.00910	0.0120	35.0	0.270	6.70	0.0200	<0.00010	0.000490	0.0110	<0.00010	<0.000050	0.0220	<0.0000050	36.0	<0.00050	<0.00010	0.00510
		3-Aug-2022	0.0170	<0.0010	0.00460	0.0100	0.0150	35.0	0.300	6.60	0.0190	<0.00010	0.000580	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	35.0	<0.00050	<0.00010	0.00500
		8-Sep-2022	<0.0051	<0.0010	0.00130	0.00400	0.0120	35.0	0.290	5.80	0.0520	<0.00010	0.000540	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	34.0	<0.00050	<0.00010	0.00480
		5-Oct-2022	<0.0051	<0.0010	<0.0010	0.00420	0.00870	38.0	0.280	5.90	0.0240	0.000110	0.000590	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00660
		2-Nov-2022	<0.0051	<0.0010	0.00110	0.00500	0.00850	36.0	0.230	6.40	0.0320	<0.00010	0.000510	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00580
		7-Dec-2022	0.0380	<0.0010	0.00620	0.00990	0.0120	38.0	0.280	5.80	0.0200	<0.00010	0.000520	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	35.0	<0.00050	<0.00010	0.00500
	HAC-05a	12-Jan-2022	0.130	<0.0010	0.00910	0.0110	0.0120	58.0	0.330	6.00	0.00880	<0.00010	0.000630	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	45.0	<0.00050	<0.00010	0.00590
		7-Feb-2022	0.0930	0.00120	0.00720	0.0110	0.0120	57.0	0.340	6.20	0.00920	0.000100	0.000610	0.0140	<0.00010	<0.000050	0.0210	<0.0000050	48.0	0.0110	<0.00010	0.00600
		9-Mar-2022	0.0640	<0.0010	0.00260	0.00900	0.00770	65.0	0.340	8.20	0.0170	<0.00010	0.000650	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	52.0	<0.00050	<0.00010	0.00680
		5-Apr-2022	0.0850	<0.0010	0.00190	0.00780	0.0110	81.0	0.470	14.0	0.0940	<0.00010	0.000500	0.0210	<0.00010	<0.000050	0.0160	0.00000890	57.0	<0.00050	<0.00010	0.0200
		3-May-2022	0.0410	<0.0010	0.00120	0.00780	0.0150	59.0	0.380	12.0	0.140	<0.00010	0.000450	0.0180	<0.00010	<0.000050	0.0110	0.00000790	43.0	0.000520	<0.00010	0.0240
		1-Jun-2022	<0.0051	<0.0010	0.00160	0.00760	0.0150	39.0	0.370	7.60	0.0480	<0.00010	0.000560	0.0110	<0.00010	<0.000050	0.0190	<0.000010	42.0	<0.00050	<0.00010	0.00640
		5-Jul-2022	0.0240	<0.0010	0.00190	0.0100	0.0140	42.0	0.290	5.90	0.0200	<0.00010	0.000560	0.0120	<0.00010	<0.000050	0.0210	<0.000010	39.0	<0.00050	<0.00010	0.00560
		3-Aug-2022	0.0710	0.00120	0.00670	0.0130	0.0160	51.0	0.320	6.40	0.0120	<0.00010	0.000640	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00520
		8-Sep-2022	0.0180	<0.0010	0.00240	0.00530	0.0130	41.0	0.320	5.60	0.0530	<0.00010	0.000700	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	38.0	<0.00050	<0.00010	0.00510
		5-Oct-2022	0.0190	<0.0010	0.00130	0.00590	0.0110	46.0	0.290	5.80	0.0250	0.000110	0.000680	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00630
		2-Nov-2022	0.0520	<0.0010	0.00190	0.00610	0.00940	52.0	0.280	6.10	0.0400	<0.00010	0.000610	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	44.0	<0.00050	<0.00010	0.00590
		7-Dec-2022	0.110	0.00110	0.00620	0.00960	0.0120	60.0	0.340	5.90	0.0200	0.000140	0.000590	0.0130	<0.00010	<0.000050	0.0210	<0.0000050	43.0	<0.00050	<0.00010	0.00490
	HAC-14	3-May-2022	0.0190	<0.0010	0.00220	0.0120	0.0180	33.0	0.420	16.0	0.240	<0.00010	0.000470	0.0140	<0.00010	<0.000050	<0.010	0.0000100	28.0	0.000760	0.000120	0.0230
		1-Jun-2022	0.0120	<0.0010	0.00280	0.00870	0.0150	38.0	0.310	6.90	0.0780	0.000120	0.000600	0.0140	<0.00010	<0.000050	0.0180	<0.000015	42.0	<0.00050	<0.00010	0.00870
		5-Jul-2022	0.0430	<0.0010	0.00440	0.0100	0.0140	41.0	0.280	6.20	0.0330	<0.00010	0.000610	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00810
		3-Aug-2022	0.0720	<0.0010	0.00590	0.0100	0.0130	48.0	0.300	5.70	0.0180	<0.00010	0.000760	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	41.0	<0.00050	<0.00010	0.00760
		8-Sep-2022	0.0200	<0.0010	0.00340	0.00750	0.00650	42.0	0.250	5.20	0.0340	<0.00010	0.000650	0.0140	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00690
		5-Oct-2022	0.0190	<0.0010	0.00230	0.00570	0.00930	46.0	0.290	5.60	0.0240	0.000110	0.000700	0.0140	<0.00010	<0.000050	0.0220	0.000170	42.0	<0.00050	<0.00010	0.00770
		2-Nov-2022	0.0670	<0.0010	0.00290	0.00530	0.00880	52.0	0.250	5.90	0.0130	<0.00010	0.000600	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00640

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Nitrate and Nitrite (as N; mg/L)	Nitrite (as N; mg/L)	Orthophosphate-Dissolved (as P; mg/L)	Phosphorus, Total Dissolved (as P; mg/L)	Phosphorus, Total (as P; mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Aluminum-Total (mg/L)	Antimony-Total (mg/L)	Arsenic-Total (mg/L)	Barium-Total (mg/L)	Beryllium-Total (mg/L)	Bismuth-Total (mg/L)	Boron Total (mg/L)	Cadmium-Total (mg/L)	Calcium-Total (mg/L)	Chromium-Total (mg/L)	Cobalt-Total (mg/L)	Copper-Total (mg/L)
2022	HAC-08	12-Jan-2022	0.130	<0.0010	0.00770	0.00870	0.00980	57.0	0.310	5.60	0.0330	<0.00010	0.000790	0.0180	<0.00010	<0.000050	0.0230	<0.0000050	47.0	<0.00050	<0.00010	0.00850
		7-Feb-2022	0.0910	<0.0010	0.00660	0.0100	0.0120	55.0	0.310	6.40	0.0330	<0.00010	0.000770	0.0180	<0.00010	<0.000050	0.0220	<0.0000050	50.0	<0.00050	<0.00010	0.00900
		9-Mar-2022	0.0530	<0.0010	0.00300	0.00690	0.0140	58.0	0.300	8.30	0.140	<0.00010	0.000930	0.0220	<0.00010	<0.000050	0.0220	0.00000780	52.0	<0.00050	0.000190	0.0120
		5-Apr-2022	0.0210	<0.0010	0.00190	0.00670	0.0110	46.0	0.400	15.0	0.260	<0.00010	0.000640	0.0210	<0.00010	<0.000050	0.0120	0.0000110	40.0	0.000740	0.000140	0.0190
		3-May-2022	0.00680	<0.0010	0.00160	0.00870	0.0220	25.0	0.540	14.0	0.240	<0.00010	0.000520	0.0160	<0.00010	<0.000050	<0.010	0.00000830	25.0	0.000810	0.000140	0.0190
		1-Jun-2022	<0.0051	<0.0010	0.00240	0.0180	0.00780	38.0	0.300	6.90	0.120	0.000100	0.000720	0.0150	<0.00010	<0.000050	0.0180	<0.000015	42.0	<0.00050	0.000110	0.0100
		5-Jul-2022	0.0120	<0.0010	0.00280	0.00910	0.0140	40.0	0.260	6.30	0.0760	<0.00010	0.000730	0.0170	<0.00010	<0.000050	0.0210	<0.000010	39.0	<0.00050	<0.00010	0.00880
		3-Aug-2022	0.0430	<0.0010	0.00360	0.00840	0.0440	46.0	0.250	5.80	0.140	<0.00010	0.00110	0.0190	<0.00010	<0.000050	0.0240	<0.000010	40.0	<0.00050	0.000170	0.00840
		8-Sep-2022	0.00510	<0.0010	0.00330	0.00440	0.0130	42.0	0.250	5.00	0.0850	<0.00010	0.000760	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	39.0	<0.00050	<0.00010	0.00790
		5-Oct-2022	0.00660	<0.0010	0.00200	0.00480	0.00910	47.0	0.260	5.40	0.0400	0.000110	0.000840	0.0160	<0.00010	<0.000050	0.0280	0.00000510	42.0	<0.00050	<0.00010	0.00790
		2-Nov-2022	0.0370	<0.0010	<0.0010	0.00390	0.00650	52.0	0.210	5.70	0.0140	<0.00010	0.000670	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	45.0	<0.00050	<0.00010	0.00610
		7-Dec-2022	0.130	<0.0010	0.00470	0.00760	0.0100	58.0	0.310	5.10	0.0180	<0.00010	0.000730	0.0180	<0.00010	<0.000050	0.0220	<0.0000050	46.0	<0.00050	<0.00010	0.00650
	W10	7-Feb-2022	0.0990	<0.0010	0.00590	0.0120	0.0130	8.80	0.500	12.0	0.0360	<0.00010	0.00120	0.0140	<0.00010	<0.000050	0.0110	<0.0000050	28.0	<0.00050	<0.00010	0.00170
		5-Apr-2022	0.0470	<0.0010	0.00280	0.0110	0.0250	3.10	0.640	21.0	0.460	<0.00010	0.000600	0.0120	<0.00010	<0.000050	<0.010	0.0000110	17.0	0.00140	0.000340	0.00380
		3-Aug-2022	0.0250	<0.0010	0.00360	0.00740	0.0120	5.90	0.350	11.0	0.0810	<0.00010	0.00170	0.0220	<0.00010	<0.000050	0.0170	0.00000560	31.0	<0.00050	0.000110	0.00210
	EDC-01a	12-Jan-2022	0.120	<0.0010	0.00640	0.00800	0.00910	52.0	0.300	6.00	0.0290	<0.00010	0.000780	0.0200	<0.00010	<0.000050	0.0210	0.00000640	46.0	<0.00050	<0.00010	0.00790
		7-Feb-2022	0.0880	<0.0010	0.00510	0.00960	0.0110	38.0	0.370	8.20	0.0340	<0.00010	0.000910	0.0180	<0.00010	<0.000050	0.0180	0.00000590	43.0	<0.00050	<0.00010	0.00720
		9-Mar-2022	0.0920	<0.0010	0.00220	0.0120	0.0140	27.0	0.490	14.0	0.120	<0.00010	0.000810	0.0170	<0.00010	<0.000050	0.0130	0.0000150	35.0	0.000630	0.000110	0.00830
		5-Apr-2022	0.0430	<0.0010	0.00220	0.0100	0.0220	11.0	0.610	20.0	0.410	<0.00010	0.000560	0.0150	<0.00010	<0.000050	<0.010	0.0000170	21.0	0.00130	0.000290	0.00720
		3-May-2022	0.00920	<0.0010	<0.0010	0.00740	0.0260	4.80	0.490	17.0	0.270	<0.00010	0.000480	0.0110	<0.00010	<0.000050	<0.010	0.0000120	14.0	0.00100	0.000230	0.00580
		1-Jun-2022	<0.0051	<0.0010	0.00170	0.00900	0.0160	18.0	0.410	13.0	0.190	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0120	<0.000010	27.0	0.000640	0.000130	0.00640
		5-Jul-2022	0.0110	<0.0010	0.00140	0.00970	0.0140	24.0	0.370	11.0	0.0860	<0.00010	0.000740	0.0160	<0.00010	<0.000050	0.0160	0.00000780	32.0	<0.00050	<0.00010	0.00660
		3-Aug-2022	0.0330	<0.0010	0.00270	0.00770	0.00990	40.0	0.260	6.10	0.0200	<0.00010	0.000950	0.0210	<0.00010	<0.000050	0.0220	<0.000010	42.0	<0.00050	<0.00010	0.00710
		8-Sep-2022	<0.0051	<0.0010	0.00320	0.00500	0.0130	40.0	0.250	5.20	0.0890	<0.00010	0.000800	0.0180	<0.00010	<0.000050	0.0210	<0.000010	40.0	<0.00050	<0.00010	0.00910
		5-Oct-2022	0.0100	<0.0010	0.00310	0.0100	0.00880	45.0	0.310	5.50	0.0390	0.000100	0.000890	0.0180	<0.00010	<0.000050	0.0220	0.00000600	43.0	<0.00050	<0.00010	0.00800
		2-Nov-2022	0.0260	<0.0010	0.00120	0.00690	0.00620	46.0	0.200	5.40	0.0240	<0.00010	0.000840	0.0180	<0.00010	<0.000050	0.0210	<0.000010	46.0	<0.00050	<0.00010	0.00600
		7-Dec-2022	0.130	<0.0010	0.00390	0.00660	0.00770	49.0	0.310	5.40	0.0100	<0.00010	0.000920	0.0200	<0.00010	<0.000050	0.0220	<0.0000050	45.0	<0.00050	<0.00010	0.00560
2023	HAC-13	4-Jan-2023	0.0470	<0.0010	0.00810	0.0120	0.0130	38.0	0.270	6.60	0.0210	<0.00010	0.000550	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00520
		8-Feb-2023	0.0460	<0.0010	0.00680	0.0110	0.0120	40.0	0.280	6.80	0.0170	0.000120	0.000550	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	39.0	<0.00050	<0.00010	0.00570
		7-Mar-2023	0.0420	<0.0010	0.00590	0.00930	0.0110	38.0	0.270	6.60	0.00820	0.000100	0.000520	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	36.0	<0.00050	<0.00010	0.00520
		3-Apr-2023	0.0220	<0.0010	0.00260	0.00740	0.0120	43.0	0.280	7.20	0.0150	<0.00010	0.000520	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	40.0	<0.00050	<0.00010	0.00560
		1-May-2023	0.0230	<0.0010	<0.0010	0.0160	0.0200	42.0	0.460	16.0	0.170	<0.00010	0.000400	0.0150	<0.00010	<0.000050	0.0120	0.00000890	36.0	0.000500	<0.00010	0.0280
		5-Jun-2023	0.00720	<0.0010	0.00180	0.00850	0.0100	34.0	0.260	6.60	0.0370	<0.00010	0.000570	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00490
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.00760	<0.0010	<0.0010	0.00680	0.0130	33.0	0.280	6.80	0.0380	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	36.0	<0.00050	<0.00010	0.00460
		6-Sep-2023	<0.0051	<0.0010	<0.0010	0.00610	0.0110	33.0	0.240	6.50	0.0160	<0.00010	0.000550	0.00980	<0.00010	<0.000050	0.0210	<0.0000050	34.0	<0.00050	<0.00010	0.00410
	HAC-05a	4-Jan-2023	0.110	<0.0010	0.00900	0.0120	0.0130	56.0	0.320	6.20	0.0130	<0.00010	0.000660	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	46.0	<0.00050	<0.00010	0.00520
		8-Feb-2023	0.0790	0.00110	0.00670	0.0100	0.0110	53.0	0.300	6.80	0.00880	0.000140	0.000560	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	43.0	<0.00050	<0.00010	0.00560
		7-Mar-2023	0.0670	<0.0010	0.00530	0.00900	0.00980	47.0	0.290	6.30	0.00570	<0.00010	0.000580	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	41.0	<0.00050	<0.00010	0.00500
		3-Apr-2023	0.0270	<0.0010	0.00190	0.00620	0.00800	56.0	0.260	6.70	0.0130	<0.00010	0.000580	0.0140	<0.00010	<0.000050	0.0200	<0.0000050	45.0	<0.00050	<0.00010	0.00600
		1-May-2023	0.0380	0.00210	0.00110	0.0160	0.0210	54.0	0.490	22.0	0.180	0.000110	0.000480	0.0180	<0.00010	<0.000050	0.0110	0.0000110	40.0	0.000640	0.000100	0.0320
		5-Jun-2023	0.0280	<0.0010	0.00240	0.00930	0.0110	49.0	0.270	6.40	0.0150	<0.00010	0.000600	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	43.0	<0.00050	<0.00010	0.00500
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.0280	<0.0010	<0.0010	0.00770	0.0140	38.0	0.280	6.40	0.0210	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00450
		6-Sep-2023	0.0170	<0.0010	0.00120	0.00750	0.0110	42.0	0.240	6.30	0.0160	<0.00010	0.000580	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00450
	HAC-14	1-May-2023	0.0120	0.00130	0.00170	0.0190	0.0270	26.0	0.520	22.0	0.550	<0.00010	0.000500	0.0160	<0.00010	<0.000050	<0.010	0.0000160	25.0	0.00130	0.000230	0.0320
		5-Jun-2023	0.0560	<0.0010	0.00450	0.00980	0.0120	49.0	0.260	5.80	0.0210	<0.00010	0.000700	0.0160	<0.00010	<0.000050	0.0230	0.00000560	46.0	<0.00050	<0.00010	0.00810
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.0120	<0.0010	0.00150	0.00740	0.0110	39.0	0.240	5.90	0.0250	<0.00010	0.000640	0.0140	<0.00010	<0.000050	0.0210	<0.0000050	40.0	<0.00050	<0.00010	0.00650
		6-Sep-2023	0.0150	<0.0010	0.00150	0.00750	0.00940	42.0	0.210	5.40	0.0150	<0.00010	0.000610	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00650
	HAC-08	4-Jan-2023	0.120	<0.0010	0.00800	0.0100	0.0120	57.0	0.300	5.20	0.0130	<0.00010	0.000820	0.0180	<0.00010	<0.000050	0.0220	<0.0000050	46.0	<0.00050	<0.00010	0.00700
		8-Feb-2023	0.0920	<0.0010	0.00590	0.0100	0.00890	53.0	0.300	6.00	0.0210	0.000110	0.000680	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	45.0	<0.00050	<0.00010	0.00740
		7-Mar-2023	0.0740	<0.0010	0.00690	0.00840	0.00950	48.0	0.280	5.80	0.0160	<0.00010	0.000720	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00690
		3-Apr-2023	0.0470	<0.0010	0.00260	0.0100	0.0120	54.0	0.270	6.00	0.0980	<0.00010	0.000810	0.0200	<0.00010	<0.000050	0.0210	0.00000770	46.0	<0.00050	0.000130	0.00920
		1-May-2023	<0.0051	<0.0010	0.00110	0.0160	0.0280	20.0	0.510	23.0	0.850	<0.00010	0.000660	0.0210	<0.00010	<0.000050	<0.010	0.0000140	23.0	0.00190	0.000360	0.0270
		5-Jun-2023	<0.0051	<0.0010	<0.0010	0.00680	0.0150	49.0	0.240	6.00	0.0560	<0.00010	0.000870	0.0190	<0.00010	<0.000050	0.0230	0.00000660	46.0	<0.00050	<0.00010	0.00940
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.0051	<0.0010	0.00110	0.00780	0.0120	39.0	0.240	6.00	0.0340	<0.00010	0.000750	0.0160	<0.00010	<0.000050	0.0210	<0.000010	39.0	<0.00050	<0.00010	0.00730
		6-Sep-2023	<0.0051	<0.0010	<0.0010	0.00590	0.00970	42.0	0.190	5.50	0.0150	0.000120	0.000660	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00640
	W10	13-Jun-2023	0.0220	<0.0010	0.00110	0.00660	0.00620	7.00	0.280	9.60	0.0140	<0.00010	0.00160	0.0220	<0.00010	<0.000050	0.0180	<0.0000050	33.0	<0.00050	<0.00010	0.00180
	EDC-01a	4-Jan-2023	0.130	<0.0010	0.00730	0.00990	0.0110	44.0	0.320	6.00	0.0100	<0.00010	0.00110	0.0190	<0.00010	<0.000050	0.0200	<0.0000050	44.0	<0.00050	<0.00010	0.00600
		8-Feb-2023	0.110	<0.0010	0.00500	0.00860	0.00990	42.0	0.320	6.70	0.0120	<0.00010	0.000930	0.0190	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00640
		7-Mar-2023	0.0900	<0.0010	0.00680	0.00790	0.00950	42.0	0.300	6.20	0.0120	<0.00010	0.000900	0.0170	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00630
		3-Apr-2023	0.130	<0.0010	0.00290	0.00600	0.00860	41.0	0.330	7.60	0.0320	<0.00010	0.000880	0.0190	<0.00010	<0.000050	0.0180	<0.0000050	41.0	<0.00050	<0.00010	0.00670
		1-May-2023	0.0520	<0.0010	0.00220	0.0180	0.0450	3.10	0.660	23.0	1.00	<0.00010	0.000780	0.0160	<0.00010	<0.000050	<0.010	0.0000210	12.0	0.00250	0.000630	0.00760
		5-Jun-2023	<0.0051	<0.0010	<0.0010	0.00520	0.00660	42.0	0.240	7.10	0.0180	<0.00010	0.000850	0.0220	<0.00010	<0.000050	0.0210	0.00000760	45.0	<0.00050	<0.00010	0.00750
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.0051	<0.0010	<0.0010	0.00610	0.0110	38.0	0.220	5.80	0.0200	<0.00010	0.000770	0.0170	<0.00010	<0.000050	0.0210	<0.0000050	41.0	<0.00050	<0.00010	0.00680
		6-Sep-2023	<0.0051	<0.0010	<0.0010	0.00590	0.00790	42.0	0.180	5.50	0.0180	<0.00010	0.000730	0.0170	<0.00010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00630

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2015	HAC-13	3-Dec-2015	0.130	<0.000050	0.00180	12.0	0.140	0.0210	0.000510	1.70	0.00110	2.90	<0.000010	16.0	0.640	<0.000010	<0.00010	<0.010	0.00110	0.000840	<0.0030	<0.0030
		7-Dec-2015	0.180	0.000270	<0.0010	10.0	0.100	0.0280	0.000510	2.00	0.00160	3.40	<0.000010	15.0	0.630	<0.000010	<0.00010	0.0120	0.000930	0.00100	0.00640	0.00400
		15-Dec-2015	0.180	<0.000050	0.00240	18.0	0.380	0.0310	0.000860	2.30	0.00150	3.90	<0.000010	22.0	0.990	<0.000010	<0.00010	<0.010	0.00190	0.000790	<0.0030	0.00440
		22-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Dec-2015	0.120	<0.000050	0.00120	15.0	0.270	0.0290	0.000680	2.00	0.00110	4.00	<0.000010	18.0	0.840	<0.000010	<0.00010	<0.010	0.00150	0.000610	<0.0030	0.00360
		29-Dec-2015	0.160	<0.000050	0.00180	14.0	0.200	0.0200	0.000650	1.90	0.000950	4.70	<0.000010	18.0	0.720	<0.000010	<0.00010	0.0130	0.00120	0.000820	<0.0030	0.00370
	HAC-05a	31-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.230	<0.000050	<0.0010	8.00	0.100	0.0120	<0.00050	1.60	0.00100	3.90	<0.000010	11.0	0.360	<0.000010	<0.00010	0.0130	0.000450	0.00120	<0.0030	0.00450
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	0.140	0.0000530	0.00800	30.0	0.180	0.130	0.000740	7.40	0.0240	4.90	<0.000010	44.0	2.70	<0.000010	<0.00010	0.0150	0.000850	0.000940	0.00580	0.0920
		7-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	24-Feb-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	0.0310	<0.000050	0.00240	13.0	0.00450	0.0120	<0.00050	1.50	0.000960	5.20	<0.000010	14.0	0.570	<0.000010	<0.00010	<0.010	0.00110	0.00110	<0.0030	0.00500
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.340	0.000140	0.00180	10.0	0.0310	0.0140	0.000640	1.70	0.00110	4.60	<0.000010	12.0	0.460	<0.000010	<0.00010	0.0210	0.000810	0.00150	<0.0030	0.00810
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	7.20	0.00300	0.0110	30.0	0.310	0.100	0.00670	6.70	0.0200	14.0	0.0000960	39.0	2.30	0.0000390	0.000200	0.350	0.00130	0.0230	0.0200	0.0750
	W10	27-Jan-2015	0.390	0.0000790	0.000620	5.60	0.00980	0.000450	0.00130	0.570	<0.00050	5.10	<0.000010	2.90	0.120	<0.000010	<0.00010	<0.010	0.0000970	<0.0010	<0.0030	0.0590
		2-Feb-2015	0.340	0.0000620	<0.00050	5.20	0.00710	0.000380	0.00130	0.520	<0.00050	5.00	<0.000010	2.70	0.100	<0.000010	<0.00010	<0.010	0.0000840	<0.0010	<0.0030	0.120
		10-Feb-2015	0.340	0.0000680	<0.00050	5.10	0.00860	0.000400	0.00130	0.520	<0.00050	4.90	<0.000010	2.80	0.110	<0.000010	<0.00010	<0.010	0.0000950	0.00100	<0.0030	0.120
		17-Feb-2015	0.460	0.000110	<0.00050	4.60	0.0110	0.000320	0.00150	0.580	<0.00050	4.90	<0.000010	2.20	0.0980	<0.000010	<0.00010	0.0120	0.0000840	0.00110	<0.0030	0.150
		24-Feb-2015	0.320	0.0000610	<0.00050	4.60	0.00650	0.000290	0.00120	0.510	<0.00050	4.70	<0.000010	2.40	0.0920	<0.000010	<0.00010	0.0100	0.0000730	<0.0010	<0.0030	0.120
		2-Mar-2015	0.280	<0.000050	<0.00050	5.20	0.00480	0.000360	0.00110	0.480	<0.00050	5.20	<0.000010	2.50	0.120	<0.000010	<0.00010	<0.010	0.0000870	<0.0010	<0.0030	0.0740
		10-Mar-2015	0.330	0.0000630	<0.00050	5.40	0.00700	0.000530	0.00120	0.490	<0.00050	5.00	<0.000010	2.50	0.100	<0.000010	<0.00010	<0.010	0.0000860	<0.0010	<0.0030	0.110
		17-Mar-2015	0.500	0.000120	<0.00050	3.70	0.0130	0.000230	0.00150	0.550	<0.00050	4.60	<0.000010	1.90	0.0750	<0.000010	<0.00010	0.0130	0.0000660	0.00130	<0.0030	0.160
		24-Mar-2015	0.410	0.0000920	<0.00050	3.60	0.00990	0.000280	0.00140	0.520	<0.00050	4.60	<0.000010	1.90	0.0800	<0.000010	<0.00010	0.0130	0.0000710	0.00100	<0.0030	0.180
		7-Apr-2015	0.430	0.000100	<0.0010	3.60	0.00930	0.000330	0.00150	0.520	0.000110	4.40	<0.000010	1.80	0.0760	<0.000010	<0.00010	0.0120	0.0000680	0.00100	<0.0030	0.170
		14-Apr-2015	0.300	0.0000790	<0.0010	3.80	0.00660	0.000570	0.00120	0.500	0.000140	4.10	0.0000120	2.00	0.0880	<0.000010	<0.00010	<0.010	0.0000740	0.000920	<0.0030	0.140
		4-May-2015	0.300	0.0000900	<0.0010	4.20	0.0100	0.000350	0.00120	0.500	0.000140	4.00	<0.000010	2.10	0.0890	<0.000010	<0.00010	<0.010	0.0000760	0.000990	<0.0030	0.0890
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Jun-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Jul-2015	0.0680	<0.000050	0.00130	15.0	0.0110	0.00230	0.000650	1.50	0.000130	4.60	0.0000990	11.0	0.300	<0.000010	<0.00010	<0.010	0.000350	0.000700	<0.0030	0.00600
		2-Aug-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Aug-2015	0.0420	<0.000050	0.00140	16.0	0.00990	0.00270	0.000610	1.60	0.000120	5.00	<0.000010	13.0	0.350	<0.000010	<0.00010	<0.010	0.000500	0.000730	<0.0030	0.00580
		3-Sep-2015	<0.030	<0.000050	0.00150	18.0	0.00450	0.00280	<0.00050	1.50	0.000130	5.80	<0.000010	13.0	0.340	<0.000010	<0.00010	<0.010	0.000560	0.000640	<0.0030	0.00340
		6-Sep-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	<0.030	<0.000050	0.00110	18.0	0.00330	0.00260	<0.00050	1.40	0.000120	6.00	<0.000010	12.0	0.360	<0.000010	<0.00010	<0.010	0.000560	0.000510	<0.0030	0.00310
		5-Nov-2015	0.0950	<0.000050	<0.0010	10.0	0.00390	0.000870	0.000740	0.940	0.000120	4.40	<0.000010	5.90	0.160	<0.000010	<0.00010	<0.010	0.000190	0.000510	<0.0030	0.0130
		3-Dec-2015	0.0460	<0.000050	<0.0010	12.0	0.00270	0.00130	0.000640	0.970	0.000120	4.70	0.0000230	7.90	0.250	<0.000010	<0.00010	<0.010	0.000280	<0.00050	<0.0030	0.00620
	EDC-01a	17-Feb-2015	4.20	0.00130	0.00330	6.00	0.110	0.000500	0.00790	1.10	<0.00050	10.0	0.0000370	2.60	0.120	0.0000170	<0.00010	0.160	0.000210	0.00920	0.0110	0.150
		24-Feb-2015	0.390	0.0000760	<0.00050	4.90	0.0110	0.000350	0.00150	0.560	<0.00050	5.20	<0.000010	2.60	0.100	<0.000010	<0.00010	0.0130	0.0000860	0.00110	<0.0030	0.140
		2-Mar-2015	0.330	0.0000670	<0.00050	5.40	0.0120	0.000420	0.00130	0.540	<0.00050	5.30	<0.000010	2.80	0.120	<0.000010	<0.00010	0.0110	0.0000960	0.00100	<0.0030	0.0720
		10-Mar-2015	0.360	0.0000830	0.000560	5.30	0.0110	0.000480	0.00140	0.540	<0.00050	4.90	0.0000150	2.70	0.120	<0.000010	<0.00010	<0.010	0.000100	<0.0010	<0.0030	0.110
		17-Mar-2015	1.40	0.000350	0.000900	4.10	0.0330	0.000290	0.00270	0.680	<0.00050	6.00	0.0000210	2.10	0.0740	0.0000130	<0.00010	0.0420	0.0000880	0.00320	0.00430	0.170
		24-Mar-2015	0.540	0.000150	<0.00050	3.70	0.0160	0.000390	0.00160	0.560	<0.00050	4.80	<0.000010	2.00	0.0850	<0.000010	<0.00010	0.0170	0.0000880	0.00130	<0.0030	0.180
		1-Apr-2015	11.0	0.00390	0.00860	5.90	0.190	0.000530	0.0140	1.30	0.000220	14.0	0.0000530	2.00	0.130	0.0000640	<0.00010	0.280	0.000290	0.0160	0.0230	0.200
		7-Apr-2015	0.550	0.000150	<0.0010	3.60	0.0160	0.000370	0.00160	0.560	0.000120	4.50	<0.000010	1.90	0.0780	<0.000010	<0.00010	0.0160	0.0000780	0.00140	<0.0030	0.170
		14-Apr-2015	0.330	0.0000750	<0.0010	3.90	0.0110	0.000470	0.00130	0.520	0.000150	4.20	0.0000120	2.10	0.0900	<0.000010	<0.00010	<0.010	0.0000810	0.000950	<0.0030	0.140
		21-Apr-2015	0.330	0.0000820	<0.0010	4.00	0.0100	0.000580	0.00120	0.510	0.000140	4.10	<0.000010	2.00	0.0970	<0.000010	<0.00010	<0.010	0.0000930	0.000930	<0.0030	0.0920
		28-Apr-2015	0.300	0.0000770	<0.0010	4.00	0.0110	0.000510	0.00150	0.500	0.000110	3.90	<0.000010	2.20	0.0900	<0.000010	<0.00010	<0.010	0.0000900	0.000990	<0.0030	0.0940
		4-May-2015	0.320	0.0000930	<0.0010	4.40	0.0130	0.000550	0.00140	0.590	0.000140	4.00	<0.000010	2.40	0.100	<0.000010	<0.00010	<0.010	0.000100	0.00110	<0.0030	0.0880
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Jun-2015	0.0800	<0.000050	<0.0010	8.60	0.0160	0.00260	0.000900	1.00	0.000250	4.40	<0.000010	5.80	0.210	<0.000010	<0.00010	<0.010	0.000300	0.000800	<0.0030	0.0160
		7-Jul-2015	0.0550	<0.000050	0.00140	12.0	0.0190	0.00670	0.000650	1.70	0.000520	5.50	<0.000010	11.0	0.340	<0.000010	<0.00010	<0.010	0.000720	0.00130	<0.0030	0.00680
		31-Aug-2015	0.0590	<0.000050	0.00120	15.0	0.00710	0.00610	0.000590	1.80	0.000420	5.30	<0.000010	14.0	0.380	<0.000010	<0.00010	<0.010	0.00100	0.00140	<0.0030	0.00820
		8-Sep-2015	0.200	0.0000980	0.00140	16.0	0.0190	0.00500	0.000790	1.80	0.000490	5.70	<0.000010	13.0	0.380	<0.000010	<0.00010	0.0120	0.000880	0.00130	<0.0030	0.00750

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2015	EDC-01a	1-Oct-2015	0.0380	<0.000050	0.00170	17.0	0.0140	0.00390	0.000540	1.50	0.000240	5.70	<0.000010	13.0	0.400	<0.000010	<0.00010	<0.010	0.000690	0.000710	<0.0030	0.00580
		15-Oct-2015	0.0540	<0.000050	0.00170	15.0	0.0790	0.00760	0.000650	1.50	0.000720	5.60	<0.000010	14.0	0.480	<0.000010	<0.00010	<0.010	0.00120	0.000930	0.00320	0.00710
		20-Oct-2015	0.680	0.000230	0.00210	16.0	0.0820	0.00710	0.00130	1.50	0.000940	6.60	<0.000010	13.0	0.460	<0.000010	<0.00010	0.0280	0.00110	0.00210	0.00480	0.00580
		26-Oct-2015	0.300	0.000120	0.00170	16.0	0.100	0.00710	0.000790	1.50	0.000680	6.20	<0.000010	13.0	0.500	<0.000010	<0.00010	0.0160	0.00120	0.00220	0.00350	0.00380
		5-Nov-2015	0.100	<0.000050	<0.0010	10.0	0.00920	0.00130	0.000750	0.970	0.000160	4.20	<0.000010	6.20	0.200	<0.000010	<0.00010	<0.010	0.000280	0.000580	<0.0030	0.0120
		3-Dec-2015	0.110	<0.000050	0.00120	13.0	0.0140	0.00410	0.000790	1.10	0.000800	4.70	<0.000010	8.80	0.300	<0.000010	<0.00010	<0.010	0.000500	0.000570	<0.0030	0.00750
	HAC-13	5-Jan-2016	0.120	<0.000050	0.00130	7.00	0.0580	0.0130	0.000530	1.60	0.000930	3.60	<0.000010	12.0	0.400	<0.000010	<0.00010	0.0150	0.000440	0.00100	<0.0030	0.00340
		7-Jan-2016	0.0810	<0.000050	0.00100	6.60	0.0360	0.0120	<0.00050	1.40	0.000780	3.40	<0.000010	9.80	0.350	<0.000010	<0.00010	<0.010	0.000330	0.000900	<0.0030	<0.0030
		12-Jan-2016	0.0580	<0.000050	0.00100	6.60	0.0370	0.0120	<0.00050	1.40	0.000830	3.30	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000880	<0.0030	<0.0030
		19-Jan-2016	0.0510	<0.000050	0.00130	6.70	0.0360	0.0120	<0.00050	1.50	0.000810	3.30	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000360	0.000920	<0.0030	<0.0030
		26-Jan-2016	0.100	<0.000050	0.00120	7.40	0.0670	0.0140	<0.00050	1.60	0.000910	3.40	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000470	0.000990	<0.0030	0.00330
		1-Feb-2016	0.140	<0.000050	0.00120	7.70	0.0730	0.0140	<0.00050	1.60	0.000940	3.70	<0.000010	12.0	0.420	<0.000010	<0.00010	0.0140	0.000480	0.00130	<0.0030	0.00480
		9-Feb-2016	0.0690	<0.000050	<0.0010	7.20	0.0660	0.0120	<0.00050	1.50	0.000790	3.40	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000400	0.000850	<0.0030	0.00530
		15-Feb-2016	0.190	0.0000510	0.00110	7.60	0.0970	0.0140	<0.00050	1.50	0.000940	3.50	<0.000010	11.0	0.410	<0.000010	<0.00010	0.0130	0.000520	0.000980	<0.0030	0.00600
		22-Feb-2016	0.150	<0.000050	0.00110	7.20	0.0780	0.0130	<0.00050	1.50	0.000820	3.50	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000460	0.00100	<0.0030	0.0120
		24-Feb-2016	0.120	<0.000050	<0.0010	7.20	0.0770	0.0130	<0.00050	1.60	0.000900	3.50	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000440	0.000970	<0.0030	0.00900
		29-Feb-2016	0.140	<0.000050	<0.0010	7.30	0.0870	0.0130	<0.00050	1.60	0.000840	3.50	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000440	0.00100	<0.0030	0.0110
		2-Mar-2016	0.110	<0.000050	<0.0010	6.90	0.0720	0.0130	<0.00050	1.50	0.000830	3.40	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000420	0.00100	<0.0030	0.00930
		8-Mar-2016	0.580	0.000140	0.00230	13.0	0.370	0.0310	0.000970	2.20	0.00140	4.60	0.0000730	17.0	0.700	<0.000010	<0.00010	0.0280	0.00120	0.00190	0.00330	0.0380
		15-Mar-2016	0.220	<0.000050	0.00110	8.00	0.120	0.0160	0.00150	1.60	0.000950	3.80	<0.000010	12.0	0.420	<0.000010	<0.00010	0.0130	0.000570	0.00110	<0.0030	0.0270
		23-Mar-2016	2.00	0.000680	0.00510	20.0	0.700	0.0640	0.00230	3.50	0.00200	8.10	0.0000360	25.0	1.20	<0.000010	<0.00010	0.0920	0.00220	0.00500	0.00820	0.0500
		29-Mar-2016	2.00	0.000660	0.00480	21.0	0.700	0.0690	0.00230	3.30	0.00230	7.60	0.0000340	27.0	1.20	<0.000010	<0.00010	0.0920	0.00230	0.00500	0.00950	0.0470
		4-Apr-2016	3.80	0.00150	0.00440	16.0	0.650	0.0390	0.00310	3.80	0.00180	12.0	0.0000720	20.0	0.810	0.0000100	0.000140	0.180	0.00150	0.0100	0.0120	0.0940
		11-Apr-2016	0.280	0.0000880	<0.0010	5.50	0.0600	0.0100	0.000570	1.30	0.000630	3.10	<0.000010	8.10	0.300	<0.000010	<0.00010	0.0160	0.000330	0.00140	<0.0030	0.0390
		13-Apr-2016	0.210	0.0000620	<0.0010	6.30	0.0480	0.0100	0.000930	1.40	0.000660	3.40	<0.000010	9.10	0.320	<0.000010	<0.00010	0.0150	0.000310	0.00110	<0.0030	0.0140
		19-Apr-2016	0.170	0.0000500	0.00110	5.90	0.0980	0.00990	<0.00050	1.30	0.000770	3.20	<0.000010	9.20	0.310	<0.000010	<0.00010	0.0140	0.000280	0.00120	<0.0030	0.00630
		25-Apr-2016	0.290	0.0000880	0.00130	5.80	0.0620	0.00960	0.000540	1.30	0.000690	3.60	<0.000010	8.80	0.300	<0.000010	<0.00010	0.0190	0.000300	0.00180	<0.0030	0.0190
		5-May-2016	0.160	0.0000570	0.00190	6.40	0.0620	0.0120	<0.00050	1.50	0.000740	3.00	<0.000010	9.80	0.350	<0.000010	<0.00010	0.0110	0.000330	0.00130	<0.0060	0.00740
		10-May-2016	0.160	0.0000570	0.00120	6.10	0.0450	0.0120	<0.00050	1.40	0.000740	2.90	<0.000010	9.90	0.320	<0.000010	<0.00010	0.0130	0.000280	0.00120	<0.0030	0.00550
		17-May-2016	0.190	0.0000690	0.00140	6.50	0.0540	0.0130	0.000670	1.40	0.000740	2.90	<0.000010	11.0	0.370	<0.000010	<0.00010	0.0130	0.000380	0.00130	0.00360	0.00530
		24-May-2016	0.100	<0.000050	0.00100	6.40	0.0390	0.0120	<0.00050	1.40	0.000770	2.50	<0.000010	9.90	0.360	<0.000010	<0.00010	<0.010	0.000350	0.00110	0.00510	0.00400
		31-May-2016	0.110	<0.000050	<0.0010	6.20	0.0280	0.0110	<0.00050	1.50	0.000690	2.70	<0.000010	9.70	0.320	<0.000010	<0.00010	<0.010	0.000310	0.00110	0.00380	0.00690
		7-Jun-2016	0.130	<0.000050	0.00100	6.10	0.0430	0.0110	<0.00050	1.40	0.000770	2.40	<0.000010	9.30	0.330	<0.000010	<0.00010	0.0140	0.000290	0.00130	0.00630	0.00560
		14-Jun-2016	0.310	0.0000770	0.00310	15.0	0.190	0.0330	0.000620	3.00	0.00110	4.10	<0.000010	22.0	0.920	<0.000010	<0.00010	0.0130	0.00140	0.00150	0.0150	0.00810
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	0.110	<0.000050	<0.0010	7.20	0.0570	0.0140	<0.00050	1.50	0.000760	2.30	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000460	0.00120	0.00720	0.00530
		27-Jun-2016	0.0750	<0.000050	<0.0010	6.20	0.0350	0.0120	<0.00050	1.50	0.000740	2.10	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000330	0.00110	0.00610	0.00590
		6-Jul-2016	0.930	0.000330	0.00220	7.50	0.0740	0.0130	0.00130	1.70	0.000910	3.80	0.0000140	11.0	0.390	<0.000010	<0.00010	0.0380	0.000410	0.00320	0.0100	0.0170
		13-Jul-2016	38.0	0.0120	0.0280	30.0	1.00	0.0230	0.0450	6.10	0.00220	63.0	0.000380	17.0	0.780	0.000120	0.000620	1.20	0.00210	0.0920	0.130	0.0260
		18-Jul-2016	8.90	0.00320	0.00910	18.0	0.370	0.0220	0.0140	4.00	0.00130	25.0	0.000110	18.0	0.720	0.0000260	0.000190	0.460	0.00140	0.0250	0.0490	0.0180
		25-Jul-2016	0.260	0.0000890	0.00110	6.80	0.0600	0.0140	0.000640	1.50	0.000830	2.80	<0.000010	10.0	0.380	<0.000010	<0.00010	0.0170	0.000400	0.00170	0.00800	0.00740
		2-Aug-2016	0.0860	<0.000050	0.00130	9.30	0.0300	0.0190	<0.00050	2.00	0.000940	3.30	<0.000010	14.0	0.470	<0.000010	<0.00010	<0.010	0.000830	0.00160	0.00920	0.00780
		10-Aug-2016	0.390	0.000190	0.00160	8.70	0.0410	0.0180	0.000980	1.80	0.00140	4.00	<0.000010	13.0	0.440	<0.000010	<0.00010	0.0250	0.000770	0.00290	0.00330	0.0150
		17-Aug-2016	28.0	0.00930	0.0260	29.0	1.10	0.0170	0.0680	6.10	0.00160	56.0	0.000290	14.0	0.620	0.0000630	0.000810	1.70	0.00140	0.0860	0.0720	0.0310
		23-Aug-2016	35.0	0.0100	0.0280	44.0	1.50	0.0160	0.140	4.10	0.00200	69.0	0.000220	11.0	0.570	0.0000410	0.000620	1.70	0.00120	0.0870	0.0810	0.0220
		30-Aug-2016	21.0	0.00590	0.0170	27.0	0.870	0.0110	0.0830	3.80	0.00120	48.0	0.000120	12.0	0.420	0.0000350	0.000390	1.30	0.000800	0.0570	0.0540	0.0260
		6-Sep-2016	2.20	0.000470	0.00310	8.40	0.0740	0.0120	0.00870	1.50	0.000900	7.40	0.0000160	10.0	0.350	<0.000010	<0.00010	0.130	0.000420	0.00620	0.00650	0.0200
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Sep-2016	20.0	0.00760	0.0160	21.0	0.590	0.0240	0.0440	4.30	0.00220	43.0	0.000180	15.0	0.570	0.0000590	0.000340	0.860	0.00130	0.0500	0.0550	0.0180
		19-Sep-2016	1.30	0.000500	0.00370	17.0	0.250	0.0580	0.00210	3.50	0.00280	6.90	0.0000280	25.0	0.940	0.0000120	<0.00010	0.0680	0.00210	0.00460	0.00570	0.0120
		27-Sep-2016	0.210	0.000120	0.00160	8.20	0.0270	0.0170	0.00110	1.80	0.000880	3.00	<0.000010	12.0	0.450	<0.000010	<0.00010	<0.010	0.000720	0.00150	<0.0030	0.0130
		2-Oct-2016	0.0490	<0.000050	<0.0010	6.60	0.0230	0.0130	<0.00050	1.40	0.000740	2.40	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000390	0.00100	<0.0030	0.00720
		3-Oct-2016	0.0470	<0.000050	<0.0010	6.60	0.00590	0.0130	<0.00050	1.40	0.000880	2.40	0.0000130	10.0	0.380	<0.000010	<0.00010	<0.010	0.000470	0.00100	<0.0030	0.00640
		11-Oct-2016	0.150	0.0000830	<0.0010	9.10	0.0290	0.0180	0.000610	1.80	0.000820	3.00	<0.000010	13.0	0.480	<0.000010	<0.00010	<0.010	0.000760	0.00140	<0.0030	0.0140
		18-Oct-2016	0.200	0.0000670	<0.0010	8.80	0.110	0.0160	0.000610	1.80	0.000820	3.20	<0.000010	13.0	0.460	<0.000010	<0.00010	<0.010	0.000710	0.00140	<0.0030	0.0140
		24-Oct-2016	0.440	0.000160	0.00200	12.0	0.120	0.0240	0.00100	2.10	0.000960	4.20	0.0000110	16.0	0.610	<0.000010	<0.00010	0.0160	0.00120	0.00170	<0.0030	0.0160
		1-Nov-2016	0.340	0.000110	<0.0010	9.10	0.0950	0.0170	0.000980	1.90	0.000980	3.60	0.0000110	13.0	0.440	<0.000010	<0.00010	<0.010	0.000800	0.00170	<0.0030	0.0210
		8-Nov-2016	0.120	0.0000740	0.00140	8.60	0.110	0.0170	<0.00050	1.80	0.000870	3.40	<0.000010	13.0	0.460	<0.000010	<0.00010	<0.010	0.000710	0.00110	<0.0030	0.00610
		15-Nov-2016	0.270	0.000110	<0.0010	7.80	0.0730	0.0140	0.000580	1.70	0.000780	3.50	<0.000010	12.0	0.410	<0.000010	<0.00010	0.0100	0.000540	0.00140	<0.0030	0.00810
		22-Nov-2016	0.250	0.0000940	<0.0010	6.50	0.0660	0.0120	0.000630	1.50	0.000730	3.50	<0.000010	10.0	0.340	<0.000010	<0.00010	0.0110	0.000390	0.00140	<0.0030	0.0160
		29-Nov-2016	0.360	0.000330	0.00140	7.70	0.0880	0.0140	0.000810	1.60	0.000690	3.80	<0.000010	11.0	0.380	<0.000010	<0.00010	0.0150	0.000460	0.00180	<0.0030	0.00910
		6-Dec-2016	0.180	0.0000760	0.00100	6.50	0.0750	0.0130	<0.00050	1.40	0.000680	3.60	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000470	0.00140	0.00310	0.0140
		14-Dec-2016	0.0370	<0.000050	<0.0010	6.20	0.0360	0.0110	<0.00050	1.40	0.000610	3.10	<0.000010	11.0	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000940	<0.0030	0.00340
		20-Dec-2016	0.0350	<0.000050	<0.0010	7.00	0.0520	0.0110	<0.00050	1.50	0.000650	3.10	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000340	0.000910	<0.0030	0.00380
		28-Dec-2016	<0.030	<0.000050	<0.0010	6.00	0.0270	0.0110	<0.00050	1.40	0.000710	3.00	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000320	0.000890	<0.0030	<0.0030

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2016	HAC-05a	5-Jan-2016	0.0570	<0.000050	0.00870	24.0	0.130	0.110	0.000620	7.70	0.0200	4.60	<0.000010	39.0	2.10	<0.000010	<0.00010	0.0220	0.000780	0.000860	0.00400	0.100
		7-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		12-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	0.100	<0.000050	0.00640	20.0	0.0990	0.0710	0.000560	6.00	0.0160	4.20	<0.000010	30.0	1.30	<0.000010	<0.00010	0.0160	0.000780	0.00110	0.00350	0.0690
		9-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Mar-2016	0.120	<0.000050	0.00560	18.0	0.150	0.0740	0.000560	5.00	0.0140	3.80	<0.000010	27.0	1.30	<0.000010	<0.00010	<0.010	0.000610	0.00110	0.00360	0.0850
		8-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	1.70	0.000540	0.00400	23.0	0.340	0.0740	0.00230	3.80	0.0200	7.60	0.0000270	22.0	1.40	<0.000010	<0.00010	0.0840	0.00110	0.00490	0.00810	0.0950
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	0.0980	<0.000050	0.0110	22.0	0.0710	0.120	<0.00050	9.70	0.0240	3.60	<0.000010	40.0	1.80	<0.000010	<0.00010	0.0150	0.000520	0.00110	<0.0030	0.0970
		10-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7-Jun-2016	0.0640	<0.000050	0.0120	22.0	0.0470	0.120	0.000570	11.0	0.0240	3.50	<0.000010	40.0	1.80	<0.000010	<0.00010	0.0230	0.000620	0.00110	<0.0030	0.130
		14-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Jul-2016	0.300	0.000110	0.0130	25.0	0.0550	0.140	0.000890	13.0	0.0270	4.20	<0.000010	48.0	2.00	<0.000010	<0.00010	0.0230	0.000950	0.00190	0.00410	0.0270
		13-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	0.0640	<0.000050	0.0160	30.0	0.0280	0.160	0.000640	16.0	0.0310	3.90	<0.000010	57.0	2.40	<0.000010	<0.00010	<0.010	0.00120	0.00130	<0.0030	0.0260
		10-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Sep-2016	0.650	0.000220	0.0160	27.0	0.0460	0.160	0.00180	14.0	0.0330	5.20	0.0000130	56.0	2.40	<0.000010	<0.00010	0.0370	0.00110	0.00280	0.00320	0.0210
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Oct-2016	0.0470	<0.000050	0.0180	27.0	0.0260	0.190	0.000660	16.0	0.0340	4.20	<0.000010	54.0	2.80	<0.000010	<0.00010	<0.010	0.00140	0.00110	<0.0030	0.0190
		11-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Nov-2016	0.250	0.0000640	0.0120	25.0	0.0740	0.130	0.000790	13.0	0.0250	4.30	<0.000010	48.0	1.90	<0.000010	<0.00010	0.0110	0.00120	0.00170	0.00380	0.0190
		8-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Nov-2016	0.400	0.000150	0.00120	7.30	0.100	0.0130	0.000830	1.70	0.000880	3.90	<0.000010	11.0	0.380	<0.000010	<0.00010	0.0150	0.000420	0.00170	0.00780	0.0170
		29-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Dec-2016	0.110	<0.000050	0.0110	20.0	0.0500	0.120	0.000520	11.0	0.0230	4.20	<0.000010	42.0	1.70	<0.000010	<0.00010	<0.010	0.00110	0.00150	0.00350	0.0130
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	5-Jan-2016	0.870	0.000380	0.00780	23.0	0.0880	0.0920	0.00120	6.20	0.0170	5.70	0.0000180	36.0	1.90	<0.000010	<0.00010	0.0680	0.00110	0.00380	0.00400	0.0350
		19-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	0.250	0.000120	0.00700	21.0	0.0950	0.0740	0.000700	5.80	0.0150	4.50	<0.000010	29.0	1.40	<0.000010	<0.00010	0.0240	0.000950	0.00160	0.00350	0.0710
		2-Mar-2016	0.420	0.000160	0.00550	18.0	0.130	0.0640	0.000970	4.50	0.0120	4.40	<0.000010	24.0	1.20	<0.000010	<0.00010	0.0180	0.000730	0.00190	0.00350	0.0840
		4-Apr-2016	7.10	0.00290	0.00710	17.0	0.340	0.0470	0.00960	3.10	0.0100	14.0	0.0000630	13.0	0.980	0.0000600	0.000140	0.250	0.00120	0.0160	0.0210	0.0970
		5-May-2016	0.200	0.0000810	0.00870	20.0	0.0710	0.0960	<0.00050	7.80	0.0200	4.00	<0.000010	35.0	1.60	<0.000010	<0.00010	0.0180	0.000630	0.00140	<0.0030	0.100
		7-Jun-2016	0.160	0.0000520	0.0100	23.0	0.0470	0.120	0.000600	10.0	0.0240	3.90	<0.000010	38.0	1.80	<0.000010	<0.00010	0.0260	0.000660	0.00120	<0.0030	0.110
		6-Jul-2016	0.340	0.000120	0.0120	25.0	0.0400	0.120	0.000900	12.0	0.0250	4.10	<0.000010	45.0	1.80	<0.000010	<0.00010	0.0240	0.000930	0.00200	<0.0030	0.0320
		2-Aug-2016	0.170	0.0000690	0.0130	26.0	0.0210	0.130	0.000710	14.0	0.0260	3.80	<0.000010	50.0	2.00	<0.000010	<0.00010	0.0100	0.00110	0.00170	<0.0030	0.0280
		6-Sep-2016	0.270	0.000100	0.0140	25.0	0.0280	0.140	0.000820	13.0	0.0270	4.30	<0.000010	48.0	2.00	0.0000180	<0.00010	0.0140	0.00110	0.00160	<0.0030	0.0170
		3-Oct-2016	0.140	0.0000660	0.0150	26.0	0.0280	0.160	0.000580	14.0	0.0300	4.30	<0.000010	51.0	2.40	<0.000010	<0.00010	<0.010	0.00130	0.00130	<0.0030	0.0130
		1-Nov-2016	0.660	0.000180	0.00860	22.0	0.0710	0.0880	0.00160	11.0	0.0210	5.10	<0.000010	42.0	1.30	<0.000010	<0.00010	0.0260	0.000970	0.00260	0.00450	0.0380
		22-Nov-2016	0.460	0.000240	0.00190	7.70	0.0810	0.0140	0.00100	2.10	0.00140	3.90	<0.000010	11.0	0.440	<0.000010	<0.00010	<0.010	0.000490	0.00180	0.00350	0.0680
		6-Dec-2016	0.220	0.0000950	0.0110	18.0	0.0480	0.110	0.000630	9.20	0.0220	4.50	<0.000010	37.0	1.70	<0.000010	<0.00010	<0.010	0.00110	0.00160	0.00380	0.0160
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2016	W10	7-Jan-2016	0.0900	<0.000050	<0.0010	12.0	0.00320	0.00100	0.000630	0.880	0.000120	4.80	<0.000010	7.10	0.230	<0.000010	<0.00010	<0.010	0.000260	<0.00050	<0.0030	0.00770
		1-Feb-2016	0.280	0.0000620	<0.0010	8.40	0.00830	0.000770	0.00100	0.780	0.000170	4.90	<0.000010	4.60	0.170	<0.000010	<0.00010	<0.010	0.000170	0.000700	<0.0030	0.0580
		2-Mar-2016	0.390	0.0000860	<0.0010	5.70	0.00940	0.000470	0.00150	0.680	0.000200	4.90	<0.000010	3.30	0.120	<0.000010	<0.00010	<0.010	0.000100	0.00140	<0.0030	0.100
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.690	0.000190	<0.0010	3.20	0.0220	0.000270	0.00200	0.580	0.000130	4.30	0.0000110	2.00	0.0690	<0.000010	<0.00010	0.0190	0.0000840	0.00170	<0.0030	0.200
		4-May-2016	0.210	<0.000050	<0.0010	4.60	0.00690	0.000430	0.00130	0.720	0.000130	4.10	<0.000010	2.50	0.100	<0.000010	<0.00010	<0.010	0.0000740	0.000930	<0.0030	0.0730
		4-May-2016	0.200	<0.000050	<0.0010	4.50	0.00710	0.000410	0.00140	0.700	0.000120	4.10	<0.000010	3.00	0.100	<0.000010	<0.00010	<0.010	0.0000740	0.000940	<0.0030	0.0740
		6-Jun-2016	0.150	<0.000050	<0.0010	6.40	0.00660	0.000630	0.00130	0.720	0.000190	4.20	<0.000010	3.50	0.150	<0.000010	<0.00010	<0.010	0.0000940	0.000780	<0.0030	0.0360
		4-Jul-2016	0.230	<0.000050	<0.0010	6.50	0.00750	0.000720	0.00160	0.630	0.000160	4.40	<0.000010	3.60	0.150	<0.000010	<0.00010	<0.010	0.0000950	0.000880	<0.0030	0.0430
		4-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	0.200	<0.000050	<0.0010	7.90	0.00620	0.000860	0.00160	0.710	0.000150	4.70	<0.000010	4.50	0.170	<0.000010	<0.00010	<0.010	0.000120	0.000940	<0.0030	0.0280
		6-Sep-2016	0.0440	<0.000050	0.00100	15.0	0.00570	0.00200	0.00130	1.30	0.000110	4.80	<0.000010	9.70	0.320	<0.000010	<0.00010	<0.010	0.000310	0.000570	<0.0030	0.00620
		3-Oct-2016	0.230	<0.000050	0.00110	6.40	0.00540	0.000610	0.00120	0.630	0.000110	4.40	<0.000010	3.60	0.150	<0.000010	<0.00010	<0.010	0.000100	0.000640	<0.0030	0.0320
		1-Nov-2016	0.470	0.0000820	<0.0010	4.70	0.0160	0.000430	0.00170	0.570	0.000130	4.80	0.0000120	2.60	0.100	<0.000010	<0.00010	<0.010	0.0000970	0.00120	<0.0030	0.160
		1-Dec-2016	0.390	0.0000670	<0.0010	4.70	0.0110	0.000410	0.00150	0.460	0.000160	5.10	<0.000010	2.40	0.110	<0.000010	<0.00010	<0.010	0.000100	0.00100	0.00350	0.160
	EDC-01a	5-Jan-2016	0.0770	<0.000050	0.00120	13.0	0.0110	0.00400	0.000640	1.00	0.00120	5.00	<0.000010	8.90	0.330	<0.000010	<0.00010	0.0110	0.000440	0.000510	<0.0030	0.00650
		1-Feb-2016	0.320	0.0000670	<0.0010	8.70	0.0120	0.00140	0.00110	0.800	0.000180	5.00	<0.000010	5.10	0.160	<0.000010	<0.00010	0.0130	0.000180	0.00110	<0.0030	0.0620
		2-Mar-2016	0.390	0.0000820	<0.0010	6.00	0.0110	0.000500	0.00140	0.640	0.000210	5.10	<0.000010	3.40	0.130	<0.000010	<0.00010	<0.010	0.000120	0.00130	<0.0030	0.0970
		10-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	1.10	0.000310	<0.0010	3.60	0.0360	0.000340	0.00260	0.680	0.000160	5.00	0.0000150	2.10	0.0700	<0.000010	<0.00010	0.0310	0.0000950	0.00260	0.00340	0.170
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	0.180	<0.000050	<0.0010	5.00	0.00760	0.000820	0.00110	0.670	0.000170	4.00	<0.000010	2.90	0.120	<0.000010	<0.00010	<0.010	0.000110	0.00100	<0.0030	0.0660
		7-Jun-2016	0.180	<0.000050	<0.0010	7.00	0.0110	0.00120	0.00140	0.880	0.000290	4.50	<0.000010	4.00	0.160	<0.000010	<0.00010	0.0110	0.000120	0.00100	<0.0030	0.0320
		6-Jul-2016	0.240	<0.000050	<0.0010	6.40	0.0120	0.000950	0.00160	0.640	0.000210	4.40	<0.000010	3.50	0.160	<0.000010	<0.00010	<0.010	0.000120	0.00100	<0.0030	0.0530
		2-Aug-2016	0.160	<0.000050	<0.0010	9.00	0.0200	0.00420	0.00160	1.10	0.000900	4.60	<0.000010	6.70	0.240	<0.000010	<0.00010	<0.010	0.000190	0.00100	<0.0030	0.0260
		6-Sep-2016	<0.030	<0.000050	0.00130	15.0	0.0230	0.00570	0.000910	1.50	0.00130	4.60	<0.000010	13.0	0.400	<0.000010	<0.00010	<0.010	0.000440	0.000720	<0.0030	0.00510
		3-Oct-2016	0.210	<0.000050	<0.0010	7.80	0.00870	0.00230	0.00120	0.810	0.000930	4.40	<0.000010	5.40	0.200	<0.000010	<0.00010	<0.010	0.000160	0.000690	<0.0030	0.0270
		1-Nov-2016	0.470	0.0000760	<0.0010	4.90	0.0170	0.000700	0.00170	0.620	0.000250	4.90	0.0000110	2.80	0.110	<0.000010	<0.00010	<0.010	0.000110	0.00120	<0.0030	0.120
		6-Dec-2016	0.400	0.0000700	<0.0010	6.50	0.0130	0.00260	0.00160	0.680	0.000800	5.50	<0.000010	4.60	0.170	<0.000010	<0.00010	<0.010	0.000180	0.00120	0.00320	0.0780
2017	HAC-13	3-Jan-2017	<0.030	<0.000050	<0.0010	6.20	0.0200	0.0110	<0.00050	1.50	0.000740	3.10	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000320	0.000990	<0.0030	0.00450
		10-Jan-2017	<0.030	<0.000050	<0.0010	6.50	0.0190	0.0100	<0.00050	1.50	0.000680	3.10	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000300	0.000970	<0.0030	0.00460
		17-Jan-2017	<0.030	<0.000050	0.00110	5.90	0.0210	0.0100	<0.00050	1.40	0.000670	3.00	<0.000010	9.90	0.330	<0.000010	<0.00010	<0.010	0.000310	0.000940	<0.0030	<0.0030
		24-Jan-2017	<0.030	<0.000050	<0.0010	6.10	0.0280	0.0100	<0.00050	1.40	0.000690	3.00	<0.000010	9.90	0.340	<0.000010	<0.00010	<0.010	0.000320	0.000840	<0.0030	0.00350
		1-Feb-2017	<0.030	<0.000050	0.00130	6.00	0.0230	0.0110	<0.00050	1.40	0.000690	3.00	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000280	0.000940	<0.0030	0.00420
		7-Feb-2017	<0.030	<0.000050	<0.0010	6.20	0.0240	0.0100	<0.00050	1.40	0.000680	3.10	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000300	0.000940	<0.0030	0.00300
		14-Feb-2017	<0.030	<0.000050	<0.0010	6.50	0.0240	0.0110	<0.00050	1.40	0.000680	3.00	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000310	0.000890	<0.0030	<0.0030
		21-Feb-2017	0.0380	<0.000050	<0.0010	6.80	0.0530	0.0120	<0.00050	1.40	0.000680	3.00	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000400	0.000910	<0.0030	0.00320
		1-Mar-2017	0.0340	<0.000050	<0.0010	6.40	0.0380	0.0100	<0.00050	1.40	0.000670	3.00	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000330	0.000890	<0.0030	<0.0030
		7-Mar-2017	0.0360	<0.000050	<0.0010	6.60	0.0340	0.0100	<0.00050	1.30	0.000660	2.70	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000280	0.000880	0.00550	0.00340
		14-Mar-2017	0.0540	<0.000050	<0.0010	7.80	0.0660	0.0120	<0.00050	1.60	0.000690	3.20	<0.000010	12.0	0.380	<0.000010	<0.00010	<0.010	0.000390	0.00140	0.00350	<0.0030
		21-Mar-2017	0.0390	<0.000050	<0.0010	6.90	0.0570	0.0110	<0.00050	1.30	0.000620	2.90	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000380	0.000880	<0.0030	0.00450
		27-Mar-2017	0.0560	<0.000050	0.00120	7.80	0.0970	0.0150	<0.00050	1.40	0.000710	3.00	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000530	0.000790	<0.0030	<0.0030
		30-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.200	0.0000640	0.00110	7.30	0.110	0.0150	0.000550	1.40	0.000850	3.40	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000540	0.00110	<0.0030	0.0320
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.0770	<0.000050	<0.0010	6.00	0.0280	0.00960	<0.00050	1.20	0.000580	2.70	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	0.0100
		1-Jun-2017	0.0350	<0.000050	<0.0010	5.60	0.0120	0.00890	<0.00050	1.30	0.000620	2.30	<0.000010	9.00	0.290	<0.000010	<0.00010	<0.010	0.000250	0.000990	<0.0030	0.00510
		6-Jun-2017	0.0410	<0.000050	<0.0010	5.40	0.0140	0.00960	<0.00050	1.20	0.000600	2.00	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000270	0.00110	<0.0030	0.00670
		13-Jun-2017	0.0340	<0.000050	0.00110	6.50	0.00870	0.0110	<0.00050	1.40	0.000670	2.20	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	0.00680
		20-Jun-2017	0.0440	<0.000050	<0.0010	6.20	0.00830	0.0110	<0.00050	1.40	0.000680	2.10	<0.000010	9.90	0.320	<0.000010	<0.00010	<0.010	0.000340	0.00110	<0.0030	0.00600
		27-Jun-2017	0.0340	<0.000050	<0.0010	7.00	0.00910	0.0120	<0.00050	1.40	0.000780	2.10	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000370	0.00120	<0.0030	0.0110
		4-Jul-2017	0.0300	<0.000050	<0.0010	5.70	0.00770	0.00980	<0.00050	1.30	0.000630	1.80	<0.000010	9.20	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	0.00730
		1-Aug-2017	<0.030	<0.000050	<0.0010	5.50	0.00850	0.00940	<0.00050	1.20	0.000650	2.00	<0.000010	8.90	0.300	<0.000010	<0.00010	<0.010	0.000270	0.00120	0.00330	0.00640
		27-Aug-2017	<0.030	<0.000050	<0.0010	6.00	0.00650	0.00920	<0.00050	1.30	0.000630	1.90	<0.000010	9.50	0.300	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	0.00600
		19-Sep-2017	<0.030	<0.000050	<0.0010	5.60	0.00240	0.00990	<0.00050	1.20	0.000590	1.90	<0.000010	8.30	0.300	<0.000010	<0.00010	<0.010	0.000280	0.000870	<0.0030	0.00430
		26-Sep-2017	<0.030	<0.000050	<0.0010	6.30	0.00390	0.0110	<0.00050	1.40	0.000680	2.20	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	0.00380
		2-Oct-2017	<0.030	<0.000050	<0.0010	6.50	0.00230	0.00930	<0.00050	1.20	0.000630	2.00	<0.000010	9.60	0.300	<0.000010	<0.00010	<0.010	0.000300	0.000800	<0.0030	0.00380
		10-Oct-2017	<0.030	<0.000050	<0.0010	6.30	0.00380	0.00970	<0.00050	1.30	0.000630	2.10	<0.000010	9.50	0.320	<0.000010	<0.00010	<0.010	0.000340	0.000760	<0.0030	0.00420
		17-Oct-2017	0.0660	<0.000050	<0.0010	7.70	0.00410	0.0140	<0.00050	1.30	0.00180	2.40	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000460	0.000890	<0.0030	0.00450
		24-Oct-2017	0.0310	<0.000050	<0.0010	8.20	0.00280	0.00970	<0.00050	1.30	0.000840	2.40	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000440	0.000850	<0.0030	0.00390
		31-Oct-2017	<0.030	<0.000050	<0.0010	6.60	0.00140	0.0100	<0.00050	1.20	0.000610	2.30	<0.000010	9.40	0.320	<0.000010	<0.00010	<0.010	0.000400	0.000730	<0.0030	<0.0030

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2017	HAC-13	7-Nov-2017	0.0820	<0.000050	0.00110	7.60	0.00550	0.0110	<0.00050	1.20	0.000670	2.80	0.0000240	11.0	0.360	<0.000010	<0.00010	<0.010	0.000380	0.000840	0.00360	0.00400
		14-Nov-2017	0.0360	<0.000050	<0.0010	7.10	0.00290	0.0110	<0.00050	1.30	0.000740	2.50	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000450	0.000750	<0.0030	0.00370
		21-Nov-2017	<0.030	<0.000050	<0.0010	7.40	0.00160	0.0110	<0.00050	1.20	0.000680	2.60	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000570	0.000710	<0.0030	<0.0030
		28-Nov-2017	0.0600	<0.000050	<0.0010	11.0	0.0120	0.0120	0.000520	1.60	0.00120	3.10	<0.000010	14.0	0.490	<0.000010	<0.00010	<0.010	0.000940	0.000850	<0.0030	0.00670
		5-Dec-2017	<0.030	<0.000050	0.00120	9.20	0.00460	0.0100	<0.00050	1.40	0.000800	2.90	<0.000010	12.0	0.460	<0.000010	<0.00010	<0.010	0.000690	0.000690	<0.0030	0.00420
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-05a	3-Jan-2017	0.0820	<0.000050	0.00530	13.0	0.0290	0.0630	<0.00050	6.20	0.0120	3.60	<0.000010	26.0	1.00	<0.000010	<0.00010	<0.010	0.000660	0.00120	0.00370	0.00980
		10-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jan-2017	0.0410	<0.000050	<0.0010	6.40	0.0370	0.0100	<0.00050	1.40	0.000680	3.10	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000870	<0.0030	<0.0030
		1-Feb-2017	0.0520	<0.000050	0.00720	15.0	0.0270	0.0740	<0.00050	6.50	0.0140	3.80	<0.000010	29.0	1.20	<0.000010	<0.00010	<0.010	0.000550	0.00110	<0.0030	0.0500
		7-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Mar-2017	0.0310	<0.000050	0.00830	18.0	0.0320	0.0930	<0.00050	8.60	0.0180	3.60	<0.000010	35.0	1.40	<0.000010	<0.00010	<0.010	0.000720	0.000990	<0.0030	0.0880
		7-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.850	0.000290	0.00130	8.20	0.190	0.0130	0.00120	1.60	0.000980	4.80	0.0000180	10.0	0.400	<0.000010	<0.00010	0.0310	0.000580	0.00250	0.00410	0.0350
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.160	0.0000750	<0.0010	6.90	0.0580	0.00940	<0.00050	1.30	0.000650	3.00	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000350	0.00120	<0.0030	0.0160
		9-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Jun-2017	0.0520	<0.000050	0.00100	5.80	0.0210	0.00900	<0.00050	1.30	0.000620	2.50	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000280	0.00110	<0.0030	0.00840
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	0.240	0.0000910	0.00850	36.0	0.0920	0.150	0.00110	6.80	0.0440	5.90	<0.000010	41.0	2.50	<0.000010	<0.00010	0.0150	0.00180	0.00190	0.00500	0.130
		20-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2017	0.250	0.000120	0.00830	30.0	0.0510	0.140	0.000890	6.90	0.0380	5.40	<0.000010	40.0	2.70	<0.000010	<0.00010	<0.010	0.00160	0.00170	<0.0030	0.110
		1-Aug-2017	0.0590	<0.000050	<0.0010	6.30	0.0160	0.00910	<0.00050	1.30	0.000690	2.00	<0.000010	9.20	0.310	<0.000010	<0.00010	<0.010	0.000300	0.00130	0.00360	0.00910
		19-Sep-2017	0.0840	<0.000050	0.00710	32.0	0.0450	0.150	0.000580	3.40	0.0330	6.00	<0.000010	38.0	3.70	<0.000010	<0.00010	<0.010	0.00230	0.00140	0.00450	0.0810
		26-Sep-2017	0.0550	<0.000050	0.0100	32.0	0.0460	0.160	0.000640	9.00	0.0370	6.40	<0.000010	54.0	3.40	<0.000010	<0.00010	<0.010	0.00190	0.00130	0.00400	0.100
		2-Oct-2017	<0.030	<0.000050	0.00110	12.0	0.0120	0.00950	<0.00050	1.60	0.00180	4.40	<0.000010	12.0	0.470	<0.000010	<0.00010	<0.010	0.000630	0.00110	<0.0030	0.0420
		10-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		31-Oct-2017	<0.030	<0.000050	<0.0010	11.0	0.0250	0.00850	<0.00050	1.30	0.00120	3.50	<0.000010	9.90	0.400	<0.000010	<0.00010	<0.010	0.000660	0.000870	<0.0030	0.0110
		7-Nov-2017	<0.030	<0.000050	<0.0010	12.0	0.0180	0.00850	<0.00050	1.20	0.00130	4.30	<0.000010	12.0	0.410	<0.000010	<0.00010	<0.010	0.000580	0.000720	<0.0030	0.0180
		14-Nov-2017	<0.030	<0.000050	<0.0010	12.0	0.0270	0.00930	<0.00050	1.30	0.00170	4.10	<0.000010	11.0	0.420	<0.000010	<0.00010	<0.010	0.000760	0.000870	<0.0030	0.00860
		21-Nov-2017	<0.030	<0.000050	<0.0010	12.0	0.0250	0.00870	<0.00050	1.20	0.00170	4.30	<0.000010	11.0	0.470	<0.000010	<0.00010	<0.010	0.000890	0.000840	<0.0030	0.00660
		28-Nov-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Nov-2017	0.0550	0.0000600	<0.0010	15.0	0.0410	0.0120	0.000810	1.70	0.00290	4.20	<0.000010	14.0	0.580	<0.000010	<0.00010	<0.010	0.00130	0.000850	0.0120	0.00710
		5-Dec-2017	<0.030	<0.000050	<0.0010	13.0	0.0280	0.00830	<0.00050	1.40	0.00160	4.40	<0.000010	13.0	0.500	<0.000010	<0.00010	<0.010	0.000880	0.000770	<0.0030	0.00630
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-14	27-Aug-2017	0.310	0.000100	<0.0010	8.20	0.0280	0.00980	0.000770	1.60	0.000810	3.30	<0.000010	11.0	0.370	<0.000010	<0.00010	0.0130	0.000400	0.00180	<0.0030	0.0120
		19-Sep-2017	0.0450	<0.000050	0.00540	33.0	0.0320	0.140	<0.00050	3.30	0.0320	6.20	<0.000010	38.0	3.20	<0.000010	<0.00010	<0.010	0.00230	0.00120	0.00310	0.0600
		26-Sep-2017	<0.030	<0.000050	0.00960	32.0	0.0300	0.160	<0.00050	8.80	0.0350	6.10	<0.000010	53.0	3.20	<0.000010	<0.00010	<0.010	0.00190	0.00120	<0.0030	0.120
		2-Oct-2017	0.0470	<0.000050	0.00270	16.0	0.0310	0.0210	<0.00050	2.40	0.00500	4.70	0.0000130	17.0	0.800	<0.000010	<0.00010	<0.010	0.000930	0.00110	0.00580	0.0460
		17-Oct-2017	0.920	0.000310	0.00240	16.0	0.0580	0.0180	0.00150	1.90	0.00450	5.50	<0.000010	13.0	0.720	<0.000010	<0.00010	0.0290	0.00140	0.00270	0.00480	0.0210
		24-Oct-2017	0.0660	<0.000050	0.00180	15.0	0.0400	0.0120	<0.00050	1.60	0.00240	3.80	<0.000010	13.0	0.550	<0.000010	<0.00010	<0.010	0.000970	0.000900	<0.0030	0.0130
		31-Oct-2017	<0.030	<0.000050	0.00160	13.0	0.0390	0.0100	<0.00050	1.40	0.00110	3.90	<0.000010	11.0	0.520	<0.000010	<0.00010	<0.010	0.000880	0.000750	<0.0030	0.130
		7-Nov-2017	0.0680	<0.000050	0.00200	16.0	0.0370	0.0120	<0.00050	1.40	0.00130	4.80	<0.000010	14.0	0.590	<0.000010	<0.00010	<0.010	0.000790	0.000770	<0.0030	0.00850
		14-Nov-2017	0.0660	<0.000050	0.00180	14.0	0.0400	0.0110	<0.00050	1.50	0.00160	4.90	<0.000010	12.0	0.570	<0.000010	<0.00010	<0.010	0.000940	0.000840	<0.0030	0.00990
		21-Nov-2017	0.0610	<0.000050	0.00190	15.0	0.0380	0.0110	<0.00050	1.40	0.00140	5.00	<0.000010	12.0	0.610	<0.000010	<0.00010	<0.010	0.00110	0.000830	<0.0030	0.00670
		28-Nov-2017	0.330	0.000130	0.00150	17.0	0.0530	0.0140	0.000750	1.70	0.00300	5.10	<0.000010	14.0	0.710	<0.000010	<0.00010	0.0110	0.00150	0.00140	<0.0030	0.00760
		5-Dec-2017	0.0600	<0.000050	0.00160	16.0	0.0390	0.0100	<0.00050	1.60	0.00140	4.90	<0.000010	14.0	0.640	<0.000010	<0.00010	<0.010	0.00100	0.000750	0.00600	0.00600
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2017	HAC-08	3-Jan-2017	0.910	0.000440	0.00570	14.0	0.0490	0.0610	0.00130	5.90	0.0110	5.00	0.0000200	26.0	1.00	0.0000110	<0.00010	0.0420	0.000840	0.00360	0.00400	0.00520
		24-Jan-2017	0.210	0.0000970	0.00130	7.20	0.0370	0.0120	<0.00050	1.70	0.000810	3.60	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000420	0.00130	<0.0030	0.00400
		1-Feb-2017	0.240	0.000140	0.00750	15.0	0.0310	0.0740	0.000800	6.20	0.0140	4.00	<0.000010	27.0	1.20	<0.000010	<0.00010	0.0120	0.000600	0.00160	0.00300	0.0390
		1-Mar-2017	0.150	0.0000960	0.00880	15.0	0.0350	0.0870	<0.00050	6.80	0.0170	3.90	<0.000010	28.0	1.30	<0.000010	<0.00010	<0.010	0.000800	0.00110	<0.0030	0.0950
		3-Apr-2017	1.60	0.000540	0.00210	7.60	0.140	0.00960	0.00260	1.60	0.000750	6.10	0.0000240	8.00	0.340	0.0000100	<0.00010	0.0520	0.000540	0.00390	0.00750	0.0740
		2-May-2017	0.350	0.000140	0.00120	7.00	0.0550	0.00820	0.000770	1.30	0.000640	3.50	<0.000010	8.80	0.310	<0.000010	<0.00010	0.0110	0.000400	0.00150	<0.0030	0.0420
		1-Jun-2017	0.120	0.0000620	0.00130	6.20	0.0260	0.00940	<0.00050	1.40	0.000640	2.60	<0.000010	9.10	0.330	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	0.0130
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	0.0910	<0.000050	0.00630	29.0	0.0440	0.110	0.000540	5.00	0.0330	4.80	<0.000010	32.0	2.00	<0.000010	<0.00010	<0.010	0.00150	0.00140	<0.0030	0.110
		4-Jul-2017	0.0470	<0.000050	0.00660	27.0	0.0210	0.120	<0.00050	6.20	0.0320	4.70	<0.000010	36.0	2.40	<0.000010	<0.00010	<0.010	0.00140	0.00130	<0.0030	0.160
		27-Aug-2017	0.260	0.000100	<0.0010	8.60	0.0230	0.0100	0.000720	1.60	0.000930	3.30	<0.000010	11.0	0.410	<0.000010	<0.00010	<0.010	0.000480	0.00160	<0.0030	0.0180
		27-Aug-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Sep-2017	1.20	0.000650	0.00440	30.0	0.120	0.100	0.00230	3.10	0.0240	7.50	0.0000110	32.0	2.30	0.0000290	<0.00010	0.0370	0.00200	0.00350	0.00480	0.0180
		10-Oct-2017	0.0500	<0.000050	0.00420	18.0	0.0260	0.0150	<0.00050	2.30	0.00230	4.80	<0.000010	18.0	0.800	<0.000010	<0.00010	<0.010	0.00160	0.00110	<0.0030	0.0180
		17-Oct-2017	2.10	0.000710	0.00400	16.0	0.0690	0.0150	0.00310	2.00	0.00460	6.80	0.0000140	12.0	0.680	0.0000140	<0.00010	0.0590	0.00160	0.00450	0.00610	0.0190
		24-Oct-2017	0.0710	<0.000050	0.00240	18.0	0.0330	0.0130	<0.00050	1.80	0.00260	4.00	<0.000010	15.0	0.610	<0.000010	<0.00010	<0.010	0.00110	0.000940	<0.0030	0.0140
		31-Oct-2017	0.0880	<0.000050	0.00220	14.0	0.0320	0.0100	<0.00050	1.40	0.00130	3.90	<0.000010	12.0	0.540	<0.000010	<0.00010	<0.010	0.000980	0.000900	<0.0030	0.0110
		7-Nov-2017	0.0830	<0.000050	0.00270	17.0	0.0380	0.0120	<0.00050	1.60	0.00130	5.10	<0.000010	15.0	0.640	<0.000010	<0.00010	<0.010	0.000980	0.000840	<0.0030	0.00890
		14-Nov-2017	0.0770	<0.000050	0.00240	15.0	0.0280	0.0110	0.000540	1.60	0.00180	4.90	<0.000010	13.0	0.610	<0.000010	<0.00010	<0.010	0.00120	0.000870	<0.0030	0.00790
		21-Nov-2017	0.0420	<0.000050	0.00230	15.0	0.0260	0.0110	<0.00050	1.40	0.00140	5.00	<0.000010	13.0	0.640	<0.000010	<0.00010	<0.010	0.00130	0.000820	0.00880	0.00590
		28-Nov-2017	0.0800	<0.000050	0.00210	18.0	0.0360	0.0140	0.000780	1.80	0.00260	4.80	<0.000010	16.0	0.740	<0.000010	<0.00010	<0.010	0.00170	0.000850	<0.0030	0.00790
		5-Dec-2017	0.0530	<0.000050	0.00210	16.0	0.0270	0.0100	0.000590	1.60	0.00150	4.90	<0.000010	14.0	0.650	<0.000010	<0.00010	<0.010	0.00120	0.000750	<0.0030	0.00570
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	W10	3-Jan-2017	0.320	<0.000050	<0.0010	7.50	0.00660	0.000610	0.00120	0.680	0.000140	5.50	<0.000010	4.60	0.160	<0.000010	<0.00010	<0.010	0.000150	0.000730	<0.0030	0.0590
		1-Feb-2017	0.320	<0.000050	0.00150	8.60	0.00580	0.000660	0.00110	0.770	0.000140	6.20	<0.000010	5.00	0.180	<0.000010	<0.00010	<0.010	0.000180	0.000860	<0.0030	0.0500
		1-Mar-2017	0.340	<0.000050	<0.0010	8.20	0.00660	0.000500	0.00110	0.740	0.000130	6.10	<0.000010	4.50	0.170	<0.000010	<0.00010	<0.010	0.000140	0.000750	<0.0030	0.0500
		3-Apr-2017	0.650	0.000140	<0.0010	5.00	0.0270	0.000340	0.00170	0.780	0.000130	5.40	0.0000150	2.60	0.110	<0.000010	<0.00010	0.0130	0.0000940	0.00130	0.00320	0.0940
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.670	0.000190	<0.0010	3.80	0.0220	0.000390	0.00180	0.640	0.000110	4.60	0.0000110	2.00	0.0820	<0.000010	<0.00010	0.0140	0.0000870	0.00150	<0.0060	0.200
		25-Apr-2017	0.470	0.000110	<0.0010	3.80	0.0130	0.000430	0.00160	0.600	0.000100	4.30	0.0000110	2.00	0.0740	<0.000010	<0.00010	<0.010	0.0000700	0.00140	<0.0030	0.120
		2-May-2017	0.300	0.000120	<0.0010	4.10	0.00960	0.000340	0.00140	0.550	0.000110	4.00	<0.000010	2.20	0.0800	<0.000010	<0.00010	<0.010	0.0000700	0.000920	<0.0030	0.100
		9-May-2017	0.350	0.0000600	<0.0010	3.80	0.0110	0.000280	0.00140	0.540	0.000110	3.40	<0.000010	2.00	0.0640	<0.000010	<0.00010	<0.010	0.0000520	0.00100	<0.0030	0.0920
		17-May-2017	0.320	0.0000840	<0.0010	4.20	0.0100	0.000360	0.00140	0.580	0.000120	3.60	0.0000150	2.20	0.0890	<0.000010	<0.00010	<0.010	0.0000750	0.00100	<0.0030	0.0870
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	0.250	0.0000520	<0.0010	4.50	0.00920	0.000440	0.00130	0.630	0.000150	3.10	<0.000010	2.50	0.100	<0.000010	<0.00010	<0.010	0.0000830	0.000870	<0.0030	0.0620
		1-Jun-2017	0.190	0.0000540	<0.0010	5.20	0.00910	0.000520	0.00130	0.690	0.000160	3.20	<0.000010	2.90	0.120	<0.000010	<0.00010	<0.010	0.0000870	0.000870	<0.0030	0.0460
		4-Jul-2017	0.0750	<0.000050	<0.0010	12.0	0.0180	0.00160	0.000950	1.20	0.000140	4.70	<0.000010	8.70	0.270	<0.000010	<0.00010	<0.010	0.000250	0.000630	<0.0030	0.0110
		17-Aug-2017	0.0470	<0.000050	0.00140	18.0	0.0150	0.00210	0.000670	1.60	0.000110	5.10	<0.000010	15.0	0.360	<0.000010	<0.00010	<0.010	0.000540	0.000620	<0.0030	0.00430
		4-Sep-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Sep-2017	0.0390	<0.000050	0.00130	18.0	0.00960	0.00240	0.000590	1.60	0.000110	5.30	<0.000010	14.0	0.370	<0.000010	<0.00010	<0.010	0.000620	0.000680	0.00400	0.00400
		11-Oct-2017	0.0350	<0.000050	0.00140	18.0	0.00540	0.00230	0.000570	1.40	0.000120	6.10	<0.000010	13.0	0.350	<0.000010	<0.00010	<0.010	0.000580	<0.00050	<0.0030	0.00330
		7-Nov-2017	0.0580	<0.000050	0.00150	14.0	0.00480	0.00120	0.000670	0.920	0.000110	4.70	<0.000010	8.20	0.250	<0.000010	<0.00010	<0.010	0.000250	<0.00050	<0.0030	0.00350
		4-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EDC-01a	3-Jan-2017	0.360	<0.000050	<0.0010	8.70	0.0240	0.00350	0.00180	0.850	0.000930	5.50	0.0000140	6.50	0.220	<0.000010	<0.00010	<0.010	0.000250	0.000860	<0.0030	0.0500
		1-Feb-2017	0.290	<0.000050	<0.0010	12.0	0.0100	0.0140	0.000980	1.50	0.00300	5.80	<0.000010	12.0	0.380	<0.000010	<0.00010	<0.010	0.000500	0.000760	<0.0030	0.0360
		1-Mar-2017	0.320	<0.000050	<0.0010	6.30	0.00760	0.00100	0.00110	0.550	0.000140	5.60	<0.000010	3.70	0.160	<0.000010	<0.00010	<0.010	0.000160	0.000630	<0.0030	0.0480
		31-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.740	0.000170	<0.0010	5.10	0.0310	0.000790	0.00190	0.850	0.000210	5.50	0.0000240	2.90	0.120	<0.000010	<0.00010	0.0150	0.000120	0.00150	<0.0030	0.0950
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.680	0.000200	<0.0010	3.80	0.0210	0.000420	0.00180	0.680	0.000130	4.70	0.0000120	2.20	0.0840	<0.000010	<0.00010	0.0130	0.0000930	0.00150	<0.0060	0.170
		25-Apr-2017	0.450	0.000100	<0.0010	3.80	0.0120	0.000390	0.00160	0.580	0.0000810	4.00	<0.000010	2.00	0.0750	<0.000010	<0.00010	<0.010	0.0000710	0.00120	<0.0030	0.120
		2-May-2017	0.270	0.0000720	<0.0010	4.20	0.00950	0.000550	0.00130	0.560	0.000140	3.90	<0.000010	2.30	0.0830	<0.000010	<0.00010	<0.010	0.0000820	0.000890	<0.0030	0.0950
		9-May-2017	0.310	0.0000770	<0.0010	3.60	0.0100	0.000410	0.00130	0.530	0.000110	3.50	<0.000010	2.00	0.0820	<0.000010	<0.00010	<0.010	0.0000670	0.000970	<0.0030	0.0890
		17-May-2017	0.260	0.0000530	<0.0010	4.20	0.00980	0.000470	0.00140	0.570	0.000110	3.50	0.0000110	2.20	0.0910	<0.000010	<0.00010	<0.010	0.0000790	0.000930	<0.0030	0.0910
		23-May-2017	0.230	<0.000050	<0.0010	4.40	0.0120	0.000540	0.00130	0.640	0.000120	3.20	<0.000010	2.70	0.110	<0.000010	<0.00010	<0.010	0.0000820	0.000890	<0.0030	0.0610
		1-Jun-2017	0.200	0.0000560	<0.0010	5.60	0.0140	0.000820	0.00130	0.770	0.000140	3.30	0.0000220	3.20	0.140	<0.000010	<0.00010	<0.010	0.000110	0.000870	<0.0030	0.0400
		4-Jul-2017	0.0470	<0.000050	<0.0010	12.0	0.0270	0.00170	0.000850	1.20	0.000200	4.40	<0.000010	8.50	0.270	<0.000010	<0.00010	<0.010	0.000330	0.000730	<0.0030	0.0120
		19-Sep-2017	<0.030	<0.000050	0.00100	18.0	0.0200	0.00300	<0.00050	1.40	0.000110	5.20	<0.000010	14.0	0.370	<0.000010	<0.00010	<0.010	0.000680	0.000530	<0.0030	0.00340
		2-Oct-2017	<0.030	<0.000050	0.00130	18.0	0.0200	0.00240	<0.00050	1.50	0.0000880	6.00	<0.000010	15.0	0.370	<0.000010	<0.00010	<0.010	0.000670	0.000570	<0.0030	0.00310
		7-Nov-2017	0.0460	<0.000050	0.00130	14.0	0.0110	0.00130	0.000640	0.960	0.000140	4.60	0.0000170	8.20	0.270	<0.000010	<0.00010	<0.010	0.000300	<0.00050	<0.0030	0.00370
		4-Dec-2017	0.0550	<0.000050	<0.0010	11.0	0.00950	0.00210	0.000650	0.940	0.000330	4.60	<0.000010	7.60	0.260	<0.000010	<0.00010	<0.010	0.000410	<0.00050	<0.0030	0.00850

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2018	HAC-13	2-Jan-2018	<0.030	<0.000050	0.00100	7.80	0.00130	0.0100	<0.00050	1.30	0.000630	2.90	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000580	0.000710	<0.0030	0.00330
		9-Jan-2018	<0.030	<0.000050	<0.0010	7.60	0.00300	0.0100	<0.00050	1.40	0.000630	3.20	<0.000010	12.0	0.390	<0.000010	<0.00010	<0.010	0.000550	0.000710	<0.0030	<0.0030
		16-Jan-2018	<0.030	<0.000050	<0.0010	8.10	0.00260	0.00980	<0.00050	1.40	0.000660	3.10	<0.000010	12.0	0.380	<0.000010	<0.00010	<0.010	0.000540	0.000740	<0.0030	<0.0030
		23-Jan-2018	<0.030	<0.000050	<0.0010	7.10	0.00500	0.00960	<0.00050	1.40	0.000530	3.00	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000510	0.000660	<0.0030	<0.0030
		30-Jan-2018	<0.030	<0.000050	0.00120	6.80	0.0130	0.00980	<0.00050	1.40	0.000570	3.00	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000430	0.000880	<0.0030	<0.0030
		6-Feb-2018	<0.030	<0.000050	<0.0010	6.50	0.0190	0.00960	<0.00050	1.40	0.000600	2.90	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000370	0.000950	<0.0030	<0.0030
		13-Feb-2018	<0.030	<0.000050	0.00100	6.00	0.0180	0.00920	<0.00050	1.40	0.000510	2.70	<0.000010	9.60	0.310	<0.000010	<0.00010	<0.010	0.000320	0.000960	<0.0030	0.00380
		20-Feb-2018	<0.030	<0.000050	<0.0010	5.70	0.0140	0.00920	<0.00050	1.30	0.000550	2.70	<0.000010	9.30	0.320	<0.000010	<0.00010	<0.010	0.000290	0.000910	<0.0030	0.0120
		1-Mar-2018	<0.030	<0.000050	<0.0010	8.60	0.00460	0.00980	<0.00050	1.40	0.000550	2.90	<0.000010	11.0	0.460	<0.000010	<0.00010	<0.010	0.000680	0.000810	0.00800	<0.0030
		8-Mar-2018	<0.030	<0.000050	0.00110	8.60	0.00410	0.00970	<0.00050	1.40	0.000580	3.00	<0.000020	12.0	0.440	<0.000010	<0.00010	<0.010	0.000700	0.000630	<0.0030	<0.0030
		14-Mar-2018	0.0590	<0.000050	<0.0010	10.0	0.0180	0.00960	0.000590	1.60	0.000540	3.30	<0.000010	13.0	0.540	<0.000010	<0.00010	<0.010	0.000900	0.000710	<0.0030	<0.0030
		20-Mar-2018	0.0900	<0.000050	<0.0010	14.0	0.220	0.00950	0.000720	1.70	0.000840	3.40	<0.000010	15.0	0.630	<0.000010	<0.00010	<0.010	0.00160	0.000640	<0.0030	0.00320
		27-Mar-2018	0.0930	<0.000050	<0.0010	14.0	0.240	0.0110	0.000820	1.90	0.00110	3.80	<0.000010	16.0	0.720	<0.000010	<0.00010	<0.010	0.00170	0.000640	<0.0030	<0.0030
		3-Apr-2018	0.0870	<0.000050	<0.0010	7.60	0.0790	0.0100	0.00120	1.40	0.000630	2.80	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000540	0.000910	<0.0030	<0.0030
		10-Apr-2018	0.0380	<0.000050	0.00100	7.00	0.0580	0.00980	<0.00050	1.30	0.000670	2.90	<0.000010	9.80	0.360	<0.000010	<0.00010	<0.010	0.000450	0.000870	<0.0030	<0.0030
		17-Apr-2018	0.0620	<0.000050	<0.0010	7.60	0.0740	0.0110	<0.00050	1.40	0.000760	3.10	<0.000010	10.0	0.410	<0.000010	<0.00010	<0.010	0.000530	0.00100	<0.0030	0.00780
		24-Apr-2018	1.00	0.000320	0.00240	14.0	0.480	0.0200	0.00160	1.90	0.00250	5.10	0.0000170	12.0	0.670	<0.000010	<0.00010	0.0410	0.00180	0.00290	0.00390	0.0300
		1-May-2018	0.190	<0.000050	<0.0010	4.30	0.0460	0.00550	0.000710	0.870	0.000580	3.60	0.0000150	5.20	0.200	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	0.0640
		8-May-2018	0.180	0.0000630	<0.0010	4.60	0.0180	0.00620	0.000590	0.980	0.000450	3.10	<0.000010	6.20	0.210	<0.000010	<0.00010	<0.010	0.000240	0.00120	<0.0030	0.0320
		16-May-2018	0.190	0.0000720	<0.0010	6.10	0.0250	0.00890	<0.00050	1.40	0.000680	2.90	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000350	0.00160	<0.0030	0.00800
		24-May-2018	0.0550	<0.000050	<0.0010	5.50	0.0140	0.00880	<0.00050	1.30	0.000580	2.50	<0.000010	8.80	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00540
		29-May-2018	0.0560	<0.000050	<0.0010	5.30	0.0120	0.00860	<0.00050	1.10	0.000530	2.40	<0.000010	8.00	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	1.20
		5-Jun-2018	<0.030	<0.000050	<0.0010	5.80	0.00740	0.00840	<0.00050	1.30	0.000500	2.30	<0.000010	8.90	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	0.00500
		12-Jun-2018	<0.030	<0.000050	<0.0010	5.90	0.00880	0.00880	<0.00050	1.30	0.000540	2.40	<0.000010	9.30	0.300	<0.000010	<0.00010	<0.010	0.000240	0.00120	<0.0030	0.00570
		18-Jun-2018	<0.030	<0.000050	<0.0010	5.90	0.00960	0.00870	<0.00050	1.30	0.000550	2.20	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000250	0.00100	<0.0030	0.00410
		26-Jun-2018	<0.030	<0.000050	<0.0010	5.90	0.00830	0.00860	<0.00050	1.30	0.000590	2.20	<0.000010	9.20	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00340
		4-Jul-2018	<0.030	<0.000050	<0.0010	6.20	0.00860	0.00910	<0.00050	1.30	0.000580	2.20	<0.000010	9.20	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	0.00370
		10-Jul-2018	<0.030	<0.000050	<0.0010	5.90	0.0110	0.00900	<0.00050	1.30	0.000580	2.20	<0.000010	8.90	0.300	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	0.00620
		17-Jul-2018	<0.030	<0.000050	<0.0010	6.00	0.0140	0.00890	<0.00050	1.40	0.000600	2.40	<0.000010	9.70	0.300	<0.000010	<0.00010	<0.010	0.000250	0.00130	<0.0030	0.00460
		24-Jul-2018	0.0360	<0.000050	<0.0010	5.70	0.0130	0.00860	<0.00050	1.30	0.000500	2.20	<0.000010	8.90	0.290	<0.000010	<0.00010	<0.010	0.000270	0.00110	<0.0030	0.00450
		2-Aug-2018	<0.030	<0.000050	<0.0010	5.70	0.0120	0.00870	<0.00050	1.30	0.000550	2.40	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	0.00410
		7-Aug-2018	<0.030	<0.000050	<0.0010	5.40	0.0120	0.00770	<0.00050	1.20	0.000530	2.30	<0.000010	8.20	0.260	<0.000010	<0.00010	<0.010	0.000240	0.00110	<0.0030	0.00350
		14-Aug-2018	<0.030	<0.000050	<0.0010	5.50	0.0150	0.00860	<0.00050	1.20	0.000450	2.20	<0.000010	8.80	0.320	<0.000010	<0.00010	<0.010	0.000240	0.00100	<0.0030	0.00380
		21-Aug-2018	<0.030	<0.000050	<0.0010	6.10	0.0120	0.00840	<0.00050	1.20	0.000490	2.30	<0.000010	9.50	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00430
		28-Aug-2018	<0.030	<0.000050	<0.0010	5.90	0.00980	0.00830	<0.00050	1.30	0.000500	2.30	<0.000010	8.90	0.280	<0.000010	<0.00010	<0.010	0.000250	0.00120	<0.0030	0.00360
		4-Sep-2018	<0.030	<0.000050	<0.0010	5.30	0.00750	0.00800	<0.00050	1.10	0.000490	2.20	<0.000010	8.60	0.260	<0.000010	<0.00010	<0.010	0.000250	0.000970	<0.0030	0.00920
		10-Sep-2018	0.130	0.0000540	0.00120	9.50	0.0220	0.00820	<0.00050	1.40	0.00120	3.20	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000530	0.00130	<0.0030	0.00810
		20-Sep-2018	<0.030	<0.000050	<0.0010	5.90	0.00800	0.00900	<0.00050	1.20	0.000580	2.30	<0.000010	9.40	0.300	<0.000010	<0.00010	<0.010	0.000260	0.000980	<0.0030	0.00300
		24-Sep-2018	<0.030	<0.000050	<0.0010	6.00	0.00860	0.00940	<0.00050	1.30	0.000670	2.20	<0.000010	9.00	0.320	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	0.00450
		2-Oct-2018	0.0320	<0.000050	<0.0010	5.80	0.00840	0.00790	<0.00050	1.20	0.000500	2.20	<0.000010	9.10	0.270	<0.000010	<0.00010	<0.010	0.000310	0.000880	<0.0030	<0.0030
		9-Oct-2018	<0.030	<0.000050	<0.0010	6.60	0.00890	0.0100	<0.00050	1.30	0.000730	2.20	<0.000010	9.40	0.330	<0.000010	<0.00010	<0.010	0.000370	0.000960	<0.0030	<0.0030
		16-Oct-2018	0.0310	<0.000050	<0.0010	6.30	0.00810	0.00950	<0.00050	1.20	0.000530	2.40	<0.000010	9.60	0.340	<0.000010	<0.00010	<0.010	0.000360	0.000900	<0.0030	<0.0030
		23-Oct-2018	0.0300	<0.000050	<0.0010	5.60	0.00580	0.00860	<0.00050	1.10	0.000510	2.10	<0.000010	8.40	0.310	<0.000010	<0.00010	<0.010	0.000300	0.000770	<0.0030	<0.0030
		30-Oct-2018	0.0450	<0.000050	<0.0010	6.00	0.00670	0.00830	<0.00050	1.30	0.000460	3.00	<0.000010	9.30	0.320	<0.000010	<0.00010	<0.010	0.000280	0.000970	<0.0030	<0.0030
		6-Nov-2018	0.180	<0.000050	<0.0010	9.00	0.0280	0.0100	0.000600	1.40	0.00110	3.30	<0.000010	10.0	0.410	<0.000010	<0.00010	<0.010	0.000690	0.00130	<0.0030	0.0380
		13-Nov-2018	0.0750	<0.000050	<0.0010	8.00	0.0210	0.00950	<0.00050	1.30	0.000680	3.00	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000540	0.000970	<0.0030	0.00930
		27-Nov-2018	0.190	0.0000550	0.00100	11.0	0.0870	0.0120	0.000510	1.60	0.00140	3.60	0.0000100	11.0	0.490	<0.000010	<0.00010	<0.010	0.00110	0.00120	<0.0030	0.0220
		4-Dec-2018	0.0600	<0.000050	<0.0010	7.70	0.0480	0.00940	<0.00050	1.40	0.000780	3.00	<0.000010	10.0	0.390	<0.000010	<0.00010	0.00160	0.000520	0.00100	<0.0030	0.0110
	HAC-05a	2-Jan-2018	<0.030	<0.000050	<0.0010	13.0	0.0190	0.00760	<0.00050	1.30	0.00140	4.90	<0.000010	12.0	0.460	<0.000010	<0.00010	<0.010	0.000780	0.000770	<0.0030	0.00490
		9-Jan-2018	0.0390	0.0000750	0.00100	12.0	0.0240	0.00830	<0.00050	1.40	0.00150	5.10	<0.000010	13.0	0.480	<0.000010	<0.00010	<0.010	0.000760	0.000840	<0.0030	0.00550
		16-Jan-2018	<0.030	<0.000050	<0.0010	12.0	0.0180	0.00790	<0.00050	1.40	0.00160	4.70	<0.000010	13.0	0.430	<0.000010	<0.00010	<0.010	0.000740	0.000820	<0.0030	0.00490
		23-Jan-2018	<0.030	<0.000050	<0.0010	11.0	0.0190	0.00790	<0.00050	1.40	0.00130	4.60	<0.000010	12.0	0.420	<0.000010	<0.00010	<0.010	0.000780	0.000770	<0.0030	0.00490
		30-Jan-2018	0.0550	<0.000050	<0.0010	9.70	0.0210	0.00830	<0.00050	1.40	0.00100	4.20	<0.000010	11.0	0.420	<0.000010	<0.00010	<0.010	0.000640	0.000990	<0.0030	0.00400
		6-Feb-2018	0.0600	<0.000050	<0.0010	7.50	0.0160	0.00960	<0.00050	1.40	0.000810	3.20	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000460	0.000980	<0.0030	0.00340
		13-Feb-2018	0.140	0.0000550	0.00130	6.50	0.0200	0.00880	<0.00050	1.30	0.000720	3.20	<0.000010	9.40	0.320	<0.000010	<0.00010	<0.010	0.000370	0.00110	<0.0030	0.00300
		20-Feb-2018	<0.030	<0.000050	<0.0010	6.00	0.0110	0.00880	<0.00050	1.30	0.000620	2.90	<0.000010	9.80	0.320	<0.000010	<0.00010	<0.010	0.000330	0.000900	<0.0030	0.0210
		14-Mar-2018	0.0970	<0.000050	<0.0010	14.0	0.0610	0.00780	<0.00050	1.50	0.00220	5.00	<0.000010	13.0	0.550	<0.000010	<0.00010	<0.010	0.00120	0.000980	0.00450	0.00590
		20-Mar-2018	0.0620	<0.000050	<0.0010	16.0	0.0560	0.00780	<0.00050	1.60	0.00250	4.30	<0.000010	14.0	0.600	<0.000010	<0.00010	<0.010	0.00170	0.000810	0.00390	0.00490
		27-Mar-2018	0.0710	<0.000050	<0.0010	17.0	0.0740	0.00880	0.000580	1.80	0.00250	4.80	<0.000010	16.0	0.660	<0.000010	<0.00010	<0.010	0.00170	0.000830	0.00360	0.00450
		3-Apr-2018	0.0730	<0.000050	<0.0010	9.20	0.0490	0.00920	<0.00050	1.40	0.00100	3.20	<0.000010	11.0	0.410	<0.000010	<0.00010	<0.010	0.000690	0.00100	<0.0030	0.00350
		10-Apr-2018	0.0730	<0.000050	<0.0010	7.70	0.0590	0.00990	<0.00050	1.40	0.000880	3.10	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000550	0.000930	<0.0030	0.00340
		17-Apr-2018	0.0910	<0.000050	<0.0010	8.60	0.0710	0.0110	<0.00050	1.50	0.00110	3.20	<0.000010	11.0	0.450	<0.000010	<0.00010	<0.010	0.000610	0.00110	<0.0030	0.00910
		24-Apr-2018	0.490	0.000140	0.00160	13.0	0.320	0.0160	0.00110	1.90	0.00250	4.30	0.0000130	11.0	0.620	<0.000010	<0.00010	0.0140	0.00170	0.00160	<0.0030	0.0250
		1-May-2018	1.10	0.000370	0.00140	5.60	0.0860	0.00540	0.00170	1.20	0.000680	5.50	0.0000200	5.50	0.220	<0.000010	<0.00010	0.0490	0.000370	0.00370	0.00450	0.0580
		8-May-2018	0.270	0.0000940	<0.0010	5.40	0.0340	0.00580	0.000790	1.10	0.000520	3.60	<0.000010	6.40	0.220	<0.000010	<0.00010	0.0110	0.000280	0.00150	<0.0030	0.0350
		16-May-2018	0.130	0.0000530	<0.0010	7.80	0.0420	0.00870	<0.00050	1.50	0.000870	3.10	<0.000010	9.50	0.340	<0.000010	<0.00010	<0.010	0.000440	0.00140	<0.0030	0.00990
		24-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2018	HAC-05a	5-Jun-2018	<0.030	<0.000050	<0.0010	7.20	0.0180	0.00820	<0.00050	1.30	0.000840	2.60	<0.000010	9.60	0.330	<0.000010	<0.00010	<0.010	0.000360	0.00120	<0.0030	0.00440
		12-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2018	0.0540	<0.000050	<0.0010	7.40	0.0150	0.00890	0.000860	1.30	0.000970	2.60	<0.000010	9.40	0.330	<0.000010	<0.00010	<0.010	0.000380	0.00100	<0.0030	0.00610
		10-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2018	<0.030	<0.000050	<0.0010	7.00	0.0110	0.00830	<0.00050	1.30	0.000890	2.50	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	0.00440
		7-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Sep-2018	<0.030	<0.000050	<0.0010	7.70	0.0110	0.00750	<0.00050	1.20	0.00110	2.80	<0.000010	9.40	0.310	<0.000010	<0.00010	<0.010	0.000350	0.000950	<0.0030	0.00600
		10-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Sep-2018	<0.030	<0.000050	<0.0010	9.00	0.0200	0.00900	<0.00050	1.40	0.00210	2.90	<0.000010	10.0	0.400	<0.000010	<0.00010	<0.010	0.000530	0.00100	<0.0030	<0.0030
		2-Oct-2018	<0.030	<0.000050	<0.0010	8.20	0.0140	0.00730	<0.00050	1.20	0.00140	2.90	<0.000010	9.90	0.320	<0.000010	<0.00010	<0.010	0.000420	0.000760	<0.0030	<0.0030
		9-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		16-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Nov-2018	0.370	0.000100	0.00100	11.0	0.0450	0.0100	0.000800	1.60	0.00170	4.20	<0.000010	10.0	0.460	<0.000010	<0.00010	0.0130	0.000820	0.00170	<0.0030	0.0360
		13-Nov-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Nov-2018	0.720	0.000250	0.00130	12.0	0.100	0.0100	0.00110	1.80	0.00200	4.80	0.0000180	9.40	0.460	<0.000010	<0.00010	0.0250	0.00110	0.00230	0.00350	0.0430
		4-Dec-2018	0.0770	<0.000050	<0.0010	9.90	0.0580	0.00860	<0.00050	1.40	0.00150	4.00	<0.000010	11.0	0.440	<0.000010	<0.00010	<0.0018	0.000630	0.000960	<0.0030	0.0120
	HAC-14	2-Jan-2018	0.0540	<0.000050	0.00170	15.0	0.0400	0.00940	<0.00050	1.40	0.00120	5.40	<0.000010	14.0	0.580	<0.000010	<0.00010	<0.010	0.000920	0.000700	<0.0030	0.00420
		9-Jan-2018	0.0670	<0.000050	0.00210	14.0	0.0430	0.00950	<0.00050	1.50	0.00120	5.40	<0.000010	14.0	0.560	<0.000010	<0.00010	<0.010	0.000920	0.000710	<0.0030	0.00480
		16-Jan-2018	0.0580	<0.000050	0.00170	15.0	0.0360	0.00960	<0.00050	1.50	0.00150	5.50	<0.000010	14.0	0.570	<0.000010	<0.00010	<0.010	0.000950	0.000750	<0.0030	0.00490
		23-Jan-2018	0.0670	<0.000050	0.00160	14.0	0.0390	0.00940	<0.00050	1.50	0.00110	5.20	<0.000010	13.0	0.520	<0.000010	<0.00010	<0.010	0.000920	0.000720	<0.0030	0.00460
		10-Apr-2018	1.20	0.000380	0.00160	8.70	0.110	0.00940	0.00210	1.50	0.00100	5.20	<0.000010	10.0	0.390	<0.000010	<0.00010	0.0510	0.000650	0.00330	0.00450	0.00790
		17-Apr-2018	0.280	0.000130	<0.0010	8.30	0.0680	0.00970	0.000910	1.40	0.000950	3.70	<0.000010	10.0	0.450	<0.000010	<0.00010	<0.010	0.000700	0.00140	0.0130	0.0240
		24-Apr-2018	1.90	0.000620	0.00230	11.0	0.230	0.0110	0.00280	1.70	0.00180	6.60	0.0000190	9.00	0.480	<0.000010	<0.00010	0.0640	0.00130	0.00460	0.00600	0.0640
		1-May-2018	2.20	0.000730	0.00220	5.70	0.0970	0.00440	0.00330	1.30	0.000610	6.80	0.0000280	4.70	0.220	0.0000130	<0.00010	0.0730	0.000400	0.00530	0.00690	0.0890
		8-May-2018	0.610	0.000220	0.00100	5.30	0.0450	0.00540	0.00140	1.10	0.000600	4.30	0.0000130	5.50	0.220	<0.000010	<0.00010	0.0210	0.000300	0.00220	<0.0030	0.0620
		16-May-2018	0.180	0.0000670	0.00120	8.40	0.0510	0.00830	<0.00050	1.50	0.000930	3.60	<0.000010	9.40	0.360	<0.000010	<0.00010	<0.010	0.000520	0.00150	<0.0030	0.0230
		24-May-2018	0.0920	0.0000650	0.00100	7.30	0.0380	0.00900	<0.00050	1.40	0.000860	3.10	<0.000010	9.50	0.350	<0.000010	<0.00010	<0.010	0.000420	0.00130	<0.0030	0.0120
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	0.0580	<0.000050	0.00100	8.40	0.0280	0.00870	<0.00050	1.40	0.000840	3.00	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000440	0.00130	<0.0030	0.00730
		12-Jun-2018	0.0540	<0.000050	<0.0010	7.50	0.0220	0.00900	<0.00050	1.40	0.000720	2.80	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000320	0.00120	<0.0030	0.00810
		18-Jun-2018	0.0530	<0.000050	<0.0010	7.60	0.0220	0.00860	<0.00050	1.40	0.000800	2.60	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000330	0.00110	<0.0030	0.00730
		26-Jun-2018	0.0760	<0.000050	0.00100	8.20	0.0240	0.00910	<0.00050	1.40	0.00140	3.00	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000420	0.00120	<0.0030	0.00870
		4-Jul-2018	0.0840	0.0000630	0.00110	8.60	0.0220	0.0100	<0.00050	1.40	0.00110	3.00	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000460	0.00120	0.00370	0.0100
		10-Jul-2018	0.0610	<0.000050	0.00110	7.70	0.0220	0.00890	<0.00050	1.30	0.000980	2.80	<0.000010	9.10	0.360	<0.000010	<0.00010	<0.010	0.000430	0.00110	<0.0030	0.00750
		17-Jul-2018	0.0810	<0.000050	<0.0010	7.50	0.0200	0.00910	<0.00050	1.40	0.000850	2.80	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000320	0.00130	<0.0030	0.00790
		24-Jul-2018	0.0330	<0.000050	<0.0010	7.30	0.0140	0.00880	<0.00050	1.30	0.000790	2.30	<0.000010	9.50	0.330	<0.000010	<0.00010	<0.010	0.000320	0.00110	<0.0030	0.0110
		2-Aug-2018	0.0390	<0.000050	<0.0010	7.80	0.0170	0.00860	<0.00050	1.40	0.000820	2.70	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000340	0.00100	<0.0030	0.00570
		7-Aug-2018	0.0660	0.0000570	<0.0010	7.20	0.0160	0.00790	<0.00050	1.30	0.000810	2.40	<0.000010	8.90	0.330	<0.000010	<0.00010	<0.010	0.000350	0.00100	<0.0030	0.00550
		14-Aug-2018	0.320	0.000150	0.00120	8.10	0.0250	0.00870	0.000740	1.40	0.000800	3.10	<0.000010	9.50	0.390	<0.000010	<0.00010	0.0150	0.000400	0.00180	<0.0030	0.0200
		21-Aug-2018	0.0880	<0.000050	0.00110	8.50	0.0180	0.00810	<0.00050	1.40	0.000940	2.70	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000410	0.00120	<0.0030	0.00770
		28-Aug-2018	0.110	<0.000050	0.00140	9.30	0.0210	0.00810	<0.00050	1.50	0.000990	3.10	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000460	0.00140	<0.0030	0.00830
		4-Sep-2018	0.110	<0.000050	0.00110	8.40	0.0190	0.00830	<0.00050	1.30	0.00110	3.00	<0.000010	9.60	0.360	<0.000010	<0.00010	<0.010	0.000480	0.00120	<0.0030	0.0130
		10-Sep-2018	<0.030	<0.000050	<0.0010	5.60	0.00930	0.00820	<0.00050	1.20	0.000500	2.10	<0.000010	8.80	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00100	<0.0030	0.00340
		20-Sep-2018	0.800	0.000280	0.00190	11.0	0.0480	0.00900	0.000970	1.60	0.00190	4.80	<0.000010	11.0	0.440	<0.000010	<0.00010	0.0340	0.000690	0.00280	0.00300	0.00740
		24-Sep-2018	1.70	0.000490	0.00260	12.0	0.0820	0.00980	0.00140	1.80	0.00210	6.50	0.0000150	11.0	0.510	<0.000010	<0.00010	0.0930	0.000780	0.00510	0.00620	0.0110
		2-Oct-2018	0.0850	<0.000050	0.00120	10.0	0.0230	0.00820	<0.00050	1.30	0.00120	3.30	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000590	0.000900	0.00330	0.00340
		9-Oct-2018	0.810	0.000280	0.00180	11.0	0.0530	0.00960	0.000850	1.50	0.00200	4.80	<0.000010	11.0	0.470	<0.000010	<0.00010	0.0400	0.000780	0.00300	0.00350	0.00680
		16-Oct-2018	0.130	<0.000050	0.00140	12.0	0.0310	0.00880	<0.00050	1.40	0.00140	4.10	<0.000010	12.0	0.460	<0.000010	<0.00010	<0.010	0.000690	0.00110	<0.0030	0.00550
		23-Oct-2018	0.120	<0.000050	0.00130	12.0	0.0300	0.00850	<0.00050	1.30	0.00140	4.20	<0.000010	11.0	0.450	<0.000010	<0.00010	<0.010	0.000620	0.00120	<0.0030	0.00460
		30-Oct-2018	0.160	0.0000650	0.00120	10.0	0.0290	0.00840	<0.00050	1.40	0.00110	4.00	<0.000010	11.0	0.440	<0.000010	<0.00010	<0.010	0.000580	0.00130	<0.0030	0.00510
		6-Nov-2018	0.740	0.000220	0.00130	11.0	0.0460	0.00770	0.00200	1.50	0.00130	5.40	0.0000200	8.70	0.430	<0.000010	<0.00010	0.0290	0.000780	0.00240	0.0210	0.170
		13-Nov-2018	0.200	0.0000600	0.00130	12.0	0.0340	0.00810	0.000540	1.40	0.00120	4.00	<0.000010	11.0	0.460	<0.000010	<0.00010	<0.010	0.000770	0.00110	<0.0030	0.0550
		27-Nov-2018	1.70	0.000730	0.00180	10.0	0.100	0.00800	0.00240	1.60	0.00150	6.00	0.0000220	7.60	0.400	<0.000010	<0.00010	0.0570	0.000970	0.00440	0.00650	0.140
		4-Dec-2018	0.260	0.0000710	0.00100	11.0	0.0450	0.00820	0.000720	1.50	0.00150	4.60	<0.000010	11.0	0.470	<0.000010	<0.00010	0.00970	0.000710	0.00130	<0.0030	0.0700

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2018	HAC-08	2-Jan-2018	0.0520	<0.000050	0.00250	17.0	0.0330	0.0100	0.000510	1.50	0.00120	5.80	<0.000010	15.0	0.650	<0.000010	<0.00010	<0.010	0.00110	0.000770	<0.0030	0.00410
		9-Jan-2018	0.0470	<0.000050	0.00240	15.0	0.0320	0.00960	0.000600	1.50	0.00120	5.50	<0.000010	14.0	0.590	<0.000010	<0.00010	<0.010	0.00110	0.000730	<0.0030	0.00460
		16-Jan-2018	0.0350	<0.000050	0.00220	19.0	0.0310	0.00970	0.000620	1.80	0.00130	5.50	<0.000010	18.0	0.590	<0.000010	<0.00010	<0.010	0.00110	0.000870	<0.0030	0.00790
		23-Jan-2018	0.0500	<0.000050	0.00230	15.0	0.0290	0.00980	<0.00050	1.50	0.00110	5.30	<0.000010	14.0	0.580	<0.000010	<0.00010	<0.010	0.00120	0.000680	<0.0030	0.00410
		30-Jan-2018	0.0630	<0.000050	0.00250	13.0	0.0280	0.00920	0.000640	1.60	0.00110	5.00	<0.000010	13.0	0.560	<0.000010	<0.00010	<0.010	0.00100	0.000910	<0.0030	0.00490
		6-Feb-2018	0.140	0.0000870	0.00110	10.0	0.0290	0.0110	0.000770	1.60	0.00100	3.90	<0.000010	12.0	0.600	<0.000010	<0.00010	<0.010	0.000840	0.00120	<0.0030	0.00500
		13-Feb-2018	0.260	0.000150	0.00170	8.10	0.0300	0.00960	0.000750	1.40	0.000700	3.60	<0.000010	10.0	0.410	<0.000010	<0.00010	0.0110	0.000560	0.00140	<0.0030	0.00490
		20-Feb-2018	<0.030	<0.000050	0.00120	7.00	0.0120	0.00930	<0.00050	1.30	0.000710	3.20	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000440	0.000860	<0.0030	0.120
		14-Mar-2018	0.0710	<0.000050	0.00280	16.0	0.0300	0.00900	0.000880	1.60	0.00180	5.20	<0.000010	16.0	0.680	<0.000010	<0.00010	<0.010	0.00140	0.000760	<0.0030	<0.0040
		20-Mar-2018	0.0570	<0.000050	0.00240	17.0	0.0310	0.00880	0.000940	1.50	0.00200	4.70	<0.000010	15.0	0.660	<0.000010	<0.00010	<0.010	0.00180	0.000770	<0.0030	0.00640
		27-Mar-2018	0.370	0.000200	0.00260	16.0	0.0520	0.00880	0.00140	1.60	0.00190	5.30	<0.000010	15.0	0.670	<0.000010	<0.00010	0.0110	0.00180	0.00140	<0.0030	0.00760
		3-Apr-2018	0.180	0.000100	0.00150	11.0	0.0350	0.00930	0.000820	1.40	0.00100	3.70	<0.000010	11.0	0.480	<0.000010	<0.00010	<0.010	0.000960	0.00110	<0.0030	0.00650
		10-Apr-2018	2.40	0.00110	0.00300	9.00	0.180	0.00840	0.00420	1.60	0.000980	6.70	0.0000320	9.70	0.410	0.0000270	<0.00010	0.0780	0.000790	0.00600	0.00900	0.00930
		17-Apr-2018	0.420	0.000390	<0.0010	8.50	0.0640	0.00830	0.00110	1.40	0.000850	3.90	<0.000010	9.20	0.390	<0.000010	<0.00010	0.0140	0.000660	0.00160	<0.0030	0.0280
		24-Apr-2018	1.30	0.000430	0.00180	9.50	0.160	0.00920	0.00220	1.50	0.00150	5.70	0.0000200	7.30	0.410	<0.000010	<0.00010	0.0440	0.00110	0.00320	0.00460	0.0600
		1-May-2018	2.20	0.000750	0.00200	5.20	0.0940	0.00390	0.00340	1.20	0.000590	6.50	0.0000230	4.20	0.200	0.0000180	<0.00010	0.0650	0.000400	0.00480	0.00670	0.0820
		8-May-2018	0.950	0.000320	0.00130	5.40	0.0480	0.00480	0.00190	1.10	0.000520	4.80	0.0000140	5.00	0.210	<0.000010	<0.00010	0.0330	0.000310	0.00280	0.00340	0.0600
		16-May-2018	0.280	0.000100	0.00140	8.40	0.0500	0.00780	0.000720	1.50	0.000840	3.80	<0.000010	9.20	0.360	<0.000010	<0.00010	<0.010	0.000550	0.00160	<0.0030	0.0230
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	0.110	<0.000050	0.00140	8.70	0.0280	0.00880	<0.00050	1.50	0.000780	3.00	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000510	0.00140	<0.0030	0.00900
		4-Jul-2018	0.110	<0.000050	0.00130	8.80	0.0210	0.00920	<0.00050	1.40	0.00100	3.00	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000480	0.00120	<0.0030	0.00810
		2-Aug-2018	0.0700	<0.000050	0.00120	7.90	0.0150	0.00890	<0.00050	1.40	0.000840	2.70	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000390	0.00110	<0.0030	0.00720
		4-Sep-2018	0.0620	<0.000050	0.00130	8.80	0.00920	0.00840	<0.00050	1.30	0.00100	2.80	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000540	0.00100	<0.0030	0.0210
		2-Oct-2018	0.0550	<0.000050	0.00140	10.0	0.0160	0.00780	0.000530	1.30	0.00110	3.20	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000630	0.000850	<0.0030	0.00370
		6-Nov-2018	0.840	0.000240	0.00150	10.0	0.0480	0.00670	0.00180	1.40	0.00130	5.30	0.0000190	8.20	0.400	<0.000010	<0.00010	0.0290	0.000750	0.00250	<0.0030	0.160
		27-Nov-2018	2.60	0.00100	0.00250	9.80	0.120	0.00690	0.00370	1.60	0.00130	7.10	0.0000250	6.90	0.370	0.0000180	<0.00010	0.0770	0.000920	0.00580	0.00860	0.0860
		4-Dec-2018	0.280	0.000100	0.00120	12.0	0.0540	0.00770	0.000910	1.50	0.00130	4.90	<0.000010	11.0	0.460	<0.000010	<0.00010	0.00940	0.000760	0.00140	<0.0030	0.0580
	W10	2-Jan-2018	0.0610	<0.000050	0.00110	14.0	0.00260	0.00130	0.000700	0.980	0.000140	5.60	<0.000010	8.80	0.280	<0.000010	<0.00010	<0.010	0.000290	<0.00050	<0.0030	0.00550
		14-Feb-2018	0.0800	<0.000050	0.00140	12.0	0.00260	0.00110	0.000580	0.940	0.000130	5.00	<0.000010	7.50	0.230	<0.000010	<0.00010	<0.010	0.000330	<0.00050	<0.0030	0.00490
		14-Mar-2018	0.0670	<0.000050	<0.0010	14.0	0.00290	0.00130	0.000610	0.930	0.000150	5.60	<0.000010	8.70	0.270	<0.000010	<0.00010	<0.010	0.000420	<0.00050	<0.0030	0.00510
		3-Apr-2018	0.220	<0.000050	<0.0010	8.20	0.00760	0.000650	0.00120	0.750	0.000180	4.80	<0.000010	4.40	0.170	<0.000010	<0.00010	<0.010	0.000160	0.000760	<0.0030	0.0300
		1-May-2018	0.850	0.000220	<0.0010	3.10	0.0230	0.000260	0.00200	0.630	0.000160	4.50	0.0000110	1.80	0.0650	<0.000010	<0.00010	0.0160	0.0000790	0.00170	<0.0030	0.110
		5-Jun-2018	0.0490	<0.000050	<0.0010	8.30	0.00360	0.00110	0.00100	0.940	0.000210	4.70	<0.000010	6.30	0.180	<0.000010	<0.00010	<0.010	0.000150	0.000760	<0.0030	0.0200
		4-Jul-2018	0.0760	<0.000050	<0.0010	9.30	0.00480	0.00100	0.00100	0.920	0.000150	4.50	<0.000020	5.60	0.190	<0.000010	<0.00010	<0.010	0.000140	0.000610	<0.0030	0.0130
		2-Aug-2018	0.0650	<0.000050	0.00140	15.0	0.00690	0.00190	0.000690	1.50	0.000130	5.80	<0.000010	11.0	0.310	<0.000010	<0.00010	<0.010	0.000350	0.000820	<0.0030	0.0100
		4-Sep-2018	<0.030	<0.000050	0.00130	17.0	0.00330	0.00210	<0.00050	1.30	0.000110	5.20	<0.000010	13.0	0.320	<0.000010	<0.00010	<0.010	0.000580	0.000590	<0.0030	0.00580
		2-Oct-2018	<0.030	<0.000050	0.00100	14.0	0.00280	0.00150	0.000670	1.20	0.000140	5.40	<0.000010	10.0	0.260	<0.000010	<0.00010	<0.010	0.000330	<0.00050	<0.0030	0.00420
		6-Nov-2018	0.570	0.000110	<0.0010	4.00	0.0120	0.000320	0.00180	0.660	0.000160	4.50	0.0000100	2.40	0.0830	<0.000010	<0.00010	0.0120	0.0000880	0.00160	<0.0030	0.180
	EDC-01a	2-Jan-2018	0.0440	<0.000050	<0.0010	14.0	0.0170	0.00380	0.000580	1.20	0.000480	4.90	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000820	<0.00050	<0.0030	<0.0030
		30-Jan-2018	0.0540	<0.000050	<0.0010	14.0	0.0200	0.00310	0.000570	1.20	0.000380	5.20	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000740	0.000590	<0.0030	0.00440
		14-Feb-2018	0.0580	<0.000050	0.00140	13.0	0.0150	0.00360	0.000570	1.20	0.000390	5.00	<0.000010	9.40	0.350	<0.000010	<0.00010	<0.010	0.000640	<0.00050	<0.0030	0.00420
		14-Mar-2018	0.0470	<0.000050	<0.0010	14.0	0.0190	0.00370	0.000540	1.20	0.000480	5.20	<0.000010	10.0	0.400	<0.000010	<0.00010	<0.010	0.000730	<0.00050	<0.0030	<0.0030
		3-Apr-2018	0.180	<0.000050	<0.0010	9.00	0.0100	0.00160	0.00100	0.850	0.000380	4.70	<0.000010	5.40	0.210	<0.000010	<0.00010	<0.010	0.000340	0.000720	<0.0030	0.0250
		1-May-2018	1.00	0.000340	<0.0010	3.20	0.0290	0.000300	0.00230	0.660	0.000150	4.80	0.0000110	1.90	0.0680	<0.000010	<0.00010	0.0230	0.000120	0.00210	0.00310	0.110
		5-Jun-2018	0.0450	<0.000050	<0.0010	8.60	0.0120	0.00110	0.000950	0.920	0.000140	4.60	<0.000010	5.90	0.190	<0.000010	<0.00010	<0.010	0.000210	0.000790	<0.0030	0.0180
		4-Jul-2018	0.0460	<0.000050	<0.0010	9.80	0.0160	0.00190	0.000920	1.00	0.000140	4.50	<0.000010	6.40	0.220	<0.000010	<0.00010	<0.010	0.000230	0.000650	<0.0030	0.0120
		2-Aug-2018	<0.030	<0.000050	0.00120	13.0	0.0320	0.00630	0.000590	1.70	0.000300	4.70	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000530	0.000780	<0.0030	0.00520
		4-Sep-2018	<0.030	<0.000050	0.00110	15.0	0.0290	0.00380	<0.00050	1.40	0.000140	4.70	<0.000010	12.0	0.320	<0.000010	<0.00010	<0.010	0.000650	0.000680	<0.0030	0.00340
		2-Oct-2018	<0.030	<0.000050	<0.0010	12.0	0.0200	0.00270	0.000710	1.20	0.000250	4.80	<0.000010	9.60	0.270	<0.000010	<0.00010	<0.010	0.000450	<0.00050	<0.0030	0.00300
		6-Nov-2018	0.540	0.0000960	<0.0010	4.40	0.0120	0.000320	0.00170	0.650	0.000150	4.40	0.0000110	2.40	0.0860	<0.000010	<0.00010	0.0110	0.0000920	0.00140	<0.0030	0.170
	HAC-13	8-Jan-2019	<0.030	<0.000050	<0.0010	6.20	0.0230	0.00870	<0.00050	1.30	0.000480	3.00	<0.000010	9.60	0.320	<0.000010	<0.00010	<0.010	0.000330	0.00100	<0.0030	0.00380
		5-Feb-2019	<0.030	<0.000050	<0.0010	6.00	0.0270	0.00750	<0.00050	1.20	0.000510	2.80	<0.000010	9.30	0.290	<0.000010	<0.00010	<0.010	0.000290	0.000950	<0.0030	0.00410
		4-Mar-2019	<0.030	<0.000050	<0.0010	6.10	0.0150	0.00820	<0.00050	1.20	0.000510	3.20	<0.000010	9.20	0.300	<0.000010	<0.00010	<0.010	0.000270	0.000920	<0.0030	0.00510
		2-Apr-2019	0.160	0.0000510	<0.0010	6.50	0.100	0.00920	0.000560	1.20	0.000750	3.80	<0.000010	8.00	0.340	<0.000010	<0.00010	<0.010	0.000510	0.00100	<0.0030	0.0370
		14-May-2019	0.0730	<0.000050	<0.0010	5.60	0.0250	0.00810	<0.00050	1.20	0.000510	2.70	<0.000010	8.10	0.300	<0.000010	<0.00010	<0.010	0.000250	0.00120	<0.0030	0.00700
		4-Jun-2019	<0.030	<0.000050	<0.0010	5.20	0.0130	0.00860	<0.00050	1.20	0.000550	2.40	<0.000010	8.50	0.300	<0.000010	<0.00010	<0.010	0.000240	0.00110	<0.0030	0.00310
		2-Jul-2019	<0.030	<0.000050	<0.0010	5.70	0.0150	0.00810	<0.00050	1.20	0.000560	2.40	<0.000010	9.00	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00340
		1-Aug-2019	<0.030	<0.000050	<0.0010	6.10	0.0170	0.00810	<0.00050	1.20	0.000600	2.50	<0.000010	8.90	0.310	<0.000010	<0.00010	<0.010	0.000270	0.00110	<0.0030	<0.0030
		3-Sep-2019	<0.030	<0.000050	<0.0010	5.60	0.0130	0.00870	<0.00050	1.20	0.000460	2.40	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000250	0.00110	<0.0030	<0.0030
		1-Oct-2019	0.0340	<0.000050	<0.0010	6.30	0.00800	0.00800	<0.00050	1.10	0.000590	2.40	<0.000010	8.80	0.310	<0.000010	<0.00010	<0.010	0.000330	0.000980	<0.0030	<0.0030
		4-Nov-2019	0.0360	<0.000050	<0.0010	6.30	0.00860	0.00780	<0.00050	1.30	0.000530	2.80	<0.000010	9.00	0.320	<0.000010	<0.00010	<0.010	0.000290	0.00100	<0.0030	0.00560
		2-Dec-2019	<0.030	<0.000050	<0.0010	6.00	0.00650	0.00790	<0.00050	1.30	0.000500	3.00	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000260	0.00120	0.0200	0.00510

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2019	HAC-05a	8-Jan-2019	<0.030	<0.000050	<0.0010	7.40	0.0260	0.00840	<0.00050	1.30	0.00110	3.40	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000430	0.000960	<0.0030	<0.0030
		5-Feb-2019	<0.030	<0.000050	<0.0010	7.30	0.0330	0.00740	<0.00050	1.30	0.000960	3.20	<0.000010	9.60	0.320	<0.000010	<0.00010	<0.010	0.000380	0.000930	<0.0030	0.00350
		4-Mar-2019	<0.030	<0.000050	<0.0010	7.40	0.0240	0.00800	<0.00050	1.30	0.000950	3.70	<0.000010	9.90	0.320	<0.000010	<0.00010	<0.010	0.000340	0.000860	<0.0030	0.00520
		2-Apr-2019	0.190	0.0000540	<0.0010	7.60	0.120	0.00890	0.000590	1.20	0.00110	4.00	<0.000010	8.20	0.380	<0.000010	<0.00010	<0.010	0.000600	0.00110	<0.0030	0.0360
		18-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-May-2019	0.0650	<0.000050	<0.0010	8.10	0.0450	0.00780	<0.00050	1.30	0.00150	3.00	<0.000010	9.00	0.350	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	0.00640
		4-Jun-2019	<0.030	<0.000050	<0.0010	7.50	0.0230	0.00770	<0.00050	1.30	0.00160	2.50	<0.000010	9.40	0.330	<0.000010	<0.00010	<0.010	0.000340	0.00110	0.0120	<0.0030
		2-Jul-2019	<0.030	<0.000050	<0.0010	7.40	0.0200	0.00760	<0.00050	1.30	0.00140	2.70	<0.000010	9.80	0.310	<0.000010	<0.00010	<0.010	0.000340	0.00100	<0.0030	<0.0030
		1-Aug-2019	0.0330	<0.000050	<0.0010	7.60	0.0210	0.00790	<0.00050	1.20	0.00110	2.80	<0.000010	9.20	0.330	<0.000010	<0.00010	<0.010	0.000350	0.00110	<0.0030	0.00300
		3-Sep-2019	<0.030	<0.000050	<0.0010	6.80	0.0210	0.00820	<0.00050	1.20	0.00110	2.70	<0.000010	9.00	0.340	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	<0.0030
		1-Oct-2019	0.0330	0.000620	<0.0010	7.90	0.0220	0.00740	<0.00050	1.20	0.00130	2.90	<0.000010	9.50	0.330	<0.000010	<0.00010	<0.010	0.000400	0.000940	<0.0030	<0.0030
		4-Nov-2019	0.0620	<0.000050	<0.0010	7.00	0.0210	0.00780	<0.00050	1.30	0.000830	3.20	<0.000010	9.00	0.340	<0.000010	<0.00010	<0.010	0.000380	0.00110	<0.0030	0.00760
		2-Dec-2019	0.0320	<0.000050	<0.0010	6.90	0.0160	0.00780	<0.00050	1.30	0.000940	3.20	<0.000010	9.20	0.320	<0.000010	<0.00010	<0.010	0.000300	0.00120	<0.0030	0.00400
	HAC-14	14-May-2019	0.0910	<0.000050	0.00100	8.80	0.0300	0.00740	<0.00050	1.30	0.00130	3.10	<0.000010	8.80	0.370	<0.000010	<0.00010	<0.010	0.000430	0.00110	<0.0030	0.0150
		4-Jun-2019	0.0600	<0.000050	0.00100	8.40	0.0270	0.00780	<0.00050	1.40	0.00140	2.80	<0.000010	9.80	0.380	<0.000010	<0.00010	<0.010	0.000400	0.00110	<0.0030	0.00560
		2-Jul-2019	1.40	0.000530	0.00190	8.50	0.0610	0.00790	0.00180	1.50	0.00130	4.40	0.0000100	9.70	0.380	<0.000010	<0.00010	0.0450	0.000460	0.00320	0.00390	0.00940
		1-Aug-2019	0.640	0.000390	0.00150	8.90	0.0510	0.00830	0.00100	1.40	0.00120	4.00	<0.000010	9.70	0.390	<0.000010	<0.00010	0.0250	0.000480	0.00270	<0.0030	0.0110
		3-Sep-2019	0.0770	0.0000540	0.00110	7.50	0.0100	0.00850	<0.00050	1.30	0.00110	3.20	<0.000010	9.40	0.370	<0.000010	<0.00010	<0.010	0.000400	0.00120	<0.0030	0.00780
		1-Oct-2019	0.0650	<0.000050	0.00110	8.80	0.0140	0.00750	<0.00050	1.20	0.00120	3.30	<0.000010	9.40	0.380	<0.000010	<0.00010	<0.010	0.000510	0.000890	<0.0030	0.0190
		4-Nov-2019	0.140	0.0000620	<0.0010	7.20	0.0180	0.00730	0.000630	1.20	0.000830	3.50	<0.000010	8.40	0.340	<0.000010	<0.00010	<0.010	0.000440	0.00120	<0.0030	0.0450
		4-Nov-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Dec-2019	0.0930	<0.000050	<0.0010	7.50	0.0150	0.00770	<0.00050	1.30	0.000850	3.40	<0.000010	9.20	0.330	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	0.00610
	HAC-08	8-Jan-2019	0.180	<0.000050	0.00130	8.70	0.0280	0.00820	<0.00050	1.30	0.000920	4.00	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000590	0.00130	<0.0030	0.0100
		5-Feb-2019	0.210	0.0000660	0.00110	8.60	0.0360	0.00720	<0.00050	1.30	0.000840	3.90	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000520	0.00130	<0.0030	0.0130
		4-Mar-2019	0.0790	<0.000050	0.00110	8.70	0.0240	0.00770	<0.00050	1.30	0.000900	4.10	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000440	0.000920	<0.0030	0.00580
		2-Apr-2019	0.830	0.000390	0.00130	7.40	0.0950	0.00630	0.00180	1.20	0.000880	5.00	0.0000150	6.80	0.330	0.0000100	<0.00010	0.0260	0.000610	0.00250	0.00560	0.100
		14-May-2019	0.540	0.000190	0.00150	8.70	0.0420	0.00710	0.00120	1.40	0.00120	3.60	<0.000010	8.60	0.380	<0.000010	<0.00010	0.0180	0.000490	0.00220	<0.0030	0.0140
		4-Jun-2019	0.150	0.0000640	0.00130	9.00	0.0340	0.00800	<0.00050	1.40	0.00130	3.10	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000440	0.00130	<0.0030	0.00480
		2-Jul-2019	2.90	0.00140	0.00320	9.80	0.130	0.00810	0.00390	1.80	0.00140	6.90	0.0000320	10.0	0.420	0.0000140	<0.00010	0.100	0.000560	0.00620	0.00880	0.0160
		1-Aug-2019	0.200	0.000140	0.00130	8.50	0.0270	0.00810	0.000650	1.40	0.00110	3.50	<0.000010	9.70	0.390	<0.000010	<0.00010	<0.010	0.000500	0.00150	<0.0030	0.0100
		3-Sep-2019	0.190	0.0000950	0.00130	7.60	0.0180	0.00820	<0.00050	1.30	0.00110	3.40	<0.000010	9.30	0.370	<0.000010	<0.00010	<0.010	0.000420	0.00140	<0.0030	0.00800
		1-Oct-2019	4.80	0.00180	0.00520	11.0	0.220	0.00720	0.00510	2.00	0.00140	11.0	0.0000580	9.30	0.400	0.0000190	0.000170	0.210	0.000670	0.0130	0.0150	0.0230
		4-Nov-2019	0.370	0.000180	0.00110	7.30	0.0250	0.00680	0.000940	1.30	0.000690	3.90	<0.000010	8.50	0.320	<0.000010	<0.00010	0.0120	0.000440	0.00160	<0.0030	0.0380
		2-Dec-2019	0.260	0.000110	0.00110	7.80	0.0220	0.00750	0.000590	1.30	0.000880	3.60	<0.000010	9.40	0.330	<0.000010	<0.00010	<0.010	0.000360	0.00150	<0.0030	0.00740
	W10	4-Jun-2019	0.160	<0.000050	<0.0010	6.20	0.00800	0.000650	0.00120	0.710	0.000150	4.60	<0.000010	3.60	0.140	<0.000010	<0.00010	<0.010	0.0000920	0.000800	<0.0030	0.0320
		8-Aug-2019	0.260	<0.000050	<0.0010	6.40	0.00870	0.000610	0.00140	0.630	0.000170	5.60	<0.000010	3.40	0.150	<0.000010	<0.00010	<0.010	0.0000850	0.000820	<0.0030	0.0310
		1-Oct-2019	0.360	<0.000050	<0.0010	6.40	0.00910	0.000460	0.00160	0.580	0.000170	5.40	<0.000010	3.10	0.140	<0.000010	<0.00010	<0.010	0.0000940	0.000780	<0.0030	0.0640
		20-Nov-2019	0.530	0.0000990	<0.0010	4.70	0.0180	0.000310	0.00170	0.520	0.000160	5.50	<0.000010	2.50	0.0950	<0.000010	<0.00010	<0.010	0.0000870	0.00130	<0.0030	0.160
	EDC-01a	8-May-2019	0.290	0.0000580	<0.0010	3.80	0.00890	0.000330	0.00140	0.480	0.000150	4.20	<0.000010	2.10	0.0750	<0.000010	<0.00010	<0.010	0.0000760	0.000960	<0.0030	0.100
		4-Jun-2019	0.110	<0.000050	<0.0010	7.10	0.0140	0.000750	0.00110	0.730	0.000160	4.50	<0.000010	4.20	0.150	<0.000010	<0.00010	<0.010	0.000120	0.000740	<0.0030	0.0290
		2-Jul-2019	0.0560	<0.000050	<0.0010	9.30	0.0160	0.00150	0.000980	0.970	0.000210	5.00	<0.000010	6.20	0.220	<0.000010	<0.00010	<0.010	0.000240	0.000570	<0.0030	0.0140
		1-Oct-2019	0.350	<0.000050	<0.0010	6.20	0.00970	0.000560	0.00140	0.570	0.000210	5.40	<0.000010	3.10	0.140	<0.000010	0.000110	<0.010	0.000100	0.000740	<0.0030	0.0630
	HAC-13	20-Jan-2020	<0.030	<0.000050	<0.0010	6.10	0.0430	0.00750	<0.00050	1.20	0.000530	3.20	<0.000010	8.40	0.300	<0.000010	<0.00010	<0.010	0.000270	0.000960	<0.0030	<0.0030
		3-Feb-2020	0.0360	<0.000050	<0.0010	5.70	0.0320	0.00720	<0.00050	1.20	0.000490	2.80	<0.000010	8.50	0.270	<0.000010	<0.00010	<0.010	0.000250	0.00100	<0.0030	0.00390
		25-Mar-2020	0.0340	<0.000050	<0.0010	6.50	0.0310	0.00760	<0.00050	1.20	0.000450	2.90	<0.000010	8.90	0.300	<0.000010	<0.00010	<0.010	0.000230	0.00110	<0.0030	<0.0030
		16-Apr-2020	0.0850	<0.000050	<0.0010	6.70	0.0880	0.00720	<0.00050	1.10	0.000610	3.50	<0.000010	7.60	0.310	<0.000010	<0.00010	<0.010	0.000350	0.00110	<0.0030	0.00880
		7-May-2020	0.160	0.0000570	<0.0010	3.30	0.0210	0.00390	0.000530	0.670	0.000560	3.10	<0.000010	3.40	0.140	<0.000010	<0.00010	<0.010	0.000150	0.00110	<0.0030	0.0880
		3-Jun-2020	0.0400	<0.000050	<0.0010	5.60	0.00920	0.00720	<0.00050	1.10	0.000460	2.90	<0.000010	7.70	0.270	<0.000010	<0.00010	<0.010	0.000250	0.00110	<0.0030	0.0100
		6-Jul-2020	<0.030	<0.000050	<0.0010	5.50	0.0110	0.00700	<0.00050	1.00	0.000510	2.80	<0.000010	7.80	0.270	<0.000010	0.000110	<0.010	0.000230	0.00110	<0.0030	0.00450
		4-Aug-2020	0.0430	<0.000050	<0.0010	5.40	0.0220	0.00650	<0.00050	0.980	0.000410	2.80	<0.000010	7.50	0.260	<0.000010	<0.00010	<0.010	0.000190	0.00130	<0.0030	0.00640
		1-Sep-2020	0.0320	<0.000050	<0.0010	5.20	0.0160	0.00680	<0.00050	1.00	0.000510	2.90	<0.000010	7.60	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00140	<0.0030	0.00460
		1-Oct-2020	<0.030	<0.000050	<0.0010	4.90	0.00700	0.00660	<0.00050	1.00	0.000450	2.70	<0.000010	7.50	0.260	<0.000010	<0.00010	<0.010	0.000220	0.00120	<0.0030	0.00340
		2-Nov-2020	0.0790	<0.000050	<0.0010	6.20	0.0150	0.00710	<0.00050	1.10	0.000700	3.50	<0.000010	7.70	0.280	<0.000010	<0.00010	<0.010	0.000280	0.00110	<0.0030	0.0230
		1-Dec-2020	0.0320	<0.000050	<0.0010	5.50	0.00770	0.00660	<0.00050	1.00	0.000510	3.40	<0.000010	7.50	0.260	<0.000010	<0.00010	<0.010	0.000220	0.00120	<0.0030	0.00610
	HAC-05a	20-Jan-2020	0.0380	<0.000050	<0.0010	8.50	0.0370	0.00710	<0.00050	1.20	0.00140	3.70	<0.000010	9.30	0.330	<0.000010	0.000160	<0.010	0.000360	0.000960	<0.0030	<0.0030
		3-Feb-2020	0.0370	<0.000050	<0.0010	6.40	0.0380	0.00710	<0.00050	1.20	0.000680	3.10	<0.000010	8.80	0.290	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	0.00300
		25-Mar-2020	0.0370	<0.000050	<0.0010	7.30	0.0310	0.00740	<0.00050	1.10	0.000990	3.10	<0.000010	9.00	0.320	<0.000010	<0.00010	<0.010	0.000280	0.00100	<0.0030	<0.0030
		16-Apr-2020	0.0810	<0.000050	<0.0010	8.40	0.0840	0.00680	<0.00050	1.20	0.00110	3.80	<0.000010	7.60	0.340	<0.000010	<0.00010	<0.010	0.000470	0.00110	<0.0030	0.0220
		7-May-2020	0.200	0.0000660	<0.0010	4.00	0.0360	0.00420	0.000580	0.770	0.000740	3.30	0.0000100	3.60	0.160	<0.000010	<0.00010	<0.010	0.000190	0.00120	<0.0030	0.0890
		3-Jun-2020	0.0480	<0.000050	<0.0010	6.10	0.0180	0.00690	<0.00050	1.20	0.000760	3.00	<0.000010	7.60	0.270	<0.000010	<0.00010	<0.010	0.000290	0.00110	<0.0030	0.0120
		6-Jul-2020	0.0520	<0.000050	<0.0010	6.20	0.0230	0.00720	<0.00050	1.10	0.000820	3.00	<0.000010	8.20	0.290	<0.000010	<0.00010	<0.010	0.000290	0.00110	<0.0030	0.00440
		4-Aug-2020	0.0340	<0.000050	<0.0010	6.60	0.0290	0.00640	<0.00050	1.00	0.00140	3.20	<0.000010	7.80	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00130	<0.0030	0.00370
		1-Sep-2020	0.0350	<0.000050	<0.0010	6.90	0.0260	0.00660	<0.00050	1.10	0.00140	3.30	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000310	0.00140	<0.0030	0.00300
		1-Oct-2020	<0.030	<0.000050	<0.0010	6.30	0.0180	0.00680	<0.00050	1.10	0.00120	3.10	<0.000010	8.00	0.300	<0.000010	<0.00010	<0.010	0.000280	0.00120	<0.0030	<0.0030
		2-Nov-2020	0.100	<0.000050	<0.0010	6.60	0.0230	0.00670	<0.00050	1.20	0.00100	3.60	<0.000010	7.50	0.300	<0.000010	<0.00010	<0.010	0.000350	0.00120	<0.0030	0.0320
		1-Dec-2020	0.0430	<0.000050	<0.0010	5.90	0.0160	0.00640	<0.00050	1.00	0.000810	3.60	<0.000010	7.40	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00120	<0.0030	0.00590

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2020	HAC-14	3-Jun-2020	0.130	0.0000510	<0.0010	6.00	0.0160	0.00650	0.000530	1.20	0.000650	3.40	<0.000010	7.20	0.270	<0.000010	<0.00010	<0.010	0.000320	0.00120	0.00650	0.0430
		6-Jul-2020	0.0600	<0.000050	<0.0010	6.50	0.0130	0.00660	<0.00050	1.10	0.000860	3.30	<0.000010	7.70	0.290	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	0.0160
		4-Aug-2020	0.0420	<0.000050	<0.0010	7.30	0.0110	0.00670	<0.00050	1.20	0.00140	3.40	<0.000010	8.10	0.330	<0.000010	<0.00010	<0.010	0.000310	0.00130	<0.0030	0.00660
		1-Sep-2020	<0.030	<0.000050	<0.0010	8.10	0.00900	0.00680	<0.00050	1.20	0.00140	3.60	<0.000010	8.40	0.340	<0.000010	<0.00010	<0.010	0.000390	0.00120	<0.0030	0.00390
		1-Oct-2020	0.0300	<0.000050	<0.0010	6.80	0.0110	0.00710	<0.00050	1.20	0.00120	3.40	<0.000010	8.40	0.340	<0.000010	<0.00010	<0.010	0.000340	0.00110	<0.0030	0.00340
		2-Nov-2020	0.220	0.0000670	<0.0010	6.40	0.0230	0.00580	0.000590	1.10	0.000880	3.90	<0.000010	6.70	0.280	<0.000010	<0.00010	<0.010	0.000350	0.00130	<0.0030	0.0770
	HAC-08	20-Jan-2020	0.160	0.0000670	0.00120	9.20	0.0240	0.00660	0.000530	1.20	0.00120	4.20	<0.000010	9.70	0.370	<0.000010	<0.00010	<0.010	0.000480	0.00110	<0.0030	0.00430
		3-Feb-2020	0.220	0.000220	<0.0010	7.10	0.0370	0.00670	0.000650	1.20	0.000630	3.50	<0.000010	8.90	0.310	<0.000010	<0.00010	<0.010	0.000370	0.00140	<0.0030	0.00770
		25-Mar-2020	0.260	0.000140	0.00110	8.60	0.0270	0.00700	0.000600	1.20	0.000850	3.80	<0.000010	9.80	0.350	<0.000010	<0.00010	0.0100	0.000390	0.00150	<0.0030	0.00430
		16-Apr-2020	0.740	0.000320	0.00150	7.90	0.0540	0.00430	0.00170	1.10	0.000850	4.90	0.0000100	5.70	0.300	<0.000010	<0.00010	0.0250	0.000520	0.00240	0.00340	0.0450
		7-May-2020	1.30	0.000460	0.00140	4.30	0.0530	0.00290	0.00230	0.880	0.000600	4.70	0.0000190	3.10	0.150	<0.000010	<0.00010	0.0370	0.000220	0.00420	0.00420	0.120
		3-Jun-2020	0.640	0.000260	0.00120	6.10	0.0300	0.00550	0.00140	1.20	0.000650	4.40	<0.000010	6.50	0.260	<0.000010	<0.00010	0.0220	0.000320	0.00230	0.00410	0.0400
		6-Jul-2020	0.140	0.000130	<0.0010	6.80	0.0170	0.00640	<0.00050	1.10	0.000840	3.60	<0.000010	7.60	0.290	<0.000010	0.000180	<0.010	0.000330	0.00120	<0.0030	0.0190
		4-Aug-2020	0.120	0.0000510	0.00120	7.50	0.0120	0.00670	<0.00050	1.20	0.00120	3.60	<0.000010	8.30	0.340	<0.000010	<0.00010	<0.010	0.000350	0.00150	<0.0030	0.00780
		1-Sep-2020	0.380	0.000150	0.00140	8.30	0.0160	0.00650	0.000690	1.20	0.00150	4.00	<0.000010	9.20	0.360	<0.000010	<0.00010	<0.010	0.000470	0.00180	<0.0030	0.00430
		1-Oct-2020	0.0350	<0.000050	0.00100	7.20	0.00810	0.00680	<0.00050	1.20	0.00120	3.30	<0.000010	8.70	0.340	<0.000010	<0.00010	<0.010	0.000380	0.00110	<0.0030	0.00320
		2-Nov-2020	0.750	0.000240	0.00120	6.50	0.0340	0.00530	0.00140	1.10	0.000770	4.60	0.0000120	6.20	0.260	<0.000010	<0.00010	0.0230	0.000360	0.00220	<0.0030	0.0760
		1-Dec-2020	0.280	0.000120	<0.0010	6.30	0.0220	0.00600	0.000610	1.00	0.000740	3.90	<0.000010	7.50	0.270	<0.000010	<0.00010	<0.010	0.000280	0.00160	<0.0030	0.0150
	W10	7-May-2020	0.530	0.000190	<0.0010	3.20	0.0180	0.000240	0.00160	0.600	0.000130	4.10	0.0000100	1.50	0.0640	<0.000010	<0.00010	<0.010	0.0000550	0.00180	<0.0030	0.130
		31-Aug-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Sep-2020	0.0680	<0.000050	<0.0010	12.0	0.0110	0.00140	0.000850	0.990	0.000120	5.40	<0.000010	7.00	0.260	<0.000010	<0.00010	<0.010	0.000310	0.000860	<0.0030	0.0110
		1-Oct-2020	0.0520	<0.000050	<0.0010	12.0	0.00850	0.00150	0.000820	1.00	0.0000930	5.30	<0.000010	7.60	0.280	<0.000010	<0.00010	<0.010	0.000320	0.000610	<0.0030	0.00850
		2-Nov-2020	0.600	0.000120	<0.0010	4.50	0.0160	0.000300	0.00160	0.620	0.000130	4.80	<0.000010	2.20	0.0890	<0.000010	0.000520	0.0100	0.0000720	0.00130	<0.0030	0.160
	EDC-01a	7-May-2020	0.690	0.000240	<0.0010	3.30	0.0220	0.000240	0.00170	0.640	0.000120	4.20	0.0000110	1.60	0.0680	<0.000010	<0.00010	0.0170	0.0000630	0.00210	0.00300	0.130
		1-Sep-2020	0.0550	<0.000050	0.00110	12.0	0.0550	0.00780	0.000750	1.70	0.000540	5.70	<0.000010	9.70	0.430	<0.000010	<0.00010	<0.010	0.000980	0.00110	<0.0030	0.00570
		1-Oct-2020	0.0400	<0.000050	<0.0010	8.30	0.0420	0.00600	<0.00050	1.20	0.00100	3.60	<0.000010	8.80	0.320	<0.000010	<0.00010	<0.010	0.000440	0.00120	<0.0030	0.00500
		2-Nov-2020	1.20	0.000300	<0.0010	5.40	0.0370	0.00140	0.00240	0.810	0.000300	5.60	0.0000120	3.30	0.140	<0.000010	<0.00010	0.0290	0.000160	0.00270	0.00330	0.140
		1-Dec-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2020	0.250	<0.000050	<0.0010	5.90	0.0250	0.00340	0.000810	0.790	0.000440	4.60	<0.000010	5.10	0.200	<0.000010	<0.00010	<0.010	0.000220	0.00110	<0.0030	0.0640
	HAC-13	12-Jan-2021	<0.030	<0.000050	<0.0010	5.70	0.0210	0.00600	<0.00050	1.10	0.000490	3.50	<0.000010	7.90	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00100	<0.0030	0.00640
		1-Feb-2021	<0.030	<0.000050	<0.0010	5.60	0.0200	0.00620	<0.00050	1.10	0.000490	3.50	<0.000010	8.00	0.260	<0.000010	<0.00010	<0.010	0.000210	0.00120	<0.0030	0.00580
		8-Mar-2021	<0.030	<0.000050	<0.0010	6.20	0.0520	0.00670	<0.00050	1.20	0.000520	3.60	<0.000010	8.40	0.290	<0.000010	<0.00010	<0.010	0.000250	0.00110	<0.0030	0.00360
		7-Apr-2021	0.0720	<0.000050	<0.0010	6.50	0.0590	0.00650	<0.00050	1.10	0.000530	3.60	<0.000010	7.80	0.300	<0.000010	<0.00010	<0.010	0.000330	0.00110	<0.0030	0.00890
		3-May-2021	0.0930	<0.000050	<0.0010	3.70	0.0130	0.00470	<0.00050	0.730	0.000450	2.60	<0.000010	4.50	0.170	<0.000010	<0.00010	<0.010	0.000160	0.000890	<0.0030	0.0360
		1-Jun-2021	<0.030	<0.000050	<0.0010	5.20	0.0100	0.00640	<0.00050	1.00	0.000470	3.10	<0.000010	7.50	0.250	<0.000010	<0.00010	<0.010	0.000220	0.00120	<0.0030	0.00520
		7-Jul-2021	<0.030	<0.000050	<0.0010	4.80	0.0180	0.00670	<0.00050	0.900	0.000520	3.00	<0.000010	7.00	0.230	<0.000010	<0.00010	<0.010	0.000190	0.00130	<0.0030	<0.0030
		4-Aug-2021	0.0350	<0.000050	<0.0010	5.40	0.0330	0.00740	<0.00050	1.10	0.000510	3.00	<0.000010	8.10	0.280	<0.000010	<0.00010	<0.010	0.000210	0.00120	<0.0030	0.00380
		1-Sep-2021	<0.030	<0.000050	<0.0010	5.10	0.0170	0.00640	<0.00050	1.00	0.000530	3.00	<0.000010	7.30	0.230	<0.000010	<0.00010	<0.010	0.000190	0.00110	<0.0030	<0.0030
		4-Oct-2021	0.0320	<0.000050	<0.0010	5.60	0.0150	0.00680	<0.00050	1.10	0.000420	3.00	<0.000010	8.10	0.270	<0.000010	<0.00010	<0.010	0.000220	0.00120	<0.0030	<0.0030
		4-Nov-2021	0.0800	<0.000050	<0.0010	7.90	0.0300	0.00920	<0.00050	1.40	0.00110	3.30	<0.000010	9.20	0.360	<0.000010	<0.00010	<0.010	0.000500	0.00100	<0.0030	<0.0030
		1-Dec-2021	0.0460	<0.000050	<0.0010	7.30	0.0440	0.00660	<0.00050	1.20	0.000780	3.20	<0.000010	8.30	0.340	<0.000010	<0.00010	<0.010	0.000460	0.000960	<0.0030	0.00360
	HAC-05a	12-Jan-2021	0.0780	<0.000050	<0.0010	6.40	0.0330	0.00600	<0.00050	1.10	0.00100	3.80	<0.000010	8.20	0.280	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	0.00540
		1-Feb-2021	0.0320	<0.000050	<0.0010	6.50	0.0240	0.00590	<0.00050	1.10	0.00110	3.60	<0.000010	8.10	0.270	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	0.00540
		8-Mar-2021	<0.030	<0.000050	<0.0010	7.60	0.0410	0.00660	<0.00050	1.20	0.00100	3.60	<0.000010	8.80	0.310	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	0.00390
		7-Apr-2021	0.0640	<0.000050	<0.0010	7.60	0.0570	0.00640	<0.00050	1.20	0.00110	3.80	<0.000010	8.10	0.330	<0.000010	<0.00010	<0.010	0.000420	0.00100	<0.0030	0.00760
		3-May-2021	0.0910	0.0000530	<0.0010	4.20	0.0260	0.00470	<0.00050	0.750	0.000720	2.60	<0.000010	4.40	0.190	0.0000190	<0.00010	<0.010	0.000220	0.000880	<0.0030	0.0350
		1-Jun-2021	0.0310	<0.000050	<0.0010	5.70	0.0180	0.00660	<0.00050	1.00	0.000780	3.00	<0.000010	7.30	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00130	<0.0030	0.00520
		7-Jul-2021	<0.030	<0.000050	<0.0010	6.20	0.0370	0.00700	<0.00050	1.00	0.00140	3.40	<0.000010	7.70	0.270	<0.000010	<0.00010	<0.010	0.000250	0.00130	<0.0030	<0.0030
		4-Aug-2021	<0.030	<0.000050	<0.0010	8.00	0.0170	0.00660	<0.00050	1.10	0.00190	3.60	<0.000010	8.50	0.310	<0.000010	<0.00010	<0.010	0.000310	0.00120	<0.0030	<0.0030
		1-Sep-2021	<0.030	<0.000050	<0.0010	8.50	0.0200	0.00640	<0.00050	1.20	0.00220	3.50	<0.000010	8.60	0.300	<0.000010	<0.00010	<0.010	0.000330	0.00110	<0.0030	<0.0030
		4-Oct-2021	<0.030	<0.000050	<0.0010	8.00	0.0200	0.00630	<0.00050	1.20	0.00170	3.60	<0.000010	9.00	0.330	<0.000010	<0.00010	<0.010	0.000330	0.00110	<0.0030	<0.0030
		4-Nov-2021	0.100	<0.000050	<0.0010	10.0	0.0340	0.00820	<0.00050	1.40	0.00290	3.90	<0.000010	9.30	0.380	<0.000010	<0.00010	<0.010	0.000770	0.00110	<0.0030	0.00440
		1-Dec-2021	0.0360	<0.000050	<0.0010	9.60	0.0280	0.00650	<0.00050	1.20	0.00220	3.60	<0.000010	9.00	0.380	<0.000010	<0.00010	<0.010	0.000660	0.000850	<0.0030	0.00320
	HAC-14	3-May-2021	0.150	<0.000050	<0.0010	4.70	0.0200	0.00410	<0.00050	0.810	0.000670	3.10	<0.000010	4.90	0.190	<0.000010	<0.00010	<0.010	0.000220	0.000980	<0.0030	0.0650
		1-Jun-2021	0.0570	<0.000050	<0.0010	5.80	0.0140	0.00650	<0.00050	1.10	0.000790	3.20	<0.000010	7.60	0.270	<0.000010	<0.00010	<0.010	0.000240	0.00130	<0.0030	0.00940
		7-Jul-2021	<0.030	<0.000050	<0.0010	6.30	0.00810	0.00690	<0.00050	1.10	0.00140	3.50	<0.000010	7.50	0.270	<0.000010	<0.00010	<0.010	0.000280	0.00140	<0.0030	0.00390
		4-Aug-2021	0.0440	<0.000050	0.00110	8.90	0.0220	0.00760	<0.00050	1.30	0.00190	4.20	<0.000010	9.30	0.370	<0.000010	<0.00010	<0.010	0.000390	0.00140	<0.0030	0.00420
		1-Sep-2021	2.10	0.00110	0.00240	10.0	0.0730	0.00660	0.00320	1.50	0.00210	6.70	0.0000200	9.30	0.380	0.0000110	<0.00010	0.0640	0.000510	0.00500	0.00600	0.00600
		4-Oct-2021	<0.030	<0.000050	0.00100	9.10	0.00960	0.00660	<0.00050	1.20	0.00160	3.90	<0.000010	9.40	0.360	<0.000010	<0.00010	<0.010	0.000420	0.000900	<0.0030	<0.0030
		4-Nov-2021	0.110	<0.000050	0.00100	11.0	0.0170	0.00850	<0.00050	1.30	0.00220	4.00	<0.000010	8.70	0.420	<0.000010	<0.00010	<0.010	0.000860	0.000950	<0.0030	0.00480

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2021	HAC-08	12-Jan-2021	0.0670	<0.000050	<0.0010	6.90	0.0160	0.00580	<0.00050	1.10	0.000840	3.90	<0.000010	8.40	0.300	<0.000010	<0.00010	<0.010	0.000370	0.000970	<0.0030	0.0110
		1-Feb-2021	0.280	0.000130	<0.0010	6.90	0.0270	0.00580	0.000600	1.10	0.000960	4.00	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000330	0.00160	<0.0030	0.00650
		8-Mar-2021	0.230	0.0000920	0.00110	8.20	0.0250	0.00620	0.000610	1.20	0.000930	4.10	<0.000010	8.90	0.340	<0.000010	<0.00010	<0.010	0.000400	0.00120	<0.0030	0.00440
		7-Apr-2021	0.200	0.0000680	0.00100	7.70	0.0310	0.00480	<0.00050	1.10	0.000910	4.20	<0.000010	6.80	0.300	<0.000010	<0.00010	<0.010	0.000470	0.00120	<0.0030	0.0300
		3-May-2021	0.580	0.000170	<0.0010	4.90	0.0300	0.00390	0.00120	0.860	0.000710	3.80	<0.000010	4.80	0.190	<0.000010	<0.00010	0.0190	0.000250	0.00180	<0.0030	0.0690
		1-Jun-2021	0.0730	<0.000050	<0.0010	6.10	0.0160	0.00630	<0.00050	1.10	0.000800	3.30	<0.000010	7.70	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00130	<0.0030	0.00800
		7-Jul-2021	0.0400	<0.000050	0.00100	7.10	0.0120	0.00700	<0.00050	1.20	0.00130	3.40	<0.000010	8.20	0.310	<0.000010	<0.00010	<0.010	0.000320	0.00140	<0.0030	0.00350
		4-Aug-2021	0.0320	<0.000050	0.00140	9.10	0.0130	0.00790	<0.00050	1.40	0.00190	4.20	<0.000010	9.80	0.380	<0.000010	<0.00010	<0.010	0.000430	0.00130	<0.0030	0.00460
		1-Sep-2021	0.0400	<0.000050	0.00130	10.0	0.0130	0.00700	<0.00050	1.30	0.00210	4.10	<0.000010	9.80	0.370	<0.000010	<0.00010	<0.010	0.000510	0.00100	<0.0030	0.00400
		4-Oct-2021	<0.030	<0.000050	0.00120	9.50	0.0110	0.00680	<0.00050	1.30	0.00150	3.80	<0.000010	9.50	0.380	<0.000010	<0.00010	<0.010	0.000480	0.000940	<0.0030	<0.0030
		4-Nov-2021	0.400	0.000170	0.00140	11.0	0.0510	0.00420	0.00100	1.20	0.00120	4.90	<0.000010	7.60	0.320	<0.000010	<0.00010	<0.010	0.000660	0.00120	<0.0030	0.00450
		1-Dec-2021	0.230	0.000100	0.00140	10.0	0.0280	0.00610	0.000650	1.10	0.00190	4.20	<0.000010	9.10	0.380	<0.000010	<0.00010	<0.010	0.000810	0.00100	<0.0030	0.00700
	W10	12-Jan-2021	0.330	<0.000050	<0.0010	6.10	0.00770	0.000410	0.00100	0.580	0.000150	5.50	<0.000010	3.40	0.120	<0.000010	<0.00010	<0.010	0.000110	0.000640	<0.0030	0.0740
		3-May-2021	0.680	0.000200	<0.0010	2.70	0.0220	0.000250	0.00150	0.500	0.0000570	3.80	<0.000010	1.40	0.0610	<0.000010	<0.00010	0.0140	0.0000600	0.00150	<0.0030	0.110
		4-Aug-2021	0.0340	<0.000050	0.00140	17.0	0.00840	0.00210	0.000730	1.70	0.000140	4.80	<0.000010	13.0	0.360	<0.000010	<0.00010	<0.010	0.000560	0.000700	<0.0030	0.00660
		4-Nov-2021	0.290	0.0000760	<0.0010	10.0	0.0410	0.000810	0.000860	1.10	0.000120	5.00	<0.000010	5.50	0.200	<0.000010	<0.00010	<0.010	0.000270	0.000700	<0.0030	0.00750
	EDC-01a	12-Jan-2021	0.170	<0.000050	<0.0010	6.80	0.0340	0.00340	0.000670	0.880	0.000560	4.70	<0.000010	6.50	0.230	<0.000010	<0.00010	<0.010	0.000310	0.000860	<0.0030	0.0360
		1-Feb-2021	0.210	<0.000050	<0.0010	7.20	0.0430	0.00370	0.000610	0.940	0.000660	4.50	<0.000010	6.40	0.240	<0.000010	<0.00010	<0.010	0.000290	0.00100	<0.0030	0.0240
		8-Mar-2021	0.230	<0.000050	<0.0010	8.30	0.0400	0.00370	0.00110	1.00	0.000620	4.90	<0.000010	6.70	0.260	<0.000010	<0.00010	<0.010	0.000320	0.000900	<0.0030	0.0230
		7-Apr-2021	0.300	0.0000660	<0.0010	6.80	0.0400	0.00240	0.000950	0.820	0.000470	5.00	<0.000010	4.90	0.210	<0.000010	<0.00010	<0.010	0.000310	0.00100	<0.0030	0.0570
		3-May-2021	0.600	0.000160	<0.0010	3.70	0.0230	0.000830	0.00150	0.640	0.000180	4.40	<0.000010	2.40	0.0910	<0.000010	<0.00010	0.0150	0.000100	0.00140	<0.0030	0.110
		1-Jun-2021	0.0830	<0.000050	<0.0010	5.60	0.0170	0.00350	0.000670	0.860	0.000410	3.60	<0.000010	5.20	0.200	<0.000010	<0.00010	<0.010	0.000190	0.00100	<0.0030	0.0890
		7-Jul-2021	0.0400	<0.000050	0.00110	7.90	0.0450	0.00640	<0.00050	1.20	0.00110	3.80	<0.000010	8.30	0.320	<0.000010	<0.00010	<0.010	0.000380	0.00130	<0.0030	0.00490
		4-Aug-2021	0.190	0.0000740	0.00140	10.0	0.0650	0.00720	0.000520	1.40	0.00160	4.60	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000550	0.00170	<0.0030	0.00890
		1-Sep-2021	0.0400	<0.000050	0.00130	12.0	0.0530	0.00610	<0.00050	1.40	0.00160	4.40	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000600	0.00100	<0.0030	0.00420
		4-Oct-2021	0.0320	<0.000050	0.00120	11.0	0.0450	0.00630	<0.00050	1.30	0.00120	4.30	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000560	0.000870	<0.0030	<0.0030
		4-Nov-2021	0.550	0.000200	0.00150	11.0	0.0520	0.00430	0.00110	1.20	0.00120	5.00	<0.000010	7.30	0.320	<0.000010	<0.00010	0.0140	0.000680	0.00140	<0.0030	0.00470
		1-Dec-2021	0.0920	<0.000050	<0.0010	9.40	0.0330	0.00350	0.000580	0.940	0.00120	4.60	<0.000010	7.00	0.290	<0.000010	<0.00010	<0.010	0.000520	0.000570	<0.0030	0.0100
	HAC-13	12-Jan-2022	<0.030	<0.000050	<0.0010	6.00	0.0160	0.00660	<0.00050	1.10	0.000500	3.50	<0.000010	8.20	0.280	<0.000010	<0.00010	<0.010	0.000220	0.00120	<0.0030	<0.0030
		7-Feb-2022	<0.030	<0.000050	<0.0010	5.90	0.0190	0.00690	<0.00050	1.10	0.000510	3.70	<0.000010	8.30	0.290	<0.000010	<0.00010	<0.010	0.000250	0.00130	<0.0030	<0.0030
		9-Mar-2022	0.0370	<0.000050	<0.0010	6.50	0.0260	0.00600	<0.00050	1.10	0.000530	3.70	<0.000010	8.50	0.290	<0.000010	<0.00010	<0.010	0.000290	0.00140	<0.0030	0.00840
		5-Apr-2022	0.160	<0.000050	<0.0010	8.20	0.0510	0.00710	0.000590	1.20	0.00190	4.80	<0.000010	7.90	0.370	<0.000010	<0.00010	<0.010	0.000580	0.00110	<0.0030	0.0620
		3-May-2022	0.160	<0.000050	<0.0010	5.90	0.0260	0.0110	0.000530	1.00	0.00170	4.00	<0.000010	5.40	0.300	<0.000010	<0.00010	<0.010	0.000530	0.000840	<0.0030	0.0620
		1-Jun-2022	0.0550	<0.000050	<0.0010	5.70	0.0130	0.00620	<0.00050	0.940	0.000480	3.30	<0.000010	7.80	0.260	<0.000010	<0.00010	<0.010	0.000210	0.00150	<0.0030	0.0130
		5-Jul-2022	<0.030	<0.000050	<0.0010	5.40	0.0120	0.00660	<0.00050	1.00	0.000420	2.90	<0.000010	7.30	0.240	<0.000010	<0.00010	<0.010	0.000210	0.00130	<0.0030	0.00350
		3-Aug-2022	<0.030	<0.000050	<0.0010	5.20	0.0210	0.00700	<0.00050	1.00	0.000640	3.00	<0.000010	7.20	0.240	<0.000010	<0.00010	<0.010	0.000190	0.00140	<0.0030	0.00500
		8-Sep-2022	0.0590	<0.000050	<0.0010	5.20	0.0170	0.00710	<0.00050	1.00	0.000690	3.00	<0.000010	7.00	0.240	<0.000010	<0.00010	<0.010	0.000200	0.00160	<0.0030	<0.0030
		5-Oct-2022	<0.030	<0.000050	<0.0010	5.40	0.00930	0.00740	<0.00050	1.10	0.000630	2.90	<0.000010	7.30	0.260	<0.000010	<0.00010	<0.010	0.000200	0.00170	<0.0030	0.00740
		2-Nov-2022	0.0340	<0.000050	<0.0010	5.60	0.00590	0.00640	<0.00050	0.990	0.000620	3.20	<0.000010	7.70	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00120	<0.0030	0.00460
		7-Dec-2022	<0.030	<0.000050	<0.0010	5.50	0.00530	0.00680	<0.00050	1.00	0.000460	3.60	<0.000010	7.70	0.250	<0.000010	<0.00010	<0.010	0.000210	0.00130	<0.0030	<0.0030
	HAC-05a	12-Jan-2022	<0.030	<0.000050	<0.0010	7.80	0.0150	0.00660	<0.00050	1.20	0.00140	4.10	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000320	0.00110	<0.0030	<0.0030
		7-Feb-2022	0.0800	<0.000050	<0.0010	7.40	0.0180	0.00690	0.000680	1.10	0.00120	4.00	<0.000010	8.80	0.320	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	<0.0030
		9-Mar-2022	0.0320	<0.000050	<0.0010	8.40	0.0300	0.00630	<0.00050	1.20	0.00160	4.10	<0.000010	9.40	0.340	<0.000010	<0.00010	<0.010	0.000430	0.00120	<0.0030	0.00610
		5-Apr-2022	0.160	<0.000050	<0.0010	10.0	0.0630	0.00680	0.000570	1.30	0.00260	4.90	<0.000010	8.00	0.420	<0.000010	<0.00010	<0.010	0.000680	0.00100	<0.0030	0.0520
		3-May-2022	0.170	<0.000050	<0.0010	6.60	0.0490	0.00830	0.000740	1.00	0.00220	4.50	0.0000140	4.90	0.280	<0.000010	<0.00010	<0.010	0.000490	0.000870	<0.0030	0.0760
		1-Jun-2022	0.0530	<0.000050	<0.0010	6.10	0.0230	0.00640	<0.00050	0.970	0.000560	3.20	<0.000010	7.90	0.270	<0.000010	<0.00010	<0.010	0.000230	0.00150	<0.0030	0.00780
		5-Jul-2022	0.0310	<0.000050	<0.0010	5.90	0.0330	0.00650	<0.00050	1.00	0.00100	3.20	<0.000010	7.50	0.250	<0.000010	<0.00010	<0.010	0.000250	0.00130	<0.0030	0.00390
		3-Aug-2022	<0.030	<0.000050	<0.0010	6.80	0.0420	0.00710	<0.00050	1.10	0.00170	3.70	<0.000010	8.00	0.280	<0.000010	<0.00010	<0.010	0.000270	0.00130	<0.0030	0.00340
		8-Sep-2022	0.0580	<0.000050	<0.0010	6.00	0.0310	0.00690	<0.00050	1.00	0.00110	3.30	<0.000010	7.60	0.260	<0.000010	<0.00010	<0.010	0.000250	0.00150	<0.0030	0.00390
		5-Oct-2022	0.0340	<0.000050	<0.0010	6.40	0.0300	0.00760	<0.00050	1.10	0.00120	3.20	<0.000010	7.60	0.280	<0.000010	<0.00010	<0.010	0.000250	0.00170	<0.0030	0.00310
		2-Nov-2022	0.0360	<0.000050	<0.0010	7.30	0.0230	0.00640	<0.00050	1.00	0.00150	3.70	<0.000010	8.20	0.290	<0.000010	<0.00010	<0.010	0.000280	0.00110	<0.0030	<0.0030
		7-Dec-2022	<0.030	<0.000050	<0.0010	7.40	0.0200	0.00680	<0.00050	1.00	0.00170	4.10	<0.000010	7.90	0.300	<0.000010	<0.00010	<0.010	0.000330	0.00120	<0.0030	<0.0030
	HAC-14	3-May-2022	0.230	0.0000700	<0.0010	4.80	0.0240	0.00480	0.000830	0.780	0.00120	4.40	<0.000010	3.40	0.190	<0.000010	<0.00010	<0.010	0.000360	0.000940	<0.0030	0.160
		1-Jun-2022	0.0900	<0.000050	<0.0010	6.20	0.0210	0.00610	<0.00050	0.980	0.000710	3.40	<0.000010	7.70	0.270	<0.000010	<0.00010	<0.010	0.000240	0.00150	<0.0030	0.0130
		5-Jul-2022	0.0400	<0.000050	<0.0010	6.30	0.0190	0.00660	<0.00050	1.10	0.00110	3.30	<0.000010	7.70	0.270	<0.000010	<0.00010	<0.010	0.000280	0.00130	<0.0030	0.0120
		3-Aug-2022	<0.030	<0.000050	<0.0010	7.00	0.0120	0.00680	<0.00050	1.10	0.00140	4.00	<0.000010	7.70	0.280	<0.000010	<0.00010	<0.010	0.000290	0.00130	<0.0030	0.00430
		8-Sep-2022	0.0410	<0.000050	<0.0010	6.50	0.0130	0.00700	<0.00050	1.00	0.00120	3.40	<0.000010	7.80	0.270	<0.000010	<0.00010	<0.010	0.000270	0.00130	<0.0030	0.00400
		5-Oct-2022	0.0370	<0.000050	<0.0010	7.00	0.0130	0.00760	<0.00050	1.10	0.00120	3.40	<0.000010	7.70	0.300	<0.000010	<0.00010	<0.010	0.000290	0.00150	<0.0030	0.00320
		2-Nov-2022	<0.030	<0.000050	<0.0010	8.00	0.00850	0.00640	<0.00050	1.00	0.00160	3.90	<0.000010	8.50	0.320	<0.000010	<0.00010	<0.010	0.000320	0.000830	<0.0030	<0.0030

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Iron-Total (mg/L)	Lead-Total (mg/L)	Lithium-Total (mg/L)	Magnesium-Total (mg/L)	Manganese-Total (mg/L)	Molybdenum-Total (mg/L)	Nickel-Total (mg/L)	Potassium-Total (mg/L)	Selenium-Total (mg/L)	Silicon-Total (mg/L)	Silver-Total (mg/L)	Sodium-Total (mg/L)	Strontium-Total (mg/L)	Thallium-Total (mg/L)	Tin-Total (mg/L)	Titanium-Total (mg/L)	Uranium-Total (mg/L)	Vanadium-Total (mg/L)	Zinc-Total (mg/L)	Aluminum-Dissolved (mg/L)
2022	HAC-08	12-Jan-2022	0.0600	<0.000050	0.00120	9.00	0.0150	0.00650	<0.00050	1.20	0.00130	4.20	<0.000010	9.00	0.360	<0.000010	<0.00010	<0.010	0.000430	0.000970	<0.0030	<0.0030
		7-Feb-2022	0.0470	<0.000050	0.00110	8.40	0.0130	0.00650	<0.00050	1.20	0.00120	4.40	<0.000010	9.10	0.350	<0.000010	<0.00010	<0.010	0.000450	0.00100	<0.0030	0.00640
		9-Mar-2022	0.190	0.0000800	0.00130	9.40	0.0200	0.00580	0.000650	1.20	0.00120	4.60	<0.000010	8.90	0.350	<0.000010	<0.00010	<0.010	0.000580	0.00130	<0.0030	0.0220
		5-Apr-2022	0.290	0.0000720	0.00110	8.00	0.0240	0.00400	0.000980	0.990	0.00150	5.00	<0.000010	6.00	0.290	<0.000010	<0.00010	<0.010	0.000520	0.00110	<0.0030	0.120
		3-May-2022	0.260	0.0000970	<0.0010	4.50	0.0220	0.00350	0.00100	0.740	0.000770	4.60	<0.000010	3.00	0.170	<0.000010	<0.00010	<0.010	0.000300	0.000950	<0.0030	0.160
		1-Jun-2022	0.160	0.0000520	<0.0010	6.60	0.0270	0.00610	0.000680	1.00	0.000660	3.50	<0.000010	7.90	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00160	<0.0030	0.0160
		5-Jul-2022	0.0990	<0.000050	<0.0010	6.60	0.0210	0.00630	<0.00050	1.10	0.000930	3.40	<0.000010	7.70	0.270	<0.000010	<0.00010	<0.010	0.000300	0.00140	<0.0030	0.00860
		3-Aug-2022	0.180	0.000120	0.00130	7.30	0.0190	0.00640	0.000560	1.20	0.00130	4.10	<0.000010	8.00	0.290	<0.000010	<0.00010	<0.010	0.000360	0.00160	<0.0030	0.00500
		8-Sep-2022	0.0980	<0.000050	<0.0010	6.70	0.0190	0.00690	<0.00050	1.10	0.00100	3.50	<0.000010	7.90	0.270	<0.000010	<0.00010	<0.010	0.000280	0.00140	<0.0030	0.00420
		5-Oct-2022	0.0720	<0.000050	0.00100	7.20	0.0150	0.00750	<0.00050	1.10	0.00110	3.50	<0.000010	8.40	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00150	<0.0030	0.00710
		2-Nov-2022	<0.030	<0.000050	<0.0010	8.20	0.00960	0.00650	<0.00050	0.990	0.00150	3.80	<0.000010	8.60	0.330	<0.000010	<0.00010	<0.010	0.000360	0.000790	<0.0030	<0.0030
		7-Dec-2022	0.0310	<0.000050	0.00110	9.00	0.0110	0.00670	<0.00050	1.10	0.00160	4.50	<0.000010	8.70	0.340	<0.000010	<0.00010	<0.010	0.000460	0.000830	<0.0030	<0.0030
	W10	7-Feb-2022	0.180	<0.000050	<0.0010	8.60	0.00780	0.000680	0.000880	0.780	0.000120	5.80	<0.000010	5.20	0.180	<0.000010	<0.00010	<0.010	0.000160	0.000510	<0.0030	0.0190
		5-Apr-2022	0.750	0.000180	<0.0010	5.00	0.0330	0.000300	0.00190	0.650	0.000170	5.70	<0.000010	2.90	0.100	<0.000010	<0.00010	0.0140	0.0000930	0.00140	<0.0030	0.120
		3-Aug-2022	0.120	<0.000050	<0.0010	10.0	0.0120	0.00120	0.000950	1.00	0.000120	5.40	<0.000010	6.20	0.220	<0.000010	<0.00010	<0.010	0.000210	0.000860	<0.0030	0.0130
	EDC-01a	12-Jan-2022	0.0580	<0.000050	0.00110	9.00	0.0540	0.00570	<0.00050	1.10	0.00120	4.40	<0.000010	8.60	0.340	<0.000010	<0.00010	<0.010	0.000450	0.000840	<0.0030	<0.0030
		7-Feb-2022	0.0910	<0.000050	<0.0010	8.80	0.0370	0.00420	0.000530	1.00	0.000730	5.00	<0.000010	7.80	0.290	<0.000010	<0.00010	<0.010	0.000370	0.000800	<0.0030	0.0100
		9-Mar-2022	0.230	0.0000690	<0.0010	8.30	0.0410	0.00270	0.000990	0.880	0.000640	5.20	<0.000010	6.50	0.230	<0.000010	<0.00010	<0.010	0.000350	0.00100	<0.0030	0.0480
		5-Apr-2022	0.650	0.000160	<0.0010	5.90	0.0410	0.000940	0.00170	0.750	0.000380	5.60	<0.000010	3.70	0.140	<0.000010	<0.00010	0.0110	0.000200	0.00140	<0.0030	0.110
		3-May-2022	0.370	0.000150	<0.0010	3.60	0.0220	0.000660	0.00140	0.540	0.000190	4.80	<0.000010	2.10	0.0880	<0.000010	<0.00010	<0.010	0.000110	0.00100	<0.0030	0.160
		1-Jun-2022	0.250	0.0000560	<0.0010	5.30	0.0260	0.00270	0.000930	0.720	0.000390	3.80	<0.000010	4.70	0.160	<0.000010	<0.00010	<0.010	0.000180	0.00140	<0.0030	0.0560
		5-Jul-2022	0.140	<0.000050	<0.0010	6.10	0.0380	0.00370	0.000770	0.880	0.000650	3.60	<0.000010	5.70	0.200	<0.000010	<0.00010	<0.010	0.000230	0.00120	<0.0030	0.0310
		3-Aug-2022	0.0380	<0.000050	<0.0010	8.20	0.0560	0.00570	<0.00050	1.10	0.00110	4.30	<0.000010	7.80	0.280	<0.000010	<0.00010	<0.010	0.000380	0.00120	<0.0030	0.00630
		8-Sep-2022	0.110	<0.000050	<0.0010	7.20	0.0350	0.00640	<0.00050	1.10	0.00100	3.80	<0.000010	8.10	0.280	<0.000010	<0.00010	<0.010	0.000320	0.00140	<0.0030	0.00480
		5-Oct-2022	0.0690	<0.000050	0.00100	7.90	0.0340	0.00720	<0.00050	1.20	0.00110	3.60	<0.000010	8.30	0.320	<0.000010	<0.00010	<0.010	0.000360	0.00150	<0.0030	0.00480
		2-Nov-2022	0.0410	<0.000050	<0.0010	9.80	0.0450	0.00560	<0.00050	1.00	0.00120	4.20	<0.000010	9.20	0.330	<0.000010	<0.00010	<0.010	0.000420	0.000780	<0.0030	<0.0030
		7-Dec-2022	0.0300	<0.000050	0.00110	10.0	0.0460	0.00560	<0.00050	1.00	0.00120	4.90	<0.000010	9.10	0.340	<0.000010	<0.00010	<0.010	0.000490	0.000730	<0.0030	<0.0030
2023	HAC-13	4-Jan-2023	<0.030	<0.000050	<0.0010	5.60	0.00360	0.00680	<0.00050	1.10	0.000590	3.70	<0.000010	7.80	0.260	<0.000010	<0.00010	<0.010	0.000200	0.00140	<0.0030	<0.0030
		8-Feb-2023	<0.030	<0.000050	<0.0010	6.10	0.0190	0.00690	<0.00050	1.10	0.000570	3.60	<0.000010	7.80	0.280	<0.000010	<0.00010	<0.010	0.000220	0.00130	<0.0030	0.00600
		7-Mar-2023	<0.030	<0.000050	<0.0010	5.70	0.00880	0.00670	<0.00050	1.10	0.000520	3.40	<0.000010	7.50	0.250	<0.000010	<0.00010	<0.010	0.000210	0.00130	<0.0030	<0.0030
		3-Apr-2023	0.0360	<0.000050	<0.0010	6.20	0.0480	0.00630	<0.00050	1.10	0.000580	3.40	<0.000010	7.80	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00440
		1-May-2023	0.200	<0.000050	<0.0010	5.00	0.0190	0.00580	0.000600	1.00	0.00110	3.20	0.0000140	4.20	0.230	<0.000010	<0.00010	<0.010	0.000330	0.00110	<0.0030	0.100
		5-Jun-2023	0.0510	<0.000050	<0.0010	5.50	0.0110	0.00590	<0.00050	0.970	0.000510	3.10	<0.000010	7.10	0.230	<0.000010	<0.00010	<0.010	0.000200	0.00150	<0.0030	0.00710
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.0470	<0.000050	<0.0010	5.20	0.0200	0.00640	<0.00050	0.980	0.000540	3.30	<0.000010	7.10	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00160	<0.0030	0.00530
		6-Sep-2023	<0.030	<0.000050	<0.0010	5.00	0.0160	0.00630	<0.00050	0.880	0.000520	3.10	<0.000010	6.70	0.230	<0.000010	<0.00010	<0.010	0.000190	0.00150	<0.0030	0.00360
	HAC-05a	4-Jan-2023	<0.030	<0.000050	<0.0010	7.80	0.0160	0.00680	<0.00050	1.10	0.00160	4.20	<0.000010	8.60	0.300	<0.000010	<0.00010	<0.010	0.000320	0.00120	<0.0030	<0.0030
		8-Feb-2023	<0.030	<0.000050	<0.0010	7.20	0.0190	0.00710	<0.00050	1.10	0.00140	3.80	<0.000010	8.00	0.310	<0.000010	<0.00010	<0.010	0.000300	0.00120	<0.0030	<0.0030
		7-Mar-2023	<0.030	<0.000050	<0.0010	6.80	0.0140	0.00670	<0.00050	1.10	0.00110	3.70	<0.000010	8.00	0.280	<0.000010	<0.00010	<0.010	0.000270	0.00120	<0.0030	<0.0030
		3-Apr-2023	<0.030	<0.000050	<0.0010	7.60	0.0340	0.00630	<0.00050	1.10	0.00140	3.60	<0.000010	8.30	0.310	<0.000010	<0.00010	<0.010	0.000340	0.00110	<0.0030	0.00690
		1-May-2023	0.200	<0.000050	<0.0010	6.00	0.0330	0.00540	0.000620	1.10	0.00170	4.00	0.0000270	4.10	0.240	<0.000010	<0.00010	<0.010	0.000360	0.00110	<0.0030	0.100
		5-Jun-2023	<0.030	<0.000050	<0.0010	7.00	0.0410	0.00620	<0.00050	1.00	0.00140	3.40	<0.000010	7.60	0.270	<0.000010	<0.00010	<0.010	0.000260	0.00130	<0.0030	0.00560
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.030	<0.000050	<0.0010	5.80	0.0360	0.00640	<0.00050	0.980	0.000890	3.30	<0.000010	7.30	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00150	<0.0030	0.00340
		6-Sep-2023	<0.030	<0.000050	<0.0010	6.20	0.0270	0.00630	<0.00050	0.960	0.00110	3.30	<0.000010	7.30	0.260	<0.000010	<0.00010	<0.010	0.000240	0.00140	<0.0030	0.00360
	HAC-14	1-May-2023	0.530	0.000140	<0.0010	4.30	0.0220	0.00280	0.00140	0.890	0.000920	4.40	0.0000220	2.70	0.160	<0.000010	<0.00010	0.0170	0.000240	0.00170	<0.0030	0.230
		5-Jun-2023	0.0390	<0.000050	<0.0010	7.60	0.0120	0.00630	<0.00050	1.10	0.00140	3.80	<0.000010	8.20	0.300	<0.000010	<0.00010	<0.010	0.000320	0.00130	<0.0030	0.0190
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.030	<0.000050	<0.0010	6.10	0.0150	0.00640	<0.00050	1.00	0.000980	3.50	<0.000010	7.30	0.270	<0.000010	<0.00010	<0.010	0.000240	0.00130	<0.0030	0.00370
		6-Sep-2023	<0.030	<0.000050	<0.0010	6.60	0.0120	0.00640	<0.00050	0.990	0.00100	3.60	<0.000010	7.40	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	0.00730
	HAC-08	4-Jan-2023	<0.030	<0.000050	0.00110	8.90	0.00860	0.00660	<0.00050	1.10	0.00160	4.50	<0.000010	9.20	0.330	<0.000010	<0.00010	<0.010	0.000430	0.000920	<0.0030	<0.0030
		8-Feb-2023	0.0340	<0.000050	<0.0010	8.10	0.00830	0.00680	<0.00050	1.00	0.00130	4.20	<0.000010	8.40	0.340	<0.000010	<0.00010	<0.010	0.000400	0.000950	<0.0030	<0.0030
		7-Mar-2023	<0.030	<0.000050	<0.0010	7.50	0.00830	0.00650	<0.00050	1.10	0.00100	3.90	<0.000010	8.20	0.300	<0.000010	<0.00010	<0.010	0.000350	0.00100	<0.0030	<0.0030
		3-Apr-2023	0.160	0.000110	0.00110	8.80	0.0200	0.00610	<0.00050	1.20	0.00130	4.10	<0.000010	8.50	0.340	<0.000010	<0.00010	<0.010	0.000470	0.00120	<0.0030	0.0370
		1-May-2023	0.800	0.000240	<0.0010	4.30	0.0280	0.00220	0.00180	0.920	0.000700	5.20	0.0000200	2.60	0.150	<0.000010	<0.00010	0.0330	0.000230	0.00260	<0.0030	0.160
		5-Jun-2023	0.0790	<0.000050	0.00110	8.00	0.0150	0.00640	<0.00050	1.10	0.00130	3.80	<0.000010	8.30	0.310	<0.000010	<0.00010	<0.010	0.000340	0.00140	<0.0030	0.0380
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.0620	<0.000050	<0.0010	6.40	0.0180	0.00640	<0.00050	1.00	0.000920	3.70	<0.000010	7.50	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00140	<0.0030	0.00530
		6-Sep-2023	<0.030	<0.000050	0.00110	6.90	0.00860	0.00650	<0.00050	0.980	0.00110	3.60	<0.000010	7.60	0.290	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	0.00420
	W10	13-Jun-2023	<0.030	<0.000050	0.00100	11.0	0.00450	0.00110	0.000720	1.20	0.000180	4.80	<0.000010	7.50	0.220	<0.000010	<0.00010	<0.010	0.000190	0.000640	<0.0030	0.0140
	EDC-01a	4-Jan-2023	0.0350	<0.000050	<0.0010	9.80	0.0390	0.00520	<0.00050	1.10	0.00120	4.80	<0.000010	9.10	0.320	<0.000010	<0.00010	<0.010	0.000440	0.000780	<0.0030	<0.0030
		8-Feb-2023	0.0380	<0.000050	0.00100	9.30	0.0320	0.00520	0.000770	1.00	0.000900	4.60	<0.000010	8.20	0.320	<0.000010	<0.00010	<0.010	0.000410	0.000810	<0.0030	<0.0030
		7-Mar-2023	0.0310	<0.000050	<0.0010	8.40	0.0330	0.00570	<0.00050	1.00	0.000970	4.30	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000390	0.000910	<0.0030	<0.0030
		3-Apr-2023	0.0720	<0.000050	<0.0010	9.60	0.0300	0.00460	<0.00050	1.10	0.00100	4.50	<0.000010	7.70	0.310	<0.000010	<0.00010	<0.010	0.000430	0.000780	<0.0030	0.00400
		1-May-2023	1.40	0.000420	0.00110	3.40	0.0390	0.000490	0.00280	0.820	0.000200	5.40	0.0000170	2.00	0.0750	0.0000100	<0.00010	0.0350	0.000120	0.00280	0.00360	0.160
		5-Jun-2023	0.0390	<0.000050	0.00100	8.70	0.0630	0.00500	<0.00050	1.10	0.000970	4.10	<0.000010	7.90	0.290	<0.000010	<0.00010	<0.010	0.000400	0.00110	<0.0030	0.00820
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	0.0360	<0.000050	<0.0010	6.80	0.0360	0.00630	<0.00050	1.00	0.000830	3.80	<0.000010	7.60	0.290	<0.000010	<0.00010	<0.010	0.000290	0.00130	<0.0030	0.00360
		6-Sep-2023	0.0320	<0.000050	0.00110	7.70	0.0350	0.00600	<0.00050	1.00	0.00100	3.80	<0.000010	8.00	0.290	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	0.00600

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2015	HAC-13	3-Dec-2015	0.000150	0.000690	0.0280	<0.00010	<0.000050	0.0340	0.0000110	79.0	<0.00050	0.000180	0.0140	<0.030	<0.000050	0.00160	12.0	0.140	-	0.0190	<0.00050
		7-Dec-2015	0.000190	0.000860	0.0220	<0.00010	<0.000050	0.0290	0.0000120	70.0	<0.00050	0.000160	0.0130	<0.030	<0.000050	0.00120	10.0	0.0980	-	0.0270	<0.00050
		15-Dec-2015	0.000200	0.000560	0.0470	<0.00010	<0.000050	0.0370	0.0000450	108	<0.00050	0.000440	0.0260	0.0560	<0.000050	0.00220	18.0	0.370	-	0.0300	0.000810
		22-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Dec-2015	0.000190	0.000540	0.0400	<0.00010	<0.000050	0.0360	0.0000340	98.0	<0.00050	0.000320	0.0220	0.0450	<0.000050	0.00120	15.0	0.270	-	0.0280	0.000680
		29-Dec-2015	0.000150	0.000540	0.0380	<0.00010	<0.000050	0.0330	0.0000260	88.0	<0.00050	0.000200	0.0190	0.0300	<0.000050	0.00160	14.0	0.190	-	0.0200	<0.00050
	HAC-05a	31-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.000130	0.000900	0.0200	<0.00010	<0.000050	0.0270	<0.0000050	54.0	<0.00050	0.000100	0.00760	0.0310	<0.000050	<0.0010	8.20	0.0810	-	0.0120	<0.00050
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	0.000660	0.000540	0.0650	<0.00010	<0.000050	0.140	0.0000340	176	<0.00050	0.000180	0.00390	<0.030	<0.000050	0.00760	30.0	0.170	-	0.130	0.000540
		7-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	24-Feb-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	0.000140	0.00140	0.0340	<0.00010	<0.000050	0.0360	<0.0000050	59.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00220	13.0	0.00360	-	0.0110	<0.00050
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	0.000120	0.000950	0.0300	<0.00010	<0.000050	0.0290	0.00000580	59.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00170	11.0	0.0190	-	0.0140	<0.00050
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	0.000490	0.00100	0.0840	<0.00010	<0.000050	0.120	0.0000280	155	<0.00050	0.000120	0.00790	<0.030	<0.000050	0.00680	28.0	0.0460	-	0.110	0.000840
	W10	27-Jan-2015	<0.00010	0.000480	0.00950	<0.00010	<0.00050	<0.010	<0.000010	20.0	0.000530	<0.00010	0.00230	0.170	<0.000050	<0.00050	5.60	0.00350	-	0.000380	0.00110
		2-Feb-2015	<0.00010	0.000500	0.00940	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.000800	<0.00010	0.00270	0.230	<0.000050	<0.00050	5.10	0.00270	-	0.000360	0.00120
		10-Feb-2015	<0.00010	0.000440	0.00900	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.000670	<0.00010	0.00250	0.200	<0.000050	<0.00050	5.00	0.00110	-	0.000350	0.00120
		17-Feb-2015	<0.00010	0.000400	0.00920	<0.00010	<0.00050	<0.010	<0.000010	17.0	0.000810	<0.00010	0.00310	0.220	<0.000050	<0.00050	4.50	0.00140	-	0.000310	0.00120
		24-Feb-2015	<0.00010	0.000450	0.00900	<0.00010	<0.00050	<0.010	<0.000010	17.0	0.000720	<0.00010	0.00280	0.190	<0.000050	<0.00050	4.70	0.00110	-	0.000320	0.00120
		2-Mar-2015	<0.00010	0.000440	0.00870	<0.00010	<0.00050	<0.010	<0.000010	19.0	0.000640	<0.00010	0.00250	0.150	<0.000050	<0.00050	5.20	0.00200	-	0.000330	0.00100
		10-Mar-2015	<0.00010	0.000450	0.00930	<0.00010	<0.00050	<0.010	<0.000010	19.0	0.000680	<0.00010	0.00270	0.190	<0.000050	<0.00050	5.30	0.00140	-	0.000410	0.00120
		17-Mar-2015	<0.00010	0.000370	0.00840	<0.00010	<0.00050	<0.010	<0.000010	14.0	0.000810	<0.00010	0.00300	0.200	<0.000050	<0.00050	3.80	0.00150	-	0.000230	0.00130
		24-Mar-2015	<0.00010	0.000330	0.00790	<0.00010	<0.00050	<0.010	<0.000010	14.0	0.000920	<0.00010	0.00280	0.200	<0.000050	<0.00050	3.60	0.00180	-	0.000280	0.00130
		7-Apr-2015	<0.00010	0.000350	0.00770	<0.00010	<0.000050	<0.010	0.00000820	14.0	0.000770	<0.00010	0.00280	0.190	<0.000050	<0.0010	3.50	0.00260	-	0.000340	0.00120
		14-Apr-2015	<0.00010	0.000350	0.00770	<0.00010	<0.000050	<0.010	<0.0000050	14.0	0.000730	<0.00010	0.00250	0.160	<0.000050	<0.0010	3.70	0.00210	-	0.000370	0.00120
		4-May-2015	<0.00010	0.000420	0.00890	<0.00010	<0.000050	<0.010	0.00000570	15.0	0.000680	<0.00010	0.00260	0.140	<0.000050	<0.0010	4.20	0.00280	-	0.000360	0.00110
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Jun-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Jul-2015	<0.00010	0.00220	0.0290	<0.00010	<0.000050	0.0230	<0.0000050	45.0	<0.00050	<0.00010	0.00120	<0.030	<0.000050	0.00130	16.0	0.00640	<0.0000050	0.00220	0.000730
		2-Aug-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Aug-2015	<0.00010	0.00230	0.0330	<0.00010	<0.000050	0.0270	<0.0000050	48.0	<0.00050	<0.00010	0.00110	<0.030	<0.000050	0.00140	16.0	0.00820	<0.0000050	0.00260	0.000590
		3-Sep-2015	<0.00010	0.00240	0.0300	<0.00010	<0.000050	0.0280	<0.0000050	47.0	<0.00050	<0.00010	0.000850	<0.030	<0.000050	0.00130	18.0	0.00290	-	0.00260	0.000550
		6-Sep-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	<0.00010	0.00260	0.0310	<0.00010	<0.000050	0.0310	<0.0000050	47.0	<0.00050	<0.00010	0.000890	<0.030	<0.000050	0.00110	18.0	0.00230	-	0.00250	0.000530
		5-Nov-2015	<0.00010	0.00140	0.0160	<0.00010	<0.000050	0.0160	<0.0000050	32.0	<0.00050	<0.00010	0.00180	0.0670	<0.000050	<0.0010	10.0	0.00230	-	0.00100	0.000790
		3-Dec-2015	<0.00010	0.00180	0.0200	<0.00010	<0.000050	0.0190	<0.0000050	35.0	<0.00050	<0.00010	0.00130	0.0360	<0.000050	<0.0010	12.0	0.00190	-	0.00120	0.000710
	EDC-01a	17-Feb-2015	<0.00010	0.000450	0.0110	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.000800	0.000100	0.00730	0.220	0.0000700	<0.00050	4.40	0.00370	-	0.000380	0.00140
		24-Feb-2015	<0.00010	0.000470	0.00980	<0.00010	<0.00050	<0.010	<0.000010	18.0	0.000770	0.000140	0.00350	0.200	<0.000050	<0.00050	4.80	0.00350	-	0.000350	0.00120
		2-Mar-2015	<0.00010	0.000460	0.00940	<0.00010	<0.00050	<0.010	<0.000010	20.0	0.000660	<0.00010	0.00310	0.160	<0.000050	<0.00050	5.40	0.00660	-	0.000400	0.00100
		10-Mar-2015	<0.00010	0.000470	0.0100	<0.00010	<0.00050	<0.010	<0.000010	20.0	0.000700	<0.00010	0.00330	0.180	<0.000050	<0.00050	5.40	0.00370	-	0.000440	0.00120
		17-Mar-2015	<0.00010	0.000390	0.00900	<0.00010	<0.00050	<0.010	<0.000010	14.0	0.000910	<0.00010	0.00420	0.230	<0.000050	<0.00050	3.90	0.00200	-	0.000230	0.00130
		24-Mar-2015	<0.00010	0.000320	0.00850	<0.00010	<0.00050	<0.010	<0.000010	15.0	0.000900	<0.00010	0.00350	0.200	<0.000050	<0.00050	3.80	0.00370	-	0.000360	0.00120
		1-Apr-2015	<0.00010	0.000450	0.00660	<0.00010	<0.000050	<0.010	0.0000120	14.0	0.000880	0.000190	0.00410	0.310	0.000100	<0.0010	3.20	0.0120	-	0.000380	0.00140
		7-Apr-2015	<0.00010	0.000360	0.00820	<0.00010	<0.000050	<0.010	0.00000650	14.0	0.000770	<0.00010	0.00320	0.180	<0.000050	<0.0010	3.50	0.00700	-	0.000350	0.00120
		14-Apr-2015	<0.00010	0.000390	0.00820	<0.00010	<0.000050	<0.010	0.00000590	14.0	0.000710	<0.00010	0.00310	0.160	<0.000050	<0.0010	3.70	0.00520	-	0.000400	0.00110
		21-Apr-2015	<0.00010	0.000390	0.00860	<0.00010	<0.000050	<0.010	0.00000560	14.0	0.000640	<0.00010	0.00320	0.130	<0.000050	<0.0010	3.80	0.00130	-	0.000450	0.00110
		28-Apr-2015	<0.00010	0.000380	0.00930	<0.00010	<0.000050	<0.010	0.00000630	15.0	0.000650	<0.00010	0.00340	0.140	<0.000050	<0.0010	4.00	0.00400	-	0.000480	0.00110
		4-May-2015	<0.00010	0.000440	0.00930	<0.00010	<0.000050	<0.010	<0.0000050	15.0	0.000770	<0.00010	0.00360	0.130	<0.000050	<0.0010	4.20	0.00580	-	0.000500	0.00110
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Jun-2015	<0.00010	0.00100	0.0220	<0.00010	<0.000050	0.0160	0.00000540	33.0	<0.00050	<0.00010	0.00790	0.0350	<0.000050	<0.0010	8.80	0.0130	-	0.00260	0.000910
		7-Jul-2015	0.000180	0.000930	0.0370	<0.00010	<0.000050	0.0280	0.00000930	49.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00150	12.0	0.0160	<0.0000050	0.00640	0.000590
		31-Aug-2015	0.000110	0.00130	0.0440	<0.00010	<0.000050	0.0290	0.00000980	57.0	<0.00050	<0.00010	0.00950	<0.030	<0.000050	0.00110	16.0	0.00510	-	0.00620	<0.00050
		8-Sep-2015	<0.00010	0.00180	0.0360	<0.00010	<0.000050	0.0280	<0.0000050	52.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	0.00110	16.0	0.0130	-	0.00440	0.000530

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2015	EDC-01a	1-Oct-2015	<0.00010	0.00170	0.0360	<0.00010	<0.000050	0.0280	0.00000510	53.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	0.00110	17.0	0.0110	-	0.00430	0.000830
		15-Oct-2015	<0.00010	0.00160	0.0370	<0.00010	<0.000050	0.0310	0.0000120	61.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00150	16.0	0.0760	-	0.00730	<0.00050
		20-Oct-2015	<0.00010	0.00170	0.0350	<0.00010	<0.000050	0.0270	0.00000880	56.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	0.00160	16.0	0.0640	-	0.00640	0.000500
		26-Oct-2015	<0.00010	0.00160	0.0340	<0.00010	<0.000050	0.0300	0.0000110	61.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	0.00150	16.0	0.0870	-	0.00610	<0.00050
		5-Nov-2015	<0.00010	0.00130	0.0200	<0.00010	<0.000050	0.0170	0.00000560	34.0	<0.00050	<0.00010	0.00370	0.0550	<0.000050	<0.0010	10.0	0.00730	-	0.00130	0.000770
		3-Dec-2015	<0.00010	0.00150	0.0270	<0.00010	<0.000050	0.0190	<0.0000050	44.0	<0.00050	<0.00010	0.00460	0.0330	<0.000050	<0.0010	13.0	0.0110	-	0.00350	0.000630
	HAC-13	5-Jan-2016	0.000130	0.000840	0.0180	<0.00010	<0.000050	0.0300	0.00000730	50.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	0.00120	6.90	0.0470	-	0.0110	<0.00050
		7-Jan-2016	0.000110	0.000810	0.0140	<0.00010	<0.000050	0.0270	<0.0000050	48.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	6.50	0.0280	-	0.0100	<0.00050
		12-Jan-2016	0.000110	0.000880	0.0140	<0.00010	<0.000050	0.0270	0.00000510	48.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	0.00100	6.50	0.0310	-	0.0100	<0.00050
		19-Jan-2016	0.000130	0.000910	0.0140	<0.00010	<0.000050	0.0330	<0.0000050	50.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	6.60	0.0310	-	0.0110	<0.00050
		26-Jan-2016	0.000140	0.000890	0.0160	<0.00010	<0.000050	0.0280	0.00000680	54.0	<0.00050	<0.00010	0.00800	<0.030	<0.000050	0.00100	7.30	0.0610	-	0.0130	<0.00050
		1-Feb-2016	0.000140	0.000920	0.0160	<0.00010	<0.000050	0.0320	0.00000640	54.0	<0.00050	0.000110	0.00720	0.0320	<0.000050	0.00110	7.50	0.0660	-	0.0120	<0.00050
		9-Feb-2016	0.000120	0.000920	0.0150	<0.00010	<0.000050	0.0280	<0.0000050	53.0	<0.00050	<0.00010	0.00650	0.0340	<0.000050	<0.0010	7.20	0.0640	-	0.0120	<0.00050
		15-Feb-2016	0.000130	0.000890	0.0160	<0.00010	<0.000050	0.0270	0.00000920	52.0	<0.00050	0.000140	0.00830	0.130	<0.000050	0.00110	7.80	0.0930	-	0.0130	<0.00050
		22-Feb-2016	0.000130	0.000850	0.0140	<0.00010	<0.000050	0.0250	0.00000860	54.0	<0.00050	0.000130	0.00770	0.0610	<0.000050	<0.0010	7.30	0.0770	-	0.0130	<0.00050
		24-Feb-2016	0.000120	0.000900	0.0140	<0.00010	<0.000050	0.0250	0.00000810	50.0	<0.00050	0.000120	0.00740	0.0570	<0.000050	<0.0010	7.20	0.0740	-	0.0120	<0.00050
		29-Feb-2016	0.000120	0.000880	0.0150	<0.00010	<0.000050	0.0270	0.0000130	51.0	<0.00050	0.000140	0.00800	0.0730	<0.000050	<0.0010	7.10	0.0830	-	0.0120	<0.00050
		2-Mar-2016	0.000120	0.000900	0.0140	<0.00010	<0.000050	0.0280	0.00000620	49.0	<0.00050	0.000120	0.00740	0.0580	<0.000050	<0.0010	7.00	0.0690	-	0.0120	<0.00050
		8-Mar-2016	0.000190	0.000780	0.0290	<0.00010	<0.000050	0.0280	0.0000440	86.0	<0.00050	0.000540	0.0310	0.230	<0.000050	0.00190	13.0	0.350	-	0.0280	0.000780
		15-Mar-2016	0.000130	0.000800	0.0160	<0.00010	<0.000050	0.0250	0.0000190	55.0	<0.00050	0.000180	0.0130	0.110	<0.000050	0.00110	7.80	0.110	-	0.0150	<0.00050
		23-Mar-2016	0.000270	0.000680	0.0490	<0.00010	<0.000050	0.0290	0.0000940	121	<0.00050	0.00100	0.0550	0.450	0.0000670	0.00350	20.0	0.680	-	0.0610	0.00130
		29-Mar-2016	0.000270	0.000690	0.0460	<0.00010	<0.000050	0.0330	0.0000740	134	<0.00050	0.000970	0.0540	0.450	0.0000630	0.00350	20.0	0.680	-	0.0670	0.00130
		4-Apr-2016	0.000230	0.000750	0.0400	<0.00010	<0.000050	0.0230	0.0000850	93.0	<0.00050	0.00110	0.0770	0.660	0.000150	0.00200	15.0	0.590	-	0.0390	0.00130
		11-Apr-2016	0.000110	0.000700	0.0130	<0.00010	<0.000050	0.0210	0.00000660	40.0	<0.00050	0.000100	0.0110	0.0910	<0.000050	<0.0010	5.50	0.0490	-	0.00950	<0.00050
		13-Apr-2016	0.000110	0.000780	0.0130	<0.00010	<0.000050	0.0230	0.00000540	47.0	<0.00050	<0.00010	0.00860	0.0560	<0.000050	<0.0010	6.40	0.0410	-	0.00950	<0.00050
		19-Apr-2016	<0.00010	0.000760	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	45.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	0.00110	6.10	0.0800	-	0.00970	<0.00050
		25-Apr-2016	0.000100	0.000710	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.00640	0.0540	<0.000050	0.00110	5.80	0.0350	-	0.00910	<0.00050
		5-May-2016	0.000110	0.000730	0.0140	<0.00010	<0.000050	0.0250	<0.0000050	46.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	6.30	0.0410	-	0.0110	<0.00050
		10-May-2016	0.000130	0.000800	0.0140	<0.00010	<0.000050	0.0300	<0.0000050	46.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	6.20	0.0300	-	0.0110	<0.00050
		17-May-2016	0.000120	0.000830	0.0140	<0.00010	<0.000050	0.0280	<0.0000050	48.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	0.00120	6.60	0.0430	-	0.0120	<0.00050
		24-May-2016	0.000120	0.000820	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	46.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	6.20	0.0300	-	0.0110	<0.00050
		31-May-2016	0.000100	0.000850	0.0110	<0.00010	<0.000050	0.0250	<0.0000050	48.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	6.20	0.0170	-	0.0100	<0.00050
		7-Jun-2016	0.000120	0.000850	0.0140	<0.00010	<0.000050	0.0270	<0.0000050	45.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.20	0.0300	-	0.0110	<0.00050
		14-Jun-2016	0.000210	0.000850	0.0390	<0.00010	<0.000050	0.0370	0.0000140	98.0	<0.00050	0.000210	0.0180	0.0600	<0.000050	0.00260	15.0	0.180	-	0.0320	0.000550
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	0.000130	0.000830	0.0160	<0.00010	<0.000050	0.0260	0.00000710	52.0	<0.00050	<0.00010	0.00780	0.0330	<0.000050	<0.0010	7.10	0.0480	-	0.0130	<0.00050
		27-Jun-2016	0.000120	0.000850	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	46.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	<0.0010	6.40	0.0260	-	0.0110	<0.00050
		6-Jul-2016	0.000130	0.000850	0.0170	<0.00010	<0.000050	0.0260	0.00000670	51.0	<0.00050	<0.00010	0.00810	<0.030	<0.000050	<0.0010	6.90	0.0400	-	0.0130	<0.00050
		13-Jul-2016	0.000250	0.000930	0.0430	<0.00020	<0.00010	0.0340	0.0000110	70.0	<0.00050	<0.00020	0.0190	<0.030	<0.00010	<0.0020	11.0	0.0370	-	0.0240	<0.0010
		18-Jul-2016	0.000230	0.00110	0.0430	<0.00010	<0.000050	0.0370	0.00000750	84.0	<0.00050	0.000160	0.0190	0.0350	<0.000050	0.00230	13.0	0.120	-	0.0220	<0.00050
		25-Jul-2016	0.000130	0.000910	0.0170	<0.00010	<0.000050	0.0290	0.00000570	48.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	0.00120	6.60	0.0400	-	0.0130	<0.00050
		2-Aug-2016	0.000210	0.000950	0.0270	<0.00010	<0.000050	0.0320	0.00000520	58.0	<0.00050	<0.00010	0.0130	<0.030	<0.000050	0.00130	9.00	0.0230	-	0.0170	<0.00050
		10-Aug-2016	0.000300	0.00100	0.0330	<0.00010	<0.000050	0.0300	0.00000510	54.0	<0.00050	<0.00010	0.0130	<0.030	<0.000050	0.00110	8.20	0.0260	-	0.0180	<0.00050
		17-Aug-2016	0.000260	0.00200	0.0500	<0.00010	<0.000050	0.0340	0.0000260	80.0	<0.00050	0.000370	0.0270	0.110	0.000100	0.00160	12.0	0.220	-	0.0230	0.000780
		23-Aug-2016	0.000290	0.00100	0.0400	<0.00020	<0.00010	0.0290	<0.000010	44.0	<0.00050	<0.00020	0.0160	<0.030	<0.00010	<0.0020	7.50	<0.00020	-	0.0150	<0.0010
		30-Aug-2016	0.000190	0.000870	0.0340	<0.00010	<0.000050	0.0260	<0.0000050	43.0	<0.00050	<0.00010	0.0130	<0.030	<0.000050	<0.0010	6.70	0.000140	-	0.0130	<0.00050
		6-Sep-2016	0.000170	0.000800	0.0320	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.00970	<0.030	<0.000050	0.00100	6.90	0.000190	-	0.0130	<0.00050
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Sep-2016	0.000330	0.000890	0.0430	<0.00010	<0.000050	0.0340	0.0000110	58.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	9.10	0.0380	-	0.0230	<0.00050
		19-Sep-2016	0.000420	0.000860	0.0630	<0.00010	<0.000050	0.0420	0.0000230	98.0	<0.00050	0.000220	0.0310	<0.030	<0.000050	0.00250	15.0	0.200	-	0.0550	0.000620
		27-Sep-2016	0.000190	0.000710	0.0320	<0.00010	<0.000050	0.0310	0.00000890	56.0	<0.00050	<0.00010	0.0150	<0.030	<0.000050	0.00130	8.60	0.0190	-	0.0170	<0.00050
		2-Oct-2016	0.000140	0.000770	0.0190	<0.00010	<0.000050	0.0270	<0.0000050	48.0	<0.00050	<0.00010	0.00890	<0.030	<0.000050	<0.0010	6.60	0.0200	-	0.0120	<0.00050
		3-Oct-2016	0.000150	0.000690	0.0230	<0.00010	<0.000050	0.0270	<0.0000050	46.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	6.60	0.00440	-	0.0120	<0.00050
		11-Oct-2016	0.000160	0.000680	0.0300	<0.00010	<0.000050	0.0300	0.00000760	56.0	<0.00050	<0.00010	0.0170	<0.030	<0.000050	<0.0010	8.80	0.0240	-	0.0160	<0.00050
		18-Oct-2016	0.000160	0.000730	0.0240	<0.00010	<0.000050	0.0280	0.0000140	54.0	<0.00050	0.000110	0.0160	0.0320	<0.000050	<0.0010	8.60	0.100	-	0.0160	<0.00050
		24-Oct-2016	0.000150	0.000730	0.0310	<0.00010	<0.000050	0.0300	0.0000150	70.0	<0.00050	0.000110	0.0220	0.0390	<0.000050	0.00170	11.0	0.110	-	0.0220	0.000510
		1-Nov-2016	0.000140	0.000870	0.0260	<0.00010	<0.000050	0.0250	0.0000150	51.0	<0.00050	0.000130	0.0200	0.0700	<0.000050	<0.0010	8.70	0.0840	-	0.0150	0.000630
		8-Nov-2016	0.000160	0.000840	0.0200	<0.00010	<0.000050	0.0290	0.00000900	52.0	<0.00050	0.000110	0.0130	<0.030	<0.000050	0.00110	8.20	0.0970	-	0.0160	<0.00050
		15-Nov-2016	0.000110	0.000810	0.0170	<0.00010	<0.000050	0.0300	0.00000650	49.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	0.00100	7.60	0.0620	-	0.0120	<0.00050
		22-Nov-2016	0.000120	0.000860	0.0160	<0.00010	<0.000050	0.0250	0.00000550	44.0	<0.00050	<0.00010	0.00850	<0.030	<0.000050	<0.0010	6.40	0.0460	-	0.0110	<0.00050
		29-Nov-2016	0.000130	0.000820	0.0170	<0.00010	<0.000050	0.0290	0.0000120	49.0	<0.00050	<0.00010	0.00990	<0.030	<0.000050	0.00120	7.70	0.0700	-	0.0120	<0.00050
		6-Dec-2016	0.000120	0.000670	0.0140	<0.00010	<0.000050	0.0270	0.00000600	48.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	<0.0010	6.70	0.0470	-	0.0120	<0.00050
		14-Dec-2016	0.000110	0.000810	0.0130	<0.00010	<0.000050	0.0250	0.00000510	38.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	5.80	0.0300	-	0.00960	<0.00050
		20-Dec-2016	<0.00010	0.000780	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	6.00	0.0430	-	0.0100	<0.00050
		28-Dec-2016	0.000120	0.000850	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	42.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	5.70	0.0250	-	0.0100	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2016	HAC-05a	5-Jan-2016	0.00100	0.000560	0.0440	<0.00010	<0.000050	0.140	0.00000960	137	<0.00050	0.000130	0.00410	<0.030	<0.000050	0.00860	25.0	0.120	-	0.0990	0.000510
		7-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		12-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	0.000670	0.000570	0.0380	<0.00010	<0.000050	0.0890	0.0000190	113	<0.00050	0.000150	0.00500	<0.030	<0.000050	0.00680	20.0	0.0910	-	0.0730	<0.00050
		9-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Mar-2016	0.000530	0.000660	0.0360	<0.00010	<0.000050	0.0790	0.0000230	109	<0.00050	0.000200	0.00570	0.0350	<0.000050	0.00570	19.0	0.140	-	0.0730	<0.00050
		8-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.000320	0.000480	0.0410	<0.00010	<0.000050	0.0560	0.0000570	137	<0.00050	0.000590	0.0260	0.190	<0.000050	0.00330	23.0	0.300	-	0.0840	0.00100
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	0.00110	0.000520	0.0470	<0.00010	<0.000050	0.0980	<0.0000050	120	<0.00050	0.000110	0.00330	<0.030	<0.000050	0.0100	22.0	0.0600	-	0.110	<0.00050
		10-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		7-Jun-2016	0.00120	0.000660	0.0480	<0.00010	<0.000050	0.100	0.00000580	119	<0.00050	<0.00010	0.00270	<0.030	<0.000050	0.0110	22.0	0.0350	-	0.120	<0.00050
		14-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Jul-2016	0.00120	0.000870	0.0540	<0.00010	<0.000050	0.100	0.00000800	132	<0.00050	<0.00010	0.00360	<0.030	<0.000050	0.0120	24.0	0.0290	-	0.130	<0.00050
		13-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	0.00160	0.000920	0.0670	<0.00010	<0.000050	0.120	<0.000015	151	<0.00050	<0.00010	0.00260	<0.030	<0.000050	0.0150	30.0	0.0170	-	0.140	0.000530
		10-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Sep-2016	0.00150	0.000860	0.0700	<0.00010	<0.000050	0.140	<0.000020	139	<0.00050	<0.00010	0.00240	<0.030	<0.000050	0.0150	27.0	0.0150	-	0.160	<0.00050
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Oct-2016	0.00190	0.000990	0.0630	<0.00010	<0.000050	0.130	0.0000120	162	<0.00050	<0.00010	0.00270	<0.030	<0.000050	0.0170	27.0	0.0200	-	0.170	<0.00050
		11-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Nov-2016	0.00120	0.000980	0.0560	<0.00010	<0.000050	0.0980	<0.000020	117	<0.00050	<0.00010	0.00780	0.0380	<0.000050	0.0110	24.0	0.0620	-	0.120	0.000500
		8-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Nov-2016	0.000130	0.000850	0.0170	<0.00010	<0.000050	0.0220	0.00000590	47.0	<0.00050	0.000100	0.00990	0.0530	<0.000050	0.00100	7.00	0.0740	-	0.0120	<0.00050
		29-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Dec-2016	0.00110	0.000950	0.0460	<0.00010	<0.000050	0.100	0.0000200	120	<0.00050	<0.00010	0.00450	<0.030	<0.000050	0.0110	22.0	0.0380	-	0.120	<0.00050
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	5-Jan-2016	0.000820	0.000790	0.0750	<0.00010	<0.000050	0.120	0.0000240	133	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00730	24.0	0.0590	-	0.0900	<0.00050
		19-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	0.000650	0.000620	0.0420	<0.00010	<0.000050	0.0890	0.0000170	113	<0.00050	0.000140	0.00580	<0.030	<0.000050	0.00690	20.0	0.0800	-	0.0690	<0.00050
		2-Mar-2016	0.000410	0.000670	0.0340	<0.00010	<0.000050	0.0560	0.0000180	100	<0.00050	0.000160	0.00700	0.0340	<0.000050	0.00460	18.0	0.100	-	0.0520	<0.00050
		4-Apr-2016	0.000190	0.000610	0.0340	<0.00010	<0.000050	0.0260	0.0000360	83.0	<0.00050	0.000340	0.0220	0.150	<0.000050	0.00170	14.0	0.170	-	0.0370	0.00120
		5-May-2016	0.000880	0.000670	0.0510	<0.00010	<0.000050	0.0850	<0.0000050	111	<0.00050	0.000100	0.00550	<0.030	<0.000050	0.00800	20.0	0.0580	-	0.0930	<0.00050
		7-Jun-2016	0.00110	0.000720	0.0540	<0.00010	<0.000050	0.0980	0.00000760	121	<0.00050	<0.00010	0.00340	<0.030	<0.000050	0.0110	23.0	0.0340	-	0.110	<0.00050
		6-Jul-2016	0.00110	0.000890	0.0600	<0.00010	<0.000050	0.100	0.0000120	129	<0.00050	<0.00010	0.00390	<0.030	<0.000050	0.0110	24.0	0.0150	-	0.120	<0.00050
		2-Aug-2016	0.00140	0.00100	0.0690	<0.00010	<0.000050	0.110	0.00000770	133	<0.00050	<0.00010	0.00340	<0.030	<0.000050	0.0130	26.0	0.00560	-	0.120	<0.00050
		6-Sep-2016	0.00130	0.000890	0.0620	<0.00010	<0.000050	0.110	<0.000020	125	<0.00050	<0.00010	0.00310	<0.030	<0.000050	0.0130	25.0	0.00680	-	0.130	<0.00050
		3-Oct-2016	0.00160	0.000930	0.0630	<0.00010	<0.000050	0.120	0.00000590	148	<0.00050	<0.00010	0.00300	<0.030	<0.000050	0.0150	25.0	0.0140	-	0.150	<0.00050
		1-Nov-2016	0.000940	0.000970	0.0530	<0.00010	<0.000050	0.0720	0.00000840	89.0	<0.00050	<0.00010	0.00970	0.0460	<0.000050	0.00830	22.0	0.0420	-	0.0830	0.000640
		22-Nov-2016	0.000200	0.000830	0.0190	<0.00010	<0.000050	0.0220	0.00000780	46.0	<0.00050	<0.00010	0.0120	0.0880	<0.000050	0.00170	7.60	0.0460	-	0.0140	0.000500
		6-Dec-2016	0.00100	0.000990	0.0490	<0.00010	<0.000050	0.0920	0.0000130	114	<0.00050	<0.00010	0.00560	<0.030	<0.000050	0.0100	22.0	0.0340	-	0.110	<0.00050
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2016	W10	7-Jan-2016	<0.00010	0.00180	0.0180	<0.00010	<0.000050	0.0140	<0.0000050	33.0	<0.00050	<0.00010	0.00130	0.0680	<0.000050	<0.0010	11.0	0.00160	-	0.00100	0.000660
		1-Feb-2016	<0.00010	0.00100	0.0140	<0.00010	<0.000050	0.0100	<0.0000050	26.0	0.000520	<0.00010	0.00220	0.190	<0.000050	<0.0010	8.20	0.00320	-	0.000650	0.000850
		2-Mar-2016	<0.00010	0.000620	0.0100	<0.00010	<0.000050	<0.010	<0.0000050	21.0	0.000700	<0.00010	0.00290	0.230	<0.000050	<0.0010	5.90	0.00320	-	0.000410	0.00120
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	<0.00010	0.000350	0.00860	<0.00010	<0.000050	<0.010	0.00000880	12.0	0.000870	<0.00010	0.00330	0.230	<0.000050	<0.0010	3.40	0.00340	-	0.000270	0.00130
		4-May-2016	<0.00010	0.000750	0.0110	<0.00010	<0.000050	<0.010	0.0000710	16.0	0.000660	<0.00010	0.00330	0.130	<0.000050	<0.0010	4.60	0.00340	-	0.000360	0.00120
		4-May-2016	<0.00010	0.000690	0.0100	<0.00010	<0.000050	<0.010	0.00000740	16.0	0.000680	<0.00010	0.00360	0.130	<0.000050	<0.0010	4.60	0.00360	-	0.000430	0.00130
		6-Jun-2016	<0.00010	0.000950	0.0140	<0.00010	<0.000050	0.0110	0.00000680	22.0	0.000520	<0.00010	0.00310	0.110	<0.000050	<0.0010	6.50	0.00320	-	0.000600	0.00110
		4-Jul-2016	<0.00010	0.00100	0.0130	<0.00010	<0.000050	0.0100	0.00000960	22.0	0.000670	<0.00010	0.00280	0.190	<0.000050	<0.0010	6.50	0.00470	-	0.000690	0.00150
		4-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	<0.00010	0.00130	0.0150	<0.00010	<0.000050	0.0120	0.00000890	25.0	0.000570	<0.00010	0.00230	0.180	<0.000050	<0.0010	7.90	0.00480	-	0.000840	0.00140
		6-Sep-2016	<0.00010	0.00210	0.0280	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00110	<0.030	<0.000050	0.00100	15.0	0.00310	-	0.00200	0.000830
		3-Oct-2016	<0.00010	0.000880	0.0120	<0.00010	<0.000050	<0.010	<0.0000050	22.0	<0.00050	<0.00010	0.00200	0.180	<0.000050	<0.0010	6.20	0.00240	-	0.000590	0.00110
		1-Nov-2016	<0.00010	0.000550	0.00980	<0.00010	<0.000050	<0.010	0.00000670	16.0	0.000920	<0.00010	0.00320	0.300	<0.000050	<0.0010	4.60	0.00340	-	0.000410	0.00140
		1-Dec-2016	<0.00010	0.000520	0.00950	<0.00010	<0.000050	<0.010	0.00000540	17.0	0.000940	<0.00010	0.00280	0.270	<0.000050	<0.0010	4.50	0.00340	-	0.000380	0.00130
	EDC-01a	5-Jan-2016	<0.00010	0.00150	0.0290	<0.00010	<0.000050	0.0190	0.00000520	46.0	<0.00050	<0.00010	0.00440	0.0500	<0.000050	0.00110	13.0	0.00930	-	0.00350	0.000570
		1-Feb-2016	<0.00010	0.00100	0.0140	<0.00010	<0.000050	0.0120	0.00000580	26.0	<0.00050	<0.00010	0.00320	0.170	<0.000050	<0.0010	8.40	0.00740	-	0.000760	0.000960
		2-Mar-2016	<0.00010	0.000680	0.0110	<0.00010	<0.000050	<0.010	<0.0000050	21.0	0.000690	<0.00010	0.00370	0.240	<0.000050	<0.0010	6.10	0.00570	-	0.000460	0.00110
		10-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	<0.00010	0.000380	0.00820	<0.00010	<0.000050	<0.010	0.00000770	12.0	0.000860	<0.00010	0.00370	0.260	<0.000050	<0.0010	3.40	0.00420	-	0.000300	0.00140
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	<0.00010	0.000670	0.0120	<0.00010	<0.000050	<0.010	0.00000960	18.0	0.000680	<0.00010	0.00470	0.120	<0.000050	<0.0010	5.00	0.00530	-	0.000840	0.00110
		7-Jun-2016	<0.00010	0.00110	0.0170	<0.00010	<0.000050	0.0130	0.00000630	25.0	0.000540	<0.00010	0.00440	0.0970	<0.000050	<0.0010	7.10	0.00640	-	0.00120	0.00110
		6-Jul-2016	<0.00010	0.000930	0.0140	<0.00010	<0.000050	0.0100	0.00000670	23.0	0.000690	<0.00010	0.00360	0.180	<0.000050	<0.0010	6.20	0.00780	-	0.000820	0.00140
		2-Aug-2016	<0.00010	0.00130	0.0320	<0.00010	<0.000050	0.0170	0.0000130	38.0	0.000550	<0.00010	0.00600	0.130	<0.000050	<0.0010	9.30	0.0190	-	0.00360	0.00140
		6-Sep-2016	<0.00010	0.00140	0.0440	<0.00010	<0.000050	0.0270	0.00000690	49.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	15.0	0.0200	-	0.00510	0.000780
		3-Oct-2016	<0.00010	0.000940	0.0180	<0.00010	<0.000050	0.0110	0.00000570	26.0	<0.00050	<0.00010	0.00320	0.160	<0.000050	<0.0010	7.60	0.00660	-	0.00170	0.00110
		1-Nov-2016	<0.00010	0.000540	0.0110	<0.00010	<0.000050	<0.010	0.00000630	16.0	0.000940	<0.00010	0.00360	0.260	<0.000050	<0.0010	5.00	0.00530	-	0.000590	0.00150
		6-Dec-2016	<0.00010	0.000630	0.0190	<0.00010	<0.000050	<0.010	0.00000620	26.0	0.000780	<0.00010	0.00460	0.200	<0.000050	<0.0010	6.70	0.00710	-	0.00330	0.00130
2017	HAC-13	3-Jan-2017	<0.00010	0.000820	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	41.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	6.00	0.0150	-	0.00940	<0.00050
		10-Jan-2017	<0.00010	0.000870	0.0130	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	<0.0010	6.10	0.0160	-	0.00940	<0.00050
		17-Jan-2017	<0.00010	0.000760	0.0120	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00460	<0.030	<0.000050	0.00120	5.60	0.0180	-	0.00910	<0.00050
		24-Jan-2017	0.000110	0.000780	0.0120	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	6.00	0.0280	-	0.00980	<0.00050
		1-Feb-2017	<0.00010	0.000840	0.0120	<0.00010	<0.000050	0.0260	<0.0000050	44.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	0.00100	6.10	0.0220	-	0.0100	<0.00050
		7-Feb-2017	0.000100	0.000850	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	41.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	6.00	0.0220	-	0.00970	<0.00050
		14-Feb-2017	0.000100	0.000880	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	45.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	6.40	0.0230	-	0.0100	<0.00050
		21-Feb-2017	0.000110	0.000850	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	45.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	6.70	0.0510	-	0.0100	<0.00050
		1-Mar-2017	<0.00010	0.000760	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	42.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.50	0.0360	-	0.00940	<0.00050
		7-Mar-2017	<0.00010	0.000780	0.0120	<0.00010	<0.000050	0.0280	<0.0000050	41.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	6.60	0.0310	-	0.00930	<0.00050
		14-Mar-2017	0.000110	0.000770	0.0140	<0.00010	<0.000050	0.0270	0.00000600	46.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	6.90	0.0570	-	0.0100	<0.00050
		21-Mar-2017	0.000110	0.000710	0.0130	<0.00010	<0.000050	0.0280	0.00000720	44.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	6.70	0.0530	-	0.0100	<0.00050
		27-Mar-2017	0.000110	0.000630	0.0150	<0.00010	<0.000050	0.0300	0.00000980	55.0	<0.00050	0.000130	0.00860	<0.030	<0.000050	0.00130	7.50	0.0910	-	0.0160	<0.00050
		30-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.000130	0.000680	0.0180	<0.00010	<0.000050	0.0220	0.0000180	46.0	<0.00050	0.000250	0.0150	0.0610	<0.000050	<0.0010	7.60	0.100	-	0.0130	<0.00050
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.000110	0.000700	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	40.0	<0.00050	<0.00010	0.00650	<0.030	<0.000050	<0.0010	6.00	0.0220	-	0.00960	<0.00050
		1-Jun-2017	0.000110	0.000810	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	6.20	0.00760	-	0.00900	<0.00050
		6-Jun-2017	0.000110	0.000730	0.0130	<0.00010	<0.000050	0.0280	<0.0000050	39.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	5.70	0.0100	-	0.00920	<0.00050
		13-Jun-2017	0.000160	0.000770	0.0160	<0.00010	<0.000050	0.0280	<0.0000050	42.0	<0.00050	<0.00010	0.00870	<0.030	<0.000050	<0.0010	6.50	0.00570	-	0.0110	<0.00050
		20-Jun-2017	0.000150	0.000730	0.0170	<0.00010	<0.000050	0.0290	0.00000520	49.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	6.10	0.00490	-	0.0120	<0.00050
		27-Jun-2017	0.000150	0.000680	0.0180	<0.00010	<0.000050	0.0250	0.00000820	44.0	<0.00050	<0.00010	0.00840	<0.030	<0.000050	<0.0010	6.10	0.00570	-	0.0110	<0.00050
		4-Jul-2017	0.000120	0.000710	0.0150	<0.00010	<0.000050	0.0260	0.00000510	40.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	<0.0010	5.70	0.00420	-	0.0100	<0.00050
		1-Aug-2017	<0.00010	0.000720	0.0140	<0.00010	<0.000050	0.0240	<0.0000050	43.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	6.00	0.00490	-	0.00880	<0.00050
		27-Aug-2017	0.000110	0.000770	0.0150	<0.00010	<0.000050	0.0250	<0.0000050	39.0	<0.00050	<0.00010	0.00670	<0.030	<0.000050	<0.0010	5.80	0.00380	-	0.00910	<0.00050
		19-Sep-2017	0.000110	0.000650	0.0180	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00850	<0.030	<0.000050	<0.0010	5.60	0.00120	-	0.00860	<0.00050
		26-Sep-2017	0.000140	0.000670	0.0210	<0.00010	<0.000050	0.0260	<0.0000050	44.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	6.10	0.00250	-	0.00920	<0.00050
		2-Oct-2017	0.000100	0.000620	0.0180	<0.00010	<0.000050	0.0220	<0.0000050	41.0	<0.00050	<0.00010	0.00900	<0.030	<0.000050	<0.0010	5.90	0.00140	-	0.00880	<0.00050
		10-Oct-2017	0.000100	0.000540	0.0190	<0.00010	<0.000050	0.0230	<0.0000050	42.0	<0.00050	<0.00010	0.00920	<0.030	<0.000050	<0.0010	5.80	0.00260	-	0.00920	<0.00050
		17-Oct-2017	0.000150	0.000680	0.0220	<0.00010	<0.000050	0.0220	0.0000110	48.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	0.00100	7.30	0.00190	-	0.0130	<0.00050
		24-Oct-2017	<0.00010	0.000620	0.0210	<0.00010	<0.000050	0.0260	<0.0000050	51.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00130	8.10	0.000880	-	0.00960	<0.00050
		31-Oct-2017	0.000110	0.000570	0.0180	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.00920	<0.030	<0.000050	<0.0010	5.90	0.000820	-	0.00990	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2017	HAC-13	7-Nov-2017	0.000100	0.000610	0.0170	<0.00010	<0.000050	0.0270	<0.0000050	43.0	<0.00050	<0.00010	0.00960	<0.030	<0.000050	0.00120	6.50	0.000780	-	0.0100	<0.00050
		14-Nov-2017	0.000110	0.000650	0.0200	<0.00010	<0.000050	0.0240	<0.0000050	45.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	0.00110	7.60	0.000920	-	0.0110	<0.00050
		21-Nov-2017	0.000120	0.000580	0.0200	<0.00010	<0.000050	0.0230	<0.0000050	50.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	7.50	0.000800	-	0.0100	<0.00050
		28-Nov-2017	0.000140	0.000540	0.0290	<0.00010	<0.000050	0.0240	0.0000110	63.0	<0.00050	<0.00010	0.0170	<0.030	<0.000050	<0.0010	10.0	0.0100	-	0.0120	<0.00050
		5-Dec-2017	0.000110	0.000550	0.0270	<0.00010	<0.000050	0.0260	0.00000750	59.0	<0.00050	<0.00010	0.0140	<0.030	<0.000050	0.00100	9.40	0.00430	-	0.00960	<0.00050
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-05a	3-Jan-2017	0.000570	0.000900	0.0270	<0.00010	<0.000050	0.0600	0.0000140	76.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	0.00510	13.0	0.0200	-	0.0580	<0.00050
		10-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jan-2017	0.000100	0.000850	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	42.0	<0.00050	<0.00010	0.00540	<0.030	<0.000050	<0.0010	6.60	0.0370	-	0.00950	<0.00050
		1-Feb-2017	0.000690	0.000660	0.0310	<0.00010	<0.000050	0.0660	0.00000810	84.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	0.00690	14.0	0.0240	-	0.0680	<0.00050
		7-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Mar-2017	0.000860	0.000550	0.0360	<0.00010	<0.000050	0.0770	<0.000035	93.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	0.00820	18.0	0.0300	-	0.0840	<0.00050
		7-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.000120	0.000670	0.0200	<0.00010	<0.000050	0.0210	0.0000200	48.0	<0.00050	0.000300	0.0180	0.120	<0.000050	<0.0010	7.90	0.170	-	0.0120	0.000580
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	0.000110	0.000740	0.0130	<0.00010	<0.000050	0.0210	0.00000600	41.0	<0.00050	<0.00010	0.00770	0.0380	<0.000050	<0.0010	6.50	0.0440	-	0.00940	<0.00050
		9-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Jun-2017	0.000110	0.000780	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	6.40	0.0150	-	0.00890	<0.00050
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	0.00130	0.000940	0.0590	<0.00010	<0.000050	0.160	<0.000090	177	<0.00050	0.000180	0.00780	<0.030	<0.000050	0.00740	35.0	0.0730	-	0.150	0.000500
		20-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2017	0.00110	0.000890	0.0500	<0.00010	<0.000050	0.170	<0.000085	168	<0.00050	<0.00010	0.00510	<0.030	<0.000050	0.00730	30.0	0.0400	-	0.140	<0.00050
		1-Aug-2017	<0.00010	0.000740	0.0160	<0.00010	<0.000050	0.0250	<0.0000050	45.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	6.70	0.0110	-	0.00870	<0.00050
		19-Sep-2017	0.000900	0.00100	0.0620	<0.00010	<0.000050	0.200	<0.000090	186	<0.00050	<0.00010	0.00600	<0.030	<0.000050	0.00670	31.0	0.0400	-	0.140	<0.00050
		26-Sep-2017	0.00100	0.000800	0.0550	<0.00010	<0.000050	0.200	<0.000050	202	<0.00050	<0.00010	0.00490	<0.030	<0.000050	0.00980	32.0	0.0430	-	0.160	<0.00050
		2-Oct-2017	0.000120	0.00100	0.0220	<0.00010	<0.000050	0.0300	0.00000730	58.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00110	12.0	0.0110	-	0.00940	<0.00050
		10-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		31-Oct-2017	<0.00010	0.000790	0.0240	<0.00010	<0.000050	0.0260	0.00000580	53.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	9.70	0.0220	-	0.00810	<0.00050
		7-Nov-2017	<0.00010	0.000910	0.0250	<0.00010	<0.000050	0.0300	<0.0000050	59.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	0.00120	12.0	0.0190	-	0.00840	<0.00050
		14-Nov-2017	<0.00010	0.000860	0.0260	<0.00010	<0.000050	0.0250	0.00000630	57.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	0.00100	12.0	0.0250	-	0.00860	<0.00050
		21-Nov-2017	0.000100	0.000850	0.0260	<0.00010	<0.000050	0.0240	<0.0000050	62.0	<0.00050	<0.00010	0.00840	<0.030	<0.000050	<0.0010	12.0	0.0230	-	0.00810	<0.00050
		28-Nov-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Nov-2017	0.000120	0.000770	0.0340	<0.00010	<0.000050	0.0250	0.00000840	74.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	14.0	0.0390	-	0.0110	<0.00050
		5-Dec-2017	<0.00010	0.000790	0.0320	<0.00010	<0.000050	0.0270	0.00000850	68.0	<0.00050	<0.00010	0.00970	<0.030	<0.000050	<0.0010	13.0	0.0280	-	0.00750	<0.00050
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-14	27-Aug-2017	0.000120	0.000870	0.0250	<0.00010	<0.000050	0.0270	0.00000610	42.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	<0.0010	7.60	0.0100	-	0.00960	<0.00050
		19-Sep-2017	0.000750	0.00100	0.0760	<0.00010	<0.000050	0.180	<0.000060	186	<0.00050	<0.00010	0.00600	<0.030	<0.000050	0.00560	30.0	0.0280	-	0.130	<0.00050
		26-Sep-2017	0.000950	0.000860	0.0610	<0.00010	<0.000050	0.200	<0.000040	197	<0.00050	<0.00010	0.00470	<0.030	<0.000050	0.00940	32.0	0.0280	-	0.150	<0.00050
		2-Oct-2017	0.000190	0.00120	0.0330	<0.00010	<0.000050	0.0500	0.0000120	70.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	0.00280	16.0	0.0290	-	0.0200	<0.00050
		17-Oct-2017	0.000160	0.000910	0.0360	<0.00010	<0.000050	0.0240	0.0000190	68.0	<0.00050	<0.00010	0.00920	<0.030	<0.000050	0.00190	15.0	0.0320	-	0.0170	<0.00050
		24-Oct-2017	<0.00010	0.000900	0.0310	<0.00010	<0.000050	0.0300	0.0000100	70.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	0.00220	14.0	0.0330	-	0.0110	<0.00050
		31-Oct-2017	0.000100	0.000970	0.0310	<0.00010	<0.000050	0.0290	0.00000930	56.0	<0.00050	0.000120	0.00900	0.160	0.0000570	0.00160	12.0	0.0460	-	0.00970	<0.00050
		7-Nov-2017	<0.00010	0.00110	0.0300	<0.00010	<0.000050	0.0320	<0.0000050	59.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	0.00210	14.0	0.0340	-	0.0110	<0.00050
		14-Nov-2017	<0.00010	0.00100	0.0300	<0.00010	<0.000050	0.0290	0.00000830	58.0	<0.00050	<0.00010	0.0130	0.0310	<0.000050	0.00180	15.0	0.0360	-	0.0100	<0.00050
		21-Nov-2017	0.000100	0.00110	0.0310	<0.00010	<0.000050	0.0280	0.00000970	65.0	<0.00050	<0.00010	0.00730	0.0320	<0.000050	0.00140	15.0	0.0350	-	0.0110	<0.00050
		28-Nov-2017	0.000120	0.000940	0.0360	<0.00010	<0.000050	0.0280	0.0000100	74.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00120	16.0	0.0410	-	0.0120	<0.00050
		5-Dec-2017	<0.00010	0.000990	0.0370	<0.00010	<0.000050	0.0330	0.00000800	69.0	<0.00050	<0.00010	0.00830	0.0340	<0.000050	0.00210	16.0	0.0370	-	0.00930	<0.00050
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2017	HAC-08	3-Jan-2017	0.000560	0.00110	0.0400	<0.00010	<0.000050	0.0600	0.0000110	77.0	<0.00050	<0.00010	0.00910	<0.030	<0.000050	0.00500	14.0	0.0160	-	0.0560	<0.00050
		24-Jan-2017	0.000130	0.000880	0.0150	<0.00010	<0.000050	0.0280	0.00000670	47.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00140	7.20	0.0270	-	0.0110	<0.00050
		1-Feb-2017	0.000690	0.000810	0.0380	<0.00010	<0.000050	0.0670	0.0000120	84.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	0.00680	14.0	0.0220	-	0.0680	<0.00050
		1-Mar-2017	0.000870	0.000610	0.0360	<0.00010	<0.000050	0.0740	<0.000030	93.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	0.00840	17.0	0.0280	-	0.0830	<0.00050
		3-Apr-2017	0.000120	0.000640	0.0190	<0.00010	<0.000050	0.0160	0.0000230	39.0	<0.00050	0.000220	0.0170	0.110	0.0000540	<0.0010	7.50	0.100	-	0.00870	0.000790
		2-May-2017	0.000110	0.000700	0.0150	<0.00010	<0.000050	0.0190	0.00000650	39.0	<0.00050	<0.00010	0.00970	0.0510	<0.000050	0.00100	6.60	0.0390	-	0.00810	<0.00050
		1-Jun-2017	0.000120	0.000830	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	42.0	<0.00050	<0.00010	0.00650	<0.030	<0.000050	0.00110	6.90	0.0140	-	0.00940	<0.00050
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	0.00100	0.000940	0.0540	<0.00010	<0.000050	0.130	<0.000060	149	<0.00050	<0.00010	0.00730	<0.030	<0.000050	0.00550	28.0	0.0340	-	0.110	<0.00050
		4-Jul-2017	0.000990	0.00100	0.0570	<0.00010	<0.000050	0.150	<0.000060	156	<0.00050	<0.00010	0.00500	<0.030	<0.000050	0.00580	27.0	0.0120	-	0.120	<0.00050
		27-Aug-2017	0.000130	0.00100	0.0260	<0.00010	<0.000050	0.0280	0.00000710	44.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	0.00110	8.50	0.00800	-	0.00980	<0.00050
		27-Aug-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Sep-2017	0.000480	0.00110	0.0830	<0.00010	<0.000050	0.140	<0.000040	151	<0.00050	<0.00010	0.0140	<0.030	0.0000830	0.00350	28.0	0.0290	-	0.0960	<0.00050
		10-Oct-2017	0.000150	0.00150	0.0360	<0.00010	<0.000050	0.0450	0.00000990	68.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	0.00410	18.0	0.0220	-	0.0150	<0.00050
		17-Oct-2017	0.000150	0.000960	0.0340	<0.00010	<0.000050	0.0250	0.0000130	66.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	0.00250	15.0	0.0230	-	0.0150	<0.00050
		24-Oct-2017	0.000110	0.00120	0.0370	<0.00010	<0.000050	0.0340	0.00000860	74.0	<0.00050	<0.00010	0.00850	<0.030	<0.000050	0.00240	17.0	0.0290	-	0.0120	<0.00050
		31-Oct-2017	0.000110	0.00110	0.0280	<0.00010	<0.000050	0.0310	0.00000930	56.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	0.00220	12.0	0.0260	-	0.00990	<0.00050
		7-Nov-2017	0.000110	0.00120	0.0310	<0.00010	<0.000050	0.0370	0.00000910	66.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	0.00300	15.0	0.0330	-	0.0120	<0.00050
		14-Nov-2017	0.000110	0.00130	0.0310	<0.00010	<0.000050	0.0290	0.00000870	56.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	0.00250	15.0	0.0230	-	0.0100	<0.00050
		21-Nov-2017	0.000110	0.00130	0.0310	<0.00010	<0.000050	0.0300	0.0000100	64.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	0.00220	16.0	0.0230	-	0.0100	<0.00050
		28-Nov-2017	0.000120	0.00120	0.0400	<0.00010	<0.000050	0.0300	0.0000120	72.0	<0.00050	0.000100	0.0100	<0.030	<0.000050	0.00200	16.0	0.0300	-	0.0120	0.000580
		5-Dec-2017	<0.00010	0.00140	0.0380	<0.00010	<0.000050	0.0320	0.00000930	67.0	<0.00050	0.000100	0.00860	<0.030	<0.000050	0.00230	16.0	0.0250	-	0.00970	0.000570
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	W10	3-Jan-2017	<0.00010	0.00120	0.0130	<0.00010	<0.000050	<0.010	0.00000520	25.0	0.000560	<0.00010	0.00220	0.250	<0.000050	<0.0010	7.80	0.00370	-	0.000560	0.00110
		1-Feb-2017	<0.00010	0.00110	0.0140	<0.00010	<0.000050	<0.010	0.00000510	29.0	0.000540	<0.00010	0.00200	0.250	<0.000050	<0.0010	9.00	0.00380	-	0.000660	0.00110
		1-Mar-2017	<0.00010	0.000990	0.0130	<0.00010	<0.000050	<0.010	0.00000680	25.0	0.000610	<0.00010	0.00240	0.250	<0.000050	<0.0010	7.60	0.00350	-	0.000470	0.00110
		3-Apr-2017	<0.00010	0.000360	0.00940	<0.00010	<0.000050	0.0130	0.00000910	17.0	0.000600	<0.00010	0.00250	0.210	<0.000050	<0.0010	4.70	0.00710	-	0.000250	0.00110
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	<0.00010	0.000380	0.00800	<0.00010	<0.000050	<0.010	0.00000780	16.0	0.000800	<0.00010	0.00300	0.230	0.0000580	<0.0010	4.20	0.00210	-	0.000290	0.00120
		25-Apr-2017	<0.00010	0.000320	0.00750	<0.00010	<0.000050	<0.010	0.00000820	12.0	0.000680	<0.00010	0.00260	0.160	<0.000050	<0.0010	3.70	0.00220	-	0.000270	0.00120
		2-May-2017	<0.00010	0.000340	0.00800	<0.00010	<0.000050	<0.010	0.00000550	13.0	0.000580	<0.00010	0.00260	0.150	<0.000050	<0.0010	4.00	0.00240	-	0.000330	0.00110
		9-May-2017	<0.00010	0.000400	0.00810	<0.00010	<0.000050	<0.010	0.00000600	14.0	0.000880	<0.00010	0.00280	0.140	<0.000050	<0.0010	4.10	0.00300	-	0.000340	0.00120
		17-May-2017	<0.00010	0.000400	0.00900	<0.00010	<0.000050	<0.010	0.0000100	15.0	0.000640	<0.00010	0.00300	0.140	<0.000050	<0.0010	4.20	0.00280	-	0.000360	0.00130
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	<0.00010	0.000540	0.0100	<0.00010	<0.000050	0.0120	0.00000620	18.0	0.000630	<0.00010	0.00290	0.130	<0.000050	<0.0010	5.00	0.00440	-	0.000460	0.00120
		1-Jun-2017	<0.00010	0.000840	0.0130	<0.00010	<0.000050	<0.010	0.00000750	19.0	0.000610	<0.00010	0.00290	0.130	<0.000050	<0.0010	6.40	0.00560	-	0.000520	0.00130
		4-Jul-2017	<0.00010	0.00220	0.0260	<0.00010	<0.000050	0.0210	<0.0000070	34.0	<0.00050	<0.00010	0.00150	0.0520	<0.000050	<0.0010	12.0	0.0150	-	0.00160	0.000810
		17-Aug-2017	<0.00010	0.00260	0.0370	<0.00010	<0.000050	0.0280	<0.0000050	49.0	<0.00050	<0.00010	0.000920	<0.030	<0.000050	0.00150	18.0	0.000610	-	0.00210	0.000630
		4-Sep-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Sep-2017	<0.00010	0.00290	0.0370	<0.00010	<0.000050	0.0260	<0.0000050	46.0	<0.00050	<0.00010	0.000930	<0.030	<0.000050	0.00160	18.0	0.00860	-	0.00210	0.000560
		11-Oct-2017	<0.00010	0.00320	0.0320	<0.00010	<0.000050	0.0290	<0.0000050	45.0	<0.00050	<0.00010	0.000800	<0.030	<0.000050	<0.0010	19.0	0.00480	-	0.00180	<0.00050
		7-Nov-2017	<0.00010	0.00200	0.0210	<0.00010	<0.000050	0.0170	<0.0000050	37.0	<0.00050	<0.00010	0.000980	0.0330	<0.000050	0.00140	13.0	0.00300	-	0.00120	0.000990
		4-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	EDC-01a	3-Jan-2017	<0.00010	0.00110	0.0210	<0.00010	<0.000050	0.0120	0.00000510	31.0	0.000570	<0.00010	0.00360	0.210	<0.000050	<0.0010	8.80	0.0150	-	0.00340	0.00100
		1-Feb-2017	<0.00010	0.000880	0.0400	<0.00010	<0.000050	0.0210	<0.0000050	41.0	<0.00050	<0.00010	0.00590	0.190	<0.000050	<0.0010	11.0	0.00540	-	0.0120	0.000840
		1-Mar-2017	<0.00010	0.000830	0.0130	<0.00010	<0.000050	<0.010	0.00000540	24.0	0.000560	<0.00010	0.00270	0.250	<0.000050	<0.0010	7.30	0.00570	-	0.000650	0.00130
		31-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	<0.00010	0.000430	0.0120	<0.00010	<0.000050	<0.010	0.00000960	18.0	0.000610	<0.00010	0.00380	0.220	<0.000050	<0.0010	5.30	0.00930	-	0.000720	0.00120
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	<0.00010	0.000370	0.0100	<0.00010	<0.000050	<0.010	0.00000830	15.0	0.000730	<0.00010	0.00320	0.220	<0.000050	<0.0010	4.00	0.00220	-	0.000410	0.00120
		25-Apr-2017	<0.00010	0.000310	0.00810	<0.00010	<0.000050	<0.010	0.00000610	13.0	0.000640	<0.00010	0.00300	0.160	<0.000050	<0.0010	3.90	0.00260	-	0.000340	0.00120
		2-May-2017	<0.00010	0.000360	0.00840	<0.00010	<0.000050	<0.010	0.00000630	14.0	0.000590	<0.00010	0.00310	0.140	<0.000050	<0.0010	4.00	0.00320	-	0.000540	0.00110
		9-May-2017	<0.00010	0.000390	0.00830	<0.00010	<0.000050	<0.010	0.00000710	13.0	0.000640	<0.00010	0.00310	0.130	<0.000050	<0.0010	4.00	0.00350	-	0.000360	0.00120
		17-May-2017	<0.00010	0.000420	0.00930	<0.00010	<0.000050	<0.010	0.00000960	15.0	0.000640	<0.00010	0.00330	0.140	<0.000050	<0.0010	4.10	0.00430	-	0.000440	0.00120
		23-May-2017	<0.00010	0.000580	0.0110	<0.00010	<0.000050	<0.010	0.00000690	17.0	0.000640	<0.00010	0.00330	0.120	<0.000050	<0.0010	5.00	0.00720	-	0.000530	0.00120
		1-Jun-2017	<0.00010	0.000770	0.0140	<0.00010	<0.000050	<0.010	0.00000800	20.0	0.000620	<0.00010	0.00640	0.120	<0.000050	<0.0010	6.20	0.00940	-	0.000830	0.00120
		4-Jul-2017	<0.00010	0.00160	0.0260	<0.00010	<0.000050	0.0200	<0.0000090	36.0	<0.00050	<0.00010	0.00340	<0.030	<0.000050	<0.0010	12.0	0.0220	-	0.00160	0.000780
		19-Sep-2017	<0.00010	0.00180	0.0300	<0.00010	<0.000050	0.0270	<0.0000050	47.0	<0.00050	<0.00010	0.00240	<0.030	<0.000050	0.00110	17.0	0.0190	-	0.00280	<0.00050
		2-Oct-2017	<0.00010	0.00220	0.0340	<0.00010	<0.000050	0.0260	<0.0000050	48.0	<0.00050	<0.00010	0.00200	<0.030	<0.000050	0.00120	18.0	0.0170	-	0.00220	<0.00050
		7-Nov-2017	<0.00010	0.00190	0.0220	<0.00010	<0.000050	0.0160	<0.0000050	38.0	<0.00050	<0.00010	0.00160	<0.030	<0.000050	0.00120	12.0	0.00950	-	0.00120	0.000610
		4-Dec-2017	<0.00010	0.00160	0.0260	<0.00010	<0.000050	0.0170	0.00000680	37.0	<0.00050	<0.00010	0.00360	0.0410	<0.000050	<0.0010	12.0	0.00940	-	0.00240	0.000730

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2018	HAC-13	2-Jan-2018	0.000120	0.000620	0.0220	<0.00010	<0.000050	0.0280	<0.0000050	55.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	8.60	0.000930	-	0.0100	<0.00050
		9-Jan-2018	0.000120	0.000690	0.0210	<0.00010	<0.000050	0.0260	0.00000850	50.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	7.70	0.00220	-	0.00880	<0.00050
		16-Jan-2018	0.000120	0.000680	0.0200	<0.00010	<0.000050	0.0270	0.00000710	51.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	7.40	0.00220	-	0.00920	<0.00050
		23-Jan-2018	0.000110	0.000670	0.0190	<0.00010	<0.000050	0.0250	0.00000680	47.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	7.20	0.00440	-	0.00850	<0.00050
		30-Jan-2018	0.000100	0.000700	0.0180	<0.00010	<0.000050	0.0230	0.00000590	47.0	<0.00050	<0.00010	0.00980	<0.030	<0.000050	<0.0010	6.60	0.0120	-	0.00800	<0.00050
		6-Feb-2018	<0.00010	0.000720	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	41.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	<0.0010	6.30	0.0140	-	0.00860	<0.00050
		13-Feb-2018	0.000120	0.000740	0.0130	<0.00010	<0.000050	0.0230	0.00000500	43.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	6.10	0.0160	-	0.00890	<0.00050
		20-Feb-2018	0.000110	0.000730	0.0130	<0.00010	<0.000050	0.0260	<0.0000050	48.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	6.30	0.0150	-	0.00940	<0.00050
		1-Mar-2018	<0.00020	0.000600	0.0210	<0.00010	<0.000050	0.0270	<0.0000050	53.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	8.50	0.00420	-	0.00870	<0.00050
		8-Mar-2018	<0.00010	0.000570	0.0210	<0.00010	<0.000050	0.0270	<0.0000050	57.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	8.80	0.00370	-	0.00830	<0.00050
		14-Mar-2018	<0.00010	0.000530	0.0260	<0.00010	<0.000050	0.0260	<0.0000050	65.0	<0.00050	<0.00010	0.0130	<0.030	<0.000050	<0.0010	10.0	0.0200	-	0.00880	<0.00050
		20-Mar-2018	0.000110	0.000440	0.0310	<0.00010	<0.000050	0.0260	0.0000420	94.0	<0.00050	0.000120	0.0170	0.0320	<0.000050	<0.0010	13.0	0.200	-	0.00980	0.000660
		27-Mar-2018	0.000140	0.000480	0.0380	<0.00010	<0.000050	0.0240	0.0000350	89.0	<0.00050	0.000150	0.0210	<0.030	<0.000050	0.00160	15.0	0.240	-	0.0110	0.000780
		3-Apr-2018	0.000110	0.000630	0.0170	<0.00010	<0.000050	0.0250	<0.0000050	46.0	<0.00050	<0.00010	0.00940	<0.030	<0.000050	<0.0010	7.60	0.0760	-	0.00970	<0.00050
		10-Apr-2018	0.000120	0.000700	0.0150	<0.00010	<0.000050	0.0250	0.00000890	48.0	<0.00050	<0.00010	0.00830	<0.030	<0.000050	<0.0010	6.50	0.0570	-	0.00990	<0.00050
		17-Apr-2018	0.000110	0.000620	0.0150	<0.00010	<0.000050	0.0230	0.0000140	46.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	7.20	0.0670	-	0.00960	<0.00050
		24-Apr-2018	0.000220	0.000430	0.0370	<0.00010	<0.000050	0.0180	0.0000680	87.0	0.00220	0.000530	0.0310	0.0860	<0.000050	0.00180	14.0	0.460	-	0.0200	0.000900
		1-May-2018	<0.00010	0.000440	0.0110	<0.00010	<0.000050	0.0120	0.0000150	28.0	<0.00050	<0.00010	0.0140	0.0660	<0.000050	<0.0010	4.70	0.0370	-	0.00550	0.000570
		8-May-2018	<0.00010	0.000460	0.0100	<0.00010	<0.000050	0.0150	0.00000700	28.0	<0.00050	<0.00010	0.00910	0.0310	<0.000050	<0.0010	4.80	0.00800	-	0.00590	<0.00050
		16-May-2018	0.000130	0.000650	0.0160	<0.00010	<0.000050	0.0220	0.0000110	41.0	<0.00050	<0.00010	0.00940	<0.030	<0.000050	<0.0010	6.00	0.00740	-	0.00880	<0.00050
		24-May-2018	0.000110	0.000710	0.0140	<0.00010	<0.000050	0.0240	0.00000660	41.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	5.80	0.00280	-	0.00870	<0.00050
		29-May-2018	<0.00010	0.000670	0.0130	<0.00010	<0.000050	0.0220	0.00000590	43.0	0.00110	<0.00010	0.00680	<0.030	<0.000050	<0.0010	5.60	0.00850	-	0.00850	0.000770
		5-Jun-2018	0.000110	0.000740	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	5.80	0.00560	-	0.00870	<0.00050
		12-Jun-2018	0.000110	0.000750	0.0140	<0.00010	<0.000050	0.0230	0.00000830	43.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.50	0.00470	-	0.00850	<0.00050
		18-Jun-2018	0.000100	0.000650	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	5.70	0.00620	-	0.00840	<0.00050
		26-Jun-2018	<0.00010	0.000720	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	5.70	0.00560	-	0.00860	<0.00050
		4-Jul-2018	0.000110	0.000700	0.0140	<0.00010	<0.000050	0.0230	0.00000530	40.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	6.00	0.00640	-	0.00880	<0.00050
		10-Jul-2018	0.000100	0.000710	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	5.80	0.00760	-	0.00840	<0.00050
		17-Jul-2018	0.000110	0.000710	0.0140	<0.00010	<0.000050	0.0240	0.00000690	40.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	5.40	0.00830	-	0.00880	<0.00050
		24-Jul-2018	0.000110	0.000700	0.0130	<0.00010	<0.000050	0.0250	0.00000680	42.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	5.30	0.00670	-	0.00850	<0.00050
		2-Aug-2018	<0.00010	0.000700	0.0130	<0.00010	<0.000050	0.0230	0.00000570	38.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	<0.0010	5.50	0.00620	-	0.00860	<0.00050
		7-Aug-2018	<0.00010	0.000730	0.0140	<0.00010	<0.000050	0.0220	0.00000570	37.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	5.60	0.00780	-	0.00820	<0.00050
		14-Aug-2018	<0.00010	0.000710	0.0160	<0.00010	<0.000050	0.0210	<0.0000050	38.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	6.40	0.00160	-	0.00780	<0.00050
		21-Aug-2018	<0.00010	0.000630	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	39.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	5.80	0.00760	-	0.00820	<0.00050
		28-Aug-2018	0.000120	0.000590	0.0140	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	5.40	0.00600	-	0.00880	<0.00050
		4-Sep-2018	<0.00010	0.000620	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	5.80	0.00490	-	0.00870	<0.00050
		10-Sep-2018	<0.00010	0.000790	0.0260	<0.00010	<0.000050	0.0260	<0.0000050	48.0	<0.00050	<0.00010	0.00840	<0.030	<0.000050	0.00110	9.10	0.0140	-	0.00820	<0.00050
		20-Sep-2018	<0.00010	0.000590	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	5.90	0.00510	-	0.00830	<0.00050
		24-Sep-2018	0.000100	0.000600	0.0140	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	6.40	0.00600	-	0.00940	<0.00050
		2-Oct-2018	<0.00010	0.000610	0.0140	<0.00010	<0.000050	0.0220	0.00000560	41.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	6.20	0.00500	-	0.00830	<0.00050
		9-Oct-2018	<0.00010	0.000620	0.0140	<0.00010	<0.000050	0.0230	0.00000510	43.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	<0.0010	6.10	0.00630	-	0.00940	<0.00050
		16-Oct-2018	<0.00010	0.000620	0.0150	<0.00010	<0.000050	0.0250	<0.0000050	42.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	6.70	0.00390	-	0.00920	<0.00050
		23-Oct-2018	0.000100	0.000600	0.0150	<0.00010	<0.000050	0.0280	0.00000740	46.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	6.50	0.00370	-	0.00880	<0.00050
		30-Oct-2018	<0.00010	0.000570	0.0140	<0.00010	<0.000050	0.0240	<0.0000050	44.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.00	0.00420	-	0.00830	<0.00050
		6-Nov-2018	0.000110	0.000540	0.0200	<0.00010	<0.000050	0.0210	0.0000160	58.0	<0.00050	<0.00010	0.0190	0.0540	<0.000050	<0.0010	8.60	0.0230	-	0.00990	<0.00050
		13-Nov-2018	<0.00010	0.000630	0.0180	<0.00010	<0.000050	0.0250	0.0000120	51.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	7.80	0.0170	-	0.00970	<0.00050
		27-Nov-2018	0.000130	0.000510	0.0250	<0.00010	<0.000050	0.0200	0.0000130	69.0	<0.00050	0.000100	0.0190	0.0480	<0.000050	<0.0010	11.0	0.0820	-	0.0110	<0.00050
		4-Dec-2018	0.000100	0.000580	0.0160	<0.00010	<0.000050	0.0250	0.0000110	49.0	0.000110	<0.00010	0.0100	0.0190	<0.000050	<0.0010	7.60	0.0420	-	0.00960	<0.00050
	HAC-05a	2-Jan-2018	0.000110	0.000960	0.0280	<0.00010	<0.000050	0.0290	0.00000700	66.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	<0.0010	14.0	0.0190	-	0.00790	<0.00050
		9-Jan-2018	<0.00010	0.000950	0.0270	<0.00010	<0.000050	0.0280	0.00000520	62.0	<0.00050	<0.00010	0.00900	<0.030	<0.000050	<0.0010	12.0	0.0210	-	0.00670	<0.00050
		16-Jan-2018	0.000110	0.000900	0.0260	<0.00010	<0.000050	0.0270	0.00000610	61.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	<0.0010	11.0	0.0160	-	0.00750	<0.00050
		23-Jan-2018	0.000110	0.000890	0.0260	<0.00010	<0.000050	0.0270	0.00000700	57.0	<0.00050	<0.00010	0.00900	<0.030	<0.000050	<0.0010	12.0	0.0180	-	0.00710	<0.00050
		30-Jan-2018	<0.00010	0.000800	0.0240	<0.00010	<0.000050	0.0250	0.00000580	58.0	<0.00050	<0.00010	0.00900	<0.030	<0.000050	<0.0010	9.40	0.0190	-	0.00720	<0.00050
		6-Feb-2018	0.000100	0.000760	0.0190	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	<0.0010	7.30	0.0130	-	0.00840	<0.00050
		13-Feb-2018	0.000120	0.000790	0.0160	<0.00010	<0.000050	0.0260	0.00000770	46.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	6.90	0.0140	-	0.00800	<0.00050
		20-Feb-2018	0.000100	0.000810	0.0160	<0.00010	<0.000050	0.0260	0.00000730	50.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	7.10	0.0130	-	0.00920	<0.00050
		14-Mar-2018	<0.00010	0.000830	0.0300	<0.00010	<0.000050	0.0260	0.00000540	74.0	<0.00050	<0.00010	0.00870	<0.030	<0.000050	<0.0010	15.0	0.0580	-	0.00700	<0.00050
		20-Mar-2018	0.000100	0.000720	0.0380	<0.00010	<0.000050	0.0250	0.0000150	97.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	18.0	0.0580	-	0.00790	<0.00050
		27-Mar-2018	0.000120	0.000710	0.0400	<0.00010	<0.000050	0.0230	0.0000140	89.0	<0.00050	<0.00010	0.0140	<0.030	<0.000050	0.00140	17.0	0.0720	-	0.00840	0.000620
		3-Apr-2018	<0.00010	0.000660	0.0220	<0.00010	<0.000050	0.0250	<0.0000050	50.0	<0.00050	<0.00010	0.00960	<0.030	<0.000050	<0.0010	9.30	0.0420	-	0.00910	<0.00050
		10-Apr-2018	0.000120	0.000690	0.0170	<0.00010	<0.000050	0.0250	0.0000120	50.0	<0.00050	<0.00010	0.00910	<0.030	<0.000050	<0.0010	7.40	0.0500	-	0.0100	<0.00050
		17-Apr-2018	0.000110	0.000630	0.0180	<0.00010	<0.000050	0.0200	0.0000120	44.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	8.10	0.0650	-	0.00900	<0.00050
		24-Apr-2018	0.000170	0.000550	0.0400	<0.00010	<0.000050	0.0160	0.0000510	84.0	<0.00050	0.000380	0.0270	0.0820	<0.000050	0.00140	14.0	0.320	-	0.0150	0.000820
		1-May-2018	<0.00010	0.000480	0.0150	<0.00010	<0.000050	0.0120	0.0000160	32.0	<0.00050	0.000120	0.0190	0.0700	<0.000050	<0.0010	5.30	0.0540	-	0.00540	0.000630
		8-May-2018	<0.00010	0.000530	0.0140	<0.00010	<0.000050	0.0150	0.00000900	32.0	<0.00050	<0.00010	0.0130	0.0390	<0.000050	<0.0010	5.30	0.0240	-	0.00580	<0.00050
		16-May-2018	0.000130	0.000680	0.0200	<0.00010	<0.000050	0.0240	0.0000140	48.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	7.80	0.0380	-	0.00830	<0.00050
		24-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2018	HAC-05a	5-Jun-2018	<0.00010	0.000730	0.0180	<0.00010	<0.000050	0.0230	0.00000530	46.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	7.50	0.0170	-	0.00820	<0.00050
		12-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2018	0.000100	0.000730	0.0170	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00720	<0.030	<0.000050	<0.0010	7.50	0.0120	-	0.00850	<0.00050
		10-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2018	<0.00010	0.000750	0.0160	<0.00010	<0.000050	0.0230	0.00000590	40.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	6.80	0.00750	-	0.00800	<0.00050
		7-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Sep-2018	<0.00010	0.000750	0.0180	<0.00010	<0.000050	0.0240	<0.0000050	46.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	7.90	0.00910	-	0.00800	<0.00050
		10-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Sep-2018	<0.00010	0.000690	0.0200	<0.00010	<0.000050	0.0240	0.00000550	53.0	<0.00050	<0.00010	0.00670	<0.030	<0.000050	<0.0010	9.50	0.0170	-	0.00840	<0.00050
		2-Oct-2018	<0.00010	0.000730	0.0180	<0.00010	<0.000050	0.0230	<0.0000050	48.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	8.80	0.0120	-	0.00740	<0.00050
		9-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		16-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Nov-2018	0.000120	0.000590	0.0280	<0.00010	<0.000050	0.0200	0.0000140	67.0	<0.00050	<0.00010	0.0190	0.0600	<0.000050	<0.0010	11.0	0.0400	-	0.00970	<0.00050
		13-Nov-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Nov-2018	0.000120	0.000620	0.0290	<0.00010	<0.000050	0.0170	0.0000160	72.0	<0.00050	0.000120	0.0210	0.0810	<0.000050	<0.0010	12.0	0.0890	-	0.00960	<0.00050
		4-Dec-2018	<0.00010	0.000690	0.0200	<0.00010	<0.000050	0.0240	0.00000750	62.0	0.000110	<0.00010	0.0120	0.0320	<0.000050	<0.0010	11.0	0.0590	-	0.00890	<0.00050
	HAC-14	2-Jan-2018	<0.00010	0.00100	0.0340	<0.00010	<0.000050	0.0330	0.00000680	68.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	0.00140	16.0	0.0370	-	0.00980	<0.00050
		9-Jan-2018	<0.00010	0.00110	0.0330	<0.00010	<0.000050	0.0310	0.00000800	64.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00140	15.0	0.0380	-	0.00780	<0.00050
		16-Jan-2018	<0.00010	0.00110	0.0320	<0.00010	<0.000050	0.0320	0.00000800	65.0	<0.00050	<0.00010	0.00770	0.0310	<0.000050	<0.0010	14.0	0.0330	-	0.00890	<0.00050
		23-Jan-2018	0.000100	0.000990	0.0310	<0.00010	<0.000050	0.0300	0.00000700	60.0	<0.00050	<0.00010	0.00790	0.0310	<0.000050	0.00110	14.0	0.0340	-	0.00850	<0.00050
		10-Apr-2018	0.000120	0.000720	0.0200	<0.00010	<0.000050	0.0240	0.0000150	49.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	<0.0010	8.00	0.0380	-	0.00970	<0.00050
		17-Apr-2018	0.000110	0.000640	0.0190	<0.00010	<0.000050	0.0190	0.0000130	44.0	<0.00050	<0.00010	0.0130	0.0350	<0.000050	<0.0010	7.80	0.0540	-	0.00860	<0.00050
		24-Apr-2018	0.000130	0.000510	0.0320	<0.00010	<0.000050	0.0130	0.0000380	65.0	0.000640	0.000260	0.0220	0.0940	<0.000050	0.00120	11.0	0.200	-	0.0110	0.000830
		1-May-2018	<0.00010	0.000510	0.0140	<0.00010	<0.000050	<0.010	0.0000190	29.0	0.000510	0.000110	0.0210	0.0780	<0.000050	<0.0010	5.00	0.0420	-	0.00440	0.000760
		8-May-2018	<0.00010	0.000550	0.0140	<0.00010	<0.000050	0.0130	0.0000100	29.0	<0.00050	<0.00010	0.0160	0.0510	<0.000050	<0.0010	5.00	0.0230	-	0.00510	0.000600
		16-May-2018	0.000130	0.000780	0.0230	<0.00010	<0.000050	0.0240	0.0000110	49.0	<0.00050	<0.00010	0.0130	<0.030	<0.000050	0.00100	8.40	0.0380	-	0.00830	<0.00050
		24-May-2018	0.000120	0.000810	0.0210	<0.00010	<0.000050	0.0260	0.00000670	46.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	0.00100	7.70	0.0160	-	0.00880	<0.00050
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	<0.00010	0.000780	0.0210	<0.00010	<0.000050	0.0240	0.00000890	49.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	<0.0010	8.60	0.0200	-	0.00850	<0.00050
		12-Jun-2018	0.000110	0.000790	0.0200	<0.00010	<0.000050	0.0250	0.0000100	49.0	<0.00050	<0.00010	0.00800	<0.030	<0.000050	<0.0010	8.20	0.0130	-	0.00870	<0.00050
		18-Jun-2018	0.000110	0.000760	0.0180	<0.00010	<0.000050	0.0250	<0.0000050	45.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	<0.0010	7.30	0.0130	-	0.00840	<0.00050
		26-Jun-2018	0.000110	0.000820	0.0210	<0.00010	<0.000050	0.0240	0.00000820	46.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	<0.0010	7.80	0.0130	-	0.00940	<0.00050
		4-Jul-2018	0.000110	0.000780	0.0200	<0.00010	<0.000050	0.0260	0.00000510	47.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	0.00100	8.40	0.0130	-	0.00890	<0.00050
		10-Jul-2018	0.000110	0.000860	0.0200	<0.00010	<0.000050	0.0260	<0.0000050	47.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	8.00	0.0130	-	0.00850	<0.00050
		17-Jul-2018	0.000120	0.000790	0.0190	<0.00010	<0.000050	0.0260	0.0000120	44.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	<0.0010	6.60	0.00970	-	0.00900	<0.00050
		24-Jul-2018	0.000100	0.000780	0.0170	<0.00010	<0.000050	0.0260	<0.0000050	46.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	<0.0010	6.80	0.00930	-	0.00840	<0.00050
		2-Aug-2018	<0.00010	0.000770	0.0180	<0.00010	<0.000050	0.0250	0.00000700	43.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	7.60	0.0100	-	0.00840	<0.00050
		7-Aug-2018	0.000110	0.000770	0.0190	<0.00010	<0.000050	0.0250	0.00000570	41.0	<0.00050	<0.00010	0.00670	<0.030	<0.000050	<0.0010	7.10	0.0110	-	0.00820	<0.00050
		14-Aug-2018	<0.00010	0.000710	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	38.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	5.90	0.0100	-	0.00750	<0.00050
		21-Aug-2018	<0.00010	0.000760	0.0200	<0.00010	<0.000050	0.0270	0.00000740	46.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00100	8.30	0.0110	-	0.00820	<0.00050
		28-Aug-2018	0.000110	0.000820	0.0240	<0.00010	<0.000050	0.0270	0.00000540	50.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	0.00110	9.40	0.0130	-	0.00870	<0.00050
		4-Sep-2018	0.000110	0.000770	0.0250	<0.00010	<0.000050	0.0260	<0.0000050	49.0	<0.00050	<0.00010	0.00820	<0.030	<0.000050	0.00110	9.50	0.0140	-	0.00910	<0.00050
		10-Sep-2018	<0.00010	0.000630	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	37.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	5.80	0.00560	-	0.00780	<0.00050
		20-Sep-2018	0.000100	0.000790	0.0290	<0.00010	<0.000050	0.0260	0.00000770	51.0	<0.00050	<0.00010	0.00890	<0.030	<0.000050	0.00120	10.0	0.0190	-	0.00850	<0.00050
		24-Sep-2018	0.000120	0.000750	0.0290	<0.00010	<0.000050	0.0280	0.00000910	58.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	0.00120	11.0	0.0210	-	0.00930	<0.00050
		2-Oct-2018	<0.00010	0.000790	0.0230	<0.00010	<0.000050	0.0260	0.00000660	52.0	<0.00050	<0.00010	0.00730	<0.030	<0.000050	0.00110	10.0	0.0190	-	0.00800	<0.00050
		9-Oct-2018	0.000100	0.000710	0.0290	<0.00010	<0.000050	0.0270	0.0000100	58.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	0.00120	9.40	0.0210	-	0.00920	<0.00050
		16-Oct-2018	<0.00010	0.000840	0.0290	<0.00010	<0.000050	0.0290	0.00000530	55.0	<0.00050	<0.00010	0.00920	<0.030	<0.000050	0.00120	12.0	0.0250	-	0.00860	<0.00050
		23-Oct-2018	<0.00010	0.000870	0.0280	<0.00010	<0.000050	0.0280	0.00000710	56.0	<0.00050	<0.00010	0.00950	<0.030	<0.000050	0.00130	12.0	0.0250	-	0.00810	<0.00050
		30-Oct-2018	<0.00010	0.000750	0.0240	<0.00010	<0.000050	0.0280	0.00000790	53.0	<0.00050	<0.00010	0.00950	<0.030	<0.000050	0.00120	10.0	0.0210	-	0.00770	<0.00050
		6-Nov-2018	0.000110	0.000630	0.0290	<0.00010	<0.000050	0.0180	0.0000140	57.0	0.000560	0.000110	0.0240	0.170	0.0000610	<0.0010	9.90	0.0320	-	0.00750	0.000840
		13-Nov-2018	<0.00010	0.000720	0.0280	<0.00010	<0.000050	0.0250	0.0000110	58.0	<0.00050	<0.00010	0.0150	0.0660	<0.000050	0.00110	11.0	0.0300	-	0.00860	<0.00050
		27-Nov-2018	0.000100	0.000600	0.0260	<0.00010	<0.000050	0.0140	0.0000180	58.0	<0.00050	0.000130	0.0200	0.150	<0.000050	<0.0010	10.0	0.0520	-	0.00750	<0.00050
		4-Dec-2018	<0.00010	0.000760	0.0280	<0.00010	<0.000050	0.0240	0.0000120	62.0	0.000270	<0.00010	0.0180	0.0850	<0.000050	0.00120	12.0	0.0400	-	0.00830	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2018	HAC-08	2-Jan-2018	<0.00010	0.00130	0.0330	<0.00010	<0.000050	0.0350	0.00000560	68.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	0.00200	17.0	0.0260	-	0.00960	<0.00050
		9-Jan-2018	<0.00010	0.00140	0.0340	<0.00010	<0.000050	0.0320	0.00000680	64.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	0.00200	15.0	0.0270	-	0.00800	0.000520
		16-Jan-2018	0.000100	0.00140	0.0340	<0.00010	<0.000050	0.0320	0.00000820	61.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00140	14.0	0.0220	-	0.00910	<0.00050
		23-Jan-2018	0.000110	0.00140	0.0340	<0.00010	<0.000050	0.0310	0.00000850	62.0	<0.00050	0.000120	0.00830	<0.030	<0.000050	0.00190	15.0	0.0250	-	0.00870	0.000610
		30-Jan-2018	0.000110	0.00130	0.0310	<0.00010	<0.000050	0.0270	0.00000830	63.0	<0.00050	<0.00010	0.00850	<0.030	<0.000050	0.00160	13.0	0.0220	-	0.00780	<0.00050
		6-Feb-2018	0.000130	0.00120	0.0340	<0.00010	<0.000050	0.0240	0.00000770	48.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	0.00150	10.0	0.0180	-	0.00940	<0.00050
		13-Feb-2018	0.000120	0.000950	0.0260	<0.00010	<0.000050	0.0280	0.0000100	50.0	<0.00050	<0.00010	0.00930	<0.030	<0.000050	0.00140	7.80	0.0100	-	0.00900	<0.00050
		20-Feb-2018	<0.00010	0.00120	0.0240	<0.00010	<0.000050	0.0290	0.00000630	48.0	<0.00050	0.000170	0.0140	0.170	0.000110	<0.0010	8.90	0.0340	-	0.00800	0.000640
		14-Mar-2018	0.000110	0.00130	0.0360	<0.00010	<0.000050	0.0310	0.00000720	72.0	<0.00050	0.000120	0.00790	<0.030	<0.000050	0.00280	17.0	0.0280	-	0.00790	0.000780
		20-Mar-2018	0.000120	0.00120	0.0400	<0.00010	<0.000050	0.0270	0.0000180	84.0	<0.00050	0.000140	0.0100	<0.030	<0.000050	0.00260	20.0	0.0310	-	0.00870	0.000950
		27-Mar-2018	0.000130	0.00110	0.0390	<0.00010	<0.000050	0.0220	0.0000140	73.0	<0.00050	0.000120	0.0110	<0.030	<0.000050	0.00280	18.0	0.0340	-	0.00840	0.000950
		3-Apr-2018	0.000100	0.000820	0.0250	<0.00010	<0.000050	0.0260	0.00000590	52.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00160	11.0	0.0250	-	0.00920	<0.00050
		10-Apr-2018	0.000110	0.000810	0.0220	<0.00010	<0.000050	0.0230	0.0000110	49.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00130	8.10	0.0300	-	0.00900	0.000580
		17-Apr-2018	<0.00010	0.000620	0.0200	<0.00010	<0.000050	0.0180	0.0000140	41.0	<0.00050	<0.00010	0.0130	0.0370	<0.000050	<0.0010	8.00	0.0470	-	0.00740	0.000550
		24-Apr-2018	0.000110	0.000510	0.0290	<0.00010	<0.000050	0.0110	0.0000280	55.0	<0.00050	0.000210	0.0190	0.0850	<0.000050	0.00110	9.20	0.140	-	0.00890	0.000960
		1-May-2018	<0.00010	0.000490	0.0150	<0.00010	<0.000050	<0.010	0.0000140	27.0	0.000540	0.000120	0.0190	0.0750	<0.000050	<0.0010	4.90	0.0370	-	0.00410	0.000910
		8-May-2018	<0.00010	0.000590	0.0150	<0.00010	<0.000050	0.0130	0.0000100	29.0	<0.00050	<0.00010	0.0160	0.0500	<0.000050	<0.0010	5.20	0.0240	-	0.00470	0.000640
		16-May-2018	0.000130	0.000850	0.0250	<0.00010	<0.000050	0.0230	0.0000120	47.0	<0.00050	<0.00010	0.0140	<0.030	<0.000050	0.00120	8.50	0.0360	-	0.00780	0.000570
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	0.000110	0.000920	0.0240	<0.00010	<0.000050	0.0250	0.0000140	50.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	0.00130	9.10	0.0180	-	0.00860	<0.00050
		4-Jul-2018	0.000110	0.000870	0.0210	<0.00010	<0.000050	0.0260	0.00000670	47.0	<0.00050	<0.00010	0.00800	<0.030	<0.000050	0.00120	8.90	0.00930	-	0.00910	<0.00050
		2-Aug-2018	0.000100	0.000810	0.0190	<0.00010	<0.000050	0.0250	0.00000790	43.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	0.00100	7.60	0.00500	-	0.00880	<0.00050
		4-Sep-2018	0.000110	0.000910	0.0280	<0.00010	<0.000050	0.0280	<0.0000050	49.0	<0.00050	<0.00010	0.00820	<0.030	<0.000050	0.00130	9.90	0.00520	-	0.00880	<0.00050
		2-Oct-2018	<0.00010	0.000890	0.0240	<0.00010	<0.000050	0.0260	0.00000880	52.0	<0.00050	<0.00010	0.00730	<0.030	<0.000050	0.00140	11.0	0.0120	-	0.00810	<0.00050
		6-Nov-2018	0.000100	0.000700	0.0290	<0.00010	<0.000050	0.0170	0.0000160	54.0	0.000530	0.000110	0.0220	0.160	0.0000590	0.00120	10.0	0.0290	-	0.00650	0.000940
		27-Nov-2018	<0.00010	0.000630	0.0250	<0.00010	<0.000050	0.0130	0.0000170	50.0	<0.00050	0.000110	0.0170	0.0970	<0.000050	<0.0010	9.70	0.0420	-	0.00670	<0.00050
		4-Dec-2018	<0.00010	0.000770	0.0260	<0.00010	<0.000050	0.0230	0.0000120	55.0	0.000290	<0.00010	0.0170	0.0770	<0.000050	0.00130	10.0	0.0440	-	0.00770	0.000590
	W10	2-Jan-2018	<0.00010	0.00230	0.0250	<0.00010	<0.000050	0.0180	<0.0000050	40.0	<0.00050	<0.00010	0.00120	0.0450	<0.000050	0.00160	14.0	0.000650	-	0.00130	0.000650
		14-Feb-2018	<0.00010	0.00190	0.0190	<0.00010	<0.000050	0.0150	<0.0000050	36.0	<0.00050	<0.00010	0.00100	0.0630	<0.000050	<0.0010	12.0	0.00140	-	0.000990	0.000530
		14-Mar-2018	<0.00010	0.00200	0.0190	<0.00010	<0.000050	0.0160	<0.0000050	35.0	<0.00050	<0.00010	0.00100	0.0450	<0.000050	0.00100	13.0	0.00160	-	0.00110	0.000600
		3-Apr-2018	<0.00010	0.000820	0.0140	<0.00010	<0.000050	<0.010	<0.0000050	23.0	<0.00050	<0.00010	0.00240	0.120	<0.000050	<0.0010	8.10	0.00220	-	0.000610	0.000880
		1-May-2018	<0.00010	0.000380	0.00780	<0.00010	<0.000050	<0.010	0.00000550	11.0	0.000740	<0.00010	0.00330	0.140	<0.000050	<0.0010	3.20	0.00210	-	0.000260	0.00120
		5-Jun-2018	<0.00010	0.00130	0.0180	<0.00010	<0.000050	0.0120	0.00000620	26.0	<0.00050	<0.00010	0.00240	0.0440	<0.000050	<0.0010	8.90	0.00280	-	0.00100	0.000990
		4-Jul-2018	<0.00010	0.00150	0.0180	<0.00010	<0.000050	0.0150	<0.0000050	26.0	<0.00050	<0.00010	0.00220	0.0470	<0.000050	<0.0010	8.90	0.00250	-	0.000940	0.000860
		2-Aug-2018	<0.00010	0.00210	0.0280	<0.00010	<0.000050	0.0240	0.00000590	36.0	<0.00050	<0.00010	0.00160	<0.030	<0.000050	0.00120	14.0	0.00480	-	0.00190	0.000570
		4-Sep-2018	<0.00010	0.00240	0.0320	<0.00010	<0.000050	0.0290	<0.0000050	46.0	<0.00050	<0.00010	0.00120	<0.030	<0.000050	0.00130	18.0	0.00290	-	0.00220	<0.00050
		2-Oct-2018	<0.00010	0.00220	0.0220	<0.00010	<0.000050	0.0190	0.00000530	35.0	<0.00050	<0.00010	0.00120	<0.030	<0.000050	0.00100	14.0	0.00190	-	0.00140	0.000680
		6-Nov-2018	<0.00010	0.000520	0.0100	<0.00010	<0.000050	<0.010	0.0000100	15.0	0.000940	0.000100	0.00460	0.340	0.0000590	<0.0010	4.30	0.00400	-	0.000300	0.00150
	EDC-01a	2-Jan-2018	0.000110	0.00140	0.0430	<0.00010	<0.000050	0.0260	<0.0000050	53.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	0.00160	15.0	0.00780	-	0.00550	<0.00050
		30-Jan-2018	<0.00010	0.00160	0.0340	<0.00010	<0.000050	0.0220	<0.0000050	46.0	<0.00050	<0.00010	0.00490	0.0350	<0.000050	<0.0010	14.0	0.0180	-	0.00360	0.000520
		14-Feb-2018	<0.00010	0.00160	0.0260	<0.00010	<0.000050	0.0180	0.00000550	45.0	<0.00050	<0.00010	0.00400	0.0480	<0.000050	<0.0010	13.0	0.0160	-	0.00280	0.000550
		14-Mar-2018	<0.00010	0.00140	0.0340	<0.00010	<0.000050	0.0210	<0.0000050	50.0	<0.00050	<0.00010	0.00480	0.0300	<0.000050	<0.0010	15.0	0.0180	-	0.00330	<0.00050
		3-Apr-2018	<0.00010	0.000790	0.0180	<0.00010	<0.000050	0.0110	<0.0000050	27.0	<0.00050	<0.00010	0.00340	0.110	<0.000050	<0.0010	8.40	0.00650	-	0.00120	0.000890
		1-May-2018	<0.00010	0.000370	0.00780	<0.00010	<0.000050	<0.010	0.00000710	11.0	0.000790	<0.00010	0.00350	0.140	<0.000050	<0.0010	3.20	0.00280	-	0.000290	0.00130
		5-Jun-2018	<0.00010	0.00110	0.0200	<0.00010	<0.000050	0.0120	0.00000580	28.0	<0.00050	<0.00010	0.00370	0.0330	<0.000050	<0.0010	9.00	0.00990	-	0.00100	0.000920
		4-Jul-2018	<0.00010	0.00120	0.0210	<0.00010	<0.000050	0.0170	0.00000660	29.0	<0.00050	<0.00010	0.00430	0.0340	<0.000050	<0.0010	9.50	0.0140	-	0.00190	0.000850
		2-Aug-2018	<0.00010	0.00120	0.0360	<0.00010	<0.000050	0.0270	0.0000160	44.0	<0.00050	<0.00010	0.00740	<0.030	<0.000050	0.00110	12.0	0.0290	-	0.00580	0.000540
		4-Sep-2018	<0.00010	0.00140	0.0350	<0.00010	<0.000050	0.0270	<0.0000050	47.0	<0.00050	<0.00010	0.00370	<0.030	<0.000050	0.00110	15.0	0.0240	-	0.00400	<0.00050
		2-Oct-2018	<0.00010	0.00160	0.0260	<0.00010	<0.000050	0.0210	0.00000580	40.0	<0.00050	<0.00010	0.00340	<0.030	<0.000050	<0.0010	13.0	0.0180	-	0.00270	0.000720
		6-Nov-2018	<0.00010	0.000530	0.00980	<0.00010	<0.000050	<0.010	0.00000940	15.0	0.000900	0.000100	0.00420	0.310	<0.000050	<0.0010	4.30	0.00400	-	0.000360	0.00140
	HAC-13	8-Jan-2019	<0.00010	0.000630	0.0120	<0.00010	<0.000050	0.0230	0.00000530	41.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	6.30	0.0210	-	0.00830	<0.00050
		5-Feb-2019	<0.00010	0.000620	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	43.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	6.50	0.0250	-	0.00800	<0.00050
		4-Mar-2019	0.000100	0.000660	0.0130	<0.00010	<0.000050	0.0250	0.00000630	42.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.20	0.0120	-	0.00800	<0.00050
		2-Apr-2019	0.000110	0.000570	0.0160	<0.00010	<0.000050	0.0210	0.0000160	45.0	<0.00050	0.000120	0.0110	0.0560	<0.000050	<0.0010	6.80	0.0940	-	0.00870	<0.00050
		14-May-2019	0.000100	0.000680	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	<0.0010	5.70	0.00720	-	0.00810	<0.00050
		4-Jun-2019	0.000100	0.000670	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	40.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	6.30	0.000660	-	0.00810	<0.00050
		2-Jul-2019	0.000110	0.000620	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	39.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	5.30	0.00700	-	0.00760	<0.00050
		1-Aug-2019	<0.00010	0.000670	0.0130	<0.00010	<0.000050	0.0240	<0.0000050	43.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	6.40	0.00390	-	0.00800	<0.00050
		3-Sep-2019	<0.00010	0.000660	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	39.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	6.10	0.000830	-	0.00820	<0.00050
		1-Oct-2019	<0.00010	0.000570	0.0120	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	7.00	0.00170	-	0.00780	<0.00050
		4-Nov-2019	<0.00010	0.000580	0.0120	<0.00010	<0.000050	0.0220	0.00000730	39.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	6.10	0.00320	-	0.00760	<0.00050
		2-Dec-2019	<0.00010	0.000650	0.0120	<0.00010	<0.000050	0.0250	<0.0000050	43.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	6.50	0.00140	-	0.00790	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2019	HAC-05a	8-Jan-2019	<0.00010	0.000690	0.0160	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	<0.0010	7.70	0.0210	-	0.00800	<0.00050
		5-Feb-2019	<0.00010	0.000660	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	45.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	7.30	0.0320	-	0.00760	<0.00050
		4-Mar-2019	<0.00010	0.000720	0.0150	<0.00010	<0.000050	0.0250	<0.0000050	46.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	<0.0010	7.20	0.0230	-	0.00760	<0.00050
		2-Apr-2019	0.000110	0.000620	0.0200	<0.00010	<0.000050	0.0200	0.0000180	51.0	<0.00050	0.000130	0.0130	0.0670	<0.000050	<0.0010	7.60	0.110	-	0.00820	<0.00050
		18-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-May-2019	0.000110	0.000720	0.0170	<0.00010	<0.000050	0.0230	0.00000610	47.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	<0.0010	7.90	0.0260	-	0.00760	<0.00050
		4-Jun-2019	<0.00010	0.000810	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	47.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	<0.0010	8.10	0.00470	-	0.00750	<0.00050
		2-Jul-2019	<0.00010	0.000670	0.0150	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00470	<0.030	<0.000050	<0.0010	7.00	0.0130	-	0.00720	<0.00050
		1-Aug-2019	<0.00010	0.000680	0.0160	<0.00010	<0.000050	0.0240	<0.0000050	45.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	7.70	0.0110	-	0.00760	<0.00050
		3-Sep-2019	<0.00010	0.000680	0.0140	<0.00010	<0.000050	0.0250	<0.0000050	42.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	7.20	0.00250	-	0.00790	<0.00050
		1-Oct-2019	<0.00010	0.000570	0.0170	<0.00010	<0.000050	0.0230	0.00000630	53.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	8.50	0.0100	-	0.00740	<0.00050
		4-Nov-2019	<0.00010	0.000650	0.0140	<0.00010	<0.000050	0.0200	0.00000690	42.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	7.20	0.0120	-	0.00740	<0.00050
		2-Dec-2019	<0.00010	0.000720	0.0130	<0.00010	<0.000050	0.0250	<0.0000050	45.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	7.20	0.00840	-	0.00780	<0.00050
	HAC-14	14-May-2019	0.000110	0.000810	0.0200	<0.00010	<0.000050	0.0240	0.00000790	48.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	9.10	0.0160	-	0.00740	<0.00050
		4-Jun-2019	<0.00010	0.000810	0.0230	<0.00010	<0.000050	0.0260	<0.0000050	52.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00100	9.80	0.00800	-	0.00780	<0.00050
		2-Jul-2019	0.000110	0.000860	0.0270	<0.00010	<0.000050	0.0250	<0.000020	45.0	<0.00050	<0.00010	0.00810	<0.030	<0.000050	<0.0010	8.00	0.0120	-	0.00770	<0.00050
		1-Aug-2019	0.000120	0.000850	0.0230	<0.00010	<0.000050	0.0260	<0.000015	48.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00110	8.70	0.0130	-	0.00840	<0.00050
		3-Sep-2019	<0.00010	0.000760	0.0220	<0.00010	<0.000050	0.0270	<0.0000050	43.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00100	8.10	0.00390	-	0.00830	<0.00050
		1-Oct-2019	<0.00010	0.000650	0.0210	<0.00010	<0.000050	0.0230	0.0000110	54.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	<0.0010	9.50	0.0100	-	0.00740	<0.00050
		4-Nov-2019	<0.00010	0.000660	0.0170	<0.00010	<0.000050	0.0200	0.0000100	41.0	<0.00050	<0.00010	0.0100	0.0440	<0.000050	<0.0010	7.30	0.0100	-	0.00710	<0.00050
		4-Nov-2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Dec-2019	<0.00010	0.000680	0.0160	<0.00010	<0.000050	0.0250	<0.0000050	46.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	7.60	0.00860	-	0.00790	<0.00050
	HAC-08	8-Jan-2019	<0.00010	0.000790	0.0230	<0.00010	<0.000050	0.0260	0.00000740	51.0	<0.00050	<0.00010	0.0110	<0.030	<0.000050	0.00130	9.00	0.0190	-	0.00790	<0.00050
		5-Feb-2019	<0.00010	0.000780	0.0210	<0.00010	<0.000050	0.0240	0.00000830	47.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	8.90	0.0210	-	0.00730	<0.00050
		4-Mar-2019	<0.00010	0.000800	0.0190	<0.00010	<0.000050	0.0270	0.00000620	47.0	<0.00050	<0.00010	0.00920	<0.030	<0.000050	0.00110	8.00	0.0190	-	0.00780	<0.00050
		2-Apr-2019	<0.00010	0.000700	0.0240	<0.00010	<0.000050	0.0160	0.0000200	41.0	<0.00050	0.000190	0.0150	0.100	<0.000050	<0.0010	7.10	0.0650	-	0.00620	0.000900
		14-May-2019	0.000110	0.000860	0.0230	<0.00010	<0.000050	0.0230	0.00000720	48.0	<0.00050	<0.00010	0.00990	<0.030	<0.000050	0.00110	8.90	0.0170	-	0.00720	<0.00050
		4-Jun-2019	0.000110	0.000890	0.0230	<0.00010	<0.000050	0.0270	<0.0000050	52.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	0.00120	8.90	0.000890	-	0.00810	<0.00050
		2-Jul-2019	0.000120	0.00110	0.0270	<0.00010	<0.000050	0.0250	<0.000020	46.0	<0.00050	<0.00010	0.00950	<0.030	<0.000050	0.00120	8.30	0.00950	-	0.00800	<0.00050
		1-Aug-2019	0.000110	0.000910	0.0240	<0.00010	<0.000050	0.0260	<0.000010	49.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	0.00120	9.00	0.0120	-	0.00840	<0.00050
		3-Sep-2019	0.000100	0.000870	0.0230	<0.00010	<0.000050	0.0270	<0.0000050	44.0	<0.00050	<0.00010	0.00930	<0.030	<0.000050	0.00110	8.40	0.00480	-	0.00810	<0.00050
		1-Oct-2019	<0.00010	0.000750	0.0240	<0.00010	<0.000050	0.0230	0.0000160	52.0	<0.00050	<0.00010	0.0150	<0.030	<0.000050	0.00100	9.60	0.0130	-	0.00720	<0.00050
		4-Nov-2019	<0.00010	0.000640	0.0180	<0.00010	<0.000050	0.0180	0.00000880	39.0	<0.00050	<0.00010	0.0100	0.0400	<0.000050	<0.0010	7.30	0.0110	-	0.00660	<0.00050
		2-Dec-2019	<0.00010	0.000720	0.0200	<0.00010	<0.000050	0.0240	<0.000010	44.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	<0.0010	7.80	0.0120	-	0.00750	<0.00050
	W10	4-Jun-2019	<0.00010	0.00100	0.0140	<0.00010	<0.000050	<0.010	0.00000840	23.0	0.000700	<0.00010	0.00260	0.100	<0.000050	<0.0010	6.90	0.00360	-	0.000610	0.00110
		8-Aug-2019	<0.00010	0.000970	0.0140	<0.00010	<0.000050	<0.010	0.00000620	23.0	0.000600	<0.00010	0.00240	0.190	<0.000050	<0.0010	6.40	0.000950	-	0.000600	0.00120
		1-Oct-2019	<0.00010	0.000730	0.0120	<0.00010	<0.000050	<0.010	0.00000770	24.0	0.000660	<0.00010	0.00230	0.280	<0.000050	<0.0010	6.80	0.00260	-	0.000460	0.00130
		20-Nov-2019	<0.00010	0.000470	0.00860	<0.00010	<0.000050	<0.010	<0.0000050	17.0	0.000790	<0.00010	0.00300	0.230	<0.000050	<0.0010	4.30	0.00280	-	0.000340	0.00120
	EDC-01a	8-May-2019	<0.00010	0.000390	0.00780	<0.00010	<0.000050	<0.010	0.00000530	13.0	0.000700	<0.00010	0.00320	0.120	<0.000050	<0.0010	3.60	0.00170	-	0.000370	0.00110
		4-Jun-2019	<0.00010	0.000990	0.0150	<0.00010	<0.000050	<0.010	0.00000560	25.0	<0.00050	<0.00010	0.00360	0.0840	<0.000050	<0.0010	6.70	0.00320	-	0.000750	0.00110
		2-Jul-2019	<0.00010	0.00140	0.0210	<0.00010	<0.000050	0.0160	0.00000510	31.0	<0.00050	<0.00010	0.00310	0.0360	<0.000050	<0.0010	9.20	0.0140	-	0.00140	0.000760
		1-Oct-2019	<0.00010	0.000710	0.0120	<0.00010	<0.000050	<0.010	0.00000790	24.0	0.000640	<0.00010	0.00260	0.270	<0.000050	<0.0010	6.80	0.00360	-	0.000570	0.00130
	HAC-13	20-Jan-2020	<0.00010	0.000630	0.0130	<0.0010	<0.000050	0.0240	<0.000010	44.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	6.50	0.0400	-	0.00740	<0.00050
		3-Feb-2020	<0.00010	0.000550	0.0120	<0.0010	<0.000050	0.0230	<0.0000050	39.0	<0.00050	<0.00010	0.00410	<0.030	<0.000050	<0.0010	5.80	0.0280	-	0.00710	<0.00050
		25-Mar-2020	<0.00010	0.000560	0.0110	<0.0010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	6.30	0.0260	-	0.00730	<0.00050
		16-Apr-2020	<0.00010	0.000530	0.0130	<0.0010	<0.000050	0.0200	<0.000015	50.0	<0.00050	<0.00010	0.00820	0.0360	<0.000050	<0.0010	7.00	0.0540	-	0.00720	<0.00050
		7-May-2020	<0.00010	0.000320	0.00840	<0.0010	<0.000050	<0.010	<0.000010	20.0	<0.00050	<0.00010	0.00890	0.0870	<0.000050	<0.0010	3.60	0.00170	-	0.00420	0.000540
		3-Jun-2020	<0.00010	0.000560	0.0120	<0.0010	<0.000050	0.0200	<0.0000050	40.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	5.70	0.00430	-	0.00670	<0.00050
		6-Jul-2020	<0.00010	0.000540	0.0110	<0.0010	<0.000050	0.0200	<0.000010	38.0	<0.00050	<0.00010	0.00460	<0.030	<0.000050	<0.0010	5.60	0.00250	-	0.00700	<0.00050
		4-Aug-2020	<0.00010	0.000640	0.0110	<0.0010	<0.000050	0.0200	<0.000010	36.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	5.20	0.00160	-	0.00710	<0.00050
		1-Sep-2020	<0.00010	0.000540	0.0100	<0.0010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	5.40	0.00970	-	0.00680	<0.00050
		1-Oct-2020	<0.00010	0.000540	0.0110	<0.0010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00470	<0.030	<0.000050	<0.0010	5.60	0.00580	-	0.00660	<0.00050
		2-Nov-2020	<0.00010	0.000490	0.0120	<0.0010	<0.000050	0.0200	<0.000010	42.0	<0.00050	<0.00010	0.00700	0.0350	<0.000050	<0.0010	5.60	0.00800	-	0.00680	<0.00050
		1-Dec-2020	<0.00010	0.000550	0.0110	<0.0010	<0.000050	0.0190	<0.0000050	34.0	<0.00050	<0.00010	0.00400	<0.030	<0.000050	<0.0010	5.30	0.00410	-	0.00610	<0.00050
	HAC-05a	20-Jan-2020	<0.00010	0.000690	0.0150	<0.0010	<0.000050	0.0240	<0.000010	49.0	<0.00050	<0.00010	0.00540	<0.030	<0.000050	<0.0010	8.40	0.0290	-	0.00690	<0.00050
		3-Feb-2020	<0.00010	0.000560	0.0130	<0.0010	<0.000050	0.0230	<0.0000050	41.0	<0.00050	<0.00010	0.00470	<0.030	<0.000050	<0.0010	6.30	0.0270	-	0.00690	<0.00050
		25-Mar-2020	<0.00010	0.000590	0.0120	<0.0010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00460	<0.030	<0.000050	<0.0010	6.80	0.0240	-	0.00650	<0.00050
		16-Apr-2020	<0.00010	0.000540	0.0170	<0.0010	<0.000050	0.0180	<0.000015	56.0	<0.00050	<0.00010	0.0100	0.0510	<0.000050	<0.0010	8.60	0.0670	-	0.00670	0.000520
		7-May-2020	<0.00010	0.000350	0.0100	<0.0010	<0.000050	<0.010	<0.000010	25.0	<0.00050	<0.00010	0.0120	0.0980	<0.000050	<0.0010	4.10	0.00230	-	0.00440	0.000540
		3-Jun-2020	<0.00010	0.000560	0.0130	<0.0010	<0.000050	0.0190	<0.0000050	42.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	6.10	0.0130	-	0.00670	<0.00050
		6-Jul-2020	<0.00010	0.000610	0.0120	<0.0010	<0.000050	0.0190	<0.000010	40.0	<0.00050	<0.00010	0.00540	<0.030	<0.000050	<0.0010	6.20	0.00610	-	0.00700	<0.00050
		4-Aug-2020	<0.00010	0.000760	0.0130	<0.0010	<0.000050	0.0210	<0.000010	41.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	6.30	0.00280	-	0.00690	<0.00050
		1-Sep-2020	<0.00010	0.000580	0.0130	<0.0010	<0.000050	0.0200	<0.000010	44.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	7.10	0.0160	-	0.00680	<0.00050
		1-Oct-2020	<0.00010	0.000570	0.0120	<0.0010	<0.000050	0.0210	<0.000010	43.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	7.20	0.0150	-	0.00630	<0.00050
		2-Nov-2020	<0.00010	0.000490	0.0140	<0.0010	<0.000050	0.0190	0.0000140	43.0	<0.00050	<0.00010	0.00890	0.0450	<0.000050	<0.0010	5.90	0.0150	-	0.00650	<0.00050
		1-Dec-2020	<0.00010	0.000560	0.0110	<0.0010	<0.000050	0.0200	<0.0000050	36.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	5.80	0.0100	-	0.00590	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2020	HAC-14	3-Jun-2020	<0.00010	0.000640	0.0150	<0.0010	<0.000050	0.0170	<0.000010	39.0	<0.00050	<0.00010	0.0100	0.0440	<0.000050	<0.0010	6.10	0.0110	-	0.00600	<0.00050
		6-Jul-2020	<0.00010	0.000670	0.0150	<0.0010	<0.000050	0.0180	<0.000010	41.0	<0.00050	<0.00010	0.00870	<0.030	<0.000050	<0.0010	6.40	0.00470	-	0.00660	<0.00050
		4-Aug-2020	<0.00010	0.000850	0.0180	<0.0010	<0.000050	0.0230	<0.000010	44.0	<0.00050	<0.00010	0.00790	<0.030	<0.000050	<0.0010	7.20	0.000580	-	0.00730	<0.00050
		1-Sep-2020	<0.00010	0.000730	0.0170	<0.0010	<0.000050	0.0220	0.0000260	45.0	<0.00050	<0.00010	0.00890	<0.030	<0.000050	<0.0010	8.00	0.00560	-	0.00660	<0.00050
		1-Oct-2020	<0.00010	0.000660	0.0170	<0.0010	<0.000050	0.0230	<0.000010	44.0	<0.00050	<0.00010	0.00820	<0.030	<0.000050	<0.0010	7.80	0.00670	-	0.00640	<0.00050
		2-Nov-2020	<0.00010	0.000520	0.0140	<0.0010	<0.000050	0.0160	0.0000140	39.0	<0.00050	<0.00010	0.0120	0.0840	<0.000050	<0.0010	5.60	0.0110	-	0.00560	<0.00050
	HAC-08	20-Jan-2020	<0.00010	0.000770	0.0210	<0.0010	<0.000050	0.0250	<0.000015	51.0	<0.00050	<0.00010	0.00860	<0.030	<0.000050	0.00100	9.40	0.0160	-	0.00660	<0.00050
		3-Feb-2020	<0.00010	0.000650	0.0190	<0.0010	<0.000050	0.0230	<0.000010	42.0	<0.00050	<0.00010	0.00870	<0.030	<0.000050	<0.0010	6.80	0.0130	-	0.00700	<0.00050
		25-Mar-2020	<0.00010	0.000700	0.0180	<0.0010	<0.000050	0.0230	0.00000510	47.0	<0.00050	<0.00010	0.00810	<0.030	<0.000050	<0.0010	8.60	0.0110	-	0.00710	<0.00050
		16-Apr-2020	<0.00010	0.000580	0.0200	<0.0010	<0.000050	0.0140	<0.000015	47.0	<0.00050	<0.00010	0.0110	0.0580	<0.000050	<0.0010	8.10	0.0280	-	0.00460	0.000810
		7-May-2020	<0.00010	0.000460	0.0140	<0.0010	<0.000050	<0.010	0.0000110	23.0	<0.00050	<0.00010	0.0160	0.120	<0.000050	<0.0010	4.10	0.0100	-	0.00330	0.000770
		3-Jun-2020	<0.00010	0.000650	0.0170	<0.0010	<0.000050	0.0170	0.00000670	38.0	<0.00050	<0.00010	0.0100	0.0400	<0.000050	<0.0010	6.20	0.0110	-	0.00540	0.000510
		6-Jul-2020	<0.00010	0.000690	0.0170	<0.0010	<0.000050	0.0180	<0.000015	41.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	<0.0010	6.60	0.00500	-	0.00640	<0.00050
		4-Aug-2020	<0.00010	0.000930	0.0210	<0.0010	<0.000050	0.0240	<0.000015	45.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00110	7.50	0.000430	-	0.00710	<0.00050
		1-Sep-2020	<0.00010	0.000770	0.0210	<0.0010	<0.000050	0.0230	<0.000010	46.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00120	8.60	0.00520	-	0.00680	<0.00050
		1-Oct-2020	<0.00010	0.000710	0.0180	<0.0010	<0.000050	0.0230	<0.000010	45.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	<0.0010	8.20	0.00480	-	0.00650	<0.00050
		2-Nov-2020	<0.00010	0.000550	0.0150	<0.0010	<0.000050	0.0150	0.0000490	36.0	<0.00050	<0.00010	0.0120	0.0880	<0.000050	<0.0010	5.40	0.0110	-	0.00480	0.000600
		1-Dec-2020	<0.00010	0.000630	0.0140	<0.0010	<0.000050	0.0190	<0.0000050	35.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	6.10	0.00910	-	0.00580	<0.00050
	W10	7-May-2020	<0.00010	0.000350	0.00750	<0.0010	<0.000050	<0.010	0.00000700	11.0	0.000640	<0.00010	0.00260	0.160	<0.000050	<0.0010	3.00	0.00130	-	0.000280	0.00110
		31-Aug-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Sep-2020	<0.00010	0.00190	0.0220	<0.0010	<0.000050	0.0160	<0.0000050	36.0	<0.00050	<0.00010	0.00140	0.0570	<0.000050	<0.0010	12.0	0.0100	-	0.00140	0.000870
		1-Oct-2020	<0.00010	0.00190	0.0230	<0.0010	<0.000050	0.0170	0.0000130	39.0	<0.00050	<0.00010	0.00170	0.0470	<0.000050	<0.0010	14.0	0.00790	-	0.00140	0.000890
		2-Nov-2020	<0.00010	0.000460	0.00870	<0.0010	<0.000050	<0.010	0.0000100	16.0	0.000960	<0.00010	0.00280	0.280	<0.000050	<0.0010	4.00	0.00390	-	0.000300	0.00140
	EDC-01a	7-May-2020	<0.00010	0.000350	0.00790	<0.0010	<0.000050	<0.010	0.00000860	12.0	0.000670	<0.00010	0.00300	0.160	<0.000050	<0.0010	3.10	0.00140	-	0.000270	0.00110
		1-Sep-2020	<0.00010	0.000690	0.0470	<0.0010	<0.000050	0.0230	0.0000320	63.0	<0.00050	<0.00010	0.0120	<0.030	<0.000050	0.00100	12.0	0.0530	-	0.00750	0.000780
		1-Oct-2020	<0.00010	0.000860	0.0250	<0.0010	<0.000050	0.0220	0.00000930	46.0	<0.00050	<0.00010	0.0100	<0.030	<0.000050	<0.0010	9.30	0.0410	-	0.00570	<0.00050
		2-Nov-2020	<0.00010	0.000470	0.0110	<0.0010	<0.000050	<0.010	0.00000970	21.0	0.000760	<0.00010	0.00550	0.230	<0.000050	<0.0010	4.60	0.00960	-	0.00130	0.00120
		1-Dec-2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2020	<0.00010	0.000620	0.0130	<0.0010	<0.000050	0.0130	0.00000520	28.0	<0.00050	<0.00010	0.00500	0.110	<0.000050	<0.0010	5.80	0.0210	-	0.00320	0.000660
	HAC-13	12-Jan-2021	<0.00010	0.000540	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	5.20	0.0190	-	0.00640	<0.00050
		1-Feb-2021	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0220	<0.0000050	40.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	5.60	0.0180	-	0.00630	<0.00050
		8-Mar-2021	<0.00010	0.000530	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	5.60	0.0490	-	0.00650	<0.00050
		7-Apr-2021	<0.00010	0.000470	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	43.0	<0.00050	<0.00010	0.00550	0.0420	<0.000050	<0.0010	6.10	0.0510	-	0.00630	<0.00050
		3-May-2021	<0.00010	0.000350	0.00900	<0.00010	<0.000050	0.0130	<0.0000050	31.0	<0.00050	<0.00010	0.00600	0.0380	<0.000050	<0.0010	4.10	0.00650	-	0.00480	<0.00050
		1-Jun-2021	<0.00010	0.000530	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	36.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	5.60	0.00550	-	0.00640	<0.00050
		7-Jul-2021	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0210	<0.000010	37.0	<0.00050	<0.00010	0.00460	<0.030	<0.000050	<0.0010	5.40	0.0160	-	0.00680	<0.00050
		4-Aug-2021	<0.00010	0.000610	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	5.50	0.0240	-	0.00670	<0.00050
		1-Sep-2021	<0.00010	0.000550	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	38.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	5.50	0.0140	-	0.00670	<0.00050
		4-Oct-2021	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	39.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	5.70	0.0120	-	0.00640	<0.00050
		4-Nov-2021	<0.00010	0.000470	0.0150	<0.00010	<0.000050	0.0190	<0.0000050	47.0	<0.00050	<0.00010	0.00810	<0.030	<0.000050	<0.0010	7.30	0.0240	-	0.00920	<0.00050
		1-Dec-2021	<0.00010	0.000500	0.0160	<0.00010	<0.000050	0.0210	0.00000540	51.0	<0.00050	<0.00010	0.00770	<0.030	<0.000050	<0.0010	7.10	0.0420	-	0.00670	<0.00050
	HAC-05a	12-Jan-2021	<0.00010	0.000550	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	6.30	0.0240	-	0.00620	<0.00050
		1-Feb-2021	<0.00010	0.000600	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	42.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	6.70	0.0220	-	0.00630	<0.00050
		8-Mar-2021	<0.00010	0.000550	0.0120	<0.00010	<0.000050	0.0220	0.0000160	44.0	<0.00050	<0.00010	0.00460	<0.030	<0.000050	<0.0010	6.70	0.0360	-	0.00660	<0.00050
		7-Apr-2021	<0.00010	0.000460	0.0130	<0.00010	<0.000050	0.0190	0.00000960	48.0	<0.00050	<0.00010	0.00630	0.0380	<0.000050	<0.0010	7.10	0.0500	-	0.00610	<0.00050
		3-May-2021	<0.00010	0.000370	0.0100	<0.00010	<0.000050	0.0130	<0.0000050	34.0	<0.00050	<0.00010	0.00740	0.0400	<0.000050	<0.0010	5.20	0.0170	-	0.00480	<0.00050
		1-Jun-2021	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	6.10	0.0140	-	0.00630	<0.00050
		7-Jul-2021	<0.00010	0.000680	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	40.0	<0.00050	<0.00010	0.00470	<0.030	<0.000050	<0.0010	6.50	0.0280	-	0.00690	<0.00050
		4-Aug-2021	<0.00010	0.000670	0.0130	<0.00010	<0.000050	0.0210	<0.0000050	48.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	<0.0010	8.40	0.00880	-	0.00640	<0.00050
		1-Sep-2021	<0.00010	0.000660	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	47.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	8.60	0.0140	-	0.00640	<0.00050
		4-Oct-2021	<0.00010	0.000580	0.0140	<0.00010	<0.000050	0.0200	<0.0000050	46.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	8.20	0.0140	-	0.00620	<0.00050
		4-Nov-2021	<0.00010	0.000600	0.0190	<0.00010	<0.000050	0.0180	<0.0000050	55.0	<0.00050	<0.00010	0.00630	<0.030	<0.000050	<0.0010	9.90	0.0250	-	0.00800	<0.00050
		1-Dec-2021	<0.00010	0.000520	0.0190	<0.00010	<0.000050	0.0210	<0.0000050	59.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	9.30	0.0240	-	0.00670	<0.00050
	HAC-14	3-May-2021	<0.00010	0.000460	0.0120	<0.00010	<0.000050	0.0120	<0.000010	31.0	<0.00050	<0.00010	0.0120	0.0640	<0.000050	<0.0010	4.80	0.0130	-	0.00460	<0.00050
		1-Jun-2021	<0.00010	0.000560	0.0140	<0.00010	<0.000050	0.0220	0.00000530	39.0	<0.00050	<0.00010	0.00720	<0.030	<0.000050	<0.0010	6.40	0.00900	-	0.00630	<0.00050
		7-Jul-2021	<0.00010	0.000820	0.0150	<0.00010	<0.000050	0.0220	<0.0000050	42.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	<0.0010	6.90	0.00650	-	0.00720	<0.00050
		4-Aug-2021	<0.00010	0.000880	0.0200	<0.00010	<0.000050	0.0250	<0.0000050	49.0	<0.00050	<0.00010	0.00880	<0.030	<0.000050	0.00100	8.80	0.00780	-	0.00710	<0.00050
		1-Sep-2021	0.000100	0.000790	0.0220	<0.00010	<0.000050	0.0250	0.00000590	51.0	<0.00050	<0.00010	0.00770	<0.030	<0.000050	0.00110	10.0	0.00840	-	0.00680	<0.00050
		4-Oct-2021	<0.00010	0.000680	0.0190	<0.00010	<0.000050	0.0220	<0.000010	50.0	<0.00050	<0.00010	0.00730	<0.030	<0.000050	<0.0010	9.50	0.00690	-	0.00660	<0.00050
		4-Nov-2021	<0.00010	0.000630	0.0200	<0.00010	<0.000050	0.0190	0.00000530	52.0	<0.00050	<0.00010	0.00870	<0.030	<0.000050	<0.0010	10.0	0.00900	-	0.00790	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2021	HAC-08	12-Jan-2021	<0.00010	0.000630	0.0140	<0.00010	<0.000050	0.0200	0.00000530	41.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	6.90	0.0130	-	0.00590	<0.00050
		1-Feb-2021	<0.00010	0.000640	0.0160	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00720	<0.030	<0.000050	<0.0010	7.30	0.0120	-	0.00610	<0.00050
		8-Mar-2021	<0.00010	0.000600	0.0160	<0.00010	<0.000050	0.0220	0.00000790	44.0	<0.00050	<0.00010	0.00700	<0.030	<0.000050	<0.0010	7.60	0.0170	-	0.00620	<0.00050
		7-Apr-2021	<0.00010	0.000510	0.0160	<0.00010	<0.000050	0.0160	0.00000670	41.0	<0.00050	<0.00010	0.00820	0.0510	<0.000050	<0.0010	7.20	0.0220	-	0.00460	<0.00050
		3-May-2021	<0.00010	0.000480	0.0140	<0.00010	<0.000050	0.0120	0.0000250	30.0	<0.00050	<0.00010	0.0120	0.0690	0.0000520	<0.0010	5.40	0.0150	-	0.00410	0.000530
		1-Jun-2021	<0.00010	0.000560	0.0150	<0.00010	<0.000050	0.0200	<0.0000050	39.0	<0.00050	<0.00010	0.00720	<0.030	<0.000050	<0.0010	6.50	0.00900	-	0.00600	<0.00050
		7-Jul-2021	<0.00010	0.000800	0.0180	<0.00010	<0.000050	0.0230	<0.0000050	44.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00110	7.30	0.00520	-	0.00740	<0.00050
		4-Aug-2021	<0.00010	0.00100	0.0220	<0.00010	<0.000050	0.0250	0.0000110	51.0	<0.00050	<0.00010	0.00910	<0.030	<0.000050	0.00130	9.30	0.00590	-	0.00750	<0.00050
		1-Sep-2021	<0.00010	0.000970	0.0230	<0.00010	<0.000050	0.0250	<0.0000050	51.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	0.00140	10.0	0.00560	-	0.00700	<0.00050
		4-Oct-2021	<0.00010	0.000780	0.0190	<0.00010	<0.000050	0.0210	<0.0000050	49.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	0.00120	9.30	0.00610	-	0.00680	<0.00050
		4-Nov-2021	<0.00010	0.000730	0.0230	<0.00010	<0.000050	0.0190	<0.0000050	52.0	<0.00050	<0.00010	0.00780	<0.030	<0.000050	0.00140	11.0	0.00780	-	0.00810	<0.00050
		1-Dec-2021	<0.00010	0.000730	0.0230	<0.00010	<0.000050	0.0200	<0.0000050	54.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	0.00140	10.0	0.00940	-	0.00620	<0.00050
	W10	12-Jan-2021	<0.00010	0.000620	0.00960	<0.00010	<0.000050	<0.010	0.00000520	21.0	0.000590	<0.00010	0.00190	0.250	0.0000500	<0.0010	5.70	0.00480	-	0.000420	0.00100
		3-May-2021	<0.00010	0.000300	0.00760	<0.00010	<0.000050	<0.010	0.00000640	12.0	0.000570	<0.00010	0.00240	0.140	<0.000050	<0.0010	3.10	0.00210	-	0.000280	0.000950
		4-Aug-2021	<0.00010	0.00210	0.0330	<0.00010	<0.000050	0.0270	<0.0000050	49.0	<0.00050	<0.00010	0.00120	<0.030	<0.000050	0.00140	17.0	0.00560	-	0.00210	0.000600
		4-Nov-2021	<0.00010	0.00110	0.0140	<0.00010	<0.000050	0.0100	<0.0000050	29.0	<0.00050	<0.00010	0.00120	0.0660	<0.000050	<0.0010	9.60	0.00580	-	0.000790	0.000610
	EDC-01a	12-Jan-2021	<0.00010	0.000640	0.0140	<0.00010	<0.000050	0.0150	0.00000690	34.0	<0.00050	<0.00010	0.00540	0.120	<0.000050	<0.0010	6.80	0.0310	-	0.00350	0.000590
		1-Feb-2021	<0.00010	0.000660	0.0160	<0.00010	<0.000050	0.0160	0.00000570	37.0	<0.00050	<0.00010	0.00560	0.120	<0.000050	<0.0010	7.40	0.0380	-	0.00360	0.000540
		8-Mar-2021	<0.00010	0.000690	0.0150	<0.00010	<0.000050	0.0150	0.00000760	36.0	<0.00050	<0.00010	0.00520	0.130	<0.000050	<0.0010	7.80	0.0350	-	0.00360	0.000540
		7-Apr-2021	<0.00010	0.000460	0.0130	<0.00010	<0.000050	0.0110	0.00000930	32.0	<0.00050	<0.00010	0.00510	0.140	<0.000050	<0.0010	6.70	0.0320	-	0.00240	0.000710
		3-May-2021	<0.00010	0.000350	0.00900	<0.00010	<0.000050	<0.010	0.00000510	16.0	0.000600	<0.00010	0.00400	0.140	<0.000050	<0.0010	3.70	0.00780	-	0.000830	0.000930
		1-Jun-2021	<0.00010	0.000620	0.0140	<0.00010	<0.000050	0.0140	0.00000680	29.0	<0.00050	<0.00010	0.00590	0.130	<0.000050	<0.0010	5.80	0.0210	-	0.00320	0.000620
		7-Jul-2021	<0.00010	0.000840	0.0210	<0.00010	<0.000050	0.0220	<0.0000050	44.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00120	8.20	0.0420	-	0.00650	<0.00050
		4-Aug-2021	<0.00010	0.00110	0.0270	<0.00010	<0.000050	0.0240	0.00000880	52.0	<0.00050	<0.00010	0.00900	<0.030	<0.000050	0.00120	10.0	0.0530	-	0.00700	<0.00050
		1-Sep-2021	<0.00010	0.00100	0.0280	<0.00010	<0.000050	0.0240	0.00000670	51.0	<0.00050	<0.00010	0.00830	<0.030	<0.000050	0.00130	12.0	0.0490	-	0.00600	<0.00050
		4-Oct-2021	<0.00010	0.000930	0.0240	<0.00010	<0.000050	0.0210	0.00000620	50.0	<0.00050	<0.00010	0.00670	<0.030	<0.000050	0.00110	11.0	0.0420	-	0.00600	<0.00050
		4-Nov-2021	<0.00010	0.00100	0.0200	<0.00010	<0.000050	0.0160	0.00000530	42.0	<0.00050	<0.00010	0.00510	0.0310	<0.000050	0.00110	10.0	0.0260	-	0.00400	0.000510
		1-Dec-2021	<0.00010	0.000830	0.0190	<0.00010	<0.000050	0.0160	0.00000620	41.0	<0.00050	<0.00010	0.00540	0.0590	<0.000050	<0.0010	9.40	0.0430	-	0.00350	0.000530
	HAC-13	12-Jan-2022	<0.00010	0.000520	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	<0.0010	5.90	0.0110	-	0.00680	<0.00050
		7-Feb-2022	<0.00010	0.000500	0.0110	<0.00010	<0.000050	0.0210	<0.0000050	42.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	5.40	0.0160	-	0.00660	<0.00050
		9-Mar-2022	<0.00010	0.000520	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	43.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	6.40	0.0240	-	0.00610	<0.00050
		5-Apr-2022	<0.00010	0.000410	0.0160	<0.00010	<0.000050	0.0140	0.00000730	48.0	<0.00050	<0.00010	0.0150	0.0810	<0.000050	<0.0010	8.30	0.0450	-	0.00660	0.000610
		3-May-2022	<0.00010	0.000300	0.0140	<0.00010	<0.000050	0.0120	0.00000660	42.0	<0.00050	<0.00010	0.0170	0.0990	<0.000050	<0.0010	5.70	0.0210	-	0.0100	<0.00050
		1-Jun-2022	<0.00010	0.000510	0.0100	<0.00010	<0.000050	0.0190	<0.0000050	35.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	5.20	0.00440	-	0.00590	<0.00050
		5-Jul-2022	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	39.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	5.10	0.00790	-	0.00620	<0.00050
		3-Aug-2022	<0.00010	0.000490	0.00990	<0.00010	<0.000050	0.0200	<0.000010	36.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	4.80	0.0120	-	0.00680	<0.00050
		8-Sep-2022	<0.00010	0.000510	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	36.0	<0.00050	<0.00010	0.00360	<0.030	<0.000050	<0.0010	5.30	0.00700	-	0.00660	<0.00050
		5-Oct-2022	<0.00010	0.000530	0.0110	<0.00010	<0.000050	0.0170	<0.0000050	33.0	<0.00050	<0.00010	0.00600	<0.030	<0.000050	<0.0010	5.30	0.00580	-	0.00660	<0.00050
		2-Nov-2022	<0.00010	0.000500	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	<0.0010	5.20	0.00350	-	0.00690	<0.00050
		7-Dec-2022	<0.00010	0.000490	0.0100	<0.00010	<0.000050	0.0220	<0.0000050	36.0	<0.00050	<0.00010	0.00440	<0.030	<0.000050	<0.0010	5.10	0.00260	-	0.00610	<0.00050
	HAC-05a	12-Jan-2022	<0.00010	0.000600	0.0130	<0.00010	<0.000050	0.0210	<0.0000050	45.0	<0.00050	<0.00010	0.00530	<0.030	<0.000050	<0.0010	7.60	0.0120	-	0.00670	<0.00050
		7-Feb-2022	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0220	<0.0000050	47.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	6.80	0.0130	-	0.00660	<0.00050
		9-Mar-2022	<0.00010	0.000580	0.0150	<0.00010	<0.000050	0.0190	0.00000590	52.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	8.60	0.0270	-	0.00620	<0.00050
		5-Apr-2022	0.000100	0.000450	0.0200	<0.00010	<0.000050	0.0150	<0.000010	60.0	<0.00050	<0.00010	0.0160	0.0800	<0.000050	<0.0010	10.0	0.0520	-	0.00630	<0.00050
		3-May-2022	<0.00010	0.000440	0.0170	<0.00010	<0.000050	0.0110	0.00000660	44.0	<0.00050	<0.00010	0.0210	0.110	<0.000050	<0.0010	6.60	0.0400	-	0.00820	<0.00050
		1-Jun-2022	<0.00010	0.000490	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	37.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	5.50	0.0120	-	0.00590	<0.00050
		5-Jul-2022	<0.00010	0.000520	0.0120	<0.00010	<0.000050	0.0180	<0.0000050	40.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	6.00	0.0240	-	0.00610	<0.00050
		3-Aug-2022	<0.00010	0.000630	0.0130	<0.00010	<0.000050	0.0210	0.00000910	42.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	6.80	0.0330	-	0.00690	<0.00050
		8-Sep-2022	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	38.0	<0.00050	<0.00010	0.00420	<0.030	<0.000050	<0.0010	6.00	0.0140	-	0.00680	<0.00050
		5-Oct-2022	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0170	<0.0000050	36.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	<0.0010	6.00	0.0140	-	0.00670	<0.00050
		2-Nov-2022	<0.00010	0.000510	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	43.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	6.70	0.0160	-	0.00710	<0.00050
		7-Dec-2022	<0.00010	0.000600	0.0130	<0.00010	<0.000050	0.0230	<0.0000050	45.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	7.30	0.0170	-	0.00660	<0.00050
	HAC-14	3-May-2022	<0.00010	0.000410	0.0140	<0.00010	<0.000050	<0.010	0.0000190	32.0	0.000580	<0.00010	0.0220	0.160	<0.000050	<0.0010	4.70	0.0190	-	0.00460	0.000750
		1-Jun-2022	<0.00010	0.000560	0.0120	<0.00010	<0.000050	0.0180	<0.0000050	36.0	<0.00050	<0.00010	0.00710	<0.030	<0.000050	<0.0010	5.50	0.00980	-	0.00600	<0.00050
		5-Jul-2022	<0.00010	0.000630	0.0150	<0.00010	<0.000050	0.0190	<0.000010	42.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	<0.0010	6.50	0.0100	-	0.00620	<0.00050
		3-Aug-2022	<0.00010	0.000700	0.0150	<0.00010	<0.000050	0.0210	<0.000010	45.0	<0.00050	<0.00010	0.00720	<0.030	<0.000050	<0.0010	7.20	0.00740	-	0.00700	<0.00050
		8-Sep-2022	<0.00010	0.000580	0.0120	<0.00010	<0.000050	0.0210	<0.0000050	38.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	6.30	0.00390	-	0.00670	<0.00050
		5-Oct-2022	<0.00010	0.000600	0.0130	<0.00010	<0.000050	0.0180	<0.0000050	38.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	6.70	0.00380	-	0.00690	<0.00050
		2-Nov-2022	<0.00010	0.000570	0.0140	<0.00010	<0.000050	0.0220	<0.000010	45.0	<0.00050	<0.00010	0.00560	<0.030	<0.000050	<0.0010	7.50	0.00470	-	0.00680	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Antimony-Dissolved (mg/L)	Arsenic-Dissolved (mg/L)	Barium-Dissolved (mg/L)	Beryllium-Dissolved (mg/L)	Bismuth-Dissolved (mg/L)	Boron-Dissolved (mg/L)	Cadmium-Dissolved (mg/L)	Calcium-Dissolved (mg/L)	Chromium-Dissolved (mg/L)	Cobalt-Dissolved (mg/L)	Copper-Dissolved (mg/L)	Iron-Dissolved (mg/L)	Lead-Dissolved (mg/L)	Lithium-Dissolved (mg/L)	Magnesium-Dissolved (mg/L)	Manganese-Dissolved (mg/L)	Mercury-Dissolved (mg/L)	Molybdenum-Dissolved (mg/L)	Nickel-Dissolved (mg/L)
2022	HAC-08	12-Jan-2022	<0.00010	0.000690	0.0180	<0.00010	<0.000050	0.0220	<0.0000050	48.0	<0.00050	<0.00010	0.00750	<0.030	<0.000050	0.00120	9.00	0.00880	-	0.00660	<0.00050
		7-Feb-2022	<0.00010	0.000670	0.0170	<0.00010	<0.000050	0.0220	<0.0000050	48.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	0.00100	8.00	0.00790	-	0.00630	<0.00050
		9-Mar-2022	<0.00010	0.000720	0.0190	<0.00010	<0.000050	0.0210	0.00000670	50.0	<0.00050	<0.00010	0.0110	0.0350	<0.000050	0.00130	9.30	0.00920	-	0.00580	<0.00050
		5-Apr-2022	<0.00010	0.000540	0.0190	<0.00010	<0.000050	0.0110	0.00000670	42.0	<0.00050	<0.00010	0.0170	0.120	<0.000050	<0.0010	7.90	0.0160	-	0.00380	0.000690
		3-May-2022	<0.00010	0.000430	0.0150	<0.00010	<0.000050	<0.010	<0.0000050	26.0	0.000540	<0.00010	0.0170	0.170	<0.000050	<0.0010	4.60	0.0160	-	0.00340	0.000770
		1-Jun-2022	<0.00010	0.000560	0.0140	<0.00010	<0.000050	0.0180	0.00000680	36.0	<0.00050	<0.00010	0.00810	<0.030	<0.000050	<0.0010	5.70	0.0100	-	0.00580	<0.00050
		5-Jul-2022	<0.00010	0.000630	0.0160	<0.00010	<0.000050	0.0190	<0.0000050	43.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	<0.0010	6.60	0.00830	-	0.00630	<0.00050
		3-Aug-2022	<0.00010	0.000790	0.0160	<0.00010	<0.000050	0.0220	<0.0000050	43.0	<0.00050	<0.00010	0.00650	<0.030	<0.000050	0.00110	7.00	0.00580	-	0.00670	<0.00050
		8-Sep-2022	<0.00010	0.000620	0.0140	<0.00010	<0.000050	0.0210	<0.0000050	39.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	6.50	0.00360	-	0.00670	<0.00050
		5-Oct-2022	<0.00010	0.000730	0.0160	<0.00010	<0.000050	0.0190	<0.0000050	40.0	<0.00050	<0.00010	0.00670	<0.030	<0.000050	<0.0010	7.00	0.00310	-	0.00700	<0.00050
		2-Nov-2022	<0.00010	0.000640	0.0160	<0.00010	<0.000050	0.0220	<0.0000050	46.0	<0.00050	<0.00010	0.00550	<0.030	<0.000050	<0.0010	7.90	0.00560	-	0.00670	<0.00050
		7-Dec-2022	<0.00010	0.000700	0.0180	<0.00010	<0.000050	0.0230	<0.0000050	46.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	0.00100	8.50	0.00660	-	0.00590	<0.00050
	W10	7-Feb-2022	<0.00010	0.00110	0.0140	<0.00010	<0.000050	0.0100	<0.0000050	27.0	<0.00050	<0.00010	0.00160	0.130	<0.000050	<0.0010	8.20	0.00420	-	0.000690	0.000740
		5-Apr-2022	<0.00010	0.000420	0.00890	<0.00010	<0.000050	<0.010	0.00000550	17.0	0.000650	<0.00010	0.00280	0.180	<0.000050	<0.0010	4.80	0.00520	-	0.000260	0.00110
		3-Aug-2022	<0.00010	0.00150	0.0200	<0.00010	<0.000050	0.0180	0.00000850	35.0	<0.00050	<0.00010	0.00160	0.0440	<0.000050	<0.0010	9.60	0.00780	-	0.00120	0.000840
	EDC-01a	12-Jan-2022	<0.00010	0.000740	0.0190	<0.00010	<0.000050	0.0210	<0.0000050	48.0	<0.00050	<0.00010	0.00690	<0.030	<0.000050	0.00110	9.00	0.0490	-	0.00590	<0.00050
		7-Feb-2022	<0.00010	0.000850	0.0170	<0.00010	<0.000050	0.0180	<0.0000050	41.0	<0.00050	<0.00010	0.00600	0.0540	<0.000050	<0.0010	8.00	0.0310	-	0.00410	<0.00050
		9-Mar-2022	<0.00010	0.000800	0.0160	<0.00010	<0.000050	0.0130	0.00000880	35.0	<0.00050	<0.00010	0.00700	0.140	<0.000050	<0.0010	8.00	0.0380	-	0.00290	0.000840
		5-Apr-2022	<0.00010	0.000470	0.0120	<0.00010	<0.000050	<0.010	0.00000710	23.0	0.000560	<0.00010	0.00570	0.170	<0.000050	<0.0010	6.00	0.0160	-	0.000840	0.00110
		3-May-2022	<0.00010	0.000420	0.00930	<0.00010	<0.000050	<0.010	<0.0000050	14.0	0.000850	<0.00010	0.00510	0.190	<0.000050	<0.0010	3.80	0.00890	-	0.000720	0.00110
		1-Jun-2022	<0.00010	0.000480	0.0110	<0.00010	<0.000050	0.0110	0.00000800	23.0	<0.00050	<0.00010	0.00520	0.0860	<0.000050	<0.0010	4.60	0.0160	-	0.00280	0.000810
		5-Jul-2022	<0.00010	0.000740	0.0170	<0.00010	<0.000050	0.0140	<0.000015	31.0	<0.00050	<0.00010	0.00560	0.0770	<0.000050	<0.0010	6.00	0.0290	-	0.00360	0.000710
		3-Aug-2022	<0.00010	0.000840	0.0210	<0.00010	<0.000050	0.0200	0.0000140	45.0	<0.00050	<0.00010	0.00660	<0.030	<0.000050	<0.0010	8.10	0.0510	-	0.00580	<0.00050
		8-Sep-2022	<0.00010	0.000700	0.0160	<0.00010	<0.000050	0.0200	<0.0000050	39.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	7.10	0.0210	-	0.00640	<0.00050
		5-Oct-2022	<0.00010	0.000760	0.0160	<0.00010	<0.000050	0.0190	<0.0000050	39.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	<0.0010	7.70	0.0250	-	0.00640	<0.00050
		2-Nov-2022	<0.00010	0.000760	0.0180	<0.00010	<0.000050	0.0210	<0.0000050	47.0	<0.00050	<0.00010	0.00500	<0.030	<0.000050	<0.0010	9.50	0.0390	-	0.00570	<0.00050
		7-Dec-2022	<0.00010	0.000940	0.0200	<0.00010	<0.000050	0.0230	<0.000010	47.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	0.00110	9.90	0.0430	-	0.00500	<0.00050
2023	HAC-13	4-Jan-2023	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0200	<0.0000050	37.0	<0.00050	<0.00010	0.00480	<0.030	<0.000050	<0.0010	5.60	0.00240	-	0.00670	<0.00050
		8-Feb-2023	<0.00010	0.000540	0.0110	<0.00010	<0.000050	0.0190	<0.0000050	38.0	<0.00050	<0.00010	0.00540	<0.030	<0.000050	<0.0010	5.70	0.0170	-	0.00660	<0.00050
		7-Mar-2023	<0.00010	0.000500	0.0100	<0.00010	<0.000050	0.0200	<0.0000050	40.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	5.60	0.00800	-	0.00630	<0.00050
		3-Apr-2023	<0.00010	0.000490	0.0120	<0.00010	<0.000050	0.0180	<0.0000050	39.0	<0.00050	<0.00010	0.00520	<0.030	<0.000050	<0.0010	6.30	0.0470	-	0.00610	<0.00050
		1-May-2023	<0.00010	0.000390	0.0140	<0.00010	<0.000050	0.0110	0.00000690	35.0	<0.00050	<0.00010	0.0260	0.130	<0.000050	<0.0010	4.80	0.0150	-	0.00560	<0.00050
		5-Jun-2023	<0.00010	0.000500	0.0100	<0.00010	<0.000050	0.0180	<0.0000050	34.0	<0.00050	<0.00010	0.00400	<0.030	<0.000050	<0.0010	5.10	0.00790	-	0.00620	<0.00050
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.00010	0.000580	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	41.0	<0.00050	<0.00010	0.00360	<0.030	<0.000050	<0.0010	5.90	0.0100	-	0.00620	<0.00050
		6-Sep-2023	<0.00010	0.000510	0.0100	<0.00010	<0.000050	0.0190	<0.0000050	36.0	<0.00050	<0.00010	0.00360	<0.030	<0.000050	<0.0010	5.40	0.0130	-	0.00590	<0.00050
	HAC-05a	4-Jan-2023	<0.00010	0.000580	0.0130	<0.00010	<0.000050	0.0210	<0.0000050	46.0	<0.00050	<0.00010	0.00490	<0.030	<0.000050	<0.0010	7.50	0.0140	-	0.00690	<0.00050
		8-Feb-2023	<0.00010	0.000550	0.0130	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00510	<0.030	<0.000050	<0.0010	7.00	0.0160	-	0.00650	<0.00050
		7-Mar-2023	<0.00010	0.000550	0.0120	<0.00010	<0.000050	0.0200	<0.0000050	44.0	<0.00050	<0.00010	0.00450	<0.030	<0.000050	<0.0010	7.10	0.0120	-	0.00640	<0.00050
		3-Apr-2023	<0.00010	0.000610	0.0140	<0.00010	<0.000050	0.0200	<0.0000050	47.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	8.30	0.0340	-	0.00630	<0.00050
		1-May-2023	0.000110	0.000430	0.0170	<0.00010	<0.000050	0.0100	0.00000640	40.0	<0.00050	<0.00010	0.0290	0.120	<0.000050	<0.0010	5.70	0.0250	-	0.00510	0.000510
		5-Jun-2023	<0.00010	0.000570	0.0120	<0.00010	<0.000050	0.0190	<0.0000050	39.0	<0.00050	<0.00010	0.00430	<0.030	<0.000050	<0.0010	6.60	0.0300	-	0.00620	<0.00050
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.00010	0.000570	0.0110	<0.00010	<0.000050	0.0180	<0.0000050	43.0	<0.00050	<0.00010	0.00370	<0.030	<0.000050	<0.0010	6.50	0.0230	-	0.00620	<0.00050
		6-Sep-2023	<0.00010	0.000520	0.0120	<0.00010	<0.000050	0.0190	<0.0000050	38.0	<0.00050	<0.00010	0.00390	<0.030	<0.000050	<0.0010	6.70	0.0180	-	0.00600	<0.00050
	HAC-14	1-May-2023	<0.00010	0.000440	0.0120	<0.00010	<0.000050	<0.010	0.0000110	25.0	0.000760	<0.00010	0.0280	0.210	0.0000540	<0.0010	4.10	0.0100	-	0.00270	0.000870
		5-Jun-2023	<0.00010	0.000660	0.0160	<0.00010	<0.000050	0.0210	0.00000800	42.0	<0.00050	<0.00010	0.00760	<0.030	<0.000050	<0.0010	7.30	0.00540	-	0.00640	<0.00050
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.00010	0.000670	0.0140	<0.00010	<0.000050	0.0180	<0.000010	45.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	7.20	0.00360	-	0.00620	<0.00050
		6-Sep-2023	<0.00010	0.000580	0.0140	<0.00010	<0.000050	0.0200	<0.0000050	39.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	7.30	0.00420	-	0.00590	<0.00050
	HAC-08	4-Jan-2023	<0.00010	0.000710	0.0170	<0.00010	<0.000050	0.0220	<0.0000050	48.0	<0.00050	<0.00010	0.00640	<0.030	<0.000050	0.00100	8.60	0.00590	-	0.00660	<0.00050
		8-Feb-2023	<0.00010	0.000700	0.0170	<0.00010	<0.000050	0.0200	<0.0000050	43.0	<0.00050	<0.00010	0.00680	<0.030	<0.000050	<0.0010	8.00	0.00550	-	0.00630	<0.00050
		7-Mar-2023	<0.00010	0.000590	0.0140	<0.00010	<0.000050	0.0220	<0.0000050	47.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	7.80	0.00530	-	0.00620	<0.00050
		3-Apr-2023	<0.00010	0.000740	0.0180	<0.00010	<0.000050	0.0200	<0.0000050	46.0	<0.00050	<0.00010	0.00810	0.110	<0.000050	0.00120	9.00	0.0160	-	0.00580	<0.00050
		1-May-2023	<0.00010	0.000430	0.0140	<0.00010	<0.000050	<0.010	0.0000380	23.0	0.000650	<0.00010	0.0230	0.170	0.0000570	<0.0010	4.00	0.0100	-	0.00270	0.000940
		5-Jun-2023	<0.00010	0.000790	0.0190	<0.00010	<0.000050	0.0210	<0.0000050	41.0	<0.00050	<0.00010	0.00840	0.0380	<0.000050	<0.0010	7.50	0.00770	-	0.00630	<0.00050
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.00010	0.000700	0.0150	<0.00010	<0.000050	0.0180	<0.0000050	44.0	<0.00050	<0.00010	0.00620	<0.030	<0.000050	<0.0010	7.30	0.00280	-	0.00640	<0.00050
		6-Sep-2023	<0.00010	0.000630	0.0150	<0.00010	<0.000050	0.0200	<0.0000050	41.0	<0.00050	<0.00010	0.00590	<0.030	<0.000050	<0.0010	7.40	0.00280	-	0.00590	<0.00050
	W10	13-Jun-2023	<0.00010	0.00160	0.0200	<0.00010	<0.000050	0.0160	0.00000510	32.0	<0.00050	<0.00010	0.00200	<0.030	<0.000050	<0.0010	10.0	0.00430	-	0.00130	0.000540
	EDC-01a	4-Jan-2023	<0.00010	0.00110	0.0190	<0.00010	<0.000050	0.0210	<0.0000050	46.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	10.0	0.0380	-	0.00520	<0.00050
		8-Feb-2023	<0.00010	0.000930	0.0180	<0.00010	<0.000050	0.0180	0.00000510	42.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	9.20	0.0300	-	0.00510	<0.00050
		7-Mar-2023	<0.00010	0.000830	0.0170	<0.00010	<0.000050	0.0190	<0.0000050	44.0	<0.00050	<0.00010	0.00570	<0.030	<0.000050	<0.0010	8.80	0.0310	-	0.00540	<0.00050
		3-Apr-2023	<0.00010	0.000860	0.0170	<0.00010	<0.000050	0.0180	<0.0000050	43.0	<0.00050	<0.00010	0.00600	0.0370	<0.000050	0.00110	9.90	0.0260	-	0.00440	<0.00050
		1-May-2023	<0.00010	0.000400	0.00830	<0.00010	<0.000050	<0.010	0.00000770	12.0	0.000880	<0.00010	0.00600	0.240	0.0000560	<0.0010	3.10	0.00700	-	0.000450	0.00120
		5-Jun-2023	<0.00010	0.000820	0.0210	<0.00010	<0.000050	0.0180	0.00000650	40.0	<0.00050	<0.00010	0.00650	<0.030	<0.000050	<0.0010	8.50	0.0560	-	0.00500	<0.00050
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	<0.00010	0.000730	0.0180	<0.00010	<0.000050	0.0190	<0.000010	46.0	<0.00050	<0.00010	0.00610	<0.030	<0.000050	<0.0010	8.00	0.0200	-	0.00610	<0.00050
		6-Sep-2023	<0.00010	0.000670	0.0170	<0.00010	<0.000050	0.0200	0.00000680	41.0	<0.00050	<0.00010	0.00580	<0.030	<0.000050	<0.0010	7.80	0.0250	-	0.00580	<0.00050

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2015	HAC-13	3-Dec-2015	1.70	0.00110	2.80	<0.000010	16.0	0.620	<0.000010	<0.00010	<0.010	0.00100	0.000610	<0.0030	-
		7-Dec-2015	1.90	0.00150	3.10	<0.000010	15.0	0.610	<0.000010	<0.00010	<0.010	0.000910	0.000710	<0.0030	-
		15-Dec-2015	2.20	0.00160	3.90	<0.000010	22.0	0.950	<0.000010	<0.00010	<0.010	0.00180	<0.00050	<0.0030	-
		22-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Dec-2015	2.10	0.00120	4.20	<0.000010	19.0	0.880	<0.000010	<0.00010	<0.010	0.00150	<0.00050	<0.0030	-
		29-Dec-2015	1.80	0.000920	4.60	<0.000010	17.0	0.700	<0.000010	<0.00010	<0.010	0.00120	<0.00050	<0.0030	-
	HAC-05a	31-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	1.60	0.00100	3.60	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000440	0.000760	<0.0030	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	7.60	0.0240	4.80	<0.000010	46.0	2.70	<0.000010	<0.00010	0.0110	0.000760	0.000580	0.00430	-
		7-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	24-Feb-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	1.50	0.000960	5.20	<0.000010	14.0	0.550	<0.000010	<0.00010	<0.010	0.000970	0.000990	<0.0030	-
		2-Nov-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Nov-2015	1.60	0.00120	4.20	<0.000010	12.0	0.450	<0.000010	<0.00010	<0.010	0.000730	0.000710	<0.0030	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Dec-2015	5.60	0.0210	4.60	<0.000010	39.0	2.20	<0.000010	<0.00010	<0.010	0.00100	0.000690	<0.0030	-
	W10	27-Jan-2015	0.540	<0.00050	4.80	<0.000010	2.80	0.120	<0.000010	<0.00010	<0.010	0.0000910	<0.0010	<0.0030	-
		2-Feb-2015	0.510	<0.00050	4.80	<0.000010	2.70	0.0940	<0.000010	<0.00010	<0.010	0.0000750	<0.0010	<0.0030	-
		10-Feb-2015	0.510	<0.00050	4.60	<0.000010	2.60	0.110	<0.000010	<0.00010	<0.010	0.0000840	<0.0010	<0.0030	-
		17-Feb-2015	0.570	<0.00050	4.70	<0.000010	2.30	0.0960	<0.000010	<0.00010	<0.010	0.0000770	<0.0010	<0.0030	-
		24-Feb-2015	0.520	<0.00050	4.70	<0.000010	2.40	0.0950	<0.000010	<0.00010	<0.010	0.0000770	<0.0010	<0.0030	-
		2-Mar-2015	0.500	<0.00050	4.90	<0.000010	2.60	0.110	<0.000010	<0.00010	<0.010	0.0000800	<0.0010	<0.0030	-
		10-Mar-2015	0.530	<0.00050	4.80	<0.000010	2.70	0.110	<0.000010	<0.00010	<0.010	0.0000870	<0.0010	<0.0030	-
		17-Mar-2015	0.560	<0.00050	4.50	<0.000010	2.20	0.0770	<0.000010	<0.00010	<0.010	0.0000600	<0.0010	<0.0030	-
		24-Mar-2015	0.500	<0.00050	4.40	<0.000010	1.90	0.0810	<0.000010	<0.00010	<0.010	0.0000670	<0.0010	<0.0030	-
		7-Apr-2015	0.510	0.0000920	4.20	<0.000010	1.90	0.0760	<0.000010	<0.00010	<0.010	0.0000610	0.000600	0.00360	-
		14-Apr-2015	0.490	0.000120	3.90	<0.000010	2.00	0.0860	<0.000010	<0.00010	<0.010	0.0000660	0.000600	<0.0030	-
		4-May-2015	0.530	0.000130	3.80	<0.000010	2.20	0.0960	<0.000010	<0.00010	<0.010	0.0000760	0.000620	<0.0030	-
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		9-Jun-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Jul-2015	1.40	0.0000940	4.70	<0.000010	11.0	0.300	<0.000010	<0.00010	<0.010	0.000350	0.000560	<0.0030	-
		2-Aug-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Aug-2015	1.60	0.000110	4.80	<0.000010	13.0	0.350	<0.000010	<0.00010	<0.010	0.000500	0.000610	<0.0030	-
		3-Sep-2015	1.50	0.000100	5.50	<0.000010	13.0	0.340	<0.000010	<0.00010	<0.010	0.000540	<0.00050	<0.0030	-
		6-Sep-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Oct-2015	1.40	0.000120	5.90	<0.000010	13.0	0.360	<0.000010	<0.00010	<0.010	0.000560	<0.00050	<0.0030	-
		5-Nov-2015	0.950	0.000130	4.50	<0.000010	6.00	0.180	<0.000010	<0.00010	<0.010	0.000200	<0.00050	<0.0030	-
		3-Dec-2015	0.980	0.000130	4.60	<0.000010	7.90	0.240	<0.000010	<0.00010	<0.010	0.000270	<0.00050	<0.0030	-
	EDC-01a	17-Feb-2015	0.620	<0.00050	4.90	<0.000010	2.40	0.100	<0.000010	<0.00010	<0.010	0.0000940	<0.0010	<0.0030	-
		24-Feb-2015	0.530	<0.00050	5.00	<0.000010	2.50	0.0970	<0.000010	<0.00010	<0.010	0.0000810	<0.0010	<0.0030	-
		2-Mar-2015	0.520	<0.00050	5.00	<0.000010	2.70	0.120	<0.000010	<0.00010	<0.010	0.0000950	<0.0010	<0.0030	-
		10-Mar-2015	0.540	<0.00050	4.90	<0.000010	2.80	0.120	<0.000010	<0.00010	<0.010	0.0000980	<0.0010	<0.0030	-
		17-Mar-2015	0.580	<0.00050	4.60	<0.000010	2.20	0.0780	<0.000010	<0.00010	<0.010	0.0000650	<0.0010	<0.0030	-
		24-Mar-2015	0.530	<0.00050	4.50	<0.000010	2.10	0.0830	<0.000010	<0.00010	<0.010	0.0000800	<0.0010	<0.0030	-
		1-Apr-2015	0.530	0.000130	4.20	<0.000010	1.60	0.0780	<0.000010	<0.00010	0.0100	0.0000880	0.00100	<0.0030	-
		7-Apr-2015	0.540	0.0000930	4.10	<0.000010	2.00	0.0790	<0.000010	<0.00010	<0.010	0.0000710	0.000640	<0.0030	-
		14-Apr-2015	0.500	0.000120	3.80	<0.000010	2.00	0.0880	<0.000010	<0.00010	<0.010	0.0000740	0.000580	<0.0030	-
		21-Apr-2015	0.510	0.000150	3.80	<0.000010	2.20	0.0860	<0.000010	<0.00010	<0.010	0.0000780	0.000740	<0.0030	-
		28-Apr-2015	0.520	0.000120	3.80	<0.000010	2.30	0.0920	<0.000010	<0.00010	<0.010	0.0000890	0.000620	<0.0030	-
		4-May-2015	0.540	0.000130	3.60	<0.000010	2.40	0.0960	<0.000010	<0.00010	<0.010	0.0000960	0.000640	<0.0030	-
		20-May-2015	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Jun-2015	1.10	0.000210	4.40	<0.000010	6.00	0.210	<0.000010	<0.00010	<0.010	0.000290	0.000650	<0.0030	-
		7-Jul-2015	1.60	0.000580	5.40	<0.000010	11.0	0.330	<0.000010	<0.00010	<0.010	0.000680	0.00110	<0.0030	-
		31-Aug-2015	1.70	0.000480	5.30	<0.000010	14.0	0.380	<0.000010	<0.00010	<0.010	0.000980	0.000940	<0.0030	-
		8-Sep-2015	1.70	0.000430	5.20	<0.000010	13.0	0.360	<0.000010	<0.00010	<0.010	0.000810	0.000780	<0.0030	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2015	EDC-01a	1-Oct-2015	1.40	0.000320	5.50	<0.000010	12.0	0.390	<0.000010	<0.00010	<0.010	0.000720	0.000650	0.00390	-
		15-Oct-2015	1.50	0.000740	5.60	<0.000010	14.0	0.480	<0.000010	<0.00010	<0.010	0.00120	0.000830	<0.0030	-
		20-Oct-2015	1.40	0.000890	5.60	<0.000010	13.0	0.440	<0.000010	<0.00010	<0.010	0.00100	0.000720	<0.0030	-
		26-Oct-2015	1.40	0.000540	5.40	<0.000010	13.0	0.460	<0.000010	<0.00010	<0.010	0.00110	0.000660	<0.0030	-
		5-Nov-2015	1.00	0.000150	4.30	<0.000010	6.50	0.200	<0.000010	<0.00010	<0.010	0.000300	<0.00050	<0.0030	-
		3-Dec-2015	1.10	0.000790	4.60	<0.000010	8.60	0.290	<0.000010	<0.00010	<0.010	0.000470	<0.00050	<0.0030	-
	HAC-13	5-Jan-2016	1.50	0.000810	3.30	<0.000010	11.0	0.390	<0.000010	<0.00010	0.0100	0.000400	0.000700	<0.0030	-
		7-Jan-2016	1.30	0.000810	3.20	<0.000010	9.50	0.340	<0.000010	<0.00010	<0.010	0.000300	0.000680	<0.0030	-
		12-Jan-2016	1.40	0.000800	3.20	<0.000010	9.90	0.340	<0.000010	<0.00010	<0.010	0.000310	0.000710	<0.0030	-
		19-Jan-2016	1.50	0.000780	3.20	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000340	0.000770	<0.0030	-
		26-Jan-2016	1.60	0.000960	3.20	<0.000010	12.0	0.390	<0.000010	<0.00010	<0.010	0.000460	0.000750	<0.0030	-
		1-Feb-2016	1.60	0.000900	3.40	<0.000010	12.0	0.400	<0.000010	<0.00010	<0.010	0.000440	0.000790	0.00360	-
		9-Feb-2016	1.50	0.000830	3.30	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000380	0.000730	<0.0030	-
		15-Feb-2016	1.50	0.000900	3.40	<0.000010	11.0	0.410	<0.000010	<0.00010	<0.010	0.000510	0.000730	0.00330	-
		22-Feb-2016	1.60	0.000810	3.40	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000460	0.000690	<0.0030	-
		24-Feb-2016	1.60	0.000740	3.40	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000410	0.000800	<0.0030	-
		29-Feb-2016	1.60	0.000900	3.40	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000420	0.000780	0.00380	-
		2-Mar-2016	1.50	0.000860	3.30	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000400	0.000830	<0.0030	-
		8-Mar-2016	2.10	0.00140	4.00	<0.000010	17.0	0.660	<0.000010	<0.00010	0.0130	0.00110	0.000820	0.00370	-
		15-Mar-2016	1.50	0.000860	3.60	<0.000010	11.0	0.410	<0.000010	<0.00010	<0.010	0.000540	0.000760	<0.0030	-
		23-Mar-2016	3.10	0.00190	4.60	0.0000100	25.0	1.10	<0.000010	<0.00010	0.0140	0.00210	0.000740	0.00340	-
		29-Mar-2016	3.10	0.00230	4.40	<0.000010	28.0	1.20	<0.000010	<0.00010	0.0130	0.00220	0.000690	0.00650	-
		4-Apr-2016	3.00	0.00160	4.50	0.0000150	20.0	0.790	<0.000010	<0.00010	0.0130	0.00140	0.00100	<0.0030	-
		11-Apr-2016	1.20	0.000660	2.80	<0.000010	7.90	0.290	<0.000010	<0.00010	<0.010	0.000300	0.000660	<0.0030	-
		13-Apr-2016	1.40	0.000710	3.10	<0.000010	9.70	0.320	<0.000010	<0.00010	<0.010	0.000290	0.000700	<0.0030	-
		19-Apr-2016	1.30	0.000790	2.90	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000270	0.000710	<0.0030	-
		25-Apr-2016	1.20	0.000640	3.00	<0.000010	8.80	0.290	<0.000010	<0.00010	<0.010	0.000260	0.000870	<0.0030	-
		5-May-2016	1.50	0.000700	2.70	<0.000010	9.80	0.340	<0.000010	<0.00010	<0.010	0.000290	0.000830	<0.0030	-
		10-May-2016	1.40	0.000820	2.60	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000300	0.000810	<0.0030	-
		17-May-2016	1.40	0.000720	2.50	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000350	0.000860	<0.0030	-
		24-May-2016	1.30	0.000670	2.40	<0.000010	9.70	0.350	<0.000010	<0.00010	<0.010	0.000330	0.000830	0.00340	-
		31-May-2016	1.40	0.000660	2.40	<0.000010	9.40	0.320	<0.000010	<0.00010	<0.010	0.000290	0.000760	0.00340	-
		7-Jun-2016	1.40	0.000750	2.20	<0.000010	9.50	0.330	<0.000010	<0.00010	<0.010	0.000290	0.000890	0.00430	-
		14-Jun-2016	3.00	0.000990	3.70	<0.000010	21.0	0.880	<0.000010	<0.00010	<0.010	0.00140	0.000790	0.0110	-
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	1.50	0.000820	2.20	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000430	0.000930	0.00640	-
		27-Jun-2016	1.50	0.000760	2.00	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000320	0.000940	0.00460	-
		6-Jul-2016	1.70	0.000820	2.20	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000380	0.000970	0.00320	-
		13-Jul-2016	2.50	0.00130	3.40	<0.000020	16.0	0.620	<0.000020	<0.00020	<0.010	0.00130	0.00140	<0.0030	-
		18-Jul-2016	2.60	0.00120	3.80	<0.000010	19.0	0.710	<0.000010	<0.00010	<0.010	0.00120	0.00160	0.00670	-
		25-Jul-2016	1.50	0.000790	2.30	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000400	0.000960	0.00600	-
		2-Aug-2016	2.00	0.000900	3.10	<0.000010	14.0	0.450	<0.000010	<0.00010	<0.010	0.000750	0.00130	0.00710	-
		10-Aug-2016	1.80	0.00120	3.00	<0.000010	12.0	0.430	<0.000010	<0.00010	<0.010	0.000710	0.00160	<0.0030	-
		17-Aug-2016	5.30	0.00100	4.90	<0.000010	18.0	0.660	<0.000010	<0.00010	<0.010	0.000930	0.00360	<0.0030	-
		23-Aug-2016	1.80	0.00120	2.90	<0.000020	11.0	0.360	<0.000020	<0.00020	<0.010	0.000540	0.00170	<0.0030	-
		30-Aug-2016	1.60	0.00100	2.60	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000400	0.00140	<0.0030	-
		6-Sep-2016	1.50	0.000970	2.40	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000400	0.00130	<0.0030	-
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Sep-2016	1.90	0.00180	3.20	<0.000010	14.0	0.450	<0.000010	<0.00010	<0.010	0.000900	0.00170	<0.0030	-
		19-Sep-2016	3.00	0.00300	3.80	<0.000010	21.0	0.920	<0.000010	<0.00010	<0.010	0.00210	0.00110	<0.0030	-
		27-Sep-2016	1.80	0.000890	2.60	<0.000010	12.0	0.470	<0.000010	<0.00010	<0.010	0.000730	0.000950	<0.0030	-
		2-Oct-2016	1.40	0.000760	2.30	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000410	0.000890	<0.0030	-
		3-Oct-2016	1.40	0.000860	2.40	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000430	0.000910	<0.0030	-
		11-Oct-2016	1.70	0.000890	2.70	<0.000010	13.0	0.470	<0.000010	<0.00010	<0.010	0.000710	0.000790	<0.0030	-
		18-Oct-2016	1.70	0.000840	2.90	<0.000010	12.0	0.450	<0.000010	<0.00010	<0.010	0.000690	0.000810	<0.0030	-
		24-Oct-2016	2.00	0.000980	3.20	<0.000010	15.0	0.590	<0.000010	<0.00010	<0.010	0.00110	0.000780	<0.0030	-
		1-Nov-2016	1.80	0.000900	2.90	<0.000010	13.0	0.420	<0.000010	<0.00010	<0.010	0.000740	0.000870	<0.0030	-
		8-Nov-2016	1.70	0.000810	3.00	<0.000010	12.0	0.430	<0.000010	<0.00010	<0.010	0.000640	0.000750	<0.0030	-
		15-Nov-2016	1.50	0.000760	2.80	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000480	0.000730	<0.0030	-
		22-Nov-2016	1.40	0.000750	2.90	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000360	0.000770	<0.0030	-
		29-Nov-2016	1.60	0.000760	3.00	<0.000010	12.0	0.370	<0.000010	<0.00010	<0.010	0.000420	0.000770	<0.0030	-
		6-Dec-2016	1.40	0.000630	3.10	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000430	0.000700	<0.0030	-
		14-Dec-2016	1.40	0.000610	2.90	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000300	0.000670	<0.0030	-
		20-Dec-2016	1.40	0.000660	2.80	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000310	0.000710	<0.0030	-
		28-Dec-2016	1.40	0.000670	2.90	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000310	0.000740	<0.0030	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2016	HAC-05a	5-Jan-2016	7.50	0.0200	4.50	<0.000010	38.0	2.10	<0.000010	<0.00010	0.0190	0.000680	0.000600	0.00320	-
		7-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		12-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	6.00	0.0160	4.00	<0.000010	29.0	1.40	<0.000010	<0.00010	0.0120	0.000750	0.000660	0.00330	-
		9-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Feb-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Mar-2016	5.20	0.0150	3.80	<0.000010	27.0	1.40	<0.000010	<0.00010	<0.010	0.000580	0.000700	<0.0030	-
		8-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	3.60	0.0200	4.90	<0.000010	23.0	1.50	<0.000010	<0.00010	0.0140	0.00120	0.000780	<0.0030	-
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	9.60	0.0240	3.40	<0.000010	40.0	1.80	<0.000010	<0.00010	0.0110	0.000470	0.000660	<0.0030	-
		10-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-May-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		7-Jun-2016	11.0	0.0240	3.30	<0.000010	40.0	1.80	<0.000010	<0.00010	0.0200	0.000590	0.000750	<0.0030	-
		14-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Jul-2016	13.0	0.0250	3.40	<0.000010	47.0	1.90	<0.000010	<0.00010	<0.010	0.000870	0.000940	<0.0030	-
		13-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	16.0	0.0320	3.70	<0.000010	57.0	2.30	<0.000010	<0.00010	<0.010	0.00110	0.00100	<0.0030	-
		10-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Aug-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Sep-2016	14.0	0.0330	3.70	<0.000010	56.0	2.40	<0.000010	<0.00010	<0.010	0.00110	0.000900	<0.0030	-
		13-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Sep-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Oct-2016	16.0	0.0350	3.90	<0.000010	54.0	2.70	<0.000010	<0.00010	<0.010	0.00130	0.000920	<0.0030	-
		11-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Nov-2016	13.0	0.0240	3.60	<0.000010	48.0	1.80	<0.000010	<0.00010	<0.010	0.00110	0.000970	0.00360	-
		8-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		22-Nov-2016	1.60	0.000910	3.10	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000400	0.000810	0.00480	-
		29-Nov-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Dec-2016	12.0	0.0220	3.90	<0.000010	43.0	1.70	<0.000010	<0.00010	<0.010	0.000990	0.000890	<0.0030	-
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-08	5-Jan-2016	6.00	0.0180	4.50	<0.000010	36.0	2.00	<0.000010	<0.00010	0.0180	0.00100	0.000710	<0.0030	-
		19-Jan-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Feb-2016	5.60	0.0150	4.20	<0.000010	29.0	1.40	<0.000010	<0.00010	0.0130	0.000860	0.000610	<0.0030	-
		2-Mar-2016	4.40	0.0130	3.90	<0.000010	23.0	1.00	<0.000010	<0.00010	<0.010	0.000550	0.000600	<0.0030	-
		4-Apr-2016	2.30	0.0110	4.40	<0.000010	13.0	0.720	<0.000010	<0.00010	0.0120	0.000760	0.000770	<0.0030	-
		5-May-2016	7.60	0.0200	3.70	<0.000010	34.0	1.50	<0.000010	<0.00010	0.0110	0.000590	0.000720	<0.0030	-
		7-Jun-2016	11.0	0.0240	3.60	<0.000010	38.0	1.80	<0.000010	<0.00010	0.0200	0.000650	0.000730	<0.0030	-
		6-Jul-2016	12.0	0.0250	3.50	<0.000010	43.0	1.80	<0.000010	<0.00010	<0.010	0.000900	0.000960	<0.0030	-
		2-Aug-2016	14.0	0.0260	3.40	<0.000010	49.0	2.00	<0.000010	<0.00010	<0.010	0.000990	0.00100	<0.0030	-
		6-Sep-2016	13.0	0.0290	3.80	<0.000010	48.0	2.00	<0.000010	<0.00010	<0.010	0.00110	0.000910	<0.0030	-
		3-Oct-2016	14.0	0.0300	3.80	<0.000010	49.0	2.40	<0.000010	<0.00010	<0.010	0.00130	0.000850	<0.0030	-
		1-Nov-2016	11.0	0.0200	3.90	<0.000010	41.0	1.30	<0.000010	<0.00010	<0.010	0.000940	0.000970	<0.0030	-
		22-Nov-2016	2.10	0.00140	3.40	<0.000010	11.0	0.420	<0.000010	<0.00010	<0.010	0.000460	0.000850	<0.0030	-
		6-Dec-2016	11.0	0.0200	3.90	<0.000010	42.0	1.60	<0.000010	<0.00010	<0.010	0.00100	0.000820	<0.0030	-
		14-Dec-2016	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2016	W10	7-Jan-2016	0.860	0.000110	4.60	<0.000010	7.30	0.220	<0.000010	<0.00010	<0.010	0.000240	<0.00050	<0.0030	-
		1-Feb-2016	0.770	0.000150	4.80	<0.000010	4.50	0.160	<0.000010	<0.00010	<0.010	0.000150	0.000550	<0.0030	-
		2-Mar-2016	0.640	0.000150	4.80	<0.000010	3.30	0.120	<0.000010	<0.00010	<0.010	0.0000920	0.000780	<0.0030	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.570	0.000130	4.00	<0.000010	2.00	0.0700	<0.000010	<0.00010	<0.010	0.0000720	0.000770	<0.0030	-
		4-May-2016	0.710	0.000110	4.10	<0.000010	2.60	0.100	<0.000010	<0.00010	<0.010	0.0000650	0.000670	<0.0030	-
		4-May-2016	0.710	0.000110	4.00	<0.000010	2.90	0.100	<0.000010	<0.00010	<0.010	0.0000700	0.000740	<0.0030	-
		6-Jun-2016	0.740	0.000140	4.10	<0.000010	3.50	0.140	<0.000010	<0.00010	<0.010	0.0000860	0.000620	<0.0030	-
		4-Jul-2016	0.630	0.000150	4.40	<0.000010	3.40	0.140	<0.000010	<0.00010	<0.010	0.0000930	0.000770	<0.0030	-
		4-Jul-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2016	0.730	0.000140	4.60	<0.000010	4.40	0.170	<0.000010	<0.00010	<0.010	0.000120	0.000770	<0.0030	-
		6-Sep-2016	1.30	0.000110	5.00	<0.000010	9.70	0.310	<0.000010	<0.00010	<0.010	0.000310	<0.00050	<0.0030	-
		3-Oct-2016	0.610	0.0000820	4.20	<0.000010	3.50	0.150	<0.000010	<0.00010	<0.010	0.000100	0.000510	<0.0030	-
		1-Nov-2016	0.570	0.000150	4.50	<0.000010	2.60	0.100	<0.000010	<0.00010	<0.010	0.0000930	0.000890	<0.0030	-
		1-Dec-2016	0.470	0.000140	5.00	<0.000010	2.60	0.100	<0.000010	<0.00010	<0.010	0.0000840	0.000800	<0.0030	-
	EDC-01a	5-Jan-2016	0.980	0.00120	4.80	<0.000010	8.50	0.320	<0.000010	<0.00010	0.0100	0.000410	<0.00050	<0.0030	-
		1-Feb-2016	0.770	0.000200	4.80	<0.000010	5.00	0.170	<0.000010	<0.00010	<0.010	0.000160	0.000620	<0.0030	-
		2-Mar-2016	0.630	0.000180	4.90	<0.000010	3.30	0.130	<0.000010	<0.00010	<0.010	0.000110	0.000780	<0.0030	-
		10-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		15-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Mar-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Apr-2016	0.600	0.000100	4.20	<0.000010	2.20	0.0690	<0.000010	<0.00010	<0.010	0.0000710	0.000720	<0.0030	-
		11-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2016	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-May-2016	0.660	0.000170	4.00	<0.000010	2.90	0.120	<0.000010	<0.00010	<0.010	0.000100	0.000710	<0.0030	-
		7-Jun-2016	0.840	0.000260	4.20	<0.000010	3.90	0.160	<0.000010	<0.00010	<0.010	0.000120	0.000680	<0.0030	-
		6-Jul-2016	0.600	0.000180	4.30	<0.000010	3.30	0.140	<0.000010	<0.00010	<0.010	0.0000970	0.000780	<0.0030	-
		2-Aug-2016	1.20	0.00100	4.60	<0.000010	7.20	0.260	<0.000010	<0.00010	<0.010	0.000190	0.000890	<0.0030	-
		6-Sep-2016	1.50	0.00140	4.60	<0.000010	13.0	0.380	<0.000010	<0.00010	<0.010	0.000410	0.000530	<0.0030	-
		3-Oct-2016	0.790	0.000770	4.30	<0.000010	5.00	0.190	<0.000010	<0.00010	<0.010	0.000140	0.000540	<0.0030	-
		1-Nov-2016	0.600	0.000230	4.40	<0.000010	2.80	0.100	<0.000010	<0.00010	<0.010	0.0000940	0.000840	<0.0030	-
		6-Dec-2016	0.750	0.00110	5.10	<0.000010	5.30	0.180	<0.000010	<0.00010	<0.010	0.000190	0.000590	<0.0030	-
2017	HAC-13	3-Jan-2017	1.40	0.000670	3.00	<0.000010	10.0	0.300	<0.000010	<0.00010	<0.010	0.000270	0.000800	<0.0030	-
		10-Jan-2017	1.40	0.000710	2.90	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000260	0.000770	<0.0030	-
		17-Jan-2017	1.30	0.000630	2.80	<0.000010	9.40	0.300	<0.000010	<0.00010	<0.010	0.000250	0.000710	<0.0030	-
		24-Jan-2017	1.40	0.000640	2.90	<0.000010	9.30	0.330	<0.000010	<0.00010	<0.010	0.000280	0.000780	<0.0030	-
		1-Feb-2017	1.30	0.000710	2.90	<0.000010	9.90	0.340	<0.000010	<0.00010	<0.010	0.000280	0.000780	<0.0030	-
		7-Feb-2017	1.40	0.000720	2.90	<0.000010	9.30	0.320	<0.000010	<0.00010	<0.010	0.000280	0.000800	<0.0030	-
		14-Feb-2017	1.40	0.000690	2.90	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000280	0.000780	<0.0030	-
		21-Feb-2017	1.40	0.000660	2.90	<0.000010	11.0	0.350	<0.000010	<0.00010	<0.010	0.000370	0.000760	<0.0030	-
		1-Mar-2017	1.40	0.000650	2.80	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000310	0.000770	<0.0030	-
		7-Mar-2017	1.30	0.000690	2.70	<0.000010	9.40	0.340	<0.000010	<0.00010	<0.010	0.000290	0.000740	<0.0030	-
		14-Mar-2017	1.50	0.000650	2.80	<0.000010	11.0	0.360	<0.000010	<0.00010	<0.010	0.000340	0.000780	<0.0030	-
		21-Mar-2017	1.30	0.000630	2.80	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000350	0.000720	<0.0030	-
		27-Mar-2017	1.40	0.000700	2.80	<0.000010	10.0	0.440	<0.000010	<0.00010	<0.010	0.000540	0.000700	<0.0030	-
		30-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	1.50	0.000850	3.00	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000480	0.000710	0.00880	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	1.20	0.000600	2.30	<0.000010	8.80	0.300	<0.000010	<0.00010	<0.010	0.000280	0.000740	<0.0030	-
		1-Jun-2017	1.30	0.000630	2.30	<0.000010	9.60	0.300	<0.000010	<0.00010	<0.010	0.000230	0.000900	<0.0030	-
		6-Jun-2017	1.30	0.000580	2.10	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000260	0.000900	<0.0030	-
		13-Jun-2017	1.40	0.000670	1.90	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000320	0.00110	<0.0030	-
		20-Jun-2017	1.40	0.000670	2.00	<0.000010	9.80	0.380	<0.000010	<0.00010	<0.010	0.000380	0.000930	<0.0030	-
		27-Jun-2017	1.40	0.000800	2.00	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000360	0.00100	0.00440	-
		4-Jul-2017	1.20	0.000660	1.80	<0.000010	9.20	0.300	<0.000010	<0.00010	<0.010	0.000300	0.000980	<0.0030	-
		1-Aug-2017	1.30	0.000590	1.80	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000240	0.000960	<0.0030	-
		27-Aug-2017	1.20	0.000630	1.80	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000260	0.000930	<0.0030	-
		19-Sep-2017	1.20	0.000560	1.80	<0.000010	8.40	0.300	<0.000010	<0.00010	<0.010	0.000270	0.000750	<0.0030	-
		26-Sep-2017	1.30	0.000680	2.10	<0.000010	9.80	0.320	<0.000010	<0.00010	<0.010	0.000280	0.000860	<0.0030	-
		2-Oct-2017	1.10	0.000600	1.90	<0.000010	8.70	0.290	<0.000010	<0.00010	<0.010	0.000280	0.000700	<0.0030	-
		10-Oct-2017	1.20	0.000620	2.00	<0.000010	8.80	0.310	<0.000010	<0.00010	<0.010	0.000320	0.000580	<0.0030	-
		17-Oct-2017	1.30	0.00170	2.20	<0.000010	9.80	0.350	<0.000010	<0.00010	<0.010	0.000430	0.000660	<0.0030	-
		24-Oct-2017	1.30	0.00100	2.30	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000440	0.000650	<0.0030	-
		31-Oct-2017	1.20	0.000750	2.20	<0.000010	9.70	0.340	<0.000010	<0.00010	<0.010	0.000390	0.000600	<0.0030	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2017	HAC-13	7-Nov-2017	1.20	0.000540	2.40	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000590	<0.0030	-
		14-Nov-2017	1.30	0.000810	2.40	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000410	0.000590	<0.0030	-
		21-Nov-2017	1.20	0.000740	2.60	<0.000010	9.60	0.390	<0.000010	<0.00010	<0.010	0.000490	0.000520	<0.0030	-
		28-Nov-2017	1.60	0.00120	3.00	<0.000010	12.0	0.480	<0.000010	<0.00010	<0.010	0.000840	0.000610	<0.0030	-
		5-Dec-2017	1.60	0.000870	2.90	<0.000010	13.0	0.460	<0.000010	<0.00010	<0.010	0.000710	0.000590	<0.0030	-
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-05a	3-Jan-2017	5.90	0.0110	3.30	<0.000010	26.0	0.950	<0.000010	<0.00010	<0.010	0.000590	0.000880	<0.0030	-
		10-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jan-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jan-2017	1.50	0.000680	3.10	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000310	0.000790	<0.0030	-
		1-Feb-2017	6.30	0.0130	3.50	<0.000010	27.0	1.10	<0.000010	<0.00010	<0.010	0.000440	0.000800	<0.0030	-
		7-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Feb-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Mar-2017	8.70	0.0180	3.40	<0.000010	36.0	1.30	<0.000010	<0.00010	<0.010	0.000560	0.000860	<0.0030	-
		7-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	1.50	0.000920	3.30	<0.000010	9.70	0.380	<0.000010	<0.00010	<0.010	0.000510	0.000740	<0.0030	-
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-May-2017	1.30	0.000620	2.60	<0.000010	8.70	0.310	<0.000010	<0.00010	<0.010	0.000330	0.000750	<0.0030	-
		9-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Jun-2017	1.30	0.000620	2.50	<0.000010	9.50	0.300	<0.000010	<0.00010	<0.010	0.000260	0.000930	<0.0030	-
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	6.30	0.0440	5.40	<0.000010	38.0	2.60	<0.000010	<0.00010	<0.010	0.00200	0.00110	<0.0030	-
		20-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2017	6.60	0.0380	5.00	<0.000010	40.0	2.70	<0.000010	<0.00010	<0.010	0.00160	0.00100	<0.0030	-
		1-Aug-2017	1.30	0.000700	1.90	<0.000010	9.60	0.320	<0.000010	<0.00010	<0.010	0.000260	0.000940	<0.0030	-
		19-Sep-2017	3.30	0.0330	5.60	<0.000010	37.0	3.40	<0.000010	<0.00010	<0.010	0.00220	0.00100	0.00310	-
		26-Sep-2017	9.00	0.0370	6.10	<0.000010	53.0	3.40	<0.000010	<0.00010	<0.010	0.00180	0.000960	<0.0030	-
		2-Oct-2017	1.60	0.00190	4.40	<0.000010	11.0	0.470	<0.000010	<0.00010	<0.010	0.000620	0.000940	<0.0030	-
		10-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Oct-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		31-Oct-2017	1.30	0.00130	3.40	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000620	0.000690	<0.0030	-
		7-Nov-2017	1.30	0.00150	4.20	<0.000010	12.0	0.430	<0.000010	<0.00010	<0.010	0.000570	0.000690	<0.0030	-
		14-Nov-2017	1.30	0.00170	4.00	<0.000010	11.0	0.420	<0.000010	<0.00010	<0.010	0.000680	0.000700	<0.0030	-
		21-Nov-2017	1.20	0.00170	4.40	<0.000010	10.0	0.470	<0.000010	<0.00010	<0.010	0.000840	0.000670	<0.0030	-
		28-Nov-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Nov-2017	1.60	0.00320	4.20	<0.000010	13.0	0.530	<0.000010	<0.00010	<0.010	0.00130	0.000690	<0.0030	-
		5-Dec-2017	1.60	0.00160	4.40	<0.000010	13.0	0.510	<0.000010	<0.00010	<0.010	0.000890	0.000690	<0.0030	-
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-14	27-Aug-2017	1.40	0.000750	2.50	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000390	0.00100	<0.0030	-
		19-Sep-2017	3.20	0.0300	5.70	<0.000010	35.0	3.20	<0.000010	<0.00010	<0.010	0.00220	0.000980	<0.0030	-
		26-Sep-2017	8.80	0.0360	5.90	<0.000010	53.0	3.20	<0.000010	<0.00010	<0.010	0.00180	0.00100	<0.0030	-
		2-Oct-2017	2.30	0.00320	4.90	<0.000010	17.0	0.790	<0.000010	<0.00010	<0.010	0.000870	0.00100	<0.0030	-
		17-Oct-2017	1.70	0.00440	3.90	<0.000010	12.0	0.680	<0.000010	<0.00010	<0.010	0.00130	0.000760	<0.0030	-
		24-Oct-2017	1.50	0.00220	3.60	<0.000010	12.0	0.550	<0.000010	<0.00010	<0.010	0.000940	0.000660	<0.0030	-
		31-Oct-2017	1.50	0.00130	4.00	<0.000010	12.0	0.560	<0.000010	<0.00010	<0.010	0.000820	0.000850	<0.0030	-
		7-Nov-2017	1.50	0.00120	4.60	<0.000010	13.0	0.560	<0.000010	<0.00010	<0.010	0.000650	0.000640	<0.0030	-
		14-Nov-2017	1.50	0.00170	4.70	<0.000010	13.0	0.570	<0.000010	<0.00010	<0.010	0.000820	0.000650	<0.0030	-
		21-Nov-2017	1.40	0.00160	5.00	<0.000010	12.0	0.640	<0.000010	<0.00010	<0.010	0.00100	0.000600	<0.0030	-
		28-Nov-2017	1.70	0.00290	4.70	<0.000010	13.0	0.630	<0.000010	<0.00010	<0.010	0.00130	0.000660	<0.0030	-
		5-Dec-2017	1.70	0.00150	5.00	<0.000010	15.0	0.630	<0.000010	<0.00010	<0.010	0.00100	0.000640	<0.0030	-
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2017	HAC-08	3-Jan-2017	5.40	0.0110	3.50	<0.000010	25.0	0.980	<0.000010	<0.00010	<0.010	0.000700	0.000860	<0.0030	-
		24-Jan-2017	1.70	0.000880	3.10	<0.000010	10.0	0.390	<0.000010	<0.00010	<0.010	0.000380	0.000730	0.00460	-
		1-Feb-2017	6.00	0.0130	3.40	<0.000010	26.0	1.10	<0.000010	<0.00010	<0.010	0.000540	0.000770	<0.0030	-
		1-Mar-2017	8.10	0.0170	3.50	<0.000010	33.0	1.30	<0.000010	<0.00010	<0.010	0.000640	0.000750	<0.0030	-
		3-Apr-2017	1.40	0.000770	3.70	<0.000010	7.80	0.310	<0.000010	<0.00010	<0.010	0.000460	0.000760	<0.0030	-
		2-May-2017	1.30	0.000620	2.90	<0.000010	8.00	0.300	<0.000010	<0.00010	<0.010	0.000370	0.000740	<0.0030	-
		1-Jun-2017	1.40	0.000620	2.50	<0.000010	9.70	0.330	<0.000010	<0.00010	<0.010	0.000300	0.000910	<0.0030	-
		6-Jun-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		13-Jun-2017	4.90	0.0330	4.60	<0.000010	30.0	2.00	<0.000010	<0.00010	<0.010	0.00160	0.00110	<0.0030	-
		4-Jul-2017	6.00	0.0320	4.60	<0.000010	36.0	2.30	<0.000010	<0.00010	<0.010	0.00140	0.00110	<0.0030	-
		27-Aug-2017	1.50	0.000850	2.60	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000440	0.00100	<0.0030	-
		27-Aug-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Sep-2017	2.80	0.0240	5.40	<0.000010	31.0	2.10	<0.000010	<0.00010	<0.010	0.00190	0.000800	0.00750	-
		10-Oct-2017	2.20	0.00260	4.60	<0.000010	18.0	0.830	<0.000010	<0.00010	<0.010	0.00150	0.000850	<0.0030	-
		17-Oct-2017	1.70	0.00430	3.80	<0.000010	12.0	0.660	<0.000010	<0.00010	<0.010	0.00150	0.000680	<0.0030	-
		24-Oct-2017	1.80	0.00240	3.70	<0.000010	15.0	0.600	<0.000010	<0.00010	<0.010	0.00100	0.000730	<0.0030	-
		31-Oct-2017	1.50	0.00140	3.80	<0.000010	12.0	0.560	<0.000010	<0.00010	<0.010	0.000940	0.000630	<0.0030	-
		7-Nov-2017	1.70	0.00130	4.80	<0.000010	15.0	0.650	<0.000010	<0.00010	<0.010	0.000940	0.000630	<0.0030	-
		14-Nov-2017	1.60	0.00150	4.60	<0.000010	14.0	0.600	<0.000010	<0.00010	<0.010	0.000990	0.000640	<0.0030	-
		21-Nov-2017	1.40	0.00150	5.00	<0.000010	12.0	0.650	<0.000010	<0.00010	<0.010	0.00120	0.000560	<0.0030	-
		28-Nov-2017	1.70	0.00300	4.70	<0.000010	15.0	0.660	<0.000010	<0.00010	<0.010	0.00140	0.000620	<0.0030	-
		5-Dec-2017	1.80	0.00150	5.00	<0.000010	16.0	0.680	<0.000010	<0.00010	<0.010	0.00120	0.000630	<0.0030	-
		12-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		19-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	W10	3-Jan-2017	0.640	0.000140	5.60	<0.000010	4.60	0.160	<0.000010	<0.00010	<0.010	0.000140	0.000580	<0.0030	-
		1-Feb-2017	0.700	0.000200	6.10	<0.000010	5.00	0.180	<0.000010	<0.00010	<0.010	0.000180	0.000550	<0.0030	-
		1-Mar-2017	0.680	0.000170	5.60	<0.000010	4.40	0.160	<0.000010	<0.00010	<0.010	0.000130	0.000580	<0.0030	-
		3-Apr-2017	0.690	0.000120	4.50	<0.000010	2.30	0.0980	<0.000010	<0.00010	<0.010	0.0000790	0.000530	<0.0030	-
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.710	0.0000910	4.30	<0.000010	2.40	0.0900	<0.000010	<0.00010	<0.010	0.0000760	0.000720	<0.0030	-
		25-Apr-2017	0.540	0.0000930	3.70	<0.000010	1.90	0.0710	<0.000010	<0.00010	<0.010	0.0000570	0.000610	<0.0030	-
		2-May-2017	0.550	0.000100	3.50	<0.000010	2.00	0.0770	<0.000010	<0.00010	<0.010	0.0000630	0.000600	<0.0030	-
		9-May-2017	0.550	0.000110	3.30	<0.000010	2.10	0.0820	<0.000010	<0.00010	<0.010	0.0000610	0.000600	<0.0030	-
		17-May-2017	0.560	0.000130	3.00	<0.000010	2.40	0.0860	<0.000010	<0.00010	<0.010	0.0000680	0.000580	<0.0030	-
		23-May-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-May-2017	0.650	0.000120	3.00	<0.000010	2.60	0.110	<0.000010	<0.00010	<0.010	0.0000830	0.000730	<0.0030	-
		1-Jun-2017	0.760	0.000140	3.20	<0.000010	3.40	0.120	<0.000010	<0.00010	<0.010	0.0000820	0.000770	<0.0030	-
		4-Jul-2017	1.10	0.000140	4.70	<0.000010	8.60	0.260	<0.000010	<0.00010	<0.010	0.000260	0.000500	<0.0030	-
		17-Aug-2017	1.60	0.000110	4.70	<0.000010	14.0	0.360	<0.000010	<0.00010	<0.010	0.000510	0.000530	<0.0030	-
		4-Sep-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Sep-2017	1.60	0.000110	5.20	<0.000010	13.0	0.360	<0.000010	<0.00010	<0.010	0.000570	0.000560	<0.0030	-
		11-Oct-2017	1.50	0.000120	6.40	<0.000010	13.0	0.380	<0.000010	<0.00010	<0.010	0.000560	<0.00050	<0.0030	-
		7-Nov-2017	1.00	0.000110	4.50	<0.000010	8.50	0.250	<0.000010	<0.00010	<0.010	0.000230	<0.00050	<0.0030	-
		4-Dec-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
	EDC-01a	3-Jan-2017	0.860	0.000920	5.30	<0.000010	6.40	0.220	<0.000010	<0.00010	<0.010	0.000240	0.000560	<0.0030	-
		1-Feb-2017	1.40	0.00270	5.30	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000440	0.000540	<0.0030	-
		1-Mar-2017	0.630	0.000190	5.60	<0.000010	4.10	0.160	<0.000010	<0.00010	<0.010	0.000150	0.000510	<0.0030	-
		31-Mar-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		3-Apr-2017	0.810	0.000150	4.60	<0.000010	2.90	0.110	<0.000010	<0.00010	<0.010	0.0000960	0.000590	<0.0030	-
		6-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		11-Apr-2017	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Apr-2017	0.680	0.000110	4.00	<0.000010	2.10	0.0880	<0.000010	<0.00010	<0.010	0.0000880	0.000710	<0.0030	-
		25-Apr-2017	0.590	0.0000850	3.70	<0.000010	2.00	0.0750	<0.000010	<0.00010	<0.010	0.0000570	0.000670	<0.0030	-
		2-May-2017	0.560	0.000110	3.50	<0.000010	2.10	0.0820	<0.000010	<0.00010	<0.010	0.0000740	0.000600	<0.0030	-
		9-May-2017	0.550	0.000100	3.30	<0.000010	2.20	0.0800	<0.000010	<0.00010	<0.010	0.0000620	0.000580	<0.0030	-
		17-May-2017	0.590	0.000120	3.10	<0.000010	2.30	0.0880	<0.000010	<0.00010	<0.010	0.0000750	0.000640	<0.0030	-
		23-May-2017	0.660	0.000150	3.00	<0.000010	2.70	0.110	<0.000010	<0.00010	<0.010	0.0000860	0.000830	<0.0030	-
		1-Jun-2017	0.750	0.000140	3.20	<0.000010	3.40	0.130	<0.000010	<0.00010	<0.010	0.000100	0.000670	<0.0030	-
		4-Jul-2017	1.20	0.000160	4.50	<0.000010	8.60	0.260	<0.000010	<0.00010	<0.010	0.000270	0.000650	<0.0030	-
		19-Sep-2017	1.40	0.000110	4.80	<0.000010	14.0	0.350	<0.000010	<0.00010	<0.010	0.000630	<0.00050	<0.0030	-
		2-Oct-2017	1.50	0.000110	5.70	<0.000010	14.0	0.360	<0.000010	<0.00010	<0.010	0.000630	<0.00050	<0.0030	-
		7-Nov-2017	1.00	0.000140	4.40	<0.000010	7.90	0.260	<0.000010	<0.00010	<0.010	0.000270	<0.00050	<0.0030	-
		4-Dec-2017	1.20	0.000370	4.60	<0.000010	8.60	0.270	<0.000010	<0.00010	<0.010	0.000440	<0.00050	<0.0030	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2018	HAC-13	2-Jan-2018	1.40	0.000750	3.10	<0.000010	13.0	0.410	<0.000010	<0.00010	<0.010	0.000580	0.000610	<0.0030	-
		9-Jan-2018	1.50	0.000600	3.00	<0.000010	12.0	0.380	<0.000010	<0.00010	<0.010	0.000530	0.000620	<0.0030	-
		16-Jan-2018	1.40	0.000740	2.90	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000530	0.000620	0.00490	-
		23-Jan-2018	1.40	0.000580	3.00	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000460	0.000600	<0.0030	-
		30-Jan-2018	1.40	0.000500	2.80	<0.000010	10.0	0.340	<0.000010	<0.00010	<0.010	0.000370	0.000630	<0.0030	-
		6-Feb-2018	1.30	0.000490	2.80	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000330	0.000810	<0.0030	-
		13-Feb-2018	1.40	0.000520	2.70	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000300	0.000820	<0.0030	-
		20-Feb-2018	1.30	0.000600	2.70	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000310	0.000810	<0.0030	-
		1-Mar-2018	1.60	0.000630	3.00	<0.000010	12.0	0.450	<0.000010	<0.00010	<0.010	0.000690	0.000620	0.00350	-
		8-Mar-2018	1.50	0.000590	3.00	<0.000010	12.0	0.430	<0.000010	<0.00010	<0.010	0.000620	<0.00050	<0.0030	-
		14-Mar-2018	1.60	0.000600	3.20	<0.000010	13.0	0.540	<0.000010	<0.00010	<0.010	0.000890	0.000540	<0.0030	-
		20-Mar-2018	1.60	0.000810	3.40	<0.000010	14.0	0.730	<0.000010	<0.00010	<0.010	0.00170	<0.00050	<0.0030	-
		27-Mar-2018	1.80	0.000990	3.60	<0.000010	16.0	0.720	<0.000010	<0.00010	<0.010	0.00170	<0.00050	<0.0030	-
		3-Apr-2018	1.40	0.000490	2.90	<0.000010	11.0	0.410	<0.000010	<0.00010	<0.010	0.000530	0.000660	<0.0030	-
		10-Apr-2018	1.40	0.000630	3.00	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000450	0.000740	<0.0030	-
		17-Apr-2018	1.40	0.000820	2.80	<0.000010	9.90	0.360	<0.000010	<0.00010	<0.010	0.000510	0.000760	<0.0030	-
		24-Apr-2018	1.70	0.00260	3.10	<0.000010	12.0	0.660	<0.000010	<0.00010	<0.010	0.00170	0.000600	<0.0030	-
		1-May-2018	0.950	0.000630	3.40	<0.000010	5.70	0.210	<0.000010	<0.00010	<0.010	0.000260	0.000830	<0.0030	-
		8-May-2018	0.950	0.000500	2.50	<0.000010	6.10	0.200	<0.000010	<0.00010	<0.010	0.000220	0.000720	<0.0030	-
		16-May-2018	1.40	0.000600	2.50	<0.000010	9.10	0.310	<0.000010	<0.00010	<0.010	0.000340	0.000970	<0.0030	-
		24-May-2018	1.40	0.000510	2.40	<0.000010	9.20	0.310	<0.000010	<0.00010	<0.010	0.000280	0.000980	<0.0030	-
		29-May-2018	1.30	0.000480	2.30	<0.000010	8.40	0.290	<0.000010	<0.00010	<0.010	0.000250	0.00110	<0.0030	-
		5-Jun-2018	1.40	0.000540	2.30	<0.000010	9.50	0.300	<0.000010	<0.00010	<0.010	0.000250	0.000990	<0.0030	-
		12-Jun-2018	1.40	0.000550	2.20	<0.000010	10.0	0.310	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	-
		18-Jun-2018	1.30	0.000490	2.20	<0.000010	8.80	0.300	<0.000010	<0.00010	<0.010	0.000240	0.000980	<0.0030	-
		26-Jun-2018	1.30	0.000570	2.10	<0.000010	8.90	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00100	<0.0030	-
		4-Jul-2018	1.30	0.000590	2.20	<0.000010	9.00	0.290	<0.000010	<0.00010	<0.010	0.000310	0.000970	<0.0030	-
		10-Jul-2018	1.30	0.000530	2.00	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000280	0.00100	<0.0030	-
		17-Jul-2018	1.30	0.000580	2.30	<0.000010	8.90	0.300	<0.000010	<0.00010	<0.010	0.000230	0.00110	<0.0030	-
		24-Jul-2018	1.20	0.000560	2.20	<0.000010	9.40	0.300	<0.000010	<0.00010	<0.010	0.000240	0.00110	<0.0030	-
		2-Aug-2018	1.20	0.000570	2.20	<0.000010	9.10	0.290	<0.000010	<0.00010	<0.010	0.000250	0.000930	<0.0030	-
		7-Aug-2018	1.30	0.000540	2.10	<0.000010	8.80	0.260	<0.000010	<0.00010	<0.010	0.000250	0.000960	<0.0030	-
		14-Aug-2018	1.50	0.000490	2.30	<0.000010	10.0	0.290	<0.000010	<0.00010	<0.010	0.000240	0.00110	<0.0030	-
		21-Aug-2018	1.20	0.000500	2.30	<0.000010	9.10	0.280	<0.000010	<0.00010	<0.010	0.000240	0.000940	<0.0030	-
		28-Aug-2018	1.20	0.000470	2.00	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000240	0.000870	<0.0030	-
		4-Sep-2018	1.20	0.000480	2.10	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000240	0.000890	<0.0030	-
		10-Sep-2018	1.30	0.00120	2.80	<0.000010	9.40	0.380	<0.000010	<0.00010	<0.010	0.000460	0.000860	<0.0030	-
		20-Sep-2018	1.10	0.000560	2.10	<0.000010	8.50	0.280	<0.000010	<0.00010	<0.010	0.000250	0.000820	<0.0030	-
		24-Sep-2018	1.20	0.000630	2.00	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000300	0.000850	<0.0030	-
		2-Oct-2018	1.10	0.000550	2.30	<0.000010	9.50	0.290	<0.000010	<0.00010	<0.010	0.000260	0.000760	<0.0030	-
		9-Oct-2018	1.40	0.000880	2.10	<0.000010	9.10	0.320	<0.000010	<0.00010	<0.010	0.000370	0.000760	<0.0030	-
		16-Oct-2018	1.20	0.000530	2.30	<0.000010	9.70	0.320	<0.000010	<0.00010	<0.010	0.000330	0.000760	<0.0030	-
		23-Oct-2018	1.40	0.000550	2.20	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000330	0.000730	<0.0030	-
		30-Oct-2018	1.30	0.000420	2.70	<0.000010	9.80	0.320	<0.000010	<0.00010	<0.010	0.000300	0.000660	<0.0030	-
		6-Nov-2018	1.30	0.000870	2.70	<0.000010	10.0	0.410	<0.000010	<0.00010	<0.010	0.000690	0.000790	<0.0030	-
		13-Nov-2018	1.50	0.000690	2.80	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000560	0.000800	<0.0030	-
		27-Nov-2018	1.60	0.00130	3.10	<0.000010	11.0	0.470	<0.000010	<0.00010	<0.010	0.00110	0.000690	0.00300	-
		4-Dec-2018	1.30	0.000750	3.00	<0.000010	10.0	0.400	<0.000010	<0.00010	0.000330	0.000530	0.000730	0.00130	-
	HAC-05a	2-Jan-2018	1.40	0.00170	5.30	<0.000010	14.0	0.480	<0.000010	<0.00010	<0.010	0.000740	0.000690	<0.0030	-
		9-Jan-2018	1.40	0.00140	4.70	<0.000010	12.0	0.440	<0.000010	<0.00010	<0.010	0.000770	0.000730	<0.0030	-
		16-Jan-2018	1.40	0.00160	4.50	<0.000010	12.0	0.460	<0.000010	<0.00010	<0.010	0.000730	0.000670	0.00320	-
		23-Jan-2018	1.40	0.00140	4.50	0.0000230	12.0	0.460	<0.000010	<0.00010	<0.010	0.000710	0.000670	<0.0030	-
		30-Jan-2018	1.30	0.00110	3.90	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000550	0.000630	<0.0030	-
		6-Feb-2018	1.30	0.000780	3.00	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000410	0.000810	<0.0030	-
		13-Feb-2018	1.40	0.000660	3.00	<0.000010	10.0	0.320	<0.000010	<0.00010	<0.010	0.000340	0.000830	<0.0030	-
		20-Feb-2018	1.30	0.000710	3.00	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000380	0.000780	<0.0030	-
		14-Mar-2018	1.50	0.00240	4.60	<0.000010	13.0	0.540	<0.000010	<0.00010	<0.010	0.00110	0.000710	0.00390	-
		20-Mar-2018	1.80	0.00220	4.30	<0.000010	15.0	0.680	<0.000010	<0.00010	<0.010	0.00170	0.000660	0.00430	-
		27-Mar-2018	1.80	0.00240	4.60	<0.000010	16.0	0.680	<0.000010	<0.00010	<0.010	0.00170	0.000580	0.00360	-
		3-Apr-2018	1.40	0.000940	3.30	<0.000010	11.0	0.430	<0.000010	<0.00010	<0.010	0.000700	0.000620	<0.0030	-
		10-Apr-2018	1.40	0.000920	3.10	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000550	0.000700	<0.0030	-
		17-Apr-2018	1.40	0.000950	2.90	<0.000010	9.60	0.360	<0.000010	<0.00010	<0.010	0.000590	0.000780	<0.0030	-
		24-Apr-2018	1.80	0.00270	3.50	<0.000010	12.0	0.590	<0.000010	<0.00010	<0.010	0.00160	0.000650	<0.0030	-
		1-May-2018	1.00	0.000920	3.60	<0.000010	6.10	0.230	<0.000010	<0.00010	<0.010	0.000330	0.000850	<0.0030	-
		8-May-2018	1.00	0.000630	2.80	<0.000010	6.00	0.220	<0.000010	<0.00010	<0.010	0.000280	0.000790	<0.0030	-
		16-May-2018	1.40	0.000920	2.90	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000460	0.000980	<0.0030	-
		24-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2018	HAC-05a	5-Jun-2018	1.40	0.000880	2.60	<0.000010	9.80	0.340	<0.000010	<0.00010	<0.010	0.000370	0.000940	<0.0030	-
		12-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		18-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		26-Jun-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Jul-2018	1.30	0.00110	2.60	<0.000010	9.60	0.320	<0.000010	<0.00010	<0.010	0.000370	0.000960	<0.0030	-
		10-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		17-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Jul-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2018	1.30	0.000850	2.30	<0.000010	9.30	0.310	<0.000010	<0.00010	<0.010	0.000290	0.000950	<0.0030	-
		7-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		21-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		28-Aug-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		4-Sep-2018	1.20	0.00120	2.70	<0.000010	9.30	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000860	<0.0030	-
		10-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		20-Sep-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		24-Sep-2018	1.20	0.00190	2.70	<0.000010	9.80	0.350	<0.000010	<0.00010	<0.010	0.000500	0.000790	<0.0030	-
		2-Oct-2018	1.20	0.00140	2.90	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000400	0.000770	<0.0030	-
		9-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		16-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		23-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		30-Oct-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		6-Nov-2018	1.60	0.00160	3.30	<0.000010	10.0	0.480	<0.000010	<0.00010	<0.010	0.000860	0.000800	<0.0030	-
		13-Nov-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		27-Nov-2018	1.70	0.00180	3.40	<0.000010	9.60	0.440	<0.000010	<0.00010	<0.010	0.00100	0.000770	<0.0030	-
		4-Dec-2018	1.40	0.00150	3.90	<0.000010	11.0	0.470	<0.000010	<0.00010	0.000330	0.000640	0.000770	<0.0010	-
	HAC-14	2-Jan-2018	1.50	0.00150	5.90	<0.000010	15.0	0.610	<0.000010	<0.00010	<0.010	0.000910	0.000540	<0.0030	-
		9-Jan-2018	1.60	0.00130	5.30	<0.000010	14.0	0.560	<0.000010	<0.00010	<0.010	0.000930	0.000590	0.00310	-
		16-Jan-2018	1.50	0.00140	5.00	<0.000010	13.0	0.600	<0.000010	<0.00010	<0.010	0.000940	0.000570	0.00360	-
		23-Jan-2018	1.50	0.00110	5.00	<0.000010	13.0	0.580	<0.000010	<0.00010	<0.010	0.000890	0.000580	<0.0030	-
		10-Apr-2018	1.40	0.000920	3.20	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000660	0.000680	<0.0030	-
		17-Apr-2018	1.30	0.000870	3.10	<0.000010	8.90	0.370	<0.000010	<0.00010	<0.010	0.000620	0.000710	<0.0030	-
		24-Apr-2018	1.40	0.00200	3.60	<0.000010	8.40	0.460	<0.000010	<0.00010	<0.010	0.00120	0.000660	<0.0030	-
		1-May-2018	1.00	0.000640	3.60	<0.000010	5.00	0.210	<0.000010	<0.00010	<0.010	0.000350	0.000840	<0.0030	-
		8-May-2018	1.00	0.000470	3.00	<0.000010	5.30	0.210	<0.000010	<0.00010	<0.010	0.000280	0.000840	<0.0030	-
		16-May-2018	1.50	0.000870	3.30	<0.000010	9.50	0.380	<0.000010	<0.00010	<0.010	0.000520	0.000980	<0.0030	-
		24-May-2018	1.50	0.000800	3.00	<0.000010	9.70	0.360	<0.000010	<0.00010	<0.010	0.000430	0.00100	<0.0030	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	1.50	0.000910	2.80	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000450	0.000910	<0.0030	-
		12-Jun-2018	1.50	0.000710	2.60	<0.000010	11.0	0.370	<0.000010	<0.00010	<0.010	0.000360	0.00110	<0.0030	-
		18-Jun-2018	1.40	0.000780	2.60	<0.000010	9.10	0.340	<0.000010	<0.00010	<0.010	0.000330	0.000970	<0.0030	-
		26-Jun-2018	1.40	0.00130	2.70	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000440	0.00100	<0.0030	-
		4-Jul-2018	1.40	0.00110	2.90	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000430	0.000940	<0.0030	-
		10-Jul-2018	1.40	0.000910	2.60	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000410	0.00100	<0.0030	-
		17-Jul-2018	1.40	0.000820	2.60	<0.000010	9.20	0.330	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	-
		24-Jul-2018	1.40	0.000870	2.30	<0.000010	9.90	0.330	<0.000010	<0.00010	<0.010	0.000320	0.00100	<0.0030	-
		2-Aug-2018	1.30	0.000910	2.40	<0.000010	9.90	0.330	<0.000010	<0.00010	<0.010	0.000350	0.000880	<0.0030	-
		7-Aug-2018	1.40	0.000830	2.20	<0.000010	9.30	0.320	<0.000010	<0.00010	<0.010	0.000370	0.000900	<0.0030	-
		14-Aug-2018	1.30	0.000560	2.30	<0.000010	9.50	0.260	<0.000010	<0.00010	<0.010	0.000240	0.000930	<0.0030	-
		21-Aug-2018	1.40	0.000970	2.60	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000370	0.000860	<0.0030	-
		28-Aug-2018	1.50	0.00100	2.70	<0.000010	10.0	0.420	<0.000010	<0.00010	<0.010	0.000450	0.000930	<0.0030	-
		4-Sep-2018	1.40	0.00110	2.80	<0.000010	10.0	0.420	<0.000010	<0.00010	<0.010	0.000460	0.000870	<0.0030	-
		10-Sep-2018	1.20	0.000500	2.00	<0.000010	8.40	0.260	<0.000010	<0.00010	<0.010	0.000240	0.000870	<0.0030	-
		20-Sep-2018	1.30	0.00170	3.20	<0.000010	10.0	0.420	<0.000010	<0.00010	<0.010	0.000650	0.000820	<0.0030	-
		24-Sep-2018	1.30	0.00210	3.00	<0.000010	11.0	0.430	<0.000010	<0.00010	<0.010	0.000700	0.000830	<0.0030	-
		2-Oct-2018	1.20	0.00140	3.20	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000530	0.000710	<0.0030	-
		9-Oct-2018	1.50	0.00220	3.20	<0.000010	9.50	0.480	<0.000010	<0.00010	<0.010	0.000770	0.000760	<0.0030	-
		16-Oct-2018	1.40	0.00160	3.60	<0.000010	11.0	0.450	<0.000010	<0.00010	<0.010	0.000620	0.000730	<0.0030	-
		23-Oct-2018	1.40	0.00160	3.60	<0.000010	11.0	0.440	<0.000010	<0.00010	<0.010	0.000630	0.000720	<0.0030	-
		30-Oct-2018	1.40	0.00120	3.50	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000560	0.000700	<0.0030	-
		6-Nov-2018	1.40	0.00140	3.90	<0.000010	8.40	0.430	<0.000010	<0.00010	<0.010	0.000810	0.00100	<0.0030	-
		13-Nov-2018	1.50	0.00120	3.80	<0.000010	11.0	0.460	<0.000010	<0.00010	<0.010	0.000790	0.000850	<0.0030	-
		27-Nov-2018	1.40	0.00140	3.70	<0.000010	7.70	0.380	<0.000010	<0.00010	<0.010	0.000940	0.000910	<0.0030	-
		4-Dec-2018	1.50	0.00130	4.20	<0.000010	11.0	0.490	<0.000010	<0.00010	0.00240	0.000720	0.000790	<0.0010	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2018	HAC-08	2-Jan-2018	1.50	0.00130	5.90	<0.000010	16.0	0.640	<0.000010	<0.00010	<0.010	0.00100	0.000550	<0.0030	-
		9-Jan-2018	1.60	0.00130	5.40	<0.000010	15.0	0.590	<0.000010	<0.00010	<0.010	0.00110	0.000570	<0.0030	-
		16-Jan-2018	1.50	0.00140	4.90	<0.000010	14.0	0.620	<0.000010	<0.00010	<0.010	0.00110	0.000540	<0.0030	-
		23-Jan-2018	1.60	0.00120	5.30	<0.000010	14.0	0.610	<0.000010	<0.00010	<0.010	0.00110	0.000560	<0.0030	-
		30-Jan-2018	1.50	0.00120	4.90	<0.000010	14.0	0.560	<0.000010	<0.00010	<0.010	0.000870	0.000580	<0.0030	-
		6-Feb-2018	1.60	0.000960	3.50	<0.000010	12.0	0.570	<0.000010	<0.00010	<0.010	0.000690	0.000810	<0.0030	-
		13-Feb-2018	1.40	0.000730	3.20	<0.000010	10.0	0.400	<0.000010	<0.00010	<0.010	0.000530	0.000750	<0.0030	-
		20-Feb-2018	1.40	0.000710	3.60	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000450	0.00110	<0.0030	-
		14-Mar-2018	1.60	0.00180	5.20	<0.000010	15.0	0.680	<0.000010	<0.00010	<0.010	0.00140	0.000630	<0.0030	-
		20-Mar-2018	1.70	0.00180	4.50	<0.000010	17.0	0.740	<0.000010	<0.00010	<0.010	0.00190	0.000640	<0.0030	-
		27-Mar-2018	1.60	0.00190	4.70	<0.000010	15.0	0.650	<0.000010	<0.00010	<0.010	0.00170	0.000550	0.00720	-
		3-Apr-2018	1.40	0.000980	3.60	<0.000010	11.0	0.480	<0.000010	<0.00010	<0.010	0.000930	0.000580	<0.0030	-
		10-Apr-2018	1.40	0.000890	3.20	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000670	0.000640	<0.0030	-
		17-Apr-2018	1.30	0.000860	3.20	<0.000010	8.70	0.340	<0.000010	<0.00010	<0.010	0.000630	0.000690	<0.0030	-
		24-Apr-2018	1.30	0.00160	3.50	<0.000010	7.20	0.400	<0.000010	<0.00010	<0.010	0.00100	0.000620	<0.0030	-
		1-May-2018	1.00	0.000560	3.70	<0.000010	4.70	0.220	<0.000010	<0.00010	<0.010	0.000350	0.000800	<0.0030	-
		8-May-2018	1.00	0.000460	3.20	<0.000010	5.10	0.200	<0.000010	<0.00010	<0.010	0.000290	0.000800	<0.0030	-
		16-May-2018	1.50	0.000780	3.40	<0.000010	9.40	0.370	<0.000010	<0.00010	<0.010	0.000560	0.000990	<0.0030	-
		29-May-2018	-	-	-	-	-	-	-	-	-	-	-	-	-
		5-Jun-2018	1.50	0.000900	2.80	<0.000010	11.0	0.400	<0.000010	<0.00010	<0.010	0.000540	0.000920	<0.0030	-
		4-Jul-2018	1.40	0.00110	3.00	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000480	0.000910	<0.0030	-
		2-Aug-2018	1.30	0.000860	2.40	<0.000010	10.0	0.360	<0.000010	<0.00010	<0.010	0.000380	0.000870	<0.0030	-
		4-Sep-2018	1.40	0.00110	2.70	<0.000010	10.0	0.430	<0.000010	<0.00010	<0.010	0.000530	0.000890	<0.0030	-
		2-Oct-2018	1.30	0.00140	3.10	<0.000010	12.0	0.390	<0.000010	<0.00010	<0.010	0.000560	0.000700	<0.0030	-
		6-Nov-2018	1.40	0.00120	4.00	<0.000010	8.30	0.420	<0.000010	<0.00010	<0.010	0.000790	0.00100	<0.0030	-
		27-Nov-2018	1.30	0.00100	3.60	<0.000010	7.00	0.350	<0.000010	<0.00010	<0.010	0.000840	0.000760	<0.0030	-
		4-Dec-2018	1.30	0.00120	4.40	<0.000010	10.0	0.460	<0.000010	<0.00010	0.00190	0.000800	0.000770	<0.0010	-
	W10	2-Jan-2018	1.20	0.000180	5.20	<0.000010	9.30	0.280	<0.000010	<0.00010	<0.010	0.000340	<0.00050	<0.0030	-
		14-Feb-2018	1.00	0.000140	5.10	<0.000010	7.70	0.240	<0.000010	<0.00010	<0.010	0.000310	<0.00050	<0.0030	-
		14-Mar-2018	0.990	0.000150	5.40	<0.000010	8.20	0.260	<0.000010	<0.00010	<0.010	0.000340	<0.00050	<0.0030	-
		3-Apr-2018	0.790	0.000180	4.80	<0.000010	4.60	0.170	<0.000010	<0.00010	<0.010	0.000150	<0.00050	<0.0030	-
		1-May-2018	0.630	0.000140	4.00	<0.000010	1.90	0.0660	<0.000010	<0.00010	<0.010	0.0000540	0.000620	<0.0030	-
		5-Jun-2018	0.950	0.000160	4.60	<0.000010	5.80	0.190	<0.000010	<0.00010	<0.010	0.000160	0.000570	<0.0030	-
		4-Jul-2018	0.940	0.000120	4.40	<0.000010	5.60	0.190	<0.000010	<0.00010	<0.010	0.000140	<0.00050	<0.0030	-
		2-Aug-2018	1.40	0.000160	5.20	<0.000010	11.0	0.300	<0.000010	<0.00010	<0.010	0.000360	0.000660	<0.0030	-
		4-Sep-2018	1.40	0.000150	5.20	<0.000010	13.0	0.380	<0.000010	<0.00010	<0.010	0.000580	0.000520	<0.0030	-
		2-Oct-2018	1.10	0.000110	5.30	<0.000010	9.80	0.250	<0.000010	<0.00010	<0.010	0.000300	<0.00050	<0.0030	-
		6-Nov-2018	0.680	0.000150	4.20	<0.000010	2.60	0.0910	<0.000010	<0.00010	<0.010	0.0000820	0.00100	0.00330	-
	EDC-01a	2-Jan-2018	1.60	0.000700	5.10	<0.000010	12.0	0.440	<0.000010	<0.00010	<0.010	0.00100	<0.00050	<0.0030	-
		30-Jan-2018	1.30	0.000440	4.90	<0.000010	9.90	0.360	<0.000010	<0.00010	<0.010	0.000710	<0.00050	<0.0030	-
		14-Feb-2018	1.20	0.000310	4.90	<0.000010	9.10	0.300	<0.000010	<0.00010	<0.010	0.000570	<0.00050	<0.0030	-
		14-Mar-2018	1.30	0.000500	5.10	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000740	<0.00050	<0.0030	-
		3-Apr-2018	0.840	0.000230	4.70	<0.000010	5.00	0.200	<0.000010	<0.00010	<0.010	0.000270	<0.00050	<0.0030	-
		1-May-2018	0.620	0.000170	3.90	<0.000010	1.90	0.0700	<0.000010	<0.00010	<0.010	0.0000600	0.000610	<0.0030	-
		5-Jun-2018	0.960	0.000180	4.50	<0.000010	5.90	0.200	<0.000010	<0.00010	<0.010	0.000210	0.000530	<0.0030	-
		4-Jul-2018	1.00	0.000220	4.60	<0.000010	6.30	0.210	<0.000010	<0.00010	<0.010	0.000220	0.000530	<0.0030	-
		2-Aug-2018	1.60	0.000290	4.50	<0.000010	11.0	0.340	<0.000010	<0.00010	<0.010	0.000530	0.000690	<0.0030	-
		4-Sep-2018	1.40	0.000120	4.70	<0.000010	12.0	0.360	<0.000010	<0.00010	<0.010	0.000670	0.000580	<0.0030	-
		2-Oct-2018	1.10	0.000300	5.00	<0.000010	9.90	0.280	<0.000010	<0.00010	<0.010	0.000420	<0.00050	<0.0030	-
		6-Nov-2018	0.660	0.000170	4.00	<0.000010	2.50	0.0890	<0.000010	<0.00010	<0.010	0.0000810	0.000980	<0.0030	-
	HAC-13	8-Jan-2019	1.20	0.000620	2.90	<0.000010	9.10	0.310	<0.000010	<0.00010	<0.010	0.000320	0.000830	0.00560	-
		5-Feb-2019	1.20	0.000520	3.00	<0.000010	9.00	0.320	<0.000010	<0.00010	<0.010	0.000300	0.000810	<0.0030	-
		4-Mar-2019	1.40	0.000520	3.00	<0.000010	9.40	0.300	<0.000010	<0.00010	<0.010	0.000260	0.000860	<0.0030	-
		2-Apr-2019	1.10	0.000890	3.60	<0.000010	8.00	0.340	<0.000010	<0.00010	<0.010	0.000480	0.000730	<0.0030	-
		14-May-2019	1.20	0.000590	2.60	<0.000010	8.50	0.280	<0.000010	<0.00010	<0.010	0.000250	0.000990	<0.0030	-
		4-Jun-2019	1.30	0.000540	2.20	<0.000010	9.40	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00100	<0.0030	-
		2-Jul-2019	1.20	0.000550	2.20	<0.000010	8.10	0.270	<0.000010	<0.00010	<0.010	0.000230	0.000930	<0.0030	-
		1-Aug-2019	1.20	0.000690	2.50	<0.000010	9.50	0.300	<0.000010	<0.00010	<0.010	0.000280	0.000960	<0.0030	-
		3-Sep-2019	1.20	0.000560	2.30	<0.000010	9.00	0.300	<0.000010	<0.00010	<0.010	0.000230	0.00100	<0.0030	-
		1-Oct-2019	1.20	0.000540	2.20	<0.000010	9.30	0.300	<0.000010	<0.00010	<0.010	0.000330	0.000920	<0.0030	-
		4-Nov-2019	1.30	0.000520	2.50	<0.000010	8.70	0.280	<0.000010	<0.00010	<0.010	0.000330	0.000940	<0.0030	-
		2-Dec-2019	1.30	0.000550	3.00	<0.000010	9.20	0.310	<0.000010	<0.00010	<0.010	0.000280	0.00100	0.00850	-

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2019	HAC-05a	8-Jan-2019	1.30	0.00100	3.20	<0.000010	9.70	0.350	<0.000010	<0.00010	<0.010	0.000410	0.000780	<0.0030	-
		5-Feb-2019	1.30	0.000950	3.10	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000380	0.000770	<0.0030	-
		4-Mar-2019	1.40	0.000950	3.60	<0.000010	10.0	0.310	<0.000010	<0.00010	<0.010	0.000330	0.000850	<0.0030	-
		2-Apr-2019	1.20	0.00130	3.70	<0.000010	8.00	0.360	<0.000010	<0.00010	<0.010	0.000590	0.000700	<0.0030	-
		18-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-
		25-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-
		29-Apr-2019	-	-	-	-	-	-	-	-	-	-	-	-	-
		14-May-2019	1.30	0.00170	3.00	<0.000010	8.80	0.320	<0.000010	<0.00010	<0.010	0.000360	0.000970	<0.0030	-
		4-Jun-2019	1.30	0.00170	2.20	<0.000010	10.0	0.330	<0.000010	<0.00010	<0.010	0.000340	0.000930	<0.0030	-
		2-Jul-2019	1.30	0.00140	2.40	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000320	0.000910	<0.0030	-
		1-Aug-2019	1.20	0.00130	2.90	<0.000010	9.60	0.320	<0.000010	<0.00010	<0.010	0.000350	0.000940	<0.0030	-
		3-Sep-2019	1.20	0.00110	2.60	<0.000010	9.40	0.320	<0.000010	<0.00010	<0.010	0.000290	0.000960	<0.0030	-
		1-Oct-2019	1.20	0.00130	2.60	<0.000010	9.70	0.340	<0.000010	<0.00010	<0.010	0.000410	0.000850	<0.0030	-
		4-Nov-2019	1.40	0.000930	2.80	<0.000010	8.90	0.300	<0.000010	<0.00010	<0.010	0.000400	0.000950	<0.0030	-
		2-Dec-2019	1.30	0.00100	3.20	<0.000010	9.40	0.320	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	-
	HAC-14	14-May-2019	1.30	0.00160	3.20	<0.000010	9.20	0.350	<0.000010	<0.00010	<0.010	0.000430	0.000960	<0.0030	-
		4-Jun-2019	1.50	0.00160	2.60	<0.000010	11.0	0.380	<0.000010	<0.00010	<0.010	0.000410	0.000890	<0.0030	-
		2-Jul-2019	1.40	0.00130	2.70	<0.000010	9.10	0.360	<0.000010	<0.00010	<0.010	0.000410	0.000910	<0.0030	-
		1-Aug-2019	1.40	0.00150	3.10	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000460	0.000970	<0.0030	-
		3-Sep-2019	1.40	0.00120	3.00	<0.000010	9.50	0.360	<0.000010	<0.00010	<0.010	0.000370	0.000930	<0.0030	-
		1-Oct-2019	1.30	0.00120	3.00	<0.000010	9.70	0.380	<0.000010	<0.00010	<0.010	0.000500	0.000760	<0.0030	-
		4-Nov-2019	1.30	0.000870	3.00	<0.000010	8.50	0.300	<0.000010	<0.00010	<0.010	0.000460	0.000930	<0.0030	-
		4-Nov-2019	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Dec-2019	1.30	0.00100	3.30	<0.000010	9.40	0.340	<0.000010	<0.00010	<0.010	0.000340	0.000920	<0.0030	-
	HAC-08	8-Jan-2019	1.40	0.000800	3.60	<0.000010	9.80	0.390	<0.000010	<0.00010	<0.010	0.000550	0.000700	<0.0030	-
		5-Feb-2019	1.20	0.000880	3.70	<0.000010	9.60	0.370	<0.000010	<0.00010	<0.010	0.000510	0.000680	<0.0030	-
		4-Mar-2019	1.40	0.000880	3.80	<0.000010	10.0	0.350	<0.000010	<0.00010	<0.010	0.000420	0.000770	<0.0030	-
		2-Apr-2019	1.10	0.00110	3.90	<0.000010	6.50	0.320	<0.000010	<0.00010	<0.010	0.000570	0.000780	<0.0030	-
		14-May-2019	1.30	0.00140	2.90	<0.000010	9.00	0.360	<0.000010	<0.00010	<0.010	0.000470	0.00100	<0.0030	-
		4-Jun-2019	1.40	0.00160	2.70	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000460	0.000950	<0.0030	-
		2-Jul-2019	1.50	0.00140	2.80	<0.000010	9.60	0.380	<0.000010	<0.00010	<0.010	0.000480	0.00100	<0.0030	-
		1-Aug-2019	1.40	0.00130	3.20	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000510	0.00100	<0.0030	-
		3-Sep-2019	1.40	0.00120	2.90	<0.000010	9.60	0.370	<0.000010	<0.00010	<0.010	0.000400	0.000950	<0.0030	-
		1-Oct-2019	1.30	0.00120	3.20	<0.000010	9.60	0.370	<0.000010	<0.00010	<0.010	0.000550	0.000860	<0.0030	-
		4-Nov-2019	1.20	0.000860	3.10	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000460	0.000910	<0.0030	-
		2-Dec-2019	1.30	0.000920	3.30	<0.000010	9.40	0.330	<0.000010	<0.00010	<0.010	0.000360	0.000860	<0.0030	-
	W10	4-Jun-2019	0.740	0.000200	4.10	<0.000010	3.90	0.150	<0.000010	<0.00010	<0.010	0.0000960	0.000600	<0.0030	-
		8-Aug-2019	0.580	0.000200	5.10	<0.000010	3.50	0.160	<0.000010	<0.00010	<0.010	0.0000900	0.000760	<0.0030	-
		1-Oct-2019	0.580	0.000160	5.20	<0.000010	3.10	0.130	<0.000010	<0.00010	<0.010	0.0000990	0.000640	<0.0030	-
		20-Nov-2019	0.490	0.000190	5.00	<0.000010	2.40	0.100	<0.000010	<0.00010	<0.010	0.0000770	0.000680	<0.0030	-
	EDC-01a	8-May-2019	0.420	0.0000900	3.80	<0.000010	2.00	0.0800	<0.000010	<0.00010	<0.010	0.0000640	0.000590	<0.0030	-
		4-Jun-2019	0.760	0.000140	4.30	<0.000010	4.00	0.150	<0.000010	<0.00010	<0.010	0.000120	0.000660	<0.0030	-
		2-Jul-2019	1.00	0.000210	4.80	<0.000010	5.80	0.220	<0.000010	<0.00010	<0.010	0.000230	0.000530	<0.0030	-
		1-Oct-2019	0.610	0.000180	4.90	<0.000010	3.30	0.140	<0.000010	<0.00010	<0.010	0.000110	0.000660	<0.0030	-
	HAC-13	20-Jan-2020	1.20	0.000540	3.20	<0.000010	9.50	0.310	<0.000010	<0.00010	<0.010	0.000260	0.000870	<0.0030	131
		3-Feb-2020	1.20	0.000490	3.10	<0.000010	8.50	0.290	<0.000010	<0.00010	<0.010	0.000260	0.000890	<0.0030	-
		25-Mar-2020	1.20	0.000520	2.80	<0.000010	9.20	0.290	<0.000010	<0.00010	<0.010	0.000230	0.000900	<0.0030	-
		16-Apr-2020	1.20	0.000580	3.50	<0.000010	8.20	0.360	<0.000010	<0.00010	<0.010	0.000360	0.000840	<0.0030	-
		7-May-2020	0.710	0.000490	3.20	<0.000010	3.60	0.140	<0.000010	<0.00010	<0.010	0.000150	0.000670	<0.0030	-
		3-Jun-2020	1.10	0.000590	2.80	<0.000010	8.00	0.280	<0.000010	<0.00010	<0.010	0.000240	0.000970	<0.0030	117
		6-Jul-2020	1.00	0.000540	2.80	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000220	0.00110	<0.0030	120
		4-Aug-2020	1.00	0.000530	3.00	<0.000010	7.40	0.260	<0.000010	<0.00010	<0.010	0.000200	0.00100	<0.0030	108
		1-Sep-2020	1.00	0.000550	2.60	<0.000010	7.80	0.270	<0.000010	<0.00010	<0.010	0.000220	0.000940	<0.0030	123
		1-Oct-2020	1.10	0.000440	2.60	<0.000010	8.10	0.260	<0.000010	<0.00010	<0.010	0.000220	0.00100	<0.0030	113
		2-Nov-2020	1.10	0.000670	3.30	<0.000010	7.20	0.280	<0.000010	<0.00010	<0.010	0.000300	0.000840	<0.0030	130
		1-Dec-2020	1.10	0.000520	3.20	<0.000010	7.70	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00100	<0.0030	123
	HAC-05a	20-Jan-2020	1.30	0.00150	3.80	<0.000010	9.70	0.350	<0.000010	<0.00010	<0.010	0.000340	0.000860	<0.0030	157
		3-Feb-2020	1.20	0.000700	3.10	<0.000010	8.60	0.290	<0.000010	<0.00010	<0.010	0.000310	0.000880	<0.0030	-
		25-Mar-2020	1.20	0.000970	3.20	<0.000010	8.60	0.300	<0.000010	<0.00010	<0.010	0.000280	0.000850	<0.0030	-
		16-Apr-2020	1.30	0.00110	3.80	<0.000010	8.00	0.370	<0.000010	<0.00010	<0.010	0.000480	0.000840	<0.0030	-
		7-May-2020	0.770	0.000860	3.30	<0.000010	3.90	0.160	<0.000010	<0.00010	<0.010	0.000190	0.000670	<0.0030	-
		3-Jun-2020	1.20	0.000870	2.90	<0.000010	7.80	0.290	<0.000010	<0.00010	<0.010	0.000280	0.000970	<0.0030	124
		6-Jul-2020	1.10	0.00100	2.90	<0.000010	8.30	0.300	<0.000010	<0.00010	<0.010	0.000250	0.00100	<0.0030	132
		4-Aug-2020	1.10	0.00170	3.30	<0.000010	7.60	0.290	<0.000010	<0.00010	<0.010	0.000270	0.00110	<0.0030	128
		1-Sep-2020	1.10	0.00170	3.10	<0.000010	8.40	0.310	<0.000010	<0.00010	<0.010	0.000290	0.000950	<0.0030	144
		1-Oct-2020	1.10	0.00120	3.40	<0.000010	8.50	0.290	<0.000010	<0.00010	<0.010	0.000280	0.000980	<0.0030	128
		2-Nov-2020	1.10	0.000990	3.40	<0.000010	6.80	0.290	<0.000010	<0.00010	<0.010	0.000360	0.000840	<0.0030	138
		1-Dec-2020	1.10	0.000830	3.40	<0.000010	7.70	0.260	<0.000010	<0.00010	<0.010	0.000220	0.000960	<0.0030	126

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2020	HAC-14	3-Jun-2020	1.10	0.000890	3.20	<0.000010	7.10	0.280	<0.000010	<0.00010	<0.010	0.000300	0.000940	<0.0030	119
		6-Jul-2020	1.10	0.00100	3.20	<0.000010	8.30	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00110	<0.0030	129
		4-Aug-2020	1.20	0.00160	3.50	<0.000010	8.10	0.330	<0.000010	<0.00010	<0.010	0.000320	0.00100	<0.0030	138
		1-Sep-2020	1.20	0.00140	3.30	<0.000010	8.90	0.340	<0.000010	0.000150	<0.010	0.000370	0.000790	<0.0030	144
		1-Oct-2020	1.20	0.00120	3.50	<0.000010	8.70	0.330	<0.000010	0.000280	<0.010	0.000330	0.000900	<0.0030	142
		2-Nov-2020	1.00	0.000820	3.60	<0.000010	6.20	0.270	<0.000010	<0.00010	<0.010	0.000360	0.000880	<0.0030	125
	HAC-08	20-Jan-2020	1.30	0.00140	4.10	<0.000010	10.0	0.380	<0.000010	<0.00010	<0.010	0.000450	0.000740	<0.0030	165
		3-Feb-2020	1.20	0.000710	3.40	<0.000010	8.80	0.320	<0.000010	<0.00010	<0.010	0.000370	0.000780	<0.0030	-
		25-Mar-2020	1.20	0.00100	3.30	<0.000010	9.60	0.350	<0.000010	<0.00010	<0.010	0.000370	0.000750	<0.0030	-
		16-Apr-2020	1.10	0.000990	4.10	<0.000010	6.30	0.330	<0.000010	<0.00010	<0.010	0.000520	0.000770	<0.0030	-
		7-May-2020	0.780	0.000650	3.60	<0.000010	3.30	0.150	<0.000010	<0.00010	<0.010	0.000200	0.000790	<0.0030	-
		3-Jun-2020	1.10	0.000710	3.30	<0.000010	6.70	0.260	<0.000010	<0.00010	<0.010	0.000300	0.000920	<0.0030	118
		6-Jul-2020	1.10	0.000860	3.30	<0.000010	7.60	0.300	<0.000010	<0.00010	<0.010	0.000310	0.00100	<0.0030	132
		4-Aug-2020	1.30	0.00150	3.50	<0.000010	8.20	0.330	<0.000010	<0.00010	<0.010	0.000350	0.00110	<0.0030	139
		1-Sep-2020	1.20	0.00160	3.20	<0.000010	9.10	0.360	<0.000010	<0.00010	<0.010	0.000440	0.000840	<0.0030	150
		1-Oct-2020	1.20	0.00110	3.10	<0.000010	9.00	0.340	<0.000010	0.000280	<0.010	0.000380	0.000920	<0.0030	141
		2-Nov-2020	1.00	0.000800	3.60	<0.000010	5.80	0.240	<0.000010	<0.00010	<0.010	0.000350	0.000780	<0.0030	122
		1-Dec-2020	1.00	0.000830	3.30	<0.000010	7.80	0.270	<0.000010	<0.00010	<0.010	0.000260	0.000880	<0.0030	127
	W10	7-May-2020	0.580	0.0000950	3.80	<0.000010	1.60	0.0670	<0.000010	<0.00010	<0.010	0.0000450	0.000560	<0.0030	-
		31-Aug-2020	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Sep-2020	0.980	0.000170	4.90	<0.000010	7.40	0.250	<0.000010	<0.00010	<0.010	0.000290	<0.00050	<0.0030	142
		1-Oct-2020	1.10	0.000100	6.00	<0.000010	8.00	0.280	<0.000010	0.000100	<0.010	0.000320	<0.00050	<0.0030	144
		2-Nov-2020	0.590	0.000110	4.50	<0.000010	2.10	0.0860	<0.000010	<0.00010	<0.010	0.0000690	0.000830	<0.0030	60
	EDC-01a	7-May-2020	0.600	0.000130	3.90	<0.000010	1.60	0.0680	<0.000010	<0.00010	<0.010	0.0000490	0.000670	<0.0030	-
		1-Sep-2020	1.70	0.000640	5.40	<0.000010	9.90	0.450	<0.000010	<0.00010	<0.010	0.000980	0.000640	<0.0030	212
		1-Oct-2020	1.20	0.000990	4.10	<0.000010	9.00	0.330	<0.000010	0.000120	<0.010	0.000440	0.000920	<0.0030	151
		2-Nov-2020	0.720	0.000330	4.30	<0.000010	3.20	0.120	<0.000010	<0.00010	<0.010	0.000140	0.000790	<0.0030	78
		1-Dec-2020	-	-	-	-	-	-	-	-	-	-	-	-	-
		1-Dec-2020	0.820	0.000460	4.10	<0.000010	5.30	0.200	<0.000010	<0.00010	<0.010	0.000210	0.000740	<0.0030	103
	HAC-13	12-Jan-2021	1.10	0.000440	3.30	<0.000010	7.70	0.260	<0.000010	<0.00010	<0.010	0.000220	0.000970	<0.0030	117
		1-Feb-2021	1.10	0.000490	3.40	<0.000010	8.20	0.280	<0.000010	<0.00010	<0.010	0.000220	0.00100	<0.0030	118
		8-Mar-2021	1.10	0.000480	3.40	<0.000010	7.80	0.300	<0.000010	<0.00010	<0.010	0.000240	0.00100	<0.0030	137
		7-Apr-2021	1.10	0.000470	3.60	<0.000010	7.40	0.290	<0.000010	<0.00010	<0.010	0.000290	0.000830	<0.0030	132
		3-May-2021	0.790	0.000400	2.50	<0.000010	5.50	0.200	<0.000010	<0.00010	<0.010	0.000190	0.000740	<0.0030	81
		1-Jun-2021	1.10	0.000540	3.00	<0.000010	7.80	0.260	<0.000010	<0.00010	<0.010	0.000210	0.00110	<0.0030	110
		7-Jul-2021	1.00	0.000430	2.70	<0.000010	7.80	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00130	<0.0030	104
		4-Aug-2021	1.10	0.000510	2.90	<0.000010	8.00	0.260	<0.000010	<0.00010	<0.010	0.000180	0.00120	<0.0030	121
		1-Sep-2021	1.10	0.000480	3.20	<0.000010	8.00	0.260	<0.000010	<0.00010	<0.010	0.000210	0.00120	<0.0030	105
		4-Oct-2021	1.00	0.000490	3.00	<0.000010	7.70	0.240	<0.000010	<0.00010	<0.010	0.000190	0.00120	<0.0030	121
		4-Nov-2021	1.30	0.00120	3.10	<0.000010	8.20	0.350	<0.000010	<0.00010	<0.010	0.000500	0.000850	<0.0030	159
		1-Dec-2021	1.20	0.000890	3.20	<0.000010	8.40	0.350	<0.000010	<0.00010	<0.010	0.000450	0.000840	<0.0030	152
	HAC-05a	12-Jan-2021	1.10	0.000850	3.40	<0.000010	7.80	0.280	<0.000010	<0.00010	<0.010	0.000300	0.000950	<0.0030	128
		1-Feb-2021	1.20	0.00100	3.50	<0.000010	8.40	0.290	<0.000010	<0.00010	<0.010	0.000280	0.00110	<0.0030	124
		8-Mar-2021	1.10	0.00100	3.40	<0.000010	8.00	0.320	<0.000010	<0.00010	<0.010	0.000300	0.000940	<0.0030	153
		7-Apr-2021	1.10	0.00110	3.70	<0.000010	7.80	0.310	<0.000010	<0.00010	<0.010	0.000390	0.000790	<0.0030	152
		3-May-2021	0.770	0.000750	2.60	<0.000010	5.40	0.210	<0.000010	<0.00010	<0.010	0.000240	0.000710	<0.0030	92
		1-Jun-2021	1.10	0.000760	3.10	<0.000010	7.90	0.260	<0.000010	<0.00010	<0.010	0.000220	0.00110	<0.0030	120
		7-Jul-2021	1.00	0.00130	3.10	<0.000010	8.00	0.280	<0.000010	<0.00010	<0.010	0.000260	0.00130	<0.0030	124
		4-Aug-2021	1.10	0.00190	3.20	<0.000010	8.70	0.320	<0.000010	<0.00010	<0.010	0.000290	0.00110	<0.0030	144
		1-Sep-2021	1.20	0.00210	3.80	<0.000010	9.10	0.330	<0.000010	<0.00010	<0.010	0.000340	0.00100	<0.0030	147
		4-Oct-2021	1.10	0.00190	3.50	<0.000010	8.50	0.290	<0.000010	<0.00010	<0.010	0.000300	0.00100	<0.0030	156
		4-Nov-2021	1.30	0.00280	3.60	<0.000010	8.40	0.370	<0.000010	<0.00010	<0.010	0.000750	0.000860	<0.0030	186
		1-Dec-2021	1.20	0.00240	3.60	<0.000010	8.90	0.400	<0.000010	<0.00010	<0.010	0.000590	0.000770	<0.0030	179
	HAC-14	3-May-2021	0.880	0.000700	3.10	<0.000010	5.10	0.220	<0.000010	<0.00010	<0.010	0.000250	0.000780	<0.0030	91
		1-Jun-2021	1.10	0.000700	3.10	<0.000010	8.30	0.280	<0.000010	<0.00010	<0.010	0.000250	0.00100	<0.0030	122
		7-Jul-2021	1.10	0.00140	3.10	<0.000010	8.20	0.300	<0.000010	<0.00010	<0.010	0.000300	0.00140	<0.0030	124
		4-Aug-2021	1.30	0.00180	4.00	<0.000010	9.20	0.370	<0.000010	<0.00010	<0.010	0.000340	0.00130	<0.0030	156
		1-Sep-2021	1.30	0.00200	4.20	<0.000010	9.70	0.380	<0.000010	<0.00010	<0.010	0.000470	0.000970	<0.0030	169
		4-Oct-2021	1.20	0.00170	3.80	<0.000010	8.90	0.340	<0.000010	<0.00010	<0.010	0.000380	0.000850	<0.0030	164
		4-Nov-2021	1.20	0.00250	3.70	<0.000010	7.80	0.390	<0.000010	<0.00010	<0.010	0.000830	0.000700	<0.0030	187

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2021	HAC-08	12-Jan-2021	1.10	0.000850	3.60	<0.000010	7.90	0.290	<0.000010	<0.00010	<0.010	0.000370	0.000850	<0.0030	130
		1-Feb-2021	1.10	0.000880	3.60	<0.000010	8.40	0.320	<0.000010	<0.00010	<0.010	0.000340	0.000850	<0.0030	128
		8-Mar-2021	1.10	0.00110	3.60	<0.000010	8.30	0.340	<0.000010	<0.00010	<0.010	0.000380	0.000800	<0.0030	159
		7-Apr-2021	0.980	0.000800	3.90	<0.000010	6.40	0.280	<0.000010	<0.00010	<0.010	0.000440	0.000670	<0.0030	138
		3-May-2021	0.890	0.000670	3.30	<0.000010	5.30	0.210	<0.000010	<0.00010	<0.010	0.000270	0.000760	0.00460	92
		1-Jun-2021	1.10	0.000770	3.10	<0.000010	8.00	0.270	<0.000010	<0.00010	<0.010	0.000270	0.00100	<0.0030	124
		7-Jul-2021	1.20	0.00130	3.10	<0.000010	8.20	0.330	<0.000010	<0.00010	<0.010	0.000320	0.00130	<0.0030	137
		4-Aug-2021	1.40	0.00190	4.00	<0.000010	9.90	0.380	<0.000010	<0.00010	<0.010	0.000400	0.00130	0.00380	158
		1-Sep-2021	1.40	0.00200	4.40	<0.000010	10.0	0.400	<0.000010	<0.00010	<0.010	0.000540	0.000930	<0.0030	165
		4-Oct-2021	1.20	0.00140	3.60	<0.000010	9.60	0.380	<0.000010	<0.00010	<0.010	0.000470	0.000870	<0.0030	167
		4-Nov-2021	1.30	0.00240	3.80	<0.000010	8.30	0.410	<0.000010	<0.00010	<0.010	0.000900	0.000680	<0.0030	153
		1-Dec-2021	1.20	0.00200	3.90	<0.000010	9.30	0.400	<0.000010	<0.00010	<0.010	0.000770	0.000580	<0.0030	171
	W10	12-Jan-2021	0.570	0.000120	5.10	<0.000010	3.20	0.130	<0.000010	<0.00010	<0.010	0.000100	<0.00050	<0.0030	78
		3-May-2021	0.520	0.0000500	3.60	<0.000010	1.60	0.0700	<0.000010	<0.00010	<0.010	0.0000560	0.000530	<0.0030	37
		4-Aug-2021	1.50	0.000110	4.60	<0.000010	13.0	0.370	<0.000010	<0.00010	<0.010	0.000510	0.000620	<0.0030	184
		4-Nov-2021	1.00	0.000160	4.60	<0.000010	5.10	0.200	<0.000010	<0.00010	<0.010	0.000250	<0.00050	<0.0030	119
	EDC-01a	12-Jan-2021	0.880	0.000540	4.30	<0.000010	6.10	0.230	<0.000010	<0.00010	<0.010	0.000300	0.000690	<0.0030	113
		1-Feb-2021	0.940	0.000540	4.40	<0.000010	6.70	0.250	<0.000010	<0.00010	<0.010	0.000300	0.000700	<0.0030	119
		8-Mar-2021	0.930	0.000610	4.60	<0.000010	6.40	0.270	<0.000010	<0.00010	<0.010	0.000300	0.000650	<0.0030	138
		7-Apr-2021	0.780	0.000510	4.60	<0.000010	4.80	0.200	<0.000010	<0.00010	<0.010	0.000300	0.000590	<0.0030	107
		3-May-2021	0.640	0.000180	3.80	<0.000010	2.50	0.100	<0.000010	<0.00010	<0.010	0.0000980	0.000650	<0.0030	53
		1-Jun-2021	0.870	0.000400	3.70	<0.000010	5.20	0.200	<0.000010	<0.00010	<0.010	0.000190	0.000970	<0.0030	96
		7-Jul-2021	1.20	0.00120	3.40	<0.000010	8.30	0.320	<0.000010	<0.00010	<0.010	0.000370	0.00110	<0.0030	144
		4-Aug-2021	1.40	0.00170	4.10	<0.000010	10.0	0.370	<0.000010	<0.00010	<0.010	0.000500	0.00130	<0.0030	167
		1-Sep-2021	1.40	0.00160	4.60	<0.000010	11.0	0.390	<0.000010	<0.00010	<0.010	0.000640	0.000930	<0.0030	171
		4-Oct-2021	1.20	0.00150	4.10	<0.000010	9.90	0.350	<0.000010	<0.00010	<0.010	0.000510	0.000800	<0.0030	175
		4-Nov-2021	1.10	0.00130	4.20	<0.000010	6.90	0.300	<0.000010	<0.00010	<0.010	0.000640	0.000500	<0.0030	155
		1-Dec-2021	0.940	0.00130	4.50	<0.000010	7.10	0.290	<0.000010	<0.00010	<0.010	0.000540	0.000520	<0.0030	143
	HAC-13	12-Jan-2022	1.20	0.000440	3.30	<0.000010	8.30	0.280	<0.000010	<0.00010	<0.010	0.000230	0.00120	<0.0030	123
		7-Feb-2022	1.00	0.000450	3.20	<0.000010	7.50	0.280	<0.000010	<0.00010	<0.010	0.000250	0.00110	<0.0030	132
		9-Mar-2022	1.10	0.000640	3.80	<0.000010	8.30	0.290	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	135
		5-Apr-2022	1.10	0.00160	4.20	<0.000010	7.50	0.360	<0.000010	<0.00010	<0.010	0.000490	0.000970	<0.0030	152
		3-May-2022	0.960	0.00160	3.60	<0.000010	5.40	0.300	<0.000010	<0.00010	<0.010	0.000530	0.000690	<0.0030	125
		1-Jun-2022	1.10	0.000470	3.30	0.0000200	7.00	0.230	<0.000010	<0.00010	<0.010	0.000200	0.00120	0.0110	125
		5-Jul-2022	0.980	0.000540	3.10	<0.000010	7.80	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00120	<0.0030	113
		3-Aug-2022	0.900	0.000610	2.90	<0.000010	6.70	0.250	<0.000010	<0.00010	<0.010	0.000190	0.00130	<0.0030	109
		8-Sep-2022	0.980	0.000660	2.80	<0.000010	7.10	0.230	<0.000010	<0.00010	<0.010	0.000210	0.00130	<0.0030	107
		5-Oct-2022	1.00	0.000630	2.60	<0.000010	6.90	0.230	<0.000010	<0.00010	<0.010	0.000200	0.00130	<0.0030	115
		2-Nov-2022	0.940	0.000590	3.00	<0.000010	7.00	0.250	<0.000010	<0.00010	<0.010	0.000230	0.00110	<0.0030	115
		7-Dec-2022	1.00	0.000510	3.10	<0.000010	7.10	0.230	<0.000010	<0.00010	<0.010	0.000190	0.00120	<0.0030	111
	HAC-05a	12-Jan-2022	1.20	0.00140	3.80	<0.000010	8.50	0.320	<0.000010	<0.00010	<0.010	0.000320	0.00110	<0.0030	144
		7-Feb-2022	1.10	0.00110	3.60	<0.000010	8.00	0.320	<0.000010	<0.00010	<0.010	0.000330	0.00100	<0.0030	151
		9-Mar-2022	1.20	0.00170	4.10	<0.000010	8.80	0.330	<0.000010	<0.00010	<0.010	0.000450	0.00110	<0.0030	164
		5-Apr-2022	1.20	0.00250	4.40	<0.000010	7.80	0.400	<0.000010	<0.00010	<0.010	0.000570	0.000840	<0.0030	185
		3-May-2022	1.00	0.00220	4.00	0.0000120	5.00	0.290	<0.000010	<0.00010	<0.010	0.000530	0.000740	<0.0030	134
		1-Jun-2022	1.00	0.000690	3.20	<0.000010	7.20	0.240	<0.000010	<0.00010	<0.010	0.000230	0.00120	<0.0030	128
		5-Jul-2022	1.00	0.000920	3.30	<0.000010	8.20	0.260	<0.000010	<0.00010	<0.010	0.000230	0.00130	<0.0030	121
		3-Aug-2022	1.00	0.00180	3.50	<0.000010	7.60	0.290	<0.000010	<0.00010	<0.010	0.000250	0.00120	<0.0030	128
		8-Sep-2022	0.990	0.00110	3.10	<0.000010	7.50	0.250	<0.000010	<0.00010	<0.010	0.000240	0.00130	<0.0030	120
		5-Oct-2022	1.00	0.00120	3.00	<0.000010	7.30	0.240	<0.000010	<0.00010	<0.010	0.000240	0.00130	<0.0030	126
		2-Nov-2022	0.950	0.00150	3.50	<0.000010	7.20	0.300	<0.000010	<0.00010	<0.010	0.000320	0.000960	<0.0030	138
		7-Dec-2022	1.10	0.00160	3.80	<0.000010	7.70	0.290	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	138
	HAC-14	3-May-2022	0.840	0.00100	3.90	0.0000120	3.40	0.200	<0.000010	<0.00010	<0.010	0.000370	0.000750	<0.0030	91
		1-Jun-2022	1.00	0.000710	3.30	<0.000010	7.10	0.240	<0.000010	<0.00010	<0.010	0.000240	0.00120	<0.0030	129
		5-Jul-2022	1.10	0.000950	3.50	<0.000010	8.00	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	125
		3-Aug-2022	1.10	0.00130	3.80	<0.000010	7.80	0.310	<0.000010	<0.00010	<0.010	0.000290	0.00120	<0.0030	131
		8-Sep-2022	1.00	0.00110	3.20	<0.000010	7.60	0.260	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	124
		5-Oct-2022	1.10	0.00100	3.20	<0.000010	7.60	0.270	<0.000010	<0.00010	<0.010	0.000270	0.00120	<0.0030	132
		2-Nov-2022	0.940	0.00140	3.60	<0.000010	7.60	0.310	<0.000010	<0.00010	<0.010	0.000390	0.000750	<0.0030	144

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.1: Surface Water Samples Collected Routinely from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Potassium-Dissolved (mg/L)	Selenium-Dissolved (mg/L)	Silicon-Dissolved (mg/L)	Silver-Dissolved (mg/L)	Sodium-Dissolved (mg/L)	Strontium-Dissolved (mg/L)	Thallium-Dissolved (mg/L)	Tin-Dissolved (mg/L)	Titanium-Dissolved (mg/L)	Uranium-Dissolved (mg/L)	Vanadium-Dissolved (mg/L)	Zinc-Dissolved (mg/L)	Hardness (as $CaCO_3$ from total Ca/Mg; mg/L)
2022	HAC-08	12-Jan-2022	1.20	0.00120	4.10	<0.000010	9.20	0.360	<0.000010	<0.00010	<0.010	0.000450	0.000810	<0.0030	153
		7-Feb-2022	1.10	0.00110	3.90	<0.000010	8.60	0.340	<0.000010	<0.00010	<0.010	0.000450	0.000810	<0.0030	161
		9-Mar-2022	1.20	0.00140	4.40	<0.000010	9.00	0.350	<0.000010	<0.00010	<0.010	0.000560	0.000830	<0.0030	168
		5-Apr-2022	0.910	0.00140	4.30	<0.000010	5.70	0.290	<0.000010	<0.00010	<0.010	0.000460	0.000830	<0.0030	132
		3-May-2022	0.780	0.000910	4.20	<0.000010	3.10	0.170	<0.000010	<0.00010	<0.010	0.000310	0.000740	<0.0030	82
		1-Jun-2022	1.10	0.000710	3.40	0.0000260	7.30	0.240	<0.000010	<0.00010	<0.010	0.000260	0.00120	0.00820	132
		5-Jul-2022	1.00	0.00100	3.50	<0.000010	7.80	0.290	<0.000010	<0.00010	<0.010	0.000280	0.00120	<0.0030	124
		3-Aug-2022	1.00	0.00130	3.60	<0.000010	7.50	0.320	<0.000010	<0.00010	<0.010	0.000340	0.00120	<0.0030	130
		8-Sep-2022	1.00	0.00120	3.30	<0.000010	7.80	0.260	<0.000010	<0.00010	<0.010	0.000280	0.00110	<0.0030	126
		5-Oct-2022	1.10	0.00110	3.30	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000300	0.00120	<0.0030	135
		2-Nov-2022	0.950	0.00140	3.60	<0.000010	7.70	0.320	<0.000010	<0.00010	<0.010	0.000430	0.000680	<0.0030	147
		7-Dec-2022	1.10	0.00160	4.00	<0.000010	8.80	0.310	<0.000010	<0.00010	<0.010	0.000410	0.000740	<0.0030	151
	W10	7-Feb-2022	0.750	0.0000880	5.20	<0.000010	4.80	0.180	<0.000010	<0.00010	<0.010	0.000160	<0.00050	<0.0030	106
		5-Apr-2022	0.560	0.000190	4.50	<0.000010	2.60	0.100	<0.000010	<0.00010	<0.010	0.0000710	0.000640	<0.0030	64
		3-Aug-2022	0.960	0.000110	5.10	<0.000010	6.30	0.240	<0.000010	<0.00010	<0.010	0.000210	0.000620	<0.0030	119
	EDC-01a	12-Jan-2022	1.10	0.00120	4.30	<0.000010	8.70	0.350	<0.000010	<0.00010	<0.010	0.000450	0.000740	<0.0030	151
		7-Feb-2022	0.960	0.000770	4.40	<0.000010	7.20	0.280	<0.000010	<0.00010	<0.010	0.000360	0.000610	<0.0030	144
		9-Mar-2022	0.860	0.000760	5.10	<0.000010	6.30	0.230	<0.000010	<0.00010	<0.010	0.000360	0.000700	<0.0030	119
		5-Apr-2022	0.660	0.000360	4.60	<0.000010	3.40	0.140	<0.000010	<0.00010	<0.010	0.000160	0.000660	<0.0030	77
		3-May-2022	0.590	0.000230	4.50	<0.000010	2.30	0.0910	<0.000010	<0.00010	<0.010	0.000110	0.000720	<0.0030	50
		1-Jun-2022	0.750	0.000420	3.60	<0.000010	4.40	0.160	<0.000010	<0.00010	<0.010	0.000160	0.000950	<0.0030	89
		5-Jul-2022	0.850	0.000690	3.90	<0.000010	6.00	0.220	<0.000010	<0.00010	<0.010	0.000220	0.00100	<0.0030	104
		3-Aug-2022	1.10	0.00100	4.30	<0.000010	8.10	0.320	<0.000010	<0.00010	<0.010	0.000370	0.00110	<0.0030	139
		8-Sep-2022	1.00	0.00100	3.40	<0.000010	7.90	0.260	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	130
		5-Oct-2022	1.10	0.00100	3.20	<0.000010	8.10	0.280	<0.000010	<0.00010	<0.010	0.000340	0.00110	<0.0030	141
		2-Nov-2022	0.980	0.00120	4.00	<0.000010	8.30	0.320	<0.000010	<0.00010	<0.010	0.000480	0.000650	<0.0030	154
		7-Dec-2022	1.10	0.00120	4.50	<0.000010	8.90	0.310	<0.000010	<0.00010	<0.010	0.000460	0.000650	<0.0030	154
2023	HAC-13	4-Jan-2023	1.00	0.000600	3.30	<0.000010	7.50	0.260	<0.000010	<0.00010	<0.010	0.000200	0.00130	<0.0030	115
		8-Feb-2023	1.00	0.000630	3.50	<0.000010	7.60	0.260	<0.000010	<0.00010	<0.010	0.000220	0.00130	<0.0030	122
		7-Mar-2023	0.960	0.000510	3.30	<0.000010	7.80	0.260	<0.000010	<0.00010	<0.010	0.000200	0.00110	<0.0030	114
		3-Apr-2023	1.00	0.000520	3.30	<0.000010	8.10	0.270	<0.000010	<0.00010	<0.010	0.000260	0.00120	<0.0030	125
		1-May-2023	0.980	0.00120	3.00	<0.000010	4.10	0.220	<0.000010	<0.00010	<0.010	0.000320	0.000860	<0.0030	109
		5-Jun-2023	0.920	0.000500	2.90	<0.000010	6.90	0.240	<0.000010	<0.00010	<0.010	0.000180	0.00130	<0.0030	115
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	1.00	0.000490	3.20	<0.000010	7.90	0.270	<0.000010	<0.00010	<0.010	0.000190	0.00160	<0.0030	112
		6-Sep-2023	0.960	0.000440	2.90	<0.000010	7.80	0.250	<0.000010	<0.00010	<0.010	0.000200	0.00130	<0.0030	105
	HAC-05a	4-Jan-2023	1.00	0.00160	3.80	<0.000010	8.10	0.310	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	146
		8-Feb-2023	1.00	0.00130	3.70	<0.000010	8.20	0.280	<0.000010	<0.00010	<0.010	0.000300	0.00120	<0.0030	138
		7-Mar-2023	1.00	0.00110	3.50	<0.000010	8.50	0.290	<0.000010	<0.00010	<0.010	0.000260	0.00110	<0.0030	130
		3-Apr-2023	1.20	0.00130	3.50	<0.000010	9.00	0.310	<0.000010	<0.00010	<0.010	0.000350	0.00110	<0.0030	144
		1-May-2023	1.10	0.00180	3.80	0.0000200	3.90	0.240	<0.000010	<0.00010	<0.010	0.000350	0.000920	<0.0030	125
		5-Jun-2023	0.930	0.00150	3.10	<0.000010	7.00	0.270	<0.000010	<0.00010	<0.010	0.000250	0.00120	<0.0030	137
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	1.00	0.000820	3.40	<0.000010	7.80	0.280	<0.000010	<0.00010	<0.010	0.000210	0.00150	<0.0030	121
		6-Sep-2023	0.990	0.000980	3.20	<0.000010	8.20	0.280	<0.000010	<0.00010	<0.010	0.000250	0.00120	<0.0030	123
	HAC-14	1-May-2023	0.840	0.000940	4.00	0.0000150	2.70	0.150	<0.000010	<0.00010	<0.010	0.000230	0.00110	<0.0030	81
		5-Jun-2023	1.10	0.00140	3.50	<0.000010	7.50	0.310	<0.000010	<0.00010	<0.010	0.000290	0.00110	<0.0030	146
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	1.00	0.00100	3.60	<0.000010	7.90	0.290	<0.000010	<0.00010	<0.010	0.000230	0.00130	<0.0030	126
		6-Sep-2023	1.00	0.00100	3.40	<0.000010	8.50	0.300	<0.000010	<0.00010	<0.010	0.000280	0.00110	0.00380	126
	HAC-08	4-Jan-2023	1.00	0.00170	4.20	<0.000010	8.50	0.360	<0.000010	<0.00010	<0.010	0.000440	0.000800	<0.0030	152
		8-Feb-2023	1.10	0.00130	4.10	<0.000010	8.50	0.310	<0.000010	<0.00010	<0.010	0.000400	0.000870	<0.0030	146
		7-Mar-2023	1.00	0.00110	3.80	<0.000010	8.60	0.320	<0.000010	<0.00010	<0.010	0.000340	0.000860	<0.0030	135
		3-Apr-2023	1.10	0.00140	3.80	<0.000010	8.70	0.330	<0.000010	<0.00010	<0.010	0.000460	0.000960	<0.0030	151
		1-May-2023	0.780	0.000950	4.10	0.0000130	2.70	0.150	<0.000010	<0.00010	<0.010	0.000220	0.000910	<0.0030	76
		5-Jun-2023	1.10	0.00130	3.40	<0.000010	7.60	0.310	<0.000010	<0.00010	<0.010	0.000320	0.00120	<0.0030	146
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	1.10	0.000800	3.60	<0.000010	8.20	0.300	<0.000010	<0.00010	<0.010	0.000250	0.00130	<0.0030	125
		6-Sep-2023	1.00	0.000940	3.40	<0.000010	8.40	0.310	<0.000010	<0.00010	<0.010	0.000310	0.00110	<0.0030	130
	W10	13-Jun-2023	1.10	0.000180	4.80	<0.000010	6.90	0.240	<0.000010	<0.00010	<0.010	0.000200	0.000590	<0.0030	126
	EDC-01a	4-Jan-2023	1.00	0.00130	4.60	<0.000010	8.50	0.330	<0.000010	<0.00010	<0.010	0.000460	0.000660	<0.0030	148
		8-Feb-2023	1.00	0.00100	4.50	<0.000010	8.20	0.300	<0.000010	<0.00010	<0.010	0.000430	0.000740	<0.0030	148
		7-Mar-2023	1.00	0.000970	4.20	<0.000010	8.60	0.310	<0.000010	<0.00010	<0.010	0.000360	0.000750	<0.0030	136
		3-Apr-2023	1.00	0.00110	4.40	<0.000010	8.10	0.290	<0.000010	<0.00010	<0.010	0.000440	0.000660	<0.0030	143
		1-May-2023	0.690	0.000130	3.80	<0.000010	2.00	0.0710	<0.000010	<0.00010	<0.010	0.0000800	0.000760	<0.0030	44
		5-Jun-2023	1.10	0.00110	3.80	<0.000010	7.40	0.300	<0.000010	<0.00010	<0.010	0.000370	0.000990	<0.0030	148
		6-Jul-2023	-	-	-	-	-	-	-	-	-	-	-	-	-
		2-Aug-2023	1.10	0.000920	3.70	<0.000010	8.60	0.320	<0.000010	<0.00010	<0.010	0.000290	0.00130	<0.0030	129
		6-Sep-2023	1.00	0.000870	3.60	<0.000010	8.90	0.310	<0.000010	<0.00010	<0.010	0.000360	0.00100	<0.0030	137

Notes: mg/L = milligrams per litre, % = percent, NTU = nephelometric turbidity units, µs/cm = miscroSiemens per centimeter, "-" = data not available, "<" = results below laboratory reporting limit. Results are displayed to three significant digits.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2015	HAC-13	03-Dec-15	Cadmium- Dissolved	mg/L	0.0000110	245	6.50	8.30	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0140	245	6.50	8.30	0.00610	0.00610
			Manganese- Total	mg/L	0.140	245	6.50	8.30	1.70	1.70
			Nickel- Total	mg/L	0.000510	245	6.50	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	245	6.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	245	6.50	8.30	0.120	0.120
		07-Dec-15	Cadmium- Dissolved	mg/L	0.0000120	216	6.30	8.60	0.000370	0.000370
			Copper- Dissolved	mg/L	0.0130	216	6.30	8.60	0.00720	0.00720
			Manganese- Total	mg/L	0.100	216	6.30	8.60	1.60	1.60
			Nickel- Total	mg/L	0.000510	216	6.30	8.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	216	6.30	8.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00640	216	6.30	8.60	0.100	0.100
		15-Dec-15	Cadmium- Dissolved	mg/L	0.0000450	345	8.10	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0260	345	8.10	8.00	0.00600	0.00600
			Manganese- Total	mg/L	0.380	345	8.10	8.00	2.10	2.10
			Nickel- Total	mg/L	0.000860	345	8.10	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	345	8.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	345	8.10	8.00	0.190	0.190
		22-Dec-15	Cadmium- Dissolved	mg/L	0.0000340	309	8.00	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0220	309	8.00	8.00	0.00600	0.00600
			Manganese- Total	mg/L	0.270	309	8.00	8.00	2.00	2.00
			Nickel- Total	mg/L	0.000680	309	8.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	309	8.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	309	8.00	8.00	0.170	0.170
		29-Dec-15	Cadmium- Dissolved	mg/L	0.0000260	276	6.70	8.10	0.000450	0.000450
			Copper- Dissolved	mg/L	0.0190	276	6.70	8.10	0.00530	0.00530
			Manganese- Total	mg/L	0.200	276	6.70	8.10	1.80	1.80
			Nickel- Total	mg/L	0.000650	276	6.70	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	276	6.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	276	6.70	8.10	0.150	0.150
	HAC-05a	09-Nov-15	Cadmium- Dissolved	mg/L	<0.0000050	167	6.80	8.30	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00760	167	6.80	8.30	0.00590	0.00590
			Manganese- Total	mg/L	0.100	167	6.80	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	167	6.80	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	167	6.80	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	167	6.80	8.30	0.0650	0.0650
		03-Dec-15	Cadmium- Dissolved	mg/L	0.0000340	564	2.80	7.80	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00390	564	2.80	7.80	0.00160	0.00160
			Manganese- Total	mg/L	0.180	564	2.80	7.80	2.60	2.60
			Nickel- Total	mg/L	0.000740	564	2.80	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	564	2.80	7.80	0.00150	0.00150
			Zinc- Total	mg/L	0.00580	564	2.80	7.80	0.190	0.190
	HAC-08	01-Oct-15	Cadmium- Dissolved	mg/L	<0.0000050	200	3.80	8.40	0.000350	0.000350
			Copper- Dissolved	mg/L	0.0120	200	3.80	8.40	0.00380	0.00380
			Manganese- Total	mg/L	0.00450	200	3.80	8.40	1.50	1.50
			Nickel- Total	mg/L	<0.00050	200	3.80	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	200	3.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	200	3.80	8.40	0.0900	0.0900
		09-Nov-15	Cadmium- Dissolved	mg/L	0.00000580	191	6.40	8.40	0.000340	0.000340
			Copper- Dissolved	mg/L	0.0120	191	6.40	8.40	0.00600	0.00600
			Manganese- Total	mg/L	0.0310	191	6.40	8.40	1.40	1.40
			Nickel- Total	mg/L	0.000640	191	6.40	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	191	6.40	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	191	6.40	8.40	0.0830	0.0830
		03-Dec-15	Cadmium- Dissolved	mg/L	0.0000280	500	2.80	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00790	500	2.80	8.00	0.00230	0.00230
			Manganese- Total	mg/L	0.310	500	2.80	8.00	2.60	2.60
			Nickel- Total	mg/L	0.00670	500	2.80	8.00	0.150	0.150
			Silver- Total	mg/L	0.0000960	500	2.80	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.0200	500	2.80	8.00	0.190	0.190
	W10	27-Jan-15	Cadmium- Dissolved	mg/L	<0.000010	74.0	18.0	7.20	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00230	74.0	18.0	7.20	0.00400	0.00400
			Manganese- Total	mg/L	0.00980	74.0	18.0	7.20	0.930	0.930
			Nickel- Total	mg/L	0.00130	74.0	18.0	7.20	0.0760	0.0760
			Silver- Total	mg/L	<0.000010	74.0	18.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	74.0	18.0	7.20	0.00750	0.00750
		02-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	66.0	20.0	7.20	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00270	66.0	20.0	7.20	0.00430	0.00430
			Manganese- Total	mg/L	0.00710	66.0	20.0	7.20	0.890	0.890
			Nickel- Total	mg/L	0.00130	66.0	20.0	7.20	0.0700	0.0700
			Silver- Total	mg/L	<0.000010	66.0	20.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	66.0	20.0	7.20	0.00750	0.00750
		10-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	66.0	19.0	7.20	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00250	66.0	19.0	7.20	0.00420	0.00420
			Manganese- Total	mg/L	0.00860	66.0	19.0	7.20	0.890	0.890
			Nickel- Total	mg/L	0.00130	66.0	19.0	7.20	0.0700	0.0700
			Silver- Total	mg/L	<0.000010	66.0	19.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	66.0	19.0	7.20	0.00750	0.00750
		17-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	60.0	22.0	7.20	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00310	60.0	22.0	7.20	0.00420	0.00420
			Manganese- Total	mg/L	0.0110	60.0	22.0	7.20	0.870	0.870
			Nickel- Total	mg/L	0.00150	60.0	22.0	7.20	0.0650	0.0650
			Silver- Total	mg/L	<0.000010	60.0	22.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	60.0	22.0	7.20	0.00750	0.00750
		24-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	62.0	21.0	7.80	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00280	62.0	21.0	7.80	0.00830	0.00830
			Manganese- Total	mg/L	0.00650	62.0	21.0	7.80	0.880	0.880
			Nickel- Total	mg/L	0.00120	62.0	21.0	7.80	0.0670	0.0670
			Silver- Total	mg/L	<0.000010	62.0	21.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	62.0	21.0	7.80	0.00750	0.00750
		02-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	70.0	20.0	7.20	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00250	70.0	20.0	7.20	0.00430	0.00430
			Manganese- Total	mg/L	0.00480	70.0	20.0	7.20	0.910	0.910
			Nickel- Total	mg/L	0.00110	70.0	20.0	7.20	0.0730	0.0730
			Silver- Total	mg/L	<0.000010	70.0	20.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	70.0	20.0	7.20	0.00750	0.00750
		10-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	70.0	19.0	7.20	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00270	70.0	19.0	7.20	0.00410	0.00410
			Manganese- Total	mg/L	0.00700	70.0	19.0	7.20	0.910	0.910
			Nickel- Total	mg/L	0.00120	70.0	19.0	7.20	0.0730	0.0730
			Silver- Total	mg/L	<0.000010	70.0	19.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	70.0	19.0	7.20	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2015	W10	17-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	50.0	23.0	7.20	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00300	50.0	23.0	7.20	0.00390	0.00390
			Manganese- Total	mg/L	0.0130	50.0	23.0	7.20	0.830	0.830
			Nickel- Total	mg/L	0.00150	50.0	23.0	7.20	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	50.0	23.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	23.0	7.20	0.00750	0.00750
		24-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	50.0	20.0	7.20	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00280	50.0	20.0	7.20	0.00390	0.00390
			Manganese- Total	mg/L	0.00990	50.0	20.0	7.20	0.830	0.830
			Nickel- Total	mg/L	0.00140	50.0	20.0	7.20	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	50.0	20.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	20.0	7.20	0.00750	0.00750
		07-Apr-15	Cadmium- Dissolved	mg/L	0.00000820	48.0	21.0	7.20	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00280	48.0	21.0	7.20	0.00390	0.00390
			Manganese- Total	mg/L	0.00930	48.0	21.0	7.20	0.820	0.820
			Nickel- Total	mg/L	0.00150	48.0	21.0	7.20	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	48.0	21.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	48.0	21.0	7.20	0.00750	0.00750
		14-Apr-15	Cadmium- Dissolved	mg/L	<0.0000050	50.0	20.0	7.20	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00250	50.0	20.0	7.20	0.00380	0.00380
			Manganese- Total	mg/L	0.00660	50.0	20.0	7.20	0.820	0.820
			Nickel- Total	mg/L	0.00120	50.0	20.0	7.20	0.0250	0.0250
			Silver- Total	mg/L	0.0000120	50.0	20.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	20.0	7.20	0.00750	0.00750
		04-May-15	Cadmium- Dissolved	mg/L	0.00000570	55.0	18.0	7.20	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00260	55.0	18.0	7.20	0.00350	0.00350
			Manganese- Total	mg/L	0.0100	55.0	18.0	7.20	0.850	0.850
			Nickel- Total	mg/L	0.00120	55.0	18.0	7.20	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	55.0	18.0	7.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	55.0	18.0	7.20	0.00750	0.00750
		23-Jul-15	Cadmium- Dissolved	mg/L	<0.0000050	176	6.60	8.10	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00120	176	6.60	8.10	0.00480	0.00480
			Manganese- Total	mg/L	0.0110	176	6.60	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000650	176	6.60	8.10	0.150	0.150
			Silver- Total	mg/L	0.0000990	176	6.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	176	6.60	8.10	0.0720	0.0720
		06-Aug-15	Cadmium- Dissolved	mg/L	<0.0000050	183	5.40	7.90	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00110	183	5.40	7.90	0.00350	0.00350
			Manganese- Total	mg/L	0.00990	183	5.40	7.90	1.40	1.40
			Nickel- Total	mg/L	0.000610	183	5.40	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	183	5.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	183	5.40	7.90	0.0770	0.0770
		03-Sep-15	Cadmium- Dissolved	mg/L	<0.0000050	189	4.70	8.20	0.000340	0.000340
			Copper- Dissolved	mg/L	0.000850	189	4.70	8.20	0.00370	0.00370
			Manganese- Total	mg/L	0.00450	189	4.70	8.20	1.40	1.40
			Nickel- Total	mg/L	<0.00050	189	4.70	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	189	4.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	189	4.70	8.20	0.0820	0.0820
		01-Oct-15	Cadmium- Dissolved	mg/L	<0.0000050	192	5.00	8.00	0.000340	0.000340
			Copper- Dissolved	mg/L	0.000890	192	5.00	8.00	0.00350	0.00350
			Manganese- Total	mg/L	0.00330	192	5.00	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	192	5.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	192	5.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	192	5.00	8.00	0.0840	0.0840
		05-Nov-15	Cadmium- Dissolved	mg/L	<0.0000050	123	11.0	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00180	123	11.0	8.30	0.00810	0.00810
			Manganese- Total	mg/L	0.00390	123	11.0	8.30	1.10	1.10
			Nickel- Total	mg/L	0.000740	123	11.0	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	11.0	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	11.0	8.30	0.0320	0.0320
		03-Dec-15	Cadmium- Dissolved	mg/L	<0.0000050	138	8.70	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00130	138	8.70	8.00	0.00540	0.00540
			Manganese- Total	mg/L	0.00270	138	8.70	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000640	138	8.70	8.00	0.120	0.120
			Silver- Total	mg/L	0.0000230	138	8.70	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	8.70	8.00	0.0440	0.0440
	EDC-01a	17-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	62.0	22.0	7.50	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00730	62.0	22.0	7.50	0.00610	0.00610
			Manganese- Total	mg/L	0.110	62.0	22.0	7.50	0.880	0.880
			Nickel- Total	mg/L	0.00790	62.0	22.0	7.50	0.0660	0.0660
			Silver- Total	mg/L	0.0000370	62.0	22.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	0.0110	62.0	22.0	7.50	0.00750	0.00750
		24-Feb-15	Cadmium- Dissolved	mg/L	<0.000010	65.0	22.0	7.90	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00350	65.0	22.0	7.90	0.00900	0.00900
			Manganese- Total	mg/L	0.0110	65.0	22.0	7.90	0.890	0.890
			Nickel- Total	mg/L	0.00150	65.0	22.0	7.90	0.0690	0.0690
			Silver- Total	mg/L	<0.000010	65.0	22.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	65.0	22.0	7.90	0.00750	0.00750
		02-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	72.0	21.0	7.50	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00310	72.0	21.0	7.50	0.00640	0.00640
			Manganese- Total	mg/L	0.0120	72.0	21.0	7.50	0.920	0.920
			Nickel- Total	mg/L	0.00130	72.0	21.0	7.50	0.0750	0.0750
			Silver- Total	mg/L	<0.000010	72.0	21.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	72.0	21.0	7.50	0.00750	0.00750
		10-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	72.0	18.0	7.50	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00330	72.0	18.0	7.50	0.00570	0.00570
			Manganese- Total	mg/L	0.0110	72.0	18.0	7.50	0.920	0.920
			Nickel- Total	mg/L	0.00140	72.0	18.0	7.50	0.0740	0.0740
			Silver- Total	mg/L	0.0000150	72.0	18.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	72.0	18.0	7.50	0.00750	0.00750
		17-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	51.0	23.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00420	51.0	23.0	7.50	0.00580	0.00580
			Manganese- Total	mg/L	0.0330	51.0	23.0	7.50	0.830	0.830
			Nickel- Total	mg/L	0.00270	51.0	23.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	0.0000210	51.0	23.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00430	51.0	23.0	7.50	0.00750	0.00750
		24-Mar-15	Cadmium- Dissolved	mg/L	<0.000010	52.0	21.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00350	52.0	21.0	7.50	0.00580	0.00580
			Manganese- Total	mg/L	0.0160	52.0	21.0	7.50	0.840	0.840
			Nickel- Total	mg/L	0.00160	52.0	21.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	52.0	21.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	52.0	21.0	7.50	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2015	EDC-01a	01-Apr-15	Cadmium- Dissolved	mg/L	0.0000120	49.0	27.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00410	49.0	27.0	7.50	0.00580	0.00580
			Manganese- Total	mg/L	0.190	49.0	27.0	7.50	0.820	0.820
			Nickel- Total	mg/L	0.0140	49.0	27.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	0.0000530	49.0	27.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	0.0230	49.0	27.0	7.50	0.00750	0.00750
		07-Apr-15	Cadmium- Dissolved	mg/L	0.00000650	48.0	20.0	7.50	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00320	48.0	20.0	7.50	0.00570	0.00570
			Manganese- Total	mg/L	0.0160	48.0	20.0	7.50	0.820	0.820
			Nickel- Total	mg/L	0.00160	48.0	20.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	48.0	20.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	48.0	20.0	7.50	0.00750	0.00750
		14-Apr-15	Cadmium- Dissolved	mg/L	0.00000590	50.0	20.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00310	50.0	20.0	7.50	0.00570	0.00570
			Manganese- Total	mg/L	0.0110	50.0	20.0	7.50	0.830	0.830
			Nickel- Total	mg/L	0.00130	50.0	20.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	0.0000120	50.0	20.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	20.0	7.50	0.00750	0.00750
		21-Apr-15	Cadmium- Dissolved	mg/L	0.00000560	52.0	18.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00320	52.0	18.0	7.50	0.00520	0.00520
			Manganese- Total	mg/L	0.0100	52.0	18.0	7.50	0.830	0.830
			Nickel- Total	mg/L	0.00120	52.0	18.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	52.0	18.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	52.0	18.0	7.50	0.00750	0.00750
		28-Apr-15	Cadmium- Dissolved	mg/L	0.00000630	55.0	19.0	7.50	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00340	55.0	19.0	7.50	0.00570	0.00570
			Manganese- Total	mg/L	0.0110	55.0	19.0	7.50	0.850	0.850
			Nickel- Total	mg/L	0.00150	55.0	19.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	55.0	19.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	55.0	19.0	7.50	0.00750	0.00750
		04-May-15	Cadmium- Dissolved	mg/L	<0.0000050	56.0	17.0	7.50	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00360	56.0	17.0	7.50	0.00520	0.00520
			Manganese- Total	mg/L	0.0130	56.0	17.0	7.50	0.850	0.850
			Nickel- Total	mg/L	0.00140	56.0	17.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	56.0	17.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	56.0	17.0	7.50	0.00750	0.00750
		02-Jun-15	Cadmium- Dissolved	mg/L	0.00000540	119	11.0	7.70	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00790	119	11.0	7.70	0.00510	0.00510
			Manganese- Total	mg/L	0.0160	119	11.0	7.70	1.10	1.10
			Nickel- Total	mg/L	0.000900	119	11.0	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	119	11.0	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	119	11.0	7.70	0.0290	0.0290
		07-Jul-15	Cadmium- Dissolved	mg/L	0.00000930	173	6.80	7.70	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0120	173	6.80	7.70	0.00360	0.00360
			Manganese- Total	mg/L	0.0190	173	6.80	7.70	1.40	1.40
			Nickel- Total	mg/L	0.000650	173	6.80	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	173	6.80	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	173	6.80	7.70	0.0700	0.0700
		31-Aug-15	Cadmium- Dissolved	mg/L	0.00000980	208	4.70	7.90	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00950	208	4.70	7.90	0.00300	0.00300
			Manganese- Total	mg/L	0.00710	208	4.70	7.90	1.50	1.50
			Nickel- Total	mg/L	0.000590	208	4.70	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	208	4.70	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	208	4.70	7.90	0.0960	0.0960
		08-Sep-15	Cadmium- Dissolved	mg/L	<0.0000050	196	6.20	8.10	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00630	196	6.20	8.10	0.00460	0.00460
			Manganese- Total	mg/L	0.0190	196	6.20	8.10	1.50	1.50
			Nickel- Total	mg/L	0.000790	196	6.20	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	196	6.20	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	196	6.20	8.10	0.0870	0.0870
		01-Oct-15	Cadmium- Dissolved	mg/L	0.00000510	200	5.00	8.10	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00580	200	5.00	8.10	0.00380	0.00380
			Manganese- Total	mg/L	0.0140	200	5.00	8.10	1.50	1.50
			Nickel- Total	mg/L	0.000540	200	5.00	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	200	5.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	200	5.00	8.10	0.0900	0.0900
		15-Oct-15	Cadmium- Dissolved	mg/L	0.0000120	217	4.50	8.40	0.000370	0.000370
			Copper- Dissolved	mg/L	0.00760	217	4.50	8.40	0.00440	0.00440
			Manganese- Total	mg/L	0.0790	217	4.50	8.40	1.60	1.60
			Nickel- Total	mg/L	0.000650	217	4.50	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	217	4.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00320	217	4.50	8.40	0.100	0.100
		20-Oct-15	Cadmium- Dissolved	mg/L	0.00000880	205	5.00	9.10	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00740	205	5.00	9.10	0.00640	0.00640
			Manganese- Total	mg/L	0.0820	205	5.00	9.10	1.50	1.50
			Nickel- Total	mg/L	0.00130	205	5.00	9.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	205	5.00	9.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00480	205	5.00	9.10	0.0940	0.0940
		26-Oct-15	Cadmium- Dissolved	mg/L	0.0000110	217	4.10	8.40	0.000370	0.000370
			Copper- Dissolved	mg/L	0.00620	217	4.10	8.40	0.00390	0.00390
			Manganese- Total	mg/L	0.100	217	4.10	8.40	1.60	1.60
			Nickel- Total	mg/L	0.000790	217	4.10	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	217	4.10	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	217	4.10	8.40	0.100	0.100
		05-Nov-15	Cadmium- Dissolved	mg/L	0.00000560	128	12.0	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00370	128	12.0	8.40	0.00930	0.00930
			Manganese- Total	mg/L	0.00920	128	12.0	8.40	1.20	1.20
			Nickel- Total	mg/L	0.000750	128	12.0	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	12.0	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	12.0	8.40	0.0360	0.0360
		03-Dec-15	Cadmium- Dissolved	mg/L	<0.0000050	163	8.40	8.10	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00460	163	8.40	8.10	0.00610	0.00610
			Manganese- Total	mg/L	0.0140	163	8.40	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000790	163	8.40	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	163	8.40	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	163	8.40	8.10	0.0620	0.0620

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	HAC-13	05-Jan-16	Cadmium- Dissolved	mg/L	0.00000730	154	5.60	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00860	154	5.60	8.00	0.00360	0.00360
			Manganese- Total	mg/L	0.0580	154	5.60	8.00	1.30	1.30
			Nickel- Total	mg/L	0.000530	154	5.60	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	5.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	5.60	8.00	0.0560	0.0560
		07-Jan-16	Cadmium- Dissolved	mg/L	<0.0000050	147	6.00	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00500	147	6.00	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.0360	147	6.00	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	6.00	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	6.00	8.00	0.0500	0.0500
		12-Jan-16	Cadmium- Dissolved	mg/L	0.00000510	147	5.80	7.80	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00510	147	5.80	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.0370	147	5.80	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	5.80	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	5.80	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	5.80	7.80	0.0500	0.0500
		19-Jan-16	Cadmium- Dissolved	mg/L	<0.0000050	151	6.10	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00520	151	6.10	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0360	151	6.10	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	6.10	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	6.10	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	6.10	8.10	0.0530	0.0530
		26-Jan-16	Cadmium- Dissolved	mg/L	0.00000680	164	6.40	7.80	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00800	164	6.40	7.80	0.00360	0.00360
			Manganese- Total	mg/L	0.0670	164	6.40	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	164	6.40	7.80	0.140	0.140
			Silver- Total	mg/L	<0.000010	164	6.40	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	6.40	7.80	0.0630	0.0630
		01-Feb-16	Cadmium- Dissolved	mg/L	0.00000640	167	6.30	7.70	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00720	167	6.30	7.70	0.00330	0.00330
			Manganese- Total	mg/L	0.0730	167	6.30	7.70	1.30	1.30
			Nickel- Total	mg/L	<0.00050	167	6.30	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	167	6.30	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	167	6.30	7.70	0.0650	0.0650
		09-Feb-16	Cadmium- Dissolved	mg/L	<0.0000050	161	6.80	7.70	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00650	161	6.80	7.70	0.00350	0.00350
			Manganese- Total	mg/L	0.0660	161	6.80	7.70	1.30	1.30
			Nickel- Total	mg/L	<0.00050	161	6.80	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	161	6.80	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	161	6.80	7.70	0.0610	0.0610
		15-Feb-16	Cadmium- Dissolved	mg/L	0.00000920	162	7.30	7.40	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00830	162	7.30	7.40	0.00270	0.00270
			Manganese- Total	mg/L	0.0970	162	7.30	7.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	162	7.30	7.40	0.140	0.140
			Silver- Total	mg/L	<0.000010	162	7.30	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	162	7.30	7.40	0.0620	0.0620
		22-Feb-16	Cadmium- Dissolved	mg/L	0.00000860	164	7.50	8.10	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00770	164	7.50	8.10	0.00530	0.00530
			Manganese- Total	mg/L	0.0780	164	7.50	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	164	7.50	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	164	7.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	7.50	8.10	0.0630	0.0630
		24-Feb-16	Cadmium- Dissolved	mg/L	0.00000810	154	7.50	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00740	154	7.50	7.80	0.00410	0.00410
			Manganese- Total	mg/L	0.0770	154	7.50	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	154	7.50	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	7.50	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	7.50	7.80	0.0560	0.0560
		29-Feb-16	Cadmium- Dissolved	mg/L	0.0000130	158	7.00	8.10	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00800	158	7.00	8.10	0.00500	0.00500
			Manganese- Total	mg/L	0.0870	158	7.00	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	158	7.00	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	158	7.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	158	7.00	8.10	0.0580	0.0580
		02-Mar-16	Cadmium- Dissolved	mg/L	0.00000620	152	6.90	8.30	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00740	152	6.90	8.30	0.00560	0.00560
			Manganese- Total	mg/L	0.0720	152	6.90	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	152	6.90	8.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	152	6.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	152	6.90	8.30	0.0540	0.0540
		08-Mar-16	Cadmium- Dissolved	mg/L	0.0000440	270	11.0	8.10	0.000440	0.000440
			Copper- Dissolved	mg/L	0.0310	270	11.0	8.10	0.00890	0.00890
			Manganese- Total	mg/L	0.370	270	11.0	8.10	1.80	1.80
			Nickel- Total	mg/L	0.000970	270	11.0	8.10	0.150	0.150
			Silver- Total	mg/L	0.0000730	270	11.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00330	270	11.0	8.10	0.140	0.140
		15-Mar-16	Cadmium- Dissolved	mg/L	0.0000190	169	9.60	8.00	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0130	169	9.60	8.00	0.00640	0.00640
			Manganese- Total	mg/L	0.120	169	9.60	8.00	1.30	1.30
			Nickel- Total	mg/L	0.00150	169	9.60	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	169	9.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	169	9.60	8.00	0.0670	0.0670
		23-Mar-16	Cadmium- Dissolved	mg/L	0.0000940	383	12.0	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0550	383	12.0	8.00	0.00940	0.00940
			Manganese- Total	mg/L	0.700	383	12.0	8.00	2.30	2.30
			Nickel- Total	mg/L	0.00230	383	12.0	8.00	0.150	0.150
			Silver- Total	mg/L	0.0000360	383	12.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00820	383	12.0	8.00	0.190	0.190
		29-Mar-16	Cadmium- Dissolved	mg/L	0.0000740	420	12.0	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0540	420	12.0	8.00	0.00940	0.00940
			Manganese- Total	mg/L	0.700	420	12.0	8.00	2.50	2.50
			Nickel- Total	mg/L	0.00230	420	12.0	8.00	0.150	0.150
			Silver- Total	mg/L	0.0000340	420	12.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00950	420	12.0	8.00	0.190	0.190
		04-Apr-16	Cadmium- Dissolved	mg/L	0.0000850	293	18.0	7.90	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0770	293	18.0	7.90	0.0120	0.0120
			Manganese- Total	mg/L	0.650	293	18.0	7.90	1.90	1.90
			Nickel- Total	mg/L	0.00310	293	18.0	7.90	0.150	0.150
			Silver- Total	mg/L	0.0000720	293	18.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.0120	293	18.0	7.90	0.160	0.160
		11-Apr-16	Cadmium- Dissolved	mg/L	0.00000660	122	7.90	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.0110	122	7.90	8.30	0.00590	0.00590
			Manganese- Total	mg/L	0.0600	122	7.90	8.30	1.10	1.10
			Nickel- Total	mg/L	0.000570	122	7.90	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	7.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	7.90	8.30	0.0320	0.0320

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	HAC-13	13-Apr-16	Cadmium- Dissolved	mg/L	0.00000540	145	6.70	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00860	145	6.70	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.0480	145	6.70	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000930	145	6.70	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	6.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	6.70	8.20	0.0490	0.0490
		19-Apr-16	Cadmium- Dissolved	mg/L	<0.0000050	138	6.40	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00570	138	6.40	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.0980	138	6.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	6.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	6.40	8.20	0.0440	0.0440
		25-Apr-16	Cadmium- Dissolved	mg/L	<0.0000050	132	8.20	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00640	132	8.20	8.30	0.00610	0.00610
			Manganese- Total	mg/L	0.0620	132	8.20	8.30	1.20	1.20
			Nickel- Total	mg/L	0.000540	132	8.20	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	8.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	8.20	8.30	0.0390	0.0390
		05-May-16	Cadmium- Dissolved	mg/L	<0.0000050	141	6.40	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00580	141	6.40	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.0620	141	6.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	6.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0060	141	6.40	8.20	0.0460	0.0460
		10-May-16	Cadmium- Dissolved	mg/L	<0.0000050	140	5.80	8.40	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00550	140	5.80	8.40	0.00500	0.00500
			Manganese- Total	mg/L	0.0450	140	5.80	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	5.80	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	5.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	5.80	8.40	0.0450	0.0450
		17-May-16	Cadmium- Dissolved	mg/L	<0.0000050	146	6.00	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00580	146	6.00	8.40	0.00510	0.00510
			Manganese- Total	mg/L	0.0540	146	6.00	8.40	1.20	1.20
			Nickel- Total	mg/L	0.000670	146	6.00	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.00	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00360	146	6.00	8.40	0.0500	0.0500
		24-May-16	Cadmium- Dissolved	mg/L	<0.0000050	141	6.10	8.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00530	141	6.10	8.60	0.00560	0.00560
			Manganese- Total	mg/L	0.0390	141	6.10	8.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	6.10	8.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	6.10	8.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00510	141	6.10	8.60	0.0460	0.0460
		31-May-16	Cadmium- Dissolved	mg/L	<0.0000050	146	5.80	8.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00480	146	5.80	8.50	0.00550	0.00550
			Manganese- Total	mg/L	0.0280	146	5.80	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	5.80	8.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.80	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00380	146	5.80	8.50	0.0500	0.0500
		07-Jun-16	Cadmium- Dissolved	mg/L	<0.0000050	137	5.80	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00600	137	5.80	8.30	0.00470	0.00470
			Manganese- Total	mg/L	0.0430	137	5.80	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	137	5.80	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	137	5.80	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00630	137	5.80	8.30	0.0430	0.0430
		14-Jun-16	Cadmium- Dissolved	mg/L	0.0000140	308	8.90	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0180	308	8.90	8.20	0.00790	0.00790
			Manganese- Total	mg/L	0.190	308	8.90	8.20	2.00	2.00
			Nickel- Total	mg/L	0.000620	308	8.90	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	308	8.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.0150	308	8.90	8.20	0.170	0.170
		20-Jun-16	Cadmium- Dissolved	mg/L	0.00000710	159	6.30	8.50	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00780	159	6.30	8.50	0.00600	0.00600
			Manganese- Total	mg/L	0.0570	159	6.30	8.50	1.30	1.30
			Nickel- Total	mg/L	<0.00050	159	6.30	8.50	0.140	0.140
			Silver- Total	mg/L	<0.000010	159	6.30	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00720	159	6.30	8.50	0.0590	0.0590
		27-Jun-16	Cadmium- Dissolved	mg/L	<0.0000050	143	6.10	8.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00560	143	6.10	8.50	0.00530	0.00530
			Manganese- Total	mg/L	0.0350	143	6.10	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	6.10	8.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	6.10	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00610	143	6.10	8.50	0.0470	0.0470
		06-Jul-16	Cadmium- Dissolved	mg/L	0.00000670	155	6.30	8.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00810	155	6.30	8.40	0.00560	0.00560
			Manganese- Total	mg/L	0.0740	155	6.30	8.40	1.30	1.30
			Nickel- Total	mg/L	0.00130	155	6.30	8.40	0.130	0.130
			Silver- Total	mg/L	0.0000140	155	6.30	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.0100	155	6.30	8.40	0.0560	0.0560
		13-Jul-16	Cadmium- Dissolved	mg/L	0.0000110	219	9.40	8.00	0.000380	0.000380
			Copper- Dissolved	mg/L	0.0190	219	9.40	8.00	0.00690	0.00690
			Manganese- Total	mg/L	1.00	219	9.40	8.00	1.60	1.60
			Nickel- Total	mg/L	0.0450	219	9.40	8.00	0.150	0.150
			Silver- Total	mg/L	0.000380	219	9.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.130	219	9.40	8.00	0.100	0.100
		18-Jul-16	Cadmium- Dissolved	mg/L	0.00000750	264	9.30	7.10	0.000430	0.000430
			Copper- Dissolved	mg/L	0.0190	264	9.30	7.10	0.00260	0.00260
			Manganese- Total	mg/L	0.370	264	9.30	7.10	1.80	1.80
			Nickel- Total	mg/L	0.0140	264	9.30	7.10	0.150	0.150
			Silver- Total	mg/L	0.000110	264	9.30	7.10	0.00150	0.00150
			Zinc- Total	mg/L	0.0490	264	9.30	7.10	0.140	0.140
		25-Jul-16	Cadmium- Dissolved	mg/L	0.00000570	146	8.10	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00790	146	8.10	8.20	0.00600	0.00600
			Manganese- Total	mg/L	0.0600	146	8.10	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000640	146	8.10	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	8.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00800	146	8.10	8.20	0.0500	0.0500
		02-Aug-16	Cadmium- Dissolved	mg/L	0.00000520	183	7.00	8.20	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0130	183	7.00	8.20	0.00560	0.00560
			Manganese- Total	mg/L	0.0300	183	7.00	8.20	1.40	1.40
			Nickel- Total	mg/L	<0.00050	183	7.00	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	183	7.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00920	183	7.00	8.20	0.0770	0.0770
		10-Aug-16	Cadmium- Dissolved	mg/L	0.00000510	170	6.60	8.30	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0130	170	6.60	8.30	0.00540	0.00540
			Manganese- Total	mg/L	0.0410	170	6.60	8.30	1.40	1.40
			Nickel- Total	mg/L	0.000980	170	6.60	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	170	6.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00330	170	6.60	8.30	0.0680	0.0680

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	HAC-13	17-Aug-16	Cadmium- Dissolved	mg/L	0.0000260	248	13.0	8.00	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0270	248	13.0	8.00	0.00970	0.00970
			Manganese- Total	mg/L	1.10	248	13.0	8.00	1.70	1.70
			Nickel- Total	mg/L	0.0680	248	13.0	8.00	0.150	0.150
			Silver- Total	mg/L	0.000290	248	13.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.0720	248	13.0	8.00	0.130	0.130
		23-Aug-16	Cadmium- Dissolved	mg/L	<0.000010	142	6.30	8.10	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0160	142	6.30	8.10	0.00440	0.00440
			Manganese- Total	mg/L	1.50	142	6.30	8.10	1.20	1.20
			Nickel- Total	mg/L	0.140	142	6.30	8.10	0.120	0.120
			Silver- Total	mg/L	0.000220	142	6.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.0810	142	6.30	8.10	0.0460	0.0460
		30-Aug-16	Cadmium- Dissolved	mg/L	<0.0000050	247	5.60	8.20	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0130	247	5.60	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.870	247	5.60	8.20	1.70	1.70
			Nickel- Total	mg/L	0.0830	247	5.60	8.20	0.150	0.150
			Silver- Total	mg/L	0.000120	247	5.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.0540	247	5.60	8.20	0.130	0.130
		06-Sep-16	Cadmium- Dissolved	mg/L	<0.0000050	136	5.60	8.40	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00970	136	5.60	8.40	0.00460	0.00460
			Manganese- Total	mg/L	0.0740	136	5.60	8.40	1.20	1.20
			Nickel- Total	mg/L	0.00870	136	5.60	8.40	0.120	0.120
			Silver- Total	mg/L	0.0000160	136	5.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00650	136	5.60	8.40	0.0420	0.0420
		13-Sep-16	Cadmium- Dissolved	mg/L	0.0000110	182	6.10	8.10	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0120	182	6.10	8.10	0.00450	0.00450
			Manganese- Total	mg/L	0.590	182	6.10	8.10	1.40	1.40
			Nickel- Total	mg/L	0.0440	182	6.10	8.10	0.150	0.150
			Silver- Total	mg/L	0.000180	182	6.10	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.0550	182	6.10	8.10	0.0760	0.0760
		19-Sep-16	Cadmium- Dissolved	mg/L	0.0000230	307	11.0	7.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0310	307	11.0	7.10	0.00310	0.00310
			Manganese- Total	mg/L	0.250	307	11.0	7.10	2.00	2.00
			Nickel- Total	mg/L	0.00210	307	11.0	7.10	0.150	0.150
			Silver- Total	mg/L	0.0000280	307	11.0	7.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00570	307	11.0	7.10	0.170	0.170
		27-Sep-16	Cadmium- Dissolved	mg/L	0.00000890	175	6.50	8.00	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0150	175	6.50	8.00	0.00440	0.00440
			Manganese- Total	mg/L	0.0270	175	6.50	8.00	1.40	1.40
			Nickel- Total	mg/L	0.00110	175	6.50	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	175	6.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	175	6.50	8.00	0.0710	0.0710
		02-Oct-16	Cadmium- Dissolved	mg/L	<0.0000050	147	5.60	8.10	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00890	147	5.60	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.0230	147	5.60	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	5.60	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	5.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	5.60	8.10	0.0500	0.0500
		03-Oct-16	Cadmium- Dissolved	mg/L	<0.0000050	142	5.50	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0100	142	5.50	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.00590	142	5.50	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	5.50	8.20	0.120	0.120
			Silver- Total	mg/L	0.0000130	142	5.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	142	5.50	8.20	0.0460	0.0460
		11-Oct-16	Cadmium- Dissolved	mg/L	0.00000760	175	7.20	8.10	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0170	175	7.20	8.10	0.00510	0.00510
			Manganese- Total	mg/L	0.0290	175	7.20	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000610	175	7.20	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	175	7.20	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	175	7.20	8.10	0.0710	0.0710
		18-Oct-16	Cadmium- Dissolved	mg/L	0.0000140	170	7.80	8.10	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0160	170	7.80	8.10	0.00580	0.00580
			Manganese- Total	mg/L	0.110	170	7.80	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000610	170	7.80	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	170	7.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	170	7.80	8.10	0.0680	0.0680
		24-Oct-16	Cadmium- Dissolved	mg/L	0.0000150	220	9.10	8.20	0.000380	0.000380
			Copper- Dissolved	mg/L	0.0220	220	9.10	8.20	0.00770	0.00770
			Manganese- Total	mg/L	0.120	220	9.10	8.20	1.60	1.60
			Nickel- Total	mg/L	0.00100	220	9.10	8.20	0.150	0.150
			Silver- Total	mg/L	0.0000110	220	9.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	220	9.10	8.20	0.100	0.100
		01-Nov-16	Cadmium- Dissolved	mg/L	0.0000150	164	9.10	8.10	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0200	164	9.10	8.10	0.00640	0.00640
			Manganese- Total	mg/L	0.0950	164	9.10	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000980	164	9.10	8.10	0.140	0.140
			Silver- Total	mg/L	0.0000110	164	9.10	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	9.10	8.10	0.0630	0.0630
		08-Nov-16	Cadmium- Dissolved	mg/L	0.00000900	164	5.80	8.90	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0130	164	5.80	8.90	0.00660	0.00660
			Manganese- Total	mg/L	0.110	164	5.80	8.90	1.30	1.30
			Nickel- Total	mg/L	<0.00050	164	5.80	8.90	0.140	0.140
			Silver- Total	mg/L	<0.000010	164	5.80	8.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	5.80	8.90	0.0630	0.0630
		15-Nov-16	Cadmium- Dissolved	mg/L	0.00000650	153	6.90	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	153	6.90	8.20	0.00530	0.00530
			Manganese- Total	mg/L	0.0730	153	6.90	8.20	1.30	1.30
			Nickel- Total	mg/L	0.000580	153	6.90	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	153	6.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	153	6.90	8.20	0.0550	0.0550
		22-Nov-16	Cadmium- Dissolved	mg/L	0.00000550	136	6.70	7.90	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00850	136	6.70	7.90	0.00380	0.00380
			Manganese- Total	mg/L	0.0660	136	6.70	7.90	1.20	1.20
			Nickel- Total	mg/L	0.000630	136	6.70	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	6.70	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	6.70	7.90	0.0420	0.0420
		29-Nov-16	Cadmium- Dissolved	mg/L	0.0000120	154	6.60	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00990	154	6.60	8.10	0.00450	0.00450
			Manganese- Total	mg/L	0.0880	154	6.60	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000810	154	6.60	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	6.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	6.60	8.10	0.0560	0.0560
		06-Dec-16	Cadmium- Dissolved	mg/L	0.00000600	148	6.70	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00700	148	6.70	8.20	0.00490	0.00490
			Manganese- Total	mg/L	0.0750	148	6.70	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	148	6.70	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	6.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00310	148	6.70	8.20	0.0510	0.0510

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	HAC-13	14-Dec-16	Cadmium- Dissolved	mg/L	0.00000510	119	5.80	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00590	119	5.80	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.0360	119	5.80	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	119	5.80	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	119	5.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	119	5.80	8.10	0.0290	0.0290
		20-Dec-16	Cadmium- Dissolved	mg/L	<0.0000050	133	6.30	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00610	133	6.30	8.10	0.00430	0.00430
			Manganese- Total	mg/L	0.0520	133	6.30	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	6.30	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	6.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	6.30	8.10	0.0400	0.0400
		28-Dec-16	Cadmium- Dissolved	mg/L	<0.0000050	128	6.00	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00530	128	6.00	8.10	0.00400	0.00400
			Manganese- Total	mg/L	0.0270	128	6.00	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	6.00	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	6.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	6.00	8.10	0.0360	0.0360
	HAC-05a	05-Jan-16	Cadmium- Dissolved	mg/L	0.00000960	444	3.20	7.80	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00410	444	3.20	7.80	0.00190	0.00190
			Manganese- Total	mg/L	0.130	444	3.20	7.80	2.60	2.60
			Nickel- Total	mg/L	0.000620	444	3.20	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	444	3.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	0.00400	444	3.20	7.80	0.190	0.190
		01-Feb-16	Cadmium- Dissolved	mg/L	0.0000190	366	4.50	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00500	366	4.50	8.00	0.00310	0.00310
			Manganese- Total	mg/L	0.0990	366	4.50	8.00	2.20	2.20
			Nickel- Total	mg/L	0.000560	366	4.50	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	366	4.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	366	4.50	8.00	0.190	0.190
		02-Mar-16	Cadmium- Dissolved	mg/L	0.0000230	352	5.00	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00570	352	5.00	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.150	352	5.00	8.20	2.20	2.20
			Nickel- Total	mg/L	0.000560	352	5.00	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	352	5.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00360	352	5.00	8.20	0.190	0.190
		04-Apr-16	Cadmium- Dissolved	mg/L	0.0000570	437	11.0	7.80	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0260	437	11.0	7.80	0.00660	0.00660
			Manganese- Total	mg/L	0.340	437	11.0	7.80	2.50	2.50
			Nickel- Total	mg/L	0.00230	437	11.0	7.80	0.150	0.150
			Silver- Total	mg/L	0.0000270	437	11.0	7.80	0.00150	0.00150
			Zinc- Total	mg/L	0.00810	437	11.0	7.80	0.190	0.190
		05-May-16	Cadmium- Dissolved	mg/L	<0.0000050	389	3.80	7.90	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00330	389	3.80	7.90	0.00280	0.00280
			Manganese- Total	mg/L	0.0710	389	3.80	7.90	2.30	2.30
			Nickel- Total	mg/L	<0.00050	389	3.80	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	389	3.80	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	389	3.80	7.90	0.190	0.190
		07-Jun-16	Cadmium- Dissolved	mg/L	0.00000580	389	3.40	7.90	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00270	389	3.40	7.90	0.00240	0.00240
			Manganese- Total	mg/L	0.0470	389	3.40	7.90	2.30	2.30
			Nickel- Total	mg/L	0.000570	389	3.40	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	389	3.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	389	3.40	7.90	0.190	0.190
		06-Jul-16	Cadmium- Dissolved	mg/L	0.00000800	429	3.10	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00360	429	3.10	8.30	0.00290	0.00290
			Manganese- Total	mg/L	0.0550	429	3.10	8.30	2.50	2.50
			Nickel- Total	mg/L	0.000890	429	3.10	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	429	3.10	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00410	429	3.10	8.30	0.190	0.190
		02-Aug-16	Cadmium- Dissolved	mg/L	<0.000015	501	2.60	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00260	501	2.60	8.30	0.00240	0.00240
			Manganese- Total	mg/L	0.0280	501	2.60	8.30	2.60	2.60
			Nickel- Total	mg/L	0.000640	501	2.60	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	501	2.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	501	2.60	8.30	0.190	0.190
		06-Sep-16	Cadmium- Dissolved	mg/L	<0.000020	459	2.40	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00240	459	2.40	8.20	0.00220	0.00220
			Manganese- Total	mg/L	0.0460	459	2.40	8.20	2.60	2.60
			Nickel- Total	mg/L	0.00180	459	2.40	8.20	0.150	0.150
			Silver- Total	mg/L	0.0000130	459	2.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00320	459	2.40	8.20	0.190	0.190
		03-Oct-16	Cadmium- Dissolved	mg/L	0.0000120	515	2.20	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00270	515	2.20	8.00	0.00160	0.00160
			Manganese- Total	mg/L	0.0260	515	2.20	8.00	2.60	2.60
			Nickel- Total	mg/L	0.000660	515	2.20	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	515	2.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	515	2.20	8.00	0.190	0.190
		01-Nov-16	Cadmium- Dissolved	mg/L	<0.000020	391	4.30	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00780	391	4.30	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0740	391	4.30	8.20	2.30	2.30
			Nickel- Total	mg/L	0.000790	391	4.30	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	391	4.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00380	391	4.30	8.20	0.190	0.190
		22-Nov-16	Cadmium- Dissolved	mg/L	0.00000590	145	7.30	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00990	145	7.30	8.00	0.00470	0.00470
			Manganese- Total	mg/L	0.100	145	7.30	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000830	145	7.30	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	7.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00780	145	7.30	8.00	0.0490	0.0490
		06-Dec-16	Cadmium- Dissolved	mg/L	0.0000200	389	3.40	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00450	389	3.40	8.00	0.00260	0.00260
			Manganese- Total	mg/L	0.0500	389	3.40	8.00	2.30	2.30
			Nickel- Total	mg/L	0.000520	389	3.40	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	389	3.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	389	3.40	8.00	0.190	0.190
	HAC-08	05-Jan-16	Cadmium- Dissolved	mg/L	0.0000240	429	3.30	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0100	429	3.30	8.00	0.00260	0.00260
			Manganese- Total	mg/L	0.0880	429	3.30	8.00	2.50	2.50
			Nickel- Total	mg/L	0.00120	429	3.30	8.00	0.150	0.150
			Silver- Total	mg/L	0.0000180	429	3.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00400	429	3.30	8.00	0.190	0.190
		01-Feb-16	Cadmium- Dissolved	mg/L	0.0000170	365	4.50	8.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00580	365	4.50	8.10	0.00370	0.00370
			Manganese- Total	mg/L	0.0950	365	4.50	8.10	2.20	2.20
			Nickel- Total	mg/L	0.000700	365	4.50	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	365	4.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	365	4.50	8.10	0.190	0.190

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	HAC-08	02-Mar-16	Cadmium- Dissolved	mg/L	0.0000180	323	6.30	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00700	323	6.30	8.00	0.00490	0.00490
			Manganese- Total	mg/L	0.130	323	6.30	8.00	2.00	2.00
			Nickel- Total	mg/L	0.000970	323	6.30	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	323	6.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	323	6.30	8.00	0.180	0.180
		04-Apr-16	Cadmium- Dissolved	mg/L	0.0000360	267	14.0	8.20	0.000440	0.000440
			Copper- Dissolved	mg/L	0.0220	267	14.0	8.20	0.0120	0.0120
			Manganese- Total	mg/L	0.340	267	14.0	8.20	1.80	1.80
			Nickel- Total	mg/L	0.00960	267	14.0	8.20	0.150	0.150
			Silver- Total	mg/L	0.0000630	267	14.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.0210	267	14.0	8.20	0.140	0.140
		05-May-16	Cadmium- Dissolved	mg/L	<0.0000050	360	4.20	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00550	360	4.20	8.30	0.00380	0.00380
			Manganese- Total	mg/L	0.0710	360	4.20	8.30	2.20	2.20
			Nickel- Total	mg/L	<0.00050	360	4.20	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	360	4.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	360	4.20	8.30	0.190	0.190
		07-Jun-16	Cadmium- Dissolved	mg/L	0.00000760	399	3.70	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00340	399	3.70	8.20	0.00310	0.00310
			Manganese- Total	mg/L	0.0470	399	3.70	8.20	2.40	2.40
			Nickel- Total	mg/L	0.000600	399	3.70	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	399	3.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	399	3.70	8.20	0.190	0.190
		06-Jul-16	Cadmium- Dissolved	mg/L	0.0000120	421	3.40	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00390	421	3.40	8.30	0.00330	0.00330
			Manganese- Total	mg/L	0.0400	421	3.40	8.30	2.50	2.50
			Nickel- Total	mg/L	0.000900	421	3.40	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	421	3.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	421	3.40	8.30	0.190	0.190
		02-Aug-16	Cadmium- Dissolved	mg/L	0.00000770	437	3.00	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00340	437	3.00	8.30	0.00290	0.00290
			Manganese- Total	mg/L	0.0210	437	3.00	8.30	2.50	2.50
			Nickel- Total	mg/L	0.000710	437	3.00	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	437	3.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	437	3.00	8.30	0.190	0.190
		06-Sep-16	Cadmium- Dissolved	mg/L	<0.000020	414	3.00	8.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00310	414	3.00	8.10	0.00250	0.00250
			Manganese- Total	mg/L	0.0280	414	3.00	8.10	2.40	2.40
			Nickel- Total	mg/L	0.000820	414	3.00	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	414	3.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	414	3.00	8.10	0.190	0.190
		03-Oct-16	Cadmium- Dissolved	mg/L	0.00000590	473	2.60	8.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00300	473	2.60	8.10	0.00210	0.00210
			Manganese- Total	mg/L	0.0280	473	2.60	8.10	2.60	2.60
			Nickel- Total	mg/L	0.000580	473	2.60	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	473	2.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	473	2.60	8.10	0.190	0.190
		01-Nov-16	Cadmium- Dissolved	mg/L	0.00000840	312	7.00	8.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00970	312	7.00	8.30	0.00660	0.00660
			Manganese- Total	mg/L	0.0710	312	7.00	8.30	2.00	2.00
			Nickel- Total	mg/L	0.00160	312	7.00	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	312	7.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00450	312	7.00	8.30	0.170	0.170
		22-Nov-16	Cadmium- Dissolved	mg/L	0.00000780	146	9.20	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0120	146	9.20	8.40	0.00720	0.00720
			Manganese- Total	mg/L	0.0810	146	9.20	8.40	1.20	1.20
			Nickel- Total	mg/L	0.00100	146	9.20	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	9.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	146	9.20	8.40	0.0500	0.0500
		06-Dec-16	Cadmium- Dissolved	mg/L	0.0000130	375	4.20	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00560	375	4.20	8.20	0.00350	0.00350
			Manganese- Total	mg/L	0.0480	375	4.20	8.20	2.30	2.30
			Nickel- Total	mg/L	0.000630	375	4.20	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	375	4.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00380	375	4.20	8.20	0.190	0.190
	W10	07-Jan-16	Cadmium- Dissolved	mg/L	<0.0000050	130	9.50	7.80	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00130	130	9.50	7.80	0.00490	0.00490
			Manganese- Total	mg/L	0.00320	130	9.50	7.80	1.20	1.20
			Nickel- Total	mg/L	0.000630	130	9.50	7.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	9.50	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	9.50	7.80	0.0380	0.0380
		01-Feb-16	Cadmium- Dissolved	mg/L	<0.0000050	97.0	15.0	8.10	0.000210	0.000210
			Copper- Dissolved	mg/L	0.00220	97.0	15.0	8.10	0.00910	0.00910
			Manganese- Total	mg/L	0.00830	97.0	15.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00100	97.0	15.0	8.10	0.0940	0.0940
			Silver- Total	mg/L	<0.000010	97.0	15.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	97.0	15.0	8.10	0.0130	0.0130
		02-Mar-16	Cadmium- Dissolved	mg/L	<0.0000050	76.0	19.0	8.10	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00290	76.0	19.0	8.10	0.0110	0.0110
			Manganese- Total	mg/L	0.00940	76.0	19.0	8.10	0.940	0.940
			Nickel- Total	mg/L	0.00150	76.0	19.0	8.10	0.0770	0.0770
			Silver- Total	mg/L	<0.000010	76.0	19.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	76.0	19.0	8.10	0.00750	0.00750
		04-Apr-16	Cadmium- Dissolved	mg/L	0.00000880	45.0	2.20	7.60	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00330	45.0	2.20	7.60	0.000600	0.000600
			Manganese- Total	mg/L	0.0220	45.0	2.20	7.60	0.800	0.800
			Nickel- Total	mg/L	0.00200	45.0	2.20	7.60	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	45.0	2.20	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	45.0	2.20	7.60	0.00750	0.00750
		04-May-16	Cadmium- Dissolved	mg/L	0.0000390	59.0	20.0	8.00	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00340	59.0	20.0	8.00	0.00950	0.00950
			Manganese- Total	mg/L	0.00700	59.0	20.0	8.00	0.860	0.860
			Nickel- Total	mg/L	0.00140	59.0	20.0	8.00	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	59.0	20.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	59.0	20.0	8.00	0.00750	0.00750
		06-Jun-16	Cadmium- Dissolved	mg/L	0.00000680	82.0	17.0	8.10	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00310	82.0	17.0	8.10	0.00960	0.00960
			Manganese- Total	mg/L	0.00660	82.0	17.0	8.10	0.970	0.970
			Nickel- Total	mg/L	0.00130	82.0	17.0	8.10	0.0830	0.0830
			Silver- Total	mg/L	<0.000010	82.0	17.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	82.0	17.0	8.10	0.00750	0.00750
		04-Jul-16	Cadmium- Dissolved	mg/L	0.00000960	83.0	19.0	8.00	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00280	83.0	19.0	8.00	0.0100	0.0100
			Manganese- Total	mg/L	0.00750	83.0	19.0	8.00	0.970	0.970
			Nickel- Total	mg/L	0.00160	83.0	19.0	8.00	0.0830	0.0830
			Silver- Total	mg/L	<0.000010	83.0	19.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	83.0	19.0	8.00	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2016	W10	02-Aug-16	Cadmium- Dissolved	mg/L	0.00000890	95.0	18.0	8.10	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00230	95.0	18.0	8.10	0.0110	0.0110
			Manganese- Total	mg/L	0.00620	95.0	18.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00160	95.0	18.0	8.10	0.0920	0.0920
			Silver- Total	mg/L	<0.000010	95.0	18.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	95.0	18.0	8.10	0.0110	0.0110
		06-Sep-16	Cadmium- Dissolved	mg/L	<0.0000050	163	7.80	8.00	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00110	163	7.80	8.00	0.00530	0.00530
			Manganese- Total	mg/L	0.00570	163	7.80	8.00	1.30	1.30
			Nickel- Total	mg/L	0.00130	163	7.80	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	163	7.80	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	163	7.80	8.00	0.0620	0.0620
		03-Oct-16	Cadmium- Dissolved	mg/L	<0.0000050	82.0	18.0	7.60	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00200	82.0	18.0	7.60	0.00660	0.00660
			Manganese- Total	mg/L	0.00540	82.0	18.0	7.60	0.960	0.960
			Nickel- Total	mg/L	0.00120	82.0	18.0	7.60	0.0820	0.0820
			Silver- Total	mg/L	<0.000010	82.0	18.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	82.0	18.0	7.60	0.00750	0.00750
		01-Nov-16	Cadmium- Dissolved	mg/L	0.00000670	59.0	24.0	8.00	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00320	59.0	24.0	8.00	0.00970	0.00970
			Manganese- Total	mg/L	0.0160	59.0	24.0	8.00	0.860	0.860
			Nickel- Total	mg/L	0.00170	59.0	24.0	8.00	0.0250	0.0250
			Silver- Total	mg/L	0.0000120	59.0	24.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	59.0	24.0	8.00	0.00750	0.00750
		01-Dec-16	Cadmium- Dissolved	mg/L	0.00000540	61.0	23.0	8.00	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00280	61.0	23.0	8.00	0.00970	0.00970
			Manganese- Total	mg/L	0.0110	61.0	23.0	8.00	0.870	0.870
			Nickel- Total	mg/L	0.00150	61.0	23.0	8.00	0.0660	0.0660
			Silver- Total	mg/L	<0.000010	61.0	23.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00350	61.0	23.0	8.00	0.00750	0.00750
		05-Jan-16	Cadmium- Dissolved	mg/L	0.00000520	171	8.70	7.60	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00440	171	8.70	7.60	0.00390	0.00390
			Manganese- Total	mg/L	0.0110	171	8.70	7.60	1.40	1.40
			Nickel- Total	mg/L	0.000640	171	8.70	7.60	0.140	0.140
			Silver- Total	mg/L	<0.000010	171	8.70	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	171	8.70	7.60	0.0680	0.0680
		01-Feb-16	Cadmium- Dissolved	mg/L	0.00000580	101	15.0	8.10	0.000210	0.000210
			Copper- Dissolved	mg/L	0.00320	101	15.0	8.10	0.00910	0.00910
			Manganese- Total	mg/L	0.0120	101	15.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00110	101	15.0	8.10	0.0960	0.0960
			Silver- Total	mg/L	<0.000010	101	15.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	101	15.0	8.10	0.0160	0.0160
		02-Mar-16	Cadmium- Dissolved	mg/L	<0.0000050	78.0	18.0	8.00	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00370	78.0	18.0	8.00	0.00950	0.00950
			Manganese- Total	mg/L	0.0110	78.0	18.0	8.00	0.950	0.950
			Nickel- Total	mg/L	0.00140	78.0	18.0	8.00	0.0790	0.0790
			Silver- Total	mg/L	<0.000010	78.0	18.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	78.0	18.0	8.00	0.00750	0.00750
		04-Apr-16	Cadmium- Dissolved	mg/L	0.00000770	45.0	22.0	7.60	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00370	45.0	22.0	7.60	0.00620	0.00620
			Manganese- Total	mg/L	0.0360	45.0	22.0	7.60	0.800	0.800
			Nickel- Total	mg/L	0.00260	45.0	22.0	7.60	0.0250	0.0250
			Silver- Total	mg/L	0.0000150	45.0	22.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00340	45.0	22.0	7.60	0.00750	0.00750
		05-May-16	Cadmium- Dissolved	mg/L	0.00000960	66.0	18.0	8.00	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00470	66.0	18.0	8.00	0.00940	0.00940
			Manganese- Total	mg/L	0.00760	66.0	18.0	8.00	0.900	0.900
			Nickel- Total	mg/L	0.00110	66.0	18.0	8.00	0.0700	0.0700
			Silver- Total	mg/L	<0.000010	66.0	18.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	66.0	18.0	8.00	0.00750	0.00750
		07-Jun-16	Cadmium- Dissolved	mg/L	0.00000630	92.0	15.0	7.90	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00440	92.0	15.0	7.90	0.00760	0.00760
			Manganese- Total	mg/L	0.0110	92.0	15.0	7.90	1.00	1.00
			Nickel- Total	mg/L	0.00140	92.0	15.0	7.90	0.0900	0.0900
			Silver- Total	mg/L	<0.000010	92.0	15.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	92.0	15.0	7.90	0.00940	0.00940
	EDC-01a	06-Jul-16	Cadmium- Dissolved	mg/L	0.00000670	83.0	19.0	8.20	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00360	83.0	19.0	8.20	0.0120	0.0120
			Manganese- Total	mg/L	0.0120	83.0	19.0	8.20	0.970	0.970
			Nickel- Total	mg/L	0.00160	83.0	19.0	8.20	0.0830	0.0830
			Silver- Total	mg/L	<0.000010	83.0	19.0	8.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	83.0	19.0	8.20	0.00750	0.00750
		02-Aug-16	Cadmium- Dissolved	mg/L	0.0000130	133	16.0	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	133	16.0	8.10	0.0100	0.0100
			Manganese- Total	mg/L	0.0200	133	16.0	8.10	1.20	1.20
			Nickel- Total	mg/L	0.00160	133	16.0	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	16.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	16.0	8.10	0.0400	0.0400
		06-Sep-16	Cadmium- Dissolved	mg/L	0.00000690	185	7.50	8.10	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00440	185	7.50	8.10	0.00560	0.00560
			Manganese- Total	mg/L	0.0230	185	7.50	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000910	185	7.50	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	185	7.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	185	7.50	8.10	0.0790	0.0790
		03-Oct-16	Cadmium- Dissolved	mg/L	0.00000570	97.0	17.0	8.10	0.000210	0.000210
			Copper- Dissolved	mg/L	0.00320	97.0	17.0	8.10	0.0100	0.0100
			Manganese- Total	mg/L	0.00870	97.0	17.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00120	97.0	17.0	8.10	0.0940	0.0940
			Silver- Total	mg/L	<0.000010	97.0	17.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	97.0	17.0	8.10	0.0130	0.0130
		01-Nov-16	Cadmium- Dissolved	mg/L	0.00000630	62.0	22.0	8.00	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00360	62.0	22.0	8.00	0.00970	0.00970
			Manganese- Total	mg/L	0.0170	62.0	22.0	8.00	0.880	0.880
			Nickel- Total	mg/L	0.00170	62.0	22.0	8.00	0.0660	0.0660
			Silver- Total	mg/L	0.0000110	62.0	22.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	62.0	22.0	8.00	0.00750	0.00750
		06-Dec-16	Cadmium- Dissolved	mg/L	0.00000620	93.0	22.0	7.90	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00460	93.0	22.0	7.90	0.0100	0.0100
			Manganese- Total	mg/L	0.0130	93.0	22.0	7.90	1.00	1.00
			Nickel- Total	mg/L	0.00160	93.0	22.0	7.90	0.0910	0.0910
			Silver- Total	mg/L	<0.000010	93.0	22.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00320	93.0	22.0	7.90	0.0100	0.0100
2017	HAC-13	03-Jan-17	Cadmium- Dissolved	mg/L	<0.0000050	126	5.60	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00490	126	5.60	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0200	126	5.60	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	5.60	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	5.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	5.60	8.20	0.0340	0.0340

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	HAC-13	10-Jan-17	Cadmium- Dissolved	mg/L	<0.0000050	136	6.00	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00510	136	6.00	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0190	136	6.00	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	136	6.00	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	6.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	6.00	8.20	0.0420	0.0420
		17-Jan-17	Cadmium- Dissolved	mg/L	<0.0000050	123	6.30	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00460	123	6.30	8.30	0.00490	0.00490
			Manganese- Total	mg/L	0.0210	123	6.30	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	6.30	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	6.30	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	6.30	8.30	0.0320	0.0320
		24-Jan-17	Cadmium- Dissolved	mg/L	<0.0000050	134	6.40	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00500	134	6.40	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0280	134	6.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.40	8.20	0.0400	0.0400
		01-Feb-17	Cadmium- Dissolved	mg/L	<0.0000050	134	6.50	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00510	134	6.50	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0230	134	6.50	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.50	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.50	8.20	0.0400	0.0400
		07-Feb-17	Cadmium- Dissolved	mg/L	<0.0000050	127	6.80	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00490	127	6.80	8.40	0.00570	0.00570
			Manganese- Total	mg/L	0.0240	127	6.80	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	6.80	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	6.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	6.80	8.40	0.0350	0.0350
		14-Feb-17	Cadmium- Dissolved	mg/L	<0.0000050	140	6.70	8.50	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00520	140	6.70	8.50	0.00580	0.00580
			Manganese- Total	mg/L	0.0240	140	6.70	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	6.70	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	6.70	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	6.70	8.50	0.0450	0.0450
		21-Feb-17	Cadmium- Dissolved	mg/L	<0.0000050	140	6.60	8.50	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00630	140	6.60	8.50	0.00580	0.00580
			Manganese- Total	mg/L	0.0530	140	6.60	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	6.60	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	6.60	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	6.60	8.50	0.0450	0.0450
		01-Mar-17	Cadmium- Dissolved	mg/L	<0.0000050	131	5.80	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	131	5.80	8.30	0.00420	0.00420
			Manganese- Total	mg/L	0.0380	131	5.80	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	131	5.80	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	131	5.80	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	131	5.80	8.30	0.0380	0.0380
		07-Mar-17	Cadmium- Dissolved	mg/L	<0.0000050	130	6.90	8.50	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00550	130	6.90	8.50	0.00600	0.00600
			Manganese- Total	mg/L	0.0340	130	6.90	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	6.90	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	6.90	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00550	130	6.90	8.50	0.0380	0.0380
		14-Mar-17	Cadmium- Dissolved	mg/L	0.00000600	142	6.70	8.10	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00680	142	6.70	8.10	0.00440	0.00440
			Manganese- Total	mg/L	0.0660	142	6.70	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	6.70	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	6.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	142	6.70	8.10	0.0460	0.0460
		21-Mar-17	Cadmium- Dissolved	mg/L	0.00000720	139	6.60	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00680	139	6.60	8.30	0.00510	0.00510
			Manganese- Total	mg/L	0.0570	139	6.60	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	139	6.60	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	139	6.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	139	6.60	8.30	0.0440	0.0440
		27-Mar-17	Cadmium- Dissolved	mg/L	0.00000980	169	6.20	8.20	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00860	169	6.20	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0970	169	6.20	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	169	6.20	8.20	0.140	0.140
			Silver- Total	mg/L	<0.000010	169	6.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	169	6.20	8.20	0.0670	0.0670
		03-Apr-17	Cadmium- Dissolved	mg/L	0.0000180	147	9.40	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0150	147	9.40	8.00	0.00610	0.00610
			Manganese- Total	mg/L	0.110	147	9.40	8.00	1.30	1.30
			Nickel- Total	mg/L	0.000550	147	9.40	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	9.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	9.40	8.00	0.0500	0.0500
		02-May-17	Cadmium- Dissolved	mg/L	<0.0000050	123	6.40	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00650	123	6.40	8.30	0.00490	0.00490
			Manganese- Total	mg/L	0.0280	123	6.40	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	6.40	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	6.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	6.40	8.30	0.0320	0.0320
		01-Jun-17	Cadmium- Dissolved	mg/L	<0.0000050	125	6.00	8.50	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00500	125	6.00	8.50	0.00500	0.00500
			Manganese- Total	mg/L	0.0120	125	6.00	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	6.00	8.50	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	6.00	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	6.00	8.50	0.0340	0.0340
		06-Jun-17	Cadmium- Dissolved	mg/L	<0.0000050	121	6.70	8.40	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00620	121	6.70	8.40	0.00520	0.00520
			Manganese- Total	mg/L	0.0140	121	6.70	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	121	6.70	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	6.70	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	6.70	8.40	0.0310	0.0310
		13-Jun-17	Cadmium- Dissolved	mg/L	<0.0000050	132	5.30	8.60	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00870	132	5.30	8.60	0.00500	0.00500
			Manganese- Total	mg/L	0.00870	132	5.30	8.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	5.30	8.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	5.30	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	5.30	8.60	0.0390	0.0390
		20-Jun-17	Cadmium- Dissolved	mg/L	0.00000520	147	5.30	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00780	147	5.30	8.40	0.00470	0.00470
			Manganese- Total	mg/L	0.00830	147	5.30	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	5.30	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	5.30	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	5.30	8.40	0.0500	0.0500

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	HAC-13	27-Jun-17	Cadmium- Dissolved	mg/L	0.00000820	135	5.60	8.40	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00840	135	5.60	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.00910	135	5.60	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	5.60	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	5.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	5.60	8.40	0.0410	0.0410
		04-Jul-17	Cadmium- Dissolved	mg/L	0.00000510	122	5.90	8.50	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00690	122	5.90	8.50	0.00500	0.00500
			Manganese- Total	mg/L	0.00770	122	5.90	8.50	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.90	8.50	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.90	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.90	8.50	0.0320	0.0320
		01-Aug-17	Cadmium- Dissolved	mg/L	<0.0000050	133	3.90	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00570	133	3.90	8.30	0.00310	0.00310
			Manganese- Total	mg/L	0.00850	133	3.90	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	3.90	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	3.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00330	133	3.90	8.30	0.0400	0.0400
		27-Aug-17	Cadmium- Dissolved	mg/L	<0.0000050	121	5.60	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00670	121	5.60	8.10	0.00360	0.00360
			Manganese- Total	mg/L	0.00650	121	5.60	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	121	5.60	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	5.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	5.60	8.10	0.0310	0.0310
		19-Sep-17	Cadmium- Dissolved	mg/L	<0.0000050	121	4.80	7.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00850	121	4.80	7.10	0.00110	0.00110
			Manganese- Total	mg/L	0.00240	121	4.80	7.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	121	4.80	7.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	4.80	7.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	4.80	7.10	0.0310	0.0310
		26-Sep-17	Cadmium- Dissolved	mg/L	<0.0000050	134	6.00	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0100	134	6.00	8.00	0.00370	0.00370
			Manganese- Total	mg/L	0.00390	134	6.00	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.00	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.00	8.00	0.0400	0.0400
		02-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	126	4.90	7.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00900	126	4.90	7.10	0.00110	0.00110
			Manganese- Total	mg/L	0.00230	126	4.90	7.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	4.90	7.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	4.90	7.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	4.90	7.10	0.0340	0.0340
		10-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	128	4.60	7.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00920	128	4.60	7.40	0.00130	0.00130
			Manganese- Total	mg/L	0.00380	128	4.60	7.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	4.60	7.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	4.60	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	4.60	7.40	0.0360	0.0360
		17-Oct-17	Cadmium- Dissolved	mg/L	0.0000110	150	6.00	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	150	6.00	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.00410	150	6.00	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	150	6.00	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	150	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	150	6.00	8.00	0.0520	0.0520
		24-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	161	6.90	8.00	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0120	161	6.90	8.00	0.00460	0.00460
			Manganese- Total	mg/L	0.00280	161	6.90	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	161	6.90	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	161	6.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	161	6.90	8.00	0.0610	0.0610
		31-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	131	5.70	7.90	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00920	131	5.70	7.90	0.00310	0.00310
			Manganese- Total	mg/L	0.00140	131	5.70	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	131	5.70	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	131	5.70	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	131	5.70	7.90	0.0380	0.0380
		07-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	134	5.90	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00960	134	5.90	8.30	0.00460	0.00460
			Manganese- Total	mg/L	0.00550	134	5.90	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	5.90	8.30	0.120	0.120
			Silver- Total	mg/L	0.0000240	134	5.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00360	134	5.90	8.30	0.0400	0.0400
		14-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	144	6.00	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0110	144	6.00	8.00	0.00410	0.00410
			Manganese- Total	mg/L	0.00290	144	6.00	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	6.00	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	6.00	8.00	0.0480	0.0480
		21-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	157	5.40	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	157	5.40	8.00	0.00360	0.00360
			Manganese- Total	mg/L	0.00160	157	5.40	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	5.40	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.40	8.00	0.0580	0.0580
		28-Nov-17	Cadmium- Dissolved	mg/L	0.0000110	200	8.50	7.80	0.000350	0.000350
			Copper- Dissolved	mg/L	0.0170	200	8.50	7.80	0.00500	0.00500
			Manganese- Total	mg/L	0.0120	200	8.50	7.80	1.50	1.50
			Nickel- Total	mg/L	0.000520	200	8.50	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	200	8.50	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	200	8.50	7.80	0.0900	0.0900
		05-Dec-17	Cadmium- Dissolved	mg/L	0.00000750	186	7.10	7.90	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0140	186	7.10	7.90	0.00450	0.00450
			Manganese- Total	mg/L	0.00460	186	7.10	7.90	1.40	1.40
			Nickel- Total	mg/L	<0.00050	186	7.10	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	186	7.10	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	186	7.10	7.90	0.0800	0.0800
	HAC-05a	03-Jan-17	Cadmium- Dissolved	mg/L	0.0000140	245	4.30	8.10	0.000410	0.000410
			Copper- Dissolved	mg/L	0.00480	245	4.30	8.10	0.00370	0.00370
			Manganese- Total	mg/L	0.0290	245	4.30	8.10	1.70	1.70
			Nickel- Total	mg/L	<0.00050	245	4.30	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	245	4.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00370	245	4.30	8.10	0.120	0.120
		24-Jan-17	Cadmium- Dissolved	mg/L	<0.0000050	134	6.10	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00540	134	6.10	8.30	0.00460	0.00460
			Manganese- Total	mg/L	0.0370	134	6.10	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.10	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.10	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.10	8.30	0.0400	0.0400

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	HAC-05a	01-Feb-17	Cadmium- Dissolved	mg/L	0.00000810	269	4.70	8.00	0.000440	0.000440
			Copper- Dissolved	mg/L	0.00430	269	4.70	8.00	0.00340	0.00340
			Manganese- Total	mg/L	0.0270	269	4.70	8.00	1.80	1.80
			Nickel- Total	mg/L	<0.00050	269	4.70	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	269	4.70	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	269	4.70	8.00	0.140	0.140
		01-Mar-17	Cadmium- Dissolved	mg/L	<0.000035	306	3.70	8.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00420	306	3.70	8.10	0.00290	0.00290
			Manganese- Total	mg/L	0.0320	306	3.70	8.10	2.00	2.00
			Nickel- Total	mg/L	<0.00050	306	3.70	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	306	3.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	306	3.70	8.10	0.170	0.170
		03-Apr-17	Cadmium- Dissolved	mg/L	0.0000200	153	10.0	7.90	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0180	153	10.0	7.90	0.00590	0.00590
			Manganese- Total	mg/L	0.190	153	10.0	7.90	1.30	1.30
			Nickel- Total	mg/L	0.00120	153	10.0	7.90	0.130	0.130
			Silver- Total	mg/L	0.0000180	153	10.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.00410	153	10.0	7.90	0.0550	0.0550
		02-May-17	Cadmium- Dissolved	mg/L	0.00000600	130	6.80	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00770	130	6.80	8.20	0.00500	0.00500
			Manganese- Total	mg/L	0.0580	130	6.80	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	6.80	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	6.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	6.80	8.20	0.0380	0.0380
		01-Jun-17	Cadmium- Dissolved	mg/L	<0.0000050	127	6.30	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00530	127	6.30	8.40	0.00530	0.00530
			Manganese- Total	mg/L	0.0210	127	6.30	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	6.30	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	6.30	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	6.30	8.40	0.0350	0.0350
		13-Jun-17	Cadmium- Dissolved	mg/L	<0.000090	584	3.40	7.90	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00780	584	3.40	7.90	0.00240	0.00240
			Manganese- Total	mg/L	0.0920	584	3.40	7.90	2.60	2.60
			Nickel- Total	mg/L	0.00110	584	3.40	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	584	3.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.00500	584	3.40	7.90	0.190	0.190
		04-Jul-17	Cadmium- Dissolved	mg/L	<0.000085	542	3.20	7.80	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00510	542	3.20	7.80	0.00190	0.00190
			Manganese- Total	mg/L	0.0510	542	3.20	7.80	2.60	2.60
			Nickel- Total	mg/L	0.000890	542	3.20	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	542	3.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	542	3.20	7.80	0.190	0.190
		01-Aug-17	Cadmium- Dissolved	mg/L	<0.0000050	141	5.50	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00630	141	5.50	8.30	0.00430	0.00430
			Manganese- Total	mg/L	0.0160	141	5.50	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	5.50	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	5.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00360	141	5.50	8.30	0.0460	0.0460
		19-Sep-17	Cadmium- Dissolved	mg/L	<0.000090	592	3.00	8.00	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00600	592	3.00	8.00	0.00230	0.00230
			Manganese- Total	mg/L	0.0450	592	3.00	8.00	2.60	2.60
			Nickel- Total	mg/L	0.000580	592	3.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	592	3.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00450	592	3.00	8.00	0.190	0.190
		26-Sep-17	Cadmium- Dissolved	mg/L	<0.000050	636	2.80	7.60	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00490	636	2.80	7.60	0.00150	0.00150
			Manganese- Total	mg/L	0.0460	636	2.80	7.60	2.60	2.60
			Nickel- Total	mg/L	0.000640	636	2.80	7.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	636	2.80	7.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00400	636	2.80	7.60	0.190	0.190
		02-Oct-17	Cadmium- Dissolved	mg/L	0.00000730	192	3.60	7.40	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00750	192	3.60	7.40	0.00120	0.00120
			Manganese- Total	mg/L	0.0120	192	3.60	7.40	1.40	1.40
			Nickel- Total	mg/L	<0.00050	192	3.60	7.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	192	3.60	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	192	3.60	7.40	0.0840	0.0840
		31-Oct-17	Cadmium- Dissolved	mg/L	0.00000580	172	5.10	8.00	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00780	172	5.10	8.00	0.00340	0.00340
			Manganese- Total	mg/L	0.0250	172	5.10	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	172	5.10	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	172	5.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	172	5.10	8.00	0.0690	0.0690
		07-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	196	4.60	8.40	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00790	196	4.60	8.40	0.00430	0.00430
			Manganese- Total	mg/L	0.0180	196	4.60	8.40	1.50	1.50
			Nickel- Total	mg/L	<0.00050	196	4.60	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	196	4.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	196	4.60	8.40	0.0870	0.0870
		14-Nov-17	Cadmium- Dissolved	mg/L	0.00000630	191	4.70	8.20	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00860	191	4.70	8.20	0.00370	0.00370
			Manganese- Total	mg/L	0.0270	191	4.70	8.20	1.40	1.40
			Nickel- Total	mg/L	<0.00050	191	4.70	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	191	4.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	191	4.70	8.20	0.0830	0.0830
		21-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	205	4.20	8.10	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00840	205	4.20	8.10	0.00310	0.00310
			Manganese- Total	mg/L	0.0250	205	4.20	8.10	1.50	1.50
			Nickel- Total	mg/L	<0.00050	205	4.20	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	205	4.20	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	205	4.20	8.10	0.0940	0.0940
		28-Nov-17	Cadmium- Dissolved	mg/L	0.00000840	242	7.90	8.00	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0120	242	7.90	8.00	0.00600	0.00600
			Manganese- Total	mg/L	0.0410	242	7.90	8.00	1.70	1.70
			Nickel- Total	mg/L	0.000810	242	7.90	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	242	7.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.0120	242	7.90	8.00	0.120	0.120
		05-Dec-17	Cadmium- Dissolved	mg/L	0.00000850	225	5.70	8.20	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00970	225	5.70	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0280	225	5.70	8.20	1.60	1.60
			Nickel- Total	mg/L	<0.00050	225	5.70	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	225	5.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	225	5.70	8.20	0.110	0.110
	HAC-14	27-Aug-17	Cadmium- Dissolved	mg/L	0.00000610	138	5.00	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00860	138	5.00	8.30	0.00390	0.00390
			Manganese- Total	mg/L	0.0280	138	5.00	8.30	1.20	1.20
			Nickel- Total	mg/L	0.000770	138	5.00	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	5.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	5.00	8.30	0.0440	0.0440

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	HAC-14	19-Sep-17	Cadmium- Dissolved	mg/L	<0.000060	588	3.20	8.40	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00600	588	3.20	8.40	0.00310	0.00310
			Manganese- Total	mg/L	0.0320	588	3.20	8.40	2.60	2.60
			Nickel- Total	mg/L	<0.00050	588	3.20	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	588	3.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00310	588	3.20	8.40	0.190	0.190
		26-Sep-17	Cadmium- Dissolved	mg/L	<0.000040	626	2.70	7.90	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00470	626	2.70	7.90	0.00170	0.00170
			Manganese- Total	mg/L	0.0300	626	2.70	7.90	2.60	2.60
			Nickel- Total	mg/L	<0.00050	626	2.70	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	626	2.70	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	626	2.70	7.90	0.190	0.190
		02-Oct-17	Cadmium- Dissolved	mg/L	0.0000120	241	3.60	7.70	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00560	241	3.60	7.70	0.00200	0.00200
			Manganese- Total	mg/L	0.0310	241	3.60	7.70	1.70	1.70
			Nickel- Total	mg/L	<0.00050	241	3.60	7.70	0.150	0.150
			Silver- Total	mg/L	0.0000130	241	3.60	7.70	0.00150	0.00150
			Zinc- Total	mg/L	0.00580	241	3.60	7.70	0.120	0.120
		17-Oct-17	Cadmium- Dissolved	mg/L	0.0000190	232	5.90	8.30	0.000390	0.000390
			Copper- Dissolved	mg/L	0.00920	232	5.90	8.30	0.00560	0.00560
			Manganese- Total	mg/L	0.0580	232	5.90	8.30	1.60	1.60
			Nickel- Total	mg/L	0.00150	232	5.90	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	232	5.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00480	232	5.90	8.30	0.110	0.110
		24-Oct-17	Cadmium- Dissolved	mg/L	0.0000100	235	5.70	8.30	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00790	235	5.70	8.30	0.00510	0.00510
			Manganese- Total	mg/L	0.0400	235	5.70	8.30	1.60	1.60
			Nickel- Total	mg/L	<0.00050	235	5.70	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	235	5.70	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	235	5.70	8.30	0.120	0.120
		31-Oct-17	Cadmium- Dissolved	mg/L	0.00000930	187	4.60	8.30	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00900	187	4.60	8.30	0.00390	0.00390
			Manganese- Total	mg/L	0.0390	187	4.60	8.30	1.40	1.40
			Nickel- Total	mg/L	<0.00050	187	4.60	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	187	4.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	187	4.60	8.30	0.0800	0.0800
		07-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	204	4.20	8.50	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00630	204	4.20	8.50	0.00410	0.00410
			Manganese- Total	mg/L	0.0370	204	4.20	8.50	1.50	1.50
			Nickel- Total	mg/L	<0.00050	204	4.20	8.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	204	4.20	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	204	4.20	8.50	0.0930	0.0930
		14-Nov-17	Cadmium- Dissolved	mg/L	0.00000830	206	4.20	8.30	0.000360	0.000360
			Copper- Dissolved	mg/L	0.0130	206	4.20	8.30	0.00360	0.00360
			Manganese- Total	mg/L	0.0400	206	4.20	8.30	1.50	1.50
			Nickel- Total	mg/L	<0.00050	206	4.20	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	206	4.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	206	4.20	8.30	0.0940	0.0940
		21-Nov-17	Cadmium- Dissolved	mg/L	0.00000970	224	3.70	8.40	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00730	224	3.70	8.40	0.00350	0.00350
			Manganese- Total	mg/L	0.0380	224	3.70	8.40	1.60	1.60
			Nickel- Total	mg/L	<0.00050	224	3.70	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	224	3.70	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	224	3.70	8.40	0.110	0.110
		28-Nov-17	Cadmium- Dissolved	mg/L	0.0000100	249	6.80	8.20	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0100	249	6.80	8.20	0.00610	0.00610
			Manganese- Total	mg/L	0.0530	249	6.80	8.20	1.70	1.70
			Nickel- Total	mg/L	0.000750	249	6.80	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	249	6.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	249	6.80	8.20	0.130	0.130
		05-Dec-17	Cadmium- Dissolved	mg/L	0.00000800	238	4.90	8.40	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00830	238	4.90	8.40	0.00500	0.00500
			Manganese- Total	mg/L	0.0390	238	4.90	8.40	1.70	1.70
			Nickel- Total	mg/L	<0.00050	238	4.90	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	238	4.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00600	238	4.90	8.40	0.120	0.120
	HAC-08	03-Jan-17	Cadmium- Dissolved	mg/L	0.0000110	250	5.30	8.20	0.000420	0.000420
			Copper- Dissolved	mg/L	0.00910	250	5.30	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.0490	250	5.30	8.20	1.70	1.70
			Nickel- Total	mg/L	0.00130	250	5.30	8.20	0.150	0.150
			Silver- Total	mg/L	0.0000200	250	5.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00400	250	5.30	8.20	0.130	0.130
		24-Jan-17	Cadmium- Dissolved	mg/L	0.00000670	146	6.00	8.30	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00760	146	6.00	8.30	0.00480	0.00480
			Manganese- Total	mg/L	0.0370	146	6.00	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	6.00	8.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.00	8.30	0.0500	0.0500
		01-Feb-17	Cadmium- Dissolved	mg/L	0.0000120	268	4.90	8.20	0.000440	0.000440
			Copper- Dissolved	mg/L	0.00740	268	4.90	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0310	268	4.90	8.20	1.80	1.80
			Nickel- Total	mg/L	0.000800	268	4.90	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	268	4.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00300	268	4.90	8.20	0.140	0.140
		01-Mar-17	Cadmium- Dissolved	mg/L	<0.000030	303	3.50	8.20	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00450	303	3.50	8.20	0.00310	0.00310
			Manganese- Total	mg/L	0.0350	303	3.50	8.20	1.90	1.90
			Nickel- Total	mg/L	<0.00050	303	3.50	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	303	3.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	303	3.50	8.20	0.170	0.170
		03-Apr-17	Cadmium- Dissolved	mg/L	0.0000230	128	13.0	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0170	128	13.0	8.20	0.00920	0.00920
			Manganese- Total	mg/L	0.140	128	13.0	8.20	1.20	1.20
			Nickel- Total	mg/L	0.00260	128	13.0	8.20	0.120	0.120
			Silver- Total	mg/L	0.0000240	128	13.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00750	128	13.0	8.20	0.0360	0.0360
		02-May-17	Cadmium- Dissolved	mg/L	0.00000650	124	8.30	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00970	124	8.30	8.30	0.00630	0.00630
			Manganese- Total	mg/L	0.0550	124	8.30	8.30	1.20	1.20
			Nickel- Total	mg/L	0.000770	124	8.30	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	8.30	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	124	8.30	8.30	0.0330	0.0330
		01-Jun-17	Cadmium- Dissolved	mg/L	<0.0000050	133	5.90	8.50	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00650	133	5.90	8.50	0.00520	0.00520
			Manganese- Total	mg/L	0.0260	133	5.90	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.90	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.90	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.90	8.50	0.0400	0.0400

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	HAC-08	13-Jun-17	Cadmium- Dissolved	mg/L	<0.000060	489	3.70	8.40	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00730	489	3.70	8.40	0.00360	0.00360
			Manganese- Total	mg/L	0.0440	489	3.70	8.40	2.60	2.60
			Nickel- Total	mg/L	0.000540	489	3.70	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	489	3.70	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	489	3.70	8.40	0.190	0.190
		04-Jul-17	Cadmium- Dissolved	mg/L	<0.000060	501	3.10	8.40	0.000460	0.000460
			Copper- Dissolved	mg/L	0.00500	501	3.10	8.40	0.00310	0.00310
			Manganese- Total	mg/L	0.0210	501	3.10	8.40	2.60	2.60
			Nickel- Total	mg/L	<0.00050	501	3.10	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	501	3.10	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	501	3.10	8.40	0.190	0.190
		27-Aug-17	Cadmium- Dissolved	mg/L	0.00000710	146	5.00	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00880	146	5.00	8.40	0.00430	0.00430
			Manganese- Total	mg/L	0.0230	146	5.00	8.40	1.20	1.20
			Nickel- Total	mg/L	0.000720	146	5.00	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.00	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	5.00	8.40	0.0500	0.0500
		19-Sep-17	Cadmium- Dissolved	mg/L	<0.000040	492	3.20	8.60	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0140	492	3.20	8.60	0.00350	0.00350
			Manganese- Total	mg/L	0.120	492	3.20	8.60	2.60	2.60
			Nickel- Total	mg/L	0.00230	492	3.20	8.60	0.150	0.150
			Silver- Total	mg/L	0.0000110	492	3.20	8.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00480	492	3.20	8.60	0.190	0.190
		10-Oct-17	Cadmium- Dissolved	mg/L	0.00000990	243	3.20	8.60	0.000410	0.000410
			Copper- Dissolved	mg/L	0.00550	243	3.20	8.60	0.00350	0.00350
			Manganese- Total	mg/L	0.0260	243	3.20	8.60	1.70	1.70
			Nickel- Total	mg/L	<0.00050	243	3.20	8.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	243	3.20	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	243	3.20	8.60	0.120	0.120
		17-Oct-17	Cadmium- Dissolved	mg/L	0.0000130	225	5.30	8.40	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00740	225	5.30	8.40	0.00540	0.00540
			Manganese- Total	mg/L	0.0690	225	5.30	8.40	1.60	1.60
			Nickel- Total	mg/L	0.00310	225	5.30	8.40	0.150	0.150
			Silver- Total	mg/L	0.0000140	225	5.30	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00610	225	5.30	8.40	0.110	0.110
		24-Oct-17	Cadmium- Dissolved	mg/L	0.00000860	255	5.50	8.40	0.000420	0.000420
			Copper- Dissolved	mg/L	0.00850	255	5.50	8.40	0.00550	0.00550
			Manganese- Total	mg/L	0.0330	255	5.50	8.40	1.70	1.70
			Nickel- Total	mg/L	<0.00050	255	5.50	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	255	5.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	255	5.50	8.40	0.130	0.130
		31-Oct-17	Cadmium- Dissolved	mg/L	0.00000930	190	4.40	8.40	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00640	190	4.40	8.40	0.00420	0.00420
			Manganese- Total	mg/L	0.0320	190	4.40	8.40	1.40	1.40
			Nickel- Total	mg/L	<0.00050	190	4.40	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	190	4.40	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	190	4.40	8.40	0.0820	0.0820
		07-Nov-17	Cadmium- Dissolved	mg/L	0.00000910	226	4.00	8.60	0.000390	0.000390
			Copper- Dissolved	mg/L	0.00700	226	4.00	8.60	0.00450	0.00450
			Manganese- Total	mg/L	0.0380	226	4.00	8.60	1.60	1.60
			Nickel- Total	mg/L	<0.00050	226	4.00	8.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	226	4.00	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	226	4.00	8.60	0.110	0.110
		14-Nov-17	Cadmium- Dissolved	mg/L	0.00000870	203	4.00	8.30	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00740	203	4.00	8.30	0.00360	0.00360
			Manganese- Total	mg/L	0.0280	203	4.00	8.30	1.50	1.50
			Nickel- Total	mg/L	0.000540	203	4.00	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	203	4.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	203	4.00	8.30	0.0920	0.0920
		21-Nov-17	Cadmium- Dissolved	mg/L	0.0000100	226	3.50	8.50	0.000390	0.000390
			Copper- Dissolved	mg/L	0.00710	226	3.50	8.50	0.00370	0.00370
			Manganese- Total	mg/L	0.0260	226	3.50	8.50	1.60	1.60
			Nickel- Total	mg/L	<0.00050	226	3.50	8.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	226	3.50	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00880	226	3.50	8.50	0.110	0.110
		28-Nov-17	Cadmium- Dissolved	mg/L	0.0000120	247	6.40	8.10	0.000410	0.000410
			Copper- Dissolved	mg/L	0.0100	247	6.40	8.10	0.00530	0.00530
			Manganese- Total	mg/L	0.0360	247	6.40	8.10	1.70	1.70
			Nickel- Total	mg/L	0.000780	247	6.40	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	247	6.40	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	247	6.40	8.10	0.130	0.130
		05-Dec-17	Cadmium- Dissolved	mg/L	0.00000930	235	4.90	8.50	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00860	235	4.90	8.50	0.00530	0.00530
			Manganese- Total	mg/L	0.0270	235	4.90	8.50	1.60	1.60
			Nickel- Total	mg/L	0.000590	235	4.90	8.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	235	4.90	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	235	4.90	8.50	0.120	0.120
	W10	03-Jan-17	Cadmium- Dissolved	mg/L	0.00000520	95.0	16.0	8.10	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00220	95.0	16.0	8.10	0.00970	0.00970
			Manganese- Total	mg/L	0.00660	95.0	16.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00120	95.0	16.0	8.10	0.0920	0.0920
			Silver- Total	mg/L	<0.000010	95.0	16.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	95.0	16.0	8.10	0.0120	0.0120
		01-Feb-17	Cadmium- Dissolved	mg/L	0.00000510	109	16.0	8.00	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00200	109	16.0	8.00	0.00900	0.00900
			Manganese- Total	mg/L	0.00580	109	16.0	8.00	1.10	1.10
			Nickel- Total	mg/L	0.00110	109	16.0	8.00	0.100	0.100
			Silver- Total	mg/L	<0.000010	109	16.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	109	16.0	8.00	0.0220	0.0220
		01-Mar-17	Cadmium- Dissolved	mg/L	0.00000680	93.0	15.0	8.00	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00240	93.0	15.0	8.00	0.00800	0.00800
			Manganese- Total	mg/L	0.00660	93.0	15.0	8.00	1.00	1.00
			Nickel- Total	mg/L	0.00110	93.0	15.0	8.00	0.0910	0.0910
			Silver- Total	mg/L	<0.000010	93.0	15.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	93.0	15.0	8.00	0.0100	0.0100
		03-Apr-17	Cadmium- Dissolved	mg/L	0.00000910	61.0	21.0	7.70	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00250	61.0	21.0	7.70	0.00750	0.00750
			Manganese- Total	mg/L	0.0270	61.0	21.0	7.70	0.870	0.870
			Nickel- Total	mg/L	0.00170	61.0	21.0	7.70	0.0650	0.0650
			Silver- Total	mg/L	0.0000150	61.0	21.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00320	61.0	21.0	7.70	0.00750	0.00750
		18-Apr-17	Cadmium- Dissolved	mg/L	0.00000780	57.0	17.0	7.80	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00300	57.0	17.0	7.80	0.00700	0.00700
			Manganese- Total	mg/L	0.0220	57.0	17.0	7.80	0.850	0.850
			Nickel- Total	mg/L	0.00180	57.0	17.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	57.0	17.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0060	57.0	17.0	7.80	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	W10	25-Apr-17	Cadmium- Dissolved	mg/L	0.00000820	46.0	17.0	7.80	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00260	46.0	17.0	7.80	0.00670	0.00670
			Manganese- Total	mg/L	0.0130	46.0	17.0	7.80	0.810	0.810
			Nickel- Total	mg/L	0.00160	46.0	17.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	46.0	17.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	46.0	17.0	7.80	0.00750	0.00750
		02-May-17	Cadmium- Dissolved	mg/L	0.00000550	48.0	18.0	7.80	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00260	48.0	18.0	7.80	0.00690	0.00690
			Manganese- Total	mg/L	0.00960	48.0	18.0	7.80	0.820	0.820
			Nickel- Total	mg/L	0.00140	48.0	18.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	48.0	18.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	48.0	18.0	7.80	0.00750	0.00750
		09-May-17	Cadmium- Dissolved	mg/L	0.00000600	52.0	18.0	7.70	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00280	52.0	18.0	7.70	0.00630	0.00630
			Manganese- Total	mg/L	0.0110	52.0	18.0	7.70	0.830	0.830
			Nickel- Total	mg/L	0.00140	52.0	18.0	7.70	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	52.0	18.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	52.0	18.0	7.70	0.00750	0.00750
		17-May-17	Cadmium- Dissolved	mg/L	0.0000100	53.0	20.0	7.80	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00300	53.0	20.0	7.80	0.00790	0.00790
			Manganese- Total	mg/L	0.0100	53.0	20.0	7.80	0.840	0.840
			Nickel- Total	mg/L	0.00140	53.0	20.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	0.0000150	53.0	20.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	53.0	20.0	7.80	0.00750	0.00750
		23-May-17	Cadmium- Dissolved	mg/L	0.00000620	65.0	19.0	7.80	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00290	65.0	19.0	7.80	0.00820	0.00820
			Manganese- Total	mg/L	0.00920	65.0	19.0	7.80	0.890	0.890
			Nickel- Total	mg/L	0.00130	65.0	19.0	7.80	0.0690	0.0690
			Silver- Total	mg/L	<0.000010	65.0	19.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	65.0	19.0	7.80	0.00750	0.00750
		01-Jun-17	Cadmium- Dissolved	mg/L	0.00000750	73.0	17.0	8.00	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00290	73.0	17.0	8.00	0.00860	0.00860
			Manganese- Total	mg/L	0.00910	73.0	17.0	8.00	0.930	0.930
			Nickel- Total	mg/L	0.00130	73.0	17.0	8.00	0.0750	0.0750
			Silver- Total	mg/L	<0.000010	73.0	17.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	73.0	17.0	8.00	0.00750	0.00750
		04-Jul-17	Cadmium- Dissolved	mg/L	<0.0000070	133	9.00	7.70	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00150	133	9.00	7.70	0.00420	0.00420
			Manganese- Total	mg/L	0.0180	133	9.00	7.70	1.20	1.20
			Nickel- Total	mg/L	0.000950	133	9.00	7.70	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	9.00	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	9.00	7.70	0.0400	0.0400
		17-Aug-17	Cadmium- Dissolved	mg/L	<0.0000050	194	5.20	7.90	0.000340	0.000340
			Copper- Dissolved	mg/L	0.000920	194	5.20	7.90	0.00320	0.00320
			Manganese- Total	mg/L	0.0150	194	5.20	7.90	1.50	1.50
			Nickel- Total	mg/L	0.000670	194	5.20	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	194	5.20	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	194	5.20	7.90	0.0860	0.0860
		05-Sep-17	Cadmium- Dissolved	mg/L	<0.0000050	189	4.60	7.20	0.000340	0.000340
			Copper- Dissolved	mg/L	0.000930	189	4.60	7.20	0.00130	0.00130
			Manganese- Total	mg/L	0.00960	189	4.60	7.20	1.40	1.40
			Nickel- Total	mg/L	0.000590	189	4.60	7.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	189	4.60	7.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00400	189	4.60	7.20	0.0820	0.0820
		11-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	190	4.90	8.40	0.000340	0.000340
			Copper- Dissolved	mg/L	0.000800	190	4.90	8.40	0.00470	0.00470
			Manganese- Total	mg/L	0.00540	190	4.90	8.40	1.40	1.40
			Nickel- Total	mg/L	0.000570	190	4.90	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	190	4.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	190	4.90	8.40	0.0820	0.0820
		07-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	145	12.0	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.000980	145	12.0	8.20	0.00880	0.00880
			Manganese- Total	mg/L	0.00480	145	12.0	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000670	145	12.0	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	12.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	12.0	8.20	0.0490	0.0490
	EDC-01a	03-Jan-17	Cadmium- Dissolved	mg/L	0.00000510	114	16.0	8.50	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00360	114	16.0	8.50	0.0120	0.0120
			Manganese- Total	mg/L	0.0240	114	16.0	8.50	1.10	1.10
			Nickel- Total	mg/L	0.00180	114	16.0	8.50	0.110	0.110
			Silver- Total	mg/L	0.0000140	114	16.0	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	16.0	8.50	0.0260	0.0260
		01-Feb-17	Cadmium- Dissolved	mg/L	<0.0000050	148	12.0	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00590	148	12.0	8.00	0.00740	0.00740
			Manganese- Total	mg/L	0.0100	148	12.0	8.00	1.30	1.30
			Nickel- Total	mg/L	0.000980	148	12.0	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	12.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	12.0	8.00	0.0510	0.0510
		01-Mar-17	Cadmium- Dissolved	mg/L	0.00000540	91.0	14.0	8.00	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00270	91.0	14.0	8.00	0.00800	0.00800
			Manganese- Total	mg/L	0.00760	91.0	14.0	8.00	1.00	1.00
			Nickel- Total	mg/L	0.00110	91.0	14.0	8.00	0.0890	0.0890
			Silver- Total	mg/L	<0.000010	91.0	14.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	91.0	14.0	8.00	0.00830	0.00830
		03-Apr-17	Cadmium- Dissolved	mg/L	0.00000960	67.0	20.0	7.80	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00380	67.0	20.0	7.80	0.00860	0.00860
			Manganese- Total	mg/L	0.0310	67.0	20.0	7.80	0.900	0.900
			Nickel- Total	mg/L	0.00190	67.0	20.0	7.80	0.0710	0.0710
			Silver- Total	mg/L	0.0000240	67.0	20.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	67.0	20.0	7.80	0.00750	0.00750
		18-Apr-17	Cadmium- Dissolved	mg/L	0.00000830	53.0	17.0	7.90	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00320	53.0	17.0	7.90	0.00730	0.00730
			Manganese- Total	mg/L	0.0210	53.0	17.0	7.90	0.840	0.840
			Nickel- Total	mg/L	0.00180	53.0	17.0	7.90	0.0250	0.0250
			Silver- Total	mg/L	0.0000120	53.0	17.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0060	53.0	17.0	7.90	0.00750	0.00750
		25-Apr-17	Cadmium- Dissolved	mg/L	0.00000610	48.0	17.0	7.70	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00300	48.0	17.0	7.70	0.00610	0.00610
			Manganese- Total	mg/L	0.0120	48.0	17.0	7.70	0.820	0.820
			Nickel- Total	mg/L	0.00160	48.0	17.0	7.70	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	48.0	17.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	48.0	17.0	7.70	0.00750	0.00750
		02-May-17	Cadmium- Dissolved	mg/L	0.00000630	50.0	17.0	7.80	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00310	50.0	17.0	7.80	0.00690	0.00690
			Manganese- Total	mg/L	0.00950	50.0	17.0	7.80	0.830	0.830
			Nickel- Total	mg/L	0.00130	50.0	17.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	50.0	17.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	17.0	7.80	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2017	EDC-01a	09-May-17	Cadmium- Dissolved	mg/L	0.00000710	50.0	17.0	7.80	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00310	50.0	17.0	7.80	0.00670	0.00670
			Manganese- Total	mg/L	0.0100	50.0	17.0	7.80	0.820	0.820
			Nickel- Total	mg/L	0.00130	50.0	17.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	50.0	17.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	50.0	17.0	7.80	0.00750	0.00750
		17-May-17	Cadmium- Dissolved	mg/L	0.00000960	55.0	19.0	8.00	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00330	55.0	19.0	8.00	0.00880	0.00880
			Manganese- Total	mg/L	0.00980	55.0	19.0	8.00	0.850	0.850
			Nickel- Total	mg/L	0.00140	55.0	19.0	8.00	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	55.0	19.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	55.0	19.0	8.00	0.00750	0.00750
		23-May-17	Cadmium- Dissolved	mg/L	0.00000690	63.0	19.0	7.90	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00330	63.0	19.0	7.90	0.00850	0.00850
			Manganese- Total	mg/L	0.0120	63.0	19.0	7.90	0.880	0.880
			Nickel- Total	mg/L	0.00130	63.0	19.0	7.90	0.0670	0.0670
			Silver- Total	mg/L	<0.000010	63.0	19.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	63.0	19.0	7.90	0.00750	0.00750
		01-Jun-17	Cadmium- Dissolved	mg/L	0.00000800	76.0	16.0	8.00	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00640	76.0	16.0	8.00	0.00870	0.00870
			Manganese- Total	mg/L	0.0140	76.0	16.0	8.00	0.940	0.940
			Nickel- Total	mg/L	0.00130	76.0	16.0	8.00	0.0780	0.0780
			Silver- Total	mg/L	0.0000220	76.0	16.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	76.0	16.0	8.00	0.00750	0.00750
		04-Jul-17	Cadmium- Dissolved	mg/L	<0.0000090	140	9.10	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00340	140	9.10	8.00	0.00570	0.00570
			Manganese- Total	mg/L	0.0270	140	9.10	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000850	140	9.10	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	9.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	9.10	8.00	0.0450	0.0450
		19-Sep-17	Cadmium- Dissolved	mg/L	<0.0000050	189	4.30	8.50	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00240	189	4.30	8.50	0.00450	0.00450
			Manganese- Total	mg/L	0.0200	189	4.30	8.50	1.40	1.40
			Nickel- Total	mg/L	<0.00050	189	4.30	8.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	189	4.30	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	189	4.30	8.50	0.0820	0.0820
		02-Oct-17	Cadmium- Dissolved	mg/L	<0.0000050	197	4.30	7.50	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00200	197	4.30	7.50	0.00190	0.00190
			Manganese- Total	mg/L	0.0200	197	4.30	7.50	1.50	1.50
			Nickel- Total	mg/L	<0.00050	197	4.30	7.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	197	4.30	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	197	4.30	7.50	0.0880	0.0880
		07-Nov-17	Cadmium- Dissolved	mg/L	<0.0000050	146	12.0	8.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00160	146	12.0	8.50	0.0100	0.0100
			Manganese- Total	mg/L	0.0110	146	12.0	8.50	1.20	1.20
			Nickel- Total	mg/L	0.000640	146	12.0	8.50	0.130	0.130
			Silver- Total	mg/L	0.0000170	146	12.0	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	12.0	8.50	0.0500	0.0500
		04-Dec-17	Cadmium- Dissolved	mg/L	0.00000680	141	10.0	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00360	141	10.0	8.30	0.00780	0.00780
			Manganese- Total	mg/L	0.00950	141	10.0	8.30	1.20	1.20
			Nickel- Total	mg/L	0.000650	141	10.0	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	10.0	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	10.0	8.30	0.0460	0.0460
2018	HAC-13	02-Jan-18	Cadmium- Dissolved	mg/L	<0.0000050	172	6.20	8.00	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0120	172	6.20	8.00	0.00370	0.00370
			Manganese- Total	mg/L	0.00130	172	6.20	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	172	6.20	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	172	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	172	6.20	8.00	0.0690	0.0690
		09-Jan-18	Cadmium- Dissolved	mg/L	0.00000850	158	5.80	7.70	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0120	158	5.80	7.70	0.00300	0.00300
			Manganese- Total	mg/L	0.00300	158	5.80	7.70	1.30	1.30
			Nickel- Total	mg/L	<0.00050	158	5.80	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	158	5.80	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	158	5.80	7.70	0.0580	0.0580
		16-Jan-18	Cadmium- Dissolved	mg/L	0.00000710	157	6.20	7.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	157	6.20	7.20	0.00170	0.00170
			Manganese- Total	mg/L	0.00260	157	6.20	7.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	6.20	7.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	6.20	7.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	6.20	7.20	0.0580	0.0580
		23-Jan-18	Cadmium- Dissolved	mg/L	0.00000680	147	6.10	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0110	147	6.10	7.90	0.00360	0.00360
			Manganese- Total	mg/L	0.00500	147	6.10	7.90	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	6.10	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	6.10	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	6.10	7.90	0.0500	0.0500
		30-Jan-18	Cadmium- Dissolved	mg/L	0.00000590	145	5.80	7.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00980	145	5.80	7.40	0.00210	0.00210
			Manganese- Total	mg/L	0.0130	145	5.80	7.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	145	5.80	7.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	5.80	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	5.80	7.40	0.0490	0.0490
		06-Feb-18	Cadmium- Dissolved	mg/L	<0.0000050	129	5.40	7.60	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00740	129	5.40	7.60	0.00230	0.00230
			Manganese- Total	mg/L	0.0190	129	5.40	7.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	5.40	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	5.40	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	5.40	7.60	0.0370	0.0370
		13-Feb-18	Cadmium- Dissolved	mg/L	0.00000500	132	5.90	7.60	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00610	132	5.90	7.60	0.00260	0.00260
			Manganese- Total	mg/L	0.0180	132	5.90	7.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	5.90	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	5.90	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	5.90	7.60	0.0390	0.0390
		20-Feb-18	Cadmium- Dissolved	mg/L	<0.0000050	146	5.80	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00610	146	5.80	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.0140	146	5.80	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	5.80	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.80	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	5.80	8.00	0.0500	0.0500
		01-Mar-18	Cadmium- Dissolved	mg/L	<0.0000050	167	6.10	7.60	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0100	167	6.10	7.60	0.00280	0.00280
			Manganese- Total	mg/L	0.00460	167	6.10	7.60	1.30	1.30
			Nickel- Total	mg/L	<0.00050	167	6.10	7.60	0.140	0.140
			Silver- Total	mg/L	<0.000010	167	6.10	7.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00800	167	6.10	7.60	0.0650	0.0650

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-13	08-Mar-18	Cadmium- Dissolved	mg/L	<0.0000050	178	5.60	7.80	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0100	178	5.60	7.80	0.00320	0.00320
			Manganese- Total	mg/L	0.00410	178	5.60	7.80	1.40	1.40
			Nickel- Total	mg/L	<0.00050	178	5.60	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000020	178	5.60	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	178	5.60	7.80	0.0740	0.0740
		14-Mar-18	Cadmium- Dissolved	mg/L	<0.0000050	206	6.40	7.50	0.000360	0.000360
			Copper- Dissolved	mg/L	0.0130	206	6.40	7.50	0.00290	0.00290
			Manganese- Total	mg/L	0.0180	206	6.40	7.50	1.50	1.50
			Nickel- Total	mg/L	0.000590	206	6.40	7.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	206	6.40	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	206	6.40	7.50	0.0940	0.0940
		20-Mar-18	Cadmium- Dissolved	mg/L	0.0000420	288	7.90	7.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0170	288	7.90	7.10	0.00220	0.00220
			Manganese- Total	mg/L	0.220	288	7.90	7.10	1.90	1.90
			Nickel- Total	mg/L	0.000720	288	7.90	7.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	288	7.90	7.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	288	7.90	7.10	0.160	0.160
		27-Mar-18	Cadmium- Dissolved	mg/L	0.0000350	285	8.00	7.30	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0210	285	8.00	7.30	0.00290	0.00290
			Manganese- Total	mg/L	0.240	285	8.00	7.30	1.90	1.90
			Nickel- Total	mg/L	0.000820	285	8.00	7.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	285	8.00	7.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	285	8.00	7.30	0.150	0.150
		03-Apr-18	Cadmium- Dissolved	mg/L	<0.0000050	146	6.00	7.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00940	146	6.00	7.50	0.00240	0.00240
			Manganese- Total	mg/L	0.0790	146	6.00	7.50	1.20	1.20
			Nickel- Total	mg/L	0.00120	146	6.00	7.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.00	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.00	7.50	0.0500	0.0500
		10-Apr-18	Cadmium- Dissolved	mg/L	0.00000890	147	6.20	7.60	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00830	147	6.20	7.60	0.00270	0.00270
			Manganese- Total	mg/L	0.0580	147	6.20	7.60	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	6.20	7.60	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	6.20	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	6.20	7.60	0.0500	0.0500
		17-Apr-18	Cadmium- Dissolved	mg/L	0.0000140	145	7.00	7.30	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0110	145	7.00	7.30	0.00210	0.00210
			Manganese- Total	mg/L	0.0740	145	7.00	7.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	145	7.00	7.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	7.00	7.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	7.00	7.30	0.0490	0.0490
		24-Apr-18	Cadmium- Dissolved	mg/L	0.0000680	275	9.20	7.30	0.000450	0.000450
			Copper- Dissolved	mg/L	0.0310	275	9.20	7.30	0.00320	0.00320
			Manganese- Total	mg/L	0.480	275	9.20	7.30	1.80	1.80
			Nickel- Total	mg/L	0.00160	275	9.20	7.30	0.150	0.150
			Silver- Total	mg/L	0.0000170	275	9.20	7.30	0.00150	0.00150
			Zinc- Total	mg/L	0.00390	275	9.20	7.30	0.150	0.150
		01-May-18	Cadmium- Dissolved	mg/L	0.0000150	88.0	12.0	7.70	0.000190	0.000190
			Copper- Dissolved	mg/L	0.0140	88.0	12.0	7.70	0.00510	0.00510
			Manganese- Total	mg/L	0.0460	88.0	12.0	7.70	0.990	0.990
			Nickel- Total	mg/L	0.000710	88.0	12.0	7.70	0.0870	0.0870
			Silver- Total	mg/L	0.0000150	88.0	12.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	88.0	12.0	7.70	0.00750	0.00750
		08-May-18	Cadmium- Dissolved	mg/L	0.00000700	90.0	7.70	7.90	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00910	90.0	7.70	7.90	0.00380	0.00380
			Manganese- Total	mg/L	0.0180	90.0	7.70	7.90	1.00	1.00
			Nickel- Total	mg/L	0.000590	90.0	7.70	7.90	0.0890	0.0890
			Silver- Total	mg/L	<0.000010	90.0	7.70	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	90.0	7.70	7.90	0.00780	0.00780
		16-May-18	Cadmium- Dissolved	mg/L	0.0000110	127	6.70	7.70	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00940	127	6.70	7.70	0.00310	0.00310
			Manganese- Total	mg/L	0.0250	127	6.70	7.70	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	6.70	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	6.70	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	6.70	7.70	0.0350	0.0350
		24-May-18	Cadmium- Dissolved	mg/L	0.00000660	127	6.00	7.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00640	127	6.00	7.40	0.00200	0.00200
			Manganese- Total	mg/L	0.0140	127	6.00	7.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	6.00	7.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	6.00	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	6.00	7.40	0.0350	0.0350
		29-May-18	Cadmium- Dissolved	mg/L	0.00000590	130	5.90	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00680	130	5.90	8.00	0.00340	0.00340
			Manganese- Total	mg/L	0.0120	130	5.90	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	5.90	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	5.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	5.90	8.00	0.0380	0.0380
		05-Jun-18	Cadmium- Dissolved	mg/L	<0.0000050	124	5.80	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00620	124	5.80	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.00740	124	5.80	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	124	5.80	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	5.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	124	5.80	8.10	0.0330	0.0330
		12-Jun-18	Cadmium- Dissolved	mg/L	0.00000830	133	5.60	8.40	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	133	5.60	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.00880	133	5.60	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.60	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.60	8.40	0.0400	0.0400
		18-Jun-18	Cadmium- Dissolved	mg/L	<0.0000050	124	5.80	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00580	124	5.80	8.40	0.00480	0.00480
			Manganese- Total	mg/L	0.00960	124	5.80	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	124	5.80	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	5.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	124	5.80	8.40	0.0330	0.0330
		26-Jun-18	Cadmium- Dissolved	mg/L	<0.0000050	123	5.50	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00590	123	5.50	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.00830	123	5.50	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	5.50	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	5.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	5.50	8.30	0.0320	0.0320
		04-Jul-18	Cadmium- Dissolved	mg/L	0.00000530	125	5.60	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00660	125	5.60	8.40	0.00440	0.00440
			Manganese- Total	mg/L	0.00860	125	5.60	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	5.60	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	5.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	5.60	8.40	0.0340	0.0340

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-13	10-Jul-18	Cadmium- Dissolved	mg/L	<0.0000050	125	5.70	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00630	125	5.70	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.0110	125	5.70	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	5.70	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	5.70	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	5.70	8.30	0.0340	0.0340
		17-Jul-18	Cadmium- Dissolved	mg/L	0.00000690	122	5.60	8.60	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00550	122	5.60	8.60	0.00480	0.00480
			Manganese- Total	mg/L	0.0140	122	5.60	8.60	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.60	8.60	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.60	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.60	8.60	0.0320	0.0320
		24-Jul-18	Cadmium- Dissolved	mg/L	0.00000680	127	5.90	8.70	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00530	127	5.90	8.70	0.00560	0.00560
			Manganese- Total	mg/L	0.0130	127	5.90	8.70	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	5.90	8.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	5.90	8.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	5.90	8.70	0.0350	0.0350
		02-Aug-18	Cadmium- Dissolved	mg/L	0.00000570	117	5.40	8.00	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00560	117	5.40	8.00	0.00310	0.00310
			Manganese- Total	mg/L	0.0120	117	5.40	8.00	1.10	1.10
			Nickel- Total	mg/L	<0.00050	117	5.40	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	117	5.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	117	5.40	8.00	0.0280	0.0280
		07-Aug-18	Cadmium- Dissolved	mg/L	0.00000570	115	5.40	8.20	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00570	115	5.40	8.20	0.00370	0.00370
			Manganese- Total	mg/L	0.0120	115	5.40	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	115	5.40	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	115	5.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	115	5.40	8.20	0.0260	0.0260
		14-Aug-18	Cadmium- Dissolved	mg/L	<0.0000050	122	5.60	7.80	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00550	122	5.60	7.80	0.00280	0.00280
			Manganese- Total	mg/L	0.0150	122	5.60	7.80	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.60	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.60	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.60	7.80	0.0320	0.0320
		21-Aug-18	Cadmium- Dissolved	mg/L	<0.0000050	121	5.60	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00570	121	5.60	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.0120	121	5.60	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	121	5.60	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	5.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	5.60	8.30	0.0310	0.0310
		28-Aug-18	Cadmium- Dissolved	mg/L	<0.0000050	121	5.10	7.70	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00590	121	5.10	7.70	0.00230	0.00230
			Manganese- Total	mg/L	0.00980	121	5.10	7.70	1.10	1.10
			Nickel- Total	mg/L	<0.00050	121	5.10	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	5.10	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	5.10	7.70	0.0310	0.0310
		04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	122	5.20	7.60	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00600	122	5.20	7.60	0.00210	0.00210
			Manganese- Total	mg/L	0.00750	122	5.20	7.60	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.20	7.60	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.20	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.20	7.60	0.0320	0.0320
		10-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	157	4.40	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00840	157	4.40	8.00	0.00300	0.00300
			Manganese- Total	mg/L	0.0220	157	4.40	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	4.40	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	4.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	4.40	8.00	0.0580	0.0580
		20-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	124	5.30	7.80	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00600	124	5.30	7.80	0.00280	0.00280
			Manganese- Total	mg/L	0.00800	124	5.30	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	124	5.30	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	5.30	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	124	5.30	7.80	0.0330	0.0330
		24-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	135	5.40	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00640	135	5.40	8.00	0.00340	0.00340
			Manganese- Total	mg/L	0.00860	135	5.40	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	5.40	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	5.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	5.40	8.00	0.0410	0.0410
		02-Oct-18	Cadmium- Dissolved	mg/L	0.00000560	127	5.40	7.70	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00590	127	5.40	7.70	0.00260	0.00260
			Manganese- Total	mg/L	0.00840	127	5.40	7.70	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	5.40	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	5.40	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	5.40	7.70	0.0350	0.0350
		09-Oct-18	Cadmium- Dissolved	mg/L	0.00000510	133	5.30	7.90	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00710	133	5.30	7.90	0.00310	0.00310
			Manganese- Total	mg/L	0.00890	133	5.30	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.30	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.30	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.30	7.90	0.0400	0.0400
		16-Oct-18	Cadmium- Dissolved	mg/L	<0.0000050	133	5.50	7.50	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00660	133	5.50	7.50	0.00210	0.00210
			Manganese- Total	mg/L	0.00810	133	5.50	7.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.50	7.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.50	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.50	7.50	0.0400	0.0400
		23-Oct-18	Cadmium- Dissolved	mg/L	0.00000740	141	5.60	7.50	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00660	141	5.60	7.50	0.00210	0.00210
			Manganese- Total	mg/L	0.00580	141	5.60	7.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	5.60	7.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	5.60	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	5.60	7.50	0.0460	0.0460
		30-Oct-18	Cadmium- Dissolved	mg/L	<0.0000050	135	4.60	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	135	4.60	8.00	0.00260	0.00260
			Manganese- Total	mg/L	0.00670	135	4.60	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	4.60	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	4.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	4.60	8.00	0.0410	0.0410
		06-Nov-18	Cadmium- Dissolved	mg/L	0.0000160	179	11.0	7.90	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0190	179	11.0	7.90	0.00690	0.00690
			Manganese- Total	mg/L	0.0280	179	11.0	7.90	1.40	1.40
			Nickel- Total	mg/L	0.000600	179	11.0	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	179	11.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	179	11.0	7.90	0.0740	0.0740

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-13	13-Nov-18	Cadmium- Dissolved	mg/L	0.0000120	160	6.50	7.90	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0110	160	6.50	7.90	0.00390	0.00390
			Manganese- Total	mg/L	0.0210	160	6.50	7.90	1.30	1.30
			Nickel- Total	mg/L	<0.00050	160	6.50	7.90	0.140	0.140
			Silver- Total	mg/L	<0.000010	160	6.50	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	160	6.50	7.90	0.0600	0.0600
		27-Nov-18	Cadmium- Dissolved	mg/L	0.0000130	220	9.10	7.10	0.000380	0.000380
			Copper- Dissolved	mg/L	0.0190	220	9.10	7.10	0.00240	0.00240
			Manganese- Total	mg/L	0.0870	220	9.10	7.10	1.60	1.60
			Nickel- Total	mg/L	0.000510	220	9.10	7.10	0.150	0.150
			Silver- Total	mg/L	0.0000100	220	9.10	7.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	220	9.10	7.10	0.100	0.100
		04-Dec-18	Cadmium- Dissolved	mg/L	0.0000110	154	6.60	7.90	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	154	6.60	7.90	0.00390	0.00390
			Manganese- Total	mg/L	0.0480	154	6.60	7.90	1.30	1.30
			Nickel- Total	mg/L	<0.00050	154	6.60	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	6.60	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	6.60	7.90	0.0560	0.0560
	HAC-05a	02-Jan-18	Cadmium- Dissolved	mg/L	0.00000700	221	4.70	7.90	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00860	221	4.70	7.90	0.00300	0.00300
			Manganese- Total	mg/L	0.0190	221	4.70	7.90	1.60	1.60
			Nickel- Total	mg/L	<0.00050	221	4.70	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	221	4.70	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	221	4.70	7.90	0.110	0.110
		09-Jan-18	Cadmium- Dissolved	mg/L	0.00000520	204	4.40	7.90	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00900	204	4.40	7.90	0.00290	0.00290
			Manganese- Total	mg/L	0.0240	204	4.40	7.90	1.50	1.50
			Nickel- Total	mg/L	<0.00050	204	4.40	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	204	4.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	204	4.40	7.90	0.0930	0.0930
		16-Jan-18	Cadmium- Dissolved	mg/L	0.00000610	198	5.10	7.50	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00860	198	5.10	7.50	0.00220	0.00220
			Manganese- Total	mg/L	0.0180	198	5.10	7.50	1.50	1.50
			Nickel- Total	mg/L	<0.00050	198	5.10	7.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	198	5.10	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	198	5.10	7.50	0.0880	0.0880
		23-Jan-18	Cadmium- Dissolved	mg/L	0.00000700	191	5.30	7.80	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00900	191	5.30	7.80	0.00320	0.00320
			Manganese- Total	mg/L	0.0190	191	5.30	7.80	1.40	1.40
			Nickel- Total	mg/L	<0.00050	191	5.30	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	191	5.30	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	191	5.30	7.80	0.0830	0.0830
		30-Jan-18	Cadmium- Dissolved	mg/L	0.00000580	182	5.20	7.60	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00900	182	5.20	7.60	0.00230	0.00230
			Manganese- Total	mg/L	0.0210	182	5.20	7.60	1.40	1.40
			Nickel- Total	mg/L	<0.00050	182	5.20	7.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	182	5.20	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	182	5.20	7.60	0.0760	0.0760
		06-Feb-18	Cadmium- Dissolved	mg/L	<0.0000050	139	5.40	7.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00880	139	5.40	7.60	0.00240	0.00240
			Manganese- Total	mg/L	0.0160	139	5.40	7.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	139	5.40	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	139	5.40	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	139	5.40	7.60	0.0440	0.0440
		13-Feb-18	Cadmium- Dissolved	mg/L	0.00000770	144	5.80	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00780	144	5.80	7.90	0.00350	0.00350
			Manganese- Total	mg/L	0.0200	144	5.80	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	5.80	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	5.80	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	5.80	7.90	0.0480	0.0480
		20-Feb-18	Cadmium- Dissolved	mg/L	0.00000730	154	5.60	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00780	154	5.60	7.80	0.00300	0.00300
			Manganese- Total	mg/L	0.0110	154	5.60	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	154	5.60	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	5.60	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	5.60	7.80	0.0560	0.0560
		14-Mar-18	Cadmium- Dissolved	mg/L	0.00000540	245	4.60	7.70	0.000410	0.000410
			Copper- Dissolved	mg/L	0.00870	245	4.60	7.70	0.00260	0.00260
			Manganese- Total	mg/L	0.0610	245	4.60	7.70	1.70	1.70
			Nickel- Total	mg/L	<0.00050	245	4.60	7.70	0.150	0.150
			Silver- Total	mg/L	<0.000010	245	4.60	7.70	0.00150	0.00150
			Zinc- Total	mg/L	0.00450	245	4.60	7.70	0.120	0.120
		20-Mar-18	Cadmium- Dissolved	mg/L	0.0000150	314	6.10	7.60	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0120	314	6.10	7.60	0.00310	0.00310
			Manganese- Total	mg/L	0.0560	314	6.10	7.60	2.00	2.00
			Nickel- Total	mg/L	<0.00050	314	6.10	7.60	0.150	0.150
			Silver- Total	mg/L	<0.000010	314	6.10	7.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00390	314	6.10	7.60	0.180	0.180
		27-Mar-18	Cadmium- Dissolved	mg/L	0.0000140	295	6.60	7.70	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0140	295	6.60	7.70	0.00370	0.00370
			Manganese- Total	mg/L	0.0740	295	6.60	7.70	1.90	1.90
			Nickel- Total	mg/L	0.000580	295	6.60	7.70	0.150	0.150
			Silver- Total	mg/L	<0.000010	295	6.60	7.70	0.00150	0.00150
			Zinc- Total	mg/L	0.00360	295	6.60	7.70	0.160	0.160
		03-Apr-18	Cadmium- Dissolved	mg/L	<0.0000050	164	5.90	7.80	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00960	164	5.90	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.0490	164	5.90	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	164	5.90	7.80	0.140	0.140
			Silver- Total	mg/L	<0.000010	164	5.90	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	5.90	7.80	0.0630	0.0630
		10-Apr-18	Cadmium- Dissolved	mg/L	0.0000120	156	6.20	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00910	156	6.20	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.0590	156	6.20	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	156	6.20	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	156	6.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	156	6.20	7.80	0.0570	0.0570
		17-Apr-18	Cadmium- Dissolved	mg/L	0.0000120	144	7.20	7.80	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0120	144	7.20	7.80	0.00370	0.00370
			Manganese- Total	mg/L	0.0710	144	7.20	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	7.20	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	7.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	7.20	7.80	0.0480	0.0480
		24-Apr-18	Cadmium- Dissolved	mg/L	0.0000510	266	9.60	7.60	0.000430	0.000430
			Copper- Dissolved	mg/L	0.0270	266	9.60	7.60	0.00490	0.00490
			Manganese- Total	mg/L	0.320	266	9.60	7.60	1.80	1.80
			Nickel- Total	mg/L	0.00110	266	9.60	7.60	0.150	0.150
			Silver- Total	mg/L	0.0000130	266	9.60	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	266	9.60	7.60	0.140	0.140

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-05a	01-May-18	Cadmium- Dissolved	mg/L	0.0000160	101	13.0	7.60	0.000210	0.000210
			Copper- Dissolved	mg/L	0.0190	101	13.0	7.60	0.00490	0.00490
			Manganese- Total	mg/L	0.0860	101	13.0	7.60	1.00	1.00
			Nickel- Total	mg/L	0.00170	101	13.0	7.60	0.0960	0.0960
			Silver- Total	mg/L	0.0000200	101	13.0	7.60	0.00150	0.00150
			Zinc- Total	mg/L	0.00450	101	13.0	7.60	0.0160	0.0160
		08-May-18	Cadmium- Dissolved	mg/L	0.00000900	101	8.70	8.00	0.000210	0.000210
			Copper- Dissolved	mg/L	0.0130	101	8.70	8.00	0.00480	0.00480
			Manganese- Total	mg/L	0.0340	101	8.70	8.00	1.00	1.00
			Nickel- Total	mg/L	0.000790	101	8.70	8.00	0.0960	0.0960
			Silver- Total	mg/L	<0.000010	101	8.70	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	101	8.70	8.00	0.0160	0.0160
		16-May-18	Cadmium- Dissolved	mg/L	0.0000140	151	6.90	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	151	6.90	7.80	0.00380	0.00380
			Manganese- Total	mg/L	0.0420	151	6.90	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	6.90	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	6.90	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	6.90	7.80	0.0530	0.0530
		05-Jun-18	Cadmium- Dissolved	mg/L	0.00000530	146	5.40	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00680	146	5.40	8.20	0.00410	0.00410
			Manganese- Total	mg/L	0.0180	146	5.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	5.40	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	5.40	8.20	0.0500	0.0500
		04-Jul-18	Cadmium- Dissolved	mg/L	<0.0000050	140	5.40	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00720	140	5.40	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0150	140	5.40	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000860	140	5.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	5.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	5.40	8.20	0.0450	0.0450
		02-Aug-18	Cadmium- Dissolved	mg/L	0.00000590	128	5.10	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00580	128	5.10	8.20	0.00360	0.00360
			Manganese- Total	mg/L	0.0110	128	5.10	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	5.10	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	5.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	5.10	8.20	0.0360	0.0360
		04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	147	4.70	8.10	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00630	147	4.70	8.10	0.00320	0.00320
			Manganese- Total	mg/L	0.0110	147	4.70	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	4.70	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	4.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	4.70	8.10	0.0500	0.0500
		24-Sep-18	Cadmium- Dissolved	mg/L	0.00000550	171	4.90	8.00	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00670	171	4.90	8.00	0.00360	0.00360
			Manganese- Total	mg/L	0.0200	171	4.90	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	171	4.90	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	171	4.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	171	4.90	8.00	0.0680	0.0680
		02-Oct-18	Cadmium- Dissolved	mg/L	<0.0000050	157	4.80	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00570	157	4.80	7.80	0.00280	0.00280
			Manganese- Total	mg/L	0.0140	157	4.80	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	4.80	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	4.80	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	4.80	7.80	0.0580	0.0580
		06-Nov-18	Cadmium- Dissolved	mg/L	0.0000140	214	12.0	8.10	0.000370	0.000370
			Copper- Dissolved	mg/L	0.0190	214	12.0	8.10	0.00890	0.00890
			Manganese- Total	mg/L	0.0450	214	12.0	8.10	1.50	1.50
			Nickel- Total	mg/L	0.000800	214	12.0	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	214	12.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	214	12.0	8.10	0.100	0.100
		27-Nov-18	Cadmium- Dissolved	mg/L	0.0000160	228	9.30	7.40	0.000390	0.000390
			Copper- Dissolved	mg/L	0.0210	228	9.30	7.40	0.00340	0.00340
			Manganese- Total	mg/L	0.100	228	9.30	7.40	1.60	1.60
			Nickel- Total	mg/L	0.00110	228	9.30	7.40	0.150	0.150
			Silver- Total	mg/L	0.0000180	228	9.30	7.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	228	9.30	7.40	0.110	0.110
		04-Dec-18	Cadmium- Dissolved	mg/L	0.00000750	199	7.00	8.00	0.000350	0.000350
			Copper- Dissolved	mg/L	0.0120	199	7.00	8.00	0.00500	0.00500
			Manganese- Total	mg/L	0.0580	199	7.00	8.00	1.50	1.50
			Nickel- Total	mg/L	<0.00050	199	7.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	199	7.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	199	7.00	8.00	0.0890	0.0890
	HAC-14	02-Jan-18	Cadmium- Dissolved	mg/L	0.00000680	236	4.00	8.00	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00660	236	4.00	8.00	0.00300	0.00300
			Manganese- Total	mg/L	0.0400	236	4.00	8.00	1.60	1.60
			Nickel- Total	mg/L	<0.00050	236	4.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	236	4.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	236	4.00	8.00	0.120	0.120
		09-Jan-18	Cadmium- Dissolved	mg/L	0.00000800	220	3.90	7.90	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00750	220	3.90	7.90	0.00270	0.00270
			Manganese- Total	mg/L	0.0430	220	3.90	7.90	1.60	1.60
			Nickel- Total	mg/L	<0.00050	220	3.90	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	220	3.90	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	220	3.90	7.90	0.100	0.100
		16-Jan-18	Cadmium- Dissolved	mg/L	0.00000800	218	5.00	7.80	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00770	218	5.00	7.80	0.00310	0.00310
			Manganese- Total	mg/L	0.0360	218	5.00	7.80	1.60	1.60
			Nickel- Total	mg/L	<0.00050	218	5.00	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	218	5.00	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	218	5.00	7.80	0.100	0.100
		23-Jan-18	Cadmium- Dissolved	mg/L	0.00000700	208	4.60	8.00	0.000360	0.000360
			Copper- Dissolved	mg/L	0.00790	208	4.60	8.00	0.00320	0.00320
			Manganese- Total	mg/L	0.0390	208	4.60	8.00	1.50	1.50
			Nickel- Total	mg/L	<0.00050	208	4.60	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	208	4.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	208	4.60	8.00	0.0960	0.0960
		10-Apr-18	Cadmium- Dissolved	mg/L	0.0000150	154	6.20	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	154	6.20	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.110	154	6.20	8.00	1.30	1.30
			Nickel- Total	mg/L	0.00210	154	6.20	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00450	154	6.20	8.00	0.0560	0.0560
		17-Apr-18	Cadmium- Dissolved	mg/L	0.0000130	142	8.30	7.80	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0130	142	8.30	7.80	0.00410	0.00410
			Manganese- Total	mg/L	0.0680	142	8.30	7.80	1.20	1.20
			Nickel- Total	mg/L	0.000910	142	8.30	7.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	8.30	7.80	0.00150	0.00150
			Zinc- Total	mg/L	0.0130	142	8.30	7.80	0.0460	0.0460

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-14	24-Apr-18	Cadmium- Dissolved	mg/L	0.0000380	207	12.0	7.90	0.000360	0.000360
			Copper- Dissolved	mg/L	0.0220	207	12.0	7.90	0.00790	0.00790
			Manganese- Total	mg/L	0.230	207	12.0	7.90	1.50	1.50
			Nickel- Total	mg/L	0.00280	207	12.0	7.90	0.150	0.150
			Silver- Total	mg/L	0.0000190	207	12.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.00600	207	12.0	7.90	0.0950	0.0950
		01-May-18	Cadmium- Dissolved	mg/L	0.0000190	92.0	14.0	7.80	0.000200	0.000200
			Copper- Dissolved	mg/L	0.0210	92.0	14.0	7.80	0.00650	0.00650
			Manganese- Total	mg/L	0.0970	92.0	14.0	7.80	1.00	1.00
			Nickel- Total	mg/L	0.00330	92.0	14.0	7.80	0.0900	0.0900
			Silver- Total	mg/L	0.0000280	92.0	14.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00690	92.0	14.0	7.80	0.00920	0.00920
		08-May-18	Cadmium- Dissolved	mg/L	0.0000100	94.0	11.0	8.10	0.000200	0.000200
			Copper- Dissolved	mg/L	0.0160	94.0	11.0	8.10	0.00650	0.00650
			Manganese- Total	mg/L	0.0450	94.0	11.0	8.10	1.00	1.00
			Nickel- Total	mg/L	0.00140	94.0	11.0	8.10	0.0910	0.0910
			Silver- Total	mg/L	0.0000130	94.0	11.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	94.0	11.0	8.10	0.0100	0.0100
		16-May-18	Cadmium- Dissolved	mg/L	0.0000110	157	8.30	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0130	157	8.30	8.00	0.00560	0.00560
			Manganese- Total	mg/L	0.0510	157	8.30	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	8.30	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	8.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	8.30	8.00	0.0580	0.0580
		24-May-18	Cadmium- Dissolved	mg/L	0.00000670	148	6.20	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00860	148	6.20	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0380	148	6.20	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	148	6.20	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	6.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	6.20	8.20	0.0510	0.0510
		05-Jun-18	Cadmium- Dissolved	mg/L	0.00000890	157	5.30	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00790	157	5.30	8.20	0.00420	0.00420
			Manganese- Total	mg/L	0.0280	157	5.30	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	5.30	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.30	8.20	0.0580	0.0580
		12-Jun-18	Cadmium- Dissolved	mg/L	0.0000100	156	5.30	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00800	156	5.30	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.0220	156	5.30	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	156	5.30	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	156	5.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	156	5.30	8.10	0.0570	0.0570
		18-Jun-18	Cadmium- Dissolved	mg/L	<0.0000050	142	5.30	8.50	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00700	142	5.30	8.50	0.00490	0.00490
			Manganese- Total	mg/L	0.0220	142	5.30	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	5.30	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	5.30	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	142	5.30	8.50	0.0460	0.0460
		26-Jun-18	Cadmium- Dissolved	mg/L	0.00000820	147	5.20	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00790	147	5.20	8.20	0.00380	0.00380
			Manganese- Total	mg/L	0.0240	147	5.20	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	5.20	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	5.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	5.20	8.20	0.0500	0.0500
		04-Jul-18	Cadmium- Dissolved	mg/L	0.00000510	151	5.20	8.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00780	151	5.20	8.40	0.00430	0.00430
			Manganese- Total	mg/L	0.0220	151	5.20	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	5.20	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	5.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00370	151	5.20	8.40	0.0530	0.0530
		10-Jul-18	Cadmium- Dissolved	mg/L	<0.0000050	151	5.00	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00780	151	5.00	8.20	0.00380	0.00380
			Manganese- Total	mg/L	0.0220	151	5.00	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	5.00	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	5.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	5.00	8.20	0.0530	0.0530
		17-Jul-18	Cadmium- Dissolved	mg/L	0.0000120	137	5.20	8.40	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00710	137	5.20	8.40	0.00420	0.00420
			Manganese- Total	mg/L	0.0200	137	5.20	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	137	5.20	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	137	5.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	137	5.20	8.40	0.0430	0.0430
		24-Jul-18	Cadmium- Dissolved	mg/L	<0.0000050	142	5.10	8.70	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00690	142	5.10	8.70	0.00490	0.00490
			Manganese- Total	mg/L	0.0140	142	5.10	8.70	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	5.10	8.70	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	5.10	8.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	142	5.10	8.70	0.0460	0.0460
		02-Aug-18	Cadmium- Dissolved	mg/L	0.00000700	138	4.90	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00660	138	4.90	8.00	0.00320	0.00320
			Manganese- Total	mg/L	0.0170	138	4.90	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	4.90	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	4.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	4.90	8.00	0.0440	0.0440
		07-Aug-18	Cadmium- Dissolved	mg/L	0.00000570	133	5.00	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00670	133	5.00	8.20	0.00360	0.00360
			Manganese- Total	mg/L	0.0160	133	5.00	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.00	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.00	8.20	0.0400	0.0400
		14-Aug-18	Cadmium- Dissolved	mg/L	<0.0000050	120	5.00	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00660	120	5.00	8.10	0.00330	0.00330
			Manganese- Total	mg/L	0.0250	120	5.00	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000740	120	5.00	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	5.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	120	5.00	8.10	0.0300	0.0300
		21-Aug-18	Cadmium- Dissolved	mg/L	0.00000740	149	4.70	8.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00760	149	4.70	8.50	0.00410	0.00410
			Manganese- Total	mg/L	0.0180	149	4.70	8.50	1.30	1.30
			Nickel- Total	mg/L	<0.00050	149	4.70	8.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	149	4.70	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	149	4.70	8.50	0.0520	0.0520
		28-Aug-18	Cadmium- Dissolved	mg/L	0.00000540	163	4.50	8.30	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00780	163	4.50	8.30	0.00370	0.00370
			Manganese- Total	mg/L	0.0210	163	4.50	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	163	4.50	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	163	4.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	163	4.50	8.30	0.0620	0.0620

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-14	04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	161	4.60	8.20	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00820	161	4.60	8.20	0.00350	0.00350
			Manganese- Total	mg/L	0.0190	161	4.60	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	161	4.60	8.20	0.140	0.140
			Silver- Total	mg/L	<0.000010	161	4.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	161	4.60	8.20	0.0610	0.0610
		10-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	117	5.30	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00640	117	5.30	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.00930	117	5.30	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	117	5.30	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	117	5.30	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	117	5.30	8.30	0.0280	0.0280
		20-Sep-18	Cadmium- Dissolved	mg/L	0.00000770	170	4.90	8.00	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00890	170	4.90	8.00	0.00310	0.00310
			Manganese- Total	mg/L	0.0480	170	4.90	8.00	1.40	1.40
			Nickel- Total	mg/L	0.000970	170	4.90	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	170	4.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00300	170	4.90	8.00	0.0680	0.0680
		24-Sep-18	Cadmium- Dissolved	mg/L	0.00000910	191	4.90	7.90	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00880	191	4.90	7.90	0.00320	0.00320
			Manganese- Total	mg/L	0.0820	191	4.90	7.90	1.40	1.40
			Nickel- Total	mg/L	0.00140	191	4.90	7.90	0.150	0.150
			Silver- Total	mg/L	0.0000150	191	4.90	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.00620	191	4.90	7.90	0.0830	0.0830
		02-Oct-18	Cadmium- Dissolved	mg/L	0.00000660	173	4.60	8.10	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00730	173	4.60	8.10	0.00330	0.00330
			Manganese- Total	mg/L	0.0230	173	4.60	8.10	1.40	1.40
			Nickel- Total	mg/L	<0.00050	173	4.60	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	173	4.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00330	173	4.60	8.10	0.0700	0.0700
		09-Oct-18	Cadmium- Dissolved	mg/L	0.0000100	183	4.80	8.10	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00880	183	4.80	8.10	0.00370	0.00370
			Manganese- Total	mg/L	0.0530	183	4.80	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000850	183	4.80	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	183	4.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00350	183	4.80	8.10	0.0770	0.0770
		16-Oct-18	Cadmium- Dissolved	mg/L	0.00000530	186	4.60	7.90	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00920	186	4.60	7.90	0.00290	0.00290
			Manganese- Total	mg/L	0.0310	186	4.60	7.90	1.40	1.40
			Nickel- Total	mg/L	<0.00050	186	4.60	7.90	0.150	0.150
			Silver- Total	mg/L	<0.000010	186	4.60	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	186	4.60	7.90	0.0800	0.0800
		23-Oct-18	Cadmium- Dissolved	mg/L	0.00000710	186	4.30	8.00	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00950	186	4.30	8.00	0.00310	0.00310
			Manganese- Total	mg/L	0.0300	186	4.30	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	186	4.30	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	186	4.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	186	4.30	8.00	0.0800	0.0800
		30-Oct-18	Cadmium- Dissolved	mg/L	0.00000790	175	4.50	8.40	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00950	175	4.50	8.40	0.00400	0.00400
			Manganese- Total	mg/L	0.0290	175	4.50	8.40	1.40	1.40
			Nickel- Total	mg/L	<0.00050	175	4.50	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	175	4.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	175	4.50	8.40	0.0710	0.0710
		06-Nov-18	Cadmium- Dissolved	mg/L	0.0000140	184	17.0	8.10	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0240	184	17.0	8.10	0.0120	0.0120
			Manganese- Total	mg/L	0.0460	184	17.0	8.10	1.40	1.40
			Nickel- Total	mg/L	0.00200	184	17.0	8.10	0.150	0.150
			Silver- Total	mg/L	0.0000200	184	17.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.0210	184	17.0	8.10	0.0780	0.0780
		13-Nov-18	Cadmium- Dissolved	mg/L	0.0000110	191	7.80	8.20	0.000340	0.000340
			Copper- Dissolved	mg/L	0.0150	191	7.80	8.20	0.00650	0.00650
			Manganese- Total	mg/L	0.0340	191	7.80	8.20	1.40	1.40
			Nickel- Total	mg/L	0.000540	191	7.80	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	191	7.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	191	7.80	8.20	0.0830	0.0830
		27-Nov-18	Cadmium- Dissolved	mg/L	0.0000180	185	12.0	7.70	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0200	185	12.0	7.70	0.00630	0.00630
			Manganese- Total	mg/L	0.100	185	12.0	7.70	1.40	1.40
			Nickel- Total	mg/L	0.00240	185	12.0	7.70	0.150	0.150
			Silver- Total	mg/L	0.0000220	185	12.0	7.70	0.00150	0.00150
			Zinc- Total	mg/L	0.00650	185	12.0	7.70	0.0790	0.0790
		04-Dec-18	Cadmium- Dissolved	mg/L	0.0000120	205	8.30	8.20	0.000360	0.000360
			Copper- Dissolved	mg/L	0.0180	205	8.30	8.20	0.00700	0.00700
			Manganese- Total	mg/L	0.0450	205	8.30	8.20	1.50	1.50
			Nickel- Total	mg/L	0.000720	205	8.30	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	205	8.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	205	8.30	8.20	0.0940	0.0940
	HAC-08	02-Jan-18	Cadmium- Dissolved	mg/L	0.00000560	240	3.70	7.70	0.000400	0.000400
			Copper- Dissolved	mg/L	0.00680	240	3.70	7.70	0.00200	0.00200
			Manganese- Total	mg/L	0.0330	240	3.70	7.70	1.70	1.70
			Nickel- Total	mg/L	0.000510	240	3.70	7.70	0.150	0.150
			Silver- Total	mg/L	<0.000010	240	3.70	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	240	3.70	7.70	0.120	0.120
		09-Jan-18	Cadmium- Dissolved	mg/L	0.00000680	222	3.70	8.10	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00780	222	3.70	8.10	0.00280	0.00280
			Manganese- Total	mg/L	0.0320	222	3.70	8.10	1.60	1.60
			Nickel- Total	mg/L	0.000600	222	3.70	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	222	3.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	222	3.70	8.10	0.110	0.110
		16-Jan-18	Cadmium- Dissolved	mg/L	0.00000820	212	4.00	8.00	0.000370	0.000370
			Copper- Dissolved	mg/L	0.00750	212	4.00	8.00	0.00290	0.00290
			Manganese- Total	mg/L	0.0310	212	4.00	8.00	1.50	1.50
			Nickel- Total	mg/L	0.000620	212	4.00	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	212	4.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	212	4.00	8.00	0.0990	0.0990
		23-Jan-18	Cadmium- Dissolved	mg/L	0.00000850	218	4.30	7.80	0.000380	0.000380
			Copper- Dissolved	mg/L	0.00830	218	4.30	7.80	0.00280	0.00280
			Manganese- Total	mg/L	0.0290	218	4.30	7.80	1.60	1.60
			Nickel- Total	mg/L	<0.00050	218	4.30	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	218	4.30	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	218	4.30	7.80	0.100	0.100
		30-Jan-18	Cadmium- Dissolved	mg/L	0.00000830	213	4.50	8.00	0.000370	0.000370
			Copper- Dissolved	mg/L	0.00850	213	4.50	8.00	0.00320	0.00320
			Manganese- Total	mg/L	0.0280	213	4.50	8.00	1.50	1.50
			Nickel- Total	mg/L	0.000640	213	4.50	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	213	4.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	213	4.50	8.00	0.100	0.100

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-08	06-Feb-18	Cadmium- Dissolved	mg/L	0.00000770	162	5.20	7.70	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0110	162	5.20	7.70	0.00250	0.00250
			Manganese- Total	mg/L	0.0290	162	5.20	7.70	1.30	1.30
			Nickel- Total	mg/L	0.000770	162	5.20	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	162	5.20	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	162	5.20	7.70	0.0620	0.0620
		13-Feb-18	Cadmium- Dissolved	mg/L	0.0000100	157	5.50	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00930	157	5.50	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.0300	157	5.50	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000750	157	5.50	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.50	8.10	0.0580	0.0580
		20-Feb-18	Cadmium- Dissolved	mg/L	0.00000630	157	5.40	7.50	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0140	157	5.40	7.50	0.00220	0.00220
			Manganese- Total	mg/L	0.0120	157	5.40	7.50	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	5.40	7.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.40	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.40	7.50	0.0580	0.0580
		14-Mar-18	Cadmium- Dissolved	mg/L	0.00000720	250	3.90	8.00	0.000420	0.000420
			Copper- Dissolved	mg/L	0.00790	250	3.90	8.00	0.00300	0.00300
			Manganese- Total	mg/L	0.0300	250	3.90	8.00	1.70	1.70
			Nickel- Total	mg/L	0.000880	250	3.90	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	250	3.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	250	3.90	8.00	0.130	0.130
		20-Mar-18	Cadmium- Dissolved	mg/L	0.0000180	291	4.80	8.10	0.000460	0.000460
			Copper- Dissolved	mg/L	0.0100	291	4.80	8.10	0.00410	0.00410
			Manganese- Total	mg/L	0.0310	291	4.80	8.10	1.90	1.90
			Nickel- Total	mg/L	0.000940	291	4.80	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	291	4.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	291	4.80	8.10	0.160	0.160
		27-Mar-18	Cadmium- Dissolved	mg/L	0.0000140	254	6.00	7.80	0.000420	0.000420
			Copper- Dissolved	mg/L	0.0110	254	6.00	7.80	0.00380	0.00380
			Manganese- Total	mg/L	0.0520	254	6.00	7.80	1.70	1.70
			Nickel- Total	mg/L	0.00140	254	6.00	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	254	6.00	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	254	6.00	7.80	0.130	0.130
		03-Apr-18	Cadmium- Dissolved	mg/L	0.00000590	176	5.80	8.10	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0100	176	5.80	8.10	0.00450	0.00450
			Manganese- Total	mg/L	0.0350	176	5.80	8.10	1.40	1.40
			Nickel- Total	mg/L	0.000820	176	5.80	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	176	5.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	176	5.80	8.10	0.0720	0.0720
		10-Apr-18	Cadmium- Dissolved	mg/L	0.0000110	156	6.30	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	156	6.30	8.10	0.00460	0.00460
			Manganese- Total	mg/L	0.180	156	6.30	8.10	1.30	1.30
			Nickel- Total	mg/L	0.00420	156	6.30	8.10	0.130	0.130
			Silver- Total	mg/L	0.0000320	156	6.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00900	156	6.30	8.10	0.0570	0.0570
		17-Apr-18	Cadmium- Dissolved	mg/L	0.0000140	135	9.30	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0130	135	9.30	8.00	0.00590	0.00590
			Manganese- Total	mg/L	0.0640	135	9.30	8.00	1.20	1.20
			Nickel- Total	mg/L	0.00110	135	9.30	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	9.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	9.30	8.00	0.0410	0.0410
		24-Apr-18	Cadmium- Dissolved	mg/L	0.0000280	176	12.0	8.00	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0190	176	12.0	8.00	0.00850	0.00850
			Manganese- Total	mg/L	0.160	176	12.0	8.00	1.40	1.40
			Nickel- Total	mg/L	0.00220	176	12.0	8.00	0.150	0.150
			Silver- Total	mg/L	0.0000200	176	12.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00460	176	12.0	8.00	0.0720	0.0720
		01-May-18	Cadmium- Dissolved	mg/L	0.0000140	88.0	14.0	7.80	0.000190	0.000190
			Copper- Dissolved	mg/L	0.0190	88.0	14.0	7.80	0.00670	0.00670
			Manganese- Total	mg/L	0.0940	88.0	14.0	7.80	0.990	0.990
			Nickel- Total	mg/L	0.00340	88.0	14.0	7.80	0.0870	0.0870
			Silver- Total	mg/L	0.0000230	88.0	14.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00670	88.0	14.0	7.80	0.00750	0.00750
		08-May-18	Cadmium- Dissolved	mg/L	0.0000100	94.0	11.0	8.00	0.000200	0.000200
			Copper- Dissolved	mg/L	0.0160	94.0	11.0	8.00	0.00650	0.00650
			Manganese- Total	mg/L	0.0480	94.0	11.0	8.00	1.00	1.00
			Nickel- Total	mg/L	0.00190	94.0	11.0	8.00	0.0910	0.0910
			Silver- Total	mg/L	0.0000140	94.0	11.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00340	94.0	11.0	8.00	0.0100	0.0100
		16-May-18	Cadmium- Dissolved	mg/L	0.0000120	152	8.00	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0140	152	8.00	8.10	0.00560	0.00560
			Manganese- Total	mg/L	0.0500	152	8.00	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000720	152	8.00	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	152	8.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	152	8.00	8.10	0.0540	0.0540
		05-Jun-18	Cadmium- Dissolved	mg/L	0.0000140	162	5.50	8.40	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00860	162	5.50	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.0280	162	5.50	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	162	5.50	8.40	0.140	0.140
			Silver- Total	mg/L	<0.000010	162	5.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	162	5.50	8.40	0.0620	0.0620
		04-Jul-18	Cadmium- Dissolved	mg/L	0.00000670	155	5.40	8.50	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00800	155	5.40	8.50	0.00500	0.00500
			Manganese- Total	mg/L	0.0210	155	5.40	8.50	1.30	1.30
			Nickel- Total	mg/L	<0.00050	155	5.40	8.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	155	5.40	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	155	5.40	8.50	0.0560	0.0560
		02-Aug-18	Cadmium- Dissolved	mg/L	0.00000790	138	5.20	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00700	138	5.20	8.00	0.00340	0.00340
			Manganese- Total	mg/L	0.0150	138	5.20	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	5.20	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	5.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	5.20	8.00	0.0440	0.0440
		04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	164	4.30	8.30	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00820	164	4.30	8.30	0.00370	0.00370
			Manganese- Total	mg/L	0.00920	164	4.30	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	164	4.30	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	164	4.30	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	164	4.30	8.30	0.0630	0.0630
		02-Oct-18	Cadmium- Dissolved	mg/L	0.00000880	173	4.40	8.30	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00730	173	4.40	8.30	0.00380	0.00380
			Manganese- Total	mg/L	0.0160	173	4.40	8.30	1.40	1.40
			Nickel- Total	mg/L	0.000530	173	4.40	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	173	4.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	173	4.40	8.30	0.0700	0.0700

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	HAC-08	06-Nov-18	Cadmium- Dissolved	mg/L	0.0000160	176	17.0	8.20	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0220	176	17.0	8.20	0.0140	0.0140
			Manganese- Total	mg/L	0.0480	176	17.0	8.20	1.40	1.40
			Nickel- Total	mg/L	0.00180	176	17.0	8.20	0.150	0.150
			Silver- Total	mg/L	0.0000190	176	17.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	176	17.0	8.20	0.0720	0.0720
		27-Nov-18	Cadmium- Dissolved	mg/L	0.0000170	166	12.0	7.80	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0170	166	12.0	7.80	0.00700	0.00700
			Manganese- Total	mg/L	0.120	166	12.0	7.80	1.30	1.30
			Nickel- Total	mg/L	0.00370	166	12.0	7.80	0.140	0.140
			Silver- Total	mg/L	0.0000250	166	12.0	7.80	0.00150	0.00150
			Zinc- Total	mg/L	0.00860	166	12.0	7.80	0.0640	0.0640
		04-Dec-18	Cadmium- Dissolved	mg/L	0.0000120	180	9.40	8.30	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0170	180	9.40	8.30	0.00810	0.00810
			Manganese- Total	mg/L	0.0540	180	9.40	8.30	1.40	1.40
			Nickel- Total	mg/L	0.000910	180	9.40	8.30	0.150	0.150
			Silver- Total	mg/L	<0.000010	180	9.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	180	9.40	8.30	0.0750	0.0750
	W10	02-Jan-18	Cadmium- Dissolved	mg/L	<0.0000050	157	9.60	7.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00120	157	9.60	7.20	0.00260	0.00260
			Manganese- Total	mg/L	0.00260	157	9.60	7.20	1.30	1.30
			Nickel- Total	mg/L	0.000700	157	9.60	7.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	9.60	7.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	9.60	7.20	0.0580	0.0580
		14-Feb-18	Cadmium- Dissolved	mg/L	<0.0000050	141	9.40	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00100	141	9.40	8.20	0.00700	0.00700
			Manganese- Total	mg/L	0.00260	141	9.40	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000580	141	9.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	9.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	9.40	8.20	0.0460	0.0460
		14-Mar-18	Cadmium- Dissolved	mg/L	<0.0000050	139	7.60	7.90	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00100	139	7.60	7.90	0.00440	0.00440
			Manganese- Total	mg/L	0.00290	139	7.60	7.90	1.20	1.20
			Nickel- Total	mg/L	0.000610	139	7.60	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	139	7.60	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	139	7.60	7.90	0.0440	0.0440
		03-Apr-18	Cadmium- Dissolved	mg/L	<0.0000050	90.0	14.0	7.70	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00240	90.0	14.0	7.70	0.00590	0.00590
			Manganese- Total	mg/L	0.00760	90.0	14.0	7.70	1.00	1.00
			Nickel- Total	mg/L	0.00120	90.0	14.0	7.70	0.0880	0.0880
			Silver- Total	mg/L	<0.000010	90.0	14.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	90.0	14.0	7.70	0.00750	0.00750
		01-May-18	Cadmium- Dissolved	mg/L	0.00000550	41.0	18.0	7.50	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00330	41.0	18.0	7.50	0.00510	0.00510
			Manganese- Total	mg/L	0.0230	41.0	18.0	7.50	0.780	0.780
			Nickel- Total	mg/L	0.00200	41.0	18.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	41.0	18.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	41.0	18.0	7.50	0.00750	0.00750
		05-Jun-18	Cadmium- Dissolved	mg/L	0.00000620	103	12.0	8.00	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00240	103	12.0	8.00	0.00650	0.00650
			Manganese- Total	mg/L	0.00360	103	12.0	8.00	1.10	1.10
			Nickel- Total	mg/L	0.00100	103	12.0	8.00	0.0980	0.0980
			Silver- Total	mg/L	<0.000010	103	12.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	103	12.0	8.00	0.0170	0.0170
		04-Jul-18	Cadmium- Dissolved	mg/L	<0.0000050	103	11.0	8.10	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00220	103	11.0	8.10	0.00670	0.00670
			Manganese- Total	mg/L	0.00480	103	11.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.00100	103	11.0	8.10	0.0980	0.0980
			Silver- Total	mg/L	<0.000020	103	11.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	103	11.0	8.10	0.0170	0.0170
		02-Aug-18	Cadmium- Dissolved	mg/L	0.00000590	146	6.00	7.30	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00160	146	6.00	7.30	0.00190	0.00190
			Manganese- Total	mg/L	0.00690	146	6.00	7.30	1.20	1.20
			Nickel- Total	mg/L	0.000690	146	6.00	7.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.00	7.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.00	7.30	0.0500	0.0500
		04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	187	3.90	7.80	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00120	187	3.90	7.80	0.00230	0.00230
			Manganese- Total	mg/L	0.00330	187	3.90	7.80	1.40	1.40
			Nickel- Total	mg/L	<0.00050	187	3.90	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	187	3.90	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	187	3.90	7.80	0.0800	0.0800
		02-Oct-18	Cadmium- Dissolved	mg/L	0.00000530	146	6.50	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00120	146	6.50	8.00	0.00420	0.00420
			Manganese- Total	mg/L	0.00280	146	6.50	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000670	146	6.50	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.50	8.00	0.0500	0.0500
		06-Nov-18	Cadmium- Dissolved	mg/L	0.0000100	56.0	27.0	7.70	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00460	56.0	27.0	7.70	0.00750	0.00750
			Manganese- Total	mg/L	0.0120	56.0	27.0	7.70	0.850	0.850
			Nickel- Total	mg/L	0.00180	56.0	27.0	7.70	0.0250	0.0250
			Silver- Total	mg/L	0.0000100	56.0	27.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	56.0	27.0	7.70	0.00750	0.00750
	EDC-01a	02-Jan-18	Cadmium- Dissolved	mg/L	<0.0000050	195	7.50	7.80	0.000350	0.000350
			Copper- Dissolved	mg/L	0.00610	195	7.50	7.80	0.00440	0.00440
			Manganese- Total	mg/L	0.0170	195	7.50	7.80	1.50	1.50
			Nickel- Total	mg/L	0.000580	195	7.50	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	195	7.50	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	195	7.50	7.80	0.0860	0.0860
		30-Jan-18	Cadmium- Dissolved	mg/L	<0.0000050	172	7.20	7.80	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00490	172	7.20	7.80	0.00360	0.00360
			Manganese- Total	mg/L	0.0200	172	7.20	7.80	1.40	1.40
			Nickel- Total	mg/L	0.000570	172	7.20	7.80	0.140	0.140
			Silver- Total	mg/L	<0.000010	172	7.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	172	7.20	7.80	0.0690	0.0690
		14-Feb-18	Cadmium- Dissolved	mg/L	0.00000550	166	8.30	8.70	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00400	166	8.30	8.70	0.00880	0.00880
			Manganese- Total	mg/L	0.0150	166	8.30	8.70	1.30	1.30
			Nickel- Total	mg/L	0.000570	166	8.30	8.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	166	8.30	8.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	166	8.30	8.70	0.0640	0.0640
		14-Mar-18	Cadmium- Dissolved	mg/L	<0.0000050	187	6.20	7.80	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00480	187	6.20	7.80	0.00350	0.00350
			Manganese- Total	mg/L	0.0190	187	6.20	7.80	1.40	1.40
			Nickel- Total	mg/L	0.000540	187	6.20	7.80	0.150	0.150
			Silver- Total	mg/L	<0.000010	187	6.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	187	6.20	7.80	0.0800	0.0800

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2018	EDC-01a	03-Apr-18	Cadmium- Dissolved	mg/L	<0.0000050	102	13.0	7.90	0.000210	0.000210
			Copper- Dissolved	mg/L	0.00340	102	13.0	7.90	0.00680	0.00680
			Manganese- Total	mg/L	0.0100	102	13.0	7.90	1.10	1.10
			Nickel- Total	mg/L	0.00100	102	13.0	7.90	0.0970	0.0970
			Silver- Total	mg/L	<0.000010	102	13.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	102	13.0	7.90	0.0160	0.0160
		01-May-18	Cadmium- Dissolved	mg/L	0.00000710	40.0	18.0	7.50	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00350	40.0	18.0	7.50	0.00510	0.00510
			Manganese- Total	mg/L	0.0290	40.0	18.0	7.50	0.780	0.780
			Nickel- Total	mg/L	0.00230	40.0	18.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	40.0	18.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00310	40.0	18.0	7.50	0.00750	0.00750
		05-Jun-18	Cadmium- Dissolved	mg/L	0.00000580	108	11.0	8.00	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00370	108	11.0	8.00	0.00640	0.00640
			Manganese- Total	mg/L	0.0120	108	11.0	8.00	1.10	1.10
			Nickel- Total	mg/L	0.000950	108	11.0	8.00	0.100	0.100
			Silver- Total	mg/L	<0.000010	108	11.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	108	11.0	8.00	0.0210	0.0210
		04-Jul-18	Cadmium- Dissolved	mg/L	0.00000660	112	10.0	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00430	112	10.0	8.10	0.00660	0.00660
			Manganese- Total	mg/L	0.0160	112	10.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000920	112	10.0	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	112	10.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	112	10.0	8.10	0.0240	0.0240
		02-Aug-18	Cadmium- Dissolved	mg/L	0.0000160	161	6.00	7.50	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00740	161	6.00	7.50	0.00240	0.00240
			Manganese- Total	mg/L	0.0320	161	6.00	7.50	1.30	1.30
			Nickel- Total	mg/L	0.000590	161	6.00	7.50	0.140	0.140
			Silver- Total	mg/L	<0.000010	161	6.00	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	161	6.00	7.50	0.0610	0.0610
		04-Sep-18	Cadmium- Dissolved	mg/L	<0.0000050	180	4.40	8.10	0.000330	0.000330
			Copper- Dissolved	mg/L	0.00370	180	4.40	8.10	0.00330	0.00330
			Manganese- Total	mg/L	0.0290	180	4.40	8.10	1.40	1.40
			Nickel- Total	mg/L	<0.00050	180	4.40	8.10	0.150	0.150
			Silver- Total	mg/L	<0.000010	180	4.40	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	180	4.40	8.10	0.0750	0.0750
		02-Oct-18	Cadmium- Dissolved	mg/L	0.00000580	156	6.10	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00340	156	6.10	8.00	0.00400	0.00400
			Manganese- Total	mg/L	0.0200	156	6.10	8.00	1.30	1.30
			Nickel- Total	mg/L	0.000710	156	6.10	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	156	6.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	156	6.10	8.00	0.0570	0.0570
		06-Nov-18	Cadmium- Dissolved	mg/L	0.00000940	54.0	26.0	7.80	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00420	54.0	26.0	7.80	0.00790	0.00790
			Manganese- Total	mg/L	0.0120	54.0	26.0	7.80	0.840	0.840
			Nickel- Total	mg/L	0.00170	54.0	26.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	54.0	26.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	54.0	26.0	7.80	0.00750	0.00750
2019	HAC-13	08-Jan-19	Cadmium- Dissolved	mg/L	0.00000530	127	5.90	8.00	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00620	127	5.90	8.00	0.00370	0.00370
			Manganese- Total	mg/L	0.0230	127	5.90	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	5.90	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	5.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	5.90	8.00	0.0350	0.0350
		05-Feb-19	Cadmium- Dissolved	mg/L	<0.0000050	133	5.60	7.80	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00640	133	5.60	7.80	0.00290	0.00290
			Manganese- Total	mg/L	0.0270	133	5.60	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.60	7.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.60	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.60	7.80	0.0400	0.0400
		04-Mar-19	Cadmium- Dissolved	mg/L	0.00000630	130	6.50	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	130	6.50	8.00	0.00370	0.00370
			Manganese- Total	mg/L	0.0150	130	6.50	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	6.50	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	6.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	6.50	8.00	0.0380	0.0380
		02-Apr-19	Cadmium- Dissolved	mg/L	0.0000160	140	9.00	7.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0110	140	9.00	7.60	0.00390	0.00390
			Manganese- Total	mg/L	0.100	140	9.00	7.60	1.20	1.20
			Nickel- Total	mg/L	0.000560	140	9.00	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	9.00	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	9.00	7.60	0.0450	0.0450
		14-May-19	Cadmium- Dissolved	mg/L	<0.0000050	122	6.40	7.90	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00690	122	6.40	7.90	0.00360	0.00360
			Manganese- Total	mg/L	0.0250	122	6.40	7.90	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	6.40	7.90	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	6.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	6.40	7.90	0.0320	0.0320
		04-Jun-19	Cadmium- Dissolved	mg/L	<0.0000050	125	5.80	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00520	125	5.80	8.20	0.00420	0.00420
			Manganese- Total	mg/L	0.0130	125	5.80	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	5.80	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	5.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	5.80	8.20	0.0340	0.0340
		02-Jul-19	Cadmium- Dissolved	mg/L	<0.0000050	118	5.60	8.60	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00450	118	5.60	8.60	0.00480	0.00480
			Manganese- Total	mg/L	0.0150	118	5.60	8.60	1.10	1.10
			Nickel- Total	mg/L	<0.00050	118	5.60	8.60	0.110	0.110
			Silver- Total	mg/L	<0.000010	118	5.60	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	118	5.60	8.60	0.0280	0.0280
		01-Aug-19	Cadmium- Dissolved	mg/L	<0.0000050	134	6.30	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00500	134	6.30	8.10	0.00430	0.00430
			Manganese- Total	mg/L	0.0170	134	6.30	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.30	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.30	8.10	0.0400	0.0400
		03-Sep-19	Cadmium- Dissolved	mg/L	<0.0000050	122	5.60	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00430	122	5.60	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.0130	122	5.60	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.60	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.60	8.30	0.0320	0.0320
		01-Oct-19	Cadmium- Dissolved	mg/L	<0.0000050	140	5.70	8.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00480	140	5.70	8.60	0.00510	0.00510
			Manganese- Total	mg/L	0.00800	140	5.70	8.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	5.70	8.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	5.70	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	5.70	8.60	0.0450	0.0450

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2019	HAC-13	04-Nov-19	Cadmium- Dissolved	mg/L	0.00000730	122	6.30	8.20	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00550	122	6.30	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.00860	122	6.30	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	6.30	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	6.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	6.30	8.20	0.0320	0.0320
		02-Dec-19	Cadmium- Dissolved	mg/L	<0.0000050	135	6.20	7.90	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00420	135	6.20	7.90	0.00340	0.00340
			Manganese- Total	mg/L	0.00650	135	6.20	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	6.20	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	6.20	7.90	0.00150	0.00150
			Zinc- Total	mg/L	0.0200	135	6.20	7.90	0.0410	0.0410
	HAC-05a	08-Jan-19	Cadmium- Dissolved	mg/L	<0.0000050	143	5.80	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00690	143	5.80	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0260	143	5.80	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	5.80	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	5.80	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	5.80	8.00	0.0470	0.0470
		05-Feb-19	Cadmium- Dissolved	mg/L	<0.0000050	143	5.40	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00680	143	5.40	7.90	0.00320	0.00320
			Manganese- Total	mg/L	0.0330	143	5.40	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	5.40	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	5.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	5.40	7.90	0.0470	0.0470
		04-Mar-19	Cadmium- Dissolved	mg/L	<0.0000050	144	6.20	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00700	144	6.20	7.90	0.00350	0.00350
			Manganese- Total	mg/L	0.0240	144	6.20	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	6.20	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	6.20	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	6.20	7.90	0.0480	0.0480
		02-Apr-19	Cadmium- Dissolved	mg/L	0.0000180	159	9.00	7.70	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0130	159	9.00	7.70	0.00450	0.00450
			Manganese- Total	mg/L	0.120	159	9.00	7.70	1.30	1.30
			Nickel- Total	mg/L	0.000590	159	9.00	7.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	159	9.00	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	159	9.00	7.70	0.0590	0.0590
		14-May-19	Cadmium- Dissolved	mg/L	0.00000610	151	6.20	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00760	151	6.20	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0450	151	6.20	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	6.20	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	6.20	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	6.20	8.10	0.0530	0.0530
		04-Jun-19	Cadmium- Dissolved	mg/L	<0.0000050	150	5.50	8.30	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00560	150	5.50	8.30	0.00440	0.00440
			Manganese- Total	mg/L	0.0230	150	5.50	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	150	5.50	8.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	150	5.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.0120	150	5.50	8.30	0.0520	0.0520
		02-Jul-19	Cadmium- Dissolved	mg/L	<0.0000050	138	5.60	8.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00470	138	5.60	8.60	0.00510	0.00510
			Manganese- Total	mg/L	0.0200	138	5.60	8.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	5.60	8.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	5.60	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	5.60	8.60	0.0440	0.0440
		01-Aug-19	Cadmium- Dissolved	mg/L	<0.0000050	144	6.00	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00550	144	6.00	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0210	144	6.00	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	6.00	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	6.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	6.00	8.20	0.0480	0.0480
		03-Sep-19	Cadmium- Dissolved	mg/L	<0.0000050	135	5.40	8.40	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00450	135	5.40	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.0210	135	5.40	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	5.40	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	5.40	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	5.40	8.40	0.0410	0.0410
		01-Oct-19	Cadmium- Dissolved	mg/L	0.00000630	167	5.40	8.60	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00530	167	5.40	8.60	0.00550	0.00550
			Manganese- Total	mg/L	0.0220	167	5.40	8.60	1.30	1.30
			Nickel- Total	mg/L	<0.00050	167	5.40	8.60	0.140	0.140
			Silver- Total	mg/L	<0.000010	167	5.40	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	167	5.40	8.60	0.0650	0.0650
		04-Nov-19	Cadmium- Dissolved	mg/L	0.00000690	135	6.40	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00610	135	6.40	8.30	0.00500	0.00500
			Manganese- Total	mg/L	0.0210	135	6.40	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	6.40	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	6.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	6.40	8.30	0.0410	0.0410
		02-Dec-19	Cadmium- Dissolved	mg/L	<0.0000050	143	6.10	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00450	143	6.10	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0160	143	6.10	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	6.10	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	6.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	6.10	8.00	0.0470	0.0470
	HAC-14	14-May-19	Cadmium- Dissolved	mg/L	0.00000790	157	6.70	8.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	157	6.70	8.40	0.00570	0.00570
			Manganese- Total	mg/L	0.0300	157	6.70	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	6.70	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	6.70	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	6.70	8.40	0.0580	0.0580
		04-Jun-19	Cadmium- Dissolved	mg/L	<0.0000050	169	5.20	8.20	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00760	169	5.20	8.20	0.00390	0.00390
			Manganese- Total	mg/L	0.0270	169	5.20	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	169	5.20	8.20	0.140	0.140
			Silver- Total	mg/L	<0.000010	169	5.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	169	5.20	8.20	0.0670	0.0670
		02-Jul-19	Cadmium- Dissolved	mg/L	<0.000020	145	5.00	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00810	145	5.00	8.40	0.00420	0.00420
			Manganese- Total	mg/L	0.0610	145	5.00	8.40	1.20	1.20
			Nickel- Total	mg/L	0.00180	145	5.00	8.40	0.130	0.130
			Silver- Total	mg/L	0.0000100	145	5.00	8.40	0.00150	0.00150
			Zinc- Total	mg/L	0.00390	145	5.00	8.40	0.0490	0.0490
		01-Aug-19	Cadmium- Dissolved	mg/L	<0.000015	157	5.60	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0120	157	5.60	8.20	0.00420	0.00420
			Manganese- Total	mg/L	0.0510	157	5.60	8.20	1.30	1.30
			Nickel- Total	mg/L	0.00100	157	5.60	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.60	8.20	0.0580	0.0580

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2019	HAC-14	03-Sep-19	Cadmium- Dissolved	mg/L	<0.0000050	141	4.90	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0100	141	4.90	8.20	0.00370	0.00370
			Manganese- Total	mg/L	0.0100	141	4.90	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	4.90	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	4.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	4.90	8.20	0.0460	0.0460
		01-Oct-19	Cadmium- Dissolved	mg/L	0.0000110	174	6.10	8.20	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0120	174	6.10	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0140	174	6.10	8.20	1.40	1.40
			Nickel- Total	mg/L	<0.00050	174	6.10	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	174	6.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	174	6.10	8.20	0.0700	0.0700
		04-Nov-19	Cadmium- Dissolved	mg/L	0.0000100	132	7.60	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0100	132	7.60	8.20	0.00540	0.00540
			Manganese- Total	mg/L	0.0180	132	7.60	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000630	132	7.60	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	7.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	7.60	8.20	0.0390	0.0390
		02-Dec-19	Cadmium- Dissolved	mg/L	<0.0000050	147	6.10	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00680	147	6.10	7.90	0.00360	0.00360
			Manganese- Total	mg/L	0.0150	147	6.10	7.90	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	6.10	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	6.10	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	6.10	7.90	0.0500	0.0500
	HAC-08	08-Jan-19	Cadmium- Dissolved	mg/L	0.00000740	165	5.90	8.20	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0110	165	5.90	8.20	0.00460	0.00460
			Manganese- Total	mg/L	0.0280	165	5.90	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	165	5.90	8.20	0.140	0.140
			Silver- Total	mg/L	<0.000010	165	5.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	165	5.90	8.20	0.0640	0.0640
		05-Feb-19	Cadmium- Dissolved	mg/L	0.00000830	155	5.10	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	155	5.10	8.00	0.00320	0.00320
			Manganese- Total	mg/L	0.0360	155	5.10	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	155	5.10	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	155	5.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	155	5.10	8.00	0.0560	0.0560
		04-Mar-19	Cadmium- Dissolved	mg/L	0.00000620	150	5.90	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00920	150	5.90	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0240	150	5.90	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	150	5.90	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	150	5.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	150	5.90	8.20	0.0520	0.0520
		02-Apr-19	Cadmium- Dissolved	mg/L	0.0000200	132	10.0	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0150	132	10.0	8.10	0.00700	0.00700
			Manganese- Total	mg/L	0.0950	132	10.0	8.10	1.20	1.20
			Nickel- Total	mg/L	0.00180	132	10.0	8.10	0.120	0.120
			Silver- Total	mg/L	0.0000150	132	10.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	0.00560	132	10.0	8.10	0.0390	0.0390
		14-May-19	Cadmium- Dissolved	mg/L	0.00000720	156	6.90	8.60	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00990	156	6.90	8.60	0.00690	0.00690
			Manganese- Total	mg/L	0.0420	156	6.90	8.60	1.30	1.30
			Nickel- Total	mg/L	0.00120	156	6.90	8.60	0.130	0.130
			Silver- Total	mg/L	<0.000010	156	6.90	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	156	6.90	8.60	0.0570	0.0570
		04-Jun-19	Cadmium- Dissolved	mg/L	<0.0000050	166	5.40	8.30	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00710	166	5.40	8.30	0.00460	0.00460
			Manganese- Total	mg/L	0.0340	166	5.40	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	166	5.40	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	166	5.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	166	5.40	8.30	0.0640	0.0640
		02-Jul-19	Cadmium- Dissolved	mg/L	<0.000020	150	5.10	8.50	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00950	150	5.10	8.50	0.00460	0.00460
			Manganese- Total	mg/L	0.130	150	5.10	8.50	1.30	1.30
			Nickel- Total	mg/L	0.00390	150	5.10	8.50	0.130	0.130
			Silver- Total	mg/L	0.0000320	150	5.10	8.50	0.00150	0.00150
			Zinc- Total	mg/L	0.00880	150	5.10	8.50	0.0520	0.0520
		01-Aug-19	Cadmium- Dissolved	mg/L	<0.000010	159	5.80	8.40	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0100	159	5.80	8.40	0.00530	0.00530
			Manganese- Total	mg/L	0.0270	159	5.80	8.40	1.30	1.30
			Nickel- Total	mg/L	0.000650	159	5.80	8.40	0.140	0.140
			Silver- Total	mg/L	<0.000010	159	5.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	159	5.80	8.40	0.0590	0.0590
		03-Sep-19	Cadmium- Dissolved	mg/L	<0.0000050	145	4.80	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00930	145	4.80	8.40	0.00420	0.00420
			Manganese- Total	mg/L	0.0180	145	4.80	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	145	4.80	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	4.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	4.80	8.40	0.0490	0.0490
		01-Oct-19	Cadmium- Dissolved	mg/L	0.0000160	168	6.60	8.30	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0150	168	6.60	8.30	0.00540	0.00540
			Manganese- Total	mg/L	0.220	168	6.60	8.30	1.30	1.30
			Nickel- Total	mg/L	0.00510	168	6.60	8.30	0.140	0.140
			Silver- Total	mg/L	0.0000580	168	6.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	0.0150	168	6.60	8.30	0.0660	0.0660
		04-Nov-19	Cadmium- Dissolved	mg/L	0.00000880	126	8.10	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0100	126	8.10	8.20	0.00570	0.00570
			Manganese- Total	mg/L	0.0250	126	8.10	8.20	1.20	1.20
			Nickel- Total	mg/L	0.000940	126	8.10	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	8.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	8.10	8.20	0.0340	0.0340
		02-Dec-19	Cadmium- Dissolved	mg/L	<0.000010	143	6.20	7.70	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00790	143	6.20	7.70	0.00290	0.00290
			Manganese- Total	mg/L	0.0220	143	6.20	7.70	1.20	1.20
			Nickel- Total	mg/L	0.000590	143	6.20	7.70	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	6.20	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	6.20	7.70	0.0470	0.0470
	W10	04-Jun-19	Cadmium- Dissolved	mg/L	0.00000840	85.0	16.0	7.80	0.000190	0.000190
			Copper- Dissolved	mg/L	0.00260	85.0	16.0	7.80	0.00680	0.00680
			Manganese- Total	mg/L	0.00800	85.0	16.0	7.80	0.980	0.980
			Nickel- Total	mg/L	0.00120	85.0	16.0	7.80	0.0850	0.0850
			Silver- Total	mg/L	<0.000010	85.0	16.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	85.0	16.0	7.80	0.00750	0.00750
		08-Aug-19	Cadmium- Dissolved	mg/L	0.00000620	85.0	20.0	7.80	0.000190	0.000190
			Copper- Dissolved	mg/L	0.00240	85.0	20.0	7.80	0.00900	0.00900
			Manganese- Total	mg/L	0.00870	85.0	20.0	7.80	0.980	0.980
			Nickel- Total	mg/L	0.00140	85.0	20.0	7.80	0.0840	0.0840
			Silver- Total	mg/L	<0.000010	85.0	20.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	85.0	20.0	7.80	0.00750	0.00750

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2019	W10	01-Oct-19	Cadmium- Dissolved	mg/L	0.00000770	87.0	20.0	8.00	0.000190	0.000190
			Copper- Dissolved	mg/L	0.00230	87.0	20.0	8.00	0.0110	0.0110
			Manganese- Total	mg/L	0.00910	87.0	20.0	8.00	0.990	0.990
			Nickel- Total	mg/L	0.00160	87.0	20.0	8.00	0.0860	0.0860
			Silver- Total	mg/L	<0.000010	87.0	20.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	87.0	20.0	8.00	0.00750	0.00750
		20-Nov-19	Cadmium- Dissolved	mg/L	<0.0000050	60.0	24.0	8.30	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00300	60.0	24.0	8.30	0.0110	0.0110
			Manganese- Total	mg/L	0.0180	60.0	24.0	8.30	0.870	0.870
			Nickel- Total	mg/L	0.00170	60.0	24.0	8.30	0.0650	0.0650
			Silver- Total	mg/L	<0.000010	60.0	24.0	8.30	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	60.0	24.0	8.30	0.00750	0.00750
	EDC-01a	08-May-19	Cadmium- Dissolved	mg/L	0.00000530	47.0	17.0	7.90	0.000120	0.000120
			Copper- Dissolved	mg/L	0.00320	47.0	17.0	7.90	0.00730	0.00730
			Manganese- Total	mg/L	0.00890	47.0	17.0	7.90	0.810	0.810
			Nickel- Total	mg/L	0.00140	47.0	17.0	7.90	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	47.0	17.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	47.0	17.0	7.90	0.00750	0.00750
		04-Jun-19	Cadmium- Dissolved	mg/L	0.00000560	90.0	16.0	7.90	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00360	90.0	16.0	7.90	0.00780	0.00780
			Manganese- Total	mg/L	0.0140	90.0	16.0	7.90	1.00	1.00
			Nickel- Total	mg/L	0.00110	90.0	16.0	7.90	0.0880	0.0880
			Silver- Total	mg/L	<0.000010	90.0	16.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	90.0	16.0	7.90	0.00750	0.00750
		02-Jul-19	Cadmium- Dissolved	mg/L	0.00000510	116	11.0	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00310	116	11.0	8.10	0.00740	0.00740
			Manganese- Total	mg/L	0.0160	116	11.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000980	116	11.0	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	116	11.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	116	11.0	8.10	0.0270	0.0270
		01-Oct-19	Cadmium- Dissolved	mg/L	0.00000790	87.0	20.0	8.20	0.000190	0.000190
			Copper- Dissolved	mg/L	0.00260	87.0	20.0	8.20	0.0120	0.0120
			Manganese- Total	mg/L	0.00970	87.0	20.0	8.20	0.990	0.990
			Nickel- Total	mg/L	0.00140	87.0	20.0	8.20	0.0860	0.0860
			Silver- Total	mg/L	<0.000010	87.0	20.0	8.20	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	87.0	20.0	8.20	0.00750	0.00750
2020	HAC-13	20-Jan-20	Cadmium- Dissolved	mg/L	<0.000010	136	6.10	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00500	136	6.10	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0430	136	6.10	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	136	6.10	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	6.10	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	6.10	8.00	0.0420	0.0420
		03-Feb-20	Cadmium- Dissolved	mg/L	<0.0000050	122	6.60	7.60	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00410	122	6.60	7.60	0.00270	0.00270
			Manganese- Total	mg/L	0.0320	122	6.60	7.60	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	6.60	7.60	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	6.60	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	6.60	7.60	0.0320	0.0320
		25-Mar-20	Cadmium- Dissolved	mg/L	<0.0000050	129	5.80	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00430	129	5.80	8.20	0.00430	0.00430
			Manganese- Total	mg/L	0.0310	129	5.80	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	5.80	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	5.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	5.80	8.20	0.0370	0.0370
		16-Apr-20	Cadmium- Dissolved	mg/L	<0.000015	153	7.90	7.70	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00820	153	7.90	7.70	0.00390	0.00390
			Manganese- Total	mg/L	0.0880	153	7.90	7.70	1.30	1.30
			Nickel- Total	mg/L	<0.00050	153	7.90	7.70	0.130	0.130
			Silver- Total	mg/L	<0.000010	153	7.90	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	153	7.90	7.70	0.0550	0.0550
		07-May-20	Cadmium- Dissolved	mg/L	<0.000010	66.0	12.0	7.60	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00890	66.0	12.0	7.60	0.00430	0.00430
			Manganese- Total	mg/L	0.0210	66.0	12.0	7.60	0.890	0.890
			Nickel- Total	mg/L	0.000530	66.0	12.0	7.60	0.0700	0.0700
			Silver- Total	mg/L	<0.000010	66.0	12.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	66.0	12.0	7.60	0.00750	0.00750
		03-Jun-20	Cadmium- Dissolved	mg/L	<0.0000050	123	6.90	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00580	123	6.90	8.10	0.00460	0.00460
			Manganese- Total	mg/L	0.00920	123	6.90	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	6.90	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	6.90	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	6.90	8.10	0.0320	0.0320
		06-Jul-20	Cadmium- Dissolved	mg/L	<0.000010	117	6.80	8.20	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00460	117	6.80	8.20	0.00490	0.00490
			Manganese- Total	mg/L	0.0110	117	6.80	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	117	6.80	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	117	6.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	117	6.80	8.20	0.0280	0.0280
		04-Aug-20	Cadmium- Dissolved	mg/L	<0.000010	112	6.30	8.30	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00420	112	6.30	8.30	0.00470	0.00470
			Manganese- Total	mg/L	0.0220	112	6.30	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	112	6.30	8.30	0.100	0.100
			Silver- Total	mg/L	<0.000010	112	6.30	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	112	6.30	8.30	0.0240	0.0240
		01-Sep-20	Cadmium- Dissolved	mg/L	<0.0000050	114	6.50	8.40	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00450	114	6.50	8.40	0.00500	0.00500
			Manganese- Total	mg/L	0.0160	114	6.50	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	114	6.50	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.50	8.40	0.0260	0.0260
		01-Oct-20	Cadmium- Dissolved	mg/L	<0.0000050	118	5.90	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00470	118	5.90	8.30	0.00450	0.00450
			Manganese- Total	mg/L	0.00700	118	5.90	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	118	5.90	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	118	5.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	118	5.90	8.30	0.0280	0.0280
		02-Nov-20	Cadmium- Dissolved	mg/L	<0.000010	127	7.20	7.80	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00700	127	7.20	7.80	0.00360	0.00360
			Manganese- Total	mg/L	0.0150	127	7.20	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	127	7.20	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	127	7.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	127	7.20	7.80	0.0350	0.0350
		01-Dec-20	Cadmium- Dissolved	mg/L	<0.0000050	107	6.50	8.10	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00400	107	6.50	8.10	0.00410	0.00410
			Manganese- Total	mg/L	0.00770	107	6.50	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	107	6.50	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	107	6.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	107	6.50	8.10	0.0200	0.0200

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2020	HAC-05a	20-Jan-20	Cadmium- Dissolved	mg/L	<0.000010	158	6.20	8.00	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00540	158	6.20	8.00	0.00400	0.00400
			Manganese- Total	mg/L	0.0370	158	6.20	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	158	6.20	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	158	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	158	6.20	8.00	0.0580	0.0580
		03-Feb-20	Cadmium- Dissolved	mg/L	<0.0000050	128	5.40	7.60	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00470	128	5.40	7.60	0.00230	0.00230
			Manganese- Total	mg/L	0.0380	128	5.40	7.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	5.40	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	5.40	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	5.40	7.60	0.0360	0.0360
		25-Mar-20	Cadmium- Dissolved	mg/L	<0.0000050	132	6.50	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00460	132	6.50	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0310	132	6.50	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	6.50	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	6.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	6.50	8.20	0.0390	0.0390
		16-Apr-20	Cadmium- Dissolved	mg/L	<0.000015	174	8.30	7.70	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0100	174	8.30	7.70	0.00440	0.00440
			Manganese- Total	mg/L	0.0840	174	8.30	7.70	1.40	1.40
			Nickel- Total	mg/L	<0.00050	174	8.30	7.70	0.150	0.150
			Silver- Total	mg/L	<0.000010	174	8.30	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	174	8.30	7.70	0.0700	0.0700
		07-May-20	Cadmium- Dissolved	mg/L	<0.000010	79.0	12.0	7.70	0.000180	0.000180
			Copper- Dissolved	mg/L	0.0120	79.0	12.0	7.70	0.00490	0.00490
			Manganese- Total	mg/L	0.0360	79.0	12.0	7.70	0.950	0.950
			Nickel- Total	mg/L	0.000580	79.0	12.0	7.70	0.0800	0.0800
			Silver- Total	mg/L	0.0000100	79.0	12.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	79.0	12.0	7.70	0.00750	0.00750
		03-Jun-20	Cadmium- Dissolved	mg/L	<0.0000050	129	7.40	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00680	129	7.40	8.20	0.00540	0.00540
			Manganese- Total	mg/L	0.0180	129	7.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	7.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	7.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	7.40	8.20	0.0370	0.0370
		06-Jul-20	Cadmium- Dissolved	mg/L	<0.000010	126	7.10	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00540	126	7.10	8.30	0.00540	0.00540
			Manganese- Total	mg/L	0.0230	126	7.10	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	7.10	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	7.10	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	7.10	8.30	0.0340	0.0340
		04-Aug-20	Cadmium- Dissolved	mg/L	<0.000010	129	6.00	8.40	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00440	129	6.00	8.40	0.00490	0.00490
			Manganese- Total	mg/L	0.0290	129	6.00	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	6.00	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	6.00	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	6.00	8.40	0.0370	0.0370
		01-Sep-20	Cadmium- Dissolved	mg/L	<0.000010	138	6.10	8.50	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00480	138	6.10	8.50	0.00530	0.00530
			Manganese- Total	mg/L	0.0260	138	6.10	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	6.10	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	6.10	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	6.10	8.50	0.0440	0.0440
		01-Oct-20	Cadmium- Dissolved	mg/L	<0.000010	137	5.50	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00490	137	5.50	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0180	137	5.50	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	137	5.50	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	137	5.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	137	5.50	8.20	0.0430	0.0430
		02-Nov-20	Cadmium- Dissolved	mg/L	0.0000140	133	8.20	7.90	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00890	133	8.20	7.90	0.00450	0.00450
			Manganese- Total	mg/L	0.0230	133	8.20	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	8.20	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	8.20	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	8.20	7.90	0.0400	0.0400
		01-Dec-20	Cadmium- Dissolved	mg/L	<0.0000050	114	6.30	8.20	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00440	114	6.30	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0160	114	6.30	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	114	6.30	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.30	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.30	8.20	0.0260	0.0260
	HAC-14	03-Jun-20	Cadmium- Dissolved	mg/L	<0.000010	124	9.60	8.00	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0100	124	9.60	8.00	0.00570	0.00570
			Manganese- Total	mg/L	0.0160	124	9.60	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000530	124	9.60	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	9.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	0.00650	124	9.60	8.00	0.0330	0.0330
		06-Jul-20	Cadmium- Dissolved	mg/L	<0.000010	128	7.90	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00870	128	7.90	8.20	0.00570	0.00570
			Manganese- Total	mg/L	0.0130	128	7.90	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	7.90	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	7.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	7.90	8.20	0.0360	0.0360
		04-Aug-20	Cadmium- Dissolved	mg/L	<0.000010	138	5.60	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00790	138	5.60	8.30	0.00430	0.00430
			Manganese- Total	mg/L	0.0110	138	5.60	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	138	5.60	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	5.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	5.60	8.30	0.0440	0.0440
		01-Sep-20	Cadmium- Dissolved	mg/L	0.0000260	145	5.40	8.30	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00890	145	5.40	8.30	0.00430	0.00430
			Manganese- Total	mg/L	0.00900	145	5.40	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	145	5.40	8.30	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	5.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	5.40	8.30	0.0490	0.0490
		01-Oct-20	Cadmium- Dissolved	mg/L	<0.000010	142	5.30	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00820	142	5.30	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0110	142	5.30	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	5.30	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	5.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	142	5.30	8.00	0.0460	0.0460
		02-Nov-20	Cadmium- Dissolved	mg/L	0.0000140	121	10.0	8.00	0.000240	0.000240
			Copper- Dissolved	mg/L	0.0120	121	10.0	8.00	0.00600	0.00600
			Manganese- Total	mg/L	0.0230	121	10.0	8.00	1.10	1.10
			Nickel- Total	mg/L	0.000590	121	10.0	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	10.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	10.0	8.00	0.0310	0.0310

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2020	HAC-08	20-Jan-20	Cadmium- Dissolved	mg/L	<0.000015	165	5.70	8.10	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00860	165	5.70	8.10	0.00390	0.00390
			Manganese- Total	mg/L	0.0240	165	5.70	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000530	165	5.70	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	165	5.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	165	5.70	8.10	0.0640	0.0640
		03-Feb-20	Cadmium- Dissolved	mg/L	<0.000010	132	6.40	7.80	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00870	132	6.40	7.80	0.00310	0.00310
			Manganese- Total	mg/L	0.0370	132	6.40	7.80	1.20	1.20
			Nickel- Total	mg/L	0.000650	132	6.40	7.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	6.40	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	6.40	7.80	0.0390	0.0390
		25-Mar-20	Cadmium- Dissolved	mg/L	0.00000510	152	6.00	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00810	152	6.00	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0270	152	6.00	8.20	1.30	1.30
			Nickel- Total	mg/L	0.000600	152	6.00	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	152	6.00	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	152	6.00	8.20	0.0540	0.0540
		16-Apr-20	Cadmium- Dissolved	mg/L	<0.000015	152	10.0	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0110	152	10.0	8.20	0.00780	0.00780
			Manganese- Total	mg/L	0.0540	152	10.0	8.20	1.30	1.30
			Nickel- Total	mg/L	0.00170	152	10.0	8.20	0.130	0.130
			Silver- Total	mg/L	0.0000100	152	10.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00340	152	10.0	8.20	0.0540	0.0540
		07-May-20	Cadmium- Dissolved	mg/L	0.0000110	73.0	15.0	7.90	0.000170	0.000170
			Copper- Dissolved	mg/L	0.0160	73.0	15.0	7.90	0.00680	0.00680
			Manganese- Total	mg/L	0.0530	73.0	15.0	7.90	0.930	0.930
			Nickel- Total	mg/L	0.00230	73.0	15.0	7.90	0.0750	0.0750
			Silver- Total	mg/L	0.0000190	73.0	15.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00420	73.0	15.0	7.90	0.00750	0.00750
		03-Jun-20	Cadmium- Dissolved	mg/L	0.00000670	120	9.60	8.20	0.000240	0.000240
			Copper- Dissolved	mg/L	0.0100	120	9.60	8.20	0.00660	0.00660
			Manganese- Total	mg/L	0.0300	120	9.60	8.20	1.10	1.10
			Nickel- Total	mg/L	0.00140	120	9.60	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	9.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	0.00410	120	9.60	8.20	0.0300	0.0300
		06-Jul-20	Cadmium- Dissolved	mg/L	<0.000015	129	8.20	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00880	129	8.20	8.30	0.00610	0.00610
			Manganese- Total	mg/L	0.0170	129	8.20	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	8.20	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	8.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	8.20	8.30	0.0370	0.0370
		04-Aug-20	Cadmium- Dissolved	mg/L	<0.000015	143	5.60	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00750	143	5.60	8.40	0.00460	0.00460
			Manganese- Total	mg/L	0.0120	143	5.60	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	5.60	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	5.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	5.60	8.40	0.0470	0.0470
		01-Sep-20	Cadmium- Dissolved	mg/L	<0.000010	149	5.50	8.40	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00760	149	5.50	8.40	0.00470	0.00470
			Manganese- Total	mg/L	0.0160	149	5.50	8.40	1.30	1.30
			Nickel- Total	mg/L	0.000690	149	5.50	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	149	5.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	149	5.50	8.40	0.0520	0.0520
		01-Oct-20	Cadmium- Dissolved	mg/L	<0.000010	146	5.40	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00780	146	5.40	8.20	0.00410	0.00410
			Manganese- Total	mg/L	0.00810	146	5.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	5.40	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	5.40	8.20	0.0500	0.0500
		02-Nov-20	Cadmium- Dissolved	mg/L	0.0000490	113	10.0	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.0120	113	10.0	8.10	0.00660	0.00660
			Manganese- Total	mg/L	0.0340	113	10.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.00140	113	10.0	8.10	0.100	0.100
			Silver- Total	mg/L	0.0000120	113	10.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	113	10.0	8.10	0.0250	0.0250
		01-Dec-20	Cadmium- Dissolved	mg/L	<0.0000050	113	6.80	8.20	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00630	113	6.80	8.20	0.00480	0.00480
			Manganese- Total	mg/L	0.0220	113	6.80	8.20	1.10	1.10
			Nickel- Total	mg/L	0.000610	113	6.80	8.20	0.100	0.100
			Silver- Total	mg/L	<0.000010	113	6.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	113	6.80	8.20	0.0250	0.0250
	W10	07-May-20	Cadmium- Dissolved	mg/L	0.00000700	41.0	19.0	7.60	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00260	41.0	19.0	7.60	0.00600	0.00600
			Manganese- Total	mg/L	0.0180	41.0	19.0	7.60	0.780	0.780
			Nickel- Total	mg/L	0.00160	41.0	19.0	7.60	0.0250	0.0250
			Silver- Total	mg/L	0.0000100	41.0	19.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	41.0	19.0	7.60	0.00750	0.00750
		01-Sep-20	Cadmium- Dissolved	mg/L	<0.0000050	138	10.0	8.10	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00140	138	10.0	8.10	0.00710	0.00710
			Manganese- Total	mg/L	0.0110	138	10.0	8.10	1.20	1.20
			Nickel- Total	mg/L	0.000850	138	10.0	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	138	10.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	138	10.0	8.10	0.0440	0.0440
		01-Oct-20	Cadmium- Dissolved	mg/L	0.0000130	155	9.00	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00170	155	9.00	7.80	0.00490	0.00490
			Manganese- Total	mg/L	0.00850	155	9.00	7.80	1.30	1.30
			Nickel- Total	mg/L	0.000820	155	9.00	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	155	9.00	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	155	9.00	7.80	0.0560	0.0560
		02-Nov-20	Cadmium- Dissolved	mg/L	0.0000100	55.0	22.0	7.80	0.000140	0.000140
			Copper- Dissolved	mg/L	0.00280	55.0	22.0	7.80	0.00830	0.00830
			Manganese- Total	mg/L	0.0160	55.0	22.0	7.80	0.850	0.850
			Nickel- Total	mg/L	0.00160	55.0	22.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	55.0	22.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	55.0	22.0	7.80	0.00750	0.00750
	EDC-01a	07-May-20	Cadmium- Dissolved	mg/L	0.00000860	42.0	20.0	7.60	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00300	42.0	20.0	7.60	0.00600	0.00600
			Manganese- Total	mg/L	0.0220	42.0	20.0	7.60	0.790	0.790
			Nickel- Total	mg/L	0.00170	42.0	20.0	7.60	0.0250	0.0250
			Silver- Total	mg/L	0.0000110	42.0	20.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00300	42.0	20.0	7.60	0.00750	0.00750
		01-Sep-20	Cadmium- Dissolved	mg/L	0.0000320	207	7.10	7.50	0.000360	0.000360
			Copper- Dissolved	mg/L	0.0120	207	7.10	7.50	0.00310	0.00310
			Manganese- Total	mg/L	0.0550	207	7.10	7.50	1.50	1.50
			Nickel- Total	mg/L	0.000750	207	7.10	7.50	0.150	0.150
			Silver- Total	mg/L	<0.000010	207	7.10	7.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	207	7.10	7.50	0.0950	0.0950

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2020	EDC-01a	01-Oct-20	Cadmium- Dissolved	mg/L	0.00000930	152	5.60	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0100	152	5.60	8.00	0.00360	0.00360
			Manganese- Total	mg/L	0.0420	152	5.60	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	152	5.60	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	152	5.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	152	5.60	8.00	0.0540	0.0540
		02-Nov-20	Cadmium- Dissolved	mg/L	0.00000970	70.0	20.0	7.80	0.000160	0.000160
			Copper- Dissolved	mg/L	0.00550	70.0	20.0	7.80	0.00840	0.00840
			Manganese- Total	mg/L	0.0370	70.0	20.0	7.80	0.910	0.910
			Nickel- Total	mg/L	0.00240	70.0	20.0	7.80	0.0730	0.0730
			Silver- Total	mg/L	0.0000120	70.0	20.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00330	70.0	20.0	7.80	0.00750	0.00750
		01-Dec-20	Cadmium- Dissolved	mg/L	0.00000520	94.0	12.0	8.00	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00500	94.0	12.0	8.00	0.00660	0.00660
			Manganese- Total	mg/L	0.0250	94.0	12.0	8.00	1.00	1.00
			Nickel- Total	mg/L	0.000810	94.0	12.0	8.00	0.0910	0.0910
			Silver- Total	mg/L	<0.000010	94.0	12.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	94.0	12.0	8.00	0.0100	0.0100
2021	HAC-13	12-Jan-21	Cadmium- Dissolved	mg/L	<0.0000050	114	6.40	8.00	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00420	114	6.40	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0210	114	6.40	8.00	1.10	1.10
			Nickel- Total	mg/L	<0.00050	114	6.40	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.40	8.00	0.0260	0.0260
		01-Feb-21	Cadmium- Dissolved	mg/L	<0.0000050	123	6.40	7.80	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00420	123	6.40	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.0200	123	6.40	7.80	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	6.40	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	6.40	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	6.40	7.80	0.0320	0.0320
		08-Mar-21	Cadmium- Dissolved	mg/L	<0.0000050	120	6.30	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00420	120	6.30	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0520	120	6.30	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	120	6.30	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	6.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	120	6.30	8.10	0.0300	0.0300
		07-Apr-21	Cadmium- Dissolved	mg/L	<0.0000050	133	7.60	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00550	133	7.60	8.00	0.00460	0.00460
			Manganese- Total	mg/L	0.0590	133	7.60	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	7.60	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	7.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	7.60	8.00	0.0400	0.0400
		03-May-21	Cadmium- Dissolved	mg/L	<0.0000050	93.0	6.80	8.10	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00600	93.0	6.80	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0130	93.0	6.80	8.10	1.00	1.00
			Nickel- Total	mg/L	<0.00050	93.0	6.80	8.10	0.0910	0.0910
			Silver- Total	mg/L	<0.000010	93.0	6.80	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	93.0	6.80	8.10	0.0100	0.0100
		01-Jun-21	Cadmium- Dissolved	mg/L	<0.0000050	113	6.60	8.40	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00480	113	6.60	8.40	0.00500	0.00500
			Manganese- Total	mg/L	0.0100	113	6.60	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	113	6.60	8.40	0.100	0.100
			Silver- Total	mg/L	<0.000010	113	6.60	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	113	6.60	8.40	0.0250	0.0250
		07-Jul-21	Cadmium- Dissolved	mg/L	<0.000010	114	6.10	8.70	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00460	114	6.10	8.70	0.00520	0.00520
			Manganese- Total	mg/L	0.0180	114	6.10	8.70	1.10	1.10
			Nickel- Total	mg/L	<0.00050	114	6.10	8.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.10	8.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.10	8.70	0.0260	0.0260
		04-Aug-21	Cadmium- Dissolved	mg/L	<0.0000050	120	6.60	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00520	120	6.60	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0330	120	6.60	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	120	6.60	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	6.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	120	6.60	8.10	0.0300	0.0300
		01-Sep-21	Cadmium- Dissolved	mg/L	<0.0000050	119	6.40	8.40	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00480	119	6.40	8.40	0.00520	0.00520
			Manganese- Total	mg/L	0.0170	119	6.40	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	119	6.40	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	119	6.40	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	119	6.40	8.40	0.0290	0.0290
		04-Oct-21	Cadmium- Dissolved	mg/L	<0.0000050	120	5.90	8.40	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00440	120	5.90	8.40	0.00480	0.00480
			Manganese- Total	mg/L	0.0150	120	5.90	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	120	5.90	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	5.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	120	5.90	8.40	0.0300	0.0300
		04-Nov-21	Cadmium- Dissolved	mg/L	<0.0000050	148	6.80	7.80	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00810	148	6.80	7.80	0.00380	0.00380
			Manganese- Total	mg/L	0.0300	148	6.80	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	148	6.80	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	6.80	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	6.80	7.80	0.0510	0.0510
		01-Dec-21	Cadmium- Dissolved	mg/L	0.00000540	155	6.40	7.80	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00770	155	6.40	7.80	0.00350	0.00350
			Manganese- Total	mg/L	0.0440	155	6.40	7.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	155	6.40	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	155	6.40	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	155	6.40	7.80	0.0560	0.0560
	HAC-05a	12-Jan-21	Cadmium- Dissolved	mg/L	<0.0000050	129	6.40	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00450	129	6.40	8.30	0.00500	0.00500
			Manganese- Total	mg/L	0.0330	129	6.40	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	129	6.40	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	6.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	6.40	8.30	0.0370	0.0370
		01-Feb-21	Cadmium- Dissolved	mg/L	<0.0000050	133	6.20	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00450	133	6.20	8.00	0.00400	0.00400
			Manganese- Total	mg/L	0.0240	133	6.20	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	6.20	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	6.20	8.00	0.0400	0.0400
		08-Mar-21	Cadmium- Dissolved	mg/L	0.0000160	136	6.20	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00460	136	6.20	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0410	136	6.20	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	136	6.20	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	6.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	6.20	8.20	0.0420	0.0420

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2021	HAC-05a	07-Apr-21	Cadmium- Dissolved	mg/L	0.0000096	148	7.40	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.0063	148	7.40	8.20	0.00560	0.00560
			Manganese- Total	mg/L	0.057	148	7.40	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	148	7.40	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	7.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	7.40	8.20	0.0510	0.0510
		03-May-21	Cadmium- Dissolved	mg/L	<0.0000050	105	7.20	8.30	0.000220	0.000220
			Copper- Dissolved	mg/L	0.0074	105	7.20	8.30	0.00490	0.00490
			Manganese- Total	mg/L	0.026	105	7.20	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	105	7.20	8.30	0.0990	0.0990
			Silver- Total	mg/L	<0.000010	105	7.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	105	7.20	8.30	0.0190	0.0190
		01-Jun-21	Cadmium- Dissolved	mg/L	<0.0000050	119	6.30	9.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.0048	119	6.30	9.10	0.00650	0.00650
			Manganese- Total	mg/L	0.018	119	6.30	9.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	119	6.30	9.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	119	6.30	9.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	119	6.30	9.10	0.0290	0.0290
		07-Jul-21	Cadmium- Dissolved	mg/L	<0.0000050	126	5.90	8.80	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0047	126	5.90	8.80	0.00580	0.00580
			Manganese- Total	mg/L	0.037	126	5.90	8.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	5.90	8.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	5.90	8.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	5.90	8.80	0.0340	0.0340
		04-Aug-21	Cadmium- Dissolved	mg/L	<0.0000050	154	6.20	8.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0051	154	6.20	8.40	0.00510	0.00510
			Manganese- Total	mg/L	0.017	154	6.20	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	154	6.20	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	6.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	6.20	8.40	0.0560	0.0560
		01-Sep-21	Cadmium- Dissolved	mg/L	<0.0000050	153	6.40	8.60	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0044	153	6.40	8.60	0.00620	0.00620
			Manganese- Total	mg/L	0.020	153	6.40	8.60	1.30	1.30
			Nickel- Total	mg/L	<0.00050	153	6.40	8.60	0.130	0.130
			Silver- Total	mg/L	<0.000010	153	6.40	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	153	6.40	8.60	0.0550	0.0550
		04-Oct-21	Cadmium- Dissolved	mg/L	<0.0000050	150	5.90	8.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0043	150	5.90	8.40	0.00510	0.00510
			Manganese- Total	mg/L	0.020	150	5.90	8.40	1.30	1.30
			Nickel- Total	mg/L	<0.00050	150	5.90	8.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	150	5.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	150	5.90	8.40	0.0520	0.0520
		04-Nov-21	Cadmium- Dissolved	mg/L	<0.0000050	176	5.90	8.00	0.000320	0.000320
			Copper- Dissolved	mg/L	0.0063	176	5.90	8.00	0.00410	0.00410
			Manganese- Total	mg/L	0.034	176	5.90	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	176	5.90	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	176	5.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	176	5.90	8.00	0.0720	0.0720
		01-Dec-21	Cadmium- Dissolved	mg/L	<0.0000050	186	5.60	8.00	0.000330	0.000330
			Copper- Dissolved	mg/L	0.0062	186	5.60	8.00	0.00350	0.00350
			Manganese- Total	mg/L	0.028	186	5.60	8.00	1.40	1.40
			Nickel- Total	mg/L	<0.00050	186	5.60	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	186	5.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	186	5.60	8.00	0.0800	0.0800
	HAC-14	03-May-21	Cadmium- Dissolved	mg/L	<0.000010	96.0	9.10	8.30	0.000210	0.000210
			Copper- Dissolved	mg/L	0.012	96.0	9.10	8.30	0.00630	0.00630
			Manganese- Total	mg/L	0.020	96.0	9.10	8.30	1.00	1.00
			Nickel- Total	mg/L	<0.00050	96.0	9.10	8.30	0.0930	0.0930
			Silver- Total	mg/L	<0.000010	96.0	9.10	8.30	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	96.0	9.10	8.30	0.0120	0.0120
		01-Jun-21	Cadmium- Dissolved	mg/L	0.0000053	125	6.50	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0072	125	6.50	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.014	125	6.50	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	6.50	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	6.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	6.50	8.10	0.0340	0.0340
		07-Jul-21	Cadmium- Dissolved	mg/L	<0.0000050	133	5.50	9.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0075	133	5.50	9.20	0.00580	0.00580
			Manganese- Total	mg/L	0.0081	133	5.50	9.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	5.50	9.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	5.50	9.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	5.50	9.20	0.0400	0.0400
		04-Aug-21	Cadmium- Dissolved	mg/L	<0.0000050	159	5.20	8.30	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0088	159	5.20	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.022	159	5.20	8.30	1.30	1.30
			Nickel- Total	mg/L	<0.00050	159	5.20	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	159	5.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	159	5.20	8.30	0.0590	0.0590
		01-Sep-21	Cadmium- Dissolved	mg/L	0.0000059	168	5.20	8.70	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0077	168	5.20	8.70	0.00530	0.00530
			Manganese- Total	mg/L	0.073	168	5.20	8.70	1.30	1.30
			Nickel- Total	mg/L	0.0032	168	5.20	8.70	0.140	0.140
			Silver- Total	mg/L	0.000020	168	5.20	8.70	0.00150	0.00150
			Zinc- Total	mg/L	0.0060	168	5.20	8.70	0.0660	0.0660
		04-Oct-21	Cadmium- Dissolved	mg/L	<0.000010	165	5.10	8.60	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0073	165	5.10	8.60	0.00490	0.00490
			Manganese- Total	mg/L	0.0096	165	5.10	8.60	1.30	1.30
			Nickel- Total	mg/L	<0.00050	165	5.10	8.60	0.140	0.140
			Silver- Total	mg/L	<0.000010	165	5.10	8.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	165	5.10	8.60	0.0640	0.0640
		04-Nov-21	Cadmium- Dissolved	mg/L	0.0000053	171	5.70	8.10	0.000310	0.000310
			Copper- Dissolved	mg/L	0.0087	171	5.70	8.10	0.00400	0.00400
			Manganese- Total	mg/L	0.017	171	5.70	8.10	1.40	1.40
			Nickel- Total	mg/L	<0.00050	171	5.70	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	171	5.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	171	5.70	8.10	0.0680	0.0680
	HAC-08	12-Jan-21	Cadmium- Dissolved	mg/L	0.0000053	130	6.50	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0068	130	6.50	8.30	0.00500	0.00500
			Manganese- Total	mg/L	0.016	130	6.50	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	6.50	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	6.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	6.50	8.30	0.0380	0.0380
		01-Feb-21	Cadmium- Dissolved	mg/L	<0.0000050	140	6.30	7.90	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0072	140	6.30	7.90	0.00380	0.00380
			Manganese- Total	mg/L	0.027	140	6.30	7.90	1.20	1.20
			Nickel- Total	mg/L	0.00060	140	6.30	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	6.30	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	6.30	7.90	0.0450	0.0450

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2021	HAC-08	08-Mar-21	Cadmium- Dissolved	mg/L	0.0000079	141	5.90	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0070	141	5.90	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.025	141	5.90	8.20	1.20	1.20
			Nickel- Total	mg/L	0.00061	141	5.90	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	5.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	5.90	8.20	0.0460	0.0460
		07-Apr-21	Cadmium- Dissolved	mg/L	0.0000067	132	8.20	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0082	132	8.20	8.30	0.00610	0.00610
			Manganese- Total	mg/L	0.031	132	8.20	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	8.20	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	8.20	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	8.20	8.30	0.0390	0.0390
		03-May-21	Cadmium- Dissolved	mg/L	0.000025	98.0	9.20	8.40	0.000210	0.000210
			Copper- Dissolved	mg/L	0.012	98.0	9.20	8.40	0.00670	0.00670
			Manganese- Total	mg/L	0.030	98.0	9.20	8.40	1.00	1.00
			Nickel- Total	mg/L	0.0012	98.0	9.20	8.40	0.0940	0.0940
			Silver- Total	mg/L	<0.000010	98.0	9.20	8.40	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	98.0	9.20	8.40	0.0140	0.0140
		01-Jun-21	Cadmium- Dissolved	mg/L	<0.0000050	123	6.40	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00720	123	6.40	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0160	123	6.40	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	6.40	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	6.40	8.20	0.0320	0.0320
		07-Jul-21	Cadmium- Dissolved	mg/L	<0.0000050	139	5.50	8.80	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00750	139	5.50	8.80	0.00550	0.00550
			Manganese- Total	mg/L	0.0120	139	5.50	8.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	139	5.50	8.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	139	5.50	8.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	139	5.50	8.80	0.0440	0.0440
		04-Aug-21	Cadmium- Dissolved	mg/L	0.0000110	165	5.10	8.50	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00910	165	5.10	8.50	0.00470	0.00470
			Manganese- Total	mg/L	0.0130	165	5.10	8.50	1.30	1.30
			Nickel- Total	mg/L	<0.00050	165	5.10	8.50	0.140	0.140
			Silver- Total	mg/L	<0.000010	165	5.10	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	165	5.10	8.50	0.0640	0.0640
		01-Sep-21	Cadmium- Dissolved	mg/L	<0.0000050	170	5.00	8.70	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00780	170	5.00	8.70	0.00530	0.00530
			Manganese- Total	mg/L	0.0130	170	5.00	8.70	1.40	1.40
			Nickel- Total	mg/L	<0.00050	170	5.00	8.70	0.140	0.140
			Silver- Total	mg/L	<0.000010	170	5.00	8.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	170	5.00	8.70	0.0680	0.0680
		04-Oct-21	Cadmium- Dissolved	mg/L	<0.0000050	162	4.70	8.80	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00660	162	4.70	8.80	0.00480	0.00480
			Manganese- Total	mg/L	0.0110	162	4.70	8.80	1.30	1.30
			Nickel- Total	mg/L	<0.00050	162	4.70	8.80	0.140	0.140
			Silver- Total	mg/L	<0.000010	162	4.70	8.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	162	4.70	8.80	0.0620	0.0620
		04-Nov-21	Cadmium- Dissolved	mg/L	<0.0000050	173	5.40	8.30	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00780	173	5.40	8.30	0.00460	0.00460
			Manganese- Total	mg/L	0.0510	173	5.40	8.30	1.40	1.40
			Nickel- Total	mg/L	0.00100	173	5.40	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	173	5.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	173	5.40	8.30	0.0700	0.0700
		01-Dec-21	Cadmium- Dissolved	mg/L	<0.0000050	177	5.20	8.20	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00710	177	5.20	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0280	177	5.20	8.20	1.40	1.40
			Nickel- Total	mg/L	0.000650	177	5.20	8.20	0.150	0.150
			Silver- Total	mg/L	<0.000010	177	5.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	177	5.20	8.20	0.0730	0.0730
	W10	12-Jan-21	Cadmium- Dissolved	mg/L	0.00000520	76.0	15.0	8.00	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00190	76.0	15.0	8.00	0.00770	0.00770
			Manganese- Total	mg/L	0.00770	76.0	15.0	8.00	0.940	0.940
			Nickel- Total	mg/L	0.00100	76.0	15.0	8.00	0.0780	0.0780
			Silver- Total	mg/L	<0.000010	76.0	15.0	8.00	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	76.0	15.0	8.00	0.00750	0.00750
		03-May-21	Cadmium- Dissolved	mg/L	0.00000640	43.0	17.0	7.90	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00240	43.0	17.0	7.90	0.00690	0.00690
			Manganese- Total	mg/L	0.0220	43.0	17.0	7.90	0.790	0.790
			Nickel- Total	mg/L	0.00150	43.0	17.0	7.90	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	43.0	17.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	43.0	17.0	7.90	0.00750	0.00750
		04-Aug-21	Cadmium- Dissolved	mg/L	<0.0000050	190	5.80	8.00	0.000340	0.000340
			Copper- Dissolved	mg/L	0.00120	190	5.80	8.00	0.00420	0.00420
			Manganese- Total	mg/L	0.00840	190	5.80	8.00	1.40	1.40
			Nickel- Total	mg/L	0.000730	190	5.80	8.00	0.150	0.150
			Silver- Total	mg/L	<0.000010	190	5.80	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	190	5.80	8.00	0.0820	0.0820
		04-Nov-21	Cadmium- Dissolved	mg/L	<0.0000050	112	11.0	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00120	112	11.0	8.10	0.00690	0.00690
			Manganese- Total	mg/L	0.0410	112	11.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000860	112	11.0	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	112	11.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	112	11.0	8.10	0.0240	0.0240
	EDC-01a	12-Jan-21	Cadmium- Dissolved	mg/L	0.00000690	114	10.0	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00540	114	10.0	8.10	0.00630	0.00630
			Manganese- Total	mg/L	0.0340	114	10.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000670	114	10.0	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	10.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	10.0	8.10	0.0260	0.0260
		01-Feb-21	Cadmium- Dissolved	mg/L	0.00000570	122	9.00	7.70	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00560	122	9.00	7.70	0.00410	0.00410
			Manganese- Total	mg/L	0.0430	122	9.00	7.70	1.10	1.10
			Nickel- Total	mg/L	0.000610	122	9.00	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	9.00	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	9.00	7.70	0.0320	0.0320
		08-Mar-21	Cadmium- Dissolved	mg/L	0.00000760	123	8.50	8.00	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00520	123	8.50	8.00	0.00510	0.00510
			Manganese- Total	mg/L	0.0400	123	8.50	8.00	1.10	1.10
			Nickel- Total	mg/L	0.00110	123	8.50	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	8.50	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	8.50	8.00	0.0320	0.0320
		07-Apr-21	Cadmium- Dissolved	mg/L	0.00000930	108	12.0	8.10	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00510	108	12.0	8.10	0.00760	0.00760
			Manganese- Total	mg/L	0.0400	108	12.0	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000950	108	12.0	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	108	12.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	108	12.0	8.10	0.0210	0.0210

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2021	EDC-01a	03-May-21	Cadmium- Dissolved	mg/L	0.00000510	54.0	16.0	7.80	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00400	54.0	16.0	7.80	0.00630	0.00630
			Manganese- Total	mg/L	0.0230	54.0	16.0	7.80	0.840	0.840
			Nickel- Total	mg/L	0.00150	54.0	16.0	7.80	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	54.0	16.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	54.0	16.0	7.80	0.00750	0.00750
		01-Jun-21	Cadmium- Dissolved	mg/L	0.00000680	96.0	11.0	8.40	0.000200	0.000200
			Copper- Dissolved	mg/L	0.00590	96.0	11.0	8.40	0.00810	0.00810
			Manganese- Total	mg/L	0.0170	96.0	11.0	8.40	1.00	1.00
			Nickel- Total	mg/L	0.000670	96.0	11.0	8.40	0.0920	0.0920
			Silver- Total	mg/L	<0.000010	96.0	11.0	8.40	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	96.0	11.0	8.40	0.0120	0.0120
		07-Jul-21	Cadmium- Dissolved	mg/L	<0.0000050	143	5.60	8.50	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00760	143	5.60	8.50	0.00490	0.00490
			Manganese- Total	mg/L	0.0450	143	5.60	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	5.60	8.50	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	5.60	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	5.60	8.50	0.0470	0.0470
		04-Aug-21	Cadmium- Dissolved	mg/L	0.00000880	172	5.50	8.30	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00900	172	5.50	8.30	0.00460	0.00460
			Manganese- Total	mg/L	0.0650	172	5.50	8.30	1.40	1.40
			Nickel- Total	mg/L	0.000520	172	5.50	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	172	5.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	172	5.50	8.30	0.0690	0.0690
		01-Sep-21	Cadmium- Dissolved	mg/L	0.00000670	175	4.90	8.40	0.000320	0.000320
			Copper- Dissolved	mg/L	0.00830	175	4.90	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.0530	175	4.90	8.40	1.40	1.40
			Nickel- Total	mg/L	<0.00050	175	4.90	8.40	0.150	0.150
			Silver- Total	mg/L	<0.000010	175	4.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	175	4.90	8.40	0.0710	0.0710
		04-Oct-21	Cadmium- Dissolved	mg/L	0.00000620	170	4.60	8.30	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00670	170	4.60	8.30	0.00380	0.00380
			Manganese- Total	mg/L	0.0450	170	4.60	8.30	1.40	1.40
			Nickel- Total	mg/L	<0.00050	170	4.60	8.30	0.140	0.140
			Silver- Total	mg/L	<0.000010	170	4.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	170	4.60	8.30	0.0680	0.0680
		04-Nov-21	Cadmium- Dissolved	mg/L	0.00000530	148	7.90	8.10	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00510	148	7.90	8.10	0.00560	0.00560
			Manganese- Total	mg/L	0.0520	148	7.90	8.10	1.30	1.30
			Nickel- Total	mg/L	0.00110	148	7.90	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	7.90	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	7.90	8.10	0.0510	0.0510
		01-Dec-21	Cadmium- Dissolved	mg/L	0.00000620	141	8.30	8.10	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00540	141	8.30	8.10	0.00580	0.00580
			Manganese- Total	mg/L	0.0330	141	8.30	8.10	1.20	1.20
			Nickel- Total	mg/L	0.000580	141	8.30	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	8.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	8.30	8.10	0.0460	0.0460
2022	HAC-13	12-Jan-22	Cadmium- Dissolved	mg/L	<0.0000050	120	6.60	8.00	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00560	120	6.60	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.0160	120	6.60	8.00	1.10	1.10
			Nickel- Total	mg/L	<0.00050	120	6.60	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	120	6.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	120	6.60	8.00	0.0300	0.0300
		07-Feb-22	Cadmium- Dissolved	mg/L	<0.0000050	126	6.00	8.00	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00500	126	6.00	8.00	0.00370	0.00370
			Manganese- Total	mg/L	0.0190	126	6.00	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	6.00	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	6.00	8.00	0.0340	0.0340
		09-Mar-22	Cadmium- Dissolved	mg/L	<0.0000050	134	7.90	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	134	7.90	8.00	0.00450	0.00450
			Manganese- Total	mg/L	0.0260	134	7.90	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	7.90	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	7.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	7.90	8.00	0.0400	0.0400
		05-Apr-22	Cadmium- Dissolved	mg/L	0.00000730	154	14.0	7.40	0.000290	0.000290
			Copper- Dissolved	mg/L	0.0150	154	14.0	7.40	0.00490	0.00490
			Manganese- Total	mg/L	0.0510	154	14.0	7.40	1.30	1.30
			Nickel- Total	mg/L	0.000590	154	14.0	7.40	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	14.0	7.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	14.0	7.40	0.0560	0.0560
		03-May-22	Cadmium- Dissolved	mg/L	0.00000660	129	11.0	7.60	0.000260	0.000260
			Copper- Dissolved	mg/L	0.0170	129	11.0	7.60	0.00470	0.00470
			Manganese- Total	mg/L	0.0260	129	11.0	7.60	1.20	1.20
			Nickel- Total	mg/L	0.000530	129	11.0	7.60	0.120	0.120
			Silver- Total	mg/L	<0.000010	129	11.0	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	129	11.0	7.60	0.0370	0.0370
		01-Jun-22	Cadmium- Dissolved	mg/L	<0.0000050	110	6.90	8.30	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00580	110	6.90	8.30	0.00510	0.00510
			Manganese- Total	mg/L	0.0130	110	6.90	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	110	6.90	8.30	0.100	0.100
			Silver- Total	mg/L	<0.000010	110	6.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	110	6.90	8.30	0.0220	0.0220
		05-Jul-22	Cadmium- Dissolved	mg/L	<0.0000050	118	6.70	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00450	118	6.70	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0120	118	6.70	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	118	6.70	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	118	6.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	118	6.70	8.10	0.0280	0.0280
		03-Aug-22	Cadmium- Dissolved	mg/L	<0.000010	111	6.60	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00440	111	6.60	8.10	0.00410	0.00410
			Manganese- Total	mg/L	0.0210	111	6.60	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	111	6.60	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	111	6.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	111	6.60	8.10	0.0230	0.0230
		08-Sep-22	Cadmium- Dissolved	mg/L	<0.0000050	110	5.80	8.30	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00360	110	5.80	8.30	0.00440	0.00440
			Manganese- Total	mg/L	0.0170	110	5.80	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	110	5.80	8.30	0.100	0.100
			Silver- Total	mg/L	<0.000010	110	5.80	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	110	5.80	8.30	0.0220	0.0220
		05-Oct-22	Cadmium- Dissolved	mg/L	<0.0000050	104	5.90	8.40	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00600	104	5.90	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.00930	104	5.90	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	104	5.90	8.40	0.0980	0.0980
			Silver- Total	mg/L	<0.000010	104	5.90	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	104	5.90	8.40	0.0180	0.0180

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2022	HAC-13	02-Nov-22	Cadmium- Dissolved	mg/L	<0.0000050	114	6.40	7.90	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00510	114	6.40	7.90	0.00350	0.00350
			Manganese- Total	mg/L	0.00590	114	6.40	7.90	1.10	1.10
			Nickel- Total	mg/L	<0.00050	114	6.40	7.90	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.40	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.40	7.90	0.0260	0.0260
		07-Dec-22	Cadmium- Dissolved	mg/L	<0.0000050	112	5.80	7.90	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00440	112	5.80	7.90	0.00320	0.00320
			Manganese- Total	mg/L	0.00530	112	5.80	7.90	1.10	1.10
			Nickel- Total	mg/L	<0.00050	112	5.80	7.90	0.100	0.100
			Silver- Total	mg/L	<0.000010	112	5.80	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	112	5.80	7.90	0.0240	0.0240
	HAC-05a	12-Jan-22	Cadmium- Dissolved	mg/L	<0.0000050	144	6.00	7.90	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00530	144	6.00	7.90	0.00350	0.00350
			Manganese- Total	mg/L	0.0150	144	6.00	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	6.00	7.90	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	6.00	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	6.00	7.90	0.0480	0.0480
		07-Feb-22	Cadmium- Dissolved	mg/L	<0.0000050	146	6.20	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00490	146	6.20	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.0180	146	6.20	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000680	146	6.20	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.20	8.00	0.0500	0.0500
		09-Mar-22	Cadmium- Dissolved	mg/L	0.00000590	165	8.20	8.00	0.000310	0.000310
			Copper- Dissolved	mg/L	0.00660	165	8.20	8.00	0.00530	0.00530
			Manganese- Total	mg/L	0.0300	165	8.20	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	165	8.20	8.00	0.140	0.140
			Silver- Total	mg/L	<0.000010	165	8.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	165	8.20	8.00	0.0640	0.0640
		05-Apr-22	Cadmium- Dissolved	mg/L	<0.000010	194	14.0	7.70	0.000340	0.000340
			Copper- Dissolved	mg/L	0.0160	194	14.0	7.70	0.00720	0.00720
			Manganese- Total	mg/L	0.0630	194	14.0	7.70	1.50	1.50
			Nickel- Total	mg/L	0.000570	194	14.0	7.70	0.150	0.150
			Silver- Total	mg/L	<0.000010	194	14.0	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	194	14.0	7.70	0.0860	0.0860
		03-May-22	Cadmium- Dissolved	mg/L	0.00000660	136	12.0	7.60	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0210	136	12.0	7.60	0.00540	0.00540
			Manganese- Total	mg/L	0.0490	136	12.0	7.60	1.20	1.20
			Nickel- Total	mg/L	0.000740	136	12.0	7.60	0.120	0.120
			Silver- Total	mg/L	0.0000140	136	12.0	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	12.0	7.60	0.0420	0.0420
		01-Jun-22	Cadmium- Dissolved	mg/L	<0.0000050	116	7.60	8.50	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00520	116	7.60	8.50	0.00620	0.00620
			Manganese- Total	mg/L	0.0230	116	7.60	8.50	1.10	1.10
			Nickel- Total	mg/L	<0.00050	116	7.60	8.50	0.110	0.110
			Silver- Total	mg/L	<0.000010	116	7.60	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	116	7.60	8.50	0.0270	0.0270
		05-Jul-22	Cadmium- Dissolved	mg/L	<0.0000050	126	5.90	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00520	126	5.90	8.10	0.00400	0.00400
			Manganese- Total	mg/L	0.0330	126	5.90	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	5.90	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	5.90	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	5.90	8.10	0.0340	0.0340
		03-Aug-22	Cadmium- Dissolved	mg/L	0.00000910	132	6.40	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00490	132	6.40	8.10	0.00430	0.00430
			Manganese- Total	mg/L	0.0420	132	6.40	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	6.40	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	6.40	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	6.40	8.10	0.0390	0.0390
		08-Sep-22	Cadmium- Dissolved	mg/L	<0.0000050	118	5.60	8.30	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00420	118	5.60	8.30	0.00410	0.00410
			Manganese- Total	mg/L	0.0310	118	5.60	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	118	5.60	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	118	5.60	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	118	5.60	8.30	0.0280	0.0280
		05-Oct-22	Cadmium- Dissolved	mg/L	<0.0000050	115	5.80	8.50	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00510	115	5.80	8.50	0.00480	0.00480
			Manganese- Total	mg/L	0.0300	115	5.80	8.50	1.10	1.10
			Nickel- Total	mg/L	<0.00050	115	5.80	8.50	0.110	0.110
			Silver- Total	mg/L	<0.000010	115	5.80	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	115	5.80	8.50	0.0260	0.0260
		02-Nov-22	Cadmium- Dissolved	mg/L	<0.0000050	134	6.10	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00450	134	6.10	8.10	0.00400	0.00400
			Manganese- Total	mg/L	0.0230	134	6.10	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.10	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.10	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.10	8.10	0.0400	0.0400
		07-Dec-22	Cadmium- Dissolved	mg/L	<0.0000050	143	5.90	7.80	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00430	143	5.90	7.80	0.00320	0.00320
			Manganese- Total	mg/L	0.0200	143	5.90	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	143	5.90	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	5.90	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	5.90	7.80	0.0470	0.0470
	HAC-14	03-May-22	Cadmium- Dissolved	mg/L	0.0000190	98.0	16.0	7.70	0.000210	0.000210
			Copper- Dissolved	mg/L	0.0220	98.0	16.0	7.70	0.00720	0.00720
			Manganese- Total	mg/L	0.0240	98.0	16.0	7.70	1.00	1.00
			Nickel- Total	mg/L	0.000830	98.0	16.0	7.70	0.0940	0.0940
			Silver- Total	mg/L	<0.000010	98.0	16.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	98.0	16.0	7.70	0.0140	0.0140
		01-Jun-22	Cadmium- Dissolved	mg/L	<0.0000050	112	6.90	8.30	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00710	112	6.90	8.30	0.00510	0.00510
			Manganese- Total	mg/L	0.0210	112	6.90	8.30	1.10	1.10
			Nickel- Total	mg/L	<0.00050	112	6.90	8.30	0.100	0.100
			Silver- Total	mg/L	<0.000010	112	6.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	112	6.90	8.30	0.0240	0.0240
		05-Jul-22	Cadmium- Dissolved	mg/L	<0.000010	132	6.20	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00760	132	6.20	8.20	0.00430	0.00430
			Manganese- Total	mg/L	0.0190	132	6.20	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	6.20	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	6.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	6.20	8.20	0.0390	0.0390
		03-Aug-22	Cadmium- Dissolved	mg/L	<0.000010	141	5.70	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00720	141	5.70	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0120	141	5.70	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	141	5.70	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	141	5.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	141	5.70	8.20	0.0460	0.0460

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2022	HAC-14	08-Sep-22	Cadmium- Dissolved	mg/L	<0.0000050	122	5.20	8.20	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00570	122	5.20	8.20	0.00350	0.00350
			Manganese- Total	mg/L	0.0130	122	5.20	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	5.20	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	5.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	5.20	8.20	0.0320	0.0320
		05-Oct-22	Cadmium- Dissolved	mg/L	<0.0000050	123	5.60	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00640	123	5.60	8.20	0.00390	0.00390
			Manganese- Total	mg/L	0.0130	123	5.60	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	5.60	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	5.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	5.60	8.20	0.0320	0.0320
		02-Nov-22	Cadmium- Dissolved	mg/L	<0.000010	144	5.90	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00560	144	5.90	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.00850	144	5.90	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	144	5.90	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	144	5.90	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	144	5.90	8.00	0.0480	0.0480
	HAC-08	12-Jan-22	Cadmium- Dissolved	mg/L	<0.0000050	158	5.60	8.20	0.000300	0.000300
			Copper- Dissolved	mg/L	0.00750	158	5.60	8.20	0.00420	0.00420
			Manganese- Total	mg/L	0.0150	158	5.60	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	158	5.60	8.20	0.140	0.140
			Silver- Total	mg/L	<0.000010	158	5.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	158	5.60	8.20	0.0580	0.0580
		07-Feb-22	Cadmium- Dissolved	mg/L	<0.0000050	153	6.40	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00760	153	6.40	8.20	0.00490	0.00490
			Manganese- Total	mg/L	0.0130	153	6.40	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	153	6.40	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	153	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	153	6.40	8.20	0.0550	0.0550
		09-Mar-22	Cadmium- Dissolved	mg/L	0.00000670	163	8.30	8.10	0.000300	0.000300
			Copper- Dissolved	mg/L	0.0110	163	8.30	8.10	0.00610	0.00610
			Manganese- Total	mg/L	0.0200	163	8.30	8.10	1.30	1.30
			Nickel- Total	mg/L	0.000650	163	8.30	8.10	0.140	0.140
			Silver- Total	mg/L	<0.000010	163	8.30	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	163	8.30	8.10	0.0620	0.0620
		05-Apr-22	Cadmium- Dissolved	mg/L	0.00000670	136	15.0	8.00	0.000270	0.000270
			Copper- Dissolved	mg/L	0.0170	136	15.0	8.00	0.00940	0.00940
			Manganese- Total	mg/L	0.0240	136	15.0	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000980	136	15.0	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	15.0	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	15.0	8.00	0.0420	0.0420
		03-May-22	Cadmium- Dissolved	mg/L	<0.0000050	85.0	14.0	7.80	0.000190	0.000190
			Copper- Dissolved	mg/L	0.0170	85.0	14.0	7.80	0.00650	0.00650
			Manganese- Total	mg/L	0.0220	85.0	14.0	7.80	0.980	0.980
			Nickel- Total	mg/L	0.00100	85.0	14.0	7.80	0.0840	0.0840
			Silver- Total	mg/L	<0.000010	85.0	14.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	85.0	14.0	7.80	0.00750	0.00750
		01-Jun-22	Cadmium- Dissolved	mg/L	0.00000680	114	6.90	8.30	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00810	114	6.90	8.30	0.00510	0.00510
			Manganese- Total	mg/L	0.0270	114	6.90	8.30	1.10	1.10
			Nickel- Total	mg/L	0.000680	114	6.90	8.30	0.110	0.110
			Silver- Total	mg/L	<0.000010	114	6.90	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	114	6.90	8.30	0.0260	0.0260
		05-Jul-22	Cadmium- Dissolved	mg/L	<0.0000050	134	6.30	8.50	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00690	134	6.30	8.50	0.00560	0.00560
			Manganese- Total	mg/L	0.0210	134	6.30	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.30	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.30	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.30	8.50	0.0400	0.0400
		03-Aug-22	Cadmium- Dissolved	mg/L	<0.0000050	136	5.80	8.40	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00650	136	5.80	8.40	0.00500	0.00500
			Manganese- Total	mg/L	0.0190	136	5.80	8.40	1.20	1.20
			Nickel- Total	mg/L	0.000560	136	5.80	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	5.80	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	5.80	8.40	0.0420	0.0420
		08-Sep-22	Cadmium- Dissolved	mg/L	<0.0000050	123	5.00	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00590	123	5.00	8.40	0.00400	0.00400
			Manganese- Total	mg/L	0.0190	123	5.00	8.40	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	5.00	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	5.00	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	5.00	8.40	0.0320	0.0320
		05-Oct-22	Cadmium- Dissolved	mg/L	<0.0000050	128	5.40	8.30	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00670	128	5.40	8.30	0.00420	0.00420
			Manganese- Total	mg/L	0.0150	128	5.40	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	5.40	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	5.40	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	5.40	8.30	0.0360	0.0360
		02-Nov-22	Cadmium- Dissolved	mg/L	<0.0000050	146	5.70	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00550	146	5.70	8.20	0.00410	0.00410
			Manganese- Total	mg/L	0.00960	146	5.70	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	5.70	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	5.70	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	5.70	8.20	0.0500	0.0500
		07-Dec-22	Cadmium- Dissolved	mg/L	<0.0000050	150	5.10	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00580	150	5.10	8.20	0.00380	0.00380
			Manganese- Total	mg/L	0.0110	150	5.10	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	150	5.10	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	150	5.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	150	5.10	8.20	0.0520	0.0520
	W10	07-Feb-22	Cadmium- Dissolved	mg/L	<0.0000050	101	12.0	7.90	0.000210	0.000210
			Copper- Dissolved	mg/L	0.00160	101	12.0	7.90	0.00650	0.00650
			Manganese- Total	mg/L	0.00780	101	12.0	7.90	1.00	1.00
			Nickel- Total	mg/L	0.000880	101	12.0	7.90	0.0960	0.0960
			Silver- Total	mg/L	<0.000010	101	12.0	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	101	12.0	7.90	0.0160	0.0160
		05-Apr-22	Cadmium- Dissolved	mg/L	0.00000550	61.0	21.0	7.90	0.000150	0.000150
			Copper- Dissolved	mg/L	0.00280	61.0	21.0	7.90	0.00900	0.00900
			Manganese- Total	mg/L	0.0330	61.0	21.0	7.90	0.870	0.870
			Nickel- Total	mg/L	0.00190	61.0	21.0	7.90	0.0660	0.0660
			Silver- Total	mg/L	<0.000010	61.0	21.0	7.90	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	61.0	21.0	7.90	0.00750	0.00750
		03-Aug-22	Cadmium- Dissolved	mg/L	0.00000850	126	11.0	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00160	126	11.0	8.10	0.00700	0.00700
			Manganese- Total	mg/L	0.0120	126	11.0	8.10	1.20	1.20
			Nickel- Total	mg/L	0.000950	126	11.0	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	11.0	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	11.0	8.10	0.0340	0.0340

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2022	EDC-01a	12-Jan-22	Cadmium- Dissolved	mg/L	<0.0000050	157	6.00	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00690	157	6.00	8.00	0.00400	0.00400
			Manganese- Total	mg/L	0.0540	157	6.00	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	6.00	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	6.00	8.00	0.0580	0.0580
		07-Feb-22	Cadmium- Dissolved	mg/L	<0.0000050	135	8.20	8.00	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00600	135	8.20	8.00	0.00490	0.00490
			Manganese- Total	mg/L	0.0370	135	8.20	8.00	1.20	1.20
			Nickel- Total	mg/L	0.000530	135	8.20	8.00	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	8.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	8.20	8.00	0.0410	0.0410
		09-Mar-22	Cadmium- Dissolved	mg/L	0.00000880	121	14.0	7.70	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00700	121	14.0	7.70	0.00640	0.00640
			Manganese- Total	mg/L	0.0410	121	14.0	7.70	1.10	1.10
			Nickel- Total	mg/L	0.000990	121	14.0	7.70	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	14.0	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	14.0	7.70	0.0310	0.0310
		05-Apr-22	Cadmium- Dissolved	mg/L	0.00000710	82.0	20.0	7.70	0.000180	0.000180
			Copper- Dissolved	mg/L	0.00570	82.0	20.0	7.70	0.00820	0.00820
			Manganese- Total	mg/L	0.0410	82.0	20.0	7.70	0.970	0.970
			Nickel- Total	mg/L	0.00170	82.0	20.0	7.70	0.0820	0.0820
			Silver- Total	mg/L	<0.000010	82.0	20.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	82.0	20.0	7.70	0.00750	0.00750
		03-May-22	Cadmium- Dissolved	mg/L	<0.0000050	52.0	17.0	7.50	0.000130	0.000130
			Copper- Dissolved	mg/L	0.00510	52.0	17.0	7.50	0.00510	0.00510
			Manganese- Total	mg/L	0.0220	52.0	17.0	7.50	0.830	0.830
			Nickel- Total	mg/L	0.00140	52.0	17.0	7.50	0.0250	0.0250
			Silver- Total	mg/L	<0.000010	52.0	17.0	7.50	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	52.0	17.0	7.50	0.00750	0.00750
		01-Jun-22	Cadmium- Dissolved	mg/L	0.00000800	77.0	13.0	8.10	0.000170	0.000170
			Copper- Dissolved	mg/L	0.00520	77.0	13.0	8.10	0.00770	0.00770
			Manganese- Total	mg/L	0.0260	77.0	13.0	8.10	0.940	0.940
			Nickel- Total	mg/L	0.000930	77.0	13.0	8.10	0.0790	0.0790
			Silver- Total	mg/L	<0.000010	77.0	13.0	8.10	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	77.0	13.0	8.10	0.00750	0.00750
		05-Jul-22	Cadmium- Dissolved	mg/L	<0.000015	103	11.0	8.20	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00560	103	11.0	8.20	0.00720	0.00720
			Manganese- Total	mg/L	0.0380	103	11.0	8.20	1.10	1.10
			Nickel- Total	mg/L	0.000770	103	11.0	8.20	0.0980	0.0980
			Silver- Total	mg/L	<0.000010	103	11.0	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	103	11.0	8.20	0.0170	0.0170
		03-Aug-22	Cadmium- Dissolved	mg/L	0.0000140	146	6.10	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00660	146	6.10	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0560	146	6.10	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	6.10	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.10	8.20	0.0500	0.0500
		08-Sep-22	Cadmium- Dissolved	mg/L	<0.0000050	126	5.20	8.40	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00590	126	5.20	8.40	0.00410	0.00410
			Manganese- Total	mg/L	0.0350	126	5.20	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	5.20	8.40	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	5.20	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	5.20	8.40	0.0340	0.0340
		05-Oct-22	Cadmium- Dissolved	mg/L	<0.0000050	130	5.50	8.40	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00640	130	5.50	8.40	0.00450	0.00450
			Manganese- Total	mg/L	0.0340	130	5.50	8.40	1.20	1.20
			Nickel- Total	mg/L	<0.00050	130	5.50	8.40	0.120	0.120
			Silver- Total	mg/L	<0.000010	130	5.50	8.40	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	130	5.50	8.40	0.0380	0.0380
		02-Nov-22	Cadmium- Dissolved	mg/L	<0.0000050	157	5.40	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00500	157	5.40	8.00	0.00360	0.00360
			Manganese- Total	mg/L	0.0450	157	5.40	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	5.40	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.40	8.00	0.0580	0.0580
		07-Dec-22	Cadmium- Dissolved	mg/L	<0.000010	157	5.40	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00510	157	5.40	8.00	0.00330	0.00330
			Manganese- Total	mg/L	0.0460	157	5.40	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	157	5.40	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	157	5.40	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	157	5.40	8.00	0.0580	0.0580
2023	HAC-13	04-Jan-23	Cadmium- Dissolved	mg/L	<0.0000050	116	6.60	7.80	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00480	116	6.60	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.00360	116	6.60	7.80	1.10	1.10
			Nickel- Total	mg/L	<0.00050	116	6.60	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	116	6.60	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	116	6.60	7.80	0.0270	0.0270
		08-Feb-23	Cadmium- Dissolved	mg/L	<0.0000050	118	6.80	7.80	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00540	118	6.80	7.80	0.00360	0.00360
			Manganese- Total	mg/L	0.0190	118	6.80	7.80	1.10	1.10
			Nickel- Total	mg/L	<0.00050	118	6.80	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	118	6.80	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	118	6.80	7.80	0.0280	0.0280
		07-Mar-23	Cadmium- Dissolved	mg/L	<0.0000050	124	6.60	7.60	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00430	124	6.60	7.60	0.00270	0.00270
			Manganese- Total	mg/L	0.00880	124	6.60	7.60	1.20	1.20
			Nickel- Total	mg/L	<0.00050	124	6.60	7.60	0.110	0.110
			Silver- Total	mg/L	<0.000010	124	6.60	7.60	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	124	6.60	7.60	0.0330	0.0330
		03-Apr-23	Cadmium- Dissolved	mg/L	<0.0000050	123	7.20	7.80	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00520	123	7.20	7.80	0.00360	0.00360
			Manganese- Total	mg/L	0.0480	123	7.20	7.80	1.10	1.10
			Nickel- Total	mg/L	<0.00050	123	7.20	7.80	0.110	0.110
			Silver- Total	mg/L	<0.000010	123	7.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	7.20	7.80	0.0320	0.0320
		01-May-23	Cadmium- Dissolved	mg/L	0.00000690	107	16.0	7.30	0.000220	0.000220
			Copper- Dissolved	mg/L	0.0260	107	16.0	7.30	0.00450	0.00450
			Manganese- Total	mg/L	0.0190	107	16.0	7.30	1.10	1.10
			Nickel- Total	mg/L	0.000600	107	16.0	7.30	0.100	0.100
			Silver- Total	mg/L	0.0000140	107	16.0	7.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	107	16.0	7.30	0.0200	0.0200
		05-Jun-23	Cadmium- Dissolved	mg/L	<0.0000050	107	6.60	8.20	0.000220	0.000220
			Copper- Dissolved	mg/L	0.00400	107	6.60	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0110	107	6.60	8.20	1.10	1.10
			Nickel- Total	mg/L	<0.00050	107	6.60	8.20	0.100	0.100
			Silver- Total	mg/L	<0.000010	107	6.60	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	107	6.60	8.20	0.0200	0.0200

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2023	HAC-13	02-Aug-23	Cadmium- Dissolved	mg/L	<0.0000050	126	6.80	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00360	126	6.80	8.20	0.00500	0.00500
			Manganese- Total	mg/L	0.0200	126	6.80	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	126	6.80	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	126	6.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	126	6.80	8.20	0.0340	0.0340
		06-Sep-23	Cadmium- Dissolved	mg/L	<0.0000050	111	6.50	8.10	0.000230	0.000230
			Copper- Dissolved	mg/L	0.00360	111	6.50	8.10	0.00410	0.00410
			Manganese- Total	mg/L	0.0160	111	6.50	8.10	1.10	1.10
			Nickel- Total	mg/L	<0.00050	111	6.50	8.10	0.100	0.100
			Silver- Total	mg/L	<0.000010	111	6.50	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	111	6.50	8.10	0.0230	0.0230
	HAC-05a	04-Jan-23	Cadmium- Dissolved	mg/L	<0.0000050	146	6.20	7.80	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00490	146	6.20	7.80	0.00330	0.00330
			Manganese- Total	mg/L	0.0160	146	6.20	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	146	6.20	7.80	0.130	0.130
			Silver- Total	mg/L	<0.000010	146	6.20	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	146	6.20	7.80	0.0500	0.0500
		08-Feb-23	Cadmium- Dissolved	mg/L	<0.0000050	131	6.80	7.90	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00510	131	6.80	7.90	0.00400	0.00400
			Manganese- Total	mg/L	0.0190	131	6.80	7.90	1.20	1.20
			Nickel- Total	mg/L	<0.00050	131	6.80	7.90	0.120	0.120
			Silver- Total	mg/L	<0.000010	131	6.80	7.90	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	131	6.80	7.90	0.0380	0.0380
		07-Mar-23	Cadmium- Dissolved	mg/L	<0.0000050	139	6.30	7.80	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00450	139	6.30	7.80	0.00350	0.00350
			Manganese- Total	mg/L	0.0140	139	6.30	7.80	1.20	1.20
			Nickel- Total	mg/L	<0.00050	139	6.30	7.80	0.120	0.120
			Silver- Total	mg/L	<0.000010	139	6.30	7.80	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	139	6.30	7.80	0.0440	0.0440
		03-Apr-23	Cadmium- Dissolved	mg/L	<0.0000050	151	6.70	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00570	151	6.70	8.00	0.00420	0.00420
			Manganese- Total	mg/L	0.0340	151	6.70	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	6.70	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	6.70	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	6.70	8.00	0.0530	0.0530
		01-May-23	Cadmium- Dissolved	mg/L	0.00000640	123	22.0	7.70	0.000250	0.000250
			Copper- Dissolved	mg/L	0.0290	123	22.0	7.70	0.00920	0.00920
			Manganese- Total	mg/L	0.0330	123	22.0	7.70	1.10	1.10
			Nickel- Total	mg/L	0.000620	123	22.0	7.70	0.110	0.110
			Silver- Total	mg/L	0.0000270	123	22.0	7.70	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	123	22.0	7.70	0.0320	0.0320
		05-Jun-23	Cadmium- Dissolved	mg/L	<0.0000050	125	6.40	8.20	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00430	125	6.40	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0410	125	6.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	125	6.40	8.20	0.110	0.110
			Silver- Total	mg/L	<0.000010	125	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	125	6.40	8.20	0.0340	0.0340
		02-Aug-23	Cadmium- Dissolved	mg/L	<0.0000050	134	6.40	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00370	134	6.40	8.20	0.00470	0.00470
			Manganese- Total	mg/L	0.0360	134	6.40	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	134	6.40	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	134	6.40	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	134	6.40	8.20	0.0400	0.0400
		06-Sep-23	Cadmium- Dissolved	mg/L	<0.0000050	122	6.30	8.00	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00390	122	6.30	8.00	0.00420	0.00420
			Manganese- Total	mg/L	0.0270	122	6.30	8.00	1.10	1.10
			Nickel- Total	mg/L	<0.00050	122	6.30	8.00	0.110	0.110
			Silver- Total	mg/L	<0.000010	122	6.30	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	122	6.30	8.00	0.0320	0.0320
	HAC-14	01-May-23	Cadmium- Dissolved	mg/L	0.0000110	79.0	22.0	7.70	0.000180	0.000180
			Copper- Dissolved	mg/L	0.0280	79.0	22.0	7.70	0.00820	0.00820
			Manganese- Total	mg/L	0.0220	79.0	22.0	7.70	0.950	0.950
			Nickel- Total	mg/L	0.00140	79.0	22.0	7.70	0.0800	0.0800
			Silver- Total	mg/L	0.0000220	79.0	22.0	7.70	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	79.0	22.0	7.70	0.00750	0.00750
		05-Jun-23	Cadmium- Dissolved	mg/L	0.00000800	135	5.80	8.10	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00760	135	5.80	8.10	0.00400	0.00400
			Manganese- Total	mg/L	0.0120	135	5.80	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	5.80	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	5.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	5.80	8.10	0.0410	0.0410
		02-Aug-23	Cadmium- Dissolved	mg/L	<0.000010	142	5.90	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00580	142	5.90	8.20	0.00440	0.00440
			Manganese- Total	mg/L	0.0150	142	5.90	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	142	5.90	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	142	5.90	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	142	5.90	8.20	0.0460	0.0460
		06-Sep-23	Cadmium- Dissolved	mg/L	<0.0000050	128	5.40	8.10	0.000250	0.000250
			Copper- Dissolved	mg/L	0.00620	128	5.40	8.10	0.00370	0.00370
			Manganese- Total	mg/L	0.0120	128	5.40	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	128	5.40	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	128	5.40	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	128	5.40	8.10	0.0360	0.0360
	HAC-08	04-Jan-23	Cadmium- Dissolved	mg/L	<0.0000050	154	5.20	8.20	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00640	154	5.20	8.20	0.00380	0.00380
			Manganese- Total	mg/L	0.00860	154	5.20	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	154	5.20	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	154	5.20	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	154	5.20	8.20	0.0560	0.0560
		08-Feb-23	Cadmium- Dissolved	mg/L	<0.0000050	140	6.00	8.10	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00680	140	6.00	8.10	0.00410	0.00410
			Manganese- Total	mg/L	0.00830	140	6.00	8.10	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	6.00	8.10	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	6.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	6.00	8.10	0.0450	0.0450
		07-Mar-23	Cadmium- Dissolved	mg/L	<0.0000050	151	5.80	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00610	151	5.80	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.00830	151	5.80	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	5.80	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	5.80	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	5.80	8.10	0.0530	0.0530
		03-Apr-23	Cadmium- Dissolved	mg/L	<0.0000050	151	6.00	8.10	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00810	151	6.00	8.10	0.00420	0.00420
			Manganese- Total	mg/L	0.0200	151	6.00	8.10	1.30	1.30
			Nickel- Total	mg/L	<0.00050	151	6.00	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	151	6.00	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	151	6.00	8.10	0.0530	0.0530

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

Table A.2: Modifying Factors Used in Calculation of Condition-Specific Guidelines for Surface Water Samples from Hazeltine Creek (HAC-13, HAC-05a, HAC-14, HAC-08) and Edney Creek (EDC-01a, W10), 2015 to Present

Year	Station	Date	Parameter	Unit	Result	Value for Guideline Calculation			BCWQG	
						Hardness (as $CaCO_3$)	Dissolved Organic Carbon	Minimum pH (Field)	Long Term Calculated Value	Short Term Calculated Value
2023	HAC-08	01-May-23	Cadmium- Dissolved	mg/L	0.0000380	75.0	23.0	7.80	0.000170	0.000170
			Copper- Dissolved	mg/L	0.0230	75.0	23.0	7.80	0.00860	0.00860
			Manganese- Total	mg/L	0.0280	75.0	23.0	7.80	0.930	0.930
			Nickel- Total	mg/L	0.00180	75.0	23.0	7.80	0.0760	0.0760
			Silver- Total	mg/L	0.0000200	75.0	23.0	7.80	0.0000500	0.0000500
			Zinc- Total	mg/L	<0.0030	75.0	23.0	7.80	0.00750	0.00750
		05-Jun-23	Cadmium- Dissolved	mg/L	<0.0000050	133	6.00	8.50	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00840	133	6.00	8.50	0.00520	0.00520
			Manganese- Total	mg/L	0.0150	133	6.00	8.50	1.20	1.20
			Nickel- Total	mg/L	<0.00050	133	6.00	8.50	0.120	0.120
			Silver- Total	mg/L	<0.000010	133	6.00	8.50	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	133	6.00	8.50	0.0400	0.0400
		02-Aug-23	Cadmium- Dissolved	mg/L	<0.0000050	140	6.00	8.30	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00620	140	6.00	8.30	0.00470	0.00470
			Manganese- Total	mg/L	0.0180	140	6.00	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	140	6.00	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	140	6.00	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	140	6.00	8.30	0.0450	0.0450
		06-Sep-23	Cadmium- Dissolved	mg/L	<0.0000050	132	5.50	8.30	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00590	132	5.50	8.30	0.00420	0.00420
			Manganese- Total	mg/L	0.00860	132	5.50	8.30	1.20	1.20
			Nickel- Total	mg/L	<0.00050	132	5.50	8.30	0.120	0.120
			Silver- Total	mg/L	<0.000010	132	5.50	8.30	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	132	5.50	8.30	0.0390	0.0390
	W10	13-Jun-23	Cadmium- Dissolved	mg/L	0.00000510	121	9.60	8.10	0.000240	0.000240
			Copper- Dissolved	mg/L	0.00200	121	9.60	8.10	0.00620	0.00620
			Manganese- Total	mg/L	0.00450	121	9.60	8.10	1.10	1.10
			Nickel- Total	mg/L	0.000720	121	9.60	8.10	0.110	0.110
			Silver- Total	mg/L	<0.000010	121	9.60	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	121	9.60	8.10	0.0310	0.0310
	EDC-01a	04-Jan-23	Cadmium- Dissolved	mg/L	<0.0000050	155	6.00	8.00	0.000290	0.000290
			Copper- Dissolved	mg/L	0.00570	155	6.00	8.00	0.00390	0.00390
			Manganese- Total	mg/L	0.0390	155	6.00	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	155	6.00	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	155	6.00	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	155	6.00	8.00	0.0560	0.0560
		08-Feb-23	Cadmium- Dissolved	mg/L	0.00000510	143	6.70	8.10	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00580	143	6.70	8.10	0.00440	0.00440
			Manganese- Total	mg/L	0.0320	143	6.70	8.10	1.20	1.20
			Nickel- Total	mg/L	0.000770	143	6.70	8.10	0.130	0.130
			Silver- Total	mg/L	<0.000010	143	6.70	8.10	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	143	6.70	8.10	0.0470	0.0470
		07-Mar-23	Cadmium- Dissolved	mg/L	<0.0000050	145	6.20	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00570	145	6.20	8.00	0.00380	0.00380
			Manganese- Total	mg/L	0.0330	145	6.20	8.00	1.20	1.20
			Nickel- Total	mg/L	<0.00050	145	6.20	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	145	6.20	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	145	6.20	8.00	0.0490	0.0490
		03-Apr-23	Cadmium- Dissolved	mg/L	<0.0000050	147	7.60	8.00	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00600	147	7.60	8.00	0.00490	0.00490
			Manganese- Total	mg/L	0.0300	147	7.60	8.00	1.30	1.30
			Nickel- Total	mg/L	<0.00050	147	7.60	8.00	0.130	0.130
			Silver- Total	mg/L	<0.000010	147	7.60	8.00	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	147	7.60	8.00	0.0500	0.0500
		01-May-23	Cadmium- Dissolved	mg/L	0.00000770	43.0	23.0	7.60	0.000110	0.000110
			Copper- Dissolved	mg/L	0.00600	43.0	23.0	7.60	0.00620	0.00620
			Manganese- Total	mg/L	0.0390	43.0	23.0	7.60	0.790	0.790
			Nickel- Total	mg/L	0.00280	43.0	23.0	7.60	0.0250	0.0250
			Silver- Total	mg/L	0.0000170	43.0	23.0	7.60	0.0000500	0.0000500
			Zinc- Total	mg/L	0.00360	43.0	23.0	7.60	0.00750	0.00750
		05-Jun-23	Cadmium- Dissolved	mg/L	0.00000650	136	7.10	8.20	0.000270	0.000270
			Copper- Dissolved	mg/L	0.00650	136	7.10	8.20	0.00510	0.00510
			Manganese- Total	mg/L	0.0630	136	7.10	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	136	7.10	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	136	7.10	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	136	7.10	8.20	0.0420	0.0420
		02-Aug-23	Cadmium- Dissolved	mg/L	<0.000010	148	5.80	8.20	0.000280	0.000280
			Copper- Dissolved	mg/L	0.00610	148	5.80	8.20	0.00450	0.00450
			Manganese- Total	mg/L	0.0360	148	5.80	8.20	1.30	1.30
			Nickel- Total	mg/L	<0.00050	148	5.80	8.20	0.130	0.130
			Silver- Total	mg/L	<0.000010	148	5.80	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	148	5.80	8.20	0.0510	0.0510
		06-Sep-23	Cadmium- Dissolved	mg/L	0.00000680	135	5.50	8.20	0.000260	0.000260
			Copper- Dissolved	mg/L	0.00580	135	5.50	8.20	0.00400	0.00400
			Manganese- Total	mg/L	0.0350	135	5.50	8.20	1.20	1.20
			Nickel- Total	mg/L	<0.00050	135	5.50	8.20	0.120	0.120
			Silver- Total	mg/L	<0.000010	135	5.50	8.20	0.00150	0.00150
			Zinc- Total	mg/L	<0.0030	135	5.50	8.20	0.0410	0.0410

Notes: mg/L = milligrams per litre, BCWQG = British Columbia Water Quality Guideline, "<" = result is below the laboratory reporting limit. All results reported to three significant figures.

APPENDIX B
SEDIMENT QUALITY

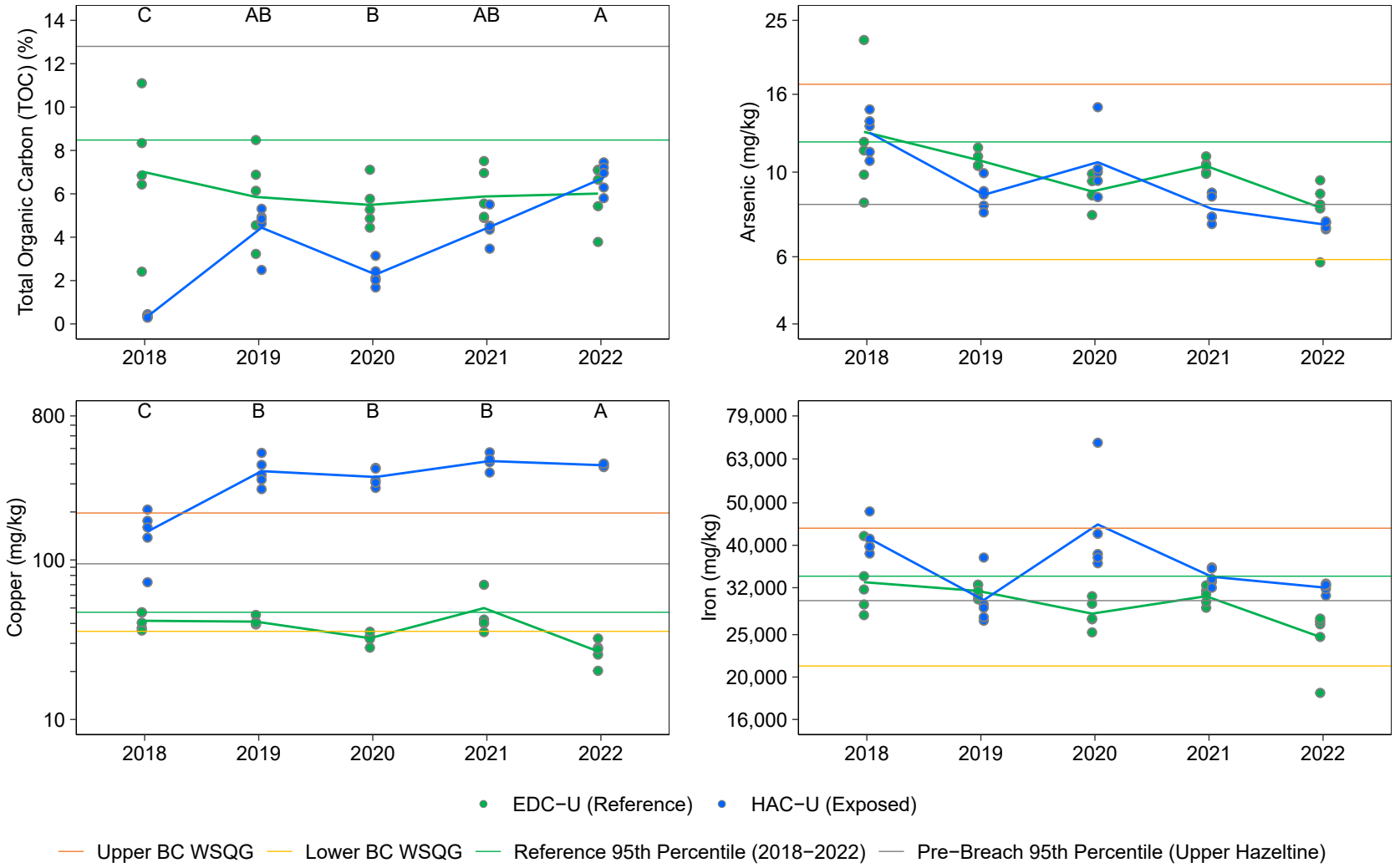

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

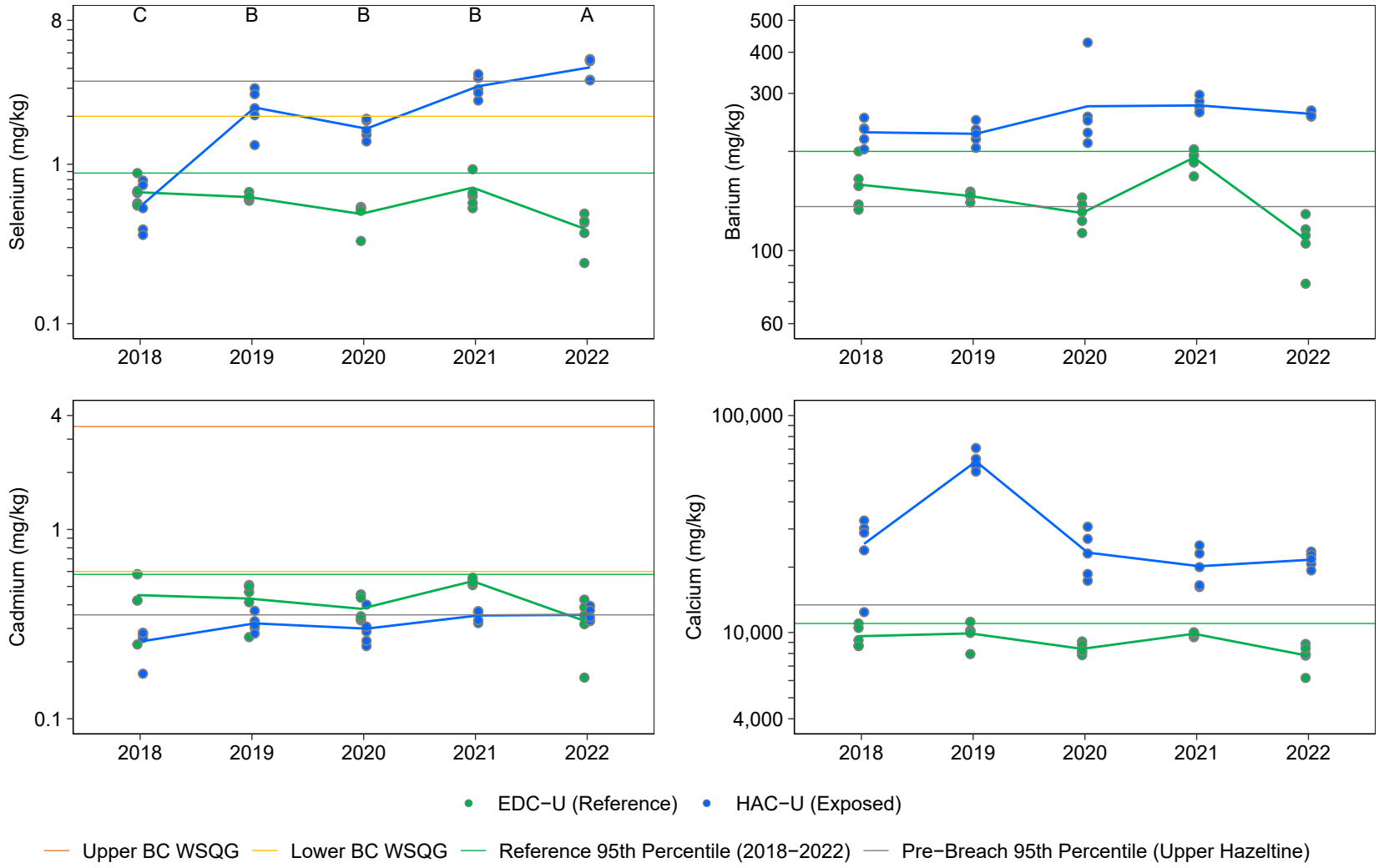

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

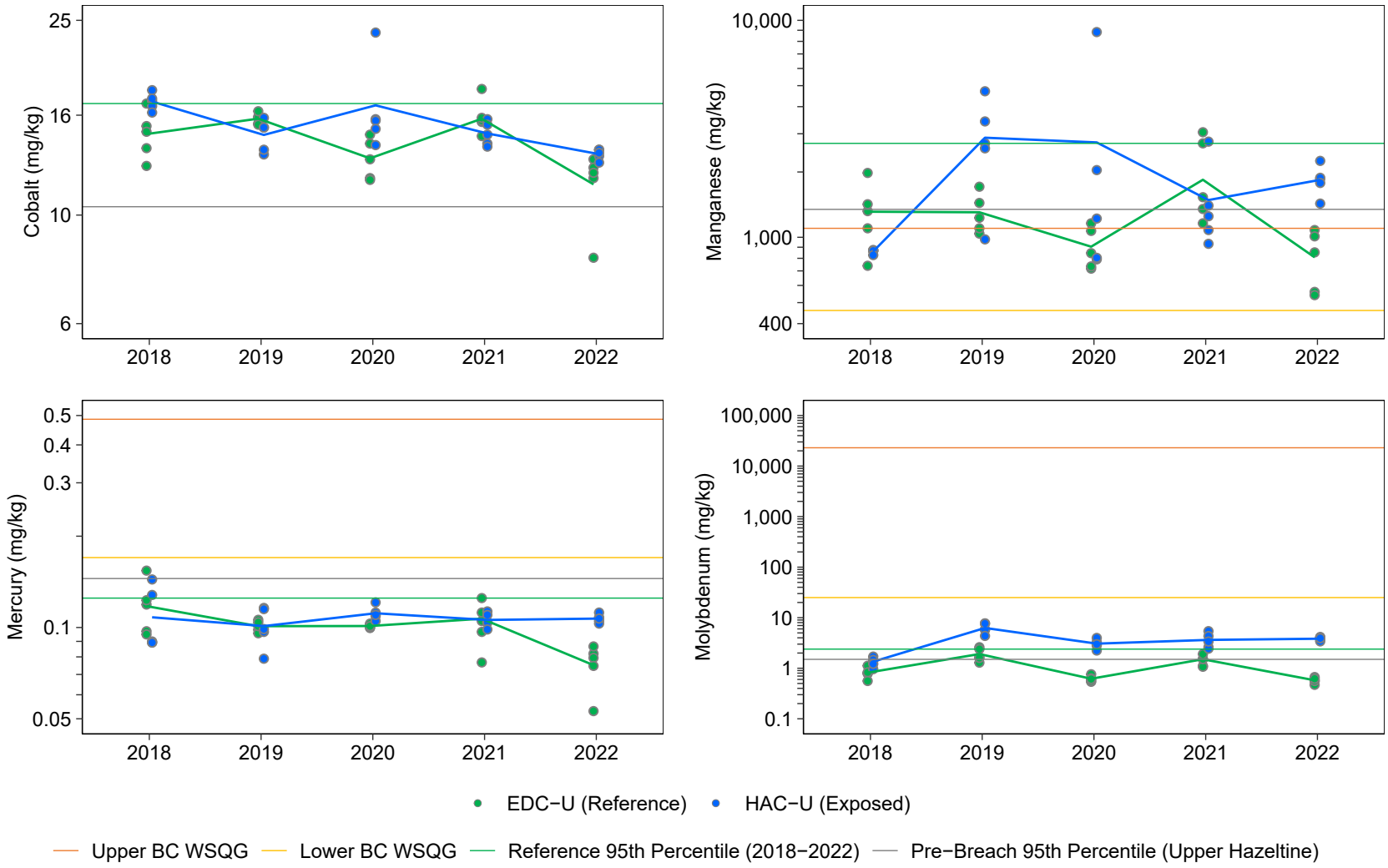

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

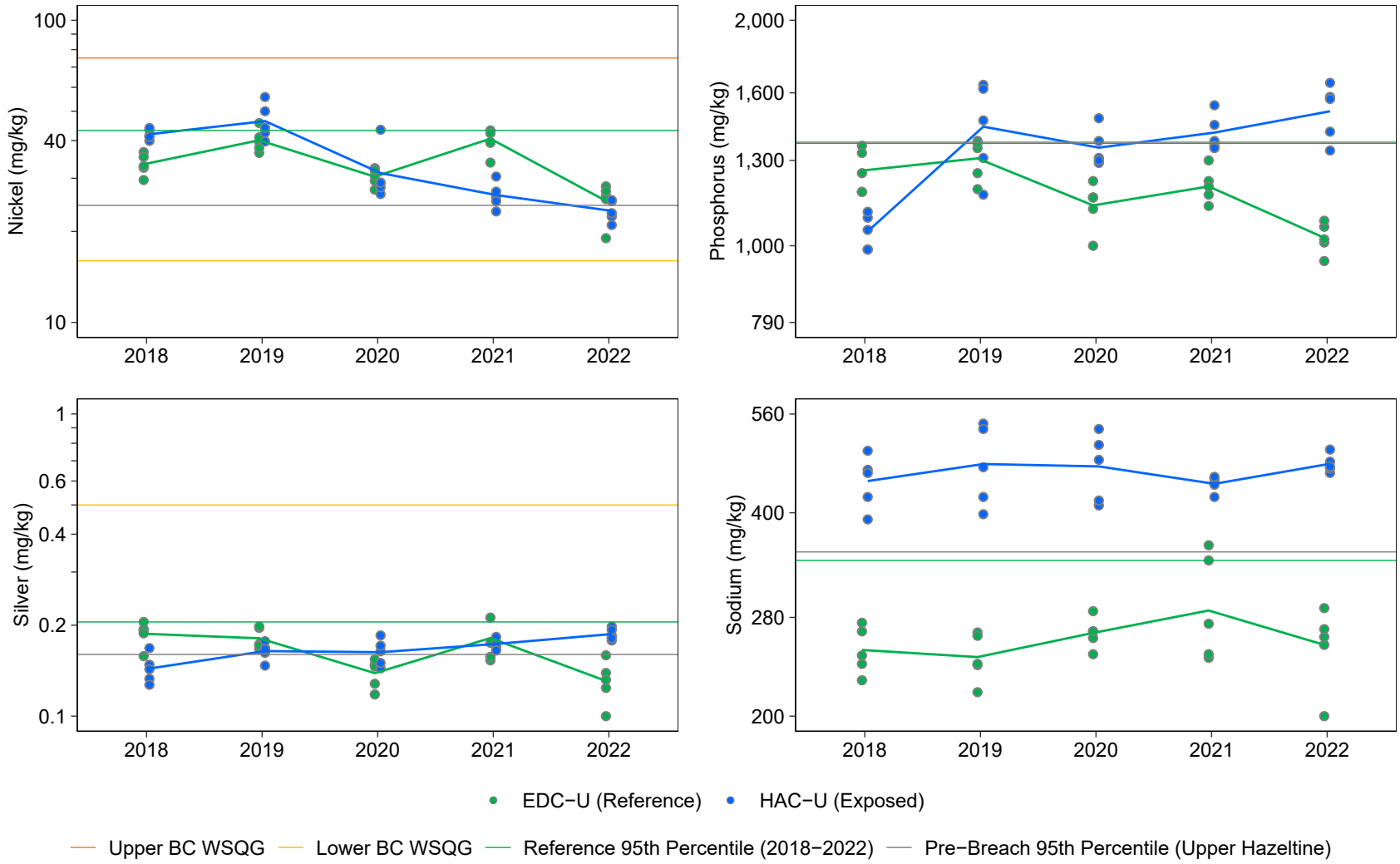

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

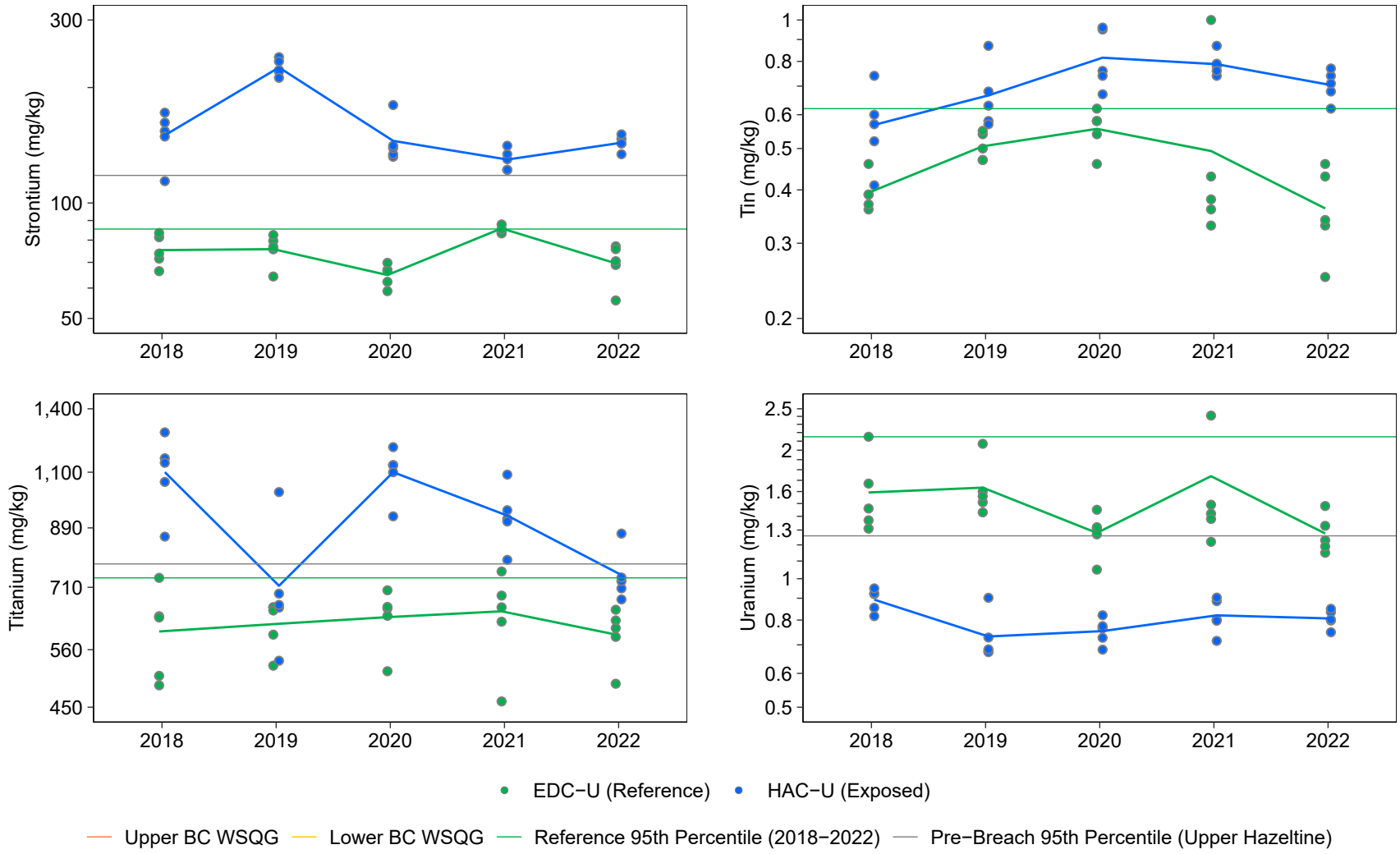

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

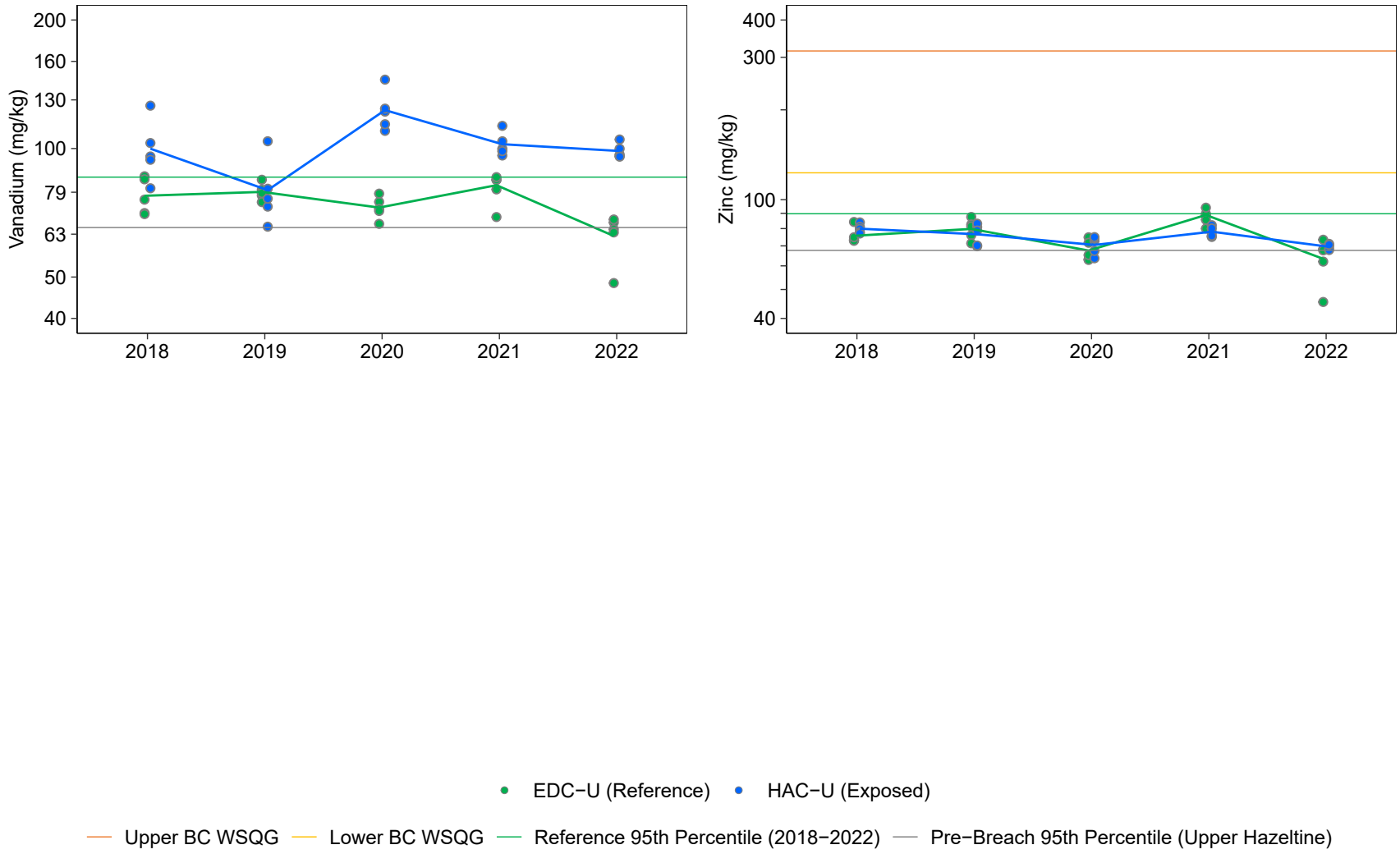

Figure B.1: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and selenium) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

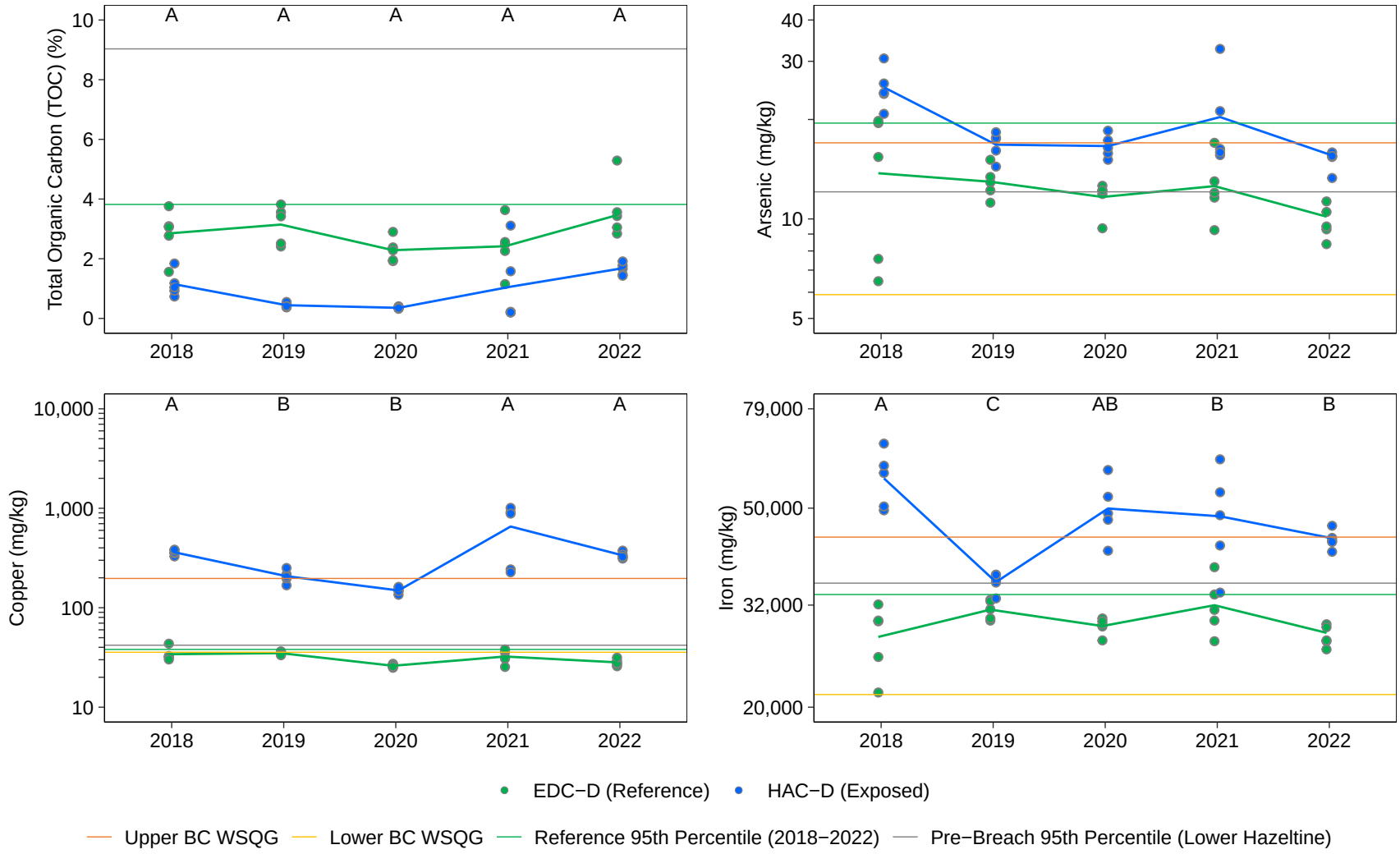

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

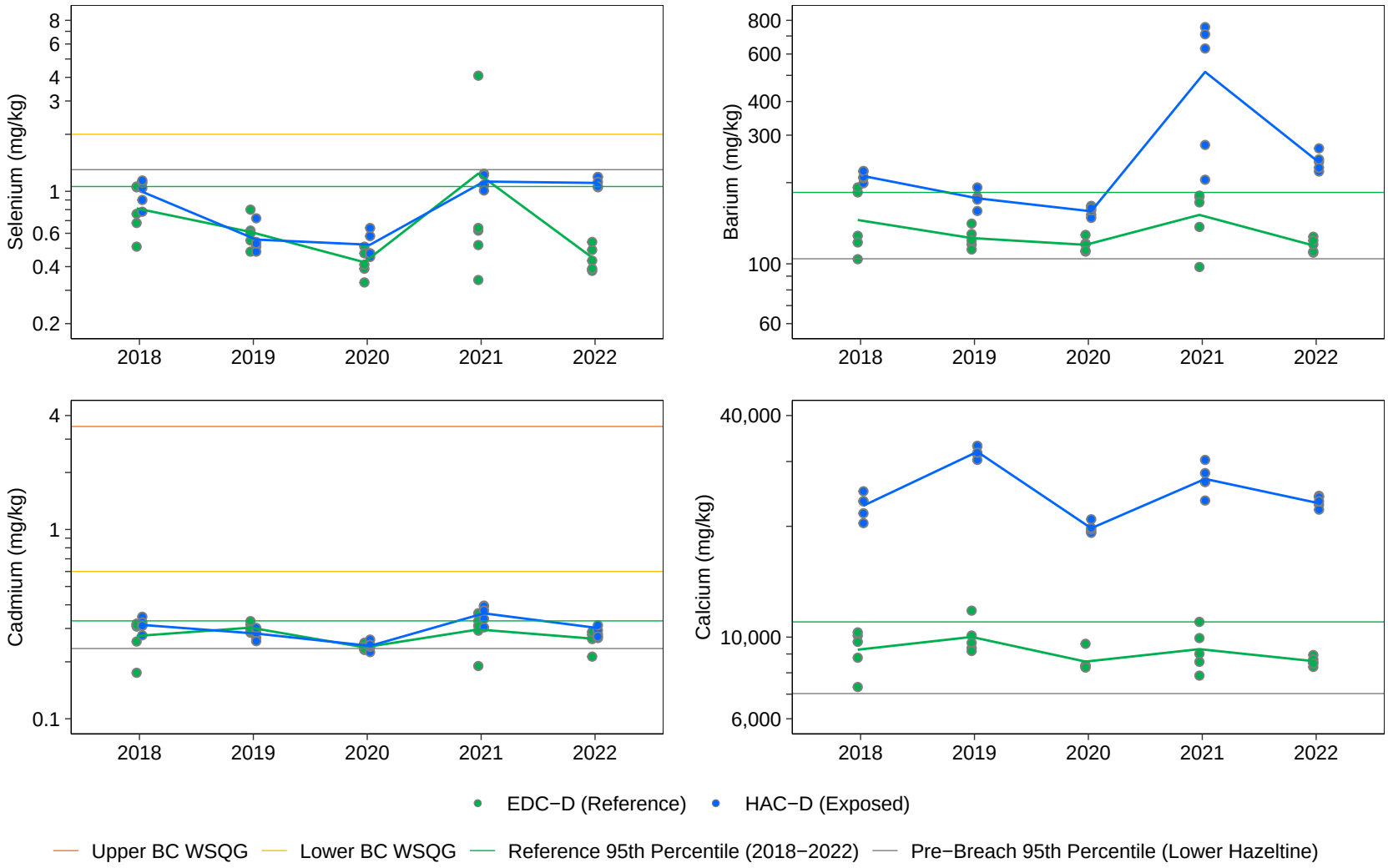

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

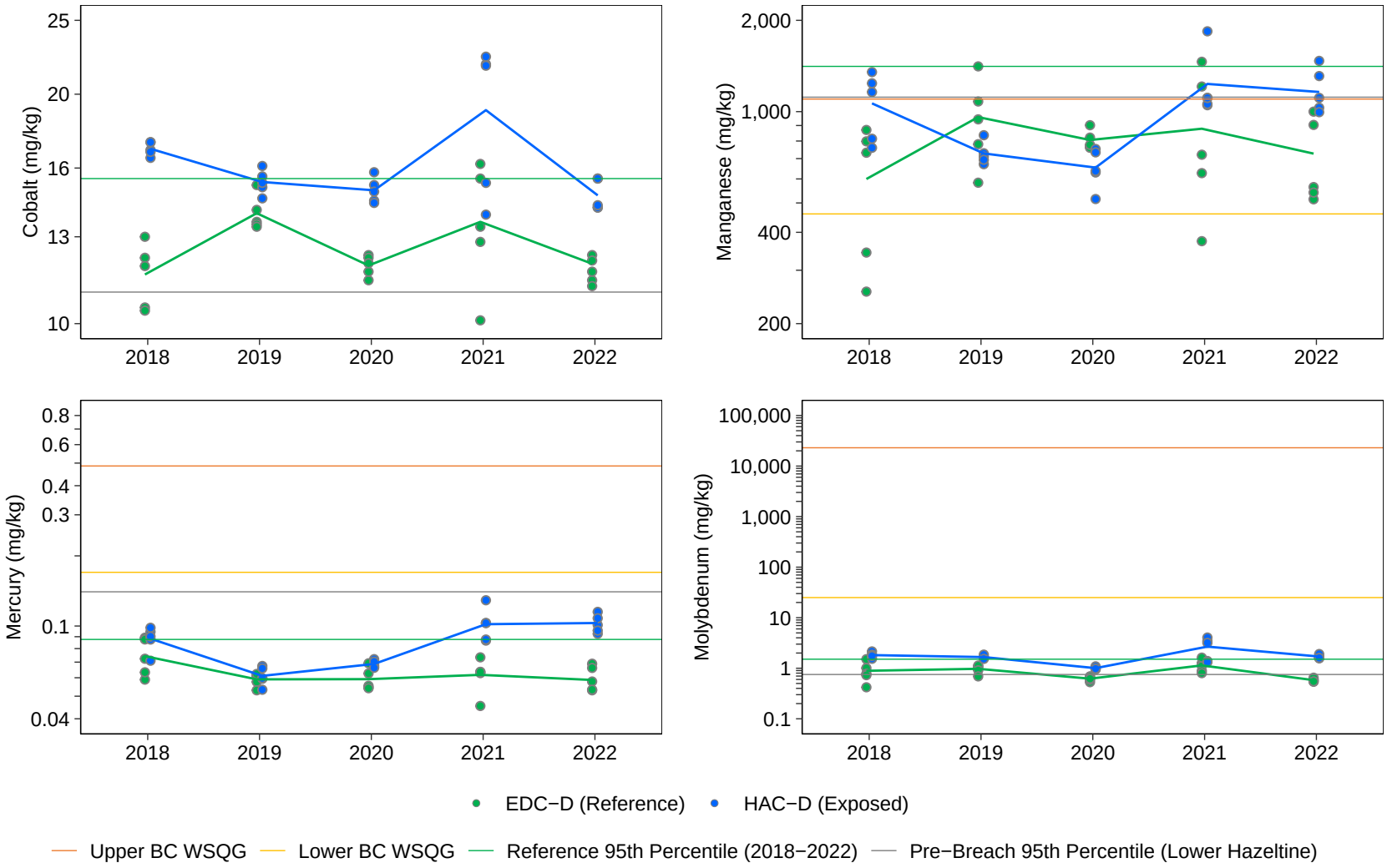

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

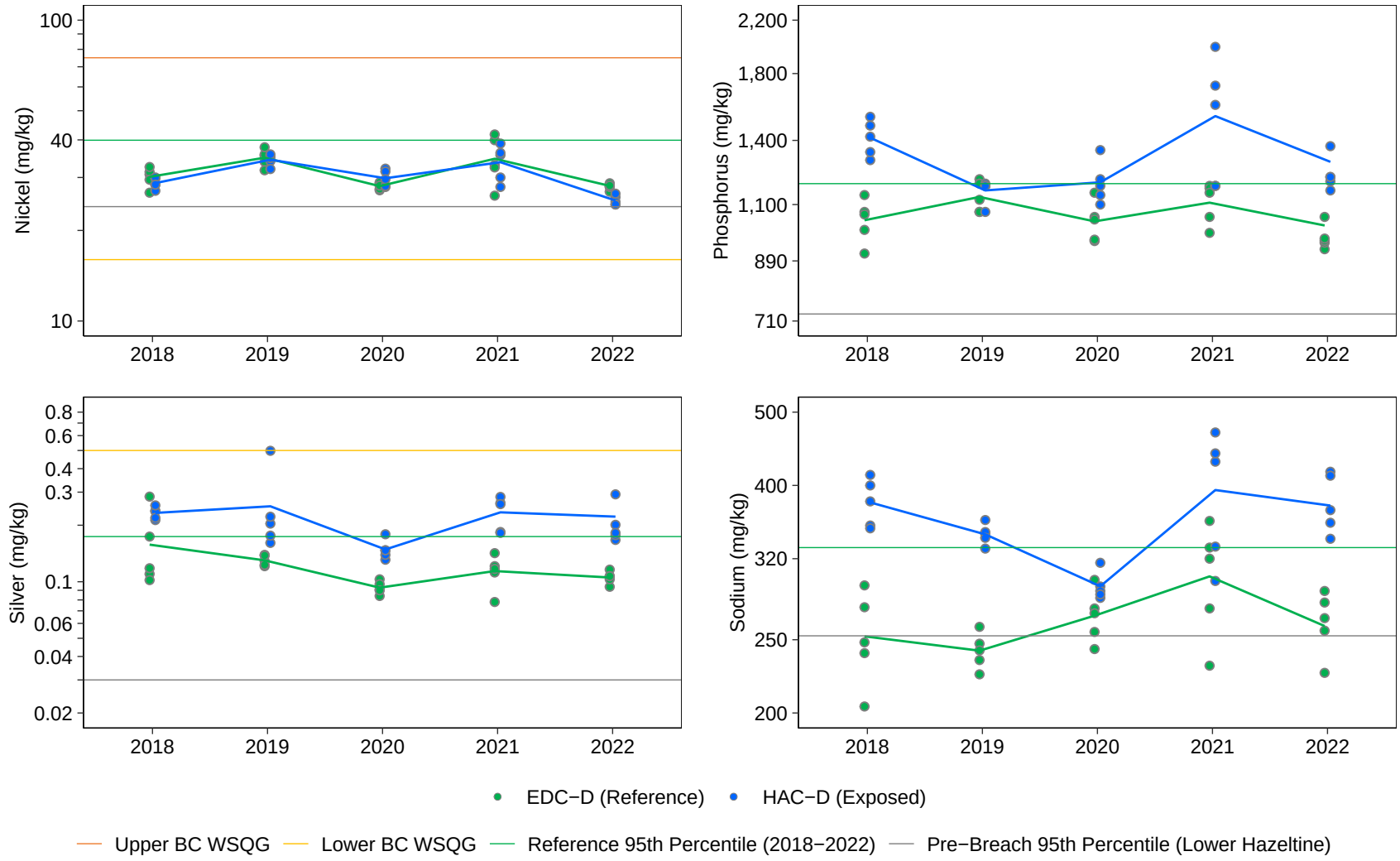

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

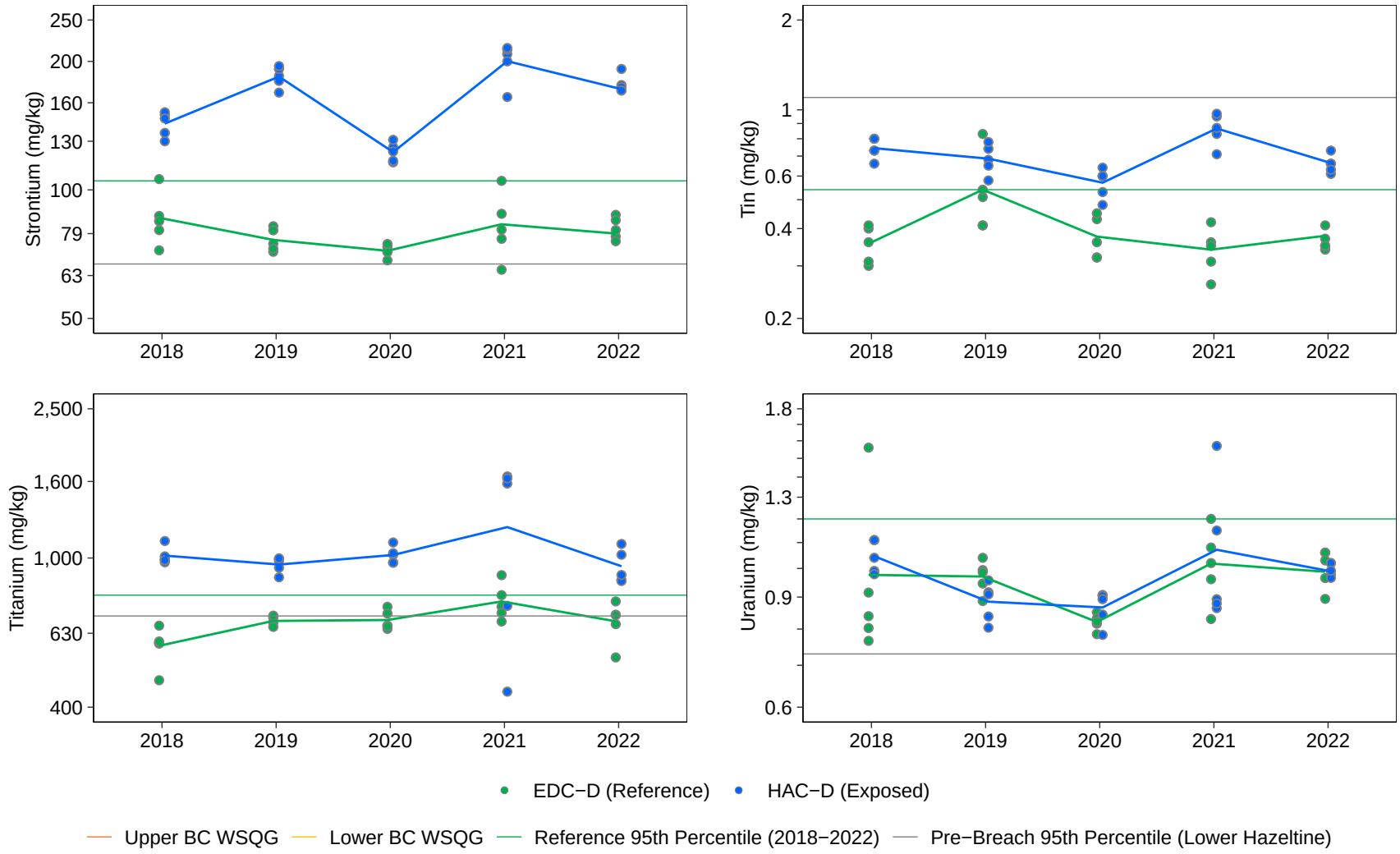

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

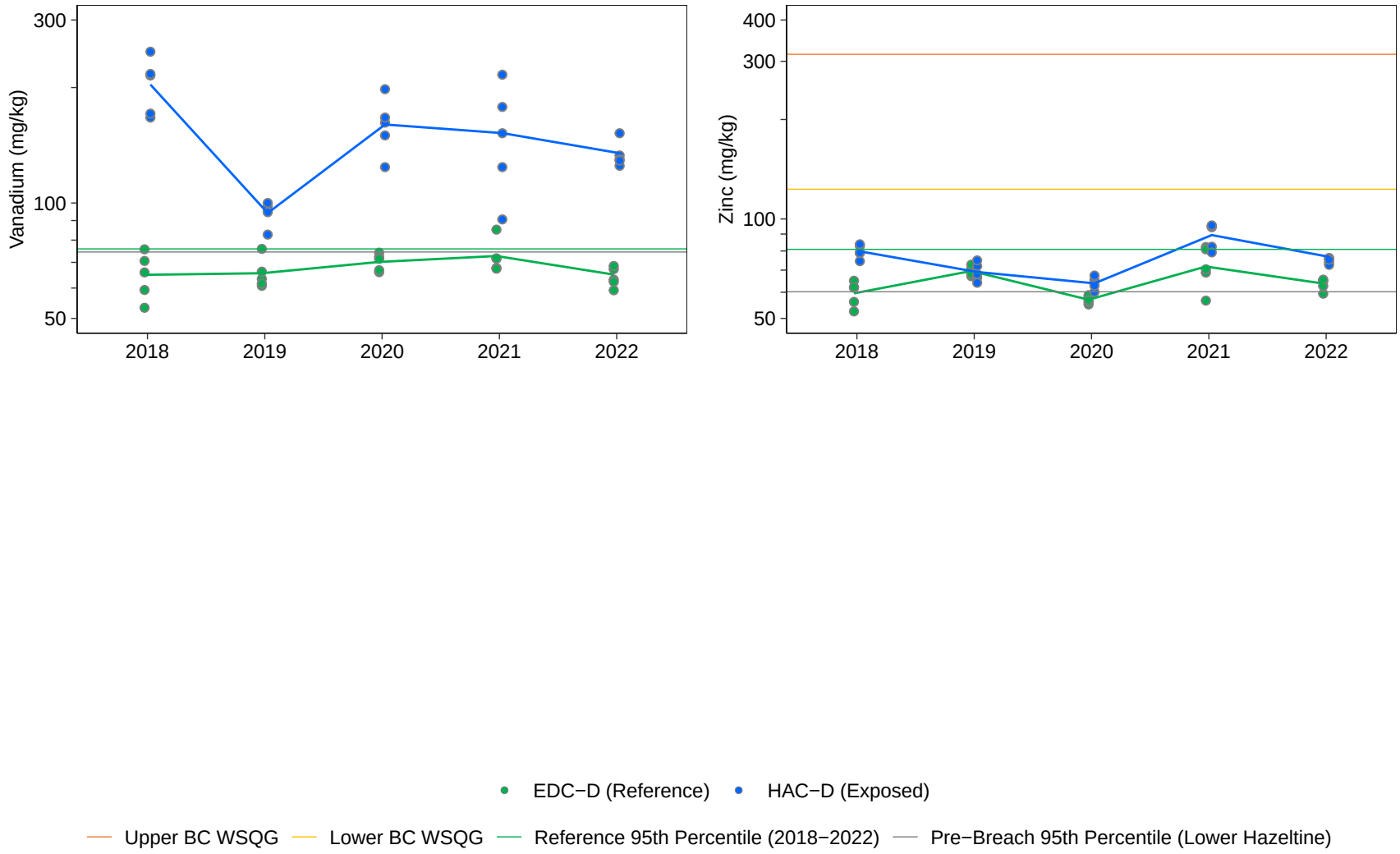

Figure B.2: Sediment Primary and Secondary Analyte Concentrations (<63 µm Fraction) for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Individual samples are plotted and lines join the least −squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). For Analytes of Interest (identified in Minnow [2023]; copper and iron) and total organic carbon, statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have differences in concentrations (Exposed − Reference) that do not differ significantly (p−value < 0.05) among years.

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Clay[a] %	Silt[a] %	Sand[a] %	Gravel[a] %	pH (1:2 soil:water) pH units	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg
2015	EDC-D	Reference	EDC-D-1	6.23	52.2	41.5	<0.10	7.60	14,300	0.370	21.0	194	0.380	0.140	<10.0	0.409	9,370	43.9
			EDC-D-2	6.64	34.3	59.1	<0.10	7.36	14,900	0.340	13.0	141	0.360	0.150	<10.0	0.298	9,300	43.1
			EDC-D-3	5.31	32.8	61.4	0.510	7.67	15,900	0.410	16.5	201	0.420	0.150	<10.0	0.362	9,670	46.6
			EDC-D-4	8.52	54.1	37.4	<0.10	7.86	15,000	0.330	11.7	133	0.410	0.150	<10.0	0.407	12,000	42.8
			EDC-D-5	6.25	51.0	42.2	0.560	8.00	19,300	0.380	28.8	208	0.430	0.150	<10.0	0.387	11,300	52.8
2018	EDC-U	Reference	EDC-U-1	6.80	50.5	42.3	<1.0	7.00	17,400	0.300	9.85	138	0.430	0.110	<10.0	0.422	9,210	53.1
			EDC-U-2	8.80	45.2	36.2	9.80	6.68	16,700	0.320	22.2	200	0.460	0.110	<10.0	0.581	11,000	51.0
			EDC-U-3	16.4	51.5	31.3	<1.0	6.90	22,800	0.360	12.0	165	0.630	0.140	<10.0	0.247	8,650	63.6
			EDC-U-4	5.60	37.7	30.2	26.6	7.00	19,800	0.310	11.4	157	0.490	0.120	<10.0	0.579	10,500	56.0
			EDC-U-5	6.40	56.4	37.2	<1.0	6.20	17,200	0.270	8.32	133	0.410	<0.10	<10.0	0.421	8,680	51.1
	HAC-U	Exposed	HAC-U-1	19.2	33.9	39.4	7.60	8.11	24,600	0.550	11.3	235	0.630	0.160	11.0	0.278	32,800	51.8
			HAC-U-2	18.6	30.7	41.9	8.90	8.22	25,800	0.610	14.6	218	0.730	0.170	<10.0	0.173	12,400	56.8
			HAC-U-3	17.4	28.6	37.9	16.1	8.56	21,400	0.540	13.2	203	0.540	0.160	<10.0	0.285	30,200	52.1
			HAC-U-4	19.3	29.8	35.8	15.1	8.27	23,500	0.620	13.6	253	0.610	0.140	<10.0	0.267	23,900	51.1
			HAC-U-5	17.2	29.6	37.6	15.6	8.44	22,100	0.540	10.7	234	0.580	0.160	<10.0	0.283	28,800	50.6
	EDC-D	Reference	EDC-D-1	2.60	7.30	87.7	2.40	8.15	13,800	0.540	19.5	184	0.510	0.130	<10.0	0.307	10,100	44.0
			EDC-D-2	3.20	11.0	83.9	1.90	7.90	14,600	0.430	19.8	192	0.470	0.120	<10.0	0.318	10,300	45.5
			EDC-D-3	5.80	31.0	57.6	5.60	7.88	13,900	0.400	15.4	127	0.380	0.120	<10.0	0.313	8,790	41.5
			EDC-D-4	4.30	33.1	51.8	10.7	8.14	13,000	0.320	7.57	104	0.350	0.110	<10.0	0.256	7,320	40.0
			EDC-D-5	4.70	25.8	62.8	6.80	7.56	15,500	0.460	6.48	120	0.410	0.130	<10.0	0.175	9,710	39.6
	HAC-D	Exposed	HAC-D-1	6.80	19.7	73.1	<1.0	8.44	14,600	0.520	20.8	199	0.500	0.140	<10.0	0.276	21,700	40.4
			HAC-D-2	6.60	12.1	81.1	<1.0	8.41	14,500	0.550	30.6	208	0.540	0.150	<10.0	0.311	20,400	36.1
			HAC-D-3	9.70	31.9	58.4	<1.0	8.16	16,100	0.610	25.7	210	0.580	0.150	10.0	0.346	23,400	33.3
			HAC-D-4	10.5	44.0	45.5	<1.0	7.72	16,900	0.530	23.9	220	0.550	0.140	<10.0	0.323	24,900	34.0
			HAC-D-5	6.50	25.1	66.7	1.70	7.92	15,400	0.520	24.1	221	0.520	0.140	<10.0	0.310	23,400	34.4
2019	EDC-U	Reference	EDC-U-1	8.60	43.1	48.1	<1.0	6.59	19,700	0.340	10.4	140	0.500	0.120	<10.0	0.413	10,200	60.0
			EDC-U-2	17.9	43.6	38.5	<1.0	6.37	22,700	0.370	11.0	146	0.600	0.140	<10.0	0.270	7,950	75.8
			EDC-U-3	8.70	34.9	56.4	<1.0	6.14	19,500	0.350	10.4	147	0.490	0.110	<10.0	0.509	10,200	63.4
			EDC-U-4	8.30	38.6	53.0	<1.0	6.15	18,500	0.340	11.6	151	0.490	0.110	<10.0	0.467	9,950	61.3
			EDC-U-5	13.4	56.9	29.7	<1.0	6.25	18,500	0.340	10.4	148	0.510	0.120	<10.0	0.499	11,200	64.9
	HAC-U	Exposed	HAC-U-1	21.7	77.3	1.10	<1.0	7.39	14,200	0.340	8.73	205	0.510	<0.10	15.0	0.303	70,800	53.9
			HAC-U-2	20.7	77.0	2.30	<1.0	7.38	16,200	0.390	8.17	233	0.520	<0.10	16.0	0.372	59,900	54.1
			HAC-U-3	20.8	65.6	13.7	<1.0	7.31	15,600	0.410	8.92	249	0.530	<0.10	16.0	0.328	58,200	74.8
			HAC-U-4	22.0	69.1	8.00	<1.0	7.38	14,100	0.370	7.84	218	0.460	<0.10	13.0	0.311	63,100	64.8
			HAC-U-5	19.6	48.5	30.7	1.30	7.59	18,400	0.520	9.94	226	0.530	0.120	11.0	0.282	55,100	46.3
	EDC-D	Reference	EDC-D-1	9.80	58.3	31.9	<1.0	6.74	15,700	0.360	11.2	118	0.400	0.120	<10.0	0.285	9,340	47.1
			EDC-D-2	7.20	35.4	57.0	<1.0	6.99	14,900	0.400	12.9	129	0.400	0.140	<10.0	0.314	10,100	49.0
			EDC-D-3	9.70	43.8	46.4	<1.0	7.48	15,500	0.420	15.1	141	0.410	0.140	<10.0	0.328	11,800	50.6
			EDC-D-4	5.90	28.7	65.0	<1.0	7.52	14,900	0.390	12.2	113	0.430	0.140	<10.0	0.292	9,650	52.3
			EDC-D-5	8.40	41.2	49.5	<1.0	7.16	15,200	0.380	13.4	122	0.390	0.130	<10.0	0.296	9,170	43.2
	HAC-D	Exposed	HAC-D-1	9.60	37.4	53.1	<1.0	8.18	16,100	0.620	17.5	177	0.510	0.160	10.0	0.300	31,300	40.1
			HAC-D-2	7.70	32.8	59.5	<1.0	8.43	15,000	0.610	17.6	157	0.510	0.150	<10.0	0.267	33,000	41.0
			HAC-D-3	8.90	35.3	55.8	<1.0	8.52	14,900	0.600	18.3	176	0.510	0.150	<10.0	0.284	33,100	40.4
			HAC-D-4	12.3	47.8	39.8	<1.0	8.02	16,000	0.620	16.1	192	0.530	0.150	10.0	0.302	30,300	41.4
			HAC-D-5	10.2	52.2	36.8	<1.0	8.32	14,900	0.550	14.4	173	0.500	0.150	<10.0	0.257	31,700	35.1

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Clay[a]	Silt[a]	Sand[a]	Gravel[a]	pH (1:2 soil:water)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium
				%	%	%	%	pH units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2020	EDC-U	Reference	EDC-U-1	4.90	26.7	68.4	<1.0	5.99	15,700	0.340	8.72	123	0.440	<0.10	<5.0	0.331	8,100	52.3
			EDC-U-2	5.70	26.8	67.5	<1.0	6.70	14,400	0.280	7.72	113	0.360	<0.10	<5.0	0.337	7,860	48.2
			EDC-U-3	4.10	17.5	77.1	1.30	6.33	15,800	0.330	9.90	145	0.470	0.110	<5.0	0.454	9,090	54.5
			EDC-U-4	6.00	35.4	58.6	<1.0	6.01	15,000	0.310	9.47	138	0.450	<0.10	<5.0	0.436	8,770	51.7
			EDC-U-5	10.5	37.6	51.5	<1.0	6.78	18,400	0.330	8.69	131	0.470	0.100	<5.0	0.348	8,200	54.5
	HAC-U	Exposed	HAC-U-1	14.3	39.7	45.1	<1.0	7.38	17,900	0.520	10.0	228	0.550	0.110	12.3	0.289	17,300	35.8
			HAC-U-2	13.8	60.4	25.8	<1.0	7.46	18,100	0.550	10.2	255	0.570	<0.10	13.2	0.242	18,600	32.2
			HAC-U-3	12.7	43.2	43.2	<1.0	7.68	17,700	0.710	14.8	428	0.590	<0.10	11.8	0.401	30,700	38.5
			HAC-U-4	13.4	65.7	20.9	<1.0	7.57	15,600	0.460	8.60	212	0.500	<0.10	12.4	0.258	27,000	33.3
			HAC-U-5	12.9	57.2	25.0	4.90	7.41	18,300	0.540	9.49	248	0.580	0.100	16.4	0.307	23,100	33.4
	EDC-D	Reference	EDC-D-1	3.60	25.3	66.9	4.20	7.53	12,000	0.340	9.37	111	0.330	0.100	<5.0	0.236	8,390	43.2
			EDC-D-2	3.50	18.5	78.0	<1.0	7.67	12,700	0.370	12.6	128	0.360	0.120	<5.0	0.252	9,590	45.6
			EDC-D-3	4.10	21.1	74.6	<1.0	7.76	12,900	0.360	11.9	119	0.350	0.110	<5.0	0.240	8,370	43.0
			EDC-D-4	3.20	15.7	79.3	1.80	7.88	11,700	0.370	12.2	118	0.360	0.100	<5.0	0.231	8,280	45.9
			EDC-D-5	3.80	18.1	73.8	4.30	7.52	11,300	0.360	12.2	112	0.350	0.100	<5.0	0.233	8,270	44.7
	HAC-D	Exposed	HAC-D-1	4.10	24.1	71.6	<1.0	8.52	11,300	0.510	15.1	152	0.390	0.120	5.70	0.225	19,300	43.1
			HAC-D-2	4.50	18.3	76.3	<1.0	8.69	12,100	0.550	18.5	164	0.470	0.150	7.00	0.240	19,200	45.2
			HAC-D-3	6.20	27.4	66.4	<1.0	8.31	12,800	0.550	15.8	148	0.450	0.150	6.20	0.262	19,600	42.4
			HAC-D-4	4.20	17.0	78.6	<1.0	8.59	11,700	0.560	17.3	158	0.430	0.140	6.10	0.241	19,800	45.7
			HAC-D-5	3.60	19.4	76.6	<1.0	8.58	11,900	0.560	16.4	161	0.430	0.140	6.00	0.246	20,900	50.9
2021	EDC-U	Reference	EDC-U-1	5.20	28.3	65.3	1.20	6.58	20,700	0.460	10.5	168	0.480	0.110	5.40	0.508	9,510	67.1
			EDC-U-2	7.90	37.0	50.5	4.60	7.32	17,400	0.270	9.99	194	0.410	<0.10	<5.0	0.540	9,590	55.1
			EDC-U-3	5.20	27.0	64.8	3.00	6.47	21,300	0.310	9.90	195	0.500	0.110	5.40	0.534	10,000	66.2
			EDC-U-4	13.6	46.2	37.7	2.50	6.63	26,200	0.420	10.4	203	0.620	0.130	<5.0	0.523	9,880	76.7
			EDC-U-5	4.10	18.3	66.3	11.3	7.03	20,900	0.300	11.0	185	0.480	0.110	<5.0	0.556	10,000	69.4
	HAC-U	Exposed	HAC-U-1	19.0	70.1	10.9	<1.0	7.23	17,900	0.360	7.31	284	0.500	<0.10	14.4	0.369	16,200	28.3
			HAC-U-2	17.3	63.2	16.0	3.50	7.32	18,600	0.500	8.84	272	0.530	<0.10	12.2	0.366	16,500	30.6
			HAC-U-3	21.1	64.7	9.20	5.00	7.21	20,900	0.490	8.63	263	0.550	0.100	15.2	0.320	20,000	35.7
			HAC-U-4	19.1	68.9	11.8	<1.0	7.46	17,200	0.370	7.64	297	0.490	<0.10	20.8	0.370	23,100	24.7
			HAC-U-5	18.7	65.5	15.8	<1.0	7.31	18,300	0.410	7.64	263	0.530	<0.10	19.8	0.332	25,200	29.2
	EDC-D	Reference	EDC-D-1	6.30	38.5	54.8	<1.0	7.37	19,000	0.330	13.0	177	0.430	0.130	6.40	0.361	9,940	60.4
			EDC-D-2	5.10	28.8	65.7	<1.0	7.55	16,500	0.330	11.6	179	0.370	0.110	5.50	0.292	9,010	50.9
			EDC-D-3	5.60	38.0	56.2	<1.0	7.83	19,800	0.410	17.0	169	0.480	0.140	6.50	0.329	11,000	67.2
			EDC-D-4	6.20	29.6	61.5	2.70	7.33	16,700	0.350	12.0	137	0.370	0.110	<5.0	0.310	8,570	51.6
			EDC-D-5	4.80	41.9	52.5	<1.0	7.41	12,500	0.310	9.25	97.3	0.290	<0.10	<5.0	0.190	7,860	47.0
	HAC-D	Exposed	HAC-D-1	12.4	56.4	30.8	<1.0	7.42	16,000	0.490	32.7	276	0.690	0.210	22.7	0.396	26,400	25.2
			HAC-D-2	8.40	28.6	61.1	1.90	8.04	16,100	0.550	21.2	205	0.520	0.170	10.7	0.304	23,500	35.2
			HAC-D-3	23.8	48.1	28.1	<1.0	8.36	27,400	0.730	15.6	755	0.820	0.130	21.8	0.393	27,900	42.2
			HAC-D-4	17.9	42.6	39.5	<1.0	8.47	28,000	0.690	16.3	710	0.840	0.110	20.0	0.337	30,300	38.8
			HAC-D-5	19.2	48.6	31.9	<1.0	8.19	27,700	0.700	15.9	629	0.810	0.130	19.4	0.373	26,400	38.1
2022	EDC-U	Reference	EDC-U-1	8.20	44.9	44.9	2.00	6.67	16,600	0.340	8.78	129	0.390	0.100	5.30	0.426	8,850	49.5
			EDC-U-2	14.3	47.4	37.7	<1.0	6.64	12,300	0.240	5.80	79.3	0.290	<0.10	<5.0	0.165	6,170	37.2
			EDC-U-3	6.30	32.7	60.7	<1.0	6.44	14,600	0.310	9.52	116	0.380	<0.10	<5.0	0.387	7,820	47.4
			EDC-U-4	8.10	36.1	55.8	<1.0	7.03	14,800	0.300	8.03	105	0.380	<0.10	<5.0	0.316	7,950	47.3
			EDC-U-5	5.20	17.6	76.2	1.00	6.97	15,400	0.310	8.23	111	0.420	<0.10	<5.0	0.351	8,440	53.2
	HAC-U	Exposed	HAC-U-1	15.1	72.0	12.9	<1.0	7.03	15,700	0.280	7.08	266	0.520	<0.10	23.3	0.395	23,600	26.7
			HAC-U-2	16.2	69.2	14.6	<1.0	7.19	16,500	0.360	7.35	255	0.550	<0.10	15.1	0.374	20,700	29.4
			HAC-U-3	14.7	70.7	14.6	<1.0	7.27	16,400	0.350	7.38	257	0.540	<0.10	16.6	0.328	22,800	25.9
			HAC-U-4	17.3	70.1	12.6	<1.0	7.18	15,400	0.290	7.16	266	0.510	<0.10	22.2	0.330	21,800	23.9
			HAC-U-5	17.3	73.7	9.00	<1.0	7.22	16,600	0.360	7.43	256	0.550	<0.10	21.8	0.344	19,300	27.6
	EDC-D	Reference	EDC-D-1	6.60	33.5	59.5	<1.0	7.30	13,800	0.340	9.30	110	0.350	0.110	<5.0	0.264	8,300	42.3
			EDC-D-2	7.40	38.7	52.7	1.20	7.71	14,600	0.330	8.39	111	0.400	0.110	<5.0	0.213	8,550	44.8
			EDC-D-3	7.00	40.9	51.2	<1.0	7.87	14,200	0.360	10.5	118	0.360	0.110	5.00	0.265	8,940	45.0
			EDC-D-4	5.80	24.1	70.0	<1.0	7.69	13,100	0.350	11.3	126	0.370	0.120	<5.0	0.278	8,700	43.9
			EDC-D-5	6.80	34.0	58.1	1.10	6.49	13,600	0.320	9.49	122	0.350	0.120	<5.0	0.288	8,480	41.1
	HAC-D	Exposed	HAC-D-1	6.80	42.5	50.5	<1.0	7.66	14,900	0.480	13.3	239	0.530	0.130	11.5	0.280	22,900	33.8
			HAC-D-2	6.60	38.6	54.3	<1.0	7.65	15,600	0.530	15.9	268	0.590	0.120	13.6	0.293	24,200	35.1
			HAC-D-3	11.5	54.8	33.7	<1.0	7.36	16,400	0.500	15.4	220	0.580	0.140	11.1	0.312	22,200	36.5
			HAC-D-4	7.30	35.5	57.0	<1.0	7.60	14,200	0.490	15.5	227	0.550	0.120	11.2	0.267	24,000	31.9
			HAC-D-5	10.0	65.4	23.7	<1.0	7.22	14,500	0.490	15.5	244	0.570	0.130	11.3	0.272	23,400	33.3

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Moisture %	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg
2015	EDC-D	Reference	EDC-D-1	16.6	31.8	31,400	7.15	15.0	6,850	5,130	0.0722	72.2	1.31	32.8	1,050	1,260	0.780	0.111
			EDC-D-2	12.8	32.5	30,700	7.08	16.2	6,900	563	0.0746	77.3	0.760	30.0	1,070	1,270	1.23	0.117
			EDC-D-3	14.4	36.1	34,000	8.42	16.9	7,530	903	0.112	74.9	0.860	32.8	1,080	1,320	0.760	0.127
			EDC-D-4	13.3	36.3	28,500	8.00	17.1	7,470	740	0.0792	75.0	0.710	32.3	975	1,270	0.640	0.144
			EDC-D-5	17.2	42.9	35,100	8.03	16.3	9,240	1,800	0.0849	91.3	0.870	40.2	1,270	1,820	1.08	0.111
2018	EDC-U	Reference	EDC-U-1	13.7	37.5	29,300	6.58	14.1	7,100	1,320	0.0972	54.8	0.780	32.5	1,180	1,060	0.570	0.158
			EDC-U-2	15.2	46.8	42,000	6.48	12.6	6,880	1,420	0.154	91.7	1.12	32.9	1,360	1,060	0.880	0.192
			EDC-U-3	14.8	47.0	34,000	8.33	18.5	7,920	1,100	0.119	58.1	0.800	36.6	1,180	1,470	0.660	0.194
			EDC-U-4	16.9	40.4	31,700	6.45	14.8	7,630	1,980	0.123	73.0	0.830	35.3	1,330	1,400	0.680	0.188
			EDC-U-5	12.6	36.1	27,700	5.78	13.1	6,650	739	0.0949	75.3	0.560	29.6	1,250	1,150	0.550	0.205
	HAC-U	Exposed	HAC-U-1	17.1	176	39,800	8.66	21.9	11,900	867	0.0892	35.4	1.41	41.5	1,050	3,010	0.790	0.133
			HAC-U-2	18.0	207	47,800	9.01	22.6	10,300	874	0.144	34.5	1.70	39.9	1,090	2,770	0.390	0.168
			HAC-U-3	16.7	72.5	38,300	8.80	21.0	11,000	869	0.0899	33.5	0.960	43.3	989	2,640	0.360	0.127
			HAC-U-4	17.3	160	41,400	8.42	21.5	11,600	867	0.128	44.5	1.46	44.0	1,110	2,510	0.530	0.148
			HAC-U-5	16.2	138	39,700	8.94	21.1	11,800	828	0.0892	35.0	1.22	41.1	988	2,710	0.740	0.143
	EDC-D	Reference	EDC-D-1	12.2	31.8	29,700	8.27	15.9	6,580	798	0.0891	27.2	1.51	30.7	1,000	1,260	0.760	0.284
			EDC-D-2	13.0	32.7	32,100	7.72	15.4	6,850	870	0.0589	28.7	1.01	31.3	1,140	1,240	1.05	0.110
			EDC-D-3	11.9	32.3	29,800	7.23	15.3	6,810	732	0.0724	43.0	0.780	29.5	1,070	1,110	0.680	0.118
			EDC-D-4	10.5	30.2	25,200	6.53	14.1	6,140	343	0.0633	48.1	0.420	26.7	1,060	890	0.510	0.102
			EDC-D-5	10.4	43.5	21,400	7.82	17.9	6,820	255	0.0876	54.6	0.730	32.5	915	1,000	1.06	0.174
	HAC-D	Exposed	HAC-D-1	16.5	328	58,800	8.63	12.2	7,570	760	0.0710	23.7	1.54	28.4	1,530	1,300	0.780	0.213
			HAC-D-2	17.3	353	67,300	9.53	11.2	7,400	814	0.0875	28.4	2.15	27.1	1,480	1,320	0.900	0.239
			HAC-D-3	16.9	360	49,500	9.86	14.2	8,440	1,160	0.0945	46.4	1.81	29.8	1,300	1,470	1.04	0.237
			HAC-D-4	16.8	380	50,400	8.99	14.7	8,760	1,240	0.0983	51.8	1.85	30.0	1,340	1,480	1.11	0.219
			HAC-D-5	17.3	383	60,800	8.66	13.4	8,220	1,350	0.0901	40.2	1.75	28.4	1,420	1,260	1.14	0.255
2019	EDC-U	Reference	EDC-U-1	15.4	39.4	30,100	7.18	16.0	7,390	1,230	0.0983	58.4	1.29	36.4	1,250	1,080	0.590	0.173
			EDC-U-2	15.8	45.2	32,500	7.74	17.8	7,790	1,040	0.106	50.0	2.61	45.7	1,190	1,410	0.670	0.196
			EDC-U-3	15.9	40.8	30,700	6.72	14.9	7,380	1,440	0.0957	66.2	1.66	39.5	1,350	1,270	0.610	0.167
			EDC-U-4	16.3	39.7	32,500	6.69	14.9	7,430	1,710	0.101	68.9	1.60	37.8	1,380	1,250	0.610	0.171
			EDC-U-5	15.3	40.2	31,500	6.78	15.0	7,030	1,100	0.104	79.7	2.39	41.0	1,370	1,210	0.630	0.198
	HAC-U	Exposed	HAC-U-1	13.3	395	26,900	5.84	13.1	8,600	2,710	0.0967	90.5	5.86	42.4	1,640	1,690	3.00	0.147
			HAC-U-2	15.8	469	29,300	6.52	14.0	9,490	3,420	0.116	90.1	5.74	44.1	1,620	1,660	2.75	0.168
			HAC-U-3	15.1	341	28,800	6.51	14.6	8,880	4,710	0.115	86.5	7.71	55.7	1,470	1,770	2.25	0.177
			HAC-U-4	13.6	319	27,400	6.51	13.5	8,100	2,570	0.0988	87.9	7.67	50.0	1,310	1,430	2.03	0.162
			HAC-U-5	15.1	278	37,500	7.59	17.5	10,300	978	0.0789	69.2	4.36	39.7	1,170	1,850	1.32	0.167
	EDC-D	Reference	EDC-D-1	13.6	36.4	29,800	7.36	16.3	7,150	583	0.0614	72.7	1.05	35.4	1,120	1,320	0.620	0.129
			EDC-D-2	14.1	35.1	31,400	8.21	16.7	7,140	943	0.0610	67.7	1.09	35.8	1,070	1,240	0.550	0.139
			EDC-D-3	15.2	36.2	32,800	8.37	16.5	7,630	1,410	0.0576	50.5	1.13	37.8	1,210	1,260	0.800	0.138
			EDC-D-4	13.5	33.8	32,600	7.97	15.8	7,160	781	0.0530	36.4	0.910	33.8	1,190	980	0.480	0.121
			EDC-D-5	13.4	33.3	30,100	7.35	15.0	6,920	1,080	0.0623	70.6	0.690	31.7	1,070	1,260	0.600	0.123
	HAC-D	Exposed	HAC-D-1	15.6	217	36,800	9.80	16.4	8,810	729	0.0674	32.0	1.66	35.3	1,190	1,390	0.510	0.498
			HAC-D-2	15.1	168	35,800	9.33	15.4	8,290	671	0.0533	27.6	1.67	34.0	1,180	1,420	0.480	0.161
			HAC-D-3	15.3	197	35,500	9.71	15.7	8,660	711	0.0594	32.1	1.59	34.8	1,180	1,360	0.540	0.204
			HAC-D-4	16.1	251	36,800	9.67	17.4	9,070	836	0.0658	36.3	1.86	35.8	1,180	1,390	0.720	0.222
			HAC-D-5	14.6	205	33,000	8.79	16.4	8,550	694	0.0597	35.1	1.53	32.0	1,070	1,270	0.530	0.176

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Moisture %	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg
2020	EDC-U	Reference	EDC-U-1	11.9	32.5	27,100	6.00	13.9	6,370	717	0.102	57.6	0.760	29.4	1,000	1,010	0.540	0.128
			EDC-U-2	11.8	28.2	25,300	5.38	13.0	6,260	734	0.103	54.8	0.540	27.5	1,160	880	0.330	0.118
			EDC-U-3	14.6	33.4	30,600	6.20	14.7	6,850	845	0.0996	50.1	0.630	32.4	1,220	1,110	0.530	0.148
			EDC-U-4	14.0	32.0	29,400	5.61	13.6	6,260	1,160	0.100	68.4	0.560	30.6	1,160	1,070	0.530	0.146
			EDC-U-5	13.0	35.5	27,200	6.04	15.5	6,890	1,070	0.101	59.4	0.610	31.9	1,120	1,260	0.510	0.154
	HAC-U	Exposed	HAC-U-1	15.7	283	38,200	6.55	17.1	9,270	2,040	0.109	82.8	2.82	29.0	1,380	1,900	1.53	0.164
			HAC-U-2	15.6	378	42,500	6.59	16.7	9,580	1,220	0.105	75.8	3.30	26.6	1,480	1,520	1.63	0.185
			HAC-U-3	23.6	316	68,600	6.23	18.1	11,700	8,830	0.121	75.4	3.98	43.4	1,290	1,600	1.88	0.144
			HAC-U-4	13.9	305	36,400	6.50	16.1	9,150	791	0.112	68.3	2.24	28.0	1,310	1,470	1.39	0.150
			HAC-U-5	15.0	374	37,500	6.94	17.5	10,000	804	0.110	80.6	2.99	29.0	1,300	1,630	1.93	0.171
	EDC-D	Reference	EDC-D-1	11.4	24.9	27,200	6.00	13.2	5,880	821	0.0692	39.2	0.530	27.2	959	1,000	0.390	0.0840
			EDC-D-2	12.3	27.3	30,100	6.48	13.4	6,360	771	0.0545	34.0	0.590	28.6	1,050	1,020	0.510	0.0910
			EDC-D-3	12.2	27.0	29,000	6.55	13.5	6,410	902	0.0626	34.8	0.690	28.9	964	1,000	0.470	0.103
			EDC-D-4	11.7	25.7	29,300	6.33	12.9	6,120	760	0.0554	30.0	0.680	27.5	1,040	960	0.410	0.0970
			EDC-D-5	12.0	25.6	29,700	6.15	12.8	6,060	777	0.0541	32.9	0.620	28.2	1,150	910	0.330	0.0900
	HAC-D	Exposed	HAC-D-1	14.5	154	48,800	7.78	11.8	6,240	630	0.0682	25.9	0.950	27.9	1,210	1,070	0.470	0.179
			HAC-D-2	15.2	148	47,400	8.87	12.5	7,210	753	0.0670	25.4	0.960	32.1	1,140	1,320	0.450	0.131
			HAC-D-3	14.9	135	41,100	8.89	13.7	7,150	637	0.0721	31.9	1.04	31.4	1,100	1,300	0.470	0.147
			HAC-D-4	14.4	147	52,700	8.54	11.4	6,570	515	0.0703	28.8	1.09	28.1	1,180	1,180	0.640	0.139
			HAC-D-5	15.8	162	59,600	8.37	11.9	6,780	734	0.0662	26.4	0.980	29.6	1,350	1,130	0.580	0.147
2021	EDC-U	Reference	EDC-U-1	15.5	40.1	31,500	7.14	13.9	7,850	1,530	0.105	51.0	1.11	39.5	1,170	1,330	0.630	0.157
			EDC-U-2	15.6	35.3	28,800	5.77	12.3	6,950	3,050	0.0767	60.4	1.07	33.8	1,220	1,170	0.530	0.153
			EDC-U-3	15.8	42.3	30,900	6.84	14.3	7,840	1,350	0.112	52.1	1.52	39.3	1,300	1,450	0.660	0.175
			EDC-U-4	14.5	69.9	29,700	7.99	16.4	8,640	1,160	0.125	59.9	1.52	43.2	1,130	1,690	0.930	0.212
			EDC-U-5	18.1	40.5	32,400	6.59	13.9	7,930	2,710	0.0967	52.4	1.91	42.3	1,200	1,390	0.570	0.157
	HAC-U	Exposed	HAC-U-1	14.6	421	33,000	5.46	12.6	9,560	1,080	0.113	85.6	2.62	26.0	1,540	1,290	2.96	0.174
			HAC-U-2	15.7	473	35,600	6.53	13.9	9,910	933	0.104	78.9	5.42	27.1	1,380	1,300	3.48	0.176
			HAC-U-3	15.3	353	35,400	7.12	16.3	10,200	1,400	0.104	82.2	2.44	30.4	1,360	1,780	2.51	0.183
			HAC-U-4	14.0	410	32,000	5.40	12.7	8,720	2,760	0.0985	87.2	4.32	23.3	1,450	1,410	3.68	0.169
			HAC-U-5	13.8	428	33,500	6.03	14.2	9,120	1,250	0.110	81.7	3.38	25.2	1,350	1,440	2.81	0.165
	EDC-D	Reference	EDC-D-1	15.5	35.8	33,600	7.76	16.0	8,140	1,460	0.0628	65.3	1.27	39.9	1,180	1,480	0.620	0.121
			EDC-D-2	12.8	31.6	29,800	7.01	14.0	7,060	721	0.0635	44.9	1.11	33.0	989	1,230	4.08	0.112
			EDC-D-3	16.2	38.1	38,100	8.62	16.8	8,760	1,210	0.0734	50.5	1.62	41.7	1,170	1,500	0.640	0.142
			EDC-D-4	13.4	30.7	31,300	6.87	13.9	7,220	627	0.0636	42.5	0.890	32.4	1,050	1,230	0.520	0.117
			EDC-D-5	10.1	25.4	27,100	5.72	10.0	5,910	374	0.0454	38.7	0.800	26.1	1,150	860	0.340	0.0780
	HAC-D	Exposed	HAC-D-1	13.9	243	33,900	12.7	10.2	7,530	1,840	0.0866	76.4	1.39	27.9	1,180	1,840	1.24	0.184
			HAC-D-2	15.3	227	42,100	9.92	12.3	7,670	1,050	0.0875	45.5	1.32	30.0	1,180	1,480	1.08	0.182
			HAC-D-3	21.9	913	53,800	9.82	18.3	15,300	1,060	0.103	35.6	3.45	38.9	1,720	1,700	1.08	0.263
			HAC-D-4	22.4	1,010	62,600	9.16	17.5	15,300	1,110	0.103	34.1	4.05	35.6	1,990	1,630	1.22	0.283
			HAC-D-5	21.8	884	48,400	9.93	18.6	15,000	1,110	0.129	43.3	3.18	36.2	1,600	1,700	1.01	0.259
2022	EDC-U	Reference	EDC-U-1	13.0	32.2	26,400	8.14	12.8	6,570	560	0.0820	63.9	0.670	28.2	1,060	1,240	0.490	0.159
			EDC-U-2	8.18	20.2	18,400	5.70	10.4	5,210	541	0.0530	70.8	0.470	19.0	954	720	0.240	0.100
			EDC-U-3	12.5	28.2	26,800	6.88	12.2	6,150	852	0.0794	64.9	0.570	26.2	1,010	1,030	0.370	0.139
			EDC-U-4	11.9	25.5	24,700	5.90	11.8	6,150	1,080	0.0747	64.5	0.560	25.6	1,020	1,000	0.430	0.124
			EDC-U-5	12.2	27.6	27,200	6.35	12.8	6,460	1,010	0.0866	45.5	0.620	27.2	1,080	1,100	0.440	0.132
	HAC-U	Exposed	HAC-U-1	13.2	393	30,700	5.50	12.4	8,460	1,860	0.108	88.4	4.06	25.2	1,650	1,420	4.43	0.185
			HAC-U-2	13.6	400	31,800	5.99	14.0	8,620	1,430	0.112	85.0	3.67	25.4	1,340	1,610	3.39	0.198
			HAC-U-3	13.6	382	32,300	5.82	13.4	8,420	1,880	0.105	87.1	4.16	22.4	1,420	1,360	3.36	0.193
			HAC-U-4	12.8	385	32,700	5.69	12.6	8,480	2,250	0.103	85.8	3.40	21.0	1,580	1,340	4.57	0.178
			HAC-U-5	13.4	402	32,500	5.87	13.0	8,560	1,780	0.107	90.3	3.92	23.0	1,570	1,440	4.52	0.181
	EDC-D	Reference	EDC-D-1	11.4	25.8	27,100	6.44	13.3	6,450	514	0.0530	50.0	0.600	26.9	930	1,120	0.380	0.0940
			EDC-D-2	11.2	29.2	26,100	7.26	15.0	6,880	564	0.0689	52.8	0.580	28.0	953	1,140	0.490	0.116
			EDC-D-3	12.3	27.3	29,300	6.73	14.0	7,100	1,000	0.0578	60.6	0.650	28.7	1,050	1,240	0.430	0.107
			EDC-D-4	12.1	27.6	28,900	6.87	13.4	6,620	904	0.0533	43.8	0.540	27.9	960	1,110	0.390	0.103
			EDC-D-5	11.7	31.5	27,200	6.77	13.9	6,760	541	0.0661	59.8	0.550	28.2	968	1,080	0.540	0.107
	HAC-D	Exposed	HAC-D-1	14.2	312	40,900	8.52	14.4	7,900	1,030	0.0926	59.0	1.57	25.8	1,220	1,290	1.19	0.167
			HAC-D-2	15.5	375	46,100	8.45	14.3	8,530	1,470	0.115	50.3	1.70	24.9	1,370	1,420	1.19	0.177
			HAC-D-3	15.5	342	43,600	8.96	15.0	8,680	996	0.101	51.8	1.66	26.5	1,200	1,500	1.05	0.201
			HAC-D-4	14.2	325	43,100	8.29	13.7	8,090	1,310	0.0956	46.1	1.91	24.4	1,160	1,340	1.12	0.182
			HAC-D-5	14.3	325	42,800	8.61	14.5	7,710	1,110	0.108	69.7	1.60	24.4	1,220	1,360	1.06	0.292

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Sodium mg/kg	Strontium mg/kg	Sulphur mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Total Nitrogen %	Total Organic Carbon %	Total Phosphorus mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg	Zirconium mg/kg
2015	EDC-D	Reference	EDC-D-1	300	87.7	1,200	0.115	0.330	672	0.206	3.38	-	0.836	68.7	64.4	-
			EDC-D-2	390	82.3	1,200	0.103	0.340	689	0.151	2.82	-	0.924	63.6	64.9	-
			EDC-D-3	300	79.5	1,200	0.112	0.480	660	0.0960	1.90	-	0.877	72.5	70.2	-
			EDC-D-4	270	99.1	1,400	0.106	0.350	532	0.291	6.40	-	0.770	59.7	68.9	-
			EDC-D-5	390	104	1,400	0.116	0.350	669	0.287	4.17	-	0.669	78.7	84.4	-
2018	EDC-U	Reference	EDC-U-1	226	71.6	2,000	0.118	0.360	489	0.290	6.43	-	1.37	70.6	73.3	-
			EDC-U-2	239	81.4	2,300	0.118	0.390	507	0.485	11.1	-	1.67	86.1	73.2	-
			EDC-U-3	246	73.8	700	0.175	0.460	736	0.167	2.41	-	2.15	84.7	72.8	-
			EDC-U-4	275	83.5	1,600	0.135	0.390	636	0.393	8.34	-	1.46	75.9	84.2	-
			EDC-U-5	267	66.4	1,600	0.114	0.370	633	0.438	6.85	-	1.31	70.2	74.8	-
	HAC-U	Exposed	HAC-U-1	494	172	1,300	0.126	0.600	1,160	0.0400	0.450	-	0.920	95.8	83.9	-
			HAC-U-2	463	114	<500	0.142	0.740	1,280	<0.020	0.343	-	0.924	126	81.1	-
			HAC-U-3	458	154	<500	0.129	0.410	861	<0.020	0.300	-	0.855	80.7	79.8	-
			HAC-U-4	391	149	<500	0.121	0.570	1,140	0.0220	0.350	-	0.817	103	77.8	-
			HAC-U-5	422	162	<500	0.125	0.520	1,060	<0.020	0.290	-	0.949	94.1	77.0	-
	EDC-D	Reference	EDC-D-1	276	106	500	0.135	0.400	591	0.0330	3.09	-	0.915	70.6	61.9	-
			EDC-D-2	295	86.9	<500	0.109	0.410	660	0.0370	1.56	-	0.803	75.7	65.0	-
			EDC-D-3	248	80.5	500	0.107	0.360	594	0.121	3.06	-	0.839	65.9	62.2	-
			EDC-D-4	240	72.2	500	0.0950	0.300	599	0.146	2.77	-	0.766	59.3	56.1	-
			EDC-D-5	204	84.5	500	0.118	0.310	472	0.0900	3.76	-	1.56	53.3	52.5	-
	HAC-D	Exposed	HAC-D-1	354	130	600	0.144	0.660	1,110	0.0260	0.732	-	1.04	215	74.5	-
			HAC-D-2	351	150	600	0.208	0.800	993	0.0230	0.931	-	1.11	248	78.8	-
			HAC-D-3	413	152	800	0.175	0.800	974	0.0800	1.18	-	1.11	167	82.8	-
			HAC-D-4	400	147	900	0.157	0.730	1,010	0.152	1.84	-	0.991	171	83.8	-
			HAC-D-5	381	136	600	0.151	0.730	987	0.0620	1.04	-	0.979	217	79.1	-
2019	EDC-U	Reference	EDC-U-1	238	75.7	3,000	0.140	0.540	527	0.322	4.55	-	1.60	77.6	76.0	-
			EDC-U-2	217	64.3	1,900	0.166	0.470	658	0.237	3.23	-	2.07	84.5	71.4	-
			EDC-U-3	266	79.6	1,900	0.129	0.550	658	0.419	6.88	-	1.51	80.1	87.5	-
			EDC-U-4	263	76.8	1,500	0.135	0.470	650	0.338	6.14	-	1.43	78.6	82.6	-
			EDC-U-5	239	82.5	1,600	0.137	0.500	593	0.615	8.48	-	1.56	74.9	81.4	-
	HAC-U	Exposed	HAC-U-1	542	240	2,300	<0.050	0.630	657	0.868	5.31	-	0.675	73.1	81.0	-
			HAC-U-2	532	234	2,700	0.0540	0.680	693	0.827	4.93	-	0.728	80.5	83.1	-
			HAC-U-3	467	222	2,500	0.0640	0.580	664	0.663	4.63	-	0.673	76.3	78.8	-
			HAC-U-4	398	220	2,300	0.0560	0.570	537	0.678	4.84	-	0.683	65.6	69.8	-
			HAC-U-5	422	212	1,800	0.0880	0.870	1,020	0.246	2.49	-	0.902	104	70.2	-
	EDC-D	Reference	EDC-D-1	247	71.6	1,200	0.111	0.410	673	0.284	3.56	-	0.994	60.8	69.1	-
			EDC-D-2	242	74.8	600	0.116	0.410	674	0.116	2.41	-	0.986	63.4	70.9	-
			EDC-D-3	260	82.2	900	0.110	0.510	693	0.200	3.42	-	0.887	66.2	72.7	-
			EDC-D-4	225	72.8	<500	0.109	0.830	702	0.106	2.51	-	1.04	75.9	67.1	-
			EDC-D-5	235	80.4	900	0.107	0.540	655	0.237	3.82	-	0.946	61.6	68.1	-
	HAC-D	Exposed	HAC-D-1	345	185	<500	0.158	0.740	993	0.0340	0.500	-	0.916	95.3	72.0	-
			HAC-D-2	330	192	<500	0.163	0.680	982	0.0240	0.370	-	0.957	98.1	66.4	-
			HAC-D-3	347	195	<500	0.169	0.780	942	0.0280	0.380	-	0.909	94.6	68.1	-
			HAC-D-4	341	169	<500	0.133	0.650	998	0.0520	0.550	-	0.838	100	74.9	-
			HAC-D-5	360	180	<500	0.135	0.580	888	0.0370	0.410	-	0.804	82.7	64.1	-

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.1: Sediment Quality Data for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2015 to 2022

Year	Area	Area Type	Station	Sodium mg/kg	Strontium mg/kg	Sulphur mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Total Nitrogen %	Total Organic Carbon %	Total Phosphorus mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg	Zirconium mg/kg
2020	EDC-U	Reference	EDC-U-1	267	62.3	1,800	0.122	0.580	655	0.276	5.27	-	1.31	75.0	63.1	1.20
			EDC-U-2	247	58.9	1,070	0.100	0.460	516	0.252	4.44	-	1.05	66.6	62.8	1.20
			EDC-U-3	286	66.9	1,080	0.115	0.580	659	0.268	5.77	-	1.27	78.4	74.8	1.10
			EDC-U-4	261	66.5	1,570	0.110	0.620	637	0.427	7.11	-	1.32	72.2	71.7	1.00
			EDC-U-5	267	69.8	1,190	0.128	0.540	702	0.292	4.86	-	1.45	71.4	65.2	<1.0
	HAC-U	Exposed	HAC-U-1	504	132	1,520	0.0780	0.950	1,130	0.209	2.13	-	0.765	122	72.7	2.20
			HAC-U-2	532	134	2,570	0.0620	0.960	1,210	0.349	3.14	-	0.821	145	74.0	2.50
			HAC-U-3	410	180	800	0.0770	0.760	1,130	0.140	1.68	-	0.727	124	63.6	3.20
			HAC-U-4	417	139	1,640	0.0710	0.670	930	0.254	2.02	-	0.682	110	67.3	2.80
			HAC-U-5	479	141	1,630	0.0770	0.740	1,100	0.279	2.43	-	0.774	114	74.9	2.70
	EDC-D	Reference	EDC-D-1	275	68.4	1,560	0.0820	0.320	741	0.136	2.90	-	0.851	66.0	55.1	1.40
			EDC-D-2	300	73.5	<500	0.0870	0.430	711	0.102	2.38	-	0.832	74.2	58.1	1.50
			EDC-D-3	271	71.9	600	0.0890	0.320	647	0.106	2.28	-	0.816	66.8	58.8	1.50
			EDC-D-4	256	74.7	<500	0.0880	0.450	661	0.0810	1.92	-	0.822	72.4	56.0	1.50
			EDC-D-5	243	71.5	<500	0.0790	0.360	657	0.0970	1.95	-	0.785	71.5	56.8	1.50
	HAC-D	Exposed	HAC-D-1	294	116	<500	0.101	0.480	973	<0.020	0.340	-	0.783	162	60.1	5.30
			HAC-D-2	316	126	<500	0.138	0.640	1,020	0.0250	0.405	-	0.907	150	65.4	5.50
			HAC-D-3	290	117	<500	0.128	0.530	971	0.0240	0.357	-	0.844	124	63.5	5.60
			HAC-D-4	284	131	<500	0.131	0.600	1,030	<0.020	0.322	-	0.904	167	62.8	5.80
			HAC-D-5	287	123	540	0.114	0.600	1,100	<0.020	0.345	-	0.893	198	67.4	5.70
2021	EDC-U	Reference	EDC-U-1	340	83.6	<500	0.136	1.00	754	0.221	4.89	-	1.49	84.4	88.7	1.00
			EDC-U-2	244	83.3	890	0.115	0.330	460	0.404	7.51	-	1.22	69.1	80.0	1.10
			EDC-U-3	358	85.5	<500	0.138	0.380	688	0.221	6.96	-	1.42	84.5	89.7	1.20
			EDC-U-4	247	85.3	620	0.164	0.430	658	0.318	4.94	-	2.41	85.7	94.0	1.90
			EDC-U-5	274	87.9	<500	0.136	0.360	623	0.167	5.55	-	1.38	80.2	85.6	1.30
	HAC-U	Exposed	HAC-U-1	444	122	2,850	0.0590	0.780	921	0.668	5.51	-	0.715	99.9	77.6	1.90
			HAC-U-2	449	122	2,900	0.0610	0.790	952	0.476	4.35	-	0.886	113	82.1	2.80
			HAC-U-3	440	130	2,130	0.0880	0.740	1,090	0.422	3.47	-	0.802	104	80.1	1.90
			HAC-U-4	452	134	2,370	0.0560	0.760	788	0.684	4.53	-	0.903	96.3	75.0	1.40
			HAC-U-5	422	141	2,050	0.0670	0.870	912	0.542	4.50	-	0.797	98.6	75.7	2.00
	EDC-D	Reference	EDC-D-1	320	87.9	540	0.125	0.360	742	0.203	3.63	-	1.02	71.7	82.2	1.40
			EDC-D-2	359	76.8	<500	0.101	0.350	714	0.113	2.49	-	0.961	67.7	68.8	1.40
			EDC-D-3	331	105	<500	0.124	0.420	900	0.139	2.26	-	1.20	85.2	80.9	1.60
			EDC-D-4	275	80.7	<500	0.0930	0.310	796	0.142	2.56	-	1.08	71.6	70.4	1.40
			EDC-D-5	231	65.0	<500	0.0680	0.260	677	0.111	1.15	-	0.830	67.4	56.6	1.60
	HAC-D	Exposed	HAC-D-1	332	208	1,480	0.230	0.830	440	0.324	3.11	-	1.57	90.6	82.4	1.40
			HAC-D-2	299	165	640	0.168	0.710	745	0.0770	1.58	-	1.15	124	79.2	2.00
			HAC-D-3	430	213	730	0.0860	0.950	1,580	<0.020	0.221	-	0.893	178	94.4	9.60
			HAC-D-4	441	215	570	0.0700	0.970	1,650	<0.020	0.197	-	0.864	216	95.2	9.40
			HAC-D-5	470	200	<500	0.0830	0.870	1,630	<0.020	0.205	-	0.879	152	95.6	8.80
2022	EDC-U	Reference	EDC-U-1	289	77.1	760	0.128	0.460	626	0.424	7.11	-	1.48	67.1	73.4	1.10
			EDC-U-2	200	55.7	710	0.0840	0.250	492	0.303	3.78	-	1.15	48.4	45.4	<1.0
			EDC-U-3	255	68.9	690	0.107	0.330	588	0.248	7.08	-	1.23	64.7	68.3	1.00
			EDC-U-4	262	70.5	610	0.103	0.340	608	0.271	5.43	-	1.19	63.6	62.0	<1.0
			EDC-U-5	269	75.8	<500	0.114	0.430	652	0.167	6.65	-	1.33	68.2	67.6	<1.0
	HAC-U	Exposed	HAC-U-1	496	147	2,120	<0.050	0.740	707	0.895	7.45	-	0.798	96.8	68.3	1.90
			HAC-U-2	458	143	2,610	0.0630	0.680	727	0.629	5.80	-	0.749	96.0	71.1	2.10
			HAC-U-3	476	151	2,520	0.0530	0.710	737	0.662	6.29	-	0.835	99.9	69.8	2.00
			HAC-U-4	465	143	2,920	<0.050	0.620	678	0.818	7.21	-	0.802	95.7	67.8	1.90
			HAC-U-5	468	134	3,420	0.0540	0.770	871	0.821	6.96	-	0.850	105	70.6	2.20
	EDC-D	Reference	EDC-D-1	280	77.8	620	0.0930	0.340	706	0.189	3.43	-	1.06	63.1	59.4	1.50
			EDC-D-2	267	87.4	530	0.106	0.350	704	0.158	2.84	-	1.06	62.3	65.0	1.90
			EDC-D-3	290	84.9	570	0.0970	0.410	766	0.210	3.56	-	1.03	67.2	64.9	1.50
			EDC-D-4	257	80.5	<500	0.0920	0.370	666	0.0870	3.05	-	0.965	68.5	62.7	1.70
			EDC-D-5	226	75.8	520	0.0900	0.350	543	0.206	5.29	-	0.894	59.2	65.5	1.60
	HAC-D	Exposed	HAC-D-1	340	176	1,090	0.106	0.610	873	0.133	1.67	-	0.979	125	74.0	2.30
			HAC-D-2	417	192	740	0.108	0.730	1,090	0.115	1.47	-	1.02	152	76.2	3.30
			HAC-D-3	412	171	630	0.123	0.660	1,020	0.140	1.77	-	1.02	133	75.9	2.90
			HAC-D-4	371	174	770	0.113	0.660	868	0.117	1.43	-	0.966	130	72.6	2.50
			HAC-D-5	357	171	780	0.116	0.630	901	0.226	1.91	-	0.992	129	75.2	2.70

Notes: mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm).

Table B.2: Baseline and Pre-Breach Sediment Quality Data for Hazeltine Creek and Edney Creek, 1995 to 2013

Year	Area	Replicate	Clay[a]	Silt[a]	Sand[a]	Gravel[a]	pH (1:2 soil:water)	Total Organic Carbon	Total Nitrogen	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron
			%	%	%	%	pH	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1995	HAC-U (W7)[c]	W7-1	-	-	-	-	-	-	-	-	***0.810***	***18.1***	-	-	-	-	<0.10	-	26.0	-	17.0	***33,000***
		W7-2	-	-	-	-	-	-	-	-	0.330	6.87	-	-	-	-	<0.10	-	30.0	-	47.0	25,400
		W7-3	-	-	-	-	-	-	-	-	***0.510***	3.69	-	-	-	-	<0.10	-	5.00	-	25.0	12,600
		W7-4	-	-	-	-	-	-	-	-	0.370	***24.5***	-	-	-	-	<0.10	-	9.00	-	20.0	17,900
		W7-5	-	-	-	-	-	-	-	-	0.120	***10.7***	-	-	-	-	<0.10	-	***45.0***	-	79.0	***57,500***
		W7-6	-	-	-	-	-	-	-	-	0.340	2.67	-	-	-	-	<0.10	-	27.0	-	39.0	***35,100***
	HAC-D (W11)[c]	W11-1	-	-	-	-	-	-	-	-	0.610	9.87	-	-	-	-	0.200	-	24.0	-	***46.0***	29,700
		W11-2	-	-	-	-	-	-	-	-	0.650	10.9	-	-	-	-	<0.10	-	22.0	-	28.0	31,600
		W11-3	-	-	-	-	-	-	-	-	***1.85***	8.79	-	-	-	-	0.100	-	23.0	-	28.0	34,900
		W11-4	-	-	-	-	-	-	-	-	1.05	8.01	-	-	-	-	<0.10	-	17.0	-	26.0	31,100
		W11-5	-	-	-	-	-	-	-	-	0.780	10.0	-	-	-	-	0.200	-	32.0	-	41.0	***37,400***
		W11-6	-	-	-	-	-	-	-	-	0.720	12.0	-	-	-	-	<0.10	-	19.0	-	32.0	20,800
1996[b]	HAC-U (W7)[c]	W7-1	-	-	-	-	-	-	-	-	***0.720***	6.77	-	-	-	-	***0.400***	-	***138***	-	***5,250***	***31,700***
		W7-2	-	-	-	-	-	-	-	-	***0.620***	3.17	-	-	-	-	0.300	-	***146***	-	***7,670***	29,100
		W7-3	-	-	-	-	-	-	-	-	***0.610***	4.12	-	-	-	-	***0.500***	-	***110***	-	***7,980***	28,600
		W7-4	-	-	-	-	-	-	-	-	***1.75***	***17.1***	-	-	-	-	***2.60***	-	***201***	-	***22,000***	***55,500***
		W7-5	-	-	-	-	-	-	-	-	***0.870***	5.56	-	-	-	-	0.100	-	***74.0***	-	***2,340***	***31,000***
		W7-6	-	-	-	-	-	-	-	-	***0.590***	5.05	-	-	-	-	***0.500***	-	***131***	-	***8,420***	29,900
	HAC-D (W11)[c]	W11-1	-	-	-	-	-	-	-	-	0.600	4.01	-	-	-	-	0.200	-	***112***	-	***4,080***	18,500
		W11-2	-	-	-	-	-	-	-	-	0.360	5.29	-	-	-	-	0.200	-	31.0	-	***480***	16,900
		W11-3	-	-	-	-	-	-	-	-	0.630	***12.6***	-	-	-	-	<0.10	-	***47.0***	-	***4,180***	22,000
		W11-4	-	-	-	-	-	-	-	-	0.770	6.94	-	-	-	-	<0.10	-	***65.0***	-	***9,060***	20,400
		W11-5	-	-	-	-	-	-	-	-	***25.4***	***17.2***	-	-	-	-	<0.10	-	***117***	-	***16,200***	23,100
		W11-6	-	-	-	-	-	-	-	-	0.740	9.27	-	-	-	-	***0.300***	-	***49.0***	-	***3,010***	21,200
1999	HAC-U (W6)[c]	W6-1	10.0	31.0	49.3	8.90	-	3.20	-	12,000	<0.20	2.50	110	0.300	<0.20	***5.50***	0.100	-	29.0	9.00	47.0	15,000
		W6-2					-		-	13,000	<0.20	3.00	110	0.400	<0.20	4.50	0.100	-	30.0	9.90	39.0	17,000
		W6-3					-		-	10,000	<0.20	3.20	84.0	0.300	<0.20	3.60	0.100	-	22.0	8.50	23.0	15,000
	HAC-D (W11)[c]	W11-1	2.00	8.00	34.0	***57.0***	-	-	-	11,000	<0.20	6.50	98.0	0.300	<0.20	***3.00***	***0.300***	-	24.0	10.0	33.0	20,000
		W11-2					-	-	-	9,700	<0.20	8.70	98.0	0.300	<0.20	2.70	0.200	-	21.0	10.0	26.0	21,000
		W11-3					-	-	-	10,000	<0.20	6.60	94.0	0.300	<0.20	2.00	0.200	-	22.0	10.0	27.0	19,000
2007	HAC-U (W7)[c]	W7-1	***15.0***	46.0	38.0	2.00	-	12.5	-	14,400	<10.0	<5.0	115	<0.50	<20.0	-	<0.50	9,470	25.3	8.70	55.9	19,600
		W7-2	***14.0***	43.0	35.0	8.00	-	10.9	-	14,300	<10.0	5.30	104	<0.50	<20.0	-	<0.50	8,910	27.6	8.90	63.6	22,500
		W7-3	12.0	41.0	46.0	1.00	-	7.77	-	16,500	<10.0	7.40	***156***	<0.50	<20.0	-	<0.50	10,600	32.0	9.70	67.0	22,900
	HAC-D (W11)[c]	W11-1	7.00	20.0	72.0	1.00	-	3.71	-	***12,800***	<10.0	9.20	99.8	<0.50	<20.0	-	<0.50	6,850	31.7	9.70	36.8	24,100
		W11-2	***11.0***	***36.0***	50.0	3.00	-	3.19	-	12,000	<10.0	10.0	***109***	<0.50	<20.0	-	<0.50	***7,120***	31.4	9.90	33.7	25,100
		W11-3	8.00	24.0	68.0	<1.0	-	1.82	-	12,300	<10.0	12.0	96.7	<0.50	<20.0	-	<0.50	6,390	***35.5***	***11.8***	30.7	27,500
2009	HAC-U (W7)[c]	W7-1	13.0	38.0	45.0	4.00	-	7.50	-	-	<10.0	5.80	117	<0.50	-	-	<0.50	-	36.5	***10.8***	53.7	-
		W7-2	9.00	39.0	50.0	2.00	-	8.37	-	-	<10.0	<5.0	127	<0.50	-	-	<0.50	-	30.7	9.10	50.1	-
		W7-3	4.00	16.0	***76.0***	5.00	-	7.40	-	-	<10.0	<5.0	83.2	<0.50	-	-	<0.50	-	18.8	6.60	34.4	-
		W7-4	4.00	27.0	58.0	11.0	-	7.47	-	-	<10.0	<5.0	97.5	<0.50	-	-	<0.50	-	25.6	7.90	45.5	-
		W7-5	5.00	30.0	62.0	2.00	-	8.73	-	-	<10.0	<5.0	96.6	<0.50	-	-	<0.50	-	24.4	7.60	45.4	-
2010	HAC-U (W7)[c]	W7-1	8.25	34.0	37.8	20.0	-	7.36	-	13,900	0.370	6.28	107	0.380	<0.20	-	0.210	9,000	35.1	***10.5***	64.5	25,900
		W7-2	1.84	5.01	63.2	29.9	-	0.580	-	10,200	0.260	5.20	67.9	0.260	<0.20	-	<0.10	6,070	26.7	8.76	24.2	21,900
		W7-3	0.800	6.74	59.0	***33.5***	-	0.520	-	9,220	0.260	5.42	54.9	0.250	<0.20	-	<0.10	5,290	26.3	8.65	23.0	22,300
		W7-4	0.460	5.41	***64.9***	29.2	-	0.490	-	8,120	0.180	3.43	46.6	0.200	<0.20	-	<0.10	5,140	16.3	6.09	13.9	15,800
		W7-5	0.680	0.760	49.5	***49.1***	-	0.540	-	9,710	0.210	4.19	67.0	0.220	<0.20	-	<0.10	6,180	16.7	7.06	16.4	19,300
	HAC-D (W11)[c]	W11-1	0.940	9.31	***85.1***	4.68	-	0.450	-	9,060	0.280	10.9	74.4	0.270	<0.20	-	0.120	5,270	29.0	8.98	17.9	22,600
		W11-2	2.28	22.7	72.0	2.99	-	1.31	-	9,550	0.340	***12.4***	74.5	0.300	<0.20	-	0.180	5,780	28.7	10.2	22.4	25,300
		W11-3	2.06	9.34	71.0	17.7	-	0.270	-	8,320	0.300	8.74	55.5	0.260	<0.20	-	0.110	4,980	29.0	8.55	17.0	23,200
		W11-4	0.580	7.58	45.3	46.5	-	0.440	-	8,390	0.290	8.45	72.6	0.260	<0.20	-	0.110	5,440	32.5	8.38	17.6	24,500
		W11-5	0.430	5.13	46.5	47.9	-	0.330	-	8,430	0.340	11.5	56.1	0.270	<0.20	-	0.120	4,780	29.5	8.80	19.2	23,600
Pre-Breach 95th Percentile[d]		HAC-U (W7)[b]	13.9	76.2	64.7	33.1	-	12.8	-	17,960	0.370	8.23	136	0.460	<0.20	5.40	0.354	13,395	40.1	10.4	94.6	29,900
		HAC-D (W11)[b]	9.80	31.2	79.9	53.4	-	9.03	-	12,550	1.33	12.1	104	0.300	<0.20	2.97	0.235	7,026	33.1	11.0	42.0	35,400

Notes: ***Bold/Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall. mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm), except for 1999 data, for which the size classes are: gravel (>2 mm), sand (2.0 - 0.050 mm), silt (0.050 - 0.002 mm), clay (<0.002 mm).

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[c] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D; W6 is the historical sampling area associated with upper Hazeltine (HAC-U, HAC-R1) from 1999.

[d] 95th percentile was calculated using all data (all years) except those from 1996 (HKP 1997; due to suspected errors).

Table B.2: Baseline and Pre-Breach Sediment Quality Data for Hazeltine Creek and Edney Creek, 1995 to 2013

Year	Area	Replicate	Clay[a]	Silt[a]	Sand[a]	Gravel[a]	pH (1:2 soil:water)	Total Organic Carbon	Total Nitrogen	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron
			%	%	%	%	pH	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2012	HAC-U (W7 Pond)[c]	W7-1	7.25	47.3	39.0	6.40	-	8.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W7-2	12.2	***76.4***	11.4	<0.10	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W7-3	9.96	70.7	19.3	<0.10	-	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W7-4	9.49	***76.4***	14.1	<0.10	-	***13.1***	-	11,000	0.250	3.31	79.9	0.290	<0.20	-	0.266	11,400	24.1	6.80	66.2	15,200
		W7-5	9.54	66.4	22.3	1.79	-	12.6	-	14,100	0.260	3.81	103	0.370	<0.20	-	0.299	11,500	30.6	8.42	78.6	18,900
		W7-6	-	-	-	-	-	9.95	-	14,500	0.220	3.60	107	0.350	<0.20	-	0.293	11,000	31.0	8.52	75.6	18,700
		W7-7	-	-	-	-	-	***13.1***	-	13,800	0.220	3.51	97.0	0.360	<0.20	-	0.263	12,000	29.2	8.70	69.4	18,300
		W7-8	-	-	-	-	-	10.4	-	14,100	0.230	3.66	94.9	0.330	<0.20	-	0.246	9,550	27.8	9.05	67.8	19,100
	HAC-D (W11 Mouth)[c]	W11-1	-	-	-	-	-	8.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W11-2	-	-	-	-	-	***9.80***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W11-3	-	-	-	-	-	4.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W11-4	-	-	-	-	-	8.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		W11-5	-	-	-	-	-	6.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013S	HAC-U (W7)[c]	W7-1	8.08	71.1	20.4	0.440	-	-	-	14,500	0.260	4.12	109	0.330	<0.20	-	0.312	10,700	29.3	8.31	76.7	18,500
		W7-2					-	-	-	15,400	0.290	4.63	121	0.370	<0.20	-	0.335	***13,400***	29.9	9.06	84.2	21,100
		W7-3					-	-	-	13,900	0.290	3.81	104	0.350	<0.20	-	0.251	10,600	28.3	8.31	62.4	17,600
		W7-4					-	-	-	17,300	0.300	5.80	133	0.450	<0.20	-	***0.354***	13,300	34.2	***10.5***	91.1	23,700
		W7-5					-	-	-	16,200	0.310	4.95	130	0.410	<0.20	-	***0.432***	***13,800***	31.9	9.41	86.4	20,100
		W7-6					-	-	-	16,000	0.320	4.91	123	0.380	<0.20	-	0.353	12,600	32.7	9.65	79.4	19,800
		W7-7					-	-	-	14,900	0.310	4.55	111	0.370	<0.20	-	0.285	11,000	31.6	9.07	72.0	18,900
		W7-8					-	-	-	14,200	0.290	4.28	114	0.360	<0.20	-	0.300	11,400	29.4	8.64	70.0	17,900
	HAC-U (W7 Pond)[c]	W7-1	8.88	68.1	22.8	0.180	-	-	-	15,100	0.270	3.87	116	0.400	<0.20	-	0.334	11,300	31.0	8.79	85.7	18,700
		W7-2					-	-	-	15,500	0.270	4.18	124	0.410	<0.20	-	0.341	13,300	32.5	9.22	89.2	19,100
		W7-3					-	-	-	16,600	0.300	4.12	118	0.420	<0.20	-	0.352	11,300	34.5	9.17	91.8	20,000
		W7-4					-	-	-	13,700	0.270	3.89	109	0.360	<0.20	-	0.279	10,800	28.4	7.97	71.5	16,900
		W7-5					-	-	-	16,300	0.320	4.63	127	0.430	<0.20	-	0.319	12,200	33.7	9.33	87.2	20,200
		W7-6					-	-	-	15,400	0.310	4.49	120	0.400	<0.20	-	0.317	11,600	31.9	8.67	83.6	18,900
		W7-7					-	-	-	16,500	0.320	4.71	131	0.440	<0.20	-	0.319	13,300	34.2	9.54	86.2	20,600
		W7-8					-	-	-	14,700	0.300	4.15	118	0.400	<0.20	-	0.290	11,800	30.6	8.54	76.6	18,100
2013F	HAC-U (USW7 Pond)[c]	W7-1	11.1	63.9	24.1	0.910	-	7.55	-	14,400	0.270	3.11	106	0.360	<0.20	-	0.208	9,600	35.5	9.15	76.9	20,400
		W7-2					-	6.98	-	17,400	0.290	3.34	122	0.440	<0.20	-	0.224	9,700	***41.4***	9.99	90.5	24,000
		W7-3					-	8.73	-	16,100	0.290	3.33	120	0.410	<0.20	-	0.200	10,600	38.6	9.45	82.3	22,000
		W7-4					-	7.86	-	17,200	0.270	3.19	121	0.420	<0.20	-	0.213	9,700	39.8	9.84	91.4	24,200
		W7-5					-	6.92	-	17,500	0.270	2.90	97.7	0.390	<0.20	-	0.193	***34,500***	34.8	10.3	67.4	26,800
	HAC-U (W7 Pond)[c]	W7-1	12.6	74.6	12.8	<0.10	-	11.9	-	***19,000***	0.310	3.87	***145***	***0.460***	<0.20	-	***0.361***	13,000	***40.8***	10.2	***103***	23,400
		W7-2					-	11.3	-	17,800	0.310	4.12	***138***	***0.460***	<0.20	-	0.336	12,300	37.8	9.53	90.9	22,200
		W7-3					-	12.3	-	17,300	0.300	3.62	133	***0.460***	<0.20	-	0.342	12,300	36.8	9.59	***95.3***	22,000
		W7-4					-	11.8	-	16,000	0.310	4.17	127	0.410	<0.20	-	0.322	11,700	34.1	9.22	94.3	19,800
		W7-5					-	11.2	-	***18,200***	0.300	3.93	132	0.430	<0.20	-	0.321	11,600	38.6	9.62	***95.7***	22,000
		W7-6					-	8.57	-	***18,000***	0.300	3.87	125	0.430	<0.20	-	0.297	13,100	36.9	9.39	89.4	21,400
		W7-7					-	11.6	-	17,200	0.290	4.13	132	0.430	<0.20	-	0.352	12,400	36.0	9.10	88.0	21,400
		W7-8					-	11.2	-	17,100	0.270	4.04	127	0.400	<0.20	-	0.302	12,200	36.1	8.77	86.5	20,100
Pre-Breach 95th Percentile[d]		HAC-U (W7)[b]	13.9	76.2	64.7	33.1	-	12.8	-	17,960	0.370	8.23	136	0.460	<0.20	5.40	0.354	13,395	40.1	10.4	94.6	29,900
		HAC-D (W11)[b]	9.80	31.2	79.9	53.4	-	9.03	-	12,550	1.33	12.1	104	0.300	<0.20	2.97	0.235	7,026	33.1	11.0	42.0	35,400

Notes: ***Bold/Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall. mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm), except for 1999 data, for which the size classes are: gravel (>2 mm), sand (2.0 - 0.050 mm), silt (0.050 - 0.002 mm), clay (<0.002 mm).

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[c] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D; W6 is the historical sampling area associated with upper Hazeltine (HAC-U, HAC-R1) from 1999.

[d] 95th percentile was calculated using all data (all years) except those from 1996 (HKP 1997; due to suspected errors).

Table B.2: Baseline and Pre-Breach Sediment Quality Data for Hazeltine Creek and Edney Creek, 1995 to 2013

Year	Area	Replicate	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Strontium mg/kg	Sulphur mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
1995	HAC-U (W7)[c]	W7-1	3.00	-	-	858	0.0250	-	16.0	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	41.0
		W7-2	4.00	-	-	613	0.0460	-	24.0	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	53.0
		W7-3	2.00	-	-	362	0.0460	-	5.00	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	33.0
		W7-4	2.00	-	-	480	0.0510	-	8.00	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	29.0
		W7-5	5.00	-	-	1,300	0.105	-	***25.0***	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	***82.0***
		W7-6	***8.00***	-	-	743	0.0470	-	18.0	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	51.0
	HAC-D (W11)[c]	W11-1	4.00	-	-	569	***0.193***	-	13.0	-	-	0.600	<1.0	-	-	-	-	-	-	-	-	***61.0***
		W11-2	5.00	-	-	814	0.0840	-	17.0	-	-	0.200	<1.0	-	-	-	-	-	-	-	-	57.0
		W11-3	3.00	-	-	930	0.0330	-	17.0	-	-	0.100	<1.0	-	-	-	-	-	-	-	-	54.0
		W11-4	3.00	-	-	694	0.0300	-	15.0	-	-	0.200	<1.0	-	-	-	-	-	-	-	-	44.0
		W11-5	4.00	-	-	909	0.0590	-	***26.0***	-	-	0.300	<1.0	-	-	-	-	-	-	-	-	60.0
		W11-6	3.00	-	-	657	0.127	-	13.0	-	-	<0.10	<1.0	-	-	-	-	-	-	-	-	39.0
1996[b]	HAC-U (W7)[c]	W7-1	***35.0***	-	-	1,260	0.0880	-	***69.0***	-	-	0.600	<0.10	-	-	-	-	-	-	-	-	***1,010***
		W7-2	***29.0***	-	-	***1,720***	0.0470	-	***68.0***	-	-	0.400	<0.10	-	-	-	-	-	-	-	-	***1,610***
		W7-3	***21.0***	-	-	***2,010***	0.0660	-	***54.0***	-	-	0.600	<0.10	-	-	-	-	-	-	-	-	***1,580***
		W7-4	***103***	-	-	***10,100***	0.0920	-	***134***	-	-	1.40	<0.10	-	-	-	-	-	-	-	-	***7,880***
		W7-5	***14.0***	-	-	***1,420***	0.0700	-	***33.0***	-	-	0.500	<0.10	-	-	-	-	-	-	-	-	***455***
		W7-6	***26.0***	-	-	***2,470***	0.0920	-	***65.0***	-	-	0.500	<0.10	-	-	-	-	-	-	-	-	***2,130***
	HAC-D (W11)[c]	W11-1	***19.0***	-	-	882	0.0550	-	***52.0***	-	-	0.200	<0.10	-	-	-	-	-	-	-	-	***785***
		W11-2	5.00	-	-	513	0.0290	-	16.0	-	-	0.200	<0.10	-	-	-	-	-	-	-	-	***109***
		W11-3	<2.0	-	-	668	<0.0050	-	23.0	-	-	0.400	<0.10	-	-	-	-	-	-	-	-	***1,030***
		W11-4	***16.0***	-	-	***1,390***	0.0340	-	***32.0***	-	-	0.800	<0.10	-	-	-	-	-	-	-	-	***2,280***
		W11-5	***190***	-	-	1,010	0.0330	-	***33.0***	-	-	0.800	<0.10	-	-	-	-	-	-	-	-	***4,040***
		W11-6	***12.0***	-	-	634	0.0240	-	***26.0***	-	-	0.300	<0.10	-	-	-	-	-	-	-	-	***690***
1999	HAC-U (W6)[c]	W6-1	***6.70***	-	-	320	<0.040	0.500	20.0	-	-	<1.0	<0.10	-	100	-	<0.20	0.700	390	0.500	39.0	51.0
		W6-2	5.80	-	-	340	<0.040	0.500	22.0	-	-	<1.0	<0.10	-	100	-	<0.20	0.600	390	0.500	42.0	46.0
		W6-3	4.20	-	-	320	<0.040	0.200	16.0	-	-	<1.0	<0.10	-	78.0	-	<0.20	0.700	380	0.300	36.0	35.0
	HAC-D (W11)[c]	W11-1	***5.80***	-	-	880	<0.040	0.500	22.0	-	-	<1.0	***0.100***	-	64.0	-	<0.20	1.10	310	***0.800***	37.0	49.0
		W11-2	4.90	-	-	***1,500***	<0.040	0.700	20.0	-	-	<1.0	<0.10	-	48.0	-	<0.20	1.10	330	0.600	44.0	46.0
		W11-3	5.50	-	-	810	<0.040	0.500	21.0	-	-	<1.0	<0.10	-	60.0	-	<0.20	1.00	290	0.600	37.0	46.0
2007	HAC-U (W7)[c]	W7-1	<30.0	12.4	5,520	***2,480***	0.113	<4.0	15.7	-	860	<2.0	<2.0	210	74.7	-	<1.0	<5.0	542	-	49.6	50.7
		W7-2	<30.0	12.6	5,780	1,290	0.118	<4.0	16.4	-	970	<2.0	<2.0	210	68.8	-	<1.0	<5.0	568	-	55.3	57.6
		W7-3	<30.0	***14.8***	***6,430***	868	0.130	<4.0	19.2	-	1,160	<2.0	<2.0	230	87.5	-	<1.0	<5.0	596	-	53.2	53.8
	HAC-D (W11)[c]	W11-1	<30.0	***13.0***	***6,190***	385	0.0688	<4.0	22.2	-	***940***	<2.0	<2.0	240	***68.1***	-	<1.0	<5.0	574	-	61.9	49.3
		W11-2	<30.0	12.4	6,050	1,020	0.108	<4.0	20.3	-	850	<5.0	<2.0	220	66.0	-	<1.0	<5.0	564	-	64.3	46.1
		W11-3	<30.0	12.8	6,100	1,010	0.0646	<4.0	22.2	-	800	<2.0	<2.0	240	53.3	-	<1.0	<5.0	621	-	71.1	47.3
2009	HAC-U (W7)[c]	W7-1	<30.0	-	-	-	0.0960	<4.0	***25.2***	-	-	0.540	<2.0	-	-	-	-	<5.0	-	-	63.4	54.6
		W7-2	<30.0	-	-	-	0.0990	<4.0	19.2	-	-	0.790	<2.0	-	-	-	-	<5.0	-	-	58.3	46.6
		W7-3	<30.0	-	-	-	0.0640	<4.0	12.2	-	-	1.14	<2.0	-	-	-	-	<5.0	-	-	49.8	43.8
		W7-4	<30.0	-	-	-	0.101	<4.0	16.0	-	-	0.600	<2.0	-	-	-	-	<5.0	-	-	56.1	51.6
		W7-5	<30.0	-	-	-	0.0870	<4.0	15.3	-	-	0.770	<2.0	-	-	-	-	<5.0	-	-	51.9	51.2
2010	HAC-U (W7)[c]	W7-1	5.28	12.0	6,080	708	0.0950	***1.56***	21.0	978	930	1.79	<0.10	***440***	91.8	-	0.0640	<2.0	738	0.755	***75.4***	66.0
		W7-2	3.35	9.80	***6,550***	426	<0.050	<0.50	15.9	777	470	0.290	<0.10	***490***	47.0	-	<0.050	<2.0	***785***	0.376	***65.4***	40.4
		W7-3	3.36	8.90	6,270	743	0.0780	<0.50	14.9	744	350	0.280	<0.10	310	45.6	-	<0.050	<2.0	724	0.346	***66.6***	41.5
		W7-4	2.75	7.20	4,490	423	<0.050	<0.50	9.47	614	290	0.260	<0.10	190	35.3	-	<0.050	<2.0	721	0.335	47.6	35.1
		W7-5	3.04	8.40	5,380	479	<0.050	<0.50	10.9	729	380	0.330	<0.10	170	59.6	-	<0.050	<2.0	***819***	0.372	57.0	40.0
	HAC-D (W11)[c]	W11-1	4.01	8.40	5,480	605	<0.050	0.620	18.3	596	510	0.240	<0.10	***260***	52.5	-	0.0500	<2.0	654	0.356	65.7	40.0
		W11-2	4.87	9.30	5,790	633	0.0520	***0.780***	20.2	***733***	530	0.340	<0.10	200	56.2	-	***0.0510***	<2.0	652	0.570	70.9	45.1
		W11-3	4.39	8.40	4,930	401	<0.050	0.590	18.2	579	450	<0.20	<0.10	170	39.9	-	<0.050	<2.0	664	0.412	67.0	39.9
		W11-4	4.15	8.20	5,190	537	<0.050	0.530	18.9	713	530	0.280	<0.10	220	47.7	-	<0.050	<2.0	***737***	0.400	***77.9***	40.1
		W11-5	4.54	8.50	5,780	512	<0.050	0.630	23.5	654	440	0.280	<0.10	210	41.7	-	<0.050	<2.0	574	0.375	69.7	41.7
Pre-Breach 95th Percentile[d]		HAC-U (W7)[b]	6.70	14.8	6,430	1,345	0.145	1.50	24.4	1,375	1,445	3.32	0.160	350	118	-	0.0941	<2.0	776	1.26	65.3	67.6
		HAC-D (W11)[b]	5.61	12.9	6,159	1,116	0.140	0.752	24.0	729	909	1.30	0.0300	253	67.1	-	0.0508	1.10	701	0.730	74.5	60.2

Notes: ***Bold/Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall. mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm), except for 1999 data, for which the size classes are: gravel (>2 mm), sand (2.0 - 0.050 mm), silt (0.050 - 0.002 mm), clay (<0.002 mm).

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[c] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D; W6 is the historical sampling area associated with upper Hazeltine (HAC-U, HAC-R1) from 1999.

[d] 95th percentile was calculated using all data (all years) except those from 1996 (HKP 1997; due to suspected errors).

Table B.2: Baseline and Pre-Breach Sediment Quality Data for Hazeltine Creek and Edney Creek, 1995 to 2013

Year	Area	Replicate	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Phosphorus mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Strontium mg/kg	Sulphur mg/kg	Thallium mg/kg	Tin mg/kg	Titanium mg/kg	Uranium mg/kg	Vanadium mg/kg	Zinc mg/kg
2012	HAC-U (W7 Pond)[c]	W7-1	-	-	-	-	-	-	-	-	-	2.09	-	-	-	-	-	-	-	-	-	-
		W7-2	-	-	-	-	-	-	-	-	-	3.32	-	-	-	-	-	-	-	-	-	-
		W7-3	-	-	-	-	-	-	-	-	-	***3.51***	-	-	-	-	-	-	-	-	-	-
		W7-4	4.86	9.50	3,850	817	-	0.980	15.7	940	760	2.75	0.110	350	93.4	-	0.0590	<2.0	382	0.796	37.6	46.2
		W7-5	5.33	11.6	4,920	895	-	1.11	19.6	996	930	2.89	0.120	190	101	-	0.0730	<2.0	462	0.868	45.7	56.8
		W7-6	5.46	11.9	5,140	772	-	0.940	19.7	1,080	980	2.29	0.120	210	101	-	0.0740	<2.0	457	0.819	45.1	58.1
		W7-7	5.07	11.6	5,040	638	-	0.830	18.9	1,050	880	2.21	0.110	220	96.6	-	0.0730	<2.0	509	0.815	46.5	54.7
		W7-8	4.94	12.2	5,740	445	-	1.09	19.2	1,050	940	2.13	0.100	180	91.1	-	0.0720	<2.0	581	0.845	51.9	56.4
	HAC-D (W11 Mouth)[c]	W11-1	-	-	-	-	-	-	-	-	-	1.28	-	-	-	-	-	-	-	-	-	-
		W11-2	-	-	-	-	-	-	-	-	-	***1.49***	-	-	-	-	-	-	-	-	-	-
		W11-3	-	-	-	-	-	-	-	-	-	0.740	-	-	-	-	-	-	-	-	-	-
		W11-4	-	-	-	-	-	-	-	-	-	1.14	-	-	-	-	-	-	-	-	-	-
		W11-5	-	-	-	-	-	-	-	-	-	0.970	-	-	-	-	-	-	-	-	-	-
2013S	HAC-U (W7)[c]	W7-1	5.77	10.8	4,790	1,210	-	1.24	19.5	1,150	870	2.76	0.120	190	98.8	-	0.0670	<2.0	461	1.13	45.7	56.9
		W7-2	6.06	12.2	5,170	1,330	-	1.35	20.4	1,290	950	3.25	0.140	200	111	-	0.0750	<2.0	466	1.23	49.3	63.1
		W7-3	5.14	12.2	4,930	992	-	0.920	17.7	1,040	820	2.05	0.120	190	98.4	-	0.0620	<2.0	589	0.979	47.4	56.2
		W7-4	6.33	14.4	5,750	***1,360***	-	1.48	23.1	***1,470***	1,300	3.09	0.160	220	***119***	-	0.0860	<2.0	553	1.20	53.4	***70.7***
		W7-5	5.96	14.1	5,300	***1,580***	-	***1.57***	21.8	1,280	1,070	3.16	0.160	200	***118***	-	0.0890	<2.0	516	***1.42***	50.0	66.8
		W7-6	5.90	12.8	5,340	1,300	-	1.18	21.0	1,160	1,070	2.82	0.150	230	113	-	0.0760	<2.0	610	1.20	52.8	66.1
		W7-7	5.60	12.5	5,010	1,030	-	1.00	19.8	1,110	990	2.36	0.120	200	103	-	0.0760	<2.0	604	1.04	52.1	62.6
		W7-8	5.29	12.1	5,000	1,070	-	1.07	18.8	1,090	850	2.47	0.110	190	107	-	0.0670	<2.0	570	1.10	48.6	59.0
	HAC-U (W7 Pond)[c]	W7-1	5.95	12.9	5,060	873	-	1.26	20.2	1,140	900	3.08	0.150	190	105	-	0.0780	<2.0	454	1.08	47.9	62.2
		W7-2	6.08	13.2	5,500	979	-	1.49	20.8	1,310	970	3.04	0.140	210	109	-	0.0710	<2.0	440	1.05	49.2	65.2
		W7-3	6.21	14.2	5,500	662	-	1.32	21.6	1,120	1,050	3.15	0.150	190	107	-	0.0800	<2.0	547	1.08	51.3	66.0
		W7-4	5.02	12.1	4,520	1,050	-	1.02	17.6	1,000	930	2.67	0.110	180	104	-	0.0680	<2.0	522	1.01	45.5	54.4
		W7-5	6.06	13.6	5,390	1,190	-	1.25	21.3	1,260	1,060	3.24	0.150	200	117	-	0.0820	<2.0	575	***1.26***	53.2	64.8
		W7-6	5.69	13.6	5,350	910	-	1.24	20.2	1,070	970	2.85	0.140	200	113	-	0.0780	<2.0	570	1.12	51.0	59.5
		W7-7	6.26	14.7	5,570	1,230	-	1.22	21.6	1,250	1,080	3.07	***0.220***	220	***125***	-	0.0800	<2.0	592	***1.26***	54.2	66.0
		W7-8	5.62	12.7	4,990	1,050	-	1.09	19.4	1,160	940	2.74	0.140	200	112	-	0.0690	<2.0	531	1.11	49.0	58.6
2013F	HAC-U (USW7 Pond)[c]	W7-1	5.65	11.6	5,730	343	0.0921	0.930	21.4	1,150	1,090	1.73	0.110	240	94.5	-	0.0730	<2.0	553	0.650	51.4	53.4
		W7-2	6.45	14.4	6,420	295	0.102	1.04	24.2	1,370	***1,450***	1.85	0.120	250	96.0	-	0.0850	<2.0	704	0.697	58.1	58.4
		W7-3	6.22	13.2	5,990	361	0.0934	1.12	22.6	1,290	1,340	2.23	0.110	280	103	-	0.0750	<2.0	680	0.800	56.2	55.3
		W7-4	6.63	13.5	6,330	351	0.0965	1.03	24.2	1,250	***1,480***	1.96	0.120	280	98.6	-	0.0830	<2.0	638	0.712	55.6	59.1
		W7-5	5.24	13.4	***6,930***	355	0.0792	0.890	21.0	1,040	1,110	1.24	<0.10	350	111	-	0.0610	<2.0	***962***	0.653	65.1	55.4
	HAC-U (W7 Pond)[c]	W7-1	***6.90***	***15.3***	6,390	616	***0.154***	1.11	***25.0***	***1,420***	***1,470***	***3.38***	0.160	260	114	-	***0.0980***	<2.0	583	1.06	55.7	***70.1***
		W7-2	6.41	14.5	5,990	716	0.141	1.09	23.3	1,330	1,320	2.92	0.150	240	111	-	0.0940	<2.0	577	1.04	55.0	64.4
		W7-3	6.69	***14.8***	5,920	593	***0.147***	1.11	23.8	1,350	1,250	***3.35***	0.160	230	112	-	0.0890	<2.0	502	1.06	52.6	64.3
		W7-4	6.37	13.1	5,560	458	0.144	***1.50***	22.1	1,170	1,070	3.27	0.160	210	106	-	0.0830	<2.0	455	1.06	50.5	62.5
		W7-5	6.59	14.3	6,190	564	0.144	0.980	23.8	1,330	1,310	3.00	***0.170***	300	109	-	***0.0950***	<2.0	603	0.970	54.6	64.7
		W7-6	6.39	13.8	6,060	552	0.137	0.960	22.6	1,300	1,330	2.88	0.150	290	105	-	0.0930	<2.0	651	1.03	55.5	62.7
		W7-7	6.25	13.7	5,690	783	0.144	1.14	22.6	1,230	1,220	3.28	0.140	230	112	-	0.0900	<2.0	595	1.11	51.9	62.0
		W7-8	5.86	12.5	5,640	605	0.136	1.14	21.7	1,100	1,250	3.05	0.130	310	99.5	-	0.0850	<2.0	595	1.02	52.2	60.8
Pre-Breach 95th Percentile[d]		HAC-U (W7)[b]	6.70	14.8	6,430	1,345	0.145	1.50	24.4	1,375	1,445	3.32	0.160	350	118	-	0.0941	<2.0	776	1.26	65.3	67.6
		HAC-D (W11)[b]	5.61	12.9	6,159	1,116	0.140	0.752	24.0	729	909	1.30	0.0300	253	67.1	-	0.0508	1.10	701	0.730	74.5	60.2

Notes: ***Bold/Italics*** indicates value is > reference 95th percentile value (<5th percentile value for pH). Pre-breach values that were reported as < the laboratory reporting limit were not used for screening. Sediment metal concentrations are based predominantly on bulk sediment samples, concentrations reported in 1995 and 1996 were for the silt and clay (< 63 µm) fraction only. S = spring. F = fall. mg/kg = milligrams per kilogram. % = percent. "-" = data not available. All results are presented as three significant digits.

[a] Particle sizes classified as clay (<4 um), silt (0.063 mm - 4 um), sand (2.0 - 0.063 mm), and gravel (>2 mm), except for 1999 data, for which the size classes are: gravel (>2 mm), sand (2.0 - 0.050 mm), silt (0.050 - 0.002 mm), clay (<0.002 mm).

[b] Some unusually high sediment metal concentrations were reported for 1996 (HKP 1997) and are suspected errors.

[c] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D; W6 is the historical sampling area associated with upper Hazeltine (HAC-U, HAC-R1) from 1999.

[d] 95th percentile was calculated using all data (all years) except those from 1996 (HKP 1997; due to suspected errors).

APPENDIX C

PERIPHYTON COMMUNITY AND PRODUCTIVITY

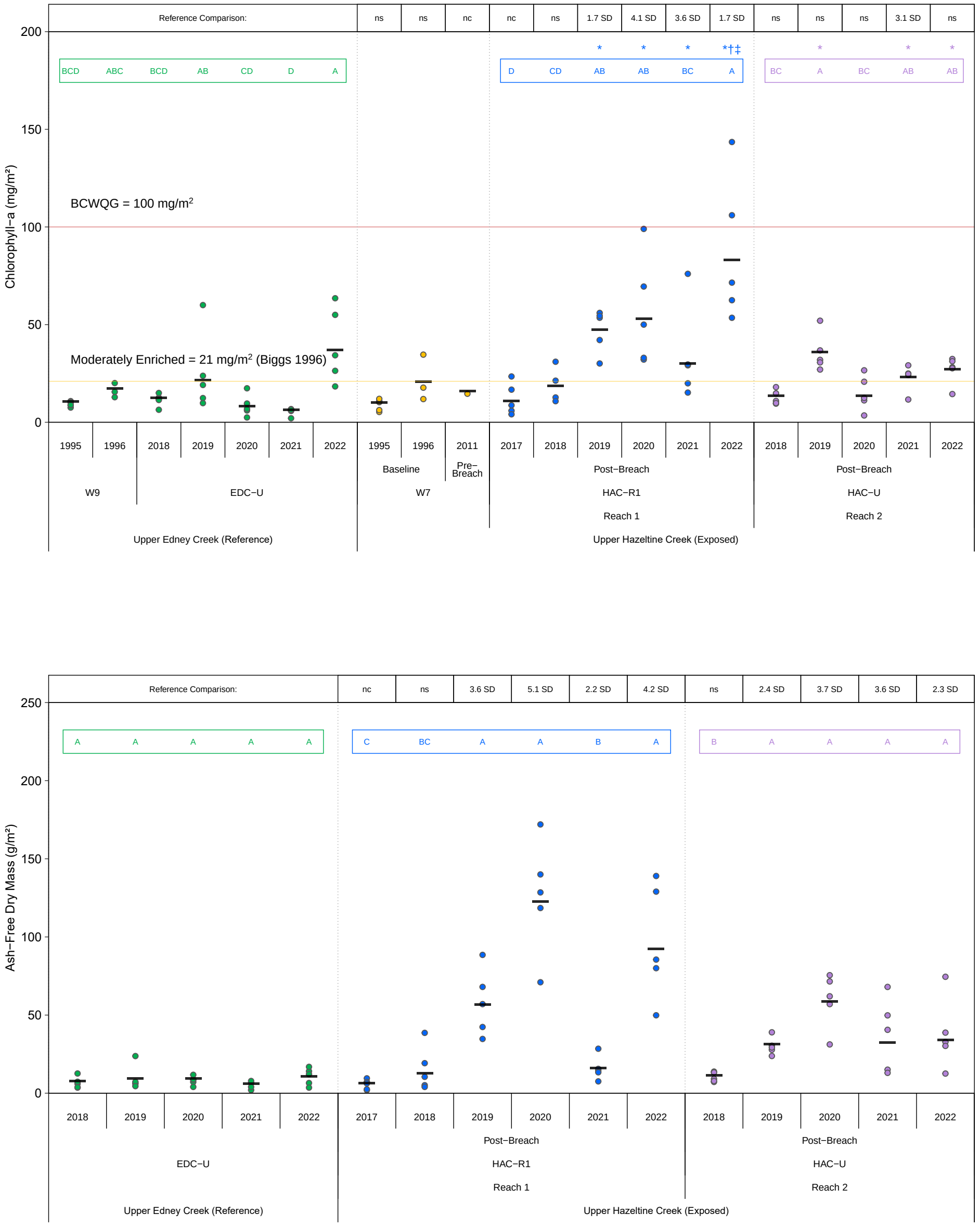

Figure C.1: Periphyton Productivity Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. For statistical contrasts of Chlorophyll−a data, the analyses compared post−breach (2017 to 2022) to baseline (1995 and 1996) to pre−breach conditions (2011) at W7. The sampling area W7 (2011) is the pre−breach equivalent of the post−breach sampling areas HAC−R1 and HAC−U (2017 to 2022). Significant differences between HAC−R1 or HAC−U post−breach (2017 to 2022) results compared to baseline (1995 and 1996) or pre−breach (2011) results for W7 are indicated as follows: an * indicates significant differences to W7 in 1995, a † indicates significant differences to W7 in 1996, and a ‡ indicates significant differences to W7 in 2011. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

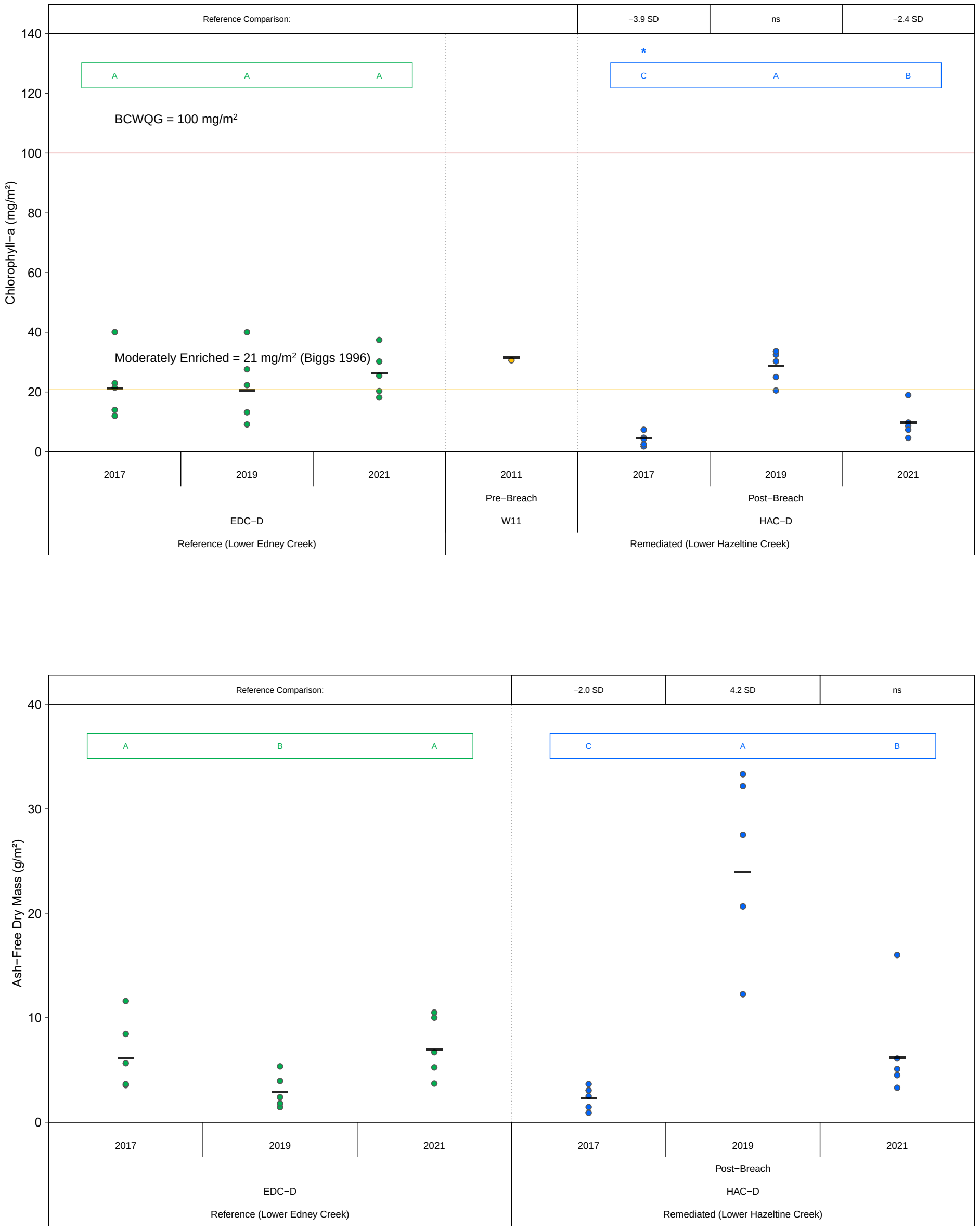

Figure C.2: Periphyton Productivity Endpoints, Lower Hazeltine Creek and Reference (Lower Edney Creek), 2011 to 2021

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank-transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. For statistical contrasts of Chlorophyll−a, an * indicates a significant difference to W11 in 2011. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. A 'nc' indicates no comparisons were possible, a 'ns' indicates a non−significant contrast, and a "nm" indicates that the MOD could not be calculated because MAD = 0.

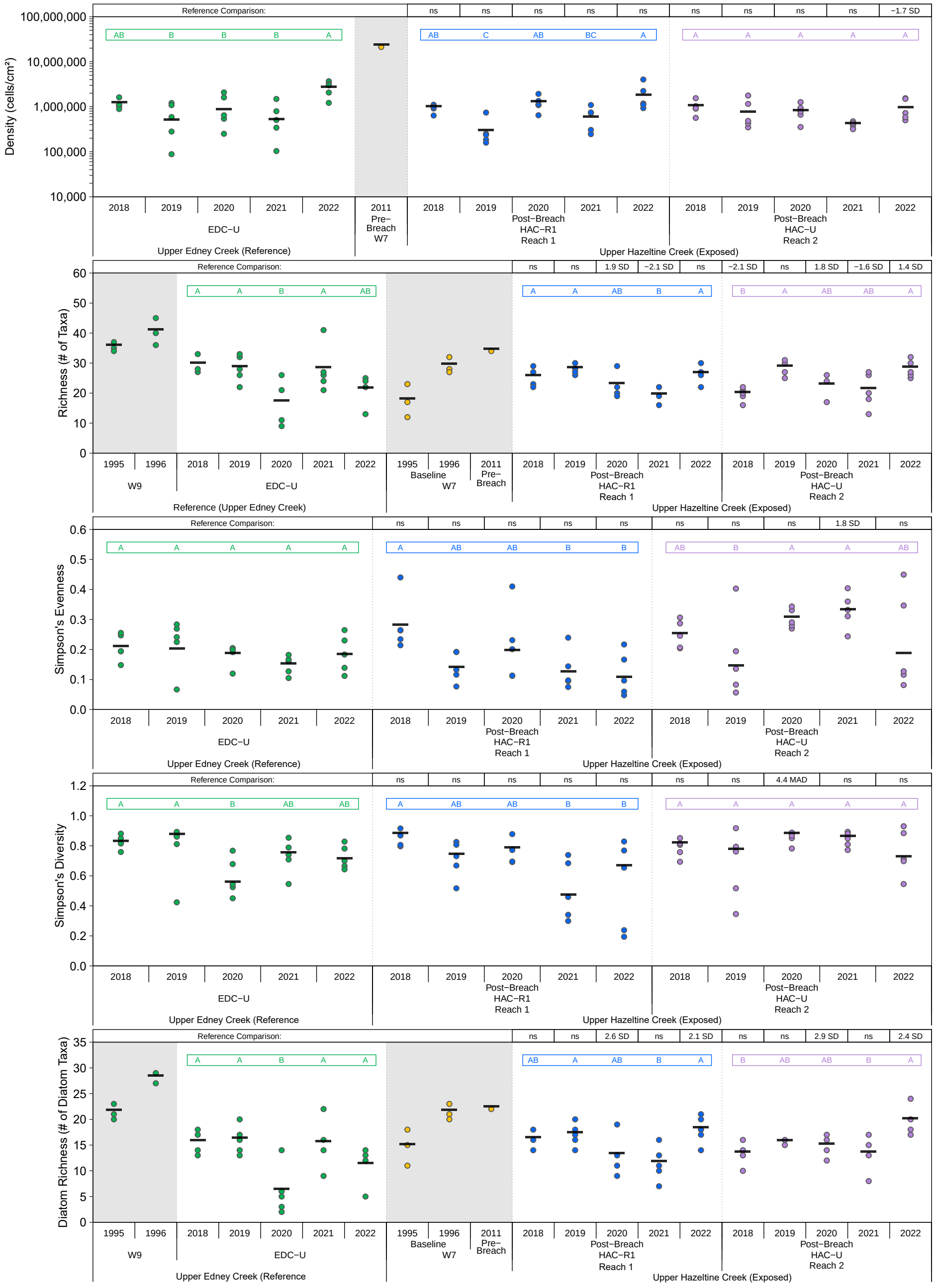

Figure C.3: Periphyton Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 1995 to 2022

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi−quantitative data that were not included in statistical comparisons but are shown for visual comparison only.

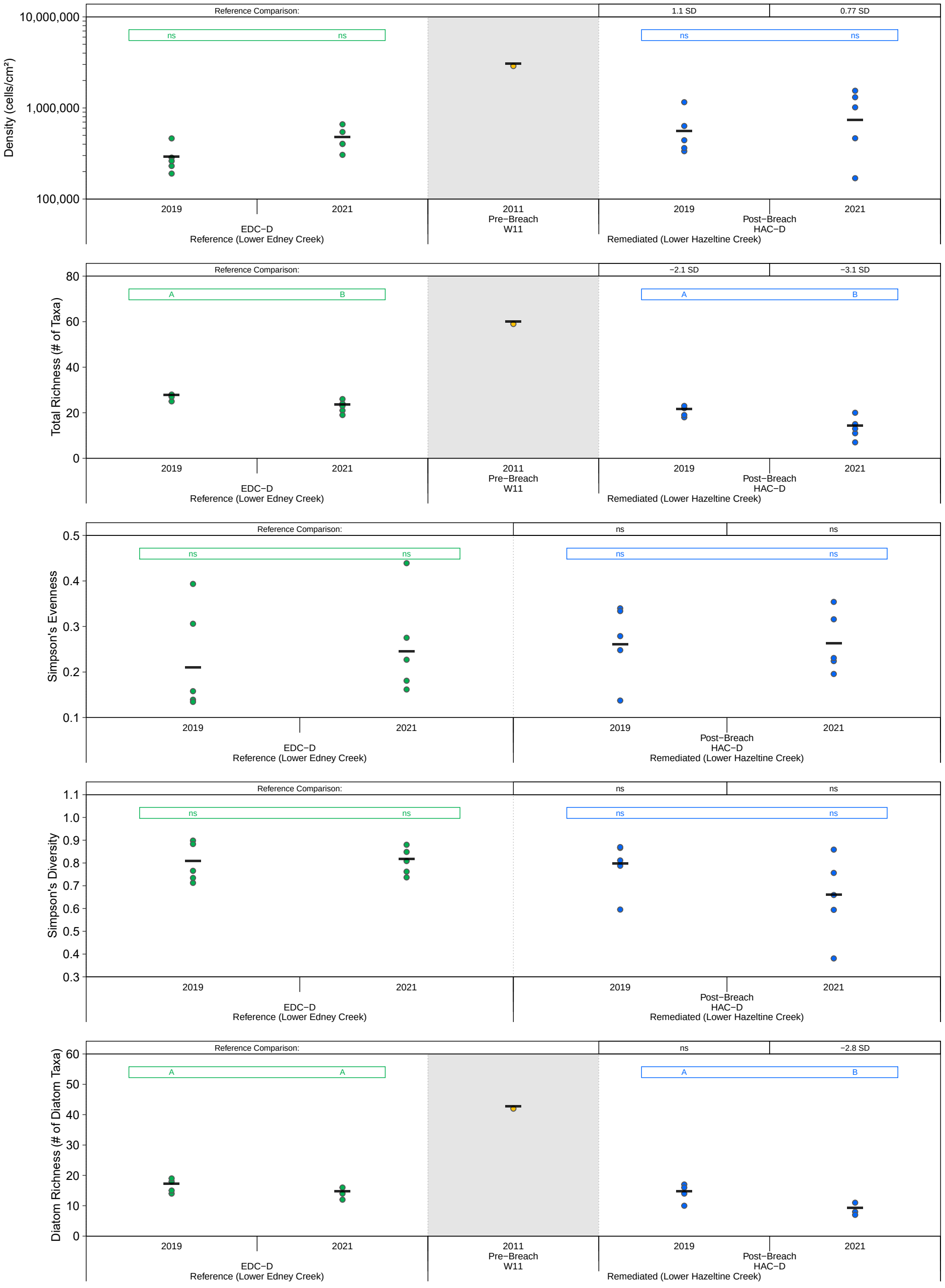

Figure C.4: Periphyton Community Endpoints, Lower Hazeltine Creek and Reference (Lower Edney Creek), 2011 and 2019 to 2021

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10−transformed or rank-transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. A 'nc' indicates no comparisons were possible, a 'ns' indicates a non −significant contrast, and a "nm" indicates that the MOD could not be calculated because MAD = 0. Grey shading indicates semi− quantitative data that were not included in statistical comparisons but are shown for visual comparison only.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Chlorophyll-a (mg/m²)	Ash-Free Dry Mass (g/m²)	Density (cells/cm²)	Total Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	Diatom Richness (# of Taxa)	Diatom (cells/cm²)	Chlorophytes (cells/cm²)	Chrysophytes (cells/cm²)	Cyanobacteria (cells/cm²)	Dinoflagellates (cells/cm²)	Phaeophytes (cells/cm²)
1995	EDC-U (W9)[a]	Reference[b]	W9-1	10.8	-	-	37	-	-	23	-	-	-	-	-	-
			W9-2	10.5	-	-	35	-	-	21	-	-	-	-	-	-
			W9-3	7.52	-	-	34	-	-	20	-	-	-	-	-	-
			W9-4	10.0	-	-	-	-	-	-	-	-	-	-	-	-
			W9-5	8.68	-	-	-	-	-	-	-	-	-	-	-	-
			W9-6	8.84	-	-	-	-	-	-	-	-	-	-	-	-
	HAC-U (W7)[a]	Baseline[b]	W7-1	10.3	-	-	12	-	-	15	-	-	-	-	-	-
			W7-2	10.8	-	-	23	-	-	18	-	-	-	-	-	-
			W7-3	10.8	-	-	17	-	-	11	-	-	-	-	-	-
			W7-4	12.0	-	-	-	-	-	-	-	-	-	-	-	-
			W7-5	5.28	-	-	-	-	-	-	-	-	-	-	-	-
			W7-6	6.23	-	-	-	-	-	-	-	-	-	-	-	-
1996	EDC-U (W9)[a]	Reference[b]	W7-1	15.6	-	-	40	-	-	27	-	-	-	-	-	-
			W7-2	20.1	-	-	36	-	-	27	-	-	-	-	-	-
			W7-3	12.8	-	-	45	-	-	29	-	-	-	-	-	-
	HAC-U (W7)[a]	Baseline[b]	W7-1	17.7	-	-	28	-	-	23	-	-	-	-	-	-
			W7-2	11.9	-	-	32	-	-	21	-	-	-	-	-	-
			W7-3	34.6	-	-	27	-	-	20	-	-	-	-	-	-
2011	HAC-U (W7)[a]	Pre-Breach	W7	14.6	-	21,200,428	34	-	-	22	52,079	10,691	0	21,108,545	0	0
	HAC-D (W11)[a]	Pre-Breach	W11	30.6	-	2,886,168	59	-	-	42	2,647,201	33,807	0	200,250	0	0
2017	HAC-R1	Exposed	HAC-R1-1	23.4	9.50	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-2	5.90	7.25	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-3	4.08	1.95	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-4	16.7	6.25	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-5	8.70	2.45	-	-	-	-	-	-	-	-	-	-	-
	EDC-D	Reference	EDC-D-1	22.9	8.45	-	-	-	-	-	-	-	-	-	-	-
			EDC-D-2	12.0	3.55	-	-	-	-	-	-	-	-	-	-	-
			EDC-D-3	14.0	3.65	-	-	-	-	-	-	-	-	-	-	-
			EDC-D-4	21.4	5.65	-	-	-	-	-	-	-	-	-	-	-
			EDC-D-5	40.0	11.6	-	-	-	-	-	-	-	-	-	-	-
	HAC-D	Exposed	HAC-R1-1	1.76	0.900	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-2	2.44	1.45	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-3	4.71	2.50	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-4	4.28	3.05	-	-	-	-	-	-	-	-	-	-	-
			HAC-R1-5	7.35	3.65	-	-	-	-	-	-	-	-	-	-	-
2018	EDC-U	Reference	EDC-U-1	12.6	6.05	1,055,389	27	0.247	0.850	13	112,365	28,552	0	909,867	0	0
			EDC-U-2	12.1	7.30	1,021,188	33	0.255	0.881	18	139,996	54,341	0	822,246	0	0
			EDC-U-3	6.40	3.55	889,906	28	0.194	0.816	14	93,777	20,765	0	770,005	0	0
			EDC-U-4	15.0	12.6	1,616,699	28	0.194	0.816	14	197,468	50,104	0	1,357,338	0	0
			EDC-U-5	11.4	3.80	1,108,844	28	0.148	0.759	17	109,786	13,263	0	982,110	0	0
	HAC-R1	Exposed	HAC-R1-1	21.3	38.6	1,107,074	23	0.214	0.797	14	383,147	112,365	0	604,193	0	0
			HAC-R1-2	31.0	19.2	992,498	22	0.234	0.806	14	565,879	110,523	0	309,465	0	0
			HAC-R1-3	12.7	10.4	915,040	29	0.263	0.869	16	419,988	40,525	0	412,159	29,473	0
			HAC-R1-4	10.8	5.10	990,411	29	0.265	0.870	18	486,302	27,631	0	474,636	0	0
			HAC-R1-5	12.7	4.00	637,877	27	0.440	0.916	16	416,830	44,209	0	176,837	0	0
	HAC-U		HAC-U-1	9.55	7.20	1,031,550	21	0.246	0.806	16	930,237	70,612	0	24,561	0	0
			HAC-U-2	10.9	13.8	908,746	19	0.287	0.816	13	692,612	58,946	0	154,732	0	0
			HAC-U-3	9.83	9.15	1,547,325	16	0.204	0.694	10	1,394,697	78,945	0	73,682	0	0
			HAC-U-4	18.0	13.2	923,483	20	0.207	0.758	14	857,169	31,929	0	34,385	0	0
			HAC-U-5	14.8	7.80	565,964	22	0.306	0.852	13	371,614	148,966	0	43,782	0	0

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Chlorophyll-a (mg/m²)	Ash-Free Dry Mass (g/m²)	Density (cells/cm²)	Total Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	Diatom Richness (# of Taxa)	Diatom (cells/cm²)	Chlorophytes (cells/cm²)	Chrysophytes (cells/cm²)	Cyanobacteria (cells/cm²)	Dinoflagellates (cells/cm²)	Phaeophytes (cells/cm²)
2019	EDC-U	Reference	EDC-U-1	19.1	5.95	1,207,383	28	0.269	0.867	14	50,640	13,598	0	1,121,577	0	0
			EDC-U-2	23.8	6.55	589,659	32	0.225	0.861	20	98,052	4,551	0	487,056	0	0
			EDC-U-3	12.4	7.25	88,329	22	0.241	0.811	13	7,207	3,821	0	68,010	0	0
			EDC-U-4	60.0	23.8	1,084,694	26	0.0667	0.424	16	27,216	8,256	0	1,046,164	0	0
			EDC-U-5	9.80	4.50	280,674	33	0.284	0.893	17	32,001	8,088	0	200,846	0	0
	HAC-R1	Exposed	HAC-R1-1	53.5	68.0	251,352	26	0.116	0.669	16	16,591	1,443	721	215,284	0	17,313
			HAC-R1-2	56.0	88.5	237,397	30	0.192	0.826	20	26,185	1,082	649	186,974	0	22,507
			HAC-R1-3	42.1	57.0	185,009	28	0.133	0.731	18	51,243	2,813	603	118,293	0	12,057
			HAC-R1-4	30.1	42.4	159,086	27	0.192	0.807	17	32,056	0	406	118,509	0	8,115
			HAC-R1-5	54.5	34.7	742,283	27	0.0767	0.517	14	20,439	1,803	601	683,973	0	35,467
	HAC-U		HAC-U-1	27.0	39.0	347,921	30	0.403	0.917	15	122,935	40,190	1,182	147,561	0	36,053
			HAC-U-2	31.9	27.8	1,157,479	25	0.0828	0.517	15	121,576	126,599	0	854,043	0	55,262
			HAC-U-3	52.0	30.4	1,771,522	27	0.0566	0.346	15	192,449	42,509	0	1,496,373	0	40,190
			HAC-U-4	36.8	29.2	426,184	31	0.136	0.762	16	84,902	23,612	0	317,670	0	0
			HAC-U-5	30.6	23.8	483,442	25	0.194	0.794	16	188,585	28,597	0	266,260	0	0
	EDC-D	Reference	EDC-D-1	27.6	3.95	190,239	25	0.393	0.898	14	35,518	22,155	0	86,849	0	17,935
			EDC-D-2	40.0	5.35	230,458	28	0.306	0.883	18	75,022	2,813	0	99,169	0	6,564
			EDC-D-3	13.2	1.45	284,602	25	0.139	0.713	19	48,178	1,407	0	192,818	0	0
			EDC-D-4	22.3	2.40	462,978	27	0.158	0.765	15	85,806	469	0	347,632	0	5,158
			EDC-D-5	9.15	1.80	261,404	28	0.134	0.734	15	27,612	1,302	0	215,818	0	5,991
	HAC-D	Exposed	HAC-R1-1	32.5	27.5	1,156,563	18	0.137	0.595	10	130,473	0	0	954,738	0	71,352
			HAC-R1-2	25.0	33.3	335,019	22	0.340	0.866	17	173,722	0	0	121,910	0	39,386
			HAC-R1-3	20.5	12.2	362,918	23	0.334	0.870	16	242,883	1,876	0	83,462	0	34,698
			HAC-R1-4	33.6	32.1	441,819	19	0.248	0.788	14	163,172	0	0	205,500	0	73,146
			HAC-R1-5	30.2	20.6	633,357	19	0.279	0.811	14	311,629	0	0	300,087	0	21,641
2020	EDC-U	Reference	EDC-U-1	6.05	7.15	540,622	26	0.120	0.679	14	9,785	11,009	0	512,285	0	0
			EDC-U-2	17.4	8.60	1,608,224	11	0.191	0.524	3	2,679	0	0	1,590,138	0	0
			EDC-U-3	6.80	8.75	2,082,852	9	0.202	0.450	2	4,689	11,387	0	2,060,077	0	0
			EDC-U-4	9.60	11.8	644,856	21	0.205	0.767	6	3,517	8,206	0	612,269	0	0
			EDC-U-5	2.46	4.00	250,654	11	0.199	0.544	5	4,995	204	0	244,945	0	0
	HAC-R1	Exposed	HAC-R1-1	32.1	140	1,085,911	29	0.112	0.692	19	110,774	36,925	0	859,088	0	79,125
			HAC-R1-2	69.5	172	1,125,327	29	0.113	0.695	19	203,966	23,913	0	728,649	0	168,799
			HAC-R1-3	99.0	71.0	1,343,828	22	0.201	0.774	13	88,620	18,287	0	1,006,230	0	230,692
			HAC-R1-4	50.0	128	646,960	20	0.410	0.878	11	73,850	3,517	0	421,016	0	148,578
			HAC-R1-5	33.0	118	1,928,410	19	0.231	0.772	9	66,113	8,440	0	1,663,958	0	189,899
	HAC-U	Exposed	HAC-U-1	11.2	57.0	939,866	24	0.331	0.874	14	221,046	7,536	0	509,076	0	202,207
			HAC-U-2	3.49	31.2	353,842	17	0.270	0.782	12	146,694	0	0	142,843	0	64,304
			HAC-U-3	20.8	75.5	1,264,235	24	0.280	0.851	17	334,081	0	0	705,088	0	225,065
			HAC-U-4	12.4	71.5	662,888	26	0.343	0.888	17	276,057	70,333	0	137,149	0	179,349
			HAC-U-5	26.6	62.0	784,377	26	0.290	0.868	16	185,723	9,891	0	482,165	0	106,598

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Chlorophyll-a (mg/m²)	Ash-Free Dry Mass (g/m²)	Density (cells/cm²)	Total Richness (# of Taxa)	Simpson's Evenness	Simpson's Diversity	Diatom Richness (# of Taxa)	Diatom (cells/cm²)	Chlorophytes (cells/cm²)	Chrysophytes (cells/cm²)	Cyanobacteria (cells/cm²)	Dinoflagellates (cells/cm²)	Phaeophytes (cells/cm²)
2021	EDC-U	Reference	EDC-U-1	6.75	6.65	1,486,106	24	0.160	0.740	16	77,132	2,624	0	1,406,351	0	0
			EDC-U-2	5.80	7.80	794,143	21	0.105	0.546	9	24,136	7,346	0	682,380	0	5,247
			EDC-U-3	2.05	2.00	103,781	41	0.167	0.854	22	13,038	10,266	0	79,862	0	0
			EDC-U-4	6.20	4.00	342,829	26	0.182	0.789	14	28,890	3,611	0	280,883	0	6,945
			EDC-U-5	6.40	4.00	507,750	27	0.127	0.709	16	38,057	9,167	0	455,527	0	0
	HAC-R1	Exposed	HAC-R1-1	19.9	28.4	1,091,336	16	0.0948	0.340	10	5,431	11,334	0	1,061,113	0	13,459
			HAC-R1-2	29.1	7.55	721,023	19	0.0973	0.459	11	8,889	23,334	0	679,355	0	9,445
			HAC-R1-3	15.2	14.4	246,090	16	0.239	0.739	7	5,833	23,334	0	177,755	0	39,168
			HAC-R1-4	29.6	15.6	305,564	22	0.144	0.684	16	23,612	19,723	0	236,673	0	25,556
			HAC-R1-5	76.0	13.3	747,243	19	0.0751	0.299	13	25,556	27,779	0	689,742	0	4,167
	HAC-U	Exposed	HAC-U-1	24.9	68.0	328,354	20	0.332	0.849	13	86,576	87,364	0	89,088	0	65,326
			HAC-U-2	24.1	49.8	383,656	26	0.360	0.893	15	145,606	14,167	0	149,900	0	73,984
			HAC-U-3	29.1	15.1	474,484	13	0.404	0.810	8	194,516	61,840	0	143,919	0	74,208
			HAC-U-4	24.8	40.5	317,353	27	0.311	0.881	17	73,084	23,050	0	145,325	0	75,895
			HAC-U-5	11.6	13.0	432,704	18	0.244	0.772	8	20,070	36,992	0	335,108	0	40,534
	EDC-D	Reference	EDC-D-1	30.2	10.5	544,195	26	0.162	0.762	16	246,237	65,213	0	222,625	0	0
			EDC-D-2	25.4	6.70	401,990	21	0.181	0.737	14	132,226	7,084	0	228,444	0	0
			EDC-D-3	37.4	10.0	403,860	19	0.439	0.880	12	154,460	80,674	0	108,713	0	0
			EDC-D-4	20.3	5.25	305,454	24	0.275	0.849	16	70,835	26,423	0	148,042	0	0
			EDC-D-5	18.1	3.70	661,376	23	0.227	0.808	14	121,994	26,563	0	369,180	0	0
	HAC-D	Exposed	HAC-D-1	9.80	16.0	169,150	15	0.196	0.659	8	43,176	15,741	0	105,286	0	4,947
			HAC-D-2	4.62	6.10	464,444	20	0.354	0.859	11	276,258	41,321	0	125,615	0	21,251
			HAC-D-3	8.60	4.50	1,310,453	11	0.224	0.594	8	1,294,712	7,871	0	7,871	0	0
			HAC-D-4	7.35	3.30	1,544,884	7	0.231	0.381	7	1,544,884	0	0	0	0	0
			HAC-D-5	18.9	5.10	1,015,306	13	0.316	0.756	11	1,001,814	3,373	0	10,119	0	0
2022	EDC-U	Reference	EDC-U-1	18.4	14.1	1,217,368	13	0.230	0.666	5	15,853	75,492	0	1,089,786	0	0
			EDC-U-2	26.4	6.50	3,685,304	25	0.112	0.643	13	322,152	16,759	0	3,335,220	0	0
			EDC-U-3	63.5	12.2	3,196,274	22	0.265	0.828	12	444,767	23,635	0	2,727,872	0	0
			EDC-U-4	55.0	16.9	2,063,768	24	0.139	0.700	14	95,647	5,925	0	1,954,579	0	0
			EDC-U-5	34.3	3.55	2,986,351	25	0.183	0.782	13	134,732	23,003	0	2,764,536	0	0
	HAC-R1	Exposed	HAC-R1-1	53.5	85.5	1,178,821	30	0.0965	0.654	20	176,094	25,503	0	839,991	0	137,232
			HAC-R1-2	71.5	49.9	932,045	27	0.217	0.829	18	125,296	0	0	746,096	0	60,653
			HAC-R1-3	106	139	4,021,097	26	0.0477	0.194	14	61,937	23,074	0	3,755,134	0	180,952
			HAC-R1-4	144	129	2,239,208	22	0.0596	0.238	17	127,517	6,072	0	1,962,315	0	143,304
			HAC-R1-5	62.5	80.0	1,109,121	26	0.166	0.769	21	371,334	6,572	0	593,196	0	138,018
	HAC-U	Exposed	HAC-U-1	32.4	32.8	723,839	30	0.116	0.712	20	124,481	13,966	0	569,605	0	15,788
			HAC-U-2	14.4	38.8	500,918	25	0.347	0.885	17	158,283	9,311	0	219,733	0	113,591
			HAC-U-3	31.2	74.5	583,291	32	0.449	0.930	24	414,054	26,289	0	85,440	0	57,508
			HAC-U-4	28.1	12.6	1,542,775	26	0.127	0.698	17	250,060	42,563	0	1,203,598	0	46,554
			HAC-U-5	27.6	30.2	1,495,113	27	0.0814	0.545	18	128,488	61,451	0	1,225,847	0	79,328

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Rhodophytes (cells/cm²)	Other (cells/cm²)	% Diatoms	% Chlorophytes	% Chrysophytes	% Cyanobacteria	% Dinoflagellates	% Phaeophytes	% Rhodophytes	% Other
1995	EDC-U (W9)[a]	Reference[b]	W9-1	-	-	80.0	20.0	0	0	0	0	0	0
			W9-2	-	-	90.0	10.0	0	1.00	0	0	0	0
			W9-3	-	-	89.0	10.0	0	1.00	0	0	0	0
			W9-4	-	-	-	-	-	-	-	-	-	-
			W9-5	-	-	-	-	-	-	-	-	-	-
			W9-6	-	-	-	-	-	-	-	-	-	-
	HAC-U (W7)[a]	Baseline[b]	W7-1	-	-	100	0	0	0	0	0	0	0
			W7-2	-	-	99.0	0	0	1.00	0	0	0	0
			W7-3	-	-	100	0	0	0	0	0	0	0
			W7-4	-	-	-	-	-	-	-	-	-	-
			W7-5	-	-	-	-	-	-	-	-	-	-
			W7-6	-	-	-	-	-	-	-	-	-	-
1996	EDC-U (W9)[a]	Reference[b]	W7-1	-	-	97.0	3.00	0	0	0	0	0	0
			W7-2	-	-	97.0	2.00	0	1.00	0	0	0	0
			W7-3	-	-	97.0	1.00	0	2.00	0	0	0	0
	HAC-U (W7)[a]	Baseline[b]	W7-1	-	-	25.0	0	0	75.0	0	0	0	0
			W7-2	-	-	49.0	0	0	51.0	0	0	0	0
			W7-3	-	-	65.0	0	0	35.0	0	0	0	0
2011	HAC-U (W7)[a]	Pre-Breach	W7	0	29,113	0	0	0	100	0	0	0	0
	HAC-D (W11)[a]	Pre-Breach	W11	0.0	4,909	91.7	1.17	0.00	6.94	0	0	0	0.137
2017	HAC-R1	Exposed	HAC-R1-1	-	-	-	-	-	-	-	-	-	-
			HAC-R1-2	-	-	-	-	-	-	-	-	-	-
			HAC-R1-3	-	-	-	-	-	-	-	-	-	-
			HAC-R1-4	-	-	-	-	-	-	-	-	-	-
			HAC-R1-5	-	-	-	-	-	-	-	-	-	-
	EDC-D	Reference	EDC-D-1	-	-	-	-	-	-	-	-	-	-
			EDC-D-2	-	-	-	-	-	-	-	-	-	-
			EDC-D-3	-	-	-	-	-	-	-	-	-	-
			EDC-D-4	-	-	-	-	-	-	-	-	-	-
			EDC-D-5	-	-	-	-	-	-	-	-	-	-
	HAC-D	Exposed	HAC-R1-1	-	-	-	-	-	-	-	-	-	-
			HAC-R1-2	-	-	-	-	-	-	-	-	-	-
			HAC-R1-3	-	-	-	-	-	-	-	-	-	-
			HAC-R1-4	-	-	-	-	-	-	-	-	-	-
			HAC-R1-5	-	-	-	-	-	-	-	-	-	-
2018	EDC-U	Reference	EDC-U-1	0	4,605	10.6	2.71	0	86.2	0	0	0	0.436
			EDC-U-2	0	4,605	13.7	5.32	0	80.5	0	0	0	0.451
			EDC-U-3	0	5,359	10.5	2.33	0	86.5	0	0	0	0.602
			EDC-U-4	0	11,789	12.2	3.10	0	84.0	0	0	0	0.729
			EDC-U-5	0	3,684	9.90	1.20	0	88.6	0	0	0	0.332
	HAC-R1	Exposed	HAC-R1-1	0	7,368	34.6	10.2	0	54.6	0	0	0	0.666
			HAC-R1-2	0	6,631	57.0	11.1	0	31.2	0	0	0	0.668
			HAC-R1-3	0	12,894	45.9	4.43	0	45.0	3.22	0	0	1.41
			HAC-R1-4	0	1,842	49.1	2.79	0	47.9	0	0	0	0.186
			HAC-R1-5	0	0	65.3	6.93	0	27.7	0	0	0	0
	HAC-U		HAC-U-1	0	6,140	90.2	6.85	0	2.38	0	0	0	0.595
			HAC-U-2	0	2,456	76.2	6.49	0	17.0	0	0	0	0.270
			HAC-U-3	0	0	90.1	5.10	0	4.76	0	0	0	0
			HAC-U-4	0	0	92.8	3.46	0	3.72	0	0	0	0
			HAC-U-5	0	1,602	65.7	26.3	0	7.74	0	0	0	0.283

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Rhodophytes (cells/cm²)	Other (cells/cm²)	% Diatoms	% Chlorophytes	% Chrysophytes	% Cyanobacteria	% Dinoflagellates	% Phaeophytes	% Rhodophytes	% Other
2019	EDC-U	Reference	EDC-U-1	21,569	0	4.19	1.13	0	92.9	0	0	1.79	0
			EDC-U-2	0	0	16.6	0.772	0	82.6	0	0	0	0
			EDC-U-3	9,291	0	8.16	4.33	0	77.0	0	0	10.5	0
			EDC-U-4	3,058	0	2.51	0.761	0	96.5	0	0	0.282	0
			EDC-U-5	39,738	0	11.4	2.88	0	71.6	0	0	14.2	0
	HAC-R1	Exposed	HAC-R1-1	0	0	6.60	0.574	0.287	85.7	0	6.89	0	0
			HAC-R1-2	0	0	11.0	0.456	0.273	78.8	0	9.48	0	0
			HAC-R1-3	0	0	27.7	1.52	0.326	63.9	0	6.52	0	0
			HAC-R1-4	0	0	20.1	0	0.255	74.5	0	5.10	0	0
			HAC-R1-5	0	0	2.75	0.243	0.0810	92.1	0	4.78	0	0
	HAC-U		HAC-U-1	0	0	35.3	11.6	0.340	42.4	0	10.4	0	0
			HAC-U-2	0	0	10.5	10.9	0	73.8	0	4.77	0	0
			HAC-U-3	0	0	10.9	2.40	0	84.5	0	2.27	0	0
			HAC-U-4	0	0	19.9	5.54	0	74.5	0	0	0	0
			HAC-U-5	0	0	39.0	5.92	0	55.1	0	0	0	0
	EDC-D	Reference	EDC-D-1	27,782	0	18.7	11.6	0	45.6	0	9.43	14.6	0
			EDC-D-2	46,889	0	32.5	1.22	0	43.0	0	2.85	20.4	0
			EDC-D-3	42,200	0	16.9	0.494	0	67.8	0	0	14.8	0
			EDC-D-4	23,913	0	18.5	0.101	0	75.1	0	1.11	5.17	0
			EDC-D-5	10,680	0	10.6	0.498	0	82.6	0	2.29	4.09	0
	HAC-D	Exposed	HAC-R1-1	0	0	11.3	0	0	82.5	0	6.17	0	0
			HAC-R1-2	0	0	51.9	0	0	36.4	0	11.8	0	0
			HAC-R1-3	0	0	66.9	0.517	0	23.0	0	9.56	0	0
			HAC-R1-4	0	0	36.9	0	0	46.5	0	16.6	0	0
			HAC-R1-5	0	0	49.2	0	0	47.4	0	3.42	0	0
2020	EDC-U	Reference	EDC-U-1	7,543	0	1.81	2.04	0	94.8	0	0	1.40	0
			EDC-U-2	15,406	0	0.167	0	0	98.9	0	0	0.958	0
			EDC-U-3	6,698	0	0.225	0.547	0	98.9	0	0	0.322	0
			EDC-U-4	20,865	0	0.545	1.27	0	95.0	0	0	3.24	0
			EDC-U-5	510	0	1.99	0.0813	0	97.7	0	0	0.203	0
	HAC-R1	Exposed	HAC-R1-1	0	0	10.2	3.40	0	79.1	0	7.29	0	0
			HAC-R1-2	0	0	18.1	2.13	0	64.8	0	15.0	0	0
			HAC-R1-3	0	0	6.59	1.36	0	74.9	0	17.2	0	0
			HAC-R1-4	0	0	11.4	0.544	0	65.1	0	23.0	0	0
			HAC-R1-5	0	0	3.43	0.438	0	86.3	0	9.85	0	0
	HAC-U	Exposed	HAC-U-1	0	0	23.5	0.802	0	54.2	0	21.5	0	0
			HAC-U-2	0	0	41.5	0	0	40.4	0	18.2	0	0
			HAC-U-3	0	0	26.4	0	0	55.8	0	17.8	0	0
			HAC-U-4	0	0	41.6	10.6	0	20.7	0	27.1	0	0
			HAC-U-5	0	0	23.7	1.26	0	61.5	0	13.6	0	0

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

Table C.1: Periphyton Community and Productivity Metrics, Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 1995 to 2022

Year	Area	Type	Station	Rhodophytes (cells/cm²)	Other (cells/cm²)	% Diatoms	% Chlorophytes	% Chrysophytes	% Cyanobacteria	% Dinoflagellates	% Phaeophytes	% Rhodophytes	% Other
2021	EDC-U	Reference	EDC-U-1	0	0	5.19	0.177	0	94.6	0	0	0	0
			EDC-U-2	75,033	0	3.04	0.925	0	85.9	0	0.661	9.45	0
			EDC-U-3	616	0	12.6	9.89	0	77.0	0	0	0.594	0
			EDC-U-4	22,501	0	8.43	1.05	0	81.9	0	2.03	6.56	0
			EDC-U-5	5,000	0	7.50	1.81	0	89.7	0	0	0.985	0
	HAC-R1	Exposed	HAC-R1-1	0	0	0.498	1.04	0	97.2	0	1.23	0	0
			HAC-R1-2	0	0	1.23	3.24	0	94.2	0	1.31	0	0
			HAC-R1-3	0	0	2.37	9.48	0	72.2	0	15.9	0	0
			HAC-R1-4	0	0	7.73	6.45	0	77.5	0	8.36	0	0
			HAC-R1-5	0	0	3.42	3.72	0	92.3	0	0.558	0	0
	HAC-U	Exposed	HAC-U-1	0	0	26.4	26.6	0	27.1	0	19.9	0	0
			HAC-U-2	0	0	38.0	3.69	0	39.1	0	19.3	0	0
			HAC-U-3	0	0	41.0	13.0	0	30.3	0	15.6	0	0
			HAC-U-4	0	0	23.0	7.26	0	45.8	0	23.9	0	0
			HAC-U-5	0	0	4.64	8.55	0	77.5	0	9.37	0	0
	EDC-D	Reference	EDC-D-1	10,119	0	45.2	12.0	0	40.9	0	0	1.86	0
			EDC-D-2	34,237	0	32.9	1.76	0	56.8	0	0	8.52	0
			EDC-D-3	60,013	0	38.2	20.0	0	26.9	0	0	14.9	0
			EDC-D-4	60,154	0	23.2	8.65	0	48.5	0	0	19.7	0
			EDC-D-5	143,638	0	18.4	4.02	0	55.8	0	0	21.7	0
	HAC-D	Exposed	HAC-D-1	0	0	25.5	9.31	0	62.2	0	2.92	0	0
			HAC-D-2	0	0	59.5	8.90	0	27.1	0	4.58	0	0
			HAC-D-3	0	0	98.8	0.601	0	0.601	0	0	0	0
			HAC-D-4	0	0	100	0	0	0	0	0	0	0
			HAC-D-5	0	0	98.7	0.332	0	0.997	0	0	0	0
2022	EDC-U	Reference	EDC-U-1	36,236	0	1.30	6.20	0	89.5	0	0	2.98	0
			EDC-U-2	11,173	0	8.74	0.455	0	90.5	0	0	0.303	0
			EDC-U-3	0	0	13.9	0.739	0	85.3	0	0	0	0
			EDC-U-4	7,618	0	4.63	0.287	0	94.7	0	0	0.369	0
			EDC-U-5	64,080	0	4.51	0.770	0	92.6	0	0	2.15	0
	HAC-R1	Exposed	HAC-R1-1	0	0	14.9	2.16	0	71.3	0	11.6	0	0
			HAC-R1-2	0	0	13.4	0	0	80.0	0	6.51	0	0
			HAC-R1-3	0	0	1.54	0.574	0	93.4	0	4.50	0	0
			HAC-R1-4	0	0	5.69	0.271	0	87.6	0	6.40	0	0
			HAC-R1-5	0	0	33.5	0.593	0	53.5	0	12.4	0	0
	HAC-U	Exposed	HAC-U-1	0	0	17.2	1.93	0	78.7	0	2.18	0	0
			HAC-U-2	0	0	31.6	1.86	0	43.9	0	22.7	0	0
			HAC-U-3	0	0	71.0	4.51	0	14.6	0	9.86	0	0
			HAC-U-4	0	0	16.2	2.76	0	78.0	0	3.02	0	0
			HAC-U-5	0	0	8.59	4.11	0	82.0	0	5.31	0	0

Notes: "-" indicates no value. Periphyton community metrics that could be calculated for historical (baseline and pre-breach) data were limited due to the qualitative nature of these data.

[a] W9 is the historical sampling area associated with EDC-U; W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

[b] Sampling locations for periphyton productivity were assumed to be the same as periphyton community samples during baseline sampling years.

APPENDIX D

BENTHIC INVERTEBRATE COMMUNITY AND PRODUCTIVITY

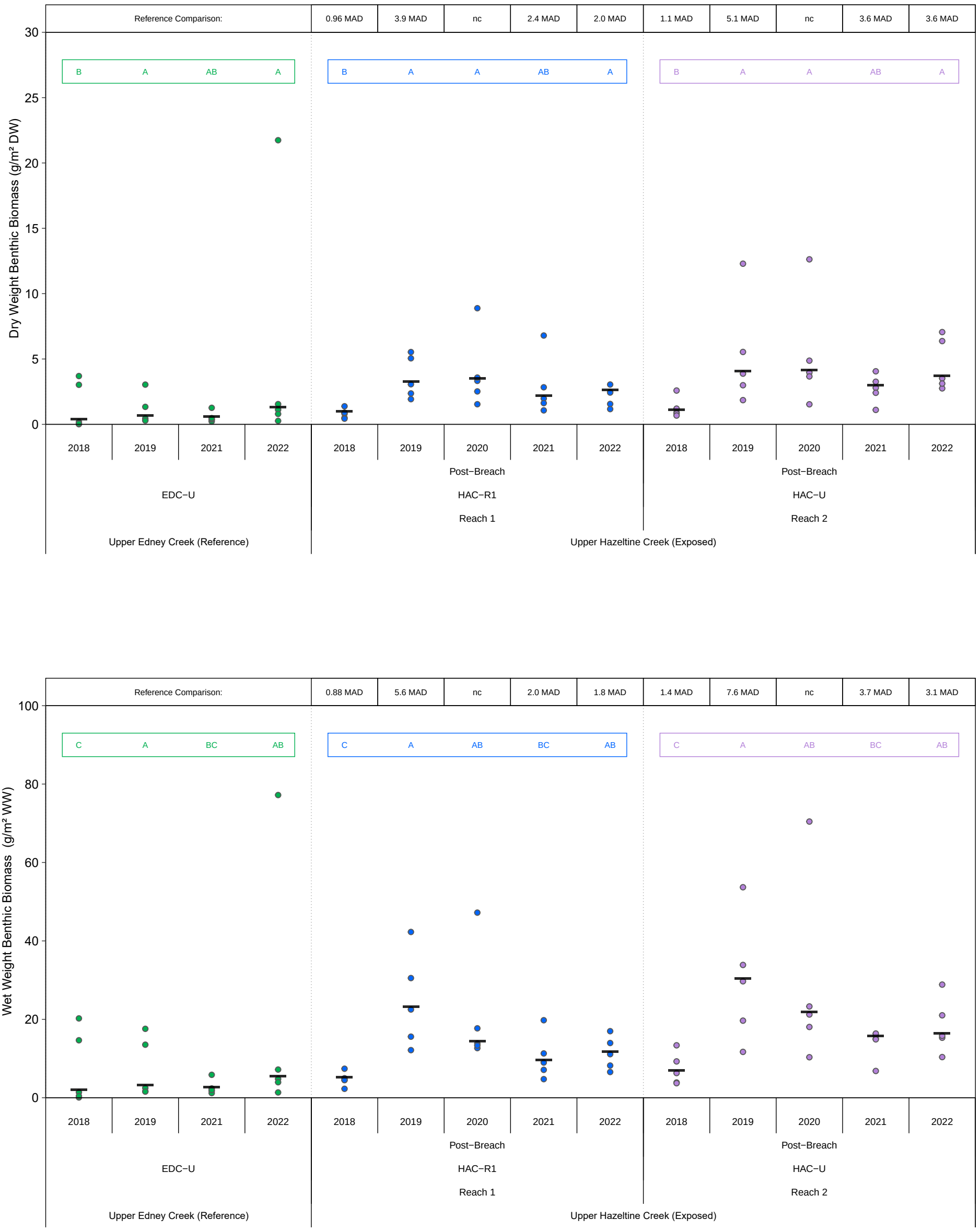

Figure D.1: Benthic Invertebrate Biomass for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2018 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log_{10}−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

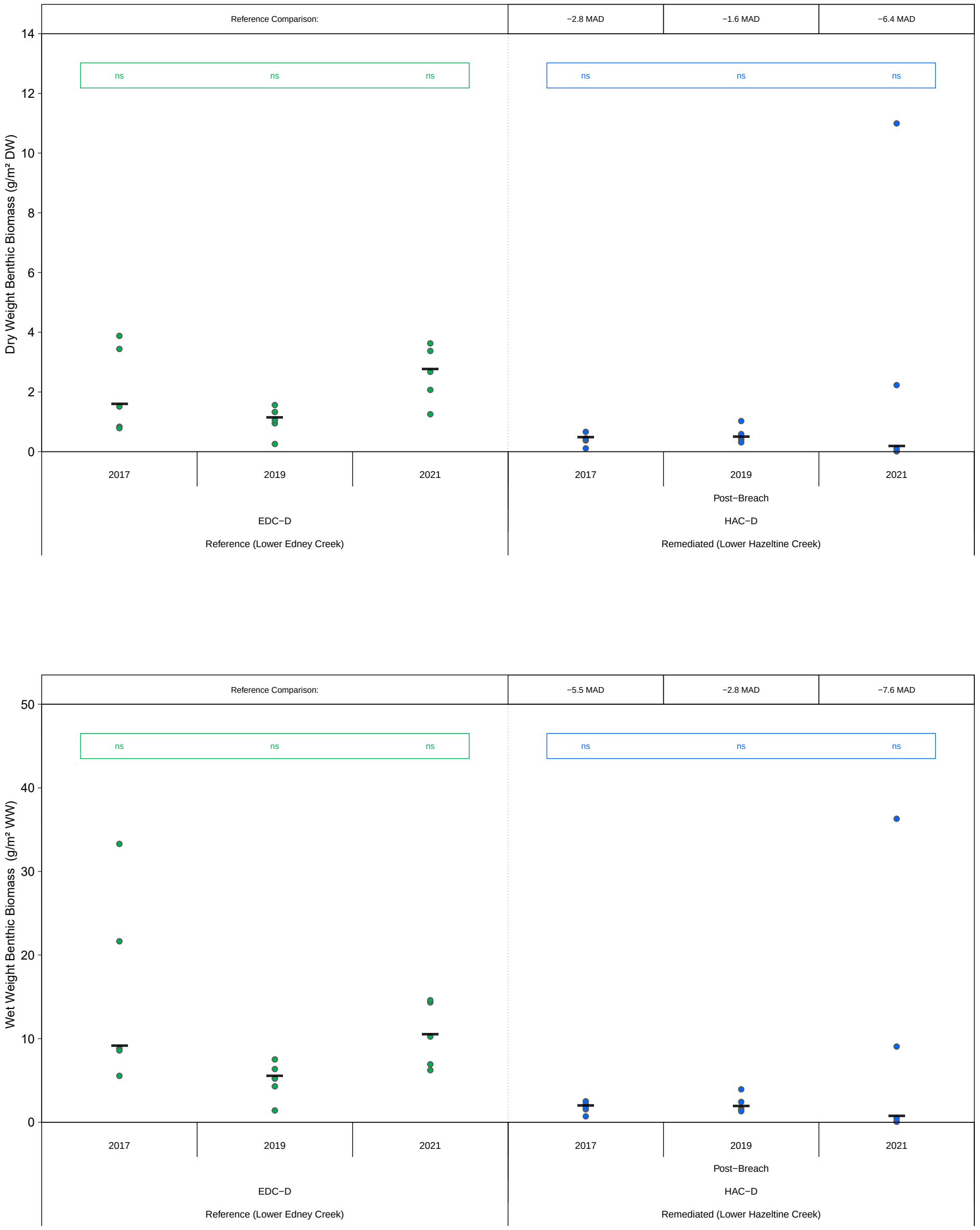

Figure D.2: Benthic Invertebrate Biomass, Lower Hazeltine Creek and Reference (Lower Edney Creek), 2017 to 2021

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$−transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. A 'nc' indicates no comparisons were possible, a 'ns' indicates a non−significant contrast, and a "nm" indicates that the MOD could not be calculated because MAD = 0.

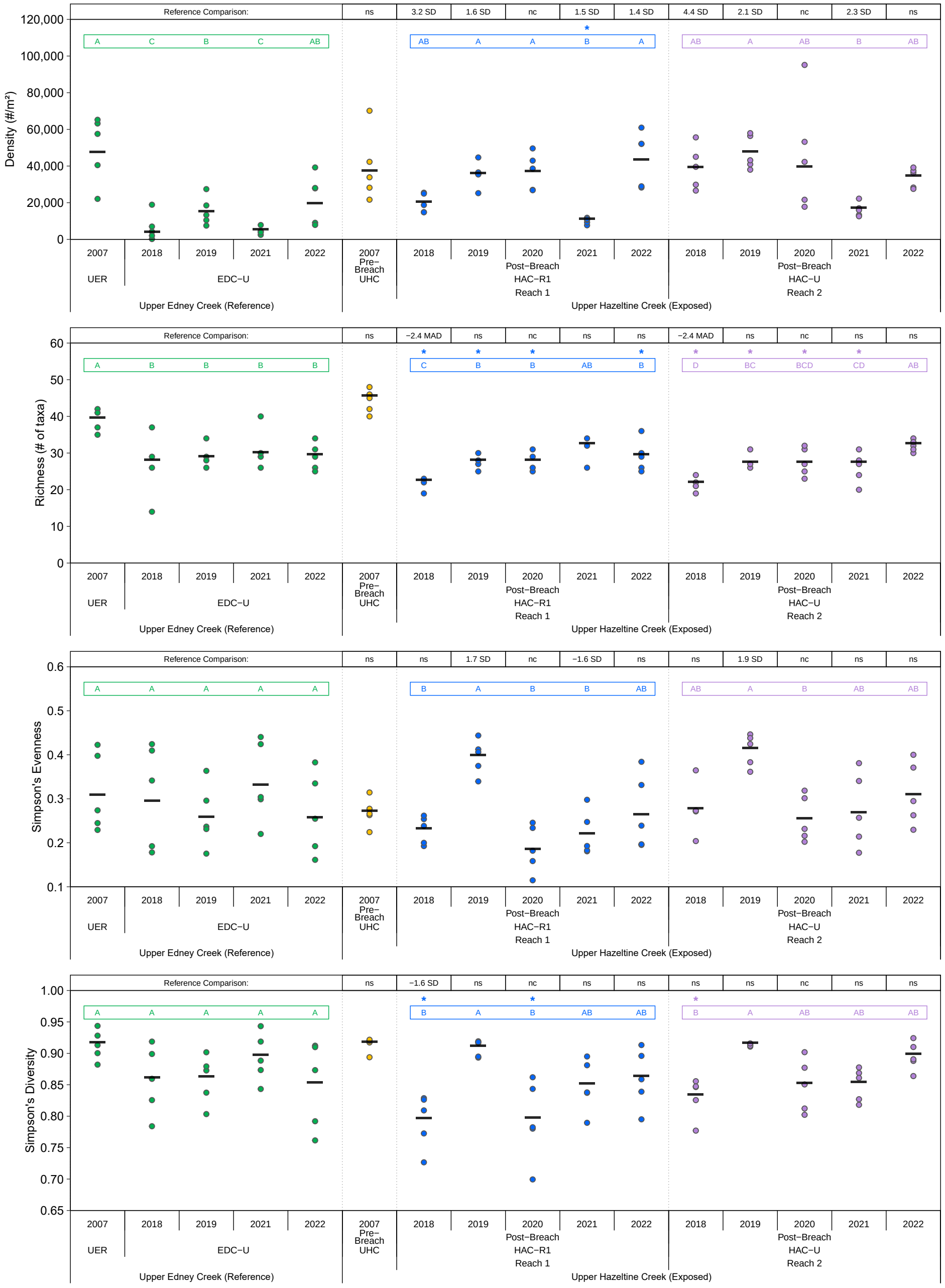

Figure D.3: Benthic Invertebrate Community Endpoints for Upper Hazeltine Creek (HAC−R1, HAC−U; Exposed) and Upper Edney Creek (EDC−U; Reference), 2007 to 2022

Notes: Reference area EDC−U was not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC−R1 and HAC−U. See Section 4.3 for details. Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, log10− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. Data from 2007 were used in the analyses to compare post−breach (2018 to 2022) to pre−breach conditions (2007). Post−breach data from HAC−R1 and HAC−U were compared to pre−breach data from UHC, and post−breach data from EDC−U was compared to pre−breach data from UER. An * indicates a significant difference between HAC−R1 or HAC−U and UHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post −hoc comparisons is expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. 'nc' indicates no comparisons were possible; 'ns' indicates a non−significant contrast; 'nm' indicates that the MOD could not be calculated because MAD = 0.

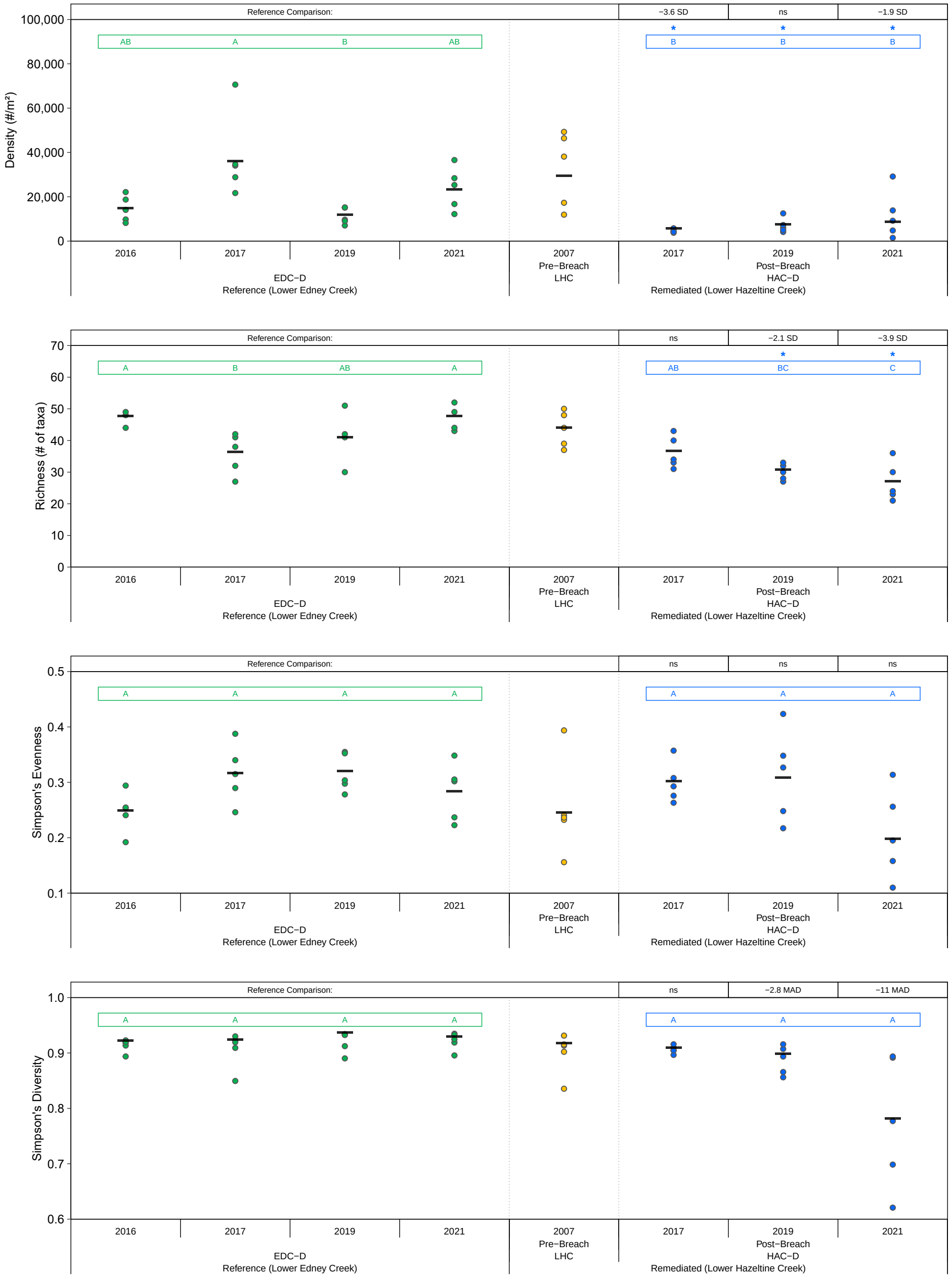

Figure D.4: Benthic Invertebrate Community Endpoints, Lower Hazeltine Creek and Reference (Lower Edney Creek), 2007 and 2016 to 2021

Notes: Black bars represent measures of central tendency (mean, geometric mean, or median depending on if analysis was conducted on untransformed, $\log_{10}$− transformed or rank−transformed data). Coloured letters represent significant (p−value <0.1) post−hoc comparisons within areas over time; years that share a letter of the same colour (e.g., A, B) within a box of the same colour do not differ significantly within an area. An * indicates significant differences to LHC in 2007. A number above the plot indicates significant exposed vs. reference post−hoc comparisons within a given year. The magnitude of difference (MOD) for these significant post−hoc comparisons are expressed in units of standard deviation (SD) or median absolute deviations (MAD; if the data were rank−transformed prior to analysis) relative to reference. A 'nc' indicates no comparisons were possible, a 'ns' indicates a non−significant contrast, and a "nm" indicates that the MOD could not be calculated because MAD = 0.

Table D.1: Benthic Invertebrate Community Metrics for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 2007 to 2022

Year	Area	Area Type	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2007	EDC-U (UER)[a]	Reference (Pre- Breach)	EDC-U-1	22,075	42	0.274	0.913	11,240	1,398	1,796	14,434	1,147	4,585	247
			EDC-U-2	57,534	42	0.423	0.944	18,473	4,731	7,950	31,154	5,849	17,319	344
			EDC-U-3	40,477	41	0.245	0.900	15,140	1,649	1,957	18,746	5,219	14,265	211
			EDC-U-4	63,208	35	0.398	0.928	25,118	5,086	11,882	42,086	2,186	15,484	233
			EDC-U-5	65,222	37	0.229	0.882	37,172	7,735	3,104	48,011	3,900	9,176	237
	HAC-U (UHC)[a]	Exposed (Pre- Breach)	HAC-U-1	70,143	46	0.263	0.917	28,986	4,602	2,943	36,530	1,778	20,416	459
			HAC-U-2	33,857	42	0.224	0.894	13,878	1,964	1,491	17,333	7,914	5,219	401
			HAC-U-3	28,201	45	0.277	0.920	11,989	2,136	1,108	15,233	1,204	8,774	229
			HAC-U-4	42,297	40	0.314	0.920	17,892	5,430	2,520	25,842	6,308	6,079	516
			HAC-U-5	21,642	48	0.266	0.922	7,986	2,573	1,319	11,878	3,563	3,928	201
	HAC-D (LHC)[a]	Exposed (Pre- Breach)	HAC-D-1	49,283	48	0.241	0.913	17,720	9,079	3,444	30,244	2,638	13,190	287
			HAC-D-2	38,122	44	0.232	0.902	13,821	8,609	2,616	25,047	2,581	8,487	287
			HAC-D-3	17,276	50	0.236	0.915	7,670	2,932	523	11,125	1,523	2,781	208
			HAC-D-4	11,914	37	0.394	0.931	4,796	1,996	219	7,011	803	3,412	115
			HAC-D-5	46,398	39	0.156	0.835	6,254	1,452	441	8,147	1,262	35,842	344
2017	EDC-D	Reference	EDC-D-1	21,685	41	0.315	0.923	7,407	2,330	1,673	11,410	1,374	7,049	1,613
			EDC-D-2	28,817	32	0.388	0.919	11,111	1,935	1,720	14,767	1,362	10,466	1,577
			EDC-D-3	70,609	42	0.340	0.930	19,211	8,602	4,373	32,186	2,007	33,835	1,505
			EDC-D-4	34,050	27	0.246	0.849	4,301	3,584	1,649	9,534	789	22,151	789
			EDC-D-5	34,624	38	0.290	0.909	10,609	3,656	2,294	16,559	2,652	12,318	2,305
	HAC-D	Exposed	HAC-D-1	3,751	31	0.357	0.910	705	705	789	2,198	23.9	872	454
			HAC-D-2	4,301	33	0.293	0.897	434	509	1,085	2,028	56.6	896	887
			HAC-D-3	4,703	40	0.263	0.905	645	731	1,233	2,609	14.3	832	674
			HAC-D-4	5,767	34	0.308	0.904	310	717	440	1,466	32.6	2,183	701
			HAC-D-5	4,102	43	0.276	0.916	345	717	518	1,580	39.8	1,646	438
2018	EDC-U	Reference	EDC-U-1	18,894	26	0.178	0.784	563	973	768	2,304	7,066	8,449	205
			EDC-U-2	179	14	0.410	0.826	0	0	0	0	57.4	100	3.58
			EDC-U-3	6,989	29	0.424	0.919	591	789	71.7	1,452	573	3,011	89.6
			EDC-U-4	4,211	29	0.341	0.899	230	474	51.2	755	410	2,317	89.6
			EDC-U-5	2,018	37	0.192	0.859	100	609	21.5	731	373	674	10.8
	HAC-R1	Exposed	HAC-R1-1	14,839	22	0.238	0.809	502	35.8	2,222	2,760	1,720	8,925	0
			HAC-R1-2	18,740	19	0.193	0.727	307	0	2,919	3,226	1,280	12,545	0
			HAC-R1-3	14,775	23	0.254	0.829	358	39.8	1,673	2,071	3,465	8,005	79.7
			HAC-R1-4	25,448	22	0.262	0.826	143	0	4,588	4,731	1,935	15,484	0
			HAC-R1-5	24,946	22	0.200	0.773	358	0	3,584	3,943	717	17,204	0
	HAC-U		HAC-U-1	55,627	19	0.365	0.856	215	0	6,953	7,168	0	35,125	573
			HAC-U-2	39,570	24	0.271	0.846	717	0	5,878	6,595	0	24,301	2,366
			HAC-U-3	29,821	24	0.273	0.847	573	0	3,656	4,229	0	19,498	860
			HAC-U-4	45,018	22	0.204	0.777	215	0	2,509	2,724	0	28,029	287
			HAC-U-5	26,595	21	0.273	0.826	573	0	3,154	3,728	0	16,272	3,297

Notes: "-" = no data available, EPT = Ephemeroptera, Trichoptera, Plecoptera, DW = dry weight, WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U. LHC is the historical sampling area associated with HAC-D.

Table D.1: Benthic Invertebrate Community Metrics for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 2007 to 2022

Year	Area	Area Type	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2019	EDC-U	Reference	EDC-U-1	18,500	26	0.237	0.837	6,667	1,444	222	8,333	4,889	4,444	222
			EDC-U-2	7,500	34	0.231	0.873	3,714	429	23.8	4,167	429	2,071	214
			EDC-U-3	27,400	29	0.175	0.803	7,533	1,333	0	8,867	10,467	6,600	400
			EDC-U-4	13,292	28	0.363	0.902	4,250	875	0	5,125	1,000	5,333	83.3
			EDC-U-5	10,467	28	0.296	0.879	4,400	233	167	4,800	233	3,533	66.7
	HAC-R1	Exposed	HAC-R1-1	35,667	25	0.375	0.893	11,600	0	9,000	20,600	5,133	8,267	267
			HAC-R1-2	36,533	27	0.444	0.917	8,333	0	9,467	17,800	5,400	10,333	2,000
			HAC-R1-3	44,667	30	0.412	0.919	10,533	0	9,867	20,400	3,400	18,933	800
			HAC-R1-4	35,400	30	0.406	0.918	6,933	0	6,067	13,000	4,200	15,267	400
			HAC-R1-5	25,200	28	0.340	0.895	6,133	66.7	8,067	14,267	267	8,000	2,267
	HAC-U		HAC-U-1	38,000	31	0.361	0.911	9,200	0	10,667	19,867	200	13,600	3,533
			HAC-U-2	56,400	26	0.446	0.914	9,533	0	12,667	22,200	0	27,667	1,867
			HAC-U-3	57,933	27	0.425	0.913	9,467	0	14,200	23,667	0	27,933	2,533
			HAC-U-4	40,933	26	0.438	0.912	5,867	66.7	11,067	17,000	200	18,467	1,867
			HAC-U-5	43,133	31	0.383	0.916	5,933	0	7,600	13,533	66.7	21,067	667
	EDC-D	Reference	EDC-D-1	15,083	41	0.278	0.912	4,917	1,750	1,000	7,667	3,083	3,250	667
			EDC-D-2	15,185	42	0.355	0.933	4,593	2,296	1,333	8,222	2,148	3,667	593
			EDC-D-3	7,040	51	0.298	0.934	1,920	613	453	2,987	853	2,640	333
			EDC-D-4	9,636	42	0.352	0.932	3,394	1,333	939	5,667	1,091	2,152	455
			EDC-D-5	9,056	30	0.304	0.890	3,278	1,528	250	5,056	2,000	1,222	194
	HAC-D	Exposed	HAC-D-1	4,107	30	0.248	0.866	400	253	760	1,413	93.3	1,627	880
			HAC-D-2	6,000	32	0.217	0.856	240	173	1,360	1,773	66.7	2,653	1,493
			HAC-D-3	4,947	33	0.327	0.907	560	240	1,373	2,173	40.0	2,053	613
			HAC-D-4	7,227	27	0.348	0.894	320	267	2,400	2,987	267	2,960	880
			HAC-D-5	12,500	28	0.423	0.916	600	533	3,367	4,500	167	7,030	670
2020	HAC-R1	Exposed	HAC-R1-1	38,600	25	0.182	0.780	2,200	0	5,933	8,133	16,800	9,933	600
			HAC-R1-2	49,600	29	0.115	0.699	2,133	0	1,067	3,200	26,133	11,733	267
			HAC-R1-3	27,000	26	0.246	0.843	1,533	0	3,067	4,600	9,400	10,667	333
			HAC-R1-4	26,800	31	0.234	0.862	2,733	0	2,600	5,333	8,600	10,133	600
			HAC-R1-5	42,933	29	0.158	0.782	2,067	0	3,133	5,200	18,933	14,667	400
	HAC-U		HAC-U-1	17,778	25	0.202	0.802	7,167	0	5,056	12,222	333	3,722	1,000
			HAC-U-2	21,600	23	0.232	0.812	8,267	0	2,933	11,200	333	3,800	5,800
			HAC-U-3	95,133	27	0.301	0.877	9,600	0	32,000	41,600	1,267	42,800	8,000
			HAC-U-4	42,267	31	0.216	0.851	3,600	0	17,933	21,533	867	16,467	1,733
			HAC-U-5	53,200	32	0.318	0.902	8,800	0	16,000	24,800	1,067	20,333	5,067

Notes: "-" = no data available, EPT = Ephemeroptera, Trichoptera, Plecoptera, DW = dry weight, WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U. LHC is the historical sampling area associated with HAC-D.

Table D.1: Benthic Invertebrate Community Metrics for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 2007 to 2022

Year	Area	Area Type	Station	Density (#/m^2)	Richness (# of taxa)	Simpson's Evenness	Simpson's Diversity	Ephemeroptera (#/m^2)	Plecoptera (#/m^2)	Trichoptera (#/m^2)	EPT (#/m^2)	Arachnida (#/m^2)	Chironomidae (#/m^2)	Non-Chironomidae Diptera (#/m^2)
2021	EDC-U	Reference	EDC-U-1	7,814	29	0.220	0.843	430	167	382	980	2,557	3,631	48.4
			EDC-U-2	2,452	40	0.440	0.943	480	136	108	724	251	1,104	21.5
			EDC-U-3	4,287	30	0.299	0.888	530	100	71.7	703	516	1,821	115
			EDC-U-4	4,344	29	0.424	0.919	946	115	43.0	1,104	244	2,437	71.7
			EDC-U-5	3,751	26	0.304	0.873	746	138	57.4	941	963	1,365	0
	HAC-R1	Exposed	HAC-R1-1	7,667	34	0.181	0.837	1,267	0	767	2,033	2,683	1,333	16.7
			HAC-R1-2	9,250	32	0.298	0.895	2,139	0	2,528	4,667	1,667	1,750	0
			HAC-R1-3	11,767	26	0.183	0.790	2,467	33.3	700	3,200	4,800	2,667	33.3
			HAC-R1-4	10,667	32	0.193	0.838	2,667	0	567	3,233	3,433	2,367	33.3
			HAC-R1-5	11,133	34	0.247	0.881	3,167	133	500	3,800	2,733	3,800	33.3
	HAC-U		HAC-U-1	13,292	24	0.340	0.878	6,458	0	3,583	10,042	250	2,458	125
			HAC-U-2	16,952	20	0.381	0.869	9,714	0	4,000	13,714	143	2,571	47.6
			HAC-U-3	12,593	28	0.257	0.861	6,704	0	2,407	9,111	148	2,296	222
			HAC-U-4	22,200	27	0.214	0.827	7,600	0	10,667	18,267	200	2,533	533
			HAC-U-5	15,952	31	0.177	0.818	4,524	47.6	7,476	12,048	0	2,190	286
	EDC-D	Reference	EDC-D-1	12,186	52	0.237	0.919	3,384	1,348	1,061	5,792	2,638	3,240	143
			EDC-D-2	36,559	43	0.223	0.896	6,595	1,004	3,154	10,753	2,867	21,290	1,290
			EDC-D-3	16,711	44	0.302	0.925	4,077	2,912	1,658	8,647	3,181	3,943	403
			EDC-D-4	25,305	44	0.348	0.935	5,018	2,151	2,151	9,319	2,796	11,828	430
			EDC-D-5	28,387	49	0.305	0.933	8,889	1,505	2,652	13,047	4,301	9,821	287
	HAC-D	Exposed	HAC-D-1	29,133	36	0.256	0.891	1,200	2,267	9,733	13,200	467	14,133	1,267
			HAC-D-2	13,833	30	0.314	0.894	333	958	4,250	5,542	167	7,458	667
			HAC-D-3	1,443	23	0.195	0.777	46.7	3.33	66.7	117	3.33	1,176	134
			HAC-D-4	4,760	21	0.158	0.698	120	13.3	240	373	13.3	4,293	80.7
			HAC-D-5	9,167	24	0.110	0.621	111	0	278	389	0	8,333	167
2022	EDC-U	Reference	EDC-U-1	27,814	26	0.161	0.761	4,086	3,441	358	7,885	12,903	4,875	143
			EDC-U-2	28,029	25	0.192	0.792	5,878	1,147	0	7,025	3,943	4,875	71.7
			EDC-U-3	39,211	31	0.255	0.873	8,961	1,434	10,538	20,932	5,806	9,749	0
			EDC-U-4	9,032	34	0.335	0.912	3,441	1,523	806	5,771	1,326	1,111	35.8
			EDC-U-5	7,860	29	0.383	0.910	1,382	794	1,126	3,303	1,357	1,920	102
	HAC-R1	Exposed	HAC-R1-1	52,067	26	0.239	0.839	3,133	0	10,067	13,200	2,733	32,467	1,333
			HAC-R1-2	52,133	25	0.195	0.795	3,000	0	13,933	16,933	1,133	31,200	1,600
			HAC-R1-3	60,933	36	0.197	0.859	3,333	0	7,733	11,067	6,333	38,800	1,267
			HAC-R1-4	28,267	30	0.384	0.913	2,667	0	5,200	7,867	1,133	15,933	267
			HAC-R1-5	28,933	29	0.331	0.896	1,533	0	4,333	5,867	933	19,867	400
	HAC-U		HAC-U-1	36,333	34	0.263	0.888	5,133	0	10,733	15,867	467	15,067	600
			HAC-U-2	28,267	30	0.371	0.910	3,933	66.7	7,067	11,067	1,867	10,533	200
			HAC-U-3	37,400	32	0.230	0.864	4,933	0	13,867	18,800	1,000	11,600	733
			HAC-U-4	39,200	31	0.295	0.891	4,933	0	13,467	18,400	733	15,261	1,473
			HAC-U-5	27,533	33	0.400	0.924	4,133	0	5,267	9,400	1,200	9,200	533

Notes: "-" = no data available, EPT = Ephemeroptera, Trichoptera, Plecoptera, DW = dry weight, WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U. LHC is the historical sampling area associated with HAC-D.

Table D.1: Benthic Invertebrate Community Metrics for Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-U, EDC-D; Reference), 2007 to 2022

Year	Area	Area Type	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2007	EDC-U (UER)[a]	Reference (Pre- Breach)	EDC-U-1	344	50.9	6.33	8.13	65.4	5.20	20.8	1.12	1.56	-	-
			EDC-U-2	0	32.1	8.22	13.8	54.1	10.2	30.1	0.598	0	-	-
			EDC-U-3	115	37.4	4.07	4.83	46.3	12.9	35.2	0.522	0.283	-	-
			EDC-U-4	0	39.7	8.05	18.8	66.6	3.46	24.5	0.369	0	-	-
			EDC-U-5	459	57.0	11.9	4.76	73.6	5.98	14.1	0.363	0.703	-	-
	HAC-U (UHC)[a]	Exposed (Pre- Breach)	HAC-U-1	344	41.3	6.56	4.20	52.1	2.53	29.1	0.654	0.491	-	-
			HAC-U-2	746	41.0	5.80	4.40	51.2	23.4	15.4	1.19	2.20	-	-
			HAC-U-3	459	42.5	7.57	3.93	54.0	4.27	31.1	0.813	1.63	-	-
			HAC-U-4	229	42.3	12.8	5.96	61.1	14.9	14.4	1.22	0.542	-	-
			HAC-U-5	832	36.9	11.9	6.09	54.9	16.5	18.1	0.927	3.84	-	-
	HAC-D (LHC)[a]	Exposed (Pre- Breach)	HAC-D-1	115	36.0	18.4	6.99	61.4	5.35	26.8	0.582	0.233	-	-
			HAC-D-2	172	36.2	22.6	6.86	65.7	6.77	22.3	0.752	0.451	-	-
			HAC-D-3	0	44.4	17.0	3.03	64.4	8.82	16.1	1.20	0	-	-
			HAC-D-4	0	40.2	16.8	1.84	58.8	6.74	28.6	0.963	0	-	-
			HAC-D-5	115	13.5	3.13	0.950	17.6	2.72	77.2	0.742	0.247	-	-
2017	EDC-D	Reference	EDC-D-1	0	34.2	10.7	7.71	52.6	6.34	32.5	7.44	0	0.836	5.55
			EDC-D-2	0	38.6	6.72	5.97	51.2	4.73	36.3	5.47	0	1.51	8.82
			EDC-D-3	71.7	27.2	12.2	6.19	45.6	2.84	47.9	2.13	0.102	3.44	21.6
			EDC-D-4	215	12.6	10.5	4.84	28.0	2.32	65.0	2.32	0.632	0.789	8.59
			EDC-D-5	0	30.6	10.6	6.63	47.8	7.66	35.6	6.66	0	3.88	33.3
	HAC-D	Exposed	HAC-D-1	167	18.8	18.8	21.0	58.6	0.637	23.2	12.1	4.46	0.111	0.706
			HAC-D-2	377	10.1	11.8	25.2	47.1	1.32	20.8	20.6	8.77	0.376	1.55
			HAC-D-3	430	13.7	15.6	26.2	55.5	0.305	17.7	14.3	9.15	0.399	2.16
			HAC-D-4	1,336	5.37	12.4	7.63	25.4	0.565	37.9	12.2	23.2	0.665	2.51
			HAC-D-5	332	8.41	17.5	12.6	38.5	0.971	40.1	10.7	8.09	0.442	1.71
2018	EDC-U	Reference	EDC-U-1	256	2.98	5.15	4.07	12.2	37.4	44.7	1.08	1.36	3.03	20.2
			EDC-U-2	7.17	0	0	0	0	32.0	56.0	2.00	4.00	0.0100	0.0710
			EDC-U-3	753	8.46	11.3	1.03	20.8	8.21	43.1	1.28	10.8	3.70	14.6
			EDC-U-4	410	5.47	11.2	1.22	17.9	9.73	55.0	2.13	9.73	0.177	1.37
			EDC-U-5	93.2	4.97	30.2	1.07	36.2	18.5	33.4	0.533	4.62	0.0548	0.419
	HAC-R1	Exposed	HAC-R1-1	430	3.38	0.242	15.0	18.6	11.6	60.1	0	2.90	0.502	4.50
			HAC-R1-2	205	1.64	0	15.6	17.2	6.83	66.9	0	1.09	0.814	4.97
			HAC-R1-3	438	2.43	0.270	11.3	14.0	23.4	54.2	0.539	2.96	0.434	2.27
			HAC-R1-4	1,505	0.563	0	18.0	18.6	7.61	60.9	0	5.92	1.38	7.40
			HAC-R1-5	1,935	1.44	0	14.4	15.8	2.87	69.0	0	7.76	0.889	4.51
	HAC-U		HAC-U-1	12,545	0.387	0	12.5	12.9	0	63.1	1.03	22.6	2.59	13.4
			HAC-U-2	6,165	1.81	0	14.9	16.7	0	61.4	5.98	15.6	1.20	9.26
			HAC-U-3	5,233	1.92	0	12.3	14.2	0	65.4	2.88	17.6	0.910	6.29
			HAC-U-4	12,545	0.478	0	5.57	6.05	0	62.3	0.637	27.9	0.824	3.89
			HAC-U-5	3,154	2.16	0	11.9	14.0	0	61.2	12.4	11.9	0.674	3.71

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Year	Area	Area Type	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2019	EDC-U	Reference	EDC-U-1	55.6	36.0	7.81	1.20	45.0	26.4	24.0	1.20	0.300	1.34	13.5
			EDC-U-2	357	49.5	5.71	0.317	55.6	5.71	27.6	2.86	4.76	0.336	1.63
			EDC-U-3	400	27.5	4.87	0	32.4	38.2	24.1	1.46	1.46	3.04	17.6
			EDC-U-4	1,167	32.0	6.58	0	38.6	7.52	40.1	0.627	8.78	0.462	2.50
			EDC-U-5	1,533	42.0	2.23	1.59	45.9	2.23	33.8	0.637	14.6	0.287	1.56
	HAC-R1	Exposed	HAC-R1-1	533	32.5	0	25.2	57.8	14.4	23.2	0.748	1.50	5.53	42.3
			HAC-R1-2	133	22.8	0	25.9	48.7	14.8	28.3	5.47	0.365	5.05	30.5
			HAC-R1-3	267	23.6	0	22.1	45.7	7.61	42.4	1.79	0.597	3.07	22.5
			HAC-R1-4	1,000	19.6	0	17.1	36.7	11.9	43.1	1.13	2.82	1.93	12.1
			HAC-R1-5	267	24.3	0.265	32.0	56.6	1.06	31.8	8.99	1.06	2.37	15.6
	HAC-U		HAC-U-1	0	24.2	0	28.1	52.3	0.526	35.8	9.30	0	12.3	53.7
			HAC-U-2	4,600	16.9	0	22.5	39.4	0	49.0	3.31	8.16	3.88	29.7
			HAC-U-3	3,667	16.3	0	24.5	40.9	0	48.2	4.37	6.33	5.54	33.9
			HAC-U-4	3,200	14.3	0.163	27.0	41.5	0.489	45.1	4.56	7.82	2.99	19.7
			HAC-U-5	4,667	13.8	0	17.6	31.4	0.155	48.8	1.55	10.8	1.85	11.7
	EDC-D	Reference	EDC-D-1	0	32.6	11.6	6.63	50.8	20.4	21.6	4.42	0	1.56	7.52
			EDC-D-2	37.0	30.2	15.1	8.78	54.1	14.2	24.1	3.90	0.244	0.948	5.21
			EDC-D-3	40.0	27.3	8.71	6.44	42.4	12.1	37.5	4.73	0.568	0.259	1.41
			EDC-D-4	0	35.2	13.8	9.75	58.8	11.3	22.3	4.72	0	1.33	6.36
			EDC-D-5	0	36.2	16.9	2.76	55.8	22.1	13.5	2.15	0	1.06	4.29
	HAC-D	Exposed	HAC-D-1	53.3	9.74	6.17	18.5	34.4	2.27	39.6	21.4	1.30	0.417	1.61
			HAC-D-2	0	4.00	2.89	22.7	29.6	1.11	44.2	24.9	0	0.345	1.44
			HAC-D-3	40.0	11.3	4.85	27.8	43.9	0.809	41.5	12.4	0.809	0.312	1.32
			HAC-D-4	107	4.43	3.69	33.2	41.3	3.69	41.0	12.2	1.48	0.589	2.43
			HAC-D-5	0	4.80	4.27	26.9	36.0	1.33	56.2	5.36	0	1.03	3.94
2020	HAC-R1	Exposed	HAC-R1-1	400	5.70	0	15.4	21.1	43.5	25.7	1.55	1.04	1.54	17.7
			HAC-R1-2	1,667	4.30	0	2.15	6.45	52.7	23.7	0.538	3.36	3.33	12.6
			HAC-R1-3	400	5.68	0	11.4	17.0	34.8	39.5	1.23	1.48	2.52	13.8
			HAC-R1-4	467	10.2	0	9.70	19.9	32.1	37.8	2.24	1.74	8.89	47.2
			HAC-R1-5	1,133	4.81	0	7.30	12.1	44.1	34.2	0.932	2.64	3.58	13.3
	HAC-U		HAC-U-1	0	40.3	0	28.4	68.8	1.87	20.9	5.62	0	3.97	21.2
			HAC-U-2	66.7	38.3	0	13.6	51.9	1.54	17.6	26.9	0.309	1.53	10.3
			HAC-U-3	133	10.1	0	33.6	43.7	1.33	45.0	8.41	0.140	12.6	70.4
			HAC-U-4	533	8.52	0	42.4	51.0	2.05	39.0	4.10	1.26	4.87	23.3
			HAC-U-5	667	16.5	0	30.1	46.6	2.01	38.2	9.52	1.25	3.67	18.1

Notes: "-" = no data available, EPT = Ephemeroptera, Trichoptera, Plecoptera, DW = dry weight, WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U.

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Year	Area	Area Type	Station	Oligochaeta (#/m^2)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Arachnida (%)	Chironomidae (%)	Non-Chironomidae Diptera (%)	Oligochaeta (%)	Dry Weight Biomass (g/m^2 DW)	Wet Weight Biomass (g/m^2 WW)
2021	EDC-U	Reference	EDC-U-1	215	5.50	2.14	4.89	12.5	32.7	46.5	0.620	2.75	0.346	1.71
			EDC-U-2	151	19.6	5.56	4.39	29.5	10.2	45.0	0.877	6.14	1.27	5.84
			EDC-U-3	1,061	12.4	2.34	1.67	16.4	12.0	42.5	2.68	24.8	0.222	1.18
			EDC-U-4	330	21.8	2.64	0.990	25.4	5.61	56.1	1.65	7.59	0.376	2.36
			EDC-U-5	252	19.9	3.67	1.53	25.1	25.7	36.4	0	6.73	0.475	1.98
	HAC-R1	Exposed	HAC-R1-1	183	16.5	0	10.0	26.5	35.0	17.4	0.217	2.39	1.98	8.97
			HAC-R1-2	55.6	23.1	0	27.3	50.5	18.0	18.9	0	0.601	2.84	11.3
			HAC-R1-3	0	21.0	0.283	5.95	27.2	40.8	22.7	0.283	0	1.63	7.11
			HAC-R1-4	100	25.0	0	5.31	30.3	32.2	22.2	0.312	0.938	1.07	4.74
			HAC-R1-5	167	28.4	1.20	4.49	34.1	24.6	34.1	0.299	1.50	6.80	19.8
	HAC-U		HAC-U-1	0	48.6	0	27.0	75.5	1.88	18.5	0.940	0	2.80	15.0
			HAC-U-2	47.6	57.3	0	23.6	80.9	0.843	15.2	0.281	0.281	1.10	6.82
			HAC-U-3	185	53.2	0	19.1	72.3	1.18	18.2	1.76	1.47	4.06	15.8
			HAC-U-4	133	34.2	0	48.0	82.3	0.901	11.4	2.40	0.601	2.41	16.4
			HAC-U-5	143	28.4	0.299	46.9	75.5	0	13.7	1.79	0.896	3.26	14.9
	EDC-D	Reference	EDC-D-1	86.0	27.8	11.1	8.71	47.5	21.6	26.6	1.18	0.706	2.07	6.93
			EDC-D-2	0	18.0	2.75	8.63	29.4	7.84	58.2	3.53	0	1.25	6.23
			EDC-D-3	0	24.4	17.4	9.92	51.7	19.0	23.6	2.41	0	3.37	14.3
			EDC-D-4	143	19.8	8.50	8.50	36.8	11.1	46.7	1.70	0.567	2.67	10.2
			EDC-D-5	0	31.3	5.30	9.34	46.0	15.2	34.6	1.01	0	3.63	14.6
	HAC-D	Exposed	HAC-D-1	66.7	4.12	7.78	33.4	45.3	1.60	48.5	4.35	0.229	11.0	36.3
			HAC-D-2	0	2.41	6.93	30.7	40.1	1.20	53.9	4.82	0	2.23	9.05
			HAC-D-3	10.0	3.23	0.231	4.62	8.08	0.231	81.5	9.26	0.693	0.0107	0.0923
			HAC-D-4	0	2.52	0.280	5.04	7.84	0.280	90.2	1.70	0	0.0280	0.0560
			HAC-D-5	250	1.21	0	3.03	4.24	0	90.9	1.82	2.73	0.108	0.458
2022	EDC-U	Reference	EDC-U-1	1,434	14.7	12.4	1.29	28.4	46.4	17.5	0.515	5.15	21.7	77.2
			EDC-U-2	215	21.0	4.09	0	25.1	14.1	17.4	0.256	0.767	1.12	4.79
			EDC-U-3	645	22.9	3.66	26.9	53.4	14.8	24.9	0	1.65	1.55	7.18
			EDC-U-4	305	38.1	16.9	8.93	63.9	14.7	12.3	0.397	3.37	0.797	3.95
			EDC-U-5	179	17.6	10.1	14.3	42.0	17.3	24.4	1.30	2.28	0.264	1.35
	HAC-R1	Exposed	HAC-R1-1	467	6.02	0	19.3	25.4	5.25	62.4	2.56	0.896	2.47	13.9
			HAC-R1-2	0	5.75	0	26.7	32.5	2.17	59.9	3.07	0	3.05	17.0
			HAC-R1-3	267	5.47	0	12.7	18.2	10.4	63.7	2.08	0.438	1.56	8.21
			HAC-R1-4	400	9.43	0	18.4	27.8	4.01	56.4	0.943	1.42	2.43	11.1
			HAC-R1-5	333	5.30	0	15.0	20.3	3.23	68.7	1.38	1.15	1.17	6.56
	HAC-U		HAC-U-1	66.7	14.1	0	29.5	43.7	1.28	41.5	1.65	0.183	6.37	21.0
			HAC-U-2	133	13.9	0.236	25.0	39.1	6.60	37.3	0.708	0.472	2.75	10.4
			HAC-U-3	133	13.2	0	37.1	50.3	2.67	31.0	1.96	0.357	3.52	15.3
			HAC-U-4	66.7	12.6	0	34.4	46.9	1.87	38.9	3.76	0.170	3.12	15.8
			HAC-U-5	200	15.0	0	19.1	34.1	4.36	33.4	1.94	0.726	7.06	28.9

Notes: "-" = no data available, EPT = Ephemeroptera, Trichoptera, Plecoptera, DW = dry weight, WW = wet weight. Reference area EDC-U not sampled in 2020 due to habitat differences (in water depth and flow) relative to the remediated areas HAC-R1 and HAC-U.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. UER is the pre-breach sampling area associated with EDC-U. LHC is the historical sampling area associated with HAC-D.

APPENDIX E
PERIPHYTON TISSUE QUALITY

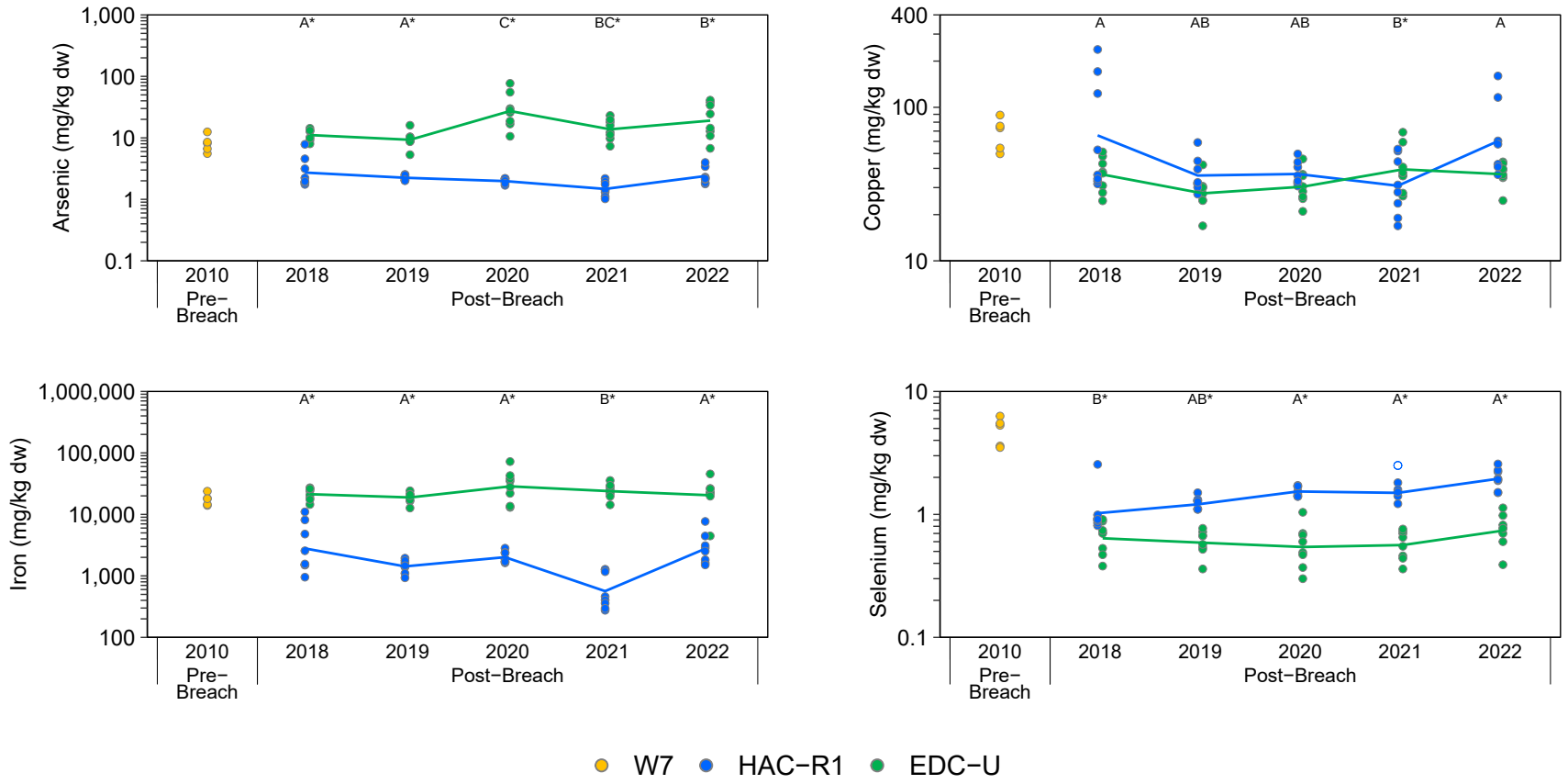

Figure E.1: Periphyton Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

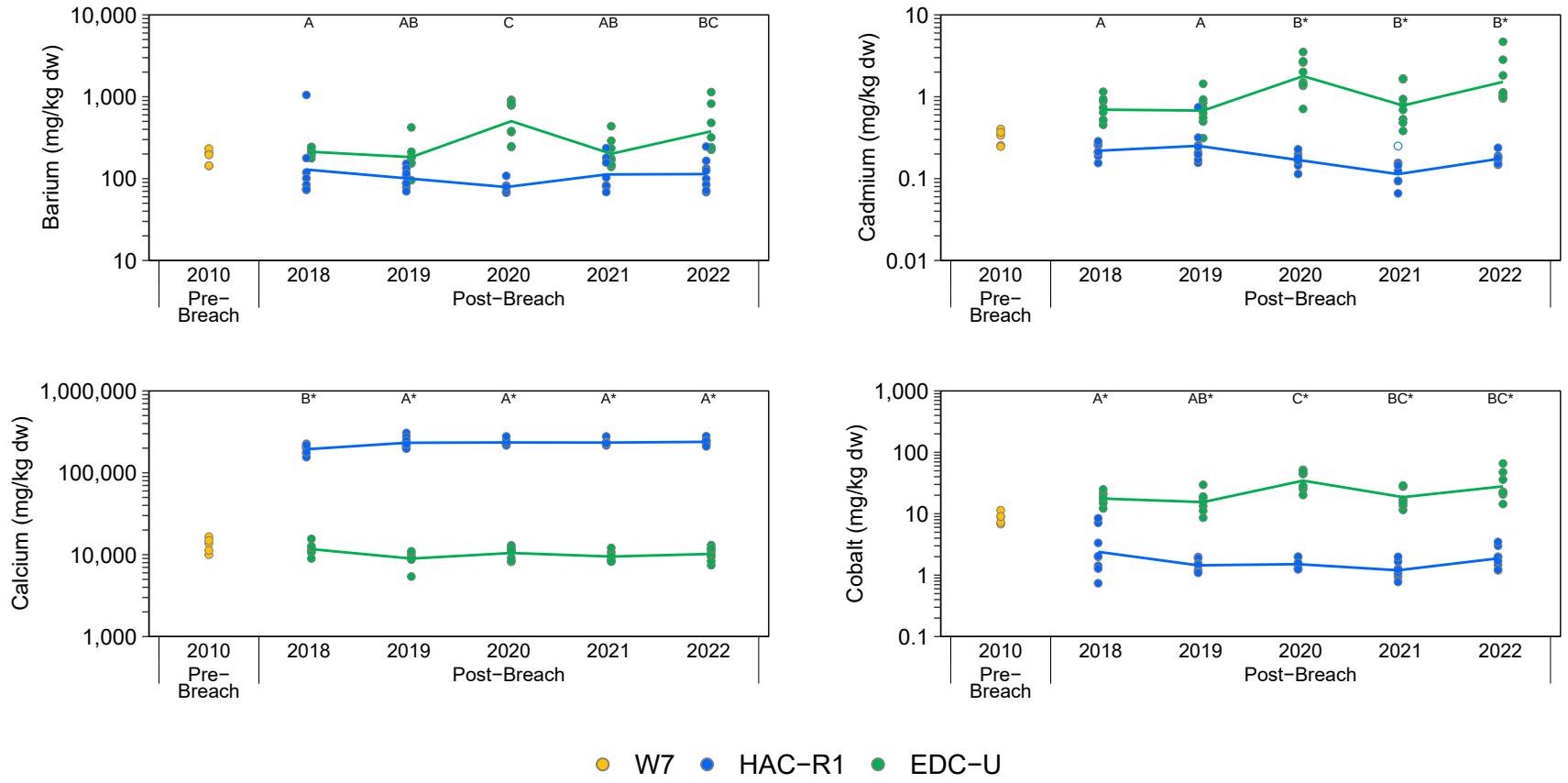

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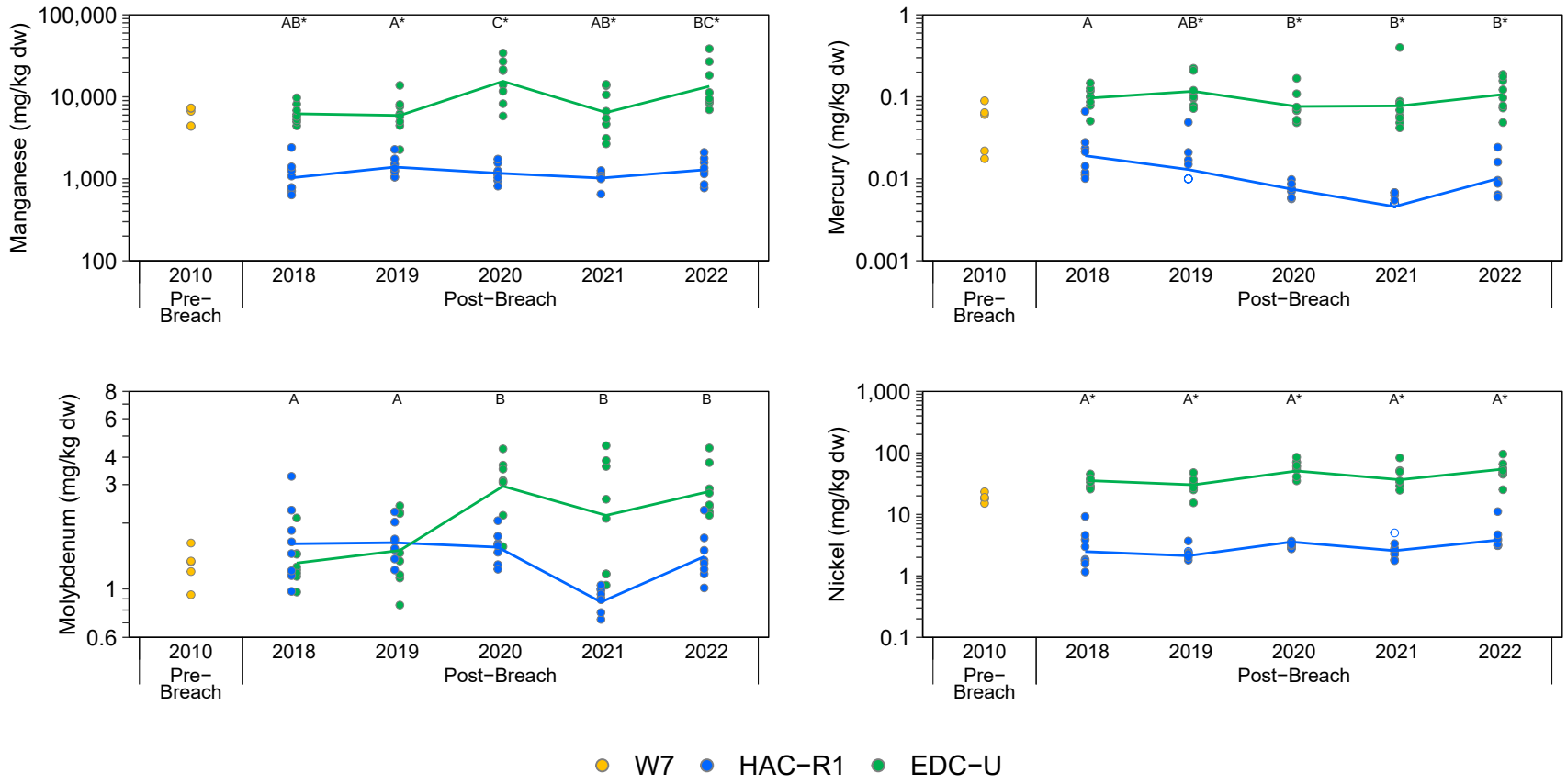

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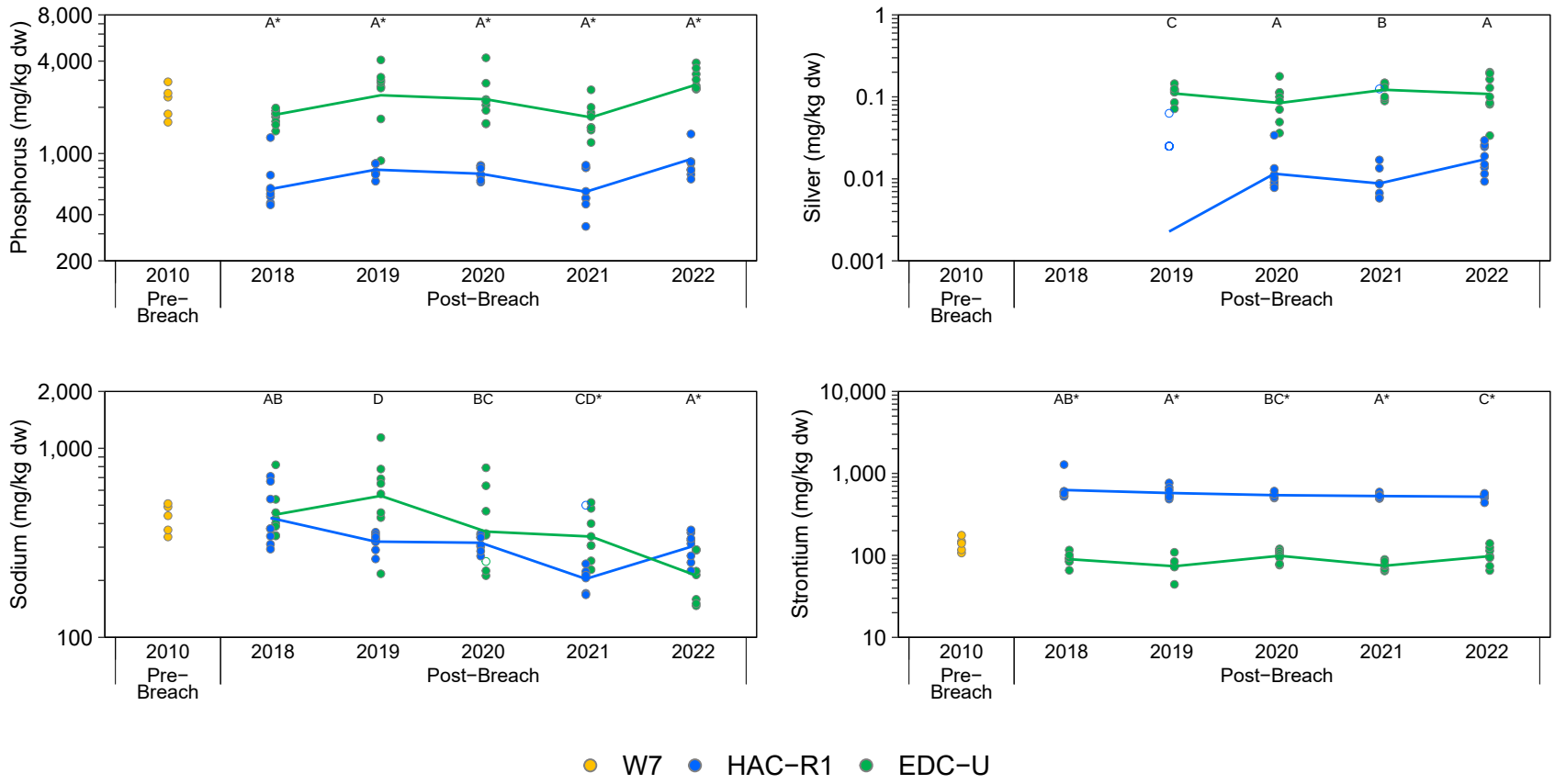

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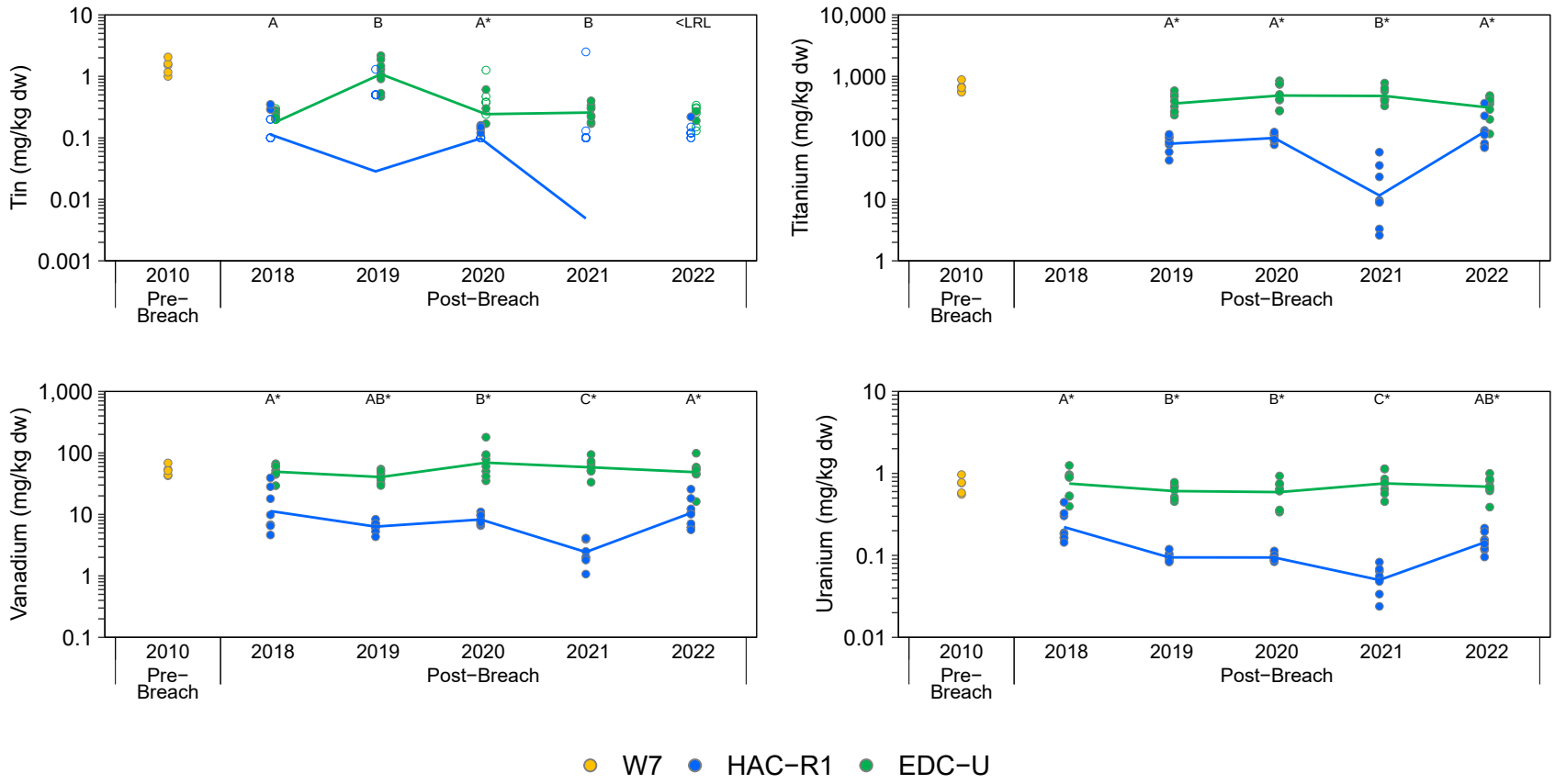

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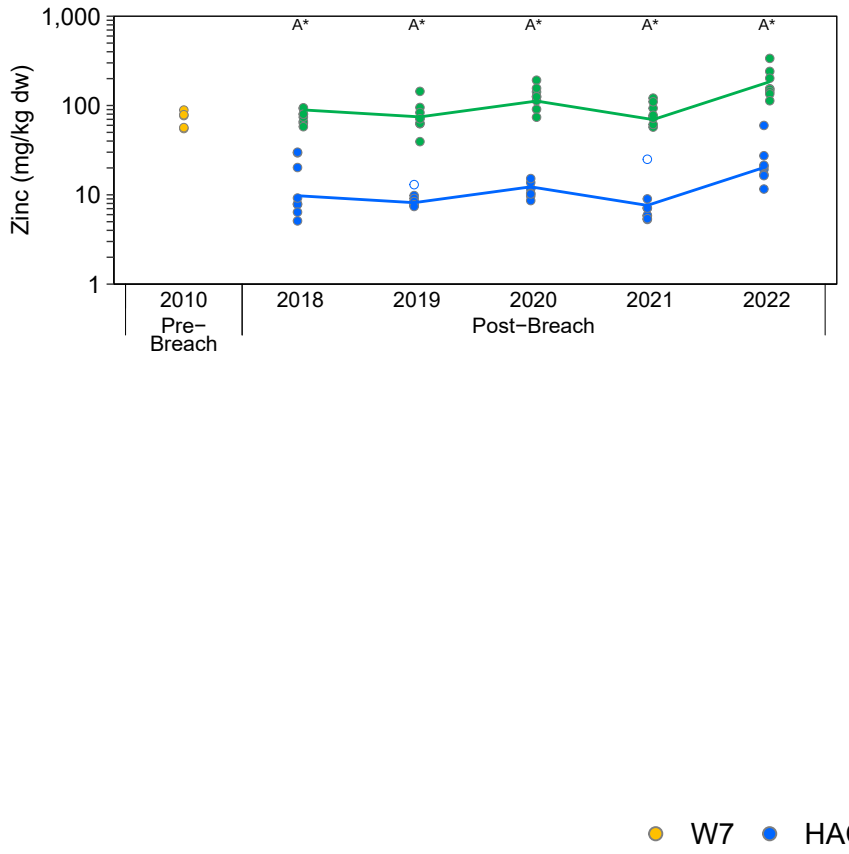

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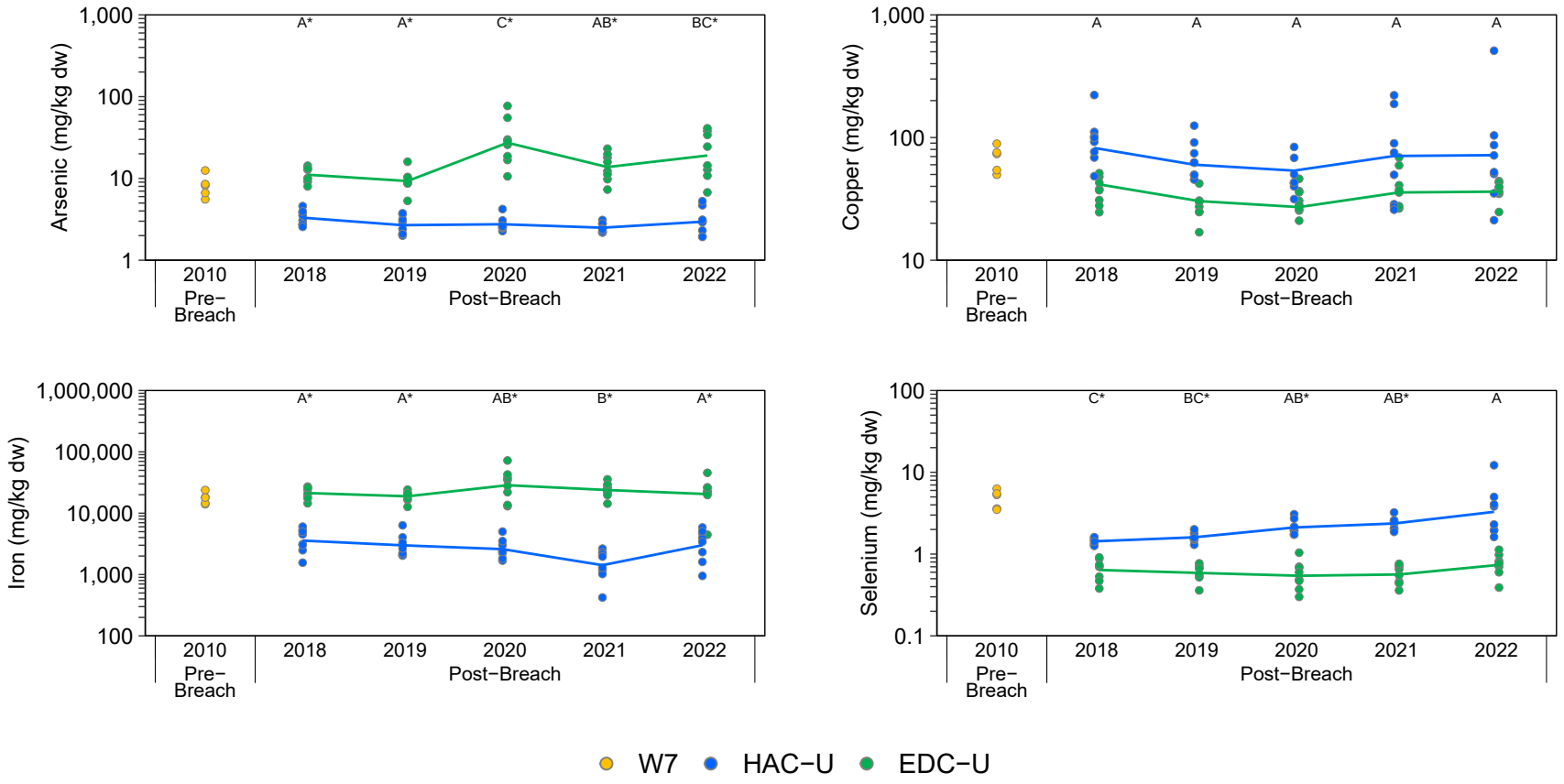

Figure E.2: Periphyton Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

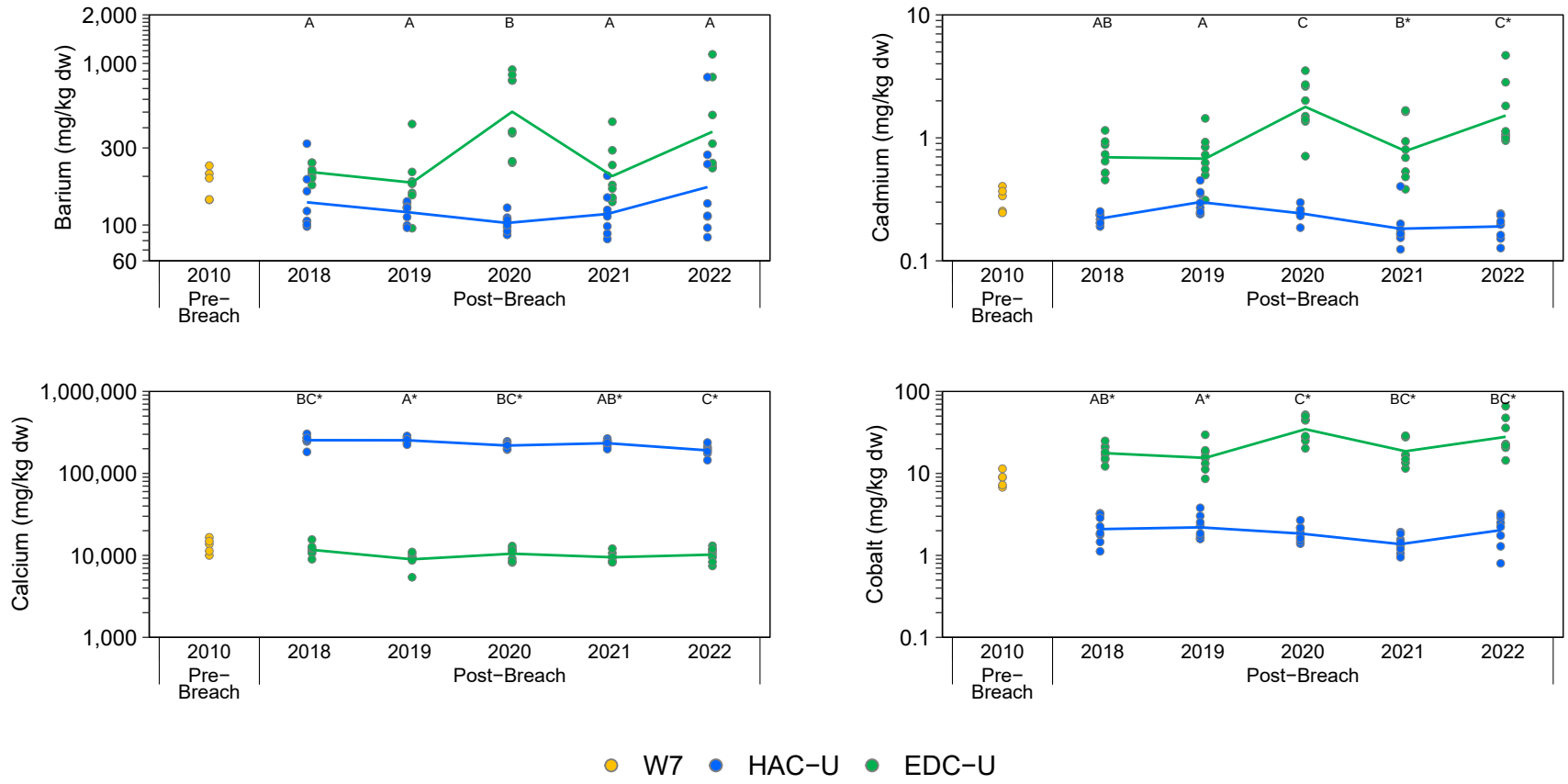

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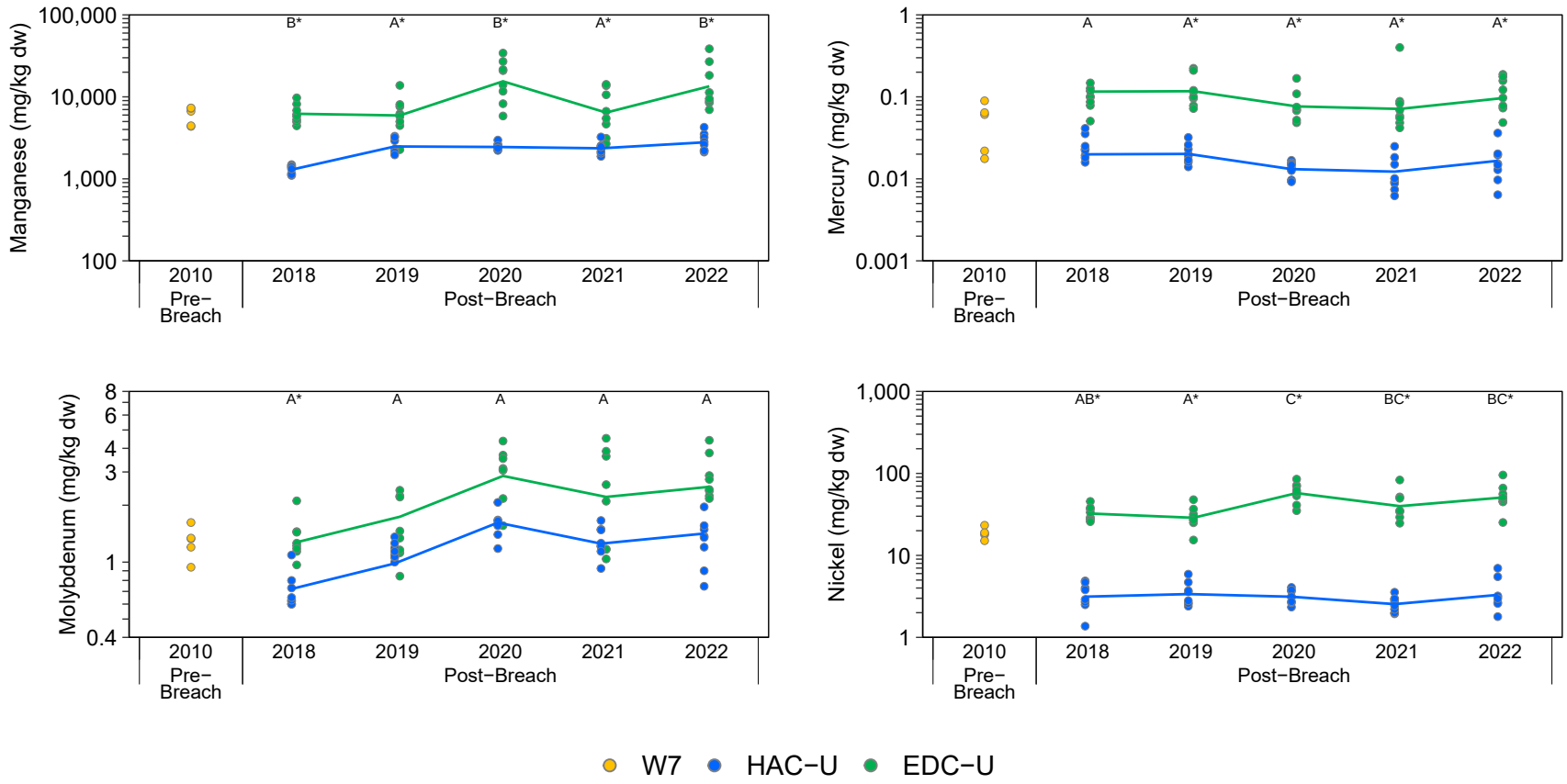

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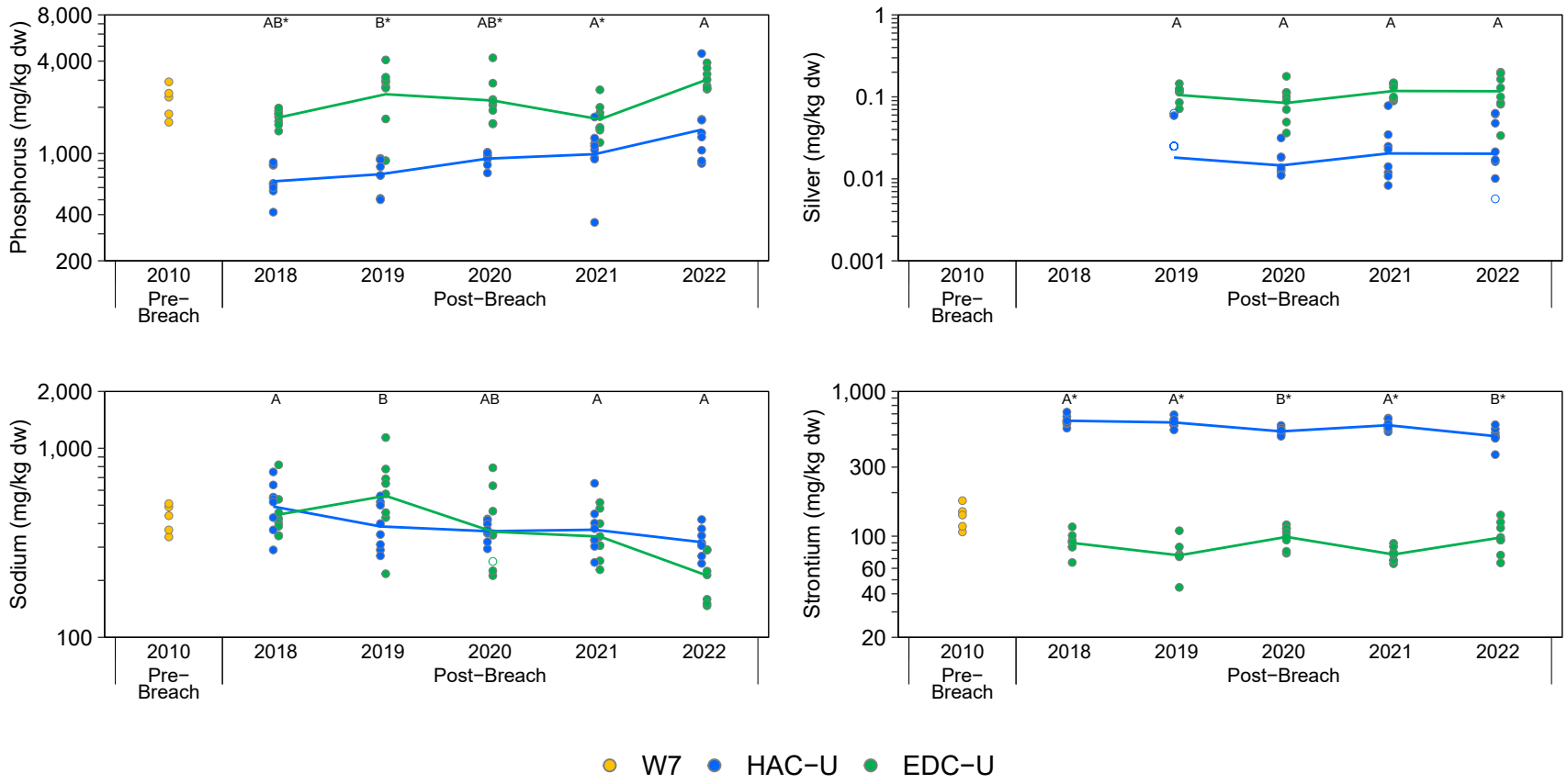

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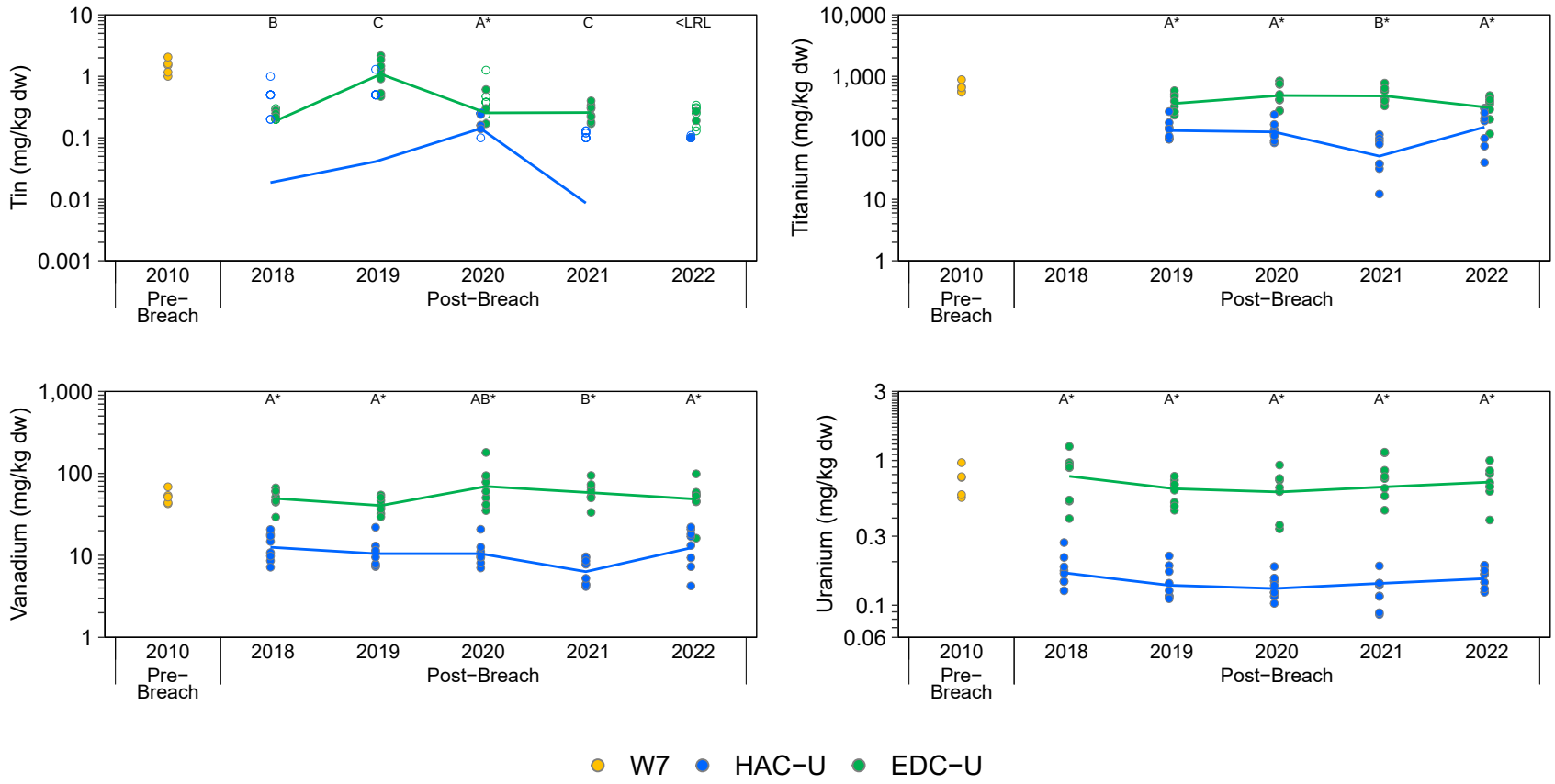

Figure E.2: Periphyton Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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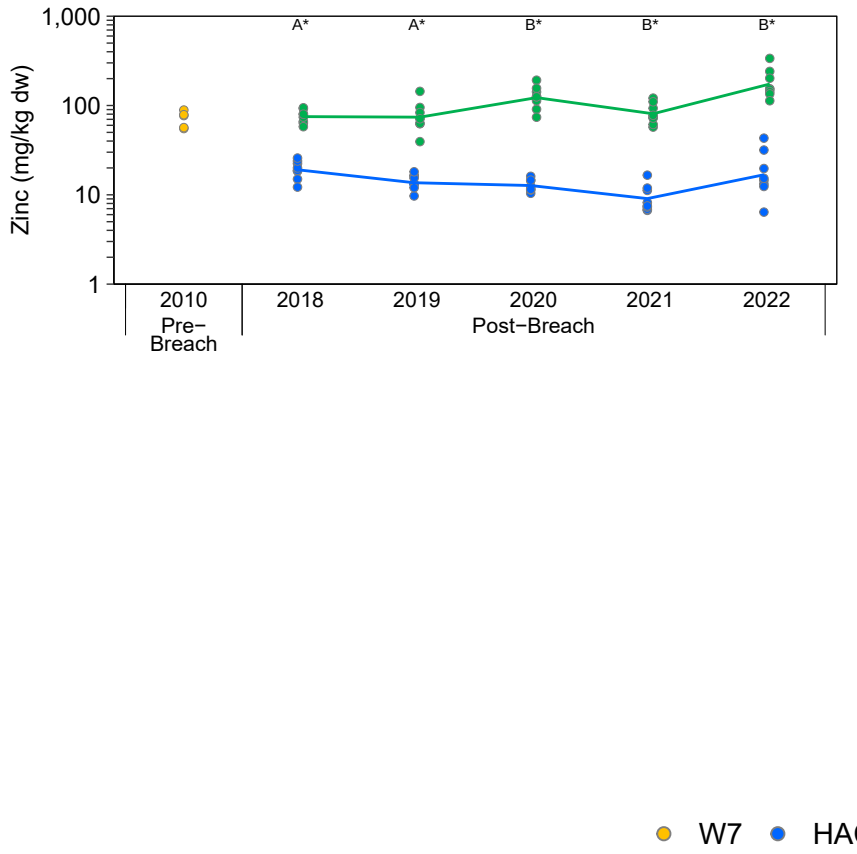

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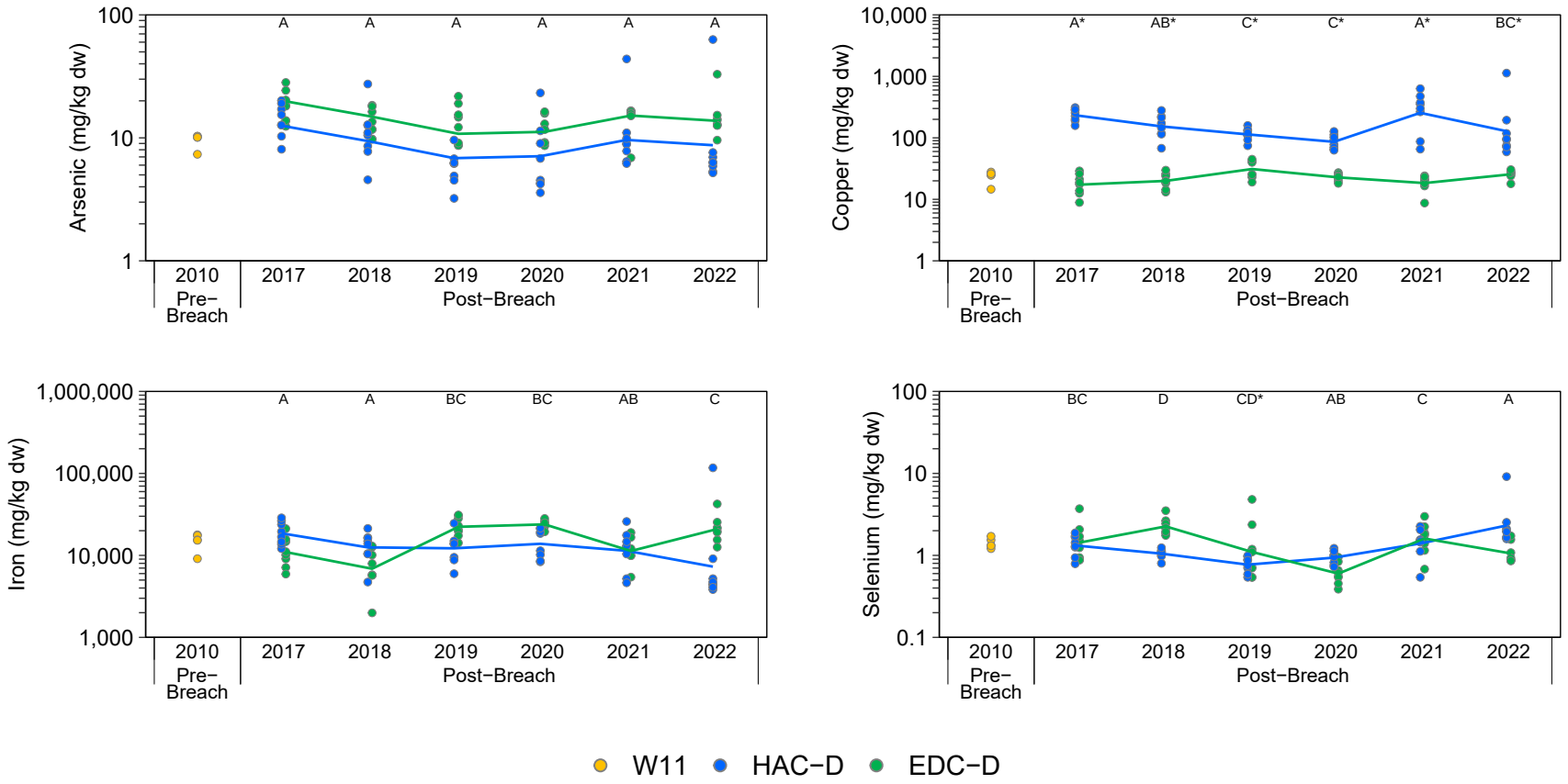

Figure E.3: Periphyton Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

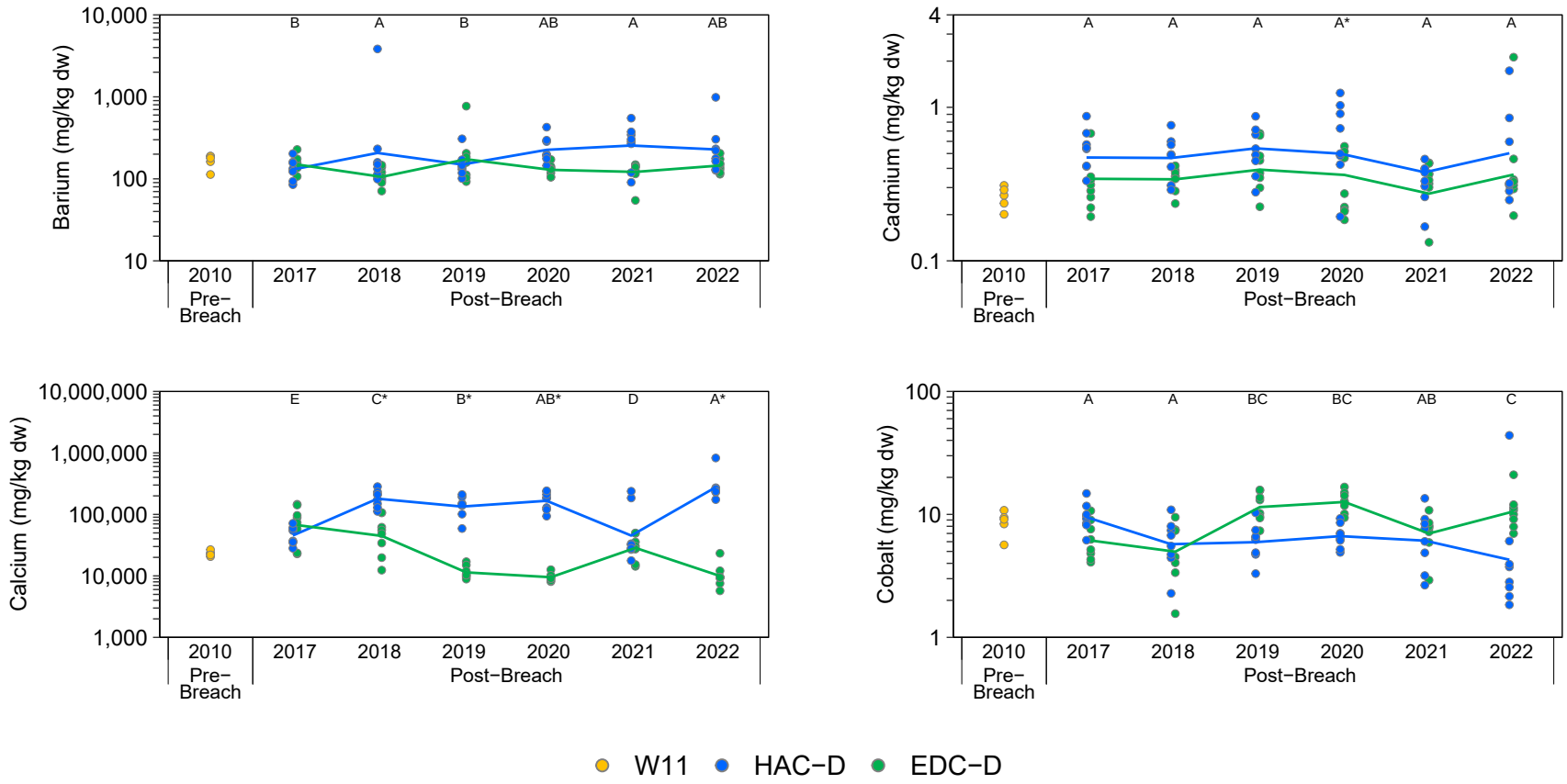

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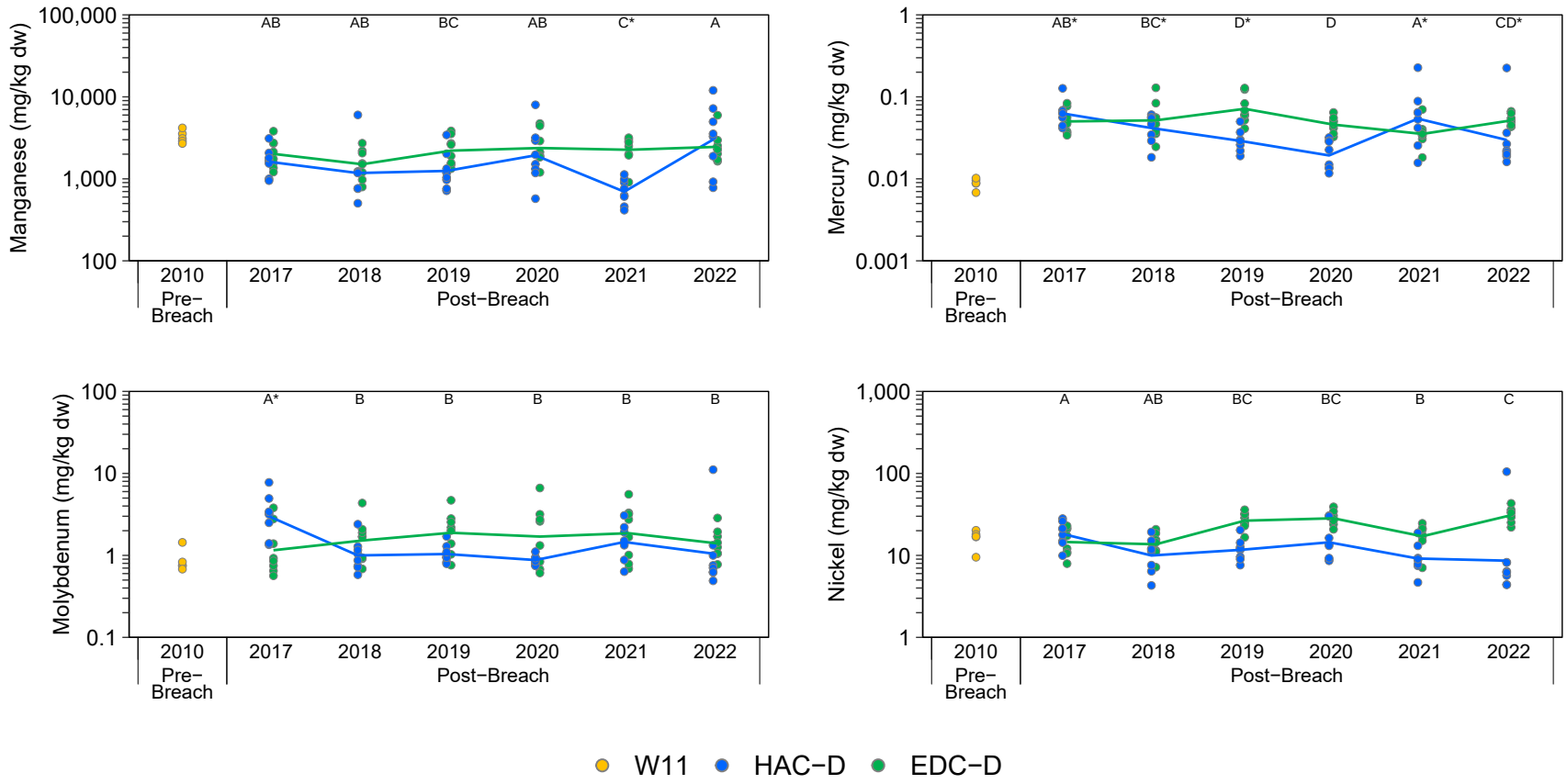

Figure E.3: Periphyton Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

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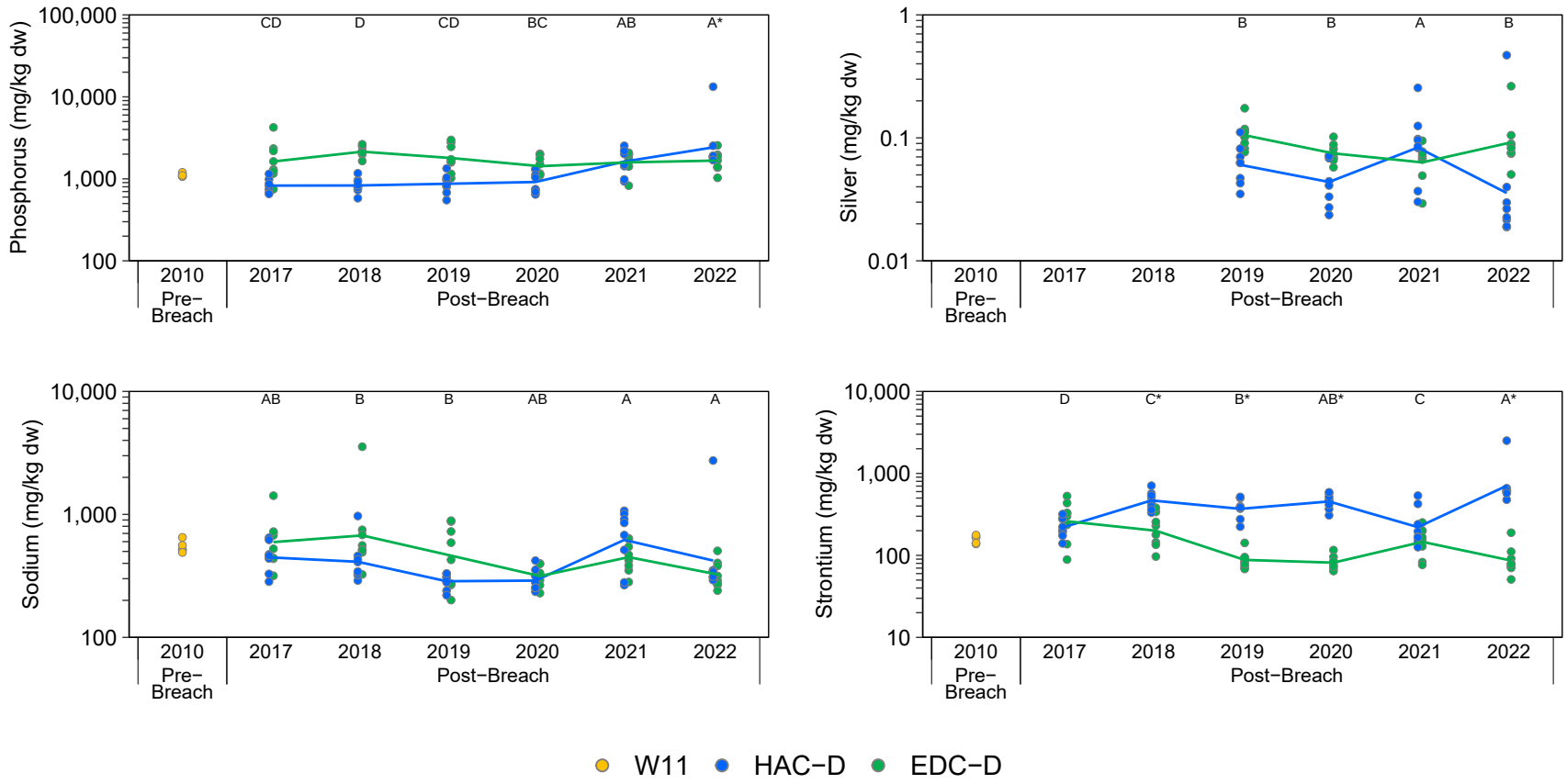

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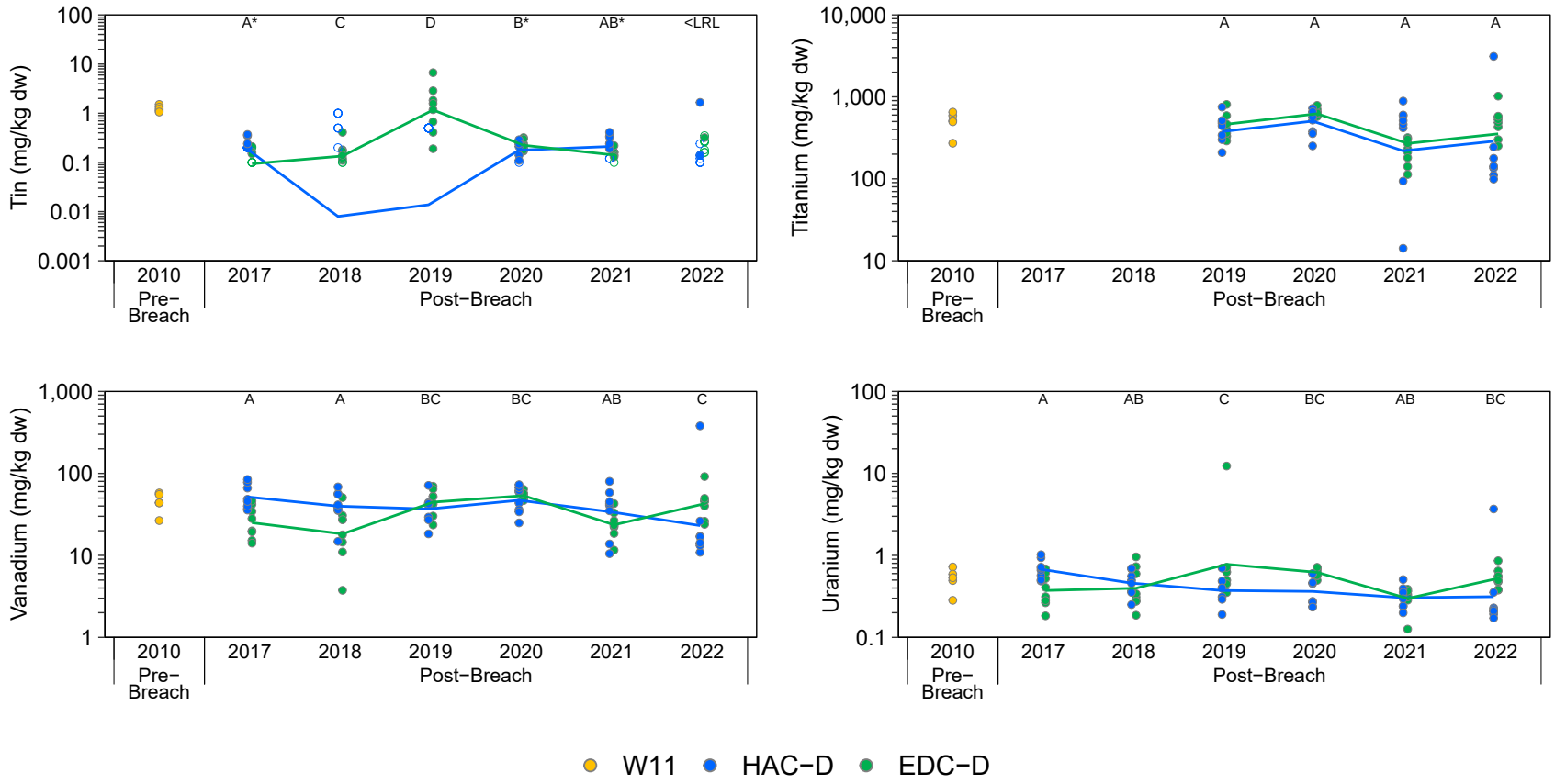

Figure E.3: Periphyton Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

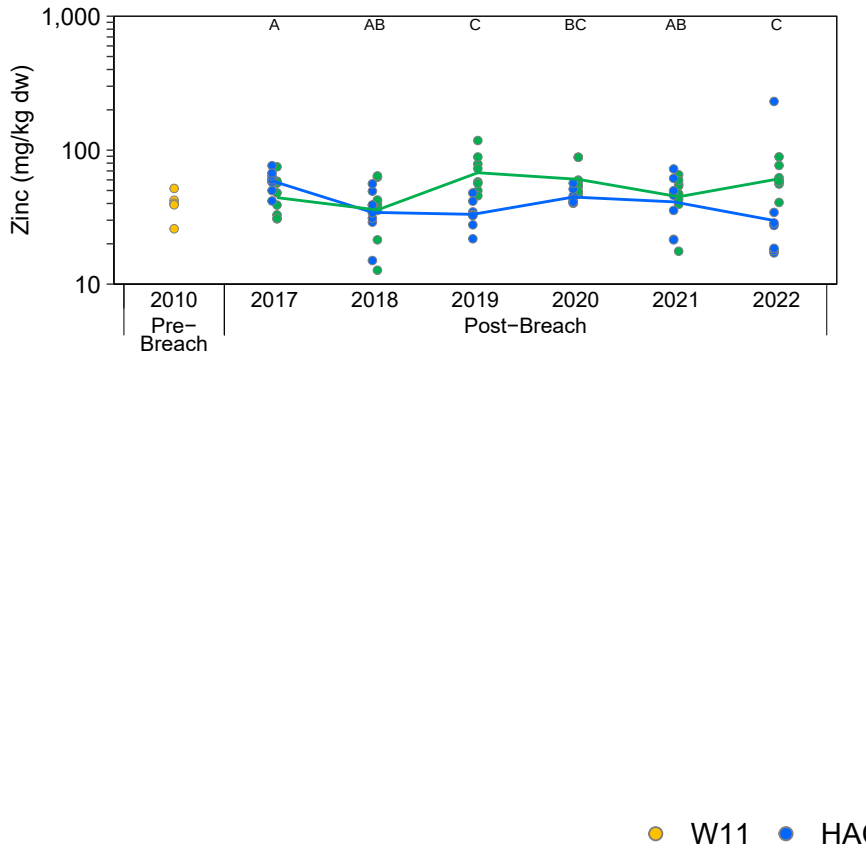

Figure E.3: Periphyton Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2010	HAC-U (UHP)[a]	Exposed	UHP-1	88.9	12,900	<0.10	5.55	143	<0.60	<0.60	-	0.254	9,990	-	36.1	6.77	49.8	-	14,000	4.19	9.10	4,340	4,360
			UHP-2	92.7	17,200	<0.15	8.18	208	<0.90	<0.90	-	0.337	13,700	-	31.9	8.94	73.4	-	18,200	5.56	10.7	5,630	6,670
			UHP-3	91.1	13,600	0.120	6.65	144	<0.60	<0.60	-	0.246	11,300	-	27.0	7.23	54.3	-	14,500	4.22	9.90	4,860	4,440
			UHP-4	92.7	20,900	0.150	12.5	233	<0.90	<0.90	-	0.404	16,600	-	45.7	11.4	89.0	-	23,800	6.74	14.4	6,960	7,250
			UHP-5	94.2	16,800	<0.15	8.53	195	<0.90	<0.90	-	0.368	14,900	-	32.8	9.01	75.5	-	18,000	5.39	11.1	5,850	7,320
	HAC-D (LHC)[a]	Exposed	LHC-1	92.3	13,700	<0.15	10.3	189	<0.90	<0.90	-	0.267	23,400	-	31.2	10.8	27.8	-	17,800	5.17	10.5	5,880	3,540
			LHC-2	92.4	11,600	<0.15	10.1	162	<0.90	<0.90	-	0.237	23,400	-	30.1	9.43	25.0	-	17,400	4.85	8.20	5,030	3,100
			LHC-3	95.1	10,900	<0.20	10.3	189	<1.2	<1.2	-	0.310	26,700	-	25.9	8.36	24.6	-	15,400	4.34	7.80	4,950	2,880
			LHC-4	94.5	10,400	<0.20	10.1	179	<1.2	<1.2	-	0.290	20,600	-	29.2	9.12	26.1	-	15,300	4.14	7.70	4,550	4,180
			LHC-5	92.9	5,660	<0.15	7.35	113	<0.90	<0.90	-	0.201	21,900	-	16.4	5.65	14.6	-	9,110	2.38	3.90	3,090	2,700
2017	EDC-D	Reference	EDC-D-1	80.0	7,080	0.0290	13.8	107	0.273	0.0470	33.6	0.260	22,800	0.718	24.6	9.01	21.2	-	14,700	4.40	9.78	5,410	1,570
			EDC-D-2	91.5	5,390	0.106	20.3	141	0.176	0.0300	67.2	0.286	88,700	0.567	9.88	4.82	17.6	-	9,070	1.98	4.03	4,840	2,700
			EDC-D-3	94.7	5,030	0.109	28.2	228	0.240	0.0330	177	0.676	146,000	0.657	12.2	6.26	29.0	-	10,100	1.96	4.00	8,140	3,810
			EDC-D-4	91.3	8,350	0.114	18.3	156	0.247	0.0490	187	0.313	58,000	0.921	18.6	7.59	18.8	-	15,700	3.18	7.00	6,110	1,750
			EDC-D-5	87.3	11,900	0.115	24.3	175	0.312	0.0720	40.1	0.338	23,600	1.33	27.4	10.7	26.0	-	21,200	4.67	10.2	6,500	2,740
			EDC-D-6	83.3	3,960	0.0520	12.4	143	0.0970	0.0190	70.3	0.194	96,400	0.366	8.17	4.08	8.89	-	7,120	1.13	3.20	4,510	1,360
			EDC-D-7	88.5	2,110	0.0590	18.1	137	0.116	0.0130	90.6	0.353	73,100	0.269	6.45	4.30	12.5	-	5,920	0.917	1.99	4,930	2,130
			EDC-D-8	88.1	5,740	0.0920	13.8	136	0.165	0.0340	119	0.222	142,000	0.646	13.5	5.17	13.8	-	11,100	2.00	5.12	5,470	1,210
	HAC-D	Exposed	HAC-D-1	53.2	7,570	0.0370	20.1	160	0.431	0.0730	12.6	0.572	36,900	1.22	20.0	14.8	281	-	19,500	6.32	12.8	8,890	1,660
			HAC-D-2	39.6	6,790	0.0250	12.7	84.9	0.353	0.0700	9.00	0.332	28,100	1.13	26.7	9.69	225	-	16,800	3.89	10.2	8,120	1,000
			HAC-D-3	42.2	4,910	0.0520	17.1	93.4	0.607	0.112	8.90	0.536	35,000	1.04	23.5	9.21	191	-	23,800	9.07	8.00	6,100	1,650
			HAC-D-4	50.5	5,830	0.0250	8.08	124	0.242	0.0510	9.30	0.412	54,500	0.692	9.93	6.17	158	-	12,100	3.17	8.00	4,860	951
			HAC-D-5	61.5	6,930	0.0480	12.7	133	0.270	0.0590	16.9	0.678	60,200	1.36	16.2	8.48	202	-	13,700	5.41	11.5	5,940	2,070
			HAC-D-6	52.3	9,670	0.0500	19.1	123	0.381	0.0860	10.9	0.415	35,700	1.23	19.5	9.98	254	-	26,400	5.56	6.88	5,870	1,540
			HAC-D-7	66.1	10,300	0.0540	15.4	157	0.371	0.0840	14.5	0.546	59,100	1.35	24.9	11.7	311	-	28,700	5.72	10.6	7,140	1,800
			HAC-D-8	64.9	6,910	0.0620	10.3	203	0.343	0.0610	23.5	0.875	71,600	1.16	12.4	8.19	289	-	14,600	4.38	9.70	5,260	3,110
2018	EDC-U	Reference	EDC-U-1	79.0	9,790	0.107	9.13	177	0.327	0.0840	53.3	0.735	10,800	0.794	30.2	14.8	37.9	-	18,400	5.21	8.50	4,720	4,430
			EDC-U-2	93.0	10,500	0.0860	14.3	220	0.382	0.0870	54.4	0.518	11,500	0.750	29.2	17.0	30.9	-	24,100	5.10	9.10	5,280	6,120
			EDC-U-3	82.0	6,880	0.153	7.99	211	0.222	0.0540	85.9	0.454	12,000	0.469	21.8	12.2	24.6	-	14,500	2.57	6.20	4,390	4,950
			EDC-U-4	82.0	9,810	0.0850	10.1	201	0.325	0.0710	48.7	0.520	10,700	0.657	28.9	15.2	27.8	-	20,700	4.03	9.00	5,100	5,280
			EDC-U-5	79.0	13,000	0.100	12.8	243	0.412	0.0950	27.7	0.878	12,200	0.908	39.4	21.5	48.0	-	25,700	5.11	11.3	5,870	8,170
			EDC-U-6	89.0	15,300	0.0850	9.89	195	0.473	0.0970	34.1	0.645	15,600	0.961	35.6	20.7	42.9	-	27,100	5.71	16.1	7,680	5,790
			EDC-U-7	75.0	9,360	0.0790	13.1	218	0.313	0.0670	27.2	1.15	8,980	0.667	33.5	18.2	37.2	-	17,500	3.89	8.91	4,740	6,830
			EDC-U-8	88.0	14,000	0.0790	13.2	243	0.459	0.112	27.5	0.933	12,700	1.07	42.2	24.9	51.2	-	26,100	5.68	12.4	6,350	9,730
	HAC-R1	Exposed	HAC-R1-1	70.0	1,080	0.0740	1.88	75.4	0.0530	<0.010	227	0.155	198,000	0.242	1.53	1.99	36.3	-	1,510	0.589	1.38	2,210	1,080
			HAC-R1-2	68.0	928	0.0690	1.75	72.9	0.0480	<0.010	194	0.189	202,000	0.235	1.34	1.42	31.7	-	1,500	0.477	1.36	2,100	710
			HAC-R1-3	67.0	3,760	0.0900	3.15	119	0.150	<0.020	194	0.254	172,000	0.509	3.58	3.35	123	-	4,790	1.59	6.80	3,030	1,260
			HAC-R1-4	65.0	11,500	0.0400	4.56	1,050	0.341	0.0400	74.7	0.265	155,000	0.999	3.45	7.10	171	-	8,130	4.98	13.1	4,130	1,400
			HAC-R1-5	70.0	6,840	0.125	7.85	178	0.242	0.0680	89.7	0.286	226,000	0.694	9.13	8.44	238	-	11,000	4.74	6.40	5,770	2,410
			HAC-R1-6	71.0	1,700	0.0650	2.23	101	0.0800	<0.020	96.6	0.209	214,000	0.292	2.55	2.04	52.8	-	2,560	0.890	2.30	2,590	778
			HAC-R1-7	67.0	906	0.0610	1.87	83.9	0.0450	<0.010	189	0.213	178,000	0.310	1.36	1.28	33.1	-	1,560	0.490	1.65	1,870	783
			HAC-R1-8	68.0	927	0.0530	1.96	73.4	0.0310	<0.010	132	0.211	218,000	0.225	0.990	0.738	34.2	-	953	0.369	0.810	1,800	636
	HAC-U		HAC-U-1	83.0	4,140	0.0580	3.81	319	0.139	0.0210	79.1	0.203	183,000	0.498	5.33	3.26	111	-	5,310	2.01	4.00	3,690	1,490
			HAC-U-2	72.0	2,070	<0.10	3.07	105	<0.10	<0.10	30.0	0.190	270,000	0.186	2.20	1.46	92.3	-	2,490	0.930	<5.0	3,040	1,100
			HAC-U-3	77.0	3,280	0.0830	4.59	162	0.110	<0.050	52.6	0.240	246,000	0.284	4.50	2.25	102	-	4,520	1.08	<2.5	3,530	1,380
			HAC-U-4	78.0	2,330	0.0670	2.73	106	0.0790	<0.050	50.9	0.217	276,000	0.285	2.90	1.79	68.7	-	3,130	0.800	<2.5	3,440	1,440
			HAC-U-5	62.0	1,280	0.0730	2.75	97.8	0.0480	<0.020	45.1	0.233	247,000	0.160	1.14	1.12	48.4	-	1,560	0.570	1.40	2,310	1,160
			HAC-U-6	72.0	2,190	0.0520	2.56	101	0.0710	<0.050	39.2	0.235	304,000	0.252	2.80	1.87	76.4	-	3,040	0.850	<2.5	3,420	1,400
			HAC-U-7	77.0	4,100	0.0630	3.54	122	0.137	<0.050	39.1	0.203	255,000	0.616	4.80	3.18	99.4	-	6,030	1.30	3.90	4,310	1,130
			HAC-U-8	73.0	3,970	0.0590	3.95	192	0.107	<0.050	34.4	0.252	270,000	0.307	3.80	2.86	222	-	5,000	1.39	3.30	3,820	1,320
	EDC-D	Reference	EDC-D-1	77.0	6,050	0.0790	18.4	120	0.225	0.0610	61.8	0.353	34,200	1.07	27.7	9.48	25.8	-	12,600	3.83	6.83	4,370	2,190
			EDC-D-2	77.0	4,840	0.0810	16.3	139	0.179	0.0560	79.8	0.387	61,800	0.864	26.8	7.51	23.9	-	10,100	2.60	5.12	5,440	2,720
			EDC-D-3	89.0	2,430	0.119	13.5	100	0.0870	0.0250	68.9	0.285	106,000	0.403	15.6	3.36	20.1	-	5,740	1.54	2.68	4,120	1,200
			EDC-D-4	89.0	762	0.0490	9.79	105	0.0330	<0.010	100	0.236	107,000	0.232	5.73	1.56	13.1	-	1,990	0.539	0.860	3,230	796
			EDC-D-5	74.0	8,620	0.142	11.7	94.6	0.217	0.0300	75.1	0.357	55,600	3.69	8.11	7.46	29.8	-	13,000	2.87	10.8	5,850	1,540
			EDC-D-6	81.0	2,040	0.135	9.73	89.9	0.156	0.0300	62.2	0.416	19,800	2.58	11.9	4.51	14.3	-	5,790	1.56	2.30	2,960	1,510
			EDC-D-7	83.0	4,300	0.0980	18.0	147	0.121	0.0250	67.3	0.373	48,500	0.386	15.5	7.38	18.4	-	7,950	1.47	4.07	6,350	2,060
			EDC-D-8	78.0	1,480	0.0740	11.7	71.0	0.166	0.0180	18.5	0.342	12,400	0.354	13.5	4.04	19.7	-	5,710	1.09	1.60	2,620	974
	HAC-D	Exposed	HAC-D-1	58.0	2,260	<0.10	4.56	106	<0.10	<0.10	77.0	0.310	283,000	0.361	4.00	2.28	67.7	-	4,730	1.20	<5.0	3,730	504
			HAC-D-2	52.0	4,260	<0.10	8.57	99.2	0.170	<0.10	49.0	0.410	211,000	0.545	6.50	4.43	173	-	10,500	2.05	<5.0	4,300	759
			HAC-D-3	42.0	6,280	0.0680	27.4	159	0.324	0.0980	66.7	0.599	175,000	0.804	10.6	5.53	118	-	14,900	7.24	4.80	4,890	1,230
			HAC-D-4	54.0	9,920	<0.050	10.5	3,840	0.272	0.0540	74.7	0.493	149,000	0.838	11.9	7.41	222	-	16,500	3.24	7.00	6,090	1,210
			HAC-D-5	59.0	4,160	<0.10	7.75	114	0.160	<0.10	115	0.570	232,000	0.591	9.10	4.73	115	-	10,400	2.05	<5.0	4,500	1,190
			HAC-D-6	52.0	6,870	0.0270	12.6	132	0.294	0.0620	20.6	0.290	112,000	1.09	11.8	8.01	214	-	16,200	4.33	8.60	4,980	765
			HAC-D-7	45.0	7,750	<0.10	11.0	150	0.260	<0.10	28.0	0.490	210,000	0.849	10.9	6.75	146	-	13,800	3.55	7.50	5,700	1,180
			HAC-D-8	57.0	8,950	0.0560	12.8	232	0.342	0.0630	25.6	0.764	129,000	1.04	20.7	10.9	279	-	21,300	3.92	8.60	6,460	6,020

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHP is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2019	EDC-U	Reference	EDC-U-1	86.8	9,750	0.0750	10.4	180	0.308	0.0670	49.4	0.729	9,350	0.591	44.8	18.3	29.9	-	20,300	3.48	7.62	4,420	6,220
			EDC-U-2	84.6	14,200	0.0320	8.81	158	0.365	0.0710	17.5	0.498	9,390	0.809	35.1	15.3	27.3	-	24,200	4.37	11.1	5,840	4,460
			EDC-U-3	75.3	8,090	0.119	8.98	186	0.403	0.0510	20.5	0.844	9,610	0.484	92.3	16.2	30.6	-	16,500	2.55	7.80	4,580	7,610
			EDC-U-4	86.9	6,940	0.0760	8.90	181	0.279	0.0660	13.0	0.627	9,060	0.447	39.1	13.2	24.8	-	17,200	3.16	5.00	3,950	5,740
			EDC-U-5	90.3	8,090	0.0580	8.67	153	0.288	0.0730	8.50	0.555	8,690	0.597	31.4	11.2	24.7	-	21,200	3.36	6.97	4,080	4,990
			EDC-U-6	86.3	7,720	0.0280	5.32	95.5	0.212	0.0410	7.80	0.312	5,410	0.452	21.4	8.60	16.9	-	12,700	2.50	6.05	3,370	2,270
			EDC-U-7	92.5	10,100	0.0630	10.3	213	0.309	0.0630	32.2	0.924	10,500	0.600	106	19.1	30.1	-	20,200	3.54	7.99	5,090	8,070
			EDC-U-8	86.8	11,500	0.125	16.0	422	0.374	0.0870	56.3	1.44	11,000	0.621	44.4	29.6	42.2	-	21,000	4.06	8.52	5,610	13,800
	HAC-R1	Exposed	HAC-R1-1	68.4	932	<0.10	2.38	79.0	<0.050	<0.050	249	0.208	219,000	0.236	1.40	1.47	32.0	-	1,470	0.310	<2.5	2,600	1,510
			HAC-R1-2	66.6	962	<0.10	2.30	108	<0.050	<0.050	290	0.156	307,000	0.251	1.20	1.22	31.5	-	1,390	0.280	<2.5	3,150	1,050
			HAC-R1-3	66.9	1,150	<0.10	2.54	88.1	<0.050	<0.050	266	0.317	210,000	0.185	<1.0	1.98	59.0	-	1,630	0.280	<2.5	2,620	2,280
			HAC-R1-4	65.0	2,140	<0.10	2.19	152	0.0590	<0.050	241	0.743	202,000	0.248	2.10	1.89	39.6	-	1,940	0.410	<2.5	2,730	1,750
			HAC-R1-5	60.4	1,250	<0.25	2.49	133	<0.13	<0.13	178	0.170	276,000	0.185	<2.5	1.54	44.7	-	1,770	<0.63	<6.3	3,040	1,050
			HAC-R1-6	73.2	1,320	<0.10	2.04	116	0.0560	<0.050	225	0.197	197,000	0.256	1.60	1.48	30.1	-	1,460	1.23	<2.5	2,980	1,260
			HAC-R1-7	68.3	778	<0.10	2.07	87.4	<0.050	<0.050	268	0.255	248,000	0.229	1.40	1.14	27.2	-	1,100	0.360	<2.5	2,790	1,240
			HAC-R1-8	69.3	559	<0.10	2.01	69.9	<0.050	<0.050	248	0.244	222,000	0.191	1.50	1.09	32.4	-	931	<0.25	<2.5	2,400	1,350
	HAC-U		HAC-U-1	66.9	1,360	<0.25	2.00	99.4	<0.13	<0.13	118	0.270	250,000	0.193	<2.5	1.60	45.4	-	2,040	0.950	<6.3	2,990	2,300
			HAC-U-2	71.2	1,410	<0.10	2.41	112	0.0510	<0.050	195	0.240	237,000	0.280	1.90	1.59	49.7	-	2,070	0.580	<2.5	3,230	2,240
			HAC-U-3	71.1	2,070	<0.10	2.96	137	0.0710	<0.050	142	0.451	275,000	0.286	3.40	2.31	62.3	-	3,070	0.750	<2.5	3,940	3,310
			HAC-U-4	66.6	1,580	<0.10	2.09	127	0.0500	<0.050	174	0.296	246,000	0.262	2.40	1.72	49.5	-	2,220	0.630	<2.5	3,160	2,170
			HAC-U-5	72.5	3,760	<0.10	3.65	140	0.0850	<0.050	190	0.351	286,000	0.358	5.60	3.03	74.4	-	4,040	1.40	2.60	4,670	2,920
			HAC-U-6	77.2	2,310	<0.10	3.14	130	0.0760	<0.050	151	0.361	258,000	0.317	6.20	2.53	91.1	-	3,300	1.11	<2.5	3,830	3,210
			HAC-U-7	79.2	4,120	<0.10	3.75	128	0.135	<0.050	123	0.241	259,000	0.485	8.60	3.80	125	-	6,340	1.62	3.50	4,590	2,120
			HAC-U-8	63.0	1,830	<0.10	2.09	96.2	0.0630	<0.050	124	0.250	224,000	0.255	2.80	1.85	62.7	-	2,660	0.680	<2.5	3,080	1,960
	EDC-D	Reference	EDC-D-1	85.8	13,900	0.0660	19.0	205	0.388	0.105	16.2	0.677	17,000	1.22	160	15.7	42.1	-	28,200	5.00	13.9	9,860	3,840
			EDC-D-2	80.6	7,130	0.0340	14.7	770	0.441	0.0780	11.1	0.373	10,000	0.720	70.1	13.1	41.6	-	30,700	3.85	6.76	5,150	2,700
			EDC-D-3	82.0	10,000	0.0510	15.4	166	0.395	0.106	9.60	0.451	10,700	1.32	87.2	13.7	39.9	-	23,000	4.89	10.1	5,370	2,620
			EDC-D-4	58.5	11,400	<0.020	8.70	112	0.288	0.0790	6.50	0.225	9,530	1.05	43.4	10.2	22.9	-	20,500	5.01	12.0	5,920	1,490
			EDC-D-5	69.9	8,710	0.0290	8.66	158	0.273	0.0720	7.80	0.348	15,000	1.37	98.6	9.60	25.6	-	19,600	4.51	8.55	7,420	1,330
			EDC-D-6	93.3	6,950	0.0560	9.09	92.6	0.180	0.0580	20.1	0.482	8,870	0.640	19.9	7.36	19.0	-	14,200	3.21	7.86	4,660	1,900
			EDC-D-7	93.5	16,600	0.0720	21.8	185	0.412	0.136	10.2	0.656	12,000	1.55	42.6	15.8	44.9	-	31,100	7.44	17.3	11,700	3,540
			EDC-D-8	93.4	8,380	0.0750	12.2	103	0.245	0.0700	17.1	0.299	10,300	0.871	27.8	9.35	25.2	-	17,400	4.35	9.09	5,540	1,560
	HAC-D	Exposed	HAC-D-1	37.7	3,230	<0.10	3.22	101	0.103	<0.050	111	0.538	150,000	0.321	28.7	3.30	74.5	-	5,980	1.44	3.10	3,530	1,180
			HAC-D-2	45.7	4,660	<0.10	4.90	131	0.152	<0.050	160	0.664	193,000	0.522	37.1	4.73	109	-	9,480	2.31	4.70	4,880	1,330
			HAC-D-3	28.4	11,700	<0.10	9.60	308	0.376	0.0880	26.8	0.280	58,900	0.999	32.2	10.3	159	-	24,600	5.58	12.3	7,050	716
			HAC-D-4	44.7	6,960	<0.10	6.22	148	0.217	0.0830	89.3	0.490	141,000	0.609	21.3	6.50	130	-	15,000	5.23	7.40	5,460	972
			HAC-D-5	51.1	6,060	<0.10	6.18	140	0.196	<0.050	122	0.448	140,000	0.645	15.8	6.23	135	-	13,900	3.21	7.30	5,270	1,040
			HAC-D-6	35.0	6,510	<0.10	6.77	118	0.226	<0.050	70.0	0.356	101,000	0.571	14.3	6.60	110	-	13,800	3.19	7.50	5,330	757
			HAC-D-7	56.7	4,200	<0.10	4.52	146	0.136	<0.050	190	0.874	210,000	0.493	27.1	4.88	92.9	-	8,800	2.12	4.80	4,730	2,020
			HAC-D-8	57.6	6,370	<0.10	6.27	171	0.199	0.0520	155	0.714	146,000	0.626	27.0	7.45	121	-	13,900	3.19	7.60	6,360	3,430

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UPC is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2020	EDC-U	Reference	EDC-U-1	76.6	10,500	0.0580	16.8	785	0.390	0.0580	78.3	2.62	12,200	0.625	86.3	44.4	30.5	-	22,000	3.65	8.87	5,290	20,900
			EDC-U-2	87.1	14,400	0.0780	77.0	243	0.813	0.164	6.60	1.36	13,000	0.812	67.9	27.5	36.6	-	72,300	7.54	9.62	6,170	8,250
			EDC-U-3	76.4	3,540	<0.126	29.9	916	0.272	<0.126	44.6	3.52	9,160	0.141	11.3	44.9	21.0	-	13,000	2.19	<6.31	2,300	34,200
			EDC-U-4	67.5	4,860	0.0640	18.7	370	0.265	<0.038	22.8	1.50	8,190	0.143	8.58	25.0	25.4	-	13,600	1.72	3.12	2,800	14,000
			EDC-U-5	74.4	12,400	0.0460	25.8	787	0.429	0.0500	8.70	2.71	11,200	0.354	25.0	52.0	46.1	-	34,900	4.68	10.2	6,820	27,000
			EDC-U-6	74.0	14,100	0.0490	10.6	248	0.392	0.0690	7.10	0.710	11,200	0.726	44.7	20.2	35.8	-	27,900	4.33	11.9	7,040	5,840
			EDC-U-7	66.2	11,600	0.0330	28.3	851	0.474	0.0500	6.20	2.01	11,600	0.340	81.3	49.8	28.3	-	38,000	3.60	8.28	5,000	21,500
			EDC-U-8	69.0	9,060	0.0480	55.2	380	0.554	0.0510	8.30	1.42	8,430	0.400	81.0	28.5	26.2	-	42,700	3.59	6.74	4,160	11,700
	HAC-R1	Exposed	HAC-R1-1	70.0	963	0.0570	1.97	68.6	0.0310	<0.010	367	0.145	231,000	0.155	1.74	1.39	30.7	-	1,630	0.271	0.790	2,680	949
			HAC-R1-2	67.3	994	0.0470	1.90	67.1	0.0330	<0.010	337	0.114	221,000	0.195	1.48	1.26	32.4	-	1,880	0.271	0.850	2,680	814
			HAC-R1-3	70.9	1,180	0.0510	2.17	108	0.0370	<0.010	354	0.165	227,000	0.152	1.53	1.58	35.9	-	1,900	0.261	0.850	2,700	1,180
			HAC-R1-4	67.8	1,340	0.0720	2.16	80.3	0.0490	<0.010	358	0.198	228,000	0.222	2.35	1.98	49.7	-	2,820	0.358	1.17	2,880	1,560
			HAC-R1-5	65.9	1,120	0.0710	2.19	81.0	0.0380	<0.010	356	0.228	216,000	0.190	2.42	2.00	40.8	-	2,390	0.322	1.02	2,890	1,740
			HAC-R1-6	68.9	1,310	0.0670	2.01	82.2	0.0410	<0.010	336	0.179	231,000	0.180	1.48	1.58	43.9	-	2,370	0.351	1.07	2,840	1,250
			HAC-R1-7	66.9	923	0.0580	1.69	71.6	0.0330	<0.010	302	0.165	251,000	0.140	1.36	1.25	31.8	-	1,710	0.230	0.820	2,610	1,110
			HAC-R1-8	63.9	1,060	0.0570	1.81	78.9	0.0330	<0.010	305	0.182	278,000	0.140	1.33	1.25	33.1	-	1,700	0.233	1.11	2,760	1,030
	HAC-U		HAC-U-1	73.7	1,540	0.0650	2.68	107	0.0540	<0.025	319	0.241	246,000	0.267	5.44	1.90	42.0	-	2,410	0.421	1.53	3,610	2,640
			HAC-U-2	66.8	1,070	0.0580	2.27	86.9	0.0360	<0.025	324	0.186	220,000	0.270	1.72	1.39	31.5	-	1,690	0.353	<1.25	3,160	2,280
			HAC-U-3	70.0	1,850	0.0760	3.06	111	0.0610	<0.025	349	0.298	235,000	0.316	3.10	2.18	50.1	-	3,020	0.600	1.86	3,440	2,970
			HAC-U-4	65.9	2,110	0.0670	2.46	96.8	0.0700	<0.010	300	0.248	214,000	0.323	3.57	2.16	68.3	-	3,510	0.715	1.85	3,280	2,540
			HAC-U-5	70.5	1,330	0.0580	2.64	91.5	0.0440	<0.010	294	0.240	195,000	0.303	2.23	1.69	42.6	-	2,240	0.425	1.02	3,230	2,300
			HAC-U-6	74.6	1,250	0.0460	2.51	100	0.0360	<0.010	275	0.257	224,000	0.241	1.65	1.49	39.9	-	1,820	0.462	0.940	3,150	2,380
			HAC-U-7	75.2	3,730	0.0540	4.22	128	0.172	0.0120	283	0.232	200,000	0.436	3.07	2.68	83.8	-	5,010	0.797	2.17	3,700	2,220
			HAC-U-8	73.6	1,440	0.0540	2.58	108	0.0430	<0.010	262	0.261	220,000	0.262	2.06	1.61	43.1	-	2,340	0.485	1.06	3,170	2,340
	EDC-D	Reference	EDC-D-1	75.0	13,500	0.0160	11.7	137	0.360	0.0980	8.50	0.274	9,520	1.39	106	12.8	27.2	-	26,300	5.63	13.4	6,550	2,120
			EDC-D-2	76.8	10,800	0.0500	15.8	172	0.289	0.0760	13.0	0.557	12,600	1.23	345	16.7	26.0	-	23,200	4.25	10.6	6,040	4,730
			EDC-D-3	60.4	11,900	0.0170	8.63	105	0.298	0.0750	5.20	0.185	8,080	1.12	41.6	10.1	19.6	-	22,600	4.50	11.3	5,800	1,200
			EDC-D-4	64.8	12,900	0.0250	16.3	118	0.319	0.0820	5.10	0.224	8,390	1.23	66.9	12.6	23.4	-	28,200	4.82	13.6	6,440	1,930
			EDC-D-5	68.9	10,000	0.0420	13.0	142	0.317	0.0610	8.10	0.516	9,060	1.55	217	15.0	24.3	-	23,200	4.04	11.0	5,220	4,440
			EDC-D-6	59.9	12,500	0.0190	11.7	133	0.271	0.0720	7.60	0.468	9,830	1.02	54.0	14.2	21.4	-	24,300	4.12	10.8	6,780	2,900
			EDC-D-7	65.6	10,300	0.0600	9.18	105	0.249	0.0610	7.40	0.214	10,200	1.00	29.6	9.40	18.2	-	19,400	3.87	10.8	5,330	1,850
			EDC-D-8	76.4	14,400	0.0550	9.06	130	0.338	0.0840	6.80	0.210	9,060	1.32	38.8	11.8	23.3	-	24,900	5.22	14.5	6,700	1,840
	HAC-D	Exposed	HAC-D-1	67.7	5,720	0.0950	6.80	198	0.222	0.0480	188	0.485	188,000	0.654	32.2	6.34	92.2	-	18,500	3.12	6.11	5,410	1,510
			HAC-D-2	47.9	9,620	0.0210	23.2	195	0.357	0.0760	16.8	0.194	93,600	0.970	62.0	9.27	112	-	21,200	4.69	8.62	8,100	573
			HAC-D-3	55.5	4,500	0.0530	3.58	191	0.166	0.0170	292	0.908	234,000	0.333	24.5	7.01	65.8	-	8,350	1.39	3.67	7,760	2,930
			HAC-D-4	42.4	7,190	0.0390	9.02	285	0.256	0.0670	86.2	0.499	129,000	0.712	23.1	6.96	127	-	19,300	3.80	6.58	4,790	1,320
			HAC-D-5	57.3	4,130	0.0380	4.53	145	0.134	0.0280	132	0.729	182,000	0.416	12.7	4.91	78.0	-	11,400	1.76	3.55	3,840	1,970
			HAC-D-6	60.2	11,400	0.0210	11.4	427	0.301	0.0720	88.0	0.424	120,000	1.04	21.5	8.55	102	-	21,500	4.33	7.35	5,890	1,180
			HAC-D-7	54.0	3,320	0.0500	4.30	176	0.121	0.0250	253	1.03	210,000	0.422	10.9	5.20	70.3	-	10,200	1.54	3.51	3,770	3,170
			HAC-D-8	59.6	2,660	0.0830	4.22	296	0.0910	0.0180	289	1.24	242,000	0.353	6.96	6.15	62.9	-	8,520	1.09	2.52	3,980	7,990

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHP is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2021	EDC-U	Reference	EDC-U-1	80.5	6,990	0.0620	7.31	146	0.236	0.0620	15.6	0.532	8,550	0.461	100	11.5	26.4	-	14,300	4.74	6.10	3,980	4,650
			EDC-U-2	62.8	7,410	0.103	23.1	177	0.376	0.156	17.2	0.804	10,700	0.525	185	16.8	40.8	-	27,800	12.5	5.76	3,930	6,670
			EDC-U-3	59.9	10,600	0.0380	12.3	139	0.387	0.0670	7.60	0.382	8,280	0.671	73.6	13.5	27.6	-	25,400	6.77	10.5	5,780	3,120
			EDC-U-4	81.5	12,400	0.0390	9.78	168	0.364	0.0880	8.20	0.690	9,480	0.780	65.4	16.7	35.9	-	23,100	5.03	11.2	5,620	5,460
			EDC-U-5	74.4	16,000	0.101	18.0	235	0.582	0.103	8.60	0.937	12,100	0.930	135	28.0	59.3	-	35,600	8.76	12.0	8,810	10,600
			EDC-U-6	74.0	16,200	0.0360	11.2	148	0.490	0.0990	6.40	0.481	9,550	1.20	111	14.9	35.7	-	29,600	7.90	14.4	6,900	2,670
			EDC-U-7	82.9	7,420	0.233	15.9	290	0.276	0.0600	13.1	1.63	9,590	0.430	405	27.7	68.8	-	21,700	6.99	5.32	3,620	13,700
			EDC-U-8	74.6	7,230	0.0610	19.8	436	0.277	0.0490	14.0	1.67	8,240	0.439	142	28.8	37.5	-	19,700	5.79	5.95	4,040	14,200
	HAC-R1	Exposed	HAC-R1-1	53.0	2,240	<0.250	2.18	236	<0.250	<0.250	271	<0.250	278,000	<0.125	<5.00	1.66	31.2	-	1,280	<1.25	<12.5	3,060	1,060
			HAC-R1-2	58.4	527	0.0490	1.31	103	0.0220	<0.010	184	0.0660	221,000	0.0505	1.73	0.947	23.7	-	460	0.211	0.790	2,530	653
			HAC-R1-3	55.2	1,500	0.0700	1.94	180	0.0340	<0.013	226	0.156	235,000	0.103	4.13	1.99	44.3	-	1,260	0.225	2.20	3,010	1,180
			HAC-R1-4	59.1	430	0.0670	1.42	82.3	0.0240	<0.010	239	0.153	236,000	0.0702	1.46	1.04	51.9	-	405	0.291	0.630	2,460	1,260
			HAC-R1-5	64.2	373	0.0550	1.43	80.8	0.0230	<0.010	172	0.0930	216,000	0.0535	1.65	1.10	28.0	-	276	0.280	0.560	2,240	1,080
			HAC-R1-6	65.9	146	0.0450	1.11	81.6	0.0110	<0.010	196	0.124	226,000	0.0384	0.540	0.775	19.0	-	359	0.107	<0.50	2,030	1,040
			HAC-R1-7	72.0	859	0.0950	1.76	68.5	0.0410	<0.010	186	0.145	235,000	0.0908	1.95	1.28	53.4	-	1,170	0.245	0.940	2,380	1,020
			HAC-R1-8	65.6	261	0.0550	1.02	157	0.0180	<0.010	181	0.0940	228,000	0.0628	1.58	1.22	16.9	-	296	0.206	0.660	2,490	1,000
	HAC-U		HAC-U-1	74.2	929	0.0750	2.18	81.9	0.0290	<0.010	232	0.124	210,000	0.206	2.60	1.05	28.6	-	1,170	0.436	0.980	2,860	1,880
			HAC-U-2	76.5	2,030	0.101	3.10	118	0.0940	<0.012	310	0.168	223,000	0.280	3.77	1.92	75.4	-	2,640	0.859	1.53	3,620	2,380
			HAC-U-3	94.3	1,700	0.0810	2.79	148	0.0580	<0.013	208	0.403	249,000	0.238	4.02	1.55	221	-	2,310	1.42	1.32	3,400	2,060
			HAC-U-4	67.1	865	0.0840	2.20	88.5	0.0370	<0.010	300	0.161	198,000	0.216	1.82	1.32	27.4	-	422	0.714	1.20	3,200	2,370
			HAC-U-5	87.2	1,460	0.0740	2.81	202	0.0500	<0.013	202	0.200	244,000	0.255	7.48	1.84	49.7	-	2,150	0.562	1.39	3,300	3,240
			HAC-U-6	72.9	749	0.0890	2.24	113	0.0240	<0.010	263	0.154	266,000	0.207	2.72	0.950	25.8	-	1,020	0.334	0.800	3,180	2,170
			HAC-U-7	63.0	787	0.0730	2.44	98.2	0.0290	<0.010	239	0.178	251,000	0.220	6.68	1.20	188	-	1,290	0.440	0.790	2,910	2,540
			HAC-U-8	61.7	1,170	0.0790	2.38	124	0.0790	<0.012	175	0.166	236,000	0.137	33.0	1.45	89.7	-	1,960	0.395	0.610	2,660	2,460
	EDC-D	Reference	EDC-D-1	79.3	3,600	0.0680	16.6	139	0.158	0.0340	30.8	0.370	35,600	0.489	42.6	8.09	16.5	-	11,400	4.06	3.78	4,010	2,880
			EDC-D-2	84.1	4,740	0.0960	16.5	126	0.143	0.0460	34.5	0.366	30,500	0.578	55.8	7.21	20.8	-	11,500	7.44	4.99	3,920	3,040
			EDC-D-3	76.3	7,290	0.0260	16.4	147	0.273	0.0560	22.2	0.318	27,400	1.19	19.8	10.8	20.3	-	19,000	5.68	7.72	5,230	2,500
			EDC-D-4	79.2	4,810	0.105	15.8	149	0.149	0.0390	39.3	0.335	49,300	0.526	47.1	5.91	18.0	-	9,940	6.06	4.18	5,000	2,000
			EDC-D-5	85.6	4,050	0.130	15.2	142	0.131	0.0590	47.4	0.435	49,800	0.565	120	7.73	24.1	-	9,930	11.0	4.30	3,850	3,170
			EDC-D-6	90.2	5,530	0.0720	15.7	139	0.187	0.0500	33.1	0.431	27,500	0.722	30.0	7.97	21.4	-	12,100	5.88	5.69	4,670	2,790
			EDC-D-7	85.6	7,510	0.0420	15.1	115	0.247	0.0660	26.8	0.301	14,300	0.944	37.5	8.54	23.2	-	16,600	4.70	7.82	4,280	1,940
			EDC-D-8	84.9	2,460	0.0220	6.88	54.6	0.0820	0.0180	18.4	0.132	15,300	0.334	32.4	2.92	8.70	-	5,430	1.10	2.36	1,860	911
	HAC-D	Exposed	HAC-D-1	52.9	3,260	0.0220	43.8	90.7	0.204	0.0580	38.8	0.261	185,000	0.273	4.62	3.18	87.2	-	5,200	3.50	2.76	3,510	904
			HAC-D-2	61.3	2,730	0.0870	6.42	119	0.122	0.0210	113	0.306	238,000	0.436	10.9	2.66	65.5	-	4,630	2.15	4.73	4,000	988
			HAC-D-3	94.1	8,950	0.0440	8.98	286	0.274	0.0420	132	0.460	33,300	0.526	18.4	9.15	265	-	12,800	4.90	4.68	4,480	1,130
			HAC-D-4	92.4	9,170	0.0420	8.88	268	0.310	0.0550	88.0	0.376	28,000	0.727	24.2	7.63	352	-	17,600	6.27	6.98	5,710	627
			HAC-D-5	87.0	15,100	0.0260	11.0	344	0.533	0.0620	63.8	0.399	32,100	1.54	11.3	13.5	631	-	25,900	7.26	14.2	9,760	762
			HAC-D-6	95.4	8,160	0.0870	9.88	374	0.298	0.0310	130	0.331	26,900	0.511	12.8	6.03	374	-	13,100	2.92	5.16	5,070	608
			HAC-D-7	96.7	6,040	0.0610	7.81	304	0.191	0.0230	126	0.398	28,000	0.434	63.2	4.87	300	-	10,400	1.96	4.55	4,250	458
			HAC-D-8	53.5	11,000	<0.010	6.18	550	0.367	0.0370	11.5	0.167	17,700	0.752	15.3	8.37	474	-	14,700	3.63	7.96	6,100	415

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UPC is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2022	EDC-U	Reference	EDC-U-2	89.1	13,300	0.0860	12.8	229	0.447	0.111	7.80	0.949	11,700	1.01	127	21.9	44.1	-	26,400	5.27	12.2	6,170	8,460
			EDC-U-3	89.5	10,600	0.0860	14.4	319	0.374	0.0840	8.80	1.07	11,000	0.783	79.1	22.8	39.1	-	22,600	3.99	9.04	5,340	11,300
			EDC-U-4	77.9	6,490	0.0930	37.9	824	0.392	0.0560	11.9	2.83	10,100	0.306	119	47.6	34.8	-	22,700	2.96	4.18	3,540	26,900
			EDC-U-5	87.2	14,700	0.0710	41.0	480	0.629	0.123	7.40	1.82	13,100	1.02	68.6	35.9	43.0	-	45,500	6.26	12.0	6,250	18,300
			EDC-U-6	86.8	10,900	0.0670	10.8	225	0.339	0.0780	15.1	0.991	9,420	0.848	145	20.6	35.3	-	21,800	3.94	9.95	5,040	8,900
			EDC-U-7	88.9	8,020	0.0850	24.5	242	0.336	0.0530	8.40	1.13	8,310	0.440	233	22.0	36.4	-	26,000	3.71	6.82	4,330	9,480
			EDC-U-8	84.3	8,050	0.110	34.0	1,140	0.422	0.0560	9.90	4.69	12,000	0.419	46.6	65.9	39.7	-	19,800	3.33	5.51	3,640	38,600
			EDC-U-1	73.8	1,960	0.0940	6.75	232	0.206	0.0140	18.6	1.03	7,430	0.0886	23.9	14.4	24.7	-	4,460	0.742	1.39	1,910	6,970
	HAC-R1	Exposed	HAC-R1-1	65.7	2,010	0.0800	2.30	133	0.0570	<0.012	363	0.148	224,000	0.216	2.64	2.00	42.1	-	2,840	0.644	1.59	3,090	1,240
			HAC-R1-2	67.7	1,750	0.0680	2.24	99.3	0.0620	<0.010	288	0.169	246,000	0.172	3.23	1.96	116	-	3,100	0.498	1.49	2,840	1,150
			HAC-R1-3	64.7	868	0.0640	1.78	68.3	0.0330	<0.012	289	0.148	236,000	0.116	2.34	1.20	36.4	-	1,630	0.298	0.910	2,570	774
			HAC-R1-4	61.0	920	0.0850	1.87	125	0.0360	<0.015	295	0.152	250,000	0.146	1.88	1.48	42.6	-	1,830	0.315	0.990	2,750	1,580
			HAC-R1-5	72.3	1,400	0.0680	2.11	84.5	0.0500	<0.010	325	0.182	223,000	0.175	2.90	1.70	60.4	-	2,520	0.484	1.39	2,840	1,360
			HAC-R1-6	67.4	857	0.0570	2.17	71.6	0.0370	<0.012	117	0.190	280,000	0.0775	5.79	1.23	41.0	-	1,510	0.280	0.960	2,610	852
			HAC-R1-7	69.8	4,720	0.0720	3.41	246	0.171	<0.012	232	0.180	247,000	0.258	19.3	3.01	57.5	-	4,450	0.747	2.56	3,260	1,780
			HAC-R1-8	71.3	4,470	0.0780	3.97	165	0.138	0.0160	150	0.238	210,000	0.267	88.5	3.47	160	-	7,680	1.17	2.80	3,660	2,100
	HAC-U		HAC-U-1	59.8	1,370	0.0820	2.31	113	0.0480	<0.010	239	0.242	212,000	0.243	2.28	1.75	50.5	-	2,320	0.541	1.27	3,020	3,500
			HAC-U-2	57.2	3,010	0.0830	2.97	238	0.162	0.0140	228	0.234	176,000	0.365	4.74	3.20	86.8	-	4,680	1.43	2.51	4,110	3,200
			HAC-U-3	70.5	1,170	0.0600	1.95	96.1	0.0400	<0.010	323	0.197	203,000	0.192	2.66	1.29	35.1	-	1,610	0.385	0.920	2,740	2,820
			HAC-U-4	74.3	3,900	0.0720	2.92	272	0.131	<0.010	197	0.237	196,000	0.202	1.96	2.50	510	-	3,940	0.885	1.53	3,420	4,260
			HAC-U-5	76.4	2,610	0.0540	3.12	136	0.0640	<0.010	114	0.152	188,000	0.249	7.92	2.23	52.2	-	3,420	0.729	1.76	3,270	2,620
			HAC-U-6	71.7	595	0.0530	1.93	84.0	0.0230	<0.011	201	0.162	238,000	0.134	1.28	0.800	21.2	-	950	0.226	0.600	2,650	2,120
			HAC-U-7	87.3	3,730	0.0610	4.70	114	0.0940	0.0110	115	0.209	145,000	0.189	17.5	2.89	71.5	-	5,860	2.53	2.31	3,780	2,220
			HAC-U-8	71.0	11,600	0.0710	5.27	823	0.180	<0.010	90.4	0.127	185,000	0.225	7.08	3.09	104	-	5,070	1.12	2.72	4,460	2,200
	EDC-D	Reference	EDC-D-1	66.6	10,500	0.0400	12.7	130	0.323	0.0690	6.60	0.338	7,550	1.27	50.3	10.8	27.3	-	21,600	4.57	10.8	6,370	2,020
			EDC-D-2	83.8	9,850	0.0640	14.2	138	0.292	0.0750	10.5	0.294	9,440	1.21	41.6	10.0	25.2	-	19,700	4.44	10.3	5,710	2,300
			EDC-D-3	82.2	11,400	0.0530	12.9	149	0.310	0.0830	9.40	0.328	9,330	1.24	54.4	11.3	26.3	-	21,600	4.39	11.2	5,980	2,540
			EDC-D-4	79.0	7,600	0.0510	9.58	114	0.260	0.0810	5.30	0.197	5,720	1.29	25.8	6.99	17.9	-	15,500	3.68	9.34	4,300	1,640
			EDC-D-5	88.3	6,060	0.0800	13.9	174	0.212	0.0620	17.8	0.461	12,100	0.815	27.1	7.94	24.1	-	12,600	2.84	6.56	4,250	2,960
			EDC-D-6	71.0	13,300	0.219	32.9	205	0.500	0.0680	27.9	2.12	23,300	1.55	54.4	21.0	27.1	-	42,400	9.34	10.1	8,000	5,970
			EDC-D-7	80.1	9,740	0.0710	12.6	119	0.318	0.0570	10.1	0.311	9,580	1.22	37.7	9.15	28.5	-	19,200	3.66	15.8	5,670	1,710
			EDC-D-8	83.1	11,700	0.0950	15.3	154	0.326	0.110	10.0	0.328	9,410	1.53	50.1	12.0	30.4	-	25,400	5.33	12.3	6,000	2,280
	HAC-D	Exposed	HAC-D-1	93.5	53,800	0.341	63.0	987	1.85	0.376	181	1.73	827,000	5.30	258	43.9	1,130	-	117,000	24.2	48.5	34,100	4,970
			HAC-D-2	73.3	4,190	0.0610	6.96	127	0.155	0.0340	36.8	0.249	174,000	0.570	11.7	3.74	93.4	-	9,110	2.10	4.52	4,000	779
			HAC-D-3	63.4	2,400	0.0550	5.32	177	0.0760	0.0160	43.0	0.285	252,000	0.301	5.88	2.16	59.1	-	4,460	1.25	2.37	3,480	921
			HAC-D-4	64.5	1,900	0.0500	5.19	130	0.0720	0.0140	41.5	0.311	271,000	0.271	5.81	1.84	118	-	3,830	0.894	2.08	3,540	1,890
			HAC-D-5	64.0	2,580	0.0600	5.89	164	0.104	0.0170	38.0	0.318	230,000	0.325	9.29	2.82	75.2	-	5,200	1.25	2.80	3,740	3,280
			HAC-D-6	62.0	2,130	0.0580	6.33	232	0.0890	0.0150	25.5	0.320	246,000	0.255	9.25	2.56	71.2	-	4,380	1.04	2.47	3,510	3,540
			HAC-D-7	61.9	2,320	0.0820	6.29	222	0.105	<0.024	88.8	0.597	260,000	0.315	7.85	3.93	194	-	4,740	1.12	2.65	4,170	7,210
			HAC-D-8	65.7	1,760	0.0820	7.60	304	0.0750	<0.014	71.3	0.853	236,000	0.265	6.83	6.07	96.3	-	4,080	0.863	1.82	3,280	12,000

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHP is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2010	HAC-U (UHP)[a]	Exposed	UHP-1	0.0608	0.00670	1.33	17.9	1,600	2,880	-	-	3.60	-	340	107	-	0.0750	-	1.00	571	0.555	42.6	-	55.2	-
			UHP-2	0.0895	0.00660	1.20	18.6	2,330	4,850	-	-	5.30	-	440	148	-	0.103	-	1.52	679	0.764	53.7	-	77.1	-
			UHP-3	0.0642	0.00570	0.940	15.1	1,810	3,540	-	-	3.50	-	370	117	-	0.0960	-	1.17	552	0.581	43.9	-	56.6	-
			UHP-4	0.0219	0.00800	1.62	23.3	2,470	4,500	-	-	6.30	-	490	176	-	0.127	-	1.61	884	0.966	68.6	-	88.9	-
			UHP-5	0.0176	0.00510	1.34	18.9	2,930	6,320	-	-	5.50	-	510	140	-	0.110	-	2.06	654	0.773	51.4	-	78.9	-
	HAC-D (LHC)[a]	Exposed	LHC-1	0.00960	0.00370	0.760	20.2	1,070	2,510	-	-	1.32	-	520	168	-	0.0980	-	1.51	590	0.722	57.7	-	51.8	-
			LHC-2	0.00880	0.00330	0.740	18.0	1,070	2,270	-	-	1.21	-	510	164	-	<0.090	-	1.13	651	0.590	55.2	-	42.3	-
			LHC-3	0.00890	0.00220	1.44	16.8	1,140	4,400	-	-	1.54	-	650	177	-	<0.12	-	1.33	513	0.494	43.8	-	40.1	-
			LHC-4	0.0102	0.00280	0.830	17.0	1,200	2,960	-	-	1.71	-	560	138	-	<0.12	-	1.21	497	0.534	43.7	-	39.1	-
			LHC-5	0.00680	0.00240	0.680	9.50	1,100	2,640	-	-	1.31	-	490	141	-	<0.090	-	1.06	272	0.283	26.6	-	25.9	-
2017	EDC-D	Reference	EDC-D-1	0.0378	0.00750	0.648	21.0	748	1,150	-	4.80	0.940	-	317	88.9	<0.02	0.132	-	<0.1	-	0.522	41.9	-	32.9	5.45
			EDC-D-2	0.0510	0.00430	0.924	12.1	2,340	4,990	-	6.93	2.07	-	709	301	0.0230	0.0387	-	0.210	-	0.264	19.9	-	38.9	3.66
			EDC-D-3	0.0770	0.00410	2.78	21.6	4,240	10,100	-	11.2	3.71	-	1,420	529	<0.04	0.0660	-	<0.2	-	0.407	19.4	-	75.1	5.53
			EDC-D-4	0.0470	0.00410	0.748	17.3	1,630	2,920	-	7.25	1.51	-	675	236	0.0220	0.0550	-	0.160	-	0.684	34.4	-	48.0	6.10
			EDC-D-5	0.0835	0.0106	0.856	22.9	1,300	2,030	-	9.42	1.24	-	436	137	0.0200	0.0834	-	0.150	-	0.610	46.1	-	56.8	6.00
			EDC-D-6	0.0360	0.00600	1.39	7.93	1,160	3,420	-	5.21	0.880	-	442	328	<0.02	0.0238	-	<0.1	-	0.183	15.2	-	30.7	2.55
			EDC-D-7	0.0560	0.00640	3.80	11.0	2,190	7,770	-	8.68	1.70	-	525	328	<0.02	0.0321	-	<0.1	-	0.313	14.1	-	58.7	2.37
			EDC-D-8	0.0340	0.00410	0.564	10.6	1,240	2,420	-	5.02	0.876	-	724	435	0.0230	0.0339	-	<0.1	-	0.281	28.1	-	30.9	4.37
	HAC-D	Exposed	HAC-D-1	0.0686	0.0321	3.33	28.1	825	1,150	-	5.50	1.26	-	450	192	<0.04	0.132	-	0.200	-	0.936	66.2	-	61.0	6.91
			HAC-D-2	0.0640	0.0387	1.35	26.1	826	873	-	4.28	0.790	-	473	140	<0.04	0.0921	-	<0.2	-	0.569	48.4	-	49.9	6.77
			HAC-D-3	0.0416	0.0241	7.76	21.0	738	968	-	5.19	1.67	-	284	203	<0.04	0.0764	-	<0.2	-	1.02	37.1	-	57.7	7.63
			HAC-D-4	0.0444	0.0220	1.40	9.93	676	875	-	3.69	0.940	-	328	223	<0.04	0.0551	-	<0.2	-	0.487	35.7	-	41.8	5.16
			HAC-D-5	0.0560	0.0216	3.17	15.0	655	1,180	-	6.38	1.43	-	438	277	<0.04	0.106	-	<0.2	-	0.502	39.9	-	60.0	5.26
			HAC-D-6	0.127	0.0606	2.50	17.8	986	1,280	-	6.80	1.29	-	462	174	0.0690	0.0885	-	0.350	-	0.659	77.8	-	64.3	6.88
			HAC-D-7	0.0670	0.0227	3.40	21.3	1,150	1,570	-	6.81	1.72	-	646	283	0.0530	0.106	-	0.370	-	0.696	84.3	-	76.6	8.14
			HAC-D-8	0.0626	0.0220	4.95	14.3	869	1,600	-	6.01	1.88	-	621	319	<0.04	0.0775	-	0.240	-	0.719	45.6	-	67.4	7.01
2018	EDC-U	Reference	EDC-U-1	0.0988	-	1.14	29.1	1,730	2,050	-	9.86	0.710	-	424	84.7	<0.040	0.114	-	<0.20	-	0.893	44.5	-	63.6	6.68
			EDC-U-2	0.101	-	1.45	27.9	1,620	3,010	-	11.7	0.530	-	402	90.3	<0.060	0.0873	-	<0.30	-	0.524	51.8	-	66.4	8.33
			EDC-U-3	0.0506	-	2.11	27.3	1,400	3,190	-	9.59	0.380	-	457	91.5	<0.040	0.0800	-	<0.20	-	0.397	29.3	-	57.9	5.70
			EDC-U-4	0.0785	-	1.22	25.8	1,540	2,470	-	10.1	0.470	-	537	84.0	<0.040	0.0955	-	<0.20	-	0.533	47.1	-	74.1	6.60
			EDC-U-5	0.118	-	1.26	36.6	1,900	2,330	-	12.1	0.880	-	387	93.6	<0.040	0.133	-	0.280	-	0.967	59.5	-	92.2	6.38
			EDC-U-6	0.127	-	0.967	33.4	1,800	2,420	-	11.8	0.700	-	818	116	<0.020	0.105	-	0.250	-	0.939	66.7	-	80.2	11.9
			EDC-U-7	0.0868	-	1.44	45.5	1,830	2,590	-	8.80	0.740	-	346	65.8	<0.020	0.185	-	0.210	-	0.901	45.9	-	94.3	5.84
			EDC-U-8	0.148	-	1.18	38.1	1,980	2,040	-	11.8	0.910	-	344	101	0.0250	0.142	-	0.220	-	1.25	61.1	-	80.0	6.53
	HAC-R1	Exposed	HAC-R1-1	0.0111	-	1.64	1.85	476	2,960	-	4.10	0.930	-	376	588	<0.020	0.00600	-	<0.10	-	0.189	6.72	-	7.90	1.30
			HAC-R1-2	0.0120	-	1.45	1.75	525	2,830	-	4.08	0.910	-	376	602	<0.020	0.00570	-	<0.10	-	0.165	6.78	-	7.80	1.14
			HAC-R1-3	0.0236	-	1.85	3.87	723	2,750	-	5.09	0.810	-	539	526	<0.040	0.0109	-	<0.20	-	0.303	18.0	-	20.2	2.98
			HAC-R1-4	0.0278	-	2.29	4.57	579	1,900	-	5.41	0.850	-	711	1,280	<0.040	0.0158	-	0.290	-	0.326	28.2	-	29.5	3.09
			HAC-R1-5	0.0665	-	3.27	9.24	1,270	1,940	-	4.50	2.55	-	669	528	<0.040	0.0150	-	0.350	-	0.445	39.3	-	30.0	5.28
			HAC-R1-6	0.0214	-	1.15	2.98	546	1,560	-	3.31	0.990	-	343	604	<0.040	0.00730	-	<0.20	-	0.181	9.83	-	9.20	2.11
			HAC-R1-7	0.0143	-	1.21	1.59	463	2,430	-	3.51	0.890	-	311	557	<0.020	0.00580	-	<0.10	-	0.163	6.53	-	6.40	1.10
			HAC-R1-8	0.0101	-	0.974	1.16	594	2,630	-	3.71	0.910	-	293	569	<0.020	0.00520	-	<0.10	-	0.144	4.63	-	5.10	0.740
	HAC-U		HAC-U-1	0.0354	-	1.09	4.88	639	1,310	-	3.97	1.59	-	552	557	<0.040	0.0161	-	<0.20	-	0.271	18.0	-	18.4	3.03
			HAC-U-2	0.0159	-	0.620	2.50	570	1,370	-	2.65	1.30	-	430	669	<0.20	<0.020	-	<1.0	-	0.126	8.60	-	15.0	<2.0
			HAC-U-3	0.0193	-	0.800	4.00	838	1,670	-	3.19	1.51	-	640	598	<0.10	0.0120	-	<0.50	-	0.173	14.8	-	22.4	2.10
			HAC-U-4	0.0231	-	0.600	2.70	625	1,340	-	2.54	1.47	-	540	622	<0.10	0.0100	-	<0.50	-	0.166	10.8	-	18.8	1.40
			HAC-U-5	0.0181	-	0.599	1.37	415	1,100	-	2.21	1.34	-	290	628	<0.040	0.00760	-	<0.20	-	0.146	7.17	-	12.2	1.09
			HAC-U-6	0.0223	-	0.730	2.90	600	1,050	-	1.94	1.61	-	370	720	<0.10	<0.010	-	<0.50	-	0.146	9.81	-	20.0	1.30
			HAC-U-7	0.0413	-	0.630	4.70	848	1,460	-	3.42	1.26	-	750	609	<0.10	0.0130	-	<0.50	-	0.214	20.7	-	23.9	2.90
			HAC-U-8	0.0250	-	0.650	3.80	878	1,650	-	3.47	1.42	-	520	628	<0.10	0.0110	-	<0.50	-	0.184	17.2	-	25.8	1.90
	EDC-D	Reference	EDC-D-1	0.0838	-	0.910	20.8	1,990	2,780	-	7.07	3.51	-	492	144	<0.020	0.0767	-	0.180	-	0.959	27.3	-	41.8	4.33
			EDC-D-2	0.0465	-	1.70	18.6	2,210	5,030	-	9.35	2.65	-	559	230	<0.020	0.0501	-	0.170	-	0.309	30.7	-	39.0	3.83
			EDC-D-3	0.0355	-	0.684	11.5	2,510	4,310	-	6.03	2.44	-	749	339	<0.020	0.0295	-	0.110	-	0.277	14.5	-	21.4	3.03
			EDC-D-4	0.0246	-	1.68	7.18	2,160	5,230	-	6.88	2.15	-	517	381	<0.020	0.0231	-	<0.10	-	0.186	3.75	-	12.7	1.85
			EDC-D-5	0.129	-	0.935	15.3	2,640	3,180	-	5.41	1.86	-	3,550	179	<0.020	0.0428	-	0.410	-	0.729	50.7	-	42.4	8.63
			EDC-D-6	0.0375	-	1.89	11.1	1,650	3,330	-	7.32	1.75	-	512	135	<0.020	0.0478	-	0.120	-	0.340	17.8	-	35.5	5.33
			EDC-D-7	0.0559	-	4.35	15.5	2,080	7,440	-	10.2	2.17	-	681	256	<0.020	0.0317	-	0.140	-	0.276	27.3	-	62.8	3.64
			EDC-D-8	0.0555	-	2.08	14.4	2,070	6,070	-	7.43	1.95	-	325	96.8	<0.020	0.0363	-	<0.10	-	0.597	11.0	-	64.2	1.50
	HAC-D	Exposed	HAC-D-1	0.0183	-	0.580	4.30	580	2,350	-	3.76	1.10	-	290	708	<0.20	0.0340	-	<1.0	-	0.251	14.8	-	15.0	<2.0
			HAC-D-2	0.0346	-	0.740	6.40	730	1,690	-	4.03	1.00	-	320	508	<0.20	0.0510	-	<1.0	-	0.367	35.3	-	29.0	3.20
			HAC-D-3	0.0466	-	0.720	12.1	779	2,380	-	6.54	1.15	-	410	441	<0.10	0.121	-	<0.50	-	0.559	38.2	-	38.8	4.70
			HAC-D-4	0.0606	-	1.28	15.1	960	2,370	-	6.04	0.980	-	460	397	<0.10	0.0660	-	<0.50	-	0.497	56.6	-	49.4	5.30
			HAC-D-5	0.0291	-	1.04	7.60	780	2,730	-	4.99	1.10	-	330	567	<0.20	0.0520	-	<1.0	-	0.354	35.9	-	31.0	3.10
			HAC-D-6	0.0567	-	1.16	11.2	838	1,120	-	5.24	0.800	-	343	332	<0.040	0.0788	-	<0.20	-	0.683	55.6	-	34.0	5.45
			HAC-D-7	0.0565	-	0.870	11.8	930	1,490	-	5.33	1.10	-	970	538	<0.20	0.0760	-	<1.0	-	0.457	41.3	-	39.0	4.60
			HAC-D-8	0.0546	-	2.40	19.3	1,170	1,580	-	6.19	1.24	-	430	361	<0.10	0.0860	-	<0.50	-	0.695	68.4	-	56.1	6.40

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHP is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2019	EDC-U	Reference	EDC-U-1	0.0960	-	1.46	29.9	2,730	3,240	-	9.74	0.670	0.114	430	73.8	<0.020	0.0874	-	1.09	323	0.682	41.7	-	71.9	5.27
			EDC-U-2	0.0780	-	1.12	27.2	1,680	1,940	-	10.5	0.540	0.120	574	74.9	<0.020	0.0920	-	0.470	511	0.732	54.5	-	62.5	6.32
			EDC-U-3	0.0720	-	2.24	31.7	2,670	5,170	-	9.49	0.520	0.0854	1,140	74.0	<0.020	0.0726	-	0.910	585	0.624	38.7	-	95.1	5.18
			EDC-U-4	0.223	-	1.34	25.0	2,910	4,590	-	9.98	0.720	0.123	457	72.9	<0.020	0.0804	-	0.530	234	0.514	32.2	-	83.3	3.69
			EDC-U-5	0.210	-	1.16	26.9	4,070	6,540	-	15.5	0.770	0.145	777	72.1	<0.020	0.0837	-	2.17	267	0.453	36.6	-	63.0	4.17
			EDC-U-6	0.115	-	0.843	15.4	899	1,410	-	6.39	0.360	0.0715	217	44.3	<0.020	0.0581	-	1.30	264	0.484	29.5	-	39.4	3.04
			EDC-U-7	0.100	-	2.40	36.7	3,000	4,610	-	12.6	0.570	0.115	690	84.2	<0.020	0.113	-	1.88	469	0.685	46.5	-	71.0	5.62
			EDC-U-8	0.120	-	2.21	47.8	3,140	4,810	-	11.0	0.670	0.125	651	109	0.0200	0.141	-	1.47	395	0.778	50.9	-	144	5.25
	HAC-R1	Exposed	HAC-R1-1	<0.010	-	1.65	2.30	860	6,030	-	5.92	1.11	<0.025	330	523	<0.10	<0.010	-	<0.50	86.9	0.0830	7.05	-	8.40	<1.0
			HAC-R1-2	0.0170	-	2.02	2.40	740	6,960	-	6.77	1.50	<0.025	360	765	<0.10	<0.010	-	<0.50	77.8	0.0980	6.36	-	7.60	<1.0
			HAC-R1-3	<0.010	-	1.69	2.10	760	5,570	-	5.29	1.29	<0.025	260	486	<0.10	<0.010	-	<0.50	84.9	0.0890	7.07	-	9.80	<1.0
			HAC-R1-4	0.0150	-	1.37	1.80	860	5,680	-	6.17	1.10	<0.025	350	534	<0.10	<0.010	-	<0.50	101	0.105	8.34	-	9.10	<1.0
			HAC-R1-5	0.0490	-	1.22	<2.5	860	4,750	-	5.05	<1.3	<0.063	290	674	<0.25	<0.025	-	<1.3	102	0.119	7.10	-	<13	<2.5
			HAC-R1-6	0.0210	-	1.51	3.70	740	6,180	-	6.52	1.10	<0.025	320	543	<0.10	<0.010	-	<0.50	114	0.0900	6.00	-	8.40	1.00
			HAC-R1-7	<0.010	-	2.25	2.30	660	6,100	-	6.10	1.32	<0.025	330	624	<0.10	<0.010	-	<0.50	59.0	0.0930	5.26	-	7.70	<1.0
			HAC-R1-8	<0.010	-	1.53	2.00	730	5,440	-	5.51	1.27	<0.025	340	515	<0.10	<0.010	-	<0.50	43.1	0.0840	4.33	-	7.40	<1.0
	HAC-U		HAC-U-1	0.0140	-	1.00	2.60	510	2,540	-	2.93	1.30	<0.063	290	602	<0.25	<0.025	-	<1.3	97.6	0.116	7.30	-	<13	<2.5
			HAC-U-2	0.0160	-	1.19	2.40	720	4,420	-	5.19	1.50	<0.025	350	589	<0.10	<0.010	-	<0.50	95.0	0.115	7.51	-	9.70	<1.0
			HAC-U-3	0.0200	-	1.06	3.60	930	3,460	-	4.26	1.65	<0.025	400	637	<0.10	<0.010	-	<0.50	147	0.142	10.9	-	16.4	1.10
			HAC-U-4	0.0190	-	1.36	2.60	720	3,390	-	4.04	1.51	<0.025	270	584	<0.10	<0.010	-	<0.50	95.3	0.111	7.88	-	13.4	<1.0
			HAC-U-5	0.0230	-	1.09	3.70	910	3,850	-	4.52	1.81	<0.025	520	690	<0.10	0.0100	-	<0.50	177	0.188	13.0	-	16.3	1.60
			HAC-U-6	0.0260	-	1.26	4.70	910	3,540	-	4.42	2.01	<0.025	500	611	<0.10	0.0110	-	<0.50	138	0.171	11.5	-	15.4	1.20
			HAC-U-7	0.0320	-	1.07	5.90	820	2,680	-	4.37	1.57	0.0590	560	640	<0.10	0.0150	-	<0.50	267	0.219	22.0	-	18.1	2.20
			HAC-U-8	0.0170	-	1.14	2.80	500	2,260	-	2.91	1.58	<0.025	310	542	<0.10	<0.010	-	<0.50	106	0.126	9.48	-	12.0	<1.0
	EDC-D	Reference	EDC-D-1	0.123	-	4.70	32.3	2,770	6,830	-	17.1	1.19	0.113	726	142	0.0220	0.220	-	1.83	808	0.631	69.7	-	118	6.27
			EDC-D-2	0.0520	-	2.81	28.7	1,590	3,250	-	9.12	4.82	0.118	267	94.1	<0.020	0.0754	-	0.670	335	12.3	64.5	-	78.8	7.18
			EDC-D-3	0.0830	-	2.19	31.6	1,730	2,840	-	10.4	2.37	0.101	427	88.3	0.0200	0.0856	-	1.58	399	0.623	52.5	-	72.8	6.30
			EDC-D-4	0.0590	-	0.759	24.2	1,020	1,370	-	9.04	0.540	0.0820	201	72.8	<0.020	0.0773	-	0.190	465	0.494	42.0	-	49.8	6.25
			EDC-D-5	0.0410	-	1.03	25.2	1,150	1,660	-	8.90	0.540	0.111	273	83.4	<0.020	0.0773	-	1.18	329	0.499	42.6	-	58.0	5.36
			EDC-D-6	0.0610	-	2.54	16.6	2,460	23,000	-	30.2	0.710	0.0766	875	68.3	<0.020	0.119	-	2.87	290	0.352	23.5	-	45.7	4.21
			EDC-D-7	0.128	-	2.01	36.0	2,980	11,900	-	22.5	1.10	0.174	589	95.2	0.0320	0.817	-	6.68	590	0.714	52.2	-	88.9	8.77
			EDC-D-8	0.0680	-	1.39	22.9	1,640	9,470	-	15.7	0.700	0.0907	889	77.7	<0.020	0.0866	-	0.410	362	0.450	30.2	-	56.5	5.87
	HAC-D	Exposed	HAC-D-1	0.0190	-	0.830	7.60	550	2,430	-	3.65	0.700	0.0350	240	372	<0.10	0.0230	-	<0.50	209	0.190	18.3	-	21.8	2.30
			HAC-D-2	0.0220	-	1.29	9.60	800	4,160	-	5.96	0.970	0.0470	310	501	<0.10	0.0430	-	<0.50	301	0.312	29.3	-	27.7	3.40
			HAC-D-3	0.0500	-	0.970	20.4	1,340	1,380	-	6.57	0.540	0.111	330	224	<0.10	0.0720	-	<0.50	750	0.699	71.4	-	48.0	7.50
			HAC-D-4	0.0290	-	1.70	12.6	990	2,160	-	4.90	0.750	0.0700	290	383	<0.10	0.0490	-	<0.50	473	0.486	43.9	-	34.6	4.90
			HAC-D-5	0.0260	-	0.940	11.7	960	3,030	-	5.78	0.890	0.0817	280	396	<0.10	0.0460	-	<0.50	494	0.398	42.5	-	33.1	4.80
			HAC-D-6	0.0300	-	0.790	12.2	830	1,480	-	4.39	0.590	0.0626	220	276	<0.10	0.0500	-	<0.50	443	0.401	40.7	-	32.7	4.40
			HAC-D-7	0.0290	-	0.940	9.00	680	2,940	-	5.09	0.990	0.0428	310	517	<0.10	0.0400	-	<0.50	341	0.291	27.2	-	32.5	3.50
			HAC-D-8	0.0370	-	1.10	14.3	1,040	3,150	-	5.96	0.870	0.0627	330	386	<0.10	0.0490	-	<0.50	514	0.400	42.6	-	41.6	4.90

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHP is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

Table E.1: Periphyton Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2020	EDC-U	Reference	EDC-U-1	0.109	-	3.68	71.5	1,560	1,980	-	8.31	0.700	0.113	212	120	<0.095	0.320	-	<0.47	411	0.611	50.4	-	142	5.17
			EDC-U-2	0.168	-	3.06	53.3	4,200	4,750	-	13.9	1.04	0.178	354	113	<0.050	0.126	-	0.610	508	0.930	180	-	90.8	10.6
			EDC-U-3	0.0484	-	3.13	69.8	2,070	2,870	-	4.31	0.490	0.0493	<252	113	<0.252	0.211	-	<1.26	278	0.337	35.2	-	192	2.77
			EDC-U-4	0.0520	-	2.17	35.1	2,250	4,300	-	5.37	0.300	0.0362	789	76.2	<0.076	0.0770	-	<0.38	273	0.358	41.6	-	113	3.46
			EDC-U-5	0.0678	-	3.53	85.1	2,870	3,290	-	7.70	0.680	0.113	465	106	<0.076	0.177	-	<0.38	738	0.610	91.2	-	156	9.03
			EDC-U-6	0.0713	-	1.56	59.0	2,190	2,510	-	10.5	0.600	0.0997	347	99.9	<0.020	0.0854	-	0.300	847	0.731	60.2	-	73.9	8.06
			EDC-U-7	0.0691	-	4.37	62.1	1,570	1,590	-	5.80	0.370	0.0890	634	94.0	<0.049	0.299	-	<0.24	760	0.651	78.3	-	126	12.1
			EDC-U-8	0.0750	-	3.09	41.0	1,910	1,910	-	6.35	0.470	0.0702	225	78.6	<0.020	0.129	-	0.170	424	0.752	93.9	-	125	7.71
	HAC-R1	Exposed	HAC-R1-1	0.00570	-	1.61	2.86	716	4,860	-	4.97	1.54	0.0112	302	556	0.0200	0.00560	-	0.140	77.4	0.0864	6.57	-	11.7	1.04
			HAC-R1-2	0.00760	-	1.47	2.75	730	5,280	-	5.44	1.47	0.0134	355	501	0.0220	0.00560	-	0.160	97.7	0.0940	7.68	-	9.70	1.05
			HAC-R1-3	0.00700	-	1.58	3.18	811	5,060	-	5.11	1.68	0.00840	338	533	0.0310	0.00630	-	<0.10	89.7	0.100	8.18	-	11.8	1.03
			HAC-R1-4	0.00980	-	2.05	3.39	837	5,610	-	5.96	1.72	0.0340	348	525	0.0250	0.00790	-	<0.10	116	0.113	11.0	-	13.7	1.23
			HAC-R1-5	0.00860	-	1.74	3.69	831	5,610	-	5.91	1.70	0.0102	338	517	0.0250	0.00870	-	<0.10	111	0.100	9.75	-	15.2	1.04
			HAC-R1-6	0.00760	-	1.58	3.20	801	5,240	-	5.37	1.40	0.00910	308	552	0.0250	0.00640	-	0.120	124	0.0916	9.61	-	10.4	1.20
			HAC-R1-7	0.00590	-	1.29	3.09	651	3,790	-	3.82	1.42	0.00780	269	558	0.0260	0.00510	-	<0.10	94.2	0.0836	6.91	-	8.62	0.960
			HAC-R1-8	0.00870	-	1.23	3.23	669	3,450	-	3.58	1.40	0.0102	286	608	0.0270	0.00450	-	0.150	94.2	0.0886	7.38	-	10.2	1.07
	HAC-U		HAC-U-1	0.0168	-	1.67	3.65	957	7,120	-	7.46	2.00	0.0137	355	582	0.0580	0.00900	-	<0.25	117	0.115	9.39	-	12.5	1.13
			HAC-U-2	0.0136	-	1.59	2.34	1,020	8,020	-	8.31	1.93	<0.0125	423	520	<0.050	0.00910	-	<0.25	83.0	0.103	7.03	-	10.4	0.860
			HAC-U-3	0.0157	-	2.07	4.07	974	6,840	-	7.23	3.07	0.0182	294	540	<0.050	0.0117	-	<0.25	136	0.147	11.1	-	14.5	1.40
			HAC-U-4	0.0152	-	1.40	3.78	747	5,010	-	6.08	1.92	0.0185	320	512	0.0310	0.0111	-	0.160	165	0.154	12.6	-	16.1	1.62
			HAC-U-5	0.0126	-	1.57	3.11	919	7,160	-	8.10	2.72	0.0134	417	504	0.0220	0.00990	-	<0.10	118	0.137	9.88	-	11.8	1.09
			HAC-U-6	0.00970	-	1.65	2.65	844	6,030	-	6.37	2.16	0.0112	360	556	<0.020	0.00800	-	0.240	88.8	0.123	8.10	-	11.3	1.10
			HAC-U-7	0.0147	-	1.56	3.12	974	5,860	-	7.21	1.73	0.0315	397	490	0.0260	0.0126	-	0.160	239	0.185	20.8	-	14.6	1.92
			HAC-U-8	0.00920	-	1.18	2.73	1,010	5,990	-	6.49	1.74	0.0110	370	539	0.0260	0.00870	-	0.140	108	0.122	9.54	-	11.5	1.04
	EDC-D	Reference	EDC-D-1	0.0645	-	1.32	30.5	1,510	2,460	-	12.8	0.655	0.102	326	83.1	0.0230	0.0979	-	0.240	652	0.704	56.5	-	59.8	8.18
			EDC-D-2	0.0510	-	6.64	39.1	2,020	4,120	-	14.3	0.950	0.0698	399	116	<0.020	0.0872	-	0.320	597	0.610	48.2	-	88.6	5.80
			EDC-D-3	0.0325	-	0.676	23.9	1,140	1,500	-	9.64	0.387	0.0738	292	69.4	<0.020	0.0766	-	0.190	704	0.693	55.7	-	46.8	7.48
			EDC-D-4	0.0416	-	0.838	27.5	1,100	1,720	-	9.54	0.550	0.0813	229	64.4	<0.020	0.0728	-	0.170	575	0.496	49.3	-	53.5	6.61
			EDC-D-5	0.0450	-	2.60	34.4	1,970	2,790	-	11.4	0.840	0.0576	396	76.2	<0.020	0.0832	-	0.300	620	0.564	52.6	-	57.6	6.04
			EDC-D-6	0.0356	-	3.17	28.1	1,750	2,730	-	10.0	0.609	0.0684	266	95.9	<0.020	0.0757	-	0.220	638	0.652	64.0	-	88.5	6.69
			EDC-D-7	0.0496	-	2.74	20.8	1,160	3,120	-	11.5	0.544	0.0659	318	85.0	<0.020	0.0708	-	0.180	636	0.571	46.6	-	54.2	6.34
			EDC-D-8	0.0554	-	0.610	26.4	1,130	2,060	-	12.5	0.454	0.0880	334	73.0	0.0200	0.0901	-	0.210	787	0.715	57.1	-	49.4	7.80
	HAC-D	Exposed	HAC-D-1	0.0226	-	0.934	13.6	1,300	2,850	-	6.27	1.00	0.0443	278	477	0.0250	0.0530	-	0.240	648	0.452	59.2	-	41.7	4.95
			HAC-D-2	0.0319	-	0.753	30.5	1,310	1,570	-	7.26	0.760	0.0719	421	308	0.0280	0.196	-	0.250	723	0.594	62.0	-	40.1	6.93
			HAC-D-3	0.0136	-	0.943	30.0	645	2,110	-	3.47	1.01	0.0236	314	573	0.0270	0.0296	-	0.290	520	0.237	24.9	-	45.5	4.10
			HAC-D-4	0.0292	-	0.805	13.1	1,120	1,850	-	5.59	0.820	0.0683	253	368	0.0300	0.0635	-	0.210	566	0.465	67.0	-	43.1	5.22
			HAC-D-5	0.0149	-	0.747	8.91	747	2,120	-	4.20	0.958	0.0410	235	465	0.0320	0.0427	-	0.140	378	0.275	43.5	-	40.6	3.32
			HAC-D-6	0.0285	-	0.847	16.3	1,040	2,180	-	7.85	0.726	0.0710	354	415	0.0320	0.0904	-	0.240	658	0.601	72.8	-	40.9	6.90
			HAC-D-7	0.0135	-	0.932	8.60	742	2,680	-	4.24	1.22	0.0332	252	518	0.0290	0.0344	-	0.110	356	0.267	36.1	-	51.2	3.35
			HAC-D-8	0.0117	-	1.11	9.26	692	2,670	-	4.16	1.13	0.0272	253	588	0.0320	0.0333	-	<0.10	252	0.234	34.0	-	56.7	2.50

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Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2021	EDC-U	Reference	EDC-U-1	0.0582	-	2.10	29.2	1,840	3,050	-	8.83	0.460	0.0891	254	64.5	<0.020	0.0662	-	0.170	331	0.453	33.4	-	57.3	4.36
			EDC-U-2	0.0483	-	4.52	34.9	1,740	3,110	-	9.11	0.700	0.142	342	67.9	0.0300	0.0972	-	0.300	407	0.643	68.0	-	74.0	7.71
			EDC-U-3	0.0688	-	1.17	24.7	1,180	1,350	-	7.92	0.360	0.0954	481	68.3	<0.020	0.0788	-	0.230	579	0.750	62.0	-	61.4	5.11
			EDC-U-4	0.0883	-	1.17	34.2	1,480	1,920	-	10.2	0.650	0.148	228	75.1	<0.020	0.107	-	0.180	430	0.855	52.2	-	72.3	7.38
			EDC-U-5	0.400	-	3.63	51.6	2,000	2,080	-	11.8	0.730	0.142	306	89.2	0.0250	0.144	-	0.340	777	1.13	94.2	-	93.3	11.0
			EDC-U-6	0.0827	-	1.04	34.8	1,420	1,700	-	12.6	0.550	0.148	517	74.6	<0.020	0.122	-	0.310	640	1.14	73.0	-	77.7	7.55
			EDC-U-7	0.0552	-	3.86	83.1	2,600	4,670	-	9.24	0.760	0.130	400	77.4	<0.020	0.139	-	0.400	426	0.774	51.7	-	121	5.47
			EDC-U-8	0.0419	-	2.57	49.7	1,470	2,280	-	7.52	0.440	0.100	306	84.6	<0.020	0.156	-	0.220	397	0.568	50.3	-	110	5.56
	HAC-R1	Exposed	HAC-R1-1	0.00680	-	<1.00	<5.00	808	2,590	-	2.12	<2.50	<0.125	<500	593	<0.500	<0.0500	-	<2.50	58.4	0.0828	4.09	-	<25.0	<5.00
			HAC-R1-2	<0.0050	-	0.725	1.82	512	1,820	-	1.50	<2.50	0.00600	213	525	0.0310	0.00320	-	<0.10	9.66	0.0505	1.99	-	5.80	<0.20
			HAC-R1-3	0.00630	-	0.986	2.49	809	2,330	-	2.27	1.53	0.00670	245	548	0.0320	0.00500	-	<0.13	23.2	0.0641	3.92	-	9.00	<0.26
			HAC-R1-4	<0.0050	-	1.04	2.27	513	2,070	-	1.81	1.81	0.0170	223	543	0.0310	0.00390	-	<0.10	8.98	0.0558	2.50	-	7.10	<0.20
			HAC-R1-5	<0.0050	-	0.908	2.25	567	2,060	-	1.91	1.41	0.00880	206	502	0.0270	0.00400	-	<0.10	3.30	0.0481	1.99	-	5.90	<0.20
			HAC-R1-6	<0.0050	-	0.779	1.77	468	1,520	-	1.23	1.59	0.00860	171	494	0.0290	0.00340	-	<0.10	2.60	0.0239	1.07	-	5.30	<0.20
			HAC-R1-7	0.00680	-	0.946	2.80	839	2,810	-	3.06	1.52	0.0135	213	505	0.0220	0.00450	-	<0.10	35.6	0.0682	4.09	-	7.10	<0.20
			HAC-R1-8	0.00550	-	0.892	3.34	335	2,190	-	1.98	1.22	0.00580	168	532	0.0330	0.00340	-	<0.10	8.94	0.0337	1.81	-	5.40	<0.20
	HAC-U		HAC-U-1	0.00920	-	1.22	1.94	939	6,790	-	7.89	2.08	0.00830	325	526	0.0260	0.00780	-	<0.10	37.1	0.0863	4.44	-	6.70	0.210
			HAC-U-2	0.0150	-	1.66	3.55	1,160	7,650	-	8.13	2.39	0.0249	450	558	0.0360	0.0118	-	<0.12	113	0.137	9.60	-	11.2	1.46
			HAC-U-3	0.0249	-	1.26	2.95	1,730	6,300	-	7.83	2.44	0.0781	653	654	0.0340	0.0110	-	<0.13	98.0	0.142	9.39	-	16.6	0.800
			HAC-U-4	0.00880	-	1.49	2.76	356	6,180	-	6.63	2.03	0.0119	303	546	0.0240	0.00860	-	<0.10	12.2	0.0888	4.17	-	8.20	<0.20
			HAC-U-5	0.0183	-	1.48	2.95	1,260	7,440	-	7.92	3.23	0.0229	402	596	0.0350	0.0107	-	<0.13	87.8	0.187	7.81	-	11.9	0.770
			HAC-U-6	0.00740	-	1.21	1.99	1,060	6,900	-	7.66	2.57	0.0141	376	645	0.0360	0.00840	-	<0.10	31.6	0.142	4.40	-	6.90	0.650
			HAC-U-7	0.0101	-	1.14	2.20	1,120	6,260	-	7.79	2.58	0.0346	329	597	0.0340	0.0100	-	<0.10	37.8	0.116	5.24	-	7.30	0.520
			HAC-U-8	0.00620	-	0.926	2.43	920	4,480	-	5.38	1.87	0.0108	249	563	0.0350	0.00540	-	<0.12	78.9	0.115	8.57	-	7.50	0.730
	EDC-D	Reference	EDC-D-1	0.0402	-	3.30	16.8	1,680	5,830	-	9.23	2.99	0.0493	423	200	<0.020	0.0419	-	0.140	141	0.366	22.2	-	55.8	3.26
			EDC-D-2	0.0306	-	1.67	17.7	1,770	5,350	-	8.35	1.88	0.0773	639	153	<0.020	0.0426	-	0.160	231	0.284	23.2	-	39.4	2.91
			EDC-D-3	0.0380	-	1.01	21.4	1,420	3,020	-	7.96	1.15	0.0666	351	129	<0.020	0.0712	-	0.160	318	0.335	42.8	-	54.2	5.97
			EDC-D-4	0.0336	-	5.56	15.1	2,010	7,000	-	11.0	1.76	0.0682	546	252	<0.020	0.0391	-	0.160	212	0.323	23.2	-	65.5	3.57
			EDC-D-5	0.0340	-	2.74	24.6	1,970	6,450	-	9.98	2.24	0.0710	469	200	<0.020	0.0459	-	0.220	181	0.311	18.5	-	47.2	3.16
			EDC-D-6	0.0353	-	3.18	20.6	2,080	6,170	-	10.4	1.82	0.0947	629	166	<0.020	0.0488	-	0.140	270	0.386	26.5	-	59.5	4.45
			EDC-D-7	0.0701	-	0.689	21.2	1,420	2,750	-	7.80	1.40	0.0743	384	82.7	<0.020	0.0547	-	0.130	305	0.367	33.0	-	42.7	4.37
			EDC-D-8	0.0182	-	0.786	7.06	825	2,250	-	4.06	0.680	0.0293	282	76.7	<0.020	0.0197	-	<0.10	113	0.126	11.6	-	17.6	1.64
	HAC-D	Exposed	HAC-D-1	0.0255	-	0.634	7.46	930	1,940	-	4.38	1.45	0.0302	266	425	0.0410	0.442	-	<0.12	14.2	0.393	10.5	-	21.6	2.34
			HAC-D-2	0.0157	-	1.40	4.68	1,430	2,580	-	4.19	1.55	0.0369	514	536	0.0320	0.0377	-	<0.12	93.8	0.240	13.8	-	21.4	1.91
			HAC-D-3	0.0419	-	1.92	8.79	2,220	4,560	-	7.03	1.55	0.0978	1,070	240	0.0230	0.0350	-	0.340	419	0.311	40.8	-	46.0	5.68
			HAC-D-4	0.0532	-	2.20	13.1	2,010	3,900	-	7.36	1.49	0.125	679	151	0.0330	0.0389	-	0.330	588	0.354	58.2	-	48.9	7.72
			HAC-D-5	0.0886	-	3.07	18.8	1,490	1,900	-	6.18	1.12	0.255	1,010	196	0.0490	0.0327	-	0.410	888	0.507	79.9	-	72.4	9.35
			HAC-D-6	0.0647	-	1.51	9.27	2,530	5,680	-	7.57	2.26	0.0828	912	169	<0.020	0.0249	-	0.240	601	0.240	42.6	-	61.6	5.58
			HAC-D-7	0.227	-	1.33	7.78	2,190	4,970	-	6.90	2.05	0.0961	853	166	<0.020	0.0266	-	0.190	461	0.199	35.0	-	49.8	3.59
			HAC-D-8	0.0642	-	0.879	9.02	983	870	-	3.16	0.540	0.0852	280	126	0.0200	0.0192	-	0.240	513	0.296	44.9	-	35.5	3.78

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Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2022	EDC-U	Reference	EDC-U-2	0.157	-	2.24	45.0	3,290	4,780	-	16.7	0.980	0.200	291	98.2	<0.038	0.116	-	0.270	458	0.809	54.4	-	152	7.61
			EDC-U-3	0.188	-	2.42	45.3	3,900	5,880	-	15.1	0.820	0.164	289	94.0	<0.025	0.116	-	0.190	353	0.658	45.0	-	143	5.87
			EDC-U-4	0.0972	-	2.87	66.3	3,030	4,850	-	8.09	0.700	0.0811	147	114	0.0340	0.200	-	<0.15	200	0.612	55.4	-	241	4.70
			EDC-U-5	0.176	-	2.74	56.0	3,600	4,140	-	14.7	1.13	0.193	291	125	<0.060	0.152	-	<0.30	487	1.00	98.8	-	202	8.94
			EDC-U-6	0.122	-	2.17	48.1	2,630	3,080	-	11.5	0.770	0.129	214	94.2	<0.062	0.105	-	<0.31	385	0.704	45.7	-	135	6.12
			EDC-U-7	0.0730	-	3.78	51.1	2,630	4,260	-	9.40	0.600	0.0847	224	74.0	<0.050	0.0929	-	<0.25	417	0.660	58.8	-	113	6.87
			EDC-U-8	0.0777	-	4.41	95.6	2,670	3,810	-	8.27	0.770	0.100	151	140	<0.068	0.404	-	<0.34	289	0.851	53.0	-	337	5.40
			EDC-U-1	0.0486	-	2.38	25.2	2,760	6,070	-	7.02	0.390	0.0337	159	65.4	<0.026	0.0419	-	<0.13	116	0.388	16.2	-	154	1.56
	HAC-R1	Exposed	HAC-R1-1	0.00960	-	1.50	3.13	866	4,980	-	5.14	2.22	0.0138	326	513	<0.025	0.00700	-	<0.12	132	0.156	10.7	-	19.2	1.42
			HAC-R1-2	0.00910	-	1.35	3.77	886	3,870	-	3.90	1.88	0.0246	358	535	0.0250	0.00610	-	<0.10	124	0.150	12.3	-	20.7	1.26
			HAC-R1-3	0.00910	-	1.17	3.10	731	3,720	-	3.54	2.28	0.0115	249	509	0.0310	0.00480	-	<0.12	72.3	0.117	6.18	-	16.9	0.960
			HAC-R1-4	0.00640	-	1.31	3.12	681	3,790	-	3.65	2.57	0.0150	270	544	0.0320	0.00630	-	<0.15	80.9	0.122	7.06	-	16.4	0.910
			HAC-R1-5	0.00880	-	1.71	3.30	787	4,480	-	4.42	1.95	0.0189	313	512	0.0250	0.00640	-	<0.10	112	0.138	10.1	-	21.4	1.23
			HAC-R1-6	0.00600	-	1.01	3.98	780	1,610	-	1.64	1.50	0.00930	225	543	0.0350	0.00360	-	<0.12	69.3	0.0956	5.61	-	11.6	0.710
			HAC-R1-7	0.0160	-	1.23	4.68	880	3,410	-	4.05	1.51	0.0259	333	571	0.0270	0.00680	-	<0.12	228	0.215	18.2	-	27.4	2.10
			HAC-R1-8	0.0243	-	2.29	11.1	1,340	3,370	-	4.55	1.92	0.0295	370	439	0.0210	0.00870	-	0.220	365	0.195	25.7	-	59.8	2.38
	HAC-U		HAC-U-1	0.0153	-	1.37	3.11	1,050	6,350	-	6.78	5.00	0.0162	317	518	<0.020	0.00970	-	<0.10	98.0	0.186	9.34	-	43.1	0.890
			HAC-U-2	0.0195	-	1.49	6.97	1,360	7,010	-	8.68	3.83	0.0616	375	488	<0.020	0.0168	-	<0.10	304	0.189	17.0	-	31.7	2.15
			HAC-U-3	0.00970	-	1.35	2.66	861	6,070	-	6.17	4.05	0.0101	307	479	<0.020	0.00880	-	<0.10	73.2	0.144	7.29	-	14.5	0.800
			HAC-U-4	0.0129	-	1.56	2.59	1,280	5,410	-	6.20	12.2	0.0631	345	494	0.0270	0.0134	-	<0.10	188	0.163	20.8	-	13.2	1.30
			HAC-U-5	0.0148	-	1.20	3.20	1,670	6,100	-	7.95	1.97	0.0171	420	474	<0.020	0.0123	-	<0.10	207	0.165	13.2	-	12.4	1.14
			HAC-U-6	0.00640	-	0.900	1.79	896	4,930	-	5.15	1.94	<0.0057	246	550	<0.023	0.00780	-	<0.11	39.6	0.123	4.24	-	6.40	0.600
			HAC-U-7	0.0362	-	1.96	5.49	4,480	6,820	-	7.94	2.30	0.0477	269	366	0.0210	0.00640	-	0.100	296	0.130	18.1	-	19.7	1.13
			HAC-U-8	0.0202	-	0.745	2.97	1,650	5,490	-	8.08	1.62	0.0214	306	589	0.0230	0.00860	-	<0.10	255	0.174	22.1	-	15.3	1.90
	EDC-D	Reference	EDC-D-1	0.0435	-	1.05	33.6	1,370	2,540	-	8.97	0.880	0.0897	266	73.7	<0.033	0.0812	-	<0.16	432	0.546	46.3	-	55.8	6.12
			EDC-D-2	0.0516	-	1.70	29.8	1,960	4,380	-	11.5	1.08	0.0744	316	91.3	<0.054	0.0726	-	<0.27	485	0.645	40.0	-	59.2	6.44
			EDC-D-3	0.0494	-	1.26	36.0	1,680	2,990	-	10.3	0.880	0.0760	289	79.9	<0.053	0.0752	-	<0.27	566	0.559	46.2	-	58.2	6.96
			EDC-D-4	0.0666	-	0.776	22.0	1,030	2,300	-	8.24	0.860	0.263	240	50.9	<0.035	0.0596	-	<0.18	301	0.377	26.1	-	40.7	4.27
			EDC-D-5	0.0550	-	2.86	25.2	2,560	5,480	-	10.9	1.56	0.0504	274	111	<0.032	0.0626	-	<0.16	252	0.382	23.9	-	76.9	2.00
			EDC-D-6	0.0630	-	1.94	43.1	1,950	2,720	-	11.7	1.73	0.0870	403	189	<0.054	0.109	-	0.320	1,020	0.860	91.5	-	89.1	16.2
			EDC-D-7	0.0433	-	1.43	29.3	1,870	3,650	-	10.3	0.930	0.105	381	70.4	<0.070	0.100	-	<0.35	529	0.477	45.8	-	62.3	6.41
			EDC-D-8	0.0452	-	1.06	33.2	1,400	2,910	-	11.6	0.860	0.0824	505	77.7	<0.052	0.108	-	<0.26	580	0.494	49.6	-	58.5	7.08
	HAC-D	Exposed	HAC-D-1	0.225	-	11.1	105	13,300	19,300	-	49.3	9.13	0.470	2,740	2,510	0.185	0.390	-	1.66	3,120	3.68	380	-	231	33.5
			HAC-D-2	0.0364	-	0.620	8.23	2,530	3,750	-	7.70	2.11	0.0398	351	478	0.0310	0.0457	-	0.140	244	0.354	26.2	-	27.4	2.75
			HAC-D-3	0.0189	-	0.490	4.41	1,820	3,550	-	6.43	1.59	0.0188	311	596	0.0310	0.0239	-	<0.10	141	0.229	13.8	-	18.0	1.30
			HAC-D-4	0.0161	-	0.755	4.38	1,850	3,640	-	5.89	1.98	0.0216	350	659	0.0280	0.0255	-	<0.12	111	0.206	10.9	-	17.1	1.06
			HAC-D-5	0.0266	-	0.703	5.67	1,690	3,610	-	6.69	1.67	0.0226	306	604	0.0330	0.0256	-	<0.10	178	0.219	17.1	-	17.8	1.75
			HAC-D-6	0.0222	-	0.626	6.38	1,890	2,980	-	5.67	1.65	0.0298	292	617	0.0260	0.0255	-	<0.10	135	0.192	13.2	-	18.5	1.24
			HAC-D-7	0.0212	-	0.998	6.17	1,910	3,480	-	5.26	2.53	0.0265	341	618	<0.048	0.0344	-	<0.24	142	0.210	16.9	-	28.6	1.22
			HAC-D-8	0.0200	-	1.33	8.18	1,700	3,370	-	5.03	1.94	0.0191	312	574	0.0360	0.0422	-	<0.14	99.1	0.172	14.2	-	34.3	1.06

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

[a] UHC is the pre-breach sampling area associated with HAC-R1 and HAC-U. LHC is the historical sampling area associated with HAC-D.

APPENDIX F

BENTHIC INVERTEBRATE TISSUE QUALITY

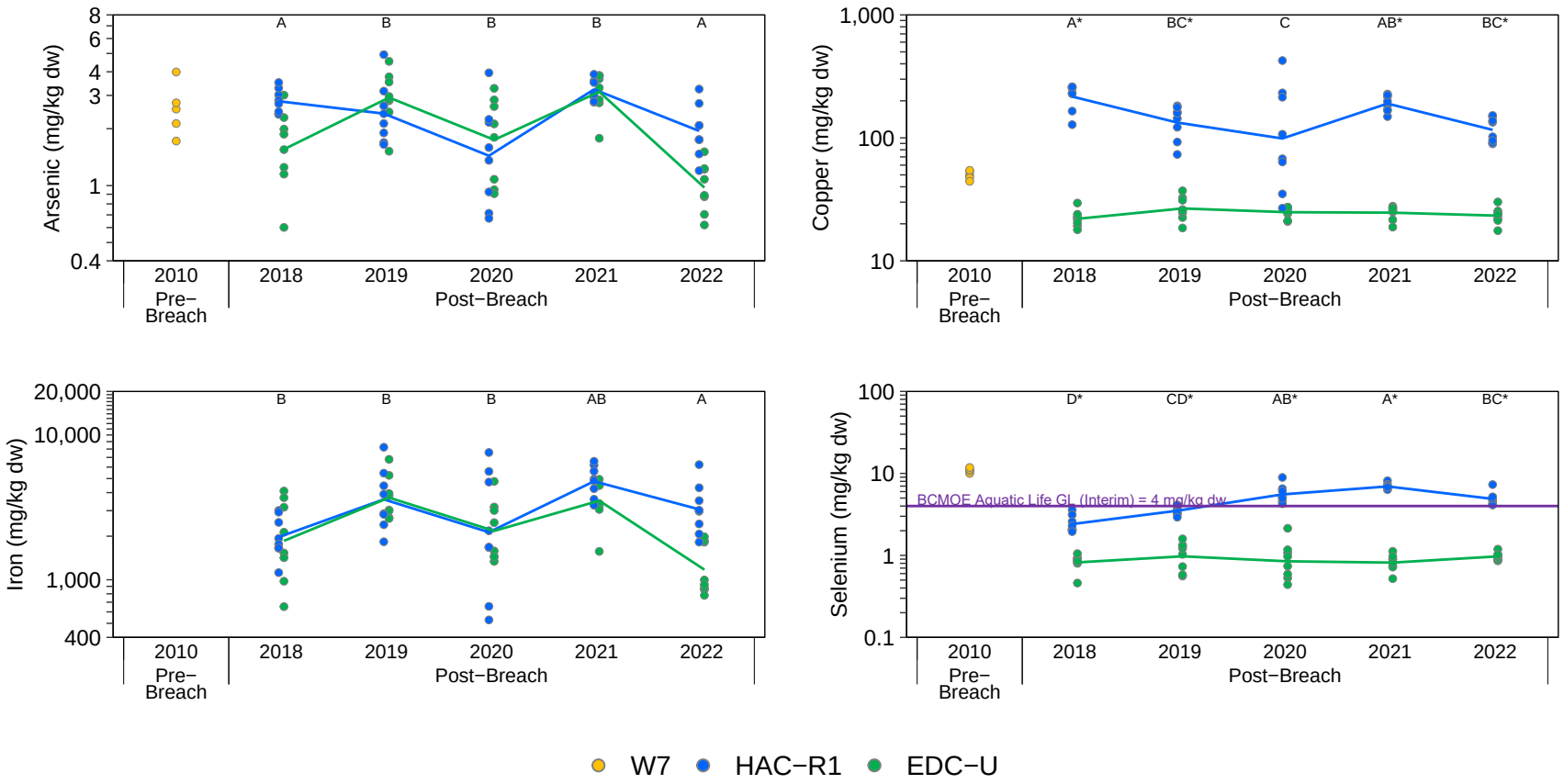

Figure F.1: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

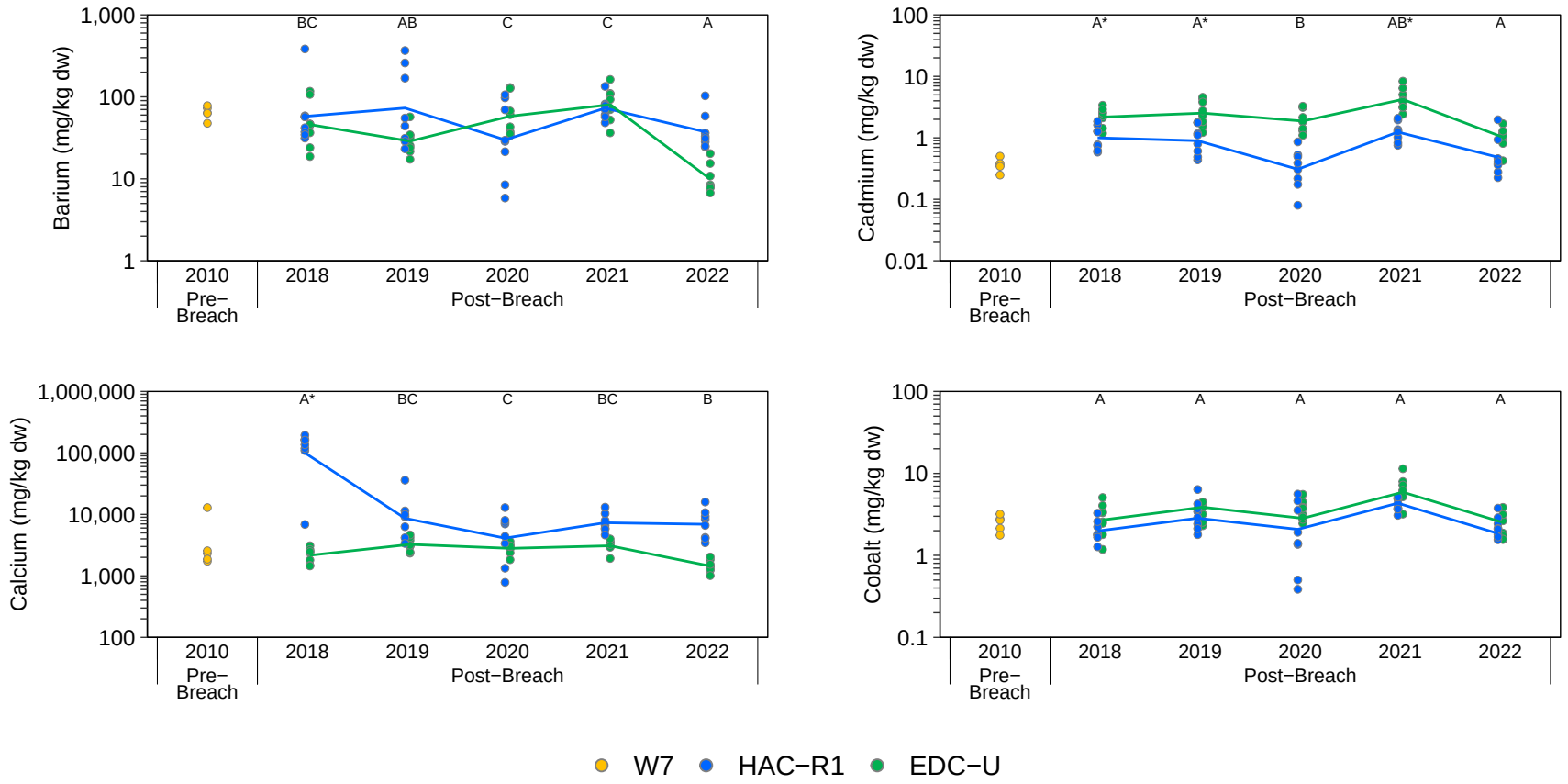

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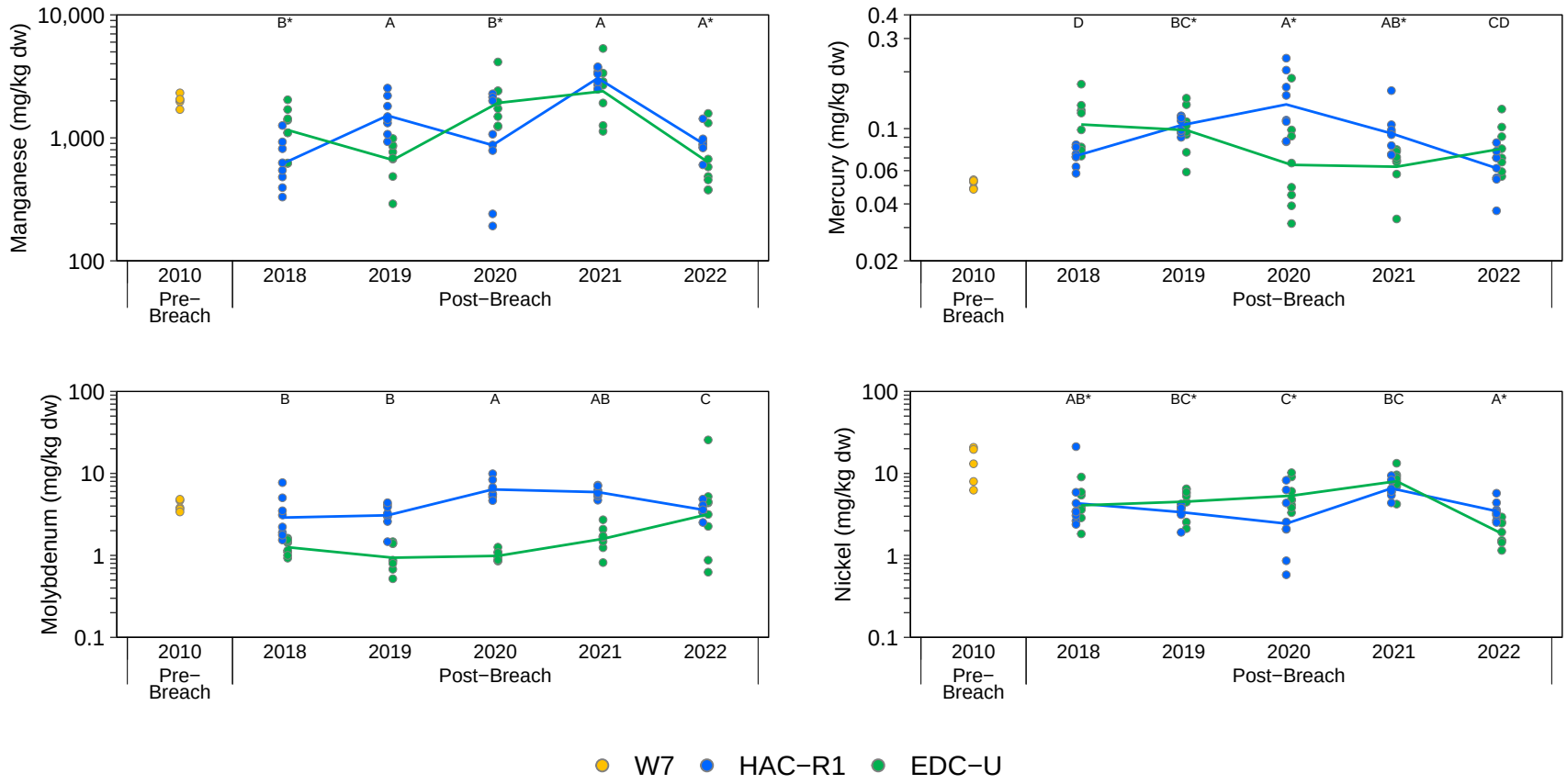

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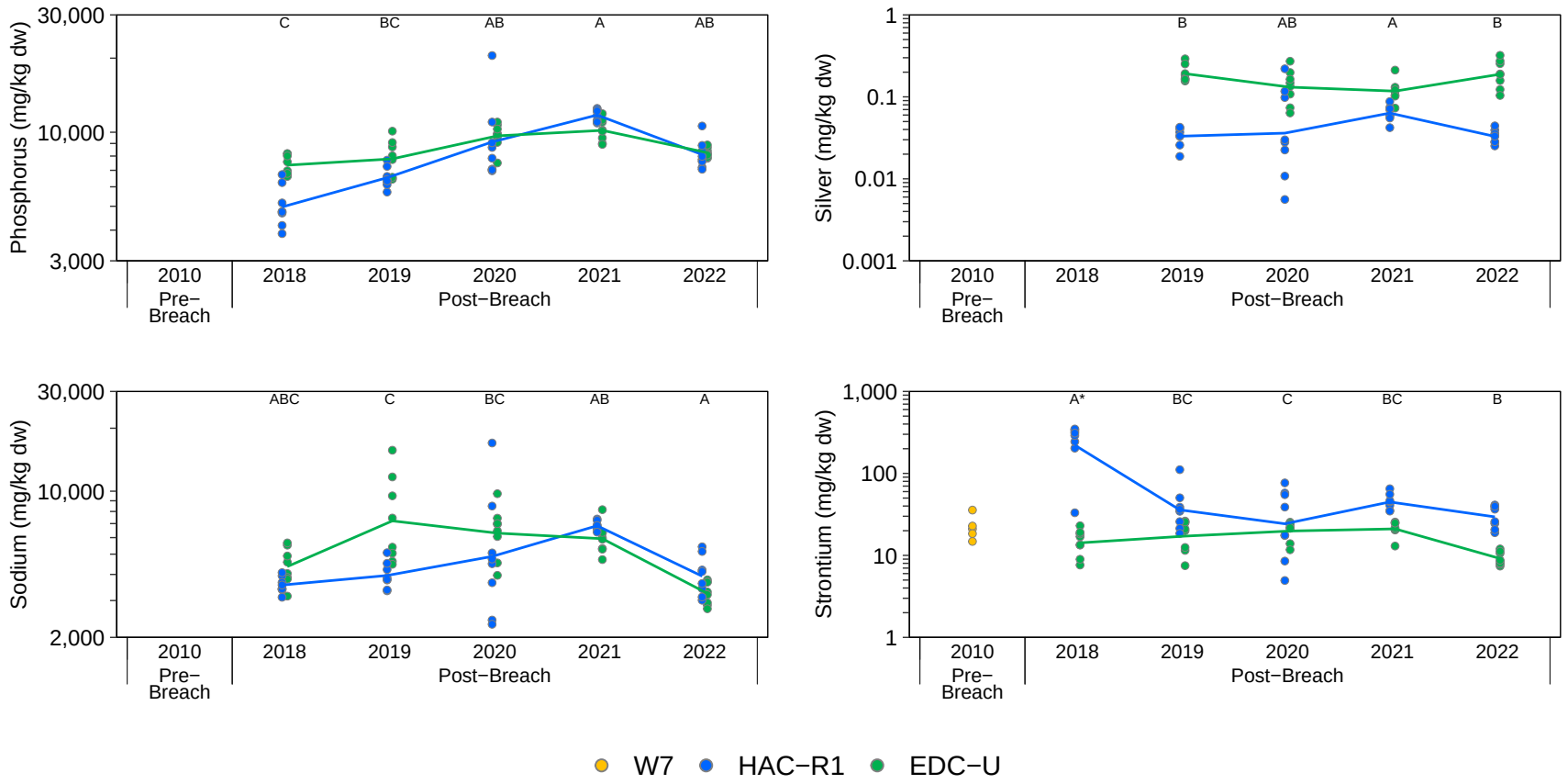

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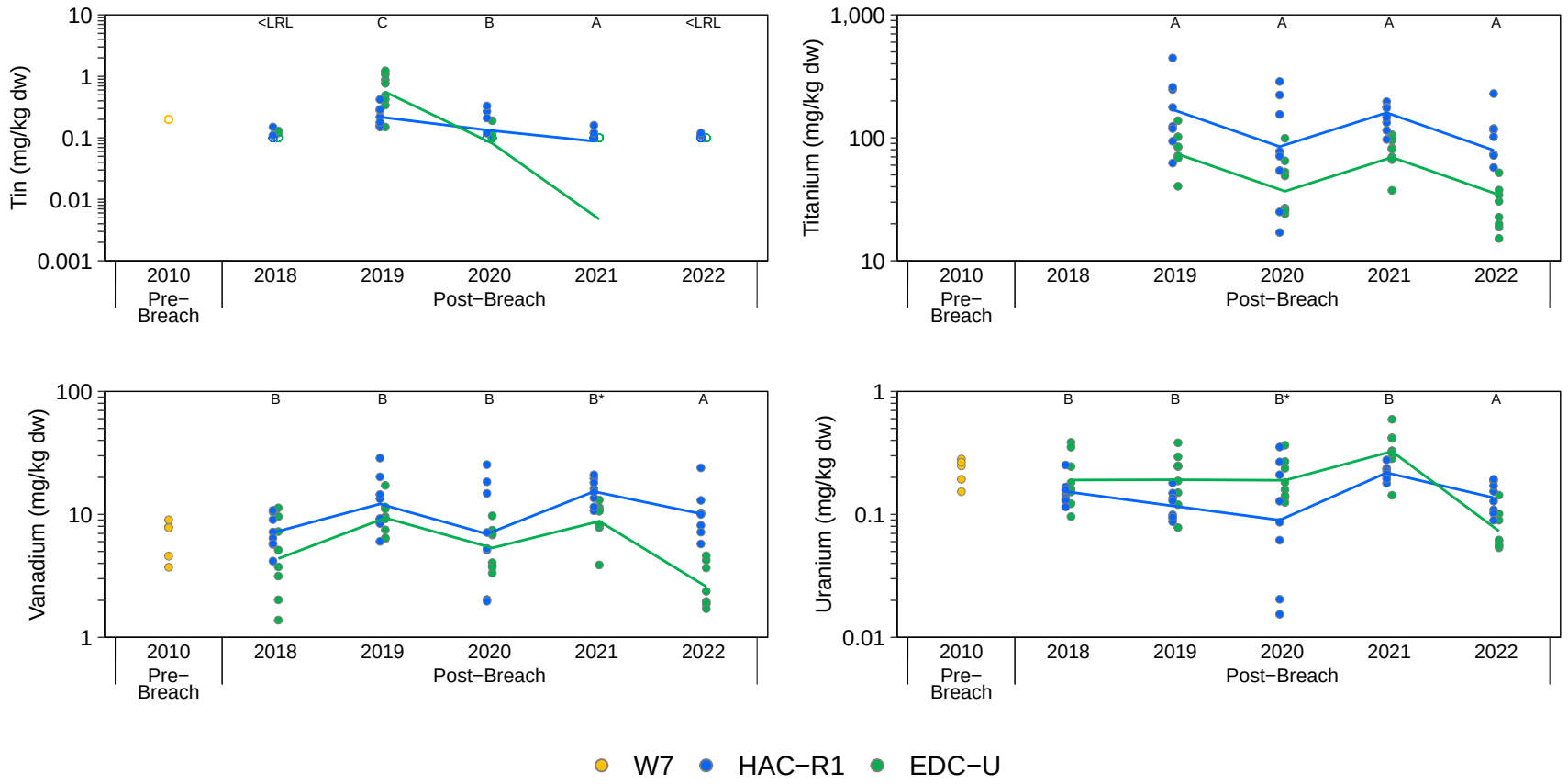

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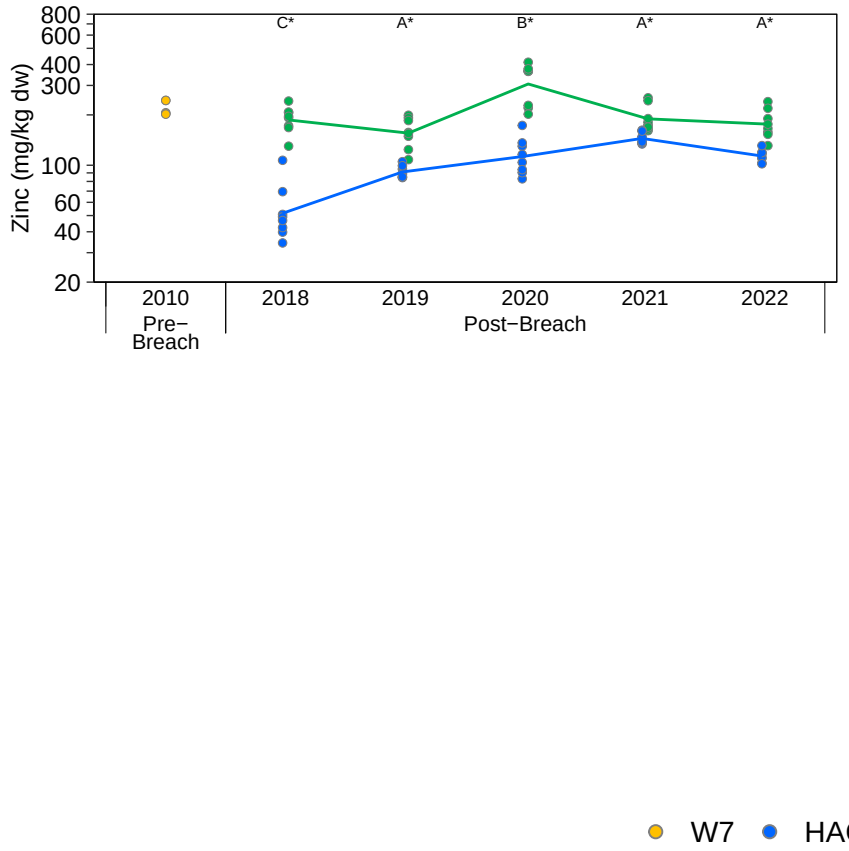

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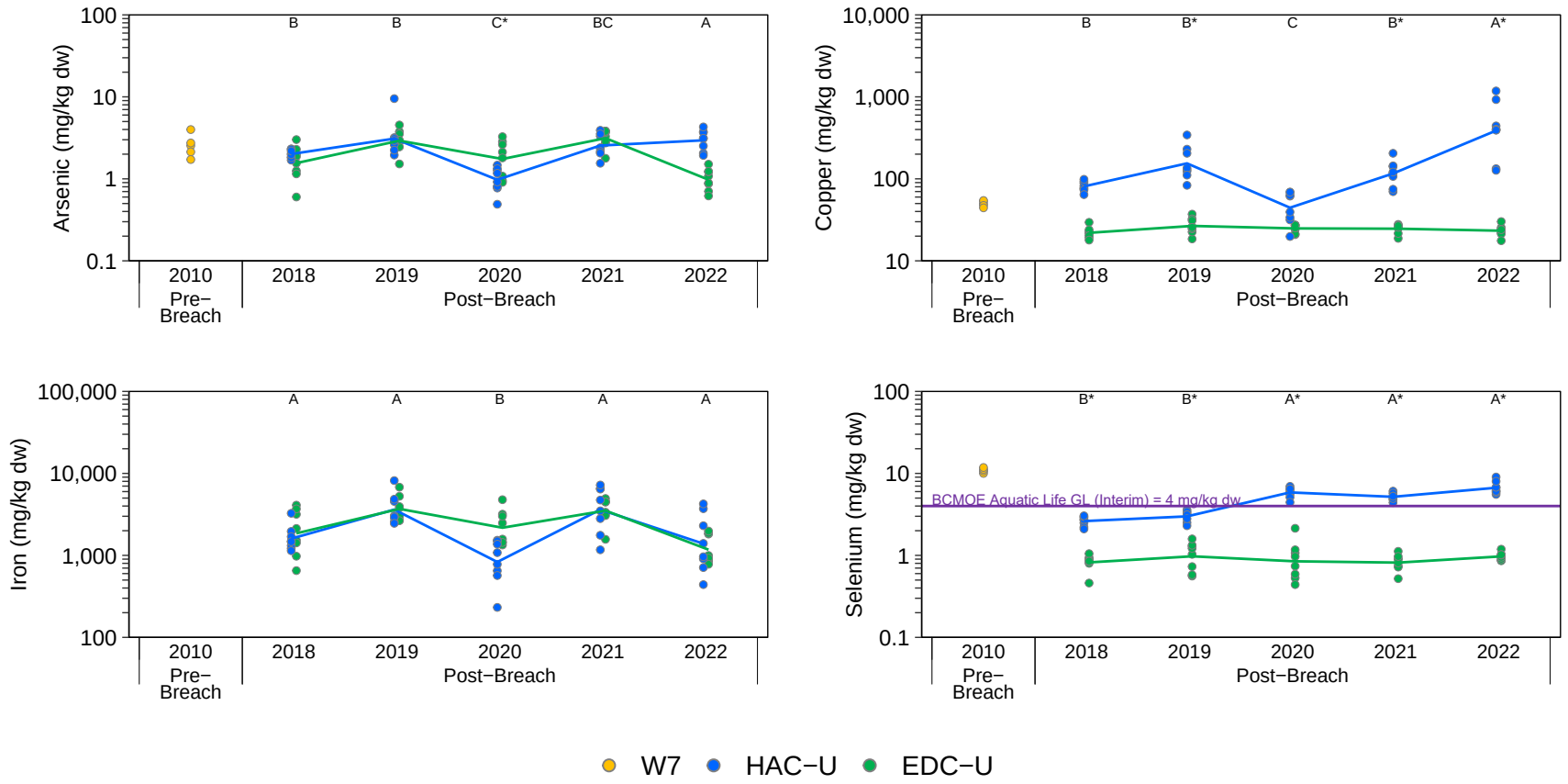

Figure F.2: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

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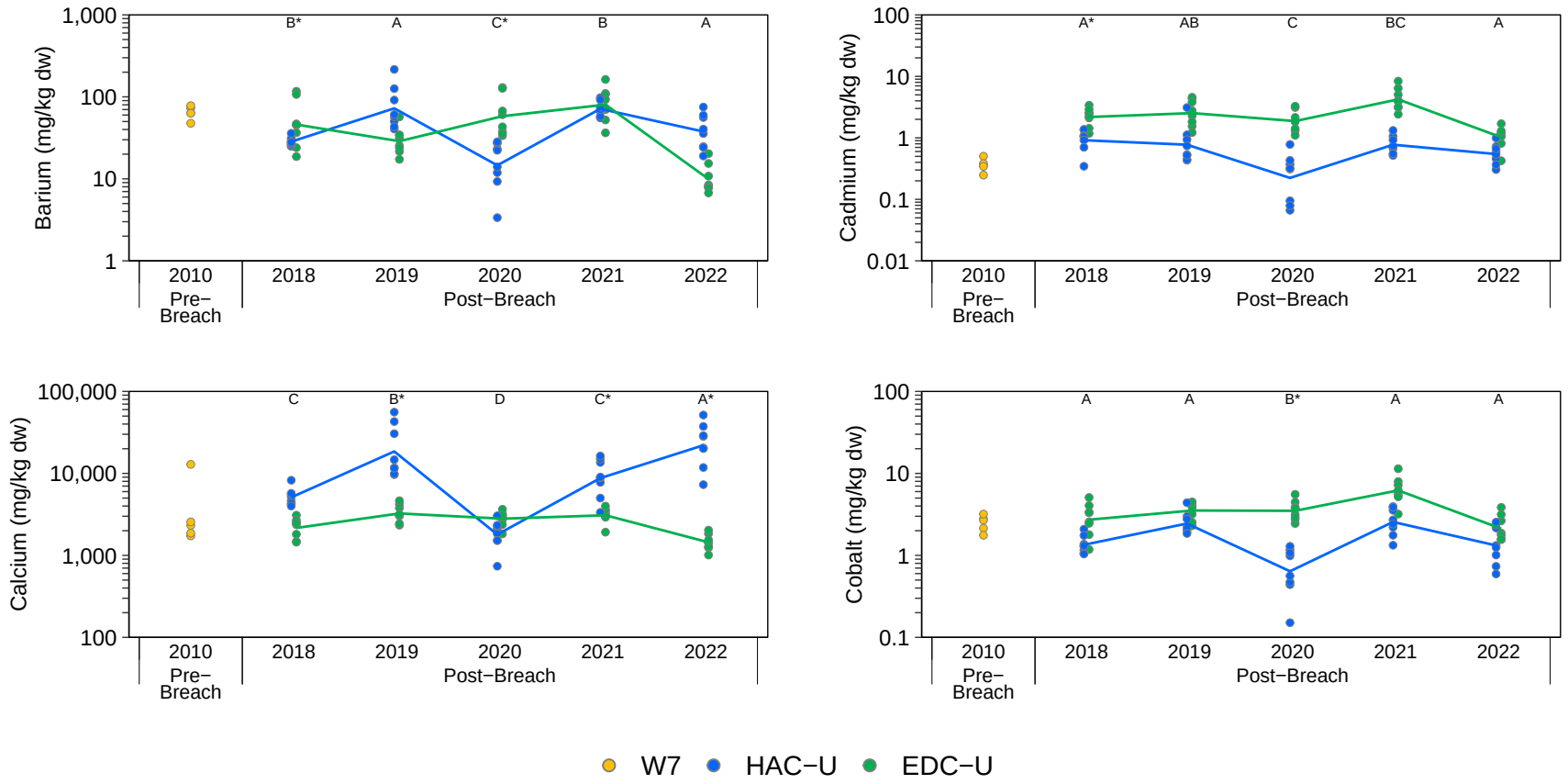

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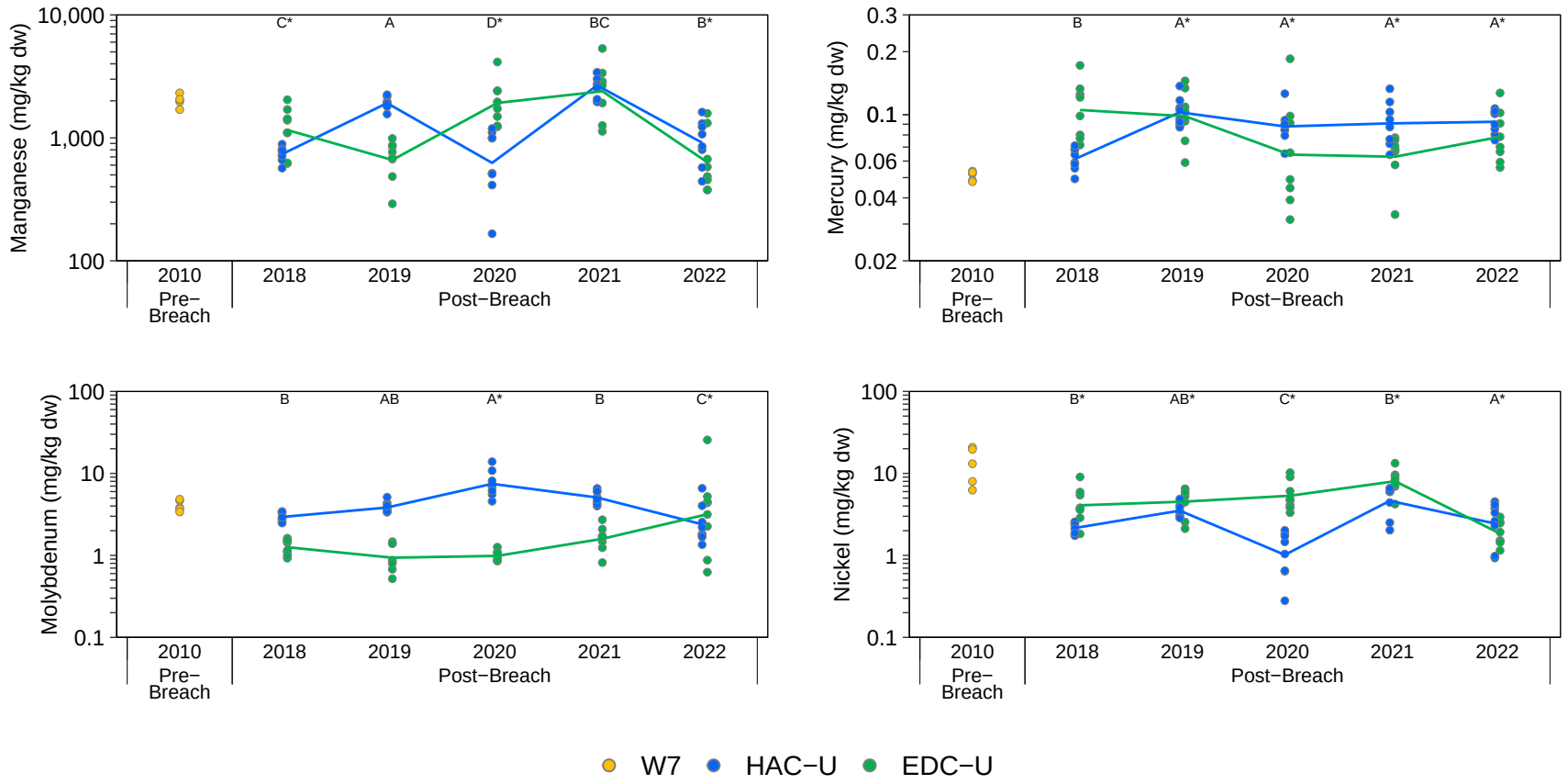

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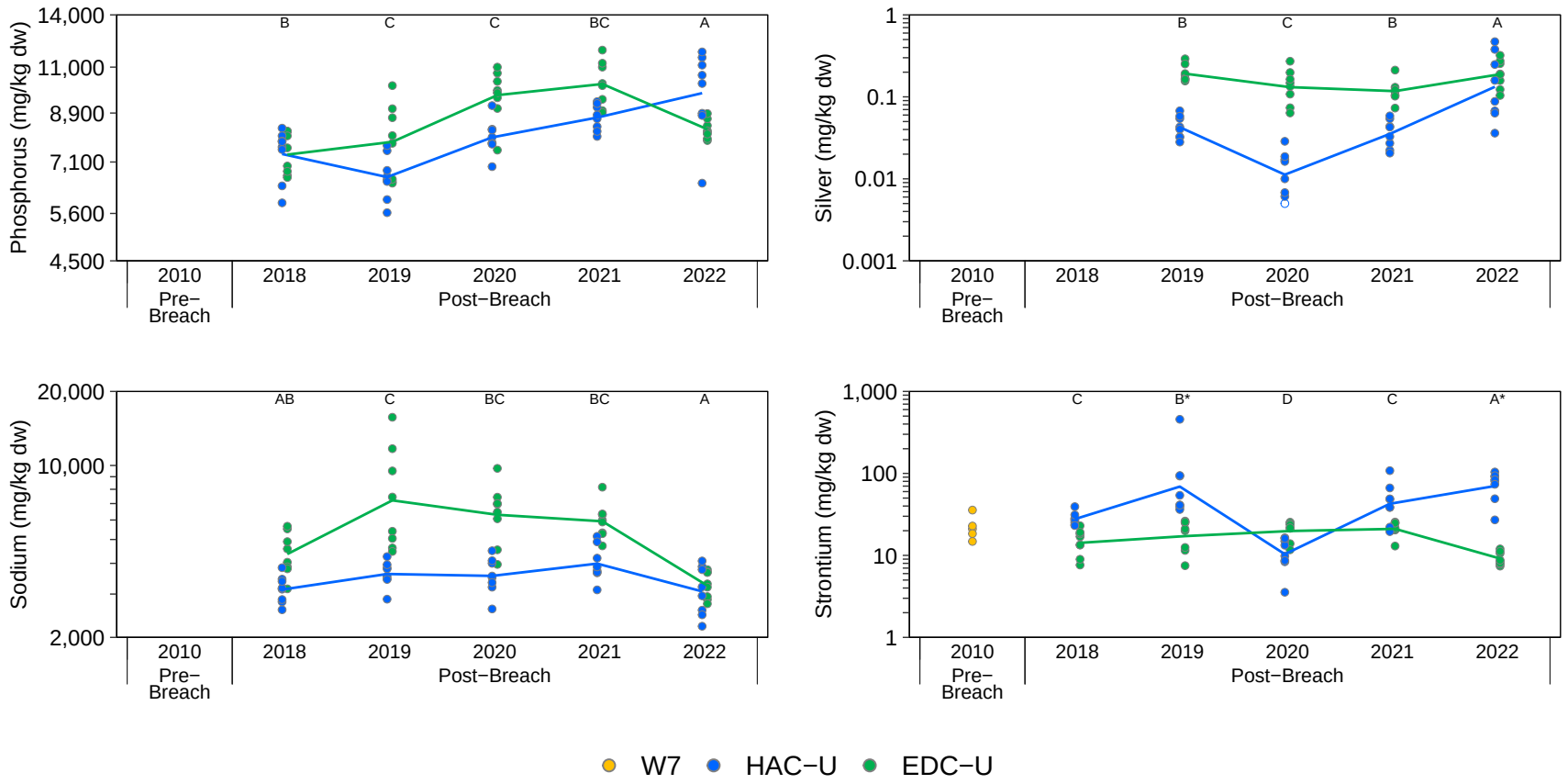

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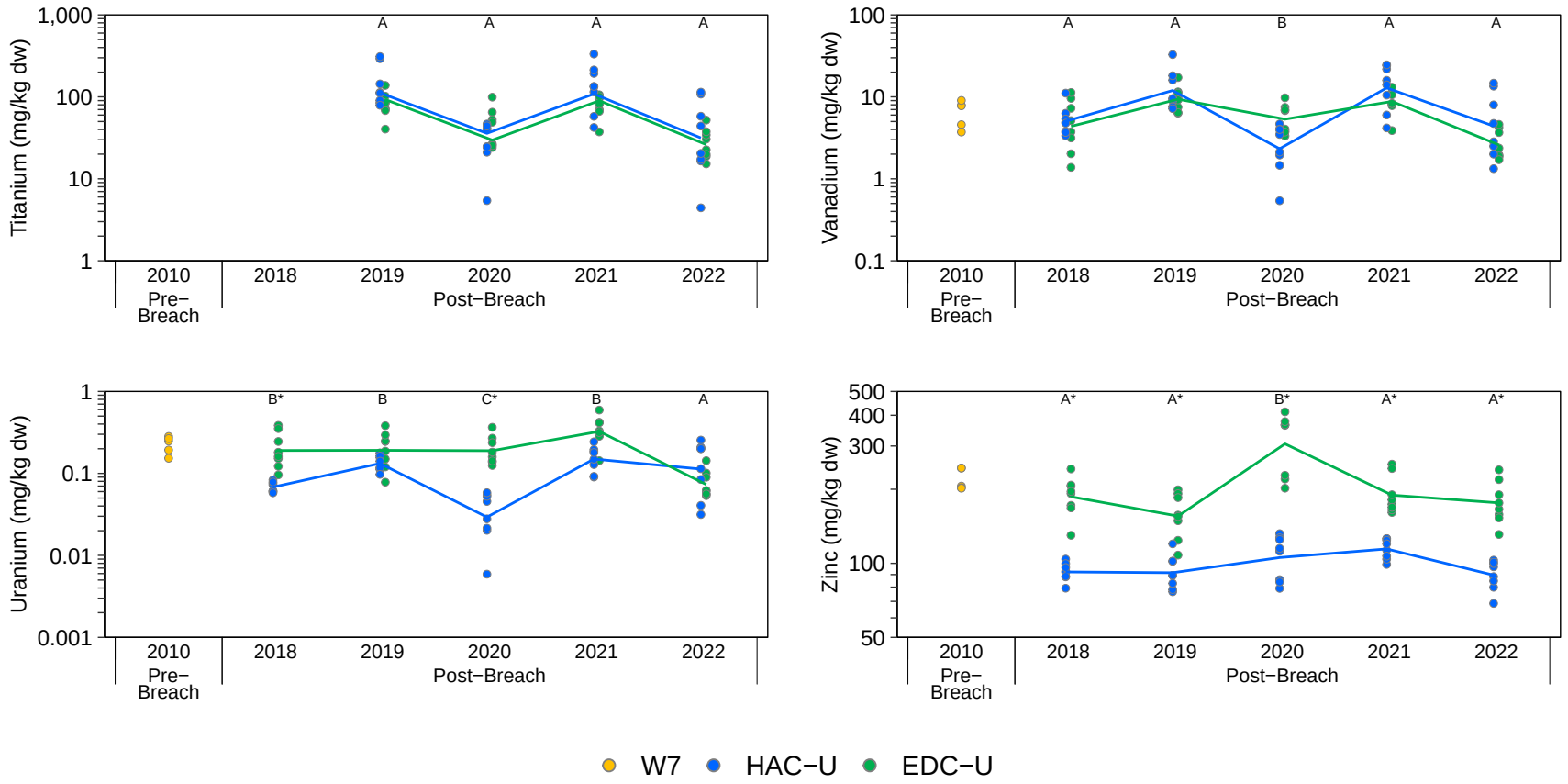

Figure F.2: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

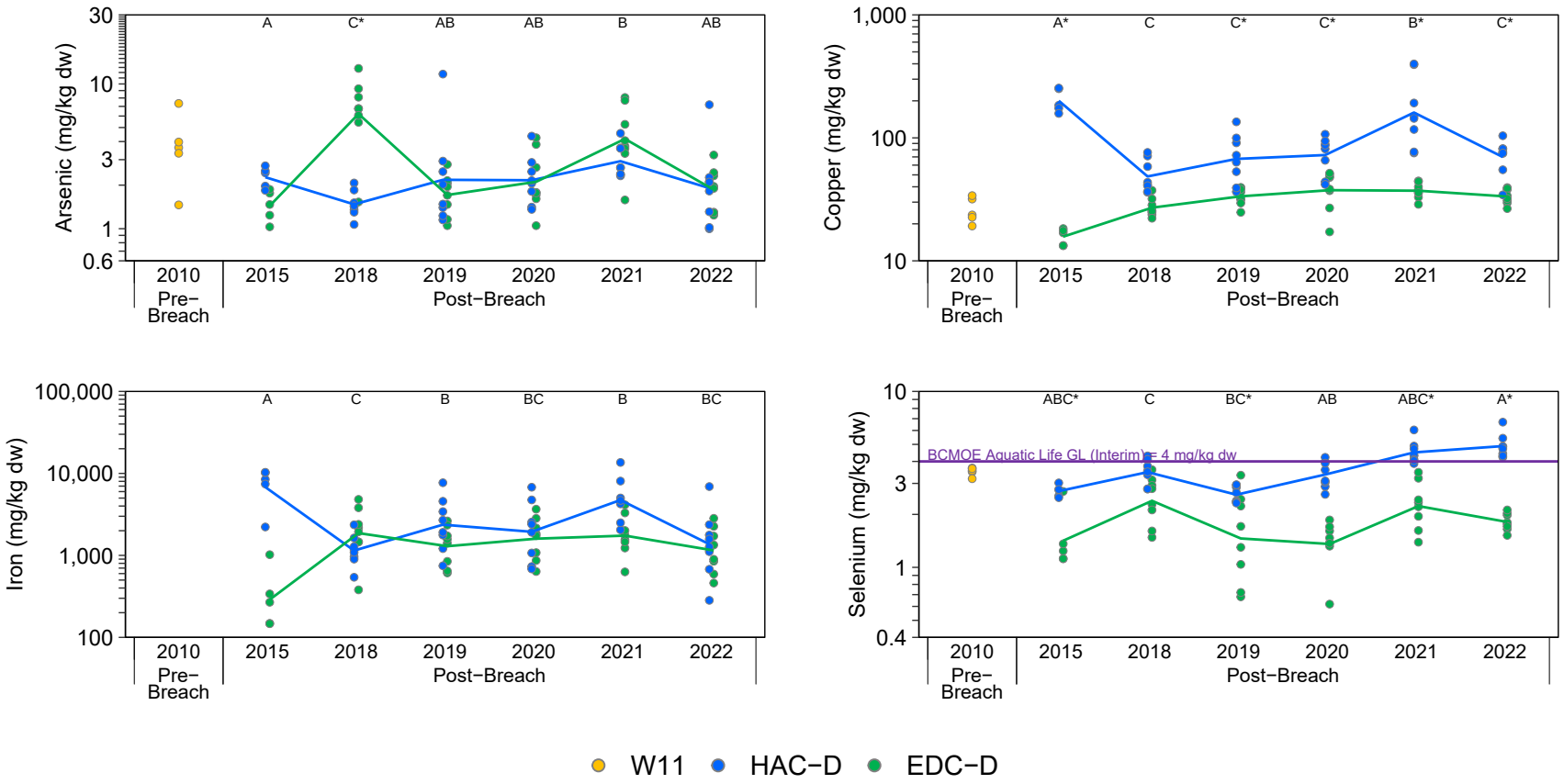

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

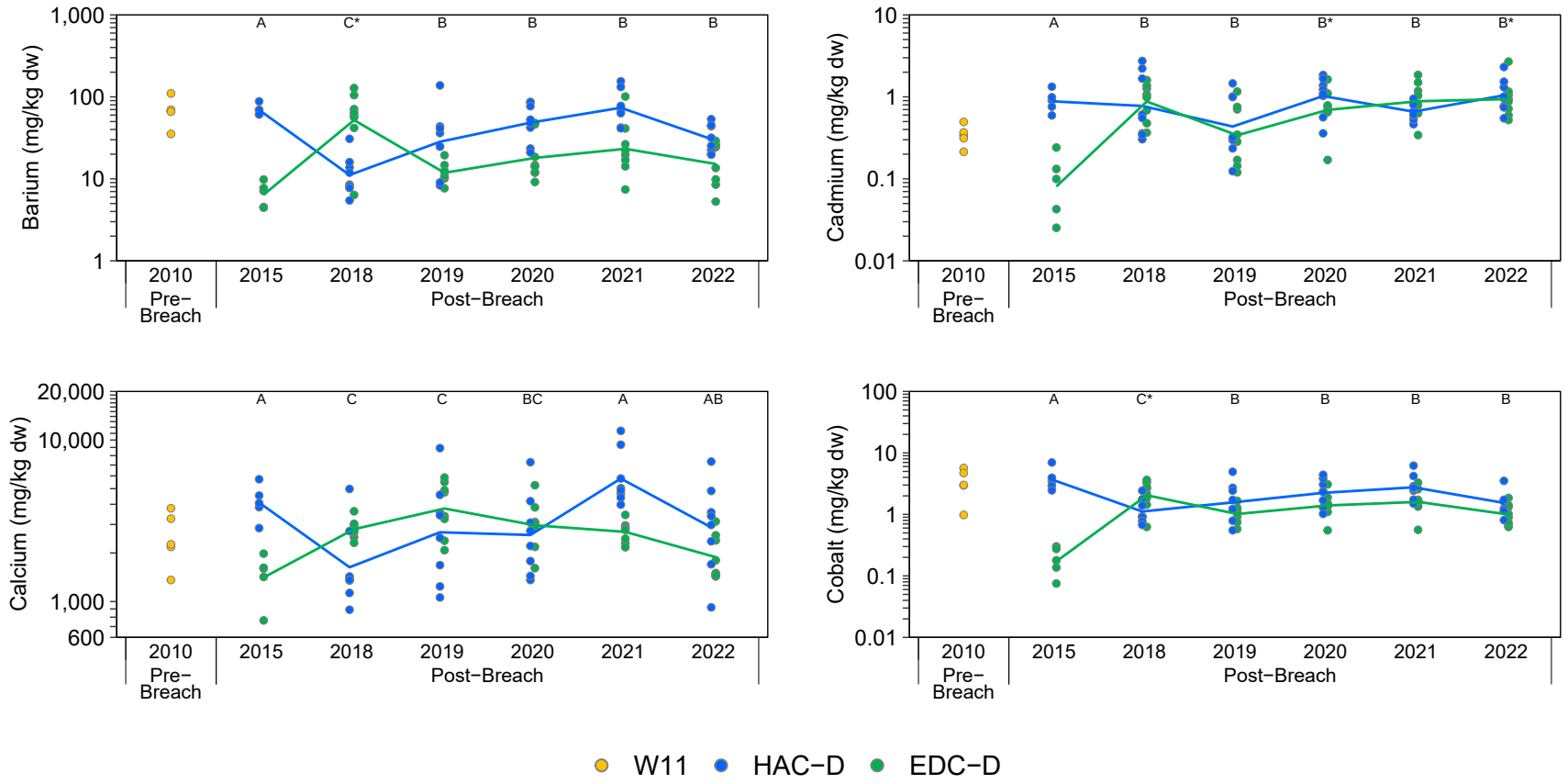

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

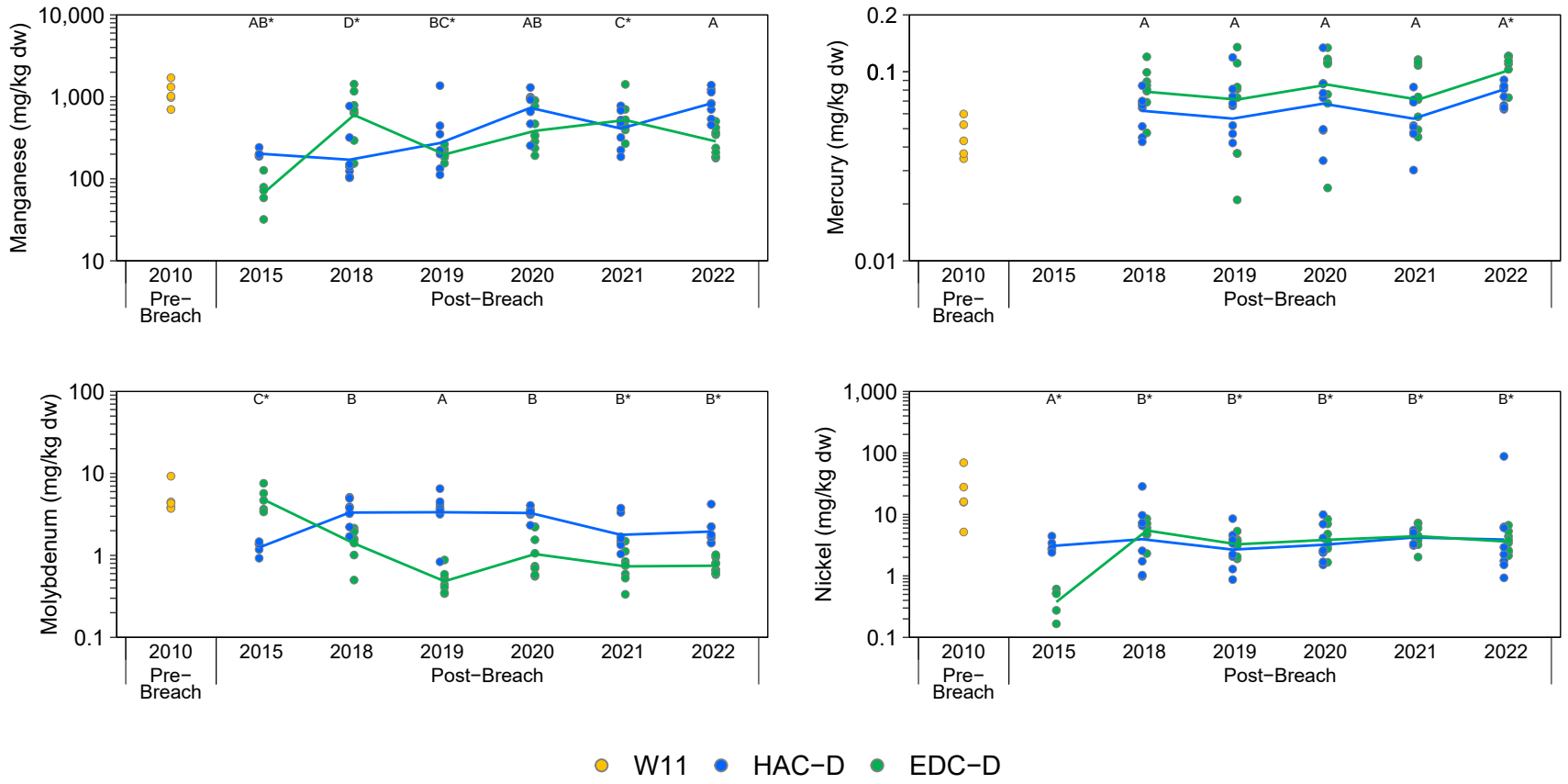

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

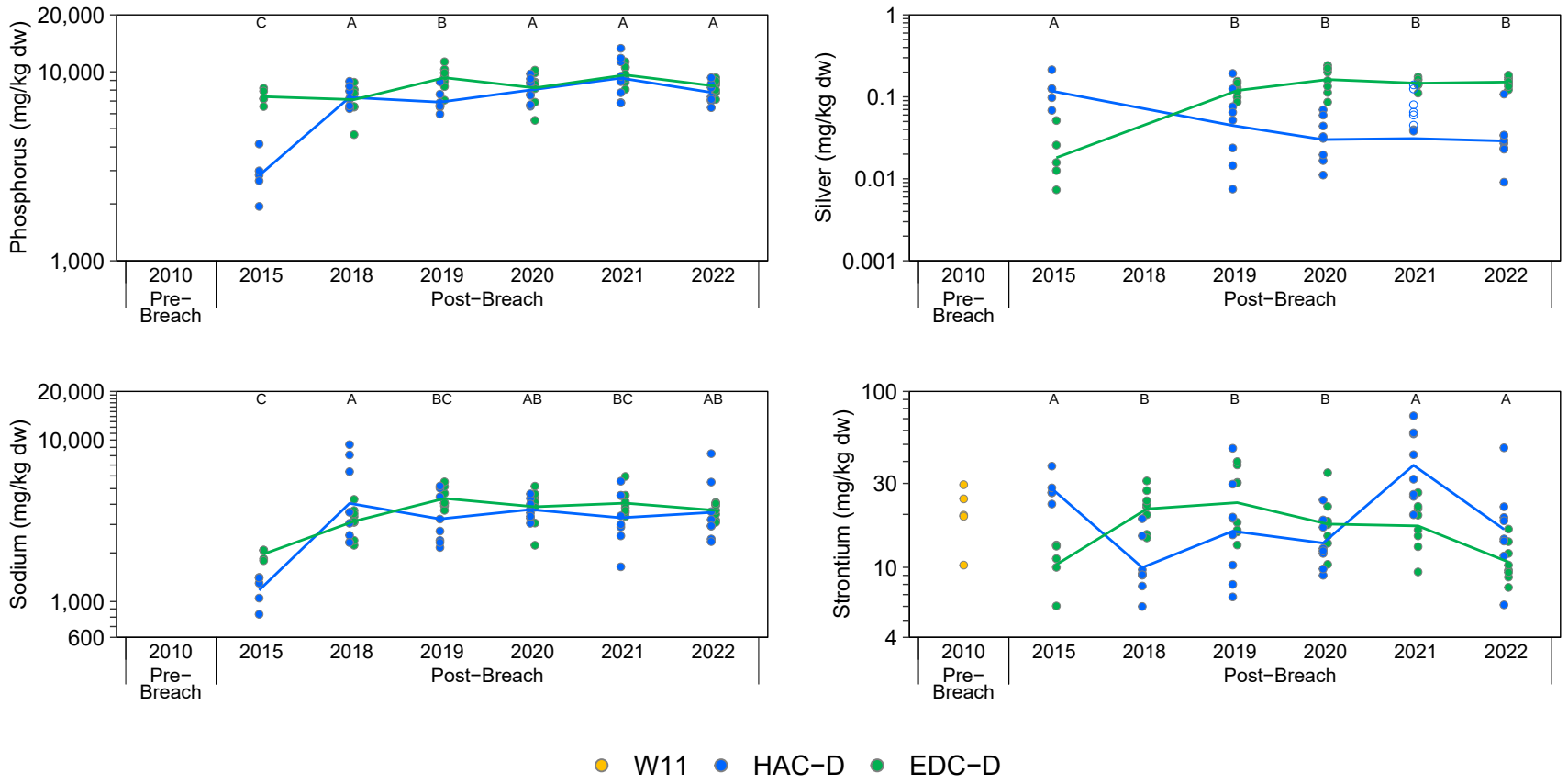

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

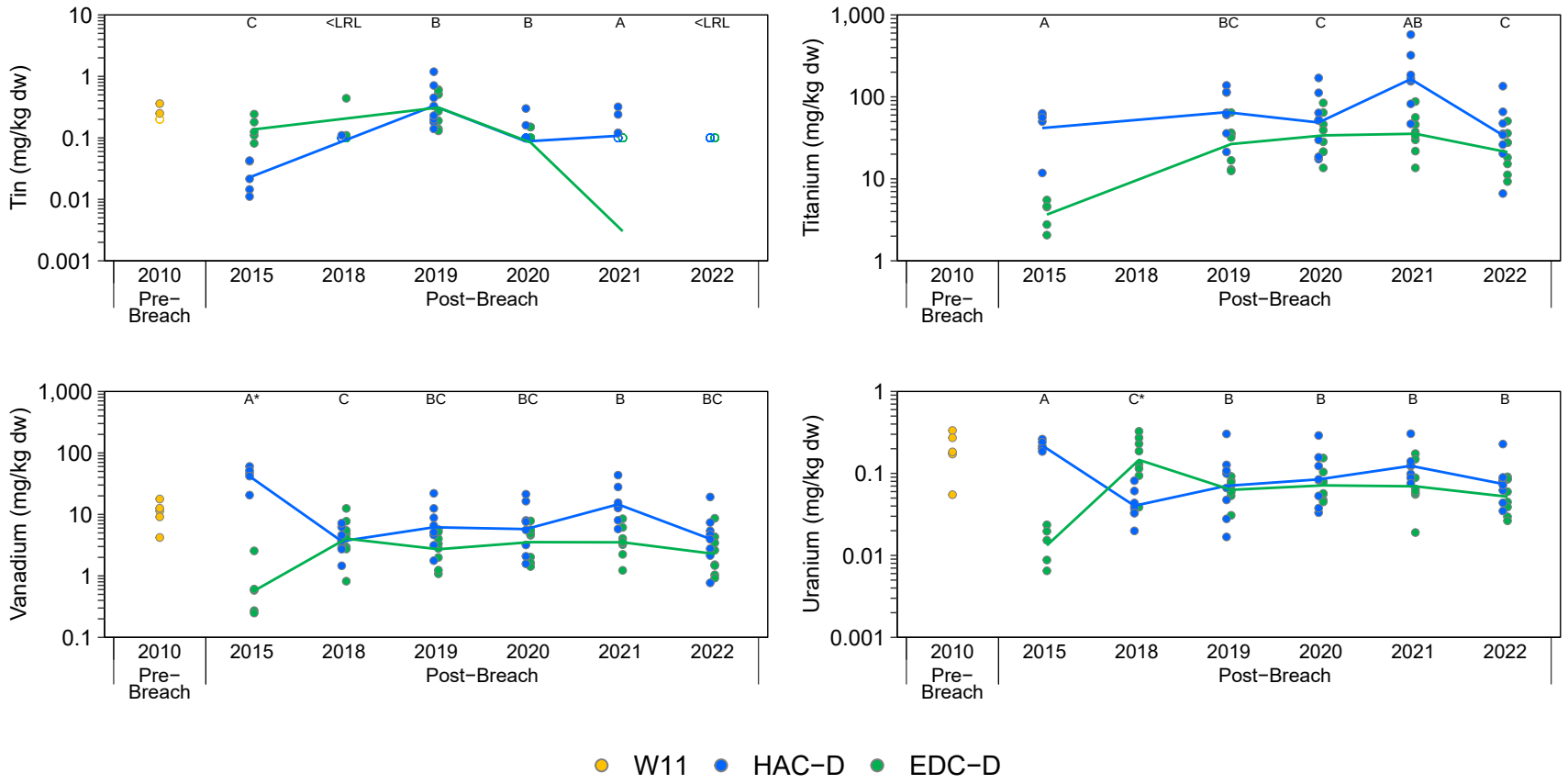

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

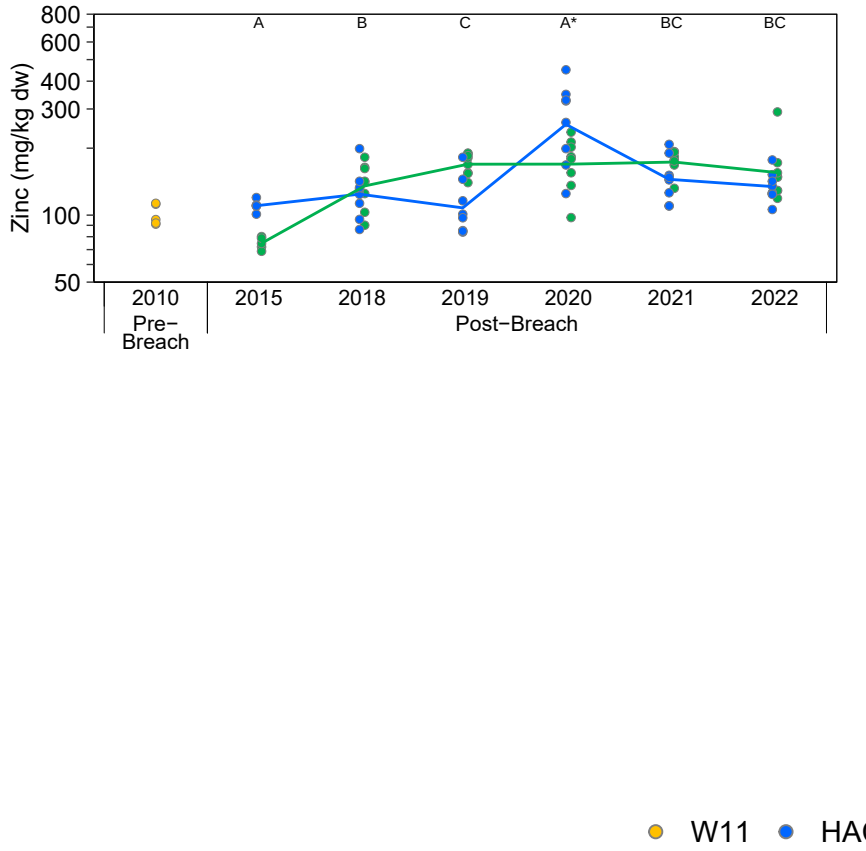

Figure F.3: Composite-Taxa Benthic Invertebrate Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2010 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted. Letters with a * designate years where the exposed site is different than pre−breach conditions.

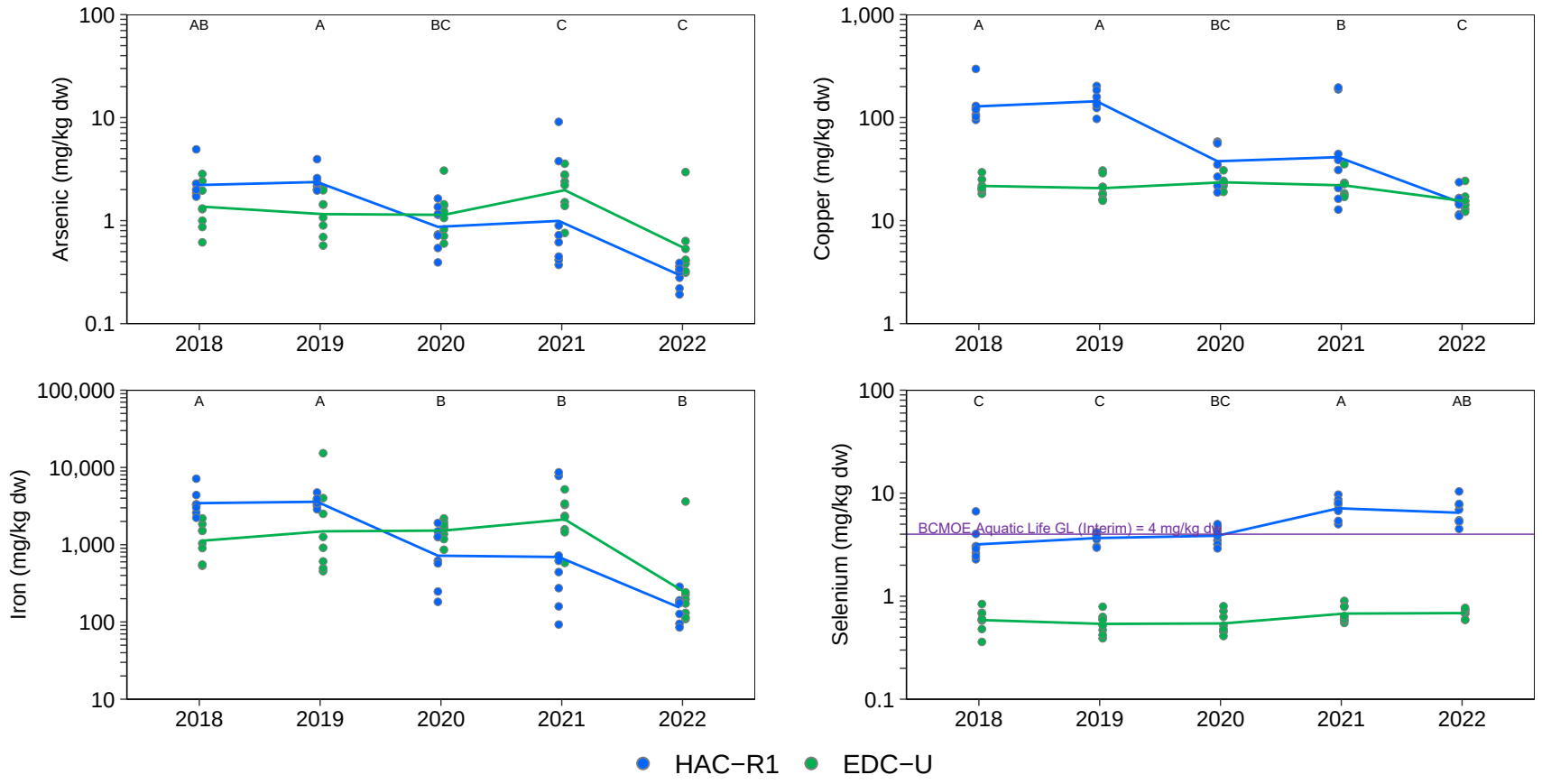

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

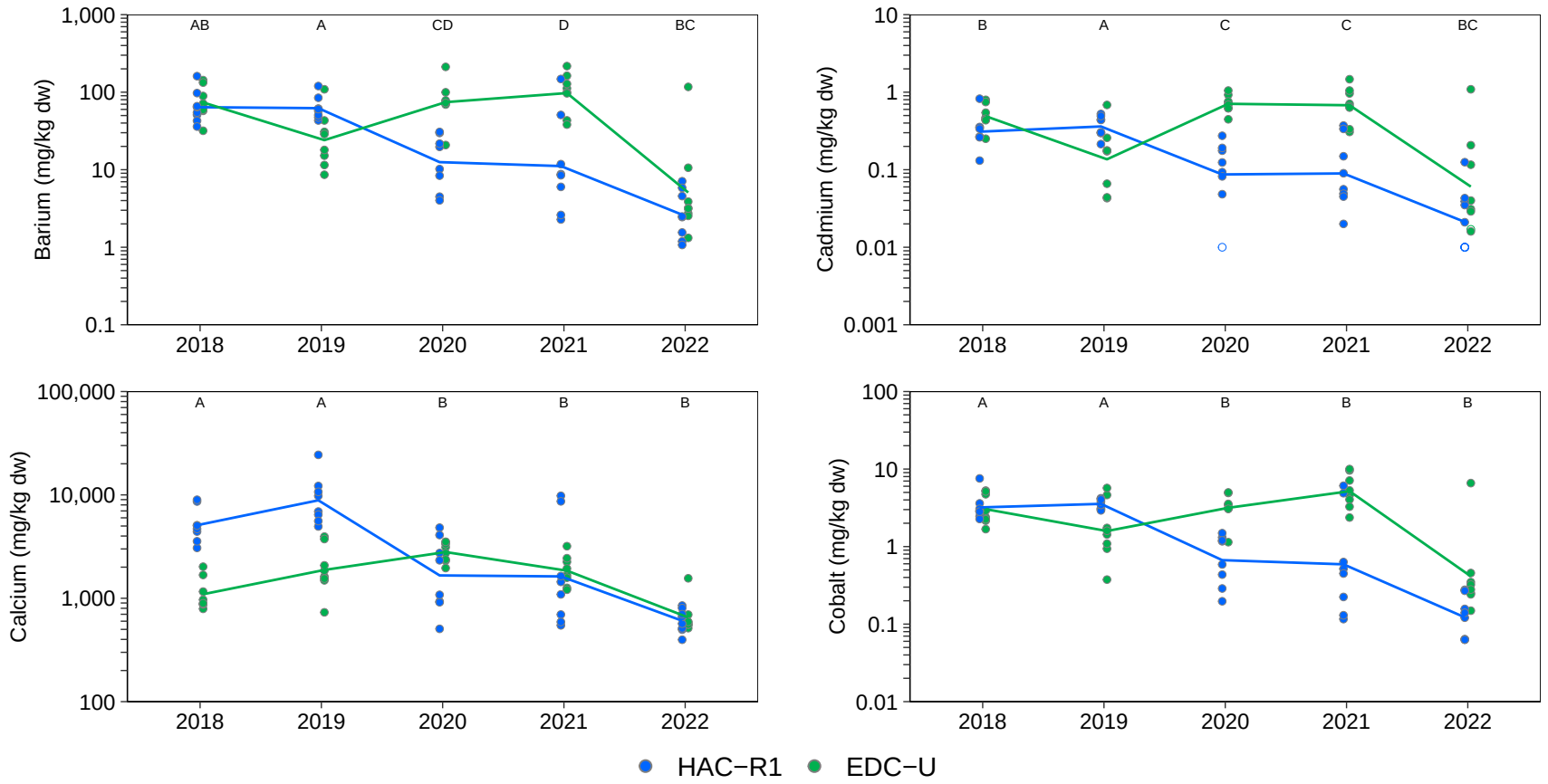

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

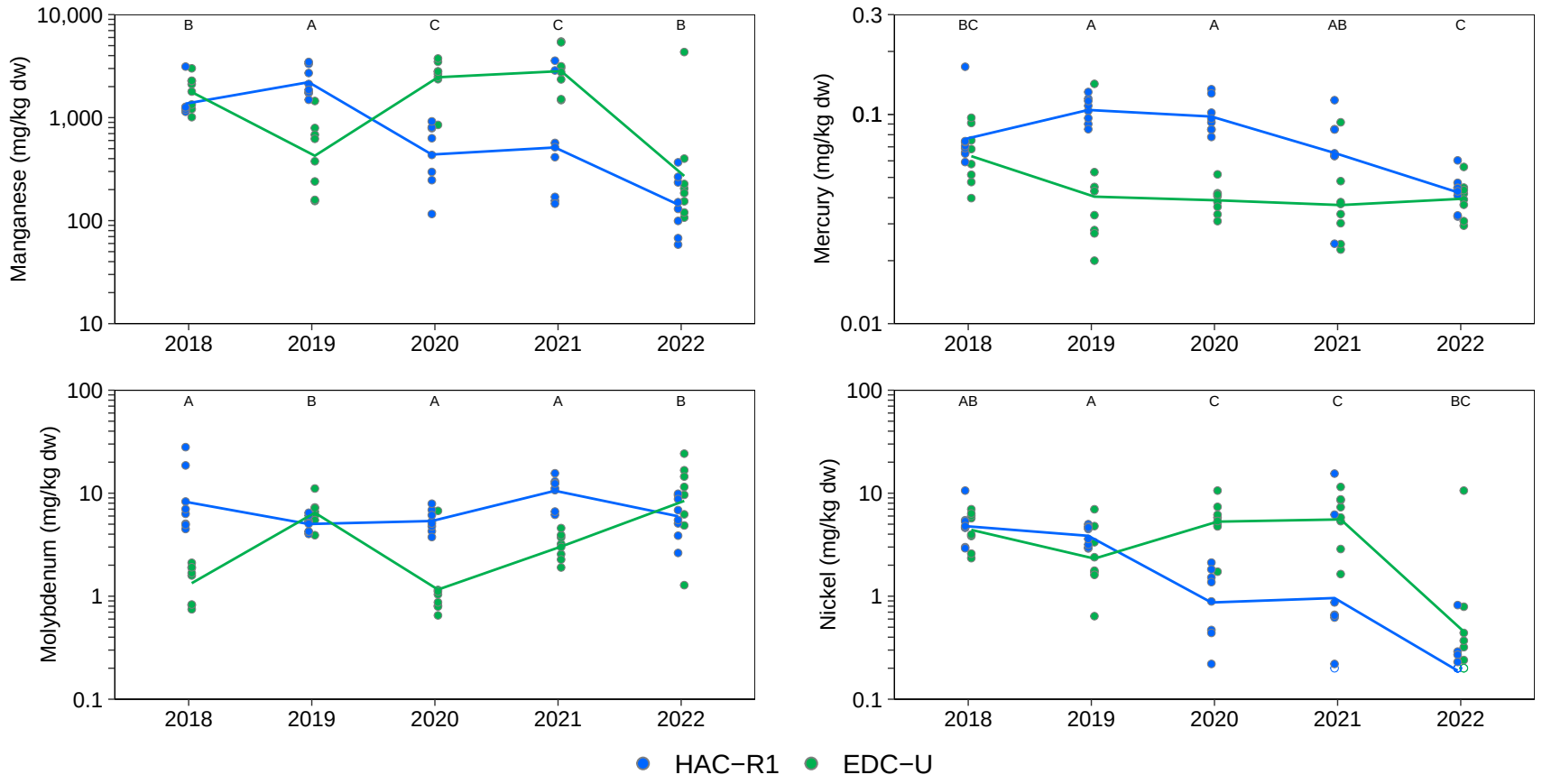

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

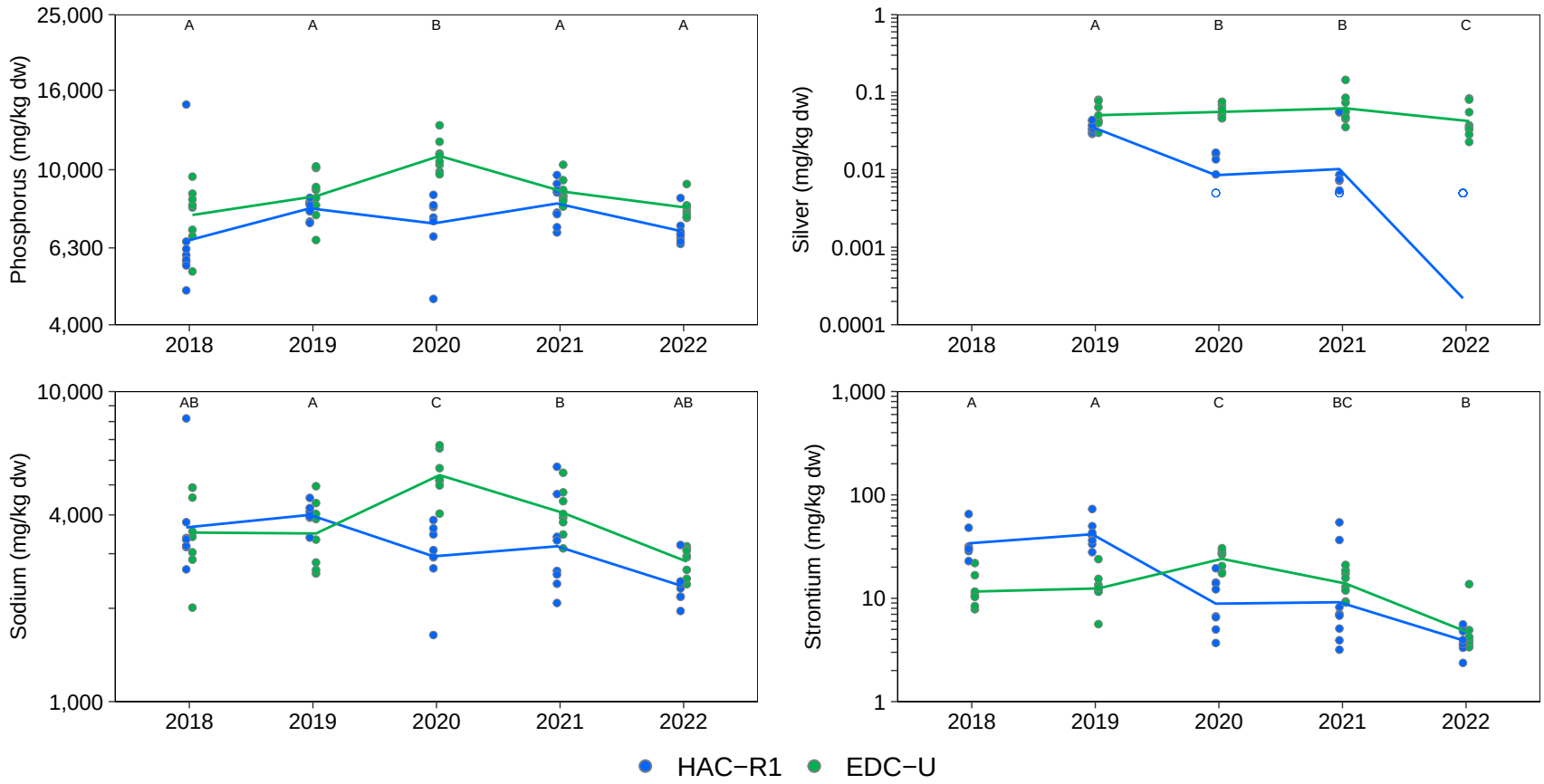

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

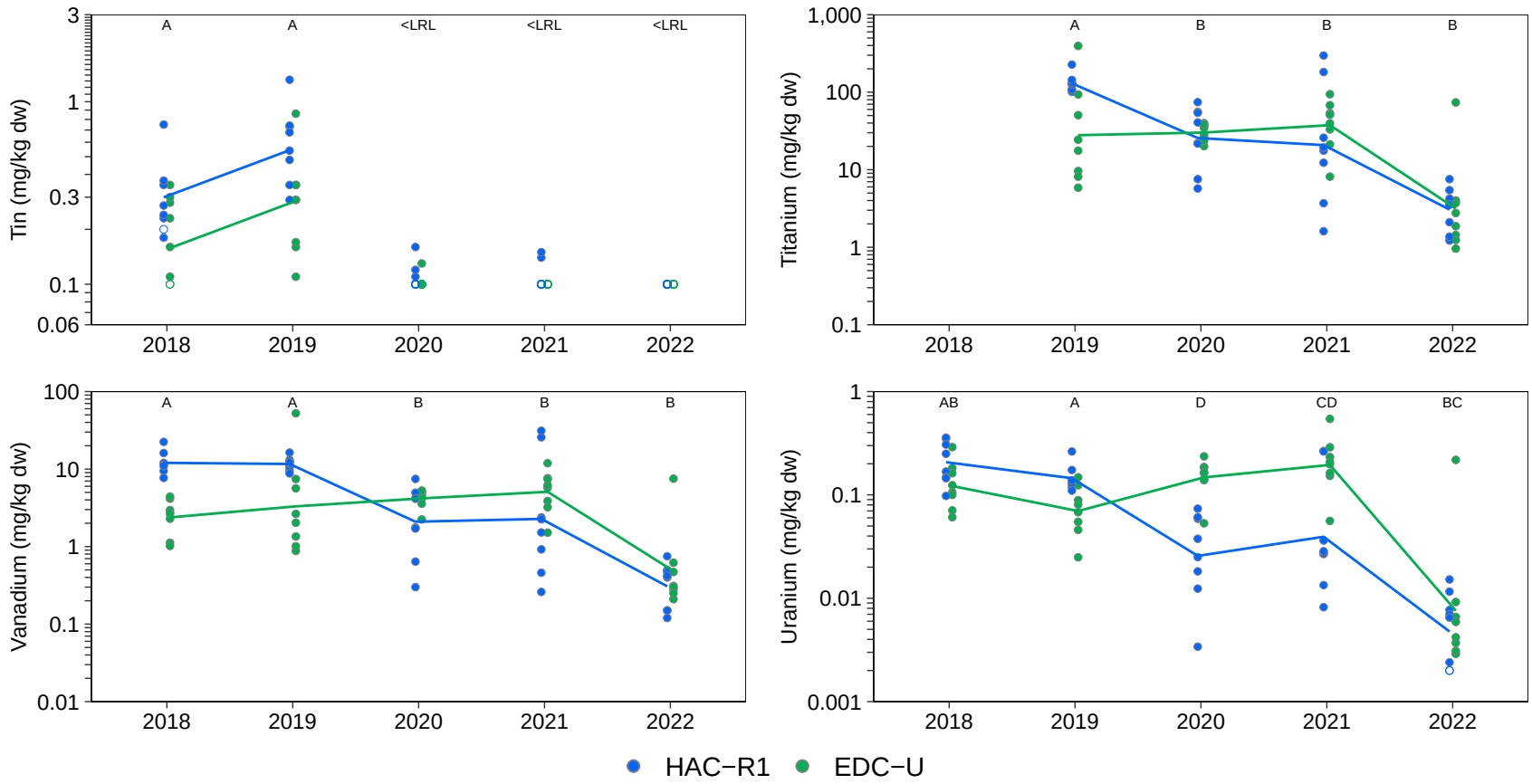

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

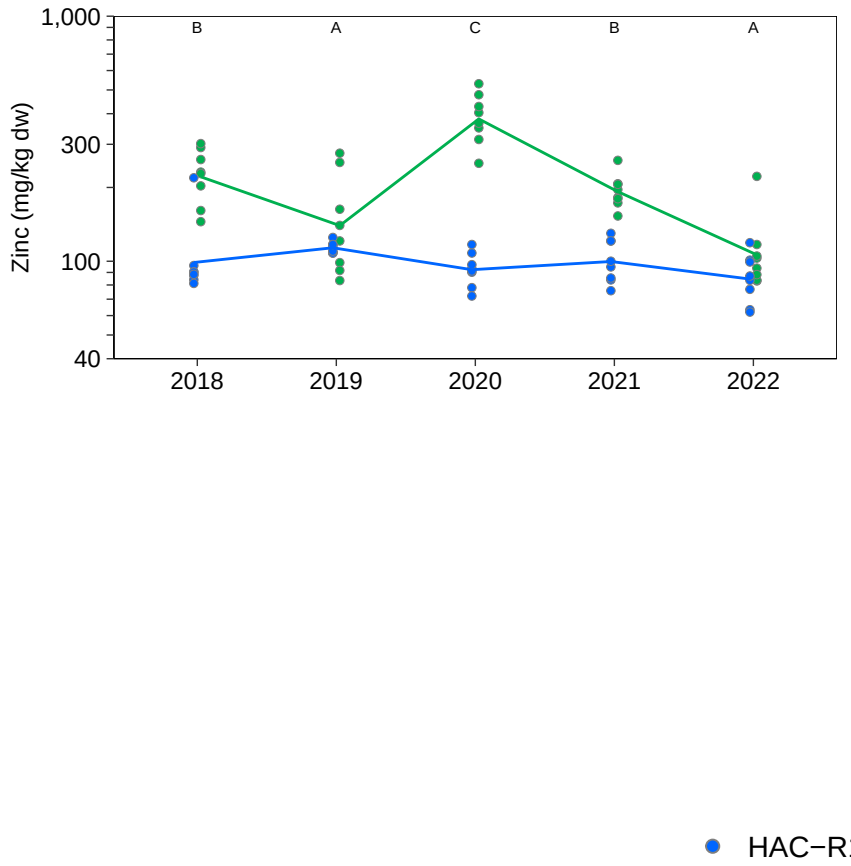

Figure F.4: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-R1; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

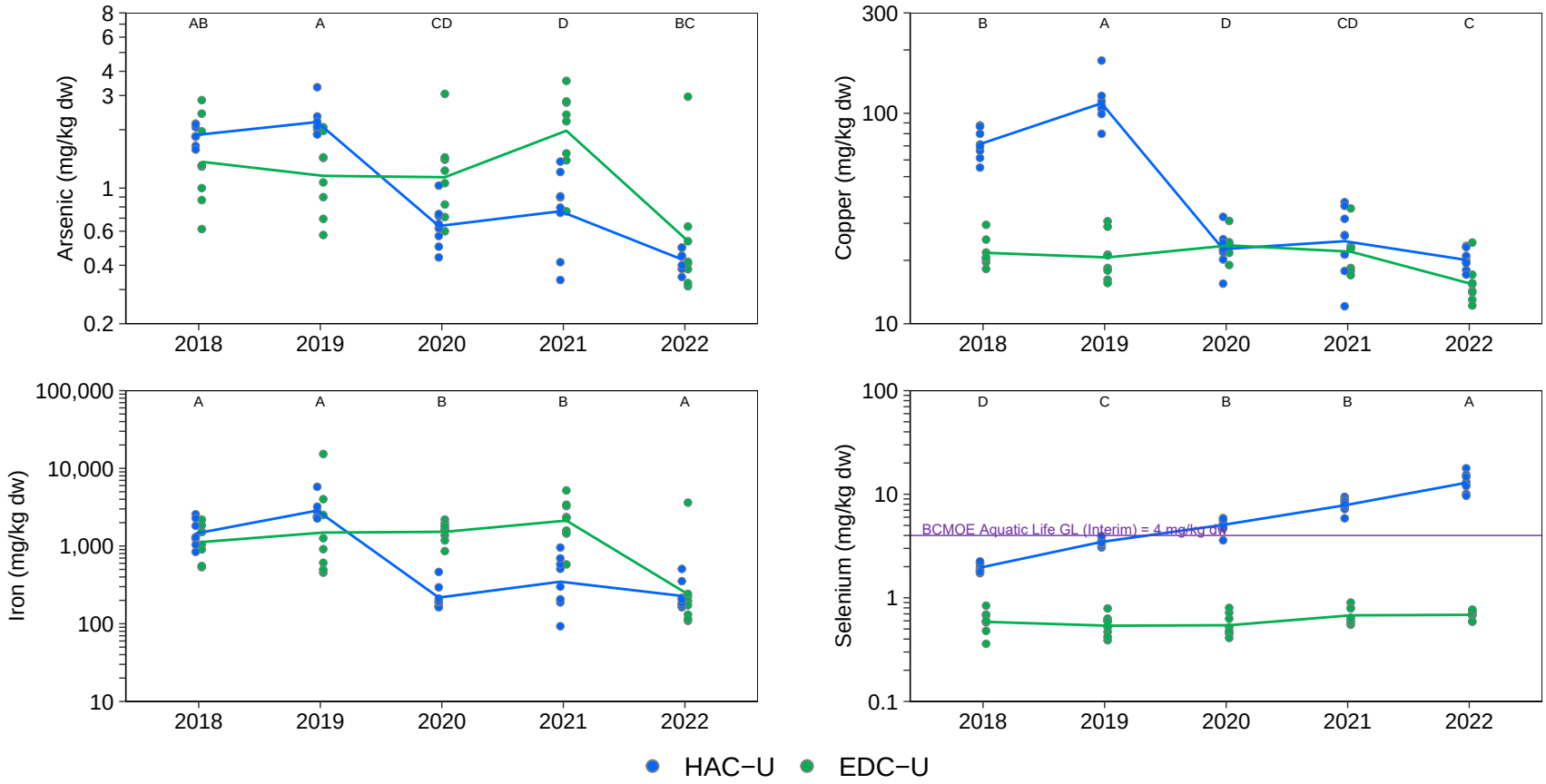

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

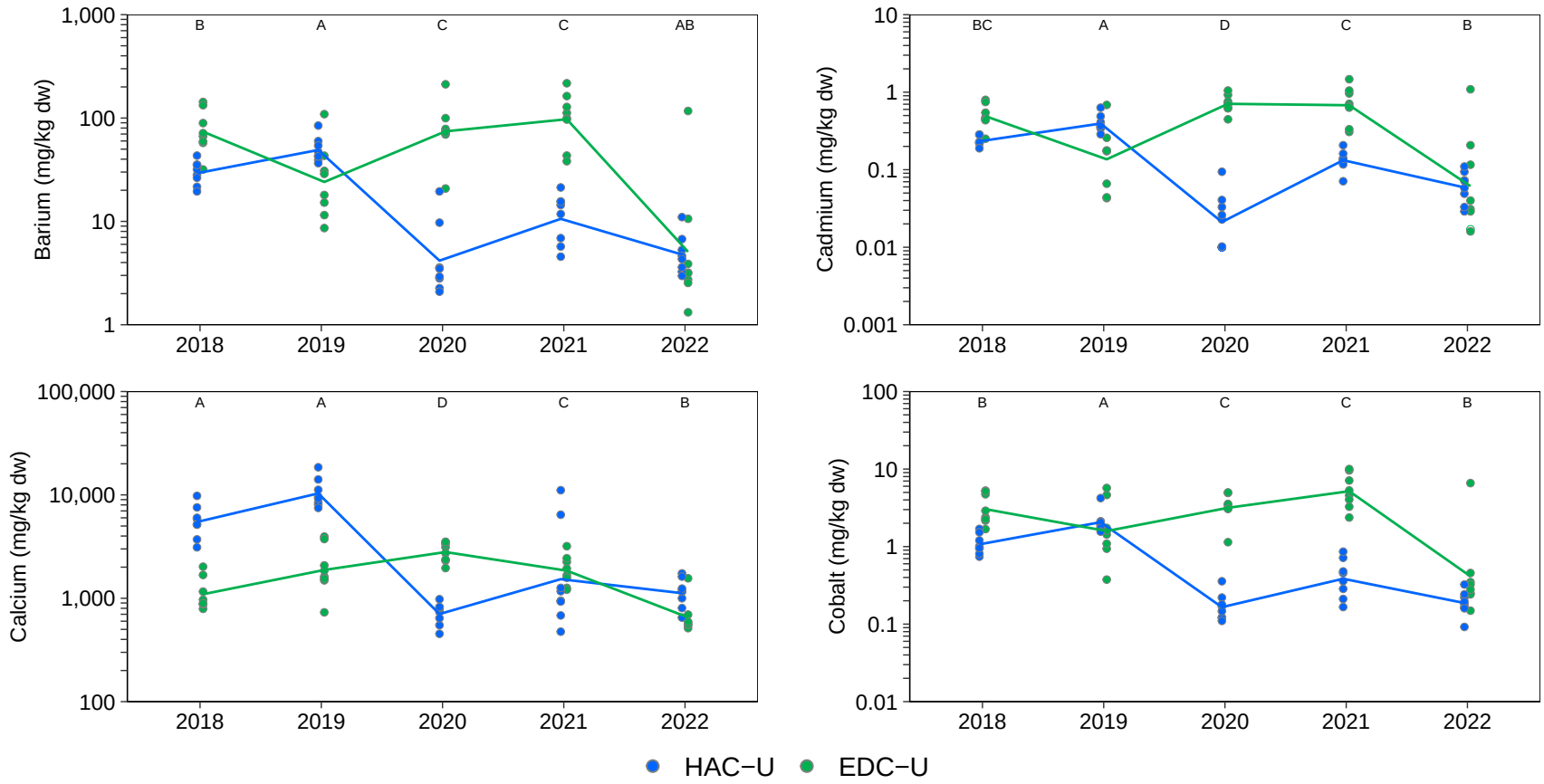

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

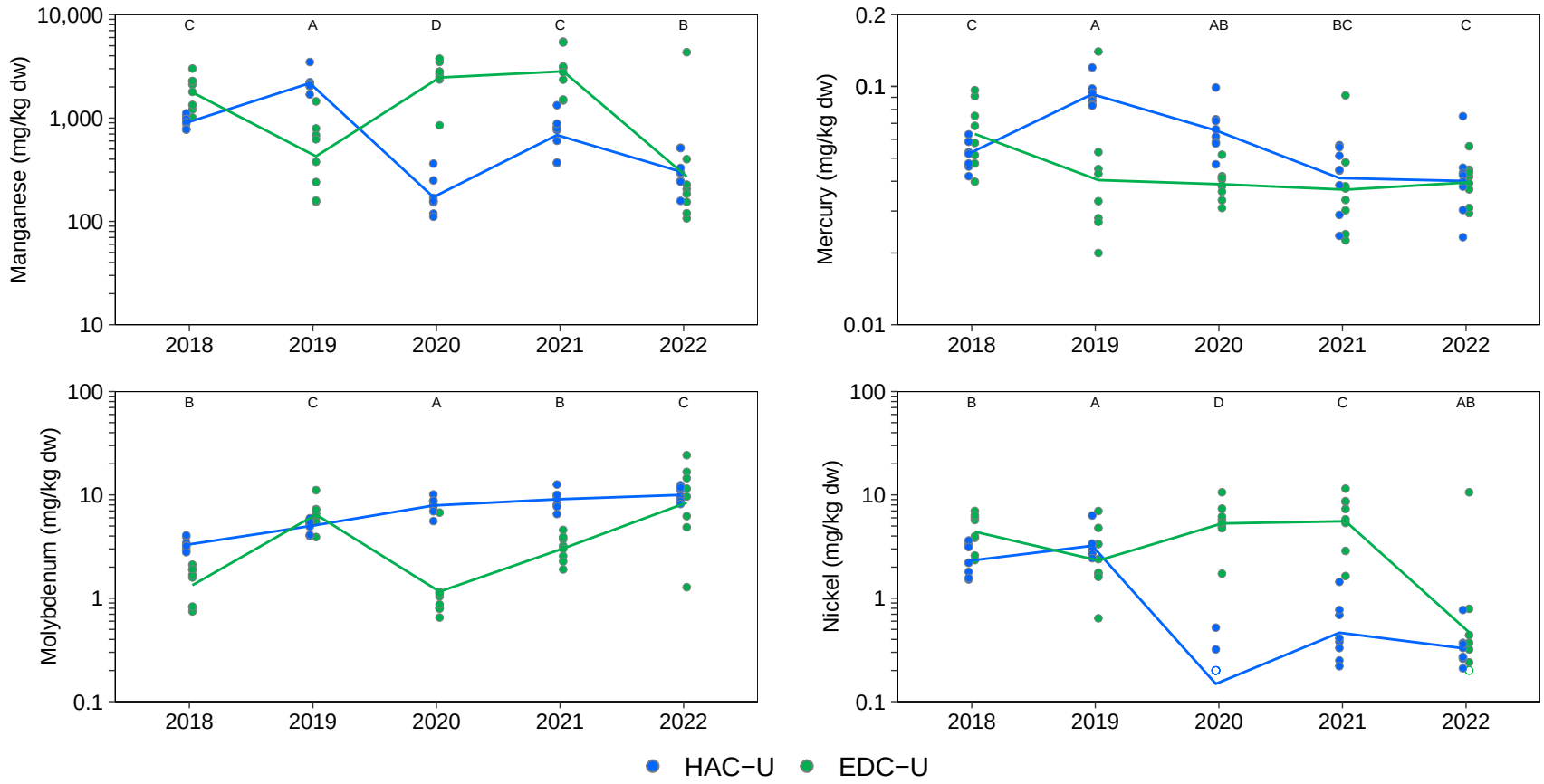

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

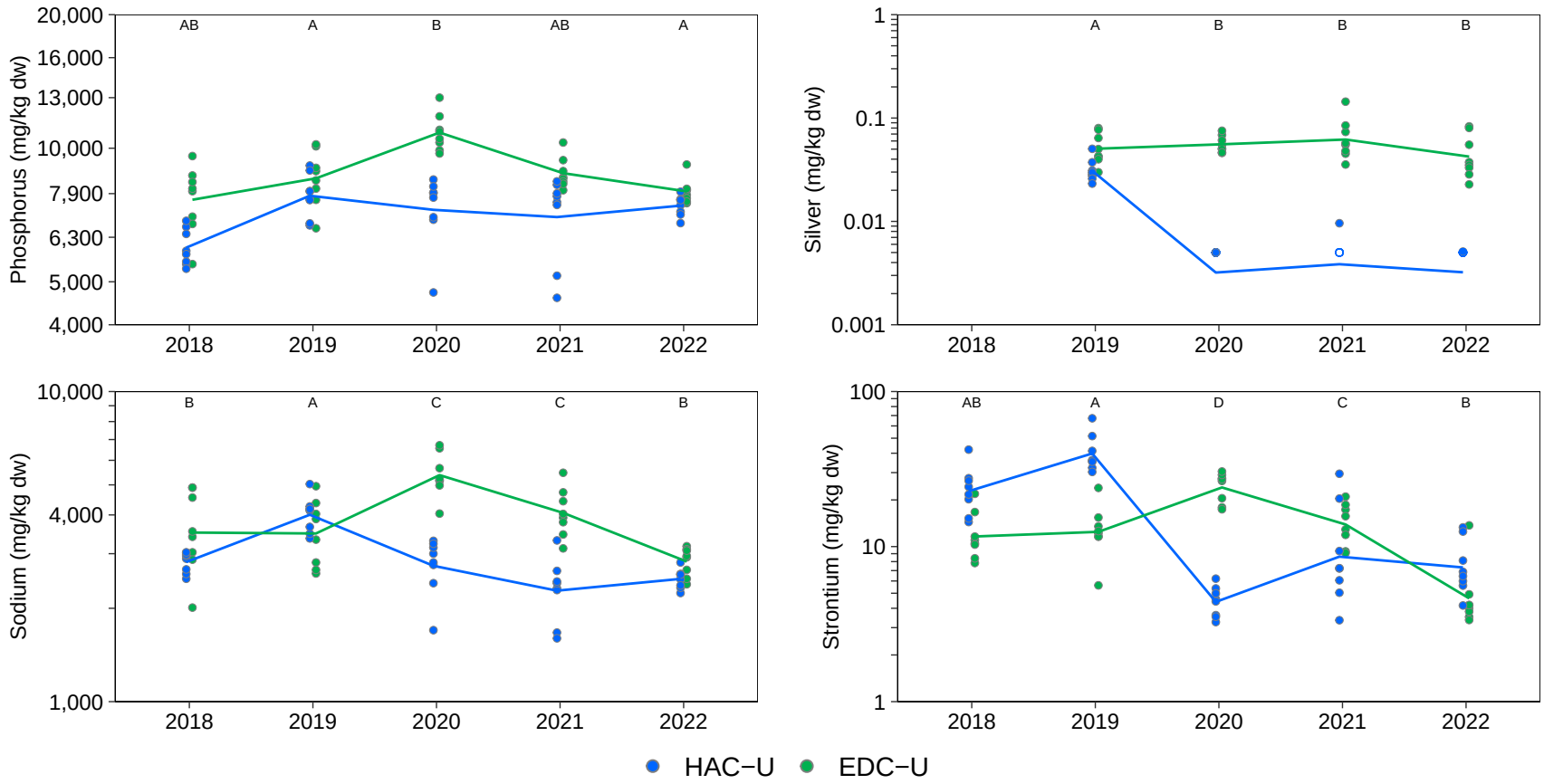

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

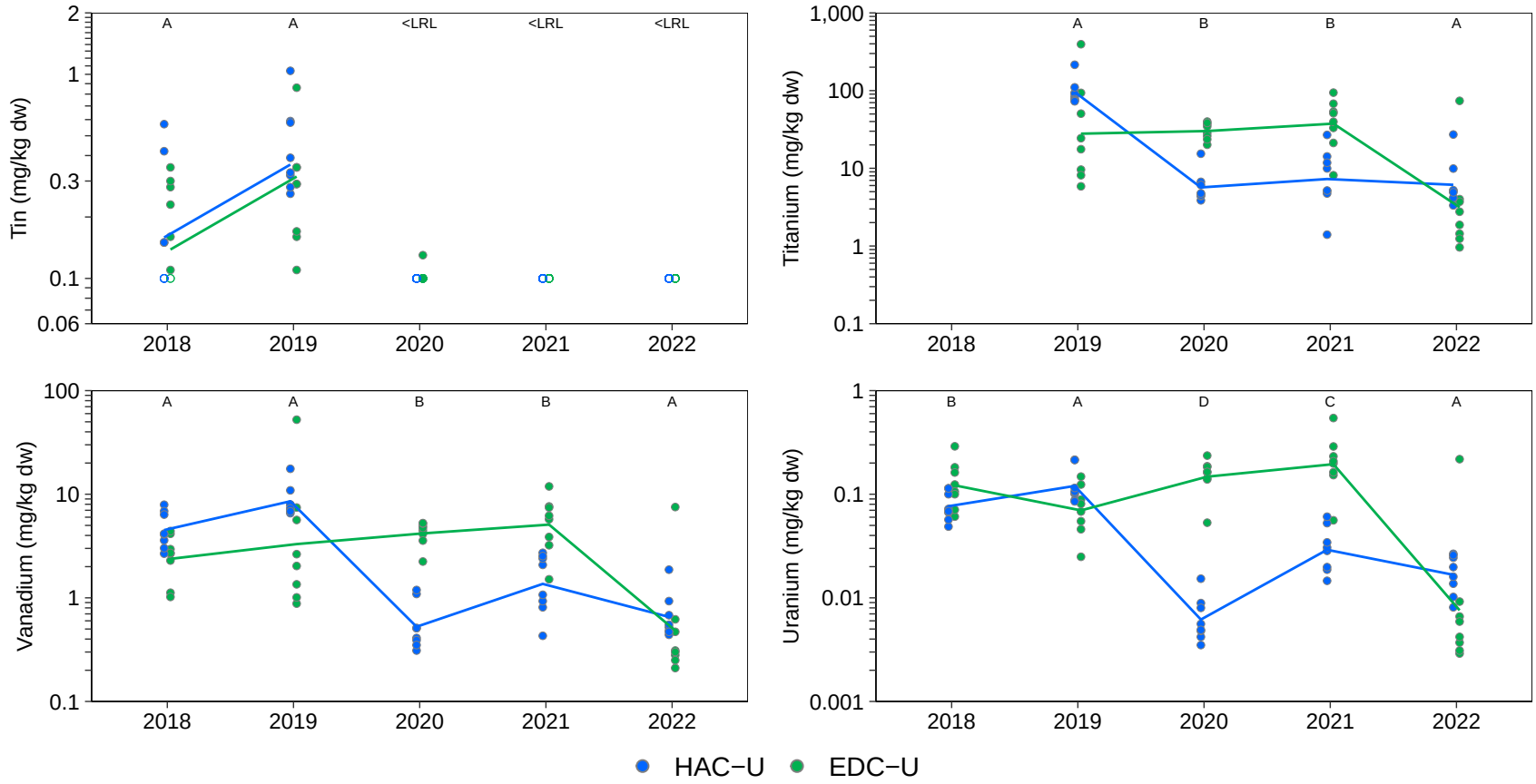

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

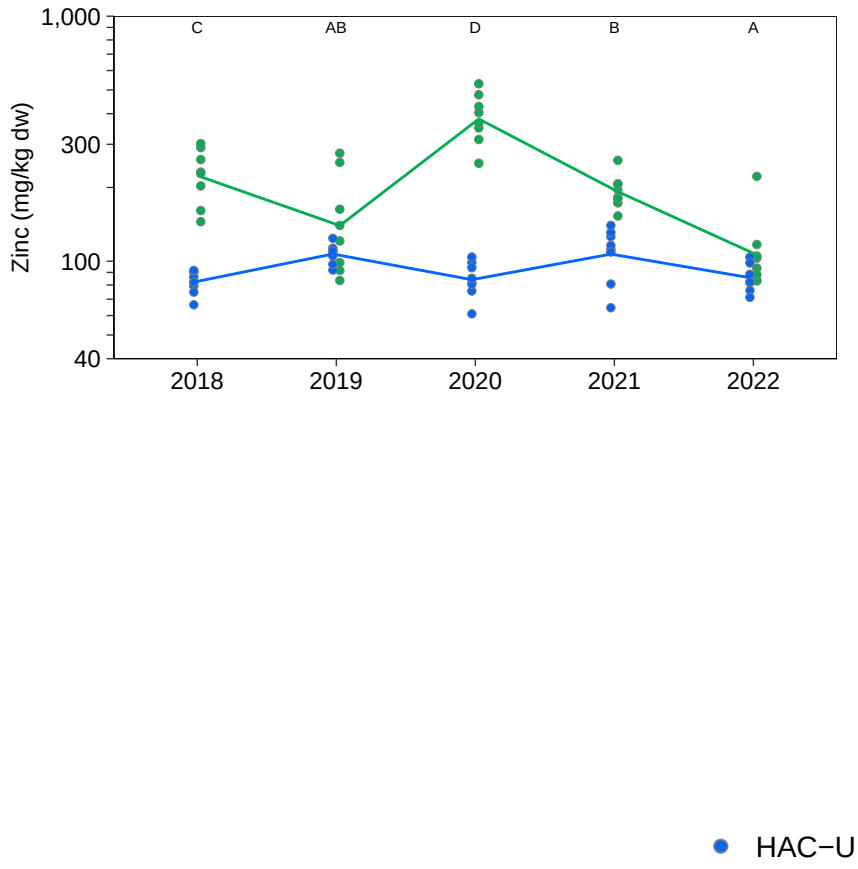

Figure F.5: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Upper Hazeltine Creek (HAC-U; Exposed) and Upper Edney Creek (EDC-U; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

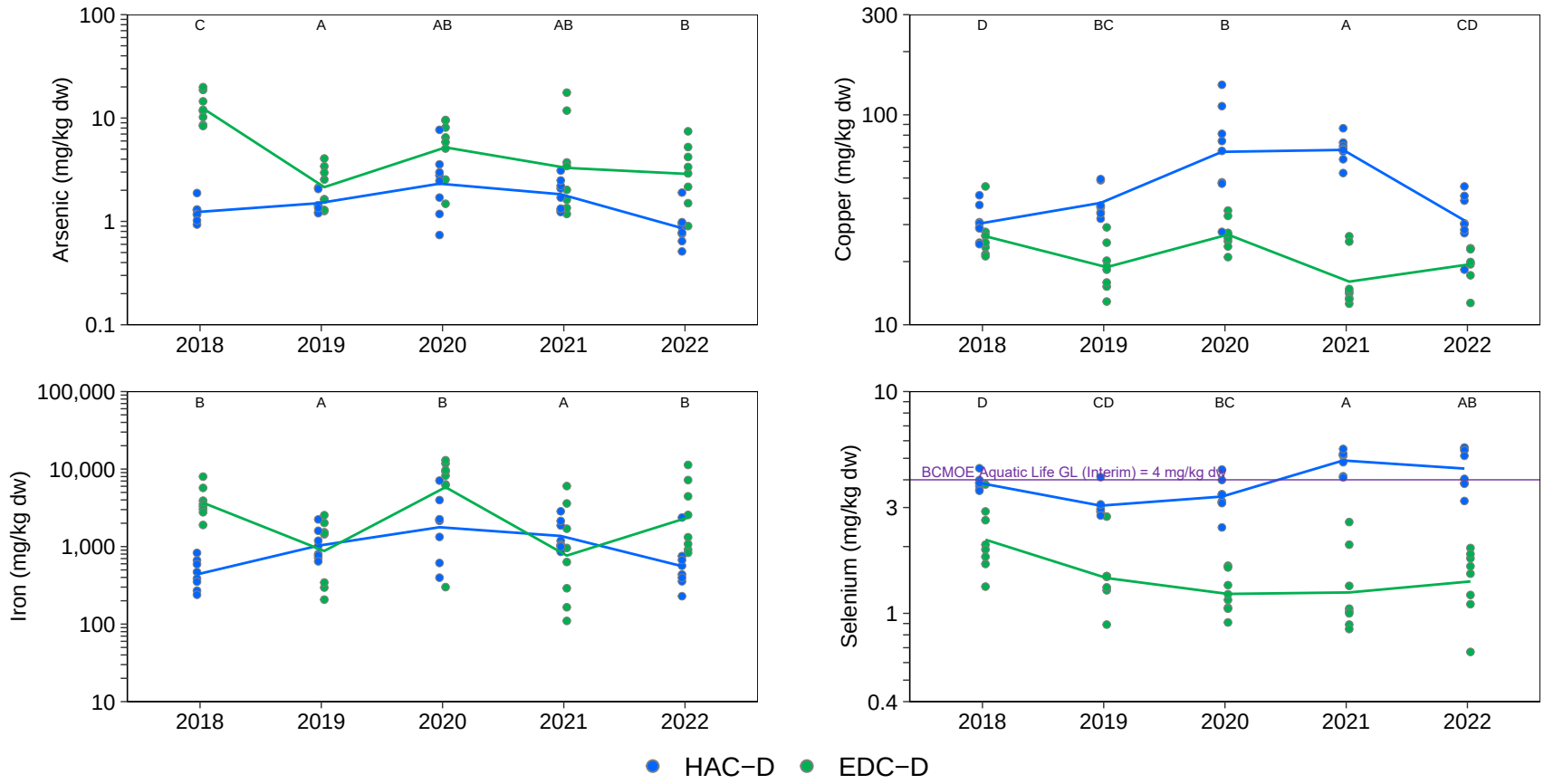

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

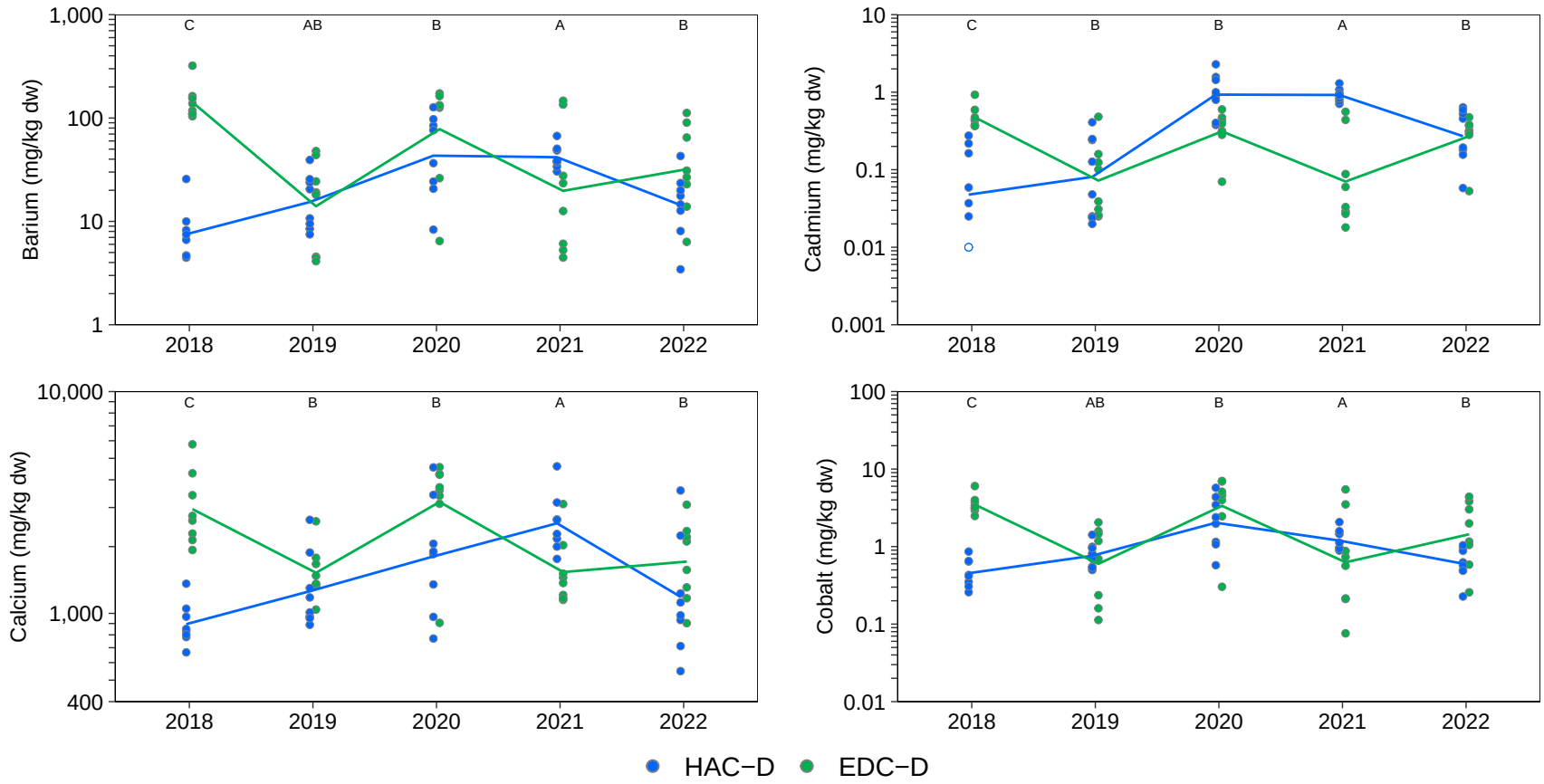

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

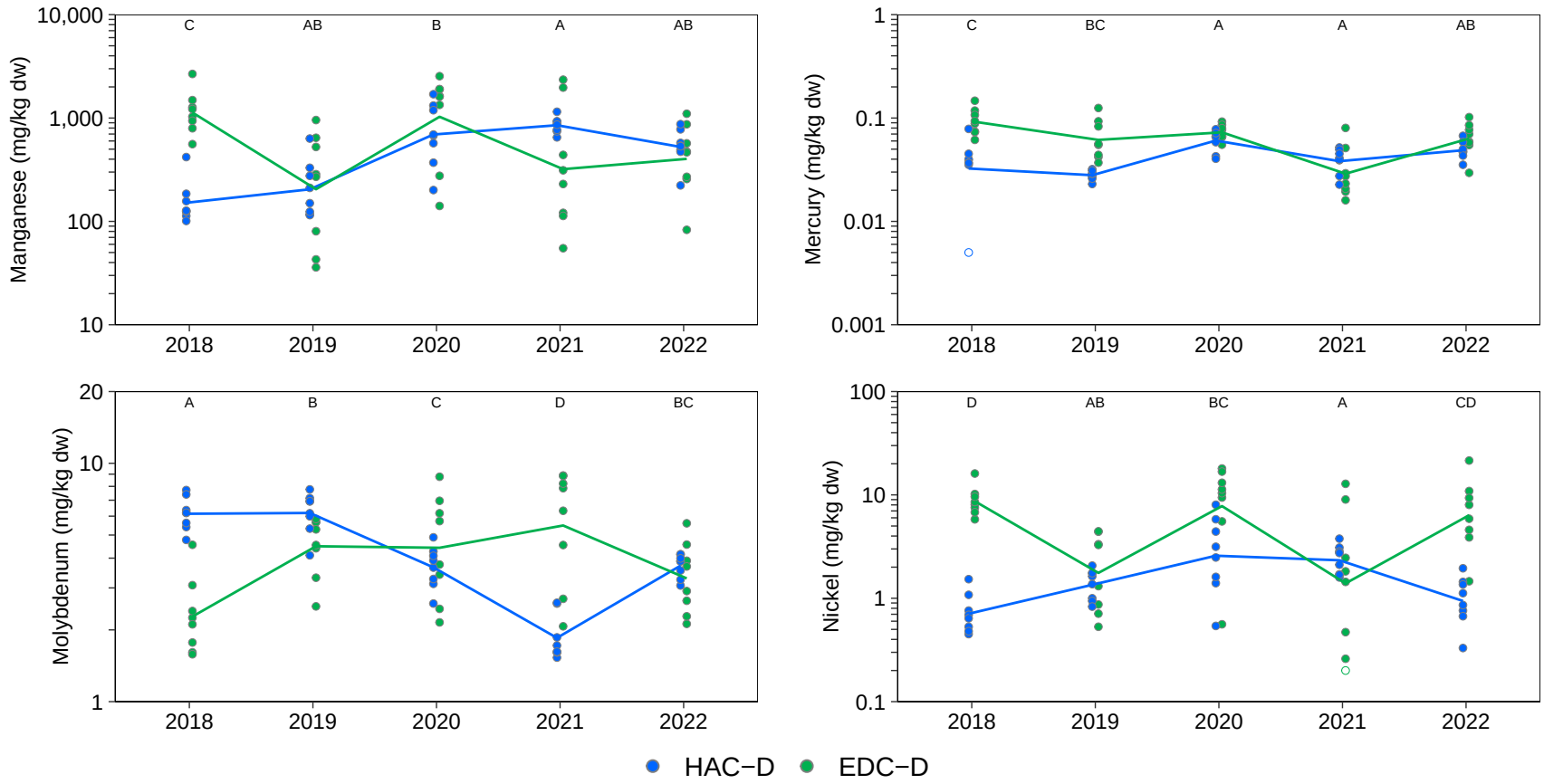

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

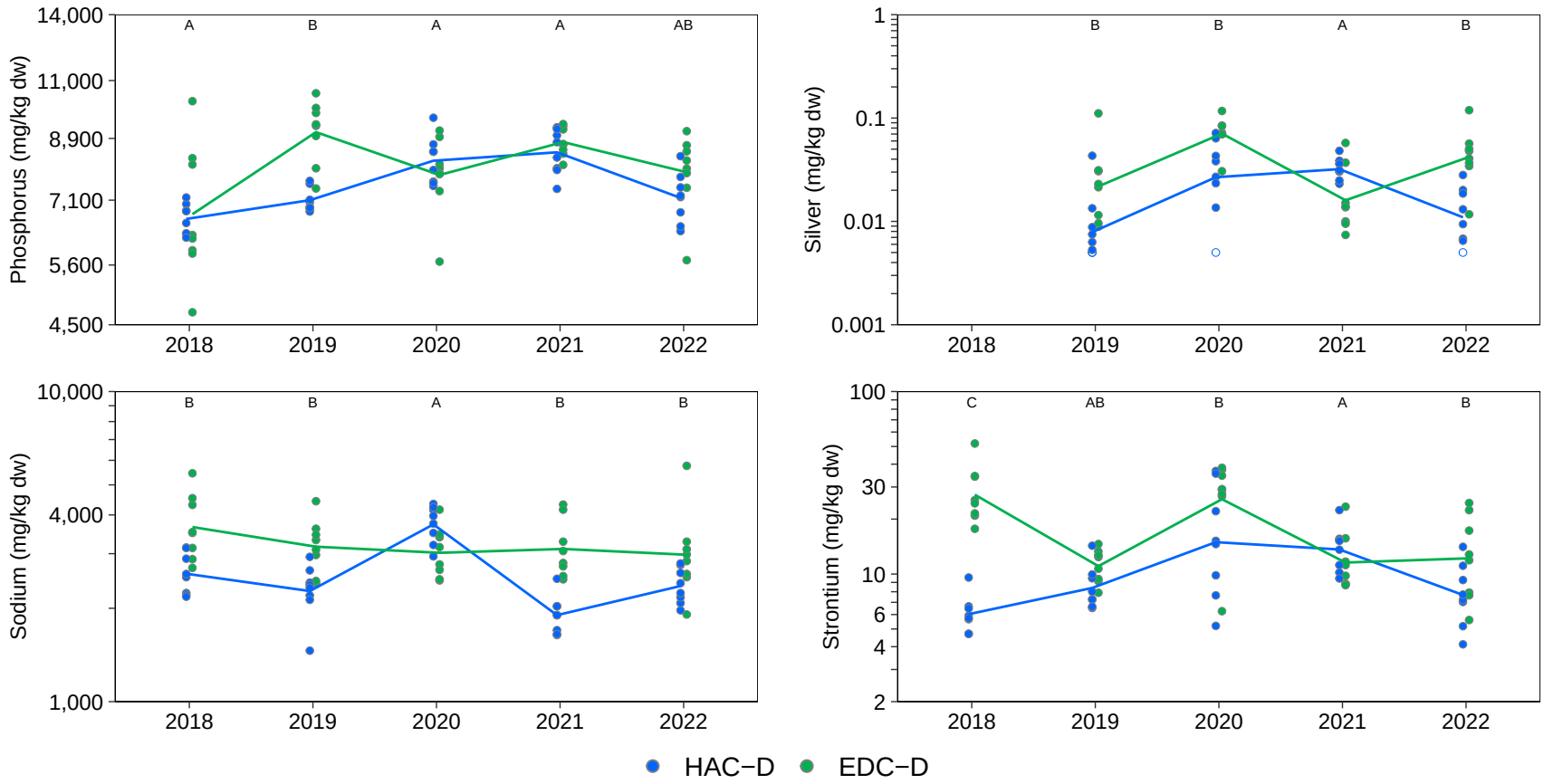

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

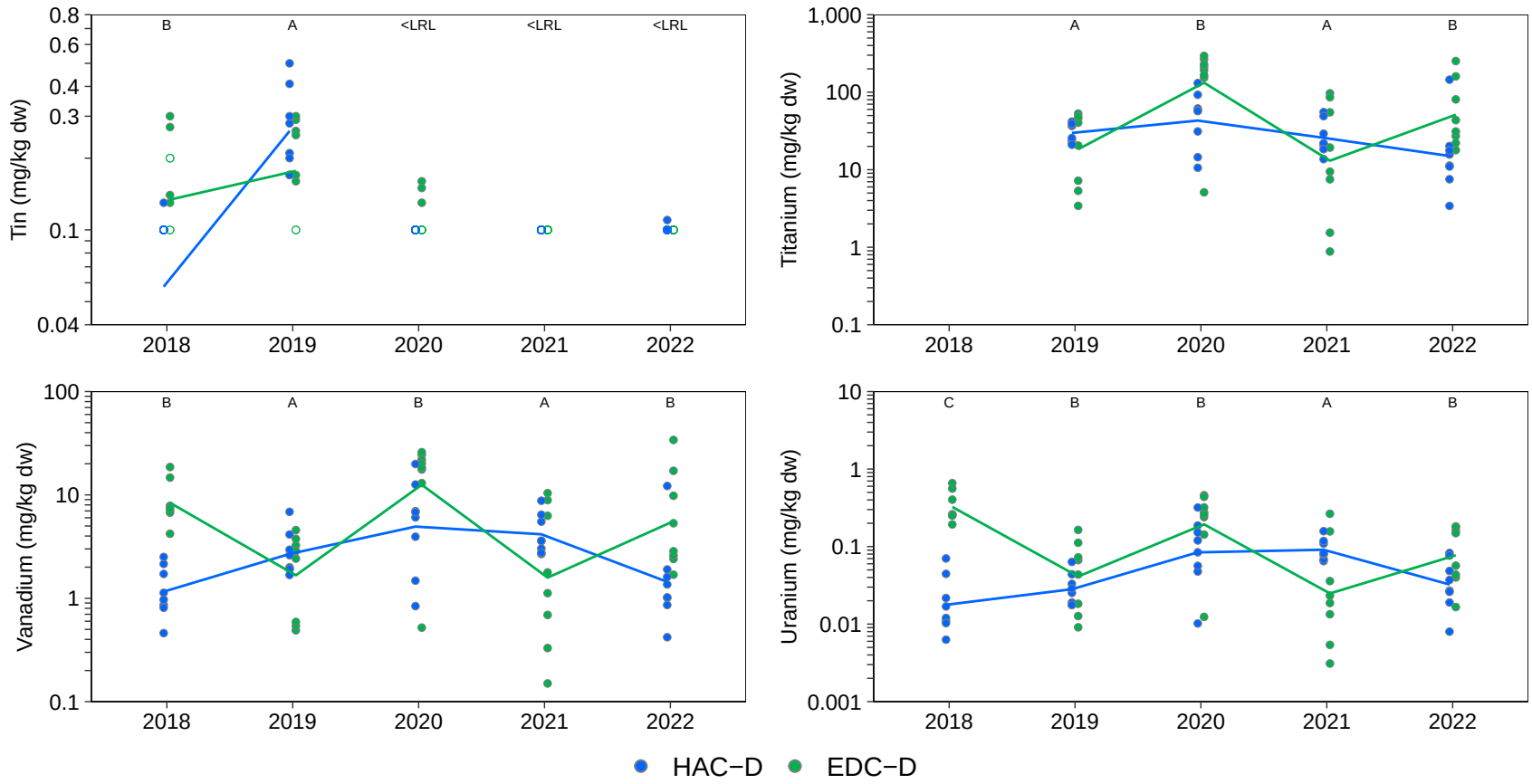

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

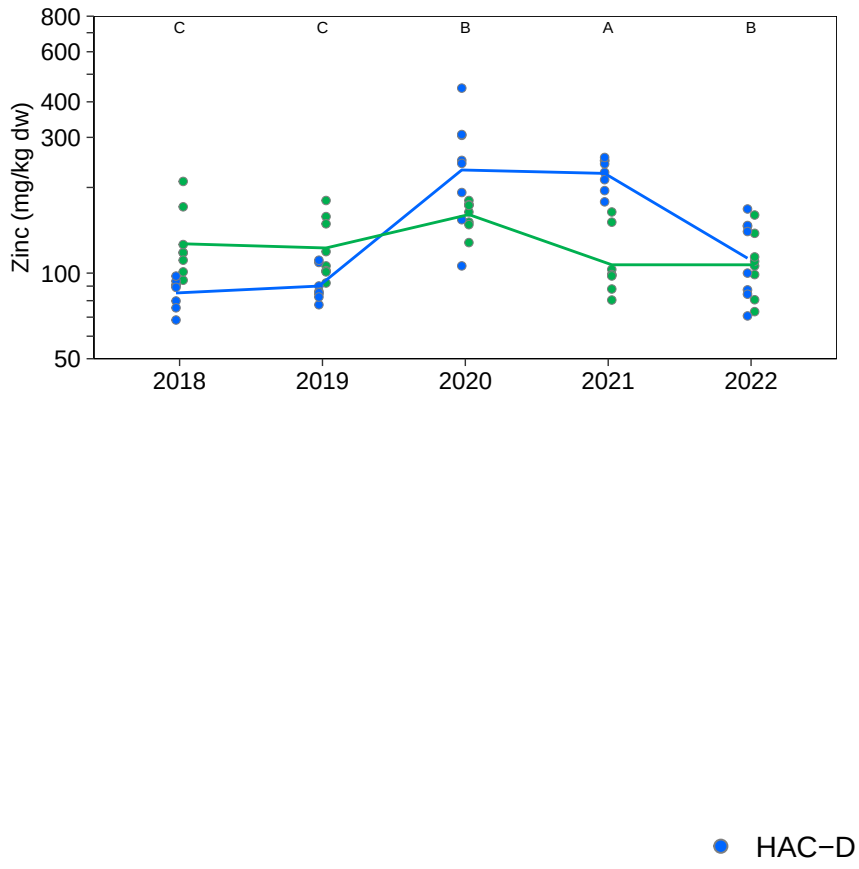

Figure F.6: Caddisfly Tissue Primary and Secondary Analyte Concentrations for Lower Hazeltine Creek (HAC-D; Exposed) and Lower Edney Creek (EDC-D; Reference), 2018 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Individual samples are plotted and lines join the least−squares estimated mean values for years included in the statistical analysis (i.e., not <LRL). Statistical analyses were conducted using a two−way ANOVA with factors Area and Year. The models were fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Years that share a letter (e.g., A,B,C) have ratios of concentrations (Exposed:Reference) that do not differ significantly (p−value < 0.05) among years. Letter A was assigned to the year with the highest ratio of concentrations (Exposed:Reference). Only years with samples from both reference and exposed areas are plotted.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2010	HAC-U (W7)[a]	Exposed	W7-1	77.5	1,610	<0.050	2.54	63.7	<0.30	<0.30	-	0.502	2,320	-	34.3	2.78	49.6	-	-	0.630	1.13	2,060	1,970
			W7-2	77.1	1,730	0.0540	3.99	72.7	<0.30	<0.30	-	0.355	12,900	-	22.4	2.69	53.3	-	-	0.710	1.25	2,060	2,040
			W7-3	77.6	1,870	<0.050	2.74	78.0	<0.30	<0.30	-	0.381	2,560	-	32.9	3.19	54.4	-	-	0.760	1.40	2,250	2,320
			W7-4	77.1	1,020	<0.050	2.13	63.1	<0.30	<0.30	-	0.344	1,730	-	12.0	2.14	47.4	-	-	0.480	0.670	1,930	2,060
			W7-5	76.6	811	<0.050	1.72	47.6	<0.30	<0.30	-	0.248	1,870	-	9.43	1.76	44.3	-	-	0.370	0.520	1,810	1,700
	HAC-D (W11)[a]	Exposed	W11-1	79.2	2,980	0.0630	7.33	110	<0.30	<0.30	-	0.495	3,260	-	38.7	5.68	31.8	-	-	1.48	2.75	3,030	1,710
			W11-2	68.8	586	<0.050	1.46	35.3	<0.30	<0.30	-	0.214	1,360	-	7.80	0.980	19.2	-	-	1.40	<0.50	1,410	701
			W11-3	74.6	1,960	<0.050	3.63	66.6	<0.30	<0.30	-	0.339	2,180	-	23.9	2.96	23.6	-	-	0.700	2.22	2,470	981
			W11-4	76.3	2,160	0.0690	3.97	69.8	<0.30	<0.30	-	0.369	3,780	-	120	4.70	33.9	-	-	1.20	1.98	2,460	1,020
			W11-5	72.7	1,540	<0.050	3.32	66.0	<0.30	<0.30	-	0.312	2,260	-	25.7	3.01	22.6	-	-	0.780	1.34	2,000	1,320
2015	HAC-U	Exposed	HAC-U-1	84.3	7,920	0.0129	2.60	135	0.145	0.0220	2.90	0.304	10,200	0.598	7.60	5.74	188	3.15	9,770	2.47	4.56	4,420	681
			HAC-U-2	83.6	5,560	0.00960	2.32	93.0	0.133	0.0219	2.62	0.333	7,010	0.603	7.16	4.23	171	2.18	3,540	2.15	3.88	3,780	577
			HAC-U-3	83.8	5,060	0.00600	2.56	87.3	0.124	0.0174	2.55	0.327	5,950	0.508	7.36	3.86	165	2.15	6,790	1.57	3.21	3,700	554
			HAC-U-4	84.3	4,930	0.0132	2.56	84.3	0.127	0.0190	2.90	0.327	6,760	0.516	6.34	3.57	168	2.12	7,240	1.63	3.06	3,210	550
			HAC-U-5	83.8	4,850	0.0113	2.78	90.1	0.114	0.0175	3.09	0.328	7,160	0.510	5.54	3.70	186	2.06	5,170	1.62	2.99	3,020	586
	EDC-D	Reference	EDC-D-1	78.0	440	0.00640	1.76	7.11	0.00680	0.00272	0.610	0.0427	1,600	0.0251	0.708	0.301	16.9	0.217	1,020	0.173	0.529	1,280	58.6
			EDC-D-2	75.9	55.6	0.00390	1.24	4.53	<0.0053	0.000790	<0.45	0.0253	1,620	0.0121	0.388	0.0751	13.3	0.0404	148	0.0569	0.0593	1,020	32.0
			EDC-D-3	72.1	177	0.00510	1.47	7.72	0.00600	0.0144	0.440	0.241	1,420	0.0255	0.529	0.179	18.3	0.0965	339	0.0806	0.287	1,000	79.1
			EDC-D-4	73.8	106	0.00540	1.87	9.81	<0.0035	0.00238	0.520	0.132	764	0.0182	0.342	0.275	13.3	0.0545	268	0.0700	0.0759	1,010	127
			EDC-D-5	71.2	56.7	0.00423	1.03	4.45	<0.0032	0.000950	<0.27	0.0996	1,980	0.0160	0.241	0.137	17.6	0.0290	147	0.0410	0.0847	1,130	72.2
	HAC-D	Exposed	HAC-D-1	79.7	2,330	0.0122	2.43	69.5	0.0659	0.0280	1.74	0.904	3,840	0.269	4.74	3.45	251	1.33	8,460	1.47	1.67	1,410	188
			HAC-D-2	83.5	2,800	0.0151	2.51	61.1	0.0906	0.0310	2.00	1.33	5,720	0.347	6.42	6.98	254	1.85	10,200	2.03	2.11	1,890	242
			HAC-D-3	80.3	2,460	0.0152	2.72	69.0	0.0630	0.0276	2.30	0.989	4,530	0.298	7.23	3.95	184	1.60	10,300	1.84	1.89	1,590	201
			HAC-D-4	77.8	2,310	0.0167	1.97	61.1	0.0904	0.0273	2.33	0.594	4,070	0.350	5.23	2.92	174	1.37	7,420	1.70	1.70	1,470	189
			HAC-D-5	76.7	2,250	0.0119	1.84	88.2	0.0538	0.0157	1.73	0.760	2,850	0.251	3.04	2.46	158	0.975	2,220	1.19	1.65	1,340	199
2018	EDC-U	Reference	EDC-U-1	81.0	804	0.0340	1.25	45.0	0.0270	<0.010	14.1	2.11	2,520	0.0710	3.47	1.79	19.2	-	1,530	0.452	0.560	1,480	1,100
			EDC-U-2	85.0	1,680	0.0500	1.99	46.7	0.0520	0.0160	12.1	3.39	3,090	0.145	6.97	3.31	22.5	-	3,170	0.841	1.37	2,170	1,100
			EDC-U-3	85.0	1,060	0.0410	1.87	24.0	0.0330	<0.010	8.50	2.56	2,370	0.0909	5.37	2.56	22.7	-	2,130	0.691	0.690	1,840	620
			EDC-U-4	87.0	2,040	0.0600	3.01	117	0.0680	0.0190	11.5	2.26	2,680	0.161	10.0	5.08	29.5	-	4,100	1.01	1.49	2,550	2,040
			EDC-U-5	86.0	668	0.0240	1.55	46.2	0.0210	<0.010	7.80	2.53	1,810	0.0585	3.78	3.36	21.5	-	1,420	0.378	<0.50	1,670	1,700
			EDC-U-6	77.0	2,250	0.0460	2.29	107	0.0820	0.0150	6.30	2.90	2,480	0.139	6.29	4.05	23.9	-	3,690	0.943	2.11	2,350	1,390
			EDC-U-7	80.0	319	0.0190	0.601	18.7	<0.010	<0.010	4.40	1.18	1,480	0.0245	2.44	1.18	20.3	-	652	0.201	<0.50	1,480	624
			EDC-U-8	78.0	424	0.0250	1.15	36.5	0.0140	<0.010	4.00	1.43	1,450	0.0385	2.72	2.46	17.9	-	977	0.270	<0.50	1,450	1,430
	HAC-R1	Exposed	HAC-R1-1	75.0	1,280	0.0770	3.02	42.0	0.0520	<0.010	6.40	0.772	166,000	0.185	3.51	1.82	252	-	1,930	0.663	1.69	2,210	394
			HAC-R1-2	75.0	1,070	0.0340	2.82	37.2	0.0420	<0.010	5.10	0.746	162,000	0.166	5.56	1.78	258	-	1,650	0.610	1.25	2,490	481
			HAC-R1-3	71.0	757	0.0240	2.38	31.4	0.0310	<0.010	4.10	0.585	194,000	0.123	2.73	1.27	260	-	1,120	0.436	0.930	1,910	330
			HAC-R1-4	78.0	1,220	0.0450	3.28	34.4	0.0450	<0.010	5.80	1.62	109,000	0.174	2.90	1.75	228	-	1,760	0.574	1.33	2,050	545
			HAC-R1-5	80.0	1,900	0.0730	2.39	58.7	0.0660	0.0100	7.70	1.85	6,860	0.245	37.4	3.27	128	-	3,010	0.857	2.23	2,240	1,260
			HAC-R1-6	78.0	1,690	0.0530	2.71	57.1	0.0620	0.0100	6.10	1.28	119,000	0.238	2.97	2.23	165	-	2,490	0.788	1.88	2,260	816
			HAC-R1-7	78.0	2,260	0.0710	3.51	384	0.0820	0.0120	5.40	1.26	136,000	0.310	7.21	2.59	230	-	2,930	0.989	2.42	2,690	927
			HAC-R1-8	79.0	1,180	0.0360	2.46	57.1	0.0390	<0.010	3.30	0.618	161,000	0.155	1.74	1.66	259	-	1,660	0.498	1.17	2,110	627
	HAC-U		HAC-U-1	71.0	700	0.0340	1.84	24.9	0.0300	<0.010	7.00	1.07	4,630	0.134	4.56	1.37	77.5	-	1,220	0.455	0.910	1,320	888
			HAC-U-2	59.0	1,300	0.0390	2.32	25.8	0.0560	<0.010	5.60	1.34	5,220	0.168	3.77	2.09	75.7	-	3,260	0.577	1.34	1,580	736
			HAC-U-3	55.0	1,040	0.0370	2.30	28.5	0.0410	<0.010	6.90	1.37	4,200	0.174	2.85	1.75	88.5	-	1,960	0.577	1.32	1,490	812
			HAC-U-4	73.0	763	0.0300	2.04	31.0	0.0320	<0.010	4.70	1.09	4,330	0.133	1.94	1.28	82.1	-	1,320	0.447	0.980	1,310	781
			HAC-U-5	80.0	737	0.0330	1.69	26.7	0.0310	<0.010	5.00	1.04	4,000	0.118	2.13	1.16	92.9	-	1,140	0.440	0.820	1,180	660
			HAC-U-6	59.0	700	0.0300	1.81	28.0	0.0260	<0.010	5.90	0.918	5,550	0.100	4.04	1.06	73.3	-	1,480	0.455	0.850	1,160	712
			HAC-U-7	75.0	928	0.0380	1.97	35.9	0.0420	<0.010	5.30	0.701	5,710	0.156	2.51	1.31	98.7	-	1,690	0.649	1.28	1,360	567
			HAC-U-8	73.0	842	0.0390	2.19	27.9	0.0350	<0.010	8.40	0.345	8,250	0.136	2.01	1.04	64.2	-	1,470	0.504	1.12	1,150	789
	EDC-D	Reference	EDC-D-1	68.0	694	0.0280	6.76	41.8	0.0230	<0.010	5.40	0.366	2,500	0.146	4.28	1.44	23.7	-	1,460	0.522	0.700	1,490	643
			EDC-D-2	70.0	804	0.0390	9.27	105	0.0400	0.0120	10.9	1.26	2,680	0.193	4.68	2.62	24.7	-	2,170	0.761	1.10	1,810	1,430
			EDC-D-3	80.0	1,610	0.0550	12.8	128	0.0780	0.0210	9.90	0.686	2,940	0.366	8.03	3.26	25.7	-	3,810	1.37	2.92	2,010	1,170
			EDC-D-4	78.0	567	0.0330	8.10	58.8	0.0280	0.0270	6.90	1.07	2,310	0.158	7.25	2.15	28.4	-	1,460	0.527	0.710	1,590	789
			EDC-D-5	72.0	811	0.0320	5.43	56.4	0.0340	0.0110	4.90	0.986	3,620	0.180	4.52	1.84	31.9	-	1,940	0.617	1.63	2,130	633
			EDC-D-6	78.0	177	0.0150	1.53	6.36	<0.010	<0.010	3.00	0.477	2,820	0.0496	1.05	0.626	37.4	-	380	0.108	<0.50	2,180	154
			EDC-D-7	82.0	924	0.0460	6.75	70.8	0.0330	0.0120	6.10	1.38	2,730	0.187	5.17	2.78	25.3	-	2,390	0.694	0.920	1,930	695
			EDC-D-8	75.0	2,310	0.0610	6.07	64.1	0.0850	0.0240	3.60	1.60	3,030	0.466	8.19	3.64	22.2	-	4,820	1.71	2.85	2,060	294
	HAC-D	Exposed	HAC-D-1	70.0	468	0.0380	2.07	8.49	0.0210	<0.010	1.70	0.608	1,130	0.116	1.21	0.924	41.7	-	1,170	0.396	0.570	1,350	107
			HAC-D-2	71.0	358	0.0370	1.35	8.20	0.0160	<0.010	1.30	0.553	1,350	0.0914	1.22	0.925	36.1	-	964	0.300	<0.50	1,190	124
			HAC-D-3	79.0	272	0.0400	1.85	30.8	0.0100	<0.010	1.40	1.67	1,390	0.0573	10.6	1.76	71.2	-	901	0.387	<0.50	1,750	772
			HAC-D-4	74.0	413	0.0410	1.42	13.8	0.0150	<0.010	1.00	0.359	1,430	0.0748	3.91	0.901	43.5	-	1,090	0.405	<0.50	1,220	140
			HAC-D-5	77.0	542	0.0420	1.51	11.9	0.0230	<0.010	1.50	2.74	2,730	0.0975	19.8	1.39	58.4	-	1,630	0.450	<0.50	1,520	150
			HAC-D-6	75.0	468	0.0560	1.30	7.74	0.0180	<0.010	<1.0	0.304	1,360	0.0839	14.4	0.775	40.8	-	1,280	0.362	<0.50	1,250	103
			HAC-D-7	81.0	248	0.0330	1.07	5.45	<0.010	<0.010	<1.0	0.346	890	0.0555	1.40	0.675	36.5	-	541	0.286	<0.50	1,300	104
			HAC-D-8	79.0	2,150	0.0400	1.44	16.0	0.0420	<0.010	2.40	2.22	4,980	0.120	54.1	2.43	76.1	-	2,360	0.625	0.720	1,880	319

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2019	EDC-U	Reference	EDC-U-1	84.8	3,160	0.0470	3.76	33.8	0.0940	0.0150	5.60	2.29	3,790	0.331	5.12	4.20	26.1	-	6,790	1.24	3.94	2,530	672
			EDC-U-2	86.9	1,080	0.0380	2.81	25.4	0.0290	<0.010	3.60	1.55	2,340	0.0441	2.63	2.30	18.5	-	2,680	0.784	1.02	1,940	485
			EDC-U-3	81.1	1,360	0.0400	2.85	21.6	0.0450	<0.010	6.30	1.22	3,040	0.0866	4.17	3.18	37.1	-	3,030	0.536	1.02	1,820	854
			EDC-U-4	85.6	2,510	0.0450	3.53	31.3	0.0740	0.0150	3.90	1.83	3,050	0.151	9.58	4.00	22.5	-	5,260	0.917	2.30	2,340	767
			EDC-U-5	86.6	1,570	<0.020	1.52	17.3	0.0230	<0.010	3.50	2.76	2,440	0.0442	2.79	2.53	24.6	-	3,000	0.284	1.60	2,720	291
			EDC-U-6	89.0	1,100	0.0430	2.45	23.9	0.0460	0.0140	6.00	4.32	3,150	0.0804	3.58	4.47	32.5	-	2,650	0.566	0.800	2,000	684
			EDC-U-7	90.3	2,000	0.0680	2.96	34.4	0.0650	0.0150	8.10	4.57	4,220	0.0996	5.72	3.87	31.1	-	3,800	0.641	1.49	2,090	868
			EDC-U-8	90.1	1,770	0.0490	4.54	57.0	0.0590	0.0170	7.40	3.82	4,640	0.203	6.17	4.46	25.5	-	3,940	0.741	1.76	1,800	988
	HAC-R1	Exposed	HAC-R1-1	81.3	8,700	0.0660	4.93	169	0.189	0.0100	18.2	0.438	36,000	0.543	2.82	6.36	162	-	8,230	1.03	7.54	4,550	1,490
			HAC-R1-2	82.1	959	0.0550	1.69	31.2	0.0310	<0.010	11.5	0.797	6,300	0.113	1.60	1.79	73.3	-	1,830	0.386	0.980	1,360	931
			HAC-R1-3	84.2	2,780	0.0690	2.40	55.1	0.0700	<0.010	9.80	1.17	11,400	0.970	2.67	3.41	122	-	3,900	0.699	2.41	2,530	1,320
			HAC-R1-4	81.7	1,570	0.0490	1.65	28.7	0.0580	<0.010	7.10	0.488	4,170	0.138	3.62	2.42	182	-	2,860	0.947	1.35	1,670	1,410
			HAC-R1-5	79.4	1,310	0.0500	1.90	23.2	0.0500	<0.010	3.80	1.11	3,370	0.123	2.54	2.12	92.5	-	2,400	0.359	1.37	1,790	1,070
			HAC-R1-6	85.5	1,670	0.0510	2.13	44.0	0.0540	<0.010	9.10	1.78	9,130	0.184	2.71	2.90	144	-	2,830	0.623	1.52	2,060	1,810
			HAC-R1-7	86.2	2,950	0.0670	3.16	259	0.0920	0.0210	9.50	1.76	9,410	0.252	4.12	3.70	159	-	4,460	0.869	2.59	2,420	2,200
			HAC-R1-8	85.0	2,800	0.0610	2.64	367	0.0780	0.0100	5.00	0.609	9,980	0.308	3.50	4.24	177	-	5,450	0.901	3.03	2,880	2,540
	HAC-U		HAC-U-1	81.3	1,910	0.0600	2.68	50.2	0.0630	<0.010	5.70	3.11	9,660	0.216	2.98	2.20	129	-	3,040	0.714	1.75	1,900	1,970
			HAC-U-2	75.2	7,880	0.0600	9.52	91.4	0.332	0.0270	7.90	0.532	30,500	0.272	4.41	4.39	343	-	8,170	1.27	4.30	4,060	1,940
			HAC-U-3	84.7	1,880	0.0630	3.18	40.5	0.0610	<0.010	6.80	1.12	11,700	0.239	2.87	2.09	124	-	2,900	0.683	1.81	1,910	2,170
			HAC-U-4	83.8	3,030	0.0580	2.61	126	0.101	0.0110	9.10	0.933	14,700	0.352	3.34	2.99	135	-	4,550	0.923	2.74	3,130	1,910
			HAC-U-5	88.5	1,570	0.0520	1.95	43.1	0.0530	0.0130	6.50	0.433	9,870	0.179	3.01	1.95	111	-	2,560	0.680	1.59	1,810	2,240
			HAC-U-6	80.4	7,400	0.0440	3.10	216	0.135	<0.010	6.50	0.442	55,900	2.62	2.96	2.78	230	-	4,850	0.688	4.34	3,420	1,820
			HAC-U-7	81.8	1,810	0.0530	2.93	57.2	0.0560	<0.010	6.20	0.740	42,900	0.221	3.70	2.12	205	-	2,940	0.666	1.79	2,180	1,560
			HAC-U-8	83.3	1,460	0.0550	2.24	60.8	0.0450	0.0100	6.90	0.524	11,600	0.184	5.16	1.85	83.4	-	2,460	0.663	1.72	1,580	1,800
	EDC-D	Reference	EDC-D-1	74.5	678	0.0390	2.06	10.1	0.0200	<0.010	2.00	0.704	2,080	0.0835	2.38	1.08	31.4	-	1,410	0.392	0.720	1,680	190
			EDC-D-2	73.1	624	0.0310	2.15	12.4	0.0210	<0.010	4.40	0.170	4,740	0.294	3.11	0.912	32.0	-	1,570	0.324	0.620	3,210	183
			EDC-D-3	73.6	265	0.0300	1.05	7.68	<0.010	<0.010	2.20	0.284	3,380	0.0327	0.930	0.580	36.2	-	611	0.196	<0.50	1,980	155
			EDC-D-4	78.3	876	0.0350	1.95	14.7	0.0250	<0.010	6.40	0.346	5,490	0.107	2.41	1.17	29.5	-	1,730	0.430	0.840	1,790	228
			EDC-D-5	73.3	327	0.0520	1.47	10.5	0.0130	<0.010	1.90	0.753	3,250	0.0554	0.990	1.06	39.3	-	845	0.379	<0.50	2,000	202
			EDC-D-6	77.7	292	0.0240	1.16	10.9	0.0110	<0.010	5.60	0.120	5,860	0.0390	0.980	0.746	39.5	-	646	0.146	<0.50	4,120	195
			EDC-D-7	78.9	1,370	0.0400	2.78	19.4	0.0350	0.0110	1.70	1.16	2,380	0.126	3.12	1.66	24.8	-	2,630	0.621	1.35	1,890	264
			EDC-D-8	78.6	1,100	0.0340	1.70	12.4	0.0320	<0.010	5.30	0.144	4,890	0.157	3.73	1.28	38.1	-	2,340	0.421	1.07	2,870	188
	HAC-D	Exposed	HAC-D-1	80.5	1,340	0.0610	2.48	24.9	0.0480	0.0120	3.10	0.311	3,530	0.191	3.26	1.72	72.2	-	2,690	0.896	1.60	1,870	219
			HAC-D-2	78.3	3,520	0.100	11.7	138	0.150	0.0330	5.50	1.46	8,910	0.548	7.90	4.93	135	-	7,690	2.19	3.45	4,030	1,370
			HAC-D-3	77.3	392	0.0490	1.15	8.33	0.0120	<0.010	1.50	0.124	1,060	0.0575	1.39	0.551	36.4	-	747	0.247	0.550	1,220	133
			HAC-D-4	81.8	2,350	0.0760	2.93	36.2	0.0780	0.0310	4.20	1.01	4,580	0.391	5.16	2.71	91.1	-	4,570	1.24	3.02	2,810	445
			HAC-D-5	76.2	584	0.0510	1.23	9.03	0.0180	0.0150	1.60	0.235	1,240	0.0766	1.51	0.789	39.2	-	1,210	0.380	0.750	1,230	112
			HAC-D-6	82.8	926	0.0710	1.40	43.6	0.0290	<0.010	3.50	0.298	2,480	0.111	2.23	1.23	63.4	-	1,770	0.562	0.990	1,330	201
			HAC-D-7	90.4	1,660	0.0590	2.02	41.3	0.0560	0.0180	9.90	0.996	3,420	0.196	4.14	2.43	99.8	-	3,420	0.979	1.96	1,940	222
			HAC-D-8	79.4	913	0.0470	1.48	24.7	0.0260	<0.010	2.30	0.321	1,680	0.0993	2.06	1.21	53.1	-	1,910	0.537	0.960	1,390	351

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2020	EDC-U	Reference	EDC-U-1	84.3	694	0.0220	1.08	60.6	0.0240	<0.010	6.90	1.87	2,930	0.0447	2.45	3.15	27.0	-	1,450	0.273	<0.50	2,510	1,730
			EDC-U-2	82.6	2,120	0.0350	2.84	130	0.0660	0.0120	6.00	1.30	3,230	0.146	6.65	4.46	24.1	-	4,780	0.759	1.71	2,970	2,410
			EDC-U-3	83.7	1,440	0.0310	3.27	67.2	0.0400	<0.010	7.80	1.83	3,650	0.114	4.13	3.86	20.9	-	3,180	0.858	1.17	2,700	2,410
			EDC-U-4	85.2	1,080	0.0480	2.12	127	0.0440	<0.010	8.40	1.41	2,740	0.0650	5.43	5.55	26.9	-	2,480	0.537	0.730	3,400	4,140
			EDC-U-5	85.3	1,180	0.0300	2.62	33.6	0.0420	<0.010	2.50	3.12	2,380	0.0848	3.80	3.76	27.3	-	3,010	0.572	0.820	2,660	1,230
			EDC-U-6	84.7	761	0.0190	0.951	37.6	0.0230	<0.010	3.10	2.15	1,830	0.0510	2.56	2.45	21.2	-	1,580	0.241	0.750	1,930	1,250
			EDC-U-7	82.7	786	0.0240	0.906	43.1	0.0270	<0.010	8.80	1.10	2,990	0.0416	2.36	2.75	25.2	-	1,340	0.272	<0.50	2,390	1,960
			EDC-U-8	89.3	676	0.0290	1.80	35.5	0.0250	<0.010	6.00	3.27	3,090	0.0552	2.65	2.93	27.3	-	1,440	0.295	<0.50	2,340	1,490
	HAC-R1	Exposed	HAC-R1-1	87.6	1,270	0.0350	1.59	28.6	0.0400	<0.010	8.30	0.527	12,900	0.119	2.18	1.91	107	-	2,180	0.441	1.17	2,260	1,070
			HAC-R1-2	89.4	856	0.0390	1.36	29.6	0.0280	<0.010	4.80	0.860	3,360	0.0919	1.58	1.36	67.6	-	1,670	0.340	0.790	1,730	875
			HAC-R1-3	88.8	3,530	0.0950	2.16	69.5	0.0940	0.0160	8.20	0.306	6,980	0.301	12.6	4.61	232	-	5,600	1.29	2.71	3,510	2,280
			HAC-R1-4	90.3	4,520	0.234	3.95	97.2	0.132	0.0290	9.50	0.494	7,420	0.400	14.1	5.59	425	-	7,570	2.08	3.42	3,830	2,140
			HAC-R1-5	83.1	2,840	0.0910	2.24	106	0.108	0.0180	7.30	0.387	7,990	0.227	5.99	3.55	214	-	4,730	1.05	2.21	2,530	2,000
			HAC-R1-6	72.4	348	0.0270	0.714	8.46	0.0110	<0.010	<1.0	0.218	1,330	0.0350	0.550	0.501	35.0	-	655	0.147	<0.50	1,120	241
			HAC-R1-7	73.1	258	0.0460	0.671	5.82	<0.010	<0.010	<1.0	0.0800	783	0.0304	0.520	0.386	26.8	-	528	0.150	<0.50	1,070	192
			HAC-R1-8	81.0	1,240	0.0360	0.926	21.4	0.0300	<0.010	3.90	0.175	4,390	0.0904	1.92	1.40	63.7	-	1,680	0.390	0.940	1,840	788
	HAC-U		HAC-U-1	79.7	625	0.0300	1.27	23.2	0.0190	<0.010	2.10	0.311	2,140	0.0620	1.64	0.988	61.6	-	1,080	0.237	<0.50	1,220	992
			HAC-U-2	74.8	950	0.0360	1.47	22.3	0.0260	<0.010	1.50	0.781	2,290	0.0983	1.68	1.17	68.8	-	1,530	0.330	0.750	1,400	1,110
			HAC-U-3	82.0	892	0.0340	1.33	27.2	0.0250	<0.010	2.90	0.371	2,330	0.0876	1.69	1.29	62.7	-	1,500	0.397	0.760	1,780	1,190
			HAC-U-4	79.8	405	0.0230	0.773	11.9	0.0110	<0.010	1.20	0.0664	1,830	0.0426	0.730	0.440	31.6	-	650	0.152	<0.50	1,590	413
			HAC-U-5	80.7	398	0.0220	0.810	9.29	<0.010	<0.010	1.00	0.0948	1,520	0.0327	0.735	0.472	33.9	-	568	0.152	<0.50	1,690	516
			HAC-U-6	77.6	83.1	0.0120	0.490	3.36	<0.010	<0.010	<1.0	0.0790	738	0.0126	0.260	0.151	19.8	-	232	0.0920	<0.50	1,010	166
			HAC-U-7	80.2	391	0.0210	0.918	14.0	0.0120	<0.010	1.80	0.319	1,520	0.0456	0.850	0.562	39.4	-	779	0.175	<0.50	1,480	507
			HAC-U-8	80.5	794	0.0340	1.17	28.3	0.0260	<0.010	3.70	0.430	3,040	0.0844	1.55	1.07	68.8	-	1,370	0.377	0.710	1,380	1,000
	EDC-D	Reference	EDC-D-1	76.3	1,340	0.0270	2.65	48.0	0.0380	0.0110	1.40	0.649	3,110	0.147	4.23	1.88	47.6	-	2,830	0.632	1.26	2,370	769
			EDC-D-2	84.0	487	0.0160	1.71	11.9	0.0150	<0.010	<1.0	1.10	3,080	0.0739	1.68	1.36	50.4	-	1,080	0.255	<0.50	2,160	342
			EDC-D-3	83.6	473	0.0140	1.61	9.16	0.0110	<0.010	1.60	0.752	3,830	0.0566	1.35	1.10	48.3	-	867	0.187	<0.50	3,060	286
			EDC-D-4	87.1	1,700	0.0340	3.82	46.1	0.0520	0.0140	2.80	1.63	3,050	0.197	5.28	3.08	37.2	-	3,660	0.874	1.59	2,340	906
			EDC-D-5	79.9	309	<0.010	1.05	12.0	<0.010	<0.010	2.00	0.681	1,610	0.0524	1.07	0.551	17.2	-	636	0.169	<0.50	1,130	192
			EDC-D-6	75.1	1,020	0.0220	1.78	14.7	0.0260	<0.010	6.00	0.170	5,250	0.0886	2.64	1.50	51.6	-	1,840	0.360	0.790	4,170	468
			EDC-D-7	82.9	1,430	0.0180	1.77	14.0	0.0260	<0.010	1.60	0.786	2,900	0.117	2.41	1.37	38.3	-	1,740	0.433	0.810	1,800	333
			EDC-D-8	79.2	728	0.0440	4.25	18.5	0.0320	0.0120	<1.0	0.670	2,180	0.117	2.50	1.48	26.9	-	2,160	0.715	0.700	1,440	236
	HAC-D	Exposed	HAC-D-1	82.0	328	0.0360	1.41	42.2	0.0110	<0.010	2.60	1.38	1,360	0.0552	1.07	2.37	88.2	-	731	0.393	<0.50	1,490	994
			HAC-D-2	79.5	1,060	0.0470	2.48	23.4	0.0410	<0.010	1.60	0.359	2,210	0.102	2.09	1.29	43.9	-	1,910	0.661	0.810	1,860	254
			HAC-D-3	80.1	1,140	0.0550	2.87	86.8	0.0400	0.0110	3.50	1.85	3,080	0.143	2.63	3.06	107	-	2,550	0.775	1.07	2,290	1,300
			HAC-D-4	81.7	478	0.0380	1.36	21.0	0.0140	<0.010	1.60	0.563	1,780	0.0551	1.50	1.02	41.8	-	1,070	0.315	<0.50	2,070	469
			HAC-D-5	76.5	2,900	0.0510	1.81	48.0	0.0980	0.0110	3.40	1.03	2,740	0.187	5.92	3.85	81.3	-	4,750	0.891	2.48	3,080	973
			HAC-D-6	86.4	2,340	0.0970	4.36	85.9	0.0820	0.0280	4.50	1.23	4,180	0.335	7.68	4.41	87.2	-	6,780	1.65	2.20	2,540	938
			HAC-D-7	77.6	1,490	0.0450	2.06	52.8	0.0300	<0.010	2.40	1.09	7,290	0.0747	2.02	2.31	94.3	-	2,400	0.585	0.970	2,310	921
			HAC-D-8	84.6	349	0.0360	2.15	76.9	0.0110	<0.010	1.60	1.67	1,440	0.0595	1.16	1.69	65.7	-	684	0.353	<0.50	1,240	658

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2021	EDC-U	Reference	EDC-U-1	86.8	851	0.0360	1.78	52.3	0.0290	<0.010	2.20	2.42	1,920	0.0521	4.02	3.19	18.8	-	1,570	0.392	0.600	1,710	1,130
			EDC-U-2	88.1	1,820	0.0600	2.74	110	0.0600	0.0140	4.40	3.13	3,040	0.113	7.76	5.96	25.0	-	3,360	0.747	1.33	2,360	3,360
			EDC-U-3	91.0	1,840	0.0650	3.29	69.9	0.0560	0.0120	3.50	5.04	2,970	0.114	6.84	5.50	21.6	-	3,240	0.660	1.36	2,140	1,920
			EDC-U-4	91.8	2,600	0.0620	3.67	108	0.0830	0.0190	2.10	4.06	2,920	0.146	9.68	7.95	27.8	-	4,490	0.948	1.77	2,310	2,860
			EDC-U-5	90.6	2,820	0.0600	3.82	163	0.0830	0.0190	4.70	3.87	3,480	0.161	12.4	11.4	26.0	-	4,940	0.983	1.90	2,520	5,330
			EDC-U-6	92.8	2,450	0.0550	3.82	92.8	0.0810	0.0160	2.40	3.16	3,240	0.141	8.83	7.21	25.6	-	4,510	0.854	1.77	2,400	2,860
			EDC-U-7	89.9	1,660	0.0720	2.84	72.7	0.0550	0.0120	4.90	6.41	3,610	0.118	10.1	6.22	27.0	-	3,060	0.730	1.17	2,220	2,680
			EDC-U-8	92.7	2,690	0.0580	3.81	36.4	0.0710	0.0160	1.60	8.35	3,990	0.172	8.90	5.18	26.8	-	4,480	0.912	1.98	2,370	1,260
	HAC-R1	Exposed	HAC-R1-1	86.3	1,700	0.0850	2.76	48.3	0.0580	0.0110	4.40	0.756	6,640	0.167	3.77	3.08	149	-	3,270	0.715	1.56	2,170	2,490
			HAC-R1-2	89.2	2,630	0.0780	3.55	134	0.0900	0.0120	5.10	1.36	7,250	0.314	5.99	3.80	184	-	4,960	0.937	2.46	2,620	2,700
			HAC-R1-3	90.8	2,170	0.0750	2.93	60.3	0.0780	0.0110	5.20	1.28	5,940	0.220	3.97	3.69	170	-	4,260	0.880	2.01	2,560	2,490
			HAC-R1-4	87.2	3,250	0.0960	3.57	70.2	0.122	0.0140	5.80	1.02	7,980	0.266	7.46	4.92	217	-	6,190	1.10	2.86	3,390	3,430
			HAC-R1-5	88.4	3,320	0.139	3.51	81.8	0.113	0.0140	5.30	1.26	10,300	0.283	6.72	4.90	227	-	6,580	1.22	2.90	3,410	3,310
			HAC-R1-6	89.1	2,680	0.100	3.03	79.0	0.104	0.0130	5.00	0.826	5,770	0.262	5.28	4.30	198	-	4,840	1.04	2.43	2,790	3,720
			HAC-R1-7	89.3	2,940	0.130	3.88	78.3	0.101	0.0170	5.80	1.95	13,100	0.266	8.02	5.14	223	-	5,620	1.21	2.68	3,070	3,780
			HAC-R1-8	87.0	2,000	0.113	2.78	57.2	0.0690	0.0120	4.90	2.08	4,620	0.217	5.58	3.68	167	-	3,600	0.835	1.80	2,460	2,860
	HAC-U		HAC-U-1	77.9	2,820	0.0830	2.35	55.4	0.0840	0.0110	4.00	0.674	7,780	0.172	7.41	3.55	141	-	6,550	1.04	2.14	2,650	3,410
			HAC-U-2	79.7	3,640	0.0590	2.40	68.0	0.140	<0.010	5.20	1.06	13,600	0.287	6.70	2.71	118	-	4,730	0.752	2.29	2,460	1,960
			HAC-U-3	74.4	3,560	0.0750	3.91	97.7	0.121	0.0100	6.00	0.691	8,870	0.564	9.59	3.94	144	-	6,440	0.913	3.02	3,220	3,400
			HAC-U-4	74.8	3,690	0.0840	3.32	65.9	0.146	0.0280	5.50	0.737	9,020	0.174	5.43	3.87	205	-	7,220	1.72	2.83	2,880	3,010
			HAC-U-5	76.0	683	0.0460	1.55	57.9	0.0240	<0.010	3.70	0.516	5,000	0.0732	1.91	1.33	69.7	-	1,170	0.310	0.570	1,260	2,750
			HAC-U-6	81.3	1,870	0.0500	2.16	92.0	0.0660	<0.010	3.60	0.553	15,000	0.143	3.93	2.20	107	-	2,810	0.612	1.54	1,950	2,630
			HAC-U-7	80.4	1,000	0.0690	2.06	69.9	0.0430	<0.010	4.10	0.926	3,340	0.0884	2.62	1.76	74.7	-	1,760	0.798	0.920	1,620	2,530
			HAC-U-8	81.4	3,540	0.0720	3.53	75.2	0.129	<0.010	9.40	1.32	16,300	0.245	8.36	2.41	121	-	3,490	0.829	1.71	2,300	2,060
	EDC-D	Reference	EDC-D-1	76.6	692	0.0280	3.71	26.4	0.0190	<0.010	1.30	0.639	2,300	0.129	3.49	1.40	38.1	-	1,760	0.289	0.670	2,060	524
			EDC-D-2	76.8	234	0.0230	1.58	7.42	<0.010	<0.010	<1.0	0.342	2,170	0.0487	1.62	0.561	44.6	-	629	0.130	<0.50	1,460	269
			EDC-D-3	85.2	1,400	0.0430	8.06	101	0.0520	0.0110	3.60	1.85	2,960	0.194	4.89	3.28	32.9	-	3,300	0.696	1.34	2,070	1,420
			EDC-D-4	81.5	900	0.0360	5.26	41.2	0.0330	<0.010	2.00	0.631	2,450	0.141	3.50	1.72	35.7	-	2,010	0.410	0.810	1,850	704
			EDC-D-5	84.0	468	0.0210	3.58	19.6	0.0180	<0.010	1.10	1.18	2,880	0.0940	2.18	1.34	40.0	-	1,230	0.246	<0.50	1,880	441
			EDC-D-6	86.5	660	0.0290	4.06	16.9	0.0230	<0.010	1.80	1.04	2,830	0.128	4.00	1.65	44.2	-	1,550	0.332	0.620	1,970	524
			EDC-D-7	83.9	1,860	0.344	7.70	22.2	0.0550	0.0130	1.70	1.50	2,780	0.269	6.77	2.57	28.8	-	4,140	1.08	1.59	1,980	395
			EDC-D-8	78.4	731	0.0230	3.31	14.2	0.0230	<0.010	3.90	0.793	3,440	0.126	2.51	1.69	35.8	-	1,460	0.285	0.590	2,560	423
	HAC-D	Exposed	HAC-D-1	73.3	1,080	0.0420	2.64	42.2	0.0400	<0.010	4.40	0.950	4,670	0.132	3.52	1.50	75.4	-	2,050	0.661	0.840	1,760	777
			HAC-D-2	82.0	1,220	0.0520	2.64	41.4	0.0420	<0.010	4.90	0.814	3,980	0.234	3.39	1.74	76.8	-	2,500	0.618	0.960	1,890	684
			HAC-D-3	77.8	2,910	0.0750	3.61	75.2	0.101	0.0190	11.0	0.463	5,780	0.308	5.17	2.87	150	-	5,010	1.44	2.34	2,770	522
			HAC-D-4	77.8	2,850	0.0600	2.37	65.6	0.0900	0.0150	6.50	0.529	5,030	0.267	6.35	2.44	117	-	4,480	1.12	2.03	2,470	320
			HAC-D-5	79.5	5,420	0.0800	3.59	155	0.171	0.0170	13.0	0.594	9,360	0.426	6.41	4.20	192	-	8,060	1.63	3.94	3,840	449
			HAC-D-6	79.6	2,390	0.0750	2.32	77.6	0.0780	0.0210	10.0	0.665	4,880	0.180	4.20	2.60	394	-	4,250	0.984	2.02	2,380	224
			HAC-D-7	70.0	2,370	0.0980	2.38	63.2	0.0850	0.0120	17.0	0.800	4,400	0.172	4.39	2.70	144	-	4,680	0.806	2.06	2,670	186
			HAC-D-8	64.2	7,320	0.106	4.56	132	0.199	0.0160	16.9	0.604	11,400	0.334	5.30	6.21	399	-	13,600	1.36	10.8	6,690	490

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2022	EDC-U	Reference	EDC-U-1	82.1	527	0.0220	1.08	7.95	0.0150	<0.010	<1.0	1.16	1,240	0.0404	2.80	1.87	24.3	-	997	0.226	<0.50	1,380	378
			EDC-U-2	82.2	439	0.0160	0.704	8.44	0.0120	<0.010	<1.0	0.811	1,440	0.0318	2.22	1.57	22.1	-	855	0.164	<0.50	1,210	377
			EDC-U-3	81.7	783	0.0230	1.51	10.8	0.0260	<0.010	<1.0	1.70	1,840	0.0518	2.71	2.64	25.4	-	1,820	0.343	0.660	1,340	580
			EDC-U-4	82.6	416	0.0100	0.873	8.06	0.0120	<0.010	<1.0	1.22	1,420	0.0303	1.48	1.76	23.5	-	879	0.160	<0.50	1,120	485
			EDC-U-5	81.0	470	0.0170	0.888	7.75	0.0130	<0.010	<1.0	1.05	1,280	0.0347	1.80	1.56	21.3	-	925	0.178	<0.50	1,380	455
			EDC-U-6	86.3	886	0.0220	1.22	15.4	0.0270	<0.010	<1.0	1.07	2,030	0.0636	3.15	3.85	30.1	-	1,860	0.352	0.680	1,380	1,580
			EDC-U-7	83.0	647	0.0210	1.23	20.3	0.0310	<0.010	2.30	1.29	1,540	0.0462	2.64	3.15	24.0	-	1,980	0.401	0.500	1,390	1,320
			EDC-U-8	77.4	324	0.0130	0.619	6.73	<0.010	<0.010	<1.0	0.424	1,010	0.0254	1.45	1.58	17.6	-	780	0.166	<0.50	1,220	672
	HAC-R1	Exposed	HAC-R1-1	74.6	1,210	0.0380	1.47	24.5	0.0430	<0.010	4.40	0.225	8,370	0.121	2.54	1.80	89.4	-	2,430	0.522	1.11	1,450	842
			HAC-R1-2	82.7	2,160	0.0550	2.08	36.2	0.0720	<0.010	4.60	0.278	9,280	0.174	3.76	2.43	102	-	3,520	0.718	1.69	2,040	875
			HAC-R1-3	75.8	1,060	0.0590	1.20	28.3	0.0370	<0.010	3.10	0.381	4,210	0.0980	2.74	1.55	91.0	-	2,070	0.434	0.970	1,700	603
			HAC-R1-4	83.2	1,580	0.0520	1.75	32.8	0.0550	<0.010	3.90	0.460	3,450	0.146	2.60	2.13	149	-	2,970	0.606	1.42	1,900	938
			HAC-R1-5	78.2	5,370	0.057	3.24	31.0	0.144	<0.010	7.00	0.362	15,900	0.163	1.84	2.88	95.2	-	4,320	0.564	2.43	1,890	890
			HAC-R1-6	72.5	4,200	0.0640	2.72	58.3	0.129	0.0170	5.10	0.411	10,700	0.244	5.15	3.77	152	-	6,240	0.933	3.26	3,250	1,430
			HAC-R1-7	81.8	2,360	0.0470	1.75	103	0.0580	<0.010	3.40	0.935	4,080	0.152	2.67	2.09	134	-	3,020	0.693	1.31	1,800	981
			HAC-R1-8	82.6	898	0.0360	2.08	25.0	0.0290	<0.010	2.30	1.97	6,620	0.0978	1.88	1.68	138	-	1,820	0.386	0.810	1,740	828
	HAC-U		HAC-U-1	79.9	2,180	0.0490	3.75	56.0	0.0860	<0.010	3.70	0.458	37,400	0.180	3.46	2.16	442	-	3,710	0.611	1.68	2,750	1,070
			HAC-U-2	80.2	496	0.0200	3.12	24.7	0.0170	<0.010	1.00	0.995	51,500	0.0701	0.960	1.32	1,180	-	907	0.199	0.520	3,050	443
			HAC-U-3	84.4	1,300	0.0380	3.68	59.6	0.0500	<0.010	9.20	0.594	28,300	0.137	2.12	2.34	926	-	2,300	0.467	1.00	2,940	1,310
			HAC-U-4	80.4	303	0.0230	2.05	24.3	0.0110	<0.010	1.90	0.305	11,800	0.0491	0.640	0.593	133	-	710	0.142	<0.50	2,800	801
			HAC-U-5	85.5	373	0.0220	3.12	35.7	0.0120	<0.010	2.90	0.720	20,400	0.0713	1.06	1.25	403	-	962	0.187	<0.50	3,320	851
			HAC-U-6	76.9	700	0.0260	1.93	19.0	0.0240	<0.010	1.60	0.540	7,290	0.0797	1.19	1.01	394	-	1,400	0.248	0.560	1,570	574
			HAC-U-7	79.4	2,360	0.0480	4.30	75.1	0.0960	0.0100	4.10	0.366	20,100	0.289	3.81	2.54	393	-	4,250	0.676	1.85	3,420	1,230
			HAC-U-8	85.3	94.1	0.0320	2.52	40.4	<0.010	<0.010	<1.0	0.667	28,800	0.0337	0.350	0.735	127	-	440	0.0940	<0.50	2,590	1,620
	EDC-D	Reference	EDC-D-3	80.1	1,180	0.0390	3.23	25.9	0.0370	0.0150	1.20	2.69	2,390	0.170	3.77	1.85	39.4	-	2,260	0.596	1.16	1,540	504
			EDC-D-4	73.8	221	0.0110	1.30	5.28	<0.010	<0.010	<1.0	0.595	2,570	0.0379	1.04	0.626	38.8	-	460	0.106	<0.50	1,900	188
			EDC-D-5	80.3	658	0.0210	1.90	24.3	0.0240	<0.010	<1.0	1.06	1,430	0.0892	2.36	1.02	30.8	-	1,340	0.341	0.640	1,610	345
			EDC-D-6	79.0	2,140	0.0330	2.32	25.6	0.0450	0.0100	2.00	0.522	3,130	0.0911	2.26	1.32	33.8	-	2,830	0.666	0.980	1,820	370
			EDC-D-7	80.1	880	0.0290	2.44	29.1	0.0290	<0.010	1.80	1.16	1,500	0.116	2.89	1.41	32.1	-	1,720	0.443	0.830	1,500	421
			EDC-D-8	80.9	396	0.0210	1.29	13.6	0.0120	0.0760	<1.0	0.717	1,440	0.0520	1.76	0.732	26.6	-	896	0.312	<0.50	1,340	210
			EDC-D-1	73.2	424	0.0200	1.96	8.50	0.0140	<0.010	<1.0	0.946	1,800	0.0625	2.02	0.896	38.0	-	848	0.198	<0.50	1,300	238
			EDC-D-2	78.5	274	0.0180	1.24	9.84	<0.010	<0.010	<1.0	0.878	1,480	0.0439	1.60	0.666	29.6	-	591	0.170	<0.50	1,640	179
	HAC-D	Exposed	HAC-D-1	69.9	3,070	0.0820	7.19	43.8	0.124	0.0230	3.30	1.31	7,350	0.362	6.21	3.51	104	-	6,910	1.57	2.64	2,580	702
			HAC-D-2	68.8	132	0.0230	0.999	20.2	<0.010	<0.010	<1.0	0.548	920	0.0250	0.480	1.24	34.4	-	283	0.141	<0.50	952	538
			HAC-D-3	75.4	870	0.0290	2.11	22.6	0.0290	0.0110	1.40	0.958	2,360	0.111	11.0	1.70	77.2	-	1,770	0.611	0.920	1,590	454
			HAC-D-4	75.9	540	0.0280	1.31	25.3	0.0220	<0.010	2.60	1.01	2,980	0.0879	1.65	1.14	74.8	-	1,110	0.332	0.540	1,310	836
			HAC-D-5	73.4	1,240	0.0350	2.26	53.4	0.0640	<0.010	1.80	1.53	3,570	0.121	1.58	1.65	81.6	-	1,580	1.49	0.740	1,540	1,230
			HAC-D-6	73.0	286	0.0180	1.02	19.7	0.0110	<0.010	<1.0	0.772	1,700	0.0601	0.950	0.809	55.0	-	677	0.196	<0.50	1,100	820
			HAC-D-7	79.6	541	0.0300	2.10	31.7	0.0210	<0.010	4.00	2.31	4,840	0.0860	2.29	1.61	81.5	-	1,270	0.350	0.560	1,500	1,390
			HAC-D-8	79.7	1,010	0.0390	1.82	45.1	0.0360	0.0100	2.40	0.744	3,380	0.122	1.90	1.73	75.2	-	2,370	0.498	1.05	1,610	1,140

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2010	HAC-U (W7)[a]	Exposed	W7-1	0.0522	-	4.67	20.8	-	-	-	-	10.8	-	-	21.0	-	<0.030	-	<0.20	-	0.248	7.89	-	206	-
			W7-2	0.0484	-	3.81	13.1	-	-	-	-	10.0	-	-	35.7	<0.030	-	-	<0.20	-	0.282	7.78	-	203	-
			W7-3	0.0478	-	4.84	19.6	-	-	-	-	10.7	-	-	22.8	<0.030	-	-	<0.20	-	0.266	9.04	-	244	-
			W7-4	0.0537	-	3.67	7.97	-	-	-	-	11.2	-	-	18.4	<0.030	-	-	<0.20	-	0.193	4.58	-	244	-
			W7-5	0.0530	-	3.39	6.25	-	-	-	-	11.8	-	-	14.8	<0.030	-	-	<0.20	-	0.153	3.72	-	202	-
	HAC-D (W11)[a]	Exposed	W11-1	0.0525	-	3.88	27.8	-	-	-	-	3.49	-	-	29.5	0.0360	-	-	0.360	-	0.334	17.8	-	112	-
			W11-2	0.0347	-	3.74	5.17	-	-	-	-	3.55	-	-	10.3	<0.030	-	-	<0.20	-	0.0550	4.21	-	91.1	-
			W11-3	0.0431	-	4.49	15.8	-	-	-	-	3.67	-	-	19.8	<0.030	-	-	<0.20	-	0.172	11.4	-	95.5	-
			W11-4	0.0598	-	9.25	69.3	-	-	-	-	3.19	-	-	24.5	<0.030	-	-	0.250	-	0.272	12.6	-	113	-
			W11-5	0.0369	-	4.32	16.1	-	-	-	-	3.64	-	-	19.5	<0.030	-	-	<0.20	-	0.183	9.11	-	92.1	-
2015	HAC-U	Exposed	HAC-U-1	-	-	1.24	9.25	3,280	6,340	0.00581	3.99	4.05	0.0889	2,980	63.8	-	0.0180	0.532	0.0306	67.2	0.230	40.0	4.00	79.2	1.69
			HAC-U-2	-	-	1.29	8.80	2,880	7,390	0.00658	4.71	4.49	0.0681	3,320	57.1	-	0.0225	0.555	0.0271	28.9	0.180	23.3	2.40	94.6	0.683
			HAC-U-3	-	-	1.53	11.1	5,340	9,310	0.00538	5.00	5.44	0.0636	4,260	53.3	-	0.0224	0.484	0.0167	27.3	0.166	22.6	2.28	93.5	1.19
			HAC-U-4	-	-	1.71	7.05	4,840	7,150	0.00774	4.37	5.56	0.0685	2,960	59.5	-	0.0208	0.472	0.0503	58.5	0.175	25.1	2.09	103	1.56
			HAC-U-5	-	-	1.57	6.00	3,360	8,050	0.00609	4.57	4.99	0.109	3,640	68.1	-	0.0197	0.470	0.0291	74.8	0.198	33.4	2.45	89.2	0.983
	EDC-D	Reference	EDC-D-1	-	-	5.72	0.612	7,190	5,140	0.000132	1.20	1.24	0.0258	2,080	13.4	-	0.00567	0.0703	0.110	5.52	0.0236	2.55	0.235	72.0	0.125
			EDC-D-2	-	-	7.57	0.166	8,190	6,290	<0.000074	1.37	1.12	0.00734	2,070	13.2	-	0.00219	0.0252	0.0814	2.77	0.00879	0.272	0.0681	68.8	0.0512
			EDC-D-3	-	-	3.66	0.525	7,210	6,250	<0.000058	1.42	2.70	0.0158	1,840	10.0	-	0.00444	0.0666	0.180	4.53	0.0197	0.581	0.124	74.6	0.0851
			EDC-D-4	-	-	3.39	0.513	6,550	6,510	<0.000049	1.27	1.36	0.0126	1,790	6.03	-	0.00268	0.0213	0.243	4.63	0.0153	0.610	0.0801	80.1	0.124
			EDC-D-5	-	-	4.69	0.275	7,900	5,580	<0.000044	1.23	1.12	0.0514	2,080	11.2	-	0.00248	0.0129	0.125	2.06	0.00648	0.249	0.0590	78.8	0.0528
	HAC-D	Exposed	HAC-D-1	-	-	1.18	2.66	2,840	4,390	0.00430	3.27	2.55	0.214	1,300	26.5	-	0.0271	0.597	0.0145	50.0	0.215	46.4	1.84	110	0.599
			HAC-D-2	-	-	1.37	4.43	1,940	3,250	0.00569	3.29	2.76	0.125	834	37.6	-	0.0342	0.673	0.0417	60.4	0.262	60.2	2.21	120	0.700
			HAC-D-3	-	-	1.38	3.41	2,990	3,590	0.00502	2.95	3.02	0.126	1,050	26.6	-	0.0263	0.684	0.0426	62.8	0.240	51.7	2.27	111	0.735
			HAC-D-4	-	-	0.924	2.81	2,650	4,400	0.00435	3.15	2.49	0.0976	1,410	28.3	-	0.0256	0.488	0.0215	56.0	0.200	41.9	1.86	101	0.575
			HAC-D-5	-	-	1.47	2.40	4,150	4,950	0.00336	3.54	2.77	0.0684	1,400	22.9	-	0.0234	0.442	0.0111	11.8	0.185	20.6	1.43	110	0.247
2018	EDC-U	Reference	EDC-U-1	0.0716	-	0.925	3.69	6,670	9,990	-	6.34	0.460	-	5,520	16.9	<0.020	0.0233	-	<0.10	-	0.152	3.74	-	130	0.970
			EDC-U-2	0.172	-	1.43	5.42	8,170	9,210	-	7.85	0.900	-	4,040	23.0	<0.020	0.0319	-	0.120	-	0.245	7.25	-	172	1.66
			EDC-U-3	0.125	-	1.62	3.80	8,190	8,020	-	7.08	0.940	-	4,580	13.4	<0.020	0.0197	-	<0.10	-	0.181	5.13	-	168	1.27
			EDC-U-4	0.121	-	1.49	9.04	7,580	11,300	-	8.37	0.890	-	5,660	18.3	<0.020	0.0323	-	0.130	-	0.385	9.59	-	192	2.92
			EDC-U-5	0.0800	-	1.10	3.60	8,010	9,310	-	7.15	0.800	-	4,900	13.4	<0.020	0.0191	-	<0.10	-	0.161	3.15	-	242	0.860
			EDC-U-6	0.133	-	1.55	5.92	6,610	8,600	-	7.72	0.840	-	3,870	19.1	<0.020	0.0309	-	<0.10	-	0.352	11.3	-	206	2.42
			EDC-U-7	0.0770	-	1.15	1.83	6,970	7,040	-	2.98	1.05	-	3,800	7.63	<0.020	0.00920	-	<0.10	-	0.0959	1.38	-	208	0.390
			EDC-U-8	0.0986	-	1.00	2.87	6,800	7,110	-	4.57	0.850	-	3,150	8.97	<0.020	0.0120	-	<0.10	-	0.122	2.02	-	196	0.590
	HAC-R1	Exposed	HAC-R1-1	0.0629	-	7.72	3.47	4,180	3,390	-	3.75	2.06	-	3,420	341	<0.020	0.0169	-	<0.10	-	0.167	7.19	-	39.8	0.240
			HAC-R1-2	0.0708	-	1.54	4.33	5,160	3,980	-	4.17	2.06	-	3,940	324	<0.020	0.0183	-	<0.10	-	0.145	5.69	-	42.4	<0.20
			HAC-R1-3	0.0580	-	1.90	2.64	3,870	3,070	-	3.02	2.06	-	3,660	348	<0.020	0.0167	-	<0.10	-	0.135	4.17	-	34.3	<0.20
			HAC-R1-4	0.0735	-	2.22	3.07	6,240	5,640	-	4.53	3.60	-	4,080	203	<0.020	0.0137	-	<0.10	-	0.156	6.42	-	69.5	0.500
			HAC-R1-5	0.0799	-	5.04	21.2	6,730	7,620	-	4.60	3.13	-	3,110	33.1	<0.020	0.00840	-	0.150	-	0.130	10.5	-	107	1.18
			HAC-R1-6	0.0823	-	3.11	3.39	4,760	4,330	-	4.16	2.58	-	3,380	244	<0.020	0.00990	-	<0.10	-	0.159	9.06	-	50.8	0.480
			HAC-R1-7	0.0799	-	3.50	5.88	4,690	4,210	-	4.33	2.29	-	3,410	290	<0.020	0.0182	-	0.110	-	0.252	10.8	-	49.1	0.460
			HAC-R1-8	0.0710	-	1.77	2.39	4,740	3,670	-	3.84	1.95	-	3,560	310	<0.020	0.0164	-	<0.10	-	0.115	5.78	-	46.7	<0.20
	HAC-U		HAC-U-1	0.0590	-	3.43	2.42	7,610	8,500	-	5.19	2.70	-	3,450	23.6	<0.020	0.00680	-	<0.10	-	0.0595	3.35	-	91.9	0.530
			HAC-U-2	0.0554	-	3.26	2.54	7,520	7,760	-	6.43	2.88	-	2,590	26.5	<0.020	0.00800	-	<0.10	-	0.0758	11.1	-	88.1	1.34
			HAC-U-3	0.0680	-	3.40	2.56	8,300	8,950	-	6.78	2.49	-	3,140	25.1	<0.020	0.00810	-	<0.10	-	0.0725	6.30	-	104	0.850
			HAC-U-4	0.0644	-	2.80	1.82	8,010	9,020	-	5.36	2.73	-	3,170	28.3	<0.020	0.00710	-	<0.10	-	0.0610	3.80	-	92.9	0.540
			HAC-U-5	0.0686	-	2.77	1.74	7,820	8,440	-	4.94	2.96	-	3,380	27.5	<0.020	0.00650	-	0.140	-	0.0610	3.68	-	99.7	0.570
			HAC-U-6	0.0580	-	2.62	2.37	6,360	7,100	-	4.61	2.21	-	2,790	23.1	<0.020	0.00600	-	<0.10	-	0.0579	4.91	-	88.5	1.32
			HAC-U-7	0.0711	-	2.48	2.12	7,800	10,300	-	5.14	3.04	-	3,840	39.3	<0.020	0.00770	-	<0.10	-	0.0831	5.37	-	96.1	0.860
			HAC-U-8	0.0493	-	2.91	1.87	5,880	7,280	-	3.08	2.10	-	2,850	31.2	<0.020	0.00570	-	<0.10	-	0.0785	4.77	-	79.2	0.800
	EDC-D	Reference	EDC-D-1	0.0887	-	1.41	4.63	6,500	8,150	-	3.58	1.48	-	2,230	15.4	<0.020	0.0119	-	<0.10	-	0.0938	2.96	-	141	0.800
			EDC-D-2	0.0790	-	1.60	6.15	8,080	14,400	-	7.10	3.14	-	3,660	22.0	<0.020	0.0222	-	<0.10	-	0.230	4.84	-	142	1.36
			EDC-D-3	0.0846	-	2.15	8.50	6,550	14,400	-	7.50	2.92	-	3,090	27.3	<0.020	0.0283	-	<0.10	-	0.272	7.74	-	103	2.52
			EDC-D-4	0.0690	-	2.00	7.03	8,030	12,800	-	7.82	3.59	-	3,360	14.7	<0.020	0.0170	-	<0.10	-	0.130	2.74	-	125	0.960
			EDC-D-5	0.0993	-	1.94	4.81	8,800	10,700	-	5.02	2.28	-	3,120	22.7	<0.020	0.0166	-	<0.10	-	0.115	4.12	-	164	0.820
			EDC-D-6	0.0475	-	0.500	2.31	7,600	5,910	-	2.69	1.61	-	3,500	19.9	<0.020	0.0110	-	<0.10	-	0.0387	0.820	-	162	<0.20
			EDC-D-7	0.120	-	1.54	5.89	7,730	12,100	-	6.46	2.80	-	4,290	23.9	<0.020	0.0224	-	0.440	-	0.187	5.48	-	182	1.33
			EDC-D-8	0.0808	-	1.01	7.20	4,650	6,710	-	6.71	2.12	-	2,390	31.0	<0.020	0.0323	-	0.110	-	0.326	12.5	-	90.1	2.25
	HAC-D	Exposed	HAC-D-1	0.0644	-	3.28	1.73	7,140	7,840	-	2.46	3.53	-	3,050	9.24	<0.020	0.0150	-	<0.10	-	0.0399	3.67	-	124	0.430
			HAC-D-2	0.0682	-	3.23	0.980	7,220	6,850	-	2.52	3.76	-	2,330	9.02	<0.020	0.00770	-	<0.10	-	0.0436	2.90	-	131	0.370
			HAC-D-3	0.0666	-	3.92	6.56	8,900	8,770	-	2.36	4.30	-	6,370	7.83	<0.020	0.00900	-	<0.10	-	0.0374	2.72	-	199	0.250
			HAC-D-4	0.0449	-	5.12	2.56	6,450	6,450	-	2.01	2.79	-	2,570	9.69	<0.020	0.00860	-	<0.10	-	0.0329	3.74	-	113	0.350
			HAC-D-5	0.0844	-	2.22	9.66	7,900	7,220	-	1.82	3.36	-	8,090	15.1	<0.020	0.0163	-	<0.10	-	0.0815	6.22	-	133	0.470
			HAC-D-6	0.0514	-	4.95	7.28	6,380	6,290	-	1.54	3.49	-	2,320	9.07	<0.020	0.00690	-	<0.10	-	0.0328	4.60	-	86.2	0.400
			HAC-D-7	0.0426	-	3.79	1.03	6,600	6,520	-	1.36	4.11	-	3,570	5.99	<0.020	0.00720	-	<0.10	-	0.0199	1.46	-	95.7	0.210
			HAC-D-8	0.0700	-	1.70	28.5	8,370	7,770	-	1.80	2.79	-	9,370	18.9	<0.020	0.0146	-	0.110	-	0.0610	7.20	-	142	0.630

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2019	EDC-U	Reference	EDC-U-1	0.0750	-	0.846	5.68	6,490	6,580	-	7.17	0.730	0.185	4,620	26.2	<0.020	0.0322	-	0.490	138	0.245	17.2	-	124	3.17
			EDC-U-2	0.0930	-	0.519	2.55	7,740	7,850	-	3.19	1.29	0.164	7,440	11.5	<0.020	0.0229	-	0.150	70.6	0.120	6.33	-	199	1.37
			EDC-U-3	0.0590	-	0.874	6.39	6,440	6,830	-	7.11	0.560	0.192	4,470	25.0	<0.020	0.0195	-	0.340	71.5	0.150	7.48	-	157	2.38
			EDC-U-4	0.109	-	0.677	6.49	6,560	6,330	-	6.46	1.03	0.156	5,400	20.0	<0.020	0.0326	-	0.420	102	0.248	11.5	-	108	1.96
			EDC-U-5	0.0960	-	0.798	2.12	8,710	8,490	-	3.64	0.580	0.168	9,500	7.49	<0.020	0.0344	-	0.880	68.1	0.0781	11.1	-	149	2.12
			EDC-U-6	0.134	-	1.47	4.46	10,100	10,000	-	5.45	1.22	0.291	15,700	12.5	<0.020	0.0383	-	0.770	40.4	0.187	6.43	-	192	2.88
			EDC-U-7	0.145	-	1.39	5.28	9,080	9,720	-	6.26	1.33	0.252	11,700	21.0	<0.020	0.0376	-	1.07	84.0	0.294	9.57	-	185	3.23
			EDC-U-8	0.104	-	1.40	5.92	8,020	8,600	-	10.7	1.59	0.163	5,050	25.6	<0.020	0.0426	-	1.23	84.6	0.382	9.18	-	155	2.80
	HAC-R1	Exposed	HAC-R1-1	0.0900	-	2.96	3.59	6,610	7,310	-	3.60	3.18	0.0407	3,850	111	<0.020	0.00890	-	0.220	446	0.180	28.7	-	94.8	3.28
			HAC-R1-2	0.0950	-	2.59	1.91	6,290	7,300	-	3.27	3.63	0.0188	3,760	25.8	<0.020	0.00400	-	0.160	62.3	0.0991	6.03	-	89.9	0.830
			HAC-R1-3	0.110	-	3.11	3.21	7,700	9,050	-	5.10	4.13	0.0330	5,080	38.7	<0.020	0.00850	-	0.420	247	0.149	13.4	-	105	1.34
			HAC-R1-4	0.116	-	3.27	3.83	6,430	7,440	-	3.06	3.64	0.0370	3,780	21.3	<0.020	0.00570	-	0.150	93.8	0.0925	9.06	-	88.1	1.06
			HAC-R1-5	0.0980	-	1.47	3.88	5,710	6,300	-	4.83	4.09	0.0258	4,220	18.5	<0.020	0.00560	-	0.160	124	0.0872	8.44	-	84.7	1.11
			HAC-R1-6	0.117	-	4.15	3.14	7,260	8,480	-	5.83	3.40	0.0334	4,520	34.5	<0.020	0.0111	-	0.280	119	0.0950	9.25	-	99.3	1.10
			HAC-R1-7	0.0980	-	3.89	4.24	6,120	7,200	-	4.23	3.23	0.0420	3,340	50.4	<0.020	0.0121	-	0.180	177	0.136	14.5	-	84.4	1.32
			HAC-R1-8	0.114	-	4.39	3.78	6,340	7,630	-	2.87	2.92	0.0426	3,370	36.4	<0.020	0.00840	-	0.290	258	0.129	20.2	-	85.2	1.68
	HAC-U		HAC-U-1	0.137	-	3.67	3.35	6,640	7,170	-	4.30	3.61	0.0429	3,460	39.0	<0.020	0.0106	-	0.130	113	0.156	9.51	-	102	1.03
			HAC-U-2	0.108	-	3.37	4.04	5,620	6,250	-	3.07	2.51	0.0676	2,860	92.8	<0.020	0.0116	-	0.300	292	0.178	32.8	-	76.6	2.34
			HAC-U-3	0.105	-	4.34	2.98	7,480	8,580	-	3.48	3.30	0.0403	4,260	41.2	<0.020	0.00990	-	0.170	111	0.116	8.96	-	102	1.24
			HAC-U-4	0.0950	-	3.66	4.87	6,540	7,500	-	4.46	3.42	0.0543	3,830	54.0	<0.020	0.0141	-	0.230	310	0.163	16.0	-	89.3	2.84
			HAC-U-5	0.117	-	5.13	3.07	7,660	9,120	-	2.74	3.10	0.0325	3,800	36.3	<0.020	0.0118	-	0.510	84.5	0.112	7.58	-	120	1.02
			HAC-U-6	0.0890	-	3.37	2.86	5,970	7,020	-	4.43	2.30	0.0580	3,540	457	0.0240	0.00730	-	0.360	144	0.141	18.1	-	78.2	0.870
			HAC-U-7	0.0870	-	3.42	3.49	6,830	6,860	-	3.80	3.13	0.0323	3,950	94.2	<0.020	0.0131	-	0.230	90.5	0.117	9.50	-	82.9	0.690
			HAC-U-8	0.0920	-	4.05	3.86	6,490	7,560	-	3.18	2.80	0.0281	3,440	41.0	<0.020	0.00740	-	0.310	79.0	0.0973	7.19	-	89.3	1.21
	EDC-D	Reference	EDC-D-1	0.111	-	0.530	3.09	8,910	8,200	-	4.19	2.44	0.155	3,910	13.4	<0.020	0.0178	-	0.140	34.1	0.0711	2.79	-	155	1.35
			EDC-D-2	0.0370	-	0.879	3.68	9,400	7,040	-	3.87	1.04	0.0987	4,040	30.4	<0.020	0.0125	-	0.130	35.5	0.0620	3.34	-	169	1.25
			EDC-D-3	0.0810	-	0.439	1.89	9,880	7,350	-	2.52	1.30	0.130	3,670	18.0	<0.020	0.00770	-	0.270	13.0	0.0308	1.08	-	140	0.660
			EDC-D-4	0.0730	-	0.409	3.90	7,080	7,260	-	4.14	2.23	0.121	4,680	30.2	<0.020	0.0184	-	0.190	36.5	0.0815	4.02	-	154	1.42
			EDC-D-5	0.0830	-	0.511	2.06	10,300	9,100	-	4.68	1.71	0.147	4,070	15.9	<0.020	0.00960	-	0.610	16.8	0.0534	1.99	-	181	1.14
			EDC-D-6	0.0210	-	0.342	3.80	11,300	6,770	-	2.82	0.680	0.0866	5,150	38.2	<0.020	0.00880	-	0.510	12.5	0.0590	1.24	-	189	0.950
			EDC-D-7	0.135	-	0.588	3.68	9,860	9,310	-	5.92	3.34	0.118	4,080	16.3	<0.020	0.0219	-	0.510	64.4	0.0921	5.67	-	190	2.04
			EDC-D-8	0.0370	-	0.350	5.34	8,350	6,570	-	3.25	0.720	0.115	5,510	39.9	<0.020	0.0137	-	0.590	32.0	0.0776	5.19	-	185	1.19
	HAC-D	Exposed	HAC-D-1	0.0470	-	6.52	3.36	7,610	7,020	-	2.23	2.85	0.0238	2,730	19.0	<0.020	0.0159	-	0.330	64.0	0.0993	6.59	-	101	0.510
			HAC-D-2	0.0740	-	3.18	8.52	6,510	7,130	-	4.09	2.39	0.0759	4,450	47.5	<0.020	0.0799	-	0.450	138	0.303	22.0	-	182	3.29
			HAC-D-3	0.0420	-	3.83	0.870	6,590	6,170	-	1.30	2.36	0.00750	2,160	6.79	<0.020	0.00560	-	0.180	21.3	0.0168	1.77	-	85.2	0.390
			HAC-D-4	0.0660	-	3.54	4.59	6,870	6,870	-	3.01	2.35	0.0647	5,030	29.7	<0.020	0.0303	-	0.200	113	0.127	12.5	-	116	1.94
			HAC-D-5	0.0520	-	3.67	1.29	6,660	6,130	-	1.53	2.66	0.0145	2,390	8.00	<0.020	0.00650	-	0.710	35.9	0.0279	3.15	-	83.9	0.540
			HAC-D-6	0.0680	-	4.19	2.06	5,970	5,470	-	1.76	2.93	0.125	2,320	15.3	<0.020	0.0115	-	0.230	60.2	0.0664	4.62	-	84.8	1.22
			HAC-D-7	0.119	-	0.835	3.86	8,840	10,100	-	2.72	2.32	0.193	5,190	19.3	<0.020	0.0219	-	1.19	114	0.108	8.81	-	145	3.51
			HAC-D-8	0.0810	-	4.51	2.24	6,580	6,500	-	1.78	2.95	0.0519	3,240	10.3	<0.020	0.0118	-	0.140	60.8	0.0475	5.12	-	97.3	1.03

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2020	EDC-U	Reference	EDC-U-1	0.0446	-	1.10	4.68	10,700	17,400	-	8.70	0.740	0.108	6,960	21.5	<0.020	0.0183	-	<0.10	26.8	0.138	3.85	-	366	0.810
			EDC-U-2	0.0985	-	0.958	9.06	9,550	14,100	-	8.16	1.07	0.134	6,460	25.4	<0.020	0.0353	-	<0.10	99.1	0.269	9.73	-	364	1.96
			EDC-U-3	0.185	-	0.960	6.06	9,880	14,500	-	9.99	2.14	0.198	4,540	24.6	<0.020	0.0414	-	0.120	65.0	0.365	7.44	-	366	1.21
			EDC-U-4	0.0391	-	0.852	10.2	11,000	17,800	-	9.79	0.530	0.0736	6,070	23.6	<0.020	0.0241	-	0.100	52.7	0.237	6.80	-	413	1.52
			EDC-U-5	0.0913	-	1.26	4.12	9,770	11,300	-	7.98	1.17	0.272	9,730	13.9	<0.020	0.0277	-	<0.10	49.1	0.159	6.94	-	220	1.27
			EDC-U-6	0.0658	-	0.869	3.32	7,500	10,100	-	5.11	0.590	0.148	7,430	11.7	<0.020	0.0185	-	<0.10	24.1	0.125	3.33	-	202	0.590
			EDC-U-7	0.0315	-	0.878	4.84	9,090	16,800	-	9.98	0.440	0.0636	3,960	21.4	<0.020	0.0164	-	<0.10	25.9	0.142	4.05	-	228	0.690
			EDC-U-8	0.0490	-	1.08	3.82	10,300	16,200	-	12.3	0.970	0.164	7,000	21.7	<0.020	0.0238	-	0.190	25.4	0.182	3.72	-	377	1.26
	HAC-R1	Exposed	HAC-R1-1	0.150	-	5.61	2.56	8,670	9,710	-	3.19	5.06	0.0280	5,070	38.8	<0.020	0.00620	-	<0.10	77.6	0.128	7.13	-	130	0.430
			HAC-R1-2	0.111	-	5.18	2.08	9,060	9,220	-	3.06	5.18	0.0225	4,500	17.5	<0.020	0.00400	-	0.270	54.2	0.0863	5.13	-	116	0.590
			HAC-R1-3	0.204	-	5.52	6.28	11,000	17,500	-	4.39	6.51	0.0981	8,490	57.7	<0.020	0.0123	-	0.210	223	0.353	18.4	-	136	2.27
			HAC-R1-4	0.236	-	6.50	8.25	20,500	32,600	-	5.33	8.92	0.220	17,000	76.6	0.0310	0.0180	-	0.330	287	0.267	25.4	-	173	2.89
			HAC-R1-5	0.166	-	4.66	4.36	7,840	9,820	-	2.71	4.57	0.117	4,740	55.0	<0.020	0.00890	-	0.120	155	0.210	14.8	-	104	1.44
			HAC-R1-6	0.0853	-	9.91	0.860	7,080	6,770	-	1.49	6.09	0.0108	2,420	8.52	<0.020	0.00240	-	<0.10	25.0	0.0204	2.03	-	82.9	0.230
			HAC-R1-7	0.0858	-	6.76	0.580	6,970	6,760	-	1.37	4.27	0.00560	2,310	4.94	<0.020	0.00200	-	<0.10	17.0	0.0154	1.97	-	90.3	<0.20
			HAC-R1-8	0.109	-	8.36	2.10	7,030	8,570	-	2.42	4.94	0.0299	3,650	17.6	<0.020	0.00480	-	0.120	70.9	0.0617	5.28	-	94.1	0.750
	HAC-U		HAC-U-1	0.0843	-	13.9	1.46	7,760	8,650	-	2.23	6.95	0.0172	3,200	14.9	<0.020	0.00370	-	<0.10	40.4	0.0455	3.48	-	132	0.470
			HAC-U-2	0.0849	-	6.88	1.84	7,960	7,230	-	2.88	6.47	0.0287	2,610	16.4	<0.020	0.00740	-	<0.10	46.6	0.0546	4.67	-	112	0.560
			HAC-U-3	0.0892	-	4.57	2.02	9,210	9,350	-	2.44	5.52	0.0163	4,000	13.3	<0.020	0.00560	-	0.120	41.0	0.0526	4.04	-	115	0.620
			HAC-U-4	0.0651	-	10.8	0.640	7,740	8,480	-	1.78	5.98	0.00610	3,500	9.81	<0.020	<0.0020	-	0.120	24.7	0.0202	1.95	-	79.1	0.250
			HAC-U-5	0.0794	-	7.34	0.650	8,260	9,460	-	1.52	5.10	0.00680	4,100	8.36	<0.020	0.00260	-	<0.10	21.1	0.0215	1.46	-	85.8	0.260
			HAC-U-6	0.0941	-	5.55	0.280	6,950	7,390	-	2.09	4.44	<0.0050	4,500	3.55	<0.020	<0.0020	-	<0.10	5.42	0.00590	0.540	-	84.0	<0.20
			HAC-U-7	0.0904	-	8.11	1.04	8,230	8,440	-	1.91	6.40	0.0100	3,550	8.65	<0.020	0.00260	-	<0.10	24.4	0.0279	2.12	-	127	0.260
			HAC-U-8	0.126	-	6.16	1.72	7,710	7,600	-	1.97	6.48	0.0187	3,340	16.1	<0.020	0.00520	-	0.110	44.2	0.0581	3.99	-	125	0.550
	EDC-D	Reference	EDC-D-1	0.113	-	1.06	4.79	8,830	8,320	-	4.39	1.38	0.218	3,060	17.5	<0.020	0.0176	-	<0.10	64.3	0.104	5.36	-	236	1.48
			EDC-D-2	0.112	-	0.738	3.30	9,860	9,100	-	5.09	1.61	0.242	4,260	15.1	<0.020	0.0179	-	0.100	21.4	0.0559	2.02	-	213	1.07
			EDC-D-3	0.0681	-	0.555	3.16	10,200	9,910	-	5.09	1.47	0.200	5,180	17.6	<0.020	0.0130	-	<0.10	21.4	0.0472	1.63	-	183	0.480
			EDC-D-4	0.0760	-	2.24	7.00	8,740	12,000	-	8.92	1.86	0.158	4,490	22.2	<0.020	0.0286	-	0.150	84.4	0.154	7.84	-	179	1.95
			EDC-D-5	0.134	-	1.55	1.66	5,530	5,610	-	3.24	1.32	0.0862	2,230	10.4	<0.020	0.0106	-	0.150	13.6	0.0450	1.42	-	97.5	0.380
			EDC-D-6	0.0243	-	0.694	8.37	8,600	7,590	-	3.01	0.618	0.113	4,130	34.5	<0.020	0.0164	-	<0.10	46.2	0.0787	4.57	-	155	0.760
			EDC-D-7	0.117	-	0.579	3.67	8,140	8,170	-	4.32	1.70	0.224	4,630	18.3	<0.020	0.0162	-	0.100	39.2	0.0793	4.86	-	202	0.890
			EDC-D-8	0.110	-	2.21	2.77	6,900	5,850	-	2.80	1.37	0.134	3,830	13.7	<0.020	0.0154	-	<0.10	28.3	0.0569	5.63	-	136	0.760
	HAC-D	Exposed	HAC-D-1	0.0728	-	3.58	2.45	7,590	8,880	-	2.71	3.58	0.0311	3,280	12.0	<0.020	0.00800	-	<0.10	17.4	0.0531	2.08	-	326	0.450
			HAC-D-2	0.0490	-	3.19	2.39	8,610	7,500	-	2.09	3.98	0.0167	3,730	12.8	<0.020	0.0117	-	0.100	51.4	0.0826	5.58	-	168	0.680
			HAC-D-3	0.0868	-	2.33	4.13	9,740	8,320	-	2.75	4.22	0.0694	3,540	16.9	<0.020	0.0171	-	0.160	63.8	0.123	7.96	-	450	0.880
			HAC-D-4	0.0339	-	3.14	1.51	7,500	8,980	-	1.86	2.88	0.0111	4,350	9.01	<0.020	0.0108	-	<0.10	29.8	0.0332	3.18	-	125	0.590
			HAC-D-5	0.0496	-	3.27	9.91	6,570	7,000	-	2.51	3.04	0.0441	3,050	12.4	<0.020	0.0142	-	<0.10	112	0.157	16.4	-	199	1.73
			HAC-D-6	0.0771	-	3.61	6.94	8,790	9,910	-	4.30	3.10	0.0598	4,640	24.1	<0.020	0.0322	-	0.300	170	0.290	21.3	-	261	2.04
			HAC-D-7	0.0864	-	4.07	2.60	9,170	9,260	-	2.67	3.91	0.0327	4,010	18.6	<0.020	0.00850	-	<0.10	52.4	0.0844	7.58	-	349	0.750
			HAC-D-8	0.134	-	3.42	1.69	6,690	7,770	-	2.47	2.60	0.0196	3,370	9.79	<0.020	0.00930	-	<0.10	18.6	0.0377	1.57	-	329	0.330

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2021	EDC-U	Reference	EDC-U-1	0.0333	-	0.817	4.22	9,000	9,190	-	6.49	0.520	0.0730	4,710	13.0	<0.020	0.0190	-	<0.10	37.4	0.143	3.88	-	161	0.700
			EDC-U-2	0.0674	-	1.24	8.07	10,200	14,000	-	8.58	0.740	0.105	6,310	20.4	<0.020	0.0341	-	<0.10	82.6	0.288	8.28	-	253	1.67
			EDC-U-3	0.0776	-	1.48	6.93	11,000	14,400	-	12.9	0.900	0.116	5,990	20.7	<0.020	0.0373	-	<0.10	69.8	0.284	7.81	-	174	1.67
			EDC-U-4	0.0758	-	1.66	9.60	9,480	13,800	-	11.2	1.12	0.118	5,320	20.7	<0.020	0.0571	-	<0.10	95.6	0.593	11.4	-	181	2.58
			EDC-U-5	0.0668	-	2.09	13.3	8,920	16,300	-	12.1	0.720	0.131	5,280	25.5	<0.020	0.0509	-	<0.10	106	0.420	13.1	-	190	2.36
			EDC-U-6	0.0686	-	2.72	9.15	10,100	12,500	-	8.38	0.810	0.122	8,160	21.7	<0.020	0.0547	-	<0.10	80.9	0.415	10.9	-	165	2.24
			EDC-U-7	0.0575	-	1.70	8.61	11,200	13,400	-	13.5	0.900	0.212	5,890	24.8	<0.020	0.0414	-	<0.10	66.5	0.329	8.26	-	243	1.47
			EDC-U-8	0.0707	-	1.72	7.29	11,900	11,200	-	17.1	0.970	0.102	6,350	24.8	<0.020	0.0433	-	<0.10	101	0.315	10.6	-	169	1.57
	HAC-R1	Exposed	HAC-R1-1	0.0732	-	6.16	4.37	12,500	13,000	-	3.80	6.70	0.0421	6,880	35.2	<0.020	0.0103	-	<0.10	97.0	0.179	10.7	-	145	1.20
			HAC-R1-2	0.0956	-	6.18	5.91	11,700	12,100	-	3.92	6.45	0.0593	6,590	43.3	<0.020	0.0133	-	0.100	148	0.235	16.2	-	148	1.83
			HAC-R1-3	0.0726	-	4.71	5.41	12,200	14,700	-	4.52	6.34	0.0582	7,360	40.7	<0.020	0.0120	-	<0.10	133	0.202	13.6	-	134	1.53
			HAC-R1-4	0.105	-	5.26	9.41	10,900	12,100	-	3.94	8.14	0.0740	6,710	45.1	<0.020	0.0138	-	0.120	197	0.235	19.6	-	137	2.16
			HAC-R1-5	0.159	-	5.49	8.09	11,200	13,500	-	4.15	7.34	0.0877	7,260	65.0	<0.020	0.0132	-	0.120	178	0.224	21.0	-	136	1.96
			HAC-R1-6	0.0985	-	5.72	6.51	11,000	12,500	-	3.48	6.83	0.0698	6,720	46.4	<0.020	0.0140	-	<0.10	146	0.213	15.2	-	138	1.85
			HAC-R1-7	0.0814	-	7.19	8.30	12,400	13,400	-	5.07	7.05	0.0718	6,850	55.6	<0.020	0.0184	-	0.160	175	0.277	18.1	-	162	2.24
			HAC-R1-8	0.0929	-	7.02	6.03	12,200	13,000	-	5.56	6.79	0.0552	6,370	34.7	<0.020	0.0135	-	<0.10	115	0.194	11.5	-	160	1.44
	HAC-U		HAC-U-1	0.115	-	6.56	6.59	9,380	9,470	-	3.31	6.08	0.0542	5,150	38.5	<0.020	0.00940	-	<0.10	333	0.187	24.1	-	126	3.30
			HAC-U-2	0.133	-	5.12	5.97	8,670	8,700	-	3.38	5.73	0.0435	4,200	108	<0.020	0.00930	-	<0.10	133	0.128	15.9	-	99.0	1.39
			HAC-U-3	0.103	-	6.01	5.99	9,140	8,670	-	3.38	5.28	0.0428	4,890	66.5	<0.020	0.0111	-	<0.10	193	0.149	21.8	-	126	2.17
			HAC-U-4	0.0948	-	6.08	4.41	7,990	7,830	-	2.83	5.14	0.0586	3,730	38.5	<0.020	0.0111	-	0.150	213	0.195	24.6	-	113	1.85
			HAC-U-5	0.0872	-	4.00	2.03	8,820	8,200	-	2.45	4.77	0.0223	3,660	22.1	<0.020	0.00580	-	<0.10	42.3	0.0902	4.18	-	104	0.460
			HAC-U-6	0.0725	-	4.51	6.09	8,360	7,100	-	2.68	4.41	0.0272	3,680	48.5	<0.020	0.00850	-	<0.10	115	0.180	10.5	-	107	1.01
			HAC-U-7	0.0763	-	4.22	2.51	9,300	8,770	-	3.23	4.94	0.0206	3,870	19.5	<0.020	0.00760	-	<0.10	57.8	0.0919	6.01	-	124	0.620
			HAC-U-8	0.0643	-	4.77	6.56	8,180	8,190	-	4.60	5.27	0.0328	3,120	48.9	<0.020	0.00900	-	<0.10	134	0.243	14.0	-	120	1.34
	EDC-D	Reference	EDC-D-1	0.116	-	0.841	4.23	9,140	8,570	-	3.89	2.21	0.161	3,360	13.1	<0.020	0.0123	-	<0.10	45.9	0.0554	3.22	-	174	0.570
			EDC-D-2	0.108	-	0.335	2.02	8,810	7,480	-	3.04	1.39	0.175	3,980	9.42	<0.020	0.00630	-	<0.10	13.6	0.0190	1.23	-	168	0.200
			EDC-D-3	0.0712	-	1.49	7.25	10,500	13,500	-	7.82	3.21	0.111	4,150	21.6	<0.020	0.0250	-	<0.10	56.2	0.174	6.14	-	193	1.40
			EDC-D-4	0.0578	-	1.12	4.52	9,220	10,300	-	4.56	1.95	0.140	3,560	16.3	<0.020	0.0156	-	<0.10	37.3	0.0884	4.06	-	177	0.790
			EDC-D-5	0.0736	-	0.593	3.22	11,300	9,690	-	4.74	2.34	0.164	5,950	15.1	<0.020	0.0135	-	<0.10	21.8	0.0576	2.24	-	183	0.350
			EDC-D-6	0.0494	-	0.750	3.82	10,600	9,620	-	5.48	2.42	0.141	4,550	19.8	<0.020	0.0142	-	<0.10	29.9	0.0646	3.46	-	192	0.560
			EDC-D-7	0.112	-	0.770	7.09	8,070	7,740	-	5.96	3.47	0.148	3,810	22.2	<0.020	0.0676	-	<0.10	87.7	0.149	8.49	-	132	1.36
			EDC-D-8	0.0452	-	0.528	5.96	9,730	7,830	-	4.46	1.62	0.142	3,660	26.6	<0.020	0.0127	-	<0.10	33.6	0.0610	3.60	-	175	0.390
	HAC-D	Exposed	HAC-D-1	0.0475	-	1.50	3.28	7,750	7,250	-	2.04	4.31	0.0397	1,640	19.9	<0.020	0.0148	-	<0.10	46.8	0.123	5.79	-	208	0.690
			HAC-D-2	0.0302	-	1.42	3.12	8,870	8,540	-	3.32	4.89	0.0382	2,550	25.3	<0.020	0.0156	-	<0.10	82.2	0.124	8.03	-	190	0.830
			HAC-D-3	0.0710	-	1.34	5.04	13,300	13,600	-	3.91	4.34	<0.0800	5,560	57.3	<0.020	0.0248	-	<0.10	155	0.127	14.2	-	151	2.18
			HAC-D-4	0.0520	-	1.04	4.67	11,300	11,300	-	3.62	3.89	<0.0600	4,530	43.7	<0.020	0.0193	-	<0.10	157	0.0985	12.9	-	126	1.83
			HAC-D-5	0.0690	-	1.69	5.53	11,800	12,600	-	4.84	4.72	<0.125	4,550	58.2	<0.020	0.0204	-	0.320	322	0.140	27.9	-	144	3.14
			HAC-D-6	0.0510	-	1.61	3.29	9,470	9,130	-	4.02	4.11	<0.140	3,390	31.7	<0.020	0.0126	-	0.120	168	0.0883	12.7	-	148	1.52
			HAC-D-7	0.0470	-	3.34	4.47	6,870	6,040	-	4.68	6.04	<0.0450	2,890	26.0	<0.020	0.0103	-	0.120	185	0.0756	15.5	-	110	1.43
			HAC-D-8	0.0830	-	3.77	5.06	6,830	5,600	-	3.33	4.04	<0.0650	3,000	72.6	<0.020	0.0121	-	0.240	575	0.305	43.5	-	110	3.25

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.1: Composite-Taxa Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2010 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2022	EDC-U	Reference	EDC-U-1	0.0700	-	25.6	1.92	8,400	6,790	-	5.42	1.19	0.158	2,850	7.40	<0.020	0.0104	-	<0.10	30.5	0.0558	2.37	-	190	0.420
			EDC-U-2	0.0559	-	5.22	1.50	8,670	7,270	-	4.68	0.870	0.190	3,300	8.53	<0.020	0.00960	-	<0.10	22.6	0.0612	1.96	-	158	0.380
			EDC-U-3	0.102	-	3.16	2.55	7,840	7,200	-	5.48	0.860	0.254	3,200	10.6	<0.020	0.0118	-	<0.10	34.3	0.101	4.24	-	166	0.550
			EDC-U-4	0.0908	-	2.26	1.52	8,200	6,910	-	4.06	0.900	0.274	2,930	7.78	<0.020	0.00950	-	<0.10	18.8	0.0619	1.85	-	176	0.360
			EDC-U-5	0.0665	-	4.37	1.44	8,140	6,960	-	3.49	0.950	0.123	3,770	8.05	<0.020	0.00820	-	<0.10	19.9	0.0535	1.90	-	153	0.380
			EDC-U-6	0.127	-	0.624	2.94	8,880	8,500	-	5.43	1.02	0.321	3,690	12.0	<0.020	0.0157	-	<0.10	37.6	0.143	3.67	-	240	0.750
			EDC-U-7	0.0784	-	0.874	2.47	7,910	8,940	-	5.36	1.01	0.188	3,670	11.2	<0.020	0.0133	-	<0.10	52.0	0.0897	4.61	-	219	0.660
			EDC-U-8	0.0593	-	4.51	1.15	8,080	6,110	-	3.39	1.02	0.104	2,740	8.72	<0.020	0.00680	-	<0.10	15.2	0.0561	1.71	-	131	0.270
	HAC-R1	Exposed	HAC-R1-1	0.0550	-	3.36	3.10	8,380	9,100	-	1.94	4.21	0.0279	4,200	24.5	<0.020	0.00580	-	<0.10	73.4	0.109	8.14	-	103	0.920
			HAC-R1-2	0.0540	-	4.05	4.39	8,840	9,400	-	2.56	4.66	0.0336	5,420	41.2	<0.020	0.00910	-	<0.10	119	0.188	13.0	-	116	1.37
			HAC-R1-3	0.0368	-	4.86	3.58	7,200	7,350	-	2.23	7.30	0.0252	3,010	18.9	<0.020	0.00540	-	<0.10	71.9	0.102	7.17	-	110	0.760
			HAC-R1-4	0.0703	-	4.09	3.42	7,750	9,400	-	2.45	5.14	0.0392	5,150	20.6	<0.020	0.0109	-	<0.10	116	0.154	10.3	-	119	1.13
			HAC-R1-5	0.0618	-	3.49	2.67	7,070	7,400	-	2.36	4.25	0.0284	3,120	39.0	<0.020	0.00580	-	0.110	118	0.171	10.2	-	111	1.70
			HAC-R1-6	0.0701	-	3.31	5.73	7,610	9,000	-	3.14	4.12	0.0443	4,130	36.6	<0.020	0.00880	-	0.120	229	0.193	23.9	-	102	1.91
			HAC-R1-7	0.0761	-	3.60	3.24	7,980	8,380	-	3.09	4.91	0.0356	3,420	39.7	<0.020	0.00700	-	<0.10	102	0.128	9.99	-	119	1.11
			HAC-R1-8	0.0844	-	2.52	2.52	10,600	8,350	-	3.95	5.16	0.0332	3,620	25.8	<0.020	0.00670	-	<0.10	57.4	0.0896	5.75	-	131	0.620
	HAC-U		HAC-U-1	0.0803	-	2.54	3.74	8,890	4,950	-	4.13	5.54	0.159	2,580	90.9	<0.020	0.0148	-	<0.10	108	0.255	13.5	-	79.9	0.240
			HAC-U-2	0.102	-	1.35	2.63	10,600	5,080	-	4.40	5.86	0.379	2,950	104	<0.020	0.0251	-	<0.10	16.5	0.201	2.83	-	88.3	<0.20
			HAC-U-3	0.101	-	1.83	4.53	10,200	4,930	-	4.08	6.68	0.471	2,470	93.7	<0.020	0.0230	-	<0.10	58.0	0.208	7.98	-	96.8	<0.20
			HAC-U-4	0.0854	-	4.03	0.930	8,800	5,710	-	3.58	6.17	0.0361	3,880	49.1	<0.020	0.00560	-	<0.10	17.3	0.0407	2.00	-	103	0.230
			HAC-U-5	0.107	-	1.76	3.31	11,500	6,750	-	4.97	6.06	0.0880	3,770	80.5	<0.020	0.00700	-	<0.10	20.4	0.114	2.50	-	99.8	0.270
			HAC-U-6	0.0897	-	6.58	2.32	6,440	4,990	-	3.14	9.03	0.0674	2,220	27.1	<0.020	0.0106	-	<0.10	44.1	0.0843	4.74	-	101	0.360
			HAC-U-7	0.104	-	2.20	4.14	11,800	7,320	-	4.59	6.78	0.248	3,210	83.7	<0.020	0.0142	-	<0.10	114	0.200	14.7	-	84.8	<0.20
			HAC-U-8	0.0755	-	1.68	0.980	11,100	8,770	-	4.53	8.01	0.0633	4,090	73.6	<0.020	0.00780	-	<0.10	4.43	0.0315	1.33	-	68.7	<0.20
	EDC-D	Reference	EDC-D-3	0.110	-	0.811	4.41	7,770	6,720	-	5.23	1.98	0.173	3,090	14.0	<0.020	0.0260	-	<0.10	50.6	0.0908	4.32	-	172	0.790
			EDC-D-4	0.0730	-	0.583	5.32	9,310	7,080	-	2.74	1.65	0.184	3,470	10.3	<0.020	0.00720	-	<0.10	9.28	0.0264	0.920	-	129	<0.20
			EDC-D-5	0.121	-	0.950	2.13	8,800	8,830	-	3.49	2.03	0.142	3,670	7.69	<0.020	0.0155	-	<0.10	27.7	0.0598	2.61	-	149	0.460
			EDC-D-6	0.121	-	0.791	3.85	8,010	8,910	-	1.90	1.71	0.151	3,930	16.5	<0.020	0.0135	-	<0.10	27.7	0.0846	8.64	-	148	0.760
			EDC-D-7	0.121	-	1.02	2.59	8,880	9,750	-	3.93	2.12	0.153	4,110	9.36	<0.020	0.0166	-	<0.10	36.0	0.0856	3.44	-	129	0.610
			EDC-D-8	0.114	-	0.613	6.67	8,960	8,600	-	2.44	1.52	0.134	4,050	12.0	<0.020	0.00970	-	<0.10	15.2	0.0389	1.47	-	155	0.280
			EDC-D-1	0.120	-	0.670	2.47	7,140	7,040	-	2.88	1.76	0.164	3,190	9.63	<0.020	0.0143	-	<0.10	18.2	0.0448	1.52	-	119	0.640
			EDC-D-2	0.103	-	0.659	3.44	8,510	8,000	-	3.49	1.80	0.122	4,000	8.80	<0.020	0.00960	-	<0.10	11.2	0.0296	1.04	-	291	0.210
	HAC-D	Exposed	HAC-D-1	0.0906	-	1.44	6.27	7,010	6,770	-	4.08	6.69	0.108	2,440	47.8	<0.020	0.0507	-	<0.10	135	0.228	19.2	-	152	1.86
			HAC-D-2	0.0664	-	4.22	0.930	6,460	4,500	-	1.07	5.42	0.00910	2,350	6.12	<0.020	0.00360	-	<0.10	6.62	0.0348	0.770	-	177	<0.20
			HAC-D-3	0.0633	-	1.66	87.8	8,470	6,390	-	2.92	4.87	0.0338	2,930	14.5	<0.020	0.0115	-	<0.10	47.4	0.0808	5.40	-	125	0.510
			HAC-D-4	0.0829	-	1.41	1.75	8,240	7,050	-	2.78	4.85	0.0271	3,220	14.1	<0.020	0.00960	-	<0.10	26.2	0.0621	2.77	-	126	0.460
			HAC-D-5	0.0810	-	1.66	6.03	8,630	7,440	-	3.49	4.43	0.0238	2,940	22.1	<0.020	0.0122	-	<0.10	35.5	0.0838	4.70	-	135	0.400
			HAC-D-6	0.0646	-	2.23	1.51	7,370	6,130	-	2.24	4.72	0.0230	3,600	11.6	<0.020	0.00750	-	<0.10	20.3	0.0438	2.14	-	106	0.250
			HAC-D-7	0.0842	-	1.79	2.23	9,300	8,210	-	3.35	4.23	0.0296	8,240	19.2	<0.020	0.0120	-	<0.10	34.4	0.0721	3.94	-	142	0.420
			HAC-D-8	0.0739	-	2.24	2.92	7,150	6,450	-	2.04	4.30	0.0341	5,490	18.4	<0.020	0.0123	-	<0.10	65.7	0.0894	7.38	-	124	0.680

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no results available. All results are presented as three significant digits.

[a] W7 is the historical sampling area associated with HAC-U; W11 is the historical sampling area associated with HAC-D.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2018	EDC-U	Reference	EDC-U-1	73.0	448	0.0210	1.29	66.7	0.0210	<0.010	4.30	0.442	790	0.0416	2.89	2.39	18.2	-	1,040	0.283	<0.50	984	1,210
			EDC-U-2	85.0	826	0.0310	2.42	143	0.0410	0.0100	9.00	0.797	2,020	0.0697	4.41	5.27	25.1	-	1,850	0.469	0.800	2,020	3,010
			EDC-U-3	80.0	614	0.0280	1.31	71.4	0.0260	<0.010	4.40	0.471	872	0.0508	5.16	2.16	19.6	-	1,510	0.312	0.600	1,550	1,010
			EDC-U-4	79.0	515	0.0230	1.96	89.3	0.0260	<0.010	2.90	0.544	968	0.0406	4.18	4.73	20.4	-	1,520	0.269	0.520	1,310	2,110
			EDC-U-5	76.0	531	0.0180	0.615	31.8	0.0160	<0.010	4.50	0.251	1,160	0.0336	2.74	1.68	20.4	-	903	0.196	0.550	1,700	1,340
			EDC-U-6	86.0	940	0.0340	2.84	133	0.0480	0.0100	4.40	0.747	1,680	0.0808	4.39	5.15	29.5	-	2,190	0.527	0.970	2,350	2,270
			EDC-U-7	77.0	192	0.0190	1.00	57.5	0.0110	<0.010	6.40	0.454	879	0.0173	3.58	2.25	21.8	-	534	0.183	<0.50	1,660	1,790
			EDC-U-8	78.0	136	0.0160	0.867	59.3	<0.010	<0.010	7.00	0.435	894	0.0109	1.28	2.90	20.7	-	553	0.102	<0.50	1,430	2,280
	HAC-R1	Exposed	HAC-R1-1	75.0	2,900	0.353	2.29	97.4	0.0920	<0.020	14.6	0.131	8,630	0.697	6.04	3.61	122	-	4,390	1.20	4.00	2,560	1,170
			HAC-R1-2	78.0	2,150	0.0720	1.76	51.0	0.0790	0.0150	9.20	0.265	5,080	0.296	4.14	2.87	107	-	3,340	1.12	2.34	1,960	1,140
			HAC-R1-3	76.0	1,540	0.0650	2.28	54.6	0.0760	0.0100	11.3	0.266	4,420	0.248	2.65	2.46	95.1	-	2,590	0.885	2.24	1,720	1,230
			HAC-R1-4	79.0	2,020	0.0690	1.87	42.8	0.0720	0.0120	9.70	0.352	4,690	0.264	4.02	2.89	126	-	3,280	1.05	1.98	2,040	1,230
			HAC-R1-5	77.0	1,400	0.0610	1.71	36.0	0.0510	<0.010	8.60	0.262	3,070	0.180	2.51	2.27	102	-	2,230	0.673	1.40	1,550	1,200
			HAC-R1-6	87.0	4,390	0.172	4.92	161	0.170	0.0350	17.4	0.824	8,970	0.604	9.01	7.57	297	-	7,150	2.54	5.20	4,890	3,130
			HAC-R1-7	78.0	2,230	0.0730	2.00	64.2	0.0880	0.0130	9.40	0.355	3,560	0.314	5.42	3.07	130	-	3,290	1.15	2.50	2,010	1,270
			HAC-R1-8	76.0	1,890	0.0740	1.99	65.9	0.0720	0.0120	7.50	0.338	5,050	0.248	5.70	2.82	120	-	3,030	0.998	1.96	1,870	1,260
	HAC-U		HAC-U-1	75.0	690	0.0360	1.84	28.1	0.0240	<0.010	5.10	0.219	5,170	0.0979	2.62	0.951	61.3	-	1,240	0.398	0.600	1,230	1,040
			HAC-U-2	78.0	1,570	0.0560	2.06	43.3	0.0610	0.0100	7.90	0.285	9,790	0.238	3.63	1.69	79.9	-	2,560	0.847	1.77	1,600	1,110
			HAC-U-3	71.0	1,340	0.0500	2.15	35.4	0.0440	<0.010	5.60	0.224	5,860	0.176	3.87	1.53	87.6	-	2,280	0.725	1.27	1,570	980
			HAC-U-4	69.0	509	0.0300	1.65	21.6	0.0190	<0.010	4.40	0.222	3,110	0.0766	1.67	0.741	55.2	-	840	0.306	<0.50	958	772
			HAC-U-5	75.0	608	0.0400	1.58	19.5	0.0190	<0.010	7.10	0.227	3,710	0.0879	4.04	0.809	66.4	-	1,040	0.388	<0.50	980	883
			HAC-U-6	74.0	796	0.0370	1.84	26.4	0.0300	<0.010	5.90	0.283	6,000	0.116	2.30	1.01	71.1	-	1,300	0.456	0.800	1,110	908
			HAC-U-7	76.0	716	0.0340	1.85	31.8	0.0250	<0.010	4.50	0.227	5,160	0.105	1.70	0.957	69.6	-	1,290	0.433	0.670	1,160	789
			HAC-U-8	78.0	1,800	0.0650	2.13	35.2	0.0660	<0.010	5.90	0.189	7,570	0.152	3.21	1.20	86.6	-	1,820	0.680	1.11	1,270	776
	EDC-D	Reference	EDC-D-1	83.0	1,720	0.0500	14.5	138	0.0970	0.0220	11.7	0.375	2,620	0.419	5.86	3.37	23.4	-	3,910	1.50	3.23	1,910	1,270
			EDC-D-2	85.0	1,380	0.0490	18.7	163	0.0780	0.0200	14.4	0.432	2,750	0.312	5.69	3.70	27.7	-	3,530	1.08	2.03	2,140	1,490
			EDC-D-3	77.0	3,720	0.148	19.9	321	0.171	0.0490	21.7	0.927	5,780	0.831	15.0	6.03	45.6	-	7,990	3.29	5.20	4,010	2,670
			EDC-D-4	82.0	1,400	0.0560	11.7	118	0.0850	0.0200	24.9	0.448	4,280	0.302	5.50	3.10	21.7	-	3,310	1.25	2.47	1,850	1,030
			EDC-D-5	78.0	1,270	0.0490	10.2	110	0.0690	0.0160	17.1	0.369	2,290	0.327	7.98	2.94	26.5	-	3,040	1.08	1.98	1,890	940
			EDC-D-6	80.0	1,080	0.0460	8.57	104	0.0560	0.0120	12.6	0.366	2,140	0.220	5.27	2.48	21.2	-	2,770	0.852	1.68	1,890	796
			EDC-D-7	86.0	770	0.0380	12.0	155	0.0410	0.0140	13.5	0.592	1,930	0.159	3.40	3.18	26.6	-	1,900	0.802	1.09	2,170	1,220
			EDC-D-8	80.0	2,840	0.0830	8.37	110	0.127	0.0390	8.50	0.472	3,410	0.643	11.7	3.98	24.6	-	5,710	2.56	3.90	2,500	559
	HAC-D	Exposed	HAC-D-1	78.0	234	0.0380	1.30	6.63	<0.010	<0.010	<1.0	0.0250	832	0.0736	0.670	0.430	30.8	-	470	0.306	<0.50	1,460	113
			HAC-D-2	79.0	304	0.0420	1.28	8.23	<0.010	<0.010	<1.0	0.0590	1,360	0.0465	0.790	0.643	30.4	-	665	0.325	<0.50	1,500	157
			HAC-D-3	77.0	215	0.0370	1.30	9.99	<0.010	<0.010	<1.0	0.163	966	0.0396	0.600	0.651	37.2	-	592	0.342	<0.50	1,380	185
			HAC-D-4	75.0	341	0.0390	1.88	25.7	0.0130	<0.010	1.70	0.275	1,050	0.0659	0.810	0.862	41.4	-	829	0.470	<0.50	1,280	419
			HAC-D-5	72.0	128	0.0270	1.18	7.47	<0.010	<0.010	<1.0	0.218	851	0.0326	0.530	0.349	29.0	-	270	0.254	<0.50	1,200	124
			HAC-D-6	73.0	101	0.0300	0.932	4.68	<0.010	<0.010	<1.0	<0.010	667	0.0253	0.660	0.258	24.6	-	239	0.199	<0.50	1,030	101
			HAC-D-7	75.0	207	0.0280	1.16	4.46	<0.010	<0.010	<1.0	0.0370	782	0.0350	1.84	0.417	28.8	-	387	0.178	<0.50	1,270	126
			HAC-D-8	74.0	164	0.0260	1.02	4.65	<0.010	<0.010	<1.0	<0.010	802	0.0344	0.620	0.307	24.2	-	352	0.155	<0.50	1,080	127

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Moisture	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Gallium	Iron	Lead	Lithium	Magnesium	Manganese
				%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2019	EDC-U	Reference	EDC-U-1	82.2	514	0.0250	2.06	109	0.0200	<0.010	2.40	0.685	1,490	0.0314	2.55	4.63	30.7	-	1,260	0.254	<0.50	1,970	1,450
			EDC-U-2	78.2	177	0.0350	1.07	43.2	<0.010	<0.010	1.50	0.258	731	0.0104	0.900	1.74	21.3	-	454	0.0990	<0.50	1,740	793
			EDC-U-3	78.5	220	<0.020	0.573	8.62	<0.010	<0.010	<1.0	0.0430	1,620	0.0158	0.640	0.375	18.4	-	496	0.0830	<0.50	1,390	155
			EDC-U-4	80.4	475	<0.020	0.898	30.8	0.0170	<0.010	1.60	0.177	1,850	0.0228	1.67	1.43	21.1	-	912	0.173	<0.50	1,540	683
			EDC-U-5	76.9	1,930	0.0290	1.97	15.2	0.0340	<0.010	<1.0	0.0660	3,950	0.0516	5.16	1.60	17.9	-	4,010	0.512	1.46	2,000	240
			EDC-U-6	76.6	260	<0.020	0.694	18.0	<0.010	<0.010	1.10	0.173	1,550	0.0117	1.26	0.939	16.2	-	608	0.0980	<0.50	1,320	377
			EDC-U-7	75.4	7,610	0.0210	1.43	28.8	0.0660	<0.010	1.10	0.176	3,740	0.149	10.2	5.70	28.9	-	15,300	0.391	5.80	6,370	623
			EDC-U-8	73.7	1,150	0.0250	1.44	11.5	0.0330	0.0130	<1.0	0.0440	2,080	0.0983	2.72	1.09	15.6	-	2,510	0.479	1.46	1,460	159
	HAC-R1	Exposed	HAC-R1-1	85.5	1,640	0.0550	2.01	43.2	0.0470	<0.010	13.9	0.214	9,770	0.159	2.17	3.11	97.2	-	3,250	0.638	2.07	1,930	1,730
			HAC-R1-2	81.8	4,110	0.0760	3.95	84.7	0.111	<0.010	31.7	0.303	24,400	0.237	2.21	4.17	124	-	4,740	0.720	4.16	3,000	1,490
			HAC-R1-3	83.1	2,110	0.0870	2.16	57.6	0.0830	0.0120	16.6	0.441	12,200	0.251	3.64	4.19	137	-	3,930	0.878	1.86	2,120	1,770
			HAC-R1-4	83.8	1,930	0.0660	2.01	47.2	0.0620	<0.010	7.00	0.297	6,900	0.181	2.53	3.02	142	-	3,150	0.720	1.58	1,790	2,120
			HAC-R1-5	83.1	1,620	0.0530	1.96	50.7	0.0510	0.0130	6.70	0.301	6,440	0.149	2.97	2.93	133	-	2,870	0.651	1.49	2,000	1,860
			HAC-R1-6	84.2	2,070	0.0670	2.44	61.4	0.0670	0.0110	5.20	0.439	4,950	0.190	3.07	3.45	203	-	3,440	0.742	1.86	2,080	2,710
			HAC-R1-7	87.3	2,170	0.0590	2.33	60.5	0.0700	0.0130	9.60	0.524	10,700	0.216	3.69	3.81	159	-	3,760	0.843	2.03	2,350	3,330
			HAC-R1-8	83.0	3,000	0.0640	2.59	120	0.0790	0.0110	5.30	0.493	5,590	0.324	3.72	4.04	185	-	3,930	0.933	2.32	2,340	3,470
	HAC-U		HAC-U-1	84.6	3,450	0.0750	3.31	84.5	0.101	0.0140	12.6	0.631	18,500	0.331	5.78	4.22	178	-	5,780	1.19	3.93	3,580	3,480
			HAC-U-2	83.2	1,480	0.0530	2.08	42.9	0.0460	<0.010	5.40	0.409	8,030	0.168	2.91	1.90	108	-	2,450	0.602	1.35	1,720	2,220
			HAC-U-3	82.2	1,730	0.0560	1.90	47.1	0.0540	0.0100	5.00	0.352	8,440	0.196	3.19	1.94	109	-	2,780	0.659	1.65	1,700	2,100
			HAC-U-4	87.6	1,900	0.0510	2.34	39.2	0.0620	<0.010	6.20	0.365	9,580	0.171	2.83	2.12	114	-	2,790	0.616	1.83	1,980	2,150
			HAC-U-5	85.8	1,410	0.0510	2.01	36.6	0.0430	<0.010	6.00	0.341	7,480	0.172	2.81	1.79	105	-	2,330	0.574	1.32	1,620	2,030
			HAC-U-6	82.1	1,850	0.0640	2.20	42.5	0.0670	0.0100	6.30	0.367	14,100	0.205	3.36	2.05	121	-	3,210	0.694	1.68	1,880	2,040
			HAC-U-7	83.5	1,240	0.0610	2.07	59.8	0.0420	<0.010	5.60	0.489	11,200	0.151	2.70	1.74	99.2	-	2,390	0.563	1.20	1,690	2,050
			HAC-U-8	82.7	1,300	0.0560	1.89	54.1	0.0400	<0.010	4.70	0.287	9,220	0.149	2.44	1.56	79.9	-	2,260	0.609	1.23	1,640	1,690
	EDC-D	Reference	EDC-D-1	76.9	501	0.0260	3.41	47.9	0.0220	<0.010	1.50	0.159	1,350	0.0478	2.83	1.58	20.2	-	1,440	0.285	<0.50	1,500	956
			EDC-D-2	76.5	113	0.0270	1.26	4.55	<0.010	<0.010	<1.0	0.0250	2,600	0.0122	0.920	0.160	15.2	-	296	0.0740	<0.50	1,220	42.9
			EDC-D-3	80.1	1,090	0.0430	2.54	19.1	0.0340	0.0130	1.30	0.482	1,780	0.114	3.66	1.18	29.1	-	2,540	0.609	1.09	1,700	286
			EDC-D-4	73.5	484	0.0280	2.96	24.4	0.0190	<0.010	<1.0	0.101	1,330	0.0417	1.90	1.46	19.0	-	1,530	0.364	<0.50	1,370	525
			EDC-D-5	70.9	496	<0.020	1.64	18.1	<0.010	<0.010	<1.0	0.0310	1,040	0.0245	1.44	0.694	12.9	-	1,490	0.149	<0.50	1,300	270
			EDC-D-6	76.8	135	<0.020	1.62	4.49	<0.010	<0.010	<1.0	0.0260	1,360	0.0367	0.730	0.236	18.3	-	344	0.0980	<0.50	1,220	80.3
			EDC-D-7	79.3	783	0.0270	4.06	43.9	0.0350	<0.010	1.50	0.124	1,480	0.0748	3.63	2.05	24.6	-	2,020	0.432	0.740	1,730	644
			EDC-D-8	75.8	73.6	<0.020	1.29	4.12	<0.010	<0.010	<1.0	0.0390	1,670	0.0100	0.460	0.113	15.9	-	207	0.0570	<0.50	1,310	35.9
	HAC-D	Exposed	HAC-D-1	73.5	543	0.0430	1.43	10.7	0.0140	<0.010	<1.0	0.0250	1,180	0.0617	2.17	0.702	36.2	-	1,020	0.323	0.560	1,500	117
			HAC-D-2	74.3	340	0.0390	2.12	39.3	<0.010	<0.010	1.10	0.409	968	0.0404	1.10	1.42	48.8	-	715	0.282	<0.50	1,350	633
			HAC-D-3	74.8	610	0.0470	1.43	20.5	0.0160	<0.010	<1.0	0.242	1,300	0.0697	1.53	0.815	36.7	-	1,190	0.380	0.650	1,340	276
			HAC-D-4	75.1	452	0.0380	1.23	8.49	0.0130	<0.010	<1.0	0.0240	1,010	0.0515	1.15	0.551	34.3	-	802	0.271	<0.50	1,310	115
			HAC-D-5	72.8	634	0.0700	2.06	9.49	0.0410	<0.010	<1.0	0.0480	1,880	0.177	2.84	0.992	37.0	-	2,240	0.544	0.640	1,680	150
			HAC-D-6	72.8	395	0.0510	1.20	7.49	0.0110	<0.010	<1.0	0.0200	888	0.0505	1.14	0.499	32.0	-	767	0.233	<0.50	1,210	124
			HAC-D-7	79.0	813	0.0450	1.43	23.8	0.0210	<0.010	1.50	0.249	2,640	0.0895	1.91	0.950	49.4	-	1,600	0.440	0.830	1,310	211
			HAC-D-8	71.5	313	0.0330	1.35	25.6	<0.010	<0.010	<1.0	0.127	951	0.0371	0.810	0.539	33.9	-	645	0.220	<0.50	1,190	330

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2020	EDC-U	Reference	EDC-U-1	83.4	874	0.0260	1.40	99.7	0.0380	<0.010	10.5	0.924	3,120	0.0530	2.69	4.92	23.5	-	1,680	0.354	<0.50	2,830	3,490
			EDC-U-2	85.4	888	0.0320	3.06	212	0.0420	<0.010	8.20	1.05	2,730	0.0610	3.54	4.99	30.8	-	2,190	0.318	0.590	3,830	3,750
			EDC-U-3	82.0	677	0.0240	0.823	71.5	0.0230	<0.010	11.1	0.718	3,490	0.0448	2.04	3.11	23.0	-	1,370	0.273	<0.50	2,980	2,810
			EDC-U-4	82.8	726	0.0320	1.23	75.3	0.0320	<0.010	6.20	0.622	2,310	0.0432	2.54	3.07	21.7	-	1,610	0.418	<0.50	2,530	2,360
			EDC-U-5	84.3	940	0.0310	1.44	69.3	0.0340	<0.010	7.30	0.759	2,370	0.0576	4.00	3.44	23.8	-	1,960	0.458	0.600	2,240	2,490
			EDC-U-6	84.8	978	0.0300	1.06	78.4	0.0320	<0.010	11.1	0.689	3,350	0.0594	3.32	3.55	23.8	-	1,800	0.334	0.640	2,580	2,650
			EDC-U-7	84.1	617	0.0230	0.709	72.7	0.0250	<0.010	11.8	0.621	3,520	0.0376	1.87	3.07	24.4	-	1,180	0.233	<0.50	3,030	2,800
			EDC-U-8	79.8	497	0.0160	0.599	20.8	0.0130	<0.010	3.10	0.447	1,960	0.0406	1.19	1.14	19.0	-	861	0.191	<0.50	1,860	850
	HAC-R1	Exposed	HAC-R1-1	84.2	901	0.0200	1.14	19.7	0.0270	<0.010	6.40	0.274	4,820	0.0624	1.28	1.31	56.4	-	1,490	0.275	0.670	1,410	789
			HAC-R1-2	83.9	640	0.0260	1.16	21.7	0.0180	<0.010	4.50	0.176	2,740	0.0635	1.22	1.17	58.5	-	1,250	0.268	0.520	1,530	805
			HAC-R1-3	79.4	92.2	0.0250	0.542	4.49	<0.010	<0.010	<1.0	<0.0100	930	0.00790	0.165	0.197	21.7	-	182	0.0540	<0.50	1,520	116
			HAC-R1-4	80.6	2,150	0.0340	1.64	29.8	0.106	<0.010	3.00	0.124	4,090	0.0590	1.39	1.49	57.8	-	1,910	0.324	0.920	2,010	920
			HAC-R1-5	77.8	1,740	0.0190	1.36	30.7	0.0430	<0.010	2.40	0.191	2,330	0.135	0.710	1.20	56.3	-	1,270	0.370	0.990	1,530	631
			HAC-R1-6	77.6	345	0.0140	0.735	10.2	0.0100	<0.010	1.10	0.0930	915	0.0344	0.800	0.588	35.0	-	619	0.147	<0.50	1,190	434
			HAC-R1-7	79.4	354	0.0270	0.716	8.38	<0.010	<0.010	<1.0	0.0483	1,080	0.0370	0.485	0.435	26.7	-	572	0.103	<0.50	1,470	297
			HAC-R1-8	72.2	126	<0.010	0.393	4.02	<0.010	<0.010	<1.0	0.0820	506	0.0136	0.380	0.288	18.8	-	248	0.0590	<0.50	756	247
	HAC-U		HAC-U-1	77.0	82.6	<0.010	0.439	19.5	<0.010	<0.010	<1.0	0.0330	453	0.0107	0.290	0.122	15.5	-	172	<0.050	<0.50	764	157
			HAC-U-2	77.0	59.3	0.0130	0.499	2.26	<0.010	<0.010	<1.0	<0.0100	736	0.0105	0.167	0.120	22.5	-	166	0.0440	<0.50	1,320	119
			HAC-U-3	75.6	68.9	<0.010	0.566	2.09	<0.010	<0.010	<1.0	<0.010	549	0.00990	<0.20	0.110	20.2	-	163	<0.050	<0.50	1,140	111
			HAC-U-4	78.6	67.1	0.0210	0.717	3.58	<0.010	0.0100	1.00	0.0407	784	0.0102	0.268	0.169	25.2	-	190	0.0610	<0.50	1,430	249
			HAC-U-5	80.1	225	0.0210	1.03	2.81	<0.010	<0.010	<1.0	0.0102	809	0.0108	0.160	0.220	24.3	-	294	0.0670	<0.50	1,520	153
			HAC-U-6	76.5	142	0.0180	0.621	3.49	<0.010	<0.010	<1.0	0.0228	825	0.0110	0.116	0.147	21.9	-	194	0.0470	<0.50	1,280	169
			HAC-U-7	77.8	81.1	0.0180	0.653	2.92	<0.010	<0.010	<1.0	0.0260	642	0.0139	0.177	0.179	22.5	-	211	0.0570	<0.50	1,270	158
			HAC-U-8	77.6	243	0.0270	0.735	9.72	<0.010	<0.010	1.30	0.0941	979	0.0276	0.435	0.357	32.2	-	464	0.140	<0.50	1,460	362
	EDC-D	Reference	EDC-D-1	76.8	3,180	0.0540	5.07	126	0.0890	0.0210	5.10	0.470	3,390	0.312	11.0	3.98	25.0	-	6,350	1.37	2.94	2,820	1,900
			EDC-D-2	80.8	5,900	0.0680	9.47	173	0.174	0.0440	7.50	0.600	4,560	0.610	19.0	6.90	35.0	-	11,800	2.62	6.08	4,010	2,540
			EDC-D-3	78.4	4,400	0.0460	6.49	131	0.115	0.0280	4.10	0.425	4,240	0.373	10.1	4.78	26.9	-	9,270	1.74	4.30	3,570	1,630
			EDC-D-4	74.4	4,530	0.0550	5.85	133	0.117	0.0260	3.80	0.313	3,120	0.519	12.4	4.59	25.8	-	8,230	1.65	4.41	3,080	1,340
			EDC-D-5	79.1	4,730	0.0550	8.09	132	0.131	0.0310	3.60	0.311	3,600	0.449	15.3	5.10	33.0	-	9,690	1.96	4.67	3,610	1,610
			EDC-D-6	74.0	6,120	0.0490	9.57	163	0.173	0.0440	4.70	0.392	4,220	0.611	19.2	7.02	27.4	-	13,000	2.79	6.38	3,810	1,900
			EDC-D-7	77.0	3,640	0.0230	2.54	26.2	0.0940	0.0140	1.50	0.282	3,700	0.582	4.03	2.46	21.0	-	6,210	0.957	2.87	2,430	276
			EDC-D-8	79.3	102	0.0200	1.48	6.46	<0.010	<0.010	<1.0	0.0700	906	0.0155	0.500	0.303	23.6	-	300	0.173	<0.50	1,310	141
	HAC-D	Exposed	HAC-D-1	81.5	986	0.0580	2.79	36.6	0.0340	0.0130	3.20	0.896	1,850	0.138	11.0	1.97	67.3	-	2,230	0.697	0.720	2,160	676
			HAC-D-2	77.9	1,640	0.0670	3.56	84.3	0.0640	0.0290	4.00	1.57	3,420	0.215	4.75	4.36	110	-	3,980	1.17	1.42	2,400	1,320
			HAC-D-3	81.8	1,080	0.0440	1.70	76.3	0.0340	<0.010	2.50	1.00	2,060	0.110	1.87	2.39	75.0	-	2,150	0.645	0.900	2,060	693
			HAC-D-4	78.2	326	0.0380	2.46	24.3	0.0160	<0.010	1.70	0.797	964	0.0672	0.970	1.15	47.7	-	614	0.400	<0.50	1,630	571
			HAC-D-5	79.4	2,440	0.108	7.69	127	0.112	0.0300	8.20	2.29	4,550	0.330	6.72	5.73	139	-	7,100	1.84	2.21	2,980	1,700
			HAC-D-6	76.6	931	0.0630	2.98	97.5	0.0320	0.0120	2.40	1.44	1,900	0.150	2.32	3.45	81.2	-	2,250	0.842	0.770	1,930	1,190
			HAC-D-7	76.8	495	0.0340	1.18	20.7	0.0160	<0.010	1.90	0.378	1,350	0.0695	1.37	1.07	47.0	-	1,330	0.481	<0.50	1,580	370
			HAC-D-8	77.8	171	0.0320	0.738	8.32	<0.010	<0.010	<1.0	0.402	770	0.0264	0.540	0.575	27.7	-	397	0.213	<0.50	1,230	201

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2021	EDC-U	Reference	EDC-U-1	82.6	1,380	0.0460	2.39	112	0.0450	<0.010	2.90	0.708	1,670	0.0767	4.71	4.57	23.1	-	2,360	0.573	0.980	2,220	2,350
			EDC-U-2	83.3	836	0.0390	1.51	99.7	0.0290	<0.010	3.70	0.660	1,580	0.0465	2.98	4.04	18.4	-	1,580	0.398	0.550	1,710	3,030
			EDC-U-3	83.9	1,680	0.0430	2.76	128	0.0580	0.0110	5.60	0.963	2,250	0.0874	6.08	7.12	22.7	-	3,270	0.625	1.18	2,150	3,150
			EDC-U-4	80.2	607	0.0360	1.39	43.3	0.0230	<0.010	<1.0	0.307	1,260	0.0314	2.06	3.27	17.8	-	1,450	0.288	<0.50	1,480	1,480
			EDC-U-5	85.3	1,120	<0.050	2.21	163	<0.050	<0.050	6.10	1.05	2,440	0.0654	4.12	9.60	23.3	-	2,290	0.482	<2.50	2,340	5,480
			EDC-U-6	85.8	2,570	0.126	3.57	217	0.105	<0.050	<5.0	1.47	3,190	0.156	9.44	10.0	35.3	-	5,200	1.30	<2.50	3,720	5,380
			EDC-U-7	80.9	244	0.0500	0.759	38.2	<0.050	<0.050	<5.0	0.333	1,210	<0.0250	<1.00	2.37	17.0	-	580	<0.250	<2.50	1,630	1,510
			EDC-U-8	82.3	1,290	0.135	2.80	96.7	<0.050	<0.050	<5.0	0.633	1,940	0.0562	4.41	5.30	22.8	-	3,400	0.570	<2.50	2,280	2,770
	HAC-R1	Exposed	HAC-R1-1	75.3	411	0.0420	0.895	11.8	0.0140	<0.010	<1.0	0.0900	1,090	0.0395	0.720	0.632	38.8	-	722	0.181	<0.50	1,320	568
			HAC-R1-2	76.9	376	0.0300	0.723	8.77	0.0140	<0.010	1.20	0.0560	1,440	0.0332	0.610	0.517	44.4	-	618	0.159	<0.50	1,450	413
			HAC-R1-3	70.8	330	0.0300	0.616	8.48	0.0100	<0.010	<1.0	0.149	1,640	0.0300	0.580	0.449	31.0	-	442	0.113	<0.50	1,100	516
			HAC-R1-4	85.6	4,610	0.137	3.78	148	0.160	0.0160	5.80	0.371	9,800	0.307	9.14	6.09	188	-	7,760	1.23	3.78	4,640	3,570
			HAC-R1-5	83.1	4,150	0.121	9.10	50.9	0.136	0.0130	4.30	0.336	8,660	0.225	5.56	4.88	196	-	8,640	0.991	2.76	3,150	2,870
			HAC-R1-6	76.1	141	0.0190	0.372	6.01	<0.010	<0.010	<1.0	0.0200	696	0.0158	1.06	0.224	20.7	-	274	<0.050	<0.50	1,080	156
			HAC-R1-7	72.8	27.9	0.0150	0.416	2.28	<0.010	<0.010	<1.0	0.0490	547	0.00550	<0.20	0.116	12.8	-	92.6	<0.050	<0.50	916	170
			HAC-R1-8	73.8	69.8	0.0200	0.448	2.61	<0.010	<0.010	<1.0	0.0450	590	0.00940	0.230	0.130	16.3	-	159	<0.050	<0.50	1,090	146
	HAC-U		HAC-U-1	52.9	51.7	<0.010	0.336	4.56	<0.010	<0.010	<1.0	0.0710	475	0.00870	<0.20	0.166	12.1	-	92.9	<0.050	<0.50	695	366
			HAC-U-2	68.8	204	0.0120	0.415	5.71	<0.010	<0.010	<1.0	0.132	682	0.0223	<0.20	0.211	17.8	-	188	<0.050	<0.50	760	371
			HAC-U-3	71.3	138	0.0170	0.895	11.8	0.0190	<0.010	<1.0	0.134	946	0.0122	0.310	0.285	21.3	-	206	0.0680	<0.50	1,160	826
			HAC-U-4	71.9	175	0.0170	0.745	6.89	<0.010	<0.010	<1.0	0.140	930	0.0161	0.390	0.455	26.4	-	509	0.0620	<0.50	1,270	602
			HAC-U-5	76.0	231	0.0190	0.793	15.6	<0.010	<0.010	<1.0	0.117	1,170	0.0192	0.340	0.358	37.8	-	300	0.101	<0.50	1,430	764
			HAC-U-6	68.4	431	0.0320	0.907	14.4	0.0130	<0.010	<1.0	0.139	1,260	0.0295	0.610	0.478	26.2	-	583	0.173	<0.50	1,380	795
			HAC-U-7	70.6	588	0.0280	1.37	15.5	0.0180	<0.010	5.60	0.161	6,430	0.0813	0.820	0.716	31.5	-	956	0.310	0.870	1,590	883
			HAC-U-8	70.4	470	0.0250	1.21	21.3	0.0170	<0.010	14.5	0.207	11,100	0.0346	0.420	0.860	36.3	-	694	0.184	0.540	1,660	1,330
	EDC-D	Reference	EDC-D-1	84.0	2,530	0.0610	17.6	135	0.0910	<0.050	8.10	0.559	3,110	0.283	8.08	5.46	26.4	-	6,030	1.08	<2.50	2,870	2,350
			EDC-D-2	74.5	230	0.0120	3.72	23.4	<0.010	<0.010	<1.0	0.0600	1,210	0.0320	0.800	0.565	14.1	-	632	0.121	<0.50	1,170	440
			EDC-D-3	82.7	1,340	<0.050	11.8	147	0.0540	<0.050	5.10	0.439	2,030	0.174	4.92	3.50	24.9	-	3,600	0.742	<2.50	2,130	1,970
			EDC-D-4	75.8	402	0.0130	3.43	27.6	0.0120	<0.010	<1.0	0.0880	1,450	0.0442	1.18	0.736	14.4	-	960	0.175	<0.50	1,390	312
			EDC-D-5	73.8	18.3	<0.010	1.18	4.47	<0.010	<0.010	<1.0	0.0180	1,370	0.00870	<0.20	0.0760	13.4	-	110	<0.050	<0.50	1,140	55.0
			EDC-D-6	75.3	55.0	<0.010	1.62	6.08	<0.010	<0.010	<1.0	0.0290	1,150	0.0107	0.250	0.211	14.8	-	165	<0.050	<0.50	1,270	121
			EDC-D-7	72.0	962	0.0110	1.35	5.26	0.0120	<0.010	<1.0	0.0270	1,510	0.0291	5.44	0.878	12.6	-	1,700	0.163	1.07	2,030	113
			EDC-D-8	73.2	112	<0.010	2.02	12.6	<0.010	<0.010	<1.0	0.0330	1,170	0.0179	0.440	0.214	13.2	-	290	0.0700	<0.50	1,160	230
	HAC-D	Exposed	HAC-D-1	72.5	629	0.0290	2.08	30.4	0.0200	<0.010	3.00	0.707	2,170	0.0649	1.60	0.967	73.7	-	1,190	0.381	0.580	1,490	650
			HAC-D-2	73.6	548	0.0340	1.70	33.9	0.0210	<0.010	3.90	0.767	3,160	0.0759	1.28	0.964	52.8	-	1,060	0.347	<0.50	1,580	744
			HAC-D-3	68.4	396	0.0260	1.28	38.3	0.0160	<0.010	3.40	0.835	2,000	0.0567	1.37	0.889	61.4	-	855	0.325	<0.50	1,350	872
			HAC-D-4	70.3	1,370	0.0540	3.10	67.1	0.0540	0.0180	8.40	1.30	4,600	0.201	3.53	2.07	86.3	-	2,850	0.966	1.16	1,960	1,150
			HAC-D-5	70.6	430	0.0290	1.23	37.1	0.0190	<0.010	3.60	0.909	2,280	0.0728	1.37	0.941	66.9	-	1,020	0.331	<0.50	1,280	770
			HAC-D-6	70.1	874	0.0390	2.21	48.6	0.0350	<0.010	5.00	1.08	2,650	0.126	2.26	1.45	71.0	-	1,870	0.592	0.730	1,720	926
			HAC-D-7	69.1	1,020	0.0390	2.49	50.5	0.0420	0.0110	5.10	0.974	2,640	0.148	2.76	1.58	69.0	-	2,140	0.672	0.830	1,610	930
			HAC-D-8	69.8	446	0.0280	1.33	38.6	0.0160	<0.010	3.30	0.913	1,760	0.0551	1.46	1.12	68.1	-	997	0.354	<0.50	1,500	863

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Moisture %	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Bismuth mg/kg	Boron mg/kg	Cadmium mg/kg	Calcium mg/kg	Cesium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Gallium mg/kg	Iron mg/kg	Lead mg/kg	Lithium mg/kg	Magnesium mg/kg	Manganese mg/kg
2022	EDC-U	Reference	EDC-U-1	75.3	89.4	0.0130	0.634	3.88	<0.010	<0.010	<1.0	0.207	548	0.00710	0.350	0.348	17.1	-	224	0.0570	<0.50	1,330	205
			EDC-U-2	75.1	21.2	0.0120	0.409	1.32	<0.010	<0.010	<1.0	<0.017	514	<0.0050	0.230	0.149	13.0	-	109	<0.050	<0.50	1,200	107
			EDC-U-3	75.7	80.5	0.0120	0.532	10.6	<0.010	<0.010	<1.0	0.116	695	0.00610	1.15	0.456	15.4	-	242	0.0660	<0.50	1,400	400
			EDC-U-4	75.2	1,670	0.0360	2.96	117	0.0600	0.0120	2.60	1.09	1,560	0.0981	11.8	6.59	24.3	-	3,620	0.626	1.22	1,800	4,330
			EDC-U-5	78.3	34.1	<0.010	0.382	2.73	<0.010	<0.010	<1.0	0.0310	558	<0.0050	<0.20	0.251	14.3	-	131	<0.050	<0.50	1,270	154
			EDC-U-6	74.9	70.9	<0.010	0.312	3.19	<0.010	<0.010	<1.0	0.0400	586	0.00510	0.800	0.323	12.2	-	196	<0.050	<0.50	1,130	227
			EDC-U-7	76.6	29.5	<0.010	0.417	2.54	<0.010	<0.010	<1.0	0.0160	559	<0.0050	0.370	0.242	14.1	-	115	<0.050	<0.50	1,340	120
			EDC-U-8	78.0	46.0	0.0110	0.324	3.16	<0.010	<0.010	<1.0	0.0290	592	<0.0050	1.84	0.279	15.6	-	173	0.0500	<0.50	1,360	185
	HAC-R1	Exposed	HAC-R1-1	68.2	18.0	0.0140	0.220	1.55	<0.010	<0.010	<1.0	<0.010	497	<0.0050	<0.20	0.0630	11.5	-	95.0	<0.050	<0.50	987	99.4
			HAC-R1-2	78.3	34.3	0.0160	0.192	1.19	<0.010	<0.010	<1.0	<0.010	512	0.00650	<0.20	0.0640	14.8	-	127	<0.050	<0.50	1,470	58.5
			HAC-R1-3	73.1	80.8	0.0180	0.361	2.45	<0.010	<0.010	<1.0	0.0210	568	0.00880	0.230	0.157	16.3	-	191	0.204	<0.50	1,040	235
			HAC-R1-4	68.8	14.7	0.0140	0.279	1.07	<0.010	<0.010	<1.0	<0.010	397	<0.0050	<0.20	0.0630	11.1	-	85.0	<0.050	<0.50	894	67.6
			HAC-R1-5	67.6	126	0.0220	0.389	7.10	<0.010	<0.010	<1.0	0.125	850	0.0140	0.530	0.277	23.6	-	286	0.0760	<0.50	876	266
			HAC-R1-6	73.2	69.1	0.0210	0.334	4.57	<0.010	<0.010	<1.0	0.0390	803	0.00960	0.210	0.121	16.6	-	179	<0.050	<0.50	1,060	130
			HAC-R1-7	71.0	64.4	0.0210	0.317	2.49	<0.010	<0.010	<1.0	0.0350	664	0.00820	0.400	0.140	14.3	-	175	0.0560	<0.50	999	151
			HAC-R1-8	73.6	56.3	0.0260	0.338	5.84	<0.010	<0.010	<1.0	0.0430	701	0.00780	0.250	0.269	16.4	-	177	<0.050	<0.50	1,020	368
	HAC-U		HAC-U-1	74.7	172	0.0240	0.493	11.0	<0.010	<0.010	1.60	0.0940	1,740	0.0226	1.10	0.324	23.4	-	353	0.110	<0.50	1,220	516
			HAC-U-2	74.9	245	0.0190	0.494	5.29	<0.010	<0.010	<1.0	0.0490	1,620	0.0138	0.460	0.221	20.0	-	507	0.0940	<0.50	1,170	246
			HAC-U-3	72.0	65.0	0.0140	0.348	3.26	<0.010	<0.010	<1.0	0.0290	1,000	0.00840	0.270	0.0920	18.0	-	163	<0.050	<0.50	1,000	158
			HAC-U-4	74.7	67.4	0.0150	0.443	3.60	<0.010	<0.010	<1.0	0.0730	804	0.0108	0.260	0.166	21.0	-	178	<0.050	<0.50	1,220	292
			HAC-U-5	71.6	138	0.0160	0.383	4.62	<0.010	<0.010	<1.0	0.0580	1,160	0.0124	0.260	0.182	17.1	-	215	0.0790	<0.50	1,060	297
			HAC-U-6	76.4	62.8	0.0210	0.447	4.32	<0.010	<0.010	<1.0	0.110	1,170	0.0107	0.210	0.242	23.1	-	173	0.0540	<0.50	1,100	329
			HAC-U-7	71.7	73.6	0.0160	0.448	6.74	<0.010	<0.010	<1.0	0.0720	1,240	0.0133	0.320	0.195	19.6	-	184	0.0540	<0.50	1,140	512
			HAC-U-8	74.3	82.1	0.0210	0.400	2.97	<0.010	<0.010	<1.0	0.0330	650	0.0112	0.240	0.160	19.4	-	205	0.0550	<0.50	1,190	242
	EDC-D	Reference	EDC-D-1	81.5	650	0.0190	2.91	31.0	0.0230	<0.010	<1.0	0.319	1,570	0.0789	4.11	1.16	17.2	-	1,320	0.324	0.620	1,490	474
			EDC-D-2	83.9	497	0.0240	2.16	13.9	0.0140	0.124	<1.0	0.369	903	0.0489	2.42	0.585	23.1	-	913	0.548	<0.50	1,280	257
			EDC-D-3	78.7	1,610	0.0600	7.44	90.3	0.0820	0.0150	1.50	0.295	2,110	0.180	10.8	3.02	19.7	-	4,450	1.33	1.52	1,760	1,100
			EDC-D-4	66.6	3,400	0.0330	4.20	22.9	0.0900	0.0320	1.00	0.307	2,210	0.311	32.9	3.83	19.4	-	7,210	1.18	3.74	3,950	270
			EDC-D-5	83.0	1,120	0.0380	3.36	64.8	0.0510	0.0100	2.40	0.474	2,350	0.130	15.7	1.99	23.1	-	2,560	0.563	1.10	1,700	870
			EDC-D-6	85.8	565	0.0310	1.50	26.7	0.0180	0.0360	<1.0	0.380	1,170	0.0979	5.27	1.05	19.9	-	1,080	0.363	<0.50	1,440	466
			EDC-D-7	74.9	6,900	0.0300	5.24	112	0.132	0.0320	1.70	0.282	3,090	0.388	9.95	4.40	22.9	-	11,300	1.23	5.41	4,030	569
			EDC-D-8	73.5	344	<0.010	0.901	6.34	0.0120	<0.010	<1.0	0.0530	1,310	0.0181	2.50	0.257	12.7	-	831	0.150	<0.50	1,440	82.9
	HAC-D	Exposed	HAC-D-1	75.7	222	0.0290	0.758	17.7	<0.010	<0.010	<1.0	0.457	934	0.0352	0.510	0.493	30.4	-	437	0.178	<0.50	1,340	575
			HAC-D-2	71.6	311	0.0250	0.874	20.0	<0.010	<0.010	<1.0	0.638	1,230	0.0375	1.18	0.626	39.0	-	565	0.202	<0.50	1,460	492
			HAC-D-3	74.0	357	0.0350	0.946	23.5	0.0150	<0.010	1.40	0.528	2,240	0.0458	1.22	0.960	45.6	-	754	0.250	<0.50	1,240	777
			HAC-D-4	72.6	339	0.0270	0.982	42.9	0.0110	<0.010	<1.0	0.592	1,120	0.0498	1.29	0.882	41.1	-	672	0.238	<0.50	1,300	873
			HAC-D-5	76.2	2,040	0.0490	1.90	14.6	0.0440	<0.010	1.50	0.181	3,580	0.0689	2.59	1.04	30.1	-	2,370	3.94	0.880	1,680	539
			HAC-D-6	73.6	130	0.0220	0.644	8.07	<0.010	<0.010	<1.0	0.156	712	0.0220	0.500	0.573	27.3	-	356	0.122	<0.50	1,220	472
			HAC-D-7	70.1	186	0.0190	0.782	12.7	<0.010	<0.010	<1.0	0.193	980	0.0269	0.860	0.488	28.3	-	396	0.130	<0.50	1,070	534
			HAC-D-8	75.0	56.9	0.0150	0.512	3.44	<0.010	<0.010	<1.0	0.0580	549	0.0130	<0.20	0.227	18.3	-	229	0.0580	<0.50	987	223

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2018	EDC-U	Reference	EDC-U-1	0.0475	-	0.818	3.84	5,480	7,920	-	2.67	0.360	-	2,010	7.83	<0.020	0.00850	-	0.160	-	0.124	2.29	-	203	0.810
			EDC-U-2	0.0752	-	1.59	6.99	8,000	15,400	-	4.93	0.480	-	4,900	21.9	<0.020	0.0171	-	0.350	-	0.182	4.15	-	231	1.56
			EDC-U-3	0.0683	-	1.88	5.71	7,010	9,040	-	2.84	0.590	-	3,030	8.40	<0.020	0.0108	-	0.230	-	0.106	2.95	-	161	1.00
			EDC-U-4	0.0910	-	1.68	6.04	6,750	9,980	-	3.35	0.580	-	2,870	10.5	<0.020	0.0104	-	0.280	-	0.162	2.67	-	145	0.970
			EDC-U-5	0.0515	-	0.746	2.34	8,110	8,850	-	3.83	0.690	-	3,400	11.0	<0.020	0.00760	-	<0.10	-	0.0608	2.71	-	291	0.390
			EDC-U-6	0.0964	-	2.11	6.35	9,600	14,500	-	5.38	0.840	-	4,900	16.7	<0.020	0.0167	-	0.110	-	0.290	4.41	-	228	1.94
			EDC-U-7	0.0398	-	1.91	3.97	8,680	10,200	-	2.66	0.680	-	4,550	11.6	<0.020	0.00720	-	<0.10	-	0.100	1.12	-	302	0.470
			EDC-U-8	0.0579	-	0.830	2.59	8,390	10,400	-	3.71	0.600	-	3,540	10.3	<0.020	0.00590	-	0.300	-	0.0708	1.02	-	260	0.360
	HAC-R1	Exposed	HAC-R1-1	0.0658	-	28.0	5.46	6,040	7,490	-	4.38	3.06	-	3,370	48.1	<0.040	0.00850	-	<0.20	-	0.351	16.1	-	96.0	1.18
			HAC-R1-2	0.0650	-	4.49	4.62	5,800	6,950	-	2.68	2.28	-	3,150	31.7	<0.020	0.00790	-	0.270	-	0.168	12.0	-	87.6	1.83
			HAC-R1-3	0.0592	-	8.30	2.99	5,870	8,260	-	2.36	4.02	-	3,340	29.5	<0.020	0.00630	-	0.180	-	0.250	9.48	-	84.1	1.52
			HAC-R1-4	0.0690	-	5.05	4.64	6,540	7,770	-	2.40	3.02	-	3,790	31.0	<0.020	0.00810	-	0.350	-	0.148	11.1	-	90.5	1.54
			HAC-R1-5	0.0707	-	4.93	2.92	6,260	7,520	-	2.59	2.62	-	3,180	22.9	<0.020	0.00550	-	0.370	-	0.0978	7.68	-	90.3	1.09
			HAC-R1-6	0.169	-	18.6	10.6	14,700	19,500	-	7.11	6.66	-	8,190	65.3	0.0390	0.0181	-	0.750	-	0.358	22.4	-	219	3.02
			HAC-R1-7	0.0738	-	6.31	5.33	5,680	7,640	-	3.23	2.44	-	3,340	28.6	<0.020	0.00970	-	0.230	-	0.145	11.4	-	81.2	1.88
			HAC-R1-8	0.0745	-	7.01	4.79	4,900	6,330	-	2.56	2.88	-	2,670	30.0	<0.020	0.00840	-	0.240	-	0.307	11.0	-	88.4	1.51
	HAC-U		HAC-U-1	0.0420	-	3.94	2.21	5,870	6,740	-	2.82	2.17	-	2,490	20.2	<0.020	0.00510	-	0.150	-	0.0667	3.59	-	90.0	0.790
			HAC-U-2	0.0629	-	4.07	3.33	5,770	6,540	-	3.29	1.73	-	2,580	42.2	<0.020	0.0101	-	<0.10	-	0.114	7.92	-	79.2	1.30
			HAC-U-3	0.0587	-	3.42	3.62	6,650	7,870	-	3.49	1.95	-	3,020	27.6	<0.020	0.00830	-	0.420	-	0.100	6.86	-	90.8	0.870
			HAC-U-4	0.0461	-	3.01	1.52	6,410	7,510	-	3.27	1.85	-	2,670	14.4	<0.020	0.00400	-	<0.10	-	0.0487	2.67	-	86.1	0.370
			HAC-U-5	0.0530	-	3.23	2.20	5,480	6,750	-	2.38	1.86	-	2,890	15.2	<0.020	0.00440	-	0.570	-	0.0568	3.02	-	66.4	0.500
			HAC-U-6	0.0521	-	2.87	1.80	5,550	7,160	-	2.96	2.13	-	2,950	24.3	<0.020	0.00550	-	<0.10	-	0.0721	4.10	-	74.8	0.700
			HAC-U-7	0.0586	-	2.79	1.57	6,860	8,340	-	4.13	2.25	-	2,980	21.7	<0.020	0.00520	-	<0.10	-	0.0685	4.16	-	91.7	0.610
			HAC-U-8	0.0475	-	3.20	3.13	5,350	6,590	-	2.98	1.78	-	3,030	26.6	<0.020	0.00730	-	0.150	-	0.114	6.36	-	82.2	0.890
	EDC-D	Reference	EDC-D-1	0.118	-	2.25	8.07	5,910	14,100	-	7.22	2.63	-	2,700	25.4	<0.020	0.0278	-	<0.10	-	0.259	7.84	-	94.4	2.74
			EDC-D-2	0.107	-	3.08	10.2	8,280	20,500	-	9.58	2.88	-	4,310	24.4	<0.020	0.0241	-	0.140	-	0.261	7.72	-	118	2.72
			EDC-D-3	0.0739	-	4.55	16.1	10,200	24,700	-	13.3	3.81	-	4,530	51.9	<0.040	0.0607	-	<0.20	-	0.658	18.6	-	210	5.86
			EDC-D-4	0.0883	-	2.11	7.54	5,840	16,600	-	7.64	2.04	-	3,130	34.2	<0.020	0.0274	-	0.130	-	0.403	7.08	-	101	2.59
			EDC-D-5	0.0733	-	1.61	8.54	6,250	14,400	-	6.37	1.94	-	3,500	20.9	<0.020	0.0244	-	0.300	-	0.252	6.74	-	118	2.32
			EDC-D-6	0.0615	-	1.77	5.80	6,170	15,300	-	6.43	1.67	-	3,520	21.5	<0.020	0.0211	-	<0.10	-	0.252	7.34	-	126	1.96
			EDC-D-7	0.147	-	2.40	6.79	8,090	20,000	-	7.36	1.80	-	5,450	17.7	<0.020	0.0213	-	0.270	-	0.193	4.21	-	171	1.79
			EDC-D-8	0.0935	-	1.58	9.61	4,710	11,700	-	6.52	1.32	-	2,880	34.4	<0.040	0.0440	-	<0.20	-	0.560	14.7	-	111	4.06
	HAC-D	Exposed	HAC-D-1	0.0396	-	6.19	0.530	7,000	7,000	-	1.37	3.87	-	3,140	6.65	<0.020	0.00480	-	<0.10	-	0.0217	1.13	-	90.5	<0.20
			HAC-D-2	0.0398	-	6.36	0.760	7,170	6,960	-	1.59	3.61	-	3,130	9.57	<0.020	0.00390	-	<0.10	-	0.0703	2.15	-	90.8	0.220
			HAC-D-3	<0.0050	-	5.40	0.690	6,830	7,020	-	1.44	3.88	-	2,890	5.90	<0.020	0.00300	-	<0.10	-	0.0169	1.72	-	93.7	<0.20
			HAC-D-4	0.0785	-	7.72	1.08	6,270	6,570	-	1.90	3.99	-	2,240	6.48	<0.020	0.00550	-	<0.10	-	0.0445	2.51	-	97.6	0.310
			HAC-D-5	0.0368	-	7.40	0.450	6,820	6,260	-	1.64	4.51	-	2,520	5.66	<0.020	0.00260	-	<0.10	-	0.0110	0.860	-	89.1	<0.20
			HAC-D-6	0.0353	-	5.62	0.480	6,290	6,060	-	1.33	3.75	-	2,210	4.71	<0.020	<0.0020	-	<0.10	-	0.00630	0.460	-	68.4	<0.20
			HAC-D-7	0.0367	-	4.77	1.53	6,530	6,430	-	1.87	3.57	-	2,580	4.70	<0.020	0.00330	-	<0.10	-	0.0120	0.970	-	79.8	0.210
			HAC-D-8	0.0451	-	6.20	0.640	6,190	5,960	-	1.31	3.87	-	2,180	5.72	<0.020	0.00250	-	0.130	-	0.0103	0.810	-	75.5	<0.20

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2019	EDC-U	Reference	EDC-U-1	0.0530	-	6.16	4.79	10,100	11,700	-	3.37	0.470	0.0799	4,950	11.6	<0.020	0.0122	-	0.860	24.4	0.148	2.64	-	253	0.940
			EDC-U-2	0.0450	-	6.60	1.71	8,880	9,230	-	2.54	0.600	0.0641	4,370	5.62	<0.020	0.00520	-	0.290	5.86	0.0549	0.880	-	276	0.420
			EDC-U-3	0.0280	-	11.1	0.640	10,200	7,830	-	2.10	0.630	0.0422	3,880	12.2	<0.020	0.00530	-	0.350	9.61	0.0249	1.01	-	98.7	0.220
			EDC-U-4	0.140	-	6.02	1.77	9,030	8,280	-	2.37	0.390	0.0428	4,030	13.5	<0.020	0.00810	-	0.290	17.6	0.0680	2.03	-	163	0.410
			EDC-U-5	0.0270	-	7.27	3.34	7,650	5,500	-	2.07	0.520	0.0501	2,590	23.9	<0.020	0.00880	-	0.160	93.4	0.0889	7.44	-	91.7	0.810
			EDC-U-6	0.0330	-	5.47	1.61	8,460	6,910	-	1.80	0.420	0.0299	3,330	11.6	<0.020	0.00550	-	0.110	8.14	0.0459	1.35	-	121	0.220
			EDC-U-7	0.0430	-	3.91	6.98	6,600	4,470	-	1.31	0.790	0.0771	2,810	12.6	<0.020	0.0147	-	0.350	395	0.0808	52.4	-	140	1.04
			EDC-U-8	0.0200	-	7.18	2.39	8,110	5,960	-	2.47	0.590	0.0399	2,660	15.4	<0.020	0.0119	-	0.170	50.5	0.124	5.64	-	83.4	0.660
	HAC-R1	Exposed	HAC-R1-1	0.0900	-	4.02	2.91	7,360	8,130	-	2.07	3.56	0.0290	3,920	40.0	<0.020	0.00510	-	0.480	101	0.134	9.55	-	109	1.29
			HAC-R1-2	0.0850	-	4.22	2.97	8,290	9,030	-	2.56	4.18	0.0300	4,000	73.0	<0.020	0.00550	-	0.540	227	0.174	16.3	-	117	2.20
			HAC-R1-3	0.104	-	4.25	5.00	8,230	9,010	-	2.96	3.99	0.0428	4,010	49.9	<0.020	0.00900	-	0.350	128	0.263	13.1	-	125	1.72
			HAC-R1-4	0.110	-	5.34	3.17	7,300	7,380	-	2.10	3.90	0.0377	3,380	33.4	<0.020	0.00710	-	0.290	107	0.119	10.6	-	108	1.38
			HAC-R1-5	0.119	-	5.27	4.76	8,170	8,670	-	2.46	4.13	0.0323	3,950	36.3	<0.020	0.00980	-	0.730	108	0.128	8.79	-	115	1.09
			HAC-R1-6	0.116	-	5.05	3.60	8,120	9,960	-	3.13	3.03	0.0342	4,100	27.9	<0.020	0.00780	-	0.740	126	0.110	12.4	-	108	1.33
			HAC-R1-7	0.0960	-	6.08	4.49	8,470	9,990	-	3.15	2.96	0.0372	4,540	42.2	<0.020	0.00900	-	1.32	133	0.138	11.6	-	110	1.37
			HAC-R1-8	0.128	-	6.46	4.64	7,820	9,040	-	2.68	3.82	0.0438	4,210	43.1	<0.020	0.0105	-	0.680	144	0.138	12.2	-	117	1.43
	HAC-U		HAC-U-1	0.120	-	5.94	6.32	9,140	10,100	-	3.76	3.59	0.0504	5,030	67.2	<0.020	0.0144	-	0.590	215	0.215	17.6	-	124	1.85
			HAC-U-2	0.0900	-	5.24	2.88	8,910	9,880	-	2.63	3.46	0.0287	4,260	32.2	<0.020	0.00770	-	0.260	83.4	0.101	7.22	-	111	0.950
			HAC-U-3	0.0980	-	5.22	3.33	6,700	7,520	-	2.39	3.06	0.0310	3,360	35.6	<0.020	0.00960	-	0.320	93.3	0.103	7.91	-	107	1.06
			HAC-U-4	0.0910	-	5.38	2.93	7,690	8,900	-	2.57	3.17	0.0276	4,130	36.1	<0.020	0.00840	-	1.04	91.6	0.106	7.95	-	113	1.16
			HAC-U-5	0.0870	-	4.92	2.94	8,000	9,530	-	2.40	3.33	0.0298	4,180	30.3	<0.020	0.00800	-	0.390	77.5	0.0876	6.56	-	105	0.940
			HAC-U-6	0.0840	-	4.00	3.38	6,770	7,810	-	2.39	3.88	0.0373	3,480	51.6	<0.020	0.00870	-	0.580	110	0.214	10.9	-	92.0	1.11
			HAC-U-7	0.0830	-	5.45	2.69	8,000	9,800	-	2.85	3.41	0.0259	4,180	41.4	<0.020	0.00840	-	0.330	74.9	0.115	7.29	-	110	0.880
			HAC-U-8	0.0940	-	4.10	2.44	7,640	8,990	-	2.32	3.94	0.0232	3,660	35.3	<0.020	0.00800	-	0.280	72.8	0.0853	6.83	-	97.2	0.850
	EDC-D	Reference	EDC-D-1	0.0550	-	4.40	3.33	9,770	10,800	-	4.73	1.27	0.0306	3,320	10.7	<0.020	0.00770	-	0.260	20.5	0.0669	2.42	-	180	0.370
			EDC-D-2	0.0420	-	5.66	0.870	9,320	6,830	-	1.37	1.46	0.00890	2,970	14.6	<0.020	0.00290	-	<0.10	5.34	0.0127	0.490	-	92.3	<0.20
			EDC-D-3	0.125	-	5.66	4.41	10,500	11,500	-	2.90	2.73	0.111	4,430	13.3	<0.020	0.0185	-	0.160	45.9	0.112	4.56	-	119	0.820
			EDC-D-4	0.0560	-	3.31	3.28	7,980	8,030	-	2.08	1.31	0.0214	2,410	9.14	<0.020	0.0141	-	0.290	53.0	0.0727	3.25	-	158	0.980
			EDC-D-5	0.0370	-	2.51	1.31	7,410	6,780	-	1.67	0.890	0.00960	2,450	7.90	<0.020	0.00320	-	<0.10	40.4	0.0183	2.86	-	106	<0.20
			EDC-D-6	0.0440	-	5.28	0.530	8,980	7,690	-	1.36	1.47	0.0230	3,090	9.40	<0.020	0.00270	-	0.170	7.22	0.00910	0.540	-	102	<0.20
			EDC-D-7	0.0930	-	4.54	4.44	9,370	11,200	-	4.08	1.47	0.0312	3,610	12.4	<0.020	0.0110	-	0.250	48.5	0.164	3.75	-	149	0.910
			EDC-D-8	0.0830	-	5.84	0.710	9,950	7,490	-	1.67	1.47	0.0115	3,450	12.7	<0.020	0.00270	-	0.300	3.42	0.0436	0.590	-	101	<0.20
	HAC-D	Exposed	HAC-D-1	0.0230	-	6.17	1.75	7,540	7,520	-	1.47	2.95	0.00630	2,650	8.01	<0.020	0.00460	-	0.210	36.8	0.0253	2.61	-	90.1	0.370
			HAC-D-2	0.0270	-	7.77	1.63	7,620	7,840	-	1.48	2.87	0.0134	2,930	7.27	<0.020	0.00390	-	0.500	24.0	0.0331	1.99	-	109	0.260
			HAC-D-3	0.0280	-	7.14	1.37	6,880	6,340	-	1.54	3.05	0.00750	2,420	9.48	<0.020	0.00520	-	0.170	37.0	0.0289	2.95	-	86.2	0.410
			HAC-D-4	0.0260	-	5.99	1.00	7,050	6,390	-	1.17	2.87	<0.0050	2,200	7.25	<0.020	0.00330	-	0.280	21.8	0.0177	1.91	-	77.4	<0.20
			HAC-D-5	0.0290	-	6.92	2.07	6,930	6,440	-	1.96	2.94	0.00880	2,380	9.95	<0.020	0.00620	-	0.410	41.7	0.0634	6.86	-	84.5	0.880
			HAC-D-6	0.0320	-	5.32	0.940	7,110	7,060	-	1.30	3.10	<0.0050	2,330	6.52	<0.020	0.00350	-	0.300	25.7	0.0190	1.92	-	85.3	0.290
			HAC-D-7	0.0290	-	4.11	1.75	6,810	4,830	-	1.19	4.11	0.0432	1,460	14.3	<0.020	0.00850	-	0.170	39.0	0.0439	4.14	-	111	0.260
			HAC-D-8	0.0310	-	6.93	0.830	6,900	6,370	-	1.32	2.76	0.00530	2,130	6.63	<0.020	0.00290	-	0.200	21.0	0.0176	1.68	-	82.4	0.240

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2020	EDC-U	Reference	EDC-U-1	0.0381	-	0.811	7.37	11,000	20,900	-	12.2	0.520	0.0685	5,160	26.5	<0.020	0.0166	-	<0.10	28.4	0.186	4.92	-	350	1.33
			EDC-U-2	0.0333	-	1.04	10.6	13,000	18,500	-	9.40	0.460	0.0549	6,560	27.6	<0.020	0.0188	-	<0.10	36.7	0.236	4.47	-	530	1.82
			EDC-U-3	0.0407	-	0.793	4.98	10,900	17,600	-	10.4	0.450	0.0506	5,160	27.2	<0.020	0.0137	-	0.130	26.1	0.142	4.13	-	478	1.24
			EDC-U-4	0.0420	-	1.15	4.76	9,890	16,000	-	9.41	0.630	0.0460	5,230	17.9	<0.020	0.0160	-	<0.10	34.6	0.139	4.74	-	251	1.56
			EDC-U-5	0.0517	-	1.11	5.80	10,300	18,500	-	10.3	0.720	0.0753	4,980	20.5	<0.020	0.0196	-	<0.10	39.9	0.184	5.22	-	314	1.56
			EDC-U-6	0.0362	-	0.872	6.17	10,500	22,200	-	11.4	0.480	0.0609	5,660	29.0	<0.020	0.0171	-	0.100	38.4	0.163	5.26	-	404	1.57
			EDC-U-7	0.0414	-	0.651	5.37	11,800	20,400	-	12.1	0.410	0.0500	6,710	30.5	<0.020	0.0119	-	<0.10	20.1	0.164	3.57	-	428	1.50
			EDC-U-8	0.0309	-	6.74	1.73	9,730	10,100	-	3.60	0.800	0.0464	4,040	17.4	<0.020	0.00670	-	<0.10	23.6	0.0531	2.24	-	366	0.830
	HAC-R1	Exposed	HAC-R1-1	0.102	-	4.28	2.12	6,740	7,960	-	2.19	3.48	0.0164	2,920	19.5	<0.020	0.00250	-	0.110	55.7	0.0736	4.96	-	108	0.780
			HAC-R1-2	0.0916	-	4.77	1.52	8,620	9,310	-	2.44	4.33	0.0159	3,460	14.2	<0.020	<0.0020	-	0.120	40.7	0.0588	4.16	-	117	0.710
			HAC-R1-3	0.0848	-	5.33	0.220	8,020	9,460	-	1.26	3.84	<0.0050	3,620	4.99	<0.020	0.00350	-	<0.10	5.72	0.00340	0.300	-	78.0	<0.20
			HAC-R1-4	0.132	-	5.08	1.82	8,060	9,990	-	2.38	4.49	0.0136	3,850	14.0	<0.020	0.00420	-	0.160	74.4	0.0609	7.46	-	90.2	1.05
			HAC-R1-5	0.126	-	3.75	1.37	7,540	8,080	-	2.64	3.19	0.0166	2,930	12.2	<0.020	0.00230	-	<0.10	54.2	0.0376	4.15	-	93.4	0.530
			HAC-R1-6	0.0954	-	6.87	0.890	7,380	7,490	-	1.65	4.11	0.00870	2,690	6.68	<0.020	<0.0020	-	<0.10	22.0	0.0250	1.76	-	91.3	0.320
			HAC-R1-7	0.0780	-	7.91	0.470	8,110	7,790	-	1.33	5.01	<0.0050	3,080	6.55	<0.020	<0.0020	-	<0.10	21.7	0.0182	1.71	-	96.8	0.230
			HAC-R1-8	0.0847	-	6.12	0.440	4,660	4,940	-	0.933	2.91	<0.0050	1,640	3.69	<0.020	<0.0020	-	<0.10	7.55	0.0124	0.640	-	72.1	<0.20
	HAC-U		HAC-U-1	0.0616	-	5.58	<0.20	4,730	4,760	-	0.731	3.59	<0.0050	1,700	3.26	<0.020	<0.0020	-	<0.10	4.71	0.00560	0.410	-	61.0	<0.20
			HAC-U-2	0.0471	-	10.1	<0.20	6,900	7,590	-	1.40	5.12	<0.0050	3,000	3.61	<0.020	<0.0020	-	<0.10	3.87	0.00350	0.310	-	75.6	<0.20
			HAC-U-3	0.0584	-	8.02	<0.20	6,990	6,840	-	1.01	4.71	<0.0050	2,410	3.53	<0.020	<0.0020	-	<0.10	4.39	0.00420	0.390	-	81.5	<0.20
			HAC-U-4	0.0728	-	7.72	0.520	7,930	8,750	-	1.30	5.55	<0.0050	3,140	5.37	<0.020	0.00310	-	<0.10	4.50	0.00890	0.350	-	98.8	0.220
			HAC-U-5	0.0717	-	8.80	<0.20	8,500	8,980	-	1.37	5.89	<0.0050	3,300	4.58	<0.020	<0.0020	-	<0.10	6.69	0.00480	1.09	-	94.1	<0.20
			HAC-U-6	0.0576	-	8.06	<0.20	7,940	7,760	-	1.48	5.22	<0.0050	2,760	4.99	<0.020	<0.0020	-	<0.10	4.75	0.00490	0.510	-	80.6	<0.20
			HAC-U-7	0.0661	-	8.77	<0.20	7,740	7,780	-	1.16	5.03	<0.0050	2,810	4.43	<0.020	<0.0020	-	<0.10	6.09	0.00800	0.510	-	85.2	<0.20
			HAC-U-8	0.0989	-	6.94	0.320	8,200	8,830	-	1.47	5.79	0.00500	3,230	6.21	<0.020	0.00200	-	<0.10	15.4	0.0153	1.19	-	104	0.290
	EDC-D	Reference	EDC-D-1	0.0768	-	5.72	9.42	8,100	13,400	-	7.36	1.15	0.0698	2,770	28.9	<0.020	0.0298	-	<0.10	154	0.240	13.0	-	174	2.73
			EDC-D-2	0.0923	-	2.45	18.0	7,980	19,200	-	11.4	1.34	0.117	4,160	37.3	<0.020	0.0520	-	0.160	266	0.460	24.3	-	180	4.76
			EDC-D-3	0.0656	-	6.96	10.4	8,950	13,000	-	7.74	1.06	0.0845	3,390	34.6	<0.020	0.0355	-	0.130	212	0.276	21.9	-	164	2.99
			EDC-D-4	0.0669	-	3.41	11.3	7,840	12,800	-	7.05	1.22	0.0719	3,150	26.7	<0.020	0.0326	-	<0.10	192	0.262	17.6	-	174	3.52
			EDC-D-5	0.0662	-	3.76	13.1	7,810	14,000	-	8.06	1.05	0.0698	3,460	29.2	<0.020	0.0362	-	<0.10	228	0.320	20.1	-	151	3.76
			EDC-D-6	0.0552	-	2.15	16.8	5,670	12,000	-	8.32	0.910	0.0839	2,460	38.2	<0.020	0.0483	-	0.150	294	0.438	25.9	-	173	5.26
			EDC-D-7	0.0860	-	6.17	5.54	7,340	5,890	-	3.69	1.64	0.0700	2,480	27.4	<0.020	0.0192	-	<0.10	166	0.143	18.4	-	148	2.76
			EDC-D-8	0.0797	-	8.78	0.560	9,160	8,570	-	1.94	1.61	0.0306	2,660	6.26	<0.020	0.00240	-	<0.10	5.11	0.0124	0.520	-	128	0.290
	HAC-D	Exposed	HAC-D-1	0.0655	-	3.12	2.48	8,710	10,200	-	3.00	4.45	0.0270	4,340	15.2	<0.020	0.0184	-	<0.10	61.6	0.0844	6.06	-	249	0.970
			HAC-D-2	0.0584	-	3.27	5.81	7,600	8,460	-	2.82	3.16	0.0636	3,500	22.1	<0.020	0.0209	-	<0.10	92.6	0.187	12.6	-	305	1.92
			HAC-D-3	0.0426	-	2.58	3.15	7,480	7,950	-	2.00	2.44	0.0382	4,150	36.7	<0.020	0.0116	-	<0.10	57.7	0.152	6.96	-	243	1.33
			HAC-D-4	0.0404	-	4.27	1.40	8,480	8,700	-	1.70	3.99	0.0136	3,750	7.64	<0.020	0.0120	-	<0.10	14.5	0.0477	1.48	-	192	0.460
			HAC-D-5	0.0737	-	3.65	8.03	9,600	10,900	-	4.43	3.44	0.0716	4,230	35.5	<0.020	0.0463	-	<0.10	131	0.319	19.9	-	447	3.43
			HAC-D-6	0.0664	-	4.89	4.42	8,480	9,170	-	2.31	3.44	0.0430	3,970	14.6	<0.020	0.0147	-	<0.10	57.1	0.120	6.81	-	307	0.880
			HAC-D-7	0.0779	-	3.91	1.61	7,930	7,410	-	1.80	3.20	0.0234	3,200	9.84	<0.020	0.00690	-	<0.10	31.2	0.0564	3.94	-	154	0.550
			HAC-D-8	0.0716	-	4.09	0.540	7,560	7,800	-	1.09	3.14	<0.0050	2,940	5.20	<0.020	0.00260	-	<0.10	10.6	0.0102	0.840	-	106	0.210

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2021	EDC-U	Reference	EDC-U-1	0.0334	-	2.56	7.31	9,400	13,500	-	5.46	0.550	0.0551	4,430	12.9	<0.020	0.0195	-	<0.10	53.5	0.198	5.73	-	207	0.990
			EDC-U-2	0.0373	-	1.90	5.35	8,040	11,800	-	3.58	0.640	0.0452	3,460	11.9	<0.020	0.0155	-	<0.10	33.1	0.153	3.87	-	182	0.700
			EDC-U-3	0.0480	-	2.27	8.55	8,600	15,200	-	6.14	0.580	0.0734	3,920	17.3	<0.020	0.0246	-	<0.10	67.8	0.289	7.62	-	196	1.69
			EDC-U-4	0.0302	-	3.22	2.87	8,540	8,640	-	2.61	0.900	0.0480	3,120	9.31	<0.020	0.0125	-	<0.10	21.2	0.163	3.22	-	153	0.640
			EDC-U-5	0.0381	-	3.00	8.70	8,880	15,900	-	7.08	0.600	0.0847	4,730	18.6	<0.10	0.0292	-	<0.10	39.7	0.232	6.20	-	206	<1.00
			EDC-U-6	0.0917	-	3.72	11.5	10,300	16,500	-	6.87	0.800	0.144	5,470	21.0	<0.10	0.0678	-	<0.10	94.1	0.544	11.9	-	258	2.20
			EDC-U-7	0.0226	-	3.92	1.64	8,410	8,930	-	2.72	0.640	0.0355	3,790	9.09	<0.10	<0.0100	-	<0.10	8.13	0.0560	1.51	-	173	<1.00
			EDC-U-8	0.0240	-	4.58	5.81	8,310	10,700	-	3.25	0.790	0.0570	4,030	15.7	<0.10	0.0209	-	<0.10	51.2	0.208	7.44	-	180	1.09
	HAC-R1	Exposed	HAC-R1-1	0.0850	-	10.7	0.870	9,200	8,050	-	1.50	7.79	0.00860	3,400	8.20	<0.020	0.00230	-	<0.10	17.6	0.0362	2.38	-	94.8	<0.20
			HAC-R1-2	0.0652	-	13.0	0.660	8,740	7,730	-	1.55	9.68	0.00720	3,310	7.05	<0.020	0.00210	-	<0.10	25.9	0.0268	2.25	-	100	<0.20
			HAC-R1-3	0.0634	-	15.6	0.620	7,760	6,880	-	1.26	8.64	0.00540	2,400	6.78	<0.020	<0.0020	-	<0.10	12.3	0.0271	1.52	-	121	<0.20
			HAC-R1-4	0.0847	-	6.17	15.5	9,690	10,200	-	3.17	5.00	0.0549	5,720	54.2	<0.020	0.0145	-	0.140	297	0.266	25.7	-	130	3.17
			HAC-R1-5	0.117	-	6.63	6.19	8,860	8,050	-	2.82	5.38	0.0558	4,670	36.6	<0.020	0.0110	-	0.150	182	0.263	31.2	-	121	1.82
			HAC-R1-6	0.0634	-	12.5	0.650	6,900	5,750	-	1.02	7.03	0.00750	2,640	5.09	<0.020	<0.0020	-	<0.10	19.3	0.0285	0.920	-	83.9	<0.20
			HAC-R1-7	0.0241	-	11.2	<0.20	7,120	5,660	-	1.01	6.74	<0.0050	2,080	3.18	<0.020	<0.0020	-	<0.10	1.61	0.00820	0.260	-	85.4	<0.20
			HAC-R1-8	0.0633	-	12.4	0.220	7,690	6,690	-	1.09	8.06	<0.0050	2,570	3.92	<0.020	<0.0020	-	<0.10	3.69	0.0134	0.460	-	75.8	<0.20
	HAC-U		HAC-U-1	0.0236	-	6.53	0.250	4,600	3,960	-	0.816	5.85	<0.0050	1,670	3.35	<0.020	<0.0020	-	<0.10	1.40	0.0146	0.430	-	64.6	<0.20
			HAC-U-2	0.0289	-	8.06	0.220	5,160	4,220	-	0.985	7.64	<0.0050	1,600	7.23	<0.020	<0.0020	-	<0.10	5.10	0.0187	0.810	-	80.7	<0.20
			HAC-U-3	0.0443	-	9.75	0.380	7,560	6,640	-	1.51	7.19	<0.0050	2,320	6.06	<0.020	<0.0020	-	<0.10	4.74	0.0284	0.930	-	126	<0.20
			HAC-U-4	0.0385	-	12.6	0.410	7,790	7,300	-	1.50	9.43	<0.0050	2,640	5.04	<0.020	<0.0020	-	<0.10	5.17	0.0306	2.08	-	112	<0.20
			HAC-U-5	0.0512	-	10.0	0.330	8,270	7,560	-	1.66	8.86	<0.0050	3,310	7.25	<0.020	<0.0020	-	<0.10	9.96	0.0198	1.07	-	116	<0.20
			HAC-U-6	0.0567	-	9.19	0.690	7,910	6,710	-	1.64	8.49	0.00960	2,290	9.36	<0.020	0.00310	-	<0.10	14.2	0.0343	2.40	-	131	<0.20
			HAC-U-7	0.0446	-	7.70	1.44	7,450	7,430	-	2.37	7.65	<0.0050	2,410	20.4	<0.020	0.00350	-	<0.10	11.8	0.0526	2.72	-	109	<0.20
			HAC-U-8	0.0556	-	10.0	0.770	8,420	7,580	-	2.34	8.00	<0.0050	2,440	29.5	<0.020	<0.0020	-	<0.10	26.9	0.0607	2.53	-	140	<0.20
	EDC-D	Reference	EDC-D-1	0.0802	-	2.07	12.8	8,690	23,100	-	8.24	2.58	0.0574	4,320	23.4	<0.10	0.0260	-	<0.10	96.7	0.265	10.4	-	164	2.83
			EDC-D-2	0.0292	-	7.86	1.44	8,420	7,480	-	2.41	1.33	0.0137	2,480	9.78	<0.020	0.00400	-	<0.10	9.44	0.0187	1.12	-	98.5	<0.20
			EDC-D-3	0.0513	-	2.70	9.03	8,720	17,100	-	6.26	2.04	0.0370	4,160	15.7	<0.10	0.0201	-	<0.10	55.0	0.157	6.28	-	151	1.36
			EDC-D-4	0.0194	-	8.88	1.82	9,310	8,260	-	2.24	1.05	0.0151	3,280	11.7	<0.020	0.00560	-	<0.10	19.3	0.0359	1.78	-	103	0.280
			EDC-D-5	0.0160	-	8.86	<0.20	9,200	6,410	-	1.64	0.890	0.0100	2,800	11.2	<0.020	<0.0020	-	<0.10	0.880	0.00310	0.150	-	80.4	<0.20
			EDC-D-6	0.0207	-	8.22	0.260	9,380	7,270	-	1.82	1.02	0.0139	3,060	8.82	<0.020	<0.0020	-	<0.10	1.54	0.00540	0.330	-	98.8	<0.20
			EDC-D-7	0.0274	-	6.32	2.46	8,080	5,730	-	1.52	0.850	0.00950	2,540	8.85	<0.020	0.00360	-	<0.10	86.1	0.0233	8.90	-	87.9	0.740
			EDC-D-8	0.0232	-	4.54	0.470	8,540	7,040	-	2.30	1.00	0.00740	2,730	8.69	<0.020	0.00300	-	<0.10	7.52	0.0134	0.690	-	97.7	<0.20
	HAC-D	Exposed	HAC-D-1	0.0275	-	2.58	1.70	8,300	7,700	-	1.89	4.15	0.0231	2,030	13.6	<0.020	0.00790	-	<0.10	20.6	0.0650	3.58	-	178	<0.20
			HAC-D-2	0.0227	-	2.60	1.59	9,270	8,740	-	1.76	4.80	0.0249	2,490	15.6	<0.020	0.00740	-	<0.10	13.7	0.0688	3.60	-	195	<0.20
			HAC-D-3	0.0519	-	1.53	1.69	7,980	7,540	-	1.29	5.13	0.0304	1,640	10.2	<0.020	0.00750	-	<0.10	21.7	0.0791	2.68	-	248	0.220
			HAC-D-4	0.0391	-	1.86	3.77	9,000	9,150	-	2.38	5.18	0.0482	1,900	22.4	<0.020	0.0204	-	<0.10	55.4	0.158	8.78	-	249	0.490
			HAC-D-5	0.0495	-	1.61	2.11	7,930	7,540	-	1.40	5.20	0.0304	1,700	11.2	<0.020	0.00750	-	<0.10	21.9	0.0808	3.03	-	226	<0.20
			HAC-D-6	0.0395	-	1.72	3.09	9,210	8,700	-	1.96	5.24	0.0386	2,030	15.3	<0.020	0.0117	-	<0.10	29.2	0.109	5.51	-	242	0.250
			HAC-D-7	0.0410	-	1.61	2.84	7,400	7,210	-	1.86	4.10	0.0360	1,650	15.2	<0.020	0.0129	-	<0.10	49.0	0.118	6.43	-	213	0.530
			HAC-D-8	0.0451	-	1.62	2.74	8,780	8,710	-	1.54	5.51	0.0312	1,900	9.46	<0.020	0.00700	-	<0.10	18.4	0.0814	2.75	-	255	<0.20

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

Table F.2: Caddisfly Tissue Chemistry Data from Hazeltine Creek (HAC-R1, HAC-U, HAC-D; Exposed) and Edney Creek (EDC-D, EDC-U; Reference), 2017 to 2022

Year	Area	Area Type	Replicate	Mercury		Molybdenum	Nickel	Phosphorus	Potassium	Rhenium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
				mg/kg	mg/kg ww	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2022	EDC-U	Reference	EDC-U-1	0.0418	-	24.2	0.320	7,850	7,170	-	3.49	0.740	0.0830	2,920	3.52	<0.020	0.00340	-	<0.10	4.01	0.00660	0.620	-	103	<0.20
			EDC-U-2	0.0294	-	16.7	<0.20	7,520	6,720	-	2.28	0.680	0.0552	2,660	3.36	<0.020	<0.0020	-	<0.10	0.960	0.00290	0.280	-	83.1	<0.20
			EDC-U-3	0.0392	-	14.5	0.790	9,190	8,350	-	3.00	0.680	0.0374	3,170	4.92	<0.020	<0.0020	-	<0.10	3.71	0.00920	0.470	-	117	<0.20
			EDC-U-4	0.0561	-	1.28	10.6	7,710	12,900	-	5.06	0.590	0.0802	2,390	13.7	<0.020	0.0259	-	<0.10	73.8	0.218	7.52	-	222	1.52
			EDC-U-5	0.0370	-	9.63	<0.20	8,060	7,410	-	2.49	0.720	0.0351	2,950	4.19	<0.020	<0.0020	-	<0.10	1.44	0.00370	0.210	-	83.7	<0.20
			EDC-U-6	0.0447	-	6.23	0.370	7,580	7,070	-	1.87	0.590	0.0331	2,490	3.99	<0.020	0.00220	-	<0.10	2.76	0.00590	0.310	-	93.7	<0.20
			EDC-U-7	0.0309	-	11.5	0.240	8,040	7,430	-	2.04	0.740	0.0228	3,100	3.81	<0.020	<0.0020	-	<0.10	1.24	0.00310	0.300	-	88.2	<0.20
			EDC-U-8	0.0435	-	4.86	0.440	8,100	7,520	-	1.35	0.770	0.0285	3,070	4.20	<0.020	<0.0020	-	<0.10	1.87	0.00420	0.250	-	105	<0.20
	HAC-R1	Exposed	HAC-R1-1	0.0471	-	3.87	<0.20	7,180	5,670	-	0.707	4.50	<0.0050	2,320	3.50	<0.020	<0.0020	-	<0.10	1.22	<0.0020	0.120	-	63.4	<0.20
			HAC-R1-2	0.0603	-	2.63	<0.20	8,460	7,880	-	0.983	5.29	<0.0050	3,200	3.32	<0.020	<0.0020	-	<0.10	2.10	0.00240	0.150	-	62.0	<0.20
			HAC-R1-3	0.0446	-	5.09	0.290	6,860	6,290	-	1.06	5.46	<0.0050	2,180	3.63	<0.020	<0.0020	-	<0.10	5.45	0.00770	0.500	-	101	<0.20
			HAC-R1-4	0.0444	-	6.85	<0.20	6,660	5,670	-	0.716	6.93	<0.0050	1,960	2.37	<0.020	<0.0020	-	<0.10	1.37	<0.0020	0.150	-	76.8	<0.20
			HAC-R1-5	0.0410	-	9.55	0.820	6,940	6,920	-	1.26	10.4	<0.0050	2,180	5.24	<0.020	<0.0020	-	<0.10	7.56	0.0152	0.750	-	119	<0.20
			HAC-R1-6	0.0325	-	9.88	<0.20	6,800	6,370	-	1.20	7.69	<0.0050	2,440	5.59	<0.020	<0.0020	-	<0.10	4.24	0.00700	0.470	-	83.6	<0.20
			HAC-R1-7	0.0329	-	8.77	0.270	6,450	6,130	-	1.01	7.87	<0.0050	2,400	3.95	<0.020	<0.0020	-	<0.10	3.56	0.00650	0.400	-	87.0	<0.20
			HAC-R1-8	0.0429	-	5.49	0.230	6,540	5,850	-	1.14	5.35	<0.0050	2,440	4.80	<0.020	<0.0020	-	<0.10	3.54	0.0116	0.420	-	99.3	<0.20
	HAC-U		HAC-U-1	0.0380	-	11.1	0.770	7,980	6,560	-	1.43	10.1	<0.0050	2,570	13.3	<0.020	0.00210	-	<0.10	9.92	0.0266	0.930	-	104	<0.20
			HAC-U-2	0.0233	-	12.4	0.370	7,660	6,160	-	1.12	17.8	0.00510	2,580	12.5	<0.020	<0.0020	-	<0.10	27.2	0.0244	1.87	-	76.0	<0.20
			HAC-U-3	0.0303	-	9.71	0.210	7,440	6,040	-	1.02	12.4	<0.0050	2,480	6.87	<0.020	<0.0020	-	<0.10	5.09	0.00810	0.440	-	71.2	<0.20
			HAC-U-4	0.0456	-	9.67	0.270	7,670	7,120	-	1.22	15.4	<0.0050	2,810	5.60	<0.020	<0.0020	-	<0.10	4.08	0.0137	0.480	-	82.1	<0.20
			HAC-U-5	0.0433	-	9.20	0.260	6,780	6,180	-	1.24	13.1	<0.0050	2,240	5.99	<0.020	<0.0020	-	<0.10	5.22	0.0160	0.680	-	88.3	<0.20
			HAC-U-6	0.0424	-	8.68	0.330	7,190	6,700	-	1.34	12.0	<0.0050	2,330	6.45	<0.020	<0.0020	-	<0.10	3.33	0.0258	0.520	-	88.3	<0.20
			HAC-U-7	0.0398	-	11.8	0.360	7,640	6,150	-	1.17	14.7	<0.0050	2,370	8.13	<0.020	<0.0020	-	<0.10	4.18	0.0198	0.550	-	98.4	<0.20
			HAC-U-8	0.0750	-	8.16	0.270	7,090	6,770	-	1.17	9.65	<0.0050	2,570	4.17	<0.020	<0.0020	-	<0.10	4.90	0.0102	0.470	-	82.0	<0.20
	EDC-D	Reference	EDC-D-1	0.0591	-	5.60	3.88	9,140	9,200	-	3.14	1.21	0.0343	3,280	11.9	<0.020	0.0111	-	<0.10	27.2	0.0567	2.40	-	98.8	0.530
			EDC-D-2	0.102	-	2.65	5.88	7,970	7,880	-	2.02	1.77	0.0480	2,840	5.60	<0.020	0.00750	-	<0.10	17.9	0.0400	1.69	-	106	0.330
			EDC-D-3	0.0548	-	4.56	8.01	7,430	8,790	-	3.96	1.51	0.0406	2,520	22.4	<0.020	0.0193	-	<0.10	80.7	0.160	9.81	-	110	1.47
			EDC-D-4	0.0579	-	2.12	21.5	5,700	5,100	-	2.93	1.10	0.0566	1,910	12.8	<0.020	0.0166	-	<0.10	160	0.182	17.1	-	73.2	2.30
			EDC-D-5	0.0698	-	2.28	10.9	7,840	8,780	-	3.67	1.97	0.0502	2,980	17.3	<0.020	0.0188	-	<0.10	43.6	0.178	5.32	-	138	0.920
			EDC-D-6	0.0769	-	2.91	4.59	8,680	7,960	-	2.20	1.85	0.0368	3,100	7.92	<0.020	0.00830	-	<0.10	22.1	0.0434	2.60	-	160	0.520
			EDC-D-7	0.0853	-	3.90	9.34	8,490	7,120	-	2.94	1.63	0.119	5,760	24.5	0.0550	0.0140	-	<0.10	252	0.149	34.0	-	114	2.52
			EDC-D-8	0.0295	-	3.69	1.46	8,210	5,490	-	1.29	0.670	0.0117	2,580	7.65	<0.020	0.00360	-	<0.10	31.1	0.0166	2.85	-	80.6	0.200
	HAC-D	Exposed	HAC-D-1	0.0466	-	4.15	0.760	7,730	7,000	-	1.33	5.56	0.00940	2,410	7.03	<0.020	0.00480	-	<0.10	11.3	0.0270	1.01	-	168	<0.20
			HAC-D-2	0.0482	-	3.07	1.12	8,340	7,790	-	1.60	5.59	0.0131	2,600	9.27	<0.020	0.00410	-	<0.10	15.7	0.0371	1.36	-	146	0.240
			HAC-D-3	0.0673	-	3.25	1.44	7,180	7,040	-	1.42	5.43	0.0201	1,970	11.1	<0.020	0.00460	-	<0.10	20.2	0.0828	1.90	-	147	0.280
			HAC-D-4	0.0586	-	3.55	1.36	7,440	7,460	-	1.41	5.13	0.0186	2,080	7.22	<0.020	0.00440	-	<0.10	17.7	0.0485	1.61	-	140	0.260
			HAC-D-5	0.0472	-	3.88	1.95	6,790	6,790	-	1.47	4.04	0.0281	2,760	14.1	<0.020	0.00550	-	0.110	145	0.0765	12.2	-	87.3	2.30
			HAC-D-6	0.0500	-	3.88	0.670	7,220	7,220	-	1.14	3.86	0.00680	2,790	5.18	<0.020	0.00220	-	<0.10	7.54	0.0261	0.860	-	100	0.290
			HAC-D-7	0.0353	-	4.15	0.860	6,340	6,210	-	1.38	3.21	0.00650	2,170	7.72	<0.020	0.00400	-	0.100	11.0	0.0190	1.02	-	84.3	<0.20
			HAC-D-8	0.0433	-	3.99	0.330	6,450	6,480	-	1.08	3.84	<0.0050	2,240	4.12	<0.020	<0.0020	-	<0.10	3.41	0.00800	0.420	-	70.7	<0.20

Notes: mg/kg = milligrams per kilogram dry weight. mg/kg ww = milligrams per kilogram wet weight. "-" = no data available. All results are presented as three significant digits.

APPENDIX G
QUALIFIED PROFESSIONALS
DECLARATIONS AND DISCLOSURES

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Pierre Stecko

   Title Senior Aquatic Scientist / Managing Principal

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 1709

3. Brief description of professional services:

   Preparation of a technical memo to support permit application.

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X 

Print Name: Pierre Stecko

Witnessed by:

X 

Print Name: Katharina Batchelar

Date signed: October 20, 2023

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA
Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act,* the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Pierre Stecko, as a member of the College of Applied Biologists declare

Select one of the following:

☑ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this permit application.
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc Lachance, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

_____

_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Signature:

X _____

Print name: Pierre Steckco

Date: October 20, 2023

Witnessed by:

X _____

Print name: Katharina Batchelar

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Katharina Batchelar

   Title Senior Aquatic Scientist

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biologists Registration # 3103

3. Brief description of professional services:

   Preparation of technical memorandum to support permit application.

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x K Batchelar

Print Name: Katharina Batchelar

Witnessed by:

x

Print Name: Pierre Stecko

Date signed: 20-Oct-23

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA
Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act,* the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Katharina Batchelar, as a member of College of Applied Biologists declare

Select one of the following:

☑ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this permit application.
I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Luc Lachance, erring on the side of caution.

☐ Real or perceived conflict of interest

Description and nature of conflict(s):

_____

_____

_____

I will maintain my objectivity, conducting my work in accordance with my Code of Ethics and standards of practice.

In addition, I will take the following steps to mitigate the real or perceived conflict(s) I have disclosed, to ensure the public interest remains paramount:

_____

_____

_____

Further, I acknowledge that this disclosure may be interpreted as a threat to my independence and will be considered by the statutory decision maker accordingly.

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Signature:

x K Batchelar

Print name: Katharina Batchelar

Date: 20-Oct-23

Witnessed by:

x

Print name: Pierre Steelco

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and

b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.

APPENDIX 2-7: Annual Groundwater Monitoring Report

REPORT

2022 Annual Groundwater Monitoring Report

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

Box 12
Likely, BC V0L 1N0

Submitted by:

WSP Canada Inc.
840 Howe Street, Suite 1000 Vancouver, British Columbia, V6Z 2M1

Reference No. 23590671-019-R-Rev0-31491

29 March 2023

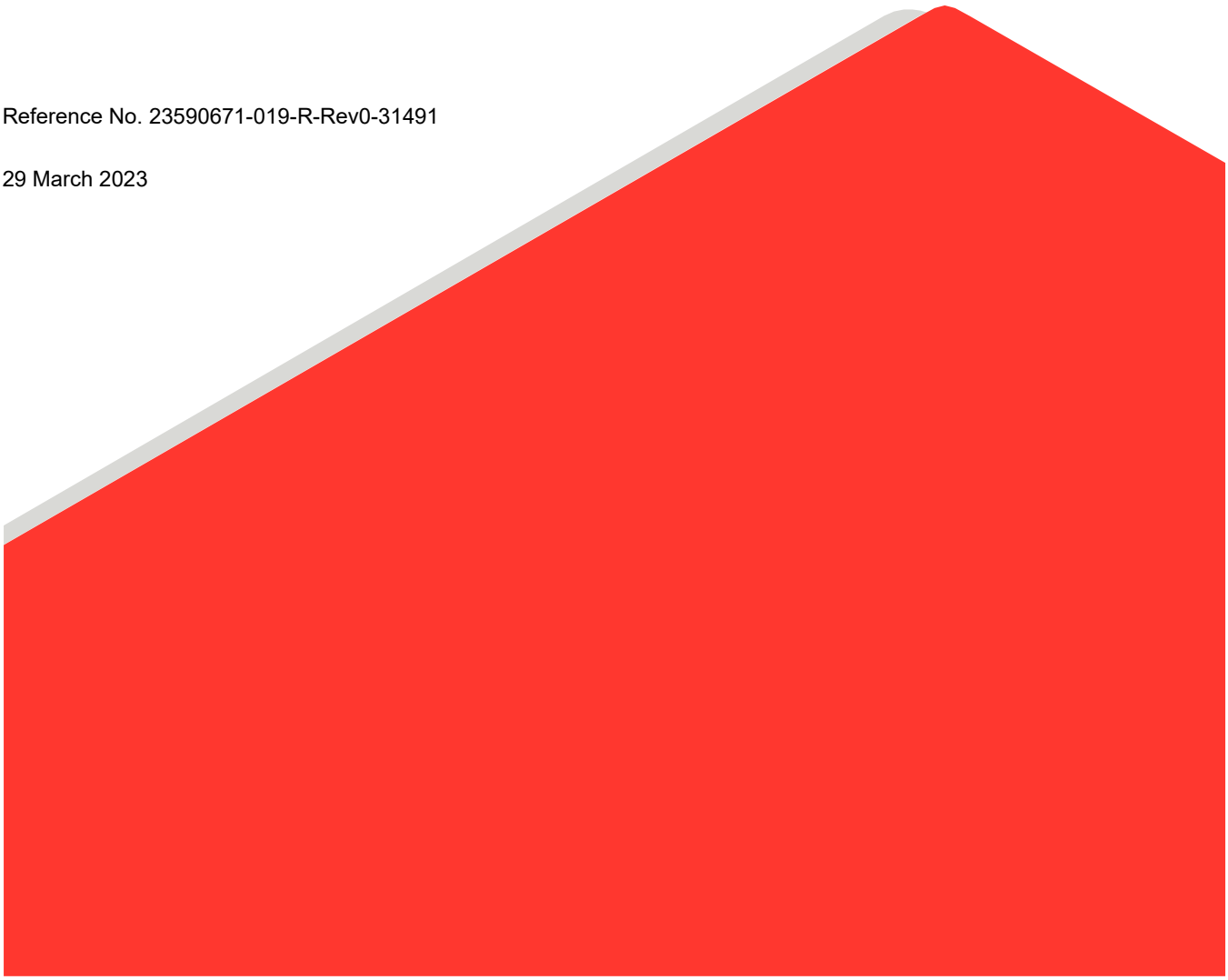

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1.0 INTRODUCTION

At the request of Mount Polley Mining Corporation (MPMC), WSP Canada Inc. (WSP; formerly Golder Associates Ltd. [Golder]) reviewed the results of the 2022 annual groundwater monitoring program for the Mount Polley mine. This monitoring program is part of the Comprehensive Environmental Monitoring Plan (CEMP), and meets the following section of the BC Ministry of Environment and Climate Change Strategy Permit 11678 (the Permit): Section 4.2.3 of the Permit, which requires a groundwater monitoring program review, including sampling, well locations, site water balance, interpretation of trends and possible environmental impacts, and recommendations, if any.

2.0 OBJECTIVE AND SCOPE OF WORK

The purpose of this letter is to summarize the results of the annual groundwater monitoring program conducted by MPMC and WSP to support the Permit requirement and annual reporting for 2022. The scope of work is summarized as follows:

- Groundwater sampling and water level monitoring between January and December 2022 (completed by MPMC).
- Review and plot groundwater level and groundwater quality data collected for available monitoring wells. This includes wells associated with the Tailings Storage Facility (TSF) and Springer Pit. Similar to previous annual monitoring reports, chemical analytical results were assessed for trends and compared against the British Columbia (BC) Ministry of Environment and Climate Change Strategy (ENV) Contaminated Site Regulation (CSR) and the BC Water Quality Guidelines (WQG).
- Summarize the results of the annual monitoring program in this letter report, providing recommendations for adjustments to the ongoing monitoring program, if applicable.
- Comment on sampling methods changes, if any.
- Comment on changes in seepage from Springer Pit, if any.

3.0 GROUNDWATER MONITORING REQUIREMENTS

Groundwater monitoring requirements were based on those outlined in Permit 11678 and within the CEMP (MPMC 2019) as follows.

3.1 Permit 11678 Requirements

Permit 11678 was originally issued on 30 May 1997, and has been amended several times since that date, with the most recent amendment issued 31 December 2020. As specified in the Permit, the objective of the monitoring being completed as part of the CEMP is to evaluate the effects of mine-related activities on various characteristics of surface waters, riparian areas and upland areas within and around the mine site. This report specifically addresses the groundwater monitoring component of the CEMP.

Reporting requirements specifically associated with the groundwater monitoring program consisted of the following:

- Reporting groundwater monitoring sample results required under the Permit.
- Providing an update to any modelling related to the Springer Pit groundwater seepage and its impacts on Bootjack Lake.
- Reporting trend analysis (graphs) of water monitoring data at each site for a minimum of the past five years.

We note that no modelling related to groundwater seepage has been conducted and is therefore not discussed herein.

3.2 Existing Monitoring Well Network

Monitoring wells were developed at the site between 1995 and 2016. A summary of wells that are listed in the CEMP as part of the groundwater monitoring program are outlined below, and their locations are shown in Figure 1. Both multi-level and single depth monitoring wells were included in the 2022 groundwater monitoring program as follows.

Table 1: Monitoring Well Network

Year	Well Series	Well Numbers	Comments
1995	95	R5	Several wells were drilled in 1995; however, only 95-R5 still exists.
1996	GW96	1b[(a)]; 2a, b; 3a, b[(b)]; 4a, b; and 7	Initially nine wells were drilled with eight installed as multi-level wells. Currently only six monitoring wells[(c)] are monitored (two multi-level wells and two single well locations).
2000	GW00	1a, b; 2a, and 3a, b	Installed along southeast embankment of TSF.
2005	GW05	1	GW05-1 was installed as a pumping well to capture groundwater moving from Polley Lake towards the Wight Pit, pumping it back into Polley Lake.
2011	GW11	1a, b; and 2a, b	Two pairs of multi-level wells were installed to monitor potential impacts from newly disturbed areas.
2012	GW12	1a, b; 2a, b; 3a, b; 4a, b; and 5a, b	Five pairs of multi-level wells were installed to collect additional groundwater information.
2014	GW14	1	Domestic well at Orica site.
2015	GW15[(d)]	1a, b; and 2a, b	Two pairs of multi-level wells installed to monitor seepage conditions associated with Springer Pit Lake.
2016	GW16	1a, b; 2a, b; 3a, b; 4a, b; 5a, b; 6a, b; 7; and 8	Additional monitoring wells installed at various locations to monitor current groundwater quality, and eventually at closure.

Notes:

In multi-level well installations, “a” represents deep well, and “b” represents shallow well.

Only wells identified in the most recent CEMP (MPMC, 2019) have been identified in the table.

(a) Groundwater monitoring at GW96-1a, and GW96-1b was ceased in 2018 based on Golder’s recommendation, and has been removed from the CEMP sampling requirements, however historical data is included in the chemistry plots.

(b) Groundwater monitoring well is decommissioned.

(c) Currently monitored wells consist of GW96-2a, GW96-2b, GW96-3a, GW96-4a, GW96-4b, and GW96-7.

(d) Only groundwater level was monitored at GW15-1a and GW15-1b.

4.0 SITE CONCEPTUAL MODEL

Situated on a topographic high and centred on Polley Mountain is the main mine site, which reaches an elevation of approximately 1250 metres above sea level (masl). Bootjack Lake is located to the southwest of the mine site, and Polley Lake is located to the northeast of the mine site. Infrastructure of note at the mine site consists of the mill, in the approximate centre of the mine site, the tailings storage facility (TSF), located about 3 km southeast of the mill in a topographically low area, several pits (Springer, Cariboo, Wight, and Boundary) and Hazeltine Creek (Figure 1). Hazeltine Creek flows southeast and then east from Polley Lake to Quesnel Lake; Quesnel Lake is located approximately 5 km to the east of the TSF. Numerous groundwater monitoring wells are located throughout the site (see Table 1).

The climate is described as a humid, continental climate with the driest season in spring and the wettest season in summer. Groundwater recharge occurs through the infiltration of precipitation in the topographic high area of Polley Mountain and the surrounding slopes, excluding the existing mine pits. The open pits act as sinks for groundwater flow when they are dewatered, and as both sinks and sources of groundwater seepage when flooded to the spillover elevation. The primary groundwater discharge areas next to the mine site are: Polley Lake to the east, Bootjack Lake to the west, and an area near the TSF and Hazeltine Creek (located to the southeast of the TSF). Bootjack Lake, Polley Lake, and Quesnel Lake, the largest lake in the area located about 5 km to the east of the mine site, strongly control regional groundwater flow and act as significant hydrogeological boundaries.

The mine site is underlain by monzonite bedrock that has been intruded by hydrothermal breccias and intersected by northwest–southeast striking faults. The bedrock in the area of the Springer and Cariboo pits is overlain by a discontinuous and relatively thin (i.e., a few metres) layer of overburden of glacio-lacustrine and glacio-fluvial origin, primarily silt/clay. Near the Wight Pit, a thicker zone of overburden is identified between the southeast crest of the pit and Polley Lake, with coarser and more permeable sand/gravel sediments present at depth directly above bedrock.

The overburden underlying the TSF consists predominantly of glacial till with interbeds of glaciofluvial and glacio-lacustrine sediments. The overburden ranges in thickness from approximately 5 m along a bedrock knoll near the south embankment to approximately 65 m along portions of the main embankment (Golder 2015a and Golder 2015b, Fig. 6 and 9). The underlying shallow bedrock is weathered and/or fractured and predominantly volcanic conglomerate (IMC 1990). The thickness of this weathered bedrock zone is highly variable and is inferred to range from 2 m to 43 m (based on borehole logs for the 1996 series monitoring wells [Knight Piésold Ltd. 1997] and the 2015 series boreholes [Golder 2015d]). Competent bedrock that underlies the weathered zone consists of Nicola Group volcanics that, according to the local geology map (Logan et al. 2007), likely consist of undivided mafic volcanic and volcaniclastic rocks and/or intrusive rocks (pseudoleucite syenite). Drilling observations in the TSF footprint prior to mining indicated predominately volcanic conglomerate bedrock (IMC 1990).

According to MPMC (2017), groundwater flow at the mine site occurs primarily in the bedrock units. Although there is groundwater flow in the overburden units, it is less significant due to its limited thickness and discontinuous nature. Prior to mining of the site, the direction of groundwater flow was inferred to be from areas of topographic high (i.e., the top of the ridge between the Polley Lake and Bootjack Lake) to areas of topographic low (i.e., the lakes). However, after mining commenced, and as a result of mine dewatering, the groundwater flow direction at the mine site has changed. Mine dewatering has lowered the groundwater elevation and created radial flow towards the various pits.

5.0 GROUNDWATER SAMPLING METHODS

Groundwater sampling was conducted by MPMC staff in 2022 as per sampling methods described in their QA/QC Manual (MPMC 2020). Between the initiation of the groundwater monitoring program in 2015 until approximately mid-2018, MPMC used a submersible pump (Grundfos) and peristaltic pump to collect groundwater samples from the groundwater monitoring well network. Due to a pump failure in mid-2018, MPMC initiated groundwater sample collection using low-flow sampling with a peristaltic pump for a majority of the monitoring wells, particularly the last two sampling events of 2018. A comparison of pre and post 2018 groundwater data inferred that the change in sampling has not affected the reliability of the analytical results. In 2022, MPMC used a Grundfos pump for wells GW12-2 (a, b), GW15-2 (a, b), GW96-2 (a, b), GW12-4 (a, b), GW16-2 (a, b), GW16-3 (a, b), and GW16-7 and GW16-8. The remainder of the monitoring wells are sampled with a peristaltic pump. MPMC followed similar sampling methods of WSP (formerly Golder) and previous MPMC programs. This includes low-flow technique (using peristaltic pump) for wells with groundwater level less than 10 metres below top of casing (mbtoc) and using submersible pump (i.e., Grundfos pump) for wells with groundwater level greater than 10 mbtoc.

During groundwater sample collection, field parameters were measured (i.e., water level, temperature, pH and conductivity). Select wells were then either purged and sampled on the same day or purged and sampled the next day.

To maintain sample integrity, groundwater samples for laboratory analyses were submitted within the laboratory recommended hold times after collection. Holding times may have been exceeded for preserved and unpreserved samples if the laboratory was unable to initiate testing promptly following sample receipt or if there were delays in sample delivery to the laboratory. Duplicate groundwater samples were collected during select sampling events. Data regarding laboratory and field quality assurance/quality control were not provided to WSP for review by MPMC.

6.0 2022 ANNUAL GROUNDWATER MONITORING

Groundwater monitoring has been ongoing at the mine site since 1995 with the objectives to monitor direction, quantity, and quality of groundwater seepage near all mine facilities (MPMC 2019).

Groundwater levels were measured, at a minimum, semi-annually on approximately the same day, and generally more frequently, in monitoring wells to detect changes in groundwater flow directions. Pressure transducers were also installed at GW12-2a and GW12-2b to record changes in pressures every hour. A barologger installed at GW12-2a records barometric pressure at the same frequency, allowing for correction of pressure transducer data for barometric changes.

The groundwater monitoring program outlined in the CEMP (MPMC 2019) currently consists of numerous multi-level monitoring wells (each set consists of deep and shallow wells), and single wells surrounding the mine site, as shown in Figure 1. Not all groundwater monitoring wells outlined in the CEMP were sampled during the 2022 monitoring program. The groundwater sampling frequency for the monitored wells in 2022 was as follows:

- Monitoring wells GW 15-2a and GW12-2 (a, b) were sampled quarterly in 2022.
- The following wells were sampled twice in 2022; once in the spring and once in the fall, to monitor seasonal changes in water quality: Wells 95-R5, GW96-2(a, b), GW96-3a, GW96-4b, GW00-1b, GW00-3b, GW11-1(a, b), GW11-2(a, b), GW12-1 (a, b), GW12-3 (a, b), GW12-4 (a, b), GW12-5(a, b), GW16-1 (a, b), GW16-2 (a, b), GW16-3 (a, b), GW16-4 (a, b), and GW16-5 (a, b), GW16-7, GW96-2(a, b).
- The following wells were sampled once in 2022: GW96-7, GW96-4a, GW00-1a, and GW00-3a.
- Monitoring wells GW15-2b and GW14-1 were sampled three times in 2022.
- The following wells were sampled more than quarterly in 2022: GW16-8, GW16-7, and GW05-01.

The above-mentioned wells were sampled for the following parameters:

- field parameters: pH, conductivity and temperature
- physical tests: conductivity, hardness, and pH
- anion and nutrients: alkalinity, ammonia, chloride, fluoride, nitrate and nitrite, nitrate, nitrite, total nitrogen, total dissolved phosphorus, total phosphorus, and sulphate
- dissolved metals: aluminium, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silicon, silver, sodium, strontium, thallium, tin, titanium, uranium, vanadium, and zinc

6.1 Groundwater Elevations

In 2022, MPMC carried out static water level monitoring from top-of-pipe for the monitoring wells within the monitoring program. Static water levels and associated groundwater elevations (or hydraulic heads) for 2022, and well coordinates and elevations are provided in Table 2; the hydraulic heads over time are shown in plots in Figure 2. Groundwater elevation data recorded at GW12-2a and GW12-2b using pressure transducers are corrected for barometric pressure and plotted for comparison from 23 February 2022 to 30 June 2022 for GW12- 2a, and 7 July 2022 for GW12-2b (Appendix A).

The following observations are provided regarding the 2022 groundwater elevations and historical trends.

General Observations

Historically, groundwater elevations on the west side of the mine site (980 masl to 1,035 masl) are generally higher than those on the east side of the mine site (905 masl to 980 masl). Groundwater elevations around the TSF historically ranged from 880 masl to 965 masl.

- Groundwater elevations were available for 19 groundwater well pairs in May/June and 11 groundwater well pairs in September/November 2022 (Table 3). Comparison of the shallow versus deeper groundwater elevations at the paired well locations indicated the following:
  - In May 2022, the vertical component of groundwater flow was upwards (from deep to shallow) at six of the 19 locations, and downwards (from shallow to deep) at 13 of the paired locations.
  - In November 2022, out of the 11 paired well locations, two paired wells exhibited an upward hydraulic gradient (from deep to shallow), three wells exhibited no vertical hydraulic gradient, and five paired wells exhibited a marginal downwards (from shallow to deep) hydraulic gradient.
  - Groundwater elevations at GW12-2a and GW12-2b were monitored using a pressure transducer. Due to the gap in data from the dataloggers between 1 January and 23 February 2022, and the lack of data after June 2022, an evaluation of annual groundwater elevations cannot be determined for 2022. However, between February and March, groundwater elevations remained fairly steady at both wells. Groundwater elevations rose approximately 4 m in late March 2022 until early May at both wells, after which time groundwater elevations began slowly dropping again. Pressure transducer data is provided in Appendix A for the period between 23 February and June 2022.

6.1.1 Monitoring Wells on the West Side of the Mine Site

- Six paired groundwater wells were monitored for vertical flow direction at this location (Table 3 and Figure 1) during the May/June 2022 groundwater level monitoring program, and four paired groundwater wells during September/November 2022. Five paired wells (GW12-1, GW12-2, GW12-3, GW15-1 and GW15-2) exhibited downward (shallow to deep) groundwater flow in May/June 2022, while GW16-6 exhibited upward (deep to shallow) groundwater flow.
- Groundwater elevations at GW15-1 exhibited a downwards vertical gradient in 2022, while in 2021 the vertical gradient was upwards.
- The remaining monitoring wells on the west side of the mine site remained relatively stable to previous years.
- Based on a review of groundwater elevations on the west side of the mine site, it can be inferred that a groundwater divide between the Springer Pit and Bootjack Lake remains in the area of GW12-2(a,b), GW15-1(a/b) and GW15-2(a,b), as groundwater elevations at these wells remained higher than the surface water elevation in Springer Pit. Monitoring well GW15-1(a,b) generally exhibited groundwater elevations more similar to the elevation of water in Springer Pit in 2022. This groundwater divide results in groundwater flow both towards the east and west from the groundwater divide (shown in Figure 2).
- Surface water elevations in Cariboo Pit starting in June 2022 began to decrease, and during December 2022 was approximately the same surface water elevation as Springer Pit (Table 2 and Figure 2).

6.1.2 Monitoring Wells on the East Side of the Mine Site

- Five paired groundwater wells were monitored for vertical flow direction on the east side of the mine site (Table 3 and Figure 1). With the exception of paired wells GW16-7 and GW16-8 (in May and November) and GW16-1(a,b) (in May and November), vertical groundwater gradients exhibited a downward (shallow to deep) groundwater flow direction.
- In 2022, groundwater monitoring wells located on the east side of the mine site remained relatively consistent with groundwater elevations in previous years.
- Monitoring wells GW16-7 and GW16-8 had the lowest groundwater elevations in 2022, between approximately 913 and 915 masl, slightly elevated to previous year's datum which ranged between 906 to 907 masl during winter and spring but increased to elevations similar to 2022 in the summer 2021. These monitoring wells are located at the north end of Polley Lake, between Wight Pit and Polley Lake. These groundwater elevations were lower in elevation than Polley Lake, where the surface water elevation has stayed relatively consistent at approximately 920 masl (between 2015 and 2022). The remaining monitoring wells within the east side of the mine site exhibited groundwater elevations greater than the elevation of Polley Lake.
- The highest groundwater elevations were measured at GW12-4b, to the north/northeast of the southeast rock disposal site (SERDS) area, with elevations of approximately 976 masl.
- Based on a review of the groundwater elevations on the east side of the mine site, groundwater is inferred to flow from higher topographic elevations towards the east, to Polley Lake.

6.1.3 Monitoring Wells Around the TSF

- Eight paired groundwater wells were monitored for vertical flow direction in the area around the TSF (Table 3 and Figure 1). With the exception of groundwater flow directions in May at GW96-4(a), and both sampling events in GW00-1(a,b) and GW00-3(a,b), all located on the southwest side of the TSF, the vertical direction of groundwater flow was downward (from shallow to deep).
- Similar to 2021 conditions, monitoring well GW96-3a exhibited flowing artesian conditions each sampling event in 2022, with the exception of 13 June 2022 (water level 0.5 mbgs, and 17 November 2022 (water level frozen at the top of pipe [assumed artesian conditions]).
- Surface water elevations for the TSF have remained relatively stable between 2018 and 2022 (961 to 963 masl). The TSF surface water elevations continue to be higher than the groundwater elevations at the monitoring wells located to the south, southeast and northeast (Figure 2). An exception to this is groundwater elevations observed at GW16-5b, which were very similar to the surface water elevations observed at the TSF; this is consistent with the trends from 2019 to 2021.
- The groundwater flow direction around the TSF is dependent on the height of water within the TSF. Provided that surface water elevations within the TSF are greater than the surrounding wells, flow will be radial from the TSF to the monitoring wells. However, when the surface water elevation at the TSF is less than the groundwater elevations (specifically on the west and southwest side of the TSF), then groundwater will flow through the TSF, discharging towards the northeast and southeast. As shown in Figure 2, and based on groundwater elevations indicated in Table 2, it can be inferred that groundwater flows from the TSF towards the northeast, southeast and southwest, with potentially some inflow into the TSF from the west (i.e., area of GW16-5(b).

6.2 Groundwater Quality

MPMC provided their 2022 groundwater quality data files; monitoring changes in groundwater quality focused on nine Parameters of Interest (POIs) that included:

- physical parameters: hardness
- anions: sulphate
- nutrients: nitrate
- dissolved metals: aluminum, arsenic, cadmium, copper, molybdenum, and selenium

Monitoring wells were grouped into the following three mine site areas:

- Monitoring wells located on the west side of the mine site, between the mine site and Polley Lake: GW12-1(a, b), GW11-1(a, b), GW15-1(a, b), GW12-2(a, b), GW15-2(a, b), GW16-6(a, b), GW12-3(a, b), and GW96-7.
- Monitoring wells located on the east side of the mine site, between the mine site and Polley Lake: GW16-8, GW16-7, GW05-01, GW12-5 (a, b), 95-R5, GW12-4 (a, b), GW16-1 (a, b), and GW11-2 (a, b).
- Monitoring wells surrounding the TSF: GW16-2 through 5 (a, b), GW14-1, GW96-2 (a,b), GW96-3a, GW96-4 (a,b), GW00-2a, GW00-3 (a,b), and GW00-1 (a, b).

As per the CEMP (2019), groundwater quality data was compared against the British Columbia (BC) Ministry of Environment and Climate Change Strategy Contaminated Site Regulation (CSR; BC Reg. 375/96, O.C. 1480/96, as updated [includes amendments up to BC Reg. 179/2021, updated to 7 July 2021]) for protection of freshwater aquatic life (BC CSR AW-F) standards (BC 2021) and the BC Water Quality Guidelines for protection of aquatic life (ENV 2021). The result of the groundwater quality data screened against these guidelines was not interpreted beyond what is provided in Appendix C.

The following provides a summary of the water quality in 2022 and a comparison to the historical data. Groundwater chemistry plots are provided in Figure 3 through Figure 5. Note that parameter concentrations reported to be less than the laboratory detection limit are not plotted, and for any wells with less than one year of monitoring data, parameter concentration trends were not discerned.

6.2.1 West of Mine Site

Historical and current groundwater quality for monitoring wells located on the west side of the mine site, including those wells located between the mine site and Bootjack Lake, are shown in Figure 3. Select plots (nitrate, sulphate, and copper) are also provided in Appendix B, with a semi-log scale in order to show the lower concentrations. For the west side of the mine site, the following observations regarding water quality are made:

- Historically (2013-2021), hardness concentrations have ranged between approximately 24.8 mg/L at GW15-1a in 2015 to 545 mg/L at GW12-3a in 2018. In 2022, hardness concentrations ranged from a minimum concentration of 48.5 mg/L at GW12-2a in June, to a maximum concentration of 382 mg/L at GW12-1b in June 2022.
- Trends in sulphate concentrations were similar to those noted for hardness, with the greatest concentration fluctuations observed at GW15-1b, GW12-3a and GW12-1b. Although GW12-1b has shown an increasing trend between 2018 and early 2021, since then, sulphate concentrations have remained relatively consistent. A slight increasing trend was observed at GW16-6b, and GW15-2b, and a decreasing trend was observed at GW12-3a. The remaining wells indicated relatively stable concentrations of sulphate. In 2022, the sulphate concentrations ranged from a minimum of 23.4 mg/L at GW11-1b in May to a maximum of 307 mg/L at GW12-1b in May.
- Nitrate (as N) concentrations in monitoring wells between the mine site and Bootjack Lake are generally highest in GW12-3a, which has shown an overall decreasing trend in concentrations between May 2014 to September 2022. In general, nitrate (as N) concentrations have also experienced a decreasing trend at GW12-3a and GW12-2b. A slight increasing trend is observed at GW16-6b since 2019, and at GW12-3b. The remaining wells sampled within the last several years have exhibited a relatively stable trend in nitrate concentrations (as N). In 2022, the nitrate concentrations ranged from a maximum of 2.5 mg/L at GW12-3a in June to less than the laboratory reporting detection limit at several wells (see Figure 3 and nitrate plot provided in Appendix B).
- The following observations were made regarding the dissolved metal POIs:
  - Dissolved aluminum concentrations in 2022 have increased slightly in 2022 as compared to 2021 concentrations. A slight increasing trend is noted at GW12-2a and GW15-2b. An anomalous spike in concentration was observed in GW12-2b and GW96-7 in August 2022, and GW15-2b in November 2022.
  - Although some wells initially exhibited either a slightly increasing or decreasing trend in dissolved arsenic, arsenic concentrations overall have continued to stabilize at wells over the past several years, and no discernable trends are noted. Dissolved arsenic concentrations at GW12-3b have historically been the highest in the west area of site, which continues to exhibit a decreasing trend from 2017 to present. Since 2020, GW16-6a has surpassed arsenic concentrations at GW12-3b, to become the highest concentration of arsenic in the west area of the site.
  - Concentrations of dissolved cadmium at GW12-1b reached a peak in 2021 and decreased in concentration in 2022.
  - Dissolved copper concentrations at GW12-1b peaked in 2020, and since then have trended downwards.

- In general, trends in dissolved molybdenum are similar to previous years. GW12-1b exhibits a decreasing trend with its lowest concentration of dissolved molybdenum (0.011 mg/L) observed in September 2022.
- Dissolved selenium concentrations continue to remain stable or show a decreasing trend compared against historical results. Concentrations of dissolved selenium at GW12-3a show a decreasing trend since reaching a peak concentration in 2018.

6.2.2 East of Mine Site

Historical and current groundwater quality for monitoring wells located on the east side of the mine site, between the mine site and Polley Lake, are shown in Figure 4. Select plots (nitrate and aluminum) are also provided in Appendix B, with a semi-log scale in order to show the lower concentrations. The following observations regarding water quality are made:

- Historically, hardness concentrations have been relatively stable at the majority of the monitoring wells, with a slightly decreasing trend observed at GW12-5b overall. Overall, hardness has fluctuated the most at GW11-2 between 2015 and the present. In 2022, hardness concentrations ranged from a minimum of 17 mg/L at GW16-1a in September to a maximum of 594 mg/L at 95-R5 in June 2022.
- Sulphate concentration trends are observed to be generally increasing at GW16-7 and GW16-1b. Decreasing trends are observed at GW12-5b and GW16-8.
- Nitrate (as N) concentrations in monitoring wells between the mine site and Polley Lake were historically highest at GW16-7, with maximum concentrations in 2017 reported to be approximately 0.617 mg/L in June, but have decreased to levels similar to surrounding wells from 2020 to present. Over the last several years, nitrate (as N) concentrations have also been decreasing at GW12-5b. A spike in nitrate concentrations were observed at GW16-8 in 2022, with the highest concentration (0.27 mg/L) in December 2022. The remaining wells indicated relatively stable concentrations of nitrate (as N).
- The following observations were made regarding the dissolved metal POI trends:
  - Dissolved aluminum concentrations are generally less than 0.1 mg/L at all wells, with the exception of concentrations at GW11-2a, which have historically ranged from a peak of 1.44 mg/L (May 2020) to 0.91 mg/L (July 2022).
  - Dissolved arsenic concentrations are generally stable at wells on the east side of the mine site, with the exception of GW16-1a/b (which show opposite trends; 16-1a has been decreasing while 16-1b has been increasing), and 95-R5 (decreasing since 2019).
  - Dissolved cadmium concentrations appear to show seasonal variability at most wells, and no discernable trends are noted. An anomalous spike was observed at GW16-8 in November 2022, before returning to concentrations similar to historical values.
  - Concentrations of dissolved copper generally exhibit seasonal fluctuations which are comparable to concentrations seen in previous years. A peak concentration of dissolved copper was observed in GW11-2a in July 2022.

- Dissolved molybdenum concentrations are generally stable from previous years. An increasing trend is observed at GW11-2a (since 2018), GW12-4a, and GW16-1a.
- Dissolved selenium concentrations at GW16-7 reached a peak concentration in 2021, and since then have shown a decreasing trend. GW05-01 reached a peak concentration in February 2022, and since then have returned to concentrations below historical.

In addition to the above, MPMC staff collected additional groundwater samples from GW16-8 and GW16-7 throughout three sampling events in 2022, to monitor water quality during the filling of Wight Pit, and due to an observed increase in groundwater levels at each well. A more in-depth discussion on Wight Pit chemistry and water levels is included in Appendix D.

6.2.3 Surrounding TSF

Historical and current groundwater quality for monitoring wells located around the TSF are shown in Figure 5. Select plots (nitrate and aluminum) are also provided in Appendix B, with a semi-log scale in order to show the lower concentrations. The following observations regarding water quality are made:

- Over the last several years, hardness concentrations have remained relatively stable at the wells surrounding the TSF, with the exception of a slightly increasing trend at GW96-4b and GW16-2b, and a decreasing trend at GW16-3a and GW16-4b. The maximum hardness concentration observed was 633 mg/L at GW96-4b in September 2022, and the minimum concentration observed was 32 mg/L at GW96-3a in September 2022.
- Sulphate concentration trends were observed to be increasing over the last several years at GW96-4b, GW16-2b and GW96-2b. Sulphate concentrations indicated a decreasing trend over the last several years at GW16-3a, GW00-1b, and GW16-4a. The remaining wells indicated relatively stable or slightly decreasing concentrations of sulphate.
- No notable changes in nitrate (as N) concentrations in monitoring wells surrounding the TSF were observed, with the exception of decreasing concentrations observed at GW16-2b since mid-2019, and stabilizing concentrations observed at GW00-1b and GW96-4b, which indicated current concentrations similar to surrounding wells.
- The following observations were made in regards to the dissolved metal POIs over the last several years:
  - Dissolved aluminum concentrations for monitoring wells surrounding TSF have stabilized to concentrations generally below 0.04 mg/L since 2019.
  - Dissolved arsenic, cadmium, copper, molybdenum and selenium concentrations have remained relatively the same at the monitoring wells over the last six years, with the following exceptions:
    - A temporary increase in dissolved arsenic concentration was observed in GW96-3a from 2019 – 2020, and has since decreased in concentration, although it still has the highest dissolved arsenic concentration observed in the TSF.
    - Dissolved cadmium concentrations showed an increasing trend in 2022 at was observed in GW00-1b and GW96-4b in 2022.

- A peak in dissolved copper concentrations was observed in GW00-1b and GW14-1 in 2022. The remaining concentrations appear to exhibit seasonal fluctuations.
- A decreasing trend in dissolved molybdenum since 2013 was observed at GW00-1b, while an increasing trend in dissolved molybdenum concentrations was observed in GW96-2b and GW96-3a.

6.3 Springer-Cariboo Pit Groundwater Seepage

Hydrogeological conditions around the Springer-Cariboo Pit are described in Golder (2016) and Golder (2017b). A key hydrogeological feature that affects groundwater movement out of the pit is a groundwater “mound” to the west of the pit. The elevation of the mound rises and falls in response to changes in surrounding water levels, including those in Springer Pit. When water levels in Springer Pit rise above approximately 1,020 masl, a small flux (~10 m^3/day) of groundwater toward Bootjack Lake is anticipated. This volume has been estimated to increase to 100 m^3/day at an elevation of 1,030 masl and 400 m^3/day at 1,050 masl (Golder 2016).

Water levels in Springer Pit in 2022 were reported to range from 982.74 masl (January) to 975.31 masl (December) and showed a general decreasing period throughout the year. In 2022, surface water elevations at Springer Pit were generally lower than the groundwater elevations within monitoring wells associated with the west side of the mine site (Figure 2). GW15-1a generally fell within the same elevation range as Springer Pit during 2022.

Water levels in Cariboo Pit in 2022 were reported to peak in April (1,027.92 masl), after which they steadily declined to an elevation of 976.13 masl (December).

Based on a review of groundwater elevations on the west side of the mine site, it can be inferred that a groundwater divide between the Springer Pit and Bootjack Lake remains in the area of GW12-2(a,b) and GW15-2(a,b), as groundwater elevations at these wells remained higher than the surface water elevation in Springer Pit. This groundwater divide results in groundwater flow both towards the east and west from the groundwater divide (shown in Figure 2).

Based on the information above it can be inferred that groundwater leakage from Springer Pit to Bootjack Lake did not occur in 2022.

7.0 CONCLUSIONS

Based on the results of 2022 monitoring program, the following conclusions are provided:

- This report meets the reporting requirements of BC ENV Permit 11678; Section 4.2.3, summarizing the results of the groundwater monitoring program at the Site, including a trend analyses for parameters of concern and groundwater levels.
- A groundwater divide is present in the area of GW15-1(a,b), GW15-2(a,b) and GW12-2(a,b) (located on the west side of the mine site), between Springer Pit and Bootjack Lake. This groundwater divide results in groundwater flowing from these monitoring wells towards the east, to Springer Pit, and towards the west to Bootjack Lake. The presence of this divide, along with a surface water elevation in Springer Pit in 2022, infers that groundwater seepage from Springer Pit to Bootjack Lake is not occurring.
- Slightly increasing and/or decreasing POI concentration trends at some locations were noted; however, significant changes to groundwater quality have not been identified in 2022.
- Based on requirements of monitoring/sampling frequency set out in the CEMP (varies dependent on well), no deficiencies were identified. Although select wells were not monitored/sampled, this was a result of the monitoring wells being dry, or containing an insufficient volume of water, which is not considered a permit deficiency. Wells not monitored/sampled included:
  - GW00-2a – sampling was attempted on 30 May 2022, 13 June 2022, and 13 September 2022; however, the well was not sampled due to insufficient groundwater and the presence of mud within the well. The well was visited again on 17 November 2022, but still no groundwater was present.
  - GW15-2b required quarterly groundwater sampling; however, only three samples were collected in 2022.
  - GW15-1b required quarterly static water level measurements; however, only one measurement was collected in 2022, due to insufficient water volumes.

8.0 RECOMMENDATIONS

Based on the results of the 2022 annual groundwater monitoring report, the following recommendations are provided.

- Continue the groundwater level and quality monitoring program at the mine site. This includes measuring the depth to groundwater at the various on-site monitoring wells as per the requirement of the 2019 CEMP (preferably on the same day in May and November 2022).
- Static water levels at GW12-2a and GW12-2b should be obtained prior to removing and after replacement of transducers.
- GW00-2a should be redeveloped in the spring/early summer, when sufficient water is available within the well, to remove the sediment within the well bottom.
- Surface water elevations at Polley Lake, Bootjack Lake, and the TSF should be conducted the same day as the groundwater elevations are collected to inform the groundwater contour figure.
- Dissolved organic carbon is a required input parameter to compare dissolved copper against the BC ENV guideline for protection of aquatic life. It is recommended that this parameter is included in the CEMP for select wells in each area (west, east and TSF) and analyzed for in the 2023 sampling program.
- If Wight Pit will continue to be used for temporary storage of dewatered groundwater from contact water sources in 2023, in order to continue assessing groundwater quality impacts resulting from the storage of water in Wight Pit, the following monitoring recommendations are provided:
  - A minimum of monthly water level measurements (i.e., geodetic elevations) should be collected from Wight Pit, GW16-7, GW17-8 and Polley Lake to assess elevations in comparison to local groundwater elevations and Polley Lake surface water elevations.
  - Consideration should be given to installing a pressure transducer and barologger at either GW16-7, GW16-8 or GW05-01, all located between Wight Pit and Polley Lake.
  - As per the CEMP, monitoring wells GW16-7 and GW16-8 should be sampled semi-annually, and GW05- 01 should be sampled quarterly, for the parameters of concern (MPMC 2019).

9.0 CLOSURE

The reader is referred to the Study Limitations, which precedes the text and forms an integral part of this report.

We trust the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate to contact the undersigned.

Signature Page

WSP Canada Inc.

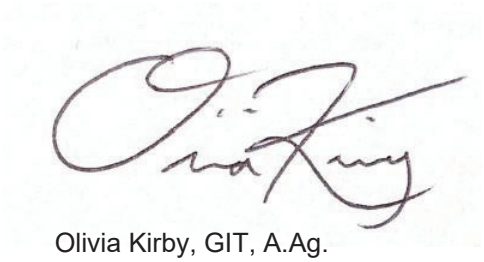

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Geoscientist

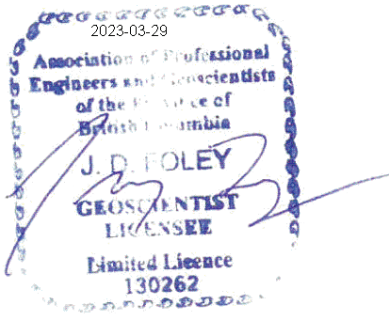

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https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/019-r-31491-cemp annual gw monitoring/rev0/23590671-019-r-rev0-31491-2022 cemp amr 29mar_23.docx

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Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
11-Jan-16																								
12-Jan-16																			1013.294	1013.76				
16-Feb-16																								
17-Feb-16																			1013.804	1014.326				
14-Mar-16																								
16-Mar-16																			1014.717	1015.543				
12-Apr-16				907.752																				
13-Apr-16																				1017.475				
14-Apr-16																			1016.019					
18-Apr-16					940.097	939.358		938.779	938.251	940.202	940.4	939.924												
20-Apr-16													1003.181	1000.235			985.524	985.537			1032.981	1033.042	965.614	975.512
27-Apr-16		900.038	913.599																					
2-May-16															933.109	933.961								
9-May-16							1017.245																	
11-May-16																			1016.113	1018.291				
26-May-16	973.905	900.058	913.633	907.799	939.851	939.106	1016.977	938.649	938.641	939.763	940.265	939.776	1003.171	1000.1	933.059	933.73	984.868	984.85	1016.229	1018.59	1032.853	1032.907	965.022	975.022
8-Jun-16																			1016.326	1018.775				
11-Jul-16																								
12-Jul-16																			1016.315	1018.746				
7-Aug-16					939.759			938.555		939.432	940.105													
16-Aug-16																								
17-Aug-16																				1017.535				
18-Aug-16																			1015.645					
13-Sep-16																								
15-Sep-16																			1015.039	1016.367				
16-Sep-16				906.553																				
21-Sep-16		900.088	913.503			939.106			938.661			939.636					984.173	984.21			1032.903	1032.982	964.497	
22-Sep-16	974.04												1003.171	1000.175	932.544	933.31								
26-Sep-16																								974.972
22-Oct-16																								
24-Oct-16																			1014.565	1015.392				
25-Oct-16					940.157			938.749		939.988	940.311													
7-Nov-16																								
8-Nov-16																			1014.299	1015.081				
19-Dec-16																			1013.004	1013.464				
16-Jan-17																			1011.59	1011.76				
20-Feb-17																								
21-Feb-17																								
22-Feb-17																			1010.224	1010.302				
23-Feb-17					939.942			938.719		940.043	940.278													
20-Mar-17																								
21-Mar-17																								
3-Apr-17																			1009.809	1009.79				
26-Apr-17																			1011.392	1011.339				
27-Apr-17																								
28-Apr-17				909.866																				
1-May-17					940.106	938.416		938.539	938.741	940.433	940.41	939.966												
2-May-17	974.473						1017.168										985.583	985.638	1011.435	1011.459	1032.891	1033.131	965.356	
4-May-17																								
7-May-17		900.243	913.926																					
8-May-17																								975.484
15-May-17													994.031	1000.305	933.394	933.75								
17-May-17																								
22-May-17																			1011.004	1011.145				
23-May-17																								
24-May-17																								
7-Jun-17		900.295		902.246	939.926		1017.218	938.636		940.05	940.248													
11-Jun-17																								
12-Jun-17																								
22-Jun-17																			1010.036	1010.195				
28-Jun-17																								
31-Jul-17	973.965	900.202	913.788	899.777	939.44	938.492	1016.223	938.277	938.246	938.794	939.938	939.403		999.777	932.68	933.028	984.214	984.208	1009.142	1009.251	1032.635	1032.876	964.561	974.172
22-Aug-17																								
22-Aug-17																			1008.776	1008.864				
23-Aug-17																								
28-Aug-17																								
12-Sep-17																			1009.494	1008.553				
13-Sep-17	973.869					938.26																		
18-Sep-17									938.186			939.163					983.626	983.628					964.307	
19-Sep-17		900.137	913.637																					
21-Sep-17																								
25-Sep-17													1003.181	999.51	931.654	932.552								974.664
3-Oct-17																					1032.449	1032.724		
4-Oct-17																								
5-Oct-17																								
16-Oct-17																								
17-Oct-17																			1008.063	1008.091				
18-Oct-17																								
29-Oct-17																								
31-Oct-17		900.073	913.563		939.686	939.006		938.589	938.576		939.875		1002.921	1000.225			983.938	984.01	1007.979	1008	1032.663	1032.782		
19-Nov-17																			1007.823	1007.845				
13-Dec-17																			1007.649	1007.683				
27-Dec-17		899.97		910.037	939.83			938.546		938.095	939.995													
17-Jan-18																			1007.461	1007.484				
27-Feb-18																								
28-Feb-18																			1007.126	1007.155				
9-Mar-18		900.023		911.547	939.743			938.572		938.052	940.025													
19-Mar-18																								
20-Mar-18																			1007.009					
21-Mar-18																				1007.04				
26-Mar-18																								
27-Mar-18																								
9-Apr-18																								

Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
10-Apr-18				912.159															1007.317	1007.34				
11-Apr-18																								
12-Apr-18																								
14-Apr-18									938.886	938.863														
15-Apr-18								938.854							931.554	933.422								
16-Apr-18					940.456	939.651			938.891	939.028														
19-Apr-18																								
30-May-18																			1009.774	1009.98				
5-Jun-18				900.731			1017.024	939.662			940.226	939.764					985.346	985.721					964.847	975.076
6-Jun-18	974.406						1016.991																	
7-Jun-18												939.686						985.195						975.022
12-Jun-18													1003.181	999.985										
14-Jun-18		900.089	914.038										1003.181	999.985										
19-Jun-18																			1009.016	1009.227				
20-Jun-18								938.581			939.171				932.554	933.341	984.831						964.433	
21-Jun-18								937.634													1032.943	1033.126		
21-Jun-18																								
25-Jun-18																								
26-Jun-18				888.392																				
12-Jul-18																			1008.304	1008.495				
12-Aug-18																								
14-Aug-18																								
15-Aug-18																			1007.55	1007.679				
16-Aug-18																								
22-Aug-18																								
25-Sep-18																			1006.744	1006.878				
30-Sep-18																								
2-Oct-18	974.361																							
9-Oct-18									938.642			939.461												
24-Oct-18																			1006.329	1006.429				
30-Oct-18																								
31-Oct-18													1003.171	999.591										
1-Nov-18						939.086			938.646			939.536												
5-Nov-18															931.949	933.167								
6-Nov-18																		984.118						
8-Nov-18																						1032.966		
13-Nov-18																			1006.699	1006.736	1032.808			
14-Nov-18			913.867																					
15-Nov-18																							964.955	975.397
20-Nov-18		900.068																						
21-Nov-18		900.079															984.526							
23-Nov-18		900.094		905.920	940.151			938.726		939.415	940.291													
1-Jan-19																								
2-Jan-19																								
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4-Jan-19																								
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Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
21-Feb-19																								
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24-May-19																								
25-May-19																								
26-May-19																								
27-May-19																								
31-May-19	974.65	900.138	914.138	911.693	939.961	939.194	1016.904	938.568	938.647	940.017	940.293	939.854	1003.081	1000.285	932.921	933.816	985.497	985.505	1009.457	1009.678	1032.848	1032.987	964.745	975.219
3-Jun-19																								
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4-Sep-19																								
9-Sep-19																								

Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
12-Sep-19																								
15-Sep-19																								
16-Sep-19																								
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22-Oct-19																								
26-Oct-19																								
27-Oct-19																								
31-Oct-19																								
4-Nov-19																								
6-Nov-19																								
14-Nov-19																								
17-Nov-19	975.043	900.444	914.342	912.594	940.262	939.722	1017.167	938.842	938.889	940.553	940.365	939.854	1003.181	1000.652	933.037	934.163	985.099	985.209	1007.804	1007.906	1032.978	1033.093	964.873	975.639
6-Jan-20																								
16-Jan-20																								
23-Jan-20																								
30-Jan-20																								
5-Feb-20																								
6-Feb-20																								
11-Feb-20						939.626																		
13-Feb-20																								
20-Feb-20																								
24-Feb-20																								
25-Feb-20																								
26-Feb-20				912.244	940.136		1016.347	938.659		940.193	940.280								1007.119	1007.29				
27-Feb-20																								
5-Mar-20																								
12-Mar-20																			1006.918	1007.092				
26-Mar-20																								
2-Apr-20																								
8-Apr-20																			1006.772	1006.945				
14-Apr-20																								
16-Apr-20																								
21-Apr-20																								
22-Apr-20																								
23-Apr-20																								
27-Apr-20																								
28-Apr-20																								
29-Apr-20																								
30-Apr-20																								
4-May-20																								
5-May-20																								
6-May-20																								
7-May-20																								
11-May-20																								
12-May-20													1003.171	1000.555		934.26				1010.56				
13-May-20				912.594	940.406	940.346		938.739	938.716		940.45	940.076												
14-May-20		900.548	931.923																		1033.063	1032.982		
19-May-20							1017.607								933.284		986.083	986.17						
20-May-20	975.13																						966.057	976.192
21-May-20																								
25-May-20																								
26-May-20																								
27-May-20																								
28-May-20																								
1-Jun-20																								
4-Jun-20																								
7-Jun-20																								
8-Jun-20																								
11-Jun-20																								
15-Jun-20																								
16-Jun-20																			1009.972	1010.822				
18-Jun-20																								
22-Jun-20																								
23-Jun-20																								
25-Jun-20																								
29-Jun-20																								
30-Jun-20																								
1-Jul-20																								
7-Jul-20																								
9-Jul-20																								
13-Jul-20																								
15-Jul-20																								
16-Jul-20																			1010.565	1010.681				
22-Jul-20																								
23-Jul-20																								
28-Jul-20																								
29-Jul-20																								
30-Jul-20																								

Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
6-Aug-20																								
13-Aug-20																								
20-Aug-20																			1009.897	1010.104				
24-Aug-20				912.594	939.866		1016.857												1009.789	1009.96				
27-Aug-20																								
1-Sep-20																								
3-Sep-20																								
9-Sep-20																								
10-Sep-20																								
15-Sep-20																								
17-Sep-20																								
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28-Sep-20																								
1-Oct-20																								
6-Oct-20																								
8-Oct-20																								
15-Oct-20																								
21-Oct-20																								
22-Oct-20																			1008.879	1008.899				
29-Oct-20																								
2-Nov-20				912.594	940.396	939.626	1016.607	938.789	940.051	940.473	940.37	940.066												
3-Nov-20													1003.181	1000.765					1009.499	1009.45		1033.252		
4-Nov-20		900.948	914.573												932.754	934.22							965.037	976.072
5-Nov-20	975.5																985.133	985.21						
11-Nov-20																			1010.053	1011.069				
19-Nov-20																								
22-Nov-20																								
26-Nov-20																								
3-Dec-20																								
9-Dec-20																								
10-Dec-20																								
17-Dec-20																								
30-Dec-20																			1010.876	1009.975				
4-Jan-21																								
12-Jan-21																								
14-Jan-21																								
18-Jan-21																								
21-Jan-21																								
28-Jan-21																								
31-Jan-21																								
4-Feb-21																								
8-Feb-21					940.16		1016.51	938.59		940.203	940.35													
11-Feb-21																								
16-Feb-21				Frozen															1008.899	1009				
18-Feb-21																								
25-Feb-21																								
27-Feb-21																								
28-Feb-21																								
2-Mar-21																								
4-Mar-21																								
9-Mar-21																								
11-Mar-21																								
18-Mar-21																								
25-Mar-21																								
31-Mar-21																								
8-Apr-21																								
15-Apr-21																								
22-Apr-21																								
29-Apr-21																								
30-Apr-21																								
3-May-21					940.398			938.695	940.547		940.453								1010.061	1010.084				
4-May-21				912.594		939.461	1017.392		938.666			936.611												
5-May-21													1002.072			933.529	986.027	986.061			1033.074	1033.182		
6-May-21	972.774	900.997	914.639												933.393								965.657	976.028
13-May-21																								
20-May-21																								
27-May-21																								
31-May-21																								
3-Jun-21																								
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8-Jul-21																								
15-Jul-21																								
22-Jul-21																								
29-Jul-21																								
31-Jul-21																								
5-Aug-21																								
12-Aug-21				Flowing Artesia	939.17		1016.02	938.02		938.53	939.755													
16-Aug-21																			1008.52	1008.655				
19-Aug-21																								
26-Aug-21																								
31-Aug-21																								
2-Sep-21																								
9-Sep-21																								

Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
16-Sep-21																								
23-Sep-21																								
29-Sep-21																								
30-Sep-21																								
7-Oct-21																								
14-Oct-21																								
20-Oct-21																								
28-Oct-21																								
31-Oct-21																								
4-Nov-21																								
13-Nov-21																								
17-Nov-21						938.966		936.694	938.532	Dry	938.853	938.297												
18-Nov-21				Frozen																				
24-Nov-21															932.24	932.25								
25-Nov-21	975.088	901.605	914.088																					
30-Nov-21																								
1-Dec-21													1001.819				984.435	984.696	1007.029	1007.142				
2-Dec-21																								
6-Dec-21														1000.211							1032.63	1033.092		
14-Dec-21																								
16-Dec-21																								
24-Dec-21																								
31-Dec-21																								
06-Jan-22																								
13-Jan-22																								
20-Jan-22																								
27-Jan-22																								
31-Jan-22																								
03-Feb-22																								
10-Feb-22				Flowing Artesain			1016.536	938.723		938.85	940.139													
17-Feb-22																								
24-Feb-22																								
28-Feb-22																			1006.977	1007.043				
03-Mar-22																								
9-Mar-22																								
10-Mar-22																								
17-Mar-22																								
22-Mar-22																								
24-Mar-22																								
28-Mar-22																								
31-Mar-22																								
07-Apr-22																								
14-Apr-22																								
21-Apr-22																								
28-Apr-22																								
09-May-22																								
11-May-22					940.385																			
12-May-22																								
19-May-22																								
26-May-22																								
30-May-22					939.736	939.423		938.732	938.713	940.277	940.375	939.969												
31-May-22														1000.661										
1-Jun-22	975.38														932.416	933.377							965.237	975.412
2-Jun-22							1017.24																	
6-Jun-22		901.028	914.673																1010.629	1010.84				
7-Jun-22																					1033.023	1033.182		
8-Jun-22																	986.173	986.71						
9-Jun-22																								
13-Jun-22	975.42	901.058	914.803	911.614	940.276	939.456	1017.257	938.759	938.741	940.303	940.42	940.026	Flowing Artesian		932.523	933.452			1010.649	1010.84	1033.023	1033.182	965.217	975.492
14-Jun-22														1000.72			986.194	986.71						
16-Jun-22																								
21-Jun-22																							965.42	
23-Jun-22																								
30-Jun-22																								
07-Jul-22																								
14-Jul-22																								
19-Jul-22																								
21-Jul-22																								
25-Jul-22	975.155				939.951										932.47								965.206	975.407
27-Jul-22																								
28-Jul-22																								
02-Aug-22																								
04-Aug-22																								
10-Aug-22		901.115	914.646																1008.984	1009.201	1032.862	1033.078		
11-Aug-22																								
17-Aug-22																								
21-Aug-22																								
24-Aug-22																								
25-Aug-22																								
31-Aug-22							1016.341									932.286								
01-Sep-22																								
08-Sep-22																								
11-Sep-22																								
13-Sep-22				Flowing Artesian		938.483		938.372	938.35		939.861	938.27												
15-Sep-22																								
20-Sep-22													Flowing Artesia	1000.011										

Table 2
2022 Groundwater Surface Elevations

	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
MOE EMS	E229695	E229681	E229682	E229683	E229685	E229686	E229690	E242385	E242385	E242387	E242389	E242388	E291219	E291211	E291212	E291213	E291969	E291970	E291971	E291972	E291973	E291974	E291976	E291977
Easting	593688	596065	596075	595769	595148	595151	592983	594368	594371	594652	594896	594900	590766	590766	594910	594910	590421	590421	591155	591154	592148	592148	594117	594116
Northing	5823791	5819450	5819447	5818309	5818165	5818163	5821521	5818476	5818476	5818338	5818238	5818238	5823845	5823845	5821020	5821020	5824613	5824617	5823180	5823177	5822098	5822102	5822894	5822891
Top of Pipe Elevation	976.82	931.798	931.923	912.594	941.366	941.306	1020.907	940.019	940.051	944.173	944.04	943.786	1003.181	1003.195	935.154	935.24	989.703	989.83	1033.679	1033.68	1037.483	1037.292	987.757	988.022
Ground Surface Elevation	975.864	931.243	931.262	912.104	940.6	940.429	1020.421	939.19	939.203	943.423	943.338	943.062	1002.313	1002.385	934.403	934.472	988.904	989.087	1032.919	1032.718	1036.572	1036.466	986.816	986.967
Stickup	-	0.50	0.60	0.50	0.70	0.70		0.08	0.08	0.07	0.06	0.07	0.00	0.00	0.00	0.00								
Stickup (check)	0.956	0.555	0.661	0.49	0.766	0.877	0.486	0.829	0.848	0.75	0.702	0.724	0.868	0.81	0.751	0.768	0.799	0.743	0.76	0.962	0.911	0.826	0.941	1.055
Completion Zone Top	-	50.9	29.7	47	19.2	2.7		13.41	3.7	13.41	17.07	6.1	12.4	5.1	26.2	11.1								
Completion Zone Bottom	-	55.2	35.7	53	25	7.3		14.94	10.58	21.55	24.29	13.66	15.4	8.1	29.3	14.2								
Completion Zone Lithology	-	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	Bedrock	Bedrock	Overburden	W. Bedrock	Overburden	OB/Bedrock	Overburden								
Date	95-R5	GW96-2A	GW96-2B	GW96-3A	GW96-4A	GW96-4B	GW96-7	GW00-1A	GW00-1B	GW00-2A	GW00-3A	GW00-3B	GW11-1A	GW11-1B	GW11-2A	GW11-2B	GW12-1A	GW12-1B	GW12-2A	GW12-2b	GW12-3A	GW12-3B	GW12-4A	GW12-4B
21-Sep-22																	984.033	984.465						
22-Sep-22																								
29-Sep-22																								
30-Sep-22																								
05-Oct-22																								
07-Oct-22																								
11-Oct-22																								
13-Oct-22																								
18-Oct-22																								
25-Oct-22																								
31-Oct-22																								
15-Nov-22																								
16-Nov-22																			1006.707	1006.846				
17-Nov-22				Flowing Artesia	939.394		1015.562	938.503		937.788	939.784													
22-Nov-22																								
24-Nov-22																								
29-Nov-22																								
30-Nov-22																								
06-Dec-22																								
13-Dec-22																								
15-Dec-22																								
24-Dec-22																								
31-Dec-22																								

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
11-Jan-16			1023.641																		1025.75	1069.99			938.57
12-Jan-16				1023.648	1023.312	1023.925																	920		
16-Feb-16			1025.07																						938.66
17-Feb-16				1025.21	1024.444	1025.237															1027.55	1067.35	920.01		
14-Mar-16			1028.055																		1031.2	1068.31	920.1		939.51
16-Mar-16				1028.299	1026.366	1027.707																	920.09		
12-Apr-16			1031.565																		1036.33	1065.4	920.55		941.06
13-Apr-16					1027.898	1030.371																	920.51		
14-Apr-16																							920.58		
18-Apr-16				1031.778																			920.6		
20-Apr-16																							920.6		
27-Apr-16																									
2-May-16	958.398	959.13																			1037.97	1061.77	920.53		937.7
9-May-16			1032.9																				920.54		
11-May-16				1033.043	1027.847	1030.552																	920.52		
26-May-16	956.918		1033.08	1033.128	1027.737	1030.455																	920.51		
8-Jun-16			1033.185	1033.233	1027.707	1030.455															1037.95	1058.5	920.51		939.02
11-Jul-16			1032.523																		1033.79	1046.55	920.4		945.43
12-Jul-16				1032.514	1027.442	1030.099																	920.42		
7-Aug-16																					1030.07		920.37		946.66
16-Aug-16			1030.094																						
17-Aug-16				1030.064	1026.329	1028.534																	920.3		
18-Aug-16																									
13-Sep-16			1027.693																		1026.42				948
15-Sep-16				1027.579	1025.053	1026.783																			
16-Sep-16																									
21-Sep-16																									
22-Sep-16																							920.29		
26-Sep-16	955.568																						920.31		
22-Oct-16			1024.737																		1021.29				950.26
24-Oct-16				1024.676	1023.751	1025.027																			
25-Oct-16																									
7-Nov-16		958.957	1022.725																		1016.49				951.81
8-Nov-16				1022.618	1023.077	1024.061																	920.39		
19-Dec-16			1016.393	1016.354	1020.73	1021.134															1012.24		920.46		952.68
16-Jan-17			1012.162	1012.051	1018.874	1019.075											1009.727	1009.56			1010.32		920.27		953.3
20-Feb-17			1009.615														1009.791				1007.32				953.88
21-Feb-17					1018.105	1018.26												1009.553							953.88
22-Feb-17				1009.468																			920.15		953.88
23-Feb-17																									953.88
20-Mar-17			1007.665	1007.593	1018.092												1009.816	1009.655			1004.43				954.79
21-Mar-17						1018.269																	920.13		
3-Apr-17						1018.975																	920.17		956.16
26-Apr-17			1012.954																						
27-Apr-17				1012.849	1020.477	1021.709																			
28-Apr-17																							920.5		
1-May-17																					1004.87				956.79
2-May-17																									
4-May-17		959.515																					920.49		
7-May-17																	1010.191								
8-May-17																									
15-May-17	958.818														958.365										
17-May-17							956.837						917.627			963.543									
22-May-17			1008.05	1007.873	1020.002	1020.31																			
23-May-17								955.875	914.368	914.364	913.552	917.457													
24-May-17																			907.037	906.626			920.45		
7-Jun-17									914.193		903.493	917.41	918.734	918.835	957.967				907.068	906.737	1004.84				956.73
11-Jun-17							956.739	955.746								960.641									
12-Jun-17									914.143	914.124			918.729		957.93								920.4		
22-Jun-17					1019.093	1018.882												1009.642					920.36		
28-Jun-17			1006.897	1006.734	#N/A																		920.32		
31-Jul-17	955.744	957.341	1005.102	1004.923	1018.001	1018.19	956.087	955.017	913.984	913.932	909.289	917.305	918.384	918.511	957.079	960.799	1009.497	1009.338	906.961	906.742	1004.14		920.07		956.74
22-Aug-17			1005.307	1005.154																	1004.01				956.87
22-Aug-17					1017.7	1017.873											1009.104	1009.257							
23-Aug-17							955.93	954.701											906.882	906.646			919.95		
28-Aug-17																									
12-Sep-17			1005.242	1005.087	1017.413	1017.583															1004				957.03
13-Sep-17	954.894									913.588				918.448											
18-Sep-17		957.403																							
19-Sep-17																									
21-Sep-17												917.334													
25-Sep-17																									
3-Oct-17							955.595	954.339	913.59				918.303			960.444					1004.24				957.51
4-Oct-17																		1008.922	906.744				919.84		
5-Oct-17																				906.466					
16-Oct-17					1017.132								918.381												
17-Oct-17						1017.3																			
18-Oct-17			1004.572	1004.399																					
29-Oct-17									909.623																
31-Oct-17					1016.557	1017.705			913.648	913.599	912.622	917.379	918.374	918.215	957.455	962.711	1009.091	1009.000							
19-Nov-17			1004.405	1004.265																	1004.36				958.03
13-Dec-17			1004.559	1004.425	1017.502	1017.68															1004.52				958.46
27-Dec-17									913.463		914.859		918.36		957.32										
17-Jan-18			1004.3	1004.103	1017.361	1017.591															1004.29		920.29		952.95
27-Feb-18			1004.231	1004.01	1017.143	1017.372															1003.68		920.14		953.9
28-Feb-18																					1003.55		920.14		953.88
9-Mar-18									913.411		916.342		918.426		957.068						1002.45		920.15		954.05
19-Mar-18							955.724	953.458									1008.584	1009.753	906.515	906.105	1001.40		920.15		954.25
20-Mar-18			1004.22	1004.018	1017.187																1001.27		920.14		954.25
21-Mar-18																					1001.09		920.13		954.29
26-Mar-18							955.547	953.635													1000.31		920.13		954.54
27-Mar-18								953.43													1000.24		920.14		954.61
9-Apr-18					1017.988	1017.955															998.62		920.20		955.24

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
10-Apr-18			1002.631	1003.248																	998.45		920.21		955.30
11-Apr-18									913.723	913.664											998.30		920.22		955.36
12-Apr-18															958.123						997.95		920.23		955.45
14-Apr-18																963.701					997.39		920.25		955.50
15-Apr-18													918.588								997.11		920.26		955.55
16-Apr-18																963.678					996.89		920.27		955.58
19-Apr-18													918.536	918.616							996.30		920.31		955.71
30-May-18			998.845	1002.883	1020.542	1021.139															990.40				961.66
5-Jun-18																					990.73				961.71
6-Jun-18												917.291									990.81				961.68
7-Jun-18																	1009.385	1009.35			990.90				961.70
12-Jun-18																					989.14				961.72
14-Jun-18																					988.85				961.73
19-Jun-18			996.407	1002.313	1019.419	1020.18																			961.71
20-Jun-18											917.179								907.008	906.707					961.74
21-Jun-18							955.856	953.824																	961.74
21-Jun-18							946.103																		961.74
25-Jun-18	955.368	958.265									915.202										987.25				961.76
26-Jun-18																					987.37				961.75
12-Jul-18			995.611	1002.064	1018.454	1019.11															987.20				
12-Aug-18			995.089	1002.054																	986.56				
14-Aug-18							955.855	953.225											907.00	906.824	986.26				
15-Aug-18																	1008.862	1008.554			986.22				
16-Aug-18							953.679	954.522													986.05				
22-Aug-18					1017.077	1018.039															986.22		920.33		
25-Sep-18			993.126	1002.08	1017.214	1017.982															986.26				
30-Sep-18						1018.115															986.16				
2-Oct-18																	1008.726	1008.47	906.884	906.668	985.78				
9-Oct-18																					986.08				
24-Oct-18			993.735	1002.083	1017.267	1018.04															986.06				
30-Oct-18							955.053	952.51													986.43				
31-Oct-18													917.716		957.31	961.292					986.36				
1-Nov-18														918.33							986.29				
5-Nov-18		959.186																			987.09				
6-Nov-18																					987.44				
8-Nov-18																					987.73				
13-Nov-18			995.946	1002.07	1018.047	1018.866															988.14				
14-Nov-18									914.398	914.399											988.25				
15-Nov-18											914.291	917.333									988.15				
20-Nov-18																					987.78				
21-Nov-18	956.163																				987.77				
23-Nov-18									914.344		908.609		918.536		958.02						987.62				
1-Jan-19																					986.96				961.70
2-Jan-19																					986.93				961.71
3-Jan-19																					986.93				
4-Jan-19																					987.00				
5-Jan-19																					987.00				
6-Jan-19																					987.00				
7-Jan-19																					987.00				
8-Jan-19																					987.03				961.78
9-Jan-19																					987.05				961.76
10-Jan-19																					987.07				961.76
11-Jan-19																					987.08				961.76
12-Jan-19																									961.77
13-Jan-19																									961.76
14-Jan-19																									961.74
15-Jan-19																									961.75
16-Jan-19																									961.73
17-Jan-19																									961.71
18-Jan-19																					987.15				961.72
19-Jan-19																									961.73
20-Jan-19																									961.72
21-Jan-19																									961.70
22-Jan-19																									961.72
23-Jan-19																									961.63
24-Jan-19																									961.63
25-Jan-19																									961.65
26-Jan-19																									961.66
27-Jan-19																					987.24				961.67
28-Jan-19																									961.66
29-Jan-19																									961.66
30-Jan-19																									961.67
31-Jan-19																									961.69
1-Feb-19																									961.68
2-Feb-19																									961.67
3-Feb-19																									961.68
4-Feb-19																									961.69
5-Feb-19																									961.67
6-Feb-19																					987.33				961.65
7-Feb-19																									961.63
8-Feb-19																									961.61
9-Feb-19																					987.34				961.55
10-Feb-19																									961.57
11-Feb-19																									961.60
12-Feb-19																									961.59
13-Feb-19																									961.56
14-Feb-19																									961.53
15-Feb-19																									961.49
16-Feb-19																									961.50
17-Feb-19																									961.46
18-Feb-19																									961.50
19-Feb-19																									961.44
20-Feb-19																									961.42

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
21-Feb-19																									961.45
22-Feb-19																									961.45
23-Feb-19																									961.46
24-Feb-19																									961.45
25-Feb-19																									961.44
26-Feb-19																									961.40
27-Feb-19																									961.40
28-Feb-19																									961.39
1-Mar-19																									961.40
2-Mar-19																									961.39
3-Mar-19																									961.37
4-Mar-19																					987.64				961.38
9-Mar-19																					987.64	950.00			
13-Mar-19																									961.29
14-Mar-19																									961.28
15-Mar-19																									961.26
16-Mar-19																					987.60	951.03			961.23
17-Mar-19																									961.20
18-Mar-19																									961.22
19-Mar-19																									961.16
20-Mar-19																									961.13
23-Mar-19																						952.64			
24-Mar-19																					987.72				
25-Mar-19																									961.27
28-Mar-19																									961.48
29-Mar-19																									961.52
30-Mar-19																					987.94	954.42			961.56
31-Mar-19																									961.61
1-Apr-19																									961.69
2-Apr-19																									961.69
4-Apr-19																									961.77
8-Apr-19																						956.77			961.91
10-Apr-19																									962.01
11-Apr-19																									962.04
12-Apr-19																									962.04
13-Apr-19																					986.31	957.44			962.07
14-Apr-19																									962.09
15-Apr-19																									962.08
18-Apr-19																									962.12
24-Apr-19																									962.16
26-Apr-19																									962.04
27-Apr-19																					988.64	960.24			962.12
28-Apr-19																									962.12
29-Apr-19																									962.15
30-Apr-19																					988.70				962.16
1-May-19																					988.69	960.49	923.02		
6-May-19																									962.09
8-May-19																									962.05
9-May-19																									962.07
10-May-19																									962.08
11-May-19																					989.01	960.96			962.06
12-May-19																									962.05
13-May-19																									962.02
22-May-19																									962.03
23-May-19																									962.02
24-May-19																									962.04
25-May-19																					989.23	961.66			962.04
26-May-19																									961.99
27-May-19																									961.96
31-May-19	957.2	959.055	994.99	1002.037	1019.477	1020.536	956.365	953.627	914.797	914.841	916.204	917.367	918.542	918.62	957.84	962.503	1009.612	1009.345	907.327	907.031					
3-Jun-19																									961.93
6-Jun-19																									961.83
11-Jun-19																					989.13	962.23			
17-Jun-19																					988.21				
18-Jun-19																					988.25				
19-Jun-19																					988.29				
20-Jun-19																					988.32				
21-Jun-19																					988.25				
22-Jun-19																					988.17				
23-Jun-19																					988.09				
24-Jun-19																					988.02	962.68			
25-Jun-19																					987.99	962.70			
26-Jun-19																					987.95	962.74			962.01
27-Jun-19																					987.91	962.78			
28-Jun-19																					987.92	962.81			
29-Jun-19																					987.93	962.84			
30-Jun-19																					987.94	962.87			
1-Jul-19																					987.95	962.90			
2-Jul-19																					987.96	962.93			
3-Jul-19																					988.14				
7-Jul-19																						963.38			
11-Jul-19																									962.23
15-Jul-19																					985.92				962.24
25-Jul-19																					986.94				
29-Jul-19																									962.15
30-Jul-19																					986.26	968.50			
6-Aug-19																									962.16
18-Aug-19																						971.70			
19-Aug-19																									962.18
20-Aug-19																					985.03		920.60		
21-Aug-19																					984.80				
4-Sep-19																					984.62		920.52		961.95
9-Sep-19																					983.86	972.36	920.52		962.07

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
12-Sep-19																					983.08				
15-Sep-19																					982.51				962.13
16-Sep-19																					982.45				
18-Sep-19																					982.22				
19-Sep-19																									962.23
22-Sep-19																									
23-Sep-19																					982.31				962.26
30-Sep-19																						973.60			962.30
2-Oct-19																					982.05				962.31
8-Oct-19																					980.76				962.36
9-Oct-19																						974.13			
11-Oct-19																						975.19			962.39
12-Oct-19																									962.39
13-Oct-19																									962.38
14-Oct-19																									962.40
15-Oct-19																					979.13				
17-Oct-19																									962.40
21-Oct-19																					978.90				962.37
22-Oct-19																							920.52		
26-Oct-19																					979.53				
27-Oct-19																					980.09				962.29
31-Oct-19																									962.12
4-Nov-19																							920.49		962.00
6-Nov-19																					982.87				
14-Nov-19																									961.92
17-Nov-19	956.461	959.356	993.23		1018.54	1019.256	956.684	953.97	914.756	914.744	910.027	917.57	918.775	918.864	958.624	963.835	1009.718	1009.438	907.414	907.027					
6-Jan-20			990.385		1018.237	1019.077																			
16-Jan-20				989.203	1018.051	1018.881																			
23-Jan-20			989.365		1017.926	1018.786																			
30-Jan-20			989.22		1017.847	1018.741															983.74	980.5	920.42		962.06
5-Feb-20			989.14		1017.847	1018.706																			
6-Feb-20																									961.96
11-Feb-20																									
13-Feb-20			989.065		1017.867	1018.715																			
20-Feb-20																									961.74
24-Feb-20			988.915																						
25-Feb-20					1017.717	1018.625											1008.961	1008.72							
26-Feb-20									914.178		915.122		918.684		957.795										
27-Feb-20																					984.25	981.00	920.36		961.58
5-Mar-20																									961.46
12-Mar-20			988.77		1018.667	1018.525																			961.40
26-Mar-20																					984.50	981.40	920.30		961.45
2-Apr-20			989.149		1017.673	1018.487																			961.44
8-Apr-20			989.369		1017.707	1018.543																			
14-Apr-20																					984.74		920.23		961.28
16-Apr-20			991.131		1017.011	1018.733																			961.32
21-Apr-20																									961.83
22-Apr-20																					985.17	982.21			961.96
23-Apr-20			996.44		1018.704	1019.709																			962.15
27-Apr-20																					985.97	983.59	920.50		962.56
28-Apr-20																									962.62
29-Apr-20			1001.007		1020.254	1022.012																			962.68
30-Apr-20																							920.57		962.71
4-May-20																					987.81	985.80	920.74		962.92
5-May-20																									962.94
6-May-20																									963.00
7-May-20			1003.855		1021.673	1023.201															988.71	986.03	920.88		963.05
11-May-20					1022.012	1023.275											1009.971	1009.57			989.73	986.87	920.90		963.04
12-May-20																									
13-May-20									915.638	915.799		917.612	918.934	919.01	958.725	963.521									
14-May-20																					990.28	987.60	920.94		963.06
19-May-20							956.677	954.26												906.972					963.09
20-May-20	958.568	959.821									904.892								907.60		991.31	989.04	920.94		963.08
21-May-20			1000.712		1021.899	1023.019																			963.06
25-May-20																									963.07
26-May-20			999.295		1021.632	1022.725																			
27-May-20																					992.36	989.88			963.05
28-May-20																							920.93		963.06
1-Jun-20			997.695		1021.247	1022.466															992.86	990.63	920.93		963.05
4-Jun-20																					993.14	990.74			963.05
7-Jun-20																					995.76	991.13			963.04
8-Jun-20			998.266		1021.142	1022.241																			963.02
11-Jun-20																					994.52	992.00			962.97
15-Jun-20																					995.50	992.69			962.89
16-Jun-20			999.168		1020.989	1022.099																			
18-Jun-20																									962.80
22-Jun-20																									962.75
23-Jun-20			999.711		1032.846028	1021.912																			
25-Jun-20																									962.64
29-Jun-20																					998.27	994.27	920.85		962.59
30-Jun-20																									962.60
1-Jul-20			1000.235		1020.612	1021.69																			962.60
7-Jul-20			1001.282		1020.533	1021.576																			
9-Jul-20																					1000.10	994.72			962.57
13-Jul-20																					1000.70				962.59
15-Jul-20																					1000.93	995.07	920.92		962.60
16-Jul-20			1003.81		1020.645	1021.751																			962.59
22-Jul-20																					1002.30	995.32			962.58
23-Jul-20			1004.64		1020.737	1021.863																			
28-Jul-20			1004.73		1020.774	1021.852																			
29-Jul-20																					1002.75				962.53
30-Jul-20																									962.46

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
6-Aug-20			1004.514		1020.594	1021.636															1003.20	995.71	920.83		962.42
13-Aug-20			1004.236	1004.013	1020.362	1021.396															1003.31	995.82			962.37
20-Aug-20			1004.003	1003.744	1020.159	1021.182															1003.40	995.91			962.35
24-Aug-20			1003.445		1020.037	1020.985											1009.781	1009.41							
27-Aug-20																					1003.36	995.96	920.74		962.30
1-Sep-20			1003.557	1003.62	1019.794	1020.633																			
3-Sep-20																									962.23
9-Sep-20																					1003.44	996.18			962.21
10-Sep-20			1003.391	1003.487	1019.502	1020.291																			
15-Sep-20			1003.289	1003.417	1019.352	1020.204																			
17-Sep-20																					1003.44	996.26			962.07
22-Sep-20			1003.027	1003.047	1019.208	1020.026																			
24-Sep-20																					1003.45	996.32			962.03
28-Sep-20			1003.1	1003.078	1018.999	1019.823																			
1-Oct-20																					1003.5	996.42	920.63		961.92
6-Oct-20			1003.004	1002.963	1018.838	1019.672																			
8-Oct-20																					1003.54	996.5			961.88
15-Oct-20																					1003.60	996.66			961.87
21-Oct-20																					1003.71	996.92			962.05
22-Oct-20			1004.014	1003.148	1018.928	1019.696																			
29-Oct-20			1004.126	1003.257	1019.163	1019.91															1003.89	997.26			962.15
2-Nov-20											914.912	917.692	918.794	918.07	958.685	964.571					1004	997.62	920.73		962.31
3-Nov-20			1005.895		1019.507	1019.945											1009.911	1009.56							
4-Nov-20	957.828	959.951					956.347	953.93	915.028	915.059									907.736	906.812					
5-Nov-20																					1004.09				962.48
11-Nov-20			1007.997	1007.703		1021.761															1004.19				962.62
19-Nov-20																									962.68
22-Nov-20					1020.442																				
26-Nov-20																									962.72
3-Dec-20																									962.70
9-Dec-20			1004.58	1004.278	1020.435	1021.477																			
10-Dec-20																									962.76
17-Dec-20			1004.712	1004.441	1020.384	1021.366																			
30-Dec-20			1004.093	1002.949	1020.048	1021.062																			
4-Jan-21																					1003.6	999.14			962.79
12-Jan-21																					1003.06	999.2			962.76
14-Jan-21																					1003.05	999.22			962.77
18-Jan-21																					1002.75	999.28			962.76
21-Jan-21																					1002.66	999.33			962.75
28-Jan-21																					1002.26	999.4			962.76
31-Jan-21																					1002.09	999.44	920.31		962.75
4-Feb-21																					1002.03	999.47			962.77
8-Feb-21									914.36		913.137		918.82		957.83										
11-Feb-21																					1001.66	999.57			962.78
16-Feb-21			1001.205	1002.783	1018.847	1019.69											1009.234	1008.947							
18-Feb-21																					1001.2	999.6			962.75
25-Feb-21																					1001.05	999.63			962.77
27-Feb-21																					1001.01	999.64			962.76
28-Feb-21																					1000.95	999.92	920.1	987.23	962.74
2-Mar-21																					1000.84	1000.47			962.71
4-Mar-21																					1000.76	1000.94			962.66
9-Mar-21																					1000.51	1002.2			962.57
11-Mar-21																					1000.41	1002.76			962.47
18-Mar-21																					1000.1	1004.51			962.32
25-Mar-21																					999.8	1006.34			962.14
31-Mar-21																					999.5	1007.94	920.26	987.23	961.95
8-Apr-21																					1001.28	1009.76			961.71
15-Apr-21																					999.36	1011.59			961.5
22-Apr-21																					999.52	1013.44			961.93
29-Apr-21																					999.7	1015.77			962.06
30-Apr-21																					999.7	1015.77	920.53	987.29	962.06
3-May-21			1004.686	1004.499	1021.078	1022.639									959.64		1010.503	1009.513							
4-May-21									915.169	915.199	916.031	917.632	918.301	918.662	958.522	962.928									
5-May-21							955.512	953.713												907					
6-May-21	958.405	959.38																	907.574		1000.05	1018.48			962.07
13-May-21																					999.91	1020.65			961.79
20-May-21																					999.95	1022.57			961.46
27-May-21																					1000.01	1022.74			961.46
31-May-21																					1000.14	1022.84	920.35	987.38	961.49
3-Jun-21																					1000.1	1022.78			961.5
10-Jun-21																					1000.01	1022.91			961.55
17-Jun-21																					999.78	1022.96			961.55
24-Jun-21																					999.5	1023.01			961.54
30-Jun-21																					998.91	1023.01	920.45	986.86	961.56
8-Jul-21																					998.58	1023.02			961.47
15-Jul-21																					998.08	1023			961.44
22-Jul-21																					997.34	1023.03			961.39
29-Jul-21																					996.79	1023.01			961.4
31-Jul-21																					996.48	1022.98	920.12	986.88	961.42
5-Aug-21																					996.23	1022.95			961.39
12-Aug-21									914.44		910.686		918.46		957.27						995.51	1022.71			961.37
16-Aug-21			995.46	1002.02	1019.041	1020.129											1008.743	1008.745							
19-Aug-21																					994.78	1022.38			961.39
26-Aug-21																					994	1022.15			961.43
31-Aug-21																					993.35	1022.02	920.06	986.89	961.49
2-Sep-21																					993.16	1021.98			961.45
9-Sep-21																					992.35	1021.98			961.48

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
16-Sep-21																					991.48	1021.8			961.45
23-Sep-21																					990.8	1021.12			961.58
29-Sep-21																					990.07	1020.92			961.6
30-Sep-21																					989.45	1020.82	920.02	986.9	961.62
7-Oct-21																					988.98	1020.7			961.7
14-Oct-21																					988.08	1020.53			961.7
20-Oct-21																					987.51	1020.4			961.73
28-Oct-21																					986.66	1020.3			961.76
31-Oct-21																					986.1	1019.99	920	986.9	961.72
4-Nov-21																					985.81	1019.83			961.82
13-Nov-21																					985.3	1019.4			961.97
17-Nov-21													917.361	918.465	957.489	962.306									
18-Nov-21											915.496	917.458									985.32	1019.2			962.02
24-Nov-21	954.75	957.822							914.173	914.204									907.206	906.782					
25-Nov-21																					985.35	1019			962.04
30-Nov-21																					985.65	1019.41	920.02	986.92	962.05
1-Dec-21			Dry	Dry																					
2-Dec-21																					984.85	1019.61			962.06
6-Dec-21																									
14-Dec-21																					983.85	1020.08			962.04
16-Dec-21																					983.79	1020.144			961.98
24-Dec-21																					983.46	1020.262			962.08
31-Dec-21																					982.88	1020.31	920.04	987	962.09
06-Jan-22																					982.74	1,020.35			
13-Jan-22																					982.66	1,020.37			
20-Jan-22																					982.05	1,020.46			
27-Jan-22																					981.54	1,020.47			
31-Jan-22																					981.25	1,020.49	920.05	987.05	
03-Feb-22																					981.00	1,020.52			
10-Feb-22									913.963		914.478				957.586						980.08	1,020.54			
17-Feb-22																					979.87	1,020.23			
24-Feb-22																					980.81	1,020.54			
28-Feb-22					1018.931													1009.049			980.15	1,020.34	920.15	987.20	
03-Mar-22																					979.46	1,020.15			
9-Mar-22																	1009.05								
10-Mar-22						1020.127															979.61	1,020.13			
17-Mar-22																					979.78	1,021.09			
22-Mar-22													918.669												
24-Mar-22																					979.98	1,021.37			
28-Mar-22																					979.98	1,021.37			
31-Mar-22																					980.28	1,022.72			
07-Apr-22																					980.58	1,023.93			
14-Apr-22																					980.84	1,025.00			
21-Apr-22																					981.02	1,025.81			
28-Apr-22																					981.30	1,027.14			
09-May-22																					981.68	1,027.92			
11-May-22																									
12-May-22																					981.76	1,027.39			
19-May-22																					981.89	1,027.00			
26-May-22																					981.86	1,026.52			
30-May-22											916.729	917.467													
31-May-22																963.222	1010.046	1009.615							
1-Jun-22	958.666	959.986							915.322	915.369									907.682	907.103					
2-Jun-22							956.412								958.248						981.63	1,025.41			
6-Jun-22													918.874	919.18											
7-Jun-22			993.465	1001.428	1020.197	1021.035	956.467	954.8																	
8-Jun-22																									
9-Jun-22																					981.36	1,024.52			
13-Jun-22	958.833	959.921	994.355		1020.267	1021.115	956.467	953.84	915.508	915.599	911.262	917.592	918.904	919.15	958.435	963.341	1010.091	1009.68	907.806	907.402					
14-Jun-22																									
16-Jun-22																					981.94	1,023.90			
21-Jun-22																									
23-Jun-22																					980.96	1,022.44			
30-Jun-22																					980.19	1,021.25			
07-Jul-22																					979.46	1,020.76			
14-Jul-22																					979.04	1,018.47			
19-Jul-22																			909.022	908.739					
21-Jul-22																					978.37	1,016.37			
25-Jul-22											917.697	917.584													
27-Jul-22																					977.93	1,014.18			
28-Jul-22																			910.871	910.459					
02-Aug-22																			911.785	911.249					
04-Aug-22																					976.56	1,011.28			
10-Aug-22			989.98		1019.619	1020.515			914.873	914.889							1009.783	1009.4							
11-Aug-22																			913.422	912.93	976.34	1,009.24			
17-Aug-22																			914.52	914.127					
21-Aug-22																					975.89	1,005.07			
24-Aug-22																			915.036	914.727					
25-Aug-22																					976.05	1,005.10			
31-Aug-22																									963.041
01-Sep-22																					975.80	1,003.55			
08-Sep-22																			915.091	914.542					
11-Sep-22																					976.28	1,002.16			
13-Sep-22																									
15-Sep-22																			915.106	914.583	976.16	1,001.32			
20-Sep-22													918.448	918.766	957.303	960.879									

Table 2
2022 Groundwater Surface Elevations

	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake	Bootjack Lake	TSF
MOE EMS	E291978	E291979					E308529	E308530	E308531	E308532	E308533	E308534	E308535	E308536	E308537	E308538	E308539	E308540	E308541	E308542	Elevation (masl)	Elevation (masl)	Elevation (masl)		Elevation (masl)
Easting	593197	593199	591291	591291	591297	591297	594528	594528	595831	595833	596336	596338	595491	595489	594208	594206	591585	591579	593034	592918					
Northing	5824582	5824569	5823239	5823239	5823060	5823060	5821581	5821574	5819731	5819734	5818752	5818757	5818107	5818110	5818539	5818541	5822562	5822566	5825273	5825501					
Top of Pipe Elevation	963.088	964.021	1047.345	1046.848	1033.387	1033.395	960.177	959.64	925.898	925.519	938.912	939.002	922.904	922.97	964.285	964.571	1013.171	1013.17	928.226	923.412					
Ground Surface Elevation	962.148	962.868	1046.662	1045.985	1032.367	1032.432	959.354	958.972	925.096	924.946	938.187	938.351	922.155	922.261	963.638	963.907	1012.383	1012.464	927.689	922.429					
Stickup							0.82	0.67	0.80	0.57	0.73	0.65	0.75	0.71	0.65	0.66	0.79	0.71	0.54	0.98					
Stickup (check)	0.94	1.153	0.683	0.863	1.02	0.963	0.823	0.668	0.802	0.573	0.725	0.651	0.749	0.709	0.647	0.664	0.788	0.706	0.537	0.983					
Completion Zone Top																									
Completion Zone Bottom																									
Completion Zone Lithology																									
Date	GW12-5A	GW12-5B	GW15-1A	GW15-1B	GW15-2A	GW15-2B	GW16-1A	GW16-1B	GW16-2A	GW16-2B	GW16-3A	GW16-3B	GW16-4A	GW16-4B	GW16-5A	GW16-5B	GW16-6A	GW16-6B	GW16-7	GW16-8	Springer Pit	Cariboo Pit	Polley Lake		TSF
21-Sep-22	955.776	958.499					955.748	952.651											914.998	914.42					
22-Sep-22																					976.34	999.95			
29-Sep-22																			914.952	914.426	976.45	998.55			
30-Sep-22																									962.935
05-Oct-22																			914.778	914.232					
07-Oct-22																					976.57	996.47			
11-Oct-22																					976.50	995.35			
13-Oct-22																			914.531	914.007					
18-Oct-22																			914.479	913.932	976.44	993.17			
25-Oct-22																			914.511	913.987	976.13	991.14			
31-Oct-22																									963.015
15-Nov-22																	1008.842	1008.775			975.41	985.22			
16-Nov-22			985.488		1017.728	1018.642													914.474	913.973					
17-Nov-22									914.117		915.197		918.365		957.019										
22-Nov-22																					975.74	983.69			
24-Nov-22																			914.467	913.951					
29-Nov-22																					975.38	980.74			
30-Nov-22																									963.200
06-Dec-22																			914.346	913.837	975.38	978.61			
13-Dec-22																					975.38	976.28			
15-Dec-22																			914.261	913.776					
24-Dec-22																					975.31	976.13			
31-Dec-22																									962.947

Table 3
2021 Vertical Groundwater

Well ID	Location	Well Depth	May 2021		November 2021		May/June 2022		September/November 2022	
			Groundwater Elevation (masl)	Approx. Vertical Gradient	Groundwater Elevation (masl)	Approx. Vertical Gradient	Groundwater Elevation (masl)	Approx. Vertical Gradient	Groundwater Elevation (masl)	Approx. Vertical Gradient
GW11-2a	E	29.40	933.393	-0.009	932.24	-0.001	932.416	-0.064		
GW11-2b	E	14.30	933.529		932.25		933.377			
GW12-4a	E	100.60	965.657	-0.161			965.237	-0.158		
GW12-4b	E	36.30	976.028				975.412			
GW12-5a	E	100.40	958.405	-0.011	954.75	-0.04	958.666	-0.015	955.776	-0.03
GW12-5b	E	12.70	959.38		957.822		959.986		958.499	
GW16-1a	E	29.25	955.512	0.116			956.467	0.107	955.748	0.20
GW16-1b	E	13.70	953.713				954.8		952.651	
GW12-1a	W	99.60	986.027	-0.0005			986.173	-0.007	984.033	-0.01
GW12-1b	W	24.40	986.061				986.71		984.465	
GW12-2a	W	100.60	1010.061	-0.0003			1010.629	-0.003	1006.707	0.00
GW12-2b	W	30.20	1010.084				1010.840		1006.846	
GW12-3a	W	99.70	1033.074	-0.001			1033.023	-0.002		
GW12-3b	W	16.10	1033.182				1033.182			
GW15-1a	W	106.02	1004.686	0.003			993.465	-0.130		
GW15-1b	W	44.84	1004.499				1001.428			
GW15-2a	W	97.66	1021.078	-0.031			1020.197	-0.016	1017.728	-0.02
GW15-2b	W	46.83	1022.639				1021.035		1018.642	
GW16-6a	W	48.75	1010.503	0.030			1010.046	0.013	1008.842	0.00
GW16-6b	W	15.25	1009.513				1009.615		1008.775	
GW96-2a	TSF	54.88	900.997	-0.710	901.605	-0.65	901.028	-0.710		
GW96-2b	TSF	35.67	914.639		914.088		914.673			
GW96-4a	TSF	24.70	940.398	0.053			939.736	0.018		
GW96-4b	TSF	7.16	939.461		938.966		939.423			
GW00-1a	TSF	21.03	938.695	0.003	936.694	-0.18	938.732	0.002	938.372	0.00
GW00-1b	TSF	10.58	938.666		938.532		938.713		938.35	
GW00-3a	TSF	24.29	940.453	0.361	938.853	0.05	940.375	0.038	939.861	0.15
GW00-3b	TSF	13.66	936.611		938.297		939.969		938.27	
GW16-2a	TSF	51.90	915.169	-0.001	914.173	-0.001	915.322	-0.002		
GW16-2b	TSF	30.50	915.199		914.204		915.369			
GW16-3a	TSF	41.15	916.031	-0.150	915.496	-0.18	916.729	-0.069		
GW16-3b	TSF	30.50	917.632		917.458		917.467			
GW16-4a	TSF	16.75	918.301	-0.047	917.361	-0.15	918.874	-0.040	918.448	-0.04
GW16-4b	TSF	9.15	918.662		918.465		919.18		918.766	
GW16-5a	TSF	25.90	958.522	-0.899	957.489	-0.98	958.435	-1.001	957.303	-0.73
GW16-5b	TSF	21.00	962.928		962.306		963.341		960.879	
GW16-7	E	37.8	907.574	0.030	907.206	0.02	907.682	0.030	914.474	0.03
GW16-8	E	18.4	907		906.782		907.103		913.973	

Notes: Negative vertical gradients denote a downward (shallow to deep) hydraulic gradient
If a groundwater elevation was missing for a paired well, or a well depth unknown, a vertical hydraulic gradient was not calculated.
E = monitoring wells located on the east side of the mine site .
W = monitoring wells located on the west side of the mine site .
TSF = monitoring wells located around the Tailings Storage Facility.
0.286 indicates vertical hydarulic gradient between paired wells.

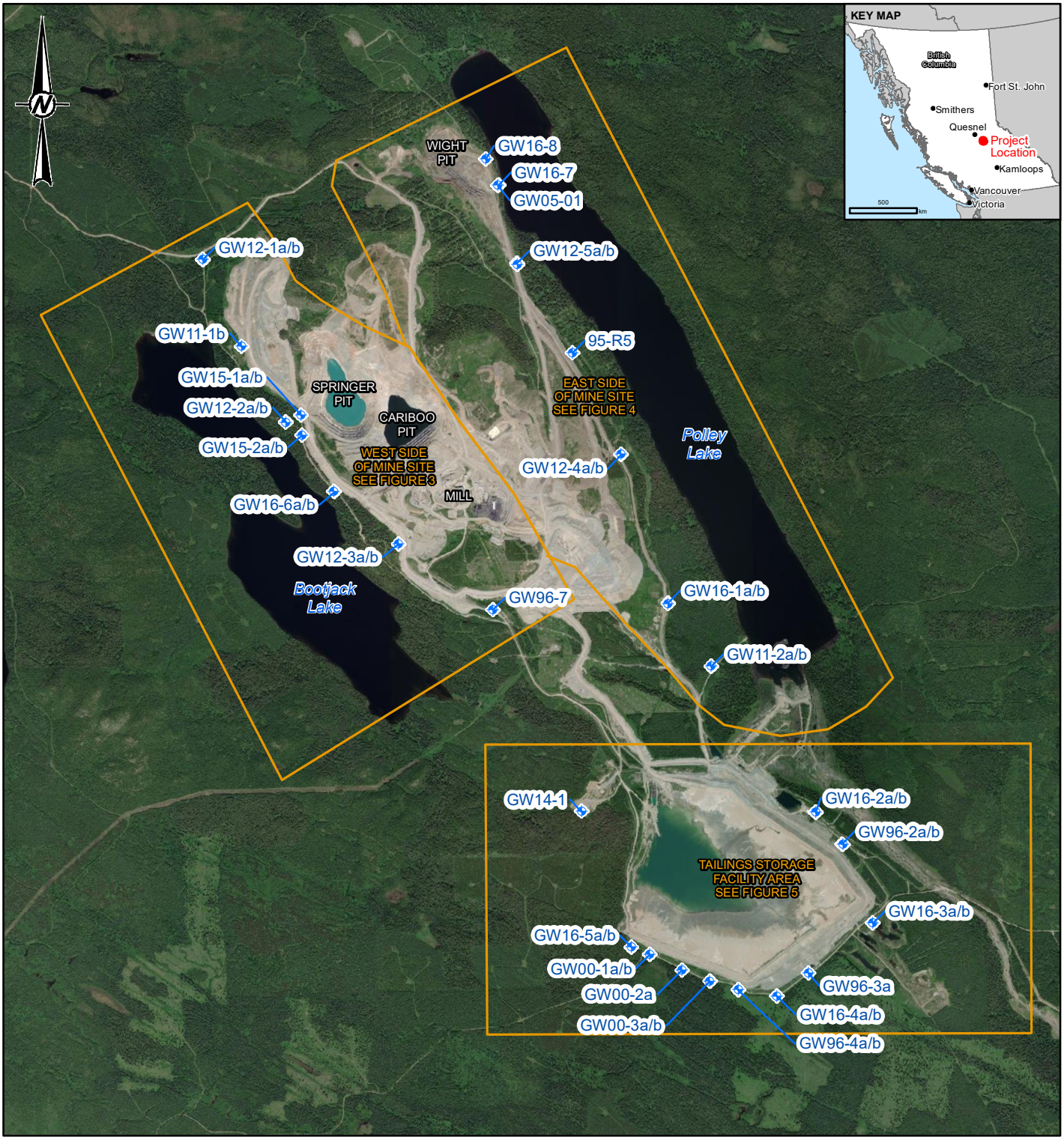

LEGEND

- GROUNDWATER MONITORING WELL
- MAP EXTENT - REFER TO FIGURES 3, 4 AND 5

0 1 2

1:50,000 KILOMETRES

REFERENCE(S)

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CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
2022 ANNUAL GROUNDWATER MONITORING REPORT

TITLE
SITE PLAN

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31400/31491	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

1 in

0

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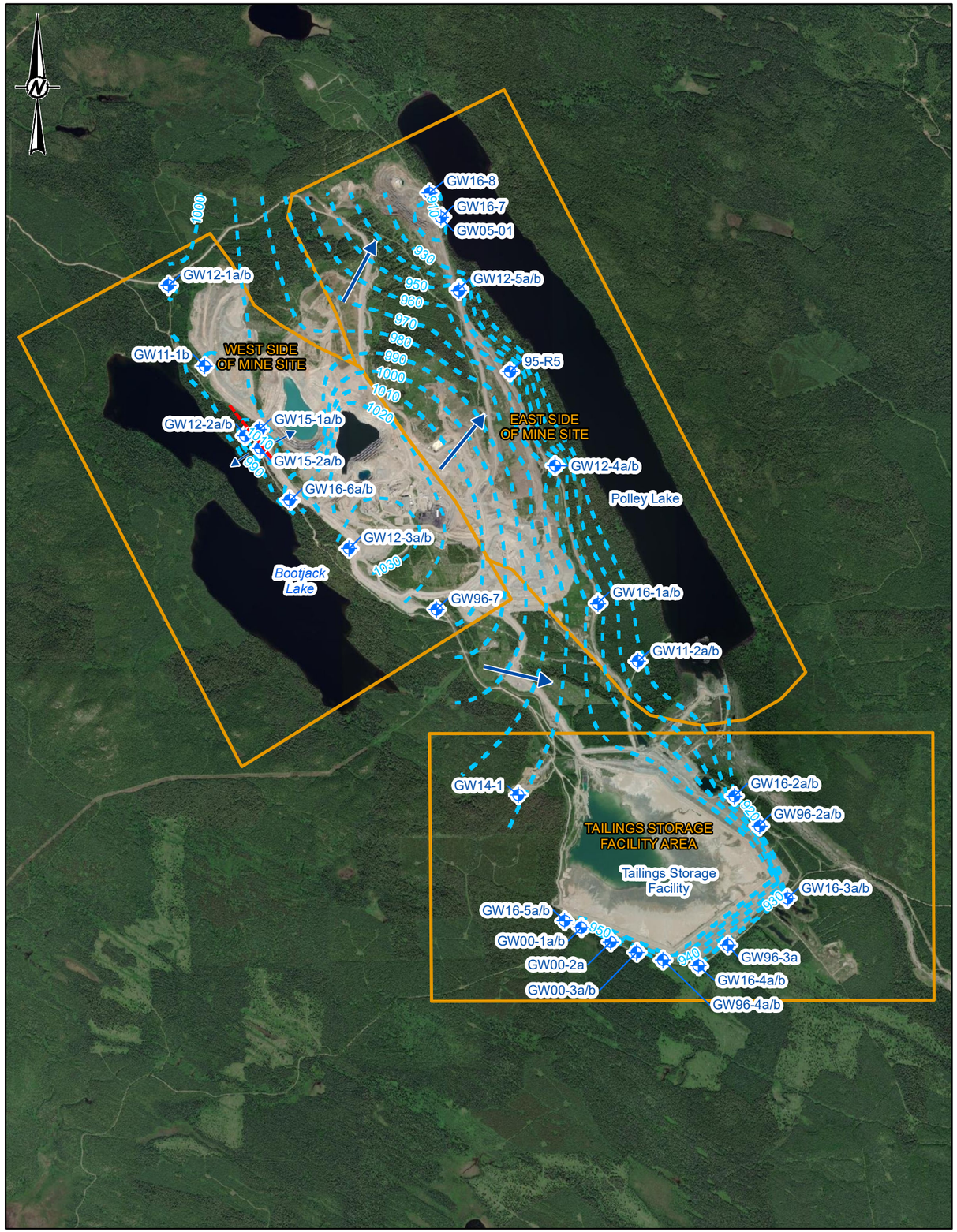

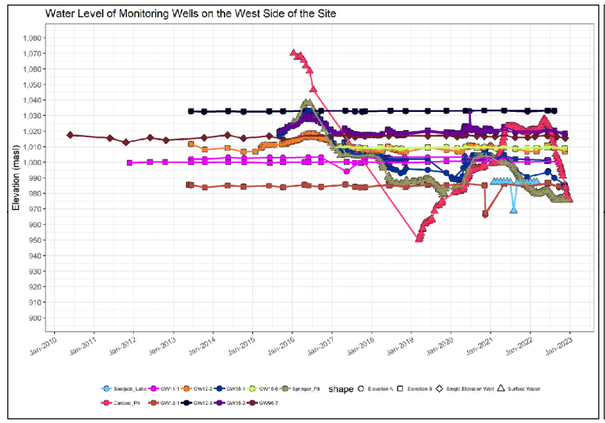

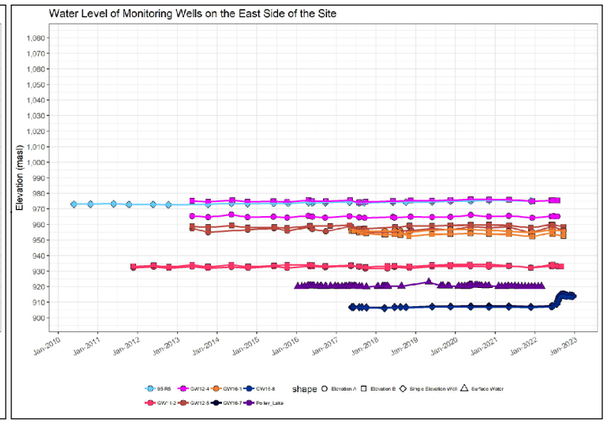

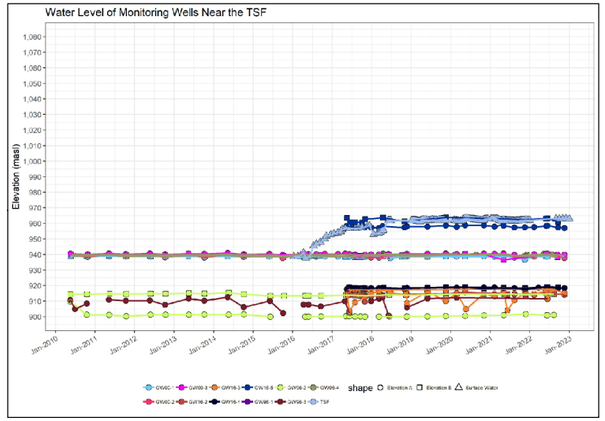

LEGEND

- GROUNDWATER MONITORING WELL
- INFERRED DIRECTION OF GROUNDWATER FLOW
- INFERRED GROUNDWATER DIVIDE
- GROUNDWATER ELEVATION CONTOUR
- MAP EXTENT (SEE FIGURES 3, 4 AND 5)

0 1 2
1:45,000 KILOMETRES

NOTE(S)
1. TAILINGS STORAGE FACILITY, POLLEY LAKE, BOOTJACK LAKE ELEVATIONS FROM FEBRUARY 2022.

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CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
2022 ANNUAL GROUNDWATER MONITORING REPORT

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

TITLE
GROUNDWATER FLOW DIRECTION PLAN (JUNE 2022)

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31400/31491	0	2

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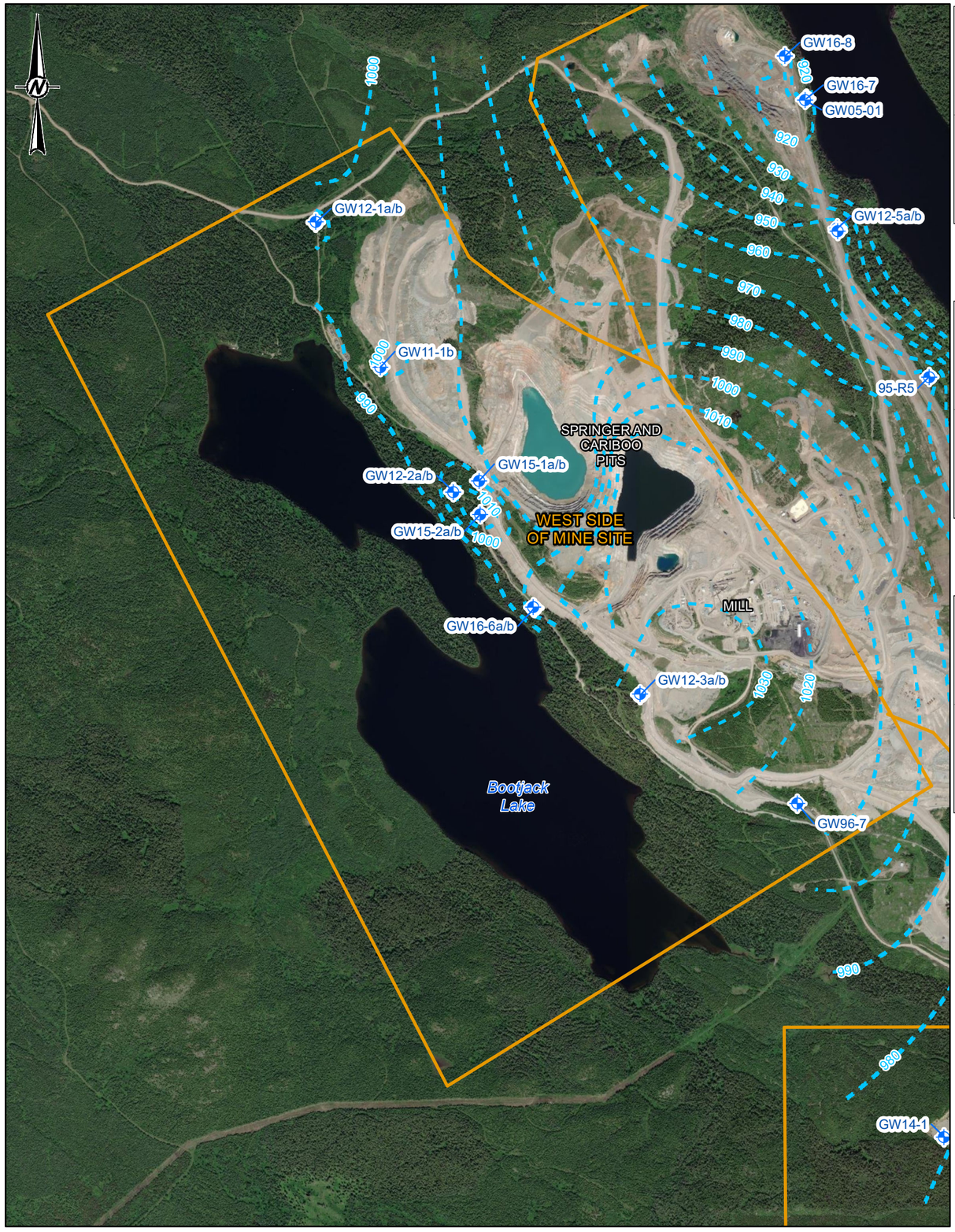

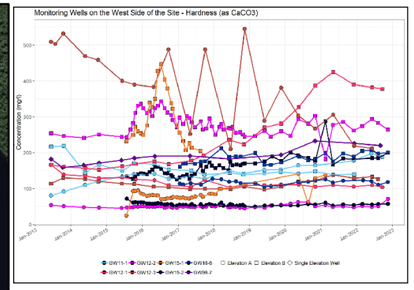

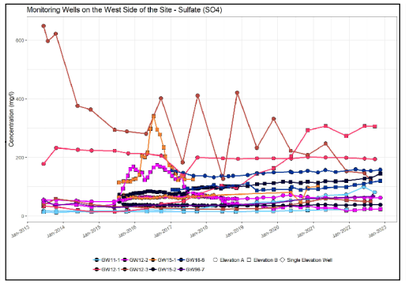

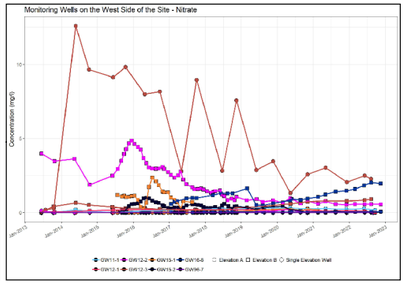

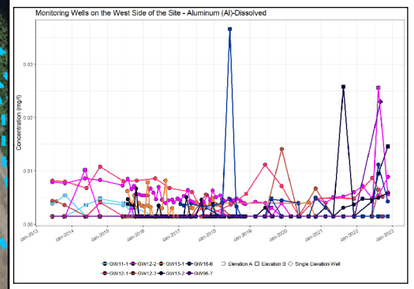

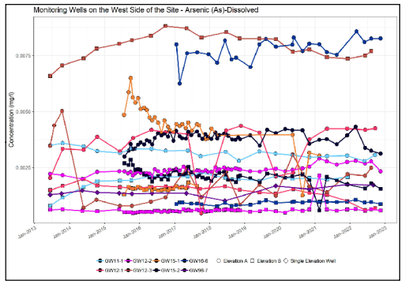

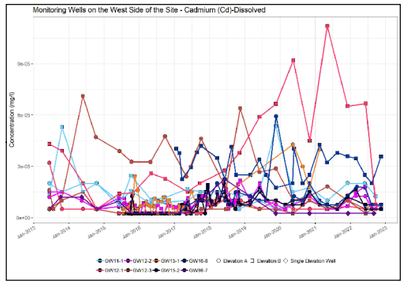

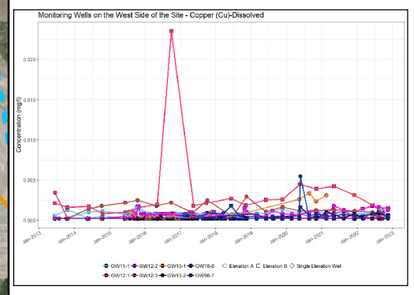

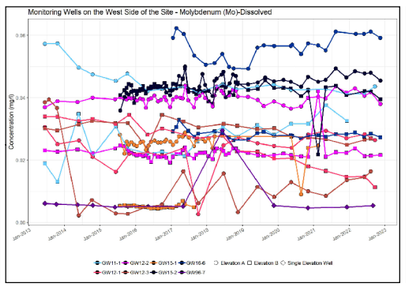

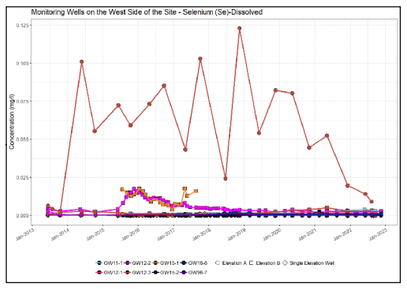

LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- MAP EXTENT

0 500 1,000

1:25,000 METRES

NOTE(S)

1. PARAMETER CONCENTRATION SCALES DIFFER ON EACH PLOT

REFERENCE(S)

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CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
2022 ANNUAL GROUNDWATER MONITORING REPORT

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
DESIGNED	OK
PREPARED	JP
REVIEWED	OK
APPROVED	JF

TITLE
GROUNDWATER QUALITY TRENDS FOR WEST SIDE OF MINE SITE

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31400/31491	0	3

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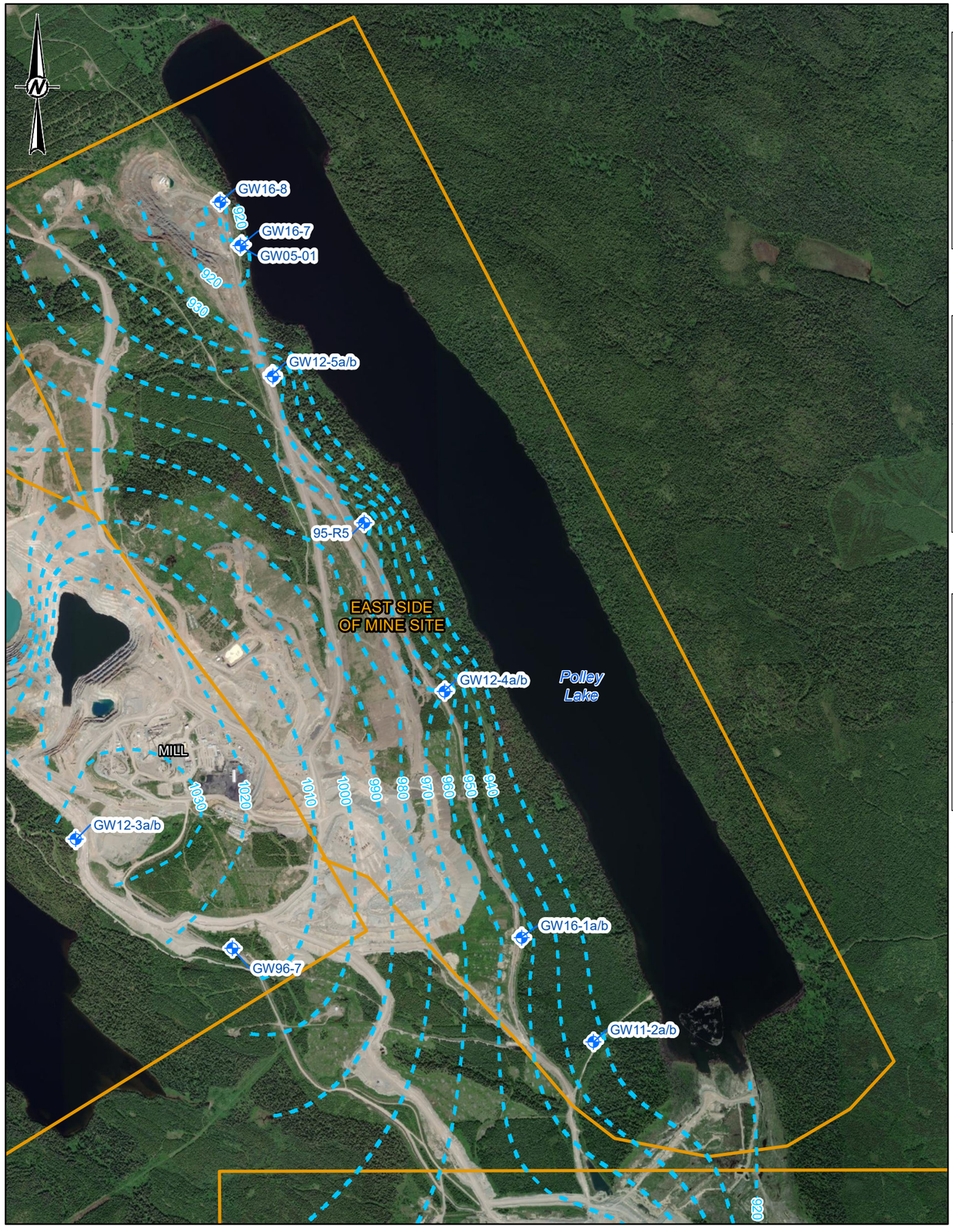

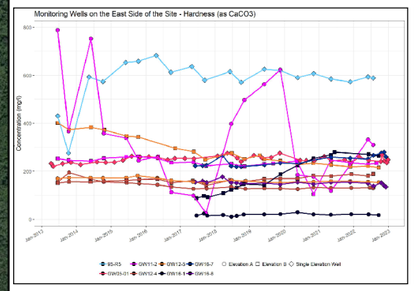

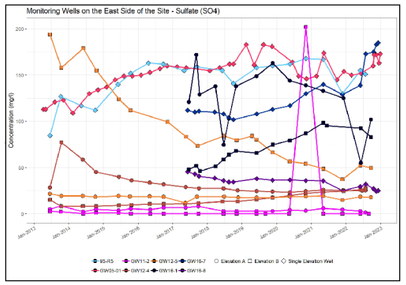

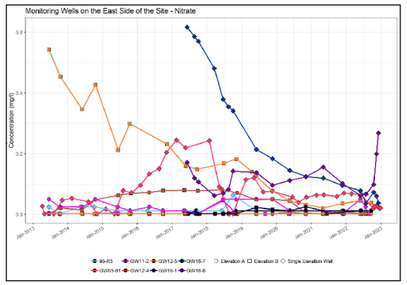

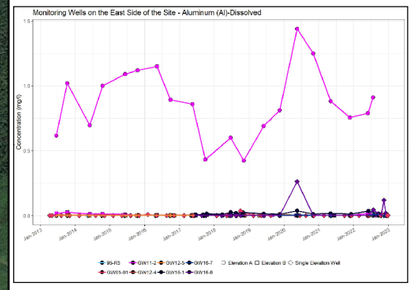

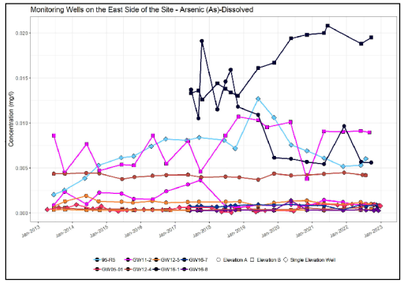

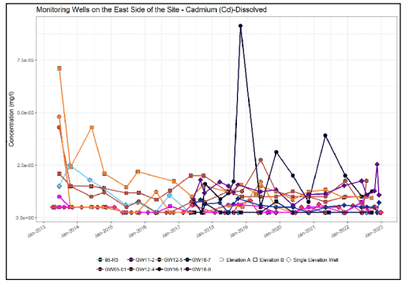

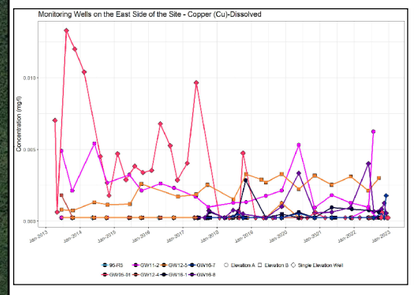

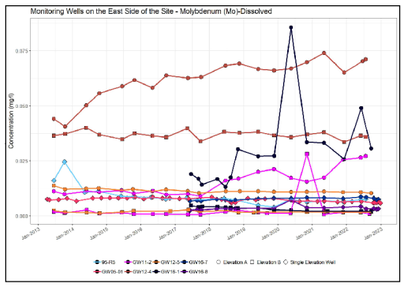

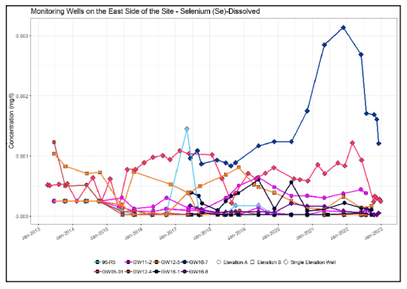

LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- MAP EXTENT

0 500 1,000
1:25,000 METRES

NOTE(S)
1. PARAMETER CONCENTRATION SCALES DIFFER ON EACH PLOT

REFERENCE(S)
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2. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
2022 ANNUAL GROUNDWATER MONITORING REPORT

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

TITLE
GROUNDWATER QUALITY TRENDS FOR EAST SIDE OF MINE SITE

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31400/31491	0	4

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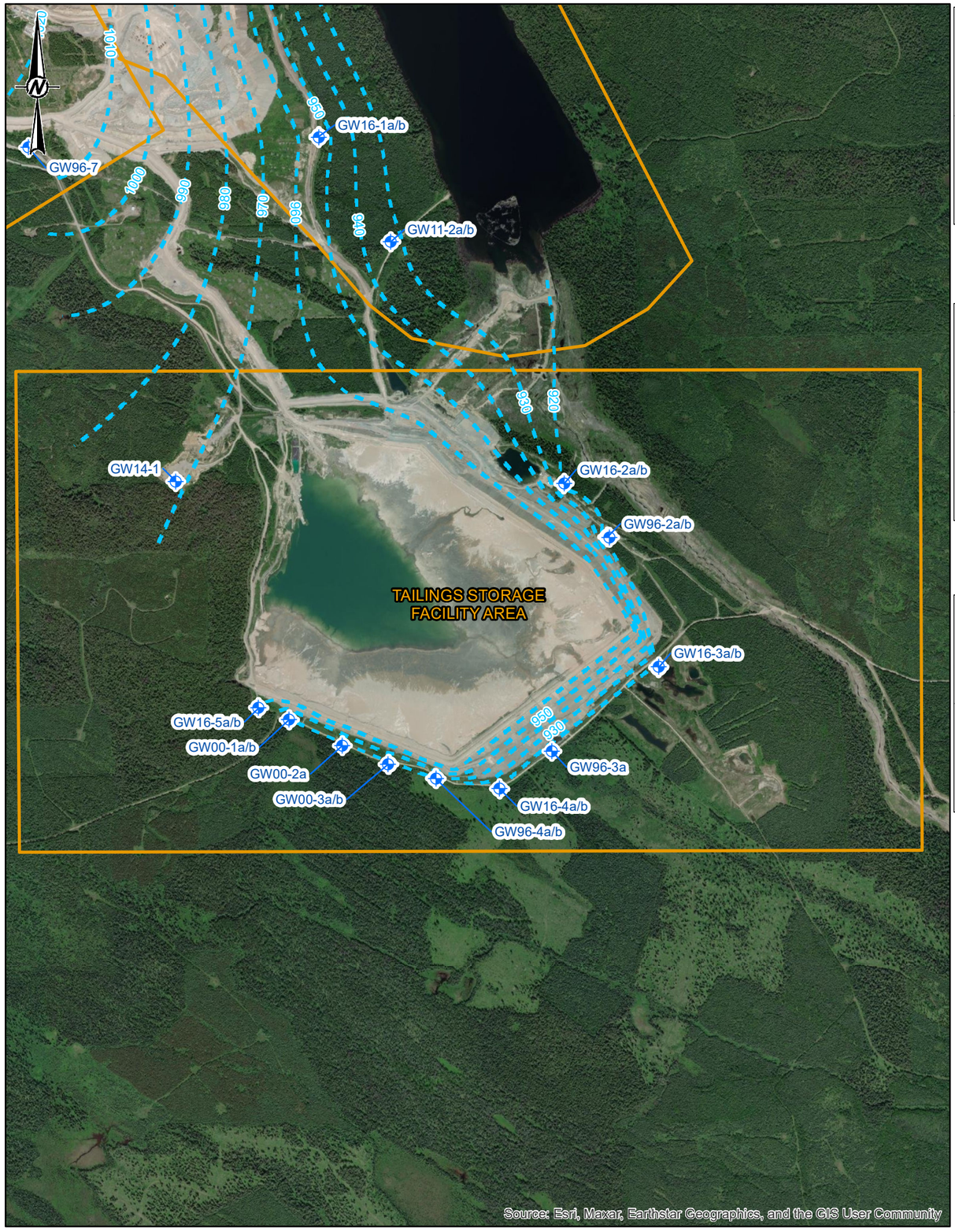

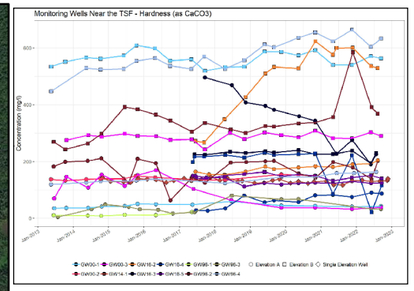

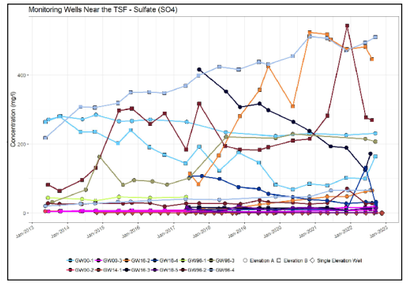

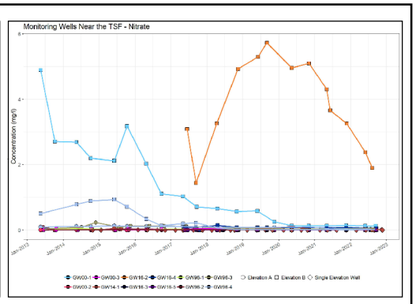

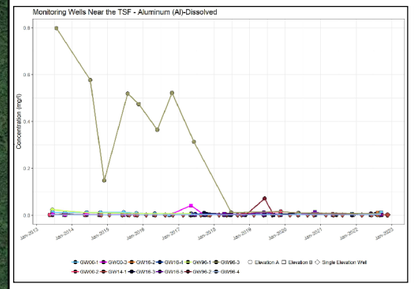

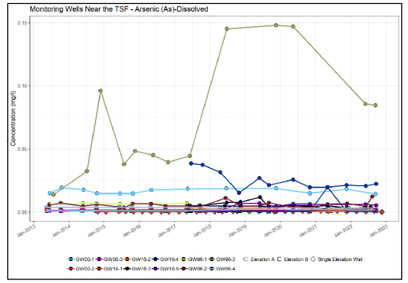

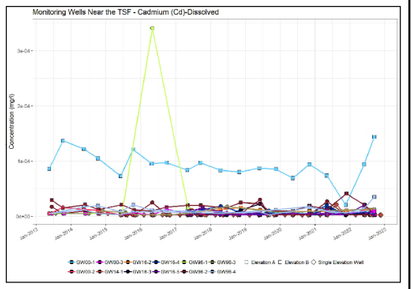

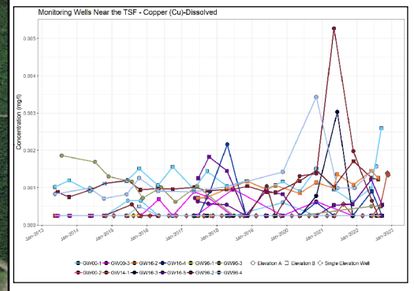

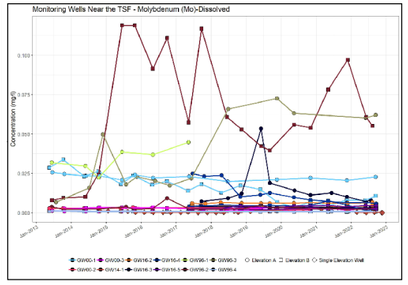

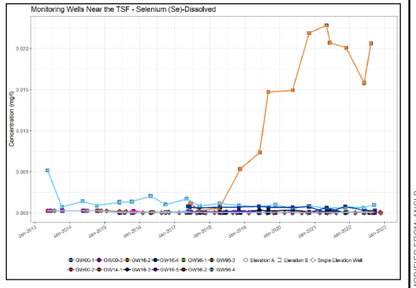

LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- MAP EXTENT

0 500 1,000

1:25,000 METRES

NOTE(S)

1. PARAMETER CONCENTRATION SCALES DIFFER ON EACH PLOT

REFERENCE(S)

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2. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
2022 ANNUAL GROUNDWATER MONITORING REPORT

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
DESIGNED	OK
PREPARED	CDB
REVIEWED	OK
APPROVED	JF

TITLE
GROUNDWATER QUALITY TRENDS FOR THE TAILINGS STORAGE FACILITY

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31400/31491	0	5

PATH: Y:\burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\23590671\31400.31491\NA\02_PRODUCTION\MXD\Report\23590671_31400_31491_05_GW_TRENDS_TSF.mxd PRINTED ON: 2023-03-29 AT: 3:21:54 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

Groundwater Elevation at GW12-2a and 2b

Appendix A
Groundwater Elevation at
GW12-2a and 2b

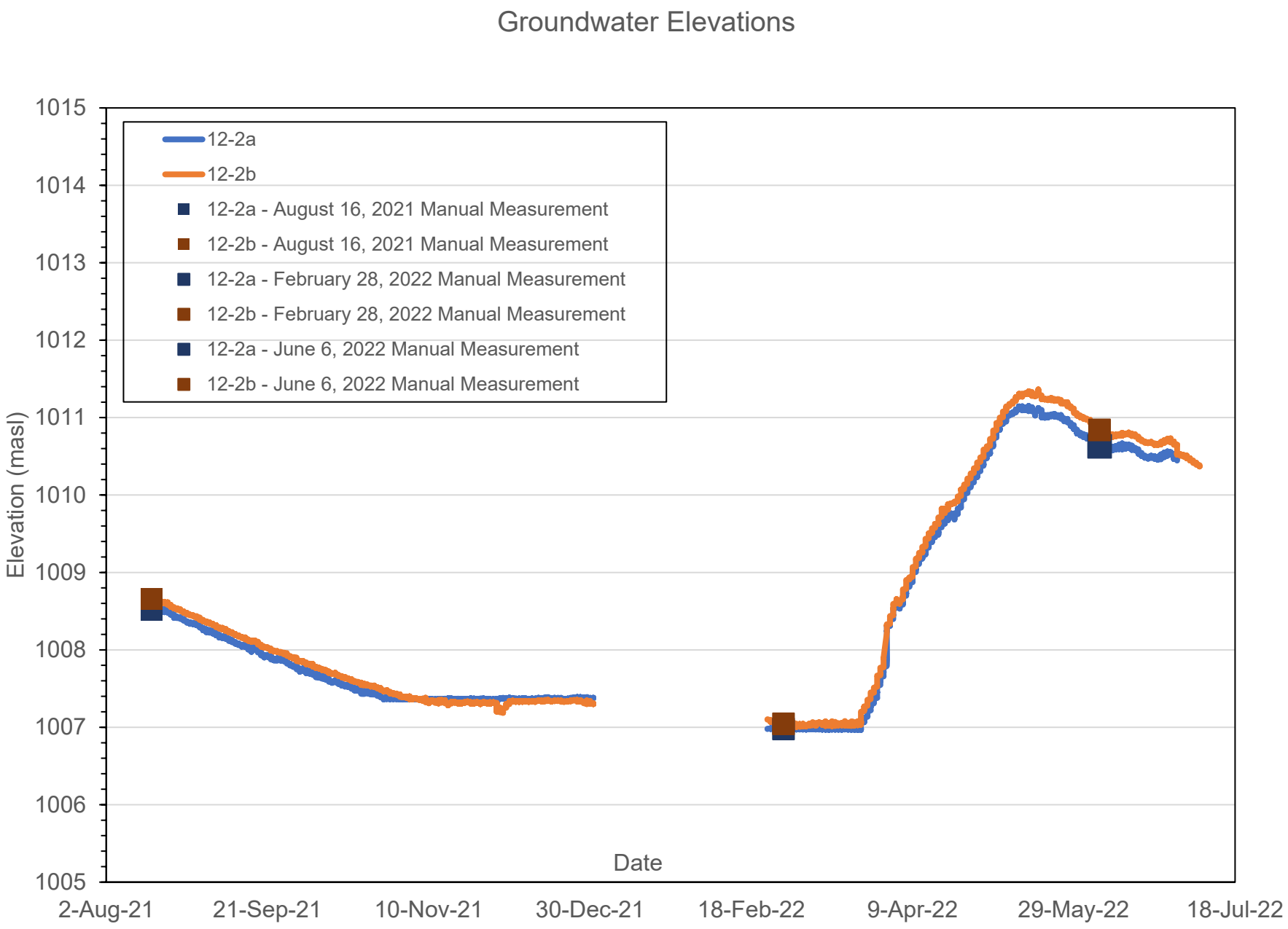

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/16/2021	1:26:51 PM	0	10.37	5.9	8/16/2021	1:33:24 PM	0	895.856	21.788	1.23	25.16	1008.52
8/16/2021	2:26:51 PM	0	10.401	5.6	8/16/2021	2:33:24 PM	0	895.364	21.782	1.27	25.12	1008.56
8/16/2021	3:26:51 PM	0	10.41	5.5	8/16/2021	3:33:24 PM	0	894.906	21.011	1.28	25.11	1008.57
8/16/2021	4:26:51 PM	0	10.415	5.5	8/16/2021	4:33:24 PM	0	894.493	19.663	1.29	25.10	1008.58
8/16/2021	5:26:51 PM	0	10.415	5.5	8/16/2021	5:33:24 PM	0	894.346	18.307	1.30	25.10	1008.58
8/16/2021	6:26:51 PM	0	10.413	5.4	8/16/2021	6:33:24 PM	0	894.209	15.787	1.29	25.10	1008.58
8/16/2021	7:26:51 PM	0	10.415	5.4	8/16/2021	7:33:24 PM	0	894.247	14.224	1.30	25.10	1008.58
8/16/2021	8:26:51 PM	0	10.413	5.4	8/16/2021	8:33:24 PM	0	894.157	12.795	1.30	25.10	1008.58
8/16/2021	9:26:51 PM	0	10.415	5.4	8/16/2021	9:33:24 PM	0	894.691	10.105	1.29	25.10	1008.58
8/16/2021	10:26:51 PM	0	10.415	5.4	8/16/2021	10:33:24 PM	0	894.852	8.168	1.29	25.10	1008.57
8/16/2021	11:26:51 PM	0	10.412	5.4	8/16/2021	11:33:24 PM	0	894.588	6.785	1.29	25.11	1008.57
8/17/2021	12:26:51 AM	0	10.41	5.4	8/17/2021	12:33:24 AM	0	894.634	6.463	1.29	25.11	1008.57
8/17/2021	1:26:51 AM	0	10.409	5.4	8/17/2021	1:33:24 AM	0	894.775	6.02	1.28	25.11	1008.57
8/17/2021	2:26:51 AM	0	10.406	5.4	8/17/2021	2:33:24 AM	0	894.904	5.618	1.28	25.11	1008.56
8/17/2021	3:26:51 AM	0	10.403	5.4	8/17/2021	3:33:24 AM	0	895.121	5.134	1.28	25.12	1008.56
8/17/2021	4:26:51 AM	0	10.398	5.4	8/17/2021	4:33:24 AM	0	895.295	4.814	1.27	25.13	1008.55
8/17/2021	5:26:51 AM	0	10.395	5.4	8/17/2021	5:33:24 AM	0	895.795	4.839	1.26	25.13	1008.54
8/17/2021	6:26:51 AM	0	10.397	5.4	8/17/2021	6:33:24 AM	0	896.374	4.411	1.26	25.14	1008.54
8/17/2021	7:26:51 AM	0	10.398	5.4	8/17/2021	7:33:24 AM	0	897.28	4.842	1.25	25.15	1008.53
8/17/2021	8:26:51 AM	0	10.4	5.4	8/17/2021	8:33:24 AM	0	897.965	7.84	1.24	25.15	1008.53
8/17/2021	9:26:51 AM	0	10.404	5.4	8/17/2021	9:33:24 AM	0	898.075	19.809	1.25	25.15	1008.53
8/17/2021	10:26:51 AM	0	10.409	5.4	8/17/2021	10:33:24 AM	0	897.765	26.24	1.25	25.14	1008.54
8/17/2021	11:26:51 AM	0	10.412	5.4	8/17/2021	11:33:24 AM	0	897.209	29.385	1.26	25.13	1008.55
8/17/2021	12:26:51 PM	0	10.415	5.4	8/17/2021	12:33:24 PM	0	896.778	30.933	1.27	25.12	1008.55
8/17/2021	1:26:51 PM	0	10.424	5.4	8/17/2021	1:33:24 PM	0	896.905	31.675	1.28	25.12	1008.56
8/17/2021	2:26:51 PM	0	10.43	5.4	8/17/2021	2:33:24 PM	0	896.844	32.902	1.28	25.11	1008.57
8/17/2021	3:26:51 PM	0	10.434	5.4	8/17/2021	3:33:24 PM	0	897.185	32.581	1.29	25.11	1008.57
8/17/2021	4:26:51 PM	0	10.437	5.4	8/17/2021	4:33:24 PM	0	897.777	25.896	1.28	25.11	1008.57
8/17/2021	5:26:51 PM	0	10.44	5.4	8/17/2021	5:33:24 PM	0	898.222	22.48	1.28	25.11	1008.56
8/17/2021	6:26:51 PM	0	10.44	5.4	8/17/2021	6:33:24 PM	0	898.574	20.34	1.28	25.12	1008.56
8/17/2021	7:26:51 PM	0	10.443	5.4	8/17/2021	7:33:24 PM	0	899.188	18.82	1.27	25.12	1008.56
8/17/2021	8:26:51 PM	0	10.445	5.4	8/17/2021	8:33:24 PM	0	899.965	16.046	1.27	25.13	1008.55
8/17/2021	9:26:51 PM	0	10.445	5.4	8/17/2021	9:33:24 PM	0	900.467	12.488	1.26	25.13	1008.55
8/17/2021	10:26:51 PM	0	10.442	5.4	8/17/2021	10:33:24 PM	0	900.256	10.383	1.26	25.13	1008.55
8/17/2021	11:26:51 PM	0	10.442	5.4	8/17/2021	11:33:24 PM	0	900.322	9.468	1.26	25.13	1008.55
8/18/2021	12:26:51 AM	0	10.442	5.4	8/18/2021	12:33:24 AM	0	900.449	8.466	1.26	25.13	1008.54
8/18/2021	1:26:51 AM	0	10.44	5.4	8/18/2021	1:33:24 AM	0	900.577	7.816	1.26	25.14	1008.54
8/18/2021	2:26:51 AM	0	10.438	5.4	8/18/2021	2:33:24 AM	0	900.721	7.243	1.25	25.14	1008.54
8/18/2021	3:26:51 AM	0	10.435	5.4	8/18/2021	3:33:24 AM	0	900.789	6.793	1.25	25.15	1008.53
8/18/2021	4:26:51 AM	0	10.43	5.4	8/18/2021	4:33:24 AM	0	900.732	6.923	1.25	25.15	1008.53
8/18/2021	5:26:51 AM	0	10.427	5.4	8/18/2021	5:33:24 AM	0	900.999	7.668	1.24	25.16	1008.52
8/18/2021	6:26:51 AM	0	10.419	5.4	8/18/2021	6:33:24 AM	0	900.999	8.317	1.23	25.16	1008.52
8/18/2021	7:26:51 AM	0	10.415	5.4	8/18/2021	7:33:24 AM	0	901.036	9.413	1.23	25.17	1008.51
8/18/2021	8:26:51 AM	0	10.412	5.4	8/18/2021	8:33:24 AM	0	901.031	11.078	1.22	25.17	1008.51
8/18/2021	9:26:51 AM	0	10.413	5.4	8/18/2021	9:33:24 AM	0	901.245	13.673	1.22	25.17	1008.51
8/18/2021	10:26:51 AM	0	10.412	5.4	8/18/2021	10:33:24 AM	0	900.449	21.482	1.23	25.16	1008.51
8/18/2021	11:26:51 AM	0	10.415	5.4	8/18/2021	11:33:24 AM	0	900.032	25.172	1.24	25.16	1008.52
8/18/2021	12:26:51 PM	0	10.419	5.4	8/18/2021	12:33:24 PM	0	899.93	27.085	1.24	25.15	1008.53
8/18/2021	1:26:51 PM	0	10.425	5.4	8/18/2021	1:33:24 PM	0	899.691	24.897	1.25	25.14	1008.53
8/18/2021	2:26:51 PM	0	10.432	5.4	8/18/2021	2:33:24 PM	0	899.978	23.532	1.25	25.14	1008.54
8/18/2021	3:26:51 PM	0	10.437	5.4	8/18/2021	3:33:24 PM	0	899.932	21.352	1.26	25.13	1008.54
8/18/2021	4:26:51 PM	0	10.443	5.4	8/18/2021	4:33:24 PM	0	900.206	21.104	1.26	25.13	1008.55
8/18/2021	5:26:51 PM	0	10.445	5.4	8/18/2021	5:33:24 PM	0	900.23	20.192	1.27	25.13	1008.55
8/18/2021	6:26:51 PM	0	10.445	5.4	8/18/2021	6:33:24 PM	0	900.404	18.871	1.26	25.13	1008.55
8/18/2021	7:26:51 PM	0	10.445	5.4	8/18/2021	7:33:24 PM	0	900.771	17.011	1.26	25.14	1008.54
8/18/2021	8:26:51 PM	0	10.44	5.4	8/18/2021	8:33:24 PM	0	900.619	15.216	1.26	25.14	1008.54
8/18/2021	9:26:51 PM	0	10.438	5.4	8/18/2021	9:33:24 PM	0	900.81	12.523	1.25	25.14	1008.54
8/18/2021	10:26:51 PM	0	10.435	5.4	8/18/2021	10:33:24 PM	0	900.768	10.953	1.25	25.15	1008.53
8/18/2021	11:26:51 PM	0	10.431	5.4	8/18/2021	11:33:24 PM	0	900.527	10.891	1.25	25.15	1008.53
8/19/2021	12:26:51 AM	0	10.431	5.4	8/19/2021	12:33:24 AM	0	900.539	11.189	1.25	25.15	1008.53
8/19/2021	1:26:51 AM	0	10.431	5.4	8/19/2021	1:33:24 AM	0	900.731	11.343	1.25	25.15	1008.53
8/19/2021	2:26:51 AM	0	10.43	5.4	8/19/2021	2:33:24 AM	0	900.874	11.638	1.24	25.15	1008.53
8/19/2021	3:26:51 AM	0	10.425	5.4	8/19/2021	3:33:24 AM	0	900.732	11.643	1.24	25.15	1008.52
8/19/2021	4:26:51 AM	0	10.424	5.4	8/19/2021	4:33:24 AM	0	900.999	11.669	1.24	25.16	1008.52
8/19/2021	5:26:51 AM	0	10.416	5.4	8/19/2021	5:33:24 AM	0	900.685	11.05	1.23	25.16	1008.52
8/19/2021	6:26:51 AM	0	10.41	5.4	8/19/2021	6:33:24 AM	0	900.751	10.729	1.22	25.17	1008.51
8/19/2021	7:26:51 AM	0	10.404	5.4	8/19/2021	7:33:24 AM	0	900.974	11.578	1.22	25.18	1008.50
8/19/2021	8:26:51 AM	0	10.401	5.4	8/19/2021	8:33:24 AM	0	901.301	13.777	1.21	25.18	1008.49
8/19/2021	9:26:51 AM	0	10.397	5.4	8/19/2021	9:33:24 AM	0	901.077	18.011	1.21	25.19	1008.49
8/19/2021	10:26:51 AM	0	10.397	5.4	8/19/2021	10:33:24 AM	0	900.995	22.15	1.21	25.19	1008.49
8/19/2021	11:26:51 AM	0	10.398	5.4	8/19/2021	11:33:24 AM	0	900.815	24.719	1.21	25.18	1008.50
8/19/2021	12:26:51 PM	0	10.4	5.4	8/19/2021	12:33:24 PM	0	900.256	26.609	1.22	25.17	1008.50

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/19/2021	1:26:51 PM	0	10.407	5.4	8/19/2021	1:33:24 PM	0	900.34	26.008	1.23	25.17	1008.51
8/19/2021	2:26:51 PM	0	10.413	5.4	8/19/2021	2:33:24 PM	0	899.985	27.47	1.24	25.16	1008.52
8/19/2021	3:26:51 PM	0	10.416	5.4	8/19/2021	3:33:24 PM	0	899.279	29.854	1.25	25.15	1008.53
8/19/2021	4:26:51 PM	0	10.421	5.4	8/19/2021	4:33:24 PM	0	899.439	25.411	1.25	25.15	1008.53
8/19/2021	5:26:51 PM	0	10.424	5.4	8/19/2021	5:33:24 PM	0	899.644	22.436	1.25	25.14	1008.53
8/19/2021	6:26:51 PM	0	10.425	5.4	8/19/2021	6:33:24 PM	0	899.774	20.306	1.25	25.14	1008.53
8/19/2021	7:26:51 PM	0	10.421	5.4	8/19/2021	7:33:24 PM	0	899.578	19.099	1.25	25.15	1008.53
8/19/2021	8:26:51 PM	0	10.419	5.4	8/19/2021	8:33:24 PM	0	899.985	16.008	1.24	25.15	1008.53
8/19/2021	9:26:51 PM	0	10.415	5.4	8/19/2021	9:33:24 PM	0	899.814	12.343	1.24	25.16	1008.52
8/19/2021	10:26:51 PM	0	10.41	5.4	8/19/2021	10:33:24 PM	0	899.68	10.175	1.24	25.16	1008.52
8/19/2021	11:26:51 PM	0	10.407	5.4	8/19/2021	11:33:24 PM	0	899.434	8.95	1.24	25.16	1008.52
8/20/2021	12:26:51 AM	0	10.406	5.4	8/20/2021	12:33:24 AM	0	899.261	8.118	1.24	25.16	1008.52
8/20/2021	1:26:51 AM	0	10.403	5.4	8/20/2021	1:33:24 AM	0	899.006	7.478	1.24	25.16	1008.52
8/20/2021	2:26:51 AM	0	10.4	5.4	8/20/2021	2:33:24 AM	0	898.708	7.318	1.24	25.16	1008.52
8/20/2021	3:26:51 AM	0	10.397	5.4	8/20/2021	3:33:24 AM	0	898.4	7.034	1.24	25.16	1008.52
8/20/2021	4:26:51 AM	0	10.392	5.4	8/20/2021	4:33:24 AM	0	898.228	6.417	1.23	25.16	1008.52
8/20/2021	5:26:51 AM	0	10.386	5.4	8/20/2021	5:33:24 AM	0	898.24	5.953	1.23	25.17	1008.51
8/20/2021	6:26:51 AM	0	10.38	5.4	8/20/2021	6:33:24 AM	0	898.254	5.426	1.22	25.17	1008.50
8/20/2021	7:26:51 AM	0	10.373	5.4	8/20/2021	7:33:24 AM	0	898.382	5.932	1.21	25.18	1008.50
8/20/2021	8:26:51 AM	0	10.364	5.4	8/20/2021	8:33:24 AM	0	898.332	8.783	1.20	25.19	1008.49
8/20/2021	9:26:51 AM	0	10.355	5.4	8/20/2021	9:33:24 AM	0	897.679	20.685	1.20	25.19	1008.49
8/20/2021	10:26:51 AM	0	10.347	5.4	8/20/2021	10:33:24 AM	0	896.834	28.108	1.20	25.19	1008.49
8/20/2021	11:26:51 AM	0	10.344	5.4	8/20/2021	11:33:24 AM	0	895.896	32.444	1.21	25.19	1008.49
8/20/2021	12:26:51 PM	0	10.344	5.4	8/20/2021	12:33:24 PM	0	895.172	34.667	1.22	25.18	1008.50
8/20/2021	1:26:51 PM	0	10.345	5.4	8/20/2021	1:33:24 PM	0	894.557	36.288	1.22	25.17	1008.51
8/20/2021	2:26:51 PM	0	10.349	5.4	8/20/2021	2:33:24 PM	0	894.116	36.217	1.23	25.16	1008.52
8/20/2021	3:26:51 PM	0	10.355	5.4	8/20/2021	3:33:24 PM	0	893.704	38.057	1.24	25.15	1008.53
8/20/2021	4:26:51 PM	0	10.358	5.4	8/20/2021	4:33:24 PM	0	894.185	30.505	1.24	25.15	1008.52
8/20/2021	5:26:51 PM	0	10.361	5.4	8/20/2021	5:33:24 PM	0	894.418	24.375	1.24	25.15	1008.52
8/20/2021	6:26:51 PM	0	10.362	5.4	8/20/2021	6:33:24 PM	0	894.402	21.409	1.24	25.15	1008.53
8/20/2021	7:26:51 PM	0	10.359	5.4	8/20/2021	7:33:24 PM	0	894.322	19.328	1.24	25.16	1008.52
8/20/2021	8:26:51 PM	0	10.358	5.4	8/20/2021	8:33:24 PM	0	894.705	16.035	1.23	25.16	1008.52
8/20/2021	9:26:51 PM	0	10.353	5.4	8/20/2021	9:33:24 PM	0	894.734	13.077	1.23	25.17	1008.51
8/20/2021	10:26:51 PM	0	10.349	5.4	8/20/2021	10:33:24 PM	0	894.55	11.405	1.23	25.17	1008.51
8/20/2021	11:26:51 PM	0	10.345	5.4	8/20/2021	11:33:24 PM	0	894.422	10.492	1.22	25.17	1008.51
8/21/2021	12:26:51 AM	0	10.344	5.4	8/21/2021	12:33:24 AM	0	894.367	9.722	1.22	25.17	1008.51
8/21/2021	1:26:51 AM	0	10.341	5.4	8/21/2021	1:33:24 AM	0	894.203	9.687	1.22	25.17	1008.51
8/21/2021	2:26:51 AM	0	10.341	5.4	8/21/2021	2:33:24 AM	0	894.119	9.229	1.22	25.17	1008.51
8/21/2021	3:26:51 AM	0	10.339	5.4	8/21/2021	3:33:24 AM	0	893.948	9.095	1.22	25.17	1008.51
8/21/2021	4:26:51 AM	0	10.336	5.4	8/21/2021	4:33:24 AM	0	893.671	8.389	1.22	25.17	1008.51
8/21/2021	5:26:51 AM	0	10.332	5.4	8/21/2021	5:33:24 AM	0	893.454	7.643	1.22	25.17	1008.51
8/21/2021	6:26:51 AM	0	10.328	5.4	8/21/2021	6:33:24 AM	0	893.517	6.851	1.22	25.18	1008.50
8/21/2021	7:26:51 AM	0	10.319	5.4	8/21/2021	7:33:24 AM	0	893.517	7.629	1.21	25.19	1008.49
8/21/2021	8:26:51 AM	0	10.308	5.4	8/21/2021	8:33:24 AM	0	893.331	10.934	1.20	25.20	1008.48
8/21/2021	9:26:51 AM	0	10.296	5.4	8/21/2021	9:33:24 AM	0	892.28	20.933	1.20	25.20	1008.48
8/21/2021	10:26:51 AM	0	10.287	5.4	8/21/2021	10:33:24 AM	0	891.331	27.701	1.20	25.20	1008.48
8/21/2021	11:26:51 AM	0	10.28	5.4	8/21/2021	11:33:24 AM	0	890.143	32.009	1.20	25.19	1008.49
8/21/2021	12:26:51 PM	0	10.274	5.4	8/21/2021	12:33:24 PM	0	889.37	30.51	1.20	25.19	1008.49
8/21/2021	1:26:51 PM	0	10.271	5.4	8/21/2021	1:33:24 PM	0	888.313	32.836	1.21	25.18	1008.50
8/21/2021	2:26:51 PM	0	10.272	5.4	8/21/2021	2:33:24 PM	0	887.449	35.224	1.22	25.17	1008.51
8/21/2021	3:26:51 PM	0	10.274	5.4	8/21/2021	3:33:24 PM	0	886.899	32.408	1.23	25.16	1008.51
8/21/2021	4:26:51 PM	0	10.274	5.4	8/21/2021	4:33:24 PM	0	886.374	28.806	1.24	25.16	1008.52
8/21/2021	5:26:51 PM	0	10.271	5.4	8/21/2021	5:33:24 PM	0	885.526	25.21	1.24	25.15	1008.53
8/21/2021	6:26:51 PM	0	10.269	5.4	8/21/2021	6:33:24 PM	0	885.106	21.709	1.24	25.15	1008.53
8/21/2021	7:26:51 PM	0	10.268	5.4	8/21/2021	7:33:24 PM	0	884.772	19.143	1.25	25.15	1008.53
8/21/2021	8:26:51 PM	0	10.266	5.4	8/21/2021	8:33:24 PM	0	885.625	17.336	1.24	25.16	1008.52
8/21/2021	9:26:51 PM	0	10.265	5.4	8/21/2021	9:33:24 PM	0	885.988	15.15	1.23	25.16	1008.51
8/21/2021	10:26:51 PM	0	10.26	5.4	8/21/2021	10:33:24 PM	0	886.105	12.399	1.22	25.17	1008.51
8/21/2021	11:26:51 PM	0	10.262	5.4	8/21/2021	11:33:24 PM	0	886.969	11.118	1.22	25.18	1008.50
8/22/2021	12:26:51 AM	0	10.262	5.4	8/22/2021	12:33:24 AM	0	887.473	10.619	1.21	25.18	1008.50
8/22/2021	1:26:51 AM	0	10.265	5.4	8/22/2021	1:33:24 AM	0	888.029	10.239	1.21	25.19	1008.49
8/22/2021	2:26:51 AM	0	10.268	5.4	8/22/2021	2:33:24 AM	0	888.33	9.354	1.21	25.19	1008.49
8/22/2021	3:26:51 AM	0	10.268	5.4	8/22/2021	3:33:24 AM	0	888.303	8.299	1.21	25.18	1008.49
8/22/2021	4:26:51 AM	0	10.266	5.4	8/22/2021	4:33:24 AM	0	888.007	7.175	1.21	25.18	1008.50
8/22/2021	5:26:51 AM	0	10.269	5.4	8/22/2021	5:33:24 AM	0	888.519	6.211	1.21	25.19	1008.49
8/22/2021	6:26:51 AM	0	10.268	5.4	8/22/2021	6:33:24 AM	0	888.758	6.22	1.21	25.19	1008.49
8/22/2021	7:26:51 AM	0	10.263	5.4	8/22/2021	7:33:24 AM	0	889.1	6.734	1.20	25.20	1008.48
8/22/2021	8:26:51 AM	0	10.256	5.4	8/22/2021	8:33:24 AM	0	889.355	8.415	1.19	25.21	1008.47
8/22/2021	9:26:51 AM	0	10.248	5.4	8/22/2021	9:33:24 AM	0	889.19	15.189	1.18	25.21	1008.46
8/22/2021	10:26:51 AM	0	10.242	5.4	8/22/2021	10:33:24 AM	0	889.233	20.848	1.17	25.22	1008.46
8/22/2021	11:26:51 AM	0	10.239	5.4	8/22/2021	11:33:24 AM	0	889.289	22.479	1.17	25.22	1008.45
8/22/2021	12:26:51 PM	0	10.238	5.4	8/22/2021	12:33:24 PM	0	889.222	23.288	1.17	25.22	1008.45

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/22/2021	1:26:51 PM	0	10.241	5.4	8/22/2021	1:33:24 PM	0	889.548	22.338	1.17	25.22	1008.45
8/22/2021	2:26:51 PM	0	10.246	5.4	8/22/2021	2:33:24 PM	0	889.48	25.475	1.18	25.22	1008.46
8/22/2021	3:26:51 PM	0	10.254	5.4	8/22/2021	3:33:24 PM	0	889.86	25.938	1.18	25.21	1008.46
8/22/2021	4:26:51 PM	0	10.262	5.4	8/22/2021	4:33:24 PM	0	890.234	20.14	1.18	25.21	1008.47
8/22/2021	5:26:51 PM	0	10.269	5.4	8/22/2021	5:33:24 PM	0	890.535	16.965	1.19	25.21	1008.47
8/22/2021	6:26:51 PM	0	10.275	5.4	8/22/2021	6:33:24 PM	0	891.008	15.715	1.19	25.21	1008.47
8/22/2021	7:26:51 PM	0	10.281	5.4	8/22/2021	7:33:24 PM	0	891.689	13.453	1.19	25.21	1008.47
8/22/2021	8:26:51 PM	0	10.284	5.4	8/22/2021	8:33:24 PM	0	892.529	11.17	1.18	25.21	1008.47
8/22/2021	9:26:51 PM	0	10.284	5.4	8/22/2021	9:33:24 PM	0	892.942	9.569	1.18	25.22	1008.46
8/22/2021	10:26:51 PM	0	10.283	5.4	8/22/2021	10:33:24 PM	0	893.286	8.656	1.17	25.22	1008.46
8/22/2021	11:26:51 PM	0	10.283	5.4	8/22/2021	11:33:24 PM	0	893.553	7.973	1.17	25.22	1008.46
8/23/2021	12:26:51 AM	0	10.283	5.4	8/23/2021	12:33:24 AM	0	893.987	7.58	1.17	25.23	1008.45
8/23/2021	1:26:51 AM	0	10.286	5.4	8/23/2021	1:33:24 AM	0	894.245	7.29	1.17	25.23	1008.45
8/23/2021	2:26:51 AM	0	10.289	5.4	8/23/2021	2:33:24 AM	0	894.454	6.851	1.17	25.23	1008.45
8/23/2021	3:26:51 AM	0	10.294	5.4	8/23/2021	3:33:24 AM	0	894.841	6.615	1.17	25.23	1008.45
8/23/2021	4:26:51 AM	0	10.297	5.4	8/23/2021	4:33:24 AM	0	895.003	6.396	1.17	25.22	1008.45
8/23/2021	5:26:51 AM	0	10.302	5.4	8/23/2021	5:33:24 AM	0	895.381	6.103	1.17	25.22	1008.46
8/23/2021	6:26:51 AM	0	10.302	5.4	8/23/2021	6:33:24 AM	0	895.621	5.52	1.17	25.23	1008.45
8/23/2021	7:26:51 AM	0	10.302	5.4	8/23/2021	7:33:24 AM	0	896.101	5.192	1.16	25.23	1008.45
8/23/2021	8:26:51 AM	0	10.299	5.4	8/23/2021	8:33:24 AM	0	896.659	5.366	1.16	25.24	1008.44
8/23/2021	9:26:51 AM	0	10.296	5.4	8/23/2021	9:33:24 AM	0	897.174	6.264	1.15	25.25	1008.43
8/23/2021	10:26:51 AM	0	10.291	5.4	8/23/2021	10:33:24 AM	0	897.615	8.619	1.14	25.26	1008.42
8/23/2021	11:26:51 AM	0	10.29	5.4	8/23/2021	11:33:24 AM	0	898.178	11.131	1.13	25.26	1008.42
8/23/2021	12:26:51 PM	0	10.29	5.4	8/23/2021	12:33:24 PM	0	898.528	13.435	1.13	25.27	1008.41
8/23/2021	1:26:51 PM	0	10.293	5.4	8/23/2021	1:33:24 PM	0	898.803	14.894	1.13	25.27	1008.41
8/23/2021	2:26:51 PM	0	10.297	5.4	8/23/2021	2:33:24 PM	0	898.914	18.041	1.13	25.26	1008.41
8/23/2021	3:26:51 PM	0	10.304	5.4	8/23/2021	3:33:24 PM	0	899.089	20.163	1.14	25.26	1008.42
8/23/2021	4:26:51 PM	0	10.313	5.4	8/23/2021	4:33:24 PM	0	899.487	16.69	1.14	25.25	1008.42
8/23/2021	5:26:51 PM	0	10.32	5.4	8/23/2021	5:33:24 PM	0	899.814	16.26	1.14	25.25	1008.43
8/23/2021	6:26:51 PM	0	10.326	5.4	8/23/2021	6:33:24 PM	0	899.895	15.134	1.15	25.25	1008.43
8/23/2021	7:26:51 PM	0	10.331	5.4	8/23/2021	7:33:24 PM	0	900.283	13.168	1.15	25.24	1008.43
8/23/2021	8:26:51 PM	0	10.332	5.4	8/23/2021	8:33:24 PM	0	900.67	12.117	1.15	25.25	1008.43
8/23/2021	9:26:51 PM	0	10.332	5.4	8/23/2021	9:33:24 PM	0	900.925	10.932	1.15	25.25	1008.43
8/23/2021	10:26:51 PM	0	10.329	5.4	8/23/2021	10:33:24 PM	0	901.011	9.957	1.14	25.25	1008.43
8/23/2021	11:26:51 PM	0	10.326	5.4	8/23/2021	11:33:24 PM	0	901.092	8.329	1.14	25.26	1008.42
8/24/2021	12:26:51 AM	0	10.325	5.4	8/24/2021	12:33:24 AM	0	901.172	6.574	1.14	25.26	1008.42
8/24/2021	1:26:51 AM	0	10.325	5.4	8/24/2021	1:33:24 AM	0	901.257	5.363	1.13	25.26	1008.42
8/24/2021	2:26:51 AM	0	10.328	5.4	8/24/2021	2:33:24 AM	0	901.421	4.582	1.14	25.26	1008.42
8/24/2021	3:26:51 AM	0	10.331	5.4	8/24/2021	3:33:24 AM	0	901.569	4.401	1.14	25.26	1008.42
8/24/2021	4:26:51 AM	0	10.335	5.4	8/24/2021	4:33:24 AM	0	901.859	3.928	1.14	25.26	1008.42
8/24/2021	5:26:51 AM	0	10.338	5.4	8/24/2021	5:33:24 AM	0	901.89	3.405	1.14	25.25	1008.43
8/24/2021	6:26:51 AM	0	10.339	5.4	8/24/2021	6:33:24 AM	0	902.133	4.053	1.14	25.26	1008.42
8/24/2021	7:26:51 AM	0	10.339	5.4	8/24/2021	7:33:24 AM	0	902.346	4.998	1.14	25.26	1008.42
8/24/2021	8:26:51 AM	0	10.335	5.4	8/24/2021	8:33:24 AM	0	902.545	7.82	1.13	25.26	1008.42
8/24/2021	9:26:51 AM	0	10.329	5.4	8/24/2021	9:33:24 AM	0	902.211	17.851	1.13	25.27	1008.41
8/24/2021	10:26:51 AM	0	10.323	5.4	8/24/2021	10:33:24 AM	0	901.778	24.184	1.13	25.27	1008.41
8/24/2021	11:26:51 AM	0	10.316	5.4	8/24/2021	11:33:24 AM	0	901.122	28.304	1.13	25.27	1008.41
8/24/2021	12:26:51 PM	0	10.31	5.4	8/24/2021	12:33:24 PM	0	900.676	29.266	1.13	25.27	1008.41
8/24/2021	1:26:51 PM	0	10.305	5.4	8/24/2021	1:33:24 PM	0	900.113	30.203	1.13	25.27	1008.41
8/24/2021	2:26:51 PM	0	10.304	5.4	8/24/2021	2:33:24 PM	0	899.493	32.039	1.13	25.26	1008.42
8/24/2021	3:26:51 PM	0	10.302	5.4	8/24/2021	3:33:24 PM	0	898.883	32.778	1.14	25.26	1008.42
8/24/2021	4:26:51 PM	0	10.305	5.4	8/24/2021	4:33:24 PM	0	899.211	25.302	1.14	25.26	1008.42
8/24/2021	5:26:51 PM	0	10.308	5.4	8/24/2021	5:33:24 PM	0	899.108	20.564	1.14	25.26	1008.42
8/24/2021	6:26:51 PM	0	10.311	5.4	8/24/2021	6:33:24 PM	0	899.139	18.047	1.14	25.25	1008.43
8/24/2021	7:26:51 PM	0	10.311	5.4	8/24/2021	7:33:24 PM	0	899.052	15.752	1.14	25.25	1008.43
8/24/2021	8:26:51 PM	0	10.311	5.4	8/24/2021	8:33:24 PM	0	899.335	13.195	1.14	25.25	1008.42
8/24/2021	9:26:51 PM	0	10.31	5.4	8/24/2021	9:33:24 PM	0	899.524	10.595	1.14	25.26	1008.42
8/24/2021	10:26:51 PM	0	10.305	5.4	8/24/2021	10:33:24 PM	0	899.496	8.818	1.13	25.26	1008.42
8/24/2021	11:26:51 PM	0	10.301	5.4	8/24/2021	11:33:24 PM	0	899.413	8.275	1.13	25.27	1008.41
8/25/2021	12:26:51 AM	0	10.296	5.4	8/25/2021	12:33:24 AM	0	899.283	7.252	1.13	25.27	1008.41
8/25/2021	1:26:51 AM	0	10.294	5.4	8/25/2021	1:33:24 AM	0	899.307	6.408	1.12	25.27	1008.41
8/25/2021	2:26:51 AM	0	10.293	5.4	8/25/2021	2:33:24 AM	0	899.175	5.728	1.12	25.27	1008.41
8/25/2021	3:26:51 AM	0	10.293	5.4	8/25/2021	3:33:24 AM	0	899.073	5.194	1.12	25.27	1008.41
8/25/2021	4:26:51 AM	0	10.296	5.4	8/25/2021	4:33:24 AM	0	899.035	4.852	1.13	25.27	1008.41
8/25/2021	5:26:51 AM	0	10.297	5.4	8/25/2021	5:33:24 AM	0	898.92	4.557	1.13	25.26	1008.41
8/25/2021	6:26:51 AM	0	10.297	5.4	8/25/2021	6:33:24 AM	0	898.746	4.434	1.13	25.26	1008.42
8/25/2021	7:26:51 AM	0	10.297	5.4	8/25/2021	7:33:24 AM	0	898.879	4.875	1.13	25.26	1008.42
8/25/2021	8:26:51 AM	0	10.296	5.4	8/25/2021	8:33:24 AM	0	899.052	8.23	1.13	25.27	1008.41
8/25/2021	9:26:51 AM	0	10.29	5.4	8/25/2021	9:33:24 AM	0	898.487	19.707	1.13	25.27	1008.41
8/25/2021	10:26:51 AM	0	10.283	5.4	8/25/2021	10:33:24 AM	0	897.833	26.308	1.13	25.27	1008.41
8/25/2021	11:26:51 AM	0	10.275	5.4	8/25/2021	11:33:24 AM	0	897.115	29.793	1.13	25.27	1008.41
8/25/2021	12:26:51 PM	0	10.268	5.4	8/25/2021	12:33:24 PM	0	896.497	30.613	1.13	25.27	1008.41

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/25/2021	1:26:51 PM	0	10.26	5.4	8/25/2021	1:33:24 PM	0	895.627	32.251	1.13	25.27	1008.41
8/25/2021	2:26:51 PM	0	10.257	5.4	8/25/2021	2:33:24 PM	0	895.113	33.409	1.13	25.27	1008.41
8/25/2021	3:26:51 PM	0	10.256	5.4	8/25/2021	3:33:24 PM	0	894.842	31.924	1.13	25.26	1008.42
8/25/2021	4:26:51 PM	0	10.254	5.4	8/25/2021	4:33:24 PM	0	894.661	27.264	1.13	25.26	1008.42
8/25/2021	5:26:51 PM	0	10.256	5.4	8/25/2021	5:33:24 PM	0	894.584	23.895	1.13	25.26	1008.42
8/25/2021	6:26:51 PM	0	10.256	5.4	8/25/2021	6:33:24 PM	0	894.567	21.583	1.13	25.26	1008.42
8/25/2021	7:26:51 PM	0	10.257	5.4	8/25/2021	7:33:24 PM	0	894.809	18.76	1.13	25.26	1008.42
8/25/2021	8:26:51 PM	0	10.257	5.4	8/25/2021	8:33:24 PM	0	895.031	17.025	1.13	25.26	1008.41
8/25/2021	9:26:51 PM	0	10.256	5.4	8/25/2021	9:33:24 PM	0	895.151	16.911	1.13	25.27	1008.41
8/25/2021	10:26:51 PM	0	10.253	5.4	8/25/2021	10:33:24 PM	0	895.543	15.237	1.12	25.27	1008.41
8/25/2021	11:26:51 PM	0	10.249	5.4	8/25/2021	11:33:24 PM	0	895.787	12.126	1.11	25.28	1008.40
8/26/2021	12:26:51 AM	0	10.246	5.4	8/26/2021	12:33:24 AM	0	896.015	10.268	1.11	25.29	1008.39
8/26/2021	1:26:51 AM	0	10.245	5.4	8/26/2021	1:33:24 AM	0	896.272	10.071	1.11	25.29	1008.39
8/26/2021	2:26:51 AM	0	10.245	5.4	8/26/2021	2:33:24 AM	0	896.432	10.314	1.10	25.29	1008.39
8/26/2021	3:26:51 AM	0	10.245	5.4	8/26/2021	3:33:24 AM	0	896.41	10.525	1.10	25.29	1008.39
8/26/2021	4:26:51 AM	0	10.248	5.4	8/26/2021	4:33:24 AM	0	896.368	10.772	1.11	25.29	1008.39
8/26/2021	5:26:51 AM	0	10.249	5.4	8/26/2021	5:33:24 AM	0	896.292	10.726	1.11	25.29	1008.39
8/26/2021	6:26:51 AM	0	10.253	5.4	8/26/2021	6:33:24 AM	0	896.338	10.488	1.11	25.28	1008.40
8/26/2021	7:26:51 AM	0	10.256	5.4	8/26/2021	7:33:24 AM	0	896.484	10.637	1.11	25.28	1008.40
8/26/2021	8:26:51 AM	0	10.254	5.4	8/26/2021	8:33:24 AM	0	896.535	11.907	1.11	25.28	1008.40
8/26/2021	9:26:51 AM	0	10.251	5.4	8/26/2021	9:33:24 AM	0	896.304	14.94	1.11	25.28	1008.40
8/26/2021	10:26:51 AM	0	10.249	5.4	8/26/2021	10:33:24 AM	0	896.351	17.804	1.11	25.29	1008.39
8/26/2021	11:26:51 AM	0	10.246	5.4	8/26/2021	11:33:24 AM	0	896.297	20.393	1.11	25.29	1008.39
8/26/2021	12:26:51 PM	0	10.242	5.4	8/26/2021	12:33:24 PM	0	896.148	19.947	1.10	25.29	1008.39
8/26/2021	1:26:51 PM	0	10.239	5.4	8/26/2021	1:33:24 PM	0	896.049	20.512	1.10	25.29	1008.39
8/26/2021	2:26:51 PM	0	10.236	5.4	8/26/2021	2:33:24 PM	0	895.78	21.607	1.10	25.29	1008.39
8/26/2021	3:26:51 PM	0	10.236	5.4	8/26/2021	3:33:24 PM	0	895.608	22.69	1.10	25.29	1008.39
8/26/2021	4:26:51 PM	0	10.238	5.4	8/26/2021	4:33:24 PM	0	895.766	20.241	1.10	25.29	1008.39
8/26/2021	5:26:51 PM	0	10.241	5.4	8/26/2021	5:33:24 PM	0	896.001	15.681	1.10	25.29	1008.39
8/26/2021	6:26:51 PM	0	10.241	5.4	8/26/2021	6:33:24 PM	0	895.812	14.459	1.11	25.29	1008.39
8/26/2021	7:26:51 PM	0	10.246	5.4	8/26/2021	7:33:24 PM	0	896.561	13.7	1.10	25.29	1008.39
8/26/2021	8:26:51 PM	0	10.249	5.4	8/26/2021	8:33:24 PM	0	897.098	11.824	1.10	25.29	1008.39
8/26/2021	9:26:51 PM	0	10.248	5.4	8/26/2021	9:33:24 PM	0	897.075	9.739	1.10	25.29	1008.38
8/26/2021	10:26:51 PM	0	10.245	5.4	8/26/2021	10:33:24 PM	0	897.167	8.963	1.10	25.30	1008.38
8/26/2021	11:26:51 PM	0	10.242	5.4	8/26/2021	11:33:24 PM	0	897.318	8.325	1.09	25.30	1008.38
8/27/2021	12:26:51 AM	0	10.239	5.4	8/27/2021	12:33:24 AM	0	897.708	8.349	1.08	25.31	1008.37
8/27/2021	1:26:51 AM	0	10.236	5.4	8/27/2021	1:33:24 AM	0	897.701	7.534	1.08	25.31	1008.37
8/27/2021	2:26:51 AM	0	10.235	5.4	8/27/2021	2:33:24 AM	0	897.76	7.448	1.08	25.31	1008.36
8/27/2021	3:26:51 AM	0	10.235	5.4	8/27/2021	3:33:24 AM	0	897.848	7.583	1.08	25.32	1008.36
8/27/2021	4:26:51 AM	0	10.238	5.4	8/27/2021	4:33:24 AM	0	898.052	7.474	1.08	25.31	1008.36
8/27/2021	5:26:51 AM	0	10.242	5.4	8/27/2021	5:33:24 AM	0	898.341	7.927	1.08	25.31	1008.37
8/27/2021	6:26:51 AM	0	10.245	5.4	8/27/2021	6:33:24 AM	0	898.504	7.906	1.08	25.31	1008.37
8/27/2021	7:26:51 AM	0	10.251	5.4	8/27/2021	7:33:24 AM	0	899.04	8.223	1.08	25.31	1008.37
8/27/2021	8:26:51 AM	0	10.256	5.4	8/27/2021	8:33:24 AM	0	899.524	9.276	1.08	25.31	1008.37
8/27/2021	9:26:51 AM	0	10.257	5.4	8/27/2021	9:33:24 AM	0	899.667	12.022	1.08	25.31	1008.37
8/27/2021	10:26:51 AM	0	10.257	5.4	8/27/2021	10:33:24 AM	0	899.788	18.992	1.08	25.31	1008.37
8/27/2021	11:26:51 AM	0	10.257	5.4	8/27/2021	11:33:24 AM	0	900.029	16.907	1.08	25.32	1008.36
8/27/2021	12:26:51 PM	0	10.254	5.4	8/27/2021	12:33:24 PM	0	900.009	19.008	1.08	25.32	1008.36
8/27/2021	1:26:51 PM	0	10.254	5.4	8/27/2021	1:33:24 PM	0	899.967	20.508	1.08	25.32	1008.36
8/27/2021	2:26:51 PM	0	10.253	5.4	8/27/2021	2:33:24 PM	0	899.851	21.334	1.08	25.32	1008.36
8/27/2021	3:26:51 PM	0	10.256	5.4	8/27/2021	3:33:24 PM	0	900.22	23.614	1.08	25.32	1008.36
8/27/2021	4:26:51 PM	0	10.256	5.4	8/27/2021	4:33:24 PM	0	900.265	17.479	1.08	25.32	1008.36
8/27/2021	5:26:51 PM	0	10.259	5.4	8/27/2021	5:33:24 PM	0	900.449	15.984	1.08	25.32	1008.36
8/27/2021	6:26:51 PM	0	10.259	5.4	8/27/2021	6:33:24 PM	0	900.398	13.542	1.08	25.32	1008.36
8/27/2021	7:26:51 PM	0	10.262	5.4	8/27/2021	7:33:24 PM	0	900.818	11.604	1.08	25.32	1008.36
8/27/2021	8:26:51 PM	0	10.263	5.4	8/27/2021	8:33:24 PM	0	901.14	10.385	1.07	25.32	1008.36
8/27/2021	9:26:51 PM	0	10.265	5.4	8/27/2021	9:33:24 PM	0	901.45	8.854	1.07	25.32	1008.36
8/27/2021	10:26:51 PM	0	10.263	5.4	8/27/2021	10:33:24 PM	0	901.683	7.775	1.07	25.33	1008.35
8/27/2021	11:26:51 PM	0	10.259	5.4	8/27/2021	11:33:24 PM	0	901.7	7.298	1.06	25.33	1008.35
8/28/2021	12:26:51 AM	0	10.254	5.4	8/28/2021	12:33:24 AM	0	901.729	7.513	1.06	25.34	1008.34
8/28/2021	1:26:51 AM	0	10.253	5.4	8/28/2021	1:33:24 AM	0	901.854	7.566	1.06	25.34	1008.34
8/28/2021	2:26:51 AM	0	10.248	5.4	8/28/2021	2:33:24 AM	0	901.764	8.592	1.05	25.34	1008.34
8/28/2021	3:26:51 AM	0	10.246	5.4	8/28/2021	3:33:24 AM	0	901.74	8.647	1.05	25.34	1008.33
8/28/2021	4:26:51 AM	0	10.246	5.4	8/28/2021	4:33:24 AM	0	901.553	8.589	1.05	25.34	1008.34
8/28/2021	5:26:51 AM	0	10.248	5.4	8/28/2021	5:33:24 AM	0	901.445	8.658	1.06	25.34	1008.34
8/28/2021	6:26:51 AM	0	10.249	5.4	8/28/2021	6:33:24 AM	0	901.416	8.64	1.06	25.34	1008.34
8/28/2021	7:26:51 AM	0	10.251	5.4	8/28/2021	7:33:24 AM	0	901.377	8.982	1.06	25.34	1008.34
8/28/2021	8:26:51 AM	0	10.253	5.4	8/28/2021	8:33:24 AM	0	901.235	10.075	1.06	25.33	1008.35
8/28/2021	9:26:51 AM	0	10.253	5.4	8/28/2021	9:33:24 AM	0	900.965	12.483	1.07	25.33	1008.35
8/28/2021	10:26:51 AM	0	10.253	5.4	8/28/2021	10:33:24 AM	0	900.941	14.641	1.07	25.33	1008.35
8/28/2021	11:26:51 AM	0	10.253	5.4	8/28/2021	11:33:24 AM	0	901.05	16.336	1.06	25.33	1008.35
8/28/2021	12:26:51 PM	0	10.249	5.4	8/28/2021	12:33:24 PM	0	900.606	18.928	1.07	25.33	1008.35

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/28/2021	1:26:51 PM	0	10.248	5.4	8/28/2021	1:33:24 PM	0	900.623	19.772	1.06	25.33	1008.35
8/28/2021	2:26:51 PM	0	10.245	5.4	8/28/2021	2:33:24 PM	0	900.18	17.41	1.07	25.33	1008.35
8/28/2021	3:26:51 PM	0	10.243	5.4	8/28/2021	3:33:24 PM	0	900.139	17.157	1.06	25.33	1008.35
8/28/2021	4:26:51 PM	0	10.241	5.4	8/28/2021	4:33:24 PM	0	899.651	18.448	1.07	25.33	1008.35
8/28/2021	5:26:51 PM	0	10.238	5.4	8/28/2021	5:33:24 PM	0	899.215	18.712	1.07	25.33	1008.35
8/28/2021	6:26:51 PM	0	10.235	5.4	8/28/2021	6:33:24 PM	0	898.821	17.122	1.07	25.33	1008.35
8/28/2021	7:26:51 PM	0	10.232	5.4	8/28/2021	7:33:24 PM	0	898.262	16.052	1.07	25.32	1008.36
8/28/2021	8:26:51 PM	0	10.232	5.4	8/28/2021	8:33:24 PM	0	898.538	14.627	1.07	25.33	1008.35
8/28/2021	9:26:51 PM	0	10.229	5.4	8/28/2021	9:33:24 PM	0	898.504	13.124	1.07	25.33	1008.35
8/28/2021	10:26:51 PM	0	10.224	5.4	8/28/2021	10:33:24 PM	0	898.435	12.385	1.06	25.33	1008.35
8/28/2021	11:26:51 PM	0	10.221	5.4	8/28/2021	11:33:24 PM	0	898.524	11.288	1.06	25.34	1008.34
8/29/2021	12:26:51 AM	0	10.217	5.4	8/29/2021	12:33:24 AM	0	898.537	10.478	1.05	25.34	1008.34
8/29/2021	1:26:51 AM	0	10.212	5.4	8/29/2021	1:33:24 AM	0	898.417	9.278	1.05	25.34	1008.33
8/29/2021	2:26:51 AM	0	10.208	5.4	8/29/2021	2:33:24 AM	0	898.408	8.325	1.05	25.35	1008.33
8/29/2021	3:26:51 AM	0	10.204	5.4	8/29/2021	3:33:24 AM	0	898.294	8.142	1.04	25.35	1008.33
8/29/2021	4:26:51 AM	0	10.203	5.4	8/29/2021	4:33:24 AM	0	898.309	7.741	1.04	25.35	1008.33
8/29/2021	5:26:51 AM	0	10.203	5.4	8/29/2021	5:33:24 AM	0	898.185	7.287	1.04	25.35	1008.33
8/29/2021	6:26:51 AM	0	10.203	5.4	8/29/2021	6:33:24 AM	0	898.051	6.798	1.05	25.35	1008.33
8/29/2021	7:26:51 AM	0	10.204	5.4	8/29/2021	7:33:24 AM	0	898.136	7.558	1.05	25.35	1008.33
8/29/2021	8:26:51 AM	0	10.204	5.4	8/29/2021	8:33:24 AM	0	898.084	10.486	1.05	25.35	1008.33
8/29/2021	9:26:51 AM	0	10.203	5.4	8/29/2021	9:33:24 AM	0	897.415	19.137	1.05	25.34	1008.34
8/29/2021	10:26:51 AM	0	10.203	5.4	8/29/2021	10:33:24 AM	0	896.679	26.359	1.06	25.34	1008.34
8/29/2021	11:26:51 AM	0	10.201	5.4	8/29/2021	11:33:24 AM	0	896.091	30.294	1.06	25.33	1008.35
8/29/2021	12:26:51 PM	0	10.198	5.4	8/29/2021	12:33:24 PM	0	895.835	28.856	1.06	25.33	1008.35
8/29/2021	1:26:51 PM	0	10.195	5.4	8/29/2021	1:33:24 PM	0	895.514	25.923	1.06	25.33	1008.35
8/29/2021	2:26:51 PM	0	10.194	5.4	8/29/2021	2:33:24 PM	0	895.171	27.542	1.07	25.33	1008.35
8/29/2021	3:26:51 PM	0	10.19	5.4	8/29/2021	3:33:24 PM	0	894.746	28.214	1.07	25.33	1008.35
8/29/2021	4:26:51 PM	0	10.188	5.4	8/29/2021	4:33:24 PM	0	894.713	24.69	1.06	25.33	1008.35
8/29/2021	5:26:51 PM	0	10.184	5.4	8/29/2021	5:33:24 PM	0	894.412	22.21	1.06	25.33	1008.35
8/29/2021	6:26:51 PM	0	10.182	5.4	8/29/2021	6:33:24 PM	0	894.317	19.38	1.06	25.33	1008.35
8/29/2021	7:26:51 PM	0	10.179	5.4	8/29/2021	7:33:24 PM	0	894.182	16.295	1.06	25.33	1008.35
8/29/2021	8:26:51 PM	0	10.178	5.4	8/29/2021	8:33:24 PM	0	894.396	13.069	1.06	25.34	1008.34
8/29/2021	9:26:51 PM	0	10.175	5.4	8/29/2021	9:33:24 PM	0	894.279	10.587	1.06	25.34	1008.34
8/29/2021	10:26:51 PM	0	10.17	5.4	8/29/2021	10:33:24 PM	0	894.136	8.954	1.05	25.34	1008.34
8/29/2021	11:26:51 PM	0	10.164	5.4	8/29/2021	11:33:24 PM	0	893.683	8.174	1.05	25.34	1008.34
8/30/2021	12:26:51 AM	0	10.16	5.4	8/30/2021	12:33:24 AM	0	893.631	7.806	1.05	25.35	1008.33
8/30/2021	1:26:51 AM	0	10.152	5.4	8/30/2021	1:33:24 AM	0	893.104	7.374	1.04	25.35	1008.33
8/30/2021	2:26:51 AM	0	10.146	5.4	8/30/2021	2:33:24 AM	0	892.614	7.344	1.04	25.35	1008.33
8/30/2021	3:26:51 AM	0	10.142	5.4	8/30/2021	3:33:24 AM	0	892.606	7.238	1.04	25.35	1008.32
8/30/2021	4:26:51 AM	0	10.137	5.4	8/30/2021	4:33:24 AM	0	892.363	6.851	1.04	25.36	1008.32
8/30/2021	5:26:51 AM	0	10.134	5.4	8/30/2021	5:33:24 AM	0	892.218	6.546	1.04	25.36	1008.32
8/30/2021	6:26:51 AM	0	10.134	5.4	8/30/2021	6:33:24 AM	0	892.308	6.35	1.03	25.36	1008.32
8/30/2021	7:26:51 AM	0	10.133	5.4	8/30/2021	7:33:24 AM	0	892.368	6.904	1.03	25.36	1008.32
8/30/2021	8:26:51 AM	0	10.134	5.4	8/30/2021	8:33:24 AM	0	892.489	8.374	1.03	25.36	1008.32
8/30/2021	9:26:51 AM	0	10.136	5.4	8/30/2021	9:33:24 AM	0	892.485	12.94	1.04	25.36	1008.32
8/30/2021	10:26:51 AM	0	10.136	5.4	8/30/2021	10:33:24 AM	0	892.067	17.716	1.04	25.36	1008.32
8/30/2021	11:26:51 AM	0	10.137	5.4	8/30/2021	11:33:24 AM	0	892.022	20.007	1.04	25.35	1008.33
8/30/2021	12:26:51 PM	0	10.139	5.4	8/30/2021	12:33:24 PM	0	891.798	19.287	1.05	25.35	1008.33
8/30/2021	1:26:51 PM	0	10.139	5.4	8/30/2021	1:33:24 PM	0	891.698	19.666	1.05	25.35	1008.33
8/30/2021	2:26:51 PM	0	10.139	5.4	8/30/2021	2:33:24 PM	0	891.577	20.688	1.05	25.35	1008.33
8/30/2021	3:26:51 PM	0	10.137	5.4	8/30/2021	3:33:24 PM	0	891.186	20.199	1.05	25.35	1008.33
8/30/2021	4:26:51 PM	0	10.133	5.4	8/30/2021	4:33:24 PM	0	890.495	18.957	1.05	25.34	1008.34
8/30/2021	5:26:51 PM	0	10.128	5.4	8/30/2021	5:33:24 PM	0	890.218	16.516	1.05	25.34	1008.33
8/30/2021	6:26:51 PM	0	10.127	5.4	8/30/2021	6:33:24 PM	0	890.178	15.59	1.05	25.35	1008.33
8/30/2021	7:26:51 PM	0	10.125	5.4	8/30/2021	7:33:24 PM	0	890.311	14.197	1.05	25.35	1008.33
8/30/2021	8:26:51 PM	0	10.124	5.4	8/30/2021	8:33:24 PM	0	890.656	12.409	1.04	25.35	1008.33
8/30/2021	9:26:51 PM	0	10.124	5.4	8/30/2021	9:33:24 PM	0	891.013	9.858	1.04	25.36	1008.32
8/30/2021	10:26:51 PM	0	10.122	5.4	8/30/2021	10:33:24 PM	0	890.993	8.097	1.04	25.36	1008.32
8/30/2021	11:26:51 PM	0	10.121	5.4	8/30/2021	11:33:24 PM	0	890.754	7.428	1.04	25.36	1008.32
8/31/2021	12:26:51 AM	0	10.115	5.4	8/31/2021	12:33:24 AM	0	890.181	7.167	1.04	25.36	1008.32
8/31/2021	1:26:51 AM	0	10.113	5.4	8/31/2021	1:33:24 AM	0	890.409	6.818	1.03	25.36	1008.32
8/31/2021	2:26:51 AM	0	10.107	5.4	8/31/2021	2:33:24 AM	0	890.2	6.377	1.03	25.37	1008.31
8/31/2021	3:26:51 AM	0	10.104	5.4	8/31/2021	3:33:24 AM	0	890.239	5.961	1.03	25.37	1008.31
8/31/2021	4:26:51 AM	0	10.1	5.4	8/31/2021	4:33:24 AM	0	890.229	5.671	1.02	25.37	1008.31
8/31/2021	5:26:51 AM	0	10.098	5.4	8/31/2021	5:33:24 AM	0	890.369	5.549	1.02	25.38	1008.30
8/31/2021	6:26:51 AM	0	10.095	5.4	8/31/2021	6:33:24 AM	0	890.491	5.474	1.01	25.38	1008.30
8/31/2021	7:26:51 AM	0	10.098	5.4	8/31/2021	7:33:24 AM	0	890.955	5.588	1.01	25.38	1008.30
8/31/2021	8:26:51 AM	0	10.098	5.4	8/31/2021	8:33:24 AM	0	891.014	5.757	1.01	25.38	1008.30
8/31/2021	9:26:51 AM	0	10.104	5.4	8/31/2021	9:33:24 AM	0	891.65	6.046	1.01	25.38	1008.30
8/31/2021	10:26:51 AM	0	10.11	5.4	8/31/2021	10:33:24 AM	0	892.144	6.466	1.01	25.38	1008.30
8/31/2021	11:26:51 AM	0	10.116	5.4	8/31/2021	11:33:24 AM	0	892.636	7.517	1.01	25.38	1008.30
8/31/2021	12:26:51 PM	0	10.122	5.4	8/31/2021	12:33:24 PM	0	893.219	8.285	1.01	25.38	1008.30

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/31/2021	1:26:51 PM	0	10.128	5.4	8/31/2021	1:33:24 PM	0	893.716	8.307	1.01	25.38	1008.30
8/31/2021	2:26:51 PM	0	10.134	5.4	8/31/2021	2:33:24 PM	0	894.231	9.438	1.02	25.38	1008.30
8/31/2021	3:26:51 PM	0	10.139	5.4	8/31/2021	3:33:24 PM	0	894.549	9.813	1.02	25.38	1008.30
8/31/2021	4:26:51 PM	0	10.143	5.4	8/31/2021	4:33:24 PM	0	894.928	10.953	1.02	25.38	1008.30
8/31/2021	5:26:51 PM	0	10.145	5.4	8/31/2021	5:33:24 PM	0	895.388	10.827	1.01	25.38	1008.30
8/31/2021	6:26:51 PM	0	10.148	5.4	8/31/2021	6:33:24 PM	0	895.717	9.981	1.01	25.38	1008.30
8/31/2021	7:26:51 PM	0	10.146	5.4	8/31/2021	7:33:24 PM	0	895.784	9.68	1.01	25.38	1008.30
8/31/2021	8:26:51 PM	0	10.148	5.4	8/31/2021	8:33:24 PM	0	896.178	8.824	1.01	25.39	1008.29
8/31/2021	9:26:51 PM	0	10.148	5.4	8/31/2021	9:33:24 PM	0	896.363	8.31	1.01	25.39	1008.29
8/31/2021	10:26:51 PM	0	10.146	5.4	8/31/2021	10:33:24 PM	0	896.476	7.839	1.00	25.39	1008.29
8/31/2021	11:26:51 PM	0	10.146	5.4	8/31/2021	11:33:24 PM	0	896.584	7.286	1.00	25.39	1008.29
9/1/2021	12:26:51 AM	0	10.145	5.4	9/1/2021	12:33:24 AM	0	896.512	6.625	1.00	25.39	1008.29
9/1/2021	1:26:51 AM	0	10.143	5.4	9/1/2021	1:33:24 AM	0	896.654	6.059	1.00	25.40	1008.28
9/1/2021	2:26:51 AM	0	10.142	5.4	9/1/2021	2:33:24 AM	0	896.817	5.253	1.00	25.40	1008.28
9/1/2021	3:26:51 AM	0	10.14	5.4	9/1/2021	3:33:24 AM	0	897.017	4.261	0.99	25.40	1008.28
9/1/2021	4:26:51 AM	0	10.14	5.4	9/1/2021	4:33:24 AM	0	897.573	3.628	0.99	25.41	1008.27
9/1/2021	5:26:51 AM	0	10.139	5.4	9/1/2021	5:33:24 AM	0	898.018	3.707	0.98	25.41	1008.27
9/1/2021	6:26:51 AM	0	10.137	5.4	9/1/2021	6:33:24 AM	0	898.308	3.374	0.98	25.42	1008.26
9/1/2021	7:26:51 AM	0	10.137	5.4	9/1/2021	7:33:24 AM	0	898.689	3.877	0.97	25.42	1008.26
9/1/2021	8:26:51 AM	0	10.139	5.4	9/1/2021	8:33:24 AM	0	899.114	4.953	0.97	25.42	1008.25
9/1/2021	9:26:51 AM	0	10.14	5.4	9/1/2021	9:33:24 AM	0	899.43	13.409	0.97	25.43	1008.25
9/1/2021	10:26:51 AM	0	10.145	5.4	9/1/2021	10:33:24 AM	0	899.48	18.864	0.97	25.42	1008.26
9/1/2021	11:26:51 AM	0	10.148	5.4	9/1/2021	11:33:24 AM	0	899.186	23.417	0.98	25.42	1008.26
9/1/2021	12:26:51 PM	0	10.152	5.4	9/1/2021	12:33:24 PM	0	899.116	23.38	0.98	25.41	1008.27
9/1/2021	1:26:51 PM	0	10.156	5.4	9/1/2021	1:33:24 PM	0	898.906	25.427	0.99	25.41	1008.27
9/1/2021	2:26:51 PM	0	10.163	5.4	9/1/2021	2:33:24 PM	0	899.301	24.879	0.99	25.40	1008.28
9/1/2021	3:26:51 PM	0	10.169	5.4	9/1/2021	3:33:24 PM	0	899.791	22.196	0.99	25.40	1008.28
9/1/2021	4:26:51 PM	0	10.17	5.4	9/1/2021	4:33:24 PM	0	899.92	18.398	0.99	25.40	1008.28
9/1/2021	5:26:51 PM	0	10.172	5.4	9/1/2021	5:33:24 PM	0	900.086	16.083	0.99	25.40	1008.28
9/1/2021	6:26:51 PM	0	10.172	5.4	9/1/2021	6:33:24 PM	0	900.197	13.543	0.99	25.40	1008.28
9/1/2021	7:26:51 PM	0	10.17	5.4	9/1/2021	7:33:24 PM	0	900.422	12.594	0.99	25.41	1008.27
9/1/2021	8:26:51 PM	0	10.172	5.4	9/1/2021	8:33:24 PM	0	900.822	10.408	0.99	25.41	1008.27
9/1/2021	9:26:51 PM	0	10.172	5.4	9/1/2021	9:33:24 PM	0	901.087	7.868	0.98	25.41	1008.27
9/1/2021	10:26:51 PM	0	10.17	5.4	9/1/2021	10:33:24 PM	0	901.037	6.47	0.98	25.41	1008.27
9/1/2021	11:26:51 PM	0	10.167	5.4	9/1/2021	11:33:24 PM	0	900.915	5.631	0.98	25.41	1008.26
9/2/2021	12:26:51 AM	0	10.17	5.4	9/2/2021	12:33:24 AM	0	901.311	4.938	0.98	25.42	1008.26
9/2/2021	1:26:51 AM	0	10.17	5.4	9/2/2021	1:33:24 AM	0	901.637	4.15	0.98	25.42	1008.26
9/2/2021	2:26:51 AM	0	10.169	5.4	9/2/2021	2:33:24 AM	0	901.749	3.485	0.97	25.42	1008.26
9/2/2021	3:26:51 AM	0	10.169	5.4	9/2/2021	3:33:24 AM	0	902.042	2.999	0.97	25.42	1008.25
9/2/2021	4:26:51 AM	0	10.166	5.4	9/2/2021	4:33:24 AM	0	902.166	2.675	0.97	25.43	1008.25
9/2/2021	5:26:51 AM	0	10.163	5.4	9/2/2021	5:33:24 AM	0	902.337	2.45	0.96	25.43	1008.25
9/2/2021	6:26:51 AM	0	10.16	5.4	9/2/2021	6:33:24 AM	0	902.479	2.132	0.96	25.44	1008.24
9/2/2021	7:26:51 AM	0	10.156	5.4	9/2/2021	7:33:24 AM	0	902.806	2.345	0.95	25.44	1008.23
9/2/2021	8:26:51 AM	0	10.155	5.4	9/2/2021	8:33:24 AM	0	903.208	6.672	0.94	25.45	1008.23
9/2/2021	9:26:51 AM	0	10.153	5.4	9/2/2021	9:33:24 AM	0	903.116	17.973	0.94	25.45	1008.23
9/2/2021	10:26:51 AM	0	10.155	5.4	9/2/2021	10:33:24 AM	0	902.666	25.222	0.95	25.44	1008.23
9/2/2021	11:26:51 AM	0	10.156	5.4	9/2/2021	11:33:24 AM	0	902.238	28.331	0.96	25.44	1008.24
9/2/2021	12:26:51 PM	0	10.16	5.4	9/2/2021	12:33:24 PM	0	901.913	27.313	0.96	25.43	1008.25
9/2/2021	1:26:51 PM	0	10.163	5.4	9/2/2021	1:33:24 PM	0	901.448	29.805	0.97	25.42	1008.25
9/2/2021	2:26:51 PM	0	10.166	5.4	9/2/2021	2:33:24 PM	0	901.026	31.521	0.98	25.42	1008.26
9/2/2021	3:26:51 PM	0	10.167	5.4	9/2/2021	3:33:24 PM	0	900.594	31.404	0.98	25.41	1008.27
9/2/2021	4:26:51 PM	0	10.169	5.4	9/2/2021	4:33:24 PM	0	900.961	22.761	0.98	25.41	1008.27
9/2/2021	5:26:51 PM	0	10.167	5.4	9/2/2021	5:33:24 PM	0	900.927	18.568	0.98	25.41	1008.26
9/2/2021	6:26:51 PM	0	10.167	5.4	9/2/2021	6:33:24 PM	0	901.033	15.701	0.98	25.42	1008.26
9/2/2021	7:26:51 PM	0	10.163	5.4	9/2/2021	7:33:24 PM	0	900.834	12.654	0.98	25.42	1008.26
9/2/2021	8:26:51 PM	0	10.161	5.4	9/2/2021	8:33:24 PM	0	901.018	9.874	0.97	25.42	1008.26
9/2/2021	9:26:51 PM	0	10.158	5.4	9/2/2021	9:33:24 PM	0	901.005	8.055	0.97	25.42	1008.25
9/2/2021	10:26:51 PM	0	10.155	5.4	9/2/2021	10:33:24 PM	0	900.827	7.086	0.97	25.43	1008.25
9/2/2021	11:26:51 PM	0	10.153	5.4	9/2/2021	11:33:24 PM	0	900.79	6.514	0.97	25.43	1008.25
9/3/2021	12:26:51 AM	0	10.153	5.4	9/3/2021	12:33:24 AM	0	900.872	6.121	0.97	25.43	1008.25
9/3/2021	1:26:51 AM	0	10.15	5.4	9/3/2021	1:33:24 AM	0	900.572	5.915	0.97	25.43	1008.25
9/3/2021	2:26:51 AM	0	10.15	5.4	9/3/2021	2:33:24 AM	0	900.651	5.342	0.97	25.43	1008.25
9/3/2021	3:26:51 AM	0	10.149	5.4	9/3/2021	3:33:24 AM	0	900.748	4.86	0.96	25.43	1008.25
9/3/2021	4:26:51 AM	0	10.145	5.4	9/3/2021	4:33:24 AM	0	900.487	4.604	0.96	25.43	1008.25
9/3/2021	5:26:51 AM	0	10.139	5.4	9/3/2021	5:33:24 AM	0	900.317	4.182	0.96	25.44	1008.24
9/3/2021	6:26:51 AM	0	10.133	5.4	9/3/2021	6:33:24 AM	0	900.282	3.914	0.95	25.44	1008.24
9/3/2021	7:26:51 AM	0	10.125	5.4	9/3/2021	7:33:24 AM	0	900.287	4.163	0.94	25.45	1008.23
9/3/2021	8:26:51 AM	0	10.119	5.4	9/3/2021	8:33:24 AM	0	900.35	7.389	0.94	25.46	1008.22
9/3/2021	9:26:51 AM	0	10.115	5.4	9/3/2021	9:33:24 AM	0	899.981	18.643	0.94	25.46	1008.22
9/3/2021	10:26:51 AM	0	10.111	5.4	9/3/2021	10:33:24 AM	0	899.576	24.827	0.94	25.46	1008.22
9/3/2021	11:26:51 AM	0	10.111	5.4	9/3/2021	11:33:24 AM	0	899.073	27.566	0.94	25.45	1008.23
9/3/2021	12:26:51 PM	0	10.113	5.4	9/3/2021	12:33:24 PM	0	898.669	27.326	0.95	25.45	1008.23

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/3/2021	1:26:51 PM	0	10.116	5.4	9/3/2021	1:33:24 PM	0	897.982	31.416	0.96	25.44	1008.24
9/3/2021	2:26:51 PM	0	10.119	5.4	9/3/2021	2:33:24 PM	0	897.301	33.343	0.97	25.43	1008.25
9/3/2021	3:26:51 PM	0	10.122	5.4	9/3/2021	3:33:24 PM	0	897.288	31.106	0.97	25.42	1008.26
9/3/2021	4:26:51 PM	0	10.127	5.4	9/3/2021	4:33:24 PM	0	897.815	25.744	0.97	25.42	1008.26
9/3/2021	5:26:51 PM	0	10.128	5.4	9/3/2021	5:33:24 PM	0	897.922	21.922	0.97	25.42	1008.26
9/3/2021	6:26:51 PM	0	10.125	5.4	9/3/2021	6:33:24 PM	0	897.753	19.652	0.97	25.42	1008.25
9/3/2021	7:26:51 PM	0	10.121	5.4	9/3/2021	7:33:24 PM	0	897.65	16.813	0.97	25.43	1008.25
9/3/2021	8:26:51 PM	0	10.119	5.4	9/3/2021	8:33:24 PM	0	897.861	14.379	0.96	25.43	1008.25
9/3/2021	9:26:51 PM	0	10.115	5.4	9/3/2021	9:33:24 PM	0	897.669	12.617	0.96	25.43	1008.25
9/3/2021	10:26:51 PM	0	10.11	5.4	9/3/2021	10:33:24 PM	0	897.469	11.464	0.96	25.44	1008.24
9/3/2021	11:26:51 PM	0	10.108	5.4	9/3/2021	11:33:24 PM	0	897.477	10.446	0.96	25.44	1008.24
9/4/2021	12:26:51 AM	0	10.107	5.4	9/4/2021	12:33:24 AM	0	897.256	9.469	0.96	25.44	1008.24
9/4/2021	1:26:51 AM	0	10.107	5.4	9/4/2021	1:33:24 AM	0	897.24	8.477	0.96	25.44	1008.24
9/4/2021	2:26:51 AM	0	10.102	5.4	9/4/2021	2:33:24 AM	0	896.655	7.847	0.96	25.44	1008.24
9/4/2021	3:26:51 AM	0	10.1	5.4	9/4/2021	3:33:24 AM	0	896.391	7.33	0.96	25.44	1008.24
9/4/2021	4:26:51 AM	0	10.097	5.4	9/4/2021	4:33:24 AM	0	896.141	7.029	0.96	25.44	1008.24
9/4/2021	5:26:51 AM	0	10.089	5.4	9/4/2021	5:33:24 AM	0	895.754	6.972	0.95	25.44	1008.24
9/4/2021	6:26:51 AM	0	10.082	5.4	9/4/2021	6:33:24 AM	0	895.755	8.124	0.95	25.45	1008.23
9/4/2021	7:26:51 AM	0	10.074	5.4	9/4/2021	7:33:24 AM	0	895.776	9.275	0.94	25.46	1008.22
9/4/2021	8:26:51 AM	0	10.063	5.4	9/4/2021	8:33:24 AM	0	895.264	10.554	0.93	25.46	1008.22
9/4/2021	9:26:51 AM	0	10.056	5.4	9/4/2021	9:33:24 AM	0	895.094	12.24	0.93	25.47	1008.21
9/4/2021	10:26:51 AM	0	10.055	5.4	9/4/2021	10:33:24 AM	0	895.241	12.993	0.93	25.47	1008.21
9/4/2021	11:26:51 AM	0	10.053	5.4	9/4/2021	11:33:24 AM	0	895.084	11.467	0.93	25.47	1008.21
9/4/2021	12:26:51 PM	0	10.053	5.4	9/4/2021	12:33:24 PM	0	894.711	11.38	0.93	25.47	1008.21
9/4/2021	1:26:51 PM	0	10.06	5.4	9/4/2021	1:33:24 PM	0	894.942	12.756	0.93	25.46	1008.22
9/4/2021	2:26:51 PM	0	10.065	5.4	9/4/2021	2:33:24 PM	0	894.878	13.593	0.94	25.46	1008.22
9/4/2021	3:26:51 PM	0	10.073	5.4	9/4/2021	3:33:24 PM	0	894.889	14.456	0.95	25.45	1008.23
9/4/2021	4:26:51 PM	0	10.073	5.4	9/4/2021	4:33:24 PM	0	894.347	15.462	0.95	25.44	1008.24
9/4/2021	5:26:51 PM	0	10.074	5.4	9/4/2021	5:33:24 PM	0	894.198	15.668	0.96	25.44	1008.24
9/4/2021	6:26:51 PM	0	10.073	5.4	9/4/2021	6:33:24 PM	0	893.773	15.137	0.96	25.44	1008.24
9/4/2021	7:26:51 PM	0	10.07	5.4	9/4/2021	7:33:24 PM	0	893.636	13.704	0.96	25.44	1008.24
9/4/2021	8:26:51 PM	0	10.068	5.4	9/4/2021	8:33:24 PM	0	894.073	12.295	0.95	25.44	1008.24
9/4/2021	9:26:51 PM	0	10.063	5.4	9/4/2021	9:33:24 PM	0	894.081	11.545	0.95	25.45	1008.23
9/4/2021	10:26:51 PM	0	10.06	5.4	9/4/2021	10:33:24 PM	0	894.196	11.114	0.94	25.45	1008.23
9/4/2021	11:26:51 PM	0	10.06	5.4	9/4/2021	11:33:24 PM	0	894.331	10.336	0.94	25.45	1008.22
9/5/2021	12:26:51 AM	0	10.06	5.4	9/5/2021	12:33:24 AM	0	894.612	9.581	0.94	25.46	1008.22
9/5/2021	1:26:51 AM	0	10.06	5.4	9/5/2021	1:33:24 AM	0	894.512	9.067	0.94	25.46	1008.22
9/5/2021	2:26:51 AM	0	10.062	5.4	9/5/2021	2:33:24 AM	0	894.544	8.225	0.94	25.45	1008.22
9/5/2021	3:26:51 AM	0	10.063	5.4	9/5/2021	3:33:24 AM	0	894.665	8.022	0.94	25.45	1008.22
9/5/2021	4:26:51 AM	0	10.067	5.4	9/5/2021	4:33:24 AM	0	895.261	7.985	0.94	25.46	1008.22
9/5/2021	5:26:51 AM	0	10.065	5.4	9/5/2021	5:33:24 AM	0	895.531	8.286	0.93	25.46	1008.22
9/5/2021	6:26:51 AM	0	10.063	5.4	9/5/2021	6:33:24 AM	0	896.013	8.013	0.93	25.47	1008.21
9/5/2021	7:26:51 AM	0	10.059	5.4	9/5/2021	7:33:24 AM	0	896.506	8.743	0.92	25.48	1008.20
9/5/2021	8:26:51 AM	0	10.055	5.4	9/5/2021	8:33:24 AM	0	897.002	11.042	0.91	25.49	1008.19
9/5/2021	9:26:51 AM	0	10.049	5.4	9/5/2021	9:33:24 AM	0	896.679	21.078	0.91	25.49	1008.19
9/5/2021	10:26:51 AM	0	10.044	5.4	9/5/2021	10:33:24 AM	0	896.33	27.67	0.90	25.49	1008.19
9/5/2021	11:26:51 AM	0	10.041	5.4	9/5/2021	11:33:24 AM	0	896.08	30.036	0.90	25.49	1008.19
9/5/2021	12:26:51 PM	0	10.041	5.4	9/5/2021	12:33:24 PM	0	895.984	27.371	0.90	25.49	1008.19
9/5/2021	1:26:51 PM	0	10.047	5.4	9/5/2021	1:33:24 PM	0	895.824	29.815	0.91	25.48	1008.20
9/5/2021	2:26:51 PM	0	10.049	5.4	9/5/2021	2:33:24 PM	0	895.275	30.017	0.92	25.48	1008.20
9/5/2021	3:26:51 PM	0	10.053	5.4	9/5/2021	3:33:24 PM	0	895.202	25.428	0.92	25.47	1008.21
9/5/2021	4:26:51 PM	0	10.057	5.4	9/5/2021	4:33:24 PM	0	895.004	21.643	0.93	25.46	1008.21
9/5/2021	5:26:51 PM	0	10.059	5.4	9/5/2021	5:33:24 PM	0	894.851	19.653	0.93	25.46	1008.22
9/5/2021	6:26:51 PM	0	10.057	5.4	9/5/2021	6:33:24 PM	0	894.593	17.623	0.93	25.46	1008.22
9/5/2021	7:26:51 PM	0	10.057	5.4	9/5/2021	7:33:24 PM	0	894.723	14.069	0.93	25.46	1008.22
9/5/2021	8:26:51 PM	0	10.056	5.4	9/5/2021	8:33:24 PM	0	895.217	11.665	0.93	25.47	1008.21
9/5/2021	9:26:51 PM	0	10.056	5.4	9/5/2021	9:33:24 PM	0	895.789	9.648	0.92	25.47	1008.21
9/5/2021	10:26:51 PM	0	10.053	5.4	9/5/2021	10:33:24 PM	0	895.856	8.514	0.92	25.48	1008.20
9/5/2021	11:26:51 PM	0	10.056	5.4	9/5/2021	11:33:24 PM	0	896.762	7.827	0.91	25.48	1008.20
9/6/2021	12:26:51 AM	0	10.057	5.4	9/6/2021	12:33:24 AM	0	897.05	6.94	0.91	25.49	1008.19
9/6/2021	1:26:51 AM	0	10.062	5.4	9/6/2021	1:33:24 AM	0	897.581	6.54	0.91	25.49	1008.19
9/6/2021	2:26:51 AM	0	10.068	5.4	9/6/2021	2:33:24 AM	0	898.343	6.869	0.91	25.49	1008.19
9/6/2021	3:26:51 AM	0	10.071	5.4	9/6/2021	3:33:24 AM	0	898.37	6.147	0.91	25.48	1008.19
9/6/2021	4:26:51 AM	0	10.077	5.4	9/6/2021	4:33:24 AM	0	898.99	6.301	0.91	25.48	1008.19
9/6/2021	5:26:51 AM	0	10.08	5.4	9/6/2021	5:33:24 AM	0	899.544	6.496	0.91	25.49	1008.19
9/6/2021	6:26:51 AM	0	10.08	5.4	9/6/2021	6:33:24 AM	0	900.12	6.663	0.90	25.49	1008.19
9/6/2021	7:26:51 AM	0	10.079	5.4	9/6/2021	7:33:24 AM	0	900.486	5.709	0.90	25.50	1008.18
9/6/2021	8:26:51 AM	0	10.074	5.4	9/6/2021	8:33:24 AM	0	900.999	8.02	0.89	25.51	1008.17
9/6/2021	9:26:51 AM	0	10.068	5.4	9/6/2021	9:33:24 AM	0	901.017	19.72	0.88	25.51	1008.16
9/6/2021	10:26:51 AM	0	10.062	5.4	9/6/2021	10:33:24 AM	0	900.651	26.809	0.88	25.52	1008.16
9/6/2021	11:26:51 AM	0	10.059	5.4	9/6/2021	11:33:24 AM	0	900.582	29.052	0.88	25.52	1008.16
9/6/2021	12:26:51 PM	0	10.059	5.4	9/6/2021	12:33:24 PM	0	900.584	25.848	0.88	25.52	1008.16

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/6/2021	1:26:51 PM	0	10.063	5.4	9/6/2021	1:33:24 PM	0	900.508	28.821	0.88	25.51	1008.16
9/6/2021	2:26:51 PM	0	10.068	5.4	9/6/2021	2:33:24 PM	0	900.467	28.038	0.89	25.51	1008.17
9/6/2021	3:26:51 PM	0	10.071	5.4	9/6/2021	3:33:24 PM	0	900.073	26.283	0.89	25.50	1008.18
9/6/2021	4:26:51 PM	0	10.077	5.4	9/6/2021	4:33:24 PM	0	900.262	22.133	0.90	25.50	1008.18
9/6/2021	5:26:51 PM	0	10.083	5.4	9/6/2021	5:33:24 PM	0	900.472	19.95	0.90	25.49	1008.18
9/6/2021	6:26:51 PM	0	10.086	5.4	9/6/2021	6:33:24 PM	0	900.56	18.379	0.90	25.49	1008.19
9/6/2021	7:26:51 PM	0	10.088	5.4	9/6/2021	7:33:24 PM	0	900.992	16.017	0.90	25.49	1008.18
9/6/2021	8:26:51 PM	0	10.085	5.4	9/6/2021	8:33:24 PM	0	900.923	13.932	0.90	25.50	1008.18
9/6/2021	9:26:51 PM	0	10.082	5.4	9/6/2021	9:33:24 PM	0	901.226	12.283	0.89	25.50	1008.18
9/6/2021	10:26:51 PM	0	10.079	5.4	9/6/2021	10:33:24 PM	0	901.484	11.48	0.89	25.51	1008.17
9/6/2021	11:26:51 PM	0	10.079	5.4	9/6/2021	11:33:24 PM	0	901.813	11.177	0.88	25.51	1008.17
9/7/2021	12:26:51 AM	0	10.076	5.4	9/7/2021	12:33:24 AM	0	901.754	10.447	0.88	25.51	1008.16
9/7/2021	1:26:51 AM	0	10.08	5.4	9/7/2021	1:33:24 AM	0	902.248	9.892	0.88	25.52	1008.16
9/7/2021	2:26:51 AM	0	10.085	5.4	9/7/2021	2:33:24 AM	0	902.457	9.993	0.88	25.51	1008.17
9/7/2021	3:26:51 AM	0	10.089	5.4	9/7/2021	3:33:24 AM	0	902.565	10.115	0.89	25.51	1008.17
9/7/2021	4:26:51 AM	0	10.094	5.4	9/7/2021	4:33:24 AM	0	902.791	9.776	0.89	25.51	1008.17
9/7/2021	5:26:51 AM	0	10.097	5.4	9/7/2021	5:33:24 AM	0	902.903	8.7	0.89	25.50	1008.17
9/7/2021	6:26:51 AM	0	10.097	5.4	9/7/2021	6:33:24 AM	0	903.003	7.987	0.89	25.51	1008.17
9/7/2021	7:26:51 AM	0	10.092	5.4	9/7/2021	7:33:24 AM	0	903.084	7.681	0.88	25.51	1008.17
9/7/2021	8:26:51 AM	0	10.088	5.4	9/7/2021	8:33:24 AM	0	903.359	10.666	0.88	25.52	1008.16
9/7/2021	9:26:51 AM	0	10.08	5.4	9/7/2021	9:33:24 AM	0	903.2	15.278	0.87	25.52	1008.15
9/7/2021	10:26:51 AM	0	10.073	5.4	9/7/2021	10:33:24 AM	0	902.5	23.876	0.87	25.52	1008.15
9/7/2021	11:26:51 AM	0	10.065	5.4	9/7/2021	11:33:24 AM	0	901.979	28.261	0.87	25.53	1008.15
9/7/2021	12:26:51 PM	0	10.06	5.4	9/7/2021	12:33:24 PM	0	901.557	28.375	0.87	25.53	1008.15
9/7/2021	1:26:51 PM	0	10.057	5.4	9/7/2021	1:33:24 PM	0	900.974	31.019	0.87	25.53	1008.15
9/7/2021	2:26:51 PM	0	10.056	5.4	9/7/2021	2:33:24 PM	0	899.947	34.672	0.88	25.52	1008.16
9/7/2021	3:26:51 PM	0	10.059	5.4	9/7/2021	3:33:24 PM	0	899.546	34.348	0.89	25.51	1008.17
9/7/2021	4:26:51 PM	0	10.06	5.4	9/7/2021	4:33:24 PM	0	899.638	27.366	0.89	25.51	1008.17
9/7/2021	5:26:51 PM	0	10.062	5.4	9/7/2021	5:33:24 PM	0	899.302	24.575	0.89	25.50	1008.18
9/7/2021	6:26:51 PM	0	10.063	5.4	9/7/2021	6:33:24 PM	0	899.275	22.058	0.89	25.50	1008.18
9/7/2021	7:26:51 PM	0	10.062	5.4	9/7/2021	7:33:24 PM	0	899.171	19.398	0.89	25.50	1008.18
9/7/2021	8:26:51 PM	0	10.057	5.4	9/7/2021	8:33:24 PM	0	899.326	16.235	0.89	25.51	1008.17
9/7/2021	9:26:51 PM	0	10.055	5.4	9/7/2021	9:33:24 PM	0	899.551	13.881	0.88	25.51	1008.17
9/7/2021	10:26:51 PM	0	10.047	5.4	9/7/2021	10:33:24 PM	0	899.234	12.811	0.88	25.52	1008.16
9/7/2021	11:26:51 PM	0	10.038	5.4	9/7/2021	11:33:24 PM	0	898.578	11.975	0.88	25.52	1008.16
9/8/2021	12:26:51 AM	0	10.032	5.4	9/8/2021	12:33:24 AM	0	898.169	11.016	0.87	25.52	1008.16
9/8/2021	1:26:51 AM	0	10.029	5.4	9/8/2021	1:33:24 AM	0	897.678	10.709	0.88	25.52	1008.16
9/8/2021	2:26:51 AM	0	10.031	5.4	9/8/2021	2:33:24 AM	0	897.633	10.547	0.88	25.52	1008.16
9/8/2021	3:26:51 AM	0	10.029	5.4	9/8/2021	3:33:24 AM	0	897.06	10.409	0.88	25.51	1008.17
9/8/2021	4:26:51 AM	0	10.028	5.4	9/8/2021	4:33:24 AM	0	896.123	10.733	0.89	25.50	1008.17
9/8/2021	5:26:51 AM	0	10.025	5.4	9/8/2021	5:33:24 AM	0	895.472	10.923	0.89	25.50	1008.18
9/8/2021	6:26:51 AM	0	10.022	5.4	9/8/2021	6:33:24 AM	0	894.941	11.392	0.90	25.50	1008.18
9/8/2021	7:26:51 AM	0	10.017	5.4	9/8/2021	7:33:24 AM	0	894.733	12.158	0.89	25.50	1008.18
9/8/2021	8:26:51 AM	0	10.02	5.4	9/8/2021	8:33:24 AM	0	895.863	13.218	0.88	25.51	1008.17
9/8/2021	9:26:51 AM	0	10.022	5.4	9/8/2021	9:33:24 AM	0	897.257	13.592	0.87	25.52	1008.16
9/8/2021	10:26:51 AM	0	10.009	5.4	9/8/2021	10:33:24 AM	0	896.497	13.427	0.87	25.53	1008.15
9/8/2021	11:26:51 AM	0	10.007	5.4	9/8/2021	11:33:24 AM	0	896.838	13.421	0.86	25.53	1008.15
9/8/2021	12:26:51 PM	0	9.998	5.4	9/8/2021	12:33:24 PM	0	896.082	15.882	0.86	25.53	1008.14
9/8/2021	1:26:51 PM	0	9.998	5.4	9/8/2021	1:33:24 PM	0	895.942	19.054	0.86	25.53	1008.15
9/8/2021	2:26:51 PM	0	9.998	5.4	9/8/2021	2:33:24 PM	0	895.826	20.409	0.86	25.53	1008.15
9/8/2021	3:26:51 PM	0	10.001	5.4	9/8/2021	3:33:24 PM	0	895.674	21.789	0.87	25.53	1008.15
9/8/2021	4:26:51 PM	0	10.002	5.4	9/8/2021	4:33:24 PM	0	895.493	20.175	0.87	25.52	1008.15
9/8/2021	5:26:51 PM	0	10.005	5.4	9/8/2021	5:33:24 PM	0	895.207	19.759	0.88	25.52	1008.16
9/8/2021	6:26:51 PM	0	10.007	5.4	9/8/2021	6:33:24 PM	0	895.123	18.33	0.88	25.52	1008.16
9/8/2021	7:26:51 PM	0	10.001	5.4	9/8/2021	7:33:24 PM	0	894.412	16.643	0.88	25.51	1008.16
9/8/2021	8:26:51 PM	0	9.998	5.4	9/8/2021	8:33:24 PM	0	894.576	15.193	0.88	25.52	1008.16
9/8/2021	9:26:51 PM	0	9.992	5.4	9/8/2021	9:33:24 PM	0	894.418	14.666	0.87	25.52	1008.16
9/8/2021	10:26:51 PM	0	9.987	5.4	9/8/2021	10:33:24 PM	0	894.607	14.144	0.86	25.53	1008.15
9/8/2021	11:26:51 PM	0	9.979	5.4	9/8/2021	11:33:24 PM	0	894.381	14.207	0.86	25.54	1008.14
9/9/2021	12:26:51 AM	0	9.978	5.4	9/9/2021	12:33:24 AM	0	894.894	14.046	0.85	25.54	1008.14
9/9/2021	1:26:51 AM	0	9.976	5.4	9/9/2021	1:33:24 AM	0	894.906	13.724	0.85	25.54	1008.13
9/9/2021	2:26:51 AM	0	9.984	5.4	9/9/2021	2:33:24 AM	0	896.112	12.448	0.85	25.55	1008.13
9/9/2021	3:26:51 AM	0	9.996	5.4	9/9/2021	3:33:24 AM	0	897.042	10.432	0.85	25.55	1008.13
9/9/2021	4:26:51 AM	0	9.998	5.4	9/9/2021	4:33:24 AM	0	896.724	9.068	0.85	25.54	1008.14
9/9/2021	5:26:51 AM	0	10.002	5.4	9/9/2021	5:33:24 AM	0	896.743	8.649	0.86	25.54	1008.14
9/9/2021	6:26:51 AM	0	10.007	5.4	9/9/2021	6:33:24 AM	0	896.836	8.609	0.86	25.53	1008.15
9/9/2021	7:26:51 AM	0	10.011	5.4	9/9/2021	7:33:24 AM	0	897.243	8.935	0.86	25.53	1008.15
9/9/2021	8:26:51 AM	0	10.009	5.4	9/9/2021	8:33:24 AM	0	897.364	9.49	0.86	25.54	1008.14
9/9/2021	9:26:51 AM	0	10.005	5.4	9/9/2021	9:33:24 AM	0	897.09	10.776	0.86	25.54	1008.14
9/9/2021	10:26:51 AM	0	9.999	5.4	9/9/2021	10:33:24 AM	0	896.926	12.831	0.85	25.54	1008.14
9/9/2021	11:26:51 AM	0	9.993	5.4	9/9/2021	11:33:24 AM	0	896.731	14.112	0.85	25.55	1008.13
9/9/2021	12:26:51 PM	0	9.987	5.4	9/9/2021	12:33:24 PM	0	896.345	16.294	0.85	25.55	1008.13

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/9/2021	1:26:51 PM	0	9.982	5.4	9/9/2021	1:33:24 PM	0	895.974	18.867	0.85	25.55	1008.13
9/9/2021	2:26:51 PM	0	9.981	5.4	9/9/2021	2:33:24 PM	0	895.8	19.288	0.85	25.55	1008.13
9/9/2021	3:26:51 PM	0	9.982	5.4	9/9/2021	3:33:24 PM	0	895.787	18.193	0.85	25.55	1008.13
9/9/2021	4:26:51 PM	0	9.986	5.4	9/9/2021	4:33:24 PM	0	895.92	18.094	0.85	25.54	1008.13
9/9/2021	5:26:51 PM	0	9.988	5.4	9/9/2021	5:33:24 PM	0	896.032	17.374	0.85	25.54	1008.14
9/9/2021	6:26:51 PM	0	9.99	5.4	9/9/2021	6:33:24 PM	0	895.939	16.141	0.85	25.54	1008.14
9/9/2021	7:26:51 PM	0	9.992	5.4	9/9/2021	7:33:24 PM	0	896.196	14.485	0.85	25.54	1008.14
9/9/2021	8:26:51 PM	0	9.992	5.4	9/9/2021	8:33:24 PM	0	896.604	12.933	0.85	25.55	1008.13
9/9/2021	9:26:51 PM	0	9.992	5.4	9/9/2021	9:33:24 PM	0	897.229	12.022	0.84	25.55	1008.13
9/9/2021	10:26:51 PM	0	9.986	5.4	9/9/2021	10:33:24 PM	0	897.259	11.182	0.84	25.56	1008.12
9/9/2021	11:26:51 PM	0	9.979	5.4	9/9/2021	11:33:24 PM	0	897.264	10.507	0.83	25.57	1008.11
9/10/2021	12:26:51 AM	0	9.975	5.4	9/10/2021	12:33:24 AM	0	897.365	10.38	0.82	25.57	1008.11
9/10/2021	1:26:51 AM	0	9.973	5.4	9/10/2021	1:33:24 AM	0	897.433	10.23	0.82	25.57	1008.11
9/10/2021	2:26:51 AM	0	9.973	5.4	9/10/2021	2:33:24 AM	0	897.405	10.334	0.82	25.57	1008.11
9/10/2021	3:26:51 AM	0	9.975	5.4	9/10/2021	3:33:24 AM	0	897.41	10.175	0.82	25.57	1008.11
9/10/2021	4:26:51 AM	0	9.981	5.4	9/10/2021	4:33:24 AM	0	897.741	10.038	0.83	25.57	1008.11
9/10/2021	5:26:51 AM	0	9.986	5.4	9/10/2021	5:33:24 AM	0	897.729	9.52	0.83	25.56	1008.12
9/10/2021	6:26:51 AM	0	9.99	5.4	9/10/2021	6:33:24 AM	0	897.652	9.619	0.84	25.56	1008.12
9/10/2021	7:26:51 AM	0	9.995	5.4	9/10/2021	7:33:24 AM	0	897.96	9.865	0.84	25.56	1008.12
9/10/2021	8:26:51 AM	0	9.996	5.4	9/10/2021	8:33:24 AM	0	898.026	10.858	0.84	25.56	1008.12
9/10/2021	9:26:51 AM	0	9.993	5.4	9/10/2021	9:33:24 AM	0	897.692	14.646	0.84	25.56	1008.12
9/10/2021	10:26:51 AM	0	9.988	5.4	9/10/2021	10:33:24 AM	0	896.882	24.82	0.84	25.55	1008.13
9/10/2021	11:26:51 AM	0	9.984	5.4	9/10/2021	11:33:24 AM	0	896.641	27.454	0.84	25.55	1008.12
9/10/2021	12:26:51 PM	0	9.979	5.4	9/10/2021	12:33:24 PM	0	896.492	25.437	0.84	25.56	1008.12
9/10/2021	1:26:51 PM	0	9.975	5.4	9/10/2021	1:33:24 PM	0	895.989	27.158	0.84	25.56	1008.12
9/10/2021	2:26:51 PM	0	9.97	5.4	9/10/2021	2:33:24 PM	0	895.656	27.509	0.84	25.56	1008.12
9/10/2021	3:26:51 PM	0	9.969	5.4	9/10/2021	3:33:24 PM	0	895.552	23.853	0.84	25.56	1008.12
9/10/2021	4:26:51 PM	0	9.969	5.4	9/10/2021	4:33:24 PM	0	895.442	21.615	0.84	25.56	1008.12
9/10/2021	5:26:51 PM	0	9.969	5.4	9/10/2021	5:33:24 PM	0	895.297	19.829	0.84	25.56	1008.12
9/10/2021	6:26:51 PM	0	9.97	5.4	9/10/2021	6:33:24 PM	0	895.678	17.304	0.84	25.56	1008.12
9/10/2021	7:26:51 PM	0	9.973	5.4	9/10/2021	7:33:24 PM	0	896.129	14.319	0.83	25.56	1008.12
9/10/2021	8:26:51 PM	0	9.973	5.4	9/10/2021	8:33:24 PM	0	896.474	11.937	0.83	25.56	1008.12
9/10/2021	9:26:51 PM	0	9.969	5.4	9/10/2021	9:33:24 PM	0	896.578	10.418	0.83	25.57	1008.11
9/10/2021	10:26:51 PM	0	9.964	5.4	9/10/2021	10:33:24 PM	0	896.711	9.483	0.82	25.57	1008.10
9/10/2021	11:26:51 PM	0	9.96	5.4	9/10/2021	11:33:24 PM	0	896.884	9.044	0.81	25.58	1008.10
9/11/2021	12:26:51 AM	0	9.955	5.4	9/11/2021	12:33:24 AM	0	897.129	9.512	0.81	25.59	1008.09
9/11/2021	1:26:51 AM	0	9.955	5.4	9/11/2021	1:33:24 AM	0	897.631	9.787	0.80	25.59	1008.09
9/11/2021	2:26:51 AM	0	9.955	5.4	9/11/2021	2:33:24 AM	0	898.122	10.293	0.80	25.60	1008.08
9/11/2021	3:26:51 AM	0	9.959	5.4	9/11/2021	3:33:24 AM	0	898.609	10.529	0.80	25.60	1008.08
9/11/2021	4:26:51 AM	0	9.963	5.4	9/11/2021	4:33:24 AM	0	898.871	10.473	0.80	25.60	1008.08
9/11/2021	5:26:51 AM	0	9.969	5.4	9/11/2021	5:33:24 AM	0	899.262	10.367	0.80	25.60	1008.08
9/11/2021	6:26:51 AM	0	9.976	5.4	9/11/2021	6:33:24 AM	0	899.475	10.33	0.80	25.59	1008.09
9/11/2021	7:26:51 AM	0	9.984	5.4	9/11/2021	7:33:24 AM	0	899.939	10.373	0.81	25.59	1008.09
9/11/2021	8:26:51 AM	0	9.99	5.4	9/11/2021	8:33:24 AM	0	900.401	12.091	0.81	25.59	1008.09
9/11/2021	9:26:51 AM	0	9.995	5.4	9/11/2021	9:33:24 AM	0	900.719	17.411	0.81	25.58	1008.09
9/11/2021	10:26:51 AM	0	9.998	5.4	9/11/2021	10:33:24 AM	0	900.718	21.664	0.81	25.58	1008.10
9/11/2021	11:26:51 AM	0	9.998	5.4	9/11/2021	11:33:24 AM	0	900.775	22.209	0.81	25.58	1008.10
9/11/2021	12:26:51 PM	0	9.995	5.4	9/11/2021	12:33:24 PM	0	900.575	22.273	0.81	25.58	1008.10
9/11/2021	1:26:51 PM	0	9.993	5.4	9/11/2021	1:33:24 PM	0	900.414	21.578	0.81	25.58	1008.10
9/11/2021	2:26:51 PM	0	9.99	5.4	9/11/2021	2:33:24 PM	0	899.992	24.253	0.81	25.58	1008.10
9/11/2021	3:26:51 PM	0	9.986	5.4	9/11/2021	3:33:24 PM	0	899.399	22.276	0.81	25.58	1008.10
9/11/2021	4:26:51 PM	0	9.984	5.4	9/11/2021	4:33:24 PM	0	899.234	19.957	0.81	25.58	1008.10
9/11/2021	5:26:51 PM	0	9.986	5.4	9/11/2021	5:33:24 PM	0	899.607	16.255	0.81	25.58	1008.10
9/11/2021	6:26:51 PM	0	9.982	5.4	9/11/2021	6:33:24 PM	0	899.016	13.6	0.81	25.58	1008.10
9/11/2021	7:26:51 PM	0	9.986	5.4	9/11/2021	7:33:24 PM	0	899.602	11.924	0.81	25.58	1008.10
9/11/2021	8:26:51 PM	0	9.987	5.4	9/11/2021	8:33:24 PM	0	899.931	10.122	0.81	25.58	1008.09
9/11/2021	9:26:51 PM	0	9.981	5.4	9/11/2021	9:33:24 PM	0	899.608	9.613	0.81	25.59	1008.09
9/11/2021	10:26:51 PM	0	9.979	5.4	9/11/2021	10:33:24 PM	0	900.116	8.669	0.80	25.59	1008.08
9/11/2021	11:26:51 PM	0	9.973	5.4	9/11/2021	11:33:24 PM	0	900.102	7.948	0.79	25.60	1008.08
9/12/2021	12:26:51 AM	0	9.97	5.4	9/12/2021	12:33:24 AM	0	900.326	7.428	0.79	25.61	1008.07
9/12/2021	1:26:51 AM	0	9.966	5.4	9/12/2021	1:33:24 AM	0	900.515	8	0.78	25.61	1008.07
9/12/2021	2:26:51 AM	0	9.961	5.4	9/12/2021	2:33:24 AM	0	900.308	8.592	0.78	25.61	1008.06
9/12/2021	3:26:51 AM	0	9.96	5.4	9/12/2021	3:33:24 AM	0	900.415	8.882	0.78	25.62	1008.06
9/12/2021	4:26:51 AM	0	9.959	5.4	9/12/2021	4:33:24 AM	0	900.053	8.517	0.78	25.61	1008.07
9/12/2021	5:26:51 AM	0	9.96	5.4	9/12/2021	5:33:24 AM	0	899.959	6.886	0.78	25.61	1008.07
9/12/2021	6:26:51 AM	0	9.964	5.4	9/12/2021	6:33:24 AM	0	900.057	5.738	0.79	25.61	1008.07
9/12/2021	7:26:51 AM	0	9.969	5.4	9/12/2021	7:33:24 AM	0	900.264	6.1	0.79	25.61	1008.07
9/12/2021	8:26:51 AM	0	9.975	5.4	9/12/2021	8:33:24 AM	0	900.833	7.818	0.79	25.61	1008.07
9/12/2021	9:26:51 AM	0	9.979	5.4	9/12/2021	9:33:24 AM	0	901.162	9.314	0.79	25.61	1008.07
9/12/2021	10:26:51 AM	0	9.981	5.4	9/12/2021	10:33:24 AM	0	900.977	12.361	0.79	25.60	1008.08
9/12/2021	11:26:51 AM	0	9.982	5.4	9/12/2021	11:33:24 AM	0	900.959	15.699	0.79	25.60	1008.08
9/12/2021	12:26:51 PM	0	9.984	5.4	9/12/2021	12:33:24 PM	0	900.918	17.919	0.80	25.60	1008.08

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/12/2021	1:26:51 PM	0	9.982	5.4	9/12/2021	1:33:24 PM	0	900.633	19.412	0.80	25.60	1008.08
9/12/2021	2:26:51 PM	0	9.981	5.4	9/12/2021	2:33:24 PM	0	900.452	20.034	0.80	25.60	1008.08
9/12/2021	3:26:51 PM	0	9.979	5.4	9/12/2021	3:33:24 PM	0	900.47	17.751	0.80	25.60	1008.08
9/12/2021	4:26:51 PM	0	9.978	5.4	9/12/2021	4:33:24 PM	0	900.214	15.924	0.80	25.60	1008.08
9/12/2021	5:26:51 PM	0	9.976	5.4	9/12/2021	5:33:24 PM	0	900.171	14.665	0.80	25.60	1008.08
9/12/2021	6:26:51 PM	0	9.975	5.4	9/12/2021	6:33:24 PM	0	900.17	11.483	0.80	25.60	1008.08
9/12/2021	7:26:51 PM	0	9.973	5.4	9/12/2021	7:33:24 PM	0	900.154	8.532	0.79	25.60	1008.08
9/12/2021	8:26:51 PM	0	9.973	5.4	9/12/2021	8:33:24 PM	0	900.355	6.507	0.79	25.60	1008.08
9/12/2021	9:26:51 PM	0	9.972	5.4	9/12/2021	9:33:24 PM	0	900.487	5.405	0.79	25.61	1008.07
9/12/2021	10:26:51 PM	0	9.969	5.4	9/12/2021	10:33:24 PM	0	900.727	4.555	0.78	25.61	1008.07
9/12/2021	11:26:51 PM	0	9.966	5.4	9/12/2021	11:33:24 PM	0	900.9	4.348	0.78	25.62	1008.06
9/13/2021	12:26:51 AM	0	9.961	5.4	9/13/2021	12:33:24 AM	0	901.1	5.328	0.77	25.62	1008.06
9/13/2021	1:26:51 AM	0	9.957	5.4	9/13/2021	1:33:24 AM	0	901.214	5.586	0.77	25.63	1008.05
9/13/2021	2:26:51 AM	0	9.953	5.4	9/13/2021	2:33:24 AM	0	901.202	5.115	0.76	25.63	1008.05
9/13/2021	3:26:51 AM	0	9.95	5.4	9/13/2021	3:33:24 AM	0	901.178	4.583	0.76	25.63	1008.04
9/13/2021	4:26:51 AM	0	9.951	5.4	9/13/2021	4:33:24 AM	0	901.465	4.121	0.76	25.64	1008.04
9/13/2021	5:26:51 AM	0	9.953	5.4	9/13/2021	5:33:24 AM	0	901.82	4.585	0.76	25.64	1008.04
9/13/2021	6:26:51 AM	0	9.954	5.4	9/13/2021	6:33:24 AM	0	902.004	4.708	0.76	25.64	1008.04
9/13/2021	7:26:51 AM	0	9.959	5.4	9/13/2021	7:33:24 AM	0	902.257	4.799	0.76	25.64	1008.04
9/13/2021	8:26:51 AM	0	9.963	5.4	9/13/2021	8:33:24 AM	0	902.417	5.947	0.76	25.63	1008.05
9/13/2021	9:26:51 AM	0	9.967	5.4	9/13/2021	9:33:24 AM	0	902.664	15.803	0.76	25.63	1008.05
9/13/2021	10:26:51 AM	0	9.972	5.4	9/13/2021	10:33:24 AM	0	902.73	18.597	0.77	25.63	1008.05
9/13/2021	11:26:51 AM	0	9.975	5.4	9/13/2021	11:33:24 AM	0	902.572	19.968	0.77	25.62	1008.06
9/13/2021	12:26:51 PM	0	9.975	5.4	9/13/2021	12:33:24 PM	0	902.224	17.934	0.77	25.62	1008.06
9/13/2021	1:26:51 PM	0	9.975	5.4	9/13/2021	1:33:24 PM	0	901.539	20.711	0.78	25.61	1008.07
9/13/2021	2:26:51 PM	0	9.976	5.4	9/13/2021	2:33:24 PM	0	901.647	22.18	0.78	25.61	1008.07
9/13/2021	3:26:51 PM	0	9.976	5.4	9/13/2021	3:33:24 PM	0	901.781	21.273	0.78	25.61	1008.06
9/13/2021	4:26:51 PM	0	9.973	5.4	9/13/2021	4:33:24 PM	0	901.388	18.166	0.78	25.61	1008.07
9/13/2021	5:26:51 PM	0	9.97	5.4	9/13/2021	5:33:24 PM	0	901.159	16.014	0.78	25.61	1008.06
9/13/2021	6:26:51 PM	0	9.967	5.4	9/13/2021	6:33:24 PM	0	900.996	12.751	0.78	25.62	1008.06
9/13/2021	7:26:51 PM	0	9.966	5.4	9/13/2021	7:33:24 PM	0	901.093	9.716	0.78	25.62	1008.06
9/13/2021	8:26:51 PM	0	9.964	5.4	9/13/2021	8:33:24 PM	0	901.136	7.446	0.77	25.62	1008.06
9/13/2021	9:26:51 PM	0	9.961	5.4	9/13/2021	9:33:24 PM	0	901.03	6.544	0.77	25.62	1008.06
9/13/2021	10:26:51 PM	0	9.957	5.4	9/13/2021	10:33:24 PM	0	900.91	5.943	0.77	25.62	1008.05
9/13/2021	11:26:51 PM	0	9.953	5.4	9/13/2021	11:33:24 PM	0	900.748	5.604	0.77	25.63	1008.05
9/14/2021	12:26:51 AM	0	9.947	5.4	9/14/2021	12:33:24 AM	0	900.743	6.28	0.76	25.63	1008.05
9/14/2021	1:26:51 AM	0	9.941	5.4	9/14/2021	1:33:24 AM	0	900.434	7.146	0.76	25.64	1008.04
9/14/2021	2:26:51 AM	0	9.934	5.4	9/14/2021	2:33:24 AM	0	900.031	6.335	0.76	25.64	1008.04
9/14/2021	3:26:51 AM	0	9.927	5.4	9/14/2021	3:33:24 AM	0	899.428	5.586	0.76	25.64	1008.04
9/14/2021	4:26:51 AM	0	9.919	5.4	9/14/2021	4:33:24 AM	0	898.867	5.58	0.75	25.64	1008.04
9/14/2021	5:26:51 AM	0	9.912	5.4	9/14/2021	5:33:24 AM	0	898.191	6.047	0.75	25.64	1008.04
9/14/2021	6:26:51 AM	0	9.905	5.4	9/14/2021	6:33:24 AM	0	897.415	6.172	0.75	25.64	1008.04
9/14/2021	7:26:51 AM	0	9.899	5.4	9/14/2021	7:33:24 AM	0	896.511	6.66	0.76	25.64	1008.04
9/14/2021	8:26:51 AM	0	9.899	5.4	9/14/2021	8:33:24 AM	0	896.469	7.652	0.76	25.64	1008.04
9/14/2021	9:26:51 AM	0	9.903	5.4	9/14/2021	9:33:24 AM	0	896.947	8	0.76	25.64	1008.04
9/14/2021	10:26:51 AM	0	9.905	5.4	9/14/2021	10:33:24 AM	0	896.589	7.703	0.76	25.63	1008.05
9/14/2021	11:26:51 AM	0	9.906	5.4	9/14/2021	11:33:24 AM	0	896.029	7.697	0.77	25.63	1008.05
9/14/2021	12:26:51 PM	0	9.905	5.4	9/14/2021	12:33:24 PM	0	895.266	8.031	0.78	25.62	1008.06
9/14/2021	1:26:51 PM	0	9.903	5.4	9/14/2021	1:33:24 PM	0	894.668	8.79	0.78	25.61	1008.06
9/14/2021	2:26:51 PM	0	9.9	5.4	9/14/2021	2:33:24 PM	0	893.745	9.79	0.79	25.61	1008.07
9/14/2021	3:26:51 PM	0	9.896	5.4	9/14/2021	3:33:24 PM	0	892.982	9.936	0.79	25.60	1008.07
9/14/2021	4:26:51 PM	0	9.888	5.4	9/14/2021	4:33:24 PM	0	891.996	10.014	0.79	25.60	1008.08
9/14/2021	5:26:51 PM	0	9.879	5.4	9/14/2021	5:33:24 PM	0	891.138	10.067	0.79	25.60	1008.08
9/14/2021	6:26:51 PM	0	9.877	5.4	9/14/2021	6:33:24 PM	0	891.211	9.846	0.79	25.61	1008.07
9/14/2021	7:26:51 PM	0	9.87	5.4	9/14/2021	7:33:24 PM	0	890.637	9.363	0.79	25.61	1008.07
9/14/2021	8:26:51 PM	0	9.873	5.4	9/14/2021	8:33:24 PM	0	891.57	8.378	0.78	25.61	1008.07
9/14/2021	9:26:51 PM	0	9.871	5.4	9/14/2021	9:33:24 PM	0	891.954	6.564	0.78	25.62	1008.06
9/14/2021	10:26:51 PM	0	9.871	5.4	9/14/2021	10:33:24 PM	0	892.433	5.612	0.77	25.62	1008.05
9/14/2021	11:26:51 PM	0	9.873	5.4	9/14/2021	11:33:24 PM	0	893.254	4.569	0.76	25.63	1008.05
9/15/2021	12:26:51 AM	0	9.873	5.4	9/15/2021	12:33:24 AM	0	893.786	3.372	0.76	25.64	1008.04
9/15/2021	1:26:51 AM	0	9.876	5.4	9/15/2021	1:33:24 AM	0	894.657	2.523	0.75	25.64	1008.04
9/15/2021	2:26:51 AM	0	9.873	5.4	9/15/2021	2:33:24 AM	0	894.915	1.411	0.75	25.65	1008.03
9/15/2021	3:26:51 AM	0	9.868	5.4	9/15/2021	3:33:24 AM	0	894.9	0.65	0.74	25.65	1008.03
9/15/2021	4:26:51 AM	0	9.866	5.4	9/15/2021	4:33:24 AM	0	895.057	0.191	0.74	25.66	1008.02
9/15/2021	5:26:51 AM	0	9.864	5.4	9/15/2021	5:33:24 AM	0	895.492	-0.211	0.73	25.66	1008.02
9/15/2021	6:26:51 AM	0	9.863	5.4	9/15/2021	6:33:24 AM	0	895.807	0.118	0.73	25.67	1008.01
9/15/2021	7:26:51 AM	0	9.863	5.4	9/15/2021	7:33:24 AM	0	896.303	1.107	0.72	25.67	1008.01
9/15/2021	8:26:51 AM	0	9.864	5.4	9/15/2021	8:33:24 AM	0	896.659	2.387	0.72	25.67	1008.00
9/15/2021	9:26:51 AM	0	9.867	5.4	9/15/2021	9:33:24 AM	0	897.062	10.66	0.72	25.68	1008.00
9/15/2021	10:26:51 AM	0	9.87	5.4	9/15/2021	10:33:24 AM	0	897.237	14.555	0.72	25.67	1008.00
9/15/2021	11:26:51 AM	0	9.876	5.4	9/15/2021	11:33:24 AM	0	897.429	11.837	0.72	25.67	1008.01
9/15/2021	12:26:51 PM	0	9.882	5.4	9/15/2021	12:33:24 PM	0	897.315	10.816	0.73	25.66	1008.02

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	SWL	Levelo	GW masl	Date	SWL	Levelogger	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/15/2021	1:26:51 PM	0	9.886	5.4	9/15/2021	1:33:24 PM	0	897.296	12.404	0.74	25.66	1008.02
9/15/2021	2:26:51 PM	0	9.894	5.4	9/15/2021	2:33:24 PM	0	897.438	12.256	0.74	25.65	1008.03
9/15/2021	3:26:51 PM	0	9.896	5.4	9/15/2021	3:33:24 PM	0	897.414	15.2	0.74	25.65	1008.03
9/15/2021	4:26:51 PM	0	9.897	5.4	9/15/2021	4:33:24 PM	0	897.274	12.065	0.75	25.65	1008.03
9/15/2021	5:26:51 PM	0	9.897	5.4	9/15/2021	5:33:24 PM	0	897.264	9.496	0.75	25.65	1008.03
9/15/2021	6:26:51 PM	0	9.9	5.4	9/15/2021	6:33:24 PM	0	897.747	7.025	0.75	25.65	1008.03
9/15/2021	7:26:51 PM	0	9.899	5.4	9/15/2021	7:33:24 PM	0	897.923	4.978	0.74	25.65	1008.03
9/15/2021	8:26:51 PM	0	9.899	5.4	9/15/2021	8:33:24 PM	0	898.234	2.56	0.74	25.66	1008.02
9/15/2021	9:26:51 PM	0	9.896	5.4	9/15/2021	9:33:24 PM	0	898.189	1.362	0.74	25.66	1008.02
9/15/2021	10:26:51 PM	0	9.896	5.4	9/15/2021	10:33:24 PM	0	898.38	0.669	0.74	25.66	1008.02
9/15/2021	11:26:51 PM	0	9.896	5.4	9/15/2021	11:33:24 PM	0	898.698	1.119	0.73	25.66	1008.02
9/16/2021	12:26:51 AM	0	9.896	5.4	9/16/2021	12:33:24 AM	0	898.938	0.653	0.73	25.67	1008.01
9/16/2021	1:26:51 AM	0	9.894	5.4	9/16/2021	1:33:24 AM	0	898.981	0.37	0.73	25.67	1008.01
9/16/2021	2:26:51 AM	0	9.896	5.4	9/16/2021	2:33:24 AM	0	899.437	0.417	0.72	25.67	1008.01
9/16/2021	3:26:51 AM	0	9.896	5.4	9/16/2021	3:33:24 AM	0	899.832	0.192	0.72	25.67	1008.00
9/16/2021	4:26:51 AM	0	9.894	5.4	9/16/2021	4:33:24 AM	0	900.129	-0.274	0.72	25.68	1008.00
9/16/2021	5:26:51 AM	0	9.889	5.4	9/16/2021	5:33:24 AM	0	900.227	-0.736	0.71	25.69	1007.99
9/16/2021	6:26:51 AM	0	9.886	5.4	9/16/2021	6:33:24 AM	0	900.458	-0.724	0.70	25.69	1007.99
9/16/2021	7:26:51 AM	0	9.885	5.4	9/16/2021	7:33:24 AM	0	900.879	-1.016	0.70	25.70	1007.98
9/16/2021	8:26:51 AM	0	9.883	5.4	9/16/2021	8:33:24 AM	0	901.011	-0.612	0.70	25.70	1007.98
9/16/2021	9:26:51 AM	0	9.882	5.4	9/16/2021	9:33:24 AM	0	901.529	11.547	0.69	25.71	1007.97
9/16/2021	10:26:51 AM	0	9.883	5.4	9/16/2021	10:33:24 AM	0	901.397	18.527	0.69	25.70	1007.98
9/16/2021	11:26:51 AM	0	9.885	5.4	9/16/2021	11:33:24 AM	0	901.029	15.144	0.70	25.70	1007.98
9/16/2021	12:26:51 PM	0	9.886	5.4	9/16/2021	12:33:24 PM	0	900.377	15.195	0.70	25.69	1007.99
9/16/2021	1:26:51 PM	0	9.891	5.4	9/16/2021	1:33:24 PM	0	900.044	18.615	0.71	25.68	1008.00
9/16/2021	2:26:51 PM	0	9.893	5.4	9/16/2021	2:33:24 PM	0	899.375	17.763	0.72	25.67	1008.01
9/16/2021	3:26:51 PM	0	9.893	5.4	9/16/2021	3:33:24 PM	0	898.638	18.529	0.73	25.67	1008.01
9/16/2021	4:26:51 PM	0	9.891	5.4	9/16/2021	4:33:24 PM	0	898.017	13.006	0.73	25.66	1008.02
9/16/2021	5:26:51 PM	0	9.888	5.4	9/16/2021	5:33:24 PM	0	897.412	10.664	0.74	25.66	1008.02
9/16/2021	6:26:51 PM	0	9.879	5.4	9/16/2021	6:33:24 PM	0	896.27	9.369	0.74	25.66	1008.02
9/16/2021	7:26:51 PM	0	9.87	5.4	9/16/2021	7:33:24 PM	0	895.38	8.124	0.74	25.66	1008.02
9/16/2021	8:26:51 PM	0	9.861	5.4	9/16/2021	8:33:24 PM	0	894.608	7.37	0.74	25.66	1008.02
9/16/2021	9:26:51 PM	0	9.852	5.4	9/16/2021	9:33:24 PM	0	893.719	7.159	0.74	25.66	1008.02
9/16/2021	10:26:51 PM	0	9.841	5.4	9/16/2021	10:33:24 PM	0	892.841	7.177	0.74	25.66	1008.02
9/16/2021	11:26:51 PM	0	9.835	5.4	9/16/2021	11:33:24 PM	0	892.281	7.102	0.74	25.66	1008.02
9/17/2021	12:26:51 AM	0	9.829	5.4	9/17/2021	12:33:24 AM	0	891.402	6.972	0.74	25.66	1008.02
9/17/2021	1:26:51 AM	0	9.823	5.4	9/17/2021	1:33:24 AM	0	890.742	6.915	0.74	25.65	1008.02
9/17/2021	2:26:51 AM	0	9.813	5.4	9/17/2021	2:33:24 AM	0	889.4	7.317	0.74	25.65	1008.03
9/17/2021	3:26:51 AM	0	9.804	5.4	9/17/2021	3:33:24 AM	0	888.459	7.281	0.74	25.65	1008.03
9/17/2021	4:26:51 AM	0	9.798	5.4	9/17/2021	4:33:24 AM	0	888.073	6.771	0.74	25.65	1008.03
9/17/2021	5:26:51 AM	0	9.793	5.4	9/17/2021	5:33:24 AM	0	888.505	6.291	0.73	25.66	1008.02
9/17/2021	6:26:51 AM	0	9.784	5.4	9/17/2021	6:33:24 AM	0	888.111	4.538	0.73	25.67	1008.01
9/17/2021	7:26:51 AM	0	9.773	5.4	9/17/2021	7:33:24 AM	0	887.294	3.912	0.73	25.67	1008.01
9/17/2021	8:26:51 AM	0	9.765	5.4	9/17/2021	8:33:24 AM	0	887.073	3.971	0.72	25.68	1008.00
9/17/2021	9:26:51 AM	0	9.759	5.4	9/17/2021	9:33:24 AM	0	886.77	3.974	0.72	25.68	1008.00
9/17/2021	10:26:51 AM	0	9.755	5.4	9/17/2021	10:33:24 AM	0	886.212	3.92	0.72	25.68	1008.00
9/17/2021	11:26:51 AM	0	9.753	5.4	9/17/2021	11:33:24 AM	0	885.891	4.277	0.72	25.68	1008.00
9/17/2021	12:26:51 PM	0	9.756	5.4	9/17/2021	12:33:24 PM	0	885.898	4.496	0.72	25.67	1008.01
9/17/2021	1:26:51 PM	0	9.761	5.4	9/17/2021	1:33:24 PM	0	885.656	4.554	0.73	25.66	1008.01
9/17/2021	2:26:51 PM	0	9.761	5.4	9/17/2021	2:33:24 PM	0	884.96	4.716	0.74	25.66	1008.02
9/17/2021	3:26:51 PM	0	9.764	5.4	9/17/2021	3:33:24 PM	0	884.431	4.493	0.75	25.65	1008.03
9/17/2021	4:26:51 PM	0	9.759	5.4	9/17/2021	4:33:24 PM	0	883.384	4.336	0.75	25.64	1008.04
9/17/2021	5:26:51 PM	0	9.755	5.4	9/17/2021	5:33:24 PM	0	882.478	3.89	0.76	25.64	1008.04
9/17/2021	6:26:51 PM	0	9.745	5.4	9/17/2021	6:33:24 PM	0	881.063	3.407	0.76	25.63	1008.04
9/17/2021	7:26:51 PM	0	9.735	5.4	9/17/2021	7:33:24 PM	0	880.215	3.194	0.76	25.64	1008.04
9/17/2021	8:26:51 PM	0	9.729	5.4	9/17/2021	8:33:24 PM	0	879.822	3.152	0.76	25.64	1008.04
9/17/2021	9:26:51 PM	0	9.72	5.4	9/17/2021	9:33:24 PM	0	879.319	3.266	0.75	25.64	1008.04
9/17/2021	10:26:51 PM	0	9.71	5.4	9/17/2021	10:33:24 PM	0	878.52	3.534	0.75	25.64	1008.04
9/17/2021	11:26:51 PM	0	9.708	5.4	9/17/2021	11:33:24 PM	0	878.923	3.905	0.75	25.65	1008.03
9/18/2021	12:26:51 AM	0	9.707	5.4	9/18/2021	12:33:24 AM	0	878.909	4.276	0.74	25.65	1008.03
9/18/2021	1:26:51 AM	0	9.704	5.4	9/18/2021	1:33:24 AM	0	878.474	4.663	0.75	25.65	1008.03
9/18/2021	2:26:51 AM	0	9.702	5.4	9/18/2021	2:33:24 AM	0	878.451	5.028	0.74	25.65	1008.03
9/18/2021	3:26:51 AM	0	9.7	5.4	9/18/2021	3:33:24 AM	0	878.364	5.242	0.74	25.65	1008.03
9/18/2021	4:26:51 AM	0	9.7	5.4	9/18/2021	4:33:24 AM	0	878.882	5.486	0.74	25.66	1008.02
9/18/2021	5:26:51 AM	0	9.697	5.4	9/18/2021	5:33:24 AM	0	879.243	5.173	0.73	25.66	1008.02
9/18/2021	6:26:51 AM	0	9.693	5.4	9/18/2021	6:33:24 AM	0	879.544	4.922	0.72	25.67	1008.01
9/18/2021	7:26:51 AM	0	9.687	5.4	9/18/2021	7:33:24 AM	0	879.853	5.49	0.71	25.68	1008.00
9/18/2021	8:26:51 AM	0	9.685	5.4	9/18/2021	8:33:24 AM	0	880.609	5.926	0.71	25.69	1007.99
9/18/2021	9:26:51 AM	0	9.682	5.4	9/18/2021	9:33:24 AM	0	881.117	15.591	0.70	25.70	1007.98
9/18/2021	10:26:51 AM	0	9.682	5.4	9/18/2021	10:33:24 AM	0	881.665	16.717	0.69	25.70	1007.98
9/18/2021	11:26:51 AM	0	9.685	5.4	9/18/2021	11:33:24 AM	0	882.169	18.512	0.69	25.71	1007.97
9/18/2021	12:26:51 PM	0	9.691	5.4	9/18/2021	12:33:24 PM	0	882.669	17.094	0.69	25.70	1007.97

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/18/2021	1:26:51 PM	0	9.699	5.4	9/18/2021	1:33:24 PM	0	883.028	16.174	0.69	25.70	1007.98
9/18/2021	2:26:51 PM	0	9.708	5.4	9/18/2021	2:33:24 PM	0	883.319	15.94	0.70	25.69	1007.98
9/18/2021	3:26:51 PM	0	9.717	5.4	9/18/2021	3:33:24 PM	0	883.652	16.503	0.71	25.69	1007.99
9/18/2021	4:26:51 PM	0	9.725	5.4	9/18/2021	4:33:24 PM	0	884.275	13.843	0.71	25.69	1007.99
9/18/2021	5:26:51 PM	0	9.73	5.4	9/18/2021	5:33:24 PM	0	884.692	11.542	0.71	25.69	1007.99
9/18/2021	6:26:51 PM	0	9.735	5.4	9/18/2021	6:33:24 PM	0	885.288	10.096	0.71	25.69	1007.99
9/18/2021	7:26:51 PM	0	9.736	5.4	9/18/2021	7:33:24 PM	0	885.929	7.712	0.70	25.69	1007.99
9/18/2021	8:26:51 PM	0	9.738	5.4	9/18/2021	8:33:24 PM	0	886.521	5.715	0.70	25.70	1007.98
9/18/2021	9:26:51 PM	0	9.738	5.4	9/18/2021	9:33:24 PM	0	887.088	4.684	0.69	25.70	1007.98
9/18/2021	10:26:51 PM	0	9.739	5.4	9/18/2021	10:33:24 PM	0	887.754	4.671	0.69	25.71	1007.97
9/18/2021	11:26:51 PM	0	9.742	5.4	9/18/2021	11:33:24 PM	0	888.414	4.808	0.68	25.71	1007.97
9/19/2021	12:26:51 AM	0	9.745	5.4	9/19/2021	12:33:24 AM	0	888.708	4.638	0.68	25.71	1007.97
9/19/2021	1:26:51 AM	0	9.752	5.4	9/19/2021	1:33:24 AM	0	889.123	4.229	0.69	25.71	1007.97
9/19/2021	2:26:51 AM	0	9.758	5.4	9/19/2021	2:33:24 AM	0	889.469	4.541	0.69	25.71	1007.97
9/19/2021	3:26:51 AM	0	9.762	5.4	9/19/2021	3:33:24 AM	0	889.853	4.968	0.69	25.71	1007.97
9/19/2021	4:26:51 AM	0	9.765	5.4	9/19/2021	4:33:24 AM	0	890.191	4.8	0.69	25.71	1007.97
9/19/2021	5:26:51 AM	0	9.768	5.4	9/19/2021	5:33:24 AM	0	890.547	4.616	0.69	25.71	1007.97
9/19/2021	6:26:51 AM	0	9.767	5.4	9/19/2021	6:33:24 AM	0	891.033	4.509	0.68	25.71	1007.97
9/19/2021	7:26:51 AM	0	9.767	5.4	9/19/2021	7:33:24 AM	0	891.747	4.466	0.67	25.72	1007.96
9/19/2021	8:26:51 AM	0	9.764	5.4	9/19/2021	8:33:24 AM	0	892.332	4.875	0.66	25.73	1007.95
9/19/2021	9:26:51 AM	0	9.762	5.4	9/19/2021	9:33:24 AM	0	893.057	6.698	0.66	25.74	1007.94
9/19/2021	10:26:51 AM	0	9.761	5.4	9/19/2021	10:33:24 AM	0	893.496	15.5	0.65	25.74	1007.93
9/19/2021	11:26:51 AM	0	9.762	5.4	9/19/2021	11:33:24 AM	0	893.796	16.442	0.65	25.75	1007.93
9/19/2021	12:26:51 PM	0	9.767	5.4	9/19/2021	12:33:24 PM	0	894.149	14.314	0.65	25.75	1007.93
9/19/2021	1:26:51 PM	0	9.771	5.4	9/19/2021	1:33:24 PM	0	894.041	20.3	0.65	25.74	1007.94
9/19/2021	2:26:51 PM	0	9.778	5.4	9/19/2021	2:33:24 PM	0	894.268	18.148	0.66	25.74	1007.94
9/19/2021	3:26:51 PM	0	9.784	5.4	9/19/2021	3:33:24 PM	0	894.328	15.848	0.66	25.73	1007.95
9/19/2021	4:26:51 PM	0	9.793	5.4	9/19/2021	4:33:24 PM	0	894.703	13.323	0.67	25.73	1007.95
9/19/2021	5:26:51 PM	0	9.798	5.4	9/19/2021	5:33:24 PM	0	895.032	11.206	0.67	25.72	1007.96
9/19/2021	6:26:51 PM	0	9.812	5.4	9/19/2021	6:33:24 PM	0	896.599	9.35	0.67	25.73	1007.95
9/19/2021	7:26:51 PM	0	9.813	5.4	9/19/2021	7:33:24 PM	0	897.103	6.279	0.67	25.73	1007.95
9/19/2021	8:26:51 PM	0	9.815	5.4	9/19/2021	8:33:24 PM	0	897.809	5.221	0.66	25.73	1007.94
9/19/2021	9:26:51 PM	0	9.816	5.4	9/19/2021	9:33:24 PM	0	898.745	4.842	0.65	25.74	1007.94
9/19/2021	10:26:51 PM	0	9.82	5.4	9/19/2021	10:33:24 PM	0	899.687	4.432	0.65	25.75	1007.93
9/19/2021	11:26:51 PM	0	9.822	5.4	9/19/2021	11:33:24 PM	0	900.124	4.793	0.64	25.75	1007.93
9/20/2021	12:26:51 AM	0	9.825	5.4	9/20/2021	12:33:24 AM	0	900.356	4.631	0.64	25.75	1007.93
9/20/2021	1:26:51 AM	0	9.834	5.4	9/20/2021	1:33:24 AM	0	901.252	3.39	0.64	25.75	1007.93
9/20/2021	2:26:51 AM	0	9.841	5.4	9/20/2021	2:33:24 AM	0	901.71	3.058	0.65	25.75	1007.93
9/20/2021	3:26:51 AM	0	9.848	5.4	9/20/2021	3:33:24 AM	0	902.074	3.416	0.65	25.75	1007.93
9/20/2021	4:26:51 AM	0	9.855	5.4	9/20/2021	4:33:24 AM	0	902.711	4.09	0.65	25.74	1007.93
9/20/2021	5:26:51 AM	0	9.861	5.4	9/20/2021	5:33:24 AM	0	903.384	4.39	0.65	25.75	1007.93
9/20/2021	6:26:51 AM	0	9.863	5.4	9/20/2021	6:33:24 AM	0	903.839	4.469	0.65	25.75	1007.93
9/20/2021	7:26:51 AM	0	9.863	5.4	9/20/2021	7:33:24 AM	0	904.35	4.723	0.64	25.75	1007.93
9/20/2021	8:26:51 AM	0	9.86	5.4	9/20/2021	8:33:24 AM	0	904.841	5.373	0.63	25.76	1007.92
9/20/2021	9:26:51 AM	0	9.856	5.4	9/20/2021	9:33:24 AM	0	905.249	7.003	0.62	25.77	1007.91
9/20/2021	10:26:51 AM	0	9.854	5.4	9/20/2021	10:33:24 AM	0	905.553	8.869	0.62	25.77	1007.90
9/20/2021	11:26:51 AM	0	9.851	5.4	9/20/2021	11:33:24 AM	0	905.58	11.22	0.62	25.78	1007.90
9/20/2021	12:26:51 PM	0	9.852	5.4	9/20/2021	12:33:24 PM	0	905.57	11.637	0.62	25.78	1007.90
9/20/2021	1:26:51 PM	0	9.856	5.4	9/20/2021	1:33:24 PM	0	905.759	11.325	0.62	25.77	1007.90
9/20/2021	2:26:51 PM	0	9.856	5.4	9/20/2021	2:33:24 PM	0	905.092	11.599	0.63	25.77	1007.91
9/20/2021	3:26:51 PM	0	9.863	5.4	9/20/2021	3:33:24 PM	0	904.917	11.663	0.64	25.76	1007.92
9/20/2021	4:26:51 PM	0	9.868	5.4	9/20/2021	4:33:24 PM	0	905.068	9.929	0.64	25.76	1007.92
9/20/2021	5:26:51 PM	0	9.873	5.4	9/20/2021	5:33:24 PM	0	905.154	8.638	0.64	25.75	1007.93
9/20/2021	6:26:51 PM	0	9.873	5.4	9/20/2021	6:33:24 PM	0	904.915	7.326	0.65	25.75	1007.93
9/20/2021	7:26:51 PM	0	9.871	5.4	9/20/2021	7:33:24 PM	0	904.816	6.636	0.64	25.75	1007.93
9/20/2021	8:26:51 PM	0	9.867	5.4	9/20/2021	8:33:24 PM	0	904.76	6.517	0.64	25.75	1007.93
9/20/2021	9:26:51 PM	0	9.864	5.4	9/20/2021	9:33:24 PM	0	904.99	6.653	0.64	25.76	1007.92
9/20/2021	10:26:51 PM	0	9.854	5.4	9/20/2021	10:33:24 PM	0	904.131	6.607	0.63	25.76	1007.92
9/20/2021	11:26:51 PM	0	9.852	5.4	9/20/2021	11:33:24 PM	0	904.303	6.618	0.63	25.76	1007.91
9/21/2021	12:26:51 AM	0	9.849	5.4	9/21/2021	12:33:24 AM	0	903.94	6.572	0.63	25.76	1007.92
9/21/2021	1:26:51 AM	0	9.849	5.4	9/21/2021	1:33:24 AM	0	903.661	6.367	0.63	25.76	1007.92
9/21/2021	2:26:51 AM	0	9.852	5.4	9/21/2021	2:33:24 AM	0	903.621	6.247	0.64	25.76	1007.92
9/21/2021	3:26:51 AM	0	9.855	5.4	9/21/2021	3:33:24 AM	0	903.284	6.255	0.64	25.75	1007.93
9/21/2021	4:26:51 AM	0	9.854	5.4	9/21/2021	4:33:24 AM	0	902.699	6.327	0.65	25.75	1007.93
9/21/2021	5:26:51 AM	0	9.856	5.4	9/21/2021	5:33:24 AM	0	902.823	6.472	0.65	25.75	1007.93
9/21/2021	6:26:51 AM	0	9.855	5.4	9/21/2021	6:33:24 AM	0	902.874	6.524	0.65	25.75	1007.93
9/21/2021	7:26:51 AM	0	9.852	5.4	9/21/2021	7:33:24 AM	0	902.783	6.59	0.65	25.75	1007.93
9/21/2021	8:26:51 AM	0	9.848	5.4	9/21/2021	8:33:24 AM	0	902.961	6.913	0.64	25.75	1007.92
9/21/2021	9:26:51 AM	0	9.841	5.4	9/21/2021	9:33:24 AM	0	902.894	7.591	0.63	25.76	1007.92
9/21/2021	10:26:51 AM	0	9.832	5.4	9/21/2021	10:33:24 AM	0	902.536	8.716	0.63	25.77	1007.91
9/21/2021	11:26:51 AM	0	9.825	5.4	9/21/2021	11:33:24 AM	0	902.207	9.431	0.63	25.77	1007.91
9/21/2021	12:26:51 PM	0	9.819	5.4	9/21/2021	12:33:24 PM	0	901.513	9.27	0.63	25.77	1007.91

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/21/2021	1:26:51 PM	0	9.816	5.4	9/21/2021	1:33:24 PM	0	901.052	9.691	0.63	25.77	1007.91
9/21/2021	2:26:51 PM	0	9.813	5.4	9/21/2021	2:33:24 PM	0	900.201	10.672	0.63	25.76	1007.92
9/21/2021	3:26:51 PM	0	9.813	5.4	9/21/2021	3:33:24 PM	0	899.682	10.891	0.64	25.76	1007.92
9/21/2021	4:26:51 PM	0	9.813	5.4	9/21/2021	4:33:24 PM	0	899.235	10.913	0.64	25.75	1007.93
9/21/2021	5:26:51 PM	0	9.812	5.4	9/21/2021	5:33:24 PM	0	898.55	10.313	0.65	25.75	1007.93
9/21/2021	6:26:51 PM	0	9.807	5.4	9/21/2021	6:33:24 PM	0	897.966	10.243	0.65	25.74	1007.93
9/21/2021	7:26:51 PM	0	9.803	5.4	9/21/2021	7:33:24 PM	0	897.632	10.041	0.65	25.75	1007.93
9/21/2021	8:26:51 PM	0	9.797	5.4	9/21/2021	8:33:24 PM	0	897.413	9.832	0.65	25.75	1007.93
9/21/2021	9:26:51 PM	0	9.789	5.4	9/21/2021	9:33:24 PM	0	897.257	9.606	0.64	25.76	1007.92
9/21/2021	10:26:51 PM	0	9.777	5.4	9/21/2021	10:33:24 PM	0	896.57	9.694	0.63	25.76	1007.92
9/21/2021	11:26:51 PM	0	9.774	5.4	9/21/2021	11:33:24 PM	0	896.489	9.429	0.63	25.76	1007.92
9/22/2021	12:26:51 AM	0	9.771	5.4	9/22/2021	12:33:24 AM	0	896.517	8.849	0.63	25.77	1007.91
9/22/2021	1:26:51 AM	0	9.773	5.4	9/22/2021	1:33:24 AM	0	896.887	8.491	0.63	25.77	1007.91
9/22/2021	2:26:51 AM	0	9.777	5.4	9/22/2021	2:33:24 AM	0	897.092	8.342	0.63	25.77	1007.91
9/22/2021	3:26:51 AM	0	9.781	5.4	9/22/2021	3:33:24 AM	0	897.148	8.25	0.63	25.76	1007.92
9/22/2021	4:26:51 AM	0	9.787	5.4	9/22/2021	4:33:24 AM	0	897.27	8.176	0.64	25.76	1007.92
9/22/2021	5:26:51 AM	0	9.793	5.4	9/22/2021	5:33:24 AM	0	897.728	8.383	0.64	25.76	1007.92
9/22/2021	6:26:51 AM	0	9.795	5.4	9/22/2021	6:33:24 AM	0	897.765	8.472	0.64	25.75	1007.92
9/22/2021	7:26:51 AM	0	9.798	5.4	9/22/2021	7:33:24 AM	0	898.218	8.428	0.64	25.76	1007.92
9/22/2021	8:26:51 AM	0	9.795	5.4	9/22/2021	8:33:24 AM	0	898.477	8.565	0.63	25.76	1007.92
9/22/2021	9:26:51 AM	0	9.792	5.4	9/22/2021	9:33:24 AM	0	899.039	11.53	0.62	25.77	1007.91
9/22/2021	10:26:51 AM	0	9.79	5.4	9/22/2021	10:33:24 AM	0	899.265	17.968	0.62	25.77	1007.90
9/22/2021	11:26:51 AM	0	9.786	5.4	9/22/2021	11:33:24 AM	0	899.43	17.198	0.61	25.78	1007.90
9/22/2021	12:26:51 PM	0	9.783	5.4	9/22/2021	12:33:24 PM	0	899.229	16.006	0.61	25.78	1007.90
9/22/2021	1:26:51 PM	0	9.784	5.4	9/22/2021	1:33:24 PM	0	899.62	17.035	0.61	25.78	1007.89
9/22/2021	2:26:51 PM	0	9.784	5.4	9/22/2021	2:33:24 PM	0	899.24	22.511	0.61	25.78	1007.90
9/22/2021	3:26:51 PM	0	9.789	5.4	9/22/2021	3:33:24 PM	0	899.737	17.667	0.61	25.78	1007.90
9/22/2021	4:26:51 PM	0	9.792	5.4	9/22/2021	4:33:24 PM	0	899.745	15.339	0.62	25.78	1007.90
9/22/2021	5:26:51 PM	0	9.795	5.4	9/22/2021	5:33:24 PM	0	899.832	12.369	0.62	25.78	1007.90
9/22/2021	6:26:51 PM	0	9.798	5.4	9/22/2021	6:33:24 PM	0	900.171	9.599	0.62	25.78	1007.90
9/22/2021	7:26:51 PM	0	9.8	5.4	9/22/2021	7:33:24 PM	0	900.572	7.317	0.62	25.78	1007.90
9/22/2021	8:26:51 PM	0	9.806	5.4	9/22/2021	8:33:24 PM	0	901.889	5.92	0.61	25.79	1007.89
9/22/2021	9:26:51 PM	0	9.804	5.4	9/22/2021	9:33:24 PM	0	902.465	5.501	0.60	25.79	1007.89
9/22/2021	10:26:51 PM	0	9.801	5.4	9/22/2021	10:33:24 PM	0	902.783	5.067	0.60	25.80	1007.88
9/22/2021	11:26:51 PM	0	9.8	5.4	9/22/2021	11:33:24 PM	0	903.03	4.809	0.59	25.80	1007.88
9/23/2021	12:26:51 AM	0	9.801	5.4	9/23/2021	12:33:24 AM	0	903.809	4.609	0.58	25.81	1007.87
9/23/2021	1:26:51 AM	0	9.804	5.4	9/23/2021	1:33:24 AM	0	904.206	4.423	0.58	25.81	1007.87
9/23/2021	2:26:51 AM	0	9.809	5.4	9/23/2021	2:33:24 AM	0	904.327	4.118	0.59	25.81	1007.87
9/23/2021	3:26:51 AM	0	9.813	5.4	9/23/2021	3:33:24 AM	0	904.183	3.24	0.59	25.80	1007.88
9/23/2021	4:26:51 AM	0	9.822	5.4	9/23/2021	4:33:24 AM	0	904.577	3.596	0.60	25.80	1007.88
9/23/2021	5:26:51 AM	0	9.828	5.4	9/23/2021	5:33:24 AM	0	904.938	3.832	0.60	25.79	1007.88
9/23/2021	6:26:51 AM	0	9.834	5.4	9/23/2021	6:33:24 AM	0	905.153	3.72	0.60	25.79	1007.89
9/23/2021	7:26:51 AM	0	9.838	5.4	9/23/2021	7:33:24 AM	0	905.6	3.839	0.60	25.79	1007.89
9/23/2021	8:26:51 AM	0	9.834	5.4	9/23/2021	8:33:24 AM	0	905.311	4.696	0.60	25.79	1007.89
9/23/2021	9:26:51 AM	0	9.835	5.4	9/23/2021	9:33:24 AM	0	906.117	7.987	0.60	25.80	1007.88
9/23/2021	10:26:51 AM	0	9.834	5.4	9/23/2021	10:33:24 AM	0	906.423	10.565	0.59	25.80	1007.88
9/23/2021	11:26:51 AM	0	9.832	5.4	9/23/2021	11:33:24 AM	0	906.687	12.991	0.59	25.81	1007.87
9/23/2021	12:26:51 PM	0	9.831	5.4	9/23/2021	12:33:24 PM	0	906.863	14.352	0.58	25.81	1007.87
9/23/2021	1:26:51 PM	0	9.829	5.4	9/23/2021	1:33:24 PM	0	906.911	14.114	0.58	25.81	1007.87
9/23/2021	2:26:51 PM	0	9.829	5.4	9/23/2021	2:33:24 PM	0	906.473	16.882	0.59	25.81	1007.87
9/23/2021	3:26:51 PM	0	9.834	5.4	9/23/2021	3:33:24 PM	0	906.986	16.56	0.59	25.81	1007.87
9/23/2021	4:26:51 PM	0	9.834	5.4	9/23/2021	4:33:24 PM	0	906.619	15.102	0.59	25.81	1007.87
9/23/2021	5:26:51 PM	0	9.832	5.4	9/23/2021	5:33:24 PM	0	906.151	13.797	0.59	25.80	1007.88
9/23/2021	6:26:51 PM	0	9.834	5.4	9/23/2021	6:33:24 PM	0	906.203	12.107	0.59	25.80	1007.88
9/23/2021	7:26:51 PM	0	9.834	5.4	9/23/2021	7:33:24 PM	0	906.355	9.864	0.59	25.80	1007.88
9/23/2021	8:26:51 PM	0	9.831	5.4	9/23/2021	8:33:24 PM	0	906.177	8.453	0.59	25.80	1007.87
9/23/2021	9:26:51 PM	0	9.826	5.4	9/23/2021	9:33:24 PM	0	906.201	7.941	0.59	25.81	1007.87
9/23/2021	10:26:51 PM	0	9.819	5.4	9/23/2021	10:33:24 PM	0	905.911	7.787	0.58	25.81	1007.87
9/23/2021	11:26:51 PM	0	9.813	5.4	9/23/2021	11:33:24 PM	0	905.638	7.635	0.58	25.82	1007.86
9/24/2021	12:26:51 AM	0	9.806	5.4	9/24/2021	12:33:24 AM	0	905.182	7.301	0.58	25.82	1007.86
9/24/2021	1:26:51 AM	0	9.803	5.4	9/24/2021	1:33:24 AM	0	904.763	5.996	0.58	25.82	1007.86
9/24/2021	2:26:51 AM	0	9.803	5.4	9/24/2021	2:33:24 AM	0	904.66	5.635	0.58	25.82	1007.86
9/24/2021	3:26:51 AM	0	9.803	5.4	9/24/2021	3:33:24 AM	0	904.365	6.892	0.58	25.81	1007.87
9/24/2021	4:26:51 AM	0	9.804	5.4	9/24/2021	4:33:24 AM	0	903.84	7.805	0.59	25.81	1007.87
9/24/2021	5:26:51 AM	0	9.807	5.4	9/24/2021	5:33:24 AM	0	903.622	8.024	0.59	25.80	1007.88
9/24/2021	6:26:51 AM	0	9.807	5.4	9/24/2021	6:33:24 AM	0	903.1	7.833	0.60	25.80	1007.88
9/24/2021	7:26:51 AM	0	9.806	5.4	9/24/2021	7:33:24 AM	0	902.589	7.89	0.60	25.79	1007.89
9/24/2021	8:26:51 AM	0	9.803	5.4	9/24/2021	8:33:24 AM	0	902.381	9.355	0.60	25.79	1007.89
9/24/2021	9:26:51 AM	0	9.801	5.4	9/24/2021	9:33:24 AM	0	902.431	12.011	0.60	25.80	1007.88
9/24/2021	10:26:51 AM	0	9.793	5.4	9/24/2021	10:33:24 AM	0	901.414	22.375	0.60	25.79	1007.89
9/24/2021	11:26:51 AM	0	9.784	5.4	9/24/2021	11:33:24 AM	0	900.787	19.849	0.60	25.80	1007.88
9/24/2021	12:26:51 PM	0	9.777	5.4	9/24/2021	12:33:24 PM	0	900.077	20.542	0.60	25.80	1007.88

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/24/2021	1:26:51 PM	0	9.77	5.4	9/24/2021	1:33:24 PM	0	899.255	20.807	0.60	25.79	1007.88
9/24/2021	2:26:51 PM	0	9.764	5.4	9/24/2021	2:33:24 PM	0	898.519	20.003	0.60	25.79	1007.89
9/24/2021	3:26:51 PM	0	9.758	5.4	9/24/2021	3:33:24 PM	0	897.639	18.855	0.60	25.79	1007.89
9/24/2021	4:26:51 PM	0	9.755	5.4	9/24/2021	4:33:24 PM	0	897.118	17.852	0.61	25.79	1007.89
9/24/2021	5:26:51 PM	0	9.748	5.4	9/24/2021	5:33:24 PM	0	896.368	16.294	0.61	25.79	1007.89
9/24/2021	6:26:51 PM	0	9.745	5.4	9/24/2021	6:33:24 PM	0	896.003	14.427	0.61	25.79	1007.89
9/24/2021	7:26:51 PM	0	9.739	5.4	9/24/2021	7:33:24 PM	0	895.567	12.008	0.61	25.79	1007.89
9/24/2021	8:26:51 PM	0	9.735	5.4	9/24/2021	8:33:24 PM	0	895.584	10.92	0.60	25.79	1007.89
9/24/2021	9:26:51 PM	0	9.729	5.4	9/24/2021	9:33:24 PM	0	895.616	9.958	0.60	25.80	1007.88
9/24/2021	10:26:51 PM	0	9.723	5.4	9/24/2021	10:33:24 PM	0	895.753	9.11	0.59	25.81	1007.87
9/24/2021	11:26:51 PM	0	9.714	5.4	9/24/2021	11:33:24 PM	0	895.24	8.135	0.59	25.81	1007.87
9/25/2021	12:26:51 AM	0	9.708	5.4	9/25/2021	12:33:24 AM	0	894.97	7.334	0.58	25.81	1007.87
9/25/2021	1:26:51 AM	0	9.7	5.4	9/25/2021	1:33:24 AM	0	894.487	7.548	0.58	25.82	1007.86
9/25/2021	2:26:51 AM	0	9.699	5.4	9/25/2021	2:33:24 AM	0	894.313	8.223	0.58	25.82	1007.86
9/25/2021	3:26:51 AM	0	9.697	5.4	9/25/2021	3:33:24 AM	0	893.951	8.396	0.58	25.81	1007.87
9/25/2021	4:26:51 AM	0	9.7	5.4	9/25/2021	4:33:24 AM	0	894.079	8.308	0.58	25.81	1007.87
9/25/2021	5:26:51 AM	0	9.702	5.4	9/25/2021	5:33:24 AM	0	893.761	8.326	0.59	25.81	1007.87
9/25/2021	6:26:51 AM	0	9.705	5.4	9/25/2021	6:33:24 AM	0	893.624	8.36	0.59	25.80	1007.88
9/25/2021	7:26:51 AM	0	9.708	5.4	9/25/2021	7:33:24 AM	0	893.69	8.465	0.59	25.80	1007.88
9/25/2021	8:26:51 AM	0	9.71	5.4	9/25/2021	8:33:24 AM	0	893.72	9.162	0.60	25.80	1007.88
9/25/2021	9:26:51 AM	0	9.71	5.4	9/25/2021	9:33:24 AM	0	894.051	10.726	0.59	25.80	1007.88
9/25/2021	10:26:51 AM	0	9.707	5.4	9/25/2021	10:33:24 AM	0	893.852	12.119	0.59	25.80	1007.88
9/25/2021	11:26:51 AM	0	9.699	5.4	9/25/2021	11:33:24 AM	0	892.944	14.022	0.59	25.80	1007.88
9/25/2021	12:26:51 PM	0	9.696	5.4	9/25/2021	12:33:24 PM	0	892.968	15.978	0.59	25.80	1007.87
9/25/2021	1:26:51 PM	0	9.69	5.4	9/25/2021	1:33:24 PM	0	892.453	17.176	0.59	25.81	1007.87
9/25/2021	2:26:51 PM	0	9.685	5.4	9/25/2021	2:33:24 PM	0	891.807	17.039	0.59	25.80	1007.88
9/25/2021	3:26:51 PM	0	9.679	5.4	9/25/2021	3:33:24 PM	0	891.006	16.662	0.59	25.80	1007.88
9/25/2021	4:26:51 PM	0	9.675	5.4	9/25/2021	4:33:24 PM	0	890.346	16.456	0.60	25.80	1007.88
9/25/2021	5:26:51 PM	0	9.677	5.4	9/25/2021	5:33:24 PM	0	890.689	14.438	0.59	25.80	1007.88
9/25/2021	6:26:51 PM	0	9.668	5.4	9/25/2021	6:33:24 PM	0	889.57	12.075	0.60	25.80	1007.88
9/25/2021	7:26:51 PM	0	9.666	5.4	9/25/2021	7:33:24 PM	0	889.623	10.983	0.59	25.80	1007.88
9/25/2021	8:26:51 PM	0	9.662	5.4	9/25/2021	8:33:24 PM	0	889.355	10.517	0.59	25.80	1007.88
9/25/2021	9:26:51 PM	0	9.656	5.4	9/25/2021	9:33:24 PM	0	889.316	10.035	0.59	25.81	1007.87
9/25/2021	10:26:51 PM	0	9.648	5.4	9/25/2021	10:33:24 PM	0	889.039	9.941	0.58	25.81	1007.87
9/25/2021	11:26:51 PM	0	9.64	5.4	9/25/2021	11:33:24 PM	0	888.742	9.797	0.58	25.82	1007.86
9/26/2021	12:26:51 AM	0	9.63	5.4	9/26/2021	12:33:24 AM	0	887.906	9.735	0.58	25.82	1007.86
9/26/2021	1:26:51 AM	0	9.623	5.4	9/26/2021	1:33:24 AM	0	887.518	9.715	0.57	25.82	1007.86
9/26/2021	2:26:51 AM	0	9.623	5.4	9/26/2021	2:33:24 AM	0	887.793	9.765	0.57	25.82	1007.85
9/26/2021	3:26:51 AM	0	9.62	5.4	9/26/2021	3:33:24 AM	0	887.28	9.614	0.57	25.82	1007.86
9/26/2021	4:26:51 AM	0	9.621	5.4	9/26/2021	4:33:24 AM	0	887.329	9.24	0.57	25.82	1007.86
9/26/2021	5:26:51 AM	0	9.626	5.4	9/26/2021	5:33:24 AM	0	887.542	8.909	0.58	25.82	1007.86
9/26/2021	6:26:51 AM	0	9.629	5.4	9/26/2021	6:33:24 AM	0	887.623	8.518	0.58	25.82	1007.86
9/26/2021	7:26:51 AM	0	9.632	5.4	9/26/2021	7:33:24 AM	0	887.502	8.197	0.58	25.81	1007.87
9/26/2021	8:26:51 AM	0	9.633	5.4	9/26/2021	8:33:24 AM	0	887.471	8.238	0.58	25.81	1007.87
9/26/2021	9:26:51 AM	0	9.633	5.4	9/26/2021	9:33:24 AM	0	887.468	14.177	0.58	25.81	1007.87
9/26/2021	10:26:51 AM	0	9.634	5.4	9/26/2021	10:33:24 AM	0	887.872	13.02	0.58	25.81	1007.86
9/26/2021	11:26:51 AM	0	9.634	5.4	9/26/2021	11:33:24 AM	0	888.071	13.73	0.58	25.82	1007.86
9/26/2021	12:26:51 PM	0	9.633	5.4	9/26/2021	12:33:24 PM	0	888.036	14.311	0.58	25.82	1007.86
9/26/2021	1:26:51 PM	0	9.629	5.4	9/26/2021	1:33:24 PM	0	887.509	18.19	0.58	25.82	1007.86
9/26/2021	2:26:51 PM	0	9.621	5.4	9/26/2021	2:33:24 PM	0	886.158	22.633	0.58	25.81	1007.87
9/26/2021	3:26:51 PM	0	9.617	5.4	9/26/2021	3:33:24 PM	0	885.999	19.151	0.58	25.81	1007.87
9/26/2021	4:26:51 PM	0	9.617	5.4	9/26/2021	4:33:24 PM	0	886.129	15.675	0.58	25.81	1007.87
9/26/2021	5:26:51 PM	0	9.615	5.4	9/26/2021	5:33:24 PM	0	885.938	14.17	0.58	25.81	1007.87
9/26/2021	6:26:51 PM	0	9.612	5.4	9/26/2021	6:33:24 PM	0	885.72	12.512	0.58	25.81	1007.86
9/26/2021	7:26:51 PM	0	9.606	5.4	9/26/2021	7:33:24 PM	0	885.021	11.438	0.58	25.81	1007.87
9/26/2021	8:26:51 PM	0	9.597	5.4	9/26/2021	8:33:24 PM	0	884.322	11.133	0.58	25.82	1007.86
9/26/2021	9:26:51 PM	0	9.589	5.4	9/26/2021	9:33:24 PM	0	883.784	11.12	0.58	25.82	1007.86
9/26/2021	10:26:51 PM	0	9.582	5.4	9/26/2021	10:33:24 PM	0	883.203	10.481	0.58	25.82	1007.86
9/26/2021	11:26:51 PM	0	9.576	5.4	9/26/2021	11:33:24 PM	0	883.268	10.104	0.57	25.83	1007.85
9/27/2021	12:26:51 AM	0	9.566	5.4	9/27/2021	12:33:24 AM	0	882.077	8.677	0.57	25.82	1007.86
9/27/2021	1:26:51 AM	0	9.555	5.4	9/27/2021	1:33:24 AM	0	881.212	8.506	0.57	25.83	1007.85
9/27/2021	2:26:51 AM	0	9.553	5.4	9/27/2021	2:33:24 AM	0	881.63	8.703	0.56	25.83	1007.85
9/27/2021	3:26:51 AM	0	9.549	5.4	9/27/2021	3:33:24 AM	0	881.334	8.928	0.56	25.83	1007.85
9/27/2021	4:26:51 AM	0	9.55	5.4	9/27/2021	4:33:24 AM	0	881.65	9.021	0.56	25.84	1007.84
9/27/2021	5:26:51 AM	0	9.552	5.4	9/27/2021	5:33:24 AM	0	881.808	8.817	0.56	25.83	1007.84
9/27/2021	6:26:51 AM	0	9.558	5.4	9/27/2021	6:33:24 AM	0	882.418	9.355	0.56	25.83	1007.84
9/27/2021	7:26:51 AM	0	9.564	5.4	9/27/2021	7:33:24 AM	0	883.165	9.017	0.56	25.84	1007.84
9/27/2021	8:26:51 AM	0	9.572	5.4	9/27/2021	8:33:24 AM	0	883.828	8.893	0.56	25.84	1007.84
9/27/2021	9:26:51 AM	0	9.576	5.4	9/27/2021	9:33:24 AM	0	884.161	19.373	0.56	25.83	1007.84
9/27/2021	10:26:51 AM	0	9.576	5.4	9/27/2021	10:33:24 AM	0	883.946	24.201	0.56	25.83	1007.85
9/27/2021	11:26:51 AM	0	9.578	5.4	9/27/2021	11:33:24 AM	0	884.031	20.321	0.56	25.83	1007.85
9/27/2021	12:26:51 PM	0	9.578	5.4	9/27/2021	12:33:24 PM	0	884.089	17.322	0.56	25.83	1007.85

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/27/2021	1:26:51 PM	0	9.575	5.4	9/27/2021	1:33:24 PM	0	883.552	18.787	0.57	25.83	1007.85
9/27/2021	2:26:51 PM	0	9.578	5.4	9/27/2021	2:33:24 PM	0	884.086	17.469	0.56	25.83	1007.85
9/27/2021	3:26:51 PM	0	9.576	5.4	9/27/2021	3:33:24 PM	0	883.854	16.576	0.56	25.83	1007.85
9/27/2021	4:26:51 PM	0	9.575	5.4	9/27/2021	4:33:24 PM	0	883.879	14.376	0.56	25.83	1007.85
9/27/2021	5:26:51 PM	0	9.575	5.4	9/27/2021	5:33:24 PM	0	883.884	12.231	0.56	25.83	1007.85
9/27/2021	6:26:51 PM	0	9.576	5.4	9/27/2021	6:33:24 PM	0	884.439	10.708	0.56	25.84	1007.84
9/27/2021	7:26:51 PM	0	9.576	5.4	9/27/2021	7:33:24 PM	0	884.756	8.794	0.55	25.84	1007.84
9/27/2021	8:26:51 PM	0	9.575	5.4	9/27/2021	8:33:24 PM	0	884.771	8.394	0.55	25.84	1007.84
9/27/2021	9:26:51 PM	0	9.573	5.4	9/27/2021	9:33:24 PM	0	885.032	6.576	0.55	25.85	1007.83
9/27/2021	10:26:51 PM	0	9.573	5.4	9/27/2021	10:33:24 PM	0	885.594	5.075	0.54	25.85	1007.83
9/27/2021	11:26:51 PM	0	9.573	5.4	9/27/2021	11:33:24 PM	0	886.03	4.129	0.54	25.86	1007.82
9/28/2021	12:26:51 AM	0	9.572	5.4	9/28/2021	12:33:24 AM	0	886.389	4.055	0.53	25.86	1007.82
9/28/2021	1:26:51 AM	0	9.57	5.4	9/28/2021	1:33:24 AM	0	886.813	4.307	0.53	25.87	1007.81
9/28/2021	2:26:51 AM	0	9.572	5.4	9/28/2021	2:33:24 AM	0	887.327	4.68	0.52	25.87	1007.81
9/28/2021	3:26:51 AM	0	9.573	5.4	9/28/2021	3:33:24 AM	0	887.851	5.11	0.52	25.88	1007.80
9/28/2021	4:26:51 AM	0	9.575	5.4	9/28/2021	4:33:24 AM	0	888.115	5.233	0.52	25.88	1007.80
9/28/2021	5:26:51 AM	0	9.578	5.4	9/28/2021	5:33:24 AM	0	888.543	5.257	0.52	25.88	1007.80
9/28/2021	6:26:51 AM	0	9.584	5.4	9/28/2021	6:33:24 AM	0	889.41	5.381	0.51	25.88	1007.80
9/28/2021	7:26:51 AM	0	9.589	5.4	9/28/2021	7:33:24 AM	0	889.792	5.064	0.52	25.88	1007.80
9/28/2021	8:26:51 AM	0	9.594	5.4	9/28/2021	8:33:24 AM	0	890.091	5.317	0.52	25.88	1007.80
9/28/2021	9:26:51 AM	0	9.601	5.4	9/28/2021	9:33:24 AM	0	890.665	6.427	0.52	25.88	1007.80
9/28/2021	10:26:51 AM	0	9.606	5.4	9/28/2021	10:33:24 AM	0	890.99	7.826	0.52	25.87	1007.80
9/28/2021	11:26:51 AM	0	9.612	5.4	9/28/2021	11:33:24 AM	0	891.381	9.651	0.52	25.87	1007.81
9/28/2021	12:26:51 PM	0	9.615	5.4	9/28/2021	12:33:24 PM	0	891.511	9.992	0.52	25.87	1007.81
9/28/2021	1:26:51 PM	0	9.615	5.4	9/28/2021	1:33:24 PM	0	891.202	13.148	0.53	25.87	1007.81
9/28/2021	2:26:51 PM	0	9.615	5.4	9/28/2021	2:33:24 PM	0	890.788	16.772	0.53	25.86	1007.82
9/28/2021	3:26:51 PM	0	9.615	5.4	9/28/2021	3:33:24 PM	0	890.768	13.927	0.53	25.86	1007.82
9/28/2021	4:26:51 PM	0	9.618	5.4	9/28/2021	4:33:24 PM	0	891.161	10.53	0.53	25.86	1007.81
9/28/2021	5:26:51 PM	0	9.617	5.4	9/28/2021	5:33:24 PM	0	890.841	7.222	0.53	25.86	1007.82
9/28/2021	6:26:51 PM	0	9.615	5.4	9/28/2021	6:33:24 PM	0	890.748	6.418	0.53	25.86	1007.82
9/28/2021	7:26:51 PM	0	9.617	5.4	9/28/2021	7:33:24 PM	0	891.238	5.266	0.53	25.87	1007.81
9/28/2021	8:26:51 PM	0	9.615	5.4	9/28/2021	8:33:24 PM	0	891.387	4.286	0.53	25.87	1007.81
9/28/2021	9:26:51 PM	0	9.617	5.4	9/28/2021	9:33:24 PM	0	891.899	4.251	0.52	25.87	1007.81
9/28/2021	10:26:51 PM	0	9.615	5.4	9/28/2021	10:33:24 PM	0	892.18	3.399	0.52	25.88	1007.80
9/28/2021	11:26:51 PM	0	9.613	5.4	9/28/2021	11:33:24 PM	0	892.33	2.861	0.51	25.88	1007.80
9/29/2021	12:26:51 AM	0	9.613	5.4	9/29/2021	12:33:24 AM	0	892.633	2.948	0.51	25.88	1007.79
9/29/2021	1:26:51 AM	0	9.611	5.4	9/29/2021	1:33:24 AM	0	892.649	2.614	0.51	25.89	1007.79
9/29/2021	2:26:51 AM	0	9.611	5.4	9/29/2021	2:33:24 AM	0	893.098	2.828	0.50	25.89	1007.79
9/29/2021	3:26:51 AM	0	9.609	5.4	9/29/2021	3:33:24 AM	0	893.222	2.386	0.50	25.89	1007.78
9/29/2021	4:26:51 AM	0	9.611	5.4	9/29/2021	4:33:24 AM	0	893.639	1.976	0.50	25.90	1007.78
9/29/2021	5:26:51 AM	0	9.607	5.4	9/29/2021	5:33:24 AM	0	893.425	1.797	0.50	25.90	1007.78
9/29/2021	6:26:51 AM	0	9.609	5.4	9/29/2021	6:33:24 AM	0	893.606	1.808	0.50	25.90	1007.78
9/29/2021	7:26:51 AM	0	9.611	5.4	9/29/2021	7:33:24 AM	0	893.936	2.667	0.50	25.90	1007.78
9/29/2021	8:26:51 AM	0	9.613	5.4	9/29/2021	8:33:24 AM	0	894.203	3.539	0.49	25.90	1007.78
9/29/2021	9:26:51 AM	0	9.618	5.4	9/29/2021	9:33:24 AM	0	894.607	4.534	0.50	25.90	1007.78
9/29/2021	10:26:51 AM	0	9.621	5.4	9/29/2021	10:33:24 AM	0	894.735	6.699	0.50	25.90	1007.78
9/29/2021	11:26:51 AM	0	9.633	5.4	9/29/2021	11:33:24 AM	0	895.664	5.649	0.50	25.90	1007.78
9/29/2021	12:26:51 PM	0	9.632	5.4	9/29/2021	12:33:24 PM	0	895.044	6.412	0.51	25.89	1007.79
9/29/2021	1:26:51 PM	0	9.636	5.4	9/29/2021	1:33:24 PM	0	895.449	8.034	0.50	25.89	1007.79
9/29/2021	2:26:51 PM	0	9.637	5.4	9/29/2021	2:33:24 PM	0	895.185	9.44	0.51	25.89	1007.79
9/29/2021	3:26:51 PM	0	9.637	5.4	9/29/2021	3:33:24 PM	0	894.955	9.005	0.51	25.88	1007.80
9/29/2021	4:26:51 PM	0	9.634	5.4	9/29/2021	4:33:24 PM	0	894.582	8.792	0.51	25.88	1007.80
9/29/2021	5:26:51 PM	0	9.63	5.4	9/29/2021	5:33:24 PM	0	893.92	8.041	0.51	25.88	1007.80
9/29/2021	6:26:51 PM	0	9.624	5.4	9/29/2021	6:33:24 PM	0	893.239	7.092	0.52	25.88	1007.80
9/29/2021	7:26:51 PM	0	9.621	5.4	9/29/2021	7:33:24 PM	0	892.979	6.624	0.52	25.88	1007.80
9/29/2021	8:26:51 PM	0	9.613	5.4	9/29/2021	8:33:24 PM	0	892.485	6.433	0.51	25.88	1007.80
9/29/2021	9:26:51 PM	0	9.607	5.4	9/29/2021	9:33:24 PM	0	891.5	5.417	0.52	25.88	1007.80
9/29/2021	10:26:51 PM	0	9.592	5.4	9/29/2021	10:33:24 PM	0	889.75	5.196	0.52	25.88	1007.80
9/29/2021	11:26:51 PM	0	9.584	5.4	9/29/2021	11:33:24 PM	0	888.85	5.253	0.52	25.87	1007.80
9/30/2021	12:26:51 AM	0	9.58	5.4	9/30/2021	12:33:24 AM	0	888.726	5.746	0.52	25.88	1007.80
9/30/2021	1:26:51 AM	0	9.576	5.4	9/30/2021	1:33:24 AM	0	888.822	6.562	0.51	25.88	1007.80
9/30/2021	2:26:51 AM	0	9.57	5.4	9/30/2021	2:33:24 AM	0	888.627	7.465	0.51	25.89	1007.79
9/30/2021	3:26:51 AM	0	9.569	5.4	9/30/2021	3:33:24 AM	0	888.918	7.78	0.50	25.89	1007.79
9/30/2021	4:26:51 AM	0	9.567	5.4	9/30/2021	4:33:24 AM	0	889.33	7.614	0.50	25.90	1007.78
9/30/2021	5:26:51 AM	0	9.567	5.4	9/30/2021	5:33:24 AM	0	889.939	7.766	0.49	25.90	1007.78
9/30/2021	6:26:51 AM	0	9.569	5.4	9/30/2021	6:33:24 AM	0	890.736	7.936	0.49	25.91	1007.77
9/30/2021	7:26:51 AM	0	9.573	5.4	9/30/2021	7:33:24 AM	0	891.591	8.125	0.48	25.91	1007.77
9/30/2021	8:26:51 AM	0	9.575	5.4	9/30/2021	8:33:24 AM	0	892.153	8.647	0.48	25.92	1007.76
9/30/2021	9:26:51 AM	0	9.58	5.4	9/30/2021	9:33:24 AM	0	892.733	9.682	0.48	25.92	1007.76
9/30/2021	10:26:51 AM	0	9.586	5.4	9/30/2021	10:33:24 AM	0	893.154	13.489	0.48	25.92	1007.76
9/30/2021	11:26:51 AM	0	9.592	5.4	9/30/2021	11:33:24 AM	0	893.524	12.196	0.48	25.91	1007.76
9/30/2021	12:26:51 PM	0	9.6	5.4	9/30/2021	12:33:24 PM	0	893.74	12.543	0.49	25.91	1007.77

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/30/2021	1:26:51 PM	0	9.603	5.4	9/30/2021	1:33:24 PM	0	893.714	13.299	0.49	25.91	1007.77
9/30/2021	2:26:51 PM	0	9.607	5.4	9/30/2021	2:33:24 PM	0	893.437	20.2	0.50	25.90	1007.78
9/30/2021	3:26:51 PM	0	9.611	5.4	9/30/2021	3:33:24 PM	0	893.892	19.756	0.50	25.90	1007.78
9/30/2021	4:26:51 PM	0	9.617	5.4	9/30/2021	4:33:24 PM	0	894.437	14.751	0.50	25.90	1007.78
9/30/2021	5:26:51 PM	0	9.62	5.4	9/30/2021	5:33:24 PM	0	895.292	11.437	0.49	25.90	1007.77
9/30/2021	6:26:51 PM	0	9.624	5.4	9/30/2021	6:33:24 PM	0	896.269	9.38	0.48	25.91	1007.77
9/30/2021	7:26:51 PM	0	9.63	5.4	9/30/2021	7:33:24 PM	0	897.383	6.808	0.48	25.92	1007.76
9/30/2021	8:26:51 PM	0	9.634	5.4	9/30/2021	8:33:24 PM	0	898.284	5.719	0.47	25.92	1007.76
9/30/2021	9:26:51 PM	0	9.639	5.4	9/30/2021	9:33:24 PM	0	899.165	5.448	0.47	25.92	1007.75
9/30/2021	10:26:51 PM	0	9.643	5.4	9/30/2021	10:33:24 PM	0	900.01	4.096	0.47	25.93	1007.75
9/30/2021	11:26:51 PM	0	9.649	5.4	9/30/2021	11:33:24 PM	0	900.825	3.146	0.46	25.93	1007.75
10/1/2021	12:26:51 AM	0	9.656	5.4	10/1/2021	12:33:24 AM	0	901.808	3.46	0.46	25.93	1007.74
10/1/2021	1:26:51 AM	0	9.66	5.4	10/1/2021	1:33:24 AM	0	902.537	4.061	0.46	25.94	1007.74
10/1/2021	2:26:51 AM	0	9.665	5.4	10/1/2021	2:33:24 AM	0	903.071	2.719	0.46	25.94	1007.74
10/1/2021	3:26:51 AM	0	9.668	5.4	10/1/2021	3:33:24 AM	0	903.497	1.822	0.45	25.94	1007.74
10/1/2021	4:26:51 AM	0	9.669	5.4	10/1/2021	4:33:24 AM	0	904.026	1.797	0.45	25.94	1007.73
10/1/2021	5:26:51 AM	0	9.668	5.4	10/1/2021	5:33:24 AM	0	904.418	1.284	0.45	25.95	1007.73
10/1/2021	6:26:51 AM	0	9.669	5.4	10/1/2021	6:33:24 AM	0	904.768	0.603	0.44	25.95	1007.73
10/1/2021	7:26:51 AM	0	9.671	5.4	10/1/2021	7:33:24 AM	0	905.39	0.981	0.44	25.96	1007.72
10/1/2021	8:26:51 AM	0	9.672	5.4	10/1/2021	8:33:24 AM	0	906.056	2.968	0.43	25.96	1007.72
10/1/2021	9:26:51 AM	0	9.674	5.4	10/1/2021	9:33:24 AM	0	906.319	11.021	0.43	25.96	1007.72
10/1/2021	10:26:51 AM	0	9.678	5.4	10/1/2021	10:33:24 AM	0	906.536	17.063	0.43	25.96	1007.72
10/1/2021	11:26:51 AM	0	9.681	5.4	10/1/2021	11:33:24 AM	0	906.224	15.646	0.44	25.95	1007.72
10/1/2021	12:26:51 PM	0	9.687	5.4	10/1/2021	12:33:24 PM	0	906.173	13.341	0.45	25.95	1007.73
10/1/2021	1:26:51 PM	0	9.687	5.4	10/1/2021	1:33:24 PM	0	905.257	15.188	0.46	25.94	1007.74
10/1/2021	2:26:51 PM	0	9.69	5.4	10/1/2021	2:33:24 PM	0	904.937	15.652	0.46	25.93	1007.75
10/1/2021	3:26:51 PM	0	9.69	5.4	10/1/2021	3:33:24 PM	0	904.297	14.591	0.47	25.93	1007.75
10/1/2021	4:26:51 PM	0	9.688	5.4	10/1/2021	4:33:24 PM	0	903.909	12.437	0.47	25.92	1007.75
10/1/2021	5:26:51 PM	0	9.684	5.4	10/1/2021	5:33:24 PM	0	903.169	10.606	0.47	25.92	1007.76
10/1/2021	6:26:51 PM	0	9.678	5.4	10/1/2021	6:33:24 PM	0	902.526	8.83	0.47	25.92	1007.76
10/1/2021	7:26:51 PM	0	9.674	5.4	10/1/2021	7:33:24 PM	0	902.256	7.615	0.47	25.92	1007.76
10/1/2021	8:26:51 PM	0	9.665	5.4	10/1/2021	8:33:24 PM	0	901.419	6.927	0.47	25.92	1007.76
10/1/2021	9:26:51 PM	0	9.66	5.4	10/1/2021	9:33:24 PM	0	901.317	6.371	0.47	25.93	1007.75
10/1/2021	10:26:51 PM	0	9.654	5.4	10/1/2021	10:33:24 PM	0	900.672	5.496	0.47	25.93	1007.75
10/1/2021	11:26:51 PM	0	9.649	5.4	10/1/2021	11:33:24 PM	0	900.014	5.044	0.47	25.92	1007.76
10/2/2021	12:26:51 AM	0	9.645	5.4	10/2/2021	12:33:24 AM	0	899.439	5.508	0.47	25.92	1007.76
10/2/2021	1:26:51 AM	0	9.64	5.4	10/2/2021	1:33:24 AM	0	898.838	5.742	0.47	25.92	1007.76
10/2/2021	2:26:51 AM	0	9.637	5.4	10/2/2021	2:33:24 AM	0	898.626	6.363	0.47	25.92	1007.76
10/2/2021	3:26:51 AM	0	9.63	5.4	10/2/2021	3:33:24 AM	0	898.019	6.67	0.47	25.92	1007.76
10/2/2021	4:26:51 AM	0	9.627	5.4	10/2/2021	4:33:24 AM	0	897.998	6.706	0.47	25.92	1007.75
10/2/2021	5:26:51 AM	0	9.618	5.4	10/2/2021	5:33:24 AM	0	897.607	6.722	0.46	25.93	1007.75
10/2/2021	6:26:51 AM	0	9.609	5.4	10/2/2021	6:33:24 AM	0	896.96	6.794	0.46	25.93	1007.75
10/2/2021	7:26:51 AM	0	9.603	5.4	10/2/2021	7:33:24 AM	0	896.77	6.457	0.46	25.94	1007.74
10/2/2021	8:26:51 AM	0	9.598	5.4	10/2/2021	8:33:24 AM	0	897.01	6.513	0.45	25.94	1007.74
10/2/2021	9:26:51 AM	0	9.594	5.4	10/2/2021	9:33:24 AM	0	896.978	7.357	0.45	25.95	1007.73
10/2/2021	10:26:51 AM	0	9.594	5.4	10/2/2021	10:33:24 AM	0	897.108	8.553	0.45	25.95	1007.73
10/2/2021	11:26:51 AM	0	9.592	5.4	10/2/2021	11:33:24 AM	0	896.628	9.343	0.45	25.95	1007.73
10/2/2021	12:26:51 PM	0	9.597	5.4	10/2/2021	12:33:24 PM	0	896.446	9.125	0.46	25.94	1007.74
10/2/2021	1:26:51 PM	0	9.598	5.4	10/2/2021	1:33:24 PM	0	895.991	9.645	0.46	25.93	1007.75
10/2/2021	2:26:51 PM	0	9.603	5.4	10/2/2021	2:33:24 PM	0	895.812	8.964	0.47	25.93	1007.75
10/2/2021	3:26:51 PM	0	9.607	5.4	10/2/2021	3:33:24 PM	0	895.823	7.742	0.47	25.92	1007.76
10/2/2021	4:26:51 PM	0	9.611	5.4	10/2/2021	4:33:24 PM	0	895.966	6.983	0.47	25.92	1007.76
10/2/2021	5:26:51 PM	0	9.607	5.4	10/2/2021	5:33:24 PM	0	895.535	6.412	0.48	25.92	1007.76
10/2/2021	6:26:51 PM	0	9.603	5.4	10/2/2021	6:33:24 PM	0	895.127	5.707	0.48	25.92	1007.76
10/2/2021	7:26:51 PM	0	9.595	5.4	10/2/2021	7:33:24 PM	0	894.655	5.24	0.47	25.92	1007.76
10/2/2021	8:26:51 PM	0	9.588	5.4	10/2/2021	8:33:24 PM	0	894.346	5.108	0.47	25.93	1007.75
10/2/2021	9:26:51 PM	0	9.582	5.4	10/2/2021	9:33:24 PM	0	893.987	4.542	0.47	25.93	1007.75
10/2/2021	10:26:51 PM	0	9.578	5.4	10/2/2021	10:33:24 PM	0	893.77	4.328	0.46	25.93	1007.75
10/2/2021	11:26:51 PM	0	9.576	5.4	10/2/2021	11:33:24 PM	0	893.605	4.283	0.46	25.93	1007.75
10/3/2021	12:26:51 AM	0	9.578	5.4	10/3/2021	12:33:24 AM	0	893.681	3.885	0.46	25.93	1007.75
10/3/2021	1:26:51 AM	0	9.578	5.4	10/3/2021	1:33:24 AM	0	893.627	3.662	0.47	25.93	1007.75
10/3/2021	2:26:51 AM	0	9.578	5.4	10/3/2021	2:33:24 AM	0	893.629	2.804	0.47	25.93	1007.75
10/3/2021	3:26:51 AM	0	9.579	5.4	10/3/2021	3:33:24 AM	0	893.908	2.173	0.46	25.93	1007.75
10/3/2021	4:26:51 AM	0	9.58	5.4	10/3/2021	4:33:24 AM	0	894.493	1.387	0.46	25.94	1007.74
10/3/2021	5:26:51 AM	0	9.584	5.4	10/3/2021	5:33:24 AM	0	895.451	0.562	0.45	25.94	1007.74
10/3/2021	6:26:51 AM	0	9.582	5.4	10/3/2021	6:33:24 AM	0	896.094	0.39	0.44	25.95	1007.73
10/3/2021	7:26:51 AM	0	9.58	5.4	10/3/2021	7:33:24 AM	0	896.71	-0.178	0.44	25.96	1007.72
10/3/2021	8:26:51 AM	0	9.579	5.4	10/3/2021	8:33:24 AM	0	897.527	0.24	0.43	25.97	1007.71
10/3/2021	9:26:51 AM	0	9.578	5.4	10/3/2021	9:33:24 AM	0	898.513	10.236	0.42	25.98	1007.70
10/3/2021	10:26:51 AM	0	9.58	5.4	10/3/2021	10:33:24 AM	0	899.055	15.421	0.41	25.98	1007.70
10/3/2021	11:26:51 AM	0	9.582	5.4	10/3/2021	11:33:24 AM	0	899.02	13.215	0.41	25.98	1007.70
10/3/2021	12:26:51 PM	0	9.586	5.4	10/3/2021	12:33:24 PM	0	898.905	10.247	0.42	25.98	1007.70

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/3/2021	1:26:51 PM	0	9.591	5.4	10/3/2021	1:33:24 PM	0	898.817	14.957	0.43	25.97	1007.71
10/3/2021	2:26:51 PM	0	9.597	5.4	10/3/2021	2:33:24 PM	0	898.61	14.324	0.43	25.96	1007.72
10/3/2021	3:26:51 PM	0	9.601	5.4	10/3/2021	3:33:24 PM	0	898.468	13.927	0.44	25.96	1007.72
10/3/2021	4:26:51 PM	0	9.603	5.4	10/3/2021	4:33:24 PM	0	898.1	10.433	0.44	25.95	1007.73
10/3/2021	5:26:51 PM	0	9.601	5.4	10/3/2021	5:33:24 PM	0	897.67	7.676	0.45	25.95	1007.73
10/3/2021	6:26:51 PM	0	9.598	5.4	10/3/2021	6:33:24 PM	0	897.514	5.16	0.45	25.95	1007.73
10/3/2021	7:26:51 PM	0	9.595	5.4	10/3/2021	7:33:24 PM	0	897.561	3.575	0.44	25.95	1007.73
10/3/2021	8:26:51 PM	0	9.591	5.4	10/3/2021	8:33:24 PM	0	897.593	2.717	0.44	25.96	1007.72
10/3/2021	9:26:51 PM	0	9.588	5.4	10/3/2021	9:33:24 PM	0	897.733	1.804	0.43	25.96	1007.72
10/3/2021	10:26:51 PM	0	9.586	5.4	10/3/2021	10:33:24 PM	0	897.87	0.864	0.43	25.96	1007.71
10/3/2021	11:26:51 PM	0	9.586	5.4	10/3/2021	11:33:24 PM	0	897.944	0.688	0.43	25.97	1007.71
10/4/2021	12:26:51 AM	0	9.586	5.4	10/4/2021	12:33:24 AM	0	897.796	0.277	0.43	25.96	1007.72
10/4/2021	1:26:51 AM	0	9.588	5.4	10/4/2021	1:33:24 AM	0	897.529	-0.28	0.44	25.96	1007.72
10/4/2021	2:26:51 AM	0	9.589	5.4	10/4/2021	2:33:24 AM	0	897.196	0.175	0.44	25.95	1007.72
10/4/2021	3:26:51 AM	0	9.591	5.4	10/4/2021	3:33:24 AM	0	897.215	0.822	0.44	25.95	1007.73
10/4/2021	4:26:51 AM	0	9.589	5.4	10/4/2021	4:33:24 AM	0	896.944	0.429	0.44	25.95	1007.73
10/4/2021	5:26:51 AM	0	9.586	5.4	10/4/2021	5:33:24 AM	0	896.667	-0.359	0.44	25.95	1007.73
10/4/2021	6:26:51 AM	0	9.58	5.4	10/4/2021	6:33:24 AM	0	896.504	-0.894	0.44	25.96	1007.72
10/4/2021	7:26:51 AM	0	9.573	5.4	10/4/2021	7:33:24 AM	0	896.455	-0.746	0.43	25.96	1007.72
10/4/2021	8:26:51 AM	0	9.566	5.4	10/4/2021	8:33:24 AM	0	896.578	0.426	0.42	25.97	1007.71
10/4/2021	9:26:51 AM	0	9.558	5.4	10/4/2021	9:33:24 AM	0	896.667	4.437	0.41	25.98	1007.70
10/4/2021	10:26:51 AM	0	9.555	5.4	10/4/2021	10:33:24 AM	0	896.988	10.495	0.41	25.99	1007.69
10/4/2021	11:26:51 AM	0	9.552	5.4	10/4/2021	11:33:24 AM	0	896.547	11.575	0.41	25.99	1007.69
10/4/2021	12:26:51 PM	0	9.552	5.4	10/4/2021	12:33:24 PM	0	896.173	11.078	0.41	25.98	1007.70
10/4/2021	1:26:51 PM	0	9.553	5.4	10/4/2021	1:33:24 PM	0	895.749	10.688	0.42	25.98	1007.70
10/4/2021	2:26:51 PM	0	9.556	5.4	10/4/2021	2:33:24 PM	0	895.277	9.844	0.43	25.97	1007.71
10/4/2021	3:26:51 PM	0	9.559	5.4	10/4/2021	3:33:24 PM	0	895.063	9.097	0.43	25.96	1007.72
10/4/2021	4:26:51 PM	0	9.561	5.4	10/4/2021	4:33:24 PM	0	894.904	8.346	0.44	25.96	1007.72
10/4/2021	5:26:51 PM	0	9.561	5.4	10/4/2021	5:33:24 PM	0	894.472	6.989	0.44	25.95	1007.72
10/4/2021	6:26:51 PM	0	9.558	5.4	10/4/2021	6:33:24 PM	0	894.272	5.387	0.44	25.96	1007.72
10/4/2021	7:26:51 PM	0	9.55	5.4	10/4/2021	7:33:24 PM	0	893.967	4.101	0.43	25.96	1007.72
10/4/2021	8:26:51 PM	0	9.544	5.4	10/4/2021	8:33:24 PM	0	893.803	3.525	0.43	25.97	1007.71
10/4/2021	9:26:51 PM	0	9.536	5.4	10/4/2021	9:33:24 PM	0	893.326	3.391	0.43	25.97	1007.71
10/4/2021	10:26:51 PM	0	9.528	5.4	10/4/2021	10:33:24 PM	0	892.709	3.052	0.42	25.97	1007.71
10/4/2021	11:26:51 PM	0	9.521	5.4	10/4/2021	11:33:24 PM	0	891.978	2.77	0.43	25.97	1007.71
10/5/2021	12:26:51 AM	0	9.516	5.4	10/5/2021	12:33:24 AM	0	890.931	2.629	0.43	25.96	1007.72
10/5/2021	1:26:51 AM	0	9.513	5.4	10/5/2021	1:33:24 AM	0	890.228	2.624	0.44	25.96	1007.72
10/5/2021	2:26:51 AM	0	9.514	5.4	10/5/2021	2:33:24 AM	0	889.881	2.653	0.44	25.96	1007.72
10/5/2021	3:26:51 AM	0	9.513	5.4	10/5/2021	3:33:24 AM	0	888.941	2.535	0.45	25.95	1007.73
10/5/2021	4:26:51 AM	0	9.513	5.4	10/5/2021	4:33:24 AM	0	888.867	2.439	0.45	25.95	1007.73
10/5/2021	5:26:51 AM	0	9.511	5.4	10/5/2021	5:33:24 AM	0	888.831	2.393	0.45	25.95	1007.73
10/5/2021	6:26:51 AM	0	9.508	5.4	10/5/2021	6:33:24 AM	0	888.758	2.299	0.45	25.95	1007.73
10/5/2021	7:26:51 AM	0	9.499	5.4	10/5/2021	7:33:24 AM	0	888.314	2.19	0.44	25.95	1007.72
10/5/2021	8:26:51 AM	0	9.491	5.4	10/5/2021	8:33:24 AM	0	888.246	2.222	0.43	25.96	1007.72
10/5/2021	9:26:51 AM	0	9.483	5.4	10/5/2021	9:33:24 AM	0	888.262	2.602	0.43	25.97	1007.71
10/5/2021	10:26:51 AM	0	9.476	5.4	10/5/2021	10:33:24 AM	0	888.237	3.438	0.42	25.98	1007.70
10/5/2021	11:26:51 AM	0	9.471	5.4	10/5/2021	11:33:24 AM	0	888.064	4.017	0.42	25.98	1007.70
10/5/2021	12:26:51 PM	0	9.466	5.4	10/5/2021	12:33:24 PM	0	887.567	4.81	0.42	25.98	1007.70
10/5/2021	1:26:51 PM	0	9.468	5.4	10/5/2021	1:33:24 PM	0	887.579	5.951	0.42	25.98	1007.70
10/5/2021	2:26:51 PM	0	9.47	5.4	10/5/2021	2:33:24 PM	0	887.063	6.504	0.42	25.97	1007.71
10/5/2021	3:26:51 PM	0	9.476	5.4	10/5/2021	3:33:24 PM	0	887.37	7.122	0.43	25.97	1007.71
10/5/2021	4:26:51 PM	0	9.479	5.4	10/5/2021	4:33:24 PM	0	887.427	7	0.43	25.97	1007.71
10/5/2021	5:26:51 PM	0	9.48	5.4	10/5/2021	5:33:24 PM	0	887.514	6.5	0.43	25.96	1007.71
10/5/2021	6:26:51 PM	0	9.483	5.4	10/5/2021	6:33:24 PM	0	888.414	6.657	0.42	25.97	1007.71
10/5/2021	7:26:51 PM	0	9.483	5.4	10/5/2021	7:33:24 PM	0	889.074	5.085	0.42	25.98	1007.70
10/5/2021	8:26:51 PM	0	9.481	5.4	10/5/2021	8:33:24 PM	0	889.652	3.233	0.41	25.99	1007.69
10/5/2021	9:26:51 PM	0	9.479	5.4	10/5/2021	9:33:24 PM	0	890.029	1.946	0.40	25.99	1007.69
10/5/2021	10:26:51 PM	0	9.474	5.4	10/5/2021	10:33:24 PM	0	890.154	1.515	0.40	26.00	1007.68
10/5/2021	11:26:51 PM	0	9.476	5.4	10/5/2021	11:33:24 PM	0	890.741	1.727	0.39	26.00	1007.68
10/6/2021	12:26:51 AM	0	9.48	5.4	10/6/2021	12:33:24 AM	0	891.381	2.095	0.39	26.00	1007.67
10/6/2021	1:26:51 AM	0	9.488	5.4	10/6/2021	1:33:24 AM	0	891.982	1.71	0.39	26.00	1007.68
10/6/2021	2:26:51 AM	0	9.496	5.4	10/6/2021	2:33:24 AM	0	892.566	0.413	0.39	26.00	1007.68
10/6/2021	3:26:51 AM	0	9.508	5.4	10/6/2021	3:33:24 AM	0	893.086	-0.496	0.40	25.99	1007.69
10/6/2021	4:26:51 AM	0	9.518	5.4	10/6/2021	4:33:24 AM	0	893.633	-0.558	0.41	25.99	1007.69
10/6/2021	5:26:51 AM	0	9.524	5.4	10/6/2021	5:33:24 AM	0	893.897	-0.708	0.41	25.99	1007.69
10/6/2021	6:26:51 AM	0	9.527	5.4	10/6/2021	6:33:24 AM	0	894.268	-1.333	0.41	25.99	1007.69
10/6/2021	7:26:51 AM	0	9.527	5.4	10/6/2021	7:33:24 AM	0	894.693	-1.796	0.40	25.99	1007.69
10/6/2021	8:26:51 AM	0	9.525	5.4	10/6/2021	8:33:24 AM	0	895.064	-1.117	0.40	26.00	1007.68
10/6/2021	9:26:51 AM	0	9.522	5.4	10/6/2021	9:33:24 AM	0	895.752	0.185	0.39	26.01	1007.67
10/6/2021	10:26:51 AM	0	9.519	5.4	10/6/2021	10:33:24 AM	0	896.375	4.734	0.38	26.02	1007.66
10/6/2021	11:26:51 AM	0	9.516	5.4	10/6/2021	11:33:24 AM	0	896.699	6.375	0.37	26.02	1007.66
10/6/2021	12:26:51 PM	0	9.518	5.4	10/6/2021	12:33:24 PM	0	896.799	7.622	0.37	26.02	1007.66

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/6/2021	1:26:51 PM	0	9.521	5.4	10/6/2021	1:33:24 PM	0	897.096	8.73	0.37	26.02	1007.66
10/6/2021	2:26:51 PM	0	9.525	5.4	10/6/2021	2:33:24 PM	0	897.197	9.554	0.38	26.02	1007.66
10/6/2021	3:26:51 PM	0	9.531	5.4	10/6/2021	3:33:24 PM	0	897.458	8.361	0.38	26.02	1007.66
10/6/2021	4:26:51 PM	0	9.537	5.4	10/6/2021	4:33:24 PM	0	897.567	7.117	0.38	26.01	1007.67
10/6/2021	5:26:51 PM	0	9.543	5.4	10/6/2021	5:33:24 PM	0	897.956	5.746	0.39	26.01	1007.67
10/6/2021	6:26:51 PM	0	9.546	5.4	10/6/2021	6:33:24 PM	0	898.447	4.291	0.38	26.01	1007.67
10/6/2021	7:26:51 PM	0	9.544	5.4	10/6/2021	7:33:24 PM	0	898.772	2.469	0.38	26.02	1007.66
10/6/2021	8:26:51 PM	0	9.54	5.4	10/6/2021	8:33:24 PM	0	898.672	1.386	0.38	26.02	1007.66
10/6/2021	9:26:51 PM	0	9.534	5.4	10/6/2021	9:33:24 PM	0	898.713	1.436	0.37	26.03	1007.65
10/6/2021	10:26:51 PM	0	9.53	5.4	10/6/2021	10:33:24 PM	0	898.932	1.379	0.36	26.03	1007.65
10/6/2021	11:26:51 PM	0	9.527	5.4	10/6/2021	11:33:24 PM	0	898.997	0.43	0.36	26.04	1007.64
10/7/2021	12:26:51 AM	0	9.528	5.4	10/7/2021	12:33:24 AM	0	899.2	-0.005	0.36	26.04	1007.64
10/7/2021	1:26:51 AM	0	9.531	5.4	10/7/2021	1:33:24 AM	0	899.241	-0.178	0.36	26.03	1007.65
10/7/2021	2:26:51 AM	0	9.536	5.4	10/7/2021	2:33:24 AM	0	899.158	-0.681	0.37	26.03	1007.65
10/7/2021	3:26:51 AM	0	9.543	5.4	10/7/2021	3:33:24 AM	0	899.072	-1.67	0.37	26.02	1007.66
10/7/2021	4:26:51 AM	0	9.549	5.4	10/7/2021	4:33:24 AM	0	899.166	-0.94	0.38	26.01	1007.66
10/7/2021	5:26:51 AM	0	9.556	5.4	10/7/2021	5:33:24 AM	0	899.23	-1.657	0.39	26.01	1007.67
10/7/2021	6:26:51 AM	0	9.559	5.4	10/7/2021	6:33:24 AM	0	899.125	-1.578	0.39	26.00	1007.67
10/7/2021	7:26:51 AM	0	9.561	5.4	10/7/2021	7:33:24 AM	0	899.204	-2.062	0.39	26.00	1007.68
10/7/2021	8:26:51 AM	0	9.558	5.4	10/7/2021	8:33:24 AM	0	899.332	-1.172	0.39	26.01	1007.67
10/7/2021	9:26:51 AM	0	9.553	5.4	10/7/2021	9:33:24 AM	0	899.65	1.08	0.38	26.02	1007.66
10/7/2021	10:26:51 AM	0	9.549	5.4	10/7/2021	10:33:24 AM	0	899.82	1.593	0.37	26.02	1007.66
10/7/2021	11:26:51 AM	0	9.543	5.4	10/7/2021	11:33:24 AM	0	899.525	2.67	0.37	26.02	1007.65
10/7/2021	12:26:51 PM	0	9.539	5.4	10/7/2021	12:33:24 PM	0	899.326	3.537	0.37	26.03	1007.65
10/7/2021	1:26:51 PM	0	9.536	5.4	10/7/2021	1:33:24 PM	0	899.027	4.362	0.37	26.03	1007.65
10/7/2021	2:26:51 PM	0	9.536	5.4	10/7/2021	2:33:24 PM	0	898.94	8.085	0.37	26.03	1007.65
10/7/2021	3:26:51 PM	0	9.534	5.4	10/7/2021	3:33:24 PM	0	898.553	9.133	0.37	26.02	1007.66
10/7/2021	4:26:51 PM	0	9.534	5.4	10/7/2021	4:33:24 PM	0	898.011	6.917	0.38	26.02	1007.66
10/7/2021	5:26:51 PM	0	9.533	5.4	10/7/2021	5:33:24 PM	0	897.362	4.644	0.38	26.01	1007.67
10/7/2021	6:26:51 PM	0	9.53	5.4	10/7/2021	6:33:24 PM	0	896.869	2.608	0.38	26.01	1007.67
10/7/2021	7:26:51 PM	0	9.525	5.4	10/7/2021	7:33:24 PM	0	896.711	1.367	0.38	26.01	1007.67
10/7/2021	8:26:51 PM	0	9.514	5.4	10/7/2021	8:33:24 PM	0	896.132	0.301	0.38	26.02	1007.66
10/7/2021	9:26:51 PM	0	9.505	5.4	10/7/2021	9:33:24 PM	0	895.808	0.632	0.37	26.02	1007.65
10/7/2021	10:26:51 PM	0	9.496	5.4	10/7/2021	10:33:24 PM	0	895.673	0.586	0.36	26.03	1007.65
10/7/2021	11:26:51 PM	0	9.489	5.4	10/7/2021	11:33:24 PM	0	895.634	0.901	0.36	26.04	1007.64
10/8/2021	12:26:51 AM	0	9.485	5.4	10/8/2021	12:33:24 AM	0	895.624	1.135	0.35	26.04	1007.64
10/8/2021	1:26:51 AM	0	9.485	5.4	10/8/2021	1:33:24 AM	0	895.448	1.232	0.35	26.04	1007.64
10/8/2021	2:26:51 AM	0	9.486	5.4	10/8/2021	2:33:24 AM	0	895.41	1.25	0.36	26.04	1007.64
10/8/2021	3:26:51 AM	0	9.492	5.4	10/8/2021	3:33:24 AM	0	895.307	0.847	0.36	26.03	1007.65
10/8/2021	4:26:51 AM	0	9.498	5.4	10/8/2021	4:33:24 AM	0	895.24	0.901	0.37	26.03	1007.65
10/8/2021	5:26:51 AM	0	9.504	5.4	10/8/2021	5:33:24 AM	0	895.267	0.767	0.37	26.02	1007.66
10/8/2021	6:26:51 AM	0	9.51	5.4	10/8/2021	6:33:24 AM	0	895.304	0.301	0.38	26.01	1007.66
10/8/2021	7:26:51 AM	0	9.516	5.4	10/8/2021	7:33:24 AM	0	895.69	-0.433	0.38	26.01	1007.67
10/8/2021	8:26:51 AM	0	9.518	5.4	10/8/2021	8:33:24 AM	0	896.062	0.392	0.38	26.01	1007.66
10/8/2021	9:26:51 AM	0	9.516	5.4	10/8/2021	9:33:24 AM	0	896.701	6.35	0.37	26.02	1007.66
10/8/2021	10:26:51 AM	0	9.513	5.4	10/8/2021	10:33:24 AM	0	897.126	13.669	0.36	26.03	1007.65
10/8/2021	11:26:51 AM	0	9.51	5.4	10/8/2021	11:33:24 AM	0	897.129	10.477	0.36	26.03	1007.65
10/8/2021	12:26:51 PM	0	9.505	5.4	10/8/2021	12:33:24 PM	0	896.846	7.574	0.36	26.04	1007.64
10/8/2021	1:26:51 PM	0	9.501	5.4	10/8/2021	1:33:24 PM	0	896.63	12.266	0.36	26.04	1007.64
10/8/2021	2:26:51 PM	0	9.499	5.4	10/8/2021	2:33:24 PM	0	896.172	15.729	0.36	26.03	1007.64
10/8/2021	3:26:51 PM	0	9.499	5.4	10/8/2021	3:33:24 PM	0	896.142	14.116	0.36	26.03	1007.65
10/8/2021	4:26:51 PM	0	9.501	5.4	10/8/2021	4:33:24 PM	0	896.204	9.41	0.36	26.03	1007.65
10/8/2021	5:26:51 PM	0	9.501	5.4	10/8/2021	5:33:24 PM	0	895.966	6.832	0.36	26.03	1007.65
10/8/2021	6:26:51 PM	0	9.499	5.4	10/8/2021	6:33:24 PM	0	895.798	4.061	0.36	26.03	1007.65
10/8/2021	7:26:51 PM	0	9.495	5.4	10/8/2021	7:33:24 PM	0	895.45	1.868	0.36	26.03	1007.65
10/8/2021	8:26:51 PM	0	9.489	5.4	10/8/2021	8:33:24 PM	0	895.149	1.578	0.36	26.03	1007.65
10/8/2021	9:26:51 PM	0	9.48	5.4	10/8/2021	9:33:24 PM	0	895.019	2.513	0.35	26.04	1007.64
10/8/2021	10:26:51 PM	0	9.47	5.4	10/8/2021	10:33:24 PM	0	894.461	1.249	0.35	26.05	1007.63
10/8/2021	11:26:51 PM	0	9.462	5.4	10/8/2021	11:33:24 PM	0	894.336	0.366	0.34	26.05	1007.63
10/9/2021	12:26:51 AM	0	9.456	5.4	10/9/2021	12:33:24 AM	0	894.39	1.03	0.34	26.06	1007.62
10/9/2021	1:26:51 AM	0	9.454	5.4	10/9/2021	1:33:24 AM	0	894.531	2.01	0.33	26.06	1007.62
10/9/2021	2:26:51 AM	0	9.457	5.4	10/9/2021	2:33:24 AM	0	894.848	2.559	0.33	26.06	1007.62
10/9/2021	3:26:51 AM	0	9.463	5.4	10/9/2021	3:33:24 AM	0	895.149	2.879	0.33	26.06	1007.62
10/9/2021	4:26:51 AM	0	9.465	5.4	10/9/2021	4:33:24 AM	0	894.711	3.01	0.34	26.05	1007.63
10/9/2021	5:26:51 AM	0	9.473	5.4	10/9/2021	5:33:24 AM	0	894.753	3.163	0.35	26.05	1007.63
10/9/2021	6:26:51 AM	0	9.481	5.4	10/9/2021	6:33:24 AM	0	895.05	3.299	0.35	26.04	1007.64
10/9/2021	7:26:51 AM	0	9.485	5.4	10/9/2021	7:33:24 AM	0	894.807	2.828	0.36	26.03	1007.64
10/9/2021	8:26:51 AM	0	9.486	5.4	10/9/2021	8:33:24 AM	0	894.643	3.042	0.36	26.03	1007.65
10/9/2021	9:26:51 AM	0	9.486	5.4	10/9/2021	9:33:24 AM	0	894.697	4.01	0.36	26.03	1007.65
10/9/2021	10:26:51 AM	0	9.485	5.4	10/9/2021	10:33:24 AM	0	894.714	4.38	0.36	26.03	1007.65
10/9/2021	11:26:51 AM	0	9.481	5.4	10/9/2021	11:33:24 AM	0	894.757	4.604	0.36	26.04	1007.64
10/9/2021	12:26:51 PM	0	9.474	5.4	10/9/2021	12:33:24 PM	0	893.946	5.565	0.36	26.04	1007.64

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/9/2021	1:26:51 PM	0	9.466	5.4	10/9/2021	1:33:24 PM	0	893.146	5.457	0.36	26.04	1007.64
10/9/2021	2:26:51 PM	0	9.46	5.4	10/9/2021	2:33:24 PM	0	892.324	5.101	0.36	26.03	1007.65
10/9/2021	3:26:51 PM	0	9.454	5.4	10/9/2021	3:33:24 PM	0	891.506	4.162	0.36	26.03	1007.65
10/9/2021	4:26:51 PM	0	9.45	5.4	10/9/2021	4:33:24 PM	0	890.742	3.706	0.37	26.03	1007.65
10/9/2021	5:26:51 PM	0	9.445	5.4	10/9/2021	5:33:24 PM	0	890.15	3.531	0.37	26.03	1007.65
10/9/2021	6:26:51 PM	0	9.441	5.4	10/9/2021	6:33:24 PM	0	889.545	3.349	0.37	26.02	1007.65
10/9/2021	7:26:51 PM	0	9.435	5.4	10/9/2021	7:33:24 PM	0	889.277	3.318	0.37	26.03	1007.65
10/9/2021	8:26:51 PM	0	9.428	5.4	10/9/2021	8:33:24 PM	0	888.793	3.375	0.36	26.03	1007.65
10/9/2021	9:26:51 PM	0	9.418	5.4	10/9/2021	9:33:24 PM	0	888.585	3.394	0.36	26.04	1007.64
10/9/2021	10:26:51 PM	0	9.411	5.4	10/9/2021	10:33:24 PM	0	888.709	3.318	0.35	26.05	1007.63
10/9/2021	11:26:51 PM	0	9.405	5.4	10/9/2021	11:33:24 PM	0	888.915	3.436	0.34	26.05	1007.62
10/10/2021	12:26:51 AM	0	9.403	5.4	10/10/2021	12:33:24 AM	0	889.718	3.292	0.33	26.06	1007.61
10/10/2021	1:26:51 AM	0	9.403	5.4	10/10/2021	1:33:24 AM	0	889.98	1.201	0.33	26.07	1007.61
10/10/2021	2:26:51 AM	0	9.405	5.4	10/10/2021	2:33:24 AM	0	890.36	0.098	0.33	26.07	1007.61
10/10/2021	3:26:51 AM	0	9.406	5.4	10/10/2021	3:33:24 AM	0	890.427	-0.363	0.33	26.07	1007.61
10/10/2021	4:26:51 AM	0	9.412	5.4	10/10/2021	4:33:24 AM	0	890.691	-0.241	0.33	26.07	1007.61
10/10/2021	5:26:51 AM	0	9.423	5.4	10/10/2021	5:33:24 AM	0	891.546	-0.555	0.33	26.06	1007.62
10/10/2021	6:26:51 AM	0	9.434	5.4	10/10/2021	6:33:24 AM	0	892.305	-0.486	0.33	26.06	1007.62
10/10/2021	7:26:51 AM	0	9.443	5.4	10/10/2021	7:33:24 AM	0	892.81	-0.574	0.34	26.06	1007.62
10/10/2021	8:26:51 AM	0	9.448	5.4	10/10/2021	8:33:24 AM	0	893.165	-0.552	0.34	26.05	1007.62
10/10/2021	9:26:51 AM	0	9.457	5.4	10/10/2021	9:33:24 AM	0	894.498	5.337	0.34	26.06	1007.62
10/10/2021	10:26:51 AM	0	9.462	5.4	10/10/2021	10:33:24 AM	0	895.257	9.037	0.33	26.06	1007.62
10/10/2021	11:26:51 AM	0	9.465	5.4	10/10/2021	11:33:24 AM	0	895.602	8.256	0.33	26.06	1007.62
10/10/2021	12:26:51 PM	0	9.466	5.4	10/10/2021	12:33:24 PM	0	895.62	6.26	0.33	26.06	1007.62
10/10/2021	1:26:51 PM	0	9.466	5.4	10/10/2021	1:33:24 PM	0	895.887	7.417	0.33	26.06	1007.61
10/10/2021	2:26:51 PM	0	9.468	5.4	10/10/2021	2:33:24 PM	0	896.115	7.506	0.33	26.06	1007.61
10/10/2021	3:26:51 PM	0	9.468	5.4	10/10/2021	3:33:24 PM	0	895.939	4.486	0.33	26.06	1007.62
10/10/2021	4:26:51 PM	0	9.471	5.4	10/10/2021	4:33:24 PM	0	896.369	3.212	0.33	26.06	1007.61
10/10/2021	5:26:51 PM	0	9.474	5.4	10/10/2021	5:33:24 PM	0	896.813	2.928	0.33	26.07	1007.61
10/10/2021	6:26:51 PM	0	9.477	5.4	10/10/2021	6:33:24 PM	0	897.334	1.506	0.33	26.07	1007.61
10/10/2021	7:26:51 PM	0	9.48	5.4	10/10/2021	7:33:24 PM	0	897.846	0.219	0.32	26.07	1007.61
10/10/2021	8:26:51 PM	0	9.479	5.4	10/10/2021	8:33:24 PM	0	898.094	-0.108	0.32	26.07	1007.61
10/10/2021	9:26:51 PM	0	9.476	5.4	10/10/2021	9:33:24 PM	0	898.316	-0.126	0.32	26.08	1007.60
10/10/2021	10:26:51 PM	0	9.474	5.4	10/10/2021	10:33:24 PM	0	898.792	-0.359	0.31	26.09	1007.59
10/10/2021	11:26:51 PM	0	9.47	5.4	10/10/2021	11:33:24 PM	0	899.01	-0.423	0.30	26.09	1007.59
10/11/2021	12:26:51 AM	0	9.466	5.4	10/11/2021	12:33:24 AM	0	899.303	-0.464	0.30	26.10	1007.58
10/11/2021	1:26:51 AM	0	9.465	5.4	10/11/2021	1:33:24 AM	0	899.533	-0.59	0.29	26.10	1007.58
10/11/2021	2:26:51 AM	0	9.465	5.4	10/11/2021	2:33:24 AM	0	899.759	-0.636	0.29	26.10	1007.57
10/11/2021	3:26:51 AM	0	9.468	5.4	10/11/2021	3:33:24 AM	0	900.126	-0.668	0.29	26.11	1007.57
10/11/2021	4:26:51 AM	0	9.473	5.4	10/11/2021	4:33:24 AM	0	900.565	-0.751	0.29	26.11	1007.57
10/11/2021	5:26:51 AM	0	9.479	5.4	10/11/2021	5:33:24 AM	0	900.771	-0.999	0.29	26.10	1007.58
10/11/2021	6:26:51 AM	0	9.485	5.4	10/11/2021	6:33:24 AM	0	901.026	-1.59	0.30	26.10	1007.58
10/11/2021	7:26:51 AM	0	9.493	5.4	10/11/2021	7:33:24 AM	0	901.414	-1.768	0.30	26.09	1007.59
10/11/2021	8:26:51 AM	0	9.499	5.4	10/11/2021	8:33:24 AM	0	901.75	-1.264	0.30	26.09	1007.59
10/11/2021	9:26:51 AM	0	9.507	5.4	10/11/2021	9:33:24 AM	0	902.426	-0.61	0.30	26.09	1007.59
10/11/2021	10:26:51 AM	0	9.513	5.4	10/11/2021	10:33:24 AM	0	902.848	0.742	0.31	26.09	1007.59
10/11/2021	11:26:51 AM	0	9.518	5.4	10/11/2021	11:33:24 AM	0	903.181	3.504	0.31	26.09	1007.59
10/11/2021	12:26:51 PM	0	9.521	5.4	10/11/2021	12:33:24 PM	0	903.506	6.09	0.31	26.09	1007.59
10/11/2021	1:26:51 PM	0	9.521	5.4	10/11/2021	1:33:24 PM	0	903.528	7.323	0.31	26.09	1007.59
10/11/2021	2:26:51 PM	0	9.521	5.4	10/11/2021	2:33:24 PM	0	903.483	6.969	0.31	26.09	1007.59
10/11/2021	3:26:51 PM	0	9.521	5.4	10/11/2021	3:33:24 PM	0	903.24	5.83	0.31	26.08	1007.59
10/11/2021	4:26:51 PM	0	9.521	5.4	10/11/2021	4:33:24 PM	0	903.438	5.854	0.31	26.09	1007.59
10/11/2021	5:26:51 PM	0	9.519	5.4	10/11/2021	5:33:24 PM	0	903.37	4.359	0.31	26.09	1007.59
10/11/2021	6:26:51 PM	0	9.518	5.4	10/11/2021	6:33:24 PM	0	903.136	1.826	0.31	26.09	1007.59
10/11/2021	7:26:51 PM	0	9.513	5.4	10/11/2021	7:33:24 PM	0	902.511	-0.56	0.31	26.08	1007.59
10/11/2021	8:26:51 PM	0	9.508	5.4	10/11/2021	8:33:24 PM	0	902.147	-1.634	0.31	26.09	1007.59
10/11/2021	9:26:51 PM	0	9.504	5.4	10/11/2021	9:33:24 PM	0	901.951	-1.112	0.31	26.09	1007.59
10/11/2021	10:26:51 PM	0	9.496	5.4	10/11/2021	10:33:24 PM	0	901.643	-0.55	0.30	26.09	1007.59
10/11/2021	11:26:51 PM	0	9.489	5.4	10/11/2021	11:33:24 PM	0	901.175	-0.561	0.30	26.10	1007.58
10/12/2021	12:26:51 AM	0	9.48	5.4	10/12/2021	12:33:24 AM	0	900.601	-0.668	0.30	26.10	1007.58
10/12/2021	1:26:51 AM	0	9.471	5.4	10/12/2021	1:33:24 AM	0	899.716	-0.983	0.30	26.10	1007.58
10/12/2021	2:26:51 AM	0	9.459	5.4	10/12/2021	2:33:24 AM	0	898.457	-1.465	0.30	26.10	1007.58
10/12/2021	3:26:51 AM	0	9.451	5.4	10/12/2021	3:33:24 AM	0	897.732	-1.612	0.30	26.10	1007.58
10/12/2021	4:26:51 AM	0	9.444	5.4	10/12/2021	4:33:24 AM	0	896.844	-1.626	0.30	26.10	1007.58
10/12/2021	5:26:51 AM	0	9.44	5.4	10/12/2021	5:33:24 AM	0	896.11	-1.655	0.30	26.09	1007.59
10/12/2021	6:26:51 AM	0	9.435	5.4	10/12/2021	6:33:24 AM	0	895.435	-1.634	0.30	26.09	1007.59
10/12/2021	7:26:51 AM	0	9.435	5.4	10/12/2021	7:33:24 AM	0	895.084	-1.167	0.31	26.09	1007.59
10/12/2021	8:26:51 AM	0	9.432	5.4	10/12/2021	8:33:24 AM	0	894.426	-0.732	0.31	26.08	1007.60
10/12/2021	9:26:51 AM	0	9.434	5.4	10/12/2021	9:33:24 AM	0	894.145	-0.45	0.32	26.08	1007.60
10/12/2021	10:26:51 AM	0	9.432	5.4	10/12/2021	10:33:24 AM	0	893.645	0.863	0.32	26.08	1007.60
10/12/2021	11:26:51 AM	0	9.435	5.4	10/12/2021	11:33:24 AM	0	893.888	2.315	0.32	26.07	1007.60
10/12/2021	12:26:51 PM	0	9.437	5.4	10/12/2021	12:33:24 PM	0	894.044	2.333	0.32	26.07	1007.60

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/12/2021	1:26:51 PM	0	9.44	5.4	10/12/2021	1:33:24 PM	0	894.022	1.711	0.32	26.07	1007.61
10/12/2021	2:26:51 PM	0	9.438	5.4	10/12/2021	2:33:24 PM	0	893.569	0.231	0.33	26.07	1007.61
10/12/2021	3:26:51 PM	0	9.437	5.4	10/12/2021	3:33:24 PM	0	893.486	-0.372	0.33	26.07	1007.61
10/12/2021	4:26:51 PM	0	9.434	5.4	10/12/2021	4:33:24 PM	0	893.052	-0.431	0.33	26.07	1007.61
10/12/2021	5:26:51 PM	0	9.431	5.4	10/12/2021	5:33:24 PM	0	893.086	-0.448	0.32	26.07	1007.61
10/12/2021	6:26:51 PM	0	9.428	5.4	10/12/2021	6:33:24 PM	0	893.115	-0.471	0.32	26.07	1007.60
10/12/2021	7:26:51 PM	0	9.423	5.4	10/12/2021	7:33:24 PM	0	893.115	-0.487	0.32	26.08	1007.60
10/12/2021	8:26:51 PM	0	9.42	5.4	10/12/2021	8:33:24 PM	0	893.084	-0.495	0.31	26.08	1007.60
10/12/2021	9:26:51 PM	0	9.417	5.4	10/12/2021	9:33:24 PM	0	893.082	-0.466	0.31	26.08	1007.59
10/12/2021	10:26:51 PM	0	9.412	5.4	10/12/2021	10:33:24 PM	0	893.152	-0.446	0.30	26.09	1007.59
10/12/2021	11:26:51 PM	0	9.409	5.4	10/12/2021	11:33:24 PM	0	893.276	-0.43	0.30	26.09	1007.58
10/13/2021	12:26:51 AM	0	9.406	5.4	10/13/2021	12:33:24 AM	0	893.373	-0.423	0.30	26.10	1007.58
10/13/2021	1:26:51 AM	0	9.402	5.4	10/13/2021	1:33:24 AM	0	893.447	-0.427	0.29	26.10	1007.58
10/13/2021	2:26:51 AM	0	9.4	5.4	10/13/2021	2:33:24 AM	0	893.645	-0.416	0.29	26.11	1007.57
10/13/2021	3:26:51 AM	0	9.396	5.4	10/13/2021	3:33:24 AM	0	893.666	-0.395	0.28	26.11	1007.57
10/13/2021	4:26:51 AM	0	9.393	5.4	10/13/2021	4:33:24 AM	0	893.657	-0.44	0.28	26.11	1007.56
10/13/2021	5:26:51 AM	0	9.393	5.4	10/13/2021	5:33:24 AM	0	893.866	-0.607	0.28	26.12	1007.56
10/13/2021	6:26:51 AM	0	9.393	5.4	10/13/2021	6:33:24 AM	0	894.056	-0.575	0.28	26.12	1007.56
10/13/2021	7:26:51 AM	0	9.395	5.4	10/13/2021	7:33:24 AM	0	894.18	-0.607	0.28	26.12	1007.56
10/13/2021	8:26:51 AM	0	9.398	5.4	10/13/2021	8:33:24 AM	0	894.367	-0.565	0.28	26.12	1007.56
10/13/2021	9:26:51 AM	0	9.4	5.4	10/13/2021	9:33:24 AM	0	894.31	-0.344	0.28	26.11	1007.56
10/13/2021	10:26:51 AM	0	9.406	5.4	10/13/2021	10:33:24 AM	0	894.61	0.446	0.28	26.11	1007.57
10/13/2021	11:26:51 AM	0	9.412	5.4	10/13/2021	11:33:24 AM	0	895.031	1.253	0.29	26.11	1007.57
10/13/2021	12:26:51 PM	0	9.415	5.4	10/13/2021	12:33:24 PM	0	895.164	4.037	0.29	26.11	1007.57
10/13/2021	1:26:51 PM	0	9.42	5.4	10/13/2021	1:33:24 PM	0	895.226	4.728	0.29	26.10	1007.58
10/13/2021	2:26:51 PM	0	9.42	5.4	10/13/2021	2:33:24 PM	0	894.912	5.094	0.29	26.10	1007.58
10/13/2021	3:26:51 PM	0	9.42	5.4	10/13/2021	3:33:24 PM	0	894.84	5.491	0.30	26.10	1007.58
10/13/2021	4:26:51 PM	0	9.418	5.4	10/13/2021	4:33:24 PM	0	894.486	3.235	0.30	26.10	1007.58
10/13/2021	5:26:51 PM	0	9.414	5.4	10/13/2021	5:33:24 PM	0	893.867	0.962	0.30	26.10	1007.58
10/13/2021	6:26:51 PM	0	9.409	5.4	10/13/2021	6:33:24 PM	0	893.537	-0.424	0.30	26.10	1007.58
10/13/2021	7:26:51 PM	0	9.406	5.4	10/13/2021	7:33:24 PM	0	893.495	-0.625	0.29	26.10	1007.58
10/13/2021	8:26:51 PM	0	9.403	5.4	10/13/2021	8:33:24 PM	0	893.596	-0.713	0.29	26.10	1007.58
10/13/2021	9:26:51 PM	0	9.4	5.4	10/13/2021	9:33:24 PM	0	893.609	-0.824	0.29	26.11	1007.57
10/13/2021	10:26:51 PM	0	9.398	5.4	10/13/2021	10:33:24 PM	0	893.602	-1.084	0.29	26.11	1007.57
10/13/2021	11:26:51 PM	0	9.396	5.4	10/13/2021	11:33:24 PM	0	893.704	-1.205	0.28	26.11	1007.57
10/14/2021	12:26:51 AM	0	9.395	5.4	10/14/2021	12:33:24 AM	0	893.756	-1.046	0.28	26.11	1007.57
10/14/2021	1:26:51 AM	0	9.393	5.4	10/14/2021	1:33:24 AM	0	894.064	-0.893	0.28	26.12	1007.56
10/14/2021	2:26:51 AM	0	9.396	5.4	10/14/2021	2:33:24 AM	0	894.794	-0.711	0.27	26.12	1007.56
10/14/2021	3:26:51 AM	0	9.392	5.4	10/14/2021	3:33:24 AM	0	894.408	-0.637	0.27	26.12	1007.56
10/14/2021	4:26:51 AM	0	9.387	5.4	10/14/2021	4:33:24 AM	0	894.367	-0.635	0.27	26.13	1007.55
10/14/2021	5:26:51 AM	0	9.387	5.4	10/14/2021	5:33:24 AM	0	894.933	-0.689	0.26	26.13	1007.55
10/14/2021	6:26:51 AM	0	9.389	5.4	10/14/2021	6:33:24 AM	0	895.566	-0.673	0.26	26.14	1007.54
10/14/2021	7:26:51 AM	0	9.39	5.4	10/14/2021	7:33:24 AM	0	896.027	-0.559	0.25	26.14	1007.54
10/14/2021	8:26:51 AM	0	9.392	5.4	10/14/2021	8:33:24 AM	0	896.274	-0.51	0.25	26.14	1007.54
10/14/2021	9:26:51 AM	0	9.398	5.4	10/14/2021	9:33:24 AM	0	896.855	-0.181	0.25	26.14	1007.54
10/14/2021	10:26:51 AM	0	9.402	5.4	10/14/2021	10:33:24 AM	0	897.237	1.282	0.25	26.14	1007.54
10/14/2021	11:26:51 AM	0	9.406	5.4	10/14/2021	11:33:24 AM	0	897.366	3.883	0.26	26.14	1007.54
10/14/2021	12:26:51 PM	0	9.412	5.4	10/14/2021	12:33:24 PM	0	897.521	5.043	0.26	26.13	1007.54
10/14/2021	1:26:51 PM	0	9.415	5.4	10/14/2021	1:33:24 PM	0	897.299	5.675	0.27	26.13	1007.55
10/14/2021	2:26:51 PM	0	9.417	5.4	10/14/2021	2:33:24 PM	0	897.017	7.901	0.27	26.12	1007.55
10/14/2021	3:26:51 PM	0	9.418	5.4	10/14/2021	3:33:24 PM	0	896.675	6.521	0.27	26.12	1007.56
10/14/2021	4:26:51 PM	0	9.415	5.4	10/14/2021	4:33:24 PM	0	896.25	5.093	0.28	26.12	1007.56
10/14/2021	5:26:51 PM	0	9.414	5.4	10/14/2021	5:33:24 PM	0	896.163	4.12	0.28	26.12	1007.56
10/14/2021	6:26:51 PM	0	9.411	5.4	10/14/2021	6:33:24 PM	0	896.169	3.113	0.27	26.12	1007.56
10/14/2021	7:26:51 PM	0	9.408	5.4	10/14/2021	7:33:24 PM	0	896.214	2.647	0.27	26.13	1007.55
10/14/2021	8:26:51 PM	0	9.403	5.4	10/14/2021	8:33:24 PM	0	896.064	2.401	0.27	26.13	1007.55
10/14/2021	9:26:51 PM	0	9.4	5.4	10/14/2021	9:33:24 PM	0	895.824	2.447	0.27	26.13	1007.55
10/14/2021	10:26:51 PM	0	9.398	5.4	10/14/2021	10:33:24 PM	0	895.67	2.331	0.26	26.13	1007.55
10/14/2021	11:26:51 PM	0	9.395	5.4	10/14/2021	11:33:24 PM	0	895.267	2.19	0.27	26.13	1007.55
10/15/2021	12:26:51 AM	0	9.393	5.4	10/15/2021	12:33:24 AM	0	895.133	2.371	0.27	26.13	1007.55
10/15/2021	1:26:51 AM	0	9.392	5.4	10/15/2021	1:33:24 AM	0	895.068	2.485	0.26	26.13	1007.55
10/15/2021	2:26:51 AM	0	9.389	5.4	10/15/2021	2:33:24 AM	0	894.977	2.122	0.26	26.13	1007.55
10/15/2021	3:26:51 AM	0	9.384	5.4	10/15/2021	3:33:24 AM	0	894.197	1.673	0.27	26.13	1007.55
10/15/2021	4:26:51 AM	0	9.377	5.4	10/15/2021	4:33:24 AM	0	893.652	1.687	0.26	26.13	1007.55
10/15/2021	5:26:51 AM	0	9.372	5.4	10/15/2021	5:33:24 AM	0	893.67	1.502	0.26	26.14	1007.54
10/15/2021	6:26:51 AM	0	9.364	5.4	10/15/2021	6:33:24 AM	0	893.239	1.472	0.26	26.14	1007.54
10/15/2021	7:26:51 AM	0	9.363	5.4	10/15/2021	7:33:24 AM	0	893.463	1.667	0.25	26.14	1007.54
10/15/2021	8:26:51 AM	0	9.361	5.4	10/15/2021	8:33:24 AM	0	893.946	2.109	0.25	26.15	1007.53
10/15/2021	9:26:51 AM	0	9.361	5.4	10/15/2021	9:33:24 AM	0	894.296	2.916	0.24	26.15	1007.53
10/15/2021	10:26:51 AM	0	9.366	5.4	10/15/2021	10:33:24 AM	0	894.874	4.911	0.24	26.15	1007.53
10/15/2021	11:26:51 AM	0	9.37	5.4	10/15/2021	11:33:24 AM	0	895.143	6.204	0.24	26.15	1007.53
10/15/2021	12:26:51 PM	0	9.373	5.4	10/15/2021	12:33:24 PM	0	894.907	7.578	0.25	26.15	1007.53

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/15/2021	1:26:51 PM	0	9.377	5.4	10/15/2021	1:33:24 PM	0	894.71	8.661	0.25	26.14	1007.54
10/15/2021	2:26:51 PM	0	9.38	5.4	10/15/2021	2:33:24 PM	0	894.584	10.639	0.26	26.14	1007.54
10/15/2021	3:26:51 PM	0	9.38	5.4	10/15/2021	3:33:24 PM	0	894.168	9.814	0.26	26.13	1007.55
10/15/2021	4:26:51 PM	0	9.378	5.4	10/15/2021	4:33:24 PM	0	893.742	8.331	0.26	26.13	1007.55
10/15/2021	5:26:51 PM	0	9.373	5.4	10/15/2021	5:33:24 PM	0	893.169	6.971	0.27	26.13	1007.55
10/15/2021	6:26:51 PM	0	9.369	5.4	10/15/2021	6:33:24 PM	0	893.087	5.639	0.26	26.13	1007.55
10/15/2021	7:26:51 PM	0	9.367	5.4	10/15/2021	7:33:24 PM	0	893.402	5.186	0.26	26.14	1007.54
10/15/2021	8:26:51 PM	0	9.363	5.4	10/15/2021	8:33:24 PM	0	893.305	4.71	0.25	26.14	1007.54
10/15/2021	9:26:51 PM	0	9.361	5.4	10/15/2021	9:33:24 PM	0	893.511	4.468	0.25	26.15	1007.53
10/15/2021	10:26:51 PM	0	9.357	5.4	10/15/2021	10:33:24 PM	0	893.042	4.417	0.25	26.14	1007.53
10/15/2021	11:26:51 PM	0	9.354	5.4	10/15/2021	11:33:24 PM	0	892.773	4.315	0.25	26.14	1007.53
10/16/2021	12:26:51 AM	0	9.354	5.4	10/16/2021	12:33:24 AM	0	892.481	4.268	0.25	26.14	1007.54
10/16/2021	1:26:51 AM	0	9.352	5.4	10/16/2021	1:33:24 AM	0	892.275	4.436	0.25	26.14	1007.54
10/16/2021	2:26:51 AM	0	9.354	5.4	10/16/2021	2:33:24 AM	0	892.137	4.404	0.26	26.14	1007.54
10/16/2021	3:26:51 AM	0	9.352	5.4	10/16/2021	3:33:24 AM	0	891.951	4.323	0.26	26.14	1007.54
10/16/2021	4:26:51 AM	0	9.345	5.4	10/16/2021	4:33:24 AM	0	891.443	4.58	0.25	26.14	1007.54
10/16/2021	5:26:51 AM	0	9.339	5.4	10/16/2021	5:33:24 AM	0	891.04	4.6	0.25	26.14	1007.54
10/16/2021	6:26:51 AM	0	9.333	5.4	10/16/2021	6:33:24 AM	0	890.913	4.47	0.25	26.15	1007.53
10/16/2021	7:26:51 AM	0	9.33	5.4	10/16/2021	7:33:24 AM	0	891.444	4.941	0.24	26.16	1007.52
10/16/2021	8:26:51 AM	0	9.324	5.4	10/16/2021	8:33:24 AM	0	891.163	5.275	0.24	26.16	1007.52
10/16/2021	9:26:51 AM	0	9.319	5.4	10/16/2021	9:33:24 AM	0	890.772	5.494	0.24	26.16	1007.52
10/16/2021	10:26:51 AM	0	9.318	5.4	10/16/2021	10:33:24 AM	0	890.759	7.007	0.23	26.16	1007.52
10/16/2021	11:26:51 AM	0	9.318	5.4	10/16/2021	11:33:24 AM	0	890.54	8.435	0.24	26.16	1007.52
10/16/2021	12:26:51 PM	0	9.321	5.4	10/16/2021	12:33:24 PM	0	890.615	7.774	0.24	26.16	1007.52
10/16/2021	1:26:51 PM	0	9.325	5.4	10/16/2021	1:33:24 PM	0	890.419	7.377	0.25	26.15	1007.53
10/16/2021	2:26:51 PM	0	9.324	5.4	10/16/2021	2:33:24 PM	0	889.491	6.909	0.25	26.14	1007.54
10/16/2021	3:26:51 PM	0	9.324	5.4	10/16/2021	3:33:24 PM	0	889.047	6.755	0.26	26.14	1007.54
10/16/2021	4:26:51 PM	0	9.321	5.4	10/16/2021	4:33:24 PM	0	888.554	6.506	0.26	26.13	1007.54
10/16/2021	5:26:51 PM	0	9.318	5.4	10/16/2021	5:33:24 PM	0	888.318	6.081	0.26	26.14	1007.54
10/16/2021	6:26:51 PM	0	9.315	5.4	10/16/2021	6:33:24 PM	0	888.348	5.898	0.26	26.14	1007.54
10/16/2021	7:26:51 PM	0	9.31	5.4	10/16/2021	7:33:24 PM	0	888.217	5.887	0.25	26.14	1007.54
10/16/2021	8:26:51 PM	0	9.304	5.4	10/16/2021	8:33:24 PM	0	888.223	5.863	0.25	26.15	1007.53
10/16/2021	9:26:51 PM	0	9.3	5.4	10/16/2021	9:33:24 PM	0	888.059	5.717	0.24	26.15	1007.53
10/16/2021	10:26:51 PM	0	9.297	5.4	10/16/2021	10:33:24 PM	0	888.114	5.636	0.24	26.15	1007.52
10/16/2021	11:26:51 PM	0	9.297	5.4	10/16/2021	11:33:24 PM	0	888.047	5.558	0.24	26.15	1007.53
10/17/2021	12:26:51 AM	0	9.299	5.4	10/17/2021	12:33:24 AM	0	887.987	5.303	0.24	26.15	1007.53
10/17/2021	1:26:51 AM	0	9.302	5.4	10/17/2021	1:33:24 AM	0	887.962	5.2	0.25	26.15	1007.53
10/17/2021	2:26:51 AM	0	9.303	5.4	10/17/2021	2:33:24 AM	0	887.717	5.062	0.25	26.14	1007.53
10/17/2021	3:26:51 AM	0	9.302	5.4	10/17/2021	3:33:24 AM	0	887.338	4.867	0.25	26.14	1007.54
10/17/2021	4:26:51 AM	0	9.297	5.4	10/17/2021	4:33:24 AM	0	886.732	4.656	0.25	26.14	1007.54
10/17/2021	5:26:51 AM	0	9.293	5.4	10/17/2021	5:33:24 AM	0	886.403	3.873	0.25	26.14	1007.54
10/17/2021	6:26:51 AM	0	9.288	5.4	10/17/2021	6:33:24 AM	0	886.294	3.284	0.25	26.14	1007.53
10/17/2021	7:26:51 AM	0	9.282	5.4	10/17/2021	7:33:24 AM	0	886.051	2.882	0.25	26.15	1007.53
10/17/2021	8:26:51 AM	0	9.277	5.4	10/17/2021	8:33:24 AM	0	886.256	2.565	0.24	26.16	1007.52
10/17/2021	9:26:51 AM	0	9.271	5.4	10/17/2021	9:33:24 AM	0	886	2.581	0.24	26.16	1007.52
10/17/2021	10:26:51 AM	0	9.27	5.4	10/17/2021	10:33:24 AM	0	886.255	2.817	0.23	26.16	1007.52
10/17/2021	11:26:51 AM	0	9.271	5.4	10/17/2021	11:33:24 AM	0	886.338	2.989	0.23	26.16	1007.52
10/17/2021	12:26:51 PM	0	9.273	5.4	10/17/2021	12:33:24 PM	0	886.351	3.434	0.23	26.16	1007.52
10/17/2021	1:26:51 PM	0	9.276	5.4	10/17/2021	1:33:24 PM	0	886.249	3.646	0.24	26.16	1007.52
10/17/2021	2:26:51 PM	0	9.285	5.4	10/17/2021	2:33:24 PM	0	886.828	3.426	0.24	26.15	1007.53
10/17/2021	3:26:51 PM	0	9.29	5.4	10/17/2021	3:33:24 PM	0	887.067	3.164	0.24	26.15	1007.53
10/17/2021	4:26:51 PM	0	9.293	5.4	10/17/2021	4:33:24 PM	0	887.435	2.918	0.24	26.15	1007.53
10/17/2021	5:26:51 PM	0	9.297	5.4	10/17/2021	5:33:24 PM	0	888.032	2.434	0.24	26.15	1007.53
10/17/2021	6:26:51 PM	0	9.296	5.4	10/17/2021	6:33:24 PM	0	888.316	1.94	0.24	26.16	1007.52
10/17/2021	7:26:51 PM	0	9.293	5.4	10/17/2021	7:33:24 PM	0	888.694	1.432	0.23	26.16	1007.52
10/17/2021	8:26:51 PM	0	9.293	5.4	10/17/2021	8:33:24 PM	0	889.504	1.155	0.22	26.17	1007.51
10/17/2021	9:26:51 PM	0	9.294	5.4	10/17/2021	9:33:24 PM	0	890.19	0.984	0.22	26.18	1007.50
10/17/2021	10:26:51 PM	0	9.296	5.4	10/17/2021	10:33:24 PM	0	890.706	0.887	0.21	26.18	1007.50
10/17/2021	11:26:51 PM	0	9.297	5.4	10/17/2021	11:33:24 PM	0	890.916	0.738	0.21	26.18	1007.50
10/18/2021	12:26:51 AM	0	9.304	5.4	10/18/2021	12:33:24 AM	0	891.592	0.589	0.21	26.18	1007.50
10/18/2021	1:26:51 AM	0	9.312	5.4	10/18/2021	1:33:24 AM	0	892.004	0.445	0.22	26.18	1007.50
10/18/2021	2:26:51 AM	0	9.318	5.4	10/18/2021	2:33:24 AM	0	892.249	0.334	0.22	26.18	1007.50
10/18/2021	3:26:51 AM	0	9.324	5.4	10/18/2021	3:33:24 AM	0	892.452	0.197	0.22	26.17	1007.51
10/18/2021	4:26:51 AM	0	9.329	5.4	10/18/2021	4:33:24 AM	0	892.891	0.148	0.22	26.17	1007.51
10/18/2021	5:26:51 AM	0	9.335	5.4	10/18/2021	5:33:24 AM	0	893.662	0.083	0.22	26.17	1007.51
10/18/2021	6:26:51 AM	0	9.335	5.4	10/18/2021	6:33:24 AM	0	893.872	-0.037	0.22	26.17	1007.50
10/18/2021	7:26:51 AM	0	9.333	5.4	10/18/2021	7:33:24 AM	0	894.426	-0.149	0.21	26.18	1007.50
10/18/2021	8:26:51 AM	0	9.332	5.4	10/18/2021	8:33:24 AM	0	894.989	-0.067	0.21	26.19	1007.49
10/18/2021	9:26:51 AM	0	9.33	5.4	10/18/2021	9:33:24 AM	0	895.339	0.34	0.20	26.19	1007.48
10/18/2021	10:26:51 AM	0	9.33	5.4	10/18/2021	10:33:24 AM	0	895.957	1.576	0.19	26.20	1007.48
10/18/2021	11:26:51 AM	0	9.333	5.4	10/18/2021	11:33:24 AM	0	896.422	2.968	0.19	26.20	1007.48
10/18/2021	12:26:51 PM	0	9.335	5.4	10/18/2021	12:33:24 PM	0	896.393	4.683	0.19	26.20	1007.48

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/18/2021	1:26:51 PM	0	9.337	5.4	10/18/2021	1:33:24 PM	0	896.389	4.752	0.20	26.20	1007.48
10/18/2021	2:26:51 PM	0	9.344	5.4	10/18/2021	2:33:24 PM	0	896.473	4.687	0.20	26.19	1007.49
10/18/2021	3:26:51 PM	0	9.348	5.4	10/18/2021	3:33:24 PM	0	896.624	4.226	0.20	26.19	1007.49
10/18/2021	4:26:51 PM	0	9.352	5.4	10/18/2021	4:33:24 PM	0	896.834	4.154	0.21	26.19	1007.49
10/18/2021	5:26:51 PM	0	9.351	5.4	10/18/2021	5:33:24 PM	0	896.727	3.892	0.21	26.19	1007.49
10/18/2021	6:26:51 PM	0	9.351	5.4	10/18/2021	6:33:24 PM	0	896.744	2.17	0.21	26.19	1007.49
10/18/2021	7:26:51 PM	0	9.347	5.4	10/18/2021	7:33:24 PM	0	896.702	0.614	0.20	26.19	1007.49
10/18/2021	8:26:51 PM	0	9.341	5.4	10/18/2021	8:33:24 PM	0	896.647	-0.152	0.20	26.20	1007.48
10/18/2021	9:26:51 PM	0	9.337	5.4	10/18/2021	9:33:24 PM	0	896.75	-0.475	0.19	26.20	1007.48
10/18/2021	10:26:51 PM	0	9.335	5.4	10/18/2021	10:33:24 PM	0	896.786	0.07	0.19	26.20	1007.47
10/18/2021	11:26:51 PM	0	9.333	5.4	10/18/2021	11:33:24 PM	0	896.72	0.782	0.19	26.21	1007.47
10/19/2021	12:26:51 AM	0	9.336	5.4	10/19/2021	12:33:24 AM	0	896.791	1.164	0.19	26.20	1007.48
10/19/2021	1:26:51 AM	0	9.339	5.4	10/19/2021	1:33:24 AM	0	896.837	1.6	0.19	26.20	1007.48
10/19/2021	2:26:51 AM	0	9.345	5.4	10/19/2021	2:33:24 AM	0	896.7	1.419	0.20	26.19	1007.49
10/19/2021	3:26:51 AM	0	9.347	5.4	10/19/2021	3:33:24 AM	0	896.238	1.345	0.21	26.19	1007.49
10/19/2021	4:26:51 AM	0	9.35	5.4	10/19/2021	4:33:24 AM	0	896.066	1.287	0.21	26.18	1007.50
10/19/2021	5:26:51 AM	0	9.351	5.4	10/19/2021	5:33:24 AM	0	895.939	1.435	0.21	26.18	1007.50
10/19/2021	6:26:51 AM	0	9.347	5.4	10/19/2021	6:33:24 AM	0	895.664	1.578	0.21	26.18	1007.50
10/19/2021	7:26:51 AM	0	9.344	5.4	10/19/2021	7:33:24 AM	0	895.533	1.663	0.21	26.18	1007.50
10/19/2021	8:26:51 AM	0	9.337	5.4	10/19/2021	8:33:24 AM	0	895.474	1.961	0.21	26.19	1007.49
10/19/2021	9:26:51 AM	0	9.33	5.4	10/19/2021	9:33:24 AM	0	895.278	2.56	0.20	26.19	1007.48
10/19/2021	10:26:51 AM	0	9.324	5.4	10/19/2021	10:33:24 AM	0	895.057	4.051	0.20	26.20	1007.48
10/19/2021	11:26:51 AM	0	9.318	5.4	10/19/2021	11:33:24 AM	0	894.638	6.121	0.20	26.20	1007.48
10/19/2021	12:26:51 PM	0	9.312	5.4	10/19/2021	12:33:24 PM	0	894.039	8.375	0.20	26.20	1007.48
10/19/2021	1:26:51 PM	0	9.309	5.4	10/19/2021	1:33:24 PM	0	893.351	9.88	0.20	26.20	1007.48
10/19/2021	2:26:51 PM	0	9.307	5.4	10/19/2021	2:33:24 PM	0	892.784	11.741	0.20	26.19	1007.49
10/19/2021	3:26:51 PM	0	9.306	5.4	10/19/2021	3:33:24 PM	0	892.137	10.647	0.21	26.19	1007.49
10/19/2021	4:26:51 PM	0	9.303	5.4	10/19/2021	4:33:24 PM	0	891.536	10.223	0.21	26.18	1007.50
10/19/2021	5:26:51 PM	0	9.299	5.4	10/19/2021	5:33:24 PM	0	890.979	9.512	0.21	26.18	1007.50
10/19/2021	6:26:51 PM	0	9.297	5.4	10/19/2021	6:33:24 PM	0	891.174	9.14	0.21	26.19	1007.49
10/19/2021	7:26:51 PM	0	9.29	5.4	10/19/2021	7:33:24 PM	0	890.856	8.479	0.21	26.19	1007.49
10/19/2021	8:26:51 PM	0	9.277	5.4	10/19/2021	8:33:24 PM	0	890.275	8.221	0.20	26.20	1007.48
10/19/2021	9:26:51 PM	0	9.268	5.4	10/19/2021	9:33:24 PM	0	889.855	7.861	0.19	26.20	1007.48
10/19/2021	10:26:51 PM	0	9.264	5.4	10/19/2021	10:33:24 PM	0	889.808	7.581	0.19	26.20	1007.47
10/19/2021	11:26:51 PM	0	9.259	5.4	10/19/2021	11:33:24 PM	0	889.62	7.322	0.19	26.21	1007.47
10/20/2021	12:26:51 AM	0	9.258	5.4	10/20/2021	12:33:24 AM	0	889.487	7.625	0.19	26.21	1007.47
10/20/2021	1:26:51 AM	0	9.259	5.4	10/20/2021	1:33:24 AM	0	889.237	8.431	0.19	26.20	1007.48
10/20/2021	2:26:51 AM	0	9.262	5.4	10/20/2021	2:33:24 AM	0	888.913	7.715	0.20	26.20	1007.48
10/20/2021	3:26:51 AM	0	9.267	5.4	10/20/2021	3:33:24 AM	0	888.614	7.277	0.21	26.19	1007.49
10/20/2021	4:26:51 AM	0	9.27	5.4	10/20/2021	4:33:24 AM	0	888.416	7.719	0.21	26.18	1007.49
10/20/2021	5:26:51 AM	0	9.27	5.4	10/20/2021	5:33:24 AM	0	887.922	7.36	0.22	26.18	1007.50
10/20/2021	6:26:51 AM	0	9.265	5.4	10/20/2021	6:33:24 AM	0	887.328	6.588	0.22	26.18	1007.50
10/20/2021	7:26:51 AM	0	9.262	5.4	10/20/2021	7:33:24 AM	0	887.15	6.269	0.22	26.18	1007.50
10/20/2021	8:26:51 AM	0	9.257	5.4	10/20/2021	8:33:24 AM	0	887.086	7.125	0.21	26.18	1007.50
10/20/2021	9:26:51 AM	0	9.251	5.4	10/20/2021	9:33:24 AM	0	887.192	8.453	0.20	26.19	1007.49
10/20/2021	10:26:51 AM	0	9.245	5.4	10/20/2021	10:33:24 AM	0	887.127	9.275	0.20	26.20	1007.48
10/20/2021	11:26:51 AM	0	9.242	5.4	10/20/2021	11:33:24 AM	0	887.174	10.73	0.20	26.20	1007.48
10/20/2021	12:26:51 PM	0	9.242	5.4	10/20/2021	12:33:24 PM	0	887.65	11.808	0.19	26.20	1007.47
10/20/2021	1:26:51 PM	0	9.248	5.4	10/20/2021	1:33:24 PM	0	888.681	11.604	0.19	26.21	1007.47
10/20/2021	2:26:51 PM	0	9.257	5.4	10/20/2021	2:33:24 PM	0	889.614	8.4	0.19	26.21	1007.47
10/20/2021	3:26:51 PM	0	9.262	5.4	10/20/2021	3:33:24 PM	0	889.9	7.058	0.19	26.21	1007.47
10/20/2021	4:26:51 PM	0	9.265	5.4	10/20/2021	4:33:24 PM	0	890.301	6.82	0.19	26.21	1007.47
10/20/2021	5:26:51 PM	0	9.268	5.4	10/20/2021	5:33:24 PM	0	890.764	6.625	0.18	26.21	1007.47
10/20/2021	6:26:51 PM	0	9.273	5.4	10/20/2021	6:33:24 PM	0	891.643	6.848	0.18	26.21	1007.46
10/20/2021	7:26:51 PM	0	9.271	5.4	10/20/2021	7:33:24 PM	0	892.073	6.603	0.17	26.22	1007.46
10/20/2021	8:26:51 PM	0	9.27	5.4	10/20/2021	8:33:24 PM	0	892.754	6.274	0.17	26.23	1007.45
10/20/2021	9:26:51 PM	0	9.271	5.4	10/20/2021	9:33:24 PM	0	893.68	6.143	0.16	26.24	1007.44
10/20/2021	10:26:51 PM	0	9.271	5.4	10/20/2021	10:33:24 PM	0	894.378	6.17	0.15	26.24	1007.44
10/20/2021	11:26:51 PM	0	9.271	5.4	10/20/2021	11:33:24 PM	0	894.739	6.218	0.15	26.25	1007.43
10/21/2021	12:26:51 AM	0	9.284	5.4	10/21/2021	12:33:24 AM	0	896.121	5.28	0.15	26.25	1007.43
10/21/2021	1:26:51 AM	0	9.288	5.4	10/21/2021	1:33:24 AM	0	896.396	4.452	0.15	26.25	1007.43
10/21/2021	2:26:51 AM	0	9.296	5.4	10/21/2021	2:33:24 AM	0	896.431	4.244	0.15	26.24	1007.44
10/21/2021	3:26:51 AM	0	9.303	5.4	10/21/2021	3:33:24 AM	0	896.152	3.906	0.16	26.23	1007.45
10/21/2021	4:26:51 AM	0	9.309	5.4	10/21/2021	4:33:24 AM	0	896.001	3.77	0.17	26.22	1007.46
10/21/2021	5:26:51 AM	0	9.313	5.4	10/21/2021	5:33:24 AM	0	895.802	3.63	0.18	26.22	1007.46
10/21/2021	6:26:51 AM	0	9.316	5.4	10/21/2021	6:33:24 AM	0	895.948	3.529	0.18	26.21	1007.46
10/21/2021	7:26:51 AM	0	9.315	5.4	10/21/2021	7:33:24 AM	0	895.465	3.3	0.18	26.21	1007.47
10/21/2021	8:26:51 AM	0	9.315	5.4	10/21/2021	8:33:24 AM	0	895.706	3.265	0.18	26.21	1007.47
10/21/2021	9:26:51 AM	0	9.309	5.4	10/21/2021	9:33:24 AM	0	895.722	5.6	0.18	26.22	1007.46
10/21/2021	10:26:51 AM	0	9.307	5.4	10/21/2021	10:33:24 AM	0	896.282	8.205	0.17	26.23	1007.45
10/21/2021	11:26:51 AM	0	9.302	5.4	10/21/2021	11:33:24 AM	0	895.608	8.2	0.17	26.23	1007.45
10/21/2021	12:26:51 PM	0	9.291	5.4	10/21/2021	12:33:24 PM	0	894.407	9.575	0.17	26.22	1007.45

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/21/2021	1:26:51 PM	0	9.288	5.4	10/21/2021	1:33:24 PM	0	893.846	11.295	0.17	26.22	1007.46
10/21/2021	2:26:51 PM	0	9.288	5.4	10/21/2021	2:33:24 PM	0	893.669	10.402	0.18	26.22	1007.46
10/21/2021	3:26:51 PM	0	9.277	5.4	10/21/2021	3:33:24 PM	0	892.028	10.374	0.18	26.21	1007.47
10/21/2021	4:26:51 PM	0	9.274	5.4	10/21/2021	4:33:24 PM	0	891.686	9.544	0.18	26.21	1007.47
10/21/2021	5:26:51 PM	0	9.27	5.4	10/21/2021	5:33:24 PM	0	891	8.743	0.18	26.21	1007.47
10/21/2021	6:26:51 PM	0	9.265	5.4	10/21/2021	6:33:24 PM	0	890.541	7.788	0.18	26.21	1007.47
10/21/2021	7:26:51 PM	0	9.254	5.4	10/21/2021	7:33:24 PM	0	889.469	7.667	0.18	26.21	1007.47
10/21/2021	8:26:51 PM	0	9.242	5.4	10/21/2021	8:33:24 PM	0	888.612	7.547	0.18	26.21	1007.46
10/21/2021	9:26:51 PM	0	9.231	5.4	10/21/2021	9:33:24 PM	0	888.173	7.821	0.17	26.22	1007.46
10/21/2021	10:26:51 PM	0	9.222	5.4	10/21/2021	10:33:24 PM	0	887.755	7.924	0.17	26.23	1007.45
10/21/2021	11:26:51 PM	0	9.217	5.4	10/21/2021	11:33:24 PM	0	887.87	8.099	0.16	26.23	1007.45
10/22/2021	12:26:51 AM	0	9.213	5.4	10/22/2021	12:33:24 AM	0	887.554	8.179	0.16	26.23	1007.45
10/22/2021	1:26:51 AM	0	9.21	5.4	10/22/2021	1:33:24 AM	0	887.153	8.586	0.16	26.23	1007.45
10/22/2021	2:26:51 AM	0	9.214	5.4	10/22/2021	2:33:24 AM	0	887.307	8.412	0.17	26.23	1007.45
10/22/2021	3:26:51 AM	0	9.214	5.4	10/22/2021	3:33:24 AM	0	886.529	8.662	0.17	26.22	1007.46
10/22/2021	4:26:51 AM	0	9.219	5.4	10/22/2021	4:33:24 AM	0	886.243	8.741	0.18	26.21	1007.47
10/22/2021	5:26:51 AM	0	9.223	5.4	10/22/2021	5:33:24 AM	0	886.095	8.786	0.19	26.21	1007.47
10/22/2021	6:26:51 AM	0	9.225	5.4	10/22/2021	6:33:24 AM	0	886.008	8.532	0.19	26.20	1007.47
10/22/2021	7:26:51 AM	0	9.229	5.4	10/22/2021	7:33:24 AM	0	886.397	8.032	0.19	26.20	1007.47
10/22/2021	8:26:51 AM	0	9.231	5.4	10/22/2021	8:33:24 AM	0	886.967	7.532	0.19	26.21	1007.47
10/22/2021	9:26:51 AM	0	9.226	5.4	10/22/2021	9:33:24 AM	0	886.848	8.039	0.18	26.21	1007.47
10/22/2021	10:26:51 AM	0	9.222	5.4	10/22/2021	10:33:24 AM	0	887.005	9.982	0.18	26.22	1007.46
10/22/2021	11:26:51 AM	0	9.216	5.4	10/22/2021	11:33:24 AM	0	886.56	10.869	0.18	26.22	1007.46
10/22/2021	12:26:51 PM	0	9.211	5.4	10/22/2021	12:33:24 PM	0	886.386	11.993	0.17	26.22	1007.46
10/22/2021	1:26:51 PM	0	9.209	5.4	10/22/2021	1:33:24 PM	0	886.071	13.161	0.17	26.22	1007.46
10/22/2021	2:26:51 PM	0	9.209	5.4	10/22/2021	2:33:24 PM	0	885.95	13.885	0.17	26.22	1007.46
10/22/2021	3:26:51 PM	0	9.207	5.4	10/22/2021	3:33:24 PM	0	885.742	13.107	0.17	26.22	1007.46
10/22/2021	4:26:51 PM	0	9.205	5.4	10/22/2021	4:33:24 PM	0	885.606	11.516	0.17	26.22	1007.46
10/22/2021	5:26:51 PM	0	9.203	5.4	10/22/2021	5:33:24 PM	0	885.197	10.205	0.18	26.22	1007.46
10/22/2021	6:26:51 PM	0	9.2	5.4	10/22/2021	6:33:24 PM	0	885.159	7.914	0.17	26.22	1007.46
10/22/2021	7:26:51 PM	0	9.194	5.4	10/22/2021	7:33:24 PM	0	884.778	6.064	0.17	26.22	1007.46
10/22/2021	8:26:51 PM	0	9.188	5.4	10/22/2021	8:33:24 PM	0	884.699	4.671	0.17	26.23	1007.45
10/22/2021	9:26:51 PM	0	9.181	5.4	10/22/2021	9:33:24 PM	0	884.747	5.123	0.16	26.24	1007.44
10/22/2021	10:26:51 PM	0	9.174	5.4	10/22/2021	10:33:24 PM	0	884.646	5.123	0.15	26.24	1007.44
10/22/2021	11:26:51 PM	0	9.169	5.4	10/22/2021	11:33:24 PM	0	884.465	4.86	0.15	26.24	1007.43
10/23/2021	12:26:51 AM	0	9.166	5.4	10/23/2021	12:33:24 AM	0	884.522	4.053	0.15	26.25	1007.43
10/23/2021	1:26:51 AM	0	9.166	5.4	10/23/2021	1:33:24 AM	0	884.377	3.472	0.15	26.25	1007.43
10/23/2021	2:26:51 AM	0	9.168	5.4	10/23/2021	2:33:24 AM	0	884.128	2.982	0.15	26.24	1007.44
10/23/2021	3:26:51 AM	0	9.174	5.4	10/23/2021	3:33:24 AM	0	884.218	2.609	0.16	26.24	1007.44
10/23/2021	4:26:51 AM	0	9.177	5.4	10/23/2021	4:33:24 AM	0	884.044	3.02	0.16	26.23	1007.45
10/23/2021	5:26:51 AM	0	9.184	5.4	10/23/2021	5:33:24 AM	0	884.121	2.852	0.17	26.23	1007.45
10/23/2021	6:26:51 AM	0	9.188	5.4	10/23/2021	6:33:24 AM	0	883.928	2.675	0.17	26.22	1007.46
10/23/2021	7:26:51 AM	0	9.189	5.4	10/23/2021	7:33:24 AM	0	883.686	3.119	0.18	26.22	1007.46
10/23/2021	8:26:51 AM	0	9.189	5.4	10/23/2021	8:33:24 AM	0	883.81	3.445	0.18	26.22	1007.46
10/23/2021	9:26:51 AM	0	9.186	5.4	10/23/2021	9:33:24 AM	0	883.581	4.073	0.18	26.22	1007.46
10/23/2021	10:26:51 AM	0	9.181	5.4	10/23/2021	10:33:24 AM	0	883.587	7.022	0.17	26.22	1007.46
10/23/2021	11:26:51 AM	0	9.178	5.4	10/23/2021	11:33:24 AM	0	883.363	6.738	0.17	26.22	1007.45
10/23/2021	12:26:51 PM	0	9.174	5.4	10/23/2021	12:33:24 PM	0	883.134	7.648	0.17	26.23	1007.45
10/23/2021	1:26:51 PM	0	9.171	5.4	10/23/2021	1:33:24 PM	0	882.98	9.173	0.17	26.23	1007.45
10/23/2021	2:26:51 PM	0	9.168	5.4	10/23/2021	2:33:24 PM	0	882.683	10.699	0.17	26.23	1007.45
10/23/2021	3:26:51 PM	0	9.168	5.4	10/23/2021	3:33:24 PM	0	882.6	9.321	0.17	26.23	1007.45
10/23/2021	4:26:51 PM	0	9.169	5.4	10/23/2021	4:33:24 PM	0	882.952	8.46	0.17	26.23	1007.45
10/23/2021	5:26:51 PM	0	9.168	5.4	10/23/2021	5:33:24 PM	0	882.799	6.476	0.17	26.23	1007.45
10/23/2021	6:26:51 PM	0	9.166	5.4	10/23/2021	6:33:24 PM	0	882.716	5.405	0.16	26.23	1007.45
10/23/2021	7:26:51 PM	0	9.164	5.4	10/23/2021	7:33:24 PM	0	882.82	4.45	0.16	26.23	1007.45
10/23/2021	8:26:51 PM	0	9.161	5.4	10/23/2021	8:33:24 PM	0	883.132	5.133	0.16	26.24	1007.44
10/23/2021	9:26:51 PM	0	9.153	5.4	10/23/2021	9:33:24 PM	0	883.084	5.398	0.15	26.25	1007.43
10/23/2021	10:26:51 PM	0	9.147	5.4	10/23/2021	10:33:24 PM	0	882.952	4.529	0.14	26.25	1007.43
10/23/2021	11:26:51 PM	0	9.141	5.4	10/23/2021	11:33:24 PM	0	882.658	3.898	0.14	26.25	1007.42
10/24/2021	12:26:51 AM	0	9.138	5.4	10/24/2021	12:33:24 AM	0	882.525	3.513	0.14	26.26	1007.42
10/24/2021	1:26:51 AM	0	9.136	5.4	10/24/2021	1:33:24 AM	0	882.41	2.815	0.14	26.26	1007.42
10/24/2021	2:26:51 AM	0	9.135	5.4	10/24/2021	2:33:24 AM	0	882.05	2.714	0.14	26.25	1007.42
10/24/2021	3:26:51 AM	0	9.133	5.4	10/24/2021	3:33:24 AM	0	881.27	2.806	0.15	26.25	1007.43
10/24/2021	4:26:51 AM	0	9.135	5.4	10/24/2021	4:33:24 AM	0	880.591	2.608	0.16	26.24	1007.44
10/24/2021	5:26:51 AM	0	9.136	5.4	10/24/2021	5:33:24 AM	0	880.043	2.253	0.16	26.23	1007.45
10/24/2021	6:26:51 AM	0	9.136	5.4	10/24/2021	6:33:24 AM	0	879.273	2.17	0.17	26.22	1007.45
10/24/2021	7:26:51 AM	0	9.136	5.4	10/24/2021	7:33:24 AM	0	879.006	2.94	0.17	26.22	1007.46
10/24/2021	8:26:51 AM	0	9.13	5.4	10/24/2021	8:33:24 AM	0	877.928	4.031	0.18	26.22	1007.46
10/24/2021	9:26:51 AM	0	9.127	5.4	10/24/2021	9:33:24 AM	0	877.572	5.497	0.18	26.22	1007.46
10/24/2021	10:26:51 AM	0	9.118	5.4	10/24/2021	10:33:24 AM	0	876.734	7.836	0.18	26.22	1007.46
10/24/2021	11:26:51 AM	0	9.114	5.4	10/24/2021	11:33:24 AM	0	876.426	8.813	0.18	26.22	1007.46
10/24/2021	12:26:51 PM	0	9.104	5.4	10/24/2021	12:33:24 PM	0	875.236	8.931	0.18	26.22	1007.46

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/24/2021	1:26:51 PM	0	9.093	5.4	10/24/2021	1:33:24 PM	0	873.979	9.455	0.18	26.21	1007.47
10/24/2021	2:26:51 PM	0	9.084	5.4	10/24/2021	2:33:24 PM	0	872.971	8.831	0.18	26.21	1007.47
10/24/2021	3:26:51 PM	0	9.078	5.4	10/24/2021	3:33:24 PM	0	872.227	8.852	0.18	26.21	1007.47
10/24/2021	4:26:51 PM	0	9.072	5.4	10/24/2021	4:33:24 PM	0	871.755	8.44	0.18	26.21	1007.47
10/24/2021	5:26:51 PM	0	9.068	5.4	10/24/2021	5:33:24 PM	0	871.434	7.703	0.18	26.21	1007.47
10/24/2021	6:26:51 PM	0	9.066	5.4	10/24/2021	6:33:24 PM	0	871.682	6.901	0.18	26.22	1007.46
10/24/2021	7:26:51 PM	0	9.063	5.4	10/24/2021	7:33:24 PM	0	871.68	5.749	0.17	26.22	1007.46
10/24/2021	8:26:51 PM	0	9.059	5.4	10/24/2021	8:33:24 PM	0	871.907	5.548	0.17	26.23	1007.45
10/24/2021	9:26:51 PM	0	9.054	5.4	10/24/2021	9:33:24 PM	0	872.021	4.294	0.16	26.23	1007.45
10/24/2021	10:26:51 PM	0	9.042	5.4	10/24/2021	10:33:24 PM	0	871.054	3.946	0.16	26.24	1007.44
10/24/2021	11:26:51 PM	0	9.039	5.4	10/24/2021	11:33:24 PM	0	871.816	4.326	0.15	26.25	1007.43
10/25/2021	12:26:51 AM	0	9.04	5.4	10/25/2021	12:33:24 AM	0	872.6	4.196	0.14	26.25	1007.43
10/25/2021	1:26:51 AM	0	9.039	5.4	10/25/2021	1:33:24 AM	0	872.921	3.38	0.14	26.26	1007.42
10/25/2021	2:26:51 AM	0	9.039	5.4	10/25/2021	2:33:24 AM	0	872.944	2.845	0.14	26.26	1007.42
10/25/2021	3:26:51 AM	0	9.042	5.4	10/25/2021	3:33:24 AM	0	873.039	2.637	0.14	26.26	1007.42
10/25/2021	4:26:51 AM	0	9.048	5.4	10/25/2021	4:33:24 AM	0	873.345	2.586	0.14	26.25	1007.43
10/25/2021	5:26:51 AM	0	9.051	5.4	10/25/2021	5:33:24 AM	0	873.261	2.616	0.15	26.25	1007.43
10/25/2021	6:26:51 AM	0	9.059	5.4	10/25/2021	6:33:24 AM	0	873.383	2.361	0.15	26.24	1007.44
10/25/2021	7:26:51 AM	0	9.065	5.4	10/25/2021	7:33:24 AM	0	873.799	2.556	0.15	26.24	1007.44
10/25/2021	8:26:51 AM	0	9.07	5.4	10/25/2021	8:33:24 AM	0	874.174	2.733	0.16	26.24	1007.44
10/25/2021	9:26:51 AM	0	9.073	5.4	10/25/2021	9:33:24 AM	0	874.587	3.965	0.15	26.24	1007.44
10/25/2021	10:26:51 AM	0	9.075	5.4	10/25/2021	10:33:24 AM	0	874.81	5.168	0.15	26.24	1007.44
10/25/2021	11:26:51 AM	0	9.072	5.4	10/25/2021	11:33:24 AM	0	874.685	6.366	0.15	26.24	1007.44
10/25/2021	12:26:51 PM	0	9.07	5.4	10/25/2021	12:33:24 PM	0	874.54	7.793	0.15	26.24	1007.44
10/25/2021	1:26:51 PM	0	9.07	5.4	10/25/2021	1:33:24 PM	0	874.767	8.458	0.15	26.24	1007.43
10/25/2021	2:26:51 PM	0	9.07	5.4	10/25/2021	2:33:24 PM	0	874.894	8.11	0.15	26.25	1007.43
10/25/2021	3:26:51 PM	0	9.072	5.4	10/25/2021	3:33:24 PM	0	875.155	7.599	0.15	26.25	1007.43
10/25/2021	4:26:51 PM	0	9.072	5.4	10/25/2021	4:33:24 PM	0	875.273	6.895	0.15	26.25	1007.43
10/25/2021	5:26:51 PM	0	9.072	5.4	10/25/2021	5:33:24 PM	0	875.426	6.41	0.15	26.25	1007.43
10/25/2021	6:26:51 PM	0	9.073	5.4	10/25/2021	6:33:24 PM	0	875.711	6.048	0.14	26.25	1007.43
10/25/2021	7:26:51 PM	0	9.07	5.4	10/25/2021	7:33:24 PM	0	875.648	5.833	0.14	26.25	1007.43
10/25/2021	8:26:51 PM	0	9.068	5.4	10/25/2021	8:33:24 PM	0	875.865	5.632	0.14	26.26	1007.42
10/25/2021	9:26:51 PM	0	9.065	5.4	10/25/2021	9:33:24 PM	0	876.092	5.598	0.13	26.26	1007.42
10/25/2021	10:26:51 PM	0	9.063	5.4	10/25/2021	10:33:24 PM	0	876.277	5.683	0.13	26.27	1007.41
10/25/2021	11:26:51 PM	0	9.06	5.4	10/25/2021	11:33:24 PM	0	876.69	5.746	0.12	26.27	1007.40
10/26/2021	12:26:51 AM	0	9.062	5.4	10/26/2021	12:33:24 AM	0	877.31	4.531	0.12	26.28	1007.40
10/26/2021	1:26:51 AM	0	9.062	5.4	10/26/2021	1:33:24 AM	0	877.6	3.433	0.11	26.28	1007.40
10/26/2021	2:26:51 AM	0	9.065	5.4	10/26/2021	2:33:24 AM	0	878.307	3.502	0.11	26.29	1007.39
10/26/2021	3:26:51 AM	0	9.072	5.4	10/26/2021	3:33:24 AM	0	879.19	4.04	0.11	26.29	1007.39
10/26/2021	4:26:51 AM	0	9.078	5.4	10/26/2021	4:33:24 AM	0	879.83	4.125	0.11	26.29	1007.39
10/26/2021	5:26:51 AM	0	9.087	5.4	10/26/2021	5:33:24 AM	0	880.418	4.024	0.11	26.29	1007.39
10/26/2021	6:26:51 AM	0	9.095	5.4	10/26/2021	6:33:24 AM	0	880.856	3.812	0.11	26.28	1007.40
10/26/2021	7:26:51 AM	0	9.102	5.4	10/26/2021	7:33:24 AM	0	881.257	3.668	0.12	26.28	1007.40
10/26/2021	8:26:51 AM	0	9.11	5.4	10/26/2021	8:33:24 AM	0	881.597	3.896	0.12	26.27	1007.40
10/26/2021	9:26:51 AM	0	9.116	5.4	10/26/2021	9:33:24 AM	0	881.972	4.361	0.12	26.27	1007.41
10/26/2021	10:26:51 AM	0	9.118	5.4	10/26/2021	10:33:24 AM	0	882.164	5.203	0.12	26.27	1007.41
10/26/2021	11:26:51 AM	0	9.12	5.4	10/26/2021	11:33:24 AM	0	882.203	6.254	0.12	26.27	1007.41
10/26/2021	12:26:51 PM	0	9.12	5.4	10/26/2021	12:33:24 PM	0	882.076	7.826	0.13	26.27	1007.41
10/26/2021	1:26:51 PM	0	9.118	5.4	10/26/2021	1:33:24 PM	0	881.796	8.805	0.13	26.27	1007.41
10/26/2021	2:26:51 PM	0	9.113	5.4	10/26/2021	2:33:24 PM	0	880.892	11.413	0.13	26.26	1007.41
10/26/2021	3:26:51 PM	0	9.106	5.4	10/26/2021	3:33:24 PM	0	879.947	9.912	0.13	26.26	1007.42
10/26/2021	4:26:51 PM	0	9.102	5.4	10/26/2021	4:33:24 PM	0	879.134	7.981	0.14	26.26	1007.42
10/26/2021	5:26:51 PM	0	9.101	5.4	10/26/2021	5:33:24 PM	0	879.022	6.377	0.14	26.26	1007.42
10/26/2021	6:26:51 PM	0	9.098	5.4	10/26/2021	6:33:24 PM	0	878.903	5.619	0.14	26.26	1007.42
10/26/2021	7:26:51 PM	0	9.095	5.4	10/26/2021	7:33:24 PM	0	878.778	5.347	0.13	26.26	1007.42
10/26/2021	8:26:51 PM	0	9.095	5.4	10/26/2021	8:33:24 PM	0	879.525	5.468	0.13	26.27	1007.41
10/26/2021	9:26:51 PM	0	9.096	5.4	10/26/2021	9:33:24 PM	0	880.076	5.001	0.12	26.27	1007.41
10/26/2021	10:26:51 PM	0	9.098	5.4	10/26/2021	10:33:24 PM	0	881.126	4.088	0.11	26.28	1007.40
10/26/2021	11:26:51 PM	0	9.098	5.4	10/26/2021	11:33:24 PM	0	881.858	3.491	0.11	26.29	1007.39
10/27/2021	12:26:51 AM	0	9.102	5.4	10/27/2021	12:33:24 AM	0	882.916	3.02	0.10	26.30	1007.38
10/27/2021	1:26:51 AM	0	9.105	5.4	10/27/2021	1:33:24 AM	0	883.901	2.506	0.09	26.30	1007.38
10/27/2021	2:26:51 AM	0	9.113	5.4	10/27/2021	2:33:24 AM	0	885.027	0.874	0.09	26.31	1007.37
10/27/2021	3:26:51 AM	0	9.118	5.4	10/27/2021	3:33:24 AM	0	885.963	0.919	0.08	26.31	1007.37
10/27/2021	4:26:51 AM	0	9.127	5.4	10/27/2021	4:33:24 AM	0	887.148	1.375	0.08	26.31	1007.36
10/27/2021	5:26:51 AM	0	9.135	5.4	10/27/2021	5:33:24 AM	0	888.007	1.287	0.08	26.31	1007.36
10/27/2021	6:26:51 AM	0	9.147	5.4	10/27/2021	6:33:24 AM	0	888.989	1.325	0.08	26.31	1007.37
10/27/2021	7:26:51 AM	0	9.159	5.4	10/27/2021	7:33:24 AM	0	890.104	1.074	0.08	26.31	1007.37
10/27/2021	8:26:51 AM	0	9.171	5.4	10/27/2021	8:33:24 AM	0	891.301	0.851	0.08	26.31	1007.37
10/27/2021	9:26:51 AM	0	9.181	5.4	10/27/2021	9:33:24 AM	0	892.068	1.87	0.08	26.31	1007.37
10/27/2021	10:26:51 AM	0	9.194	5.4	10/27/2021	10:33:24 AM	0	893.324	3.733	0.08	26.31	1007.37
10/27/2021	11:26:51 AM	0	9.201	5.4	10/27/2021	11:33:24 AM	0	894.031	5.984	0.08	26.31	1007.37
10/27/2021	12:26:51 PM	0	9.207	5.4	10/27/2021	12:33:24 PM	0	894.367	6.014	0.09	26.31	1007.37

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/27/2021	1:26:51 PM	0	9.211	5.4	10/27/2021	1:33:24 PM	0	894.93	8.553	0.09	26.31	1007.37
10/27/2021	2:26:51 PM	0	9.216	5.4	10/27/2021	2:33:24 PM	0	895.185	9.079	0.09	26.31	1007.37
10/27/2021	3:26:51 PM	0	9.222	5.4	10/27/2021	3:33:24 PM	0	895.798	7.782	0.09	26.31	1007.37
10/27/2021	4:26:51 PM	0	9.226	5.4	10/27/2021	4:33:24 PM	0	896.482	7.894	0.08	26.31	1007.37
10/27/2021	5:26:51 PM	0	9.231	5.4	10/27/2021	5:33:24 PM	0	897.128	5.225	0.08	26.31	1007.37
10/27/2021	6:26:51 PM	0	9.236	5.4	10/27/2021	6:33:24 PM	0	897.577	1.734	0.08	26.31	1007.37
10/27/2021	7:26:51 PM	0	9.238	5.4	10/27/2021	7:33:24 PM	0	898.094	-0.611	0.08	26.31	1007.36
10/27/2021	8:26:51 PM	0	9.243	5.4	10/27/2021	8:33:24 PM	0	898.703	-1.803	0.08	26.32	1007.36
10/27/2021	9:26:51 PM	0	9.243	5.4	10/27/2021	9:33:24 PM	0	899.104	-1.319	0.07	26.32	1007.36
10/27/2021	10:26:51 PM	0	9.251	5.4	10/27/2021	10:33:24 PM	0	899.251	-1.562	0.08	26.31	1007.37
10/27/2021	11:26:51 PM	0	9.254	5.4	10/27/2021	11:33:24 PM	0	899.434	-1.727	0.08	26.31	1007.37
10/28/2021	12:26:51 AM	0	9.252	5.4	10/28/2021	12:33:24 AM	0	899.406	-0.764	0.08	26.31	1007.36
10/28/2021	1:26:51 AM	0	9.251	5.4	10/28/2021	1:33:24 AM	0	899.155	-1.21	0.08	26.31	1007.37
10/28/2021	2:26:51 AM	0	9.249	5.4	10/28/2021	2:33:24 AM	0	899.106	-1.301	0.08	26.31	1007.36
10/28/2021	3:26:51 AM	0	9.24	5.4	10/28/2021	3:33:24 AM	0	898.302	-0.885	0.08	26.31	1007.36
10/28/2021	4:26:51 AM	0	9.237	5.4	10/28/2021	4:33:24 AM	0	897.842	-1.028	0.08	26.31	1007.37
10/28/2021	5:26:51 AM	0	9.229	5.4	10/28/2021	5:33:24 AM	0	896.893	-1.284	0.08	26.31	1007.37
10/28/2021	6:26:51 AM	0	9.228	5.4	10/28/2021	6:33:24 AM	0	896.666	-1.065	0.08	26.31	1007.37
10/28/2021	7:26:51 AM	0	9.229	5.4	10/28/2021	7:33:24 AM	0	896.461	-0.776	0.09	26.31	1007.37
10/28/2021	8:26:51 AM	0	9.231	5.4	10/28/2021	8:33:24 AM	0	896.486	-0.555	0.09	26.31	1007.37
10/28/2021	9:26:51 AM	0	9.231	5.4	10/28/2021	9:33:24 AM	0	896.02	-0.264	0.09	26.30	1007.38
10/28/2021	10:26:51 AM	0	9.231	5.4	10/28/2021	10:33:24 AM	0	895.547	1.288	0.10	26.30	1007.38
10/28/2021	11:26:51 AM	0	9.229	5.4	10/28/2021	11:33:24 AM	0	894.954	2.384	0.10	26.29	1007.39
10/28/2021	12:26:51 PM	0	9.231	5.4	10/28/2021	12:33:24 PM	0	894.939	2.824	0.11	26.29	1007.39
10/28/2021	1:26:51 PM	0	9.228	5.4	10/28/2021	1:33:24 PM	0	894.201	3.403	0.11	26.29	1007.39
10/28/2021	2:26:51 PM	0	9.228	5.4	10/28/2021	2:33:24 PM	0	894.058	3.431	0.11	26.28	1007.40
10/28/2021	3:26:51 PM	0	9.228	5.4	10/28/2021	3:33:24 PM	0	894.163	3.057	0.11	26.28	1007.39
10/28/2021	4:26:51 PM	0	9.222	5.4	10/28/2021	4:33:24 PM	0	893.508	2.915	0.11	26.28	1007.39
10/28/2021	5:26:51 PM	0	9.219	5.4	10/28/2021	5:33:24 PM	0	893.365	2.419	0.11	26.29	1007.39
10/28/2021	6:26:51 PM	0	9.219	5.4	10/28/2021	6:33:24 PM	0	893.65	1.799	0.11	26.29	1007.39
10/28/2021	7:26:51 PM	0	9.214	5.4	10/28/2021	7:33:24 PM	0	893.674	0.771	0.10	26.29	1007.39
10/28/2021	8:26:51 PM	0	9.214	5.4	10/28/2021	8:33:24 PM	0	893.877	-0.572	0.10	26.30	1007.38
10/28/2021	9:26:51 PM	0	9.213	5.4	10/28/2021	9:33:24 PM	0	893.97	-0.615	0.10	26.30	1007.38
10/28/2021	10:26:51 PM	0	9.21	5.4	10/28/2021	10:33:24 PM	0	894.06	-0.634	0.09	26.30	1007.38
10/28/2021	11:26:51 PM	0	9.209	5.4	10/28/2021	11:33:24 PM	0	894.029	-0.904	0.09	26.30	1007.38
10/29/2021	12:26:51 AM	0	9.209	5.4	10/29/2021	12:33:24 AM	0	894.22	-1.177	0.09	26.30	1007.37
10/29/2021	1:26:51 AM	0	9.205	5.4	10/29/2021	1:33:24 AM	0	894.121	-0.911	0.09	26.31	1007.37
10/29/2021	2:26:51 AM	0	9.204	5.4	10/29/2021	2:33:24 AM	0	894.38	-0.692	0.08	26.31	1007.37
10/29/2021	3:26:51 AM	0	9.203	5.4	10/29/2021	3:33:24 AM	0	894.544	-0.684	0.08	26.31	1007.37
10/29/2021	4:26:51 AM	0	9.203	5.4	10/29/2021	4:33:24 AM	0	894.692	-0.637	0.08	26.32	1007.36
10/29/2021	5:26:51 AM	0	9.209	5.4	10/29/2021	5:33:24 AM	0	895.128	-0.805	0.08	26.31	1007.37
10/29/2021	6:26:51 AM	0	9.213	5.4	10/29/2021	6:33:24 AM	0	895.392	-1.739	0.08	26.31	1007.37
10/29/2021	7:26:51 AM	0	9.219	5.4	10/29/2021	7:33:24 AM	0	895.873	-2.821	0.08	26.31	1007.37
10/29/2021	8:26:51 AM	0	9.223	5.4	10/29/2021	8:33:24 AM	0	896.239	-3.631	0.08	26.31	1007.37
10/29/2021	9:26:51 AM	0	9.231	5.4	10/29/2021	9:33:24 AM	0	897.157	-3.009	0.08	26.31	1007.37
10/29/2021	10:26:51 AM	0	9.238	5.4	10/29/2021	10:33:24 AM	0	898.226	-0.666	0.08	26.32	1007.36
10/29/2021	11:26:51 AM	0	9.246	5.4	10/29/2021	11:33:24 AM	0	899.026	-0.529	0.08	26.32	1007.36
10/29/2021	12:26:51 PM	0	9.252	5.4	10/29/2021	12:33:24 PM	0	899.581	-0.532	0.08	26.32	1007.36
10/29/2021	1:26:51 PM	0	9.258	5.4	10/29/2021	1:33:24 PM	0	900.312	0.303	0.08	26.32	1007.36
10/29/2021	2:26:51 PM	0	9.264	5.4	10/29/2021	2:33:24 PM	0	901.129	3.462	0.08	26.32	1007.36
10/29/2021	3:26:51 PM	0	9.273	5.4	10/29/2021	3:33:24 PM	0	901.724	1.67	0.08	26.32	1007.36
10/29/2021	4:26:51 PM	0	9.281	5.4	10/29/2021	4:33:24 PM	0	902.292	0.206	0.08	26.31	1007.36
10/29/2021	5:26:51 PM	0	9.287	5.4	10/29/2021	5:33:24 PM	0	902.822	-0.882	0.08	26.31	1007.36
10/29/2021	6:26:51 PM	0	9.293	5.4	10/29/2021	6:33:24 PM	0	903.411	-0.916	0.08	26.31	1007.36
10/29/2021	7:26:51 PM	0	9.299	5.4	10/29/2021	7:33:24 PM	0	903.79	-2.891	0.08	26.31	1007.37
10/29/2021	8:26:51 PM	0	9.306	5.4	10/29/2021	8:33:24 PM	0	904.212	-4.552	0.09	26.31	1007.37
10/29/2021	9:26:51 PM	0	9.31	5.4	10/29/2021	9:33:24 PM	0	904.559	-5.241	0.09	26.31	1007.37
10/29/2021	10:26:51 PM	0	9.315	5.4	10/29/2021	10:33:24 PM	0	905.005	-5.671	0.09	26.31	1007.37
10/29/2021	11:26:51 PM	0	9.318	5.4	10/29/2021	11:33:24 PM	0	905.244	-6.03	0.09	26.31	1007.37
10/30/2021	12:26:51 AM	0	9.322	5.4	10/30/2021	12:33:24 AM	0	905.534	-6.31	0.09	26.31	1007.37
10/30/2021	1:26:51 AM	0	9.325	5.4	10/30/2021	1:33:24 AM	0	905.803	-6.564	0.09	26.31	1007.37
10/30/2021	2:26:51 AM	0	9.33	5.4	10/30/2021	2:33:24 AM	0	906.227	-6.839	0.09	26.31	1007.37
10/30/2021	3:26:51 AM	0	9.335	5.4	10/30/2021	3:33:24 AM	0	906.648	-6.806	0.09	26.31	1007.37
10/30/2021	4:26:51 AM	0	9.336	5.4	10/30/2021	4:33:24 AM	0	906.805	-7.089	0.09	26.31	1007.37
10/30/2021	5:26:51 AM	0	9.337	5.4	10/30/2021	5:33:24 AM	0	906.873	-7.345	0.09	26.31	1007.37
10/30/2021	6:26:51 AM	0	9.337	5.4	10/30/2021	6:33:24 AM	0	906.957	-7.378	0.09	26.31	1007.37
10/30/2021	7:26:51 AM	0	9.339	5.4	10/30/2021	7:33:24 AM	0	907.005	-7.27	0.09	26.30	1007.37
10/30/2021	8:26:51 AM	0	9.342	5.4	10/30/2021	8:33:24 AM	0	907.427	-7.038	0.09	26.31	1007.37
10/30/2021	9:26:51 AM	0	9.345	5.4	10/30/2021	9:33:24 AM	0	907.917	-5.815	0.09	26.31	1007.37
10/30/2021	10:26:51 AM	0	9.347	5.4	10/30/2021	10:33:24 AM	0	908.77	-1.606	0.08	26.31	1007.36
10/30/2021	11:26:51 AM	0	9.348	5.4	10/30/2021	11:33:24 AM	0	908.904	-1.833	0.08	26.32	1007.36
10/30/2021	12:26:51 PM	0	9.345	5.4	10/30/2021	12:33:24 PM	0	908.465	-2.237	0.08	26.31	1007.37

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/30/2021	1:26:51 PM	0	9.342	5.4	10/30/2021	1:33:24 PM	0	908.355	-0.741	0.08	26.32	1007.36
10/30/2021	2:26:51 PM	0	9.335	5.4	10/30/2021	2:33:24 PM	0	907.685	-0.464	0.08	26.32	1007.36
10/30/2021	3:26:51 PM	0	9.33	5.4	10/30/2021	3:33:24 PM	0	907.272	0.13	0.08	26.32	1007.36
10/30/2021	4:26:51 PM	0	9.329	5.4	10/30/2021	4:33:24 PM	0	906.987	-0.515	0.08	26.31	1007.36
10/30/2021	5:26:51 PM	0	9.325	5.4	10/30/2021	5:33:24 PM	0	906.664	-0.695	0.08	26.32	1007.36
10/30/2021	6:26:51 PM	0	9.324	5.4	10/30/2021	6:33:24 PM	0	906.318	-2.514	0.08	26.31	1007.37
10/30/2021	7:26:51 PM	0	9.324	5.4	10/30/2021	7:33:24 PM	0	906.055	-4.665	0.08	26.31	1007.37
10/30/2021	8:26:51 PM	0	9.322	5.4	10/30/2021	8:33:24 PM	0	905.728	-5.587	0.09	26.31	1007.37
10/30/2021	9:26:51 PM	0	9.324	5.4	10/30/2021	9:33:24 PM	0	905.732	-6.112	0.09	26.31	1007.37
10/30/2021	10:26:51 PM	0	9.322	5.4	10/30/2021	10:33:24 PM	0	905.67	-6.348	0.09	26.31	1007.37
10/30/2021	11:26:51 PM	0	9.321	5.4	10/30/2021	11:33:24 PM	0	905.407	-6.636	0.09	26.31	1007.37
10/31/2021	12:26:51 AM	0	9.319	5.4	10/31/2021	12:33:24 AM	0	905.286	-6.813	0.09	26.31	1007.37
10/31/2021	1:26:51 AM	0	9.318	5.4	10/31/2021	1:33:24 AM	0	905.117	-6.92	0.09	26.31	1007.37
10/31/2021	2:26:51 AM	0	9.316	5.4	10/31/2021	2:33:24 AM	0	904.829	-7.077	0.09	26.31	1007.37
10/31/2021	3:26:51 AM	0	9.313	5.4	10/31/2021	3:33:24 AM	0	904.485	-7.243	0.09	26.30	1007.37
10/31/2021	4:26:51 AM	0	9.309	5.4	10/31/2021	4:33:24 AM	0	904.115	-7.435	0.09	26.31	1007.37
10/31/2021	5:26:51 AM	0	9.307	5.4	10/31/2021	5:33:24 AM	0	903.876	-7.631	0.09	26.30	1007.37
10/31/2021	6:26:51 AM	0	9.306	5.4	10/31/2021	6:33:24 AM	0	903.696	-7.901	0.09	26.30	1007.38
10/31/2021	7:26:51 AM	0	9.304	5.4	10/31/2021	7:33:24 AM	0	903.51	-8.073	0.09	26.30	1007.37
10/31/2021	8:26:51 AM	0	9.304	5.4	10/31/2021	8:33:24 AM	0	903.555	-8.032	0.09	26.30	1007.37
10/31/2021	9:26:51 AM	0	9.304	5.4	10/31/2021	9:33:24 AM	0	903.779	-6.957	0.09	26.31	1007.37
10/31/2021	10:26:51 AM	0	9.302	5.4	10/31/2021	10:33:24 AM	0	904.232	-2.832	0.08	26.31	1007.37
10/31/2021	11:26:51 AM	0	9.3	5.4	10/31/2021	11:33:24 AM	0	904.151	-2.216	0.08	26.31	1007.36
10/31/2021	12:26:51 PM	0	9.294	5.4	10/31/2021	12:33:24 PM	0	903.595	-2.218	0.08	26.31	1007.36
10/31/2021	1:26:51 PM	0	9.287	5.4	10/31/2021	1:33:24 PM	0	903.01	-0.797	0.08	26.32	1007.36
10/31/2021	2:26:51 PM	0	9.282	5.4	10/31/2021	2:33:24 PM	0	902.586	-0.561	0.08	26.32	1007.36
10/31/2021	3:26:51 PM	0	9.277	5.4	10/31/2021	3:33:24 PM	0	902.216	0.312	0.08	26.32	1007.36
10/31/2021	4:26:51 PM	0	9.273	5.4	10/31/2021	4:33:24 PM	0	901.713	-0.351	0.08	26.32	1007.36
10/31/2021	5:26:51 PM	0	9.273	5.4	10/31/2021	5:33:24 PM	0	901.576	-0.652	0.08	26.32	1007.36
10/31/2021	6:26:51 PM	0	9.271	5.4	10/31/2021	6:33:24 PM	0	901.191	-2.638	0.08	26.31	1007.37
10/31/2021	7:26:51 PM	0	9.268	5.4	10/31/2021	7:33:24 PM	0	900.565	-4.769	0.08	26.31	1007.37
10/31/2021	8:26:51 PM	0	9.267	5.4	10/31/2021	8:33:24 PM	0	900.358	-5.633	0.09	26.31	1007.37
10/31/2021	9:26:51 PM	0	9.267	5.4	10/31/2021	9:33:24 PM	0	900.19	-6.131	0.09	26.31	1007.37
10/31/2021	10:26:51 PM	0	9.267	5.4	10/31/2021	10:33:24 PM	0	900.134	-6.508	0.09	26.31	1007.37
10/31/2021	11:26:51 PM	0	9.265	5.4	10/31/2021	11:33:24 PM	0	899.987	-6.73	0.09	26.31	1007.37
11/1/2021	12:26:51 AM	0	9.262	5.4	11/1/2021	12:33:24 AM	0	899.675	-6.874	0.09	26.31	1007.37
11/1/2021	1:26:51 AM	0	9.259	5.4	11/1/2021	1:33:24 AM	0	899.343	-7.263	0.09	26.31	1007.37
11/1/2021	2:26:51 AM	0	9.258	5.4	11/1/2021	2:33:24 AM	0	899.244	-7.209	0.09	26.31	1007.37
11/1/2021	3:26:51 AM	0	9.258	5.4	11/1/2021	3:33:24 AM	0	899.161	-7.262	0.09	26.31	1007.37
11/1/2021	4:26:51 AM	0	9.254	5.4	11/1/2021	4:33:24 AM	0	898.679	-7.392	0.09	26.30	1007.37
11/1/2021	5:26:51 AM	0	9.251	5.4	11/1/2021	5:33:24 AM	0	898.423	-7.473	0.09	26.31	1007.37
11/1/2021	6:26:51 AM	0	9.248	5.4	11/1/2021	6:33:24 AM	0	898.076	-7.688	0.09	26.30	1007.37
11/1/2021	7:26:51 AM	0	9.246	5.4	11/1/2021	7:33:24 AM	0	897.868	-7.815	0.09	26.30	1007.37
11/1/2021	8:26:51 AM	0	9.246	5.4	11/1/2021	8:33:24 AM	0	897.901	-7.466	0.09	26.30	1007.37
11/1/2021	9:26:51 AM	0	9.242	5.4	11/1/2021	9:33:24 AM	0	897.79	-6.346	0.09	26.31	1007.37
11/1/2021	10:26:51 AM	0	9.236	5.4	11/1/2021	10:33:24 AM	0	897.786	-2.9	0.08	26.31	1007.37
11/1/2021	11:26:51 AM	0	9.232	5.4	11/1/2021	11:33:24 AM	0	897.631	-1.665	0.08	26.32	1007.36
11/1/2021	12:26:51 PM	0	9.225	5.4	11/1/2021	12:33:24 PM	0	896.947	-1.138	0.08	26.32	1007.36
11/1/2021	1:26:51 PM	0	9.219	5.4	11/1/2021	1:33:24 PM	0	896.367	-0.489	0.08	26.32	1007.36
11/1/2021	2:26:51 PM	0	9.21	5.4	11/1/2021	2:33:24 PM	0	895.65	1.618	0.08	26.32	1007.36
11/1/2021	3:26:51 PM	0	9.205	5.4	11/1/2021	3:33:24 PM	0	895.326	3.483	0.08	26.32	1007.36
11/1/2021	4:26:51 PM	0	9.203	5.4	11/1/2021	4:33:24 PM	0	895.089	3.431	0.08	26.32	1007.36
11/1/2021	5:26:51 PM	0	9.198	5.4	11/1/2021	5:33:24 PM	0	894.608	2.815	0.08	26.32	1007.36
11/1/2021	6:26:51 PM	0	9.197	5.4	11/1/2021	6:33:24 PM	0	894.515	2.914	0.08	26.32	1007.36
11/1/2021	7:26:51 PM	0	9.198	5.4	11/1/2021	7:33:24 PM	0	894.559	2.635	0.08	26.32	1007.36
11/1/2021	8:26:51 PM	0	9.198	5.4	11/1/2021	8:33:24 PM	0	894.523	2.677	0.08	26.32	1007.36
11/1/2021	9:26:51 PM	0	9.203	5.4	11/1/2021	9:33:24 PM	0	894.945	2.351	0.08	26.32	1007.36
11/1/2021	10:26:51 PM	0	9.209	5.4	11/1/2021	10:33:24 PM	0	895.394	2.202	0.08	26.32	1007.36
11/1/2021	11:26:51 PM	0	9.214	5.4	11/1/2021	11:33:24 PM	0	896.169	2.849	0.08	26.32	1007.36
11/2/2021	12:26:51 AM	0	9.223	5.4	11/2/2021	12:33:24 AM	0	897.064	3.285	0.08	26.32	1007.36
11/2/2021	1:26:51 AM	0	9.231	5.4	11/2/2021	1:33:24 AM	0	897.82	3.828	0.08	26.32	1007.36
11/2/2021	2:26:51 AM	0	9.237	5.4	11/2/2021	2:33:24 AM	0	898.252	2.46	0.08	26.32	1007.36
11/2/2021	3:26:51 AM	0	9.242	5.4	11/2/2021	3:33:24 AM	0	898.565	1.625	0.08	26.32	1007.36
11/2/2021	4:26:51 AM	0	9.246	5.4	11/2/2021	4:33:24 AM	0	898.972	1.492	0.08	26.32	1007.36
11/2/2021	5:26:51 AM	0	9.251	5.4	11/2/2021	5:33:24 AM	0	899.394	1.305	0.08	26.32	1007.36
11/2/2021	6:26:51 AM	0	9.254	5.4	11/2/2021	6:33:24 AM	0	899.624	0.849	0.08	26.31	1007.36
11/2/2021	7:26:51 AM	0	9.255	5.4	11/2/2021	7:33:24 AM	0	899.878	0.502	0.08	26.32	1007.36
11/2/2021	8:26:51 AM	0	9.259	5.4	11/2/2021	8:33:24 AM	0	900.416	0.894	0.08	26.32	1007.36
11/2/2021	9:26:51 AM	0	9.262	5.4	11/2/2021	9:33:24 AM	0	900.768	1.307	0.08	26.32	1007.36
11/2/2021	10:26:51 AM	0	9.264	5.4	11/2/2021	10:33:24 AM	0	900.984	2.814	0.08	26.32	1007.36
11/2/2021	11:26:51 AM	0	9.262	5.4	11/2/2021	11:33:24 AM	0	901.077	3.941	0.07	26.32	1007.36
11/2/2021	12:26:51 PM	0	9.259	5.4	11/2/2021	12:33:24 PM	0	900.698	5.141	0.07	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/2/2021	1:26:51 PM	0	9.255	5.4	11/2/2021	1:33:24 PM	0	900.311	6.508	0.07	26.32	1007.36
11/2/2021	2:26:51 PM	0	9.254	5.4	11/2/2021	2:33:24 PM	0	899.986	5.844	0.08	26.32	1007.36
11/2/2021	3:26:51 PM	0	9.248	5.4	11/2/2021	3:33:24 PM	0	899.445	5.855	0.08	26.32	1007.36
11/2/2021	4:26:51 PM	0	9.246	5.4	11/2/2021	4:33:24 PM	0	899.278	5.161	0.08	26.32	1007.36
11/2/2021	5:26:51 PM	0	9.24	5.4	11/2/2021	5:33:24 PM	0	898.627	4.131	0.08	26.32	1007.36
11/2/2021	6:26:51 PM	0	9.238	5.4	11/2/2021	6:33:24 PM	0	898.45	3.296	0.08	26.32	1007.36
11/2/2021	7:26:51 PM	0	9.238	5.4	11/2/2021	7:33:24 PM	0	898.372	3.658	0.08	26.32	1007.36
11/2/2021	8:26:51 PM	0	9.238	5.4	11/2/2021	8:33:24 PM	0	898.326	2.38	0.08	26.32	1007.36
11/2/2021	9:26:51 PM	0	9.238	5.4	11/2/2021	9:33:24 PM	0	898.17	1.797	0.08	26.32	1007.36
11/2/2021	10:26:51 PM	0	9.238	5.4	11/2/2021	10:33:24 PM	0	898.217	1.79	0.08	26.32	1007.36
11/2/2021	11:26:51 PM	0	9.236	5.4	11/2/2021	11:33:24 PM	0	897.884	1.593	0.08	26.31	1007.36
11/3/2021	12:26:51 AM	0	9.231	5.4	11/3/2021	12:33:24 AM	0	897.563	1.677	0.08	26.32	1007.36
11/3/2021	1:26:51 AM	0	9.228	5.4	11/3/2021	1:33:24 AM	0	897.328	1.813	0.08	26.32	1007.36
11/3/2021	2:26:51 AM	0	9.226	5.4	11/3/2021	2:33:24 AM	0	897.031	1.923	0.08	26.32	1007.36
11/3/2021	3:26:51 AM	0	9.225	5.4	11/3/2021	3:33:24 AM	0	897.022	2.089	0.08	26.32	1007.36
11/3/2021	4:26:51 AM	0	9.226	5.4	11/3/2021	4:33:24 AM	0	897.188	2.241	0.08	26.32	1007.36
11/3/2021	5:26:51 AM	0	9.22	5.4	11/3/2021	5:33:24 AM	0	896.675	2.466	0.08	26.32	1007.36
11/3/2021	6:26:51 AM	0	9.223	5.4	11/3/2021	6:33:24 AM	0	896.86	2.586	0.08	26.32	1007.36
11/3/2021	7:26:51 AM	0	9.222	5.4	11/3/2021	7:33:24 AM	0	896.689	2.502	0.08	26.32	1007.36
11/3/2021	8:26:51 AM	0	9.223	5.4	11/3/2021	8:33:24 AM	0	896.909	2.209	0.08	26.32	1007.36
11/3/2021	9:26:51 AM	0	9.226	5.4	11/3/2021	9:33:24 AM	0	897.154	2.52	0.08	26.32	1007.36
11/3/2021	10:26:51 AM	0	9.226	5.4	11/3/2021	10:33:24 AM	0	897.361	3.029	0.08	26.32	1007.36
11/3/2021	11:26:51 AM	0	9.223	5.4	11/3/2021	11:33:24 AM	0	896.927	3.556	0.08	26.32	1007.36
11/3/2021	12:26:51 PM	0	9.22	5.4	11/3/2021	12:33:24 PM	0	896.789	3.832	0.08	26.32	1007.36
11/3/2021	1:26:51 PM	0	9.217	5.4	11/3/2021	1:33:24 PM	0	896.416	4.189	0.08	26.32	1007.36
11/3/2021	2:26:51 PM	0	9.219	5.4	11/3/2021	2:33:24 PM	0	896.658	4.598	0.08	26.32	1007.36
11/3/2021	3:26:51 PM	0	9.214	5.4	11/3/2021	3:33:24 PM	0	896.275	4.293	0.07	26.32	1007.36
11/3/2021	4:26:51 PM	0	9.209	5.4	11/3/2021	4:33:24 PM	0	895.485	3.763	0.08	26.32	1007.36
11/3/2021	5:26:51 PM	0	9.203	5.4	11/3/2021	5:33:24 PM	0	894.898	3.537	0.08	26.32	1007.36
11/3/2021	6:26:51 PM	0	9.194	5.4	11/3/2021	6:33:24 PM	0	894.039	3.279	0.08	26.32	1007.36
11/3/2021	7:26:51 PM	0	9.188	5.4	11/3/2021	7:33:24 PM	0	893.356	3.119	0.08	26.32	1007.36
11/3/2021	8:26:51 PM	0	9.18	5.4	11/3/2021	8:33:24 PM	0	892.584	3.016	0.08	26.32	1007.36
11/3/2021	9:26:51 PM	0	9.169	5.4	11/3/2021	9:33:24 PM	0	891.658	3.041	0.08	26.32	1007.36
11/3/2021	10:26:51 PM	0	9.159	5.4	11/3/2021	10:33:24 PM	0	890.563	3.089	0.08	26.32	1007.36
11/3/2021	11:26:51 PM	0	9.147	5.4	11/3/2021	11:33:24 PM	0	889.467	3.111	0.08	26.32	1007.36
11/4/2021	12:26:51 AM	0	9.149	5.4	11/4/2021	12:33:24 AM	0	889.637	3.248	0.08	26.32	1007.36
11/4/2021	1:26:51 AM	0	9.138	5.4	11/4/2021	1:33:24 AM	0	888.54	3.486	0.08	26.32	1007.36
11/4/2021	2:26:51 AM	0	9.121	5.4	11/4/2021	2:33:24 AM	0	886.958	3.638	0.08	26.32	1007.36
11/4/2021	3:26:51 AM	0	9.113	5.4	11/4/2021	3:33:24 AM	0	886.211	3.763	0.08	26.32	1007.36
11/4/2021	4:26:51 AM	0	9.102	5.4	11/4/2021	4:33:24 AM	0	885.136	3.957	0.08	26.32	1007.36
11/4/2021	5:26:51 AM	0	9.091	5.4	11/4/2021	5:33:24 AM	0	884.209	4.256	0.07	26.32	1007.36
11/4/2021	6:26:51 AM	0	9.081	5.4	11/4/2021	6:33:24 AM	0	883.247	4.386	0.07	26.32	1007.36
11/4/2021	7:26:51 AM	0	9.072	5.4	11/4/2021	7:33:24 AM	0	882.24	4.443	0.08	26.32	1007.36
11/4/2021	8:26:51 AM	0	9.069	5.4	11/4/2021	8:33:24 AM	0	882.053	4.49	0.07	26.32	1007.36
11/4/2021	9:26:51 AM	0	9.07	5.4	11/4/2021	9:33:24 AM	0	882.098	4.73	0.08	26.32	1007.36
11/4/2021	10:26:51 AM	0	9.066	5.4	11/4/2021	10:33:24 AM	0	881.887	5.257	0.07	26.32	1007.36
11/4/2021	11:26:51 AM	0	9.065	5.4	11/4/2021	11:33:24 AM	0	881.703	5.852	0.07	26.32	1007.36
11/4/2021	12:26:51 PM	0	9.066	5.4	11/4/2021	12:33:24 PM	0	881.791	6.929	0.07	26.32	1007.36
11/4/2021	1:26:51 PM	0	9.063	5.4	11/4/2021	1:33:24 PM	0	881.575	7.16	0.07	26.32	1007.36
11/4/2021	2:26:51 PM	0	9.065	5.4	11/4/2021	2:33:24 PM	0	881.768	7.13	0.07	26.32	1007.36
11/4/2021	3:26:51 PM	0	9.062	5.4	11/4/2021	3:33:24 PM	0	881.334	6.883	0.07	26.32	1007.36
11/4/2021	4:26:51 PM	0	9.063	5.4	11/4/2021	4:33:24 PM	0	881.563	6.782	0.07	26.32	1007.36
11/4/2021	5:26:51 PM	0	9.068	5.4	11/4/2021	5:33:24 PM	0	881.835	6.185	0.08	26.32	1007.36
11/4/2021	6:26:51 PM	0	9.075	5.4	11/4/2021	6:33:24 PM	0	882.623	6.103	0.07	26.32	1007.36
11/4/2021	7:26:51 PM	0	9.081	5.4	11/4/2021	7:33:24 PM	0	883.171	5.648	0.08	26.32	1007.36
11/4/2021	8:26:51 PM	0	9.087	5.4	11/4/2021	8:33:24 PM	0	883.725	5.415	0.08	26.32	1007.36
11/4/2021	9:26:51 PM	0	9.099	5.4	11/4/2021	9:33:24 PM	0	884.839	5.249	0.08	26.32	1007.36
11/4/2021	10:26:51 PM	0	9.105	5.4	11/4/2021	10:33:24 PM	0	885.463	5.352	0.08	26.32	1007.36
11/4/2021	11:26:51 PM	0	9.114	5.4	11/4/2021	11:33:24 PM	0	886.277	5.076	0.08	26.32	1007.36
11/5/2021	12:26:51 AM	0	9.124	5.4	11/5/2021	12:33:24 AM	0	887.16	3.781	0.08	26.32	1007.36
11/5/2021	1:26:51 AM	0	9.129	5.4	11/5/2021	1:33:24 AM	0	887.625	3.107	0.08	26.32	1007.36
11/5/2021	2:26:51 AM	0	9.133	5.4	11/5/2021	2:33:24 AM	0	888.08	3.154	0.08	26.32	1007.36
11/5/2021	3:26:51 AM	0	9.133	5.4	11/5/2021	3:33:24 AM	0	887.997	2.392	0.08	26.32	1007.36
11/5/2021	4:26:51 AM	0	9.133	5.4	11/5/2021	4:33:24 AM	0	888.034	2.135	0.08	26.32	1007.36
11/5/2021	5:26:51 AM	0	9.136	5.4	11/5/2021	5:33:24 AM	0	888.272	2.136	0.08	26.32	1007.36
11/5/2021	6:26:51 AM	0	9.13	5.4	11/5/2021	6:33:24 AM	0	887.762	1.901	0.08	26.32	1007.36
11/5/2021	7:26:51 AM	0	9.129	5.4	11/5/2021	7:33:24 AM	0	887.564	1.918	0.08	26.32	1007.36
11/5/2021	8:26:51 AM	0	9.129	5.4	11/5/2021	8:33:24 AM	0	887.5	1.991	0.08	26.32	1007.36
11/5/2021	9:26:51 AM	0	9.126	5.4	11/5/2021	9:33:24 AM	0	887.238	2.361	0.08	26.32	1007.36
11/5/2021	10:26:51 AM	0	9.123	5.4	11/5/2021	10:33:24 AM	0	887.08	3.169	0.08	26.32	1007.36
11/5/2021	11:26:51 AM	0	9.12	5.4	11/5/2021	11:33:24 AM	0	886.88	3.769	0.08	26.32	1007.36
11/5/2021	12:26:51 PM	0	9.117	5.4	11/5/2021	12:33:24 PM	0	886.589	4.117	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/5/2021	1:26:51 PM	0	9.114	5.4	11/5/2021	1:33:24 PM	0	886.328	3.928	0.08	26.32	1007.36
11/5/2021	2:26:51 PM	0	9.114	5.4	11/5/2021	2:33:24 PM	0	886.254	3.474	0.08	26.32	1007.36
11/5/2021	3:26:51 PM	0	9.129	5.4	11/5/2021	3:33:24 PM	0	887.645	2.653	0.08	26.32	1007.36
11/5/2021	4:26:51 PM	0	9.141	5.4	11/5/2021	4:33:24 PM	0	888.678	1.064	0.08	26.32	1007.36
11/5/2021	5:26:51 PM	0	9.147	5.4	11/5/2021	5:33:24 PM	0	889.27	0.257	0.08	26.32	1007.36
11/5/2021	6:26:51 PM	0	9.152	5.4	11/5/2021	6:33:24 PM	0	889.479	-1.012	0.08	26.31	1007.37
11/5/2021	7:26:51 PM	0	9.153	5.4	11/5/2021	7:33:24 PM	0	889.709	-0.639	0.08	26.31	1007.36
11/5/2021	8:26:51 PM	0	9.153	5.4	11/5/2021	8:33:24 PM	0	889.696	-0.715	0.08	26.31	1007.36
11/5/2021	9:26:51 PM	0	9.153	5.4	11/5/2021	9:33:24 PM	0	889.717	-0.972	0.08	26.31	1007.36
11/5/2021	10:26:51 PM	0	9.158	5.4	11/5/2021	10:33:24 PM	0	890.21	-0.781	0.08	26.31	1007.36
11/5/2021	11:26:51 PM	0	9.158	5.4	11/5/2021	11:33:24 PM	0	890.179	-0.871	0.08	26.31	1007.36
11/6/2021	12:26:51 AM	0	9.156	5.4	11/6/2021	12:33:24 AM	0	889.984	-1.203	0.08	26.31	1007.36
11/6/2021	1:26:51 AM	0	9.158	5.4	11/6/2021	1:33:24 AM	0	889.984	-1.528	0.08	26.31	1007.37
11/6/2021	2:26:51 AM	0	9.153	5.4	11/6/2021	2:33:24 AM	0	889.479	-2.045	0.08	26.31	1007.37
11/6/2021	3:26:51 AM	0	9.15	5.4	11/6/2021	3:33:24 AM	0	889.275	-1.572	0.08	26.31	1007.37
11/6/2021	4:26:51 AM	0	9.149	5.4	11/6/2021	4:33:24 AM	0	889.101	-1.844	0.08	26.31	1007.37
11/6/2021	5:26:51 AM	0	9.144	5.4	11/6/2021	5:33:24 AM	0	888.767	-1.688	0.08	26.31	1007.37
11/6/2021	6:26:51 AM	0	9.136	5.4	11/6/2021	6:33:24 AM	0	888.171	-1.416	0.08	26.32	1007.36
11/6/2021	7:26:51 AM	0	9.133	5.4	11/6/2021	7:33:24 AM	0	887.804	-1.376	0.08	26.31	1007.36
11/6/2021	8:26:51 AM	0	9.132	5.4	11/6/2021	8:33:24 AM	0	887.424	-1.706	0.08	26.31	1007.37
11/6/2021	9:26:51 AM	0	9.13	5.4	11/6/2021	9:33:24 AM	0	887.403	-1.855	0.08	26.31	1007.37
11/6/2021	10:26:51 AM	0	9.127	5.4	11/6/2021	10:33:24 AM	0	887.283	-1.352	0.08	26.32	1007.36
11/6/2021	11:26:51 AM	0	9.129	5.4	11/6/2021	11:33:24 AM	0	887.512	-0.705	0.08	26.32	1007.36
11/6/2021	12:26:51 PM	0	9.13	5.4	11/6/2021	12:33:24 PM	0	887.561	-0.018	0.08	26.32	1007.36
11/6/2021	1:26:51 PM	0	9.126	5.4	11/6/2021	1:33:24 PM	0	887.468	1.879	0.08	26.32	1007.36
11/6/2021	2:26:51 PM	0	9.126	5.4	11/6/2021	2:33:24 PM	0	887.471	2.906	0.08	26.32	1007.36
11/6/2021	3:26:51 PM	0	9.124	5.4	11/6/2021	3:33:24 PM	0	887.365	2.394	0.08	26.32	1007.36
11/6/2021	4:26:51 PM	0	9.127	5.4	11/6/2021	4:33:24 PM	0	887.449	1.657	0.08	26.32	1007.36
11/6/2021	5:26:51 PM	0	9.126	5.4	11/6/2021	5:33:24 PM	0	887.121	0.63	0.08	26.31	1007.36
11/6/2021	6:26:51 PM	0	9.124	5.4	11/6/2021	6:33:24 PM	0	886.938	-0.269	0.08	26.32	1007.36
11/6/2021	7:26:51 PM	0	9.123	5.4	11/6/2021	7:33:24 PM	0	886.788	-0.573	0.08	26.31	1007.36
11/6/2021	8:26:51 PM	0	9.123	5.4	11/6/2021	8:33:24 PM	0	886.757	-1.248	0.08	26.31	1007.36
11/6/2021	9:26:51 PM	0	9.126	5.4	11/6/2021	9:33:24 PM	0	886.943	-2.475	0.08	26.31	1007.37
11/6/2021	10:26:51 PM	0	9.129	5.4	11/6/2021	10:33:24 PM	0	887.273	-1.172	0.08	26.31	1007.37
11/6/2021	11:26:51 PM	0	9.13	5.4	11/6/2021	11:33:24 PM	0	887.499	-1.086	0.08	26.31	1007.36
11/7/2021	12:26:51 AM	0	9.132	5.4	11/7/2021	12:33:24 AM	0	887.627	-1.451	0.08	26.31	1007.36
11/7/2021	1:26:51 AM	0	9.135	5.4	11/7/2021	1:33:24 AM	0	887.809	-1.797	0.08	26.31	1007.37
11/7/2021	2:26:51 AM	0	9.136	5.4	11/7/2021	2:33:24 AM	0	888.044	-2.007	0.08	26.31	1007.36
11/7/2021	3:26:51 AM	0	9.138	5.4	11/7/2021	3:33:24 AM	0	887.956	-2.518	0.08	26.31	1007.37
11/7/2021	4:26:51 AM	0	9.141	5.4	11/7/2021	4:33:24 AM	0	888.402	-2.011	0.08	26.31	1007.37
11/7/2021	5:26:51 AM	0	9.144	5.4	11/7/2021	5:33:24 AM	0	888.721	-1.823	0.08	26.31	1007.37
11/7/2021	6:26:51 AM	0	9.146	5.4	11/7/2021	6:33:24 AM	0	888.88	-2.038	0.08	26.31	1007.37
11/7/2021	7:26:51 AM	0	9.149	5.4	11/7/2021	7:33:24 AM	0	889.086	-2.639	0.08	26.31	1007.37
11/7/2021	8:26:51 AM	0	9.153	5.4	11/7/2021	8:33:24 AM	0	889.538	-2.654	0.08	26.31	1007.37
11/7/2021	9:26:51 AM	0	9.153	5.4	11/7/2021	9:33:24 AM	0	889.444	-2.912	0.08	26.31	1007.37
11/7/2021	10:26:51 AM	0	9.156	5.4	11/7/2021	10:33:24 AM	0	889.896	-2.055	0.08	26.31	1007.37
11/7/2021	11:26:51 AM	0	9.159	5.4	11/7/2021	11:33:24 AM	0	890.315	-1.135	0.08	26.31	1007.36
11/7/2021	12:26:51 PM	0	9.155	5.4	11/7/2021	12:33:24 PM	0	890.002	-0.615	0.08	26.32	1007.36
11/7/2021	1:26:51 PM	0	9.15	5.4	11/7/2021	1:33:24 PM	0	889.602	-0.231	0.08	26.32	1007.36
11/7/2021	2:26:51 PM	0	9.147	5.4	11/7/2021	2:33:24 PM	0	889.504	1.362	0.08	26.32	1007.36
11/7/2021	3:26:51 PM	0	9.146	5.4	11/7/2021	3:33:24 PM	0	889.312	1.702	0.08	26.32	1007.36
11/7/2021	4:26:51 PM	0	9.141	5.4	11/7/2021	4:33:24 PM	0	888.773	1.067	0.08	26.32	1007.36
11/7/2021	5:26:51 PM	0	9.135	5.4	11/7/2021	5:33:24 PM	0	888.115	0.541	0.08	26.32	1007.36
11/7/2021	6:26:51 PM	0	9.132	5.4	11/7/2021	6:33:24 PM	0	887.747	0.056	0.08	26.32	1007.36
11/7/2021	7:26:51 PM	0	9.132	5.4	11/7/2021	7:33:24 PM	0	887.789	-0.171	0.08	26.32	1007.36
11/7/2021	8:26:51 PM	0	9.13	5.4	11/7/2021	8:33:24 PM	0	887.605	-0.354	0.08	26.32	1007.36
11/7/2021	9:26:51 PM	0	9.135	5.4	11/7/2021	9:33:24 PM	0	887.963	-0.921	0.08	26.31	1007.36
11/7/2021	10:26:51 PM	0	9.144	5.4	11/7/2021	10:33:24 PM	0	888.694	-1.483	0.08	26.31	1007.37
11/7/2021	11:26:51 PM	0	9.153	5.4	11/7/2021	11:33:24 PM	0	889.513	-1.914	0.08	26.31	1007.37
11/8/2021	12:26:51 AM	0	9.159	5.4	11/8/2021	12:33:24 AM	0	890.19	-2.046	0.08	26.31	1007.37
11/8/2021	1:26:51 AM	0	9.166	5.4	11/8/2021	1:33:24 AM	0	890.882	-2.349	0.08	26.31	1007.37
11/8/2021	2:26:51 AM	0	9.172	5.4	11/8/2021	2:33:24 AM	0	891.601	-1.418	0.08	26.31	1007.36
11/8/2021	3:26:51 AM	0	9.18	5.4	11/8/2021	3:33:24 AM	0	892.369	-1.285	0.08	26.31	1007.36
11/8/2021	4:26:51 AM	0	9.186	5.4	11/8/2021	4:33:24 AM	0	892.623	-3.2	0.08	26.31	1007.37
11/8/2021	5:26:51 AM	0	9.192	5.4	11/8/2021	5:33:24 AM	0	893.175	-4.057	0.08	26.31	1007.37
11/8/2021	6:26:51 AM	0	9.2	5.4	11/8/2021	6:33:24 AM	0	893.864	-4.437	0.09	26.31	1007.37
11/8/2021	7:26:51 AM	0	9.201	5.4	11/8/2021	7:33:24 AM	0	893.988	-4.834	0.08	26.31	1007.37
11/8/2021	8:26:51 AM	0	9.203	5.4	11/8/2021	8:33:24 AM	0	894.104	-4.855	0.09	26.31	1007.37
11/8/2021	9:26:51 AM	0	9.205	5.4	11/8/2021	9:33:24 AM	0	894.684	-3.367	0.08	26.31	1007.37
11/8/2021	10:26:51 AM	0	9.209	5.4	11/8/2021	10:33:24 AM	0	895.183	-2.097	0.08	26.31	1007.36
11/8/2021	11:26:51 AM	0	9.207	5.4	11/8/2021	11:33:24 AM	0	895.115	-1.004	0.08	26.32	1007.36
11/8/2021	12:26:51 PM	0	9.203	5.4	11/8/2021	12:33:24 PM	0	894.693	-0.581	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/8/2021	1:26:51 PM	0	9.194	5.4	11/8/2021	1:33:24 PM	0	893.866	-0.298	0.08	26.32	1007.36
11/8/2021	2:26:51 PM	0	9.184	5.4	11/8/2021	2:33:24 PM	0	893.233	1.025	0.08	26.32	1007.36
11/8/2021	3:26:51 PM	0	9.181	5.4	11/8/2021	3:33:24 PM	0	892.861	1.098	0.08	26.32	1007.36
11/8/2021	4:26:51 PM	0	9.172	5.4	11/8/2021	4:33:24 PM	0	891.836	0.629	0.08	26.32	1007.36
11/8/2021	5:26:51 PM	0	9.169	5.4	11/8/2021	5:33:24 PM	0	891.393	0.106	0.08	26.32	1007.36
11/8/2021	6:26:51 PM	0	9.164	5.4	11/8/2021	6:33:24 PM	0	890.978	0.127	0.08	26.32	1007.36
11/8/2021	7:26:51 PM	0	9.155	5.4	11/8/2021	7:33:24 PM	0	889.923	0.322	0.08	26.31	1007.36
11/8/2021	8:26:51 PM	0	9.147	5.4	11/8/2021	8:33:24 PM	0	889.425	0.586	0.08	26.32	1007.36
11/8/2021	9:26:51 PM	0	9.139	5.4	11/8/2021	9:33:24 PM	0	888.651	0.627	0.08	26.32	1007.36
11/8/2021	10:26:51 PM	0	9.13	5.4	11/8/2021	10:33:24 PM	0	887.758	0.308	0.08	26.32	1007.36
11/8/2021	11:26:51 PM	0	9.117	5.4	11/8/2021	11:33:24 PM	0	886.535	0.759	0.08	26.32	1007.36
11/9/2021	12:26:51 AM	0	9.101	5.4	11/9/2021	12:33:24 AM	0	884.972	0.675	0.08	26.32	1007.36
11/9/2021	1:26:51 AM	0	9.088	5.4	11/9/2021	1:33:24 AM	0	883.755	0.696	0.08	26.32	1007.36
11/9/2021	2:26:51 AM	0	9.072	5.4	11/9/2021	2:33:24 AM	0	882.194	0.927	0.08	26.32	1007.36
11/9/2021	3:26:51 AM	0	9.054	5.4	11/9/2021	3:33:24 AM	0	880.32	1.352	0.08	26.32	1007.36
11/9/2021	4:26:51 AM	0	9.04	5.4	11/9/2021	4:33:24 AM	0	879.052	1.871	0.08	26.32	1007.36
11/9/2021	5:26:51 AM	0	9.027	5.4	11/9/2021	5:33:24 AM	0	877.832	2.238	0.08	26.32	1007.36
11/9/2021	6:26:51 AM	0	9.024	5.4	11/9/2021	6:33:24 AM	0	877.764	2.311	0.07	26.32	1007.36
11/9/2021	7:26:51 AM	0	9.02	5.4	11/9/2021	7:33:24 AM	0	876.867	1.55	0.08	26.32	1007.36
11/9/2021	8:26:51 AM	0	9.015	5.4	11/9/2021	8:33:24 AM	0	876.186	0.842	0.08	26.31	1007.36
11/9/2021	9:26:51 AM	0	9.011	5.4	11/9/2021	9:33:24 AM	0	876.073	1	0.08	26.32	1007.36
11/9/2021	10:26:51 AM	0	9.012	5.4	11/9/2021	10:33:24 AM	0	876.285	1.907	0.08	26.32	1007.36
11/9/2021	11:26:51 AM	0	9.027	5.4	11/9/2021	11:33:24 AM	0	877.835	2.384	0.08	26.32	1007.36
11/9/2021	12:26:51 PM	0	9.056	5.4	11/9/2021	12:33:24 PM	0	880.587	2.384	0.08	26.32	1007.36
11/9/2021	1:26:51 PM	0	9.062	5.4	11/9/2021	1:33:24 PM	0	881.06	1.704	0.08	26.32	1007.36
11/9/2021	2:26:51 PM	0	9.069	5.4	11/9/2021	2:33:24 PM	0	881.732	1.468	0.08	26.32	1007.36
11/9/2021	3:26:51 PM	0	9.072	5.4	11/9/2021	3:33:24 PM	0	882.353	2.348	0.07	26.32	1007.36
11/9/2021	4:26:51 PM	0	9.087	5.4	11/9/2021	4:33:24 PM	0	883.757	2.432	0.08	26.32	1007.36
11/9/2021	5:26:51 PM	0	9.098	5.4	11/9/2021	5:33:24 PM	0	884.616	1.864	0.08	26.32	1007.36
11/9/2021	6:26:51 PM	0	9.105	5.4	11/9/2021	6:33:24 PM	0	885.259	1.225	0.08	26.32	1007.36
11/9/2021	7:26:51 PM	0	9.116	5.4	11/9/2021	7:33:24 PM	0	886.225	0.475	0.08	26.32	1007.36
11/9/2021	8:26:51 PM	0	9.126	5.4	11/9/2021	8:33:24 PM	0	887.229	-0.221	0.08	26.32	1007.36
11/9/2021	9:26:51 PM	0	9.138	5.4	11/9/2021	9:33:24 PM	0	888.282	-0.617	0.08	26.31	1007.36
11/9/2021	10:26:51 PM	0	9.147	5.4	11/9/2021	10:33:24 PM	0	889.025	-0.758	0.08	26.31	1007.37
11/9/2021	11:26:51 PM	0	9.159	5.4	11/9/2021	11:33:24 PM	0	890.307	-0.966	0.08	26.31	1007.36
11/10/2021	12:26:51 AM	0	9.169	5.4	11/10/2021	12:33:24 AM	0	891.252	-1.37	0.08	26.31	1007.36
11/10/2021	1:26:51 AM	0	9.178	5.4	11/10/2021	1:33:24 AM	0	892.044	-2.006	0.08	26.31	1007.37
11/10/2021	2:26:51 AM	0	9.189	5.4	11/10/2021	2:33:24 AM	0	893.088	-2.424	0.08	26.31	1007.37
11/10/2021	3:26:51 AM	0	9.198	5.4	11/10/2021	3:33:24 AM	0	894.209	-0.827	0.08	26.32	1007.36
11/10/2021	4:26:51 AM	0	9.207	5.4	11/10/2021	4:33:24 AM	0	894.886	-1.553	0.08	26.31	1007.37
11/10/2021	5:26:51 AM	0	9.216	5.4	11/10/2021	5:33:24 AM	0	895.686	-2.112	0.08	26.31	1007.37
11/10/2021	6:26:51 AM	0	9.223	5.4	11/10/2021	6:33:24 AM	0	896.476	-2.539	0.08	26.31	1007.37
11/10/2021	7:26:51 AM	0	9.231	5.4	11/10/2021	7:33:24 AM	0	897.065	-3.356	0.08	26.31	1007.37
11/10/2021	8:26:51 AM	0	9.238	5.4	11/10/2021	8:33:24 AM	0	897.73	-4.328	0.08	26.31	1007.37
11/10/2021	9:26:51 AM	0	9.248	5.4	11/10/2021	9:33:24 AM	0	898.594	-3.849	0.08	26.31	1007.37
11/10/2021	10:26:51 AM	0	9.252	5.4	11/10/2021	10:33:24 AM	0	899.404	-1.836	0.08	26.31	1007.36
11/10/2021	11:26:51 AM	0	9.258	5.4	11/10/2021	11:33:24 AM	0	900.217	-0.613	0.08	26.32	1007.36
11/10/2021	12:26:51 PM	0	9.259	5.4	11/10/2021	12:33:24 PM	0	900.453	0.564	0.08	26.32	1007.36
11/10/2021	1:26:51 PM	0	9.261	5.4	11/10/2021	1:33:24 PM	0	900.721	2.798	0.08	26.32	1007.36
11/10/2021	2:26:51 PM	0	9.264	5.4	11/10/2021	2:33:24 PM	0	901.019	2.749	0.08	26.32	1007.36
11/10/2021	3:26:51 PM	0	9.267	5.4	11/10/2021	3:33:24 PM	0	901.243	2.314	0.08	26.32	1007.36
11/10/2021	4:26:51 PM	0	9.268	5.4	11/10/2021	4:33:24 PM	0	901.509	2.938	0.08	26.32	1007.36
11/10/2021	5:26:51 PM	0	9.268	5.4	11/10/2021	5:33:24 PM	0	901.211	0.261	0.08	26.32	1007.36
11/10/2021	6:26:51 PM	0	9.27	5.4	11/10/2021	6:33:24 PM	0	900.913	-2.159	0.08	26.31	1007.37
11/10/2021	7:26:51 PM	0	9.267	5.4	11/10/2021	7:33:24 PM	0	900.87	-0.97	0.08	26.31	1007.36
11/10/2021	8:26:51 PM	0	9.264	5.4	11/10/2021	8:33:24 PM	0	900.303	-3.105	0.08	26.31	1007.37
11/10/2021	9:26:51 PM	0	9.264	5.4	11/10/2021	9:33:24 PM	0	900.15	-4.493	0.08	26.31	1007.37
11/10/2021	10:26:51 PM	0	9.267	5.4	11/10/2021	10:33:24 PM	0	900.645	-3.226	0.08	26.31	1007.37
11/10/2021	11:26:51 PM	0	9.265	5.4	11/10/2021	11:33:24 PM	0	900.751	-2.033	0.08	26.31	1007.36
11/11/2021	12:26:51 AM	0	9.259	5.4	11/11/2021	12:33:24 AM	0	900.207	-1.636	0.08	26.32	1007.36
11/11/2021	1:26:51 AM	0	9.255	5.4	11/11/2021	1:33:24 AM	0	899.802	-1.56	0.08	26.32	1007.36
11/11/2021	2:26:51 AM	0	9.252	5.4	11/11/2021	2:33:24 AM	0	899.439	-1.369	0.08	26.31	1007.36
11/11/2021	3:26:51 AM	0	9.255	5.4	11/11/2021	3:33:24 AM	0	899.731	-1.201	0.08	26.31	1007.36
11/11/2021	4:26:51 AM	0	9.258	5.4	11/11/2021	4:33:24 AM	0	899.941	-1.518	0.08	26.31	1007.37
11/11/2021	5:26:51 AM	0	9.251	5.4	11/11/2021	5:33:24 AM	0	899.186	-2.107	0.08	26.31	1007.37
11/11/2021	6:26:51 AM	0	9.252	5.4	11/11/2021	6:33:24 AM	0	899.368	-2.107	0.08	26.31	1007.37
11/11/2021	7:26:51 AM	0	9.252	5.4	11/11/2021	7:33:24 AM	0	899.316	-2.092	0.08	26.31	1007.37
11/11/2021	8:26:51 AM	0	9.254	5.4	11/11/2021	8:33:24 AM	0	899.498	-2.221	0.08	26.31	1007.37
11/11/2021	9:26:51 AM	0	9.259	5.4	11/11/2021	9:33:24 AM	0	900.085	-1.568	0.08	26.31	1007.36
11/11/2021	10:26:51 AM	0	9.261	5.4	11/11/2021	10:33:24 AM	0	900.425	-0.722	0.08	26.32	1007.36
11/11/2021	11:26:51 AM	0	9.261	5.4	11/11/2021	11:33:24 AM	0	900.438	-0.5	0.08	26.32	1007.36
11/11/2021	12:26:51 PM	0	9.257	5.4	11/11/2021	12:33:24 PM	0	900.115	-0.198	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/11/2021	1:26:51 PM	0	9.248	5.4	11/11/2021	1:33:24 PM	0	899.407	1.505	0.08	26.32	1007.36
11/11/2021	2:26:51 PM	0	9.245	5.4	11/11/2021	2:33:24 PM	0	899.057	2.619	0.08	26.32	1007.36
11/11/2021	3:26:51 PM	0	9.234	5.4	11/11/2021	3:33:24 PM	0	898.166	2.703	0.08	26.32	1007.36
11/11/2021	4:26:51 PM	0	9.225	5.4	11/11/2021	4:33:24 PM	0	897.028	1.987	0.08	26.32	1007.36
11/11/2021	5:26:51 PM	0	9.211	5.4	11/11/2021	5:33:24 PM	0	895.707	1.087	0.08	26.32	1007.36
11/11/2021	6:26:51 PM	0	9.207	5.4	11/11/2021	6:33:24 PM	0	895.22	0.843	0.08	26.32	1007.36
11/11/2021	7:26:51 PM	0	9.197	5.4	11/11/2021	7:33:24 PM	0	894.089	1.066	0.08	26.31	1007.36
11/11/2021	8:26:51 PM	0	9.188	5.4	11/11/2021	8:33:24 PM	0	893.319	1.563	0.08	26.32	1007.36
11/11/2021	9:26:51 PM	0	9.18	5.4	11/11/2021	9:33:24 PM	0	892.449	-0.052	0.08	26.32	1007.36
11/11/2021	10:26:51 PM	0	9.178	5.4	11/11/2021	10:33:24 PM	0	892.181	-0.367	0.08	26.31	1007.36
11/11/2021	11:26:51 PM	0	9.174	5.4	11/11/2021	11:33:24 PM	0	891.907	-0.119	0.08	26.32	1007.36
11/12/2021	12:26:51 AM	0	9.166	5.4	11/12/2021	12:33:24 AM	0	891.265	0.427	0.08	26.32	1007.36
11/12/2021	1:26:51 AM	0	9.161	5.4	11/12/2021	1:33:24 AM	0	890.665	0.839	0.08	26.32	1007.36
11/12/2021	2:26:51 AM	0	9.158	5.4	11/12/2021	2:33:24 AM	0	890.458	1.237	0.08	26.32	1007.36
11/12/2021	3:26:51 AM	0	9.156	5.4	11/12/2021	3:33:24 AM	0	890.34	1.59	0.08	26.32	1007.36
11/12/2021	4:26:51 AM	0	9.155	5.4	11/12/2021	4:33:24 AM	0	890.23	1.456	0.08	26.32	1007.36
11/12/2021	5:26:51 AM	0	9.158	5.4	11/12/2021	5:33:24 AM	0	890.467	1.348	0.08	26.32	1007.36
11/12/2021	6:26:51 AM	0	9.161	5.4	11/12/2021	6:33:24 AM	0	890.764	1.337	0.08	26.32	1007.36
11/12/2021	7:26:51 AM	0	9.166	5.4	11/12/2021	7:33:24 AM	0	891.267	0.724	0.08	26.32	1007.36
11/12/2021	8:26:51 AM	0	9.169	5.4	11/12/2021	8:33:24 AM	0	891.477	0.23	0.08	26.32	1007.36
11/12/2021	9:26:51 AM	0	9.172	5.4	11/12/2021	9:33:24 AM	0	891.805	0.212	0.08	26.32	1007.36
11/12/2021	10:26:51 AM	0	9.175	5.4	11/12/2021	10:33:24 AM	0	892.19	0.526	0.08	26.32	1007.36
11/12/2021	11:26:51 AM	0	9.178	5.4	11/12/2021	11:33:24 AM	0	892.565	1.514	0.08	26.32	1007.36
11/12/2021	12:26:51 PM	0	9.177	5.4	11/12/2021	12:33:24 PM	0	892.4	2.417	0.08	26.32	1007.36
11/12/2021	1:26:51 PM	0	9.177	5.4	11/12/2021	1:33:24 PM	0	892.567	4.017	0.08	26.32	1007.36
11/12/2021	2:26:51 PM	0	9.175	5.4	11/12/2021	2:33:24 PM	0	892.577	6.077	0.07	26.32	1007.36
11/12/2021	3:26:51 PM	0	9.177	5.4	11/12/2021	3:33:24 PM	0	892.598	5.224	0.07	26.32	1007.36
11/12/2021	4:26:51 PM	0	9.178	5.4	11/12/2021	4:33:24 PM	0	892.627	3.686	0.08	26.32	1007.36
11/12/2021	5:26:51 PM	0	9.183	5.4	11/12/2021	5:33:24 PM	0	892.853	0.914	0.08	26.32	1007.36
11/12/2021	6:26:51 PM	0	9.188	5.4	11/12/2021	6:33:24 PM	0	893.199	0.284	0.08	26.31	1007.36
11/12/2021	7:26:51 PM	0	9.195	5.4	11/12/2021	7:33:24 PM	0	893.863	0.395	0.08	26.31	1007.36
11/12/2021	8:26:51 PM	0	9.201	5.4	11/12/2021	8:33:24 PM	0	894.528	0.224	0.08	26.32	1007.36
11/12/2021	9:26:51 PM	0	9.21	5.4	11/12/2021	9:33:24 PM	0	895.418	0.724	0.08	26.32	1007.36
11/12/2021	10:26:51 PM	0	9.219	5.4	11/12/2021	10:33:24 PM	0	896.314	0.931	0.08	26.32	1007.36
11/12/2021	11:26:51 PM	0	9.228	5.4	11/12/2021	11:33:24 PM	0	897.222	1.048	0.08	26.32	1007.36
11/13/2021	12:26:51 AM	0	9.232	5.4	11/13/2021	12:33:24 AM	0	897.628	0.537	0.08	26.32	1007.36
11/13/2021	1:26:51 AM	0	9.242	5.4	11/13/2021	1:33:24 AM	0	898.457	0.092	0.08	26.31	1007.36
11/13/2021	2:26:51 AM	0	9.251	5.4	11/13/2021	2:33:24 AM	0	899.182	-0.549	0.08	26.31	1007.37
11/13/2021	3:26:51 AM	0	9.255	5.4	11/13/2021	3:33:24 AM	0	899.726	-0.569	0.08	26.31	1007.36
11/13/2021	4:26:51 AM	0	9.259	5.4	11/13/2021	4:33:24 AM	0	899.998	-1.25	0.08	26.31	1007.37
11/13/2021	5:26:51 AM	0	9.265	5.4	11/13/2021	5:33:24 AM	0	900.752	-0.506	0.08	26.31	1007.36
11/13/2021	6:26:51 AM	0	9.27	5.4	11/13/2021	6:33:24 AM	0	901.243	-0.579	0.08	26.31	1007.36
11/13/2021	7:26:51 AM	0	9.274	5.4	11/13/2021	7:33:24 AM	0	901.442	-1.642	0.08	26.31	1007.37
11/13/2021	8:26:51 AM	0	9.281	5.4	11/13/2021	8:33:24 AM	0	902.02	-2.72	0.08	26.31	1007.37
11/13/2021	9:26:51 AM	0	9.284	5.4	11/13/2021	9:33:24 AM	0	902.486	-1.902	0.08	26.31	1007.37
11/13/2021	10:26:51 AM	0	9.284	5.4	11/13/2021	10:33:24 AM	0	902.608	-0.656	0.08	26.31	1007.36
11/13/2021	11:26:51 AM	0	9.285	5.4	11/13/2021	11:33:24 AM	0	902.933	1.145	0.08	26.32	1007.36
11/13/2021	12:26:51 PM	0	9.284	5.4	11/13/2021	12:33:24 PM	0	902.889	2.462	0.08	26.32	1007.36
11/13/2021	1:26:51 PM	0	9.27	5.4	11/13/2021	1:33:24 PM	0	901.617	3.204	0.08	26.32	1007.36
11/13/2021	2:26:51 PM	0	9.262	5.4	11/13/2021	2:33:24 PM	0	900.87	3.503	0.08	26.32	1007.36
11/13/2021	3:26:51 PM	0	9.252	5.4	11/13/2021	3:33:24 PM	0	899.837	2.769	0.08	26.32	1007.36
11/13/2021	4:26:51 PM	0	9.242	5.4	11/13/2021	4:33:24 PM	0	898.574	1.751	0.08	26.32	1007.36
11/13/2021	5:26:51 PM	0	9.234	5.4	11/13/2021	5:33:24 PM	0	897.735	0.545	0.08	26.32	1007.36
11/13/2021	6:26:51 PM	0	9.219	5.4	11/13/2021	6:33:24 PM	0	896.254	0.157	0.08	26.32	1007.36
11/13/2021	7:26:51 PM	0	9.205	5.4	11/13/2021	7:33:24 PM	0	895.103	0.552	0.08	26.32	1007.36
11/13/2021	8:26:51 PM	0	9.197	5.4	11/13/2021	8:33:24 PM	0	894.041	0.256	0.08	26.31	1007.36
11/13/2021	9:26:51 PM	0	9.181	5.4	11/13/2021	9:33:24 PM	0	892.512	-0.461	0.08	26.31	1007.36
11/13/2021	10:26:51 PM	0	9.162	5.4	11/13/2021	10:33:24 PM	0	890.602	-0.549	0.08	26.31	1007.36
11/13/2021	11:26:51 PM	0	9.146	5.4	11/13/2021	11:33:24 PM	0	888.967	-0.539	0.08	26.31	1007.37
11/14/2021	12:26:51 AM	0	9.127	5.4	11/14/2021	12:33:24 AM	0	887.311	-0.547	0.08	26.32	1007.36
11/14/2021	1:26:51 AM	0	9.116	5.4	11/14/2021	1:33:24 AM	0	886.12	-0.554	0.08	26.31	1007.36
11/14/2021	2:26:51 AM	0	9.106	5.4	11/14/2021	2:33:24 AM	0	885.171	-0.555	0.08	26.32	1007.36
11/14/2021	3:26:51 AM	0	9.098	5.4	11/14/2021	3:33:24 AM	0	884.249	-0.551	0.08	26.31	1007.37
11/14/2021	4:26:51 AM	0	9.085	5.4	11/14/2021	4:33:24 AM	0	883.017	-0.544	0.08	26.31	1007.36
11/14/2021	5:26:51 AM	0	9.079	5.4	11/14/2021	5:33:24 AM	0	882.51	-0.537	0.08	26.31	1007.36
11/14/2021	6:26:51 AM	0	9.076	5.4	11/14/2021	6:33:24 AM	0	882.244	-0.527	0.08	26.32	1007.36
11/14/2021	7:26:51 AM	0	9.075	5.4	11/14/2021	7:33:24 AM	0	882.167	-0.524	0.08	26.32	1007.36
11/14/2021	8:26:51 AM	0	9.082	5.4	11/14/2021	8:33:24 AM	0	882.782	-0.517	0.08	26.31	1007.36
11/14/2021	9:26:51 AM	0	9.091	5.4	11/14/2021	9:33:24 AM	0	883.73	-0.513	0.08	26.32	1007.36
11/14/2021	10:26:51 AM	0	9.104	5.4	11/14/2021	10:33:24 AM	0	884.917	-0.499	0.08	26.31	1007.36
11/14/2021	11:26:51 AM	0	9.113	5.4	11/14/2021	11:33:24 AM	0	885.718	-0.454	0.08	26.31	1007.37
11/14/2021	12:26:51 PM	0	9.12	5.4	11/14/2021	12:33:24 PM	0	886.593	0.056	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/14/2021	1:26:51 PM	0	9.123	5.4	11/14/2021	1:33:24 PM	0	886.999	1.205	0.08	26.32	1007.36
11/14/2021	2:26:51 PM	0	9.124	5.4	11/14/2021	2:33:24 PM	0	887.345	2.426	0.08	26.32	1007.36
11/14/2021	3:26:51 PM	0	9.13	5.4	11/14/2021	3:33:24 PM	0	887.786	1.571	0.08	26.32	1007.36
11/14/2021	4:26:51 PM	0	9.13	5.4	11/14/2021	4:33:24 PM	0	887.631	0.6	0.08	26.32	1007.36
11/14/2021	5:26:51 PM	0	9.135	5.4	11/14/2021	5:33:24 PM	0	888.071	0.072	0.08	26.32	1007.36
11/14/2021	6:26:51 PM	0	9.139	5.4	11/14/2021	6:33:24 PM	0	888.511	-0.154	0.08	26.32	1007.36
11/14/2021	7:26:51 PM	0	9.141	5.4	11/14/2021	7:33:24 PM	0	888.575	-0.44	0.08	26.31	1007.36
11/14/2021	8:26:51 PM	0	9.136	5.4	11/14/2021	8:33:24 PM	0	888.101	-0.498	0.08	26.31	1007.36
11/14/2021	9:26:51 PM	0	9.138	5.4	11/14/2021	9:33:24 PM	0	888.226	-0.683	0.08	26.31	1007.36
11/14/2021	10:26:51 PM	0	9.136	5.4	11/14/2021	10:33:24 PM	0	888.067	-0.536	0.08	26.31	1007.36
11/14/2021	11:26:51 PM	0	9.135	5.4	11/14/2021	11:33:24 PM	0	887.928	-0.498	0.08	26.31	1007.36
11/15/2021	12:26:51 AM	0	9.126	5.4	11/15/2021	12:33:24 AM	0	887.034	-0.48	0.08	26.31	1007.36
11/15/2021	1:26:51 AM	0	9.12	5.4	11/15/2021	1:33:24 AM	0	886.402	-0.508	0.08	26.31	1007.37
11/15/2021	2:26:51 AM	0	9.11	5.4	11/15/2021	2:33:24 AM	0	885.522	-0.489	0.08	26.31	1007.36
11/15/2021	3:26:51 AM	0	9.104	5.4	11/15/2021	3:33:24 AM	0	884.769	-0.47	0.08	26.31	1007.37
11/15/2021	4:26:51 AM	0	9.093	5.4	11/15/2021	4:33:24 AM	0	883.795	-0.434	0.08	26.31	1007.36
11/15/2021	5:26:51 AM	0	9.082	5.4	11/15/2021	5:33:24 AM	0	882.804	-0.452	0.08	26.31	1007.36
11/15/2021	6:26:51 AM	0	9.07	5.4	11/15/2021	6:33:24 AM	0	881.681	-0.474	0.08	26.32	1007.36
11/15/2021	7:26:51 AM	0	9.059	5.4	11/15/2021	7:33:24 AM	0	880.388	-0.493	0.08	26.31	1007.37
11/15/2021	8:26:51 AM	0	9.037	5.4	11/15/2021	8:33:24 AM	0	878.415	-0.499	0.08	26.32	1007.36
11/15/2021	9:26:51 AM	0	9.027	5.4	11/15/2021	9:33:24 AM	0	877.373	-0.466	0.08	26.31	1007.36
11/15/2021	10:26:51 AM	0	9.014	5.4	11/15/2021	10:33:24 AM	0	876.066	-0.359	0.08	26.31	1007.36
11/15/2021	11:26:51 AM	0	9.003	5.4	11/15/2021	11:33:24 AM	0	875.171	0.025	0.08	26.32	1007.36
11/15/2021	12:26:51 PM	0	8.989	5.4	11/15/2021	12:33:24 PM	0	873.828	0.469	0.08	26.32	1007.36
11/15/2021	1:26:51 PM	0	8.983	5.4	11/15/2021	1:33:24 PM	0	873.427	0.926	0.08	26.32	1007.36
11/15/2021	2:26:51 PM	0	8.975	5.4	11/15/2021	2:33:24 PM	0	872.353	0.51	0.08	26.32	1007.36
11/15/2021	3:26:51 PM	0	8.979	5.4	11/15/2021	3:33:24 PM	0	872.839	-0.038	0.08	26.32	1007.36
11/15/2021	4:26:51 PM	0	8.991	5.4	11/15/2021	4:33:24 PM	0	873.836	-0.574	0.08	26.31	1007.36
11/15/2021	5:26:51 PM	0	9.005	5.4	11/15/2021	5:33:24 PM	0	875.137	-0.564	0.08	26.31	1007.37
11/15/2021	6:26:51 PM	0	9.031	5.4	11/15/2021	6:33:24 PM	0	877.677	-0.652	0.08	26.31	1007.37
11/15/2021	7:26:51 PM	0	9.057	5.4	11/15/2021	7:33:24 PM	0	880.004	-1.895	0.08	26.31	1007.37
11/15/2021	8:26:51 PM	0	9.076	5.4	11/15/2021	8:33:24 PM	0	882.034	-3.083	0.08	26.31	1007.37
11/15/2021	9:26:51 PM	0	9.095	5.4	11/15/2021	9:33:24 PM	0	883.49	-3.432	0.09	26.31	1007.37
11/15/2021	10:26:51 PM	0	9.116	5.4	11/15/2021	10:33:24 PM	0	885.647	-3.757	0.08	26.31	1007.37
11/15/2021	11:26:51 PM	0	9.132	5.4	11/15/2021	11:33:24 PM	0	887.449	-4.162	0.08	26.31	1007.37
11/16/2021	12:26:51 AM	0	9.15	5.4	11/16/2021	12:33:24 AM	0	888.906	-5.365	0.09	26.31	1007.37
11/16/2021	1:26:51 AM	0	9.165	5.4	11/16/2021	1:33:24 AM	0	890.164	-6.816	0.09	26.31	1007.37
11/16/2021	2:26:51 AM	0	9.18	5.4	11/16/2021	2:33:24 AM	0	891.389	-7.835	0.09	26.30	1007.37
11/16/2021	3:26:51 AM	0	9.191	5.4	11/16/2021	3:33:24 AM	0	892.374	-8.195	0.09	26.30	1007.38
11/16/2021	4:26:51 AM	0	9.2	5.4	11/16/2021	4:33:24 AM	0	893.256	-8.484	0.09	26.30	1007.38
11/16/2021	5:26:51 AM	0	9.213	5.4	11/16/2021	5:33:24 AM	0	894.532	-8.469	0.09	26.30	1007.38
11/16/2021	6:26:51 AM	0	9.223	5.4	11/16/2021	6:33:24 AM	0	895.781	-7.486	0.09	26.31	1007.37
11/16/2021	7:26:51 AM	0	9.234	5.4	11/16/2021	7:33:24 AM	0	896.849	-7.748	0.09	26.31	1007.37
11/16/2021	8:26:51 AM	0	9.246	5.4	11/16/2021	8:33:24 AM	0	898.005	-7.517	0.09	26.31	1007.37
11/16/2021	9:26:51 AM	0	9.259	5.4	11/16/2021	9:33:24 AM	0	899.488	-6.288	0.09	26.31	1007.37
11/16/2021	10:26:51 AM	0	9.27	5.4	11/16/2021	10:33:24 AM	0	900.831	-4.583	0.08	26.31	1007.37
11/16/2021	11:26:51 AM	0	9.279	5.4	11/16/2021	11:33:24 AM	0	901.977	-3.118	0.08	26.31	1007.37
11/16/2021	12:26:51 PM	0	9.285	5.4	11/16/2021	12:33:24 PM	0	902.696	-2.502	0.08	26.31	1007.36
11/16/2021	1:26:51 PM	0	9.293	5.4	11/16/2021	1:33:24 PM	0	903.493	-1.241	0.08	26.31	1007.36
11/16/2021	2:26:51 PM	0	9.299	5.4	11/16/2021	2:33:24 PM	0	904.162	-1.072	0.08	26.32	1007.36
11/16/2021	3:26:51 PM	0	9.304	5.4	11/16/2021	3:33:24 PM	0	904.659	-1.624	0.08	26.32	1007.36
11/16/2021	4:26:51 PM	0	9.312	5.4	11/16/2021	4:33:24 PM	0	904.946	-3.974	0.08	26.31	1007.37
11/16/2021	5:26:51 PM	0	9.318	5.4	11/16/2021	5:33:24 PM	0	905.12	-6.349	0.09	26.31	1007.37
11/16/2021	6:26:51 PM	0	9.319	5.4	11/16/2021	6:33:24 PM	0	905.157	-7.576	0.09	26.31	1007.37
11/16/2021	7:26:51 PM	0	9.324	5.4	11/16/2021	7:33:24 PM	0	905.448	-7.957	0.09	26.30	1007.38
11/16/2021	8:26:51 PM	0	9.33	5.4	11/16/2021	8:33:24 PM	0	905.939	-8.255	0.09	26.30	1007.38
11/16/2021	9:26:51 PM	0	9.332	5.4	11/16/2021	9:33:24 PM	0	906.108	-8.431	0.09	26.30	1007.38
11/16/2021	10:26:51 PM	0	9.335	5.4	11/16/2021	10:33:24 PM	0	906.382	-8.523	0.09	26.30	1007.38
11/16/2021	11:26:51 PM	0	9.336	5.4	11/16/2021	11:33:24 PM	0	906.659	-8.277	0.09	26.30	1007.37
11/17/2021	12:26:51 AM	0	9.339	5.4	11/17/2021	12:33:24 AM	0	906.791	-8.414	0.09	26.30	1007.38
11/17/2021	1:26:51 AM	0	9.341	5.4	11/17/2021	1:33:24 AM	0	907.352	-6.967	0.09	26.31	1007.37
11/17/2021	2:26:51 AM	0	9.337	5.4	11/17/2021	2:33:24 AM	0	907.235	-6.279	0.09	26.31	1007.37
11/17/2021	3:26:51 AM	0	9.337	5.4	11/17/2021	3:33:24 AM	0	907.258	-6.039	0.09	26.31	1007.37
11/17/2021	4:26:51 AM	0	9.335	5.4	11/17/2021	4:33:24 AM	0	906.901	-6.201	0.09	26.31	1007.37
11/17/2021	5:26:51 AM	0	9.333	5.4	11/17/2021	5:33:24 AM	0	906.647	-6.529	0.09	26.31	1007.37
11/17/2021	6:26:51 AM	0	9.329	5.4	11/17/2021	6:33:24 AM	0	906.385	-6.223	0.09	26.31	1007.37
11/17/2021	7:26:51 AM	0	9.325	5.4	11/17/2021	7:33:24 AM	0	905.974	-6.391	0.09	26.31	1007.37
11/17/2021	8:26:51 AM	0	9.325	5.4	11/17/2021	8:33:24 AM	0	905.956	-6.544	0.09	26.31	1007.37
11/17/2021	9:26:51 AM	0	9.319	5.4	11/17/2021	9:33:24 AM	0	905.397	-6.537	0.09	26.31	1007.37
11/17/2021	10:26:51 AM	0	9.319	5.4	11/17/2021	10:33:24 AM	0	905.431	-5.895	0.09	26.31	1007.37
11/17/2021	11:26:51 AM	0	9.318	5.4	11/17/2021	11:33:24 AM	0	905.574	-4.487	0.08	26.31	1007.37
11/17/2021	12:26:51 PM	0	9.31	5.4	11/17/2021	12:33:24 PM	0	905.15	-2.428	0.08	26.31	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/17/2021	1:26:51 PM	0	9.304	5.4	11/17/2021	1:33:24 PM	0	904.486	-2.261	0.08	26.31	1007.36
11/17/2021	2:26:51 PM	0	9.297	5.4	11/17/2021	2:33:24 PM	0	903.777	-2.443	0.08	26.31	1007.37
11/17/2021	3:26:51 PM	0	9.288	5.4	11/17/2021	3:33:24 PM	0	902.909	-2.702	0.08	26.31	1007.37
11/17/2021	4:26:51 PM	0	9.284	5.4	11/17/2021	4:33:24 PM	0	902.262	-3.181	0.08	26.31	1007.37
11/17/2021	5:26:51 PM	0	9.279	5.4	11/17/2021	5:33:24 PM	0	901.729	-3.863	0.08	26.31	1007.37
11/17/2021	6:26:51 PM	0	9.273	5.4	11/17/2021	6:33:24 PM	0	901.117	-4.072	0.08	26.31	1007.37
11/17/2021	7:26:51 PM	0	9.264	5.4	11/17/2021	7:33:24 PM	0	900.331	-4.134	0.08	26.31	1007.37
11/17/2021	8:26:51 PM	0	9.257	5.4	11/17/2021	8:33:24 PM	0	899.591	-4.07	0.08	26.31	1007.37
11/17/2021	9:26:51 PM	0	9.252	5.4	11/17/2021	9:33:24 PM	0	899.065	-4.178	0.08	26.31	1007.37
11/17/2021	10:26:51 PM	0	9.243	5.4	11/17/2021	10:33:24 PM	0	898.241	-4.262	0.08	26.31	1007.37
11/17/2021	11:26:51 PM	0	9.237	5.4	11/17/2021	11:33:24 PM	0	897.674	-4.166	0.08	26.31	1007.37
11/18/2021	12:26:51 AM	0	9.231	5.4	11/18/2021	12:33:24 AM	0	897.159	-3.876	0.08	26.31	1007.37
11/18/2021	1:26:51 AM	0	9.225	5.4	11/18/2021	1:33:24 AM	0	896.508	-3.763	0.08	26.31	1007.37
11/18/2021	2:26:51 AM	0	9.214	5.4	11/18/2021	2:33:24 AM	0	895.522	-3.733	0.08	26.31	1007.37
11/18/2021	3:26:51 AM	0	9.209	5.4	11/18/2021	3:33:24 AM	0	894.909	-3.637	0.08	26.31	1007.37
11/18/2021	4:26:51 AM	0	9.207	5.4	11/18/2021	4:33:24 AM	0	894.691	-3.757	0.08	26.31	1007.37
11/18/2021	5:26:51 AM	0	9.204	5.4	11/18/2021	5:33:24 AM	0	894.487	-3.726	0.08	26.31	1007.37
11/18/2021	6:26:51 AM	0	9.2	5.4	11/18/2021	6:33:24 AM	0	894.062	-3.711	0.08	26.31	1007.37
11/18/2021	7:26:51 AM	0	9.198	5.4	11/18/2021	7:33:24 AM	0	894.012	-3.827	0.08	26.31	1007.37
11/18/2021	8:26:51 AM	0	9.203	5.4	11/18/2021	8:33:24 AM	0	894.282	-4.032	0.08	26.31	1007.37
11/18/2021	9:26:51 AM	0	9.203	5.4	11/18/2021	9:33:24 AM	0	894.357	-3.875	0.08	26.31	1007.37
11/18/2021	10:26:51 AM	0	9.203	5.4	11/18/2021	10:33:24 AM	0	894.455	-3.549	0.08	26.31	1007.37
11/18/2021	11:26:51 AM	0	9.2	5.4	11/18/2021	11:33:24 AM	0	894.294	-2.732	0.08	26.31	1007.36
11/18/2021	12:26:51 PM	0	9.203	5.4	11/18/2021	12:33:24 PM	0	894.557	-2.215	0.08	26.31	1007.37
11/18/2021	1:26:51 PM	0	9.201	5.4	11/18/2021	1:33:24 PM	0	894.637	-1.37	0.08	26.32	1007.36
11/18/2021	2:26:51 PM	0	9.2	5.4	11/18/2021	2:33:24 PM	0	894.423	-0.828	0.08	26.32	1007.36
11/18/2021	3:26:51 PM	0	9.2	5.4	11/18/2021	3:33:24 PM	0	894.463	-0.915	0.08	26.32	1007.36
11/18/2021	4:26:51 PM	0	9.198	5.4	11/18/2021	4:33:24 PM	0	894.149	-2.167	0.08	26.31	1007.36
11/18/2021	5:26:51 PM	0	9.201	5.4	11/18/2021	5:33:24 PM	0	894.203	-3.538	0.08	26.31	1007.37
11/18/2021	6:26:51 PM	0	9.203	5.4	11/18/2021	6:33:24 PM	0	894.238	-3.698	0.08	26.31	1007.37
11/18/2021	7:26:51 PM	0	9.205	5.4	11/18/2021	7:33:24 PM	0	894.587	-3.595	0.08	26.31	1007.37
11/18/2021	8:26:51 PM	0	9.205	5.4	11/18/2021	8:33:24 PM	0	894.649	-3.634	0.08	26.31	1007.37
11/18/2021	9:26:51 PM	0	9.204	5.4	11/18/2021	9:33:24 PM	0	894.481	-3.767	0.08	26.31	1007.37
11/18/2021	10:26:51 PM	0	9.204	5.4	11/18/2021	10:33:24 PM	0	894.35	-3.854	0.08	26.31	1007.37
11/18/2021	11:26:51 PM	0	9.203	5.4	11/18/2021	11:33:24 PM	0	894.257	-4.005	0.08	26.31	1007.37
11/19/2021	12:26:51 AM	0	9.205	5.4	11/19/2021	12:33:24 AM	0	894.537	-4.136	0.08	26.31	1007.37
11/19/2021	1:26:51 AM	0	9.204	5.4	11/19/2021	1:33:24 AM	0	894.391	-4.253	0.08	26.31	1007.37
11/19/2021	2:26:51 AM	0	9.205	5.4	11/19/2021	2:33:24 AM	0	894.439	-4.412	0.08	26.31	1007.37
11/19/2021	3:26:51 AM	0	9.207	5.4	11/19/2021	3:33:24 AM	0	894.606	-4.628	0.08	26.31	1007.37
11/19/2021	4:26:51 AM	0	9.207	5.4	11/19/2021	4:33:24 AM	0	894.519	-5.452	0.09	26.31	1007.37
11/19/2021	5:26:51 AM	0	9.21	5.4	11/19/2021	5:33:24 AM	0	894.731	-5.51	0.09	26.31	1007.37
11/19/2021	6:26:51 AM	0	9.214	5.4	11/19/2021	6:33:24 AM	0	895.308	-5.165	0.08	26.31	1007.37
11/19/2021	7:26:51 AM	0	9.216	5.4	11/19/2021	7:33:24 AM	0	895.462	-5.15	0.08	26.31	1007.37
11/19/2021	8:26:51 AM	0	9.222	5.4	11/19/2021	8:33:24 AM	0	896.079	-4.883	0.08	26.31	1007.37
11/19/2021	9:26:51 AM	0	9.228	5.4	11/19/2021	9:33:24 AM	0	896.708	-4.516	0.08	26.31	1007.37
11/19/2021	10:26:51 AM	0	9.234	5.4	11/19/2021	10:33:24 AM	0	897.47	-3.559	0.08	26.31	1007.37
11/19/2021	11:26:51 AM	0	9.24	5.4	11/19/2021	11:33:24 AM	0	898.399	-1.958	0.08	26.32	1007.36
11/19/2021	12:26:51 PM	0	9.238	5.4	11/19/2021	12:33:24 PM	0	897.95	-2.812	0.08	26.31	1007.37
11/19/2021	1:26:51 PM	0	9.243	5.4	11/19/2021	1:33:24 PM	0	898.458	-2.723	0.08	26.31	1007.37
11/19/2021	2:26:51 PM	0	9.246	5.4	11/19/2021	2:33:24 PM	0	899.027	-0.893	0.08	26.32	1007.36
11/19/2021	3:26:51 PM	0	9.245	5.4	11/19/2021	3:33:24 PM	0	898.848	-0.684	0.08	26.32	1007.36
11/19/2021	4:26:51 PM	0	9.246	5.4	11/19/2021	4:33:24 PM	0	898.858	-2.176	0.08	26.31	1007.36
11/19/2021	5:26:51 PM	0	9.248	5.4	11/19/2021	5:33:24 PM	0	898.803	-2.997	0.08	26.31	1007.37
11/19/2021	6:26:51 PM	0	9.246	5.4	11/19/2021	6:33:24 PM	0	898.7	-3.099	0.08	26.31	1007.37
11/19/2021	7:26:51 PM	0	9.248	5.4	11/19/2021	7:33:24 PM	0	898.676	-3.177	0.08	26.31	1007.37
11/19/2021	8:26:51 PM	0	9.246	5.4	11/19/2021	8:33:24 PM	0	898.524	-3.461	0.08	26.31	1007.37
11/19/2021	9:26:51 PM	0	9.246	5.4	11/19/2021	9:33:24 PM	0	898.592	-3.694	0.08	26.31	1007.37
11/19/2021	10:26:51 PM	0	9.249	5.4	11/19/2021	10:33:24 PM	0	898.883	-3.72	0.08	26.31	1007.37
11/19/2021	11:26:51 PM	0	9.251	5.4	11/19/2021	11:33:24 PM	0	899.109	-3.688	0.08	26.31	1007.37
11/20/2021	12:26:51 AM	0	9.255	5.4	11/20/2021	12:33:24 AM	0	899.384	-3.758	0.08	26.31	1007.37
11/20/2021	1:26:51 AM	0	9.255	5.4	11/20/2021	1:33:24 AM	0	899.341	-3.8	0.08	26.31	1007.37
11/20/2021	2:26:51 AM	0	9.255	5.4	11/20/2021	2:33:24 AM	0	899.355	-4.072	0.08	26.31	1007.37
11/20/2021	3:26:51 AM	0	9.261	5.4	11/20/2021	3:33:24 AM	0	899.908	-4.425	0.08	26.31	1007.37
11/20/2021	4:26:51 AM	0	9.262	5.4	11/20/2021	4:33:24 AM	0	900.032	-4.5	0.08	26.31	1007.37
11/20/2021	5:26:51 AM	0	9.264	5.4	11/20/2021	5:33:24 AM	0	900.183	-4.336	0.08	26.31	1007.37
11/20/2021	6:26:51 AM	0	9.267	5.4	11/20/2021	6:33:24 AM	0	900.45	-4.44	0.08	26.31	1007.37
11/20/2021	7:26:51 AM	0	9.268	5.4	11/20/2021	7:33:24 AM	0	900.69	-4.237	0.08	26.31	1007.37
11/20/2021	8:26:51 AM	0	9.271	5.4	11/20/2021	8:33:24 AM	0	901.156	-4.171	0.08	26.31	1007.37
11/20/2021	9:26:51 AM	0	9.277	5.4	11/20/2021	9:33:24 AM	0	901.632	-3.982	0.08	26.31	1007.37
11/20/2021	10:26:51 AM	0	9.279	5.4	11/20/2021	10:33:24 AM	0	901.916	-3.406	0.08	26.31	1007.37
11/20/2021	11:26:51 AM	0	9.285	5.4	11/20/2021	11:33:24 AM	0	902.687	-2.628	0.08	26.31	1007.36
11/20/2021	12:26:51 PM	0	9.29	5.4	11/20/2021	12:33:24 PM	0	903.245	-1.966	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/20/2021	1:26:51 PM	0	9.296	5.4	11/20/2021	1:33:24 PM	0	903.777	-1.414	0.08	26.31	1007.36
11/20/2021	2:26:51 PM	0	9.302	5.4	11/20/2021	2:33:24 PM	0	904.477	-0.942	0.08	26.32	1007.36
11/20/2021	3:26:51 PM	0	9.303	5.4	11/20/2021	3:33:24 PM	0	904.627	-1.235	0.08	26.32	1007.36
11/20/2021	4:26:51 PM	0	9.31	5.4	11/20/2021	4:33:24 PM	0	905.187	-1.755	0.08	26.32	1007.36
11/20/2021	5:26:51 PM	0	9.309	5.4	11/20/2021	5:33:24 PM	0	905.003	-2.14	0.08	26.31	1007.36
11/20/2021	6:26:51 PM	0	9.304	5.4	11/20/2021	6:33:24 PM	0	904.498	-2.204	0.08	26.31	1007.36
11/20/2021	7:26:51 PM	0	9.299	5.4	11/20/2021	7:33:24 PM	0	903.932	-2.165	0.08	26.31	1007.37
11/20/2021	8:26:51 PM	0	9.296	5.4	11/20/2021	8:33:24 PM	0	903.62	-2.049	0.08	26.31	1007.37
11/20/2021	9:26:51 PM	0	9.3	5.4	11/20/2021	9:33:24 PM	0	904.179	-1.944	0.08	26.31	1007.36
11/20/2021	10:26:51 PM	0	9.299	5.4	11/20/2021	10:33:24 PM	0	904.007	-1.823	0.08	26.31	1007.36
11/20/2021	11:26:51 PM	0	9.297	5.4	11/20/2021	11:33:24 PM	0	903.887	-1.656	0.08	26.31	1007.36
11/21/2021	12:26:51 AM	0	9.296	5.4	11/21/2021	12:33:24 AM	0	903.699	-1.479	0.08	26.31	1007.37
11/21/2021	1:26:51 AM	0	9.294	5.4	11/21/2021	1:33:24 AM	0	903.741	-1.481	0.08	26.32	1007.36
11/21/2021	2:26:51 AM	0	9.296	5.4	11/21/2021	2:33:24 AM	0	903.766	-1.399	0.08	26.31	1007.36
11/21/2021	3:26:51 AM	0	9.297	5.4	11/21/2021	3:33:24 AM	0	903.935	-1.351	0.08	26.32	1007.36
11/21/2021	4:26:51 AM	0	9.293	5.4	11/21/2021	4:33:24 AM	0	903.551	-1.311	0.08	26.32	1007.36
11/21/2021	5:26:51 AM	0	9.291	5.4	11/21/2021	5:33:24 AM	0	903.347	-1.309	0.08	26.32	1007.36
11/21/2021	6:26:51 AM	0	9.291	5.4	11/21/2021	6:33:24 AM	0	903.393	-1.286	0.08	26.32	1007.36
11/21/2021	7:26:51 AM	0	9.288	5.4	11/21/2021	7:33:24 AM	0	903.001	-1.261	0.08	26.31	1007.36
11/21/2021	8:26:51 AM	0	9.284	5.4	11/21/2021	8:33:24 AM	0	902.638	-1.241	0.08	26.32	1007.36
11/21/2021	9:26:51 AM	0	9.282	5.4	11/21/2021	9:33:24 AM	0	902.508	-1.175	0.08	26.32	1007.36
11/21/2021	10:26:51 AM	0	9.281	5.4	11/21/2021	10:33:24 AM	0	902.42	-0.837	0.08	26.32	1007.36
11/21/2021	11:26:51 AM	0	9.274	5.4	11/21/2021	11:33:24 AM	0	901.853	-0.593	0.08	26.32	1007.36
11/21/2021	12:26:51 PM	0	9.271	5.4	11/21/2021	12:33:24 PM	0	901.624	-0.527	0.08	26.32	1007.36
11/21/2021	1:26:51 PM	0	9.262	5.4	11/21/2021	1:33:24 PM	0	900.686	-0.435	0.08	26.32	1007.36
11/21/2021	2:26:51 PM	0	9.257	5.4	11/21/2021	2:33:24 PM	0	900.141	-0.32	0.08	26.32	1007.36
11/21/2021	3:26:51 PM	0	9.251	5.4	11/21/2021	3:33:24 PM	0	899.602	-0.367	0.08	26.32	1007.36
11/21/2021	4:26:51 PM	0	9.249	5.4	11/21/2021	4:33:24 PM	0	899.352	-0.474	0.08	26.32	1007.36
11/21/2021	5:26:51 PM	0	9.243	5.4	11/21/2021	5:33:24 PM	0	898.802	-0.539	0.08	26.32	1007.36
11/21/2021	6:26:51 PM	0	9.236	5.4	11/21/2021	6:33:24 PM	0	897.978	-0.534	0.08	26.32	1007.36
11/21/2021	7:26:51 PM	0	9.232	5.4	11/21/2021	7:33:24 PM	0	897.645	-0.531	0.08	26.32	1007.36
11/21/2021	8:26:51 PM	0	9.228	5.4	11/21/2021	8:33:24 PM	0	897.2	-0.525	0.08	26.32	1007.36
11/21/2021	9:26:51 PM	0	9.22	5.4	11/21/2021	9:33:24 PM	0	896.516	-0.529	0.08	26.32	1007.36
11/21/2021	10:26:51 PM	0	9.214	5.4	11/21/2021	10:33:24 PM	0	895.981	-0.533	0.08	26.32	1007.36
11/21/2021	11:26:51 PM	0	9.207	5.4	11/21/2021	11:33:24 PM	0	895.292	-0.537	0.08	26.32	1007.36
11/22/2021	12:26:51 AM	0	9.2	5.4	11/22/2021	12:33:24 AM	0	894.413	-0.549	0.08	26.32	1007.36
11/22/2021	1:26:51 AM	0	9.189	5.4	11/22/2021	1:33:24 AM	0	893.383	-0.547	0.08	26.32	1007.36
11/22/2021	2:26:51 AM	0	9.178	5.4	11/22/2021	2:33:24 AM	0	892.42	-0.58	0.08	26.32	1007.36
11/22/2021	3:26:51 AM	0	9.174	5.4	11/22/2021	3:33:24 AM	0	891.922	-0.656	0.08	26.32	1007.36
11/22/2021	4:26:51 AM	0	9.165	5.4	11/22/2021	4:33:24 AM	0	890.928	-0.782	0.08	26.31	1007.36
11/22/2021	5:26:51 AM	0	9.156	5.4	11/22/2021	5:33:24 AM	0	890.27	-1.072	0.08	26.32	1007.36
11/22/2021	6:26:51 AM	0	9.144	5.4	11/22/2021	6:33:24 AM	0	888.897	-1.324	0.08	26.32	1007.36
11/22/2021	7:26:51 AM	0	9.133	5.4	11/22/2021	7:33:24 AM	0	887.908	-1.401	0.08	26.32	1007.36
11/22/2021	8:26:51 AM	0	9.135	5.4	11/22/2021	8:33:24 AM	0	888.084	-1.407	0.08	26.32	1007.36
11/22/2021	9:26:51 AM	0	9.132	5.4	11/22/2021	9:33:24 AM	0	887.813	-1.32	0.08	26.32	1007.36
11/22/2021	10:26:51 AM	0	9.133	5.4	11/22/2021	10:33:24 AM	0	888.044	-0.776	0.08	26.32	1007.36
11/22/2021	11:26:51 AM	0	9.136	5.4	11/22/2021	11:33:24 AM	0	888.348	-0.55	0.08	26.32	1007.36
11/22/2021	12:26:51 PM	0	9.129	5.4	11/22/2021	12:33:24 PM	0	887.768	-0.335	0.08	26.32	1007.36
11/22/2021	1:26:51 PM	0	9.127	5.4	11/22/2021	1:33:24 PM	0	887.632	0.953	0.08	26.32	1007.36
11/22/2021	2:26:51 PM	0	9.127	5.4	11/22/2021	2:33:24 PM	0	887.58	1.615	0.08	26.32	1007.36
11/22/2021	3:26:51 PM	0	9.124	5.4	11/22/2021	3:33:24 PM	0	887.242	1.074	0.08	26.32	1007.36
11/22/2021	4:26:51 PM	0	9.127	5.4	11/22/2021	4:33:24 PM	0	887.371	0.264	0.08	26.32	1007.36
11/22/2021	5:26:51 PM	0	9.127	5.4	11/22/2021	5:33:24 PM	0	887.364	-0.527	0.08	26.32	1007.36
11/22/2021	6:26:51 PM	0	9.129	5.4	11/22/2021	6:33:24 PM	0	887.397	-0.788	0.08	26.31	1007.36
11/22/2021	7:26:51 PM	0	9.132	5.4	11/22/2021	7:33:24 PM	0	887.613	-1.767	0.08	26.31	1007.37
11/22/2021	8:26:51 PM	0	9.132	5.4	11/22/2021	8:33:24 PM	0	887.357	-2.957	0.08	26.31	1007.37
11/22/2021	9:26:51 PM	0	9.13	5.4	11/22/2021	9:33:24 PM	0	887.192	-3.465	0.08	26.31	1007.37
11/22/2021	10:26:51 PM	0	9.129	5.4	11/22/2021	10:33:24 PM	0	887.135	-3.555	0.08	26.31	1007.37
11/22/2021	11:26:51 PM	0	9.13	5.4	11/22/2021	11:33:24 PM	0	887.081	-4.027	0.08	26.31	1007.37
11/23/2021	12:26:51 AM	0	9.133	5.4	11/23/2021	12:33:24 AM	0	887.428	-4.343	0.08	26.31	1007.37
11/23/2021	1:26:51 AM	0	9.135	5.4	11/23/2021	1:33:24 AM	0	887.489	-4.609	0.09	26.31	1007.37
11/23/2021	2:26:51 AM	0	9.136	5.4	11/23/2021	2:33:24 AM	0	887.652	-4.694	0.08	26.31	1007.37
11/23/2021	3:26:51 AM	0	9.136	5.4	11/23/2021	3:33:24 AM	0	887.626	-4.923	0.08	26.31	1007.37
11/23/2021	4:26:51 AM	0	9.138	5.4	11/23/2021	4:33:24 AM	0	887.631	-5.364	0.09	26.31	1007.37
11/23/2021	5:26:51 AM	0	9.141	5.4	11/23/2021	5:33:24 AM	0	887.937	-5.892	0.09	26.31	1007.37
11/23/2021	6:26:51 AM	0	9.149	5.4	11/23/2021	6:33:24 AM	0	888.577	-6.482	0.09	26.31	1007.37
11/23/2021	7:26:51 AM	0	9.155	5.4	11/23/2021	7:33:24 AM	0	888.989	-7.123	0.09	26.30	1007.37
11/23/2021	8:26:51 AM	0	9.162	5.4	11/23/2021	8:33:24 AM	0	889.737	-7.127	0.09	26.31	1007.37
11/23/2021	9:26:51 AM	0	9.168	5.4	11/23/2021	9:33:24 AM	0	890.299	-6.922	0.09	26.31	1007.37
11/23/2021	10:26:51 AM	0	9.172	5.4	11/23/2021	10:33:24 AM	0	891.037	-5.994	0.09	26.31	1007.37
11/23/2021	11:26:51 AM	0	9.178	5.4	11/23/2021	11:33:24 AM	0	891.84	-5.099	0.08	26.31	1007.37
11/23/2021	12:26:51 PM	0	9.184	5.4	11/23/2021	12:33:24 PM	0	892.482	-4.756	0.08	26.31	1007.37

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/23/2021	1:26:51 PM	0	9.191	5.4	11/23/2021	1:33:24 PM	0	893.182	-4.097	0.08	26.31	1007.37
11/23/2021	2:26:51 PM	0	9.195	5.4	11/23/2021	2:33:24 PM	0	893.536	-4.207	0.08	26.31	1007.37
11/23/2021	3:26:51 PM	0	9.201	5.4	11/23/2021	3:33:24 PM	0	894.368	-3.271	0.08	26.31	1007.37
11/23/2021	4:26:51 PM	0	9.207	5.4	11/23/2021	4:33:24 PM	0	894.728	-3.737	0.08	26.31	1007.37
11/23/2021	5:26:51 PM	0	9.211	5.4	11/23/2021	5:33:24 PM	0	894.951	-5.523	0.09	26.31	1007.37
11/23/2021	6:26:51 PM	0	9.213	5.4	11/23/2021	6:33:24 PM	0	894.938	-6.566	0.09	26.31	1007.37
11/23/2021	7:26:51 PM	0	9.219	5.4	11/23/2021	7:33:24 PM	0	895.317	-7.091	0.09	26.31	1007.37
11/23/2021	8:26:51 PM	0	9.225	5.4	11/23/2021	8:33:24 PM	0	895.817	-7.219	0.09	26.30	1007.37
11/23/2021	9:26:51 PM	0	9.229	5.4	11/23/2021	9:33:24 PM	0	896.555	-6.457	0.09	26.31	1007.37
11/23/2021	10:26:51 PM	0	9.237	5.4	11/23/2021	10:33:24 PM	0	897.476	-5.073	0.09	26.31	1007.37
11/23/2021	11:26:51 PM	0	9.242	5.4	11/23/2021	11:33:24 PM	0	898.005	-4.915	0.08	26.31	1007.37
11/24/2021	12:26:51 AM	0	9.248	5.4	11/24/2021	12:33:24 AM	0	898.463	-5.692	0.09	26.31	1007.37
11/24/2021	1:26:51 AM	0	9.252	5.4	11/24/2021	1:33:24 AM	0	898.727	-6.163	0.09	26.31	1007.37
11/24/2021	2:26:51 AM	0	9.257	5.4	11/24/2021	2:33:24 AM	0	899.201	-6.512	0.09	26.31	1007.37
11/24/2021	3:26:51 AM	0	9.261	5.4	11/24/2021	3:33:24 AM	0	899.651	-6.405	0.09	26.31	1007.37
11/24/2021	4:26:51 AM	0	9.262	5.4	11/24/2021	4:33:24 AM	0	899.833	-5.894	0.09	26.31	1007.37
11/24/2021	5:26:51 AM	0	9.262	5.4	11/24/2021	5:33:24 AM	0	899.81	-5.813	0.09	26.31	1007.37
11/24/2021	6:26:51 AM	0	9.264	5.4	11/24/2021	6:33:24 AM	0	899.994	-5.918	0.09	26.31	1007.37
11/24/2021	7:26:51 AM	0	9.261	5.4	11/24/2021	7:33:24 AM	0	899.905	-5.464	0.08	26.31	1007.37
11/24/2021	8:26:51 AM	0	9.261	5.4	11/24/2021	8:33:24 AM	0	899.986	-4.848	0.08	26.31	1007.37
11/24/2021	9:26:51 AM	0	9.264	5.4	11/24/2021	9:33:24 AM	0	900.28	-4.307	0.08	26.31	1007.37
11/24/2021	10:26:51 AM	0	9.261	5.4	11/24/2021	10:33:24 AM	0	900.084	-3.698	0.08	26.31	1007.37
11/24/2021	11:26:51 AM	0	9.262	5.4	11/24/2021	11:33:24 AM	0	900.268	-3.121	0.08	26.31	1007.37
11/24/2021	12:26:51 PM	0	9.255	5.4	11/24/2021	12:33:24 PM	0	899.734	-2.681	0.08	26.31	1007.36
11/24/2021	1:26:51 PM	0	9.254	5.4	11/24/2021	1:33:24 PM	0	899.618	-2.34	0.08	26.31	1007.36
11/24/2021	2:26:51 PM	0	9.246	5.4	11/24/2021	2:33:24 PM	0	898.8	-2.388	0.08	26.31	1007.36
11/24/2021	3:26:51 PM	0	9.232	5.4	11/24/2021	3:33:24 PM	0	897.434	-2.477	0.08	26.31	1007.36
11/24/2021	4:26:51 PM	0	9.232	5.4	11/24/2021	4:33:24 PM	0	897.595	-2.412	0.08	26.32	1007.36
11/24/2021	5:26:51 PM	0	9.226	5.4	11/24/2021	5:33:24 PM	0	896.838	-2.397	0.08	26.31	1007.36
11/24/2021	6:26:51 PM	0	9.22	5.4	11/24/2021	6:33:24 PM	0	896.449	-2.323	0.08	26.32	1007.36
11/24/2021	7:26:51 PM	0	9.216	5.4	11/24/2021	7:33:24 PM	0	895.991	-2.19	0.08	26.32	1007.36
11/24/2021	8:26:51 PM	0	9.213	5.4	11/24/2021	8:33:24 PM	0	895.705	-2.021	0.08	26.32	1007.36
11/24/2021	9:26:51 PM	0	9.204	5.4	11/24/2021	9:33:24 PM	0	894.766	-1.864	0.08	26.31	1007.36
11/24/2021	10:26:51 PM	0	9.201	5.4	11/24/2021	10:33:24 PM	0	894.45	-1.673	0.08	26.31	1007.36
11/24/2021	11:26:51 PM	0	9.194	5.4	11/24/2021	11:33:24 PM	0	893.836	-1.54	0.08	26.32	1007.36
11/25/2021	12:26:51 AM	0	9.189	5.4	11/25/2021	12:33:24 AM	0	893.32	-1.437	0.08	26.32	1007.36
11/25/2021	1:26:51 AM	0	9.184	5.4	11/25/2021	1:33:24 AM	0	892.814	-1.56	0.08	26.31	1007.36
11/25/2021	2:26:51 AM	0	9.186	5.4	11/25/2021	2:33:24 AM	0	893.111	-1.599	0.08	26.32	1007.36
11/25/2021	3:26:51 AM	0	9.183	5.4	11/25/2021	3:33:24 AM	0	892.795	-1.565	0.08	26.32	1007.36
11/25/2021	4:26:51 AM	0	9.181	5.4	11/25/2021	4:33:24 AM	0	892.588	-1.294	0.08	26.32	1007.36
11/25/2021	5:26:51 AM	0	9.178	5.4	11/25/2021	5:33:24 AM	0	892.352	-1.298	0.08	26.32	1007.36
11/25/2021	6:26:51 AM	0	9.18	5.4	11/25/2021	6:33:24 AM	0	892.502	-1.121	0.08	26.32	1007.36
11/25/2021	7:26:51 AM	0	9.18	5.4	11/25/2021	7:33:24 AM	0	892.573	-0.92	0.08	26.32	1007.36
11/25/2021	8:26:51 AM	0	9.184	5.4	11/25/2021	8:33:24 AM	0	893.006	-0.847	0.08	26.32	1007.36
11/25/2021	9:26:51 AM	0	9.181	5.4	11/25/2021	9:33:24 AM	0	892.676	-0.744	0.08	26.32	1007.36
11/25/2021	10:26:51 AM	0	9.177	5.4	11/25/2021	10:33:24 AM	0	892.245	-0.617	0.08	26.32	1007.36
11/25/2021	11:26:51 AM	0	9.171	5.4	11/25/2021	11:33:24 AM	0	891.716	-0.541	0.08	26.32	1007.36
11/25/2021	12:26:51 PM	0	9.169	5.4	11/25/2021	12:33:24 PM	0	891.597	-0.49	0.08	26.32	1007.36
11/25/2021	1:26:51 PM	0	9.164	5.4	11/25/2021	1:33:24 PM	0	891.083	-0.412	0.08	26.32	1007.36
11/25/2021	2:26:51 PM	0	9.159	5.4	11/25/2021	2:33:24 PM	0	890.553	0.089	0.08	26.32	1007.36
11/25/2021	3:26:51 PM	0	9.156	5.4	11/25/2021	3:33:24 PM	0	890.371	0.512	0.08	26.32	1007.36
11/25/2021	4:26:51 PM	0	9.156	5.4	11/25/2021	4:33:24 PM	0	890.313	0.417	0.08	26.32	1007.36
11/25/2021	5:26:51 PM	0	9.158	5.4	11/25/2021	5:33:24 PM	0	890.415	-0.28	0.08	26.32	1007.36
11/25/2021	6:26:51 PM	0	9.158	5.4	11/25/2021	6:33:24 PM	0	890.375	-0.148	0.08	26.32	1007.36
11/25/2021	7:26:51 PM	0	9.161	5.4	11/25/2021	7:33:24 PM	0	890.649	-0.045	0.08	26.32	1007.36
11/25/2021	8:26:51 PM	0	9.159	5.4	11/25/2021	8:33:24 PM	0	890.52	-0.449	0.08	26.32	1007.36
11/25/2021	9:26:51 PM	0	9.161	5.4	11/25/2021	9:33:24 PM	0	890.608	-0.519	0.08	26.32	1007.36
11/25/2021	10:26:51 PM	0	9.162	5.4	11/25/2021	10:33:24 PM	0	890.861	-0.342	0.08	26.32	1007.36
11/25/2021	11:26:51 PM	0	9.161	5.4	11/25/2021	11:33:24 PM	0	890.665	-0.059	0.08	26.32	1007.36
11/26/2021	12:26:51 AM	0	9.159	5.4	11/26/2021	12:33:24 AM	0	890.584	-0.013	0.08	26.32	1007.36
11/26/2021	1:26:51 AM	0	9.156	5.4	11/26/2021	1:33:24 AM	0	890.292	-0.104	0.08	26.32	1007.36
11/26/2021	2:26:51 AM	0	9.158	5.4	11/26/2021	2:33:24 AM	0	890.308	-0.471	0.08	26.32	1007.36
11/26/2021	3:26:51 AM	0	9.161	5.4	11/26/2021	3:33:24 AM	0	890.716	-0.177	0.08	26.32	1007.36
11/26/2021	4:26:51 AM	0	9.165	5.4	11/26/2021	4:33:24 AM	0	891.128	-0.043	0.08	26.32	1007.36
11/26/2021	5:26:51 AM	0	9.168	5.4	11/26/2021	5:33:24 AM	0	891.405	-0.432	0.08	26.32	1007.36
11/26/2021	6:26:51 AM	0	9.171	5.4	11/26/2021	6:33:24 AM	0	891.665	-0.596	0.08	26.32	1007.36
11/26/2021	7:26:51 AM	0	9.177	5.4	11/26/2021	7:33:24 AM	0	892.227	-0.653	0.08	26.32	1007.36
11/26/2021	8:26:51 AM	0	9.188	5.4	11/26/2021	8:33:24 AM	0	893.282	-0.705	0.08	26.32	1007.36
11/26/2021	9:26:51 AM	0	9.198	5.4	11/26/2021	9:33:24 AM	0	894.085	-2.084	0.08	26.31	1007.37
11/26/2021	10:26:51 AM	0	9.207	5.4	11/26/2021	10:33:24 AM	0	894.997	-2.425	0.08	26.31	1007.36
11/26/2021	11:26:51 AM	0	9.216	5.4	11/26/2021	11:33:24 AM	0	895.871	-1.515	0.08	26.31	1007.36
11/26/2021	12:26:51 PM	0	9.225	5.4	11/26/2021	12:33:24 PM	0	896.922	-1.019	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/26/2021	1:26:51 PM	0	9.228	5.4	11/26/2021	1:33:24 PM	0	897.213	-0.667	0.08	26.32	1007.36
11/26/2021	2:26:51 PM	0	9.232	5.4	11/26/2021	2:33:24 PM	0	897.667	-0.624	0.08	26.32	1007.36
11/26/2021	3:26:51 PM	0	9.238	5.4	11/26/2021	3:33:24 PM	0	898.094	-1.088	0.08	26.31	1007.36
11/26/2021	4:26:51 PM	0	9.243	5.4	11/26/2021	4:33:24 PM	0	898.413	-2.404	0.08	26.31	1007.37
11/26/2021	5:26:51 PM	0	9.251	5.4	11/26/2021	5:33:24 PM	0	898.85	-4.168	0.09	26.31	1007.37
11/26/2021	6:26:51 PM	0	9.251	5.4	11/26/2021	6:33:24 PM	0	898.705	-5.366	0.09	26.31	1007.37
11/26/2021	7:26:51 PM	0	9.254	5.4	11/26/2021	7:33:24 PM	0	898.792	-6.329	0.09	26.31	1007.37
11/26/2021	8:26:51 PM	0	9.252	5.4	11/26/2021	8:33:24 PM	0	898.585	-6.734	0.09	26.31	1007.37
11/26/2021	9:26:51 PM	0	9.254	5.4	11/26/2021	9:33:24 PM	0	898.783	-6.944	0.09	26.31	1007.37
11/26/2021	10:26:51 PM	0	9.257	5.4	11/26/2021	10:33:24 PM	0	899.053	-7.069	0.09	26.31	1007.37
11/26/2021	11:26:51 PM	0	9.255	5.4	11/26/2021	11:33:24 PM	0	898.965	-6.708	0.09	26.31	1007.37
11/27/2021	12:26:51 AM	0	9.257	5.4	11/27/2021	12:33:24 AM	0	899.033	-6.777	0.09	26.31	1007.37
11/27/2021	1:26:51 AM	0	9.246	5.4	11/27/2021	1:33:24 AM	0	898.195	-6.209	0.09	26.31	1007.37
11/27/2021	2:26:51 AM	0	9.242	5.4	11/27/2021	2:33:24 AM	0	897.668	-6.098	0.09	26.31	1007.37
11/27/2021	3:26:51 AM	0	9.243	5.4	11/27/2021	3:33:24 AM	0	897.959	-5.261	0.09	26.31	1007.37
11/27/2021	4:26:51 AM	0	9.231	5.4	11/27/2021	4:33:24 AM	0	897.012	-4.754	0.08	26.31	1007.37
11/27/2021	5:26:51 AM	0	9.222	5.4	11/27/2021	5:33:24 AM	0	896.109	-4.357	0.08	26.31	1007.37
11/27/2021	6:26:51 AM	0	9.21	5.4	11/27/2021	6:33:24 AM	0	895.107	-3.928	0.08	26.31	1007.37
11/27/2021	7:26:51 AM	0	9.203	5.4	11/27/2021	7:33:24 AM	0	894.377	-3.417	0.08	26.31	1007.37
11/27/2021	8:26:51 AM	0	9.194	5.4	11/27/2021	8:33:24 AM	0	893.634	-2.968	0.08	26.31	1007.37
11/27/2021	9:26:51 AM	0	9.194	5.4	11/27/2021	9:33:24 AM	0	893.819	-2.356	0.08	26.32	1007.36
11/27/2021	10:26:51 AM	0	9.191	5.4	11/27/2021	10:33:24 AM	0	893.394	-1.904	0.08	26.31	1007.37
11/27/2021	11:26:51 AM	0	9.181	5.4	11/27/2021	11:33:24 AM	0	892.654	-1.352	0.08	26.32	1007.36
11/27/2021	12:26:51 PM	0	9.171	5.4	11/27/2021	12:33:24 PM	0	891.598	-0.799	0.08	26.32	1007.36
11/27/2021	1:26:51 PM	0	9.169	5.4	11/27/2021	1:33:24 PM	0	891.572	-0.571	0.08	26.32	1007.36
11/27/2021	2:26:51 PM	0	9.164	5.4	11/27/2021	2:33:24 PM	0	890.998	-0.495	0.08	26.32	1007.36
11/27/2021	3:26:51 PM	0	9.159	5.4	11/27/2021	3:33:24 PM	0	890.51	-0.49	0.08	26.32	1007.36
11/27/2021	4:26:51 PM	0	9.161	5.4	11/27/2021	4:33:24 PM	0	890.696	-0.514	0.08	26.32	1007.36
11/27/2021	5:26:51 PM	0	9.156	5.4	11/27/2021	5:33:24 PM	0	890.3	-0.521	0.08	26.32	1007.36
11/27/2021	6:26:51 PM	0	9.158	5.4	11/27/2021	6:33:24 PM	0	890.403	-0.505	0.08	26.32	1007.36
11/27/2021	7:26:51 PM	0	9.153	5.4	11/27/2021	7:33:24 PM	0	889.958	-0.455	0.08	26.32	1007.36
11/27/2021	8:26:51 PM	0	9.153	5.4	11/27/2021	8:33:24 PM	0	890	-0.452	0.08	26.32	1007.36
11/27/2021	9:26:51 PM	0	9.15	5.4	11/27/2021	9:33:24 PM	0	889.774	-0.429	0.08	26.32	1007.36
11/27/2021	10:26:51 PM	0	9.143	5.4	11/27/2021	10:33:24 PM	0	888.952	-0.381	0.08	26.32	1007.36
11/27/2021	11:26:51 PM	0	9.141	5.4	11/27/2021	11:33:24 PM	0	888.757	-0.278	0.08	26.32	1007.36
11/28/2021	12:26:51 AM	0	9.143	5.4	11/28/2021	12:33:24 AM	0	888.978	-0.176	0.08	26.32	1007.36
11/28/2021	1:26:51 AM	0	9.143	5.4	11/28/2021	1:33:24 AM	0	888.919	-0.204	0.08	26.32	1007.36
11/28/2021	2:26:51 AM	0	9.139	5.4	11/28/2021	2:33:24 AM	0	888.651	-0.206	0.08	26.32	1007.36
11/28/2021	3:26:51 AM	0	9.143	5.4	11/28/2021	3:33:24 AM	0	888.98	-0.095	0.08	26.32	1007.36
11/28/2021	4:26:51 AM	0	9.143	5.4	11/28/2021	4:33:24 AM	0	888.95	-0.028	0.08	26.32	1007.36
11/28/2021	5:26:51 AM	0	9.144	5.4	11/28/2021	5:33:24 AM	0	889.118	0.062	0.08	26.32	1007.36
11/28/2021	6:26:51 AM	0	9.149	5.4	11/28/2021	6:33:24 AM	0	889.541	0.093	0.08	26.32	1007.36
11/28/2021	7:26:51 AM	0	9.152	5.4	11/28/2021	7:33:24 AM	0	889.916	0.02	0.08	26.32	1007.36
11/28/2021	8:26:51 AM	0	9.152	5.4	11/28/2021	8:33:24 AM	0	889.821	-0.057	0.08	26.32	1007.36
11/28/2021	9:26:51 AM	0	9.156	5.4	11/28/2021	9:33:24 AM	0	890.242	0.03	0.08	26.32	1007.36
11/28/2021	10:26:51 AM	0	9.158	5.4	11/28/2021	10:33:24 AM	0	890.455	0.262	0.08	26.32	1007.36
11/28/2021	11:26:51 AM	0	9.159	5.4	11/28/2021	11:33:24 AM	0	890.594	0.587	0.08	26.32	1007.36
11/28/2021	12:26:51 PM	0	9.164	5.4	11/28/2021	12:33:24 PM	0	891.131	1.241	0.08	26.32	1007.36
11/28/2021	1:26:51 PM	0	9.165	5.4	11/28/2021	1:33:24 PM	0	891.323	1.684	0.08	26.32	1007.36
11/28/2021	2:26:51 PM	0	9.165	5.4	11/28/2021	2:33:24 PM	0	891.361	2.91	0.08	26.32	1007.36
11/28/2021	3:26:51 PM	0	9.168	5.4	11/28/2021	3:33:24 PM	0	891.509	1.909	0.08	26.32	1007.36
11/28/2021	4:26:51 PM	0	9.172	5.4	11/28/2021	4:33:24 PM	0	891.749	0.46	0.08	26.32	1007.36
11/28/2021	5:26:51 PM	0	9.178	5.4	11/28/2021	5:33:24 PM	0	892.194	-0.82	0.08	26.31	1007.36
11/28/2021	6:26:51 PM	0	9.184	5.4	11/28/2021	6:33:24 PM	0	892.763	-0.602	0.08	26.31	1007.36
11/28/2021	7:26:51 PM	0	9.188	5.4	11/28/2021	7:33:24 PM	0	893.193	-0.534	0.08	26.31	1007.36
11/28/2021	8:26:51 PM	0	9.197	5.4	11/28/2021	8:33:24 PM	0	894.015	-0.514	0.08	26.31	1007.36
11/28/2021	9:26:51 PM	0	9.2	5.4	11/28/2021	9:33:24 PM	0	894.423	-0.511	0.08	26.32	1007.36
11/28/2021	10:26:51 PM	0	9.205	5.4	11/28/2021	10:33:24 PM	0	894.943	-0.665	0.08	26.32	1007.36
11/28/2021	11:26:51 PM	0	9.211	5.4	11/28/2021	11:33:24 PM	0	895.412	-1.115	0.08	26.31	1007.36
11/29/2021	12:26:51 AM	0	9.216	5.4	11/29/2021	12:33:24 AM	0	895.804	-1.226	0.08	26.31	1007.37
11/29/2021	1:26:51 AM	0	9.217	5.4	11/29/2021	1:33:24 AM	0	896.044	-0.846	0.08	26.31	1007.36
11/29/2021	2:26:51 AM	0	9.22	5.4	11/29/2021	2:33:24 AM	0	896.323	-0.712	0.08	26.31	1007.36
11/29/2021	3:26:51 AM	0	9.223	5.4	11/29/2021	3:33:24 AM	0	896.625	-0.82	0.08	26.31	1007.36
11/29/2021	4:26:51 AM	0	9.223	5.4	11/29/2021	4:33:24 AM	0	896.69	-0.837	0.08	26.32	1007.36
11/29/2021	5:26:51 AM	0	9.232	5.4	11/29/2021	5:33:24 AM	0	897.562	-0.649	0.08	26.32	1007.36
11/29/2021	6:26:51 AM	0	9.238	5.4	11/29/2021	6:33:24 AM	0	898.187	-0.566	0.08	26.32	1007.36
11/29/2021	7:26:51 AM	0	9.24	5.4	11/29/2021	7:33:24 AM	0	898.321	-0.536	0.08	26.32	1007.36
11/29/2021	8:26:51 AM	0	9.242	5.4	11/29/2021	8:33:24 AM	0	898.496	-0.547	0.08	26.31	1007.36
11/29/2021	9:26:51 AM	0	9.243	5.4	11/29/2021	9:33:24 AM	0	898.472	-1.182	0.08	26.31	1007.37
11/29/2021	10:26:51 AM	0	9.249	5.4	11/29/2021	10:33:24 AM	0	899.17	-0.902	0.08	26.31	1007.36
11/29/2021	11:26:51 AM	0	9.243	5.4	11/29/2021	11:33:24 AM	0	898.636	-0.554	0.08	26.32	1007.36
11/29/2021	12:26:51 PM	0	9.232	5.4	11/29/2021	12:33:24 PM	0	897.64	-0.478	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/29/2021	1:26:51 PM	0	9.234	5.4	11/29/2021	1:33:24 PM	0	897.917	0.666	0.08	26.32	1007.36
11/29/2021	2:26:51 PM	0	9.236	5.4	11/29/2021	2:33:24 PM	0	898.258	2.275	0.08	26.32	1007.36
11/29/2021	3:26:51 PM	0	9.222	5.4	11/29/2021	3:33:24 PM	0	896.9	1.963	0.08	26.32	1007.36
11/29/2021	4:26:51 PM	0	9.209	5.4	11/29/2021	4:33:24 PM	0	895.386	0.913	0.08	26.32	1007.36
11/29/2021	5:26:51 PM	0	9.204	5.4	11/29/2021	5:33:24 PM	0	894.926	0.433	0.08	26.32	1007.36
11/29/2021	6:26:51 PM	0	9.203	5.4	11/29/2021	6:33:24 PM	0	894.826	0.651	0.08	26.32	1007.36
11/29/2021	7:26:51 PM	0	9.195	5.4	11/29/2021	7:33:24 PM	0	894.053	1.034	0.08	26.32	1007.36
11/29/2021	8:26:51 PM	0	9.183	5.4	11/29/2021	8:33:24 PM	0	892.836	1.01	0.08	26.32	1007.36
11/29/2021	9:26:51 PM	0	9.188	5.4	11/29/2021	9:33:24 PM	0	893.244	1.111	0.08	26.32	1007.36
11/29/2021	10:26:51 PM	0	9.184	5.4	11/29/2021	10:33:24 PM	0	893.142	1.356	0.08	26.32	1007.36
11/29/2021	11:26:51 PM	0	9.181	5.4	11/29/2021	11:33:24 PM	0	892.852	1.45	0.08	26.32	1007.36
11/30/2021	12:26:51 AM	0	9.18	5.4	11/30/2021	12:33:24 AM	0	892.613	1.287	0.08	26.32	1007.36
11/30/2021	1:26:51 AM	0	9.171	5.4	11/30/2021	1:33:24 AM	0	891.777	1.276	0.08	26.32	1007.36
11/30/2021	2:26:51 AM	0	9.177	5.4	11/30/2021	2:33:24 AM	0	892.356	1.452	0.08	26.32	1007.36
11/30/2021	3:26:51 AM	0	9.174	5.4	11/30/2021	3:33:24 AM	0	892.123	1.617	0.08	26.32	1007.36
11/30/2021	4:26:51 AM	0	9.171	5.4	11/30/2021	4:33:24 AM	0	891.79	1.471	0.08	26.32	1007.36
11/30/2021	5:26:51 AM	0	9.172	5.4	11/30/2021	5:33:24 AM	0	891.87	1.177	0.08	26.32	1007.36
11/30/2021	6:26:51 AM	0	9.171	5.4	11/30/2021	6:33:24 AM	0	891.667	1.023	0.08	26.32	1007.36
11/30/2021	7:26:51 AM	0	9.165	5.4	11/30/2021	7:33:24 AM	0	891.017	0.883	0.08	26.32	1007.36
11/30/2021	8:26:51 AM	0	9.161	5.4	11/30/2021	8:33:24 AM	0	890.561	0.839	0.08	26.32	1007.36
11/30/2021	9:26:51 AM	0	9.161	5.4	11/30/2021	9:33:24 AM	0	890.482	0.731	0.08	26.31	1007.36
11/30/2021	10:26:51 AM	0	9.156	5.4	11/30/2021	10:33:24 AM	0	890.275	0.675	0.08	26.32	1007.36
11/30/2021	11:26:51 AM	0	9.147	5.4	11/30/2021	11:33:24 AM	0	889.432	1.154	0.08	26.32	1007.36
11/30/2021	12:26:51 PM	0	9.136	5.4	11/30/2021	12:33:24 PM	0	888.485	1.182	0.08	26.32	1007.36
11/30/2021	1:26:51 PM	0	9.135	5.4	11/30/2021	1:33:24 PM	0	888.193	1.299	0.08	26.32	1007.36
11/30/2021	2:26:51 PM	0	9.126	5.4	11/30/2021	2:33:24 PM	0	887.414	1.622	0.08	26.32	1007.36
11/30/2021	3:26:51 PM	0	9.123	5.4	11/30/2021	3:33:24 PM	0	887.228	1.748	0.08	26.32	1007.36
11/30/2021	4:26:51 PM	0	9.126	5.4	11/30/2021	4:33:24 PM	0	887.431	1.687	0.08	26.32	1007.36
11/30/2021	5:26:51 PM	0	9.121	5.4	11/30/2021	5:33:24 PM	0	886.792	1.067	0.08	26.32	1007.36
11/30/2021	6:26:51 PM	0	9.127	5.4	11/30/2021	6:33:24 PM	0	887.545	1.26	0.08	26.32	1007.36
11/30/2021	7:26:51 PM	0	9.126	5.4	11/30/2021	7:33:24 PM	0	887.458	1.744	0.08	26.32	1007.36
11/30/2021	8:26:51 PM	0	9.139	5.4	11/30/2021	8:33:24 PM	0	888.769	1.336	0.08	26.32	1007.36
11/30/2021	9:26:51 PM	0	9.144	5.4	11/30/2021	9:33:24 PM	0	889.118	0.882	0.08	26.32	1007.36
11/30/2021	10:26:51 PM	0	9.146	5.4	11/30/2021	10:33:24 PM	0	889.246	0.677	0.08	26.32	1007.36
11/30/2021	11:26:51 PM	0	9.156	5.4	11/30/2021	11:33:24 PM	0	890.224	0.687	0.08	26.32	1007.36
12/1/2021	12:26:51 AM	0	9.169	5.4	12/1/2021	12:33:24 AM	0	891.496	0.921	0.08	26.32	1007.36
12/1/2021	1:26:51 AM	0	9.164	5.4	12/1/2021	1:33:24 AM	0	891.007	0.702	0.08	26.32	1007.36
12/1/2021	2:26:51 AM	0	9.174	5.4	12/1/2021	2:33:24 AM	0	891.943	0.448	0.08	26.32	1007.36
12/1/2021	3:26:51 AM	0	9.171	5.4	12/1/2021	3:33:24 AM	0	891.684	0.435	0.08	26.32	1007.36
12/1/2021	4:26:51 AM	0	9.169	5.4	12/1/2021	4:33:24 AM	0	891.582	0.167	0.08	26.32	1007.36
12/1/2021	5:26:51 AM	0	9.171	5.4	12/1/2021	5:33:24 AM	0	891.448	-0.299	0.08	26.31	1007.36
12/1/2021	6:26:51 AM	0	9.171	5.4	12/1/2021	6:33:24 AM	0	891.451	-0.481	0.08	26.31	1007.36
12/1/2021	7:26:51 AM	0	9.169	5.4	12/1/2021	7:33:24 AM	0	891.28	-0.533	0.08	26.31	1007.36
12/1/2021	8:26:51 AM	0	9.168	5.4	12/1/2021	8:33:24 AM	0	891.179	-0.545	0.08	26.31	1007.36
12/1/2021	9:26:51 AM	0	9.168	5.4	12/1/2021	9:33:24 AM	0	891.272	-0.517	0.08	26.32	1007.36
12/1/2021	10:26:51 AM	0	9.169	5.4	12/1/2021	10:33:24 AM	0	891.318	-0.467	0.08	26.31	1007.36
12/1/2021	11:26:51 AM	0	9.174	5.4	12/1/2021	11:33:24 AM	0	891.847	-0.326	0.08	26.32	1007.36
12/1/2021	12:26:51 PM	0	9.174	5.4	12/1/2021	12:33:24 PM	0	891.901	-0.107	0.08	26.32	1007.36
12/1/2021	1:26:51 PM	0	9.172	5.4	12/1/2021	1:33:24 PM	0	891.705	-0.016	0.08	26.32	1007.36
12/1/2021	2:26:51 PM	0	9.171	5.4	12/1/2021	2:33:24 PM	0	891.701	0.154	0.08	26.32	1007.36
12/1/2021	3:26:51 PM	0	9.171	5.4	12/1/2021	3:33:24 PM	0	891.468	-0.365	0.08	26.31	1007.36
12/1/2021	4:26:51 PM	0	9.166	5.4	12/1/2021	4:33:24 PM	0	891.099	-0.492	0.08	26.32	1007.36
12/1/2021	5:26:51 PM	0	9.166	5.4	12/1/2021	5:33:24 PM	0	891.046	-0.535	0.08	26.31	1007.36
12/1/2021	6:26:51 PM	0	9.164	5.4	12/1/2021	6:33:24 PM	0	890.657	-0.537	0.08	26.31	1007.37
12/1/2021	7:26:51 PM	0	9.161	5.4	12/1/2021	7:33:24 PM	0	890.459	-0.544	0.08	26.31	1007.37
12/1/2021	8:26:51 PM	0	9.155	5.4	12/1/2021	8:33:24 PM	0	889.789	-0.555	0.08	26.31	1007.37
12/1/2021	9:26:51 PM	0	9.158	5.4	12/1/2021	9:33:24 PM	0	890.09	-0.59	0.08	26.31	1007.37
12/1/2021	10:26:51 PM	0	9.164	5.4	12/1/2021	10:33:24 PM	0	890.695	-0.621	0.08	26.31	1007.37
12/1/2021	11:26:51 PM	0	9.169	5.4	12/1/2021	11:33:24 PM	0	891.167	-1.772	0.08	26.31	1007.37
12/2/2021	12:26:51 AM	0	9.177	5.4	12/2/2021	12:33:24 AM	0	891.797	-3.039	0.08	26.31	1007.37
12/2/2021	1:26:51 AM	0	9.191	5.4	12/2/2021	1:33:24 AM	0	893.154	-2.98	0.08	26.31	1007.37
12/2/2021	2:26:51 AM	0	9.201	5.4	12/2/2021	2:33:24 AM	0	894.353	-1.912	0.08	26.31	1007.37
12/2/2021	3:26:51 AM	0	9.213	5.4	12/2/2021	3:33:24 AM	0	895.449	-2.075	0.08	26.31	1007.37
12/2/2021	4:26:51 AM	0	9.219	5.4	12/2/2021	4:33:24 AM	0	895.969	-2.802	0.08	26.31	1007.37
12/2/2021	5:26:51 AM	0	9.225	5.4	12/2/2021	5:33:24 AM	0	896.274	-4.478	0.09	26.31	1007.37
12/2/2021	6:26:51 AM	0	9.232	5.4	12/2/2021	6:33:24 AM	0	896.737	-5.998	0.09	26.31	1007.37
12/2/2021	7:26:51 AM	0	9.238	5.4	12/2/2021	7:33:24 AM	0	897.173	-6.869	0.09	26.31	1007.37
12/2/2021	8:26:51 AM	0	9.245	5.4	12/2/2021	8:33:24 AM	0	897.746	-7.457	0.09	26.30	1007.37
12/2/2021	9:26:51 AM	0	9.252	5.4	12/2/2021	9:33:24 AM	0	898.387	-7.8	0.09	26.30	1007.38
12/2/2021	10:26:51 AM	0	9.261	5.4	12/2/2021	10:33:24 AM	0	899.358	-7.493	0.09	26.30	1007.37
12/2/2021	11:26:51 AM	0	9.265	5.4	12/2/2021	11:33:24 AM	0	899.958	-6.684	0.09	26.31	1007.37
12/2/2021	12:26:51 PM	0	9.265	5.4	12/2/2021	12:33:24 PM	0	900.176	-6.059	0.09	26.31	1007.37

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/2/2021	1:26:51 PM	0	9.27	5.4	12/2/2021	1:33:24 PM	0	900.791	-4.842	0.08	26.31	1007.37
12/2/2021	2:26:51 PM	0	9.27	5.4	12/2/2021	2:33:24 PM	0	900.858	-4.334	0.08	26.31	1007.37
12/2/2021	3:26:51 PM	0	9.271	5.4	12/2/2021	3:33:24 PM	0	901.376	-2.559	0.08	26.32	1007.36
12/2/2021	4:26:51 PM	0	9.274	5.4	12/2/2021	4:33:24 PM	0	901.48	-3.292	0.08	26.31	1007.37
12/2/2021	5:26:51 PM	0	9.277	5.4	12/2/2021	5:33:24 PM	0	901.463	-5.025	0.08	26.31	1007.37
12/2/2021	6:26:51 PM	0	9.281	5.4	12/2/2021	6:33:24 PM	0	901.626	-4.986	0.09	26.31	1007.37
12/2/2021	7:26:51 PM	0	9.282	5.4	12/2/2021	7:33:24 PM	0	901.888	-4.798	0.09	26.31	1007.37
12/2/2021	8:26:51 PM	0	9.287	5.4	12/2/2021	8:33:24 PM	0	902.338	-4.921	0.09	26.31	1007.37
12/2/2021	9:26:51 PM	0	9.291	5.4	12/2/2021	9:33:24 PM	0	902.682	-4.974	0.09	26.31	1007.37
12/2/2021	10:26:51 PM	0	9.296	5.4	12/2/2021	10:33:24 PM	0	903.204	-4.772	0.09	26.31	1007.37
12/2/2021	11:26:51 PM	0	9.303	5.4	12/2/2021	11:33:24 PM	0	903.725	-5.63	0.09	26.31	1007.37
12/3/2021	12:26:51 AM	0	9.306	5.4	12/3/2021	12:33:24 AM	0	903.939	-6.712	0.09	26.31	1007.37
12/3/2021	1:26:51 AM	0	9.307	5.4	12/3/2021	1:33:24 AM	0	903.7	-7.702	0.09	26.30	1007.38
12/3/2021	2:26:51 AM	0	9.31	5.4	12/3/2021	2:33:24 AM	0	904.002	-8.597	0.09	26.30	1007.38
12/3/2021	3:26:51 AM	0	9.312	5.4	12/3/2021	3:33:24 AM	0	903.914	-9.36	0.09	26.30	1007.38
12/3/2021	4:26:51 AM	0	9.312	5.4	12/3/2021	4:33:24 AM	0	903.866	-9.799	0.10	26.30	1007.38
12/3/2021	5:26:51 AM	0	9.313	5.4	12/3/2021	5:33:24 AM	0	904.001	-10.169	0.09	26.30	1007.38
12/3/2021	6:26:51 AM	0	9.312	5.4	12/3/2021	6:33:24 AM	0	903.779	-10.169	0.10	26.30	1007.38
12/3/2021	7:26:51 AM	0	9.312	5.4	12/3/2021	7:33:24 AM	0	903.812	-10.206	0.10	26.30	1007.38
12/3/2021	8:26:51 AM	0	9.31	5.4	12/3/2021	8:33:24 AM	0	903.878	-9.551	0.09	26.30	1007.38
12/3/2021	9:26:51 AM	0	9.315	5.4	12/3/2021	9:33:24 AM	0	904.399	-9.102	0.09	26.30	1007.38
12/3/2021	10:26:51 AM	0	9.316	5.4	12/3/2021	10:33:24 AM	0	904.91	-7.27	0.09	26.31	1007.37
12/3/2021	11:26:51 AM	0	9.315	5.4	12/3/2021	11:33:24 AM	0	905.002	-6.131	0.09	26.31	1007.37
12/3/2021	12:26:51 PM	0	9.312	5.4	12/3/2021	12:33:24 PM	0	904.808	-5.759	0.09	26.31	1007.37
12/3/2021	1:26:51 PM	0	9.304	5.4	12/3/2021	1:33:24 PM	0	904.187	-5.277	0.08	26.31	1007.37
12/3/2021	2:26:51 PM	0	9.302	5.4	12/3/2021	2:33:24 PM	0	903.948	-4.833	0.08	26.31	1007.37
12/3/2021	3:26:51 PM	0	9.294	5.4	12/3/2021	3:33:24 PM	0	903.293	-4.574	0.08	26.31	1007.37
12/3/2021	4:26:51 PM	0	9.291	5.4	12/3/2021	4:33:24 PM	0	902.799	-5.446	0.08	26.31	1007.37
12/3/2021	5:26:51 PM	0	9.285	5.4	12/3/2021	5:33:24 PM	0	901.982	-6.419	0.09	26.31	1007.37
12/3/2021	6:26:51 PM	0	9.281	5.4	12/3/2021	6:33:24 PM	0	901.449	-6.723	0.09	26.31	1007.37
12/3/2021	7:26:51 PM	0	9.277	5.4	12/3/2021	7:33:24 PM	0	901.019	-6.862	0.09	26.31	1007.37
12/3/2021	8:26:51 PM	0	9.273	5.4	12/3/2021	8:33:24 PM	0	900.618	-6.919	0.09	26.31	1007.37
12/3/2021	9:26:51 PM	0	9.268	5.4	12/3/2021	9:33:24 PM	0	900.097	-7.386	0.09	26.31	1007.37
12/3/2021	10:26:51 PM	0	9.261	5.4	12/3/2021	10:33:24 PM	0	899.231	-8.095	0.09	26.30	1007.38
12/3/2021	11:26:51 PM	0	9.255	5.4	12/3/2021	11:33:24 PM	0	898.526	-8.527	0.09	26.30	1007.38
12/4/2021	12:26:51 AM	0	9.246	5.4	12/4/2021	12:33:24 AM	0	897.717	-8.417	0.09	26.30	1007.38
12/4/2021	1:26:51 AM	0	9.232	5.4	12/4/2021	1:33:24 AM	0	896.32	-8.784	0.09	26.30	1007.38
12/4/2021	2:26:51 AM	0	9.222	5.4	12/4/2021	2:33:24 AM	0	895.347	-8.739	0.09	26.30	1007.38
12/4/2021	3:26:51 AM	0	9.213	5.4	12/4/2021	3:33:24 AM	0	894.306	-9.199	0.09	26.30	1007.38
12/4/2021	4:26:51 AM	0	9.205	5.4	12/4/2021	4:33:24 AM	0	893.51	-9.726	0.09	26.30	1007.38
12/4/2021	5:26:51 AM	0	9.2	5.4	12/4/2021	5:33:24 AM	0	892.843	-9.797	0.10	26.30	1007.38
12/4/2021	6:26:51 AM	0	9.194	5.4	12/4/2021	6:33:24 AM	0	892.268	-9.719	0.10	26.30	1007.38
12/4/2021	7:26:51 AM	0	9.184	5.4	12/4/2021	7:33:24 AM	0	891.624	-9.068	0.09	26.30	1007.38
12/4/2021	8:26:51 AM	0	9.184	5.4	12/4/2021	8:33:24 AM	0	891.766	-8.485	0.09	26.30	1007.37
12/4/2021	9:26:51 AM	0	9.188	5.4	12/4/2021	9:33:24 AM	0	892.137	-8.159	0.09	26.30	1007.37
12/4/2021	10:26:51 AM	0	9.189	5.4	12/4/2021	10:33:24 AM	0	892.471	-7.445	0.09	26.31	1007.37
12/4/2021	11:26:51 AM	0	9.189	5.4	12/4/2021	11:33:24 AM	0	892.776	-6.203	0.09	26.31	1007.37
12/4/2021	12:26:51 PM	0	9.191	5.4	12/4/2021	12:33:24 PM	0	892.943	-5.619	0.09	26.31	1007.37
12/4/2021	1:26:51 PM	0	9.191	5.4	12/4/2021	1:33:24 PM	0	892.816	-6.326	0.09	26.31	1007.37
12/4/2021	2:26:51 PM	0	9.194	5.4	12/4/2021	2:33:24 PM	0	892.951	-6.75	0.09	26.31	1007.37
12/4/2021	3:26:51 PM	0	9.2	5.4	12/4/2021	3:33:24 PM	0	893.548	-6.781	0.09	26.31	1007.37
12/4/2021	4:26:51 PM	0	9.207	5.4	12/4/2021	4:33:24 PM	0	894.226	-7.187	0.09	26.31	1007.37
12/4/2021	5:26:51 PM	0	9.216	5.4	12/4/2021	5:33:24 PM	0	895.179	-6.742	0.09	26.31	1007.37
12/4/2021	6:26:51 PM	0	9.219	5.4	12/4/2021	6:33:24 PM	0	895.512	-6.804	0.09	26.31	1007.37
12/4/2021	7:26:51 PM	0	9.225	5.4	12/4/2021	7:33:24 PM	0	895.909	-7.206	0.09	26.31	1007.37
12/4/2021	8:26:51 PM	0	9.236	5.4	12/4/2021	8:33:24 PM	0	896.951	-7.345	0.09	26.31	1007.37
12/4/2021	9:26:51 PM	0	9.249	5.4	12/4/2021	9:33:24 PM	0	898.348	-6.905	0.09	26.31	1007.37
12/4/2021	10:26:51 PM	0	9.262	5.4	12/4/2021	10:33:24 PM	0	899.574	-7.136	0.09	26.31	1007.37
12/4/2021	11:26:51 PM	0	9.273	5.4	12/4/2021	11:33:24 PM	0	900.352	-8.132	0.09	26.30	1007.38
12/5/2021	12:26:51 AM	0	9.284	5.4	12/5/2021	12:33:24 AM	0	901.373	-8.63	0.09	26.30	1007.38
12/5/2021	1:26:51 AM	0	9.293	5.4	12/5/2021	1:33:24 AM	0	902.264	-8.684	0.09	26.30	1007.38
12/5/2021	2:26:51 AM	0	9.304	5.4	12/5/2021	2:33:24 AM	0	903.351	-8.526	0.09	26.30	1007.38
12/5/2021	3:26:51 AM	0	9.315	5.4	12/5/2021	3:33:24 AM	0	904.402	-8.513	0.09	26.30	1007.38
12/5/2021	4:26:51 AM	0	9.322	5.4	12/5/2021	4:33:24 AM	0	905.134	-8.799	0.09	26.30	1007.38
12/5/2021	5:26:51 AM	0	9.332	5.4	12/5/2021	5:33:24 AM	0	905.845	-9.58	0.09	26.30	1007.38
12/5/2021	6:26:51 AM	0	9.339	5.4	12/5/2021	6:33:24 AM	0	906.322	-10.5	0.10	26.30	1007.38
12/5/2021	7:26:51 AM	0	9.342	5.4	12/5/2021	7:33:24 AM	0	906.502	-11.676	0.10	26.30	1007.38
12/5/2021	8:26:51 AM	0	9.348	5.4	12/5/2021	8:33:24 AM	0	906.896	-12.628	0.10	26.29	1007.38
12/5/2021	9:26:51 AM	0	9.352	5.4	12/5/2021	9:33:24 AM	0	907.239	-13.101	0.10	26.29	1007.38
12/5/2021	10:26:51 AM	0	9.361	5.4	12/5/2021	10:33:24 AM	0	908.225	-12.607	0.10	26.30	1007.38
12/5/2021	11:26:51 AM	0	9.363	5.4	12/5/2021	11:33:24 AM	0	908.694	-11.405	0.10	26.30	1007.38
12/5/2021	12:26:51 PM	0	9.369	5.4	12/5/2021	12:33:24 PM	0	909.548	-10.179	0.09	26.30	1007.38

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/5/2021	1:26:51 PM	0	9.36	5.4	12/5/2021	1:33:24 PM	0	908.982	-9.112	0.09	26.30	1007.38
12/5/2021	2:26:51 PM	0	9.355	5.4	12/5/2021	2:33:24 PM	0	908.645	-8.212	0.09	26.31	1007.37
12/5/2021	3:26:51 PM	0	9.347	5.4	12/5/2021	3:33:24 PM	0	907.908	-7.869	0.09	26.31	1007.37
12/5/2021	4:26:51 PM	0	9.344	5.4	12/5/2021	4:33:24 PM	0	907.281	-8.52	0.09	26.30	1007.38
12/5/2021	5:26:51 PM	0	9.339	5.4	12/5/2021	5:33:24 PM	0	906.794	-9.182	0.09	26.30	1007.38
12/5/2021	6:26:51 PM	0	9.332	5.4	12/5/2021	6:33:24 PM	0	906.104	-9.229	0.09	26.30	1007.38
12/5/2021	7:26:51 PM	0	9.319	5.4	12/5/2021	7:33:24 PM	0	904.903	-9.194	0.09	26.30	1007.38
12/5/2021	8:26:51 PM	0	9.315	5.4	12/5/2021	8:33:24 PM	0	904.46	-9.098	0.09	26.30	1007.38
12/5/2021	9:26:51 PM	0	9.304	5.4	12/5/2021	9:33:24 PM	0	903.487	-8.946	0.09	26.30	1007.38
12/5/2021	10:26:51 PM	0	9.297	5.4	12/5/2021	10:33:24 PM	0	902.735	-8.851	0.09	26.30	1007.38
12/5/2021	11:26:51 PM	0	9.285	5.4	12/5/2021	11:33:24 PM	0	901.64	-8.779	0.09	26.30	1007.38
12/6/2021	12:26:51 AM	0	9.273	5.4	12/6/2021	12:33:24 AM	0	900.385	-8.658	0.09	26.30	1007.38
12/6/2021	1:26:51 AM	0	9.262	5.4	12/6/2021	1:33:24 AM	0	899.515	-8.529	0.09	26.31	1007.37
12/6/2021	2:26:51 AM	0	9.257	5.4	12/6/2021	2:33:24 AM	0	898.893	-8.447	0.09	26.30	1007.38
12/6/2021	3:26:51 AM	0	9.251	5.4	12/6/2021	3:33:24 AM	0	898.289	-8.463	0.09	26.30	1007.38
12/6/2021	4:26:51 AM	0	9.238	5.4	12/6/2021	4:33:24 AM	0	897.217	-8.382	0.09	26.31	1007.37
12/6/2021	5:26:51 AM	0	9.232	5.4	12/6/2021	5:33:24 AM	0	896.552	-8.325	0.09	26.31	1007.37
12/6/2021	6:26:51 AM	0	9.228	5.4	12/6/2021	6:33:24 AM	0	896.212	-8.227	0.09	26.31	1007.37
12/6/2021	7:26:51 AM	0	9.225	5.4	12/6/2021	7:33:24 AM	0	895.9	-8.414	0.09	26.31	1007.37
12/6/2021	8:26:51 AM	0	9.225	5.4	12/6/2021	8:33:24 AM	0	895.675	-8.789	0.09	26.30	1007.38
12/6/2021	9:26:51 AM	0	9.223	5.4	12/6/2021	9:33:24 AM	0	895.681	-8.652	0.09	26.31	1007.37
12/6/2021	10:26:51 AM	0	9.228	5.4	12/6/2021	10:33:24 AM	0	896.22	-8.176	0.09	26.31	1007.37
12/6/2021	11:26:51 AM	0	9.222	5.4	12/6/2021	11:33:24 AM	0	895.709	-7.561	0.09	26.31	1007.37
12/6/2021	12:26:51 PM	0	9.217	5.4	12/6/2021	12:33:24 PM	0	895.534	-6.228	0.09	26.31	1007.37
12/6/2021	1:26:51 PM	0	9.214	5.4	12/6/2021	1:33:24 PM	0	895.339	-5.368	0.08	26.31	1007.37
12/6/2021	2:26:51 PM	0	9.219	5.4	12/6/2021	2:33:24 PM	0	895.772	-5.436	0.08	26.31	1007.37
12/6/2021	3:26:51 PM	0	9.216	5.4	12/6/2021	3:33:24 PM	0	895.511	-5.7	0.08	26.31	1007.37
12/6/2021	4:26:51 PM	0	9.207	5.4	12/6/2021	4:33:24 PM	0	894.266	-6.715	0.09	26.31	1007.37
12/6/2021	5:26:51 PM	0	9.204	5.4	12/6/2021	5:33:24 PM	0	893.675	-8.189	0.09	26.30	1007.38
12/6/2021	6:26:51 PM	0	9.207	5.4	12/6/2021	6:33:24 PM	0	893.761	-9.263	0.09	26.30	1007.38
12/6/2021	7:26:51 PM	0	9.207	5.4	12/6/2021	7:33:24 PM	0	893.566	-9.728	0.10	26.30	1007.38
12/6/2021	8:26:51 PM	0	9.204	5.4	12/6/2021	8:33:24 PM	0	893.394	-9.444	0.09	26.30	1007.38
12/6/2021	9:26:51 PM	0	9.201	5.4	12/6/2021	9:33:24 PM	0	893.318	-8.971	0.09	26.30	1007.38
12/6/2021	10:26:51 PM	0	9.197	5.4	12/6/2021	10:33:24 PM	0	892.917	-8.829	0.09	26.30	1007.38
12/6/2021	11:26:51 PM	0	9.195	5.4	12/6/2021	11:33:24 PM	0	892.777	-8.559	0.09	26.30	1007.38
12/7/2021	12:26:51 AM	0	9.198	5.4	12/7/2021	12:33:24 AM	0	893.22	-8.304	0.09	26.31	1007.37
12/7/2021	1:26:51 AM	0	9.195	5.4	12/7/2021	1:33:24 AM	0	892.974	-7.923	0.09	26.31	1007.37
12/7/2021	2:26:51 AM	0	9.195	5.4	12/7/2021	2:33:24 AM	0	892.983	-7.721	0.09	26.31	1007.37
12/7/2021	3:26:51 AM	0	9.194	5.4	12/7/2021	3:33:24 AM	0	892.898	-7.578	0.09	26.31	1007.37
12/7/2021	4:26:51 AM	0	9.191	5.4	12/7/2021	4:33:24 AM	0	892.622	-7.518	0.09	26.31	1007.37
12/7/2021	5:26:51 AM	0	9.186	5.4	12/7/2021	5:33:24 AM	0	892.185	-7.334	0.09	26.31	1007.37
12/7/2021	6:26:51 AM	0	9.181	5.4	12/7/2021	6:33:24 AM	0	891.84	-7.197	0.09	26.31	1007.37
12/7/2021	7:26:51 AM	0	9.177	5.4	12/7/2021	7:33:24 AM	0	891.455	-7.008	0.09	26.31	1007.37
12/7/2021	8:26:51 AM	0	9.174	5.4	12/7/2021	8:33:24 AM	0	891.097	-6.808	0.09	26.31	1007.37
12/7/2021	9:26:51 AM	0	9.166	5.4	12/7/2021	9:33:24 AM	0	890.521	-6.574	0.09	26.31	1007.37
12/7/2021	10:26:51 AM	0	9.166	5.4	12/7/2021	10:33:24 AM	0	890.501	-6.16	0.09	26.31	1007.37
12/7/2021	11:26:51 AM	0	9.162	5.4	12/7/2021	11:33:24 AM	0	890.204	-5.231	0.08	26.31	1007.37
12/7/2021	12:26:51 PM	0	9.156	5.4	12/7/2021	12:33:24 PM	0	889.81	-4.36	0.08	26.31	1007.37
12/7/2021	1:26:51 PM	0	9.152	5.4	12/7/2021	1:33:24 PM	0	889.46	-3.687	0.08	26.31	1007.37
12/7/2021	2:26:51 PM	0	9.144	5.4	12/7/2021	2:33:24 PM	0	888.764	-3.506	0.08	26.31	1007.37
12/7/2021	3:26:51 PM	0	9.135	5.4	12/7/2021	3:33:24 PM	0	887.784	-3.651	0.08	26.31	1007.37
12/7/2021	4:26:51 PM	0	9.124	5.4	12/7/2021	4:33:24 PM	0	886.782	-4.022	0.08	26.31	1007.37
12/7/2021	5:26:51 PM	0	9.106	5.4	12/7/2021	5:33:24 PM	0	884.905	-4.259	0.08	26.31	1007.37
12/7/2021	6:26:51 PM	0	9.098	5.4	12/7/2021	6:33:24 PM	0	884.044	-4.406	0.08	26.31	1007.37
12/7/2021	7:26:51 PM	0	9.085	5.4	12/7/2021	7:33:24 PM	0	882.867	-4.12	0.08	26.31	1007.37
12/7/2021	8:26:51 PM	0	9.084	5.4	12/7/2021	8:33:24 PM	0	882.838	-3.792	0.08	26.31	1007.37
12/7/2021	9:26:51 PM	0	9.072	5.4	12/7/2021	9:33:24 PM	0	881.709	-3.568	0.08	26.31	1007.37
12/7/2021	10:26:51 PM	0	9.06	5.4	12/7/2021	10:33:24 PM	0	880.482	-3.512	0.08	26.31	1007.37
12/7/2021	11:26:51 PM	0	9.05	5.4	12/7/2021	11:33:24 PM	0	879.424	-3.547	0.08	26.31	1007.37
12/8/2021	12:26:51 AM	0	9.039	5.4	12/8/2021	12:33:24 AM	0	878.477	-3.333	0.08	26.31	1007.37
12/8/2021	1:26:51 AM	0	9.037	5.4	12/8/2021	1:33:24 AM	0	878.417	-3	0.08	26.32	1007.36
12/8/2021	2:26:51 AM	0	9.034	5.4	12/8/2021	2:33:24 AM	0	878.172	-2.736	0.08	26.32	1007.36
12/8/2021	3:26:51 AM	0	9.034	5.4	12/8/2021	3:33:24 AM	0	878.136	-2.502	0.08	26.32	1007.36
12/8/2021	4:26:51 AM	0	9.039	5.4	12/8/2021	4:33:24 AM	0	878.593	-2.371	0.08	26.31	1007.36
12/8/2021	5:26:51 AM	0	9.048	5.4	12/8/2021	5:33:24 AM	0	879.624	-2.268	0.08	26.32	1007.36
12/8/2021	6:26:51 AM	0	9.056	5.4	12/8/2021	6:33:24 AM	0	880.217	-2.645	0.08	26.31	1007.36
12/8/2021	7:26:51 AM	0	9.06	5.4	12/8/2021	7:33:24 AM	0	880.568	-3.103	0.08	26.31	1007.36
12/8/2021	8:26:51 AM	0	9.069	5.4	12/8/2021	8:33:24 AM	0	881.267	-3.666	0.08	26.31	1007.37
12/8/2021	9:26:51 AM	0	9.075	5.4	12/8/2021	9:33:24 AM	0	881.6	-4.955	0.09	26.31	1007.37
12/8/2021	10:26:51 AM	0	9.078	5.4	12/8/2021	10:33:24 AM	0	881.885	-5.453	0.09	26.31	1007.37
12/8/2021	11:26:51 AM	0	9.087	5.4	12/8/2021	11:33:24 AM	0	882.858	-4.815	0.08	26.31	1007.37
12/8/2021	12:26:51 PM	0	9.088	5.4	12/8/2021	12:33:24 PM	0	883.324	-3.406	0.08	26.31	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/8/2021	1:26:51 PM	0	9.09	5.4	12/8/2021	1:33:24 PM	0	883.727	-2.469	0.08	26.32	1007.36
12/8/2021	2:26:51 PM	0	9.091	5.4	12/8/2021	2:33:24 PM	0	883.874	-1.965	0.08	26.32	1007.36
12/8/2021	3:26:51 PM	0	9.093	5.4	12/8/2021	3:33:24 PM	0	883.877	-2.423	0.08	26.31	1007.36
12/8/2021	4:26:51 PM	0	9.098	5.4	12/8/2021	4:33:24 PM	0	883.838	-4.577	0.09	26.31	1007.37
12/8/2021	5:26:51 PM	0	9.101	5.4	12/8/2021	5:33:24 PM	0	883.906	-5.896	0.09	26.31	1007.37
12/8/2021	6:26:51 PM	0	9.099	5.4	12/8/2021	6:33:24 PM	0	883.832	-5.826	0.09	26.31	1007.37
12/8/2021	7:26:51 PM	0	9.098	5.4	12/8/2021	7:33:24 PM	0	883.622	-5.501	0.09	26.31	1007.37
12/8/2021	8:26:51 PM	0	9.099	5.4	12/8/2021	8:33:24 PM	0	883.71	-5.945	0.09	26.31	1007.37
12/8/2021	9:26:51 PM	0	9.101	5.4	12/8/2021	9:33:24 PM	0	883.814	-6.493	0.09	26.31	1007.37
12/8/2021	10:26:51 PM	0	9.105	5.4	12/8/2021	10:33:24 PM	0	884.342	-5.954	0.09	26.31	1007.37
12/8/2021	11:26:51 PM	0	9.105	5.4	12/8/2021	11:33:24 PM	0	884.533	-5.407	0.09	26.31	1007.37
12/9/2021	12:26:51 AM	0	9.104	5.4	12/9/2021	12:33:24 AM	0	884.291	-5.948	0.09	26.31	1007.37
12/9/2021	1:26:51 AM	0	9.104	5.4	12/9/2021	1:33:24 AM	0	884.026	-6.767	0.09	26.31	1007.37
12/9/2021	2:26:51 AM	0	9.104	5.4	12/9/2021	2:33:24 AM	0	884.052	-7.192	0.09	26.31	1007.37
12/9/2021	3:26:51 AM	0	9.108	5.4	12/9/2021	3:33:24 AM	0	884.323	-7.363	0.09	26.30	1007.37
12/9/2021	4:26:51 AM	0	9.105	5.4	12/9/2021	4:33:24 AM	0	883.943	-7.802	0.09	26.30	1007.38
12/9/2021	5:26:51 AM	0	9.106	5.4	12/9/2021	5:33:24 AM	0	884.179	-7.804	0.09	26.30	1007.37
12/9/2021	6:26:51 AM	0	9.106	5.4	12/9/2021	6:33:24 AM	0	884.38	-7.057	0.09	26.31	1007.37
12/9/2021	7:26:51 AM	0	9.105	5.4	12/9/2021	7:33:24 AM	0	884.299	-6.62	0.09	26.31	1007.37
12/9/2021	8:26:51 AM	0	9.106	5.4	12/9/2021	8:33:24 AM	0	884.635	-6.171	0.09	26.31	1007.37
12/9/2021	9:26:51 AM	0	9.111	5.4	12/9/2021	9:33:24 AM	0	884.98	-6.242	0.09	26.31	1007.37
12/9/2021	10:26:51 AM	0	9.116	5.4	12/9/2021	10:33:24 AM	0	885.555	-5.936	0.09	26.31	1007.37
12/9/2021	11:26:51 AM	0	9.117	5.4	12/9/2021	11:33:24 AM	0	885.843	-4.862	0.08	26.31	1007.37
12/9/2021	12:26:51 PM	0	9.117	5.4	12/9/2021	12:33:24 PM	0	886.058	-3.905	0.08	26.31	1007.37
12/9/2021	1:26:51 PM	0	9.118	5.4	12/9/2021	1:33:24 PM	0	886.324	-2.576	0.08	26.31	1007.36
12/9/2021	2:26:51 PM	0	9.117	5.4	12/9/2021	2:33:24 PM	0	886.396	-2.127	0.08	26.32	1007.36
12/9/2021	3:26:51 PM	0	9.12	5.4	12/9/2021	3:33:24 PM	0	886.614	-2.232	0.08	26.32	1007.36
12/9/2021	4:26:51 PM	0	9.123	5.4	12/9/2021	4:33:24 PM	0	886.69	-2.882	0.08	26.31	1007.37
12/9/2021	5:26:51 PM	0	9.124	5.4	12/9/2021	5:33:24 PM	0	886.689	-4.091	0.08	26.31	1007.37
12/9/2021	6:26:51 PM	0	9.127	5.4	12/9/2021	6:33:24 PM	0	886.772	-4.94	0.08	26.31	1007.37
12/9/2021	7:26:51 PM	0	9.13	5.4	12/9/2021	7:33:24 PM	0	886.903	-5.891	0.09	26.31	1007.37
12/9/2021	8:26:51 PM	0	9.133	5.4	12/9/2021	8:33:24 PM	0	886.968	-6.935	0.09	26.31	1007.37
12/9/2021	9:26:51 PM	0	9.135	5.4	12/9/2021	9:33:24 PM	0	887.13	-7.121	0.09	26.31	1007.37
12/9/2021	10:26:51 PM	0	9.136	5.4	12/9/2021	10:33:24 PM	0	887.291	-6.67	0.09	26.31	1007.37
12/9/2021	11:26:51 PM	0	9.139	5.4	12/9/2021	11:33:24 PM	0	887.509	-6.908	0.09	26.31	1007.37
12/10/2021	12:26:51 AM	0	9.139	5.4	12/10/2021	12:33:24 AM	0	887.407	-7.554	0.09	26.30	1007.37
12/10/2021	1:26:51 AM	0	9.136	5.4	12/10/2021	1:33:24 AM	0	887.059	-7.72	0.09	26.30	1007.37
12/10/2021	2:26:51 AM	0	9.136	5.4	12/10/2021	2:33:24 AM	0	887.147	-7.281	0.09	26.31	1007.37
12/10/2021	3:26:51 AM	0	9.138	5.4	12/10/2021	3:33:24 AM	0	887.404	-6.835	0.09	26.31	1007.37
12/10/2021	4:26:51 AM	0	9.136	5.4	12/10/2021	4:33:24 AM	0	887.417	-6.85	0.09	26.31	1007.37
12/10/2021	5:26:51 AM	0	9.138	5.4	12/10/2021	5:33:24 AM	0	887.358	-7.104	0.09	26.31	1007.37
12/10/2021	6:26:51 AM	0	9.139	5.4	12/10/2021	6:33:24 AM	0	887.504	-7.112	0.09	26.31	1007.37
12/10/2021	7:26:51 AM	0	9.138	5.4	12/10/2021	7:33:24 AM	0	887.411	-6.896	0.09	26.31	1007.37
12/10/2021	8:26:51 AM	0	9.136	5.4	12/10/2021	8:33:24 AM	0	887.362	-6.721	0.09	26.31	1007.37
12/10/2021	9:26:51 AM	0	9.132	5.4	12/10/2021	9:33:24 AM	0	887.022	-6.446	0.09	26.31	1007.37
12/10/2021	10:26:51 AM	0	9.127	5.4	12/10/2021	10:33:24 AM	0	886.682	-6.075	0.09	26.31	1007.37
12/10/2021	11:26:51 AM	0	9.124	5.4	12/10/2021	11:33:24 AM	0	886.534	-5.481	0.08	26.31	1007.37
12/10/2021	12:26:51 PM	0	9.117	5.4	12/10/2021	12:33:24 PM	0	885.923	-4.687	0.08	26.31	1007.37
12/10/2021	1:26:51 PM	0	9.108	5.4	12/10/2021	1:33:24 PM	0	885.041	-4.257	0.08	26.31	1007.37
12/10/2021	2:26:51 PM	0	9.096	5.4	12/10/2021	2:33:24 PM	0	883.913	-4.05	0.08	26.31	1007.37
12/10/2021	3:26:51 PM	0	9.084	5.4	12/10/2021	3:33:24 PM	0	882.772	-4.012	0.08	26.31	1007.37
12/10/2021	4:26:51 PM	0	9.07	5.4	12/10/2021	4:33:24 PM	0	881.456	-4.24	0.08	26.31	1007.37
12/10/2021	5:26:51 PM	0	9.06	5.4	12/10/2021	5:33:24 PM	0	880.169	-4.696	0.08	26.31	1007.37
12/10/2021	6:26:51 PM	0	9.045	5.4	12/10/2021	6:33:24 PM	0	878.77	-4.792	0.08	26.31	1007.37
12/10/2021	7:26:51 PM	0	9.034	5.4	12/10/2021	7:33:24 PM	0	877.852	-4.545	0.08	26.31	1007.37
12/10/2021	8:26:51 PM	0	9.018	5.4	12/10/2021	8:33:24 PM	0	876.418	-4.296	0.08	26.31	1007.37
12/10/2021	9:26:51 PM	0	9.003	5.4	12/10/2021	9:33:24 PM	0	874.891	-4.127	0.08	26.31	1007.37
12/10/2021	10:26:51 PM	0	8.991	5.4	12/10/2021	10:33:24 PM	0	873.541	-4.303	0.08	26.31	1007.37
12/10/2021	11:26:51 PM	0	8.975	5.4	12/10/2021	11:33:24 PM	0	872.073	-4.2	0.08	26.31	1007.37
12/11/2021	12:26:51 AM	0	8.962	5.4	12/11/2021	12:33:24 AM	0	870.914	-3.922	0.08	26.31	1007.37
12/11/2021	1:26:51 AM	0	8.949	5.4	12/11/2021	1:33:24 AM	0	869.587	-3.572	0.08	26.31	1007.37
12/11/2021	2:26:51 AM	0	8.938	5.4	12/11/2021	2:33:24 AM	0	868.627	-3.599	0.08	26.31	1007.36
12/11/2021	3:26:51 AM	0	8.938	5.4	12/11/2021	3:33:24 AM	0	868.612	-3.753	0.08	26.31	1007.36
12/11/2021	4:26:51 AM	0	8.934	5.4	12/11/2021	4:33:24 AM	0	868.195	-3.772	0.08	26.31	1007.37
12/11/2021	5:26:51 AM	0	8.928	5.4	12/11/2021	5:33:24 AM	0	867.564	-3.433	0.08	26.31	1007.37
12/11/2021	6:26:51 AM	0	8.941	5.4	12/11/2021	6:33:24 AM	0	868.981	-3.127	0.08	26.31	1007.36
12/11/2021	7:26:51 AM	0	8.941	5.4	12/11/2021	7:33:24 AM	0	868.873	-3.18	0.08	26.31	1007.37
12/11/2021	8:26:51 AM	0	8.949	5.4	12/11/2021	8:33:24 AM	0	869.677	-3.404	0.08	26.31	1007.36
12/11/2021	9:26:51 AM	0	8.95	5.4	12/11/2021	9:33:24 AM	0	869.782	-3.792	0.08	26.31	1007.36
12/11/2021	10:26:51 AM	0	8.954	5.4	12/11/2021	10:33:24 AM	0	869.842	-4.11	0.08	26.31	1007.37
12/11/2021	11:26:51 AM	0	8.95	5.4	12/11/2021	11:33:24 AM	0	869.731	-3.637	0.08	26.31	1007.37
12/11/2021	12:26:51 PM	0	8.946	5.4	12/11/2021	12:33:24 PM	0	869.537	-2.05	0.08	26.32	1007.36

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/11/2021	1:26:51 PM	0	8.947	5.4	12/11/2021	1:33:24 PM	0	869.765	-1.655	0.08	26.32	1007.36
12/11/2021	2:26:51 PM	0	8.944	5.4	12/11/2021	2:33:24 PM	0	869.458	-1.826	0.08	26.32	1007.36
12/11/2021	3:26:51 PM	0	8.946	5.4	12/11/2021	3:33:24 PM	0	869.557	-2.193	0.08	26.32	1007.36
12/11/2021	4:26:51 PM	0	8.941	5.4	12/11/2021	4:33:24 PM	0	868.899	-2.884	0.08	26.31	1007.36
12/11/2021	5:26:51 PM	0	8.938	5.4	12/11/2021	5:33:24 PM	0	868.427	-3.59	0.08	26.31	1007.37
12/11/2021	6:26:51 PM	0	8.937	5.4	12/11/2021	6:33:24 PM	0	868.305	-3.997	0.08	26.31	1007.37
12/11/2021	7:26:51 PM	0	8.94	5.4	12/11/2021	7:33:24 PM	0	868.456	-4.231	0.08	26.31	1007.37
12/11/2021	8:26:51 PM	0	8.94	5.4	12/11/2021	8:33:24 PM	0	868.488	-4.084	0.08	26.31	1007.37
12/11/2021	9:26:51 PM	0	8.946	5.4	12/11/2021	9:33:24 PM	0	869.258	-3.726	0.08	26.31	1007.37
12/11/2021	10:26:51 PM	0	8.954	5.4	12/11/2021	10:33:24 PM	0	869.999	-3.72	0.08	26.31	1007.37
12/11/2021	11:26:51 PM	0	8.964	5.4	12/11/2021	11:33:24 PM	0	870.964	-4.021	0.08	26.31	1007.37
12/12/2021	12:26:51 AM	0	8.976	5.4	12/12/2021	12:33:24 AM	0	871.902	-4.554	0.09	26.31	1007.37
12/12/2021	1:26:51 AM	0	8.977	5.4	12/12/2021	1:33:24 AM	0	871.939	-5.637	0.09	26.31	1007.37
12/12/2021	2:26:51 AM	0	8.983	5.4	12/12/2021	2:33:24 AM	0	872.276	-6.739	0.09	26.31	1007.37
12/12/2021	3:26:51 AM	0	8.982	5.4	12/12/2021	3:33:24 AM	0	871.993	-6.989	0.09	26.30	1007.37
12/12/2021	4:26:51 AM	0	8.982	5.4	12/12/2021	4:33:24 AM	0	872.08	-6.729	0.09	26.31	1007.37
12/12/2021	5:26:51 AM	0	8.98	5.4	12/12/2021	5:33:24 AM	0	871.987	-6.673	0.09	26.31	1007.37
12/12/2021	6:26:51 AM	0	8.983	5.4	12/12/2021	6:33:24 AM	0	872.436	-6.069	0.09	26.31	1007.37
12/12/2021	7:26:51 AM	0	8.986	5.4	12/12/2021	7:33:24 AM	0	872.996	-5.343	0.08	26.31	1007.37
12/12/2021	8:26:51 AM	0	8.989	5.4	12/12/2021	8:33:24 AM	0	873.34	-5.104	0.08	26.31	1007.37
12/12/2021	9:26:51 AM	0	8.995	5.4	12/12/2021	9:33:24 AM	0	873.839	-5.103	0.08	26.31	1007.37
12/12/2021	10:26:51 AM	0	9.005	5.4	12/12/2021	10:33:24 AM	0	874.825	-4.864	0.08	26.31	1007.37
12/12/2021	11:26:51 AM	0	9.012	5.4	12/12/2021	11:33:24 AM	0	875.777	-4.215	0.08	26.31	1007.37
12/12/2021	12:26:51 PM	0	9.02	5.4	12/12/2021	12:33:24 PM	0	876.579	-3.776	0.08	26.31	1007.37
12/12/2021	1:26:51 PM	0	9.025	5.4	12/12/2021	1:33:24 PM	0	877.123	-3.391	0.08	26.31	1007.37
12/12/2021	2:26:51 PM	0	9.03	5.4	12/12/2021	2:33:24 PM	0	877.437	-3.672	0.08	26.31	1007.37
12/12/2021	3:26:51 PM	0	9.034	5.4	12/12/2021	3:33:24 PM	0	877.914	-3.821	0.08	26.31	1007.37
12/12/2021	4:26:51 PM	0	9.04	5.4	12/12/2021	4:33:24 PM	0	878.55	-3.896	0.08	26.31	1007.37
12/12/2021	5:26:51 PM	0	9.043	5.4	12/12/2021	5:33:24 PM	0	878.601	-4.536	0.08	26.31	1007.37
12/12/2021	6:26:51 PM	0	9.045	5.4	12/12/2021	6:33:24 PM	0	878.693	-4.726	0.08	26.31	1007.37
12/12/2021	7:26:51 PM	0	9.047	5.4	12/12/2021	7:33:24 PM	0	878.863	-5.123	0.09	26.31	1007.37
12/12/2021	8:26:51 PM	0	9.048	5.4	12/12/2021	8:33:24 PM	0	878.941	-4.997	0.09	26.31	1007.37
12/12/2021	9:26:51 PM	0	9.051	5.4	12/12/2021	9:33:24 PM	0	879.344	-4.828	0.08	26.31	1007.37
12/12/2021	10:26:51 PM	0	9.054	5.4	12/12/2021	10:33:24 PM	0	879.701	-4.534	0.08	26.31	1007.37
12/12/2021	11:26:51 PM	0	9.059	5.4	12/12/2021	11:33:24 PM	0	880.316	-4.282	0.08	26.31	1007.37
12/13/2021	12:26:51 AM	0	9.062	5.4	12/13/2021	12:33:24 AM	0	880.531	-4.068	0.08	26.31	1007.37
12/13/2021	1:26:51 AM	0	9.065	5.4	12/13/2021	1:33:24 AM	0	880.865	-4.123	0.08	26.31	1007.37
12/13/2021	2:26:51 AM	0	9.069	5.4	12/13/2021	2:33:24 AM	0	881.199	-4.525	0.08	26.31	1007.37
12/13/2021	3:26:51 AM	0	9.075	5.4	12/13/2021	3:33:24 AM	0	881.738	-4.806	0.08	26.31	1007.37
12/13/2021	4:26:51 AM	0	9.079	5.4	12/13/2021	4:33:24 AM	0	882.03	-5.003	0.08	26.31	1007.37
12/13/2021	5:26:51 AM	0	9.075	5.4	12/13/2021	5:33:24 AM	0	881.507	-5.141	0.09	26.31	1007.37
12/13/2021	6:26:51 AM	0	9.073	5.4	12/13/2021	6:33:24 AM	0	881.408	-5.457	0.09	26.31	1007.37
12/13/2021	7:26:51 AM	0	9.076	5.4	12/13/2021	7:33:24 AM	0	881.503	-5.85	0.09	26.31	1007.37
12/13/2021	8:26:51 AM	0	9.072	5.4	12/13/2021	8:33:24 AM	0	881.202	-5.776	0.09	26.31	1007.37
12/13/2021	9:26:51 AM	0	9.066	5.4	12/13/2021	9:33:24 AM	0	880.589	-5.702	0.09	26.31	1007.37
12/13/2021	10:26:51 AM	0	9.065	5.4	12/13/2021	10:33:24 AM	0	880.557	-5.399	0.09	26.31	1007.37
12/13/2021	11:26:51 AM	0	9.06	5.4	12/13/2021	11:33:24 AM	0	880.338	-4.779	0.08	26.31	1007.37
12/13/2021	12:26:51 PM	0	9.054	5.4	12/13/2021	12:33:24 PM	0	879.842	-4.209	0.08	26.31	1007.37
12/13/2021	1:26:51 PM	0	9.053	5.4	12/13/2021	1:33:24 PM	0	879.651	-3.754	0.08	26.31	1007.37
12/13/2021	2:26:51 PM	0	9.062	5.4	12/13/2021	2:33:24 PM	0	880.722	-3.085	0.08	26.31	1007.37
12/13/2021	3:26:51 PM	0	9.065	5.4	12/13/2021	3:33:24 PM	0	881.097	-2.577	0.08	26.31	1007.36
12/13/2021	4:26:51 PM	0	9.065	5.4	12/13/2021	4:33:24 PM	0	881.012	-2.925	0.08	26.31	1007.37
12/13/2021	5:26:51 PM	0	9.068	5.4	12/13/2021	5:33:24 PM	0	881.198	-3.534	0.08	26.31	1007.37
12/13/2021	6:26:51 PM	0	9.069	5.4	12/13/2021	6:33:24 PM	0	881.187	-3.938	0.08	26.31	1007.37
12/13/2021	7:26:51 PM	0	9.066	5.4	12/13/2021	7:33:24 PM	0	880.825	-4.51	0.08	26.31	1007.37
12/13/2021	8:26:51 PM	0	9.068	5.4	12/13/2021	8:33:24 PM	0	880.834	-5.104	0.09	26.31	1007.37
12/13/2021	9:26:51 PM	0	9.063	5.4	12/13/2021	9:33:24 PM	0	880.305	-5.371	0.09	26.31	1007.37
12/13/2021	10:26:51 PM	0	9.063	5.4	12/13/2021	10:33:24 PM	0	880.256	-5.823	0.09	26.31	1007.37
12/13/2021	11:26:51 PM	0	9.065	5.4	12/13/2021	11:33:24 PM	0	880.21	-6.678	0.09	26.31	1007.37
12/14/2021	12:26:51 AM	0	9.062	5.4	12/14/2021	12:33:24 AM	0	879.735	-7.502	0.09	26.30	1007.38
12/14/2021	1:26:51 AM	0	9.062	5.4	12/14/2021	1:33:24 AM	0	879.641	-8.193	0.09	26.30	1007.38
12/14/2021	2:26:51 AM	0	9.065	5.4	12/14/2021	2:33:24 AM	0	879.685	-8.758	0.09	26.30	1007.38
12/14/2021	3:26:51 AM	0	9.066	5.4	12/14/2021	3:33:24 AM	0	879.924	-9.192	0.09	26.30	1007.38
12/14/2021	4:26:51 AM	0	9.073	5.4	12/14/2021	4:33:24 AM	0	880.568	-9.507	0.09	26.30	1007.38
12/14/2021	5:26:51 AM	0	9.078	5.4	12/14/2021	5:33:24 AM	0	880.907	-9.699	0.10	26.30	1007.38
12/14/2021	6:26:51 AM	0	9.088	5.4	12/14/2021	6:33:24 AM	0	881.931	-9.871	0.09	26.30	1007.38
12/14/2021	7:26:51 AM	0	9.096	5.4	12/14/2021	7:33:24 AM	0	882.722	-10.109	0.09	26.30	1007.38
12/14/2021	8:26:51 AM	0	9.104	5.4	12/14/2021	8:33:24 AM	0	883.228	-10.501	0.10	26.30	1007.38
12/14/2021	9:26:51 AM	0	9.113	5.4	12/14/2021	9:33:24 AM	0	884.127	-10.785	0.10	26.30	1007.38
12/14/2021	10:26:51 AM	0	9.118	5.4	12/14/2021	10:33:24 AM	0	884.662	-10.896	0.10	26.30	1007.38
12/14/2021	11:26:51 AM	0	9.123	5.4	12/14/2021	11:33:24 AM	0	885.297	-10.62	0.10	26.30	1007.38
12/14/2021	12:26:51 PM	0	9.126	5.4	12/14/2021	12:33:24 PM	0	885.741	-9.937	0.09	26.30	1007.38

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/14/2021	1:26:51 PM	0	9.129	5.4	12/14/2021	1:33:24 PM	0	886.23	-9.144	0.09	26.30	1007.38
12/14/2021	2:26:51 PM	0	9.127	5.4	12/14/2021	2:33:24 PM	0	886.191	-8.544	0.09	26.30	1007.37
12/14/2021	3:26:51 PM	0	9.126	5.4	12/14/2021	3:33:24 PM	0	886.102	-8.46	0.09	26.30	1007.37
12/14/2021	4:26:51 PM	0	9.127	5.4	12/14/2021	4:33:24 PM	0	886.159	-8.778	0.09	26.30	1007.37
12/14/2021	5:26:51 PM	0	9.133	5.4	12/14/2021	5:33:24 PM	0	886.481	-9.24	0.09	26.30	1007.38
12/14/2021	6:26:51 PM	0	9.136	5.4	12/14/2021	6:33:24 PM	0	886.791	-9.651	0.09	26.30	1007.38
12/14/2021	7:26:51 PM	0	9.135	5.4	12/14/2021	7:33:24 PM	0	886.549	-9.929	0.09	26.30	1007.38
12/14/2021	8:26:51 PM	0	9.133	5.4	12/14/2021	8:33:24 PM	0	886.296	-10.506	0.10	26.30	1007.38
12/14/2021	9:26:51 PM	0	9.133	5.4	12/14/2021	9:33:24 PM	0	886.29	-10.227	0.10	26.30	1007.38
12/14/2021	10:26:51 PM	0	9.132	5.4	12/14/2021	10:33:24 PM	0	886.338	-9.902	0.09	26.30	1007.38
12/14/2021	11:26:51 PM	0	9.135	5.4	12/14/2021	11:33:24 PM	0	886.727	-9.662	0.09	26.30	1007.38
12/15/2021	12:26:51 AM	0	9.138	5.4	12/15/2021	12:33:24 AM	0	886.984	-9.569	0.09	26.30	1007.38
12/15/2021	1:26:51 AM	0	9.139	5.4	12/15/2021	1:33:24 AM	0	887.086	-9.418	0.09	26.30	1007.38
12/15/2021	2:26:51 AM	0	9.138	5.4	12/15/2021	2:33:24 AM	0	887.099	-9.442	0.09	26.30	1007.38
12/15/2021	3:26:51 AM	0	9.135	5.4	12/15/2021	3:33:24 AM	0	886.721	-9.521	0.09	26.30	1007.38
12/15/2021	4:26:51 AM	0	9.133	5.4	12/15/2021	4:33:24 AM	0	886.432	-9.828	0.09	26.30	1007.38
12/15/2021	5:26:51 AM	0	9.136	5.4	12/15/2021	5:33:24 AM	0	886.771	-9.881	0.09	26.30	1007.38
12/15/2021	6:26:51 AM	0	9.136	5.4	12/15/2021	6:33:24 AM	0	886.662	-9.925	0.09	26.30	1007.38
12/15/2021	7:26:51 AM	0	9.136	5.4	12/15/2021	7:33:24 AM	0	886.702	-9.837	0.09	26.30	1007.38
12/15/2021	8:26:51 AM	0	9.138	5.4	12/15/2021	8:33:24 AM	0	886.937	-9.607	0.09	26.30	1007.38
12/15/2021	9:26:51 AM	0	9.139	5.4	12/15/2021	9:33:24 AM	0	887.236	-9.431	0.09	26.30	1007.38
12/15/2021	10:26:51 AM	0	9.143	5.4	12/15/2021	10:33:24 AM	0	887.66	-8.685	0.09	26.30	1007.38
12/15/2021	11:26:51 AM	0	9.144	5.4	12/15/2021	11:33:24 AM	0	888.055	-7.189	0.09	26.31	1007.37
12/15/2021	12:26:51 PM	0	9.141	5.4	12/15/2021	12:33:24 PM	0	888.025	-6.139	0.09	26.31	1007.37
12/15/2021	1:26:51 PM	0	9.138	5.4	12/15/2021	1:33:24 PM	0	887.857	-5.44	0.08	26.31	1007.37
12/15/2021	2:26:51 PM	0	9.132	5.4	12/15/2021	2:33:24 PM	0	887.362	-5.262	0.08	26.31	1007.37
12/15/2021	3:26:51 PM	0	9.13	5.4	12/15/2021	3:33:24 PM	0	887.209	-5.14	0.08	26.31	1007.37
12/15/2021	4:26:51 PM	0	9.13	5.4	12/15/2021	4:33:24 PM	0	887.308	-5.055	0.08	26.31	1007.37
12/15/2021	5:26:51 PM	0	9.126	5.4	12/15/2021	5:33:24 PM	0	886.711	-5.18	0.08	26.31	1007.37
12/15/2021	6:26:51 PM	0	9.124	5.4	12/15/2021	6:33:24 PM	0	886.634	-5.148	0.08	26.31	1007.37
12/15/2021	7:26:51 PM	0	9.123	5.4	12/15/2021	7:33:24 PM	0	886.433	-5.036	0.08	26.31	1007.37
12/15/2021	8:26:51 PM	0	9.121	5.4	12/15/2021	8:33:24 PM	0	886.308	-5.001	0.08	26.31	1007.37
12/15/2021	9:26:51 PM	0	9.118	5.4	12/15/2021	9:33:24 PM	0	886.092	-4.941	0.08	26.31	1007.37
12/15/2021	10:26:51 PM	0	9.12	5.4	12/15/2021	10:33:24 PM	0	886.148	-4.811	0.08	26.31	1007.37
12/15/2021	11:26:51 PM	0	9.118	5.4	12/15/2021	11:33:24 PM	0	886.176	-4.709	0.08	26.31	1007.37
12/16/2021	12:26:51 AM	0	9.116	5.4	12/16/2021	12:33:24 AM	0	885.874	-4.717	0.08	26.31	1007.37
12/16/2021	1:26:51 AM	0	9.114	5.4	12/16/2021	1:33:24 AM	0	885.653	-4.668	0.08	26.31	1007.37
12/16/2021	2:26:51 AM	0	9.117	5.4	12/16/2021	2:33:24 AM	0	885.917	-4.61	0.08	26.31	1007.37
12/16/2021	3:26:51 AM	0	9.123	5.4	12/16/2021	3:33:24 AM	0	886.542	-4.748	0.08	26.31	1007.37
12/16/2021	4:26:51 AM	0	9.129	5.4	12/16/2021	4:33:24 AM	0	886.927	-5.466	0.08	26.31	1007.37
12/16/2021	5:26:51 AM	0	9.135	5.4	12/16/2021	5:33:24 AM	0	887.319	-6.342	0.09	26.31	1007.37
12/16/2021	6:26:51 AM	0	9.144	5.4	12/16/2021	6:33:24 AM	0	888.049	-7.331	0.09	26.31	1007.37
12/16/2021	7:26:51 AM	0	9.156	5.4	12/16/2021	7:33:24 AM	0	888.859	-8.378	0.09	26.30	1007.38
12/16/2021	8:26:51 AM	0	9.162	5.4	12/16/2021	8:33:24 AM	0	889.306	-8.914	0.09	26.30	1007.38
12/16/2021	9:26:51 AM	0	9.171	5.4	12/16/2021	9:33:24 AM	0	890.17	-9.049	0.09	26.30	1007.38
12/16/2021	10:26:51 AM	0	9.18	5.4	12/16/2021	10:33:24 AM	0	891.157	-8.959	0.09	26.30	1007.38
12/16/2021	11:26:51 AM	0	9.188	5.4	12/16/2021	11:33:24 AM	0	892.133	-8.36	0.09	26.30	1007.37
12/16/2021	12:26:51 PM	0	9.195	5.4	12/16/2021	12:33:24 PM	0	892.961	-7.693	0.09	26.31	1007.37
12/16/2021	1:26:51 PM	0	9.203	5.4	12/16/2021	1:33:24 PM	0	893.785	-7.48	0.09	26.31	1007.37
12/16/2021	2:26:51 PM	0	9.211	5.4	12/16/2021	2:33:24 PM	0	894.678	-6.885	0.09	26.31	1007.37
12/16/2021	3:26:51 PM	0	9.217	5.4	12/16/2021	3:33:24 PM	0	895.305	-7.13	0.09	26.31	1007.37
12/16/2021	4:26:51 PM	0	9.226	5.4	12/16/2021	4:33:24 PM	0	895.917	-8.316	0.09	26.30	1007.37
12/16/2021	5:26:51 PM	0	9.234	5.4	12/16/2021	5:33:24 PM	0	896.221	-9.863	0.10	26.30	1007.38
12/16/2021	6:26:51 PM	0	9.243	5.4	12/16/2021	6:33:24 PM	0	896.983	-10.806	0.10	26.30	1007.38
12/16/2021	7:26:51 PM	0	9.252	5.4	12/16/2021	7:33:24 PM	0	897.618	-11.593	0.10	26.30	1007.38
12/16/2021	8:26:51 PM	0	9.259	5.4	12/16/2021	8:33:24 PM	0	898.272	-12.103	0.10	26.30	1007.38
12/16/2021	9:26:51 PM	0	9.264	5.4	12/16/2021	9:33:24 PM	0	898.542	-12.745	0.10	26.29	1007.39
12/16/2021	10:26:51 PM	0	9.27	5.4	12/16/2021	10:33:24 PM	0	899.032	-13.28	0.10	26.29	1007.39
12/16/2021	11:26:51 PM	0	9.276	5.4	12/16/2021	11:33:24 PM	0	899.519	-13.805	0.10	26.29	1007.39
12/17/2021	12:26:51 AM	0	9.281	5.4	12/17/2021	12:33:24 AM	0	899.885	-14.26	0.10	26.29	1007.39
12/17/2021	1:26:51 AM	0	9.281	5.4	12/17/2021	1:33:24 AM	0	899.916	-14.418	0.10	26.29	1007.39
12/17/2021	2:26:51 AM	0	9.284	5.4	12/17/2021	2:33:24 AM	0	900.347	-13.836	0.10	26.29	1007.39
12/17/2021	3:26:51 AM	0	9.284	5.4	12/17/2021	3:33:24 AM	0	900.39	-13.668	0.10	26.29	1007.39
12/17/2021	4:26:51 AM	0	9.284	5.4	12/17/2021	4:33:24 AM	0	900.395	-14	0.10	26.29	1007.39
12/17/2021	5:26:51 AM	0	9.287	5.4	12/17/2021	5:33:24 AM	0	900.566	-13.966	0.10	26.29	1007.39
12/17/2021	6:26:51 AM	0	9.288	5.4	12/17/2021	6:33:24 AM	0	900.873	-13.69	0.10	26.29	1007.39
12/17/2021	7:26:51 AM	0	9.293	5.4	12/17/2021	7:33:24 AM	0	901.44	-13.161	0.10	26.29	1007.39
12/17/2021	8:26:51 AM	0	9.287	5.4	12/17/2021	8:33:24 AM	0	901.009	-12.781	0.10	26.30	1007.38
12/17/2021	9:26:51 AM	0	9.282	5.4	12/17/2021	9:33:24 AM	0	900.506	-12.611	0.10	26.30	1007.38
12/17/2021	10:26:51 AM	0	9.285	5.4	12/17/2021	10:33:24 AM	0	900.876	-12.309	0.10	26.30	1007.38
12/17/2021	11:26:51 AM	0	9.282	5.4	12/17/2021	11:33:24 AM	0	900.87	-11.495	0.10	26.30	1007.38
12/17/2021	12:26:51 PM	0	9.276	5.4	12/17/2021	12:33:24 PM	0	900.445	-10.525	0.09	26.30	1007.38

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/17/2021	1:26:51 PM	0	9.271	5.4	12/17/2021	1:33:24 PM	0	900.174	-9.953	0.09	26.30	1007.38
12/17/2021	2:26:51 PM	0	9.264	5.4	12/17/2021	2:33:24 PM	0	899.495	-9.227	0.09	26.30	1007.38
12/17/2021	3:26:51 PM	0	9.258	5.4	12/17/2021	3:33:24 PM	0	899.06	-8.952	0.09	26.30	1007.37
12/17/2021	4:26:51 PM	0	9.262	5.4	12/17/2021	4:33:24 PM	0	899.348	-9.002	0.09	26.30	1007.38
12/17/2021	5:26:51 PM	0	9.259	5.4	12/17/2021	5:33:24 PM	0	899.061	-9.124	0.09	26.30	1007.38
12/17/2021	6:26:51 PM	0	9.257	5.4	12/17/2021	6:33:24 PM	0	898.662	-9.352	0.09	26.30	1007.38
12/17/2021	7:26:51 PM	0	9.252	5.4	12/17/2021	7:33:24 PM	0	898.162	-9.606	0.09	26.30	1007.38
12/17/2021	8:26:51 PM	0	9.249	5.4	12/17/2021	8:33:24 PM	0	897.94	-9.694	0.09	26.30	1007.38
12/17/2021	9:26:51 PM	0	9.243	5.4	12/17/2021	9:33:24 PM	0	897.358	-9.732	0.09	26.30	1007.38
12/17/2021	10:26:51 PM	0	9.237	5.4	12/17/2021	10:33:24 PM	0	896.815	-9.452	0.09	26.30	1007.38
12/17/2021	11:26:51 PM	0	9.229	5.4	12/17/2021	11:33:24 PM	0	896.217	-9.025	0.09	26.30	1007.37
12/18/2021	12:26:51 AM	0	9.222	5.4	12/18/2021	12:33:24 AM	0	895.497	-8.691	0.09	26.30	1007.37
12/18/2021	1:26:51 AM	0	9.213	5.4	12/18/2021	1:33:24 AM	0	894.612	-8.351	0.09	26.30	1007.37
12/18/2021	2:26:51 AM	0	9.197	5.4	12/18/2021	2:33:24 AM	0	893.118	-8.067	0.09	26.31	1007.37
12/18/2021	3:26:51 AM	0	9.184	5.4	12/18/2021	3:33:24 AM	0	892.096	-7.867	0.09	26.31	1007.37
12/18/2021	4:26:51 AM	0	9.171	5.4	12/18/2021	4:33:24 AM	0	890.749	-7.451	0.09	26.31	1007.37
12/18/2021	5:26:51 AM	0	9.161	5.4	12/18/2021	5:33:24 AM	0	889.813	-6.922	0.09	26.31	1007.37
12/18/2021	6:26:51 AM	0	9.146	5.4	12/18/2021	6:33:24 AM	0	888.414	-6.493	0.09	26.31	1007.37
12/18/2021	7:26:51 AM	0	9.132	5.4	12/18/2021	7:33:24 AM	0	887.138	-6.176	0.09	26.31	1007.37
12/18/2021	8:26:51 AM	0	9.118	5.4	12/18/2021	8:33:24 AM	0	885.973	-5.906	0.08	26.31	1007.37
12/18/2021	9:26:51 AM	0	9.108	5.4	12/18/2021	9:33:24 AM	0	884.931	-5.689	0.08	26.31	1007.37
12/18/2021	10:26:51 AM	0	9.099	5.4	12/18/2021	10:33:24 AM	0	884.053	-5.433	0.08	26.31	1007.37
12/18/2021	11:26:51 AM	0	9.088	5.4	12/18/2021	11:33:24 AM	0	883.094	-5.091	0.08	26.31	1007.37
12/18/2021	12:26:51 PM	0	9.078	5.4	12/18/2021	12:33:24 PM	0	882.138	-4.744	0.08	26.31	1007.37
12/18/2021	1:26:51 PM	0	9.07	5.4	12/18/2021	1:33:24 PM	0	881.486	-4.403	0.08	26.31	1007.37
12/18/2021	2:26:51 PM	0	9.068	5.4	12/18/2021	2:33:24 PM	0	881.295	-4.061	0.08	26.31	1007.37
12/18/2021	3:26:51 PM	0	9.069	5.4	12/18/2021	3:33:24 PM	0	881.458	-3.907	0.08	26.31	1007.36
12/18/2021	4:26:51 PM	0	9.075	5.4	12/18/2021	4:33:24 PM	0	881.967	-3.852	0.08	26.31	1007.37
12/18/2021	5:26:51 PM	0	9.081	5.4	12/18/2021	5:33:24 PM	0	882.607	-4.046	0.08	26.31	1007.37
12/18/2021	6:26:51 PM	0	9.087	5.4	12/18/2021	6:33:24 PM	0	882.971	-4.318	0.08	26.31	1007.37
12/18/2021	7:26:51 PM	0	9.095	5.4	12/18/2021	7:33:24 PM	0	883.814	-4.63	0.08	26.31	1007.37
12/18/2021	8:26:51 PM	0	9.108	5.4	12/18/2021	8:33:24 PM	0	884.934	-5.101	0.08	26.31	1007.37
12/18/2021	9:26:51 PM	0	9.12	5.4	12/18/2021	9:33:24 PM	0	885.967	-5.771	0.09	26.31	1007.37
12/18/2021	10:26:51 PM	0	9.133	5.4	12/18/2021	10:33:24 PM	0	887.034	-6.326	0.09	26.31	1007.37
12/18/2021	11:26:51 PM	0	9.146	5.4	12/18/2021	11:33:24 PM	0	888.185	-6.852	0.09	26.31	1007.37
12/19/2021	12:26:51 AM	0	9.158	5.4	12/19/2021	12:33:24 AM	0	889.203	-7.443	0.09	26.30	1007.37
12/19/2021	1:26:51 AM	0	9.168	5.4	12/19/2021	1:33:24 AM	0	890.082	-7.949	0.09	26.30	1007.38
12/19/2021	2:26:51 AM	0	9.18	5.4	12/19/2021	2:33:24 AM	0	891.189	-8.436	0.09	26.30	1007.38
12/19/2021	3:26:51 AM	0	9.192	5.4	12/19/2021	3:33:24 AM	0	892.322	-8.774	0.09	26.30	1007.38
12/19/2021	4:26:51 AM	0	9.2	5.4	12/19/2021	4:33:24 AM	0	893.02	-8.839	0.09	26.30	1007.38
12/19/2021	5:26:51 AM	0	9.207	5.4	12/19/2021	5:33:24 AM	0	893.807	-8.988	0.09	26.30	1007.38
12/19/2021	6:26:51 AM	0	9.216	5.4	12/19/2021	6:33:24 AM	0	894.537	-9.012	0.09	26.30	1007.38
12/19/2021	7:26:51 AM	0	9.225	5.4	12/19/2021	7:33:24 AM	0	895.467	-9.151	0.09	26.30	1007.38
12/19/2021	8:26:51 AM	0	9.229	5.4	12/19/2021	8:33:24 AM	0	895.956	-9.335	0.09	26.30	1007.38
12/19/2021	9:26:51 AM	0	9.238	5.4	12/19/2021	9:33:24 AM	0	896.598	-10.139	0.10	26.30	1007.38
12/19/2021	10:26:51 AM	0	9.245	5.4	12/19/2021	10:33:24 AM	0	897.03	-10.75	0.10	26.30	1007.38
12/19/2021	11:26:51 AM	0	9.251	5.4	12/19/2021	11:33:24 AM	0	897.643	-10.811	0.10	26.30	1007.38
12/19/2021	12:26:51 PM	0	9.252	5.4	12/19/2021	12:33:24 PM	0	898.14	-9.65	0.09	26.30	1007.38
12/19/2021	1:26:51 PM	0	9.254	5.4	12/19/2021	1:33:24 PM	0	898.693	-8.198	0.09	26.30	1007.37
12/19/2021	2:26:51 PM	0	9.255	5.4	12/19/2021	2:33:24 PM	0	898.931	-7.489	0.09	26.31	1007.37
12/19/2021	3:26:51 PM	0	9.257	5.4	12/19/2021	3:33:24 PM	0	899.163	-7.213	0.09	26.31	1007.37
12/19/2021	4:26:51 PM	0	9.259	5.4	12/19/2021	4:33:24 PM	0	899.357	-7.374	0.09	26.31	1007.37
12/19/2021	5:26:51 PM	0	9.259	5.4	12/19/2021	5:33:24 PM	0	899.304	-7.834	0.09	26.31	1007.37
12/19/2021	6:26:51 PM	0	9.261	5.4	12/19/2021	6:33:24 PM	0	899.297	-8.211	0.09	26.30	1007.37
12/19/2021	7:26:51 PM	0	9.264	5.4	12/19/2021	7:33:24 PM	0	899.487	-8.287	0.09	26.30	1007.38
12/19/2021	8:26:51 PM	0	9.264	5.4	12/19/2021	8:33:24 PM	0	899.596	-8.316	0.09	26.30	1007.37
12/19/2021	9:26:51 PM	0	9.264	5.4	12/19/2021	9:33:24 PM	0	899.515	-8.312	0.09	26.30	1007.38
12/19/2021	10:26:51 PM	0	9.264	5.4	12/19/2021	10:33:24 PM	0	899.598	-8.33	0.09	26.30	1007.37
12/19/2021	11:26:51 PM	0	9.261	5.4	12/19/2021	11:33:24 PM	0	899.284	-8.371	0.09	26.30	1007.38
12/20/2021	12:26:51 AM	0	9.261	5.4	12/20/2021	12:33:24 AM	0	899.214	-8.524	0.09	26.30	1007.38
12/20/2021	1:26:51 AM	0	9.259	5.4	12/20/2021	1:33:24 AM	0	899.03	-8.665	0.09	26.30	1007.38
12/20/2021	2:26:51 AM	0	9.257	5.4	12/20/2021	2:33:24 AM	0	898.721	-8.707	0.09	26.30	1007.38
12/20/2021	3:26:51 AM	0	9.258	5.4	12/20/2021	3:33:24 AM	0	898.879	-8.714	0.09	26.30	1007.38
12/20/2021	4:26:51 AM	0	9.257	5.4	12/20/2021	4:33:24 AM	0	898.713	-8.721	0.09	26.30	1007.38
12/20/2021	5:26:51 AM	0	9.254	5.4	12/20/2021	5:33:24 AM	0	898.45	-8.788	0.09	26.30	1007.38
12/20/2021	6:26:51 AM	0	9.255	5.4	12/20/2021	6:33:24 AM	0	898.474	-8.853	0.09	26.30	1007.38
12/20/2021	7:26:51 AM	0	9.254	5.4	12/20/2021	7:33:24 AM	0	898.308	-8.873	0.09	26.30	1007.38
12/20/2021	8:26:51 AM	0	9.252	5.4	12/20/2021	8:33:24 AM	0	898.247	-8.984	0.09	26.30	1007.38
12/20/2021	9:26:51 AM	0	9.255	5.4	12/20/2021	9:33:24 AM	0	898.405	-9.093	0.09	26.30	1007.38
12/20/2021	10:26:51 AM	0	9.255	5.4	12/20/2021	10:33:24 AM	0	898.541	-8.973	0.09	26.30	1007.38
12/20/2021	11:26:51 AM	0	9.258	5.4	12/20/2021	11:33:24 AM	0	898.963	-8.638	0.09	26.30	1007.38
12/20/2021	12:26:51 PM	0	9.257	5.4	12/20/2021	12:33:24 PM	0	898.849	-8.185	0.09	26.30	1007.38

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/20/2021	1:26:51 PM	0	9.258	5.4	12/20/2021	1:33:24 PM	0	899.111	-7.871	0.09	26.31	1007.37
12/20/2021	2:26:51 PM	0	9.258	5.4	12/20/2021	2:33:24 PM	0	899.206	-7.839	0.09	26.31	1007.37
12/20/2021	3:26:51 PM	0	9.261	5.4	12/20/2021	3:33:24 PM	0	899.345	-8.151	0.09	26.30	1007.37
12/20/2021	4:26:51 PM	0	9.264	5.4	12/20/2021	4:33:24 PM	0	899.586	-8.532	0.09	26.30	1007.37
12/20/2021	5:26:51 PM	0	9.267	5.4	12/20/2021	5:33:24 PM	0	899.641	-8.992	0.09	26.30	1007.38
12/20/2021	6:26:51 PM	0	9.268	5.4	12/20/2021	6:33:24 PM	0	899.692	-9.426	0.09	26.30	1007.38
12/20/2021	7:26:51 PM	0	9.267	5.4	12/20/2021	7:33:24 PM	0	899.537	-9.598	0.09	26.30	1007.38
12/20/2021	8:26:51 PM	0	9.268	5.4	12/20/2021	8:33:24 PM	0	899.656	-9.752	0.09	26.30	1007.38
12/20/2021	9:26:51 PM	0	9.273	5.4	12/20/2021	9:33:24 PM	0	899.938	-9.92	0.10	26.30	1007.38
12/20/2021	10:26:51 PM	0	9.262	5.4	12/20/2021	10:33:24 PM	0	899.04	-9.856	0.09	26.30	1007.38
12/20/2021	11:26:51 PM	0	9.262	5.4	12/20/2021	11:33:24 PM	0	898.978	-9.945	0.09	26.30	1007.38
12/21/2021	12:26:51 AM	0	9.259	5.4	12/21/2021	12:33:24 AM	0	898.649	-10.047	0.10	26.30	1007.38
12/21/2021	1:26:51 AM	0	9.258	5.4	12/21/2021	1:33:24 AM	0	898.568	-10.15	0.10	26.30	1007.38
12/21/2021	2:26:51 AM	0	9.254	5.4	12/21/2021	2:33:24 AM	0	898.09	-10.217	0.10	26.30	1007.38
12/21/2021	3:26:51 AM	0	9.246	5.4	12/21/2021	3:33:24 AM	0	897.275	-10.333	0.10	26.30	1007.38
12/21/2021	4:26:51 AM	0	9.237	5.4	12/21/2021	4:33:24 AM	0	896.453	-10.217	0.10	26.30	1007.38
12/21/2021	5:26:51 AM	0	9.226	5.4	12/21/2021	5:33:24 AM	0	895.537	-10.108	0.09	26.30	1007.38
12/21/2021	6:26:51 AM	0	9.226	5.4	12/21/2021	6:33:24 AM	0	895.444	-10.064	0.09	26.30	1007.38
12/21/2021	7:26:51 AM	0	9.214	5.4	12/21/2021	7:33:24 AM	0	894.377	-9.759	0.09	26.30	1007.38
12/21/2021	8:26:51 AM	0	9.211	5.4	12/21/2021	8:33:24 AM	0	894.182	-9.597	0.09	26.30	1007.38
12/21/2021	9:26:51 AM	0	9.207	5.4	12/21/2021	9:33:24 AM	0	893.771	-9.501	0.09	26.30	1007.38
12/21/2021	10:26:51 AM	0	9.203	5.4	12/21/2021	10:33:24 AM	0	893.407	-9.165	0.09	26.30	1007.38
12/21/2021	11:26:51 AM	0	9.197	5.4	12/21/2021	11:33:24 AM	0	892.942	-8.828	0.09	26.30	1007.38
12/21/2021	12:26:51 PM	0	9.184	5.4	12/21/2021	12:33:24 PM	0	891.866	-8.419	0.09	26.31	1007.37
12/21/2021	1:26:51 PM	0	9.174	5.4	12/21/2021	1:33:24 PM	0	890.827	-7.899	0.09	26.30	1007.37
12/21/2021	2:26:51 PM	0	9.166	5.4	12/21/2021	2:33:24 PM	0	890.321	-7.471	0.09	26.31	1007.37
12/21/2021	3:26:51 PM	0	9.159	5.4	12/21/2021	3:33:24 PM	0	889.571	-7.194	0.09	26.31	1007.37
12/21/2021	4:26:51 PM	0	9.152	5.4	12/21/2021	4:33:24 PM	0	888.984	-6.918	0.09	26.31	1007.37
12/21/2021	5:26:51 PM	0	9.144	5.4	12/21/2021	5:33:24 PM	0	888.255	-6.698	0.09	26.31	1007.37
12/21/2021	6:26:51 PM	0	9.136	5.4	12/21/2021	6:33:24 PM	0	887.557	-6.512	0.09	26.31	1007.37
12/21/2021	7:26:51 PM	0	9.126	5.4	12/21/2021	7:33:24 PM	0	886.601	-6.288	0.09	26.31	1007.37
12/21/2021	8:26:51 PM	0	9.116	5.4	12/21/2021	8:33:24 PM	0	885.512	-6.061	0.09	26.31	1007.37
12/21/2021	9:26:51 PM	0	9.108	5.4	12/21/2021	9:33:24 PM	0	884.828	-5.889	0.09	26.31	1007.37
12/21/2021	10:26:51 PM	0	9.096	5.4	12/21/2021	10:33:24 PM	0	883.754	-5.654	0.08	26.31	1007.37
12/21/2021	11:26:51 PM	0	9.084	5.4	12/21/2021	11:33:24 PM	0	882.68	-5.417	0.08	26.31	1007.37
12/22/2021	12:26:51 AM	0	9.068	5.4	12/22/2021	12:33:24 AM	0	881.085	-5.149	0.08	26.31	1007.37
12/22/2021	1:26:51 AM	0	9.047	5.4	12/22/2021	1:33:24 AM	0	879.037	-4.928	0.08	26.31	1007.37
12/22/2021	2:26:51 AM	0	9.036	5.4	12/22/2021	2:33:24 AM	0	878.053	-4.705	0.08	26.31	1007.37
12/22/2021	3:26:51 AM	0	9.027	5.4	12/22/2021	3:33:24 AM	0	877.292	-4.487	0.08	26.31	1007.37
12/22/2021	4:26:51 AM	0	9.021	5.4	12/22/2021	4:33:24 AM	0	876.656	-4.277	0.08	26.31	1007.37
12/22/2021	5:26:51 AM	0	9.021	5.4	12/22/2021	5:33:24 AM	0	876.709	-4.085	0.08	26.31	1007.37
12/22/2021	6:26:51 AM	0	9.02	5.4	12/22/2021	6:33:24 AM	0	876.539	-3.921	0.08	26.31	1007.37
12/22/2021	7:26:51 AM	0	9.018	5.4	12/22/2021	7:33:24 AM	0	876.496	-3.795	0.08	26.31	1007.36
12/22/2021	8:26:51 AM	0	9.018	5.4	12/22/2021	8:33:24 AM	0	876.498	-3.653	0.08	26.31	1007.36
12/22/2021	9:26:51 AM	0	9.023	5.4	12/22/2021	9:33:24 AM	0	876.835	-3.535	0.08	26.31	1007.37
12/22/2021	10:26:51 AM	0	9.024	5.4	12/22/2021	10:33:24 AM	0	877.052	-3.416	0.08	26.31	1007.36
12/22/2021	11:26:51 AM	0	9.024	5.4	12/22/2021	11:33:24 AM	0	877	-3.233	0.08	26.31	1007.37
12/22/2021	12:26:51 PM	0	9.02	5.4	12/22/2021	12:33:24 PM	0	876.704	-3.099	0.08	26.31	1007.36
12/22/2021	1:26:51 PM	0	9.017	5.4	12/22/2021	1:33:24 PM	0	876.314	-3.081	0.08	26.31	1007.37
12/22/2021	2:26:51 PM	0	9.015	5.4	12/22/2021	2:33:24 PM	0	876.236	-3.049	0.08	26.31	1007.36
12/22/2021	3:26:51 PM	0	9.017	5.4	12/22/2021	3:33:24 PM	0	876.312	-3.072	0.08	26.31	1007.37
12/22/2021	4:26:51 PM	0	9.015	5.4	12/22/2021	4:33:24 PM	0	876.151	-3.188	0.08	26.31	1007.36
12/22/2021	5:26:51 PM	0	9.015	5.4	12/22/2021	5:33:24 PM	0	876.189	-3.451	0.08	26.31	1007.36
12/22/2021	6:26:51 PM	0	9.015	5.4	12/22/2021	6:33:24 PM	0	876.01	-3.758	0.08	26.31	1007.37
12/22/2021	7:26:51 PM	0	9.006	5.4	12/22/2021	7:33:24 PM	0	875.135	-4.021	0.08	26.31	1007.37
12/22/2021	8:26:51 PM	0	9.005	5.4	12/22/2021	8:33:24 PM	0	874.99	-4.191	0.08	26.31	1007.37
12/22/2021	9:26:51 PM	0	9	5.4	12/22/2021	9:33:24 PM	0	874.522	-4.388	0.08	26.31	1007.37
12/22/2021	10:26:51 PM	0	9	5.4	12/22/2021	10:33:24 PM	0	874.402	-4.476	0.08	26.31	1007.37
12/22/2021	11:26:51 PM	0	9	5.4	12/22/2021	11:33:24 PM	0	874.348	-4.548	0.08	26.31	1007.37
12/23/2021	12:26:51 AM	0	9.002	5.4	12/23/2021	12:33:24 AM	0	874.489	-4.605	0.08	26.31	1007.37
12/23/2021	1:26:51 AM	0	8.995	5.4	12/23/2021	1:33:24 AM	0	873.934	-4.635	0.08	26.31	1007.37
12/23/2021	2:26:51 AM	0	8.992	5.4	12/23/2021	2:33:24 AM	0	873.587	-4.663	0.08	26.31	1007.37
12/23/2021	3:26:51 AM	0	8.992	5.4	12/23/2021	3:33:24 AM	0	873.651	-4.701	0.08	26.31	1007.37
12/23/2021	4:26:51 AM	0	8.989	5.4	12/23/2021	4:33:24 AM	0	873.262	-4.763	0.08	26.31	1007.37
12/23/2021	5:26:51 AM	0	8.988	5.4	12/23/2021	5:33:24 AM	0	873.122	-4.842	0.08	26.31	1007.37
12/23/2021	6:26:51 AM	0	8.986	5.4	12/23/2021	6:33:24 AM	0	872.879	-4.915	0.09	26.31	1007.37
12/23/2021	7:26:51 AM	0	8.983	5.4	12/23/2021	7:33:24 AM	0	872.654	-5.006	0.08	26.31	1007.37
12/23/2021	8:26:51 AM	0	8.983	5.4	12/23/2021	8:33:24 AM	0	872.697	-5.125	0.08	26.31	1007.37
12/23/2021	9:26:51 AM	0	8.988	5.4	12/23/2021	9:33:24 AM	0	872.986	-5.2	0.09	26.31	1007.37
12/23/2021	10:26:51 AM	0	8.991	5.4	12/23/2021	10:33:24 AM	0	873.446	-5.274	0.08	26.31	1007.37
12/23/2021	11:26:51 AM	0	8.989	5.4	12/23/2021	11:33:24 AM	0	873.172	-5.404	0.09	26.31	1007.37
12/23/2021	12:26:51 PM	0	8.986	5.4	12/23/2021	12:33:24 PM	0	872.854	-5.432	0.09	26.31	1007.37

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/23/2021	1:26:51 PM	0	8.983	5.4	12/23/2021	1:33:24 PM	0	872.515	-5.5	0.09	26.31	1007.37
12/23/2021	2:26:51 PM	0	8.983	5.4	12/23/2021	2:33:24 PM	0	872.606	-5.578	0.08	26.31	1007.37
12/23/2021	3:26:51 PM	0	8.986	5.4	12/23/2021	3:33:24 PM	0	872.789	-5.607	0.09	26.31	1007.37
12/23/2021	4:26:51 PM	0	8.991	5.4	12/23/2021	4:33:24 PM	0	873.346	-5.698	0.09	26.31	1007.37
12/23/2021	5:26:51 PM	0	8.992	5.4	12/23/2021	5:33:24 PM	0	873.469	-5.739	0.09	26.31	1007.37
12/23/2021	6:26:51 PM	0	8.992	5.4	12/23/2021	6:33:24 PM	0	873.516	-5.811	0.08	26.31	1007.37
12/23/2021	7:26:51 PM	0	8.994	5.4	12/23/2021	7:33:24 PM	0	873.523	-5.879	0.09	26.31	1007.37
12/23/2021	8:26:51 PM	0	8.995	5.4	12/23/2021	8:33:24 PM	0	873.647	-5.912	0.09	26.31	1007.37
12/23/2021	9:26:51 PM	0	8.995	5.4	12/23/2021	9:33:24 PM	0	873.708	-5.956	0.09	26.31	1007.37
12/23/2021	10:26:51 PM	0	8.998	5.4	12/23/2021	10:33:24 PM	0	874.026	-6.036	0.09	26.31	1007.37
12/23/2021	11:26:51 PM	0	9.003	5.4	12/23/2021	11:33:24 PM	0	874.398	-6.076	0.09	26.31	1007.37
12/24/2021	12:26:51 AM	0	9.006	5.4	12/24/2021	12:33:24 AM	0	874.658	-6.11	0.09	26.31	1007.37
12/24/2021	1:26:51 AM	0	9.008	5.4	12/24/2021	1:33:24 AM	0	874.858	-6.177	0.09	26.31	1007.37
12/24/2021	2:26:51 AM	0	9.012	5.4	12/24/2021	2:33:24 AM	0	875.308	-6.258	0.09	26.31	1007.37
12/24/2021	3:26:51 AM	0	9.015	5.4	12/24/2021	3:33:24 AM	0	875.537	-6.318	0.09	26.31	1007.37
12/24/2021	4:26:51 AM	0	9.015	5.4	12/24/2021	4:33:24 AM	0	875.482	-6.512	0.09	26.31	1007.37
12/24/2021	5:26:51 AM	0	9.015	5.4	12/24/2021	5:33:24 AM	0	875.417	-6.69	0.09	26.31	1007.37
12/24/2021	6:26:51 AM	0	9.018	5.4	12/24/2021	6:33:24 AM	0	875.656	-6.819	0.09	26.31	1007.37
12/24/2021	7:26:51 AM	0	9.021	5.4	12/24/2021	7:33:24 AM	0	876.004	-6.999	0.09	26.31	1007.37
12/24/2021	8:26:51 AM	0	9.025	5.4	12/24/2021	8:33:24 AM	0	876.318	-7.26	0.09	26.31	1007.37
12/24/2021	9:26:51 AM	0	9.033	5.4	12/24/2021	9:33:24 AM	0	876.931	-7.53	0.09	26.30	1007.37
12/24/2021	10:26:51 AM	0	9.037	5.4	12/24/2021	10:33:24 AM	0	877.446	-7.814	0.09	26.31	1007.37
12/24/2021	11:26:51 AM	0	9.045	5.4	12/24/2021	11:33:24 AM	0	877.978	-8.144	0.09	26.30	1007.38
12/24/2021	12:26:51 PM	0	9.043	5.4	12/24/2021	12:33:24 PM	0	877.913	-8.444	0.09	26.30	1007.37
12/24/2021	1:26:51 PM	0	9.043	5.4	12/24/2021	1:33:24 PM	0	877.883	-8.664	0.09	26.30	1007.38
12/24/2021	2:26:51 PM	0	9.043	5.4	12/24/2021	2:33:24 PM	0	877.782	-8.849	0.09	26.30	1007.38
12/24/2021	3:26:51 PM	0	9.048	5.4	12/24/2021	3:33:24 PM	0	878.273	-9.018	0.09	26.30	1007.38
12/24/2021	4:26:51 PM	0	9.053	5.4	12/24/2021	4:33:24 PM	0	878.518	-9.269	0.09	26.30	1007.38
12/24/2021	5:26:51 PM	0	9.054	5.4	12/24/2021	5:33:24 PM	0	878.689	-9.641	0.09	26.30	1007.38
12/24/2021	6:26:51 PM	0	9.056	5.4	12/24/2021	6:33:24 PM	0	878.702	-9.922	0.10	26.30	1007.38
12/24/2021	7:26:51 PM	0	9.06	5.4	12/24/2021	7:33:24 PM	0	879.019	-10.088	0.10	26.30	1007.38
12/24/2021	8:26:51 PM	0	9.062	5.4	12/24/2021	8:33:24 PM	0	879.213	-10.24	0.10	26.30	1007.38
12/24/2021	9:26:51 PM	0	9.063	5.4	12/24/2021	9:33:24 PM	0	879.311	-10.476	0.10	26.30	1007.38
12/24/2021	10:26:51 PM	0	9.066	5.4	12/24/2021	10:33:24 PM	0	879.53	-10.703	0.10	26.30	1007.38
12/24/2021	11:26:51 PM	0	9.069	5.4	12/24/2021	11:33:24 PM	0	879.851	-10.96	0.10	26.30	1007.38
12/25/2021	12:26:51 AM	0	9.069	5.4	12/25/2021	12:33:24 AM	0	879.812	-11.134	0.10	26.30	1007.38
12/25/2021	1:26:51 AM	0	9.075	5.4	12/25/2021	1:33:24 AM	0	880.417	-11.203	0.10	26.30	1007.38
12/25/2021	2:26:51 AM	0	9.078	5.4	12/25/2021	2:33:24 AM	0	880.529	-11.566	0.10	26.30	1007.38
12/25/2021	3:26:51 AM	0	9.084	5.4	12/25/2021	3:33:24 AM	0	881.15	-11.858	0.10	26.30	1007.38
12/25/2021	4:26:51 AM	0	9.088	5.4	12/25/2021	4:33:24 AM	0	881.51	-12.041	0.10	26.30	1007.38
12/25/2021	5:26:51 AM	0	9.091	5.4	12/25/2021	5:33:24 AM	0	881.813	-12.33	0.10	26.30	1007.38
12/25/2021	6:26:51 AM	0	9.098	5.4	12/25/2021	6:33:24 AM	0	882.196	-12.627	0.10	26.29	1007.39
12/25/2021	7:26:51 AM	0	9.101	5.4	12/25/2021	7:33:24 AM	0	882.566	-12.621	0.10	26.29	1007.39
12/25/2021	8:26:51 AM	0	9.102	5.4	12/25/2021	8:33:24 AM	0	882.741	-12.729	0.10	26.29	1007.38
12/25/2021	9:26:51 AM	0	9.105	5.4	12/25/2021	9:33:24 AM	0	882.985	-12.837	0.10	26.29	1007.39
12/25/2021	10:26:51 AM	0	9.11	5.4	12/25/2021	10:33:24 AM	0	883.43	-12.85	0.10	26.29	1007.39
12/25/2021	11:26:51 AM	0	9.111	5.4	12/25/2021	11:33:24 AM	0	883.581	-12.762	0.10	26.29	1007.39
12/25/2021	12:26:51 PM	0	9.106	5.4	12/25/2021	12:33:24 PM	0	883.216	-12.653	0.10	26.30	1007.38
12/25/2021	1:26:51 PM	0	9.11	5.4	12/25/2021	1:33:24 PM	0	883.496	-12.394	0.10	26.29	1007.39
12/25/2021	2:26:51 PM	0	9.105	5.4	12/25/2021	2:33:24 PM	0	883.131	-12.034	0.10	26.30	1007.38
12/25/2021	3:26:51 PM	0	9.105	5.4	12/25/2021	3:33:24 PM	0	883.259	-12.141	0.10	26.30	1007.38
12/25/2021	4:26:51 PM	0	9.105	5.4	12/25/2021	4:33:24 PM	0	883.091	-12.378	0.10	26.29	1007.38
12/25/2021	5:26:51 PM	0	9.101	5.4	12/25/2021	5:33:24 PM	0	882.633	-12.526	0.10	26.29	1007.38
12/25/2021	6:26:51 PM	0	9.102	5.4	12/25/2021	6:33:24 PM	0	882.684	-12.672	0.10	26.29	1007.39
12/25/2021	7:26:51 PM	0	9.099	5.4	12/25/2021	7:33:24 PM	0	882.311	-12.858	0.10	26.29	1007.39
12/25/2021	8:26:51 PM	0	9.098	5.4	12/25/2021	8:33:24 PM	0	882.224	-13.005	0.10	26.29	1007.39
12/25/2021	9:26:51 PM	0	9.096	5.4	12/25/2021	9:33:24 PM	0	882.073	-13.055	0.10	26.29	1007.39
12/25/2021	10:26:51 PM	0	9.095	5.4	12/25/2021	10:33:24 PM	0	881.815	-13.172	0.10	26.29	1007.39
12/25/2021	11:26:51 PM	0	9.096	5.4	12/25/2021	11:33:24 PM	0	881.911	-13.331	0.10	26.29	1007.39
12/26/2021	12:26:51 AM	0	9.093	5.4	12/26/2021	12:33:24 AM	0	881.567	-13.572	0.10	26.29	1007.39
12/26/2021	1:26:51 AM	0	9.093	5.4	12/26/2021	1:33:24 AM	0	881.554	-13.859	0.10	26.29	1007.39
12/26/2021	2:26:51 AM	0	9.091	5.4	12/26/2021	2:33:24 AM	0	881.431	-14.141	0.10	26.29	1007.39
12/26/2021	3:26:51 AM	0	9.093	5.4	12/26/2021	3:33:24 AM	0	881.554	-14.385	0.10	26.29	1007.39
12/26/2021	4:26:51 AM	0	9.095	5.4	12/26/2021	4:33:24 AM	0	881.633	-14.619	0.10	26.29	1007.39
12/26/2021	5:26:51 AM	0	9.091	5.4	12/26/2021	5:33:24 AM	0	881.179	-14.904	0.11	26.29	1007.39
12/26/2021	6:26:51 AM	0	9.093	5.4	12/26/2021	6:33:24 AM	0	881.352	-15.125	0.11	26.29	1007.39
12/26/2021	7:26:51 AM	0	9.095	5.4	12/26/2021	7:33:24 AM	0	881.506	-15.249	0.11	26.29	1007.39
12/26/2021	8:26:51 AM	0	9.099	5.4	12/26/2021	8:33:24 AM	0	881.913	-15.471	0.11	26.29	1007.39
12/26/2021	9:26:51 AM	0	9.104	5.4	12/26/2021	9:33:24 AM	0	882.291	-15.401	0.11	26.29	1007.39
12/26/2021	10:26:51 AM	0	9.113	5.4	12/26/2021	10:33:24 AM	0	883.179	-15.302	0.11	26.29	1007.39
12/26/2021	11:26:51 AM	0	9.117	5.4	12/26/2021	11:33:24 AM	0	883.727	-15.214	0.11	26.29	1007.39
12/26/2021	12:26:51 PM	0	9.12	5.4	12/26/2021	12:33:24 PM	0	883.966	-15.204	0.11	26.29	1007.39

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/26/2021	1:26:51 PM	0	9.124	5.4	12/26/2021	1:33:24 PM	0	884.554	-15.114	0.10	26.29	1007.39
12/26/2021	2:26:51 PM	0	9.138	5.4	12/26/2021	2:33:24 PM	0	885.788	-15.045	0.11	26.29	1007.39
12/26/2021	3:26:51 PM	0	9.146	5.4	12/26/2021	3:33:24 PM	0	886.609	-14.611	0.11	26.29	1007.39
12/26/2021	4:26:51 PM	0	9.155	5.4	12/26/2021	4:33:24 PM	0	887.647	-14.25	0.10	26.29	1007.39
12/26/2021	5:26:51 PM	0	9.162	5.4	12/26/2021	5:33:24 PM	0	888.461	-14.14	0.10	26.29	1007.39
12/26/2021	6:26:51 PM	0	9.169	5.4	12/26/2021	6:33:24 PM	0	889.089	-14.236	0.10	26.29	1007.39
12/26/2021	7:26:51 PM	0	9.175	5.4	12/26/2021	7:33:24 PM	0	889.591	-14.418	0.10	26.29	1007.39
12/26/2021	8:26:51 PM	0	9.175	5.4	12/26/2021	8:33:24 PM	0	889.665	-14.508	0.10	26.29	1007.39
12/26/2021	9:26:51 PM	0	9.177	5.4	12/26/2021	9:33:24 PM	0	889.776	-14.546	0.10	26.29	1007.39
12/26/2021	10:26:51 PM	0	9.184	5.4	12/26/2021	10:33:24 PM	0	890.43	-14.599	0.10	26.29	1007.39
12/26/2021	11:26:51 PM	0	9.186	5.4	12/26/2021	11:33:24 PM	0	890.538	-14.672	0.11	26.29	1007.39
12/27/2021	12:26:51 AM	0	9.188	5.4	12/27/2021	12:33:24 AM	0	890.774	-14.727	0.10	26.29	1007.39
12/27/2021	1:26:51 AM	0	9.181	5.4	12/27/2021	1:33:24 AM	0	890.14	-14.894	0.10	26.29	1007.39
12/27/2021	2:26:51 AM	0	9.178	5.4	12/27/2021	2:33:24 AM	0	889.803	-14.891	0.10	26.29	1007.39
12/27/2021	3:26:51 AM	0	9.177	5.4	12/27/2021	3:33:24 AM	0	889.593	-14.898	0.11	26.29	1007.39
12/27/2021	4:26:51 AM	0	9.172	5.4	12/27/2021	4:33:24 AM	0	889.182	-14.946	0.10	26.29	1007.39
12/27/2021	5:26:51 AM	0	9.165	5.4	12/27/2021	5:33:24 AM	0	888.453	-15.076	0.11	26.29	1007.39
12/27/2021	6:26:51 AM	0	9.158	5.4	12/27/2021	6:33:24 AM	0	887.726	-15.1	0.11	26.29	1007.39
12/27/2021	7:26:51 AM	0	9.152	5.4	12/27/2021	7:33:24 AM	0	887.082	-15.033	0.11	26.29	1007.39
12/27/2021	8:26:51 AM	0	9.139	5.4	12/27/2021	8:33:24 AM	0	885.982	-14.941	0.10	26.29	1007.39
12/27/2021	9:26:51 AM	0	9.135	5.4	12/27/2021	9:33:24 AM	0	885.563	-14.937	0.10	26.29	1007.39
12/27/2021	10:26:51 AM	0	9.13	5.4	12/27/2021	10:33:24 AM	0	885.154	-14.807	0.10	26.29	1007.39
12/27/2021	11:26:51 AM	0	9.118	5.4	12/27/2021	11:33:24 AM	0	884.134	-14.481	0.10	26.29	1007.39
12/27/2021	12:26:51 PM	0	9.11	5.4	12/27/2021	12:33:24 PM	0	883.267	-14.115	0.10	26.29	1007.39
12/27/2021	1:26:51 PM	0	9.106	5.4	12/27/2021	1:33:24 PM	0	883.151	-13.559	0.10	26.29	1007.38
12/27/2021	2:26:51 PM	0	9.101	5.4	12/27/2021	2:33:24 PM	0	882.745	-13.08	0.10	26.30	1007.38
12/27/2021	3:26:51 PM	0	9.098	5.4	12/27/2021	3:33:24 PM	0	882.509	-12.766	0.10	26.30	1007.38
12/27/2021	4:26:51 PM	0	9.104	5.4	12/27/2021	4:33:24 PM	0	882.975	-12.66	0.10	26.29	1007.38
12/27/2021	5:26:51 PM	0	9.106	5.4	12/27/2021	5:33:24 PM	0	883.358	-12.667	0.10	26.30	1007.38
12/27/2021	6:26:51 PM	0	9.11	5.4	12/27/2021	6:33:24 PM	0	883.631	-12.8	0.10	26.30	1007.38
12/27/2021	7:26:51 PM	0	9.113	5.4	12/27/2021	7:33:24 PM	0	883.952	-12.951	0.10	26.30	1007.38
12/27/2021	8:26:51 PM	0	9.121	5.4	12/27/2021	8:33:24 PM	0	884.582	-13.189	0.10	26.29	1007.38
12/27/2021	9:26:51 PM	0	9.132	5.4	12/27/2021	9:33:24 PM	0	885.579	-13.384	0.10	26.29	1007.39
12/27/2021	10:26:51 PM	0	9.135	5.4	12/27/2021	10:33:24 PM	0	885.958	-13.335	0.10	26.29	1007.38
12/27/2021	11:26:51 PM	0	9.139	5.4	12/27/2021	11:33:24 PM	0	886.392	-13.263	0.10	26.29	1007.38
12/28/2021	12:26:51 AM	0	9.141	5.4	12/28/2021	12:33:24 AM	0	886.454	-13.469	0.10	26.29	1007.39
12/28/2021	1:26:51 AM	0	9.141	5.4	12/28/2021	1:33:24 AM	0	886.418	-13.47	0.10	26.29	1007.39
12/28/2021	2:26:51 AM	0	9.141	5.4	12/28/2021	2:33:24 AM	0	886.556	-13.235	0.10	26.29	1007.38
12/28/2021	3:26:51 AM	0	9.139	5.4	12/28/2021	3:33:24 AM	0	886.511	-13.113	0.10	26.30	1007.38
12/28/2021	4:26:51 AM	0	9.135	5.4	12/28/2021	4:33:24 AM	0	886.115	-13.125	0.10	26.30	1007.38
12/28/2021	5:26:51 AM	0	9.135	5.4	12/28/2021	5:33:24 AM	0	886.111	-13.034	0.10	26.30	1007.38
12/28/2021	6:26:51 AM	0	9.133	5.4	12/28/2021	6:33:24 AM	0	885.962	-12.922	0.10	26.30	1007.38
12/28/2021	7:26:51 AM	0	9.133	5.4	12/28/2021	7:33:24 AM	0	885.969	-12.759	0.10	26.30	1007.38
12/28/2021	8:26:51 AM	0	9.127	5.4	12/28/2021	8:33:24 AM	0	885.434	-12.759	0.10	26.30	1007.38
12/28/2021	9:26:51 AM	0	9.127	5.4	12/28/2021	9:33:24 AM	0	885.471	-12.777	0.10	26.30	1007.38
12/28/2021	10:26:51 AM	0	9.126	5.4	12/28/2021	10:33:24 AM	0	885.33	-12.669	0.10	26.30	1007.38
12/28/2021	11:26:51 AM	0	9.126	5.4	12/28/2021	11:33:24 AM	0	885.277	-12.459	0.10	26.30	1007.38
12/28/2021	12:26:51 PM	0	9.121	5.4	12/28/2021	12:33:24 PM	0	884.991	-12.147	0.10	26.30	1007.38
12/28/2021	1:26:51 PM	0	9.124	5.4	12/28/2021	1:33:24 PM	0	885.345	-11.844	0.10	26.30	1007.38
12/28/2021	2:26:51 PM	0	9.124	5.4	12/28/2021	2:33:24 PM	0	885.339	-11.597	0.10	26.30	1007.38
12/28/2021	3:26:51 PM	0	9.132	5.4	12/28/2021	3:33:24 PM	0	886.23	-11.432	0.09	26.30	1007.38
12/28/2021	4:26:51 PM	0	9.132	5.4	12/28/2021	4:33:24 PM	0	886.166	-11.492	0.10	26.30	1007.38
12/28/2021	5:26:51 PM	0	9.146	5.4	12/28/2021	5:33:24 PM	0	887.475	-11.654	0.10	26.30	1007.38
12/28/2021	6:26:51 PM	0	9.153	5.4	12/28/2021	6:33:24 PM	0	887.96	-12.03	0.10	26.30	1007.38
12/28/2021	7:26:51 PM	0	9.161	5.4	12/28/2021	7:33:24 PM	0	888.648	-12.444	0.10	26.30	1007.38
12/28/2021	8:26:51 PM	0	9.165	5.4	12/28/2021	8:33:24 PM	0	888.914	-12.857	0.10	26.29	1007.38
12/28/2021	9:26:51 PM	0	9.172	5.4	12/28/2021	9:33:24 PM	0	889.546	-13.151	0.10	26.29	1007.39
12/28/2021	10:26:51 PM	0	9.174	5.4	12/28/2021	10:33:24 PM	0	889.726	-13.411	0.10	26.29	1007.39
12/28/2021	11:26:51 PM	0	9.18	5.4	12/28/2021	11:33:24 PM	0	890.199	-13.582	0.10	26.29	1007.39
12/29/2021	12:26:51 AM	0	9.184	5.4	12/29/2021	12:33:24 AM	0	890.658	-13.774	0.10	26.29	1007.39
12/29/2021	1:26:51 AM	0	9.189	5.4	12/29/2021	1:33:24 AM	0	891.004	-13.904	0.10	26.29	1007.39
12/29/2021	2:26:51 AM	0	9.197	5.4	12/29/2021	2:33:24 AM	0	891.779	-14.026	0.10	26.29	1007.39
12/29/2021	3:26:51 AM	0	9.201	5.4	12/29/2021	3:33:24 AM	0	892.049	-14.191	0.10	26.29	1007.39
12/29/2021	4:26:51 AM	0	9.204	5.4	12/29/2021	4:33:24 AM	0	892.464	-14.249	0.10	26.29	1007.39
12/29/2021	5:26:51 AM	0	9.201	5.4	12/29/2021	5:33:24 AM	0	892.048	-14.3	0.10	26.29	1007.39
12/29/2021	6:26:51 AM	0	9.2	5.4	12/29/2021	6:33:24 AM	0	891.971	-14.413	0.10	26.29	1007.39
12/29/2021	7:26:51 AM	0	9.197	5.4	12/29/2021	7:33:24 AM	0	891.659	-14.351	0.10	26.29	1007.39
12/29/2021	8:26:51 AM	0	9.197	5.4	12/29/2021	8:33:24 AM	0	891.71	-14.007	0.10	26.29	1007.39
12/29/2021	9:26:51 AM	0	9.192	5.4	12/29/2021	9:33:24 AM	0	891.355	-13.714	0.10	26.29	1007.39
12/29/2021	10:26:51 AM	0	9.184	5.4	12/29/2021	10:33:24 AM	0	890.757	-13.45	0.10	26.29	1007.38
12/29/2021	11:26:51 AM	0	9.183	5.4	12/29/2021	11:33:24 AM	0	890.804	-13.128	0.10	26.30	1007.38
12/29/2021	12:26:51 PM	0	9.162	5.4	12/29/2021	12:33:24 PM	0	888.618	-12.818	0.10	26.29	1007.38

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/29/2021	1:26:51 PM	0	9.149	5.4	12/29/2021	1:33:24 PM	0	887.541	-12.468	0.10	26.30	1007.38
12/29/2021	2:26:51 PM	0	9.127	5.4	12/29/2021	2:33:24 PM	0	885.549	-12.258	0.10	26.30	1007.38
12/29/2021	3:26:51 PM	0	9.106	5.4	12/29/2021	3:33:24 PM	0	883.543	-12.019	0.10	26.30	1007.38
12/29/2021	4:26:51 PM	0	9.102	5.4	12/29/2021	4:33:24 PM	0	883.079	-11.85	0.10	26.30	1007.38
12/29/2021	5:26:51 PM	0	9.088	5.4	12/29/2021	5:33:24 PM	0	881.846	-11.804	0.10	26.30	1007.38
12/29/2021	6:26:51 PM	0	9.075	5.4	12/29/2021	6:33:24 PM	0	880.424	-11.72	0.10	26.30	1007.38
12/29/2021	7:26:51 PM	0	9.06	5.4	12/29/2021	7:33:24 PM	0	879.121	-11.569	0.10	26.30	1007.38
12/29/2021	8:26:51 PM	0	9.056	5.4	12/29/2021	8:33:24 PM	0	878.652	-11.275	0.10	26.30	1007.38
12/29/2021	9:26:51 PM	0	9.054	5.4	12/29/2021	9:33:24 PM	0	878.724	-10.932	0.09	26.30	1007.38
12/29/2021	10:26:51 PM	0	9.053	5.4	12/29/2021	10:33:24 PM	0	878.632	-10.634	0.09	26.30	1007.38
12/29/2021	11:26:51 PM	0	9.054	5.4	12/29/2021	11:33:24 PM	0	878.803	-10.397	0.09	26.30	1007.38
12/30/2021	12:26:51 AM	0	9.056	5.4	12/30/2021	12:33:24 AM	0	878.931	-10.247	0.09	26.30	1007.38
12/30/2021	1:26:51 AM	0	9.057	5.4	12/30/2021	1:33:24 AM	0	879.192	-10.12	0.09	26.30	1007.38
12/30/2021	2:26:51 AM	0	9.062	5.4	12/30/2021	2:33:24 AM	0	879.531	-10.057	0.09	26.30	1007.38
12/30/2021	3:26:51 AM	0	9.069	5.4	12/30/2021	3:33:24 AM	0	880.273	-9.993	0.09	26.30	1007.38
12/30/2021	4:26:51 AM	0	9.072	5.4	12/30/2021	4:33:24 AM	0	880.67	-9.945	0.09	26.30	1007.38
12/30/2021	5:26:51 AM	0	9.078	5.4	12/30/2021	5:33:24 AM	0	881.172	-10.064	0.09	26.30	1007.38
12/30/2021	6:26:51 AM	0	9.084	5.4	12/30/2021	6:33:24 AM	0	881.708	-10.262	0.09	26.30	1007.38
12/30/2021	7:26:51 AM	0	9.093	5.4	12/30/2021	7:33:24 AM	0	882.495	-10.516	0.09	26.30	1007.38
12/30/2021	8:26:51 AM	0	9.101	5.4	12/30/2021	8:33:24 AM	0	883.176	-10.68	0.10	26.30	1007.38
12/30/2021	9:26:51 AM	0	9.108	5.4	12/30/2021	9:33:24 AM	0	883.888	-10.913	0.09	26.30	1007.38
12/30/2021	10:26:51 AM	0	9.116	5.4	12/30/2021	10:33:24 AM	0	884.57	-10.988	0.10	26.30	1007.38
12/30/2021	11:26:51 AM	0	9.118	5.4	12/30/2021	11:33:24 AM	0	884.954	-10.902	0.09	26.30	1007.38
12/30/2021	12:26:51 PM	0	9.118	5.4	12/30/2021	12:33:24 PM	0	884.878	-10.755	0.09	26.30	1007.38
12/30/2021	1:26:51 PM	0	9.121	5.4	12/30/2021	1:33:24 PM	0	885.364	-10.475	0.09	26.30	1007.38
12/30/2021	2:26:51 PM	0	9.123	5.4	12/30/2021	2:33:24 PM	0	885.566	-10.285	0.09	26.30	1007.38
12/30/2021	3:26:51 PM	0	9.126	5.4	12/30/2021	3:33:24 PM	0	885.927	-10.101	0.09	26.30	1007.38
12/30/2021	4:26:51 PM	0	9.133	5.4	12/30/2021	4:33:24 PM	0	886.615	-10.068	0.09	26.30	1007.38
12/30/2021	5:26:51 PM	0	9.138	5.4	12/30/2021	5:33:24 PM	0	887.006	-10.279	0.09	26.30	1007.38
12/30/2021	6:26:51 PM	0	9.139	5.4	12/30/2021	6:33:24 PM	0	887.129	-10.495	0.09	26.30	1007.38
12/30/2021	7:26:51 PM	0	9.143	5.4	12/30/2021	7:33:24 PM	0	887.401	-10.475	0.09	26.30	1007.38
12/30/2021	8:26:51 PM	0	9.15	5.4	12/30/2021	8:33:24 PM	0	888.093	-10.435	0.09	26.30	1007.38
12/30/2021	9:26:51 PM	0	9.152	5.4	12/30/2021	9:33:24 PM	0	888.213	-10.411	0.09	26.30	1007.38
12/30/2021	10:26:51 PM	0	9.15	5.4	12/30/2021	10:33:24 PM	0	888.178	-10.408	0.09	26.30	1007.38
12/30/2021	11:26:51 PM	0	9.155	5.4	12/30/2021	11:33:24 PM	0	888.556	-10.581	0.09	26.30	1007.38
12/31/2021	12:26:51 AM	0	9.159	5.4	12/31/2021	12:33:24 AM	0	888.967	-10.77	0.09	26.30	1007.38
12/31/2021	1:26:51 AM	0	9.162	5.4	12/31/2021	1:33:24 AM	0	889.216	-10.948	0.09	26.30	1007.38
12/31/2021	2:26:51 AM	0	9.171	5.4	12/31/2021	2:33:24 AM	0	889.962	-11.127	0.10	26.30	1007.38
12/31/2021	3:26:51 AM	0	9.178	5.4	12/31/2021	3:33:24 AM	0	890.565	-11.391	0.10	26.30	1007.38
12/31/2021	4:26:51 AM	0	9.178	5.4	12/31/2021	4:33:24 AM	0	890.628	-11.54	0.10	26.30	1007.38
12/31/2021	5:26:51 AM	0	9.183	5.4	12/31/2021	5:33:24 AM	0	891.024	-11.614	0.10	26.30	1007.38
12/31/2021	6:26:51 AM	0	9.192	5.4	12/31/2021	6:33:24 AM	0	891.782	-11.703	0.10	26.30	1007.38
12/31/2021	7:26:51 AM	0	9.197	5.4	12/31/2021	7:33:24 AM	0	892.25	-11.778	0.10	26.30	1007.38
12/31/2021	8:26:51 AM	0	9.204	5.4	12/31/2021	8:33:24 AM	0	893.04	-11.811	0.10	26.30	1007.38
12/31/2021	9:26:51 AM	0	9.207	5.4	12/31/2021	9:33:24 AM	0	893.3	-11.946	0.10	26.30	1007.38
12/31/2021	10:26:51 AM	0	9.211	5.4	12/31/2021	10:33:24 AM	0	893.632	-11.943	0.10	26.30	1007.38
12/31/2021	11:26:51 AM	0	9.216	5.4	12/31/2021	11:33:24 AM	0	894.153	-11.841	0.10	26.30	1007.38
12/31/2021	12:26:51 PM	0	9.213	5.4	12/31/2021	12:33:24 PM	0	894.042	-11.369	0.10	26.30	1007.38
12/31/2021	1:26:51 PM	0	9.207	5.4	12/31/2021	1:33:24 PM	0	893.63	-10.966	0.09	26.30	1007.38
12/31/2021	2:26:51 PM	0	9.21	5.4	12/31/2021	2:33:24 PM	0	893.888	-10.597	0.09	26.30	1007.38
12/31/2021	3:26:51 PM	0	9.205	5.4	12/31/2021	3:33:24 PM	0	893.661	-10.333	0.09	26.30	1007.38
12/31/2021	4:26:51 PM	0	9.209	5.4	12/31/2021	4:33:24 PM	0	893.943	-10.14	0.09	26.30	1007.38
12/31/2021	5:26:51 PM	0	9.214	5.4	12/31/2021	5:33:24 PM	0	894.495	-10.218	0.09	26.30	1007.38
12/31/2021	6:26:51 PM	0	9.207	5.4	12/31/2021	6:33:24 PM	0	893.798	-10.33	0.09	26.30	1007.38
12/31/2021	7:26:51 PM	0	9.21	5.4	12/31/2021	7:33:24 PM	0	893.986	-10.254	0.09	26.30	1007.38
12/31/2021	8:26:51 PM	0	9.207	5.4	12/31/2021	8:33:24 PM	0	893.862	-10.165	0.09	26.30	1007.38
12/31/2021	9:26:51 PM	0	9.205	5.4	12/31/2021	9:33:24 PM	0	893.678	-10.041	0.09	26.30	1007.38
12/31/2021	10:26:51 PM	0	9.204	5.4	12/31/2021	10:33:24 PM	0	893.482	-9.912	0.09	26.30	1007.38
12/31/2021	11:26:51 PM	0	9.2	5.4	12/31/2021	11:33:24 PM	0	893.184	-9.84	0.09	26.30	1007.38
2/23/2022	5:00:00 PM	0	9.259	5.4	2/23/2022	5:00:00 PM	0	899.726	-4.105	0.08	26.70	1006.977
2/23/2022	6:00:00 PM	0	9.262	5.4	2/23/2022	6:00:00 PM	0	899.924	-4.384	0.09	26.70	1006.977981
2/23/2022	7:00:00 PM	0	9.267	5.4	2/23/2022	7:00:00 PM	0	900.345	-4.66	0.09	26.70	1006.978688
2/23/2022	8:00:00 PM	0	9.27	5.4	2/23/2022	8:00:00 PM	0	900.578	-5.072	0.09	26.70	1006.979312
2/23/2022	9:00:00 PM	0	9.274	5.4	2/23/2022	9:00:00 PM	0	900.908	-5.687	0.09	26.70	1006.979947
2/23/2022	10:00:00 PM	0	9.281	5.4	2/23/2022	10:00:00 PM	0	901.411	-6.309	0.09	26.70	1006.981818
2/23/2022	11:00:00 PM	0	9.282	5.4	2/23/2022	11:00:00 PM	0	901.415	-6.844	0.09	26.70	1006.982777
2/24/2022	12:00:00 AM	0	9.288	5.4	2/24/2022	12:00:00 AM	0	901.986	-7.277	0.09	26.70	1006.982954
2/24/2022	1:00:00 AM	0	9.297	5.4	2/24/2022	1:00:00 AM	0	902.674	-7.668	0.09	26.69	1006.984939
2/24/2022	2:00:00 AM	0	9.302	5.4	2/24/2022	2:00:00 AM	0	903.16	-7.975	0.09	26.69	1006.984983
2/24/2022	3:00:00 AM	0	9.304	5.4	2/24/2022	3:00:00 AM	0	903.375	-8.217	0.09	26.69	1006.98479
2/24/2022	4:00:00 AM	0	9.31	5.4	2/24/2022	4:00:00 AM	0	903.899	-8.474	0.09	26.69	1006.985447
2/24/2022	5:00:00 AM	0	9.312	5.4	2/24/2022	5:00:00 AM	0	903.967	-8.741	0.09	26.69	1006.986754

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	SWL	Levelo	GW masl	Date	SWL	Levelogger	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
2/24/2022	6:00:00 AM	0	9.313	5.4	2/24/2022	6:00:00 AM	0	904.162	-8.938	0.09	26.69	1006.985765
2/24/2022	7:00:00 AM	0	9.315	5.4	2/24/2022	7:00:00 AM	0	904.214	-9.18	0.09	26.69	1006.987235
2/24/2022	8:00:00 AM	0	9.321	5.4	2/24/2022	8:00:00 AM	0	904.868	-9.314	0.09	26.69	1006.986566
2/24/2022	9:00:00 AM	0	9.327	5.4	2/24/2022	9:00:00 AM	0	905.512	-8.948	0.09	26.69	1006.985999
2/24/2022	10:00:00 AM	0	9.33	5.4	2/24/2022	10:00:00 AM	0	906.148	-7.613	0.09	26.70	1006.982514
2/24/2022	11:00:00 AM	0	9.329	5.4	2/24/2022	11:00:00 AM	0	906.326	-6.462	0.09	26.70	1006.979698
2/24/2022	12:00:00 PM	0	9.327	5.4	2/24/2022	12:00:00 PM	0	906.143	-6.564	0.09	26.70	1006.979565
2/24/2022	1:00:00 PM	0	9.322	5.4	2/24/2022	1:00:00 PM	0	905.739	-6.32	0.09	26.70	1006.978684
2/24/2022	2:00:00 PM	0	9.319	5.4	2/24/2022	2:00:00 PM	0	905.457	-6.154	0.09	26.70	1006.97856
2/24/2022	3:00:00 PM	0	9.315	5.4	2/24/2022	3:00:00 PM	0	905.102	-5.777	0.09	26.70	1006.97818
2/24/2022	4:00:00 PM	0	9.312	5.4	2/24/2022	4:00:00 PM	0	904.729	-5.754	0.09	26.70	1006.978983
2/24/2022	5:00:00 PM	0	9.307	5.4	2/24/2022	5:00:00 PM	0	904.371	-6.054	0.08	26.70	1006.977634
2/24/2022	6:00:00 PM	0	9.309	5.4	2/24/2022	6:00:00 PM	0	904.326	-6.537	0.09	26.70	1006.980093
2/24/2022	7:00:00 PM	0	9.312	5.4	2/24/2022	7:00:00 PM	0	904.419	-7.12	0.09	26.70	1006.982145
2/24/2022	8:00:00 PM	0	9.309	5.4	2/24/2022	8:00:00 PM	0	904.042	-7.603	0.09	26.70	1006.982989
2/24/2022	9:00:00 PM	0	9.31	5.4	2/24/2022	9:00:00 PM	0	904.063	-7.964	0.09	26.70	1006.983775
2/24/2022	10:00:00 PM	0	9.312	5.4	2/24/2022	10:00:00 PM	0	904.157	-8.255	0.09	26.69	1006.984816
2/24/2022	11:00:00 PM	0	9.31	5.4	2/24/2022	11:00:00 PM	0	903.899	-8.366	0.09	26.69	1006.985447
2/25/2022	12:00:00 AM	0	9.309	5.4	2/25/2022	12:00:00 AM	0	903.856	-8.345	0.09	26.69	1006.984886
2/25/2022	1:00:00 AM	0	9.31	5.4	2/25/2022	1:00:00 AM	0	903.907	-8.385	0.09	26.69	1006.985366
2/25/2022	2:00:00 AM	0	9.31	5.4	2/25/2022	2:00:00 AM	0	904.026	-8.377	0.09	26.69	1006.984152
2/25/2022	3:00:00 AM	0	9.307	5.4	2/25/2022	3:00:00 AM	0	903.636	-8.521	0.09	26.69	1006.985129
2/25/2022	4:00:00 AM	0	9.307	5.4	2/25/2022	4:00:00 AM	0	903.654	-8.619	0.09	26.69	1006.984945
2/25/2022	5:00:00 AM	0	9.307	5.4	2/25/2022	5:00:00 AM	0	903.614	-8.683	0.09	26.69	1006.985353
2/25/2022	6:00:00 AM	0	9.309	5.4	2/25/2022	6:00:00 AM	0	903.841	-8.639	0.09	26.69	1006.985039
2/25/2022	7:00:00 AM	0	9.312	5.4	2/25/2022	7:00:00 AM	0	904.137	-8.445	0.09	26.69	1006.98502
2/25/2022	8:00:00 AM	0	9.313	5.4	2/25/2022	8:00:00 AM	0	904.343	-8.346	0.09	26.70	1006.98392
2/25/2022	9:00:00 AM	0	9.313	5.4	2/25/2022	9:00:00 AM	0	904.544	-7.999	0.09	26.70	1006.98187
2/25/2022	10:00:00 AM	0	9.312	5.4	2/25/2022	10:00:00 AM	0	904.655	-6.728	0.09	26.70	1006.979738
2/25/2022	11:00:00 AM	0	9.312	5.4	2/25/2022	11:00:00 AM	0	904.834	-5.793	0.09	26.70	1006.977913
2/25/2022	12:00:00 PM	0	9.307	5.4	2/25/2022	12:00:00 PM	0	904.433	-5.767	0.08	26.70	1006.977002
2/25/2022	1:00:00 PM	0	9.3	5.4	2/25/2022	1:00:00 PM	0	903.671	-5.456	0.09	26.70	1006.977772
2/25/2022	2:00:00 PM	0	9.297	5.4	2/25/2022	2:00:00 PM	0	903.503	-5.158	0.08	26.70	1006.976485
2/25/2022	3:00:00 PM	0	9.294	5.4	2/25/2022	3:00:00 PM	0	903.231	-4.774	0.08	26.70	1006.976259
2/25/2022	4:00:00 PM	0	9.294	5.4	2/25/2022	4:00:00 PM	0	903.247	-4.68	0.08	26.70	1006.976096
2/25/2022	5:00:00 PM	0	9.291	5.4	2/25/2022	5:00:00 PM	0	902.922	-4.724	0.08	26.70	1006.97641
2/25/2022	6:00:00 PM	0	9.29	5.4	2/25/2022	6:00:00 PM	0	902.662	-4.948	0.09	26.70	1006.978061
2/25/2022	7:00:00 PM	0	9.287	5.4	2/25/2022	7:00:00 PM	0	902.365	-5.169	0.09	26.70	1006.97809
2/25/2022	8:00:00 PM	0	9.282	5.4	2/25/2022	8:00:00 PM	0	901.958	-5.162	0.08	26.70	1006.97724
2/25/2022	9:00:00 PM	0	9.277	5.4	2/25/2022	9:00:00 PM	0	901.52	-5.244	0.08	26.70	1006.976706
2/25/2022	10:00:00 PM	0	9.273	5.4	2/25/2022	10:00:00 PM	0	901.009	-5.349	0.09	26.70	1006.977917
2/25/2022	11:00:00 PM	0	9.271	5.4	2/25/2022	11:00:00 PM	0	900.919	-5.38	0.08	26.70	1006.976835
2/26/2022	12:00:00 AM	0	9.267	5.4	2/26/2022	12:00:00 AM	0	900.445	-5.417	0.08	26.70	1006.977668
2/26/2022	1:00:00 AM	0	9.264	5.4	2/26/2022	1:00:00 AM	0	900.099	-5.457	0.09	26.70	1006.978196
2/26/2022	2:00:00 AM	0	9.257	5.4	2/26/2022	2:00:00 AM	0	899.291	-5.497	0.09	26.70	1006.979436
2/26/2022	3:00:00 AM	0	9.252	5.4	2/26/2022	3:00:00 AM	0	898.927	-5.543	0.09	26.70	1006.978148
2/26/2022	4:00:00 AM	0	9.246	5.4	2/26/2022	4:00:00 AM	0	898.365	-5.55	0.09	26.70	1006.977878
2/26/2022	5:00:00 AM	0	9.242	5.4	2/26/2022	5:00:00 AM	0	897.944	-5.532	0.09	26.70	1006.978171
2/26/2022	6:00:00 AM	0	9.238	5.4	2/26/2022	6:00:00 AM	0	897.626	-5.446	0.08	26.70	1006.977414
2/26/2022	7:00:00 AM	0	9.234	5.4	2/26/2022	7:00:00 AM	0	897.177	-5.437	0.09	26.70	1006.977993
2/26/2022	8:00:00 AM	0	9.232	5.4	2/26/2022	8:00:00 AM	0	897.094	-5.295	0.08	26.70	1006.976839
2/26/2022	9:00:00 AM	0	9.228	5.4	2/26/2022	9:00:00 AM	0	896.649	-5.046	0.08	26.70	1006.977377
2/26/2022	10:00:00 AM	0	9.223	5.4	2/26/2022	10:00:00 AM	0	896.352	-4.666	0.08	26.70	1006.975405
2/26/2022	11:00:00 AM	0	9.219	5.4	2/26/2022	11:00:00 AM	0	895.942	-4.325	0.08	26.70	1006.975586
2/26/2022	12:00:00 PM	0	9.214	5.4	2/26/2022	12:00:00 PM	0	895.585	-3.966	0.08	26.70	1006.974227
2/26/2022	1:00:00 PM	0	9.21	5.4	2/26/2022	1:00:00 PM	0	895.156	-3.665	0.08	26.70	1006.974601
2/26/2022	2:00:00 PM	0	9.207	5.4	2/26/2022	2:00:00 PM	0	895.006	-3.475	0.08	26.71	1006.973131
2/26/2022	3:00:00 PM	0	9.209	5.4	2/26/2022	3:00:00 PM	0	895.035	-3.31	0.08	26.70	1006.974835
2/26/2022	4:00:00 PM	0	9.209	5.4	2/26/2022	4:00:00 PM	0	895.072	-3.138	0.08	26.70	1006.974458
2/26/2022	5:00:00 PM	0	9.203	5.4	2/26/2022	5:00:00 PM	0	894.546	-2.979	0.08	26.71	1006.973821
2/26/2022	6:00:00 PM	0	9.198	5.4	2/26/2022	6:00:00 PM	0	894.118	-2.917	0.08	26.71	1006.973186
2/26/2022	7:00:00 PM	0	9.2	5.4	2/26/2022	7:00:00 PM	0	894.224	-2.917	0.08	26.70	1006.974105
2/26/2022	8:00:00 PM	0	9.204	5.4	2/26/2022	8:00:00 PM	0	894.644	-2.904	0.08	26.71	1006.973822
2/26/2022	9:00:00 PM	0	9.201	5.4	2/26/2022	9:00:00 PM	0	894.37	-2.88	0.08	26.71	1006.973616
2/26/2022	10:00:00 PM	0	9.198	5.4	2/26/2022	10:00:00 PM	0	894.094	-2.839	0.08	26.71	1006.973431
2/26/2022	11:00:00 PM	0	9.192	5.4	2/26/2022	11:00:00 PM	0	893.485	-2.798	0.08	26.71	1006.973641
2/27/2022	12:00:00 AM	0	9.191	5.4	2/27/2022	12:00:00 AM	0	893.312	-2.775	0.08	26.70	1006.974405
2/27/2022	1:00:00 AM	0	9.184	5.4	2/27/2022	1:00:00 AM	0	892.87	-2.802	0.08	26.71	1006.971912
2/27/2022	2:00:00 AM	0	9.178	5.4	2/27/2022	2:00:00 AM	0	892.253	-2.828	0.08	26.71	1006.972204
2/27/2022	3:00:00 AM	0	9.175	5.4	2/27/2022	3:00:00 AM	0	891.873	-2.841	0.08	26.71	1006.973079
2/27/2022	4:00:00 AM	0	9.169	5.4	2/27/2022	4:00:00 AM	0	891.337	-2.829	0.08	26.71	1006.972544
2/27/2022	5:00:00 AM	0	9.169	5.4	2/27/2022	5:00:00 AM	0	891.323	-2.78	0.08	26.71	1006.972687

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
2/27/2022	6:00:00 AM	0	9.166	5.4	2/27/2022	6:00:00 AM	0	891.14	-2.739	0.08	26.71	1006.971553
2/27/2022	7:00:00 AM	0	9.166	5.4	2/27/2022	7:00:00 AM	0	890.986	-2.705	0.08	26.71	1006.973124
2/27/2022	8:00:00 AM	0	9.168	5.4	2/27/2022	8:00:00 AM	0	891.189	-2.679	0.08	26.71	1006.973053
2/27/2022	9:00:00 AM	0	9.174	5.4	2/27/2022	9:00:00 AM	0	891.812	-2.483	0.08	26.71	1006.972701
2/27/2022	10:00:00 AM	0	9.175	5.4	2/27/2022	10:00:00 AM	0	892.086	-1.973	0.08	26.71	1006.970907
2/27/2022	11:00:00 AM	0	9.18	5.4	2/27/2022	11:00:00 AM	0	892.576	-1.47	0.08	26.71	1006.97091
2/27/2022	12:00:00 PM	0	9.189	5.4	2/27/2022	12:00:00 PM	0	893.504	-1.14	0.08	26.71	1006.970447
2/27/2022	1:00:00 PM	0	9.197	5.4	2/27/2022	1:00:00 PM	0	894.103	-0.878	0.08	26.71	1006.972339
2/27/2022	2:00:00 PM	0	9.197	5.4	2/27/2022	2:00:00 PM	0	894.282	-0.638	0.08	26.71	1006.970514
2/27/2022	3:00:00 PM	0	9.201	5.4	2/27/2022	3:00:00 PM	0	894.615	-0.543	0.08	26.71	1006.971118
2/27/2022	4:00:00 PM	0	9.204	5.4	2/27/2022	4:00:00 PM	0	894.927	-0.524	0.08	26.71	1006.970936
2/27/2022	5:00:00 PM	0	9.207	5.4	2/27/2022	5:00:00 PM	0	895.244	-0.541	0.08	26.71	1006.970704
2/27/2022	6:00:00 PM	0	9.205	5.4	2/27/2022	6:00:00 PM	0	895.12	-0.562	0.08	26.71	1006.969968
2/27/2022	7:00:00 PM	0	9.203	5.4	2/27/2022	7:00:00 PM	0	894.75	-0.583	0.08	26.71	1006.971741
2/27/2022	8:00:00 PM	0	9.2	5.4	2/27/2022	8:00:00 PM	0	894.492	-0.614	0.08	26.71	1006.971372
2/27/2022	9:00:00 PM	0	9.195	5.4	2/27/2022	9:00:00 PM	0	894.031	-0.695	0.08	26.71	1006.971073
2/27/2022	10:00:00 PM	0	9.189	5.4	2/27/2022	10:00:00 PM	0	893.376	-0.855	0.08	26.71	1006.971752
2/27/2022	11:00:00 PM	0	9.184	5.4	2/27/2022	11:00:00 PM	0	892.87	-1.073	0.08	26.71	1006.971912
2/28/2022	12:00:00 AM	0	9.181	5.4	2/28/2022	12:00:00 AM	0	892.547	-1.194	0.08	26.71	1006.972206
2/28/2022	1:00:00 AM	0	9.171	5.4	2/28/2022	1:00:00 AM	0	891.555	-1.235	0.08	26.71	1006.972321
2/28/2022	2:00:00 AM	0	9.159	5.4	2/28/2022	2:00:00 AM	0	890.332	-1.273	0.08	26.71	1006.972792
2/28/2022	3:00:00 AM	0	9.152	5.4	2/28/2022	3:00:00 AM	0	889.617	-1.309	0.08	26.71	1006.973083
2/28/2022	4:00:00 AM	0	9.147	5.4	2/28/2022	4:00:00 AM	0	889.15	-1.333	0.08	26.71	1006.972846
2/28/2022	5:00:00 AM	0	9.144	5.4	2/28/2022	5:00:00 AM	0	888.974	-1.361	0.08	26.71	1006.97164
2/28/2022	6:00:00 AM	0	9.141	5.4	2/28/2022	6:00:00 AM	0	888.585	-1.397	0.08	26.71	1006.972607
2/28/2022	7:00:00 AM	0	9.139	5.4	2/28/2022	7:00:00 AM	0	888.45	-1.488	0.08	26.71	1006.971984
2/28/2022	8:00:00 AM	0	9.141	5.4	2/28/2022	8:00:00 AM	0	888.619	-1.524	0.08	26.71	1006.97226
2/28/2022	9:00:00 AM	0	9.144	5.4	2/28/2022	9:00:00 AM	0	888.884	-1.387	0.08	26.71	1006.972558
2/28/2022	10:00:00 AM	0	9.144	5.4	2/28/2022	10:00:00 AM	0	888.991	-0.82	0.08	26.71	1006.971467
2/28/2022	11:00:00 AM	0	9.146	5.4	2/28/2022	11:00:00 AM	0	889.181	-0.567	0.08	26.71	1006.971529
2/28/2022	12:00:00 PM	0	9.121	4.2	2/28/2022	12:00:00 PM	0	888.91	4.899	0.06	26.73	1006.949293
2/28/2022	1:00:00 PM	0	9.144	5.4	2/28/2022	1:00:00 PM	0	888.916	0.061	0.08	26.71	1006.972232
2/28/2022	2:00:00 PM	0	9.144	5.4	2/28/2022	2:00:00 PM	0	888.893	-0.334	0.08	26.71	1006.972466
2/28/2022	3:00:00 PM	0	9.15	5.4	2/28/2022	3:00:00 PM	0	889.403	-0.365	0.08	26.71	1006.973266
2/28/2022	4:00:00 PM	0	9.153	5.4	2/28/2022	4:00:00 PM	0	889.757	-0.397	0.08	26.71	1006.972656
2/28/2022	5:00:00 PM	0	9.153	5.4	2/28/2022	5:00:00 PM	0	889.659	-0.438	0.08	26.71	1006.973655
2/28/2022	6:00:00 PM	0	9.153	5.4	2/28/2022	6:00:00 PM	0	889.703	-0.47	0.08	26.71	1006.973207
2/28/2022	7:00:00 PM	0	9.152	5.4	2/28/2022	7:00:00 PM	0	889.613	-0.51	0.08	26.71	1006.973124
2/28/2022	8:00:00 PM	0	9.152	5.4	2/28/2022	8:00:00 PM	0	889.467	-0.538	0.08	26.70	1006.974613
2/28/2022	9:00:00 PM	0	9.152	5.4	2/28/2022	9:00:00 PM	0	889.451	-0.542	0.08	26.70	1006.974776
2/28/2022	10:00:00 PM	0	9.156	5.4	2/28/2022	10:00:00 PM	0	890.011	-0.551	0.08	26.71	1006.973066
2/28/2022	11:00:00 PM	0	9.153	5.4	2/28/2022	11:00:00 PM	0	889.723	-0.552	0.08	26.71	1006.973003
3/1/2022	12:00:00 AM	0	9.159	5.4	3/1/2022	12:00:00 AM	0	890.269	-0.552	0.08	26.71	1006.973435
3/1/2022	1:00:00 AM	0	9.158	5.4	3/1/2022	1:00:00 AM	0	890.06	-0.541	0.08	26.70	1006.974566
3/1/2022	2:00:00 AM	0	9.159	5.4	3/1/2022	2:00:00 AM	0	890.219	-0.549	0.08	26.71	1006.973945
3/1/2022	3:00:00 AM	0	9.156	5.4	3/1/2022	3:00:00 AM	0	889.953	-0.548	0.08	26.71	1006.973657
3/1/2022	4:00:00 AM	0	9.159	5.4	3/1/2022	4:00:00 AM	0	890.269	-0.537	0.08	26.71	1006.973435
3/1/2022	5:00:00 AM	0	9.152	5.4	3/1/2022	5:00:00 AM	0	889.573	-0.544	0.08	26.71	1006.973532
3/1/2022	6:00:00 AM	0	9.156	5.4	3/1/2022	6:00:00 AM	0	889.993	-0.577	0.08	26.71	1006.973249
3/1/2022	7:00:00 AM	0	9.159	5.4	3/1/2022	7:00:00 AM	0	890.232	-0.588	0.08	26.71	1006.973812
3/1/2022	8:00:00 AM	0	9.166	5.4	3/1/2022	8:00:00 AM	0	890.919	-0.588	0.08	26.71	1006.973807
3/1/2022	9:00:00 AM	0	9.168	5.4	3/1/2022	9:00:00 AM	0	891.203	-0.545	0.08	26.71	1006.972911
3/1/2022	10:00:00 AM	0	9.172	5.4	3/1/2022	10:00:00 AM	0	891.664	-0.357	0.08	26.71	1006.97221
3/1/2022	11:00:00 AM	0	9.177	5.4	3/1/2022	11:00:00 AM	0	892.054	-0.305	0.08	26.71	1006.973233
3/1/2022	12:00:00 PM	0	9.177	5.4	3/1/2022	12:00:00 PM	0	892.11	-0.381	0.08	26.71	1006.972662
3/1/2022	1:00:00 PM	0	9.175	5.4	3/1/2022	1:00:00 PM	0	891.967	-0.274	0.08	26.71	1006.97212
3/1/2022	2:00:00 PM	0	9.178	5.4	3/1/2022	2:00:00 PM	0	892.246	-0.217	0.08	26.71	1006.972275
3/1/2022	3:00:00 PM	0	9.18	5.4	3/1/2022	3:00:00 PM	0	892.512	-0.138	0.08	26.71	1006.971563
3/1/2022	4:00:00 PM	0	9.18	5.4	3/1/2022	4:00:00 PM	0	892.437	-0.169	0.08	26.71	1006.972327
3/1/2022	5:00:00 PM	0	9.183	5.4	3/1/2022	5:00:00 PM	0	892.715	-0.219	0.08	26.71	1006.972493
3/1/2022	6:00:00 PM	0	9.184	5.4	3/1/2022	6:00:00 PM	0	892.7	-0.341	0.08	26.71	1006.973646
3/1/2022	7:00:00 PM	0	9.189	5.4	3/1/2022	7:00:00 PM	0	893.201	-0.477	0.08	26.71	1006.973537
3/1/2022	8:00:00 PM	0	9.191	5.4	3/1/2022	8:00:00 PM	0	893.304	-0.531	0.08	26.70	1006.974486
3/1/2022	9:00:00 PM	0	9.192	5.4	3/1/2022	9:00:00 PM	0	893.539	-0.595	0.08	26.71	1006.97309
3/1/2022	10:00:00 PM	0	9.197	5.4	3/1/2022	10:00:00 PM	0	893.863	-0.567	0.08	26.70	1006.974786
3/1/2022	11:00:00 PM	0	9.2	5.4	3/1/2022	11:00:00 PM	0	894.225	-0.525	0.08	26.70	1006.974095
3/2/2022	12:00:00 AM	0	9.2	5.4	3/2/2022	12:00:00 AM	0	894.23	-0.486	0.08	26.70	1006.974044
3/2/2022	1:00:00 AM	0	9.201	5.4	3/2/2022	1:00:00 AM	0	894.464	-0.499	0.08	26.71	1006.972658
3/2/2022	2:00:00 AM	0	9.204	5.4	3/2/2022	2:00:00 AM	0	894.692	-0.525	0.08	26.71	1006.973333
3/2/2022	3:00:00 AM	0	9.205	5.4	3/2/2022	3:00:00 AM	0	894.772	-0.549	0.08	26.71	1006.973517
3/2/2022	4:00:00 AM	0	9.201	5.4	3/2/2022	4:00:00 AM	0	894.394	-0.551	0.08	26.71	1006.973371
3/2/2022	5:00:00 AM	0	9.205	5.4	3/2/2022	5:00:00 AM	0	894.888	-0.542	0.08	26.71	1006.972334

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/2/2022	6:00:00 AM	0	9.207	5.4	3/2/2022	6:00:00 AM	0	894.906	-0.542	0.08	26.70	1006.974151
3/2/2022	7:00:00 AM	0	9.21	5.4	3/2/2022	7:00:00 AM	0	895.218	-0.585	0.08	26.71	1006.973969
3/2/2022	8:00:00 AM	0	9.213	5.4	3/2/2022	8:00:00 AM	0	895.495	-0.553	0.08	26.70	1006.974144
3/2/2022	9:00:00 AM	0	9.216	5.4	3/2/2022	9:00:00 AM	0	895.805	-0.364	0.08	26.71	1006.973983
3/2/2022	10:00:00 AM	0	9.216	5.4	3/2/2022	10:00:00 AM	0	895.983	0.183	0.08	26.71	1006.972168
3/2/2022	11:00:00 AM	0	9.214	5.4	3/2/2022	11:00:00 AM	0	895.923	0.329	0.08	26.71	1006.97078
3/2/2022	12:00:00 PM	0	9.214	5.4	3/2/2022	12:00:00 PM	0	895.796	0.046	0.08	26.71	1006.972075
3/2/2022	1:00:00 PM	0	9.21	5.4	3/2/2022	1:00:00 PM	0	895.383	0.326	0.08	26.71	1006.972286
3/2/2022	2:00:00 PM	0	9.205	5.4	3/2/2022	2:00:00 PM	0	894.969	0.339	0.08	26.71	1006.971508
3/2/2022	3:00:00 PM	0	9.204	5.4	3/2/2022	3:00:00 PM	0	894.795	0.254	0.08	26.71	1006.972282
3/2/2022	4:00:00 PM	0	9.204	5.4	3/2/2022	4:00:00 PM	0	894.733	0.039	0.08	26.71	1006.972915
3/2/2022	5:00:00 PM	0	9.203	5.4	3/2/2022	5:00:00 PM	0	894.663	-0.088	0.08	26.71	1006.972628
3/2/2022	6:00:00 PM	0	9.203	5.4	3/2/2022	6:00:00 PM	0	894.588	-0.299	0.08	26.71	1006.973393
3/2/2022	7:00:00 PM	0	9.207	5.4	3/2/2022	7:00:00 PM	0	894.908	-0.41	0.08	26.70	1006.97413
3/2/2022	8:00:00 PM	0	9.21	5.4	3/2/2022	8:00:00 PM	0	895.199	-0.597	0.08	26.70	1006.974163
3/2/2022	9:00:00 PM	0	9.213	5.4	3/2/2022	9:00:00 PM	0	895.435	-0.792	0.08	26.70	1006.974756
3/2/2022	10:00:00 PM	0	9.216	5.4	3/2/2022	10:00:00 PM	0	895.72	-0.845	0.08	26.70	1006.97485
3/2/2022	11:00:00 PM	0	9.216	5.4	3/2/2022	11:00:00 PM	0	895.787	-0.814	0.08	26.70	1006.974167
3/3/2022	12:00:00 AM	0	9.217	5.4	3/3/2022	12:00:00 AM	0	895.997	-0.771	0.08	26.71	1006.973025
3/3/2022	1:00:00 AM	0	9.219	5.4	3/3/2022	1:00:00 AM	0	896.088	-0.838	0.08	26.70	1006.974097
3/3/2022	2:00:00 AM	0	9.219	5.4	3/3/2022	2:00:00 AM	0	896.068	-0.957	0.08	26.70	1006.974301
3/3/2022	3:00:00 AM	0	9.217	5.4	3/3/2022	3:00:00 AM	0	895.798	-1.189	0.08	26.70	1006.975055
3/3/2022	4:00:00 AM	0	9.216	5.4	3/3/2022	4:00:00 AM	0	895.733	-1.569	0.08	26.70	1006.974717
3/3/2022	5:00:00 AM	0	9.217	5.4	3/3/2022	5:00:00 AM	0	895.827	-1.836	0.08	26.70	1006.974759
3/3/2022	6:00:00 AM	0	9.219	5.4	3/3/2022	6:00:00 AM	0	895.971	-1.939	0.08	26.70	1006.97529
3/3/2022	7:00:00 AM	0	9.22	5.4	3/3/2022	7:00:00 AM	0	896.097	-1.93	0.08	26.70	1006.975006
3/3/2022	8:00:00 AM	0	9.22	5.4	3/3/2022	8:00:00 AM	0	896.16	-1.737	0.08	26.70	1006.974363
3/3/2022	9:00:00 AM	0	9.222	5.4	3/3/2022	9:00:00 AM	0	896.464	-1.192	0.08	26.71	1006.973263
3/3/2022	10:00:00 AM	0	9.222	5.4	3/3/2022	10:00:00 AM	0	896.517	-0.68	0.08	26.71	1006.972723
3/3/2022	11:00:00 AM	0	9.22	5.4	3/3/2022	11:00:00 AM	0	896.348	-0.49	0.08	26.71	1006.972446
3/3/2022	12:00:00 PM	0	9.217	5.4	3/3/2022	12:00:00 PM	0	896.133	-0.449	0.08	26.71	1006.971639
3/3/2022	1:00:00 PM	0	9.213	5.4	3/3/2022	1:00:00 PM	0	895.627	-0.27	0.08	26.71	1006.972798
3/3/2022	2:00:00 PM	0	9.21	5.4	3/3/2022	2:00:00 PM	0	895.425	-0.059	0.08	26.71	1006.971858
3/3/2022	3:00:00 PM	0	9.21	5.4	3/3/2022	3:00:00 PM	0	895.575	0.517	0.08	26.71	1006.970329
3/3/2022	4:00:00 PM	0	9.211	5.4	3/3/2022	4:00:00 PM	0	895.643	0.557	0.08	26.71	1006.970635
3/3/2022	5:00:00 PM	0	9.209	5.4	3/3/2022	5:00:00 PM	0	895.429	0.46	0.08	26.71	1006.970817
3/3/2022	6:00:00 PM	0	9.211	5.4	3/3/2022	6:00:00 PM	0	895.545	-0.103	0.08	26.71	1006.971634
3/3/2022	7:00:00 PM	0	9.213	5.4	3/3/2022	7:00:00 PM	0	895.542	-0.601	0.08	26.71	1006.973665
3/3/2022	8:00:00 PM	0	9.214	5.4	3/3/2022	8:00:00 PM	0	895.617	-0.736	0.08	26.71	1006.9739
3/3/2022	9:00:00 PM	0	9.214	5.4	3/3/2022	9:00:00 PM	0	895.699	-0.718	0.08	26.71	1006.973064
3/3/2022	10:00:00 PM	0	9.216	5.4	3/3/2022	10:00:00 PM	0	895.85	-0.822	0.08	26.71	1006.973524
3/3/2022	11:00:00 PM	0	9.219	5.4	3/3/2022	11:00:00 PM	0	896.105	-1.087	0.08	26.71	1006.973924
3/4/2022	12:00:00 AM	0	9.222	5.4	3/4/2022	12:00:00 AM	0	896.306	-1.414	0.08	26.70	1006.974874
3/4/2022	1:00:00 AM	0	9.223	5.4	3/4/2022	1:00:00 AM	0	896.488	-1.577	0.08	26.70	1006.974019
3/4/2022	2:00:00 AM	0	9.228	5.4	3/4/2022	2:00:00 AM	0	896.813	-1.705	0.08	26.70	1006.975704
3/4/2022	3:00:00 AM	0	9.228	5.4	3/4/2022	3:00:00 AM	0	896.846	-1.927	0.08	26.70	1006.975368
3/4/2022	4:00:00 AM	0	9.231	5.4	3/4/2022	4:00:00 AM	0	897.053	-2.142	0.08	26.70	1006.976257
3/4/2022	5:00:00 AM	0	9.234	5.4	3/4/2022	5:00:00 AM	0	897.365	-2.26	0.08	26.70	1006.976076
3/4/2022	6:00:00 AM	0	9.238	5.4	3/4/2022	6:00:00 AM	0	897.734	-2.334	0.08	26.70	1006.976313
3/4/2022	7:00:00 AM	0	9.242	5.4	3/4/2022	7:00:00 AM	0	898.1	-2.334	0.08	26.70	1006.976581
3/4/2022	8:00:00 AM	0	9.248	5.4	3/4/2022	8:00:00 AM	0	898.742	-2.172	0.08	26.70	1006.976034
3/4/2022	9:00:00 AM	0	9.251	5.4	3/4/2022	9:00:00 AM	0	899.092	-1.794	0.08	26.70	1006.975465
3/4/2022	10:00:00 AM	0	9.252	5.4	3/4/2022	10:00:00 AM	0	899.46	-1.13	0.08	26.71	1006.972712
3/4/2022	11:00:00 AM	0	9.254	5.4	3/4/2022	11:00:00 AM	0	899.602	-0.597	0.08	26.71	1006.973264
3/4/2022	12:00:00 PM	0	9.252	5.4	3/4/2022	12:00:00 PM	0	899.578	-0.286	0.08	26.71	1006.971509
3/4/2022	1:00:00 PM	0	9.246	5.4	3/4/2022	1:00:00 PM	0	899.079	0.055	0.08	26.71	1006.970598
3/4/2022	2:00:00 PM	0	9.248	5.4	3/4/2022	2:00:00 PM	0	899.167	0.35	0.08	26.71	1006.9717
3/4/2022	3:00:00 PM	0	9.248	5.4	3/4/2022	3:00:00 PM	0	899.264	0.555	0.08	26.71	1006.970711
3/4/2022	4:00:00 PM	0	9.249	5.4	3/4/2022	4:00:00 PM	0	899.356	0.328	0.08	26.71	1006.970773
3/4/2022	5:00:00 PM	0	9.252	5.4	3/4/2022	5:00:00 PM	0	899.503	-0.165	0.08	26.71	1006.972274
3/4/2022	6:00:00 PM	0	9.257	5.4	3/4/2022	6:00:00 PM	0	899.861	-0.523	0.08	26.71	1006.973623
3/4/2022	7:00:00 PM	0	9.261	5.4	3/4/2022	7:00:00 PM	0	900.204	-0.705	0.08	26.70	1006.974126
3/4/2022	8:00:00 PM	0	9.267	5.4	3/4/2022	8:00:00 PM	0	900.784	-0.802	0.08	26.70	1006.974211
3/4/2022	9:00:00 PM	0	9.271	5.4	3/4/2022	9:00:00 PM	0	901.177	-1.092	0.08	26.70	1006.974204
3/4/2022	10:00:00 PM	0	9.271	5.4	3/4/2022	10:00:00 PM	0	901.157	-1.558	0.08	26.70	1006.974408
3/4/2022	11:00:00 PM	0	9.273	5.4	3/4/2022	11:00:00 PM	0	901.173	-2.047	0.08	26.70	1006.976245
3/5/2022	12:00:00 AM	0	9.274	5.4	3/5/2022	12:00:00 AM	0	901.357	-2.456	0.08	26.70	1006.975368
3/5/2022	1:00:00 AM	0	9.279	5.4	3/5/2022	1:00:00 AM	0	901.677	-2.739	0.08	26.70	1006.977105
3/5/2022	2:00:00 AM	0	9.282	5.4	3/5/2022	2:00:00 AM	0	901.983	-3.058	0.08	26.70	1006.976985
3/5/2022	3:00:00 AM	0	9.282	5.4	3/5/2022	3:00:00 AM	0	901.943	-2.991	0.08	26.70	1006.977393
3/5/2022	4:00:00 AM	0	9.285	5.4	3/5/2022	4:00:00 AM	0	902.266	-2.893	0.08	26.70	1006.977099
3/5/2022	5:00:00 AM	0	9.29	5.4	3/5/2022	5:00:00 AM	0	902.785	-2.743	0.08	26.70	1006.976807

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/5/2022	6:00:00 AM	0	9.291	5.4	3/5/2022	6:00:00 AM	0	903.022	-2.593	0.08	26.70	1006.97539
3/5/2022	7:00:00 AM	0	9.296	5.4	3/5/2022	7:00:00 AM	0	903.462	-2.555	0.08	26.70	1006.975903
3/5/2022	8:00:00 AM	0	9.3	5.4	3/5/2022	8:00:00 AM	0	903.923	-2.455	0.08	26.70	1006.975202
3/5/2022	9:00:00 AM	0	9.302	5.4	3/5/2022	9:00:00 AM	0	904.223	-1.9	0.08	26.70	1006.974143
3/5/2022	10:00:00 AM	0	9.304	5.4	3/5/2022	10:00:00 AM	0	904.581	-0.845	0.08	26.71	1006.972493
3/5/2022	11:00:00 AM	0	9.307	5.4	3/5/2022	11:00:00 AM	0	904.9	-0.449	0.08	26.71	1006.97224
3/5/2022	12:00:00 PM	0	9.306	5.4	3/5/2022	12:00:00 PM	0	904.844	-0.291	0.08	26.71	1006.971811
3/5/2022	1:00:00 PM	0	9.304	5.4	3/5/2022	1:00:00 PM	0	904.78	0.034	0.08	26.71	1006.970463
3/5/2022	2:00:00 PM	0	9.302	5.4	3/5/2022	2:00:00 PM	0	904.417	0.053	0.08	26.71	1006.972165
3/5/2022	3:00:00 PM	0	9.3	5.4	3/5/2022	3:00:00 PM	0	904.188	-0.114	0.08	26.71	1006.9725
3/5/2022	4:00:00 PM	0	9.296	5.4	3/5/2022	4:00:00 PM	0	903.752	-0.418	0.08	26.71	1006.972946
3/5/2022	5:00:00 PM	0	9.297	5.4	3/5/2022	5:00:00 PM	0	903.892	-0.617	0.08	26.71	1006.972518
3/5/2022	6:00:00 PM	0	9.3	5.4	3/5/2022	6:00:00 PM	0	904.059	-0.648	0.08	26.71	1006.973816
3/5/2022	7:00:00 PM	0	9.303	5.4	3/5/2022	7:00:00 PM	0	904.406	-0.82	0.08	26.71	1006.973277
3/5/2022	8:00:00 PM	0	9.306	5.4	3/5/2022	8:00:00 PM	0	904.592	-1.268	0.08	26.70	1006.97438
3/5/2022	9:00:00 PM	0	9.31	5.4	3/5/2022	9:00:00 PM	0	904.838	-2.297	0.08	26.70	1006.975872
3/5/2022	10:00:00 PM	0	9.312	5.4	3/5/2022	10:00:00 PM	0	904.955	-2.924	0.08	26.70	1006.976679
3/5/2022	11:00:00 PM	0	9.318	5.4	3/5/2022	11:00:00 PM	0	905.479	-3.411	0.08	26.70	1006.977336
3/6/2022	12:00:00 AM	0	9.324	5.4	3/6/2022	12:00:00 AM	0	905.843	-3.869	0.09	26.70	1006.979624
3/6/2022	1:00:00 AM	0	9.327	5.4	3/6/2022	1:00:00 AM	0	906.238	-4.094	0.09	26.70	1006.978596
3/6/2022	2:00:00 AM	0	9.329	5.4	3/6/2022	2:00:00 AM	0	906.307	-4.444	0.09	26.70	1006.979892
3/6/2022	3:00:00 AM	0	9.332	5.4	3/6/2022	3:00:00 AM	0	906.476	-4.706	0.09	26.70	1006.981169
3/6/2022	4:00:00 AM	0	9.335	5.4	3/6/2022	4:00:00 AM	0	906.744	-4.953	0.09	26.70	1006.981436
3/6/2022	5:00:00 AM	0	9.335	5.4	3/6/2022	5:00:00 AM	0	906.821	-5.144	0.09	26.70	1006.980651
3/6/2022	6:00:00 AM	0	9.339	5.4	3/6/2022	6:00:00 AM	0	907.147	-5.286	0.09	26.70	1006.981327
3/6/2022	7:00:00 AM	0	9.339	5.4	3/6/2022	7:00:00 AM	0	907.17	-5.428	0.09	26.70	1006.981092
3/6/2022	8:00:00 AM	0	9.344	5.4	3/6/2022	8:00:00 AM	0	907.594	-5.647	0.09	26.70	1006.981768
3/6/2022	9:00:00 AM	0	9.348	5.4	3/6/2022	9:00:00 AM	0	908.316	-4.259	0.09	26.70	1006.978406
3/6/2022	10:00:00 AM	0	9.348	5.4	3/6/2022	10:00:00 AM	0	908.821	-2.124	0.08	26.71	1006.973256
3/6/2022	11:00:00 AM	0	9.348	5.4	3/6/2022	11:00:00 AM	0	908.929	-1.327	0.08	26.71	1006.972155
3/6/2022	12:00:00 PM	0	9.345	5.4	3/6/2022	12:00:00 PM	0	908.542	-1.111	0.08	26.71	1006.973101
3/6/2022	1:00:00 PM	0	9.344	5.4	3/6/2022	1:00:00 PM	0	908.449	-0.643	0.08	26.71	1006.97305
3/6/2022	2:00:00 PM	0	9.339	5.4	3/6/2022	2:00:00 PM	0	908.126	-0.399	0.08	26.71	1006.971344
3/6/2022	3:00:00 PM	0	9.336	5.4	3/6/2022	3:00:00 PM	0	907.84	-0.259	0.08	26.71	1006.97126
3/6/2022	4:00:00 PM	0	9.333	5.4	3/6/2022	4:00:00 PM	0	907.45	-0.139	0.08	26.71	1006.972237
3/6/2022	5:00:00 PM	0	9.327	5.4	3/6/2022	5:00:00 PM	0	906.935	-0.284	0.08	26.71	1006.971488
3/6/2022	6:00:00 PM	0	9.321	5.4	3/6/2022	6:00:00 PM	0	906.267	-0.53	0.08	26.71	1006.9723
3/6/2022	7:00:00 PM	0	9.322	5.4	3/6/2022	7:00:00 PM	0	906.245	-0.739	0.08	26.71	1006.973524
3/6/2022	8:00:00 PM	0	9.322	5.4	3/6/2022	8:00:00 PM	0	906.368	-0.955	0.08	26.71	1006.97227
3/6/2022	9:00:00 PM	0	9.319	5.4	3/6/2022	9:00:00 PM	0	905.899	-1.413	0.08	26.70	1006.974053
3/6/2022	10:00:00 PM	0	9.319	5.4	3/6/2022	10:00:00 PM	0	905.864	-1.578	0.08	26.70	1006.97441
3/6/2022	11:00:00 PM	0	9.318	5.4	3/6/2022	11:00:00 PM	0	905.824	-1.573	0.08	26.71	1006.973817
3/7/2022	12:00:00 AM	0	9.316	5.4	3/7/2022	12:00:00 AM	0	905.658	-1.6	0.08	26.71	1006.97351
3/7/2022	1:00:00 AM	0	9.316	5.4	3/7/2022	1:00:00 AM	0	905.574	-1.586	0.08	26.70	1006.974367
3/7/2022	2:00:00 AM	0	9.318	5.4	3/7/2022	2:00:00 AM	0	905.754	-1.582	0.08	26.70	1006.974531
3/7/2022	3:00:00 AM	0	9.318	5.4	3/7/2022	3:00:00 AM	0	905.77	-1.529	0.08	26.70	1006.974368
3/7/2022	4:00:00 AM	0	9.319	5.4	3/7/2022	4:00:00 AM	0	906.029	-1.412	0.08	26.71	1006.972727
3/7/2022	5:00:00 AM	0	9.316	5.4	3/7/2022	5:00:00 AM	0	905.847	-1.223	0.08	26.71	1006.971583
3/7/2022	6:00:00 AM	0	9.318	5.4	3/7/2022	6:00:00 AM	0	905.909	-1.092	0.08	26.71	1006.972951
3/7/2022	7:00:00 AM	0	9.321	5.4	3/7/2022	7:00:00 AM	0	906.153	-1.036	0.08	26.71	1006.973463
3/7/2022	8:00:00 AM	0	9.322	5.4	3/7/2022	8:00:00 AM	0	906.342	-0.977	0.08	26.71	1006.972535
3/7/2022	9:00:00 AM	0	9.324	5.4	3/7/2022	9:00:00 AM	0	906.509	-0.803	0.08	26.71	1006.972832
3/7/2022	10:00:00 AM	0	9.322	5.4	3/7/2022	10:00:00 AM	0	906.471	-0.536	0.08	26.71	1006.97122
3/7/2022	11:00:00 AM	0	9.322	5.4	3/7/2022	11:00:00 AM	0	906.594	-0.29	0.08	26.71	1006.969966
3/7/2022	12:00:00 PM	0	9.325	5.4	3/7/2022	12:00:00 PM	0	906.718	-0.219	0.08	26.71	1006.971701
3/7/2022	1:00:00 PM	0	9.322	5.4	3/7/2022	1:00:00 PM	0	906.543	-0.054	0.08	26.71	1006.970486
3/7/2022	2:00:00 PM	0	9.318	5.4	3/7/2022	2:00:00 PM	0	906.136	0.231	0.08	26.71	1006.970636
3/7/2022	3:00:00 PM	0	9.316	5.4	3/7/2022	3:00:00 PM	0	905.958	-0.059	0.08	26.71	1006.970451
3/7/2022	4:00:00 PM	0	9.315	5.4	3/7/2022	4:00:00 PM	0	905.717	-0.379	0.08	26.71	1006.971909
3/7/2022	5:00:00 PM	0	9.315	5.4	3/7/2022	5:00:00 PM	0	905.724	-0.657	0.08	26.71	1006.971837
3/7/2022	6:00:00 PM	0	9.321	5.4	3/7/2022	6:00:00 PM	0	906.267	-0.64	0.08	26.71	1006.9723
3/7/2022	7:00:00 PM	0	9.327	5.4	3/7/2022	7:00:00 PM	0	906.702	-0.769	0.08	26.71	1006.973864
3/7/2022	8:00:00 PM	0	9.329	5.4	3/7/2022	8:00:00 PM	0	906.793	-1.183	0.08	26.70	1006.974936
3/7/2022	9:00:00 PM	0	9.329	5.4	3/7/2022	9:00:00 PM	0	906.738	-2.176	0.08	26.70	1006.975497
3/7/2022	10:00:00 PM	0	9.333	5.4	3/7/2022	10:00:00 PM	0	906.953	-2.95	0.08	26.70	1006.977305
3/7/2022	11:00:00 PM	0	9.333	5.4	3/7/2022	11:00:00 PM	0	906.941	-3.454	0.08	26.70	1006.977427
3/8/2022	12:00:00 AM	0	9.333	5.4	3/8/2022	12:00:00 AM	0	906.773	-3.975	0.09	26.70	1006.97914
3/8/2022	1:00:00 AM	0	9.335	5.4	3/8/2022	1:00:00 AM	0	906.981	-4.432	0.09	26.70	1006.979019
3/8/2022	2:00:00 AM	0	9.336	5.4	3/8/2022	2:00:00 AM	0	907.067	-4.815	0.09	26.70	1006.979142
3/8/2022	3:00:00 AM	0	9.336	5.4	3/8/2022	3:00:00 AM	0	906.984	-5.26	0.09	26.70	1006.979989
3/8/2022	4:00:00 AM	0	9.337	5.4	3/8/2022	4:00:00 AM	0	907.076	-5.649	0.09	26.70	1006.980051
3/8/2022	5:00:00 AM	0	9.337	5.4	3/8/2022	5:00:00 AM	0	906.943	-5.896	0.09	26.70	1006.981407

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/8/2022	6:00:00 AM	0	9.337	5.4	3/8/2022	6:00:00 AM	0	906.961	-6.115	0.09	26.70	1006.981223
3/8/2022	7:00:00 AM	0	9.336	5.4	3/8/2022	7:00:00 AM	0	906.654	-6.532	0.09	26.70	1006.983354
3/8/2022	8:00:00 AM	0	9.335	5.4	3/8/2022	8:00:00 AM	0	906.471	-6.78	0.09	26.69	1006.98422
3/8/2022	9:00:00 AM	0	9.333	5.4	3/8/2022	9:00:00 AM	0	906.743	-5.58	0.09	26.70	1006.979446
3/8/2022	10:00:00 AM	0	9.33	5.4	3/8/2022	10:00:00 AM	0	906.893	-3.037	0.08	26.70	1006.974917
3/8/2022	11:00:00 AM	0	9.329	5.4	3/8/2022	11:00:00 AM	0	906.892	-2.167	0.08	26.71	1006.973927
3/8/2022	12:00:00 PM	0	9.322	5.4	3/8/2022	12:00:00 PM	0	906.129	-2.869	0.08	26.70	1006.974707
3/8/2022	1:00:00 PM	0	9.315	5.4	3/8/2022	1:00:00 PM	0	905.615	-1.906	0.08	26.71	1006.972949
3/8/2022	2:00:00 PM	0	9.309	5.4	3/8/2022	2:00:00 PM	0	905.07	-1.638	0.08	26.71	1006.972506
3/8/2022	3:00:00 PM	0	9.306	5.4	3/8/2022	3:00:00 PM	0	904.611	-2.042	0.08	26.70	1006.974187
3/8/2022	4:00:00 PM	0	9.304	5.4	3/8/2022	4:00:00 PM	0	904.329	-2.741	0.08	26.70	1006.975062
3/8/2022	5:00:00 PM	0	9.304	5.4	3/8/2022	5:00:00 PM	0	904.398	-3	0.08	26.70	1006.974359
3/8/2022	6:00:00 PM	0	9.306	5.4	3/8/2022	6:00:00 PM	0	904.448	-3.251	0.08	26.70	1006.975849
3/8/2022	7:00:00 PM	0	9.309	5.4	3/8/2022	7:00:00 PM	0	904.601	-3.938	0.08	26.70	1006.977289
3/8/2022	8:00:00 PM	0	9.31	5.4	3/8/2022	8:00:00 PM	0	904.53	-4.762	0.09	26.70	1006.979013
3/8/2022	9:00:00 PM	0	9.315	5.4	3/8/2022	9:00:00 PM	0	904.824	-5.426	0.09	26.70	1006.981015
3/8/2022	10:00:00 PM	0	9.316	5.4	3/8/2022	10:00:00 PM	0	904.837	-5.991	0.09	26.70	1006.981882
3/8/2022	11:00:00 PM	0	9.315	5.4	3/8/2022	11:00:00 PM	0	904.69	-6.476	0.09	26.70	1006.982381
3/9/2022	12:00:00 AM	0	9.315	5.4	3/9/2022	12:00:00 AM	0	904.576	-6.764	0.09	26.70	1006.983544
3/9/2022	1:00:00 AM	0	9.315	5.4	3/9/2022	1:00:00 AM	0	904.621	-6.978	0.09	26.70	1006.983085
3/9/2022	2:00:00 AM	0	9.315	5.4	3/9/2022	2:00:00 AM	0	904.35	-7.438	0.09	26.69	1006.985848
3/9/2022	3:00:00 AM	0	9.313	5.4	3/9/2022	3:00:00 AM	0	904.238	-7.945	0.09	26.69	1006.98499
3/9/2022	4:00:00 AM	0	9.313	5.4	3/9/2022	4:00:00 AM	0	904.148	-8.367	0.09	26.69	1006.985908
3/9/2022	5:00:00 AM	0	9.313	5.4	3/9/2022	5:00:00 AM	0	904.12	-8.838	0.09	26.69	1006.986194
3/9/2022	6:00:00 AM	0	9.313	5.4	3/9/2022	6:00:00 AM	0	903.907	-9.245	0.10	26.69	1006.988366
3/9/2022	7:00:00 AM	0	9.316	5.4	3/9/2022	7:00:00 AM	0	904.2	-9.642	0.10	26.69	1006.988378
3/9/2022	8:00:00 AM	0	9.316	5.4	3/9/2022	8:00:00 AM	0	904.217	-9.873	0.10	26.69	1006.988204
3/9/2022	9:00:00 AM	0	9.315	5.4	3/9/2022	9:00:00 AM	0	904.462	-8.334	0.09	26.69	1006.984706
3/9/2022	10:00:00 AM	0	9.316	5.4	3/9/2022	10:00:00 AM	0	905.261	-5.391	0.08	26.70	1006.977558
3/9/2022	11:00:00 AM	0	9.312	5.4	3/9/2022	11:00:00 AM	0	905.055	-4.34	0.08	26.70	1006.975659
3/9/2022	12:00:00 PM	0	9.306	5.4	3/9/2022	12:00:00 PM	0	904.269	-5.042	0.08	26.70	1006.977674
3/9/2022	1:00:00 PM	0	9.302	5.4	3/9/2022	1:00:00 PM	0	904.038	-3.935	0.08	26.70	1006.97603
3/9/2022	2:00:00 PM	0	9.297	5.4	3/9/2022	2:00:00 PM	0	903.623	-3.529	0.08	26.70	1006.975262
3/9/2022	3:00:00 PM	0	9.294	5.4	3/9/2022	3:00:00 PM	0	903.243	-3.68	0.08	26.70	1006.976136
3/9/2022	4:00:00 PM	0	9.29	5.4	3/9/2022	4:00:00 PM	0	902.778	-3.963	0.08	26.70	1006.976878
3/9/2022	5:00:00 PM	0	9.284	5.4	3/9/2022	5:00:00 PM	0	902.032	-4.58	0.09	26.70	1006.978485
3/9/2022	6:00:00 PM	0	9.279	5.4	3/9/2022	6:00:00 PM	0	901.402	-5.419	0.09	26.70	1006.979909
3/9/2022	7:00:00 PM	0	9.273	5.4	3/9/2022	7:00:00 PM	0	900.726	-6.125	0.09	26.70	1006.980803
3/9/2022	8:00:00 PM	0	9.27	5.4	3/9/2022	8:00:00 PM	0	900.204	-6.776	0.09	26.70	1006.983126
3/9/2022	9:00:00 PM	0	9.267	5.4	3/9/2022	9:00:00 PM	0	899.891	-7.134	0.09	26.70	1006.983317
3/9/2022	10:00:00 PM	0	9.264	5.4	3/9/2022	10:00:00 PM	0	899.625	-7.111	0.09	26.70	1006.98303
3/9/2022	11:00:00 PM	0	9.261	5.4	3/9/2022	11:00:00 PM	0	899.329	-6.908	0.09	26.70	1006.983048
3/10/2022	12:00:00 AM	0	9.261	5.4	3/10/2022	12:00:00 AM	0	899.383	-6.727	0.09	26.70	1006.982498
3/10/2022	1:00:00 AM	0	9.265	5.4	3/10/2022	1:00:00 AM	0	899.855	-6.674	0.09	26.70	1006.981685
3/10/2022	2:00:00 AM	0	9.262	5.4	3/10/2022	2:00:00 AM	0	899.514	-6.763	0.09	26.70	1006.982162
3/10/2022	3:00:00 AM	0	9.259	5.4	3/10/2022	3:00:00 AM	0	899.275	-6.853	0.09	26.70	1006.981599
3/10/2022	4:00:00 AM	0	9.261	5.4	3/10/2022	4:00:00 AM	0	899.313	-7.098	0.09	26.70	1006.983211
3/10/2022	5:00:00 AM	0	9.264	5.4	3/10/2022	5:00:00 AM	0	899.658	-7.209	0.09	26.70	1006.982693
3/10/2022	6:00:00 AM	0	9.267	5.4	3/10/2022	6:00:00 AM	0	899.865	-7.237	0.09	26.70	1006.983583
3/10/2022	7:00:00 AM	0	9.267	5.4	3/10/2022	7:00:00 AM	0	899.949	-7.141	0.09	26.70	1006.982726
3/10/2022	8:00:00 AM	0	9.268	5.4	3/10/2022	8:00:00 AM	0	900.259	-6.665	0.09	26.70	1006.980565
3/10/2022	9:00:00 AM	0	9.274	5.4	3/10/2022	9:00:00 AM	0	900.992	-5.713	0.09	26.70	1006.97909
3/10/2022	10:00:00 AM	0	9.274	5.4	3/10/2022	10:00:00 AM	0	901.259	-4.756	0.08	26.70	1006.976368
3/10/2022	11:00:00 AM	0	9.273	5.4	3/10/2022	11:00:00 AM	0	901.231	-3.659	0.08	26.70	1006.975653
3/10/2022	12:00:00 PM	0	9.271	5.4	3/10/2022	12:00:00 PM	0	901.284	-2.932	0.08	26.71	1006.973113
3/10/2022	1:00:00 PM	0	9.27	5.4	3/10/2022	1:00:00 PM	0	901.242	-1.992	0.08	26.71	1006.972541
3/10/2022	2:00:00 PM	0	9.265	5.4	3/10/2022	2:00:00 PM	0	900.866	-1.392	0.08	26.71	1006.971375
3/10/2022	3:00:00 PM	0	9.264	5.4	3/10/2022	3:00:00 PM	0	900.645	-1.349	0.08	26.71	1006.972629
3/10/2022	4:00:00 PM	0	9.264	5.4	3/10/2022	4:00:00 PM	0	900.679	-1.244	0.08	26.71	1006.972282
3/10/2022	5:00:00 PM	0	9.261	5.4	3/10/2022	5:00:00 PM	0	900.422	-1.36	0.08	26.71	1006.971903
3/10/2022	6:00:00 PM	0	9.259	5.4	3/10/2022	6:00:00 PM	0	900.117	-1.824	0.08	26.71	1006.973013
3/10/2022	7:00:00 PM	0	9.259	5.4	3/10/2022	7:00:00 PM	0	900.075	-2.382	0.08	26.71	1006.973441
3/10/2022	8:00:00 PM	0	9.259	5.4	3/10/2022	8:00:00 PM	0	899.88	-2.88	0.08	26.70	1006.97543
3/10/2022	9:00:00 PM	0	9.261	5.4	3/10/2022	9:00:00 PM	0	900.08	-3.055	0.08	26.70	1006.97539
3/10/2022	10:00:00 PM	0	9.261	5.4	3/10/2022	10:00:00 PM	0	899.983	-3.143	0.08	26.70	1006.976379
3/10/2022	11:00:00 PM	0	9.261	5.4	3/10/2022	11:00:00 PM	0	900	-3.227	0.08	26.70	1006.976206
3/11/2022	12:00:00 AM	0	9.259	5.4	3/11/2022	12:00:00 AM	0	899.736	-3.413	0.08	26.70	1006.976898
3/11/2022	1:00:00 AM	0	9.257	5.4	3/11/2022	1:00:00 AM	0	899.544	-3.495	0.08	26.70	1006.976856
3/11/2022	2:00:00 AM	0	9.255	5.4	3/11/2022	2:00:00 AM	0	899.374	-3.57	0.08	26.70	1006.976589
3/11/2022	3:00:00 AM	0	9.251	5.4	3/11/2022	3:00:00 AM	0	898.878	-3.681	0.08	26.70	1006.977647
3/11/2022	4:00:00 AM	0	9.248	5.4	3/11/2022	4:00:00 AM	0	898.664	-3.735	0.08	26.70	1006.976829
3/11/2022	5:00:00 AM	0	9.243	5.4	3/11/2022	5:00:00 AM	0	898.227	-3.771	0.08	26.70	1006.976286

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/11/2022	6:00:00 AM	0	9.237	5.4	3/11/2022	6:00:00 AM	0	897.574	-3.863	0.08	26.70	1006.976944
3/11/2022	7:00:00 AM	0	9.237	5.4	3/11/2022	7:00:00 AM	0	897.589	-3.868	0.08	26.70	1006.976791
3/11/2022	8:00:00 AM	0	9.236	5.4	3/11/2022	8:00:00 AM	0	897.398	-3.738	0.09	26.70	1006.977739
3/11/2022	9:00:00 AM	0	9.231	5.4	3/11/2022	9:00:00 AM	0	897.135	-3.508	0.08	26.70	1006.975421
3/11/2022	10:00:00 AM	0	9.228	5.4	3/11/2022	10:00:00 AM	0	896.797	-3.3	0.08	26.70	1006.975868
3/11/2022	11:00:00 AM	0	9.223	5.4	3/11/2022	11:00:00 AM	0	896.356	-3.158	0.08	26.70	1006.975365
3/11/2022	12:00:00 PM	0	9.22	5.4	3/11/2022	12:00:00 PM	0	896.186	-2.903	0.08	26.70	1006.974098
3/11/2022	1:00:00 PM	0	9.214	5.4	3/11/2022	1:00:00 PM	0	895.618	-2.588	0.08	26.71	1006.97389
3/11/2022	2:00:00 PM	0	9.204	5.4	3/11/2022	2:00:00 PM	0	894.646	-2.378	0.08	26.71	1006.973802
3/11/2022	3:00:00 PM	0	9.2	5.4	3/11/2022	3:00:00 PM	0	894.238	-2.15	0.08	26.71	1006.973962
3/11/2022	4:00:00 PM	0	9.192	5.4	3/11/2022	4:00:00 PM	0	893.676	-1.831	0.08	26.71	1006.971693
3/11/2022	5:00:00 PM	0	9.184	5.4	3/11/2022	5:00:00 PM	0	892.776	-1.742	0.08	26.71	1006.972871
3/11/2022	6:00:00 PM	0	9.177	5.4	3/11/2022	6:00:00 PM	0	892.114	-1.861	0.08	26.71	1006.972621
3/11/2022	7:00:00 PM	0	9.171	5.4	3/11/2022	7:00:00 PM	0	891.531	-2.047	0.08	26.71	1006.972566
3/11/2022	8:00:00 PM	0	9.172	5.4	3/11/2022	8:00:00 PM	0	891.621	-2.166	0.08	26.71	1006.972648
3/11/2022	9:00:00 PM	0	9.177	5.4	3/11/2022	9:00:00 PM	0	891.999	-2.217	0.08	26.71	1006.973794
3/11/2022	10:00:00 PM	0	9.178	5.4	3/11/2022	10:00:00 PM	0	892.209	-2.224	0.08	26.71	1006.972652
3/11/2022	11:00:00 PM	0	9.178	5.4	3/11/2022	11:00:00 PM	0	892.169	-2.224	0.08	26.71	1006.97306
3/12/2022	12:00:00 AM	0	9.181	5.4	3/12/2022	12:00:00 AM	0	892.412	-2.233	0.08	26.71	1006.973582
3/12/2022	1:00:00 AM	0	9.18	5.4	3/12/2022	1:00:00 AM	0	892.366	-2.26	0.08	26.71	1006.973051
3/12/2022	2:00:00 AM	0	9.188	5.4	3/12/2022	2:00:00 AM	0	893.059	-2.317	0.08	26.71	1006.973985
3/12/2022	3:00:00 AM	0	9.188	5.4	3/12/2022	3:00:00 AM	0	892.881	-2.782	0.08	26.70	1006.9758
3/12/2022	4:00:00 AM	0	9.186	5.4	3/12/2022	4:00:00 AM	0	892.617	-3.185	0.08	26.70	1006.976492
3/12/2022	5:00:00 AM	0	9.189	5.4	3/12/2022	5:00:00 AM	0	892.876	-3.401	0.08	26.70	1006.976851
3/12/2022	6:00:00 AM	0	9.189	5.4	3/12/2022	6:00:00 AM	0	892.849	-3.666	0.08	26.70	1006.977126
3/12/2022	7:00:00 AM	0	9.189	5.4	3/12/2022	7:00:00 AM	0	892.824	-3.836	0.08	26.70	1006.977381
3/12/2022	8:00:00 AM	0	9.189	5.4	3/12/2022	8:00:00 AM	0	892.866	-3.801	0.08	26.70	1006.976953
3/12/2022	9:00:00 AM	0	9.189	5.4	3/12/2022	9:00:00 AM	0	893.025	-3.052	0.08	26.70	1006.975331
3/12/2022	10:00:00 AM	0	9.186	5.4	3/12/2022	10:00:00 AM	0	893.06	-1.781	0.08	26.71	1006.971975
3/12/2022	11:00:00 AM	0	9.181	5.4	3/12/2022	11:00:00 AM	0	892.678	-0.948	0.08	26.71	1006.97087
3/12/2022	12:00:00 PM	0	9.174	5.4	3/12/2022	12:00:00 PM	0	891.976	-0.796	0.08	26.71	1006.971028
3/12/2022	1:00:00 PM	0	9.166	5.4	3/12/2022	1:00:00 PM	0	891.33	-0.523	0.08	26.71	1006.969616
3/12/2022	2:00:00 PM	0	9.161	5.4	3/12/2022	2:00:00 PM	0	890.659	-0.349	0.08	26.71	1006.971458
3/12/2022	3:00:00 PM	0	9.153	5.4	3/12/2022	3:00:00 PM	0	889.985	-0.345	0.08	26.71	1006.970331
3/12/2022	4:00:00 PM	0	9.146	5.4	3/12/2022	4:00:00 PM	0	889.261	-0.357	0.08	26.71	1006.970714
3/12/2022	5:00:00 PM	0	9.138	5.4	3/12/2022	5:00:00 PM	0	888.471	-0.4	0.08	26.71	1006.970769
3/12/2022	6:00:00 PM	0	9.133	5.4	3/12/2022	6:00:00 PM	0	888.022	-0.487	0.08	26.71	1006.970348
3/12/2022	7:00:00 PM	0	9.13	5.4	3/12/2022	7:00:00 PM	0	887.646	-0.613	0.08	26.71	1006.971182
3/12/2022	8:00:00 PM	0	9.127	5.4	3/12/2022	8:00:00 PM	0	887.313	-0.756	0.08	26.71	1006.971578
3/12/2022	9:00:00 PM	0	9.126	5.4	3/12/2022	9:00:00 PM	0	887.096	-1.006	0.08	26.71	1006.972791
3/12/2022	10:00:00 PM	0	9.123	5.4	3/12/2022	10:00:00 PM	0	886.658	-1.744	0.08	26.70	1006.974257
3/12/2022	11:00:00 PM	0	9.117	5.4	3/12/2022	11:00:00 PM	0	885.975	-2.409	0.08	26.70	1006.975222
3/13/2022	12:00:00 AM	0	9.117	5.4	3/13/2022	12:00:00 AM	0	885.864	-2.729	0.08	26.70	1006.976354
3/13/2022	1:00:00 AM	0	9.114	5.4	3/13/2022	1:00:00 AM	0	885.718	-2.819	0.08	26.70	1006.974842
3/13/2022	2:00:00 AM	0	9.113	5.4	3/13/2022	2:00:00 AM	0	885.578	-2.651	0.08	26.70	1006.97527
3/13/2022	3:00:00 AM	0	9.11	5.4	3/13/2022	3:00:00 AM	0	885.318	-2.491	0.08	26.70	1006.974921
3/13/2022	4:00:00 AM	0	9.11	5.4	3/13/2022	4:00:00 AM	0	885.365	-2.384	0.08	26.70	1006.974442
3/13/2022	5:00:00 AM	0	9.116	5.4	3/13/2022	5:00:00 AM	0	885.875	-2.312	0.08	26.70	1006.975241
3/13/2022	6:00:00 AM	0	9.117	5.4	3/13/2022	6:00:00 AM	0	886.111	-2.28	0.08	26.71	1006.973835
3/13/2022	7:00:00 AM	0	9.118	5.4	3/13/2022	7:00:00 AM	0	886.177	-2.267	0.08	26.70	1006.974162
3/13/2022	8:00:00 AM	0	9.121	5.4	3/13/2022	8:00:00 AM	0	886.472	-2.15	0.08	26.70	1006.974154
3/13/2022	9:00:00 AM	0	9.126	5.4	3/13/2022	9:00:00 AM	0	887.041	-1.78	0.08	26.71	1006.973351
3/13/2022	10:00:00 AM	0	9.129	5.4	3/13/2022	10:00:00 AM	0	887.399	-1.161	0.08	26.71	1006.972701
3/13/2022	11:00:00 AM	0	9.136	5.4	3/13/2022	11:00:00 AM	0	888.25	-0.75	0.08	26.71	1006.971023
3/13/2022	12:00:00 PM	0	9.141	5.4	3/13/2022	12:00:00 PM	0	888.704	-0.497	0.08	26.71	1006.971394
3/13/2022	1:00:00 PM	0	9.143	5.4	3/13/2022	1:00:00 PM	0	888.952	-0.364	0.08	26.71	1006.970865
3/13/2022	2:00:00 PM	0	9.144	5.4	3/13/2022	2:00:00 PM	0	889.017	-0.193	0.08	26.71	1006.971202
3/13/2022	3:00:00 PM	0	9.141	5.4	3/13/2022	3:00:00 PM	0	888.853	0.031	0.08	26.71	1006.969874
3/13/2022	4:00:00 PM	0	9.141	5.4	3/13/2022	4:00:00 PM	0	888.795	0.023	0.08	26.71	1006.970466
3/13/2022	5:00:00 PM	0	9.139	5.4	3/13/2022	5:00:00 PM	0	888.637	-0.033	0.08	26.71	1006.970077
3/13/2022	6:00:00 PM	0	9.138	5.4	3/13/2022	6:00:00 PM	0	888.491	-0.223	0.08	26.71	1006.970566
3/13/2022	7:00:00 PM	0	9.139	5.4	3/13/2022	7:00:00 PM	0	888.618	-0.377	0.08	26.71	1006.97027
3/13/2022	8:00:00 PM	0	9.139	5.4	3/13/2022	8:00:00 PM	0	888.521	-0.428	0.08	26.71	1006.97126
3/13/2022	9:00:00 PM	0	9.139	5.4	3/13/2022	9:00:00 PM	0	888.499	-0.418	0.08	26.71	1006.971484
3/13/2022	10:00:00 PM	0	9.141	5.4	3/13/2022	10:00:00 PM	0	888.769	-0.384	0.08	26.71	1006.970731
3/13/2022	11:00:00 PM	0	9.146	5.4	3/13/2022	11:00:00 PM	0	889.113	-0.337	0.08	26.71	1006.972223
3/14/2022	12:00:00 AM	0	9.149	5.4	3/14/2022	12:00:00 AM	0	889.407	-0.358	0.08	26.71	1006.972225
3/14/2022	1:00:00 AM	0	9.147	5.4	3/14/2022	1:00:00 AM	0	889.254	-0.421	0.08	26.71	1006.971785
3/14/2022	2:00:00 AM	0	9.155	5.4	3/14/2022	2:00:00 AM	0	890	-0.455	0.08	26.71	1006.972178
3/14/2022	3:00:00 AM	0	9.155	5.4	3/14/2022	3:00:00 AM	0	889.988	-0.52	0.08	26.71	1006.9723
3/14/2022	4:00:00 AM	0	9.158	5.4	3/14/2022	4:00:00 AM	0	890.282	-0.567	0.08	26.71	1006.972302
3/14/2022	5:00:00 AM	0	9.166	5.4	3/14/2022	5:00:00 AM	0	891.072	-0.611	0.08	26.71	1006.972247

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/14/2022	6:00:00 AM	0	9.166	5.4	3/14/2022	6:00:00 AM	0	891.129	-0.614	0.08	26.71	1006.971665
3/14/2022	7:00:00 AM	0	9.165	5.4	3/14/2022	7:00:00 AM	0	890.929	-0.648	0.08	26.71	1006.972705
3/14/2022	8:00:00 AM	0	9.165	5.4	3/14/2022	8:00:00 AM	0	890.949	-0.556	0.08	26.71	1006.972501
3/14/2022	9:00:00 AM	0	9.168	5.4	3/14/2022	9:00:00 AM	0	891.499	0.267	0.08	26.71	1006.969892
3/14/2022	10:00:00 AM	0	9.172	5.4	3/14/2022	10:00:00 AM	0	892.038	1.333	0.08	26.71	1006.968396
3/14/2022	11:00:00 AM	0	9.169	5.4	3/14/2022	11:00:00 AM	0	891.697	1.239	0.08	26.71	1006.968873
3/14/2022	12:00:00 PM	0	9.166	5.4	3/14/2022	12:00:00 PM	0	891.467	1.116	0.08	26.71	1006.968219
3/14/2022	1:00:00 PM	0	9.165	5.4	3/14/2022	1:00:00 PM	0	891.255	2.106	0.08	26.71	1006.96938
3/14/2022	2:00:00 PM	0	9.161	5.4	3/14/2022	2:00:00 PM	0	890.898	2.18	0.08	26.71	1006.969021
3/14/2022	3:00:00 PM	0	9.156	5.4	3/14/2022	3:00:00 PM	0	890.416	2.026	0.08	26.71	1006.968936
3/14/2022	4:00:00 PM	0	9.152	5.4	3/14/2022	4:00:00 PM	0	889.838	1.679	0.08	26.71	1006.97083
3/14/2022	5:00:00 PM	0	9.141	5.4	3/14/2022	5:00:00 PM	0	888.869	1.223	0.08	26.71	1006.969711
3/14/2022	6:00:00 PM	0	9.136	5.4	3/14/2022	6:00:00 PM	0	888.376	0.797	0.08	26.71	1006.969738
3/14/2022	7:00:00 PM	0	9.132	5.4	3/14/2022	7:00:00 PM	0	887.786	0.435	0.08	26.71	1006.971755
3/14/2022	8:00:00 PM	0	9.127	5.4	3/14/2022	8:00:00 PM	0	887.38	0.269	0.08	26.71	1006.970895
3/14/2022	9:00:00 PM	0	9.129	5.4	3/14/2022	9:00:00 PM	0	887.413	0.263	0.08	26.71	1006.972558
3/14/2022	10:00:00 PM	0	9.123	5.4	3/14/2022	10:00:00 PM	0	886.904	0.282	0.08	26.71	1006.971748
3/14/2022	11:00:00 PM	0	9.121	5.4	3/14/2022	11:00:00 PM	0	886.809	0.28	0.08	26.71	1006.970717
3/15/2022	12:00:00 AM	0	9.118	5.4	3/15/2022	12:00:00 AM	0	886.451	0.279	0.08	26.71	1006.971368
3/15/2022	1:00:00 AM	0	9.113	5.4	3/15/2022	1:00:00 AM	0	885.816	0.229	0.08	26.71	1006.972843
3/15/2022	2:00:00 AM	0	9.11	5.4	3/15/2022	2:00:00 AM	0	885.539	0.143	0.08	26.71	1006.972668
3/15/2022	3:00:00 AM	0	9.11	5.4	3/15/2022	3:00:00 AM	0	885.499	-0.037	0.08	26.71	1006.973076
3/15/2022	4:00:00 AM	0	9.11	5.4	3/15/2022	4:00:00 AM	0	885.578	-0.1	0.08	26.71	1006.97227
3/15/2022	5:00:00 AM	0	9.114	5.4	3/15/2022	5:00:00 AM	0	885.883	-0.327	0.08	26.71	1006.97316
3/15/2022	6:00:00 AM	0	9.118	5.4	3/15/2022	6:00:00 AM	0	886.336	-0.422	0.08	26.71	1006.972541
3/15/2022	7:00:00 AM	0	9.124	5.4	3/15/2022	7:00:00 AM	0	886.951	-0.393	0.08	26.71	1006.972269
3/15/2022	8:00:00 AM	0	9.133	5.4	3/15/2022	8:00:00 AM	0	887.793	-0.311	0.08	26.71	1006.972683
3/15/2022	9:00:00 AM	0	9.139	5.4	3/15/2022	9:00:00 AM	0	888.454	-0.125	0.08	26.71	1006.971943
3/15/2022	10:00:00 AM	0	9.144	5.4	3/15/2022	10:00:00 AM	0	889.106	0.697	0.08	26.71	1006.970294
3/15/2022	11:00:00 AM	0	9.15	5.4	3/15/2022	11:00:00 AM	0	889.815	1.631	0.08	26.71	1006.969064
3/15/2022	12:00:00 PM	0	9.155	5.4	3/15/2022	12:00:00 PM	0	890.206	2.014	0.08	26.71	1006.970077
3/15/2022	1:00:00 PM	0	9.159	5.4	3/15/2022	1:00:00 PM	0	890.73	2.566	0.08	26.71	1006.968734
3/15/2022	2:00:00 PM	0	9.161	5.4	3/15/2022	2:00:00 PM	0	890.92	2.786	0.08	26.71	1006.968797
3/15/2022	3:00:00 PM	0	9.165	5.4	3/15/2022	3:00:00 PM	0	891.283	2.624	0.08	26.71	1006.969095
3/15/2022	4:00:00 PM	0	9.166	5.4	3/15/2022	4:00:00 PM	0	891.351	1.951	0.08	26.71	1006.969402
3/15/2022	5:00:00 PM	0	9.166	5.4	3/15/2022	5:00:00 PM	0	891.293	1.195	0.08	26.71	1006.969993
3/15/2022	6:00:00 PM	0	9.172	5.4	3/15/2022	6:00:00 PM	0	891.698	0.494	0.08	26.71	1006.971863
3/15/2022	7:00:00 PM	0	9.178	5.4	3/15/2022	7:00:00 PM	0	892.111	-0.313	0.08	26.71	1006.973652
3/15/2022	8:00:00 PM	0	9.183	5.4	3/15/2022	8:00:00 PM	0	892.537	-0.863	0.08	26.70	1006.974308
3/15/2022	9:00:00 PM	0	9.191	5.4	3/15/2022	9:00:00 PM	0	893.25	-0.759	0.08	26.70	1006.975037
3/15/2022	10:00:00 PM	0	9.198	5.4	3/15/2022	10:00:00 PM	0	894.059	-0.756	0.08	26.71	1006.973788
3/15/2022	11:00:00 PM	0	9.205	5.4	3/15/2022	11:00:00 PM	0	894.765	-0.977	0.08	26.71	1006.973588
3/16/2022	12:00:00 AM	0	9.211	5.4	3/16/2022	12:00:00 AM	0	895.425	-0.724	0.08	26.71	1006.972858
3/16/2022	1:00:00 AM	0	9.219	5.4	3/16/2022	1:00:00 AM	0	896.116	-0.591	0.08	26.71	1006.973812
3/16/2022	2:00:00 AM	0	9.223	5.4	3/16/2022	2:00:00 AM	0	896.575	-0.59	0.08	26.71	1006.973131
3/16/2022	3:00:00 AM	0	9.225	5.4	3/16/2022	3:00:00 AM	0	896.751	-0.632	0.08	26.71	1006.973337
3/16/2022	4:00:00 AM	0	9.229	5.4	3/16/2022	4:00:00 AM	0	897.129	-0.717	0.08	26.71	1006.973482
3/16/2022	5:00:00 AM	0	9.234	5.4	3/16/2022	5:00:00 AM	0	897.569	-0.799	0.08	26.71	1006.973995
3/16/2022	6:00:00 AM	0	9.238	5.4	3/16/2022	6:00:00 AM	0	897.978	-1.018	0.08	26.71	1006.973825
3/16/2022	7:00:00 AM	0	9.245	5.4	3/16/2022	7:00:00 AM	0	898.468	-1.235	0.08	26.70	1006.975828
3/16/2022	8:00:00 AM	0	9.248	5.4	3/16/2022	8:00:00 AM	0	898.765	-1.224	0.08	26.70	1006.9758
3/16/2022	9:00:00 AM	0	9.251	5.4	3/16/2022	9:00:00 AM	0	899.269	-0.475	0.08	26.71	1006.97366
3/16/2022	10:00:00 AM	0	9.252	5.4	3/16/2022	10:00:00 AM	0	899.736	1.506	0.08	26.71	1006.969898
3/16/2022	11:00:00 AM	0	9.251	5.4	3/16/2022	11:00:00 AM	0	899.718	2.087	0.08	26.71	1006.969082
3/16/2022	12:00:00 PM	0	9.248	5.4	3/16/2022	12:00:00 PM	0	899.382	2.065	0.08	26.71	1006.969508
3/16/2022	1:00:00 PM	0	9.245	5.4	3/16/2022	1:00:00 PM	0	899.189	3.714	0.08	26.71	1006.968476
3/16/2022	2:00:00 PM	0	9.242	5.4	3/16/2022	2:00:00 PM	0	898.948	4.697	0.08	26.71	1006.967933
3/16/2022	3:00:00 PM	0	9.24	5.4	3/16/2022	3:00:00 PM	0	898.683	3.294	0.08	26.71	1006.968636
3/16/2022	4:00:00 PM	0	9.236	5.4	3/16/2022	4:00:00 PM	0	898.045	1.652	0.08	26.71	1006.971141
3/16/2022	5:00:00 PM	0	9.234	5.4	3/16/2022	5:00:00 PM	0	897.639	0.839	0.08	26.71	1006.973282
3/16/2022	6:00:00 PM	0	9.231	5.4	3/16/2022	6:00:00 PM	0	897.331	0.355	0.08	26.71	1006.973422
3/16/2022	7:00:00 PM	0	9.232	5.4	3/16/2022	7:00:00 PM	0	897.374	0.063	0.08	26.71	1006.973984
3/16/2022	8:00:00 PM	0	9.231	5.4	3/16/2022	8:00:00 PM	0	897.223	-0.038	0.08	26.70	1006.974524
3/16/2022	9:00:00 PM	0	9.231	5.4	3/16/2022	9:00:00 PM	0	897.341	-0.045	0.08	26.71	1006.97332
3/16/2022	10:00:00 PM	0	9.232	5.4	3/16/2022	10:00:00 PM	0	897.42	-0.161	0.08	26.71	1006.973515
3/16/2022	11:00:00 PM	0	9.231	5.4	3/16/2022	11:00:00 PM	0	897.363	-0.172	0.08	26.71	1006.973096
3/17/2022	12:00:00 AM	0	9.226	5.4	3/17/2022	12:00:00 AM	0	896.858	-0.188	0.08	26.71	1006.973246
3/17/2022	1:00:00 AM	0	9.226	5.4	3/17/2022	1:00:00 AM	0	896.851	-0.148	0.08	26.71	1006.973317
3/17/2022	2:00:00 AM	0	9.225	5.4	3/17/2022	2:00:00 AM	0	896.654	-0.308	0.08	26.70	1006.974326
3/17/2022	3:00:00 AM	0	9.22	5.4	3/17/2022	3:00:00 AM	0	896.214	-0.456	0.08	26.71	1006.973813
3/17/2022	4:00:00 AM	0	9.217	5.4	3/17/2022	4:00:00 AM	0	895.829	-0.489	0.08	26.70	1006.974738
3/17/2022	5:00:00 AM	0	9.216	5.4	3/17/2022	5:00:00 AM	0	895.771	-0.576	0.08	26.70	1006.97433

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/17/2022	6:00:00 AM	0	9.211	5.4	3/17/2022	6:00:00 AM	0	895.375	-0.716	0.08	26.71	1006.973368
3/17/2022	7:00:00 AM	0	9.213	5.4	3/17/2022	7:00:00 AM	0	895.459	-0.706	0.08	26.70	1006.974511
3/17/2022	8:00:00 AM	0	9.211	5.4	3/17/2022	8:00:00 AM	0	895.417	-0.408	0.08	26.71	1006.97294
3/17/2022	9:00:00 AM	0	9.21	5.4	3/17/2022	9:00:00 AM	0	895.428	0.061	0.08	26.71	1006.971828
3/17/2022	10:00:00 AM	0	9.207	5.4	3/17/2022	10:00:00 AM	0	895.158	0.501	0.08	26.71	1006.971581
3/17/2022	11:00:00 AM	0	9.205	5.4	3/17/2022	11:00:00 AM	0	895.013	1.055	0.08	26.71	1006.971059
3/17/2022	12:00:00 PM	0	9.201	5.4	3/17/2022	12:00:00 PM	0	894.719	1.701	0.08	26.71	1006.970057
3/17/2022	1:00:00 PM	0	9.198	5.4	3/17/2022	1:00:00 PM	0	894.428	2.343	0.08	26.71	1006.970025
3/17/2022	2:00:00 PM	0	9.195	5.4	3/17/2022	2:00:00 PM	0	894.293	3.223	0.08	26.71	1006.968401
3/17/2022	3:00:00 PM	0	9.192	5.4	3/17/2022	3:00:00 PM	0	893.956	3.103	0.08	26.71	1006.968838
3/17/2022	4:00:00 PM	0	9.188	5.4	3/17/2022	4:00:00 PM	0	893.394	1.821	0.08	26.71	1006.970569
3/17/2022	5:00:00 PM	0	9.184	5.4	3/17/2022	5:00:00 PM	0	892.879	0.928	0.08	26.71	1006.97182
3/17/2022	6:00:00 PM	0	9.195	5.4	3/17/2022	6:00:00 PM	0	893.868	0.35	0.08	26.71	1006.972735
3/17/2022	7:00:00 PM	0	9.197	5.4	3/17/2022	7:00:00 PM	0	894.019	-0.131	0.08	26.71	1006.973195
3/17/2022	8:00:00 PM	0	9.198	5.4	3/17/2022	8:00:00 PM	0	894.006	-0.836	0.08	26.70	1006.974328
3/17/2022	9:00:00 PM	0	9.203	5.4	3/17/2022	9:00:00 PM	0	894.365	-1.282	0.08	26.70	1006.975667
3/17/2022	10:00:00 PM	0	9.204	5.4	3/17/2022	10:00:00 PM	0	894.446	-1.334	0.08	26.70	1006.975841
3/17/2022	11:00:00 PM	0	9.204	5.4	3/17/2022	11:00:00 PM	0	894.513	-1.507	0.08	26.70	1006.975158
3/18/2022	12:00:00 AM	0	9.205	5.4	3/18/2022	12:00:00 AM	0	894.659	-1.275	0.08	26.70	1006.974669
3/18/2022	1:00:00 AM	0	9.205	5.4	3/18/2022	1:00:00 AM	0	894.683	-1.09	0.08	26.70	1006.974424
3/18/2022	2:00:00 AM	0	9.204	5.4	3/18/2022	2:00:00 AM	0	894.632	-1.045	0.08	26.71	1006.973945
3/18/2022	3:00:00 AM	0	9.2	5.4	3/18/2022	3:00:00 AM	0	894.139	-0.989	0.08	26.70	1006.974972
3/18/2022	4:00:00 AM	0	9.201	5.4	3/18/2022	4:00:00 AM	0	894.413	-0.862	0.08	26.71	1006.973178
3/18/2022	5:00:00 AM	0	9.201	5.4	3/18/2022	5:00:00 AM	0	894.354	-0.739	0.08	26.71	1006.973779
3/18/2022	6:00:00 AM	0	9.2	5.4	3/18/2022	6:00:00 AM	0	894.129	-0.807	0.08	26.70	1006.975074
3/18/2022	7:00:00 AM	0	9.198	5.4	3/18/2022	7:00:00 AM	0	893.979	-0.906	0.08	26.70	1006.974603
3/18/2022	8:00:00 AM	0	9.198	5.4	3/18/2022	8:00:00 AM	0	894.152	-0.495	0.08	26.71	1006.972839
3/18/2022	9:00:00 AM	0	9.195	5.4	3/18/2022	9:00:00 AM	0	893.805	0.188	0.08	26.71	1006.973378
3/18/2022	10:00:00 AM	0	9.191	5.4	3/18/2022	10:00:00 AM	0	893.672	1.925	0.08	26.71	1006.970734
3/18/2022	11:00:00 AM	0	9.186	5.4	3/18/2022	11:00:00 AM	0	893.358	2.483	0.08	26.71	1006.968936
3/18/2022	12:00:00 PM	0	9.181	5.4	3/18/2022	12:00:00 PM	0	892.835	2.554	0.08	26.71	1006.969269
3/18/2022	1:00:00 PM	0	9.175	5.4	3/18/2022	1:00:00 PM	0	892.49	4.254	0.07	26.71	1006.966787
3/18/2022	2:00:00 PM	0	9.168	5.4	3/18/2022	2:00:00 PM	0	891.838	4.211	0.07	26.71	1006.966436
3/18/2022	3:00:00 PM	0	9.166	5.4	3/18/2022	3:00:00 PM	0	891.433	3.476	0.08	26.71	1006.968565
3/18/2022	4:00:00 PM	0	9.164	5.4	3/18/2022	4:00:00 PM	0	891.07	3.063	0.08	26.71	1006.970267
3/18/2022	5:00:00 PM	0	9.161	5.4	3/18/2022	5:00:00 PM	0	890.629	2.351	0.08	26.71	1006.971764
3/18/2022	6:00:00 PM	0	9.159	5.4	3/18/2022	6:00:00 PM	0	890.463	1.705	0.08	26.71	1006.971457
3/18/2022	7:00:00 PM	0	9.158	5.4	3/18/2022	7:00:00 PM	0	890.156	0.921	0.08	26.71	1006.973587
3/18/2022	8:00:00 PM	0	9.158	5.4	3/18/2022	8:00:00 PM	0	890.106	0.628	0.08	26.70	1006.974097
3/18/2022	9:00:00 PM	0	9.156	5.4	3/18/2022	9:00:00 PM	0	890.112	0.557	0.08	26.71	1006.972036
3/18/2022	10:00:00 PM	0	9.153	5.4	3/18/2022	10:00:00 PM	0	889.703	0.303	0.08	26.71	1006.973207
3/18/2022	11:00:00 PM	0	9.15	5.4	3/18/2022	11:00:00 PM	0	889.326	0.057	0.08	26.70	1006.974051
3/19/2022	12:00:00 AM	0	9.146	5.4	3/19/2022	12:00:00 AM	0	888.905	-0.269	0.08	26.70	1006.974344
3/19/2022	1:00:00 AM	0	9.141	5.4	3/19/2022	1:00:00 AM	0	888.44	-0.528	0.08	26.70	1006.974086
3/19/2022	2:00:00 AM	0	9.136	5.4	3/19/2022	2:00:00 AM	0	887.946	-0.635	0.08	26.70	1006.974123
3/19/2022	3:00:00 AM	0	9.13	5.4	3/19/2022	3:00:00 AM	0	887.37	-0.606	0.08	26.71	1006.973997
3/19/2022	4:00:00 AM	0	9.126	5.4	3/19/2022	4:00:00 AM	0	886.994	-0.577	0.08	26.71	1006.973831
3/19/2022	5:00:00 AM	0	9.123	5.4	3/19/2022	5:00:00 AM	0	886.655	-0.552	0.08	26.70	1006.974288
3/19/2022	6:00:00 AM	0	9.114	5.4	3/19/2022	6:00:00 AM	0	885.747	-0.574	0.08	26.70	1006.974547
3/19/2022	7:00:00 AM	0	9.108	5.4	3/19/2022	7:00:00 AM	0	885.231	-0.575	0.08	26.71	1006.973808
3/19/2022	8:00:00 AM	0	9.105	5.4	3/19/2022	8:00:00 AM	0	885.013	-0.539	0.08	26.71	1006.973031
3/19/2022	9:00:00 AM	0	9.104	5.4	3/19/2022	9:00:00 AM	0	884.759	-0.48	0.08	26.70	1006.974621
3/19/2022	10:00:00 AM	0	9.102	5.4	3/19/2022	10:00:00 AM	0	884.763	-0.325	0.08	26.71	1006.972581
3/19/2022	11:00:00 AM	0	9.104	5.4	3/19/2022	11:00:00 AM	0	885.016	0.442	0.08	26.71	1006.972001
3/19/2022	12:00:00 PM	0	9.104	5.4	3/19/2022	12:00:00 PM	0	885.068	1.069	0.08	26.71	1006.971471
3/19/2022	1:00:00 PM	0	9.099	5.4	3/19/2022	1:00:00 PM	0	884.664	1.622	0.08	26.71	1006.97059
3/19/2022	2:00:00 PM	0	9.113	5.4	3/19/2022	2:00:00 PM	0	885.783	0.788	0.08	26.71	1006.97318
3/19/2022	3:00:00 PM	0	9.117	5.4	3/19/2022	3:00:00 PM	0	886.054	-0.275	0.08	26.70	1006.974416
3/19/2022	4:00:00 PM	0	9.132	5.4	3/19/2022	4:00:00 PM	0	887.636	-0.062	0.08	26.71	1006.973284
3/19/2022	5:00:00 PM	0	9.136	5.4	3/19/2022	5:00:00 PM	0	888.111	0.067	0.08	26.71	1006.97244
3/19/2022	6:00:00 PM	0	9.143	5.4	3/19/2022	6:00:00 PM	0	888.645	-0.465	0.08	26.71	1006.973995
3/19/2022	7:00:00 PM	0	9.152	5.4	3/19/2022	7:00:00 PM	0	889.443	-0.644	0.08	26.70	1006.974858
3/19/2022	8:00:00 PM	0	9.159	5.4	3/19/2022	8:00:00 PM	0	890.074	-0.762	0.08	26.70	1006.975423
3/19/2022	9:00:00 PM	0	9.166	5.4	3/19/2022	9:00:00 PM	0	890.779	-1.119	0.08	26.70	1006.975234
3/19/2022	10:00:00 PM	0	9.174	5.4	3/19/2022	10:00:00 PM	0	891.467	-1.675	0.08	26.70	1006.976219
3/19/2022	11:00:00 PM	0	9.178	5.4	3/19/2022	11:00:00 PM	0	891.839	-2.448	0.08	26.70	1006.976425
3/20/2022	12:00:00 AM	0	9.183	5.4	3/20/2022	12:00:00 AM	0	892.194	-2.862	0.09	26.70	1006.977805
3/20/2022	1:00:00 AM	0	9.188	5.4	3/20/2022	1:00:00 AM	0	892.676	-3.247	0.09	26.70	1006.97789
3/20/2022	2:00:00 AM	0	9.192	5.4	3/20/2022	2:00:00 AM	0	893.059	-3.838	0.09	26.70	1006.977985
3/20/2022	3:00:00 AM	0	9.198	5.4	3/20/2022	3:00:00 AM	0	893.545	-4.385	0.09	26.70	1006.979029
3/20/2022	4:00:00 AM	0	9.204	5.4	3/20/2022	4:00:00 AM	0	894.072	-4.961	0.09	26.70	1006.979655
3/20/2022	5:00:00 AM	0	9.207	5.4	3/20/2022	5:00:00 AM	0	894.174	-5.677	0.09	26.70	1006.981615

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/20/2022	6:00:00 AM	0	9.211	5.4	3/20/2022	6:00:00 AM	0	894.568	-6.106	0.09	26.70	1006.981597
3/20/2022	7:00:00 AM	0	9.213	5.4	3/20/2022	7:00:00 AM	0	894.703	-6.198	0.09	26.70	1006.982221
3/20/2022	8:00:00 AM	0	9.216	5.4	3/20/2022	8:00:00 AM	0	895.132	-5.435	0.09	26.70	1006.980846
3/20/2022	9:00:00 AM	0	9.216	5.4	3/20/2022	9:00:00 AM	0	895.857	-1.898	0.08	26.71	1006.973453
3/20/2022	10:00:00 AM	0	9.219	5.4	3/20/2022	10:00:00 AM	0	896.419	-0.577	0.08	26.71	1006.970722
3/20/2022	11:00:00 AM	0	9.225	5.4	3/20/2022	11:00:00 AM	0	896.948	-0.216	0.08	26.71	1006.971328
3/20/2022	12:00:00 PM	0	9.222	5.4	3/20/2022	12:00:00 PM	0	896.652	-0.08	0.08	26.71	1006.971346
3/20/2022	1:00:00 PM	0	9.217	5.4	3/20/2022	1:00:00 PM	0	896.413	1.248	0.08	26.71	1006.968783
3/20/2022	2:00:00 PM	0	9.216	5.4	3/20/2022	2:00:00 PM	0	896.347	1.498	0.08	26.71	1006.968456
3/20/2022	3:00:00 PM	0	9.214	5.4	3/20/2022	3:00:00 PM	0	896.181	1.555	0.08	26.71	1006.968149
3/20/2022	4:00:00 PM	0	9.211	5.4	3/20/2022	4:00:00 PM	0	895.732	1.238	0.08	26.71	1006.969728
3/20/2022	5:00:00 PM	0	9.211	5.4	3/20/2022	5:00:00 PM	0	895.694	0.69	0.08	26.71	1006.970115
3/20/2022	6:00:00 PM	0	9.217	5.4	3/20/2022	6:00:00 PM	0	896.149	-0.15	0.08	26.71	1006.971475
3/20/2022	7:00:00 PM	0	9.214	5.4	3/20/2022	7:00:00 PM	0	895.707	-0.57	0.08	26.71	1006.972983
3/20/2022	8:00:00 PM	0	9.216	5.4	3/20/2022	8:00:00 PM	0	895.838	-0.604	0.08	26.71	1006.973647
3/20/2022	9:00:00 PM	0	9.219	5.4	3/20/2022	9:00:00 PM	0	896.125	-0.632	0.08	26.71	1006.97372
3/20/2022	10:00:00 PM	0	9.222	5.4	3/20/2022	10:00:00 PM	0	896.419	-0.711	0.08	26.71	1006.973722
3/20/2022	11:00:00 PM	0	9.223	5.4	3/20/2022	11:00:00 PM	0	896.601	-0.888	0.08	26.71	1006.972866
3/21/2022	12:00:00 AM	0	9.228	5.4	3/21/2022	12:00:00 AM	0	896.892	-1.202	0.08	26.70	1006.974899
3/21/2022	1:00:00 AM	0	9.229	5.4	3/21/2022	1:00:00 AM	0	897.06	-1.325	0.08	26.70	1006.974186
3/21/2022	2:00:00 AM	0	9.234	5.4	3/21/2022	2:00:00 AM	0	897.509	-1.474	0.08	26.70	1006.974607
3/21/2022	3:00:00 AM	0	9.236	5.4	3/21/2022	3:00:00 AM	0	897.598	-1.656	0.08	26.70	1006.9757
3/21/2022	4:00:00 AM	0	9.236	5.4	3/21/2022	4:00:00 AM	0	897.679	-1.778	0.08	26.70	1006.974874
3/21/2022	5:00:00 AM	0	9.24	5.4	3/21/2022	5:00:00 AM	0	897.987	-1.895	0.08	26.70	1006.975733
3/21/2022	6:00:00 AM	0	9.245	5.4	3/21/2022	6:00:00 AM	0	898.458	-2.009	0.08	26.70	1006.97593
3/21/2022	7:00:00 AM	0	9.252	5.4	3/21/2022	7:00:00 AM	0	899.173	-1.92	0.08	26.70	1006.975639
3/21/2022	8:00:00 AM	0	9.258	5.4	3/21/2022	8:00:00 AM	0	899.88	-1.301	0.08	26.70	1006.97443
3/21/2022	9:00:00 AM	0	9.262	5.4	3/21/2022	9:00:00 AM	0	900.437	-0.717	0.08	26.71	1006.97275
3/21/2022	10:00:00 AM	0	9.265	5.4	3/21/2022	10:00:00 AM	0	900.962	0.162	0.08	26.71	1006.970396
3/21/2022	11:00:00 AM	0	9.264	5.4	3/21/2022	11:00:00 AM	0	900.929	1.596	0.08	26.71	1006.969733
3/21/2022	12:00:00 PM	0	9.268	5.4	3/21/2022	12:00:00 PM	0	901.496	2.631	0.08	26.71	1006.967951
3/21/2022	1:00:00 PM	0	9.267	5.4	3/21/2022	1:00:00 PM	0	901.52	4.414	0.07	26.71	1006.966706
3/21/2022	2:00:00 PM	0	9.267	5.4	3/21/2022	2:00:00 PM	0	901.562	4.826	0.07	26.71	1006.966278
3/21/2022	3:00:00 PM	0	9.267	5.4	3/21/2022	3:00:00 PM	0	901.392	4.119	0.08	26.71	1006.968011
3/21/2022	4:00:00 PM	0	9.271	5.4	3/21/2022	4:00:00 PM	0	901.626	2.95	0.08	26.71	1006.969625
3/21/2022	5:00:00 PM	0	9.271	5.4	3/21/2022	5:00:00 PM	0	901.632	2.509	0.08	26.71	1006.969564
3/21/2022	6:00:00 PM	0	9.274	5.4	3/21/2022	6:00:00 PM	0	901.757	1.749	0.08	26.71	1006.971289
3/21/2022	7:00:00 PM	0	9.271	5.4	3/21/2022	7:00:00 PM	0	901.287	0.932	0.08	26.71	1006.973082
3/21/2022	8:00:00 PM	0	9.273	5.4	3/21/2022	8:00:00 PM	0	901.483	0.766	0.08	26.71	1006.973084
3/21/2022	9:00:00 PM	0	9.274	5.4	3/21/2022	9:00:00 PM	0	901.702	0.496	0.08	26.71	1006.97185
3/21/2022	10:00:00 PM	0	9.276	5.4	3/21/2022	10:00:00 PM	0	901.72	0.466	0.08	26.71	1006.973667
3/21/2022	11:00:00 PM	0	9.282	5.4	3/21/2022	11:00:00 PM	0	902.452	0.535	0.08	26.71	1006.972202
3/22/2022	12:00:00 AM	0	9.288	5.4	3/22/2022	12:00:00 AM	0	902.886	0.394	0.08	26.71	1006.973777
3/22/2022	1:00:00 AM	0	9.288	5.4	3/22/2022	1:00:00 AM	0	902.903	0.245	0.08	26.71	1006.973603
3/22/2022	2:00:00 AM	0	9.291	5.4	3/22/2022	2:00:00 AM	0	903.134	0.084	0.08	26.70	1006.974248
3/22/2022	3:00:00 AM	0	9.294	5.4	3/22/2022	3:00:00 AM	0	903.44	-0.028	0.08	26.70	1006.974128
3/22/2022	4:00:00 AM	0	9.293	5.4	3/22/2022	4:00:00 AM	0	903.379	-0.148	0.08	26.71	1006.97375
3/22/2022	5:00:00 AM	0	9.288	5.4	3/22/2022	5:00:00 AM	0	902.919	-0.194	0.08	26.71	1006.97344
3/22/2022	6:00:00 AM	0	9.288	5.4	3/22/2022	6:00:00 AM	0	902.833	-0.167	0.08	26.70	1006.974317
3/22/2022	7:00:00 AM	0	9.291	5.4	3/22/2022	7:00:00 AM	0	903.055	-0.021	0.08	26.70	1006.975054
3/22/2022	8:00:00 AM	0	9.287	5.4	3/22/2022	8:00:00 AM	0	902.782	0.203	0.08	26.71	1006.973837
3/22/2022	9:00:00 AM	0	9.287	5.4	3/22/2022	9:00:00 AM	0	902.957	1.025	0.08	26.71	1006.972053
3/22/2022	10:00:00 AM	0	9.293	5.4	3/22/2022	10:00:00 AM	0	903.671	2.447	0.08	26.71	1006.970772
3/22/2022	11:00:00 AM	0	9.29	5.4	3/22/2022	11:00:00 AM	0	903.49	3.452	0.08	26.71	1006.969618
3/22/2022	12:00:00 PM	0	9.288	5.4	3/22/2022	12:00:00 PM	0	903.4	4.013	0.08	26.71	1006.968535
3/22/2022	1:00:00 PM	0	9.284	5.4	3/22/2022	1:00:00 PM	0	902.873	4.314	0.08	26.71	1006.969909
3/22/2022	2:00:00 PM	0	9.277	5.4	3/22/2022	2:00:00 PM	0	902.481	4.521	0.07	26.71	1006.966907
3/22/2022	3:00:00 PM	0	9.273	5.4	3/22/2022	3:00:00 PM	0	902.017	4.429	0.07	26.71	1006.967638
3/22/2022	4:00:00 PM	0	9.268	5.4	3/22/2022	4:00:00 PM	0	901.436	3.951	0.08	26.71	1006.968563
3/22/2022	5:00:00 PM	0	9.264	5.4	3/22/2022	5:00:00 PM	0	900.951	3.441	0.08	26.71	1006.969508
3/22/2022	6:00:00 PM	0	9.258	5.4	3/22/2022	6:00:00 PM	0	900.243	2.67	0.08	26.71	1006.970728
3/22/2022	7:00:00 PM	0	9.251	5.4	3/22/2022	7:00:00 PM	0	899.405	2.046	0.08	26.71	1006.972273
3/22/2022	8:00:00 PM	0	9.249	5.4	3/22/2022	8:00:00 PM	0	899.279	1.728	0.08	26.71	1006.971558
3/22/2022	9:00:00 PM	0	9.242	5.4	3/22/2022	9:00:00 PM	0	898.621	1.745	0.08	26.71	1006.971268
3/22/2022	10:00:00 PM	0	9.234	5.4	3/22/2022	10:00:00 PM	0	897.846	1.761	0.08	26.71	1006.971171
3/22/2022	11:00:00 PM	0	9.228	5.4	3/22/2022	11:00:00 PM	0	897.228	1.816	0.08	26.71	1006.971473
3/23/2022	12:00:00 AM	0	9.222	5.4	3/23/2022	12:00:00 AM	0	896.612	1.879	0.08	26.71	1006.971754
3/23/2022	1:00:00 AM	0	9.211	5.4	3/23/2022	1:00:00 AM	0	895.607	1.988	0.08	26.71	1006.971002
3/23/2022	2:00:00 AM	0	9.21	5.4	3/23/2022	2:00:00 AM	0	895.474	1.965	0.08	26.71	1006.971358
3/23/2022	3:00:00 AM	0	9.201	5.4	3/23/2022	3:00:00 AM	0	894.568	1.957	0.08	26.71	1006.971597
3/23/2022	4:00:00 AM	0	9.195	5.4	3/23/2022	4:00:00 AM	0	893.996	1.766	0.08	26.71	1006.97143
3/23/2022	5:00:00 AM	0	9.191	5.4	3/23/2022	5:00:00 AM	0	893.566	1.569	0.08	26.71	1006.971815

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/23/2022	6:00:00 AM	0	9.188	5.4	3/23/2022	6:00:00 AM	0	893.167	1.533	0.08	26.71	1006.972883
3/23/2022	7:00:00 AM	0	9.189	5.4	3/23/2022	7:00:00 AM	0	893.386	1.712	0.08	26.71	1006.97165
3/23/2022	8:00:00 AM	0	9.191	5.4	3/23/2022	8:00:00 AM	0	893.615	2.632	0.08	26.71	1006.971315
3/23/2022	9:00:00 AM	0	9.192	5.4	3/23/2022	9:00:00 AM	0	894.26	5.736	0.07	26.71	1006.965738
3/23/2022	10:00:00 AM	0	9.194	5.4	3/23/2022	10:00:00 AM	0	894.233	6.523	0.08	26.71	1006.968013
3/23/2022	11:00:00 AM	0	9.216	5.4	3/23/2022	11:00:00 AM	0	896.164	2.9	0.08	26.71	1006.970322
3/23/2022	12:00:00 PM	0	9.217	5.4	3/23/2022	12:00:00 PM	0	896.048	2.032	0.08	26.71	1006.972505
3/23/2022	1:00:00 PM	0	9.219	5.4	3/23/2022	1:00:00 PM	0	896.434	2.459	0.08	26.71	1006.970569
3/23/2022	2:00:00 PM	0	9.225	5.4	3/23/2022	2:00:00 PM	0	897.051	3.539	0.08	26.71	1006.970278
3/23/2022	3:00:00 PM	0	9.226	5.4	3/23/2022	3:00:00 PM	0	897.277	3.743	0.08	26.71	1006.968973
3/23/2022	4:00:00 PM	0	9.229	5.4	3/23/2022	4:00:00 PM	0	897.629	4.305	0.08	26.71	1006.968384
3/23/2022	5:00:00 PM	0	9.232	5.4	3/23/2022	5:00:00 PM	0	897.807	3.229	0.08	26.71	1006.969568
3/23/2022	6:00:00 PM	0	9.237	5.4	3/23/2022	6:00:00 PM	0	897.979	1.496	0.08	26.71	1006.972815
3/23/2022	7:00:00 PM	0	9.245	5.4	3/23/2022	7:00:00 PM	0	898.558	-0.4	0.08	26.70	1006.97491
3/23/2022	8:00:00 PM	0	9.254	5.4	3/23/2022	8:00:00 PM	0	899.321	-0.718	0.08	26.70	1006.97613
3/23/2022	9:00:00 PM	0	9.264	5.4	3/23/2022	9:00:00 PM	0	900.361	-1.207	0.08	26.70	1006.975525
3/23/2022	10:00:00 PM	0	9.274	5.4	3/23/2022	10:00:00 PM	0	901.239	-2.239	0.08	26.70	1006.976572
3/23/2022	11:00:00 PM	0	9.282	5.4	3/23/2022	11:00:00 PM	0	901.936	-3.203	0.08	26.70	1006.977464
3/24/2022	12:00:00 AM	0	9.288	5.4	3/24/2022	12:00:00 AM	0	902.489	-3.973	0.09	26.70	1006.977825
3/24/2022	1:00:00 AM	0	9.297	5.4	3/24/2022	1:00:00 AM	0	903.192	-4.465	0.09	26.70	1006.979657
3/24/2022	2:00:00 AM	0	9.302	5.4	3/24/2022	2:00:00 AM	0	903.556	-4.954	0.09	26.70	1006.980945
3/24/2022	3:00:00 AM	0	9.306	5.4	3/24/2022	3:00:00 AM	0	904.013	-5.307	0.09	26.70	1006.980285
3/24/2022	4:00:00 AM	0	9.309	5.4	3/24/2022	4:00:00 AM	0	904.335	-5.489	0.09	26.70	1006.980001
3/24/2022	5:00:00 AM	0	9.313	5.4	3/24/2022	5:00:00 AM	0	904.657	-5.958	0.09	26.70	1006.980718
3/24/2022	6:00:00 AM	0	9.316	5.4	3/24/2022	6:00:00 AM	0	904.924	-6.231	0.09	26.70	1006.980995
3/24/2022	7:00:00 AM	0	9.318	5.4	3/24/2022	7:00:00 AM	0	905.137	-6.092	0.09	26.70	1006.980823
3/24/2022	8:00:00 AM	0	9.321	5.4	3/24/2022	8:00:00 AM	0	905.687	-4.677	0.09	26.70	1006.978214
3/24/2022	9:00:00 AM	0	9.322	5.4	3/24/2022	9:00:00 AM	0	906.796	0.494	0.08	26.71	1006.967906
3/24/2022	10:00:00 AM	0	9.321	5.4	3/24/2022	10:00:00 AM	0	906.968	8.255	0.07	26.71	1006.965152
3/24/2022	11:00:00 AM	0	9.321	5.4	3/24/2022	11:00:00 AM	0	906.611	6.822	0.08	26.71	1006.968792
3/24/2022	12:00:00 PM	0	9.321	5.4	3/24/2022	12:00:00 PM	0	906.094	6.267	0.08	26.70	1006.974064
3/24/2022	1:00:00 PM	0	9.319	5.4	3/24/2022	1:00:00 PM	0	905.731	10.954	0.08	26.70	1006.975766
3/24/2022	2:00:00 PM	0	9.318	5.4	3/24/2022	2:00:00 PM	0	904.885	11.348	0.09	26.70	1006.983393
3/24/2022	3:00:00 PM	0	9.318	5.4	3/24/2022	3:00:00 PM	0	904.097	7.667	0.10	26.69	1006.991428
3/24/2022	4:00:00 PM	0	9.319	5.4	3/24/2022	4:00:00 PM	0	903.154	4.358	0.11	26.68	1007.002044
3/24/2022	5:00:00 PM	0	9.321	5.4	3/24/2022	5:00:00 PM	0	902.505	3.484	0.12	26.67	1007.010662
3/24/2022	6:00:00 PM	0	9.322	5.4	3/24/2022	6:00:00 PM	0	901.688	1.809	0.13	26.66	1007.019993
3/24/2022	7:00:00 PM	0	9.327	5.4	3/24/2022	7:00:00 PM	0	901.009	-0.185	0.14	26.65	1007.031917
3/24/2022	8:00:00 PM	0	9.332	5.4	3/24/2022	8:00:00 PM	0	900.403	-0.897	0.15	26.64	1007.043096
3/24/2022	9:00:00 PM	0	9.336	5.4	3/24/2022	9:00:00 PM	0	899.884	-0.598	0.16	26.63	1007.052389
3/24/2022	10:00:00 PM	0	9.342	5.4	3/24/2022	10:00:00 PM	0	899.659	-0.568	0.17	26.62	1007.060683
3/24/2022	11:00:00 PM	0	9.348	5.4	3/24/2022	11:00:00 PM	0	899.223	-0.604	0.18	26.61	1007.071129
3/25/2022	12:00:00 AM	0	9.35	5.4	3/25/2022	12:00:00 AM	0	898.388	-0.63	0.19	26.60	1007.081644
3/25/2022	1:00:00 AM	0	9.354	5.4	3/25/2022	1:00:00 AM	0	897.985	-0.712	0.20	26.59	1007.089753
3/25/2022	2:00:00 AM	0	9.354	5.4	3/25/2022	2:00:00 AM	0	897.551	-0.667	0.20	26.58	1007.094179
3/25/2022	3:00:00 AM	0	9.357	5.4	3/25/2022	3:00:00 AM	0	897.286	-0.801	0.21	26.58	1007.099881
3/25/2022	4:00:00 AM	0	9.358	5.4	3/25/2022	4:00:00 AM	0	896.959	-1.182	0.21	26.57	1007.104216
3/25/2022	5:00:00 AM	0	9.358	5.4	3/25/2022	5:00:00 AM	0	896.66	-1.858	0.21	26.57	1007.107265
3/25/2022	6:00:00 AM	0	9.36	5.4	3/25/2022	6:00:00 AM	0	896.577	-1.917	0.22	26.57	1007.110111
3/25/2022	7:00:00 AM	0	9.36	5.4	3/25/2022	7:00:00 AM	0	896.578	-1.318	0.22	26.57	1007.110101
3/25/2022	8:00:00 AM	0	9.361	5.4	3/25/2022	8:00:00 AM	0	896.763	-0.676	0.22	26.57	1007.109214
3/25/2022	9:00:00 AM	0	9.36	5.4	3/25/2022	9:00:00 AM	0	896.793	-0.229	0.22	26.57	1007.107908
3/25/2022	10:00:00 AM	0	9.361	5.4	3/25/2022	10:00:00 AM	0	897.122	2.517	0.21	26.57	1007.105554
3/25/2022	11:00:00 AM	0	9.36	5.4	3/25/2022	11:00:00 AM	0	897.12	5.238	0.21	26.57	1007.104574
3/25/2022	12:00:00 PM	0	9.361	5.4	3/25/2022	12:00:00 PM	0	897.296	7.062	0.21	26.58	1007.103779
3/25/2022	1:00:00 PM	0	9.361	5.4	3/25/2022	1:00:00 PM	0	897.308	6.295	0.21	26.58	1007.103657
3/25/2022	2:00:00 PM	0	9.322	5.4	3/25/2022	2:00:00 PM	0	897.404	5.914	0.17	26.62	1007.063678
3/25/2022	3:00:00 PM	0	9.333	5.4	3/25/2022	3:00:00 PM	0	897.481	6.242	0.18	26.61	1007.073893
3/25/2022	4:00:00 PM	0	9.336	5.4	3/25/2022	4:00:00 PM	0	897.256	5.946	0.19	26.60	1007.079187
3/25/2022	5:00:00 PM	0	9.341	5.4	3/25/2022	5:00:00 PM	0	897.063	4.596	0.19	26.59	1007.086155
3/25/2022	6:00:00 PM	0	9.347	5.4	3/25/2022	6:00:00 PM	0	896.98	2.911	0.20	26.59	1007.093002
3/25/2022	7:00:00 PM	0	9.35	5.4	3/25/2022	7:00:00 PM	0	896.558	1.357	0.21	26.58	1007.100305
3/25/2022	8:00:00 PM	0	9.355	5.4	3/25/2022	8:00:00 PM	0	896.161	-0.131	0.22	26.57	1007.109353
3/25/2022	9:00:00 PM	0	9.364	5.4	3/25/2022	9:00:00 PM	0	896.404	-0.884	0.22	26.56	1007.115875
3/25/2022	10:00:00 PM	0	9.373	5.4	3/25/2022	10:00:00 PM	0	896.37	-0.876	0.23	26.55	1007.125222
3/25/2022	11:00:00 PM	0	9.381	5.4	3/25/2022	11:00:00 PM	0	896.208	-0.995	0.24	26.54	1007.134874
3/26/2022	12:00:00 AM	0	9.389	5.4	3/26/2022	12:00:00 AM	0	895.948	-1.108	0.25	26.53	1007.145525
3/26/2022	1:00:00 AM	0	9.396	5.4	3/26/2022	1:00:00 AM	0	895.788	-1.529	0.26	26.52	1007.154157
3/26/2022	2:00:00 AM	0	9.399	5.4	3/26/2022	2:00:00 AM	0	895.353	-1.639	0.27	26.52	1007.161592
3/26/2022	3:00:00 AM	0	9.402	5.4	3/26/2022	3:00:00 AM	0	894.878	-0.82	0.28	26.51	1007.169436
3/26/2022	4:00:00 AM	0	9.403	5.4	3/26/2022	4:00:00 AM	0	894.404	-1.659	0.28	26.50	1007.175269
3/26/2022	5:00:00 AM	0	9.403	5.4	3/26/2022	5:00:00 AM	0	893.791	-2.609	0.29	26.50	1007.18152

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/26/2022	6:00:00 AM	0	9.4	5.4	3/26/2022	6:00:00 AM	0	893.078	-3.07	0.29	26.49	1007.185791
3/26/2022	7:00:00 AM	0	9.4	5.4	3/26/2022	7:00:00 AM	0	892.835	-2.646	0.30	26.49	1007.188269
3/26/2022	8:00:00 AM	0	9.399	5.4	3/26/2022	8:00:00 AM	0	892.893	-1.113	0.29	26.49	1007.186677
3/26/2022	9:00:00 AM	0	9.4	5.4	3/26/2022	9:00:00 AM	0	893.217	-0.637	0.29	26.49	1007.184374
3/26/2022	10:00:00 AM	0	9.402	5.4	3/26/2022	10:00:00 AM	0	893.414	0.237	0.29	26.49	1007.184365
3/26/2022	11:00:00 AM	0	9.399	5.4	3/26/2022	11:00:00 AM	0	892.784	2.438	0.30	26.49	1007.187789
3/26/2022	12:00:00 PM	0	9.398	5.4	3/26/2022	12:00:00 PM	0	892.568	4.977	0.30	26.49	1007.188992
3/26/2022	1:00:00 PM	0	9.4	5.4	3/26/2022	1:00:00 PM	0	892.69	4.64	0.30	26.49	1007.189747
3/26/2022	2:00:00 PM	0	9.402	5.4	3/26/2022	2:00:00 PM	0	893.093	5.646	0.29	26.49	1007.187638
3/26/2022	3:00:00 PM	0	9.402	5.4	3/26/2022	3:00:00 PM	0	893.447	6.159	0.29	26.49	1007.184028
3/26/2022	4:00:00 PM	0	9.399	5.4	3/26/2022	4:00:00 PM	0	892.925	4.719	0.29	26.49	1007.186351
3/26/2022	5:00:00 PM	0	9.399	5.4	3/26/2022	5:00:00 PM	0	892.75	3.727	0.30	26.49	1007.188136
3/26/2022	6:00:00 PM	0	9.399	5.4	3/26/2022	6:00:00 PM	0	892.592	2.721	0.30	26.49	1007.189747
3/26/2022	7:00:00 PM	0	9.4	5.4	3/26/2022	7:00:00 PM	0	892.51	1.107	0.30	26.49	1007.191583
3/26/2022	8:00:00 PM	0	9.4	5.4	3/26/2022	8:00:00 PM	0	892.225	0.431	0.30	26.48	1007.194489
3/26/2022	9:00:00 PM	0	9.403	5.4	3/26/2022	9:00:00 PM	0	891.955	0.837	0.31	26.48	1007.200242
3/26/2022	10:00:00 PM	0	9.411	5.4	3/26/2022	10:00:00 PM	0	891.96	0.393	0.32	26.47	1007.208191
3/26/2022	11:00:00 PM	0	9.417	5.4	3/26/2022	11:00:00 PM	0	891.709	0.135	0.32	26.46	1007.216751
3/27/2022	12:00:00 AM	0	9.425	5.4	3/27/2022	12:00:00 AM	0	891.409	-0.347	0.34	26.45	1007.22781
3/27/2022	1:00:00 AM	0	9.432	5.4	3/27/2022	1:00:00 AM	0	891.332	-0.23	0.34	26.44	1007.235595
3/27/2022	2:00:00 AM	0	9.437	5.4	3/27/2022	2:00:00 AM	0	890.884	-0.219	0.35	26.43	1007.245164
3/27/2022	3:00:00 AM	0	9.443	5.4	3/27/2022	3:00:00 AM	0	890.72	-0.245	0.36	26.43	1007.252836
3/27/2022	4:00:00 AM	0	9.444	5.4	3/27/2022	4:00:00 AM	0	890.405	-0.326	0.36	26.42	1007.257048
3/27/2022	5:00:00 AM	0	9.445	5.4	3/27/2022	5:00:00 AM	0	890.245	-0.389	0.37	26.42	1007.25968
3/27/2022	6:00:00 AM	0	9.444	5.4	3/27/2022	6:00:00 AM	0	889.879	-0.39	0.37	26.42	1007.262412
3/27/2022	7:00:00 AM	0	9.443	5.4	3/27/2022	7:00:00 AM	0	889.701	-0.071	0.37	26.42	1007.263227
3/27/2022	8:00:00 AM	0	9.44	5.4	3/27/2022	8:00:00 AM	0	889.514	1.279	0.37	26.42	1007.262134
3/27/2022	9:00:00 AM	0	9.44	5.4	3/27/2022	9:00:00 AM	0	889.647	3.822	0.37	26.42	1007.260778
3/27/2022	10:00:00 AM	0	9.44	5.4	3/27/2022	10:00:00 AM	0	889.507	5.834	0.37	26.42	1007.262205
3/27/2022	11:00:00 AM	0	9.44	5.4	3/27/2022	11:00:00 AM	0	889.262	6.156	0.37	26.41	1007.264704
3/27/2022	12:00:00 PM	0	9.44	5.4	3/27/2022	12:00:00 PM	0	888.906	7.18	0.38	26.41	1007.268334
3/27/2022	1:00:00 PM	0	9.441	5.4	3/27/2022	1:00:00 PM	0	888.582	7.729	0.38	26.41	1007.272638
3/27/2022	2:00:00 PM	0	9.441	5.4	3/27/2022	2:00:00 PM	0	888.131	8.013	0.38	26.40	1007.277237
3/27/2022	3:00:00 PM	0	9.44	5.4	3/27/2022	3:00:00 PM	0	887.907	8.202	0.39	26.40	1007.278521
3/27/2022	4:00:00 PM	0	9.438	5.4	3/27/2022	4:00:00 PM	0	887.362	6.477	0.39	26.40	1007.282078
3/27/2022	5:00:00 PM	0	9.437	5.4	3/27/2022	5:00:00 PM	0	887.023	4.661	0.39	26.39	1007.284535
3/27/2022	6:00:00 PM	0	9.434	5.4	3/27/2022	6:00:00 PM	0	886.597	2.474	0.39	26.39	1007.285879
3/27/2022	7:00:00 PM	0	9.432	5.4	3/27/2022	7:00:00 PM	0	886.431	1.081	0.39	26.39	1007.285572
3/27/2022	8:00:00 PM	0	9.432	5.4	3/27/2022	8:00:00 PM	0	886.086	0.563	0.40	26.39	1007.28909
3/27/2022	9:00:00 PM	0	9.434	5.4	3/27/2022	9:00:00 PM	0	885.917	0.333	0.40	26.39	1007.292813
3/27/2022	10:00:00 PM	0	9.437	5.4	3/27/2022	10:00:00 PM	0	885.605	0.06	0.41	26.38	1007.298995
3/27/2022	11:00:00 PM	0	9.443	5.4	3/27/2022	11:00:00 PM	0	885.332	-0.25	0.42	26.37	1007.307778
3/28/2022	12:00:00 AM	0	9.453	5.4	3/28/2022	12:00:00 AM	0	885.566	-0.445	0.42	26.36	1007.315392
3/28/2022	1:00:00 AM	0	9.463	5.4	3/28/2022	1:00:00 AM	0	885.736	-0.512	0.43	26.36	1007.323659
3/28/2022	2:00:00 AM	0	9.474	5.4	3/28/2022	2:00:00 AM	0	885.874	-0.528	0.44	26.35	1007.333252
3/28/2022	3:00:00 AM	0	9.483	5.4	3/28/2022	3:00:00 AM	0	886.208	-0.54	0.45	26.34	1007.338846
3/28/2022	4:00:00 AM	0	9.491	5.4	3/28/2022	4:00:00 AM	0	886.561	-0.573	0.45	26.34	1007.343246
3/28/2022	5:00:00 AM	0	9.496	5.4	3/28/2022	5:00:00 AM	0	887.011	-0.596	0.45	26.34	1007.343657
3/28/2022	6:00:00 AM	0	9.502	5.4	3/28/2022	6:00:00 AM	0	887.449	-0.581	0.45	26.33	1007.345191
3/28/2022	7:00:00 AM	0	9.507	5.4	3/28/2022	7:00:00 AM	0	888.066	-0.582	0.45	26.34	1007.343899
3/28/2022	8:00:00 AM	0	9.51	5.4	3/28/2022	8:00:00 AM	0	888.68	-0.4	0.45	26.34	1007.340638
3/28/2022	9:00:00 AM	0	9.518	5.4	3/28/2022	9:00:00 AM	0	890.124	4.616	0.44	26.35	1007.333914
3/28/2022	10:00:00 AM	0	9.524	5.4	3/28/2022	10:00:00 AM	0	890.939	11.66	0.44	26.35	1007.331603
3/28/2022	11:00:00 AM	0	9.531	5.4	3/28/2022	11:00:00 AM	0	891.237	10.222	0.44	26.34	1007.335564
3/28/2022	12:00:00 PM	0	9.543	5.4	3/28/2022	12:00:00 PM	0	891.78	11.385	0.45	26.34	1007.342027
3/28/2022	1:00:00 PM	0	9.552	5.4	3/28/2022	1:00:00 PM	0	892.312	14.499	0.45	26.33	1007.345602
3/28/2022	2:00:00 PM	0	9.561	5.4	3/28/2022	2:00:00 PM	0	892.659	11.962	0.46	26.33	1007.351064
3/28/2022	3:00:00 PM	0	9.567	5.4	3/28/2022	3:00:00 PM	0	892.974	13.17	0.46	26.33	1007.353851
3/28/2022	4:00:00 PM	0	9.572	5.4	3/28/2022	4:00:00 PM	0	892.813	6.03	0.47	26.32	1007.360493
3/28/2022	5:00:00 PM	0	9.576	5.4	3/28/2022	5:00:00 PM	0	892.821	3.435	0.47	26.31	1007.364412
3/28/2022	6:00:00 PM	0	9.58	5.4	3/28/2022	6:00:00 PM	0	893.195	1.544	0.47	26.31	1007.364598
3/28/2022	7:00:00 PM	0	9.585	5.4	3/28/2022	7:00:00 PM	0	893.675	-0.37	0.47	26.31	1007.364703
3/28/2022	8:00:00 PM	0	9.589	5.4	3/28/2022	8:00:00 PM	0	894.03	-1.649	0.47	26.31	1007.365083
3/28/2022	9:00:00 PM	0	9.597	5.4	3/28/2022	9:00:00 PM	0	894.635	-1.012	0.47	26.31	1007.366914
3/28/2022	10:00:00 PM	0	9.606	5.4	3/28/2022	10:00:00 PM	0	895.281	-0.987	0.48	26.31	1007.369327
3/28/2022	11:00:00 PM	0	9.617	5.4	3/28/2022	11:00:00 PM	0	895.523	-2.161	0.49	26.30	1007.377859
3/29/2022	12:00:00 AM	0	9.63	5.4	3/29/2022	12:00:00 AM	0	895.521	-3.004	0.50	26.29	1007.390879
3/29/2022	1:00:00 AM	0	9.643	5.4	3/29/2022	1:00:00 AM	0	895.562	-3.839	0.51	26.28	1007.403461
3/29/2022	2:00:00 AM	0	9.657	5.4	3/29/2022	2:00:00 AM	0	895.565	-4.308	0.52	26.26	1007.417431
3/29/2022	3:00:00 AM	0	9.671	5.4	3/29/2022	3:00:00 AM	0	895.686	-4.484	0.54	26.25	1007.430197
3/29/2022	4:00:00 AM	0	9.681	5.4	3/29/2022	4:00:00 AM	0	895.822	-4.716	0.55	26.24	1007.43881
3/29/2022	5:00:00 AM	0	9.688	5.4	3/29/2022	5:00:00 AM	0	895.892	-4.731	0.55	26.23	1007.445096

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/29/2022	6:00:00 AM	0	9.691	5.4	3/29/2022	6:00:00 AM	0	895.628	-4.696	0.56	26.23	1007.450788
3/29/2022	7:00:00 AM	0	9.694	5.4	3/29/2022	7:00:00 AM	0	895.569	-4.392	0.56	26.22	1007.45439
3/29/2022	8:00:00 AM	0	9.699	5.4	3/29/2022	8:00:00 AM	0	896.042	-1.65	0.56	26.22	1007.454566
3/29/2022	9:00:00 AM	0	9.7	5.4	3/29/2022	9:00:00 AM	0	896.502	6.644	0.56	26.23	1007.450876
3/29/2022	10:00:00 AM	0	9.704	5.4	3/29/2022	10:00:00 AM	0	896.356	11.152	0.56	26.22	1007.456365
3/29/2022	11:00:00 AM	0	9.708	5.4	3/29/2022	11:00:00 AM	0	895.977	9.883	0.57	26.21	1007.464229
3/29/2022	12:00:00 PM	0	9.714	5.4	3/29/2022	12:00:00 PM	0	895.446	10.706	0.58	26.20	1007.475644
3/29/2022	1:00:00 PM	0	9.717	5.4	3/29/2022	1:00:00 PM	0	894.731	11.28	0.59	26.19	1007.485935
3/29/2022	2:00:00 PM	0	9.725	5.4	3/29/2022	2:00:00 PM	0	894.411	11.715	0.60	26.18	1007.497198
3/29/2022	3:00:00 PM	0	9.73	5.4	3/29/2022	3:00:00 PM	0	893.807	11.301	0.62	26.17	1007.508357
3/29/2022	4:00:00 PM	0	9.733	5.4	3/29/2022	4:00:00 PM	0	893.233	8.641	0.62	26.16	1007.51721
3/29/2022	5:00:00 PM	0	9.733	5.4	3/29/2022	5:00:00 PM	0	892.644	7.051	0.63	26.16	1007.523217
3/29/2022	6:00:00 PM	0	9.735	5.4	3/29/2022	6:00:00 PM	0	892.366	5.927	0.64	26.15	1007.528051
3/29/2022	7:00:00 PM	0	9.733	5.4	3/29/2022	7:00:00 PM	0	891.912	4.542	0.64	26.15	1007.530681
3/29/2022	8:00:00 PM	0	9.729	5.4	3/29/2022	8:00:00 PM	0	891.142	3.654	0.64	26.14	1007.534533
3/29/2022	9:00:00 PM	0	9.729	5.4	3/29/2022	9:00:00 PM	0	890.967	3.081	0.64	26.14	1007.536317
3/29/2022	10:00:00 PM	0	9.732	5.4	3/29/2022	10:00:00 PM	0	890.985	2.925	0.65	26.14	1007.539134
3/29/2022	11:00:00 PM	0	9.738	5.4	3/29/2022	11:00:00 PM	0	891.067	2.867	0.65	26.13	1007.544298
3/30/2022	12:00:00 AM	0	9.747	5.4	3/30/2022	12:00:00 AM	0	891.156	2.347	0.66	26.13	1007.55239
3/30/2022	1:00:00 AM	0	9.758	5.4	3/30/2022	1:00:00 AM	0	891.312	1.854	0.67	26.12	1007.561799
3/30/2022	2:00:00 AM	0	9.767	5.4	3/30/2022	2:00:00 AM	0	891.13	1.58	0.68	26.11	1007.572655
3/30/2022	3:00:00 AM	0	9.778	5.4	3/30/2022	3:00:00 AM	0	891.421	1.705	0.69	26.10	1007.580688
3/30/2022	4:00:00 AM	0	9.787	5.4	3/30/2022	4:00:00 AM	0	891.444	1.409	0.70	26.09	1007.589453
3/30/2022	5:00:00 AM	0	9.792	5.4	3/30/2022	5:00:00 AM	0	891.19	0.955	0.70	26.08	1007.597043
3/30/2022	6:00:00 AM	0	9.801	5.4	3/30/2022	6:00:00 AM	0	891.957	0.604	0.71	26.08	1007.598222
3/30/2022	7:00:00 AM	0	9.807	5.4	3/30/2022	7:00:00 AM	0	892.733	0.47	0.70	26.08	1007.596309
3/30/2022	8:00:00 AM	0	9.81	5.4	3/30/2022	8:00:00 AM	0	893.053	-0.096	0.70	26.08	1007.596046
3/30/2022	9:00:00 AM	0	9.816	5.4	3/30/2022	9:00:00 AM	0	893.824	0.591	0.70	26.08	1007.594184
3/30/2022	10:00:00 AM	0	9.819	5.4	3/30/2022	10:00:00 AM	0	894.299	2.932	0.70	26.09	1007.59234
3/30/2022	11:00:00 AM	0	9.826	5.4	3/30/2022	11:00:00 AM	0	895.119	5.82	0.70	26.09	1007.590979
3/30/2022	12:00:00 PM	0	9.837	5.4	3/30/2022	12:00:00 PM	0	895.63	7.359	0.70	26.08	1007.596768
3/30/2022	1:00:00 PM	0	9.845	5.4	3/30/2022	1:00:00 PM	0	895.706	10.36	0.71	26.08	1007.603993
3/30/2022	2:00:00 PM	0	9.854	5.4	3/30/2022	2:00:00 PM	0	895.461	12.42	0.72	26.06	1007.615491
3/30/2022	3:00:00 PM	0	9.868	5.4	3/30/2022	3:00:00 PM	0	895.788	6.514	0.73	26.05	1007.626157
3/30/2022	4:00:00 PM	0	9.876	5.4	3/30/2022	4:00:00 PM	0	895.529	3.974	0.74	26.04	1007.636798
3/30/2022	5:00:00 PM	0	9.883	5.4	3/30/2022	5:00:00 PM	0	895.665	2.324	0.75	26.04	1007.642411
3/30/2022	6:00:00 PM	0	9.888	5.4	3/30/2022	6:00:00 PM	0	895.788	1.521	0.75	26.03	1007.646157
3/30/2022	7:00:00 PM	0	9.891	5.4	3/30/2022	7:00:00 PM	0	895.894	-0.537	0.76	26.03	1007.648076
3/30/2022	8:00:00 PM	0	9.891	5.4	3/30/2022	8:00:00 PM	0	895.878	-1.106	0.76	26.03	1007.648239
3/30/2022	9:00:00 PM	0	9.893	5.4	3/30/2022	9:00:00 PM	0	895.733	-1.386	0.76	26.03	1007.651717
3/30/2022	10:00:00 PM	0	9.896	5.4	3/30/2022	10:00:00 PM	0	895.739	-1.749	0.76	26.02	1007.654656
3/30/2022	11:00:00 PM	0	9.9	5.4	3/30/2022	11:00:00 PM	0	896.023	-0.87	0.76	26.02	1007.65576
3/31/2022	12:00:00 AM	0	9.909	5.4	3/31/2022	12:00:00 AM	0	896.328	-0.74	0.77	26.02	1007.66165
3/31/2022	1:00:00 AM	0	9.919	5.4	3/31/2022	1:00:00 AM	0	896.267	-1.077	0.78	26.01	1007.672272
3/31/2022	2:00:00 AM	0	9.931	5.4	3/31/2022	2:00:00 AM	0	896.292	-1.573	0.79	25.99	1007.684017
3/31/2022	3:00:00 AM	0	9.944	5.4	3/31/2022	3:00:00 AM	0	896.508	-1.875	0.80	25.98	1007.694815
3/31/2022	4:00:00 AM	0	9.954	5.4	3/31/2022	4:00:00 AM	0	896.731	-1.744	0.81	25.98	1007.702541
3/31/2022	5:00:00 AM	0	9.961	5.4	3/31/2022	5:00:00 AM	0	896.832	-1.667	0.82	25.97	1007.708511
3/31/2022	6:00:00 AM	0	9.966	5.4	3/31/2022	6:00:00 AM	0	896.834	-2.003	0.82	25.97	1007.71349
3/31/2022	7:00:00 AM	0	9.969	5.4	3/31/2022	7:00:00 AM	0	896.734	-2.027	0.82	25.96	1007.71751
3/31/2022	8:00:00 AM	0	9.97	5.4	3/31/2022	8:00:00 AM	0	897.222	-0.421	0.82	25.97	1007.713534
3/31/2022	9:00:00 AM	0	9.972	5.4	3/31/2022	9:00:00 AM	0	897.466	1.583	0.82	25.97	1007.713046
3/31/2022	10:00:00 AM	0	9.972	5.4	3/31/2022	10:00:00 AM	0	897.551	5.807	0.82	25.97	1007.712179
3/31/2022	11:00:00 AM	0	9.976	5.4	3/31/2022	11:00:00 AM	0	897.513	7.301	0.82	25.96	1007.716566
3/31/2022	12:00:00 PM	0	9.982	5.4	3/31/2022	12:00:00 PM	0	897.427	7.616	0.83	25.96	1007.723443
3/31/2022	1:00:00 PM	0	9.99	5.4	3/31/2022	1:00:00 PM	0	897.318	10.528	0.84	25.95	1007.732555
3/31/2022	2:00:00 PM	0	9.999	5.4	3/31/2022	2:00:00 PM	0	896.964	8.982	0.85	25.93	1007.745165
3/31/2022	3:00:00 PM	0	10.007	5.4	3/31/2022	3:00:00 PM	0	896.499	8.49	0.87	25.92	1007.757906
3/31/2022	4:00:00 PM	0	10.014	5.4	3/31/2022	4:00:00 PM	0	895.993	6.583	0.88	25.91	1007.770066
3/31/2022	5:00:00 PM	0	10.017	5.4	3/31/2022	5:00:00 PM	0	895.176	5.34	0.89	25.90	1007.781397
3/31/2022	6:00:00 PM	0	10.019	5.4	3/31/2022	6:00:00 PM	0	894.604	3.523	0.90	25.89	1007.78923
3/31/2022	7:00:00 PM	0	10.022	5.4	3/31/2022	7:00:00 PM	0	894.462	1.033	0.90	25.89	1007.793678
3/31/2022	8:00:00 PM	0	10.023	5.4	3/31/2022	8:00:00 PM	0	894.759	-0.726	0.90	25.89	1007.791649
3/31/2022	9:00:00 PM	0	10.023	5.4	3/31/2022	9:00:00 PM	0	894.749	-1.428	0.90	25.89	1007.791751
3/31/2022	10:00:00 PM	0	10.025	5.4	3/31/2022	10:00:00 PM	0	894.907	-2.253	0.90	25.89	1007.79214
3/31/2022	11:00:00 PM	0	10.028	5.4	3/31/2022	11:00:00 PM	0	894.959	-2.447	0.90	25.88	1007.79461
4/1/2022	12:00:00 AM	0	10.032	5.4	4/1/2022	12:00:00 AM	0	895.235	-0.718	0.90	25.48	1008.195039
4/1/2022	1:00:00 AM	0	10.038	5.4	4/1/2022	1:00:00 AM	0	895.155	-0.725	0.91	25.48	1008.201855
4/1/2022	2:00:00 AM	0	10.044	5.4	4/1/2022	2:00:00 AM	0	894.872	-1.294	0.92	25.47	1008.210741
4/1/2022	3:00:00 AM	0	10.052	5.4	4/1/2022	3:00:00 AM	0	894.394	-2.386	0.93	25.46	1008.223615
4/1/2022	4:00:00 AM	0	10.059	5.4	4/1/2022	4:00:00 AM	0	894.182	-3.656	0.94	25.45	1008.232777
4/1/2022	5:00:00 AM	0	10.065	5.4	4/1/2022	5:00:00 AM	0	894.296	-3.219	0.95	25.44	1008.237614

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/1/2022	6:00:00 AM	0	10.067	5.4	4/1/2022	6:00:00 AM	0	894.016	-3.241	0.95	25.44	1008.24247
4/1/2022	7:00:00 AM	0	10.067	5.4	4/1/2022	7:00:00 AM	0	893.912	-2.492	0.95	25.44	1008.24353
4/1/2022	8:00:00 AM	0	10.063	5.4	4/1/2022	8:00:00 AM	0	893.666	-0.693	0.95	25.44	1008.242039
4/1/2022	9:00:00 AM	0	10.062	5.4	4/1/2022	9:00:00 AM	0	893.703	0.277	0.95	25.44	1008.240661
4/1/2022	10:00:00 AM	0	10.06	5.4	4/1/2022	10:00:00 AM	0	893.718	2.233	0.95	25.44	1008.238508
4/1/2022	11:00:00 AM	0	10.062	5.4	4/1/2022	11:00:00 AM	0	893.544	3.435	0.95	25.44	1008.242283
4/1/2022	12:00:00 PM	0	10.067	5.4	4/1/2022	12:00:00 PM	0	893.649	4.455	0.95	25.43	1008.246212
4/1/2022	1:00:00 PM	0	10.073	5.4	4/1/2022	1:00:00 PM	0	893.351	3.84	0.96	25.42	1008.255251
4/1/2022	2:00:00 PM	0	10.08	5.4	4/1/2022	2:00:00 PM	0	893.152	4.522	0.97	25.41	1008.26428
4/1/2022	3:00:00 PM	0	10.089	5.4	4/1/2022	3:00:00 PM	0	892.882	3.768	0.98	25.40	1008.276033
4/1/2022	4:00:00 PM	0	10.097	5.4	4/1/2022	4:00:00 PM	0	892.721	4.03	0.99	25.39	1008.285675
4/1/2022	5:00:00 PM	0	10.102	5.4	4/1/2022	5:00:00 PM	0	892.275	3.299	1.00	25.38	1008.295223
4/1/2022	6:00:00 PM	0	10.107	5.4	4/1/2022	6:00:00 PM	0	891.901	2.19	1.01	25.37	1008.304037
4/1/2022	7:00:00 PM	0	10.115	5.4	4/1/2022	7:00:00 PM	0	892.4	0.756	1.02	25.37	1008.306948
4/1/2022	8:00:00 PM	0	10.11	5.4	4/1/2022	8:00:00 PM	0	891.604	-0.113	1.02	25.37	1008.310065
4/1/2022	9:00:00 PM	0	10.108	5.4	4/1/2022	9:00:00 PM	0	891.516	-0.504	1.02	25.37	1008.308963
4/1/2022	10:00:00 PM	0	10.11	5.4	4/1/2022	10:00:00 PM	0	891.77	-0.59	1.02	25.37	1008.308372
4/1/2022	11:00:00 PM	0	10.111	5.4	4/1/2022	11:00:00 PM	0	891.977	-0.586	1.02	25.37	1008.307262
4/2/2022	12:00:00 AM	0	10.115	5.4	4/2/2022	12:00:00 AM	0	892.046	-0.599	1.02	25.37	1008.310558
4/2/2022	1:00:00 AM	0	10.119	5.4	4/2/2022	1:00:00 AM	0	892.192	-0.684	1.02	25.37	1008.313069
4/2/2022	2:00:00 AM	0	10.128	5.4	4/2/2022	2:00:00 AM	0	892.461	-0.878	1.03	25.36	1008.319326
4/2/2022	3:00:00 AM	0	10.134	5.4	4/2/2022	3:00:00 AM	0	892.514	-1.203	1.03	25.35	1008.324786
4/2/2022	4:00:00 AM	0	10.143	5.4	4/2/2022	4:00:00 AM	0	892.764	-1.593	1.04	25.35	1008.331236
4/2/2022	5:00:00 AM	0	10.15	5.4	4/2/2022	5:00:00 AM	0	893.326	-1.717	1.04	25.35	1008.332506
4/2/2022	6:00:00 AM	0	10.156	5.4	4/2/2022	6:00:00 AM	0	893.79	-1.518	1.04	25.35	1008.333774
4/2/2022	7:00:00 AM	0	10.158	5.4	4/2/2022	7:00:00 AM	0	893.935	-1.393	1.04	25.34	1008.334296
4/2/2022	8:00:00 AM	0	10.16	5.4	4/2/2022	8:00:00 AM	0	894.652	-0.024	1.04	25.35	1008.328984
4/2/2022	9:00:00 AM	0	10.16	5.4	4/2/2022	9:00:00 AM	0	895.553	6.556	1.03	25.36	1008.319796
4/2/2022	10:00:00 AM	0	10.16	5.4	4/2/2022	10:00:00 AM	0	895.748	11.354	1.03	25.36	1008.317808
4/2/2022	11:00:00 AM	0	10.161	5.4	4/2/2022	11:00:00 AM	0	895.75	9.575	1.03	25.36	1008.318788
4/2/2022	12:00:00 PM	0	10.164	5.4	4/2/2022	12:00:00 PM	0	895.952	11.889	1.03	25.36	1008.319728
4/2/2022	1:00:00 PM	0	10.169	5.4	4/2/2022	1:00:00 PM	0	895.459	14.223	1.04	25.35	1008.329755
4/2/2022	2:00:00 PM	0	10.176	5.4	4/2/2022	2:00:00 PM	0	895.184	14.659	1.05	25.34	1008.339559
4/2/2022	3:00:00 PM	0	10.185	5.4	4/2/2022	3:00:00 PM	0	895.027	11.612	1.06	25.33	1008.35016
4/2/2022	4:00:00 PM	0	10.194	5.4	4/2/2022	4:00:00 PM	0	894.556	6.918	1.07	25.32	1008.363963
4/2/2022	5:00:00 PM	0	10.2	5.4	4/2/2022	5:00:00 PM	0	894.128	5.237	1.08	25.30	1008.374327
4/2/2022	6:00:00 PM	0	10.208	5.4	4/2/2022	6:00:00 PM	0	894.019	3.667	1.09	25.30	1008.383439
4/2/2022	7:00:00 PM	0	10.214	5.4	4/2/2022	7:00:00 PM	0	894.067	2.47	1.10	25.29	1008.38895
4/2/2022	8:00:00 PM	0	10.215	5.4	4/2/2022	8:00:00 PM	0	893.987	1.954	1.10	25.29	1008.390765
4/2/2022	9:00:00 PM	0	10.215	5.4	4/2/2022	9:00:00 PM	0	893.875	1.79	1.10	25.29	1008.391907
4/2/2022	10:00:00 PM	0	10.214	5.4	4/2/2022	10:00:00 PM	0	893.463	1.525	1.10	25.28	1008.395109
4/2/2022	11:00:00 PM	0	10.211	5.4	4/2/2022	11:00:00 PM	0	892.95	1.121	1.11	25.28	1008.39734
4/3/2022	12:00:00 AM	0	10.211	5.4	4/3/2022	12:00:00 AM	0	892.528	0.721	1.11	25.28	1008.401643
4/3/2022	1:00:00 AM	0	10.212	5.4	4/3/2022	1:00:00 AM	0	892.152	0.654	1.11	25.27	1008.406477
4/3/2022	2:00:00 AM	0	10.212	5.4	4/3/2022	2:00:00 AM	0	891.431	0.543	1.12	25.27	1008.413829
4/3/2022	3:00:00 AM	0	10.214	5.4	4/3/2022	3:00:00 AM	0	890.664	0.473	1.13	25.26	1008.423651
4/3/2022	4:00:00 AM	0	10.215	5.4	4/3/2022	4:00:00 AM	0	890.051	0.315	1.14	25.25	1008.430901
4/3/2022	5:00:00 AM	0	10.215	5.4	4/3/2022	5:00:00 AM	0	889.261	0.302	1.15	25.24	1008.438957
4/3/2022	6:00:00 AM	0	10.214	5.4	4/3/2022	6:00:00 AM	0	888.283	0.204	1.16	25.23	1008.44793
4/3/2022	7:00:00 AM	0	10.209	5.4	4/3/2022	7:00:00 AM	0	887.612	0.469	1.16	25.23	1008.449772
4/3/2022	8:00:00 AM	0	10.203	5.4	4/3/2022	8:00:00 AM	0	887.003	1.231	1.16	25.23	1008.449983
4/3/2022	9:00:00 AM	0	10.197	5.4	4/3/2022	9:00:00 AM	0	886.278	2.599	1.16	25.23	1008.451376
4/3/2022	10:00:00 AM	0	10.19	5.4	4/3/2022	10:00:00 AM	0	885.551	4.293	1.16	25.23	1008.451789
4/3/2022	11:00:00 AM	0	10.185	5.4	4/3/2022	11:00:00 AM	0	885.302	6.871	1.16	25.23	1008.449328
4/3/2022	12:00:00 PM	0	10.182	5.4	4/3/2022	12:00:00 PM	0	884.492	6.851	1.16	25.22	1008.454588
4/3/2022	1:00:00 PM	0	10.179	5.4	4/3/2022	1:00:00 PM	0	883.413	5.211	1.17	25.22	1008.46259
4/3/2022	2:00:00 PM	0	10.182	5.4	4/3/2022	2:00:00 PM	0	882.604	4.137	1.18	25.21	1008.47384
4/3/2022	3:00:00 PM	0	10.194	5.4	4/3/2022	3:00:00 PM	0	882.867	3.436	1.19	25.20	1008.483158
4/3/2022	4:00:00 PM	0	10.2	5.4	4/3/2022	4:00:00 PM	0	882.902	2.136	1.20	25.19	1008.488801
4/3/2022	5:00:00 PM	0	10.204	5.4	4/3/2022	5:00:00 PM	0	882.327	2.268	1.21	25.18	1008.498665
4/3/2022	6:00:00 PM	0	10.209	5.4	4/3/2022	6:00:00 PM	0	881.854	1.216	1.22	25.17	1008.508488
4/3/2022	7:00:00 PM	0	10.209	5.4	4/3/2022	7:00:00 PM	0	881.073	-0.281	1.22	25.16	1008.516452
4/3/2022	8:00:00 PM	0	10.206	5.4	4/3/2022	8:00:00 PM	0	879.988	-0.747	1.23	25.15	1008.524516
4/3/2022	9:00:00 PM	0	10.2	5.4	4/3/2022	9:00:00 PM	0	878.779	-1.441	1.24	25.15	1008.530844
4/3/2022	10:00:00 PM	0	10.193	5.4	4/3/2022	10:00:00 PM	0	877.364	-1.918	1.25	25.14	1008.538273
4/3/2022	11:00:00 PM	0	10.184	5.4	4/3/2022	11:00:00 PM	0	875.997	-1.723	1.25	25.14	1008.543213
4/4/2022	12:00:00 AM	0	10.173	5.4	4/4/2022	12:00:00 AM	0	873.953	-1.403	1.26	25.13	1008.553056
4/4/2022	1:00:00 AM	0	10.161	5.4	4/4/2022	1:00:00 AM	0	871.458	-1.573	1.27	25.11	1008.566498
4/4/2022	2:00:00 AM	0	10.15	5.4	4/4/2022	2:00:00 AM	0	869.212	-1.272	1.29	25.10	1008.578401
4/4/2022	3:00:00 AM	0	10.145	5.4	4/4/2022	3:00:00 AM	0	867.401	-0.79	1.30	25.09	1008.591868
4/4/2022	4:00:00 AM	0	10.142	5.4	4/4/2022	4:00:00 AM	0	866.098	-0.598	1.31	25.08	1008.602155
4/4/2022	5:00:00 AM	0	10.139	5.4	4/4/2022	5:00:00 AM	0	865.48	-0.554	1.31	25.07	1008.605457

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/4/2022	6:00:00 AM	0	10.137	5.4	4/4/2022	6:00:00 AM	0	865.127	-0.507	1.32	25.07	1008.607056
4/4/2022	7:00:00 AM	0	10.134	5.4	4/4/2022	7:00:00 AM	0	865.218	-0.029	1.31	25.08	1008.603129
4/4/2022	8:00:00 AM	0	10.136	5.4	4/4/2022	8:00:00 AM	0	865.904	1.662	1.31	25.08	1008.598133
4/4/2022	9:00:00 AM	0	10.134	5.4	4/4/2022	9:00:00 AM	0	866.692	3.6	1.30	25.09	1008.588098
4/4/2022	10:00:00 AM	0	10.133	5.4	4/4/2022	10:00:00 AM	0	867.562	5.561	1.29	25.10	1008.578226
4/4/2022	11:00:00 AM	0	10.136	5.4	4/4/2022	11:00:00 AM	0	868.33	7.965	1.28	25.11	1008.573395
4/4/2022	12:00:00 PM	0	10.145	5.4	4/4/2022	12:00:00 PM	0	870.019	2.367	1.27	25.11	1008.565172
4/4/2022	1:00:00 PM	0	10.149	5.4	4/4/2022	1:00:00 PM	0	870.766	3.481	1.27	25.12	1008.561554
4/4/2022	2:00:00 PM	0	10.153	5.4	4/4/2022	2:00:00 PM	0	871.232	7.842	1.27	25.12	1008.560803
4/4/2022	3:00:00 PM	0	10.163	5.4	4/4/2022	3:00:00 PM	0	871.797	8.909	1.27	25.11	1008.565041
4/4/2022	4:00:00 PM	0	10.173	5.4	4/4/2022	4:00:00 PM	0	872.238	4.977	1.28	25.11	1008.570544
4/4/2022	5:00:00 PM	0	10.185	5.4	4/4/2022	5:00:00 PM	0	872.67	3.036	1.29	25.10	1008.578139
4/4/2022	6:00:00 PM	0	10.195	5.4	4/4/2022	6:00:00 PM	0	872.992	2.1	1.29	25.09	1008.584856
4/4/2022	7:00:00 PM	0	10.208	5.4	4/4/2022	7:00:00 PM	0	873.974	0.785	1.30	25.09	1008.587842
4/4/2022	8:00:00 PM	0	10.221	5.4	4/4/2022	8:00:00 PM	0	875.27	-0.353	1.30	25.09	1008.587626
4/4/2022	9:00:00 PM	0	10.23	5.4	4/4/2022	9:00:00 PM	0	876.445	-0.642	1.29	25.09	1008.584645
4/4/2022	10:00:00 PM	0	10.239	5.4	4/4/2022	10:00:00 PM	0	877.676	-0.599	1.29	25.10	1008.581092
4/4/2022	11:00:00 PM	0	10.248	5.4	4/4/2022	11:00:00 PM	0	878.845	-0.86	1.29	25.10	1008.578171
4/5/2022	12:00:00 AM	0	10.257	5.4	4/5/2022	12:00:00 AM	0	880.105	-1.516	1.28	25.10	1008.574323
4/5/2022	1:00:00 AM	0	10.266	5.4	4/5/2022	1:00:00 AM	0	881.3	-2.004	1.28	25.11	1008.571137
4/5/2022	2:00:00 AM	0	10.277	5.4	4/5/2022	2:00:00 AM	0	882.406	-3.153	1.28	25.11	1008.570859
4/5/2022	3:00:00 AM	0	10.289	5.4	4/5/2022	3:00:00 AM	0	883.635	-3.384	1.28	25.11	1008.570327
4/5/2022	4:00:00 AM	0	10.302	5.4	4/5/2022	4:00:00 AM	0	884.918	-3.999	1.28	25.11	1008.570244
4/5/2022	5:00:00 AM	0	10.314	5.4	4/5/2022	5:00:00 AM	0	886.269	-3.81	1.28	25.11	1008.568467
4/5/2022	6:00:00 AM	0	10.325	5.4	4/5/2022	6:00:00 AM	0	887.714	-3.153	1.27	25.11	1008.564732
4/5/2022	7:00:00 AM	0	10.335	5.4	4/5/2022	7:00:00 AM	0	889.246	-1.778	1.27	25.12	1008.55911
4/5/2022	8:00:00 AM	0	10.345	5.4	4/5/2022	8:00:00 AM	0	890.965	-0.629	1.26	25.13	1008.551581
4/5/2022	9:00:00 AM	0	10.355	5.4	4/5/2022	9:00:00 AM	0	892.384	1.219	1.26	25.13	1008.547111
4/5/2022	10:00:00 AM	0	10.361	5.4	4/5/2022	10:00:00 AM	0	893.774	4.152	1.25	25.14	1008.538937
4/5/2022	11:00:00 AM	0	10.37	5.4	4/5/2022	11:00:00 AM	0	895.129	7.682	1.24	25.14	1008.53412
4/5/2022	12:00:00 PM	0	10.374	5.4	4/5/2022	12:00:00 PM	0	895.706	9.447	1.24	25.15	1008.532236
4/5/2022	1:00:00 PM	0	10.384	5.4	4/5/2022	1:00:00 PM	0	896.657	9.137	1.24	25.15	1008.532539
4/5/2022	2:00:00 PM	0	10.4	5.4	4/5/2022	2:00:00 PM	0	897.902	7.96	1.24	25.14	1008.535843
4/5/2022	3:00:00 PM	0	10.41	5.4	4/5/2022	3:00:00 PM	0	898.28	7.416	1.25	25.14	1008.541989
4/5/2022	4:00:00 PM	0	10.43	5.4	4/5/2022	4:00:00 PM	0	899.667	4.694	1.26	25.13	1008.547845
4/5/2022	5:00:00 PM	0	10.442	5.4	4/5/2022	5:00:00 PM	0	899.922	3.145	1.27	25.12	1008.557245
4/5/2022	6:00:00 PM	0	10.458	5.4	4/5/2022	6:00:00 PM	0	900.552	0.891	1.27	25.11	1008.566821
4/5/2022	7:00:00 PM	0	10.473	5.4	4/5/2022	7:00:00 PM	0	901.487	0.108	1.28	25.11	1008.572286
4/5/2022	8:00:00 PM	0	10.49	5.4	4/5/2022	8:00:00 PM	0	902.625	-1.963	1.29	25.10	1008.577682
4/5/2022	9:00:00 PM	0	10.503	5.4	4/5/2022	9:00:00 PM	0	903.907	-1.046	1.29	25.10	1008.577609
4/5/2022	10:00:00 PM	0	10.517	5.4	4/5/2022	10:00:00 PM	0	904.811	-2.855	1.29	25.10	1008.582391
4/5/2022	11:00:00 PM	0	10.527	5.4	4/5/2022	11:00:00 PM	0	905.686	-3.785	1.29	25.10	1008.583468
4/6/2022	12:00:00 AM	0	10.536	5.4	4/6/2022	12:00:00 AM	0	906.321	-4.288	1.29	25.09	1008.585993
4/6/2022	1:00:00 AM	0	10.545	5.4	4/6/2022	1:00:00 AM	0	906.968	-5.222	1.30	25.09	1008.588395
4/6/2022	2:00:00 AM	0	10.554	5.4	4/6/2022	2:00:00 AM	0	907.451	-6.039	1.30	25.09	1008.59247
4/6/2022	3:00:00 AM	0	10.563	5.4	4/6/2022	3:00:00 AM	0	907.9	-6.504	1.30	25.08	1008.596892
4/6/2022	4:00:00 AM	0	10.573	5.4	4/6/2022	4:00:00 AM	0	908.593	-6.794	1.31	25.08	1008.599825
4/6/2022	5:00:00 AM	0	10.579	5.4	4/6/2022	5:00:00 AM	0	908.606	-7.172	1.31	25.07	1008.605692
4/6/2022	6:00:00 AM	0	10.586	5.4	4/6/2022	6:00:00 AM	0	908.863	-7.368	1.32	25.07	1008.610072
4/6/2022	7:00:00 AM	0	10.592	5.4	4/6/2022	7:00:00 AM	0	909.53	-6.616	1.32	25.07	1008.60927
4/6/2022	8:00:00 AM	0	10.599	5.4	4/6/2022	8:00:00 AM	0	911.15	-0.201	1.31	25.08	1008.599751
4/6/2022	9:00:00 AM	0	10.601	5.4	4/6/2022	9:00:00 AM	0	911.665	7.002	1.30	25.08	1008.596499
4/6/2022	10:00:00 AM	0	10.599	5.4	4/6/2022	10:00:00 AM	0	911.26	7.69	1.31	25.08	1008.598629
4/6/2022	11:00:00 AM	0	10.599	5.4	4/6/2022	11:00:00 AM	0	910.996	7.872	1.31	25.08	1008.601321
4/6/2022	12:00:00 PM	0	10.598	5.4	4/6/2022	12:00:00 PM	0	910.441	8.358	1.31	25.07	1008.605981
4/6/2022	1:00:00 PM	0	10.596	5.4	4/6/2022	1:00:00 PM	0	909.453	9.563	1.32	25.06	1008.614055
4/6/2022	2:00:00 PM	0	10.599	5.4	4/6/2022	2:00:00 PM	0	909.058	9.14	1.33	25.06	1008.621083
4/6/2022	3:00:00 PM	0	10.601	5.4	4/6/2022	3:00:00 PM	0	908.164	7.713	1.34	25.05	1008.6322
4/6/2022	4:00:00 PM	0	10.607	5.4	4/6/2022	4:00:00 PM	0	907.693	5.955	1.35	25.04	1008.643002
4/6/2022	5:00:00 PM	0	10.614	5.4	4/6/2022	5:00:00 PM	0	907.538	4.405	1.36	25.03	1008.651583
4/6/2022	6:00:00 PM	0	10.623	5.4	4/6/2022	6:00:00 PM	0	907.524	3.1	1.37	25.02	1008.660726
4/6/2022	7:00:00 PM	0	10.632	5.4	4/6/2022	7:00:00 PM	0	907.586	1.851	1.38	25.01	1008.669094
4/6/2022	8:00:00 PM	0	10.641	5.4	4/6/2022	8:00:00 PM	0	907.823	1.146	1.38	25.00	1008.675677
4/6/2022	9:00:00 PM	0	10.646	5.4	4/6/2022	9:00:00 PM	0	907.538	-0.103	1.39	25.00	1008.683583
4/6/2022	10:00:00 PM	0	10.646	5.4	4/6/2022	10:00:00 PM	0	906.789	-0.559	1.40	24.99	1008.691221
4/6/2022	11:00:00 PM	0	10.649	5.4	4/6/2022	11:00:00 PM	0	906.405	-0.417	1.41	24.98	1008.698136
4/7/2022	12:00:00 AM	0	10.65	5.4	4/7/2022	12:00:00 AM	0	906.152	-0.164	1.41	24.98	1008.701716
4/7/2022	1:00:00 AM	0	10.653	5.4	4/7/2022	1:00:00 AM	0	906.21	0.036	1.41	24.97	1008.704125
4/7/2022	2:00:00 AM	0	10.655	5.4	4/7/2022	2:00:00 AM	0	905.812	0.137	1.42	24.97	1008.710183
4/7/2022	3:00:00 AM	0	10.656	5.4	4/7/2022	3:00:00 AM	0	905.508	0.351	1.42	24.96	1008.714283
4/7/2022	4:00:00 AM	0	10.655	5.4	4/7/2022	4:00:00 AM	0	904.744	0.431	1.43	24.96	1008.721074
4/7/2022	5:00:00 AM	0	10.656	5.4	4/7/2022	5:00:00 AM	0	904.677	0.161	1.43	24.96	1008.722757

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/7/2022	6:00:00 AM	0	10.655	5.4	4/7/2022	6:00:00 AM	0	904.077	-0.219	1.44	24.95	1008.727876
4/7/2022	7:00:00 AM	0	10.655	5.4	4/7/2022	7:00:00 AM	0	904.017	1.048	1.44	24.95	1008.728487
4/7/2022	8:00:00 AM	0	10.652	5.4	4/7/2022	8:00:00 AM	0	903.857	4.281	1.44	24.95	1008.727119
4/7/2022	9:00:00 AM	0	10.646	5.4	4/7/2022	9:00:00 AM	0	903.147	7.962	1.44	24.95	1008.728359
4/7/2022	10:00:00 AM	0	10.647	5.4	4/7/2022	10:00:00 AM	0	902.734	9.538	1.44	24.95	1008.73357
4/7/2022	11:00:00 AM	0	10.64	5.4	4/7/2022	11:00:00 AM	0	902.075	12.038	1.44	24.95	1008.73329
4/7/2022	12:00:00 PM	0	10.637	5.4	4/7/2022	12:00:00 PM	0	901.525	11.22	1.44	24.94	1008.735899
4/7/2022	1:00:00 PM	0	10.634	5.4	4/7/2022	1:00:00 PM	0	900.734	8.656	1.45	24.94	1008.740965
4/7/2022	2:00:00 PM	0	10.631	5.4	4/7/2022	2:00:00 PM	0	900.065	8.23	1.45	24.93	1008.744787
4/7/2022	3:00:00 PM	0	10.626	5.4	4/7/2022	3:00:00 PM	0	899.215	9.7	1.46	24.93	1008.748454
4/7/2022	4:00:00 PM	0	10.624	5.4	4/7/2022	4:00:00 PM	0	898.256	8.675	1.46	24.92	1008.756233
4/7/2022	5:00:00 PM	0	10.621	5.4	4/7/2022	5:00:00 PM	0	896.958	8.129	1.47	24.91	1008.766469
4/7/2022	6:00:00 PM	0	10.62	5.4	4/7/2022	6:00:00 PM	0	895.73	6.917	1.49	24.90	1008.777992
4/7/2022	7:00:00 PM	0	10.623	5.4	4/7/2022	7:00:00 PM	0	895.076	5.511	1.50	24.89	1008.787661
4/7/2022	8:00:00 PM	0	10.624	5.4	4/7/2022	8:00:00 PM	0	894.572	5.013	1.50	24.89	1008.7938
4/7/2022	9:00:00 PM	0	10.624	5.4	4/7/2022	9:00:00 PM	0	893.968	5.362	1.51	24.88	1008.799959
4/7/2022	10:00:00 PM	0	10.624	5.4	4/7/2022	10:00:00 PM	0	893.14	5.963	1.52	24.87	1008.808402
4/7/2022	11:00:00 PM	0	10.621	5.4	4/7/2022	11:00:00 PM	0	892.336	5.815	1.52	24.87	1008.813601
4/8/2022	12:00:00 AM	0	10.62	5.4	4/8/2022	12:00:00 AM	0	891.061	5.563	1.53	24.85	1008.825602
4/8/2022	1:00:00 AM	0	10.616	5.4	4/8/2022	1:00:00 AM	0	889.86	5.588	1.54	24.85	1008.833849
4/8/2022	2:00:00 AM	0	10.613	5.4	4/8/2022	2:00:00 AM	0	888.96	5.993	1.55	24.84	1008.840027
4/8/2022	3:00:00 AM	0	10.611	5.4	4/8/2022	3:00:00 AM	0	888.159	6.003	1.55	24.83	1008.846195
4/8/2022	4:00:00 AM	0	10.608	5.4	4/8/2022	4:00:00 AM	0	887.391	5.507	1.56	24.83	1008.851026
4/8/2022	5:00:00 AM	0	10.611	5.4	4/8/2022	5:00:00 AM	0	887.575	5.096	1.56	24.83	1008.85215
4/8/2022	6:00:00 AM	0	10.613	5.4	4/8/2022	6:00:00 AM	0	887.813	4.496	1.56	24.83	1008.851723
4/8/2022	7:00:00 AM	0	10.616	5.4	4/8/2022	7:00:00 AM	0	888.258	4.49	1.56	24.83	1008.850185
4/8/2022	8:00:00 AM	0	10.62	5.4	4/8/2022	8:00:00 AM	0	889.331	6.643	1.55	24.84	1008.843243
4/8/2022	9:00:00 AM	0	10.618	5.4	4/8/2022	9:00:00 AM	0	889.15	16.906	1.55	24.84	1008.843089
4/8/2022	10:00:00 AM	0	10.618	5.4	4/8/2022	10:00:00 AM	0	889.326	21.275	1.55	24.84	1008.841294
4/8/2022	11:00:00 AM	0	10.618	5.4	4/8/2022	11:00:00 AM	0	889.514	17.26	1.55	24.84	1008.839377
4/8/2022	12:00:00 PM	0	10.62	5.4	4/8/2022	12:00:00 PM	0	889.949	12.051	1.55	24.84	1008.836942
4/8/2022	1:00:00 PM	0	10.626	5.4	4/8/2022	1:00:00 PM	0	890.412	13.309	1.55	24.84	1008.83822
4/8/2022	2:00:00 PM	0	10.628	5.4	4/8/2022	2:00:00 PM	0	890.784	11.511	1.54	24.84	1008.836427
4/8/2022	3:00:00 PM	0	10.631	5.4	4/8/2022	3:00:00 PM	0	890.893	10.036	1.55	24.84	1008.838315
4/8/2022	4:00:00 PM	0	10.638	5.4	4/8/2022	4:00:00 PM	0	891.486	8.162	1.55	24.84	1008.839268
4/8/2022	5:00:00 PM	0	10.646	5.4	4/8/2022	5:00:00 PM	0	891.938	6.18	1.55	24.84	1008.842659
4/8/2022	6:00:00 PM	0	10.655	5.4	4/8/2022	6:00:00 PM	0	892.375	4.13	1.56	24.83	1008.847203
4/8/2022	7:00:00 PM	0	10.665	5.4	4/8/2022	7:00:00 PM	0	893.105	2.198	1.56	24.83	1008.849759
4/8/2022	8:00:00 PM	0	10.677	5.4	4/8/2022	8:00:00 PM	0	893.928	0.425	1.56	24.83	1008.853367
4/8/2022	9:00:00 PM	0	10.689	5.4	4/8/2022	9:00:00 PM	0	894.572	0.049	1.57	24.82	1008.8588
4/8/2022	10:00:00 PM	0	10.7	5.4	4/8/2022	10:00:00 PM	0	894.802	-0.32	1.58	24.81	1008.867455
4/8/2022	11:00:00 PM	0	10.71	5.4	4/8/2022	11:00:00 PM	0	895.281	-1.407	1.58	24.81	1008.87257
4/9/2022	12:00:00 AM	0	10.72	5.4	4/9/2022	12:00:00 AM	0	895.607	-1.966	1.59	24.80	1008.879246
4/9/2022	1:00:00 AM	0	10.731	5.4	4/9/2022	1:00:00 AM	0	896.155	-1.209	1.59	24.79	1008.884658
4/9/2022	2:00:00 AM	0	10.74	5.4	4/9/2022	2:00:00 AM	0	896.482	-1.539	1.60	24.79	1008.890323
4/9/2022	3:00:00 AM	0	10.748	5.4	4/9/2022	3:00:00 AM	0	896.501	-2.93	1.61	24.78	1008.89813
4/9/2022	4:00:00 AM	0	10.754	5.4	4/9/2022	4:00:00 AM	0	896.545	-4.219	1.61	24.78	1008.903681
4/9/2022	5:00:00 AM	0	10.759	5.4	4/9/2022	5:00:00 AM	0	896.509	-4.789	1.62	24.77	1008.909048
4/9/2022	6:00:00 AM	0	10.764	5.4	4/9/2022	6:00:00 AM	0	896.685	-4.512	1.62	24.77	1008.912253
4/9/2022	7:00:00 AM	0	10.769	5.4	4/9/2022	7:00:00 AM	0	897.155	-2.894	1.62	24.77	1008.912461
4/9/2022	8:00:00 AM	0	10.773	5.4	4/9/2022	8:00:00 AM	0	897.488	0.1	1.62	24.77	1008.913065
4/9/2022	9:00:00 AM	0	10.776	5.4	4/9/2022	9:00:00 AM	0	897.538	3.524	1.62	24.76	1008.915555
4/9/2022	10:00:00 AM	0	10.778	5.4	4/9/2022	10:00:00 AM	0	897.401	8.491	1.63	24.76	1008.918952
4/9/2022	11:00:00 AM	0	10.778	5.4	4/9/2022	11:00:00 AM	0	896.891	7.9	1.63	24.75	1008.924153
4/9/2022	12:00:00 PM	0	10.781	5.4	4/9/2022	12:00:00 PM	0	896.584	8.864	1.64	24.75	1008.930283
4/9/2022	1:00:00 PM	0	10.788	5.4	4/9/2022	1:00:00 PM	0	897.139	7.083	1.64	24.75	1008.931624
4/9/2022	2:00:00 PM	0	10.788	5.4	4/9/2022	2:00:00 PM	0	896.312	5.89	1.65	24.74	1008.940057
4/9/2022	3:00:00 PM	0	10.79	5.4	4/9/2022	3:00:00 PM	0	896.229	6.4	1.65	24.74	1008.942903
4/9/2022	4:00:00 PM	0	10.793	5.4	4/9/2022	4:00:00 PM	0	895.956	3.253	1.66	24.73	1008.948687
4/9/2022	5:00:00 PM	0	10.796	5.4	4/9/2022	5:00:00 PM	0	895.539	2.426	1.66	24.72	1008.955939
4/9/2022	6:00:00 PM	0	10.799	5.4	4/9/2022	6:00:00 PM	0	895.306	1.317	1.67	24.72	1008.961315
4/9/2022	7:00:00 PM	0	10.805	5.4	4/9/2022	7:00:00 PM	0	895.151	-1.476	1.68	24.71	1008.968896
4/9/2022	8:00:00 PM	0	10.812	5.4	4/9/2022	8:00:00 PM	0	895.285	-1.269	1.68	24.70	1008.974529
4/9/2022	9:00:00 PM	0	10.818	5.4	4/9/2022	9:00:00 PM	0	894.869	-3.39	1.69	24.69	1008.984771
4/9/2022	10:00:00 PM	0	10.826	5.4	4/9/2022	10:00:00 PM	0	894.652	-4.871	1.70	24.68	1008.994984
4/9/2022	11:00:00 PM	0	10.836	5.4	4/9/2022	11:00:00 PM	0	894.77	-5.713	1.71	24.68	1009.003781
4/10/2022	12:00:00 AM	0	10.844	5.4	4/10/2022	12:00:00 AM	0	894.818	-6.178	1.72	24.67	1009.011291
4/10/2022	1:00:00 AM	0	10.851	5.4	4/10/2022	1:00:00 AM	0	894.709	-6.523	1.73	24.66	1009.019403
4/10/2022	2:00:00 AM	0	10.857	5.4	4/10/2022	2:00:00 AM	0	894.695	-6.514	1.73	24.65	1009.025546
4/10/2022	3:00:00 AM	0	10.861	5.4	4/10/2022	3:00:00 AM	0	894.648	-6.143	1.74	24.65	1009.030025
4/10/2022	4:00:00 AM	0	10.865	5.4	4/10/2022	4:00:00 AM	0	894.677	-5.796	1.74	24.65	1009.033729
4/10/2022	5:00:00 AM	0	10.868	5.4	4/10/2022	5:00:00 AM	0	894.643	-5.955	1.75	24.64	1009.037076

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/10/2022	6:00:00 AM	0	10.869	5.4	4/10/2022	6:00:00 AM	0	894.449	-5.901	1.75	24.64	1009.040054
4/10/2022	7:00:00 AM	0	10.871	5.4	4/10/2022	7:00:00 AM	0	894.625	-4.399	1.75	24.64	1009.040259
4/10/2022	8:00:00 AM	0	10.872	5.4	4/10/2022	8:00:00 AM	0	894.98	-0.926	1.75	24.64	1009.037639
4/10/2022	9:00:00 AM	0	10.872	5.4	4/10/2022	9:00:00 AM	0	894.858	1.221	1.75	24.64	1009.038884
4/10/2022	10:00:00 AM	0	10.874	5.4	4/10/2022	10:00:00 AM	0	894.827	7.505	1.75	24.64	1009.0412
4/10/2022	11:00:00 AM	0	10.874	5.4	4/10/2022	11:00:00 AM	0	894.504	9.879	1.75	24.63	1009.044493
4/10/2022	12:00:00 PM	0	10.877	5.4	4/10/2022	12:00:00 PM	0	894.123	8.084	1.76	24.63	1009.051378
4/10/2022	1:00:00 PM	0	10.875	5.4	4/10/2022	1:00:00 PM	0	893.582	8.009	1.76	24.62	1009.054895
4/10/2022	2:00:00 PM	0	10.877	5.4	4/10/2022	2:00:00 PM	0	893.25	10.677	1.77	24.62	1009.060281
4/10/2022	3:00:00 PM	0	10.875	5.4	4/10/2022	3:00:00 PM	0	892.549	7.119	1.77	24.61	1009.065429
4/10/2022	4:00:00 PM	0	10.877	5.4	4/10/2022	4:00:00 PM	0	892.214	4.292	1.78	24.61	1009.070845
4/10/2022	5:00:00 PM	0	10.877	5.4	4/10/2022	5:00:00 PM	0	891.891	2.114	1.78	24.60	1009.074139
4/10/2022	6:00:00 PM	0	10.877	5.4	4/10/2022	6:00:00 PM	0	891.531	0.671	1.79	24.60	1009.07781
4/10/2022	7:00:00 PM	0	10.88	5.4	4/10/2022	7:00:00 PM	0	891.436	-0.928	1.79	24.60	1009.081778
4/10/2022	8:00:00 PM	0	10.884	5.4	4/10/2022	8:00:00 PM	0	891.433	-1.65	1.79	24.59	1009.085809
4/10/2022	9:00:00 PM	0	10.889	5.4	4/10/2022	9:00:00 PM	0	891.259	-2.319	1.80	24.59	1009.092583
4/10/2022	10:00:00 PM	0	10.895	5.4	4/10/2022	10:00:00 PM	0	891.138	-3.594	1.81	24.58	1009.099817
4/10/2022	11:00:00 PM	0	10.902	5.4	4/10/2022	11:00:00 PM	0	890.987	-4.35	1.82	24.57	1009.108357
4/11/2022	12:00:00 AM	0	10.91	5.4	4/11/2022	12:00:00 AM	0	890.832	-4.738	1.83	24.56	1009.117937
4/11/2022	1:00:00 AM	0	10.916	5.4	4/11/2022	1:00:00 AM	0	890.613	-5.063	1.83	24.55	1009.126171
4/11/2022	2:00:00 AM	0	10.919	5.4	4/11/2022	2:00:00 AM	0	890.083	-5.515	1.84	24.54	1009.134575
4/11/2022	3:00:00 AM	0	10.922	5.4	4/11/2022	3:00:00 AM	0	889.485	-5.977	1.85	24.54	1009.143673
4/11/2022	4:00:00 AM	0	10.923	5.4	4/11/2022	4:00:00 AM	0	889.024	-6.621	1.86	24.53	1009.149374
4/11/2022	5:00:00 AM	0	10.923	5.4	4/11/2022	5:00:00 AM	0	888.659	-7.478	1.86	24.53	1009.153096
4/11/2022	6:00:00 AM	0	10.925	5.4	4/11/2022	6:00:00 AM	0	888.533	-8.039	1.86	24.52	1009.156381
4/11/2022	7:00:00 AM	0	10.925	5.4	4/11/2022	7:00:00 AM	0	888.708	-7.321	1.86	24.52	1009.154596
4/11/2022	8:00:00 AM	0	10.923	5.4	4/11/2022	8:00:00 AM	0	889.662	0.534	1.85	24.54	1009.142868
4/11/2022	9:00:00 AM	0	10.925	5.4	4/11/2022	9:00:00 AM	0	889.978	9.099	1.85	24.54	1009.141646
4/11/2022	10:00:00 AM	0	10.923	5.4	4/11/2022	10:00:00 AM	0	889.612	13.357	1.85	24.54	1009.143378
4/11/2022	11:00:00 AM	0	10.925	5.4	4/11/2022	11:00:00 AM	0	889.228	12.847	1.86	24.53	1009.149294
4/11/2022	12:00:00 PM	0	10.926	5.4	4/11/2022	12:00:00 PM	0	888.855	14.945	1.86	24.52	1009.154097
4/11/2022	1:00:00 PM	0	10.928	5.4	4/11/2022	1:00:00 PM	0	888.433	15.514	1.87	24.52	1009.160401
4/11/2022	2:00:00 PM	0	10.928	5.4	4/11/2022	2:00:00 PM	0	888.246	15.23	1.87	24.52	1009.162307
4/11/2022	3:00:00 PM	0	10.931	5.4	4/11/2022	3:00:00 PM	0	888.291	8.209	1.87	24.51	1009.164849
4/11/2022	4:00:00 PM	0	10.932	5.4	4/11/2022	4:00:00 PM	0	888.014	4.604	1.88	24.51	1009.168673
4/11/2022	5:00:00 PM	0	10.932	5.4	4/11/2022	5:00:00 PM	0	887.915	3.185	1.88	24.51	1009.169683
4/11/2022	6:00:00 PM	0	10.934	5.4	4/11/2022	6:00:00 PM	0	888.179	1.669	1.88	24.51	1009.168991
4/11/2022	7:00:00 PM	0	10.937	5.4	4/11/2022	7:00:00 PM	0	888.516	-0.849	1.88	24.51	1009.168554
4/11/2022	8:00:00 PM	0	10.941	5.4	4/11/2022	8:00:00 PM	0	889.003	-2.752	1.88	24.51	1009.167588
4/11/2022	9:00:00 PM	0	10.948	5.4	4/11/2022	9:00:00 PM	0	889.576	-2.648	1.88	24.51	1009.168745
4/11/2022	10:00:00 PM	0	10.956	5.4	4/11/2022	10:00:00 PM	0	889.894	-4.272	1.88	24.51	1009.173502
4/11/2022	11:00:00 PM	0	10.965	5.4	4/11/2022	11:00:00 PM	0	890.237	-5.404	1.89	24.50	1009.179005
4/12/2022	12:00:00 AM	0	10.977	5.4	4/12/2022	12:00:00 AM	0	890.739	-6.074	1.89	24.49	1009.185886
4/12/2022	1:00:00 AM	0	10.986	5.4	4/12/2022	1:00:00 AM	0	891.043	-6.579	1.90	24.49	1009.191786
4/12/2022	2:00:00 AM	0	10.996	5.4	4/12/2022	2:00:00 AM	0	891.459	-6.957	1.91	24.48	1009.197544
4/12/2022	3:00:00 AM	0	11.004	5.4	4/12/2022	3:00:00 AM	0	891.846	-7.404	1.91	24.48	1009.201598
4/12/2022	4:00:00 AM	0	11.012	5.4	4/12/2022	4:00:00 AM	0	892.405	-7.887	1.91	24.48	1009.203897
4/12/2022	5:00:00 AM	0	11.016	5.4	4/12/2022	5:00:00 AM	0	892.826	-8.313	1.91	24.48	1009.203604
4/12/2022	6:00:00 AM	0	11.019	5.4	4/12/2022	6:00:00 AM	0	893.373	-8.591	1.91	24.48	1009.201026
4/12/2022	7:00:00 AM	0	11.024	5.4	4/12/2022	7:00:00 AM	0	894.286	-7.817	1.90	24.48	1009.196716
4/12/2022	8:00:00 AM	0	11.027	5.4	4/12/2022	8:00:00 AM	0	895.856	-0.424	1.89	24.50	1009.183707
4/12/2022	9:00:00 AM	0	11.03	5.4	4/12/2022	9:00:00 AM	0	896.549	7.246	1.89	24.50	1009.17964
4/12/2022	10:00:00 AM	0	11.034	5.4	4/12/2022	10:00:00 AM	0	896.817	11.787	1.89	24.50	1009.180907
4/12/2022	11:00:00 AM	0	11.039	5.4	4/12/2022	11:00:00 AM	0	896.908	10.828	1.89	24.49	1009.184979
4/12/2022	12:00:00 PM	0	11.043	5.4	4/12/2022	12:00:00 PM	0	896.883	13.11	1.90	24.49	1009.189234
4/12/2022	1:00:00 PM	0	11.047	5.4	4/12/2022	1:00:00 PM	0	896.654	14.958	1.90	24.48	1009.195569
4/12/2022	2:00:00 PM	0	11.052	5.4	4/12/2022	2:00:00 PM	0	896.444	17.5	1.91	24.48	1009.202711
4/12/2022	3:00:00 PM	0	11.057	5.4	4/12/2022	3:00:00 PM	0	896.781	11.312	1.91	24.47	1009.204274
4/12/2022	4:00:00 PM	0	11.058	5.4	4/12/2022	4:00:00 PM	0	896.155	4.206	1.92	24.47	1009.211658
4/12/2022	5:00:00 PM	0	11.061	5.4	4/12/2022	5:00:00 PM	0	896.091	2.53	1.92	24.46	1009.21531
4/12/2022	6:00:00 PM	0	11.064	5.4	4/12/2022	6:00:00 PM	0	896.288	0.244	1.92	24.46	1009.216302
4/12/2022	7:00:00 PM	0	11.066	5.4	4/12/2022	7:00:00 PM	0	896.483	-2.162	1.92	24.46	1009.216313
4/12/2022	8:00:00 PM	0	11.069	5.4	4/12/2022	8:00:00 PM	0	896.937	-2.264	1.92	24.46	1009.214684
4/12/2022	9:00:00 PM	0	11.073	5.4	4/12/2022	9:00:00 PM	0	897.095	-4.424	1.93	24.46	1009.217072
4/12/2022	10:00:00 PM	0	11.079	5.4	4/12/2022	10:00:00 PM	0	897.1	-5.874	1.93	24.46	1009.223021
4/12/2022	11:00:00 PM	0	11.086	5.4	4/12/2022	11:00:00 PM	0	897.165	-6.792	1.94	24.45	1009.229359
4/13/2022	12:00:00 AM	0	11.097	5.4	4/13/2022	12:00:00 AM	0	897.553	-7.349	1.94	24.44	1009.236402
4/13/2022	1:00:00 AM	0	11.108	5.4	4/13/2022	1:00:00 AM	0	897.768	-7.781	1.95	24.43	1009.24521
4/13/2022	2:00:00 AM	0	11.117	5.4	4/13/2022	2:00:00 AM	0	897.809	-8.767	1.96	24.43	1009.253792
4/13/2022	3:00:00 AM	0	11.124	5.4	4/13/2022	3:00:00 AM	0	897.795	-9.756	1.97	24.42	1009.260934
4/13/2022	4:00:00 AM	0	11.13	5.4	4/13/2022	4:00:00 AM	0	897.923	-10.548	1.97	24.41	1009.265629
4/13/2022	5:00:00 AM	0	11.133	5.4	4/13/2022	5:00:00 AM	0	897.934	-11.329	1.98	24.41	1009.268517

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/13/2022	6:00:00 AM	0	11.136	5.4	4/13/2022	6:00:00 AM	0	898.195	-11.818	1.98	24.41	1009.268855
4/13/2022	7:00:00 AM	0	11.137	5.4	4/13/2022	7:00:00 AM	0	898.773	-11.07	1.97	24.42	1009.263962
4/13/2022	8:00:00 AM	0	11.136	5.4	4/13/2022	8:00:00 AM	0	900.149	-2.396	1.96	24.43	1009.24893
4/13/2022	9:00:00 AM	0	11.137	5.4	4/13/2022	9:00:00 AM	0	900.531	5.273	1.95	24.43	1009.246035
4/13/2022	10:00:00 AM	0	11.137	5.4	4/13/2022	10:00:00 AM	0	900.378	10.144	1.96	24.43	1009.247595
4/13/2022	11:00:00 AM	0	11.14	5.4	4/13/2022	11:00:00 AM	0	900.114	9.449	1.96	24.43	1009.253287
4/13/2022	12:00:00 PM	0	11.147	5.4	4/13/2022	12:00:00 PM	0	899.721	11.65	1.97	24.41	1009.264295
4/13/2022	1:00:00 PM	0	11.151	5.4	4/13/2022	1:00:00 PM	0	899.336	11.535	1.98	24.41	1009.27222
4/13/2022	2:00:00 PM	0	11.154	5.4	4/13/2022	2:00:00 PM	0	898.645	14.227	1.99	24.40	1009.282267
4/13/2022	3:00:00 PM	0	11.156	5.4	4/13/2022	3:00:00 PM	0	898.074	8.847	2.00	24.39	1009.290089
4/13/2022	4:00:00 PM	0	11.159	5.4	4/13/2022	4:00:00 PM	0	897.352	2.826	2.01	24.38	1009.300452
4/13/2022	5:00:00 PM	0	11.16	5.4	4/13/2022	5:00:00 PM	0	897.151	1.33	2.01	24.38	1009.303501
4/13/2022	6:00:00 PM	0	11.159	5.4	4/13/2022	6:00:00 PM	0	897.008	0.199	2.01	24.38	1009.30396
4/13/2022	7:00:00 PM	0	11.157	5.4	4/13/2022	7:00:00 PM	0	896.817	-1.5	2.01	24.38	1009.303907
4/13/2022	8:00:00 PM	0	11.156	5.4	4/13/2022	8:00:00 PM	0	896.704	-1.984	2.01	24.37	1009.30406
4/13/2022	9:00:00 PM	0	11.153	5.4	4/13/2022	9:00:00 PM	0	896.165	-4.258	2.01	24.37	1009.306556
4/13/2022	10:00:00 PM	0	11.156	5.4	4/13/2022	10:00:00 PM	0	895.832	-5.757	2.02	24.37	1009.312951
4/13/2022	11:00:00 PM	0	11.159	5.4	4/13/2022	11:00:00 PM	0	895.415	-6.663	2.03	24.36	1009.320204
4/14/2022	12:00:00 AM	0	11.166	5.4	4/14/2022	12:00:00 AM	0	895.431	-7.273	2.04	24.35	1009.327041
4/14/2022	1:00:00 AM	0	11.172	5.4	4/14/2022	1:00:00 AM	0	895.265	-7.837	2.04	24.34	1009.334733
4/14/2022	2:00:00 AM	0	11.18	5.4	4/14/2022	2:00:00 AM	0	895.013	-8.532	2.05	24.33	1009.345303
4/14/2022	3:00:00 AM	0	11.184	5.4	4/14/2022	3:00:00 AM	0	894.678	-9.176	2.06	24.33	1009.352719
4/14/2022	4:00:00 AM	0	11.188	5.4	4/14/2022	4:00:00 AM	0	894.726	-9.613	2.06	24.32	1009.35623
4/14/2022	5:00:00 AM	0	11.19	5.4	4/14/2022	5:00:00 AM	0	894.521	-9.965	2.07	24.32	1009.36032
4/14/2022	6:00:00 AM	0	11.19	5.4	4/14/2022	6:00:00 AM	0	894.572	-9.634	2.07	24.32	1009.3598
4/14/2022	7:00:00 AM	0	11.188	5.4	4/14/2022	7:00:00 AM	0	895.027	-8.071	2.06	24.33	1009.35316
4/14/2022	8:00:00 AM	0	11.185	5.4	4/14/2022	8:00:00 AM	0	895.786	-2.702	2.05	24.34	1009.342421
4/14/2022	9:00:00 AM	0	11.184	5.4	4/14/2022	9:00:00 AM	0	895.941	2.223	2.05	24.34	1009.33984
4/14/2022	10:00:00 AM	0	11.184	5.4	4/14/2022	10:00:00 AM	0	896	8.397	2.05	24.34	1009.339238
4/14/2022	11:00:00 AM	0	11.185	5.4	4/14/2022	11:00:00 AM	0	895.706	9.433	2.05	24.34	1009.343236
4/14/2022	12:00:00 PM	0	11.19	5.4	4/14/2022	12:00:00 PM	0	895.47	11.592	2.06	24.33	1009.350643
4/14/2022	1:00:00 PM	0	11.195	5.4	4/14/2022	1:00:00 PM	0	894.925	13.9	2.07	24.32	1009.3612
4/14/2022	2:00:00 PM	0	11.201	5.4	4/14/2022	2:00:00 PM	0	894.811	11.971	2.08	24.31	1009.368363
4/14/2022	3:00:00 PM	0	11.207	5.4	4/14/2022	3:00:00 PM	0	894.631	10.043	2.08	24.30	1009.376198
4/14/2022	4:00:00 PM	0	11.208	5.4	4/14/2022	4:00:00 PM	0	893.805	4.385	2.09	24.29	1009.385621
4/14/2022	5:00:00 PM	0	11.214	5.4	4/14/2022	5:00:00 PM	0	893.677	2.638	2.10	24.29	1009.392926
4/14/2022	6:00:00 PM	0	11.213	5.4	4/14/2022	6:00:00 PM	0	893.289	0.416	2.10	24.28	1009.395883
4/14/2022	7:00:00 PM	0	11.211	5.4	4/14/2022	7:00:00 PM	0	893.123	-1.365	2.10	24.28	1009.395576
4/14/2022	8:00:00 PM	0	11.211	5.4	4/14/2022	8:00:00 PM	0	893.381	-1.82	2.10	24.29	1009.392945
4/14/2022	9:00:00 PM	0	11.208	5.4	4/14/2022	9:00:00 PM	0	893.263	-3.62	2.10	24.29	1009.391148
4/14/2022	10:00:00 PM	0	11.208	5.4	4/14/2022	10:00:00 PM	0	893.062	-4.756	2.10	24.29	1009.393198
4/14/2022	11:00:00 PM	0	11.211	5.4	4/14/2022	11:00:00 PM	0	893.056	-5.538	2.10	24.28	1009.396259
4/15/2022	12:00:00 AM	0	11.217	5.4	4/15/2022	12:00:00 AM	0	893.164	-6.037	2.11	24.28	1009.401158
4/15/2022	1:00:00 AM	0	11.223	5.4	4/15/2022	1:00:00 AM	0	893.19	-6.58	2.11	24.27	1009.406892
4/15/2022	2:00:00 AM	0	11.232	5.4	4/15/2022	2:00:00 AM	0	893.259	-7.076	2.12	24.26	1009.415189
4/15/2022	3:00:00 AM	0	11.238	5.4	4/15/2022	3:00:00 AM	0	893.35	-7.373	2.13	24.26	1009.420261
4/15/2022	4:00:00 AM	0	11.244	5.4	4/15/2022	4:00:00 AM	0	893.399	-8.078	2.13	24.25	1009.425761
4/15/2022	5:00:00 AM	0	11.247	5.4	4/15/2022	5:00:00 AM	0	893.667	-8.816	2.13	24.25	1009.426028
4/15/2022	6:00:00 AM	0	11.249	5.4	4/15/2022	6:00:00 AM	0	894.012	-8.79	2.13	24.25	1009.42451
4/15/2022	7:00:00 AM	0	11.249	5.4	4/15/2022	7:00:00 AM	0	894.879	-7.185	2.12	24.26	1009.415669
4/15/2022	8:00:00 AM	0	11.247	5.4	4/15/2022	8:00:00 AM	0	896.107	-0.98	2.11	24.28	1009.401147
4/15/2022	9:00:00 AM	0	11.246	5.4	4/15/2022	9:00:00 AM	0	896.564	5.92	2.10	24.28	1009.395487
4/15/2022	10:00:00 AM	0	11.246	5.4	4/15/2022	10:00:00 AM	0	896.854	11.398	2.10	24.29	1009.39253
4/15/2022	11:00:00 AM	0	11.249	5.4	4/15/2022	11:00:00 AM	0	896.934	12.589	2.10	24.28	1009.394714
4/15/2022	12:00:00 PM	0	11.253	5.4	4/15/2022	12:00:00 PM	0	896.563	9.703	2.11	24.28	1009.402497
4/15/2022	1:00:00 PM	0	11.261	5.4	4/15/2022	1:00:00 PM	0	896.53	12.834	2.12	24.27	1009.410834
4/15/2022	2:00:00 PM	0	11.271	5.4	4/15/2022	2:00:00 PM	0	896.564	16.172	2.13	24.26	1009.420487
4/15/2022	3:00:00 PM	0	11.277	5.4	4/15/2022	3:00:00 PM	0	896.239	9.222	2.14	24.25	1009.429801
4/15/2022	4:00:00 PM	0	11.285	5.4	4/15/2022	4:00:00 PM	0	895.797	5.868	2.15	24.24	1009.442308
4/15/2022	5:00:00 PM	0	11.289	5.4	4/15/2022	5:00:00 PM	0	895.599	4.246	2.16	24.23	1009.448327
4/15/2022	6:00:00 PM	0	11.291	5.4	4/15/2022	6:00:00 PM	0	895.253	1.558	2.16	24.23	1009.453856
4/15/2022	7:00:00 PM	0	11.292	5.4	4/15/2022	7:00:00 PM	0	895.351	-0.618	2.16	24.23	1009.453856
4/15/2022	8:00:00 PM	0	11.292	5.4	4/15/2022	8:00:00 PM	0	895.564	-1.419	2.16	24.23	1009.451684
4/15/2022	9:00:00 PM	0	11.291	5.4	4/15/2022	9:00:00 PM	0	895.572	-2.902	2.16	24.23	1009.450603
4/15/2022	10:00:00 PM	0	11.291	5.4	4/15/2022	10:00:00 PM	0	895.594	-3.966	2.16	24.23	1009.450378
4/15/2022	11:00:00 PM	0	11.292	5.4	4/15/2022	11:00:00 PM	0	895.382	-5.021	2.16	24.23	1009.45354
4/16/2022	12:00:00 AM	0	11.294	5.4	4/16/2022	12:00:00 AM	0	895.29	-5.618	2.16	24.22	1009.456478
4/16/2022	1:00:00 AM	0	11.3	5.4	4/16/2022	1:00:00 AM	0	895.292	-6.135	2.17	24.22	1009.462458
4/16/2022	2:00:00 AM	0	11.306	5.4	4/16/2022	2:00:00 AM	0	895.042	-6.651	2.18	24.21	1009.471007
4/16/2022	3:00:00 AM	0	11.31	5.4	4/16/2022	3:00:00 AM	0	894.725	-7.05	2.19	24.20	1009.47824
4/16/2022	4:00:00 AM	0	11.313	5.4	4/16/2022	4:00:00 AM	0	894.327	-7.177	2.19	24.19	1009.485298
4/16/2022	5:00:00 AM	0	11.313	5.4	4/16/2022	5:00:00 AM	0	894.064	-6.533	2.20	24.19	1009.48798

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/16/2022	6:00:00 AM	0	11.312	5.4	4/16/2022	6:00:00 AM	0	893.717	-6.518	2.20	24.19	1009.490519
4/16/2022	7:00:00 AM	0	11.307	5.4	4/16/2022	7:00:00 AM	0	893.583	-5.719	2.19	24.19	1009.486885
4/16/2022	8:00:00 AM	0	11.303	5.4	4/16/2022	8:00:00 AM	0	894.26	1.917	2.18	24.20	1009.475981
4/16/2022	9:00:00 AM	0	11.298	5.4	4/16/2022	9:00:00 AM	0	894.36	11.381	2.18	24.21	1009.469962
4/16/2022	10:00:00 AM	0	11.294	5.4	4/16/2022	10:00:00 AM	0	893.987	15.468	2.18	24.21	1009.469765
4/16/2022	11:00:00 AM	0	11.292	5.4	4/16/2022	11:00:00 AM	0	893.588	15.428	2.18	24.21	1009.471834
4/16/2022	12:00:00 PM	0	11.294	5.4	4/16/2022	12:00:00 PM	0	893.302	9.159	2.18	24.20	1009.47675
4/16/2022	1:00:00 PM	0	11.301	5.4	4/16/2022	1:00:00 PM	0	892.8	6.828	2.20	24.19	1009.488869
4/16/2022	2:00:00 PM	0	11.31	5.4	4/16/2022	2:00:00 PM	0	892.868	13.99	2.21	24.18	1009.497176
4/16/2022	3:00:00 PM	0	11.319	5.4	4/16/2022	3:00:00 PM	0	892.959	7.994	2.21	24.17	1009.505248
4/16/2022	4:00:00 PM	0	11.328	5.4	4/16/2022	4:00:00 PM	0	892.738	6.29	2.22	24.16	1009.516502
4/16/2022	5:00:00 PM	0	11.337	5.4	4/16/2022	5:00:00 PM	0	893.071	5.4	2.23	24.16	1009.522106
4/16/2022	6:00:00 PM	0	11.342	5.4	4/16/2022	6:00:00 PM	0	893.044	2.722	2.24	24.15	1009.527381
4/16/2022	7:00:00 PM	0	11.348	5.4	4/16/2022	7:00:00 PM	0	893.673	0.306	2.24	24.15	1009.526967
4/16/2022	8:00:00 PM	0	11.351	5.4	4/16/2022	8:00:00 PM	0	894.262	-1.865	2.23	24.16	1009.523961
4/16/2022	9:00:00 PM	0	11.351	5.4	4/16/2022	9:00:00 PM	0	894.64	-2.276	2.23	24.16	1009.520107
4/16/2022	10:00:00 PM	0	11.352	5.4	4/16/2022	10:00:00 PM	0	895.045	-3.846	2.23	24.16	1009.516977
4/16/2022	11:00:00 PM	0	11.354	5.4	4/16/2022	11:00:00 PM	0	895.438	-4.48	2.22	24.16	1009.514969
4/17/2022	12:00:00 AM	0	11.358	5.4	4/17/2022	12:00:00 AM	0	895.896	-5.023	2.22	24.16	1009.514299
4/17/2022	1:00:00 AM	0	11.364	5.4	4/17/2022	1:00:00 AM	0	896.223	-5.587	2.23	24.16	1009.516964
4/17/2022	2:00:00 AM	0	11.371	5.4	4/17/2022	2:00:00 AM	0	896.764	-6.101	2.23	24.16	1009.518448
4/17/2022	3:00:00 AM	0	11.379	5.4	4/17/2022	3:00:00 AM	0	897.162	-6.637	2.23	24.16	1009.522389
4/17/2022	4:00:00 AM	0	11.388	5.4	4/17/2022	4:00:00 AM	0	897.61	-6.933	2.23	24.15	1009.526821
4/17/2022	5:00:00 AM	0	11.393	5.4	4/17/2022	5:00:00 AM	0	898.139	-6.878	2.23	24.15	1009.526427
4/17/2022	6:00:00 AM	0	11.396	5.4	4/17/2022	6:00:00 AM	0	898.836	-6.502	2.23	24.16	1009.522319
4/17/2022	7:00:00 AM	0	11.397	5.4	4/17/2022	7:00:00 AM	0	899.789	-4.829	2.22	24.17	1009.513601
4/17/2022	8:00:00 AM	0	11.396	5.4	4/17/2022	8:00:00 AM	0	900.972	3.248	2.21	24.18	1009.500538
4/17/2022	9:00:00 AM	0	11.394	5.4	4/17/2022	9:00:00 AM	0	901.592	10.38	2.20	24.19	1009.492216
4/17/2022	10:00:00 AM	0	11.391	5.4	4/17/2022	10:00:00 AM	0	901.718	14.115	2.20	24.19	1009.487931
4/17/2022	11:00:00 AM	0	11.39	5.4	4/17/2022	11:00:00 AM	0	901.459	15.316	2.20	24.19	1009.489572
4/17/2022	12:00:00 PM	0	11.393	5.4	4/17/2022	12:00:00 PM	0	901.37	10.214	2.20	24.19	1009.493479
4/17/2022	1:00:00 PM	0	11.397	5.4	4/17/2022	1:00:00 PM	0	901.019	9.371	2.21	24.18	1009.501059
4/17/2022	2:00:00 PM	0	11.406	5.4	4/17/2022	2:00:00 PM	0	900.769	11.112	2.22	24.17	1009.512608
4/17/2022	3:00:00 PM	0	11.415	5.4	4/17/2022	3:00:00 PM	0	900.345	9.657	2.23	24.15	1009.525932
4/17/2022	4:00:00 PM	0	11.424	5.4	4/17/2022	4:00:00 PM	0	899.804	8.956	2.25	24.14	1009.540448
4/17/2022	5:00:00 PM	0	11.43	5.4	4/17/2022	5:00:00 PM	0	899.233	7.428	2.26	24.13	1009.552271
4/17/2022	6:00:00 PM	0	11.435	5.4	4/17/2022	6:00:00 PM	0	898.534	4.923	2.27	24.11	1009.564399
4/17/2022	7:00:00 PM	0	11.441	5.4	4/17/2022	7:00:00 PM	0	898.491	3.382	2.28	24.11	1009.570837
4/17/2022	8:00:00 PM	0	11.441	5.4	4/17/2022	8:00:00 PM	0	898.112	1.216	2.28	24.10	1009.574702
4/17/2022	9:00:00 PM	0	11.439	5.4	4/17/2022	9:00:00 PM	0	897.831	0.008	2.28	24.10	1009.575567
4/17/2022	10:00:00 PM	0	11.435	5.4	4/17/2022	10:00:00 PM	0	897.122	-0.404	2.29	24.10	1009.578797
4/17/2022	11:00:00 PM	0	11.432	5.4	4/17/2022	11:00:00 PM	0	896.583	-0.779	2.29	24.10	1009.581293
4/18/2022	12:00:00 AM	0	11.429	5.4	4/18/2022	12:00:00 AM	0	895.981	-1.113	2.29	24.09	1009.584432
4/18/2022	1:00:00 AM	0	11.426	5.4	4/18/2022	1:00:00 AM	0	895.221	-1.326	2.30	24.09	1009.589182
4/18/2022	2:00:00 AM	0	11.426	5.4	4/18/2022	2:00:00 AM	0	894.646	-1.123	2.30	24.08	1009.595045
4/18/2022	3:00:00 AM	0	11.424	5.4	4/18/2022	3:00:00 AM	0	893.802	-1.164	2.31	24.08	1009.601652
4/18/2022	4:00:00 AM	0	11.422	5.4	4/18/2022	4:00:00 AM	0	892.79	-1.171	2.32	24.07	1009.609971
4/18/2022	5:00:00 AM	0	11.421	5.4	4/18/2022	5:00:00 AM	0	892.046	-0.866	2.32	24.06	1009.616558
4/18/2022	6:00:00 AM	0	11.415	5.4	4/18/2022	6:00:00 AM	0	891.432	-0.368	2.32	24.06	1009.616819
4/18/2022	7:00:00 AM	0	11.409	5.4	4/18/2022	7:00:00 AM	0	890.798	0.78	2.33	24.06	1009.617284
4/18/2022	8:00:00 AM	0	11.4	5.4	4/18/2022	8:00:00 AM	0	890.355	2.006	2.32	24.07	1009.612802
4/18/2022	9:00:00 AM	0	11.391	5.4	4/18/2022	9:00:00 AM	0	889.596	2.722	2.32	24.07	1009.611541
4/18/2022	10:00:00 AM	0	11.382	5.4	4/18/2022	10:00:00 AM	0	889.045	3.042	2.32	24.07	1009.60816
4/18/2022	11:00:00 AM	0	11.374	5.4	4/18/2022	11:00:00 AM	0	888.332	2.85	2.32	24.07	1009.60743
4/18/2022	12:00:00 PM	0	11.371	5.4	4/18/2022	12:00:00 PM	0	887.466	2.604	2.32	24.07	1009.613261
4/18/2022	1:00:00 PM	0	11.368	5.4	4/18/2022	1:00:00 PM	0	886.094	1.395	2.33	24.05	1009.624252
4/18/2022	2:00:00 PM	0	11.368	5.4	4/18/2022	2:00:00 PM	0	885.085	1.304	2.34	24.04	1009.634541
4/18/2022	3:00:00 PM	0	11.37	5.4	4/18/2022	3:00:00 PM	0	884.002	1.394	2.36	24.03	1009.647584
4/18/2022	4:00:00 PM	0	11.374	5.4	4/18/2022	4:00:00 PM	0	882.932	1.22	2.37	24.02	1009.662495
4/18/2022	5:00:00 PM	0	11.376	5.4	4/18/2022	5:00:00 PM	0	881.685	0.98	2.39	24.00	1009.677211
4/18/2022	6:00:00 PM	0	11.379	5.4	4/18/2022	6:00:00 PM	0	880.683	0.645	2.40	23.99	1009.690429
4/18/2022	7:00:00 PM	0	11.381	5.4	4/18/2022	7:00:00 PM	0	879.827	-0.305	2.41	23.98	1009.701158
4/18/2022	8:00:00 PM	0	11.382	5.4	4/18/2022	8:00:00 PM	0	879.441	-0.497	2.41	23.97	1009.706094
4/18/2022	9:00:00 PM	0	11.378	5.4	4/18/2022	9:00:00 PM	0	878.618	-0.523	2.42	23.97	1009.710486
4/18/2022	10:00:00 PM	0	11.374	5.4	4/18/2022	10:00:00 PM	0	878.13	-0.526	2.42	23.97	1009.711462
4/18/2022	11:00:00 PM	0	11.37	5.4	4/18/2022	11:00:00 PM	0	877.853	-0.526	2.42	23.97	1009.710287
4/19/2022	12:00:00 AM	0	11.366	5.4	4/19/2022	12:00:00 AM	0	877.406	-0.529	2.42	23.97	1009.710845
4/19/2022	1:00:00 AM	0	11.364	5.4	4/19/2022	1:00:00 AM	0	877.242	-0.527	2.42	23.97	1009.710517
4/19/2022	2:00:00 AM	0	11.364	5.4	4/19/2022	2:00:00 AM	0	877.259	-0.525	2.42	23.97	1009.710344
4/19/2022	3:00:00 AM	0	11.366	5.4	4/19/2022	3:00:00 AM	0	877.31	-0.531	2.42	23.97	1009.711824
4/19/2022	4:00:00 AM	0	11.371	5.4	4/19/2022	4:00:00 AM	0	878.098	-0.537	2.42	23.97	1009.708789
4/19/2022	5:00:00 AM	0	11.378	5.4	4/19/2022	5:00:00 AM	0	878.998	-0.573	2.41	23.97	1009.706611

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/19/2022	6:00:00 AM	0	11.385	5.4	4/19/2022	6:00:00 AM	0	880.67	-0.584	2.40	23.98	1009.696561
4/19/2022	7:00:00 AM	0	11.388	5.4	4/19/2022	7:00:00 AM	0	881.956	-0.552	2.39	23.99	1009.686448
4/19/2022	8:00:00 AM	0	11.393	5.4	4/19/2022	8:00:00 AM	0	883.444	-0.518	2.38	24.00	1009.676274
4/19/2022	9:00:00 AM	0	11.391	5.4	4/19/2022	9:00:00 AM	0	884.579	-0.218	2.37	24.02	1009.662701
4/19/2022	10:00:00 AM	0	11.391	5.4	4/19/2022	10:00:00 AM	0	885.767	0.708	2.36	24.03	1009.650586
4/19/2022	11:00:00 AM	0	11.39	5.4	4/19/2022	11:00:00 AM	0	886.831	3.707	2.35	24.04	1009.638736
4/19/2022	12:00:00 PM	0	11.39	5.4	4/19/2022	12:00:00 PM	0	887.511	12.584	2.34	24.05	1009.631802
4/19/2022	1:00:00 PM	0	11.394	5.4	4/19/2022	1:00:00 PM	0	888.111	14.422	2.34	24.05	1009.629684
4/19/2022	2:00:00 PM	0	11.4	5.4	4/19/2022	2:00:00 PM	0	888.431	15.579	2.34	24.05	1009.632421
4/19/2022	3:00:00 PM	0	11.408	5.4	4/19/2022	3:00:00 PM	0	888.734	13.953	2.35	24.04	1009.637331
4/19/2022	4:00:00 PM	0	11.418	5.4	4/19/2022	4:00:00 PM	0	889.076	8.445	2.35	24.04	1009.643844
4/19/2022	5:00:00 PM	0	11.43	5.4	4/19/2022	5:00:00 PM	0	889.146	3.801	2.36	24.02	1009.65513
4/19/2022	6:00:00 PM	0	11.441	5.4	4/19/2022	6:00:00 PM	0	889.201	0.986	2.37	24.01	1009.665569
4/19/2022	7:00:00 PM	0	11.454	5.4	4/19/2022	7:00:00 PM	0	889.564	-0.714	2.38	24.00	1009.674868
4/19/2022	8:00:00 PM	0	11.46	5.4	4/19/2022	8:00:00 PM	0	889.776	-0.98	2.39	24.00	1009.678706
4/19/2022	9:00:00 PM	0	11.467	5.4	4/19/2022	9:00:00 PM	0	890.038	-3.286	2.39	24.00	1009.683034
4/19/2022	10:00:00 PM	0	11.472	5.4	4/19/2022	10:00:00 PM	0	890.208	-4.802	2.39	23.99	1009.686301
4/19/2022	11:00:00 PM	0	11.475	5.4	4/19/2022	11:00:00 PM	0	890.32	-5.716	2.40	23.99	1009.688158
4/20/2022	12:00:00 AM	0	11.477	5.4	4/20/2022	12:00:00 AM	0	890.61	-5.148	2.40	23.99	1009.687201
4/20/2022	1:00:00 AM	0	11.478	5.4	4/20/2022	1:00:00 AM	0	890.937	-4.058	2.39	23.99	1009.684867
4/20/2022	2:00:00 AM	0	11.481	5.4	4/20/2022	2:00:00 AM	0	890.789	-5.318	2.40	23.99	1009.689376
4/20/2022	3:00:00 AM	0	11.483	5.4	4/20/2022	3:00:00 AM	0	890.306	-7.126	2.40	23.98	1009.696301
4/20/2022	4:00:00 AM	0	11.486	5.4	4/20/2022	4:00:00 AM	0	890.323	-7.967	2.41	23.98	1009.699128
4/20/2022	5:00:00 AM	0	11.489	5.4	4/20/2022	5:00:00 AM	0	890.251	-8.931	2.41	23.98	1009.702862
4/20/2022	6:00:00 AM	0	11.489	5.4	4/20/2022	6:00:00 AM	0	890.141	-9.13	2.41	23.98	1009.703984
4/20/2022	7:00:00 AM	0	11.489	5.4	4/20/2022	7:00:00 AM	0	890.927	-5.935	2.40	23.98	1009.695969
4/20/2022	8:00:00 AM	0	11.486	5.4	4/20/2022	8:00:00 AM	0	891.584	-1.363	2.39	23.99	1009.686269
4/20/2022	9:00:00 AM	0	11.483	5.4	4/20/2022	9:00:00 AM	0	891.781	1.654	2.39	24.00	1009.68126
4/20/2022	10:00:00 AM	0	11.475	5.4	4/20/2022	10:00:00 AM	0	891.497	15.074	2.38	24.00	1009.676156
4/20/2022	11:00:00 AM	0	11.467	5.4	4/20/2022	11:00:00 AM	0	890.737	21.124	2.38	24.00	1009.675906
4/20/2022	12:00:00 PM	0	11.461	5.4	4/20/2022	12:00:00 PM	0	889.853	23.485	2.39	24.00	1009.678921
4/20/2022	1:00:00 PM	0	11.457	5.4	4/20/2022	1:00:00 PM	0	889.268	23.935	2.39	24.00	1009.680886
4/20/2022	2:00:00 PM	0	11.456	5.4	4/20/2022	2:00:00 PM	0	888.675	24.369	2.39	23.99	1009.685933
4/20/2022	3:00:00 PM	0	11.457	5.4	4/20/2022	3:00:00 PM	0	888.47	15.425	2.40	23.99	1009.689023
4/20/2022	4:00:00 PM	0	11.46	5.4	4/20/2022	4:00:00 PM	0	887.783	9.368	2.41	23.98	1009.699029
4/20/2022	5:00:00 PM	0	11.466	5.4	4/20/2022	5:00:00 PM	0	887.166	6.983	2.42	23.97	1009.71132
4/20/2022	6:00:00 PM	0	11.472	5.4	4/20/2022	6:00:00 PM	0	886.709	6.083	2.43	23.96	1009.721981
4/20/2022	7:00:00 PM	0	11.48	5.4	4/20/2022	7:00:00 PM	0	886.412	3.425	2.44	23.95	1009.733009
4/20/2022	8:00:00 PM	0	11.489	5.4	4/20/2022	8:00:00 PM	0	886.532	1.45	2.45	23.94	1009.740785
4/20/2022	9:00:00 PM	0	11.492	5.4	4/20/2022	9:00:00 PM	0	886.333	-0.163	2.45	23.93	1009.745815
4/20/2022	10:00:00 PM	0	11.495	5.4	4/20/2022	10:00:00 PM	0	885.933	-1.405	2.46	23.93	1009.752894
4/20/2022	11:00:00 PM	0	11.496	5.4	4/20/2022	11:00:00 PM	0	885.922	-0.715	2.46	23.92	1009.754006
4/21/2022	12:00:00 AM	0	11.496	5.4	4/21/2022	12:00:00 AM	0	885.726	0.03	2.46	23.92	1009.756004
4/21/2022	1:00:00 AM	0	11.496	5.4	4/21/2022	1:00:00 AM	0	885.685	0.42	2.46	23.92	1009.756422
4/21/2022	2:00:00 AM	0	11.495	5.4	4/21/2022	2:00:00 AM	0	885.169	0.176	2.47	23.92	1009.760684
4/21/2022	3:00:00 AM	0	11.495	5.4	4/21/2022	3:00:00 AM	0	884.974	-0.62	2.47	23.92	1009.762673
4/21/2022	4:00:00 AM	0	11.496	5.4	4/21/2022	4:00:00 AM	0	885.164	-0.89	2.47	23.92	1009.761735
4/21/2022	5:00:00 AM	0	11.499	5.4	4/21/2022	5:00:00 AM	0	885.547	-0.929	2.47	23.92	1009.76083
4/21/2022	6:00:00 AM	0	11.499	5.4	4/21/2022	6:00:00 AM	0	885.743	-0.675	2.47	23.92	1009.758831
4/21/2022	7:00:00 AM	0	11.498	5.4	4/21/2022	7:00:00 AM	0	885.9	0.496	2.46	23.92	1009.75623
4/21/2022	8:00:00 AM	0	11.496	5.4	4/21/2022	8:00:00 AM	0	886.613	11.521	2.46	23.93	1009.746959
4/21/2022	9:00:00 AM	0	11.495	5.4	4/21/2022	9:00:00 AM	0	886.749	18.143	2.45	23.93	1009.744573
4/21/2022	10:00:00 AM	0	11.49	5.4	4/21/2022	10:00:00 AM	0	886.893	19.081	2.45	23.94	1009.738104
4/21/2022	11:00:00 AM	0	11.487	5.4	4/21/2022	11:00:00 AM	0	886.94	15.627	2.44	23.94	1009.734625
4/21/2022	12:00:00 PM	0	11.484	5.4	4/21/2022	12:00:00 PM	0	886.99	15.949	2.44	23.95	1009.731115
4/21/2022	1:00:00 PM	0	11.484	5.4	4/21/2022	1:00:00 PM	0	887.209	17.174	2.44	23.95	1009.728882
4/21/2022	2:00:00 PM	0	11.484	5.4	4/21/2022	2:00:00 PM	0	887.354	16.245	2.44	23.95	1009.727403
4/21/2022	3:00:00 PM	0	11.486	5.4	4/21/2022	3:00:00 PM	0	887.405	14.992	2.44	23.95	1009.728883
4/21/2022	4:00:00 PM	0	11.492	5.4	4/21/2022	4:00:00 PM	0	887.952	13.193	2.44	23.95	1009.729305
4/21/2022	5:00:00 PM	0	11.501	5.4	4/21/2022	5:00:00 PM	0	888.844	11.072	2.44	23.95	1009.72921
4/21/2022	6:00:00 PM	0	11.511	5.4	4/21/2022	6:00:00 PM	0	889.502	7.512	2.44	23.95	1009.7325
4/21/2022	7:00:00 PM	0	11.523	5.4	4/21/2022	7:00:00 PM	0	890.187	5.073	2.45	23.94	1009.737515
4/21/2022	8:00:00 PM	0	11.534	5.4	4/21/2022	8:00:00 PM	0	890.653	2.895	2.45	23.94	1009.743763
4/21/2022	9:00:00 PM	0	11.543	5.4	4/21/2022	9:00:00 PM	0	891.026	2.215	2.46	23.93	1009.748959
4/21/2022	10:00:00 PM	0	11.55	5.4	4/21/2022	10:00:00 PM	0	891.287	1.013	2.46	23.93	1009.753298
4/21/2022	11:00:00 PM	0	11.556	5.4	4/21/2022	11:00:00 PM	0	891.496	0.137	2.47	23.92	1009.757167
4/22/2022	12:00:00 AM	0	11.562	5.4	4/22/2022	12:00:00 AM	0	891.88	-0.086	2.47	23.92	1009.759251
4/22/2022	1:00:00 AM	0	11.567	5.4	4/22/2022	1:00:00 AM	0	892.136	-0.101	2.47	23.92	1009.76164
4/22/2022	2:00:00 AM	0	11.571	5.4	4/22/2022	2:00:00 AM	0	892.427	-0.653	2.47	23.92	1009.762673
4/22/2022	3:00:00 AM	0	11.577	5.4	4/22/2022	3:00:00 AM	0	893.103	-0.927	2.47	23.92	1009.76178
4/22/2022	4:00:00 AM	0	11.579	5.4	4/22/2022	4:00:00 AM	0	893.447	-0.898	2.47	23.92	1009.760272
4/22/2022	5:00:00 AM	0	11.582	5.4	4/22/2022	5:00:00 AM	0	893.946	-0.881	2.47	23.92	1009.758183

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/22/2022	6:00:00 AM	0	11.585	5.4	4/22/2022	6:00:00 AM	0	894.234	-0.889	2.47	23.92	1009.758247
4/22/2022	7:00:00 AM	0	11.588	5.4	4/22/2022	7:00:00 AM	0	895	1.239	2.46	23.93	1009.753436
4/22/2022	8:00:00 AM	0	11.589	5.4	4/22/2022	8:00:00 AM	0	895.659	4.63	2.46	23.93	1009.747716
4/22/2022	9:00:00 AM	0	11.591	5.4	4/22/2022	9:00:00 AM	0	896.139	6.308	2.45	23.93	1009.744821
4/22/2022	10:00:00 AM	0	11.591	5.4	4/22/2022	10:00:00 AM	0	896.48	12.294	2.45	23.94	1009.741344
4/22/2022	11:00:00 AM	0	11.591	5.4	4/22/2022	11:00:00 AM	0	896.442	15.513	2.45	23.94	1009.741731
4/22/2022	12:00:00 PM	0	11.589	5.4	4/22/2022	12:00:00 PM	0	896.456	17.786	2.45	23.94	1009.739588
4/22/2022	1:00:00 PM	0	11.588	5.4	4/22/2022	1:00:00 PM	0	896.325	16.811	2.45	23.94	1009.739924
4/22/2022	2:00:00 PM	0	11.537	5.4	4/22/2022	2:00:00 PM	0	896.752	14.379	2.39	23.99	1009.68457
4/22/2022	3:00:00 PM	0	11.553	5.4	4/22/2022	3:00:00 PM	0	897.395	10.083	2.40	23.98	1009.694013
4/22/2022	4:00:00 PM	0	11.56	5.4	4/22/2022	4:00:00 PM	0	897.389	9.636	2.41	23.98	1009.701074
4/22/2022	5:00:00 PM	0	11.571	5.4	4/22/2022	5:00:00 PM	0	897.777	8.619	2.42	23.97	1009.708118
4/22/2022	6:00:00 PM	0	11.58	5.4	4/22/2022	6:00:00 PM	0	898.006	5.585	2.42	23.96	1009.714783
4/22/2022	7:00:00 PM	0	11.594	5.4	4/22/2022	7:00:00 PM	0	898.818	3.47	2.43	23.96	1009.720503
4/22/2022	8:00:00 PM	0	11.602	5.4	4/22/2022	8:00:00 PM	0	898.878	1.823	2.44	23.95	1009.727891
4/22/2022	9:00:00 PM	0	11.615	5.4	4/22/2022	9:00:00 PM	0	899.146	0.022	2.45	23.94	1009.738158
4/22/2022	10:00:00 PM	0	11.627	5.4	4/22/2022	10:00:00 PM	0	899.521	-0.317	2.45	23.93	1009.746334
4/22/2022	11:00:00 PM	0	11.636	5.4	4/22/2022	11:00:00 PM	0	899.851	-0.576	2.46	23.93	1009.751969
4/23/2022	12:00:00 AM	0	11.646	5.4	4/23/2022	12:00:00 AM	0	900.363	-1.124	2.46	23.92	1009.756748
4/23/2022	1:00:00 AM	0	11.652	5.4	4/23/2022	1:00:00 AM	0	900.527	-1.817	2.47	23.92	1009.761076
4/23/2022	2:00:00 AM	0	11.66	5.4	4/23/2022	2:00:00 AM	0	900.688	-2.038	2.48	23.91	1009.767434
4/23/2022	3:00:00 AM	0	11.666	5.4	4/23/2022	3:00:00 AM	0	901.146	-1.603	2.48	23.91	1009.768764
4/23/2022	4:00:00 AM	0	11.672	5.4	4/23/2022	4:00:00 AM	0	901.622	-1.981	2.48	23.91	1009.76991
4/23/2022	5:00:00 AM	0	11.675	5.4	4/23/2022	5:00:00 AM	0	901.849	-2.5	2.48	23.91	1009.770595
4/23/2022	6:00:00 AM	0	11.681	5.4	4/23/2022	6:00:00 AM	0	902.512	-2.289	2.48	23.91	1009.769834
4/23/2022	7:00:00 AM	0	11.682	5.4	4/23/2022	7:00:00 AM	0	902.843	-0.83	2.48	23.91	1009.767459
4/23/2022	8:00:00 AM	0	11.685	5.4	4/23/2022	8:00:00 AM	0	903.559	7.261	2.47	23.92	1009.763158
4/23/2022	9:00:00 AM	0	11.685	5.4	4/23/2022	9:00:00 AM	0	903.572	12.827	2.47	23.92	1009.763025
4/23/2022	10:00:00 AM	0	11.685	5.4	4/23/2022	10:00:00 AM	0	903.104	16.417	2.48	23.91	1009.767797
4/23/2022	11:00:00 AM	0	11.685	5.4	4/23/2022	11:00:00 AM	0	902.649	19.537	2.48	23.91	1009.772437
4/23/2022	12:00:00 PM	0	11.685	5.4	4/23/2022	12:00:00 PM	0	902.229	21.056	2.48	23.90	1009.77672
4/23/2022	1:00:00 PM	0	11.684	5.4	4/23/2022	1:00:00 PM	0	901.656	20.906	2.49	23.90	1009.781563
4/23/2022	2:00:00 PM	0	11.684	5.4	4/23/2022	2:00:00 PM	0	901.349	20.843	2.49	23.89	1009.784694
4/23/2022	3:00:00 PM	0	11.685	5.4	4/23/2022	3:00:00 PM	0	901.269	18.117	2.49	23.89	1009.786509
4/23/2022	4:00:00 PM	0	11.685	5.4	4/23/2022	4:00:00 PM	0	901.071	14.549	2.50	23.89	1009.788528
4/23/2022	5:00:00 PM	0	11.687	5.4	4/23/2022	5:00:00 PM	0	900.851	11.951	2.50	23.89	1009.792772
4/23/2022	6:00:00 PM	0	11.688	5.4	4/23/2022	6:00:00 PM	0	900.484	10.05	2.51	23.88	1009.797514
4/23/2022	7:00:00 PM	0	11.694	5.4	4/23/2022	7:00:00 PM	0	900.333	8.87	2.51	23.87	1009.805054
4/23/2022	8:00:00 PM	0	11.701	5.4	4/23/2022	8:00:00 PM	0	900.459	7.378	2.52	23.87	1009.810769
4/23/2022	9:00:00 PM	0	11.708	5.4	4/23/2022	9:00:00 PM	0	900.464	6.318	2.53	23.86	1009.817718
4/23/2022	10:00:00 PM	0	11.718	5.4	4/23/2022	10:00:00 PM	0	900.606	4.339	2.53	23.85	1009.82627
4/23/2022	11:00:00 PM	0	11.726	5.4	4/23/2022	11:00:00 PM	0	900.458	2.958	2.54	23.84	1009.835779
4/24/2022	12:00:00 AM	0	11.732	5.4	4/24/2022	12:00:00 AM	0	900.299	3.04	2.55	23.84	1009.843401
4/24/2022	1:00:00 AM	0	11.738	5.4	4/24/2022	1:00:00 AM	0	899.913	2.871	2.56	23.83	1009.853337
4/24/2022	2:00:00 AM	0	11.742	5.4	4/24/2022	2:00:00 AM	0	899.65	2.564	2.57	23.82	1009.860019
4/24/2022	3:00:00 AM	0	11.745	5.4	4/24/2022	3:00:00 AM	0	899.596	2.634	2.57	23.82	1009.863569
4/24/2022	4:00:00 AM	0	11.746	5.4	4/24/2022	4:00:00 AM	0	899.233	2.364	2.58	23.81	1009.868271
4/24/2022	5:00:00 AM	0	11.748	5.4	4/24/2022	5:00:00 AM	0	899.314	2.434	2.58	23.81	1009.869445
4/24/2022	6:00:00 AM	0	11.749	5.4	4/24/2022	6:00:00 AM	0	899.316	2.869	2.58	23.81	1009.870424
4/24/2022	7:00:00 AM	0	11.748	5.4	4/24/2022	7:00:00 AM	0	899.08	4.473	2.58	23.81	1009.871831
4/24/2022	8:00:00 AM	0	11.748	5.4	4/24/2022	8:00:00 AM	0	899.072	5.382	2.58	23.81	1009.871913
4/24/2022	9:00:00 AM	0	11.751	5.4	4/24/2022	9:00:00 AM	0	899.176	7.549	2.58	23.81	1009.873852
4/24/2022	10:00:00 AM	0	11.754	5.4	4/24/2022	10:00:00 AM	0	899.195	8.454	2.58	23.80	1009.876658
4/24/2022	11:00:00 AM	0	11.754	5.4	4/24/2022	11:00:00 AM	0	898.921	9.356	2.59	23.80	1009.879452
4/24/2022	12:00:00 PM	0	11.754	5.4	4/24/2022	12:00:00 PM	0	898.374	11.829	2.59	23.79	1009.88503
4/24/2022	1:00:00 PM	0	11.754	5.4	4/24/2022	1:00:00 PM	0	897.61	16.495	2.60	23.79	1009.892821
4/24/2022	2:00:00 PM	0	11.754	5.4	4/24/2022	2:00:00 PM	0	897.353	17.25	2.60	23.78	1009.895442
4/24/2022	3:00:00 PM	0	11.749	5.4	4/24/2022	3:00:00 PM	0	896.508	15.277	2.61	23.78	1009.899058
4/24/2022	4:00:00 PM	0	11.748	5.4	4/24/2022	4:00:00 PM	0	895.923	14.306	2.61	23.77	1009.904024
4/24/2022	5:00:00 PM	0	11.743	5.4	4/24/2022	5:00:00 PM	0	895.142	12.188	2.62	23.77	1009.906988
4/24/2022	6:00:00 PM	0	11.742	5.4	4/24/2022	6:00:00 PM	0	894.455	10.497	2.62	23.77	1009.912993
4/24/2022	7:00:00 PM	0	11.742	5.4	4/24/2022	7:00:00 PM	0	893.94	9.497	2.63	23.76	1009.918245
4/24/2022	8:00:00 PM	0	11.746	5.4	4/24/2022	8:00:00 PM	0	893.894	8.747	2.63	23.76	1009.922714
4/24/2022	9:00:00 PM	0	11.753	5.4	4/24/2022	9:00:00 PM	0	894.083	8.501	2.64	23.75	1009.927786
4/24/2022	10:00:00 PM	0	11.757	5.4	4/24/2022	10:00:00 PM	0	893.716	7.864	2.64	23.74	1009.935529
4/24/2022	11:00:00 PM	0	11.766	5.4	4/24/2022	11:00:00 PM	0	893.808	7.176	2.65	23.74	1009.943591
4/25/2022	12:00:00 AM	0	11.772	5.4	4/25/2022	12:00:00 AM	0	893.673	6.646	2.66	23.73	1009.950967
4/25/2022	1:00:00 AM	0	11.78	5.4	4/25/2022	1:00:00 AM	0	893.584	6.296	2.67	23.72	1009.959875
4/25/2022	2:00:00 AM	0	11.786	5.4	4/25/2022	2:00:00 AM	0	893.41	5.867	2.68	23.71	1009.967649
4/25/2022	3:00:00 AM	0	11.787	5.4	4/25/2022	3:00:00 AM	0	893.019	5.66	2.68	23.71	1009.972636
4/25/2022	4:00:00 AM	0	11.789	5.4	4/25/2022	4:00:00 AM	0	892.834	5.329	2.68	23.70	1009.976523
4/25/2022	5:00:00 AM	0	11.789	5.4	4/25/2022	5:00:00 AM	0	892.553	4.848	2.69	23.70	1009.979388

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/25/2022	6:00:00 AM	0	11.787	5.4	4/25/2022	6:00:00 AM	0	892.157	4.756	2.69	23.70	1009.981426
4/25/2022	7:00:00 AM	0	11.786	5.4	4/25/2022	7:00:00 AM	0	892.046	5.825	2.69	23.70	1009.981558
4/25/2022	8:00:00 AM	0	11.786	5.4	4/25/2022	8:00:00 AM	0	892.061	7.193	2.69	23.70	1009.981405
4/25/2022	9:00:00 AM	0	11.787	5.4	4/25/2022	9:00:00 AM	0	891.691	6.707	2.69	23.69	1009.986178
4/25/2022	10:00:00 AM	0	11.784	5.4	4/25/2022	10:00:00 AM	0	891.109	11.858	2.70	23.69	1009.989113
4/25/2022	11:00:00 AM	0	11.794	5.4	4/25/2022	11:00:00 AM	0	891.674	10.373	2.70	23.69	1009.993351
4/25/2022	12:00:00 PM	0	11.804	5.4	4/25/2022	12:00:00 PM	0	892.451	7.052	2.70	23.68	1009.995428
4/25/2022	1:00:00 PM	0	11.807	5.4	4/25/2022	1:00:00 PM	0	892.448	8.545	2.71	23.68	1009.998459
4/25/2022	2:00:00 PM	0	11.808	5.4	4/25/2022	2:00:00 PM	0	892.116	14.586	2.71	23.68	1010.002844
4/25/2022	3:00:00 PM	0	11.81	5.4	4/25/2022	3:00:00 PM	0	891.988	12.552	2.71	23.67	1010.00615
4/25/2022	4:00:00 PM	0	11.811	5.4	4/25/2022	4:00:00 PM	0	891.86	9.191	2.72	23.67	1010.008455
4/25/2022	5:00:00 PM	0	11.813	5.4	4/25/2022	5:00:00 PM	0	892.054	8.911	2.72	23.67	1010.008476
4/25/2022	6:00:00 PM	0	11.814	5.4	4/25/2022	6:00:00 PM	0	892.123	8.101	2.72	23.67	1010.008773
4/25/2022	7:00:00 PM	0	11.817	5.4	4/25/2022	7:00:00 PM	0	892.315	6.153	2.72	23.67	1010.009815
4/25/2022	8:00:00 PM	0	11.82	5.4	4/25/2022	8:00:00 PM	0	892.497	3.665	2.72	23.67	1010.010959
4/25/2022	9:00:00 PM	0	11.825	5.4	4/25/2022	9:00:00 PM	0	892.515	2.074	2.72	23.66	1010.015776
4/25/2022	10:00:00 PM	0	11.834	5.4	4/25/2022	10:00:00 PM	0	892.917	1.148	2.73	23.66	1010.020676
4/25/2022	11:00:00 PM	0	11.841	5.4	4/25/2022	11:00:00 PM	0	893.155	0.764	2.73	23.65	1010.025249
4/26/2022	12:00:00 AM	0	11.849	5.4	4/26/2022	12:00:00 AM	0	893.02	0.757	2.74	23.64	1010.034626
4/26/2022	1:00:00 AM	0	11.856	5.4	4/26/2022	1:00:00 AM	0	892.948	-0.042	2.75	23.64	1010.04236
4/26/2022	2:00:00 AM	0	11.862	5.4	4/26/2022	2:00:00 AM	0	892.865	-0.607	2.76	23.63	1010.049207
4/26/2022	3:00:00 AM	0	11.867	5.4	4/26/2022	3:00:00 AM	0	892.659	-0.769	2.76	23.62	1010.056307
4/26/2022	4:00:00 AM	0	11.87	5.4	4/26/2022	4:00:00 AM	0	892.722	-0.89	2.77	23.62	1010.058665
4/26/2022	5:00:00 AM	0	11.87	5.4	4/26/2022	5:00:00 AM	0	892.605	-1.454	2.77	23.62	1010.059858
4/26/2022	6:00:00 AM	0	11.87	5.4	4/26/2022	6:00:00 AM	0	892.35	-1.65	2.77	23.62	1010.062458
4/26/2022	7:00:00 AM	0	11.868	5.4	4/26/2022	7:00:00 AM	0	892.598	0.864	2.77	23.62	1010.057929
4/26/2022	8:00:00 AM	0	11.868	5.4	4/26/2022	8:00:00 AM	0	892.798	7.997	2.76	23.62	1010.05589
4/26/2022	9:00:00 AM	0	11.868	5.4	4/26/2022	9:00:00 AM	0	892.63	13.332	2.77	23.62	1010.057603
4/26/2022	10:00:00 AM	0	11.87	5.4	4/26/2022	10:00:00 AM	0	892.352	15.735	2.77	23.62	1010.062438
4/26/2022	11:00:00 AM	0	11.874	5.4	4/26/2022	11:00:00 AM	0	891.979	18.055	2.78	23.61	1010.070241
4/26/2022	12:00:00 PM	0	11.879	5.4	4/26/2022	12:00:00 PM	0	891.901	16.568	2.78	23.60	1010.076037
4/26/2022	1:00:00 PM	0	11.883	5.4	4/26/2022	1:00:00 PM	0	891.609	14.641	2.79	23.60	1010.083014
4/26/2022	2:00:00 PM	0	11.89	5.4	4/26/2022	2:00:00 PM	0	892.065	15.762	2.79	23.59	1010.085364
4/26/2022	3:00:00 PM	0	11.895	5.4	4/26/2022	3:00:00 PM	0	892.062	13.841	2.80	23.59	1010.090395
4/26/2022	4:00:00 PM	0	11.898	5.4	4/26/2022	4:00:00 PM	0	892.301	10.897	2.80	23.59	1010.090958
4/26/2022	5:00:00 PM	0	11.9	5.4	4/26/2022	5:00:00 PM	0	892.249	8.687	2.80	23.59	1010.093488
4/26/2022	6:00:00 PM	0	11.901	5.4	4/26/2022	6:00:00 PM	0	892.457	7.23	2.80	23.59	1010.092367
4/26/2022	7:00:00 PM	0	11.9	5.4	4/26/2022	7:00:00 PM	0	892.555	5.212	2.80	23.59	1010.090368
4/26/2022	8:00:00 PM	0	11.901	5.4	4/26/2022	8:00:00 PM	0	892.875	2.053	2.80	23.59	1010.088105
4/26/2022	9:00:00 PM	0	11.904	5.4	4/26/2022	9:00:00 PM	0	892.994	0.087	2.80	23.59	1010.089891
4/26/2022	10:00:00 PM	0	11.907	5.4	4/26/2022	10:00:00 PM	0	892.936	-0.97	2.80	23.59	1010.093483
4/26/2022	11:00:00 PM	0	11.913	5.4	4/26/2022	11:00:00 PM	0	893.077	-1.598	2.81	23.58	1010.098045
4/27/2022	12:00:00 AM	0	11.922	5.4	4/27/2022	12:00:00 AM	0	893.411	-1.03	2.81	23.58	1010.103639
4/27/2022	1:00:00 AM	0	11.93	5.4	4/27/2022	1:00:00 AM	0	893.707	-0.873	2.82	23.57	1010.108621
4/27/2022	2:00:00 AM	0	11.937	5.4	4/27/2022	2:00:00 AM	0	893.901	-0.527	2.82	23.57	1010.113642
4/27/2022	3:00:00 AM	0	11.945	5.4	4/27/2022	3:00:00 AM	0	894.289	-0.312	2.83	23.56	1010.117686
4/27/2022	4:00:00 AM	0	11.948	5.4	4/27/2022	4:00:00 AM	0	894.367	-0.426	2.83	23.56	1010.11989
4/27/2022	5:00:00 AM	0	11.948	5.4	4/27/2022	5:00:00 AM	0	894.184	-0.409	2.83	23.56	1010.121756
4/27/2022	6:00:00 AM	0	11.946	5.4	4/27/2022	6:00:00 AM	0	894.116	-0.252	2.83	23.56	1010.12045
4/27/2022	7:00:00 AM	0	11.945	5.4	4/27/2022	7:00:00 AM	0	894.096	-0.03	2.83	23.56	1010.119654
4/27/2022	8:00:00 AM	0	11.945	5.4	4/27/2022	8:00:00 AM	0	894.087	0.481	2.83	23.56	1010.119746
4/27/2022	9:00:00 AM	0	11.946	5.4	4/27/2022	9:00:00 AM	0	894.328	2.113	2.83	23.56	1010.118288
4/27/2022	10:00:00 AM	0	11.949	5.4	4/27/2022	10:00:00 AM	0	894.55	4.884	2.83	23.56	1010.119024
4/27/2022	11:00:00 AM	0	11.954	5.4	4/27/2022	11:00:00 AM	0	894.623	9.387	2.83	23.56	1010.12328
4/27/2022	12:00:00 PM	0	11.96	5.4	4/27/2022	12:00:00 PM	0	894.499	14.041	2.84	23.55	1010.130544
4/27/2022	1:00:00 PM	0	11.969	5.4	4/27/2022	1:00:00 PM	0	894.64	13.624	2.85	23.54	1010.138107
4/27/2022	2:00:00 PM	0	11.977	5.4	4/27/2022	2:00:00 PM	0	894.978	12.915	2.85	23.54	1010.14266
4/27/2022	3:00:00 PM	0	11.988	5.4	4/27/2022	3:00:00 PM	0	895.411	7.076	2.86	23.53	1010.149244
4/27/2022	4:00:00 PM	0	11.999	5.4	4/27/2022	4:00:00 PM	0	895.725	2.123	2.87	23.52	1010.157043
4/27/2022	5:00:00 PM	0	11.997	5.4	4/27/2022	5:00:00 PM	0	895.516	2.914	2.87	23.52	1010.157174
4/27/2022	6:00:00 PM	0	11.996	5.4	4/27/2022	6:00:00 PM	0	895.54	4.887	2.86	23.52	1010.155929
4/27/2022	7:00:00 PM	0	11.999	5.4	4/27/2022	7:00:00 PM	0	895.908	4.124	2.86	23.52	1010.155176
4/27/2022	8:00:00 PM	0	12	5.4	4/27/2022	8:00:00 PM	0	895.993	0.473	2.86	23.52	1010.15531
4/27/2022	9:00:00 PM	0	11.999	5.4	4/27/2022	9:00:00 PM	0	895.933	-0.514	2.86	23.52	1010.154922
4/27/2022	10:00:00 PM	0	12.002	5.4	4/27/2022	10:00:00 PM	0	895.876	-0.772	2.87	23.52	1010.158503
4/27/2022	11:00:00 PM	0	12.005	5.4	4/27/2022	11:00:00 PM	0	895.795	-1.887	2.87	23.52	1010.162329
4/28/2022	12:00:00 AM	0	12.011	5.4	4/28/2022	12:00:00 AM	0	895.683	-1.649	2.88	23.51	1010.169471
4/28/2022	1:00:00 AM	0	12.018	5.4	4/28/2022	1:00:00 AM	0	895.789	-1.614	2.88	23.50	1010.17539
4/28/2022	2:00:00 AM	0	12.024	5.4	4/28/2022	2:00:00 AM	0	895.698	-1.662	2.89	23.50	1010.182318
4/28/2022	3:00:00 AM	0	12.03	5.4	4/28/2022	3:00:00 AM	0	895.826	-1.538	2.90	23.49	1010.187013
4/28/2022	4:00:00 AM	0	12.031	5.4	4/28/2022	4:00:00 AM	0	895.647	-1.511	2.90	23.49	1010.189838
4/28/2022	5:00:00 AM	0	12.033	5.4	4/28/2022	5:00:00 AM	0	895.492	-1.452	2.90	23.49	1010.193419

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/28/2022	6:00:00 AM	0	12.031	5.4	4/28/2022	6:00:00 AM	0	895.58	-0.827	2.90	23.49	1010.190521
4/28/2022	7:00:00 AM	0	12.03	5.4	4/28/2022	7:00:00 AM	0	895.681	0.196	2.90	23.49	1010.188491
4/28/2022	8:00:00 AM	0	12.027	5.4	4/28/2022	8:00:00 AM	0	896.009	8.97	2.89	23.50	1010.182147
4/28/2022	9:00:00 AM	0	12.027	5.4	4/28/2022	9:00:00 AM	0	896.13	11.06	2.89	23.50	1010.180913
4/28/2022	10:00:00 AM	0	12.027	5.4	4/28/2022	10:00:00 AM	0	895.863	12.027	2.89	23.50	1010.183635
4/28/2022	11:00:00 AM	0	12.03	5.4	4/28/2022	11:00:00 AM	0	895.658	12.928	2.90	23.49	1010.188726
4/28/2022	12:00:00 PM	0	12.036	5.4	4/28/2022	12:00:00 PM	0	895.261	8.688	2.91	23.48	1010.198774
4/28/2022	1:00:00 PM	0	12.045	5.4	4/28/2022	1:00:00 PM	0	895.082	7.296	2.92	23.47	1010.209599
4/28/2022	2:00:00 PM	0	12.056	5.4	4/28/2022	2:00:00 PM	0	895.459	6.94	2.92	23.46	1010.216755
4/28/2022	3:00:00 PM	0	12.065	5.4	4/28/2022	3:00:00 PM	0	895.485	6.483	2.93	23.45	1010.22549
4/28/2022	4:00:00 PM	0	12.068	5.4	4/28/2022	4:00:00 PM	0	895.182	6.607	2.94	23.45	1010.23158
4/28/2022	5:00:00 PM	0	12.072	5.4	4/28/2022	5:00:00 PM	0	895.089	4.866	2.94	23.44	1010.236528
4/28/2022	6:00:00 PM	0	12.073	5.4	4/28/2022	6:00:00 PM	0	894.847	3.268	2.95	23.44	1010.239996
4/28/2022	7:00:00 PM	0	12.075	5.4	4/28/2022	7:00:00 PM	0	895.164	3.255	2.95	23.44	1010.238763
4/28/2022	8:00:00 PM	0	12.076	5.4	4/28/2022	8:00:00 PM	0	895.43	0.221	2.95	23.44	1010.237051
4/28/2022	9:00:00 PM	0	12.078	5.4	4/28/2022	9:00:00 PM	0	895.675	-1.453	2.94	23.44	1010.236552
4/28/2022	10:00:00 PM	0	12.081	5.4	4/28/2022	10:00:00 PM	0	896.024	-1.141	2.94	23.44	1010.235994
4/28/2022	11:00:00 PM	0	12.084	5.4	4/28/2022	11:00:00 PM	0	896.439	-1.1	2.94	23.44	1010.234762
4/29/2022	12:00:00 AM	0	12.092	5.4	4/29/2022	12:00:00 AM	0	896.665	-2.085	2.95	23.44	1010.240457
4/29/2022	1:00:00 AM	0	12.098	5.4	4/29/2022	1:00:00 AM	0	896.955	-2.231	2.95	23.44	1010.2435
4/29/2022	2:00:00 AM	0	12.107	5.4	4/29/2022	2:00:00 AM	0	897.38	-2.127	2.96	23.43	1010.248166
4/29/2022	3:00:00 AM	0	12.113	5.4	4/29/2022	3:00:00 AM	0	897.492	-2.4	2.96	23.43	1010.253024
4/29/2022	4:00:00 AM	0	12.118	5.4	4/29/2022	4:00:00 AM	0	897.806	-3.096	2.96	23.42	1010.254822
4/29/2022	5:00:00 AM	0	12.123	5.4	4/29/2022	5:00:00 AM	0	898.182	-3.426	2.96	23.42	1010.255988
4/29/2022	6:00:00 AM	0	12.126	5.4	4/29/2022	6:00:00 AM	0	898.885	-3.226	2.96	23.43	1010.251819
4/29/2022	7:00:00 AM	0	12.124	5.4	4/29/2022	7:00:00 AM	0	899.409	-1.404	2.95	23.43	1010.244476
4/29/2022	8:00:00 AM	0	12.121	5.4	4/29/2022	8:00:00 AM	0	900.079	5.136	2.94	23.44	1010.234644
4/29/2022	9:00:00 AM	0	12.121	5.4	4/29/2022	9:00:00 AM	0	900.466	11.465	2.94	23.45	1010.230698
4/29/2022	10:00:00 AM	0	12.121	5.4	4/29/2022	10:00:00 AM	0	900.227	16.624	2.94	23.45	1010.233135
4/29/2022	11:00:00 AM	0	12.124	5.4	4/29/2022	11:00:00 AM	0	899.842	20.138	2.95	23.44	1010.240061
4/29/2022	12:00:00 PM	0	12.129	5.4	4/29/2022	12:00:00 PM	0	899.549	17.919	2.96	23.43	1010.248048
4/29/2022	1:00:00 PM	0	12.138	5.4	4/29/2022	1:00:00 PM	0	899.43	20.025	2.97	23.42	1010.258262
4/29/2022	2:00:00 PM	0	12.147	5.4	4/29/2022	2:00:00 PM	0	899.207	17.206	2.98	23.41	1010.269536
4/29/2022	3:00:00 PM	0	12.156	5.4	4/29/2022	3:00:00 PM	0	899.151	13.748	2.99	23.40	1010.279107
4/29/2022	4:00:00 PM	0	12.162	5.4	4/29/2022	4:00:00 PM	0	898.827	10.944	3.00	23.39	1010.288411
4/29/2022	5:00:00 PM	0	12.166	5.4	4/29/2022	5:00:00 PM	0	898.461	9.124	3.00	23.38	1010.296143
4/29/2022	6:00:00 PM	0	12.168	5.4	4/29/2022	6:00:00 PM	0	898.15	8.084	3.01	23.38	1010.301314
4/29/2022	7:00:00 PM	0	12.171	5.4	4/29/2022	7:00:00 PM	0	898.248	7.875	3.01	23.38	1010.303315
4/29/2022	8:00:00 PM	0	12.171	5.4	4/29/2022	8:00:00 PM	0	898.306	4.904	3.01	23.38	1010.302724
4/29/2022	9:00:00 PM	0	12.171	5.4	4/29/2022	9:00:00 PM	0	898.228	3.167	3.01	23.38	1010.303519
4/29/2022	10:00:00 PM	0	12.171	5.4	4/29/2022	10:00:00 PM	0	898.136	2.521	3.01	23.37	1010.304457
4/29/2022	11:00:00 PM	0	12.172	5.4	4/29/2022	11:00:00 PM	0	898.054	1.12	3.01	23.37	1010.306293
4/30/2022	12:00:00 AM	0	12.174	5.4	4/30/2022	12:00:00 AM	0	897.683	0.148	3.02	23.37	1010.312076
4/30/2022	1:00:00 AM	0	12.179	5.4	4/30/2022	1:00:00 AM	0	897.632	-0.624	3.03	23.36	1010.317597
4/30/2022	2:00:00 AM	0	12.183	5.4	4/30/2022	2:00:00 AM	0	897.393	-1.57	3.03	23.35	1010.324034
4/30/2022	3:00:00 AM	0	12.186	5.4	4/30/2022	3:00:00 AM	0	897.065	-1.823	3.04	23.35	1010.330378
4/30/2022	4:00:00 AM	0	12.189	5.4	4/30/2022	4:00:00 AM	0	897.005	-1.692	3.04	23.35	1010.33399
4/30/2022	5:00:00 AM	0	12.189	5.4	4/30/2022	5:00:00 AM	0	896.759	-2.457	3.04	23.34	1010.336499
4/30/2022	6:00:00 AM	0	12.189	5.4	4/30/2022	6:00:00 AM	0	896.898	-1.744	3.04	23.34	1010.335081
4/30/2022	7:00:00 AM	0	12.188	5.4	4/30/2022	7:00:00 AM	0	897.331	1.15	3.04	23.35	1010.329666
4/30/2022	8:00:00 AM	0	12.185	5.4	4/30/2022	8:00:00 AM	0	897.74	8.095	3.03	23.36	1010.322495
4/30/2022	9:00:00 AM	0	12.182	5.4	4/30/2022	9:00:00 AM	0	897.737	9.758	3.03	23.36	1010.319526
4/30/2022	10:00:00 AM	0	12.182	5.4	4/30/2022	10:00:00 AM	0	897.701	13.043	3.03	23.36	1010.319893
4/30/2022	11:00:00 AM	0	12.183	5.4	4/30/2022	11:00:00 AM	0	897.66	16.24	3.03	23.36	1010.321311
4/30/2022	12:00:00 PM	0	12.188	5.4	4/30/2022	12:00:00 PM	0	897.629	16.59	3.03	23.35	1010.326627
4/30/2022	1:00:00 PM	0	12.195	5.4	4/30/2022	1:00:00 PM	0	897.567	16.779	3.04	23.34	1010.334259
4/30/2022	2:00:00 PM	0	12.203	5.4	4/30/2022	2:00:00 PM	0	897.074	21.096	3.06	23.33	1010.347287
4/30/2022	3:00:00 PM	0	12.213	5.4	4/30/2022	3:00:00 PM	0	897.508	17.279	3.06	23.33	1010.352861
4/30/2022	4:00:00 PM	0	12.224	5.4	4/30/2022	4:00:00 PM	0	897.742	13.835	3.07	23.32	1010.361475
4/30/2022	5:00:00 PM	0	12.233	5.4	4/30/2022	5:00:00 PM	0	897.99	12.384	3.08	23.31	1010.367946
4/30/2022	6:00:00 PM	0	12.237	5.4	4/30/2022	6:00:00 PM	0	897.996	9.751	3.08	23.31	1010.371885
4/30/2022	7:00:00 PM	0	12.242	5.4	4/30/2022	7:00:00 PM	0	898.314	8.371	3.08	23.31	1010.373642
4/30/2022	8:00:00 PM	0	12.245	5.4	4/30/2022	8:00:00 PM	0	898.508	4.901	3.08	23.30	1010.374664
4/30/2022	9:00:00 PM	0	12.245	5.4	4/30/2022	9:00:00 PM	0	898.397	2.114	3.08	23.30	1010.375796
4/30/2022	10:00:00 PM	0	12.245	5.4	4/30/2022	10:00:00 PM	0	898.486	0.968	3.08	23.30	1010.374888
4/30/2022	11:00:00 PM	0	12.245	5.4	4/30/2022	11:00:00 PM	0	898.24	0.335	3.09	23.30	1010.377397
5/1/2022	12:00:00 AM	0	12.249	5.4	5/1/2022	12:00:00 AM	0	898.369	-0.26	3.09	23.30	1010.380081
5/1/2022	1:00:00 AM	0	12.252	5.4	5/1/2022	1:00:00 AM	0	898.328	-0.869	3.09	23.30	1010.383499
5/1/2022	2:00:00 AM	0	12.255	5.4	5/1/2022	2:00:00 AM	0	897.938	-1.288	3.10	23.29	1010.390476
5/1/2022	3:00:00 AM	0	12.258	5.4	5/1/2022	3:00:00 AM	0	897.584	-1.699	3.11	23.28	1010.397086
5/1/2022	4:00:00 AM	0	12.262	5.4	5/1/2022	4:00:00 AM	0	897.731	-1.73	3.11	23.28	1010.399587
5/1/2022	5:00:00 AM	0	12.264	5.4	5/1/2022	5:00:00 AM	0	897.791	-2.024	3.11	23.28	1010.400975

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/1/2022	6:00:00 AM	0	12.262	5.4	5/1/2022	6:00:00 AM	0	897.538	-1.832	3.11	23.28	1010.401555
5/1/2022	7:00:00 AM	0	12.259	5.4	5/1/2022	7:00:00 AM	0	897.653	1.324	3.11	23.28	1010.397382
5/1/2022	8:00:00 AM	0	12.254	5.4	5/1/2022	8:00:00 AM	0	897.64	9.664	3.10	23.29	1010.392515
5/1/2022	9:00:00 AM	0	12.249	5.4	5/1/2022	9:00:00 AM	0	897.173	15.18	3.10	23.29	1010.392277
5/1/2022	10:00:00 AM	0	12.246	5.4	5/1/2022	10:00:00 AM	0	896.759	19.104	3.10	23.29	1010.393499
5/1/2022	11:00:00 AM	0	12.242	5.4	5/1/2022	11:00:00 AM	0	895.867	20.74	3.11	23.28	1010.398595
5/1/2022	12:00:00 PM	0	12.242	5.4	5/1/2022	12:00:00 PM	0	895.131	21.259	3.11	23.27	1010.4061
5/1/2022	1:00:00 PM	0	12.245	5.4	5/1/2022	1:00:00 PM	0	894.519	18.848	3.12	23.26	1010.41534
5/1/2022	2:00:00 PM	0	12.252	5.4	5/1/2022	2:00:00 PM	0	893.87	17.972	3.14	23.25	1010.428958
5/1/2022	3:00:00 PM	0	12.258	5.4	5/1/2022	3:00:00 PM	0	893.415	17.317	3.15	23.24	1010.439598
5/1/2022	4:00:00 PM	0	12.264	5.4	5/1/2022	4:00:00 PM	0	892.789	15.499	3.16	23.23	1010.451982
5/1/2022	5:00:00 PM	0	12.272	5.4	5/1/2022	5:00:00 PM	0	892.45	13.542	3.17	23.22	1010.463438
5/1/2022	6:00:00 PM	0	12.276	5.4	5/1/2022	6:00:00 PM	0	892.063	11.79	3.18	23.21	1010.471385
5/1/2022	7:00:00 PM	0	12.278	5.4	5/1/2022	7:00:00 PM	0	891.649	10.052	3.19	23.20	1010.477606
5/1/2022	8:00:00 PM	0	12.279	5.4	5/1/2022	8:00:00 PM	0	891.389	8.574	3.19	23.20	1010.481258
5/1/2022	9:00:00 PM	0	12.279	5.4	5/1/2022	9:00:00 PM	0	891.382	7.866	3.19	23.20	1010.481329
5/1/2022	10:00:00 PM	0	12.278	5.4	5/1/2022	10:00:00 PM	0	891.25	6.664	3.19	23.20	1010.481675
5/1/2022	11:00:00 PM	0	12.276	5.4	5/1/2022	11:00:00 PM	0	891.028	5.5	3.19	23.20	1010.481939
5/2/2022	12:00:00 AM	0	12.278	5.4	5/2/2022	12:00:00 AM	0	891.089	4.568	3.19	23.20	1010.483317
5/2/2022	1:00:00 AM	0	12.279	5.4	5/2/2022	1:00:00 AM	0	890.878	4.054	3.19	23.19	1010.486468
5/2/2022	2:00:00 AM	0	12.281	5.4	5/2/2022	2:00:00 AM	0	890.475	3.616	3.20	23.19	1010.492578
5/2/2022	3:00:00 AM	0	12.284	5.4	5/2/2022	3:00:00 AM	0	890.492	2.882	3.20	23.18	1010.495405
5/2/2022	4:00:00 AM	0	12.287	5.4	5/2/2022	4:00:00 AM	0	890.391	2.182	3.21	23.18	1010.499434
5/2/2022	5:00:00 AM	0	12.29	5.4	5/2/2022	5:00:00 AM	0	890.594	2.216	3.21	23.18	1010.500364
5/2/2022	6:00:00 AM	0	12.293	5.4	5/2/2022	6:00:00 AM	0	891.142	2.97	3.21	23.18	1010.497776
5/2/2022	7:00:00 AM	0	12.293	5.4	5/2/2022	7:00:00 AM	0	891.651	3.962	3.20	23.19	1010.492586
5/2/2022	8:00:00 AM	0	12.293	5.4	5/2/2022	8:00:00 AM	0	892.154	5.154	3.20	23.19	1010.487457
5/2/2022	9:00:00 AM	0	12.29	5.4	5/2/2022	9:00:00 AM	0	892.478	5.822	3.19	23.20	1010.481153
5/2/2022	10:00:00 AM	0	12.29	5.4	5/2/2022	10:00:00 AM	0	892.702	7.832	3.19	23.20	1010.478869
5/2/2022	11:00:00 AM	0	12.29	5.4	5/2/2022	11:00:00 AM	0	892.992	10.615	3.18	23.20	1010.475912
5/2/2022	12:00:00 PM	0	12.293	5.4	5/2/2022	12:00:00 PM	0	892.995	12.983	3.19	23.20	1010.478881
5/2/2022	1:00:00 PM	0	12.299	5.4	5/2/2022	1:00:00 PM	0	893.059	14.508	3.19	23.19	1010.484228
5/2/2022	2:00:00 PM	0	12.307	5.4	5/2/2022	2:00:00 PM	0	892.805	16.755	3.20	23.18	1010.494818
5/2/2022	3:00:00 PM	0	12.32	5.4	5/2/2022	3:00:00 PM	0	893.346	16.208	3.21	23.18	1010.502302
5/2/2022	4:00:00 PM	0	12.33	5.4	5/2/2022	4:00:00 PM	0	893.398	14.605	3.22	23.17	1010.511771
5/2/2022	5:00:00 PM	0	12.341	5.4	5/2/2022	5:00:00 PM	0	893.66	13.283	3.23	23.16	1010.5201
5/2/2022	6:00:00 PM	0	12.35	5.4	5/2/2022	6:00:00 PM	0	894.103	10.599	3.23	23.15	1010.524582
5/2/2022	7:00:00 PM	0	12.36	5.4	5/2/2022	7:00:00 PM	0	894.613	8.346	3.24	23.15	1010.529382
5/2/2022	8:00:00 PM	0	12.368	5.4	5/2/2022	8:00:00 PM	0	895.206	5.73	3.24	23.15	1010.531335
5/2/2022	9:00:00 PM	0	12.371	5.4	5/2/2022	9:00:00 PM	0	895.467	3.663	3.24	23.15	1010.531673
5/2/2022	10:00:00 PM	0	12.372	5.4	5/2/2022	10:00:00 PM	0	895.612	2.406	3.24	23.15	1010.531195
5/2/2022	11:00:00 PM	0	12.377	5.4	5/2/2022	11:00:00 PM	0	895.96	1.7	3.24	23.15	1010.532646
5/3/2022	12:00:00 AM	0	12.378	5.4	5/3/2022	12:00:00 AM	0	896.022	1.155	3.24	23.15	1010.533014
5/3/2022	1:00:00 AM	0	12.381	5.4	5/3/2022	1:00:00 AM	0	896.155	0.607	3.24	23.14	1010.534658
5/3/2022	2:00:00 AM	0	12.386	5.4	5/3/2022	2:00:00 AM	0	896.259	0.13	3.25	23.14	1010.538597
5/3/2022	3:00:00 AM	0	12.392	5.4	5/3/2022	3:00:00 AM	0	896.54	0.006	3.25	23.14	1010.541732
5/3/2022	4:00:00 AM	0	12.396	5.4	5/3/2022	4:00:00 AM	0	896.712	0.508	3.25	23.14	1010.543978
5/3/2022	5:00:00 AM	0	12.4	5.4	5/3/2022	5:00:00 AM	0	896.967	0.856	3.25	23.13	1010.545378
5/3/2022	6:00:00 AM	0	12.402	5.4	5/3/2022	6:00:00 AM	0	897.084	0.924	3.25	23.13	1010.546185
5/3/2022	7:00:00 AM	0	12.403	5.4	5/3/2022	7:00:00 AM	0	897.522	3.438	3.25	23.14	1010.542718
5/3/2022	8:00:00 AM	0	12.399	5.4	5/3/2022	8:00:00 AM	0	897.571	9.717	3.25	23.14	1010.538219
5/3/2022	9:00:00 AM	0	12.398	5.4	5/3/2022	9:00:00 AM	0	897.638	11.45	3.24	23.14	1010.536535
5/3/2022	10:00:00 AM	0	12.396	5.4	5/3/2022	10:00:00 AM	0	897.368	11.863	3.25	23.14	1010.537289
5/3/2022	11:00:00 AM	0	12.395	5.4	5/3/2022	11:00:00 AM	0	897.147	13.291	3.25	23.14	1010.538542
5/3/2022	12:00:00 PM	0	12.395	5.4	5/3/2022	12:00:00 PM	0	896.654	14.796	3.25	23.14	1010.543569
5/3/2022	1:00:00 PM	0	12.396	5.4	5/3/2022	1:00:00 PM	0	895.889	19.578	3.26	23.13	1010.55237
5/3/2022	2:00:00 PM	0	12.4	5.4	5/3/2022	2:00:00 PM	0	895.336	21.18	3.27	23.12	1010.562009
5/3/2022	3:00:00 PM	0	12.408	5.4	5/3/2022	3:00:00 PM	0	895.175	19.275	3.28	23.11	1010.571651
5/3/2022	4:00:00 PM	0	12.419	5.4	5/3/2022	4:00:00 PM	0	895.153	15.961	3.29	23.10	1010.582875
5/3/2022	5:00:00 PM	0	12.429	5.4	5/3/2022	5:00:00 PM	0	895.306	12.738	3.30	23.09	1010.591315
5/3/2022	6:00:00 PM	0	12.438	5.4	5/3/2022	6:00:00 PM	0	895.247	9.66	3.31	23.08	1010.600917
5/3/2022	7:00:00 PM	0	12.447	5.4	5/3/2022	7:00:00 PM	0	895.492	7.508	3.32	23.07	1010.607419
5/3/2022	8:00:00 PM	0	12.451	5.4	5/3/2022	8:00:00 PM	0	895.33	6.184	3.32	23.07	1010.61307
5/3/2022	9:00:00 PM	0	12.458	5.4	5/3/2022	9:00:00 PM	0	895.31	5.532	3.33	23.06	1010.620274
5/3/2022	10:00:00 PM	0	12.459	5.4	5/3/2022	10:00:00 PM	0	895.18	5.039	3.33	23.06	1010.6226
5/3/2022	11:00:00 PM	0	12.459	5.4	5/3/2022	11:00:00 PM	0	894.919	4.705	3.33	23.05	1010.625262
5/4/2022	12:00:00 AM	0	12.464	5.4	5/4/2022	12:00:00 AM	0	895.013	4.467	3.34	23.05	1010.629303
5/4/2022	1:00:00 AM	0	12.464	5.4	5/4/2022	1:00:00 AM	0	894.789	4.168	3.34	23.05	1010.631587
5/4/2022	2:00:00 AM	0	12.465	5.4	5/4/2022	2:00:00 AM	0	894.524	3.678	3.34	23.04	1010.635289
5/4/2022	3:00:00 AM	0	12.467	5.4	5/4/2022	3:00:00 AM	0	894.175	3.556	3.35	23.04	1010.640848
5/4/2022	4:00:00 AM	0	12.471	5.4	5/4/2022	4:00:00 AM	0	894.108	3.405	3.35	23.03	1010.645531
5/4/2022	5:00:00 AM	0	12.473	5.4	5/4/2022	5:00:00 AM	0	894.148	3.387	3.36	23.03	1010.647124

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/4/2022	6:00:00 AM	0	12.477	5.4	5/4/2022	6:00:00 AM	0	894.535	3.767	3.36	23.03	1010.647177
5/4/2022	7:00:00 AM	0	12.477	5.4	5/4/2022	7:00:00 AM	0	894.56	4.282	3.35	23.03	1010.646922
5/4/2022	8:00:00 AM	0	12.476	5.4	5/4/2022	8:00:00 AM	0	894.691	6.317	3.35	23.03	1010.644586
5/4/2022	9:00:00 AM	0	12.473	5.4	5/4/2022	9:00:00 AM	0	894.671	9.474	3.35	23.04	1010.64179
5/4/2022	10:00:00 AM	0	12.47	5.4	5/4/2022	10:00:00 AM	0	894.504	9.756	3.35	23.04	1010.640493
5/4/2022	11:00:00 AM	0	12.467	5.4	5/4/2022	11:00:00 AM	0	894.117	10.341	3.35	23.04	1010.64144
5/4/2022	12:00:00 PM	0	12.465	5.4	5/4/2022	12:00:00 PM	0	893.648	12.907	3.35	23.03	1010.644222
5/4/2022	1:00:00 PM	0	12.468	5.4	5/4/2022	1:00:00 PM	0	893.342	14.529	3.36	23.03	1010.650342
5/4/2022	2:00:00 PM	0	12.47	5.4	5/4/2022	2:00:00 PM	0	892.815	12.903	3.37	23.02	1010.657716
5/4/2022	3:00:00 PM	0	12.474	5.4	5/4/2022	3:00:00 PM	0	892.24	11.591	3.38	23.01	1010.66758
5/4/2022	4:00:00 PM	0	12.482	5.4	5/4/2022	4:00:00 PM	0	891.675	10.249	3.39	23.00	1010.681341
5/4/2022	5:00:00 PM	0	12.488	5.4	5/4/2022	5:00:00 PM	0	891.085	8.507	3.40	22.99	1010.693358
5/4/2022	6:00:00 PM	0	12.492	5.4	5/4/2022	6:00:00 PM	0	890.275	8.263	3.41	22.97	1010.705617
5/4/2022	7:00:00 PM	0	12.496	5.4	5/4/2022	7:00:00 PM	0	889.671	7.17	3.42	22.96	1010.715776
5/4/2022	8:00:00 PM	0	12.503	5.4	5/4/2022	8:00:00 PM	0	889.416	6.079	3.43	22.95	1010.725377
5/4/2022	9:00:00 PM	0	12.507	5.4	5/4/2022	9:00:00 PM	0	889.227	4.731	3.44	22.95	1010.731304
5/4/2022	10:00:00 PM	0	12.509	5.4	5/4/2022	10:00:00 PM	0	888.889	4.344	3.44	22.94	1010.736751
5/4/2022	11:00:00 PM	0	12.51	5.4	5/4/2022	11:00:00 PM	0	888.567	4.482	3.45	22.94	1010.741034
5/5/2022	12:00:00 AM	0	12.512	5.4	5/5/2022	12:00:00 AM	0	888.481	4.383	3.45	22.94	1010.743911
5/5/2022	1:00:00 AM	0	12.512	5.4	5/5/2022	1:00:00 AM	0	888.315	4.678	3.45	22.93	1010.745604
5/5/2022	2:00:00 AM	0	12.512	5.4	5/5/2022	2:00:00 AM	0	887.81	4.469	3.46	22.93	1010.750753
5/5/2022	3:00:00 AM	0	12.513	5.4	5/5/2022	3:00:00 AM	0	887.43	3.947	3.46	22.92	1010.755628
5/5/2022	4:00:00 AM	0	12.515	5.4	5/5/2022	4:00:00 AM	0	887.147	3.9	3.47	22.92	1010.760514
5/5/2022	5:00:00 AM	0	12.515	5.4	5/5/2022	5:00:00 AM	0	886.884	3.472	3.47	22.92	1010.763196
5/5/2022	6:00:00 AM	0	12.516	5.4	5/5/2022	6:00:00 AM	0	886.568	3.269	3.48	22.91	1010.767418
5/5/2022	7:00:00 AM	0	12.513	5.4	5/5/2022	7:00:00 AM	0	886.227	3.754	3.48	22.91	1010.767896
5/5/2022	8:00:00 AM	0	12.51	5.4	5/5/2022	8:00:00 AM	0	885.886	4.832	3.48	22.91	1010.768373
5/5/2022	9:00:00 AM	0	12.507	5.4	5/5/2022	9:00:00 AM	0	885.71	7.41	3.48	22.91	1010.767168
5/5/2022	10:00:00 AM	0	12.499	5.4	5/5/2022	10:00:00 AM	0	884.848	11.286	3.48	22.91	1010.767958
5/5/2022	11:00:00 AM	0	12.495	5.4	5/5/2022	11:00:00 AM	0	884.046	13.909	3.48	22.91	1010.772136
5/5/2022	12:00:00 PM	0	12.491	5.4	5/5/2022	12:00:00 PM	0	883.267	13.227	3.48	22.90	1010.776079
5/5/2022	1:00:00 PM	0	12.488	5.4	5/5/2022	1:00:00 PM	0	882.347	14.263	3.49	22.90	1010.782461
5/5/2022	2:00:00 PM	0	12.489	5.4	5/5/2022	2:00:00 PM	0	881.873	10.974	3.50	22.89	1010.788294
5/5/2022	3:00:00 PM	0	12.492	5.4	5/5/2022	3:00:00 PM	0	881.45	10.542	3.50	22.88	1010.795608
5/5/2022	4:00:00 PM	0	12.498	5.4	5/5/2022	4:00:00 PM	0	881.065	8.96	3.51	22.87	1010.805534
5/5/2022	5:00:00 PM	0	12.504	5.4	5/5/2022	5:00:00 PM	0	880.781	8.449	3.52	22.86	1010.81443
5/5/2022	6:00:00 PM	0	12.509	5.4	5/5/2022	6:00:00 PM	0	880.342	7.305	3.53	22.86	1010.823906
5/5/2022	7:00:00 PM	0	12.518	5.4	5/5/2022	7:00:00 PM	0	880.203	5.988	3.54	22.84	1010.834324
5/5/2022	8:00:00 PM	0	12.524	5.4	5/5/2022	8:00:00 PM	0	880.299	5.223	3.55	22.84	1010.839345
5/5/2022	9:00:00 PM	0	12.53	5.4	5/5/2022	9:00:00 PM	0	880.214	4.541	3.55	22.83	1010.846211
5/5/2022	10:00:00 PM	0	12.533	5.4	5/5/2022	10:00:00 PM	0	880.214	4.164	3.56	22.83	1010.849211
5/5/2022	11:00:00 PM	0	12.539	5.4	5/5/2022	11:00:00 PM	0	880.479	3.715	3.56	22.83	1010.852509
5/6/2022	12:00:00 AM	0	12.543	5.4	5/6/2022	12:00:00 AM	0	880.836	3.252	3.56	22.83	1010.852869
5/6/2022	1:00:00 AM	0	12.547	5.4	5/6/2022	1:00:00 AM	0	881.211	3.049	3.56	22.83	1010.853045
5/6/2022	2:00:00 AM	0	12.555	5.4	5/6/2022	2:00:00 AM	0	882.116	2.436	3.56	22.83	1010.851816
5/6/2022	3:00:00 AM	0	12.561	5.4	5/6/2022	3:00:00 AM	0	882.944	1.912	3.56	22.83	1010.849373
5/6/2022	4:00:00 AM	0	12.566	5.4	5/6/2022	4:00:00 AM	0	883.371	1.792	3.56	22.83	1010.850019
5/6/2022	5:00:00 AM	0	12.57	5.4	5/6/2022	5:00:00 AM	0	883.91	1.658	3.56	22.83	1010.848522
5/6/2022	6:00:00 AM	0	12.573	5.4	5/6/2022	6:00:00 AM	0	884.305	2.345	3.56	22.83	1010.847495
5/6/2022	7:00:00 AM	0	12.576	5.4	5/6/2022	7:00:00 AM	0	884.828	4.707	3.55	22.83	1010.845161
5/6/2022	8:00:00 AM	0	12.576	5.4	5/6/2022	8:00:00 AM	0	885.161	7.356	3.55	22.84	1010.841766
5/6/2022	9:00:00 AM	0	12.576	5.4	5/6/2022	9:00:00 AM	0	885.245	11.664	3.55	22.84	1010.840909
5/6/2022	10:00:00 AM	0	12.576	5.4	5/6/2022	10:00:00 AM	0	885.114	12.4	3.55	22.84	1010.842245
5/6/2022	11:00:00 AM	0	12.575	5.4	5/6/2022	11:00:00 AM	0	885.035	14.725	3.55	22.84	1010.842051
5/6/2022	12:00:00 PM	0	12.575	5.4	5/6/2022	12:00:00 PM	0	884.704	15	3.55	22.83	1010.845426
5/6/2022	1:00:00 PM	0	12.576	5.4	5/6/2022	1:00:00 PM	0	884.419	13.909	3.56	22.83	1010.849332
5/6/2022	2:00:00 PM	0	12.579	5.4	5/6/2022	2:00:00 PM	0	884.312	14.9	3.56	22.83	1010.853423
5/6/2022	3:00:00 PM	0	12.582	5.4	5/6/2022	3:00:00 PM	0	884.28	12.961	3.56	22.82	1010.85675
5/6/2022	4:00:00 PM	0	12.588	5.4	5/6/2022	4:00:00 PM	0	884.015	12.187	3.57	22.81	1010.865452
5/6/2022	5:00:00 PM	0	12.592	5.4	5/6/2022	5:00:00 PM	0	883.705	9.654	3.58	22.81	1010.872613
5/6/2022	6:00:00 PM	0	12.602	5.4	5/6/2022	6:00:00 PM	0	883.737	8.466	3.59	22.80	1010.882287
5/6/2022	7:00:00 PM	0	12.609	5.4	5/6/2022	7:00:00 PM	0	883.76	8.146	3.60	22.79	1010.889052
5/6/2022	8:00:00 PM	0	12.62	5.4	5/6/2022	8:00:00 PM	0	883.788	3.687	3.61	22.78	1010.899767
5/6/2022	9:00:00 PM	0	12.626	5.4	5/6/2022	9:00:00 PM	0	883.795	0.94	3.61	22.77	1010.905695
5/6/2022	10:00:00 PM	0	12.632	5.4	5/6/2022	10:00:00 PM	0	883.554	-0.454	3.62	22.76	1010.914153
5/6/2022	11:00:00 PM	0	12.637	5.4	5/6/2022	11:00:00 PM	0	883.66	-1.178	3.63	22.76	1010.918072
5/7/2022	12:00:00 AM	0	12.642	5.4	5/7/2022	12:00:00 AM	0	883.747	-1.661	3.63	22.76	1010.922185
5/7/2022	1:00:00 AM	0	12.647	5.4	5/7/2022	1:00:00 AM	0	883.934	-2.073	3.63	22.75	1010.925278
5/7/2022	2:00:00 AM	0	12.651	5.4	5/7/2022	2:00:00 AM	0	884.173	-2.317	3.63	22.75	1010.926841
5/7/2022	3:00:00 AM	0	12.654	5.4	5/7/2022	3:00:00 AM	0	884.23	-2.282	3.64	22.75	1010.929259
5/7/2022	4:00:00 AM	0	12.659	5.4	5/7/2022	4:00:00 AM	0	884.833	-0.903	3.64	22.75	1010.92811
5/7/2022	5:00:00 AM	0	12.662	5.4	5/7/2022	5:00:00 AM	0	885.071	-1.013	3.64	22.75	1010.928684

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/7/2022	6:00:00 AM	0	12.663	5.4	5/7/2022	6:00:00 AM	0	885.098	-1.43	3.64	22.75	1010.929408
5/7/2022	7:00:00 AM	0	12.666	5.4	5/7/2022	7:00:00 AM	0	885.627	-0.095	3.64	22.75	1010.927014
5/7/2022	8:00:00 AM	0	12.668	5.4	5/7/2022	8:00:00 AM	0	886.202	9.667	3.63	22.76	1010.923151
5/7/2022	9:00:00 AM	0	12.668	5.4	5/7/2022	9:00:00 AM	0	886.092	15.649	3.63	22.75	1010.924272
5/7/2022	10:00:00 AM	0	12.668	5.4	5/7/2022	10:00:00 AM	0	886.111	14.062	3.63	22.75	1010.924078
5/7/2022	11:00:00 AM	0	12.666	5.4	5/7/2022	11:00:00 AM	0	885.842	11.854	3.63	22.75	1010.924821
5/7/2022	12:00:00 PM	0	12.666	5.4	5/7/2022	12:00:00 PM	0	885.793	11.896	3.63	22.75	1010.925321
5/7/2022	1:00:00 PM	0	12.666	5.4	5/7/2022	1:00:00 PM	0	885.508	13.119	3.64	22.75	1010.928227
5/7/2022	2:00:00 PM	0	12.668	5.4	5/7/2022	2:00:00 PM	0	885.372	16.314	3.64	22.75	1010.931614
5/7/2022	3:00:00 PM	0	12.671	5.4	5/7/2022	3:00:00 PM	0	885.16	14.133	3.64	22.74	1010.936776
5/7/2022	4:00:00 PM	0	12.672	5.4	5/7/2022	4:00:00 PM	0	884.897	13.242	3.65	22.74	1010.940458
5/7/2022	5:00:00 PM	0	12.677	5.4	5/7/2022	5:00:00 PM	0	884.802	10.193	3.65	22.73	1010.946427
5/7/2022	6:00:00 PM	0	12.682	5.4	5/7/2022	6:00:00 PM	0	884.546	8.644	3.66	22.72	1010.954037
5/7/2022	7:00:00 PM	0	12.69	5.4	5/7/2022	7:00:00 PM	0	884.806	8.879	3.67	22.72	1010.959386
5/7/2022	8:00:00 PM	0	12.698	5.4	5/7/2022	8:00:00 PM	0	884.919	3.902	3.67	22.71	1010.966234
5/7/2022	9:00:00 PM	0	12.705	5.4	5/7/2022	9:00:00 PM	0	884.841	1.085	3.68	22.70	1010.974029
5/7/2022	10:00:00 PM	0	12.713	5.4	5/7/2022	10:00:00 PM	0	884.788	-0.415	3.69	22.70	1010.982569
5/7/2022	11:00:00 PM	0	12.717	5.4	5/7/2022	11:00:00 PM	0	884.67	-1.209	3.70	22.69	1010.987773
5/8/2022	12:00:00 AM	0	12.722	5.4	5/8/2022	12:00:00 AM	0	884.684	-1.664	3.70	22.69	1010.99263
5/8/2022	1:00:00 AM	0	12.725	5.4	5/8/2022	1:00:00 AM	0	884.468	-2.109	3.71	22.68	1010.997832
5/8/2022	2:00:00 AM	0	12.729	5.4	5/8/2022	2:00:00 AM	0	884.713	-2.539	3.71	22.68	1010.999334
5/8/2022	3:00:00 AM	0	12.732	5.4	5/8/2022	3:00:00 AM	0	884.985	-1.577	3.71	22.68	1010.99956
5/8/2022	4:00:00 AM	0	12.732	5.4	5/8/2022	4:00:00 AM	0	884.814	-1.809	3.71	22.68	1011.001304
5/8/2022	5:00:00 AM	0	12.732	5.4	5/8/2022	5:00:00 AM	0	884.501	-2.86	3.71	22.67	1011.004496
5/8/2022	6:00:00 AM	0	12.733	5.4	5/8/2022	6:00:00 AM	0	884.385	-2.766	3.71	22.67	1011.006679
5/8/2022	7:00:00 AM	0	12.733	5.4	5/8/2022	7:00:00 AM	0	884.615	-0.311	3.71	22.67	1011.004333
5/8/2022	8:00:00 AM	0	12.732	5.4	5/8/2022	8:00:00 AM	0	884.996	9.442	3.71	22.68	1010.999448
5/8/2022	9:00:00 AM	0	12.732	5.4	5/8/2022	9:00:00 AM	0	884.724	14.92	3.71	22.68	1011.002222
5/8/2022	10:00:00 AM	0	12.729	5.4	5/8/2022	10:00:00 AM	0	884.097	18.131	3.71	22.67	1011.005616
5/8/2022	11:00:00 AM	0	12.73	5.4	5/8/2022	11:00:00 AM	0	884.075	16.605	3.71	22.67	1011.00684
5/8/2022	12:00:00 PM	0	12.732	5.4	5/8/2022	12:00:00 PM	0	883.962	13.409	3.72	22.67	1011.009992
5/8/2022	1:00:00 PM	0	12.733	5.4	5/8/2022	1:00:00 PM	0	884.12	10.945	3.72	22.67	1011.009381
5/8/2022	2:00:00 PM	0	12.672	5.4	5/8/2022	2:00:00 PM	0	883.975	12.638	3.66	22.73	1010.94986
5/8/2022	3:00:00 PM	0	12.684	5.4	5/8/2022	3:00:00 PM	0	883.792	12.198	3.67	22.72	1010.963726
5/8/2022	4:00:00 PM	0	12.695	5.4	5/8/2022	4:00:00 PM	0	883.846	11.583	3.68	22.70	1010.974175
5/8/2022	5:00:00 PM	0	12.704	5.4	5/8/2022	5:00:00 PM	0	884.242	9.608	3.69	22.70	1010.979137
5/8/2022	6:00:00 PM	0	12.707	5.4	5/8/2022	6:00:00 PM	0	883.582	7.174	3.70	22.69	1010.988867
5/8/2022	7:00:00 PM	0	12.716	5.4	5/8/2022	7:00:00 PM	0	883.704	5.813	3.70	22.68	1010.996623
5/8/2022	8:00:00 PM	0	12.726	5.4	5/8/2022	8:00:00 PM	0	884.053	3.583	3.71	22.68	1011.003064
5/8/2022	9:00:00 PM	0	12.736	5.4	5/8/2022	9:00:00 PM	0	884.366	1.472	3.72	22.67	1011.009873
5/8/2022	10:00:00 PM	0	12.744	5.4	5/8/2022	10:00:00 PM	0	884.351	0.721	3.73	22.66	1011.018026
5/8/2022	11:00:00 PM	0	12.75	5.4	5/8/2022	11:00:00 PM	0	884.235	0.033	3.73	22.65	1011.025208
5/9/2022	12:00:00 AM	0	12.759	5.4	5/9/2022	12:00:00 AM	0	884.404	-0.427	3.74	22.65	1011.032485
5/9/2022	1:00:00 AM	0	12.765	5.4	5/9/2022	1:00:00 AM	0	884.704	0.114	3.74	22.64	1011.035426
5/9/2022	2:00:00 AM	0	12.77	5.4	5/9/2022	2:00:00 AM	0	885.038	0.537	3.75	22.64	1011.03702
5/9/2022	3:00:00 AM	0	12.773	5.4	5/9/2022	3:00:00 AM	0	885.276	0.528	3.75	22.64	1011.037593
5/9/2022	4:00:00 AM	0	12.775	5.4	5/9/2022	4:00:00 AM	0	885.471	0.393	3.75	22.64	1011.037605
5/9/2022	5:00:00 AM	0	12.777	5.4	5/9/2022	5:00:00 AM	0	885.633	0.184	3.75	22.64	1011.037953
5/9/2022	6:00:00 AM	0	12.78	5.4	5/9/2022	6:00:00 AM	0	886.046	0.445	3.74	22.64	1011.036741
5/9/2022	7:00:00 AM	0	12.781	5.4	5/9/2022	7:00:00 AM	0	886.461	1.526	3.74	22.65	1011.033509
5/9/2022	8:00:00 AM	0	12.785	5.4	5/9/2022	8:00:00 AM	0	886.833	3.114	3.74	22.65	1011.033716
5/9/2022	9:00:00 AM	0	12.788	5.4	5/9/2022	9:00:00 AM	0	887.028	5.326	3.74	22.64	1011.034728
5/9/2022	10:00:00 AM	0	12.788	5.4	5/9/2022	10:00:00 AM	0	887.095	9.863	3.74	22.64	1011.034044
5/9/2022	11:00:00 AM	0	12.791	5.4	5/9/2022	11:00:00 AM	0	887.188	8.71	3.74	22.64	1011.036096
5/9/2022	12:00:00 PM	0	12.794	5.4	5/9/2022	12:00:00 PM	0	887.207	11.353	3.75	22.64	1011.038902
5/9/2022	1:00:00 PM	0	12.797	5.4	5/9/2022	1:00:00 PM	0	887.442	10.434	3.75	22.64	1011.039506
5/9/2022	2:00:00 PM	0	12.798	5.4	5/9/2022	2:00:00 PM	0	887.525	11.414	3.75	22.64	1011.03966
5/9/2022	3:00:00 PM	0	12.8	5.4	5/9/2022	3:00:00 PM	0	887.623	11.97	3.75	22.64	1011.04066
5/9/2022	4:00:00 PM	0	12.803	5.4	5/9/2022	4:00:00 PM	0	888.099	11.451	3.75	22.64	1011.038806
5/9/2022	5:00:00 PM	0	12.806	5.4	5/9/2022	5:00:00 PM	0	888.452	9.594	3.75	22.64	1011.038207
5/9/2022	6:00:00 PM	0	12.81	5.4	5/9/2022	6:00:00 PM	0	888.722	6.448	3.75	22.64	1011.039454
5/9/2022	7:00:00 PM	0	12.816	5.4	5/9/2022	7:00:00 PM	0	889.087	4.828	3.75	22.64	1011.041732
5/9/2022	8:00:00 PM	0	12.822	5.4	5/9/2022	8:00:00 PM	0	889.594	2.992	3.75	22.64	1011.042562
5/9/2022	9:00:00 PM	0	12.828	5.4	5/9/2022	9:00:00 PM	0	889.837	1.544	3.75	22.63	1011.046084
5/9/2022	10:00:00 PM	0	12.836	5.4	5/9/2022	10:00:00 PM	0	890.035	1.377	3.76	22.63	1011.052065
5/9/2022	11:00:00 PM	0	12.843	5.4	5/9/2022	11:00:00 PM	0	890.324	1.262	3.76	22.62	1011.056118
5/10/2022	12:00:00 AM	0	12.849	5.4	5/10/2022	12:00:00 AM	0	890.627	1.349	3.77	22.62	1011.059028
5/10/2022	1:00:00 AM	0	12.855	5.4	5/10/2022	1:00:00 AM	0	890.896	1.219	3.77	22.62	1011.062285
5/10/2022	2:00:00 AM	0	12.861	5.4	5/10/2022	2:00:00 AM	0	891.18	0.904	3.77	22.61	1011.065389
5/10/2022	3:00:00 AM	0	12.866	5.4	5/10/2022	3:00:00 AM	0	891.534	0.741	3.77	22.61	1011.066779
5/10/2022	4:00:00 AM	0	12.867	5.4	5/10/2022	4:00:00 AM	0	891.951	0.744	3.77	22.62	1011.063527
5/10/2022	5:00:00 AM	0	12.868	5.4	5/10/2022	5:00:00 AM	0	892.42	0.758	3.77	22.62	1011.059744

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/10/2022	6:00:00 AM	0	12.87	5.4	5/10/2022	6:00:00 AM	0	892.92	1.204	3.76	22.62	1011.056646
5/10/2022	7:00:00 AM	0	12.873	5.4	5/10/2022	7:00:00 AM	0	893.744	3.245	3.76	22.63	1011.051243
5/10/2022	8:00:00 AM	0	12.876	5.4	5/10/2022	8:00:00 AM	0	894.567	4.558	3.75	22.63	1011.045851
5/10/2022	9:00:00 AM	0	12.881	5.4	5/10/2022	9:00:00 AM	0	894.924	5.092	3.76	22.63	1011.047211
5/10/2022	10:00:00 AM	0	12.885	5.4	5/10/2022	10:00:00 AM	0	895.399	4.535	3.75	22.63	1011.046367
5/10/2022	11:00:00 AM	0	12.891	5.4	5/10/2022	11:00:00 AM	0	895.953	5.381	3.75	22.63	1011.046718
5/10/2022	12:00:00 PM	0	12.896	5.4	5/10/2022	12:00:00 PM	0	896.194	6.783	3.76	22.63	1011.04926
5/10/2022	1:00:00 PM	0	12.899	5.4	5/10/2022	1:00:00 PM	0	896.367	10.099	3.76	22.63	1011.050496
5/10/2022	2:00:00 PM	0	12.9	5.4	5/10/2022	2:00:00 PM	0	896.507	13.372	3.76	22.63	1011.050068
5/10/2022	3:00:00 PM	0	12.903	5.4	5/10/2022	3:00:00 PM	0	896.576	13.943	3.76	22.63	1011.052365
5/10/2022	4:00:00 PM	0	12.905	5.4	5/10/2022	4:00:00 PM	0	896.779	12.18	3.76	22.63	1011.052295
5/10/2022	5:00:00 PM	0	12.905	5.4	5/10/2022	5:00:00 PM	0	896.836	10.236	3.76	22.63	1011.051713
5/10/2022	6:00:00 PM	0	12.906	5.4	5/10/2022	6:00:00 PM	0	896.948	8.627	3.76	22.63	1011.051571
5/10/2022	7:00:00 PM	0	12.909	5.4	5/10/2022	7:00:00 PM	0	897.197	6.797	3.76	22.63	1011.052032
5/10/2022	8:00:00 PM	0	12.914	5.4	5/10/2022	8:00:00 PM	0	897.601	5.01	3.76	22.63	1011.052913
5/10/2022	9:00:00 PM	0	12.918	5.4	5/10/2022	9:00:00 PM	0	897.927	3.812	3.76	22.63	1011.053588
5/10/2022	10:00:00 PM	0	12.919	5.3	5/10/2022	10:00:00 PM	0	897.662	3.148	3.77	22.62	1011.057291
5/10/2022	11:00:00 PM	0	12.929	5.4	5/10/2022	11:00:00 PM	0	897.717	2.852	3.77	22.61	1011.06673
5/11/2022	12:00:00 AM	0	12.935	5.4	5/11/2022	12:00:00 AM	0	897.86	2.615	3.78	22.61	1011.071272
5/11/2022	1:00:00 AM	0	12.941	5.4	5/11/2022	1:00:00 AM	0	897.968	2.456	3.78	22.60	1011.07617
5/11/2022	2:00:00 AM	0	12.944	5.4	5/11/2022	2:00:00 AM	0	897.904	2.166	3.79	22.60	1011.079823
5/11/2022	3:00:00 AM	0	12.945	5.4	5/11/2022	3:00:00 AM	0	897.983	2.146	3.79	22.60	1011.080017
5/11/2022	4:00:00 AM	0	12.944	5.4	5/11/2022	4:00:00 AM	0	897.762	1.889	3.79	22.60	1011.081271
5/11/2022	5:00:00 AM	0	12.942	5.4	5/11/2022	5:00:00 AM	0	897.635	1.769	3.79	22.60	1011.080566
5/11/2022	6:00:00 AM	0	12.942	5.4	5/11/2022	6:00:00 AM	0	897.979	1.964	3.79	22.60	1011.077058
5/11/2022	7:00:00 AM	0	12.939	5.4	5/11/2022	7:00:00 AM	0	897.974	3.205	3.78	22.60	1011.074109
5/11/2022	8:00:00 AM	0	12.939	5.4	5/11/2022	8:00:00 AM	0	898.078	4.838	3.78	22.61	1011.073049
5/11/2022	9:00:00 AM	0	12.938	5.4	5/11/2022	9:00:00 AM	0	897.947	9.761	3.78	22.61	1011.073384
5/11/2022	10:00:00 AM	0	12.938	5.4	5/11/2022	10:00:00 AM	0	897.605	13.112	3.78	22.60	1011.076872
5/11/2022	11:00:00 AM	0	12.942	5.4	5/11/2022	11:00:00 AM	0	897.555	9.641	3.79	22.60	1011.081382
5/11/2022	12:00:00 PM	0	12.945	5.4	5/11/2022	12:00:00 PM	0	897.239	9.904	3.80	22.59	1011.087604
5/11/2022	1:00:00 PM	0	12.945	5.4	5/11/2022	1:00:00 PM	0	896.701	13.866	3.80	22.59	1011.09309
5/11/2022	2:00:00 PM	0	12.948	5.4	5/11/2022	2:00:00 PM	0	896.431	11.226	3.81	22.58	1011.098843
5/11/2022	3:00:00 PM	0	12.948	5.4	5/11/2022	3:00:00 PM	0	895.963	9.273	3.81	22.58	1011.103616
5/11/2022	4:00:00 PM	0	12.947	5.4	5/11/2022	4:00:00 PM	0	895.815	8.487	3.81	22.57	1011.104125
5/11/2022	5:00:00 PM	0	12.945	5.4	5/11/2022	5:00:00 PM	0	895.716	9.456	3.81	22.58	1011.103134
5/11/2022	6:00:00 PM	0	12.942	5.4	5/11/2022	6:00:00 PM	0	895.476	9.041	3.81	22.58	1011.102582
5/11/2022	7:00:00 PM	0	12.941	5.4	5/11/2022	7:00:00 PM	0	895.373	7.541	3.81	22.58	1011.102632
5/11/2022	8:00:00 PM	0	12.941	5.3	5/11/2022	8:00:00 PM	0	895.732	5.616	3.81	22.58	1011.098971
5/11/2022	9:00:00 PM	0	12.944	5.4	5/11/2022	9:00:00 PM	0	895.916	4.334	3.81	22.58	1011.100095
5/11/2022	10:00:00 PM	0	12.945	5.4	5/11/2022	10:00:00 PM	0	895.57	2.732	3.81	22.57	1011.104623
5/11/2022	11:00:00 PM	0	12.948	5.4	5/11/2022	11:00:00 PM	0	895.597	2.766	3.82	22.57	1011.107348
5/12/2022	12:00:00 AM	0	12.954	5.4	5/12/2022	12:00:00 AM	0	895.685	2.888	3.82	22.57	1011.11245
5/12/2022	1:00:00 AM	0	12.956	5.4	5/12/2022	1:00:00 AM	0	895.44	2.904	3.83	22.56	1011.116949
5/12/2022	2:00:00 AM	0	12.957	5.3	5/12/2022	2:00:00 AM	0	895.436	2.78	3.83	22.56	1011.11799
5/12/2022	3:00:00 AM	0	12.957	5.4	5/12/2022	3:00:00 AM	0	895.208	2.871	3.83	22.56	1011.120315
5/12/2022	4:00:00 AM	0	12.957	5.4	5/12/2022	4:00:00 AM	0	895.129	2.732	3.83	22.56	1011.12112
5/12/2022	5:00:00 AM	0	12.953	5.4	5/12/2022	5:00:00 AM	0	894.907	2.753	3.83	22.56	1011.119384
5/12/2022	6:00:00 AM	0	12.95	5.4	5/12/2022	6:00:00 AM	0	894.839	3.002	3.83	22.56	1011.117077
5/12/2022	7:00:00 AM	0	12.947	5.4	5/12/2022	7:00:00 AM	0	895.484	5.545	3.82	22.57	1011.1075
5/12/2022	8:00:00 AM	0	12.941	5.3	5/12/2022	8:00:00 AM	0	895.389	11.384	3.81	22.58	1011.102469
5/12/2022	9:00:00 AM	0	12.938	5.4	5/12/2022	9:00:00 AM	0	894.848	15.731	3.81	22.57	1011.104986
5/12/2022	10:00:00 AM	0	12.938	5.3	5/12/2022	10:00:00 AM	0	894.772	17.406	3.81	22.57	1011.105761
5/12/2022	11:00:00 AM	0	12.939	5.3	5/12/2022	11:00:00 AM	0	894.36	15.49	3.82	22.57	1011.110962
5/12/2022	12:00:00 PM	0	12.945	5.4	5/12/2022	12:00:00 PM	0	893.963	16.329	3.83	22.56	1011.12101
5/12/2022	1:00:00 PM	0	12.947	5.4	5/12/2022	1:00:00 PM	0	893.609	16.102	3.83	22.55	1011.12662
5/12/2022	2:00:00 PM	0	12.951	5.4	5/12/2022	2:00:00 PM	0	893.284	16.647	3.84	22.55	1011.133934
5/12/2022	3:00:00 PM	0	12.953	5.4	5/12/2022	3:00:00 PM	0	892.918	14.817	3.85	22.54	1011.139666
5/12/2022	4:00:00 PM	0	12.951	5.4	5/12/2022	4:00:00 PM	0	892.21	14.323	3.85	22.53	1011.144886
5/12/2022	5:00:00 PM	0	12.948	5.4	5/12/2022	5:00:00 PM	0	892.2	11.584	3.85	22.54	1011.141988
5/12/2022	6:00:00 PM	0	12.945	5.4	5/12/2022	6:00:00 PM	0	891.724	11.614	3.85	22.54	1011.143842
5/12/2022	7:00:00 PM	0	12.939	5.4	5/12/2022	7:00:00 PM	0	891.684	10.556	3.85	22.54	1011.138249
5/12/2022	8:00:00 PM	0	12.938	5.4	5/12/2022	8:00:00 PM	0	891.679	7.483	3.85	22.54	1011.1373
5/12/2022	9:00:00 PM	0	12.936	5.4	5/12/2022	9:00:00 PM	0	891.558	5.614	3.84	22.54	1011.136534
5/12/2022	10:00:00 PM	0	12.936	5.4	5/12/2022	10:00:00 PM	0	891.432	4.439	3.85	22.54	1011.137819
5/12/2022	11:00:00 PM	0	12.938	5.4	5/12/2022	11:00:00 PM	0	891.321	4.057	3.85	22.54	1011.140951
5/13/2022	12:00:00 AM	0	12.941	5.4	5/13/2022	12:00:00 AM	0	891.485	3.726	3.85	22.54	1011.142279
5/13/2022	1:00:00 AM	0	12.945	5.4	5/13/2022	1:00:00 AM	0	891.586	2.906	3.85	22.53	1011.145249
5/13/2022	2:00:00 AM	0	12.948	5.4	5/13/2022	2:00:00 AM	0	891.764	2.66	3.85	22.53	1011.146434
5/13/2022	3:00:00 AM	0	12.951	5.4	5/13/2022	3:00:00 AM	0	892.141	2.429	3.85	22.53	1011.145589
5/13/2022	4:00:00 AM	0	12.95	5.4	5/13/2022	4:00:00 AM	0	892.473	2.256	3.85	22.54	1011.141204
5/13/2022	5:00:00 AM	0	12.95	5.4	5/13/2022	5:00:00 AM	0	892.851	1.814	3.85	22.54	1011.137349

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/13/2022	6:00:00 AM	0	12.948	5.4	5/13/2022	6:00:00 AM	0	893.538	1.323	3.84	22.55	1011.128344
5/13/2022	7:00:00 AM	0	12.947	5.4	5/13/2022	7:00:00 AM	0	894.434	1.964	3.83	22.56	1011.118207
5/13/2022	8:00:00 AM	0	12.945	5.4	5/13/2022	8:00:00 AM	0	895.282	2.53	3.82	22.57	1011.10756
5/13/2022	9:00:00 AM	0	12.947	5.4	5/13/2022	9:00:00 AM	0	896.279	4.166	3.81	22.58	1011.099393
5/13/2022	10:00:00 AM	0	12.951	5.4	5/13/2022	10:00:00 AM	0	897.232	5.59	3.80	22.59	1011.093675
5/13/2022	11:00:00 AM	0	12.957	5.4	5/13/2022	11:00:00 AM	0	897.821	5.705	3.80	22.59	1011.093669
5/13/2022	12:00:00 PM	0	12.963	5.4	5/13/2022	12:00:00 PM	0	898.166	8.63	3.80	22.58	1011.096151
5/13/2022	1:00:00 PM	0	12.969	5.4	5/13/2022	1:00:00 PM	0	898.164	11.26	3.81	22.58	1011.102172
5/13/2022	2:00:00 PM	0	12.974	5.4	5/13/2022	2:00:00 PM	0	898.01	11.955	3.82	22.57	1011.108742
5/13/2022	3:00:00 PM	0	12.98	5.4	5/13/2022	3:00:00 PM	0	897.835	10.663	3.82	22.56	1011.116526
5/13/2022	4:00:00 PM	0	12.983	5.4	5/13/2022	4:00:00 PM	0	897.821	10.371	3.83	22.56	1011.119669
5/13/2022	5:00:00 PM	0	12.984	5.4	5/13/2022	5:00:00 PM	0	897.872	10.58	3.83	22.56	1011.120149
5/13/2022	6:00:00 PM	0	12.981	5.4	5/13/2022	6:00:00 PM	0	897.49	7.982	3.83	22.56	1011.121045
5/13/2022	7:00:00 PM	0	12.98	5.3	5/13/2022	7:00:00 PM	0	897.738	5.148	3.83	22.56	1011.117516
5/13/2022	8:00:00 PM	0	12.975	5.3	5/13/2022	8:00:00 PM	0	897.314	3.034	3.82	22.56	1011.116839
5/13/2022	9:00:00 PM	0	12.972	5.4	5/13/2022	9:00:00 PM	0	897.138	1.146	3.82	22.56	1011.115634
5/13/2022	10:00:00 PM	0	12.972	5.4	5/13/2022	10:00:00 PM	0	896.984	0.102	3.83	22.56	1011.117204
5/13/2022	11:00:00 PM	0	12.97	5.4	5/13/2022	11:00:00 PM	0	896.734	0.077	3.83	22.56	1011.117754
5/14/2022	12:00:00 AM	0	12.972	5.4	5/14/2022	12:00:00 AM	0	896.54	-0.386	3.83	22.56	1011.121732
5/14/2022	1:00:00 AM	0	12.97	5.3	5/14/2022	1:00:00 AM	0	896.168	-0.808	3.83	22.56	1011.123525
5/14/2022	2:00:00 AM	0	12.974	5.4	5/14/2022	2:00:00 AM	0	895.992	-0.788	3.84	22.55	1011.12932
5/14/2022	3:00:00 AM	0	12.974	5.4	5/14/2022	3:00:00 AM	0	895.685	-1.094	3.84	22.55	1011.13245
5/14/2022	4:00:00 AM	0	12.969	5.3	5/14/2022	4:00:00 AM	0	895.529	-0.72	3.84	22.55	1011.129041
5/14/2022	5:00:00 AM	0	12.964	5.3	5/14/2022	5:00:00 AM	0	895.428	-0.711	3.83	22.55	1011.125071
5/14/2022	6:00:00 AM	0	12.961	5.4	5/14/2022	6:00:00 AM	0	895.695	0.418	3.83	22.56	1011.119348
5/14/2022	7:00:00 AM	0	12.954	5.4	5/14/2022	7:00:00 AM	0	896.008	3.571	3.82	22.57	1011.109157
5/14/2022	8:00:00 AM	0	12.95	5.4	5/14/2022	8:00:00 AM	0	896.34	8.799	3.81	22.58	1011.101771
5/14/2022	9:00:00 AM	0	12.944	5.3	5/14/2022	9:00:00 AM	0	896.324	8.61	3.80	22.58	1011.095934
5/14/2022	10:00:00 AM	0	12.942	5.4	5/14/2022	10:00:00 AM	0	896.232	10.418	3.80	22.58	1011.094873
5/14/2022	11:00:00 AM	0	12.944	5.4	5/14/2022	11:00:00 AM	0	896.164	11.59	3.81	22.58	1011.097566
5/14/2022	12:00:00 PM	0	12.948	5.4	5/14/2022	12:00:00 PM	0	896.028	13.478	3.81	22.58	1011.102953
5/14/2022	1:00:00 PM	0	12.953	5.3	5/14/2022	1:00:00 PM	0	895.948	16.007	3.82	22.57	1011.108769
5/14/2022	2:00:00 PM	0	12.963	5.4	5/14/2022	2:00:00 PM	0	896.267	18.284	3.82	22.56	1011.115516
5/14/2022	3:00:00 PM	0	12.97	5.4	5/14/2022	3:00:00 PM	0	896.217	15.27	3.83	22.56	1011.123026
5/14/2022	4:00:00 PM	0	12.974	5.4	5/14/2022	4:00:00 PM	0	895.855	14.083	3.84	22.55	1011.130717
5/14/2022	5:00:00 PM	0	12.977	5.3	5/14/2022	5:00:00 PM	0	895.89	10.637	3.84	22.55	1011.13336
5/14/2022	6:00:00 PM	0	12.977	5.4	5/14/2022	6:00:00 PM	0	895.965	9.786	3.84	22.55	1011.132595
5/14/2022	7:00:00 PM	0	12.975	5.3	5/14/2022	7:00:00 PM	0	896.263	8.546	3.84	22.55	1011.127556
5/14/2022	8:00:00 PM	0	12.975	5.4	5/14/2022	8:00:00 PM	0	896.308	7.019	3.84	22.55	1011.127098
5/14/2022	9:00:00 PM	0	12.969	5.3	5/14/2022	9:00:00 PM	0	896.593	5.379	3.83	22.56	1011.118191
5/14/2022	10:00:00 PM	0	12.966	5.3	5/14/2022	10:00:00 PM	0	896.544	4.445	3.82	22.56	1011.115691
5/14/2022	11:00:00 PM	0	12.964	5.3	5/14/2022	11:00:00 PM	0	896.615	4.342	3.82	22.57	1011.112967
5/15/2022	12:00:00 AM	0	12.967	5.3	5/15/2022	12:00:00 AM	0	896.957	4.449	3.82	22.57	1011.11248
5/15/2022	1:00:00 AM	0	12.97	5.4	5/15/2022	1:00:00 AM	0	897.151	4.565	3.82	22.57	1011.113501
5/15/2022	2:00:00 AM	0	12.967	5.3	5/15/2022	2:00:00 AM	0	896.692	4.285	3.82	22.56	1011.115182
5/15/2022	3:00:00 AM	0	12.967	5.4	5/15/2022	3:00:00 AM	0	896.379	4.013	3.83	22.56	1011.118374
5/15/2022	4:00:00 AM	0	12.963	5.3	5/15/2022	4:00:00 AM	0	896.159	4.312	3.82	22.56	1011.116617
5/15/2022	5:00:00 AM	0	12.963	5.4	5/15/2022	5:00:00 AM	0	896.35	4.55	3.82	22.56	1011.114669
5/15/2022	6:00:00 AM	0	12.957	5.4	5/15/2022	6:00:00 AM	0	896.426	5.306	3.82	22.57	1011.107894
5/15/2022	7:00:00 AM	0	12.95	5.3	5/15/2022	7:00:00 AM	0	896.603	7.352	3.81	22.58	1011.099089
5/15/2022	8:00:00 AM	0	12.941	5.3	5/15/2022	8:00:00 AM	0	896.689	9.591	3.80	22.59	1011.089212
5/15/2022	9:00:00 AM	0	12.935	5.4	5/15/2022	9:00:00 AM	0	896.441	10.792	3.79	22.59	1011.085741
5/15/2022	10:00:00 AM	0	12.927	5.4	5/15/2022	10:00:00 AM	0	895.885	12.406	3.79	22.60	1011.083411
5/15/2022	11:00:00 AM	0	12.924	5.4	5/15/2022	11:00:00 AM	0	895.159	12.64	3.80	22.59	1011.087814
5/15/2022	12:00:00 PM	0	12.922	5.4	5/15/2022	12:00:00 PM	0	894.386	11.886	3.80	22.59	1011.093697
5/15/2022	1:00:00 PM	0	12.924	5.3	5/15/2022	1:00:00 PM	0	893.715	9.289	3.81	22.58	1011.102539
5/15/2022	2:00:00 PM	0	12.93	5.3	5/15/2022	2:00:00 PM	0	893.08	8.649	3.82	22.56	1011.115014
5/15/2022	3:00:00 PM	0	12.935	5.3	5/15/2022	3:00:00 PM	0	892.402	9.849	3.83	22.55	1011.126928
5/15/2022	4:00:00 PM	0	12.938	5.3	5/15/2022	4:00:00 PM	0	891.607	9.878	3.85	22.54	1011.138035
5/15/2022	5:00:00 PM	0	12.941	5.3	5/15/2022	5:00:00 PM	0	891.227	10.666	3.85	22.53	1011.14491
5/15/2022	6:00:00 PM	0	12.942	5.3	5/15/2022	6:00:00 PM	0	890.922	10.259	3.86	22.53	1011.14902
5/15/2022	7:00:00 PM	0	12.941	5.4	5/15/2022	7:00:00 PM	0	890.692	8.885	3.86	22.53	1011.150365
5/15/2022	8:00:00 PM	0	12.939	5.3	5/15/2022	8:00:00 PM	0	890.967	7.556	3.85	22.53	1011.145561
5/15/2022	9:00:00 PM	0	12.936	5.4	5/15/2022	9:00:00 PM	0	890.902	6.788	3.85	22.54	1011.143224
5/15/2022	10:00:00 PM	0	12.929	5.3	5/15/2022	10:00:00 PM	0	890.839	6.302	3.84	22.54	1011.136866
5/15/2022	11:00:00 PM	0	12.924	5.3	5/15/2022	11:00:00 PM	0	890.617	6.365	3.84	22.54	1011.13413
5/16/2022	12:00:00 AM	0	12.924	5.3	5/16/2022	12:00:00 AM	0	890.72	6.108	3.84	22.55	1011.13308
5/16/2022	1:00:00 AM	0	12.921	5.3	5/16/2022	1:00:00 AM	0	890.6	6.157	3.84	22.55	1011.131303
5/16/2022	2:00:00 AM	0	12.921	5.3	5/16/2022	2:00:00 AM	0	890.504	5.794	3.84	22.55	1011.132282
5/16/2022	3:00:00 AM	0	12.919	5.3	5/16/2022	3:00:00 AM	0	890.443	5.507	3.84	22.55	1011.130904
5/16/2022	4:00:00 AM	0	12.919	5.4	5/16/2022	4:00:00 AM	0	890.44	5.754	3.84	22.55	1011.130935
5/16/2022	5:00:00 AM	0	12.914	5.3	5/16/2022	5:00:00 AM	0	890.325	5.899	3.84	22.55	1011.127107

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/16/2022	6:00:00 AM	0	12.909	5.4	5/16/2022	6:00:00 AM	0	890.465	6.413	3.83	22.56	1011.12068
5/16/2022	7:00:00 AM	0	12.9	5.4	5/16/2022	7:00:00 AM	0	890.414	8.096	3.82	22.57	1011.1122
5/16/2022	8:00:00 AM	0	12.893	5.4	5/16/2022	8:00:00 AM	0	890.599	11.785	3.81	22.58	1011.103313
5/16/2022	9:00:00 AM	0	12.884	5.3	5/16/2022	9:00:00 AM	0	890.7	15.459	3.80	22.59	1011.093283
5/16/2022	10:00:00 AM	0	12.876	5.3	5/16/2022	10:00:00 AM	0	890.512	17.515	3.80	22.59	1011.087201
5/16/2022	11:00:00 AM	0	12.876	5.3	5/16/2022	11:00:00 AM	0	890.61	17.128	3.79	22.59	1011.086201
5/16/2022	12:00:00 PM	0	12.879	5.3	5/16/2022	12:00:00 PM	0	891.275	18.402	3.79	22.60	1011.08242
5/16/2022	1:00:00 PM	0	12.884	5.3	5/16/2022	1:00:00 PM	0	891.329	17.75	3.79	22.59	1011.086869
5/16/2022	2:00:00 PM	0	12.888	5.3	5/16/2022	2:00:00 PM	0	890.979	20.064	3.80	22.58	1011.094438
5/16/2022	3:00:00 PM	0	12.905	5.3	5/16/2022	3:00:00 PM	0	892.197	18.049	3.81	22.58	1011.099018
5/16/2022	4:00:00 PM	0	12.921	5.4	5/16/2022	4:00:00 PM	0	893.283	15.76	3.81	22.58	1011.103944
5/16/2022	5:00:00 PM	0	12.93	5.3	5/16/2022	5:00:00 PM	0	894.158	13.393	3.81	22.57	1011.104022
5/16/2022	6:00:00 PM	0	12.939	5.3	5/16/2022	6:00:00 PM	0	895.091	11.233	3.81	22.58	1011.103508
5/16/2022	7:00:00 PM	0	12.945	5.3	5/16/2022	7:00:00 PM	0	895.76	8.864	3.81	22.58	1011.102686
5/16/2022	8:00:00 PM	0	12.95	5.4	5/16/2022	8:00:00 PM	0	896.32	6.272	3.81	22.58	1011.101975
5/16/2022	9:00:00 PM	0	12.95	5.3	5/16/2022	9:00:00 PM	0	896.967	4.821	3.80	22.58	1011.095378
5/16/2022	10:00:00 PM	0	12.95	5.3	5/16/2022	10:00:00 PM	0	897.411	4.081	3.80	22.59	1011.09085
5/16/2022	11:00:00 PM	0	12.948	5.4	5/16/2022	11:00:00 PM	0	897.805	3.931	3.79	22.59	1011.084832
5/17/2022	12:00:00 AM	0	12.95	5.4	5/17/2022	12:00:00 AM	0	898.318	3.276	3.79	22.60	1011.081601
5/17/2022	1:00:00 AM	0	12.95	5.4	5/17/2022	1:00:00 AM	0	898.47	2.461	3.79	22.60	1011.080051
5/17/2022	2:00:00 AM	0	12.95	5.3	5/17/2022	2:00:00 AM	0	898.629	1.898	3.79	22.60	1011.07843
5/17/2022	3:00:00 AM	0	12.951	5.4	5/17/2022	3:00:00 AM	0	898.694	1.112	3.79	22.60	1011.078767
5/17/2022	4:00:00 AM	0	12.95	5.3	5/17/2022	4:00:00 AM	0	898.832	0.724	3.78	22.60	1011.07636
5/17/2022	5:00:00 AM	0	12.95	5.3	5/17/2022	5:00:00 AM	0	899.08	0.829	3.78	22.61	1011.073831
5/17/2022	6:00:00 AM	0	12.947	5.3	5/17/2022	6:00:00 AM	0	899.389	2.039	3.78	22.61	1011.06768
5/17/2022	7:00:00 AM	0	12.942	5.3	5/17/2022	7:00:00 AM	0	899.847	3.399	3.77	22.62	1011.05801
5/17/2022	8:00:00 AM	0	12.936	5.3	5/17/2022	8:00:00 AM	0	900.357	5.092	3.75	22.63	1011.046809
5/17/2022	9:00:00 AM	0	12.93	5.4	5/17/2022	9:00:00 AM	0	900.549	11.384	3.75	22.64	1011.038851
5/17/2022	10:00:00 AM	0	12.921	5.3	5/17/2022	10:00:00 AM	0	900.506	15.143	3.74	22.65	1011.03029
5/17/2022	11:00:00 AM	0	12.921	5.4	5/17/2022	11:00:00 AM	0	900.665	15.187	3.74	22.65	1011.028668
5/17/2022	12:00:00 PM	0	12.916	5.3	5/17/2022	12:00:00 PM	0	900.372	13.943	3.73	22.65	1011.026656
5/17/2022	1:00:00 PM	0	12.919	5.3	5/17/2022	1:00:00 PM	0	900.298	16.499	3.74	22.65	1011.030411
5/17/2022	2:00:00 PM	0	12.924	5.3	5/17/2022	2:00:00 PM	0	900.278	16.743	3.74	22.64	1011.035615
5/17/2022	3:00:00 PM	0	12.932	5.3	5/17/2022	3:00:00 PM	0	900.43	12.637	3.75	22.64	1011.042065
5/17/2022	4:00:00 PM	0	12.941	5.3	5/17/2022	4:00:00 PM	0	900.146	18.679	3.76	22.63	1011.053961
5/17/2022	5:00:00 PM	0	12.948	5.3	5/17/2022	5:00:00 PM	0	900.337	12.751	3.77	22.62	1011.059013
5/17/2022	6:00:00 PM	0	12.954	5.3	5/17/2022	6:00:00 PM	0	900.005	11.606	3.78	22.61	1011.068399
5/17/2022	7:00:00 PM	0	12.957	5.3	5/17/2022	7:00:00 PM	0	899.747	9.75	3.78	22.60	1011.074029
5/17/2022	8:00:00 PM	0	12.957	5.3	5/17/2022	8:00:00 PM	0	899.207	5.081	3.79	22.60	1011.079536
5/17/2022	9:00:00 PM	0	12.956	5.3	5/17/2022	9:00:00 PM	0	898.737	2.727	3.79	22.60	1011.083329
5/17/2022	10:00:00 PM	0	12.953	5.3	5/17/2022	10:00:00 PM	0	898.3	2.012	3.79	22.59	1011.084785
5/17/2022	11:00:00 PM	0	12.944	5.3	5/17/2022	11:00:00 PM	0	897.295	1.633	3.79	22.59	1011.086033
5/18/2022	12:00:00 AM	0	12.935	5.3	5/18/2022	12:00:00 AM	0	895.897	1.612	3.80	22.59	1011.091289
5/18/2022	1:00:00 AM	0	12.927	5.4	5/18/2022	1:00:00 AM	0	894.671	1.436	3.80	22.58	1011.09579
5/18/2022	2:00:00 AM	0	12.924	5.3	5/18/2022	2:00:00 AM	0	894.227	2.001	3.81	22.58	1011.097318
5/18/2022	3:00:00 AM	0	12.911	5.3	5/18/2022	3:00:00 AM	0	892.34	2.31	3.81	22.58	1011.10356
5/18/2022	4:00:00 AM	0	12.9	5.4	5/18/2022	4:00:00 AM	0	890.098	2.405	3.82	22.56	1011.115422
5/18/2022	5:00:00 AM	0	12.893	5.3	5/18/2022	5:00:00 AM	0	889.316	2.32	3.82	22.56	1011.116396
5/18/2022	6:00:00 AM	0	12.882	5.3	5/18/2022	6:00:00 AM	0	887.557	0.244	3.83	22.56	1011.123333
5/18/2022	7:00:00 AM	0	12.87	5.3	5/18/2022	7:00:00 AM	0	886.316	-0.238	3.83	22.56	1011.123988
5/18/2022	8:00:00 AM	0	12.857	5.3	5/18/2022	8:00:00 AM	0	885.114	0.473	3.83	22.56	1011.123245
5/18/2022	9:00:00 AM	0	12.846	5.3	5/18/2022	9:00:00 AM	0	885.01	3.221	3.82	22.57	1011.113306
5/18/2022	10:00:00 AM	0	12.834	5.3	5/18/2022	10:00:00 AM	0	884.62	5.436	3.81	22.57	1011.105282
5/18/2022	11:00:00 AM	0	12.828	5.4	5/18/2022	11:00:00 AM	0	884.588	12.229	3.81	22.58	1011.099609
5/18/2022	12:00:00 PM	0	12.822	5.3	5/18/2022	12:00:00 PM	0	884.808	12.98	3.80	22.59	1011.091365
5/18/2022	1:00:00 PM	0	12.819	5.3	5/18/2022	1:00:00 PM	0	884.623	9.962	3.80	22.59	1011.090252
5/18/2022	2:00:00 PM	0	12.823	5.3	5/18/2022	2:00:00 PM	0	885.229	14.276	3.80	22.59	1011.088072
5/18/2022	3:00:00 PM	0	12.833	5.3	5/18/2022	3:00:00 PM	0	885.744	6.988	3.80	22.59	1011.092821
5/18/2022	4:00:00 PM	0	12.842	5.3	5/18/2022	4:00:00 PM	0	886.151	6.083	3.81	22.58	1011.097671
5/18/2022	5:00:00 PM	0	12.854	5.3	5/18/2022	5:00:00 PM	0	887.054	2.903	3.81	22.58	1011.100462
5/18/2022	6:00:00 PM	0	12.86	5.3	5/18/2022	6:00:00 PM	0	887.326	2.748	3.81	22.58	1011.103689
5/18/2022	7:00:00 PM	0	12.867	5.3	5/18/2022	7:00:00 PM	0	887.881	3.425	3.81	22.57	1011.105029
5/18/2022	8:00:00 PM	0	12.871	5.3	5/18/2022	8:00:00 PM	0	888.262	2.828	3.81	22.57	1011.105144
5/18/2022	9:00:00 PM	0	12.876	5.3	5/18/2022	9:00:00 PM	0	888.565	2.367	3.82	22.57	1011.107055
5/18/2022	10:00:00 PM	0	12.878	5.3	5/18/2022	10:00:00 PM	0	888.894	2.068	3.81	22.57	1011.1057
5/18/2022	11:00:00 PM	0	12.879	5.3	5/18/2022	11:00:00 PM	0	889.498	1.785	3.81	22.58	1011.100541
5/19/2022	12:00:00 AM	0	12.879	5.3	5/19/2022	12:00:00 AM	0	889.907	1.708	3.80	22.58	1011.09637
5/19/2022	1:00:00 AM	0	12.879	5.3	5/19/2022	1:00:00 AM	0	890.344	1.31	3.80	22.59	1011.091914
5/19/2022	2:00:00 AM	0	12.879	5.3	5/19/2022	2:00:00 AM	0	890.923	1.061	3.79	22.59	1011.08601
5/19/2022	3:00:00 AM	0	12.881	5.3	5/19/2022	3:00:00 AM	0	891.456	1.142	3.79	22.60	1011.082574
5/19/2022	4:00:00 AM	0	12.882	5.3	5/19/2022	4:00:00 AM	0	892.08	1.099	3.79	22.60	1011.077211
5/19/2022	5:00:00 AM	0	12.884	5.3	5/19/2022	5:00:00 AM	0	892.602	0.929	3.78	22.61	1011.073888

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/19/2022	6:00:00 AM	0	12.887	5.3	5/19/2022	6:00:00 AM	0	893.521	1.154	3.78	22.61	1011.067517
5/19/2022	7:00:00 AM	0	12.885	5.3	5/19/2022	7:00:00 AM	0	894.35	2.143	3.77	22.62	1011.057064
5/19/2022	8:00:00 AM	0	12.884	5.3	5/19/2022	8:00:00 AM	0	895.3	4.434	3.75	22.63	1011.046376
5/19/2022	9:00:00 AM	0	12.882	5.3	5/19/2022	9:00:00 AM	0	896.353	6.869	3.74	22.65	1011.033639
5/19/2022	10:00:00 AM	0	12.881	5.3	5/19/2022	10:00:00 AM	0	897.263	8.735	3.73	22.66	1011.023359
5/19/2022	11:00:00 AM	0	12.879	5.3	5/19/2022	11:00:00 AM	0	897.951	9.968	3.72	22.66	1011.014344
5/19/2022	12:00:00 PM	0	12.874	5.3	5/19/2022	12:00:00 PM	0	898.273	11.97	3.71	22.67	1011.00606
5/19/2022	1:00:00 PM	0	12.874	5.3	5/19/2022	1:00:00 PM	0	898.465	14.62	3.71	22.67	1011.004102
5/19/2022	2:00:00 PM	0	12.881	5.3	5/19/2022	2:00:00 PM	0	899.076	14.332	3.71	22.67	1011.004872
5/19/2022	3:00:00 PM	0	12.885	5.3	5/19/2022	3:00:00 PM	0	899.736	12.446	3.71	22.68	1011.002142
5/19/2022	4:00:00 PM	0	12.89	5.3	5/19/2022	4:00:00 PM	0	899.566	15.082	3.72	22.67	1011.008875
5/19/2022	5:00:00 PM	0	12.9	5.3	5/19/2022	5:00:00 PM	0	900.359	9.675	3.72	22.67	1011.010789
5/19/2022	6:00:00 PM	0	12.911	5.3	5/19/2022	6:00:00 PM	0	900.724	6.837	3.73	22.66	1011.018067
5/19/2022	7:00:00 PM	0	12.919	5.3	5/19/2022	7:00:00 PM	0	901.192	6.971	3.73	22.66	1011.021294
5/19/2022	8:00:00 PM	0	12.929	5.3	5/19/2022	8:00:00 PM	0	901.565	4.123	3.74	22.65	1011.027491
5/19/2022	9:00:00 PM	0	12.936	5.3	5/19/2022	9:00:00 PM	0	902.013	2.245	3.74	22.65	1011.029923
5/19/2022	10:00:00 PM	0	12.939	5.3	5/19/2022	10:00:00 PM	0	902.098	1.298	3.74	22.65	1011.032056
5/19/2022	11:00:00 PM	0	12.941	5.3	5/19/2022	11:00:00 PM	0	902.144	0.54	3.74	22.65	1011.033587
5/20/2022	12:00:00 AM	0	12.944	5.3	5/20/2022	12:00:00 AM	0	902.552	0.007	3.74	22.65	1011.032426
5/20/2022	1:00:00 AM	0	12.944	5.3	5/20/2022	1:00:00 AM	0	902.609	-0.418	3.74	22.65	1011.031845
5/20/2022	2:00:00 AM	0	12.944	5.3	5/20/2022	2:00:00 AM	0	902.822	-0.689	3.74	22.65	1011.029673
5/20/2022	3:00:00 AM	0	12.944	5.3	5/20/2022	3:00:00 AM	0	902.986	-1.093	3.74	22.65	1011.028001
5/20/2022	4:00:00 AM	0	12.944	5.3	5/20/2022	4:00:00 AM	0	903.014	-0.805	3.74	22.65	1011.027715
5/20/2022	5:00:00 AM	0	12.945	5.3	5/20/2022	5:00:00 AM	0	903.401	-0.692	3.73	22.65	1011.024769
5/20/2022	6:00:00 AM	0	12.944	5.3	5/20/2022	6:00:00 AM	0	903.563	-0.696	3.73	22.66	1011.022117
5/20/2022	7:00:00 AM	0	12.944	5.3	5/20/2022	7:00:00 AM	0	904.335	3.776	3.72	22.66	1011.014245
5/20/2022	8:00:00 AM	0	12.941	5.3	5/20/2022	8:00:00 AM	0	904.442	13.249	3.72	22.67	1011.010154
5/20/2022	9:00:00 AM	0	12.936	5.3	5/20/2022	9:00:00 AM	0	904.392	14.071	3.71	22.67	1011.005663
5/20/2022	10:00:00 AM	0	12.93	5.3	5/20/2022	10:00:00 AM	0	903.902	17.91	3.71	22.67	1011.00466
5/20/2022	11:00:00 AM	0	12.926	5.3	5/20/2022	11:00:00 AM	0	903.71	18.239	3.71	22.68	1011.002618
5/20/2022	12:00:00 PM	0	12.921	5.3	5/20/2022	12:00:00 PM	0	903.581	16.683	3.71	22.68	1010.998933
5/20/2022	1:00:00 PM	0	12.916	5.3	5/20/2022	1:00:00 PM	0	903.071	20.062	3.71	22.68	1010.999134
5/20/2022	2:00:00 PM	0	12.914	5.3	5/20/2022	2:00:00 PM	0	902.836	20.74	3.71	22.68	1010.99953
5/20/2022	3:00:00 PM	0	12.912	5.3	5/20/2022	3:00:00 PM	0	902.855	16.318	3.71	22.68	1010.997337
5/20/2022	4:00:00 PM	0	12.916	5.3	5/20/2022	4:00:00 PM	0	902.919	14.746	3.71	22.68	1011.000684
5/20/2022	5:00:00 PM	0	12.921	5.3	5/20/2022	5:00:00 PM	0	902.961	12.668	3.71	22.67	1011.005256
5/20/2022	6:00:00 PM	0	12.927	5.3	5/20/2022	6:00:00 PM	0	903.062	10.565	3.72	22.67	1011.010226
5/20/2022	7:00:00 PM	0	12.935	5.3	5/20/2022	7:00:00 PM	0	903.317	10.288	3.72	22.66	1011.015625
5/20/2022	8:00:00 PM	0	12.942	5.3	5/20/2022	8:00:00 PM	0	903.538	6.868	3.73	22.66	1011.020372
5/20/2022	9:00:00 PM	0	12.948	5.3	5/20/2022	9:00:00 PM	0	903.735	4.024	3.73	22.65	1011.024363
5/20/2022	10:00:00 PM	0	12.954	5.3	5/20/2022	10:00:00 PM	0	903.78	2.302	3.74	22.65	1011.029904
5/20/2022	11:00:00 PM	0	12.957	5.3	5/20/2022	11:00:00 PM	0	903.868	0.905	3.74	22.65	1011.032007
5/21/2022	12:00:00 AM	0	12.959	5.3	5/21/2022	12:00:00 AM	0	903.968	-0.076	3.74	22.65	1011.032987
5/21/2022	1:00:00 AM	0	12.959	5.3	5/21/2022	1:00:00 AM	0	903.929	-0.851	3.74	22.65	1011.033385
5/21/2022	2:00:00 AM	0	12.959	5.3	5/21/2022	2:00:00 AM	0	904.064	-1.42	3.74	22.65	1011.032008
5/21/2022	3:00:00 AM	0	12.959	5.3	5/21/2022	3:00:00 AM	0	904.159	-1.932	3.74	22.65	1011.031039
5/21/2022	4:00:00 AM	0	12.959	5.3	5/21/2022	4:00:00 AM	0	904.355	-1.863	3.74	22.65	1011.029041
5/21/2022	5:00:00 AM	0	12.957	5.3	5/21/2022	5:00:00 AM	0	904.813	-0.967	3.73	22.66	1011.02237
5/21/2022	6:00:00 AM	0	12.957	5.3	5/21/2022	6:00:00 AM	0	905.091	-0.984	3.73	22.66	1011.019536
5/21/2022	7:00:00 AM	0	12.956	5.3	5/21/2022	7:00:00 AM	0	905.559	5.006	3.72	22.67	1011.013763
5/21/2022	8:00:00 AM	0	12.951	5.3	5/21/2022	8:00:00 AM	0	905.51	15.245	3.72	22.67	1011.009263
5/21/2022	9:00:00 AM	0	12.948	5.3	5/21/2022	9:00:00 AM	0	905.11	19.654	3.72	22.67	1011.010342
5/21/2022	10:00:00 AM	0	12.945	5.3	5/21/2022	10:00:00 AM	0	904.766	22.37	3.72	22.67	1011.01085
5/21/2022	11:00:00 AM	0	12.941	5.3	5/21/2022	11:00:00 AM	0	904.427	26.095	3.72	22.67	1011.010307
5/21/2022	12:00:00 PM	0	12.936	5.3	5/21/2022	12:00:00 PM	0	904.216	26.887	3.72	22.67	1011.007458
5/21/2022	1:00:00 PM	0	12.932	5.3	5/21/2022	1:00:00 PM	0	903.827	26.474	3.72	22.67	1011.007425
5/21/2022	2:00:00 PM	0	12.929	5.3	5/21/2022	2:00:00 PM	0	903.766	24.169	3.71	22.67	1011.005047
5/21/2022	3:00:00 PM	0	12.927	5.3	5/21/2022	3:00:00 PM	0	903.825	17.916	3.71	22.68	1011.002445
5/21/2022	4:00:00 PM	0	12.926	5.3	5/21/2022	4:00:00 PM	0	903.334	22.28	3.71	22.67	1011.006452
5/21/2022	5:00:00 PM	0	12.926	5.3	5/21/2022	5:00:00 PM	0	903.41	15.598	3.71	22.67	1011.005677
5/21/2022	6:00:00 PM	0	12.929	5.3	5/21/2022	6:00:00 PM	0	903.069	16.02	3.72	22.67	1011.012154
5/21/2022	7:00:00 PM	0	12.933	5.3	5/21/2022	7:00:00 PM	0	903.287	14.476	3.72	22.67	1011.013931
5/21/2022	8:00:00 PM	0	12.939	5.3	5/21/2022	8:00:00 PM	0	903.519	8.338	3.73	22.66	1011.017566
5/21/2022	9:00:00 PM	0	12.945	5.3	5/21/2022	9:00:00 PM	0	903.539	5.029	3.73	22.66	1011.023362
5/21/2022	10:00:00 PM	0	12.95	5.3	5/21/2022	10:00:00 PM	0	903.352	3.551	3.74	22.65	1011.030269
5/21/2022	11:00:00 PM	0	12.953	5.3	5/21/2022	11:00:00 PM	0	903.389	2.774	3.74	22.65	1011.032891
5/22/2022	12:00:00 AM	0	12.956	5.3	5/22/2022	12:00:00 AM	0	903.455	1.993	3.74	22.64	1011.035218
5/22/2022	1:00:00 AM	0	12.956	5.3	5/22/2022	1:00:00 AM	0	903.463	1.244	3.74	22.64	1011.035137
5/22/2022	2:00:00 AM	0	12.956	5.3	5/22/2022	2:00:00 AM	0	903.583	0.27	3.74	22.65	1011.033913
5/22/2022	3:00:00 AM	0	12.954	5.3	5/22/2022	3:00:00 AM	0	903.41	-0.434	3.74	22.65	1011.033677
5/22/2022	4:00:00 AM	0	12.951	5.3	5/22/2022	4:00:00 AM	0	903.408	-0.542	3.74	22.65	1011.030697
5/22/2022	5:00:00 AM	0	12.948	5.3	5/22/2022	5:00:00 AM	0	903.423	-0.076	3.74	22.65	1011.027545

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	SWL	Levelo	GW masl	Date	SWL	Levelogger	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/22/2022	6:00:00 AM	0	12.947	5.3	5/22/2022	6:00:00 AM	0	903.65	0.893	3.73	22.65	1011.02423
5/22/2022	7:00:00 AM	0	12.945	5.3	5/22/2022	7:00:00 AM	0	904.187	7.56	3.72	22.66	1011.016754
5/22/2022	8:00:00 AM	0	12.942	5.3	5/22/2022	8:00:00 AM	0	903.969	14.946	3.72	22.66	1011.015977
5/22/2022	9:00:00 AM	0	12.939	5.3	5/22/2022	9:00:00 AM	0	903.415	20.044	3.73	22.66	1011.018626
5/22/2022	10:00:00 AM	0	12.935	5.3	5/22/2022	10:00:00 AM	0	902.741	23.882	3.73	22.66	1011.021499
5/22/2022	11:00:00 AM	0	12.932	5.3	5/22/2022	11:00:00 AM	0	902.224	26.654	3.73	22.66	1011.023771
5/22/2022	12:00:00 PM	0	12.927	5.3	5/22/2022	12:00:00 PM	0	901.593	27.895	3.73	22.65	1011.025205
5/22/2022	1:00:00 PM	0	12.921	5.3	5/22/2022	1:00:00 PM	0	900.864	28.428	3.73	22.65	1011.026639
5/22/2022	2:00:00 PM	0	12.916	5.3	5/22/2022	2:00:00 PM	0	900.431	27.823	3.73	22.65	1011.026055
5/22/2022	3:00:00 PM	0	12.912	5.3	5/22/2022	3:00:00 PM	0	900.131	23.109	3.73	22.65	1011.025114
5/22/2022	4:00:00 PM	0	12.909	5.4	5/22/2022	4:00:00 PM	0	899.364	27.187	3.74	22.65	1011.029935
5/22/2022	5:00:00 PM	0	12.903	5.3	5/22/2022	5:00:00 PM	0	899.163	19.761	3.73	22.65	1011.025985
5/22/2022	6:00:00 PM	0	12.902	5.3	5/22/2022	6:00:00 PM	0	898.589	18.038	3.74	22.65	1011.030838
5/22/2022	7:00:00 PM	0	12.902	5.3	5/22/2022	7:00:00 PM	0	898.487	15.399	3.74	22.65	1011.031878
5/22/2022	8:00:00 PM	0	12.903	5.3	5/22/2022	8:00:00 PM	0	898.409	11.323	3.74	22.65	1011.033673
5/22/2022	9:00:00 PM	0	12.906	5.3	5/22/2022	9:00:00 PM	0	898.129	8.475	3.75	22.64	1011.039528
5/22/2022	10:00:00 PM	0	12.912	5.3	5/22/2022	10:00:00 PM	0	898.499	7.457	3.75	22.64	1011.041756
5/22/2022	11:00:00 PM	0	12.915	5.3	5/22/2022	11:00:00 PM	0	898.482	6.217	3.75	22.63	1011.044929
5/23/2022	12:00:00 AM	0	12.918	5.3	5/23/2022	12:00:00 AM	0	898.582	5.421	3.75	22.63	1011.046909
5/23/2022	1:00:00 AM	0	12.918	5.3	5/23/2022	1:00:00 AM	0	898.611	4.797	3.75	22.63	1011.046613
5/23/2022	2:00:00 AM	0	12.918	5.3	5/23/2022	2:00:00 AM	0	898.706	4.537	3.75	22.63	1011.045645
5/23/2022	3:00:00 AM	0	12.914	5.3	5/23/2022	3:00:00 AM	0	898.527	4.28	3.75	22.64	1011.04347
5/23/2022	4:00:00 AM	0	12.912	5.3	5/23/2022	4:00:00 AM	0	898.581	3.636	3.75	22.64	1011.040919
5/23/2022	5:00:00 AM	0	12.908	5.3	5/23/2022	5:00:00 AM	0	898.622	3.726	3.74	22.64	1011.036501
5/23/2022	6:00:00 AM	0	12.906	5.3	5/23/2022	6:00:00 AM	0	898.848	4.87	3.74	22.65	1011.032197
5/23/2022	7:00:00 AM	0	12.903	5.3	5/23/2022	7:00:00 AM	0	899.193	7.444	3.73	22.65	1011.025679
5/23/2022	8:00:00 AM	0	12.902	5.3	5/23/2022	8:00:00 AM	0	899.216	12.259	3.73	22.65	1011.024444
5/23/2022	9:00:00 AM	0	12.9	5.3	5/23/2022	9:00:00 AM	0	899.144	16.593	3.73	22.66	1011.023178
5/23/2022	10:00:00 AM	0	12.902	5.3	5/23/2022	10:00:00 AM	0	899.36	17.661	3.73	22.66	1011.022976
5/23/2022	11:00:00 AM	0	12.903	5.3	5/23/2022	11:00:00 AM	0	899.489	17.206	3.73	22.66	1011.02266
5/23/2022	12:00:00 PM	0	12.902	5.3	5/23/2022	12:00:00 PM	0	899.358	16.701	3.73	22.66	1011.022996
5/23/2022	1:00:00 PM	0	12.9	5.3	5/23/2022	1:00:00 PM	0	899.161	18.483	3.73	22.66	1011.023005
5/23/2022	2:00:00 PM	0	12.897	5.3	5/23/2022	2:00:00 PM	0	898.983	18.684	3.73	22.66	1011.02182
5/23/2022	3:00:00 PM	0	12.893	5.3	5/23/2022	3:00:00 PM	0	898.51	18.906	3.73	22.66	1011.022643
5/23/2022	4:00:00 PM	0	12.891	5.3	5/23/2022	4:00:00 PM	0	898.467	16.243	3.73	22.66	1011.021082
5/23/2022	5:00:00 PM	0	12.894	5.3	5/23/2022	5:00:00 PM	0	899.292	10.374	3.72	22.66	1011.015669
5/23/2022	6:00:00 PM	0	12.891	5.3	5/23/2022	6:00:00 PM	0	899.034	10.94	3.72	22.66	1011.0153
5/23/2022	7:00:00 PM	0	12.893	5.3	5/23/2022	7:00:00 PM	0	899.619	11.815	3.72	22.67	1011.011335
5/23/2022	8:00:00 PM	0	12.891	5.3	5/23/2022	8:00:00 PM	0	899.017	7.639	3.72	22.66	1011.015473
5/23/2022	9:00:00 PM	0	12.896	5.3	5/23/2022	9:00:00 PM	0	899.312	4.821	3.73	22.66	1011.017465
5/23/2022	10:00:00 PM	0	12.897	5.3	5/23/2022	10:00:00 PM	0	899.321	4.453	3.73	22.66	1011.018373
5/23/2022	11:00:00 PM	0	12.9	5.3	5/23/2022	11:00:00 PM	0	899.259	4.244	3.73	22.66	1011.022006
5/24/2022	12:00:00 AM	0	12.903	5.3	5/24/2022	12:00:00 AM	0	899.506	4.3	3.73	22.66	1011.022487
5/24/2022	1:00:00 AM	0	12.902	5.3	5/24/2022	1:00:00 AM	0	899.112	4.126	3.73	22.65	1011.025505
5/24/2022	2:00:00 AM	0	12.899	5.3	5/24/2022	2:00:00 AM	0	898.589	4.063	3.74	22.65	1011.027838
5/24/2022	3:00:00 AM	0	12.897	5.3	5/24/2022	3:00:00 AM	0	898.592	3.893	3.73	22.65	1011.025807
5/24/2022	4:00:00 AM	0	12.894	5.3	5/24/2022	4:00:00 AM	0	898.727	3.816	3.73	22.66	1011.021431
5/24/2022	5:00:00 AM	0	12.888	5.3	5/24/2022	5:00:00 AM	0	898.443	3.867	3.73	22.66	1011.018327
5/24/2022	6:00:00 AM	0	12.882	5.3	5/24/2022	6:00:00 AM	0	898.162	4.801	3.72	22.66	1011.015192
5/24/2022	7:00:00 AM	0	12.879	5.3	5/24/2022	7:00:00 AM	0	898.434	7.749	3.72	22.67	1011.009418
5/24/2022	8:00:00 AM	0	12.874	5.3	5/24/2022	8:00:00 AM	0	898.289	9.137	3.71	22.67	1011.005897
5/24/2022	9:00:00 AM	0	12.871	5.3	5/24/2022	9:00:00 AM	0	897.842	11.358	3.72	22.67	1011.007455
5/24/2022	10:00:00 AM	0	12.868	5.3	5/24/2022	10:00:00 AM	0	897.107	16.435	3.72	22.67	1011.01195
5/24/2022	11:00:00 AM	0	12.867	5.3	5/24/2022	11:00:00 AM	0	896.564	15.44	3.72	22.66	1011.016487
5/24/2022	12:00:00 PM	0	12.866	5.3	5/24/2022	12:00:00 PM	0	895.902	13.596	3.73	22.66	1011.022238
5/24/2022	1:00:00 PM	0	12.863	5.3	5/24/2022	1:00:00 PM	0	895.283	16.614	3.73	22.65	1011.02555
5/24/2022	2:00:00 PM	0	12.863	5.3	5/24/2022	2:00:00 PM	0	894.736	18.47	3.74	22.65	1011.031128
5/24/2022	3:00:00 PM	0	12.857	5.3	5/24/2022	3:00:00 PM	0	894.041	17.344	3.74	22.65	1011.032215
5/24/2022	4:00:00 PM	0	12.857	5.3	5/24/2022	4:00:00 PM	0	894.125	13.032	3.74	22.65	1011.031358
5/24/2022	5:00:00 PM	0	12.849	5.3	5/24/2022	5:00:00 PM	0	893.454	12.319	3.74	22.65	1011.0302
5/24/2022	6:00:00 PM	0	12.846	5.3	5/24/2022	6:00:00 PM	0	893.405	10.477	3.74	22.65	1011.0277
5/24/2022	7:00:00 PM	0	12.845	5.3	5/24/2022	7:00:00 PM	0	893.529	9.396	3.73	22.65	1011.025436
5/24/2022	8:00:00 PM	0	12.84	5.3	5/24/2022	8:00:00 PM	0	893.137	7.945	3.73	22.65	1011.024433
5/24/2022	9:00:00 PM	0	12.84	5.3	5/24/2022	9:00:00 PM	0	893.109	6.846	3.73	22.65	1011.024718
5/24/2022	10:00:00 PM	0	12.839	5.3	5/24/2022	10:00:00 PM	0	892.781	6.25	3.74	22.65	1011.027063
5/24/2022	11:00:00 PM	0	12.837	5.3	5/24/2022	11:00:00 PM	0	892.393	5.656	3.74	22.65	1011.02902
5/25/2022	12:00:00 AM	0	12.839	5.3	5/25/2022	12:00:00 AM	0	892.374	4.965	3.74	22.65	1011.031213
5/25/2022	1:00:00 AM	0	12.839	5.3	5/25/2022	1:00:00 AM	0	892.186	4.337	3.74	22.65	1011.03313
5/25/2022	2:00:00 AM	0	12.837	5.3	5/25/2022	2:00:00 AM	0	892.144	4.391	3.74	22.65	1011.031559
5/25/2022	3:00:00 AM	0	12.834	5.3	5/25/2022	3:00:00 AM	0	892.035	4.513	3.74	22.65	1011.02967
5/25/2022	4:00:00 AM	0	12.828	5.3	5/25/2022	4:00:00 AM	0	891.925	4.685	3.73	22.65	1011.024792
5/25/2022	5:00:00 AM	0	12.823	5.3	5/25/2022	5:00:00 AM	0	891.91	4.478	3.73	22.66	1011.019945

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/25/2022	6:00:00 AM	0	12.82	5.3	5/25/2022	6:00:00 AM	0	892.315	5.233	3.72	22.67	1011.012815
5/25/2022	7:00:00 AM	0	12.813	5.3	5/25/2022	7:00:00 AM	0	892.334	6.894	3.71	22.67	1011.005621
5/25/2022	8:00:00 AM	0	12.807	5.3	5/25/2022	8:00:00 AM	0	892.261	13.538	3.71	22.68	1011.000366
5/25/2022	9:00:00 AM	0	12.803	5.3	5/25/2022	9:00:00 AM	0	891.634	18.115	3.71	22.68	1011.002759
5/25/2022	10:00:00 AM	0	12.801	5.3	5/25/2022	10:00:00 AM	0	891.308	20.285	3.71	22.67	1011.004084
5/25/2022	11:00:00 AM	0	12.803	5.3	5/25/2022	11:00:00 AM	0	891.033	22.785	3.72	22.67	1011.008888
5/25/2022	12:00:00 PM	0	12.803	5.3	5/25/2022	12:00:00 PM	0	890.865	19.567	3.72	22.67	1011.010601
5/25/2022	1:00:00 PM	0	12.806	5.3	5/25/2022	1:00:00 PM	0	890.716	16.347	3.72	22.66	1011.01512
5/25/2022	2:00:00 PM	0	12.807	5.3	5/25/2022	2:00:00 PM	0	890.895	13.665	3.72	22.66	1011.014295
5/25/2022	3:00:00 PM	0	12.807	5.3	5/25/2022	3:00:00 PM	0	890.578	14.892	3.73	22.66	1011.017528
5/25/2022	4:00:00 PM	0	12.81	5.3	5/25/2022	4:00:00 PM	0	891.294	14.937	3.72	22.67	1011.013226
5/25/2022	5:00:00 PM	0	12.807	5.3	5/25/2022	5:00:00 PM	0	891.373	14.484	3.72	22.67	1011.009421
5/25/2022	6:00:00 PM	0	12.809	5.3	5/25/2022	6:00:00 PM	0	892.228	13.026	3.71	22.68	1011.002702
5/25/2022	7:00:00 PM	0	12.806	5.3	5/25/2022	7:00:00 PM	0	892.391	12.505	3.71	22.68	1010.99804
5/25/2022	8:00:00 PM	0	12.806	5.3	5/25/2022	8:00:00 PM	0	892.996	9.939	3.70	22.69	1010.991871
5/25/2022	9:00:00 PM	0	12.807	5.3	5/25/2022	9:00:00 PM	0	893.756	8.239	3.69	22.69	1010.985121
5/25/2022	10:00:00 PM	0	12.81	5.3	5/25/2022	10:00:00 PM	0	894.224	7.102	3.69	22.70	1010.983349
5/25/2022	11:00:00 PM	0	12.815	5.3	5/25/2022	11:00:00 PM	0	894.872	6.438	3.69	22.70	1010.981741
5/26/2022	12:00:00 AM	0	12.813	5.3	5/26/2022	12:00:00 AM	0	894.595	5.531	3.69	22.70	1010.982565
5/26/2022	1:00:00 AM	0	12.815	5.3	5/26/2022	1:00:00 AM	0	894.848	3.879	3.69	22.70	1010.981986
5/26/2022	2:00:00 AM	0	12.813	5.3	5/26/2022	2:00:00 AM	0	894.419	3.379	3.69	22.69	1010.98436
5/26/2022	3:00:00 AM	0	12.815	5.3	5/26/2022	3:00:00 AM	0	894.831	2.672	3.69	22.70	1010.982159
5/26/2022	4:00:00 AM	0	12.81	5.3	5/26/2022	4:00:00 AM	0	894.795	3.015	3.69	22.70	1010.977526
5/26/2022	5:00:00 AM	0	12.804	5.3	5/26/2022	5:00:00 AM	0	894.87	3.615	3.68	22.71	1010.970761
5/26/2022	6:00:00 AM	0	12.8	5.3	5/26/2022	6:00:00 AM	0	895.065	5.365	3.67	22.71	1010.964773
5/26/2022	7:00:00 AM	0	12.794	5.3	5/26/2022	7:00:00 AM	0	895.226	8.536	3.67	22.72	1010.957131
5/26/2022	8:00:00 AM	0	12.789	5.3	5/26/2022	8:00:00 AM	0	895.242	11.081	3.66	22.73	1010.951968
5/26/2022	9:00:00 AM	0	12.785	5.3	5/26/2022	9:00:00 AM	0	894.691	16.395	3.66	22.73	1010.953586
5/26/2022	10:00:00 AM	0	12.783	5.3	5/26/2022	10:00:00 AM	0	894.271	18.339	3.66	22.72	1010.955869
5/26/2022	11:00:00 AM	0	12.78	5.3	5/26/2022	11:00:00 AM	0	893.464	20.534	3.67	22.72	1010.961098
5/26/2022	12:00:00 PM	0	12.781	5.3	5/26/2022	12:00:00 PM	0	892.9	22.956	3.68	22.71	1010.96785
5/26/2022	1:00:00 PM	0	12.78	5.3	5/26/2022	1:00:00 PM	0	891.964	24.265	3.68	22.70	1010.976394
5/26/2022	2:00:00 PM	0	12.78	5.3	5/26/2022	2:00:00 PM	0	891.32	24.094	3.69	22.70	1010.982961
5/26/2022	3:00:00 PM	0	12.781	5.3	5/26/2022	3:00:00 PM	0	890.952	20.856	3.70	22.69	1010.987714
5/26/2022	4:00:00 PM	0	12.78	5.3	5/26/2022	4:00:00 PM	0	890.746	19.49	3.70	22.69	1010.988814
5/26/2022	5:00:00 PM	0	12.777	5.3	5/26/2022	5:00:00 PM	0	890.612	18.137	3.70	22.69	1010.987181
5/26/2022	6:00:00 PM	0	12.773	5.3	5/26/2022	6:00:00 PM	0	890.235	17.012	3.70	22.69	1010.987025
5/26/2022	7:00:00 PM	0	12.765	5.3	5/26/2022	7:00:00 PM	0	889.718	14.405	3.69	22.69	1010.984297
5/26/2022	8:00:00 PM	0	12.759	5.3	5/26/2022	8:00:00 PM	0	889.331	11.839	3.69	22.70	1010.982243
5/26/2022	9:00:00 PM	0	12.755	5.3	5/26/2022	9:00:00 PM	0	889.121	11.188	3.69	22.70	1010.980385
5/26/2022	10:00:00 PM	0	12.75	5.3	5/26/2022	10:00:00 PM	0	888.894	10.403	3.69	22.70	1010.9777
5/26/2022	11:00:00 PM	0	12.747	5.3	5/26/2022	11:00:00 PM	0	888.431	10.003	3.69	22.70	1010.979421
5/27/2022	12:00:00 AM	0	12.744	5.3	5/27/2022	12:00:00 AM	0	888.022	9.932	3.69	22.70	1010.980592
5/27/2022	1:00:00 AM	0	12.741	5.3	5/27/2022	1:00:00 AM	0	887.495	9.614	3.69	22.70	1010.982966
5/27/2022	2:00:00 AM	0	12.736	5.3	5/27/2022	2:00:00 AM	0	886.856	9.462	3.69	22.69	1010.984482
5/27/2022	3:00:00 AM	0	12.732	5.3	5/27/2022	3:00:00 AM	0	886.522	9.228	3.69	22.70	1010.983887
5/27/2022	4:00:00 AM	0	12.729	5.3	5/27/2022	4:00:00 AM	0	886.663	7.66	3.69	22.70	1010.97945
5/27/2022	5:00:00 AM	0	12.723	5.3	5/27/2022	5:00:00 AM	0	886.491	6.422	3.68	22.70	1010.975204
5/27/2022	6:00:00 AM	0	12.714	5.3	5/27/2022	6:00:00 AM	0	886.058	6.36	3.68	22.71	1010.970619
5/27/2022	7:00:00 AM	0	12.708	5.3	5/27/2022	7:00:00 AM	0	886.214	7.395	3.67	22.72	1010.963028
5/27/2022	8:00:00 AM	0	12.707	5.3	5/27/2022	8:00:00 AM	0	886.904	7.315	3.66	22.72	1010.954992
5/27/2022	9:00:00 AM	0	12.705	5.3	5/27/2022	9:00:00 AM	0	887.345	7.406	3.66	22.73	1010.948495
5/27/2022	10:00:00 AM	0	12.702	5.3	5/27/2022	10:00:00 AM	0	887.333	12.848	3.65	22.73	1010.945617
5/27/2022	11:00:00 AM	0	12.701	5.3	5/27/2022	11:00:00 AM	0	886.859	20.603	3.66	22.73	1010.949451
5/27/2022	12:00:00 PM	0	12.701	5.3	5/27/2022	12:00:00 PM	0	886.664	19.2	3.66	22.73	1010.951439
5/27/2022	1:00:00 PM	0	12.716	5.3	5/27/2022	1:00:00 PM	0	887.993	10.899	3.66	22.73	1010.952887
5/27/2022	2:00:00 PM	0	12.717	5.3	5/27/2022	2:00:00 PM	0	887.621	11.268	3.67	22.72	1010.957681
5/27/2022	3:00:00 PM	0	12.723	5.3	5/27/2022	3:00:00 PM	0	887.786	12.243	3.67	22.72	1010.961998
5/27/2022	4:00:00 PM	0	12.723	5.3	5/27/2022	4:00:00 PM	0	887.717	17.583	3.67	22.72	1010.962702
5/27/2022	5:00:00 PM	0	12.725	5.3	5/27/2022	5:00:00 PM	0	888.013	14.005	3.67	22.72	1010.961683
5/27/2022	6:00:00 PM	0	12.726	5.3	5/27/2022	6:00:00 PM	0	888.477	10.255	3.67	22.72	1010.957952
5/27/2022	7:00:00 PM	0	12.723	5.3	5/27/2022	7:00:00 PM	0	888.606	7.885	3.66	22.73	1010.953636
5/27/2022	8:00:00 PM	0	12.72	5.3	5/27/2022	8:00:00 PM	0	889.017	6.521	3.65	22.73	1010.946445
5/27/2022	9:00:00 PM	0	12.717	5.3	5/27/2022	9:00:00 PM	0	889.25	5.631	3.65	22.74	1010.941069
5/27/2022	10:00:00 PM	0	12.719	5.3	5/27/2022	10:00:00 PM	0	889.798	4.391	3.65	22.74	1010.937481
5/27/2022	11:00:00 PM	0	12.716	5.3	5/27/2022	11:00:00 PM	0	889.839	4.107	3.64	22.74	1010.934063
5/28/2022	12:00:00 AM	0	12.716	5.3	5/28/2022	12:00:00 AM	0	889.851	4.094	3.64	22.75	1010.933941
5/28/2022	1:00:00 AM	0	12.714	5.3	5/28/2022	1:00:00 AM	0	889.607	3.784	3.64	22.74	1010.934429
5/28/2022	2:00:00 AM	0	12.714	5.3	5/28/2022	2:00:00 AM	0	889.723	2.815	3.64	22.75	1010.933246
5/28/2022	3:00:00 AM	0	12.713	5.3	5/28/2022	3:00:00 AM	0	889.796	2.213	3.64	22.75	1010.931502
5/28/2022	4:00:00 AM	0	12.708	5.3	5/28/2022	4:00:00 AM	0	889.679	2.752	3.64	22.75	1010.927695
5/28/2022	5:00:00 AM	0	12.704	5.3	5/28/2022	5:00:00 AM	0	889.979	3.514	3.63	22.76	1010.920636

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/28/2022	6:00:00 AM	0	12.699	5.3	5/28/2022	6:00:00 AM	0	890.088	4.477	3.62	22.76	1010.914524
5/28/2022	7:00:00 AM	0	12.692	5.3	5/28/2022	7:00:00 AM	0	890.311	6.183	3.61	22.77	1010.90525
5/28/2022	8:00:00 AM	0	12.684	5.3	5/28/2022	8:00:00 AM	0	890.506	8.578	3.60	22.78	1010.895262
5/28/2022	9:00:00 AM	0	12.68	5.3	5/28/2022	9:00:00 AM	0	890.417	11.108	3.60	22.79	1010.892169
5/28/2022	10:00:00 AM	0	12.675	5.3	5/28/2022	10:00:00 AM	0	889.581	17.026	3.60	22.78	1010.895694
5/28/2022	11:00:00 AM	0	12.677	5.3	5/28/2022	11:00:00 AM	0	889.709	17.456	3.60	22.78	1010.896389
5/28/2022	12:00:00 PM	0	12.678	5.3	5/28/2022	12:00:00 PM	0	889.512	11.262	3.61	22.78	1010.899398
5/28/2022	1:00:00 PM	0	12.681	5.3	5/28/2022	1:00:00 PM	0	889.218	18.834	3.61	22.77	1010.905396
5/28/2022	2:00:00 PM	0	12.685	5.3	5/28/2022	2:00:00 PM	0	888.96	18.533	3.62	22.77	1010.912027
5/28/2022	3:00:00 PM	0	12.688	5.3	5/28/2022	3:00:00 PM	0	888.708	15.825	3.63	22.76	1010.917596
5/28/2022	4:00:00 PM	0	12.695	5.3	5/28/2022	4:00:00 PM	0	889.071	12.301	3.63	22.76	1010.920895
5/28/2022	5:00:00 PM	0	12.695	5.3	5/28/2022	5:00:00 PM	0	888.704	11.654	3.63	22.75	1010.924637
5/28/2022	6:00:00 PM	0	12.695	5.3	5/28/2022	6:00:00 PM	0	888.574	13.543	3.63	22.75	1010.925963
5/28/2022	7:00:00 PM	0	12.693	5.3	5/28/2022	7:00:00 PM	0	888.894	12.602	3.63	22.76	1010.9207
5/28/2022	8:00:00 PM	0	12.69	5.3	5/28/2022	8:00:00 PM	0	889.118	7.966	3.62	22.76	1010.915415
5/28/2022	9:00:00 PM	0	12.687	5.3	5/28/2022	9:00:00 PM	0	889.229	5.716	3.62	22.77	1010.911284
5/28/2022	10:00:00 PM	0	12.684	5.3	5/28/2022	10:00:00 PM	0	889.307	4.207	3.62	22.77	1010.907488
5/28/2022	11:00:00 PM	0	12.681	5.3	5/28/2022	11:00:00 PM	0	889.332	3.193	3.61	22.77	1010.904233
5/29/2022	12:00:00 AM	0	12.681	5.3	5/29/2022	12:00:00 AM	0	889.454	2.504	3.61	22.78	1010.902989
5/29/2022	1:00:00 AM	0	12.68	5.3	5/29/2022	1:00:00 AM	0	889.524	2.385	3.61	22.78	1010.901275
5/29/2022	2:00:00 AM	0	12.68	5.3	5/29/2022	2:00:00 AM	0	889.604	1.864	3.61	22.78	1010.90046
5/29/2022	3:00:00 AM	0	12.68	5.3	5/29/2022	3:00:00 AM	0	889.813	2.192	3.61	22.78	1010.898328
5/29/2022	4:00:00 AM	0	12.677	5.3	5/29/2022	4:00:00 AM	0	890.096	2.759	3.60	22.79	1010.892443
5/29/2022	5:00:00 AM	0	12.674	5.3	5/29/2022	5:00:00 AM	0	890.229	3.041	3.60	22.79	1010.888086
5/29/2022	6:00:00 AM	0	12.671	5.3	5/29/2022	6:00:00 AM	0	890.64	3.362	3.59	22.80	1010.880895
5/29/2022	7:00:00 AM	0	12.663	5.3	5/29/2022	7:00:00 AM	0	891.009	5.877	3.58	22.81	1010.869133
5/29/2022	8:00:00 AM	0	12.657	5.3	5/29/2022	8:00:00 AM	0	891.458	9.84	3.57	22.82	1010.858554
5/29/2022	9:00:00 AM	0	12.651	5.3	5/29/2022	9:00:00 AM	0	891.347	16.625	3.56	22.83	1010.853686
5/29/2022	10:00:00 AM	0	12.648	5.3	5/29/2022	10:00:00 AM	0	891.433	17.841	3.56	22.83	1010.849809
5/29/2022	11:00:00 AM	0	12.648	5.3	5/29/2022	11:00:00 AM	0	891.299	20.843	3.56	22.83	1010.851175
5/29/2022	12:00:00 PM	0	12.653	5.3	5/29/2022	12:00:00 PM	0	891.558	20.109	3.56	22.83	1010.853534
5/29/2022	1:00:00 PM	0	12.657	5.3	5/29/2022	1:00:00 PM	0	891.645	18.937	3.56	22.82	1010.856647
5/29/2022	2:00:00 PM	0	12.665	5.3	5/29/2022	2:00:00 PM	0	891.887	19.036	3.57	22.82	1010.862179
5/29/2022	3:00:00 PM	0	12.672	5.3	5/29/2022	3:00:00 PM	0	891.927	17.892	3.58	22.81	1010.868772
5/29/2022	4:00:00 PM	0	12.68	5.3	5/29/2022	4:00:00 PM	0	892.298	17.755	3.58	22.81	1010.872988
5/29/2022	5:00:00 PM	0	12.684	5.3	5/29/2022	5:00:00 PM	0	892.473	15.119	3.58	22.80	1010.875204
5/29/2022	6:00:00 PM	0	12.688	5.3	5/29/2022	6:00:00 PM	0	892.966	14.435	3.58	22.80	1010.874177
5/29/2022	7:00:00 PM	0	12.692	5.3	5/29/2022	7:00:00 PM	0	893.628	12.056	3.58	22.81	1010.871426
5/29/2022	8:00:00 PM	0	12.692	5.3	5/29/2022	8:00:00 PM	0	894.326	9.884	3.57	22.81	1010.864308
5/29/2022	9:00:00 PM	0	12.693	5.3	5/29/2022	9:00:00 PM	0	895.017	8.556	3.57	22.82	1010.858262
5/29/2022	10:00:00 PM	0	12.693	5.3	5/29/2022	10:00:00 PM	0	895.546	7.321	3.56	22.83	1010.852868
5/29/2022	11:00:00 PM	0	12.693	5.3	5/29/2022	11:00:00 PM	0	896.248	7.188	3.55	22.83	1010.845709
5/30/2022	12:00:00 AM	0	12.693	5.3	5/30/2022	12:00:00 AM	0	896.425	7.191	3.55	22.84	1010.843905
5/30/2022	1:00:00 AM	0	12.695	5.3	5/30/2022	1:00:00 AM	0	896.846	6.659	3.55	22.84	1010.841612
5/30/2022	2:00:00 AM	0	12.696	5.3	5/30/2022	2:00:00 AM	0	897.173	4.834	3.55	22.84	1010.839277
5/30/2022	3:00:00 AM	0	12.699	5.3	5/30/2022	3:00:00 AM	0	897.646	3.828	3.55	22.84	1010.837454
5/30/2022	4:00:00 AM	0	12.701	5.3	5/30/2022	4:00:00 AM	0	898.047	3.045	3.54	22.84	1010.835365
5/30/2022	5:00:00 AM	0	12.699	5.3	5/30/2022	5:00:00 AM	0	898.625	3.067	3.54	22.85	1010.827471
5/30/2022	6:00:00 AM	0	12.699	5.3	5/30/2022	6:00:00 AM	0	899.548	4.169	3.53	22.86	1010.818059
5/30/2022	7:00:00 AM	0	12.695	5.3	5/30/2022	7:00:00 AM	0	900.249	9.443	3.51	22.87	1010.80691
5/30/2022	8:00:00 AM	0	12.688	5.3	5/30/2022	8:00:00 AM	0	900.409	16.765	3.51	22.88	1010.798279
5/30/2022	9:00:00 AM	0	12.684	5.3	5/30/2022	9:00:00 AM	0	900.204	22.99	3.50	22.88	1010.796369
5/30/2022	10:00:00 AM	0	12.681	5.3	5/30/2022	10:00:00 AM	0	900.095	25.47	3.50	22.88	1010.794481
5/30/2022	11:00:00 AM	0	12.68	5.3	5/30/2022	11:00:00 AM	0	899.708	28.539	3.51	22.88	1010.797427
5/30/2022	12:00:00 PM	0	12.681	5.3	5/30/2022	12:00:00 PM	0	899.804	28.549	3.51	22.88	1010.797448
5/30/2022	1:00:00 PM	0	12.688	5.3	5/30/2022	1:00:00 PM	0	900.703	23.422	3.50	22.88	1010.795281
5/30/2022	2:00:00 PM	0	12.698	5.3	5/30/2022	2:00:00 PM	0	901.207	18.052	3.51	22.88	1010.800142
5/30/2022	3:00:00 PM	0	12.707	5.3	5/30/2022	3:00:00 PM	0	901.536	17.102	3.51	22.87	1010.805787
5/30/2022	4:00:00 PM	0	12.714	5.3	5/30/2022	4:00:00 PM	0	901.644	16.488	3.52	22.87	1010.811685
5/30/2022	5:00:00 PM	0	12.72	5.3	5/30/2022	5:00:00 PM	0	901.721	17.023	3.52	22.86	1010.8169
5/30/2022	6:00:00 PM	0	12.725	5.3	5/30/2022	6:00:00 PM	0	901.909	16.042	3.53	22.86	1010.819983
5/30/2022	7:00:00 PM	0	12.726	5.3	5/30/2022	7:00:00 PM	0	902.297	14.195	3.53	22.86	1010.817027
5/30/2022	8:00:00 PM	0	12.727	5.3	5/30/2022	8:00:00 PM	0	902.643	11.724	3.52	22.86	1010.814498
5/30/2022	9:00:00 PM	0	12.726	5.3	5/30/2022	9:00:00 PM	0	902.87	9.805	3.52	22.87	1010.811184
5/30/2022	10:00:00 PM	0	12.725	5.3	5/30/2022	10:00:00 PM	0	902.912	8.686	3.52	22.87	1010.809755
5/30/2022	11:00:00 PM	0	12.723	5.3	5/30/2022	11:00:00 PM	0	903.048	7.332	3.51	22.87	1010.806368
5/31/2022	12:00:00 AM	0	12.723	5.3	5/31/2022	12:00:00 AM	0	903.179	6.749	3.51	22.87	1010.805033
5/31/2022	1:00:00 AM	0	12.723	5.3	5/31/2022	1:00:00 AM	0	903.334	5.701	3.51	22.88	1010.803452
5/31/2022	2:00:00 AM	0	12.722	5.3	5/31/2022	2:00:00 AM	0	903.206	4.912	3.51	22.88	1010.803757
5/31/2022	3:00:00 AM	0	12.722	5.3	5/31/2022	3:00:00 AM	0	903.201	4.175	3.51	22.88	1010.803808
5/31/2022	4:00:00 AM	0	12.72	5.3	5/31/2022	4:00:00 AM	0	903.257	4.174	3.51	22.88	1010.801237
5/31/2022	5:00:00 AM	0	12.719	5.3	5/31/2022	5:00:00 AM	0	903.343	4.44	3.51	22.88	1010.79936

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/31/2022	6:00:00 AM	0	12.717	5.3	5/31/2022	6:00:00 AM	0	903.68	5.593	3.50	22.89	1010.793924
5/31/2022	7:00:00 AM	0	12.711	5.3	5/31/2022	7:00:00 AM	0	904.043	10.083	3.49	22.89	1010.784222
5/31/2022	8:00:00 AM	0	12.702	5.3	5/31/2022	8:00:00 AM	0	903.843	15.638	3.49	22.90	1010.777262
5/31/2022	9:00:00 AM	0	12.695	5.3	5/31/2022	9:00:00 AM	0	903.311	21.694	3.48	22.90	1010.775687
5/31/2022	10:00:00 AM	0	12.688	5.3	5/31/2022	10:00:00 AM	0	903.195	23.51	3.48	22.91	1010.769869
5/31/2022	11:00:00 AM	0	12.682	5.3	5/31/2022	11:00:00 AM	0	902.429	25.675	3.48	22.91	1010.771681
5/31/2022	12:00:00 PM	0	12.68	5.3	5/31/2022	12:00:00 PM	0	902.004	26.595	3.48	22.90	1010.774014
5/31/2022	1:00:00 PM	0	12.682	5.3	5/31/2022	1:00:00 PM	0	902.023	25.291	3.48	22.90	1010.775821
5/31/2022	2:00:00 PM	0	12.688	5.3	5/31/2022	2:00:00 PM	0	902.066	23.47	3.49	22.90	1010.781382
5/31/2022	3:00:00 PM	0	12.696	5.3	5/31/2022	3:00:00 PM	0	902.702	20.055	3.49	22.90	1010.782897
5/31/2022	4:00:00 PM	0	12.705	5.3	5/31/2022	4:00:00 PM	0	903.403	16.003	3.49	22.89	1010.784748
5/31/2022	5:00:00 PM	0	12.711	5.3	5/31/2022	5:00:00 PM	0	903.353	16.095	3.50	22.89	1010.791258
5/31/2022	6:00:00 PM	0	12.716	5.3	5/31/2022	6:00:00 PM	0	903.251	16.235	3.51	22.88	1010.797298
5/31/2022	7:00:00 PM	0	12.717	5.3	5/31/2022	7:00:00 PM	0	903.309	15.323	3.51	22.88	1010.797707
5/31/2022	8:00:00 PM	0	12.719	5.3	5/31/2022	8:00:00 PM	0	903.732	12.512	3.50	22.88	1010.795394
5/31/2022	9:00:00 PM	0	12.717	5.3	5/31/2022	9:00:00 PM	0	903.852	10.524	3.50	22.89	1010.79217
5/31/2022	10:00:00 PM	0	12.714	5.3	5/31/2022	10:00:00 PM	0	903.744	9.41	3.50	22.89	1010.790271
5/31/2022	11:00:00 PM	0	12.71	5.3	5/31/2022	11:00:00 PM	0	903.566	8.506	3.50	22.89	1010.788086
6/1/2022	12:00:00 AM	0	12.708	5.3	6/1/2022	12:00:00 AM	0	903.56	7.654	3.49	22.89	1010.786148
6/1/2022	1:00:00 AM	0	12.705	5.3	6/1/2022	1:00:00 AM	0	903.388	6.701	3.49	22.89	1010.784901
6/1/2022	2:00:00 AM	0	12.704	5.3	6/1/2022	2:00:00 AM	0	903.287	5.57	3.49	22.89	1010.784931
6/1/2022	3:00:00 AM	0	12.702	5.3	6/1/2022	3:00:00 AM	0	903.084	5.462	3.49	22.89	1010.785001
6/1/2022	4:00:00 AM	0	12.699	5.3	6/1/2022	4:00:00 AM	0	903.122	5.695	3.49	22.90	1010.781614
6/1/2022	5:00:00 AM	0	12.698	5.3	6/1/2022	5:00:00 AM	0	903.159	5.145	3.49	22.90	1010.780237
6/1/2022	6:00:00 AM	0	12.695	5.3	6/1/2022	6:00:00 AM	0	903.445	6.84	3.48	22.90	1010.77432
6/1/2022	7:00:00 AM	0	12.687	5.3	6/1/2022	7:00:00 AM	0	903.374	11.763	3.48	22.91	1010.767044
6/1/2022	8:00:00 AM	0	12.678	5.3	6/1/2022	8:00:00 AM	0	902.794	19.124	3.47	22.92	1010.763959
6/1/2022	9:00:00 AM	0	12.671	5.3	6/1/2022	9:00:00 AM	0	902.59	22.744	3.47	22.92	1010.759039
6/1/2022	10:00:00 AM	0	12.659	5.3	6/1/2022	10:00:00 AM	0	902.497	21.622	3.46	22.93	1010.747987
6/1/2022	11:00:00 AM	0	12.653	5.3	6/1/2022	11:00:00 AM	0	901.89	24.302	3.46	22.93	1010.748177
6/1/2022	12:00:00 PM	0	12.648	5.3	6/1/2022	12:00:00 PM	0	901.394	24.114	3.46	22.93	1010.748235
6/1/2022	1:00:00 PM	0	12.645	5.3	6/1/2022	1:00:00 PM	0	900.838	22.917	3.46	22.93	1010.750904
6/1/2022	2:00:00 PM	0	12.645	5.3	6/1/2022	2:00:00 PM	0	900.032	28.678	3.47	22.92	1010.759123
6/1/2022	3:00:00 PM	0	12.651	5.3	6/1/2022	3:00:00 PM	0	900.772	22.723	3.47	22.92	1010.757577
6/1/2022	4:00:00 PM	0	12.656	5.3	6/1/2022	4:00:00 PM	0	900.465	18.517	3.47	22.91	1010.765708
6/1/2022	5:00:00 PM	0	12.659	5.3	6/1/2022	5:00:00 PM	0	900.118	19.105	3.48	22.91	1010.772246
6/1/2022	6:00:00 PM	0	12.665	5.3	6/1/2022	6:00:00 PM	0	900.12	18.947	3.49	22.90	1010.778226
6/1/2022	7:00:00 PM	0	12.669	5.3	6/1/2022	7:00:00 PM	0	900.849	15.807	3.48	22.90	1010.774792
6/1/2022	8:00:00 PM	0	12.666	5.3	6/1/2022	8:00:00 PM	0	900.273	12.003	3.49	22.90	1010.777666
6/1/2022	9:00:00 PM	0	12.663	5.3	6/1/2022	9:00:00 PM	0	899.919	9.949	3.49	22.90	1010.778276
6/1/2022	10:00:00 PM	0	12.66	5.3	6/1/2022	10:00:00 PM	0	899.779	8.16	3.48	22.90	1010.776703
6/1/2022	11:00:00 PM	0	12.657	5.3	6/1/2022	11:00:00 PM	0	899.706	7.029	3.48	22.90	1010.774448
6/2/2022	12:00:00 AM	0	12.651	5.3	6/2/2022	12:00:00 AM	0	899.368	6.403	3.48	22.91	1010.771894
6/2/2022	1:00:00 AM	0	12.648	5.3	6/2/2022	1:00:00 AM	0	899.128	5.888	3.48	22.91	1010.771341
6/2/2022	2:00:00 AM	0	12.647	5.3	6/2/2022	2:00:00 AM	0	899.113	5.362	3.48	22.91	1010.770494
6/2/2022	3:00:00 AM	0	12.645	5.3	6/2/2022	3:00:00 AM	0	899.297	4.967	3.47	22.91	1010.766618
6/2/2022	4:00:00 AM	0	12.64	5.3	6/2/2022	4:00:00 AM	0	899.071	4.89	3.47	22.92	1010.763923
6/2/2022	5:00:00 AM	0	12.637	5.3	6/2/2022	5:00:00 AM	0	898.889	5.565	3.47	22.92	1010.762779
6/2/2022	6:00:00 AM	0	12.632	5.3	6/2/2022	6:00:00 AM	0	898.863	8.552	3.47	22.92	1010.758044
6/2/2022	7:00:00 AM	0	12.627	5.3	6/2/2022	7:00:00 AM	0	898.864	9.893	3.46	22.93	1010.753034
6/2/2022	8:00:00 AM	0	12.618	5.3	6/2/2022	8:00:00 AM	0	898.568	12.822	3.46	22.93	1010.747052
6/2/2022	9:00:00 AM	0	12.611	5.3	6/2/2022	9:00:00 AM	0	898.273	18.733	3.45	22.94	1010.74306
6/2/2022	10:00:00 AM	0	12.602	5.3	6/2/2022	10:00:00 AM	0	898.113	19.745	3.44	22.94	1010.735692
6/2/2022	11:00:00 AM	0	12.595	5.3	6/2/2022	11:00:00 AM	0	897.937	18.454	3.44	22.95	1010.730486
6/2/2022	12:00:00 PM	0	12.588	5.3	6/2/2022	12:00:00 PM	0	897.397	20.01	3.44	22.95	1010.728993
6/2/2022	1:00:00 PM	0	12.585	5.3	6/2/2022	1:00:00 PM	0	896.962	22.854	3.44	22.95	1010.730429
6/2/2022	2:00:00 PM	0	12.582	5.3	6/2/2022	2:00:00 PM	0	896.233	24.018	3.44	22.94	1010.734862
6/2/2022	3:00:00 PM	0	12.584	5.3	6/2/2022	3:00:00 PM	0	896.033	21.363	3.45	22.94	1010.738902
6/2/2022	4:00:00 PM	0	12.585	5.3	6/2/2022	4:00:00 PM	0	895.645	21.218	3.45	22.94	1010.743858
6/2/2022	5:00:00 PM	0	12.586	5.3	6/2/2022	5:00:00 PM	0	895.258	19.537	3.46	22.93	1010.748805
6/2/2022	6:00:00 PM	0	12.588	5.3	6/2/2022	6:00:00 PM	0	894.636	20.578	3.47	22.92	1010.757147
6/2/2022	7:00:00 PM	0	12.589	5.3	6/2/2022	7:00:00 PM	0	894.69	17.734	3.47	22.92	1010.757597
6/2/2022	8:00:00 PM	0	12.589	5.3	6/2/2022	8:00:00 PM	0	894.557	14.708	3.47	22.92	1010.758953
6/2/2022	9:00:00 PM	0	12.586	5.3	6/2/2022	9:00:00 PM	0	894.325	12.198	3.47	22.92	1010.758319
6/2/2022	10:00:00 PM	0	12.584	5.3	6/2/2022	10:00:00 PM	0	893.847	10.775	3.47	22.92	1010.761193
6/2/2022	11:00:00 PM	0	12.579	5.3	6/2/2022	11:00:00 PM	0	893.65	9.851	3.47	22.92	1010.758202
6/3/2022	12:00:00 AM	0	12.573	5.3	6/3/2022	12:00:00 AM	0	893.27	8.82	3.46	22.92	1010.756077
6/3/2022	1:00:00 AM	0	12.569	5.3	6/3/2022	1:00:00 AM	0	892.835	7.7	3.46	22.92	1010.756512
6/3/2022	2:00:00 AM	0	12.563	5.3	6/3/2022	2:00:00 AM	0	892.349	7.212	3.46	22.92	1010.755468
6/3/2022	3:00:00 AM	0	12.558	5.3	6/3/2022	3:00:00 AM	0	891.952	7.228	3.46	22.92	1010.754517
6/3/2022	4:00:00 AM	0	12.554	5.3	6/3/2022	4:00:00 AM	0	891.756	7.421	3.46	22.93	1010.752515
6/3/2022	5:00:00 AM	0	12.552	5.3	6/3/2022	5:00:00 AM	0	891.866	7.659	3.46	22.93	1010.749394

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/3/2022	6:00:00 AM	0	12.546	5.3	6/3/2022	6:00:00 AM	0	891.613	7.384	3.45	22.93	1010.745973
6/3/2022	7:00:00 AM	0	12.539	5.3	6/3/2022	7:00:00 AM	0	891.167	7.608	3.45	22.94	1010.743521
6/3/2022	8:00:00 AM	0	12.531	5.3	6/3/2022	8:00:00 AM	0	890.761	8.503	3.45	22.94	1010.739661
6/3/2022	9:00:00 AM	0	12.524	5.3	6/3/2022	9:00:00 AM	0	890.523	8.897	3.44	22.94	1010.735088
6/3/2022	10:00:00 AM	0	12.513	5.3	6/3/2022	10:00:00 AM	0	890.194	9.782	3.44	22.95	1010.727443
6/3/2022	11:00:00 AM	0	12.507	5.3	6/3/2022	11:00:00 AM	0	890.232	10.181	3.43	22.96	1010.721056
6/3/2022	12:00:00 PM	0	12.499	5.3	6/3/2022	12:00:00 PM	0	889.931	10.616	3.42	22.96	1010.716125
6/3/2022	1:00:00 PM	0	12.495	5.3	6/3/2022	1:00:00 PM	0	889.617	12.551	3.42	22.96	1010.715327
6/3/2022	2:00:00 PM	0	12.491	5.3	6/3/2022	2:00:00 PM	0	889.116	14.627	3.42	22.96	1010.716436
6/3/2022	3:00:00 PM	0	12.489	5.3	6/3/2022	3:00:00 PM	0	888.667	16.52	3.43	22.96	1010.719014
6/3/2022	4:00:00 PM	0	12.489	5.3	6/3/2022	4:00:00 PM	0	888.225	18.216	3.43	22.96	1010.723522
6/3/2022	5:00:00 PM	0	12.491	5.3	6/3/2022	5:00:00 PM	0	887.855	15.307	3.44	22.95	1010.729295
6/3/2022	6:00:00 PM	0	12.495	5.3	6/3/2022	6:00:00 PM	0	888.012	11.338	3.44	22.95	1010.731694
6/3/2022	7:00:00 PM	0	12.498	5.3	6/3/2022	7:00:00 PM	0	888.035	9.816	3.44	22.94	1010.734459
6/3/2022	8:00:00 PM	0	12.501	5.3	6/3/2022	8:00:00 PM	0	888.261	9.194	3.44	22.94	1010.735154
6/3/2022	9:00:00 PM	0	12.509	5.3	6/3/2022	9:00:00 PM	0	889.05	8.858	3.44	22.94	1010.735109
6/3/2022	10:00:00 PM	0	12.509	5.3	6/3/2022	10:00:00 PM	0	889.338	8.177	3.44	22.95	1010.732172
6/3/2022	11:00:00 PM	0	12.507	5.3	6/3/2022	11:00:00 PM	0	889.352	8.027	3.44	22.95	1010.730029
6/4/2022	12:00:00 AM	0	12.504	5.3	6/4/2022	12:00:00 AM	0	889.535	7.935	3.43	22.95	1010.725163
6/4/2022	1:00:00 AM	0	12.501	5.3	6/4/2022	1:00:00 AM	0	889.675	7.602	3.43	22.96	1010.720736
6/4/2022	2:00:00 AM	0	12.499	5.3	6/4/2022	2:00:00 AM	0	889.976	7.217	3.42	22.96	1010.715666
6/4/2022	3:00:00 AM	0	12.498	5.3	6/4/2022	3:00:00 AM	0	890.214	6.581	3.42	22.97	1010.712239
6/4/2022	4:00:00 AM	0	12.496	5.3	6/4/2022	4:00:00 AM	0	890.414	5.639	3.42	22.97	1010.7082
6/4/2022	5:00:00 AM	0	12.495	5.3	6/4/2022	5:00:00 AM	0	890.46	5.126	3.41	22.97	1010.706731
6/4/2022	6:00:00 AM	0	12.493	5.3	6/4/2022	6:00:00 AM	0	890.663	5.774	3.41	22.98	1010.702661
6/4/2022	7:00:00 AM	0	12.489	5.3	6/4/2022	7:00:00 AM	0	891.021	8.505	3.40	22.98	1010.69501
6/4/2022	8:00:00 AM	0	12.483	5.3	6/4/2022	8:00:00 AM	0	890.814	14.144	3.40	22.99	1010.691121
6/4/2022	9:00:00 AM	0	12.477	5.3	6/4/2022	9:00:00 AM	0	890.645	19.281	3.39	22.99	1010.686844
6/4/2022	10:00:00 AM	0	12.471	5.3	6/4/2022	10:00:00 AM	0	890.333	20.06	3.39	22.99	1010.684026
6/4/2022	11:00:00 AM	0	12.465	5.3	6/4/2022	11:00:00 AM	0	890.092	22.477	3.39	23.00	1010.680483
6/4/2022	12:00:00 PM	0	12.458	5.3	6/4/2022	12:00:00 PM	0	889.84	21.985	3.38	23.00	1010.676053
6/4/2022	1:00:00 PM	0	12.451	5.3	6/4/2022	1:00:00 PM	0	889.622	23.062	3.38	23.01	1010.671276
6/4/2022	2:00:00 PM	0	12.45	5.3	6/4/2022	2:00:00 PM	0	889.543	21.908	3.38	23.01	1010.671082
6/4/2022	3:00:00 PM	0	12.447	5.3	6/4/2022	3:00:00 PM	0	889.189	20.603	3.38	23.01	1010.671691
6/4/2022	4:00:00 PM	0	12.447	5.3	6/4/2022	4:00:00 PM	0	888.95	21.404	3.38	23.00	1010.674129
6/4/2022	5:00:00 PM	0	12.447	5.3	6/4/2022	5:00:00 PM	0	888.64	19.844	3.39	23.00	1010.67729
6/4/2022	6:00:00 PM	0	12.448	5.3	6/4/2022	6:00:00 PM	0	888.192	19.895	3.39	23.00	1010.682858
6/4/2022	7:00:00 PM	0	12.448	5.3	6/4/2022	7:00:00 PM	0	888.003	17.843	3.39	22.99	1010.684785
6/4/2022	8:00:00 PM	0	12.45	5.3	6/4/2022	8:00:00 PM	0	887.838	13.963	3.40	22.99	1010.688468
6/4/2022	9:00:00 PM	0	12.451	5.3	6/4/2022	9:00:00 PM	0	887.909	11.451	3.40	22.99	1010.688744
6/4/2022	10:00:00 PM	0	12.451	5.3	6/4/2022	10:00:00 PM	0	887.903	9.895	3.40	22.99	1010.688805
6/4/2022	11:00:00 PM	0	12.45	5.3	6/4/2022	11:00:00 PM	0	887.919	9.373	3.40	22.99	1010.687642
6/5/2022	12:00:00 AM	0	12.445	5.3	6/5/2022	12:00:00 AM	0	887.617	10.125	3.39	22.99	1010.685721
6/5/2022	1:00:00 AM	0	12.443	5.3	6/5/2022	1:00:00 AM	0	887.6	9.785	3.39	23.00	1010.683895
6/5/2022	2:00:00 AM	0	12.438	5.3	6/5/2022	2:00:00 AM	0	887.263	8.065	3.39	23.00	1010.682331
6/5/2022	3:00:00 AM	0	12.434	5.3	6/5/2022	3:00:00 AM	0	886.939	7.306	3.39	23.00	1010.681635
6/5/2022	4:00:00 AM	0	12.429	5.3	6/5/2022	4:00:00 AM	0	886.801	7.793	3.39	23.00	1010.678042
6/5/2022	5:00:00 AM	0	12.426	5.3	6/5/2022	5:00:00 AM	0	886.755	7.827	3.38	23.00	1010.675511
6/5/2022	6:00:00 AM	0	12.423	5.3	6/5/2022	6:00:00 AM	0	886.584	9.046	3.38	23.00	1010.674255
6/5/2022	7:00:00 AM	0	12.419	5.3	6/5/2022	7:00:00 AM	0	886.613	11.859	3.38	23.01	1010.669959
6/5/2022	8:00:00 AM	0	12.414	5.3	6/5/2022	8:00:00 AM	0	886.473	14.77	3.37	23.01	1010.666387
6/5/2022	9:00:00 AM	0	12.41	5.3	6/5/2022	9:00:00 AM	0	886.309	16.846	3.37	23.01	1010.664059
6/5/2022	10:00:00 AM	0	12.403	5.3	6/5/2022	10:00:00 AM	0	886.338	18.293	3.36	23.02	1010.656764
6/5/2022	11:00:00 AM	0	12.402	5.3	6/5/2022	11:00:00 AM	0	886.765	17.308	3.36	23.03	1010.651409
6/5/2022	12:00:00 PM	0	12.399	5.3	6/5/2022	12:00:00 PM	0	887.031	12.558	3.35	23.03	1010.645697
6/5/2022	1:00:00 PM	0	12.396	5.3	6/5/2022	1:00:00 PM	0	887.049	11.993	3.35	23.04	1010.642513
6/5/2022	2:00:00 PM	0	12.392	5.3	6/5/2022	2:00:00 PM	0	886.999	14.145	3.35	23.04	1010.639023
6/5/2022	3:00:00 PM	0	12.389	5.3	6/5/2022	3:00:00 PM	0	886.882	16.594	3.35	23.04	1010.637216
6/5/2022	4:00:00 PM	0	12.39	5.3	6/5/2022	4:00:00 PM	0	886.991	19.176	3.35	23.04	1010.637105
6/5/2022	5:00:00 PM	0	12.395	5.3	6/5/2022	5:00:00 PM	0	887.776	11.88	3.34	23.04	1010.6341
6/5/2022	6:00:00 PM	0	12.398	5.3	6/5/2022	6:00:00 PM	0	887.989	9.7	3.34	23.04	1010.634928
6/5/2022	7:00:00 PM	0	12.403	5.3	6/5/2022	7:00:00 PM	0	888.48	10.255	3.34	23.04	1010.634921
6/5/2022	8:00:00 PM	0	12.405	5.3	6/5/2022	8:00:00 PM	0	888.185	9.726	3.35	23.04	1010.639929
6/5/2022	9:00:00 PM	0	12.411	5.3	6/5/2022	9:00:00 PM	0	889.236	8.722	3.34	23.04	1010.635212
6/5/2022	10:00:00 PM	0	12.42	5.3	6/5/2022	10:00:00 PM	0	890.051	8.702	3.34	23.04	1010.635901
6/5/2022	11:00:00 PM	0	12.422	5.3	6/5/2022	11:00:00 PM	0	890.423	8.455	3.34	23.04	1010.634108
6/6/2022	12:00:00 AM	0	12.423	5.3	6/6/2022	12:00:00 AM	0	891.022	8.119	3.34	23.05	1010.629
6/6/2022	1:00:00 AM	0	12.423	5.3	6/6/2022	1:00:00 AM	0	891.523	7.764	3.33	23.06	1010.623891
6/6/2022	2:00:00 AM	0	12.423	5.3	6/6/2022	2:00:00 AM	0	891.996	7.773	3.33	23.06	1010.619068
6/6/2022	3:00:00 AM	0	12.425	5.3	6/6/2022	3:00:00 AM	0	892.637	7.893	3.32	23.06	1010.614532
6/6/2022	4:00:00 AM	0	12.428	5.3	6/6/2022	4:00:00 AM	0	893.364	7.818	3.32	23.07	1010.610118
6/6/2022	5:00:00 AM	0	12.429	5.3	6/6/2022	5:00:00 AM	0	893.903	7.739	3.31	23.07	1010.605622

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/6/2022	6:00:00 AM	0	12.432	5.3	6/6/2022	6:00:00 AM	0	894.587	7.651	3.31	23.08	1010.601647
6/6/2022	7:00:00 AM	0	12.434	5.3	6/6/2022	7:00:00 AM	0	895.261	7.919	3.30	23.08	1010.596774
6/6/2022	8:00:00 AM	0	12.437	5.3	6/6/2022	8:00:00 AM	0	895.916	8.894	3.30	23.09	1010.593095
6/6/2022	9:00:00 AM	0	12.441	5.3	6/6/2022	9:00:00 AM	0	896.657	10.086	3.30	23.09	1010.589539
6/6/2022	10:00:00 AM	0	12.444	5.3	6/6/2022	10:00:00 AM	0	897.358	9.614	3.29	23.09	1010.585391
6/6/2022	11:00:00 AM	0	12.444	5.4	6/6/2022	11:00:00 AM	0	897.78	12.931	3.29	23.10	1010.58
6/6/2022	12:00:00 PM	0	12.384	5.7	6/6/2022	12:00:00 PM	0	898.397	14.191	3.22	23.16	1010.514796
6/6/2022	1:00:00 PM	0	12.402	5.5	6/6/2022	1:00:00 PM	0	898.574	16.041	3.24	23.15	1010.530991
6/6/2022	2:00:00 PM	0	12.406	5.4	6/6/2022	2:00:00 PM	0	898.63	16.08	3.24	23.14	1010.53442
6/6/2022	3:00:00 PM	0	12.411	5.4	6/6/2022	3:00:00 PM	0	898.675	17.849	3.25	23.14	1010.538961
6/6/2022	4:00:00 PM	0	12.414	5.4	6/6/2022	4:00:00 PM	0	898.634	20.899	3.25	23.14	1010.542379
6/6/2022	5:00:00 PM	0	12.419	5.4	6/6/2022	5:00:00 PM	0	898.816	16.493	3.25	23.13	1010.545523
6/6/2022	6:00:00 PM	0	12.423	5.4	6/6/2022	6:00:00 PM	0	898.707	19.641	3.26	23.13	1010.550635
6/6/2022	7:00:00 PM	0	12.429	5.4	6/6/2022	7:00:00 PM	0	899.404	16.744	3.26	23.13	1010.549527
6/6/2022	8:00:00 PM	0	12.437	5.4	6/6/2022	8:00:00 PM	0	899.934	10.944	3.26	23.13	1010.552123
6/6/2022	9:00:00 PM	0	12.444	5.4	6/6/2022	9:00:00 PM	0	900.298	8.398	3.26	23.12	1010.555411
6/6/2022	10:00:00 PM	0	12.45	5.4	6/6/2022	10:00:00 PM	0	900.561	7.229	3.27	23.12	1010.558729
6/6/2022	11:00:00 PM	0	12.454	5.4	6/6/2022	11:00:00 PM	0	900.857	7.05	3.27	23.12	1010.559711
6/7/2022	12:00:00 AM	0	12.458	5.4	6/7/2022	12:00:00 AM	0	901.044	6.436	3.27	23.12	1010.561804
6/7/2022	1:00:00 AM	0	12.458	5.4	6/7/2022	1:00:00 AM	0	901.217	5.821	3.27	23.12	1010.56004
6/7/2022	2:00:00 AM	0	12.458	5.4	6/7/2022	2:00:00 AM	0	901.245	5.395	3.27	23.12	1010.559754
6/7/2022	3:00:00 AM	0	12.456	5.4	6/7/2022	3:00:00 AM	0	901.092	4.94	3.27	23.12	1010.559314
6/7/2022	4:00:00 AM	0	12.456	5.4	6/7/2022	4:00:00 AM	0	901.335	4.484	3.26	23.12	1010.556836
6/7/2022	5:00:00 AM	0	12.454	5.4	6/7/2022	5:00:00 AM	0	901.525	4.302	3.26	23.13	1010.552899
6/7/2022	6:00:00 AM	0	12.451	5.4	6/7/2022	6:00:00 AM	0	901.26	4.927	3.26	23.13	1010.552601
6/7/2022	7:00:00 AM	0	12.451	5.4	6/7/2022	7:00:00 AM	0	901.433	7.536	3.26	23.13	1010.550837
6/7/2022	8:00:00 AM	0	12.45	5.4	6/7/2022	8:00:00 AM	0	901.331	14.727	3.26	23.13	1010.550877
6/7/2022	9:00:00 AM	0	12.448	5.4	6/7/2022	9:00:00 AM	0	900.701	20.188	3.26	23.12	1010.555301
6/7/2022	10:00:00 AM	0	12.445	5.4	6/7/2022	10:00:00 AM	0	899.989	24.053	3.27	23.12	1010.559562
6/7/2022	11:00:00 AM	0	12.443	5.4	6/7/2022	11:00:00 AM	0	899.29	27.199	3.27	23.11	1010.56469
6/7/2022	12:00:00 PM	0	12.44	5.4	6/7/2022	12:00:00 PM	0	898.589	27.122	3.28	23.11	1010.568838
6/7/2022	1:00:00 PM	0	12.435	5.4	6/7/2022	1:00:00 PM	0	897.885	27.743	3.28	23.11	1010.571017
6/7/2022	2:00:00 PM	0	12.431	5.4	6/7/2022	2:00:00 PM	0	897.494	25.095	3.28	23.11	1010.571004
6/7/2022	3:00:00 PM	0	12.426	5.4	6/7/2022	3:00:00 PM	0	896.994	21.117	3.28	23.11	1010.571102
6/7/2022	4:00:00 PM	0	12.42	5.3	6/7/2022	4:00:00 PM	0	896.266	23.726	3.28	23.11	1010.572526
6/7/2022	5:00:00 PM	0	12.419	5.4	6/7/2022	5:00:00 PM	0	895.884	19.095	3.28	23.10	1010.575421
6/7/2022	6:00:00 PM	0	12.416	5.3	6/7/2022	6:00:00 PM	0	895.418	18.013	3.29	23.10	1010.577173
6/7/2022	7:00:00 PM	0	12.416	5.4	6/7/2022	7:00:00 PM	0	895.116	16.992	3.29	23.10	1010.580253
6/7/2022	8:00:00 PM	0	12.416	5.4	6/7/2022	8:00:00 PM	0	894.916	14.836	3.29	23.10	1010.582292
6/7/2022	9:00:00 PM	0	12.416	5.4	6/7/2022	9:00:00 PM	0	894.435	13.156	3.30	23.09	1010.587197
6/7/2022	10:00:00 PM	0	12.416	5.3	6/7/2022	10:00:00 PM	0	894.043	12.432	3.30	23.09	1010.591194
6/7/2022	11:00:00 PM	0	12.417	5.3	6/7/2022	11:00:00 PM	0	893.739	12.007	3.30	23.08	1010.595294
6/8/2022	12:00:00 AM	0	12.425	5.3	6/8/2022	12:00:00 AM	0	895.019	10.079	3.30	23.09	1010.590242
6/8/2022	1:00:00 AM	0	12.417	5.3	6/8/2022	1:00:00 AM	0	894.173	9.133	3.30	23.09	1010.590869
6/8/2022	2:00:00 AM	0	12.414	5.3	6/8/2022	2:00:00 AM	0	893.57	9.039	3.30	23.08	1010.594018
6/8/2022	3:00:00 AM	0	12.413	5.3	6/8/2022	3:00:00 AM	0	893.9	8.918	3.30	23.09	1010.589652
6/8/2022	4:00:00 AM	0	12.413	5.3	6/8/2022	4:00:00 AM	0	894.098	8.55	3.30	23.09	1010.587633
6/8/2022	5:00:00 AM	0	12.406	5.3	6/8/2022	5:00:00 AM	0	893.892	8.37	3.29	23.10	1010.582734
6/8/2022	6:00:00 AM	0	12.405	5.3	6/8/2022	6:00:00 AM	0	893.905	8.587	3.29	23.10	1010.581601
6/8/2022	7:00:00 AM	0	12.403	5.3	6/8/2022	7:00:00 AM	0	894.189	10.126	3.28	23.10	1010.576705
6/8/2022	8:00:00 AM	0	12.402	5.3	6/8/2022	8:00:00 AM	0	894.216	12.694	3.28	23.10	1010.57543
6/8/2022	9:00:00 AM	0	12.403	5.3	6/8/2022	9:00:00 AM	0	894.24	15.39	3.28	23.10	1010.576185
6/8/2022	10:00:00 AM	0	12.403	5.3	6/8/2022	10:00:00 AM	0	893.946	20.359	3.29	23.10	1010.579183
6/8/2022	11:00:00 AM	0	12.403	5.3	6/8/2022	11:00:00 AM	0	893.756	21.896	3.29	23.10	1010.581121
6/8/2022	12:00:00 PM	0	12.403	5.3	6/8/2022	12:00:00 PM	0	893.392	22.438	3.29	23.09	1010.584833
6/8/2022	1:00:00 PM	0	12.4	5.3	6/8/2022	1:00:00 PM	0	892.889	20.643	3.30	23.09	1010.586962
6/8/2022	2:00:00 PM	0	12.402	5.3	6/8/2022	2:00:00 PM	0	892.797	22.027	3.30	23.09	1010.5899
6/8/2022	3:00:00 PM	0	12.41	5.3	6/8/2022	3:00:00 PM	0	894.309	16.721	3.29	23.10	1010.582482
6/8/2022	4:00:00 PM	0	12.403	5.3	6/8/2022	4:00:00 PM	0	893.49	14.897	3.29	23.10	1010.583833
6/8/2022	5:00:00 PM	0	12.406	5.3	6/8/2022	5:00:00 PM	0	894.431	14.111	3.29	23.10	1010.577238
6/8/2022	6:00:00 PM	0	12.405	5.3	6/8/2022	6:00:00 PM	0	894.463	10.226	3.28	23.10	1010.575911
6/8/2022	7:00:00 PM	0	12.403	5.3	6/8/2022	7:00:00 PM	0	893.804	10.054	3.29	23.10	1010.580631
6/8/2022	8:00:00 PM	0	12.406	5.3	6/8/2022	8:00:00 PM	0	894.226	9.47	3.29	23.10	1010.579328
6/8/2022	9:00:00 PM	0	12.41	5.3	6/8/2022	9:00:00 PM	0	894.631	8.505	3.29	23.10	1010.579198
6/8/2022	10:00:00 PM	0	12.416	5.3	6/8/2022	10:00:00 PM	0	895.1	7.485	3.29	23.10	1010.580416
6/8/2022	11:00:00 PM	0	12.419	5.3	6/8/2022	11:00:00 PM	0	895.313	6.679	3.29	23.10	1010.581244
6/9/2022	12:00:00 AM	0	12.42	5.3	6/9/2022	12:00:00 AM	0	895.246	6.011	3.29	23.10	1010.582927
6/9/2022	1:00:00 AM	0	12.423	5.3	6/9/2022	1:00:00 AM	0	895.646	5.733	3.29	23.10	1010.581848
6/9/2022	2:00:00 AM	0	12.422	5.3	6/9/2022	2:00:00 AM	0	895.731	5.316	3.29	23.10	1010.579981
6/9/2022	3:00:00 AM	0	12.417	5.3	6/9/2022	3:00:00 AM	0	895.477	4.769	3.29	23.10	1010.577571
6/9/2022	4:00:00 AM	0	12.414	5.3	6/9/2022	4:00:00 AM	0	895.281	4.235	3.28	23.10	1010.57657
6/9/2022	5:00:00 AM	0	12.41	5.3	6/9/2022	5:00:00 AM	0	895.197	4.909	3.28	23.11	1010.573427

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/9/2022	6:00:00 AM	0	12.405	5.3	6/9/2022	6:00:00 AM	0	895.033	6.589	3.28	23.11	1010.570099
6/9/2022	7:00:00 AM	0	12.402	5.3	6/9/2022	7:00:00 AM	0	894.886	8.073	3.28	23.11	1010.568598
6/9/2022	8:00:00 AM	0	12.396	5.3	6/9/2022	8:00:00 AM	0	894.057	13.721	3.28	23.11	1010.571051
6/9/2022	9:00:00 AM	0	12.393	5.3	6/9/2022	9:00:00 AM	0	893.121	18.758	3.29	23.10	1010.577596
6/9/2022	10:00:00 AM	0	12.392	5.3	6/9/2022	10:00:00 AM	0	892.452	20.648	3.29	23.10	1010.583418
6/9/2022	11:00:00 AM	0	12.393	5.3	6/9/2022	11:00:00 AM	0	891.635	21.793	3.30	23.09	1010.592749
6/9/2022	12:00:00 PM	0	12.395	5.3	6/9/2022	12:00:00 PM	0	891.332	21.142	3.31	23.08	1010.597839
6/9/2022	1:00:00 PM	0	12.395	5.3	6/9/2022	1:00:00 PM	0	890.572	19.863	3.31	23.07	1010.605589
6/9/2022	2:00:00 PM	0	12.402	5.3	6/9/2022	2:00:00 PM	0	890.273	17.926	3.32	23.06	1010.615638
6/9/2022	3:00:00 PM	0	12.403	5.3	6/9/2022	3:00:00 PM	0	890.663	16.499	3.32	23.07	1010.612661
6/9/2022	4:00:00 PM	0	12.402	5.3	6/9/2022	4:00:00 PM	0	890.562	11.898	3.32	23.07	1010.612691
6/9/2022	5:00:00 PM	0	12.396	5.3	6/9/2022	5:00:00 PM	0	889.947	9.16	3.32	23.07	1010.612962
6/9/2022	6:00:00 PM	0	12.393	5.3	6/9/2022	6:00:00 PM	0	889.394	8.136	3.32	23.06	1010.615601
6/9/2022	7:00:00 PM	0	12.389	5.3	6/9/2022	7:00:00 PM	0	889.029	7.712	3.32	23.06	1010.615323
6/9/2022	8:00:00 PM	0	12.384	5.3	6/9/2022	8:00:00 PM	0	888.277	6.961	3.33	23.06	1010.617991
6/9/2022	9:00:00 PM	0	12.386	5.3	6/9/2022	9:00:00 PM	0	888.245	6.805	3.33	23.06	1010.620318
6/9/2022	10:00:00 PM	0	12.384	5.3	6/9/2022	10:00:00 PM	0	888.187	6.79	3.33	23.06	1010.618909
6/9/2022	11:00:00 PM	0	12.392	5.3	6/9/2022	11:00:00 PM	0	888.831	6.69	3.33	23.06	1010.620342
6/10/2022	12:00:00 AM	0	12.39	5.3	6/10/2022	12:00:00 AM	0	888.485	6.719	3.33	23.06	1010.62187
6/10/2022	1:00:00 AM	0	12.395	5.3	6/10/2022	1:00:00 AM	0	889.133	6.625	3.33	23.06	1010.620263
6/10/2022	2:00:00 AM	0	12.395	5.3	6/10/2022	2:00:00 AM	0	889.44	6.596	3.33	23.06	1010.617132
6/10/2022	3:00:00 AM	0	12.396	5.3	6/10/2022	3:00:00 AM	0	890.173	6.591	3.32	23.07	1010.610657
6/10/2022	4:00:00 AM	0	12.393	5.3	6/10/2022	4:00:00 AM	0	890.812	5.832	3.31	23.08	1010.601141
6/10/2022	5:00:00 AM	0	12.392	5.3	6/10/2022	5:00:00 AM	0	891.391	5.582	3.30	23.08	1010.594237
6/10/2022	6:00:00 AM	0	12.389	5.3	6/10/2022	6:00:00 AM	0	891.897	6.609	3.29	23.09	1010.586077
6/10/2022	7:00:00 AM	0	12.389	5.3	6/10/2022	7:00:00 AM	0	892.48	8.522	3.29	23.10	1010.580132
6/10/2022	8:00:00 AM	0	12.386	5.3	6/10/2022	8:00:00 AM	0	892.579	14.466	3.28	23.10	1010.576123
6/10/2022	9:00:00 AM	0	12.387	5.3	6/10/2022	9:00:00 AM	0	892.452	20.167	3.29	23.10	1010.578418
6/10/2022	10:00:00 AM	0	12.389	5.3	6/10/2022	10:00:00 AM	0	891.978	23.398	3.29	23.09	1010.585251
6/10/2022	11:00:00 AM	0	12.393	5.3	6/10/2022	11:00:00 AM	0	891.932	23.223	3.30	23.09	1010.589721
6/10/2022	12:00:00 PM	0	12.396	5.3	6/10/2022	12:00:00 PM	0	891.379	21.768	3.31	23.08	1010.59836
6/10/2022	1:00:00 PM	0	12.4	5.3	6/10/2022	1:00:00 PM	0	890.729	25.869	3.32	23.07	1010.608988
6/10/2022	2:00:00 PM	0	12.402	5.3	6/10/2022	2:00:00 PM	0	890.306	23.626	3.32	23.06	1010.615301
6/10/2022	3:00:00 PM	0	12.406	5.3	6/10/2022	3:00:00 PM	0	890.229	21.409	3.33	23.06	1010.620086
6/10/2022	4:00:00 PM	0	12.403	5.3	6/10/2022	4:00:00 PM	0	889.485	24.83	3.33	23.05	1010.624673
6/10/2022	5:00:00 PM	0	12.402	5.3	6/10/2022	5:00:00 PM	0	889.4	20.685	3.33	23.05	1010.62454
6/10/2022	6:00:00 PM	0	12.4	5.3	6/10/2022	6:00:00 PM	0	889.08	22.895	3.33	23.05	1010.625803
6/10/2022	7:00:00 PM	0	12.399	5.3	6/10/2022	7:00:00 PM	0	889.371	21.102	3.33	23.06	1010.621836
6/10/2022	8:00:00 PM	0	12.398	5.3	6/10/2022	8:00:00 PM	0	889.786	14.863	3.32	23.06	1010.616604
6/10/2022	9:00:00 PM	0	12.4	5.3	6/10/2022	9:00:00 PM	0	890.287	11.7	3.32	23.07	1010.613495
6/10/2022	10:00:00 PM	0	12.4	5.3	6/10/2022	10:00:00 PM	0	890.298	9.596	3.32	23.07	1010.613383
6/10/2022	11:00:00 PM	0	12.402	5.3	6/10/2022	11:00:00 PM	0	890.464	8.457	3.32	23.07	1010.61369
6/11/2022	12:00:00 AM	0	12.402	5.3	6/11/2022	12:00:00 AM	0	890.219	7.332	3.32	23.06	1010.616188
6/11/2022	1:00:00 AM	0	12.405	5.3	6/11/2022	1:00:00 AM	0	890.386	6.464	3.33	23.06	1010.617485
6/11/2022	2:00:00 AM	0	12.406	5.3	6/11/2022	2:00:00 AM	0	890.621	6.776	3.32	23.06	1010.616089
6/11/2022	3:00:00 AM	0	12.405	5.3	6/11/2022	3:00:00 AM	0	890.83	6.976	3.32	23.07	1010.612958
6/11/2022	4:00:00 AM	0	12.402	5.3	6/11/2022	4:00:00 AM	0	890.959	6.944	3.32	23.07	1010.608642
6/11/2022	5:00:00 AM	0	12.395	5.3	6/11/2022	5:00:00 AM	0	890.811	7.411	3.31	23.08	1010.603152
6/11/2022	6:00:00 AM	0	12.393	5.3	6/11/2022	6:00:00 AM	0	891.33	7.569	3.30	23.08	1010.595859
6/11/2022	7:00:00 AM	0	12.387	5.3	6/11/2022	7:00:00 AM	0	891.493	9.184	3.30	23.09	1010.588197
6/11/2022	8:00:00 AM	0	12.383	5.3	6/11/2022	8:00:00 AM	0	891.333	17.627	3.29	23.09	1010.585829
6/11/2022	9:00:00 AM	0	12.384	5.3	6/11/2022	9:00:00 AM	0	891.341	19.901	3.29	23.09	1010.586747
6/11/2022	10:00:00 AM	0	12.384	5.3	6/11/2022	10:00:00 AM	0	890.998	20.753	3.30	23.09	1010.590245
6/11/2022	11:00:00 AM	0	12.387	5.3	6/11/2022	11:00:00 AM	0	890.426	23.238	3.31	23.08	1010.599078
6/11/2022	12:00:00 PM	0	12.39	5.3	6/11/2022	12:00:00 PM	0	889.859	23.294	3.32	23.07	1010.607859
6/11/2022	1:00:00 PM	0	12.395	5.3	6/11/2022	1:00:00 PM	0	889.051	26.75	3.33	23.06	1010.621099
6/11/2022	2:00:00 PM	0	12.41	5.3	6/11/2022	2:00:00 PM	0	890.31	21.15	3.33	23.06	1010.62326
6/11/2022	3:00:00 PM	0	12.413	5.3	6/11/2022	3:00:00 PM	0	890.388	16.135	3.33	23.05	1010.625465
6/11/2022	4:00:00 PM	0	12.414	5.3	6/11/2022	4:00:00 PM	0	889.642	19.864	3.34	23.04	1010.634072
6/11/2022	5:00:00 PM	0	12.422	5.3	6/11/2022	5:00:00 PM	0	890.622	15.815	3.34	23.05	1010.632079
6/11/2022	6:00:00 PM	0	12.42	5.3	6/11/2022	6:00:00 PM	0	890.427	14.441	3.34	23.05	1010.632067
6/11/2022	7:00:00 PM	0	12.42	5.3	6/11/2022	7:00:00 PM	0	890.883	14.131	3.34	23.05	1010.627417
6/11/2022	8:00:00 PM	0	12.423	5.3	6/11/2022	8:00:00 PM	0	891.845	10.812	3.33	23.06	1010.620608
6/11/2022	9:00:00 PM	0	12.42	5.3	6/11/2022	9:00:00 PM	0	891.845	8.756	3.33	23.06	1010.617608
6/11/2022	10:00:00 PM	0	12.419	5.3	6/11/2022	10:00:00 PM	0	891.83	6.906	3.32	23.06	1010.616761
6/11/2022	11:00:00 PM	0	12.42	5.3	6/11/2022	11:00:00 PM	0	891.683	5.586	3.33	23.06	1010.61926
6/12/2022	12:00:00 AM	0	12.422	5.3	6/12/2022	12:00:00 AM	0	891.938	4.803	3.33	23.06	1010.618659
6/12/2022	1:00:00 AM	0	12.423	5.3	6/12/2022	1:00:00 AM	0	892.011	4.595	3.33	23.06	1010.618915
6/12/2022	2:00:00 AM	0	12.423	5.3	6/12/2022	2:00:00 AM	0	891.916	4.766	3.33	23.06	1010.619884
6/12/2022	3:00:00 AM	0	12.42	5.3	6/12/2022	3:00:00 AM	0	891.545	4.32	3.33	23.06	1010.620667
6/12/2022	4:00:00 AM	0	12.417	5.3	6/12/2022	4:00:00 AM	0	891.524	3.759	3.33	23.06	1010.617881
6/12/2022	5:00:00 AM	0	12.41	5.3	6/12/2022	5:00:00 AM	0	891.474	4.355	3.32	23.07	1010.611391

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/12/2022	6:00:00 AM	0	12.405	5.3	6/12/2022	6:00:00 AM	0	891.644	5.212	3.31	23.07	1010.604657
6/12/2022	7:00:00 AM	0	12.399	5.3	6/12/2022	7:00:00 AM	0	891.813	7.134	3.31	23.08	1010.596934
6/12/2022	8:00:00 AM	0	12.392	5.3	6/12/2022	8:00:00 AM	0	891.595	10.031	3.30	23.09	1010.592157
6/12/2022	9:00:00 AM	0	12.387	5.3	6/12/2022	9:00:00 AM	0	891.185	13.909	3.30	23.09	1010.591338
6/12/2022	10:00:00 AM	0	12.384	5.3	6/12/2022	10:00:00 AM	0	890.271	22.62	3.31	23.08	1010.597658
6/12/2022	11:00:00 AM	0	12.384	5.3	6/12/2022	11:00:00 AM	0	889.395	25.072	3.31	23.07	1010.606591
6/12/2022	12:00:00 PM	0	12.389	5.3	6/12/2022	12:00:00 PM	0	889.139	23.505	3.32	23.06	1010.614201
6/12/2022	1:00:00 PM	0	12.396	5.3	6/12/2022	1:00:00 PM	0	889.021	17.839	3.33	23.06	1010.622405
6/12/2022	2:00:00 PM	0	12.406	5.3	6/12/2022	2:00:00 PM	0	888.979	18.143	3.34	23.05	1010.632833
6/12/2022	3:00:00 PM	0	12.42	5.3	6/12/2022	3:00:00 PM	0	890.306	13.274	3.34	23.05	1010.633301
6/12/2022	4:00:00 PM	0	12.426	5.3	6/12/2022	4:00:00 PM	0	889.994	16.096	3.35	23.04	1010.642483
6/12/2022	5:00:00 PM	0	12.426	5.3	6/12/2022	5:00:00 PM	0	889.572	13.501	3.35	23.03	1010.646786
6/12/2022	6:00:00 PM	0	12.426	5.3	6/12/2022	6:00:00 PM	0	889.177	11.592	3.36	23.03	1010.650814
6/12/2022	7:00:00 PM	0	12.425	5.3	6/12/2022	7:00:00 PM	0	889.287	10.633	3.36	23.03	1010.648692
6/12/2022	8:00:00 PM	0	12.423	5.3	6/12/2022	8:00:00 PM	0	889.381	9.11	3.35	23.03	1010.645734
6/12/2022	9:00:00 PM	0	12.42	5.3	6/12/2022	9:00:00 PM	0	889.465	7.37	3.35	23.04	1010.641877
6/12/2022	10:00:00 PM	0	12.419	5.3	6/12/2022	10:00:00 PM	0	889.613	6.717	3.35	23.04	1010.639368
6/12/2022	11:00:00 PM	0	12.417	5.3	6/12/2022	11:00:00 PM	0	889.524	6.962	3.35	23.04	1010.638275
6/13/2022	12:00:00 AM	0	12.417	5.3	6/13/2022	12:00:00 AM	0	889.507	7.123	3.35	23.04	1010.638449
6/13/2022	1:00:00 AM	0	12.417	5.3	6/13/2022	1:00:00 AM	0	889.544	7.005	3.35	23.04	1010.638071
6/13/2022	2:00:00 AM	0	12.419	5.3	6/13/2022	2:00:00 AM	0	889.727	5.873	3.35	23.04	1010.638205
6/13/2022	3:00:00 AM	0	12.419	5.3	6/13/2022	3:00:00 AM	0	889.898	5.23	3.34	23.04	1010.636462
6/13/2022	4:00:00 AM	0	12.416	5.3	6/13/2022	4:00:00 AM	0	890.039	5.131	3.34	23.05	1010.632024
6/13/2022	5:00:00 AM	0	12.413	5.3	6/13/2022	5:00:00 AM	0	890.245	5.416	3.33	23.05	1010.626923
6/13/2022	6:00:00 AM	0	12.408	5.3	6/13/2022	6:00:00 AM	0	891.019	7.06	3.32	23.06	1010.614031
6/13/2022	7:00:00 AM	0	12.402	5.3	6/13/2022	7:00:00 AM	0	891.391	9.086	3.31	23.07	1010.604237
6/13/2022	8:00:00 AM	0	12.396	5.3	6/13/2022	8:00:00 AM	0	891.73	10.514	3.30	23.08	1010.59478
6/13/2022	9:00:00 AM	0	12.392	5.3	6/13/2022	9:00:00 AM	0	891.718	12.608	3.30	23.09	1010.590903
6/13/2022	10:00:00 AM	0	12.392	5.3	6/13/2022	10:00:00 AM	0	891.817	17.571	3.30	23.09	1010.589893
6/13/2022	11:00:00 AM	0	12.425	5.4	6/13/2022	11:00:00 AM	0	891.525	22.866	3.33	23.05	1010.625871
6/13/2022	12:00:00 PM	0	12.432	5.4	6/13/2022	12:00:00 PM	0	891.826	21.023	3.34	23.05	1010.629801
6/13/2022	1:00:00 PM	0	12.44	5.4	6/13/2022	1:00:00 PM	0	891.888	20.503	3.35	23.04	1010.637169
6/13/2022	2:00:00 PM	0	12.45	5.4	6/13/2022	2:00:00 PM	0	891.584	21.409	3.36	23.03	1010.650269
6/13/2022	3:00:00 PM	0	12.461	5.4	6/13/2022	3:00:00 PM	0	892.03	18.917	3.36	23.02	1010.656721
6/13/2022	4:00:00 PM	0	12.47	5.3	6/13/2022	4:00:00 PM	0	892.545	16.769	3.37	23.02	1010.66047
6/13/2022	5:00:00 PM	0	12.477	5.3	6/13/2022	5:00:00 PM	0	892.802	15.836	3.37	23.01	1010.664849
6/13/2022	6:00:00 PM	0	12.483	5.3	6/13/2022	6:00:00 PM	0	893.122	14.626	3.38	23.01	1010.667586
6/13/2022	7:00:00 PM	0	12.485	5.3	6/13/2022	7:00:00 PM	0	893.421	12.8	3.37	23.01	1010.666537
6/13/2022	8:00:00 PM	0	12.486	5.3	6/13/2022	8:00:00 PM	0	893.825	11.232	3.37	23.02	1010.663417
6/13/2022	9:00:00 PM	0	12.486	5.3	6/13/2022	9:00:00 PM	0	894.151	9.796	3.37	23.02	1010.660093
6/13/2022	10:00:00 PM	0	12.485	5.3	6/13/2022	10:00:00 PM	0	894.35	8.681	3.37	23.02	1010.657064
6/13/2022	11:00:00 PM	0	12.483	5.3	6/13/2022	11:00:00 PM	0	894.542	8	3.36	23.03	1010.653106
6/14/2022	12:00:00 AM	0	12.482	5.3	6/14/2022	12:00:00 AM	0	894.621	7.157	3.36	23.03	1010.6513
6/14/2022	1:00:00 AM	0	12.485	5.3	6/14/2022	1:00:00 AM	0	894.868	6.722	3.36	23.03	1010.651782
6/14/2022	2:00:00 AM	0	12.486	5.3	6/14/2022	2:00:00 AM	0	895.045	6.455	3.36	23.03	1010.650977
6/14/2022	3:00:00 AM	0	12.486	5.3	6/14/2022	3:00:00 AM	0	895.311	6.321	3.36	23.03	1010.648264
6/14/2022	4:00:00 AM	0	12.486	5.3	6/14/2022	4:00:00 AM	0	895.513	5.865	3.35	23.03	1010.646204
6/14/2022	5:00:00 AM	0	12.485	5.3	6/14/2022	5:00:00 AM	0	896.026	5.832	3.35	23.04	1010.639973
6/14/2022	6:00:00 AM	0	12.482	5.3	6/14/2022	6:00:00 AM	0	896.479	6.334	3.34	23.05	1010.632354
6/14/2022	7:00:00 AM	0	12.474	5.3	6/14/2022	7:00:00 AM	0	897.021	8.158	3.33	23.06	1010.618827
6/14/2022	8:00:00 AM	0	12.468	5.3	6/14/2022	8:00:00 AM	0	897.247	12.991	3.32	23.07	1010.610522
6/14/2022	9:00:00 AM	0	12.462	5.3	6/14/2022	9:00:00 AM	0	897.548	16.227	3.31	23.08	1010.601453
6/14/2022	10:00:00 AM	0	12.458	5.3	6/14/2022	10:00:00 AM	0	897.518	20.45	3.31	23.08	1010.597759
6/14/2022	11:00:00 AM	0	12.456	5.3	6/14/2022	11:00:00 AM	0	897.373	23.088	3.31	23.08	1010.597238
6/14/2022	12:00:00 PM	0	12.456	5.3	6/14/2022	12:00:00 PM	0	897.026	24.01	3.31	23.08	1010.600776
6/14/2022	1:00:00 PM	0	12.462	5.3	6/14/2022	1:00:00 PM	0	896.949	24.704	3.32	23.07	1010.607561
6/14/2022	2:00:00 PM	0	12.471	5.3	6/14/2022	2:00:00 PM	0	896.934	26.514	3.32	23.06	1010.616714
6/14/2022	3:00:00 PM	0	12.48	5.3	6/14/2022	3:00:00 PM	0	897.18	22.226	3.33	23.06	1010.623206
6/14/2022	4:00:00 PM	0	12.489	5.3	6/14/2022	4:00:00 PM	0	896.829	27.235	3.34	23.04	1010.635785
6/14/2022	5:00:00 PM	0	12.496	5.3	6/14/2022	5:00:00 PM	0	896.993	20.833	3.35	23.04	1010.641113
6/14/2022	6:00:00 PM	0	12.504	5.3	6/14/2022	6:00:00 PM	0	896.965	21.156	3.36	23.03	1010.649398
6/14/2022	7:00:00 PM	0	12.507	5.3	6/14/2022	7:00:00 PM	0	897.392	19.104	3.36	23.03	1010.648044
6/14/2022	8:00:00 PM	0	12.509	5.3	6/14/2022	8:00:00 PM	0	897.567	14.173	3.36	23.03	1010.648259
6/14/2022	9:00:00 PM	0	12.509	5.3	6/14/2022	9:00:00 PM	0	897.983	10.992	3.35	23.03	1010.644017
6/14/2022	10:00:00 PM	0	12.507	5.3	6/14/2022	10:00:00 PM	0	898.031	9.014	3.35	23.04	1010.641528
6/14/2022	11:00:00 PM	0	12.506	5.3	6/14/2022	11:00:00 PM	0	898.15	7.852	3.35	23.04	1010.639314
6/15/2022	12:00:00 AM	0	12.503	5.3	6/15/2022	12:00:00 AM	0	898.303	7.028	3.34	23.04	1010.634754
6/15/2022	1:00:00 AM	0	12.499	5.3	6/15/2022	1:00:00 AM	0	898.046	6.541	3.34	23.05	1010.633375
6/15/2022	2:00:00 AM	0	12.498	5.3	6/15/2022	2:00:00 AM	0	897.805	6.283	3.34	23.04	1010.634832
6/15/2022	3:00:00 AM	0	12.496	5.3	6/15/2022	3:00:00 AM	0	897.613	5.865	3.34	23.04	1010.63479
6/15/2022	4:00:00 AM	0	12.495	5.3	6/15/2022	4:00:00 AM	0	897.454	5.457	3.34	23.04	1010.635412
6/15/2022	5:00:00 AM	0	12.492	5.3	6/15/2022	5:00:00 AM	0	897.41	5.428	3.34	23.05	1010.63286

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/15/2022	6:00:00 AM	0	12.486	5.3	6/15/2022	6:00:00 AM	0	897.547	5.627	3.33	23.05	1010.625463
6/15/2022	7:00:00 AM	0	12.479	5.3	6/15/2022	7:00:00 AM	0	897.758	7.683	3.32	23.06	1010.616312
6/15/2022	8:00:00 AM	0	12.468	5.3	6/15/2022	8:00:00 AM	0	897.335	15.885	3.32	23.07	1010.609625
6/15/2022	9:00:00 AM	0	12.459	5.3	6/15/2022	9:00:00 AM	0	896.572	23.402	3.32	23.07	1010.608406
6/15/2022	10:00:00 AM	0	12.451	5.3	6/15/2022	10:00:00 AM	0	896.069	27.347	3.31	23.07	1010.605535
6/15/2022	11:00:00 AM	0	12.444	5.3	6/15/2022	11:00:00 AM	0	895.515	29.147	3.31	23.07	1010.604184
6/15/2022	12:00:00 PM	0	12.441	5.3	6/15/2022	12:00:00 PM	0	895.081	30.241	3.31	23.07	1010.60561
6/15/2022	1:00:00 PM	0	12.44	5.3	6/15/2022	1:00:00 PM	0	894.538	30.613	3.32	23.07	1010.610147
6/15/2022	2:00:00 PM	0	12.441	5.3	6/15/2022	2:00:00 PM	0	893.758	31.522	3.33	23.06	1010.6191
6/15/2022	3:00:00 PM	0	12.448	5.3	6/15/2022	3:00:00 PM	0	894.306	24.88	3.33	23.06	1010.620512
6/15/2022	4:00:00 PM	0	12.458	5.3	6/15/2022	4:00:00 PM	0	894.063	26.795	3.34	23.05	1010.63299
6/15/2022	5:00:00 PM	0	12.461	5.3	6/15/2022	5:00:00 PM	0	893.791	22.34	3.35	23.04	1010.638764
6/15/2022	6:00:00 PM	0	12.465	5.3	6/15/2022	6:00:00 PM	0	893.24	23.196	3.36	23.03	1010.648383
6/15/2022	7:00:00 PM	0	12.468	5.3	6/15/2022	7:00:00 PM	0	893.311	21.354	3.36	23.03	1010.650659
6/15/2022	8:00:00 PM	0	12.467	5.3	6/15/2022	8:00:00 PM	0	893.33	16.664	3.36	23.03	1010.649465
6/15/2022	9:00:00 PM	0	12.467	5.3	6/15/2022	9:00:00 PM	0	893.164	13.589	3.36	23.03	1010.651158
6/15/2022	10:00:00 PM	0	12.477	5.3	6/15/2022	10:00:00 PM	0	894.749	12.081	3.35	23.03	1010.644995
6/15/2022	11:00:00 PM	0	12.473	5.3	6/15/2022	11:00:00 PM	0	894.927	10.408	3.35	23.04	1010.63918
6/16/2022	12:00:00 AM	0	12.471	5.3	6/16/2022	12:00:00 AM	0	895.207	9.735	3.34	23.04	1010.634325
6/16/2022	1:00:00 AM	0	12.465	5.3	6/16/2022	1:00:00 AM	0	894.483	9.089	3.34	23.04	1010.635707
6/16/2022	2:00:00 AM	0	12.459	5.3	6/16/2022	2:00:00 AM	0	893.891	8.539	3.34	23.04	1010.635744
6/16/2022	3:00:00 AM	0	12.459	5.3	6/16/2022	3:00:00 AM	0	893.963	8.721	3.34	23.04	1010.63501
6/16/2022	4:00:00 AM	0	12.459	5.3	6/16/2022	4:00:00 AM	0	894.216	8.489	3.34	23.05	1010.63243
6/16/2022	5:00:00 AM	0	12.454	5.3	6/16/2022	5:00:00 AM	0	894.059	8.475	3.34	23.05	1010.629031
6/16/2022	6:00:00 AM	0	12.45	5.3	6/16/2022	6:00:00 AM	0	894.087	8.801	3.33	23.05	1010.624746
6/16/2022	7:00:00 AM	0	12.445	5.3	6/16/2022	7:00:00 AM	0	894.456	9.854	3.32	23.06	1010.615983
6/16/2022	8:00:00 AM	0	12.435	5.3	6/16/2022	8:00:00 AM	0	894.086	10.078	3.32	23.07	1010.609756
6/16/2022	9:00:00 AM	0	12.426	5.3	6/16/2022	9:00:00 AM	0	894.03	11.239	3.31	23.08	1010.601327
6/16/2022	10:00:00 AM	0	12.419	5.3	6/16/2022	10:00:00 AM	0	893.931	10.587	3.30	23.08	1010.595336
6/16/2022	11:00:00 AM	0	12.419	5.3	6/16/2022	11:00:00 AM	0	894.612	10.005	3.30	23.09	1010.588392
6/16/2022	12:00:00 PM	0	12.411	5.3	6/16/2022	12:00:00 PM	0	894.139	9.534	3.29	23.09	1010.585215
6/16/2022	1:00:00 PM	0	12.405	5.3	6/16/2022	1:00:00 PM	0	893.859	12.454	3.29	23.10	1010.582071
6/16/2022	2:00:00 PM	0	12.41	5.3	6/16/2022	2:00:00 PM	0	893.84	11.982	3.30	23.09	1010.587264
6/16/2022	3:00:00 PM	0	12.414	5.3	6/16/2022	3:00:00 PM	0	894.12	13.051	3.30	23.09	1010.588409
6/16/2022	4:00:00 PM	0	12.42	5.3	6/16/2022	4:00:00 PM	0	894.04	14.067	3.30	23.08	1010.595225
6/16/2022	5:00:00 PM	0	12.426	5.3	6/16/2022	5:00:00 PM	0	893.867	13.246	3.31	23.08	1010.602989
6/16/2022	6:00:00 PM	0	12.434	5.3	6/16/2022	6:00:00 PM	0	894.18	12.734	3.32	23.07	1010.607797
6/16/2022	7:00:00 PM	0	12.443	5.3	6/16/2022	7:00:00 PM	0	894.729	11.677	3.32	23.07	1010.611199
6/16/2022	8:00:00 PM	0	12.448	5.3	6/16/2022	8:00:00 PM	0	895.277	10.067	3.32	23.07	1010.610611
6/16/2022	9:00:00 PM	0	12.448	5.3	6/16/2022	9:00:00 PM	0	895.184	7.958	3.32	23.07	1010.611559
6/16/2022	10:00:00 PM	0	12.448	5.3	6/16/2022	10:00:00 PM	0	894.932	6.651	3.32	23.06	1010.614129
6/16/2022	11:00:00 PM	0	12.447	5.3	6/16/2022	11:00:00 PM	0	895.254	5.495	3.32	23.07	1010.609845
6/17/2022	12:00:00 AM	0	12.443	5.3	6/17/2022	12:00:00 AM	0	894.932	4.912	3.32	23.07	1010.609129
6/17/2022	1:00:00 AM	0	12.44	5.3	6/17/2022	1:00:00 AM	0	894.858	4.353	3.31	23.07	1010.606884
6/17/2022	2:00:00 AM	0	12.438	5.3	6/17/2022	2:00:00 AM	0	894.833	3.861	3.31	23.07	1010.605138
6/17/2022	3:00:00 AM	0	12.434	5.3	6/17/2022	3:00:00 AM	0	894.666	4.404	3.31	23.08	1010.602841
6/17/2022	4:00:00 AM	0	12.432	5.3	6/17/2022	4:00:00 AM	0	894.724	4.767	3.31	23.08	1010.60025
6/17/2022	5:00:00 AM	0	12.431	5.3	6/17/2022	5:00:00 AM	0	894.756	4.951	3.31	23.08	1010.598924
6/17/2022	6:00:00 AM	0	12.425	5.3	6/17/2022	6:00:00 AM	0	894.323	5.878	3.31	23.08	1010.597339
6/17/2022	7:00:00 AM	0	12.417	5.3	6/17/2022	7:00:00 AM	0	893.973	8.13	3.30	23.09	1010.592908
6/17/2022	8:00:00 AM	0	12.408	5.3	6/17/2022	8:00:00 AM	0	893.335	13.287	3.30	23.09	1010.590414
6/17/2022	9:00:00 AM	0	12.402	5.3	6/17/2022	9:00:00 AM	0	893.077	18.69	3.30	23.09	1010.587045
6/17/2022	10:00:00 AM	0	12.39	5.3	6/17/2022	10:00:00 AM	0	892.31	22.63	3.29	23.10	1010.582866
6/17/2022	11:00:00 AM	0	12.38	5.3	6/17/2022	11:00:00 AM	0	891.581	23.498	3.29	23.10	1010.5803
6/17/2022	12:00:00 PM	0	12.371	5.3	6/17/2022	12:00:00 PM	0	890.8	25.284	3.29	23.10	1010.579264
6/17/2022	1:00:00 PM	0	12.365	5.3	6/17/2022	1:00:00 PM	0	890.274	26.224	3.29	23.10	1010.578628
6/17/2022	2:00:00 PM	0	12.365	5.3	6/17/2022	2:00:00 PM	0	890.412	25.206	3.29	23.10	1010.57722
6/17/2022	3:00:00 PM	0	12.365	5.3	6/17/2022	3:00:00 PM	0	890.359	23.996	3.29	23.10	1010.577761
6/17/2022	4:00:00 PM	0	12.366	5.3	6/17/2022	4:00:00 PM	0	890.059	23.758	3.29	23.10	1010.58182
6/17/2022	5:00:00 PM	0	12.372	5.3	6/17/2022	5:00:00 PM	0	890.266	20.982	3.29	23.09	1010.585709
6/17/2022	6:00:00 PM	0	12.377	5.3	6/17/2022	6:00:00 PM	0	890.257	18.419	3.30	23.09	1010.590801
6/17/2022	7:00:00 PM	0	12.383	5.3	6/17/2022	7:00:00 PM	0	890.587	15.411	3.30	23.09	1010.593436
6/17/2022	8:00:00 PM	0	12.389	5.3	6/17/2022	8:00:00 PM	0	891.172	13.563	3.30	23.09	1010.59347
6/17/2022	9:00:00 PM	0	12.393	5.3	6/17/2022	9:00:00 PM	0	891.524	12.245	3.30	23.09	1010.593881
6/17/2022	10:00:00 PM	0	12.396	5.3	6/17/2022	10:00:00 PM	0	891.864	10.459	3.30	23.09	1010.593414
6/17/2022	11:00:00 PM	0	12.392	5.3	6/17/2022	11:00:00 PM	0	891.624	9.198	3.30	23.09	1010.591861
6/18/2022	12:00:00 AM	0	12.39	5.3	6/18/2022	12:00:00 AM	0	891.613	8.765	3.30	23.09	1010.589973
6/18/2022	1:00:00 AM	0	12.389	5.3	6/18/2022	1:00:00 AM	0	891.698	8.417	3.30	23.09	1010.588107
6/18/2022	2:00:00 AM	0	12.384	5.3	6/18/2022	2:00:00 AM	0	891.593	8.231	3.29	23.09	1010.584177
6/18/2022	3:00:00 AM	0	12.384	5.3	6/18/2022	3:00:00 AM	0	891.74	8.127	3.29	23.10	1010.582678
6/18/2022	4:00:00 AM	0	12.384	5.3	6/18/2022	4:00:00 AM	0	892.119	7.83	3.29	23.10	1010.578814
6/18/2022	5:00:00 AM	0	12.383	5.3	6/18/2022	5:00:00 AM	0	892.43	7.709	3.28	23.10	1010.574642

Baro unit	Water Column Equivalent (m)									QA/QC Date:	23-Feb-23	
1 mbar	0.0101972									Completed by:	OK	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/18/2022	6:00:00 AM	0	12.383	5.3	6/18/2022	6:00:00 AM	0	892.596	8.068	3.28	23.11	1010.57295
6/18/2022	7:00:00 AM	0	12.38	5.3	6/18/2022	7:00:00 AM	0	892.669	8.293	3.28	23.11	1010.569205
6/18/2022	8:00:00 AM	0	12.377	5.3	6/18/2022	8:00:00 AM	0	892.899	9.236	3.27	23.12	1010.56386
6/18/2022	9:00:00 AM	0	12.374	5.3	6/18/2022	9:00:00 AM	0	893.177	10.796	3.27	23.12	1010.558025
6/18/2022	10:00:00 AM	0	12.369	5.3	6/18/2022	10:00:00 AM	0	893.43	10.985	3.26	23.13	1010.550445
6/18/2022	11:00:00 AM	0	12.365	5.3	6/18/2022	11:00:00 AM	0	893.486	12.592	3.25	23.13	1010.545874
6/18/2022	12:00:00 PM	0	12.358	5.3	6/18/2022	12:00:00 PM	0	893.343	17.072	3.25	23.14	1010.540332
6/18/2022	1:00:00 PM	0	12.352	5.3	6/18/2022	1:00:00 PM	0	892.643	23.455	3.25	23.14	1010.54147
6/18/2022	2:00:00 PM	0	12.351	5.3	6/18/2022	2:00:00 PM	0	893.024	23.049	3.24	23.14	1010.536585
6/18/2022	3:00:00 PM	0	12.355	5.3	6/18/2022	3:00:00 PM	0	893.72	19.507	3.24	23.15	1010.533488
6/18/2022	4:00:00 PM	0	12.354	5.3	6/18/2022	4:00:00 PM	0	893.697	15.186	3.24	23.15	1010.532722
6/18/2022	5:00:00 PM	0	12.361	5.3	6/18/2022	5:00:00 PM	0	894.172	15.649	3.24	23.14	1010.534879
6/18/2022	6:00:00 PM	0	12.368	5.3	6/18/2022	6:00:00 PM	0	894.168	16.5	3.25	23.14	1010.54192
6/18/2022	7:00:00 PM	0	12.374	5.3	6/18/2022	7:00:00 PM	0	894.72	15.338	3.25	23.14	1010.542291
6/18/2022	8:00:00 PM	0	12.38	5.3	6/18/2022	8:00:00 PM	0	894.816	12.754	3.26	23.13	1010.547312
6/18/2022	9:00:00 PM	0	12.387	5.3	6/18/2022	9:00:00 PM	0	895.553	10.983	3.25	23.13	1010.546796
6/18/2022	10:00:00 PM	0	12.389	5.3	6/18/2022	10:00:00 PM	0	895.812	9.984	3.25	23.13	1010.546155
6/18/2022	11:00:00 PM	0	12.392	5.3	6/18/2022	11:00:00 PM	0	896.151	9.248	3.25	23.13	1010.545699
6/19/2022	12:00:00 AM	0	12.39	5.3	6/19/2022	12:00:00 AM	0	896.293	8.918	3.25	23.14	1010.542251
6/19/2022	1:00:00 AM	0	12.389	5.3	6/19/2022	1:00:00 AM	0	896.352	8.352	3.25	23.14	1010.540649
6/19/2022	2:00:00 AM	0	12.387	5.3	6/19/2022	2:00:00 AM	0	896.513	8.557	3.25	23.14	1010.537007
6/19/2022	3:00:00 AM	0	12.387	5.3	6/19/2022	3:00:00 AM	0	896.88	8.626	3.24	23.15	1010.533265
6/19/2022	4:00:00 AM	0	12.389	5.3	6/19/2022	4:00:00 AM	0	897.311	8.502	3.24	23.15	1010.53087
6/19/2022	5:00:00 AM	0	12.389	5.3	6/19/2022	5:00:00 AM	0	897.77	8.758	3.23	23.15	1010.526189
6/19/2022	6:00:00 AM	0	12.39	5.3	6/19/2022	6:00:00 AM	0	898.107	9.239	3.23	23.16	1010.523753
6/19/2022	7:00:00 AM	0	12.39	5.3	6/19/2022	7:00:00 AM	0	898.491	9.996	3.23	23.16	1010.519837
6/19/2022	8:00:00 AM	0	12.39	5.3	6/19/2022	8:00:00 AM	0	898.935	10.858	3.22	23.16	1010.51531
6/19/2022	9:00:00 AM	0	12.39	5.3	6/19/2022	9:00:00 AM	0	899.191	11.355	3.22	23.17	1010.512699
6/19/2022	10:00:00 AM	0	12.387	5.3	6/19/2022	10:00:00 AM	0	899.115	14.016	3.22	23.17	1010.510474
6/19/2022	11:00:00 AM	0	12.386	5.3	6/19/2022	11:00:00 AM	0	899.008	18.682	3.22	23.17	1010.510565
6/19/2022	12:00:00 PM	0	12.384	5.3	6/19/2022	12:00:00 PM	0	899.245	19.562	3.21	23.17	1010.506148
6/19/2022	1:00:00 PM	0	12.38	5.3	6/19/2022	1:00:00 PM	0	899.002	22.261	3.21	23.17	1010.504626
6/19/2022	2:00:00 PM	0	12.377	5.3	6/19/2022	2:00:00 PM	0	898.808	23.758	3.21	23.18	1010.503605
6/19/2022	3:00:00 PM	0	12.375	5.3	6/19/2022	3:00:00 PM	0	898.623	21.417	3.21	23.18	1010.503491
6/19/2022	4:00:00 PM	0	12.372	5.3	6/19/2022	4:00:00 PM	0	898.187	24.148	3.21	23.17	1010.504937
6/19/2022	5:00:00 PM	0	12.375	5.3	6/19/2022	5:00:00 PM	0	898.24	19.705	3.22	23.17	1010.507397
6/19/2022	6:00:00 PM	0	12.378	5.3	6/19/2022	6:00:00 PM	0	898.083	20.598	3.22	23.17	1010.511998
6/19/2022	7:00:00 PM	0	12.383	5.3	6/19/2022	7:00:00 PM	0	898.448	19.745	3.22	23.17	1010.513276
6/19/2022	8:00:00 PM	0	12.389	5.3	6/19/2022	8:00:00 PM	0	899.09	15.024	3.22	23.17	1010.512729
6/19/2022	9:00:00 PM	0	12.396	5.3	6/19/2022	9:00:00 PM	0	899.728	11.731	3.22	23.17	1010.513223
6/19/2022	10:00:00 PM	0	12.399	5.3	6/19/2022	10:00:00 PM	0	900.014	9.647	3.22	23.17	1010.513307
6/19/2022	11:00:00 PM	0	12.4	5.3	6/19/2022	11:00:00 PM	0	900.333	8.518	3.22	23.17	1010.511054
6/20/2022	12:00:00 AM	0	12.4	5.3	6/20/2022	12:00:00 AM	0	900.404	7.919	3.22	23.17	1010.51033
6/20/2022	1:00:00 AM	0	12.4	5.3	6/20/2022	1:00:00 AM	0	900.489	7.74	3.22	23.17	1010.509463
6/20/2022	2:00:00 AM	0	12.4	5.3	6/20/2022	2:00:00 AM	0	900.862	7.253	3.21	23.17	1010.50566
6/20/2022	3:00:00 AM	0	12.399	5.3	6/20/2022	3:00:00 AM	0	901.441	7.414	3.21	23.18	1010.498755
6/20/2022	4:00:00 AM	0	12.4	5.3	6/20/2022	4:00:00 AM	0	901.741	6.875	3.20	23.18	1010.496696
6/20/2022	5:00:00 AM	0	12.4	5.3	6/20/2022	5:00:00 AM	0	902.321	6.431	3.20	23.19	1010.490782
6/20/2022	6:00:00 AM	0	12.4	5.3	6/20/2022	6:00:00 AM	0	902.722	6.804	3.19	23.19	1010.486693
6/20/2022	7:00:00 AM	0	12.402	5.3	6/20/2022	7:00:00 AM	0	902.889	8.059	3.20	23.19	1010.48699
6/20/2022	8:00:00 AM	0	12.4	5.3	6/20/2022	8:00:00 AM	0	902.946	14.707	3.19	23.19	1010.484409
6/20/2022	9:00:00 AM	0	12.4	5.3	6/20/2022	9:00:00 AM	0	902.597	22.698	3.20	23.19	1010.487967
6/20/2022	10:00:00 AM	0	12.402	5.3	6/20/2022	10:00:00 AM	0	902.547	26.488	3.20	23.19	1010.490477
6/20/2022	11:00:00 AM	0	12.402	5.3	6/20/2022	11:00:00 AM	0	902.481	27.57	3.20	23.19	1010.49115
6/20/2022	12:00:00 PM	0	12.4	5.3	6/20/2022	12:00:00 PM	0	902.618	25.691	3.20	23.19	1010.487753
6/20/2022	1:00:00 PM	0	12.398	5.3	6/20/2022	1:00:00 PM	0	902.193	28.156	3.20	23.19	1010.490087
6/20/2022	2:00:00 PM	0	12.395	5.3	6/20/2022	2:00:00 PM	0	902.144	28.26	3.20	23.19	1010.487587
6/20/2022	3:00:00 PM	0	12.395	5.3	6/20/2022	3:00:00 PM	0	902.677	22.832	3.19	23.20	1010.482152
6/20/2022	4:00:00 PM	0	12.395	5.3	6/20/2022	4:00:00 PM	0	902.547	22.672	3.19	23.20	1010.483477
6/20/2022	5:00:00 PM	0	12.395	5.3	6/20/2022	5:00:00 PM	0	902.763	19.629	3.19	23.20	1010.481275
6/20/2022	6:00:00 PM	0	12.395	5.3	6/20/2022	6:00:00 PM	0	902.567	19.52	3.19	23.20	1010.483273
6/20/2022	7:00:00 PM	0	12.398	5.3	6/20/2022	7:00:00 PM	0	902.692	19.773	3.19	23.19	1010.484999
6/20/2022	8:00:00 PM	0	12.402	5.3	6/20/2022	8:00:00 PM	0	903.218	15.635	3.19	23.20	1010.483635
6/20/2022	9:00:00 PM	0	12.406	5.3	6/20/2022	9:00:00 PM	0	903.488	13.19	3.19	23.19	1010.484882
6/20/2022	10:00:00 PM	0	12.41	5.3	6/20/2022	10:00:00 PM	0	903.745	12.219	3.19	23.19	1010.486261
6/20/2022	11:00:00 PM	0	12.41	5.3	6/20/2022	11:00:00 PM	0	903.672	11.504	3.20	23.19	1010.487005
6/21/2022	12:00:00 AM	0	12.411	5.3	6/21/2022	12:00:00 AM	0	903.918	10.826	3.19	23.19	1010.485497
6/21/2022	1:00:00 AM	0	12.413	5.3	6/21/2022	1:00:00 AM	0	904.207	10.051	3.19	23.19	1010.48455
6/21/2022	2:00:00 AM	0	12.41	5.3	6/21/2022	2:00:00 AM	0	904.233	10.148	3.19	23.20	1010.481285
6/21/2022	3:00:00 AM	0	12.406	5.3	6/21/2022	3:00:00 AM	0	904.325	9.527	3.18	23.20	1010.476347
6/21/2022	4:00:00 AM	0	12.405	5.3	6/21/2022	4:00:00 AM	0	904.528	8.604	3.18	23.21	1010.473277
6/21/2022	5:00:00 AM	0	12.4	5.3	6/21/2022	5:00:00 AM	0	904.263	8.95	3.18	23.21	1010.470979

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/21/2022	6:00:00 AM	0	12.396	5.3	6/21/2022	6:00:00 AM	0	904.002	10.388	3.18	23.21	1010.46964
6/21/2022	7:00:00 AM	0	12.395	5.3	6/21/2022	7:00:00 AM	0	903.787	13.08	3.18	23.21	1010.470833
6/21/2022	8:00:00 AM	0	12.393	5.3	6/21/2022	8:00:00 AM	0	903.518	15.419	3.18	23.21	1010.471576
6/21/2022	9:00:00 AM	0	12.392	5.3	6/21/2022	9:00:00 AM	0	903.066	15.983	3.18	23.20	1010.475185
6/21/2022	10:00:00 AM	0	12.392	5.3	6/21/2022	10:00:00 AM	0	902.378	13.194	3.19	23.20	1010.482201
6/21/2022	11:00:00 AM	0	12.393	5.3	6/21/2022	11:00:00 AM	0	902.395	13.373	3.19	23.20	1010.483027
6/21/2022	12:00:00 PM	0	12.393	5.3	6/21/2022	12:00:00 PM	0	902.121	12.632	3.19	23.19	1010.485821
6/21/2022	1:00:00 PM	0	12.393	5.3	6/21/2022	1:00:00 PM	0	902.048	12.369	3.19	23.19	1010.486566
6/21/2022	2:00:00 PM	0	12.392	5.3	6/21/2022	2:00:00 PM	0	901.861	11.97	3.20	23.19	1010.487473
6/21/2022	3:00:00 PM	0	12.389	5.3	6/21/2022	3:00:00 PM	0	901.622	11.638	3.19	23.19	1010.48691
6/21/2022	4:00:00 PM	0	12.386	5.3	6/21/2022	4:00:00 PM	0	901.336	11.317	3.19	23.19	1010.486826
6/21/2022	5:00:00 PM	0	12.384	5.3	6/21/2022	5:00:00 PM	0	901.154	11.661	3.19	23.19	1010.486682
6/21/2022	6:00:00 PM	0	12.383	5.3	6/21/2022	6:00:00 PM	0	900.886	11.855	3.20	23.19	1010.488415
6/21/2022	7:00:00 PM	0	12.378	5.3	6/21/2022	7:00:00 PM	0	900.463	11.521	3.20	23.19	1010.487728
6/21/2022	8:00:00 PM	0	12.38	5.3	6/21/2022	8:00:00 PM	0	900.453	11.634	3.20	23.19	1010.48983
6/21/2022	9:00:00 PM	0	12.383	5.3	6/21/2022	9:00:00 PM	0	900.429	9.911	3.20	23.19	1010.493075
6/21/2022	10:00:00 PM	0	12.383	5.3	6/21/2022	10:00:00 PM	0	900.157	9.098	3.20	23.18	1010.495849
6/21/2022	11:00:00 PM	0	12.383	5.3	6/21/2022	11:00:00 PM	0	899.979	8.934	3.21	23.18	1010.497664
6/22/2022	12:00:00 AM	0	12.38	5.3	6/22/2022	12:00:00 AM	0	899.652	8.759	3.21	23.18	1010.497998
6/22/2022	1:00:00 AM	0	12.378	5.3	6/22/2022	1:00:00 AM	0	899.559	8.664	3.21	23.18	1010.496947
6/22/2022	2:00:00 AM	0	12.372	5.3	6/22/2022	2:00:00 AM	0	899.18	8.504	3.20	23.18	1010.494811
6/22/2022	3:00:00 AM	0	12.368	5.3	6/22/2022	3:00:00 AM	0	898.753	8.418	3.20	23.18	1010.495165
6/22/2022	4:00:00 AM	0	12.368	5.3	6/22/2022	4:00:00 AM	0	898.862	8.276	3.20	23.18	1010.494054
6/22/2022	5:00:00 AM	0	12.363	5.3	6/22/2022	5:00:00 AM	0	898.794	8.212	3.20	23.19	1010.489747
6/22/2022	6:00:00 AM	0	12.361	5.3	6/22/2022	6:00:00 AM	0	899.152	8.758	3.19	23.19	1010.484097
6/22/2022	7:00:00 AM	0	12.358	5.3	6/22/2022	7:00:00 AM	0	899.164	9.05	3.19	23.20	1010.480974
6/22/2022	8:00:00 AM	0	12.358	5.3	6/22/2022	8:00:00 AM	0	899.312	12.98	3.19	23.20	1010.479465
6/22/2022	9:00:00 AM	0	12.358	5.3	6/22/2022	9:00:00 AM	0	898.912	19.191	3.19	23.20	1010.483544
6/22/2022	10:00:00 AM	0	12.361	5.3	6/22/2022	10:00:00 AM	0	898.91	15.82	3.19	23.19	1010.486564
6/22/2022	11:00:00 AM	0	12.361	5.3	6/22/2022	11:00:00 AM	0	898.513	18.76	3.20	23.19	1010.490613
6/22/2022	12:00:00 PM	0	12.361	5.3	6/22/2022	12:00:00 PM	0	897.726	21.404	3.21	23.18	1010.498638
6/22/2022	1:00:00 PM	0	12.361	5.3	6/22/2022	1:00:00 PM	0	896.997	23.487	3.21	23.17	1010.506072
6/22/2022	2:00:00 PM	0	12.361	5.3	6/22/2022	2:00:00 PM	0	896.849	18.187	3.22	23.17	1010.507581
6/22/2022	3:00:00 PM	0	12.368	5.3	6/22/2022	3:00:00 PM	0	898	11.106	3.21	23.18	1010.502844
6/22/2022	4:00:00 PM	0	12.365	5.3	6/22/2022	4:00:00 PM	0	897.527	14.556	3.21	23.17	1010.504667
6/22/2022	5:00:00 PM	0	12.368	5.3	6/22/2022	5:00:00 PM	0	897.886	12.815	3.21	23.17	1010.504006
6/22/2022	6:00:00 PM	0	12.369	5.3	6/22/2022	6:00:00 PM	0	898.291	9.691	3.21	23.18	1010.500877
6/22/2022	7:00:00 PM	0	12.365	5.3	6/22/2022	7:00:00 PM	0	897.794	8.23	3.21	23.18	1010.501945
6/22/2022	8:00:00 PM	0	12.368	5.3	6/22/2022	8:00:00 PM	0	898.002	7.07	3.21	23.18	1010.502824
6/22/2022	9:00:00 PM	0	12.369	5.3	6/22/2022	9:00:00 PM	0	898.203	5.812	3.21	23.18	1010.501774
6/22/2022	10:00:00 PM	0	12.371	5.3	6/22/2022	10:00:00 PM	0	898.444	5.418	3.21	23.18	1010.501316
6/22/2022	11:00:00 PM	0	12.372	5.3	6/22/2022	11:00:00 PM	0	898.688	4.677	3.21	23.18	1010.499828
6/23/2022	12:00:00 AM	0	12.372	5.3	6/23/2022	12:00:00 AM	0	898.736	3.774	3.21	23.18	1010.499339
6/23/2022	1:00:00 AM	0	12.374	5.3	6/23/2022	1:00:00 AM	0	898.862	2.766	3.21	23.18	1010.500054
6/23/2022	2:00:00 AM	0	12.371	5.3	6/23/2022	2:00:00 AM	0	899.01	2.067	3.20	23.18	1010.495545
6/23/2022	3:00:00 AM	0	12.368	5.3	6/23/2022	3:00:00 AM	0	898.991	2.211	3.20	23.19	1010.492739
6/23/2022	4:00:00 AM	0	12.365	5.3	6/23/2022	4:00:00 AM	0	899.183	2.321	3.20	23.19	1010.487781
6/23/2022	5:00:00 AM	0	12.365	5.3	6/23/2022	5:00:00 AM	0	899.793	2.619	3.19	23.20	1010.48156
6/23/2022	6:00:00 AM	0	12.361	5.3	6/23/2022	6:00:00 AM	0	899.962	3.378	3.18	23.20	1010.475837
6/23/2022	7:00:00 AM	0	12.36	5.3	6/23/2022	7:00:00 AM	0	900.242	6.413	3.18	23.21	1010.471982
6/23/2022	8:00:00 AM	0	12.361	5.3	6/23/2022	8:00:00 AM	0	900.732	7.515	3.18	23.21	1010.467985
6/23/2022	9:00:00 AM	0	12.365	5.3	6/23/2022	9:00:00 AM	0	901.105	9.43	3.18	23.21	1010.468182
6/23/2022	10:00:00 AM	0	12.368	5.3	6/23/2022	10:00:00 AM	0	901.229	11.796	3.18	23.21	1010.469917
6/23/2022	11:00:00 AM	0	12.375	5.3	6/23/2022	11:00:00 AM	0	901.567	13.134	3.18	23.21	1010.473471
6/23/2022	12:00:00 PM	0	12.383	5.3	6/23/2022	12:00:00 PM	0	902.146	13.824	3.18	23.20	1010.475566
6/23/2022	1:00:00 PM	0	12.389	5.3	6/23/2022	1:00:00 PM	0	902.508	14.063	3.19	23.20	1010.477875
6/23/2022	2:00:00 PM	0	12.395	5.3	6/23/2022	2:00:00 PM	0	902.86	12.337	3.19	23.20	1010.480286
6/23/2022	3:00:00 PM	0	12.396	5.3	6/23/2022	3:00:00 PM	0	902.727	12.137	3.19	23.20	1010.482642
6/23/2022	4:00:00 PM	0	12.4	5.3	6/23/2022	4:00:00 PM	0	903.254	12.933	3.19	23.20	1010.481268
6/23/2022	5:00:00 PM	0	12.396	5.3	6/23/2022	5:00:00 PM	0	902.686	11.755	3.19	23.20	1010.48306
6/23/2022	6:00:00 PM	0	12.398	5.3	6/23/2022	6:00:00 PM	0	902.754	10.955	3.19	23.19	1010.484366
6/23/2022	7:00:00 PM	0	12.398	5.3	6/23/2022	7:00:00 PM	0	903.016	9.959	3.19	23.20	1010.481695
6/23/2022	8:00:00 PM	0	12.4	5.3	6/23/2022	8:00:00 PM	0	903.198	9.193	3.19	23.20	1010.481839
6/23/2022	9:00:00 PM	0	12.4	5.3	6/23/2022	9:00:00 PM	0	903.354	7.863	3.19	23.20	1010.480248
6/23/2022	10:00:00 PM	0	12.402	5.3	6/23/2022	10:00:00 PM	0	903.334	6.736	3.19	23.20	1010.482452
6/23/2022	11:00:00 PM	0	12.405	5.3	6/23/2022	11:00:00 PM	0	903.579	5.87	3.19	23.20	1010.482954
6/24/2022	12:00:00 AM	0	12.405	5.3	6/24/2022	12:00:00 AM	0	903.35	5.215	3.19	23.19	1010.485289
6/24/2022	1:00:00 AM	0	12.406	5.3	6/24/2022	1:00:00 AM	0	903.656	5.435	3.19	23.20	1010.483169
6/24/2022	2:00:00 AM	0	12.406	5.3	6/24/2022	2:00:00 AM	0	903.932	5.995	3.19	23.20	1010.480354
6/24/2022	3:00:00 AM	0	12.406	5.3	6/24/2022	3:00:00 AM	0	904.137	6.161	3.19	23.20	1010.478264
6/24/2022	4:00:00 AM	0	12.405	5.3	6/24/2022	4:00:00 AM	0	904.374	5.73	3.18	23.20	1010.474847
6/24/2022	5:00:00 AM	0	12.405	5.3	6/24/2022	5:00:00 AM	0	905.007	5.473	3.18	23.21	1010.468392

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/24/2022	6:00:00 AM	0	12.403	5.3	6/24/2022	6:00:00 AM	0	905.28	5.674	3.17	23.22	1010.463608
6/24/2022	7:00:00 AM	0	12.402	5.3	6/24/2022	7:00:00 AM	0	905.646	6.794	3.17	23.22	1010.458876
6/24/2022	8:00:00 AM	0	12.403	5.3	6/24/2022	8:00:00 AM	0	906.232	11.553	3.16	23.23	1010.453901
6/24/2022	9:00:00 AM	0	12.405	5.3	6/24/2022	9:00:00 AM	0	906.133	19.199	3.16	23.22	1010.45691
6/24/2022	10:00:00 AM	0	12.41	5.3	6/24/2022	10:00:00 AM	0	906.251	17.409	3.17	23.22	1010.460707
6/24/2022	11:00:00 AM	0	12.416	5.3	6/24/2022	11:00:00 AM	0	906.425	20.542	3.17	23.21	1010.464933
6/24/2022	12:00:00 PM	0	12.423	5.3	6/24/2022	12:00:00 PM	0	906.376	22.418	3.18	23.21	1010.472432
6/24/2022	1:00:00 PM	0	12.429	5.3	6/24/2022	1:00:00 PM	0	906.474	22.009	3.19	23.20	1010.477433
6/24/2022	2:00:00 PM	0	12.435	5.3	6/24/2022	2:00:00 PM	0	906.295	23.778	3.19	23.19	1010.485258
6/24/2022	3:00:00 PM	0	12.441	5.3	6/24/2022	3:00:00 PM	0	906.415	23.058	3.20	23.19	1010.490035
6/24/2022	4:00:00 PM	0	12.444	5.3	6/24/2022	4:00:00 PM	0	906.576	20.575	3.20	23.19	1010.491393
6/24/2022	5:00:00 PM	0	12.444	5.3	6/24/2022	5:00:00 PM	0	906.431	19.684	3.20	23.19	1010.492871
6/24/2022	6:00:00 PM	0	12.447	5.3	6/24/2022	6:00:00 PM	0	906.384	22.278	3.20	23.18	1010.496351
6/24/2022	7:00:00 PM	0	12.445	5.3	6/24/2022	7:00:00 PM	0	906.634	19.59	3.20	23.19	1010.491801
6/24/2022	8:00:00 PM	0	12.447	5.3	6/24/2022	8:00:00 PM	0	907.11	15.295	3.20	23.19	1010.488947
6/24/2022	9:00:00 PM	0	12.448	5.3	6/24/2022	9:00:00 PM	0	907.47	12.036	3.19	23.19	1010.486276
6/24/2022	10:00:00 PM	0	12.451	5.3	6/24/2022	10:00:00 PM	0	907.789	9.526	3.19	23.19	1010.486024
6/24/2022	11:00:00 PM	0	12.453	5.3	6/24/2022	11:00:00 PM	0	907.925	7.938	3.19	23.19	1010.486637
6/25/2022	12:00:00 AM	0	12.453	5.3	6/25/2022	12:00:00 AM	0	907.918	6.753	3.19	23.19	1010.486708
6/25/2022	1:00:00 AM	0	12.458	5.3	6/25/2022	1:00:00 AM	0	908.108	5.852	3.20	23.19	1010.489771
6/25/2022	2:00:00 AM	0	12.458	5.3	6/25/2022	2:00:00 AM	0	908.313	5.028	3.20	23.19	1010.48768
6/25/2022	3:00:00 AM	0	12.458	5.3	6/25/2022	3:00:00 AM	0	908.583	4.531	3.19	23.19	1010.484927
6/25/2022	4:00:00 AM	0	12.456	5.3	6/25/2022	4:00:00 AM	0	908.789	3.966	3.19	23.20	1010.480826
6/25/2022	5:00:00 AM	0	12.454	5.3	6/25/2022	5:00:00 AM	0	908.942	3.797	3.19	23.20	1010.477266
6/25/2022	6:00:00 AM	0	12.451	5.3	6/25/2022	6:00:00 AM	0	909.128	4.381	3.18	23.21	1010.472369
6/25/2022	7:00:00 AM	0	12.447	5.3	6/25/2022	7:00:00 AM	0	909.388	6.174	3.17	23.21	1010.465718
6/25/2022	8:00:00 AM	0	12.444	5.3	6/25/2022	8:00:00 AM	0	909.473	13.903	3.17	23.22	1010.461851
6/25/2022	9:00:00 AM	0	12.445	5.3	6/25/2022	9:00:00 AM	0	909.145	23.236	3.17	23.21	1010.466196
6/25/2022	10:00:00 AM	0	12.445	5.3	6/25/2022	10:00:00 AM	0	908.633	27.149	3.18	23.21	1010.471417
6/25/2022	11:00:00 AM	0	12.447	5.3	6/25/2022	11:00:00 AM	0	908.139	28.231	3.19	23.20	1010.478455
6/25/2022	12:00:00 PM	0	12.451	5.3	6/25/2022	12:00:00 PM	0	907.699	28.879	3.20	23.19	1010.486941
6/25/2022	1:00:00 PM	0	12.458	5.3	6/25/2022	1:00:00 PM	0	907.233	29.633	3.21	23.18	1010.498693
6/25/2022	2:00:00 PM	0	12.464	5.3	6/25/2022	2:00:00 PM	0	906.806	31.376	3.22	23.17	1010.509047
6/25/2022	3:00:00 PM	0	12.467	5.3	6/25/2022	3:00:00 PM	0	907.038	25.277	3.22	23.17	1010.509682
6/25/2022	4:00:00 PM	0	12.47	5.3	6/25/2022	4:00:00 PM	0	905.955	31.674	3.23	23.16	1010.523725
6/25/2022	5:00:00 PM	0	12.471	5.3	6/25/2022	5:00:00 PM	0	906.359	24.29	3.23	23.16	1010.520606
6/25/2022	6:00:00 PM	0	12.471	5.3	6/25/2022	6:00:00 PM	0	906.021	23.625	3.23	23.15	1010.524052
6/25/2022	7:00:00 PM	0	12.468	5.3	6/25/2022	7:00:00 PM	0	906.115	21.761	3.23	23.16	1010.520094
6/25/2022	8:00:00 PM	0	12.468	5.3	6/25/2022	8:00:00 PM	0	906.38	15.712	3.23	23.16	1010.517391
6/25/2022	9:00:00 PM	0	12.467	5.3	6/25/2022	9:00:00 PM	0	906.535	12.681	3.22	23.16	1010.514811
6/25/2022	10:00:00 PM	0	12.467	5.3	6/25/2022	10:00:00 PM	0	906.699	10.884	3.22	23.17	1010.513138
6/25/2022	11:00:00 PM	0	12.467	5.3	6/25/2022	11:00:00 PM	0	906.714	10.001	3.22	23.17	1010.512986
6/26/2022	12:00:00 AM	0	12.468	5.3	6/26/2022	12:00:00 AM	0	906.866	9.144	3.22	23.17	1010.512436
6/26/2022	1:00:00 AM	0	12.468	5.3	6/26/2022	1:00:00 AM	0	906.886	8.445	3.22	23.17	1010.512232
6/26/2022	2:00:00 AM	0	12.468	5.3	6/26/2022	2:00:00 AM	0	906.805	8.176	3.22	23.17	1010.513058
6/26/2022	3:00:00 AM	0	12.467	5.3	6/26/2022	3:00:00 AM	0	906.867	7.942	3.22	23.17	1010.511425
6/26/2022	4:00:00 AM	0	12.465	5.3	6/26/2022	4:00:00 AM	0	906.914	7.09	3.22	23.17	1010.508946
6/26/2022	5:00:00 AM	0	12.459	5.3	6/26/2022	5:00:00 AM	0	906.863	6.67	3.21	23.18	1010.503466
6/26/2022	6:00:00 AM	0	12.456	5.3	6/26/2022	6:00:00 AM	0	906.973	7.283	3.21	23.18	1010.499344
6/26/2022	7:00:00 AM	0	12.45	5.3	6/26/2022	7:00:00 AM	0	907.177	9.046	3.20	23.19	1010.491264
6/26/2022	8:00:00 AM	0	12.445	5.3	6/26/2022	8:00:00 AM	0	907.002	16.073	3.20	23.19	1010.488049
6/26/2022	9:00:00 AM	0	12.441	5.3	6/26/2022	9:00:00 AM	0	906.124	26.236	3.20	23.19	1010.493002
6/26/2022	10:00:00 AM	0	12.438	5.3	6/26/2022	10:00:00 AM	0	905.434	30.557	3.21	23.18	1010.497038
6/26/2022	11:00:00 AM	0	12.44	5.3	6/26/2022	11:00:00 AM	0	904.889	32.633	3.21	23.17	1010.504595
6/26/2022	12:00:00 PM	0	12.441	5.3	6/26/2022	12:00:00 PM	0	904.269	33.13	3.22	23.17	1010.511918
6/26/2022	1:00:00 PM	0	12.444	5.3	6/26/2022	1:00:00 PM	0	903.469	34.103	3.23	23.16	1010.523075
6/26/2022	2:00:00 PM	0	12.45	5.3	6/26/2022	2:00:00 PM	0	903.298	32.168	3.24	23.15	1010.530819
6/26/2022	3:00:00 PM	0	12.454	5.3	6/26/2022	3:00:00 PM	0	903.349	28.688	3.24	23.14	1010.534299
6/26/2022	4:00:00 PM	0	12.458	5.3	6/26/2022	4:00:00 PM	0	902.317	34.36	3.26	23.13	1010.548823
6/26/2022	5:00:00 PM	0	12.459	5.3	6/26/2022	5:00:00 PM	0	902.753	27.394	3.25	23.13	1010.545377
6/26/2022	6:00:00 PM	0	12.459	5.3	6/26/2022	6:00:00 PM	0	902.499	26.056	3.26	23.13	1010.547967
6/26/2022	7:00:00 PM	0	12.458	5.3	6/26/2022	7:00:00 PM	0	902.643	24.064	3.25	23.13	1010.545498
6/26/2022	8:00:00 PM	0	12.456	5.3	6/26/2022	8:00:00 PM	0	902.959	18.175	3.25	23.14	1010.540276
6/26/2022	9:00:00 PM	0	12.454	5.3	6/26/2022	9:00:00 PM	0	903.141	15.168	3.24	23.14	1010.53642
6/26/2022	10:00:00 PM	0	12.451	5.3	6/26/2022	10:00:00 PM	0	903.214	13.204	3.24	23.15	1010.532676
6/26/2022	11:00:00 PM	0	12.45	5.3	6/26/2022	11:00:00 PM	0	903.209	12.031	3.24	23.15	1010.531727
6/27/2022	12:00:00 AM	0	12.448	5.3	6/27/2022	12:00:00 AM	0	903.015	11.164	3.24	23.15	1010.531705
6/27/2022	1:00:00 AM	0	12.448	5.3	6/27/2022	1:00:00 AM	0	903.066	10.262	3.24	23.15	1010.531185
6/27/2022	2:00:00 AM	0	12.447	5.3	6/27/2022	2:00:00 AM	0	902.917	9.461	3.24	23.15	1010.531704
6/27/2022	3:00:00 AM	0	12.444	5.3	6/27/2022	3:00:00 AM	0	902.846	8.955	3.24	23.15	1010.529428
6/27/2022	4:00:00 AM	0	12.441	5.3	6/27/2022	4:00:00 AM	0	902.746	8.339	3.24	23.15	1010.527448
6/27/2022	5:00:00 AM	0	12.437	5.3	6/27/2022	5:00:00 AM	0	902.679	8.056	3.23	23.15	1010.524131

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/27/2022	6:00:00 AM	0	12.431	5.3	6/27/2022	6:00:00 AM	0	902.694	9.412	3.23	23.16	1010.517978
6/27/2022	7:00:00 AM	0	12.423	5.3	6/27/2022	7:00:00 AM	0	902.661	11.8	3.22	23.17	1010.510315
6/27/2022	8:00:00 AM	0	12.416	5.3	6/27/2022	8:00:00 AM	0	902.269	18.1	3.22	23.17	1010.507312
6/27/2022	9:00:00 AM	0	12.408	5.3	6/27/2022	9:00:00 AM	0	901.159	27.282	3.22	23.17	1010.510631
6/27/2022	10:00:00 AM	0	12.402	5.3	6/27/2022	10:00:00 AM	0	900.095	32.323	3.22	23.16	1010.515481
6/27/2022	11:00:00 AM	0	12.402	5.3	6/27/2022	11:00:00 AM	0	899.462	34.656	3.23	23.16	1010.521936
6/27/2022	12:00:00 PM	0	12.4	5.3	6/27/2022	12:00:00 PM	0	898.718	35.407	3.24	23.15	1010.527522
6/27/2022	1:00:00 PM	0	12.403	5.3	6/27/2022	1:00:00 PM	0	898.024	36.039	3.25	23.14	1010.537599
6/27/2022	2:00:00 PM	0	12.41	5.3	6/27/2022	2:00:00 PM	0	897.568	37.51	3.26	23.13	1010.549249
6/27/2022	3:00:00 PM	0	12.413	5.3	6/27/2022	3:00:00 PM	0	897.865	31.872	3.26	23.13	1010.549221
6/27/2022	4:00:00 PM	0	12.414	5.3	6/27/2022	4:00:00 PM	0	896.911	33.588	3.27	23.12	1010.559949
6/27/2022	5:00:00 PM	0	12.417	5.3	6/27/2022	5:00:00 PM	0	897.087	29.374	3.27	23.12	1010.561154
6/27/2022	6:00:00 PM	0	12.419	5.3	6/27/2022	6:00:00 PM	0	897.023	26.353	3.27	23.12	1010.563807
6/27/2022	7:00:00 PM	0	12.414	5.3	6/27/2022	7:00:00 PM	0	896.899	23.984	3.27	23.12	1010.560071
6/27/2022	8:00:00 PM	0	12.41	5.3	6/27/2022	8:00:00 PM	0	896.599	21.84	3.27	23.12	1010.55913
6/27/2022	9:00:00 PM	0	12.406	5.3	6/27/2022	9:00:00 PM	0	896.601	19.594	3.26	23.12	1010.55511
6/27/2022	10:00:00 PM	0	12.402	5.3	6/27/2022	10:00:00 PM	0	896.441	18.391	3.26	23.13	1010.552741
6/27/2022	11:00:00 PM	0	12.398	5.3	6/27/2022	11:00:00 PM	0	896.295	16.887	3.26	23.13	1010.55023
6/28/2022	12:00:00 AM	0	12.396	5.3	6/28/2022	12:00:00 AM	0	896.256	14.909	3.26	23.13	1010.548628
6/28/2022	1:00:00 AM	0	12.396	5.3	6/28/2022	1:00:00 AM	0	896.287	14.539	3.26	23.13	1010.548312
6/28/2022	2:00:00 AM	0	12.396	5.3	6/28/2022	2:00:00 AM	0	896.561	14.902	3.25	23.13	1010.545518
6/28/2022	3:00:00 AM	0	12.398	5.3	6/28/2022	3:00:00 AM	0	897.115	15.255	3.25	23.14	1010.541868
6/28/2022	4:00:00 AM	0	12.387	5.3	6/28/2022	4:00:00 AM	0	895.994	13.131	3.25	23.14	1010.5423
6/28/2022	5:00:00 AM	0	12.383	5.3	6/28/2022	5:00:00 AM	0	895.784	12.576	3.25	23.14	1010.540441
6/28/2022	6:00:00 AM	0	12.374	5.3	6/28/2022	6:00:00 AM	0	895.336	13.061	3.24	23.14	1010.536009
6/28/2022	7:00:00 AM	0	12.365	5.3	6/28/2022	7:00:00 AM	0	894.926	14.737	3.24	23.15	1010.53119
6/28/2022	8:00:00 AM	0	12.352	5.3	6/28/2022	8:00:00 AM	0	894.229	17.099	3.23	23.15	1010.525298
6/28/2022	9:00:00 AM	0	12.342	5.3	6/28/2022	9:00:00 AM	0	893.008	22.553	3.24	23.15	1010.527748
6/28/2022	10:00:00 AM	0	12.335	5.3	6/28/2022	10:00:00 AM	0	892.332	27.044	3.24	23.15	1010.527642
6/28/2022	11:00:00 AM	0	12.33	5.3	6/28/2022	11:00:00 AM	0	891.513	29.293	3.24	23.15	1010.530993
6/28/2022	12:00:00 PM	0	12.327	5.3	6/28/2022	12:00:00 PM	0	890.832	29.438	3.24	23.14	1010.534937
6/28/2022	1:00:00 PM	0	12.33	5.3	6/28/2022	1:00:00 PM	0	890.863	27.744	3.25	23.14	1010.537621
6/28/2022	2:00:00 PM	0	12.35	5.3	6/28/2022	2:00:00 PM	0	891.705	25.141	3.26	23.13	1010.549035
6/28/2022	3:00:00 PM	0	12.344	5.3	6/28/2022	3:00:00 PM	0	892.425	15.82	3.24	23.14	1010.535693
6/28/2022	4:00:00 PM	0	12.348	5.3	6/28/2022	4:00:00 PM	0	891.598	16.356	3.26	23.13	1010.548126
6/28/2022	5:00:00 PM	0	12.365	5.3	6/28/2022	5:00:00 PM	0	892.561	16.036	3.26	23.12	1010.555307
6/28/2022	6:00:00 PM	0	12.372	5.3	6/28/2022	6:00:00 PM	0	894.205	12.131	3.25	23.13	1010.545542
6/28/2022	7:00:00 PM	0	12.381	5.3	6/28/2022	7:00:00 PM	0	895.511	10.528	3.25	23.14	1010.541225
6/28/2022	8:00:00 PM	0	12.374	5.3	6/28/2022	8:00:00 PM	0	895.051	10.366	3.25	23.14	1010.538915
6/28/2022	9:00:00 PM	0	12.371	5.3	6/28/2022	9:00:00 PM	0	895.057	10.077	3.24	23.14	1010.535854
6/28/2022	10:00:00 PM	0	12.368	5.3	6/28/2022	10:00:00 PM	0	895.292	9.652	3.24	23.15	1010.530458
6/28/2022	11:00:00 PM	0	12.366	5.3	6/28/2022	11:00:00 PM	0	895.308	9.368	3.24	23.15	1010.528295
6/29/2022	12:00:00 AM	0	12.363	5.3	6/29/2022	12:00:00 AM	0	895.465	8.839	3.23	23.16	1010.523694
6/29/2022	1:00:00 AM	0	12.363	5.3	6/29/2022	1:00:00 AM	0	895.372	8.542	3.23	23.15	1010.524642
6/29/2022	2:00:00 AM	0	12.361	5.3	6/29/2022	2:00:00 AM	0	895.245	8.481	3.23	23.16	1010.523937
6/29/2022	3:00:00 AM	0	12.361	5.3	6/29/2022	3:00:00 AM	0	895.351	8.56	3.23	23.16	1010.522856
6/29/2022	4:00:00 AM	0	12.36	5.3	6/29/2022	4:00:00 AM	0	895.537	8.546	3.23	23.16	1010.51996
6/29/2022	5:00:00 AM	0	12.357	5.3	6/29/2022	5:00:00 AM	0	895.748	8.645	3.22	23.16	1010.514808
6/29/2022	6:00:00 AM	0	12.354	5.3	6/29/2022	6:00:00 AM	0	896.021	8.844	3.22	23.17	1010.509024
6/29/2022	7:00:00 AM	0	12.35	5.3	6/29/2022	7:00:00 AM	0	896.351	9.247	3.21	23.18	1010.501659
6/29/2022	8:00:00 AM	0	12.345	5.3	6/29/2022	8:00:00 AM	0	896.808	10.129	3.20	23.19	1010.491999
6/29/2022	9:00:00 AM	0	12.341	5.3	6/29/2022	9:00:00 AM	0	897.299	10.96	3.19	23.20	1010.482992
6/29/2022	10:00:00 AM	0	12.339	5.3	6/29/2022	10:00:00 AM	0	897.891	12.427	3.18	23.20	1010.474955
6/29/2022	11:00:00 AM	0	12.339	5.3	6/29/2022	11:00:00 AM	0	898.604	12.365	3.18	23.21	1010.467685
6/29/2022	12:00:00 PM	0	12.341	5.3	6/29/2022	12:00:00 PM	0	899.052	13.813	3.17	23.21	1010.465116
6/29/2022	1:00:00 PM	0	12.347	5.3	6/29/2022	1:00:00 PM	0	899.419	17.639	3.18	23.21	1010.467374
6/29/2022	2:00:00 PM	0	12.354	5.3	6/29/2022	2:00:00 PM	0	899.79	18.567	3.18	23.21	1010.470591
6/29/2022	3:00:00 PM	0	12.361	5.3	6/29/2022	3:00:00 PM	0	900.181	18.863	3.18	23.21	1010.473604
6/29/2022	4:00:00 PM	0	12.369	5.3	6/29/2022	4:00:00 PM	0	900.434	16.564	3.19	23.20	1010.479024
6/29/2022	5:00:00 PM	0	12.378	5.3	6/29/2022	5:00:00 PM	0	900.814	17.39	3.19	23.19	1010.484149
6/29/2022	6:00:00 PM	0	12.384	5.3	6/29/2022	6:00:00 PM	0	901.146	18.455	3.19	23.19	1010.486764
6/29/2022	7:00:00 PM	0	12.387	5.3	6/29/2022	7:00:00 PM	0	901.593	17.595	3.19	23.19	1010.485205
6/29/2022	8:00:00 PM	0	12.39	5.3	6/29/2022	8:00:00 PM	0	902.053	13.333	3.19	23.20	1010.483515
6/29/2022	9:00:00 PM	0	12.392	5.3	6/29/2022	9:00:00 PM	0	902.657	10.874	3.19	23.20	1010.479356
6/29/2022	10:00:00 PM	0	12.39	5.3	6/29/2022	10:00:00 PM	0	902.919	9.333	3.18	23.20	1010.474684
6/29/2022	11:00:00 PM	0	12.39	5.3	6/29/2022	11:00:00 PM	0	903.158	8.686	3.18	23.21	1010.472247
6/30/2022	12:00:00 AM	0	12.392	5.3	6/30/2022	12:00:00 AM	0	903.621	8.58	3.18	23.21	1010.469525
6/30/2022	1:00:00 AM	0	12.392	5.3	6/30/2022	1:00:00 AM	0	903.777	7.926	3.18	23.21	1010.467935
6/30/2022	2:00:00 AM	0	12.392	5.3	6/30/2022	2:00:00 AM	0	903.881	7.356	3.17	23.21	1010.466874
6/30/2022	3:00:00 AM	0	12.392	5.3	6/30/2022	3:00:00 AM	0	904.076	7.055	3.17	23.21	1010.464886
6/30/2022	4:00:00 AM	0	12.392	5.3	6/30/2022	4:00:00 AM	0	904.095	7.085	3.17	23.21	1010.464692
6/30/2022	5:00:00 AM	0	12.389	5.3	6/30/2022	5:00:00 AM	0	904.043	6.94	3.17	23.22	1010.462222

Appendix A
Groundwater Elevation at GW12-2a

Baro unit	**Water Column Equivalent (m)**									QA/QC Date:	**23-Feb-23**	
1 mbar	0.0101972									Completed by:	**OK**	
Date	**SWL**	**Levelo**	GW masl	**Date**	**SWL**	**Levelogger**	GW masl					
2021-01-12	26.65	NA	1007.029	2022-02-28	26.702	0.08	1006.98					
2021-02-16	24.78	NA	1008.899	2022-06-06	23.05	3.34	1010.63					
2021-03-05	23.62	NA	1010.059									
2021-08-16	25.16	1.23	1008.519									
Elevation TOC	1033.679											
Raw Level Logger Data					Baro DATA (mbar)					Baro corrected	WL (mbtc	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/30/2022	6:00:00 AM	0	12.386	5.3	6/30/2022	6:00:00 AM	0	904.116	7.347	3.17	23.22	1010.458478
6/30/2022	7:00:00 AM	0	12.38	5.3	6/30/2022	7:00:00 AM	0	904.215	8.731	3.16	23.23	1010.451468
6/30/2022	8:00:00 AM	0	12.372	5.3	6/30/2022	8:00:00 AM	0	904.066	13.763	3.15	23.23	1010.444988

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/16/2021	2:01:31 PM	0	10.4474	5.187	8/16/2021	1:33:24 PM	0	895.856	21.788	1.31	25.03	1008.66
8/16/2021	3:01:31 PM	0	10.4553	5.064	8/16/2021	2:33:24 PM	0	895.364	21.782	1.33	25.01	1008.67
8/16/2021	4:01:31 PM	0	10.4568	5.019	8/16/2021	3:33:24 PM	0	894.906	21.011	1.33	25.01	1008.67
8/16/2021	5:01:31 PM	0	10.4572	4.999	8/16/2021	4:33:24 PM	0	894.493	19.663	1.34	25.00	1008.68
8/16/2021	6:01:31 PM	0	10.4557	4.987	8/16/2021	5:33:24 PM	0	894.346	18.307	1.34	25.00	1008.68
8/16/2021	7:01:31 PM	0	10.4537	4.981	8/16/2021	6:33:24 PM	0	894.209	15.787	1.34	25.00	1008.68
8/16/2021	8:01:31 PM	0	10.4524	4.978	8/16/2021	7:33:24 PM	0	894.247	14.224	1.33	25.00	1008.68
8/16/2021	9:01:31 PM	0	10.451	4.975	8/16/2021	8:33:24 PM	0	894.157	12.795	1.33	25.00	1008.68
8/16/2021	10:01:31 PM	0	10.4519	4.974	8/16/2021	9:33:24 PM	0	894.691	10.105	1.33	25.01	1008.67
8/16/2021	11:01:31 PM	0	10.4521	4.972	8/16/2021	10:33:24 PM	0	894.852	8.168	1.33	25.01	1008.67
8/17/2021	12:01:31 AM	0	10.452	4.971	8/16/2021	11:33:24 PM	0	894.588	6.785	1.33	25.01	1008.67
8/17/2021	1:01:31 AM	0	10.4515	4.97	8/17/2021	12:33:24 AM	0	894.634	6.463	1.33	25.01	1008.67
8/17/2021	2:01:31 AM	0	10.4512	4.97	8/17/2021	1:33:24 AM	0	894.775	6.02	1.33	25.01	1008.67
8/17/2021	3:01:31 AM	0	10.4516	4.969	8/17/2021	2:33:24 AM	0	894.904	5.618	1.33	25.01	1008.67
8/17/2021	4:01:31 AM	0	10.4517	4.969	8/17/2021	3:33:24 AM	0	895.121	5.134	1.32	25.01	1008.67
8/17/2021	5:01:31 AM	0	10.4525	4.968	8/17/2021	4:33:24 AM	0	895.295	4.814	1.32	25.01	1008.67
8/17/2021	6:01:31 AM	0	10.4538	4.968	8/17/2021	5:33:24 AM	0	895.795	4.839	1.32	25.02	1008.66
8/17/2021	7:01:31 AM	0	10.4561	4.968	8/17/2021	6:33:24 AM	0	896.374	4.411	1.32	25.02	1008.66
8/17/2021	8:01:31 AM	0	10.4601	4.967	8/17/2021	7:33:24 AM	0	897.28	4.842	1.31	25.03	1008.65
8/17/2021	9:01:31 AM	0	10.4632	4.967	8/17/2021	8:33:24 AM	0	897.965	7.84	1.31	25.03	1008.65
8/17/2021	10:01:31 AM	0	10.4664	4.967	8/17/2021	9:33:24 AM	0	898.075	19.809	1.31	25.03	1008.65
8/17/2021	11:01:31 AM	0	10.4674	4.967	8/17/2021	10:33:24 AM	0	897.765	26.24	1.31	25.02	1008.66
8/17/2021	12:01:31 PM	0	10.4676	4.967	8/17/2021	11:33:24 AM	0	897.209	29.385	1.32	25.02	1008.66
8/17/2021	1:01:31 PM	0	10.4667	4.967	8/17/2021	12:33:24 PM	0	896.778	30.933	1.32	25.02	1008.66
8/17/2021	2:01:31 PM	0	10.4659	4.967	8/17/2021	1:33:24 PM	0	896.905	31.675	1.32	25.02	1008.66
8/17/2021	3:01:31 PM	0	10.4661	4.967	8/17/2021	2:33:24 PM	0	896.844	32.902	1.32	25.02	1008.66
8/17/2021	4:01:31 PM	0	10.4664	4.967	8/17/2021	3:33:24 PM	0	897.185	32.581	1.32	25.02	1008.66
8/17/2021	5:01:31 PM	0	10.4678	4.966	8/17/2021	4:33:24 PM	0	897.777	25.896	1.31	25.02	1008.66
8/17/2021	6:01:31 PM	0	10.4697	4.967	8/17/2021	5:33:24 PM	0	898.222	22.48	1.31	25.03	1008.65
8/17/2021	7:01:31 PM	0	10.4716	4.966	8/17/2021	6:33:24 PM	0	898.574	20.34	1.31	25.03	1008.65
8/17/2021	8:01:31 PM	0	10.4738	4.967	8/17/2021	7:33:24 PM	0	899.188	18.82	1.30	25.03	1008.65
8/17/2021	9:01:31 PM	0	10.4775	4.966	8/17/2021	8:33:24 PM	0	899.965	16.046	1.30	25.04	1008.64
8/17/2021	10:01:31 PM	0	10.4815	4.966	8/17/2021	9:33:24 PM	0	900.467	12.488	1.30	25.04	1008.64
8/17/2021	11:01:31 PM	0	10.483	4.966	8/17/2021	10:33:24 PM	0	900.256	10.383	1.30	25.03	1008.65
8/18/2021	12:01:31 AM	0	10.4836	4.966	8/17/2021	11:33:24 PM	0	900.322	9.468	1.30	25.03	1008.65
8/18/2021	1:01:31 AM	0	10.484	4.966	8/18/2021	12:33:24 AM	0	900.449	8.466	1.30	25.04	1008.64
8/18/2021	2:01:31 AM	0	10.4845	4.966	8/18/2021	1:33:24 AM	0	900.577	7.816	1.30	25.04	1008.64
8/18/2021	3:01:31 AM	0	10.4853	4.965	8/18/2021	2:33:24 AM	0	900.721	7.243	1.30	25.04	1008.64
8/18/2021	4:01:31 AM	0	10.4856	4.965	8/18/2021	3:33:24 AM	0	900.789	6.793	1.30	25.04	1008.64
8/18/2021	5:01:31 AM	0	10.4851	4.966	8/18/2021	4:33:24 AM	0	900.732	6.923	1.30	25.04	1008.64
8/18/2021	6:01:31 AM	0	10.485	4.966	8/18/2021	5:33:24 AM	0	900.999	7.668	1.30	25.04	1008.64
8/18/2021	7:01:31 AM	0	10.4844	4.966	8/18/2021	6:33:24 AM	0	900.999	8.317	1.30	25.04	1008.64
8/18/2021	8:01:31 AM	0	10.4836	4.966	8/18/2021	7:33:24 AM	0	901.036	9.413	1.30	25.04	1008.64
8/18/2021	9:01:31 AM	0	10.4836	4.966	8/18/2021	8:33:24 AM	0	901.031	11.078	1.30	25.04	1008.64
8/18/2021	10:01:31 AM	0	10.4826	4.966	8/18/2021	9:33:24 AM	0	901.245	13.673	1.29	25.04	1008.64
8/18/2021	11:01:31 AM	0	10.481	4.966	8/18/2021	10:33:24 AM	0	900.449	21.482	1.30	25.04	1008.64
8/18/2021	12:01:31 PM	0	10.4781	4.966	8/18/2021	11:33:24 AM	0	900.032	25.172	1.30	25.04	1008.64
8/18/2021	1:01:31 PM	0	10.4764	4.966	8/18/2021	12:33:24 PM	0	899.93	27.085	1.30	25.04	1008.64
8/18/2021	2:01:31 PM	0	10.4744	4.965	8/18/2021	1:33:24 PM	0	899.691	24.897	1.30	25.04	1008.64
8/18/2021	3:01:31 PM	0	10.4726	4.965	8/18/2021	2:33:24 PM	0	899.978	23.532	1.30	25.04	1008.64
8/18/2021	4:01:31 PM	0	10.4721	4.966	8/18/2021	3:33:24 PM	0	899.932	21.352	1.30	25.04	1008.64
8/18/2021	5:01:31 PM	0	10.4714	4.965	8/18/2021	4:33:24 PM	0	900.206	21.104	1.29	25.05	1008.63
8/18/2021	6:01:31 PM	0	10.4716	4.965	8/18/2021	5:33:24 PM	0	900.23	20.192	1.29	25.05	1008.63
8/18/2021	7:01:31 PM	0	10.4713	4.965	8/18/2021	6:33:24 PM	0	900.404	18.871	1.29	25.05	1008.63
8/18/2021	8:01:31 PM	0	10.4722	4.965	8/18/2021	7:33:24 PM	0	900.771	17.011	1.29	25.05	1008.63
8/18/2021	9:01:31 PM	0	10.472	4.965	8/18/2021	8:33:24 PM	0	900.619	15.216	1.29	25.05	1008.63
8/18/2021	10:01:31 PM	0	10.4715	4.966	8/18/2021	9:33:24 PM	0	900.81	12.523	1.29	25.05	1008.63
8/18/2021	11:01:31 PM	0	10.4715	4.965	8/18/2021	10:33:24 PM	0	900.768	10.953	1.29	25.05	1008.63
8/19/2021	12:01:31 AM	0	10.47	4.965	8/18/2021	11:33:24 PM	0	900.527	10.891	1.29	25.05	1008.63
8/19/2021	1:01:31 AM	0	10.4686	4.965	8/19/2021	12:33:24 AM	0	900.539	11.189	1.29	25.05	1008.63
8/19/2021	2:01:31 AM	0	10.4681	4.965	8/19/2021	1:33:24 AM	0	900.731	11.343	1.28	25.05	1008.63
8/19/2021	3:01:31 AM	0	10.4677	4.965	8/19/2021	2:33:24 AM	0	900.874	11.638	1.28	25.06	1008.62
8/19/2021	4:01:31 AM	0	10.4676	4.966	8/19/2021	3:33:24 AM	0	900.732	11.643	1.28	25.05	1008.63
8/19/2021	5:01:31 AM	0	10.4673	4.965	8/19/2021	4:33:24 AM	0	900.999	11.669	1.28	25.06	1008.62
8/19/2021	6:01:31 AM	0	10.4664	4.965	8/19/2021	5:33:24 AM	0	900.685	11.05	1.28	25.06	1008.62
8/19/2021	7:01:31 AM	0	10.4656	4.966	8/19/2021	6:33:24 AM	0	900.751	10.729	1.28	25.06	1008.62
8/19/2021	8:01:31 AM	0	10.4652	4.965	8/19/2021	7:33:24 AM	0	900.974	11.578	1.28	25.06	1008.62
8/19/2021	9:01:31 AM	0	10.4654	4.965	8/19/2021	8:33:24 AM	0	901.301	13.777	1.27	25.06	1008.62
8/19/2021	10:01:31 AM	0	10.4652	4.965	8/19/2021	9:33:24 AM	0	901.077	18.011	1.28	25.06	1008.62
8/19/2021	11:01:31 AM	0	10.4639	4.965	8/19/2021	10:33:24 AM	0	900.995	22.15	1.28	25.06	1008.62

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/19/2021	12:01:31 PM	0	10.463	4.965	8/19/2021	11:33:24 AM	0	900.815	24.719	1.28	25.06	1008.62
8/19/2021	1:01:31 PM	0	10.4612	4.965	8/19/2021	12:33:24 PM	0	900.256	26.609	1.28	25.06	1008.62
8/19/2021	2:01:31 PM	0	10.4594	4.965	8/19/2021	1:33:24 PM	0	900.34	26.008	1.28	25.06	1008.62
8/19/2021	3:01:31 PM	0	10.4576	4.965	8/19/2021	2:33:24 PM	0	899.985	27.47	1.28	25.06	1008.62
8/19/2021	4:01:31 PM	0	10.4543	4.965	8/19/2021	3:33:24 PM	0	899.279	29.854	1.28	25.05	1008.63
8/19/2021	5:01:31 PM	0	10.452	4.965	8/19/2021	4:33:24 PM	0	899.439	25.411	1.28	25.06	1008.62
8/19/2021	6:01:31 PM	0	10.4508	4.965	8/19/2021	5:33:24 PM	0	899.644	22.436	1.28	25.06	1008.62
8/19/2021	7:01:31 PM	0	10.4497	4.965	8/19/2021	6:33:24 PM	0	899.774	20.306	1.27	25.06	1008.62
8/19/2021	8:01:31 PM	0	10.4486	4.965	8/19/2021	7:33:24 PM	0	899.578	19.099	1.28	25.06	1008.62
8/19/2021	9:01:31 PM	0	10.4479	4.965	8/19/2021	8:33:24 PM	0	899.985	16.008	1.27	25.07	1008.61
8/19/2021	10:01:31 PM	0	10.447	4.965	8/19/2021	9:33:24 PM	0	899.814	12.343	1.27	25.07	1008.61
8/19/2021	11:01:31 PM	0	10.4454	4.965	8/19/2021	10:33:24 PM	0	899.68	10.175	1.27	25.07	1008.61
8/20/2021	12:01:31 AM	0	10.4432	4.965	8/19/2021	11:33:24 PM	0	899.434	8.95	1.27	25.07	1008.61
8/20/2021	1:01:31 AM	0	10.4406	4.965	8/20/2021	12:33:24 AM	0	899.261	8.118	1.27	25.07	1008.61
8/20/2021	2:01:31 AM	0	10.4385	4.965	8/20/2021	1:33:24 AM	0	899.006	7.478	1.27	25.07	1008.61
8/20/2021	3:01:31 AM	0	10.4354	4.965	8/20/2021	2:33:24 AM	0	898.708	7.318	1.27	25.07	1008.61
8/20/2021	4:01:31 AM	0	10.4327	4.965	8/20/2021	3:33:24 AM	0	898.4	7.034	1.27	25.07	1008.61
8/20/2021	5:01:31 AM	0	10.4297	4.965	8/20/2021	4:33:24 AM	0	898.228	6.417	1.27	25.07	1008.61
8/20/2021	6:01:31 AM	0	10.4278	4.965	8/20/2021	5:33:24 AM	0	898.24	5.953	1.27	25.07	1008.61
8/20/2021	7:01:31 AM	0	10.4259	4.965	8/20/2021	6:33:24 AM	0	898.254	5.426	1.27	25.07	1008.61
8/20/2021	8:01:31 AM	0	10.4247	4.965	8/20/2021	7:33:24 AM	0	898.382	5.932	1.26	25.07	1008.61
8/20/2021	9:01:31 AM	0	10.4224	4.965	8/20/2021	8:33:24 AM	0	898.332	8.783	1.26	25.08	1008.60
8/20/2021	10:01:31 AM	0	10.419	4.965	8/20/2021	9:33:24 AM	0	897.679	20.685	1.27	25.07	1008.61
8/20/2021	11:01:31 AM	0	10.4143	4.965	8/20/2021	10:33:24 AM	0	896.834	28.108	1.27	25.07	1008.61
8/20/2021	12:01:31 PM	0	10.4096	4.965	8/20/2021	11:33:24 AM	0	895.896	32.444	1.27	25.06	1008.62
8/20/2021	1:01:31 PM	0	10.4056	4.965	8/20/2021	12:33:24 PM	0	895.172	34.667	1.28	25.06	1008.62
8/20/2021	2:01:31 PM	0	10.4002	4.965	8/20/2021	1:33:24 PM	0	894.557	36.288	1.28	25.06	1008.62
8/20/2021	3:01:31 PM	0	10.3963	4.966	8/20/2021	2:33:24 PM	0	894.116	36.217	1.28	25.06	1008.62
8/20/2021	4:01:31 PM	0	10.392	4.965	8/20/2021	3:33:24 PM	0	893.704	38.057	1.28	25.06	1008.62
8/20/2021	5:01:31 PM	0	10.3886	4.965	8/20/2021	4:33:24 PM	0	894.185	30.505	1.27	25.07	1008.61
8/20/2021	6:01:31 PM	0	10.3869	4.965	8/20/2021	5:33:24 PM	0	894.418	24.375	1.27	25.07	1008.61
8/20/2021	7:01:31 PM	0	10.3841	4.965	8/20/2021	6:33:24 PM	0	894.402	21.409	1.26	25.07	1008.61
8/20/2021	8:01:31 PM	0	10.3821	4.965	8/20/2021	7:33:24 PM	0	894.322	19.328	1.26	25.07	1008.61
8/20/2021	9:01:31 PM	0	10.3813	4.964	8/20/2021	8:33:24 PM	0	894.705	16.035	1.26	25.08	1008.60
8/20/2021	10:01:31 PM	0	10.3806	4.965	8/20/2021	9:33:24 PM	0	894.734	13.077	1.26	25.08	1008.60
8/20/2021	11:01:31 PM	0	10.379	4.965	8/20/2021	10:33:24 PM	0	894.55	11.405	1.26	25.08	1008.60
8/21/2021	12:01:31 AM	0	10.3772	4.965	8/20/2021	11:33:24 PM	0	894.422	10.492	1.26	25.08	1008.60
8/21/2021	1:01:31 AM	0	10.3755	4.965	8/21/2021	12:33:24 AM	0	894.367	9.722	1.26	25.08	1008.60
8/21/2021	2:01:31 AM	0	10.374	4.965	8/21/2021	1:33:24 AM	0	894.203	9.687	1.26	25.08	1008.60
8/21/2021	3:01:31 AM	0	10.3726	4.965	8/21/2021	2:33:24 AM	0	894.119	9.229	1.26	25.08	1008.60
8/21/2021	4:01:31 AM	0	10.3708	4.965	8/21/2021	3:33:24 AM	0	893.948	9.095	1.26	25.08	1008.60
8/21/2021	5:01:31 AM	0	10.3687	4.965	8/21/2021	4:33:24 AM	0	893.671	8.389	1.26	25.08	1008.60
8/21/2021	6:01:31 AM	0	10.366	4.965	8/21/2021	5:33:24 AM	0	893.454	7.643	1.26	25.08	1008.60
8/21/2021	7:01:31 AM	0	10.3642	4.965	8/21/2021	6:33:24 AM	0	893.517	6.851	1.25	25.08	1008.60
8/21/2021	8:01:31 AM	0	10.3625	4.965	8/21/2021	7:33:24 AM	0	893.517	7.629	1.25	25.09	1008.59
8/21/2021	9:01:31 AM	0	10.36	4.965	8/21/2021	8:33:24 AM	0	893.331	10.934	1.25	25.09	1008.59
8/21/2021	10:01:31 AM	0	10.3553	4.965	8/21/2021	9:33:24 AM	0	892.28	20.933	1.26	25.08	1008.60
8/21/2021	11:01:31 AM	0	10.3491	4.965	8/21/2021	10:33:24 AM	0	891.331	27.701	1.26	25.08	1008.60
8/21/2021	12:01:31 PM	0	10.3422	4.965	8/21/2021	11:33:24 AM	0	890.143	32.009	1.27	25.07	1008.61
8/21/2021	1:01:31 PM	0	10.3361	4.965	8/21/2021	12:33:24 PM	0	889.37	30.51	1.27	25.07	1008.61
8/21/2021	2:01:31 PM	0	10.3286	4.965	8/21/2021	1:33:24 PM	0	888.313	32.836	1.27	25.07	1008.61
8/21/2021	3:01:31 PM	0	10.3216	4.965	8/21/2021	2:33:24 PM	0	887.449	35.224	1.27	25.07	1008.61
8/21/2021	4:01:31 PM	0	10.3143	4.965	8/21/2021	3:33:24 PM	0	886.899	32.408	1.27	25.07	1008.61
8/21/2021	5:01:31 PM	0	10.3069	4.965	8/21/2021	4:33:24 PM	0	886.374	28.806	1.27	25.07	1008.61
8/21/2021	6:01:31 PM	0	10.2996	4.965	8/21/2021	5:33:24 PM	0	885.526	25.21	1.27	25.07	1008.61
8/21/2021	7:01:31 PM	0	10.2918	4.966	8/21/2021	6:33:24 PM	0	885.106	21.709	1.27	25.07	1008.61
8/21/2021	8:01:31 PM	0	10.2854	4.965	8/21/2021	7:33:24 PM	0	884.772	19.143	1.26	25.07	1008.61
8/21/2021	9:01:31 PM	0	10.2825	4.965	8/21/2021	8:33:24 PM	0	885.625	17.336	1.25	25.09	1008.59
8/21/2021	10:01:31 PM	0	10.2807	4.965	8/21/2021	9:33:24 PM	0	885.988	15.15	1.25	25.09	1008.59
8/21/2021	11:01:31 PM	0	10.2811	4.965	8/21/2021	10:33:24 PM	0	886.105	12.399	1.25	25.09	1008.59
8/22/2021	12:01:31 AM	0	10.283	4.965	8/21/2021	11:33:24 PM	0	886.969	11.118	1.24	25.10	1008.58
8/22/2021	1:01:31 AM	0	10.2862	4.965	8/22/2021	12:33:24 AM	0	887.473	10.619	1.24	25.10	1008.58
8/22/2021	2:01:31 AM	0	10.29	4.965	8/22/2021	1:33:24 AM	0	888.029	10.239	1.23	25.10	1008.58
8/22/2021	3:01:31 AM	0	10.2931	4.965	8/22/2021	2:33:24 AM	0	888.33	9.354	1.23	25.10	1008.58
8/22/2021	4:01:31 AM	0	10.2948	4.965	8/22/2021	3:33:24 AM	0	888.303	8.299	1.24	25.10	1008.58
8/22/2021	5:01:31 AM	0	10.295	4.966	8/22/2021	4:33:24 AM	0	888.007	7.175	1.24	25.10	1008.58
8/22/2021	6:01:31 AM	0	10.2958	4.965	8/22/2021	5:33:24 AM	0	888.519	6.211	1.24	25.10	1008.58
8/22/2021	7:01:31 AM	0	10.2976	4.965	8/22/2021	6:33:24 AM	0	888.758	6.22	1.23	25.10	1008.58
8/22/2021	8:01:31 AM	0	10.2992	4.965	8/22/2021	7:33:24 AM	0	889.1	6.734	1.23	25.10	1008.58
8/22/2021	9:01:31 AM	0	10.3001	4.965	8/22/2021	8:33:24 AM	0	889.355	8.415	1.23	25.11	1008.57

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/22/2021	10:01:31 AM	0	10.2997	4.966	8/22/2021	9:33:24 AM	0	889.19	15.189	1.23	25.10	1008.58
8/22/2021	11:01:31 AM	0	10.2981	4.965	8/22/2021	10:33:24 AM	0	889.233	20.848	1.23	25.11	1008.57
8/22/2021	12:01:31 PM	0	10.298	4.965	8/22/2021	11:33:24 AM	0	889.289	22.479	1.23	25.11	1008.57
8/22/2021	1:01:31 PM	0	10.2977	4.965	8/22/2021	12:33:24 PM	0	889.222	23.288	1.23	25.11	1008.57
8/22/2021	2:01:31 PM	0	10.2987	4.965	8/22/2021	1:33:24 PM	0	889.548	22.338	1.23	25.11	1008.57
8/22/2021	3:01:31 PM	0	10.299	4.965	8/22/2021	2:33:24 PM	0	889.48	25.475	1.23	25.11	1008.57
8/22/2021	4:01:31 PM	0	10.2999	4.965	8/22/2021	3:33:24 PM	0	889.86	25.938	1.23	25.11	1008.57
8/22/2021	5:01:31 PM	0	10.3019	4.965	8/22/2021	4:33:24 PM	0	890.234	20.14	1.22	25.11	1008.57
8/22/2021	6:01:31 PM	0	10.3032	4.965	8/22/2021	5:33:24 PM	0	890.535	16.965	1.22	25.11	1008.57
8/22/2021	7:01:31 PM	0	10.3057	4.965	8/22/2021	6:33:24 PM	0	891.008	15.715	1.22	25.12	1008.56
8/22/2021	8:01:31 PM	0	10.3088	4.965	8/22/2021	7:33:24 PM	0	891.689	13.453	1.22	25.12	1008.56
8/22/2021	9:01:31 PM	0	10.3128	4.965	8/22/2021	8:33:24 PM	0	892.529	11.17	1.21	25.13	1008.55
8/22/2021	10:01:31 PM	0	10.3171	4.964	8/22/2021	9:33:24 PM	0	892.942	9.569	1.21	25.13	1008.55
8/22/2021	11:01:31 PM	0	10.3203	4.965	8/22/2021	10:33:24 PM	0	893.286	8.656	1.21	25.13	1008.55
8/23/2021	12:01:31 AM	0	10.3234	4.965	8/22/2021	11:33:24 PM	0	893.553	7.973	1.21	25.13	1008.55
8/23/2021	1:01:31 AM	0	10.3265	4.965	8/23/2021	12:33:24 AM	0	893.987	7.58	1.21	25.13	1008.55
8/23/2021	2:01:31 AM	0	10.3294	4.965	8/23/2021	1:33:24 AM	0	894.245	7.29	1.21	25.13	1008.55
8/23/2021	3:01:31 AM	0	10.3312	4.965	8/23/2021	2:33:24 AM	0	894.454	6.851	1.21	25.13	1008.55
8/23/2021	4:01:31 AM	0	10.3339	4.965	8/23/2021	3:33:24 AM	0	894.841	6.615	1.21	25.13	1008.55
8/23/2021	5:01:31 AM	0	10.3359	4.966	8/23/2021	4:33:24 AM	0	895.003	6.396	1.21	25.13	1008.55
8/23/2021	6:01:31 AM	0	10.3378	4.965	8/23/2021	5:33:24 AM	0	895.381	6.103	1.21	25.13	1008.55
8/23/2021	7:01:31 AM	0	10.34	4.965	8/23/2021	6:33:24 AM	0	895.621	5.52	1.21	25.13	1008.55
8/23/2021	8:01:31 AM	0	10.3425	4.966	8/23/2021	7:33:24 AM	0	896.101	5.192	1.20	25.13	1008.55
8/23/2021	9:01:31 AM	0	10.3454	4.965	8/23/2021	8:33:24 AM	0	896.659	5.366	1.20	25.14	1008.54
8/23/2021	10:01:31 AM	0	10.3484	4.965	8/23/2021	9:33:24 AM	0	897.174	6.264	1.20	25.14	1008.54
8/23/2021	11:01:31 AM	0	10.3511	4.965	8/23/2021	10:33:24 AM	0	897.615	8.619	1.20	25.14	1008.54
8/23/2021	12:01:31 PM	0	10.354	4.965	8/23/2021	11:33:24 AM	0	898.178	11.131	1.20	25.14	1008.54
8/23/2021	1:01:31 PM	0	10.357	4.965	8/23/2021	12:33:24 PM	0	898.528	13.435	1.19	25.14	1008.54
8/23/2021	2:01:31 PM	0	10.3593	4.965	8/23/2021	1:33:24 PM	0	898.803	14.894	1.19	25.14	1008.54
8/23/2021	3:01:31 PM	0	10.3614	4.965	8/23/2021	2:33:24 PM	0	898.914	18.041	1.19	25.14	1008.54
8/23/2021	4:01:31 PM	0	10.3637	4.965	8/23/2021	3:33:24 PM	0	899.089	20.163	1.20	25.14	1008.54
8/23/2021	5:01:31 PM	0	10.3655	4.965	8/23/2021	4:33:24 PM	0	899.487	16.69	1.19	25.14	1008.54
8/23/2021	6:01:31 PM	0	10.3682	4.965	8/23/2021	5:33:24 PM	0	899.814	16.26	1.19	25.14	1008.54
8/23/2021	7:01:31 PM	0	10.3699	4.965	8/23/2021	6:33:24 PM	0	899.895	15.134	1.19	25.14	1008.54
8/23/2021	8:01:31 PM	0	10.3712	4.965	8/23/2021	7:33:24 PM	0	900.283	13.168	1.19	25.15	1008.53
8/23/2021	9:01:31 PM	0	10.3737	4.965	8/23/2021	8:33:24 PM	0	900.67	12.117	1.19	25.15	1008.53
8/23/2021	10:01:31 PM	0	10.3759	4.965	8/23/2021	9:33:24 PM	0	900.925	10.932	1.19	25.15	1008.53
8/23/2021	11:01:31 PM	0	10.3769	4.965	8/23/2021	10:33:24 PM	0	901.011	9.957	1.19	25.15	1008.53
8/24/2021	12:01:31 AM	0	10.3779	4.965	8/23/2021	11:33:24 PM	0	901.092	8.329	1.19	25.15	1008.53
8/24/2021	1:01:31 AM	0	10.3786	4.965	8/24/2021	12:33:24 AM	0	901.172	6.574	1.19	25.15	1008.53
8/24/2021	2:01:31 AM	0	10.3792	4.965	8/24/2021	1:33:24 AM	0	901.257	5.363	1.19	25.15	1008.53
8/24/2021	3:01:31 AM	0	10.3798	4.965	8/24/2021	2:33:24 AM	0	901.421	4.582	1.19	25.15	1008.53
8/24/2021	4:01:31 AM	0	10.3804	4.965	8/24/2021	3:33:24 AM	0	901.569	4.401	1.19	25.15	1008.53
8/24/2021	5:01:31 AM	0	10.3816	4.966	8/24/2021	4:33:24 AM	0	901.859	3.928	1.19	25.15	1008.53
8/24/2021	6:01:31 AM	0	10.3823	4.965	8/24/2021	5:33:24 AM	0	901.89	3.405	1.19	25.15	1008.53
8/24/2021	7:01:31 AM	0	10.3834	4.965	8/24/2021	6:33:24 AM	0	902.133	4.053	1.18	25.15	1008.53
8/24/2021	8:01:31 AM	0	10.3839	4.965	8/24/2021	7:33:24 AM	0	902.346	4.998	1.18	25.15	1008.53
8/24/2021	9:01:31 AM	0	10.3837	4.965	8/24/2021	8:33:24 AM	0	902.545	7.82	1.18	25.16	1008.52
8/24/2021	10:01:31 AM	0	10.3822	4.965	8/24/2021	9:33:24 AM	0	902.211	17.851	1.18	25.16	1008.52
8/24/2021	11:01:31 AM	0	10.3788	4.965	8/24/2021	10:33:24 AM	0	901.778	24.184	1.18	25.15	1008.53
8/24/2021	12:01:31 PM	0	10.3759	4.965	8/24/2021	11:33:24 AM	0	901.122	28.304	1.19	25.15	1008.53
8/24/2021	1:01:31 PM	0	10.373	4.965	8/24/2021	12:33:24 PM	0	900.676	29.266	1.19	25.15	1008.53
8/24/2021	2:01:31 PM	0	10.369	4.965	8/24/2021	1:33:24 PM	0	900.113	30.203	1.19	25.15	1008.53
8/24/2021	3:01:31 PM	0	10.3653	4.965	8/24/2021	2:33:24 PM	0	899.493	32.039	1.19	25.14	1008.54
8/24/2021	4:01:31 PM	0	10.3605	4.965	8/24/2021	3:33:24 PM	0	898.883	32.778	1.19	25.14	1008.54
8/24/2021	5:01:31 PM	0	10.3563	4.965	8/24/2021	4:33:24 PM	0	899.211	25.302	1.19	25.15	1008.53
8/24/2021	6:01:31 PM	0	10.3533	4.965	8/24/2021	5:33:24 PM	0	899.108	20.564	1.18	25.15	1008.53
8/24/2021	7:01:31 PM	0	10.3505	4.966	8/24/2021	6:33:24 PM	0	899.139	18.047	1.18	25.16	1008.52
8/24/2021	8:01:31 PM	0	10.3483	4.964	8/24/2021	7:33:24 PM	0	899.052	15.752	1.18	25.16	1008.52
8/24/2021	9:01:31 PM	0	10.3468	4.965	8/24/2021	8:33:24 PM	0	899.335	13.195	1.18	25.16	1008.52
8/24/2021	10:01:31 PM	0	10.3469	4.965	8/24/2021	9:33:24 PM	0	899.524	10.595	1.17	25.16	1008.52
8/24/2021	11:01:31 PM	0	10.3463	4.966	8/24/2021	10:33:24 PM	0	899.496	8.818	1.17	25.16	1008.52
8/25/2021	12:01:31 AM	0	10.3453	4.966	8/24/2021	11:33:24 PM	0	899.413	8.275	1.17	25.16	1008.52
8/25/2021	1:01:31 AM	0	10.3445	4.965	8/25/2021	12:33:24 AM	0	899.283	7.252	1.17	25.16	1008.52
8/25/2021	2:01:31 AM	0	10.3437	4.965	8/25/2021	1:33:24 AM	0	899.307	6.408	1.17	25.16	1008.52
8/25/2021	3:01:31 AM	0	10.3424	4.965	8/25/2021	2:33:24 AM	0	899.175	5.728	1.17	25.16	1008.52
8/25/2021	4:01:31 AM	0	10.3412	4.966	8/25/2021	3:33:24 AM	0	899.073	5.194	1.17	25.16	1008.52
8/25/2021	5:01:31 AM	0	10.34	4.965	8/25/2021	4:33:24 AM	0	899.035	4.852	1.17	25.16	1008.52
8/25/2021	6:01:31 AM	0	10.3389	4.966	8/25/2021	5:33:24 AM	0	898.92	4.557	1.17	25.16	1008.52
8/25/2021	7:01:31 AM	0	10.3372	4.965	8/25/2021	6:33:24 AM	0	898.746	4.434	1.17	25.16	1008.52

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/25/2021	8:01:31 AM	0	10.3358	4.965	8/25/2021	7:33:24 AM	0	898.879	4.875	1.17	25.17	1008.51
8/25/2021	9:01:31 AM	0	10.3344	4.965	8/25/2021	8:33:24 AM	0	899.052	8.23	1.17	25.17	1008.51
8/25/2021	10:01:31 AM	0	10.3314	4.965	8/25/2021	9:33:24 AM	0	898.487	19.707	1.17	25.17	1008.51
8/25/2021	11:01:31 AM	0	10.3273	4.965	8/25/2021	10:33:24 AM	0	897.833	26.308	1.17	25.17	1008.51
8/25/2021	12:01:31 PM	0	10.3231	4.965	8/25/2021	11:33:24 AM	0	897.115	29.793	1.18	25.16	1008.52
8/25/2021	1:01:31 PM	0	10.3192	4.965	8/25/2021	12:33:24 PM	0	896.497	30.613	1.18	25.16	1008.52
8/25/2021	2:01:31 PM	0	10.314	4.966	8/25/2021	1:33:24 PM	0	895.627	32.251	1.18	25.16	1008.52
8/25/2021	3:01:31 PM	0	10.3086	4.965	8/25/2021	2:33:24 PM	0	895.113	33.409	1.18	25.16	1008.52
8/25/2021	4:01:31 PM	0	10.3047	4.965	8/25/2021	3:33:24 PM	0	894.842	31.924	1.18	25.16	1008.52
8/25/2021	5:01:31 PM	0	10.2998	4.965	8/25/2021	4:33:24 PM	0	894.661	27.264	1.18	25.16	1008.52
8/25/2021	6:01:31 PM	0	10.2961	4.965	8/25/2021	5:33:24 PM	0	894.584	23.895	1.17	25.16	1008.52
8/25/2021	7:01:31 PM	0	10.293	4.966	8/25/2021	6:33:24 PM	0	894.567	21.583	1.17	25.17	1008.51
8/25/2021	8:01:31 PM	0	10.2907	4.965	8/25/2021	7:33:24 PM	0	894.809	18.76	1.17	25.17	1008.51
8/25/2021	9:01:31 PM	0	10.29	4.965	8/25/2021	8:33:24 PM	0	895.031	17.025	1.16	25.17	1008.51
8/25/2021	10:01:31 PM	0	10.2891	4.965	8/25/2021	9:33:24 PM	0	895.151	16.911	1.16	25.18	1008.50
8/25/2021	11:01:31 PM	0	10.2897	4.965	8/25/2021	10:33:24 PM	0	895.543	15.237	1.16	25.18	1008.50
8/26/2021	12:01:31 AM	0	10.2904	4.966	8/25/2021	11:33:24 PM	0	895.787	12.126	1.16	25.18	1008.50
8/26/2021	1:01:31 AM	0	10.2918	4.965	8/26/2021	12:33:24 AM	0	896.015	10.268	1.15	25.18	1008.50
8/26/2021	2:01:31 AM	0	10.2926	4.966	8/26/2021	1:33:24 AM	0	896.272	10.071	1.15	25.18	1008.50
8/26/2021	3:01:31 AM	0	10.2937	4.965	8/26/2021	2:33:24 AM	0	896.432	10.314	1.15	25.18	1008.50
8/26/2021	4:01:31 AM	0	10.2942	4.966	8/26/2021	3:33:24 AM	0	896.41	10.525	1.15	25.18	1008.50
8/26/2021	5:01:31 AM	0	10.2938	4.965	8/26/2021	4:33:24 AM	0	896.368	10.772	1.15	25.18	1008.50
8/26/2021	6:01:31 AM	0	10.2929	4.965	8/26/2021	5:33:24 AM	0	896.292	10.726	1.15	25.18	1008.50
8/26/2021	7:01:31 AM	0	10.2927	4.966	8/26/2021	6:33:24 AM	0	896.338	10.488	1.15	25.18	1008.50
8/26/2021	8:01:31 AM	0	10.2922	4.966	8/26/2021	7:33:24 AM	0	896.484	10.637	1.15	25.19	1008.49
8/26/2021	9:01:31 AM	0	10.2919	4.966	8/26/2021	8:33:24 AM	0	896.535	11.907	1.15	25.19	1008.49
8/26/2021	10:01:31 AM	0	10.2913	4.965	8/26/2021	9:33:24 AM	0	896.304	14.94	1.15	25.19	1008.49
8/26/2021	11:01:31 AM	0	10.2907	4.966	8/26/2021	10:33:24 AM	0	896.351	17.804	1.15	25.19	1008.49
8/26/2021	12:01:31 PM	0	10.2898	4.965	8/26/2021	11:33:24 AM	0	896.297	20.393	1.15	25.19	1008.49
8/26/2021	1:01:31 PM	0	10.2888	4.965	8/26/2021	12:33:24 PM	0	896.148	19.947	1.15	25.19	1008.49
8/26/2021	2:01:31 PM	0	10.2875	4.965	8/26/2021	1:33:24 PM	0	896.049	20.512	1.15	25.19	1008.49
8/26/2021	3:01:31 PM	0	10.2858	4.966	8/26/2021	2:33:24 PM	0	895.78	21.607	1.15	25.19	1008.49
8/26/2021	4:01:31 PM	0	10.2838	4.965	8/26/2021	3:33:24 PM	0	895.608	22.69	1.15	25.19	1008.49
8/26/2021	5:01:31 PM	0	10.2826	4.965	8/26/2021	4:33:24 PM	0	895.766	20.241	1.15	25.19	1008.49
8/26/2021	6:01:31 PM	0	10.282	4.966	8/26/2021	5:33:24 PM	0	896.001	15.681	1.15	25.19	1008.49
8/26/2021	7:01:31 PM	0	10.2805	4.965	8/26/2021	6:33:24 PM	0	895.812	14.459	1.15	25.19	1008.49
8/26/2021	8:01:31 PM	0	10.281	4.965	8/26/2021	7:33:24 PM	0	896.561	13.7	1.14	25.20	1008.48
8/26/2021	9:01:31 PM	0	10.2838	4.966	8/26/2021	8:33:24 PM	0	897.098	11.824	1.14	25.20	1008.48
8/26/2021	10:01:31 PM	0	10.2855	4.966	8/26/2021	9:33:24 PM	0	897.075	9.739	1.14	25.20	1008.48
8/26/2021	11:01:31 PM	0	10.2863	4.965	8/26/2021	10:33:24 PM	0	897.167	8.963	1.14	25.20	1008.48
8/27/2021	12:01:31 AM	0	10.2868	4.966	8/26/2021	11:33:24 PM	0	897.318	8.325	1.14	25.20	1008.48
8/27/2021	1:01:31 AM	0	10.2881	4.965	8/27/2021	12:33:24 AM	0	897.708	8.349	1.13	25.20	1008.48
8/27/2021	2:01:31 AM	0	10.2888	4.966	8/27/2021	1:33:24 AM	0	897.701	7.534	1.13	25.20	1008.48
8/27/2021	3:01:31 AM	0	10.289	4.965	8/27/2021	2:33:24 AM	0	897.76	7.448	1.13	25.20	1008.48
8/27/2021	4:01:31 AM	0	10.2893	4.965	8/27/2021	3:33:24 AM	0	897.848	7.583	1.13	25.20	1008.48
8/27/2021	5:01:31 AM	0	10.2897	4.965	8/27/2021	4:33:24 AM	0	898.052	7.474	1.13	25.21	1008.47
8/27/2021	6:01:31 AM	0	10.2908	4.966	8/27/2021	5:33:24 AM	0	898.341	7.927	1.13	25.21	1008.47
8/27/2021	7:01:31 AM	0	10.2918	4.965	8/27/2021	6:33:24 AM	0	898.504	7.906	1.13	25.21	1008.47
8/27/2021	8:01:31 AM	0	10.2939	4.966	8/27/2021	7:33:24 AM	0	899.04	8.223	1.13	25.21	1008.47
8/27/2021	9:01:31 AM	0	10.2964	4.965	8/27/2021	8:33:24 AM	0	899.524	9.276	1.12	25.21	1008.47
8/27/2021	10:01:31 AM	0	10.2985	4.965	8/27/2021	9:33:24 AM	0	899.667	12.022	1.12	25.21	1008.47
8/27/2021	11:01:31 AM	0	10.299	4.965	8/27/2021	10:33:24 AM	0	899.788	18.992	1.12	25.21	1008.47
8/27/2021	12:01:31 PM	0	10.3006	4.966	8/27/2021	11:33:24 AM	0	900.029	16.907	1.12	25.21	1008.47
8/27/2021	1:01:31 PM	0	10.3013	4.966	8/27/2021	12:33:24 PM	0	900.009	19.008	1.12	25.21	1008.47
8/27/2021	2:01:31 PM	0	10.3015	4.965	8/27/2021	1:33:24 PM	0	899.967	20.508	1.12	25.21	1008.47
8/27/2021	3:01:31 PM	0	10.3005	4.966	8/27/2021	2:33:24 PM	0	899.851	21.334	1.12	25.21	1008.47
8/27/2021	4:01:31 PM	0	10.3014	4.966	8/27/2021	3:33:24 PM	0	900.22	23.614	1.12	25.22	1008.46
8/27/2021	5:01:31 PM	0	10.3019	4.965	8/27/2021	4:33:24 PM	0	900.265	17.479	1.12	25.22	1008.46
8/27/2021	6:01:31 PM	0	10.302	4.966	8/27/2021	5:33:24 PM	0	900.449	15.984	1.12	25.22	1008.46
8/27/2021	7:01:31 PM	0	10.3021	4.966	8/27/2021	6:33:24 PM	0	900.398	13.542	1.12	25.22	1008.46
8/27/2021	8:01:31 PM	0	10.3024	4.965	8/27/2021	7:33:24 PM	0	900.818	11.604	1.12	25.22	1008.46
8/27/2021	9:01:31 PM	0	10.3039	4.965	8/27/2021	8:33:24 PM	0	901.14	10.385	1.11	25.22	1008.46
8/27/2021	10:01:31 PM	0	10.3057	4.966	8/27/2021	9:33:24 PM	0	901.45	8.854	1.11	25.22	1008.46
8/27/2021	11:01:31 PM	0	10.3076	4.966	8/27/2021	10:33:24 PM	0	901.683	7.775	1.11	25.22	1008.46
8/28/2021	12:01:31 AM	0	10.3083	4.965	8/27/2021	11:33:24 PM	0	901.7	7.298	1.11	25.22	1008.46
8/28/2021	1:01:31 AM	0	10.3087	4.965	8/28/2021	12:33:24 AM	0	901.729	7.513	1.11	25.22	1008.46
8/28/2021	2:01:31 AM	0	10.3088	4.966	8/28/2021	1:33:24 AM	0	901.854	7.566	1.11	25.22	1008.46
8/28/2021	3:01:31 AM	0	10.3084	4.966	8/28/2021	2:33:24 AM	0	901.764	8.592	1.11	25.22	1008.46
8/28/2021	4:01:31 AM	0	10.3074	4.965	8/28/2021	3:33:24 AM	0	901.74	8.647	1.11	25.23	1008.45
8/28/2021	5:01:31 AM	0	10.3061	4.966	8/28/2021	4:33:24 AM	0	901.553	8.589	1.11	25.22	1008.46

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/28/2021	6:01:31 AM	0	10.3044	4.965	8/28/2021	5:33:24 AM	0	901.445	8.658	1.11	25.22	1008.46
8/28/2021	7:01:31 AM	0	10.3027	4.965	8/28/2021	6:33:24 AM	0	901.416	8.64	1.11	25.23	1008.45
8/28/2021	8:01:31 AM	0	10.3009	4.966	8/28/2021	7:33:24 AM	0	901.377	8.982	1.11	25.23	1008.45
8/28/2021	9:01:31 AM	0	10.2998	4.965	8/28/2021	8:33:24 AM	0	901.235	10.075	1.11	25.23	1008.45
8/28/2021	10:01:31 AM	0	10.2978	4.965	8/28/2021	9:33:24 AM	0	900.965	12.483	1.11	25.23	1008.45
8/28/2021	11:01:31 AM	0	10.296	4.965	8/28/2021	10:33:24 AM	0	900.941	14.641	1.11	25.23	1008.45
8/28/2021	12:01:31 PM	0	10.2949	4.965	8/28/2021	11:33:24 AM	0	901.05	16.336	1.11	25.23	1008.45
8/28/2021	1:01:31 PM	0	10.2924	4.965	8/28/2021	12:33:24 PM	0	900.606	18.928	1.11	25.23	1008.45
8/28/2021	2:01:31 PM	0	10.2915	4.965	8/28/2021	1:33:24 PM	0	900.623	19.772	1.11	25.23	1008.45
8/28/2021	3:01:31 PM	0	10.2891	4.965	8/28/2021	2:33:24 PM	0	900.18	17.41	1.11	25.23	1008.45
8/28/2021	4:01:31 PM	0	10.2868	4.966	8/28/2021	3:33:24 PM	0	900.139	17.157	1.11	25.23	1008.45
8/28/2021	5:01:31 PM	0	10.2836	4.965	8/28/2021	4:33:24 PM	0	899.651	18.448	1.11	25.23	1008.45
8/28/2021	6:01:31 PM	0	10.2795	4.965	8/28/2021	5:33:24 PM	0	899.215	18.712	1.11	25.23	1008.45
8/28/2021	7:01:31 PM	0	10.2753	4.965	8/28/2021	6:33:24 PM	0	898.821	17.122	1.11	25.23	1008.45
8/28/2021	8:01:31 PM	0	10.2712	4.966	8/28/2021	7:33:24 PM	0	898.262	16.052	1.11	25.23	1008.45
8/28/2021	9:01:31 PM	0	10.2684	4.966	8/28/2021	8:33:24 PM	0	898.538	14.627	1.11	25.23	1008.45
8/28/2021	10:01:31 PM	0	10.2666	4.966	8/28/2021	9:33:24 PM	0	898.504	13.124	1.10	25.23	1008.45
8/28/2021	11:01:31 PM	0	10.2649	4.966	8/28/2021	10:33:24 PM	0	898.435	12.385	1.10	25.23	1008.45
8/29/2021	12:01:31 AM	0	10.2635	4.966	8/28/2021	11:33:24 PM	0	898.524	11.288	1.10	25.24	1008.44
8/29/2021	1:01:31 AM	0	10.2628	4.966	8/29/2021	12:33:24 AM	0	898.537	10.478	1.10	25.24	1008.44
8/29/2021	2:01:31 AM	0	10.2616	4.965	8/29/2021	1:33:24 AM	0	898.417	9.278	1.10	25.24	1008.44
8/29/2021	3:01:31 AM	0	10.2605	4.966	8/29/2021	2:33:24 AM	0	898.408	8.325	1.10	25.24	1008.44
8/29/2021	4:01:31 AM	0	10.259	4.966	8/29/2021	3:33:24 AM	0	898.294	8.142	1.10	25.24	1008.44
8/29/2021	5:01:31 AM	0	10.2577	4.965	8/29/2021	4:33:24 AM	0	898.309	7.741	1.10	25.24	1008.44
8/29/2021	6:01:31 AM	0	10.2567	4.965	8/29/2021	5:33:24 AM	0	898.185	7.287	1.10	25.24	1008.44
8/29/2021	7:01:31 AM	0	10.2553	4.965	8/29/2021	6:33:24 AM	0	898.051	6.798	1.10	25.24	1008.44
8/29/2021	8:01:31 AM	0	10.2541	4.966	8/29/2021	7:33:24 AM	0	898.136	7.558	1.10	25.24	1008.44
8/29/2021	9:01:31 AM	0	10.2522	4.966	8/29/2021	8:33:24 AM	0	898.084	10.486	1.09	25.24	1008.44
8/29/2021	10:01:31 AM	0	10.2484	4.965	8/29/2021	9:33:24 AM	0	897.415	19.137	1.10	25.24	1008.44
8/29/2021	11:01:31 AM	0	10.2433	4.965	8/29/2021	10:33:24 AM	0	896.679	26.359	1.10	25.24	1008.44
8/29/2021	12:01:31 PM	0	10.24	4.965	8/29/2021	11:33:24 AM	0	896.091	30.294	1.10	25.23	1008.45
8/29/2021	1:01:31 PM	0	10.2365	4.965	8/29/2021	12:33:24 PM	0	895.835	28.856	1.10	25.24	1008.44
8/29/2021	2:01:31 PM	0	10.2337	4.966	8/29/2021	1:33:24 PM	0	895.514	25.923	1.10	25.24	1008.44
8/29/2021	3:01:31 PM	0	10.2301	4.966	8/29/2021	2:33:24 PM	0	895.171	27.542	1.10	25.24	1008.44
8/29/2021	4:01:31 PM	0	10.2265	4.966	8/29/2021	3:33:24 PM	0	894.746	28.214	1.10	25.23	1008.45
8/29/2021	5:01:31 PM	0	10.2231	4.966	8/29/2021	4:33:24 PM	0	894.713	24.69	1.10	25.24	1008.44
8/29/2021	6:01:31 PM	0	10.2194	4.966	8/29/2021	5:33:24 PM	0	894.412	22.21	1.10	25.24	1008.44
8/29/2021	7:01:31 PM	0	10.2157	4.965	8/29/2021	6:33:24 PM	0	894.317	19.38	1.10	25.24	1008.44
8/29/2021	8:01:31 PM	0	10.2126	4.966	8/29/2021	7:33:24 PM	0	894.182	16.295	1.09	25.24	1008.44
8/29/2021	9:01:31 PM	0	10.2107	4.966	8/29/2021	8:33:24 PM	0	894.396	13.069	1.09	25.25	1008.43
8/29/2021	10:01:31 PM	0	10.2085	4.965	8/29/2021	9:33:24 PM	0	894.279	10.587	1.09	25.25	1008.43
8/29/2021	11:01:31 PM	0	10.2068	4.966	8/29/2021	10:33:24 PM	0	894.136	8.954	1.09	25.25	1008.43
8/30/2021	12:01:31 AM	0	10.2041	4.966	8/29/2021	11:33:24 PM	0	893.683	8.174	1.09	25.25	1008.43
8/30/2021	1:01:31 AM	0	10.2011	4.966	8/30/2021	12:33:24 AM	0	893.631	7.806	1.09	25.25	1008.43
8/30/2021	2:01:31 AM	0	10.1982	4.966	8/30/2021	1:33:24 AM	0	893.104	7.374	1.09	25.25	1008.43
8/30/2021	3:01:31 AM	0	10.1944	4.966	8/30/2021	2:33:24 AM	0	892.614	7.344	1.09	25.24	1008.44
8/30/2021	4:01:31 AM	0	10.1912	4.965	8/30/2021	3:33:24 AM	0	892.606	7.238	1.09	25.25	1008.43
8/30/2021	5:01:31 AM	0	10.188	4.966	8/30/2021	4:33:24 AM	0	892.363	6.851	1.09	25.25	1008.43
8/30/2021	6:01:31 AM	0	10.1853	4.966	8/30/2021	5:33:24 AM	0	892.218	6.546	1.09	25.25	1008.43
8/30/2021	7:01:31 AM	0	10.1836	4.966	8/30/2021	6:33:24 AM	0	892.308	6.35	1.08	25.25	1008.43
8/30/2021	8:01:31 AM	0	10.1824	4.966	8/30/2021	7:33:24 AM	0	892.368	6.904	1.08	25.25	1008.43
8/30/2021	9:01:31 AM	0	10.1816	4.966	8/30/2021	8:33:24 AM	0	892.489	8.374	1.08	25.26	1008.42
8/30/2021	10:01:31 AM	0	10.1804	4.965	8/30/2021	9:33:24 AM	0	892.485	12.94	1.08	25.26	1008.42
8/30/2021	11:01:31 AM	0	10.1779	4.965	8/30/2021	10:33:24 AM	0	892.067	17.716	1.08	25.26	1008.42
8/30/2021	12:01:31 PM	0	10.1761	4.966	8/30/2021	11:33:24 AM	0	892.022	20.007	1.08	25.26	1008.42
8/30/2021	1:01:31 PM	0	10.1746	4.965	8/30/2021	12:33:24 PM	0	891.798	19.287	1.08	25.26	1008.42
8/30/2021	2:01:31 PM	0	10.1725	4.966	8/30/2021	1:33:24 PM	0	891.698	19.666	1.08	25.26	1008.42
8/30/2021	3:01:31 PM	0	10.171	4.966	8/30/2021	2:33:24 PM	0	891.577	20.688	1.08	25.26	1008.42
8/30/2021	4:01:31 PM	0	10.1687	4.966	8/30/2021	3:33:24 PM	0	891.186	20.199	1.08	25.26	1008.42
8/30/2021	5:01:31 PM	0	10.1645	4.966	8/30/2021	4:33:24 PM	0	890.495	18.957	1.08	25.25	1008.43
8/30/2021	6:01:31 PM	0	10.1603	4.966	8/30/2021	5:33:24 PM	0	890.218	16.516	1.08	25.25	1008.43
8/30/2021	7:01:31 PM	0	10.1574	4.966	8/30/2021	6:33:24 PM	0	890.178	15.59	1.08	25.26	1008.42
8/30/2021	8:01:31 PM	0	10.1548	4.966	8/30/2021	7:33:24 PM	0	890.311	14.197	1.08	25.26	1008.42
8/30/2021	9:01:31 PM	0	10.1548	4.965	8/30/2021	8:33:24 PM	0	890.656	12.409	1.07	25.26	1008.42
8/30/2021	10:01:31 PM	0	10.1553	4.965	8/30/2021	9:33:24 PM	0	891.013	9.858	1.07	25.27	1008.41
8/30/2021	11:01:31 PM	0	10.1559	4.966	8/30/2021	10:33:24 PM	0	890.993	8.097	1.07	25.27	1008.41
8/31/2021	12:01:31 AM	0	10.1554	4.966	8/30/2021	11:33:24 PM	0	890.754	7.428	1.07	25.26	1008.42
8/31/2021	1:01:31 AM	0	10.1538	4.965	8/31/2021	12:33:24 AM	0	890.181	7.167	1.08	25.26	1008.42
8/31/2021	2:01:31 AM	0	10.1524	4.965	8/31/2021	1:33:24 AM	0	890.409	6.818	1.07	25.26	1008.42
8/31/2021	3:01:31 AM	0	10.1503	4.966	8/31/2021	2:33:24 AM	0	890.2	6.377	1.07	25.26	1008.42

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
8/31/2021	4:01:31 AM	0	10.1485	4.966	8/31/2021	3:33:24 AM	0	890.239	5.961	1.07	25.27	1008.41
8/31/2021	5:01:31 AM	0	10.1479	4.966	8/31/2021	4:33:24 AM	0	890.229	5.671	1.07	25.27	1008.41
8/31/2021	6:01:31 AM	0	10.1471	4.966	8/31/2021	5:33:24 AM	0	890.369	5.549	1.07	25.27	1008.41
8/31/2021	7:01:31 AM	0	10.1468	4.966	8/31/2021	6:33:24 AM	0	890.491	5.474	1.07	25.27	1008.41
8/31/2021	8:01:31 AM	0	10.148	4.966	8/31/2021	7:33:24 AM	0	890.955	5.588	1.06	25.27	1008.41
8/31/2021	9:01:31 AM	0	10.1489	4.965	8/31/2021	8:33:24 AM	0	891.014	5.757	1.06	25.27	1008.41
8/31/2021	10:01:31 AM	0	10.1508	4.966	8/31/2021	9:33:24 AM	0	891.65	6.046	1.06	25.28	1008.40
8/31/2021	11:01:31 AM	0	10.1538	4.966	8/31/2021	10:33:24 AM	0	892.144	6.466	1.06	25.28	1008.40
8/31/2021	12:01:31 PM	0	10.1566	4.966	8/31/2021	11:33:24 AM	0	892.636	7.517	1.05	25.28	1008.40
8/31/2021	1:01:31 PM	0	10.1596	4.966	8/31/2021	12:33:24 PM	0	893.219	8.285	1.05	25.29	1008.39
8/31/2021	2:01:31 PM	0	10.1633	4.966	8/31/2021	1:33:24 PM	0	893.716	8.307	1.05	25.29	1008.39
8/31/2021	3:01:31 PM	0	10.1671	4.966	8/31/2021	2:33:24 PM	0	894.231	9.438	1.05	25.29	1008.39
8/31/2021	4:01:31 PM	0	10.1707	4.966	8/31/2021	3:33:24 PM	0	894.549	9.813	1.05	25.29	1008.39
8/31/2021	5:01:31 PM	0	10.1736	4.967	8/31/2021	4:33:24 PM	0	894.928	10.953	1.05	25.29	1008.39
8/31/2021	6:01:31 PM	0	10.1765	4.965	8/31/2021	5:33:24 PM	0	895.388	10.827	1.05	25.29	1008.39
8/31/2021	7:01:31 PM	0	10.1797	4.966	8/31/2021	6:33:24 PM	0	895.717	9.981	1.05	25.29	1008.39
8/31/2021	8:01:31 PM	0	10.1819	4.966	8/31/2021	7:33:24 PM	0	895.784	9.68	1.05	25.29	1008.39
8/31/2021	9:01:31 PM	0	10.1844	4.966	8/31/2021	8:33:24 PM	0	896.178	8.824	1.05	25.29	1008.39
8/31/2021	10:01:31 PM	0	10.1865	4.966	8/31/2021	9:33:24 PM	0	896.363	8.31	1.05	25.29	1008.39
8/31/2021	11:01:31 PM	0	10.188	4.966	8/31/2021	10:33:24 PM	0	896.476	7.839	1.05	25.29	1008.39
9/1/2021	12:01:31 AM	0	10.1887	4.966	8/31/2021	11:33:24 PM	0	896.584	7.286	1.05	25.29	1008.39
9/1/2021	1:01:31 AM	0	10.1892	4.966	9/1/2021	12:33:24 AM	0	896.512	6.625	1.05	25.29	1008.39
9/1/2021	2:01:31 AM	0	10.19	4.966	9/1/2021	1:33:24 AM	0	896.654	6.059	1.05	25.29	1008.39
9/1/2021	3:01:31 AM	0	10.1908	4.966	9/1/2021	2:33:24 AM	0	896.817	5.253	1.05	25.29	1008.39
9/1/2021	4:01:31 AM	0	10.1914	4.966	9/1/2021	3:33:24 AM	0	897.017	4.261	1.04	25.29	1008.39
9/1/2021	5:01:31 AM	0	10.1937	4.966	9/1/2021	4:33:24 AM	0	897.573	3.628	1.04	25.30	1008.38
9/1/2021	6:01:31 AM	0	10.1964	4.966	9/1/2021	5:33:24 AM	0	898.018	3.707	1.04	25.30	1008.38
9/1/2021	7:01:31 AM	0	10.199	4.965	9/1/2021	6:33:24 AM	0	898.308	3.374	1.04	25.30	1008.38
9/1/2021	8:01:31 AM	0	10.201	4.965	9/1/2021	7:33:24 AM	0	898.689	3.877	1.04	25.30	1008.38
9/1/2021	9:01:31 AM	0	10.203	4.966	9/1/2021	8:33:24 AM	0	899.114	4.953	1.03	25.30	1008.38
9/1/2021	10:01:31 AM	0	10.2043	4.966	9/1/2021	9:33:24 AM	0	899.43	13.409	1.03	25.30	1008.38
9/1/2021	11:01:31 AM	0	10.2043	4.966	9/1/2021	10:33:24 AM	0	899.48	18.864	1.03	25.31	1008.37
9/1/2021	12:01:31 PM	0	10.2044	4.966	9/1/2021	11:33:24 AM	0	899.186	23.417	1.04	25.30	1008.38
9/1/2021	1:01:31 PM	0	10.2048	4.966	9/1/2021	12:33:24 PM	0	899.116	23.38	1.04	25.30	1008.38
9/1/2021	2:01:31 PM	0	10.204	4.966	9/1/2021	1:33:24 PM	0	898.906	25.427	1.04	25.30	1008.38
9/1/2021	3:01:31 PM	0	10.2044	4.966	9/1/2021	2:33:24 PM	0	899.301	24.879	1.03	25.30	1008.38
9/1/2021	4:01:31 PM	0	10.2061	4.966	9/1/2021	3:33:24 PM	0	899.791	22.196	1.03	25.31	1008.37
9/1/2021	5:01:31 PM	0	10.2076	4.966	9/1/2021	4:33:24 PM	0	899.92	18.398	1.03	25.31	1008.37
9/1/2021	6:01:31 PM	0	10.2078	4.966	9/1/2021	5:33:24 PM	0	900.086	16.083	1.03	25.31	1008.37
9/1/2021	7:01:31 PM	0	10.2081	4.966	9/1/2021	6:33:24 PM	0	900.197	13.543	1.03	25.31	1008.37
9/1/2021	8:01:31 PM	0	10.2088	4.966	9/1/2021	7:33:24 PM	0	900.422	12.594	1.03	25.31	1008.37
9/1/2021	9:01:31 PM	0	10.2101	4.966	9/1/2021	8:33:24 PM	0	900.822	10.408	1.02	25.31	1008.37
9/1/2021	10:01:31 PM	0	10.212	4.966	9/1/2021	9:33:24 PM	0	901.087	7.868	1.02	25.31	1008.37
9/1/2021	11:01:31 PM	0	10.213	4.966	9/1/2021	10:33:24 PM	0	901.037	6.47	1.02	25.31	1008.37
9/2/2021	12:01:31 AM	0	10.2131	4.966	9/1/2021	11:33:24 PM	0	900.915	5.631	1.03	25.31	1008.37
9/2/2021	1:01:31 AM	0	10.2139	4.966	9/2/2021	12:33:24 AM	0	901.311	4.938	1.02	25.31	1008.37
9/2/2021	2:01:31 AM	0	10.2155	4.966	9/2/2021	1:33:24 AM	0	901.637	4.15	1.02	25.32	1008.36
9/2/2021	3:01:31 AM	0	10.2171	4.965	9/2/2021	2:33:24 AM	0	901.749	3.485	1.02	25.32	1008.36
9/2/2021	4:01:31 AM	0	10.2185	4.966	9/2/2021	3:33:24 AM	0	902.042	2.999	1.02	25.32	1008.36
9/2/2021	5:01:31 AM	0	10.22	4.966	9/2/2021	4:33:24 AM	0	902.166	2.675	1.02	25.32	1008.36
9/2/2021	6:01:31 AM	0	10.2209	4.966	9/2/2021	5:33:24 AM	0	902.337	2.45	1.02	25.32	1008.36
9/2/2021	7:01:31 AM	0	10.2218	4.966	9/2/2021	6:33:24 AM	0	902.479	2.132	1.02	25.32	1008.36
9/2/2021	8:01:31 AM	0	10.2232	4.966	9/2/2021	7:33:24 AM	0	902.806	2.345	1.02	25.32	1008.36
9/2/2021	9:01:31 AM	0	10.2239	4.966	9/2/2021	8:33:24 AM	0	903.208	6.672	1.01	25.32	1008.36
9/2/2021	10:01:31 AM	0	10.2224	4.966	9/2/2021	9:33:24 AM	0	903.116	17.973	1.01	25.32	1008.36
9/2/2021	11:01:31 AM	0	10.2197	4.966	9/2/2021	10:33:24 AM	0	902.666	25.222	1.02	25.32	1008.36
9/2/2021	12:01:31 PM	0	10.2189	4.966	9/2/2021	11:33:24 AM	0	902.238	28.331	1.02	25.32	1008.36
9/2/2021	1:01:31 PM	0	10.2175	4.965	9/2/2021	12:33:24 PM	0	901.913	27.313	1.02	25.32	1008.36
9/2/2021	2:01:31 PM	0	10.2149	4.966	9/2/2021	1:33:24 PM	0	901.448	29.805	1.02	25.31	1008.37
9/2/2021	3:01:31 PM	0	10.2124	4.966	9/2/2021	2:33:24 PM	0	901.026	31.521	1.02	25.31	1008.37
9/2/2021	4:01:31 PM	0	10.2088	4.966	9/2/2021	3:33:24 PM	0	900.594	31.404	1.03	25.31	1008.37
9/2/2021	5:01:31 PM	0	10.2061	4.966	9/2/2021	4:33:24 PM	0	900.961	22.761	1.02	25.32	1008.36
9/2/2021	6:01:31 PM	0	10.2035	4.966	9/2/2021	5:33:24 PM	0	900.927	18.568	1.02	25.32	1008.36
9/2/2021	7:01:31 PM	0	10.2012	4.966	9/2/2021	6:33:24 PM	0	901.033	15.701	1.01	25.32	1008.36
9/2/2021	8:01:31 PM	0	10.1997	4.966	9/2/2021	7:33:24 PM	0	900.834	12.654	1.01	25.32	1008.36
9/2/2021	9:01:31 PM	0	10.1981	4.966	9/2/2021	8:33:24 PM	0	901.018	9.874	1.01	25.33	1008.35
9/2/2021	10:01:31 PM	0	10.1972	4.966	9/2/2021	9:33:24 PM	0	901.005	8.055	1.01	25.33	1008.35
9/2/2021	11:01:31 PM	0	10.1966	4.966	9/2/2021	10:33:24 PM	0	900.827	7.086	1.01	25.33	1008.35
9/3/2021	12:01:31 AM	0	10.1952	4.966	9/2/2021	11:33:24 PM	0	900.79	6.514	1.01	25.33	1008.35
9/3/2021	1:01:31 AM	0	10.1944	4.966	9/3/2021	12:33:24 AM	0	900.872	6.121	1.01	25.33	1008.35

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/3/2021	2:01:31 AM	0	10.1936	4.966	9/3/2021	1:33:24 AM	0	900.572	5.915	1.01	25.33	1008.35
9/3/2021	3:01:31 AM	0	10.1921	4.966	9/3/2021	2:33:24 AM	0	900.651	5.342	1.01	25.33	1008.35
9/3/2021	4:01:31 AM	0	10.1917	4.966	9/3/2021	3:33:24 AM	0	900.748	4.86	1.01	25.33	1008.35
9/3/2021	5:01:31 AM	0	10.1905	4.966	9/3/2021	4:33:24 AM	0	900.487	4.604	1.01	25.33	1008.35
9/3/2021	6:01:31 AM	0	10.1884	4.966	9/3/2021	5:33:24 AM	0	900.317	4.182	1.01	25.33	1008.35
9/3/2021	7:01:31 AM	0	10.1867	4.966	9/3/2021	6:33:24 AM	0	900.282	3.914	1.01	25.33	1008.35
9/3/2021	8:01:31 AM	0	10.1853	4.966	9/3/2021	7:33:24 AM	0	900.287	4.163	1.00	25.33	1008.35
9/3/2021	9:01:31 AM	0	10.1838	4.966	9/3/2021	8:33:24 AM	0	900.35	7.389	1.00	25.33	1008.35
9/3/2021	10:01:31 AM	0	10.1797	4.966	9/3/2021	9:33:24 AM	0	899.981	18.643	1.00	25.33	1008.35
9/3/2021	11:01:31 AM	0	10.176	4.966	9/3/2021	10:33:24 AM	0	899.576	24.827	1.00	25.33	1008.35
9/3/2021	12:01:31 PM	0	10.1735	4.966	9/3/2021	11:33:24 AM	0	899.073	27.566	1.01	25.33	1008.35
9/3/2021	1:01:31 PM	0	10.1705	4.966	9/3/2021	12:33:24 PM	0	898.669	27.326	1.01	25.33	1008.35
9/3/2021	2:01:31 PM	0	10.1671	4.965	9/3/2021	1:33:24 PM	0	897.982	31.416	1.01	25.33	1008.35
9/3/2021	3:01:31 PM	0	10.1635	4.966	9/3/2021	2:33:24 PM	0	897.301	33.343	1.01	25.32	1008.36
9/3/2021	4:01:31 PM	0	10.1606	4.966	9/3/2021	3:33:24 PM	0	897.288	31.106	1.01	25.33	1008.35
9/3/2021	5:01:31 PM	0	10.1588	4.966	9/3/2021	4:33:24 PM	0	897.815	25.744	1.00	25.33	1008.35
9/3/2021	6:01:31 PM	0	10.1574	4.966	9/3/2021	5:33:24 PM	0	897.922	21.922	1.00	25.34	1008.34
9/3/2021	7:01:31 PM	0	10.1552	4.966	9/3/2021	6:33:24 PM	0	897.753	19.652	1.00	25.34	1008.34
9/3/2021	8:01:31 PM	0	10.1529	4.966	9/3/2021	7:33:24 PM	0	897.65	16.813	1.00	25.34	1008.34
9/3/2021	9:01:31 PM	0	10.1513	4.966	9/3/2021	8:33:24 PM	0	897.861	14.379	1.00	25.34	1008.34
9/3/2021	10:01:31 PM	0	10.1494	4.966	9/3/2021	9:33:24 PM	0	897.669	12.617	1.00	25.34	1008.34
9/3/2021	11:01:31 PM	0	10.1471	4.966	9/3/2021	10:33:24 PM	0	897.469	11.464	1.00	25.34	1008.34
9/4/2021	12:01:31 AM	0	10.1452	4.966	9/3/2021	11:33:24 PM	0	897.477	10.446	0.99	25.34	1008.34
9/4/2021	1:01:31 AM	0	10.1435	4.966	9/4/2021	12:33:24 AM	0	897.256	9.469	0.99	25.34	1008.34
9/4/2021	2:01:31 AM	0	10.1421	4.966	9/4/2021	1:33:24 AM	0	897.24	8.477	0.99	25.34	1008.34
9/4/2021	3:01:31 AM	0	10.1393	4.966	9/4/2021	2:33:24 AM	0	896.655	7.847	1.00	25.34	1008.34
9/4/2021	4:01:31 AM	0	10.1363	4.967	9/4/2021	3:33:24 AM	0	896.391	7.33	1.00	25.34	1008.34
9/4/2021	5:01:31 AM	0	10.133	4.966	9/4/2021	4:33:24 AM	0	896.141	7.029	0.99	25.34	1008.34
9/4/2021	6:01:31 AM	0	10.1297	4.966	9/4/2021	5:33:24 AM	0	895.754	6.972	1.00	25.34	1008.34
9/4/2021	7:01:31 AM	0	10.1265	4.966	9/4/2021	6:33:24 AM	0	895.755	8.124	0.99	25.34	1008.34
9/4/2021	8:01:31 AM	0	10.1241	4.966	9/4/2021	7:33:24 AM	0	895.776	9.275	0.99	25.35	1008.33
9/4/2021	9:01:31 AM	0	10.1212	4.966	9/4/2021	8:33:24 AM	0	895.264	10.554	0.99	25.35	1008.33
9/4/2021	10:01:31 AM	0	10.1173	4.966	9/4/2021	9:33:24 AM	0	895.094	12.24	0.99	25.35	1008.33
9/4/2021	11:01:31 AM	0	10.1149	4.966	9/4/2021	10:33:24 AM	0	895.241	12.993	0.99	25.35	1008.33
9/4/2021	12:01:31 PM	0	10.113	4.966	9/4/2021	11:33:24 AM	0	895.084	11.467	0.99	25.35	1008.33
9/4/2021	1:01:31 PM	0	10.1115	4.966	9/4/2021	12:33:24 PM	0	894.711	11.38	0.99	25.35	1008.33
9/4/2021	2:01:31 PM	0	10.1099	4.966	9/4/2021	1:33:24 PM	0	894.942	12.756	0.98	25.35	1008.33
9/4/2021	3:01:31 PM	0	10.1086	4.966	9/4/2021	2:33:24 PM	0	894.878	13.593	0.98	25.35	1008.33
9/4/2021	4:01:31 PM	0	10.1069	4.966	9/4/2021	3:33:24 PM	0	894.889	14.456	0.98	25.36	1008.32
9/4/2021	5:01:31 PM	0	10.105	4.966	9/4/2021	4:33:24 PM	0	894.347	15.462	0.99	25.35	1008.33
9/4/2021	6:01:31 PM	0	10.1031	4.966	9/4/2021	5:33:24 PM	0	894.198	15.668	0.98	25.35	1008.33
9/4/2021	7:01:31 PM	0	10.1003	4.967	9/4/2021	6:33:24 PM	0	893.773	15.137	0.99	25.35	1008.33
9/4/2021	8:01:31 PM	0	10.0977	4.966	9/4/2021	7:33:24 PM	0	893.636	13.704	0.99	25.35	1008.33
9/4/2021	9:01:31 PM	0	10.0966	4.966	9/4/2021	8:33:24 PM	0	894.073	12.295	0.98	25.36	1008.32
9/4/2021	10:01:31 PM	0	10.0961	4.967	9/4/2021	9:33:24 PM	0	894.081	11.545	0.98	25.36	1008.32
9/4/2021	11:01:31 PM	0	10.0956	4.966	9/4/2021	10:33:24 PM	0	894.196	11.114	0.98	25.36	1008.32
9/5/2021	12:01:31 AM	0	10.0955	4.966	9/4/2021	11:33:24 PM	0	894.331	10.336	0.98	25.36	1008.32
9/5/2021	1:01:31 AM	0	10.0963	4.966	9/5/2021	12:33:24 AM	0	894.612	9.581	0.97	25.36	1008.32
9/5/2021	2:01:31 AM	0	10.0967	4.966	9/5/2021	1:33:24 AM	0	894.512	9.067	0.98	25.36	1008.32
9/5/2021	3:01:31 AM	0	10.0967	4.966	9/5/2021	2:33:24 AM	0	894.544	8.225	0.97	25.36	1008.32
9/5/2021	4:01:31 AM	0	10.0971	4.966	9/5/2021	3:33:24 AM	0	894.665	8.022	0.97	25.36	1008.32
9/5/2021	5:01:31 AM	0	10.0986	4.966	9/5/2021	4:33:24 AM	0	895.261	7.985	0.97	25.37	1008.31
9/5/2021	6:01:31 AM	0	10.1003	4.966	9/5/2021	5:33:24 AM	0	895.531	8.286	0.97	25.37	1008.31
9/5/2021	7:01:31 AM	0	10.1026	4.966	9/5/2021	6:33:24 AM	0	896.013	8.013	0.97	25.37	1008.31
9/5/2021	8:01:31 AM	0	10.106	4.966	9/5/2021	7:33:24 AM	0	896.506	8.743	0.96	25.37	1008.31
9/5/2021	9:01:31 AM	0	10.1086	4.966	9/5/2021	8:33:24 AM	0	897.002	11.042	0.96	25.38	1008.30
9/5/2021	10:01:31 AM	0	10.1094	4.967	9/5/2021	9:33:24 AM	0	896.679	21.078	0.97	25.37	1008.31
9/5/2021	11:01:31 AM	0	10.1089	4.966	9/5/2021	10:33:24 AM	0	896.33	27.67	0.97	25.37	1008.31
9/5/2021	12:01:31 PM	0	10.1088	4.967	9/5/2021	11:33:24 AM	0	896.08	30.036	0.97	25.37	1008.31
9/5/2021	1:01:31 PM	0	10.1083	4.966	9/5/2021	12:33:24 PM	0	895.984	27.371	0.97	25.37	1008.31
9/5/2021	2:01:31 PM	0	10.1072	4.966	9/5/2021	1:33:24 PM	0	895.824	29.815	0.97	25.36	1008.32
9/5/2021	3:01:31 PM	0	10.1047	4.967	9/5/2021	2:33:24 PM	0	895.275	30.017	0.98	25.36	1008.32
9/5/2021	4:01:31 PM	0	10.102	4.966	9/5/2021	3:33:24 PM	0	895.202	25.428	0.97	25.36	1008.32
9/5/2021	5:01:31 PM	0	10.0987	4.966	9/5/2021	4:33:24 PM	0	895.004	21.643	0.97	25.37	1008.31
9/5/2021	6:01:31 PM	0	10.0952	4.966	9/5/2021	5:33:24 PM	0	894.851	19.653	0.97	25.37	1008.31
9/5/2021	7:01:31 PM	0	10.0921	4.966	9/5/2021	6:33:24 PM	0	894.593	17.623	0.97	25.37	1008.31
9/5/2021	8:01:31 PM	0	10.0892	4.966	9/5/2021	7:33:24 PM	0	894.723	14.069	0.97	25.37	1008.31
9/5/2021	9:01:31 PM	0	10.0889	4.966	9/5/2021	8:33:24 PM	0	895.217	11.665	0.96	25.38	1008.30
9/5/2021	10:01:31 PM	0	10.0895	4.966	9/5/2021	9:33:24 PM	0	895.789	9.648	0.95	25.38	1008.30
9/5/2021	11:01:31 PM	0	10.0909	4.966	9/5/2021	10:33:24 PM	0	895.856	8.514	0.96	25.38	1008.30

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/6/2021	12:01:31 AM	0	10.0944	4.966	9/5/2021	11:33:24 PM	0	896.762	7.827	0.95	25.39	1008.29
9/6/2021	1:01:31 AM	0	10.0978	4.966	9/6/2021	12:33:24 AM	0	897.05	6.94	0.95	25.39	1008.29
9/6/2021	2:01:31 AM	0	10.1017	4.966	9/6/2021	1:33:24 AM	0	897.581	6.54	0.95	25.39	1008.29
9/6/2021	3:01:31 AM	0	10.106	4.966	9/6/2021	2:33:24 AM	0	898.343	6.869	0.95	25.39	1008.29
9/6/2021	4:01:31 AM	0	10.1098	4.966	9/6/2021	3:33:24 AM	0	898.37	6.147	0.95	25.39	1008.29
9/6/2021	5:01:31 AM	0	10.1134	4.966	9/6/2021	4:33:24 AM	0	898.99	6.301	0.95	25.39	1008.29
9/6/2021	6:01:31 AM	0	10.1172	4.966	9/6/2021	5:33:24 AM	0	899.544	6.496	0.94	25.39	1008.29
9/6/2021	7:01:31 AM	0	10.121	4.966	9/6/2021	6:33:24 AM	0	900.12	6.663	0.94	25.39	1008.29
9/6/2021	8:01:31 AM	0	10.1247	4.966	9/6/2021	7:33:24 AM	0	900.486	5.709	0.94	25.39	1008.29
9/6/2021	9:01:31 AM	0	10.1283	4.966	9/6/2021	8:33:24 AM	0	900.999	8.02	0.94	25.40	1008.28
9/6/2021	10:01:31 AM	0	10.1293	4.966	9/6/2021	9:33:24 AM	0	901.017	19.72	0.94	25.40	1008.28
9/6/2021	11:01:31 AM	0	10.1296	4.966	9/6/2021	10:33:24 AM	0	900.651	26.809	0.95	25.39	1008.29
9/6/2021	12:01:31 PM	0	10.1303	4.967	9/6/2021	11:33:24 AM	0	900.582	29.052	0.95	25.39	1008.29
9/6/2021	1:01:31 PM	0	10.1311	4.966	9/6/2021	12:33:24 PM	0	900.584	25.848	0.95	25.39	1008.29
9/6/2021	2:01:31 PM	0	10.1308	4.966	9/6/2021	1:33:24 PM	0	900.508	28.821	0.95	25.39	1008.29
9/6/2021	3:01:31 PM	0	10.1309	4.966	9/6/2021	2:33:24 PM	0	900.467	28.038	0.95	25.39	1008.29
9/6/2021	4:01:31 PM	0	10.129	4.966	9/6/2021	3:33:24 PM	0	900.073	26.283	0.95	25.39	1008.29
9/6/2021	5:01:31 PM	0	10.1263	4.966	9/6/2021	4:33:24 PM	0	900.262	22.133	0.95	25.39	1008.29
9/6/2021	6:01:31 PM	0	10.1249	4.966	9/6/2021	5:33:24 PM	0	900.472	19.95	0.94	25.39	1008.29
9/6/2021	7:01:31 PM	0	10.1236	4.966	9/6/2021	6:33:24 PM	0	900.56	18.379	0.94	25.40	1008.28
9/6/2021	8:01:31 PM	0	10.1244	4.967	9/6/2021	7:33:24 PM	0	900.992	16.017	0.94	25.40	1008.28
9/6/2021	9:01:31 PM	0	10.1238	4.966	9/6/2021	8:33:24 PM	0	900.923	13.932	0.94	25.40	1008.28
9/6/2021	10:01:31 PM	0	10.1238	4.966	9/6/2021	9:33:24 PM	0	901.226	12.283	0.93	25.40	1008.28
9/6/2021	11:01:31 PM	0	10.1248	4.966	9/6/2021	10:33:24 PM	0	901.484	11.48	0.93	25.40	1008.28
9/7/2021	12:01:31 AM	0	10.1262	4.966	9/6/2021	11:33:24 PM	0	901.813	11.177	0.93	25.41	1008.27
9/7/2021	1:01:31 AM	0	10.1269	4.967	9/7/2021	12:33:24 AM	0	901.754	10.447	0.93	25.41	1008.27
9/7/2021	2:01:31 AM	0	10.1283	4.966	9/7/2021	1:33:24 AM	0	902.248	9.892	0.93	25.41	1008.27
9/7/2021	3:01:31 AM	0	10.1305	4.966	9/7/2021	2:33:24 AM	0	902.457	9.993	0.93	25.41	1008.27
9/7/2021	4:01:31 AM	0	10.1318	4.967	9/7/2021	3:33:24 AM	0	902.565	10.115	0.93	25.41	1008.27
9/7/2021	5:01:31 AM	0	10.1333	4.966	9/7/2021	4:33:24 AM	0	902.791	9.776	0.93	25.41	1008.27
9/7/2021	6:01:31 AM	0	10.1343	4.966	9/7/2021	5:33:24 AM	0	902.903	8.7	0.93	25.41	1008.27
9/7/2021	7:01:31 AM	0	10.135	4.967	9/7/2021	6:33:24 AM	0	903.003	7.987	0.93	25.41	1008.27
9/7/2021	8:01:31 AM	0	10.1355	4.966	9/7/2021	7:33:24 AM	0	903.084	7.681	0.93	25.41	1008.27
9/7/2021	9:01:31 AM	0	10.1354	4.966	9/7/2021	8:33:24 AM	0	903.359	10.666	0.92	25.41	1008.27
9/7/2021	10:01:31 AM	0	10.1341	4.966	9/7/2021	9:33:24 AM	0	903.2	15.278	0.92	25.41	1008.27
9/7/2021	11:01:31 AM	0	10.132	4.966	9/7/2021	10:33:24 AM	0	902.5	23.876	0.93	25.41	1008.27
9/7/2021	12:01:31 PM	0	10.1304	4.966	9/7/2021	11:33:24 AM	0	901.979	28.261	0.93	25.40	1008.28
9/7/2021	1:01:31 PM	0	10.1276	4.966	9/7/2021	12:33:24 PM	0	901.557	28.375	0.93	25.40	1008.28
9/7/2021	2:01:31 PM	0	10.1235	4.966	9/7/2021	1:33:24 PM	0	900.974	31.019	0.94	25.40	1008.28
9/7/2021	3:01:31 PM	0	10.1196	4.966	9/7/2021	2:33:24 PM	0	899.947	34.672	0.94	25.39	1008.29
9/7/2021	4:01:31 PM	0	10.1143	4.966	9/7/2021	3:33:24 PM	0	899.546	34.348	0.94	25.40	1008.28
9/7/2021	5:01:31 PM	0	10.1093	4.966	9/7/2021	4:33:24 PM	0	899.638	27.366	0.94	25.40	1008.28
9/7/2021	6:01:31 PM	0	10.1045	4.966	9/7/2021	5:33:24 PM	0	899.302	24.575	0.93	25.40	1008.28
9/7/2021	7:01:31 PM	0	10.1003	4.966	9/7/2021	6:33:24 PM	0	899.275	22.058	0.93	25.41	1008.27
9/7/2021	8:01:31 PM	0	10.0964	4.967	9/7/2021	7:33:24 PM	0	899.171	19.398	0.93	25.41	1008.27
9/7/2021	9:01:31 PM	0	10.0944	4.966	9/7/2021	8:33:24 PM	0	899.326	16.235	0.92	25.41	1008.27
9/7/2021	10:01:31 PM	0	10.0924	4.966	9/7/2021	9:33:24 PM	0	899.551	13.881	0.92	25.42	1008.26
9/7/2021	11:01:31 PM	0	10.0905	4.967	9/7/2021	10:33:24 PM	0	899.234	12.811	0.92	25.42	1008.26
9/8/2021	12:01:31 AM	0	10.087	4.967	9/7/2021	11:33:24 PM	0	898.578	11.975	0.92	25.41	1008.27
9/8/2021	1:01:31 AM	0	10.083	4.966	9/8/2021	12:33:24 AM	0	898.169	11.016	0.92	25.41	1008.27
9/8/2021	2:01:31 AM	0	10.0784	4.966	9/8/2021	1:33:24 AM	0	897.678	10.709	0.92	25.41	1008.27
9/8/2021	3:01:31 AM	0	10.0745	4.966	9/8/2021	2:33:24 AM	0	897.633	10.547	0.92	25.42	1008.26
9/8/2021	4:01:31 AM	0	10.0707	4.966	9/8/2021	3:33:24 AM	0	897.06	10.409	0.92	25.41	1008.27
9/8/2021	5:01:31 AM	0	10.0651	4.967	9/8/2021	4:33:24 AM	0	896.123	10.733	0.93	25.41	1008.27
9/8/2021	6:01:31 AM	0	10.058	4.966	9/8/2021	5:33:24 AM	0	895.472	10.923	0.93	25.41	1008.27
9/8/2021	7:01:31 AM	0	10.0519	4.966	9/8/2021	6:33:24 AM	0	894.941	11.392	0.93	25.41	1008.27
9/8/2021	8:01:31 AM	0	10.0464	4.966	9/8/2021	7:33:24 AM	0	894.733	12.158	0.92	25.41	1008.27
9/8/2021	9:01:31 AM	0	10.0458	4.967	9/8/2021	8:33:24 AM	0	895.863	13.218	0.91	25.43	1008.25
9/8/2021	10:01:31 AM	0	10.0502	4.967	9/8/2021	9:33:24 AM	0	897.257	13.592	0.90	25.44	1008.24
9/8/2021	11:01:31 AM	0	10.0527	4.966	9/8/2021	10:33:24 AM	0	896.497	13.427	0.91	25.43	1008.25
9/8/2021	12:01:31 PM	0	10.054	4.966	9/8/2021	11:33:24 AM	0	896.838	13.421	0.91	25.43	1008.25
9/8/2021	1:01:31 PM	0	10.0523	4.967	9/8/2021	12:33:24 PM	0	896.082	15.882	0.91	25.42	1008.26
9/8/2021	2:01:31 PM	0	10.05	4.967	9/8/2021	1:33:24 PM	0	895.942	19.054	0.91	25.42	1008.26
9/8/2021	3:01:31 PM	0	10.048	4.966	9/8/2021	2:33:24 PM	0	895.826	20.409	0.91	25.42	1008.26
9/8/2021	4:01:31 PM	0	10.0459	4.967	9/8/2021	3:33:24 PM	0	895.674	21.789	0.91	25.42	1008.26
9/8/2021	5:01:31 PM	0	10.0436	4.967	9/8/2021	4:33:24 PM	0	895.493	20.175	0.91	25.43	1008.25
9/8/2021	6:01:31 PM	0	10.0416	4.967	9/8/2021	5:33:24 PM	0	895.207	19.759	0.91	25.42	1008.26
9/8/2021	7:01:31 PM	0	10.039	4.966	9/8/2021	6:33:24 PM	0	895.123	18.33	0.91	25.43	1008.25
9/8/2021	8:01:31 PM	0	10.0356	4.967	9/8/2021	7:33:24 PM	0	894.412	16.643	0.92	25.42	1008.26
9/8/2021	9:01:31 PM	0	10.0321	4.967	9/8/2021	8:33:24 PM	0	894.576	15.193	0.91	25.43	1008.25

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/8/2021	10:01:31 PM	0	10.0298	4.967	9/8/2021	9:33:24 PM	0	894.418	14.666	0.91	25.43	1008.25
9/8/2021	11:01:31 PM	0	10.0285	4.966	9/8/2021	10:33:24 PM	0	894.607	14.144	0.91	25.43	1008.25
9/9/2021	12:01:31 AM	0	10.0268	4.967	9/8/2021	11:33:24 PM	0	894.381	14.207	0.91	25.43	1008.25
9/9/2021	1:01:31 AM	0	10.0268	4.966	9/9/2021	12:33:24 AM	0	894.894	14.046	0.90	25.44	1008.24
9/9/2021	2:01:31 AM	0	10.0267	4.967	9/9/2021	1:33:24 AM	0	894.906	13.724	0.90	25.44	1008.24
9/9/2021	3:01:31 AM	0	10.0313	4.967	9/9/2021	2:33:24 AM	0	896.112	12.448	0.89	25.44	1008.24
9/9/2021	4:01:31 AM	0	10.0369	4.966	9/9/2021	3:33:24 AM	0	897.042	10.432	0.89	25.45	1008.23
9/9/2021	5:01:31 AM	0	10.0392	4.966	9/9/2021	4:33:24 AM	0	896.724	9.068	0.90	25.44	1008.24
9/9/2021	6:01:31 AM	0	10.0406	4.967	9/9/2021	5:33:24 AM	0	896.743	8.649	0.90	25.44	1008.24
9/9/2021	7:01:31 AM	0	10.0416	4.966	9/9/2021	6:33:24 AM	0	896.836	8.609	0.90	25.44	1008.24
9/9/2021	8:01:31 AM	0	10.0424	4.966	9/9/2021	7:33:24 AM	0	897.243	8.935	0.89	25.44	1008.24
9/9/2021	9:01:31 AM	0	10.0436	4.966	9/9/2021	8:33:24 AM	0	897.364	9.49	0.89	25.44	1008.24
9/9/2021	10:01:31 AM	0	10.0433	4.966	9/9/2021	9:33:24 AM	0	897.09	10.776	0.90	25.44	1008.24
9/9/2021	11:01:31 AM	0	10.0418	4.967	9/9/2021	10:33:24 AM	0	896.926	12.831	0.90	25.44	1008.24
9/9/2021	12:01:31 PM	0	10.0402	4.966	9/9/2021	11:33:24 AM	0	896.731	14.112	0.90	25.44	1008.24
9/9/2021	1:01:31 PM	0	10.0369	4.967	9/9/2021	12:33:24 PM	0	896.345	16.294	0.90	25.44	1008.24
9/9/2021	2:01:31 PM	0	10.0341	4.966	9/9/2021	1:33:24 PM	0	895.974	18.867	0.90	25.44	1008.24
9/9/2021	3:01:31 PM	0	10.0316	4.967	9/9/2021	2:33:24 PM	0	895.8	19.288	0.90	25.44	1008.24
9/9/2021	4:01:31 PM	0	10.0298	4.966	9/9/2021	3:33:24 PM	0	895.787	18.193	0.90	25.44	1008.24
9/9/2021	5:01:31 PM	0	10.0283	4.966	9/9/2021	4:33:24 PM	0	895.92	18.094	0.89	25.44	1008.24
9/9/2021	6:01:31 PM	0	10.0278	4.966	9/9/2021	5:33:24 PM	0	896.032	17.374	0.89	25.45	1008.23
9/9/2021	7:01:31 PM	0	10.0273	4.967	9/9/2021	6:33:24 PM	0	895.939	16.141	0.89	25.45	1008.23
9/9/2021	8:01:31 PM	0	10.0271	4.966	9/9/2021	7:33:24 PM	0	896.196	14.485	0.89	25.45	1008.23
9/9/2021	9:01:31 PM	0	10.0279	4.966	9/9/2021	8:33:24 PM	0	896.604	12.933	0.89	25.45	1008.23
9/9/2021	10:01:31 PM	0	10.0299	4.967	9/9/2021	9:33:24 PM	0	897.229	12.022	0.88	25.46	1008.22
9/9/2021	11:01:31 PM	0	10.0318	4.966	9/9/2021	10:33:24 PM	0	897.259	11.182	0.88	25.45	1008.23
9/10/2021	12:01:31 AM	0	10.0322	4.966	9/9/2021	11:33:24 PM	0	897.264	10.507	0.88	25.45	1008.23
9/10/2021	1:01:31 AM	0	10.0328	4.967	9/10/2021	12:33:24 AM	0	897.365	10.38	0.88	25.45	1008.23
9/10/2021	2:01:31 AM	0	10.0329	4.967	9/10/2021	1:33:24 AM	0	897.433	10.23	0.88	25.46	1008.22
9/10/2021	3:01:31 AM	0	10.0328	4.967	9/10/2021	2:33:24 AM	0	897.405	10.334	0.88	25.46	1008.22
9/10/2021	4:01:31 AM	0	10.032	4.967	9/10/2021	3:33:24 AM	0	897.41	10.175	0.88	25.46	1008.22
9/10/2021	5:01:31 AM	0	10.0326	4.967	9/10/2021	4:33:24 AM	0	897.741	10.038	0.88	25.46	1008.22
9/10/2021	6:01:31 AM	0	10.0327	4.967	9/10/2021	5:33:24 AM	0	897.729	9.52	0.88	25.46	1008.22
9/10/2021	7:01:31 AM	0	10.0327	4.967	9/10/2021	6:33:24 AM	0	897.652	9.619	0.88	25.46	1008.22
9/10/2021	8:01:31 AM	0	10.0329	4.966	9/10/2021	7:33:24 AM	0	897.96	9.865	0.88	25.46	1008.22
9/10/2021	9:01:31 AM	0	10.0332	4.967	9/10/2021	8:33:24 AM	0	898.026	10.858	0.88	25.46	1008.22
9/10/2021	10:01:31 AM	0	10.0313	4.966	9/10/2021	9:33:24 AM	0	897.692	14.646	0.88	25.46	1008.22
9/10/2021	11:01:31 AM	0	10.0284	4.967	9/10/2021	10:33:24 AM	0	896.882	24.82	0.88	25.45	1008.23
9/10/2021	12:01:31 PM	0	10.0262	4.966	9/10/2021	11:33:24 AM	0	896.641	27.454	0.88	25.45	1008.23
9/10/2021	1:01:31 PM	0	10.0244	4.967	9/10/2021	12:33:24 PM	0	896.492	25.437	0.88	25.45	1008.23
9/10/2021	2:01:31 PM	0	10.0214	4.967	9/10/2021	1:33:24 PM	0	895.989	27.158	0.88	25.45	1008.23
9/10/2021	3:01:31 PM	0	10.0182	4.966	9/10/2021	2:33:24 PM	0	895.656	27.509	0.89	25.45	1008.23
9/10/2021	4:01:31 PM	0	10.0147	4.967	9/10/2021	3:33:24 PM	0	895.552	23.853	0.88	25.45	1008.23
9/10/2021	5:01:31 PM	0	10.0109	4.967	9/10/2021	4:33:24 PM	0	895.442	21.615	0.88	25.46	1008.22
9/10/2021	6:01:31 PM	0	10.0081	4.967	9/10/2021	5:33:24 PM	0	895.297	19.829	0.88	25.46	1008.22
9/10/2021	7:01:31 PM	0	10.007	4.967	9/10/2021	6:33:24 PM	0	895.678	17.304	0.87	25.46	1008.22
9/10/2021	8:01:31 PM	0	10.0068	4.967	9/10/2021	7:33:24 PM	0	896.129	14.319	0.87	25.47	1008.21
9/10/2021	9:01:31 PM	0	10.0079	4.967	9/10/2021	8:33:24 PM	0	896.474	11.937	0.87	25.47	1008.21
9/10/2021	10:01:31 PM	0	10.0089	4.967	9/10/2021	9:33:24 PM	0	896.578	10.418	0.87	25.47	1008.21
9/10/2021	11:01:31 PM	0	10.0094	4.966	9/10/2021	10:33:24 PM	0	896.711	9.483	0.87	25.47	1008.21
9/11/2021	12:01:31 AM	0	10.0103	4.967	9/10/2021	11:33:24 PM	0	896.884	9.044	0.86	25.47	1008.21
9/11/2021	1:01:31 AM	0	10.0109	4.966	9/11/2021	12:33:24 AM	0	897.129	9.512	0.86	25.47	1008.21
9/11/2021	2:01:31 AM	0	10.0125	4.967	9/11/2021	1:33:24 AM	0	897.631	9.787	0.86	25.48	1008.20
9/11/2021	3:01:31 AM	0	10.0152	4.967	9/11/2021	2:33:24 AM	0	898.122	10.293	0.86	25.48	1008.20
9/11/2021	4:01:31 AM	0	10.0182	4.967	9/11/2021	3:33:24 AM	0	898.609	10.529	0.85	25.48	1008.20
9/11/2021	5:01:31 AM	0	10.0212	4.967	9/11/2021	4:33:24 AM	0	898.871	10.473	0.86	25.48	1008.20
9/11/2021	6:01:31 AM	0	10.0236	4.967	9/11/2021	5:33:24 AM	0	899.262	10.367	0.85	25.48	1008.20
9/11/2021	7:01:31 AM	0	10.0261	4.967	9/11/2021	6:33:24 AM	0	899.475	10.33	0.85	25.48	1008.20
9/11/2021	8:01:31 AM	0	10.0286	4.967	9/11/2021	7:33:24 AM	0	899.939	10.373	0.85	25.49	1008.19
9/11/2021	9:01:31 AM	0	10.0313	4.967	9/11/2021	8:33:24 AM	0	900.401	12.091	0.85	25.49	1008.19
9/11/2021	10:01:31 AM	0	10.034	4.967	9/11/2021	9:33:24 AM	0	900.719	17.411	0.85	25.49	1008.19
9/11/2021	11:01:31 AM	0	10.0367	4.968	9/11/2021	10:33:24 AM	0	900.718	21.664	0.85	25.49	1008.19
9/11/2021	12:01:31 PM	0	10.0386	4.966	9/11/2021	11:33:24 AM	0	900.775	22.209	0.85	25.48	1008.20
9/11/2021	1:01:31 PM	0	10.0384	4.967	9/11/2021	12:33:24 PM	0	900.575	22.273	0.86	25.48	1008.20
9/11/2021	2:01:31 PM	0	10.0381	4.967	9/11/2021	1:33:24 PM	0	900.414	21.578	0.86	25.48	1008.20
9/11/2021	3:01:31 PM	0	10.0363	4.966	9/11/2021	2:33:24 PM	0	899.992	24.253	0.86	25.48	1008.20
9/11/2021	4:01:31 PM	0	10.0331	4.966	9/11/2021	3:33:24 PM	0	899.399	22.276	0.86	25.48	1008.20
9/11/2021	5:01:31 PM	0	10.0293	4.966	9/11/2021	4:33:24 PM	0	899.234	19.957	0.86	25.48	1008.20
9/11/2021	6:01:31 PM	0	10.0284	4.967	9/11/2021	5:33:24 PM	0	899.607	16.255	0.85	25.48	1008.20
9/11/2021	7:01:31 PM	0	10.0248	4.967	9/11/2021	6:33:24 PM	0	899.016	13.6	0.86	25.48	1008.20

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/11/2021	8:01:31 PM	0	10.0219	4.967	9/11/2021	7:33:24 PM	0	899.602	11.924	0.85	25.49	1008.19
9/11/2021	9:01:31 PM	0	10.0234	4.967	9/11/2021	8:33:24 PM	0	899.931	10.122	0.85	25.49	1008.19
9/11/2021	10:01:31 PM	0	10.0229	4.967	9/11/2021	9:33:24 PM	0	899.608	9.613	0.85	25.49	1008.19
9/11/2021	11:01:31 PM	0	10.0229	4.967	9/11/2021	10:33:24 PM	0	900.116	8.669	0.84	25.49	1008.19
9/12/2021	12:01:31 AM	0	10.0239	4.967	9/11/2021	11:33:24 PM	0	900.102	7.948	0.85	25.49	1008.19
9/12/2021	1:01:31 AM	0	10.0245	4.967	9/12/2021	12:33:24 AM	0	900.326	7.428	0.84	25.49	1008.19
9/12/2021	2:01:31 AM	0	10.025	4.967	9/12/2021	1:33:24 AM	0	900.515	8	0.84	25.49	1008.19
9/12/2021	3:01:31 AM	0	10.0242	4.966	9/12/2021	2:33:24 AM	0	900.308	8.592	0.84	25.49	1008.19
9/12/2021	4:01:31 AM	0	10.0233	4.967	9/12/2021	3:33:24 AM	0	900.415	8.882	0.84	25.50	1008.18
9/12/2021	5:01:31 AM	0	10.0219	4.967	9/12/2021	4:33:24 AM	0	900.053	8.517	0.84	25.49	1008.19
9/12/2021	6:01:31 AM	0	10.0208	4.967	9/12/2021	5:33:24 AM	0	899.959	6.886	0.84	25.49	1008.19
9/12/2021	7:01:31 AM	0	10.0197	4.967	9/12/2021	6:33:24 AM	0	900.057	5.738	0.84	25.50	1008.18
9/12/2021	8:01:31 AM	0	10.0199	4.967	9/12/2021	7:33:24 AM	0	900.264	6.1	0.84	25.50	1008.18
9/12/2021	9:01:31 AM	0	10.0207	4.967	9/12/2021	8:33:24 AM	0	900.833	7.818	0.83	25.50	1008.18
9/12/2021	10:01:31 AM	0	10.0224	4.967	9/12/2021	9:33:24 AM	0	901.162	9.314	0.83	25.50	1008.18
9/12/2021	11:01:31 AM	0	10.0222	4.966	9/12/2021	10:33:24 AM	0	900.977	12.361	0.83	25.50	1008.18
9/12/2021	12:01:31 PM	0	10.0223	4.967	9/12/2021	11:33:24 AM	0	900.959	15.699	0.84	25.50	1008.18
9/12/2021	1:01:31 PM	0	10.0217	4.967	9/12/2021	12:33:24 PM	0	900.918	17.919	0.83	25.50	1008.18
9/12/2021	2:01:31 PM	0	10.0207	4.967	9/12/2021	1:33:24 PM	0	900.633	19.412	0.84	25.50	1008.18
9/12/2021	3:01:31 PM	0	10.0191	4.967	9/12/2021	2:33:24 PM	0	900.452	20.034	0.84	25.50	1008.18
9/12/2021	4:01:31 PM	0	10.0179	4.967	9/12/2021	3:33:24 PM	0	900.47	17.751	0.84	25.50	1008.18
9/12/2021	5:01:31 PM	0	10.0154	4.967	9/12/2021	4:33:24 PM	0	900.214	15.924	0.84	25.50	1008.18
9/12/2021	7:01:31 PM	0	10.0125	4.967	9/12/2021	6:33:24 PM	0	900.17	11.483	0.83	25.50	1008.18
9/12/2021	8:01:31 PM	0	10.0112	4.967	9/12/2021	7:33:24 PM	0	900.154	8.532	0.83	25.51	1008.17
9/12/2021	9:01:31 PM	0	10.0113	4.966	9/12/2021	8:33:24 PM	0	900.355	6.507	0.83	25.51	1008.17
9/12/2021	10:01:31 PM	0	10.0117	4.967	9/12/2021	9:33:24 PM	0	900.487	5.405	0.83	25.51	1008.17
9/12/2021	11:01:31 PM	0	10.0126	4.967	9/12/2021	10:33:24 PM	0	900.727	4.555	0.83	25.51	1008.17
9/13/2021	12:01:31 AM	0	10.0134	4.966	9/12/2021	11:33:24 PM	0	900.9	4.348	0.83	25.51	1008.17
9/13/2021	1:01:31 AM	0	10.014	4.966	9/13/2021	12:33:24 AM	0	901.1	5.328	0.83	25.51	1008.17
9/13/2021	2:01:31 AM	0	10.0141	4.967	9/13/2021	1:33:24 AM	0	901.214	5.586	0.82	25.51	1008.17
9/13/2021	3:01:31 AM	0	10.0143	4.967	9/13/2021	2:33:24 AM	0	901.202	5.115	0.82	25.51	1008.17
9/13/2021	4:01:31 AM	0	10.0146	4.967	9/13/2021	3:33:24 AM	0	901.178	4.583	0.83	25.51	1008.17
9/13/2021	5:01:31 AM	0	10.0148	4.967	9/13/2021	4:33:24 AM	0	901.465	4.121	0.82	25.51	1008.17
9/13/2021	6:01:31 AM	0	10.0155	4.967	9/13/2021	5:33:24 AM	0	901.82	4.585	0.82	25.52	1008.16
9/13/2021	7:01:31 AM	0	10.017	4.967	9/13/2021	6:33:24 AM	0	902.004	4.708	0.82	25.52	1008.16
9/13/2021	8:01:31 AM	0	10.0185	4.967	9/13/2021	7:33:24 AM	0	902.257	4.799	0.82	25.52	1008.16
9/13/2021	9:01:31 AM	0	10.0193	4.967	9/13/2021	8:33:24 AM	0	902.417	5.947	0.82	25.52	1008.16
9/13/2021	10:01:31 AM	0	10.0186	4.968	9/13/2021	9:33:24 AM	0	902.664	15.803	0.81	25.52	1008.16
9/13/2021	11:01:31 AM	0	10.0191	4.967	9/13/2021	10:33:24 AM	0	902.73	18.597	0.81	25.52	1008.16
9/13/2021	12:01:31 PM	0	10.019	4.967	9/13/2021	11:33:24 AM	0	902.572	19.968	0.82	25.52	1008.16
9/13/2021	1:01:31 PM	0	10.0183	4.967	9/13/2021	12:33:24 PM	0	902.224	17.934	0.82	25.52	1008.16
9/13/2021	2:01:31 PM	0	10.0154	4.968	9/13/2021	1:33:24 PM	0	901.539	20.711	0.82	25.51	1008.17
9/13/2021	3:01:31 PM	0	10.0137	4.967	9/13/2021	2:33:24 PM	0	901.647	22.18	0.82	25.52	1008.16
9/13/2021	4:01:31 PM	0	10.0123	4.967	9/13/2021	3:33:24 PM	0	901.781	21.273	0.82	25.52	1008.16
9/13/2021	5:01:31 PM	0	10.0099	4.967	9/13/2021	4:33:24 PM	0	901.388	18.166	0.82	25.52	1008.16
9/13/2021	6:01:31 PM	0	10.0067	4.968	9/13/2021	5:33:24 PM	0	901.159	16.014	0.82	25.52	1008.16
9/13/2021	7:01:31 PM	0	10.0039	4.967	9/13/2021	6:33:24 PM	0	900.996	12.751	0.82	25.52	1008.16
9/13/2021	8:01:31 PM	0	10.002	4.967	9/13/2021	7:33:24 PM	0	901.093	9.716	0.81	25.52	1008.16
9/13/2021	9:01:31 PM	0	10.001	4.967	9/13/2021	8:33:24 PM	0	901.136	7.446	0.81	25.53	1008.15
9/13/2021	10:01:31 PM	0	10.0004	4.967	9/13/2021	9:33:24 PM	0	901.03	6.544	0.81	25.52	1008.16
9/13/2021	11:01:31 PM	0	9.9987	4.967	9/13/2021	10:33:24 PM	0	900.91	5.943	0.81	25.53	1008.15
9/14/2021	12:01:31 AM	0	9.9969	4.967	9/13/2021	11:33:24 PM	0	900.748	5.604	0.81	25.53	1008.15
9/14/2021	1:01:31 AM	0	9.9953	4.966	9/14/2021	12:33:24 AM	0	900.743	6.28	0.81	25.53	1008.15
9/14/2021	2:01:31 AM	0	9.9932	4.967	9/14/2021	1:33:24 AM	0	900.434	7.146	0.81	25.53	1008.15
9/14/2021	3:01:31 AM	0	9.9898	4.967	9/14/2021	2:33:24 AM	0	900.031	6.335	0.81	25.53	1008.15
9/14/2021	4:01:31 AM	0	9.9857	4.967	9/14/2021	3:33:24 AM	0	899.428	5.586	0.81	25.52	1008.16
9/14/2021	5:01:31 AM	0	9.9808	4.967	9/14/2021	4:33:24 AM	0	898.867	5.58	0.81	25.52	1008.16
9/14/2021	6:01:31 AM	0	9.9755	4.967	9/14/2021	5:33:24 AM	0	898.191	6.047	0.82	25.52	1008.16
9/14/2021	7:01:31 AM	0	9.9689	4.967	9/14/2021	6:33:24 AM	0	897.415	6.172	0.82	25.52	1008.16
9/14/2021	8:01:31 AM	0	9.9612	4.967	9/14/2021	7:33:24 AM	0	896.511	6.66	0.82	25.52	1008.16
9/14/2021	9:01:31 AM	0	9.9548	4.967	9/14/2021	8:33:24 AM	0	896.469	7.652	0.81	25.52	1008.16
9/14/2021	10:01:31 AM	0	9.9518	4.967	9/14/2021	9:33:24 AM	0	896.947	8	0.81	25.53	1008.15
9/14/2021	11:01:31 AM	0	9.95	4.967	9/14/2021	10:33:24 AM	0	896.589	7.703	0.81	25.53	1008.15
9/14/2021	12:01:31 PM	0	9.9462	4.967	9/14/2021	11:33:24 AM	0	896.029	7.697	0.81	25.53	1008.15
9/14/2021	1:01:31 PM	0	9.9406	4.967	9/14/2021	12:33:24 PM	0	895.266	8.031	0.81	25.53	1008.15
9/14/2021	2:01:31 PM	0	9.9354	4.967	9/14/2021	1:33:24 PM	0	894.668	8.79	0.81	25.52	1008.16
9/14/2021	3:01:31 PM	0	9.9277	4.967	9/14/2021	2:33:24 PM	0	893.745	9.79	0.81	25.52	1008.16
9/14/2021	4:01:31 PM	0	9.9202	4.967	9/14/2021	3:33:24 PM	0	892.982	9.936	0.81	25.52	1008.16
9/14/2021	5:01:31 PM	0	9.9121	4.967	9/14/2021	4:33:24 PM	0	891.996	10.014	0.82	25.52	1008.16
9/14/2021	6:01:31 PM	0	9.9036	4.967	9/14/2021	5:33:24 PM	0	891.138	10.067	0.82	25.52	1008.16

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/14/2021	7:01:31 PM	0	9.8963	4.967	9/14/2021	6:33:24 PM	0	891.211	9.846	0.81	25.53	1008.15
9/14/2021	8:01:31 PM	0	9.8911	4.967	9/14/2021	7:33:24 PM	0	890.637	9.363	0.81	25.53	1008.15
9/14/2021	9:01:31 PM	0	9.8913	4.967	9/14/2021	8:33:24 PM	0	891.57	8.378	0.80	25.54	1008.14
9/14/2021	10:01:31 PM	0	9.8928	4.967	9/14/2021	9:33:24 PM	0	891.954	6.564	0.80	25.54	1008.14
9/14/2021	11:01:31 PM	0	9.8959	4.967	9/14/2021	10:33:24 PM	0	892.433	5.612	0.80	25.54	1008.14
9/15/2021	12:01:31 AM	0	9.8998	4.967	9/14/2021	11:33:24 PM	0	893.254	4.569	0.79	25.55	1008.13
9/15/2021	1:01:31 AM	0	9.9049	4.967	9/15/2021	12:33:24 AM	0	893.786	3.372	0.79	25.55	1008.13
9/15/2021	2:01:31 AM	0	9.9106	4.968	9/15/2021	1:33:24 AM	0	894.657	2.523	0.79	25.55	1008.13
9/15/2021	3:01:31 AM	0	9.9157	4.967	9/15/2021	2:33:24 AM	0	894.915	1.411	0.79	25.55	1008.13
9/15/2021	4:01:31 AM	0	9.9183	4.967	9/15/2021	3:33:24 AM	0	894.9	0.65	0.79	25.54	1008.14
9/15/2021	5:01:31 AM	0	9.9199	4.967	9/15/2021	4:33:24 AM	0	895.057	0.191	0.79	25.54	1008.14
9/15/2021	6:01:31 AM	0	9.9223	4.967	9/15/2021	5:33:24 AM	0	895.492	-0.211	0.79	25.55	1008.13
9/15/2021	7:01:31 AM	0	9.9243	4.968	9/15/2021	6:33:24 AM	0	895.807	0.118	0.79	25.55	1008.13
9/15/2021	8:01:31 AM	0	9.9264	4.967	9/15/2021	7:33:24 AM	0	896.303	1.107	0.79	25.55	1008.13
9/15/2021	9:01:31 AM	0	9.9284	4.967	9/15/2021	8:33:24 AM	0	896.659	2.387	0.78	25.55	1008.13
9/15/2021	10:01:31 AM	0	9.9289	4.967	9/15/2021	9:33:24 AM	0	897.062	10.66	0.78	25.56	1008.12
9/15/2021	11:01:31 AM	0	9.9294	4.967	9/15/2021	10:33:24 AM	0	897.237	14.555	0.78	25.56	1008.12
9/15/2021	12:01:31 PM	0	9.9307	4.967	9/15/2021	11:33:24 AM	0	897.429	11.837	0.78	25.56	1008.12
9/15/2021	1:01:31 PM	0	9.9309	4.967	9/15/2021	12:33:24 PM	0	897.315	10.816	0.78	25.56	1008.12
9/15/2021	2:01:31 PM	0	9.9305	4.967	9/15/2021	1:33:24 PM	0	897.296	12.404	0.78	25.56	1008.12
9/15/2021	3:01:31 PM	0	9.9305	4.967	9/15/2021	2:33:24 PM	0	897.438	12.256	0.78	25.56	1008.12
9/15/2021	4:01:31 PM	0	9.9308	4.967	9/15/2021	3:33:24 PM	0	897.414	15.2	0.78	25.56	1008.12
9/15/2021	5:01:31 PM	0	9.9299	4.967	9/15/2021	4:33:24 PM	0	897.274	12.065	0.78	25.56	1008.12
9/15/2021	6:01:31 PM	0	9.9296	4.967	9/15/2021	5:33:24 PM	0	897.264	9.496	0.78	25.56	1008.12
9/15/2021	7:01:31 PM	0	9.9304	4.967	9/15/2021	6:33:24 PM	0	897.747	7.025	0.78	25.56	1008.12
9/15/2021	8:01:31 PM	0	9.9326	4.967	9/15/2021	7:33:24 PM	0	897.923	4.978	0.78	25.56	1008.12
9/15/2021	9:01:31 PM	0	9.9344	4.967	9/15/2021	8:33:24 PM	0	898.234	2.56	0.77	25.56	1008.12
9/15/2021	10:01:31 PM	0	9.9363	4.967	9/15/2021	9:33:24 PM	0	898.189	1.362	0.78	25.56	1008.12
9/15/2021	11:01:31 PM	0	9.9377	4.967	9/15/2021	10:33:24 PM	0	898.38	0.669	0.78	25.56	1008.12
9/16/2021	12:01:31 AM	0	9.9392	4.967	9/15/2021	11:33:24 PM	0	898.698	1.119	0.77	25.56	1008.12
9/16/2021	1:01:31 AM	0	9.9407	4.967	9/16/2021	12:33:24 AM	0	898.938	0.653	0.77	25.56	1008.12
9/16/2021	2:01:31 AM	0	9.9419	4.967	9/16/2021	1:33:24 AM	0	898.981	0.37	0.77	25.56	1008.12
9/16/2021	3:01:31 AM	0	9.9439	4.967	9/16/2021	2:33:24 AM	0	899.437	0.417	0.77	25.57	1008.11
9/16/2021	4:01:31 AM	0	9.9461	4.967	9/16/2021	3:33:24 AM	0	899.832	0.192	0.77	25.57	1008.11
9/16/2021	5:01:31 AM	0	9.9485	4.967	9/16/2021	4:33:24 AM	0	900.129	-0.274	0.77	25.57	1008.11
9/16/2021	6:01:31 AM	0	9.9502	4.968	9/16/2021	5:33:24 AM	0	900.227	-0.736	0.77	25.57	1008.11
9/16/2021	7:01:31 AM	0	9.9515	4.967	9/16/2021	6:33:24 AM	0	900.458	-0.724	0.77	25.57	1008.11
9/16/2021	8:01:31 AM	0	9.9533	4.967	9/16/2021	7:33:24 AM	0	900.879	-1.016	0.77	25.57	1008.11
9/16/2021	9:01:31 AM	0	9.9547	4.967	9/16/2021	8:33:24 AM	0	901.011	-0.612	0.77	25.57	1008.11
9/16/2021	10:01:31 AM	0	9.954	4.967	9/16/2021	9:33:24 AM	0	901.529	11.547	0.76	25.58	1008.10
9/16/2021	11:01:31 AM	0	9.9519	4.967	9/16/2021	10:33:24 AM	0	901.397	18.527	0.76	25.58	1008.10
9/16/2021	12:01:31 PM	0	9.9505	4.968	9/16/2021	11:33:24 AM	0	901.029	15.144	0.76	25.57	1008.11
9/16/2021	1:01:31 PM	0	9.9474	4.967	9/16/2021	12:33:24 PM	0	900.377	15.195	0.77	25.57	1008.11
9/16/2021	2:01:31 PM	0	9.9433	4.967	9/16/2021	1:33:24 PM	0	900.044	18.615	0.77	25.57	1008.11
9/16/2021	3:01:31 PM	0	9.939	4.967	9/16/2021	2:33:24 PM	0	899.375	17.763	0.77	25.57	1008.11
9/16/2021	4:01:31 PM	0	9.9331	4.967	9/16/2021	3:33:24 PM	0	898.638	18.529	0.77	25.57	1008.11
9/16/2021	5:01:31 PM	0	9.9269	4.967	9/16/2021	4:33:24 PM	0	898.017	13.006	0.77	25.57	1008.11
9/16/2021	6:01:31 PM	0	9.9206	4.967	9/16/2021	5:33:24 PM	0	897.412	10.664	0.77	25.57	1008.11
9/16/2021	7:01:31 PM	0	9.913	4.967	9/16/2021	6:33:24 PM	0	896.27	9.369	0.77	25.56	1008.12
9/16/2021	8:01:31 PM	0	9.9045	4.967	9/16/2021	7:33:24 PM	0	895.38	8.124	0.77	25.56	1008.12
9/16/2021	9:01:31 PM	0	9.897	4.967	9/16/2021	8:33:24 PM	0	894.608	7.37	0.77	25.56	1008.12
9/16/2021	10:01:31 PM	0	9.8889	4.967	9/16/2021	9:33:24 PM	0	893.719	7.159	0.78	25.56	1008.12
9/16/2021	11:01:31 PM	0	9.8803	4.967	9/16/2021	10:33:24 PM	0	892.841	7.177	0.78	25.56	1008.12
9/17/2021	12:01:31 AM	0	9.8723	4.967	9/16/2021	11:33:24 PM	0	892.281	7.102	0.77	25.56	1008.12
9/17/2021	1:01:31 AM	0	9.8647	4.967	9/17/2021	12:33:24 AM	0	891.402	6.972	0.77	25.56	1008.12
9/17/2021	2:01:31 AM	0	9.857	4.967	9/17/2021	1:33:24 AM	0	890.742	6.915	0.77	25.56	1008.12
9/17/2021	3:01:31 AM	0	9.8481	4.968	9/17/2021	2:33:24 AM	0	889.4	7.317	0.78	25.56	1008.12
9/17/2021	4:01:31 AM	0	9.8382	4.968	9/17/2021	3:33:24 AM	0	888.459	7.281	0.78	25.56	1008.12
9/17/2021	5:01:31 AM	0	9.83	4.967	9/17/2021	4:33:24 AM	0	888.073	6.771	0.77	25.56	1008.12
9/17/2021	6:01:31 AM	0	9.8257	4.967	9/17/2021	5:33:24 AM	0	888.505	6.291	0.77	25.57	1008.11
9/17/2021	7:01:31 AM	0	9.8228	4.967	9/17/2021	6:33:24 AM	0	888.111	4.538	0.77	25.57	1008.11
9/17/2021	8:01:31 AM	0	9.818	4.968	9/17/2021	7:33:24 AM	0	887.294	3.912	0.77	25.57	1008.11
9/17/2021	9:01:31 AM	0	9.8137	4.968	9/17/2021	8:33:24 AM	0	887.073	3.971	0.77	25.57	1008.11
9/17/2021	10:01:31 AM	0	9.8096	4.967	9/17/2021	9:33:24 AM	0	886.77	3.974	0.77	25.57	1008.11
9/17/2021	11:01:31 AM	0	9.8047	4.967	9/17/2021	10:33:24 AM	0	886.212	3.92	0.77	25.57	1008.11
9/17/2021	12:01:31 PM	0	9.7999	4.967	9/17/2021	11:33:24 AM	0	885.891	4.277	0.77	25.57	1008.11
9/17/2021	1:01:31 PM	0	9.7962	4.966	9/17/2021	12:33:24 PM	0	885.898	4.496	0.76	25.57	1008.11
9/17/2021	2:01:31 PM	0	9.7936	4.968	9/17/2021	1:33:24 PM	0	885.656	4.554	0.76	25.57	1008.11
9/17/2021	3:01:31 PM	0	9.7896	4.967	9/17/2021	2:33:24 PM	0	884.96	4.716	0.77	25.57	1008.11
9/17/2021	4:01:31 PM	0	9.7845	4.967	9/17/2021	3:33:24 PM	0	884.431	4.493	0.77	25.57	1008.11

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/17/2021	5:01:31 PM	0	9.7789	4.967	9/17/2021	4:33:24 PM	0	883.384	4.336	0.77	25.57	1008.11
9/17/2021	6:01:31 PM	0	9.7712	4.967	9/17/2021	5:33:24 PM	0	882.478	3.89	0.77	25.56	1008.12
9/17/2021	7:01:31 PM	0	9.7624	4.967	9/17/2021	6:33:24 PM	0	881.063	3.407	0.78	25.56	1008.12
9/17/2021	8:01:31 PM	0	9.7529	4.967	9/17/2021	7:33:24 PM	0	880.215	3.194	0.78	25.56	1008.12
9/17/2021	9:01:31 PM	0	9.7448	4.967	9/17/2021	8:33:24 PM	0	879.822	3.152	0.77	25.56	1008.12
9/17/2021	10:01:31 PM	0	9.7375	4.968	9/17/2021	9:33:24 PM	0	879.319	3.266	0.77	25.57	1008.11
9/17/2021	11:01:31 PM	0	9.7315	4.968	9/17/2021	10:33:24 PM	0	878.52	3.534	0.77	25.56	1008.12
9/18/2021	12:01:31 AM	0	9.7267	4.967	9/17/2021	11:33:24 PM	0	878.923	3.905	0.76	25.57	1008.11
9/18/2021	1:01:31 AM	0	9.7238	4.968	9/18/2021	12:33:24 AM	0	878.909	4.276	0.76	25.58	1008.10
9/18/2021	2:01:31 AM	0	9.7207	4.967	9/18/2021	1:33:24 AM	0	878.474	4.663	0.76	25.57	1008.11
9/18/2021	3:01:31 AM	0	9.718	4.968	9/18/2021	2:33:24 AM	0	878.451	5.028	0.76	25.58	1008.10
9/18/2021	4:01:31 AM	0	9.7157	4.967	9/18/2021	3:33:24 AM	0	878.364	5.242	0.76	25.58	1008.10
9/18/2021	5:01:31 AM	0	9.7153	4.967	9/18/2021	4:33:24 AM	0	878.882	5.486	0.75	25.58	1008.10
9/18/2021	6:01:31 AM	0	9.7163	4.967	9/18/2021	5:33:24 AM	0	879.243	5.173	0.75	25.59	1008.09
9/18/2021	7:01:31 AM	0	9.718	4.966	9/18/2021	6:33:24 AM	0	879.544	4.922	0.75	25.59	1008.09
9/18/2021	8:01:31 AM	0	9.7204	4.967	9/18/2021	7:33:24 AM	0	879.853	5.49	0.75	25.59	1008.09
9/18/2021	9:01:31 AM	0	9.723	4.967	9/18/2021	8:33:24 AM	0	880.609	5.926	0.74	25.59	1008.09
9/18/2021	10:01:31 AM	0	9.7249	4.967	9/18/2021	9:33:24 AM	0	881.117	15.591	0.74	25.60	1008.08
9/18/2021	11:01:31 AM	0	9.7285	4.967	9/18/2021	10:33:24 AM	0	881.665	16.717	0.74	25.60	1008.08
9/18/2021	12:01:31 PM	0	9.7321	4.968	9/18/2021	11:33:24 AM	0	882.169	18.512	0.74	25.60	1008.08
9/18/2021	1:01:31 PM	0	9.7366	4.967	9/18/2021	12:33:24 PM	0	882.669	17.094	0.74	25.60	1008.08
9/18/2021	2:01:31 PM	0	9.7408	4.967	9/18/2021	1:33:24 PM	0	883.028	16.174	0.74	25.60	1008.08
9/18/2021	3:01:31 PM	0	9.7437	4.967	9/18/2021	2:33:24 PM	0	883.319	15.94	0.74	25.60	1008.08
9/18/2021	4:01:31 PM	0	9.7471	4.967	9/18/2021	3:33:24 PM	0	883.652	16.503	0.74	25.60	1008.08
9/18/2021	5:01:31 PM	0	9.7502	4.968	9/18/2021	4:33:24 PM	0	884.275	13.843	0.73	25.60	1008.08
9/18/2021	6:01:31 PM	0	9.7546	4.968	9/18/2021	5:33:24 PM	0	884.692	11.542	0.73	25.60	1008.08
9/18/2021	7:01:31 PM	0	9.7585	4.967	9/18/2021	6:33:24 PM	0	885.288	10.096	0.73	25.61	1008.07
9/18/2021	8:01:31 PM	0	9.7631	4.967	9/18/2021	7:33:24 PM	0	885.929	7.712	0.73	25.61	1008.07
9/18/2021	9:01:31 PM	0	9.7681	4.968	9/18/2021	8:33:24 PM	0	886.521	5.715	0.73	25.61	1008.07
9/18/2021	10:01:31 PM	0	9.7731	4.967	9/18/2021	9:33:24 PM	0	887.088	4.684	0.73	25.61	1008.07
9/18/2021	11:01:31 PM	0	9.7787	4.967	9/18/2021	10:33:24 PM	0	887.754	4.671	0.73	25.61	1008.07
9/19/2021	12:01:31 AM	0	9.7844	4.967	9/18/2021	11:33:24 PM	0	888.414	4.808	0.73	25.61	1008.07
9/19/2021	1:01:31 AM	0	9.7886	4.967	9/19/2021	12:33:24 AM	0	888.708	4.638	0.73	25.61	1008.07
9/19/2021	2:01:31 AM	0	9.7929	4.967	9/19/2021	1:33:24 AM	0	889.123	4.229	0.73	25.61	1008.07
9/19/2021	3:01:31 AM	0	9.7965	4.967	9/19/2021	2:33:24 AM	0	889.469	4.541	0.73	25.61	1008.07
9/19/2021	4:01:31 AM	0	9.7994	4.967	9/19/2021	3:33:24 AM	0	889.853	4.968	0.73	25.61	1008.07
9/19/2021	5:01:31 AM	0	9.8025	4.968	9/19/2021	4:33:24 AM	0	890.191	4.8	0.73	25.61	1008.07
9/19/2021	6:01:31 AM	0	9.8052	4.967	9/19/2021	5:33:24 AM	0	890.547	4.616	0.72	25.61	1008.07
9/19/2021	7:01:31 AM	0	9.8078	4.967	9/19/2021	6:33:24 AM	0	891.033	4.509	0.72	25.62	1008.06
9/19/2021	8:01:31 AM	0	9.8125	4.967	9/19/2021	7:33:24 AM	0	891.747	4.466	0.72	25.62	1008.06
9/19/2021	9:01:31 AM	0	9.8166	4.968	9/19/2021	8:33:24 AM	0	892.332	4.875	0.72	25.62	1008.06
9/19/2021	10:01:31 AM	0	9.8206	4.969	9/19/2021	9:33:24 AM	0	893.057	6.698	0.71	25.62	1008.06
9/19/2021	11:01:31 AM	0	9.8238	4.967	9/19/2021	10:33:24 AM	0	893.496	15.5	0.71	25.62	1008.06
9/19/2021	12:01:31 PM	0	9.8265	4.967	9/19/2021	11:33:24 AM	0	893.796	16.442	0.71	25.62	1008.06
9/19/2021	1:01:31 PM	0	9.8296	4.967	9/19/2021	12:33:24 PM	0	894.149	14.314	0.71	25.63	1008.05
9/19/2021	2:01:31 PM	0	9.8319	4.967	9/19/2021	1:33:24 PM	0	894.041	20.3	0.72	25.62	1008.06
9/19/2021	3:01:31 PM	0	9.8336	4.967	9/19/2021	2:33:24 PM	0	894.268	18.148	0.71	25.62	1008.06
9/19/2021	4:01:31 PM	0	9.8344	4.967	9/19/2021	3:33:24 PM	0	894.328	15.848	0.71	25.62	1008.06
9/19/2021	5:01:31 PM	0	9.8363	4.968	9/19/2021	4:33:24 PM	0	894.703	13.323	0.71	25.62	1008.06
9/19/2021	6:01:31 PM	0	9.8377	4.968	9/19/2021	5:33:24 PM	0	895.032	11.206	0.71	25.63	1008.05
9/19/2021	7:01:31 PM	0	9.8425	4.968	9/19/2021	6:33:24 PM	0	896.599	9.35	0.70	25.64	1008.04
9/19/2021	8:01:31 PM	0	9.849	4.968	9/19/2021	7:33:24 PM	0	897.103	6.279	0.70	25.64	1008.04
9/19/2021	9:01:31 PM	0	9.8553	4.967	9/19/2021	8:33:24 PM	0	897.809	5.221	0.70	25.64	1008.04
9/19/2021	10:01:31 PM	0	9.8626	4.967	9/19/2021	9:33:24 PM	0	898.745	4.842	0.70	25.64	1008.04
9/19/2021	11:01:31 PM	0	9.8695	4.968	9/19/2021	10:33:24 PM	0	899.687	4.432	0.70	25.64	1008.04
9/20/2021	12:01:31 AM	0	9.876	4.967	9/19/2021	11:33:24 PM	0	900.124	4.793	0.70	25.64	1008.04
9/20/2021	1:01:31 AM	0	9.8802	4.967	9/20/2021	12:33:24 AM	0	900.356	4.631	0.70	25.64	1008.04
9/20/2021	2:01:31 AM	0	9.8859	4.968	9/20/2021	1:33:24 AM	0	901.252	3.39	0.70	25.64	1008.04
9/20/2021	3:01:31 AM	0	9.8909	4.967	9/20/2021	2:33:24 AM	0	901.71	3.058	0.70	25.64	1008.04
9/20/2021	4:01:31 AM	0	9.8954	4.967	9/20/2021	3:33:24 AM	0	902.074	3.416	0.70	25.64	1008.04
9/20/2021	5:01:31 AM	0	9.8998	4.967	9/20/2021	4:33:24 AM	0	902.711	4.09	0.69	25.64	1008.04
9/20/2021	6:01:31 AM	0	9.9043	4.968	9/20/2021	5:33:24 AM	0	903.384	4.39	0.69	25.64	1008.04
9/20/2021	7:01:31 AM	0	9.9083	4.968	9/20/2021	6:33:24 AM	0	903.839	4.469	0.69	25.65	1008.03
9/20/2021	8:01:31 AM	0	9.9125	4.967	9/20/2021	7:33:24 AM	0	904.35	4.723	0.69	25.65	1008.03
9/20/2021	9:01:31 AM	0	9.9162	4.968	9/20/2021	8:33:24 AM	0	904.841	5.373	0.69	25.65	1008.03
9/20/2021	10:01:31 AM	0	9.9196	4.967	9/20/2021	9:33:24 AM	0	905.249	7.003	0.69	25.65	1008.03
9/20/2021	11:01:31 AM	0	9.9222	4.968	9/20/2021	10:33:24 AM	0	905.553	8.869	0.69	25.65	1008.03
9/20/2021	12:01:31 PM	0	9.9232	4.968	9/20/2021	11:33:24 AM	0	905.58	11.22	0.69	25.65	1008.03
9/20/2021	1:01:31 PM	0	9.9238	4.967	9/20/2021	12:33:24 PM	0	905.57	11.637	0.69	25.65	1008.03
9/20/2021	2:01:31 PM	0	9.9241	4.968	9/20/2021	1:33:24 PM	0	905.759	11.325	0.69	25.65	1008.03

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/20/2021	3:01:31 PM	0	9.9228	4.968	9/20/2021	2:33:24 PM	0	905.092	11.599	0.69	25.64	1008.04
9/20/2021	4:01:31 PM	0	9.9199	4.967	9/20/2021	3:33:24 PM	0	904.917	11.663	0.69	25.64	1008.04
9/20/2021	5:01:31 PM	0	9.9189	4.967	9/20/2021	4:33:24 PM	0	905.068	9.929	0.69	25.65	1008.03
9/20/2021	6:01:31 PM	0	9.9186	4.968	9/20/2021	5:33:24 PM	0	905.154	8.638	0.69	25.65	1008.03
9/20/2021	7:01:31 PM	0	9.9176	4.967	9/20/2021	6:33:24 PM	0	904.915	7.326	0.69	25.65	1008.03
9/20/2021	8:01:31 PM	0	9.9168	4.967	9/20/2021	7:33:24 PM	0	904.816	6.636	0.69	25.65	1008.03
9/20/2021	9:01:31 PM	0	9.915	4.968	9/20/2021	8:33:24 PM	0	904.76	6.517	0.69	25.65	1008.03
9/20/2021	10:01:31 PM	0	9.9142	4.968	9/20/2021	9:33:24 PM	0	904.99	6.653	0.69	25.65	1008.03
9/20/2021	11:01:31 PM	0	9.9121	4.968	9/20/2021	10:33:24 PM	0	904.131	6.607	0.69	25.64	1008.04
9/21/2021	12:01:31 AM	0	9.9092	4.967	9/20/2021	11:33:24 PM	0	904.303	6.618	0.69	25.65	1008.03
9/21/2021	1:01:31 AM	0	9.9072	4.967	9/21/2021	12:33:24 AM	0	903.94	6.572	0.69	25.65	1008.03
9/21/2021	2:01:31 AM	0	9.9041	4.967	9/21/2021	1:33:24 AM	0	903.661	6.367	0.69	25.65	1008.03
9/21/2021	3:01:31 AM	0	9.9017	4.967	9/21/2021	2:33:24 AM	0	903.621	6.247	0.69	25.65	1008.03
9/21/2021	4:01:31 AM	0	9.8991	4.967	9/21/2021	3:33:24 AM	0	903.284	6.255	0.69	25.65	1008.03
9/21/2021	5:01:31 AM	0	9.8954	4.967	9/21/2021	4:33:24 AM	0	902.699	6.327	0.69	25.65	1008.03
9/21/2021	6:01:31 AM	0	9.8924	4.968	9/21/2021	5:33:24 AM	0	902.823	6.472	0.69	25.65	1008.03
9/21/2021	7:01:31 AM	0	9.8904	4.968	9/21/2021	6:33:24 AM	0	902.874	6.524	0.68	25.65	1008.03
9/21/2021	8:01:31 AM	0	9.8888	4.968	9/21/2021	7:33:24 AM	0	902.783	6.59	0.68	25.65	1008.03
9/21/2021	9:01:31 AM	0	9.8881	4.967	9/21/2021	8:33:24 AM	0	902.961	6.913	0.68	25.66	1008.02
9/21/2021	10:01:31 AM	0	9.8872	4.968	9/21/2021	9:33:24 AM	0	902.894	7.591	0.68	25.66	1008.02
9/21/2021	11:01:31 AM	0	9.8855	4.968	9/21/2021	10:33:24 AM	0	902.536	8.716	0.68	25.66	1008.02
9/21/2021	12:01:31 PM	0	9.8818	4.968	9/21/2021	11:33:24 AM	0	902.207	9.431	0.68	25.66	1008.02
9/21/2021	1:01:31 PM	0	9.8765	4.968	9/21/2021	12:33:24 PM	0	901.513	9.27	0.68	25.65	1008.03
9/21/2021	2:01:31 PM	0	9.8716	4.967	9/21/2021	1:33:24 PM	0	901.052	9.691	0.68	25.65	1008.03
9/21/2021	3:01:31 PM	0	9.8655	4.967	9/21/2021	2:33:24 PM	0	900.201	10.672	0.69	25.65	1008.03
9/21/2021	4:01:31 PM	0	9.8592	4.967	9/21/2021	3:33:24 PM	0	899.682	10.891	0.68	25.65	1008.03
9/21/2021	5:01:31 PM	0	9.8533	4.968	9/21/2021	4:33:24 PM	0	899.235	10.913	0.68	25.65	1008.03
9/21/2021	6:01:31 PM	0	9.8473	4.967	9/21/2021	5:33:24 PM	0	898.55	10.313	0.68	25.65	1008.03
9/21/2021	7:01:31 PM	0	9.8414	4.968	9/21/2021	6:33:24 PM	0	897.966	10.243	0.68	25.65	1008.03
9/21/2021	8:01:31 PM	0	9.8359	4.968	9/21/2021	7:33:24 PM	0	897.632	10.041	0.68	25.65	1008.03
9/21/2021	9:01:31 PM	0	9.8315	4.968	9/21/2021	8:33:24 PM	0	897.413	9.832	0.68	25.66	1008.02
9/21/2021	10:01:31 PM	0	9.8278	4.968	9/21/2021	9:33:24 PM	0	897.257	9.606	0.68	25.66	1008.02
9/21/2021	11:01:31 PM	0	9.824	4.968	9/21/2021	10:33:24 PM	0	896.57	9.694	0.68	25.66	1008.02
9/22/2021	12:01:31 AM	0	9.8203	4.968	9/21/2021	11:33:24 PM	0	896.489	9.429	0.68	25.66	1008.02
9/22/2021	1:01:31 AM	0	9.8182	4.968	9/22/2021	12:33:24 AM	0	896.517	8.849	0.68	25.66	1008.02
9/22/2021	2:01:31 AM	0	9.8171	4.968	9/22/2021	1:33:24 AM	0	896.887	8.491	0.67	25.67	1008.01
9/22/2021	3:01:31 AM	0	9.818	4.968	9/22/2021	2:33:24 AM	0	897.092	8.342	0.67	25.67	1008.01
9/22/2021	4:01:31 AM	0	9.8183	4.967	9/22/2021	3:33:24 AM	0	897.148	8.25	0.67	25.67	1008.01
9/22/2021	5:01:31 AM	0	9.8187	4.968	9/22/2021	4:33:24 AM	0	897.27	8.176	0.67	25.67	1008.01
9/22/2021	6:01:31 AM	0	9.8204	4.968	9/22/2021	5:33:24 AM	0	897.728	8.383	0.67	25.67	1008.01
9/22/2021	7:01:31 AM	0	9.8219	4.968	9/22/2021	6:33:24 AM	0	897.765	8.472	0.67	25.67	1008.01
9/22/2021	8:01:31 AM	0	9.8232	4.968	9/22/2021	7:33:24 AM	0	898.218	8.428	0.66	25.67	1008.01
9/22/2021	9:01:31 AM	0	9.825	4.968	9/22/2021	8:33:24 AM	0	898.477	8.565	0.66	25.67	1008.01
9/22/2021	10:01:31 AM	0	9.8271	4.967	9/22/2021	9:33:24 AM	0	899.039	11.53	0.66	25.68	1008.00
9/22/2021	11:01:31 AM	0	9.829	4.968	9/22/2021	10:33:24 AM	0	899.265	17.968	0.66	25.68	1008.00
9/22/2021	12:01:31 PM	0	9.8308	4.968	9/22/2021	11:33:24 AM	0	899.43	17.198	0.66	25.68	1008.00
9/22/2021	1:01:31 PM	0	9.8317	4.968	9/22/2021	12:33:24 PM	0	899.229	16.006	0.66	25.68	1008.00
9/22/2021	2:01:31 PM	0	9.8322	4.968	9/22/2021	1:33:24 PM	0	899.62	17.035	0.66	25.68	1008.00
9/22/2021	3:01:31 PM	0	9.8333	4.968	9/22/2021	2:33:24 PM	0	899.24	22.511	0.66	25.67	1008.01
9/22/2021	4:01:31 PM	0	9.8348	4.968	9/22/2021	3:33:24 PM	0	899.737	17.667	0.66	25.68	1008.00
9/22/2021	5:01:31 PM	0	9.8349	4.968	9/22/2021	4:33:24 PM	0	899.745	15.339	0.66	25.68	1008.00
9/22/2021	6:01:31 PM	0	9.835	4.967	9/22/2021	5:33:24 PM	0	899.832	12.369	0.66	25.68	1008.00
9/22/2021	7:01:31 PM	0	9.8354	4.968	9/22/2021	6:33:24 PM	0	900.171	9.599	0.66	25.68	1008.00
9/22/2021	8:01:31 PM	0	9.8378	4.968	9/22/2021	7:33:24 PM	0	900.572	7.317	0.65	25.68	1008.00
9/22/2021	9:01:31 PM	0	9.8425	4.968	9/22/2021	8:33:24 PM	0	901.889	5.92	0.65	25.69	1007.99
9/22/2021	10:01:31 PM	0	9.8486	4.968	9/22/2021	9:33:24 PM	0	902.465	5.501	0.65	25.69	1007.99
9/22/2021	11:01:31 PM	0	9.8528	4.968	9/22/2021	10:33:24 PM	0	902.783	5.067	0.65	25.69	1007.99
9/23/2021	12:01:31 AM	0	9.8567	4.968	9/22/2021	11:33:24 PM	0	903.03	4.809	0.65	25.69	1007.99
9/23/2021	1:01:31 AM	0	9.8605	4.968	9/23/2021	12:33:24 AM	0	903.809	4.609	0.64	25.69	1007.99
9/23/2021	2:01:31 AM	0	9.8646	4.968	9/23/2021	1:33:24 AM	0	904.206	4.423	0.64	25.69	1007.99
9/23/2021	3:01:31 AM	0	9.8687	4.968	9/23/2021	2:33:24 AM	0	904.327	4.118	0.65	25.69	1007.99
9/23/2021	4:01:31 AM	0	9.8697	4.968	9/23/2021	3:33:24 AM	0	904.183	3.24	0.65	25.69	1007.99
9/23/2021	5:01:31 AM	0	9.8706	4.968	9/23/2021	4:33:24 AM	0	904.577	3.596	0.65	25.69	1007.99
9/23/2021	6:01:31 AM	0	9.8732	4.968	9/23/2021	5:33:24 AM	0	904.938	3.832	0.65	25.69	1007.99
9/23/2021	7:01:31 AM	0	9.8752	4.968	9/23/2021	6:33:24 AM	0	905.153	3.72	0.65	25.69	1007.99
9/23/2021	8:01:31 AM	0	9.8777	4.968	9/23/2021	7:33:24 AM	0	905.6	3.839	0.64	25.69	1007.99
9/23/2021	9:01:31 AM	0	9.8784	4.968	9/23/2021	8:33:24 AM	0	905.311	4.696	0.65	25.69	1007.99
9/23/2021	10:01:31 AM	0	9.8789	4.967	9/23/2021	9:33:24 AM	0	906.117	7.987	0.64	25.70	1007.98
9/23/2021	11:01:31 AM	0	9.8803	4.968	9/23/2021	10:33:24 AM	0	906.423	10.565	0.64	25.70	1007.98
9/23/2021	12:01:31 PM	0	9.8817	4.968	9/23/2021	11:33:24 AM	0	906.687	12.991	0.64	25.70	1007.98

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/23/2021	1:01:31 PM	0	9.8838	4.969	9/23/2021	12:33:24 PM	0	906.863	14.352	0.64	25.70	1007.98
9/23/2021	2:01:31 PM	0	9.8848	4.967	9/23/2021	1:33:24 PM	0	906.911	14.114	0.64	25.70	1007.98
9/23/2021	3:01:31 PM	0	9.8841	4.968	9/23/2021	2:33:24 PM	0	906.473	16.882	0.64	25.70	1007.98
9/23/2021	4:01:31 PM	0	9.8843	4.968	9/23/2021	3:33:24 PM	0	906.986	16.56	0.64	25.70	1007.98
9/23/2021	5:01:31 PM	0	9.8831	4.968	9/23/2021	4:33:24 PM	0	906.619	15.102	0.64	25.70	1007.98
9/23/2021	6:01:31 PM	0	9.881	4.968	9/23/2021	5:33:24 PM	0	906.151	13.797	0.64	25.70	1007.98
9/23/2021	7:01:31 PM	0	9.8793	4.968	9/23/2021	6:33:24 PM	0	906.203	12.107	0.64	25.70	1007.98
9/23/2021	8:01:31 PM	0	9.8787	4.967	9/23/2021	7:33:24 PM	0	906.355	9.864	0.64	25.70	1007.98
9/23/2021	9:01:31 PM	0	9.8772	4.968	9/23/2021	8:33:24 PM	0	906.177	8.453	0.64	25.70	1007.98
9/23/2021	10:01:31 PM	0	9.8762	4.968	9/23/2021	9:33:24 PM	0	906.201	7.941	0.64	25.70	1007.98
9/23/2021	11:01:31 PM	0	9.8746	4.968	9/23/2021	10:33:24 PM	0	905.911	7.787	0.64	25.70	1007.98
9/24/2021	12:01:31 AM	0	9.872	4.968	9/23/2021	11:33:24 PM	0	905.638	7.635	0.64	25.70	1007.98
9/24/2021	1:01:31 AM	0	9.8691	4.968	9/24/2021	12:33:24 AM	0	905.182	7.301	0.64	25.70	1007.98
9/24/2021	2:01:31 AM	0	9.8657	4.968	9/24/2021	1:33:24 AM	0	904.763	5.996	0.64	25.70	1007.98
9/24/2021	3:01:31 AM	0	9.8625	4.968	9/24/2021	2:33:24 AM	0	904.66	5.635	0.64	25.70	1007.98
9/24/2021	4:01:31 AM	0	9.8587	4.968	9/24/2021	3:33:24 AM	0	904.365	6.892	0.64	25.70	1007.98
9/24/2021	5:01:31 AM	0	9.855	4.968	9/24/2021	4:33:24 AM	0	903.84	7.805	0.64	25.70	1007.98
9/24/2021	6:01:31 AM	0	9.85	4.968	9/24/2021	5:33:24 AM	0	903.622	8.024	0.64	25.70	1007.98
9/24/2021	7:01:31 AM	0	9.8455	4.968	9/24/2021	6:33:24 AM	0	903.1	7.833	0.64	25.70	1007.98
9/24/2021	8:01:31 AM	0	9.8408	4.968	9/24/2021	7:33:24 AM	0	902.589	7.89	0.64	25.70	1007.98
9/24/2021	9:01:31 AM	0	9.8364	4.968	9/24/2021	8:33:24 AM	0	902.381	9.355	0.63	25.70	1007.98
9/24/2021	10:01:31 AM	0	9.8328	4.968	9/24/2021	9:33:24 AM	0	902.431	12.011	0.63	25.71	1007.97
9/24/2021	11:01:31 AM	0	9.8281	4.968	9/24/2021	10:33:24 AM	0	901.414	22.375	0.64	25.70	1007.98
9/24/2021	12:01:31 PM	0	9.8234	4.968	9/24/2021	11:33:24 AM	0	900.787	19.849	0.64	25.70	1007.98
9/24/2021	1:01:31 PM	0	9.8174	4.968	9/24/2021	12:33:24 PM	0	900.077	20.542	0.64	25.70	1007.98
9/24/2021	2:01:31 PM	0	9.8106	4.968	9/24/2021	1:33:24 PM	0	899.255	20.807	0.64	25.70	1007.98
9/24/2021	3:01:31 PM	0	9.803	4.968	9/24/2021	2:33:24 PM	0	898.519	20.003	0.64	25.70	1007.98
9/24/2021	4:01:31 PM	0	9.7956	4.968	9/24/2021	3:33:24 PM	0	897.639	18.855	0.64	25.69	1007.99
9/24/2021	5:01:31 PM	0	9.7886	4.968	9/24/2021	4:33:24 PM	0	897.118	17.852	0.64	25.70	1007.98
9/24/2021	6:01:31 PM	0	9.7809	4.967	9/24/2021	5:33:24 PM	0	896.368	16.294	0.64	25.70	1007.98
9/24/2021	7:01:31 PM	0	9.7746	4.968	9/24/2021	6:33:24 PM	0	896.003	14.427	0.64	25.70	1007.98
9/24/2021	8:01:31 PM	0	9.7685	4.968	9/24/2021	7:33:24 PM	0	895.567	12.008	0.64	25.70	1007.98
9/24/2021	9:01:31 PM	0	9.7642	4.968	9/24/2021	8:33:24 PM	0	895.584	10.92	0.63	25.71	1007.97
9/24/2021	10:01:31 PM	0	9.7612	4.968	9/24/2021	9:33:24 PM	0	895.616	9.958	0.63	25.71	1007.97
9/24/2021	11:01:31 PM	0	9.7602	4.968	9/24/2021	10:33:24 PM	0	895.753	9.11	0.63	25.71	1007.97
9/25/2021	12:01:31 AM	0	9.7578	4.968	9/24/2021	11:33:24 PM	0	895.24	8.135	0.63	25.71	1007.97
9/25/2021	1:01:31 AM	0	9.7547	4.968	9/25/2021	12:33:24 AM	0	894.97	7.334	0.63	25.71	1007.97
9/25/2021	2:01:31 AM	0	9.7516	4.968	9/25/2021	1:33:24 AM	0	894.487	7.548	0.63	25.71	1007.97
9/25/2021	3:01:31 AM	0	9.748	4.968	9/25/2021	2:33:24 AM	0	894.313	8.223	0.63	25.71	1007.97
9/25/2021	4:01:31 AM	0	9.7442	4.968	9/25/2021	3:33:24 AM	0	893.951	8.396	0.63	25.71	1007.97
9/25/2021	5:01:31 AM	0	9.7414	4.968	9/25/2021	4:33:24 AM	0	894.079	8.308	0.62	25.71	1007.97
9/25/2021	6:01:31 AM	0	9.739	4.969	9/25/2021	5:33:24 AM	0	893.761	8.326	0.63	25.71	1007.97
9/25/2021	7:01:31 AM	0	9.7361	4.968	9/25/2021	6:33:24 AM	0	893.624	8.36	0.62	25.71	1007.97
9/25/2021	8:01:31 AM	0	9.735	4.968	9/25/2021	7:33:24 AM	0	893.69	8.465	0.62	25.72	1007.96
9/25/2021	9:01:31 AM	0	9.7334	4.968	9/25/2021	8:33:24 AM	0	893.72	9.162	0.62	25.72	1007.96
9/25/2021	10:01:31 AM	0	9.7337	4.969	9/25/2021	9:33:24 AM	0	894.051	10.726	0.62	25.72	1007.96
9/25/2021	11:01:31 AM	0	9.733	4.968	9/25/2021	10:33:24 AM	0	893.852	12.119	0.62	25.72	1007.96
9/25/2021	12:01:31 PM	0	9.73	4.968	9/25/2021	11:33:24 AM	0	892.944	14.022	0.62	25.71	1007.97
9/25/2021	1:01:31 PM	0	9.7271	4.968	9/25/2021	12:33:24 PM	0	892.968	15.978	0.62	25.72	1007.96
9/25/2021	2:01:31 PM	0	9.7233	4.968	9/25/2021	1:33:24 PM	0	892.453	17.176	0.62	25.71	1007.97
9/25/2021	3:01:31 PM	0	9.7187	4.969	9/25/2021	2:33:24 PM	0	891.807	17.039	0.62	25.71	1007.97
9/25/2021	4:01:31 PM	0	9.7126	4.968	9/25/2021	3:33:24 PM	0	891.006	16.662	0.63	25.71	1007.97
9/25/2021	5:01:31 PM	0	9.7065	4.968	9/25/2021	4:33:24 PM	0	890.346	16.456	0.63	25.71	1007.97
9/25/2021	6:01:31 PM	0	9.7016	4.968	9/25/2021	5:33:24 PM	0	890.689	14.438	0.62	25.72	1007.96
9/25/2021	7:01:31 PM	0	9.6964	4.968	9/25/2021	6:33:24 PM	0	889.57	12.075	0.63	25.71	1007.97
9/25/2021	8:01:31 PM	0	9.6925	4.969	9/25/2021	7:33:24 PM	0	889.623	10.983	0.62	25.72	1007.96
9/25/2021	9:01:31 PM	0	9.6897	4.968	9/25/2021	8:33:24 PM	0	889.355	10.517	0.62	25.72	1007.96
9/25/2021	10:01:31 PM	0	9.6864	4.968	9/25/2021	9:33:24 PM	0	889.316	10.035	0.62	25.72	1007.96
9/25/2021	11:01:31 PM	0	9.6841	4.969	9/25/2021	10:33:24 PM	0	889.039	9.941	0.62	25.72	1007.96
9/26/2021	12:01:31 AM	0	9.6808	4.968	9/25/2021	11:33:24 PM	0	888.742	9.797	0.62	25.72	1007.96
9/26/2021	1:01:31 AM	0	9.6758	4.968	9/26/2021	12:33:24 AM	0	887.906	9.735	0.62	25.72	1007.96
9/26/2021	2:01:31 AM	0	9.6706	4.968	9/26/2021	1:33:24 AM	0	887.518	9.715	0.62	25.72	1007.96
9/26/2021	3:01:31 AM	0	9.667	4.968	9/26/2021	2:33:24 AM	0	887.793	9.765	0.61	25.72	1007.96
9/26/2021	4:01:31 AM	0	9.6639	4.968	9/26/2021	3:33:24 AM	0	887.28	9.614	0.62	25.72	1007.96
9/26/2021	5:01:31 AM	0	9.6621	4.968	9/26/2021	4:33:24 AM	0	887.329	9.24	0.61	25.72	1007.96
9/26/2021	6:01:31 AM	0	9.6614	4.968	9/26/2021	5:33:24 AM	0	887.542	8.909	0.61	25.73	1007.95
9/26/2021	7:01:31 AM	0	9.6616	4.968	9/26/2021	6:33:24 AM	0	887.623	8.518	0.61	25.73	1007.95
9/26/2021	8:01:31 AM	0	9.6606	4.968	9/26/2021	7:33:24 AM	0	887.502	8.197	0.61	25.73	1007.95
9/26/2021	9:01:31 AM	0	9.6596	4.968	9/26/2021	8:33:24 AM	0	887.471	8.238	0.61	25.73	1007.95
9/26/2021	10:01:31 AM	0	9.6579	4.968	9/26/2021	9:33:24 AM	0	887.468	14.177	0.61	25.73	1007.95

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/26/2021	11:01:31 AM	0	9.6584	4.968	9/26/2021	10:33:24 AM	0	887.872	13.02	0.60	25.73	1007.95
9/26/2021	12:01:31 PM	0	9.659	4.968	9/26/2021	11:33:24 AM	0	888.071	13.73	0.60	25.73	1007.95
9/26/2021	1:01:31 PM	0	9.6592	4.968	9/26/2021	12:33:24 PM	0	888.036	14.311	0.60	25.73	1007.95
9/26/2021	2:01:31 PM	0	9.6578	4.968	9/26/2021	1:33:24 PM	0	887.509	18.19	0.61	25.73	1007.95
9/26/2021	3:01:31 PM	0	9.6536	4.968	9/26/2021	2:33:24 PM	0	886.158	22.633	0.62	25.72	1007.96
9/26/2021	4:01:31 PM	0	9.6501	4.968	9/26/2021	3:33:24 PM	0	885.999	19.151	0.62	25.72	1007.96
9/26/2021	5:01:31 PM	0	9.6465	4.968	9/26/2021	4:33:24 PM	0	886.129	15.675	0.61	25.73	1007.95
9/26/2021	6:01:31 PM	0	9.6428	4.969	9/26/2021	5:33:24 PM	0	885.938	14.17	0.61	25.73	1007.95
9/26/2021	7:01:31 PM	0	9.6401	4.968	9/26/2021	6:33:24 PM	0	885.72	12.512	0.61	25.73	1007.95
9/26/2021	8:01:31 PM	0	9.6357	4.968	9/26/2021	7:33:24 PM	0	885.021	11.438	0.61	25.73	1007.95
9/26/2021	9:01:31 PM	0	9.6302	4.968	9/26/2021	8:33:24 PM	0	884.322	11.133	0.61	25.72	1007.96
9/26/2021	10:01:31 PM	0	9.624	4.968	9/26/2021	9:33:24 PM	0	883.784	11.12	0.61	25.73	1007.95
9/26/2021	11:01:31 PM	0	9.6176	4.968	9/26/2021	10:33:24 PM	0	883.203	10.481	0.61	25.73	1007.95
9/27/2021	12:01:31 AM	0	9.6142	4.968	9/26/2021	11:33:24 PM	0	883.268	10.104	0.61	25.73	1007.95
9/27/2021	1:01:31 AM	0	9.6084	4.968	9/27/2021	12:33:24 AM	0	882.077	8.677	0.61	25.72	1007.96
9/27/2021	2:01:31 AM	0	9.6019	4.968	9/27/2021	1:33:24 AM	0	881.212	8.506	0.62	25.72	1007.96
9/27/2021	3:01:31 AM	0	9.5966	4.968	9/27/2021	2:33:24 AM	0	881.63	8.703	0.61	25.73	1007.95
9/27/2021	4:01:31 AM	0	9.5931	4.968	9/27/2021	3:33:24 AM	0	881.334	8.928	0.61	25.73	1007.95
9/27/2021	5:01:31 AM	0	9.5914	4.968	9/27/2021	4:33:24 AM	0	881.65	9.021	0.60	25.74	1007.94
9/27/2021	6:01:31 AM	0	9.5908	4.968	9/27/2021	5:33:24 AM	0	881.808	8.817	0.60	25.74	1007.94
9/27/2021	7:01:31 AM	0	9.5918	4.968	9/27/2021	6:33:24 AM	0	882.418	9.355	0.59	25.74	1007.94
9/27/2021	8:01:31 AM	0	9.5949	4.968	9/27/2021	7:33:24 AM	0	883.165	9.017	0.59	25.75	1007.93
9/27/2021	9:01:31 AM	0	9.599	4.968	9/27/2021	8:33:24 AM	0	883.828	8.893	0.59	25.75	1007.93
9/27/2021	10:01:31 AM	0	9.6017	4.968	9/27/2021	9:33:24 AM	0	884.161	19.373	0.59	25.75	1007.93
9/27/2021	11:01:31 AM	0	9.6041	4.969	9/27/2021	10:33:24 AM	0	883.946	24.201	0.59	25.75	1007.93
9/27/2021	12:01:31 PM	0	9.6057	4.968	9/27/2021	11:33:24 AM	0	884.031	20.321	0.59	25.75	1007.93
9/27/2021	1:01:31 PM	0	9.6074	4.969	9/27/2021	12:33:24 PM	0	884.089	17.322	0.59	25.75	1007.93
9/27/2021	2:01:31 PM	0	9.6057	4.968	9/27/2021	1:33:24 PM	0	883.552	18.787	0.60	25.74	1007.94
9/27/2021	3:01:31 PM	0	9.6053	4.968	9/27/2021	2:33:24 PM	0	884.086	17.469	0.59	25.75	1007.93
9/27/2021	4:01:31 PM	0	9.6048	4.968	9/27/2021	3:33:24 PM	0	883.854	16.576	0.59	25.75	1007.93
9/27/2021	5:01:31 PM	0	9.6039	4.968	9/27/2021	4:33:24 PM	0	883.879	14.376	0.59	25.75	1007.93
9/27/2021	6:01:31 PM	0	9.6032	4.969	9/27/2021	5:33:24 PM	0	883.884	12.231	0.59	25.75	1007.93
9/27/2021	7:01:31 PM	0	9.6039	4.969	9/27/2021	6:33:24 PM	0	884.439	10.708	0.59	25.75	1007.93
9/27/2021	8:01:31 PM	0	9.6057	4.968	9/27/2021	7:33:24 PM	0	884.756	8.794	0.58	25.75	1007.93
9/27/2021	9:01:31 PM	0	9.6069	4.968	9/27/2021	8:33:24 PM	0	884.771	8.394	0.58	25.75	1007.93
9/27/2021	10:01:31 PM	0	9.6089	4.968	9/27/2021	9:33:24 PM	0	885.032	6.576	0.58	25.75	1007.93
9/27/2021	11:01:31 PM	0	9.611	4.969	9/27/2021	10:33:24 PM	0	885.594	5.075	0.58	25.76	1007.92
9/28/2021	12:01:31 AM	0	9.6144	4.968	9/27/2021	11:33:24 PM	0	886.03	4.129	0.58	25.76	1007.92
9/28/2021	1:01:31 AM	0	9.6175	4.968	9/28/2021	12:33:24 AM	0	886.389	4.055	0.58	25.76	1007.92
9/28/2021	2:01:31 AM	0	9.6203	4.968	9/28/2021	1:33:24 AM	0	886.813	4.307	0.58	25.76	1007.92
9/28/2021	3:01:31 AM	0	9.624	4.968	9/28/2021	2:33:24 AM	0	887.327	4.68	0.58	25.76	1007.92
9/28/2021	4:01:31 AM	0	9.627	4.968	9/28/2021	3:33:24 AM	0	887.851	5.11	0.57	25.76	1007.92
9/28/2021	5:01:31 AM	0	9.63	4.968	9/28/2021	4:33:24 AM	0	888.115	5.233	0.57	25.76	1007.92
9/28/2021	6:01:31 AM	0	9.6332	4.968	9/28/2021	5:33:24 AM	0	888.543	5.257	0.57	25.76	1007.92
9/28/2021	7:01:31 AM	0	9.6373	4.968	9/28/2021	6:33:24 AM	0	889.41	5.381	0.57	25.77	1007.91
9/28/2021	8:01:31 AM	0	9.6416	4.968	9/28/2021	7:33:24 AM	0	889.792	5.064	0.57	25.77	1007.91
9/28/2021	9:01:31 AM	0	9.6451	4.969	9/28/2021	8:33:24 AM	0	890.091	5.317	0.57	25.77	1007.91
9/28/2021	10:01:31 AM	0	9.6484	4.968	9/28/2021	9:33:24 AM	0	890.665	6.427	0.57	25.77	1007.91
9/28/2021	11:01:31 AM	0	9.6514	4.969	9/28/2021	10:33:24 AM	0	890.99	7.826	0.57	25.77	1007.91
9/28/2021	12:01:31 PM	0	9.6541	4.969	9/28/2021	11:33:24 AM	0	891.381	9.651	0.56	25.77	1007.91
9/28/2021	1:01:31 PM	0	9.6561	4.969	9/28/2021	12:33:24 PM	0	891.511	9.992	0.57	25.77	1007.91
9/28/2021	2:01:31 PM	0	9.6565	4.969	9/28/2021	1:33:24 PM	0	891.202	13.148	0.57	25.77	1007.91
9/28/2021	3:01:31 PM	0	9.6548	4.968	9/28/2021	2:33:24 PM	0	890.788	16.772	0.57	25.77	1007.91
9/28/2021	4:01:31 PM	0	9.6529	4.968	9/28/2021	3:33:24 PM	0	890.768	13.927	0.57	25.77	1007.91
9/28/2021	5:01:31 PM	0	9.6523	4.968	9/28/2021	4:33:24 PM	0	891.161	10.53	0.56	25.77	1007.91
9/28/2021	6:01:31 PM	0	9.652	4.968	9/28/2021	5:33:24 PM	0	890.841	7.222	0.57	25.77	1007.91
9/28/2021	7:01:31 PM	0	9.6512	4.969	9/28/2021	6:33:24 PM	0	890.748	6.418	0.57	25.77	1007.91
9/28/2021	8:01:31 PM	0	9.6522	4.968	9/28/2021	7:33:24 PM	0	891.238	5.266	0.56	25.77	1007.91
9/28/2021	9:01:31 PM	0	9.6535	4.969	9/28/2021	8:33:24 PM	0	891.387	4.286	0.56	25.77	1007.91
9/28/2021	10:01:31 PM	0	9.6553	4.968	9/28/2021	9:33:24 PM	0	891.899	4.251	0.56	25.78	1007.90
9/28/2021	11:01:31 PM	0	9.6579	4.969	9/28/2021	10:33:24 PM	0	892.18	3.399	0.56	25.78	1007.90
9/29/2021	12:01:31 AM	0	9.66	4.968	9/28/2021	11:33:24 PM	0	892.33	2.861	0.56	25.78	1007.90
9/29/2021	1:01:31 AM	0	9.662	4.968	9/29/2021	12:33:24 AM	0	892.633	2.948	0.56	25.78	1007.90
9/29/2021	2:01:31 AM	0	9.6628	4.968	9/29/2021	1:33:24 AM	0	892.649	2.614	0.56	25.78	1007.90
9/29/2021	3:01:31 AM	0	9.6644	4.969	9/29/2021	2:33:24 AM	0	893.098	2.828	0.56	25.78	1007.90
9/29/2021	4:01:31 AM	0	9.6659	4.968	9/29/2021	3:33:24 AM	0	893.222	2.386	0.56	25.78	1007.90
9/29/2021	5:01:31 AM	0	9.6679	4.969	9/29/2021	4:33:24 AM	0	893.639	1.976	0.56	25.78	1007.90
9/29/2021	6:01:31 AM	0	9.669	4.969	9/29/2021	5:33:24 AM	0	893.425	1.797	0.56	25.78	1007.90
9/29/2021	7:01:31 AM	0	9.6693	4.968	9/29/2021	6:33:24 AM	0	893.606	1.808	0.56	25.78	1007.90
9/29/2021	8:01:31 AM	0	9.6698	4.969	9/29/2021	7:33:24 AM	0	893.936	2.667	0.55	25.78	1007.90

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
9/29/2021	9:01:31 AM	0	9.67	4.968	9/29/2021	8:33:24 AM	0	894.203	3.539	0.55	25.79	1007.89
9/29/2021	10:01:31 AM	0	9.6719	4.968	9/29/2021	9:33:24 AM	0	894.607	4.534	0.55	25.79	1007.89
9/29/2021	11:01:31 AM	0	9.673	4.969	9/29/2021	10:33:24 AM	0	894.735	6.699	0.55	25.79	1007.89
9/29/2021	12:01:31 PM	0	9.6759	4.968	9/29/2021	11:33:24 AM	0	895.664	5.649	0.54	25.79	1007.89
9/29/2021	1:01:31 PM	0	9.6762	4.968	9/29/2021	12:33:24 PM	0	895.044	6.412	0.55	25.79	1007.89
9/29/2021	2:01:31 PM	0	9.6761	4.968	9/29/2021	1:33:24 PM	0	895.449	8.034	0.55	25.79	1007.89
9/29/2021	3:01:31 PM	0	9.6762	4.969	9/29/2021	2:33:24 PM	0	895.185	9.44	0.55	25.79	1007.89
9/29/2021	4:01:31 PM	0	9.6744	4.968	9/29/2021	3:33:24 PM	0	894.955	9.005	0.55	25.79	1007.89
9/29/2021	5:01:31 PM	0	9.6726	4.968	9/29/2021	4:33:24 PM	0	894.582	8.792	0.55	25.79	1007.89
9/29/2021	6:01:31 PM	0	9.6686	4.968	9/29/2021	5:33:24 PM	0	893.92	8.041	0.55	25.78	1007.90
9/29/2021	7:01:31 PM	0	9.6638	4.969	9/29/2021	6:33:24 PM	0	893.239	7.092	0.56	25.78	1007.90
9/29/2021	8:01:31 PM	0	9.6592	4.968	9/29/2021	7:33:24 PM	0	892.979	6.624	0.55	25.78	1007.90
9/29/2021	9:01:31 PM	0	9.6545	4.968	9/29/2021	8:33:24 PM	0	892.485	6.433	0.55	25.78	1007.90
9/29/2021	10:01:31 PM	0	9.648	4.968	9/29/2021	9:33:24 PM	0	891.5	5.417	0.56	25.78	1007.90
9/29/2021	11:01:31 PM	0	9.638	4.968	9/29/2021	10:33:24 PM	0	889.75	5.196	0.57	25.77	1007.91
9/30/2021	12:01:31 AM	0	9.6283	4.968	9/29/2021	11:33:24 PM	0	888.85	5.253	0.56	25.77	1007.91
9/30/2021	1:01:31 AM	0	9.6208	4.969	9/30/2021	12:33:24 AM	0	888.726	5.746	0.56	25.78	1007.90
9/30/2021	2:01:31 AM	0	9.6157	4.968	9/30/2021	1:33:24 AM	0	888.822	6.562	0.55	25.78	1007.90
9/30/2021	3:01:31 AM	0	9.6119	4.969	9/30/2021	2:33:24 AM	0	888.627	7.465	0.55	25.79	1007.89
9/30/2021	4:01:31 AM	0	9.6084	4.968	9/30/2021	3:33:24 AM	0	888.918	7.78	0.54	25.79	1007.89
9/30/2021	5:01:31 AM	0	9.6084	4.968	9/30/2021	4:33:24 AM	0	889.33	7.614	0.54	25.80	1007.88
9/30/2021	6:01:31 AM	0	9.6108	4.969	9/30/2021	5:33:24 AM	0	889.939	7.766	0.54	25.80	1007.88
9/30/2021	7:01:31 AM	0	9.6139	4.968	9/30/2021	6:33:24 AM	0	890.736	7.936	0.53	25.81	1007.87
9/30/2021	8:01:31 AM	0	9.6191	4.968	9/30/2021	7:33:24 AM	0	891.591	8.125	0.53	25.81	1007.87
9/30/2021	9:01:31 AM	0	9.6243	4.968	9/30/2021	8:33:24 AM	0	892.153	8.647	0.53	25.81	1007.87
9/30/2021	10:01:31 AM	0	9.6294	4.969	9/30/2021	9:33:24 AM	0	892.733	9.682	0.53	25.81	1007.87
9/30/2021	11:01:31 AM	0	9.6333	4.968	9/30/2021	10:33:24 AM	0	893.154	13.489	0.53	25.81	1007.87
9/30/2021	12:01:31 PM	0	9.6373	4.968	9/30/2021	11:33:24 AM	0	893.524	12.196	0.53	25.81	1007.87
9/30/2021	1:01:31 PM	0	9.6405	4.969	9/30/2021	12:33:24 PM	0	893.74	12.543	0.53	25.81	1007.87
9/30/2021	2:01:31 PM	0	9.642	4.968	9/30/2021	1:33:24 PM	0	893.714	13.299	0.53	25.81	1007.87
9/30/2021	3:01:31 PM	0	9.6427	4.968	9/30/2021	2:33:24 PM	0	893.437	20.2	0.53	25.81	1007.87
9/30/2021	4:01:31 PM	0	9.6435	4.969	9/30/2021	3:33:24 PM	0	893.892	19.756	0.53	25.81	1007.87
9/30/2021	5:01:31 PM	0	9.6462	4.969	9/30/2021	4:33:24 PM	0	894.437	14.751	0.53	25.81	1007.87
9/30/2021	6:01:31 PM	0	9.6512	4.968	9/30/2021	5:33:24 PM	0	895.292	11.437	0.52	25.82	1007.86
9/30/2021	7:01:31 PM	0	9.6564	4.969	9/30/2021	6:33:24 PM	0	896.269	9.38	0.52	25.82	1007.86
9/30/2021	8:01:31 PM	0	9.6643	4.969	9/30/2021	7:33:24 PM	0	897.383	6.808	0.51	25.82	1007.86
9/30/2021	9:01:31 PM	0	9.6721	4.968	9/30/2021	8:33:24 PM	0	898.284	5.719	0.51	25.83	1007.85
9/30/2021	10:01:31 PM	0	9.6803	4.968	9/30/2021	9:33:24 PM	0	899.165	5.448	0.51	25.83	1007.85
9/30/2021	11:01:31 PM	0	9.6886	4.969	9/30/2021	10:33:24 PM	0	900.01	4.096	0.51	25.83	1007.85
10/1/2021	12:01:31 AM	0	9.6967	4.968	9/30/2021	11:33:24 PM	0	900.825	3.146	0.51	25.83	1007.85
10/1/2021	1:01:31 AM	0	9.7038	4.969	10/1/2021	12:33:24 AM	0	901.808	3.46	0.51	25.83	1007.85
10/1/2021	2:01:31 AM	0	9.711	4.969	10/1/2021	1:33:24 AM	0	902.537	4.061	0.51	25.83	1007.85
10/1/2021	3:01:31 AM	0	9.7174	4.969	10/1/2021	2:33:24 AM	0	903.071	2.719	0.51	25.83	1007.85
10/1/2021	4:01:31 AM	0	9.723	4.969	10/1/2021	3:33:24 AM	0	903.497	1.822	0.51	25.83	1007.85
10/1/2021	5:01:31 AM	0	9.7287	4.968	10/1/2021	4:33:24 AM	0	904.026	1.797	0.51	25.83	1007.85
10/1/2021	6:01:31 AM	0	9.7328	4.969	10/1/2021	5:33:24 AM	0	904.418	1.284	0.51	25.83	1007.85
10/1/2021	7:01:31 AM	0	9.7363	4.968	10/1/2021	6:33:24 AM	0	904.768	0.603	0.51	25.83	1007.85
10/1/2021	8:01:31 AM	0	9.7403	4.969	10/1/2021	7:33:24 AM	0	905.39	0.981	0.51	25.83	1007.85
10/1/2021	9:01:31 AM	0	9.7438	4.969	10/1/2021	8:33:24 AM	0	906.056	2.968	0.50	25.83	1007.85
10/1/2021	10:01:31 AM	0	9.7452	4.969	10/1/2021	9:33:24 AM	0	906.319	11.021	0.50	25.83	1007.85
10/1/2021	11:01:31 AM	0	9.747	4.968	10/1/2021	10:33:24 AM	0	906.536	17.063	0.50	25.83	1007.85
10/1/2021	12:01:31 PM	0	9.7474	4.969	10/1/2021	11:33:24 AM	0	906.224	15.646	0.51	25.83	1007.85
10/1/2021	1:01:31 PM	0	9.7467	4.969	10/1/2021	12:33:24 PM	0	906.173	13.341	0.51	25.83	1007.85
10/1/2021	2:01:31 PM	0	9.7439	4.969	10/1/2021	1:33:24 PM	0	905.257	15.188	0.51	25.82	1007.86
10/1/2021	3:01:31 PM	0	9.7399	4.969	10/1/2021	2:33:24 PM	0	904.937	15.652	0.51	25.83	1007.85
10/1/2021	4:01:31 PM	0	9.7353	4.969	10/1/2021	3:33:24 PM	0	904.297	14.591	0.51	25.82	1007.86
10/1/2021	5:01:31 PM	0	9.7305	4.969	10/1/2021	4:33:24 PM	0	903.909	12.437	0.51	25.82	1007.86
10/1/2021	6:01:31 PM	0	9.725	4.968	10/1/2021	5:33:24 PM	0	903.169	10.606	0.52	25.82	1007.86
10/1/2021	7:01:31 PM	0	9.719	4.969	10/1/2021	6:33:24 PM	0	902.526	8.83	0.52	25.82	1007.86
10/1/2021	8:01:31 PM	0	9.7138	4.969	10/1/2021	7:33:24 PM	0	902.256	7.615	0.51	25.82	1007.86
10/1/2021	9:01:31 PM	0	9.7084	4.969	10/1/2021	8:33:24 PM	0	901.419	6.927	0.52	25.82	1007.86
10/1/2021	10:01:31 PM	0	9.7031	4.969	10/1/2021	9:33:24 PM	0	901.317	6.371	0.51	25.82	1007.86
10/1/2021	11:01:31 PM	0	9.6987	4.969	10/1/2021	10:33:24 PM	0	900.672	5.496	0.51	25.82	1007.86
10/2/2021	12:01:31 AM	0	9.6927	4.968	10/1/2021	11:33:24 PM	0	900.014	5.044	0.52	25.82	1007.86
10/2/2021	1:01:31 AM	0	9.6865	4.968	10/2/2021	12:33:24 AM	0	899.439	5.508	0.51	25.82	1007.86
10/2/2021	2:01:31 AM	0	9.68	4.969	10/2/2021	1:33:24 AM	0	898.838	5.742	0.51	25.82	1007.86
10/2/2021	3:01:31 AM	0	9.6744	4.968	10/2/2021	2:33:24 AM	0	898.626	6.363	0.51	25.83	1007.85
10/2/2021	4:01:31 AM	0	9.6693	4.969	10/2/2021	3:33:24 AM	0	898.019	6.67	0.51	25.83	1007.85
10/2/2021	5:01:31 AM	0	9.6643	4.968	10/2/2021	4:33:24 AM	0	897.998	6.706	0.51	25.83	1007.85
10/2/2021	6:01:31 AM	0	9.661	4.969	10/2/2021	5:33:24 AM	0	897.607	6.722	0.51	25.83	1007.85

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/2/2021	7:01:31 AM	0	9.6567	4.969	10/2/2021	6:33:24 AM	0	896.96	6.794	0.51	25.83	1007.85
10/2/2021	8:01:31 AM	0	9.6522	4.969	10/2/2021	7:33:24 AM	0	896.77	6.457	0.51	25.83	1007.85
10/2/2021	9:01:31 AM	0	9.6493	4.969	10/2/2021	8:33:24 AM	0	897.01	6.513	0.50	25.83	1007.85
10/2/2021	10:01:31 AM	0	9.6476	4.969	10/2/2021	9:33:24 AM	0	896.978	7.357	0.50	25.84	1007.84
10/2/2021	11:01:31 AM	0	9.6461	4.969	10/2/2021	10:33:24 AM	0	897.108	8.553	0.50	25.84	1007.84
10/2/2021	12:01:31 PM	0	9.6436	4.969	10/2/2021	11:33:24 AM	0	896.628	9.343	0.50	25.84	1007.84
10/2/2021	1:01:31 PM	0	9.6413	4.968	10/2/2021	12:33:24 PM	0	896.446	9.125	0.50	25.84	1007.84
10/2/2021	2:01:31 PM	0	9.6378	4.968	10/2/2021	1:33:24 PM	0	895.991	9.645	0.50	25.84	1007.84
10/2/2021	3:01:31 PM	0	9.6346	4.969	10/2/2021	2:33:24 PM	0	895.812	8.964	0.50	25.84	1007.84
10/2/2021	4:01:31 PM	0	9.6324	4.969	10/2/2021	3:33:24 PM	0	895.823	7.742	0.50	25.84	1007.84
10/2/2021	5:01:31 PM	0	9.6322	4.969	10/2/2021	4:33:24 PM	0	895.966	6.983	0.50	25.84	1007.84
10/2/2021	6:01:31 PM	0	9.6317	4.968	10/2/2021	5:33:24 PM	0	895.535	6.412	0.50	25.84	1007.84
10/2/2021	7:01:31 PM	0	9.6287	4.969	10/2/2021	6:33:24 PM	0	895.127	5.707	0.50	25.84	1007.84
10/2/2021	8:01:31 PM	0	9.6248	4.969	10/2/2021	7:33:24 PM	0	894.655	5.24	0.50	25.84	1007.84
10/2/2021	9:01:31 PM	0	9.6216	4.968	10/2/2021	8:33:24 PM	0	894.346	5.108	0.50	25.84	1007.84
10/2/2021	10:01:31 PM	0	9.6174	4.968	10/2/2021	9:33:24 PM	0	893.987	4.542	0.50	25.84	1007.84
10/2/2021	11:01:31 PM	0	9.6144	4.969	10/2/2021	10:33:24 PM	0	893.77	4.328	0.50	25.84	1007.84
10/3/2021	12:01:31 AM	0	9.6115	4.968	10/2/2021	11:33:24 PM	0	893.605	4.283	0.50	25.84	1007.84
10/3/2021	1:01:31 AM	0	9.6095	4.969	10/3/2021	12:33:24 AM	0	893.681	3.885	0.50	25.84	1007.84
10/3/2021	2:01:31 AM	0	9.6077	4.969	10/3/2021	1:33:24 AM	0	893.627	3.662	0.50	25.84	1007.84
10/3/2021	3:01:31 AM	0	9.6072	4.969	10/3/2021	2:33:24 AM	0	893.629	2.804	0.49	25.84	1007.84
10/3/2021	4:01:31 AM	0	9.6073	4.969	10/3/2021	3:33:24 AM	0	893.908	2.173	0.49	25.85	1007.83
10/3/2021	5:01:31 AM	0	9.6095	4.968	10/3/2021	4:33:24 AM	0	894.493	1.387	0.49	25.85	1007.83
10/3/2021	6:01:31 AM	0	9.6131	4.969	10/3/2021	5:33:24 AM	0	895.451	0.562	0.48	25.86	1007.82
10/3/2021	7:01:31 AM	0	9.6184	4.968	10/3/2021	6:33:24 AM	0	896.094	0.39	0.48	25.86	1007.82
10/3/2021	8:01:31 AM	0	9.6241	4.969	10/3/2021	7:33:24 AM	0	896.71	-0.178	0.48	25.86	1007.82
10/3/2021	9:01:31 AM	0	9.629	4.969	10/3/2021	8:33:24 AM	0	897.527	0.24	0.48	25.86	1007.82
10/3/2021	10:01:31 AM	0	9.6333	4.968	10/3/2021	9:33:24 AM	0	898.513	10.236	0.47	25.87	1007.81
10/3/2021	11:01:31 AM	0	9.6372	4.969	10/3/2021	10:33:24 AM	0	899.055	15.421	0.47	25.87	1007.81
10/3/2021	12:01:31 PM	0	9.6399	4.969	10/3/2021	11:33:24 AM	0	899.02	13.215	0.47	25.86	1007.82
10/3/2021	1:01:31 PM	0	9.6414	4.969	10/3/2021	12:33:24 PM	0	898.905	10.247	0.48	25.86	1007.82
10/3/2021	2:01:31 PM	0	9.6416	4.969	10/3/2021	1:33:24 PM	0	898.817	14.957	0.48	25.86	1007.82
10/3/2021	3:01:31 PM	0	9.6408	4.968	10/3/2021	2:33:24 PM	0	898.61	14.324	0.48	25.86	1007.82
10/3/2021	4:01:31 PM	0	9.6393	4.968	10/3/2021	3:33:24 PM	0	898.468	13.927	0.48	25.86	1007.82
10/3/2021	5:01:31 PM	0	9.6371	4.969	10/3/2021	4:33:24 PM	0	898.1	10.433	0.48	25.86	1007.82
10/3/2021	6:01:31 PM	0	9.6346	4.969	10/3/2021	5:33:24 PM	0	897.67	7.676	0.48	25.86	1007.82
10/3/2021	7:01:31 PM	0	9.6322	4.968	10/3/2021	6:33:24 PM	0	897.514	5.16	0.48	25.86	1007.82
10/3/2021	8:01:31 PM	0	9.6307	4.969	10/3/2021	7:33:24 PM	0	897.561	3.575	0.48	25.86	1007.82
10/3/2021	9:01:31 PM	0	9.63	4.969	10/3/2021	8:33:24 PM	0	897.593	2.717	0.48	25.86	1007.82
10/3/2021	10:01:31 PM	0	9.6303	4.968	10/3/2021	9:33:24 PM	0	897.733	1.804	0.48	25.86	1007.82
10/3/2021	11:01:31 PM	0	9.6307	4.969	10/3/2021	10:33:24 PM	0	897.87	0.864	0.47	25.86	1007.82
10/4/2021	12:01:31 AM	0	9.6313	4.968	10/3/2021	11:33:24 PM	0	897.944	0.688	0.47	25.86	1007.82
10/4/2021	1:01:31 AM	0	9.6312	4.969	10/4/2021	12:33:24 AM	0	897.796	0.277	0.48	25.86	1007.82
10/4/2021	2:01:31 AM	0	9.6302	4.969	10/4/2021	1:33:24 AM	0	897.529	-0.28	0.48	25.86	1007.82
10/4/2021	3:01:31 AM	0	9.6279	4.969	10/4/2021	2:33:24 AM	0	897.196	0.175	0.48	25.86	1007.82
10/4/2021	4:01:31 AM	0	9.6252	4.969	10/4/2021	3:33:24 AM	0	897.215	0.822	0.48	25.86	1007.82
10/4/2021	5:01:31 AM	0	9.6229	4.969	10/4/2021	4:33:24 AM	0	896.944	0.429	0.48	25.86	1007.82
10/4/2021	6:01:31 AM	0	9.6204	4.968	10/4/2021	5:33:24 AM	0	896.667	-0.359	0.48	25.86	1007.82
10/4/2021	7:01:31 AM	0	9.6181	4.969	10/4/2021	6:33:24 AM	0	896.504	-0.894	0.48	25.86	1007.82
10/4/2021	8:01:31 AM	0	9.6166	4.97	10/4/2021	7:33:24 AM	0	896.455	-0.746	0.48	25.86	1007.82
10/4/2021	9:01:31 AM	0	9.6147	4.969	10/4/2021	8:33:24 AM	0	896.578	0.426	0.47	25.87	1007.81
10/4/2021	10:01:31 AM	0	9.6127	4.969	10/4/2021	9:33:24 AM	0	896.667	4.437	0.47	25.87	1007.81
10/4/2021	11:01:31 AM	0	9.611	4.969	10/4/2021	10:33:24 AM	0	896.988	10.495	0.46	25.87	1007.81
10/4/2021	12:01:31 PM	0	9.6086	4.968	10/4/2021	11:33:24 AM	0	896.547	11.575	0.47	25.87	1007.81
10/4/2021	1:01:31 PM	0	9.6055	4.968	10/4/2021	12:33:24 PM	0	896.173	11.078	0.47	25.87	1007.81
10/4/2021	2:01:31 PM	0	9.6021	4.968	10/4/2021	1:33:24 PM	0	895.749	10.688	0.47	25.87	1007.81
10/4/2021	3:01:31 PM	0	9.5981	4.969	10/4/2021	2:33:24 PM	0	895.277	9.844	0.47	25.87	1007.81
10/4/2021	4:01:31 PM	0	9.5944	4.968	10/4/2021	3:33:24 PM	0	895.063	9.097	0.47	25.87	1007.81
10/4/2021	5:01:31 PM	0	9.5912	4.969	10/4/2021	4:33:24 PM	0	894.904	8.346	0.47	25.87	1007.81
10/4/2021	6:01:31 PM	0	9.588	4.969	10/4/2021	5:33:24 PM	0	894.472	6.989	0.47	25.87	1007.81
10/4/2021	7:01:31 PM	0	9.5848	4.969	10/4/2021	6:33:24 PM	0	894.272	5.387	0.47	25.87	1007.81
10/4/2021	8:01:31 PM	0	9.5827	4.969	10/4/2021	7:33:24 PM	0	893.967	4.101	0.47	25.87	1007.81
10/4/2021	9:01:31 PM	0	9.5797	4.969	10/4/2021	8:33:24 PM	0	893.803	3.525	0.47	25.87	1007.81
10/4/2021	10:01:31 PM	0	9.5769	4.968	10/4/2021	9:33:24 PM	0	893.326	3.391	0.47	25.87	1007.81
10/4/2021	11:01:31 PM	0	9.5727	4.969	10/4/2021	10:33:24 PM	0	892.709	3.052	0.47	25.87	1007.81
10/5/2021	12:01:31 AM	0	9.5675	4.969	10/4/2021	11:33:24 PM	0	891.978	2.77	0.47	25.87	1007.81
10/5/2021	1:01:31 AM	0	9.5603	4.969	10/5/2021	12:33:24 AM	0	890.931	2.629	0.48	25.86	1007.82
10/5/2021	2:01:31 AM	0	9.5531	4.969	10/5/2021	1:33:24 AM	0	890.228	2.624	0.48	25.86	1007.82
10/5/2021	3:01:31 AM	0	9.546	4.969	10/5/2021	2:33:24 AM	0	889.881	2.653	0.47	25.87	1007.81
10/5/2021	4:01:31 AM	0	9.5389	4.968	10/5/2021	3:33:24 AM	0	888.941	2.535	0.47	25.86	1007.82

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/5/2021	5:01:31 AM	0	9.533	4.969	10/5/2021	4:33:24 AM	0	888.867	2.439	0.47	25.87	1007.81
10/5/2021	6:01:31 AM	0	9.5289	4.969	10/5/2021	5:33:24 AM	0	888.831	2.393	0.47	25.87	1007.81
10/5/2021	7:01:31 AM	0	9.5267	4.969	10/5/2021	6:33:24 AM	0	888.758	2.299	0.46	25.87	1007.81
10/5/2021	8:01:31 AM	0	9.5242	4.969	10/5/2021	7:33:24 AM	0	888.314	2.19	0.47	25.87	1007.81
10/5/2021	9:01:31 AM	0	9.5211	4.969	10/5/2021	8:33:24 AM	0	888.246	2.222	0.46	25.87	1007.81
10/5/2021	10:01:31 AM	0	9.519	4.969	10/5/2021	9:33:24 AM	0	888.262	2.602	0.46	25.88	1007.80
10/5/2021	11:01:31 AM	0	9.5173	4.969	10/5/2021	10:33:24 AM	0	888.237	3.438	0.46	25.88	1007.80
10/5/2021	12:01:31 PM	0	9.5153	4.97	10/5/2021	11:33:24 AM	0	888.064	4.017	0.46	25.88	1007.80
10/5/2021	1:01:31 PM	0	9.5116	4.969	10/5/2021	12:33:24 PM	0	887.567	4.81	0.46	25.88	1007.80
10/5/2021	2:01:31 PM	0	9.5084	4.969	10/5/2021	1:33:24 PM	0	887.579	5.951	0.46	25.88	1007.80
10/5/2021	3:01:31 PM	0	9.5053	4.968	10/5/2021	2:33:24 PM	0	887.063	6.504	0.46	25.88	1007.80
10/5/2021	4:01:31 PM	0	9.5025	4.969	10/5/2021	3:33:24 PM	0	887.37	7.122	0.45	25.88	1007.80
10/5/2021	5:01:31 PM	0	9.5014	4.968	10/5/2021	4:33:24 PM	0	887.427	7	0.45	25.89	1007.79
10/5/2021	6:01:31 PM	0	9.5008	4.969	10/5/2021	5:33:24 PM	0	887.514	6.5	0.45	25.89	1007.79
10/5/2021	7:01:31 PM	0	9.5034	4.969	10/5/2021	6:33:24 PM	0	888.414	6.657	0.44	25.89	1007.79
10/5/2021	8:01:31 PM	0	9.5077	4.969	10/5/2021	7:33:24 PM	0	889.074	5.085	0.44	25.90	1007.78
10/5/2021	9:01:31 PM	0	9.5129	4.969	10/5/2021	8:33:24 PM	0	889.652	3.233	0.44	25.90	1007.78
10/5/2021	10:01:31 PM	0	9.5177	4.969	10/5/2021	9:33:24 PM	0	890.029	1.946	0.44	25.90	1007.78
10/5/2021	11:01:31 PM	0	9.5217	4.969	10/5/2021	10:33:24 PM	0	890.154	1.515	0.44	25.89	1007.79
10/6/2021	12:01:31 AM	0	9.5253	4.969	10/5/2021	11:33:24 PM	0	890.741	1.727	0.44	25.89	1007.79
10/6/2021	1:01:31 AM	0	9.5294	4.969	10/6/2021	12:33:24 AM	0	891.381	2.095	0.44	25.90	1007.78
10/6/2021	2:01:31 AM	0	9.534	4.969	10/6/2021	1:33:24 AM	0	891.982	1.71	0.44	25.90	1007.78
10/6/2021	3:01:31 AM	0	9.5389	4.969	10/6/2021	2:33:24 AM	0	892.566	0.413	0.44	25.90	1007.78
10/6/2021	4:01:31 AM	0	9.5439	4.969	10/6/2021	3:33:24 AM	0	893.086	-0.496	0.44	25.90	1007.78
10/6/2021	5:01:31 AM	0	9.5493	4.969	10/6/2021	4:33:24 AM	0	893.633	-0.558	0.44	25.90	1007.78
10/6/2021	6:01:31 AM	0	9.5534	4.969	10/6/2021	5:33:24 AM	0	893.897	-0.708	0.44	25.90	1007.78
10/6/2021	7:01:31 AM	0	9.5569	4.969	10/6/2021	6:33:24 AM	0	894.268	-1.333	0.44	25.90	1007.78
10/6/2021	8:01:31 AM	0	9.5605	4.969	10/6/2021	7:33:24 AM	0	894.693	-1.796	0.44	25.90	1007.78
10/6/2021	9:01:31 AM	0	9.5637	4.969	10/6/2021	8:33:24 AM	0	895.064	-1.117	0.44	25.90	1007.78
10/6/2021	10:01:31 AM	0	9.5665	4.969	10/6/2021	9:33:24 AM	0	895.752	0.185	0.43	25.90	1007.78
10/6/2021	11:01:31 AM	0	9.5698	4.969	10/6/2021	10:33:24 AM	0	896.375	4.734	0.43	25.91	1007.77
10/6/2021	12:01:31 PM	0	9.5716	4.969	10/6/2021	11:33:24 AM	0	896.699	6.375	0.43	25.91	1007.77
10/6/2021	1:01:31 PM	0	9.573	4.969	10/6/2021	12:33:24 PM	0	896.799	7.622	0.43	25.91	1007.77
10/6/2021	2:01:31 PM	0	9.5746	4.969	10/6/2021	1:33:24 PM	0	897.096	8.73	0.43	25.91	1007.77
10/6/2021	3:01:31 PM	0	9.5755	4.969	10/6/2021	2:33:24 PM	0	897.197	9.554	0.43	25.91	1007.77
10/6/2021	4:01:31 PM	0	9.5772	4.969	10/6/2021	3:33:24 PM	0	897.458	8.361	0.43	25.91	1007.77
10/6/2021	5:01:31 PM	0	9.5785	4.969	10/6/2021	4:33:24 PM	0	897.567	7.117	0.43	25.91	1007.77
10/6/2021	6:01:31 PM	0	9.5808	4.969	10/6/2021	5:33:24 PM	0	897.956	5.746	0.42	25.91	1007.77
10/6/2021	7:01:31 PM	0	9.5838	4.969	10/6/2021	6:33:24 PM	0	898.447	4.291	0.42	25.92	1007.76
10/6/2021	8:01:31 PM	0	9.5876	4.969	10/6/2021	7:33:24 PM	0	898.772	2.469	0.42	25.91	1007.77
10/6/2021	9:01:31 PM	0	9.5898	4.969	10/6/2021	8:33:24 PM	0	898.672	1.386	0.43	25.91	1007.77
10/6/2021	10:01:31 PM	0	9.5909	4.969	10/6/2021	9:33:24 PM	0	898.713	1.436	0.43	25.91	1007.77
10/6/2021	11:01:31 PM	0	9.5916	4.969	10/6/2021	10:33:24 PM	0	898.932	1.379	0.43	25.91	1007.77
10/7/2021	12:01:31 AM	0	9.5925	4.969	10/6/2021	11:33:24 PM	0	898.997	0.43	0.43	25.91	1007.77
10/7/2021	1:01:31 AM	0	9.5935	4.969	10/7/2021	12:33:24 AM	0	899.2	-0.005	0.42	25.91	1007.77
10/7/2021	2:01:31 AM	0	9.594	4.969	10/7/2021	1:33:24 AM	0	899.241	-0.178	0.42	25.91	1007.77
10/7/2021	3:01:31 AM	0	9.5943	4.969	10/7/2021	2:33:24 AM	0	899.158	-0.681	0.43	25.91	1007.77
10/7/2021	4:01:31 AM	0	9.594	4.969	10/7/2021	3:33:24 AM	0	899.072	-1.67	0.43	25.91	1007.77
10/7/2021	5:01:31 AM	0	9.5938	4.969	10/7/2021	4:33:24 AM	0	899.166	-0.94	0.42	25.91	1007.77
10/7/2021	6:01:31 AM	0	9.5934	4.969	10/7/2021	5:33:24 AM	0	899.23	-1.657	0.42	25.91	1007.77
10/7/2021	7:01:31 AM	0	9.5933	4.969	10/7/2021	6:33:24 AM	0	899.125	-1.578	0.42	25.91	1007.77
10/7/2021	8:01:31 AM	0	9.5927	4.969	10/7/2021	7:33:24 AM	0	899.204	-2.062	0.42	25.91	1007.77
10/7/2021	9:01:31 AM	0	9.5924	4.969	10/7/2021	8:33:24 AM	0	899.332	-1.172	0.42	25.92	1007.76
10/7/2021	10:01:31 AM	0	9.5917	4.969	10/7/2021	9:33:24 AM	0	899.65	1.08	0.42	25.92	1007.76
10/7/2021	11:01:31 AM	0	9.5916	4.969	10/7/2021	10:33:24 AM	0	899.82	1.593	0.42	25.92	1007.76
10/7/2021	12:01:31 PM	0	9.5903	4.969	10/7/2021	11:33:24 AM	0	899.525	2.67	0.42	25.92	1007.76
10/7/2021	1:01:31 PM	0	9.5884	4.969	10/7/2021	12:33:24 PM	0	899.326	3.537	0.42	25.92	1007.76
10/7/2021	2:01:31 PM	0	9.5854	4.969	10/7/2021	1:33:24 PM	0	899.027	4.362	0.42	25.92	1007.76
10/7/2021	3:01:31 PM	0	9.5822	4.969	10/7/2021	2:33:24 PM	0	898.94	8.085	0.42	25.92	1007.76
10/7/2021	4:01:31 PM	0	9.5784	4.969	10/7/2021	3:33:24 PM	0	898.553	9.133	0.42	25.92	1007.76
10/7/2021	5:01:31 PM	0	9.5748	4.969	10/7/2021	4:33:24 PM	0	898.011	6.917	0.42	25.92	1007.76
10/7/2021	6:01:31 PM	0	9.5707	4.969	10/7/2021	5:33:24 PM	0	897.362	4.644	0.42	25.92	1007.76
10/7/2021	7:01:31 PM	0	9.5662	4.969	10/7/2021	6:33:24 PM	0	896.869	2.608	0.42	25.92	1007.76
10/7/2021	8:01:31 PM	0	9.5624	4.969	10/7/2021	7:33:24 PM	0	896.711	1.367	0.42	25.92	1007.76
10/7/2021	9:01:31 PM	0	9.5587	4.969	10/7/2021	8:33:24 PM	0	896.132	0.301	0.42	25.92	1007.76
10/7/2021	10:01:31 PM	0	9.5542	4.969	10/7/2021	9:33:24 PM	0	895.808	0.632	0.42	25.92	1007.76
10/7/2021	11:01:31 PM	0	9.5508	4.969	10/7/2021	10:33:24 PM	0	895.673	0.586	0.42	25.92	1007.76
10/8/2021	12:01:31 AM	0	9.548	4.969	10/7/2021	11:33:24 PM	0	895.634	0.901	0.42	25.92	1007.76
10/8/2021	1:01:31 AM	0	9.5458	4.969	10/8/2021	12:33:24 AM	0	895.624	1.135	0.41	25.92	1007.76
10/8/2021	2:01:31 AM	0	9.5434	4.969	10/8/2021	1:33:24 AM	0	895.448	1.232	0.41	25.92	1007.76

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/8/2021	3:01:31 AM	0	9.5415	4.969	10/8/2021	2:33:24 AM	0	895.41	1.25	0.41	25.93	1007.75
10/8/2021	4:01:31 AM	0	9.5401	4.969	10/8/2021	3:33:24 AM	0	895.307	0.847	0.41	25.93	1007.75
10/8/2021	5:01:31 AM	0	9.5388	4.968	10/8/2021	4:33:24 AM	0	895.24	0.901	0.41	25.93	1007.75
10/8/2021	6:01:31 AM	0	9.538	4.969	10/8/2021	5:33:24 AM	0	895.267	0.767	0.41	25.93	1007.75
10/8/2021	7:01:31 AM	0	9.5374	4.969	10/8/2021	6:33:24 AM	0	895.304	0.301	0.41	25.93	1007.75
10/8/2021	8:01:31 AM	0	9.5383	4.969	10/8/2021	7:33:24 AM	0	895.69	-0.433	0.40	25.93	1007.75
10/8/2021	9:01:31 AM	0	9.5402	4.969	10/8/2021	8:33:24 AM	0	896.062	0.392	0.40	25.93	1007.75
10/8/2021	10:01:31 AM	0	9.5413	4.969	10/8/2021	9:33:24 AM	0	896.701	6.35	0.40	25.94	1007.74
10/8/2021	11:01:31 AM	0	9.5424	4.969	10/8/2021	10:33:24 AM	0	897.126	13.669	0.39	25.94	1007.74
10/8/2021	12:01:31 PM	0	9.543	4.969	10/8/2021	11:33:24 AM	0	897.129	10.477	0.39	25.94	1007.74
10/8/2021	1:01:31 PM	0	9.5425	4.969	10/8/2021	12:33:24 PM	0	896.846	7.574	0.40	25.94	1007.74
10/8/2021	2:01:31 PM	0	9.5417	4.969	10/8/2021	1:33:24 PM	0	896.63	12.266	0.40	25.94	1007.74
10/8/2021	3:01:31 PM	0	9.5389	4.969	10/8/2021	2:33:24 PM	0	896.172	15.729	0.40	25.94	1007.74
10/8/2021	4:01:31 PM	0	9.537	4.969	10/8/2021	3:33:24 PM	0	896.142	14.116	0.40	25.94	1007.74
10/8/2021	5:01:31 PM	0	9.5354	4.969	10/8/2021	4:33:24 PM	0	896.204	9.41	0.40	25.94	1007.74
10/8/2021	6:01:31 PM	0	9.5342	4.969	10/8/2021	5:33:24 PM	0	895.966	6.832	0.40	25.94	1007.74
10/8/2021	7:01:31 PM	0	9.533	4.97	10/8/2021	6:33:24 PM	0	895.798	4.061	0.40	25.94	1007.74
10/8/2021	8:01:31 PM	0	9.5322	4.969	10/8/2021	7:33:24 PM	0	895.45	1.868	0.40	25.94	1007.74
10/8/2021	9:01:31 PM	0	9.5296	4.969	10/8/2021	8:33:24 PM	0	895.149	1.578	0.40	25.94	1007.74
10/8/2021	10:01:31 PM	0	9.5268	4.969	10/8/2021	9:33:24 PM	0	895.019	2.513	0.40	25.94	1007.74
10/8/2021	11:01:31 PM	0	9.5236	4.969	10/8/2021	10:33:24 PM	0	894.461	1.249	0.40	25.93	1007.75
10/9/2021	12:01:31 AM	0	9.5205	4.969	10/8/2021	11:33:24 PM	0	894.336	0.366	0.40	25.94	1007.74
10/9/2021	1:01:31 AM	0	9.5186	4.969	10/9/2021	12:33:24 AM	0	894.39	1.03	0.40	25.94	1007.74
10/9/2021	2:01:31 AM	0	9.517	4.969	10/9/2021	1:33:24 AM	0	894.531	2.01	0.40	25.94	1007.74
10/9/2021	3:01:31 AM	0	9.5164	4.969	10/9/2021	2:33:24 AM	0	894.848	2.559	0.39	25.95	1007.73
10/9/2021	4:01:31 AM	0	9.5165	4.97	10/9/2021	3:33:24 AM	0	895.149	2.879	0.39	25.95	1007.73
10/9/2021	5:01:31 AM	0	9.5156	4.969	10/9/2021	4:33:24 AM	0	894.711	3.01	0.39	25.95	1007.73
10/9/2021	6:01:31 AM	0	9.5145	4.969	10/9/2021	5:33:24 AM	0	894.753	3.163	0.39	25.95	1007.73
10/9/2021	7:01:31 AM	0	9.5133	4.969	10/9/2021	6:33:24 AM	0	895.05	3.299	0.39	25.95	1007.73
10/9/2021	8:01:31 AM	0	9.5128	4.969	10/9/2021	7:33:24 AM	0	894.807	2.828	0.39	25.95	1007.73
10/9/2021	9:01:31 AM	0	9.5126	4.969	10/9/2021	8:33:24 AM	0	894.643	3.042	0.39	25.95	1007.73
10/9/2021	10:01:31 AM	0	9.5118	4.969	10/9/2021	9:33:24 AM	0	894.697	4.01	0.39	25.95	1007.73
10/9/2021	11:01:31 AM	0	9.5115	4.969	10/9/2021	10:33:24 AM	0	894.714	4.38	0.39	25.95	1007.73
10/9/2021	12:01:31 PM	0	9.5105	4.969	10/9/2021	11:33:24 AM	0	894.757	4.604	0.39	25.95	1007.73
10/9/2021	1:01:31 PM	0	9.5074	4.969	10/9/2021	12:33:24 PM	0	893.946	5.565	0.39	25.95	1007.73
10/9/2021	2:01:31 PM	0	9.5016	4.969	10/9/2021	1:33:24 PM	0	893.146	5.457	0.39	25.94	1007.74
10/9/2021	3:01:31 PM	0	9.494	4.969	10/9/2021	2:33:24 PM	0	892.324	5.101	0.39	25.94	1007.74
10/9/2021	4:01:31 PM	0	9.4878	4.969	10/9/2021	3:33:24 PM	0	891.506	4.162	0.40	25.94	1007.74
10/9/2021	5:01:31 PM	0	9.481	4.97	10/9/2021	4:33:24 PM	0	890.742	3.706	0.40	25.94	1007.74
10/9/2021	6:01:31 PM	0	9.4738	4.969	10/9/2021	5:33:24 PM	0	890.15	3.531	0.40	25.94	1007.74
10/9/2021	7:01:31 PM	0	9.4674	4.97	10/9/2021	6:33:24 PM	0	889.545	3.349	0.40	25.94	1007.74
10/9/2021	8:01:31 PM	0	9.4621	4.969	10/9/2021	7:33:24 PM	0	889.277	3.318	0.39	25.94	1007.74
10/9/2021	9:01:31 PM	0	9.4574	4.969	10/9/2021	8:33:24 PM	0	888.793	3.375	0.39	25.94	1007.74
10/9/2021	10:01:31 PM	0	9.453	4.969	10/9/2021	9:33:24 PM	0	888.585	3.394	0.39	25.95	1007.73
10/9/2021	11:01:31 PM	0	9.4499	4.969	10/9/2021	10:33:24 PM	0	888.709	3.318	0.39	25.95	1007.73
10/10/2021	12:01:31 AM	0	9.4492	4.969	10/9/2021	11:33:24 PM	0	888.915	3.436	0.38	25.95	1007.73
10/10/2021	1:01:31 AM	0	9.45	4.969	10/10/202	12:33:24 AM	0	889.718	3.292	0.38	25.96	1007.72
10/10/2021	2:01:31 AM	0	9.4526	4.969	10/10/202	1:33:24 AM	0	889.98	1.201	0.38	25.96	1007.72
10/10/2021	3:01:31 AM	0	9.456	4.97	10/10/202	2:33:24 AM	0	890.36	0.098	0.38	25.96	1007.72
10/10/2021	4:01:31 AM	0	9.4583	4.969	10/10/202	3:33:24 AM	0	890.427	-0.363	0.38	25.96	1007.72
10/10/2021	5:01:31 AM	0	9.4612	4.97	10/10/202	4:33:24 AM	0	890.691	-0.241	0.38	25.96	1007.72
10/10/2021	6:01:31 AM	0	9.4646	4.969	10/10/202	5:33:24 AM	0	891.546	-0.555	0.37	25.96	1007.72
10/10/2021	7:01:31 AM	0	9.4694	4.97	10/10/202	6:33:24 AM	0	892.305	-0.486	0.37	25.97	1007.71
10/10/2021	8:01:31 AM	0	9.4746	4.969	10/10/202	7:33:24 AM	0	892.81	-0.574	0.37	25.97	1007.71
10/10/2021	9:01:31 AM	0	9.479	4.969	10/10/202	8:33:24 AM	0	893.165	-0.552	0.37	25.97	1007.71
10/10/2021	10:01:31 AM	0	9.4833	4.969	10/10/202	9:33:24 AM	0	894.498	5.337	0.36	25.98	1007.70
10/10/2021	11:01:31 AM	0	9.4885	4.969	10/10/202	10:33:24 AM	0	895.257	9.037	0.36	25.98	1007.70
10/10/2021	12:01:31 PM	0	9.4928	4.97	10/10/202	11:33:24 AM	0	895.602	8.256	0.36	25.98	1007.70
10/10/2021	1:01:31 PM	0	9.4964	4.969	10/10/202	12:33:24 PM	0	895.62	6.26	0.36	25.97	1007.71
10/10/2021	2:01:31 PM	0	9.4989	4.969	10/10/202	1:33:24 PM	0	895.887	7.417	0.36	25.97	1007.71
10/10/2021	3:01:31 PM	0	9.5007	4.969	10/10/202	2:33:24 PM	0	896.115	7.506	0.36	25.97	1007.71
10/10/2021	4:01:31 PM	0	9.5026	4.969	10/10/202	3:33:24 PM	0	895.939	4.486	0.37	25.97	1007.71
10/10/2021	5:01:31 PM	0	9.5045	4.969	10/10/202	4:33:24 PM	0	896.369	3.212	0.36	25.97	1007.71
10/10/2021	6:01:31 PM	0	9.5074	4.969	10/10/202	5:33:24 PM	0	896.813	2.928	0.36	25.97	1007.71
10/10/2021	7:01:31 PM	0	9.5108	4.97	10/10/202	6:33:24 PM	0	897.334	1.506	0.36	25.98	1007.70
10/10/2021	8:01:31 PM	0	9.5144	4.969	10/10/202	7:33:24 PM	0	897.846	0.219	0.36	25.98	1007.70
10/10/2021	9:01:31 PM	0	9.5184	4.969	10/10/202	8:33:24 PM	0	898.094	-0.108	0.36	25.98	1007.70
10/10/2021	10:01:31 PM	0	9.5221	4.969	10/10/202	9:33:24 PM	0	898.316	-0.126	0.36	25.98	1007.70
10/10/2021	11:01:31 PM	0	9.5247	4.969	10/10/202	10:33:24 PM	0	898.792	-0.359	0.36	25.98	1007.70
10/11/2021	12:01:31 AM	0	9.5275	4.969	10/10/202	11:33:24 PM	0	899.01	-0.423	0.36	25.98	1007.70

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/11/2021	1:01:31 AM	0	9.5295	4.969	10/11/202	12:33:24 AM	0	899.303	-0.464	0.36	25.98	1007.70
10/11/2021	2:01:31 AM	0	9.5315	4.969	10/11/202	1:33:24 AM	0	899.533	-0.59	0.36	25.98	1007.70
10/11/2021	3:01:31 AM	0	9.5332	4.97	10/11/202	2:33:24 AM	0	899.759	-0.636	0.36	25.98	1007.70
10/11/2021	4:01:31 AM	0	9.5354	4.97	10/11/202	3:33:24 AM	0	900.126	-0.668	0.36	25.98	1007.70
10/11/2021	5:01:31 AM	0	9.5379	4.97	10/11/202	4:33:24 AM	0	900.565	-0.751	0.35	25.98	1007.70
10/11/2021	6:01:31 AM	0	9.5405	4.969	10/11/202	5:33:24 AM	0	900.771	-0.999	0.36	25.98	1007.70
10/11/2021	7:01:31 AM	0	9.5429	4.969	10/11/202	6:33:24 AM	0	901.026	-1.59	0.35	25.98	1007.70
10/11/2021	8:01:31 AM	0	9.5456	4.969	10/11/202	7:33:24 AM	0	901.414	-1.768	0.35	25.98	1007.70
10/11/2021	9:01:31 AM	0	9.5482	4.97	10/11/202	8:33:24 AM	0	901.75	-1.264	0.35	25.98	1007.70
10/11/2021	10:01:31 AM	0	9.5513	4.969	10/11/202	9:33:24 AM	0	902.426	-0.61	0.35	25.99	1007.69
10/11/2021	11:01:31 AM	0	9.5539	4.969	10/11/202	10:33:24 AM	0	902.848	0.742	0.35	25.99	1007.69
10/11/2021	12:01:31 PM	0	9.5565	4.97	10/11/202	11:33:24 AM	0	903.181	3.504	0.35	25.99	1007.69
10/11/2021	1:01:31 PM	0	9.5579	4.969	10/11/202	12:33:24 PM	0	903.506	6.09	0.34	25.99	1007.69
10/11/2021	2:01:31 PM	0	9.558	4.969	10/11/202	1:33:24 PM	0	903.528	7.323	0.34	25.99	1007.69
10/11/2021	3:01:31 PM	0	9.5583	4.969	10/11/202	2:33:24 PM	0	903.483	6.969	0.35	25.99	1007.69
10/11/2021	4:01:31 PM	0	9.5572	4.97	10/11/202	3:33:24 PM	0	903.24	5.83	0.35	25.99	1007.69
10/11/2021	5:01:31 PM	0	9.5571	4.969	10/11/202	4:33:24 PM	0	903.438	5.854	0.34	25.99	1007.69
10/11/2021	6:01:31 PM	0	9.5572	4.97	10/11/202	5:33:24 PM	0	903.37	4.359	0.35	25.99	1007.69
10/11/2021	7:01:31 PM	0	9.5569	4.97	10/11/202	6:33:24 PM	0	903.136	1.826	0.35	25.99	1007.69
10/11/2021	8:01:31 PM	0	9.555	4.969	10/11/202	7:33:24 PM	0	902.511	-0.56	0.35	25.99	1007.69
10/11/2021	9:01:31 PM	0	9.5524	4.969	10/11/202	8:33:24 PM	0	902.147	-1.634	0.35	25.98	1007.70
10/11/2021	10:01:31 PM	0	9.5492	4.969	10/11/202	9:33:24 PM	0	901.951	-1.112	0.35	25.99	1007.69
10/11/2021	11:01:31 PM	0	9.5462	4.969	10/11/202	10:33:24 PM	0	901.643	-0.55	0.35	25.99	1007.69
10/12/2021	12:01:31 AM	0	9.5418	4.97	10/11/202	11:33:24 PM	0	901.175	-0.561	0.35	25.98	1007.70
10/12/2021	1:01:31 AM	0	9.5368	4.97	10/12/202	12:33:24 AM	0	900.601	-0.668	0.35	25.98	1007.70
10/12/2021	2:01:31 AM	0	9.5307	4.969	10/12/202	1:33:24 AM	0	899.716	-0.983	0.36	25.98	1007.70
10/12/2021	3:01:31 AM	0	9.5229	4.969	10/12/202	2:33:24 AM	0	898.457	-1.465	0.36	25.98	1007.70
10/12/2021	4:01:31 AM	0	9.5137	4.969	10/12/202	3:33:24 AM	0	897.732	-1.612	0.36	25.98	1007.70
10/12/2021	5:01:31 AM	0	9.5054	4.969	10/12/202	4:33:24 AM	0	896.844	-1.626	0.36	25.98	1007.70
10/12/2021	6:01:31 AM	0	9.4971	4.969	10/12/202	5:33:24 AM	0	896.11	-1.655	0.36	25.98	1007.70
10/12/2021	7:01:31 AM	0	9.4893	4.97	10/12/202	6:33:24 AM	0	895.435	-1.634	0.36	25.98	1007.70
10/12/2021	8:01:31 AM	0	9.482	4.97	10/12/202	7:33:24 AM	0	895.084	-1.167	0.35	25.98	1007.70
10/12/2021	9:01:31 AM	0	9.475	4.969	10/12/202	8:33:24 AM	0	894.426	-0.732	0.35	25.98	1007.70
10/12/2021	10:01:31 AM	0	9.469	4.969	10/12/202	9:33:24 AM	0	894.145	-0.45	0.35	25.99	1007.69
10/12/2021	11:01:31 AM	0	9.4628	4.97	10/12/202	10:33:24 AM	0	893.645	0.863	0.35	25.99	1007.69
10/12/2021	12:01:31 PM	0	9.4588	4.97	10/12/202	11:33:24 AM	0	893.888	2.315	0.34	25.99	1007.69
10/12/2021	1:01:31 PM	0	9.4563	4.97	10/12/202	12:33:24 PM	0	894.044	2.333	0.34	26.00	1007.68
10/12/2021	2:01:31 PM	0	9.4557	4.97	10/12/202	1:33:24 PM	0	894.022	1.711	0.34	26.00	1007.68
10/12/2021	3:01:31 PM	0	9.4544	4.97	10/12/202	2:33:24 PM	0	893.569	0.231	0.34	25.99	1007.69
10/12/2021	4:01:31 PM	0	9.4527	4.969	10/12/202	3:33:24 PM	0	893.486	-0.372	0.34	26.00	1007.68
10/12/2021	5:01:31 PM	0	9.4504	4.97	10/12/202	4:33:24 PM	0	893.052	-0.431	0.34	25.99	1007.69
10/12/2021	6:01:31 PM	0	9.449	4.969	10/12/202	5:33:24 PM	0	893.086	-0.448	0.34	26.00	1007.68
10/12/2021	7:01:31 PM	0	9.4476	4.969	10/12/202	6:33:24 PM	0	893.115	-0.471	0.34	26.00	1007.68
10/12/2021	8:01:31 PM	0	9.4467	4.969	10/12/202	7:33:24 PM	0	893.115	-0.487	0.34	26.00	1007.68
10/12/2021	9:01:31 PM	0	9.4457	4.969	10/12/202	8:33:24 PM	0	893.084	-0.495	0.34	26.00	1007.68
10/12/2021	10:01:31 PM	0	9.4451	4.969	10/12/202	9:33:24 PM	0	893.082	-0.466	0.34	26.00	1007.68
10/12/2021	11:01:31 PM	0	9.4444	4.969	10/12/202	10:33:24 PM	0	893.152	-0.446	0.34	26.00	1007.68
10/13/2021	12:01:31 AM	0	9.4446	4.97	10/12/202	11:33:24 PM	0	893.276	-0.43	0.34	26.00	1007.68
10/13/2021	1:01:31 AM	0	9.4446	4.97	10/13/202	12:33:24 AM	0	893.373	-0.423	0.33	26.00	1007.68
10/13/2021	2:01:31 AM	0	9.4441	4.969	10/13/202	1:33:24 AM	0	893.447	-0.427	0.33	26.00	1007.68
10/13/2021	3:01:31 AM	0	9.4443	4.969	10/13/202	2:33:24 AM	0	893.645	-0.416	0.33	26.01	1007.67
10/13/2021	4:01:31 AM	0	9.4449	4.969	10/13/202	3:33:24 AM	0	893.666	-0.395	0.33	26.01	1007.67
10/13/2021	5:01:31 AM	0	9.4449	4.97	10/13/202	4:33:24 AM	0	893.657	-0.44	0.33	26.01	1007.67
10/13/2021	6:01:31 AM	0	9.4447	4.969	10/13/202	5:33:24 AM	0	893.866	-0.607	0.33	26.01	1007.67
10/13/2021	7:01:31 AM	0	9.4454	4.969	10/13/202	6:33:24 AM	0	894.056	-0.575	0.33	26.01	1007.67
10/13/2021	8:01:31 AM	0	9.4462	4.97	10/13/202	7:33:24 AM	0	894.18	-0.607	0.33	26.01	1007.67
10/13/2021	9:01:31 AM	0	9.4468	4.969	10/13/202	8:33:24 AM	0	894.367	-0.565	0.33	26.01	1007.67
10/13/2021	10:01:31 AM	0	9.4475	4.97	10/13/202	9:33:24 AM	0	894.31	-0.344	0.33	26.01	1007.67
10/13/2021	11:01:31 AM	0	9.4478	4.97	10/13/202	10:33:24 AM	0	894.61	0.446	0.33	26.01	1007.67
10/13/2021	12:01:31 PM	0	9.449	4.97	10/13/202	11:33:24 AM	0	895.031	1.253	0.32	26.01	1007.67
10/13/2021	1:01:31 PM	0	9.4497	4.969	10/13/202	12:33:24 PM	0	895.164	4.037	0.32	26.02	1007.66
10/13/2021	2:01:31 PM	0	9.4494	4.97	10/13/202	1:33:24 PM	0	895.226	4.728	0.32	26.02	1007.66
10/13/2021	3:01:31 PM	0	9.4478	4.969	10/13/202	2:33:24 PM	0	894.912	5.094	0.32	26.01	1007.67
10/13/2021	4:01:31 PM	0	9.4462	4.969	10/13/202	3:33:24 PM	0	894.84	5.491	0.32	26.02	1007.66
10/13/2021	5:01:31 PM	0	9.4444	4.97	10/13/202	4:33:24 PM	0	894.486	3.235	0.32	26.01	1007.67
10/13/2021	6:01:31 PM	0	9.4416	4.969	10/13/202	5:33:24 PM	0	893.867	0.962	0.33	26.01	1007.67
10/13/2021	7:01:31 PM	0	9.439	4.97	10/13/202	6:33:24 PM	0	893.537	-0.424	0.33	26.01	1007.67
10/13/2021	8:01:31 PM	0	9.437	4.97	10/13/202	7:33:24 PM	0	893.495	-0.625	0.33	26.01	1007.67
10/13/2021	9:01:31 PM	0	9.4356	4.97	10/13/202	8:33:24 PM	0	893.596	-0.713	0.32	26.01	1007.67
10/13/2021	10:01:31 PM	0	9.4347	4.969	10/13/202	9:33:24 PM	0	893.609	-0.824	0.32	26.01	1007.67

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/13/2021	11:01:31 PM	0	9.434	4.969	10/13/202	10:33:24 PM	0	893.602	-1.084	0.32	26.02	1007.66
10/14/2021	12:01:31 AM	0	9.4331	4.97	10/13/202	11:33:24 PM	0	893.704	-1.205	0.32	26.02	1007.66
10/14/2021	1:01:31 AM	0	9.433	4.97	10/14/202	12:33:24 AM	0	893.756	-1.046	0.32	26.02	1007.66
10/14/2021	2:01:31 AM	0	9.4337	4.969	10/14/202	1:33:24 AM	0	894.064	-0.893	0.32	26.02	1007.66
10/14/2021	3:01:31 AM	0	9.4358	4.969	10/14/202	2:33:24 AM	0	894.794	-0.711	0.31	26.03	1007.65
10/14/2021	4:01:31 AM	0	9.4362	4.97	10/14/202	3:33:24 AM	0	894.408	-0.637	0.32	26.02	1007.66
10/14/2021	5:01:31 AM	0	9.4365	4.97	10/14/202	4:33:24 AM	0	894.367	-0.635	0.32	26.02	1007.66
10/14/2021	6:01:31 AM	0	9.4369	4.97	10/14/202	5:33:24 AM	0	894.933	-0.689	0.31	26.03	1007.65
10/14/2021	7:01:31 AM	0	9.4397	4.97	10/14/202	6:33:24 AM	0	895.566	-0.673	0.31	26.03	1007.65
10/14/2021	8:01:31 AM	0	9.4431	4.97	10/14/202	7:33:24 AM	0	896.027	-0.559	0.31	26.03	1007.65
10/14/2021	9:01:31 AM	0	9.4459	4.969	10/14/202	8:33:24 AM	0	896.274	-0.51	0.31	26.03	1007.65
10/14/2021	10:01:31 AM	0	9.4493	4.97	10/14/202	9:33:24 AM	0	896.855	-0.181	0.30	26.03	1007.65
10/14/2021	11:01:31 AM	0	9.4523	4.969	10/14/202	10:33:24 AM	0	897.237	1.282	0.30	26.03	1007.65
10/14/2021	12:01:31 PM	0	9.4544	4.97	10/14/202	11:33:24 AM	0	897.366	3.883	0.30	26.03	1007.65
10/14/2021	1:01:31 PM	0	9.4548	4.97	10/14/202	12:33:24 PM	0	897.521	5.043	0.30	26.03	1007.65
10/14/2021	2:01:31 PM	0	9.4544	4.97	10/14/202	1:33:24 PM	0	897.299	5.675	0.30	26.03	1007.65
10/14/2021	3:01:31 PM	0	9.4525	4.97	10/14/202	2:33:24 PM	0	897.017	7.901	0.31	26.03	1007.65
10/14/2021	4:01:31 PM	0	9.4498	4.969	10/14/202	3:33:24 PM	0	896.675	6.521	0.31	26.03	1007.65
10/14/2021	5:01:31 PM	0	9.4475	4.969	10/14/202	4:33:24 PM	0	896.25	5.093	0.31	26.03	1007.65
10/14/2021	6:01:31 PM	0	9.4447	4.97	10/14/202	5:33:24 PM	0	896.163	4.12	0.31	26.03	1007.65
10/14/2021	7:01:31 PM	0	9.4439	4.97	10/14/202	6:33:24 PM	0	896.169	3.113	0.31	26.03	1007.65
10/14/2021	8:01:31 PM	0	9.4427	4.97	10/14/202	7:33:24 PM	0	896.214	2.647	0.30	26.03	1007.65
10/14/2021	9:01:31 PM	0	9.4427	4.97	10/14/202	8:33:24 PM	0	896.064	2.401	0.31	26.03	1007.65
10/14/2021	10:01:31 PM	0	9.4405	4.97	10/14/202	9:33:24 PM	0	895.824	2.447	0.31	26.03	1007.65
10/14/2021	11:01:31 PM	0	9.4383	4.969	10/14/202	10:33:24 PM	0	895.67	2.331	0.30	26.03	1007.65
10/15/2021	12:01:31 AM	0	9.4361	4.969	10/14/202	11:33:24 PM	0	895.267	2.19	0.31	26.03	1007.65
10/15/2021	1:01:31 AM	0	9.4328	4.97	10/15/202	12:33:24 AM	0	895.133	2.371	0.30	26.03	1007.65
10/15/2021	2:01:31 AM	0	9.4306	4.97	10/15/202	1:33:24 AM	0	895.068	2.485	0.30	26.03	1007.65
10/15/2021	3:01:31 AM	0	9.4289	4.97	10/15/202	2:33:24 AM	0	894.977	2.122	0.30	26.03	1007.65
10/15/2021	4:01:31 AM	0	9.4248	4.969	10/15/202	3:33:24 AM	0	894.197	1.673	0.31	26.03	1007.65
10/15/2021	5:01:31 AM	0	9.4202	4.97	10/15/202	4:33:24 AM	0	893.652	1.687	0.31	26.03	1007.65
10/15/2021	6:01:31 AM	0	9.4155	4.97	10/15/202	5:33:24 AM	0	893.67	1.502	0.30	26.03	1007.65
10/15/2021	7:01:31 AM	0	9.4125	4.969	10/15/202	6:33:24 AM	0	893.239	1.472	0.30	26.03	1007.65
10/15/2021	8:01:31 AM	0	9.4101	4.969	10/15/202	7:33:24 AM	0	893.463	1.667	0.30	26.04	1007.64
10/15/2021	9:01:31 AM	0	9.4095	4.97	10/15/202	8:33:24 AM	0	893.946	2.109	0.29	26.04	1007.64
10/15/2021	10:01:31 AM	0	9.4106	4.97	10/15/202	9:33:24 AM	0	894.296	2.916	0.29	26.05	1007.63
10/15/2021	11:01:31 AM	0	9.4122	4.97	10/15/202	10:33:24 AM	0	894.874	4.911	0.29	26.05	1007.63
10/15/2021	12:01:31 PM	0	9.4142	4.97	10/15/202	11:33:24 AM	0	895.143	6.204	0.29	26.05	1007.63
10/15/2021	1:01:31 PM	0	9.4141	4.969	10/15/202	12:33:24 PM	0	894.907	7.578	0.29	26.05	1007.63
10/15/2021	2:01:31 PM	0	9.413	4.97	10/15/202	1:33:24 PM	0	894.71	8.661	0.29	26.05	1007.63
10/15/2021	3:01:31 PM	0	9.4116	4.97	10/15/202	2:33:24 PM	0	894.584	10.639	0.29	26.05	1007.63
10/15/2021	4:01:31 PM	0	9.4094	4.969	10/15/202	3:33:24 PM	0	894.168	9.814	0.29	26.05	1007.63
10/15/2021	5:01:31 PM	0	9.4059	4.97	10/15/202	4:33:24 PM	0	893.742	8.331	0.29	26.04	1007.64
10/15/2021	6:01:31 PM	0	9.4028	4.97	10/15/202	5:33:24 PM	0	893.169	6.971	0.29	26.04	1007.64
10/15/2021	7:01:31 PM	0	9.4003	4.97	10/15/202	6:33:24 PM	0	893.087	5.639	0.29	26.04	1007.64
10/15/2021	8:01:31 PM	0	9.3987	4.97	10/15/202	7:33:24 PM	0	893.402	5.186	0.29	26.05	1007.63
10/15/2021	9:01:31 PM	0	9.3987	4.97	10/15/202	8:33:24 PM	0	893.305	4.71	0.29	26.05	1007.63
10/15/2021	10:01:31 PM	0	9.3985	4.97	10/15/202	9:33:24 PM	0	893.511	4.468	0.29	26.05	1007.63
10/15/2021	11:01:31 PM	0	9.397	4.97	10/15/202	10:33:24 PM	0	893.042	4.417	0.29	26.05	1007.63
10/16/2021	12:01:31 AM	0	9.3944	4.969	10/15/202	11:33:24 PM	0	892.773	4.315	0.29	26.05	1007.63
10/16/2021	1:01:31 AM	0	9.3912	4.97	10/16/202	12:33:24 AM	0	892.481	4.268	0.29	26.05	1007.63
10/16/2021	2:01:31 AM	0	9.3882	4.969	10/16/202	1:33:24 AM	0	892.275	4.436	0.29	26.05	1007.63
10/16/2021	3:01:31 AM	0	9.3859	4.97	10/16/202	2:33:24 AM	0	892.137	4.404	0.29	26.05	1007.63
10/16/2021	4:01:31 AM	0	9.3834	4.97	10/16/202	3:33:24 AM	0	891.951	4.323	0.29	26.05	1007.63
10/16/2021	5:01:31 AM	0	9.3798	4.97	10/16/202	4:33:24 AM	0	891.443	4.58	0.29	26.05	1007.63
10/16/2021	6:01:31 AM	0	9.3754	4.97	10/16/202	5:33:24 AM	0	891.04	4.6	0.29	26.05	1007.63
10/16/2021	7:01:31 AM	0	9.372	4.97	10/16/202	6:33:24 AM	0	890.913	4.47	0.29	26.05	1007.63
10/16/2021	8:01:31 AM	0	9.3716	4.97	10/16/202	7:33:24 AM	0	891.444	4.941	0.28	26.06	1007.62
10/16/2021	9:01:31 AM	0	9.3702	4.97	10/16/202	8:33:24 AM	0	891.163	5.275	0.28	26.05	1007.63
10/16/2021	10:01:31 AM	0	9.3673	4.97	10/16/202	9:33:24 AM	0	890.772	5.494	0.28	26.05	1007.63
10/16/2021	11:01:31 AM	0	9.3645	4.97	10/16/202	10:33:24 AM	0	890.759	7.007	0.28	26.06	1007.62
10/16/2021	12:01:31 PM	0	9.3618	4.97	10/16/202	11:33:24 AM	0	890.54	8.435	0.28	26.06	1007.62
10/16/2021	1:01:31 PM	0	9.3597	4.97	10/16/202	12:33:24 PM	0	890.615	7.774	0.28	26.06	1007.62
10/16/2021	2:01:31 PM	0	9.3579	4.97	10/16/202	1:33:24 PM	0	890.419	7.377	0.28	26.06	1007.62
10/16/2021	3:01:31 PM	0	9.3545	4.97	10/16/202	2:33:24 PM	0	889.491	6.909	0.28	26.05	1007.63
10/16/2021	4:01:31 PM	0	9.3504	4.97	10/16/202	3:33:24 PM	0	889.047	6.755	0.28	26.05	1007.63
10/16/2021	5:01:31 PM	0	9.3453	4.97	10/16/202	4:33:24 PM	0	888.554	6.506	0.28	26.05	1007.63
10/16/2021	6:01:31 PM	0	9.3413	4.97	10/16/202	5:33:24 PM	0	888.318	6.081	0.28	26.05	1007.63
10/16/2021	7:01:31 PM	0	9.3391	4.969	10/16/202	6:33:24 PM	0	888.348	5.898	0.28	26.06	1007.62
10/16/2021	8:01:31 PM	0	9.3368	4.97	10/16/202	7:33:24 PM	0	888.217	5.887	0.28	26.06	1007.62

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/16/2021	9:01:31 PM	0	9.3347	4.971	10/16/202	8:33:24 PM	0	888.223	5.863	0.28	26.06	1007.62
10/16/2021	10:01:31 PM	0	9.333	4.97	10/16/202	9:33:24 PM	0	888.059	5.717	0.28	26.06	1007.62
10/16/2021	11:01:31 PM	0	9.3321	4.971	10/16/202	10:33:24 PM	0	888.114	5.636	0.28	26.06	1007.62
10/17/2021	12:01:31 AM	0	9.3312	4.97	10/16/202	11:33:24 PM	0	888.047	5.558	0.28	26.06	1007.62
10/17/2021	1:01:31 AM	0	9.3303	4.97	10/17/202	12:33:24 AM	0	887.987	5.303	0.28	26.06	1007.62
10/17/2021	2:01:31 AM	0	9.3295	4.97	10/17/202	1:33:24 AM	0	887.962	5.2	0.27	26.06	1007.62
10/17/2021	3:01:31 AM	0	9.3282	4.97	10/17/202	2:33:24 AM	0	887.717	5.062	0.28	26.06	1007.62
10/17/2021	4:01:31 AM	0	9.3258	4.97	10/17/202	3:33:24 AM	0	887.338	4.867	0.28	26.06	1007.62
10/17/2021	5:01:31 AM	0	9.3222	4.97	10/17/202	4:33:24 AM	0	886.732	4.656	0.28	26.06	1007.62
10/17/2021	6:01:31 AM	0	9.3184	4.97	10/17/202	5:33:24 AM	0	886.403	3.873	0.28	26.06	1007.62
10/17/2021	7:01:31 AM	0	9.3155	4.97	10/17/202	6:33:24 AM	0	886.294	3.284	0.28	26.06	1007.62
10/17/2021	8:01:31 AM	0	9.3129	4.969	10/17/202	7:33:24 AM	0	886.051	2.882	0.28	26.06	1007.62
10/17/2021	9:01:31 AM	0	9.3109	4.97	10/17/202	8:33:24 AM	0	886.256	2.565	0.27	26.06	1007.62
10/17/2021	10:01:31 AM	0	9.3091	4.97	10/17/202	9:33:24 AM	0	886	2.581	0.27	26.06	1007.62
10/17/2021	11:01:31 AM	0	9.3082	4.97	10/17/202	10:33:24 AM	0	886.255	2.817	0.27	26.07	1007.61
10/17/2021	12:01:31 PM	0	9.3077	4.97	10/17/202	11:33:24 AM	0	886.338	2.989	0.27	26.07	1007.61
10/17/2021	1:01:31 PM	0	9.3072	4.97	10/17/202	12:33:24 PM	0	886.351	3.434	0.27	26.07	1007.61
10/17/2021	2:01:31 PM	0	9.3066	4.97	10/17/202	1:33:24 PM	0	886.249	3.646	0.27	26.07	1007.61
10/17/2021	3:01:31 PM	0	9.307	4.97	10/17/202	2:33:24 PM	0	886.828	3.426	0.26	26.07	1007.61
10/17/2021	4:01:31 PM	0	9.3089	4.969	10/17/202	3:33:24 PM	0	887.067	3.164	0.26	26.07	1007.61
10/17/2021	5:01:31 PM	0	9.3116	4.97	10/17/202	4:33:24 PM	0	887.435	2.918	0.26	26.07	1007.61
10/17/2021	6:01:31 PM	0	9.315	4.97	10/17/202	5:33:24 PM	0	888.032	2.434	0.26	26.08	1007.60
10/17/2021	7:01:31 PM	0	9.3191	4.97	10/17/202	6:33:24 PM	0	888.316	1.94	0.26	26.08	1007.60
10/17/2021	8:01:31 PM	0	9.3225	4.97	10/17/202	7:33:24 PM	0	888.694	1.432	0.26	26.08	1007.60
10/17/2021	9:01:31 PM	0	9.3264	4.97	10/17/202	8:33:24 PM	0	889.504	1.155	0.26	26.08	1007.60
10/17/2021	10:01:31 PM	0	9.3317	4.97	10/17/202	9:33:24 PM	0	890.19	0.984	0.25	26.08	1007.60
10/17/2021	11:01:31 PM	0	9.337	4.97	10/17/202	10:33:24 PM	0	890.706	0.887	0.25	26.08	1007.60
10/18/2021	12:01:31 AM	0	9.341	4.97	10/17/202	11:33:24 PM	0	890.916	0.738	0.26	26.08	1007.60
10/18/2021	1:01:31 AM	0	9.3449	4.97	10/18/202	12:33:24 AM	0	891.592	0.589	0.25	26.08	1007.60
10/18/2021	2:01:31 AM	0	9.349	4.97	10/18/202	1:33:24 AM	0	892.004	0.445	0.25	26.08	1007.60
10/18/2021	3:01:31 AM	0	9.3524	4.97	10/18/202	2:33:24 AM	0	892.249	0.334	0.25	26.08	1007.60
10/18/2021	4:01:31 AM	0	9.3555	4.97	10/18/202	3:33:24 AM	0	892.452	0.197	0.25	26.08	1007.60
10/18/2021	5:01:31 AM	0	9.3584	4.97	10/18/202	4:33:24 AM	0	892.891	0.148	0.25	26.08	1007.60
10/18/2021	6:01:31 AM	0	9.3623	4.97	10/18/202	5:33:24 AM	0	893.662	0.083	0.25	26.09	1007.59
10/18/2021	7:01:31 AM	0	9.3658	4.97	10/18/202	6:33:24 AM	0	893.872	-0.037	0.25	26.09	1007.59
10/18/2021	8:01:31 AM	0	9.3697	4.97	10/18/202	7:33:24 AM	0	894.426	-0.149	0.25	26.09	1007.59
10/18/2021	9:01:31 AM	0	9.3741	4.969	10/18/202	8:33:24 AM	0	894.989	-0.067	0.25	26.09	1007.59
10/18/2021	10:01:31 AM	0	9.3775	4.97	10/18/202	9:33:24 AM	0	895.339	0.34	0.25	26.09	1007.59
10/18/2021	11:01:31 AM	0	9.3806	4.97	10/18/202	10:33:24 AM	0	895.957	1.576	0.24	26.09	1007.59
10/18/2021	12:01:31 PM	0	9.3842	4.97	10/18/202	11:33:24 AM	0	896.422	2.968	0.24	26.09	1007.59
10/18/2021	1:01:31 PM	0	9.3857	4.97	10/18/202	12:33:24 PM	0	896.393	4.683	0.25	26.09	1007.59
10/18/2021	2:01:31 PM	0	9.3861	4.97	10/18/202	1:33:24 PM	0	896.389	4.752	0.25	26.09	1007.59
10/18/2021	3:01:31 PM	0	9.3864	4.97	10/18/202	2:33:24 PM	0	896.473	4.687	0.24	26.09	1007.59
10/18/2021	4:01:31 PM	0	9.3874	4.97	10/18/202	3:33:24 PM	0	896.624	4.226	0.24	26.09	1007.59
10/18/2021	5:01:31 PM	0	9.388	4.97	10/18/202	4:33:24 PM	0	896.834	4.154	0.24	26.09	1007.59
10/18/2021	6:01:31 PM	0	9.3886	4.97	10/18/202	5:33:24 PM	0	896.727	3.892	0.24	26.09	1007.59
10/18/2021	7:01:31 PM	0	9.3891	4.97	10/18/202	6:33:24 PM	0	896.744	2.17	0.24	26.09	1007.59
10/18/2021	8:01:31 PM	0	9.3894	4.97	10/18/202	7:33:24 PM	0	896.702	0.614	0.25	26.09	1007.59
10/18/2021	9:01:31 PM	0	9.3897	4.97	10/18/202	8:33:24 PM	0	896.647	-0.152	0.25	26.09	1007.59
10/18/2021	10:01:31 PM	0	9.3895	4.97	10/18/202	9:33:24 PM	0	896.75	-0.475	0.25	26.09	1007.59
10/18/2021	11:01:31 PM	0	9.389	4.97	10/18/202	10:33:24 PM	0	896.786	0.07	0.24	26.09	1007.59
10/19/2021	12:01:31 AM	0	9.3881	4.97	10/18/202	11:33:24 PM	0	896.72	0.782	0.24	26.09	1007.59
10/19/2021	1:01:31 AM	0	9.3878	4.97	10/19/202	12:33:24 AM	0	896.791	1.164	0.24	26.09	1007.59
10/19/2021	2:01:31 AM	0	9.3868	4.971	10/19/202	1:33:24 AM	0	896.837	1.6	0.24	26.10	1007.58
10/19/2021	3:01:31 AM	0	9.3861	4.97	10/19/202	2:33:24 AM	0	896.7	1.419	0.24	26.09	1007.59
10/19/2021	4:01:31 AM	0	9.3837	4.97	10/19/202	3:33:24 AM	0	896.238	1.345	0.24	26.09	1007.59
10/19/2021	5:01:31 AM	0	9.3815	4.971	10/19/202	4:33:24 AM	0	896.066	1.287	0.24	26.09	1007.59
10/19/2021	6:01:31 AM	0	9.379	4.97	10/19/202	5:33:24 AM	0	895.939	1.435	0.24	26.09	1007.59
10/19/2021	7:01:31 AM	0	9.3764	4.97	10/19/202	6:33:24 AM	0	895.664	1.578	0.24	26.09	1007.59
10/19/2021	8:01:31 AM	0	9.3736	4.97	10/19/202	7:33:24 AM	0	895.533	1.663	0.24	26.10	1007.58
10/19/2021	9:01:31 AM	0	9.3716	4.97	10/19/202	8:33:24 AM	0	895.474	1.961	0.24	26.10	1007.58
10/19/2021	10:01:31 AM	0	9.369	4.97	10/19/202	9:33:24 AM	0	895.278	2.56	0.24	26.10	1007.58
10/19/2021	11:01:31 AM	0	9.3666	4.97	10/19/202	10:33:24 AM	0	895.057	4.051	0.24	26.10	1007.58
10/19/2021	12:01:31 PM	0	9.3628	4.97	10/19/202	11:33:24 AM	0	894.638	6.121	0.24	26.10	1007.58
10/19/2021	1:01:31 PM	0	9.358	4.969	10/19/202	12:33:24 PM	0	894.039	8.375	0.24	26.10	1007.58
10/19/2021	2:01:31 PM	0	9.3517	4.97	10/19/202	1:33:24 PM	0	893.351	9.88	0.24	26.10	1007.58
10/19/2021	3:01:31 PM	0	9.3452	4.97	10/19/202	2:33:24 PM	0	892.784	11.741	0.24	26.10	1007.58
10/19/2021	4:01:31 PM	0	9.3388	4.971	10/19/202	3:33:24 PM	0	892.137	10.647	0.24	26.10	1007.58
10/19/2021	5:01:31 PM	0	9.3328	4.97	10/19/202	4:33:24 PM	0	891.536	10.223	0.24	26.10	1007.58
10/19/2021	6:01:31 PM	0	9.3269	4.97	10/19/202	5:33:24 PM	0	890.979	9.512	0.24	26.10	1007.58

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/19/2021	7:01:31 PM	0	9.3227	4.97	10/19/202	6:33:24 PM	0	891.174	9.14	0.24	26.10	1007.58
10/19/2021	8:01:31 PM	0	9.3195	4.97	10/19/202	7:33:24 PM	0	890.856	8.479	0.24	26.10	1007.58
10/19/2021	9:01:31 PM	0	9.3153	4.97	10/19/202	8:33:24 PM	0	890.275	8.221	0.24	26.10	1007.58
10/19/2021	10:01:31 PM	0	9.3113	4.97	10/19/202	9:33:24 PM	0	889.855	7.861	0.24	26.10	1007.58
10/19/2021	11:01:31 PM	0	9.3077	4.97	10/19/202	10:33:24 PM	0	889.808	7.581	0.23	26.10	1007.58
10/20/2021	12:01:31 AM	0	9.3048	4.97	10/19/202	11:33:24 PM	0	889.62	7.322	0.23	26.10	1007.58
10/20/2021	1:01:31 AM	0	9.3019	4.97	10/20/202	12:33:24 AM	0	889.487	7.625	0.23	26.11	1007.57
10/20/2021	2:01:31 AM	0	9.2994	4.97	10/20/202	1:33:24 AM	0	889.237	8.431	0.23	26.11	1007.57
10/20/2021	3:01:31 AM	0	9.2963	4.97	10/20/202	2:33:24 AM	0	888.913	7.715	0.23	26.11	1007.57
10/20/2021	4:01:31 AM	0	9.2933	4.97	10/20/202	3:33:24 AM	0	888.614	7.277	0.23	26.11	1007.57
10/20/2021	5:01:31 AM	0	9.2907	4.97	10/20/202	4:33:24 AM	0	888.416	7.719	0.23	26.11	1007.57
10/20/2021	6:01:31 AM	0	9.2878	4.97	10/20/202	5:33:24 AM	0	887.922	7.36	0.23	26.10	1007.58
10/20/2021	7:01:31 AM	0	9.2838	4.97	10/20/202	6:33:24 AM	0	887.328	6.588	0.24	26.10	1007.58
10/20/2021	8:01:31 AM	0	9.2799	4.97	10/20/202	7:33:24 AM	0	887.15	6.269	0.23	26.10	1007.58
10/20/2021	9:01:31 AM	0	9.2767	4.97	10/20/202	8:33:24 AM	0	887.086	7.125	0.23	26.11	1007.57
10/20/2021	10:01:31 AM	0	9.2745	4.97	10/20/202	9:33:24 AM	0	887.192	8.453	0.23	26.11	1007.57
10/20/2021	11:01:31 AM	0	9.2721	4.97	10/20/202	10:33:24 AM	0	887.127	9.275	0.23	26.11	1007.57
10/20/2021	12:01:31 PM	0	9.2708	4.97	10/20/202	11:33:24 AM	0	887.174	10.73	0.22	26.11	1007.57
10/20/2021	1:01:31 PM	0	9.2707	4.97	10/20/202	12:33:24 PM	0	887.65	11.808	0.22	26.12	1007.56
10/20/2021	2:01:31 PM	0	9.2739	4.97	10/20/202	1:33:24 PM	0	888.681	11.604	0.21	26.13	1007.55
10/20/2021	3:01:31 PM	0	9.2799	4.97	10/20/202	2:33:24 PM	0	889.614	8.4	0.21	26.13	1007.55
10/20/2021	4:01:31 PM	0	9.2859	4.97	10/20/202	3:33:24 PM	0	889.9	7.058	0.21	26.13	1007.55
10/20/2021	5:01:31 PM	0	9.2905	4.97	10/20/202	4:33:24 PM	0	890.301	6.82	0.21	26.13	1007.55
10/20/2021	6:01:31 PM	0	9.2948	4.97	10/20/202	5:33:24 PM	0	890.764	6.625	0.21	26.13	1007.55
10/20/2021	7:01:31 PM	0	9.2996	4.97	10/20/202	6:33:24 PM	0	891.643	6.848	0.21	26.13	1007.55
10/20/2021	8:01:31 PM	0	9.305	4.97	10/20/202	7:33:24 PM	0	892.073	6.603	0.21	26.13	1007.55
10/20/2021	9:01:31 PM	0	9.3105	4.97	10/20/202	8:33:24 PM	0	892.754	6.274	0.21	26.13	1007.55
10/20/2021	10:01:31 PM	0	9.3167	4.97	10/20/202	9:33:24 PM	0	893.68	6.143	0.20	26.13	1007.55
10/20/2021	11:01:31 PM	0	9.3233	4.97	10/20/202	10:33:24 PM	0	894.378	6.17	0.20	26.13	1007.55
10/21/2021	12:01:31 AM	0	9.3287	4.97	10/20/202	11:33:24 PM	0	894.739	6.218	0.20	26.13	1007.55
10/21/2021	1:01:31 AM	0	9.3354	4.97	10/21/202	12:33:24 AM	0	896.121	5.28	0.20	26.14	1007.54
10/21/2021	2:01:31 AM	0	9.343	4.97	10/21/202	1:33:24 AM	0	896.396	4.452	0.20	26.13	1007.55
10/21/2021	3:01:31 AM	0	9.3466	4.971	10/21/202	2:33:24 AM	0	896.431	4.244	0.21	26.13	1007.55
10/21/2021	4:01:31 AM	0	9.3482	4.97	10/21/202	3:33:24 AM	0	896.152	3.906	0.21	26.13	1007.55
10/21/2021	5:01:31 AM	0	9.3488	4.97	10/21/202	4:33:24 AM	0	896.001	3.77	0.21	26.13	1007.55
10/21/2021	6:01:31 AM	0	9.3482	4.971	10/21/202	5:33:24 AM	0	895.802	3.63	0.21	26.12	1007.56
10/21/2021	7:01:31 AM	0	9.3477	4.97	10/21/202	6:33:24 AM	0	895.948	3.529	0.21	26.13	1007.55
10/21/2021	8:01:31 AM	0	9.3461	4.97	10/21/202	7:33:24 AM	0	895.465	3.3	0.21	26.12	1007.56
10/21/2021	9:01:31 AM	0	9.3452	4.97	10/21/202	8:33:24 AM	0	895.706	3.265	0.21	26.13	1007.55
10/21/2021	10:01:31 AM	0	9.3442	4.97	10/21/202	9:33:24 AM	0	895.722	5.6	0.21	26.13	1007.55
10/21/2021	11:01:31 AM	0	9.3433	4.97	10/21/202	10:33:24 AM	0	896.282	8.205	0.20	26.13	1007.55
10/21/2021	12:01:31 PM	0	9.3411	4.97	10/21/202	11:33:24 AM	0	895.608	8.2	0.21	26.13	1007.55
10/21/2021	1:01:31 PM	0	9.3365	4.97	10/21/202	12:33:24 PM	0	894.407	9.575	0.22	26.12	1007.56
10/21/2021	2:01:31 PM	0	9.33	4.97	10/21/202	1:33:24 PM	0	893.846	11.295	0.22	26.12	1007.56
10/21/2021	3:01:31 PM	0	9.3244	4.97	10/21/202	2:33:24 PM	0	893.669	10.402	0.21	26.13	1007.55
10/21/2021	4:01:31 PM	0	9.3164	4.97	10/21/202	3:33:24 PM	0	892.028	10.374	0.22	26.12	1007.56
10/21/2021	5:01:31 PM	0	9.3088	4.97	10/21/202	4:33:24 PM	0	891.686	9.544	0.22	26.12	1007.56
10/21/2021	6:01:31 PM	0	9.3014	4.97	10/21/202	5:33:24 PM	0	891	8.743	0.22	26.12	1007.56
10/21/2021	7:01:31 PM	0	9.2949	4.97	10/21/202	6:33:24 PM	0	890.541	7.788	0.21	26.12	1007.56
10/21/2021	8:01:31 PM	0	9.2877	4.97	10/21/202	7:33:24 PM	0	889.469	7.667	0.22	26.12	1007.56
10/21/2021	9:01:31 PM	0	9.2801	4.971	10/21/202	8:33:24 PM	0	888.612	7.547	0.22	26.12	1007.56
10/21/2021	10:01:31 PM	0	9.2733	4.97	10/21/202	9:33:24 PM	0	888.173	7.821	0.22	26.12	1007.56
10/21/2021	11:01:31 PM	0	9.2674	4.97	10/21/202	10:33:24 PM	0	887.755	7.924	0.21	26.12	1007.56
10/22/2021	12:01:31 AM	0	9.2614	4.971	10/21/202	11:33:24 PM	0	887.87	8.099	0.21	26.13	1007.55
10/22/2021	1:01:31 AM	0	9.2584	4.97	10/22/202	12:33:24 AM	0	887.554	8.179	0.21	26.13	1007.55
10/22/2021	2:01:31 AM	0	9.255	4.97	10/22/202	1:33:24 AM	0	887.153	8.586	0.21	26.13	1007.55
10/22/2021	3:01:31 AM	0	9.2528	4.97	10/22/202	2:33:24 AM	0	887.307	8.412	0.20	26.13	1007.55
10/22/2021	4:01:31 AM	0	9.2491	4.97	10/22/202	3:33:24 AM	0	886.529	8.662	0.21	26.13	1007.55
10/22/2021	5:01:31 AM	0	9.2447	4.97	10/22/202	4:33:24 AM	0	886.243	8.741	0.21	26.13	1007.55
10/22/2021	6:01:31 AM	0	9.241	4.971	10/22/202	5:33:24 AM	0	886.095	8.786	0.21	26.13	1007.55
10/22/2021	7:01:31 AM	0	9.2389	4.97	10/22/202	6:33:24 AM	0	886.008	8.532	0.20	26.13	1007.55
10/22/2021	8:01:31 AM	0	9.2383	4.97	10/22/202	7:33:24 AM	0	886.397	8.032	0.20	26.14	1007.54
10/22/2021	9:01:31 AM	0	9.2399	4.97	10/22/202	8:33:24 AM	0	886.967	7.532	0.20	26.14	1007.54
10/22/2021	10:01:31 AM	0	9.2411	4.971	10/22/202	9:33:24 AM	0	886.848	8.039	0.20	26.14	1007.54
10/22/2021	11:01:31 AM	0	9.2413	4.971	10/22/202	10:33:24 AM	0	887.005	9.982	0.20	26.14	1007.54
10/22/2021	12:01:31 PM	0	9.2398	4.97	10/22/202	11:33:24 AM	0	886.56	10.869	0.20	26.14	1007.54
10/22/2021	1:01:31 PM	0	9.2379	4.971	10/22/202	12:33:24 PM	0	886.386	11.993	0.20	26.14	1007.54
10/22/2021	2:01:31 PM	0	9.2353	4.97	10/22/202	1:33:24 PM	0	886.071	13.161	0.20	26.14	1007.54
10/22/2021	3:01:31 PM	0	9.2329	4.97	10/22/202	2:33:24 PM	0	885.95	13.885	0.20	26.14	1007.54
10/22/2021	4:01:31 PM	0	9.2308	4.97	10/22/202	3:33:24 PM	0	885.742	13.107	0.20	26.14	1007.54

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/22/2021	5:01:31 PM	0	9.229	4.971	10/22/202	4:33:24 PM	0	885.606	11.516	0.20	26.14	1007.54
10/22/2021	6:01:31 PM	0	9.2261	4.971	10/22/202	5:33:24 PM	0	885.197	10.205	0.20	26.14	1007.54
10/22/2021	7:01:31 PM	0	9.2243	4.971	10/22/202	6:33:24 PM	0	885.159	7.914	0.20	26.14	1007.54
10/22/2021	8:01:31 PM	0	9.2225	4.971	10/22/202	7:33:24 PM	0	884.778	6.064	0.20	26.14	1007.54
10/22/2021	9:01:31 PM	0	9.2205	4.971	10/22/202	8:33:24 PM	0	884.699	4.671	0.20	26.14	1007.54
10/22/2021	10:01:31 PM	0	9.2187	4.97	10/22/202	9:33:24 PM	0	884.747	5.123	0.20	26.14	1007.54
10/22/2021	11:01:31 PM	0	9.2174	4.97	10/22/202	10:33:24 PM	0	884.646	5.123	0.20	26.14	1007.54
10/23/2021	12:01:31 AM	0	9.2162	4.97	10/22/202	11:33:24 PM	0	884.465	4.86	0.20	26.14	1007.54
10/23/2021	1:01:31 AM	0	9.215	4.97	10/23/202	12:33:24 AM	0	884.522	4.053	0.20	26.14	1007.54
10/23/2021	2:01:31 AM	0	9.214	4.971	10/23/202	1:33:24 AM	0	884.377	3.472	0.20	26.14	1007.54
10/23/2021	3:01:31 AM	0	9.2123	4.97	10/23/202	2:33:24 AM	0	884.128	2.982	0.20	26.14	1007.54
10/23/2021	4:01:31 AM	0	9.2112	4.97	10/23/202	3:33:24 AM	0	884.218	2.609	0.19	26.14	1007.54
10/23/2021	5:01:31 AM	0	9.2104	4.97	10/23/202	4:33:24 AM	0	884.044	3.02	0.20	26.14	1007.54
10/23/2021	6:01:31 AM	0	9.2096	4.971	10/23/202	5:33:24 AM	0	884.121	2.852	0.19	26.14	1007.54
10/23/2021	7:01:31 AM	0	9.2085	4.97	10/23/202	6:33:24 AM	0	883.928	2.675	0.19	26.14	1007.54
10/23/2021	8:01:31 AM	0	9.2067	4.97	10/23/202	7:33:24 AM	0	883.686	3.119	0.20	26.14	1007.54
10/23/2021	9:01:31 AM	0	9.2051	4.97	10/23/202	8:33:24 AM	0	883.81	3.445	0.19	26.14	1007.54
10/23/2021	10:01:31 AM	0	9.2032	4.969	10/23/202	9:33:24 AM	0	883.581	4.073	0.19	26.14	1007.54
10/23/2021	11:01:31 AM	0	9.2006	4.97	10/23/202	10:33:24 AM	0	883.587	7.022	0.19	26.15	1007.53
10/23/2021	12:01:31 PM	0	9.1984	4.97	10/23/202	11:33:24 AM	0	883.363	6.738	0.19	26.15	1007.53
10/23/2021	1:01:31 PM	0	9.1959	4.971	10/23/202	12:33:24 PM	0	883.134	7.648	0.19	26.15	1007.53
10/23/2021	2:01:31 PM	0	9.1932	4.97	10/23/202	1:33:24 PM	0	882.98	9.173	0.19	26.15	1007.53
10/23/2021	3:01:31 PM	0	9.1907	4.971	10/23/202	2:33:24 PM	0	882.683	10.699	0.19	26.15	1007.53
10/23/2021	4:01:31 PM	0	9.1883	4.97	10/23/202	3:33:24 PM	0	882.6	9.321	0.19	26.15	1007.53
10/23/2021	5:01:31 PM	0	9.1874	4.97	10/23/202	4:33:24 PM	0	882.952	8.46	0.18	26.15	1007.53
10/23/2021	6:01:31 PM	0	9.1875	4.971	10/23/202	5:33:24 PM	0	882.799	6.476	0.19	26.15	1007.53
10/23/2021	7:01:31 PM	0	9.1876	4.97	10/23/202	6:33:24 PM	0	882.716	5.405	0.19	26.15	1007.53
10/23/2021	8:01:31 PM	0	9.1876	4.97	10/23/202	7:33:24 PM	0	882.82	4.45	0.19	26.15	1007.53
10/23/2021	9:01:31 PM	0	9.1882	4.971	10/23/202	8:33:24 PM	0	883.132	5.133	0.18	26.15	1007.53
10/23/2021	10:01:31 PM	0	9.1883	4.97	10/23/202	9:33:24 PM	0	883.084	5.398	0.18	26.15	1007.53
10/23/2021	11:01:31 PM	0	9.1881	4.971	10/23/202	10:33:24 PM	0	882.952	4.529	0.18	26.15	1007.53
10/24/2021	12:01:31 AM	0	9.1872	4.971	10/23/202	11:33:24 PM	0	882.658	3.898	0.19	26.15	1007.53
10/24/2021	1:01:31 AM	0	9.1856	4.971	10/24/202	12:33:24 AM	0	882.525	3.513	0.19	26.15	1007.53
10/24/2021	2:01:31 AM	0	9.184	4.971	10/24/202	1:33:24 AM	0	882.41	2.815	0.19	26.15	1007.53
10/24/2021	3:01:31 AM	0	9.182	4.97	10/24/202	2:33:24 AM	0	882.05	2.714	0.19	26.15	1007.53
10/24/2021	4:01:31 AM	0	9.1779	4.97	10/24/202	3:33:24 AM	0	881.27	2.806	0.19	26.15	1007.53
10/24/2021	5:01:31 AM	0	9.1725	4.97	10/24/202	4:33:24 AM	0	880.591	2.608	0.19	26.14	1007.54
10/24/2021	6:01:31 AM	0	9.1671	4.97	10/24/202	5:33:24 AM	0	880.043	2.253	0.19	26.14	1007.54
10/24/2021	7:01:31 AM	0	9.1609	4.97	10/24/202	6:33:24 AM	0	879.273	2.17	0.19	26.14	1007.54
10/24/2021	8:01:31 AM	0	9.1552	4.97	10/24/202	7:33:24 AM	0	879.006	2.94	0.19	26.15	1007.53
10/24/2021	9:01:31 AM	0	9.148	4.971	10/24/202	8:33:24 AM	0	877.928	4.031	0.20	26.14	1007.54
10/24/2021	10:01:31 AM	0	9.1403	4.97	10/24/202	9:33:24 AM	0	877.572	5.497	0.19	26.15	1007.53
10/24/2021	11:01:31 AM	0	9.1334	4.971	10/24/202	10:33:24 AM	0	876.734	7.836	0.19	26.14	1007.54
10/24/2021	12:01:31 PM	0	9.1261	4.97	10/24/202	11:33:24 AM	0	876.426	8.813	0.19	26.15	1007.53
10/24/2021	1:01:31 PM	0	9.1184	4.97	10/24/202	12:33:24 PM	0	875.236	8.931	0.19	26.14	1007.54
10/24/2021	2:01:31 PM	0	9.1084	4.97	10/24/202	1:33:24 PM	0	873.979	9.455	0.20	26.14	1007.54
10/24/2021	3:01:31 PM	0	9.0985	4.97	10/24/202	2:33:24 PM	0	872.971	8.831	0.20	26.14	1007.54
10/24/2021	4:01:31 PM	0	9.0892	4.971	10/24/202	3:33:24 PM	0	872.227	8.852	0.19	26.14	1007.54
10/24/2021	5:01:31 PM	0	9.0814	4.97	10/24/202	4:33:24 PM	0	871.755	8.44	0.19	26.15	1007.53
10/24/2021	6:01:31 PM	0	9.0756	4.97	10/24/202	5:33:24 PM	0	871.434	7.703	0.19	26.15	1007.53
10/24/2021	7:01:31 PM	0	9.0715	4.97	10/24/202	6:33:24 PM	0	871.682	6.901	0.18	26.15	1007.53
10/24/2021	8:01:31 PM	0	9.0696	4.971	10/24/202	7:33:24 PM	0	871.68	5.749	0.18	26.16	1007.52
10/24/2021	9:01:31 PM	0	9.0692	4.97	10/24/202	8:33:24 PM	0	871.907	5.548	0.18	26.16	1007.52
10/24/2021	10:01:31 PM	0	9.0694	4.97	10/24/202	9:33:24 PM	0	872.021	4.294	0.18	26.16	1007.52
10/24/2021	11:01:31 PM	0	9.0679	4.971	10/24/202	10:33:24 PM	0	871.054	3.946	0.19	26.15	1007.53
10/25/2021	12:01:31 AM	0	9.068	4.971	10/24/202	11:33:24 PM	0	871.816	4.326	0.18	26.16	1007.52
10/25/2021	1:01:31 AM	0	9.0699	4.97	10/25/202	12:33:24 AM	0	872.6	4.196	0.17	26.17	1007.51
10/25/2021	2:01:31 AM	0	9.0737	4.971	10/25/202	1:33:24 AM	0	872.921	3.38	0.17	26.16	1007.52
10/25/2021	3:01:31 AM	0	9.0756	4.971	10/25/202	2:33:24 AM	0	872.944	2.845	0.17	26.16	1007.52
10/25/2021	4:01:31 AM	0	9.0773	4.971	10/25/202	3:33:24 AM	0	873.039	2.637	0.17	26.16	1007.52
10/25/2021	5:01:31 AM	0	9.079	4.971	10/25/202	4:33:24 AM	0	873.345	2.586	0.17	26.16	1007.52
10/25/2021	6:01:31 AM	0	9.0801	4.97	10/25/202	5:33:24 AM	0	873.261	2.616	0.18	26.16	1007.52
10/25/2021	7:01:31 AM	0	9.0803	4.971	10/25/202	6:33:24 AM	0	873.383	2.361	0.17	26.16	1007.52
10/25/2021	8:01:31 AM	0	9.0819	4.971	10/25/202	7:33:24 AM	0	873.799	2.556	0.17	26.17	1007.51
10/25/2021	9:01:31 AM	0	9.084	4.97	10/25/202	8:33:24 AM	0	874.174	2.733	0.17	26.17	1007.51
10/25/2021	10:01:31 AM	0	9.0865	4.97	10/25/202	9:33:24 AM	0	874.587	3.965	0.17	26.17	1007.51
10/25/2021	11:01:31 AM	0	9.0884	4.97	10/25/202	10:33:24 AM	0	874.81	5.168	0.17	26.17	1007.51
10/25/2021	12:01:31 PM	0	9.0891	4.971	10/25/202	11:33:24 AM	0	874.685	6.366	0.17	26.17	1007.51
10/25/2021	1:01:31 PM	0	9.0882	4.97	10/25/202	12:33:24 PM	0	874.54	7.793	0.17	26.17	1007.51
10/25/2021	2:01:31 PM	0	9.0877	4.971	10/25/202	1:33:24 PM	0	874.767	8.458	0.17	26.17	1007.51

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/25/2021	3:01:31 PM	0	9.0882	4.971	10/25/202	2:33:24 PM	0	874.894	8.11	0.17	26.17	1007.51
10/25/2021	4:01:31 PM	0	9.0891	4.97	10/25/202	3:33:24 PM	0	875.155	7.599	0.16	26.17	1007.51
10/25/2021	5:01:31 PM	0	9.0903	4.97	10/25/202	4:33:24 PM	0	875.273	6.895	0.16	26.17	1007.51
10/25/2021	6:01:31 PM	0	9.0917	4.971	10/25/202	5:33:24 PM	0	875.426	6.41	0.16	26.17	1007.51
10/25/2021	7:01:31 PM	0	9.0935	4.97	10/25/202	6:33:24 PM	0	875.711	6.048	0.16	26.17	1007.51
10/25/2021	8:01:31 PM	0	9.0943	4.971	10/25/202	7:33:24 PM	0	875.648	5.833	0.17	26.17	1007.51
10/25/2021	9:01:31 PM	0	9.0952	4.971	10/25/202	8:33:24 PM	0	875.865	5.632	0.16	26.17	1007.51
10/25/2021	10:01:31 PM	0	9.0964	4.97	10/25/202	9:33:24 PM	0	876.092	5.598	0.16	26.17	1007.51
10/25/2021	11:01:31 PM	0	9.0975	4.97	10/25/202	10:33:24 PM	0	876.277	5.683	0.16	26.18	1007.50
10/26/2021	12:01:31 AM	0	9.0992	4.971	10/25/202	11:33:24 PM	0	876.69	5.746	0.16	26.18	1007.50
10/26/2021	1:01:31 AM	0	9.103	4.97	10/26/202	12:33:24 AM	0	877.31	4.531	0.16	26.18	1007.50
10/26/2021	2:01:31 AM	0	9.1061	4.971	10/26/202	1:33:24 AM	0	877.6	3.433	0.16	26.18	1007.50
10/26/2021	3:01:31 AM	0	9.1103	4.971	10/26/202	2:33:24 AM	0	878.307	3.502	0.15	26.18	1007.50
10/26/2021	4:01:31 AM	0	9.1158	4.971	10/26/202	3:33:24 AM	0	879.19	4.04	0.15	26.19	1007.49
10/26/2021	5:01:31 AM	0	9.1212	4.971	10/26/202	4:33:24 AM	0	879.83	4.125	0.15	26.19	1007.49
10/26/2021	6:01:31 AM	0	9.1267	4.971	10/26/202	5:33:24 AM	0	880.418	4.024	0.15	26.19	1007.49
10/26/2021	7:01:31 AM	0	9.132	4.97	10/26/202	6:33:24 AM	0	880.856	3.812	0.15	26.19	1007.49
10/26/2021	8:01:31 AM	0	9.1367	4.971	10/26/202	7:33:24 AM	0	881.257	3.668	0.15	26.19	1007.49
10/26/2021	9:01:31 AM	0	9.1406	4.971	10/26/202	8:33:24 AM	0	881.597	3.896	0.15	26.19	1007.49
10/26/2021	10:01:31 AM	0	9.1437	4.97	10/26/202	9:33:24 AM	0	881.972	4.361	0.15	26.19	1007.49
10/26/2021	11:01:31 AM	0	9.1465	4.971	10/26/202	10:33:24 AM	0	882.164	5.203	0.15	26.19	1007.49
10/26/2021	12:01:31 PM	0	9.1482	4.971	10/26/202	11:33:24 AM	0	882.203	6.254	0.15	26.18	1007.50
10/26/2021	1:01:31 PM	0	9.148	4.971	10/26/202	12:33:24 PM	0	882.076	7.826	0.15	26.18	1007.50
10/26/2021	2:01:31 PM	0	9.1464	4.971	10/26/202	1:33:24 PM	0	881.796	8.805	0.15	26.18	1007.50
10/26/2021	3:01:31 PM	0	9.1424	4.971	10/26/202	2:33:24 PM	0	880.892	11.413	0.16	26.18	1007.50
10/26/2021	4:01:31 PM	0	9.1369	4.971	10/26/202	3:33:24 PM	0	879.947	9.912	0.16	26.17	1007.51
10/26/2021	5:01:31 PM	0	9.1301	4.97	10/26/202	4:33:24 PM	0	879.134	7.981	0.17	26.17	1007.51
10/26/2021	6:01:31 PM	0	9.1246	4.971	10/26/202	5:33:24 PM	0	879.022	6.377	0.16	26.18	1007.50
10/26/2021	7:01:31 PM	0	9.1211	4.971	10/26/202	6:33:24 PM	0	878.903	5.619	0.16	26.18	1007.50
10/26/2021	8:01:31 PM	0	9.1183	4.97	10/26/202	7:33:24 PM	0	878.778	5.347	0.16	26.18	1007.50
10/26/2021	9:01:31 PM	0	9.1181	4.97	10/26/202	8:33:24 PM	0	879.525	5.468	0.15	26.19	1007.49
10/26/2021	10:01:31 PM	0	9.1209	4.971	10/26/202	9:33:24 PM	0	880.076	5.001	0.15	26.19	1007.49
10/26/2021	11:01:31 PM	0	9.1254	4.971	10/26/202	10:33:24 PM	0	881.126	4.088	0.14	26.20	1007.48
10/27/2021	12:01:31 AM	0	9.1317	4.97	10/26/202	11:33:24 PM	0	881.858	3.491	0.14	26.20	1007.48
10/27/2021	1:01:31 AM	0	9.1387	4.971	10/27/202	12:33:24 AM	0	882.916	3.02	0.14	26.20	1007.48
10/27/2021	2:01:31 AM	0	9.1472	4.971	10/27/202	1:33:24 AM	0	883.901	2.506	0.13	26.20	1007.48
10/27/2021	3:01:31 AM	0	9.156	4.971	10/27/202	2:33:24 AM	0	885.027	0.874	0.13	26.21	1007.47
10/27/2021	4:01:31 AM	0	9.1654	4.97	10/27/202	3:33:24 AM	0	885.963	0.919	0.13	26.21	1007.47
10/27/2021	5:01:31 AM	0	9.1745	4.971	10/27/202	4:33:24 AM	0	887.148	1.375	0.13	26.21	1007.47
10/27/2021	6:01:31 AM	0	9.1835	4.971	10/27/202	5:33:24 AM	0	888.007	1.287	0.13	26.21	1007.47
10/27/2021	7:01:31 AM	0	9.1928	4.971	10/27/202	6:33:24 AM	0	888.989	1.325	0.13	26.21	1007.47
10/27/2021	8:01:31 AM	0	9.2015	4.971	10/27/202	7:33:24 AM	0	890.104	1.074	0.12	26.21	1007.47
10/27/2021	9:01:31 AM	0	9.2121	4.971	10/27/202	8:33:24 AM	0	891.301	0.851	0.12	26.21	1007.47
10/27/2021	10:01:31 AM	0	9.2214	4.97	10/27/202	9:33:24 AM	0	892.068	1.87	0.12	26.21	1007.47
10/27/2021	11:01:31 AM	0	9.2302	4.97	10/27/202	10:33:24 AM	0	893.324	3.733	0.12	26.22	1007.46
10/27/2021	12:01:31 PM	0	9.2378	4.971	10/27/202	11:33:24 AM	0	894.031	5.984	0.12	26.22	1007.46
10/27/2021	1:01:31 PM	0	9.2439	4.971	10/27/202	12:33:24 PM	0	894.367	6.014	0.12	26.21	1007.47
10/27/2021	2:01:31 PM	0	9.2483	4.971	10/27/202	1:33:24 PM	0	894.93	8.553	0.12	26.21	1007.47
10/27/2021	3:01:31 PM	0	9.2524	4.971	10/27/202	2:33:24 PM	0	895.185	9.079	0.12	26.21	1007.47
10/27/2021	4:01:31 PM	0	9.2567	4.971	10/27/202	3:33:24 PM	0	895.798	7.782	0.12	26.22	1007.46
10/27/2021	5:01:31 PM	0	9.2622	4.971	10/27/202	4:33:24 PM	0	896.482	7.894	0.12	26.22	1007.46
10/27/2021	6:01:31 PM	0	9.2683	4.971	10/27/202	5:33:24 PM	0	897.128	5.225	0.12	26.22	1007.46
10/27/2021	7:01:31 PM	0	9.2747	4.971	10/27/202	6:33:24 PM	0	897.577	1.734	0.12	26.22	1007.46
10/27/2021	8:01:31 PM	0	9.2807	4.971	10/27/202	7:33:24 PM	0	898.094	-0.611	0.12	26.21	1007.47
10/27/2021	9:01:31 PM	0	9.2874	4.971	10/27/202	8:33:24 PM	0	898.703	-1.803	0.12	26.21	1007.47
10/27/2021	10:01:31 PM	0	9.2918	4.971	10/27/202	9:33:24 PM	0	899.104	-1.319	0.12	26.21	1007.47
10/27/2021	11:01:31 PM	0	9.2949	4.97	10/27/202	10:33:24 PM	0	899.251	-1.562	0.13	26.21	1007.47
10/28/2021	12:01:31 AM	0	9.2983	4.971	10/27/202	11:33:24 PM	0	899.434	-1.727	0.13	26.21	1007.47
10/28/2021	1:01:31 AM	0	9.299	4.971	10/28/202	12:33:24 AM	0	899.406	-0.764	0.13	26.21	1007.47
10/28/2021	2:01:31 AM	0	9.2982	4.97	10/28/202	1:33:24 AM	0	899.155	-1.21	0.13	26.21	1007.47
10/28/2021	3:01:31 AM	0	9.2971	4.971	10/28/202	2:33:24 AM	0	899.106	-1.301	0.13	26.21	1007.47
10/28/2021	4:01:31 AM	0	9.2939	4.971	10/28/202	3:33:24 AM	0	898.302	-0.885	0.13	26.20	1007.48
10/28/2021	5:01:31 AM	0	9.2897	4.971	10/28/202	4:33:24 AM	0	897.842	-1.028	0.13	26.20	1007.48
10/28/2021	6:01:31 AM	0	9.2838	4.971	10/28/202	5:33:24 AM	0	896.893	-1.284	0.14	26.20	1007.48
10/28/2021	7:01:31 AM	0	9.278	4.971	10/28/202	6:33:24 AM	0	896.666	-1.065	0.13	26.20	1007.48
10/28/2021	8:01:31 AM	0	9.2733	4.971	10/28/202	7:33:24 AM	0	896.461	-0.776	0.13	26.21	1007.47
10/28/2021	9:01:31 AM	0	9.2693	4.971	10/28/202	8:33:24 AM	0	896.486	-0.555	0.13	26.21	1007.47
10/28/2021	10:01:31 AM	0	9.2656	4.971	10/28/202	9:33:24 AM	0	896.02	-0.264	0.13	26.21	1007.47
10/28/2021	11:01:31 AM	0	9.2614	4.971	10/28/202	10:33:24 AM	0	895.547	1.288	0.13	26.21	1007.47
10/28/2021	12:01:31 PM	0	9.2565	4.971	10/28/202	11:33:24 AM	0	894.954	2.384	0.13	26.21	1007.47

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/28/2021	1:01:31 PM	0	9.2518	4.971	10/28/202	12:33:24 PM	0	894.939	2.824	0.13	26.21	1007.47
10/28/2021	2:01:31 PM	0	9.2468	4.971	10/28/202	1:33:24 PM	0	894.201	3.403	0.13	26.21	1007.47
10/28/2021	3:01:31 PM	0	9.2421	4.971	10/28/202	2:33:24 PM	0	894.058	3.431	0.13	26.21	1007.47
10/28/2021	4:01:31 PM	0	9.2396	4.97	10/28/202	3:33:24 PM	0	894.163	3.057	0.12	26.22	1007.46
10/28/2021	5:01:31 PM	0	9.2362	4.97	10/28/202	4:33:24 PM	0	893.508	2.915	0.12	26.21	1007.47
10/28/2021	6:01:31 PM	0	9.2332	4.971	10/28/202	5:33:24 PM	0	893.365	2.419	0.12	26.21	1007.47
10/28/2021	7:01:31 PM	0	9.2322	4.971	10/28/202	6:33:24 PM	0	893.65	1.799	0.12	26.22	1007.46
10/28/2021	8:01:31 PM	0	9.2321	4.971	10/28/202	7:33:24 PM	0	893.674	0.771	0.12	26.22	1007.46
10/28/2021	9:01:31 PM	0	9.2327	4.971	10/28/202	8:33:24 PM	0	893.877	-0.572	0.12	26.22	1007.46
10/28/2021	10:01:31 PM	0	9.2333	4.971	10/28/202	9:33:24 PM	0	893.97	-0.615	0.12	26.22	1007.46
10/28/2021	11:01:31 PM	0	9.2343	4.971	10/28/202	10:33:24 PM	0	894.06	-0.634	0.12	26.22	1007.46
10/29/2021	12:01:31 AM	0	9.2347	4.971	10/28/202	11:33:24 PM	0	894.029	-0.904	0.12	26.22	1007.46
10/29/2021	1:01:31 AM	0	9.2355	4.971	10/29/202	12:33:24 AM	0	894.22	-1.177	0.12	26.22	1007.46
10/29/2021	2:01:31 AM	0	9.2351	4.971	10/29/202	1:33:24 AM	0	894.121	-0.911	0.12	26.22	1007.46
10/29/2021	3:01:31 AM	0	9.2352	4.971	10/29/202	2:33:24 AM	0	894.38	-0.692	0.12	26.22	1007.46
10/29/2021	4:01:31 AM	0	9.2358	4.971	10/29/202	3:33:24 AM	0	894.544	-0.684	0.11	26.22	1007.46
10/29/2021	5:01:31 AM	0	9.2361	4.971	10/29/202	4:33:24 AM	0	894.692	-0.637	0.11	26.22	1007.46
10/29/2021	6:01:31 AM	0	9.2377	4.971	10/29/202	5:33:24 AM	0	895.128	-0.805	0.11	26.23	1007.45
10/29/2021	7:01:31 AM	0	9.2404	4.971	10/29/202	6:33:24 AM	0	895.392	-1.739	0.11	26.23	1007.45
10/29/2021	8:01:31 AM	0	9.2437	4.97	10/29/202	7:33:24 AM	0	895.873	-2.821	0.11	26.23	1007.45
10/29/2021	9:01:31 AM	0	9.2476	4.971	10/29/202	8:33:24 AM	0	896.239	-3.631	0.11	26.23	1007.45
10/29/2021	10:01:31 AM	0	9.2529	4.971	10/29/202	9:33:24 AM	0	897.157	-3.009	0.10	26.23	1007.45
10/29/2021	11:01:31 AM	0	9.2584	4.971	10/29/202	10:33:24 AM	0	898.226	-0.666	0.10	26.24	1007.44
10/29/2021	12:01:31 PM	0	9.2644	4.971	10/29/202	11:33:24 AM	0	899.026	-0.529	0.10	26.24	1007.44
10/29/2021	1:01:31 PM	0	9.2701	4.971	10/29/202	12:33:24 PM	0	899.581	-0.532	0.10	26.24	1007.44
10/29/2021	2:01:31 PM	0	9.276	4.971	10/29/202	1:33:24 PM	0	900.312	0.303	0.10	26.24	1007.44
10/29/2021	3:01:31 PM	0	9.2816	4.971	10/29/202	2:33:24 PM	0	901.129	3.462	0.09	26.24	1007.44
10/29/2021	4:01:31 PM	0	9.2872	4.971	10/29/202	3:33:24 PM	0	901.724	1.67	0.09	26.25	1007.43
10/29/2021	5:01:31 PM	0	9.2937	4.971	10/29/202	4:33:24 PM	0	902.292	0.206	0.09	26.24	1007.44
10/29/2021	6:01:31 PM	0	9.3001	4.972	10/29/202	5:33:24 PM	0	902.822	-0.882	0.09	26.24	1007.44
10/29/2021	7:01:31 PM	0	9.3057	4.971	10/29/202	6:33:24 PM	0	903.411	-0.916	0.09	26.24	1007.44
10/29/2021	8:01:31 PM	0	9.3114	4.972	10/29/202	7:33:24 PM	0	903.79	-2.891	0.10	26.24	1007.44
10/29/2021	9:01:31 PM	0	9.3169	4.971	10/29/202	8:33:24 PM	0	904.212	-4.552	0.10	26.24	1007.44
10/29/2021	10:01:31 PM	0	9.3219	4.971	10/29/202	9:33:24 PM	0	904.559	-5.241	0.10	26.24	1007.44
10/29/2021	11:01:31 PM	0	9.3267	4.971	10/29/202	10:33:24 PM	0	905.005	-5.671	0.10	26.24	1007.44
10/30/2021	12:01:31 AM	0	9.33	4.971	10/29/202	11:33:24 PM	0	905.244	-6.03	0.10	26.24	1007.44
10/30/2021	1:01:31 AM	0	9.3331	4.971	10/30/202	12:33:24 AM	0	905.534	-6.31	0.10	26.24	1007.44
10/30/2021	2:01:31 AM	0	9.3362	4.971	10/30/202	1:33:24 AM	0	905.803	-6.564	0.10	26.24	1007.44
10/30/2021	3:01:31 AM	0	9.3391	4.971	10/30/202	2:33:24 AM	0	906.227	-6.839	0.10	26.24	1007.44
10/30/2021	4:01:31 AM	0	9.3424	4.971	10/30/202	3:33:24 AM	0	906.648	-6.806	0.10	26.24	1007.44
10/30/2021	5:01:31 AM	0	9.3443	4.971	10/30/202	4:33:24 AM	0	906.805	-7.089	0.10	26.24	1007.44
10/30/2021	6:01:31 AM	0	9.3461	4.971	10/30/202	5:33:24 AM	0	906.873	-7.345	0.10	26.24	1007.44
10/30/2021	7:01:31 AM	0	9.3468	4.971	10/30/202	6:33:24 AM	0	906.957	-7.378	0.10	26.24	1007.44
10/30/2021	8:01:31 AM	0	9.3472	4.971	10/30/202	7:33:24 AM	0	907.005	-7.27	0.10	26.24	1007.44
10/30/2021	9:01:31 AM	0	9.3486	4.971	10/30/202	8:33:24 AM	0	907.427	-7.038	0.10	26.24	1007.44
10/30/2021	10:01:31 AM	0	9.3498	4.971	10/30/202	9:33:24 AM	0	907.917	-5.815	0.09	26.25	1007.43
10/30/2021	11:01:31 AM	0	9.3516	4.971	10/30/202	10:33:24 AM	0	908.77	-1.606	0.08	26.25	1007.43
10/30/2021	12:01:31 PM	0	9.3536	4.971	10/30/202	11:33:24 AM	0	908.904	-1.833	0.09	26.25	1007.43
10/30/2021	1:01:31 PM	0	9.3529	4.971	10/30/202	12:33:24 PM	0	908.465	-2.237	0.09	26.25	1007.43
10/30/2021	2:01:31 PM	0	9.3509	4.971	10/30/202	1:33:24 PM	0	908.355	-0.741	0.09	26.25	1007.43
10/30/2021	3:01:31 PM	0	9.3478	4.971	10/30/202	2:33:24 PM	0	907.685	-0.464	0.09	26.25	1007.43
10/30/2021	4:01:31 PM	0	9.3428	4.971	10/30/202	3:33:24 PM	0	907.272	0.13	0.09	26.25	1007.43
10/30/2021	5:01:31 PM	0	9.3392	4.972	10/30/202	4:33:24 PM	0	906.987	-0.515	0.09	26.25	1007.43
10/30/2021	6:01:31 PM	0	9.3353	4.971	10/30/202	5:33:24 PM	0	906.664	-0.695	0.09	26.25	1007.43
10/30/2021	7:01:31 PM	0	9.3324	4.971	10/30/202	6:33:24 PM	0	906.318	-2.514	0.09	26.25	1007.43
10/30/2021	8:01:31 PM	0	9.3305	4.971	10/30/202	7:33:24 PM	0	906.055	-4.665	0.09	26.25	1007.43
10/30/2021	9:01:31 PM	0	9.3287	4.971	10/30/202	8:33:24 PM	0	905.728	-5.587	0.09	26.24	1007.44
10/30/2021	10:01:31 PM	0	9.3267	4.972	10/30/202	9:33:24 PM	0	905.732	-6.112	0.09	26.25	1007.43
10/30/2021	11:01:31 PM	0	9.3261	4.971	10/30/202	10:33:24 PM	0	905.67	-6.348	0.09	26.25	1007.43
10/31/2021	12:01:31 AM	0	9.3247	4.971	10/30/202	11:33:24 PM	0	905.407	-6.636	0.09	26.25	1007.43
10/31/2021	1:01:31 AM	0	9.323	4.971	10/31/202	12:33:24 AM	0	905.286	-6.813	0.09	26.25	1007.43
10/31/2021	2:01:31 AM	0	9.3211	4.971	10/31/202	1:33:24 AM	0	905.117	-6.92	0.09	26.25	1007.43
10/31/2021	3:01:31 AM	0	9.3189	4.971	10/31/202	2:33:24 AM	0	904.829	-7.077	0.09	26.24	1007.44
10/31/2021	4:01:31 AM	0	9.3164	4.971	10/31/202	3:33:24 AM	0	904.485	-7.243	0.09	26.24	1007.44
10/31/2021	5:01:31 AM	0	9.3133	4.971	10/31/202	4:33:24 AM	0	904.115	-7.435	0.09	26.24	1007.44
10/31/2021	6:01:31 AM	0	9.3101	4.97	10/31/202	5:33:24 AM	0	903.876	-7.631	0.09	26.24	1007.44
10/31/2021	7:01:31 AM	0	9.307	4.971	10/31/202	6:33:24 AM	0	903.696	-7.901	0.09	26.25	1007.43
10/31/2021	8:01:31 AM	0	9.3047	4.971	10/31/202	7:33:24 AM	0	903.51	-8.073	0.09	26.25	1007.43
10/31/2021	9:01:31 AM	0	9.3026	4.97	10/31/202	8:33:24 AM	0	903.555	-8.032	0.09	26.25	1007.43
10/31/2021	10:01:31 AM	0	9.3014	4.971	10/31/202	9:33:24 AM	0	903.779	-6.957	0.09	26.25	1007.43

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
10/31/2021	11:01:31 AM	0	9.2993	4.971	10/31/202	10:33:24 AM	0	904.232	-2.832	0.08	26.26	1007.42
10/31/2021	12:01:31 PM	0	9.2973	4.971	10/31/202	11:33:24 AM	0	904.151	-2.216	0.08	26.26	1007.42
10/31/2021	1:01:31 PM	0	9.2946	4.971	10/31/202	12:33:24 PM	0	903.595	-2.218	0.08	26.26	1007.42
10/31/2021	2:01:31 PM	0	9.2899	4.971	10/31/202	1:33:24 PM	0	903.01	-0.797	0.08	26.26	1007.42
10/31/2021	3:01:31 PM	0	9.2852	4.971	10/31/202	2:33:24 PM	0	902.586	-0.561	0.08	26.26	1007.42
10/31/2021	4:01:31 PM	0	9.2797	4.971	10/31/202	3:33:24 PM	0	902.216	0.312	0.08	26.26	1007.42
10/31/2021	5:01:31 PM	0	9.2751	4.971	10/31/202	4:33:24 PM	0	901.713	-0.351	0.08	26.26	1007.42
10/31/2021	6:01:31 PM	0	9.2712	4.971	10/31/202	5:33:24 PM	0	901.576	-0.652	0.08	26.26	1007.42
10/31/2021	7:01:31 PM	0	9.2683	4.971	10/31/202	6:33:24 PM	0	901.191	-2.638	0.08	26.26	1007.42
10/31/2021	8:01:31 PM	0	9.2654	4.971	10/31/202	7:33:24 PM	0	900.565	-4.769	0.08	26.26	1007.42
10/31/2021	9:01:31 PM	0	9.2627	4.97	10/31/202	8:33:24 PM	0	900.358	-5.633	0.08	26.26	1007.42
10/31/2021	10:01:31 PM	0	9.2603	4.971	10/31/202	9:33:24 PM	0	900.19	-6.131	0.08	26.26	1007.42
10/31/2021	11:01:31 PM	0	9.2589	4.972	10/31/202	10:33:24 PM	0	900.134	-6.508	0.08	26.26	1007.42
11/1/2021	12:01:31 AM	0	9.2579	4.971	10/31/202	11:33:24 PM	0	899.987	-6.73	0.08	26.26	1007.42
11/1/2021	1:01:31 AM	0	9.2557	4.971	11/1/2021	12:33:24 AM	0	899.675	-6.874	0.08	26.26	1007.42
11/1/2021	2:01:31 AM	0	9.2532	4.971	11/1/2021	1:33:24 AM	0	899.343	-7.263	0.08	26.25	1007.43
11/1/2021	3:01:31 AM	0	9.2509	4.971	11/1/2021	2:33:24 AM	0	899.244	-7.209	0.08	26.26	1007.42
11/1/2021	4:01:31 AM	0	9.2488	4.972	11/1/2021	3:33:24 AM	0	899.161	-7.262	0.08	26.26	1007.42
11/1/2021	5:01:31 AM	0	9.2464	4.971	11/1/2021	4:33:24 AM	0	898.679	-7.392	0.08	26.25	1007.43
11/1/2021	6:01:31 AM	0	9.2436	4.971	11/1/2021	5:33:24 AM	0	898.423	-7.473	0.08	26.25	1007.43
11/1/2021	7:01:31 AM	0	9.2406	4.971	11/1/2021	6:33:24 AM	0	898.076	-7.688	0.08	26.25	1007.43
11/1/2021	8:01:31 AM	0	9.238	4.972	11/1/2021	7:33:24 AM	0	897.868	-7.815	0.08	26.25	1007.43
11/1/2021	9:01:31 AM	0	9.2351	4.971	11/1/2021	8:33:24 AM	0	897.901	-7.466	0.08	26.26	1007.42
11/1/2021	10:01:31 AM	0	9.2324	4.972	11/1/2021	9:33:24 AM	0	897.79	-6.346	0.08	26.26	1007.42
11/1/2021	11:01:31 AM	0	9.2287	4.971	11/1/2021	10:33:24 AM	0	897.786	-2.9	0.07	26.26	1007.42
11/1/2021	12:01:31 PM	0	9.2245	4.972	11/1/2021	11:33:24 AM	0	897.631	-1.665	0.07	26.27	1007.41
11/1/2021	1:01:31 PM	0	9.2195	4.971	11/1/2021	12:33:24 PM	0	896.947	-1.138	0.07	26.26	1007.42
11/1/2021	2:01:31 PM	0	9.2134	4.971	11/1/2021	1:33:24 PM	0	896.367	-0.489	0.07	26.26	1007.42
11/1/2021	3:01:31 PM	0	9.2069	4.971	11/1/2021	2:33:24 PM	0	895.65	1.618	0.07	26.26	1007.42
11/1/2021	4:01:31 PM	0	9.2004	4.971	11/1/2021	3:33:24 PM	0	895.326	3.483	0.07	26.27	1007.41
11/1/2021	5:01:31 PM	0	9.1948	4.971	11/1/2021	4:33:24 PM	0	895.089	3.431	0.07	26.27	1007.41
11/1/2021	6:01:31 PM	0	9.1903	4.972	11/1/2021	5:33:24 PM	0	894.608	2.815	0.07	26.27	1007.41
11/1/2021	7:01:31 PM	0	9.1863	4.971	11/1/2021	6:33:24 PM	0	894.515	2.914	0.06	26.27	1007.41
11/1/2021	8:01:31 PM	0	9.1837	4.971	11/1/2021	7:33:24 PM	0	894.559	2.635	0.06	26.28	1007.40
11/1/2021	9:01:31 PM	0	9.1828	4.972	11/1/2021	8:33:24 PM	0	894.523	2.677	0.06	26.28	1007.40
11/1/2021	10:01:31 PM	0	9.183	4.971	11/1/2021	9:33:24 PM	0	894.945	2.351	0.06	26.28	1007.40
11/1/2021	11:01:31 PM	0	9.1847	4.971	11/1/2021	10:33:24 PM	0	895.394	2.202	0.05	26.28	1007.40
11/2/2021	12:01:31 AM	0	9.188	4.972	11/1/2021	11:33:24 PM	0	896.169	2.849	0.05	26.29	1007.39
11/2/2021	1:01:31 AM	0	9.1928	4.971	11/2/2021	12:33:24 AM	0	897.064	3.285	0.05	26.29	1007.39
11/2/2021	2:01:31 AM	0	9.1987	4.971	11/2/2021	1:33:24 AM	0	897.82	3.828	0.04	26.29	1007.39
11/2/2021	3:01:31 AM	0	9.205	4.971	11/2/2021	2:33:24 AM	0	898.252	2.46	0.05	26.29	1007.39
11/2/2021	4:01:31 AM	0	9.2098	4.971	11/2/2021	3:33:24 AM	0	898.565	1.625	0.05	26.29	1007.39
11/2/2021	5:01:31 AM	0	9.2138	4.971	11/2/2021	4:33:24 AM	0	898.972	1.492	0.05	26.29	1007.39
11/2/2021	6:01:31 AM	0	9.2186	4.972	11/2/2021	5:33:24 AM	0	899.394	1.305	0.05	26.29	1007.39
11/2/2021	7:01:31 AM	0	9.2226	4.971	11/2/2021	6:33:24 AM	0	899.624	0.849	0.05	26.29	1007.39
11/2/2021	8:01:31 AM	0	9.2256	4.972	11/2/2021	7:33:24 AM	0	899.878	0.502	0.05	26.29	1007.39
11/2/2021	9:01:31 AM	0	9.2287	4.971	11/2/2021	8:33:24 AM	0	900.416	0.894	0.05	26.29	1007.39
11/2/2021	10:01:31 AM	0	9.2322	4.971	11/2/2021	9:33:24 AM	0	900.768	1.307	0.05	26.29	1007.39
11/2/2021	11:01:31 AM	0	9.2341	4.972	11/2/2021	10:33:24 AM	0	900.984	2.814	0.05	26.29	1007.39
11/2/2021	12:01:31 PM	0	9.2347	4.971	11/2/2021	11:33:24 AM	0	901.077	3.941	0.05	26.29	1007.39
11/2/2021	1:01:31 PM	0	9.2339	4.971	11/2/2021	12:33:24 PM	0	900.698	5.141	0.05	26.29	1007.39
11/2/2021	2:01:31 PM	0	9.2313	4.972	11/2/2021	1:33:24 PM	0	900.311	6.508	0.05	26.29	1007.39
11/2/2021	3:01:31 PM	0	9.2286	4.972	11/2/2021	2:33:24 PM	0	899.986	5.844	0.05	26.29	1007.39
11/2/2021	4:01:31 PM	0	9.2252	4.971	11/2/2021	3:33:24 PM	0	899.445	5.855	0.05	26.28	1007.40
11/2/2021	5:01:31 PM	0	9.2216	4.971	11/2/2021	4:33:24 PM	0	899.278	5.161	0.05	26.29	1007.39
11/2/2021	6:01:31 PM	0	9.2179	4.971	11/2/2021	5:33:24 PM	0	898.627	4.131	0.05	26.28	1007.40
11/2/2021	7:01:31 PM	0	9.2143	4.971	11/2/2021	6:33:24 PM	0	898.45	3.296	0.05	26.28	1007.40
11/2/2021	8:01:31 PM	0	9.2111	4.971	11/2/2021	7:33:24 PM	0	898.372	3.658	0.05	26.29	1007.39
11/2/2021	9:01:31 PM	0	9.2094	4.971	11/2/2021	8:33:24 PM	0	898.326	2.38	0.05	26.29	1007.39
11/2/2021	10:01:31 PM	0	9.208	4.971	11/2/2021	9:33:24 PM	0	898.17	1.797	0.05	26.29	1007.39
11/2/2021	11:01:31 PM	0	9.2075	4.972	11/2/2021	10:33:24 PM	0	898.217	1.79	0.05	26.29	1007.39
11/3/2021	12:01:31 AM	0	9.2062	4.971	11/2/2021	11:33:24 PM	0	897.884	1.593	0.05	26.29	1007.39
11/3/2021	1:01:31 AM	0	9.2036	4.971	11/3/2021	12:33:24 AM	0	897.563	1.677	0.05	26.29	1007.39
11/3/2021	2:01:31 AM	0	9.2006	4.971	11/3/2021	1:33:24 AM	0	897.328	1.813	0.05	26.29	1007.39
11/3/2021	3:01:31 AM	0	9.1973	4.972	11/3/2021	2:33:24 AM	0	897.031	1.923	0.05	26.29	1007.39
11/3/2021	4:01:31 AM	0	9.195	4.972	11/3/2021	3:33:24 AM	0	897.022	2.089	0.05	26.29	1007.39
11/3/2021	5:01:31 AM	0	9.1937	4.972	11/3/2021	4:33:24 AM	0	897.188	2.241	0.04	26.29	1007.39
11/3/2021	6:01:31 AM	0	9.1907	4.972	11/3/2021	5:33:24 AM	0	896.675	2.466	0.05	26.29	1007.39
11/3/2021	7:01:31 AM	0	9.189	4.972	11/3/2021	6:33:24 AM	0	896.86	2.586	0.04	26.29	1007.39
11/3/2021	8:01:31 AM	0	9.1889	4.971	11/3/2021	7:33:24 AM	0	896.689	2.502	0.05	26.29	1007.39

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/3/2021	9:01:31 AM	0	9.1889	4.971	11/3/2021	8:33:24 AM	0	896.909	2.209	0.04	26.29	1007.39
11/3/2021	10:01:31 AM	0	9.1891	4.971	11/3/2021	9:33:24 AM	0	897.154	2.52	0.04	26.30	1007.38
11/3/2021	11:01:31 AM	0	9.1896	4.971	11/3/2021	10:33:24 AM	0	897.361	3.029	0.04	26.30	1007.38
11/3/2021	12:01:31 PM	0	9.1885	4.972	11/3/2021	11:33:24 AM	0	896.927	3.556	0.04	26.29	1007.39
11/3/2021	1:01:31 PM	0	9.1863	4.971	11/3/2021	12:33:24 PM	0	896.789	3.832	0.04	26.30	1007.38
11/3/2021	2:01:31 PM	0	9.1843	4.972	11/3/2021	1:33:24 PM	0	896.416	4.189	0.04	26.29	1007.39
11/3/2021	3:01:31 PM	0	9.1823	4.971	11/3/2021	2:33:24 PM	0	896.658	4.598	0.04	26.30	1007.38
11/3/2021	4:01:31 PM	0	9.1805	4.971	11/3/2021	3:33:24 PM	0	896.275	4.293	0.04	26.30	1007.38
11/3/2021	5:01:31 PM	0	9.177	4.972	11/3/2021	4:33:24 PM	0	895.485	3.763	0.05	26.29	1007.39
11/3/2021	6:01:31 PM	0	9.1726	4.972	11/3/2021	5:33:24 PM	0	894.898	3.537	0.05	26.29	1007.39
11/3/2021	7:01:31 PM	0	9.1664	4.971	11/3/2021	6:33:24 PM	0	894.039	3.279	0.05	26.29	1007.39
11/3/2021	8:01:31 PM	0	9.1599	4.971	11/3/2021	7:33:24 PM	0	893.356	3.119	0.05	26.29	1007.39
11/3/2021	9:01:31 PM	0	9.1526	4.971	11/3/2021	8:33:24 PM	0	892.584	3.016	0.05	26.29	1007.39
11/3/2021	10:01:31 PM	0	9.1448	4.971	11/3/2021	9:33:24 PM	0	891.658	3.041	0.05	26.28	1007.40
11/3/2021	11:01:31 PM	0	9.1358	4.972	11/3/2021	10:33:24 PM	0	890.563	3.089	0.05	26.28	1007.40
11/4/2021	12:01:31 AM	0	9.1257	4.972	11/3/2021	11:33:24 PM	0	889.467	3.111	0.06	26.28	1007.40
11/4/2021	1:01:31 AM	0	9.1183	4.971	11/4/2021	12:33:24 AM	0	889.637	3.248	0.05	26.29	1007.39
11/4/2021	2:01:31 AM	0	9.111	4.971	11/4/2021	1:33:24 AM	0	888.54	3.486	0.05	26.29	1007.39
11/4/2021	3:01:31 AM	0	9.1013	4.971	11/4/2021	2:33:24 AM	0	886.958	3.638	0.06	26.28	1007.40
11/4/2021	4:01:31 AM	0	9.0908	4.972	11/4/2021	3:33:24 AM	0	886.211	3.763	0.05	26.28	1007.40
11/4/2021	5:01:31 AM	0	9.0815	4.971	11/4/2021	4:33:24 AM	0	885.136	3.957	0.06	26.28	1007.40
11/4/2021	6:01:31 AM	0	9.0712	4.971	11/4/2021	5:33:24 AM	0	884.209	4.256	0.05	26.28	1007.40
11/4/2021	7:01:31 AM	0	9.0612	4.971	11/4/2021	6:33:24 AM	0	883.247	4.386	0.05	26.28	1007.40
11/4/2021	8:01:31 AM	0	9.0519	4.972	11/4/2021	7:33:24 AM	0	882.24	4.443	0.06	26.28	1007.40
11/4/2021	9:01:31 AM	0	9.0445	4.972	11/4/2021	8:33:24 AM	0	882.053	4.49	0.05	26.29	1007.39
11/4/2021	10:01:31 AM	0	9.0397	4.971	11/4/2021	9:33:24 AM	0	882.098	4.73	0.04	26.29	1007.39
11/4/2021	11:01:31 AM	0	9.0358	4.971	11/4/2021	10:33:24 AM	0	881.887	5.257	0.04	26.29	1007.39
11/4/2021	12:01:31 PM	0	9.0325	4.972	11/4/2021	11:33:24 AM	0	881.703	5.852	0.04	26.30	1007.38
11/4/2021	1:01:31 PM	0	9.0303	4.971	11/4/2021	12:33:24 PM	0	881.791	6.929	0.04	26.30	1007.38
11/4/2021	2:01:31 PM	0	9.0285	4.972	11/4/2021	1:33:24 PM	0	881.575	7.16	0.04	26.30	1007.38
11/4/2021	3:01:31 PM	0	9.0269	4.971	11/4/2021	2:33:24 PM	0	881.768	7.13	0.04	26.30	1007.38
11/4/2021	4:01:31 PM	0	9.0252	4.972	11/4/2021	3:33:24 PM	0	881.334	6.883	0.04	26.30	1007.38
11/4/2021	5:01:31 PM	0	9.0247	4.971	11/4/2021	4:33:24 PM	0	881.563	6.782	0.04	26.30	1007.38
11/4/2021	6:01:31 PM	0	9.0253	4.971	11/4/2021	5:33:24 PM	0	881.835	6.185	0.03	26.30	1007.38
11/4/2021	7:01:31 PM	0	9.0277	4.972	11/4/2021	6:33:24 PM	0	882.623	6.103	0.03	26.31	1007.37
11/4/2021	8:01:31 PM	0	9.0315	4.972	11/4/2021	7:33:24 PM	0	883.171	5.648	0.03	26.31	1007.37
11/4/2021	9:01:31 PM	0	9.0367	4.972	11/4/2021	8:33:24 PM	0	883.725	5.415	0.03	26.31	1007.37
11/4/2021	10:01:31 PM	0	9.0431	4.972	11/4/2021	9:33:24 PM	0	884.839	5.249	0.02	26.32	1007.36
11/4/2021	11:01:31 PM	0	9.05	4.971	11/4/2021	10:33:24 PM	0	885.463	5.352	0.02	26.32	1007.36
11/5/2021	12:01:31 AM	0	9.0572	4.972	11/4/2021	11:33:24 PM	0	886.277	5.076	0.02	26.32	1007.36
11/5/2021	1:01:31 AM	0	9.0645	4.972	11/5/2021	12:33:24 AM	0	887.16	3.781	0.02	26.32	1007.36
11/5/2021	2:01:31 AM	0	9.0722	4.971	11/5/2021	1:33:24 AM	0	887.625	3.107	0.02	26.32	1007.36
11/5/2021	3:01:31 AM	0	9.078	4.971	11/5/2021	2:33:24 AM	0	888.08	3.154	0.02	26.32	1007.36
11/5/2021	4:01:31 AM	0	9.0819	4.972	11/5/2021	3:33:24 AM	0	887.997	2.392	0.03	26.31	1007.37
11/5/2021	5:01:31 AM	0	9.0843	4.971	11/5/2021	4:33:24 AM	0	888.034	2.135	0.03	26.31	1007.37
11/5/2021	6:01:31 AM	0	9.0862	4.972	11/5/2021	5:33:24 AM	0	888.272	2.136	0.03	26.31	1007.37
11/5/2021	7:01:31 AM	0	9.0865	4.972	11/5/2021	6:33:24 AM	0	887.762	1.901	0.03	26.30	1007.38
11/5/2021	8:01:31 AM	0	9.0854	4.972	11/5/2021	7:33:24 AM	0	887.564	1.918	0.03	26.30	1007.38
11/5/2021	9:01:31 AM	0	9.0837	4.972	11/5/2021	8:33:24 AM	0	887.5	1.991	0.03	26.30	1007.38
11/5/2021	10:01:31 AM	0	9.0828	4.972	11/5/2021	9:33:24 AM	0	887.238	2.361	0.04	26.30	1007.38
11/5/2021	11:01:31 AM	0	9.0806	4.972	11/5/2021	10:33:24 AM	0	887.08	3.169	0.03	26.30	1007.38
11/5/2021	12:01:31 PM	0	9.0777	4.972	11/5/2021	11:33:24 AM	0	886.88	3.769	0.03	26.30	1007.38
11/5/2021	1:01:31 PM	0	9.0749	4.971	11/5/2021	12:33:24 PM	0	886.589	4.117	0.03	26.30	1007.38
11/5/2021	2:01:31 PM	0	9.0722	4.971	11/5/2021	1:33:24 PM	0	886.328	3.928	0.03	26.30	1007.38
11/5/2021	3:01:31 PM	0	9.0704	4.971	11/5/2021	2:33:24 PM	0	886.254	3.474	0.03	26.30	1007.38
11/5/2021	4:01:31 PM	0	9.0733	4.972	11/5/2021	3:33:24 PM	0	887.645	2.653	0.02	26.32	1007.36
11/5/2021	5:01:31 PM	0	9.0797	4.972	11/5/2021	4:33:24 PM	0	888.678	1.064	0.02	26.32	1007.36
11/5/2021	6:01:31 PM	0	9.0867	4.971	11/5/2021	5:33:24 PM	0	889.27	0.257	0.02	26.32	1007.36
11/5/2021	7:01:31 PM	0	9.0926	4.972	11/5/2021	6:33:24 PM	0	889.479	-1.012	0.02	26.31	1007.37
11/5/2021	8:01:31 PM	0	9.0963	4.971	11/5/2021	7:33:24 PM	0	889.709	-0.639	0.02	26.31	1007.37
11/5/2021	9:01:31 PM	0	9.0989	4.971	11/5/2021	8:33:24 PM	0	889.696	-0.715	0.03	26.31	1007.37
11/5/2021	10:01:31 PM	0	9.1003	4.972	11/5/2021	9:33:24 PM	0	889.717	-0.972	0.03	26.31	1007.37
11/5/2021	11:01:31 PM	0	9.102	4.972	11/5/2021	10:33:24 PM	0	890.21	-0.781	0.02	26.31	1007.37
11/6/2021	12:01:31 AM	0	9.1039	4.972	11/5/2021	11:33:24 PM	0	890.179	-0.871	0.03	26.31	1007.37
11/6/2021	1:01:31 AM	0	9.1042	4.972	11/6/2021	12:33:24 AM	0	889.984	-1.203	0.03	26.31	1007.37
11/6/2021	2:01:31 AM	0	9.1042	4.972	11/6/2021	1:33:24 AM	0	889.984	-1.528	0.03	26.31	1007.37
11/6/2021	3:01:31 AM	0	9.1028	4.972	11/6/2021	2:33:24 AM	0	889.479	-2.045	0.03	26.30	1007.38
11/6/2021	4:01:31 AM	0	9.101	4.971	11/6/2021	3:33:24 AM	0	889.275	-1.572	0.03	26.30	1007.38
11/6/2021	5:01:31 AM	0	9.0989	4.971	11/6/2021	4:33:24 AM	0	889.101	-1.844	0.03	26.30	1007.38
11/6/2021	6:01:31 AM	0	9.0961	4.972	11/6/2021	5:33:24 AM	0	888.767	-1.688	0.03	26.30	1007.38

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/6/2021	7:01:31 AM	0	9.0927	4.972	11/6/2021	6:33:24 AM	0	888.171	-1.416	0.04	26.30	1007.38
11/6/2021	8:01:31 AM	0	9.0887	4.972	11/6/2021	7:33:24 AM	0	887.804	-1.376	0.04	26.30	1007.38
11/6/2021	9:01:31 AM	0	9.085	4.971	11/6/2021	8:33:24 AM	0	887.424	-1.706	0.04	26.30	1007.38
11/6/2021	10:01:31 AM	0	9.0822	4.972	11/6/2021	9:33:24 AM	0	887.403	-1.855	0.03	26.30	1007.38
11/6/2021	11:01:31 AM	0	9.0801	4.972	11/6/2021	10:33:24 AM	0	887.283	-1.352	0.03	26.30	1007.38
11/6/2021	12:01:31 PM	0	9.0786	4.971	11/6/2021	11:33:24 AM	0	887.512	-0.705	0.03	26.31	1007.37
11/6/2021	1:01:31 PM	0	9.078	4.972	11/6/2021	12:33:24 PM	0	887.561	-0.018	0.03	26.31	1007.37
11/6/2021	2:01:31 PM	0	9.0763	4.972	11/6/2021	1:33:24 PM	0	887.468	1.879	0.03	26.31	1007.37
11/6/2021	3:01:31 PM	0	9.0748	4.972	11/6/2021	2:33:24 PM	0	887.471	2.906	0.03	26.31	1007.37
11/6/2021	4:01:31 PM	0	9.0735	4.971	11/6/2021	3:33:24 PM	0	887.365	2.394	0.02	26.31	1007.37
11/6/2021	5:01:31 PM	0	9.073	4.971	11/6/2021	4:33:24 PM	0	887.449	1.657	0.02	26.31	1007.37
11/6/2021	6:01:31 PM	0	9.0723	4.972	11/6/2021	5:33:24 PM	0	887.121	0.63	0.03	26.31	1007.37
11/6/2021	7:01:31 PM	0	9.0714	4.971	11/6/2021	6:33:24 PM	0	886.938	-0.269	0.03	26.31	1007.37
11/6/2021	8:01:31 PM	0	9.0705	4.972	11/6/2021	7:33:24 PM	0	886.788	-0.573	0.03	26.31	1007.37
11/6/2021	9:01:31 PM	0	9.0693	4.972	11/6/2021	8:33:24 PM	0	886.757	-1.248	0.03	26.31	1007.37
11/6/2021	10:01:31 PM	0	9.0693	4.971	11/6/2021	9:33:24 PM	0	886.943	-2.475	0.02	26.31	1007.37
11/6/2021	11:01:31 PM	0	9.0697	4.972	11/6/2021	10:33:24 PM	0	887.273	-1.172	0.02	26.32	1007.36
11/7/2021	12:01:31 AM	0	9.0708	4.972	11/6/2021	11:33:24 PM	0	887.499	-1.086	0.02	26.32	1007.36
11/7/2021	1:01:31 AM	0	9.072	4.972	11/7/2021	12:33:24 AM	0	887.627	-1.451	0.02	26.32	1007.36
11/7/2021	2:01:31 AM	0	9.0734	4.972	11/7/2021	1:33:24 AM	0	887.809	-1.797	0.02	26.32	1007.36
11/7/2021	3:01:31 AM	0	9.0748	4.972	11/7/2021	2:33:24 AM	0	888.044	-2.007	0.02	26.32	1007.36
11/7/2021	4:01:31 AM	0	9.0763	4.972	11/7/2021	3:33:24 AM	0	887.956	-2.518	0.02	26.32	1007.36
11/7/2021	5:01:31 AM	0	9.0776	4.972	11/7/2021	4:33:24 AM	0	888.402	-2.011	0.02	26.32	1007.36
11/7/2021	6:01:31 AM	0	9.0798	4.972	11/7/2021	5:33:24 AM	0	888.721	-1.823	0.02	26.32	1007.36
11/7/2021	7:01:31 AM	0	9.0819	4.972	11/7/2021	6:33:24 AM	0	888.88	-2.038	0.02	26.32	1007.36
11/7/2021	8:01:31 AM	0	9.0841	4.972	11/7/2021	7:33:24 AM	0	889.086	-2.639	0.02	26.32	1007.36
11/7/2021	9:01:31 AM	0	9.0867	4.972	11/7/2021	8:33:24 AM	0	889.538	-2.654	0.02	26.32	1007.36
11/7/2021	10:01:31 AM	0	9.0891	4.972	11/7/2021	9:33:24 AM	0	889.444	-2.912	0.02	26.32	1007.36
11/7/2021	11:01:31 AM	0	9.0907	4.972	11/7/2021	10:33:24 AM	0	889.896	-2.055	0.02	26.32	1007.36
11/7/2021	12:01:31 PM	0	9.0926	4.972	11/7/2021	11:33:24 AM	0	890.315	-1.135	0.01	26.32	1007.36
11/7/2021	1:01:31 PM	0	9.0929	4.972	11/7/2021	12:33:24 PM	0	890.002	-0.615	0.02	26.32	1007.36
11/7/2021	2:01:31 PM	0	9.0916	4.972	11/7/2021	1:33:24 PM	0	889.602	-0.231	0.02	26.32	1007.36
11/7/2021	3:01:31 PM	0	9.0897	4.972	11/7/2021	2:33:24 PM	0	889.504	1.362	0.02	26.32	1007.36
11/7/2021	4:01:31 PM	0	9.0869	4.972	11/7/2021	3:33:24 PM	0	889.312	1.702	0.02	26.32	1007.36
11/7/2021	5:01:31 PM	0	9.0842	4.972	11/7/2021	4:33:24 PM	0	888.773	1.067	0.02	26.32	1007.36
11/7/2021	6:01:31 PM	0	9.0808	4.972	11/7/2021	5:33:24 PM	0	888.115	0.541	0.02	26.31	1007.37
11/7/2021	7:01:31 PM	0	9.0764	4.972	11/7/2021	6:33:24 PM	0	887.747	0.056	0.02	26.31	1007.37
11/7/2021	8:01:31 PM	0	9.0737	4.972	11/7/2021	7:33:24 PM	0	887.789	-0.171	0.02	26.32	1007.36
11/7/2021	9:01:31 PM	0	9.0714	4.972	11/7/2021	8:33:24 PM	0	887.605	-0.354	0.02	26.32	1007.36
11/7/2021	10:01:31 PM	0	9.0713	4.972	11/7/2021	9:33:24 PM	0	887.963	-0.921	0.02	26.32	1007.36
11/7/2021	11:01:31 PM	0	9.0736	4.972	11/7/2021	10:33:24 PM	0	888.694	-1.483	0.01	26.33	1007.35
11/8/2021	12:01:31 AM	0	9.0778	4.971	11/7/2021	11:33:24 PM	0	889.513	-1.914	0.01	26.33	1007.35
11/8/2021	1:01:31 AM	0	9.083	4.972	11/8/2021	12:33:24 AM	0	890.19	-2.046	0.01	26.33	1007.35
11/8/2021	2:01:31 AM	0	9.0894	4.972	11/8/2021	1:33:24 AM	0	890.882	-2.349	0.00	26.33	1007.35
11/8/2021	3:01:31 AM	0	9.0952	4.972	11/8/2021	2:33:24 AM	0	891.601	-1.418	0.00	26.33	1007.35
11/8/2021	4:01:31 AM	0	9.1011	4.972	11/8/2021	3:33:24 AM	0	892.369	-1.285	0.00	26.34	1007.34
11/8/2021	5:01:31 AM	0	9.1069	4.972	11/8/2021	4:33:24 AM	0	892.623	-3.2	0.00	26.33	1007.35
11/8/2021	6:01:31 AM	0	9.1125	4.972	11/8/2021	5:33:24 AM	0	893.175	-4.057	0.00	26.33	1007.35
11/8/2021	7:01:31 AM	0	9.119	4.972	11/8/2021	6:33:24 AM	0	893.864	-4.437	0.00	26.33	1007.35
11/8/2021	8:01:31 AM	0	9.1244	4.972	11/8/2021	7:33:24 AM	0	893.988	-4.834	0.01	26.33	1007.35
11/8/2021	9:01:31 AM	0	9.1278	4.972	11/8/2021	8:33:24 AM	0	894.104	-4.855	0.01	26.33	1007.35
11/8/2021	10:01:31 AM	0	9.1305	4.972	11/8/2021	9:33:24 AM	0	894.684	-3.367	0.01	26.33	1007.35
11/8/2021	11:01:31 AM	0	9.1332	4.971	11/8/2021	10:33:24 AM	0	895.183	-2.097	0.00	26.33	1007.35
11/8/2021	12:01:31 PM	0	9.1347	4.972	11/8/2021	11:33:24 AM	0	895.115	-1.004	0.01	26.33	1007.35
11/8/2021	1:01:31 PM	0	9.1346	4.972	11/8/2021	12:33:24 PM	0	894.693	-0.581	0.01	26.33	1007.35
11/8/2021	2:01:31 PM	0	9.1311	4.972	11/8/2021	1:33:24 PM	0	893.866	-0.298	0.02	26.32	1007.36
11/8/2021	3:01:31 PM	0	9.1258	4.972	11/8/2021	2:33:24 PM	0	893.233	1.025	0.02	26.32	1007.36
11/8/2021	4:01:31 PM	0	9.1206	4.972	11/8/2021	3:33:24 PM	0	892.861	1.098	0.02	26.32	1007.36
11/8/2021	5:01:31 PM	0	9.1149	4.972	11/8/2021	4:33:24 PM	0	891.836	0.629	0.02	26.32	1007.36
11/8/2021	6:01:31 PM	0	9.1096	4.972	11/8/2021	5:33:24 PM	0	891.393	0.106	0.02	26.32	1007.36
11/8/2021	7:01:31 PM	0	9.1038	4.972	11/8/2021	6:33:24 PM	0	890.978	0.127	0.02	26.32	1007.36
11/8/2021	8:01:31 PM	0	9.097	4.973	11/8/2021	7:33:24 PM	0	889.923	0.322	0.02	26.31	1007.37
11/8/2021	9:01:31 PM	0	9.0908	4.972	11/8/2021	8:33:24 PM	0	889.425	0.586	0.02	26.32	1007.36
11/8/2021	10:01:31 PM	0	9.084	4.972	11/8/2021	9:33:24 PM	0	888.651	0.627	0.02	26.31	1007.37
11/8/2021	11:01:31 PM	0	9.0767	4.971	11/8/2021	10:33:24 PM	0	887.758	0.308	0.02	26.31	1007.37
11/9/2021	12:01:31 AM	0	9.067	4.972	11/8/2021	11:33:24 PM	0	886.535	0.759	0.03	26.31	1007.37
11/9/2021	1:01:31 AM	0	9.0561	4.972	11/9/2021	12:33:24 AM	0	884.972	0.675	0.03	26.31	1007.37
11/9/2021	2:01:31 AM	0	9.0433	4.971	11/9/2021	1:33:24 AM	0	883.755	0.696	0.03	26.31	1007.37
11/9/2021	3:01:31 AM	0	9.0313	4.972	11/9/2021	2:33:24 AM	0	882.194	0.927	0.04	26.30	1007.38
11/9/2021	4:01:31 AM	0	9.0163	4.972	11/9/2021	3:33:24 AM	0	880.32	1.352	0.04	26.30	1007.38

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/9/2021	5:01:31 AM	0	9.0023	4.971	11/9/2021	4:33:24 AM	0	879.052	1.871	0.04	26.30	1007.38
11/9/2021	6:01:31 AM	0	8.9898	4.972	11/9/2021	5:33:24 AM	0	877.832	2.238	0.04	26.30	1007.38
11/9/2021	7:01:31 AM	0	8.9792	4.972	11/9/2021	6:33:24 AM	0	877.764	2.311	0.03	26.31	1007.37
11/9/2021	8:01:31 AM	0	8.9696	4.972	11/9/2021	7:33:24 AM	0	876.867	1.55	0.03	26.31	1007.37
11/9/2021	9:01:31 AM	0	8.963	4.972	11/9/2021	8:33:24 AM	0	876.186	0.842	0.03	26.31	1007.37
11/9/2021	10:01:31 AM	0	8.957	4.972	11/9/2021	9:33:24 AM	0	876.073	1	0.02	26.31	1007.37
11/9/2021	11:01:31 AM	0	8.953	4.972	11/9/2021	10:33:24 AM	0	876.285	1.907	0.02	26.32	1007.36
11/9/2021	12:01:31 PM	0	8.9547	4.972	11/9/2021	11:33:24 AM	0	877.835	2.384	0.00	26.33	1007.35
11/9/2021	1:01:31 PM	0	8.9698	4.972	11/9/2021	12:33:24 PM	0	880.587	2.384	-0.01	26.35	1007.33
11/9/2021	2:01:31 PM	0	8.9734	4.973	11/9/2021	1:33:24 PM	0	881.06	1.704	-0.01	26.35	1007.33
11/9/2021	3:01:31 PM	0	8.9847	4.972	11/9/2021	2:33:24 PM	0	881.732	1.468	-0.01	26.34	1007.34
11/9/2021	4:01:31 PM	0	8.9922	4.973	11/9/2021	3:33:24 PM	0	882.353	2.348	-0.01	26.34	1007.34
11/9/2021	5:01:31 PM	0	9.0011	4.972	11/9/2021	4:33:24 PM	0	883.757	2.432	-0.01	26.35	1007.33
11/9/2021	6:01:31 PM	0	9.0085	4.972	11/9/2021	5:33:24 PM	0	884.616	1.864	-0.01	26.35	1007.33
11/9/2021	7:01:31 PM	0	9.0156	4.973	11/9/2021	6:33:24 PM	0	885.259	1.225	-0.01	26.35	1007.33
11/9/2021	8:01:31 PM	0	9.0242	4.973	11/9/2021	7:33:24 PM	0	886.225	0.475	-0.01	26.35	1007.33
11/9/2021	9:01:31 PM	0	9.0301	4.972	11/9/2021	8:33:24 PM	0	887.229	-0.221	-0.02	26.35	1007.33
11/9/2021	10:01:31 PM	0	9.041	4.973	11/9/2021	9:33:24 PM	0	888.282	-0.617	-0.02	26.35	1007.33
11/9/2021	11:01:31 PM	0	9.0487	4.972	11/9/2021	10:33:24 PM	0	889.025	-0.758	-0.02	26.35	1007.33
11/10/2021	12:01:31 AM	0	9.0582	4.972	11/9/2021	11:33:24 PM	0	890.307	-0.966	-0.02	26.36	1007.32
11/10/2021	1:01:31 AM	0	9.0654	4.972	11/10/202	12:33:24 AM	0	891.252	-1.37	-0.02	26.36	1007.32
11/10/2021	2:01:31 AM	0	9.0749	4.973	11/10/202	1:33:24 AM	0	892.044	-2.006	-0.02	26.36	1007.32
11/10/2021	3:01:31 AM	0	9.0832	4.972	11/10/202	2:33:24 AM	0	893.088	-2.424	-0.02	26.36	1007.32
11/10/2021	4:01:31 AM	0	9.0907	4.972	11/10/202	3:33:24 AM	0	894.209	-0.827	-0.03	26.36	1007.32
11/10/2021	5:01:31 AM	0	9.0985	4.973	11/10/202	4:33:24 AM	0	894.886	-1.553	-0.03	26.36	1007.32
11/10/2021	6:01:31 AM	0	9.1061	4.972	11/10/202	5:33:24 AM	0	895.686	-2.112	-0.03	26.36	1007.32
11/10/2021	7:01:31 AM	0	9.1136	4.972	11/10/202	6:33:24 AM	0	896.476	-2.539	-0.03	26.37	1007.31
11/10/2021	8:01:31 AM	0	9.1205	4.972	11/10/202	7:33:24 AM	0	897.065	-3.356	-0.03	26.36	1007.32
11/10/2021	9:01:31 AM	0	9.1286	4.973	11/10/202	8:33:24 AM	0	897.73	-4.328	-0.03	26.36	1007.32
11/10/2021	10:01:31 AM	0	9.1356	4.972	11/10/202	9:33:24 AM	0	898.594	-3.849	-0.03	26.36	1007.32
11/10/2021	11:01:31 AM	0	9.1407	4.973	11/10/202	10:33:24 AM	0	899.404	-1.836	-0.03	26.37	1007.31
11/10/2021	12:01:31 PM	0	9.1466	4.972	11/10/202	11:33:24 AM	0	900.217	-0.613	-0.03	26.37	1007.31
11/10/2021	1:01:31 PM	0	9.1508	4.972	11/10/202	12:33:24 PM	0	900.453	0.564	-0.03	26.37	1007.31
11/10/2021	2:01:31 PM	0	9.157	4.972	11/10/202	1:33:24 PM	0	900.721	2.798	-0.03	26.37	1007.31
11/10/2021	3:01:31 PM	0	9.1618	4.972	11/10/202	2:33:24 PM	0	901.019	2.749	-0.03	26.36	1007.32
11/10/2021	4:01:31 PM	0	9.1671	4.972	11/10/202	3:33:24 PM	0	901.243	2.314	-0.02	26.36	1007.32
11/10/2021	5:01:31 PM	0	9.17	4.972	11/10/202	4:33:24 PM	0	901.509	2.938	-0.02	26.36	1007.32
11/10/2021	6:01:31 PM	0	9.1737	4.973	11/10/202	5:33:24 PM	0	901.211	0.261	-0.02	26.35	1007.33
11/10/2021	7:01:31 PM	0	9.1773	4.972	11/10/202	6:33:24 PM	0	900.913	-2.159	-0.01	26.35	1007.33
11/10/2021	8:01:31 PM	0	9.1834	4.973	11/10/202	7:33:24 PM	0	900.87	-0.97	0.00	26.34	1007.34
11/10/2021	9:01:31 PM	0	9.1816	4.972	11/10/202	8:33:24 PM	0	900.303	-3.105	0.00	26.34	1007.34
11/10/2021	10:01:31 PM	0	9.1806	4.972	11/10/202	9:33:24 PM	0	900.15	-4.493	0.00	26.34	1007.34
11/10/2021	11:01:31 PM	0	9.1803	4.973	11/10/202	10:33:24 PM	0	900.645	-3.226	0.00	26.34	1007.34
11/11/2021	12:01:31 AM	0	9.1797	4.972	11/10/202	11:33:24 PM	0	900.751	-2.033	-0.01	26.34	1007.34
11/11/2021	1:01:31 AM	0	9.1782	4.972	11/11/202	12:33:24 AM	0	900.207	-1.636	0.00	26.34	1007.34
11/11/2021	2:01:31 AM	0	9.1754	4.972	11/11/202	1:33:24 AM	0	899.802	-1.56	0.00	26.34	1007.34
11/11/2021	3:01:31 AM	0	9.1722	4.972	11/11/202	2:33:24 AM	0	899.439	-1.369	0.00	26.34	1007.34
11/11/2021	4:01:31 AM	0	9.1706	4.972	11/11/202	3:33:24 AM	0	899.731	-1.201	0.00	26.34	1007.34
11/11/2021	5:01:31 AM	0	9.1697	4.973	11/11/202	4:33:24 AM	0	899.941	-1.518	-0.01	26.34	1007.34
11/11/2021	6:01:31 AM	0	9.168	4.972	11/11/202	5:33:24 AM	0	899.186	-2.107	0.00	26.34	1007.34
11/11/2021	7:01:31 AM	0	9.1665	4.972	11/11/202	6:33:24 AM	0	899.368	-2.107	0.00	26.34	1007.34
11/11/2021	8:01:31 AM	0	9.1666	4.972	11/11/202	7:33:24 AM	0	899.316	-2.092	0.00	26.34	1007.34
11/11/2021	9:01:31 AM	0	9.1673	4.972	11/11/202	8:33:24 AM	0	899.498	-2.221	-0.01	26.34	1007.34
11/11/2021	10:01:31 AM	0	9.1689	4.972	11/11/202	9:33:24 AM	0	900.085	-1.568	-0.01	26.35	1007.33
11/11/2021	11:01:31 AM	0	9.1688	4.972	11/11/202	10:33:24 AM	0	900.425	-0.722	-0.01	26.35	1007.33
11/11/2021	12:01:31 PM	0	9.1681	4.973	11/11/202	11:33:24 AM	0	900.438	-0.5	-0.01	26.35	1007.33
11/11/2021	1:01:31 PM	0	9.1685	4.972	11/11/202	12:33:24 PM	0	900.115	-0.198	-0.01	26.35	1007.33
11/11/2021	2:01:31 PM	0	9.1662	4.973	11/11/202	1:33:24 PM	0	899.407	1.505	-0.01	26.34	1007.34
11/11/2021	3:01:31 PM	0	9.1621	4.972	11/11/202	2:33:24 PM	0	899.057	2.619	-0.01	26.34	1007.34
11/11/2021	4:01:31 PM	0	9.1572	4.973	11/11/202	3:33:24 PM	0	898.166	2.703	0.00	26.34	1007.34
11/11/2021	5:01:31 PM	0	9.151	4.972	11/11/202	4:33:24 PM	0	897.028	1.987	0.00	26.33	1007.35
11/11/2021	6:01:31 PM	0	9.1417	4.972	11/11/202	5:33:24 PM	0	895.707	1.087	0.01	26.33	1007.35
11/11/2021	7:01:31 PM	0	9.1332	4.972	11/11/202	6:33:24 PM	0	895.22	0.843	0.00	26.33	1007.35
11/11/2021	8:01:31 PM	0	9.1241	4.973	11/11/202	7:33:24 PM	0	894.089	1.066	0.01	26.33	1007.35
11/11/2021	9:01:31 PM	0	9.1159	4.972	11/11/202	8:33:24 PM	0	893.319	1.563	0.01	26.33	1007.35
11/11/2021	10:01:31 PM	0	9.1075	4.972	11/11/202	9:33:24 PM	0	892.449	-0.052	0.01	26.33	1007.35
11/11/2021	11:01:31 PM	0	9.1015	4.972	11/11/202	10:33:24 PM	0	892.181	-0.367	0.00	26.33	1007.35
11/12/2021	12:01:31 AM	0	9.0957	4.972	11/11/202	11:33:24 PM	0	891.907	-0.119	0.00	26.34	1007.34
11/12/2021	1:01:31 AM	0	9.0898	4.972	11/12/202	12:33:24 AM	0	891.265	0.427	0.00	26.34	1007.34
11/12/2021	2:01:31 AM	0	9.084	4.973	11/12/202	1:33:24 AM	0	890.665	0.839	0.00	26.34	1007.34

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/12/2021	3:01:31 AM	0	9.0791	4.972	11/12/202	2:33:24 AM	0	890.458	1.237	0.00	26.34	1007.34
11/12/2021	4:01:31 AM	0	9.0748	4.972	11/12/202	3:33:24 AM	0	890.34	1.59	0.00	26.34	1007.34
11/12/2021	5:01:31 AM	0	9.0722	4.972	11/12/202	4:33:24 AM	0	890.23	1.456	-0.01	26.34	1007.34
11/12/2021	6:01:31 AM	0	9.0726	4.973	11/12/202	5:33:24 AM	0	890.467	1.348	-0.01	26.34	1007.34
11/12/2021	7:01:31 AM	0	9.0739	4.972	11/12/202	6:33:24 AM	0	890.764	1.337	-0.01	26.35	1007.33
11/12/2021	8:01:31 AM	0	9.0768	4.973	11/12/202	7:33:24 AM	0	891.267	0.724	-0.01	26.35	1007.33
11/12/2021	9:01:31 AM	0	9.0784	4.973	11/12/202	8:33:24 AM	0	891.477	0.23	-0.01	26.35	1007.33
11/12/2021	10:01:31 AM	0	9.0808	4.972	11/12/202	9:33:24 AM	0	891.805	0.212	-0.01	26.35	1007.33
11/12/2021	11:01:31 AM	0	9.082	4.972	11/12/202	10:33:24 AM	0	892.19	0.526	-0.02	26.35	1007.33
11/12/2021	12:01:31 PM	0	9.0825	4.973	11/12/202	11:33:24 AM	0	892.565	1.514	-0.02	26.36	1007.32
11/12/2021	1:01:31 PM	0	9.0815	4.973	11/12/202	12:33:24 PM	0	892.4	2.417	-0.02	26.36	1007.32
11/12/2021	2:01:31 PM	0	9.0812	4.973	11/12/202	1:33:24 PM	0	892.567	4.017	-0.02	26.36	1007.32
11/12/2021	3:01:31 PM	0	9.0815	4.972	11/12/202	2:33:24 PM	0	892.577	6.077	-0.02	26.36	1007.32
11/12/2021	4:01:31 PM	0	9.0825	4.972	11/12/202	3:33:24 PM	0	892.598	5.224	-0.02	26.36	1007.32
11/12/2021	5:01:31 PM	0	9.0834	4.972	11/12/202	4:33:24 PM	0	892.627	3.686	-0.02	26.36	1007.32
11/12/2021	6:01:31 PM	0	9.0867	4.973	11/12/202	5:33:24 PM	0	892.853	0.914	-0.02	26.36	1007.32
11/12/2021	7:01:31 PM	0	9.0913	4.973	11/12/202	6:33:24 PM	0	893.199	0.284	-0.02	26.35	1007.33
11/12/2021	8:01:31 PM	0	9.0961	4.972	11/12/202	7:33:24 PM	0	893.863	0.395	-0.02	26.36	1007.32
11/12/2021	9:01:31 PM	0	9.1015	4.973	11/12/202	8:33:24 PM	0	894.528	0.224	-0.02	26.36	1007.32
11/12/2021	10:01:31 PM	0	9.1073	4.973	11/12/202	9:33:24 PM	0	895.418	0.724	-0.02	26.36	1007.32
11/12/2021	11:01:31 PM	0	9.1138	4.973	11/12/202	10:33:24 PM	0	896.314	0.931	-0.03	26.36	1007.32
11/13/2021	12:01:31 AM	0	9.1203	4.972	11/12/202	11:33:24 PM	0	897.222	1.048	-0.03	26.37	1007.31
11/13/2021	1:01:31 AM	0	9.1259	4.972	11/13/202	12:33:24 AM	0	897.628	0.537	-0.03	26.36	1007.32
11/13/2021	2:01:31 AM	0	9.1328	4.973	11/13/202	1:33:24 AM	0	898.457	0.092	-0.03	26.37	1007.31
11/13/2021	3:01:31 AM	0	9.1392	4.972	11/13/202	2:33:24 AM	0	899.182	-0.549	-0.03	26.37	1007.31
11/13/2021	4:01:31 AM	0	9.1439	4.973	11/13/202	3:33:24 AM	0	899.726	-0.569	-0.03	26.37	1007.31
11/13/2021	5:01:31 AM	0	9.1482	4.973	11/13/202	4:33:24 AM	0	899.998	-1.25	-0.03	26.37	1007.31
11/13/2021	6:01:31 AM	0	9.1532	4.973	11/13/202	5:33:24 AM	0	900.752	-0.506	-0.03	26.37	1007.31
11/13/2021	7:01:31 AM	0	9.1572	4.973	11/13/202	6:33:24 AM	0	901.243	-0.579	-0.03	26.37	1007.31
11/13/2021	8:01:31 AM	0	9.1616	4.973	11/13/202	7:33:24 AM	0	901.442	-1.642	-0.03	26.37	1007.31
11/13/2021	9:01:31 AM	0	9.1663	4.972	11/13/202	8:33:24 AM	0	902.02	-2.72	-0.03	26.37	1007.31
11/13/2021	10:01:31 AM	0	9.1697	4.972	11/13/202	9:33:24 AM	0	902.486	-1.902	-0.03	26.37	1007.31
11/13/2021	11:01:31 AM	0	9.1714	4.972	11/13/202	10:33:24 AM	0	902.608	-0.656	-0.03	26.37	1007.31
11/13/2021	12:01:31 PM	0	9.1735	4.973	11/13/202	11:33:24 AM	0	902.933	1.145	-0.03	26.37	1007.31
11/13/2021	1:01:31 PM	0	9.1707	4.973	11/13/202	12:33:24 PM	0	902.889	2.462	-0.04	26.37	1007.31
11/13/2021	2:01:31 PM	0	9.1661	4.972	11/13/202	1:33:24 PM	0	901.617	3.204	-0.03	26.37	1007.31
11/13/2021	3:01:31 PM	0	9.163	4.972	11/13/202	2:33:24 PM	0	900.87	3.503	-0.02	26.36	1007.32
11/13/2021	4:01:31 PM	0	9.1657	4.972	11/13/202	3:33:24 PM	0	899.837	2.769	-0.01	26.35	1007.33
11/13/2021	5:01:31 PM	0	9.157	4.973	11/13/202	4:33:24 PM	0	898.574	1.751	-0.01	26.34	1007.34
11/13/2021	6:01:31 PM	0	9.1489	4.973	11/13/202	5:33:24 PM	0	897.735	0.545	-0.01	26.34	1007.34
11/13/2021	7:01:31 PM	0	9.1392	4.973	11/13/202	6:33:24 PM	0	896.254	0.157	0.00	26.34	1007.34
11/13/2021	8:01:31 PM	0	9.1289	4.972	11/13/202	7:33:24 PM	0	895.103	0.552	0.00	26.34	1007.34
11/13/2021	9:01:31 PM	0	9.1183	4.972	11/13/202	8:33:24 PM	0	894.041	0.256	0.00	26.34	1007.34
11/13/2021	10:01:31 PM	0	9.107	4.973	11/13/202	9:33:24 PM	0	892.512	-0.461	0.01	26.33	1007.35
11/13/2021	11:01:31 PM	0	9.0926	4.972	11/13/202	10:33:24 PM	0	890.602	-0.549	0.01	26.33	1007.35
11/14/2021	12:01:31 AM	0	9.0771	4.972	11/13/202	11:33:24 PM	0	888.967	-0.539	0.01	26.33	1007.35
11/14/2021	1:01:31 AM	0	9.0615	4.972	11/14/202	12:33:24 AM	0	887.311	-0.547	0.01	26.32	1007.36
11/14/2021	2:01:31 AM	0	9.0474	4.972	11/14/202	1:33:24 AM	0	886.12	-0.554	0.01	26.33	1007.35
11/14/2021	3:01:31 AM	0	9.0355	4.973	11/14/202	2:33:24 AM	0	885.171	-0.555	0.01	26.33	1007.35
11/14/2021	4:01:31 AM	0	9.0241	4.973	11/14/202	3:33:24 AM	0	884.249	-0.551	0.01	26.33	1007.35
11/14/2021	5:01:31 AM	0	9.0132	4.972	11/14/202	4:33:24 AM	0	883.017	-0.544	0.01	26.33	1007.35
11/14/2021	6:01:31 AM	0	9.0031	4.973	11/14/202	5:33:24 AM	0	882.51	-0.537	0.00	26.33	1007.35
11/14/2021	7:01:31 AM	0	8.9959	4.972	11/14/202	6:33:24 AM	0	882.244	-0.527	0.00	26.34	1007.34
11/14/2021	8:01:31 AM	0	8.991	4.973	11/14/202	7:33:24 AM	0	882.167	-0.524	0.00	26.34	1007.34
11/14/2021	9:01:31 AM	0	8.9974	4.972	11/14/202	8:33:24 AM	0	882.782	-0.517	0.00	26.34	1007.34
11/14/2021	10:01:31 AM	0	9.0055	4.973	11/14/202	9:33:24 AM	0	883.73	-0.513	-0.01	26.34	1007.34
11/14/2021	11:01:31 AM	0	9.0118	4.973	11/14/202	10:33:24 AM	0	884.917	-0.499	-0.01	26.35	1007.33
11/14/2021	12:01:31 PM	0	9.0189	4.972	11/14/202	11:33:24 AM	0	885.718	-0.454	-0.01	26.35	1007.33
11/14/2021	1:01:31 PM	0	9.0244	4.973	11/14/202	12:33:24 PM	0	886.593	0.056	-0.02	26.35	1007.33
11/14/2021	2:01:31 PM	0	9.0259	4.972	11/14/202	1:33:24 PM	0	886.999	1.205	-0.02	26.36	1007.32
11/14/2021	3:01:31 PM	0	9.0286	4.972	11/14/202	2:33:24 PM	0	887.345	2.426	-0.02	26.36	1007.32
11/14/2021	4:01:31 PM	0	9.0305	4.972	11/14/202	3:33:24 PM	0	887.786	1.571	-0.02	26.36	1007.32
11/14/2021	5:01:31 PM	0	9.031	4.972	11/14/202	4:33:24 PM	0	887.631	0.6	-0.02	26.36	1007.32
11/14/2021	6:01:31 PM	0	9.0353	4.973	11/14/202	5:33:24 PM	0	888.071	0.072	-0.02	26.36	1007.32
11/14/2021	7:01:31 PM	0	9.0379	4.973	11/14/202	6:33:24 PM	0	888.511	-0.154	-0.02	26.36	1007.32
11/14/2021	8:01:31 PM	0	9.0375	4.973	11/14/202	7:33:24 PM	0	888.575	-0.44	-0.02	26.36	1007.32
11/14/2021	9:01:31 PM	0	9.0358	4.973	11/14/202	8:33:24 PM	0	888.101	-0.498	-0.02	26.36	1007.32
11/14/2021	10:01:31 PM	0	9.0365	4.973	11/14/202	9:33:24 PM	0	888.226	-0.683	-0.02	26.36	1007.32
11/14/2021	11:01:31 PM	0	9.0351	4.973	11/14/202	10:33:24 PM	0	888.067	-0.536	-0.02	26.36	1007.32
11/15/2021	12:01:31 AM	0	9.0326	4.973	11/14/202	11:33:24 PM	0	887.928	-0.498	-0.02	26.36	1007.32

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/15/2021	1:01:31 AM	0	9.0272	4.972	11/15/202	12:33:24 AM	0	887.034	-0.48	-0.02	26.36	1007.32
11/15/2021	2:01:31 AM	0	9.0217	4.972	11/15/202	1:33:24 AM	0	886.402	-0.508	-0.02	26.35	1007.33
11/15/2021	3:01:31 AM	0	9.0187	4.972	11/15/202	2:33:24 AM	0	885.522	-0.489	-0.01	26.35	1007.33
11/15/2021	4:01:31 AM	0	9.0148	4.973	11/15/202	3:33:24 AM	0	884.769	-0.47	-0.01	26.34	1007.34
11/15/2021	5:01:31 AM	0	9.0069	4.973	11/15/202	4:33:24 AM	0	883.795	-0.434	-0.01	26.34	1007.34
11/15/2021	6:01:31 AM	0	8.9984	4.973	11/15/202	5:33:24 AM	0	882.804	-0.452	0.00	26.34	1007.34
11/15/2021	7:01:31 AM	0	8.9892	4.973	11/15/202	6:33:24 AM	0	881.681	-0.474	0.00	26.34	1007.34
11/15/2021	8:01:31 AM	0	8.9783	4.973	11/15/202	7:33:24 AM	0	880.388	-0.493	0.00	26.34	1007.34
11/15/2021	9:01:31 AM	0	8.9662	4.973	11/15/202	8:33:24 AM	0	878.415	-0.499	0.01	26.33	1007.35
11/15/2021	10:01:31 AM	0	8.9536	4.972	11/15/202	9:33:24 AM	0	877.373	-0.466	0.01	26.33	1007.35
11/15/2021	11:01:31 AM	0	8.9407	4.972	11/15/202	10:33:24 AM	0	876.066	-0.359	0.01	26.33	1007.35
11/15/2021	12:01:31 PM	0	8.9291	4.973	11/15/202	11:33:24 AM	0	875.171	0.025	0.00	26.33	1007.35
11/15/2021	1:01:31 PM	0	8.9173	4.973	11/15/202	12:33:24 PM	0	873.828	0.469	0.01	26.33	1007.35
11/15/2021	2:01:31 PM	0	8.9056	4.973	11/15/202	1:33:24 PM	0	873.427	0.926	0.00	26.34	1007.34
11/15/2021	3:01:31 PM	0	8.8962	4.973	11/15/202	2:33:24 PM	0	872.353	0.51	0.00	26.34	1007.34
11/15/2021	4:01:31 PM	0	8.898	4.973	11/15/202	3:33:24 PM	0	872.839	-0.038	0.00	26.34	1007.34
11/15/2021	5:01:31 PM	0	8.9042	4.973	11/15/202	4:33:24 PM	0	873.836	-0.574	-0.01	26.34	1007.34
11/15/2021	6:01:31 PM	0	8.9167	4.973	11/15/202	5:33:24 PM	0	875.137	-0.564	-0.01	26.34	1007.34
11/15/2021	7:01:31 PM	0	8.9364	4.972	11/15/202	6:33:24 PM	0	877.677	-0.652	-0.01	26.35	1007.33
11/15/2021	8:01:31 PM	0	8.9537	4.973	11/15/202	7:33:24 PM	0	880.004	-1.895	-0.02	26.36	1007.32
11/15/2021	9:01:31 PM	0	8.9692	4.972	11/15/202	8:33:24 PM	0	882.034	-3.083	-0.03	26.36	1007.32
11/15/2021	10:01:31 PM	0	8.9842	4.973	11/15/202	9:33:24 PM	0	883.49	-3.432	-0.02	26.36	1007.32
11/15/2021	11:01:31 PM	0	8.9999	4.973	11/15/202	10:33:24 PM	0	885.647	-3.757	-0.03	26.37	1007.31
11/16/2021	12:01:31 AM	0	9.0148	4.973	11/15/202	11:33:24 PM	0	887.449	-4.162	-0.03	26.37	1007.31
11/16/2021	1:01:31 AM	0	9.0269	4.973	11/16/202	12:33:24 AM	0	888.906	-5.365	-0.04	26.37	1007.31
11/16/2021	2:01:31 AM	0	9.0395	4.973	11/16/202	1:33:24 AM	0	890.164	-6.816	-0.04	26.37	1007.31
11/16/2021	3:01:31 AM	0	9.0506	4.972	11/16/202	2:33:24 AM	0	891.389	-7.835	-0.04	26.38	1007.30
11/16/2021	4:01:31 AM	0	9.0609	4.973	11/16/202	3:33:24 AM	0	892.374	-8.195	-0.04	26.38	1007.30
11/16/2021	5:01:31 AM	0	9.0708	4.973	11/16/202	4:33:24 AM	0	893.256	-8.484	-0.04	26.38	1007.30
11/16/2021	6:01:31 AM	0	9.0808	4.972	11/16/202	5:33:24 AM	0	894.532	-8.469	-0.04	26.38	1007.30
11/16/2021	7:01:31 AM	0	9.0907	4.974	11/16/202	6:33:24 AM	0	895.781	-7.486	-0.04	26.38	1007.30
11/16/2021	8:01:31 AM	0	9.1007	4.973	11/16/202	7:33:24 AM	0	896.849	-7.748	-0.04	26.38	1007.30
11/16/2021	9:01:31 AM	0	9.11	4.973	11/16/202	8:33:24 AM	0	898.005	-7.517	-0.05	26.38	1007.30
11/16/2021	10:01:31 AM	0	9.12	4.972	11/16/202	9:33:24 AM	0	899.488	-6.288	-0.05	26.39	1007.29
11/16/2021	11:01:31 AM	0	9.1295	4.972	11/16/202	10:33:24 AM	0	900.831	-4.583	-0.06	26.39	1007.29
11/16/2021	12:01:31 PM	0	9.1384	4.973	11/16/202	11:33:24 AM	0	901.977	-3.118	-0.06	26.40	1007.28
11/16/2021	1:01:31 PM	0	9.1461	4.973	11/16/202	12:33:24 PM	0	902.696	-2.502	-0.06	26.40	1007.28
11/16/2021	2:01:31 PM	0	9.1534	4.973	11/16/202	1:33:24 PM	0	903.493	-1.241	-0.06	26.40	1007.28
11/16/2021	3:01:31 PM	0	9.1605	4.973	11/16/202	2:33:24 PM	0	904.162	-1.072	-0.06	26.40	1007.28
11/16/2021	4:01:31 PM	0	9.1673	4.973	11/16/202	3:33:24 PM	0	904.659	-1.624	-0.06	26.39	1007.29
11/16/2021	5:01:31 PM	0	9.1742	4.972	11/16/202	4:33:24 PM	0	904.946	-3.974	-0.05	26.39	1007.29
11/16/2021	6:01:31 PM	0	9.1807	4.973	11/16/202	5:33:24 PM	0	905.12	-6.349	-0.05	26.39	1007.29
11/16/2021	7:01:31 PM	0	9.1858	4.973	11/16/202	6:33:24 PM	0	905.157	-7.576	-0.04	26.38	1007.30
11/16/2021	8:01:31 PM	0	9.1915	4.973	11/16/202	7:33:24 PM	0	905.448	-7.957	-0.04	26.38	1007.30
11/16/2021	9:01:31 PM	0	9.1966	4.973	11/16/202	8:33:24 PM	0	905.939	-8.255	-0.04	26.38	1007.30
11/16/2021	10:01:31 PM	0	9.2006	4.973	11/16/202	9:33:24 PM	0	906.108	-8.431	-0.04	26.38	1007.30
11/16/2021	11:01:31 PM	0	9.205	4.973	11/16/202	10:33:24 PM	0	906.382	-8.523	-0.04	26.37	1007.31
11/17/2021	12:01:31 AM	0	9.2084	4.973	11/16/202	11:33:24 PM	0	906.659	-8.277	-0.04	26.37	1007.31
11/17/2021	1:01:31 AM	0	9.2124	4.973	11/17/202	12:33:24 AM	0	906.791	-8.414	-0.03	26.37	1007.31
11/17/2021	2:01:31 AM	0	9.2142	4.973	11/17/202	1:33:24 AM	0	907.352	-6.967	-0.04	26.38	1007.30
11/17/2021	3:01:31 AM	0	9.2161	4.973	11/17/202	2:33:24 AM	0	907.235	-6.279	-0.04	26.37	1007.31
11/17/2021	4:01:31 AM	0	9.2166	4.973	11/17/202	3:33:24 AM	0	907.258	-6.039	-0.03	26.37	1007.31
11/17/2021	5:01:31 AM	0	9.2159	4.973	11/17/202	4:33:24 AM	0	906.901	-6.201	-0.03	26.37	1007.31
11/17/2021	6:01:31 AM	0	9.2162	4.973	11/17/202	5:33:24 AM	0	906.647	-6.529	-0.03	26.37	1007.31
11/17/2021	7:01:31 AM	0	9.2142	4.973	11/17/202	6:33:24 AM	0	906.385	-6.223	-0.03	26.37	1007.31
11/17/2021	8:01:31 AM	0	9.2129	4.973	11/17/202	7:33:24 AM	0	905.974	-6.391	-0.03	26.36	1007.32
11/17/2021	9:01:31 AM	0	9.2124	4.973	11/17/202	8:33:24 AM	0	905.956	-6.544	-0.03	26.36	1007.32
11/17/2021	10:01:31 AM	0	9.2095	4.973	11/17/202	9:33:24 AM	0	905.397	-6.537	-0.02	26.36	1007.32
11/17/2021	11:01:31 AM	0	9.2086	4.973	11/17/202	10:33:24 AM	0	905.431	-5.895	-0.02	26.36	1007.32
11/17/2021	12:01:31 PM	0	9.2075	4.973	11/17/202	11:33:24 AM	0	905.574	-4.487	-0.03	26.36	1007.32
11/17/2021	1:01:31 PM	0	9.202	4.972	11/17/202	12:33:24 PM	0	905.15	-2.428	-0.03	26.37	1007.31
11/17/2021	2:01:31 PM	0	9.1975	4.973	11/17/202	1:33:24 PM	0	904.486	-2.261	-0.03	26.36	1007.32
11/17/2021	3:01:31 PM	0	9.1913	4.973	11/17/202	2:33:24 PM	0	903.777	-2.443	-0.02	26.36	1007.32
11/17/2021	4:01:31 PM	0	9.1859	4.973	11/17/202	3:33:24 PM	0	902.909	-2.702	-0.02	26.36	1007.32
11/17/2021	5:01:31 PM	0	9.1822	4.972	11/17/202	4:33:24 PM	0	902.262	-3.181	-0.02	26.36	1007.32
11/17/2021	6:01:31 PM	0	9.1772	4.973	11/17/202	5:33:24 PM	0	901.729	-3.863	-0.02	26.36	1007.32
11/17/2021	7:01:31 PM	0	9.1721	4.973	11/17/202	6:33:24 PM	0	901.117	-4.072	-0.02	26.35	1007.33
11/17/2021	8:01:31 PM	0	9.1655	4.973	11/17/202	7:33:24 PM	0	900.331	-4.134	-0.02	26.35	1007.33
11/17/2021	9:01:31 PM	0	9.1597	4.973	11/17/202	8:33:24 PM	0	899.591	-4.07	-0.01	26.35	1007.33
11/17/2021	10:01:31 PM	0	9.1525	4.973	11/17/202	9:33:24 PM	0	899.065	-4.178	-0.02	26.35	1007.33

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/17/2021	11:01:31 PM	0	9.1471	4.973	11/17/202	10:33:24 PM	0	898.241	-4.262	-0.01	26.35	1007.33
11/18/2021	12:01:31 AM	0	9.1391	4.973	11/17/202	11:33:24 PM	0	897.674	-4.166	-0.01	26.35	1007.33
11/18/2021	1:01:31 AM	0	9.1343	4.973	11/18/202	12:33:24 AM	0	897.159	-3.876	-0.01	26.35	1007.33
11/18/2021	2:01:31 AM	0	9.1267	4.973	11/18/202	1:33:24 AM	0	896.508	-3.763	-0.02	26.35	1007.33
11/18/2021	3:01:31 AM	0	9.1198	4.974	11/18/202	2:33:24 AM	0	895.522	-3.733	-0.01	26.35	1007.33
11/18/2021	4:01:31 AM	0	9.1139	4.972	11/18/202	3:33:24 AM	0	894.909	-3.637	-0.01	26.35	1007.33
11/18/2021	5:01:31 AM	0	9.1099	4.973	11/18/202	4:33:24 AM	0	894.691	-3.757	-0.01	26.35	1007.33
11/18/2021	6:01:31 AM	0	9.1072	4.973	11/18/202	5:33:24 AM	0	894.487	-3.726	-0.01	26.35	1007.33
11/18/2021	7:01:31 AM	0	9.1028	4.973	11/18/202	6:33:24 AM	0	894.062	-3.711	-0.01	26.35	1007.33
11/18/2021	8:01:31 AM	0	9.1011	4.973	11/18/202	7:33:24 AM	0	894.012	-3.827	-0.02	26.35	1007.33
11/18/2021	9:01:31 AM	0	9.1024	4.973	11/18/202	8:33:24 AM	0	894.282	-4.032	-0.02	26.35	1007.33
11/18/2021	10:01:31 AM	0	9.1021	4.973	11/18/202	9:33:24 AM	0	894.357	-3.875	-0.02	26.36	1007.32
11/18/2021	11:01:31 AM	0	9.1008	4.974	11/18/202	10:33:24 AM	0	894.455	-3.549	-0.02	26.36	1007.32
11/18/2021	12:01:31 PM	0	9.0986	4.973	11/18/202	11:33:24 AM	0	894.294	-2.732	-0.02	26.36	1007.32
11/18/2021	1:01:31 PM	0	9.0996	4.973	11/18/202	12:33:24 PM	0	894.557	-2.215	-0.02	26.36	1007.32
11/18/2021	2:01:31 PM	0	9.0974	4.973	11/18/202	1:33:24 PM	0	894.637	-1.37	-0.03	26.36	1007.32
11/18/2021	3:01:31 PM	0	9.0964	4.973	11/18/202	2:33:24 PM	0	894.423	-0.828	-0.02	26.36	1007.32
11/18/2021	4:01:31 PM	0	9.0965	4.973	11/18/202	3:33:24 PM	0	894.463	-0.915	-0.02	26.36	1007.32
11/18/2021	5:01:31 PM	0	9.0952	4.973	11/18/202	4:33:24 PM	0	894.149	-2.167	-0.02	26.36	1007.32
11/18/2021	6:01:31 PM	0	9.0968	4.973	11/18/202	5:33:24 PM	0	894.203	-3.538	-0.02	26.36	1007.32
11/18/2021	7:01:31 PM	0	9.0978	4.973	11/18/202	6:33:24 PM	0	894.238	-3.698	-0.02	26.36	1007.32
11/18/2021	8:01:31 PM	0	9.0994	4.974	11/18/202	7:33:24 PM	0	894.587	-3.595	-0.02	26.36	1007.32
11/18/2021	9:01:31 PM	0	9.0991	4.974	11/18/202	8:33:24 PM	0	894.649	-3.634	-0.02	26.36	1007.32
11/18/2021	10:01:31 PM	0	9.098	4.973	11/18/202	9:33:24 PM	0	894.481	-3.767	-0.02	26.36	1007.32
11/18/2021	11:01:31 PM	0	9.0976	4.973	11/18/202	10:33:24 PM	0	894.35	-3.854	-0.02	26.36	1007.32
11/19/2021	12:01:31 AM	0	9.0971	4.973	11/18/202	11:33:24 PM	0	894.257	-4.005	-0.02	26.36	1007.32
11/19/2021	1:01:31 AM	0	9.0995	4.973	11/19/202	12:33:24 AM	0	894.537	-4.136	-0.02	26.36	1007.32
11/19/2021	2:01:31 AM	0	9.0985	4.974	11/19/202	1:33:24 AM	0	894.391	-4.253	-0.02	26.36	1007.32
11/19/2021	3:01:31 AM	0	9.0996	4.973	11/19/202	2:33:24 AM	0	894.439	-4.412	-0.02	26.36	1007.32
11/19/2021	4:01:31 AM	0	9.1001	4.973	11/19/202	3:33:24 AM	0	894.606	-4.628	-0.02	26.36	1007.32
11/19/2021	5:01:31 AM	0	9.1003	4.973	11/19/202	4:33:24 AM	0	894.519	-5.452	-0.02	26.36	1007.32
11/19/2021	6:01:31 AM	0	9.1029	4.973	11/19/202	5:33:24 AM	0	894.731	-5.51	-0.02	26.36	1007.32
11/19/2021	7:01:31 AM	0	9.1067	4.973	11/19/202	6:33:24 AM	0	895.308	-5.165	-0.02	26.36	1007.32
11/19/2021	8:01:31 AM	0	9.1089	4.973	11/19/202	7:33:24 AM	0	895.462	-5.15	-0.02	26.36	1007.32
11/19/2021	9:01:31 AM	0	9.1127	4.973	11/19/202	8:33:24 AM	0	896.079	-4.883	-0.02	26.36	1007.32
11/19/2021	10:01:31 AM	0	9.1167	4.973	11/19/202	9:33:24 AM	0	896.708	-4.516	-0.03	26.36	1007.32
11/19/2021	11:01:31 AM	0	9.1205	4.973	11/19/202	10:33:24 AM	0	897.47	-3.559	-0.03	26.37	1007.31
11/19/2021	12:01:31 PM	0	9.1252	4.973	11/19/202	11:33:24 AM	0	898.399	-1.958	-0.04	26.37	1007.31
11/19/2021	1:01:31 PM	0	9.1259	4.974	11/19/202	12:33:24 PM	0	897.95	-2.812	-0.03	26.37	1007.31
11/19/2021	2:01:31 PM	0	9.1293	4.973	11/19/202	1:33:24 PM	0	898.458	-2.723	-0.03	26.37	1007.31
11/19/2021	3:01:31 PM	0	9.1309	4.973	11/19/202	2:33:24 PM	0	899.027	-0.893	-0.04	26.37	1007.31
11/19/2021	4:01:31 PM	0	9.1312	4.973	11/19/202	3:33:24 PM	0	898.848	-0.684	-0.03	26.37	1007.31
11/19/2021	5:01:31 PM	0	9.1336	4.973	11/19/202	4:33:24 PM	0	898.858	-2.176	-0.03	26.37	1007.31
11/19/2021	6:01:31 PM	0	9.1339	4.974	11/19/202	5:33:24 PM	0	898.803	-2.997	-0.03	26.37	1007.31
11/19/2021	7:01:31 PM	0	9.1353	4.973	11/19/202	6:33:24 PM	0	898.7	-3.099	-0.03	26.37	1007.31
11/19/2021	8:01:31 PM	0	9.1347	4.972	11/19/202	7:33:24 PM	0	898.676	-3.177	-0.03	26.37	1007.31
11/19/2021	9:01:31 PM	0	9.135	4.973	11/19/202	8:33:24 PM	0	898.524	-3.461	-0.03	26.36	1007.32
11/19/2021	10:01:31 PM	0	9.1374	4.973	11/19/202	9:33:24 PM	0	898.592	-3.694	-0.03	26.36	1007.32
11/19/2021	11:01:31 PM	0	9.1393	4.973	11/19/202	10:33:24 PM	0	898.883	-3.72	-0.03	26.36	1007.32
11/20/2021	12:01:31 AM	0	9.1406	4.973	11/19/202	11:33:24 PM	0	899.109	-3.688	-0.03	26.36	1007.32
11/20/2021	1:01:31 AM	0	9.1426	4.973	11/20/202	12:33:24 AM	0	899.384	-3.758	-0.03	26.37	1007.31
11/20/2021	2:01:31 AM	0	9.1442	4.973	11/20/202	1:33:24 AM	0	899.341	-3.8	-0.03	26.36	1007.32
11/20/2021	3:01:31 AM	0	9.1458	4.973	11/20/202	2:33:24 AM	0	899.355	-4.072	-0.03	26.36	1007.32
11/20/2021	4:01:31 AM	0	9.1482	4.973	11/20/202	3:33:24 AM	0	899.908	-4.425	-0.03	26.37	1007.31
11/20/2021	5:01:31 AM	0	9.1501	4.973	11/20/202	4:33:24 AM	0	900.032	-4.5	-0.03	26.36	1007.32
11/20/2021	6:01:31 AM	0	9.153	4.973	11/20/202	5:33:24 AM	0	900.183	-4.336	-0.03	26.36	1007.32
11/20/2021	7:01:31 AM	0	9.1547	4.973	11/20/202	6:33:24 AM	0	900.45	-4.44	-0.03	26.36	1007.32
11/20/2021	8:01:31 AM	0	9.1572	4.973	11/20/202	7:33:24 AM	0	900.69	-4.237	-0.03	26.36	1007.32
11/20/2021	9:01:31 AM	0	9.1593	4.973	11/20/202	8:33:24 AM	0	901.156	-4.171	-0.03	26.37	1007.31
11/20/2021	10:01:31 AM	0	9.1634	4.973	11/20/202	9:33:24 AM	0	901.632	-3.982	-0.03	26.37	1007.31
11/20/2021	11:01:31 AM	0	9.1662	4.973	11/20/202	10:33:24 AM	0	901.916	-3.406	-0.03	26.37	1007.31
11/20/2021	12:01:31 PM	0	9.1707	4.974	11/20/202	11:33:24 AM	0	902.687	-2.628	-0.03	26.37	1007.31
11/20/2021	1:01:31 PM	0	9.1748	4.973	11/20/202	12:33:24 PM	0	903.245	-1.966	-0.04	26.37	1007.31
11/20/2021	2:01:31 PM	0	9.179	4.973	11/20/202	1:33:24 PM	0	903.777	-1.414	-0.04	26.37	1007.31
11/20/2021	3:01:31 PM	0	9.183	4.974	11/20/202	2:33:24 PM	0	904.477	-0.942	-0.04	26.38	1007.30
11/20/2021	4:01:31 PM	0	9.1867	4.973	11/20/202	3:33:24 PM	0	904.627	-1.235	-0.04	26.38	1007.30
11/20/2021	5:01:31 PM	0	9.1904	4.974	11/20/202	4:33:24 PM	0	905.187	-1.755	-0.04	26.38	1007.30
11/20/2021	6:01:31 PM	0	9.1922	4.973	11/20/202	5:33:24 PM	0	905.003	-2.14	-0.04	26.37	1007.31
11/20/2021	7:01:31 PM	0	9.1909	4.973	11/20/202	6:33:24 PM	0	904.498	-2.204	-0.03	26.37	1007.31
11/20/2021	8:01:31 PM	0	9.1885	4.973	11/20/202	7:33:24 PM	0	903.932	-2.165	-0.03	26.37	1007.31

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/20/2021	9:01:31 PM	0	9.1871	4.973	11/20/202	8:33:24 PM	0	903.62	-2.049	-0.03	26.36	1007.32
11/20/2021	10:01:31 PM	0	9.1879	4.973	11/20/202	9:33:24 PM	0	904.179	-1.944	-0.03	26.37	1007.31
11/20/2021	11:01:31 PM	0	9.1893	4.974	11/20/202	10:33:24 PM	0	904.007	-1.823	-0.03	26.37	1007.31
11/21/2021	12:01:31 AM	0	9.1898	4.973	11/20/202	11:33:24 PM	0	903.887	-1.656	-0.03	26.36	1007.32
11/21/2021	1:01:31 AM	0	9.1877	4.973	11/21/202	12:33:24 AM	0	903.699	-1.479	-0.03	26.36	1007.32
11/21/2021	2:01:31 AM	0	9.1868	4.973	11/21/202	1:33:24 AM	0	903.741	-1.481	-0.03	26.37	1007.31
11/21/2021	3:01:31 AM	0	9.188	4.974	11/21/202	2:33:24 AM	0	903.766	-1.399	-0.03	26.37	1007.31
11/21/2021	4:01:31 AM	0	9.1865	4.973	11/21/202	3:33:24 AM	0	903.935	-1.351	-0.03	26.37	1007.31
11/21/2021	5:01:31 AM	0	9.1851	4.973	11/21/202	4:33:24 AM	0	903.551	-1.311	-0.03	26.37	1007.31
11/21/2021	6:01:31 AM	0	9.184	4.973	11/21/202	5:33:24 AM	0	903.347	-1.309	-0.03	26.36	1007.32
11/21/2021	7:01:31 AM	0	9.1836	4.973	11/21/202	6:33:24 AM	0	903.393	-1.286	-0.03	26.37	1007.31
11/21/2021	8:01:31 AM	0	9.1815	4.973	11/21/202	7:33:24 AM	0	903.001	-1.261	-0.03	26.36	1007.32
11/21/2021	9:01:31 AM	0	9.1782	4.974	11/21/202	8:33:24 AM	0	902.638	-1.241	-0.03	26.36	1007.32
11/21/2021	10:01:31 AM	0	9.1779	4.974	11/21/202	9:33:24 AM	0	902.508	-1.175	-0.03	26.36	1007.32
11/21/2021	11:01:31 AM	0	9.1733	4.973	11/21/202	10:33:24 AM	0	902.42	-0.837	-0.03	26.37	1007.31
11/21/2021	12:01:31 PM	0	9.1718	4.974	11/21/202	11:33:24 AM	0	901.853	-0.593	-0.02	26.36	1007.32
11/21/2021	1:01:31 PM	0	9.1682	4.974	11/21/202	12:33:24 PM	0	901.624	-0.527	-0.03	26.36	1007.32
11/21/2021	2:01:31 PM	0	9.1612	4.973	11/21/202	1:33:24 PM	0	900.686	-0.435	-0.02	26.36	1007.32
11/21/2021	3:01:31 PM	0	9.1571	4.973	11/21/202	2:33:24 PM	0	900.141	-0.32	-0.02	26.36	1007.32
11/21/2021	4:01:31 PM	0	9.1538	4.973	11/21/202	3:33:24 PM	0	899.602	-0.367	-0.02	26.36	1007.32
11/21/2021	5:01:31 PM	0	9.1492	4.974	11/21/202	4:33:24 PM	0	899.352	-0.474	-0.02	26.36	1007.32
11/21/2021	6:01:31 PM	0	9.1436	4.973	11/21/202	5:33:24 PM	0	898.802	-0.539	-0.02	26.36	1007.32
11/21/2021	7:01:31 PM	0	9.1382	4.974	11/21/202	6:33:24 PM	0	897.978	-0.534	-0.02	26.36	1007.32
11/21/2021	8:01:31 PM	0	9.1338	4.974	11/21/202	7:33:24 PM	0	897.645	-0.531	-0.02	26.36	1007.32
11/21/2021	9:01:31 PM	0	9.1293	4.973	11/21/202	8:33:24 PM	0	897.2	-0.525	-0.02	26.36	1007.32
11/21/2021	10:01:31 PM	0	9.124	4.973	11/21/202	9:33:24 PM	0	896.516	-0.529	-0.02	26.36	1007.32
11/21/2021	11:01:31 PM	0	9.1172	4.973	11/21/202	10:33:24 PM	0	895.981	-0.533	-0.02	26.36	1007.32
11/22/2021	12:01:31 AM	0	9.1119	4.973	11/21/202	11:33:24 PM	0	895.292	-0.537	-0.02	26.35	1007.33
11/22/2021	1:01:31 AM	0	9.104	4.973	11/22/202	12:33:24 AM	0	894.413	-0.549	-0.02	26.35	1007.33
11/22/2021	2:01:31 AM	0	9.0922	4.973	11/22/202	1:33:24 AM	0	893.383	-0.547	-0.02	26.35	1007.33
11/22/2021	3:01:31 AM	0	9.0839	4.973	11/22/202	2:33:24 AM	0	892.42	-0.58	-0.02	26.35	1007.33
11/22/2021	4:01:31 AM	0	9.0769	4.973	11/22/202	3:33:24 AM	0	891.922	-0.656	-0.02	26.36	1007.32
11/22/2021	5:01:31 AM	0	9.0713	4.973	11/22/202	4:33:24 AM	0	890.928	-0.782	-0.01	26.35	1007.33
11/22/2021	6:01:31 AM	0	9.0595	4.973	11/22/202	5:33:24 AM	0	890.27	-1.072	-0.02	26.36	1007.32
11/22/2021	7:01:31 AM	0	9.0494	4.973	11/22/202	6:33:24 AM	0	888.897	-1.324	-0.01	26.35	1007.33
11/22/2021	8:01:31 AM	0	9.0473	4.973	11/22/202	7:33:24 AM	0	887.908	-1.401	-0.01	26.34	1007.34
11/22/2021	9:01:31 AM	0	9.0433	4.974	11/22/202	8:33:24 AM	0	888.084	-1.407	-0.01	26.35	1007.33
11/22/2021	10:01:31 AM	0	9.0411	4.973	11/22/202	9:33:24 AM	0	887.813	-1.32	-0.01	26.35	1007.33
11/22/2021	11:01:31 AM	0	9.041	4.973	11/22/202	10:33:24 AM	0	888.044	-0.776	-0.01	26.35	1007.33
11/22/2021	12:01:31 PM	0	9.0389	4.974	11/22/202	11:33:24 AM	0	888.348	-0.55	-0.02	26.36	1007.32
11/22/2021	1:01:31 PM	0	9.0362	4.974	11/22/202	12:33:24 PM	0	887.768	-0.335	-0.02	26.35	1007.33
11/22/2021	2:01:31 PM	0	9.0331	4.974	11/22/202	1:33:24 PM	0	887.632	0.953	-0.02	26.36	1007.32
11/22/2021	3:01:31 PM	0	9.0304	4.973	11/22/202	2:33:24 PM	0	887.58	1.615	-0.02	26.36	1007.32
11/22/2021	4:01:31 PM	0	9.029	4.973	11/22/202	3:33:24 PM	0	887.242	1.074	-0.02	26.36	1007.32
11/22/2021	5:01:31 PM	0	9.0289	4.974	11/22/202	4:33:24 PM	0	887.371	0.264	-0.02	26.36	1007.32
11/22/2021	6:01:31 PM	0	9.0284	4.973	11/22/202	5:33:24 PM	0	887.364	-0.527	-0.02	26.36	1007.32
11/22/2021	7:01:31 PM	0	9.0293	4.974	11/22/202	6:33:24 PM	0	887.397	-0.788	-0.02	26.36	1007.32
11/22/2021	8:01:31 PM	0	9.03	4.974	11/22/202	7:33:24 PM	0	887.613	-1.767	-0.02	26.36	1007.32
11/22/2021	9:01:31 PM	0	9.029	4.973	11/22/202	8:33:24 PM	0	887.357	-2.957	-0.02	26.36	1007.32
11/22/2021	10:01:31 PM	0	9.0287	4.974	11/22/202	9:33:24 PM	0	887.192	-3.465	-0.02	26.36	1007.32
11/22/2021	11:01:31 PM	0	9.0284	4.974	11/22/202	10:33:24 PM	0	887.135	-3.555	-0.02	26.36	1007.32
11/23/2021	12:01:31 AM	0	9.0282	4.973	11/22/202	11:33:24 PM	0	887.081	-4.027	-0.02	26.35	1007.33
11/23/2021	1:01:31 AM	0	9.0302	4.974	11/23/202	12:33:24 AM	0	887.428	-4.343	-0.02	26.36	1007.32
11/23/2021	2:01:31 AM	0	9.0313	4.973	11/23/202	1:33:24 AM	0	887.489	-4.609	-0.02	26.36	1007.32
11/23/2021	3:01:31 AM	0	9.032	4.974	11/23/202	2:33:24 AM	0	887.652	-4.694	-0.02	26.36	1007.32
11/23/2021	4:01:31 AM	0	9.0322	4.974	11/23/202	3:33:24 AM	0	887.626	-4.923	-0.02	26.36	1007.32
11/23/2021	5:01:31 AM	0	9.0336	4.973	11/23/202	4:33:24 AM	0	887.631	-5.364	-0.02	26.35	1007.33
11/23/2021	6:01:31 AM	0	9.0368	4.974	11/23/202	5:33:24 AM	0	887.937	-5.892	-0.02	26.35	1007.33
11/23/2021	7:01:31 AM	0	9.0416	4.974	11/23/202	6:33:24 AM	0	888.577	-6.482	-0.02	26.36	1007.32
11/23/2021	8:01:31 AM	0	9.0453	4.974	11/23/202	7:33:24 AM	0	888.989	-7.123	-0.02	26.36	1007.32
11/23/2021	9:01:31 AM	0	9.0506	4.973	11/23/202	8:33:24 AM	0	889.737	-7.127	-0.02	26.36	1007.32
11/23/2021	10:01:31 AM	0	9.0551	4.973	11/23/202	9:33:24 AM	0	890.299	-6.922	-0.02	26.36	1007.32
11/23/2021	11:01:31 AM	0	9.0594	4.973	11/23/202	10:33:24 AM	0	891.037	-5.994	-0.03	26.36	1007.32
11/23/2021	12:01:31 PM	0	9.0645	4.974	11/23/202	11:33:24 AM	0	891.84	-5.099	-0.03	26.37	1007.31
11/23/2021	1:01:31 PM	0	9.0684	4.974	11/23/202	12:33:24 PM	0	892.482	-4.756	-0.03	26.37	1007.31
11/23/2021	2:01:31 PM	0	9.0738	4.973	11/23/202	1:33:24 PM	0	893.182	-4.097	-0.03	26.37	1007.31
11/23/2021	3:01:31 PM	0	9.0785	4.973	11/23/202	2:33:24 PM	0	893.536	-4.207	-0.03	26.37	1007.31
11/23/2021	4:01:31 PM	0	9.0831	4.974	11/23/202	3:33:24 PM	0	894.368	-3.271	-0.04	26.37	1007.31
11/23/2021	5:01:31 PM	0	9.0877	4.974	11/23/202	4:33:24 PM	0	894.728	-3.737	-0.04	26.37	1007.31
11/23/2021	6:01:31 PM	0	9.0915	4.973	11/23/202	5:33:24 PM	0	894.951	-5.523	-0.03	26.37	1007.31

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/23/2021	7:01:31 PM	0	9.0958	4.973	11/23/202	6:33:24 PM	0	894.938	-6.566	-0.03	26.37	1007.31
11/23/2021	8:01:31 PM	0	9.0989	4.974	11/23/202	7:33:24 PM	0	895.317	-7.091	-0.03	26.37	1007.31
11/23/2021	9:01:31 PM	0	9.104	4.973	11/23/202	8:33:24 PM	0	895.817	-7.219	-0.03	26.37	1007.31
11/23/2021	10:01:31 PM	0	9.1084	4.974	11/23/202	9:33:24 PM	0	896.555	-6.457	-0.03	26.37	1007.31
11/23/2021	11:01:31 PM	0	9.1136	4.974	11/23/202	10:33:24 PM	0	897.476	-5.073	-0.04	26.38	1007.30
11/24/2021	12:01:31 AM	0	9.1188	4.974	11/23/202	11:33:24 PM	0	898.005	-4.915	-0.04	26.38	1007.30
11/24/2021	1:01:31 AM	0	9.1238	4.974	11/24/202	12:33:24 AM	0	898.463	-5.692	-0.04	26.38	1007.30
11/24/2021	2:01:31 AM	0	9.1281	4.973	11/24/202	1:33:24 AM	0	898.727	-6.163	-0.04	26.37	1007.31
11/24/2021	3:01:31 AM	0	9.1329	4.974	11/24/202	2:33:24 AM	0	899.201	-6.512	-0.04	26.37	1007.31
11/24/2021	4:01:31 AM	0	9.1365	4.974	11/24/202	3:33:24 AM	0	899.651	-6.405	-0.04	26.37	1007.31
11/24/2021	5:01:31 AM	0	9.1393	4.973	11/24/202	4:33:24 AM	0	899.833	-5.894	-0.04	26.37	1007.31
11/24/2021	6:01:31 AM	0	9.1404	4.974	11/24/202	5:33:24 AM	0	899.81	-5.813	-0.04	26.37	1007.31
11/24/2021	7:01:31 AM	0	9.1428	4.973	11/24/202	6:33:24 AM	0	899.994	-5.918	-0.03	26.37	1007.31
11/24/2021	8:01:31 AM	0	9.1441	4.974	11/24/202	7:33:24 AM	0	899.905	-5.464	-0.03	26.37	1007.31
11/24/2021	9:01:31 AM	0	9.1453	4.973	11/24/202	8:33:24 AM	0	899.986	-4.848	-0.03	26.37	1007.31
11/24/2021	10:01:31 AM	0	9.1471	4.974	11/24/202	9:33:24 AM	0	900.28	-4.307	-0.03	26.37	1007.31
11/24/2021	11:01:31 AM	0	9.1456	4.974	11/24/202	10:33:24 AM	0	900.084	-3.698	-0.03	26.37	1007.31
11/24/2021	12:01:31 PM	0	9.1466	4.974	11/24/202	11:33:24 AM	0	900.268	-3.121	-0.03	26.37	1007.31
11/24/2021	1:01:31 PM	0	9.1445	4.973	11/24/202	12:33:24 PM	0	899.734	-2.681	-0.03	26.37	1007.31
11/24/2021	2:01:31 PM	0	9.1411	4.973	11/24/202	1:33:24 PM	0	899.618	-2.34	-0.03	26.37	1007.31
11/24/2021	3:01:31 PM	0	9.1337	4.974	11/24/202	2:33:24 PM	0	898.8	-2.388	-0.03	26.37	1007.31
11/24/2021	4:01:31 PM	0	9.1292	4.973	11/24/202	3:33:24 PM	0	897.434	-2.477	-0.02	26.36	1007.32
11/24/2021	5:01:31 PM	0	9.1263	4.974	11/24/202	4:33:24 PM	0	897.595	-2.412	-0.03	26.36	1007.32
11/24/2021	6:01:31 PM	0	9.1247	4.974	11/24/202	5:33:24 PM	0	896.838	-2.397	-0.02	26.36	1007.32
11/24/2021	7:01:31 PM	0	9.1206	4.974	11/24/202	6:33:24 PM	0	896.449	-2.323	-0.02	26.36	1007.32
11/24/2021	8:01:31 PM	0	9.1156	4.974	11/24/202	7:33:24 PM	0	895.991	-2.19	-0.02	26.36	1007.32
11/24/2021	9:01:31 PM	0	9.1116	4.973	11/24/202	8:33:24 PM	0	895.705	-2.021	-0.02	26.36	1007.32
11/24/2021	10:01:31 PM	0	9.1065	4.974	11/24/202	9:33:24 PM	0	894.766	-1.864	-0.02	26.35	1007.33
11/24/2021	11:01:31 PM	0	9.1011	4.974	11/24/202	10:33:24 PM	0	894.45	-1.673	-0.02	26.36	1007.32
11/25/2021	12:01:31 AM	0	9.0957	4.974	11/24/202	11:33:24 PM	0	893.836	-1.54	-0.02	26.36	1007.32
11/25/2021	1:01:31 AM	0	9.0919	4.973	11/25/202	12:33:24 AM	0	893.32	-1.437	-0.02	26.35	1007.33
11/25/2021	2:01:31 AM	0	9.089	4.974	11/25/202	1:33:24 AM	0	892.814	-1.56	-0.02	26.35	1007.33
11/25/2021	3:01:31 AM	0	9.0851	4.973	11/25/202	2:33:24 AM	0	893.111	-1.599	-0.02	26.36	1007.32
11/25/2021	4:01:31 AM	0	9.0839	4.973	11/25/202	3:33:24 AM	0	892.795	-1.565	-0.02	26.36	1007.32
11/25/2021	5:01:31 AM	0	9.0806	4.974	11/25/202	4:33:24 AM	0	892.588	-1.294	-0.02	26.36	1007.32
11/25/2021	6:01:31 AM	0	9.0799	4.974	11/25/202	5:33:24 AM	0	892.352	-1.298	-0.02	26.36	1007.32
11/25/2021	7:01:31 AM	0	9.0813	4.974	11/25/202	6:33:24 AM	0	892.502	-1.121	-0.02	26.36	1007.32
11/25/2021	8:01:31 AM	0	9.0794	4.974	11/25/202	7:33:24 AM	0	892.573	-0.92	-0.02	26.36	1007.32
11/25/2021	9:01:31 AM	0	9.0814	4.974	11/25/202	8:33:24 AM	0	893.006	-0.847	-0.02	26.36	1007.32
11/25/2021	10:01:31 AM	0	9.0787	4.974	11/25/202	9:33:24 AM	0	892.676	-0.744	-0.02	26.36	1007.32
11/25/2021	11:01:31 AM	0	9.0728	4.974	11/25/202	10:33:24 AM	0	892.245	-0.617	-0.03	26.36	1007.32
11/25/2021	12:01:31 PM	0	9.0711	4.973	11/25/202	11:33:24 AM	0	891.716	-0.541	-0.02	26.36	1007.32
11/25/2021	1:01:31 PM	0	9.0655	4.973	11/25/202	12:33:24 PM	0	891.597	-0.49	-0.03	26.36	1007.32
11/25/2021	2:01:31 PM	0	9.0629	4.973	11/25/202	1:33:24 PM	0	891.083	-0.412	-0.02	26.36	1007.32
11/25/2021	3:01:31 PM	0	9.0594	4.974	11/25/202	2:33:24 PM	0	890.553	0.089	-0.02	26.36	1007.32
11/25/2021	4:01:31 PM	0	9.0569	4.974	11/25/202	3:33:24 PM	0	890.371	0.512	-0.02	26.36	1007.32
11/25/2021	5:01:31 PM	0	9.057	4.974	11/25/202	4:33:24 PM	0	890.313	0.417	-0.02	26.36	1007.32
11/25/2021	6:01:31 PM	0	9.0584	4.974	11/25/202	5:33:24 PM	0	890.415	-0.28	-0.02	26.36	1007.32
11/25/2021	7:01:31 PM	0	9.0568	4.974	11/25/202	6:33:24 PM	0	890.375	-0.148	-0.02	26.36	1007.32
11/25/2021	8:01:31 PM	0	9.0569	4.973	11/25/202	7:33:24 PM	0	890.649	-0.045	-0.03	26.36	1007.32
11/25/2021	9:01:31 PM	0	9.0558	4.974	11/25/202	8:33:24 PM	0	890.52	-0.449	-0.03	26.36	1007.32
11/25/2021	10:01:31 PM	0	9.0591	4.974	11/25/202	9:33:24 PM	0	890.608	-0.519	-0.02	26.36	1007.32
11/25/2021	11:01:31 PM	0	9.0579	4.974	11/25/202	10:33:24 PM	0	890.861	-0.342	-0.03	26.36	1007.32
11/26/2021	12:01:31 AM	0	9.0571	4.974	11/25/202	11:33:24 PM	0	890.665	-0.059	-0.03	26.36	1007.32
11/26/2021	1:01:31 AM	0	9.0565	4.974	11/26/202	12:33:24 AM	0	890.584	-0.013	-0.02	26.36	1007.32
11/26/2021	2:01:31 AM	0	9.0521	4.973	11/26/202	1:33:24 AM	0	890.292	-0.104	-0.03	26.36	1007.32
11/26/2021	3:01:31 AM	0	9.0546	4.974	11/26/202	2:33:24 AM	0	890.308	-0.471	-0.02	26.36	1007.32
11/26/2021	4:01:31 AM	0	9.0583	4.974	11/26/202	3:33:24 AM	0	890.716	-0.177	-0.02	26.36	1007.32
11/26/2021	5:01:31 AM	0	9.0595	4.974	11/26/202	4:33:24 AM	0	891.128	-0.043	-0.03	26.36	1007.32
11/26/2021	6:01:31 AM	0	9.0622	4.974	11/26/202	5:33:24 AM	0	891.405	-0.432	-0.03	26.36	1007.32
11/26/2021	7:01:31 AM	0	9.0649	4.973	11/26/202	6:33:24 AM	0	891.665	-0.596	-0.03	26.36	1007.32
11/26/2021	8:01:31 AM	0	9.0692	4.974	11/26/202	7:33:24 AM	0	892.227	-0.653	-0.03	26.37	1007.31
11/26/2021	9:01:31 AM	0	9.0748	4.974	11/26/202	8:33:24 AM	0	893.282	-0.705	-0.03	26.37	1007.31
11/26/2021	10:01:31 AM	0	9.0831	4.973	11/26/202	9:33:24 AM	0	894.085	-2.084	-0.03	26.37	1007.31
11/26/2021	11:01:31 AM	0	9.0905	4.974	11/26/202	10:33:24 AM	0	894.997	-2.425	-0.04	26.37	1007.31
11/26/2021	12:01:31 PM	0	9.0964	4.974	11/26/202	11:33:24 AM	0	895.871	-1.515	-0.04	26.38	1007.30
11/26/2021	1:01:31 PM	0	9.1022	4.974	11/26/202	12:33:24 PM	0	896.922	-1.019	-0.04	26.38	1007.30
11/26/2021	2:01:31 PM	0	9.1056	4.974	11/26/202	1:33:24 PM	0	897.213	-0.667	-0.04	26.38	1007.30
11/26/2021	3:01:31 PM	0	9.111	4.974	11/26/202	2:33:24 PM	0	897.667	-0.624	-0.04	26.38	1007.30
11/26/2021	4:01:31 PM	0	9.1151	4.974	11/26/202	3:33:24 PM	0	898.094	-1.088	-0.04	26.38	1007.30

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/26/2021	5:01:31 PM	0	9.1205	4.974	11/26/202	4:33:24 PM	0	898.413	-2.404	-0.04	26.38	1007.30
11/26/2021	6:01:31 PM	0	9.1244	4.974	11/26/202	5:33:24 PM	0	898.85	-4.168	-0.04	26.38	1007.30
11/26/2021	7:01:31 PM	0	9.1275	4.974	11/26/202	6:33:24 PM	0	898.705	-5.366	-0.04	26.37	1007.31
11/26/2021	8:01:31 PM	0	9.1308	4.974	11/26/202	7:33:24 PM	0	898.792	-6.329	-0.03	26.37	1007.31
11/26/2021	9:01:31 PM	0	9.1332	4.974	11/26/202	8:33:24 PM	0	898.585	-6.734	-0.03	26.37	1007.31
11/26/2021	10:01:31 PM	0	9.1348	4.974	11/26/202	9:33:24 PM	0	898.783	-6.944	-0.03	26.37	1007.31
11/26/2021	11:01:31 PM	0	9.1374	4.974	11/26/202	10:33:24 PM	0	899.053	-7.069	-0.03	26.37	1007.31
11/27/2021	12:01:31 AM	0	9.1371	4.974	11/26/202	11:33:24 PM	0	898.965	-6.708	-0.03	26.37	1007.31
11/27/2021	1:01:31 AM	0	9.1384	4.973	11/27/202	12:33:24 AM	0	899.033	-6.777	-0.03	26.37	1007.31
11/27/2021	2:01:31 AM	0	9.1349	4.974	11/27/202	1:33:24 AM	0	898.195	-6.209	-0.02	26.36	1007.32
11/27/2021	3:01:31 AM	0	9.1316	4.974	11/27/202	2:33:24 AM	0	897.668	-6.098	-0.02	26.36	1007.32
11/27/2021	4:01:31 AM	0	9.1287	4.974	11/27/202	3:33:24 AM	0	897.959	-5.261	-0.03	26.37	1007.31
11/27/2021	5:01:31 AM	0	9.1227	4.974	11/27/202	4:33:24 AM	0	897.012	-4.754	-0.02	26.36	1007.32
11/27/2021	6:01:31 AM	0	9.1173	4.974	11/27/202	5:33:24 AM	0	896.109	-4.357	-0.02	26.36	1007.32
11/27/2021	7:01:31 AM	0	9.1078	4.974	11/27/202	6:33:24 AM	0	895.107	-3.928	-0.02	26.36	1007.32
11/27/2021	8:01:31 AM	0	9.1027	4.974	11/27/202	7:33:24 AM	0	894.377	-3.417	-0.02	26.35	1007.33
11/27/2021	9:01:31 AM	0	9.0965	4.974	11/27/202	8:33:24 AM	0	893.634	-2.968	-0.02	26.35	1007.33
11/27/2021	10:01:31 AM	0	9.0949	4.974	11/27/202	9:33:24 AM	0	893.819	-2.356	-0.02	26.36	1007.32
11/27/2021	11:01:31 AM	0	9.0902	4.974	11/27/202	10:33:24 AM	0	893.394	-1.904	-0.02	26.36	1007.32
11/27/2021	12:01:31 PM	0	9.0856	4.974	11/27/202	11:33:24 AM	0	892.654	-1.352	-0.02	26.35	1007.33
11/27/2021	1:01:31 PM	0	9.0775	4.974	11/27/202	12:33:24 PM	0	891.598	-0.799	-0.01	26.35	1007.33
11/27/2021	2:01:31 PM	0	9.074	4.974	11/27/202	1:33:24 PM	0	891.572	-0.571	-0.02	26.35	1007.33
11/27/2021	3:01:31 PM	0	9.0672	4.974	11/27/202	2:33:24 PM	0	890.998	-0.495	-0.02	26.36	1007.32
11/27/2021	4:01:31 PM	0	9.0657	4.974	11/27/202	3:33:24 PM	0	890.51	-0.49	-0.02	26.35	1007.33
11/27/2021	5:01:31 PM	0	9.0642	4.974	11/27/202	4:33:24 PM	0	890.696	-0.514	-0.02	26.36	1007.32
11/27/2021	6:01:31 PM	0	9.0611	4.973	11/27/202	5:33:24 PM	0	890.3	-0.521	-0.02	26.35	1007.33
11/27/2021	7:01:31 PM	0	9.0591	4.974	11/27/202	6:33:24 PM	0	890.403	-0.505	-0.02	26.36	1007.32
11/27/2021	8:01:31 PM	0	9.0553	4.974	11/27/202	7:33:24 PM	0	889.958	-0.455	-0.02	26.36	1007.32
11/27/2021	9:01:31 PM	0	9.0549	4.974	11/27/202	8:33:24 PM	0	890	-0.452	-0.02	26.36	1007.32
11/27/2021	10:01:31 PM	0	9.0498	4.974	11/27/202	9:33:24 PM	0	889.774	-0.429	-0.02	26.36	1007.32
11/27/2021	11:01:31 PM	0	9.0471	4.974	11/27/202	10:33:24 PM	0	888.952	-0.381	-0.02	26.35	1007.33
11/28/2021	12:01:31 AM	0	9.0442	4.974	11/27/202	11:33:24 PM	0	888.757	-0.278	-0.02	26.36	1007.32
11/28/2021	1:01:31 AM	0	9.0447	4.974	11/28/202	12:33:24 AM	0	888.978	-0.176	-0.02	26.36	1007.32
11/28/2021	2:01:31 AM	0	9.0434	4.974	11/28/202	1:33:24 AM	0	888.919	-0.204	-0.02	26.36	1007.32
11/28/2021	3:01:31 AM	0	9.0405	4.974	11/28/202	2:33:24 AM	0	888.651	-0.206	-0.02	26.36	1007.32
11/28/2021	4:01:31 AM	0	9.0425	4.974	11/28/202	3:33:24 AM	0	888.98	-0.095	-0.02	26.36	1007.32
11/28/2021	5:01:31 AM	0	9.0405	4.974	11/28/202	4:33:24 AM	0	888.95	-0.028	-0.02	26.36	1007.32
11/28/2021	6:01:31 AM	0	9.0427	4.974	11/28/202	5:33:24 AM	0	889.118	0.062	-0.02	26.36	1007.32
11/28/2021	7:01:31 AM	0	9.0445	4.974	11/28/202	6:33:24 AM	0	889.541	0.093	-0.03	26.36	1007.32
11/28/2021	8:01:31 AM	0	9.0464	4.973	11/28/202	7:33:24 AM	0	889.916	0.02	-0.03	26.37	1007.31
11/28/2021	9:01:31 AM	0	9.0478	4.974	11/28/202	8:33:24 AM	0	889.821	-0.057	-0.03	26.36	1007.32
11/28/2021	10:01:31 AM	0	9.0488	4.974	11/28/202	9:33:24 AM	0	890.242	0.03	-0.03	26.37	1007.31
11/28/2021	11:01:31 AM	0	9.0507	4.974	11/28/202	10:33:24 AM	0	890.455	0.262	-0.03	26.37	1007.31
11/28/2021	12:01:31 PM	0	9.0523	4.974	11/28/202	11:33:24 AM	0	890.594	0.587	-0.03	26.37	1007.31
11/28/2021	1:01:31 PM	0	9.0554	4.974	11/28/202	12:33:24 PM	0	891.131	1.241	-0.03	26.37	1007.31
11/28/2021	2:01:31 PM	0	9.056	4.974	11/28/202	1:33:24 PM	0	891.323	1.684	-0.03	26.37	1007.31
11/28/2021	3:01:31 PM	0	9.0564	4.974	11/28/202	2:33:24 PM	0	891.361	2.91	-0.03	26.37	1007.31
11/28/2021	4:01:31 PM	0	9.0592	4.974	11/28/202	3:33:24 PM	0	891.509	1.909	-0.03	26.37	1007.31
11/28/2021	5:01:31 PM	0	9.0622	4.974	11/28/202	4:33:24 PM	0	891.749	0.46	-0.03	26.37	1007.31
11/28/2021	6:01:31 PM	0	9.067	4.974	11/28/202	5:33:24 PM	0	892.194	-0.82	-0.03	26.37	1007.31
11/28/2021	7:01:31 PM	0	9.0709	4.974	11/28/202	6:33:24 PM	0	892.763	-0.602	-0.03	26.37	1007.31
11/28/2021	8:01:31 PM	0	9.0758	4.974	11/28/202	7:33:24 PM	0	893.193	-0.534	-0.03	26.37	1007.31
11/28/2021	9:01:31 PM	0	9.0811	4.974	11/28/202	8:33:24 PM	0	894.015	-0.514	-0.04	26.37	1007.31
11/28/2021	10:01:31 PM	0	9.0846	4.974	11/28/202	9:33:24 PM	0	894.423	-0.511	-0.04	26.37	1007.31
11/28/2021	11:01:31 PM	0	9.0899	4.974	11/28/202	10:33:24 PM	0	894.943	-0.665	-0.04	26.37	1007.31
11/29/2021	12:01:31 AM	0	9.0936	4.974	11/28/202	11:33:24 PM	0	895.412	-1.115	-0.04	26.37	1007.31
11/29/2021	1:01:31 AM	0	9.0978	4.974	11/29/202	12:33:24 AM	0	895.804	-1.226	-0.04	26.37	1007.31
11/29/2021	2:01:31 AM	0	9.0994	4.974	11/29/202	1:33:24 AM	0	896.044	-0.846	-0.04	26.37	1007.31
11/29/2021	3:01:31 AM	0	9.1023	4.974	11/29/202	2:33:24 AM	0	896.323	-0.712	-0.04	26.37	1007.31
11/29/2021	4:01:31 AM	0	9.1054	4.974	11/29/202	3:33:24 AM	0	896.625	-0.82	-0.04	26.37	1007.31
11/29/2021	5:01:31 AM	0	9.1078	4.974	11/29/202	4:33:24 AM	0	896.69	-0.837	-0.04	26.37	1007.31
11/29/2021	6:01:31 AM	0	9.1131	4.974	11/29/202	5:33:24 AM	0	897.562	-0.649	-0.04	26.38	1007.30
11/29/2021	7:01:31 AM	0	9.118	4.974	11/29/202	6:33:24 AM	0	898.187	-0.566	-0.04	26.38	1007.30
11/29/2021	8:01:31 AM	0	9.1206	4.974	11/29/202	7:33:24 AM	0	898.321	-0.536	-0.04	26.38	1007.30
11/29/2021	9:01:31 AM	0	9.1218	4.974	11/29/202	8:33:24 AM	0	898.496	-0.547	-0.04	26.38	1007.30
11/29/2021	10:01:31 AM	0	9.1272	4.974	11/29/202	9:33:24 AM	0	898.472	-1.182	-0.03	26.37	1007.31
11/29/2021	11:01:31 AM	0	9.1288	4.974	11/29/202	10:33:24 AM	0	899.17	-0.902	-0.04	26.38	1007.30
11/29/2021	12:01:31 PM	0	9.1251	4.974	11/29/202	11:33:24 AM	0	898.636	-0.554	-0.04	26.38	1007.30
11/29/2021	1:01:31 PM	0	9.1198	4.974	11/29/202	12:33:24 PM	0	897.64	-0.478	-0.03	26.37	1007.31
11/29/2021	2:01:31 PM	0	9.1235	4.974	11/29/202	1:33:24 PM	0	897.917	0.666	-0.03	26.37	1007.31

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
11/29/2021	3:01:31 PM	0	9.1227	4.974	11/29/202	2:33:24 PM	0	898.258	2.275	-0.04	26.37	1007.31
11/29/2021	4:01:31 PM	0	9.1128	4.974	11/29/202	3:33:24 PM	0	896.9	1.963	-0.03	26.37	1007.31
11/29/2021	5:01:31 PM	0	9.1036	4.974	11/29/202	4:33:24 PM	0	895.386	0.913	-0.03	26.36	1007.32
11/29/2021	6:01:31 PM	0	9.102	4.974	11/29/202	5:33:24 PM	0	894.926	0.433	-0.02	26.36	1007.32
11/29/2021	7:01:31 PM	0	9.1008	4.974	11/29/202	6:33:24 PM	0	894.826	0.651	-0.02	26.36	1007.32
11/29/2021	8:01:31 PM	0	9.0932	4.974	11/29/202	7:33:24 PM	0	894.053	1.034	-0.02	26.36	1007.32
11/29/2021	9:01:31 PM	0	9.0874	4.974	11/29/202	8:33:24 PM	0	892.836	1.01	-0.02	26.35	1007.33
11/29/2021	10:01:31 PM	0	9.088	4.974	11/29/202	9:33:24 PM	0	893.244	1.111	-0.02	26.36	1007.32
11/29/2021	11:01:31 PM	0	9.0843	4.974	11/29/202	10:33:24 PM	0	893.142	1.356	-0.02	26.36	1007.32
11/30/2021	12:01:31 AM	0	9.0818	4.974	11/29/202	11:33:24 PM	0	892.852	1.45	-0.02	26.36	1007.32
11/30/2021	1:01:31 AM	0	9.0758	4.974	11/30/202	12:33:24 AM	0	892.613	1.287	-0.03	26.36	1007.32
11/30/2021	2:01:31 AM	0	9.074	4.974	11/30/202	1:33:24 AM	0	891.777	1.276	-0.02	26.36	1007.32
11/30/2021	3:01:31 AM	0	9.0766	4.974	11/30/202	2:33:24 AM	0	892.356	1.452	-0.02	26.36	1007.32
11/30/2021	4:01:31 AM	0	9.0749	4.974	11/30/202	3:33:24 AM	0	892.123	1.617	-0.02	26.36	1007.32
11/30/2021	5:01:31 AM	0	9.0718	4.974	11/30/202	4:33:24 AM	0	891.79	1.471	-0.02	26.36	1007.32
11/30/2021	6:01:31 AM	0	9.0728	4.974	11/30/202	5:33:24 AM	0	891.87	1.177	-0.02	26.36	1007.32
11/30/2021	7:01:31 AM	0	9.0706	4.974	11/30/202	6:33:24 AM	0	891.667	1.023	-0.02	26.36	1007.32
11/30/2021	8:01:31 AM	0	9.0646	4.974	11/30/202	7:33:24 AM	0	891.017	0.883	-0.02	26.36	1007.32
11/30/2021	9:01:31 AM	0	9.062	4.974	11/30/202	8:33:24 AM	0	890.561	0.839	-0.02	26.36	1007.32
11/30/2021	10:01:31 AM	0	9.0612	4.974	11/30/202	9:33:24 AM	0	890.482	0.731	-0.02	26.36	1007.32
11/30/2021	11:01:31 AM	0	9.0564	4.974	11/30/202	10:33:24 AM	0	890.275	0.675	-0.02	26.36	1007.32
11/30/2021	12:01:31 PM	0	9.0491	4.974	11/30/202	11:33:24 AM	0	889.432	1.154	-0.02	26.36	1007.32
11/30/2021	1:01:31 PM	0	9.0406	4.974	11/30/202	12:33:24 PM	0	888.485	1.182	-0.02	26.36	1007.32
11/30/2021	2:01:31 PM	0	9.0352	4.974	11/30/202	1:33:24 PM	0	888.193	1.299	-0.02	26.36	1007.32
11/30/2021	3:01:31 PM	0	9.0313	4.974	11/30/202	2:33:24 PM	0	887.414	1.622	-0.02	26.36	1007.32
11/30/2021	4:01:31 PM	0	9.0289	4.974	11/30/202	3:33:24 PM	0	887.228	1.748	-0.02	26.36	1007.32
11/30/2021	5:01:31 PM	0	9.0263	4.974	11/30/202	4:33:24 PM	0	887.431	1.687	-0.02	26.36	1007.32
11/30/2021	6:01:31 PM	0	9.0252	4.974	11/30/202	5:33:24 PM	0	886.792	1.067	-0.02	26.35	1007.33
11/30/2021	7:01:31 PM	0	9.0298	4.974	11/30/202	6:33:24 PM	0	887.545	1.26	-0.02	26.36	1007.32
11/30/2021	8:01:31 PM	0	9.0288	4.974	11/30/202	7:33:24 PM	0	887.458	1.744	-0.02	26.36	1007.32
11/30/2021	9:01:31 PM	0	9.0377	4.974	11/30/202	8:33:24 PM	0	888.769	1.336	-0.03	26.36	1007.32
11/30/2021	10:01:31 PM	0	9.0391	4.974	11/30/202	9:33:24 PM	0	889.118	0.882	-0.03	26.36	1007.32
11/30/2021	11:01:31 PM	0	9.0416	4.974	11/30/202	10:33:24 PM	0	889.246	0.677	-0.03	26.36	1007.32
12/1/2021	12:01:31 AM	0	9.0485	4.974	11/30/202	11:33:24 PM	0	890.224	0.687	-0.03	26.37	1007.31
12/1/2021	1:01:31 AM	0	9.0543	4.974	12/1/2021	12:33:24 AM	0	891.496	0.921	-0.04	26.37	1007.31
12/1/2021	2:01:31 AM	0	9.0535	4.974	12/1/2021	1:33:24 AM	0	891.007	0.702	-0.03	26.37	1007.31
12/1/2021	3:01:31 AM	0	9.0601	4.974	12/1/2021	2:33:24 AM	0	891.943	0.448	-0.04	26.37	1007.31
12/1/2021	4:01:31 AM	0	9.0593	4.974	12/1/2021	3:33:24 AM	0	891.684	0.435	-0.03	26.37	1007.31
12/1/2021	5:01:31 AM	0	9.0606	4.974	12/1/2021	4:33:24 AM	0	891.582	0.167	-0.03	26.37	1007.31
12/1/2021	6:01:31 AM	0	9.0597	4.974	12/1/2021	5:33:24 AM	0	891.448	-0.299	-0.03	26.37	1007.31
12/1/2021	7:01:31 AM	0	9.0595	4.974	12/1/2021	6:33:24 AM	0	891.451	-0.481	-0.03	26.37	1007.31
12/1/2021	8:01:31 AM	0	9.0591	4.974	12/1/2021	7:33:24 AM	0	891.28	-0.533	-0.03	26.37	1007.31
12/1/2021	9:01:31 AM	0	9.0602	4.974	12/1/2021	8:33:24 AM	0	891.179	-0.545	-0.03	26.36	1007.32
12/1/2021	10:01:31 AM	0	9.0615	4.974	12/1/2021	9:33:24 AM	0	891.272	-0.517	-0.03	26.36	1007.32
12/1/2021	11:01:31 AM	0	9.0609	4.974	12/1/2021	10:33:24 AM	0	891.318	-0.467	-0.03	26.37	1007.31
12/1/2021	12:01:31 PM	0	9.064	4.974	12/1/2021	11:33:24 AM	0	891.847	-0.326	-0.03	26.37	1007.31
12/1/2021	1:01:31 PM	0	9.0638	4.974	12/1/2021	12:33:24 PM	0	891.901	-0.107	-0.03	26.37	1007.31
12/1/2021	2:01:31 PM	0	9.0448	7.969	12/1/2021	1:33:24 PM	0	891.705	-0.016	-0.05	26.39	1007.29
12/1/2021	3:01:31 PM	0	8.9527	5.295	12/1/2021	2:33:24 PM	0	891.701	0.154	-0.14	26.48	1007.20
12/1/2021	4:01:31 PM	0	8.9656	5.036	12/1/2021	3:33:24 PM	0	891.468	-0.365	-0.12	26.46	1007.22
12/1/2021	5:01:31 PM	0	8.97	5.017	12/1/2021	4:33:24 PM	0	891.099	-0.492	-0.12	26.45	1007.23
12/1/2021	6:01:31 PM	0	8.9738	5.011	12/1/2021	5:33:24 PM	0	891.046	-0.535	-0.11	26.45	1007.23
12/1/2021	7:01:31 PM	0	8.984	5.01	12/1/2021	6:33:24 PM	0	890.657	-0.537	-0.10	26.44	1007.24
12/1/2021	8:01:31 PM	0	8.9904	5.007	12/1/2021	7:33:24 PM	0	890.459	-0.544	-0.09	26.43	1007.25
12/1/2021	9:01:31 PM	0	8.9948	5.006	12/1/2021	8:33:24 PM	0	889.789	-0.555	-0.08	26.42	1007.26
12/1/2021	10:01:31 PM	0	8.9984	5.003	12/1/2021	9:33:24 PM	0	890.09	-0.59	-0.08	26.42	1007.26
12/1/2021	11:01:31 PM	0	9.0023	5.002	12/1/2021	10:33:24 PM	0	890.695	-0.621	-0.08	26.42	1007.26
12/2/2021	12:01:31 AM	0	9.0058	5.001	12/1/2021	11:33:24 PM	0	891.167	-1.772	-0.08	26.42	1007.26
12/2/2021	1:01:31 AM	0	9.0091	4.999	12/2/2021	12:33:24 AM	0	891.797	-3.039	-0.08	26.42	1007.26
12/2/2021	2:01:31 AM	0	9.0144	4.998	12/2/2021	1:33:24 AM	0	893.154	-2.98	-0.09	26.43	1007.25
12/2/2021	3:01:31 AM	0	9.018	4.997	12/2/2021	2:33:24 AM	0	894.353	-1.912	-0.10	26.44	1007.24
12/2/2021	4:01:31 AM	0	9.0227	4.995	12/2/2021	3:33:24 AM	0	895.449	-2.075	-0.11	26.45	1007.23
12/2/2021	5:01:31 AM	0	9.0259	4.994	12/2/2021	4:33:24 AM	0	895.969	-2.802	-0.11	26.45	1007.23
12/2/2021	6:01:31 AM	0	9.0284	4.993	12/2/2021	5:33:24 AM	0	896.274	-4.478	-0.11	26.45	1007.23
12/2/2021	7:01:31 AM	0	9.0313	4.992	12/2/2021	6:33:24 AM	0	896.737	-5.998	-0.11	26.45	1007.23
12/2/2021	8:01:31 AM	0	9.0344	4.992	12/2/2021	7:33:24 AM	0	897.173	-6.869	-0.11	26.45	1007.23
12/2/2021	9:01:31 AM	0	9.0381	4.991	12/2/2021	8:33:24 AM	0	897.746	-7.457	-0.12	26.45	1007.23
12/2/2021	10:01:31 AM	0	9.0414	4.99	12/2/2021	9:33:24 AM	0	898.387	-7.8	-0.12	26.46	1007.22
12/2/2021	11:01:31 AM	0	9.0468	4.989	12/2/2021	10:33:24 AM	0	899.358	-7.493	-0.12	26.46	1007.22
12/2/2021	12:01:31 PM	0	9.0493	4.988	12/2/2021	11:33:24 AM	0	899.958	-6.684	-0.13	26.46	1007.22

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/2/2021	1:01:31 PM	0	9.0509	4.988	12/2/2021	12:33:24 PM	0	900.176	-6.059	-0.13	26.47	1007.21
12/2/2021	2:01:31 PM	0	9.0525	4.987	12/2/2021	1:33:24 PM	0	900.791	-4.842	-0.13	26.47	1007.21
12/2/2021	3:01:31 PM	0	9.054	4.987	12/2/2021	2:33:24 PM	0	900.858	-4.334	-0.13	26.47	1007.21
12/2/2021	4:01:31 PM	0	9.056	4.987	12/2/2021	3:33:24 PM	0	901.376	-2.559	-0.14	26.47	1007.21
12/2/2021	5:01:31 PM	0	9.0586	4.986	12/2/2021	4:33:24 PM	0	901.48	-3.292	-0.13	26.47	1007.21
12/2/2021	6:01:31 PM	0	9.0601	4.986	12/2/2021	5:33:24 PM	0	901.463	-5.025	-0.13	26.47	1007.21
12/2/2021	7:01:31 PM	0	9.0612	4.985	12/2/2021	6:33:24 PM	0	901.626	-4.986	-0.13	26.47	1007.21
12/2/2021	8:01:31 PM	0	9.0623	4.985	12/2/2021	7:33:24 PM	0	901.888	-4.798	-0.13	26.47	1007.21
12/2/2021	9:01:31 PM	0	9.0634	4.984	12/2/2021	8:33:24 PM	0	902.338	-4.921	-0.14	26.48	1007.20
12/2/2021	10:01:31 PM	0	9.0642	4.984	12/2/2021	9:33:24 PM	0	902.682	-4.974	-0.14	26.48	1007.20
12/2/2021	11:01:31 PM	0	9.065	4.983	12/2/2021	10:33:24 PM	0	903.204	-4.772	-0.15	26.48	1007.20
12/3/2021	12:01:31 AM	0	9.0669	4.984	12/2/2021	11:33:24 PM	0	903.725	-5.63	-0.15	26.49	1007.19
12/3/2021	1:01:31 AM	0	9.068	4.984	12/3/2021	12:33:24 AM	0	903.939	-6.712	-0.15	26.49	1007.19
12/3/2021	2:01:31 AM	0	9.0685	4.984	12/3/2021	1:33:24 AM	0	903.7	-7.702	-0.15	26.48	1007.20
12/3/2021	3:01:31 AM	0	9.0689	4.982	12/3/2021	2:33:24 AM	0	904.002	-8.597	-0.15	26.49	1007.19
12/3/2021	4:01:31 AM	0	9.0694	4.982	12/3/2021	3:33:24 AM	0	903.914	-9.36	-0.15	26.49	1007.19
12/3/2021	5:01:31 AM	0	9.0699	4.982	12/3/2021	4:33:24 AM	0	903.866	-9.799	-0.15	26.48	1007.20
12/3/2021	6:01:31 AM	0	9.0697	4.982	12/3/2021	5:33:24 AM	0	904.001	-10.169	-0.15	26.49	1007.19
12/3/2021	7:01:31 AM	0	9.0699	4.982	12/3/2021	6:33:24 AM	0	903.779	-10.169	-0.15	26.48	1007.20
12/3/2021	8:01:31 AM	0	9.0695	4.982	12/3/2021	7:33:24 AM	0	903.812	-10.206	-0.15	26.48	1007.20
12/3/2021	9:01:31 AM	0	9.0699	4.982	12/3/2021	8:33:24 AM	0	903.878	-9.551	-0.15	26.48	1007.20
12/3/2021	10:01:31 AM	0	9.0711	4.982	12/3/2021	9:33:24 AM	0	904.399	-9.102	-0.15	26.49	1007.19
12/3/2021	11:01:31 AM	0	9.0711	4.981	12/3/2021	10:33:24 AM	0	904.91	-7.27	-0.16	26.49	1007.19
12/3/2021	12:01:31 PM	0	9.0715	4.981	12/3/2021	11:33:24 AM	0	905.002	-6.131	-0.16	26.49	1007.19
12/3/2021	1:01:31 PM	0	9.0714	4.981	12/3/2021	12:33:24 PM	0	904.808	-5.759	-0.16	26.49	1007.19
12/3/2021	2:01:31 PM	0	9.0705	4.981	12/3/2021	1:33:24 PM	0	904.187	-5.277	-0.15	26.49	1007.19
12/3/2021	3:01:31 PM	0	9.0708	4.981	12/3/2021	2:33:24 PM	0	903.948	-4.833	-0.15	26.48	1007.20
12/3/2021	4:01:31 PM	0	9.0701	4.981	12/3/2021	3:33:24 PM	0	903.293	-4.574	-0.14	26.48	1007.20
12/3/2021	5:01:31 PM	0	9.0696	4.98	12/3/2021	4:33:24 PM	0	902.799	-5.446	-0.14	26.47	1007.21
12/3/2021	6:01:31 PM	0	9.0689	4.98	12/3/2021	5:33:24 PM	0	901.982	-6.419	-0.13	26.47	1007.21
12/3/2021	7:01:31 PM	0	9.0683	4.98	12/3/2021	6:33:24 PM	0	901.449	-6.723	-0.12	26.46	1007.22
12/3/2021	8:01:31 PM	0	9.0674	4.98	12/3/2021	7:33:24 PM	0	901.019	-6.862	-0.12	26.46	1007.22
12/3/2021	9:01:31 PM	0	9.0664	4.98	12/3/2021	8:33:24 PM	0	900.618	-6.919	-0.12	26.45	1007.23
12/3/2021	10:01:31 PM	0	9.0657	4.98	12/3/2021	9:33:24 PM	0	900.097	-7.386	-0.11	26.45	1007.23
12/3/2021	11:01:31 PM	0	9.0645	4.979	12/3/2021	10:33:24 PM	0	899.231	-8.095	-0.11	26.44	1007.24
12/4/2021	12:01:31 AM	0	9.0633	4.98	12/3/2021	11:33:24 PM	0	898.526	-8.527	-0.10	26.44	1007.24
12/4/2021	1:01:31 AM	0	9.0623	4.98	12/4/2021	12:33:24 AM	0	897.717	-8.417	-0.09	26.43	1007.25
12/4/2021	2:01:31 AM	0	9.0597	4.98	12/4/2021	1:33:24 AM	0	896.32	-8.784	-0.08	26.42	1007.26
12/4/2021	3:01:31 AM	0	9.0576	4.98	12/4/2021	2:33:24 AM	0	895.347	-8.739	-0.07	26.41	1007.27
12/4/2021	4:01:31 AM	0	9.0562	4.979	12/4/2021	3:33:24 AM	0	894.306	-9.199	-0.06	26.40	1007.28
12/4/2021	5:01:31 AM	0	9.054	4.979	12/4/2021	4:33:24 AM	0	893.51	-9.726	-0.06	26.39	1007.29
12/4/2021	6:01:31 AM	0	9.0516	4.98	12/4/2021	5:33:24 AM	0	892.843	-9.797	-0.05	26.39	1007.29
12/4/2021	7:01:31 AM	0	9.0494	4.979	12/4/2021	6:33:24 AM	0	892.268	-9.719	-0.05	26.39	1007.29
12/4/2021	8:01:31 AM	0	9.0462	4.979	12/4/2021	7:33:24 AM	0	891.624	-9.068	-0.05	26.38	1007.30
12/4/2021	9:01:31 AM	0	9.0459	4.979	12/4/2021	8:33:24 AM	0	891.766	-8.485	-0.05	26.38	1007.30
12/4/2021	10:01:31 AM	0	9.0472	4.979	12/4/2021	9:33:24 AM	0	892.137	-8.159	-0.05	26.39	1007.29
12/4/2021	11:01:31 AM	0	9.0484	4.979	12/4/2021	10:33:24 AM	0	892.471	-7.445	-0.05	26.39	1007.29
12/4/2021	12:01:31 PM	0	9.0497	4.979	12/4/2021	11:33:24 AM	0	892.776	-6.203	-0.05	26.39	1007.29
12/4/2021	1:01:31 PM	0	9.0512	4.979	12/4/2021	12:33:24 PM	0	892.943	-5.619	-0.05	26.39	1007.29
12/4/2021	2:01:31 PM	0	9.0541	4.978	12/4/2021	1:33:24 PM	0	892.816	-6.326	-0.05	26.39	1007.29
12/4/2021	3:01:31 PM	0	9.0589	4.979	12/4/2021	2:33:24 PM	0	892.951	-6.75	-0.05	26.38	1007.30
12/4/2021	4:01:31 PM	0	9.065	4.978	12/4/2021	3:33:24 PM	0	893.548	-6.781	-0.05	26.38	1007.30
12/4/2021	5:01:31 PM	0	9.0729	4.979	12/4/2021	4:33:24 PM	0	894.226	-7.187	-0.05	26.38	1007.30
12/4/2021	6:01:31 PM	0	9.0811	4.978	12/4/2021	5:33:24 PM	0	895.179	-6.742	-0.05	26.38	1007.30
12/4/2021	7:01:31 PM	0	9.088	4.979	12/4/2021	6:33:24 PM	0	895.512	-6.804	-0.04	26.38	1007.30
12/4/2021	8:01:31 PM	0	9.0953	4.979	12/4/2021	7:33:24 PM	0	895.909	-7.206	-0.04	26.38	1007.30
12/4/2021	9:01:31 PM	0	9.1049	4.978	12/4/2021	8:33:24 PM	0	896.951	-7.345	-0.04	26.38	1007.30
12/4/2021	10:01:31 PM	0	9.115	4.978	12/4/2021	9:33:24 PM	0	898.348	-6.905	-0.05	26.38	1007.30
12/4/2021	11:01:31 PM	0	9.1255	4.978	12/4/2021	10:33:24 PM	0	899.574	-7.136	-0.05	26.38	1007.30
12/5/2021	12:01:31 AM	0	9.1356	4.978	12/4/2021	11:33:24 PM	0	900.352	-8.132	-0.05	26.38	1007.30
12/5/2021	1:01:31 AM	0	9.1461	4.978	12/5/2021	12:33:24 AM	0	901.373	-8.63	-0.05	26.38	1007.30
12/5/2021	2:01:31 AM	0	9.1565	4.978	12/5/2021	1:33:24 AM	0	902.264	-8.684	-0.04	26.38	1007.30
12/5/2021	3:01:31 AM	0	9.1675	4.978	12/5/2021	2:33:24 AM	0	903.351	-8.526	-0.04	26.38	1007.30
12/5/2021	4:01:31 AM	0	9.1786	4.977	12/5/2021	3:33:24 AM	0	904.402	-8.513	-0.04	26.38	1007.30
12/5/2021	5:01:31 AM	0	9.1888	4.978	12/5/2021	4:33:24 AM	0	905.134	-8.799	-0.04	26.38	1007.30
12/5/2021	6:01:31 AM	0	9.1999	4.978	12/5/2021	5:33:24 AM	0	905.845	-9.58	-0.04	26.37	1007.31
12/5/2021	7:01:31 AM	0	9.2091	4.977	12/5/2021	6:33:24 AM	0	906.322	-10.5	-0.03	26.37	1007.31
12/5/2021	8:01:31 AM	0	9.2181	4.978	12/5/2021	7:33:24 AM	0	906.502	-11.676	-0.03	26.36	1007.32
12/5/2021	9:01:31 AM	0	9.227	4.978	12/5/2021	8:33:24 AM	0	906.896	-12.628	-0.02	26.36	1007.32
12/5/2021	10:01:31 AM	0	9.2344	4.978	12/5/2021	9:33:24 AM	0	907.239	-13.101	-0.02	26.35	1007.33

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/5/2021	11:01:31 AM	0	9.2416	4.978	12/5/2021	10:33:24 AM	0	908.225	-12.607	-0.02	26.36	1007.32
12/5/2021	12:01:31 PM	0	9.2475	4.977	12/5/2021	11:33:24 AM	0	908.694	-11.405	-0.02	26.36	1007.32
12/5/2021	1:01:31 PM	0	9.2513	4.978	12/5/2021	12:33:24 PM	0	909.548	-10.179	-0.02	26.36	1007.32
12/5/2021	2:01:31 PM	0	9.2504	4.977	12/5/2021	1:33:24 PM	0	908.982	-9.112	-0.02	26.36	1007.32
12/5/2021	3:01:31 PM	0	9.2477	4.977	12/5/2021	2:33:24 PM	0	908.645	-8.212	-0.02	26.36	1007.32
12/5/2021	4:01:31 PM	0	9.2425	4.977	12/5/2021	3:33:24 PM	0	907.908	-7.869	-0.02	26.35	1007.33
12/5/2021	5:01:31 PM	0	9.2398	4.977	12/5/2021	4:33:24 PM	0	907.281	-8.52	-0.01	26.35	1007.33
12/5/2021	6:01:31 PM	0	9.238	4.977	12/5/2021	5:33:24 PM	0	906.794	-9.182	-0.01	26.35	1007.33
12/5/2021	7:01:31 PM	0	9.2317	4.978	12/5/2021	6:33:24 PM	0	906.104	-9.229	-0.01	26.35	1007.33
12/5/2021	8:01:31 PM	0	9.2252	4.977	12/5/2021	7:33:24 PM	0	904.903	-9.194	0.00	26.34	1007.34
12/5/2021	9:01:31 PM	0	9.2188	4.977	12/5/2021	8:33:24 PM	0	904.46	-9.098	0.00	26.34	1007.34
12/5/2021	10:01:31 PM	0	9.2104	4.978	12/5/2021	9:33:24 PM	0	903.487	-8.946	0.00	26.34	1007.34
12/5/2021	11:01:31 PM	0	9.2025	4.977	12/5/2021	10:33:24 PM	0	902.735	-8.851	0.00	26.34	1007.34
12/6/2021	12:01:31 AM	0	9.1911	4.977	12/5/2021	11:33:24 PM	0	901.64	-8.779	0.00	26.34	1007.34
12/6/2021	1:01:31 AM	0	9.1798	4.977	12/6/2021	12:33:24 AM	0	900.385	-8.658	0.00	26.34	1007.34
12/6/2021	2:01:31 AM	0	9.1736	4.977	12/6/2021	1:33:24 AM	0	899.515	-8.529	0.00	26.34	1007.34
12/6/2021	3:01:31 AM	0	9.1651	4.977	12/6/2021	2:33:24 AM	0	898.893	-8.447	0.00	26.34	1007.34
12/6/2021	4:01:31 AM	0	9.1575	4.977	12/6/2021	3:33:24 AM	0	898.289	-8.463	0.00	26.34	1007.34
12/6/2021	5:01:31 AM	0	9.1485	4.977	12/6/2021	4:33:24 AM	0	897.217	-8.382	0.00	26.34	1007.34
12/6/2021	6:01:31 AM	0	9.1409	4.977	12/6/2021	5:33:24 AM	0	896.552	-8.325	0.00	26.34	1007.34
12/6/2021	7:01:31 AM	0	9.1348	4.977	12/6/2021	6:33:24 AM	0	896.212	-8.227	0.00	26.34	1007.34
12/6/2021	8:01:31 AM	0	9.1324	4.977	12/6/2021	7:33:24 AM	0	895.9	-8.414	0.00	26.34	1007.34
12/6/2021	9:01:31 AM	0	9.1317	4.977	12/6/2021	8:33:24 AM	0	895.675	-8.789	0.00	26.34	1007.34
12/6/2021	10:01:31 AM	0	9.1313	4.977	12/6/2021	9:33:24 AM	0	895.681	-8.652	0.00	26.34	1007.34
12/6/2021	11:01:31 AM	0	9.1323	4.976	12/6/2021	10:33:24 AM	0	896.22	-8.176	-0.01	26.34	1007.34
12/6/2021	12:01:31 PM	0	9.1273	4.977	12/6/2021	11:33:24 AM	0	895.709	-7.561	-0.01	26.34	1007.34
12/6/2021	1:01:31 PM	0	9.1232	4.976	12/6/2021	12:33:24 PM	0	895.534	-6.228	-0.01	26.35	1007.33
12/6/2021	2:01:31 PM	0	9.1218	4.977	12/6/2021	1:33:24 PM	0	895.339	-5.368	-0.01	26.35	1007.33
12/6/2021	3:01:31 PM	0	9.123	4.977	12/6/2021	2:33:24 PM	0	895.772	-5.436	-0.01	26.35	1007.33
12/6/2021	4:01:31 PM	0	9.1191	4.976	12/6/2021	3:33:24 PM	0	895.511	-5.7	-0.01	26.35	1007.33
12/6/2021	5:01:31 PM	0	9.1147	4.977	12/6/2021	4:33:24 PM	0	894.266	-6.715	0.00	26.34	1007.34
12/6/2021	6:01:31 PM	0	9.1105	4.976	12/6/2021	5:33:24 PM	0	893.675	-8.189	0.00	26.34	1007.34
12/6/2021	7:01:31 PM	0	9.1147	4.977	12/6/2021	6:33:24 PM	0	893.761	-9.263	0.00	26.34	1007.34
12/6/2021	8:01:31 PM	0	9.1117	4.976	12/6/2021	7:33:24 PM	0	893.566	-9.728	0.00	26.34	1007.34
12/6/2021	9:01:31 PM	0	9.1094	4.977	12/6/2021	8:33:24 PM	0	893.394	-9.444	0.00	26.34	1007.34
12/6/2021	10:01:31 PM	0	9.1032	4.977	12/6/2021	9:33:24 PM	0	893.318	-8.971	-0.01	26.34	1007.34
12/6/2021	11:01:31 PM	0	9.1035	4.977	12/6/2021	10:33:24 PM	0	892.917	-8.829	0.00	26.34	1007.34
12/7/2021	12:01:31 AM	0	9.1021	4.977	12/6/2021	11:33:24 PM	0	892.777	-8.559	0.00	26.34	1007.34
12/7/2021	1:01:31 AM	0	9.1039	4.977	12/7/2021	12:33:24 AM	0	893.22	-8.304	0.00	26.34	1007.34
12/7/2021	2:01:31 AM	0	9.0989	4.977	12/7/2021	1:33:24 AM	0	892.974	-7.923	-0.01	26.34	1007.34
12/7/2021	3:01:31 AM	0	9.1015	4.977	12/7/2021	2:33:24 AM	0	892.983	-7.721	0.00	26.34	1007.34
12/7/2021	4:01:31 AM	0	9.0997	4.977	12/7/2021	3:33:24 AM	0	892.898	-7.578	-0.01	26.34	1007.34
12/7/2021	5:01:31 AM	0	9.0968	4.976	12/7/2021	4:33:24 AM	0	892.622	-7.518	-0.01	26.34	1007.34
12/7/2021	6:01:31 AM	0	9.0925	4.977	12/7/2021	5:33:24 AM	0	892.185	-7.334	-0.01	26.34	1007.34
12/7/2021	7:01:31 AM	0	9.0886	4.976	12/7/2021	6:33:24 AM	0	891.84	-7.197	-0.01	26.34	1007.34
12/7/2021	8:01:31 AM	0	9.0859	4.976	12/7/2021	7:33:24 AM	0	891.455	-7.008	0.00	26.34	1007.34
12/7/2021	9:01:31 AM	0	9.08	4.977	12/7/2021	8:33:24 AM	0	891.097	-6.808	-0.01	26.34	1007.34
12/7/2021	10:01:31 AM	0	9.0761	4.976	12/7/2021	9:33:24 AM	0	890.521	-6.574	0.00	26.34	1007.34
12/7/2021	11:01:31 AM	0	9.0734	4.977	12/7/2021	10:33:24 AM	0	890.501	-6.16	-0.01	26.34	1007.34
12/7/2021	12:01:31 PM	0	9.0686	4.976	12/7/2021	11:33:24 AM	0	890.204	-5.231	-0.01	26.35	1007.33
12/7/2021	1:01:31 PM	0	9.0639	4.976	12/7/2021	12:33:24 PM	0	889.81	-4.36	-0.01	26.35	1007.33
12/7/2021	2:01:31 PM	0	9.0583	4.977	12/7/2021	1:33:24 PM	0	889.46	-3.687	-0.01	26.35	1007.33
12/7/2021	3:01:31 PM	0	9.0493	4.976	12/7/2021	2:33:24 PM	0	888.764	-3.506	-0.01	26.35	1007.33
12/7/2021	4:01:31 PM	0	9.0429	4.977	12/7/2021	3:33:24 PM	0	887.784	-3.651	-0.01	26.35	1007.33
12/7/2021	5:01:31 PM	0	9.0279	4.976	12/7/2021	4:33:24 PM	0	886.782	-4.022	-0.01	26.35	1007.33
12/7/2021	6:01:31 PM	0	9.0147	4.976	12/7/2021	5:33:24 PM	0	884.905	-4.259	-0.01	26.35	1007.33
12/7/2021	7:01:31 PM	0	9.0049	4.976	12/7/2021	6:33:24 PM	0	884.044	-4.406	-0.01	26.35	1007.33
12/7/2021	8:01:31 PM	0	8.9955	4.977	12/7/2021	7:33:24 PM	0	882.867	-4.12	-0.01	26.34	1007.34
12/7/2021	9:01:31 PM	0	8.9872	4.976	12/7/2021	8:33:24 PM	0	882.838	-3.792	-0.02	26.35	1007.33
12/7/2021	10:01:31 PM	0	8.9798	4.976	12/7/2021	9:33:24 PM	0	881.709	-3.568	-0.01	26.35	1007.33
12/7/2021	11:01:31 PM	0	8.9663	4.977	12/7/2021	10:33:24 PM	0	880.482	-3.512	-0.01	26.35	1007.33
12/8/2021	12:01:31 AM	0	8.9568	4.976	12/7/2021	11:33:24 PM	0	879.424	-3.547	-0.01	26.35	1007.33
12/8/2021	1:01:31 AM	0	8.9493	4.976	12/8/2021	12:33:24 AM	0	878.477	-3.333	-0.01	26.35	1007.33
12/8/2021	2:01:31 AM	0	8.9465	4.976	12/8/2021	1:33:24 AM	0	878.417	-3	-0.01	26.35	1007.33
12/8/2021	3:01:31 AM	0	8.9422	4.976	12/8/2021	2:33:24 AM	0	878.172	-2.736	-0.01	26.35	1007.33
12/8/2021	4:01:31 AM	0	8.9413	4.976	12/8/2021	3:33:24 AM	0	878.136	-2.502	-0.01	26.35	1007.33
12/8/2021	5:01:31 AM	0	8.9477	4.977	12/8/2021	4:33:24 AM	0	878.593	-2.371	-0.01	26.35	1007.33
12/8/2021	6:01:31 AM	0	8.9549	4.976	12/8/2021	5:33:24 AM	0	879.624	-2.268	-0.01	26.35	1007.33
12/8/2021	7:01:31 AM	0	8.9613	4.976	12/8/2021	6:33:24 AM	0	880.217	-2.645	-0.01	26.35	1007.33
12/8/2021	8:01:31 AM	0	8.9673	4.977	12/8/2021	7:33:24 AM	0	880.568	-3.103	-0.01	26.35	1007.33

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/8/2021	9:01:31 AM	0	8.9744	4.976	12/8/2021	8:33:24 AM	0	881.267	-3.666	-0.01	26.35	1007.33
12/8/2021	10:01:31 AM	0	8.9806	4.976	12/8/2021	9:33:24 AM	0	881.6	-4.955	-0.01	26.35	1007.33
12/8/2021	11:01:31 AM	0	8.9856	4.976	12/8/2021	10:33:24 AM	0	881.885	-5.453	-0.01	26.34	1007.34
12/8/2021	12:01:31 PM	0	8.9923	4.976	12/8/2021	11:33:24 AM	0	882.858	-4.815	-0.01	26.35	1007.33
12/8/2021	1:01:31 PM	0	8.9947	4.976	12/8/2021	12:33:24 PM	0	883.324	-3.406	-0.01	26.35	1007.33
12/8/2021	2:01:31 PM	0	8.9956	4.976	12/8/2021	1:33:24 PM	0	883.727	-2.469	-0.02	26.35	1007.33
12/8/2021	3:01:31 PM	0	8.9976	4.976	12/8/2021	2:33:24 PM	0	883.874	-1.965	-0.02	26.35	1007.33
12/8/2021	4:01:31 PM	0	9.0004	4.976	12/8/2021	3:33:24 PM	0	883.877	-2.423	-0.01	26.35	1007.33
12/8/2021	5:01:31 PM	0	9.0033	4.976	12/8/2021	4:33:24 PM	0	883.838	-4.577	-0.01	26.35	1007.33
12/8/2021	6:01:31 PM	0	9.0062	4.976	12/8/2021	5:33:24 PM	0	883.906	-5.896	-0.01	26.34	1007.34
12/8/2021	7:01:31 PM	0	9.0047	4.976	12/8/2021	6:33:24 PM	0	883.832	-5.826	-0.01	26.35	1007.33
12/8/2021	8:01:31 PM	0	9.0033	4.976	12/8/2021	7:33:24 PM	0	883.622	-5.501	-0.01	26.34	1007.34
12/8/2021	9:01:31 PM	0	9.0047	4.976	12/8/2021	8:33:24 PM	0	883.71	-5.945	-0.01	26.34	1007.34
12/8/2021	10:01:31 PM	0	9.0071	4.976	12/8/2021	9:33:24 PM	0	883.814	-6.493	-0.01	26.34	1007.34
12/8/2021	11:01:31 PM	0	9.0102	4.976	12/8/2021	10:33:24 PM	0	884.342	-5.954	-0.01	26.34	1007.34
12/9/2021	12:01:31 AM	0	9.0102	4.976	12/8/2021	11:33:24 PM	0	884.533	-5.407	-0.01	26.35	1007.33
12/9/2021	1:01:31 AM	0	9.0113	4.977	12/9/2021	12:33:24 AM	0	884.291	-5.948	-0.01	26.34	1007.34
12/9/2021	2:01:31 AM	0	9.0099	4.976	12/9/2021	1:33:24 AM	0	884.026	-6.767	0.00	26.34	1007.34
12/9/2021	3:01:31 AM	0	9.0118	4.976	12/9/2021	2:33:24 AM	0	884.052	-7.192	0.00	26.34	1007.34
12/9/2021	4:01:31 AM	0	9.0125	4.976	12/9/2021	3:33:24 AM	0	884.323	-7.363	-0.01	26.34	1007.34
12/9/2021	5:01:31 AM	0	9.011	4.976	12/9/2021	4:33:24 AM	0	883.943	-7.802	0.00	26.34	1007.34
12/9/2021	6:01:31 AM	0	9.0131	4.976	12/9/2021	5:33:24 AM	0	884.179	-7.804	0.00	26.34	1007.34
12/9/2021	7:01:31 AM	0	9.0125	4.976	12/9/2021	6:33:24 AM	0	884.38	-7.057	-0.01	26.34	1007.34
12/9/2021	8:01:31 AM	0	9.0126	4.976	12/9/2021	7:33:24 AM	0	884.299	-6.62	0.00	26.34	1007.34
12/9/2021	9:01:31 AM	0	9.014	4.976	12/9/2021	8:33:24 AM	0	884.635	-6.171	-0.01	26.34	1007.34
12/9/2021	10:01:31 AM	0	9.0182	4.976	12/9/2021	9:33:24 AM	0	884.98	-6.242	-0.01	26.34	1007.34
12/9/2021	11:01:31 AM	0	9.0209	4.976	12/9/2021	10:33:24 AM	0	885.555	-5.936	-0.01	26.35	1007.33
12/9/2021	12:01:31 PM	0	9.0221	4.976	12/9/2021	11:33:24 AM	0	885.843	-4.862	-0.01	26.35	1007.33
12/9/2021	1:01:31 PM	0	9.023	4.976	12/9/2021	12:33:24 PM	0	886.058	-3.905	-0.01	26.35	1007.33
12/9/2021	2:01:31 PM	0	9.0237	4.976	12/9/2021	1:33:24 PM	0	886.324	-2.576	-0.01	26.35	1007.33
12/9/2021	3:01:31 PM	0	9.025	4.976	12/9/2021	2:33:24 PM	0	886.396	-2.127	-0.01	26.35	1007.33
12/9/2021	4:01:31 PM	0	9.0267	4.976	12/9/2021	3:33:24 PM	0	886.614	-2.232	-0.01	26.35	1007.33
12/9/2021	5:01:31 PM	0	9.0291	4.976	12/9/2021	4:33:24 PM	0	886.69	-2.882	-0.01	26.35	1007.33
12/9/2021	6:01:31 PM	0	9.0319	4.976	12/9/2021	5:33:24 PM	0	886.689	-4.091	-0.01	26.35	1007.33
12/9/2021	7:01:31 PM	0	9.0346	4.976	12/9/2021	6:33:24 PM	0	886.772	-4.94	-0.01	26.35	1007.33
12/9/2021	8:01:31 PM	0	9.0374	4.976	12/9/2021	7:33:24 PM	0	886.903	-5.891	-0.01	26.34	1007.34
12/9/2021	9:01:31 PM	0	9.0402	4.976	12/9/2021	8:33:24 PM	0	886.968	-6.935	0.00	26.34	1007.34
12/9/2021	10:01:31 PM	0	9.0422	4.976	12/9/2021	9:33:24 PM	0	887.13	-7.121	0.00	26.34	1007.34
12/9/2021	11:01:31 PM	0	9.0421	4.976	12/9/2021	10:33:24 PM	0	887.291	-6.67	-0.01	26.34	1007.34
12/10/2021	12:01:31 AM	0	9.0461	4.976	12/9/2021	11:33:24 PM	0	887.509	-6.908	0.00	26.34	1007.34
12/10/2021	1:01:31 AM	0	9.0457	4.976	12/10/202	12:33:24 AM	0	887.407	-7.554	0.00	26.34	1007.34
12/10/2021	2:01:31 AM	0	9.0427	4.976	12/10/202	1:33:24 AM	0	887.059	-7.72	0.00	26.34	1007.34
12/10/2021	3:01:31 AM	0	9.0422	4.976	12/10/202	2:33:24 AM	0	887.147	-7.281	0.00	26.34	1007.34
12/10/2021	4:01:31 AM	0	9.0431	4.976	12/10/202	3:33:24 AM	0	887.404	-6.835	-0.01	26.34	1007.34
12/10/2021	5:01:31 AM	0	9.044	4.976	12/10/202	4:33:24 AM	0	887.417	-6.85	-0.01	26.34	1007.34
12/10/2021	6:01:31 AM	0	9.0448	4.976	12/10/202	5:33:24 AM	0	887.358	-7.104	0.00	26.34	1007.34
12/10/2021	7:01:31 AM	0	9.044	4.976	12/10/202	6:33:24 AM	0	887.504	-7.112	-0.01	26.34	1007.34
12/10/2021	8:01:31 AM	0	9.0442	4.976	12/10/202	7:33:24 AM	0	887.411	-6.896	0.00	26.34	1007.34
12/10/2021	9:01:31 AM	0	9.0422	4.976	12/10/202	8:33:24 AM	0	887.362	-6.721	-0.01	26.34	1007.34
12/10/2021	10:01:31 AM	0	9.0384	4.976	12/10/202	9:33:24 AM	0	887.022	-6.446	-0.01	26.34	1007.34
12/10/2021	11:01:31 AM	0	9.0341	4.976	12/10/202	10:33:24 AM	0	886.682	-6.075	-0.01	26.34	1007.34
12/10/2021	12:01:31 PM	0	9.0318	4.976	12/10/202	11:33:24 AM	0	886.534	-5.481	-0.01	26.35	1007.33
12/10/2021	1:01:31 PM	0	9.0233	4.976	12/10/202	12:33:24 PM	0	885.923	-4.687	-0.01	26.35	1007.33
12/10/2021	2:01:31 PM	0	9.0118	4.976	12/10/202	1:33:24 PM	0	885.041	-4.257	-0.01	26.35	1007.33
12/10/2021	3:01:31 PM	0	9.001	4.975	12/10/202	2:33:24 PM	0	883.913	-4.05	-0.01	26.35	1007.33
12/10/2021	4:01:31 PM	0	8.9915	4.976	12/10/202	3:33:24 PM	0	882.772	-4.012	-0.01	26.35	1007.33
12/10/2021	5:01:31 PM	0	8.9795	4.976	12/10/202	4:33:24 PM	0	881.456	-4.24	-0.01	26.35	1007.33
12/10/2021	6:01:31 PM	0	8.9655	4.976	12/10/202	5:33:24 PM	0	880.169	-4.696	-0.01	26.35	1007.33
12/10/2021	7:01:31 PM	0	8.9528	4.975	12/10/202	6:33:24 PM	0	878.77	-4.792	-0.01	26.35	1007.33
12/10/2021	8:01:31 PM	0	8.9412	4.976	12/10/202	7:33:24 PM	0	877.852	-4.545	-0.01	26.35	1007.33
12/10/2021	9:01:31 PM	0	8.9258	4.976	12/10/202	8:33:24 PM	0	876.418	-4.296	-0.01	26.35	1007.33
12/10/2021	10:01:31 PM	0	8.9117	4.976	12/10/202	9:33:24 PM	0	874.891	-4.127	-0.01	26.35	1007.33
12/10/2021	11:01:31 PM	0	8.8983	4.976	12/10/202	10:33:24 PM	0	873.541	-4.303	-0.01	26.35	1007.33
12/11/2021	12:01:31 AM	0	8.8824	4.975	12/10/202	11:33:24 PM	0	872.073	-4.2	-0.01	26.35	1007.33
12/11/2021	1:01:31 AM	0	8.8697	4.976	12/11/202	12:33:24 AM	0	870.914	-3.922	-0.01	26.35	1007.33
12/11/2021	2:01:31 AM	0	8.8564	4.976	12/11/202	1:33:24 AM	0	869.587	-3.572	-0.01	26.35	1007.33
12/11/2021	3:01:31 AM	0	8.8501	4.975	12/11/202	2:33:24 AM	0	868.627	-3.599	-0.01	26.34	1007.34
12/11/2021	4:01:31 AM	0	8.846	4.975	12/11/202	3:33:24 AM	0	868.612	-3.753	-0.01	26.35	1007.33
12/11/2021	5:01:31 AM	0	8.8413	4.976	12/11/202	4:33:24 AM	0	868.195	-3.772	-0.01	26.35	1007.33
12/11/2021	6:01:31 AM	0	8.8381	4.976	12/11/202	5:33:24 AM	0	867.564	-3.433	-0.01	26.35	1007.33

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/11/2021	7:01:31 AM	0	8.8463	4.976	12/11/202	6:33:24 AM	0	868.981	-3.127	-0.01	26.35	1007.33
12/11/2021	8:01:31 AM	0	8.8464	4.976	12/11/202	7:33:24 AM	0	868.873	-3.18	-0.01	26.35	1007.33
12/11/2021	9:01:31 AM	0	8.8546	4.976	12/11/202	8:33:24 AM	0	869.677	-3.404	-0.01	26.35	1007.33
12/11/2021	10:01:31 AM	0	8.8575	4.976	12/11/202	9:33:24 AM	0	869.782	-3.792	-0.01	26.35	1007.33
12/11/2021	11:01:31 AM	0	8.8593	4.976	12/11/202	10:33:24 AM	0	869.842	-4.11	-0.01	26.35	1007.33
12/11/2021	12:01:31 PM	0	8.8564	4.976	12/11/202	11:33:24 AM	0	869.731	-3.637	-0.01	26.35	1007.33
12/11/2021	1:01:31 PM	0	8.8541	4.976	12/11/202	12:33:24 PM	0	869.537	-2.05	-0.01	26.35	1007.33
12/11/2021	2:01:31 PM	0	8.8539	4.976	12/11/202	1:33:24 PM	0	869.765	-1.655	-0.02	26.35	1007.33
12/11/2021	3:01:31 PM	0	8.8526	4.976	12/11/202	2:33:24 PM	0	869.458	-1.826	-0.01	26.35	1007.33
12/11/2021	4:01:31 PM	0	8.8521	4.976	12/11/202	3:33:24 PM	0	869.557	-2.193	-0.01	26.35	1007.33
12/11/2021	5:01:31 PM	0	8.8478	4.975	12/11/202	4:33:24 PM	0	868.899	-2.884	-0.01	26.35	1007.33
12/11/2021	6:01:31 PM	0	8.846	4.976	12/11/202	5:33:24 PM	0	868.427	-3.59	-0.01	26.35	1007.33
12/11/2021	7:01:31 PM	0	8.8448	4.976	12/11/202	6:33:24 PM	0	868.305	-3.997	-0.01	26.35	1007.33
12/11/2021	8:01:31 PM	0	8.8462	4.976	12/11/202	7:33:24 PM	0	868.456	-4.231	-0.01	26.35	1007.33
12/11/2021	9:01:31 PM	0	8.848	4.976	12/11/202	8:33:24 PM	0	868.488	-4.084	-0.01	26.35	1007.33
12/11/2021	10:01:31 PM	0	8.8545	4.975	12/11/202	9:33:24 PM	0	869.258	-3.726	-0.01	26.35	1007.33
12/11/2021	11:01:31 PM	0	8.863	4.976	12/11/202	10:33:24 PM	0	869.999	-3.72	-0.01	26.35	1007.33
12/12/2021	12:01:31 AM	0	8.8734	4.976	12/11/202	11:33:24 PM	0	870.964	-4.021	-0.01	26.35	1007.33
12/12/2021	1:01:31 AM	0	8.8809	4.976	12/12/202	12:33:24 AM	0	871.902	-4.554	-0.01	26.35	1007.33
12/12/2021	2:01:31 AM	0	8.8854	4.975	12/12/202	1:33:24 AM	0	871.939	-5.637	-0.01	26.34	1007.34
12/12/2021	3:01:31 AM	0	8.8897	4.976	12/12/202	2:33:24 AM	0	872.276	-6.739	-0.01	26.34	1007.34
12/12/2021	4:01:31 AM	0	8.8899	4.976	12/12/202	3:33:24 AM	0	871.993	-6.989	0.00	26.34	1007.34
12/12/2021	5:01:31 AM	0	8.8883	4.976	12/12/202	4:33:24 AM	0	872.08	-6.729	0.00	26.34	1007.34
12/12/2021	6:01:31 AM	0	8.8865	4.975	12/12/202	5:33:24 AM	0	871.987	-6.673	-0.01	26.34	1007.34
12/12/2021	7:01:31 AM	0	8.8894	4.976	12/12/202	6:33:24 AM	0	872.436	-6.069	-0.01	26.34	1007.34
12/12/2021	8:01:31 AM	0	8.8931	4.976	12/12/202	7:33:24 AM	0	872.996	-5.343	-0.01	26.35	1007.33
12/12/2021	9:01:31 AM	0	8.897	4.975	12/12/202	8:33:24 AM	0	873.34	-5.104	-0.01	26.35	1007.33
12/12/2021	10:01:31 AM	0	8.9025	4.976	12/12/202	9:33:24 AM	0	873.839	-5.103	-0.01	26.35	1007.33
12/12/2021	11:01:31 AM	0	8.9109	4.976	12/12/202	10:33:24 AM	0	874.825	-4.864	-0.01	26.35	1007.33
12/12/2021	12:01:31 PM	0	8.9196	4.976	12/12/202	11:33:24 AM	0	875.777	-4.215	-0.01	26.35	1007.33
12/12/2021	1:01:31 PM	0	8.926	4.975	12/12/202	12:33:24 PM	0	876.579	-3.776	-0.01	26.35	1007.33
12/12/2021	2:01:31 PM	0	8.9314	4.975	12/12/202	1:33:24 PM	0	877.123	-3.391	-0.01	26.35	1007.33
12/12/2021	3:01:31 PM	0	8.9361	4.975	12/12/202	2:33:24 PM	0	877.437	-3.672	-0.01	26.35	1007.33
12/12/2021	4:01:31 PM	0	8.9408	4.976	12/12/202	3:33:24 PM	0	877.914	-3.821	-0.01	26.35	1007.33
12/12/2021	5:01:31 PM	0	8.9466	4.975	12/12/202	4:33:24 PM	0	878.55	-3.896	-0.01	26.35	1007.33
12/12/2021	6:01:31 PM	0	8.9494	4.975	12/12/202	5:33:24 PM	0	878.601	-4.536	-0.01	26.35	1007.33
12/12/2021	7:01:31 PM	0	8.9512	4.976	12/12/202	6:33:24 PM	0	878.693	-4.726	-0.01	26.35	1007.33
12/12/2021	8:01:31 PM	0	8.9536	4.976	12/12/202	7:33:24 PM	0	878.863	-5.123	-0.01	26.35	1007.33
12/12/2021	9:01:31 PM	0	8.9549	4.976	12/12/202	8:33:24 PM	0	878.941	-4.997	-0.01	26.35	1007.33
12/12/2021	10:01:31 PM	0	8.9576	4.976	12/12/202	9:33:24 PM	0	879.344	-4.828	-0.01	26.35	1007.33
12/12/2021	11:01:31 PM	0	8.9618	4.976	12/12/202	10:33:24 PM	0	879.701	-4.534	-0.01	26.35	1007.33
12/13/2021	12:01:31 AM	0	8.9654	4.976	12/12/202	11:33:24 PM	0	880.316	-4.282	-0.01	26.35	1007.33
12/13/2021	1:01:31 AM	0	8.9679	4.976	12/13/202	12:33:24 AM	0	880.531	-4.068	-0.01	26.35	1007.33
12/13/2021	2:01:31 AM	0	8.9716	4.976	12/13/202	1:33:24 AM	0	880.865	-4.123	-0.01	26.35	1007.33
12/13/2021	3:01:31 AM	0	8.9749	4.976	12/13/202	2:33:24 AM	0	881.199	-4.525	-0.01	26.35	1007.33
12/13/2021	4:01:31 AM	0	8.983	4.976	12/13/202	3:33:24 AM	0	881.738	-4.806	-0.01	26.35	1007.33
12/13/2021	5:01:31 AM	0	8.9799	4.976	12/13/202	4:33:24 AM	0	882.03	-5.003	-0.01	26.35	1007.33
12/13/2021	6:01:31 AM	0	8.9805	4.975	12/13/202	5:33:24 AM	0	881.507	-5.141	-0.01	26.35	1007.33
12/13/2021	7:01:31 AM	0	8.9825	4.976	12/13/202	6:33:24 AM	0	881.408	-5.457	-0.01	26.34	1007.34
12/13/2021	8:01:31 AM	0	8.9815	4.976	12/13/202	7:33:24 AM	0	881.503	-5.85	-0.01	26.34	1007.34
12/13/2021	9:01:31 AM	0	8.9787	4.976	12/13/202	8:33:24 AM	0	881.202	-5.776	-0.01	26.34	1007.34
12/13/2021	10:01:31 AM	0	8.9747	4.976	12/13/202	9:33:24 AM	0	880.589	-5.702	0.00	26.34	1007.34
12/13/2021	11:01:31 AM	0	8.9703	4.976	12/13/202	10:33:24 AM	0	880.557	-5.399	-0.01	26.35	1007.33
12/13/2021	12:01:31 PM	0	8.9671	4.976	12/13/202	11:33:24 AM	0	880.338	-4.779	-0.01	26.35	1007.33
12/13/2021	1:01:31 PM	0	8.9617	4.976	12/13/202	12:33:24 PM	0	879.842	-4.209	-0.01	26.35	1007.33
12/13/2021	2:01:31 PM	0	8.9585	4.976	12/13/202	1:33:24 PM	0	879.651	-3.754	-0.01	26.35	1007.33
12/13/2021	3:01:31 PM	0	8.9683	4.975	12/13/202	2:33:24 PM	0	880.722	-3.085	-0.01	26.35	1007.33
12/13/2021	4:01:31 PM	0	8.9701	4.976	12/13/202	3:33:24 PM	0	881.097	-2.577	-0.01	26.35	1007.33
12/13/2021	5:01:31 PM	0	8.9719	4.975	12/13/202	4:33:24 PM	0	881.012	-2.925	-0.01	26.35	1007.33
12/13/2021	6:01:31 PM	0	8.9744	4.976	12/13/202	5:33:24 PM	0	881.198	-3.534	-0.01	26.35	1007.33
12/13/2021	7:01:31 PM	0	8.9731	4.976	12/13/202	6:33:24 PM	0	881.187	-3.938	-0.01	26.35	1007.33
12/13/2021	8:01:31 PM	0	8.9727	4.976	12/13/202	7:33:24 PM	0	880.825	-4.51	-0.01	26.35	1007.33
12/13/2021	9:01:31 PM	0	8.972	4.976	12/13/202	8:33:24 PM	0	880.834	-5.104	-0.01	26.35	1007.33
12/13/2021	10:01:31 PM	0	8.9712	4.975	12/13/202	9:33:24 PM	0	880.305	-5.371	-0.01	26.34	1007.34
12/13/2021	11:01:31 PM	0	8.9688	4.975	12/13/202	10:33:24 PM	0	880.256	-5.823	-0.01	26.34	1007.34
12/14/2021	12:01:31 AM	0	8.9697	4.975	12/13/202	11:33:24 PM	0	880.21	-6.678	-0.01	26.34	1007.34
12/14/2021	1:01:31 AM	0	8.9673	4.976	12/14/202	12:33:24 AM	0	879.735	-7.502	0.00	26.34	1007.34
12/14/2021	2:01:31 AM	0	8.969	4.976	12/14/202	1:33:24 AM	0	879.641	-8.193	0.00	26.34	1007.34
12/14/2021	3:01:31 AM	0	8.9702	4.976	12/14/202	2:33:24 AM	0	879.685	-8.758	0.00	26.34	1007.34
12/14/2021	4:01:31 AM	0	8.9764	4.976	12/14/202	3:33:24 AM	0	879.924	-9.192	0.00	26.33	1007.35

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/14/2021	5:01:31 AM	0	8.9784	4.976	12/14/202	4:33:24 AM	0	880.568	-9.507	0.00	26.34	1007.34
12/14/2021	6:01:31 AM	0	8.9851	4.977	12/14/202	5:33:24 AM	0	880.907	-9.699	0.00	26.33	1007.35
12/14/2021	7:01:31 AM	0	8.995	4.975	12/14/202	6:33:24 AM	0	881.931	-9.871	0.00	26.34	1007.34
12/14/2021	8:01:31 AM	0	9.003	4.976	12/14/202	7:33:24 AM	0	882.722	-10.109	0.00	26.34	1007.34
12/14/2021	9:01:31 AM	0	9.012	4.976	12/14/202	8:33:24 AM	0	883.228	-10.501	0.01	26.33	1007.35
12/14/2021	10:01:31 AM	0	9.02	4.976	12/14/202	9:33:24 AM	0	884.127	-10.785	0.00	26.33	1007.35
12/14/2021	11:01:31 AM	0	9.0265	4.975	12/14/202	10:33:24 AM	0	884.662	-10.896	0.01	26.33	1007.35
12/14/2021	12:01:31 PM	0	9.0292	4.976	12/14/202	11:33:24 AM	0	885.297	-10.62	0.00	26.34	1007.34
12/14/2021	1:01:31 PM	0	9.0332	4.976	12/14/202	12:33:24 PM	0	885.741	-9.937	0.00	26.34	1007.34
12/14/2021	2:01:31 PM	0	9.0346	4.976	12/14/202	1:33:24 PM	0	886.23	-9.144	0.00	26.34	1007.34
12/14/2021	3:01:31 PM	0	9.0346	4.976	12/14/202	2:33:24 PM	0	886.191	-8.544	0.00	26.34	1007.34
12/14/2021	4:01:31 PM	0	9.0328	4.976	12/14/202	3:33:24 PM	0	886.102	-8.46	0.00	26.34	1007.34
12/14/2021	5:01:31 PM	0	9.0353	4.976	12/14/202	4:33:24 PM	0	886.159	-8.778	0.00	26.34	1007.34
12/14/2021	6:01:31 PM	0	9.0394	4.975	12/14/202	5:33:24 PM	0	886.481	-9.24	0.00	26.34	1007.34
12/14/2021	7:01:31 PM	0	9.0415	4.976	12/14/202	6:33:24 PM	0	886.791	-9.651	0.00	26.34	1007.34
12/14/2021	8:01:31 PM	0	9.0424	4.975	12/14/202	7:33:24 PM	0	886.549	-9.929	0.00	26.34	1007.34
12/14/2021	9:01:31 PM	0	9.0405	4.975	12/14/202	8:33:24 PM	0	886.296	-10.506	0.00	26.33	1007.35
12/14/2021	10:01:31 PM	0	9.0395	4.975	12/14/202	9:33:24 PM	0	886.29	-10.227	0.00	26.34	1007.34
12/14/2021	11:01:31 PM	0	9.0394	4.975	12/14/202	10:33:24 PM	0	886.338	-9.902	0.00	26.34	1007.34
12/15/2021	12:01:31 AM	0	9.0429	4.975	12/14/202	11:33:24 PM	0	886.727	-9.662	0.00	26.34	1007.34
12/15/2021	1:01:31 AM	0	9.0447	4.976	12/15/202	12:33:24 AM	0	886.984	-9.569	0.00	26.34	1007.34
12/15/2021	2:01:31 AM	0	9.0457	4.976	12/15/202	1:33:24 AM	0	887.086	-9.418	0.00	26.34	1007.34
12/15/2021	3:01:31 AM	0	9.0454	4.976	12/15/202	2:33:24 AM	0	887.099	-9.442	0.00	26.34	1007.34
12/15/2021	4:01:31 AM	0	9.0425	4.975	12/15/202	3:33:24 AM	0	886.721	-9.521	0.00	26.34	1007.34
12/15/2021	5:01:31 AM	0	9.0414	4.976	12/15/202	4:33:24 AM	0	886.432	-9.828	0.00	26.33	1007.35
12/15/2021	6:01:31 AM	0	9.0435	4.976	12/15/202	5:33:24 AM	0	886.771	-9.881	0.00	26.34	1007.34
12/15/2021	7:01:31 AM	0	9.042	4.976	12/15/202	6:33:24 AM	0	886.662	-9.925	0.00	26.34	1007.34
12/15/2021	8:01:31 AM	0	9.043	4.976	12/15/202	7:33:24 AM	0	886.702	-9.837	0.00	26.34	1007.34
12/15/2021	9:01:31 AM	0	9.0437	4.976	12/15/202	8:33:24 AM	0	886.937	-9.607	0.00	26.34	1007.34
12/15/2021	10:01:31 AM	0	9.0469	4.976	12/15/202	9:33:24 AM	0	887.236	-9.431	0.00	26.34	1007.34
12/15/2021	11:01:31 AM	0	9.0497	4.976	12/15/202	10:33:24 AM	0	887.66	-8.685	0.00	26.34	1007.34
12/15/2021	12:01:31 PM	0	9.0492	4.976	12/15/202	11:33:24 AM	0	888.055	-7.189	-0.01	26.34	1007.34
12/15/2021	1:01:31 PM	0	9.0461	4.976	12/15/202	12:33:24 PM	0	888.025	-6.139	-0.01	26.35	1007.33
12/15/2021	2:01:31 PM	0	9.0439	4.976	12/15/202	1:33:24 PM	0	887.857	-5.44	-0.01	26.35	1007.33
12/15/2021	3:01:31 PM	0	9.0397	4.976	12/15/202	2:33:24 PM	0	887.362	-5.262	-0.01	26.35	1007.33
12/15/2021	4:01:31 PM	0	9.0382	4.976	12/15/202	3:33:24 PM	0	887.209	-5.14	-0.01	26.35	1007.33
12/15/2021	5:01:31 PM	0	9.0373	4.976	12/15/202	4:33:24 PM	0	887.308	-5.055	-0.01	26.35	1007.33
12/15/2021	6:01:31 PM	0	9.0329	4.976	12/15/202	5:33:24 PM	0	886.711	-5.18	-0.01	26.35	1007.33
12/15/2021	7:01:31 PM	0	9.0311	4.975	12/15/202	6:33:24 PM	0	886.634	-5.148	-0.01	26.35	1007.33
12/15/2021	8:01:31 PM	0	9.0296	4.975	12/15/202	7:33:24 PM	0	886.433	-5.036	-0.01	26.35	1007.33
12/15/2021	9:01:31 PM	0	9.0262	4.976	12/15/202	8:33:24 PM	0	886.308	-5.001	-0.01	26.35	1007.33
12/15/2021	10:01:31 PM	0	9.0255	4.976	12/15/202	9:33:24 PM	0	886.092	-4.941	-0.01	26.35	1007.33
12/15/2021	11:01:31 PM	0	9.026	4.975	12/15/202	10:33:24 PM	0	886.148	-4.811	-0.01	26.35	1007.33
12/16/2021	12:01:31 AM	0	9.0261	4.976	12/15/202	11:33:24 PM	0	886.176	-4.709	-0.01	26.35	1007.33
12/16/2021	1:01:31 AM	0	9.023	4.976	12/16/202	12:33:24 AM	0	885.874	-4.717	-0.01	26.35	1007.33
12/16/2021	2:01:31 AM	0	9.0224	4.976	12/16/202	1:33:24 AM	0	885.653	-4.668	-0.01	26.35	1007.33
12/16/2021	3:01:31 AM	0	9.025	4.976	12/16/202	2:33:24 AM	0	885.917	-4.61	-0.01	26.35	1007.33
12/16/2021	4:01:31 AM	0	9.0309	4.975	12/16/202	3:33:24 AM	0	886.542	-4.748	-0.01	26.35	1007.33
12/16/2021	5:01:31 AM	0	9.0365	4.976	12/16/202	4:33:24 AM	0	886.927	-5.466	-0.01	26.34	1007.34
12/16/2021	6:01:31 AM	0	9.0437	4.975	12/16/202	5:33:24 AM	0	887.319	-6.342	0.00	26.34	1007.34
12/16/2021	7:01:31 AM	0	9.0539	4.976	12/16/202	6:33:24 AM	0	888.049	-7.331	0.00	26.34	1007.34
12/16/2021	8:01:31 AM	0	9.0639	4.976	12/16/202	7:33:24 AM	0	888.859	-8.378	0.00	26.34	1007.34
12/16/2021	9:01:31 AM	0	9.0696	4.976	12/16/202	8:33:24 AM	0	889.306	-8.914	0.00	26.34	1007.34
12/16/2021	10:01:31 AM	0	9.0786	4.976	12/16/202	9:33:24 AM	0	890.17	-9.049	0.00	26.34	1007.34
12/16/2021	11:01:31 AM	0	9.0873	4.976	12/16/202	10:33:24 AM	0	891.157	-8.959	0.00	26.34	1007.34
12/16/2021	12:01:31 PM	0	9.0954	4.975	12/16/202	11:33:24 AM	0	892.133	-8.36	0.00	26.34	1007.34
12/16/2021	1:01:31 PM	0	9.1015	4.976	12/16/202	12:33:24 PM	0	892.961	-7.693	0.00	26.34	1007.34
12/16/2021	2:01:31 PM	0	9.1097	4.975	12/16/202	1:33:24 PM	0	893.785	-7.48	0.00	26.34	1007.34
12/16/2021	3:01:31 PM	0	9.1181	4.976	12/16/202	2:33:24 PM	0	894.678	-6.885	-0.01	26.34	1007.34
12/16/2021	4:01:31 PM	0	9.1253	4.976	12/16/202	3:33:24 PM	0	895.305	-7.13	0.00	26.34	1007.34
12/16/2021	5:01:31 PM	0	9.1344	4.976	12/16/202	4:33:24 PM	0	895.917	-8.316	0.00	26.34	1007.34
12/16/2021	6:01:31 PM	0	9.1421	4.976	12/16/202	5:33:24 PM	0	896.221	-9.863	0.00	26.33	1007.35
12/16/2021	7:01:31 PM	0	9.1519	4.976	12/16/202	6:33:24 PM	0	896.983	-10.806	0.01	26.33	1007.35
12/16/2021	8:01:31 PM	0	9.1588	4.976	12/16/202	7:33:24 PM	0	897.618	-11.593	0.01	26.33	1007.35
12/16/2021	9:01:31 PM	0	9.1661	4.976	12/16/202	8:33:24 PM	0	898.272	-12.103	0.01	26.33	1007.35
12/16/2021	10:01:31 PM	0	9.1723	4.976	12/16/202	9:33:24 PM	0	898.542	-12.745	0.01	26.33	1007.35
12/16/2021	11:01:31 PM	0	9.1779	4.975	12/16/202	10:33:24 PM	0	899.032	-13.28	0.01	26.33	1007.35
12/17/2021	12:01:31 AM	0	9.1827	4.976	12/16/202	11:33:24 PM	0	899.519	-13.805	0.01	26.33	1007.35
12/17/2021	1:01:31 AM	0	9.1871	4.976	12/17/202	12:33:24 AM	0	899.885	-14.26	0.01	26.33	1007.35
12/17/2021	2:01:31 AM	0	9.1887	4.976	12/17/202	1:33:24 AM	0	899.916	-14.418	0.01	26.33	1007.35

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/17/2021	3:01:31 AM	0	9.1916	4.976	12/17/202	2:33:24 AM	0	900.347	-13.836	0.01	26.33	1007.35
12/17/2021	4:01:31 AM	0	9.1922	4.976	12/17/202	3:33:24 AM	0	900.39	-13.668	0.01	26.33	1007.35
12/17/2021	5:01:31 AM	0	9.1914	4.975	12/17/202	4:33:24 AM	0	900.395	-14	0.01	26.33	1007.35
12/17/2021	6:01:31 AM	0	9.1939	4.976	12/17/202	5:33:24 AM	0	900.566	-13.966	0.01	26.33	1007.35
12/17/2021	7:01:31 AM	0	9.1949	4.976	12/17/202	6:33:24 AM	0	900.873	-13.69	0.01	26.33	1007.35
12/17/2021	8:01:31 AM	0	9.1984	4.976	12/17/202	7:33:24 AM	0	901.44	-13.161	0.01	26.33	1007.35
12/17/2021	9:01:31 AM	0	9.1934	4.975	12/17/202	8:33:24 AM	0	901.009	-12.781	0.01	26.33	1007.35
12/17/2021	10:01:31 AM	0	9.1907	4.975	12/17/202	9:33:24 AM	0	900.506	-12.611	0.01	26.33	1007.35
12/17/2021	11:01:31 AM	0	9.1912	4.976	12/17/202	10:33:24 AM	0	900.876	-12.309	0.00	26.33	1007.35
12/17/2021	12:01:31 PM	0	9.1877	4.975	12/17/202	11:33:24 AM	0	900.87	-11.495	0.00	26.34	1007.34
12/17/2021	1:01:31 PM	0	9.1818	4.976	12/17/202	12:33:24 PM	0	900.445	-10.525	0.00	26.34	1007.34
12/17/2021	2:01:31 PM	0	9.1781	4.976	12/17/202	1:33:24 PM	0	900.174	-9.953	0.00	26.34	1007.34
12/17/2021	3:01:31 PM	0	9.1688	4.976	12/17/202	2:33:24 PM	0	899.495	-9.227	0.00	26.34	1007.34
12/17/2021	4:01:31 PM	0	9.1642	4.976	12/17/202	3:33:24 PM	0	899.06	-8.952	0.00	26.34	1007.34
12/17/2021	5:01:31 PM	0	9.1681	4.976	12/17/202	4:33:24 PM	0	899.348	-9.002	0.00	26.34	1007.34
12/17/2021	6:01:31 PM	0	9.165	4.975	12/17/202	5:33:24 PM	0	899.061	-9.124	0.00	26.34	1007.34
12/17/2021	7:01:31 PM	0	9.1611	4.975	12/17/202	6:33:24 PM	0	898.662	-9.352	0.00	26.34	1007.34
12/17/2021	8:01:31 PM	0	9.1576	4.975	12/17/202	7:33:24 PM	0	898.162	-9.606	0.00	26.34	1007.34
12/17/2021	9:01:31 PM	0	9.1562	4.976	12/17/202	8:33:24 PM	0	897.94	-9.694	0.00	26.34	1007.34
12/17/2021	10:01:31 PM	0	9.1493	4.976	12/17/202	9:33:24 PM	0	897.358	-9.732	0.00	26.34	1007.34
12/17/2021	11:01:31 PM	0	9.1444	4.976	12/17/202	10:33:24 PM	0	896.815	-9.452	0.00	26.34	1007.34
12/18/2021	12:01:31 AM	0	9.1371	4.975	12/17/202	11:33:24 PM	0	896.217	-9.025	0.00	26.34	1007.34
12/18/2021	1:01:31 AM	0	9.1308	4.976	12/18/202	12:33:24 AM	0	895.497	-8.691	0.00	26.34	1007.34
12/18/2021	2:01:31 AM	0	9.1167	4.976	12/18/202	1:33:24 AM	0	894.612	-8.351	-0.01	26.34	1007.34
12/18/2021	3:01:31 AM	0	9.1017	4.975	12/18/202	2:33:24 AM	0	893.118	-8.067	-0.01	26.34	1007.34
12/18/2021	4:01:31 AM	0	9.0881	4.976	12/18/202	3:33:24 AM	0	892.096	-7.867	-0.01	26.35	1007.33
12/18/2021	5:01:31 AM	0	9.0757	4.976	12/18/202	4:33:24 AM	0	890.749	-7.451	-0.01	26.34	1007.34
12/18/2021	6:01:31 AM	0	9.0625	4.976	12/18/202	5:33:24 AM	0	889.813	-6.922	-0.01	26.35	1007.33
12/18/2021	7:01:31 AM	0	9.0477	4.976	12/18/202	6:33:24 AM	0	888.414	-6.493	-0.01	26.35	1007.33
12/18/2021	8:01:31 AM	0	9.0344	4.976	12/18/202	7:33:24 AM	0	887.138	-6.176	-0.01	26.35	1007.33
12/18/2021	9:01:31 AM	0	9.0238	4.976	12/18/202	8:33:24 AM	0	885.973	-5.906	-0.01	26.35	1007.33
12/18/2021	10:01:31 AM	0	9.0155	4.976	12/18/202	9:33:24 AM	0	884.931	-5.689	-0.01	26.35	1007.33
12/18/2021	11:01:31 AM	0	9.0026	4.975	12/18/202	10:33:24 AM	0	884.053	-5.433	-0.01	26.35	1007.33
12/18/2021	12:01:31 PM	0	8.995	4.976	12/18/202	11:33:24 AM	0	883.094	-5.091	-0.01	26.35	1007.33
12/18/2021	1:01:31 PM	0	8.984	4.976	12/18/202	12:33:24 PM	0	882.138	-4.744	-0.01	26.35	1007.33
12/18/2021	2:01:31 PM	0	8.9787	4.976	12/18/202	1:33:24 PM	0	881.486	-4.403	-0.01	26.35	1007.33
12/18/2021	3:01:31 PM	0	8.9752	4.976	12/18/202	2:33:24 PM	0	881.295	-4.061	-0.01	26.35	1007.33
12/18/2021	4:01:31 PM	0	8.9759	4.976	12/18/202	3:33:24 PM	0	881.458	-3.907	-0.01	26.35	1007.33
12/18/2021	5:01:31 PM	0	8.9826	4.976	12/18/202	4:33:24 PM	0	881.967	-3.852	-0.01	26.35	1007.33
12/18/2021	6:01:31 PM	0	8.9891	4.975	12/18/202	5:33:24 PM	0	882.607	-4.046	-0.01	26.35	1007.33
12/18/2021	7:01:31 PM	0	8.9939	4.976	12/18/202	6:33:24 PM	0	882.971	-4.318	-0.01	26.35	1007.33
12/18/2021	8:01:31 PM	0	9.0049	4.975	12/18/202	7:33:24 PM	0	883.814	-4.63	-0.01	26.34	1007.34
12/18/2021	9:01:31 PM	0	9.0169	4.976	12/18/202	8:33:24 PM	0	884.934	-5.101	-0.01	26.34	1007.34
12/18/2021	10:01:31 PM	0	9.0292	4.975	12/18/202	9:33:24 PM	0	885.967	-5.771	-0.01	26.34	1007.34
12/18/2021	11:01:31 PM	0	9.0404	4.975	12/18/202	10:33:24 PM	0	887.034	-6.326	0.00	26.34	1007.34
12/19/2021	12:01:31 AM	0	9.0534	4.976	12/18/202	11:33:24 PM	0	888.185	-6.852	0.00	26.34	1007.34
12/19/2021	1:01:31 AM	0	9.0653	4.976	12/19/202	12:33:24 AM	0	889.203	-7.443	0.00	26.34	1007.34
12/19/2021	2:01:31 AM	0	9.0765	4.976	12/19/202	1:33:24 AM	0	890.082	-7.949	0.00	26.34	1007.34
12/19/2021	3:01:31 AM	0	9.0875	4.976	12/19/202	2:33:24 AM	0	891.189	-8.436	0.00	26.34	1007.34
12/19/2021	4:01:31 AM	0	9.1002	4.976	12/19/202	3:33:24 AM	0	892.322	-8.774	0.00	26.34	1007.34
12/19/2021	5:01:31 AM	0	9.1078	4.976	12/19/202	4:33:24 AM	0	893.02	-8.839	0.00	26.34	1007.34
12/19/2021	6:01:31 AM	0	9.1152	4.976	12/19/202	5:33:24 AM	0	893.807	-8.988	0.00	26.34	1007.34
12/19/2021	7:01:31 AM	0	9.1225	4.975	12/19/202	6:33:24 AM	0	894.537	-9.012	0.00	26.34	1007.34
12/19/2021	8:01:31 AM	0	9.1324	4.976	12/19/202	7:33:24 AM	0	895.467	-9.151	0.00	26.34	1007.34
12/19/2021	9:01:31 AM	0	9.1383	4.976	12/19/202	8:33:24 AM	0	895.956	-9.335	0.00	26.34	1007.34
12/19/2021	10:01:31 AM	0	9.1471	4.976	12/19/202	9:33:24 AM	0	896.598	-10.139	0.00	26.33	1007.35
12/19/2021	11:01:31 AM	0	9.152	4.975	12/19/202	10:33:24 AM	0	897.03	-10.75	0.00	26.33	1007.35
12/19/2021	12:01:31 PM	0	9.1567	4.976	12/19/202	11:33:24 AM	0	897.643	-10.811	0.00	26.33	1007.35
12/19/2021	1:01:31 PM	0	9.1599	4.975	12/19/202	12:33:24 PM	0	898.14	-9.65	0.00	26.34	1007.34
12/19/2021	2:01:31 PM	0	9.1606	4.976	12/19/202	1:33:24 PM	0	898.693	-8.198	0.00	26.34	1007.34
12/19/2021	3:01:31 PM	0	9.1625	4.975	12/19/202	2:33:24 PM	0	898.931	-7.489	0.00	26.34	1007.34
12/19/2021	4:01:31 PM	0	9.1638	4.975	12/19/202	3:33:24 PM	0	899.163	-7.213	-0.01	26.34	1007.34
12/19/2021	5:01:31 PM	0	9.1656	4.976	12/19/202	4:33:24 PM	0	899.357	-7.374	-0.01	26.34	1007.34
12/19/2021	6:01:31 PM	0	9.1679	4.976	12/19/202	5:33:24 PM	0	899.304	-7.834	0.00	26.34	1007.34
12/19/2021	7:01:31 PM	0	9.1679	4.976	12/19/202	6:33:24 PM	0	899.297	-8.211	0.00	26.34	1007.34
12/19/2021	8:01:31 PM	0	9.1711	4.976	12/19/202	7:33:24 PM	0	899.487	-8.287	0.00	26.34	1007.34
12/19/2021	9:01:31 PM	0	9.1718	4.976	12/19/202	8:33:24 PM	0	899.596	-8.316	0.00	26.34	1007.34
12/19/2021	10:01:31 PM	0	9.1711	4.976	12/19/202	9:33:24 PM	0	899.515	-8.312	0.00	26.34	1007.34
12/19/2021	11:01:31 PM	0	9.1707	4.976	12/19/202	10:33:24 PM	0	899.598	-8.33	0.00	26.34	1007.34
12/20/2021	12:01:31 AM	0	9.1688	4.976	12/19/202	11:33:24 PM	0	899.284	-8.371	0.00	26.34	1007.34

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/20/2021	1:01:31 AM	0	9.1676	4.976	12/20/202	12:33:24 AM	0	899.214	-8.524	0.00	26.34	1007.34
12/20/2021	2:01:31 AM	0	9.1647	4.976	12/20/202	1:33:24 AM	0	899.03	-8.665	0.00	26.34	1007.34
12/20/2021	3:01:31 AM	0	9.163	4.975	12/20/202	2:33:24 AM	0	898.721	-8.707	0.00	26.34	1007.34
12/20/2021	4:01:31 AM	0	9.1635	4.976	12/20/202	3:33:24 AM	0	898.879	-8.714	0.00	26.34	1007.34
12/20/2021	5:01:31 AM	0	9.1634	4.976	12/20/202	4:33:24 AM	0	898.713	-8.721	0.00	26.34	1007.34
12/20/2021	6:01:31 AM	0	9.1608	4.976	12/20/202	5:33:24 AM	0	898.45	-8.788	0.00	26.34	1007.34
12/20/2021	7:01:31 AM	0	9.1606	4.975	12/20/202	6:33:24 AM	0	898.474	-8.853	0.00	26.34	1007.34
12/20/2021	8:01:31 AM	0	9.1606	4.976	12/20/202	7:33:24 AM	0	898.308	-8.873	0.00	26.34	1007.34
12/20/2021	9:01:31 AM	0	9.1575	4.976	12/20/202	8:33:24 AM	0	898.247	-8.984	0.00	26.34	1007.34
12/20/2021	10:01:31 AM	0	9.1619	4.975	12/20/202	9:33:24 AM	0	898.405	-9.093	0.00	26.34	1007.34
12/20/2021	11:01:31 AM	0	9.163	4.976	12/20/202	10:33:24 AM	0	898.541	-8.973	0.00	26.34	1007.34
12/20/2021	12:01:31 PM	0	9.1649	4.976	12/20/202	11:33:24 AM	0	898.963	-8.638	0.00	26.34	1007.34
12/20/2021	1:01:31 PM	0	9.1645	4.976	12/20/202	12:33:24 PM	0	898.849	-8.185	0.00	26.34	1007.34
12/20/2021	2:01:31 PM	0	9.1641	4.976	12/20/202	1:33:24 PM	0	899.111	-7.871	0.00	26.34	1007.34
12/20/2021	3:01:31 PM	0	9.1663	4.976	12/20/202	2:33:24 PM	0	899.206	-7.839	0.00	26.34	1007.34
12/20/2021	4:01:31 PM	0	9.1675	4.976	12/20/202	3:33:24 PM	0	899.345	-8.151	0.00	26.34	1007.34
12/20/2021	5:01:31 PM	0	9.1728	4.976	12/20/202	4:33:24 PM	0	899.586	-8.532	0.00	26.34	1007.34
12/20/2021	6:01:31 PM	0	9.1737	4.975	12/20/202	5:33:24 PM	0	899.641	-8.992	0.00	26.34	1007.34
12/20/2021	7:01:31 PM	0	9.1756	4.975	12/20/202	6:33:24 PM	0	899.692	-9.426	0.00	26.34	1007.34
12/20/2021	8:01:31 PM	0	9.1739	4.976	12/20/202	7:33:24 PM	0	899.537	-9.598	0.00	26.34	1007.34
12/20/2021	9:01:31 PM	0	9.1775	4.976	12/20/202	8:33:24 PM	0	899.656	-9.752	0.00	26.33	1007.35
12/20/2021	10:01:31 PM	0	9.1753	4.976	12/20/202	9:33:24 PM	0	899.938	-9.92	0.00	26.34	1007.34
12/20/2021	11:01:31 PM	0	9.1684	4.976	12/20/202	10:33:24 PM	0	899.04	-9.856	0.00	26.34	1007.34
12/21/2021	12:01:31 AM	0	9.1685	4.976	12/20/202	11:33:24 PM	0	898.978	-9.945	0.00	26.34	1007.34
12/21/2021	1:01:31 AM	0	9.1637	4.975	12/21/202	12:33:24 AM	0	898.649	-10.047	0.00	26.34	1007.34
12/21/2021	2:01:31 AM	0	9.1638	4.976	12/21/202	1:33:24 AM	0	898.568	-10.15	0.00	26.34	1007.34
12/21/2021	3:01:31 AM	0	9.1552	4.976	12/21/202	2:33:24 AM	0	898.09	-10.217	0.00	26.34	1007.34
12/21/2021	4:01:31 AM	0	9.1522	4.976	12/21/202	3:33:24 AM	0	897.275	-10.333	0.00	26.33	1007.35
12/21/2021	5:01:31 AM	0	9.1446	4.976	12/21/202	4:33:24 AM	0	896.453	-10.217	0.00	26.33	1007.35
12/21/2021	6:01:31 AM	0	9.1314	4.976	12/21/202	5:33:24 AM	0	895.537	-10.108	0.00	26.34	1007.34
12/21/2021	7:01:31 AM	0	9.1327	4.976	12/21/202	6:33:24 AM	0	895.444	-10.064	0.00	26.34	1007.34
12/21/2021	8:01:31 AM	0	9.1204	4.976	12/21/202	7:33:24 AM	0	894.377	-9.759	0.00	26.34	1007.34
12/21/2021	9:01:31 AM	0	9.117	4.976	12/21/202	8:33:24 AM	0	894.182	-9.597	0.00	26.34	1007.34
12/21/2021	10:01:31 AM	0	9.1149	4.976	12/21/202	9:33:24 AM	0	893.771	-9.501	0.00	26.34	1007.34
12/21/2021	11:01:31 AM	0	9.109	4.975	12/21/202	10:33:24 AM	0	893.407	-9.165	0.00	26.34	1007.34
12/21/2021	12:01:31 PM	0	9.1026	4.975	12/21/202	11:33:24 AM	0	892.942	-8.828	0.00	26.34	1007.34
12/21/2021	1:01:31 PM	0	9.0905	4.976	12/21/202	12:33:24 PM	0	891.866	-8.419	0.00	26.34	1007.34
12/21/2021	2:01:31 PM	0	9.0812	4.976	12/21/202	1:33:24 PM	0	890.827	-7.899	0.00	26.34	1007.34
12/21/2021	3:01:31 PM	0	9.073	4.976	12/21/202	2:33:24 PM	0	890.321	-7.471	-0.01	26.34	1007.34
12/21/2021	4:01:31 PM	0	9.064	4.975	12/21/202	3:33:24 PM	0	889.571	-7.194	-0.01	26.34	1007.34
12/21/2021	5:01:31 PM	0	9.0582	4.975	12/21/202	4:33:24 PM	0	888.984	-6.918	-0.01	26.34	1007.34
12/21/2021	6:01:31 PM	0	9.0512	4.976	12/21/202	5:33:24 PM	0	888.255	-6.698	-0.01	26.34	1007.34
12/21/2021	7:01:31 PM	0	9.0415	4.975	12/21/202	6:33:24 PM	0	887.557	-6.512	-0.01	26.35	1007.33
12/21/2021	8:01:31 PM	0	9.0336	4.975	12/21/202	7:33:24 PM	0	886.601	-6.288	-0.01	26.34	1007.34
12/21/2021	9:01:31 PM	0	9.0219	4.975	12/21/202	8:33:24 PM	0	885.512	-6.061	-0.01	26.35	1007.33
12/21/2021	10:01:31 PM	0	9.0135	4.976	12/21/202	9:33:24 PM	0	884.828	-5.889	-0.01	26.35	1007.33
12/21/2021	11:01:31 PM	0	9.004	4.976	12/21/202	10:33:24 PM	0	883.754	-5.654	-0.01	26.34	1007.34
12/22/2021	12:01:31 AM	0	8.9872	4.976	12/21/202	11:33:24 PM	0	882.68	-5.417	-0.01	26.35	1007.33
12/22/2021	1:01:31 AM	0	8.9723	4.975	12/22/202	12:33:24 AM	0	881.085	-5.149	-0.01	26.35	1007.33
12/22/2021	2:01:31 AM	0	8.9545	4.976	12/22/202	1:33:24 AM	0	879.037	-4.928	-0.01	26.35	1007.33
12/22/2021	3:01:31 AM	0	8.9421	4.976	12/22/202	2:33:24 AM	0	878.053	-4.705	-0.01	26.35	1007.33
12/22/2021	4:01:31 AM	0	8.9351	4.976	12/22/202	3:33:24 AM	0	877.292	-4.487	-0.01	26.35	1007.33
12/22/2021	5:01:31 AM	0	8.9286	4.976	12/22/202	4:33:24 AM	0	876.656	-4.277	-0.01	26.35	1007.33
12/22/2021	6:01:31 AM	0	8.9285	4.976	12/22/202	5:33:24 AM	0	876.709	-4.085	-0.01	26.35	1007.33
12/22/2021	7:01:31 AM	0	8.9267	4.976	12/22/202	6:33:24 AM	0	876.539	-3.921	-0.01	26.35	1007.33
12/22/2021	8:01:31 AM	0	8.9261	4.976	12/22/202	7:33:24 AM	0	876.496	-3.795	-0.01	26.35	1007.33
12/22/2021	9:01:31 AM	0	8.9267	4.976	12/22/202	8:33:24 AM	0	876.498	-3.653	-0.01	26.35	1007.33
12/22/2021	10:01:31 AM	0	8.9291	4.976	12/22/202	9:33:24 AM	0	876.835	-3.535	-0.01	26.35	1007.33
12/22/2021	11:01:31 AM	0	8.9306	4.976	12/22/202	10:33:24 AM	0	877.052	-3.416	-0.01	26.35	1007.33
12/22/2021	12:01:31 PM	0	8.9294	4.976	12/22/202	11:33:24 AM	0	877	-3.233	-0.01	26.35	1007.33
12/22/2021	1:01:31 PM	0	8.9268	4.976	12/22/202	12:33:24 PM	0	876.704	-3.099	-0.01	26.35	1007.33
12/22/2021	2:01:31 PM	0	8.9237	4.976	12/22/202	1:33:24 PM	0	876.314	-3.081	-0.01	26.35	1007.33
12/22/2021	3:01:31 PM	0	8.9233	4.976	12/22/202	2:33:24 PM	0	876.236	-3.049	-0.01	26.35	1007.33
12/22/2021	4:01:31 PM	0	8.9226	4.975	12/22/202	3:33:24 PM	0	876.312	-3.072	-0.01	26.35	1007.33
12/22/2021	5:01:31 PM	0	8.9224	4.976	12/22/202	4:33:24 PM	0	876.151	-3.188	-0.01	26.35	1007.33
12/22/2021	6:01:31 PM	0	8.9219	4.975	12/22/202	5:33:24 PM	0	876.189	-3.451	-0.01	26.35	1007.33
12/22/2021	7:01:31 PM	0	8.9183	4.976	12/22/202	6:33:24 PM	0	876.01	-3.758	-0.01	26.35	1007.33
12/22/2021	8:01:31 PM	0	8.9132	4.976	12/22/202	7:33:24 PM	0	875.135	-4.021	-0.01	26.35	1007.33
12/22/2021	9:01:31 PM	0	8.911	4.975	12/22/202	8:33:24 PM	0	874.99	-4.191	-0.01	26.35	1007.33
12/22/2021	10:01:31 PM	0	8.9068	4.976	12/22/202	9:33:24 PM	0	874.522	-4.388	-0.01	26.35	1007.33

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/22/2021	11:01:31 PM	0	8.9072	4.976	12/22/202	10:33:24 PM	0	874.402	-4.476	-0.01	26.35	1007.33
12/23/2021	12:01:31 AM	0	8.9062	4.976	12/22/202	11:33:24 PM	0	874.348	-4.548	-0.01	26.35	1007.33
12/23/2021	1:01:31 AM	0	8.9069	4.976	12/23/202	12:33:24 AM	0	874.489	-4.605	-0.01	26.35	1007.33
12/23/2021	2:01:31 AM	0	8.9015	4.976	12/23/202	1:33:24 AM	0	873.934	-4.635	-0.01	26.35	1007.33
12/23/2021	3:01:31 AM	0	8.9005	4.976	12/23/202	2:33:24 AM	0	873.587	-4.663	-0.01	26.34	1007.34
12/23/2021	4:01:31 AM	0	8.899	4.976	12/23/202	3:33:24 AM	0	873.651	-4.701	-0.01	26.35	1007.33
12/23/2021	5:01:31 AM	0	8.8961	4.976	12/23/202	4:33:24 AM	0	873.262	-4.763	-0.01	26.35	1007.33
12/23/2021	6:01:31 AM	0	8.8943	4.976	12/23/202	5:33:24 AM	0	873.122	-4.842	-0.01	26.35	1007.33
12/23/2021	7:01:31 AM	0	8.8938	4.976	12/23/202	6:33:24 AM	0	872.879	-4.915	-0.01	26.34	1007.34
12/23/2021	8:01:31 AM	0	8.8883	4.975	12/23/202	7:33:24 AM	0	872.654	-5.006	-0.01	26.35	1007.33
12/23/2021	9:01:31 AM	0	8.8924	4.976	12/23/202	8:33:24 AM	0	872.697	-5.125	-0.01	26.34	1007.34
12/23/2021	10:01:31 AM	0	8.8949	4.975	12/23/202	9:33:24 AM	0	872.986	-5.2	-0.01	26.34	1007.34
12/23/2021	11:01:31 AM	0	8.8983	4.975	12/23/202	10:33:24 AM	0	873.446	-5.274	-0.01	26.35	1007.33
12/23/2021	12:01:31 PM	0	8.8957	4.976	12/23/202	11:33:24 AM	0	873.172	-5.404	-0.01	26.35	1007.33
12/23/2021	1:01:31 PM	0	8.8918	4.976	12/23/202	12:33:24 PM	0	872.854	-5.432	-0.01	26.35	1007.33
12/23/2021	2:01:31 PM	0	8.8908	4.975	12/23/202	1:33:24 PM	0	872.515	-5.5	-0.01	26.34	1007.34
12/23/2021	3:01:31 PM	0	8.8895	4.976	12/23/202	2:33:24 PM	0	872.606	-5.578	-0.01	26.35	1007.33
12/23/2021	4:01:31 PM	0	8.8934	4.976	12/23/202	3:33:24 PM	0	872.789	-5.607	-0.01	26.34	1007.34
12/23/2021	5:01:31 PM	0	8.8978	4.976	12/23/202	4:33:24 PM	0	873.346	-5.698	-0.01	26.35	1007.33
12/23/2021	6:01:31 PM	0	8.8995	4.975	12/23/202	5:33:24 PM	0	873.469	-5.739	-0.01	26.34	1007.34
12/23/2021	7:01:31 PM	0	8.9008	4.976	12/23/202	6:33:24 PM	0	873.516	-5.811	-0.01	26.34	1007.34
12/23/2021	8:01:31 PM	0	8.9023	4.975	12/23/202	7:33:24 PM	0	873.523	-5.879	-0.01	26.34	1007.34
12/23/2021	9:01:31 PM	0	8.9033	4.975	12/23/202	8:33:24 PM	0	873.647	-5.912	-0.01	26.34	1007.34
12/23/2021	10:01:31 PM	0	8.9033	4.976	12/23/202	9:33:24 PM	0	873.708	-5.956	-0.01	26.34	1007.34
12/23/2021	11:01:31 PM	0	8.9053	4.976	12/23/202	10:33:24 PM	0	874.026	-6.036	-0.01	26.34	1007.34
12/24/2021	12:01:31 AM	0	8.9098	4.976	12/23/202	11:33:24 PM	0	874.398	-6.076	-0.01	26.34	1007.34
12/24/2021	1:01:31 AM	0	8.9134	4.976	12/24/202	12:33:24 AM	0	874.658	-6.11	-0.01	26.34	1007.34
12/24/2021	2:01:31 AM	0	8.9138	4.976	12/24/202	1:33:24 AM	0	874.858	-6.177	-0.01	26.34	1007.34
12/24/2021	3:01:31 AM	0	8.9193	4.976	12/24/202	2:33:24 AM	0	875.308	-6.258	-0.01	26.34	1007.34
12/24/2021	4:01:31 AM	0	8.9218	4.976	12/24/202	3:33:24 AM	0	875.537	-6.318	-0.01	26.34	1007.34
12/24/2021	5:01:31 AM	0	8.921	4.976	12/24/202	4:33:24 AM	0	875.482	-6.512	-0.01	26.34	1007.34
12/24/2021	6:01:31 AM	0	8.9221	4.976	12/24/202	5:33:24 AM	0	875.417	-6.69	0.00	26.34	1007.34
12/24/2021	7:01:31 AM	0	8.9254	4.976	12/24/202	6:33:24 AM	0	875.656	-6.819	0.00	26.34	1007.34
12/24/2021	8:01:31 AM	0	8.9291	4.975	12/24/202	7:33:24 AM	0	876.004	-6.999	0.00	26.34	1007.34
12/24/2021	9:01:31 AM	0	8.9334	4.976	12/24/202	8:33:24 AM	0	876.318	-7.26	0.00	26.34	1007.34
12/24/2021	10:01:31 AM	0	8.9395	4.975	12/24/202	9:33:24 AM	0	876.931	-7.53	0.00	26.34	1007.34
12/24/2021	11:01:31 AM	0	8.9457	4.976	12/24/202	10:33:24 AM	0	877.446	-7.814	0.00	26.34	1007.34
12/24/2021	12:01:31 PM	0	8.9516	4.976	12/24/202	11:33:24 AM	0	877.978	-8.144	0.00	26.34	1007.34
12/24/2021	1:01:31 PM	0	8.9512	4.976	12/24/202	12:33:24 PM	0	877.913	-8.444	0.00	26.34	1007.34
12/24/2021	2:01:31 PM	0	8.9514	4.976	12/24/202	1:33:24 PM	0	877.883	-8.664	0.00	26.34	1007.34
12/24/2021	3:01:31 PM	0	8.9515	4.976	12/24/202	2:33:24 PM	0	877.782	-8.849	0.00	26.34	1007.34
12/24/2021	4:01:31 PM	0	8.9564	4.976	12/24/202	3:33:24 PM	0	878.273	-9.018	0.00	26.34	1007.34
12/24/2021	5:01:31 PM	0	8.9592	4.976	12/24/202	4:33:24 PM	0	878.518	-9.269	0.00	26.34	1007.34
12/24/2021	6:01:31 PM	0	8.9617	4.976	12/24/202	5:33:24 PM	0	878.689	-9.641	0.00	26.34	1007.34
12/24/2021	7:01:31 PM	0	8.9628	4.976	12/24/202	6:33:24 PM	0	878.702	-9.922	0.00	26.33	1007.35
12/24/2021	8:01:31 PM	0	8.9659	4.976	12/24/202	7:33:24 PM	0	879.019	-10.088	0.00	26.33	1007.35
12/24/2021	9:01:31 PM	0	8.9687	4.976	12/24/202	8:33:24 PM	0	879.213	-10.24	0.00	26.33	1007.35
12/24/2021	10:01:31 PM	0	8.9689	4.976	12/24/202	9:33:24 PM	0	879.311	-10.476	0.00	26.33	1007.35
12/24/2021	11:01:31 PM	0	8.9726	4.976	12/24/202	10:33:24 PM	0	879.53	-10.703	0.00	26.33	1007.35
12/25/2021	12:01:31 AM	0	8.9757	4.975	12/24/202	11:33:24 PM	0	879.851	-10.96	0.00	26.33	1007.35
12/25/2021	1:01:31 AM	0	8.977	4.975	12/25/202	12:33:24 AM	0	879.812	-11.134	0.01	26.33	1007.35
12/25/2021	2:01:31 AM	0	8.9827	4.975	12/25/202	1:33:24 AM	0	880.417	-11.203	0.00	26.33	1007.35
12/25/2021	3:01:31 AM	0	8.985	4.976	12/25/202	2:33:24 AM	0	880.529	-11.566	0.01	26.33	1007.35
12/25/2021	4:01:31 AM	0	8.9927	4.976	12/25/202	3:33:24 AM	0	881.15	-11.858	0.01	26.33	1007.35
12/25/2021	5:01:31 AM	0	8.9955	4.975	12/25/202	4:33:24 AM	0	881.51	-12.041	0.01	26.33	1007.35
12/25/2021	6:01:31 AM	0	8.9996	4.976	12/25/202	5:33:24 AM	0	881.813	-12.33	0.01	26.33	1007.35
12/25/2021	7:01:31 AM	0	9.004	4.976	12/25/202	6:33:24 AM	0	882.196	-12.627	0.01	26.33	1007.35
12/25/2021	8:01:31 AM	0	9.0074	4.976	12/25/202	7:33:24 AM	0	882.566	-12.621	0.01	26.33	1007.35
12/25/2021	9:01:31 AM	0	9.0087	4.976	12/25/202	8:33:24 AM	0	882.741	-12.729	0.01	26.33	1007.35
12/25/2021	10:01:31 AM	0	9.0128	4.976	12/25/202	9:33:24 AM	0	882.985	-12.837	0.01	26.33	1007.35
12/25/2021	11:01:31 AM	0	9.0157	4.976	12/25/202	10:33:24 AM	0	883.43	-12.85	0.01	26.33	1007.35
12/25/2021	12:01:31 PM	0	9.016	4.976	12/25/202	11:33:24 AM	0	883.581	-12.762	0.01	26.33	1007.35
12/25/2021	1:01:31 PM	0	9.0134	4.976	12/25/202	12:33:24 PM	0	883.216	-12.653	0.01	26.33	1007.35
12/25/2021	2:01:31 PM	0	9.0149	4.975	12/25/202	1:33:24 PM	0	883.496	-12.394	0.01	26.33	1007.35
12/25/2021	3:01:31 PM	0	9.0129	4.976	12/25/202	2:33:24 PM	0	883.131	-12.034	0.01	26.33	1007.35
12/25/2021	4:01:31 PM	0	9.0115	4.976	12/25/202	3:33:24 PM	0	883.259	-12.141	0.00	26.33	1007.35
12/25/2021	5:01:31 PM	0	9.0112	4.976	12/25/202	4:33:24 PM	0	883.091	-12.378	0.01	26.33	1007.35
12/25/2021	6:01:31 PM	0	9.0072	4.976	12/25/202	5:33:24 PM	0	882.633	-12.526	0.01	26.33	1007.35
12/25/2021	7:01:31 PM	0	9.009	4.976	12/25/202	6:33:24 PM	0	882.684	-12.672	0.01	26.33	1007.35
12/25/2021	8:01:31 PM	0	9.0048	4.976	12/25/202	7:33:24 PM	0	882.311	-12.858	0.01	26.33	1007.35

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	SWL	Levelogge	GW masl	Date	SWL	Levelogger	GW masl					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/25/2021	9:01:31 PM	0	9.0044	4.976	12/25/202	8:33:24 PM	0	882.224	-13.005	0.01	26.33	1007.35
12/25/2021	10:01:31 PM	0	9.003	4.976	12/25/202	9:33:24 PM	0	882.073	-13.055	0.01	26.33	1007.35
12/25/2021	11:01:31 PM	0	9.0013	4.976	12/25/202	10:33:24 PM	0	881.815	-13.172	0.01	26.33	1007.35
12/26/2021	12:01:31 AM	0	9.0018	4.976	12/25/202	11:33:24 PM	0	881.911	-13.331	0.01	26.33	1007.35
12/26/2021	1:01:31 AM	0	8.9987	4.976	12/26/202	12:33:24 AM	0	881.567	-13.572	0.01	26.33	1007.35
12/26/2021	2:01:31 AM	0	8.999	4.976	12/26/202	1:33:24 AM	0	881.554	-13.859	0.01	26.33	1007.35
12/26/2021	3:01:31 AM	0	8.9978	4.976	12/26/202	2:33:24 AM	0	881.431	-14.141	0.01	26.33	1007.35
12/26/2021	4:01:31 AM	0	8.9993	4.976	12/26/202	3:33:24 AM	0	881.554	-14.385	0.01	26.33	1007.35
12/26/2021	5:01:31 AM	0	9.0004	4.976	12/26/202	4:33:24 AM	0	881.633	-14.619	0.01	26.33	1007.35
12/26/2021	6:01:31 AM	0	8.998	4.976	12/26/202	5:33:24 AM	0	881.179	-14.904	0.01	26.32	1007.36
12/26/2021	7:01:31 AM	0	8.9976	4.975	12/26/202	6:33:24 AM	0	881.352	-15.125	0.01	26.33	1007.35
12/26/2021	8:01:31 AM	0	8.9995	4.976	12/26/202	7:33:24 AM	0	881.506	-15.249	0.01	26.33	1007.35
12/26/2021	9:01:31 AM	0	9.0026	4.976	12/26/202	8:33:24 AM	0	881.913	-15.471	0.01	26.33	1007.35
12/26/2021	10:01:31 AM	0	9.0058	4.975	12/26/202	9:33:24 AM	0	882.291	-15.401	0.01	26.33	1007.35
12/26/2021	11:01:31 AM	0	9.0123	4.976	12/26/202	10:33:24 AM	0	883.179	-15.302	0.01	26.33	1007.35
12/26/2021	12:01:31 PM	0	9.0152	4.976	12/26/202	11:33:24 AM	0	883.727	-15.214	0.00	26.33	1007.35
12/26/2021	1:01:31 PM	0	9.0177	4.975	12/26/202	12:33:24 PM	0	883.966	-15.204	0.00	26.33	1007.35
12/26/2021	2:01:31 PM	0	9.0225	4.976	12/26/202	1:33:24 PM	0	884.554	-15.114	0.00	26.33	1007.35
12/26/2021	3:01:31 PM	0	9.0312	4.976	12/26/202	2:33:24 PM	0	885.788	-15.045	0.00	26.34	1007.34
12/26/2021	4:01:31 PM	0	9.0378	4.976	12/26/202	3:33:24 PM	0	886.609	-14.611	0.00	26.34	1007.34
12/26/2021	5:01:31 PM	0	9.0446	4.976	12/26/202	4:33:24 PM	0	887.647	-14.25	-0.01	26.34	1007.34
12/26/2021	6:01:31 PM	0	9.0504	4.976	12/26/202	5:33:24 PM	0	888.461	-14.14	-0.01	26.35	1007.33
12/26/2021	7:01:31 PM	0	9.0554	4.976	12/26/202	6:33:24 PM	0	889.089	-14.236	-0.01	26.35	1007.33
12/26/2021	8:01:31 PM	0	9.0597	4.976	12/26/202	7:33:24 PM	0	889.591	-14.418	-0.01	26.35	1007.33
12/26/2021	9:01:31 PM	0	9.064	4.976	12/26/202	8:33:24 PM	0	889.665	-14.508	-0.01	26.35	1007.33
12/26/2021	10:01:31 PM	0	9.0656	4.975	12/26/202	9:33:24 PM	0	889.776	-14.546	-0.01	26.34	1007.34
12/26/2021	11:01:31 PM	0	9.0716	4.976	12/26/202	10:33:24 PM	0	890.43	-14.599	-0.01	26.35	1007.33
12/27/2021	12:01:31 AM	0	9.0724	4.976	12/26/202	11:33:24 PM	0	890.538	-14.672	-0.01	26.35	1007.33
12/27/2021	1:01:31 AM	0	9.0736	4.976	12/27/202	12:33:24 AM	0	890.774	-14.727	-0.01	26.35	1007.33
12/27/2021	2:01:31 AM	0	9.0707	4.976	12/27/202	1:33:24 AM	0	890.14	-14.894	-0.01	26.34	1007.34
12/27/2021	3:01:31 AM	0	9.0691	4.976	12/27/202	2:33:24 AM	0	889.803	-14.891	0.00	26.34	1007.34
12/27/2021	4:01:31 AM	0	9.0653	4.976	12/27/202	3:33:24 AM	0	889.593	-14.898	-0.01	26.34	1007.34
12/27/2021	5:01:31 AM	0	9.0615	4.976	12/27/202	4:33:24 AM	0	889.182	-14.946	-0.01	26.34	1007.34
12/27/2021	6:01:31 AM	0	9.057	4.976	12/27/202	5:33:24 AM	0	888.453	-15.076	0.00	26.34	1007.34
12/27/2021	7:01:31 AM	0	9.0512	4.976	12/27/202	6:33:24 AM	0	887.726	-15.1	0.00	26.34	1007.34
12/27/2021	8:01:31 AM	0	9.0444	4.975	12/27/202	7:33:24 AM	0	887.082	-15.033	0.00	26.34	1007.34
12/27/2021	9:01:31 AM	0	9.0372	4.976	12/27/202	8:33:24 AM	0	885.982	-14.941	0.00	26.33	1007.35
12/27/2021	10:01:31 AM	0	9.0335	4.977	12/27/202	9:33:24 AM	0	885.563	-14.937	0.00	26.33	1007.35
12/27/2021	11:01:31 AM	0	9.0285	4.976	12/27/202	10:33:24 AM	0	885.154	-14.807	0.00	26.33	1007.35
12/27/2021	12:01:31 PM	0	9.019	4.977	12/27/202	11:33:24 AM	0	884.134	-14.481	0.00	26.33	1007.35
12/27/2021	1:01:31 PM	0	9.0131	4.976	12/27/202	12:33:24 PM	0	883.267	-14.115	0.01	26.33	1007.35
12/27/2021	2:01:31 PM	0	9.0104	4.976	12/27/202	1:33:24 PM	0	883.151	-13.559	0.00	26.33	1007.35
12/27/2021	3:01:31 PM	0	9.0059	4.977	12/27/202	2:33:24 PM	0	882.745	-13.08	0.00	26.33	1007.35
12/27/2021	4:01:31 PM	0	9.0046	4.976	12/27/202	3:33:24 PM	0	882.509	-12.766	0.01	26.33	1007.35
12/27/2021	5:01:31 PM	0	9.0044	4.976	12/27/202	4:33:24 PM	0	882.975	-12.66	0.00	26.34	1007.34
12/27/2021	6:01:31 PM	0	9.0063	4.976	12/27/202	5:33:24 PM	0	883.358	-12.667	0.00	26.34	1007.34
12/27/2021	7:01:31 PM	0	9.0095	4.976	12/27/202	6:33:24 PM	0	883.631	-12.8	0.00	26.34	1007.34
12/27/2021	8:01:31 PM	0	9.0117	4.976	12/27/202	7:33:24 PM	0	883.952	-12.951	0.00	26.34	1007.34
12/27/2021	9:01:31 PM	0	9.0188	4.976	12/27/202	8:33:24 PM	0	884.582	-13.189	0.00	26.34	1007.34
12/27/2021	10:01:31 PM	0	9.0208	4.976	12/27/202	9:33:24 PM	0	885.579	-13.384	-0.01	26.35	1007.33
12/27/2021	11:01:31 PM	0	9.0244	4.976	12/27/202	10:33:24 PM	0	885.958	-13.335	-0.01	26.35	1007.33
12/28/2021	12:01:31 AM	0	9.0272	4.976	12/27/202	11:33:24 PM	0	886.392	-13.263	-0.01	26.35	1007.33
12/28/2021	1:01:31 AM	0	9.028	4.976	12/28/202	12:33:24 AM	0	886.454	-13.469	-0.01	26.35	1007.33
12/28/2021	2:01:31 AM	0	9.0251	4.976	12/28/202	1:33:24 AM	0	886.418	-13.47	-0.01	26.35	1007.33
12/28/2021	3:01:31 AM	0	9.0268	4.976	12/28/202	2:33:24 AM	0	886.556	-13.235	-0.01	26.35	1007.33
12/28/2021	4:01:31 AM	0	9.024	4.977	12/28/202	3:33:24 AM	0	886.511	-13.113	-0.02	26.35	1007.33
12/28/2021	5:01:31 AM	0	9.0224	4.976	12/28/202	4:33:24 AM	0	886.115	-13.125	-0.01	26.35	1007.33
12/28/2021	6:01:31 AM	0	9.0213	4.976	12/28/202	5:33:24 AM	0	886.111	-13.034	-0.01	26.35	1007.33
12/28/2021	7:01:31 AM	0	9.0205	4.976	12/28/202	6:33:24 AM	0	885.962	-12.922	-0.01	26.35	1007.33
12/28/2021	8:01:31 AM	0	9.02	4.976	12/28/202	7:33:24 AM	0	885.969	-12.759	-0.01	26.35	1007.33
12/28/2021	9:01:31 AM	0	9.0183	4.976	12/28/202	8:33:24 AM	0	885.434	-12.759	-0.01	26.35	1007.33
12/28/2021	10:01:31 AM	0	9.0174	4.976	12/28/202	9:33:24 AM	0	885.471	-12.777	-0.01	26.35	1007.33
12/28/2021	11:01:31 AM	0	9.0159	4.976	12/28/202	10:33:24 AM	0	885.33	-12.669	-0.01	26.35	1007.33
12/28/2021	12:01:31 PM	0	9.0113	4.976	12/28/202	11:33:24 AM	0	885.277	-12.459	-0.02	26.35	1007.33
12/28/2021	1:01:31 PM	0	9.011	4.977	12/28/202	12:33:24 PM	0	884.991	-12.147	-0.01	26.35	1007.33
12/28/2021	2:01:31 PM	0	9.0122	4.976	12/28/202	1:33:24 PM	0	885.345	-11.844	-0.02	26.35	1007.33
12/28/2021	3:01:31 PM	0	9.0142	4.976	12/28/202	2:33:24 PM	0	885.339	-11.597	-0.01	26.35	1007.33
12/28/2021	4:01:31 PM	0	9.0162	4.976	12/28/202	3:33:24 PM	0	886.23	-11.432	-0.02	26.36	1007.32
12/28/2021	5:01:31 PM	0	9.0189	4.976	12/28/202	4:33:24 PM	0	886.166	-11.492	-0.02	26.35	1007.33
12/28/2021	6:01:31 PM	0	9.0245	4.976	12/28/202	5:33:24 PM	0	887.475	-11.654	-0.03	26.36	1007.32

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/28/2021	7:01:31 PM	0	9.0276	4.976	12/28/202	6:33:24 PM	0	887.96	-12.03	-0.03	26.36	1007.32
12/28/2021	8:01:31 PM	0	9.0326	4.976	12/28/202	7:33:24 PM	0	888.648	-12.444	-0.03	26.37	1007.31
12/28/2021	9:01:31 PM	0	9.0347	4.976	12/28/202	8:33:24 PM	0	888.914	-12.857	-0.03	26.37	1007.31
12/28/2021	10:01:31 PM	0	9.0381	4.976	12/28/202	9:33:24 PM	0	889.546	-13.151	-0.03	26.37	1007.31
12/28/2021	11:01:31 PM	0	9.0392	4.976	12/28/202	10:33:24 PM	0	889.726	-13.411	-0.03	26.37	1007.31
12/29/2021	12:01:31 AM	0	9.0438	4.976	12/28/202	11:33:24 PM	0	890.199	-13.582	-0.03	26.37	1007.31
12/29/2021	1:01:31 AM	0	9.0465	4.976	12/29/202	12:33:24 AM	0	890.658	-13.774	-0.04	26.37	1007.31
12/29/2021	2:01:31 AM	0	9.0484	4.976	12/29/202	1:33:24 AM	0	891.004	-13.904	-0.04	26.37	1007.31
12/29/2021	3:01:31 AM	0	9.0529	4.976	12/29/202	2:33:24 AM	0	891.779	-14.026	-0.04	26.38	1007.30
12/29/2021	4:01:31 AM	0	9.0555	4.977	12/29/202	3:33:24 AM	0	892.049	-14.191	-0.04	26.38	1007.30
12/29/2021	5:01:31 AM	0	9.0572	4.976	12/29/202	4:33:24 AM	0	892.464	-14.249	-0.04	26.38	1007.30
12/29/2021	6:01:31 AM	0	9.0576	4.976	12/29/202	5:33:24 AM	0	892.048	-14.3	-0.04	26.38	1007.30
12/29/2021	7:01:31 AM	0	9.0574	4.977	12/29/202	6:33:24 AM	0	891.971	-14.413	-0.04	26.38	1007.30
12/29/2021	8:01:31 AM	0	9.0579	4.976	12/29/202	7:33:24 AM	0	891.659	-14.351	-0.03	26.37	1007.31
12/29/2021	9:01:31 AM	0	9.0593	4.976	12/29/202	8:33:24 AM	0	891.71	-14.007	-0.03	26.37	1007.31
12/29/2021	10:01:31 AM	0	9.059	4.977	12/29/202	9:33:24 AM	0	891.355	-13.714	-0.03	26.37	1007.31
12/29/2021	11:01:31 AM	0	9.0575	4.976	12/29/202	10:33:24 AM	0	890.757	-13.45	-0.03	26.36	1007.32
12/29/2021	12:01:31 PM	0	9.053	4.976	12/29/202	11:33:24 AM	0	890.804	-13.128	-0.03	26.37	1007.31
12/29/2021	1:01:31 PM	0	9.044	4.976	12/29/202	12:33:24 PM	0	888.618	-12.818	-0.02	26.35	1007.33
12/29/2021	2:01:31 PM	0	9.0344	4.977	12/29/202	1:33:24 PM	0	887.541	-12.468	-0.02	26.35	1007.33
12/29/2021	3:01:31 PM	0	9.0174	4.976	12/29/202	2:33:24 PM	0	885.549	-12.258	-0.01	26.35	1007.33
12/29/2021	4:01:31 PM	0	9.0076	4.976	12/29/202	3:33:24 PM	0	883.543	-12.019	0.00	26.34	1007.34
12/29/2021	5:01:31 PM	0	9.0011	4.976	12/29/202	4:33:24 PM	0	883.079	-11.85	0.00	26.34	1007.34
12/29/2021	6:01:31 PM	0	8.9899	4.976	12/29/202	5:33:24 PM	0	881.846	-11.804	0.00	26.34	1007.34
12/29/2021	7:01:31 PM	0	8.9792	4.977	12/29/202	6:33:24 PM	0	880.424	-11.72	0.00	26.34	1007.34
12/29/2021	8:01:31 PM	0	8.9684	4.976	12/29/202	7:33:24 PM	0	879.121	-11.569	0.00	26.33	1007.35
12/29/2021	9:01:31 PM	0	8.9637	4.976	12/29/202	8:33:24 PM	0	878.652	-11.275	0.00	26.33	1007.35
12/29/2021	10:01:31 PM	0	8.962	4.976	12/29/202	9:33:24 PM	0	878.724	-10.932	0.00	26.34	1007.34
12/29/2021	11:01:31 PM	0	8.9607	4.977	12/29/202	10:33:24 PM	0	878.632	-10.634	0.00	26.34	1007.34
12/30/2021	12:01:31 AM	0	8.9598	4.977	12/29/202	11:33:24 PM	0	878.803	-10.397	0.00	26.34	1007.34
12/30/2021	1:01:31 AM	0	8.9597	4.977	12/30/202	12:33:24 AM	0	878.931	-10.247	0.00	26.34	1007.34
12/30/2021	2:01:31 AM	0	8.9598	4.976	12/30/202	1:33:24 AM	0	879.192	-10.12	-0.01	26.34	1007.34
12/30/2021	3:01:31 AM	0	8.9636	4.977	12/30/202	2:33:24 AM	0	879.531	-10.057	-0.01	26.34	1007.34
12/30/2021	4:01:31 AM	0	8.9672	4.976	12/30/202	3:33:24 AM	0	880.273	-9.993	-0.01	26.35	1007.33
12/30/2021	5:01:31 AM	0	8.9684	4.977	12/30/202	4:33:24 AM	0	880.67	-9.945	-0.01	26.35	1007.33
12/30/2021	6:01:31 AM	0	8.9714	4.976	12/30/202	5:33:24 AM	0	881.172	-10.064	-0.01	26.35	1007.33
12/30/2021	7:01:31 AM	0	8.9769	4.976	12/30/202	6:33:24 AM	0	881.708	-10.262	-0.01	26.35	1007.33
12/30/2021	8:01:31 AM	0	8.9817	4.976	12/30/202	7:33:24 AM	0	882.495	-10.516	-0.02	26.35	1007.33
12/30/2021	9:01:31 AM	0	8.9857	4.976	12/30/202	8:33:24 AM	0	883.176	-10.68	-0.02	26.36	1007.32
12/30/2021	10:01:31 AM	0	8.9918	4.976	12/30/202	9:33:24 AM	0	883.888	-10.913	-0.02	26.36	1007.32
12/30/2021	11:01:31 AM	0	8.9955	4.976	12/30/202	10:33:24 AM	0	884.57	-10.988	-0.02	26.36	1007.32
12/30/2021	12:01:31 PM	0	8.9971	4.976	12/30/202	11:33:24 AM	0	884.954	-10.902	-0.03	26.36	1007.32
12/30/2021	1:01:31 PM	0	8.9966	4.976	12/30/202	12:33:24 PM	0	884.878	-10.755	-0.03	26.36	1007.32
12/30/2021	2:01:31 PM	0	8.9996	4.976	12/30/202	1:33:24 PM	0	885.364	-10.475	-0.03	26.37	1007.31
12/30/2021	3:01:31 PM	0	9.001	4.976	12/30/202	2:33:24 PM	0	885.566	-10.285	-0.03	26.37	1007.31
12/30/2021	4:01:31 PM	0	9.0037	4.976	12/30/202	3:33:24 PM	0	885.927	-10.101	-0.03	26.37	1007.31
12/30/2021	5:01:31 PM	0	9.0077	4.976	12/30/202	4:33:24 PM	0	886.615	-10.068	-0.03	26.37	1007.31
12/30/2021	6:01:31 PM	0	9.0108	4.976	12/30/202	5:33:24 PM	0	887.006	-10.279	-0.03	26.37	1007.31
12/30/2021	7:01:31 PM	0	9.0126	4.976	12/30/202	6:33:24 PM	0	887.129	-10.495	-0.03	26.37	1007.31
12/30/2021	8:01:31 PM	0	9.0151	4.976	12/30/202	7:33:24 PM	0	887.401	-10.475	-0.03	26.37	1007.31
12/30/2021	9:01:31 PM	0	9.0195	4.977	12/30/202	8:33:24 PM	0	888.093	-10.435	-0.04	26.37	1007.31
12/30/2021	10:01:31 PM	0	9.021	4.977	12/30/202	9:33:24 PM	0	888.213	-10.411	-0.04	26.37	1007.31
12/30/2021	11:01:31 PM	0	9.0229	4.977	12/30/202	10:33:24 PM	0	888.178	-10.408	-0.03	26.37	1007.31
12/31/2021	12:01:31 AM	0	9.0257	4.976	12/30/202	11:33:24 PM	0	888.556	-10.581	-0.04	26.37	1007.31
12/31/2021	1:01:31 AM	0	9.0293	4.976	12/31/202	12:33:24 AM	0	888.967	-10.77	-0.04	26.37	1007.31
12/31/2021	2:01:31 AM	0	9.0327	4.976	12/31/202	1:33:24 AM	0	889.216	-10.948	-0.03	26.37	1007.31
12/31/2021	3:01:31 AM	0	9.038	4.977	12/31/202	2:33:24 AM	0	889.962	-11.127	-0.04	26.37	1007.31
12/31/2021	4:01:31 AM	0	9.0413	4.976	12/31/202	3:33:24 AM	0	890.565	-11.391	-0.04	26.38	1007.30
12/31/2021	5:01:31 AM	0	9.0448	4.976	12/31/202	4:33:24 AM	0	890.628	-11.54	-0.04	26.37	1007.31
12/31/2021	6:01:31 AM	0	9.0484	4.976	12/31/202	5:33:24 AM	0	891.024	-11.614	-0.04	26.37	1007.31
12/31/2021	7:01:31 AM	0	9.0527	4.977	12/31/202	6:33:24 AM	0	891.782	-11.703	-0.04	26.38	1007.30
12/31/2021	8:01:31 AM	0	9.0577	4.976	12/31/202	7:33:24 AM	0	892.25	-11.778	-0.04	26.38	1007.30
12/31/2021	9:01:31 AM	0	9.0627	4.977	12/31/202	8:33:24 AM	0	893.04	-11.811	-0.04	26.38	1007.30
12/31/2021	10:01:31 AM	0	9.0664	4.976	12/31/202	9:33:24 AM	0	893.3	-11.946	-0.04	26.38	1007.30
12/31/2021	11:01:31 AM	0	9.071	4.977	12/31/202	10:33:24 AM	0	893.632	-11.943	-0.04	26.38	1007.30
12/31/2021	12:01:31 PM	0	9.0739	4.977	12/31/202	11:33:24 AM	0	894.153	-11.841	-0.04	26.38	1007.30
12/31/2021	1:01:31 PM	0	9.0745	4.976	12/31/202	12:33:24 PM	0	894.042	-11.369	-0.04	26.38	1007.30
12/31/2021	2:01:31 PM	0	9.0735	4.977	12/31/202	1:33:24 PM	0	893.63	-10.966	-0.04	26.38	1007.30
12/31/2021	3:01:31 PM	0	9.0744	4.976	12/31/202	2:33:24 PM	0	893.888	-10.597	-0.04	26.38	1007.30
12/31/2021	4:01:31 PM	0	9.0758	4.977	12/31/202	3:33:24 PM	0	893.661	-10.333	-0.04	26.37	1007.31

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
12/31/2021	5:01:31 PM	0	9.077	4.976	12/31/202	4:33:24 PM	0	893.943	-10.14	-0.04	26.38	1007.30
12/31/2021	6:01:31 PM	0	9.0796	4.976	12/31/202	5:33:24 PM	0	894.495	-10.218	-0.04	26.38	1007.30
12/31/2021	7:01:31 PM	0	9.0798	4.976	12/31/202	6:33:24 PM	0	893.798	-10.33	-0.03	26.37	1007.31
12/31/2021	8:01:31 PM	0	9.0808	4.976	12/31/202	7:33:24 PM	0	893.986	-10.254	-0.04	26.37	1007.31
12/31/2021	9:01:31 PM	0	9.0813	4.977	12/31/202	8:33:24 PM	0	893.862	-10.165	-0.03	26.37	1007.31
12/31/2021	10:01:31 PM	0	9.0813	4.977	12/31/202	9:33:24 PM	0	893.678	-10.041	-0.03	26.37	1007.31
12/31/2021	11:01:31 PM	0	9.0802	4.976	12/31/202	10:33:24 PM	0	893.482	-9.912	-0.03	26.37	1007.31
2/23/2022	5:00:00 PM	0	9.1758	4.956	2/23/2022	5:00:00 PM	0	899.726	-4.105	0.00	26.58	1007.10
2/23/2022	6:00:00 PM	0	9.1757	4.973	2/23/2022	6:00:00 PM	0	899.924	-4.384	0.00	26.58	1007.10
2/23/2022	7:00:00 PM	0	9.1784	4.976	2/23/2022	7:00:00 PM	0	900.345	-4.66	0.00	26.58	1007.10
2/23/2022	8:00:00 PM	0	9.1797	4.977	2/23/2022	8:00:00 PM	0	900.578	-5.072	0.00	26.58	1007.10
2/23/2022	9:00:00 PM	0	9.1825	4.978	2/23/2022	9:00:00 PM	0	900.908	-5.687	0.00	26.58	1007.10
2/23/2022	10:00:00 PM	0	9.1866	4.978	2/23/2022	10:00:00 PM	0	901.411	-6.309	-0.01	26.58	1007.10
2/23/2022	11:00:00 PM	0	9.1867	4.978	2/23/2022	11:00:00 PM	0	901.415	-6.844	-0.01	26.58	1007.10
2/24/2022	12:00:00 AM	0	9.1911	4.979	2/24/2022	12:00:00 AM	0	901.986	-7.277	-0.01	26.58	1007.10
2/24/2022	1:00:00 AM	0	9.1957	4.978	2/24/2022	1:00:00 AM	0	902.674	-7.668	-0.01	26.59	1007.09
2/24/2022	2:00:00 AM	0	9.1991	4.978	2/24/2022	2:00:00 AM	0	903.16	-7.975	-0.01	26.59	1007.09
2/24/2022	3:00:00 AM	0	9.1999	4.979	2/24/2022	3:00:00 AM	0	903.375	-8.217	-0.01	26.59	1007.09
2/24/2022	4:00:00 AM	0	9.2023	4.979	2/24/2022	4:00:00 AM	0	903.899	-8.474	-0.01	26.59	1007.09
2/24/2022	5:00:00 AM	0	9.2023	4.979	2/24/2022	5:00:00 AM	0	903.967	-8.741	-0.02	26.59	1007.09
2/24/2022	6:00:00 AM	0	9.203	4.979	2/24/2022	6:00:00 AM	0	904.162	-8.938	-0.02	26.59	1007.09
2/24/2022	7:00:00 AM	0	9.2024	4.979	2/24/2022	7:00:00 AM	0	904.214	-9.18	-0.02	26.60	1007.08
2/24/2022	8:00:00 AM	0	9.205	4.979	2/24/2022	8:00:00 AM	0	904.868	-9.314	-0.02	26.60	1007.08
2/24/2022	9:00:00 AM	0	9.2084	4.979	2/24/2022	9:00:00 AM	0	905.512	-8.948	-0.03	26.60	1007.08
2/24/2022	10:00:00 AM	0	9.2099	4.979	2/24/2022	10:00:00 AM	0	906.148	-7.613	-0.03	26.61	1007.07
2/24/2022	11:00:00 AM	0	9.2095	4.979	2/24/2022	11:00:00 AM	0	906.326	-6.462	-0.03	26.61	1007.07
2/24/2022	12:00:00 PM	0	9.2078	4.978	2/24/2022	12:00:00 PM	0	906.143	-6.564	-0.03	26.61	1007.07
2/24/2022	1:00:00 PM	0	9.2046	4.979	2/24/2022	1:00:00 PM	0	905.739	-6.32	-0.03	26.61	1007.07
2/24/2022	2:00:00 PM	0	9.201	4.978	2/24/2022	2:00:00 PM	0	905.457	-6.154	-0.03	26.61	1007.07
2/24/2022	3:00:00 PM	0	9.1975	4.979	2/24/2022	3:00:00 PM	0	905.102	-5.777	-0.03	26.61	1007.07
2/24/2022	4:00:00 PM	0	9.1942	4.979	2/24/2022	4:00:00 PM	0	904.729	-5.754	-0.03	26.61	1007.07
2/24/2022	5:00:00 PM	0	9.1913	4.979	2/24/2022	5:00:00 PM	0	904.371	-6.054	-0.03	26.61	1007.07
2/24/2022	6:00:00 PM	0	9.1903	4.979	2/24/2022	6:00:00 PM	0	904.326	-6.537	-0.03	26.61	1007.07
2/24/2022	7:00:00 PM	0	9.191	4.979	2/24/2022	7:00:00 PM	0	904.419	-7.12	-0.03	26.61	1007.07
2/24/2022	8:00:00 PM	0	9.1885	4.979	2/24/2022	8:00:00 PM	0	904.042	-7.603	-0.03	26.61	1007.07
2/24/2022	9:00:00 PM	0	9.1881	4.979	2/24/2022	9:00:00 PM	0	904.063	-7.964	-0.03	26.61	1007.07
2/24/2022	10:00:00 PM	0	9.1878	4.979	2/24/2022	10:00:00 PM	0	904.157	-8.255	-0.03	26.61	1007.07
2/24/2022	11:00:00 PM	0	9.1882	4.979	2/24/2022	11:00:00 PM	0	903.899	-8.366	-0.03	26.61	1007.07
2/25/2022	12:00:00 AM	0	9.1874	4.979	2/25/2022	12:00:00 AM	0	903.856	-8.345	-0.03	26.61	1007.07
2/25/2022	1:00:00 AM	0	9.1869	4.979	2/25/2022	1:00:00 AM	0	903.907	-8.385	-0.03	26.61	1007.07
2/25/2022	2:00:00 AM	0	9.1868	4.979	2/25/2022	2:00:00 AM	0	904.026	-8.377	-0.03	26.61	1007.07
2/25/2022	3:00:00 AM	0	9.1845	4.978	2/25/2022	3:00:00 AM	0	903.636	-8.521	-0.03	26.61	1007.07
2/25/2022	4:00:00 AM	0	9.1834	4.979	2/25/2022	4:00:00 AM	0	903.654	-8.619	-0.03	26.61	1007.07
2/25/2022	5:00:00 AM	0	9.1829	4.979	2/25/2022	5:00:00 AM	0	903.614	-8.683	-0.03	26.61	1007.07
2/25/2022	6:00:00 AM	0	9.1827	4.979	2/25/2022	6:00:00 AM	0	903.841	-8.639	-0.03	26.61	1007.07
2/25/2022	7:00:00 AM	0	9.1833	4.979	2/25/2022	7:00:00 AM	0	904.137	-8.445	-0.04	26.61	1007.07
2/25/2022	8:00:00 AM	0	9.1834	4.979	2/25/2022	8:00:00 AM	0	904.343	-8.346	-0.04	26.62	1007.06
2/25/2022	9:00:00 AM	0	9.1833	4.978	2/25/2022	9:00:00 AM	0	904.544	-7.999	-0.04	26.62	1007.06
2/25/2022	10:00:00 AM	0	9.1821	4.978	2/25/2022	10:00:00 AM	0	904.655	-6.728	-0.04	26.62	1007.06
2/25/2022	11:00:00 AM	0	9.181	4.978	2/25/2022	11:00:00 AM	0	904.834	-5.793	-0.05	26.62	1007.06
2/25/2022	12:00:00 PM	0	9.1784	4.978	2/25/2022	12:00:00 PM	0	904.433	-5.767	-0.04	26.62	1007.06
2/25/2022	1:00:00 PM	0	9.1743	4.979	2/25/2022	1:00:00 PM	0	903.671	-5.456	-0.04	26.62	1007.06
2/25/2022	2:00:00 PM	0	9.1715	4.979	2/25/2022	2:00:00 PM	0	903.503	-5.158	-0.04	26.62	1007.06
2/25/2022	3:00:00 PM	0	9.1691	4.979	2/25/2022	3:00:00 PM	0	903.231	-4.774	-0.04	26.62	1007.06
2/25/2022	4:00:00 PM	0	9.1673	4.979	2/25/2022	4:00:00 PM	0	903.247	-4.68	-0.04	26.62	1007.06
2/25/2022	5:00:00 PM	0	9.1656	4.979	2/25/2022	5:00:00 PM	0	902.922	-4.724	-0.04	26.62	1007.06
2/25/2022	6:00:00 PM	0	9.1634	4.979	2/25/2022	6:00:00 PM	0	902.662	-4.948	-0.04	26.62	1007.06
2/25/2022	7:00:00 PM	0	9.1613	4.979	2/25/2022	7:00:00 PM	0	902.365	-5.169	-0.04	26.62	1007.06
2/25/2022	8:00:00 PM	0	9.1581	4.978	2/25/2022	8:00:00 PM	0	901.958	-5.162	-0.04	26.62	1007.06
2/25/2022	9:00:00 PM	0	9.1553	4.978	2/25/2022	9:00:00 PM	0	901.52	-5.244	-0.04	26.61	1007.07
2/25/2022	10:00:00 PM	0	9.1517	4.979	2/25/2022	10:00:00 PM	0	901.009	-5.349	-0.04	26.61	1007.07
2/25/2022	11:00:00 PM	0	9.1496	4.978	2/25/2022	11:00:00 PM	0	900.919	-5.38	-0.04	26.61	1007.07
2/26/2022	12:00:00 AM	0	9.1465	4.978	2/26/2022	12:00:00 AM	0	900.445	-5.417	-0.04	26.61	1007.07
2/26/2022	1:00:00 AM	0	9.1438	4.979	2/26/2022	1:00:00 AM	0	900.099	-5.457	-0.03	26.61	1007.07
2/26/2022	2:00:00 AM	0	9.1388	4.978	2/26/2022	2:00:00 AM	0	899.291	-5.497	-0.03	26.61	1007.07
2/26/2022	3:00:00 AM	0	9.1361	4.979	2/26/2022	3:00:00 AM	0	898.927	-5.543	-0.03	26.61	1007.07
2/26/2022	4:00:00 AM	0	9.1315	4.979	2/26/2022	4:00:00 AM	0	898.365	-5.55	-0.03	26.61	1007.07
2/26/2022	5:00:00 AM	0	9.1286	4.978	2/26/2022	5:00:00 AM	0	897.944	-5.532	-0.03	26.60	1007.08
2/26/2022	6:00:00 AM	0	9.1251	4.979	2/26/2022	6:00:00 AM	0	897.626	-5.446	-0.03	26.61	1007.07
2/26/2022	7:00:00 AM	0	9.1212	4.979	2/26/2022	7:00:00 AM	0	897.177	-5.437	-0.03	26.60	1007.08

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
2/26/2022	8:00:00 AM	0	9.1187	4.978	2/26/2022	8:00:00 AM	0	897.094	-5.295	-0.03	26.61	1007.07
2/26/2022	9:00:00 AM	0	9.1154	4.979	2/26/2022	9:00:00 AM	0	896.649	-5.046	-0.03	26.60	1007.08
2/26/2022	10:00:00 AM	0	9.1123	4.978	2/26/2022	10:00:00 AM	0	896.352	-4.666	-0.03	26.60	1007.08
2/26/2022	11:00:00 AM	0	9.1088	4.979	2/26/2022	11:00:00 AM	0	895.942	-4.325	-0.03	26.60	1007.08
2/26/2022	12:00:00 PM	0	9.1054	4.979	2/26/2022	12:00:00 PM	0	895.585	-3.966	-0.03	26.60	1007.08
2/26/2022	1:00:00 PM	0	9.1017	4.978	2/26/2022	1:00:00 PM	0	895.156	-3.665	-0.03	26.60	1007.08
2/26/2022	2:00:00 PM	0	9.0985	4.978	2/26/2022	2:00:00 PM	0	895.006	-3.475	-0.03	26.61	1007.07
2/26/2022	3:00:00 PM	0	9.0967	4.978	2/26/2022	3:00:00 PM	0	895.035	-3.31	-0.03	26.61	1007.07
2/26/2022	4:00:00 PM	0	9.0962	4.979	2/26/2022	4:00:00 PM	0	895.072	-3.138	-0.03	26.61	1007.07
2/26/2022	5:00:00 PM	0	9.0922	4.978	2/26/2022	5:00:00 PM	0	894.546	-2.979	-0.03	26.61	1007.07
2/26/2022	6:00:00 PM	0	9.0883	4.979	2/26/2022	6:00:00 PM	0	894.118	-2.917	-0.03	26.61	1007.07
2/26/2022	7:00:00 PM	0	9.0867	4.979	2/26/2022	7:00:00 PM	0	894.224	-2.917	-0.03	26.61	1007.07
2/26/2022	8:00:00 PM	0	9.0878	4.979	2/26/2022	8:00:00 PM	0	894.644	-2.904	-0.04	26.61	1007.07
2/26/2022	9:00:00 PM	0	9.0853	4.978	2/26/2022	9:00:00 PM	0	894.37	-2.88	-0.03	26.61	1007.07
2/26/2022	10:00:00 PM	0	9.0835	4.978	2/26/2022	10:00:00 PM	0	894.094	-2.839	-0.03	26.61	1007.07
2/26/2022	11:00:00 PM	0	9.0793	4.978	2/26/2022	11:00:00 PM	0	893.485	-2.798	-0.03	26.61	1007.07
2/27/2022	12:00:00 AM	0	9.0768	4.979	2/27/2022	12:00:00 AM	0	893.312	-2.775	-0.03	26.61	1007.07
2/27/2022	1:00:00 AM	0	9.0734	4.979	2/27/2022	1:00:00 AM	0	892.87	-2.802	-0.03	26.61	1007.07
2/27/2022	2:00:00 AM	0	9.0698	4.978	2/27/2022	2:00:00 AM	0	892.253	-2.828	-0.03	26.61	1007.07
2/27/2022	3:00:00 AM	0	9.066	4.978	2/27/2022	3:00:00 AM	0	891.873	-2.841	-0.03	26.61	1007.07
2/27/2022	4:00:00 AM	0	9.0623	4.978	2/27/2022	4:00:00 AM	0	891.337	-2.829	-0.03	26.60	1007.08
2/27/2022	5:00:00 AM	0	9.0604	4.978	2/27/2022	5:00:00 AM	0	891.323	-2.78	-0.03	26.61	1007.07
2/27/2022	6:00:00 AM	0	9.0578	4.979	2/27/2022	6:00:00 AM	0	891.14	-2.739	-0.03	26.61	1007.07
2/27/2022	7:00:00 AM	0	9.0561	4.978	2/27/2022	7:00:00 AM	0	890.986	-2.705	-0.03	26.61	1007.07
2/27/2022	8:00:00 AM	0	9.0556	4.978	2/27/2022	8:00:00 AM	0	891.189	-2.679	-0.03	26.61	1007.07
2/27/2022	9:00:00 AM	0	9.0565	4.978	2/27/2022	9:00:00 AM	0	891.812	-2.483	-0.04	26.61	1007.07
2/27/2022	10:00:00 AM	0	9.0566	4.978	2/27/2022	10:00:00 AM	0	892.086	-1.973	-0.04	26.62	1007.06
2/27/2022	11:00:00 AM	0	9.0574	4.978	2/27/2022	11:00:00 AM	0	892.576	-1.47	-0.04	26.62	1007.06
2/27/2022	12:00:00 PM	0	9.0607	4.978	2/27/2022	12:00:00 PM	0	893.504	-1.14	-0.05	26.63	1007.05
2/27/2022	1:00:00 PM	0	9.0624	4.978	2/27/2022	1:00:00 PM	0	894.103	-0.878	-0.05	26.63	1007.05
2/27/2022	2:00:00 PM	0	9.0622	4.978	2/27/2022	2:00:00 PM	0	894.282	-0.638	-0.06	26.63	1007.05
2/27/2022	3:00:00 PM	0	9.0623	4.979	2/27/2022	3:00:00 PM	0	894.615	-0.543	-0.06	26.64	1007.04
2/27/2022	4:00:00 PM	0	9.0626	4.978	2/27/2022	4:00:00 PM	0	894.927	-0.524	-0.06	26.64	1007.04
2/27/2022	5:00:00 PM	0	9.063	4.978	2/27/2022	5:00:00 PM	0	895.244	-0.541	-0.07	26.64	1007.04
2/27/2022	6:00:00 PM	0	9.0615	4.978	2/27/2022	6:00:00 PM	0	895.12	-0.562	-0.07	26.64	1007.04
2/27/2022	7:00:00 PM	0	9.0588	4.978	2/27/2022	7:00:00 PM	0	894.75	-0.583	-0.07	26.64	1007.04
2/27/2022	8:00:00 PM	0	9.0567	4.978	2/27/2022	8:00:00 PM	0	894.492	-0.614	-0.06	26.64	1007.04
2/27/2022	9:00:00 PM	0	9.0541	4.979	2/27/2022	9:00:00 PM	0	894.031	-0.695	-0.06	26.64	1007.04
2/27/2022	10:00:00 PM	0	9.05	4.978	2/27/2022	10:00:00 PM	0	893.376	-0.855	-0.06	26.64	1007.04
2/27/2022	11:00:00 PM	0	9.0464	4.978	2/27/2022	11:00:00 PM	0	892.87	-1.073	-0.06	26.64	1007.04
2/28/2022	12:00:00 AM	0	9.0438	4.978	2/28/2022	12:00:00 AM	0	892.547	-1.194	-0.06	26.63	1007.05
2/28/2022	1:00:00 AM	0	9.0393	4.979	2/28/2022	1:00:00 AM	0	891.555	-1.235	-0.05	26.63	1007.05
2/28/2022	2:00:00 AM	0	9.0328	4.978	2/28/2022	2:00:00 AM	0	890.332	-1.273	-0.05	26.62	1007.06
2/28/2022	3:00:00 AM	0	9.0281	4.978	2/28/2022	3:00:00 AM	0	889.617	-1.309	-0.04	26.62	1007.06
2/28/2022	4:00:00 AM	0	9.0246	4.978	2/28/2022	4:00:00 AM	0	889.15	-1.333	-0.04	26.62	1007.06
2/28/2022	5:00:00 AM	0	9.0223	4.979	2/28/2022	5:00:00 AM	0	888.974	-1.361	-0.04	26.62	1007.06
2/28/2022	6:00:00 AM	0	9.019	4.978	2/28/2022	6:00:00 AM	0	888.585	-1.397	-0.04	26.62	1007.06
2/28/2022	7:00:00 AM	0	9.0166	4.978	2/28/2022	7:00:00 AM	0	888.45	-1.488	-0.04	26.62	1007.06
2/28/2022	8:00:00 AM	0	9.0158	4.979	2/28/2022	8:00:00 AM	0	888.619	-1.524	-0.05	26.62	1007.06
2/28/2022	9:00:00 AM	0	9.0151	4.978	2/28/2022	9:00:00 AM	0	888.884	-1.387	-0.05	26.63	1007.05
2/28/2022	10:00:00 AM	0	9.0138	4.979	2/28/2022	10:00:00 AM	0	888.991	-0.82	-0.05	26.63	1007.05
2/28/2022	11:00:00 AM	0	9.013	4.978	2/28/2022	11:00:00 AM	0	889.181	-0.567	-0.05	26.63	1007.05
2/28/2022	12:00:00 PM	0	9.0116	4.978	2/28/2022	12:00:00 PM	0	888.91	4.899	-0.05	26.63	1007.05
2/28/2022	1:00:00 PM	0	9.0638	4.774	2/28/2022	1:00:00 PM	0	888.916	0.061	0.00	26.58	1007.10
2/28/2022	2:00:00 PM	0	9.064	4.972	2/28/2022	2:00:00 PM	0	888.893	-0.334	0.00	26.58	1007.10
2/28/2022	3:00:00 PM	0	9.0678	4.979	2/28/2022	3:00:00 PM	0	889.403	-0.365	0.00	26.58	1007.10
2/28/2022	4:00:00 PM	0	9.0718	4.98	2/28/2022	4:00:00 PM	0	889.757	-0.397	0.00	26.58	1007.10
2/28/2022	5:00:00 PM	0	9.0699	4.98	2/28/2022	5:00:00 PM	0	889.659	-0.438	0.00	26.58	1007.10
2/28/2022	6:00:00 PM	0	9.0704	4.98	2/28/2022	6:00:00 PM	0	889.703	-0.47	0.00	26.58	1007.10
2/28/2022	7:00:00 PM	0	9.0693	4.98	2/28/2022	7:00:00 PM	0	889.613	-0.51	0.00	26.58	1007.10
2/28/2022	8:00:00 PM	0	9.0678	4.98	2/28/2022	8:00:00 PM	0	889.467	-0.538	0.00	26.58	1007.10
2/28/2022	9:00:00 PM	0	9.0673	4.981	2/28/2022	9:00:00 PM	0	889.451	-0.542	0.00	26.58	1007.10
2/28/2022	10:00:00 PM	0	9.0721	4.98	2/28/2022	10:00:00 PM	0	890.011	-0.551	0.00	26.58	1007.10
2/28/2022	11:00:00 PM	0	9.0699	4.981	2/28/2022	11:00:00 PM	0	889.723	-0.552	0.00	26.58	1007.10
3/1/2022	12:00:00 AM	0	9.0739	4.981	3/1/2022	12:00:00 AM	0	890.269	-0.552	0.00	26.58	1007.10
3/1/2022	1:00:00 AM	0	9.0717	4.981	3/1/2022	1:00:00 AM	0	890.06	-0.541	0.00	26.58	1007.10
3/1/2022	2:00:00 AM	0	9.0732	4.981	3/1/2022	2:00:00 AM	0	890.219	-0.549	0.00	26.58	1007.10
3/1/2022	3:00:00 AM	0	9.0705	4.981	3/1/2022	3:00:00 AM	0	889.953	-0.548	0.00	26.58	1007.10
3/1/2022	4:00:00 AM	0	9.0728	4.981	3/1/2022	4:00:00 AM	0	890.269	-0.537	-0.01	26.58	1007.10
3/1/2022	5:00:00 AM	0	9.0667	4.981	3/1/2022	5:00:00 AM	0	889.573	-0.544	0.00	26.58	1007.10

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/1/2022	6:00:00 AM	0	9.0699	4.981	3/1/2022	6:00:00 AM	0	889.993	-0.577	-0.01	26.58	1007.10
3/1/2022	7:00:00 AM	0	9.0723	4.981	3/1/2022	7:00:00 AM	0	890.232	-0.588	-0.01	26.58	1007.10
3/1/2022	8:00:00 AM	0	9.0781	4.981	3/1/2022	8:00:00 AM	0	890.919	-0.588	-0.01	26.58	1007.10
3/1/2022	9:00:00 AM	0	9.0803	4.981	3/1/2022	9:00:00 AM	0	891.203	-0.545	-0.01	26.58	1007.10
3/1/2022	10:00:00 AM	0	9.0833	4.981	3/1/2022	10:00:00 AM	0	891.664	-0.357	-0.01	26.59	1007.09
3/1/2022	11:00:00 AM	0	9.0864	4.981	3/1/2022	11:00:00 AM	0	892.054	-0.305	-0.01	26.59	1007.09
3/1/2022	12:00:00 PM	0	9.087	4.981	3/1/2022	12:00:00 PM	0	892.11	-0.381	-0.01	26.59	1007.09
3/1/2022	1:00:00 PM	0	9.0854	4.98	3/1/2022	1:00:00 PM	0	891.967	-0.274	-0.01	26.59	1007.09
3/1/2022	2:00:00 PM	0	9.0874	4.98	3/1/2022	2:00:00 PM	0	892.246	-0.217	-0.01	26.59	1007.09
3/1/2022	3:00:00 PM	0	9.0891	4.981	3/1/2022	3:00:00 PM	0	892.512	-0.138	-0.01	26.59	1007.09
3/1/2022	4:00:00 PM	0	9.0883	4.98	3/1/2022	4:00:00 PM	0	892.437	-0.169	-0.01	26.59	1007.09
3/1/2022	5:00:00 PM	0	9.09	4.981	3/1/2022	5:00:00 PM	0	892.715	-0.219	-0.01	26.59	1007.09
3/1/2022	6:00:00 PM	0	9.0902	4.98	3/1/2022	6:00:00 PM	0	892.7	-0.341	-0.01	26.59	1007.09
3/1/2022	7:00:00 PM	0	9.0942	4.98	3/1/2022	7:00:00 PM	0	893.201	-0.477	-0.01	26.59	1007.09
3/1/2022	8:00:00 PM	0	9.0949	4.98	3/1/2022	8:00:00 PM	0	893.304	-0.531	-0.01	26.59	1007.09
3/1/2022	9:00:00 PM	0	9.0962	4.981	3/1/2022	9:00:00 PM	0	893.539	-0.595	-0.02	26.59	1007.09
3/1/2022	10:00:00 PM	0	9.0983	4.98	3/1/2022	10:00:00 PM	0	893.863	-0.567	-0.02	26.59	1007.09
3/1/2022	11:00:00 PM	0	9.101	4.98	3/1/2022	11:00:00 PM	0	894.225	-0.525	-0.02	26.59	1007.09
3/2/2022	12:00:00 AM	0	9.1002	4.98	3/2/2022	12:00:00 AM	0	894.23	-0.486	-0.02	26.60	1007.08
3/2/2022	1:00:00 AM	0	9.1014	4.98	3/2/2022	1:00:00 AM	0	894.464	-0.499	-0.02	26.60	1007.08
3/2/2022	2:00:00 AM	0	9.1034	4.98	3/2/2022	2:00:00 AM	0	894.692	-0.525	-0.02	26.60	1007.08
3/2/2022	3:00:00 AM	0	9.1032	4.98	3/2/2022	3:00:00 AM	0	894.772	-0.549	-0.02	26.60	1007.08
3/2/2022	4:00:00 AM	0	9.1001	4.98	3/2/2022	4:00:00 AM	0	894.394	-0.551	-0.02	26.60	1007.08
3/2/2022	5:00:00 AM	0	9.1035	4.98	3/2/2022	5:00:00 AM	0	894.888	-0.542	-0.02	26.60	1007.08
3/2/2022	6:00:00 AM	0	9.1033	4.98	3/2/2022	6:00:00 AM	0	894.906	-0.542	-0.02	26.60	1007.08
3/2/2022	7:00:00 AM	0	9.1052	4.98	3/2/2022	7:00:00 AM	0	895.218	-0.585	-0.02	26.60	1007.08
3/2/2022	8:00:00 AM	0	9.1064	4.98	3/2/2022	8:00:00 AM	0	895.495	-0.553	-0.03	26.60	1007.08
3/2/2022	9:00:00 AM	0	9.1079	4.98	3/2/2022	9:00:00 AM	0	895.805	-0.364	-0.03	26.60	1007.08
3/2/2022	10:00:00 AM	0	9.1082	4.98	3/2/2022	10:00:00 AM	0	895.983	0.183	-0.03	26.61	1007.07
3/2/2022	11:00:00 AM	0	9.1065	4.98	3/2/2022	11:00:00 AM	0	895.923	0.329	-0.03	26.61	1007.07
3/2/2022	12:00:00 PM	0	9.1056	4.98	3/2/2022	12:00:00 PM	0	895.796	0.046	-0.03	26.61	1007.07
3/2/2022	1:00:00 PM	0	9.102	4.98	3/2/2022	1:00:00 PM	0	895.383	0.326	-0.03	26.61	1007.07
3/2/2022	2:00:00 PM	0	9.0982	4.98	3/2/2022	2:00:00 PM	0	894.969	0.339	-0.03	26.60	1007.08
3/2/2022	3:00:00 PM	0	9.0962	4.98	3/2/2022	3:00:00 PM	0	894.795	0.254	-0.03	26.61	1007.07
3/2/2022	4:00:00 PM	0	9.0955	4.98	3/2/2022	4:00:00 PM	0	894.733	0.039	-0.03	26.61	1007.07
3/2/2022	5:00:00 PM	0	9.0943	4.98	3/2/2022	5:00:00 PM	0	894.663	-0.088	-0.03	26.61	1007.07
3/2/2022	6:00:00 PM	0	9.093	4.98	3/2/2022	6:00:00 PM	0	894.588	-0.299	-0.03	26.61	1007.07
3/2/2022	7:00:00 PM	0	9.0943	4.98	3/2/2022	7:00:00 PM	0	894.908	-0.41	-0.03	26.61	1007.07
3/2/2022	8:00:00 PM	0	9.0961	4.98	3/2/2022	8:00:00 PM	0	895.199	-0.597	-0.03	26.61	1007.07
3/2/2022	9:00:00 PM	0	9.0975	4.98	3/2/2022	9:00:00 PM	0	895.435	-0.792	-0.03	26.61	1007.07
3/2/2022	10:00:00 PM	0	9.099	4.98	3/2/2022	10:00:00 PM	0	895.72	-0.845	-0.03	26.61	1007.07
3/2/2022	11:00:00 PM	0	9.0983	4.98	3/2/2022	11:00:00 PM	0	895.787	-0.814	-0.04	26.61	1007.07
3/3/2022	12:00:00 AM	0	9.099	4.98	3/3/2022	12:00:00 AM	0	895.997	-0.771	-0.04	26.61	1007.07
3/3/2022	1:00:00 AM	0	9.0988	4.979	3/3/2022	1:00:00 AM	0	896.088	-0.838	-0.04	26.62	1007.06
3/3/2022	2:00:00 AM	0	9.0981	4.979	3/3/2022	2:00:00 AM	0	896.068	-0.957	-0.04	26.62	1007.06
3/3/2022	3:00:00 AM	0	9.0963	4.979	3/3/2022	3:00:00 AM	0	895.798	-1.189	-0.04	26.62	1007.06
3/3/2022	4:00:00 AM	0	9.095	4.98	3/3/2022	4:00:00 AM	0	895.733	-1.569	-0.04	26.62	1007.06
3/3/2022	5:00:00 AM	0	9.0956	4.98	3/3/2022	5:00:00 AM	0	895.827	-1.836	-0.04	26.62	1007.06
3/3/2022	6:00:00 AM	0	9.0966	4.979	3/3/2022	6:00:00 AM	0	895.971	-1.939	-0.04	26.62	1007.06
3/3/2022	7:00:00 AM	0	9.0968	4.979	3/3/2022	7:00:00 AM	0	896.097	-1.93	-0.04	26.62	1007.06
3/3/2022	8:00:00 AM	0	9.096	4.98	3/3/2022	8:00:00 AM	0	896.16	-1.737	-0.04	26.62	1007.06
3/3/2022	9:00:00 AM	0	9.096	4.98	3/3/2022	9:00:00 AM	0	896.464	-1.192	-0.05	26.62	1007.06
3/3/2022	10:00:00 AM	0	9.0957	4.98	3/3/2022	10:00:00 AM	0	896.517	-0.68	-0.05	26.62	1007.06
3/3/2022	11:00:00 AM	0	9.094	4.979	3/3/2022	11:00:00 AM	0	896.348	-0.49	-0.05	26.62	1007.06
3/3/2022	12:00:00 PM	0	9.0915	4.979	3/3/2022	12:00:00 PM	0	896.133	-0.449	-0.05	26.62	1007.06
3/3/2022	1:00:00 PM	0	9.0879	4.979	3/3/2022	1:00:00 PM	0	895.627	-0.27	-0.04	26.62	1007.06
3/3/2022	2:00:00 PM	0	9.0852	4.979	3/3/2022	2:00:00 PM	0	895.425	-0.059	-0.05	26.62	1007.06
3/3/2022	3:00:00 PM	0	9.0837	4.98	3/3/2022	3:00:00 PM	0	895.575	0.517	-0.05	26.63	1007.05
3/3/2022	4:00:00 PM	0	9.0837	4.979	3/3/2022	4:00:00 PM	0	895.643	0.557	-0.05	26.63	1007.05
3/3/2022	5:00:00 PM	0	9.0819	4.979	3/3/2022	5:00:00 PM	0	895.429	0.46	-0.05	26.63	1007.05
3/3/2022	6:00:00 PM	0	9.0813	4.979	3/3/2022	6:00:00 PM	0	895.545	-0.103	-0.05	26.63	1007.05
3/3/2022	7:00:00 PM	0	9.0812	4.979	3/3/2022	7:00:00 PM	0	895.542	-0.601	-0.05	26.63	1007.05
3/3/2022	8:00:00 PM	0	9.0802	4.979	3/3/2022	8:00:00 PM	0	895.617	-0.736	-0.05	26.63	1007.05
3/3/2022	9:00:00 PM	0	9.0798	4.98	3/3/2022	9:00:00 PM	0	895.699	-0.718	-0.05	26.63	1007.05
3/3/2022	10:00:00 PM	0	9.0796	4.98	3/3/2022	10:00:00 PM	0	895.85	-0.822	-0.06	26.63	1007.05
3/3/2022	11:00:00 PM	0	9.082	4.979	3/3/2022	11:00:00 PM	0	896.105	-1.087	-0.06	26.63	1007.05
3/4/2022	12:00:00 AM	0	9.0837	4.98	3/4/2022	12:00:00 AM	0	896.306	-1.414	-0.06	26.63	1007.05
3/4/2022	1:00:00 AM	0	9.0831	4.98	3/4/2022	1:00:00 AM	0	896.488	-1.577	-0.06	26.64	1007.04
3/4/2022	2:00:00 AM	0	9.0839	4.979	3/4/2022	2:00:00 AM	0	896.813	-1.705	-0.06	26.64	1007.04
3/4/2022	3:00:00 AM	0	9.0834	4.979	3/4/2022	3:00:00 AM	0	896.846	-1.927	-0.06	26.64	1007.04

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/4/2022	4:00:00 AM	0	9.0833	4.98	3/4/2022	4:00:00 AM	0	897.053	-2.142	-0.06	26.64	1007.04
3/4/2022	5:00:00 AM	0	9.0833	4.979	3/4/2022	5:00:00 AM	0	897.365	-2.26	-0.07	26.64	1007.04
3/4/2022	6:00:00 AM	0	9.0835	4.979	3/4/2022	6:00:00 AM	0	897.734	-2.334	-0.07	26.65	1007.03
3/4/2022	7:00:00 AM	0	9.0835	4.979	3/4/2022	7:00:00 AM	0	898.1	-2.334	-0.07	26.65	1007.03
3/4/2022	8:00:00 AM	0	9.0845	4.979	3/4/2022	8:00:00 AM	0	898.742	-2.172	-0.08	26.66	1007.02
3/4/2022	9:00:00 AM	0	9.0844	4.979	3/4/2022	9:00:00 AM	0	899.092	-1.794	-0.08	26.66	1007.02
3/4/2022	10:00:00 AM	0	9.0845	4.979	3/4/2022	10:00:00 AM	0	899.46	-1.13	-0.09	26.66	1007.02
3/4/2022	11:00:00 AM	0	9.0832	4.979	3/4/2022	11:00:00 AM	0	899.602	-0.597	-0.09	26.67	1007.01
3/4/2022	12:00:00 PM	0	9.082	4.979	3/4/2022	12:00:00 PM	0	899.578	-0.286	-0.09	26.67	1007.01
3/4/2022	1:00:00 PM	0	9.0795	4.98	3/4/2022	1:00:00 PM	0	899.079	0.055	-0.09	26.67	1007.01
3/4/2022	2:00:00 PM	0	9.078	4.979	3/4/2022	2:00:00 PM	0	899.167	0.35	-0.09	26.67	1007.01
3/4/2022	3:00:00 PM	0	9.0765	4.98	3/4/2022	3:00:00 PM	0	899.264	0.555	-0.09	26.67	1007.01
3/4/2022	4:00:00 PM	0	9.0757	4.979	3/4/2022	4:00:00 PM	0	899.356	0.328	-0.10	26.67	1007.01
3/4/2022	5:00:00 PM	0	9.0751	4.979	3/4/2022	5:00:00 PM	0	899.503	-0.165	-0.10	26.67	1007.01
3/4/2022	6:00:00 PM	0	9.0806	4.98	3/4/2022	6:00:00 PM	0	899.861	-0.523	-0.10	26.67	1007.01
3/4/2022	7:00:00 PM	0	9.0806	4.98	3/4/2022	7:00:00 PM	0	900.204	-0.705	-0.10	26.68	1007.00
3/4/2022	8:00:00 PM	0	9.1147	4.979	3/4/2022	8:00:00 PM	0	900.784	-0.802	-0.07	26.65	1007.03
3/4/2022	9:00:00 PM	0	9.1059	4.979	3/4/2022	9:00:00 PM	0	901.177	-1.092	-0.08	26.66	1007.02
3/4/2022	10:00:00 PM	0	9.1031	4.979	3/4/2022	10:00:00 PM	0	901.157	-1.558	-0.09	26.66	1007.02
3/4/2022	11:00:00 PM	0	9.1006	4.98	3/4/2022	11:00:00 PM	0	901.173	-2.047	-0.09	26.67	1007.01
3/5/2022	12:00:00 AM	0	9.099	4.979	3/5/2022	12:00:00 AM	0	901.357	-2.456	-0.09	26.67	1007.01
3/5/2022	1:00:00 AM	0	9.1173	4.979	3/5/2022	1:00:00 AM	0	901.677	-2.739	-0.08	26.65	1007.03
3/5/2022	2:00:00 AM	0	9.1138	4.979	3/5/2022	2:00:00 AM	0	901.983	-3.058	-0.08	26.66	1007.02
3/5/2022	3:00:00 AM	0	9.1107	4.979	3/5/2022	3:00:00 AM	0	901.943	-2.991	-0.09	26.66	1007.02
3/5/2022	4:00:00 AM	0	9.1091	4.98	3/5/2022	4:00:00 AM	0	902.266	-2.893	-0.09	26.67	1007.01
3/5/2022	5:00:00 AM	0	9.1459	4.979	3/5/2022	5:00:00 AM	0	902.785	-2.743	-0.06	26.64	1007.04
3/5/2022	6:00:00 AM	0	9.1407	4.979	3/5/2022	6:00:00 AM	0	903.022	-2.593	-0.07	26.64	1007.04
3/5/2022	7:00:00 AM	0	9.138	4.979	3/5/2022	7:00:00 AM	0	903.462	-2.555	-0.07	26.65	1007.03
3/5/2022	8:00:00 AM	0	9.1365	4.979	3/5/2022	8:00:00 AM	0	903.923	-2.455	-0.08	26.66	1007.02
3/5/2022	9:00:00 AM	0	9.135	4.979	3/5/2022	9:00:00 AM	0	904.223	-1.9	-0.09	26.66	1007.02
3/5/2022	10:00:00 AM	0	9.1329	4.979	3/5/2022	10:00:00 AM	0	904.581	-0.845	-0.09	26.67	1007.01
3/5/2022	11:00:00 AM	0	9.1316	4.979	3/5/2022	11:00:00 AM	0	904.9	-0.449	-0.10	26.67	1007.01
3/5/2022	12:00:00 PM	0	9.1475	4.979	3/5/2022	12:00:00 PM	0	904.844	-0.291	-0.08	26.66	1007.02
3/5/2022	1:00:00 PM	0	9.1431	4.979	3/5/2022	1:00:00 PM	0	904.78	0.034	-0.08	26.66	1007.02
3/5/2022	2:00:00 PM	0	9.1395	4.979	3/5/2022	2:00:00 PM	0	904.417	0.053	-0.08	26.66	1007.02
3/5/2022	3:00:00 PM	0	9.1364	4.98	3/5/2022	3:00:00 PM	0	904.188	-0.114	-0.08	26.66	1007.02
3/5/2022	4:00:00 PM	0	9.1329	4.979	3/5/2022	4:00:00 PM	0	903.752	-0.418	-0.08	26.66	1007.02
3/5/2022	5:00:00 PM	0	9.1311	4.98	3/5/2022	5:00:00 PM	0	903.892	-0.617	-0.09	26.66	1007.02
3/5/2022	6:00:00 PM	0	9.129	4.98	3/5/2022	6:00:00 PM	0	904.059	-0.648	-0.09	26.67	1007.01
3/5/2022	7:00:00 PM	0	9.1409	4.979	3/5/2022	7:00:00 PM	0	904.406	-0.82	-0.08	26.66	1007.02
3/5/2022	8:00:00 PM	0	9.1373	4.979	3/5/2022	8:00:00 PM	0	904.592	-1.268	-0.09	26.66	1007.02
3/5/2022	9:00:00 PM	0	9.1355	4.979	3/5/2022	9:00:00 PM	0	904.838	-2.297	-0.09	26.67	1007.01
3/5/2022	10:00:00 PM	0	9.1686	4.979	3/5/2022	10:00:00 PM	0	904.955	-2.924	-0.06	26.64	1007.04
3/5/2022	11:00:00 PM	0	9.1655	4.979	3/5/2022	11:00:00 PM	0	905.479	-3.411	-0.07	26.64	1007.04
3/6/2022	12:00:00 AM	0	9.1632	4.979	3/6/2022	12:00:00 AM	0	905.843	-3.869	-0.07	26.65	1007.03
3/6/2022	1:00:00 AM	0	9.1612	4.979	3/6/2022	1:00:00 AM	0	906.238	-4.094	-0.08	26.66	1007.02
3/6/2022	2:00:00 AM	0	9.159	4.979	3/6/2022	2:00:00 AM	0	906.307	-4.444	-0.08	26.66	1007.02
3/6/2022	3:00:00 AM	0	9.1575	4.979	3/6/2022	3:00:00 AM	0	906.476	-4.706	-0.09	26.66	1007.02
3/6/2022	4:00:00 AM	0	9.1898	4.978	3/6/2022	4:00:00 AM	0	906.744	-4.953	-0.06	26.63	1007.05
3/6/2022	5:00:00 AM	0	9.1846	4.979	3/6/2022	5:00:00 AM	0	906.821	-5.144	-0.06	26.64	1007.04
3/6/2022	6:00:00 AM	0	9.1819	4.978	3/6/2022	6:00:00 AM	0	907.147	-5.286	-0.07	26.65	1007.03
3/6/2022	7:00:00 AM	0	9.1789	4.979	3/6/2022	7:00:00 AM	0	907.17	-5.428	-0.07	26.65	1007.03
3/6/2022	8:00:00 AM	0	9.1776	4.979	3/6/2022	8:00:00 AM	0	907.594	-5.647	-0.08	26.65	1007.03
3/6/2022	9:00:00 AM	0	9.1767	4.979	3/6/2022	9:00:00 AM	0	908.316	-4.259	-0.09	26.66	1007.02
3/6/2022	10:00:00 AM	0	9.1852	4.979	3/6/2022	10:00:00 AM	0	908.821	-2.124	-0.08	26.66	1007.02
3/6/2022	11:00:00 AM	0	9.1804	4.979	3/6/2022	11:00:00 AM	0	908.929	-1.327	-0.09	26.67	1007.01
3/6/2022	12:00:00 PM	0	9.177	4.979	3/6/2022	12:00:00 PM	0	908.542	-1.111	-0.09	26.66	1007.02
3/6/2022	1:00:00 PM	0	9.1738	4.979	3/6/2022	1:00:00 PM	0	908.449	-0.643	-0.09	26.67	1007.01
3/6/2022	2:00:00 PM	0	9.1704	4.979	3/6/2022	2:00:00 PM	0	908.126	-0.399	-0.09	26.67	1007.01
3/6/2022	3:00:00 PM	0	9.1671	4.979	3/6/2022	3:00:00 PM	0	907.84	-0.259	-0.09	26.67	1007.01
3/6/2022	4:00:00 PM	0	9.1641	4.979	3/6/2022	4:00:00 PM	0	907.45	-0.139	-0.09	26.67	1007.01
3/6/2022	5:00:00 PM	0	9.1607	4.979	3/6/2022	5:00:00 PM	0	906.935	-0.284	-0.09	26.66	1007.02
3/6/2022	6:00:00 PM	0	9.1572	4.98	3/6/2022	6:00:00 PM	0	906.267	-0.53	-0.08	26.66	1007.02
3/6/2022	7:00:00 PM	0	9.1716	4.979	3/6/2022	7:00:00 PM	0	906.245	-0.739	-0.07	26.65	1007.03
3/6/2022	8:00:00 PM	0	9.1671	4.979	3/6/2022	8:00:00 PM	0	906.368	-0.955	-0.08	26.65	1007.03
3/6/2022	9:00:00 PM	0	9.1628	4.979	3/6/2022	9:00:00 PM	0	905.899	-1.413	-0.07	26.65	1007.03
3/6/2022	10:00:00 PM	0	9.1604	4.978	3/6/2022	10:00:00 PM	0	905.864	-1.578	-0.08	26.65	1007.03
3/6/2022	11:00:00 PM	0	9.1577	4.979	3/6/2022	11:00:00 PM	0	905.824	-1.573	-0.08	26.66	1007.02
3/7/2022	12:00:00 AM	0	9.1551	4.979	3/7/2022	12:00:00 AM	0	905.658	-1.6	-0.08	26.66	1007.02
3/7/2022	1:00:00 AM	0	9.1526	4.979	3/7/2022	1:00:00 AM	0	905.574	-1.586	-0.08	26.66	1007.02

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/7/2022	2:00:00 AM	0	9.151	4.979	3/7/2022	2:00:00 AM	0	905.754	-1.582	-0.09	26.66	1007.02
3/7/2022	3:00:00 AM	0	9.1497	4.979	3/7/2022	3:00:00 AM	0	905.77	-1.529	-0.09	26.66	1007.02
3/7/2022	4:00:00 AM	0	9.163	4.979	3/7/2022	4:00:00 AM	0	906.029	-1.412	-0.08	26.65	1007.03
3/7/2022	5:00:00 AM	0	9.1584	4.979	3/7/2022	5:00:00 AM	0	905.847	-1.223	-0.08	26.66	1007.02
3/7/2022	6:00:00 AM	0	9.1554	4.979	3/7/2022	6:00:00 AM	0	905.909	-1.092	-0.08	26.66	1007.02
3/7/2022	7:00:00 AM	0	9.1535	4.979	3/7/2022	7:00:00 AM	0	906.153	-1.036	-0.09	26.66	1007.02
3/7/2022	8:00:00 AM	0	9.1526	4.979	3/7/2022	8:00:00 AM	0	906.342	-0.977	-0.09	26.67	1007.01
3/7/2022	9:00:00 AM	0	9.1684	4.979	3/7/2022	9:00:00 AM	0	906.509	-0.803	-0.08	26.65	1007.03
3/7/2022	10:00:00 AM	0	9.1637	4.979	3/7/2022	10:00:00 AM	0	906.471	-0.536	-0.08	26.66	1007.02
3/7/2022	11:00:00 AM	0	9.1614	4.979	3/7/2022	11:00:00 AM	0	906.594	-0.29	-0.08	26.66	1007.02
3/7/2022	12:00:00 PM	0	9.1587	4.979	3/7/2022	12:00:00 PM	0	906.718	-0.219	-0.09	26.66	1007.02
3/7/2022	1:00:00 PM	0	9.1558	4.979	3/7/2022	1:00:00 PM	0	906.543	-0.054	-0.09	26.67	1007.01
3/7/2022	2:00:00 PM	0	9.1526	4.979	3/7/2022	2:00:00 PM	0	906.136	0.231	-0.09	26.66	1007.02
3/7/2022	3:00:00 PM	0	9.1502	4.979	3/7/2022	3:00:00 PM	0	905.958	-0.059	-0.09	26.67	1007.01
3/7/2022	4:00:00 PM	0	9.1478	4.979	3/7/2022	4:00:00 PM	0	905.717	-0.379	-0.09	26.66	1007.02
3/7/2022	5:00:00 PM	0	9.1634	4.98	3/7/2022	5:00:00 PM	0	905.724	-0.657	-0.07	26.65	1007.03
3/7/2022	6:00:00 PM	0	9.1606	4.979	3/7/2022	6:00:00 PM	0	906.267	-0.64	-0.08	26.66	1007.02
3/7/2022	7:00:00 PM	0	9.1597	4.979	3/7/2022	7:00:00 PM	0	906.702	-0.769	-0.09	26.66	1007.02
3/7/2022	8:00:00 PM	0	9.1585	4.979	3/7/2022	8:00:00 PM	0	906.793	-1.183	-0.09	26.67	1007.01
3/7/2022	9:00:00 PM	0	9.174	4.979	3/7/2022	9:00:00 PM	0	906.738	-2.176	-0.07	26.65	1007.03
3/7/2022	10:00:00 PM	0	9.1712	4.979	3/7/2022	10:00:00 PM	0	906.953	-2.95	-0.08	26.65	1007.03
3/7/2022	11:00:00 PM	0	9.1685	4.979	3/7/2022	11:00:00 PM	0	906.941	-3.454	-0.08	26.66	1007.02
3/8/2022	12:00:00 AM	0	9.1652	4.979	3/8/2022	12:00:00 AM	0	906.773	-3.975	-0.08	26.66	1007.02
3/8/2022	1:00:00 AM	0	9.1641	4.979	3/8/2022	1:00:00 AM	0	906.981	-4.432	-0.08	26.66	1007.02
3/8/2022	2:00:00 AM	0	9.1947	4.979	3/8/2022	2:00:00 AM	0	907.067	-4.815	-0.05	26.63	1007.05
3/8/2022	3:00:00 AM	0	9.1888	4.979	3/8/2022	3:00:00 AM	0	906.984	-5.26	-0.06	26.64	1007.04
3/8/2022	4:00:00 AM	0	9.1852	4.979	3/8/2022	4:00:00 AM	0	907.076	-5.649	-0.06	26.64	1007.04
3/8/2022	5:00:00 AM	0	9.1817	4.979	3/8/2022	5:00:00 AM	0	906.943	-5.896	-0.07	26.64	1007.04
3/8/2022	6:00:00 AM	0	9.1792	4.979	3/8/2022	6:00:00 AM	0	906.961	-6.115	-0.07	26.65	1007.03
3/8/2022	7:00:00 AM	0	9.1757	4.979	3/8/2022	7:00:00 AM	0	906.654	-6.532	-0.07	26.65	1007.03
3/8/2022	8:00:00 AM	0	9.1731	4.979	3/8/2022	8:00:00 AM	0	906.471	-6.78	-0.07	26.65	1007.03
3/8/2022	9:00:00 AM	0	9.1709	4.98	3/8/2022	9:00:00 AM	0	906.743	-5.58	-0.08	26.65	1007.03
3/8/2022	10:00:00 AM	0	9.1676	4.979	3/8/2022	10:00:00 AM	0	906.893	-3.037	-0.08	26.66	1007.02
3/8/2022	11:00:00 AM	0	9.1648	4.978	3/8/2022	11:00:00 AM	0	906.892	-2.167	-0.08	26.66	1007.02
3/8/2022	12:00:00 PM	0	9.1613	4.979	3/8/2022	12:00:00 PM	0	906.129	-2.869	-0.08	26.66	1007.02
3/8/2022	1:00:00 PM	0	9.157	4.979	3/8/2022	1:00:00 PM	0	905.615	-1.906	-0.08	26.65	1007.03
3/8/2022	2:00:00 PM	0	9.1536	4.979	3/8/2022	2:00:00 PM	0	905.07	-1.638	-0.08	26.65	1007.03
3/8/2022	3:00:00 PM	0	9.15	4.979	3/8/2022	3:00:00 PM	0	904.611	-2.042	-0.07	26.65	1007.03
3/8/2022	4:00:00 PM	0	9.1474	4.979	3/8/2022	4:00:00 PM	0	904.329	-2.741	-0.07	26.65	1007.03
3/8/2022	5:00:00 PM	0	9.1457	4.979	3/8/2022	5:00:00 PM	0	904.398	-3	-0.08	26.65	1007.03
3/8/2022	6:00:00 PM	0	9.1437	4.979	3/8/2022	6:00:00 PM	0	904.448	-3.251	-0.08	26.66	1007.02
3/8/2022	7:00:00 PM	0	9.1426	4.979	3/8/2022	7:00:00 PM	0	904.601	-3.938	-0.08	26.66	1007.02
3/8/2022	8:00:00 PM	0	9.1607	4.979	3/8/2022	8:00:00 PM	0	904.53	-4.762	-0.06	26.64	1007.04
3/8/2022	9:00:00 PM	0	9.1554	4.98	3/8/2022	9:00:00 PM	0	904.824	-5.426	-0.07	26.65	1007.03
3/8/2022	10:00:00 PM	0	9.1524	4.979	3/8/2022	10:00:00 PM	0	904.837	-5.991	-0.07	26.65	1007.03
3/8/2022	11:00:00 PM	0	9.1504	4.98	3/8/2022	11:00:00 PM	0	904.69	-6.476	-0.07	26.65	1007.03
3/9/2022	12:00:00 AM	0	9.148	4.98	3/9/2022	12:00:00 AM	0	904.576	-6.764	-0.08	26.65	1007.03
3/9/2022	1:00:00 AM	0	9.1889	4.979	3/9/2022	1:00:00 AM	0	904.621	-6.978	-0.04	26.61	1007.07
3/9/2022	2:00:00 AM	0	9.1806	4.98	3/9/2022	2:00:00 AM	0	904.35	-7.438	-0.04	26.62	1007.06
3/9/2022	3:00:00 AM	0	9.1754	4.979	3/9/2022	3:00:00 AM	0	904.238	-7.945	-0.05	26.62	1007.06
3/9/2022	4:00:00 AM	0	9.1715	4.979	3/9/2022	4:00:00 AM	0	904.148	-8.367	-0.05	26.63	1007.05
3/9/2022	5:00:00 AM	0	9.1689	4.979	3/9/2022	5:00:00 AM	0	904.12	-8.838	-0.05	26.63	1007.05
3/9/2022	6:00:00 AM	0	9.166	4.979	3/9/2022	6:00:00 AM	0	903.907	-9.245	-0.05	26.63	1007.05
3/9/2022	7:00:00 AM	0	9.1641	4.979	3/9/2022	7:00:00 AM	0	904.2	-9.642	-0.06	26.63	1007.05
3/9/2022	8:00:00 AM	0	9.1621	4.979	3/9/2022	8:00:00 AM	0	904.217	-9.873	-0.06	26.64	1007.04
3/9/2022	9:00:00 AM	0	9.1595	4.979	3/9/2022	9:00:00 AM	0	904.462	-8.334	-0.06	26.64	1007.04
3/9/2022	10:00:00 AM	0	9.1576	4.98	3/9/2022	10:00:00 AM	0	905.261	-5.391	-0.07	26.65	1007.03
3/9/2022	11:00:00 AM	0	9.1546	4.979	3/9/2022	11:00:00 AM	0	905.055	-4.34	-0.07	26.65	1007.03
3/9/2022	12:00:00 PM	0	9.1507	4.979	3/9/2022	12:00:00 PM	0	904.269	-5.042	-0.07	26.65	1007.03
3/9/2022	1:00:00 PM	0	9.1476	4.979	3/9/2022	1:00:00 PM	0	904.038	-3.935	-0.07	26.65	1007.03
3/9/2022	2:00:00 PM	0	9.1435	4.979	3/9/2022	2:00:00 PM	0	903.623	-3.529	-0.07	26.65	1007.03
3/9/2022	3:00:00 PM	0	9.1405	4.979	3/9/2022	3:00:00 PM	0	903.243	-3.68	-0.07	26.65	1007.03
3/9/2022	4:00:00 PM	0	9.138	4.979	3/9/2022	4:00:00 PM	0	902.778	-3.963	-0.07	26.64	1007.04
3/9/2022	5:00:00 PM	0	9.1342	4.979	3/9/2022	5:00:00 PM	0	902.032	-4.58	-0.06	26.64	1007.04
3/9/2022	6:00:00 PM	0	9.1308	4.979	3/9/2022	6:00:00 PM	0	901.402	-5.419	-0.06	26.64	1007.04
3/9/2022	7:00:00 PM	0	9.1277	4.979	3/9/2022	7:00:00 PM	0	900.726	-6.125	-0.06	26.63	1007.05
3/9/2022	8:00:00 PM	0	9.1238	4.979	3/9/2022	8:00:00 PM	0	900.204	-6.776	-0.06	26.63	1007.05
3/9/2022	9:00:00 PM	0	9.1216	4.979	3/9/2022	9:00:00 PM	0	899.891	-7.134	-0.05	26.63	1007.05
3/9/2022	10:00:00 PM	0	9.1183	4.98	3/9/2022	10:00:00 PM	0	899.625	-7.111	-0.06	26.63	1007.05
3/9/2022	11:00:00 PM	0	9.1152	4.979	3/9/2022	11:00:00 PM	0	899.329	-6.908	-0.06	26.63	1007.05

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/10/2022	12:00:00 AM	0	9.1136	4.979	3/10/2022	12:00:00 AM	0	899.383	-6.727	-0.06	26.63	1007.05
3/10/2022	1:00:00 AM	0	9.1126	4.979	3/10/2022	1:00:00 AM	0	899.855	-6.674	-0.06	26.64	1007.04
3/10/2022	2:00:00 AM	0	9.1103	4.98	3/10/2022	2:00:00 AM	0	899.514	-6.763	-0.06	26.64	1007.04
3/10/2022	3:00:00 AM	0	9.1082	4.979	3/10/2022	3:00:00 AM	0	899.275	-6.853	-0.06	26.64	1007.04
3/10/2022	4:00:00 AM	0	9.1065	4.978	3/10/2022	4:00:00 AM	0	899.313	-7.098	-0.06	26.64	1007.04
3/10/2022	5:00:00 AM	0	9.1058	4.979	3/10/2022	5:00:00 AM	0	899.658	-7.209	-0.07	26.65	1007.03
3/10/2022	6:00:00 AM	0	9.105	4.979	3/10/2022	6:00:00 AM	0	899.865	-7.237	-0.07	26.65	1007.03
3/10/2022	7:00:00 AM	0	9.1034	4.979	3/10/2022	7:00:00 AM	0	899.949	-7.141	-0.07	26.65	1007.03
3/10/2022	8:00:00 AM	0	9.1183	4.979	3/10/2022	8:00:00 AM	0	900.259	-6.665	-0.06	26.64	1007.04
3/10/2022	9:00:00 AM	0	9.1135	4.979	3/10/2022	9:00:00 AM	0	900.992	-5.713	-0.07	26.65	1007.03
3/10/2022	10:00:00 AM	0	9.111	4.979	3/10/2022	10:00:00 AM	0	901.259	-4.756	-0.08	26.66	1007.02
3/10/2022	11:00:00 AM	0	9.1087	4.979	3/10/2022	11:00:00 AM	0	901.231	-3.659	-0.08	26.66	1007.02
3/10/2022	12:00:00 PM	0	9.1067	4.979	3/10/2022	12:00:00 PM	0	901.284	-2.932	-0.08	26.66	1007.02
3/10/2022	1:00:00 PM	0	9.122	4.979	3/10/2022	1:00:00 PM	0	901.242	-1.992	-0.07	26.65	1007.03
3/10/2022	2:00:00 PM	0	9.1163	4.978	3/10/2022	2:00:00 PM	0	900.866	-1.392	-0.07	26.65	1007.03
3/10/2022	3:00:00 PM	0	9.1121	4.979	3/10/2022	3:00:00 PM	0	900.645	-1.349	-0.07	26.65	1007.03
3/10/2022	4:00:00 PM	0	9.1093	4.979	3/10/2022	4:00:00 PM	0	900.679	-1.244	-0.08	26.65	1007.03
3/10/2022	5:00:00 PM	0	9.1065	4.979	3/10/2022	5:00:00 PM	0	900.422	-1.36	-0.08	26.65	1007.03
3/10/2022	6:00:00 PM	0	9.1038	4.979	3/10/2022	6:00:00 PM	0	900.117	-1.824	-0.07	26.65	1007.03
3/10/2022	7:00:00 PM	0	9.1012	4.979	3/10/2022	7:00:00 PM	0	900.075	-2.382	-0.08	26.65	1007.03
3/10/2022	8:00:00 PM	0	9.0992	4.979	3/10/2022	8:00:00 PM	0	899.88	-2.88	-0.08	26.65	1007.03
3/10/2022	9:00:00 PM	0	9.098	4.978	3/10/2022	9:00:00 PM	0	900.08	-3.055	-0.08	26.66	1007.02
3/10/2022	10:00:00 PM	0	9.0961	4.979	3/10/2022	10:00:00 PM	0	899.983	-3.143	-0.08	26.66	1007.02
3/10/2022	11:00:00 PM	0	9.1294	4.979	3/10/2022	11:00:00 PM	0	900	-3.227	-0.05	26.63	1007.05
3/11/2022	12:00:00 AM	0	9.1235	4.979	3/11/2022	12:00:00 AM	0	899.736	-3.413	-0.05	26.63	1007.05
3/11/2022	1:00:00 AM	0	9.1191	4.979	3/11/2022	1:00:00 AM	0	899.544	-3.495	-0.05	26.63	1007.05
3/11/2022	2:00:00 AM	0	9.1152	4.979	3/11/2022	2:00:00 AM	0	899.374	-3.57	-0.06	26.63	1007.05
3/11/2022	3:00:00 AM	0	9.1114	4.979	3/11/2022	3:00:00 AM	0	898.878	-3.681	-0.05	26.63	1007.05
3/11/2022	4:00:00 AM	0	9.1079	4.979	3/11/2022	4:00:00 AM	0	898.664	-3.735	-0.06	26.63	1007.05
3/11/2022	5:00:00 AM	0	9.1039	4.979	3/11/2022	5:00:00 AM	0	898.227	-3.771	-0.06	26.63	1007.05
3/11/2022	6:00:00 AM	0	9.0999	4.979	3/11/2022	6:00:00 AM	0	897.574	-3.863	-0.05	26.63	1007.05
3/11/2022	7:00:00 AM	0	9.0978	4.979	3/11/2022	7:00:00 AM	0	897.589	-3.868	-0.06	26.63	1007.05
3/11/2022	8:00:00 AM	0	9.095	4.979	3/11/2022	8:00:00 AM	0	897.398	-3.738	-0.06	26.63	1007.05
3/11/2022	9:00:00 AM	0	9.092	4.979	3/11/2022	9:00:00 AM	0	897.135	-3.508	-0.06	26.63	1007.05
3/11/2022	10:00:00 AM	0	9.089	4.98	3/11/2022	10:00:00 AM	0	896.797	-3.3	-0.06	26.63	1007.05
3/11/2022	11:00:00 AM	0	9.0861	4.979	3/11/2022	11:00:00 AM	0	896.356	-3.158	-0.05	26.63	1007.05
3/11/2022	12:00:00 PM	0	9.0831	4.979	3/11/2022	12:00:00 PM	0	896.186	-2.903	-0.06	26.63	1007.05
3/11/2022	1:00:00 PM	0	9.079	4.979	3/11/2022	1:00:00 PM	0	895.618	-2.588	-0.05	26.63	1007.05
3/11/2022	2:00:00 PM	0	9.0746	4.979	3/11/2022	2:00:00 PM	0	894.646	-2.378	-0.05	26.63	1007.05
3/11/2022	3:00:00 PM	0	9.0711	4.979	3/11/2022	3:00:00 PM	0	894.238	-2.15	-0.05	26.62	1007.06
3/11/2022	4:00:00 PM	0	9.0669	4.979	3/11/2022	4:00:00 PM	0	893.676	-1.831	-0.05	26.62	1007.06
3/11/2022	5:00:00 PM	0	9.0616	4.979	3/11/2022	5:00:00 PM	0	892.776	-1.742	-0.04	26.62	1007.06
3/11/2022	6:00:00 PM	0	9.0579	4.979	3/11/2022	6:00:00 PM	0	892.114	-1.861	-0.04	26.62	1007.06
3/11/2022	7:00:00 PM	0	9.0532	4.979	3/11/2022	7:00:00 PM	0	891.531	-2.047	-0.04	26.61	1007.07
3/11/2022	8:00:00 PM	0	9.0511	4.979	3/11/2022	8:00:00 PM	0	891.621	-2.166	-0.04	26.62	1007.06
3/11/2022	9:00:00 PM	0	9.0502	4.979	3/11/2022	9:00:00 PM	0	891.999	-2.217	-0.05	26.62	1007.06
3/11/2022	10:00:00 PM	0	9.0497	4.979	3/11/2022	10:00:00 PM	0	892.209	-2.224	-0.05	26.63	1007.05
3/11/2022	11:00:00 PM	0	9.0477	4.979	3/11/2022	11:00:00 PM	0	892.169	-2.224	-0.05	26.63	1007.05
3/12/2022	12:00:00 AM	0	9.0466	4.979	3/12/2022	12:00:00 AM	0	892.412	-2.233	-0.05	26.63	1007.05
3/12/2022	1:00:00 AM	0	9.045	4.979	3/12/2022	1:00:00 AM	0	892.366	-2.26	-0.05	26.63	1007.05
3/12/2022	2:00:00 AM	0	9.0451	4.979	3/12/2022	2:00:00 AM	0	893.059	-2.317	-0.06	26.64	1007.04
3/12/2022	3:00:00 AM	0	9.0439	4.979	3/12/2022	3:00:00 AM	0	892.881	-2.782	-0.06	26.64	1007.04
3/12/2022	4:00:00 AM	0	9.0421	4.979	3/12/2022	4:00:00 AM	0	892.617	-3.185	-0.06	26.64	1007.04
3/12/2022	5:00:00 AM	0	9.0413	4.98	3/12/2022	5:00:00 AM	0	892.876	-3.401	-0.06	26.64	1007.04
3/12/2022	6:00:00 AM	0	9.0398	4.979	3/12/2022	6:00:00 AM	0	892.849	-3.666	-0.06	26.64	1007.04
3/12/2022	7:00:00 AM	0	9.0382	4.98	3/12/2022	7:00:00 AM	0	892.824	-3.836	-0.07	26.64	1007.04
3/12/2022	8:00:00 AM	0	9.0368	4.98	3/12/2022	8:00:00 AM	0	892.866	-3.801	-0.07	26.64	1007.04
3/12/2022	9:00:00 AM	0	9.0353	4.979	3/12/2022	9:00:00 AM	0	893.025	-3.052	-0.07	26.65	1007.03
3/12/2022	10:00:00 AM	0	9.0332	4.978	3/12/2022	10:00:00 AM	0	893.06	-1.781	-0.07	26.65	1007.03
3/12/2022	11:00:00 AM	0	9.0299	4.979	3/12/2022	11:00:00 AM	0	892.678	-0.948	-0.07	26.65	1007.03
3/12/2022	12:00:00 PM	0	9.0262	4.979	3/12/2022	12:00:00 PM	0	891.976	-0.796	-0.07	26.65	1007.03
3/12/2022	1:00:00 PM	0	9.0225	4.979	3/12/2022	1:00:00 PM	0	891.33	-0.523	-0.07	26.64	1007.04
3/12/2022	2:00:00 PM	0	9.0187	4.979	3/12/2022	2:00:00 PM	0	890.659	-0.349	-0.06	26.64	1007.04
3/12/2022	3:00:00 PM	0	9.0149	4.979	3/12/2022	3:00:00 PM	0	889.985	-0.345	-0.06	26.64	1007.04
3/12/2022	4:00:00 PM	0	9.0109	4.979	3/12/2022	4:00:00 PM	0	889.261	-0.357	-0.06	26.63	1007.05
3/12/2022	5:00:00 PM	0	9.0066	4.979	3/12/2022	5:00:00 PM	0	888.471	-0.4	-0.05	26.63	1007.05
3/12/2022	6:00:00 PM	0	9.0034	4.979	3/12/2022	6:00:00 PM	0	888.022	-0.487	-0.05	26.63	1007.05
3/12/2022	7:00:00 PM	0	9.0006	4.979	3/12/2022	7:00:00 PM	0	887.646	-0.613	-0.05	26.63	1007.05
3/12/2022	8:00:00 PM	0	8.9978	4.979	3/12/2022	8:00:00 PM	0	887.313	-0.756	-0.05	26.63	1007.05
3/12/2022	9:00:00 PM	0	8.9951	4.979	3/12/2022	9:00:00 PM	0	887.096	-1.006	-0.05	26.63	1007.05

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/12/2022	10:00:00 PM	0	8.9925	4.98	3/12/2022	10:00:00 PM	0	886.658	-1.744	-0.05	26.63	1007.05
3/12/2022	11:00:00 PM	0	8.9893	4.979	3/12/2022	11:00:00 PM	0	885.975	-2.409	-0.05	26.62	1007.06
3/13/2022	12:00:00 AM	0	8.9869	4.979	3/13/2022	12:00:00 AM	0	885.864	-2.729	-0.05	26.62	1007.06
3/13/2022	1:00:00 AM	0	8.9844	4.979	3/13/2022	1:00:00 AM	0	885.718	-2.819	-0.05	26.62	1007.06
3/13/2022	2:00:00 AM	0	8.9823	4.979	3/13/2022	2:00:00 AM	0	885.578	-2.651	-0.05	26.63	1007.05
3/13/2022	3:00:00 AM	0	8.9799	4.979	3/13/2022	3:00:00 AM	0	885.318	-2.491	-0.05	26.62	1007.06
3/13/2022	4:00:00 AM	0	8.9783	4.979	3/13/2022	4:00:00 AM	0	885.365	-2.384	-0.05	26.63	1007.05
3/13/2022	5:00:00 AM	0	8.9778	4.978	3/13/2022	5:00:00 AM	0	885.875	-2.312	-0.06	26.63	1007.05
3/13/2022	6:00:00 AM	0	8.9773	4.979	3/13/2022	6:00:00 AM	0	886.111	-2.28	-0.06	26.64	1007.04
3/13/2022	7:00:00 AM	0	8.9758	4.979	3/13/2022	7:00:00 AM	0	886.177	-2.267	-0.06	26.64	1007.04
3/13/2022	8:00:00 AM	0	8.9752	4.979	3/13/2022	8:00:00 AM	0	886.472	-2.15	-0.06	26.64	1007.04
3/13/2022	9:00:00 AM	0	8.9753	4.98	3/13/2022	9:00:00 AM	0	887.041	-1.78	-0.07	26.65	1007.03
3/13/2022	10:00:00 AM	0	8.9749	4.979	3/13/2022	10:00:00 AM	0	887.399	-1.161	-0.07	26.65	1007.03
3/13/2022	11:00:00 AM	0	8.9755	4.979	3/13/2022	11:00:00 AM	0	888.25	-0.75	-0.08	26.66	1007.02
3/13/2022	12:00:00 PM	0	8.9757	4.98	3/13/2022	12:00:00 PM	0	888.704	-0.497	-0.09	26.66	1007.02
3/13/2022	1:00:00 PM	0	9.0381	4.98	3/13/2022	1:00:00 PM	0	888.952	-0.364	-0.03	26.60	1007.08
3/13/2022	2:00:00 PM	0	9.035	4.979	3/13/2022	2:00:00 PM	0	889.017	-0.193	-0.03	26.61	1007.07
3/13/2022	3:00:00 PM	0	9.0274	4.979	3/13/2022	3:00:00 PM	0	888.853	0.031	-0.04	26.61	1007.07
3/13/2022	4:00:00 PM	0	9.0224	4.979	3/13/2022	4:00:00 PM	0	888.795	0.023	-0.04	26.62	1007.06
3/13/2022	5:00:00 PM	0	9.0176	4.979	3/13/2022	5:00:00 PM	0	888.637	-0.033	-0.04	26.62	1007.06
3/13/2022	6:00:00 PM	0	9.0137	4.979	3/13/2022	6:00:00 PM	0	888.491	-0.223	-0.05	26.62	1007.06
3/13/2022	7:00:00 PM	0	9.0111	4.979	3/13/2022	7:00:00 PM	0	888.618	-0.377	-0.05	26.63	1007.05
3/13/2022	8:00:00 PM	0	9.0081	4.979	3/13/2022	8:00:00 PM	0	888.521	-0.428	-0.05	26.63	1007.05
3/13/2022	9:00:00 PM	0	9.0056	4.979	3/13/2022	9:00:00 PM	0	888.499	-0.418	-0.05	26.63	1007.05
3/13/2022	10:00:00 PM	0	9.0041	4.979	3/13/2022	10:00:00 PM	0	888.769	-0.384	-0.06	26.64	1007.04
3/13/2022	11:00:00 PM	0	9.0029	4.979	3/13/2022	11:00:00 PM	0	889.113	-0.337	-0.06	26.64	1007.04
3/14/2022	12:00:00 AM	0	9.0018	4.979	3/14/2022	12:00:00 AM	0	889.407	-0.358	-0.07	26.64	1007.04
3/14/2022	1:00:00 AM	0	8.9997	4.979	3/14/2022	1:00:00 AM	0	889.254	-0.421	-0.07	26.65	1007.03
3/14/2022	2:00:00 AM	0	9.0001	4.979	3/14/2022	2:00:00 AM	0	890	-0.455	-0.08	26.65	1007.03
3/14/2022	3:00:00 AM	0	8.9985	4.979	3/14/2022	3:00:00 AM	0	889.988	-0.52	-0.08	26.65	1007.03
3/14/2022	4:00:00 AM	0	8.9978	4.979	3/14/2022	4:00:00 AM	0	890.282	-0.567	-0.08	26.66	1007.02
3/14/2022	5:00:00 AM	0	9.0204	4.979	3/14/2022	5:00:00 AM	0	891.072	-0.611	-0.07	26.64	1007.04
3/14/2022	6:00:00 AM	0	9.0142	4.979	3/14/2022	6:00:00 AM	0	891.129	-0.614	-0.07	26.65	1007.03
3/14/2022	7:00:00 AM	0	9.0103	4.979	3/14/2022	7:00:00 AM	0	890.929	-0.648	-0.07	26.65	1007.03
3/14/2022	8:00:00 AM	0	9.0079	4.979	3/14/2022	8:00:00 AM	0	890.949	-0.556	-0.08	26.65	1007.03
3/14/2022	9:00:00 AM	0	9.0062	4.98	3/14/2022	9:00:00 AM	0	891.499	0.267	-0.08	26.66	1007.02
3/14/2022	10:00:00 AM	0	9.0446	4.98	3/14/2022	10:00:00 AM	0	892.038	1.333	-0.05	26.63	1007.05
3/14/2022	11:00:00 AM	0	9.0351	4.98	3/14/2022	11:00:00 AM	0	891.697	1.239	-0.06	26.63	1007.05
3/14/2022	12:00:00 PM	0	9.0301	4.979	3/14/2022	12:00:00 PM	0	891.467	1.116	-0.06	26.64	1007.04
3/14/2022	1:00:00 PM	0	9.0263	4.979	3/14/2022	1:00:00 PM	0	891.255	2.106	-0.06	26.64	1007.04
3/14/2022	2:00:00 PM	0	9.0217	4.979	3/14/2022	2:00:00 PM	0	890.898	2.18	-0.06	26.64	1007.04
3/14/2022	3:00:00 PM	0	9.018	4.98	3/14/2022	3:00:00 PM	0	890.416	2.026	-0.06	26.64	1007.04
3/14/2022	4:00:00 PM	0	9.0136	4.978	3/14/2022	4:00:00 PM	0	889.838	1.679	-0.06	26.64	1007.04
3/14/2022	5:00:00 PM	0	9.0085	4.979	3/14/2022	5:00:00 PM	0	888.869	1.223	-0.06	26.63	1007.05
3/14/2022	6:00:00 PM	0	9.0048	4.98	3/14/2022	6:00:00 PM	0	888.376	0.797	-0.05	26.63	1007.05
3/14/2022	7:00:00 PM	0	9.0007	4.979	3/14/2022	7:00:00 PM	0	887.786	0.435	-0.05	26.63	1007.05
3/14/2022	8:00:00 PM	0	8.9977	4.979	3/14/2022	8:00:00 PM	0	887.38	0.269	-0.05	26.63	1007.05
3/14/2022	9:00:00 PM	0	8.9956	4.979	3/14/2022	9:00:00 PM	0	887.413	0.263	-0.05	26.63	1007.05
3/14/2022	10:00:00 PM	0	8.992	4.979	3/14/2022	10:00:00 PM	0	886.904	0.282	-0.05	26.63	1007.05
3/14/2022	11:00:00 PM	0	8.9895	4.979	3/14/2022	11:00:00 PM	0	886.809	0.28	-0.05	26.63	1007.05
3/15/2022	12:00:00 AM	0	8.9864	4.979	3/15/2022	12:00:00 AM	0	886.451	0.279	-0.05	26.63	1007.05
3/15/2022	1:00:00 AM	0	8.9831	4.979	3/15/2022	1:00:00 AM	0	885.816	0.229	-0.05	26.63	1007.05
3/15/2022	2:00:00 AM	0	8.9795	4.979	3/15/2022	2:00:00 AM	0	885.539	0.143	-0.05	26.63	1007.05
3/15/2022	3:00:00 AM	0	8.978	4.979	3/15/2022	3:00:00 AM	0	885.499	-0.037	-0.05	26.63	1007.05
3/15/2022	4:00:00 AM	0	8.976	4.979	3/15/2022	4:00:00 AM	0	885.578	-0.1	-0.05	26.63	1007.05
3/15/2022	5:00:00 AM	0	8.9755	4.979	3/15/2022	5:00:00 AM	0	885.883	-0.327	-0.06	26.64	1007.04
3/15/2022	6:00:00 AM	0	8.9749	4.979	3/15/2022	6:00:00 AM	0	886.336	-0.422	-0.06	26.64	1007.04
3/15/2022	7:00:00 AM	0	8.9754	4.979	3/15/2022	7:00:00 AM	0	886.951	-0.393	-0.07	26.65	1007.03
3/15/2022	8:00:00 AM	0	8.9758	4.979	3/15/2022	8:00:00 AM	0	887.793	-0.311	-0.08	26.65	1007.03
3/15/2022	9:00:00 AM	0	8.9767	4.98	3/15/2022	9:00:00 AM	0	888.454	-0.125	-0.08	26.66	1007.02
3/15/2022	10:00:00 AM	0	8.977	4.979	3/15/2022	10:00:00 AM	0	889.106	0.697	-0.09	26.67	1007.01
3/15/2022	11:00:00 AM	0	9.0471	4.979	3/15/2022	11:00:00 AM	0	889.815	1.631	-0.03	26.60	1007.08
3/15/2022	12:00:00 PM	0	9.0388	4.979	3/15/2022	12:00:00 PM	0	890.206	2.014	-0.04	26.62	1007.06
3/15/2022	1:00:00 PM	0	9.0353	4.979	3/15/2022	1:00:00 PM	0	890.73	2.566	-0.05	26.62	1007.06
3/15/2022	2:00:00 PM	0	9.0316	4.979	3/15/2022	2:00:00 PM	0	890.92	2.786	-0.05	26.63	1007.05
3/15/2022	3:00:00 PM	0	9.0294	4.98	3/15/2022	3:00:00 PM	0	891.283	2.624	-0.06	26.64	1007.04
3/15/2022	4:00:00 PM	0	9.0268	4.979	3/15/2022	4:00:00 PM	0	891.351	1.951	-0.06	26.64	1007.04
3/15/2022	5:00:00 PM	0	9.0238	4.979	3/15/2022	5:00:00 PM	0	891.293	1.195	-0.06	26.64	1007.04
3/15/2022	6:00:00 PM	0	9.0221	4.98	3/15/2022	6:00:00 PM	0	891.698	0.494	-0.07	26.65	1007.03
3/15/2022	7:00:00 PM	0	9.0215	4.979	3/15/2022	7:00:00 PM	0	892.111	-0.313	-0.08	26.65	1007.03

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/15/2022	8:00:00 PM	0	9.0204	4.979	3/15/2022	8:00:00 PM	0	892.537	-0.863	-0.08	26.66	1007.02
3/15/2022	9:00:00 PM	0	9.0586	4.979	3/15/2022	9:00:00 PM	0	893.25	-0.759	-0.05	26.63	1007.05
3/15/2022	10:00:00 PM	0	9.0541	4.979	3/15/2022	10:00:00 PM	0	894.059	-0.756	-0.06	26.64	1007.04
3/15/2022	11:00:00 PM	0	9.0517	4.98	3/15/2022	11:00:00 PM	0	894.765	-0.977	-0.07	26.65	1007.03
3/16/2022	12:00:00 AM	0	9.0504	4.979	3/16/2022	12:00:00 AM	0	895.425	-0.724	-0.08	26.66	1007.02
3/16/2022	1:00:00 AM	0	9.0882	4.98	3/16/2022	1:00:00 AM	0	896.116	-0.591	-0.05	26.63	1007.05
3/16/2022	2:00:00 AM	0	9.0797	4.98	3/16/2022	2:00:00 AM	0	896.575	-0.59	-0.06	26.64	1007.04
3/16/2022	3:00:00 AM	0	9.0756	4.979	3/16/2022	3:00:00 AM	0	896.751	-0.632	-0.07	26.65	1007.03
3/16/2022	4:00:00 AM	0	9.073	4.979	3/16/2022	4:00:00 AM	0	897.129	-0.717	-0.08	26.65	1007.03
3/16/2022	5:00:00 AM	0	9.0709	4.979	3/16/2022	5:00:00 AM	0	897.569	-0.799	-0.08	26.66	1007.02
3/16/2022	6:00:00 AM	0	9.0873	4.979	3/16/2022	6:00:00 AM	0	897.978	-1.018	-0.07	26.65	1007.03
3/16/2022	7:00:00 AM	0	9.0834	4.979	3/16/2022	7:00:00 AM	0	898.468	-1.235	-0.08	26.66	1007.02
3/16/2022	8:00:00 AM	0	9.081	4.979	3/16/2022	8:00:00 AM	0	898.765	-1.224	-0.08	26.66	1007.02
3/16/2022	9:00:00 AM	0	9.098	4.979	3/16/2022	9:00:00 AM	0	899.269	-0.475	-0.07	26.65	1007.03
3/16/2022	10:00:00 AM	0	9.0944	4.979	3/16/2022	10:00:00 AM	0	899.736	1.506	-0.08	26.66	1007.02
3/16/2022	11:00:00 AM	0	9.0907	4.979	3/16/2022	11:00:00 AM	0	899.718	2.087	-0.08	26.66	1007.02
3/16/2022	12:00:00 PM	0	9.0876	4.979	3/16/2022	12:00:00 PM	0	899.382	2.065	-0.08	26.66	1007.02
3/16/2022	1:00:00 PM	0	9.0835	4.979	3/16/2022	1:00:00 PM	0	899.189	3.714	-0.09	26.66	1007.02
3/16/2022	2:00:00 PM	0	9.0958	4.979	3/16/2022	2:00:00 PM	0	898.948	4.697	-0.07	26.65	1007.03
3/16/2022	3:00:00 PM	0	9.0905	4.979	3/16/2022	3:00:00 PM	0	898.683	3.294	-0.07	26.65	1007.03
3/16/2022	4:00:00 PM	0	9.0859	4.979	3/16/2022	4:00:00 PM	0	898.045	1.652	-0.07	26.65	1007.03
3/16/2022	5:00:00 PM	0	9.0823	4.979	3/16/2022	5:00:00 PM	0	897.639	0.839	-0.07	26.65	1007.03
3/16/2022	6:00:00 PM	0	9.079	4.979	3/16/2022	6:00:00 PM	0	897.331	0.355	-0.07	26.65	1007.03
3/16/2022	7:00:00 PM	0	9.0764	4.979	3/16/2022	7:00:00 PM	0	897.374	0.063	-0.07	26.65	1007.03
3/16/2022	8:00:00 PM	0	9.0737	4.98	3/16/2022	8:00:00 PM	0	897.223	-0.038	-0.08	26.65	1007.03
3/16/2022	9:00:00 PM	0	9.0712	4.979	3/16/2022	9:00:00 PM	0	897.341	-0.045	-0.08	26.66	1007.02
3/16/2022	10:00:00 PM	0	9.1184	4.98	3/16/2022	10:00:00 PM	0	897.42	-0.161	-0.03	26.61	1007.07
3/16/2022	11:00:00 PM	0	9.1022	4.979	3/16/2022	11:00:00 PM	0	897.363	-0.172	-0.05	26.63	1007.05
3/17/2022	12:00:00 AM	0	9.096	4.98	3/17/2022	12:00:00 AM	0	896.858	-0.188	-0.05	26.63	1007.05
3/17/2022	1:00:00 AM	0	9.092	4.979	3/17/2022	1:00:00 AM	0	896.851	-0.148	-0.05	26.63	1007.05
3/17/2022	2:00:00 AM	0	9.0883	4.979	3/17/2022	2:00:00 AM	0	896.654	-0.308	-0.06	26.63	1007.05
3/17/2022	3:00:00 AM	0	9.0847	4.98	3/17/2022	3:00:00 AM	0	896.214	-0.456	-0.05	26.63	1007.05
3/17/2022	4:00:00 AM	0	9.0803	4.979	3/17/2022	4:00:00 AM	0	895.829	-0.489	-0.05	26.63	1007.05
3/17/2022	5:00:00 AM	0	9.0776	4.979	3/17/2022	5:00:00 AM	0	895.771	-0.576	-0.06	26.63	1007.05
3/17/2022	6:00:00 AM	0	9.0738	4.979	3/17/2022	6:00:00 AM	0	895.375	-0.716	-0.06	26.63	1007.05
3/17/2022	7:00:00 AM	0	9.0713	4.979	3/17/2022	7:00:00 AM	0	895.459	-0.706	-0.06	26.64	1007.04
3/17/2022	8:00:00 AM	0	9.0688	4.979	3/17/2022	8:00:00 AM	0	895.417	-0.408	-0.06	26.64	1007.04
3/17/2022	9:00:00 AM	0	9.0664	4.98	3/17/2022	9:00:00 AM	0	895.428	0.061	-0.06	26.64	1007.04
3/17/2022	10:00:00 AM	0	9.0635	4.979	3/17/2022	10:00:00 AM	0	895.158	0.501	-0.06	26.64	1007.04
3/17/2022	11:00:00 AM	0	9.0609	4.979	3/17/2022	11:00:00 AM	0	895.013	1.055	-0.07	26.64	1007.04
3/17/2022	12:00:00 PM	0	9.0577	4.979	3/17/2022	12:00:00 PM	0	894.719	1.701	-0.07	26.64	1007.04
3/17/2022	1:00:00 PM	0	9.0544	4.979	3/17/2022	1:00:00 PM	0	894.428	2.343	-0.07	26.64	1007.04
3/17/2022	2:00:00 PM	0	9.0514	4.98	3/17/2022	2:00:00 PM	0	894.293	3.223	-0.07	26.64	1007.04
3/17/2022	3:00:00 PM	0	9.0488	4.979	3/17/2022	3:00:00 PM	0	893.956	3.103	-0.07	26.64	1007.04
3/17/2022	4:00:00 PM	0	9.0458	4.979	3/17/2022	4:00:00 PM	0	893.394	1.821	-0.06	26.64	1007.04
3/17/2022	5:00:00 PM	0	9.0428	4.979	3/17/2022	5:00:00 PM	0	892.879	0.928	-0.06	26.64	1007.04
3/17/2022	6:00:00 PM	0	9.0435	4.979	3/17/2022	6:00:00 PM	0	893.868	0.35	-0.07	26.65	1007.03
3/17/2022	7:00:00 PM	0	9.0427	4.979	3/17/2022	7:00:00 PM	0	894.019	-0.131	-0.07	26.65	1007.03
3/17/2022	8:00:00 PM	0	9.0415	4.979	3/17/2022	8:00:00 PM	0	894.006	-0.836	-0.07	26.65	1007.03
3/17/2022	9:00:00 PM	0	9.041	4.979	3/17/2022	9:00:00 PM	0	894.365	-1.282	-0.08	26.66	1007.02
3/17/2022	10:00:00 PM	0	9.0576	4.979	3/17/2022	10:00:00 PM	0	894.446	-1.334	-0.06	26.64	1007.04
3/17/2022	11:00:00 PM	0	9.0543	4.98	3/17/2022	11:00:00 PM	0	894.513	-1.507	-0.07	26.64	1007.04
3/18/2022	12:00:00 AM	0	9.0514	4.979	3/18/2022	12:00:00 AM	0	894.659	-1.275	-0.07	26.65	1007.03
3/18/2022	1:00:00 AM	0	9.049	4.979	3/18/2022	1:00:00 AM	0	894.683	-1.09	-0.07	26.65	1007.03
3/18/2022	2:00:00 AM	0	9.0464	4.979	3/18/2022	2:00:00 AM	0	894.632	-1.045	-0.08	26.65	1007.03
3/18/2022	3:00:00 AM	0	9.0435	4.979	3/18/2022	3:00:00 AM	0	894.139	-0.989	-0.07	26.65	1007.03
3/18/2022	4:00:00 AM	0	9.0416	4.979	3/18/2022	4:00:00 AM	0	894.413	-0.862	-0.08	26.66	1007.02
3/18/2022	5:00:00 AM	0	9.075	4.979	3/18/2022	5:00:00 AM	0	894.354	-0.739	-0.04	26.62	1007.06
3/18/2022	6:00:00 AM	0	9.0667	4.979	3/18/2022	6:00:00 AM	0	894.129	-0.807	-0.05	26.63	1007.05
3/18/2022	7:00:00 AM	0	9.0621	4.98	3/18/2022	7:00:00 AM	0	893.979	-0.906	-0.05	26.63	1007.05
3/18/2022	8:00:00 AM	0	9.0587	4.979	3/18/2022	8:00:00 AM	0	894.152	-0.495	-0.06	26.64	1007.04
3/18/2022	9:00:00 AM	0	9.0552	4.979	3/18/2022	9:00:00 AM	0	893.805	0.188	-0.06	26.64	1007.04
3/18/2022	10:00:00 AM	0	9.0511	4.979	3/18/2022	10:00:00 AM	0	893.672	1.925	-0.06	26.64	1007.04
3/18/2022	11:00:00 AM	0	9.0472	4.979	3/18/2022	11:00:00 AM	0	893.358	2.483	-0.06	26.64	1007.04
3/18/2022	12:00:00 PM	0	9.0436	4.979	3/18/2022	12:00:00 PM	0	892.835	2.554	-0.06	26.64	1007.04
3/18/2022	1:00:00 PM	0	9.0396	4.979	3/18/2022	1:00:00 PM	0	892.49	4.254	-0.06	26.64	1007.04
3/18/2022	2:00:00 PM	0	9.0357	4.979	3/18/2022	2:00:00 PM	0	891.838	4.211	-0.06	26.64	1007.04
3/18/2022	3:00:00 PM	0	9.0325	4.98	3/18/2022	3:00:00 PM	0	891.433	3.476	-0.06	26.63	1007.05
3/18/2022	4:00:00 PM	0	9.0288	4.979	3/18/2022	4:00:00 PM	0	891.07	3.063	-0.06	26.63	1007.05
3/18/2022	5:00:00 PM	0	9.0261	4.979	3/18/2022	5:00:00 PM	0	890.629	2.351	-0.06	26.63	1007.05

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/18/2022	6:00:00 PM	0	9.0236	4.979	3/18/2022	6:00:00 PM	0	890.463	1.705	-0.06	26.63	1007.05
3/18/2022	7:00:00 PM	0	9.021	4.979	3/18/2022	7:00:00 PM	0	890.156	0.921	-0.06	26.63	1007.05
3/18/2022	8:00:00 PM	0	9.0194	4.979	3/18/2022	8:00:00 PM	0	890.106	0.628	-0.06	26.63	1007.05
3/18/2022	9:00:00 PM	0	9.0177	4.98	3/18/2022	9:00:00 PM	0	890.112	0.557	-0.06	26.64	1007.04
3/18/2022	10:00:00 PM	0	9.0145	4.98	3/18/2022	10:00:00 PM	0	889.703	0.303	-0.06	26.63	1007.05
3/18/2022	11:00:00 PM	0	9.012	4.979	3/18/2022	11:00:00 PM	0	889.326	0.057	-0.06	26.63	1007.05
3/19/2022	12:00:00 AM	0	9.009	4.979	3/19/2022	12:00:00 AM	0	888.905	-0.269	-0.06	26.63	1007.05
3/19/2022	1:00:00 AM	0	9.0056	4.979	3/19/2022	1:00:00 AM	0	888.44	-0.528	-0.05	26.63	1007.05
3/19/2022	2:00:00 AM	0	9.0024	4.979	3/19/2022	2:00:00 AM	0	887.946	-0.635	-0.05	26.63	1007.05
3/19/2022	3:00:00 AM	0	8.9988	4.979	3/19/2022	3:00:00 AM	0	887.37	-0.606	-0.05	26.63	1007.05
3/19/2022	4:00:00 AM	0	8.9954	4.979	3/19/2022	4:00:00 AM	0	886.994	-0.577	-0.05	26.63	1007.05
3/19/2022	5:00:00 AM	0	8.9924	4.98	3/19/2022	5:00:00 AM	0	886.655	-0.552	-0.05	26.63	1007.05
3/19/2022	6:00:00 AM	0	8.9883	4.979	3/19/2022	6:00:00 AM	0	885.747	-0.574	-0.04	26.62	1007.06
3/19/2022	7:00:00 AM	0	8.9842	4.979	3/19/2022	7:00:00 AM	0	885.231	-0.575	-0.04	26.62	1007.06
3/19/2022	8:00:00 AM	0	8.9817	4.979	3/19/2022	8:00:00 AM	0	885.013	-0.539	-0.04	26.62	1007.06
3/19/2022	9:00:00 AM	0	8.9787	4.98	3/19/2022	9:00:00 AM	0	884.759	-0.48	-0.04	26.62	1007.06
3/19/2022	10:00:00 AM	0	8.9766	4.979	3/19/2022	10:00:00 AM	0	884.763	-0.325	-0.05	26.62	1007.06
3/19/2022	11:00:00 AM	0	8.9756	4.979	3/19/2022	11:00:00 AM	0	885.016	0.442	-0.05	26.63	1007.05
3/19/2022	12:00:00 PM	0	8.9737	4.979	3/19/2022	12:00:00 PM	0	885.068	1.069	-0.05	26.63	1007.05
3/19/2022	1:00:00 PM	0	8.9705	4.979	3/19/2022	1:00:00 PM	0	884.664	1.622	-0.05	26.63	1007.05
3/19/2022	2:00:00 PM	0	8.9717	4.979	3/19/2022	2:00:00 PM	0	885.783	0.788	-0.06	26.64	1007.04
3/19/2022	3:00:00 PM	0	8.9718	4.978	3/19/2022	3:00:00 PM	0	886.054	-0.275	-0.06	26.64	1007.04
3/19/2022	4:00:00 PM	0	8.9752	4.979	3/19/2022	4:00:00 PM	0	887.636	-0.062	-0.08	26.65	1007.03
3/19/2022	5:00:00 PM	0	8.975	4.979	3/19/2022	5:00:00 PM	0	888.111	0.067	-0.08	26.66	1007.02
3/19/2022	6:00:00 PM	0	9.0376	4.979	3/19/2022	6:00:00 PM	0	888.645	-0.465	-0.02	26.60	1007.08
3/19/2022	7:00:00 PM	0	9.0456	4.979	3/19/2022	7:00:00 PM	0	889.443	-0.644	-0.02	26.60	1007.08
3/19/2022	8:00:00 PM	0	9.0401	4.979	3/19/2022	8:00:00 PM	0	890.074	-0.762	-0.04	26.61	1007.07
3/19/2022	9:00:00 PM	0	9.0376	4.979	3/19/2022	9:00:00 PM	0	890.779	-1.119	-0.05	26.62	1007.06
3/19/2022	10:00:00 PM	0	9.0361	4.979	3/19/2022	10:00:00 PM	0	891.467	-1.675	-0.05	26.63	1007.05
3/19/2022	11:00:00 PM	0	9.0342	4.979	3/19/2022	11:00:00 PM	0	891.839	-2.448	-0.06	26.64	1007.04
3/20/2022	12:00:00 AM	0	9.0324	4.98	3/20/2022	12:00:00 AM	0	892.194	-2.862	-0.07	26.64	1007.04
3/20/2022	1:00:00 AM	0	9.0305	4.979	3/20/2022	1:00:00 AM	0	892.676	-3.247	-0.07	26.65	1007.03
3/20/2022	2:00:00 AM	0	9.0292	4.979	3/20/2022	2:00:00 AM	0	893.059	-3.838	-0.08	26.65	1007.03
3/20/2022	3:00:00 AM	0	9.0649	4.979	3/20/2022	3:00:00 AM	0	893.545	-4.385	-0.05	26.62	1007.06
3/20/2022	4:00:00 AM	0	9.061	4.979	3/20/2022	4:00:00 AM	0	894.072	-4.961	-0.06	26.63	1007.05
3/20/2022	5:00:00 AM	0	9.0577	4.979	3/20/2022	5:00:00 AM	0	894.174	-5.677	-0.06	26.64	1007.04
3/20/2022	6:00:00 AM	0	9.0553	4.98	3/20/2022	6:00:00 AM	0	894.568	-6.106	-0.07	26.64	1007.04
3/20/2022	7:00:00 AM	0	9.053	4.979	3/20/2022	7:00:00 AM	0	894.703	-6.198	-0.07	26.65	1007.03
3/20/2022	8:00:00 AM	0	9.0853	4.979	3/20/2022	8:00:00 AM	0	895.132	-5.435	-0.04	26.62	1007.06
3/20/2022	9:00:00 AM	0	9.0773	4.979	3/20/2022	9:00:00 AM	0	895.857	-1.898	-0.06	26.63	1007.05
3/20/2022	10:00:00 AM	0	9.0739	4.979	3/20/2022	10:00:00 AM	0	896.419	-0.577	-0.07	26.64	1007.04
3/20/2022	11:00:00 AM	0	9.0719	4.98	3/20/2022	11:00:00 AM	0	896.948	-0.216	-0.07	26.65	1007.03
3/20/2022	12:00:00 PM	0	9.068	4.979	3/20/2022	12:00:00 PM	0	896.652	-0.08	-0.08	26.65	1007.03
3/20/2022	1:00:00 PM	0	9.0639	4.979	3/20/2022	1:00:00 PM	0	896.413	1.248	-0.08	26.65	1007.03
3/20/2022	2:00:00 PM	0	9.0609	4.979	3/20/2022	2:00:00 PM	0	896.347	1.498	-0.08	26.66	1007.02
3/20/2022	3:00:00 PM	0	9.0582	4.979	3/20/2022	3:00:00 PM	0	896.181	1.555	-0.08	26.66	1007.02
3/20/2022	4:00:00 PM	0	9.0547	4.979	3/20/2022	4:00:00 PM	0	895.732	1.238	-0.08	26.66	1007.02
3/20/2022	5:00:00 PM	0	9.0523	4.979	3/20/2022	5:00:00 PM	0	895.694	0.69	-0.08	26.66	1007.02
3/20/2022	6:00:00 PM	0	9.0767	4.979	3/20/2022	6:00:00 PM	0	896.149	-0.15	-0.06	26.64	1007.04
3/20/2022	7:00:00 PM	0	9.0714	4.979	3/20/2022	7:00:00 PM	0	895.707	-0.57	-0.06	26.64	1007.04
3/20/2022	8:00:00 PM	0	9.0682	4.98	3/20/2022	8:00:00 PM	0	895.838	-0.604	-0.07	26.64	1007.04
3/20/2022	9:00:00 PM	0	9.066	4.979	3/20/2022	9:00:00 PM	0	896.125	-0.632	-0.07	26.65	1007.03
3/20/2022	10:00:00 PM	0	9.0644	4.98	3/20/2022	10:00:00 PM	0	896.419	-0.711	-0.08	26.65	1007.03
3/20/2022	11:00:00 PM	0	9.0628	4.979	3/20/2022	11:00:00 PM	0	896.601	-0.888	-0.08	26.66	1007.02
3/21/2022	12:00:00 AM	0	9.0784	4.98	3/21/2022	12:00:00 AM	0	896.892	-1.202	-0.07	26.64	1007.04
3/21/2022	1:00:00 AM	0	9.0755	4.979	3/21/2022	1:00:00 AM	0	897.06	-1.325	-0.07	26.65	1007.03
3/21/2022	2:00:00 AM	0	9.0742	4.979	3/21/2022	2:00:00 AM	0	897.509	-1.474	-0.08	26.65	1007.03
3/21/2022	3:00:00 AM	0	9.1123	4.979	3/21/2022	3:00:00 AM	0	897.598	-1.656	-0.04	26.62	1007.06
3/21/2022	4:00:00 AM	0	9.1045	4.98	3/21/2022	4:00:00 AM	0	897.679	-1.778	-0.05	26.63	1007.05
3/21/2022	5:00:00 AM	0	9.1006	4.979	3/21/2022	5:00:00 AM	0	897.987	-1.895	-0.06	26.63	1007.05
3/21/2022	6:00:00 AM	0	9.0982	4.979	3/21/2022	6:00:00 AM	0	898.458	-2.009	-0.06	26.64	1007.04
3/21/2022	7:00:00 AM	0	9.0971	4.979	3/21/2022	7:00:00 AM	0	899.173	-1.92	-0.07	26.65	1007.03
3/21/2022	8:00:00 AM	0	9.0964	4.979	3/21/2022	8:00:00 AM	0	899.88	-1.301	-0.08	26.66	1007.02
3/21/2022	9:00:00 AM	0	9.1258	4.98	3/21/2022	9:00:00 AM	0	900.437	-0.717	-0.06	26.63	1007.05
3/21/2022	10:00:00 AM	0	9.1216	4.979	3/21/2022	10:00:00 AM	0	900.962	0.162	-0.07	26.64	1007.04
3/21/2022	11:00:00 AM	0	9.1172	4.979	3/21/2022	11:00:00 AM	0	900.929	1.596	-0.07	26.65	1007.03
3/21/2022	12:00:00 PM	0	9.1147	4.979	3/21/2022	12:00:00 PM	0	901.496	2.631	-0.08	26.66	1007.02
3/21/2022	1:00:00 PM	0	9.1113	4.98	3/21/2022	1:00:00 PM	0	901.52	4.414	-0.08	26.66	1007.02
3/21/2022	2:00:00 PM	0	9.1083	4.979	3/21/2022	2:00:00 PM	0	901.562	4.826	-0.09	26.66	1007.02
3/21/2022	3:00:00 PM	0	9.1427	4.979	3/21/2022	3:00:00 PM	0	901.392	4.119	-0.05	26.63	1007.05

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/21/2022	4:00:00 PM	0	9.133	4.98	3/21/2022	4:00:00 PM	0	901.626	2.95	-0.06	26.64	1007.04
3/21/2022	5:00:00 PM	0	9.1286	4.98	3/21/2022	5:00:00 PM	0	901.632	2.509	-0.07	26.64	1007.04
3/21/2022	6:00:00 PM	0	9.1256	4.979	3/21/2022	6:00:00 PM	0	901.757	1.749	-0.07	26.65	1007.03
3/21/2022	7:00:00 PM	0	9.1224	4.98	3/21/2022	7:00:00 PM	0	901.287	0.932	-0.07	26.65	1007.03
3/21/2022	8:00:00 PM	0	9.1199	4.979	3/21/2022	8:00:00 PM	0	901.483	0.766	-0.07	26.65	1007.03
3/21/2022	9:00:00 PM	0	9.1178	4.98	3/21/2022	9:00:00 PM	0	901.702	0.496	-0.08	26.65	1007.03
3/21/2022	10:00:00 PM	0	9.1154	4.979	3/21/2022	10:00:00 PM	0	901.72	0.466	-0.08	26.66	1007.02
3/21/2022	11:00:00 PM	0	9.1748	4.979	3/21/2022	11:00:00 PM	0	902.452	0.535	-0.03	26.60	1007.08
3/22/2022	12:00:00 AM	0	9.1675	4.979	3/22/2022	12:00:00 AM	0	902.886	0.394	-0.04	26.62	1007.06
3/22/2022	1:00:00 AM	0	9.1626	4.98	3/22/2022	1:00:00 AM	0	902.903	0.245	-0.04	26.62	1007.06
3/22/2022	2:00:00 AM	0	9.1589	4.98	3/22/2022	2:00:00 AM	0	903.134	0.084	-0.05	26.63	1007.05
3/22/2022	3:00:00 AM	0	9.1562	4.979	3/22/2022	3:00:00 AM	0	903.44	-0.028	-0.06	26.63	1007.05
3/22/2022	4:00:00 AM	0	9.1526	4.98	3/22/2022	4:00:00 AM	0	903.379	-0.148	-0.06	26.64	1007.04
3/22/2022	5:00:00 AM	0	9.1482	4.979	3/22/2022	5:00:00 AM	0	902.919	-0.194	-0.06	26.64	1007.04
3/22/2022	6:00:00 AM	0	9.1451	4.979	3/22/2022	6:00:00 AM	0	902.833	-0.167	-0.06	26.64	1007.04
3/22/2022	7:00:00 AM	0	9.1419	4.979	3/22/2022	7:00:00 AM	0	903.055	-0.021	-0.07	26.64	1007.04
3/22/2022	8:00:00 AM	0	9.1387	4.979	3/22/2022	8:00:00 AM	0	902.782	0.203	-0.07	26.64	1007.04
3/22/2022	9:00:00 AM	0	9.1366	4.979	3/22/2022	9:00:00 AM	0	902.957	1.025	-0.07	26.65	1007.03
3/22/2022	10:00:00 AM	0	9.1355	4.979	3/22/2022	10:00:00 AM	0	903.671	2.447	-0.08	26.66	1007.02
3/22/2022	11:00:00 AM	0	9.1331	4.98	3/22/2022	11:00:00 AM	0	903.49	3.452	-0.08	26.66	1007.02
3/22/2022	12:00:00 PM	0	9.1303	4.979	3/22/2022	12:00:00 PM	0	903.4	4.013	-0.08	26.66	1007.02
3/22/2022	1:00:00 PM	0	9.127	4.979	3/22/2022	1:00:00 PM	0	902.873	4.314	-0.08	26.66	1007.02
3/22/2022	2:00:00 PM	0	9.1235	4.979	3/22/2022	2:00:00 PM	0	902.481	4.521	-0.08	26.66	1007.02
3/22/2022	3:00:00 PM	0	9.1199	4.979	3/22/2022	3:00:00 PM	0	902.017	4.429	-0.08	26.66	1007.02
3/22/2022	4:00:00 PM	0	9.1168	4.979	3/22/2022	4:00:00 PM	0	901.436	3.951	-0.08	26.65	1007.03
3/22/2022	5:00:00 PM	0	9.1136	4.979	3/22/2022	5:00:00 PM	0	900.951	3.441	-0.07	26.65	1007.03
3/22/2022	6:00:00 PM	0	9.1098	4.979	3/22/2022	6:00:00 PM	0	900.243	2.67	-0.07	26.65	1007.03
3/22/2022	7:00:00 PM	0	9.1054	4.979	3/22/2022	7:00:00 PM	0	899.405	2.046	-0.07	26.64	1007.04
3/22/2022	8:00:00 PM	0	9.103	4.98	3/22/2022	8:00:00 PM	0	899.279	1.728	-0.07	26.64	1007.04
3/22/2022	9:00:00 PM	0	9.099	4.979	3/22/2022	9:00:00 PM	0	898.621	1.745	-0.06	26.64	1007.04
3/22/2022	10:00:00 PM	0	9.0948	4.979	3/22/2022	10:00:00 PM	0	897.846	1.761	-0.06	26.64	1007.04
3/22/2022	11:00:00 PM	0	9.0906	4.979	3/22/2022	11:00:00 PM	0	897.228	1.816	-0.06	26.64	1007.04
3/23/2022	12:00:00 AM	0	9.0864	4.979	3/23/2022	12:00:00 AM	0	896.612	1.879	-0.06	26.63	1007.05
3/23/2022	1:00:00 AM	0	9.0816	4.979	3/23/2022	1:00:00 AM	0	895.607	1.988	-0.05	26.63	1007.05
3/23/2022	2:00:00 AM	0	9.0781	4.979	3/23/2022	2:00:00 AM	0	895.474	1.965	-0.05	26.63	1007.05
3/23/2022	3:00:00 AM	0	9.074	4.979	3/23/2022	3:00:00 AM	0	894.568	1.957	-0.05	26.63	1007.05
3/23/2022	4:00:00 AM	0	9.0701	4.98	3/23/2022	4:00:00 AM	0	893.996	1.766	-0.05	26.62	1007.06
3/23/2022	5:00:00 AM	0	9.0668	4.979	3/23/2022	5:00:00 AM	0	893.566	1.569	-0.05	26.62	1007.06
3/23/2022	6:00:00 AM	0	9.0638	4.98	3/23/2022	6:00:00 AM	0	893.167	1.533	-0.04	26.62	1007.06
3/23/2022	7:00:00 AM	0	9.0616	4.979	3/23/2022	7:00:00 AM	0	893.386	1.712	-0.05	26.63	1007.05
3/23/2022	8:00:00 AM	0	9.0605	4.979	3/23/2022	8:00:00 AM	0	893.615	2.632	-0.05	26.63	1007.05
3/23/2022	9:00:00 AM	0	9.0595	4.979	3/23/2022	9:00:00 AM	0	894.26	5.736	-0.06	26.64	1007.04
3/23/2022	10:00:00 AM	0	9.0578	4.979	3/23/2022	10:00:00 AM	0	894.233	6.523	-0.06	26.64	1007.04
3/23/2022	11:00:00 AM	0	9.0615	4.979	3/23/2022	11:00:00 AM	0	896.164	2.9	-0.08	26.65	1007.03
3/23/2022	12:00:00 PM	0	9.0613	4.98	3/23/2022	12:00:00 PM	0	896.048	2.032	-0.08	26.65	1007.03
3/23/2022	1:00:00 PM	0	9.1158	4.979	3/23/2022	1:00:00 PM	0	896.434	2.459	-0.03	26.60	1007.08
3/23/2022	2:00:00 PM	0	9.1069	4.98	3/23/2022	2:00:00 PM	0	897.051	3.539	-0.04	26.62	1007.06
3/23/2022	3:00:00 PM	0	9.1024	4.979	3/23/2022	3:00:00 PM	0	897.277	3.743	-0.05	26.62	1007.06
3/23/2022	4:00:00 PM	0	9.0996	4.98	3/23/2022	4:00:00 PM	0	897.629	4.305	-0.05	26.63	1007.05
3/23/2022	5:00:00 PM	0	9.0971	4.979	3/23/2022	5:00:00 PM	0	897.807	3.229	-0.06	26.64	1007.04
3/23/2022	6:00:00 PM	0	9.0954	4.979	3/23/2022	6:00:00 PM	0	897.979	1.496	-0.06	26.64	1007.04
3/23/2022	7:00:00 PM	0	9.0947	4.98	3/23/2022	7:00:00 PM	0	898.558	-0.4	-0.07	26.65	1007.03
3/23/2022	8:00:00 PM	0	9.0948	4.98	3/23/2022	8:00:00 PM	0	899.321	-0.718	-0.08	26.65	1007.03
3/23/2022	9:00:00 PM	0	9.1328	4.979	3/23/2022	9:00:00 PM	0	900.361	-1.207	-0.05	26.63	1007.05
3/23/2022	10:00:00 PM	0	9.1294	4.98	3/23/2022	10:00:00 PM	0	901.239	-2.239	-0.06	26.64	1007.04
3/23/2022	11:00:00 PM	0	9.128	4.98	3/23/2022	11:00:00 PM	0	901.936	-3.203	-0.07	26.65	1007.03
3/24/2022	12:00:00 AM	0	9.1695	4.979	3/24/2022	12:00:00 AM	0	902.489	-3.973	-0.03	26.61	1007.07
3/24/2022	1:00:00 AM	0	9.1591	4.98	3/24/2022	1:00:00 AM	0	903.192	-4.465	-0.05	26.63	1007.05
3/24/2022	2:00:00 AM	0	9.1554	4.979	3/24/2022	2:00:00 AM	0	903.556	-4.954	-0.06	26.64	1007.04
3/24/2022	3:00:00 AM	0	9.1531	4.979	3/24/2022	3:00:00 AM	0	904.013	-5.307	-0.07	26.64	1007.04
3/24/2022	4:00:00 AM	0	9.1509	4.979	3/24/2022	4:00:00 AM	0	904.335	-5.489	-0.07	26.65	1007.03
3/24/2022	5:00:00 AM	0	9.2017	4.979	3/24/2022	5:00:00 AM	0	904.657	-5.958	-0.02	26.60	1007.08
3/24/2022	6:00:00 AM	0	9.193	4.979	3/24/2022	6:00:00 AM	0	904.924	-6.231	-0.03	26.61	1007.07
3/24/2022	7:00:00 AM	0	9.1887	4.98	3/24/2022	7:00:00 AM	0	905.137	-6.092	-0.04	26.62	1007.06
3/24/2022	8:00:00 AM	0	9.1853	4.979	3/24/2022	8:00:00 AM	0	905.687	-4.677	-0.05	26.63	1007.05
3/24/2022	9:00:00 AM	0	9.2466	4.979	3/24/2022	9:00:00 AM	0	906.796	0.494	0.00	26.58	1007.10
3/24/2022	10:00:00 AM	0	9.2523	4.979	3/24/2022	10:00:00 AM	0	906.968	8.255	0.00	26.57	1007.11
3/24/2022	11:00:00 AM	0	9.2587	4.98	3/24/2022	11:00:00 AM	0	906.611	6.822	0.01	26.56	1007.12
3/24/2022	12:00:00 PM	0	9.2636	4.979	3/24/2022	12:00:00 PM	0	906.094	6.267	0.02	26.55	1007.13
3/24/2022	1:00:00 PM	0	9.267	4.979	3/24/2022	1:00:00 PM	0	905.731	10.954	0.03	26.55	1007.13

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/24/2022	2:00:00 PM	0	9.2686	4.979	3/24/2022	2:00:00 PM	0	904.885	11.348	0.04	26.54	1007.14
3/24/2022	3:00:00 PM	0	9.2704	4.978	3/24/2022	3:00:00 PM	0	904.097	7.667	0.05	26.53	1007.15
3/24/2022	4:00:00 PM	0	9.2714	4.979	3/24/2022	4:00:00 PM	0	903.154	4.358	0.06	26.52	1007.16
3/24/2022	5:00:00 PM	0	9.2713	4.979	3/24/2022	5:00:00 PM	0	902.505	3.484	0.07	26.51	1007.17
3/24/2022	6:00:00 PM	0	9.2712	4.979	3/24/2022	6:00:00 PM	0	901.688	1.809	0.08	26.50	1007.18
3/24/2022	7:00:00 PM	0	9.2708	4.979	3/24/2022	7:00:00 PM	0	901.009	-0.185	0.08	26.49	1007.19
3/24/2022	8:00:00 PM	0	9.2702	4.978	3/24/2022	8:00:00 PM	0	900.403	-0.897	0.09	26.49	1007.19
3/24/2022	9:00:00 PM	0	9.2691	4.979	3/24/2022	9:00:00 PM	0	899.884	-0.598	0.09	26.48	1007.20
3/24/2022	10:00:00 PM	0	9.2687	4.979	3/24/2022	10:00:00 PM	0	899.659	-0.568	0.09	26.48	1007.20
3/24/2022	11:00:00 PM	0	9.2683	4.979	3/24/2022	11:00:00 PM	0	899.223	-0.604	0.10	26.48	1007.20
3/25/2022	12:00:00 AM	0	9.2672	4.979	3/25/2022	12:00:00 AM	0	898.388	-0.63	0.11	26.47	1007.21
3/25/2022	1:00:00 AM	0	9.2661	4.979	3/25/2022	1:00:00 AM	0	897.985	-0.712	0.11	26.47	1007.21
3/25/2022	2:00:00 AM	0	9.2659	4.979	3/25/2022	2:00:00 AM	0	897.551	-0.667	0.11	26.46	1007.22
3/25/2022	3:00:00 AM	0	9.2653	4.979	3/25/2022	3:00:00 AM	0	897.286	-0.801	0.12	26.46	1007.22
3/25/2022	4:00:00 AM	0	9.2653	4.979	3/25/2022	4:00:00 AM	0	896.959	-1.182	0.12	26.46	1007.22
3/25/2022	5:00:00 AM	0	9.2655	4.979	3/25/2022	5:00:00 AM	0	896.66	-1.858	0.12	26.45	1007.23
3/25/2022	6:00:00 AM	0	9.266	4.979	3/25/2022	6:00:00 AM	0	896.577	-1.917	0.12	26.45	1007.23
3/25/2022	7:00:00 AM	0	9.2668	4.979	3/25/2022	7:00:00 AM	0	896.578	-1.318	0.12	26.45	1007.23
3/25/2022	8:00:00 AM	0	9.2682	4.979	3/25/2022	8:00:00 AM	0	896.763	-0.676	0.12	26.45	1007.23
3/25/2022	9:00:00 AM	0	9.2695	4.979	3/25/2022	9:00:00 AM	0	896.793	-0.229	0.12	26.45	1007.23
3/25/2022	10:00:00 AM	0	9.2717	4.978	3/25/2022	10:00:00 AM	0	897.122	2.517	0.12	26.45	1007.23
3/25/2022	11:00:00 AM	0	9.2739	4.979	3/25/2022	11:00:00 AM	0	897.12	5.238	0.13	26.45	1007.23
3/25/2022	12:00:00 PM	0	9.2758	4.979	3/25/2022	12:00:00 PM	0	897.296	7.062	0.13	26.45	1007.23
3/25/2022	1:00:00 PM	0	9.2784	4.979	3/25/2022	1:00:00 PM	0	897.308	6.295	0.13	26.45	1007.23
3/25/2022	2:00:00 PM	0	9.2804	4.979	3/25/2022	2:00:00 PM	0	897.404	5.914	0.13	26.45	1007.23
3/25/2022	3:00:00 PM	0	9.2834	4.979	3/25/2022	3:00:00 PM	0	897.481	6.242	0.13	26.45	1007.23
3/25/2022	4:00:00 PM	0	9.2868	4.979	3/25/2022	4:00:00 PM	0	897.256	5.946	0.14	26.44	1007.24
3/25/2022	5:00:00 PM	0	9.2896	4.979	3/25/2022	5:00:00 PM	0	897.063	4.596	0.14	26.43	1007.25
3/25/2022	6:00:00 PM	0	9.2922	4.979	3/25/2022	6:00:00 PM	0	896.98	2.911	0.15	26.43	1007.25
3/25/2022	7:00:00 PM	0	9.2951	4.979	3/25/2022	7:00:00 PM	0	896.558	1.357	0.15	26.42	1007.26
3/25/2022	8:00:00 PM	0	9.2977	4.979	3/25/2022	8:00:00 PM	0	896.161	-0.131	0.16	26.42	1007.26
3/25/2022	9:00:00 PM	0	9.2998	4.979	3/25/2022	9:00:00 PM	0	896.404	-0.884	0.16	26.42	1007.26
3/25/2022	10:00:00 PM	0	9.3031	4.979	3/25/2022	10:00:00 PM	0	896.37	-0.876	0.16	26.41	1007.27
3/25/2022	11:00:00 PM	0	9.3064	4.979	3/25/2022	11:00:00 PM	0	896.208	-0.995	0.17	26.41	1007.27
3/26/2022	12:00:00 AM	0	9.3095	4.979	3/26/2022	12:00:00 AM	0	895.948	-1.108	0.17	26.40	1007.28
3/26/2022	1:00:00 AM	0	9.3122	4.979	3/26/2022	1:00:00 AM	0	895.788	-1.529	0.18	26.40	1007.28
3/26/2022	2:00:00 AM	0	9.3143	4.979	3/26/2022	2:00:00 AM	0	895.353	-1.639	0.18	26.39	1007.29
3/26/2022	3:00:00 AM	0	9.3164	4.979	3/26/2022	3:00:00 AM	0	894.878	-0.82	0.19	26.39	1007.29
3/26/2022	4:00:00 AM	0	9.3171	4.978	3/26/2022	4:00:00 AM	0	894.404	-1.659	0.20	26.38	1007.30
3/26/2022	5:00:00 AM	0	9.3182	4.979	3/26/2022	5:00:00 AM	0	893.791	-2.609	0.20	26.37	1007.31
3/26/2022	6:00:00 AM	0	9.3185	4.979	3/26/2022	6:00:00 AM	0	893.078	-3.07	0.21	26.37	1007.31
3/26/2022	7:00:00 AM	0	9.3184	4.98	3/26/2022	7:00:00 AM	0	892.835	-2.646	0.21	26.36	1007.32
3/26/2022	8:00:00 AM	0	9.3191	4.979	3/26/2022	8:00:00 AM	0	892.893	-1.113	0.21	26.36	1007.32
3/26/2022	9:00:00 AM	0	9.3192	4.979	3/26/2022	9:00:00 AM	0	893.217	-0.637	0.21	26.37	1007.31
3/26/2022	10:00:00 AM	0	9.3209	4.979	3/26/2022	10:00:00 AM	0	893.414	0.237	0.21	26.37	1007.31
3/26/2022	11:00:00 AM	0	9.3222	4.979	3/26/2022	11:00:00 AM	0	892.784	2.438	0.22	26.36	1007.32
3/26/2022	12:00:00 PM	0	9.3224	4.979	3/26/2022	12:00:00 PM	0	892.568	4.977	0.22	26.36	1007.32
3/26/2022	1:00:00 PM	0	9.3229	4.979	3/26/2022	1:00:00 PM	0	892.69	4.64	0.22	26.36	1007.32
3/26/2022	2:00:00 PM	0	9.3245	4.979	3/26/2022	2:00:00 PM	0	893.093	5.646	0.22	26.36	1007.32
3/26/2022	3:00:00 PM	0	9.3269	4.978	3/26/2022	3:00:00 PM	0	893.447	6.159	0.22	26.36	1007.32
3/26/2022	4:00:00 PM	0	9.3294	4.979	3/26/2022	4:00:00 PM	0	892.925	4.719	0.22	26.35	1007.33
3/26/2022	5:00:00 PM	0	9.3316	4.979	3/26/2022	5:00:00 PM	0	892.75	3.727	0.23	26.35	1007.33
3/26/2022	6:00:00 PM	0	9.3341	4.979	3/26/2022	6:00:00 PM	0	892.592	2.721	0.23	26.34	1007.34
3/26/2022	7:00:00 PM	0	9.3365	4.979	3/26/2022	7:00:00 PM	0	892.51	1.107	0.24	26.34	1007.34
3/26/2022	8:00:00 PM	0	9.3391	4.979	3/26/2022	8:00:00 PM	0	892.225	0.431	0.24	26.34	1007.34
3/26/2022	9:00:00 PM	0	9.3413	4.978	3/26/2022	9:00:00 PM	0	891.955	0.837	0.25	26.33	1007.35
3/26/2022	10:00:00 PM	0	9.3434	4.979	3/26/2022	10:00:00 PM	0	891.96	0.393	0.25	26.33	1007.35
3/26/2022	11:00:00 PM	0	9.3458	4.979	3/26/2022	11:00:00 PM	0	891.709	0.135	0.25	26.32	1007.36
3/27/2022	12:00:00 AM	0	9.3481	4.979	3/27/2022	12:00:00 AM	0	891.409	-0.347	0.26	26.32	1007.36
3/27/2022	1:00:00 AM	0	9.3503	4.979	3/27/2022	1:00:00 AM	0	891.332	-0.23	0.26	26.32	1007.36
3/27/2022	2:00:00 AM	0	9.3519	4.979	3/27/2022	2:00:00 AM	0	890.884	-0.219	0.27	26.31	1007.37
3/27/2022	3:00:00 AM	0	9.3531	4.979	3/27/2022	3:00:00 AM	0	890.72	-0.245	0.27	26.31	1007.37
3/27/2022	4:00:00 AM	0	9.3548	4.979	3/27/2022	4:00:00 AM	0	890.405	-0.326	0.28	26.30	1007.38
3/27/2022	5:00:00 AM	0	9.3563	4.979	3/27/2022	5:00:00 AM	0	890.245	-0.389	0.28	26.30	1007.38
3/27/2022	6:00:00 AM	0	9.3577	4.979	3/27/2022	6:00:00 AM	0	889.879	-0.39	0.28	26.29	1007.39
3/27/2022	7:00:00 AM	0	9.359	4.979	3/27/2022	7:00:00 AM	0	889.701	-0.071	0.29	26.29	1007.39
3/27/2022	8:00:00 AM	0	9.3594	4.979	3/27/2022	8:00:00 AM	0	889.514	1.279	0.29	26.29	1007.39
3/27/2022	9:00:00 AM	0	9.361	4.979	3/27/2022	9:00:00 AM	0	889.647	3.822	0.29	26.29	1007.39
3/27/2022	10:00:00 AM	0	9.3618	4.979	3/27/2022	10:00:00 AM	0	889.507	5.834	0.29	26.29	1007.39
3/27/2022	11:00:00 AM	0	9.3628	4.979	3/27/2022	11:00:00 AM	0	889.262	6.156	0.29	26.28	1007.40

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/27/2022	12:00:00 PM	0	9.3637	4.978	3/27/2022	12:00:00 PM	0	888.906	7.18	0.30	26.28	1007.40
3/27/2022	1:00:00 PM	0	9.3645	4.979	3/27/2022	1:00:00 PM	0	888.582	7.729	0.30	26.27	1007.41
3/27/2022	2:00:00 PM	0	9.365	4.979	3/27/2022	2:00:00 PM	0	888.131	8.013	0.31	26.27	1007.41
3/27/2022	3:00:00 PM	0	9.3655	4.979	3/27/2022	3:00:00 PM	0	887.907	8.202	0.31	26.27	1007.41
3/27/2022	4:00:00 PM	0	9.3661	4.979	3/27/2022	4:00:00 PM	0	887.362	6.477	0.32	26.26	1007.42
3/27/2022	5:00:00 PM	0	9.3665	4.979	3/27/2022	5:00:00 PM	0	887.023	4.661	0.32	26.26	1007.42
3/27/2022	6:00:00 PM	0	9.3677	4.979	3/27/2022	6:00:00 PM	0	886.597	2.474	0.33	26.25	1007.43
3/27/2022	7:00:00 PM	0	9.3689	4.979	3/27/2022	7:00:00 PM	0	886.431	1.081	0.33	26.25	1007.43
3/27/2022	8:00:00 PM	0	9.3702	4.979	3/27/2022	8:00:00 PM	0	886.086	0.563	0.33	26.24	1007.44
3/27/2022	9:00:00 PM	0	9.3715	4.979	3/27/2022	9:00:00 PM	0	885.917	0.333	0.34	26.24	1007.44
3/27/2022	10:00:00 PM	0	9.3729	4.979	3/27/2022	10:00:00 PM	0	885.605	0.06	0.34	26.23	1007.45
3/27/2022	11:00:00 PM	0	9.3749	4.979	3/27/2022	11:00:00 PM	0	885.332	-0.25	0.35	26.23	1007.45
3/28/2022	12:00:00 AM	0	9.3772	4.979	3/28/2022	12:00:00 AM	0	885.566	-0.445	0.35	26.23	1007.45
3/28/2022	1:00:00 AM	0	9.3802	4.979	3/28/2022	1:00:00 AM	0	885.736	-0.512	0.35	26.23	1007.45
3/28/2022	2:00:00 AM	0	9.3831	4.979	3/28/2022	2:00:00 AM	0	885.874	-0.528	0.35	26.23	1007.45
3/28/2022	3:00:00 AM	0	9.3872	4.979	3/28/2022	3:00:00 AM	0	886.208	-0.54	0.35	26.23	1007.45
3/28/2022	4:00:00 AM	0	9.3915	4.979	3/28/2022	4:00:00 AM	0	886.561	-0.573	0.35	26.23	1007.45
3/28/2022	5:00:00 AM	0	9.3968	4.979	3/28/2022	5:00:00 AM	0	887.011	-0.596	0.35	26.23	1007.45
3/28/2022	6:00:00 AM	0	9.4028	4.979	3/28/2022	6:00:00 AM	0	887.449	-0.581	0.35	26.22	1007.46
3/28/2022	7:00:00 AM	0	9.4093	4.979	3/28/2022	7:00:00 AM	0	888.066	-0.582	0.35	26.22	1007.46
3/28/2022	8:00:00 AM	0	9.4166	4.978	3/28/2022	8:00:00 AM	0	888.68	-0.4	0.35	26.22	1007.46
3/28/2022	9:00:00 AM	0	9.424	4.979	3/28/2022	9:00:00 AM	0	890.124	4.616	0.35	26.23	1007.45
3/28/2022	10:00:00 AM	0	9.4313	4.979	3/28/2022	10:00:00 AM	0	890.939	11.66	0.35	26.23	1007.45
3/28/2022	11:00:00 AM	0	9.44	4.98	3/28/2022	11:00:00 AM	0	891.237	10.222	0.35	26.23	1007.45
3/28/2022	12:00:00 PM	0	9.4485	4.978	3/28/2022	12:00:00 PM	0	891.78	11.385	0.35	26.22	1007.46
3/28/2022	1:00:00 PM	0	9.4574	4.979	3/28/2022	1:00:00 PM	0	892.312	14.499	0.36	26.22	1007.46
3/28/2022	2:00:00 PM	0	9.4657	4.979	3/28/2022	2:00:00 PM	0	892.659	11.962	0.36	26.21	1007.47
3/28/2022	3:00:00 PM	0	9.4747	4.98	3/28/2022	3:00:00 PM	0	892.974	13.17	0.37	26.21	1007.47
3/28/2022	4:00:00 PM	0	9.4831	4.979	3/28/2022	4:00:00 PM	0	892.813	6.03	0.38	26.20	1007.48
3/28/2022	5:00:00 PM	0	9.4914	4.979	3/28/2022	5:00:00 PM	0	892.821	3.435	0.39	26.19	1007.49
3/28/2022	6:00:00 PM	0	9.4993	4.979	3/28/2022	6:00:00 PM	0	893.195	1.544	0.39	26.19	1007.49
3/28/2022	7:00:00 PM	0	9.5077	4.979	3/28/2022	7:00:00 PM	0	893.675	-0.37	0.39	26.18	1007.50
3/28/2022	8:00:00 PM	0	9.5159	4.979	3/28/2022	8:00:00 PM	0	894.03	-1.649	0.40	26.18	1007.50
3/28/2022	9:00:00 PM	0	9.5242	4.979	3/28/2022	9:00:00 PM	0	894.635	-1.012	0.40	26.18	1007.50
3/28/2022	10:00:00 PM	0	9.533	4.98	3/28/2022	10:00:00 PM	0	895.281	-0.987	0.40	26.17	1007.51
3/28/2022	11:00:00 PM	0	9.5421	4.98	3/28/2022	11:00:00 PM	0	895.523	-2.161	0.41	26.17	1007.51
3/29/2022	12:00:00 AM	0	9.5513	4.979	3/29/2022	12:00:00 AM	0	895.521	-3.004	0.42	26.16	1007.52
3/29/2022	1:00:00 AM	0	9.5595	4.979	3/29/2022	1:00:00 AM	0	895.562	-3.839	0.43	26.15	1007.53
3/29/2022	2:00:00 AM	0	9.5675	4.979	3/29/2022	2:00:00 AM	0	895.565	-4.308	0.44	26.14	1007.54
3/29/2022	3:00:00 AM	0	9.5752	4.979	3/29/2022	3:00:00 AM	0	895.686	-4.484	0.44	26.14	1007.54
3/29/2022	4:00:00 AM	0	9.5826	4.978	3/29/2022	4:00:00 AM	0	895.822	-4.716	0.45	26.13	1007.55
3/29/2022	5:00:00 AM	0	9.5896	4.979	3/29/2022	5:00:00 AM	0	895.892	-4.731	0.45	26.12	1007.56
3/29/2022	6:00:00 AM	0	9.5963	4.979	3/29/2022	6:00:00 AM	0	895.628	-4.696	0.46	26.11	1007.57
3/29/2022	7:00:00 AM	0	9.6025	4.978	3/29/2022	7:00:00 AM	0	895.569	-4.392	0.47	26.11	1007.57
3/29/2022	8:00:00 AM	0	9.6086	4.979	3/29/2022	8:00:00 AM	0	896.042	-1.65	0.47	26.11	1007.57
3/29/2022	9:00:00 AM	0	9.6135	4.979	3/29/2022	9:00:00 AM	0	896.502	6.644	0.47	26.11	1007.57
3/29/2022	10:00:00 AM	0	9.618	4.979	3/29/2022	10:00:00 AM	0	896.356	11.152	0.48	26.10	1007.58
3/29/2022	11:00:00 AM	0	9.6226	4.979	3/29/2022	11:00:00 AM	0	895.977	9.883	0.49	26.09	1007.59
3/29/2022	12:00:00 PM	0	9.6267	4.979	3/29/2022	12:00:00 PM	0	895.446	10.706	0.50	26.08	1007.60
3/29/2022	1:00:00 PM	0	9.6296	4.979	3/29/2022	1:00:00 PM	0	894.731	11.28	0.51	26.07	1007.61
3/29/2022	2:00:00 PM	0	9.6327	4.979	3/29/2022	2:00:00 PM	0	894.411	11.715	0.51	26.06	1007.62
3/29/2022	3:00:00 PM	0	9.6349	4.979	3/29/2022	3:00:00 PM	0	893.807	11.301	0.52	26.06	1007.62
3/29/2022	4:00:00 PM	0	9.6368	4.98	3/29/2022	4:00:00 PM	0	893.233	8.641	0.53	26.05	1007.63
3/29/2022	5:00:00 PM	0	9.6388	4.978	3/29/2022	5:00:00 PM	0	892.644	7.051	0.54	26.04	1007.64
3/29/2022	6:00:00 PM	0	9.6405	4.979	3/29/2022	6:00:00 PM	0	892.366	5.927	0.54	26.04	1007.64
3/29/2022	7:00:00 PM	0	9.6428	4.979	3/29/2022	7:00:00 PM	0	891.912	4.542	0.55	26.03	1007.65
3/29/2022	8:00:00 PM	0	9.6447	4.979	3/29/2022	8:00:00 PM	0	891.142	3.654	0.56	26.02	1007.66
3/29/2022	9:00:00 PM	0	9.6463	4.979	3/29/2022	9:00:00 PM	0	890.967	3.081	0.56	26.02	1007.66
3/29/2022	10:00:00 PM	0	9.6488	4.979	3/29/2022	10:00:00 PM	0	890.985	2.925	0.56	26.01	1007.67
3/29/2022	11:00:00 PM	0	9.6512	4.979	3/29/2022	11:00:00 PM	0	891.067	2.867	0.56	26.01	1007.67
3/30/2022	12:00:00 AM	0	9.6547	4.979	3/30/2022	12:00:00 AM	0	891.156	2.347	0.57	26.01	1007.67
3/30/2022	1:00:00 AM	0	9.6588	4.979	3/30/2022	1:00:00 AM	0	891.312	1.854	0.57	26.01	1007.67
3/30/2022	2:00:00 AM	0	9.6632	4.978	3/30/2022	2:00:00 AM	0	891.13	1.58	0.58	26.00	1007.68
3/30/2022	3:00:00 AM	0	9.6676	4.979	3/30/2022	3:00:00 AM	0	891.421	1.705	0.58	26.00	1007.68
3/30/2022	4:00:00 AM	0	9.6727	4.979	3/30/2022	4:00:00 AM	0	891.444	1.409	0.58	25.99	1007.69
3/30/2022	5:00:00 AM	0	9.6777	4.979	3/30/2022	5:00:00 AM	0	891.19	0.955	0.59	25.99	1007.69
3/30/2022	6:00:00 AM	0	9.6831	4.979	3/30/2022	6:00:00 AM	0	891.957	0.604	0.59	25.99	1007.69
3/30/2022	7:00:00 AM	0	9.689	4.979	3/30/2022	7:00:00 AM	0	892.733	0.47	0.59	25.99	1007.69
3/30/2022	8:00:00 AM	0	9.6962	4.978	3/30/2022	8:00:00 AM	0	893.053	-0.096	0.59	25.99	1007.69
3/30/2022	9:00:00 AM	0	9.7035	4.979	3/30/2022	9:00:00 AM	0	893.824	0.591	0.59	25.99	1007.69

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
3/30/2022	10:00:00 AM	0	9.7116	4.979	3/30/2022	10:00:00 AM	0	894.299	2.932	0.59	25.98	1007.70
3/30/2022	11:00:00 AM	0	9.7188	4.979	3/30/2022	11:00:00 AM	0	895.119	5.82	0.59	25.99	1007.69
3/30/2022	12:00:00 PM	0	9.7265	4.979	3/30/2022	12:00:00 PM	0	895.63	7.359	0.59	25.98	1007.70
3/30/2022	1:00:00 PM	0	9.7341	4.979	3/30/2022	1:00:00 PM	0	895.706	10.36	0.60	25.98	1007.70
3/30/2022	2:00:00 PM	0	9.7414	4.979	3/30/2022	2:00:00 PM	0	895.461	12.42	0.61	25.97	1007.71
3/30/2022	3:00:00 PM	0	9.7482	4.979	3/30/2022	3:00:00 PM	0	895.788	6.514	0.61	25.96	1007.72
3/30/2022	4:00:00 PM	0	9.7557	4.979	3/30/2022	4:00:00 PM	0	895.529	3.974	0.62	25.95	1007.73
3/30/2022	5:00:00 PM	0	9.7633	4.979	3/30/2022	5:00:00 PM	0	895.665	2.324	0.63	25.95	1007.73
3/30/2022	6:00:00 PM	0	9.7706	4.979	3/30/2022	6:00:00 PM	0	895.788	1.521	0.64	25.94	1007.74
3/30/2022	7:00:00 PM	0	9.7779	4.979	3/30/2022	7:00:00 PM	0	895.894	-0.537	0.64	25.93	1007.75
3/30/2022	8:00:00 PM	0	9.7852	4.979	3/30/2022	8:00:00 PM	0	895.878	-1.106	0.65	25.93	1007.75
3/30/2022	9:00:00 PM	0	9.7917	4.979	3/30/2022	9:00:00 PM	0	895.733	-1.386	0.66	25.92	1007.76
3/30/2022	10:00:00 PM	0	9.7982	4.979	3/30/2022	10:00:00 PM	0	895.739	-1.749	0.66	25.91	1007.77
3/30/2022	11:00:00 PM	0	9.8044	4.979	3/30/2022	11:00:00 PM	0	896.023	-0.87	0.67	25.91	1007.77
3/31/2022	12:00:00 AM	0	9.811	4.979	3/31/2022	12:00:00 AM	0	896.328	-0.74	0.67	25.91	1007.77
3/31/2022	1:00:00 AM	0	9.8167	4.978	3/31/2022	1:00:00 AM	0	896.267	-1.077	0.68	25.90	1007.78
3/31/2022	2:00:00 AM	0	9.8235	4.978	3/31/2022	2:00:00 AM	0	896.292	-1.573	0.68	25.89	1007.79
3/31/2022	3:00:00 AM	0	9.8298	4.979	3/31/2022	3:00:00 AM	0	896.508	-1.875	0.69	25.89	1007.79
3/31/2022	4:00:00 AM	0	9.8361	4.979	3/31/2022	4:00:00 AM	0	896.731	-1.744	0.69	25.89	1007.79
3/31/2022	5:00:00 AM	0	9.8427	4.978	3/31/2022	5:00:00 AM	0	896.832	-1.667	0.70	25.88	1007.80
3/31/2022	6:00:00 AM	0	9.849	4.979	3/31/2022	6:00:00 AM	0	896.834	-2.003	0.70	25.87	1007.81
3/31/2022	7:00:00 AM	0	9.8552	4.979	3/31/2022	7:00:00 AM	0	896.734	-2.027	0.71	25.87	1007.81
3/31/2022	8:00:00 AM	0	9.8611	4.979	3/31/2022	8:00:00 AM	0	897.222	-0.421	0.71	25.87	1007.81
3/31/2022	9:00:00 AM	0	9.8672	4.979	3/31/2022	9:00:00 AM	0	897.466	1.583	0.72	25.86	1007.82
3/31/2022	10:00:00 AM	0	9.8726	4.98	3/31/2022	10:00:00 AM	0	897.551	5.807	0.72	25.86	1007.82
3/31/2022	11:00:00 AM	0	9.8775	4.979	3/31/2022	11:00:00 AM	0	897.513	7.301	0.73	25.85	1007.83
3/31/2022	12:00:00 PM	0	9.8824	4.979	3/31/2022	12:00:00 PM	0	897.427	7.616	0.73	25.85	1007.83
3/31/2022	1:00:00 PM	0	9.8864	4.98	3/31/2022	1:00:00 PM	0	897.318	10.528	0.74	25.84	1007.84
3/31/2022	2:00:00 PM	0	9.8912	4.979	3/31/2022	2:00:00 PM	0	896.964	8.982	0.74	25.83	1007.85
3/31/2022	3:00:00 PM	0	9.8951	4.979	3/31/2022	3:00:00 PM	0	896.499	8.49	0.75	25.82	1007.86
3/31/2022	4:00:00 PM	0	9.8985	4.979	3/31/2022	4:00:00 PM	0	895.993	6.583	0.76	25.82	1007.86
3/31/2022	5:00:00 PM	0	9.9016	4.978	3/31/2022	5:00:00 PM	0	895.176	5.34	0.77	25.80	1007.88
3/31/2022	6:00:00 PM	0	9.9038	4.979	3/31/2022	6:00:00 PM	0	894.604	3.523	0.78	25.80	1007.88
3/31/2022	7:00:00 PM	0	9.9068	4.979	3/31/2022	7:00:00 PM	0	894.462	1.033	0.79	25.79	1007.89
3/31/2022	8:00:00 PM	0	9.9096	4.978	3/31/2022	8:00:00 PM	0	894.759	-0.726	0.79	25.79	1007.89
3/31/2022	9:00:00 PM	0	9.9139	4.98	3/31/2022	9:00:00 PM	0	894.749	-1.428	0.79	25.79	1007.89
3/31/2022	10:00:00 PM	0	9.918	4.979	3/31/2022	10:00:00 PM	0	894.907	-2.253	0.79	25.78	1007.90
3/31/2022	11:00:00 PM	0	9.9227	4.979	3/31/2022	11:00:00 PM	0	894.959	-2.447	0.80	25.78	1007.90
4/1/2022	12:00:00 AM	0	9.9277	4.979	4/1/2022	12:00:00 AM	0	895.235	-0.718	0.80	25.46	1008.22
4/1/2022	1:00:00 AM	0	9.9323	4.979	4/1/2022	1:00:00 AM	0	895.155	-0.725	0.80	25.46	1008.22
4/1/2022	2:00:00 AM	0	9.9367	4.979	4/1/2022	2:00:00 AM	0	894.872	-1.294	0.81	25.45	1008.23
4/1/2022	3:00:00 AM	0	9.9409	4.979	4/1/2022	3:00:00 AM	0	894.394	-2.386	0.82	25.44	1008.24
4/1/2022	4:00:00 AM	0	9.9444	4.979	4/1/2022	4:00:00 AM	0	894.182	-3.656	0.83	25.43	1008.25
4/1/2022	5:00:00 AM	0	9.9489	4.979	4/1/2022	5:00:00 AM	0	894.296	-3.219	0.83	25.43	1008.25
4/1/2022	6:00:00 AM	0	9.9525	4.979	4/1/2022	6:00:00 AM	0	894.016	-3.241	0.84	25.42	1008.26
4/1/2022	7:00:00 AM	0	9.9563	4.978	4/1/2022	7:00:00 AM	0	893.912	-2.492	0.84	25.42	1008.26
4/1/2022	8:00:00 AM	0	9.9592	4.979	4/1/2022	8:00:00 AM	0	893.666	-0.693	0.85	25.41	1008.27
4/1/2022	9:00:00 AM	0	9.962	4.979	4/1/2022	9:00:00 AM	0	893.703	0.277	0.85	25.41	1008.27
4/1/2022	10:00:00 AM	0	9.9648	4.979	4/1/2022	10:00:00 AM	0	893.718	2.233	0.85	25.41	1008.27
4/1/2022	11:00:00 AM	0	9.9679	4.979	4/1/2022	11:00:00 AM	0	893.544	3.435	0.86	25.40	1008.28
4/1/2022	12:00:00 PM	0	9.9706	4.979	4/1/2022	12:00:00 PM	0	893.649	4.455	0.86	25.40	1008.28
4/1/2022	1:00:00 PM	0	9.9741	4.979	4/1/2022	1:00:00 PM	0	893.351	3.84	0.86	25.40	1008.28
4/1/2022	2:00:00 PM	0	9.9771	4.979	4/1/2022	2:00:00 PM	0	893.152	4.522	0.87	25.39	1008.29
4/1/2022	3:00:00 PM	0	9.98	4.979	4/1/2022	3:00:00 PM	0	892.882	3.768	0.88	25.38	1008.30
4/1/2022	4:00:00 PM	0	9.9831	4.979	4/1/2022	4:00:00 PM	0	892.721	4.03	0.88	25.38	1008.30
4/1/2022	5:00:00 PM	0	9.9863	4.979	4/1/2022	5:00:00 PM	0	892.275	3.299	0.89	25.37	1008.31
4/1/2022	6:00:00 PM	0	9.9892	4.979	4/1/2022	6:00:00 PM	0	891.901	2.19	0.89	25.37	1008.31
4/1/2022	7:00:00 PM	0	9.9923	4.979	4/1/2022	7:00:00 PM	0	892.4	0.756	0.89	25.37	1008.31
4/1/2022	8:00:00 PM	0	9.9955	4.979	4/1/2022	8:00:00 PM	0	891.604	-0.113	0.90	25.36	1008.32
4/1/2022	9:00:00 PM	0	9.9989	4.979	4/1/2022	9:00:00 PM	0	891.516	-0.504	0.91	25.35	1008.33
4/1/2022	10:00:00 PM	0	10.0024	4.979	4/1/2022	10:00:00 PM	0	891.77	-0.59	0.91	25.35	1008.33
4/1/2022	11:00:00 PM	0	10.0063	4.979	4/1/2022	11:00:00 PM	0	891.977	-0.586	0.91	25.35	1008.33
4/2/2022	12:00:00 AM	0	10.0106	4.978	4/2/2022	12:00:00 AM	0	892.046	-0.599	0.91	25.35	1008.33
4/2/2022	1:00:00 AM	0	10.015	4.979	4/2/2022	1:00:00 AM	0	892.192	-0.684	0.92	25.34	1008.34
4/2/2022	2:00:00 AM	0	10.0197	4.979	4/2/2022	2:00:00 AM	0	892.461	-0.878	0.92	25.34	1008.34
4/2/2022	3:00:00 AM	0	10.0249	4.979	4/2/2022	3:00:00 AM	0	892.514	-1.203	0.92	25.34	1008.34
4/2/2022	4:00:00 AM	0	10.0302	4.979	4/2/2022	4:00:00 AM	0	892.764	-1.593	0.93	25.33	1008.35
4/2/2022	5:00:00 AM	0	10.0364	4.979	4/2/2022	5:00:00 AM	0	893.326	-1.717	0.93	25.33	1008.35
4/2/2022	6:00:00 AM	0	10.0425	4.979	4/2/2022	6:00:00 AM	0	893.79	-1.518	0.93	25.33	1008.35
4/2/2022	7:00:00 AM	0	10.0485	4.979	4/2/2022	7:00:00 AM	0	893.935	-1.393	0.93	25.33	1008.35

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/2/2022	8:00:00 AM	0	10.0549	4.979	4/2/2022	8:00:00 AM	0	894.652	-0.024	0.93	25.33	1008.35
4/2/2022	9:00:00 AM	0	10.0611	4.979	4/2/2022	9:00:00 AM	0	895.553	6.556	0.93	25.33	1008.35
4/2/2022	10:00:00 AM	0	10.0667	4.979	4/2/2022	10:00:00 AM	0	895.748	11.354	0.93	25.33	1008.35
4/2/2022	11:00:00 AM	0	10.0723	4.979	4/2/2022	11:00:00 AM	0	895.75	9.575	0.94	25.32	1008.36
4/2/2022	12:00:00 PM	0	10.0782	4.979	4/2/2022	12:00:00 PM	0	895.952	11.889	0.94	25.32	1008.36
4/2/2022	1:00:00 PM	0	10.0832	4.979	4/2/2022	1:00:00 PM	0	895.459	14.223	0.95	25.31	1008.37
4/2/2022	2:00:00 PM	0	10.0875	4.979	4/2/2022	2:00:00 PM	0	895.184	14.659	0.96	25.30	1008.38
4/2/2022	3:00:00 PM	0	10.0918	4.979	4/2/2022	3:00:00 PM	0	895.027	11.612	0.97	25.29	1008.39
4/2/2022	4:00:00 PM	0	10.096	4.979	4/2/2022	4:00:00 PM	0	894.556	6.918	0.97	25.29	1008.39
4/2/2022	5:00:00 PM	0	10.1004	4.979	4/2/2022	5:00:00 PM	0	894.128	5.237	0.98	25.28	1008.40
4/2/2022	6:00:00 PM	0	10.1037	4.979	4/2/2022	6:00:00 PM	0	894.019	3.667	0.99	25.27	1008.41
4/2/2022	7:00:00 PM	0	10.1072	4.979	4/2/2022	7:00:00 PM	0	894.067	2.47	0.99	25.27	1008.41
4/2/2022	8:00:00 PM	0	10.1116	4.979	4/2/2022	8:00:00 PM	0	893.987	1.954	1.00	25.26	1008.42
4/2/2022	9:00:00 PM	0	10.1154	4.979	4/2/2022	9:00:00 PM	0	893.875	1.79	1.00	25.26	1008.42
4/2/2022	10:00:00 PM	0	10.1195	4.979	4/2/2022	10:00:00 PM	0	893.463	1.525	1.01	25.25	1008.43
4/2/2022	11:00:00 PM	0	10.1227	4.979	4/2/2022	11:00:00 PM	0	892.95	1.121	1.02	25.24	1008.44
4/3/2022	12:00:00 AM	0	10.125	4.979	4/3/2022	12:00:00 AM	0	892.528	0.721	1.02	25.24	1008.44
4/3/2022	1:00:00 AM	0	10.1271	4.979	4/3/2022	1:00:00 AM	0	892.152	0.654	1.03	25.23	1008.45
4/3/2022	2:00:00 AM	0	10.1282	4.979	4/3/2022	2:00:00 AM	0	891.431	0.543	1.04	25.22	1008.46
4/3/2022	3:00:00 AM	0	10.1288	4.979	4/3/2022	3:00:00 AM	0	890.664	0.473	1.05	25.21	1008.47
4/3/2022	4:00:00 AM	0	10.1299	4.979	4/3/2022	4:00:00 AM	0	890.051	0.315	1.05	25.21	1008.47
4/3/2022	5:00:00 AM	0	10.1299	4.979	4/3/2022	5:00:00 AM	0	889.261	0.302	1.06	25.20	1008.48
4/3/2022	6:00:00 AM	0	10.1293	4.979	4/3/2022	6:00:00 AM	0	888.283	0.204	1.07	25.19	1008.49
4/3/2022	7:00:00 AM	0	10.1279	4.979	4/3/2022	7:00:00 AM	0	887.612	0.469	1.08	25.18	1008.50
4/3/2022	8:00:00 AM	0	10.1261	4.979	4/3/2022	8:00:00 AM	0	887.003	1.231	1.08	25.18	1008.50
4/3/2022	9:00:00 AM	0	10.1249	4.979	4/3/2022	9:00:00 AM	0	886.278	2.599	1.09	25.17	1008.51
4/3/2022	10:00:00 AM	0	10.1228	4.979	4/3/2022	10:00:00 AM	0	885.551	4.293	1.09	25.17	1008.51
4/3/2022	11:00:00 AM	0	10.1212	4.979	4/3/2022	11:00:00 AM	0	885.302	6.871	1.09	25.17	1008.51
4/3/2022	12:00:00 PM	0	10.1189	4.979	4/3/2022	12:00:00 PM	0	884.492	6.851	1.10	25.16	1008.52
4/3/2022	1:00:00 PM	0	10.1165	4.979	4/3/2022	1:00:00 PM	0	883.413	5.211	1.11	25.15	1008.53
4/3/2022	2:00:00 PM	0	10.1148	4.979	4/3/2022	2:00:00 PM	0	882.604	4.137	1.11	25.15	1008.53
4/3/2022	3:00:00 PM	0	10.1129	4.979	4/3/2022	3:00:00 PM	0	882.867	3.436	1.11	25.15	1008.53
4/3/2022	4:00:00 PM	0	10.1123	4.979	4/3/2022	4:00:00 PM	0	882.902	2.136	1.11	25.15	1008.53
4/3/2022	5:00:00 PM	0	10.1132	4.978	4/3/2022	5:00:00 PM	0	882.327	2.268	1.12	25.14	1008.54
4/3/2022	6:00:00 PM	0	10.1141	4.979	4/3/2022	6:00:00 PM	0	881.854	1.216	1.12	25.14	1008.54
4/3/2022	7:00:00 PM	0	10.1142	4.979	4/3/2022	7:00:00 PM	0	881.073	-0.281	1.13	25.13	1008.55
4/3/2022	8:00:00 PM	0	10.114	4.98	4/3/2022	8:00:00 PM	0	879.988	-0.747	1.14	25.12	1008.56
4/3/2022	9:00:00 PM	0	10.1129	4.979	4/3/2022	9:00:00 PM	0	878.779	-1.441	1.15	25.11	1008.57
4/3/2022	10:00:00 PM	0	10.1103	4.979	4/3/2022	10:00:00 PM	0	877.364	-1.918	1.16	25.10	1008.58
4/3/2022	11:00:00 PM	0	10.1067	4.979	4/3/2022	11:00:00 PM	0	875.997	-1.723	1.17	25.09	1008.59
4/4/2022	12:00:00 AM	0	10.102	4.978	4/4/2022	12:00:00 AM	0	873.953	-1.403	1.19	25.07	1008.61
4/4/2022	1:00:00 AM	0	10.0954	4.979	4/4/2022	1:00:00 AM	0	871.458	-1.573	1.21	25.05	1008.63
4/4/2022	2:00:00 AM	0	10.0871	4.979	4/4/2022	2:00:00 AM	0	869.212	-1.272	1.22	25.04	1008.64
4/4/2022	3:00:00 AM	0	10.0777	4.979	4/4/2022	3:00:00 AM	0	867.401	-0.79	1.23	25.03	1008.65
4/4/2022	4:00:00 AM	0	10.0682	4.978	4/4/2022	4:00:00 AM	0	866.098	-0.598	1.24	25.02	1008.66
4/4/2022	5:00:00 AM	0	10.0604	4.979	4/4/2022	5:00:00 AM	0	865.48	-0.554	1.23	25.03	1008.65
4/4/2022	6:00:00 AM	0	10.0528	4.979	4/4/2022	6:00:00 AM	0	865.127	-0.507	1.23	25.03	1008.65
4/4/2022	7:00:00 AM	0	10.0477	4.98	4/4/2022	7:00:00 AM	0	865.218	-0.029	1.22	25.04	1008.64
4/4/2022	8:00:00 AM	0	10.0442	4.979	4/4/2022	8:00:00 AM	0	865.904	1.662	1.21	25.05	1008.63
4/4/2022	9:00:00 AM	0	10.0437	4.979	4/4/2022	9:00:00 AM	0	866.692	3.6	1.21	25.05	1008.63
4/4/2022	10:00:00 AM	0	10.0438	4.979	4/4/2022	10:00:00 AM	0	867.562	5.561	1.20	25.06	1008.62
4/4/2022	11:00:00 AM	0	10.0459	4.979	4/4/2022	11:00:00 AM	0	868.33	7.965	1.19	25.07	1008.61
4/4/2022	12:00:00 PM	0	10.0513	4.979	4/4/2022	12:00:00 PM	0	870.019	2.367	1.18	25.08	1008.60
4/4/2022	1:00:00 PM	0	10.0579	4.979	4/4/2022	1:00:00 PM	0	870.766	3.481	1.18	25.08	1008.60
4/4/2022	2:00:00 PM	0	10.0643	4.979	4/4/2022	2:00:00 PM	0	871.232	7.842	1.18	25.08	1008.60
4/4/2022	3:00:00 PM	0	10.0706	4.979	4/4/2022	3:00:00 PM	0	871.797	8.909	1.18	25.08	1008.60
4/4/2022	4:00:00 PM	0	10.078	4.979	4/4/2022	4:00:00 PM	0	872.238	4.977	1.18	25.08	1008.60
4/4/2022	5:00:00 PM	0	10.0851	4.979	4/4/2022	5:00:00 PM	0	872.67	3.036	1.19	25.07	1008.61
4/4/2022	6:00:00 PM	0	10.0931	4.979	4/4/2022	6:00:00 PM	0	872.992	2.1	1.19	25.07	1008.61
4/4/2022	7:00:00 PM	0	10.1008	4.979	4/4/2022	7:00:00 PM	0	873.974	0.785	1.19	25.07	1008.61
4/4/2022	8:00:00 PM	0	10.1101	4.979	4/4/2022	8:00:00 PM	0	875.27	-0.353	1.18	25.08	1008.60
4/4/2022	9:00:00 PM	0	10.1203	4.979	4/4/2022	9:00:00 PM	0	876.445	-0.642	1.18	25.08	1008.60
4/4/2022	10:00:00 PM	0	10.1309	4.979	4/4/2022	10:00:00 PM	0	877.676	-0.599	1.18	25.08	1008.60
4/4/2022	11:00:00 PM	0	10.142	4.978	4/4/2022	11:00:00 PM	0	878.845	-0.86	1.18	25.08	1008.60
4/5/2022	12:00:00 AM	0	10.154	4.979	4/5/2022	12:00:00 AM	0	880.105	-1.516	1.18	25.08	1008.60
4/5/2022	1:00:00 AM	0	10.166	4.979	4/5/2022	1:00:00 AM	0	881.3	-2.004	1.18	25.08	1008.60
4/5/2022	2:00:00 AM	0	10.1787	4.98	4/5/2022	2:00:00 AM	0	882.406	-3.153	1.18	25.08	1008.60
4/5/2022	3:00:00 AM	0	10.1922	4.979	4/5/2022	3:00:00 AM	0	883.635	-3.384	1.18	25.08	1008.60
4/5/2022	4:00:00 AM	0	10.2056	4.979	4/5/2022	4:00:00 AM	0	884.918	-3.999	1.18	25.08	1008.60
4/5/2022	5:00:00 AM	0	10.2193	4.979	4/5/2022	5:00:00 AM	0	886.269	-3.81	1.18	25.08	1008.60

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/5/2022	6:00:00 AM	0	10.233	4.979	4/5/2022	6:00:00 AM	0	887.714	-3.153	1.18	25.08	1008.60
4/5/2022	7:00:00 AM	0	10.2474	4.979	4/5/2022	7:00:00 AM	0	889.246	-1.778	1.18	25.08	1008.60
4/5/2022	8:00:00 AM	0	10.2615	4.979	4/5/2022	8:00:00 AM	0	890.965	-0.629	1.18	25.08	1008.60
4/5/2022	9:00:00 AM	0	10.2761	4.979	4/5/2022	9:00:00 AM	0	892.384	1.219	1.18	25.08	1008.60
4/5/2022	10:00:00 AM	0	10.2907	4.979	4/5/2022	10:00:00 AM	0	893.774	4.152	1.18	25.08	1008.60
4/5/2022	11:00:00 AM	0	10.3045	4.979	4/5/2022	11:00:00 AM	0	895.129	7.682	1.18	25.08	1008.60
4/5/2022	12:00:00 PM	0	10.3182	4.979	4/5/2022	12:00:00 PM	0	895.706	9.447	1.18	25.08	1008.60
4/5/2022	1:00:00 PM	0	10.3308	4.979	4/5/2022	1:00:00 PM	0	896.657	9.137	1.19	25.07	1008.61
4/5/2022	2:00:00 PM	0	10.344	4.98	4/5/2022	2:00:00 PM	0	897.902	7.96	1.19	25.07	1008.61
4/5/2022	3:00:00 PM	0	10.3566	4.979	4/5/2022	3:00:00 PM	0	898.28	7.416	1.20	25.06	1008.62
4/5/2022	4:00:00 PM	0	10.369	4.979	4/5/2022	4:00:00 PM	0	899.667	4.694	1.19	25.07	1008.61
4/5/2022	5:00:00 PM	0	10.3821	4.979	4/5/2022	5:00:00 PM	0	899.922	3.145	1.21	25.05	1008.63
4/5/2022	6:00:00 PM	0	10.3946	4.979	4/5/2022	6:00:00 PM	0	900.552	0.891	1.21	25.05	1008.63
4/5/2022	7:00:00 PM	0	10.4074	4.98	4/5/2022	7:00:00 PM	0	901.487	0.108	1.21	25.05	1008.63
4/5/2022	8:00:00 PM	0	10.42	4.979	4/5/2022	8:00:00 PM	0	902.625	-1.963	1.22	25.04	1008.64
4/5/2022	9:00:00 PM	0	10.4328	4.979	4/5/2022	9:00:00 PM	0	903.907	-1.046	1.22	25.04	1008.64
4/5/2022	10:00:00 PM	0	10.446	4.98	4/5/2022	10:00:00 PM	0	904.811	-2.855	1.22	25.04	1008.64
4/5/2022	11:00:00 PM	0	10.4595	4.979	4/5/2022	11:00:00 PM	0	905.686	-3.785	1.22	25.04	1008.64
4/6/2022	12:00:00 AM	0	10.4722	4.979	4/6/2022	12:00:00 AM	0	906.321	-4.288	1.23	25.03	1008.65
4/6/2022	1:00:00 AM	0	10.4845	4.979	4/6/2022	1:00:00 AM	0	906.968	-5.222	1.24	25.02	1008.66
4/6/2022	2:00:00 AM	0	10.4965	4.979	4/6/2022	2:00:00 AM	0	907.451	-6.039	1.24	25.02	1008.66
4/6/2022	3:00:00 AM	0	10.5075	4.979	4/6/2022	3:00:00 AM	0	907.9	-6.504	1.25	25.01	1008.67
4/6/2022	4:00:00 AM	0	10.5187	4.979	4/6/2022	4:00:00 AM	0	908.593	-6.794	1.25	25.01	1008.67
4/6/2022	5:00:00 AM	0	10.5284	4.979	4/6/2022	5:00:00 AM	0	908.606	-7.172	1.26	25.00	1008.68
4/6/2022	6:00:00 AM	0	10.538	4.979	4/6/2022	6:00:00 AM	0	908.863	-7.368	1.27	24.99	1008.69
4/6/2022	7:00:00 AM	0	10.5465	4.979	4/6/2022	7:00:00 AM	0	909.53	-6.616	1.27	24.99	1008.69
4/6/2022	8:00:00 AM	0	10.5551	4.98	4/6/2022	8:00:00 AM	0	911.15	-0.201	1.26	25.00	1008.68
4/6/2022	9:00:00 AM	0	10.5623	4.979	4/6/2022	9:00:00 AM	0	911.665	7.002	1.27	24.99	1008.69
4/6/2022	10:00:00 AM	0	10.5695	4.98	4/6/2022	10:00:00 AM	0	911.26	7.69	1.28	24.98	1008.70
4/6/2022	11:00:00 AM	0	10.575	4.979	4/6/2022	11:00:00 AM	0	910.996	7.872	1.29	24.97	1008.71
4/6/2022	12:00:00 PM	0	10.5798	4.98	4/6/2022	12:00:00 PM	0	910.441	8.358	1.30	24.96	1008.72
4/6/2022	1:00:00 PM	0	10.5832	4.979	4/6/2022	1:00:00 PM	0	909.453	9.563	1.31	24.95	1008.73
4/6/2022	2:00:00 PM	0	10.5852	4.98	4/6/2022	2:00:00 PM	0	909.058	9.14	1.32	24.94	1008.74
4/6/2022	3:00:00 PM	0	10.5868	4.979	4/6/2022	3:00:00 PM	0	908.164	7.713	1.33	24.93	1008.75
4/6/2022	4:00:00 PM	0	10.5878	4.979	4/6/2022	4:00:00 PM	0	907.693	5.955	1.33	24.93	1008.75
4/6/2022	5:00:00 PM	0	10.5895	4.979	4/6/2022	5:00:00 PM	0	907.538	4.405	1.34	24.92	1008.76
4/6/2022	6:00:00 PM	0	10.5915	4.979	4/6/2022	6:00:00 PM	0	907.524	3.1	1.34	24.92	1008.76
4/6/2022	7:00:00 PM	0	10.5946	4.979	4/6/2022	7:00:00 PM	0	907.586	1.851	1.34	24.92	1008.76
4/6/2022	8:00:00 PM	0	10.5975	4.979	4/6/2022	8:00:00 PM	0	907.823	1.146	1.34	24.92	1008.76
4/6/2022	9:00:00 PM	0	10.601	4.979	4/6/2022	9:00:00 PM	0	907.538	-0.103	1.35	24.91	1008.77
4/6/2022	10:00:00 PM	0	10.6036	4.979	4/6/2022	10:00:00 PM	0	906.789	-0.559	1.36	24.90	1008.78
4/6/2022	11:00:00 PM	0	10.6056	4.979	4/6/2022	11:00:00 PM	0	906.405	-0.417	1.36	24.90	1008.78
4/7/2022	12:00:00 AM	0	10.6068	4.98	4/7/2022	12:00:00 AM	0	906.152	-0.164	1.37	24.89	1008.79
4/7/2022	1:00:00 AM	0	10.6087	4.979	4/7/2022	1:00:00 AM	0	906.21	0.036	1.37	24.89	1008.79
4/7/2022	2:00:00 AM	0	10.6104	4.979	4/7/2022	2:00:00 AM	0	905.812	0.137	1.37	24.89	1008.79
4/7/2022	3:00:00 AM	0	10.6114	4.979	4/7/2022	3:00:00 AM	0	905.508	0.351	1.38	24.88	1008.80
4/7/2022	4:00:00 AM	0	10.6125	4.979	4/7/2022	4:00:00 AM	0	904.744	0.431	1.39	24.87	1008.81
4/7/2022	5:00:00 AM	0	10.6133	4.979	4/7/2022	5:00:00 AM	0	904.677	0.161	1.39	24.87	1008.81
4/7/2022	6:00:00 AM	0	10.6136	4.979	4/7/2022	6:00:00 AM	0	904.077	-0.219	1.39	24.87	1008.81
4/7/2022	7:00:00 AM	0	10.6143	4.979	4/7/2022	7:00:00 AM	0	904.017	1.048	1.40	24.86	1008.82
4/7/2022	8:00:00 AM	0	10.6147	4.979	4/7/2022	8:00:00 AM	0	903.857	4.281	1.40	24.86	1008.82
4/7/2022	9:00:00 AM	0	10.6143	4.979	4/7/2022	9:00:00 AM	0	903.147	7.962	1.40	24.86	1008.82
4/7/2022	10:00:00 AM	0	10.6131	4.98	4/7/2022	10:00:00 AM	0	902.734	9.538	1.41	24.85	1008.83
4/7/2022	11:00:00 AM	0	10.6118	4.979	4/7/2022	11:00:00 AM	0	902.075	12.038	1.41	24.85	1008.83
4/7/2022	12:00:00 PM	0	10.6107	4.979	4/7/2022	12:00:00 PM	0	901.525	11.22	1.42	24.84	1008.84
4/7/2022	1:00:00 PM	0	10.6095	4.979	4/7/2022	1:00:00 PM	0	900.734	8.656	1.42	24.84	1008.84
4/7/2022	2:00:00 PM	0	10.6077	4.979	4/7/2022	2:00:00 PM	0	900.065	8.23	1.43	24.83	1008.85
4/7/2022	3:00:00 PM	0	10.6059	4.979	4/7/2022	3:00:00 PM	0	899.215	9.7	1.44	24.82	1008.86
4/7/2022	4:00:00 PM	0	10.6037	4.98	4/7/2022	4:00:00 PM	0	898.256	8.675	1.44	24.82	1008.86
4/7/2022	5:00:00 PM	0	10.6004	4.979	4/7/2022	5:00:00 PM	0	896.958	8.129	1.45	24.81	1008.87
4/7/2022	6:00:00 PM	0	10.5969	4.979	4/7/2022	6:00:00 PM	0	895.73	6.917	1.46	24.80	1008.88
4/7/2022	7:00:00 PM	0	10.5933	4.979	4/7/2022	7:00:00 PM	0	895.076	5.511	1.47	24.79	1008.89
4/7/2022	8:00:00 PM	0	10.5899	4.979	4/7/2022	8:00:00 PM	0	894.572	5.013	1.47	24.79	1008.89
4/7/2022	9:00:00 PM	0	10.5869	4.979	4/7/2022	9:00:00 PM	0	893.968	5.362	1.47	24.79	1008.89
4/7/2022	10:00:00 PM	0	10.5836	4.978	4/7/2022	10:00:00 PM	0	893.14	5.963	1.48	24.78	1008.90
4/7/2022	11:00:00 PM	0	10.5815	4.979	4/7/2022	11:00:00 PM	0	892.336	5.815	1.48	24.78	1008.90
4/8/2022	12:00:00 AM	0	10.5773	4.979	4/8/2022	12:00:00 AM	0	891.061	5.563	1.49	24.77	1008.91
4/8/2022	1:00:00 AM	0	10.5735	4.979	4/8/2022	1:00:00 AM	0	889.86	5.588	1.50	24.76	1008.92
4/8/2022	2:00:00 AM	0	10.5692	4.979	4/8/2022	2:00:00 AM	0	888.96	5.993	1.50	24.76	1008.92
4/8/2022	3:00:00 AM	0	10.5645	4.979	4/8/2022	3:00:00 AM	0	888.159	6.003	1.51	24.75	1008.93

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/8/2022	4:00:00 AM	0	10.5613	4.98	4/8/2022	4:00:00 AM	0	887.391	5.507	1.51	24.75	1008.93
4/8/2022	5:00:00 AM	0	10.5588	4.979	4/8/2022	5:00:00 AM	0	887.575	5.096	1.51	24.75	1008.93
4/8/2022	6:00:00 AM	0	10.5575	4.979	4/8/2022	6:00:00 AM	0	887.813	4.496	1.50	24.76	1008.92
4/8/2022	7:00:00 AM	0	10.5581	4.979	4/8/2022	7:00:00 AM	0	888.258	4.49	1.50	24.76	1008.92
4/8/2022	8:00:00 AM	0	10.5606	4.979	4/8/2022	8:00:00 AM	0	889.331	6.643	1.49	24.77	1008.91
4/8/2022	9:00:00 AM	0	10.561	4.98	4/8/2022	9:00:00 AM	0	889.15	16.906	1.49	24.77	1008.91
4/8/2022	10:00:00 AM	0	10.5627	4.98	4/8/2022	10:00:00 AM	0	889.326	21.275	1.49	24.77	1008.91
4/8/2022	11:00:00 AM	0	10.5662	4.98	4/8/2022	11:00:00 AM	0	889.514	17.26	1.50	24.76	1008.92
4/8/2022	12:00:00 PM	0	10.5717	4.979	4/8/2022	12:00:00 PM	0	889.949	12.051	1.50	24.76	1008.92
4/8/2022	1:00:00 PM	0	10.5757	4.979	4/8/2022	1:00:00 PM	0	890.412	13.309	1.50	24.76	1008.92
4/8/2022	2:00:00 PM	0	10.5804	4.979	4/8/2022	2:00:00 PM	0	890.784	11.511	1.50	24.76	1008.92
4/8/2022	3:00:00 PM	0	10.5861	4.98	4/8/2022	3:00:00 PM	0	890.893	10.036	1.50	24.76	1008.92
4/8/2022	4:00:00 PM	0	10.5917	4.979	4/8/2022	4:00:00 PM	0	891.486	8.162	1.50	24.76	1008.92
4/8/2022	5:00:00 PM	0	10.5979	4.979	4/8/2022	5:00:00 PM	0	891.938	6.18	1.50	24.76	1008.92
4/8/2022	6:00:00 PM	0	10.605	4.979	4/8/2022	6:00:00 PM	0	892.375	4.13	1.51	24.75	1008.93
4/8/2022	7:00:00 PM	0	10.6128	4.979	4/8/2022	7:00:00 PM	0	893.105	2.198	1.51	24.75	1008.93
4/8/2022	8:00:00 PM	0	10.6205	4.979	4/8/2022	8:00:00 PM	0	893.928	0.425	1.50	24.76	1008.92
4/8/2022	9:00:00 PM	0	10.6293	4.979	4/8/2022	9:00:00 PM	0	894.572	0.049	1.51	24.75	1008.93
4/8/2022	10:00:00 PM	0	10.6378	4.979	4/8/2022	10:00:00 PM	0	894.802	-0.32	1.51	24.75	1008.93
4/8/2022	11:00:00 PM	0	10.6465	4.98	4/8/2022	11:00:00 PM	0	895.281	-1.407	1.52	24.74	1008.94
4/9/2022	12:00:00 AM	0	10.6549	4.979	4/9/2022	12:00:00 AM	0	895.607	-1.966	1.52	24.74	1008.94
4/9/2022	1:00:00 AM	0	10.6633	4.979	4/9/2022	1:00:00 AM	0	896.155	-1.209	1.53	24.73	1008.95
4/9/2022	2:00:00 AM	0	10.6711	4.979	4/9/2022	2:00:00 AM	0	896.482	-1.539	1.53	24.73	1008.95
4/9/2022	3:00:00 AM	0	10.6795	4.979	4/9/2022	3:00:00 AM	0	896.501	-2.93	1.54	24.72	1008.96
4/9/2022	4:00:00 AM	0	10.6872	4.979	4/9/2022	4:00:00 AM	0	896.545	-4.219	1.54	24.72	1008.96
4/9/2022	5:00:00 AM	0	10.6944	4.979	4/9/2022	5:00:00 AM	0	896.509	-4.789	1.55	24.71	1008.97
4/9/2022	6:00:00 AM	0	10.7013	4.979	4/9/2022	6:00:00 AM	0	896.685	-4.512	1.56	24.70	1008.98
4/9/2022	7:00:00 AM	0	10.7079	4.979	4/9/2022	7:00:00 AM	0	897.155	-2.894	1.56	24.70	1008.98
4/9/2022	8:00:00 AM	0	10.7144	4.979	4/9/2022	8:00:00 AM	0	897.488	0.1	1.56	24.70	1008.98
4/9/2022	9:00:00 AM	0	10.7203	4.979	4/9/2022	9:00:00 AM	0	897.538	3.524	1.57	24.69	1008.99
4/9/2022	10:00:00 AM	0	10.7241	4.979	4/9/2022	10:00:00 AM	0	897.401	8.491	1.57	24.69	1008.99
4/9/2022	11:00:00 AM	0	10.7287	4.979	4/9/2022	11:00:00 AM	0	896.891	7.9	1.58	24.68	1009.00
4/9/2022	12:00:00 PM	0	10.7326	4.979	4/9/2022	12:00:00 PM	0	896.584	8.864	1.59	24.67	1009.01
4/9/2022	1:00:00 PM	0	10.7364	4.979	4/9/2022	1:00:00 PM	0	897.139	7.083	1.59	24.67	1009.01
4/9/2022	2:00:00 PM	0	10.7404	4.98	4/9/2022	2:00:00 PM	0	896.312	5.89	1.60	24.66	1009.02
4/9/2022	3:00:00 PM	0	10.7448	4.98	4/9/2022	3:00:00 PM	0	896.229	6.4	1.61	24.65	1009.03
4/9/2022	4:00:00 PM	0	10.748	4.979	4/9/2022	4:00:00 PM	0	895.956	3.253	1.61	24.65	1009.03
4/9/2022	5:00:00 PM	0	10.752	4.979	4/9/2022	5:00:00 PM	0	895.539	2.426	1.62	24.64	1009.04
4/9/2022	6:00:00 PM	0	10.7556	4.979	4/9/2022	6:00:00 PM	0	895.306	1.317	1.63	24.63	1009.05
4/9/2022	7:00:00 PM	0	10.7593	4.979	4/9/2022	7:00:00 PM	0	895.151	-1.476	1.63	24.63	1009.05
4/9/2022	8:00:00 PM	0	10.7631	4.979	4/9/2022	8:00:00 PM	0	895.285	-1.269	1.63	24.63	1009.05
4/9/2022	9:00:00 PM	0	10.7667	4.979	4/9/2022	9:00:00 PM	0	894.869	-3.39	1.64	24.62	1009.06
4/9/2022	10:00:00 PM	0	10.7707	4.979	4/9/2022	10:00:00 PM	0	894.652	-4.871	1.65	24.61	1009.07
4/9/2022	11:00:00 PM	0	10.7749	4.979	4/9/2022	11:00:00 PM	0	894.77	-5.713	1.65	24.61	1009.07
4/10/2022	12:00:00 AM	0	10.779	4.979	4/10/2022	12:00:00 AM	0	894.818	-6.178	1.65	24.61	1009.07
4/10/2022	1:00:00 AM	0	10.7837	4.979	4/10/2022	1:00:00 AM	0	894.709	-6.523	1.66	24.60	1009.08
4/10/2022	2:00:00 AM	0	10.7875	4.98	4/10/2022	2:00:00 AM	0	894.695	-6.514	1.66	24.60	1009.08
4/10/2022	3:00:00 AM	0	10.7916	4.979	4/10/2022	3:00:00 AM	0	894.648	-6.143	1.67	24.59	1009.09
4/10/2022	4:00:00 AM	0	10.7959	4.979	4/10/2022	4:00:00 AM	0	894.677	-5.796	1.67	24.59	1009.09
4/10/2022	5:00:00 AM	0	10.7996	4.979	4/10/2022	5:00:00 AM	0	894.643	-5.955	1.68	24.58	1009.10
4/10/2022	6:00:00 AM	0	10.803	4.979	4/10/2022	6:00:00 AM	0	894.449	-5.901	1.68	24.58	1009.10
4/10/2022	7:00:00 AM	0	10.8066	4.979	4/10/2022	7:00:00 AM	0	894.625	-4.399	1.68	24.58	1009.10
4/10/2022	8:00:00 AM	0	10.8105	4.98	4/10/2022	8:00:00 AM	0	894.98	-0.926	1.68	24.58	1009.10
4/10/2022	9:00:00 AM	0	10.8134	4.979	4/10/2022	9:00:00 AM	0	894.858	1.221	1.69	24.57	1009.11
4/10/2022	10:00:00 AM	0	10.8156	4.98	4/10/2022	10:00:00 AM	0	894.827	7.505	1.69	24.57	1009.11
4/10/2022	11:00:00 AM	0	10.8176	4.979	4/10/2022	11:00:00 AM	0	894.504	9.879	1.70	24.56	1009.12
4/10/2022	12:00:00 PM	0	10.8196	4.979	4/10/2022	12:00:00 PM	0	894.123	8.084	1.70	24.56	1009.12
4/10/2022	1:00:00 PM	0	10.8222	4.98	4/10/2022	1:00:00 PM	0	893.582	8.009	1.71	24.55	1009.13
4/10/2022	2:00:00 PM	0	10.8233	4.98	4/10/2022	2:00:00 PM	0	893.25	10.677	1.71	24.55	1009.13
4/10/2022	3:00:00 PM	0	10.8246	4.98	4/10/2022	3:00:00 PM	0	892.549	7.119	1.72	24.54	1009.14
4/10/2022	4:00:00 PM	0	10.826	4.979	4/10/2022	4:00:00 PM	0	892.214	4.292	1.73	24.53	1009.15
4/10/2022	5:00:00 PM	0	10.8275	4.979	4/10/2022	5:00:00 PM	0	891.891	2.114	1.73	24.53	1009.15
4/10/2022	6:00:00 PM	0	10.8292	4.979	4/10/2022	6:00:00 PM	0	891.531	0.671	1.74	24.52	1009.16
4/10/2022	7:00:00 PM	0	10.8319	4.979	4/10/2022	7:00:00 PM	0	891.436	-0.928	1.74	24.52	1009.16
4/10/2022	8:00:00 PM	0	10.8346	4.979	4/10/2022	8:00:00 PM	0	891.433	-1.65	1.74	24.52	1009.16
4/10/2022	9:00:00 PM	0	10.8373	4.979	4/10/2022	9:00:00 PM	0	891.259	-2.319	1.75	24.51	1009.17
4/10/2022	10:00:00 PM	0	10.8405	4.979	4/10/2022	10:00:00 PM	0	891.138	-3.594	1.75	24.51	1009.17
4/10/2022	11:00:00 PM	0	10.8436	4.979	4/10/2022	11:00:00 PM	0	890.987	-4.35	1.76	24.50	1009.18
4/11/2022	12:00:00 AM	0	10.8468	4.98	4/11/2022	12:00:00 AM	0	890.832	-4.738	1.76	24.50	1009.18
4/11/2022	1:00:00 AM	0	10.8498	4.979	4/11/2022	1:00:00 AM	0	890.613	-5.063	1.77	24.49	1009.19

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/11/2022	2:00:00 AM	0	10.8524	4.979	4/11/2022	2:00:00 AM	0	890.083	-5.515	1.78	24.48	1009.20
4/11/2022	3:00:00 AM	0	10.8549	4.98	4/11/2022	3:00:00 AM	0	889.485	-5.977	1.78	24.48	1009.20
4/11/2022	4:00:00 AM	0	10.8566	4.979	4/11/2022	4:00:00 AM	0	889.024	-6.621	1.79	24.47	1009.21
4/11/2022	5:00:00 AM	0	10.8581	4.979	4/11/2022	5:00:00 AM	0	888.659	-7.478	1.80	24.46	1009.22
4/11/2022	6:00:00 AM	0	10.8594	4.979	4/11/2022	6:00:00 AM	0	888.533	-8.039	1.80	24.46	1009.22
4/11/2022	7:00:00 AM	0	10.8616	4.979	4/11/2022	7:00:00 AM	0	888.708	-7.321	1.80	24.46	1009.22
4/11/2022	8:00:00 AM	0	10.8637	4.98	4/11/2022	8:00:00 AM	0	889.662	0.534	1.79	24.47	1009.21
4/11/2022	9:00:00 AM	0	10.8652	4.98	4/11/2022	9:00:00 AM	0	889.978	9.099	1.79	24.47	1009.21
4/11/2022	10:00:00 AM	0	10.8655	4.979	4/11/2022	10:00:00 AM	0	889.612	13.357	1.79	24.47	1009.21
4/11/2022	11:00:00 AM	0	10.8682	4.979	4/11/2022	11:00:00 AM	0	889.228	12.847	1.80	24.46	1009.22
4/11/2022	12:00:00 PM	0	10.8697	4.979	4/11/2022	12:00:00 PM	0	888.855	14.945	1.81	24.45	1009.23
4/11/2022	1:00:00 PM	0	10.8711	4.979	4/11/2022	1:00:00 PM	0	888.433	15.514	1.81	24.45	1009.23
4/11/2022	2:00:00 PM	0	10.8728	4.98	4/11/2022	2:00:00 PM	0	888.246	15.23	1.82	24.44	1009.24
4/11/2022	3:00:00 PM	0	10.8754	4.979	4/11/2022	3:00:00 PM	0	888.291	8.209	1.82	24.44	1009.24
4/11/2022	4:00:00 PM	0	10.8787	4.979	4/11/2022	4:00:00 PM	0	888.014	4.604	1.82	24.44	1009.24
4/11/2022	5:00:00 PM	0	10.8811	4.979	4/11/2022	5:00:00 PM	0	887.915	3.185	1.83	24.43	1009.25
4/11/2022	6:00:00 PM	0	10.8848	4.98	4/11/2022	6:00:00 PM	0	888.179	1.669	1.83	24.43	1009.25
4/11/2022	7:00:00 PM	0	10.8884	4.979	4/11/2022	7:00:00 PM	0	888.516	-0.849	1.83	24.43	1009.25
4/11/2022	8:00:00 PM	0	10.8932	4.979	4/11/2022	8:00:00 PM	0	889.003	-2.752	1.83	24.43	1009.25
4/11/2022	9:00:00 PM	0	10.899	4.979	4/11/2022	9:00:00 PM	0	889.576	-2.648	1.83	24.43	1009.25
4/11/2022	10:00:00 PM	0	10.9055	4.979	4/11/2022	10:00:00 PM	0	889.894	-4.272	1.83	24.43	1009.25
4/11/2022	11:00:00 PM	0	10.9118	4.979	4/11/2022	11:00:00 PM	0	890.237	-5.404	1.83	24.43	1009.25
4/12/2022	12:00:00 AM	0	10.9187	4.979	4/12/2022	12:00:00 AM	0	890.739	-6.074	1.84	24.42	1009.26
4/12/2022	1:00:00 AM	0	10.9251	4.98	4/12/2022	1:00:00 AM	0	891.043	-6.579	1.84	24.42	1009.26
4/12/2022	2:00:00 AM	0	10.9321	4.98	4/12/2022	2:00:00 AM	0	891.459	-6.957	1.84	24.42	1009.26
4/12/2022	3:00:00 AM	0	10.9391	4.98	4/12/2022	3:00:00 AM	0	891.846	-7.404	1.84	24.42	1009.26
4/12/2022	4:00:00 AM	0	10.9458	4.979	4/12/2022	4:00:00 AM	0	892.405	-7.887	1.85	24.41	1009.27
4/12/2022	5:00:00 AM	0	10.953	4.979	4/12/2022	5:00:00 AM	0	892.826	-8.313	1.85	24.41	1009.27
4/12/2022	6:00:00 AM	0	10.9605	4.979	4/12/2022	6:00:00 AM	0	893.373	-8.591	1.85	24.41	1009.27
4/12/2022	7:00:00 AM	0	10.9675	4.979	4/12/2022	7:00:00 AM	0	894.286	-7.817	1.85	24.41	1009.27
4/12/2022	8:00:00 AM	0	10.9758	4.979	4/12/2022	8:00:00 AM	0	895.856	-0.424	1.84	24.42	1009.26
4/12/2022	9:00:00 AM	0	10.9826	4.979	4/12/2022	9:00:00 AM	0	896.549	7.246	1.84	24.42	1009.26
4/12/2022	10:00:00 AM	0	10.9882	4.979	4/12/2022	10:00:00 AM	0	896.817	11.787	1.84	24.42	1009.26
4/12/2022	11:00:00 AM	0	10.9947	4.979	4/12/2022	11:00:00 AM	0	896.908	10.828	1.85	24.41	1009.27
4/12/2022	12:00:00 PM	0	11.0015	4.979	4/12/2022	12:00:00 PM	0	896.883	13.11	1.86	24.40	1009.28
4/12/2022	1:00:00 PM	0	11.0073	4.979	4/12/2022	1:00:00 PM	0	896.654	14.958	1.86	24.40	1009.28
4/12/2022	2:00:00 PM	0	11.0118	4.979	4/12/2022	2:00:00 PM	0	896.444	17.5	1.87	24.39	1009.29
4/12/2022	3:00:00 PM	0	11.0166	4.979	4/12/2022	3:00:00 PM	0	896.781	11.312	1.87	24.39	1009.29
4/12/2022	4:00:00 PM	0	11.0222	4.979	4/12/2022	4:00:00 PM	0	896.155	4.206	1.88	24.38	1009.30
4/12/2022	5:00:00 PM	0	11.0272	4.979	4/12/2022	5:00:00 PM	0	896.091	2.53	1.89	24.37	1009.31
4/12/2022	6:00:00 PM	0	11.0319	4.979	4/12/2022	6:00:00 PM	0	896.288	0.244	1.89	24.37	1009.31
4/12/2022	7:00:00 PM	0	11.0373	4.979	4/12/2022	7:00:00 PM	0	896.483	-2.162	1.90	24.36	1009.32
4/12/2022	8:00:00 PM	0	11.0427	4.979	4/12/2022	8:00:00 PM	0	896.937	-2.264	1.90	24.36	1009.32
4/12/2022	9:00:00 PM	0	11.0486	4.979	4/12/2022	9:00:00 PM	0	897.095	-4.424	1.90	24.36	1009.32
4/12/2022	10:00:00 PM	0	11.0546	4.979	4/12/2022	10:00:00 PM	0	897.1	-5.874	1.91	24.35	1009.33
4/12/2022	11:00:00 PM	0	11.06	4.979	4/12/2022	11:00:00 PM	0	897.165	-6.792	1.91	24.35	1009.33
4/13/2022	12:00:00 AM	0	11.0657	4.98	4/13/2022	12:00:00 AM	0	897.553	-7.349	1.91	24.35	1009.33
4/13/2022	1:00:00 AM	0	11.0716	4.979	4/13/2022	1:00:00 AM	0	897.768	-7.781	1.92	24.34	1009.34
4/13/2022	2:00:00 AM	0	11.0774	4.979	4/13/2022	2:00:00 AM	0	897.809	-8.767	1.92	24.34	1009.34
4/13/2022	3:00:00 AM	0	11.0831	4.979	4/13/2022	3:00:00 AM	0	897.795	-9.756	1.93	24.33	1009.35
4/13/2022	4:00:00 AM	0	11.0885	4.98	4/13/2022	4:00:00 AM	0	897.923	-10.548	1.93	24.33	1009.35
4/13/2022	5:00:00 AM	0	11.0934	4.979	4/13/2022	5:00:00 AM	0	897.934	-11.329	1.94	24.32	1009.36
4/13/2022	6:00:00 AM	0	11.0992	4.979	4/13/2022	6:00:00 AM	0	898.195	-11.818	1.94	24.32	1009.36
4/13/2022	7:00:00 AM	0	11.1042	4.979	4/13/2022	7:00:00 AM	0	898.773	-11.07	1.94	24.32	1009.36
4/13/2022	8:00:00 AM	0	11.1099	4.979	4/13/2022	8:00:00 AM	0	900.149	-2.396	1.93	24.33	1009.35
4/13/2022	9:00:00 AM	0	11.1142	4.979	4/13/2022	9:00:00 AM	0	900.531	5.273	1.93	24.33	1009.35
4/13/2022	10:00:00 AM	0	11.1178	4.98	4/13/2022	10:00:00 AM	0	900.378	10.144	1.94	24.32	1009.36
4/13/2022	11:00:00 AM	0	11.1214	4.979	4/13/2022	11:00:00 AM	0	900.114	9.449	1.94	24.32	1009.36
4/13/2022	12:00:00 PM	0	11.1243	4.98	4/13/2022	12:00:00 PM	0	899.721	11.65	1.95	24.31	1009.37
4/13/2022	1:00:00 PM	0	11.1269	4.98	4/13/2022	1:00:00 PM	0	899.336	11.535	1.96	24.30	1009.38
4/13/2022	2:00:00 PM	0	11.129	4.979	4/13/2022	2:00:00 PM	0	898.645	14.227	1.97	24.29	1009.39
4/13/2022	3:00:00 PM	0	11.1305	4.979	4/13/2022	3:00:00 PM	0	898.074	8.847	1.97	24.29	1009.39
4/13/2022	4:00:00 PM	0	11.1319	4.979	4/13/2022	4:00:00 PM	0	897.352	2.826	1.98	24.28	1009.40
4/13/2022	5:00:00 PM	0	11.1341	4.979	4/13/2022	5:00:00 PM	0	897.151	1.33	1.99	24.27	1009.41
4/13/2022	6:00:00 PM	0	11.1358	4.979	4/13/2022	6:00:00 PM	0	897.008	0.199	1.99	24.27	1009.41
4/13/2022	7:00:00 PM	0	11.1378	4.979	4/13/2022	7:00:00 PM	0	896.817	-1.5	1.99	24.27	1009.41
4/13/2022	8:00:00 PM	0	11.1403	4.979	4/13/2022	8:00:00 PM	0	896.704	-1.984	2.00	24.26	1009.42
4/13/2022	9:00:00 PM	0	11.1422	4.979	4/13/2022	9:00:00 PM	0	896.165	-4.258	2.00	24.26	1009.42
4/13/2022	10:00:00 PM	0	11.1441	4.979	4/13/2022	10:00:00 PM	0	895.832	-5.757	2.01	24.25	1009.43
4/13/2022	11:00:00 PM	0	11.146	4.979	4/13/2022	11:00:00 PM	0	895.415	-6.663	2.02	24.24	1009.44

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/14/2022	12:00:00 AM	0	11.1485	4.98	4/14/2022	12:00:00 AM	0	895.431	-7.273	2.02	24.24	1009.44
4/14/2022	1:00:00 AM	0	11.1501	4.979	4/14/2022	1:00:00 AM	0	895.265	-7.837	2.02	24.24	1009.44
4/14/2022	2:00:00 AM	0	11.1528	4.979	4/14/2022	2:00:00 AM	0	895.013	-8.532	2.03	24.23	1009.45
4/14/2022	3:00:00 AM	0	11.1547	4.979	4/14/2022	3:00:00 AM	0	894.678	-9.176	2.03	24.23	1009.45
4/14/2022	4:00:00 AM	0	11.1569	4.98	4/14/2022	4:00:00 AM	0	894.726	-9.613	2.03	24.23	1009.45
4/14/2022	5:00:00 AM	0	11.1591	4.979	4/14/2022	5:00:00 AM	0	894.521	-9.965	2.04	24.22	1009.46
4/14/2022	6:00:00 AM	0	11.1607	4.979	4/14/2022	6:00:00 AM	0	894.572	-9.634	2.04	24.22	1009.46
4/14/2022	7:00:00 AM	0	11.1634	4.979	4/14/2022	7:00:00 AM	0	895.027	-8.071	2.04	24.22	1009.46
4/14/2022	8:00:00 AM	0	11.1661	4.979	4/14/2022	8:00:00 AM	0	895.786	-2.702	2.03	24.23	1009.45
4/14/2022	9:00:00 AM	0	11.1681	4.979	4/14/2022	9:00:00 AM	0	895.941	2.223	2.03	24.23	1009.45
4/14/2022	10:00:00 AM	0	11.1694	4.98	4/14/2022	10:00:00 AM	0	896	8.397	2.03	24.23	1009.45
4/14/2022	11:00:00 AM	0	11.1711	4.979	4/14/2022	11:00:00 AM	0	895.706	9.433	2.04	24.22	1009.46
4/14/2022	12:00:00 PM	0	11.1729	4.979	4/14/2022	12:00:00 PM	0	895.47	11.592	2.04	24.22	1009.46
4/14/2022	1:00:00 PM	0	11.1739	4.979	4/14/2022	1:00:00 PM	0	894.925	13.9	2.05	24.21	1009.47
4/14/2022	2:00:00 PM	0	11.1759	4.979	4/14/2022	2:00:00 PM	0	894.811	11.971	2.05	24.21	1009.47
4/14/2022	3:00:00 PM	0	11.1774	4.979	4/14/2022	3:00:00 PM	0	894.631	10.043	2.05	24.21	1009.47
4/14/2022	4:00:00 PM	0	11.1795	4.98	4/14/2022	4:00:00 PM	0	893.805	4.385	2.07	24.19	1009.49
4/14/2022	5:00:00 PM	0	11.1813	4.979	4/14/2022	5:00:00 PM	0	893.677	2.638	2.07	24.19	1009.49
4/14/2022	6:00:00 PM	0	11.1834	4.98	4/14/2022	6:00:00 PM	0	893.289	0.416	2.07	24.19	1009.49
4/14/2022	7:00:00 PM	0	11.1848	4.98	4/14/2022	7:00:00 PM	0	893.123	-1.365	2.08	24.18	1009.50
4/14/2022	8:00:00 PM	0	11.1865	4.98	4/14/2022	8:00:00 PM	0	893.381	-1.82	2.08	24.18	1009.50
4/14/2022	9:00:00 PM	0	11.1896	4.98	4/14/2022	9:00:00 PM	0	893.263	-3.62	2.08	24.18	1009.50
4/14/2022	10:00:00 PM	0	11.1921	4.979	4/14/2022	10:00:00 PM	0	893.062	-4.756	2.09	24.17	1009.51
4/14/2022	11:00:00 PM	0	11.195	4.98	4/14/2022	11:00:00 PM	0	893.056	-5.538	2.09	24.17	1009.51
4/15/2022	12:00:00 AM	0	11.1977	4.979	4/15/2022	12:00:00 AM	0	893.164	-6.037	2.09	24.17	1009.51
4/15/2022	1:00:00 AM	0	11.2011	4.979	4/15/2022	1:00:00 AM	0	893.19	-6.58	2.09	24.17	1009.51
4/15/2022	2:00:00 AM	0	11.2047	4.98	4/15/2022	2:00:00 AM	0	893.259	-7.076	2.10	24.16	1009.52
4/15/2022	3:00:00 AM	0	11.2083	4.979	4/15/2022	3:00:00 AM	0	893.35	-7.373	2.10	24.16	1009.52
4/15/2022	4:00:00 AM	0	11.2115	4.979	4/15/2022	4:00:00 AM	0	893.399	-8.078	2.10	24.16	1009.52
4/15/2022	5:00:00 AM	0	11.2154	4.98	4/15/2022	5:00:00 AM	0	893.667	-8.816	2.10	24.16	1009.52
4/15/2022	6:00:00 AM	0	11.2194	4.979	4/15/2022	6:00:00 AM	0	894.012	-8.79	2.10	24.16	1009.52
4/15/2022	7:00:00 AM	0	11.224	4.979	4/15/2022	7:00:00 AM	0	894.879	-7.185	2.10	24.16	1009.52
4/15/2022	8:00:00 AM	0	11.2289	4.979	4/15/2022	8:00:00 AM	0	896.107	-0.98	2.09	24.17	1009.51
4/15/2022	9:00:00 AM	0	11.2329	4.979	4/15/2022	9:00:00 AM	0	896.564	5.92	2.09	24.17	1009.51
4/15/2022	10:00:00 AM	0	11.2364	4.98	4/15/2022	10:00:00 AM	0	896.854	11.398	2.09	24.17	1009.51
4/15/2022	11:00:00 AM	0	11.2404	4.98	4/15/2022	11:00:00 AM	0	896.934	12.589	2.09	24.17	1009.51
4/15/2022	12:00:00 PM	0	11.2448	4.98	4/15/2022	12:00:00 PM	0	896.563	9.703	2.10	24.16	1009.52
4/15/2022	1:00:00 PM	0	11.2485	4.98	4/15/2022	1:00:00 PM	0	896.53	12.834	2.11	24.15	1009.53
4/15/2022	2:00:00 PM	0	11.252	4.979	4/15/2022	2:00:00 PM	0	896.564	16.172	2.11	24.15	1009.53
4/15/2022	3:00:00 PM	0	11.2552	4.979	4/15/2022	3:00:00 PM	0	896.239	9.222	2.12	24.14	1009.54
4/15/2022	4:00:00 PM	0	11.2588	4.979	4/15/2022	4:00:00 PM	0	895.797	5.868	2.12	24.14	1009.54
4/15/2022	5:00:00 PM	0	11.2618	4.979	4/15/2022	5:00:00 PM	0	895.599	4.246	2.13	24.13	1009.55
4/15/2022	6:00:00 PM	0	11.265	4.979	4/15/2022	6:00:00 PM	0	895.253	1.558	2.14	24.12	1009.56
4/15/2022	7:00:00 PM	0	11.2679	4.979	4/15/2022	7:00:00 PM	0	895.351	-0.618	2.14	24.12	1009.56
4/15/2022	8:00:00 PM	0	11.2712	4.979	4/15/2022	8:00:00 PM	0	895.564	-1.419	2.14	24.12	1009.56
4/15/2022	9:00:00 PM	0	11.2748	4.979	4/15/2022	9:00:00 PM	0	895.572	-2.902	2.14	24.12	1009.56
4/15/2022	10:00:00 PM	0	11.2784	4.979	4/15/2022	10:00:00 PM	0	895.594	-3.966	2.15	24.11	1009.57
4/15/2022	11:00:00 PM	0	11.2821	4.98	4/15/2022	11:00:00 PM	0	895.382	-5.021	2.15	24.11	1009.57
4/16/2022	12:00:00 AM	0	11.2851	4.979	4/16/2022	12:00:00 AM	0	895.29	-5.618	2.16	24.10	1009.58
4/16/2022	1:00:00 AM	0	11.2888	4.979	4/16/2022	1:00:00 AM	0	895.292	-6.135	2.16	24.10	1009.58
4/16/2022	2:00:00 AM	0	11.2917	4.98	4/16/2022	2:00:00 AM	0	895.042	-6.651	2.16	24.10	1009.58
4/16/2022	3:00:00 AM	0	11.2947	4.979	4/16/2022	3:00:00 AM	0	894.725	-7.05	2.17	24.09	1009.59
4/16/2022	4:00:00 AM	0	11.2971	4.979	4/16/2022	4:00:00 AM	0	894.327	-7.177	2.18	24.08	1009.60
4/16/2022	5:00:00 AM	0	11.299	4.98	4/16/2022	5:00:00 AM	0	894.064	-6.533	2.18	24.08	1009.60
4/16/2022	6:00:00 AM	0	11.3002	4.979	4/16/2022	6:00:00 AM	0	893.717	-6.518	2.19	24.07	1009.61
4/16/2022	7:00:00 AM	0	11.3013	4.979	4/16/2022	7:00:00 AM	0	893.583	-5.719	2.19	24.07	1009.61
4/16/2022	8:00:00 AM	0	11.3019	4.979	4/16/2022	8:00:00 AM	0	894.26	1.917	2.18	24.08	1009.60
4/16/2022	9:00:00 AM	0	11.3014	4.979	4/16/2022	9:00:00 AM	0	894.36	11.381	2.18	24.08	1009.60
4/16/2022	10:00:00 AM	0	11.3002	4.979	4/16/2022	10:00:00 AM	0	893.987	15.468	2.18	24.08	1009.60
4/16/2022	11:00:00 AM	0	11.3008	4.98	4/16/2022	11:00:00 AM	0	893.588	15.428	2.19	24.07	1009.61
4/16/2022	12:00:00 PM	0	11.3021	4.979	4/16/2022	12:00:00 PM	0	893.302	9.159	2.19	24.07	1009.61
4/16/2022	1:00:00 PM	0	11.3034	4.979	4/16/2022	1:00:00 PM	0	892.8	6.828	2.20	24.06	1009.62
4/16/2022	2:00:00 PM	0	11.3045	4.979	4/16/2022	2:00:00 PM	0	892.868	13.99	2.20	24.06	1009.62
4/16/2022	3:00:00 PM	0	11.306	4.979	4/16/2022	3:00:00 PM	0	892.959	7.994	2.20	24.06	1009.62
4/16/2022	4:00:00 PM	0	11.3084	4.98	4/16/2022	4:00:00 PM	0	892.738	6.29	2.20	24.06	1009.62
4/16/2022	5:00:00 PM	0	11.3108	4.979	4/16/2022	5:00:00 PM	0	893.071	5.4	2.20	24.06	1009.62
4/16/2022	6:00:00 PM	0	11.3139	4.979	4/16/2022	6:00:00 PM	0	893.044	2.722	2.21	24.05	1009.63
4/16/2022	7:00:00 PM	0	11.3177	4.98	4/16/2022	7:00:00 PM	0	893.673	0.306	2.20	24.06	1009.62
4/16/2022	8:00:00 PM	0	11.3222	4.979	4/16/2022	8:00:00 PM	0	894.262	-1.865	2.20	24.06	1009.62
4/16/2022	9:00:00 PM	0	11.3274	4.979	4/16/2022	9:00:00 PM	0	894.64	-2.276	2.20	24.06	1009.62

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/16/2022	10:00:00 PM	0	11.333	4.979	4/16/2022	10:00:00 PM	0	895.045	-3.846	2.21	24.05	1009.63
4/16/2022	11:00:00 PM	0	11.3386	4.979	4/16/2022	11:00:00 PM	0	895.438	-4.48	2.21	24.05	1009.63
4/17/2022	12:00:00 AM	0	11.3447	4.98	4/17/2022	12:00:00 AM	0	895.896	-5.023	2.21	24.05	1009.63
4/17/2022	1:00:00 AM	0	11.3503	4.979	4/17/2022	1:00:00 AM	0	896.223	-5.587	2.21	24.05	1009.63
4/17/2022	2:00:00 AM	0	11.3564	4.979	4/17/2022	2:00:00 AM	0	896.764	-6.101	2.21	24.05	1009.63
4/17/2022	3:00:00 AM	0	11.3629	4.979	4/17/2022	3:00:00 AM	0	897.162	-6.637	2.21	24.05	1009.63
4/17/2022	4:00:00 AM	0	11.3691	4.98	4/17/2022	4:00:00 AM	0	897.61	-6.933	2.22	24.04	1009.64
4/17/2022	5:00:00 AM	0	11.3757	4.979	4/17/2022	5:00:00 AM	0	898.139	-6.878	2.22	24.04	1009.64
4/17/2022	6:00:00 AM	0	11.3816	4.98	4/17/2022	6:00:00 AM	0	898.836	-6.502	2.22	24.04	1009.64
4/17/2022	7:00:00 AM	0	11.3885	4.979	4/17/2022	7:00:00 AM	0	899.789	-4.829	2.21	24.05	1009.63
4/17/2022	8:00:00 AM	0	11.3946	4.98	4/17/2022	8:00:00 AM	0	900.972	3.248	2.21	24.05	1009.63
4/17/2022	9:00:00 AM	0	11.3999	4.979	4/17/2022	9:00:00 AM	0	901.592	10.38	2.21	24.05	1009.63
4/17/2022	10:00:00 AM	0	11.4044	4.98	4/17/2022	10:00:00 AM	0	901.718	14.115	2.21	24.05	1009.63
4/17/2022	11:00:00 AM	0	11.4094	4.979	4/17/2022	11:00:00 AM	0	901.459	15.316	2.22	24.04	1009.64
4/17/2022	12:00:00 PM	0	11.4144	4.979	4/17/2022	12:00:00 PM	0	901.37	10.214	2.22	24.04	1009.64
4/17/2022	1:00:00 PM	0	11.4183	4.979	4/17/2022	1:00:00 PM	0	901.019	9.371	2.23	24.03	1009.65
4/17/2022	2:00:00 PM	0	11.4217	4.98	4/17/2022	2:00:00 PM	0	900.769	11.112	2.24	24.02	1009.66
4/17/2022	3:00:00 PM	0	11.4243	4.979	4/17/2022	3:00:00 PM	0	900.345	9.657	2.24	24.02	1009.66
4/17/2022	4:00:00 PM	0	11.427	4.979	4/17/2022	4:00:00 PM	0	899.804	8.956	2.25	24.01	1009.67
4/17/2022	5:00:00 PM	0	11.4284	4.979	4/17/2022	5:00:00 PM	0	899.233	7.428	2.26	24.00	1009.68
4/17/2022	6:00:00 PM	0	11.4297	4.979	4/17/2022	6:00:00 PM	0	898.534	4.923	2.27	23.99	1009.69
4/17/2022	7:00:00 PM	0	11.4307	4.98	4/17/2022	7:00:00 PM	0	898.491	3.382	2.27	23.99	1009.69
4/17/2022	8:00:00 PM	0	11.4318	4.979	4/17/2022	8:00:00 PM	0	898.112	1.216	2.27	23.99	1009.69
4/17/2022	9:00:00 PM	0	11.4331	4.98	4/17/2022	9:00:00 PM	0	897.831	0.008	2.28	23.98	1009.70
4/17/2022	10:00:00 PM	0	11.434	4.979	4/17/2022	10:00:00 PM	0	897.122	-0.404	2.29	23.97	1009.71
4/17/2022	11:00:00 PM	0	11.4338	4.98	4/17/2022	11:00:00 PM	0	896.583	-0.779	2.29	23.97	1009.71
4/18/2022	12:00:00 AM	0	11.4338	4.979	4/18/2022	12:00:00 AM	0	895.981	-1.113	2.30	23.96	1009.72
4/18/2022	1:00:00 AM	0	11.4336	4.98	4/18/2022	1:00:00 AM	0	895.221	-1.326	2.30	23.96	1009.72
4/18/2022	2:00:00 AM	0	11.4324	4.979	4/18/2022	2:00:00 AM	0	894.646	-1.123	2.31	23.95	1009.73
4/18/2022	3:00:00 AM	0	11.4307	4.979	4/18/2022	3:00:00 AM	0	893.802	-1.164	2.32	23.94	1009.74
4/18/2022	4:00:00 AM	0	11.429	4.98	4/18/2022	4:00:00 AM	0	892.79	-1.171	2.33	23.93	1009.75
4/18/2022	5:00:00 AM	0	11.4261	4.98	4/18/2022	5:00:00 AM	0	892.046	-0.866	2.33	23.93	1009.75
4/18/2022	6:00:00 AM	0	11.4234	4.98	4/18/2022	6:00:00 AM	0	891.432	-0.368	2.33	23.93	1009.75
4/18/2022	7:00:00 AM	0	11.4196	4.979	4/18/2022	7:00:00 AM	0	890.798	0.78	2.34	23.92	1009.76
4/18/2022	8:00:00 AM	0	11.4165	4.979	4/18/2022	8:00:00 AM	0	890.355	2.006	2.34	23.92	1009.76
4/18/2022	9:00:00 AM	0	11.4133	4.979	4/18/2022	9:00:00 AM	0	889.596	2.722	2.34	23.92	1009.76
4/18/2022	10:00:00 AM	0	11.4102	4.98	4/18/2022	10:00:00 AM	0	889.045	3.042	2.34	23.92	1009.76
4/18/2022	11:00:00 AM	0	11.4072	4.979	4/18/2022	11:00:00 AM	0	888.332	2.85	2.35	23.91	1009.77
4/18/2022	12:00:00 PM	0	11.4035	4.979	4/18/2022	12:00:00 PM	0	887.466	2.604	2.35	23.91	1009.77
4/18/2022	1:00:00 PM	0	11.4	4.98	4/18/2022	1:00:00 PM	0	886.094	1.395	2.36	23.90	1009.78
4/18/2022	2:00:00 PM	0	11.3953	4.98	4/18/2022	2:00:00 PM	0	885.085	1.304	2.37	23.89	1009.79
4/18/2022	3:00:00 PM	0	11.3912	4.98	4/18/2022	3:00:00 PM	0	884.002	1.394	2.38	23.88	1009.80
4/18/2022	4:00:00 PM	0	11.3867	4.98	4/18/2022	4:00:00 PM	0	882.932	1.22	2.38	23.88	1009.80
4/18/2022	5:00:00 PM	0	11.3817	4.979	4/18/2022	5:00:00 PM	0	881.685	0.98	2.39	23.87	1009.81
4/18/2022	6:00:00 PM	0	11.3762	4.98	4/18/2022	6:00:00 PM	0	880.683	0.645	2.40	23.86	1009.82
4/18/2022	7:00:00 PM	0	11.3711	4.98	4/18/2022	7:00:00 PM	0	879.827	-0.305	2.40	23.86	1009.82
4/18/2022	8:00:00 PM	0	11.3666	4.979	4/18/2022	8:00:00 PM	0	879.441	-0.497	2.40	23.86	1009.82
4/18/2022	9:00:00 PM	0	11.3627	4.979	4/18/2022	9:00:00 PM	0	878.618	-0.523	2.40	23.86	1009.82
4/18/2022	10:00:00 PM	0	11.3589	4.979	4/18/2022	10:00:00 PM	0	878.13	-0.526	2.40	23.86	1009.82
4/18/2022	11:00:00 PM	0	11.3554	4.979	4/18/2022	11:00:00 PM	0	877.853	-0.526	2.40	23.86	1009.82
4/19/2022	12:00:00 AM	0	11.3524	4.979	4/19/2022	12:00:00 AM	0	877.406	-0.529	2.41	23.85	1009.83
4/19/2022	1:00:00 AM	0	11.3499	4.979	4/19/2022	1:00:00 AM	0	877.242	-0.527	2.40	23.86	1009.82
4/19/2022	2:00:00 AM	0	11.3482	4.979	4/19/2022	2:00:00 AM	0	877.259	-0.525	2.40	23.86	1009.82
4/19/2022	3:00:00 AM	0	11.3474	4.98	4/19/2022	3:00:00 AM	0	877.31	-0.531	2.40	23.86	1009.82
4/19/2022	4:00:00 AM	0	11.3476	4.98	4/19/2022	4:00:00 AM	0	878.098	-0.537	2.39	23.87	1009.81
4/19/2022	5:00:00 AM	0	11.3495	4.979	4/19/2022	5:00:00 AM	0	878.998	-0.573	2.39	23.87	1009.81
4/19/2022	6:00:00 AM	0	11.3534	4.98	4/19/2022	6:00:00 AM	0	880.67	-0.584	2.37	23.89	1009.79
4/19/2022	7:00:00 AM	0	11.3589	4.98	4/19/2022	7:00:00 AM	0	881.956	-0.552	2.37	23.89	1009.79
4/19/2022	8:00:00 AM	0	11.3658	4.98	4/19/2022	8:00:00 AM	0	883.444	-0.518	2.36	23.90	1009.78
4/19/2022	9:00:00 AM	0	11.3735	4.98	4/19/2022	9:00:00 AM	0	884.579	-0.218	2.35	23.91	1009.77
4/19/2022	10:00:00 AM	0	11.3824	4.979	4/19/2022	10:00:00 AM	0	885.767	0.708	2.35	23.91	1009.77
4/19/2022	11:00:00 AM	0	11.3908	4.979	4/19/2022	11:00:00 AM	0	886.831	3.707	2.35	23.91	1009.77
4/19/2022	12:00:00 PM	0	11.397	4.98	4/19/2022	12:00:00 PM	0	887.511	12.584	2.35	23.91	1009.77
4/19/2022	1:00:00 PM	0	11.4034	4.98	4/19/2022	1:00:00 PM	0	888.111	14.422	2.35	23.91	1009.77
4/19/2022	2:00:00 PM	0	11.41	4.979	4/19/2022	2:00:00 PM	0	888.431	15.579	2.35	23.91	1009.77
4/19/2022	3:00:00 PM	0	11.4163	4.979	4/19/2022	3:00:00 PM	0	888.734	13.953	2.35	23.91	1009.77
4/19/2022	4:00:00 PM	0	11.4236	4.979	4/19/2022	4:00:00 PM	0	889.076	8.445	2.36	23.90	1009.78
4/19/2022	5:00:00 PM	0	11.431	4.979	4/19/2022	5:00:00 PM	0	889.146	3.801	2.36	23.90	1009.78
4/19/2022	6:00:00 PM	0	11.4374	4.98	4/19/2022	6:00:00 PM	0	889.201	0.986	2.37	23.89	1009.79
4/19/2022	7:00:00 PM	0	11.4435	4.98	4/19/2022	7:00:00 PM	0	889.564	-0.714	2.37	23.89	1009.79

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/19/2022	8:00:00 PM	0	11.45	4.98	4/19/2022	8:00:00 PM	0	889.776	-0.98	2.38	23.88	1009.80
4/19/2022	9:00:00 PM	0	11.4558	4.98	4/19/2022	9:00:00 PM	0	890.038	-3.286	2.38	23.88	1009.80
4/19/2022	10:00:00 PM	0	11.4616	4.979	4/19/2022	10:00:00 PM	0	890.208	-4.802	2.38	23.88	1009.80
4/19/2022	11:00:00 PM	0	11.4672	4.98	4/19/2022	11:00:00 PM	0	890.32	-5.716	2.39	23.87	1009.81
4/20/2022	12:00:00 AM	0	11.4724	4.98	4/20/2022	12:00:00 AM	0	890.61	-5.148	2.39	23.87	1009.81
4/20/2022	1:00:00 AM	0	11.4772	4.979	4/20/2022	1:00:00 AM	0	890.937	-4.058	2.39	23.87	1009.81
4/20/2022	2:00:00 AM	0	11.4819	4.98	4/20/2022	2:00:00 AM	0	890.789	-5.318	2.40	23.86	1009.82
4/20/2022	3:00:00 AM	0	11.4856	4.98	4/20/2022	3:00:00 AM	0	890.306	-7.126	2.41	23.85	1009.83
4/20/2022	4:00:00 AM	0	11.4892	4.979	4/20/2022	4:00:00 AM	0	890.323	-7.967	2.41	23.85	1009.83
4/20/2022	5:00:00 AM	0	11.4923	4.98	4/20/2022	5:00:00 AM	0	890.251	-8.931	2.41	23.85	1009.83
4/20/2022	6:00:00 AM	0	11.4953	4.979	4/20/2022	6:00:00 AM	0	890.141	-9.13	2.42	23.84	1009.84
4/20/2022	7:00:00 AM	0	11.4983	4.979	4/20/2022	7:00:00 AM	0	890.927	-5.935	2.41	23.85	1009.83
4/20/2022	8:00:00 AM	0	11.5009	4.98	4/20/2022	8:00:00 AM	0	891.584	-1.363	2.41	23.85	1009.83
4/20/2022	9:00:00 AM	0	11.5034	4.98	4/20/2022	9:00:00 AM	0	891.781	1.654	2.41	23.85	1009.83
4/20/2022	10:00:00 AM	0	11.5046	4.979	4/20/2022	10:00:00 AM	0	891.497	15.074	2.41	23.85	1009.83
4/20/2022	11:00:00 AM	0	11.5032	4.979	4/20/2022	11:00:00 AM	0	890.737	21.124	2.42	23.84	1009.84
4/20/2022	12:00:00 PM	0	11.5019	4.98	4/20/2022	12:00:00 PM	0	889.853	23.485	2.43	23.83	1009.85
4/20/2022	1:00:00 PM	0	11.5018	4.98	4/20/2022	1:00:00 PM	0	889.268	23.935	2.43	23.83	1009.85
4/20/2022	2:00:00 PM	0	11.5012	4.98	4/20/2022	2:00:00 PM	0	888.675	24.369	2.44	23.82	1009.86
4/20/2022	3:00:00 PM	0	11.5009	4.98	4/20/2022	3:00:00 PM	0	888.47	15.425	2.44	23.82	1009.86
4/20/2022	4:00:00 PM	0	11.5003	4.98	4/20/2022	4:00:00 PM	0	887.783	9.368	2.45	23.81	1009.87
4/20/2022	5:00:00 PM	0	11.4994	4.98	4/20/2022	5:00:00 PM	0	887.166	6.983	2.45	23.81	1009.87
4/20/2022	6:00:00 PM	0	11.4984	4.979	4/20/2022	6:00:00 PM	0	886.709	6.083	2.46	23.80	1009.88
4/20/2022	7:00:00 PM	0	11.4973	4.98	4/20/2022	7:00:00 PM	0	886.412	3.425	2.46	23.80	1009.88
4/20/2022	8:00:00 PM	0	11.4973	4.979	4/20/2022	8:00:00 PM	0	886.532	1.45	2.46	23.80	1009.88
4/20/2022	9:00:00 PM	0	11.4971	4.979	4/20/2022	9:00:00 PM	0	886.333	-0.163	2.46	23.80	1009.88
4/20/2022	10:00:00 PM	0	11.4977	4.98	4/20/2022	10:00:00 PM	0	885.933	-1.405	2.46	23.80	1009.88
4/20/2022	11:00:00 PM	0	11.4977	4.98	4/20/2022	11:00:00 PM	0	885.922	-0.715	2.46	23.80	1009.88
4/21/2022	12:00:00 AM	0	11.4981	4.98	4/21/2022	12:00:00 AM	0	885.726	0.03	2.47	23.79	1009.89
4/21/2022	1:00:00 AM	0	11.4985	4.979	4/21/2022	1:00:00 AM	0	885.685	0.42	2.47	23.79	1009.89
4/21/2022	2:00:00 AM	0	11.4986	4.98	4/21/2022	2:00:00 AM	0	885.169	0.176	2.47	23.79	1009.89
4/21/2022	3:00:00 AM	0	11.4984	4.98	4/21/2022	3:00:00 AM	0	884.974	-0.62	2.47	23.79	1009.89
4/21/2022	4:00:00 AM	0	11.4991	4.98	4/21/2022	4:00:00 AM	0	885.164	-0.89	2.47	23.79	1009.89
4/21/2022	5:00:00 AM	0	11.5004	4.98	4/21/2022	5:00:00 AM	0	885.547	-0.929	2.47	23.79	1009.89
4/21/2022	6:00:00 AM	0	11.5017	4.98	4/21/2022	6:00:00 AM	0	885.743	-0.675	2.47	23.79	1009.89
4/21/2022	7:00:00 AM	0	11.5039	4.98	4/21/2022	7:00:00 AM	0	885.9	0.496	2.47	23.79	1009.89
4/21/2022	8:00:00 AM	0	11.5051	4.98	4/21/2022	8:00:00 AM	0	886.613	11.521	2.46	23.80	1009.88
4/21/2022	9:00:00 AM	0	11.5046	4.98	4/21/2022	9:00:00 AM	0	886.749	18.143	2.46	23.80	1009.88
4/21/2022	10:00:00 AM	0	11.5061	4.98	4/21/2022	10:00:00 AM	0	886.893	19.081	2.46	23.80	1009.88
4/21/2022	11:00:00 AM	0	11.5087	4.98	4/21/2022	11:00:00 AM	0	886.94	15.627	2.46	23.80	1009.88
4/21/2022	12:00:00 PM	0	11.5112	4.98	4/21/2022	12:00:00 PM	0	886.99	15.949	2.47	23.79	1009.89
4/21/2022	1:00:00 PM	0	11.5136	4.98	4/21/2022	1:00:00 PM	0	887.209	17.174	2.47	23.79	1009.89
4/21/2022	2:00:00 PM	0	11.5168	4.979	4/21/2022	2:00:00 PM	0	887.354	16.245	2.47	23.79	1009.89
4/21/2022	3:00:00 PM	0	11.5191	4.979	4/21/2022	3:00:00 PM	0	887.405	14.992	2.47	23.79	1009.89
4/21/2022	4:00:00 PM	0	11.5222	4.98	4/21/2022	4:00:00 PM	0	887.952	13.193	2.47	23.79	1009.89
4/21/2022	5:00:00 PM	0	11.5258	4.98	4/21/2022	5:00:00 PM	0	888.844	11.072	2.46	23.80	1009.88
4/21/2022	6:00:00 PM	0	11.5311	4.98	4/21/2022	6:00:00 PM	0	889.502	7.512	2.46	23.80	1009.88
4/21/2022	7:00:00 PM	0	11.5368	4.98	4/21/2022	7:00:00 PM	0	890.187	5.073	2.46	23.80	1009.88
4/21/2022	8:00:00 PM	0	11.5431	4.979	4/21/2022	8:00:00 PM	0	890.653	2.895	2.46	23.80	1009.88
4/21/2022	9:00:00 PM	0	11.5489	4.979	4/21/2022	9:00:00 PM	0	891.026	2.215	2.46	23.80	1009.88
4/21/2022	10:00:00 PM	0	11.5551	4.98	4/21/2022	10:00:00 PM	0	891.287	1.013	2.47	23.79	1009.89
4/21/2022	11:00:00 PM	0	11.5607	4.979	4/21/2022	11:00:00 PM	0	891.496	0.137	2.47	23.79	1009.89
4/22/2022	12:00:00 AM	0	11.5662	4.979	4/22/2022	12:00:00 AM	0	891.88	-0.086	2.47	23.79	1009.89
4/22/2022	1:00:00 AM	0	11.5713	4.98	4/22/2022	1:00:00 AM	0	892.136	-0.101	2.47	23.79	1009.89
4/22/2022	2:00:00 AM	0	11.5762	4.979	4/22/2022	2:00:00 AM	0	892.427	-0.653	2.48	23.78	1009.90
4/22/2022	3:00:00 AM	0	11.5814	4.98	4/22/2022	3:00:00 AM	0	893.103	-0.927	2.47	23.79	1009.89
4/22/2022	4:00:00 AM	0	11.587	4.98	4/22/2022	4:00:00 AM	0	893.447	-0.898	2.48	23.78	1009.90
4/22/2022	5:00:00 AM	0	11.5924	4.98	4/22/2022	5:00:00 AM	0	893.946	-0.881	2.48	23.78	1009.90
4/22/2022	6:00:00 AM	0	11.5976	4.98	4/22/2022	6:00:00 AM	0	894.234	-0.889	2.48	23.78	1009.90
4/22/2022	7:00:00 AM	0	11.6026	4.98	4/22/2022	7:00:00 AM	0	895	1.239	2.48	23.78	1009.90
4/22/2022	8:00:00 AM	0	11.6077	4.98	4/22/2022	8:00:00 AM	0	895.659	4.63	2.47	23.79	1009.89
4/22/2022	9:00:00 AM	0	11.6127	4.979	4/22/2022	9:00:00 AM	0	896.139	6.308	2.47	23.79	1009.89
4/22/2022	10:00:00 AM	0	11.6167	4.98	4/22/2022	10:00:00 AM	0	896.48	12.294	2.48	23.78	1009.90
4/22/2022	11:00:00 AM	0	11.6205	4.98	4/22/2022	11:00:00 AM	0	896.442	15.513	2.48	23.78	1009.90
4/22/2022	12:00:00 PM	0	11.6235	4.979	4/22/2022	12:00:00 PM	0	896.456	17.786	2.48	23.78	1009.90
4/22/2022	1:00:00 PM	0	11.6271	4.98	4/22/2022	1:00:00 PM	0	896.325	16.811	2.49	23.77	1009.91
4/22/2022	2:00:00 PM	0	11.628	4.979	4/22/2022	2:00:00 PM	0	896.752	14.379	2.48	23.78	1009.90
4/22/2022	3:00:00 PM	0	11.6327	4.98	4/22/2022	3:00:00 PM	0	897.395	10.083	2.48	23.78	1009.90
4/22/2022	4:00:00 PM	0	11.6371	4.98	4/22/2022	4:00:00 PM	0	897.389	9.636	2.49	23.77	1009.91
4/22/2022	5:00:00 PM	0	11.641	4.979	4/22/2022	5:00:00 PM	0	897.777	8.619	2.49	23.77	1009.91

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/22/2022	6:00:00 PM	0	11.6454	4.98	4/22/2022	6:00:00 PM	0	898.006	5.585	2.49	23.77	1009.91
4/22/2022	7:00:00 PM	0	11.6508	4.979	4/22/2022	7:00:00 PM	0	898.818	3.47	2.49	23.77	1009.91
4/22/2022	8:00:00 PM	0	11.6556	4.98	4/22/2022	8:00:00 PM	0	898.878	1.823	2.49	23.77	1009.91
4/22/2022	9:00:00 PM	0	11.6608	4.98	4/22/2022	9:00:00 PM	0	899.146	0.022	2.49	23.77	1009.91
4/22/2022	10:00:00 PM	0	11.6665	4.98	4/22/2022	10:00:00 PM	0	899.521	-0.317	2.49	23.77	1009.91
4/22/2022	11:00:00 PM	0	11.6717	4.979	4/22/2022	11:00:00 PM	0	899.851	-0.576	2.50	23.76	1009.92
4/23/2022	12:00:00 AM	0	11.677	4.979	4/23/2022	12:00:00 AM	0	900.363	-1.124	2.50	23.76	1009.92
4/23/2022	1:00:00 AM	0	11.6822	4.979	4/23/2022	1:00:00 AM	0	900.527	-1.817	2.50	23.76	1009.92
4/23/2022	2:00:00 AM	0	11.6877	4.98	4/23/2022	2:00:00 AM	0	900.688	-2.038	2.50	23.76	1009.92
4/23/2022	3:00:00 AM	0	11.6927	4.98	4/23/2022	3:00:00 AM	0	901.146	-1.603	2.50	23.76	1009.92
4/23/2022	4:00:00 AM	0	11.6977	4.98	4/23/2022	4:00:00 AM	0	901.622	-1.981	2.50	23.76	1009.92
4/23/2022	5:00:00 AM	0	11.7028	4.98	4/23/2022	5:00:00 AM	0	901.849	-2.5	2.51	23.75	1009.93
4/23/2022	6:00:00 AM	0	11.708	4.98	4/23/2022	6:00:00 AM	0	902.512	-2.289	2.50	23.76	1009.92
4/23/2022	7:00:00 AM	0	11.7133	4.98	4/23/2022	7:00:00 AM	0	902.843	-0.83	2.51	23.75	1009.93
4/23/2022	8:00:00 AM	0	11.7179	4.98	4/23/2022	8:00:00 AM	0	903.559	7.261	2.50	23.76	1009.92
4/23/2022	9:00:00 AM	0	11.7212	4.98	4/23/2022	9:00:00 AM	0	903.572	12.827	2.51	23.75	1009.93
4/23/2022	10:00:00 AM	0	11.7233	4.98	4/23/2022	10:00:00 AM	0	903.104	16.417	2.51	23.75	1009.93
4/23/2022	11:00:00 AM	0	11.726	4.98	4/23/2022	11:00:00 AM	0	902.649	19.537	2.52	23.74	1009.94
4/23/2022	12:00:00 PM	0	11.7282	4.98	4/23/2022	12:00:00 PM	0	902.229	21.056	2.53	23.73	1009.95
4/23/2022	1:00:00 PM	0	11.7294	4.98	4/23/2022	1:00:00 PM	0	901.656	20.906	2.54	23.72	1009.96
4/23/2022	2:00:00 PM	0	11.7308	4.98	4/23/2022	2:00:00 PM	0	901.349	20.843	2.54	23.72	1009.96
4/23/2022	3:00:00 PM	0	11.7314	4.979	4/23/2022	3:00:00 PM	0	901.269	18.117	2.54	23.72	1009.96
4/23/2022	4:00:00 PM	0	11.7329	4.98	4/23/2022	4:00:00 PM	0	901.071	14.549	2.54	23.72	1009.96
4/23/2022	5:00:00 PM	0	11.7344	4.98	4/23/2022	5:00:00 PM	0	900.851	11.951	2.55	23.71	1009.97
4/23/2022	6:00:00 PM	0	11.7349	4.98	4/23/2022	6:00:00 PM	0	900.484	10.05	2.55	23.71	1009.97
4/23/2022	7:00:00 PM	0	11.7355	4.98	4/23/2022	7:00:00 PM	0	900.333	8.87	2.55	23.71	1009.97
4/23/2022	8:00:00 PM	0	11.737	4.979	4/23/2022	8:00:00 PM	0	900.459	7.378	2.55	23.71	1009.97
4/23/2022	9:00:00 PM	0	11.7391	4.98	4/23/2022	9:00:00 PM	0	900.464	6.318	2.56	23.70	1009.98
4/23/2022	10:00:00 PM	0	11.7414	4.98	4/23/2022	10:00:00 PM	0	900.606	4.339	2.56	23.70	1009.98
4/23/2022	11:00:00 PM	0	11.7442	4.98	4/23/2022	11:00:00 PM	0	900.458	2.958	2.56	23.70	1009.98
4/24/2022	12:00:00 AM	0	11.7469	4.98	4/24/2022	12:00:00 AM	0	900.299	3.04	2.57	23.69	1009.99
4/24/2022	1:00:00 AM	0	11.7494	4.98	4/24/2022	1:00:00 AM	0	899.913	2.871	2.57	23.69	1009.99
4/24/2022	2:00:00 AM	0	11.7514	4.98	4/24/2022	2:00:00 AM	0	899.65	2.564	2.58	23.68	1010.00
4/24/2022	3:00:00 AM	0	11.7532	4.98	4/24/2022	3:00:00 AM	0	899.596	2.634	2.58	23.68	1010.00
4/24/2022	4:00:00 AM	0	11.7551	4.98	4/24/2022	4:00:00 AM	0	899.233	2.364	2.59	23.67	1010.01
4/24/2022	5:00:00 AM	0	11.7573	4.98	4/24/2022	5:00:00 AM	0	899.314	2.434	2.59	23.67	1010.01
4/24/2022	6:00:00 AM	0	11.7591	4.98	4/24/2022	6:00:00 AM	0	899.316	2.869	2.59	23.67	1010.01
4/24/2022	7:00:00 AM	0	11.761	4.98	4/24/2022	7:00:00 AM	0	899.08	4.473	2.59	23.67	1010.01
4/24/2022	8:00:00 AM	0	11.7625	4.98	4/24/2022	8:00:00 AM	0	899.072	5.382	2.59	23.67	1010.01
4/24/2022	9:00:00 AM	0	11.7644	4.979	4/24/2022	9:00:00 AM	0	899.176	7.549	2.60	23.66	1010.02
4/24/2022	10:00:00 AM	0	11.766	4.98	4/24/2022	10:00:00 AM	0	899.195	8.454	2.60	23.66	1010.02
4/24/2022	11:00:00 AM	0	11.7678	4.98	4/24/2022	11:00:00 AM	0	898.921	9.356	2.60	23.66	1010.02
4/24/2022	12:00:00 PM	0	11.7694	4.98	4/24/2022	12:00:00 PM	0	898.374	11.829	2.61	23.65	1010.03
4/24/2022	1:00:00 PM	0	11.769	4.98	4/24/2022	1:00:00 PM	0	897.61	16.495	2.62	23.64	1010.04
4/24/2022	2:00:00 PM	0	11.7691	4.979	4/24/2022	2:00:00 PM	0	897.353	17.25	2.62	23.64	1010.04
4/24/2022	3:00:00 PM	0	11.7694	4.98	4/24/2022	3:00:00 PM	0	896.508	15.277	2.63	23.63	1010.05
4/24/2022	4:00:00 PM	0	11.7685	4.98	4/24/2022	4:00:00 PM	0	895.923	14.306	2.63	23.63	1010.05
4/24/2022	5:00:00 PM	0	11.7682	4.98	4/24/2022	5:00:00 PM	0	895.142	12.188	2.64	23.62	1010.06
4/24/2022	6:00:00 PM	0	11.7669	4.98	4/24/2022	6:00:00 PM	0	894.455	10.497	2.65	23.61	1010.07
4/24/2022	7:00:00 PM	0	11.7662	4.98	4/24/2022	7:00:00 PM	0	893.94	9.497	2.65	23.61	1010.07
4/24/2022	8:00:00 PM	0	11.7658	4.98	4/24/2022	8:00:00 PM	0	893.894	8.747	2.65	23.61	1010.07
4/24/2022	9:00:00 PM	0	11.7655	4.98	4/24/2022	9:00:00 PM	0	894.083	8.501	2.65	23.61	1010.07
4/24/2022	10:00:00 PM	0	11.7662	4.98	4/24/2022	10:00:00 PM	0	893.716	7.864	2.65	23.61	1010.07
4/24/2022	11:00:00 PM	0	11.7679	4.98	4/24/2022	11:00:00 PM	0	893.808	7.176	2.65	23.61	1010.07
4/25/2022	12:00:00 AM	0	11.7691	4.98	4/25/2022	12:00:00 AM	0	893.673	6.646	2.66	23.60	1010.08
4/25/2022	1:00:00 AM	0	11.7711	4.979	4/25/2022	1:00:00 AM	0	893.584	6.296	2.66	23.60	1010.08
4/25/2022	2:00:00 AM	0	11.7731	4.98	4/25/2022	2:00:00 AM	0	893.41	5.867	2.66	23.60	1010.08
4/25/2022	3:00:00 AM	0	11.7751	4.98	4/25/2022	3:00:00 AM	0	893.019	5.66	2.67	23.59	1010.09
4/25/2022	4:00:00 AM	0	11.7769	4.98	4/25/2022	4:00:00 AM	0	892.834	5.329	2.67	23.59	1010.09
4/25/2022	5:00:00 AM	0	11.778	4.98	4/25/2022	5:00:00 AM	0	892.553	4.848	2.68	23.58	1010.10
4/25/2022	6:00:00 AM	0	11.7794	4.98	4/25/2022	6:00:00 AM	0	892.157	4.756	2.68	23.58	1010.10
4/25/2022	7:00:00 AM	0	11.7802	4.98	4/25/2022	7:00:00 AM	0	892.046	5.825	2.68	23.58	1010.10
4/25/2022	8:00:00 AM	0	11.7813	4.98	4/25/2022	8:00:00 AM	0	892.061	7.193	2.68	23.58	1010.10
4/25/2022	9:00:00 AM	0	11.7827	4.98	4/25/2022	9:00:00 AM	0	891.691	6.707	2.69	23.57	1010.11
4/25/2022	10:00:00 AM	0	11.7832	4.98	4/25/2022	10:00:00 AM	0	891.109	11.858	2.70	23.56	1010.12
4/25/2022	11:00:00 AM	0	11.7845	4.98	4/25/2022	11:00:00 AM	0	891.674	10.373	2.69	23.57	1010.11
4/25/2022	12:00:00 PM	0	11.7866	4.98	4/25/2022	12:00:00 PM	0	892.451	7.052	2.69	23.57	1010.11
4/25/2022	1:00:00 PM	0	11.7902	4.98	4/25/2022	1:00:00 PM	0	892.448	8.545	2.69	23.57	1010.11
4/25/2022	2:00:00 PM	0	11.7923	4.98	4/25/2022	2:00:00 PM	0	892.116	14.586	2.70	23.56	1010.12
4/25/2022	3:00:00 PM	0	11.7934	4.98	4/25/2022	3:00:00 PM	0	891.988	12.552	2.70	23.56	1010.12

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/25/2022	4:00:00 PM	0	11.7959	4.98	4/25/2022	4:00:00 PM	0	891.86	9.191	2.70	23.56	1010.12
4/25/2022	5:00:00 PM	0	11.7992	4.98	4/25/2022	5:00:00 PM	0	892.054	8.911	2.70	23.56	1010.12
4/25/2022	6:00:00 PM	0	11.8025	4.98	4/25/2022	6:00:00 PM	0	892.123	8.101	2.71	23.55	1010.13
4/25/2022	7:00:00 PM	0	11.8062	4.98	4/25/2022	7:00:00 PM	0	892.315	6.153	2.71	23.55	1010.13
4/25/2022	8:00:00 PM	0	11.8101	4.98	4/25/2022	8:00:00 PM	0	892.497	3.665	2.71	23.55	1010.13
4/25/2022	9:00:00 PM	0	11.8144	4.98	4/25/2022	9:00:00 PM	0	892.515	2.074	2.71	23.55	1010.13
4/25/2022	10:00:00 PM	0	11.8193	4.98	4/25/2022	10:00:00 PM	0	892.917	1.148	2.71	23.55	1010.13
4/25/2022	11:00:00 PM	0	11.824	4.98	4/25/2022	11:00:00 PM	0	893.155	0.764	2.72	23.54	1010.14
4/26/2022	12:00:00 AM	0	11.8288	4.979	4/26/2022	12:00:00 AM	0	893.02	0.757	2.72	23.54	1010.14
4/26/2022	1:00:00 AM	0	11.8332	4.98	4/26/2022	1:00:00 AM	0	892.948	-0.042	2.73	23.53	1010.15
4/26/2022	2:00:00 AM	0	11.8373	4.98	4/26/2022	2:00:00 AM	0	892.865	-0.607	2.73	23.53	1010.15
4/26/2022	3:00:00 AM	0	11.8408	4.98	4/26/2022	3:00:00 AM	0	892.659	-0.769	2.74	23.52	1010.16
4/26/2022	4:00:00 AM	0	11.8444	4.98	4/26/2022	4:00:00 AM	0	892.722	-0.89	2.74	23.52	1010.16
4/26/2022	5:00:00 AM	0	11.848	4.98	4/26/2022	5:00:00 AM	0	892.605	-1.454	2.75	23.51	1010.17
4/26/2022	6:00:00 AM	0	11.8513	4.98	4/26/2022	6:00:00 AM	0	892.35	-1.65	2.75	23.51	1010.17
4/26/2022	7:00:00 AM	0	11.8542	4.98	4/26/2022	7:00:00 AM	0	892.598	0.864	2.75	23.51	1010.17
4/26/2022	8:00:00 AM	0	11.8565	4.981	4/26/2022	8:00:00 AM	0	892.798	7.997	2.75	23.51	1010.17
4/26/2022	9:00:00 AM	0	11.8575	4.981	4/26/2022	9:00:00 AM	0	892.63	13.332	2.76	23.50	1010.18
4/26/2022	10:00:00 AM	0	11.8589	4.98	4/26/2022	10:00:00 AM	0	892.352	15.735	2.76	23.50	1010.18
4/26/2022	11:00:00 AM	0	11.8601	4.98	4/26/2022	11:00:00 AM	0	891.979	18.055	2.76	23.50	1010.18
4/26/2022	12:00:00 PM	0	11.862	4.98	4/26/2022	12:00:00 PM	0	891.901	16.568	2.77	23.49	1010.19
4/26/2022	1:00:00 PM	0	11.8641	4.98	4/26/2022	1:00:00 PM	0	891.609	14.641	2.77	23.49	1010.19
4/26/2022	2:00:00 PM	0	11.8665	4.98	4/26/2022	2:00:00 PM	0	892.065	15.762	2.77	23.49	1010.19
4/26/2022	3:00:00 PM	0	11.8692	4.98	4/26/2022	3:00:00 PM	0	892.062	13.841	2.77	23.49	1010.19
4/26/2022	4:00:00 PM	0	11.8728	4.98	4/26/2022	4:00:00 PM	0	892.301	10.897	2.77	23.49	1010.19
4/26/2022	5:00:00 PM	0	11.8758	4.98	4/26/2022	5:00:00 PM	0	892.249	8.687	2.78	23.48	1010.20
4/26/2022	6:00:00 PM	0	11.8794	4.98	4/26/2022	6:00:00 PM	0	892.457	7.23	2.78	23.48	1010.20
4/26/2022	7:00:00 PM	0	11.883	4.98	4/26/2022	7:00:00 PM	0	892.555	5.212	2.78	23.48	1010.20
4/26/2022	8:00:00 PM	0	11.887	4.98	4/26/2022	8:00:00 PM	0	892.875	2.053	2.78	23.48	1010.20
4/26/2022	9:00:00 PM	0	11.8918	4.98	4/26/2022	9:00:00 PM	0	892.994	0.087	2.79	23.47	1010.21
4/26/2022	10:00:00 PM	0	11.8959	4.98	4/26/2022	10:00:00 PM	0	892.936	-0.97	2.79	23.47	1010.21
4/26/2022	11:00:00 PM	0	11.9005	4.98	4/26/2022	11:00:00 PM	0	893.077	-1.598	2.79	23.47	1010.21
4/27/2022	12:00:00 AM	0	11.9044	4.98	4/27/2022	12:00:00 AM	0	893.411	-1.03	2.79	23.47	1010.21
4/27/2022	1:00:00 AM	0	11.9091	4.98	4/27/2022	1:00:00 AM	0	893.707	-0.873	2.80	23.46	1010.22
4/27/2022	2:00:00 AM	0	11.9134	4.98	4/27/2022	2:00:00 AM	0	893.901	-0.527	2.80	23.46	1010.22
4/27/2022	3:00:00 AM	0	11.9177	4.98	4/27/2022	3:00:00 AM	0	894.289	-0.312	2.80	23.46	1010.22
4/27/2022	4:00:00 AM	0	11.9226	4.98	4/27/2022	4:00:00 AM	0	894.367	-0.426	2.80	23.46	1010.22
4/27/2022	5:00:00 AM	0	11.9266	4.98	4/27/2022	5:00:00 AM	0	894.184	-0.409	2.81	23.45	1010.23
4/27/2022	6:00:00 AM	0	11.9301	4.98	4/27/2022	6:00:00 AM	0	894.116	-0.252	2.81	23.45	1010.23
4/27/2022	7:00:00 AM	0	11.9333	4.98	4/27/2022	7:00:00 AM	0	894.096	-0.03	2.82	23.44	1010.24
4/27/2022	8:00:00 AM	0	11.9365	4.98	4/27/2022	8:00:00 AM	0	894.087	0.481	2.82	23.44	1010.24
4/27/2022	9:00:00 AM	0	11.9398	4.98	4/27/2022	9:00:00 AM	0	894.328	2.113	2.82	23.44	1010.24
4/27/2022	10:00:00 AM	0	11.9429	4.98	4/27/2022	10:00:00 AM	0	894.55	4.884	2.82	23.44	1010.24
4/27/2022	11:00:00 AM	0	11.9456	4.98	4/27/2022	11:00:00 AM	0	894.623	9.387	2.82	23.44	1010.24
4/27/2022	12:00:00 PM	0	11.9475	4.98	4/27/2022	12:00:00 PM	0	894.499	14.041	2.83	23.43	1010.25
4/27/2022	1:00:00 PM	0	11.9499	4.98	4/27/2022	1:00:00 PM	0	894.64	13.624	2.83	23.43	1010.25
4/27/2022	2:00:00 PM	0	11.9535	4.98	4/27/2022	2:00:00 PM	0	894.978	12.915	2.83	23.43	1010.25
4/27/2022	3:00:00 PM	0	11.958	4.98	4/27/2022	3:00:00 PM	0	895.411	7.076	2.83	23.43	1010.25
4/27/2022	4:00:00 PM	0	11.9631	4.98	4/27/2022	4:00:00 PM	0	895.725	2.123	2.83	23.43	1010.25
4/27/2022	5:00:00 PM	0	11.9682	4.98	4/27/2022	5:00:00 PM	0	895.516	2.914	2.84	23.42	1010.26
4/27/2022	6:00:00 PM	0	11.9722	4.98	4/27/2022	6:00:00 PM	0	895.54	4.887	2.84	23.42	1010.26
4/27/2022	7:00:00 PM	0	11.9763	4.98	4/27/2022	7:00:00 PM	0	895.908	4.124	2.84	23.42	1010.26
4/27/2022	8:00:00 PM	0	11.9807	4.98	4/27/2022	8:00:00 PM	0	895.993	0.473	2.84	23.42	1010.26
4/27/2022	9:00:00 PM	0	11.9853	4.979	4/27/2022	9:00:00 PM	0	895.933	-0.514	2.85	23.41	1010.27
4/27/2022	10:00:00 PM	0	11.9894	4.981	4/27/2022	10:00:00 PM	0	895.876	-0.772	2.85	23.41	1010.27
4/27/2022	11:00:00 PM	0	11.9933	4.98	4/27/2022	11:00:00 PM	0	895.795	-1.887	2.86	23.40	1010.28
4/28/2022	12:00:00 AM	0	11.9972	4.98	4/28/2022	12:00:00 AM	0	895.683	-1.649	2.86	23.40	1010.28
4/28/2022	1:00:00 AM	0	12.0009	4.98	4/28/2022	1:00:00 AM	0	895.789	-1.614	2.87	23.39	1010.29
4/28/2022	2:00:00 AM	0	12.0042	4.98	4/28/2022	2:00:00 AM	0	895.698	-1.662	2.87	23.39	1010.29
4/28/2022	3:00:00 AM	0	12.0079	4.98	4/28/2022	3:00:00 AM	0	895.826	-1.538	2.87	23.39	1010.29
4/28/2022	4:00:00 AM	0	12.0111	4.98	4/28/2022	4:00:00 AM	0	895.647	-1.511	2.88	23.38	1010.30
4/28/2022	5:00:00 AM	0	12.0143	4.98	4/28/2022	5:00:00 AM	0	895.492	-1.452	2.88	23.38	1010.30
4/28/2022	6:00:00 AM	0	12.0169	4.98	4/28/2022	6:00:00 AM	0	895.58	-0.827	2.88	23.38	1010.30
4/28/2022	7:00:00 AM	0	12.0197	4.98	4/28/2022	7:00:00 AM	0	895.681	0.196	2.89	23.37	1010.31
4/28/2022	8:00:00 AM	0	12.0217	4.98	4/28/2022	8:00:00 AM	0	896.009	8.97	2.88	23.38	1010.30
4/28/2022	9:00:00 AM	0	12.0233	4.98	4/28/2022	9:00:00 AM	0	896.13	11.06	2.89	23.37	1010.31
4/28/2022	10:00:00 AM	0	12.0253	4.98	4/28/2022	10:00:00 AM	0	895.863	12.027	2.89	23.37	1010.31
4/28/2022	11:00:00 AM	0	12.0273	4.98	4/28/2022	11:00:00 AM	0	895.658	12.928	2.89	23.37	1010.31
4/28/2022	12:00:00 PM	0	12.03	4.98	4/28/2022	12:00:00 PM	0	895.261	8.688	2.90	23.36	1010.32
4/28/2022	1:00:00 PM	0	12.0324	4.98	4/28/2022	1:00:00 PM	0	895.082	7.296	2.91	23.35	1010.33

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
4/28/2022	2:00:00 PM	0	12.0355	4.98	4/28/2022	2:00:00 PM	0	895.459	6.94	2.90	23.36	1010.32
4/28/2022	3:00:00 PM	0	12.0389	4.98	4/28/2022	3:00:00 PM	0	895.485	6.483	2.91	23.35	1010.33
4/28/2022	4:00:00 PM	0	12.0419	4.98	4/28/2022	4:00:00 PM	0	895.182	6.607	2.91	23.35	1010.33
4/28/2022	5:00:00 PM	0	12.0447	4.98	4/28/2022	5:00:00 PM	0	895.089	4.866	2.92	23.34	1010.34
4/28/2022	6:00:00 PM	0	12.0475	4.98	4/28/2022	6:00:00 PM	0	894.847	3.268	2.92	23.34	1010.34
4/28/2022	7:00:00 PM	0	12.0505	4.981	4/28/2022	7:00:00 PM	0	895.164	3.255	2.92	23.34	1010.34
4/28/2022	8:00:00 PM	0	12.0541	4.98	4/28/2022	8:00:00 PM	0	895.43	0.221	2.92	23.34	1010.34
4/28/2022	9:00:00 PM	0	12.058	4.98	4/28/2022	9:00:00 PM	0	895.675	-1.453	2.92	23.34	1010.34
4/28/2022	10:00:00 PM	0	12.0623	4.98	4/28/2022	10:00:00 PM	0	896.024	-1.141	2.93	23.33	1010.35
4/28/2022	11:00:00 PM	0	12.0667	4.98	4/28/2022	11:00:00 PM	0	896.439	-1.1	2.93	23.33	1010.35
4/29/2022	12:00:00 AM	0	12.0713	4.98	4/29/2022	12:00:00 AM	0	896.665	-2.085	2.93	23.33	1010.35
4/29/2022	1:00:00 AM	0	12.0766	4.98	4/29/2022	1:00:00 AM	0	896.955	-2.231	2.93	23.33	1010.35
4/29/2022	2:00:00 AM	0	12.0817	4.981	4/29/2022	2:00:00 AM	0	897.38	-2.127	2.93	23.33	1010.35
4/29/2022	3:00:00 AM	0	12.0869	4.98	4/29/2022	3:00:00 AM	0	897.492	-2.4	2.93	23.33	1010.35
4/29/2022	4:00:00 AM	0	12.0919	4.98	4/29/2022	4:00:00 AM	0	897.806	-3.096	2.94	23.32	1010.36
4/29/2022	5:00:00 AM	0	12.0972	4.98	4/29/2022	5:00:00 AM	0	898.182	-3.426	2.94	23.32	1010.36
4/29/2022	6:00:00 AM	0	12.1022	4.98	4/29/2022	6:00:00 AM	0	898.885	-3.226	2.94	23.32	1010.36
4/29/2022	7:00:00 AM	0	12.1079	4.98	4/29/2022	7:00:00 AM	0	899.409	-1.404	2.94	23.32	1010.36
4/29/2022	8:00:00 AM	0	12.1128	4.98	4/29/2022	8:00:00 AM	0	900.079	5.136	2.93	23.33	1010.35
4/29/2022	9:00:00 AM	0	12.1164	4.98	4/29/2022	9:00:00 AM	0	900.466	11.465	2.93	23.33	1010.35
4/29/2022	10:00:00 AM	0	12.1197	4.981	4/29/2022	10:00:00 AM	0	900.227	16.624	2.94	23.32	1010.36
4/29/2022	11:00:00 AM	0	12.1226	4.981	4/29/2022	11:00:00 AM	0	899.842	20.138	2.95	23.31	1010.37
4/29/2022	12:00:00 PM	0	12.1263	4.98	4/29/2022	12:00:00 PM	0	899.549	17.919	2.95	23.31	1010.37
4/29/2022	1:00:00 PM	0	12.1298	4.98	4/29/2022	1:00:00 PM	0	899.43	20.025	2.96	23.30	1010.38
4/29/2022	2:00:00 PM	0	12.1334	4.98	4/29/2022	2:00:00 PM	0	899.207	17.206	2.96	23.30	1010.38
4/29/2022	3:00:00 PM	0	12.1367	4.98	4/29/2022	3:00:00 PM	0	899.151	13.748	2.97	23.29	1010.39
4/29/2022	4:00:00 PM	0	12.1404	4.98	4/29/2022	4:00:00 PM	0	898.827	10.944	2.97	23.29	1010.39
4/29/2022	5:00:00 PM	0	12.1428	4.98	4/29/2022	5:00:00 PM	0	898.461	9.124	2.98	23.28	1010.40
4/29/2022	6:00:00 PM	0	12.1452	4.98	4/29/2022	6:00:00 PM	0	898.15	8.084	2.99	23.27	1010.41
4/29/2022	7:00:00 PM	0	12.1473	4.98	4/29/2022	7:00:00 PM	0	898.248	7.875	2.99	23.27	1010.41
4/29/2022	8:00:00 PM	0	12.1498	4.98	4/29/2022	8:00:00 PM	0	898.306	4.904	2.99	23.27	1010.41
4/29/2022	9:00:00 PM	0	12.153	4.98	4/29/2022	9:00:00 PM	0	898.228	3.167	2.99	23.27	1010.41
4/29/2022	10:00:00 PM	0	12.1556	4.98	4/29/2022	10:00:00 PM	0	898.136	2.521	3.00	23.26	1010.42
4/29/2022	11:00:00 PM	0	12.1584	4.981	4/29/2022	11:00:00 PM	0	898.054	1.12	3.00	23.26	1010.42
4/30/2022	12:00:00 AM	0	12.1612	4.981	4/30/2022	12:00:00 AM	0	897.683	0.148	3.01	23.25	1010.43
4/30/2022	1:00:00 AM	0	12.164	4.98	4/30/2022	1:00:00 AM	0	897.632	-0.624	3.01	23.25	1010.43
4/30/2022	2:00:00 AM	0	12.1666	4.98	4/30/2022	2:00:00 AM	0	897.393	-1.57	3.02	23.24	1010.44
4/30/2022	3:00:00 AM	0	12.1685	4.98	4/30/2022	3:00:00 AM	0	897.065	-1.823	3.02	23.24	1010.44
4/30/2022	4:00:00 AM	0	12.1707	4.98	4/30/2022	4:00:00 AM	0	897.005	-1.692	3.02	23.24	1010.44
4/30/2022	5:00:00 AM	0	12.1729	4.98	4/30/2022	5:00:00 AM	0	896.759	-2.457	3.03	23.23	1010.45
4/30/2022	6:00:00 AM	0	12.1752	4.98	4/30/2022	6:00:00 AM	0	896.898	-1.744	3.03	23.23	1010.45
4/30/2022	7:00:00 AM	0	12.1772	4.98	4/30/2022	7:00:00 AM	0	897.331	1.15	3.03	23.23	1010.45
4/30/2022	8:00:00 AM	0	12.1791	4.98	4/30/2022	8:00:00 AM	0	897.74	8.095	3.02	23.24	1010.44
4/30/2022	9:00:00 AM	0	12.1812	4.98	4/30/2022	9:00:00 AM	0	897.737	9.758	3.03	23.23	1010.45
4/30/2022	10:00:00 AM	0	12.1831	4.98	4/30/2022	10:00:00 AM	0	897.701	13.043	3.03	23.23	1010.45
4/30/2022	11:00:00 AM	0	12.1848	4.98	4/30/2022	11:00:00 AM	0	897.66	16.24	3.03	23.23	1010.45
4/30/2022	12:00:00 PM	0	12.1873	4.98	4/30/2022	12:00:00 PM	0	897.629	16.59	3.03	23.23	1010.45
4/30/2022	1:00:00 PM	0	12.1895	4.98	4/30/2022	1:00:00 PM	0	897.567	16.779	3.04	23.22	1010.46
4/30/2022	2:00:00 PM	0	12.1914	4.98	4/30/2022	2:00:00 PM	0	897.074	21.096	3.04	23.22	1010.46
4/30/2022	3:00:00 PM	0	12.1933	4.98	4/30/2022	3:00:00 PM	0	897.508	17.279	3.04	23.22	1010.46
4/30/2022	4:00:00 PM	0	12.1975	4.98	4/30/2022	4:00:00 PM	0	897.742	13.835	3.04	23.22	1010.46
4/30/2022	5:00:00 PM	0	12.2015	4.98	4/30/2022	5:00:00 PM	0	897.99	12.384	3.04	23.22	1010.46
4/30/2022	6:00:00 PM	0	12.2055	4.98	4/30/2022	6:00:00 PM	0	897.996	9.751	3.05	23.21	1010.47
4/30/2022	7:00:00 PM	0	12.2097	4.98	4/30/2022	7:00:00 PM	0	898.314	8.371	3.05	23.21	1010.47
4/30/2022	8:00:00 PM	0	12.2138	4.98	4/30/2022	8:00:00 PM	0	898.508	4.901	3.05	23.21	1010.47
4/30/2022	9:00:00 PM	0	12.2183	4.98	4/30/2022	9:00:00 PM	0	898.397	2.114	3.06	23.20	1010.48
4/30/2022	10:00:00 PM	0	12.2227	4.98	4/30/2022	10:00:00 PM	0	898.486	0.968	3.06	23.20	1010.48
4/30/2022	11:00:00 PM	0	12.2268	4.98	4/30/2022	11:00:00 PM	0	898.24	0.335	3.07	23.19	1010.49
5/1/2022	12:00:00 AM	0	12.2308	4.98	5/1/2022	12:00:00 AM	0	898.369	-0.26	3.07	23.19	1010.49
5/1/2022	1:00:00 AM	0	12.2342	4.98	5/1/2022	1:00:00 AM	0	898.328	-0.869	3.07	23.19	1010.49
5/1/2022	2:00:00 AM	0	12.2371	4.98	5/1/2022	2:00:00 AM	0	897.938	-1.288	3.08	23.18	1010.50
5/1/2022	3:00:00 AM	0	12.2405	4.98	5/1/2022	3:00:00 AM	0	897.584	-1.699	3.09	23.17	1010.51
5/1/2022	4:00:00 AM	0	12.2429	4.98	5/1/2022	4:00:00 AM	0	897.731	-1.73	3.09	23.17	1010.51
5/1/2022	5:00:00 AM	0	12.2455	4.98	5/1/2022	5:00:00 AM	0	897.791	-2.024	3.09	23.17	1010.51
5/1/2022	6:00:00 AM	0	12.2481	4.98	5/1/2022	6:00:00 AM	0	897.538	-1.832	3.10	23.16	1010.52
5/1/2022	7:00:00 AM	0	12.2506	4.98	5/1/2022	7:00:00 AM	0	897.653	1.324	3.10	23.16	1010.52
5/1/2022	8:00:00 AM	0	12.2515	4.981	5/1/2022	8:00:00 AM	0	897.64	9.664	3.10	23.16	1010.52
5/1/2022	9:00:00 AM	0	12.2515	4.98	5/1/2022	9:00:00 AM	0	897.173	15.18	3.10	23.16	1010.52
5/1/2022	10:00:00 AM	0	12.2518	4.98	5/1/2022	10:00:00 AM	0	896.759	19.104	3.11	23.15	1010.53
5/1/2022	11:00:00 AM	0	12.2515	4.98	5/1/2022	11:00:00 AM	0	895.867	20.74	3.12	23.14	1010.54

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/1/2022	12:00:00 PM	0	12.2515	4.98	5/1/2022	12:00:00 PM	0	895.131	21.259	3.12	23.14	1010.54
5/1/2022	1:00:00 PM	0	12.2516	4.981	5/1/2022	1:00:00 PM	0	894.519	18.848	3.13	23.13	1010.55
5/1/2022	2:00:00 PM	0	12.2519	4.98	5/1/2022	2:00:00 PM	0	893.87	17.972	3.14	23.12	1010.56
5/1/2022	3:00:00 PM	0	12.2513	4.98	5/1/2022	3:00:00 PM	0	893.415	17.317	3.14	23.12	1010.56
5/1/2022	4:00:00 PM	0	12.2515	4.98	5/1/2022	4:00:00 PM	0	892.789	15.499	3.15	23.11	1010.57
5/1/2022	5:00:00 PM	0	12.2511	4.98	5/1/2022	5:00:00 PM	0	892.45	13.542	3.15	23.11	1010.57
5/1/2022	6:00:00 PM	0	12.251	4.98	5/1/2022	6:00:00 PM	0	892.063	11.79	3.15	23.11	1010.57
5/1/2022	7:00:00 PM	0	12.2516	4.98	5/1/2022	7:00:00 PM	0	891.649	10.052	3.16	23.10	1010.58
5/1/2022	8:00:00 PM	0	12.2511	4.98	5/1/2022	8:00:00 PM	0	891.389	8.574	3.16	23.10	1010.58
5/1/2022	9:00:00 PM	0	12.2516	4.98	5/1/2022	9:00:00 PM	0	891.382	7.866	3.16	23.10	1010.58
5/1/2022	10:00:00 PM	0	12.2527	4.98	5/1/2022	10:00:00 PM	0	891.25	6.664	3.16	23.10	1010.58
5/1/2022	11:00:00 PM	0	12.2537	4.98	5/1/2022	11:00:00 PM	0	891.028	5.5	3.17	23.09	1010.59
5/2/2022	12:00:00 AM	0	12.2556	4.98	5/2/2022	12:00:00 AM	0	891.089	4.568	3.17	23.09	1010.59
5/2/2022	1:00:00 AM	0	12.2571	4.98	5/2/2022	1:00:00 AM	0	890.878	4.054	3.17	23.09	1010.59
5/2/2022	2:00:00 AM	0	12.2593	4.98	5/2/2022	2:00:00 AM	0	890.475	3.616	3.18	23.08	1010.60
5/2/2022	3:00:00 AM	0	12.2609	4.98	5/2/2022	3:00:00 AM	0	890.492	2.882	3.18	23.08	1010.60
5/2/2022	4:00:00 AM	0	12.2633	4.98	5/2/2022	4:00:00 AM	0	890.391	2.182	3.18	23.08	1010.60
5/2/2022	5:00:00 AM	0	12.2654	4.981	5/2/2022	5:00:00 AM	0	890.594	2.216	3.18	23.08	1010.60
5/2/2022	6:00:00 AM	0	12.2681	4.98	5/2/2022	6:00:00 AM	0	891.142	2.97	3.18	23.08	1010.60
5/2/2022	7:00:00 AM	0	12.2714	4.981	5/2/2022	7:00:00 AM	0	891.651	3.962	3.18	23.08	1010.60
5/2/2022	8:00:00 AM	0	12.2755	4.981	5/2/2022	8:00:00 AM	0	892.154	5.154	3.18	23.08	1010.60
5/2/2022	9:00:00 AM	0	12.2796	4.98	5/2/2022	9:00:00 AM	0	892.478	5.822	3.18	23.08	1010.60
5/2/2022	10:00:00 AM	0	12.2835	4.98	5/2/2022	10:00:00 AM	0	892.702	7.832	3.18	23.08	1010.60
5/2/2022	11:00:00 AM	0	12.2875	4.98	5/2/2022	11:00:00 AM	0	892.992	10.615	3.18	23.08	1010.60
5/2/2022	12:00:00 PM	0	12.2917	4.98	5/2/2022	12:00:00 PM	0	892.995	12.983	3.19	23.07	1010.61
5/2/2022	1:00:00 PM	0	12.2947	4.98	5/2/2022	1:00:00 PM	0	893.059	14.508	3.19	23.07	1010.61
5/2/2022	2:00:00 PM	0	12.2982	4.981	5/2/2022	2:00:00 PM	0	892.805	16.755	3.19	23.07	1010.61
5/2/2022	3:00:00 PM	0	12.302	4.981	5/2/2022	3:00:00 PM	0	893.346	16.208	3.19	23.07	1010.61
5/2/2022	4:00:00 PM	0	12.3062	4.98	5/2/2022	4:00:00 PM	0	893.398	14.605	3.20	23.06	1010.62
5/2/2022	5:00:00 PM	0	12.3106	4.98	5/2/2022	5:00:00 PM	0	893.66	13.283	3.20	23.06	1010.62
5/2/2022	6:00:00 PM	0	12.3159	4.98	5/2/2022	6:00:00 PM	0	894.103	10.599	3.20	23.06	1010.62
5/2/2022	7:00:00 PM	0	12.3214	4.981	5/2/2022	7:00:00 PM	0	894.613	8.346	3.20	23.06	1010.62
5/2/2022	8:00:00 PM	0	12.3274	4.98	5/2/2022	8:00:00 PM	0	895.206	5.73	3.20	23.06	1010.62
5/2/2022	9:00:00 PM	0	12.3338	4.981	5/2/2022	9:00:00 PM	0	895.467	3.663	3.20	23.06	1010.62
5/2/2022	10:00:00 PM	0	12.3401	4.98	5/2/2022	10:00:00 PM	0	895.612	2.406	3.21	23.05	1010.63
5/2/2022	11:00:00 PM	0	12.3456	4.98	5/2/2022	11:00:00 PM	0	895.96	1.7	3.21	23.05	1010.63
5/3/2022	12:00:00 AM	0	12.3512	4.98	5/3/2022	12:00:00 AM	0	896.022	1.155	3.21	23.05	1010.63
5/3/2022	1:00:00 AM	0	12.3568	4.98	5/3/2022	1:00:00 AM	0	896.155	0.607	3.22	23.04	1010.64
5/3/2022	2:00:00 AM	0	12.3624	4.98	5/3/2022	2:00:00 AM	0	896.259	0.13	3.22	23.04	1010.64
5/3/2022	3:00:00 AM	0	12.3673	4.98	5/3/2022	3:00:00 AM	0	896.54	0.006	3.23	23.03	1010.65
5/3/2022	4:00:00 AM	0	12.3723	4.98	5/3/2022	4:00:00 AM	0	896.712	0.508	3.23	23.03	1010.65
5/3/2022	5:00:00 AM	0	12.3774	4.981	5/3/2022	5:00:00 AM	0	896.967	0.856	3.23	23.03	1010.65
5/3/2022	6:00:00 AM	0	12.3821	4.981	5/3/2022	6:00:00 AM	0	897.084	0.924	3.23	23.03	1010.65
5/3/2022	7:00:00 AM	0	12.3867	4.98	5/3/2022	7:00:00 AM	0	897.522	3.438	3.23	23.03	1010.65
5/3/2022	8:00:00 AM	0	12.3903	4.98	5/3/2022	8:00:00 AM	0	897.571	9.717	3.24	23.02	1010.66
5/3/2022	9:00:00 AM	0	12.394	4.98	5/3/2022	9:00:00 AM	0	897.638	11.45	3.24	23.02	1010.66
5/3/2022	10:00:00 AM	0	12.3972	4.98	5/3/2022	10:00:00 AM	0	897.368	11.863	3.25	23.01	1010.67
5/3/2022	11:00:00 AM	0	12.4005	4.98	5/3/2022	11:00:00 AM	0	897.147	13.291	3.25	23.01	1010.67
5/3/2022	12:00:00 PM	0	12.4031	4.98	5/3/2022	12:00:00 PM	0	896.654	14.796	3.26	23.00	1010.68
5/3/2022	1:00:00 PM	0	12.4047	4.98	5/3/2022	1:00:00 PM	0	895.889	19.578	3.27	22.99	1010.69
5/3/2022	2:00:00 PM	0	12.4055	4.981	5/3/2022	2:00:00 PM	0	895.336	21.18	3.28	22.98	1010.70
5/3/2022	3:00:00 PM	0	12.4069	4.98	5/3/2022	3:00:00 PM	0	895.175	19.275	3.28	22.98	1010.70
5/3/2022	4:00:00 PM	0	12.4094	4.98	5/3/2022	4:00:00 PM	0	895.153	15.961	3.28	22.98	1010.70
5/3/2022	5:00:00 PM	0	12.4121	4.98	5/3/2022	5:00:00 PM	0	895.306	12.738	3.28	22.98	1010.70
5/3/2022	6:00:00 PM	0	12.4148	4.98	5/3/2022	6:00:00 PM	0	895.247	9.66	3.29	22.97	1010.71
5/3/2022	7:00:00 PM	0	12.4182	4.98	5/3/2022	7:00:00 PM	0	895.492	7.508	3.29	22.97	1010.71
5/3/2022	8:00:00 PM	0	12.4219	4.981	5/3/2022	8:00:00 PM	0	895.33	6.184	3.29	22.97	1010.71
5/3/2022	9:00:00 PM	0	12.4251	4.98	5/3/2022	9:00:00 PM	0	895.31	5.532	3.30	22.96	1010.72
5/3/2022	10:00:00 PM	0	12.4283	4.98	5/3/2022	10:00:00 PM	0	895.18	5.039	3.30	22.96	1010.72
5/3/2022	11:00:00 PM	0	12.431	4.981	5/3/2022	11:00:00 PM	0	894.919	4.705	3.31	22.95	1010.73
5/4/2022	12:00:00 AM	0	12.4343	4.98	5/4/2022	12:00:00 AM	0	895.013	4.467	3.31	22.95	1010.73
5/4/2022	1:00:00 AM	0	12.4374	4.98	5/4/2022	1:00:00 AM	0	894.789	4.168	3.31	22.95	1010.73
5/4/2022	2:00:00 AM	0	12.4402	4.98	5/4/2022	2:00:00 AM	0	894.524	3.678	3.32	22.94	1010.74
5/4/2022	3:00:00 AM	0	12.4426	4.981	5/4/2022	3:00:00 AM	0	894.175	3.556	3.32	22.94	1010.74
5/4/2022	4:00:00 AM	0	12.4451	4.98	5/4/2022	4:00:00 AM	0	894.108	3.405	3.33	22.93	1010.75
5/4/2022	5:00:00 AM	0	12.4475	4.98	5/4/2022	5:00:00 AM	0	894.148	3.387	3.33	22.93	1010.75
5/4/2022	6:00:00 AM	0	12.4506	4.98	5/4/2022	6:00:00 AM	0	894.535	3.767	3.33	22.93	1010.75
5/4/2022	7:00:00 AM	0	12.4536	4.98	5/4/2022	7:00:00 AM	0	894.56	4.282	3.33	22.93	1010.75
5/4/2022	8:00:00 AM	0	12.4567	4.98	5/4/2022	8:00:00 AM	0	894.691	6.317	3.33	22.93	1010.75
5/4/2022	9:00:00 AM	0	12.4598	4.98	5/4/2022	9:00:00 AM	0	894.671	9.474	3.34	22.92	1010.76

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/4/2022	10:00:00 AM	0	12.4624	4.98	5/4/2022	10:00:00 AM	0	894.504	9.756	3.34	22.92	1010.76
5/4/2022	11:00:00 AM	0	12.4649	4.98	5/4/2022	11:00:00 AM	0	894.117	10.341	3.35	22.91	1010.77
5/4/2022	12:00:00 PM	0	12.4668	4.98	5/4/2022	12:00:00 PM	0	893.648	12.907	3.35	22.91	1010.77
5/4/2022	1:00:00 PM	0	12.4672	4.981	5/4/2022	1:00:00 PM	0	893.342	14.529	3.36	22.90	1010.78
5/4/2022	2:00:00 PM	0	12.4691	4.98	5/4/2022	2:00:00 PM	0	892.815	12.903	3.36	22.90	1010.78
5/4/2022	3:00:00 PM	0	12.4699	4.981	5/4/2022	3:00:00 PM	0	892.24	11.591	3.37	22.89	1010.79
5/4/2022	4:00:00 PM	0	12.4718	4.98	5/4/2022	4:00:00 PM	0	891.675	10.249	3.38	22.88	1010.80
5/4/2022	5:00:00 PM	0	12.4722	4.98	5/4/2022	5:00:00 PM	0	891.085	8.507	3.39	22.87	1010.81
5/4/2022	6:00:00 PM	0	12.473	4.98	5/4/2022	6:00:00 PM	0	890.275	8.263	3.39	22.87	1010.81
5/4/2022	7:00:00 PM	0	12.4733	4.981	5/4/2022	7:00:00 PM	0	889.671	7.17	3.40	22.86	1010.82
5/4/2022	8:00:00 PM	0	12.4737	4.981	5/4/2022	8:00:00 PM	0	889.416	6.079	3.40	22.86	1010.82
5/4/2022	9:00:00 PM	0	12.4743	4.98	5/4/2022	9:00:00 PM	0	889.227	4.731	3.41	22.85	1010.83
5/4/2022	10:00:00 PM	0	12.4756	4.98	5/4/2022	10:00:00 PM	0	888.889	4.344	3.41	22.85	1010.83
5/4/2022	11:00:00 PM	0	12.4764	4.98	5/4/2022	11:00:00 PM	0	888.567	4.482	3.42	22.84	1010.84
5/5/2022	12:00:00 AM	0	12.4776	4.981	5/5/2022	12:00:00 AM	0	888.481	4.383	3.42	22.84	1010.84
5/5/2022	1:00:00 AM	0	12.4788	4.981	5/5/2022	1:00:00 AM	0	888.315	4.678	3.42	22.84	1010.84
5/5/2022	2:00:00 AM	0	12.4804	4.98	5/5/2022	2:00:00 AM	0	887.81	4.469	3.43	22.83	1010.85
5/5/2022	3:00:00 AM	0	12.4814	4.98	5/5/2022	3:00:00 AM	0	887.43	3.947	3.43	22.83	1010.85
5/5/2022	4:00:00 AM	0	12.4826	4.981	5/5/2022	4:00:00 AM	0	887.147	3.9	3.44	22.82	1010.86
5/5/2022	5:00:00 AM	0	12.484	4.98	5/5/2022	5:00:00 AM	0	886.884	3.472	3.44	22.82	1010.86
5/5/2022	6:00:00 AM	0	12.4849	4.98	5/5/2022	6:00:00 AM	0	886.568	3.269	3.44	22.82	1010.86
5/5/2022	7:00:00 AM	0	12.4864	4.98	5/5/2022	7:00:00 AM	0	886.227	3.754	3.45	22.81	1010.87
5/5/2022	8:00:00 AM	0	12.4868	4.98	5/5/2022	8:00:00 AM	0	885.886	4.832	3.45	22.81	1010.87
5/5/2022	9:00:00 AM	0	12.4876	4.98	5/5/2022	9:00:00 AM	0	885.71	7.41	3.46	22.80	1010.88
5/5/2022	10:00:00 AM	0	12.4874	4.98	5/5/2022	10:00:00 AM	0	884.848	11.286	3.46	22.80	1010.88
5/5/2022	11:00:00 AM	0	12.4864	4.98	5/5/2022	11:00:00 AM	0	884.046	13.909	3.47	22.79	1010.89
5/5/2022	12:00:00 PM	0	12.4851	4.981	5/5/2022	12:00:00 PM	0	883.267	13.227	3.48	22.78	1010.90
5/5/2022	1:00:00 PM	0	12.4834	4.981	5/5/2022	1:00:00 PM	0	882.347	14.263	3.49	22.77	1010.91
5/5/2022	2:00:00 PM	0	12.4821	4.98	5/5/2022	2:00:00 PM	0	881.873	10.974	3.49	22.77	1010.91
5/5/2022	3:00:00 PM	0	12.4812	4.981	5/5/2022	3:00:00 PM	0	881.45	10.542	3.49	22.77	1010.91
5/5/2022	4:00:00 PM	0	12.4803	4.98	5/5/2022	4:00:00 PM	0	881.065	8.96	3.50	22.76	1010.92
5/5/2022	5:00:00 PM	0	12.4802	4.98	5/5/2022	5:00:00 PM	0	880.781	8.449	3.50	22.76	1010.92
5/5/2022	6:00:00 PM	0	12.48	4.98	5/5/2022	6:00:00 PM	0	880.342	7.305	3.50	22.76	1010.92
5/5/2022	7:00:00 PM	0	12.481	4.98	5/5/2022	7:00:00 PM	0	880.203	5.988	3.51	22.75	1010.93
5/5/2022	8:00:00 PM	0	12.4818	4.98	5/5/2022	8:00:00 PM	0	880.299	5.223	3.51	22.75	1010.93
5/5/2022	9:00:00 PM	0	12.4828	4.981	5/5/2022	9:00:00 PM	0	880.214	4.541	3.51	22.75	1010.93
5/5/2022	10:00:00 PM	0	12.4849	4.98	5/5/2022	10:00:00 PM	0	880.214	4.164	3.51	22.75	1010.93
5/5/2022	11:00:00 PM	0	12.4873	4.981	5/5/2022	11:00:00 PM	0	880.479	3.715	3.51	22.75	1010.93
5/6/2022	12:00:00 AM	0	12.4902	4.98	5/6/2022	12:00:00 AM	0	880.836	3.252	3.51	22.75	1010.93
5/6/2022	1:00:00 AM	0	12.4939	4.98	5/6/2022	1:00:00 AM	0	881.211	3.049	3.51	22.75	1010.93
5/6/2022	2:00:00 AM	0	12.499	4.98	5/6/2022	2:00:00 AM	0	882.116	2.436	3.50	22.76	1010.92
5/6/2022	3:00:00 AM	0	12.5044	4.98	5/6/2022	3:00:00 AM	0	882.944	1.912	3.50	22.76	1010.92
5/6/2022	4:00:00 AM	0	12.5102	4.981	5/6/2022	4:00:00 AM	0	883.371	1.792	3.50	22.76	1010.92
5/6/2022	5:00:00 AM	0	12.5168	4.98	5/6/2022	5:00:00 AM	0	883.91	1.658	3.50	22.76	1010.92
5/6/2022	6:00:00 AM	0	12.5232	4.981	5/6/2022	6:00:00 AM	0	884.305	2.345	3.51	22.75	1010.93
5/6/2022	7:00:00 AM	0	12.5296	4.981	5/6/2022	7:00:00 AM	0	884.828	4.707	3.51	22.75	1010.93
5/6/2022	8:00:00 AM	0	12.5348	4.981	5/6/2022	8:00:00 AM	0	885.161	7.356	3.51	22.75	1010.93
5/6/2022	9:00:00 AM	0	12.5399	4.98	5/6/2022	9:00:00 AM	0	885.245	11.664	3.51	22.75	1010.93
5/6/2022	10:00:00 AM	0	12.5436	4.98	5/6/2022	10:00:00 AM	0	885.114	12.4	3.52	22.74	1010.94
5/6/2022	11:00:00 AM	0	12.5478	4.98	5/6/2022	11:00:00 AM	0	885.035	14.725	3.52	22.74	1010.94
5/6/2022	12:00:00 PM	0	12.5515	4.98	5/6/2022	12:00:00 PM	0	884.704	15	3.53	22.73	1010.95
5/6/2022	1:00:00 PM	0	12.5552	4.98	5/6/2022	1:00:00 PM	0	884.419	13.909	3.54	22.72	1010.96
5/6/2022	2:00:00 PM	0	12.5584	4.98	5/6/2022	2:00:00 PM	0	884.312	14.9	3.54	22.72	1010.96
5/6/2022	3:00:00 PM	0	12.5621	4.981	5/6/2022	3:00:00 PM	0	884.28	12.961	3.54	22.72	1010.96
5/6/2022	4:00:00 PM	0	12.5657	4.981	5/6/2022	4:00:00 PM	0	884.015	12.187	3.55	22.71	1010.97
5/6/2022	5:00:00 PM	0	12.5692	4.981	5/6/2022	5:00:00 PM	0	883.705	9.654	3.56	22.70	1010.98
5/6/2022	6:00:00 PM	0	12.5727	4.98	5/6/2022	6:00:00 PM	0	883.737	8.466	3.56	22.70	1010.98
5/6/2022	7:00:00 PM	0	12.5761	4.981	5/6/2022	7:00:00 PM	0	883.76	8.146	3.56	22.70	1010.98
5/6/2022	8:00:00 PM	0	12.5798	4.98	5/6/2022	8:00:00 PM	0	883.788	3.687	3.57	22.69	1010.99
5/6/2022	9:00:00 PM	0	12.5836	4.981	5/6/2022	9:00:00 PM	0	883.795	0.94	3.57	22.69	1010.99
5/6/2022	10:00:00 PM	0	12.5877	4.98	5/6/2022	10:00:00 PM	0	883.554	-0.454	3.58	22.68	1011.00
5/6/2022	11:00:00 PM	0	12.5916	4.981	5/6/2022	11:00:00 PM	0	883.66	-1.178	3.58	22.68	1011.00
5/7/2022	12:00:00 AM	0	12.5954	4.98	5/7/2022	12:00:00 AM	0	883.747	-1.661	3.58	22.68	1011.00
5/7/2022	1:00:00 AM	0	12.5995	4.981	5/7/2022	1:00:00 AM	0	883.934	-2.073	3.59	22.67	1011.01
5/7/2022	2:00:00 AM	0	12.6036	4.98	5/7/2022	2:00:00 AM	0	884.173	-2.317	3.59	22.67	1011.01
5/7/2022	3:00:00 AM	0	12.6082	4.981	5/7/2022	3:00:00 AM	0	884.23	-2.282	3.59	22.67	1011.01
5/7/2022	4:00:00 AM	0	12.6124	4.981	5/7/2022	4:00:00 AM	0	884.833	-0.903	3.59	22.67	1011.01
5/7/2022	5:00:00 AM	0	12.6169	4.981	5/7/2022	5:00:00 AM	0	885.071	-1.013	3.59	22.67	1011.01
5/7/2022	6:00:00 AM	0	12.6219	4.981	5/7/2022	6:00:00 AM	0	885.098	-1.43	3.60	22.66	1011.02
5/7/2022	7:00:00 AM	0	12.6263	4.981	5/7/2022	7:00:00 AM	0	885.627	-0.095	3.60	22.66	1011.02

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/7/2022	8:00:00 AM	0	12.6301	4.981	5/7/2022	8:00:00 AM	0	886.202	9.667	3.59	22.67	1011.01
5/7/2022	9:00:00 AM	0	12.6334	4.981	5/7/2022	9:00:00 AM	0	886.092	15.649	3.60	22.66	1011.02
5/7/2022	10:00:00 AM	0	12.6369	4.98	5/7/2022	10:00:00 AM	0	886.111	14.062	3.60	22.66	1011.02
5/7/2022	11:00:00 AM	0	12.6407	4.981	5/7/2022	11:00:00 AM	0	885.842	11.854	3.61	22.65	1011.03
5/7/2022	12:00:00 PM	0	12.6445	4.981	5/7/2022	12:00:00 PM	0	885.793	11.896	3.61	22.65	1011.03
5/7/2022	1:00:00 PM	0	12.648	4.98	5/7/2022	1:00:00 PM	0	885.508	13.119	3.62	22.64	1011.04
5/7/2022	2:00:00 PM	0	12.6504	4.98	5/7/2022	2:00:00 PM	0	885.372	16.314	3.62	22.64	1011.04
5/7/2022	3:00:00 PM	0	12.6533	4.981	5/7/2022	3:00:00 PM	0	885.16	14.133	3.63	22.63	1011.05
5/7/2022	4:00:00 PM	0	12.6564	4.981	5/7/2022	4:00:00 PM	0	884.897	13.242	3.63	22.63	1011.05
5/7/2022	5:00:00 PM	0	12.6594	4.98	5/7/2022	5:00:00 PM	0	884.802	10.193	3.64	22.62	1011.06
5/7/2022	6:00:00 PM	0	12.6622	4.981	5/7/2022	6:00:00 PM	0	884.546	8.644	3.64	22.62	1011.06
5/7/2022	7:00:00 PM	0	12.6655	4.98	5/7/2022	7:00:00 PM	0	884.806	8.879	3.64	22.62	1011.06
5/7/2022	8:00:00 PM	0	12.6684	4.98	5/7/2022	8:00:00 PM	0	884.919	3.902	3.64	22.62	1011.06
5/7/2022	9:00:00 PM	0	12.6728	4.981	5/7/2022	9:00:00 PM	0	884.841	1.085	3.65	22.61	1011.07
5/7/2022	10:00:00 PM	0	12.6763	4.98	5/7/2022	10:00:00 PM	0	884.788	-0.415	3.65	22.61	1011.07
5/7/2022	11:00:00 PM	0	12.6796	4.981	5/7/2022	11:00:00 PM	0	884.67	-1.209	3.66	22.60	1011.08
5/8/2022	12:00:00 AM	0	12.6835	4.981	5/8/2022	12:00:00 AM	0	884.684	-1.664	3.66	22.60	1011.08
5/8/2022	1:00:00 AM	0	12.6866	4.98	5/8/2022	1:00:00 AM	0	884.468	-2.109	3.67	22.59	1011.09
5/8/2022	2:00:00 AM	0	12.6902	4.98	5/8/2022	2:00:00 AM	0	884.713	-2.539	3.67	22.59	1011.09
5/8/2022	3:00:00 AM	0	12.6932	4.981	5/8/2022	3:00:00 AM	0	884.985	-1.577	3.67	22.59	1011.09
5/8/2022	4:00:00 AM	0	12.6968	4.98	5/8/2022	4:00:00 AM	0	884.814	-1.809	3.67	22.59	1011.09
5/8/2022	5:00:00 AM	0	12.6997	4.98	5/8/2022	5:00:00 AM	0	884.501	-2.86	3.68	22.58	1011.10
5/8/2022	6:00:00 AM	0	12.7024	4.98	5/8/2022	6:00:00 AM	0	884.385	-2.766	3.68	22.58	1011.10
5/8/2022	7:00:00 AM	0	12.7052	4.98	5/8/2022	7:00:00 AM	0	884.615	-0.311	3.68	22.58	1011.10
5/8/2022	8:00:00 AM	0	12.7072	4.981	5/8/2022	8:00:00 AM	0	884.996	9.442	3.68	22.58	1011.10
5/8/2022	9:00:00 AM	0	12.7078	4.98	5/8/2022	9:00:00 AM	0	884.724	14.92	3.69	22.57	1011.11
5/8/2022	10:00:00 AM	0	12.7082	4.981	5/8/2022	10:00:00 AM	0	884.097	18.131	3.69	22.57	1011.11
5/8/2022	11:00:00 AM	0	12.7095	4.981	5/8/2022	11:00:00 AM	0	884.075	16.605	3.69	22.57	1011.11
5/8/2022	12:00:00 PM	0	12.7124	4.981	5/8/2022	12:00:00 PM	0	883.962	13.409	3.70	22.56	1011.12
5/8/2022	1:00:00 PM	0	12.7155	4.981	5/8/2022	1:00:00 PM	0	884.12	10.945	3.70	22.56	1011.12
5/8/2022	2:00:00 PM	0	12.7149	4.98	5/8/2022	2:00:00 PM	0	883.975	12.638	3.70	22.56	1011.12
5/8/2022	3:00:00 PM	0	12.7173	4.981	5/8/2022	3:00:00 PM	0	883.792	12.198	3.71	22.55	1011.13
5/8/2022	4:00:00 PM	0	12.7193	4.981	5/8/2022	4:00:00 PM	0	883.846	11.583	3.71	22.55	1011.13
5/8/2022	5:00:00 PM	0	12.7221	4.981	5/8/2022	5:00:00 PM	0	884.242	9.608	3.71	22.55	1011.13
5/8/2022	6:00:00 PM	0	12.7249	4.981	5/8/2022	6:00:00 PM	0	883.582	7.174	3.71	22.55	1011.13
5/8/2022	7:00:00 PM	0	12.7274	4.981	5/8/2022	7:00:00 PM	0	883.704	5.813	3.72	22.54	1011.14
5/8/2022	8:00:00 PM	0	12.7308	4.981	5/8/2022	8:00:00 PM	0	884.053	3.583	3.72	22.54	1011.14
5/8/2022	9:00:00 PM	0	12.7348	4.981	5/8/2022	9:00:00 PM	0	884.366	1.472	3.72	22.54	1011.14
5/8/2022	10:00:00 PM	0	12.7386	4.981	5/8/2022	10:00:00 PM	0	884.351	0.721	3.72	22.54	1011.14
5/8/2022	11:00:00 PM	0	12.7422	4.981	5/8/2022	11:00:00 PM	0	884.235	0.033	3.73	22.53	1011.15
5/9/2022	12:00:00 AM	0	12.7458	4.98	5/9/2022	12:00:00 AM	0	884.404	-0.427	3.73	22.53	1011.15
5/9/2022	1:00:00 AM	0	12.7495	4.981	5/9/2022	1:00:00 AM	0	884.704	0.114	3.73	22.53	1011.15
5/9/2022	2:00:00 AM	0	12.753	4.98	5/9/2022	2:00:00 AM	0	885.038	0.537	3.73	22.53	1011.15
5/9/2022	3:00:00 AM	0	12.7568	4.981	5/9/2022	3:00:00 AM	0	885.276	0.528	3.73	22.53	1011.15
5/9/2022	4:00:00 AM	0	12.7608	4.98	5/9/2022	4:00:00 AM	0	885.471	0.393	3.73	22.53	1011.15
5/9/2022	5:00:00 AM	0	12.7647	4.98	5/9/2022	5:00:00 AM	0	885.633	0.184	3.73	22.53	1011.15
5/9/2022	6:00:00 AM	0	12.7689	4.981	5/9/2022	6:00:00 AM	0	886.046	0.445	3.73	22.53	1011.15
5/9/2022	7:00:00 AM	0	12.773	4.981	5/9/2022	7:00:00 AM	0	886.461	1.526	3.73	22.53	1011.15
5/9/2022	8:00:00 AM	0	12.777	4.981	5/9/2022	8:00:00 AM	0	886.833	3.114	3.73	22.53	1011.15
5/9/2022	9:00:00 AM	0	12.7812	4.981	5/9/2022	9:00:00 AM	0	887.028	5.326	3.74	22.52	1011.16
5/9/2022	10:00:00 AM	0	12.7847	4.98	5/9/2022	10:00:00 AM	0	887.095	9.863	3.74	22.52	1011.16
5/9/2022	11:00:00 AM	0	12.7881	4.981	5/9/2022	11:00:00 AM	0	887.188	8.71	3.74	22.52	1011.16
5/9/2022	12:00:00 PM	0	12.7909	4.98	5/9/2022	12:00:00 PM	0	887.207	11.353	3.74	22.52	1011.16
5/9/2022	1:00:00 PM	0	12.7939	4.98	5/9/2022	1:00:00 PM	0	887.442	10.434	3.74	22.52	1011.16
5/9/2022	2:00:00 PM	0	12.7976	4.981	5/9/2022	2:00:00 PM	0	887.525	11.414	3.75	22.51	1011.17
5/9/2022	3:00:00 PM	0	12.8005	4.981	5/9/2022	3:00:00 PM	0	887.623	11.97	3.75	22.51	1011.17
5/9/2022	4:00:00 PM	0	12.8038	4.98	5/9/2022	4:00:00 PM	0	888.099	11.451	3.75	22.51	1011.17
5/9/2022	5:00:00 PM	0	12.8082	4.98	5/9/2022	5:00:00 PM	0	888.452	9.594	3.75	22.51	1011.17
5/9/2022	6:00:00 PM	0	12.8123	4.98	5/9/2022	6:00:00 PM	0	888.722	6.448	3.75	22.51	1011.17
5/9/2022	7:00:00 PM	0	12.8171	4.981	5/9/2022	7:00:00 PM	0	889.087	4.828	3.75	22.51	1011.17
5/9/2022	8:00:00 PM	0	12.8219	4.981	5/9/2022	8:00:00 PM	0	889.594	2.992	3.75	22.51	1011.17
5/9/2022	9:00:00 PM	0	12.8271	4.98	5/9/2022	9:00:00 PM	0	889.837	1.544	3.75	22.51	1011.17
5/9/2022	10:00:00 PM	0	12.8321	4.981	5/9/2022	10:00:00 PM	0	890.035	1.377	3.76	22.50	1011.18
5/9/2022	11:00:00 PM	0	12.8367	4.98	5/9/2022	11:00:00 PM	0	890.324	1.262	3.76	22.50	1011.18
5/10/2022	12:00:00 AM	0	12.842	4.981	5/10/2022	12:00:00 AM	0	890.627	1.349	3.76	22.50	1011.18
5/10/2022	1:00:00 AM	0	12.8465	4.981	5/10/2022	1:00:00 AM	0	890.896	1.219	3.76	22.50	1011.18
5/10/2022	2:00:00 AM	0	12.8511	4.981	5/10/2022	2:00:00 AM	0	891.18	0.904	3.76	22.50	1011.18
5/10/2022	3:00:00 AM	0	12.8558	4.981	5/10/2022	3:00:00 AM	0	891.534	0.741	3.76	22.50	1011.18
5/10/2022	4:00:00 AM	0	12.8605	4.98	5/10/2022	4:00:00 AM	0	891.951	0.744	3.77	22.49	1011.19
5/10/2022	5:00:00 AM	0	12.8653	4.981	5/10/2022	5:00:00 AM	0	892.42	0.758	3.77	22.49	1011.19

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/10/2022	6:00:00 AM	0	12.8699	4.981	5/10/2022	6:00:00 AM	0	892.92	1.204	3.76	22.50	1011.18
5/10/2022	7:00:00 AM	0	12.8751	4.981	5/10/2022	7:00:00 AM	0	893.744	3.245	3.76	22.50	1011.18
5/10/2022	8:00:00 AM	0	12.8806	4.98	5/10/2022	8:00:00 AM	0	894.567	4.558	3.76	22.50	1011.18
5/10/2022	9:00:00 AM	0	12.8857	4.981	5/10/2022	9:00:00 AM	0	894.924	5.092	3.76	22.50	1011.18
5/10/2022	10:00:00 AM	0	12.8915	4.981	5/10/2022	10:00:00 AM	0	895.399	4.535	3.76	22.50	1011.18
5/10/2022	11:00:00 AM	0	12.897	4.98	5/10/2022	11:00:00 AM	0	895.953	5.381	3.76	22.50	1011.18
5/10/2022	12:00:00 PM	0	12.9022	4.981	5/10/2022	12:00:00 PM	0	896.194	6.783	3.76	22.50	1011.18
5/10/2022	1:00:00 PM	0	12.9064	4.981	5/10/2022	1:00:00 PM	0	896.367	10.099	3.77	22.49	1011.19
5/10/2022	2:00:00 PM	0	12.9105	4.981	5/10/2022	2:00:00 PM	0	896.507	13.372	3.77	22.49	1011.19
5/10/2022	3:00:00 PM	0	12.9143	4.98	5/10/2022	3:00:00 PM	0	896.576	13.943	3.77	22.49	1011.19
5/10/2022	4:00:00 PM	0	12.9182	4.981	5/10/2022	4:00:00 PM	0	896.779	12.18	3.77	22.49	1011.19
5/10/2022	5:00:00 PM	0	12.9222	4.981	5/10/2022	5:00:00 PM	0	896.836	10.236	3.78	22.48	1011.20
5/10/2022	6:00:00 PM	0	12.9257	4.981	5/10/2022	6:00:00 PM	0	896.948	8.627	3.78	22.48	1011.20
5/10/2022	7:00:00 PM	0	12.9296	4.981	5/10/2022	7:00:00 PM	0	897.197	6.797	3.78	22.48	1011.20
5/10/2022	8:00:00 PM	0	12.9339	4.981	5/10/2022	8:00:00 PM	0	897.601	5.01	3.78	22.48	1011.20
5/10/2022	9:00:00 PM	0	12.938	4.981	5/10/2022	9:00:00 PM	0	897.927	3.812	3.78	22.48	1011.20
5/10/2022	10:00:00 PM	0	12.942	4.981	5/10/2022	10:00:00 PM	0	897.662	3.148	3.79	22.47	1011.21
5/10/2022	11:00:00 PM	0	12.9458	4.981	5/10/2022	11:00:00 PM	0	897.717	2.852	3.79	22.47	1011.21
5/11/2022	12:00:00 AM	0	12.9491	4.98	5/11/2022	12:00:00 AM	0	897.86	2.615	3.79	22.47	1011.21
5/11/2022	1:00:00 AM	0	12.9526	4.981	5/11/2022	1:00:00 AM	0	897.968	2.456	3.80	22.46	1011.22
5/11/2022	2:00:00 AM	0	12.9556	4.982	5/11/2022	2:00:00 AM	0	897.904	2.166	3.80	22.46	1011.22
5/11/2022	3:00:00 AM	0	12.9585	4.98	5/11/2022	3:00:00 AM	0	897.983	2.146	3.80	22.46	1011.22
5/11/2022	4:00:00 AM	0	12.9612	4.981	5/11/2022	4:00:00 AM	0	897.762	1.889	3.81	22.45	1011.23
5/11/2022	5:00:00 AM	0	12.963	4.982	5/11/2022	5:00:00 AM	0	897.635	1.769	3.81	22.45	1011.23
5/11/2022	6:00:00 AM	0	12.9653	4.98	5/11/2022	6:00:00 AM	0	897.979	1.964	3.81	22.45	1011.23
5/11/2022	7:00:00 AM	0	12.9673	4.981	5/11/2022	7:00:00 AM	0	897.974	3.205	3.81	22.45	1011.23
5/11/2022	8:00:00 AM	0	12.9693	4.981	5/11/2022	8:00:00 AM	0	898.078	4.838	3.81	22.45	1011.23
5/11/2022	9:00:00 AM	0	12.9706	4.981	5/11/2022	9:00:00 AM	0	897.947	9.761	3.81	22.45	1011.23
5/11/2022	10:00:00 AM	0	12.9705	4.981	5/11/2022	10:00:00 AM	0	897.605	13.112	3.82	22.44	1011.24
5/11/2022	11:00:00 AM	0	12.9716	4.981	5/11/2022	11:00:00 AM	0	897.555	9.641	3.82	22.44	1011.24
5/11/2022	12:00:00 PM	0	12.9729	4.981	5/11/2022	12:00:00 PM	0	897.239	9.904	3.82	22.44	1011.24
5/11/2022	1:00:00 PM	0	12.9732	4.981	5/11/2022	1:00:00 PM	0	896.701	13.866	3.83	22.43	1011.25
5/11/2022	2:00:00 PM	0	12.9733	4.981	5/11/2022	2:00:00 PM	0	896.431	11.226	3.83	22.43	1011.25
5/11/2022	3:00:00 PM	0	12.9738	4.981	5/11/2022	3:00:00 PM	0	895.963	9.273	3.84	22.42	1011.26
5/11/2022	4:00:00 PM	0	12.9737	4.981	5/11/2022	4:00:00 PM	0	895.815	8.487	3.84	22.42	1011.26
5/11/2022	5:00:00 PM	0	12.9736	4.981	5/11/2022	5:00:00 PM	0	895.716	9.456	3.84	22.42	1011.26
5/11/2022	6:00:00 PM	0	12.9736	4.981	5/11/2022	6:00:00 PM	0	895.476	9.041	3.84	22.42	1011.26
5/11/2022	7:00:00 PM	0	12.9742	4.981	5/11/2022	7:00:00 PM	0	895.373	7.541	3.84	22.42	1011.26
5/11/2022	8:00:00 PM	0	12.9747	4.981	5/11/2022	8:00:00 PM	0	895.732	5.616	3.84	22.42	1011.26
5/11/2022	9:00:00 PM	0	12.9759	4.981	5/11/2022	9:00:00 PM	0	895.916	4.334	3.84	22.42	1011.26
5/11/2022	10:00:00 PM	0	12.9774	4.981	5/11/2022	10:00:00 PM	0	895.57	2.732	3.85	22.41	1011.27
5/11/2022	11:00:00 PM	0	12.9786	4.981	5/11/2022	11:00:00 PM	0	895.597	2.766	3.85	22.41	1011.27
5/12/2022	12:00:00 AM	0	12.9797	4.981	5/12/2022	12:00:00 AM	0	895.685	2.888	3.85	22.41	1011.27
5/12/2022	1:00:00 AM	0	12.9811	4.981	5/12/2022	1:00:00 AM	0	895.44	2.904	3.85	22.41	1011.27
5/12/2022	2:00:00 AM	0	12.9821	4.981	5/12/2022	2:00:00 AM	0	895.436	2.78	3.85	22.41	1011.27
5/12/2022	3:00:00 AM	0	12.9832	4.981	5/12/2022	3:00:00 AM	0	895.208	2.871	3.85	22.41	1011.27
5/12/2022	4:00:00 AM	0	12.9838	4.981	5/12/2022	4:00:00 AM	0	895.129	2.732	3.86	22.40	1011.28
5/12/2022	5:00:00 AM	0	12.984	4.981	5/12/2022	5:00:00 AM	0	894.907	2.753	3.86	22.40	1011.28
5/12/2022	6:00:00 AM	0	12.9845	4.981	5/12/2022	6:00:00 AM	0	894.839	3.002	3.86	22.40	1011.28
5/12/2022	7:00:00 AM	0	12.985	4.981	5/12/2022	7:00:00 AM	0	895.484	5.545	3.85	22.41	1011.27
5/12/2022	8:00:00 AM	0	12.9851	4.98	5/12/2022	8:00:00 AM	0	895.389	11.384	3.85	22.41	1011.27
5/12/2022	9:00:00 AM	0	12.9845	4.981	5/12/2022	9:00:00 AM	0	894.848	15.731	3.86	22.40	1011.28
5/12/2022	10:00:00 AM	0	12.983	4.981	5/12/2022	10:00:00 AM	0	894.772	17.406	3.86	22.40	1011.28
5/12/2022	11:00:00 AM	0	12.9832	4.981	5/12/2022	11:00:00 AM	0	894.36	15.49	3.86	22.40	1011.28
5/12/2022	12:00:00 PM	0	12.983	4.981	5/12/2022	12:00:00 PM	0	893.963	16.329	3.87	22.39	1011.29
5/12/2022	1:00:00 PM	0	12.9828	4.981	5/12/2022	1:00:00 PM	0	893.609	16.102	3.87	22.39	1011.29
5/12/2022	2:00:00 PM	0	12.9818	4.981	5/12/2022	2:00:00 PM	0	893.284	16.647	3.87	22.39	1011.29
5/12/2022	3:00:00 PM	0	12.9816	4.981	5/12/2022	3:00:00 PM	0	892.918	14.817	3.88	22.38	1011.30
5/12/2022	4:00:00 PM	0	12.9808	4.981	5/12/2022	4:00:00 PM	0	892.21	14.323	3.88	22.38	1011.30
5/12/2022	5:00:00 PM	0	12.9799	4.981	5/12/2022	5:00:00 PM	0	892.2	11.584	3.88	22.38	1011.30
5/12/2022	6:00:00 PM	0	12.9788	4.981	5/12/2022	6:00:00 PM	0	891.724	11.614	3.89	22.37	1011.31
5/12/2022	7:00:00 PM	0	12.9776	4.981	5/12/2022	7:00:00 PM	0	891.684	10.556	3.88	22.38	1011.30
5/12/2022	8:00:00 PM	0	12.977	4.981	5/12/2022	8:00:00 PM	0	891.679	7.483	3.88	22.38	1011.30
5/12/2022	9:00:00 PM	0	12.9772	4.981	5/12/2022	9:00:00 PM	0	891.558	5.614	3.89	22.37	1011.31
5/12/2022	10:00:00 PM	0	12.9771	4.981	5/12/2022	10:00:00 PM	0	891.432	4.439	3.89	22.37	1011.31
5/12/2022	11:00:00 PM	0	12.977	4.981	5/12/2022	11:00:00 PM	0	891.321	4.057	3.89	22.37	1011.31
5/13/2022	12:00:00 AM	0	12.9775	4.981	5/13/2022	12:00:00 AM	0	891.485	3.726	3.89	22.37	1011.31
5/13/2022	1:00:00 AM	0	12.9779	4.981	5/13/2022	1:00:00 AM	0	891.586	2.906	3.89	22.37	1011.31
5/13/2022	2:00:00 AM	0	12.979	4.981	5/13/2022	2:00:00 AM	0	891.764	2.66	3.89	22.37	1011.31
5/13/2022	3:00:00 AM	0	12.9799	4.981	5/13/2022	3:00:00 AM	0	892.141	2.429	3.88	22.38	1011.30

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/13/2022	4:00:00 AM	0	12.9812	4.981	5/13/2022	4:00:00 AM	0	892.473	2.256	3.88	22.38	1011.30
5/13/2022	5:00:00 AM	0	12.9834	4.981	5/13/2022	5:00:00 AM	0	892.851	1.814	3.88	22.38	1011.30
5/13/2022	6:00:00 AM	0	12.9856	4.982	5/13/2022	6:00:00 AM	0	893.538	1.323	3.87	22.39	1011.29
5/13/2022	7:00:00 AM	0	12.9888	4.981	5/13/2022	7:00:00 AM	0	894.434	1.964	3.87	22.39	1011.29
5/13/2022	8:00:00 AM	0	12.9923	4.982	5/13/2022	8:00:00 AM	0	895.282	2.53	3.86	22.40	1011.28
5/13/2022	9:00:00 AM	0	12.9961	4.981	5/13/2022	9:00:00 AM	0	896.279	4.166	3.86	22.40	1011.28
5/13/2022	10:00:00 AM	0	13.0003	4.981	5/13/2022	10:00:00 AM	0	897.232	5.59	3.85	22.41	1011.27
5/13/2022	11:00:00 AM	0	13.0052	4.981	5/13/2022	11:00:00 AM	0	897.821	5.705	3.85	22.41	1011.27
5/13/2022	12:00:00 PM	0	13.0099	4.981	5/13/2022	12:00:00 PM	0	898.166	8.63	3.85	22.41	1011.27
5/13/2022	1:00:00 PM	0	13.0134	4.981	5/13/2022	1:00:00 PM	0	898.164	11.26	3.85	22.41	1011.27
5/13/2022	2:00:00 PM	0	13.0164	4.981	5/13/2022	2:00:00 PM	0	898.01	11.955	3.86	22.40	1011.28
5/13/2022	3:00:00 PM	0	13.0189	4.981	5/13/2022	3:00:00 PM	0	897.835	10.663	3.86	22.40	1011.28
5/13/2022	4:00:00 PM	0	13.0209	4.981	5/13/2022	4:00:00 PM	0	897.821	10.371	3.87	22.39	1011.29
5/13/2022	5:00:00 PM	0	13.023	4.981	5/13/2022	5:00:00 PM	0	897.872	10.58	3.87	22.39	1011.29
5/13/2022	6:00:00 PM	0	13.0244	4.981	5/13/2022	6:00:00 PM	0	897.49	7.982	3.87	22.39	1011.29
5/13/2022	7:00:00 PM	0	13.0265	4.981	5/13/2022	7:00:00 PM	0	897.738	5.148	3.87	22.39	1011.29
5/13/2022	8:00:00 PM	0	13.0275	4.982	5/13/2022	8:00:00 PM	0	897.314	3.034	3.88	22.38	1011.30
5/13/2022	9:00:00 PM	0	13.0287	4.981	5/13/2022	9:00:00 PM	0	897.138	1.146	3.88	22.38	1011.30
5/13/2022	10:00:00 PM	0	13.0292	4.981	5/13/2022	10:00:00 PM	0	896.984	0.102	3.88	22.38	1011.30
5/13/2022	11:00:00 PM	0	13.0299	4.981	5/13/2022	11:00:00 PM	0	896.734	0.077	3.89	22.37	1011.31
5/14/2022	12:00:00 AM	0	13.0301	4.981	5/14/2022	12:00:00 AM	0	896.54	-0.386	3.89	22.37	1011.31
5/14/2022	1:00:00 AM	0	13.0301	4.981	5/14/2022	1:00:00 AM	0	896.168	-0.808	3.89	22.37	1011.31
5/14/2022	2:00:00 AM	0	13.0298	4.981	5/14/2022	2:00:00 AM	0	895.992	-0.788	3.89	22.37	1011.31
5/14/2022	3:00:00 AM	0	13.0296	4.981	5/14/2022	3:00:00 AM	0	895.685	-1.094	3.90	22.36	1011.32
5/14/2022	4:00:00 AM	0	13.0287	4.981	5/14/2022	4:00:00 AM	0	895.529	-0.72	3.90	22.36	1011.32
5/14/2022	5:00:00 AM	0	13.0258	4.981	5/14/2022	5:00:00 AM	0	895.428	-0.711	3.89	22.37	1011.31
5/14/2022	6:00:00 AM	0	13.0263	4.981	5/14/2022	6:00:00 AM	0	895.695	0.418	3.89	22.37	1011.31
5/14/2022	7:00:00 AM	0	13.026	4.981	5/14/2022	7:00:00 AM	0	896.008	3.571	3.89	22.37	1011.31
5/14/2022	8:00:00 AM	0	13.0253	4.981	5/14/2022	8:00:00 AM	0	896.34	8.799	3.89	22.37	1011.31
5/14/2022	9:00:00 AM	0	13.025	4.98	5/14/2022	9:00:00 AM	0	896.324	8.61	3.89	22.37	1011.31
5/14/2022	10:00:00 AM	0	13.0249	4.981	5/14/2022	10:00:00 AM	0	896.232	10.418	3.89	22.37	1011.31
5/14/2022	11:00:00 AM	0	13.024	4.981	5/14/2022	11:00:00 AM	0	896.164	11.59	3.89	22.37	1011.31
5/14/2022	12:00:00 PM	0	13.0238	4.981	5/14/2022	12:00:00 PM	0	896.028	13.478	3.89	22.37	1011.31
5/14/2022	1:00:00 PM	0	13.0237	4.981	5/14/2022	1:00:00 PM	0	895.948	16.007	3.89	22.37	1011.31
5/14/2022	2:00:00 PM	0	13.0232	4.981	5/14/2022	2:00:00 PM	0	896.267	18.284	3.88	22.38	1011.30
5/14/2022	3:00:00 PM	0	13.0238	4.982	5/14/2022	3:00:00 PM	0	896.217	15.27	3.88	22.38	1011.30
5/14/2022	4:00:00 PM	0	13.0251	4.981	5/14/2022	4:00:00 PM	0	895.855	14.083	3.89	22.37	1011.31
5/14/2022	5:00:00 PM	0	13.0259	4.981	5/14/2022	5:00:00 PM	0	895.89	10.637	3.89	22.37	1011.31
5/14/2022	6:00:00 PM	0	13.0261	4.981	5/14/2022	6:00:00 PM	0	895.965	9.786	3.89	22.37	1011.31
5/14/2022	7:00:00 PM	0	13.0269	4.981	5/14/2022	7:00:00 PM	0	896.263	8.546	3.89	22.37	1011.31
5/14/2022	8:00:00 PM	0	13.0279	4.981	5/14/2022	8:00:00 PM	0	896.308	7.019	3.89	22.37	1011.31
5/14/2022	9:00:00 PM	0	13.0287	4.981	5/14/2022	9:00:00 PM	0	896.593	5.379	3.89	22.37	1011.31
5/14/2022	10:00:00 PM	0	13.0297	4.981	5/14/2022	10:00:00 PM	0	896.544	4.445	3.89	22.37	1011.31
5/14/2022	11:00:00 PM	0	13.0307	4.981	5/14/2022	11:00:00 PM	0	896.615	4.342	3.89	22.37	1011.31
5/15/2022	12:00:00 AM	0	13.0316	4.982	5/15/2022	12:00:00 AM	0	896.957	4.449	3.89	22.37	1011.31
5/15/2022	1:00:00 AM	0	13.033	4.981	5/15/2022	1:00:00 AM	0	897.151	4.565	3.88	22.38	1011.30
5/15/2022	2:00:00 AM	0	13.0339	4.981	5/15/2022	2:00:00 AM	0	896.692	4.285	3.89	22.37	1011.31
5/15/2022	3:00:00 AM	0	13.0343	4.981	5/15/2022	3:00:00 AM	0	896.379	4.013	3.89	22.37	1011.31
5/15/2022	4:00:00 AM	0	13.0338	4.981	5/15/2022	4:00:00 AM	0	896.159	4.312	3.90	22.36	1011.32
5/15/2022	5:00:00 AM	0	13.0334	4.982	5/15/2022	5:00:00 AM	0	896.35	4.55	3.89	22.37	1011.31
5/15/2022	6:00:00 AM	0	13.0326	4.981	5/15/2022	6:00:00 AM	0	896.426	5.306	3.89	22.37	1011.31
5/15/2022	7:00:00 AM	0	13.0325	4.981	5/15/2022	7:00:00 AM	0	896.603	7.352	3.89	22.37	1011.31
5/15/2022	8:00:00 AM	0	13.0326	4.981	5/15/2022	8:00:00 AM	0	896.689	9.591	3.89	22.37	1011.31
5/15/2022	9:00:00 AM	0	13.0313	4.982	5/15/2022	9:00:00 AM	0	896.441	10.792	3.89	22.37	1011.31
5/15/2022	10:00:00 AM	0	13.03	4.981	5/15/2022	10:00:00 AM	0	895.885	12.406	3.89	22.37	1011.31
5/15/2022	11:00:00 AM	0	13.0283	4.981	5/15/2022	11:00:00 AM	0	895.159	12.64	3.90	22.36	1011.32
5/15/2022	12:00:00 PM	0	13.0259	4.981	5/15/2022	12:00:00 PM	0	894.386	11.886	3.91	22.35	1011.33
5/15/2022	1:00:00 PM	0	13.0232	4.981	5/15/2022	1:00:00 PM	0	893.715	9.289	3.91	22.35	1011.33
5/15/2022	2:00:00 PM	0	13.0202	4.981	5/15/2022	2:00:00 PM	0	893.08	8.649	3.91	22.35	1011.33
5/15/2022	3:00:00 PM	0	13.0164	4.981	5/15/2022	3:00:00 PM	0	892.402	9.849	3.92	22.34	1011.34
5/15/2022	4:00:00 PM	0	13.0131	4.981	5/15/2022	4:00:00 PM	0	891.607	9.878	3.92	22.34	1011.34
5/15/2022	5:00:00 PM	0	13.0091	4.981	5/15/2022	5:00:00 PM	0	891.227	10.666	3.92	22.34	1011.34
5/15/2022	6:00:00 PM	0	13.0056	4.981	5/15/2022	6:00:00 PM	0	890.922	10.259	3.92	22.34	1011.34
5/15/2022	7:00:00 PM	0	13.0022	4.981	5/15/2022	7:00:00 PM	0	890.692	8.885	3.92	22.34	1011.34
5/15/2022	8:00:00 PM	0	13.0002	4.981	5/15/2022	8:00:00 PM	0	890.967	7.556	3.91	22.35	1011.33
5/15/2022	9:00:00 PM	0	12.9981	4.981	5/15/2022	9:00:00 PM	0	890.902	6.788	3.91	22.35	1011.33
5/15/2022	10:00:00 PM	0	12.9969	4.981	5/15/2022	10:00:00 PM	0	890.839	6.302	3.91	22.35	1011.33
5/15/2022	11:00:00 PM	0	12.9954	4.981	5/15/2022	11:00:00 PM	0	890.617	6.365	3.91	22.35	1011.33
5/16/2022	12:00:00 AM	0	12.9943	4.981	5/16/2022	12:00:00 AM	0	890.72	6.108	3.91	22.35	1011.33
5/16/2022	1:00:00 AM	0	12.9928	4.981	5/16/2022	1:00:00 AM	0	890.6	6.157	3.91	22.35	1011.33

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/16/2022	2:00:00 AM	0	12.9923	4.981	5/16/2022	2:00:00 AM	0	890.504	5.794	3.91	22.35	1011.33
5/16/2022	3:00:00 AM	0	12.9912	4.981	5/16/2022	3:00:00 AM	0	890.443	5.507	3.91	22.35	1011.33
5/16/2022	4:00:00 AM	0	12.9904	4.981	5/16/2022	4:00:00 AM	0	890.44	5.754	3.91	22.35	1011.33
5/16/2022	5:00:00 AM	0	12.9893	4.982	5/16/2022	5:00:00 AM	0	890.325	5.899	3.91	22.35	1011.33
5/16/2022	6:00:00 AM	0	12.9884	4.981	5/16/2022	6:00:00 AM	0	890.465	6.413	3.91	22.35	1011.33
5/16/2022	7:00:00 AM	0	12.9879	4.982	5/16/2022	7:00:00 AM	0	890.414	8.096	3.91	22.35	1011.33
5/16/2022	8:00:00 AM	0	12.986	4.981	5/16/2022	8:00:00 AM	0	890.599	11.785	3.90	22.36	1011.32
5/16/2022	9:00:00 AM	0	12.9839	4.981	5/16/2022	9:00:00 AM	0	890.7	15.459	3.90	22.36	1011.32
5/16/2022	10:00:00 AM	0	12.9827	4.981	5/16/2022	10:00:00 AM	0	890.512	17.515	3.90	22.36	1011.32
5/16/2022	11:00:00 AM	0	12.9821	4.982	5/16/2022	11:00:00 AM	0	890.61	17.128	3.90	22.36	1011.32
5/16/2022	12:00:00 PM	0	12.9823	4.981	5/16/2022	12:00:00 PM	0	891.275	18.402	3.89	22.37	1011.31
5/16/2022	1:00:00 PM	0	12.9828	4.981	5/16/2022	1:00:00 PM	0	891.329	17.75	3.89	22.37	1011.31
5/16/2022	2:00:00 PM	0	12.983	4.982	5/16/2022	2:00:00 PM	0	890.979	20.064	3.90	22.36	1011.32
5/16/2022	3:00:00 PM	0	12.9839	4.981	5/16/2022	3:00:00 PM	0	892.197	18.049	3.89	22.37	1011.31
5/16/2022	4:00:00 PM	0	12.9861	4.982	5/16/2022	4:00:00 PM	0	893.283	15.76	3.88	22.38	1011.30
5/16/2022	5:00:00 PM	0	12.9899	4.981	5/16/2022	5:00:00 PM	0	894.158	13.393	3.87	22.39	1011.29
5/16/2022	6:00:00 PM	0	12.994	4.981	5/16/2022	6:00:00 PM	0	895.091	11.233	3.87	22.39	1011.29
5/16/2022	7:00:00 PM	0	12.9989	4.981	5/16/2022	7:00:00 PM	0	895.76	8.864	3.86	22.40	1011.28
5/16/2022	8:00:00 PM	0	13.0034	4.981	5/16/2022	8:00:00 PM	0	896.32	6.272	3.86	22.40	1011.28
5/16/2022	9:00:00 PM	0	13.0083	4.981	5/16/2022	9:00:00 PM	0	896.967	4.821	3.86	22.40	1011.28
5/16/2022	10:00:00 PM	0	13.0124	4.981	5/16/2022	10:00:00 PM	0	897.411	4.081	3.86	22.40	1011.28
5/16/2022	11:00:00 PM	0	13.0167	4.981	5/16/2022	11:00:00 PM	0	897.805	3.931	3.86	22.40	1011.28
5/17/2022	12:00:00 AM	0	13.0205	4.981	5/17/2022	12:00:00 AM	0	898.318	3.276	3.86	22.40	1011.28
5/17/2022	1:00:00 AM	0	13.0238	4.981	5/17/2022	1:00:00 AM	0	898.47	2.461	3.86	22.40	1011.28
5/17/2022	2:00:00 AM	0	13.0272	4.982	5/17/2022	2:00:00 AM	0	898.629	1.898	3.86	22.40	1011.28
5/17/2022	3:00:00 AM	0	13.0294	4.981	5/17/2022	3:00:00 AM	0	898.694	1.112	3.87	22.39	1011.29
5/17/2022	4:00:00 AM	0	13.0314	4.981	5/17/2022	4:00:00 AM	0	898.832	0.724	3.87	22.39	1011.29
5/17/2022	5:00:00 AM	0	13.0336	4.981	5/17/2022	5:00:00 AM	0	899.08	0.829	3.87	22.39	1011.29
5/17/2022	6:00:00 AM	0	13.035	4.981	5/17/2022	6:00:00 AM	0	899.389	2.039	3.86	22.40	1011.28
5/17/2022	7:00:00 AM	0	13.0367	4.981	5/17/2022	7:00:00 AM	0	899.847	3.399	3.86	22.40	1011.28
5/17/2022	8:00:00 AM	0	13.0384	4.981	5/17/2022	8:00:00 AM	0	900.357	5.092	3.86	22.40	1011.28
5/17/2022	9:00:00 AM	0	13.0388	4.981	5/17/2022	9:00:00 AM	0	900.549	11.384	3.86	22.40	1011.28
5/17/2022	10:00:00 AM	0	13.0397	4.982	5/17/2022	10:00:00 AM	0	900.506	15.143	3.86	22.40	1011.28
5/17/2022	11:00:00 AM	0	13.0395	4.981	5/17/2022	11:00:00 AM	0	900.665	15.187	3.86	22.40	1011.28
5/17/2022	12:00:00 PM	0	13.0401	4.981	5/17/2022	12:00:00 PM	0	900.372	13.943	3.86	22.40	1011.28
5/17/2022	1:00:00 PM	0	13.0397	4.981	5/17/2022	1:00:00 PM	0	900.298	16.499	3.86	22.40	1011.28
5/17/2022	2:00:00 PM	0	13.0396	4.981	5/17/2022	2:00:00 PM	0	900.278	16.743	3.86	22.40	1011.28
5/17/2022	3:00:00 PM	0	13.0399	4.981	5/17/2022	3:00:00 PM	0	900.43	12.637	3.86	22.40	1011.28
5/17/2022	4:00:00 PM	0	13.0406	4.982	5/17/2022	4:00:00 PM	0	900.146	18.679	3.86	22.40	1011.28
5/17/2022	5:00:00 PM	0	13.0412	4.981	5/17/2022	5:00:00 PM	0	900.337	12.751	3.86	22.40	1011.28
5/17/2022	6:00:00 PM	0	13.0418	4.982	5/17/2022	6:00:00 PM	0	900.005	11.606	3.86	22.40	1011.28
5/17/2022	7:00:00 PM	0	13.0418	4.981	5/17/2022	7:00:00 PM	0	899.747	9.75	3.87	22.39	1011.29
5/17/2022	8:00:00 PM	0	13.0407	4.981	5/17/2022	8:00:00 PM	0	899.207	5.081	3.87	22.39	1011.29
5/17/2022	9:00:00 PM	0	13.0393	4.982	5/17/2022	9:00:00 PM	0	898.737	2.727	3.87	22.39	1011.29
5/17/2022	10:00:00 PM	0	13.0377	4.981	5/17/2022	10:00:00 PM	0	898.3	2.012	3.88	22.38	1011.30
5/17/2022	11:00:00 PM	0	13.0351	4.981	5/17/2022	11:00:00 PM	0	897.295	1.633	3.89	22.37	1011.31
5/18/2022	12:00:00 AM	0	13.0314	4.982	5/18/2022	12:00:00 AM	0	895.897	1.612	3.90	22.36	1011.32
5/18/2022	1:00:00 AM	0	13.0266	4.981	5/18/2022	1:00:00 AM	0	894.671	1.436	3.90	22.36	1011.32
5/18/2022	2:00:00 AM	0	13.021	4.981	5/18/2022	2:00:00 AM	0	894.227	2.001	3.90	22.36	1011.32
5/18/2022	3:00:00 AM	0	13.0153	4.981	5/18/2022	3:00:00 AM	0	892.34	2.31	3.92	22.34	1011.34
5/18/2022	4:00:00 AM	0	13.0071	4.981	5/18/2022	4:00:00 AM	0	890.098	2.405	3.93	22.33	1011.35
5/18/2022	5:00:00 AM	0	12.9982	4.981	5/18/2022	5:00:00 AM	0	889.316	2.32	3.93	22.33	1011.35
5/18/2022	6:00:00 AM	0	12.989	4.981	5/18/2022	6:00:00 AM	0	887.557	0.244	3.94	22.32	1011.36
5/18/2022	7:00:00 AM	0	12.9799	4.981	5/18/2022	7:00:00 AM	0	886.316	-0.238	3.94	22.32	1011.36
5/18/2022	8:00:00 AM	0	12.9711	4.981	5/18/2022	8:00:00 AM	0	885.114	0.473	3.95	22.31	1011.37
5/18/2022	9:00:00 AM	0	12.9615	4.981	5/18/2022	9:00:00 AM	0	885.01	3.221	3.94	22.32	1011.36
5/18/2022	10:00:00 AM	0	12.954	4.981	5/18/2022	10:00:00 AM	0	884.62	5.436	3.93	22.33	1011.35
5/18/2022	11:00:00 AM	0	12.9459	4.982	5/18/2022	11:00:00 AM	0	884.588	12.229	3.93	22.33	1011.35
5/18/2022	12:00:00 PM	0	12.9395	4.981	5/18/2022	12:00:00 PM	0	884.808	12.98	3.92	22.34	1011.34
5/18/2022	1:00:00 PM	0	12.9354	4.982	5/18/2022	1:00:00 PM	0	884.623	9.962	3.91	22.35	1011.33
5/18/2022	2:00:00 PM	0	12.9316	4.982	5/18/2022	2:00:00 PM	0	885.229	14.276	3.90	22.36	1011.32
5/18/2022	3:00:00 PM	0	12.9301	4.981	5/18/2022	3:00:00 PM	0	885.744	6.988	3.90	22.36	1011.32
5/18/2022	4:00:00 PM	0	12.9292	4.982	5/18/2022	4:00:00 PM	0	886.151	6.083	3.89	22.37	1011.31
5/18/2022	5:00:00 PM	0	12.9302	4.982	5/18/2022	5:00:00 PM	0	887.054	2.903	3.88	22.38	1011.30
5/18/2022	6:00:00 PM	0	12.9318	4.981	5/18/2022	6:00:00 PM	0	887.326	2.748	3.88	22.38	1011.30
5/18/2022	7:00:00 PM	0	12.9335	4.982	5/18/2022	7:00:00 PM	0	887.881	3.425	3.88	22.38	1011.30
5/18/2022	8:00:00 PM	0	12.935	4.981	5/18/2022	8:00:00 PM	0	888.262	2.828	3.88	22.38	1011.30
5/18/2022	9:00:00 PM	0	12.9368	4.982	5/18/2022	9:00:00 PM	0	888.565	2.367	3.88	22.38	1011.30
5/18/2022	10:00:00 PM	0	12.9387	4.981	5/18/2022	10:00:00 PM	0	888.894	2.068	3.87	22.39	1011.29
5/18/2022	11:00:00 PM	0	12.9406	4.982	5/18/2022	11:00:00 PM	0	889.498	1.785	3.87	22.39	1011.29

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/19/2022	12:00:00 AM	0	12.9431	4.981	5/19/2022	12:00:00 AM	0	889.907	1.708	3.87	22.39	1011.29
5/19/2022	1:00:00 AM	0	12.945	4.981	5/19/2022	1:00:00 AM	0	890.344	1.31	3.87	22.39	1011.29
5/19/2022	2:00:00 AM	0	12.9479	4.982	5/19/2022	2:00:00 AM	0	890.923	1.061	3.86	22.40	1011.28
5/19/2022	3:00:00 AM	0	12.9502	4.981	5/19/2022	3:00:00 AM	0	891.456	1.142	3.86	22.40	1011.28
5/19/2022	4:00:00 AM	0	12.9528	4.982	5/19/2022	4:00:00 AM	0	892.08	1.099	3.86	22.40	1011.28
5/19/2022	5:00:00 AM	0	12.9558	4.982	5/19/2022	5:00:00 AM	0	892.602	0.929	3.85	22.41	1011.27
5/19/2022	6:00:00 AM	0	12.9593	4.981	5/19/2022	6:00:00 AM	0	893.521	1.154	3.85	22.41	1011.27
5/19/2022	7:00:00 AM	0	12.9632	4.981	5/19/2022	7:00:00 AM	0	894.35	2.143	3.84	22.42	1011.26
5/19/2022	8:00:00 AM	0	12.9669	4.981	5/19/2022	8:00:00 AM	0	895.3	4.434	3.84	22.42	1011.26
5/19/2022	9:00:00 AM	0	12.9709	4.981	5/19/2022	9:00:00 AM	0	896.353	6.869	3.83	22.43	1011.25
5/19/2022	10:00:00 AM	0	12.9754	4.981	5/19/2022	10:00:00 AM	0	897.263	8.735	3.83	22.43	1011.25
5/19/2022	11:00:00 AM	0	12.9795	4.981	5/19/2022	11:00:00 AM	0	897.951	9.968	3.82	22.44	1011.24
5/19/2022	12:00:00 PM	0	12.9836	4.981	5/19/2022	12:00:00 PM	0	898.273	11.97	3.82	22.44	1011.24
5/19/2022	1:00:00 PM	0	12.987	4.981	5/19/2022	1:00:00 PM	0	898.465	14.62	3.83	22.43	1011.25
5/19/2022	2:00:00 PM	0	12.99	4.981	5/19/2022	2:00:00 PM	0	899.076	14.332	3.82	22.44	1011.24
5/19/2022	3:00:00 PM	0	12.9927	4.982	5/19/2022	3:00:00 PM	0	899.736	12.446	3.82	22.44	1011.24
5/19/2022	4:00:00 PM	0	12.9961	4.982	5/19/2022	4:00:00 PM	0	899.566	15.082	3.82	22.44	1011.24
5/19/2022	5:00:00 PM	0	13.0004	4.981	5/19/2022	5:00:00 PM	0	900.359	9.675	3.82	22.44	1011.24
5/19/2022	6:00:00 PM	0	13.0042	4.981	5/19/2022	6:00:00 PM	0	900.724	6.837	3.82	22.44	1011.24
5/19/2022	7:00:00 PM	0	13.008	4.981	5/19/2022	7:00:00 PM	0	901.192	6.971	3.82	22.44	1011.24
5/19/2022	8:00:00 PM	0	13.0114	4.981	5/19/2022	8:00:00 PM	0	901.565	4.123	3.82	22.44	1011.24
5/19/2022	9:00:00 PM	0	13.0149	4.981	5/19/2022	9:00:00 PM	0	902.013	2.245	3.82	22.44	1011.24
5/19/2022	10:00:00 PM	0	13.0185	4.981	5/19/2022	10:00:00 PM	0	902.098	1.298	3.82	22.44	1011.24
5/19/2022	11:00:00 PM	0	13.0211	4.981	5/19/2022	11:00:00 PM	0	902.144	0.54	3.82	22.44	1011.24
5/20/2022	12:00:00 AM	0	13.0236	4.982	5/20/2022	12:00:00 AM	0	902.552	0.007	3.82	22.44	1011.24
5/20/2022	1:00:00 AM	0	13.0257	4.981	5/20/2022	1:00:00 AM	0	902.609	-0.418	3.82	22.44	1011.24
5/20/2022	2:00:00 AM	0	13.0278	4.982	5/20/2022	2:00:00 AM	0	902.822	-0.689	3.82	22.44	1011.24
5/20/2022	3:00:00 AM	0	13.0297	4.982	5/20/2022	3:00:00 AM	0	902.986	-1.093	3.82	22.44	1011.24
5/20/2022	4:00:00 AM	0	13.0311	4.981	5/20/2022	4:00:00 AM	0	903.014	-0.805	3.82	22.44	1011.24
5/20/2022	5:00:00 AM	0	13.0322	4.981	5/20/2022	5:00:00 AM	0	903.401	-0.692	3.82	22.44	1011.24
5/20/2022	6:00:00 AM	0	13.0345	4.981	5/20/2022	6:00:00 AM	0	903.563	-0.696	3.82	22.44	1011.24
5/20/2022	7:00:00 AM	0	13.0349	4.982	5/20/2022	7:00:00 AM	0	904.335	3.776	3.81	22.45	1011.23
5/20/2022	8:00:00 AM	0	13.0355	4.981	5/20/2022	8:00:00 AM	0	904.442	13.249	3.81	22.45	1011.23
5/20/2022	9:00:00 AM	0	13.0348	4.981	5/20/2022	9:00:00 AM	0	904.392	14.071	3.81	22.45	1011.23
5/20/2022	10:00:00 AM	0	13.0344	4.982	5/20/2022	10:00:00 AM	0	903.902	17.91	3.82	22.44	1011.24
5/20/2022	11:00:00 AM	0	13.0336	4.982	5/20/2022	11:00:00 AM	0	903.71	18.239	3.82	22.44	1011.24
5/20/2022	12:00:00 PM	0	13.0329	4.981	5/20/2022	12:00:00 PM	0	903.581	16.683	3.82	22.44	1011.24
5/20/2022	1:00:00 PM	0	13.032	4.981	5/20/2022	1:00:00 PM	0	903.071	20.062	3.82	22.44	1011.24
5/20/2022	2:00:00 PM	0	13.0304	4.982	5/20/2022	2:00:00 PM	0	902.836	20.74	3.82	22.44	1011.24
5/20/2022	3:00:00 PM	0	13.0295	4.981	5/20/2022	3:00:00 PM	0	902.855	16.318	3.82	22.44	1011.24
5/20/2022	4:00:00 PM	0	13.0296	4.981	5/20/2022	4:00:00 PM	0	902.919	14.746	3.82	22.44	1011.24
5/20/2022	5:00:00 PM	0	13.0291	4.981	5/20/2022	5:00:00 PM	0	902.961	12.668	3.82	22.44	1011.24
5/20/2022	6:00:00 PM	0	13.0291	4.982	5/20/2022	6:00:00 PM	0	903.062	10.565	3.82	22.44	1011.24
5/20/2022	7:00:00 PM	0	13.029	4.982	5/20/2022	7:00:00 PM	0	903.317	10.288	3.82	22.44	1011.24
5/20/2022	8:00:00 PM	0	13.0298	4.982	5/20/2022	8:00:00 PM	0	903.538	6.868	3.82	22.44	1011.24
5/20/2022	9:00:00 PM	0	13.0311	4.982	5/20/2022	9:00:00 PM	0	903.735	4.024	3.82	22.44	1011.24
5/20/2022	10:00:00 PM	0	13.032	4.982	5/20/2022	10:00:00 PM	0	903.78	2.302	3.82	22.44	1011.24
5/20/2022	11:00:00 PM	0	13.0332	4.981	5/20/2022	11:00:00 PM	0	903.868	0.905	3.82	22.44	1011.24
5/21/2022	12:00:00 AM	0	13.0344	4.981	5/21/2022	12:00:00 AM	0	903.968	-0.076	3.82	22.44	1011.24
5/21/2022	1:00:00 AM	0	13.0351	4.981	5/21/2022	1:00:00 AM	0	903.929	-0.851	3.82	22.44	1011.24
5/21/2022	2:00:00 AM	0	13.0355	4.982	5/21/2022	2:00:00 AM	0	904.064	-1.42	3.82	22.44	1011.24
5/21/2022	3:00:00 AM	0	13.0363	4.981	5/21/2022	3:00:00 AM	0	904.159	-1.932	3.82	22.44	1011.24
5/21/2022	4:00:00 AM	0	13.0369	4.981	5/21/2022	4:00:00 AM	0	904.355	-1.863	3.82	22.44	1011.24
5/21/2022	5:00:00 AM	0	13.0377	4.982	5/21/2022	5:00:00 AM	0	904.813	-0.967	3.81	22.45	1011.23
5/21/2022	6:00:00 AM	0	13.0391	4.981	5/21/2022	6:00:00 AM	0	905.091	-0.984	3.81	22.45	1011.23
5/21/2022	7:00:00 AM	0	13.0395	4.982	5/21/2022	7:00:00 AM	0	905.559	5.006	3.81	22.45	1011.23
5/21/2022	8:00:00 AM	0	13.0388	4.981	5/21/2022	8:00:00 AM	0	905.51	15.245	3.81	22.45	1011.23
5/21/2022	9:00:00 AM	0	13.0375	4.982	5/21/2022	9:00:00 AM	0	905.11	19.654	3.81	22.45	1011.23
5/21/2022	10:00:00 AM	0	13.0356	4.981	5/21/2022	10:00:00 AM	0	904.766	22.37	3.81	22.45	1011.23
5/21/2022	11:00:00 AM	0	13.0344	4.982	5/21/2022	11:00:00 AM	0	904.427	26.095	3.81	22.45	1011.23
5/21/2022	12:00:00 PM	0	13.0331	4.981	5/21/2022	12:00:00 PM	0	904.216	26.887	3.81	22.45	1011.23
5/21/2022	1:00:00 PM	0	13.0329	4.982	5/21/2022	1:00:00 PM	0	903.827	26.474	3.82	22.44	1011.24
5/21/2022	2:00:00 PM	0	13.0318	4.982	5/21/2022	2:00:00 PM	0	903.766	24.169	3.82	22.44	1011.24
5/21/2022	3:00:00 PM	0	13.031	4.981	5/21/2022	3:00:00 PM	0	903.825	17.916	3.81	22.45	1011.23
5/21/2022	4:00:00 PM	0	13.0308	4.982	5/21/2022	4:00:00 PM	0	903.334	22.28	3.82	22.44	1011.24
5/21/2022	5:00:00 PM	0	13.0294	4.981	5/21/2022	5:00:00 PM	0	903.41	15.598	3.82	22.44	1011.24
5/21/2022	6:00:00 PM	0	13.0281	4.981	5/21/2022	6:00:00 PM	0	903.069	16.02	3.82	22.44	1011.24
5/21/2022	7:00:00 PM	0	13.027	4.981	5/21/2022	7:00:00 PM	0	903.287	14.476	3.82	22.44	1011.24
5/21/2022	8:00:00 PM	0	13.0261	4.981	5/21/2022	8:00:00 PM	0	903.519	8.338	3.81	22.45	1011.23
5/21/2022	9:00:00 PM	0	13.0263	4.982	5/21/2022	9:00:00 PM	0	903.539	5.029	3.81	22.45	1011.23

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/21/2022	10:00:00 PM	0	13.0261	4.982	5/21/2022	10:00:00 PM	0	903.352	3.551	3.81	22.45	1011.23
5/21/2022	11:00:00 PM	0	13.0263	4.981	5/21/2022	11:00:00 PM	0	903.389	2.774	3.81	22.45	1011.23
5/22/2022	12:00:00 AM	0	13.0255	4.982	5/22/2022	12:00:00 AM	0	903.455	1.993	3.81	22.45	1011.23
5/22/2022	1:00:00 AM	0	13.0257	4.982	5/22/2022	1:00:00 AM	0	903.463	1.244	3.81	22.45	1011.23
5/22/2022	2:00:00 AM	0	13.026	4.981	5/22/2022	2:00:00 AM	0	903.583	0.27	3.81	22.45	1011.23
5/22/2022	3:00:00 AM	0	13.0257	4.982	5/22/2022	3:00:00 AM	0	903.41	-0.434	3.81	22.45	1011.23
5/22/2022	4:00:00 AM	0	13.0258	4.982	5/22/2022	4:00:00 AM	0	903.408	-0.542	3.81	22.45	1011.23
5/22/2022	5:00:00 AM	0	13.0251	4.981	5/22/2022	5:00:00 AM	0	903.423	-0.076	3.81	22.45	1011.23
5/22/2022	6:00:00 AM	0	13.0249	4.981	5/22/2022	6:00:00 AM	0	903.65	0.893	3.81	22.45	1011.23
5/22/2022	7:00:00 AM	0	13.0242	4.982	5/22/2022	7:00:00 AM	0	904.187	7.56	3.80	22.46	1011.22
5/22/2022	8:00:00 AM	0	13.0231	4.981	5/22/2022	8:00:00 AM	0	903.969	14.946	3.81	22.45	1011.23
5/22/2022	9:00:00 AM	0	13.0207	4.982	5/22/2022	9:00:00 AM	0	903.415	20.044	3.81	22.45	1011.23
5/22/2022	10:00:00 AM	0	13.0183	4.982	5/22/2022	10:00:00 AM	0	902.741	23.882	3.81	22.45	1011.23
5/22/2022	11:00:00 AM	0	13.0159	4.981	5/22/2022	11:00:00 AM	0	902.224	26.654	3.82	22.44	1011.24
5/22/2022	12:00:00 PM	0	13.0136	4.981	5/22/2022	12:00:00 PM	0	901.593	27.895	3.82	22.44	1011.24
5/22/2022	1:00:00 PM	0	13.0106	4.982	5/22/2022	1:00:00 PM	0	900.864	28.428	3.82	22.44	1011.24
5/22/2022	2:00:00 PM	0	13.0077	4.982	5/22/2022	2:00:00 PM	0	900.431	27.823	3.83	22.43	1011.25
5/22/2022	3:00:00 PM	0	13.0056	4.982	5/22/2022	3:00:00 PM	0	900.131	23.109	3.83	22.43	1011.25
5/22/2022	4:00:00 PM	0	13.0035	4.981	5/22/2022	4:00:00 PM	0	899.364	27.187	3.83	22.43	1011.25
5/22/2022	5:00:00 PM	0	13	4.982	5/22/2022	5:00:00 PM	0	899.163	19.761	3.83	22.43	1011.25
5/22/2022	6:00:00 PM	0	12.9964	4.982	5/22/2022	6:00:00 PM	0	898.589	18.038	3.83	22.43	1011.25
5/22/2022	7:00:00 PM	0	12.9927	4.982	5/22/2022	7:00:00 PM	0	898.487	15.399	3.83	22.43	1011.25
5/22/2022	8:00:00 PM	0	12.9898	4.982	5/22/2022	8:00:00 PM	0	898.409	11.323	3.83	22.43	1011.25
5/22/2022	9:00:00 PM	0	12.9873	4.982	5/22/2022	9:00:00 PM	0	898.129	8.475	3.83	22.43	1011.25
5/22/2022	10:00:00 PM	0	12.9851	4.982	5/22/2022	10:00:00 PM	0	898.499	7.457	3.82	22.44	1011.24
5/22/2022	11:00:00 PM	0	12.9841	4.982	5/22/2022	11:00:00 PM	0	898.482	6.217	3.82	22.44	1011.24
5/23/2022	12:00:00 AM	0	12.9833	4.981	5/23/2022	12:00:00 AM	0	898.582	5.421	3.82	22.44	1011.24
5/23/2022	1:00:00 AM	0	12.9822	4.981	5/23/2022	1:00:00 AM	0	898.611	4.797	3.82	22.44	1011.24
5/23/2022	2:00:00 AM	0	12.9817	4.982	5/23/2022	2:00:00 AM	0	898.706	4.537	3.82	22.44	1011.24
5/23/2022	3:00:00 AM	0	12.9811	4.981	5/23/2022	3:00:00 AM	0	898.527	4.28	3.82	22.44	1011.24
5/23/2022	4:00:00 AM	0	12.9803	4.982	5/23/2022	4:00:00 AM	0	898.581	3.636	3.82	22.44	1011.24
5/23/2022	5:00:00 AM	0	12.9797	4.982	5/23/2022	5:00:00 AM	0	898.622	3.726	3.82	22.44	1011.24
5/23/2022	6:00:00 AM	0	12.979	4.982	5/23/2022	6:00:00 AM	0	898.848	4.87	3.81	22.45	1011.23
5/23/2022	7:00:00 AM	0	12.9783	4.982	5/23/2022	7:00:00 AM	0	899.193	7.444	3.81	22.45	1011.23
5/23/2022	8:00:00 AM	0	12.9776	4.981	5/23/2022	8:00:00 AM	0	899.216	12.259	3.81	22.45	1011.23
5/23/2022	9:00:00 AM	0	12.9762	4.981	5/23/2022	9:00:00 AM	0	899.144	16.593	3.81	22.45	1011.23
5/23/2022	10:00:00 AM	0	12.9756	4.982	5/23/2022	10:00:00 AM	0	899.36	17.661	3.80	22.46	1011.22
5/23/2022	11:00:00 AM	0	12.9754	4.982	5/23/2022	11:00:00 AM	0	899.489	17.206	3.80	22.46	1011.22
5/23/2022	12:00:00 PM	0	12.9756	4.982	5/23/2022	12:00:00 PM	0	899.358	16.701	3.80	22.46	1011.22
5/23/2022	1:00:00 PM	0	12.975	4.982	5/23/2022	1:00:00 PM	0	899.161	18.483	3.81	22.45	1011.23
5/23/2022	2:00:00 PM	0	12.9738	4.981	5/23/2022	2:00:00 PM	0	898.983	18.684	3.81	22.45	1011.23
5/23/2022	3:00:00 PM	0	12.9728	4.982	5/23/2022	3:00:00 PM	0	898.51	18.906	3.81	22.45	1011.23
5/23/2022	4:00:00 PM	0	12.9713	4.981	5/23/2022	4:00:00 PM	0	898.467	16.243	3.81	22.45	1011.23
5/23/2022	5:00:00 PM	0	12.9711	4.982	5/23/2022	5:00:00 PM	0	899.292	10.374	3.80	22.46	1011.22
5/23/2022	6:00:00 PM	0	12.9698	4.982	5/23/2022	6:00:00 PM	0	899.034	10.94	3.80	22.46	1011.22
5/23/2022	7:00:00 PM	0	12.9701	4.982	5/23/2022	7:00:00 PM	0	899.619	11.815	3.80	22.46	1011.22
5/23/2022	8:00:00 PM	0	12.9704	4.981	5/23/2022	8:00:00 PM	0	899.017	7.639	3.80	22.46	1011.22
5/23/2022	9:00:00 PM	0	12.9708	4.982	5/23/2022	9:00:00 PM	0	899.312	4.821	3.80	22.46	1011.22
5/23/2022	10:00:00 PM	0	12.9707	4.981	5/23/2022	10:00:00 PM	0	899.321	4.453	3.80	22.46	1011.22
5/23/2022	11:00:00 PM	0	12.9707	4.982	5/23/2022	11:00:00 PM	0	899.259	4.244	3.80	22.46	1011.22
5/24/2022	12:00:00 AM	0	12.971	4.982	5/24/2022	12:00:00 AM	0	899.506	4.3	3.80	22.46	1011.22
5/24/2022	1:00:00 AM	0	12.971	4.981	5/24/2022	1:00:00 AM	0	899.112	4.126	3.80	22.46	1011.22
5/24/2022	2:00:00 AM	0	12.9695	4.981	5/24/2022	2:00:00 AM	0	898.589	4.063	3.81	22.45	1011.23
5/24/2022	3:00:00 AM	0	12.9683	4.982	5/24/2022	3:00:00 AM	0	898.592	3.893	3.81	22.45	1011.23
5/24/2022	4:00:00 AM	0	12.967	4.982	5/24/2022	4:00:00 AM	0	898.727	3.816	3.80	22.46	1011.22
5/24/2022	5:00:00 AM	0	12.9658	4.982	5/24/2022	5:00:00 AM	0	898.443	3.867	3.80	22.46	1011.22
5/24/2022	6:00:00 AM	0	12.9641	4.982	5/24/2022	6:00:00 AM	0	898.162	4.801	3.81	22.45	1011.23
5/24/2022	7:00:00 AM	0	12.9625	4.982	5/24/2022	7:00:00 AM	0	898.434	7.749	3.80	22.46	1011.22
5/24/2022	8:00:00 AM	0	12.9612	4.981	5/24/2022	8:00:00 AM	0	898.289	9.137	3.80	22.46	1011.22
5/24/2022	9:00:00 AM	0	12.9588	4.982	5/24/2022	9:00:00 AM	0	897.842	11.358	3.80	22.46	1011.22
5/24/2022	10:00:00 AM	0	12.9556	4.982	5/24/2022	10:00:00 AM	0	897.107	16.435	3.81	22.45	1011.23
5/24/2022	11:00:00 AM	0	12.952	4.982	5/24/2022	11:00:00 AM	0	896.564	15.44	3.81	22.45	1011.23
5/24/2022	12:00:00 PM	0	12.9486	4.982	5/24/2022	12:00:00 PM	0	895.902	13.596	3.81	22.45	1011.23
5/24/2022	1:00:00 PM	0	12.9443	4.981	5/24/2022	1:00:00 PM	0	895.283	16.614	3.81	22.45	1011.23
5/24/2022	2:00:00 PM	0	12.9391	4.982	5/24/2022	2:00:00 PM	0	894.736	18.47	3.82	22.44	1011.24
5/24/2022	3:00:00 PM	0	12.935	4.982	5/24/2022	3:00:00 PM	0	894.041	17.344	3.82	22.44	1011.24
5/24/2022	4:00:00 PM	0	12.9314	4.982	5/24/2022	4:00:00 PM	0	894.125	13.032	3.81	22.45	1011.23
5/24/2022	5:00:00 PM	0	12.9284	4.982	5/24/2022	5:00:00 PM	0	893.454	12.319	3.82	22.44	1011.24
5/24/2022	6:00:00 PM	0	12.9249	4.981	5/24/2022	6:00:00 PM	0	893.405	10.477	3.81	22.45	1011.23
5/24/2022	7:00:00 PM	0	12.9221	4.982	5/24/2022	7:00:00 PM	0	893.529	9.396	3.81	22.45	1011.23

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/24/2022	8:00:00 PM	0	12.9194	4.982	5/24/2022	8:00:00 PM	0	893.137	7.945	3.81	22.45	1011.23
5/24/2022	9:00:00 PM	0	12.9172	4.982	5/24/2022	9:00:00 PM	0	893.109	6.846	3.81	22.45	1011.23
5/24/2022	10:00:00 PM	0	12.9145	4.981	5/24/2022	10:00:00 PM	0	892.781	6.25	3.81	22.45	1011.23
5/24/2022	11:00:00 PM	0	12.9119	4.982	5/24/2022	11:00:00 PM	0	892.393	5.656	3.81	22.45	1011.23
5/25/2022	12:00:00 AM	0	12.9097	4.982	5/25/2022	12:00:00 AM	0	892.374	4.965	3.81	22.45	1011.23
5/25/2022	1:00:00 AM	0	12.907	4.982	5/25/2022	1:00:00 AM	0	892.186	4.337	3.81	22.45	1011.23
5/25/2022	2:00:00 AM	0	12.9052	4.982	5/25/2022	2:00:00 AM	0	892.144	4.391	3.81	22.45	1011.23
5/25/2022	3:00:00 AM	0	12.903	4.982	5/25/2022	3:00:00 AM	0	892.035	4.513	3.81	22.45	1011.23
5/25/2022	4:00:00 AM	0	12.901	4.982	5/25/2022	4:00:00 AM	0	891.925	4.685	3.81	22.45	1011.23
5/25/2022	5:00:00 AM	0	12.899	4.982	5/25/2022	5:00:00 AM	0	891.91	4.478	3.80	22.46	1011.22
5/25/2022	6:00:00 AM	0	12.8974	4.981	5/25/2022	6:00:00 AM	0	892.315	5.233	3.80	22.46	1011.22
5/25/2022	7:00:00 AM	0	12.896	4.982	5/25/2022	7:00:00 AM	0	892.334	6.894	3.80	22.46	1011.22
5/25/2022	8:00:00 AM	0	12.8938	4.982	5/25/2022	8:00:00 AM	0	892.261	13.538	3.80	22.46	1011.22
5/25/2022	9:00:00 AM	0	12.8904	4.982	5/25/2022	9:00:00 AM	0	891.634	18.115	3.80	22.46	1011.22
5/25/2022	10:00:00 AM	0	12.887	4.982	5/25/2022	10:00:00 AM	0	891.308	20.285	3.80	22.46	1011.22
5/25/2022	11:00:00 AM	0	12.8839	4.982	5/25/2022	11:00:00 AM	0	891.033	22.785	3.80	22.46	1011.22
5/25/2022	12:00:00 PM	0	12.8823	4.982	5/25/2022	12:00:00 PM	0	890.865	19.567	3.80	22.46	1011.22
5/25/2022	1:00:00 PM	0	12.881	4.982	5/25/2022	1:00:00 PM	0	890.716	16.347	3.80	22.46	1011.22
5/25/2022	2:00:00 PM	0	12.8794	4.982	5/25/2022	2:00:00 PM	0	890.895	13.665	3.79	22.47	1011.21
5/25/2022	3:00:00 PM	0	12.8778	4.982	5/25/2022	3:00:00 PM	0	890.578	14.892	3.80	22.46	1011.22
5/25/2022	4:00:00 PM	0	12.8769	4.982	5/25/2022	4:00:00 PM	0	891.294	14.937	3.79	22.47	1011.21
5/25/2022	5:00:00 PM	0	12.8758	4.982	5/25/2022	5:00:00 PM	0	891.373	14.484	3.79	22.47	1011.21
5/25/2022	6:00:00 PM	0	12.8761	4.982	5/25/2022	6:00:00 PM	0	892.228	13.026	3.78	22.48	1011.20
5/25/2022	7:00:00 PM	0	12.8768	4.982	5/25/2022	7:00:00 PM	0	892.391	12.505	3.78	22.48	1011.20
5/25/2022	8:00:00 PM	0	12.8782	4.982	5/25/2022	8:00:00 PM	0	892.996	9.939	3.77	22.49	1011.19
5/25/2022	9:00:00 PM	0	12.8805	4.983	5/25/2022	9:00:00 PM	0	893.756	8.239	3.77	22.49	1011.19
5/25/2022	10:00:00 PM	0	12.8829	4.981	5/25/2022	10:00:00 PM	0	894.224	7.102	3.76	22.50	1011.18
5/25/2022	11:00:00 PM	0	12.8857	4.982	5/25/2022	11:00:00 PM	0	894.872	6.438	3.76	22.50	1011.18
5/26/2022	12:00:00 AM	0	12.8879	4.982	5/26/2022	12:00:00 AM	0	894.595	5.531	3.77	22.49	1011.19
5/26/2022	1:00:00 AM	0	12.8896	4.982	5/26/2022	1:00:00 AM	0	894.848	3.879	3.76	22.50	1011.18
5/26/2022	2:00:00 AM	0	12.8903	4.982	5/26/2022	2:00:00 AM	0	894.419	3.379	3.77	22.49	1011.19
5/26/2022	3:00:00 AM	0	12.8909	4.982	5/26/2022	3:00:00 AM	0	894.831	2.672	3.77	22.49	1011.19
5/26/2022	4:00:00 AM	0	12.891	4.982	5/26/2022	4:00:00 AM	0	894.795	3.015	3.77	22.49	1011.19
5/26/2022	5:00:00 AM	0	12.8909	4.981	5/26/2022	5:00:00 AM	0	894.87	3.615	3.77	22.49	1011.19
5/26/2022	6:00:00 AM	0	12.8907	4.982	5/26/2022	6:00:00 AM	0	895.065	5.365	3.76	22.50	1011.18
5/26/2022	7:00:00 AM	0	12.8897	4.982	5/26/2022	7:00:00 AM	0	895.226	8.536	3.76	22.50	1011.18
5/26/2022	8:00:00 AM	0	12.8889	4.982	5/26/2022	8:00:00 AM	0	895.242	11.081	3.76	22.50	1011.18
5/26/2022	9:00:00 AM	0	12.8868	4.982	5/26/2022	9:00:00 AM	0	894.691	16.395	3.76	22.50	1011.18
5/26/2022	10:00:00 AM	0	12.8837	4.982	5/26/2022	10:00:00 AM	0	894.271	18.339	3.76	22.50	1011.18
5/26/2022	11:00:00 AM	0	12.8806	4.982	5/26/2022	11:00:00 AM	0	893.464	20.534	3.77	22.49	1011.19
5/26/2022	12:00:00 PM	0	12.8773	4.981	5/26/2022	12:00:00 PM	0	892.9	22.956	3.77	22.49	1011.19
5/26/2022	1:00:00 PM	0	12.8735	4.982	5/26/2022	1:00:00 PM	0	891.964	24.265	3.78	22.48	1011.20
5/26/2022	2:00:00 PM	0	12.8689	4.982	5/26/2022	2:00:00 PM	0	891.32	24.094	3.78	22.48	1011.20
5/26/2022	3:00:00 PM	0	12.865	4.981	5/26/2022	3:00:00 PM	0	890.952	20.856	3.78	22.48	1011.20
5/26/2022	4:00:00 PM	0	12.8613	4.982	5/26/2022	4:00:00 PM	0	890.746	19.49	3.78	22.48	1011.20
5/26/2022	5:00:00 PM	0	12.8572	4.982	5/26/2022	5:00:00 PM	0	890.612	18.137	3.78	22.48	1011.20
5/26/2022	6:00:00 PM	0	12.8538	4.982	5/26/2022	6:00:00 PM	0	890.235	17.012	3.78	22.48	1011.20
5/26/2022	7:00:00 PM	0	12.85	4.982	5/26/2022	7:00:00 PM	0	889.718	14.405	3.78	22.48	1011.20
5/26/2022	8:00:00 PM	0	12.8463	4.981	5/26/2022	8:00:00 PM	0	889.331	11.839	3.78	22.48	1011.20
5/26/2022	9:00:00 PM	0	12.842	4.981	5/26/2022	9:00:00 PM	0	889.121	11.188	3.78	22.48	1011.20
5/26/2022	10:00:00 PM	0	12.8383	4.982	5/26/2022	10:00:00 PM	0	888.894	10.403	3.77	22.49	1011.19
5/26/2022	11:00:00 PM	0	12.8343	4.982	5/26/2022	11:00:00 PM	0	888.431	10.003	3.77	22.49	1011.19
5/27/2022	12:00:00 AM	0	12.8305	4.982	5/27/2022	12:00:00 AM	0	888.022	9.932	3.78	22.48	1011.20
5/27/2022	1:00:00 AM	0	12.8266	4.981	5/27/2022	1:00:00 AM	0	887.495	9.614	3.78	22.48	1011.20
5/27/2022	2:00:00 AM	0	12.8224	4.982	5/27/2022	2:00:00 AM	0	886.856	9.462	3.78	22.48	1011.20
5/27/2022	3:00:00 AM	0	12.8177	4.982	5/27/2022	3:00:00 AM	0	886.522	9.228	3.78	22.48	1011.20
5/27/2022	4:00:00 AM	0	12.8139	4.982	5/27/2022	4:00:00 AM	0	886.663	7.66	3.77	22.49	1011.19
5/27/2022	5:00:00 AM	0	12.8107	4.981	5/27/2022	5:00:00 AM	0	886.491	6.422	3.77	22.49	1011.19
5/27/2022	6:00:00 AM	0	12.8072	4.982	5/27/2022	6:00:00 AM	0	886.058	6.36	3.77	22.49	1011.19
5/27/2022	7:00:00 AM	0	12.8038	4.982	5/27/2022	7:00:00 AM	0	886.214	7.395	3.77	22.49	1011.19
5/27/2022	8:00:00 AM	0	12.8014	4.981	5/27/2022	8:00:00 AM	0	886.904	7.315	3.76	22.50	1011.18
5/27/2022	9:00:00 AM	0	12.8001	4.982	5/27/2022	9:00:00 AM	0	887.345	7.406	3.75	22.51	1011.17
5/27/2022	10:00:00 AM	0	12.7988	4.982	5/27/2022	10:00:00 AM	0	887.333	12.848	3.75	22.51	1011.17
5/27/2022	11:00:00 AM	0	12.7965	4.982	5/27/2022	11:00:00 AM	0	886.859	20.603	3.75	22.51	1011.17
5/27/2022	12:00:00 PM	0	12.7945	4.982	5/27/2022	12:00:00 PM	0	886.664	19.2	3.75	22.51	1011.17
5/27/2022	1:00:00 PM	0	12.7943	4.982	5/27/2022	1:00:00 PM	0	887.993	10.899	3.74	22.52	1011.16
5/27/2022	2:00:00 PM	0	12.7942	4.982	5/27/2022	2:00:00 PM	0	887.621	11.268	3.74	22.52	1011.16
5/27/2022	3:00:00 PM	0	12.7944	4.982	5/27/2022	3:00:00 PM	0	887.786	12.243	3.74	22.52	1011.16
5/27/2022	4:00:00 PM	0	12.7936	4.982	5/27/2022	4:00:00 PM	0	887.717	17.583	3.74	22.52	1011.16
5/27/2022	5:00:00 PM	0	12.7932	4.982	5/27/2022	5:00:00 PM	0	888.013	14.005	3.74	22.52	1011.16

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/27/2022	6:00:00 PM	0	12.7935	4.982	5/27/2022	6:00:00 PM	0	888.477	10.255	3.73	22.53	1011.15
5/27/2022	7:00:00 PM	0	12.7938	4.982	5/27/2022	7:00:00 PM	0	888.606	7.885	3.73	22.53	1011.15
5/27/2022	8:00:00 PM	0	12.7948	4.982	5/27/2022	8:00:00 PM	0	889.017	6.521	3.73	22.53	1011.15
5/27/2022	9:00:00 PM	0	12.7955	4.982	5/27/2022	9:00:00 PM	0	889.25	5.631	3.73	22.53	1011.15
5/27/2022	10:00:00 PM	0	12.7966	4.982	5/27/2022	10:00:00 PM	0	889.798	4.391	3.72	22.54	1011.14
5/27/2022	11:00:00 PM	0	12.7978	4.983	5/27/2022	11:00:00 PM	0	889.839	4.107	3.72	22.54	1011.14
5/28/2022	12:00:00 AM	0	12.7985	4.982	5/28/2022	12:00:00 AM	0	889.851	4.094	3.72	22.54	1011.14
5/28/2022	1:00:00 AM	0	12.7987	4.982	5/28/2022	1:00:00 AM	0	889.607	3.784	3.73	22.53	1011.15
5/28/2022	2:00:00 AM	0	12.7982	4.982	5/28/2022	2:00:00 AM	0	889.723	2.815	3.73	22.53	1011.15
5/28/2022	3:00:00 AM	0	12.7979	4.983	5/28/2022	3:00:00 AM	0	889.796	2.213	3.72	22.54	1011.14
5/28/2022	4:00:00 AM	0	12.797	4.982	5/28/2022	4:00:00 AM	0	889.679	2.752	3.72	22.54	1011.14
5/28/2022	5:00:00 AM	0	12.7961	4.982	5/28/2022	5:00:00 AM	0	889.979	3.514	3.72	22.54	1011.14
5/28/2022	6:00:00 AM	0	12.7951	4.982	5/28/2022	6:00:00 AM	0	890.088	4.477	3.72	22.54	1011.14
5/28/2022	7:00:00 AM	0	12.794	4.982	5/28/2022	7:00:00 AM	0	890.311	6.183	3.72	22.54	1011.14
5/28/2022	8:00:00 AM	0	12.7933	4.982	5/28/2022	8:00:00 AM	0	890.506	8.578	3.71	22.55	1011.13
5/28/2022	9:00:00 AM	0	12.7919	4.982	5/28/2022	9:00:00 AM	0	890.417	11.108	3.71	22.55	1011.13
5/28/2022	10:00:00 AM	0	12.7896	4.982	5/28/2022	10:00:00 AM	0	889.581	17.026	3.72	22.54	1011.14
5/28/2022	11:00:00 AM	0	12.7865	4.982	5/28/2022	11:00:00 AM	0	889.709	17.456	3.71	22.55	1011.13
5/28/2022	12:00:00 PM	0	12.7843	4.982	5/28/2022	12:00:00 PM	0	889.512	11.262	3.71	22.55	1011.13
5/28/2022	1:00:00 PM	0	12.7823	4.982	5/28/2022	1:00:00 PM	0	889.218	18.834	3.71	22.55	1011.13
5/28/2022	2:00:00 PM	0	12.7791	4.982	5/28/2022	2:00:00 PM	0	888.96	18.533	3.71	22.55	1011.13
5/28/2022	3:00:00 PM	0	12.7774	4.982	5/28/2022	3:00:00 PM	0	888.708	15.825	3.72	22.54	1011.14
5/28/2022	4:00:00 PM	0	12.776	4.982	5/28/2022	4:00:00 PM	0	889.071	12.301	3.71	22.55	1011.13
5/28/2022	5:00:00 PM	0	12.7745	4.982	5/28/2022	5:00:00 PM	0	888.704	11.654	3.71	22.55	1011.13
5/28/2022	6:00:00 PM	0	12.7727	4.982	5/28/2022	6:00:00 PM	0	888.574	13.543	3.71	22.55	1011.13
5/28/2022	7:00:00 PM	0	12.771	4.982	5/28/2022	7:00:00 PM	0	888.894	12.602	3.71	22.55	1011.13
5/28/2022	8:00:00 PM	0	12.7702	4.982	5/28/2022	8:00:00 PM	0	889.118	7.966	3.70	22.56	1011.12
5/28/2022	9:00:00 PM	0	12.7694	4.982	5/28/2022	9:00:00 PM	0	889.229	5.716	3.70	22.56	1011.12
5/28/2022	10:00:00 PM	0	12.7687	4.982	5/28/2022	10:00:00 PM	0	889.307	4.207	3.70	22.56	1011.12
5/28/2022	11:00:00 PM	0	12.7683	4.982	5/28/2022	11:00:00 PM	0	889.332	3.193	3.70	22.56	1011.12
5/29/2022	12:00:00 AM	0	12.7683	4.982	5/29/2022	12:00:00 AM	0	889.454	2.504	3.70	22.56	1011.12
5/29/2022	1:00:00 AM	0	12.7675	4.982	5/29/2022	1:00:00 AM	0	889.524	2.385	3.70	22.56	1011.12
5/29/2022	2:00:00 AM	0	12.7669	4.982	5/29/2022	2:00:00 AM	0	889.604	1.864	3.70	22.56	1011.12
5/29/2022	3:00:00 AM	0	12.7667	4.983	5/29/2022	3:00:00 AM	0	889.813	2.192	3.69	22.57	1011.11
5/29/2022	4:00:00 AM	0	12.7661	4.982	5/29/2022	4:00:00 AM	0	890.096	2.759	3.69	22.57	1011.11
5/29/2022	5:00:00 AM	0	12.7658	4.982	5/29/2022	5:00:00 AM	0	890.229	3.041	3.69	22.57	1011.11
5/29/2022	6:00:00 AM	0	12.7655	4.982	5/29/2022	6:00:00 AM	0	890.64	3.362	3.68	22.58	1011.10
5/29/2022	7:00:00 AM	0	12.7652	4.982	5/29/2022	7:00:00 AM	0	891.009	5.877	3.68	22.58	1011.10
5/29/2022	8:00:00 AM	0	12.7647	4.982	5/29/2022	8:00:00 AM	0	891.458	9.84	3.67	22.59	1011.09
5/29/2022	9:00:00 AM	0	12.7634	4.982	5/29/2022	9:00:00 AM	0	891.347	16.625	3.67	22.59	1011.09
5/29/2022	10:00:00 AM	0	12.7626	4.982	5/29/2022	10:00:00 AM	0	891.433	17.841	3.67	22.59	1011.09
5/29/2022	11:00:00 AM	0	12.7614	4.982	5/29/2022	11:00:00 AM	0	891.299	20.843	3.67	22.59	1011.09
5/29/2022	12:00:00 PM	0	12.7614	4.982	5/29/2022	12:00:00 PM	0	891.558	20.109	3.67	22.59	1011.09
5/29/2022	1:00:00 PM	0	12.7615	4.982	5/29/2022	1:00:00 PM	0	891.645	18.937	3.67	22.59	1011.09
5/29/2022	2:00:00 PM	0	12.7618	4.982	5/29/2022	2:00:00 PM	0	891.887	19.036	3.67	22.59	1011.09
5/29/2022	3:00:00 PM	0	12.762	4.982	5/29/2022	3:00:00 PM	0	891.927	17.892	3.67	22.59	1011.09
5/29/2022	4:00:00 PM	0	12.7628	4.982	5/29/2022	4:00:00 PM	0	892.298	17.755	3.66	22.60	1011.08
5/29/2022	5:00:00 PM	0	12.7636	4.982	5/29/2022	5:00:00 PM	0	892.473	15.119	3.66	22.60	1011.08
5/29/2022	6:00:00 PM	0	12.7645	4.982	5/29/2022	6:00:00 PM	0	892.966	14.435	3.66	22.60	1011.08
5/29/2022	7:00:00 PM	0	12.7655	4.982	5/29/2022	7:00:00 PM	0	893.628	12.056	3.65	22.61	1011.07
5/29/2022	8:00:00 PM	0	12.7679	4.982	5/29/2022	8:00:00 PM	0	894.326	9.884	3.65	22.61	1011.07
5/29/2022	9:00:00 PM	0	12.7705	4.982	5/29/2022	9:00:00 PM	0	895.017	8.556	3.64	22.62	1011.06
5/29/2022	10:00:00 PM	0	12.7735	4.982	5/29/2022	10:00:00 PM	0	895.546	7.321	3.64	22.62	1011.06
5/29/2022	11:00:00 PM	0	12.7766	4.982	5/29/2022	11:00:00 PM	0	896.248	7.188	3.64	22.62	1011.06
5/30/2022	12:00:00 AM	0	12.7794	4.982	5/30/2022	12:00:00 AM	0	896.425	7.191	3.64	22.62	1011.06
5/30/2022	1:00:00 AM	0	12.7822	4.982	5/30/2022	1:00:00 AM	0	896.846	6.659	3.64	22.62	1011.06
5/30/2022	2:00:00 AM	0	12.7847	4.983	5/30/2022	2:00:00 AM	0	897.173	4.834	3.64	22.62	1011.06
5/30/2022	3:00:00 AM	0	12.787	4.982	5/30/2022	3:00:00 AM	0	897.646	3.828	3.63	22.63	1011.05
5/30/2022	4:00:00 AM	0	12.7894	4.982	5/30/2022	4:00:00 AM	0	898.047	3.045	3.63	22.63	1011.05
5/30/2022	5:00:00 AM	0	12.7916	4.982	5/30/2022	5:00:00 AM	0	898.625	3.067	3.63	22.63	1011.05
5/30/2022	6:00:00 AM	0	12.7946	4.982	5/30/2022	6:00:00 AM	0	899.548	4.169	3.62	22.64	1011.04
5/30/2022	7:00:00 AM	0	12.797	4.982	5/30/2022	7:00:00 AM	0	900.249	9.443	3.62	22.64	1011.04
5/30/2022	8:00:00 AM	0	12.7988	4.982	5/30/2022	8:00:00 AM	0	900.409	16.765	3.62	22.64	1011.04
5/30/2022	9:00:00 AM	0	12.7988	4.982	5/30/2022	9:00:00 AM	0	900.204	22.99	3.62	22.64	1011.04
5/30/2022	10:00:00 AM	0	12.799	4.982	5/30/2022	10:00:00 AM	0	900.095	25.47	3.62	22.64	1011.04
5/30/2022	11:00:00 AM	0	12.7999	4.982	5/30/2022	11:00:00 AM	0	899.708	28.539	3.63	22.63	1011.05
5/30/2022	12:00:00 PM	0	12.8004	4.982	5/30/2022	12:00:00 PM	0	899.804	28.549	3.62	22.64	1011.04
5/30/2022	1:00:00 PM	0	12.8011	4.982	5/30/2022	1:00:00 PM	0	900.703	23.422	3.62	22.64	1011.04
5/30/2022	2:00:00 PM	0	12.8034	4.982	5/30/2022	2:00:00 PM	0	901.207	18.052	3.61	22.65	1011.03
5/30/2022	3:00:00 PM	0	12.8051	4.982	5/30/2022	3:00:00 PM	0	901.536	17.102	3.61	22.65	1011.03

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
5/30/2022	4:00:00 PM	0	12.8064	4.982	5/30/2022	4:00:00 PM	0	901.644	16.488	3.61	22.65	1011.03
5/30/2022	5:00:00 PM	0	12.8075	4.982	5/30/2022	5:00:00 PM	0	901.721	17.023	3.61	22.65	1011.03
5/30/2022	6:00:00 PM	0	12.8086	4.982	5/30/2022	6:00:00 PM	0	901.909	16.042	3.61	22.65	1011.03
5/30/2022	7:00:00 PM	0	12.8093	4.982	5/30/2022	7:00:00 PM	0	902.297	14.195	3.61	22.65	1011.03
5/30/2022	8:00:00 PM	0	12.8103	4.982	5/30/2022	8:00:00 PM	0	902.643	11.724	3.61	22.65	1011.03
5/30/2022	9:00:00 PM	0	12.8119	4.982	5/30/2022	9:00:00 PM	0	902.87	9.805	3.61	22.65	1011.03
5/30/2022	10:00:00 PM	0	12.8131	4.982	5/30/2022	10:00:00 PM	0	902.912	8.686	3.61	22.65	1011.03
5/30/2022	11:00:00 PM	0	12.8137	4.982	5/30/2022	11:00:00 PM	0	903.048	7.332	3.61	22.65	1011.03
5/31/2022	12:00:00 AM	0	12.8143	4.982	5/31/2022	12:00:00 AM	0	903.179	6.749	3.60	22.66	1011.02
5/31/2022	1:00:00 AM	0	12.8148	4.982	5/31/2022	1:00:00 AM	0	903.334	5.701	3.60	22.66	1011.02
5/31/2022	2:00:00 AM	0	12.8152	4.982	5/31/2022	2:00:00 AM	0	903.206	4.912	3.61	22.65	1011.03
5/31/2022	3:00:00 AM	0	12.815	4.982	5/31/2022	3:00:00 AM	0	903.201	4.175	3.60	22.66	1011.02
5/31/2022	4:00:00 AM	0	12.8146	4.982	5/31/2022	4:00:00 AM	0	903.257	4.174	3.60	22.66	1011.02
5/31/2022	5:00:00 AM	0	12.8145	4.983	5/31/2022	5:00:00 AM	0	903.343	4.44	3.60	22.66	1011.02
5/31/2022	6:00:00 AM	0	12.8136	4.982	5/31/2022	6:00:00 AM	0	903.68	5.593	3.60	22.66	1011.02
5/31/2022	7:00:00 AM	0	12.813	4.982	5/31/2022	7:00:00 AM	0	904.043	10.083	3.59	22.67	1011.01
5/31/2022	8:00:00 AM	0	12.812	4.982	5/31/2022	8:00:00 AM	0	903.843	15.638	3.60	22.66	1011.02
5/31/2022	9:00:00 AM	0	12.8102	4.982	5/31/2022	9:00:00 AM	0	903.311	21.694	3.60	22.66	1011.02
5/31/2022	10:00:00 AM	0	12.8075	4.982	5/31/2022	10:00:00 AM	0	903.195	23.51	3.60	22.66	1011.02
5/31/2022	11:00:00 AM	0	12.8048	4.981	5/31/2022	11:00:00 AM	0	902.429	25.675	3.60	22.66	1011.02
5/31/2022	12:00:00 PM	0	12.8018	4.982	5/31/2022	12:00:00 PM	0	902.004	26.595	3.60	22.66	1011.02
5/31/2022	1:00:00 PM	0	12.7992	4.982	5/31/2022	1:00:00 PM	0	902.023	25.291	3.60	22.66	1011.02
5/31/2022	2:00:00 PM	0	12.7975	4.982	5/31/2022	2:00:00 PM	0	902.066	23.47	3.60	22.66	1011.02
5/31/2022	3:00:00 PM	0	12.7962	4.982	5/31/2022	3:00:00 PM	0	902.702	20.055	3.59	22.67	1011.01
5/31/2022	4:00:00 PM	0	12.7963	4.982	5/31/2022	4:00:00 PM	0	903.403	16.003	3.58	22.68	1011.00
5/31/2022	5:00:00 PM	0	12.797	4.982	5/31/2022	5:00:00 PM	0	903.353	16.095	3.59	22.67	1011.01
5/31/2022	6:00:00 PM	0	12.797	4.983	5/31/2022	6:00:00 PM	0	903.251	16.235	3.59	22.67	1011.01
5/31/2022	7:00:00 PM	0	12.7966	4.982	5/31/2022	7:00:00 PM	0	903.309	15.323	3.59	22.67	1011.01
5/31/2022	8:00:00 PM	0	12.7968	4.982	5/31/2022	8:00:00 PM	0	903.732	12.512	3.58	22.68	1011.00
5/31/2022	9:00:00 PM	0	12.797	4.982	5/31/2022	9:00:00 PM	0	903.852	10.524	3.58	22.68	1011.00
5/31/2022	10:00:00 PM	0	12.7968	4.983	5/31/2022	10:00:00 PM	0	903.744	9.41	3.58	22.68	1011.00
5/31/2022	11:00:00 PM	0	12.7966	4.982	5/31/2022	11:00:00 PM	0	903.566	8.506	3.58	22.68	1011.00
6/1/2022	12:00:00 AM	0	12.7955	4.982	6/1/2022	12:00:00 AM	0	903.56	7.654	3.58	22.68	1011.00
6/1/2022	1:00:00 AM	0	12.7949	4.982	6/1/2022	1:00:00 AM	0	903.388	6.701	3.58	22.68	1011.00
6/1/2022	2:00:00 AM	0	12.7931	4.982	6/1/2022	2:00:00 AM	0	903.287	5.57	3.58	22.68	1011.00
6/1/2022	3:00:00 AM	0	12.7917	4.982	6/1/2022	3:00:00 AM	0	903.084	5.462	3.58	22.68	1011.00
6/1/2022	4:00:00 AM	0	12.7899	4.983	6/1/2022	4:00:00 AM	0	903.122	5.695	3.58	22.68	1011.00
6/1/2022	5:00:00 AM	0	12.7882	4.982	6/1/2022	5:00:00 AM	0	903.159	5.145	3.58	22.68	1011.00
6/1/2022	6:00:00 AM	0	12.7872	4.982	6/1/2022	6:00:00 AM	0	903.445	6.84	3.57	22.69	1010.99
6/1/2022	7:00:00 AM	0	12.7856	4.982	6/1/2022	7:00:00 AM	0	903.374	11.763	3.57	22.69	1010.99
6/1/2022	8:00:00 AM	0	12.7827	4.983	6/1/2022	8:00:00 AM	0	902.794	19.124	3.58	22.68	1011.00
6/1/2022	9:00:00 AM	0	12.7789	4.982	6/1/2022	9:00:00 AM	0	902.59	22.744	3.58	22.68	1011.00
6/1/2022	10:00:00 AM	0	12.7763	4.982	6/1/2022	10:00:00 AM	0	902.497	21.622	3.57	22.69	1010.99
6/1/2022	11:00:00 AM	0	12.7734	4.982	6/1/2022	11:00:00 AM	0	901.89	24.302	3.58	22.68	1011.00
6/1/2022	12:00:00 PM	0	12.7701	4.982	6/1/2022	12:00:00 PM	0	901.394	24.114	3.58	22.68	1011.00
6/1/2022	1:00:00 PM	0	12.7663	4.982	6/1/2022	1:00:00 PM	0	900.838	22.917	3.58	22.68	1011.00
6/1/2022	2:00:00 PM	0	12.7621	4.982	6/1/2022	2:00:00 PM	0	900.032	28.678	3.58	22.68	1011.00
6/1/2022	3:00:00 PM	0	12.7593	4.983	6/1/2022	3:00:00 PM	0	900.772	22.723	3.57	22.69	1010.99
6/1/2022	4:00:00 PM	0	12.757	4.982	6/1/2022	4:00:00 PM	0	900.465	18.517	3.57	22.69	1010.99
6/1/2022	5:00:00 PM	0	12.7546	4.982	6/1/2022	5:00:00 PM	0	900.118	19.105	3.58	22.68	1011.00
6/1/2022	6:00:00 PM	0	12.7517	4.982	6/1/2022	6:00:00 PM	0	900.12	18.947	3.57	22.69	1010.99
6/1/2022	7:00:00 PM	0	12.7504	4.982	6/1/2022	7:00:00 PM	0	900.849	15.807	3.56	22.70	1010.98
6/1/2022	8:00:00 PM	0	12.7492	4.982	6/1/2022	8:00:00 PM	0	900.273	12.003	3.57	22.69	1010.99
6/1/2022	9:00:00 PM	0	12.7469	4.983	6/1/2022	9:00:00 PM	0	899.919	9.949	3.57	22.69	1010.99
6/1/2022	10:00:00 PM	0	12.7445	4.982	6/1/2022	10:00:00 PM	0	899.779	8.16	3.57	22.69	1010.99
6/1/2022	11:00:00 PM	0	12.742	4.982	6/1/2022	11:00:00 PM	0	899.706	7.029	3.57	22.69	1010.99
6/2/2022	12:00:00 AM	0	12.7394	4.982	6/2/2022	12:00:00 AM	0	899.368	6.403	3.57	22.69	1010.99
6/2/2022	1:00:00 AM	0	12.7366	4.982	6/2/2022	1:00:00 AM	0	899.128	5.888	3.57	22.69	1010.99
6/2/2022	2:00:00 AM	0	12.7337	4.982	6/2/2022	2:00:00 AM	0	899.113	5.362	3.57	22.69	1010.99
6/2/2022	3:00:00 AM	0	12.7315	4.982	6/2/2022	3:00:00 AM	0	899.297	4.967	3.56	22.70	1010.98
6/2/2022	4:00:00 AM	0	12.7296	4.982	6/2/2022	4:00:00 AM	0	899.071	4.89	3.56	22.70	1010.98
6/2/2022	5:00:00 AM	0	12.7277	4.982	6/2/2022	5:00:00 AM	0	898.889	5.565	3.56	22.70	1010.98
6/2/2022	6:00:00 AM	0	12.7253	4.982	6/2/2022	6:00:00 AM	0	898.863	8.552	3.56	22.70	1010.98
6/2/2022	7:00:00 AM	0	12.7228	4.983	6/2/2022	7:00:00 AM	0	898.864	9.893	3.56	22.70	1010.98
6/2/2022	8:00:00 AM	0	12.7196	4.983	6/2/2022	8:00:00 AM	0	898.568	12.822	3.56	22.70	1010.98
6/2/2022	9:00:00 AM	0	12.7157	4.982	6/2/2022	9:00:00 AM	0	898.273	18.733	3.56	22.70	1010.98
6/2/2022	10:00:00 AM	0	12.7128	4.983	6/2/2022	10:00:00 AM	0	898.113	19.745	3.55	22.71	1010.97
6/2/2022	11:00:00 AM	0	12.7099	4.982	6/2/2022	11:00:00 AM	0	897.937	18.454	3.55	22.71	1010.97
6/2/2022	12:00:00 PM	0	12.7071	4.983	6/2/2022	12:00:00 PM	0	897.397	20.01	3.56	22.70	1010.98
6/2/2022	1:00:00 PM	0	12.7031	4.983	6/2/2022	1:00:00 PM	0	896.962	22.854	3.56	22.70	1010.98

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/2/2022	2:00:00 PM	0	12.6989	4.982	6/2/2022	2:00:00 PM	0	896.233	24.018	3.56	22.70	1010.98
6/2/2022	3:00:00 PM	0	12.6947	4.982	6/2/2022	3:00:00 PM	0	896.033	21.363	3.56	22.70	1010.98
6/2/2022	4:00:00 PM	0	12.6906	4.982	6/2/2022	4:00:00 PM	0	895.645	21.218	3.56	22.70	1010.98
6/2/2022	5:00:00 PM	0	12.6874	4.982	6/2/2022	5:00:00 PM	0	895.258	19.537	3.56	22.70	1010.98
6/2/2022	6:00:00 PM	0	12.6836	4.982	6/2/2022	6:00:00 PM	0	894.636	20.578	3.56	22.70	1010.98
6/2/2022	7:00:00 PM	0	12.6795	4.983	6/2/2022	7:00:00 PM	0	894.69	17.734	3.56	22.70	1010.98
6/2/2022	8:00:00 PM	0	12.6757	4.983	6/2/2022	8:00:00 PM	0	894.557	14.708	3.55	22.71	1010.97
6/2/2022	9:00:00 PM	0	12.6724	4.982	6/2/2022	9:00:00 PM	0	894.325	12.198	3.55	22.71	1010.97
6/2/2022	10:00:00 PM	0	12.6687	4.982	6/2/2022	10:00:00 PM	0	893.847	10.775	3.55	22.71	1010.97
6/2/2022	11:00:00 PM	0	12.6649	4.982	6/2/2022	11:00:00 PM	0	893.65	9.851	3.55	22.71	1010.97
6/3/2022	12:00:00 AM	0	12.6611	4.983	6/3/2022	12:00:00 AM	0	893.27	8.82	3.55	22.71	1010.97
6/3/2022	1:00:00 AM	0	12.657	4.983	6/3/2022	1:00:00 AM	0	892.835	7.7	3.55	22.71	1010.97
6/3/2022	2:00:00 AM	0	12.6531	4.982	6/3/2022	2:00:00 AM	0	892.349	7.212	3.55	22.71	1010.97
6/3/2022	3:00:00 AM	0	12.6489	4.982	6/3/2022	3:00:00 AM	0	891.952	7.228	3.55	22.71	1010.97
6/3/2022	4:00:00 AM	0	12.6446	4.982	6/3/2022	4:00:00 AM	0	891.756	7.421	3.55	22.71	1010.97
6/3/2022	5:00:00 AM	0	12.6409	4.982	6/3/2022	5:00:00 AM	0	891.866	7.659	3.55	22.71	1010.97
6/3/2022	6:00:00 AM	0	12.6373	4.982	6/3/2022	6:00:00 AM	0	891.613	7.384	3.55	22.71	1010.97
6/3/2022	7:00:00 AM	0	12.634	4.983	6/3/2022	7:00:00 AM	0	891.167	7.608	3.55	22.71	1010.97
6/3/2022	8:00:00 AM	0	12.6303	4.982	6/3/2022	8:00:00 AM	0	890.761	8.503	3.55	22.71	1010.97
6/3/2022	9:00:00 AM	0	12.6257	4.982	6/3/2022	9:00:00 AM	0	890.523	8.897	3.54	22.72	1010.96
6/3/2022	10:00:00 AM	0	12.6218	4.982	6/3/2022	10:00:00 AM	0	890.194	9.782	3.54	22.72	1010.96
6/3/2022	11:00:00 AM	0	12.6174	4.982	6/3/2022	11:00:00 AM	0	890.232	10.181	3.54	22.72	1010.96
6/3/2022	12:00:00 PM	0	12.614	4.983	6/3/2022	12:00:00 PM	0	889.931	10.616	3.54	22.72	1010.96
6/3/2022	1:00:00 PM	0	12.6105	4.982	6/3/2022	1:00:00 PM	0	889.617	12.551	3.54	22.72	1010.96
6/3/2022	2:00:00 PM	0	12.6058	4.982	6/3/2022	2:00:00 PM	0	889.116	14.627	3.54	22.72	1010.96
6/3/2022	3:00:00 PM	0	12.6016	4.982	6/3/2022	3:00:00 PM	0	888.667	16.52	3.54	22.72	1010.96
6/3/2022	4:00:00 PM	0	12.5971	4.983	6/3/2022	4:00:00 PM	0	888.225	18.216	3.54	22.72	1010.96
6/3/2022	5:00:00 PM	0	12.5931	4.982	6/3/2022	5:00:00 PM	0	887.855	15.307	3.54	22.72	1010.96
6/3/2022	6:00:00 PM	0	12.5894	4.982	6/3/2022	6:00:00 PM	0	888.012	11.338	3.53	22.73	1010.95
6/3/2022	7:00:00 PM	0	12.5864	4.982	6/3/2022	7:00:00 PM	0	888.035	9.816	3.53	22.73	1010.95
6/3/2022	8:00:00 PM	0	12.5841	4.983	6/3/2022	8:00:00 PM	0	888.261	9.194	3.53	22.73	1010.95
6/3/2022	9:00:00 PM	0	12.5831	4.982	6/3/2022	9:00:00 PM	0	889.05	8.858	3.52	22.74	1010.94
6/3/2022	10:00:00 PM	0	12.5839	4.982	6/3/2022	10:00:00 PM	0	889.338	8.177	3.52	22.74	1010.94
6/3/2022	11:00:00 PM	0	12.5836	4.982	6/3/2022	11:00:00 PM	0	889.352	8.027	3.51	22.75	1010.93
6/4/2022	12:00:00 AM	0	12.5833	4.982	6/4/2022	12:00:00 AM	0	889.535	7.935	3.51	22.75	1010.93
6/4/2022	1:00:00 AM	0	12.583	4.983	6/4/2022	1:00:00 AM	0	889.675	7.602	3.51	22.75	1010.93
6/4/2022	2:00:00 AM	0	12.5825	4.982	6/4/2022	2:00:00 AM	0	889.976	7.217	3.51	22.75	1010.93
6/4/2022	3:00:00 AM	0	12.5827	4.983	6/4/2022	3:00:00 AM	0	890.214	6.581	3.51	22.75	1010.93
6/4/2022	4:00:00 AM	0	12.5829	4.983	6/4/2022	4:00:00 AM	0	890.414	5.639	3.50	22.76	1010.92
6/4/2022	5:00:00 AM	0	12.5828	4.982	6/4/2022	5:00:00 AM	0	890.46	5.126	3.50	22.76	1010.92
6/4/2022	6:00:00 AM	0	12.5829	4.983	6/4/2022	6:00:00 AM	0	890.663	5.774	3.50	22.76	1010.92
6/4/2022	7:00:00 AM	0	12.5822	4.983	6/4/2022	7:00:00 AM	0	891.021	8.505	3.50	22.76	1010.92
6/4/2022	8:00:00 AM	0	12.581	4.983	6/4/2022	8:00:00 AM	0	890.814	14.144	3.50	22.76	1010.92
6/4/2022	9:00:00 AM	0	12.5782	4.983	6/4/2022	9:00:00 AM	0	890.645	19.281	3.50	22.76	1010.92
6/4/2022	10:00:00 AM	0	12.5758	4.982	6/4/2022	10:00:00 AM	0	890.333	20.06	3.50	22.76	1010.92
6/4/2022	11:00:00 AM	0	12.5735	4.983	6/4/2022	11:00:00 AM	0	890.092	22.477	3.50	22.76	1010.92
6/4/2022	12:00:00 PM	0	12.5713	4.983	6/4/2022	12:00:00 PM	0	889.84	21.985	3.50	22.76	1010.92
6/4/2022	1:00:00 PM	0	12.5689	4.982	6/4/2022	1:00:00 PM	0	889.622	23.062	3.50	22.76	1010.92
6/4/2022	2:00:00 PM	0	12.5667	4.982	6/4/2022	2:00:00 PM	0	889.543	21.908	3.50	22.76	1010.92
6/4/2022	3:00:00 PM	0	12.5645	4.982	6/4/2022	3:00:00 PM	0	889.189	20.603	3.50	22.76	1010.92
6/4/2022	4:00:00 PM	0	12.5619	4.983	6/4/2022	4:00:00 PM	0	888.95	21.404	3.50	22.76	1010.92
6/4/2022	5:00:00 PM	0	12.5586	4.983	6/4/2022	5:00:00 PM	0	888.64	19.844	3.50	22.76	1010.92
6/4/2022	6:00:00 PM	0	12.5556	4.983	6/4/2022	6:00:00 PM	0	888.192	19.895	3.50	22.76	1010.92
6/4/2022	7:00:00 PM	0	12.5522	4.983	6/4/2022	7:00:00 PM	0	888.003	17.843	3.50	22.76	1010.92
6/4/2022	8:00:00 PM	0	12.5482	4.982	6/4/2022	8:00:00 PM	0	887.838	13.963	3.49	22.77	1010.91
6/4/2022	9:00:00 PM	0	12.5453	4.983	6/4/2022	9:00:00 PM	0	887.909	11.451	3.49	22.77	1010.91
6/4/2022	10:00:00 PM	0	12.5431	4.982	6/4/2022	10:00:00 PM	0	887.903	9.895	3.49	22.77	1010.91
6/4/2022	11:00:00 PM	0	12.5404	4.982	6/4/2022	11:00:00 PM	0	887.919	9.373	3.49	22.77	1010.91
6/5/2022	12:00:00 AM	0	12.5386	4.983	6/5/2022	12:00:00 AM	0	887.617	10.125	3.49	22.77	1010.91
6/5/2022	1:00:00 AM	0	12.5359	4.983	6/5/2022	1:00:00 AM	0	887.6	9.785	3.48	22.78	1010.90
6/5/2022	2:00:00 AM	0	12.5337	4.982	6/5/2022	2:00:00 AM	0	887.263	8.065	3.49	22.77	1010.91
6/5/2022	3:00:00 AM	0	12.5304	4.982	6/5/2022	3:00:00 AM	0	886.939	7.306	3.49	22.77	1010.91
6/5/2022	4:00:00 AM	0	12.5274	4.983	6/5/2022	4:00:00 AM	0	886.801	7.793	3.48	22.78	1010.90
6/5/2022	5:00:00 AM	0	12.5242	4.982	6/5/2022	5:00:00 AM	0	886.755	7.827	3.48	22.78	1010.90
6/5/2022	6:00:00 AM	0	12.5211	4.983	6/5/2022	6:00:00 AM	0	886.584	9.046	3.48	22.78	1010.90
6/5/2022	7:00:00 AM	0	12.5184	4.982	6/5/2022	7:00:00 AM	0	886.613	11.859	3.48	22.78	1010.90
6/5/2022	8:00:00 AM	0	12.5153	4.983	6/5/2022	8:00:00 AM	0	886.473	14.77	3.48	22.78	1010.90
6/5/2022	9:00:00 AM	0	12.5122	4.983	6/5/2022	9:00:00 AM	0	886.309	16.846	3.47	22.79	1010.89
6/5/2022	10:00:00 AM	0	12.5096	4.982	6/5/2022	10:00:00 AM	0	886.338	18.293	3.47	22.79	1010.89
6/5/2022	11:00:00 AM	0	12.5075	4.983	6/5/2022	11:00:00 AM	0	886.765	17.308	3.46	22.80	1010.88

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/5/2022	12:00:00 PM	0	12.5063	4.982	6/5/2022	12:00:00 PM	0	887.031	12.558	3.46	22.80	1010.88
6/5/2022	1:00:00 PM	0	12.5056	4.982	6/5/2022	1:00:00 PM	0	887.049	11.993	3.46	22.80	1010.88
6/5/2022	2:00:00 PM	0	12.5046	4.982	6/5/2022	2:00:00 PM	0	886.999	14.145	3.46	22.80	1010.88
6/5/2022	3:00:00 PM	0	12.503	4.983	6/5/2022	3:00:00 PM	0	886.882	16.594	3.46	22.80	1010.88
6/5/2022	4:00:00 PM	0	12.5015	4.983	6/5/2022	4:00:00 PM	0	886.991	19.176	3.46	22.80	1010.88
6/5/2022	5:00:00 PM	0	12.5009	4.983	6/5/2022	5:00:00 PM	0	887.776	11.88	3.45	22.81	1010.87
6/5/2022	6:00:00 PM	0	12.5011	4.983	6/5/2022	6:00:00 PM	0	887.989	9.7	3.45	22.81	1010.87
6/5/2022	7:00:00 PM	0	12.5014	4.983	6/5/2022	7:00:00 PM	0	888.48	10.255	3.44	22.82	1010.86
6/5/2022	8:00:00 PM	0	12.502	4.982	6/5/2022	8:00:00 PM	0	888.185	9.726	3.44	22.82	1010.86
6/5/2022	9:00:00 PM	0	12.5026	4.983	6/5/2022	9:00:00 PM	0	889.236	8.722	3.43	22.83	1010.85
6/5/2022	10:00:00 PM	0	12.5041	4.983	6/5/2022	10:00:00 PM	0	890.051	8.702	3.43	22.83	1010.85
6/5/2022	11:00:00 PM	0	12.5071	4.983	6/5/2022	11:00:00 PM	0	890.423	8.455	3.43	22.83	1010.85
6/6/2022	12:00:00 AM	0	12.5091	4.982	6/6/2022	12:00:00 AM	0	891.022	8.119	3.42	22.84	1010.84
6/6/2022	1:00:00 AM	0	12.5117	4.982	6/6/2022	1:00:00 AM	0	891.523	7.764	3.42	22.84	1010.84
6/6/2022	2:00:00 AM	0	12.5143	4.982	6/6/2022	2:00:00 AM	0	891.996	7.773	3.42	22.84	1010.84
6/6/2022	3:00:00 AM	0	12.5169	4.983	6/6/2022	3:00:00 AM	0	892.637	7.893	3.41	22.85	1010.83
6/6/2022	4:00:00 AM	0	12.5196	4.983	6/6/2022	4:00:00 AM	0	893.364	7.818	3.41	22.85	1010.83
6/6/2022	5:00:00 AM	0	12.5228	4.982	6/6/2022	5:00:00 AM	0	893.903	7.739	3.41	22.85	1010.83
6/6/2022	6:00:00 AM	0	12.5259	4.983	6/6/2022	6:00:00 AM	0	894.587	7.651	3.40	22.86	1010.82
6/6/2022	7:00:00 AM	0	12.5295	4.982	6/6/2022	7:00:00 AM	0	895.261	7.919	3.40	22.86	1010.82
6/6/2022	8:00:00 AM	0	12.5329	4.983	6/6/2022	8:00:00 AM	0	895.916	8.894	3.40	22.86	1010.82
6/6/2022	9:00:00 AM	0	12.5367	4.982	6/6/2022	9:00:00 AM	0	896.657	10.086	3.39	22.87	1010.81
6/6/2022	10:00:00 AM	0	12.5405	4.983	6/6/2022	10:00:00 AM	0	897.358	9.614	3.39	22.87	1010.81
6/6/2022	11:00:00 AM	0	12.5385	4.984	6/6/2022	11:00:00 AM	0	897.78	12.931	3.38	22.88	1010.80
6/6/2022	12:00:00 PM	0	12.483	6.147	6/6/2022	12:00:00 PM	0	898.397	14.191	3.32	22.94	1010.74
6/6/2022	1:00:00 PM	0	12.5028	5.288	6/6/2022	1:00:00 PM	0	898.574	16.041	3.34	22.92	1010.76
6/6/2022	2:00:00 PM	0	12.5085	5.119	6/6/2022	2:00:00 PM	0	898.63	16.08	3.34	22.92	1010.76
6/6/2022	3:00:00 PM	0	12.5111	5.06	6/6/2022	3:00:00 PM	0	898.675	17.849	3.35	22.91	1010.77
6/6/2022	4:00:00 PM	0	12.5129	5.032	6/6/2022	4:00:00 PM	0	898.634	20.899	3.35	22.91	1010.77
6/6/2022	5:00:00 PM	0	12.515	5.019	6/6/2022	5:00:00 PM	0	898.816	16.493	3.35	22.91	1010.77
6/6/2022	6:00:00 PM	0	12.5163	5.009	6/6/2022	6:00:00 PM	0	898.707	19.641	3.35	22.91	1010.77
6/6/2022	7:00:00 PM	0	12.5176	5.005	6/6/2022	7:00:00 PM	0	899.404	16.744	3.35	22.91	1010.77
6/6/2022	8:00:00 PM	0	12.5201	5.001	6/6/2022	8:00:00 PM	0	899.934	10.944	3.34	22.92	1010.76
6/6/2022	9:00:00 PM	0	12.5222	4.998	6/6/2022	9:00:00 PM	0	900.298	8.398	3.34	22.92	1010.76
6/6/2022	10:00:00 PM	0	12.5239	4.996	6/6/2022	10:00:00 PM	0	900.561	7.229	3.34	22.92	1010.76
6/6/2022	11:00:00 PM	0	12.5266	4.994	6/6/2022	11:00:00 PM	0	900.857	7.05	3.34	22.92	1010.76
6/7/2022	12:00:00 AM	0	12.5288	4.994	6/7/2022	12:00:00 AM	0	901.044	6.436	3.34	22.92	1010.76
6/7/2022	1:00:00 AM	0	12.5305	4.992	6/7/2022	1:00:00 AM	0	901.217	5.821	3.34	22.92	1010.76
6/7/2022	2:00:00 AM	0	12.5315	4.992	6/7/2022	2:00:00 AM	0	901.245	5.395	3.34	22.92	1010.76
6/7/2022	3:00:00 AM	0	12.5328	4.991	6/7/2022	3:00:00 AM	0	901.092	4.94	3.34	22.92	1010.76
6/7/2022	4:00:00 AM	0	12.5333	4.991	6/7/2022	4:00:00 AM	0	901.335	4.484	3.34	22.92	1010.76
6/7/2022	5:00:00 AM	0	12.5339	4.99	6/7/2022	5:00:00 AM	0	901.525	4.302	3.34	22.92	1010.76
6/7/2022	6:00:00 AM	0	12.5343	4.989	6/7/2022	6:00:00 AM	0	901.26	4.927	3.34	22.92	1010.76
6/7/2022	7:00:00 AM	0	12.5341	4.989	6/7/2022	7:00:00 AM	0	901.433	7.536	3.34	22.92	1010.76
6/7/2022	8:00:00 AM	0	12.533	4.989	6/7/2022	8:00:00 AM	0	901.331	14.727	3.34	22.92	1010.76
6/7/2022	9:00:00 AM	0	12.5303	4.989	6/7/2022	9:00:00 AM	0	900.701	20.188	3.35	22.91	1010.77
6/7/2022	10:00:00 AM	0	12.5275	4.989	6/7/2022	10:00:00 AM	0	899.989	24.053	3.35	22.91	1010.77
6/7/2022	11:00:00 AM	0	12.5248	4.988	6/7/2022	11:00:00 AM	0	899.29	27.199	3.35	22.91	1010.77
6/7/2022	12:00:00 PM	0	12.5218	4.988	6/7/2022	12:00:00 PM	0	898.589	27.122	3.36	22.90	1010.78
6/7/2022	1:00:00 PM	0	12.5186	4.988	6/7/2022	1:00:00 PM	0	897.885	27.743	3.36	22.90	1010.78
6/7/2022	2:00:00 PM	0	12.5142	4.987	6/7/2022	2:00:00 PM	0	897.494	25.095	3.36	22.90	1010.78
6/7/2022	3:00:00 PM	0	12.5111	4.987	6/7/2022	3:00:00 PM	0	896.994	21.117	3.36	22.90	1010.78
6/7/2022	4:00:00 PM	0	12.5083	4.987	6/7/2022	4:00:00 PM	0	896.266	23.726	3.37	22.89	1010.79
6/7/2022	5:00:00 PM	0	12.5041	4.986	6/7/2022	5:00:00 PM	0	895.884	19.095	3.37	22.89	1010.79
6/7/2022	6:00:00 PM	0	12.4993	4.987	6/7/2022	6:00:00 PM	0	895.418	18.013	3.37	22.89	1010.79
6/7/2022	7:00:00 PM	0	12.4952	4.986	6/7/2022	7:00:00 PM	0	895.116	16.992	3.37	22.89	1010.79
6/7/2022	8:00:00 PM	0	12.4909	4.986	6/7/2022	8:00:00 PM	0	894.916	14.836	3.37	22.89	1010.79
6/7/2022	9:00:00 PM	0	12.4877	4.987	6/7/2022	9:00:00 PM	0	894.435	13.156	3.37	22.89	1010.79
6/7/2022	10:00:00 PM	0	12.484	4.986	6/7/2022	10:00:00 PM	0	894.043	12.432	3.37	22.89	1010.79
6/7/2022	11:00:00 PM	0	12.4804	4.987	6/7/2022	11:00:00 PM	0	893.739	12.007	3.37	22.89	1010.79
6/8/2022	12:00:00 AM	0	12.4789	4.986	6/8/2022	12:00:00 AM	0	895.019	10.079	3.35	22.91	1010.77
6/8/2022	1:00:00 AM	0	12.4775	4.987	6/8/2022	1:00:00 AM	0	894.173	9.133	3.36	22.90	1010.78
6/8/2022	2:00:00 AM	0	12.475	4.986	6/8/2022	2:00:00 AM	0	893.57	9.039	3.36	22.90	1010.78
6/8/2022	3:00:00 AM	0	12.4726	4.986	6/8/2022	3:00:00 AM	0	893.9	8.918	3.36	22.90	1010.78
6/8/2022	4:00:00 AM	0	12.4706	4.986	6/8/2022	4:00:00 AM	0	894.098	8.55	3.35	22.91	1010.77
6/8/2022	5:00:00 AM	0	12.4693	4.986	6/8/2022	5:00:00 AM	0	893.892	8.37	3.35	22.91	1010.77
6/8/2022	6:00:00 AM	0	12.4682	4.986	6/8/2022	6:00:00 AM	0	893.905	8.587	3.35	22.91	1010.77
6/8/2022	7:00:00 AM	0	12.4668	4.986	6/8/2022	7:00:00 AM	0	894.189	10.126	3.35	22.91	1010.77
6/8/2022	8:00:00 AM	0	12.4661	4.986	6/8/2022	8:00:00 AM	0	894.216	12.694	3.35	22.91	1010.77
6/8/2022	9:00:00 AM	0	12.4648	4.986	6/8/2022	9:00:00 AM	0	894.24	15.39	3.35	22.91	1010.77

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/8/2022	10:00:00 AM	0	12.4633	4.986	6/8/2022	10:00:00 AM	0	893.946	20.359	3.35	22.91	1010.77
6/8/2022	11:00:00 AM	0	12.4617	4.986	6/8/2022	11:00:00 AM	0	893.756	21.896	3.35	22.91	1010.77
6/8/2022	12:00:00 PM	0	12.4601	4.986	6/8/2022	12:00:00 PM	0	893.392	22.438	3.35	22.91	1010.77
6/8/2022	1:00:00 PM	0	12.4588	4.986	6/8/2022	1:00:00 PM	0	892.889	20.643	3.35	22.91	1010.77
6/8/2022	2:00:00 PM	0	12.4576	4.985	6/8/2022	2:00:00 PM	0	892.797	22.027	3.35	22.91	1010.77
6/8/2022	3:00:00 PM	0	12.4573	4.985	6/8/2022	3:00:00 PM	0	894.309	16.721	3.34	22.92	1010.76
6/8/2022	4:00:00 PM	0	12.4584	4.985	6/8/2022	4:00:00 PM	0	893.49	14.897	3.35	22.91	1010.77
6/8/2022	5:00:00 PM	0	12.4585	4.985	6/8/2022	5:00:00 PM	0	894.431	14.111	3.34	22.92	1010.76
6/8/2022	6:00:00 PM	0	12.4587	4.985	6/8/2022	6:00:00 PM	0	894.463	10.226	3.34	22.92	1010.76
6/8/2022	7:00:00 PM	0	12.4586	4.985	6/8/2022	7:00:00 PM	0	893.804	10.054	3.34	22.92	1010.76
6/8/2022	8:00:00 PM	0	12.458	4.985	6/8/2022	8:00:00 PM	0	894.226	9.47	3.34	22.92	1010.76
6/8/2022	9:00:00 PM	0	12.4599	4.986	6/8/2022	9:00:00 PM	0	894.631	8.505	3.34	22.92	1010.76
6/8/2022	10:00:00 PM	0	12.4609	4.985	6/8/2022	10:00:00 PM	0	895.1	7.485	3.33	22.93	1010.75
6/8/2022	11:00:00 PM	0	12.4622	4.985	6/8/2022	11:00:00 PM	0	895.313	6.679	3.33	22.93	1010.75
6/9/2022	12:00:00 AM	0	12.4639	4.985	6/9/2022	12:00:00 AM	0	895.246	6.011	3.33	22.93	1010.75
6/9/2022	1:00:00 AM	0	12.4652	4.984	6/9/2022	1:00:00 AM	0	895.646	5.733	3.33	22.93	1010.75
6/9/2022	2:00:00 AM	0	12.4661	4.985	6/9/2022	2:00:00 AM	0	895.731	5.316	3.33	22.93	1010.75
6/9/2022	3:00:00 AM	0	12.4674	4.985	6/9/2022	3:00:00 AM	0	895.477	4.769	3.34	22.92	1010.76
6/9/2022	4:00:00 AM	0	12.4675	4.985	6/9/2022	4:00:00 AM	0	895.281	4.235	3.34	22.92	1010.76
6/9/2022	5:00:00 AM	0	12.4673	4.985	6/9/2022	5:00:00 AM	0	895.197	4.909	3.34	22.92	1010.76
6/9/2022	6:00:00 AM	0	12.4669	4.985	6/9/2022	6:00:00 AM	0	895.033	6.589	3.34	22.92	1010.76
6/9/2022	7:00:00 AM	0	12.4659	4.985	6/9/2022	7:00:00 AM	0	894.886	8.073	3.34	22.92	1010.76
6/9/2022	8:00:00 AM	0	12.464	4.985	6/9/2022	8:00:00 AM	0	894.057	13.721	3.35	22.91	1010.77
6/9/2022	9:00:00 AM	0	12.4608	4.985	6/9/2022	9:00:00 AM	0	893.121	18.758	3.35	22.91	1010.77
6/9/2022	10:00:00 AM	0	12.4572	4.985	6/9/2022	10:00:00 AM	0	892.452	20.648	3.36	22.90	1010.78
6/9/2022	11:00:00 AM	0	12.4535	4.985	6/9/2022	11:00:00 AM	0	891.635	21.793	3.36	22.90	1010.78
6/9/2022	12:00:00 PM	0	12.45	4.984	6/9/2022	12:00:00 PM	0	891.332	21.142	3.36	22.90	1010.78
6/9/2022	1:00:00 PM	0	12.4465	4.985	6/9/2022	1:00:00 PM	0	890.572	19.863	3.37	22.89	1010.79
6/9/2022	2:00:00 PM	0	12.4427	4.985	6/9/2022	2:00:00 PM	0	890.273	17.926	3.36	22.90	1010.78
6/9/2022	3:00:00 PM	0	12.4403	4.984	6/9/2022	3:00:00 PM	0	890.663	16.499	3.36	22.90	1010.78
6/9/2022	4:00:00 PM	0	12.4389	4.984	6/9/2022	4:00:00 PM	0	890.562	11.898	3.36	22.90	1010.78
6/9/2022	5:00:00 PM	0	12.4367	4.984	6/9/2022	5:00:00 PM	0	889.947	9.16	3.36	22.90	1010.78
6/9/2022	6:00:00 PM	0	12.4344	4.984	6/9/2022	6:00:00 PM	0	889.394	8.136	3.37	22.89	1010.79
6/9/2022	7:00:00 PM	0	12.4314	4.985	6/9/2022	7:00:00 PM	0	889.029	7.712	3.37	22.89	1010.79
6/9/2022	8:00:00 PM	0	12.4285	4.985	6/9/2022	8:00:00 PM	0	888.277	6.961	3.37	22.89	1010.79
6/9/2022	9:00:00 PM	0	12.4253	4.985	6/9/2022	9:00:00 PM	0	888.245	6.805	3.37	22.89	1010.79
6/9/2022	10:00:00 PM	0	12.4226	4.985	6/9/2022	10:00:00 PM	0	888.187	6.79	3.37	22.89	1010.79
6/9/2022	11:00:00 PM	0	12.421	4.984	6/9/2022	11:00:00 PM	0	888.831	6.69	3.36	22.90	1010.78
6/10/2022	12:00:00 AM	0	12.4202	4.985	6/10/2022	12:00:00 AM	0	888.485	6.719	3.36	22.90	1010.78
6/10/2022	1:00:00 AM	0	12.4197	4.985	6/10/2022	1:00:00 AM	0	889.133	6.625	3.35	22.91	1010.77
6/10/2022	2:00:00 AM	0	12.4198	4.985	6/10/2022	2:00:00 AM	0	889.44	6.596	3.35	22.91	1010.77
6/10/2022	3:00:00 AM	0	12.4207	4.985	6/10/2022	3:00:00 AM	0	890.173	6.591	3.34	22.92	1010.76
6/10/2022	4:00:00 AM	0	12.4225	4.985	6/10/2022	4:00:00 AM	0	890.812	5.832	3.34	22.92	1010.76
6/10/2022	5:00:00 AM	0	12.4247	4.985	6/10/2022	5:00:00 AM	0	891.391	5.582	3.34	22.92	1010.76
6/10/2022	6:00:00 AM	0	12.4268	4.985	6/10/2022	6:00:00 AM	0	891.897	6.609	3.33	22.93	1010.75
6/10/2022	7:00:00 AM	0	12.4294	4.984	6/10/2022	7:00:00 AM	0	892.48	8.522	3.33	22.93	1010.75
6/10/2022	8:00:00 AM	0	12.431	4.984	6/10/2022	8:00:00 AM	0	892.579	14.466	3.33	22.93	1010.75
6/10/2022	9:00:00 AM	0	12.4323	4.984	6/10/2022	9:00:00 AM	0	892.452	20.167	3.33	22.93	1010.75
6/10/2022	10:00:00 AM	0	12.4326	4.985	6/10/2022	10:00:00 AM	0	891.978	23.398	3.34	22.92	1010.76
6/10/2022	11:00:00 AM	0	12.4334	4.985	6/10/2022	11:00:00 AM	0	891.932	23.223	3.34	22.92	1010.76
6/10/2022	12:00:00 PM	0	12.434	4.984	6/10/2022	12:00:00 PM	0	891.379	21.768	3.34	22.92	1010.76
6/10/2022	1:00:00 PM	0	12.4335	4.985	6/10/2022	1:00:00 PM	0	890.729	25.869	3.35	22.91	1010.77
6/10/2022	2:00:00 PM	0	12.4327	4.985	6/10/2022	2:00:00 PM	0	890.306	23.626	3.35	22.91	1010.77
6/10/2022	3:00:00 PM	0	12.4323	4.984	6/10/2022	3:00:00 PM	0	890.229	21.409	3.35	22.91	1010.77
6/10/2022	4:00:00 PM	0	12.4312	4.984	6/10/2022	4:00:00 PM	0	889.485	24.83	3.36	22.90	1010.78
6/10/2022	5:00:00 PM	0	12.43	4.985	6/10/2022	5:00:00 PM	0	889.4	20.685	3.36	22.90	1010.78
6/10/2022	6:00:00 PM	0	12.4282	4.984	6/10/2022	6:00:00 PM	0	889.08	22.895	3.36	22.90	1010.78
6/10/2022	7:00:00 PM	0	12.4272	4.984	6/10/2022	7:00:00 PM	0	889.371	21.102	3.36	22.90	1010.78
6/10/2022	8:00:00 PM	0	12.4264	4.984	6/10/2022	8:00:00 PM	0	889.786	14.863	3.35	22.91	1010.77
6/10/2022	9:00:00 PM	0	12.4267	4.984	6/10/2022	9:00:00 PM	0	890.287	11.7	3.35	22.91	1010.77
6/10/2022	10:00:00 PM	0	12.427	4.984	6/10/2022	10:00:00 PM	0	890.298	9.596	3.35	22.91	1010.77
6/10/2022	11:00:00 PM	0	12.4277	4.985	6/10/2022	11:00:00 PM	0	890.464	8.457	3.35	22.91	1010.77
6/11/2022	12:00:00 AM	0	12.4283	4.984	6/11/2022	12:00:00 AM	0	890.219	7.332	3.35	22.91	1010.77
6/11/2022	1:00:00 AM	0	12.4285	4.984	6/11/2022	1:00:00 AM	0	890.386	6.464	3.35	22.91	1010.77
6/11/2022	2:00:00 AM	0	12.4292	4.984	6/11/2022	2:00:00 AM	0	890.621	6.776	3.35	22.91	1010.77
6/11/2022	3:00:00 AM	0	12.4296	4.985	6/11/2022	3:00:00 AM	0	890.83	6.976	3.35	22.91	1010.77
6/11/2022	4:00:00 AM	0	12.4304	4.984	6/11/2022	4:00:00 AM	0	890.959	6.944	3.35	22.91	1010.77
6/11/2022	5:00:00 AM	0	12.4312	4.985	6/11/2022	5:00:00 AM	0	890.811	7.411	3.35	22.91	1010.77
6/11/2022	6:00:00 AM	0	12.4317	4.984	6/11/2022	6:00:00 AM	0	891.33	7.569	3.34	22.92	1010.76
6/11/2022	7:00:00 AM	0	12.4322	4.985	6/11/2022	7:00:00 AM	0	891.493	9.184	3.34	22.92	1010.76

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/11/2022	8:00:00 AM	0	12.4325	4.984	6/11/2022	8:00:00 AM	0	891.333	17.627	3.34	22.92	1010.76
6/11/2022	9:00:00 AM	0	12.4325	4.985	6/11/2022	9:00:00 AM	0	891.341	19.901	3.34	22.92	1010.76
6/11/2022	10:00:00 AM	0	12.432	4.984	6/11/2022	10:00:00 AM	0	890.998	20.753	3.35	22.91	1010.77
6/11/2022	11:00:00 AM	0	12.4312	4.984	6/11/2022	11:00:00 AM	0	890.426	23.238	3.35	22.91	1010.77
6/11/2022	12:00:00 PM	0	12.4302	4.985	6/11/2022	12:00:00 PM	0	889.859	23.294	3.36	22.90	1010.78
6/11/2022	1:00:00 PM	0	12.4286	4.985	6/11/2022	1:00:00 PM	0	889.051	26.75	3.36	22.90	1010.78
6/11/2022	2:00:00 PM	0	12.4279	4.984	6/11/2022	2:00:00 PM	0	890.31	21.15	3.35	22.91	1010.77
6/11/2022	3:00:00 PM	0	12.429	4.984	6/11/2022	3:00:00 PM	0	890.388	16.135	3.35	22.91	1010.77
6/11/2022	4:00:00 PM	0	12.4295	4.984	6/11/2022	4:00:00 PM	0	889.642	19.864	3.36	22.90	1010.78
6/11/2022	5:00:00 PM	0	12.4299	4.984	6/11/2022	5:00:00 PM	0	890.622	15.815	3.35	22.91	1010.77
6/11/2022	6:00:00 PM	0	12.4306	4.984	6/11/2022	6:00:00 PM	0	890.427	14.441	3.35	22.91	1010.77
6/11/2022	7:00:00 PM	0	12.431	4.984	6/11/2022	7:00:00 PM	0	890.883	14.131	3.35	22.91	1010.77
6/11/2022	8:00:00 PM	0	12.4331	4.984	6/11/2022	8:00:00 PM	0	891.845	10.812	3.34	22.92	1010.76
6/11/2022	9:00:00 PM	0	12.4355	4.985	6/11/2022	9:00:00 PM	0	891.845	8.756	3.34	22.92	1010.76
6/11/2022	10:00:00 PM	0	12.4373	4.984	6/11/2022	10:00:00 PM	0	891.83	6.906	3.34	22.92	1010.76
6/11/2022	11:00:00 PM	0	12.4389	4.984	6/11/2022	11:00:00 PM	0	891.683	5.586	3.35	22.91	1010.77
6/12/2022	12:00:00 AM	0	12.44	4.984	6/12/2022	12:00:00 AM	0	891.938	4.803	3.34	22.92	1010.76
6/12/2022	1:00:00 AM	0	12.4413	4.985	6/12/2022	1:00:00 AM	0	892.011	4.595	3.35	22.91	1010.77
6/12/2022	2:00:00 AM	0	12.4423	4.984	6/12/2022	2:00:00 AM	0	891.916	4.766	3.35	22.91	1010.77
6/12/2022	3:00:00 AM	0	12.443	4.984	6/12/2022	3:00:00 AM	0	891.545	4.32	3.35	22.91	1010.77
6/12/2022	4:00:00 AM	0	12.4432	4.985	6/12/2022	4:00:00 AM	0	891.524	3.759	3.35	22.91	1010.77
6/12/2022	5:00:00 AM	0	12.4433	4.984	6/12/2022	5:00:00 AM	0	891.474	4.355	3.35	22.91	1010.77
6/12/2022	6:00:00 AM	0	12.4429	4.984	6/12/2022	6:00:00 AM	0	891.644	5.212	3.35	22.91	1010.77
6/12/2022	7:00:00 AM	0	12.4431	4.985	6/12/2022	7:00:00 AM	0	891.813	7.134	3.35	22.91	1010.77
6/12/2022	8:00:00 AM	0	12.4426	4.985	6/12/2022	8:00:00 AM	0	891.595	10.031	3.35	22.91	1010.77
6/12/2022	9:00:00 AM	0	12.4416	4.984	6/12/2022	9:00:00 AM	0	891.185	13.909	3.35	22.91	1010.77
6/12/2022	10:00:00 AM	0	12.4389	4.984	6/12/2022	10:00:00 AM	0	890.271	22.62	3.36	22.90	1010.78
6/12/2022	11:00:00 AM	0	12.4358	4.984	6/12/2022	11:00:00 AM	0	889.395	25.072	3.37	22.89	1010.79
6/12/2022	12:00:00 PM	0	12.4335	4.985	6/12/2022	12:00:00 PM	0	889.139	23.505	3.37	22.89	1010.79
6/12/2022	1:00:00 PM	0	12.4323	4.984	6/12/2022	1:00:00 PM	0	889.021	17.839	3.37	22.89	1010.79
6/12/2022	2:00:00 PM	0	12.4311	4.984	6/12/2022	2:00:00 PM	0	888.979	18.143	3.37	22.89	1010.79
6/12/2022	3:00:00 PM	0	12.4315	4.984	6/12/2022	3:00:00 PM	0	890.306	13.274	3.35	22.91	1010.77
6/12/2022	4:00:00 PM	0	12.4324	4.984	6/12/2022	4:00:00 PM	0	889.994	16.096	3.36	22.90	1010.78
6/12/2022	5:00:00 PM	0	12.4325	4.984	6/12/2022	5:00:00 PM	0	889.572	13.501	3.36	22.90	1010.78
6/12/2022	6:00:00 PM	0	12.4327	4.984	6/12/2022	6:00:00 PM	0	889.177	11.592	3.37	22.89	1010.79
6/12/2022	7:00:00 PM	0	12.4322	4.985	6/12/2022	7:00:00 PM	0	889.287	10.633	3.36	22.90	1010.78
6/12/2022	8:00:00 PM	0	12.4314	4.984	6/12/2022	8:00:00 PM	0	889.381	9.11	3.36	22.90	1010.78
6/12/2022	9:00:00 PM	0	12.4313	4.984	6/12/2022	9:00:00 PM	0	889.465	7.37	3.36	22.90	1010.78
6/12/2022	10:00:00 PM	0	12.4315	4.984	6/12/2022	10:00:00 PM	0	889.613	6.717	3.36	22.90	1010.78
6/12/2022	11:00:00 PM	0	12.432	4.984	6/12/2022	11:00:00 PM	0	889.524	6.962	3.36	22.90	1010.78
6/13/2022	12:00:00 AM	0	12.4318	4.984	6/13/2022	12:00:00 AM	0	889.507	7.123	3.36	22.90	1010.78
6/13/2022	1:00:00 AM	0	12.4321	4.985	6/13/2022	1:00:00 AM	0	889.544	7.005	3.36	22.90	1010.78
6/13/2022	2:00:00 AM	0	12.4326	4.984	6/13/2022	2:00:00 AM	0	889.727	5.873	3.36	22.90	1010.78
6/13/2022	3:00:00 AM	0	12.4329	4.985	6/13/2022	3:00:00 AM	0	889.898	5.23	3.36	22.90	1010.78
6/13/2022	4:00:00 AM	0	12.4335	4.984	6/13/2022	4:00:00 AM	0	890.039	5.131	3.36	22.90	1010.78
6/13/2022	5:00:00 AM	0	12.4343	4.984	6/13/2022	5:00:00 AM	0	890.245	5.416	3.36	22.90	1010.78
6/13/2022	6:00:00 AM	0	12.4357	4.984	6/13/2022	6:00:00 AM	0	891.019	7.06	3.35	22.91	1010.77
6/13/2022	7:00:00 AM	0	12.4374	4.984	6/13/2022	7:00:00 AM	0	891.391	9.086	3.35	22.91	1010.77
6/13/2022	8:00:00 AM	0	12.4384	4.984	6/13/2022	8:00:00 AM	0	891.73	10.514	3.35	22.91	1010.77
6/13/2022	9:00:00 AM	0	12.4395	4.984	6/13/2022	9:00:00 AM	0	891.718	12.608	3.35	22.91	1010.77
6/13/2022	10:00:00 AM	0	12.4404	4.984	6/13/2022	10:00:00 AM	0	891.817	17.571	3.35	22.91	1010.77
6/13/2022	11:00:00 AM	0	12.4706	5.108	6/13/2022	11:00:00 AM	0	891.525	22.866	3.38	22.88	1010.80
6/13/2022	12:00:00 PM	0	12.4729	5.014	6/13/2022	12:00:00 PM	0	891.826	21.023	3.38	22.88	1010.80
6/13/2022	1:00:00 PM	0	12.4748	4.997	6/13/2022	1:00:00 PM	0	891.888	20.503	3.38	22.88	1010.80
6/13/2022	2:00:00 PM	0	12.4754	4.991	6/13/2022	2:00:00 PM	0	891.584	21.409	3.38	22.88	1010.80
6/13/2022	3:00:00 PM	0	12.4771	4.988	6/13/2022	3:00:00 PM	0	892.03	18.917	3.38	22.88	1010.80
6/13/2022	4:00:00 PM	0	12.4792	4.988	6/13/2022	4:00:00 PM	0	892.545	16.769	3.38	22.88	1010.80
6/13/2022	5:00:00 PM	0	12.4813	4.987	6/13/2022	5:00:00 PM	0	892.802	15.836	3.38	22.88	1010.80
6/13/2022	6:00:00 PM	0	12.4834	4.986	6/13/2022	6:00:00 PM	0	893.122	14.626	3.38	22.88	1010.80
6/13/2022	7:00:00 PM	0	12.4858	4.985	6/13/2022	7:00:00 PM	0	893.421	12.8	3.38	22.88	1010.80
6/13/2022	8:00:00 PM	0	12.4878	4.986	6/13/2022	8:00:00 PM	0	893.825	11.232	3.37	22.89	1010.79
6/13/2022	9:00:00 PM	0	12.49	4.986	6/13/2022	9:00:00 PM	0	894.151	9.796	3.37	22.89	1010.79
6/13/2022	10:00:00 PM	0	12.4923	4.985	6/13/2022	10:00:00 PM	0	894.35	8.681	3.37	22.89	1010.79
6/13/2022	11:00:00 PM	0	12.4946	4.985	6/13/2022	11:00:00 PM	0	894.542	8	3.37	22.89	1010.79
6/14/2022	12:00:00 AM	0	12.4967	4.985	6/14/2022	12:00:00 AM	0	894.621	7.157	3.37	22.89	1010.79
6/14/2022	1:00:00 AM	0	12.498	4.985	6/14/2022	1:00:00 AM	0	894.868	6.722	3.37	22.89	1010.79
6/14/2022	2:00:00 AM	0	12.5001	4.985	6/14/2022	2:00:00 AM	0	895.045	6.455	3.37	22.89	1010.79
6/14/2022	3:00:00 AM	0	12.5019	4.985	6/14/2022	3:00:00 AM	0	895.311	6.321	3.37	22.89	1010.79
6/14/2022	4:00:00 AM	0	12.5037	4.985	6/14/2022	4:00:00 AM	0	895.513	5.865	3.37	22.89	1010.79
6/14/2022	5:00:00 AM	0	12.5049	4.984	6/14/2022	5:00:00 AM	0	896.026	5.832	3.37	22.89	1010.79

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/14/2022	6:00:00 AM	0	12.5069	4.985	6/14/2022	6:00:00 AM	0	896.479	6.334	3.37	22.89	1010.79
6/14/2022	7:00:00 AM	0	12.5096	4.985	6/14/2022	7:00:00 AM	0	897.021	8.158	3.36	22.90	1010.78
6/14/2022	8:00:00 AM	0	12.511	4.984	6/14/2022	8:00:00 AM	0	897.247	12.991	3.36	22.90	1010.78
6/14/2022	9:00:00 AM	0	12.5128	4.985	6/14/2022	9:00:00 AM	0	897.548	16.227	3.36	22.90	1010.78
6/14/2022	10:00:00 AM	0	12.5133	4.984	6/14/2022	10:00:00 AM	0	897.518	20.45	3.36	22.90	1010.78
6/14/2022	11:00:00 AM	0	12.5138	4.984	6/14/2022	11:00:00 AM	0	897.373	23.088	3.36	22.90	1010.78
6/14/2022	12:00:00 PM	0	12.5146	4.985	6/14/2022	12:00:00 PM	0	897.026	24.01	3.37	22.89	1010.79
6/14/2022	1:00:00 PM	0	12.5151	4.985	6/14/2022	1:00:00 PM	0	896.949	24.704	3.37	22.89	1010.79
6/14/2022	2:00:00 PM	0	12.5155	4.985	6/14/2022	2:00:00 PM	0	896.934	26.514	3.37	22.89	1010.79
6/14/2022	3:00:00 PM	0	12.5159	4.984	6/14/2022	3:00:00 PM	0	897.18	22.226	3.37	22.89	1010.79
6/14/2022	4:00:00 PM	0	12.5175	4.985	6/14/2022	4:00:00 PM	0	896.829	27.235	3.37	22.89	1010.79
6/14/2022	5:00:00 PM	0	12.5184	4.985	6/14/2022	5:00:00 PM	0	896.993	20.833	3.37	22.89	1010.79
6/14/2022	6:00:00 PM	0	12.5191	4.985	6/14/2022	6:00:00 PM	0	896.965	21.156	3.37	22.89	1010.79
6/14/2022	7:00:00 PM	0	12.5195	4.984	6/14/2022	7:00:00 PM	0	897.392	19.104	3.37	22.89	1010.79
6/14/2022	8:00:00 PM	0	12.5203	4.984	6/14/2022	8:00:00 PM	0	897.567	14.173	3.37	22.89	1010.79
6/14/2022	9:00:00 PM	0	12.5213	4.985	6/14/2022	9:00:00 PM	0	897.983	10.992	3.36	22.90	1010.78
6/14/2022	10:00:00 PM	0	12.5223	4.984	6/14/2022	10:00:00 PM	0	898.031	9.014	3.36	22.90	1010.78
6/14/2022	11:00:00 PM	0	12.5234	4.985	6/14/2022	11:00:00 PM	0	898.15	7.852	3.36	22.90	1010.78
6/15/2022	12:00:00 AM	0	12.5244	4.985	6/15/2022	12:00:00 AM	0	898.303	7.028	3.36	22.90	1010.78
6/15/2022	1:00:00 AM	0	12.5247	4.985	6/15/2022	1:00:00 AM	0	898.046	6.541	3.37	22.89	1010.79
6/15/2022	2:00:00 AM	0	12.5246	4.984	6/15/2022	2:00:00 AM	0	897.805	6.283	3.37	22.89	1010.79
6/15/2022	3:00:00 AM	0	12.524	4.984	6/15/2022	3:00:00 AM	0	897.613	5.865	3.37	22.89	1010.79
6/15/2022	4:00:00 AM	0	12.5237	4.984	6/15/2022	4:00:00 AM	0	897.454	5.457	3.37	22.89	1010.79
6/15/2022	5:00:00 AM	0	12.5225	4.984	6/15/2022	5:00:00 AM	0	897.41	5.428	3.37	22.89	1010.79
6/15/2022	6:00:00 AM	0	12.5217	4.985	6/15/2022	6:00:00 AM	0	897.547	5.627	3.37	22.89	1010.79
6/15/2022	7:00:00 AM	0	12.521	4.984	6/15/2022	7:00:00 AM	0	897.758	7.683	3.37	22.89	1010.79
6/15/2022	8:00:00 AM	0	12.5192	4.984	6/15/2022	8:00:00 AM	0	897.335	15.885	3.37	22.89	1010.79
6/15/2022	9:00:00 AM	0	12.5164	4.985	6/15/2022	9:00:00 AM	0	896.572	23.402	3.37	22.89	1010.79
6/15/2022	10:00:00 AM	0	12.5124	4.985	6/15/2022	10:00:00 AM	0	896.069	27.347	3.38	22.88	1010.80
6/15/2022	11:00:00 AM	0	12.5104	4.985	6/15/2022	11:00:00 AM	0	895.515	29.147	3.38	22.88	1010.80
6/15/2022	12:00:00 PM	0	12.5078	4.985	6/15/2022	12:00:00 PM	0	895.081	30.241	3.38	22.88	1010.80
6/15/2022	1:00:00 PM	0	12.5045	4.985	6/15/2022	1:00:00 PM	0	894.538	30.613	3.38	22.88	1010.80
6/15/2022	2:00:00 PM	0	12.5016	4.984	6/15/2022	2:00:00 PM	0	893.758	31.522	3.39	22.87	1010.81
6/15/2022	3:00:00 PM	0	12.499	4.985	6/15/2022	3:00:00 PM	0	894.306	24.88	3.38	22.88	1010.80
6/15/2022	4:00:00 PM	0	12.4979	4.984	6/15/2022	4:00:00 PM	0	894.063	26.795	3.38	22.88	1010.80
6/15/2022	5:00:00 PM	0	12.4959	4.984	6/15/2022	5:00:00 PM	0	893.791	22.34	3.38	22.88	1010.80
6/15/2022	6:00:00 PM	0	12.4938	4.985	6/15/2022	6:00:00 PM	0	893.24	23.196	3.39	22.87	1010.81
6/15/2022	7:00:00 PM	0	12.4914	4.985	6/15/2022	7:00:00 PM	0	893.311	21.354	3.38	22.88	1010.80
6/15/2022	8:00:00 PM	0	12.4896	4.985	6/15/2022	8:00:00 PM	0	893.33	16.664	3.38	22.88	1010.80
6/15/2022	9:00:00 PM	0	12.4874	4.984	6/15/2022	9:00:00 PM	0	893.164	13.589	3.38	22.88	1010.80
6/15/2022	10:00:00 PM	0	12.4862	4.984	6/15/2022	10:00:00 PM	0	894.749	12.081	3.36	22.90	1010.78
6/15/2022	11:00:00 PM	0	12.4869	4.985	6/15/2022	11:00:00 PM	0	894.927	10.408	3.36	22.90	1010.78
6/16/2022	12:00:00 AM	0	12.4881	4.985	6/16/2022	12:00:00 AM	0	895.207	9.735	3.36	22.90	1010.78
6/16/2022	1:00:00 AM	0	12.4884	4.985	6/16/2022	1:00:00 AM	0	894.483	9.089	3.37	22.89	1010.79
6/16/2022	2:00:00 AM	0	12.4873	4.984	6/16/2022	2:00:00 AM	0	893.891	8.539	3.37	22.89	1010.79
6/16/2022	3:00:00 AM	0	12.4852	4.985	6/16/2022	3:00:00 AM	0	893.963	8.721	3.37	22.89	1010.79
6/16/2022	4:00:00 AM	0	12.484	4.984	6/16/2022	4:00:00 AM	0	894.216	8.489	3.37	22.89	1010.79
6/16/2022	5:00:00 AM	0	12.483	4.984	6/16/2022	5:00:00 AM	0	894.059	8.475	3.37	22.89	1010.79
6/16/2022	6:00:00 AM	0	12.4823	4.984	6/16/2022	6:00:00 AM	0	894.087	8.801	3.37	22.89	1010.79
6/16/2022	7:00:00 AM	0	12.4816	4.985	6/16/2022	7:00:00 AM	0	894.456	9.854	3.36	22.90	1010.78
6/16/2022	8:00:00 AM	0	12.4809	4.984	6/16/2022	8:00:00 AM	0	894.086	10.078	3.36	22.90	1010.78
6/16/2022	9:00:00 AM	0	12.4798	4.984	6/16/2022	9:00:00 AM	0	894.03	11.239	3.36	22.90	1010.78
6/16/2022	10:00:00 AM	0	12.4779	4.984	6/16/2022	10:00:00 AM	0	893.931	10.587	3.36	22.90	1010.78
6/16/2022	11:00:00 AM	0	12.4774	4.985	6/16/2022	11:00:00 AM	0	894.612	10.005	3.35	22.91	1010.77
6/16/2022	12:00:00 PM	0	12.4764	4.985	6/16/2022	12:00:00 PM	0	894.139	9.534	3.36	22.90	1010.78
6/16/2022	1:00:00 PM	0	12.4756	4.985	6/16/2022	1:00:00 PM	0	893.859	12.454	3.36	22.90	1010.78
6/16/2022	2:00:00 PM	0	12.4737	4.984	6/16/2022	2:00:00 PM	0	893.84	11.982	3.36	22.90	1010.78
6/16/2022	3:00:00 PM	0	12.4727	4.984	6/16/2022	3:00:00 PM	0	894.12	13.051	3.36	22.90	1010.78
6/16/2022	4:00:00 PM	0	12.4716	4.985	6/16/2022	4:00:00 PM	0	894.04	14.067	3.35	22.91	1010.77
6/16/2022	5:00:00 PM	0	12.4711	4.984	6/16/2022	5:00:00 PM	0	893.867	13.246	3.36	22.90	1010.78
6/16/2022	6:00:00 PM	0	12.4699	4.985	6/16/2022	6:00:00 PM	0	894.18	12.734	3.35	22.91	1010.77
6/16/2022	7:00:00 PM	0	12.4703	4.985	6/16/2022	7:00:00 PM	0	894.729	11.677	3.35	22.91	1010.77
6/16/2022	8:00:00 PM	0	12.4717	4.984	6/16/2022	8:00:00 PM	0	895.277	10.067	3.34	22.92	1010.76
6/16/2022	9:00:00 PM	0	12.4734	4.984	6/16/2022	9:00:00 PM	0	895.184	7.958	3.35	22.91	1010.77
6/16/2022	10:00:00 PM	0	12.4741	4.985	6/16/2022	10:00:00 PM	0	894.932	6.651	3.35	22.91	1010.77
6/16/2022	11:00:00 PM	0	12.4744	4.985	6/16/2022	11:00:00 PM	0	895.254	5.495	3.35	22.91	1010.77
6/17/2022	12:00:00 AM	0	12.4743	4.984	6/17/2022	12:00:00 AM	0	894.932	4.912	3.35	22.91	1010.77
6/17/2022	1:00:00 AM	0	12.4742	4.984	6/17/2022	1:00:00 AM	0	894.858	4.353	3.35	22.91	1010.77
6/17/2022	2:00:00 AM	0	12.4735	4.985	6/17/2022	2:00:00 AM	0	894.833	3.861	3.35	22.91	1010.77
6/17/2022	3:00:00 AM	0	12.4725	4.984	6/17/2022	3:00:00 AM	0	894.666	4.404	3.35	22.91	1010.77

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/17/2022	4:00:00 AM	0	12.4714	4.984	6/17/2022	4:00:00 AM	0	894.724	4.767	3.35	22.91	1010.77
6/17/2022	5:00:00 AM	0	12.4703	4.985	6/17/2022	5:00:00 AM	0	894.756	4.951	3.35	22.91	1010.77
6/17/2022	6:00:00 AM	0	12.4689	4.985	6/17/2022	6:00:00 AM	0	894.323	5.878	3.35	22.91	1010.77
6/17/2022	7:00:00 AM	0	12.4669	4.985	6/17/2022	7:00:00 AM	0	893.973	8.13	3.35	22.91	1010.77
6/17/2022	8:00:00 AM	0	12.4629	4.984	6/17/2022	8:00:00 AM	0	893.335	13.287	3.35	22.91	1010.77
6/17/2022	9:00:00 AM	0	12.4593	4.985	6/17/2022	9:00:00 AM	0	893.077	18.69	3.35	22.91	1010.77
6/17/2022	10:00:00 AM	0	12.4554	4.984	6/17/2022	10:00:00 AM	0	892.31	22.63	3.36	22.90	1010.78
6/17/2022	11:00:00 AM	0	12.4511	4.984	6/17/2022	11:00:00 AM	0	891.581	23.498	3.36	22.90	1010.78
6/17/2022	12:00:00 PM	0	12.4466	4.984	6/17/2022	12:00:00 PM	0	890.8	25.284	3.36	22.90	1010.78
6/17/2022	1:00:00 PM	0	12.4418	4.985	6/17/2022	1:00:00 PM	0	890.274	26.224	3.36	22.90	1010.78
6/17/2022	2:00:00 PM	0	12.4383	4.985	6/17/2022	2:00:00 PM	0	890.412	25.206	3.36	22.90	1010.78
6/17/2022	3:00:00 PM	0	12.4352	4.985	6/17/2022	3:00:00 PM	0	890.359	23.996	3.36	22.90	1010.78
6/17/2022	4:00:00 PM	0	12.4326	4.984	6/17/2022	4:00:00 PM	0	890.059	23.758	3.36	22.90	1010.78
6/17/2022	5:00:00 PM	0	12.4303	4.985	6/17/2022	5:00:00 PM	0	890.266	20.982	3.35	22.91	1010.77
6/17/2022	6:00:00 PM	0	12.4287	4.984	6/17/2022	6:00:00 PM	0	890.257	18.419	3.35	22.91	1010.77
6/17/2022	7:00:00 PM	0	12.4269	4.984	6/17/2022	7:00:00 PM	0	890.587	15.411	3.35	22.91	1010.77
6/17/2022	8:00:00 PM	0	12.4261	4.984	6/17/2022	8:00:00 PM	0	891.172	13.563	3.34	22.92	1010.76
6/17/2022	9:00:00 PM	0	12.4267	4.984	6/17/2022	9:00:00 PM	0	891.524	12.245	3.34	22.92	1010.76
6/17/2022	10:00:00 PM	0	12.4274	4.985	6/17/2022	10:00:00 PM	0	891.864	10.459	3.33	22.93	1010.75
6/17/2022	11:00:00 PM	0	12.428	4.985	6/17/2022	11:00:00 PM	0	891.624	9.198	3.34	22.92	1010.76
6/18/2022	12:00:00 AM	0	12.428	4.984	6/18/2022	12:00:00 AM	0	891.613	8.765	3.34	22.92	1010.76
6/18/2022	1:00:00 AM	0	12.4274	4.984	6/18/2022	1:00:00 AM	0	891.698	8.417	3.33	22.93	1010.75
6/18/2022	2:00:00 AM	0	12.4272	4.985	6/18/2022	2:00:00 AM	0	891.593	8.231	3.34	22.92	1010.76
6/18/2022	3:00:00 AM	0	12.4263	4.984	6/18/2022	3:00:00 AM	0	891.74	8.127	3.33	22.93	1010.75
6/18/2022	4:00:00 AM	0	12.426	4.985	6/18/2022	4:00:00 AM	0	892.119	7.83	3.33	22.93	1010.75
6/18/2022	5:00:00 AM	0	12.4264	4.985	6/18/2022	5:00:00 AM	0	892.43	7.709	3.33	22.93	1010.75
6/18/2022	6:00:00 AM	0	12.4269	4.985	6/18/2022	6:00:00 AM	0	892.596	8.068	3.32	22.94	1010.74
6/18/2022	7:00:00 AM	0	12.4271	4.984	6/18/2022	7:00:00 AM	0	892.669	8.293	3.32	22.94	1010.74
6/18/2022	8:00:00 AM	0	12.4275	4.985	6/18/2022	8:00:00 AM	0	892.899	9.236	3.32	22.94	1010.74
6/18/2022	9:00:00 AM	0	12.4275	4.984	6/18/2022	9:00:00 AM	0	893.177	10.796	3.32	22.94	1010.74
6/18/2022	10:00:00 AM	0	12.4278	4.984	6/18/2022	10:00:00 AM	0	893.43	10.985	3.32	22.94	1010.74
6/18/2022	11:00:00 AM	0	12.4283	4.985	6/18/2022	11:00:00 AM	0	893.486	12.592	3.32	22.94	1010.74
6/18/2022	12:00:00 PM	0	12.4275	4.984	6/18/2022	12:00:00 PM	0	893.343	17.072	3.32	22.94	1010.74
6/18/2022	1:00:00 PM	0	12.426	4.984	6/18/2022	1:00:00 PM	0	892.643	23.455	3.32	22.94	1010.74
6/18/2022	2:00:00 PM	0	12.4247	4.985	6/18/2022	2:00:00 PM	0	893.024	23.049	3.32	22.94	1010.74
6/18/2022	3:00:00 PM	0	12.4248	4.985	6/18/2022	3:00:00 PM	0	893.72	19.507	3.31	22.95	1010.73
6/18/2022	4:00:00 PM	0	12.4257	4.985	6/18/2022	4:00:00 PM	0	893.697	15.186	3.31	22.95	1010.73
6/18/2022	5:00:00 PM	0	12.4263	4.984	6/18/2022	5:00:00 PM	0	894.172	15.649	3.31	22.95	1010.73
6/18/2022	6:00:00 PM	0	12.4274	4.984	6/18/2022	6:00:00 PM	0	894.168	16.5	3.31	22.95	1010.73
6/18/2022	7:00:00 PM	0	12.4287	4.985	6/18/2022	7:00:00 PM	0	894.72	15.338	3.31	22.95	1010.73
6/18/2022	8:00:00 PM	0	12.4298	4.985	6/18/2022	8:00:00 PM	0	894.816	12.754	3.31	22.95	1010.73
6/18/2022	9:00:00 PM	0	12.4318	4.984	6/18/2022	9:00:00 PM	0	895.553	10.983	3.30	22.96	1010.72
6/18/2022	10:00:00 PM	0	12.4336	4.984	6/18/2022	10:00:00 PM	0	895.812	9.984	3.30	22.96	1010.72
6/18/2022	11:00:00 PM	0	12.4355	4.985	6/18/2022	11:00:00 PM	0	896.151	9.248	3.30	22.96	1010.72
6/19/2022	12:00:00 AM	0	12.4375	4.985	6/19/2022	12:00:00 AM	0	896.293	8.918	3.30	22.96	1010.72
6/19/2022	1:00:00 AM	0	12.4384	4.985	6/19/2022	1:00:00 AM	0	896.352	8.352	3.30	22.96	1010.72
6/19/2022	2:00:00 AM	0	12.4391	4.985	6/19/2022	2:00:00 AM	0	896.513	8.557	3.30	22.96	1010.72
6/19/2022	3:00:00 AM	0	12.4405	4.984	6/19/2022	3:00:00 AM	0	896.88	8.626	3.29	22.97	1010.71
6/19/2022	4:00:00 AM	0	12.4417	4.985	6/19/2022	4:00:00 AM	0	897.311	8.502	3.29	22.97	1010.71
6/19/2022	5:00:00 AM	0	12.4435	4.984	6/19/2022	5:00:00 AM	0	897.77	8.758	3.29	22.97	1010.71
6/19/2022	6:00:00 AM	0	12.4453	4.985	6/19/2022	6:00:00 AM	0	898.107	9.239	3.29	22.97	1010.71
6/19/2022	7:00:00 AM	0	12.4474	4.985	6/19/2022	7:00:00 AM	0	898.491	9.996	3.29	22.97	1010.71
6/19/2022	8:00:00 AM	0	12.4491	4.984	6/19/2022	8:00:00 AM	0	898.935	10.858	3.28	22.98	1010.70
6/19/2022	9:00:00 AM	0	12.4511	4.985	6/19/2022	9:00:00 AM	0	899.191	11.355	3.28	22.98	1010.70
6/19/2022	10:00:00 AM	0	12.4523	4.984	6/19/2022	10:00:00 AM	0	899.115	14.016	3.28	22.98	1010.70
6/19/2022	11:00:00 AM	0	12.4532	4.985	6/19/2022	11:00:00 AM	0	899.008	18.682	3.29	22.97	1010.71
6/19/2022	12:00:00 PM	0	12.4535	4.984	6/19/2022	12:00:00 PM	0	899.245	19.562	3.28	22.98	1010.70
6/19/2022	1:00:00 PM	0	12.4535	4.984	6/19/2022	1:00:00 PM	0	899.002	22.261	3.29	22.97	1010.71
6/19/2022	2:00:00 PM	0	12.4526	4.985	6/19/2022	2:00:00 PM	0	898.808	23.758	3.29	22.97	1010.71
6/19/2022	3:00:00 PM	0	12.4524	4.985	6/19/2022	3:00:00 PM	0	898.623	21.417	3.29	22.97	1010.71
6/19/2022	4:00:00 PM	0	12.4521	4.984	6/19/2022	4:00:00 PM	0	898.187	24.148	3.29	22.97	1010.71
6/19/2022	5:00:00 PM	0	12.4515	4.985	6/19/2022	5:00:00 PM	0	898.24	19.705	3.29	22.97	1010.71
6/19/2022	6:00:00 PM	0	12.4505	4.984	6/19/2022	6:00:00 PM	0	898.083	20.598	3.29	22.97	1010.71
6/19/2022	7:00:00 PM	0	12.4496	4.985	6/19/2022	7:00:00 PM	0	898.448	19.745	3.29	22.97	1010.71
6/19/2022	8:00:00 PM	0	12.45	4.985	6/19/2022	8:00:00 PM	0	899.09	15.024	3.28	22.98	1010.70
6/19/2022	9:00:00 PM	0	12.4505	4.984	6/19/2022	9:00:00 PM	0	899.728	11.731	3.28	22.98	1010.70
6/19/2022	10:00:00 PM	0	12.4526	4.985	6/19/2022	10:00:00 PM	0	900.014	9.647	3.27	22.99	1010.69
6/19/2022	11:00:00 PM	0	12.4539	4.984	6/19/2022	11:00:00 PM	0	900.333	8.518	3.27	22.99	1010.69
6/20/2022	12:00:00 AM	0	12.4552	4.984	6/20/2022	12:00:00 AM	0	900.404	7.919	3.27	22.99	1010.69
6/20/2022	1:00:00 AM	0	12.4565	4.984	6/20/2022	1:00:00 AM	0	900.489	7.74	3.27	22.99	1010.69

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/20/2022	2:00:00 AM	0	12.4575	4.985	6/20/2022	2:00:00 AM	0	900.862	7.253	3.27	22.99	1010.69
6/20/2022	3:00:00 AM	0	12.4587	4.985	6/20/2022	3:00:00 AM	0	901.441	7.414	3.27	22.99	1010.69
6/20/2022	4:00:00 AM	0	12.4605	4.985	6/20/2022	4:00:00 AM	0	901.741	6.875	3.27	22.99	1010.69
6/20/2022	5:00:00 AM	0	12.4625	4.984	6/20/2022	5:00:00 AM	0	902.321	6.431	3.26	23.00	1010.68
6/20/2022	6:00:00 AM	0	12.4649	4.985	6/20/2022	6:00:00 AM	0	902.722	6.804	3.26	23.00	1010.68
6/20/2022	7:00:00 AM	0	12.4667	4.985	6/20/2022	7:00:00 AM	0	902.889	8.059	3.26	23.00	1010.68
6/20/2022	8:00:00 AM	0	12.4674	4.984	6/20/2022	8:00:00 AM	0	902.946	14.707	3.26	23.00	1010.68
6/20/2022	9:00:00 AM	0	12.4671	4.985	6/20/2022	9:00:00 AM	0	902.597	22.698	3.26	23.00	1010.68
6/20/2022	10:00:00 AM	0	12.467	4.984	6/20/2022	10:00:00 AM	0	902.547	26.488	3.26	23.00	1010.68
6/20/2022	11:00:00 AM	0	12.467	4.985	6/20/2022	11:00:00 AM	0	902.481	27.57	3.26	23.00	1010.68
6/20/2022	12:00:00 PM	0	12.4678	4.984	6/20/2022	12:00:00 PM	0	902.618	25.691	3.26	23.00	1010.68
6/20/2022	1:00:00 PM	0	12.4685	4.985	6/20/2022	1:00:00 PM	0	902.193	28.156	3.27	22.99	1010.69
6/20/2022	2:00:00 PM	0	12.4679	4.984	6/20/2022	2:00:00 PM	0	902.144	28.26	3.27	22.99	1010.69
6/20/2022	3:00:00 PM	0	12.4684	4.985	6/20/2022	3:00:00 PM	0	902.677	22.832	3.26	23.00	1010.68
6/20/2022	4:00:00 PM	0	12.4686	4.985	6/20/2022	4:00:00 PM	0	902.547	22.672	3.27	22.99	1010.69
6/20/2022	5:00:00 PM	0	12.4684	4.985	6/20/2022	5:00:00 PM	0	902.763	19.629	3.26	23.00	1010.68
6/20/2022	6:00:00 PM	0	12.4683	4.984	6/20/2022	6:00:00 PM	0	902.567	19.52	3.26	23.00	1010.68
6/20/2022	7:00:00 PM	0	12.468	4.985	6/20/2022	7:00:00 PM	0	902.692	19.773	3.26	23.00	1010.68
6/20/2022	8:00:00 PM	0	12.4683	4.985	6/20/2022	8:00:00 PM	0	903.218	15.635	3.26	23.00	1010.68
6/20/2022	9:00:00 PM	0	12.4689	4.985	6/20/2022	9:00:00 PM	0	903.488	13.19	3.26	23.00	1010.68
6/20/2022	10:00:00 PM	0	12.4695	4.985	6/20/2022	10:00:00 PM	0	903.745	12.219	3.25	23.01	1010.67
6/20/2022	11:00:00 PM	0	12.4705	4.985	6/20/2022	11:00:00 PM	0	903.672	11.504	3.26	23.00	1010.68
6/21/2022	12:00:00 AM	0	12.4705	4.984	6/21/2022	12:00:00 AM	0	903.918	10.826	3.25	23.01	1010.67
6/21/2022	1:00:00 AM	0	12.4713	4.985	6/21/2022	1:00:00 AM	0	904.207	10.051	3.25	23.01	1010.67
6/21/2022	2:00:00 AM	0	12.4723	4.985	6/21/2022	2:00:00 AM	0	904.233	10.148	3.25	23.01	1010.67
6/21/2022	3:00:00 AM	0	12.4728	4.984	6/21/2022	3:00:00 AM	0	904.325	9.527	3.25	23.01	1010.67
6/21/2022	4:00:00 AM	0	12.4735	4.985	6/21/2022	4:00:00 AM	0	904.528	8.604	3.25	23.01	1010.67
6/21/2022	5:00:00 AM	0	12.4737	4.985	6/21/2022	5:00:00 AM	0	904.263	8.95	3.25	23.01	1010.67
6/21/2022	6:00:00 AM	0	12.4728	4.984	6/21/2022	6:00:00 AM	0	904.002	10.388	3.25	23.01	1010.67
6/21/2022	7:00:00 AM	0	12.4712	4.985	6/21/2022	7:00:00 AM	0	903.787	13.08	3.26	23.00	1010.68
6/21/2022	8:00:00 AM	0	12.4701	4.985	6/21/2022	8:00:00 AM	0	903.518	15.419	3.26	23.00	1010.68
6/21/2022	9:00:00 AM	0	12.4676	4.984	6/21/2022	9:00:00 AM	0	903.066	15.983	3.26	23.00	1010.68
6/21/2022	10:00:00 AM	0	12.4645	4.984	6/21/2022	10:00:00 AM	0	902.378	13.194	3.26	23.00	1010.68
6/21/2022	11:00:00 AM	0	12.4618	4.985	6/21/2022	11:00:00 AM	0	902.395	13.373	3.26	23.00	1010.68
6/21/2022	12:00:00 PM	0	12.4592	4.985	6/21/2022	12:00:00 PM	0	902.121	12.632	3.26	23.00	1010.68
6/21/2022	1:00:00 PM	0	12.4573	4.985	6/21/2022	1:00:00 PM	0	902.048	12.369	3.26	23.00	1010.68
6/21/2022	2:00:00 PM	0	12.455	4.984	6/21/2022	2:00:00 PM	0	901.861	11.97	3.26	23.00	1010.68
6/21/2022	3:00:00 PM	0	12.4535	4.984	6/21/2022	3:00:00 PM	0	901.622	11.638	3.26	23.00	1010.68
6/21/2022	4:00:00 PM	0	12.4513	4.984	6/21/2022	4:00:00 PM	0	901.336	11.317	3.26	23.00	1010.68
6/21/2022	5:00:00 PM	0	12.4486	4.984	6/21/2022	5:00:00 PM	0	901.154	11.661	3.26	23.00	1010.68
6/21/2022	6:00:00 PM	0	12.4463	4.984	6/21/2022	6:00:00 PM	0	900.886	11.855	3.26	23.00	1010.68
6/21/2022	7:00:00 PM	0	12.4435	4.984	6/21/2022	7:00:00 PM	0	900.463	11.521	3.26	23.00	1010.68
6/21/2022	8:00:00 PM	0	12.4412	4.985	6/21/2022	8:00:00 PM	0	900.453	11.634	3.26	23.00	1010.68
6/21/2022	9:00:00 PM	0	12.4394	4.985	6/21/2022	9:00:00 PM	0	900.429	9.911	3.26	23.00	1010.68
6/21/2022	10:00:00 PM	0	12.4375	4.985	6/21/2022	10:00:00 PM	0	900.157	9.098	3.26	23.00	1010.68
6/21/2022	11:00:00 PM	0	12.4359	4.985	6/21/2022	11:00:00 PM	0	899.979	8.934	3.26	23.00	1010.68
6/22/2022	12:00:00 AM	0	12.434	4.985	6/22/2022	12:00:00 AM	0	899.652	8.759	3.26	23.00	1010.68
6/22/2022	1:00:00 AM	0	12.4323	4.984	6/22/2022	1:00:00 AM	0	899.559	8.664	3.26	23.00	1010.68
6/22/2022	2:00:00 AM	0	12.4301	4.985	6/22/2022	2:00:00 AM	0	899.18	8.504	3.26	23.00	1010.68
6/22/2022	3:00:00 AM	0	12.4278	4.984	6/22/2022	3:00:00 AM	0	898.753	8.418	3.26	23.00	1010.68
6/22/2022	4:00:00 AM	0	12.4258	4.984	6/22/2022	4:00:00 AM	0	898.862	8.276	3.26	23.00	1010.68
6/22/2022	5:00:00 AM	0	12.4243	4.985	6/22/2022	5:00:00 AM	0	898.794	8.212	3.26	23.00	1010.68
6/22/2022	6:00:00 AM	0	12.4227	4.984	6/22/2022	6:00:00 AM	0	899.152	8.758	3.25	23.01	1010.67
6/22/2022	7:00:00 AM	0	12.4223	4.985	6/22/2022	7:00:00 AM	0	899.164	9.05	3.25	23.01	1010.67
6/22/2022	8:00:00 AM	0	12.4217	4.985	6/22/2022	8:00:00 AM	0	899.312	12.98	3.25	23.01	1010.67
6/22/2022	9:00:00 AM	0	12.4209	4.984	6/22/2022	9:00:00 AM	0	898.912	19.191	3.25	23.01	1010.67
6/22/2022	10:00:00 AM	0	12.4201	4.984	6/22/2022	10:00:00 AM	0	898.91	15.82	3.25	23.01	1010.67
6/22/2022	11:00:00 AM	0	12.4192	4.985	6/22/2022	11:00:00 AM	0	898.513	18.76	3.26	23.00	1010.68
6/22/2022	12:00:00 PM	0	12.4172	4.985	6/22/2022	12:00:00 PM	0	897.726	21.404	3.26	23.00	1010.68
6/22/2022	1:00:00 PM	0	12.4149	4.985	6/22/2022	1:00:00 PM	0	896.997	23.487	3.27	22.99	1010.69
6/22/2022	2:00:00 PM	0	12.4129	4.985	6/22/2022	2:00:00 PM	0	896.849	18.187	3.27	22.99	1010.69
6/22/2022	3:00:00 PM	0	12.4119	4.985	6/22/2022	3:00:00 PM	0	898	11.106	3.25	23.01	1010.67
6/22/2022	4:00:00 PM	0	12.4117	4.985	6/22/2022	4:00:00 PM	0	897.527	14.556	3.26	23.00	1010.68
6/22/2022	5:00:00 PM	0	12.4113	4.985	6/22/2022	5:00:00 PM	0	897.886	12.815	3.26	23.00	1010.68
6/22/2022	6:00:00 PM	0	12.4116	4.985	6/22/2022	6:00:00 PM	0	898.291	9.691	3.25	23.01	1010.67
6/22/2022	7:00:00 PM	0	12.4115	4.985	6/22/2022	7:00:00 PM	0	897.794	8.23	3.26	23.00	1010.68
6/22/2022	8:00:00 PM	0	12.4116	4.985	6/22/2022	8:00:00 PM	0	898.002	7.07	3.25	23.01	1010.67
6/22/2022	9:00:00 PM	0	12.4114	4.984	6/22/2022	9:00:00 PM	0	898.203	5.812	3.25	23.01	1010.67
6/22/2022	10:00:00 PM	0	12.4122	4.985	6/22/2022	10:00:00 PM	0	898.444	5.418	3.25	23.01	1010.67
6/22/2022	11:00:00 PM	0	12.4131	4.985	6/22/2022	11:00:00 PM	0	898.688	4.677	3.25	23.01	1010.67

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/23/2022	12:00:00 AM	0	12.4143	4.985	6/23/2022	12:00:00 AM	0	898.736	3.774	3.25	23.01	1010.67
6/23/2022	1:00:00 AM	0	12.4154	4.985	6/23/2022	1:00:00 AM	0	898.862	2.766	3.25	23.01	1010.67
6/23/2022	2:00:00 AM	0	12.4159	4.985	6/23/2022	2:00:00 AM	0	899.01	2.067	3.25	23.01	1010.67
6/23/2022	3:00:00 AM	0	12.4167	4.985	6/23/2022	3:00:00 AM	0	898.991	2.211	3.25	23.01	1010.67
6/23/2022	4:00:00 AM	0	12.4166	4.985	6/23/2022	4:00:00 AM	0	899.183	2.321	3.25	23.01	1010.67
6/23/2022	5:00:00 AM	0	12.4179	4.985	6/23/2022	5:00:00 AM	0	899.793	2.619	3.24	23.02	1010.66
6/23/2022	6:00:00 AM	0	12.4191	4.984	6/23/2022	6:00:00 AM	0	899.962	3.378	3.24	23.02	1010.66
6/23/2022	7:00:00 AM	0	12.4203	4.985	6/23/2022	7:00:00 AM	0	900.242	6.413	3.24	23.02	1010.66
6/23/2022	8:00:00 AM	0	12.4217	4.985	6/23/2022	8:00:00 AM	0	900.732	7.515	3.24	23.02	1010.66
6/23/2022	9:00:00 AM	0	12.4233	4.984	6/23/2022	9:00:00 AM	0	901.105	9.43	3.23	23.03	1010.65
6/23/2022	10:00:00 AM	0	12.4247	4.985	6/23/2022	10:00:00 AM	0	901.229	11.796	3.23	23.03	1010.65
6/23/2022	11:00:00 AM	0	12.4266	4.985	6/23/2022	11:00:00 AM	0	901.567	13.134	3.23	23.03	1010.65
6/23/2022	12:00:00 PM	0	12.429	4.985	6/23/2022	12:00:00 PM	0	902.146	13.824	3.23	23.03	1010.65
6/23/2022	1:00:00 PM	0	12.4312	4.985	6/23/2022	1:00:00 PM	0	902.508	14.063	3.23	23.03	1010.65
6/23/2022	2:00:00 PM	0	12.4339	4.985	6/23/2022	2:00:00 PM	0	902.86	12.337	3.23	23.03	1010.65
6/23/2022	3:00:00 PM	0	12.436	4.984	6/23/2022	3:00:00 PM	0	902.727	12.137	3.23	23.03	1010.65
6/23/2022	4:00:00 PM	0	12.4387	4.985	6/23/2022	4:00:00 PM	0	903.254	12.933	3.23	23.03	1010.65
6/23/2022	5:00:00 PM	0	12.4399	4.985	6/23/2022	5:00:00 PM	0	902.686	11.755	3.24	23.02	1010.66
6/23/2022	6:00:00 PM	0	12.4414	4.984	6/23/2022	6:00:00 PM	0	902.754	10.955	3.24	23.02	1010.66
6/23/2022	7:00:00 PM	0	12.4428	4.985	6/23/2022	7:00:00 PM	0	903.016	9.959	3.23	23.03	1010.65
6/23/2022	8:00:00 PM	0	12.4443	4.985	6/23/2022	8:00:00 PM	0	903.198	9.193	3.23	23.03	1010.65
6/23/2022	9:00:00 PM	0	12.4463	4.985	6/23/2022	9:00:00 PM	0	903.354	7.863	3.23	23.03	1010.65
6/23/2022	10:00:00 PM	0	12.4478	4.984	6/23/2022	10:00:00 PM	0	903.334	6.736	3.24	23.02	1010.66
6/23/2022	11:00:00 PM	0	12.4492	4.985	6/23/2022	11:00:00 PM	0	903.579	5.87	3.24	23.02	1010.66
6/24/2022	12:00:00 AM	0	12.4504	4.985	6/24/2022	12:00:00 AM	0	903.35	5.215	3.24	23.02	1010.66
6/24/2022	1:00:00 AM	0	12.4517	4.985	6/24/2022	1:00:00 AM	0	903.656	5.435	3.24	23.02	1010.66
6/24/2022	2:00:00 AM	0	12.453	4.985	6/24/2022	2:00:00 AM	0	903.932	5.995	3.24	23.02	1010.66
6/24/2022	3:00:00 AM	0	12.4544	4.985	6/24/2022	3:00:00 AM	0	904.137	6.161	3.23	23.03	1010.65
6/24/2022	4:00:00 AM	0	12.456	4.985	6/24/2022	4:00:00 AM	0	904.374	5.73	3.23	23.03	1010.65
6/24/2022	5:00:00 AM	0	12.4577	4.985	6/24/2022	5:00:00 AM	0	905.007	5.473	3.23	23.03	1010.65
6/24/2022	6:00:00 AM	0	12.46	4.985	6/24/2022	6:00:00 AM	0	905.28	5.674	3.23	23.03	1010.65
6/24/2022	7:00:00 AM	0	12.462	4.985	6/24/2022	7:00:00 AM	0	905.646	6.794	3.23	23.03	1010.65
6/24/2022	8:00:00 AM	0	12.4647	4.985	6/24/2022	8:00:00 AM	0	906.232	11.553	3.22	23.04	1010.64
6/24/2022	9:00:00 AM	0	12.466	4.985	6/24/2022	9:00:00 AM	0	906.133	19.199	3.23	23.03	1010.65
6/24/2022	10:00:00 AM	0	12.4682	4.985	6/24/2022	10:00:00 AM	0	906.251	17.409	3.23	23.03	1010.65
6/24/2022	11:00:00 AM	0	12.4701	4.985	6/24/2022	11:00:00 AM	0	906.425	20.542	3.23	23.03	1010.65
6/24/2022	12:00:00 PM	0	12.4724	4.985	6/24/2022	12:00:00 PM	0	906.376	22.418	3.23	23.03	1010.65
6/24/2022	1:00:00 PM	0	12.4739	4.985	6/24/2022	1:00:00 PM	0	906.474	22.009	3.23	23.03	1010.65
6/24/2022	2:00:00 PM	0	12.4757	4.985	6/24/2022	2:00:00 PM	0	906.295	23.778	3.23	23.03	1010.65
6/24/2022	3:00:00 PM	0	12.4768	4.985	6/24/2022	3:00:00 PM	0	906.415	23.058	3.23	23.03	1010.65
6/24/2022	4:00:00 PM	0	12.4791	4.985	6/24/2022	4:00:00 PM	0	906.576	20.575	3.23	23.03	1010.65
6/24/2022	5:00:00 PM	0	12.4808	4.985	6/24/2022	5:00:00 PM	0	906.431	19.684	3.24	23.02	1010.66
6/24/2022	6:00:00 PM	0	12.482	4.985	6/24/2022	6:00:00 PM	0	906.384	22.278	3.24	23.02	1010.66
6/24/2022	7:00:00 PM	0	12.4831	4.985	6/24/2022	7:00:00 PM	0	906.634	19.59	3.24	23.02	1010.66
6/24/2022	8:00:00 PM	0	12.4843	4.985	6/24/2022	8:00:00 PM	0	907.11	15.295	3.23	23.03	1010.65
6/24/2022	9:00:00 PM	0	12.4863	4.984	6/24/2022	9:00:00 PM	0	907.47	12.036	3.23	23.03	1010.65
6/24/2022	10:00:00 PM	0	12.4885	4.985	6/24/2022	10:00:00 PM	0	907.789	9.526	3.23	23.03	1010.65
6/24/2022	11:00:00 PM	0	12.4906	4.985	6/24/2022	11:00:00 PM	0	907.925	7.938	3.23	23.03	1010.65
6/25/2022	12:00:00 AM	0	12.4926	4.985	6/25/2022	12:00:00 AM	0	907.918	6.753	3.23	23.03	1010.65
6/25/2022	1:00:00 AM	0	12.4939	4.985	6/25/2022	1:00:00 AM	0	908.108	5.852	3.23	23.03	1010.65
6/25/2022	2:00:00 AM	0	12.496	4.985	6/25/2022	2:00:00 AM	0	908.313	5.028	3.23	23.03	1010.65
6/25/2022	3:00:00 AM	0	12.4976	4.985	6/25/2022	3:00:00 AM	0	908.583	4.531	3.23	23.03	1010.65
6/25/2022	4:00:00 AM	0	12.4998	4.984	6/25/2022	4:00:00 AM	0	908.789	3.966	3.23	23.03	1010.65
6/25/2022	5:00:00 AM	0	12.5015	4.984	6/25/2022	5:00:00 AM	0	908.942	3.797	3.23	23.03	1010.65
6/25/2022	6:00:00 AM	0	12.5029	4.985	6/25/2022	6:00:00 AM	0	909.128	4.381	3.23	23.03	1010.65
6/25/2022	7:00:00 AM	0	12.5045	4.985	6/25/2022	7:00:00 AM	0	909.388	6.174	3.23	23.03	1010.65
6/25/2022	8:00:00 AM	0	12.5048	4.985	6/25/2022	8:00:00 AM	0	909.473	13.903	3.23	23.03	1010.65
6/25/2022	9:00:00 AM	0	12.5048	4.985	6/25/2022	9:00:00 AM	0	909.145	23.236	3.23	23.03	1010.65
6/25/2022	10:00:00 AM	0	12.5047	4.986	6/25/2022	10:00:00 AM	0	908.633	27.149	3.24	23.02	1010.66
6/25/2022	11:00:00 AM	0	12.5047	4.985	6/25/2022	11:00:00 AM	0	908.139	28.231	3.24	23.02	1010.66
6/25/2022	12:00:00 PM	0	12.5046	4.985	6/25/2022	12:00:00 PM	0	907.699	28.879	3.25	23.01	1010.67
6/25/2022	1:00:00 PM	0	12.5046	4.985	6/25/2022	1:00:00 PM	0	907.233	29.633	3.25	23.01	1010.67
6/25/2022	2:00:00 PM	0	12.5043	4.985	6/25/2022	2:00:00 PM	0	906.806	31.376	3.26	23.00	1010.68
6/25/2022	3:00:00 PM	0	12.5041	4.985	6/25/2022	3:00:00 PM	0	907.038	25.277	3.25	23.01	1010.67
6/25/2022	4:00:00 PM	0	12.5043	4.985	6/25/2022	4:00:00 PM	0	905.955	31.674	3.27	22.99	1010.69
6/25/2022	5:00:00 PM	0	12.5035	4.985	6/25/2022	5:00:00 PM	0	906.359	24.29	3.26	23.00	1010.68
6/25/2022	6:00:00 PM	0	12.5026	4.985	6/25/2022	6:00:00 PM	0	906.021	23.625	3.26	23.00	1010.68
6/25/2022	7:00:00 PM	0	12.5021	4.985	6/25/2022	7:00:00 PM	0	906.115	21.761	3.26	23.00	1010.68
6/25/2022	8:00:00 PM	0	12.5012	4.985	6/25/2022	8:00:00 PM	0	906.38	15.712	3.26	23.00	1010.68
6/25/2022	9:00:00 PM	0	12.5005	4.985	6/25/2022	9:00:00 PM	0	906.535	12.681	3.26	23.00	1010.68

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/25/2022	10:00:00 PM	0	12.5005	4.985	6/25/2022	10:00:00 PM	0	906.699	10.884	3.25	23.01	1010.67
6/25/2022	11:00:00 PM	0	12.5005	4.986	6/25/2022	11:00:00 PM	0	906.714	10.001	3.25	23.01	1010.67
6/26/2022	12:00:00 AM	0	12.501	4.985	6/26/2022	12:00:00 AM	0	906.866	9.144	3.25	23.01	1010.67
6/26/2022	1:00:00 AM	0	12.5015	4.985	6/26/2022	1:00:00 AM	0	906.886	8.445	3.25	23.01	1010.67
6/26/2022	2:00:00 AM	0	12.5017	4.985	6/26/2022	2:00:00 AM	0	906.805	8.176	3.25	23.01	1010.67
6/26/2022	3:00:00 AM	0	12.5024	4.985	6/26/2022	3:00:00 AM	0	906.867	7.942	3.25	23.01	1010.67
6/26/2022	4:00:00 AM	0	12.5025	4.985	6/26/2022	4:00:00 AM	0	906.914	7.09	3.25	23.01	1010.67
6/26/2022	5:00:00 AM	0	12.5031	4.985	6/26/2022	5:00:00 AM	0	906.863	6.67	3.26	23.00	1010.68
6/26/2022	6:00:00 AM	0	12.5033	4.986	6/26/2022	6:00:00 AM	0	906.973	7.283	3.25	23.01	1010.67
6/26/2022	7:00:00 AM	0	12.5032	4.985	6/26/2022	7:00:00 AM	0	907.177	9.046	3.25	23.01	1010.67
6/26/2022	8:00:00 AM	0	12.5021	4.985	6/26/2022	8:00:00 AM	0	907.002	16.073	3.25	23.01	1010.67
6/26/2022	9:00:00 AM	0	12.5003	4.985	6/26/2022	9:00:00 AM	0	906.124	26.236	3.26	23.00	1010.68
6/26/2022	10:00:00 AM	0	12.4983	4.985	6/26/2022	10:00:00 AM	0	905.434	30.557	3.27	22.99	1010.69
6/26/2022	11:00:00 AM	0	12.4969	4.985	6/26/2022	11:00:00 AM	0	904.889	32.633	3.27	22.99	1010.69
6/26/2022	12:00:00 PM	0	12.4959	4.985	6/26/2022	12:00:00 PM	0	904.269	33.13	3.27	22.99	1010.69
6/26/2022	1:00:00 PM	0	12.4933	4.984	6/26/2022	1:00:00 PM	0	903.469	34.103	3.28	22.98	1010.70
6/26/2022	2:00:00 PM	0	12.4923	4.985	6/26/2022	2:00:00 PM	0	903.298	32.168	3.28	22.98	1010.70
6/26/2022	3:00:00 PM	0	12.4903	4.985	6/26/2022	3:00:00 PM	0	903.349	28.688	3.28	22.98	1010.70
6/26/2022	4:00:00 PM	0	12.4895	4.985	6/26/2022	4:00:00 PM	0	902.317	34.36	3.29	22.97	1010.71
6/26/2022	5:00:00 PM	0	12.4876	4.985	6/26/2022	5:00:00 PM	0	902.753	27.394	3.28	22.98	1010.70
6/26/2022	6:00:00 PM	0	12.486	4.985	6/26/2022	6:00:00 PM	0	902.499	26.056	3.28	22.98	1010.70
6/26/2022	7:00:00 PM	0	12.4842	4.985	6/26/2022	7:00:00 PM	0	902.643	24.064	3.28	22.98	1010.70
6/26/2022	8:00:00 PM	0	12.483	4.985	6/26/2022	8:00:00 PM	0	902.959	18.175	3.28	22.98	1010.70
6/26/2022	9:00:00 PM	0	12.4819	4.985	6/26/2022	9:00:00 PM	0	903.141	15.168	3.27	22.99	1010.69
6/26/2022	10:00:00 PM	0	12.4815	4.985	6/26/2022	10:00:00 PM	0	903.214	13.204	3.27	22.99	1010.69
6/26/2022	11:00:00 PM	0	12.4814	4.985	6/26/2022	11:00:00 PM	0	903.209	12.031	3.27	22.99	1010.69
6/27/2022	12:00:00 AM	0	12.4803	4.985	6/27/2022	12:00:00 AM	0	903.015	11.164	3.27	22.99	1010.69
6/27/2022	1:00:00 AM	0	12.4805	4.985	6/27/2022	1:00:00 AM	0	903.066	10.262	3.27	22.99	1010.69
6/27/2022	2:00:00 AM	0	12.4798	4.985	6/27/2022	2:00:00 AM	0	902.917	9.461	3.27	22.99	1010.69
6/27/2022	3:00:00 AM	0	12.479	4.985	6/27/2022	3:00:00 AM	0	902.846	8.955	3.27	22.99	1010.69
6/27/2022	4:00:00 AM	0	12.4783	4.985	6/27/2022	4:00:00 AM	0	902.746	8.339	3.27	22.99	1010.69
6/27/2022	5:00:00 AM	0	12.4775	4.985	6/27/2022	5:00:00 AM	0	902.679	8.056	3.27	22.99	1010.69
6/27/2022	6:00:00 AM	0	12.4763	4.985	6/27/2022	6:00:00 AM	0	902.694	9.412	3.27	22.99	1010.69
6/27/2022	7:00:00 AM	0	12.4757	4.986	6/27/2022	7:00:00 AM	0	902.661	11.8	3.27	22.99	1010.69
6/27/2022	8:00:00 AM	0	12.4739	4.985	6/27/2022	8:00:00 AM	0	902.269	18.1	3.27	22.99	1010.69
6/27/2022	9:00:00 AM	0	12.4708	4.985	6/27/2022	9:00:00 AM	0	901.159	27.282	3.28	22.98	1010.70
6/27/2022	10:00:00 AM	0	12.4673	4.985	6/27/2022	10:00:00 AM	0	900.095	32.323	3.29	22.97	1010.71
6/27/2022	11:00:00 AM	0	12.4642	4.986	6/27/2022	11:00:00 AM	0	899.462	34.656	3.29	22.97	1010.71
6/27/2022	12:00:00 PM	0	12.4616	4.984	6/27/2022	12:00:00 PM	0	898.718	35.407	3.30	22.96	1010.72
6/27/2022	1:00:00 PM	0	12.4586	4.985	6/27/2022	1:00:00 PM	0	898.024	36.039	3.30	22.96	1010.72
6/27/2022	2:00:00 PM	0	12.4554	4.985	6/27/2022	2:00:00 PM	0	897.568	37.51	3.30	22.96	1010.72
6/27/2022	3:00:00 PM	0	12.4534	4.985	6/27/2022	3:00:00 PM	0	897.865	31.872	3.30	22.96	1010.72
6/27/2022	4:00:00 PM	0	12.4518	4.985	6/27/2022	4:00:00 PM	0	896.911	33.588	3.31	22.95	1010.73
6/27/2022	5:00:00 PM	0	12.4487	4.985	6/27/2022	5:00:00 PM	0	897.087	29.374	3.30	22.96	1010.72
6/27/2022	6:00:00 PM	0	12.4454	4.985	6/27/2022	6:00:00 PM	0	897.023	26.353	3.30	22.96	1010.72
6/27/2022	7:00:00 PM	0	12.443	4.985	6/27/2022	7:00:00 PM	0	896.899	23.984	3.30	22.96	1010.72
6/27/2022	8:00:00 PM	0	12.4404	4.985	6/27/2022	8:00:00 PM	0	896.599	21.84	3.30	22.96	1010.72
6/27/2022	9:00:00 PM	0	12.4378	4.984	6/27/2022	9:00:00 PM	0	896.601	19.594	3.29	22.97	1010.71
6/27/2022	10:00:00 PM	0	12.4354	4.985	6/27/2022	10:00:00 PM	0	896.441	18.391	3.29	22.97	1010.71
6/27/2022	11:00:00 PM	0	12.4329	4.985	6/27/2022	11:00:00 PM	0	896.295	16.887	3.29	22.97	1010.71
6/28/2022	12:00:00 AM	0	12.4309	4.984	6/28/2022	12:00:00 AM	0	896.256	14.909	3.29	22.97	1010.71
6/28/2022	1:00:00 AM	0	12.4294	4.985	6/28/2022	1:00:00 AM	0	896.287	14.539	3.29	22.97	1010.71
6/28/2022	2:00:00 AM	0	12.4282	4.985	6/28/2022	2:00:00 AM	0	896.561	14.902	3.29	22.97	1010.71
6/28/2022	3:00:00 AM	0	12.4273	4.985	6/28/2022	3:00:00 AM	0	897.115	15.255	3.28	22.98	1010.70
6/28/2022	4:00:00 AM	0	12.4273	4.985	6/28/2022	4:00:00 AM	0	895.994	13.131	3.29	22.97	1010.71
6/28/2022	5:00:00 AM	0	12.4254	4.985	6/28/2022	5:00:00 AM	0	895.784	12.576	3.29	22.97	1010.71
6/28/2022	6:00:00 AM	0	12.4228	4.985	6/28/2022	6:00:00 AM	0	895.336	13.061	3.29	22.97	1010.71
6/28/2022	7:00:00 AM	0	12.42	4.985	6/28/2022	7:00:00 AM	0	894.926	14.737	3.29	22.97	1010.71
6/28/2022	8:00:00 AM	0	12.4166	4.985	6/28/2022	8:00:00 AM	0	894.229	17.099	3.30	22.96	1010.72
6/28/2022	9:00:00 AM	0	12.4118	4.985	6/28/2022	9:00:00 AM	0	893.008	22.553	3.31	22.95	1010.73
6/28/2022	10:00:00 AM	0	12.4055	4.985	6/28/2022	10:00:00 AM	0	892.332	27.044	3.31	22.95	1010.73
6/28/2022	11:00:00 AM	0	12.4006	4.985	6/28/2022	11:00:00 AM	0	891.513	29.293	3.31	22.95	1010.73
6/28/2022	12:00:00 PM	0	12.3963	4.985	6/28/2022	12:00:00 PM	0	890.832	29.438	3.31	22.95	1010.73
6/28/2022	1:00:00 PM	0	12.3918	4.985	6/28/2022	1:00:00 PM	0	890.863	27.744	3.31	22.95	1010.73
6/28/2022	2:00:00 PM	0	12.3894	4.985	6/28/2022	2:00:00 PM	0	891.705	25.141	3.30	22.96	1010.72
6/28/2022	3:00:00 PM	0	12.3892	4.985	6/28/2022	3:00:00 PM	0	892.425	15.82	3.29	22.97	1010.71
6/28/2022	4:00:00 PM	0	12.3882	4.985	6/28/2022	4:00:00 PM	0	891.598	16.356	3.30	22.96	1010.72
6/28/2022	5:00:00 PM	0	12.3867	4.985	6/28/2022	5:00:00 PM	0	892.561	16.036	3.29	22.97	1010.71
6/28/2022	6:00:00 PM	0	12.388	4.984	6/28/2022	6:00:00 PM	0	894.205	12.131	3.27	22.99	1010.69
6/28/2022	7:00:00 PM	0	12.3918	4.984	6/28/2022	7:00:00 PM	0	895.511	10.528	3.26	23.00	1010.68

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
6/28/2022	8:00:00 PM	0	12.3943	4.985	6/28/2022	8:00:00 PM	0	895.051	10.366	3.27	22.99	1010.69
6/28/2022	9:00:00 PM	0	12.396	4.985	6/28/2022	9:00:00 PM	0	895.057	10.077	3.27	22.99	1010.69
6/28/2022	10:00:00 PM	0	12.3975	4.985	6/28/2022	10:00:00 PM	0	895.292	9.652	3.27	22.99	1010.69
6/28/2022	11:00:00 PM	0	12.3989	4.986	6/28/2022	11:00:00 PM	0	895.308	9.368	3.27	22.99	1010.69
6/29/2022	12:00:00 AM	0	12.3997	4.985	6/29/2022	12:00:00 AM	0	895.465	8.839	3.27	22.99	1010.69
6/29/2022	1:00:00 AM	0	12.4002	4.985	6/29/2022	1:00:00 AM	0	895.372	8.542	3.27	22.99	1010.69
6/29/2022	2:00:00 AM	0	12.4007	4.985	6/29/2022	2:00:00 AM	0	895.245	8.481	3.27	22.99	1010.69
6/29/2022	3:00:00 AM	0	12.4005	4.986	6/29/2022	3:00:00 AM	0	895.351	8.56	3.27	22.99	1010.69
6/29/2022	4:00:00 AM	0	12.4006	4.985	6/29/2022	4:00:00 AM	0	895.537	8.546	3.27	22.99	1010.69
6/29/2022	5:00:00 AM	0	12.4007	4.985	6/29/2022	5:00:00 AM	0	895.748	8.645	3.27	22.99	1010.69
6/29/2022	6:00:00 AM	0	12.4013	4.986	6/29/2022	6:00:00 AM	0	896.021	8.844	3.26	23.00	1010.68
6/29/2022	7:00:00 AM	0	12.4015	4.985	6/29/2022	7:00:00 AM	0	896.351	9.247	3.26	23.00	1010.68
6/29/2022	8:00:00 AM	0	12.4028	4.986	6/29/2022	8:00:00 AM	0	896.808	10.129	3.26	23.00	1010.68
6/29/2022	9:00:00 AM	0	12.4036	4.986	6/29/2022	9:00:00 AM	0	897.299	10.96	3.25	23.01	1010.67
6/29/2022	10:00:00 AM	0	12.4054	4.985	6/29/2022	10:00:00 AM	0	897.891	12.427	3.25	23.01	1010.67
6/29/2022	11:00:00 AM	0	12.4073	4.985	6/29/2022	11:00:00 AM	0	898.604	12.365	3.24	23.02	1010.66
6/29/2022	12:00:00 PM	0	12.4094	4.985	6/29/2022	12:00:00 PM	0	899.052	13.813	3.24	23.02	1010.66
6/29/2022	1:00:00 PM	0	12.412	4.985	6/29/2022	1:00:00 PM	0	899.419	17.639	3.24	23.02	1010.66
6/29/2022	2:00:00 PM	0	12.4147	4.985	6/29/2022	2:00:00 PM	0	899.79	18.567	3.24	23.02	1010.66
6/29/2022	3:00:00 PM	0	12.4171	4.985	6/29/2022	3:00:00 PM	0	900.181	18.863	3.24	23.02	1010.66
6/29/2022	4:00:00 PM	0	12.42	4.985	6/29/2022	4:00:00 PM	0	900.434	16.564	3.24	23.02	1010.66
6/29/2022	5:00:00 PM	0	12.4225	4.985	6/29/2022	5:00:00 PM	0	900.814	17.39	3.24	23.02	1010.66
6/29/2022	6:00:00 PM	0	12.425	4.984	6/29/2022	6:00:00 PM	0	901.146	18.455	3.24	23.02	1010.66
6/29/2022	7:00:00 PM	0	12.4279	4.985	6/29/2022	7:00:00 PM	0	901.593	17.595	3.23	23.03	1010.65
6/29/2022	8:00:00 PM	0	12.4306	4.985	6/29/2022	8:00:00 PM	0	902.053	13.333	3.23	23.03	1010.65
6/29/2022	9:00:00 PM	0	12.4329	4.985	6/29/2022	9:00:00 PM	0	902.657	10.874	3.23	23.03	1010.65
6/29/2022	10:00:00 PM	0	12.4357	4.986	6/29/2022	10:00:00 PM	0	902.919	9.333	3.23	23.03	1010.65
6/29/2022	11:00:00 PM	0	12.4382	4.985	6/29/2022	11:00:00 PM	0	903.158	8.686	3.23	23.03	1010.65
6/30/2022	12:00:00 AM	0	12.4402	4.985	6/30/2022	12:00:00 AM	0	903.621	8.58	3.23	23.03	1010.65
6/30/2022	1:00:00 AM	0	12.4427	4.985	6/30/2022	1:00:00 AM	0	903.777	7.926	3.23	23.03	1010.65
6/30/2022	2:00:00 AM	0	12.4447	4.986	6/30/2022	2:00:00 AM	0	903.881	7.356	3.23	23.03	1010.65
6/30/2022	3:00:00 AM	0	12.4466	4.985	6/30/2022	3:00:00 AM	0	904.076	7.055	3.23	23.03	1010.65
6/30/2022	4:00:00 AM	0	12.4478	4.985	6/30/2022	4:00:00 AM	0	904.095	7.085	3.23	23.03	1010.65
6/30/2022	5:00:00 AM	0	12.4483	4.985	6/30/2022	5:00:00 AM	0	904.043	6.94	3.23	23.03	1010.65
6/30/2022	6:00:00 AM	0	12.4489	4.986	6/30/2022	6:00:00 AM	0	904.116	7.347	3.23	23.03	1010.65
6/30/2022	7:00:00 AM	0	12.4489	4.985	6/30/2022	7:00:00 AM	0	904.215	8.731	3.23	23.03	1010.65
6/30/2022	8:00:00 AM	0	12.4475	4.985	6/30/2022	8:00:00 AM	0	904.066	13.763	3.23	23.03	1010.65
6/30/2022	9:00:00 AM	0	12.3136	5.124	6/30/2022	10:07:15 AM	0	903.514	23.107	3.10	23.16	1010.52
6/30/2022	10:00:00 AM	0	12.3138	5.023	6/30/2022	11:07:15 AM	0	903.023	26.532	3.11	23.15	1010.53
6/30/2022	11:00:00 AM	0	12.3126	5.003	6/30/2022	12:07:15 PM	0	902.45	28.961	3.11	23.15	1010.53
6/30/2022	12:00:00 PM	0	12.3111	4.996	6/30/2022	1:07:15 PM	0	901.878	31.155	3.11	23.15	1010.53
6/30/2022	1:00:00 PM	0	12.3086	4.992	6/30/2022	2:07:15 PM	0	901.245	32.781	3.12	23.14	1010.54
6/30/2022	2:00:00 PM	0	12.306	4.99	6/30/2022	3:07:15 PM	0	900.613	34.498	3.12	23.14	1010.54
6/30/2022	3:00:00 PM	0	12.3037	4.989	6/30/2022	4:07:15 PM	0	901.016	27.61	3.12	23.14	1010.54
6/30/2022	4:00:00 PM	0	12.3024	4.988	6/30/2022	5:07:15 PM	0	900.678	26.707	3.12	23.14	1010.54
6/30/2022	5:00:00 PM	0	12.3007	4.988	6/30/2022	6:07:15 PM	0	900.408	22.055	3.12	23.14	1010.54
6/30/2022	6:00:00 PM	0	12.2975	4.987	6/30/2022	7:07:15 PM	0	900.042	22.927	3.12	23.14	1010.54
6/30/2022	7:00:00 PM	0	12.2949	4.987	6/30/2022	8:07:15 PM	0	900.061	20.804	3.12	23.14	1010.54
6/30/2022	8:00:00 PM	0	12.2926	4.988	6/30/2022	9:07:15 PM	0	900.45	17.099	3.11	23.15	1010.53
6/30/2022	9:00:00 PM	0	12.2911	4.987	6/30/2022	10:07:15 PM	0	900.732	15.391	3.11	23.15	1010.53
6/30/2022	10:00:00 PM	0	12.2901	4.987	6/30/2022	11:07:15 PM	0	900.471	13.813	3.11	23.15	1010.53
6/30/2022	11:00:00 PM	0	12.2889	4.987	7/1/2022	12:07:15 AM	0	900.424	12.01	3.11	23.15	1010.53
7/1/2022	12:00:00 AM	0	12.2874	4.986	7/1/2022	1:07:15 AM	0	900.431	11.021	3.11	23.15	1010.53
7/1/2022	1:00:00 AM	0	12.2859	4.986	7/1/2022	2:07:15 AM	0	900.248	10.724	3.11	23.15	1010.53
7/1/2022	2:00:00 AM	0	12.2846	4.987	7/1/2022	3:07:15 AM	0	900.204	10.139	3.11	23.15	1010.53
7/1/2022	3:00:00 AM	0	12.2831	4.986	7/1/2022	4:07:15 AM	0	899.926	9.595	3.11	23.15	1010.53
7/1/2022	4:00:00 AM	0	12.2817	4.987	7/1/2022	5:07:15 AM	0	899.952	8.926	3.10	23.16	1010.52
7/1/2022	5:00:00 AM	0	12.2797	4.987	7/1/2022	6:07:15 AM	0	899.904	8.747	3.10	23.16	1010.52
7/1/2022	6:00:00 AM	0	12.2785	4.986	7/1/2022	7:07:15 AM	0	899.97	9.387	3.10	23.16	1010.52
7/1/2022	7:00:00 AM	0	12.2772	4.986	7/1/2022	8:07:15 AM	0	900.214	11.308	3.10	23.16	1010.52
7/1/2022	8:00:00 AM	0	12.2755	4.986	7/1/2022	9:07:15 AM	0	899.976	17.708	3.10	23.16	1010.52
7/1/2022	9:00:00 AM	0	12.2725	4.987	7/1/2022	10:07:15 AM	0	899.136	25.912	3.10	23.16	1010.52
7/1/2022	10:00:00 AM	0	12.2691	4.986	7/1/2022	11:07:15 AM	0	898.577	29.519	3.11	23.15	1010.53
7/1/2022	11:00:00 AM	0	12.2659	4.986	7/1/2022	12:07:15 PM	0	898.071	32.23	3.11	23.15	1010.53
7/1/2022	12:00:00 PM	0	12.2638	4.987	7/1/2022	1:07:15 PM	0	897.745	30.539	3.11	23.15	1010.53
7/1/2022	1:00:00 PM	0	12.261	4.986	7/1/2022	2:07:15 PM	0	897.739	31.543	3.11	23.15	1010.53
7/1/2022	2:00:00 PM	0	12.2604	4.986	7/1/2022	3:07:15 PM	0	899.031	20.498	3.09	23.17	1010.51
7/1/2022	3:00:00 PM	0	12.2606	4.987	7/1/2022	4:07:15 PM	0	898.758	14.498	3.10	23.16	1010.52
7/1/2022	4:00:00 PM	0	12.2592	4.987	7/1/2022	5:07:15 PM	0	898.72	20.845	3.09	23.17	1010.51
7/1/2022	5:00:00 PM	0	12.2581	4.986	7/1/2022	6:07:15 PM	0	898.367	18.381	3.10	23.16	1010.52

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
7/1/2022	6:00:00 PM	0	12.2563	4.986	7/1/2022	7:07:15 PM	0	898.287	17.711	3.10	23.16	1010.52
7/1/2022	7:00:00 PM	0	12.2547	4.986	7/1/2022	8:07:15 PM	0	898.092	16.653	3.10	23.16	1010.52
7/1/2022	8:00:00 PM	0	12.2536	4.987	7/1/2022	9:07:15 PM	0	898.363	13.757	3.09	23.17	1010.51
7/1/2022	9:00:00 PM	0	12.2527	4.987	7/1/2022	10:07:15 PM	0	898.584	11.842	3.09	23.17	1010.51
7/1/2022	10:00:00 PM	0	12.2519	4.986	7/1/2022	11:07:15 PM	0	898.641	10.918	3.09	23.17	1010.51
7/1/2022	11:00:00 PM	0	12.2514	4.986	7/2/2022	12:07:15 AM	0	898.688	10.375	3.09	23.17	1010.51
7/2/2022	12:00:00 AM	0	12.2504	4.986	7/2/2022	1:07:15 AM	0	898.607	9.98	3.09	23.17	1010.51
7/2/2022	1:00:00 AM	0	12.2499	4.986	7/2/2022	2:07:15 AM	0	898.676	9.72	3.09	23.17	1010.51
7/2/2022	2:00:00 AM	0	12.249	4.985	7/2/2022	3:07:15 AM	0	898.629	9.526	3.09	23.17	1010.51
7/2/2022	3:00:00 AM	0	12.2482	4.986	7/2/2022	4:07:15 AM	0	898.76	9.935	3.08	23.18	1010.50
7/2/2022	4:00:00 AM	0	12.2474	4.986	7/2/2022	5:07:15 AM	0	898.734	9.679	3.08	23.18	1010.50
7/2/2022	5:00:00 AM	0	12.2471	4.986	7/2/2022	6:07:15 AM	0	898.797	9.331	3.08	23.18	1010.50
7/2/2022	6:00:00 AM	0	12.2464	4.986	7/2/2022	7:07:15 AM	0	898.971	10.135	3.08	23.18	1010.50
7/2/2022	7:00:00 AM	0	12.2456	4.986	7/2/2022	8:07:15 AM	0	899.054	11.386	3.08	23.18	1010.50
7/2/2022	8:00:00 AM	0	12.2444	4.986	7/2/2022	9:07:15 AM	0	898.748	17.461	3.08	23.18	1010.50
7/2/2022	9:00:00 AM	0	12.242	4.987	7/2/2022	10:07:15 AM	0	898.101	24.846	3.08	23.18	1010.50
7/2/2022	10:00:00 AM	0	12.2393	4.986	7/2/2022	11:07:15 AM	0	897.484	29.454	3.09	23.17	1010.51
7/2/2022	11:00:00 AM	0	12.2368	4.986	7/2/2022	12:07:15 PM	0	897.273	28.842	3.09	23.17	1010.51
7/2/2022	12:00:00 PM	0	12.2348	4.986	7/2/2022	1:07:15 PM	0	897.086	28.489	3.09	23.17	1010.51
7/2/2022	1:00:00 PM	0	12.2328	4.986	7/2/2022	2:07:15 PM	0	896.191	31.987	3.09	23.17	1010.51
7/2/2022	2:00:00 PM	0	12.2297	4.986	7/2/2022	3:07:15 PM	0	895.624	35.499	3.10	23.16	1010.52
7/2/2022	3:00:00 PM	0	12.2274	4.986	7/2/2022	4:07:15 PM	0	896.06	26.701	3.09	23.17	1010.51
7/2/2022	4:00:00 PM	0	12.2254	4.986	7/2/2022	5:07:15 PM	0	895.242	30.708	3.10	23.16	1010.52
7/2/2022	5:00:00 PM	0	12.2228	4.987	7/2/2022	6:07:15 PM	0	895.293	24.142	3.09	23.17	1010.51
7/2/2022	6:00:00 PM	0	12.22	4.986	7/2/2022	7:07:15 PM	0	895.3	22.709	3.09	23.17	1010.51
7/2/2022	7:00:00 PM	0	12.2177	4.986	7/2/2022	8:07:15 PM	0	895.232	21.349	3.09	23.17	1010.51
7/2/2022	8:00:00 PM	0	12.2155	4.986	7/2/2022	9:07:15 PM	0	895.57	17.149	3.08	23.18	1010.50
7/2/2022	9:00:00 PM	0	12.2139	4.986	7/2/2022	10:07:15 PM	0	895.79	14.775	3.08	23.18	1010.50
7/2/2022	10:00:00 PM	0	12.2126	4.986	7/2/2022	11:07:15 PM	0	895.731	13.258	3.08	23.18	1010.50
7/2/2022	11:00:00 PM	0	12.2111	4.986	7/3/2022	12:07:15 AM	0	895.601	11.998	3.08	23.18	1010.50
7/3/2022	12:00:00 AM	0	12.2098	4.986	7/3/2022	1:07:15 AM	0	895.59	10.905	3.08	23.18	1010.50
7/3/2022	1:00:00 AM	0	12.2083	4.986	7/3/2022	2:07:15 AM	0	895.511	10.317	3.08	23.18	1010.50
7/3/2022	2:00:00 AM	0	12.2067	4.986	7/3/2022	3:07:15 AM	0	895.422	10.089	3.08	23.18	1010.50
7/3/2022	3:00:00 AM	0	12.2052	4.986	7/3/2022	4:07:15 AM	0	895.371	9.528	3.07	23.19	1010.49
7/3/2022	4:00:00 AM	0	12.2038	4.986	7/3/2022	5:07:15 AM	0	894.939	9.05	3.08	23.18	1010.50
7/3/2022	5:00:00 AM	0	12.2013	4.986	7/3/2022	6:07:15 AM	0	895.006	9.277	3.07	23.19	1010.49
7/3/2022	6:00:00 AM	0	12.1993	4.986	7/3/2022	7:07:15 AM	0	894.841	9.524	3.07	23.19	1010.49
7/3/2022	7:00:00 AM	0	12.1978	4.986	7/3/2022	8:07:15 AM	0	894.645	11.318	3.07	23.19	1010.49
7/3/2022	8:00:00 AM	0	12.1943	4.986	7/3/2022	9:07:15 AM	0	894.221	17.824	3.08	23.18	1010.50
7/3/2022	9:00:00 AM	0	12.1903	4.986	7/3/2022	10:07:15 AM	0	893.137	26.171	3.08	23.18	1010.50
7/3/2022	10:00:00 AM	0	12.1855	4.986	7/3/2022	11:07:15 AM	0	892.368	30.173	3.09	23.17	1010.51
7/3/2022	11:00:00 AM	0	12.1814	4.986	7/3/2022	12:07:15 PM	0	891.723	32.56	3.09	23.17	1010.51
7/3/2022	12:00:00 PM	0	12.1779	4.986	7/3/2022	1:07:15 PM	0	891.283	33.668	3.09	23.17	1010.51
7/3/2022	1:00:00 PM	0	12.1748	4.986	7/3/2022	2:07:15 PM	0	891.298	32.079	3.09	23.17	1010.51
7/3/2022	2:00:00 PM	0	12.1723	4.986	7/3/2022	3:07:15 PM	0	891.766	29.205	3.08	23.18	1010.50
7/3/2022	3:00:00 PM	0	12.1702	4.987	7/3/2022	4:07:15 PM	0	891.545	23.519	3.08	23.18	1010.50
7/3/2022	4:00:00 PM	0	12.1685	4.986	7/3/2022	5:07:15 PM	0	893.019	21.784	3.06	23.20	1010.48
7/3/2022	5:00:00 PM	0	12.1683	4.986	7/3/2022	6:07:15 PM	0	893.306	17.4	3.06	23.20	1010.48
7/3/2022	6:00:00 PM	0	12.169	4.986	7/3/2022	7:07:15 PM	0	893.502	15.817	3.06	23.20	1010.48
7/3/2022	7:00:00 PM	0	12.1696	4.986	7/3/2022	8:07:15 PM	0	893.928	15.314	3.05	23.21	1010.47
7/3/2022	8:00:00 PM	0	12.1701	4.986	7/3/2022	9:07:15 PM	0	893.779	14.373	3.06	23.20	1010.48
7/3/2022	9:00:00 PM	0	12.1703	4.986	7/3/2022	10:07:15 PM	0	893.986	13.148	3.05	23.21	1010.47
7/3/2022	10:00:00 PM	0	12.1704	4.986	7/3/2022	11:07:15 PM	0	893.91	12.242	3.06	23.20	1010.48
7/3/2022	11:00:00 PM	0	12.1701	4.987	7/4/2022	12:07:15 AM	0	894.01	11.479	3.05	23.21	1010.47
7/4/2022	12:00:00 AM	0	12.1697	4.986	7/4/2022	1:07:15 AM	0	894.127	11.323	3.05	23.21	1010.47
7/4/2022	1:00:00 AM	0	12.169	4.986	7/4/2022	2:07:15 AM	0	893.809	11.372	3.05	23.21	1010.47
7/4/2022	2:00:00 AM	0	12.1674	4.986	7/4/2022	3:07:15 AM	0	893.492	11.519	3.06	23.20	1010.48
7/4/2022	3:00:00 AM	0	12.1662	4.987	7/4/2022	4:07:15 AM	0	893.474	11.43	3.06	23.20	1010.48
7/4/2022	4:00:00 AM	0	12.1648	4.986	7/4/2022	5:07:15 AM	0	894.005	11.424	3.05	23.21	1010.47
7/4/2022	5:00:00 AM	0	12.1643	4.987	7/4/2022	6:07:15 AM	0	894.151	11.607	3.05	23.21	1010.47
7/4/2022	6:00:00 AM	0	12.1644	4.987	7/4/2022	7:07:15 AM	0	894.229	11.954	3.05	23.21	1010.47
7/4/2022	7:00:00 AM	0	12.164	4.986	7/4/2022	8:07:15 AM	0	894.415	12.468	3.04	23.22	1010.46
7/4/2022	8:00:00 AM	0	12.1638	4.986	7/4/2022	9:07:15 AM	0	894.447	16.054	3.04	23.22	1010.46
7/4/2022	9:00:00 AM	0	12.1629	4.986	7/4/2022	10:07:15 AM	0	894.474	19.978	3.04	23.22	1010.46
7/4/2022	10:00:00 AM	0	12.1617	4.986	7/4/2022	11:07:15 AM	0	894.066	23.162	3.04	23.22	1010.46
7/4/2022	11:00:00 AM	0	12.1595	4.985	7/4/2022	12:07:15 PM	0	893.686	27.03	3.05	23.21	1010.47
7/4/2022	12:00:00 PM	0	12.1584	4.986	7/4/2022	1:07:15 PM	0	893.979	24.913	3.04	23.22	1010.46
7/4/2022	1:00:00 PM	0	12.1582	4.986	7/4/2022	2:07:15 PM	0	893.867	26.716	3.04	23.22	1010.46
7/4/2022	2:00:00 PM	0	12.1567	4.987	7/4/2022	3:07:15 PM	0	893.448	26.157	3.05	23.21	1010.47
7/4/2022	3:00:00 PM	0	12.1551	4.986	7/4/2022	4:07:15 PM	0	893.546	23.763	3.04	23.22	1010.46

Appendix A
Groundwater Elevation at GW12-2b

Baro unit	Water Column Equivalent (m)								QA/QC Date:		23-Feb-23	
1 mbar	0.0101972								Completed by:		OK	
Date	**SWL**	**Levelogge**	**GW masl**	**Date**	**SWL**	**Levelogger**	**GW masl**					
2021-01-12	26.538	NA	1007.142	2022-02-28	26.637	-0.06	1007.043					
2021-02-16	24.68	NA	1009	2022-06-06	22.84	3.42	1010.84					
2021-03-05	23.596	NA	1010.084									
2021-08-16	25.025	1.31	1008.655									
Elevation TOC	1033.68											
Raw Level Logger Data					Baro DATA (mbar)					Baro correcte	WL (mbtoc)	GW (masl)
Date	Time	ms	LEVEL	TEMPERATU	Date	Time	ms	LEVEL	TEMPERATURE			
7/4/2022	4:00:00 PM	0	12.1543	4.986	7/4/2022	5:07:15 PM	0	893.412	26.527	3.04	23.22	1010.46
7/4/2022	5:00:00 PM	0	12.1534	4.986	7/4/2022	6:07:15 PM	0	893.294	22.106	3.04	23.22	1010.46
7/4/2022	6:00:00 PM	0	12.1519	4.986	7/4/2022	7:07:15 PM	0	893.882	20.547	3.04	23.22	1010.46
7/4/2022	7:00:00 PM	0	12.152	4.986	7/4/2022	8:07:15 PM	0	894.042	17.03	3.04	23.22	1010.46
7/4/2022	8:00:00 PM	0	12.1517	4.986	7/4/2022	9:07:15 PM	0	894.567	14.023	3.03	23.23	1010.45
7/4/2022	9:00:00 PM	0	12.1522	4.986	7/4/2022	10:07:15 PM	0	894.876	12.852	3.03	23.23	1010.45
7/4/2022	10:00:00 PM	0	12.1526	4.987	7/4/2022	11:07:15 PM	0	894.847	12.036	3.03	23.23	1010.45
7/4/2022	11:00:00 PM	0	12.1524	4.986	7/5/2022	12:07:15 AM	0	894.477	11.286	3.03	23.23	1010.45
7/5/2022	12:00:00 AM	0	12.1515	4.986	7/5/2022	1:07:15 AM	0	894.82	10.407	3.03	23.23	1010.45
7/5/2022	1:00:00 AM	0	12.151	4.986	7/5/2022	2:07:15 AM	0	895.009	10.439	3.02	23.24	1010.44
7/5/2022	2:00:00 AM	0	12.1506	4.986	7/5/2022	3:07:15 AM	0	895.182	10.902	3.02	23.24	1010.44
7/5/2022	3:00:00 AM	0	12.1504	4.986	7/5/2022	4:07:15 AM	0	895.499	10.784	3.02	23.24	1010.44
7/5/2022	4:00:00 AM	0	12.1505	4.987	7/5/2022	5:07:15 AM	0	895.749	10.652	3.02	23.24	1010.44
7/5/2022	5:00:00 AM	0	12.1512	4.986	7/5/2022	6:07:15 AM	0	895.867	10.742	3.02	23.24	1010.44
7/5/2022	6:00:00 AM	0	12.1508	4.986	7/5/2022	7:07:15 AM	0	896.071	11.123	3.01	23.25	1010.43
7/5/2022	7:00:00 AM	0	12.1517	4.986	7/5/2022	8:07:15 AM	0	896.532	11.608	3.01	23.25	1010.43
7/5/2022	8:00:00 AM	0	12.1521	4.987	7/5/2022	9:07:15 AM	0	896.745	11.339	3.01	23.25	1010.43
7/5/2022	9:00:00 AM	0	12.1532	4.987	7/5/2022	10:07:15 AM	0	897.002	11.245	3.01	23.25	1010.43
7/5/2022	10:00:00 AM	0	12.1542	4.986	7/5/2022	11:07:15 AM	0	897.386	10.833	3.00	23.26	1010.42
7/5/2022	11:00:00 AM	0	12.1554	4.986	7/5/2022	12:07:15 PM	0	897.671	10.813	3.00	23.26	1010.42
7/5/2022	12:00:00 PM	0	12.1561	4.987	7/5/2022	1:07:15 PM	0	897.826	11.968	3.00	23.26	1010.42
7/5/2022	1:00:00 PM	0	12.1565	4.987	7/5/2022	2:07:15 PM	0	897.669	15.699	3.00	23.26	1010.42
7/5/2022	2:00:00 PM	0	12.1562	4.987	7/5/2022	3:07:15 PM	0	897.429	18.521	3.00	23.26	1010.42
7/5/2022	3:00:00 PM	0	12.1544	4.987	7/5/2022	4:07:15 PM	0	897.253	19.923	3.00	23.26	1010.42
7/5/2022	4:00:00 PM	0	12.1537	4.986	7/5/2022	5:07:15 PM	0	896.761	23.197	3.01	23.25	1010.43
7/5/2022	5:00:00 PM	0	12.1523	4.986	7/5/2022	6:07:15 PM	0	896.808	20.225	3.01	23.25	1010.43
7/5/2022	6:00:00 PM	0	12.1509	4.986	7/5/2022	7:07:15 PM	0	897.083	16.526	3.00	23.26	1010.42
7/5/2022	7:00:00 PM	0	12.15	4.986	7/5/2022	8:07:15 PM	0	897.087	15.511	3.00	23.26	1010.42
7/5/2022	8:00:00 PM	0	12.1492	4.986	7/5/2022	9:07:15 PM	0	897.144	13.596	3.00	23.26	1010.42
7/5/2022	9:00:00 PM	0	12.1485	4.987	7/5/2022	10:07:15 PM	0	897.483	11.756	3.00	23.26	1010.42
7/5/2022	10:00:00 PM	0	12.1485	4.986	7/5/2022	11:07:15 PM	0	897.742	10.454	2.99	23.27	1010.41
7/5/2022	11:00:00 PM	0	12.1482	4.987	7/6/2022	12:07:15 AM	0	897.725	9.653	2.99	23.27	1010.41
7/6/2022	12:00:00 AM	0	12.1474	4.986	7/6/2022	1:07:15 AM	0	897.413	9.337	3.00	23.26	1010.42
7/6/2022	1:00:00 AM	0	12.1461	4.987	7/6/2022	2:07:15 AM	0	897.357	9.658	3.00	23.26	1010.42
7/6/2022	2:00:00 AM	0	12.1446	4.987	7/6/2022	3:07:15 AM	0	897.357	9.523	2.99	23.27	1010.41
7/6/2022	3:00:00 AM	0	12.1434	4.986	7/6/2022	4:07:15 AM	0	897.245	9.466	2.99	23.27	1010.41
7/6/2022	4:00:00 AM	0	12.1417	4.986	7/6/2022	5:07:15 AM	0	897.186	8.491	2.99	23.27	1010.41
7/6/2022	5:00:00 AM	0	12.1406	4.986	7/6/2022	6:07:15 AM	0	897.385	7.818	2.99	23.27	1010.41
7/6/2022	6:00:00 AM	0	12.139	4.986	7/6/2022	7:07:15 AM	0	897.358	8.065	2.99	23.27	1010.41
7/6/2022	7:00:00 AM	0	12.1381	4.987	7/6/2022	8:07:15 AM	0	897.436	10.085	2.99	23.27	1010.41
7/6/2022	8:00:00 AM	0	12.1361	4.986	7/6/2022	9:07:15 AM	0	897.195	16.095	2.99	23.27	1010.41
7/6/2022	9:00:00 AM	0	12.1333	4.986	7/6/2022	10:07:15 AM	0	896.763	22.343	2.99	23.27	1010.41
7/6/2022	10:00:00 AM	0	12.1311	4.987	7/6/2022	11:07:15 AM	0	896.375	24.959	2.99	23.27	1010.41
7/6/2022	11:00:00 AM	0	12.1284	4.986	7/6/2022	12:07:15 PM	0	896.427	25.329	2.99	23.27	1010.41
7/6/2022	12:00:00 PM	0	12.1265	4.987	7/6/2022	1:07:15 PM	0	896.315	23.001	2.99	23.27	1010.41
7/6/2022	1:00:00 PM	0	12.1251	4.986	7/6/2022	2:07:15 PM	0	895.887	23.831	2.99	23.27	1010.41
7/6/2022	2:00:00 PM	0	12.1226	4.986	7/6/2022	3:07:15 PM	0	895.95	21.502	2.99	23.27	1010.41
7/6/2022	3:00:00 PM	0	12.1206	4.986	7/6/2022	4:07:15 PM	0	895.927	20.951	2.98	23.28	1010.40
7/6/2022	4:00:00 PM	0	12.119	4.987	7/6/2022	5:07:15 PM	0	895.787	20.271	2.98	23.28	1010.40
7/6/2022	5:00:00 PM	0	12.1165	4.986	7/6/2022	6:07:15 PM	0	895.408	19.264	2.99	23.27	1010.41
7/6/2022	6:00:00 PM	0	12.1142	4.986	7/6/2022	7:07:15 PM	0	895.197	18.52	2.99	23.27	1010.41
7/6/2022	7:00:00 PM	0	12.1113	4.986	7/6/2022	8:07:15 PM	0	895.285	18.034	2.98	23.28	1010.40
7/6/2022	8:00:00 PM	0	12.1092	4.987	7/6/2022	9:07:15 PM	0	895.362	15.573	2.98	23.28	1010.40
7/6/2022	9:00:00 PM	0	12.1074	4.987	7/6/2022	10:07:15 PM	0	895.589	13.847	2.97	23.29	1010.39
7/6/2022	10:00:00 PM	0	12.1061	4.987	7/6/2022	11:07:15 PM	0	895.908	12.573	2.97	23.29	1010.39
7/6/2022	11:00:00 PM	0	12.1053	4.986	7/7/2022	12:07:15 AM	0	896.02	12.018	2.97	23.29	1010.39
7/7/2022	12:00:00 AM	0	12.1046	4.986	7/7/2022	1:07:15 AM	0	896.139	11.504	2.97	23.29	1010.39
7/7/2022	1:00:00 AM	0	12.1038	4.987	7/7/2022	2:07:15 AM	0	896.162	10.777	2.97	23.29	1010.39
7/7/2022	2:00:00 AM	0	12.1031	4.987	7/7/2022	3:07:15 AM	0	896.234	10.095	2.96	23.30	1010.38
7/7/2022	3:00:00 AM	0	12.1023	4.987	7/7/2022	4:07:15 AM	0	896.23	9.7	2.96	23.30	1010.38
7/7/2022	4:00:00 AM	0	12.1009	4.986	7/7/2022	5:07:15 AM	0	896.422	9.738	2.96	23.30	1010.38
7/7/2022	5:00:00 AM	0	12.1004	4.987	7/7/2022	6:07:15 AM	0	896.675	9.951	2.96	23.30	1010.38
7/7/2022	6:00:00 AM	0	12.1	4.987	7/7/2022	7:07:15 AM	0	896.986	10.915	2.95	23.31	1010.37
7/7/2022	7:00:00 AM	0	12.0998	4.987	7/7/2022	8:07:15 AM	0	897.431	12.854	2.95	23.31	1010.37
7/7/2022	8:00:00 AM	0	12.1003	4.987	7/7/2022	9:07:15 AM	0	897.484	15.26	2.95	23.31	1010.37
7/7/2022	9:00:00 AM	0	12.0992	4.987	7/7/2022	10:07:15 AM	0	896.988	20.586	2.95	23.31	1010.37

APPENDIX B

Additional Groundwater Chemistry Plots

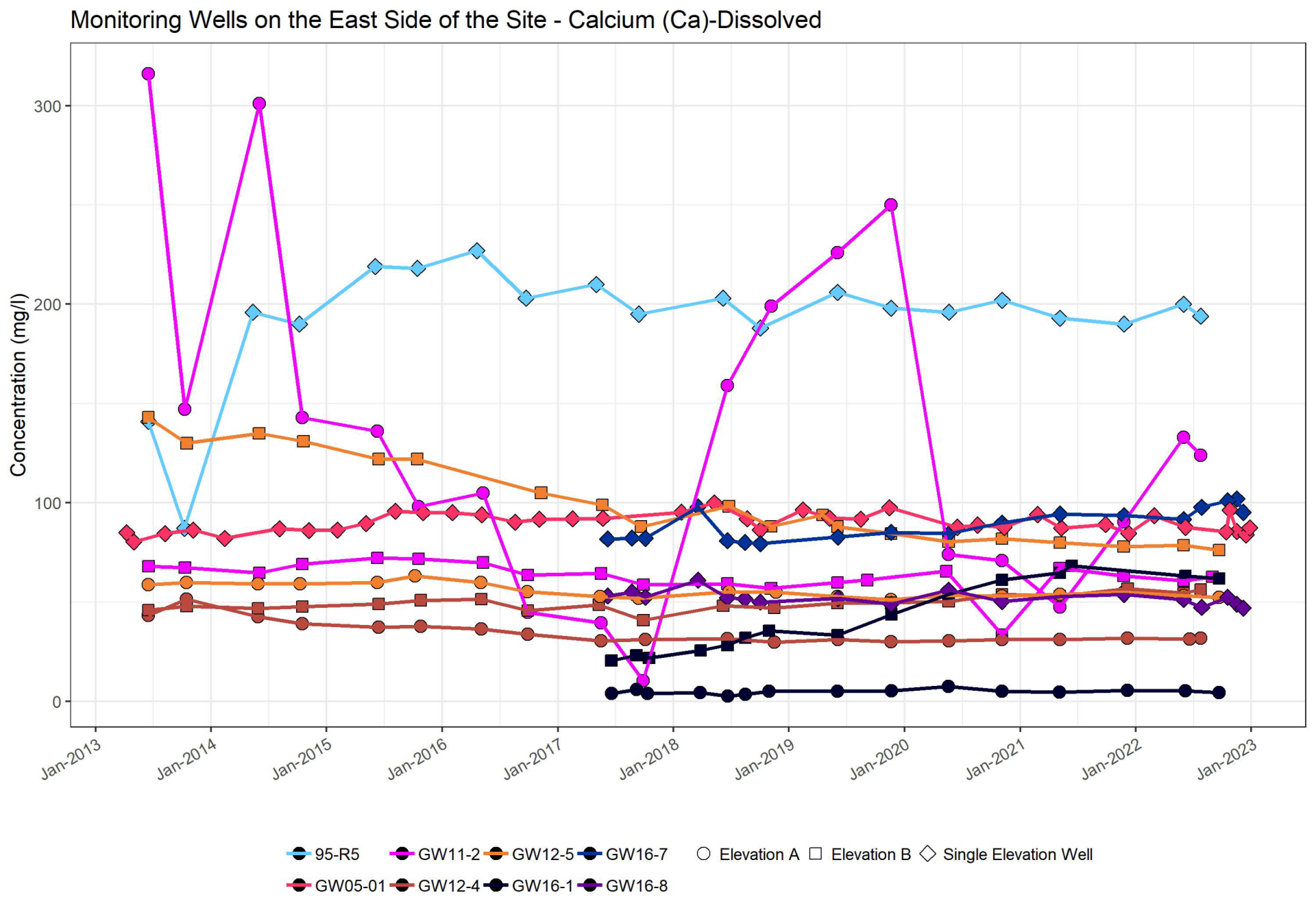
Monitoring Wells on the East Side of the Site - Calcium (Ca)-Dissolved
Concentration (mg/l)
300
200
100
0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

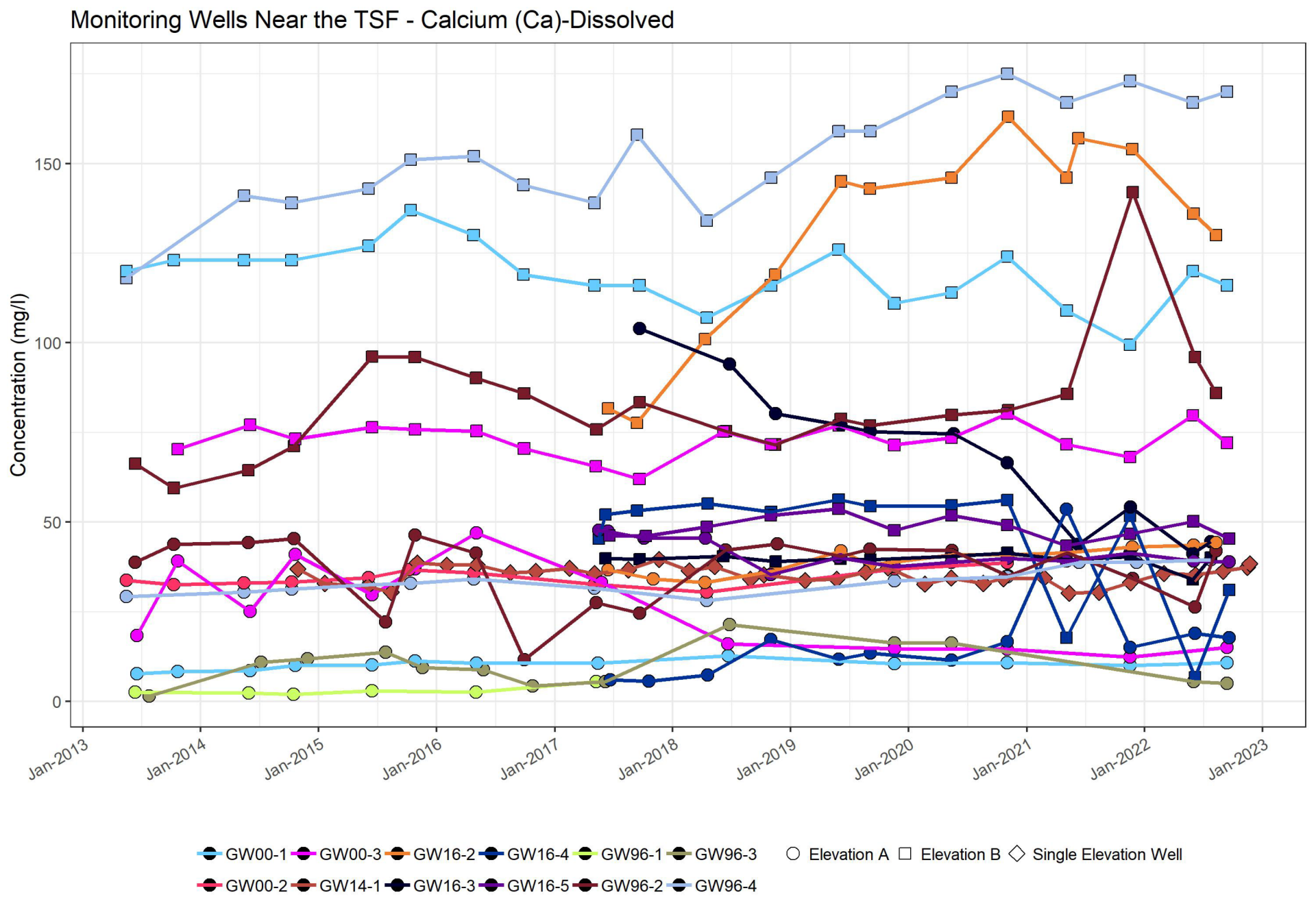
Monitoring Wells Near the TSF - Calcium (Ca)-Dissolved
Concentration (mg/l)
0
50
100
150
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

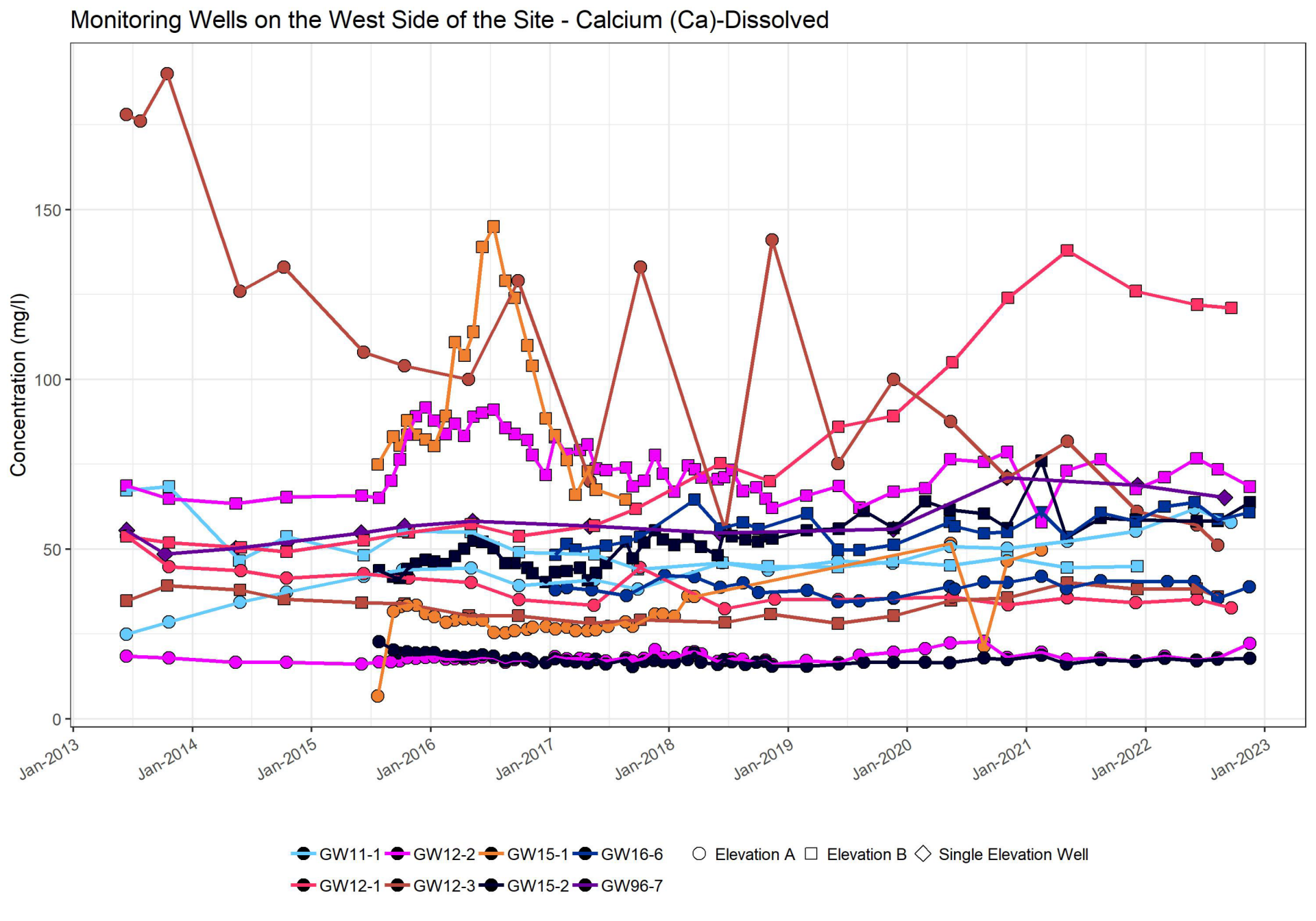
Monitoring Wells on the West Side of the Site - Calcium (Ca)-Dissolved
Concentration (mg/l)
0
50
100
150
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

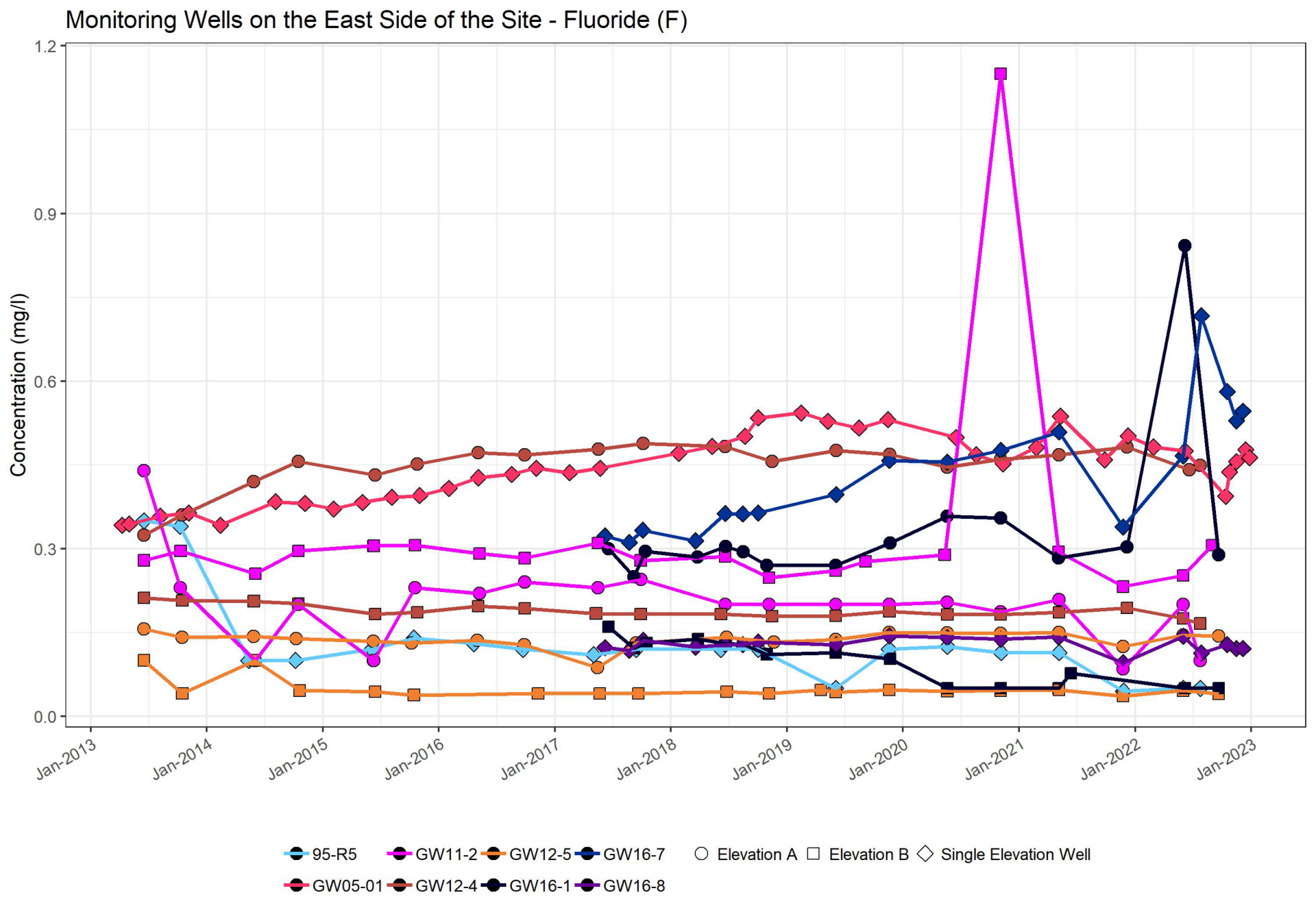
Monitoring Wells on the East Side of the Site - Fluoride (F)
Concentration (mg/l)
1.2
0.9
0.6
0.3
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

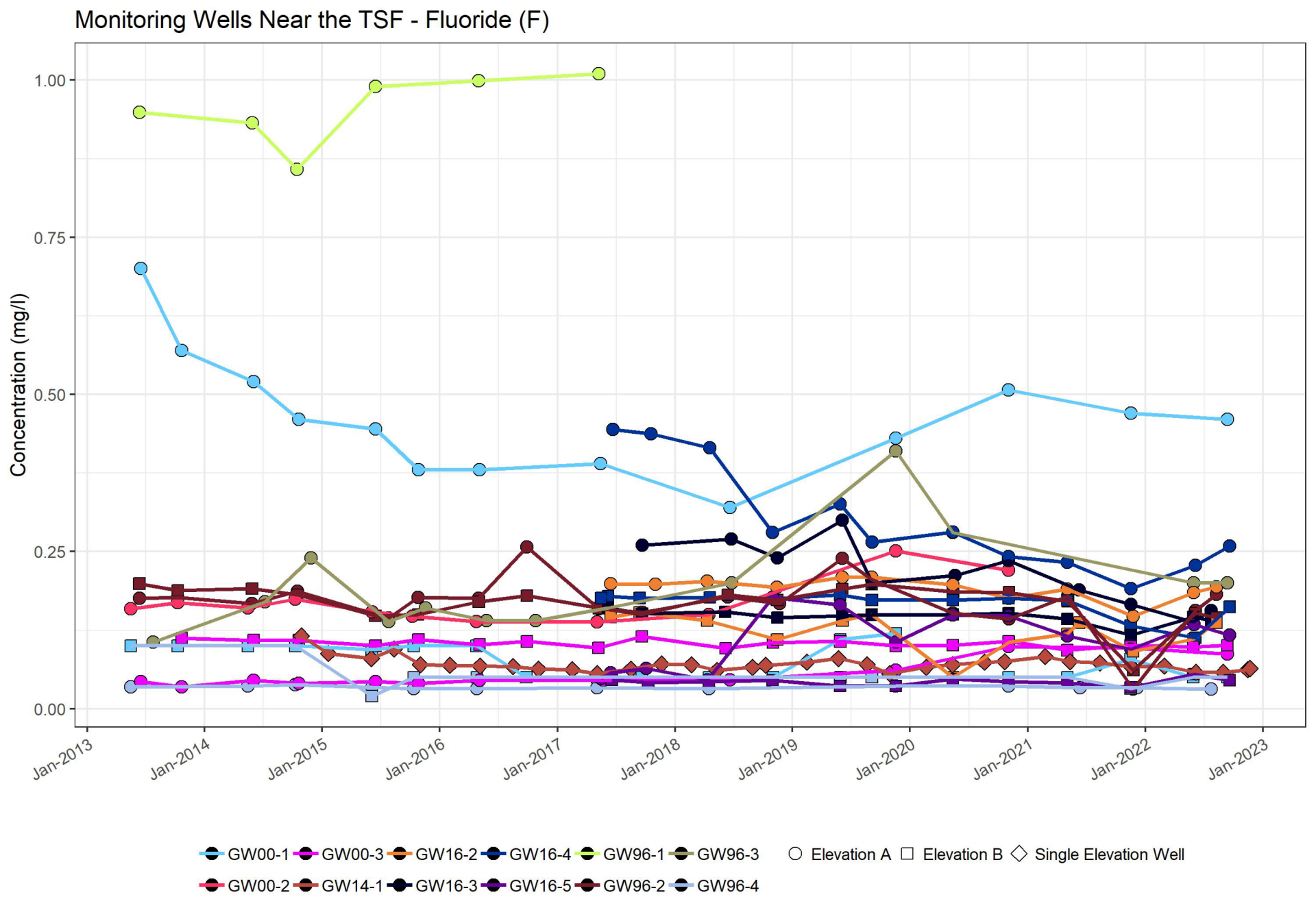
Monitoring Wells Near the TSF - Fluoride (F)
Concentration (mg/l)
1.00
0.75
0.50
0.25
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

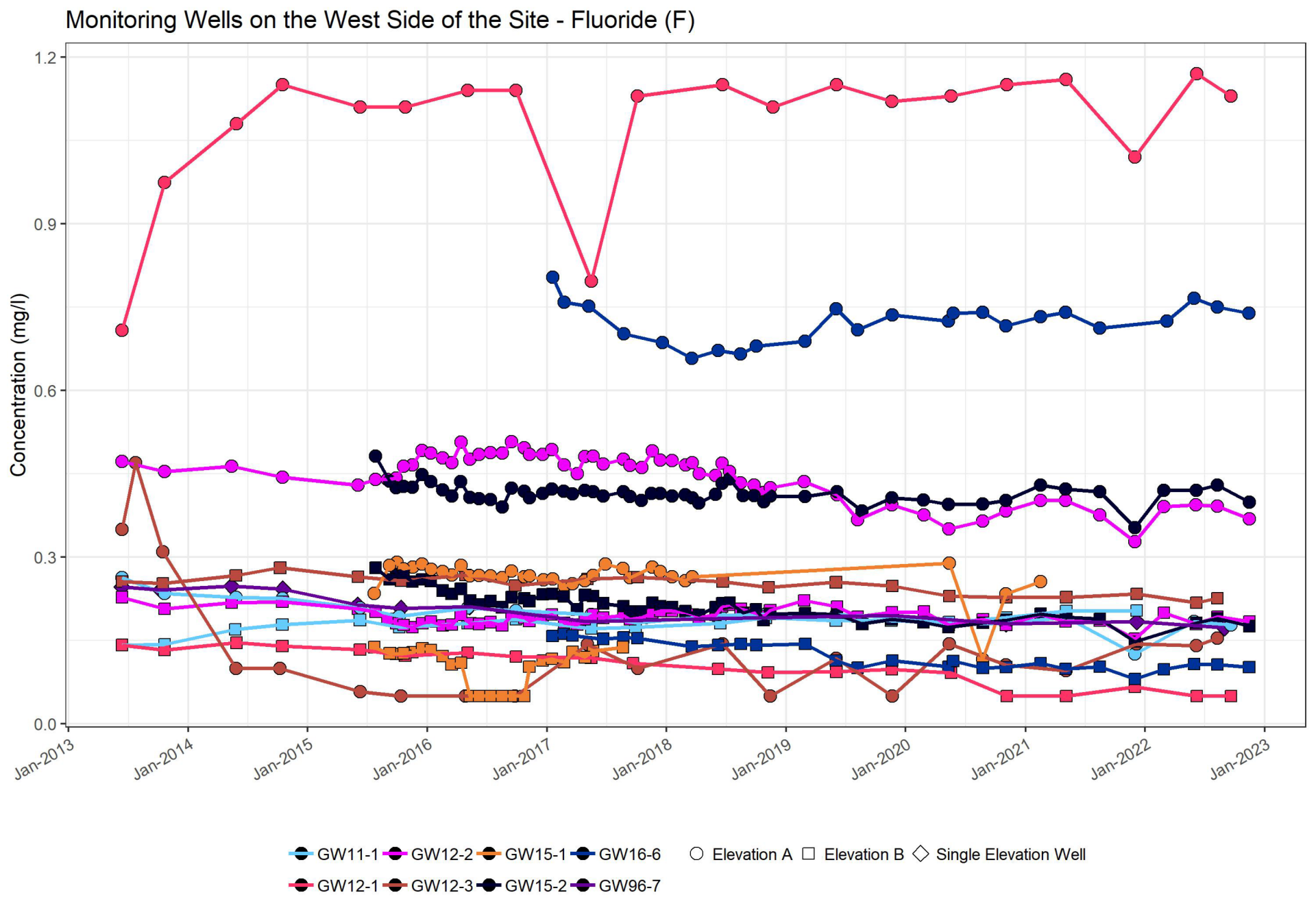
Monitoring Wells on the West Side of the Site - Fluoride (F)
Concentration (mg/l)
1.2
0.9
0.6
0.3
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

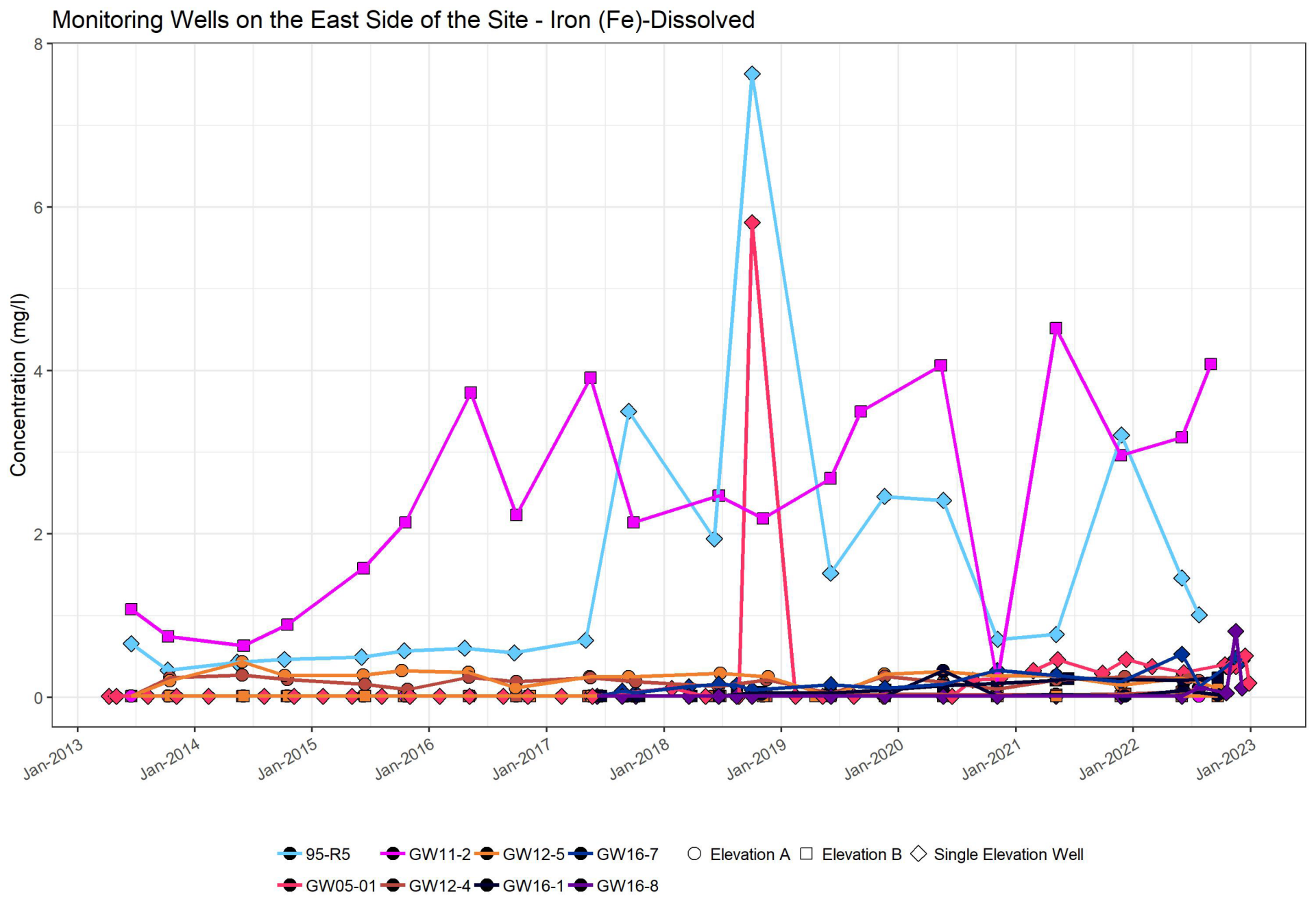
Monitoring Wells on the East Side of the Site - Iron (Fe)-Dissolved
Concentration (mg/l)
8
6
4
2
0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

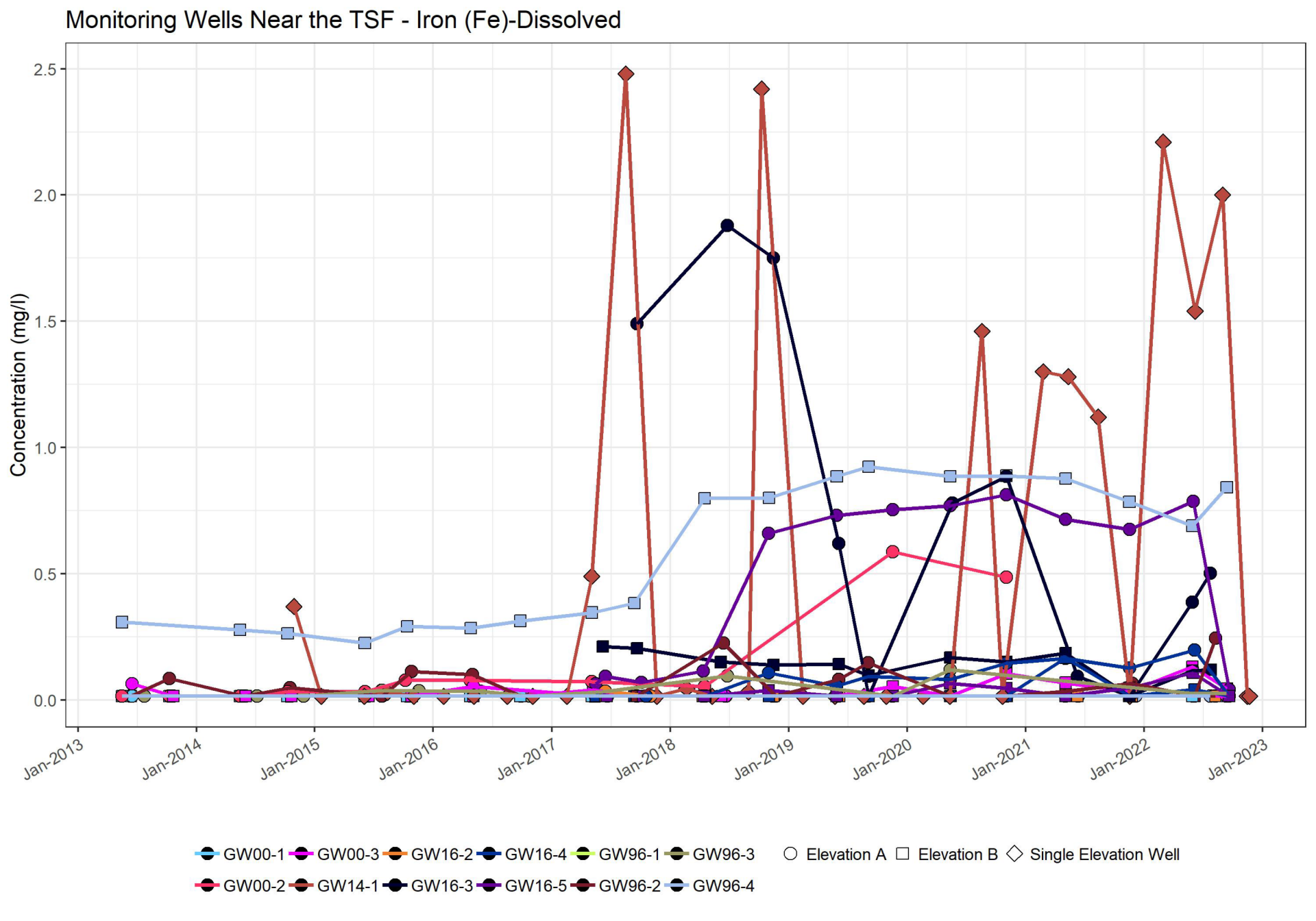
Monitoring Wells Near the TSF - Iron (Fe)-Dissolved
Concentration (mg/l)
2.5
2.0
1.5
1.0
0.5
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

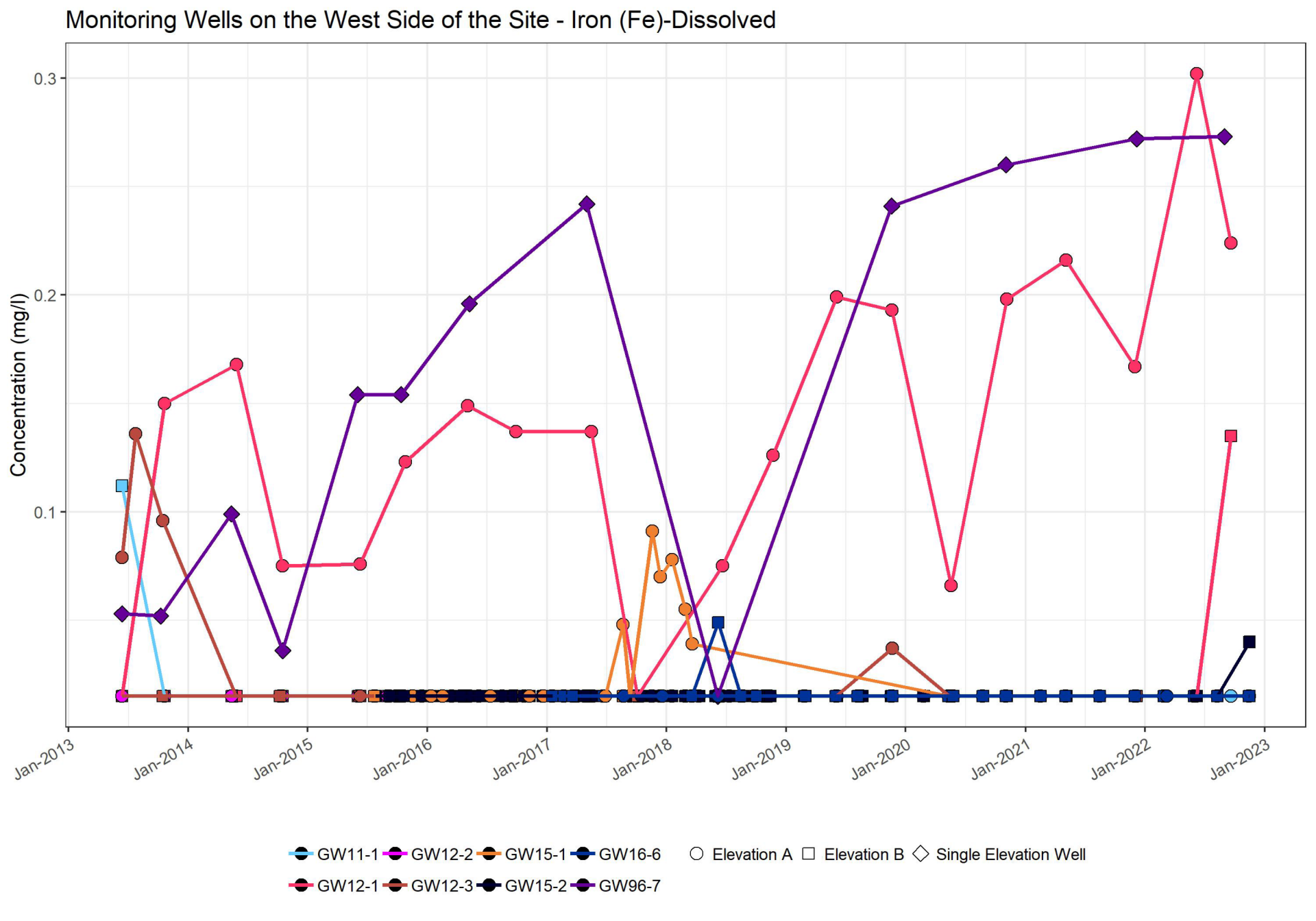
Monitoring Wells on the West Side of the Site - Iron (Fe)-Dissolved
Concentration (mg/l)
0.3
0.2
0.1
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

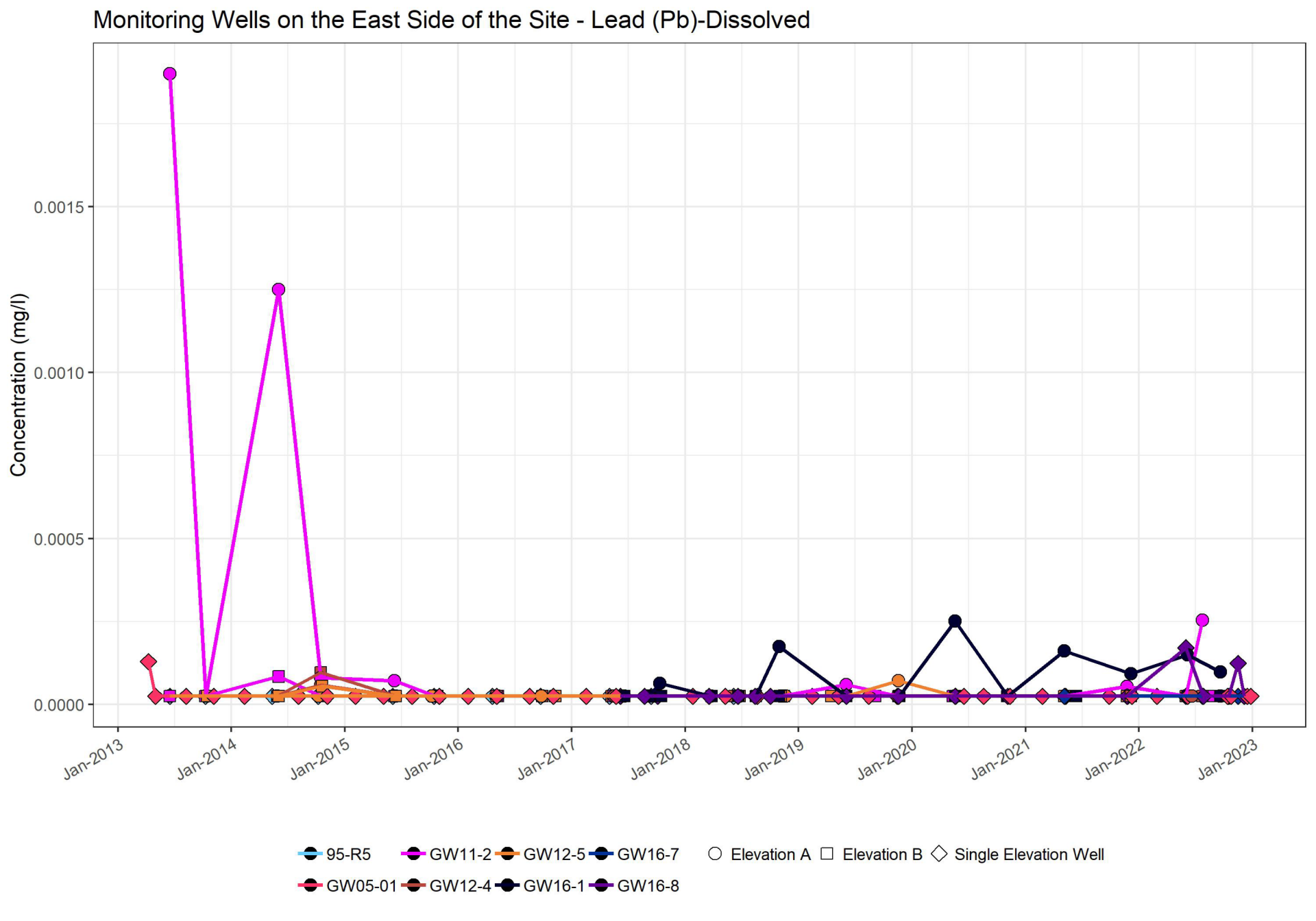
Monitoring Wells on the East Side of the Site - Lead (Pb)-Dissolved
Concentration (mg/l)
0.0015
0.0010
0.0005
0.0000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

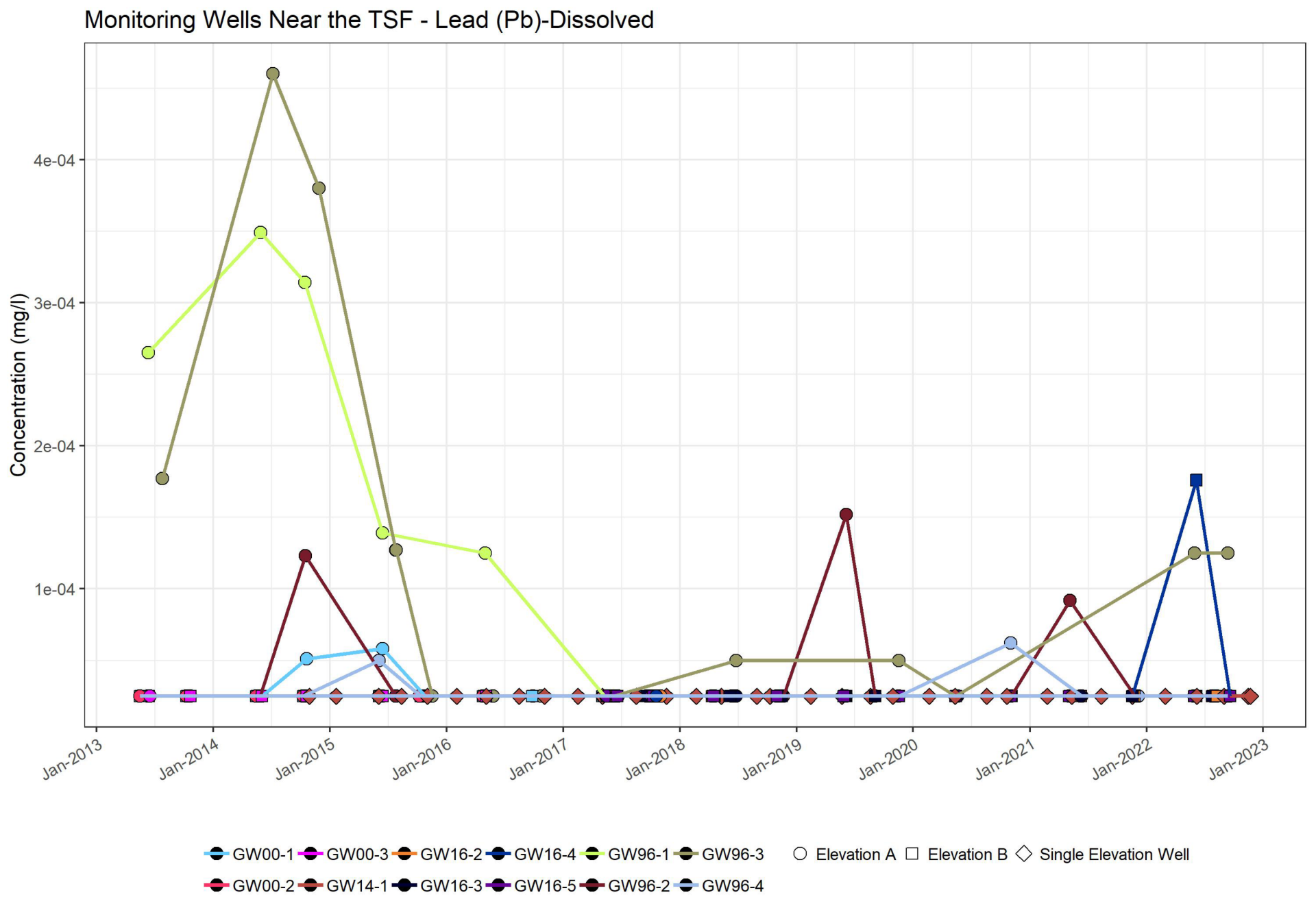
Monitoring Wells Near the TSF - Lead (Pb)-Dissolved
Concentration (mg/l)
4e-04
3e-04
2e-04
1e-04
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

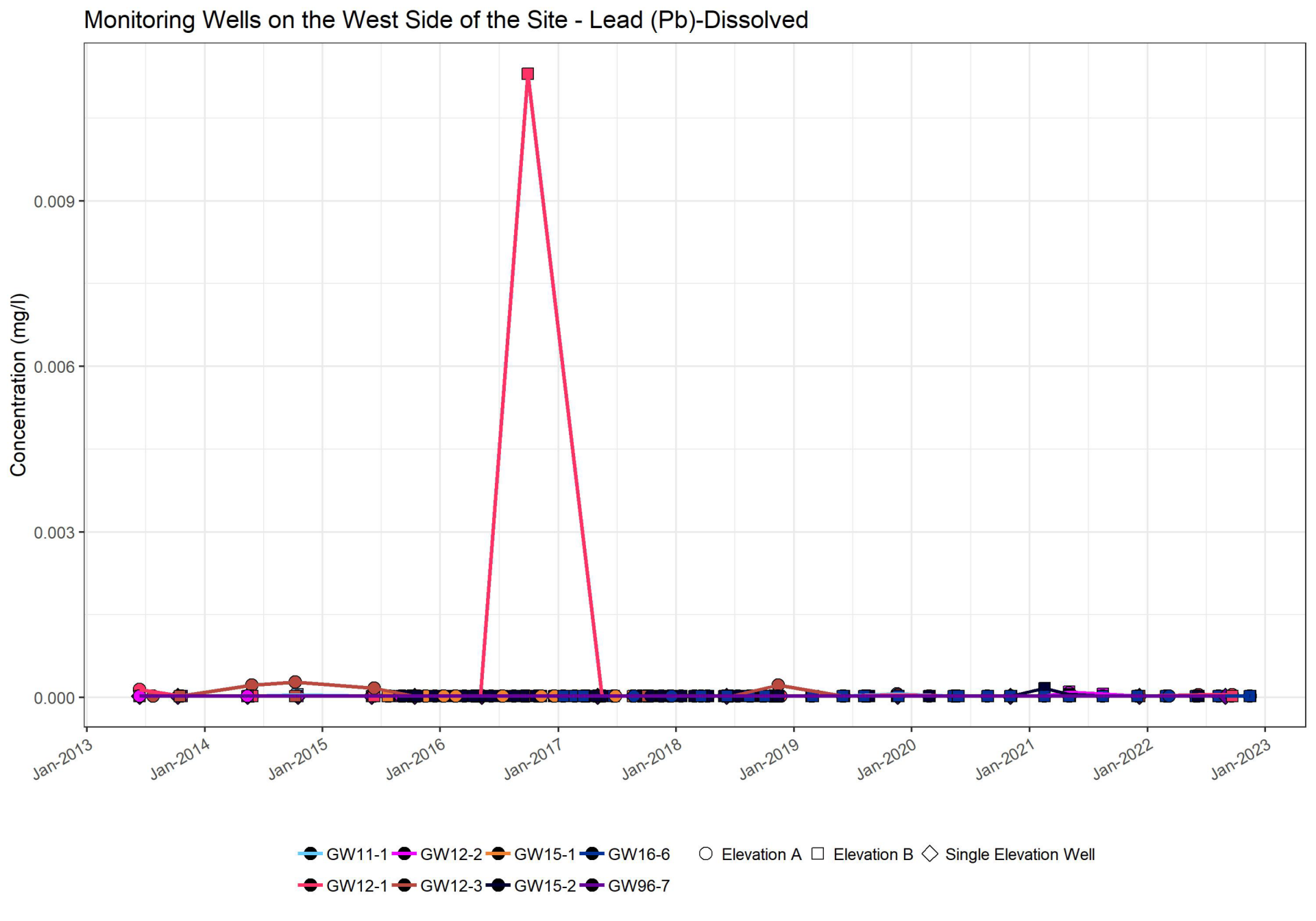
Monitoring Wells on the West Side of the Site - Lead (Pb)-Dissolved
Concentration (mg/l)
0.009
0.006
0.003
0.000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

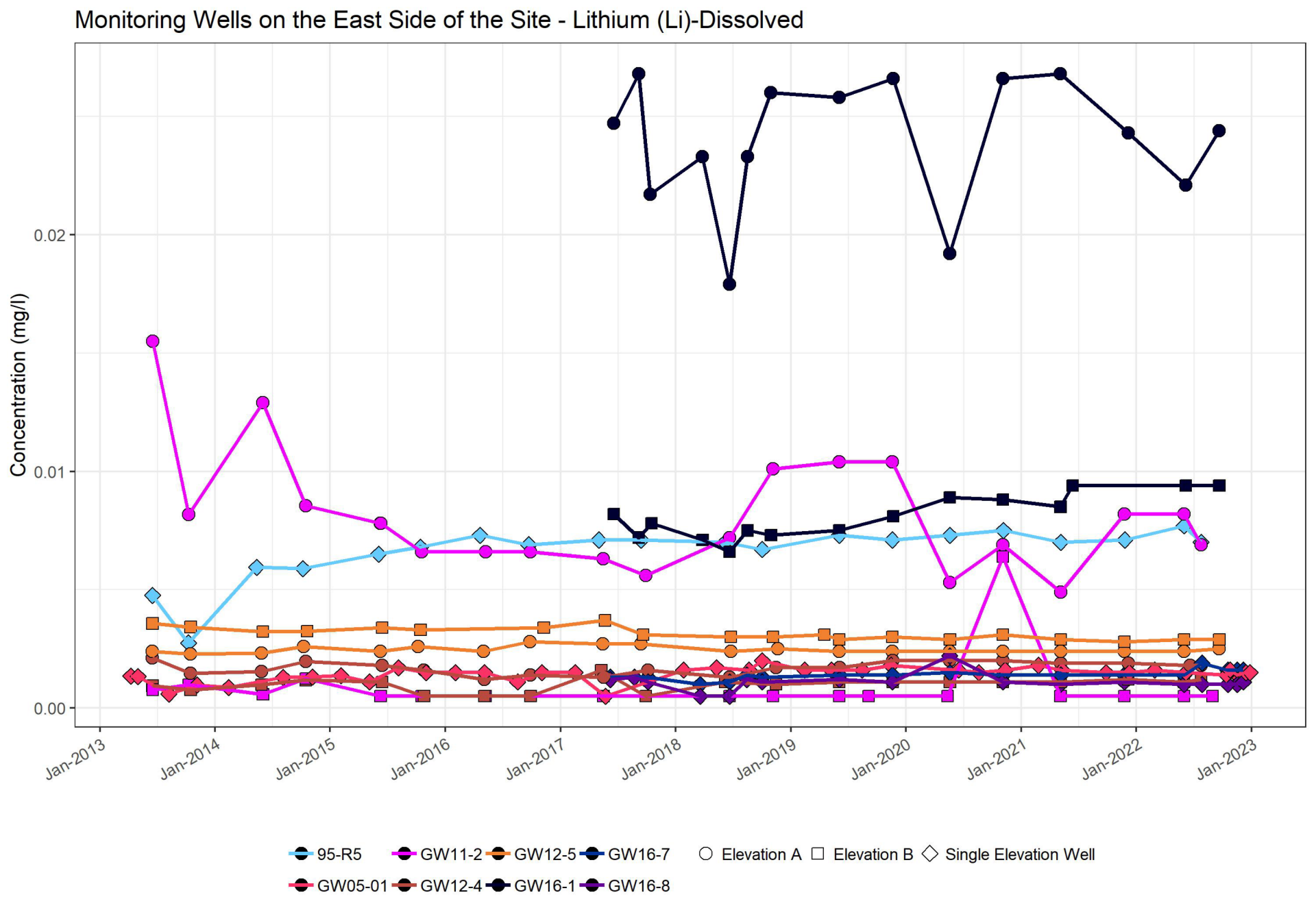
Monitoring Wells on the East Side of the Site - Lithium (Li)-Dissolved
Concentration (mg/l)
0.02
0.01
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

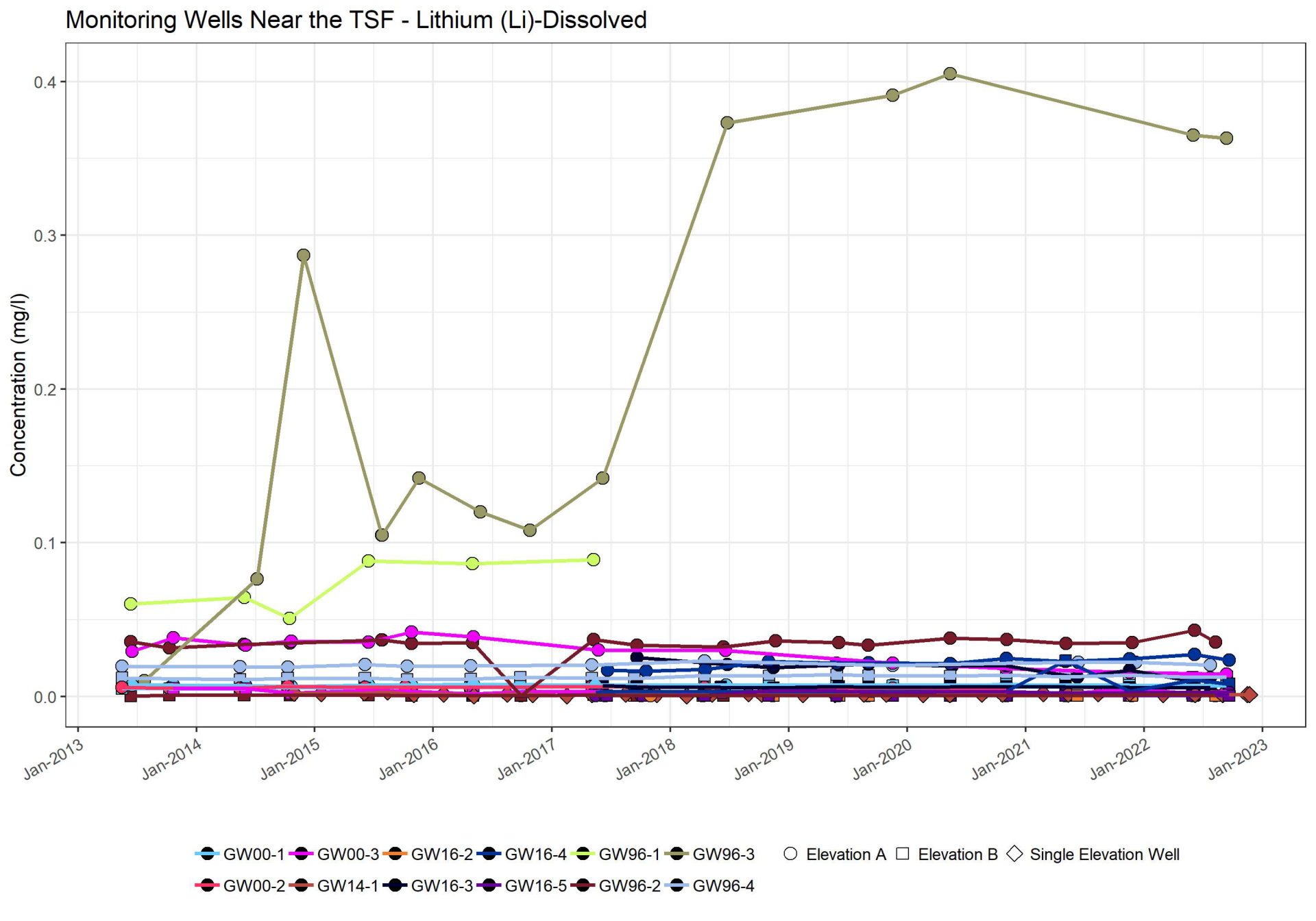
Monitoring Wells Near the TSF - Lithium (Li)-Dissolved
Concentration (mg/l)
0.4
0.3
0.2
0.1
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
Elevation A
Elevation B
Single Elevation Well
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4

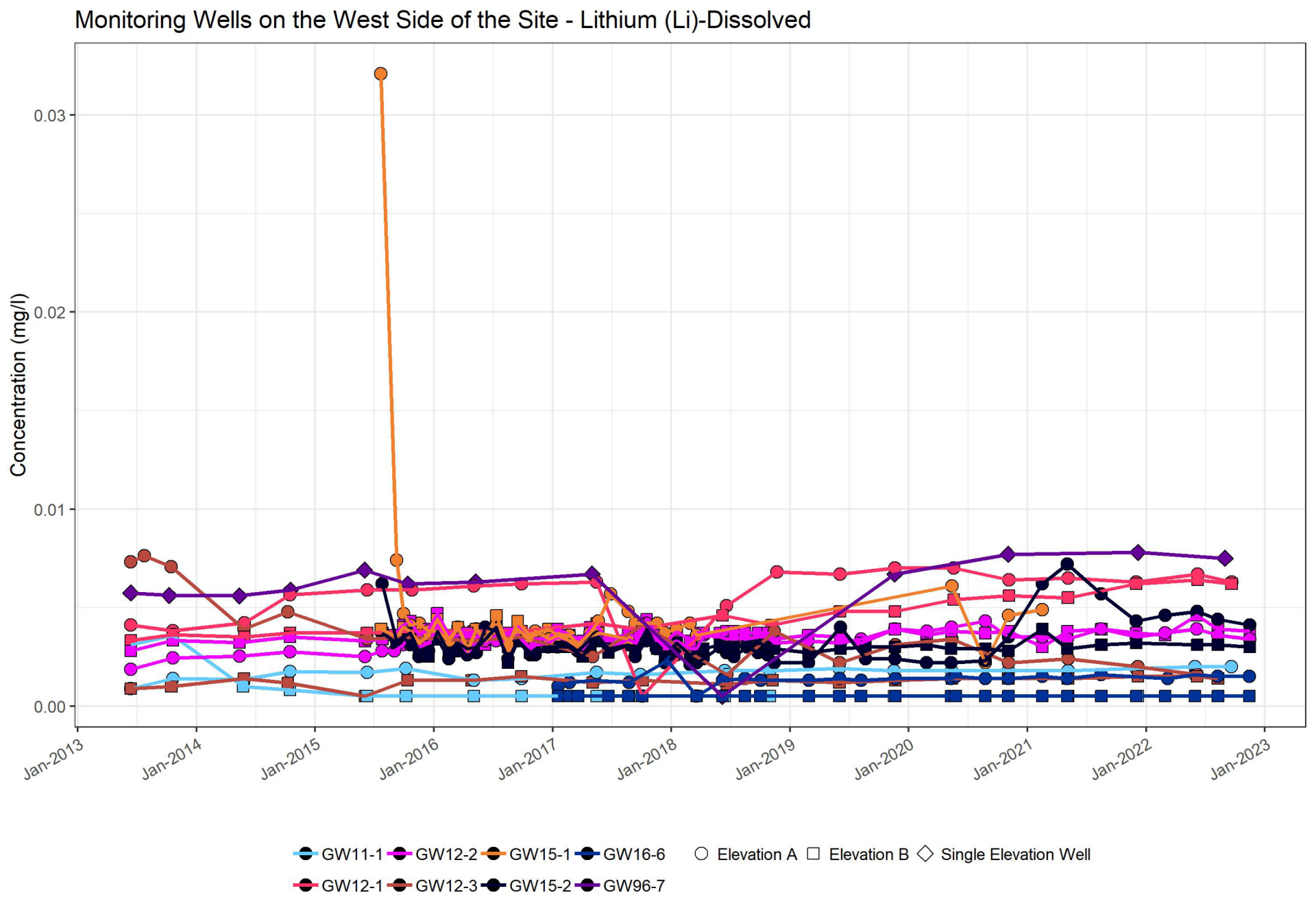
Monitoring Wells on the West Side of the Site - Lithium (Li)-Dissolved
Concentration (mg/l)
0.03
0.02
0.01
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

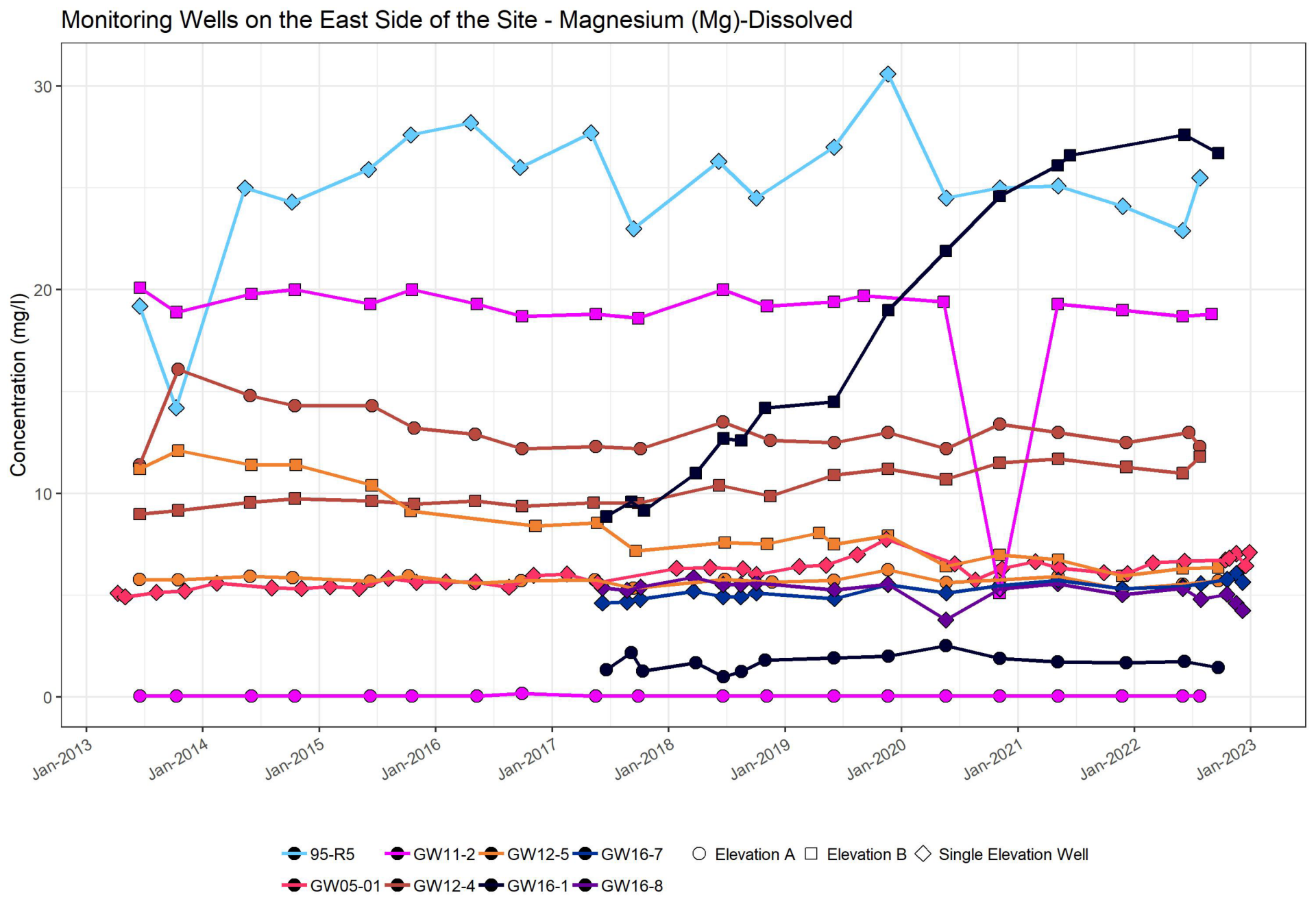
Monitoring Wells on the East Side of the Site - Magnesium (Mg)-Dissolved
Concentration (mg/l)
30
20
10
0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

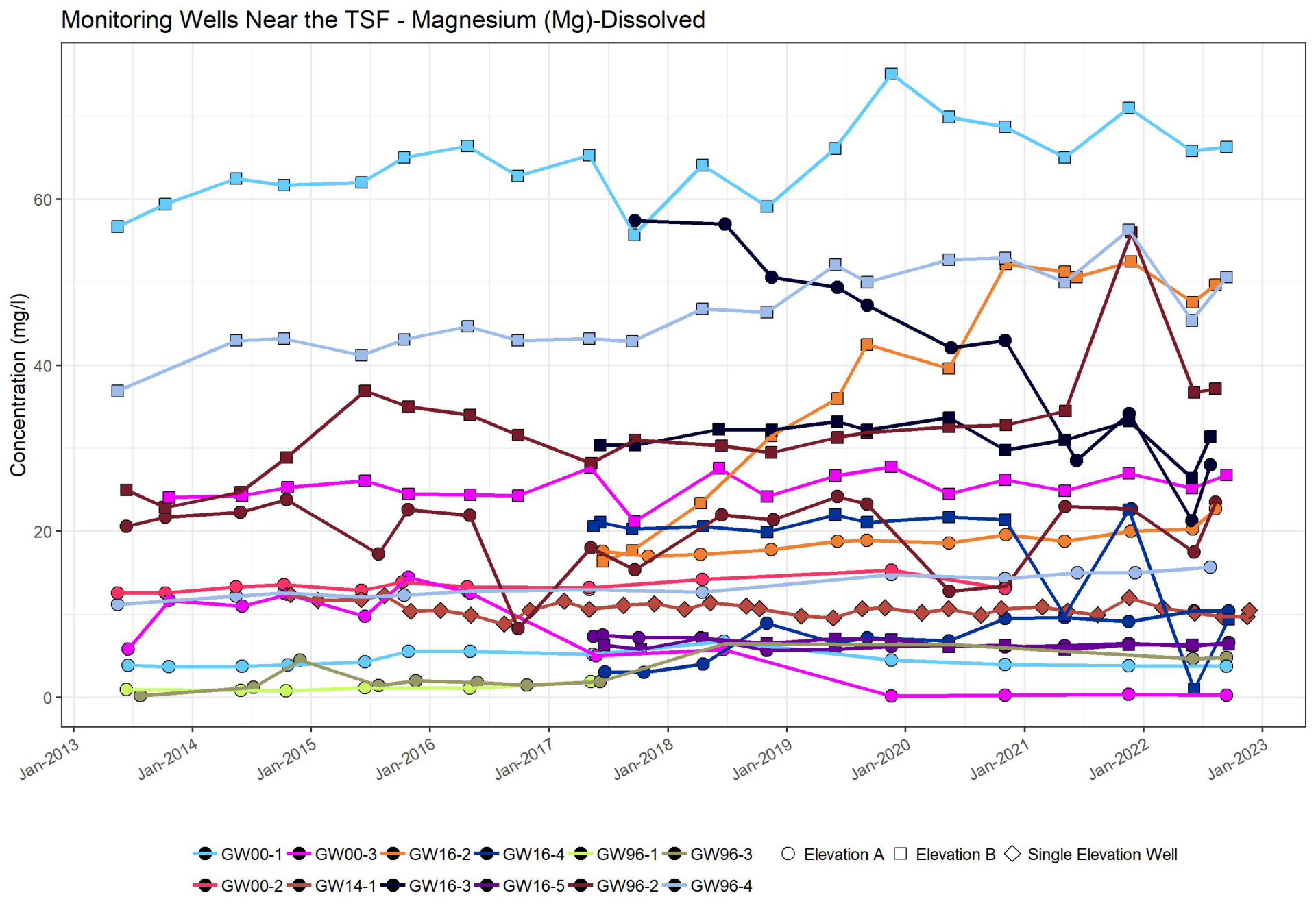
Monitoring Wells Near the TSF - Magnesium (Mg)-Dissolved
Concentration (mg/l)
0
20
40
60
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

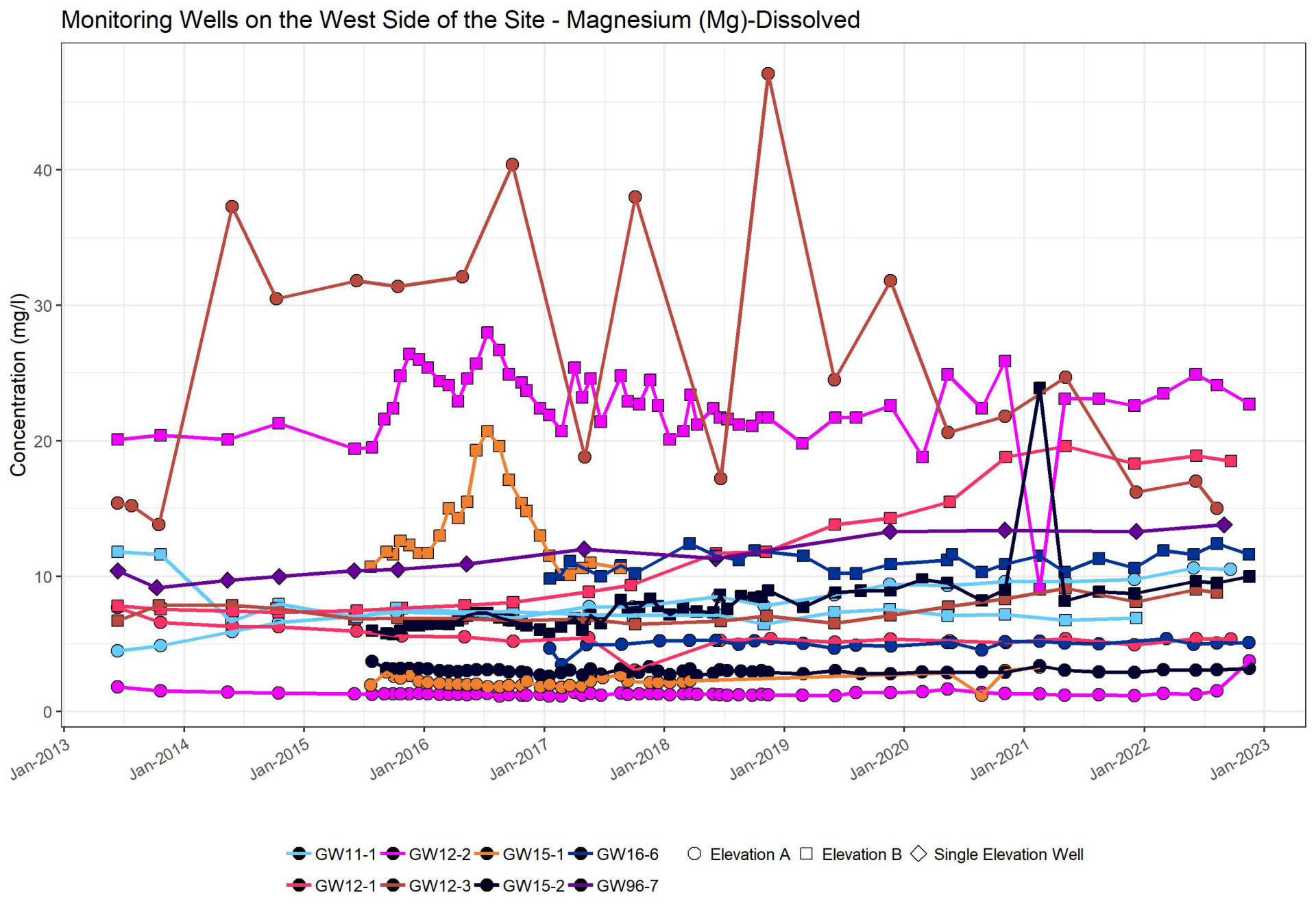
Monitoring Wells on the West Side of the Site - Magnesium (Mg)-Dissolved
Concentration (mg/l)
0
10
20
30
40
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

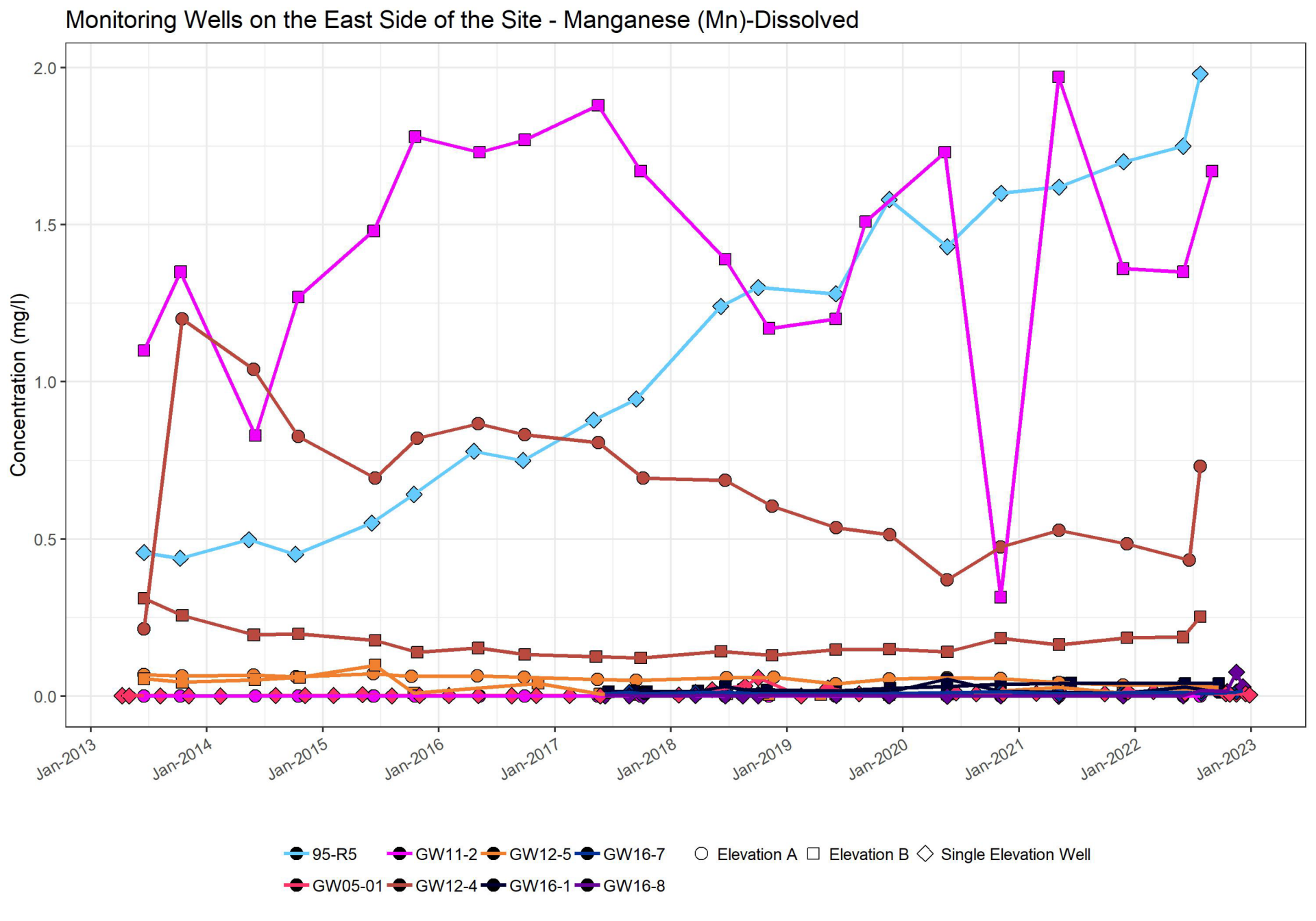
Monitoring Wells on the East Side of the Site - Manganese (Mn)-Dissolved
Concentration (mg/l)
2.0
1.5
1.0
0.5
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

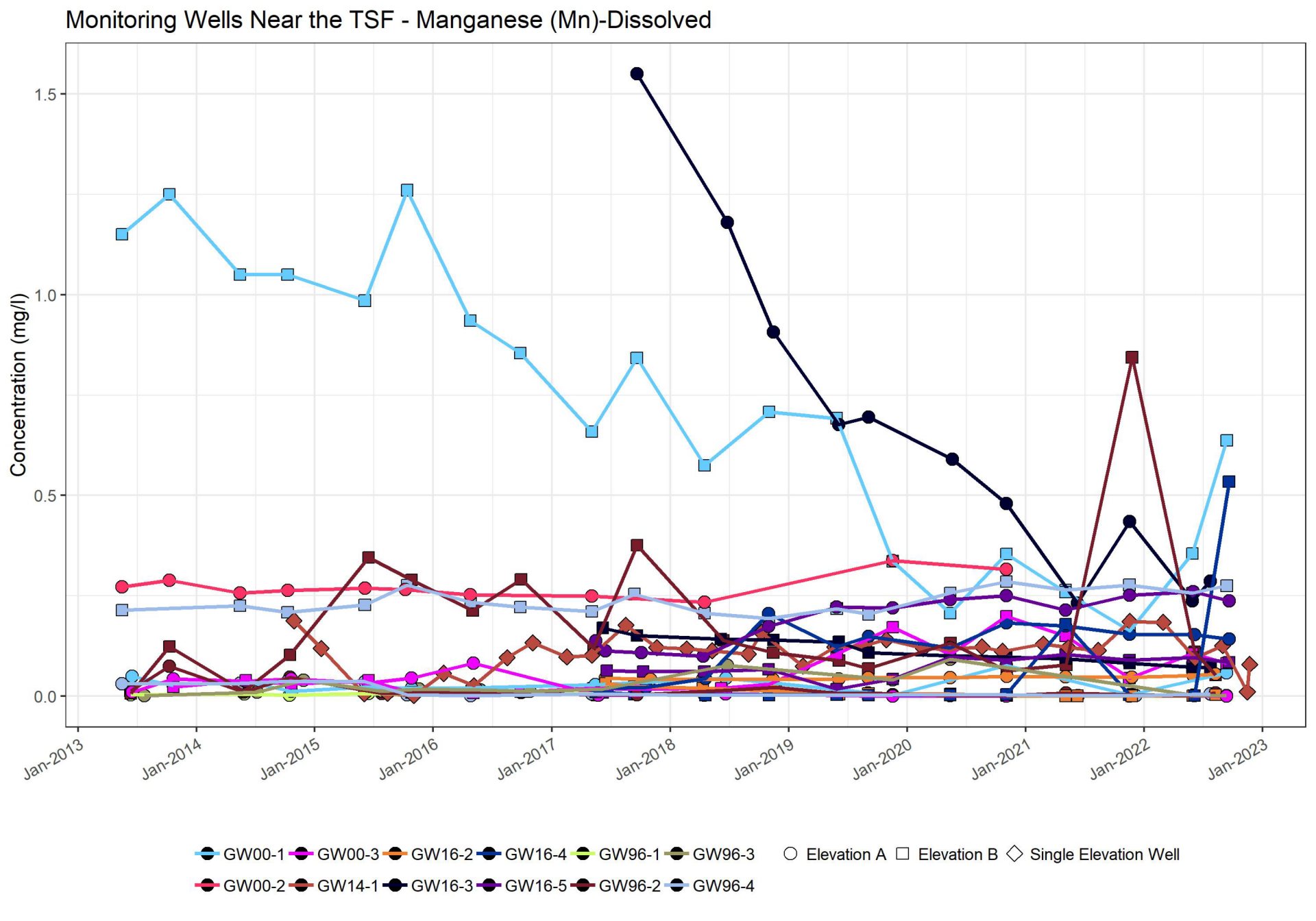
Monitoring Wells Near the TSF - Manganese (Mn)-Dissolved
Concentration (mg/l)
1.5
1.0
0.5
0.0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
Elevation A
Elevation B
Single Elevation Well
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4

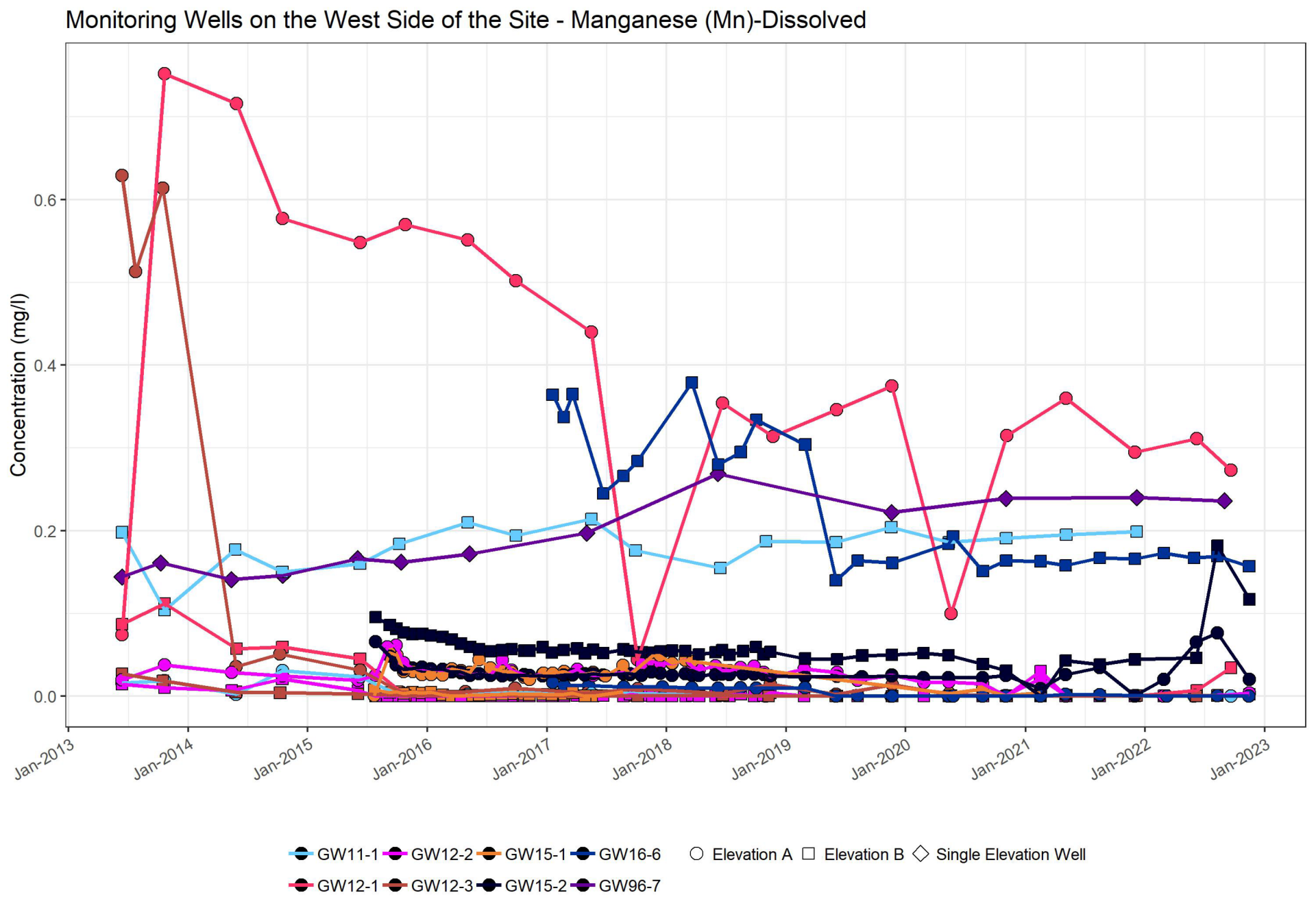
Monitoring Wells on the West Side of the Site - Manganese (Mn)-Dissolved
Concentration (mg/l)
0.0
0.2
0.4
0.6
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

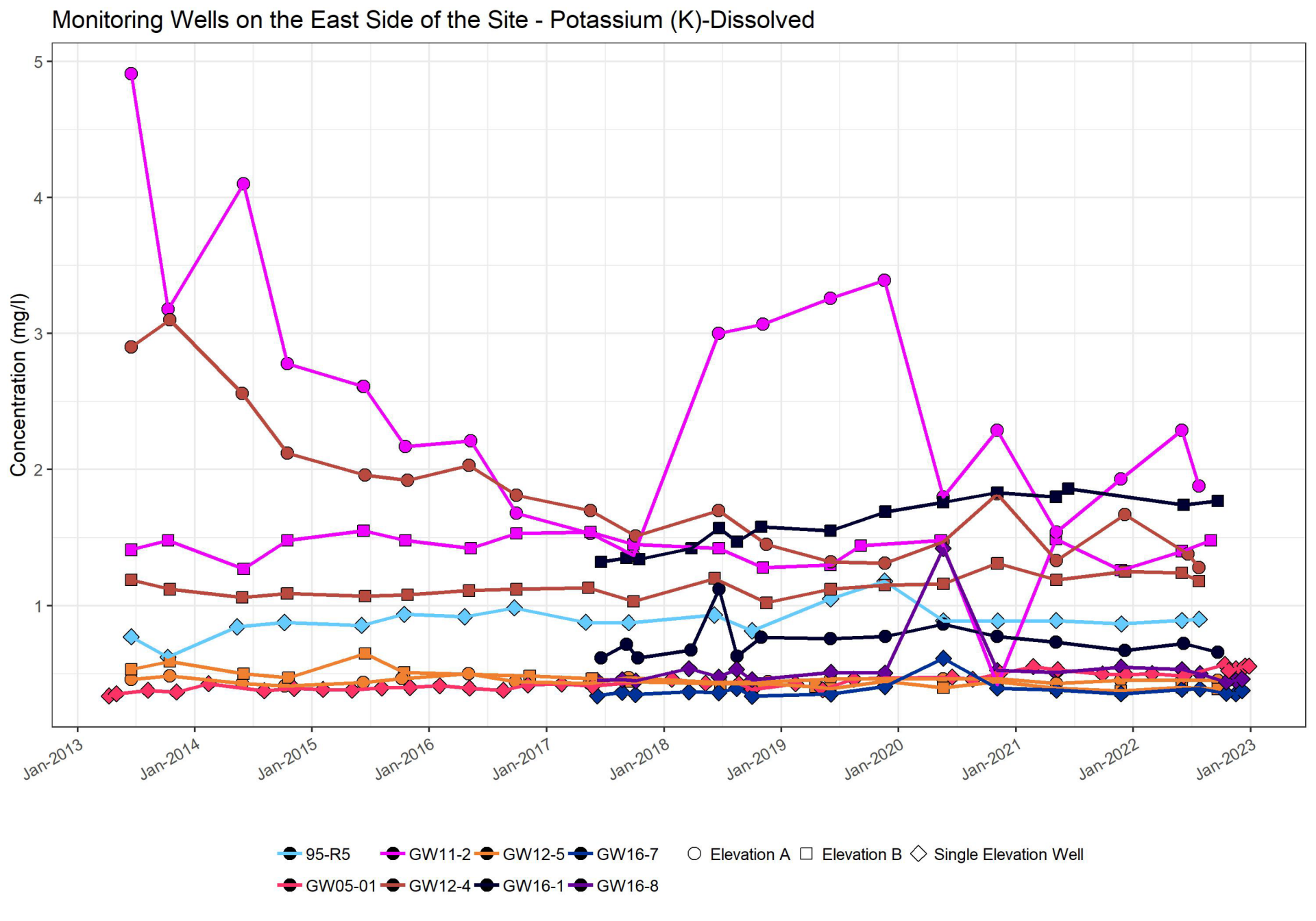
Monitoring Wells on the East Side of the Site - Potassium (K)-Dissolved
Concentration (mg/l)
5
4
3
2
1
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

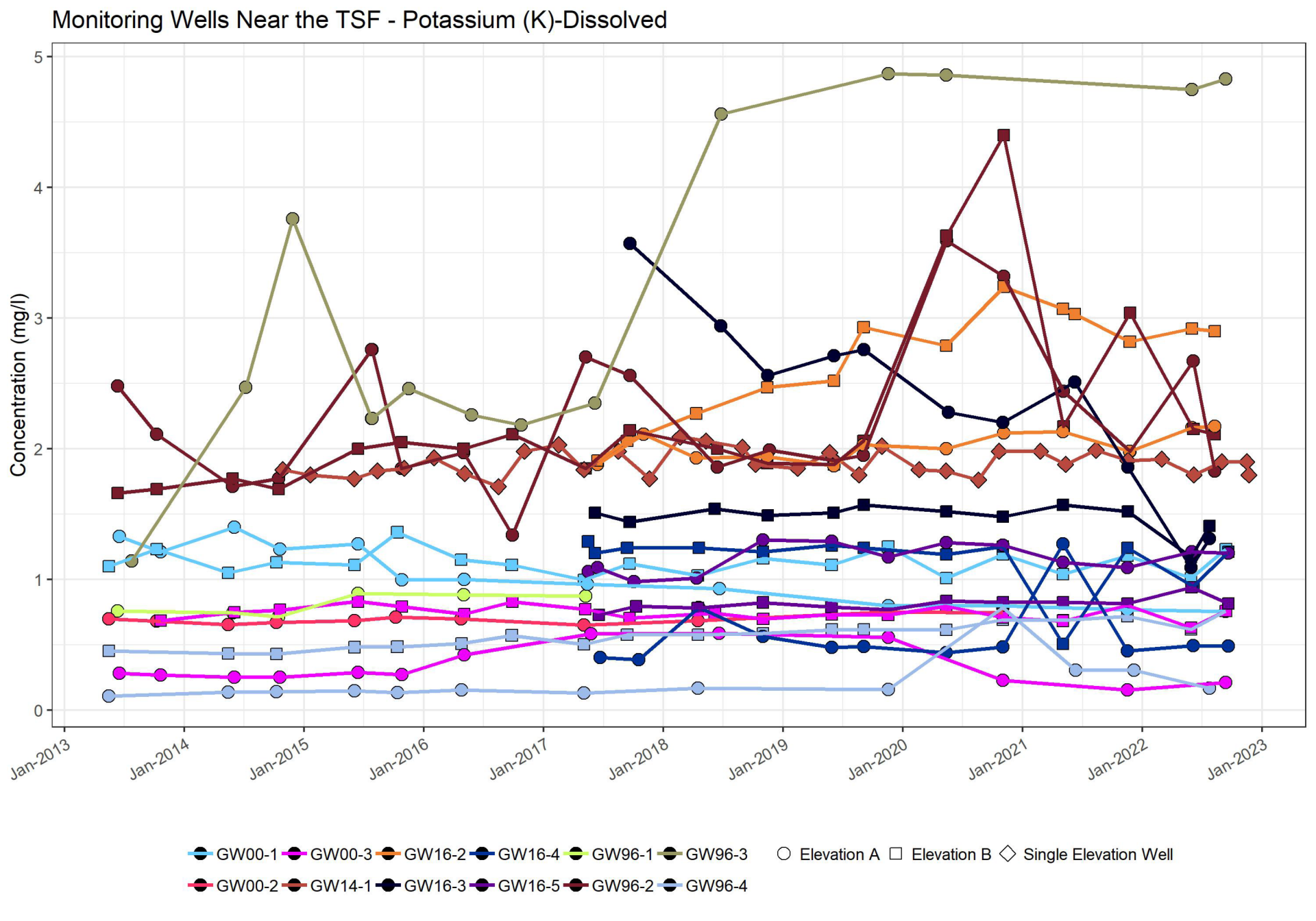
Monitoring Wells Near the TSF - Potassium (K)-Dissolved
Concentration (mg/l)
0
1
2
3
4
5
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

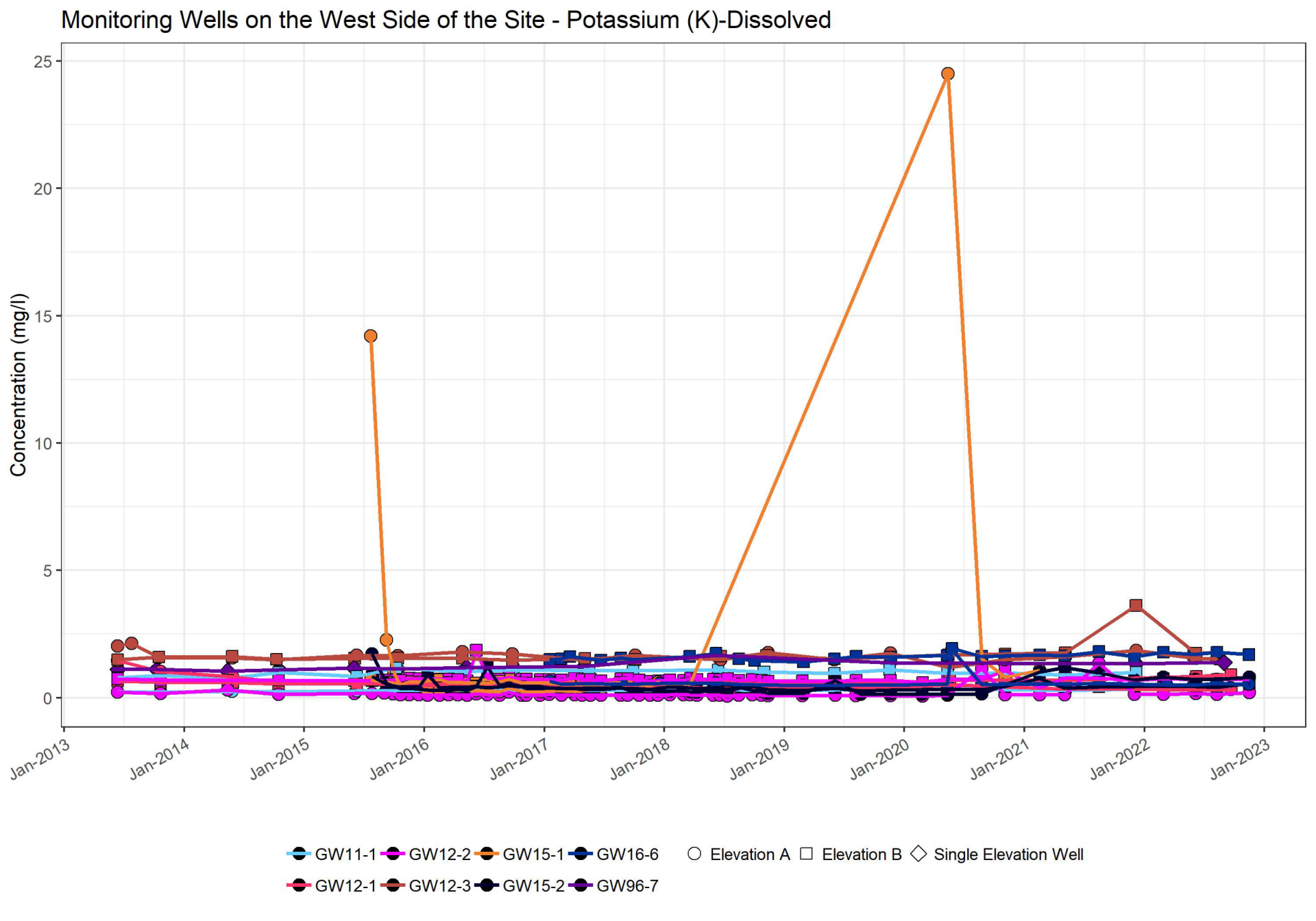
Monitoring Wells on the West Side of the Site - Potassium (K)-Dissolved
Concentration (mg/l)
25
20
15
10
5
0
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

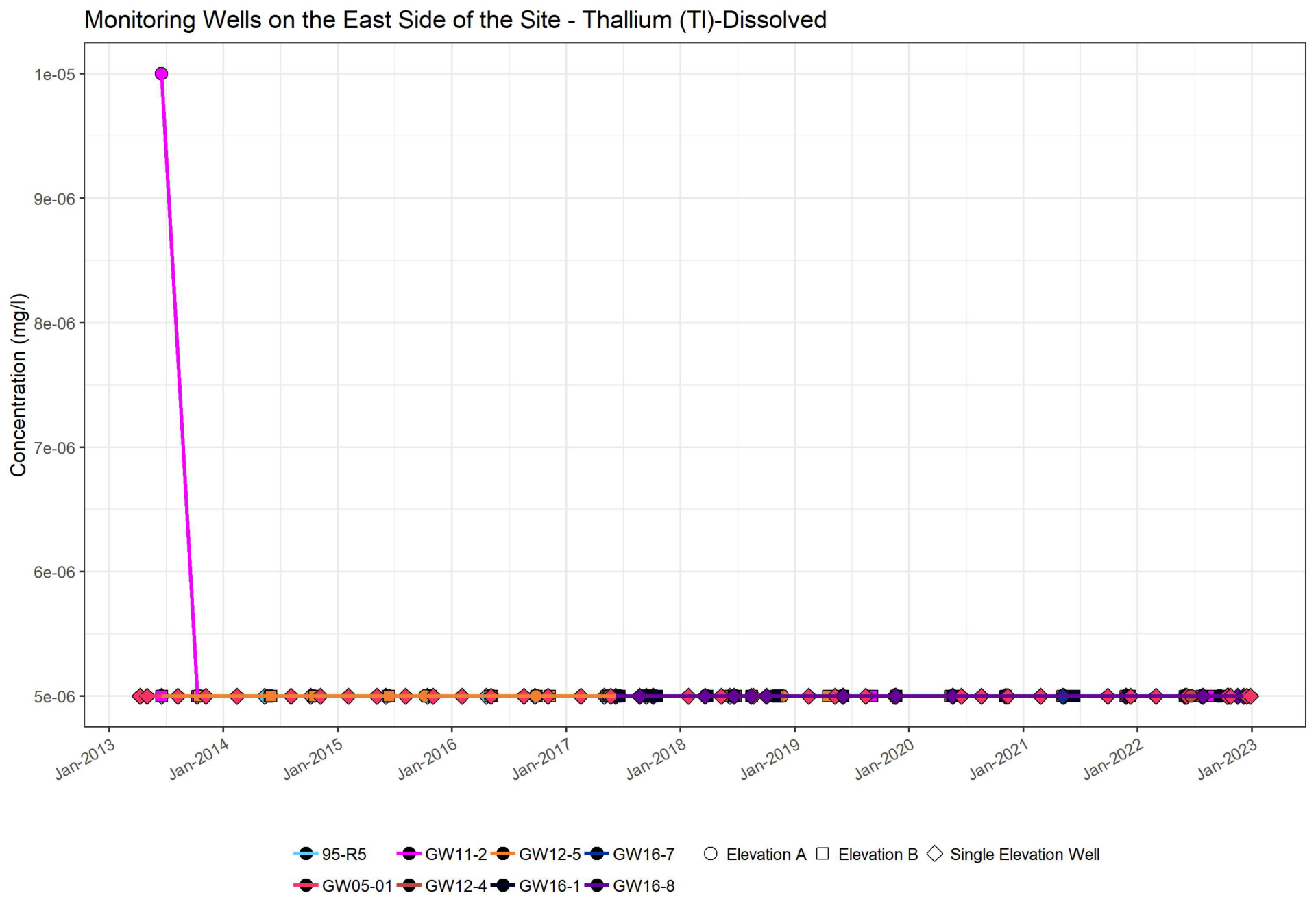
Monitoring Wells on the East Side of the Site - Thallium (Tl)-Dissolved
Concentration (mg/l)
1e-05
9e-06
8e-06
7e-06
6e-06
5e-06
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

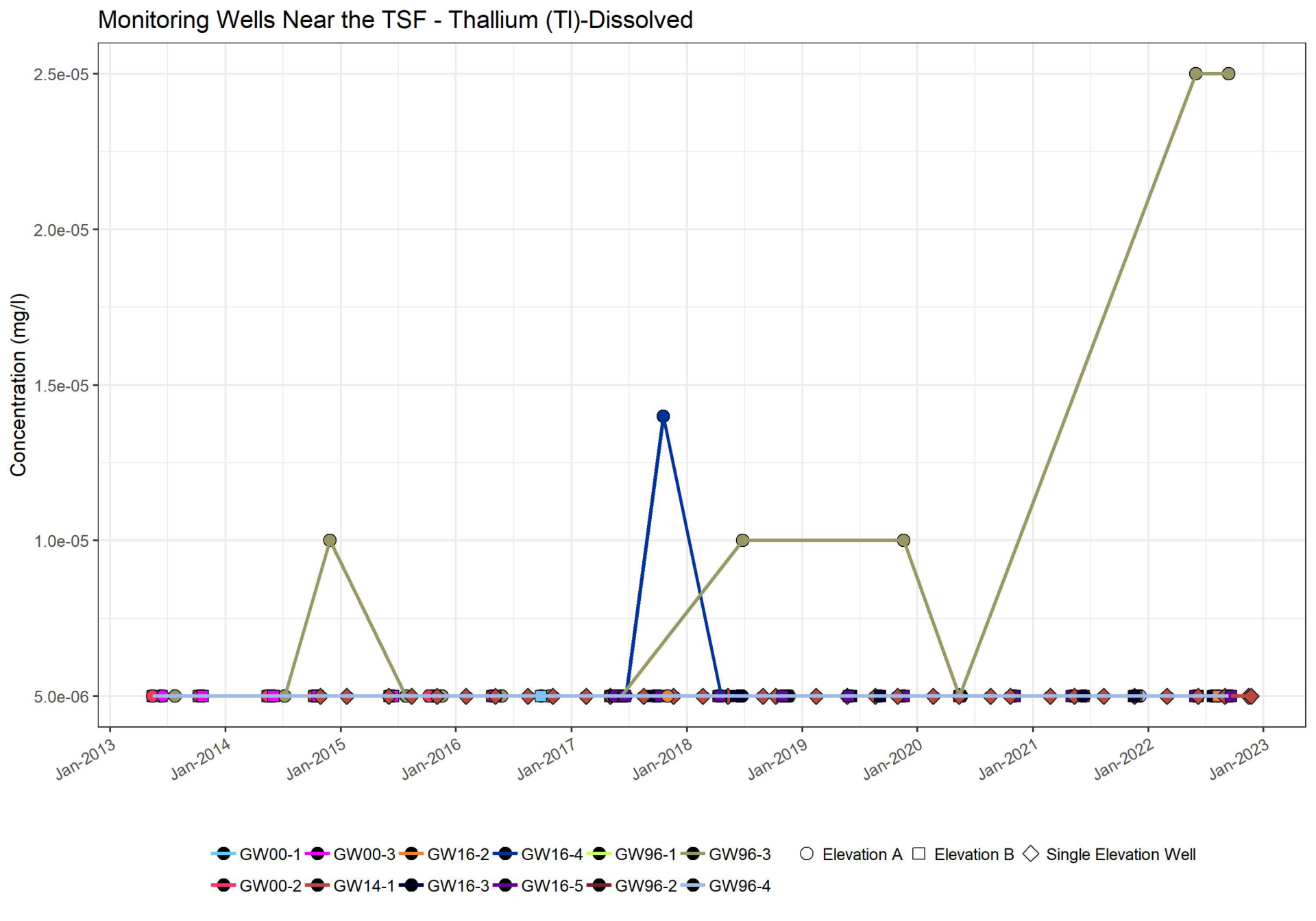
Monitoring Wells Near the TSF - Thallium (Tl)-Dissolved
Concentration (mg/l)
2.5e-05
2.0e-05
1.5e-05
1.0e-05
5.0e-06
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

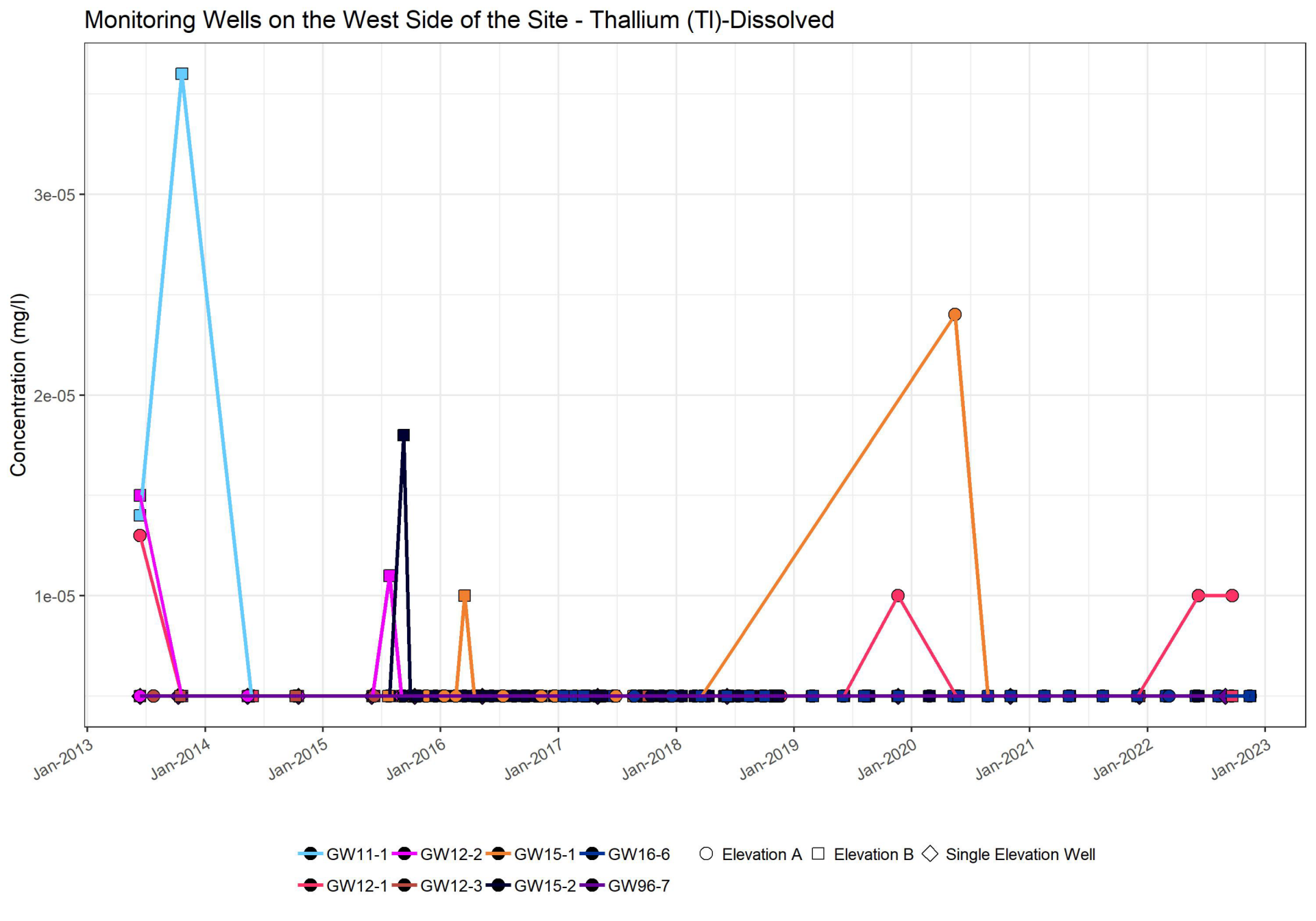
Monitoring Wells on the West Side of the Site - Thallium (Tl)-Dissolved
Concentration (mg/l)
3e-05
2e-05
1e-05
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

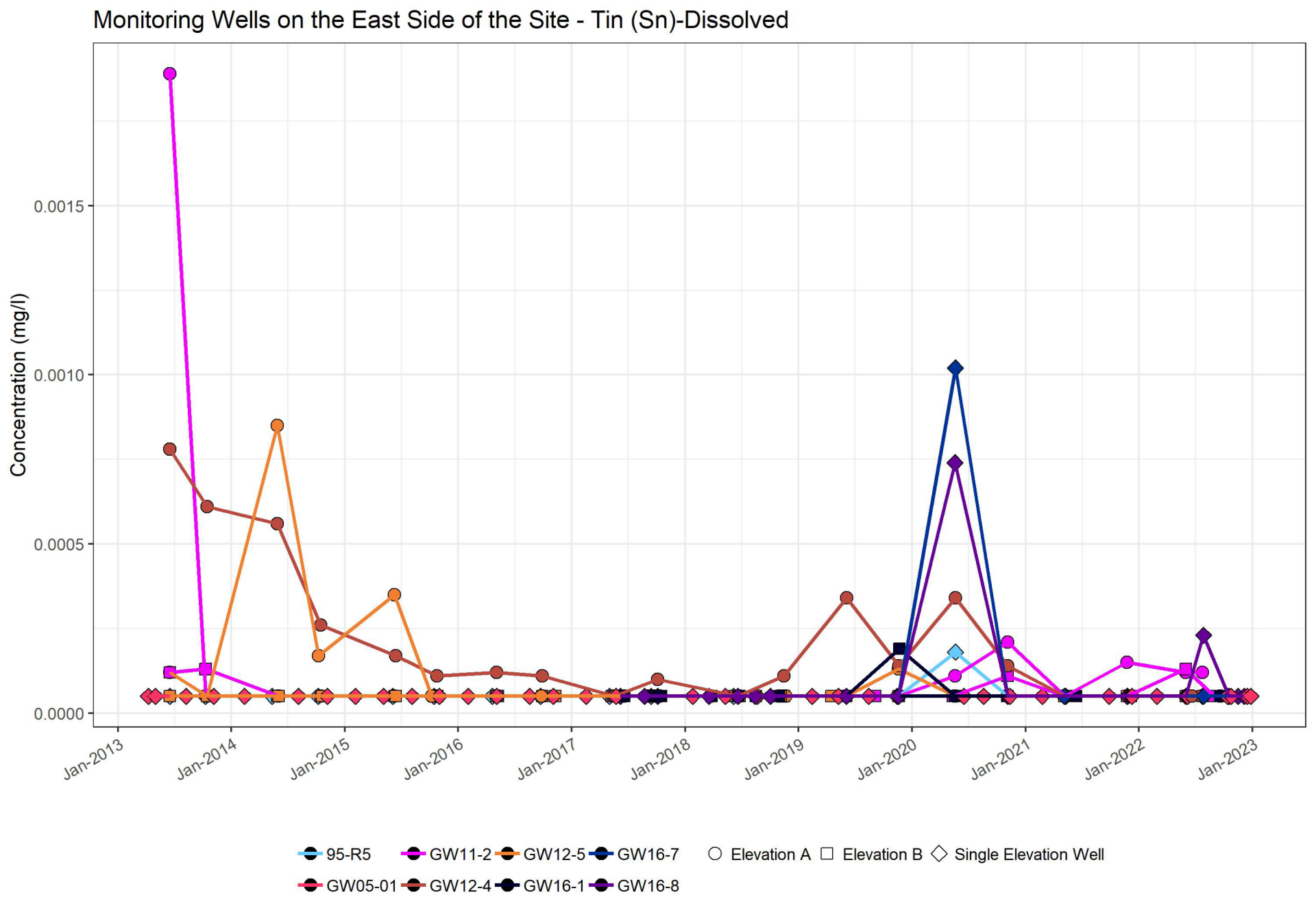
Monitoring Wells on the East Side of the Site - Tin (Sn)-Dissolved
Concentration (mg/l)
0.0015
0.0010
0.0005
0.0000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

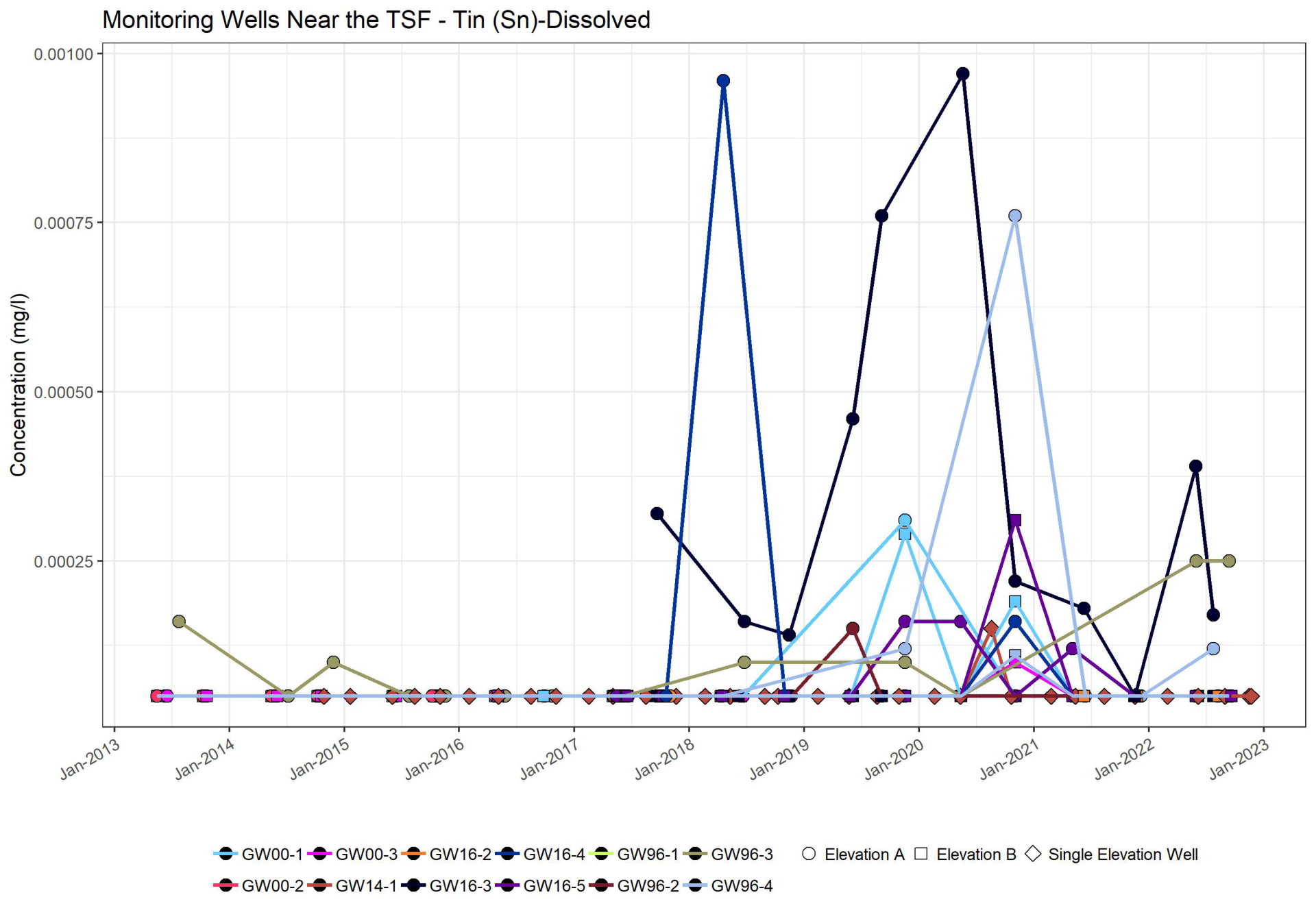
Monitoring Wells Near the TSF - Tin (Sn)-Dissolved
Concentration (mg/l)
0.00100
0.00075
0.00050
0.00025
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
Elevation A
Elevation B
Single Elevation Well
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4

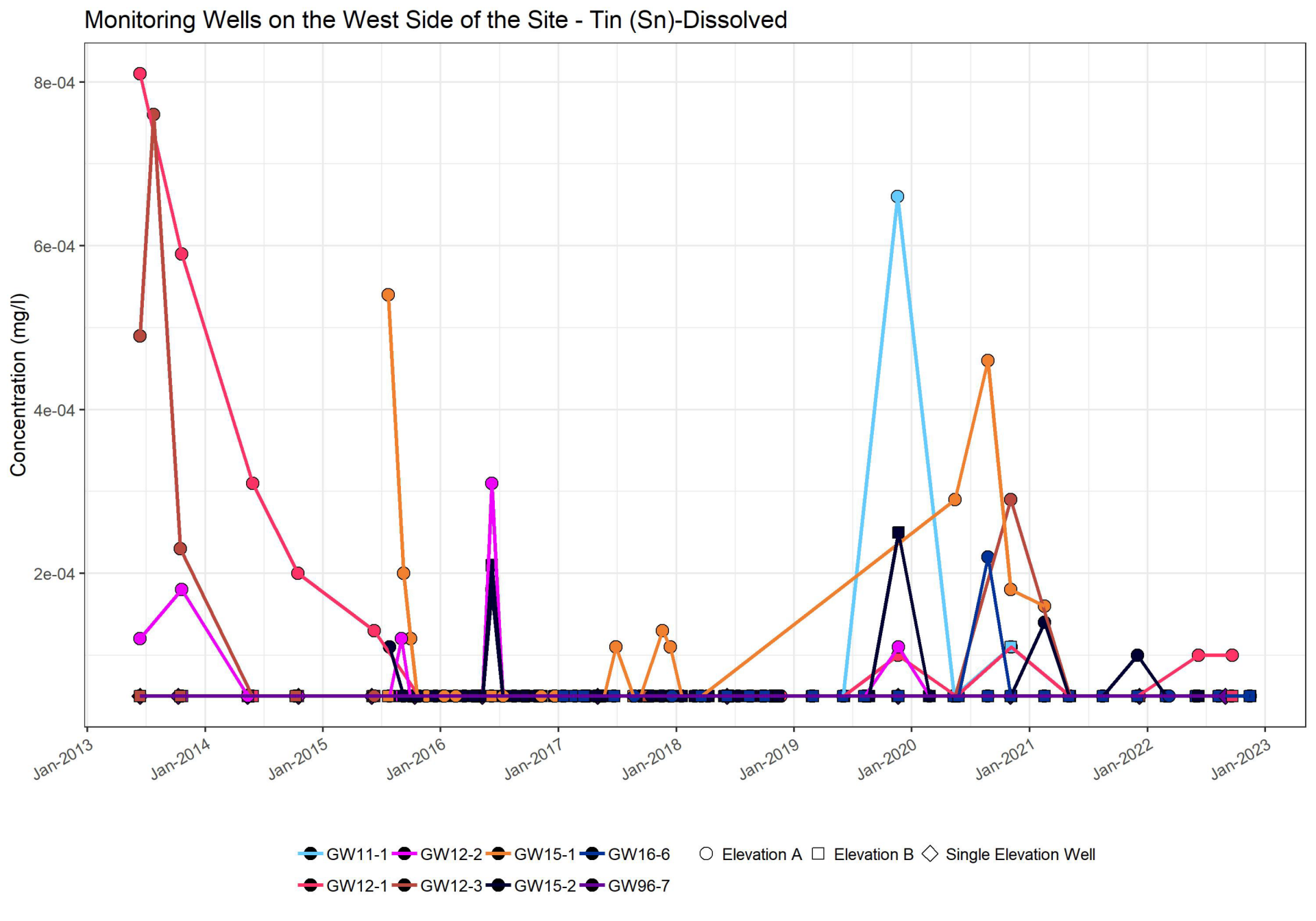
Monitoring Wells on the West Side of the Site - Tin (Sn)-Dissolved
Concentration (mg/l)
8e-04
6e-04
4e-04
2e-04
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

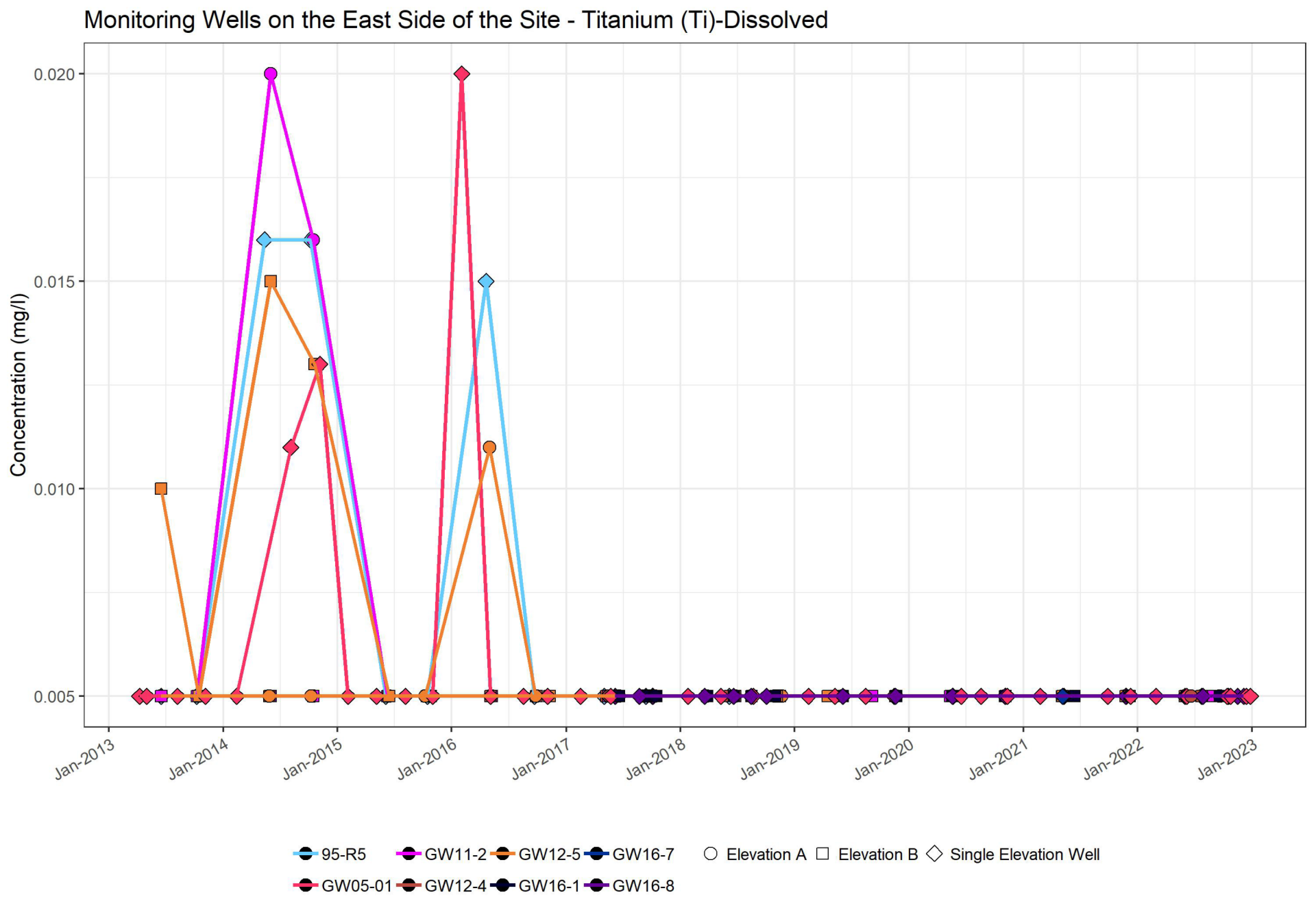
Monitoring Wells on the East Side of the Site - Titanium (Ti)-Dissolved
Concentration (mg/l)
0.020
0.015
0.010
0.005
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

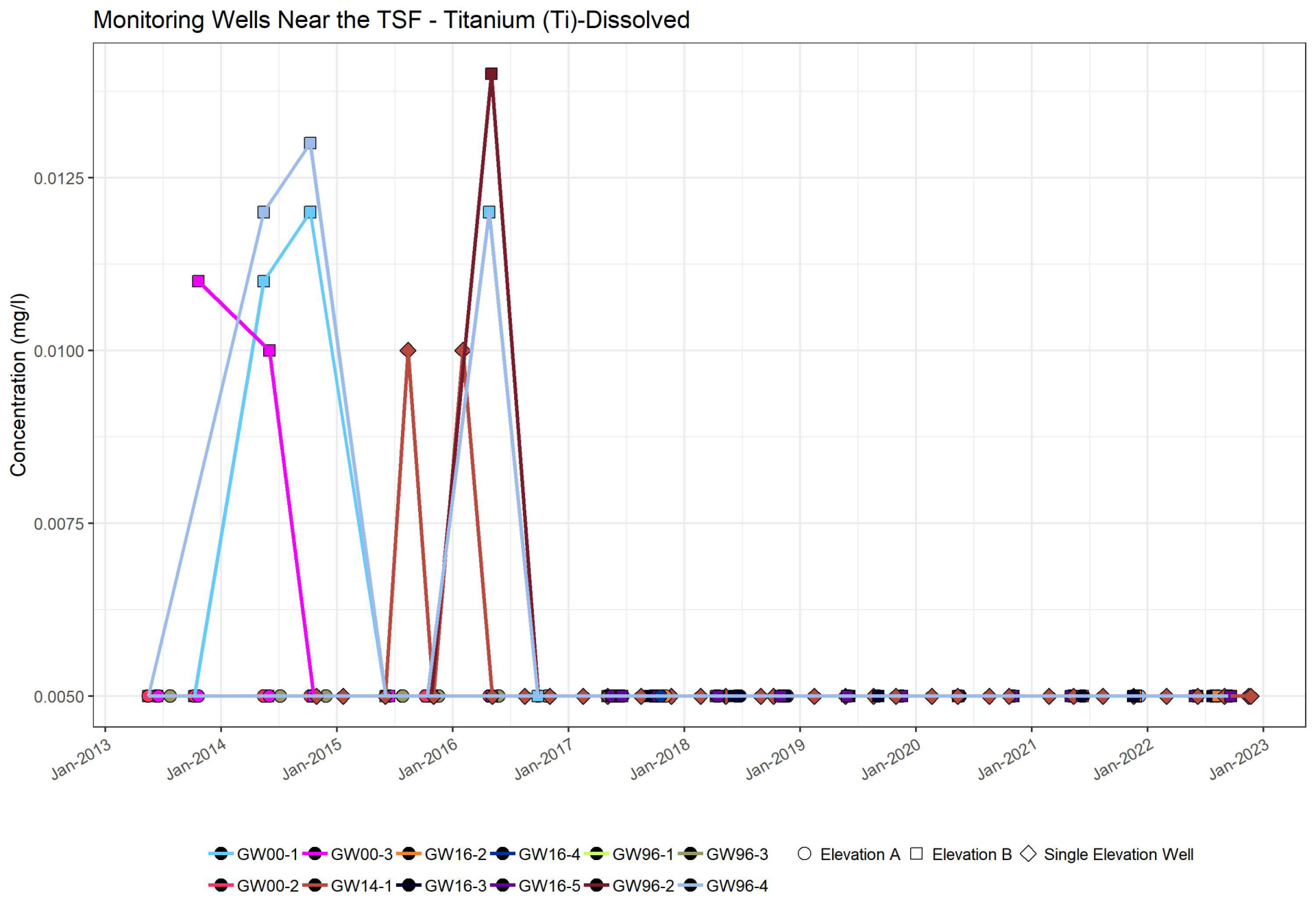
Monitoring Wells Near the TSF - Titanium (Ti)-Dissolved
Concentration (mg/l)
0.0125
0.0100
0.0075
0.0050
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

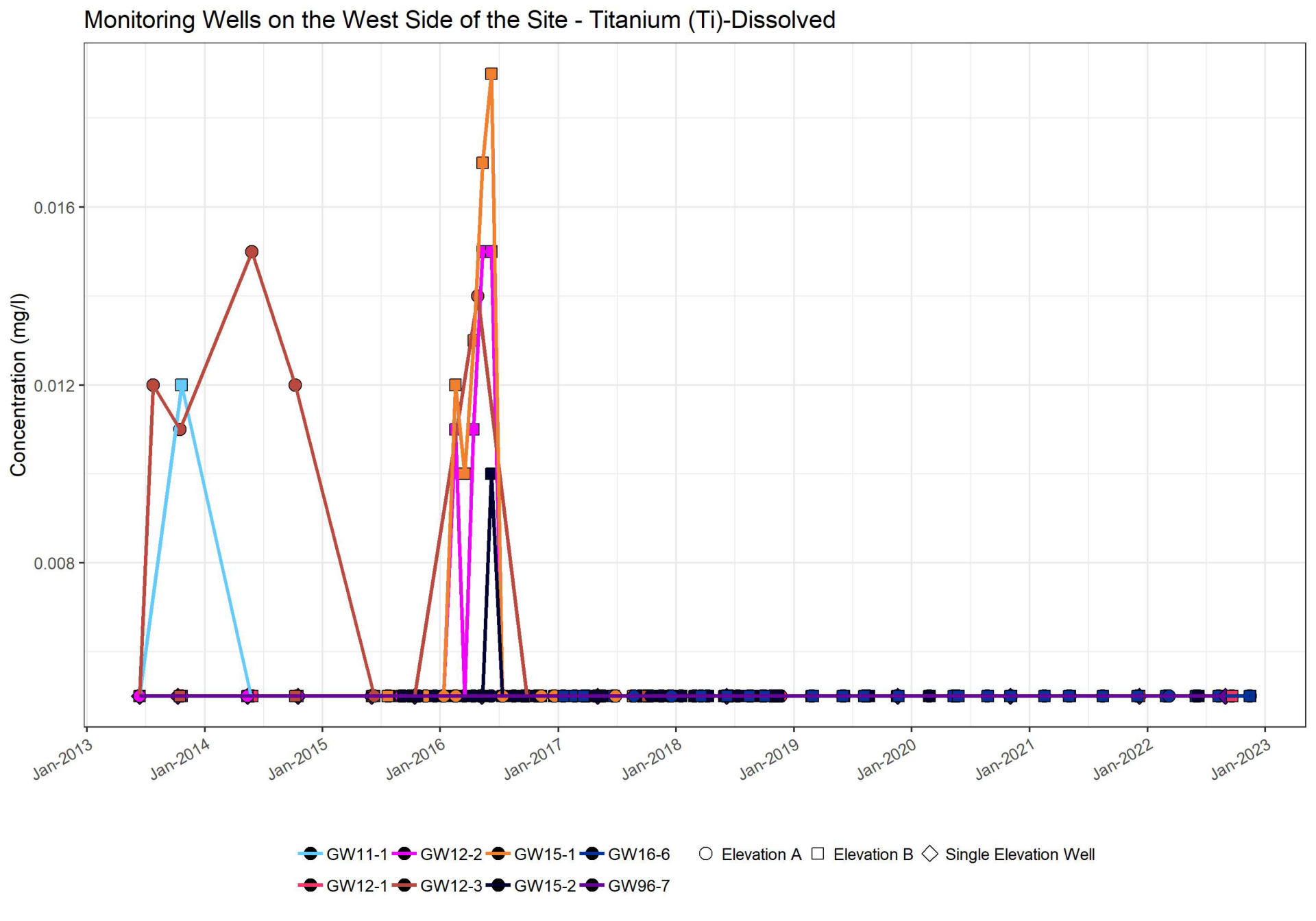
Monitoring Wells on the West Side of the Site - Titanium (Ti)-Dissolved
Concentration (mg/l)
0.016
0.012
0.008
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

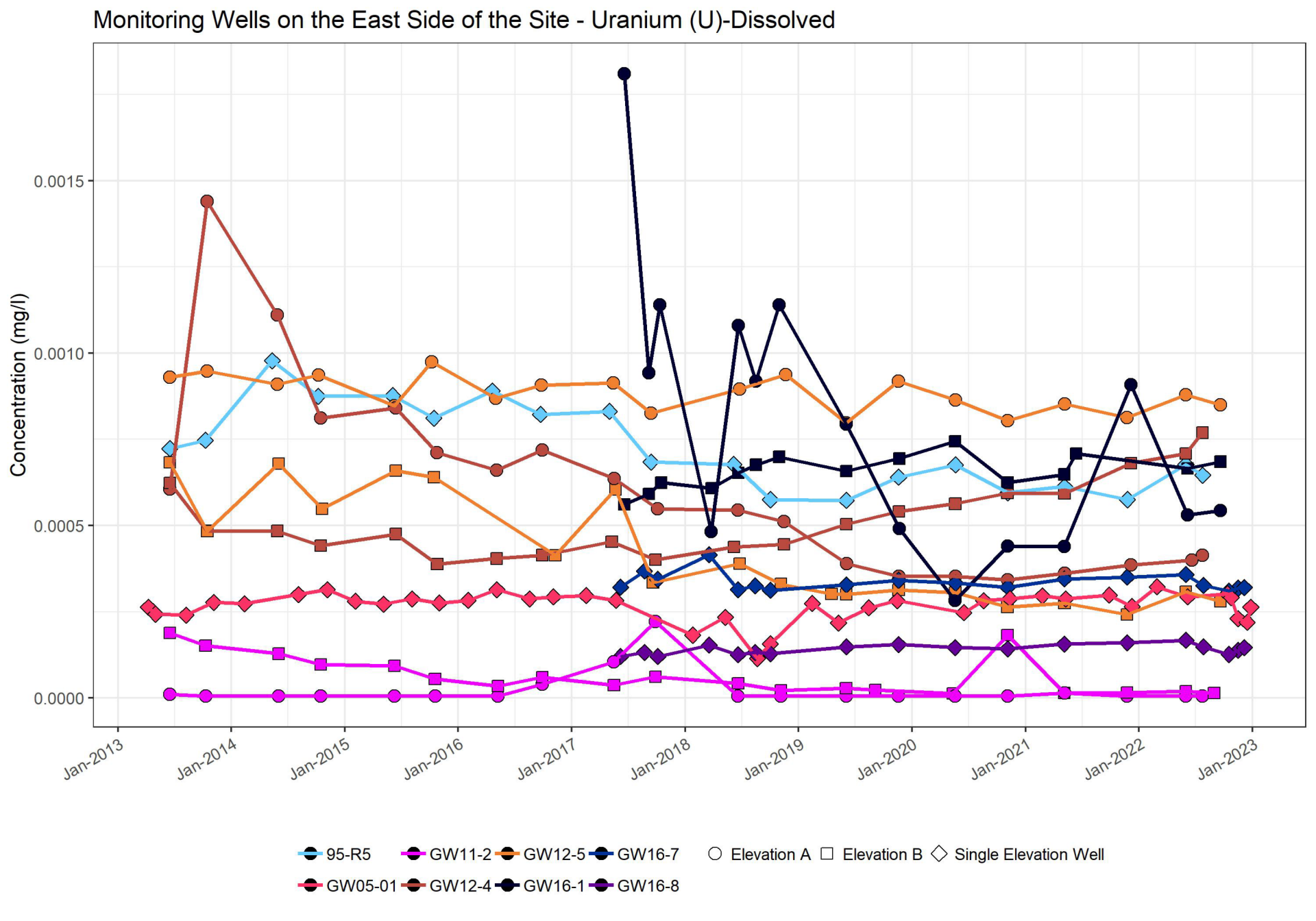
Monitoring Wells on the East Side of the Site - Uranium (U)-Dissolved
Concentration (mg/l)
0.0015
0.0010
0.0005
0.0000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

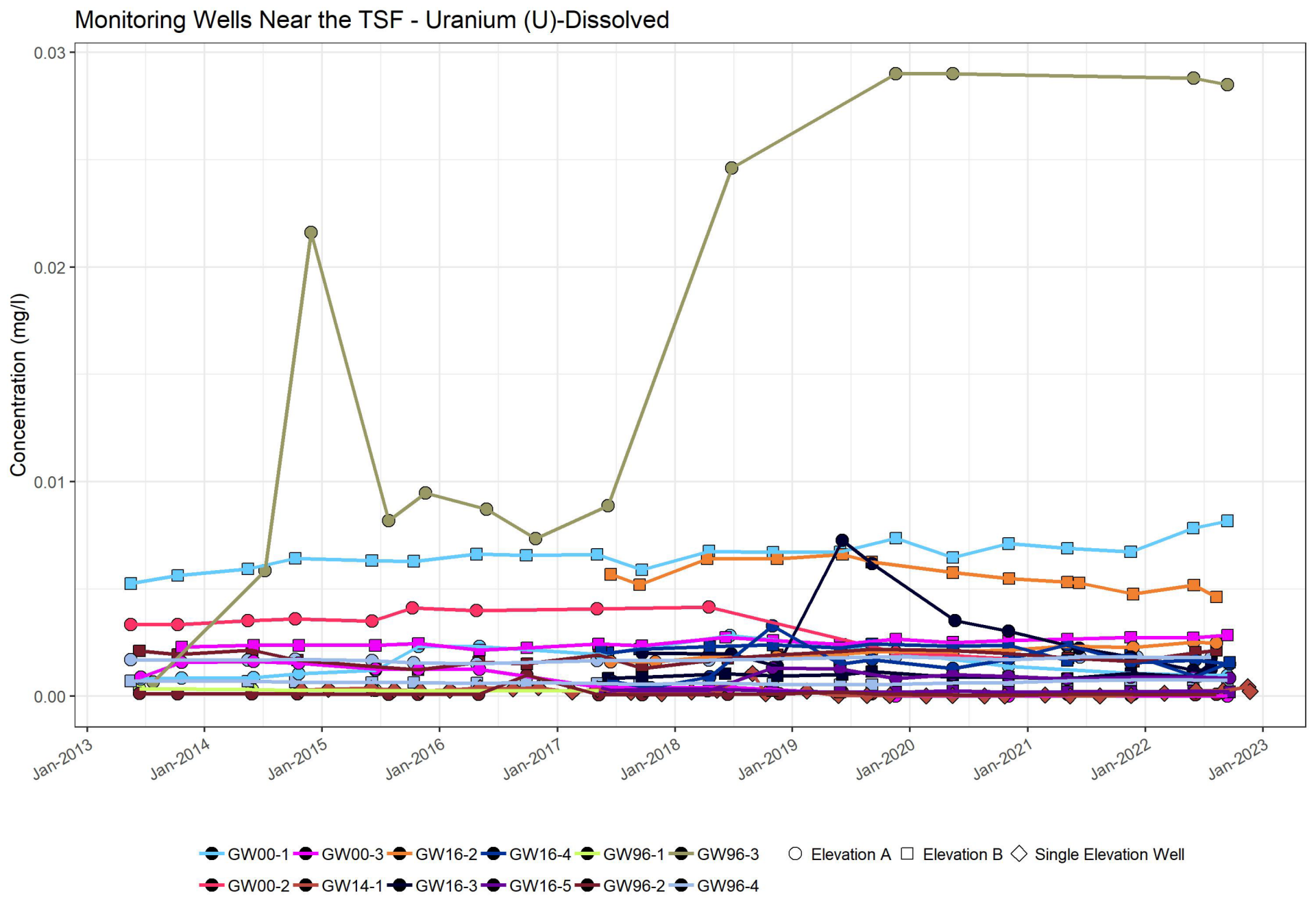
Monitoring Wells Near the TSF - Uranium (U)-Dissolved
Concentration (mg/l)
0.03
0.02
0.01
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

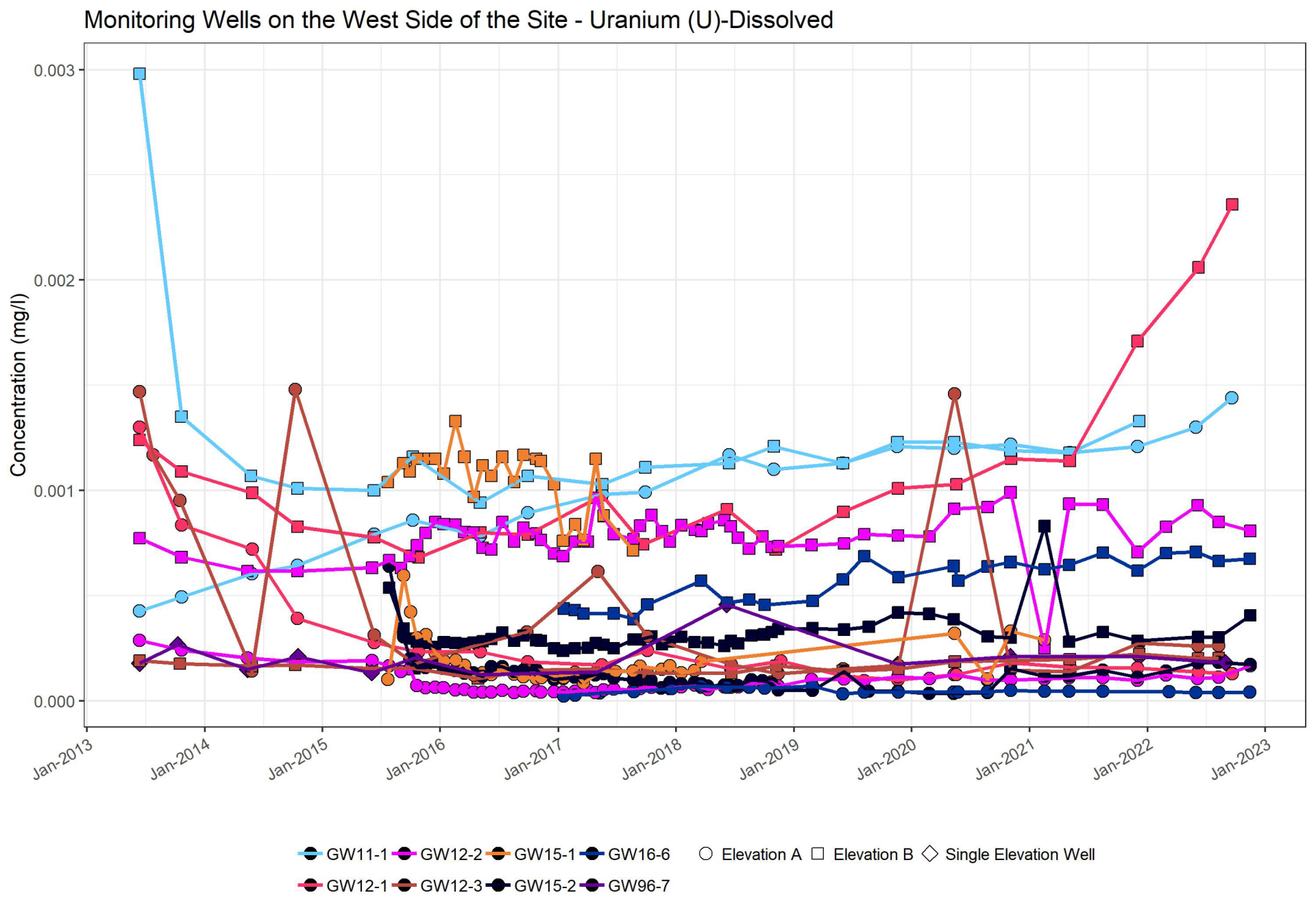
Monitoring Wells on the West Side of the Site - Uranium (U)-Dissolved
Concentration (mg/l)
0.003
0.002
0.001
0.000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

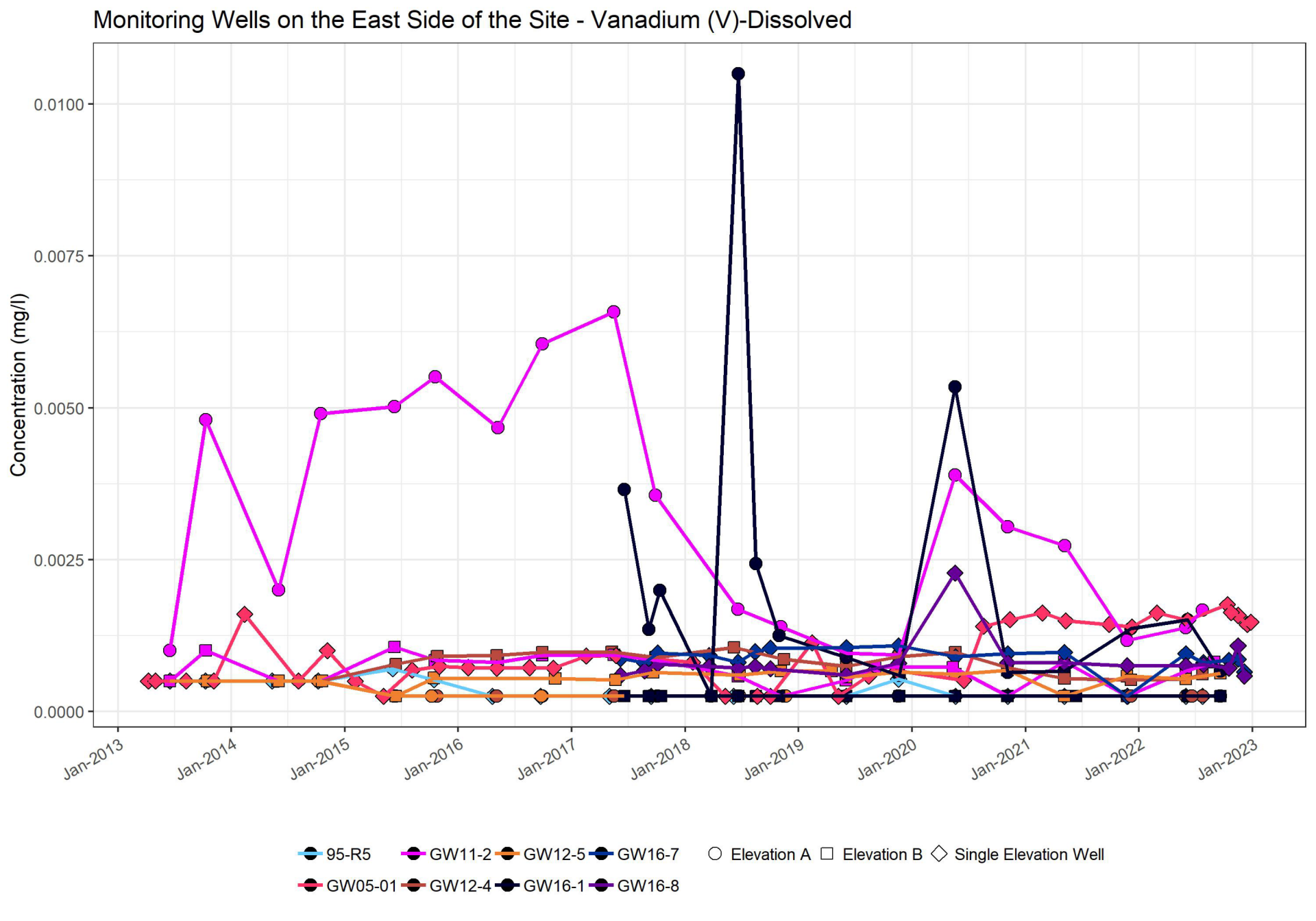
Monitoring Wells on the East Side of the Site - Vanadium (V)-Dissolved
Concentration (mg/l)
0.0100
0.0075
0.0050
0.0025
0.0000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

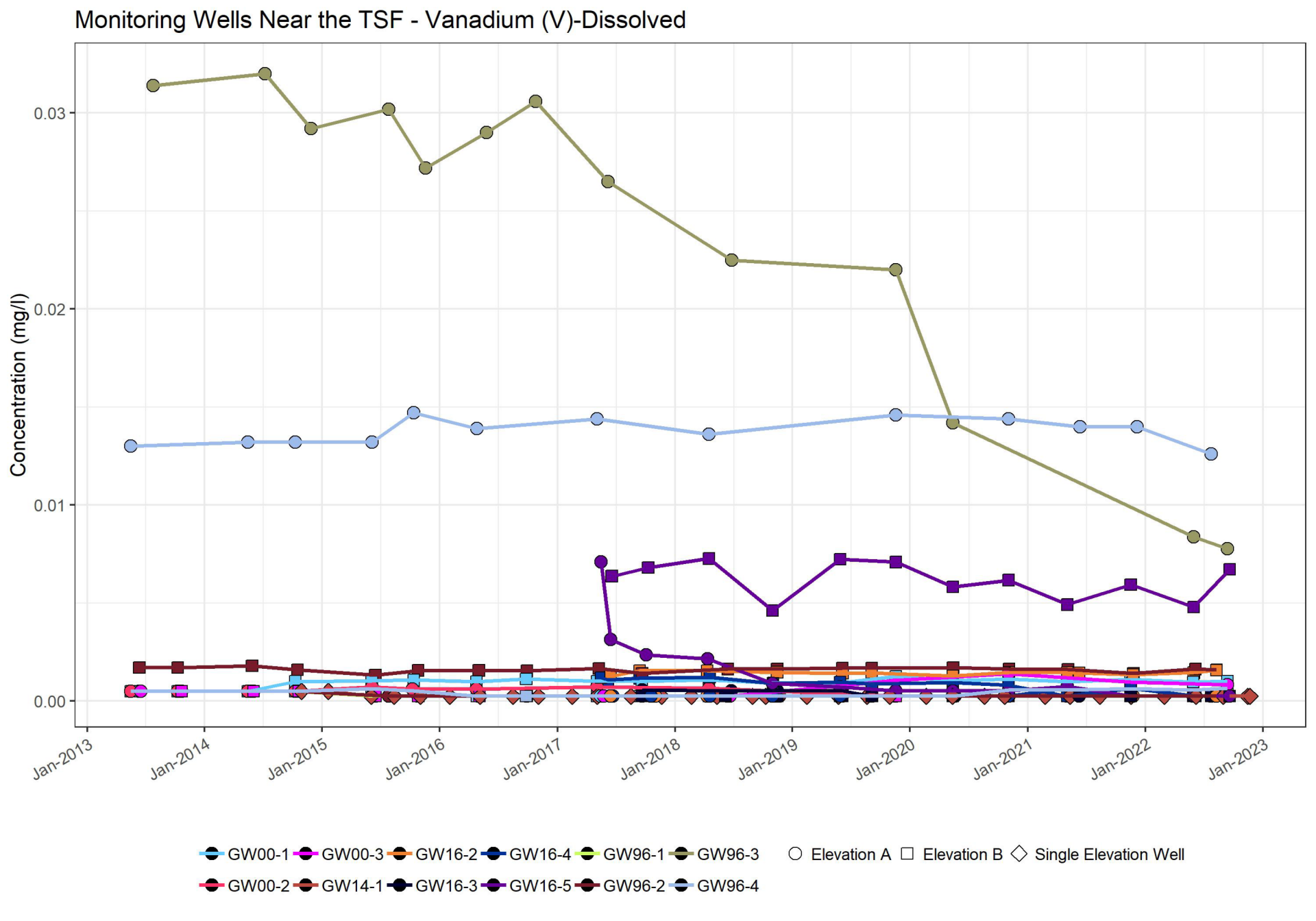
Monitoring Wells Near the TSF - Vanadium (V)-Dissolved
Concentration (mg/l)
0.03
0.02
0.01
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
Elevation A
Elevation B
Single Elevation Well
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4

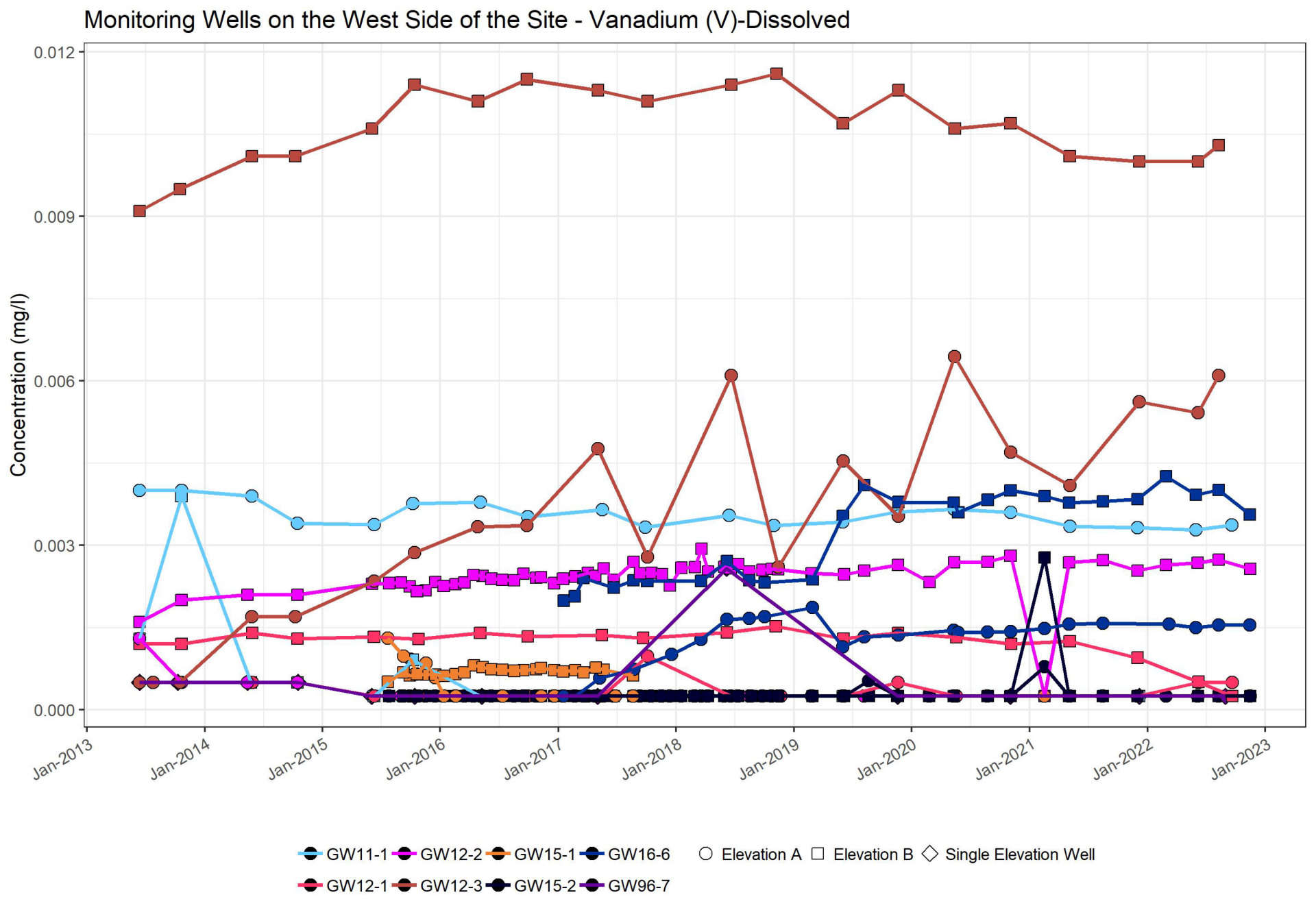
Monitoring Wells on the West Side of the Site - Vanadium (V)-Dissolved
Concentration (mg/l)
0.012
0.009
0.006
0.003
0.000
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

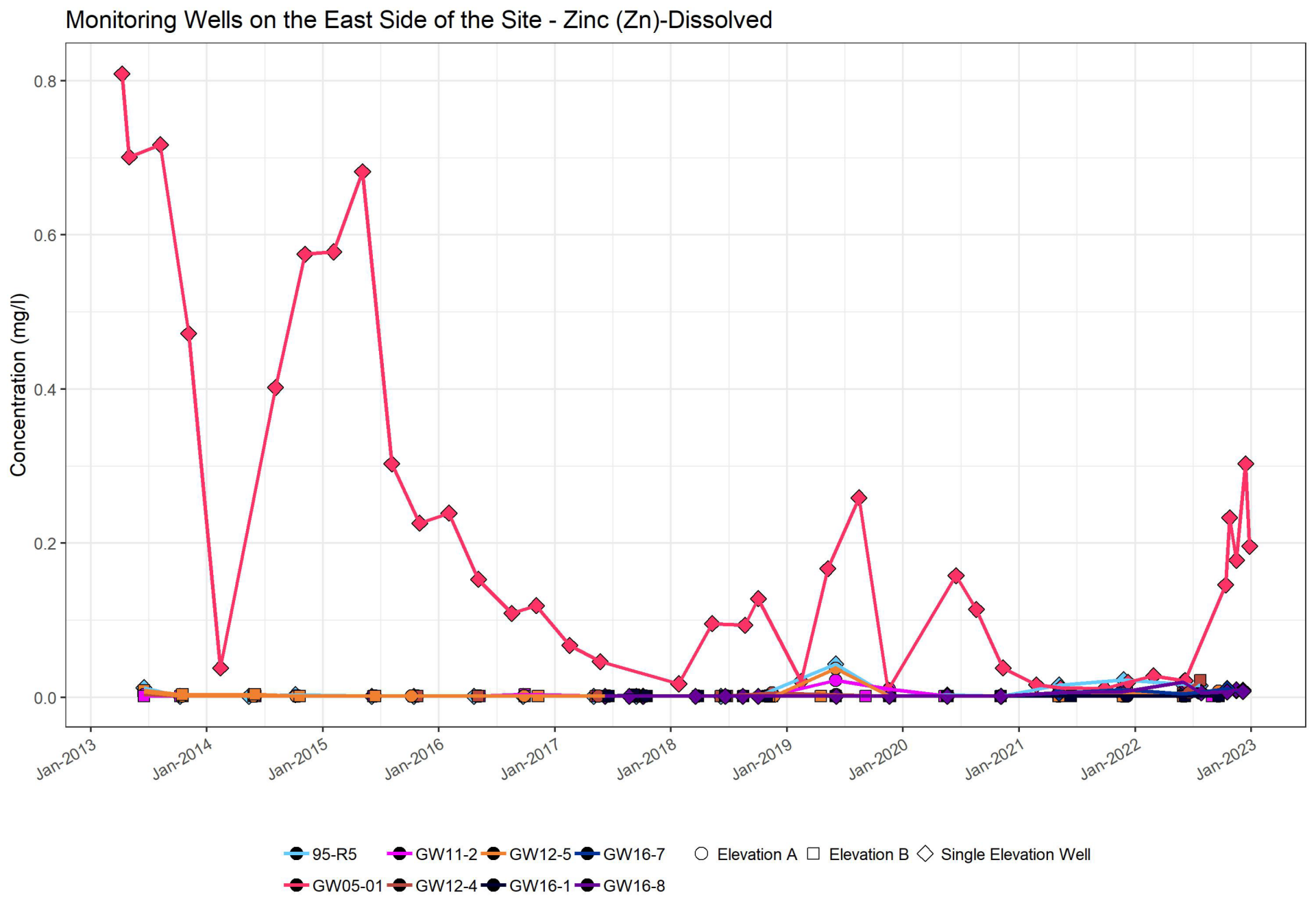
Monitoring Wells on the East Side of the Site - Zinc (Zn)-Dissolved
Concentration (mg/l)
0.0
0.2
0.4
0.6
0.8
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
95-R5
GW11-2
GW12-5
GW16-7
Elevation A
Elevation B
Single Elevation Well
GW05-01
GW12-4
GW16-1
GW16-8

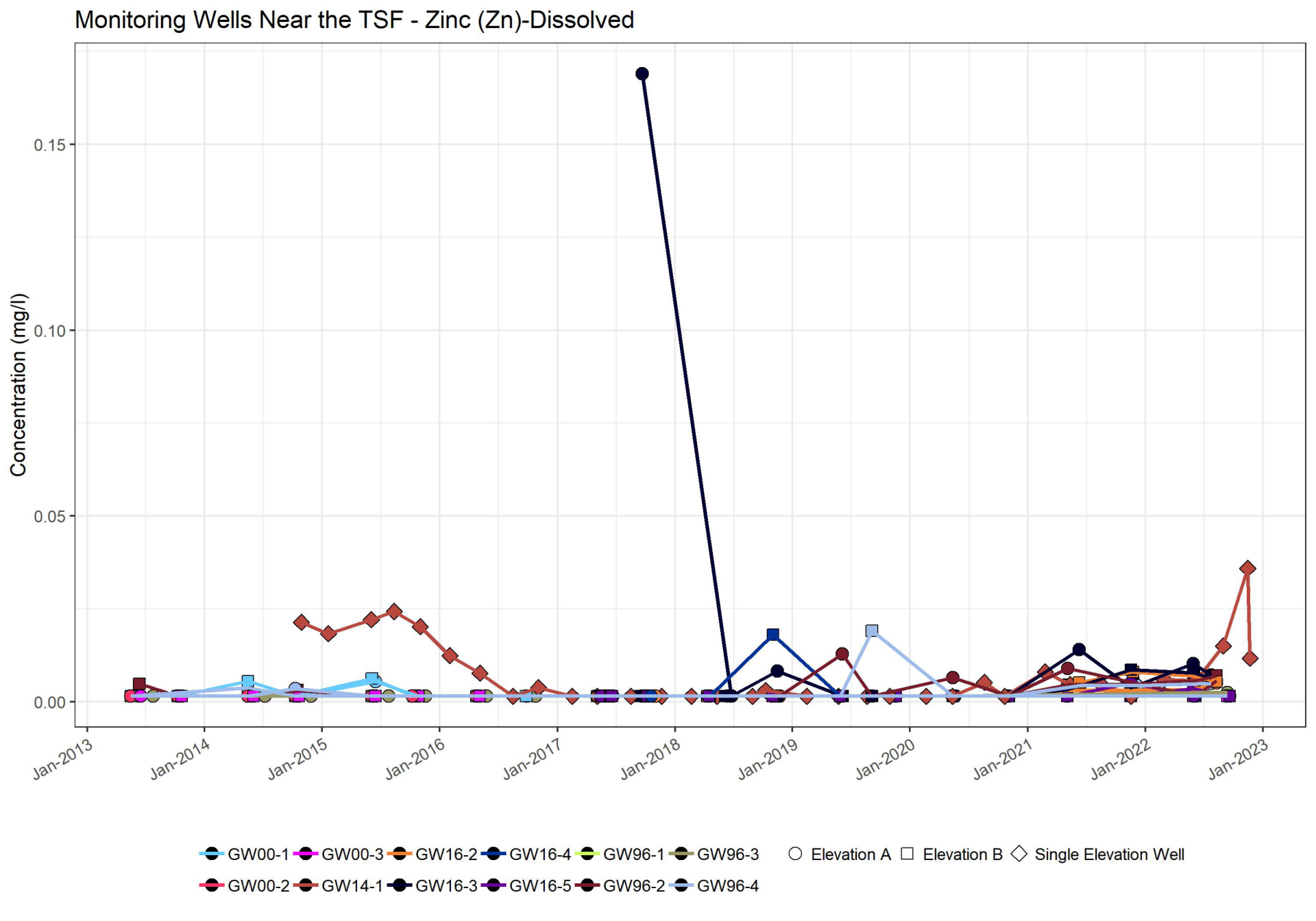
Monitoring Wells Near the TSF - Zinc (Zn)-Dissolved
Concentration (mg/l)
0.15
0.10
0.05
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW00-1
GW00-3
GW16-2
GW16-4
GW96-1
GW96-3
GW00-2
GW14-1
GW16-3
GW16-5
GW96-2
GW96-4
Elevation A
Elevation B
Single Elevation Well

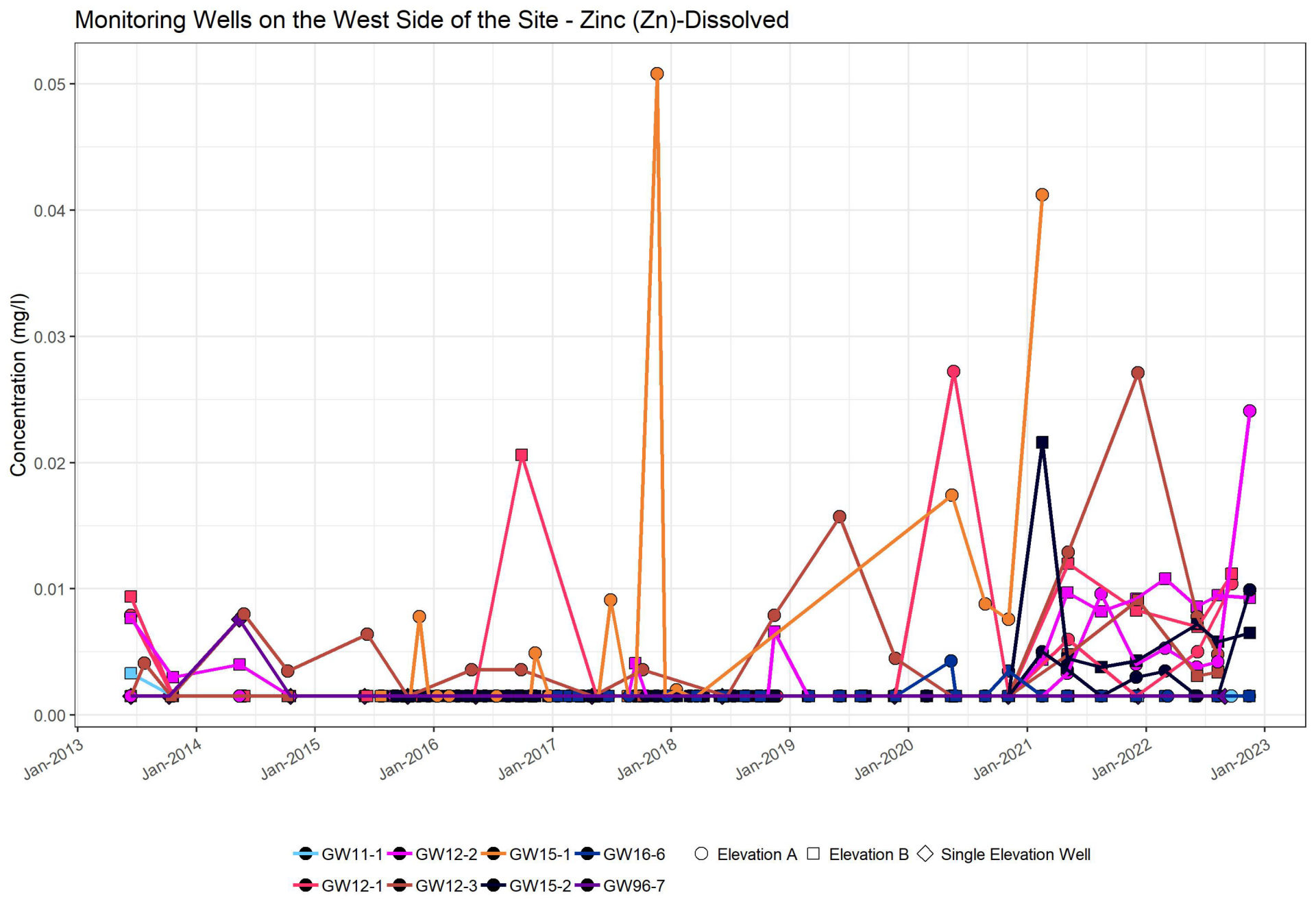
Monitoring Wells on the West Side of the Site - Zinc (Zn)-Dissolved
Concentration (mg/l)
0.05
0.04
0.03
0.02
0.01
0.00
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
GW11-1
GW12-2
GW15-1
GW16-6
Elevation A
Elevation B
Single Elevation Well
GW12-1
GW12-3
GW15-2
GW96-7

APPENDIX C

Groundwater Chemistry Results

Table 1: Water Quality Summary, 2022

Parameter	Unit	CSR AW-F	Water Quality Guideline - Aquatic Life		GW96-7	GW96-4b	GW96-4b	GW96-4a	GW96-3a	GW96-3a	GW96-2b	GW96-2b	GW96-2a	GW96-2a	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-6b	GW16-6b	GW16-6b
			Chronic (Mn)	Acute (Mx)	31-Aug-22	30-May-22	13-Sep-22	25-Jul-22	1-Jun-22	13-Sep-22	6-Jun-22	10-Aug-22	6-Jun-22	10-Aug-22	1-Jun-22	28-Jul-22	18-Oct-22	16-Nov-22	6-Dec-22	1-Jun-22	28-Jul-22	18-Oct-22	16-Nov-22	6-Dec-22	28-Feb-22	31-May-22	10-Aug-22
Field Measured																											
pH	-		6.5 - 9.0	6.5 - 9.0	7.6	7.4	7.7	9.0	8.7	8.9	7.9	7.8	8.0	7.9	7.0	7.2	6.9	7.0	7.5	7.5	7.7	7.5	7.4	7.6	7.8	7.6	7.7
Temperature	°C		-	-	11	7.3	8.3	14	9.4	11	6.0	12	6.0	12	8.8	17	8.7	7.8	5.3	8.8	9.8	8.2	4.9	7.4	4.9	6.6	9.4
Conductivity	µs/cm				421	1,271	1,218	496	2,250	2,180	725	805	404	452	319	384	306	326	338	541	599	567	591	280	422	447	454
Conventional Parameters																											
Hardness, as $CaCO_3$	mg/L		-	-	220	604	633	163	33	32	391	368	138	202	150	138	152	141	135	251	267	276	280	261	205	207	198
Total alkalinity, as $CaCO_3$	mg/L		20 [a]	-	186	184	201	166	1,090	1,100	156	154	186	229	141	141	142	146	143	152	148	131	138	133	113	111	109
Turbidity	NTU		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																											
Calcium	mg/L		-	-	65	167	170	40	5.5	5.0	96	86	26	42	51	47	52	49	47	92	98	101	102	95	63	64	59
Chloride	mg/L	1,500	150	600	0.72	15	15	3.9	12	14	22	22	<0.5	<0.5	0.70	0.53	0.73	0.61	0.71	0.75	<0.5	0.56	0.50	0.53	2.1	2.2	2.3
Fluoride	mg/L	2-3 [b]	-	0.67 - 2.1 [b]	0.17	<0.1	<0.1	0.031	<0.4	<0.4	0.15	0.15	0.16	0.18	0.14	0.11	0.13	0.12	0.12	0.47	0.72	0.58	0.53	0.55	0.098	0.11	0.11
Magnesium	mg/L		-	-	14	45	51	16	4.7	4.8	37	37	18	24	5.4	4.8	5.1	4.6	4.3	5.4	5.6	5.8	6.1	5.7	12	12	12
Potassium	mg/L		-	-	1.4	0.62	0.76	0.17	4.8	4.8	2.2	2.1	2.7	1.8	0.53	0.50	0.44	0.45	0.46	0.38	0.39	0.35	0.35	0.38	1.8	1.7	1.8
Sodium	mg/L		-	-	9.4	40	46	34	578	598	36	34	24	24	7.9	7.4	7.0	8.2	9.4	14	18	16	15	16	14	13	13
Sulphate	mg/L	1280-4290 [b]	128 - 429 [b, c]	-	68	494 [Mn]	510 [Mn]	66	215	207	277	269	27	28	30	32	27	24	25	139	173	175	183	185	106	110	115
Ammonia, as N	mg-N/L		0.102 - 2.08 [d, i]	0.681 - 28.7 [d, i]	<0.005	0.023	0.024	<0.005	0.066	0.069	0.017	0.017	0.040	0.11	<0.005	0.0083	<0.005	0.0052	<0.005	<0.005	0.0065	<0.005	0.0059	0.012	<0.005	<0.005	<0.005
Nutrients																											
Nitrate, as N	mg/L	400	3	32.8	<0.005	<0.025	<0.025	0.027	<0.1	<0.1	<0.025	<0.025	0.058	<0.005	0.062	0.067	0.099	0.20	0.27	0.078	0.037	0.073	0.061	0.038	1.6	1.8	2.0
Nitrite, as N	mg/L	0.2 - 2 [h]	0.02 - 0.20	0.06 - 0.60	<0.001	<0.005	<0.005	0.0015	<0.02	<0.02	<0.005	<0.005	0.0028	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0049	0.0044	0.0051
Total nitrogen	mg-N/L		-	-	0.045	0.069	0.064	0.079	0.099	0.11	0.063	0.062	0.10	0.12	0.10	0.14	0.12	0.28	0.36	0.12	0.076	0.11	0.092	0.060	1.5	1.6	2.1
Total phosphorus	mg-P/L		-	-	0.017	0.013	0.015	0.0078	0.096	0.088	0.031	0.034	0.027	0.048	0.016	0.0098	0.028	0.053	0.073	0.011	0.022	0.0063	0.0066	0.014	0.032	0.023	0.027
Dissolved phosphorus	mg-P/L		-	-	0.011	0.013	0.012	0.0023	0.097	0.066	0.030	0.028	0.0067	0.016	0.0036	0.0052	0.0049	0.011	0.0054	0.0083	0.0046	0.010	0.0052	0.0068	0.026	0.023	0.027
Nitrate + nitrite	mg-N/L	400	-	-	<0.0051	<0.0255	<0.0255	0.028	<0.102	<0.102	<0.0255	<0.0255	0.060	<0.0051	0.062	0.067	0.099	0.20	0.27	0.078	0.037	0.073	0.061	0.038	1.6	1.8	2.0
Dissolved Metals																											
Aluminum	mg/L		0.040 - 0.050 [e]	0.074 - 0.10 [e]	0.023	<0.003	0.0033	0.0044	0.0078	0.0091	<0.003	<0.003	<0.003	0.0096	<0.003	0.044	<0.003	0.12 [Mn, Mx]	0.019	<0.003	0.0065	0.0073	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.09	-	-	<0.0001	<0.0001	<0.0001	0.00010	<0.0005	<0.0005	<0.0001	<0.0001	0.00030	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	0.05	-	-	0.0017	0.0017	0.0017	0.0031	0.086	0.085	0.0014	0.0015	0.0044	0.012	0.00037	0.00033	0.00028	0.00041	0.00026	0.00091	0.00075	0.00088	0.00087	0.00078	0.0011	0.00094	0.00096
Barium	mg/L	10	-	-	0.026	0.072	0.082	0.022	0.012	0.011	0.022	0.019	0.072	0.066	0.011	0.013	0.010	0.012	0.012	0.0083	0.0094	0.010	0.0093	0.0097	0.014	0.013	0.013
Beryllium	mg/L	0.0015	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00025	<0.00025	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	12	-	-	0.017	0.093	0.094	0.23	4.5	4.6	0.051	0.051	0.049	0.055	0.047	0.046	0.045	0.046	0.052	0.21	0.31	0.22	0.23	0.24	0.090	0.11	0.10
Cadmium	mg/L	0.0005-0.0004 [b]	0.000058 - 0.00046 [b]	0.000097 - 0.0028 [b]	<0.000005	0.000014	0.000035	0.000010	<0.000025	<0.000025	<0.00004	<0.00002	<0.000005	<0.000005	0.000018	0.000011	0.000013	0.000025	0.000011	<0.00001	<0.00001	<0.00001	<0.000005	0.0000072	0.000035	<0.00005	<0.00004
Chromium	mg/L	0.01	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.04	-	-	<0.0001	0.00017	0.00017	<0.0001	<0.0005	<0.0005	<0.0001	<0.0001	<0.0001	0.00011	<0.0001	0.00012	<0.0001	0.00045	0.00012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00021	0.00021	0.00020
Copper	mg/L	0.02-0.09 [b]	(f)	(f)	<0.0005	<0.0005	<0.0005	0.0016	<0.001	<0.001	0.0013	0.0012	0.00065	<0.0005	0.0040	0.00068	0.00084	0.0013	0.00056	<0.0005	<0.0005	0.00055	<0.0005	0.0018	0.00060	0.00083	0.0011
Iron	mg/L	-	0.35	0.69 [Mx]	0.27	0.69 [Mx]	0.84 [Mx]	0.03	<0.05	<0.05	<0.03	<0.03	<0.03	0.25	<0.03	0.12	0.054	0.81 [Mx]	0.12	0.53 [Mx]	0.14	0.38 [Mx]	0.46 [Mx]	0.46 [Mx]	<0.03	<0.03	<0.03
Lead	mg/L	0.04-0.16 [b]	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00025	<0.00025	<0.00005	<0.00005	<0.00005	<0.00005	0.00017	<0.00005	<0.00005	0.00012	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0075	0.013	0.013	0.021	0.37	0.36	0.0011	<0.001	0.043	0.035	0.0010	0.0010	0.0010	0.0010	0.0011	0.0014	0.0019	0.0016	0.0016	0.0016	<0.001	<0.001	<0.001
Manganese	mg/L	-	-	-	0.24	0.26	0.28	0.0055	0.0027	0.0015	0.11	0.053	0.0013	0.0073	0.0012	0.018	0.015	0.077	0.030	0.013	0.0091	0.012	0.013	0.017	0.17	0.17	0.17
Molybdenum	mg/L	10	7.6 [g]	46 [g]	0.0054	0.00064	0.00066	0.0012	0.060	0.062	0.061	0.055	0.0025	0.0024	0.0043	0.0032	0.0034	0.0030	0.0033	0.0087	0.0085	0.0081	0.0074	0.0077	0.029	0.028	0.029
Nickel	mg/L	0.25-1.5 [b]	-	-	<0.0005	0.00057	0.00056	0.00063	<0.0025	<0.0025	<0.0005	<0.0005	0.00062	0.00065	<0.0005	0.0010	0.00054	0.0019	0.00077	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.02	-	-	<0.00005	0.000064	<0.00005	<0.00005	<0.00025	<0.00025	0.000070	<0.00005	<0.00005	<0.00005	0.000057	0.00013	<0.00005	<0.00005	0.000052	0.0027	0.0017	0.0017	0.0016	0.0012	0.00033	0.00076	0.00040
Silicon	mg/L	-	-	-	13	11	10	9.4	7.7	7.5	8.5	8.9	2.3	3.5	7.3	8.0	7.6	8.4	8.0	8.5	9.4	8.4	9.1	8.7	10	9.5	9.8
Silver	mg/L	0.0005-0.015 [b]	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00005	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.18	2.7	3.1	1.7	0.27	0.29	0.80	0.69	1.0	0.37	0.25	0.27	0.26	0.25	0.24	0.63	0.92	0.85	0.87	0.81	0.16	0.17	0.17
Thallium	mg/L	0.003	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00005	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	0.00012	<0.0005	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00023	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.001	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.085	-	-	0.00018	0.00076	0.00074	0.0018	0.029	0.029	0.0020	0.0021	0.000069	0.000087	0.00017	0.00015	0.00013	0.00014	0.00015	0.00036	0.00033	0.00031	0.00032	0.00032	0.00070	0.00071	0.00067
Vanadium	mg/L	-	-	-	<0.0005	0.00056	0.00065	0.013	0.0084	0.0078	0.0016	0.0016	<0.0005	<0.0005	0.00075	0.00077	0.00071	0.0011	0.00058	0.00095	0.00080	0.00084	0.00086	0.00065	0.0043	0.0039	0.0040
Zinc	mg/L	0.075-2.4 [b, e]	-	-	<0.003	<0.003	<0.003	0.0049	<0.005	<0.005	0.0056	0.0070	<0.003	0.0063	0.0056	0.020	0.0056	0.0072	0.010	0.0076	0.0045	0.0065	0.012	0.0086	0.0093	<0.003	<0.003	<0.003

BC Contaminated Sites Regulation (CSR), BC Reg 375/96, O.C. 1480/96, Deposited December 16, 1996; last amended July 7, 2021 by BC Reg. 179/2021.
BC Approved Water Quality Guidelines (WQG): Aquatic Life, Wildlife and Agriculture - Guideline Summary. Water Quality Guidelines Series, WQG-20.
[a] = guideline is a minimum value, unless the background concentration or value is lowe
[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (19 to 664 mg/L). The guideline is calculated based on the individual hardness value for each sam
[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purpos
[d] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.4 to 12.0). The guideline is calculated based on the individual pH for each sample with a pH less than
[e] = zinc standards are not available for groundwater with a hardness greater than 400 mg/L
[f] = copper water quality guidelines are calculated using the BC Biotic Ligand Model, which take into account temperature, hardness, pH and dissolved organic carbon (DOC). As DOC has not been analyzed a standard cannot be calculated at this tin
[g] = WQG is for total molybdenum.
[h] = guideline is chloride dependent. The guideline range shown is based on the chloride range observed in the dataset. The guideline is calculated based on the individual chloride value for each sample.
[i] = guideline is temperature dependent. The guideline range shown is based on the temperature range observed in the datase
[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity rang
[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity rang
Bolded concentrations are higher than water quality guidelines.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedan
- = no guideline or no data.
Data Source: Analytical data provided by Mount Polley Mining Corporation.

(Mn) concentration is higher than the 30-day mean (chronic) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx) concentration is higher than the maximum (Acute) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx, Mn) concentration is higher than both the acute and chronic BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(F) concentration is higher than the British Columbia Contaminated Site Regulation for Protection of Fresh Water Aquatic Life (BC CSR AW-F) guideline.

Table 1: Water Quality Summary, 2022

Parameter	Unit	CSR AW-F	Water Quality Guideline - Aquatic Life		GW16-6b	GW16-6a	GW16-6a	GW16-6a	GW16-6a	GW16-5b	GW16-5b	GW16-5a	GW16-5a	GW16-4b	GW16-4b	GW16-4a	GW16-4a	GW16-3b	GW16-3b	GW16-3a	GW16-3a	GW16-2b	GW16-2b	GW16-2a	GW16-2a	GW16-1b	GW16-1b
			Chronic (Mn)	Acute (Mx)	15-Nov-22	9-Mar-22	31-May-22	10-Aug-22	15-Nov-22	31-May-22	20-Sep-22	2-Jun-22	20-Sep-22	6-Jun-22	20-Sep-22	6-Jun-22	20-Sep-22	30-May-22	25-Jul-22	30-May-22	25-Jul-22	1-Jun-22	10-Aug-22	1-Jun-22	10-Aug-22	7-Jun-22	21-Sep-22
Field Measured																											
pH	-		6.5 - 9.0	6.5 - 9.0	7.8	8.4	8.3	8.3	8.4	7.5	7.8	7.7	7.7	8.4	7.9	8.1	8.1	7.6	7.6	7.5	7.6	7.5	7.6	7.7	7.9	7.0	7.4
Temperature	°C		-	-	5.9	4.0	8.9	11	5.2	7.1	6.2	7.3	6.6	4.0	7.1	4.5	6.8	9.5	13	9.6	14	8.4	8.6	7.4	12	5.3	9.6
Conductivity	µs/cm				435	397	418	406	392	350	334	376	403	448	473	555	615	452	517	651	651	1,121	1,102	512	551	883	785
Conventional Parameters																											
Hardness, as $CaCO_3$	mg/L		-	-	200	123	121	110	118	151	140	123	124	21	116	90	87	194	229	190	226	536	529	192	204	271	264
Total alkalinity, as $CaCO_3$	mg/L		20 [a]	-	108	38	34	36	35	197	184	216	213	131	250	342	316	226	252	165	209	154	166	224	224	323	360
Turbidity	NTU		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																											
Calcium	mg/L		-	-	61	40	40	36	39	50	45	39	39	6.7	31	19	18	34	40	41	45	136	130	44	44	63	62
Chloride	mg/L	1,500	150	600	2.2	1.0	1.0	1.0	1.0	<0.5	<0.5	2.0	1.9	<0.5	0.73	6.7	5.7	<0.5	<0.5	4.3	5.5	10	8.7	1.6	1.6	<2.5	<2.5
Fluoride	mg/L	2-3 [b]	-	0.67 - 2.1 [b]	0.10	0.73	0.77	0.75	0.74	0.055	0.045	0.13	0.12	0.11	0.16	0.23	0.26	0.15	0.14	0.14	0.16	0.11	0.14	0.19	0.19	<0.1	<0.1
Magnesium	mg/L		-	-	12	5.4	5.0	5.1	5.1	6.3	6.4	6.2	6.6	0.98	9.4	10	10	26	31	21	28	48	50	20	23	28	27
Potassium	mg/L		-	-	1.7	0.51	0.50	0.56	0.53	0.94	0.82	1.2	1.2	0.95	1.2	0.49	0.49	1.2	1.4	1.1	1.3	2.9	2.9	2.2	2.2	1.7	1.8
Sodium	mg/L		-	-	13	36	34	35	35	18	17	46	44	106	64	126	121	12	15	37	49	36	37	40	42	81	79
Sulphate	mg/L	1280-4290 [b]	128 - 429 [b, c]	-	120	159	155	154	158	2.0	1.9	14	15	131 [Mn]	23	32	32	13	11	125	172	482 [Mn]	446 [Mn]	63	65	93	83
Ammonia, as N	mg-N/L		0.102 - 2.08 [d, i]	0.681 - 28.7 [d, i]	0.0098	<0.005	<0.005	<0.005	<0.005	0.0088	0.0081	0.026	0.029	0.0063	0.096	<0.005	<0.005	0.010	0.0067	0.11	0.20	<0.005	<0.005	0.016	0.016	0.14	0.14
Nutrients																											
Nitrate, as N	mg/L	400	3	32.8	2.0	0.055	0.058	0.060	0.058	<0.005	<0.005	<0.005	<0.005	0.062	0.055	<0.025	0.012	0.015	<0.005	0.0056	<0.025	2.4	1.9	<0.005	<0.005	<0.025	<0.025
Nitrite, as N	mg/L	0.2 - 2 [h]	0.02 - 0.20	0.06 - 0.60	0.0051	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0016	<0.001	<0.005	0.0018	<0.001	<0.001	0.0016	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	1.8	0.056	0.068	0.066	0.051	0.29	0.10	0.090	0.095	<0.15	0.27	0.051	0.055	0.036	0.044	0.21	0.36	2.2	2.0	0.033	0.050	0.28	0.28
Total phosphorus	mg-P/L	-	-	-	0.023	<0.002	<0.002	0.0030	<0.002	0.027	0.021	0.10	0.11	0.21	0.076	0.086	0.099	0.019	0.13	0.029	0.090	0.024	0.062	0.030	0.028	0.013	0.014
Dissolved phosphorus	mg-P/L	-	-	-	0.023	0.0037	<0.002	<0.002	<0.002	0.027	0.011	0.10	0.11	0.012	0.0043	0.090	0.064	0.016	0.015	0.016	0.032	0.012	0.015	0.027	0.030	0.014	0.0074
Nitrate + nitrite	mg-N/L	400	-	-	2.0	0.055	0.058	0.060	0.058	<0.0051	<0.0051	<0.0051	<0.0051	0.064	0.055	<0.0255	0.014	0.015	<0.0051	0.0072	<0.0255	2.4	1.9	<0.0051	<0.0051	<0.0255	<0.0255
Dissolved Metals																											
Aluminum	mg/L		0.040 - 0.050 [e]	0.074 - 0.10 [b]	<0.003	<0.003	<0.003	0.011	0.0043	0.0057	<0.003	<0.003	<0.003	0.0038	<0.003	0.0036	<0.003	<0.003	0.0053	<0.003	0.0041	<0.003	0.011	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.09	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00020	0.00044	<0.0001	<0.0001	0.00034	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	0.05	-	-	0.00088	0.0086	0.0081	0.0083	0.0083	0.0018	0.0013	0.0061	0.0052	0.00036	0.00044	0.021	0.022	0.0036	0.0027	0.0023	0.0037	0.00062	0.00080	0.0023	0.0025	0.019	0.020
Barium	mg/L	10	-	-	0.013	0.0013	0.0014	0.0019	0.0014	0.039	0.023	0.057	0.050	0.0098	0.034	0.042	0.041	0.098	0.11	0.032	0.032	0.025	0.029	0.086	0.089	0.13	0.13
Beryllium	mg/L	0.0015	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	12	-	-	0.093	0.56	0.60	0.55	0.59	<0.01	<0.01	0.037	0.018	<0.01	0.043	0.60	0.48	0.028	0.026	0.065	0.083	0.059	0.068	0.096	0.11	0.13	0.14
Cadmium	mg/L	0.0005-0.0004 [b]	0.000058 - 0.00046 [b]	0.000097 - 0.0028 [b]	0.000036	0.000018	<0.000035	<0.000015	<0.000015	0.000020	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.0000079	<0.000005	<0.000005	<0.00001	<0.00001	<0.000005	0.000012	0.000012	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.01	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0011	0.0011	<0.0005	0.00086	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.04	-	-	0.00018	<0.0001	<0.0001	<0.0001	<0.0001	0.00023	0.00018	0.00034	0.00026	<0.0001	0.00090	0.00034	0.00028	0.00017	0.00015	0.00061	0.00049	<0.0001	<0.0001	<0.0001	<0.0001	0.00042	0.00042
Copper	mg/L	0.02-0.09 [b]	[f]	[f]	0.00054	<0.0005	<0.0005	0.0011	<0.0005	0.0012	0.00054	<0.0005	<0.0005	0.00090	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0015	0.0013	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	<0.03	0.35	<0.03	<0.03	<0.03	<0.03	0.11	<0.03	0.79 [Mn]	0.041	0.041	<0.03	0.20	<0.03	0.12	0.12	0.39 [Mn]	0.59 [Mn]	<0.03	<0.03	<0.03	<0.03	<0.03	0.21	0.24
Lead	mg/L	0.04-0.16 [b]	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	<0.001	0.0014	0.0016	0.0015	0.0015	<0.001	<0.001	0.0028	0.0026	0.011	0.0081	0.027	0.024	0.0056	0.0056	0.010	0.012	<0.001	<0.001	<0.001	<0.001	0.0094	0.0094
Manganese	mg/L	-	-	-	0.16	0.00022	0.00032	0.00062	0.00037	0.097	0.085	0.26	0.24	0.0016	0.53	0.15	0.14	0.072	0.071	0.24	0.29	0.0015	0.0035	0.052	0.054	0.041	0.040
Molybdenum	mg/L	10	7.6 [g]	46 [g]	0.027	0.061	0.061	0.061	0.059	0.0029	0.0025	0.0047	0.0043	0.0014	0.0027	0.0068	0.0059	0.0034	0.0032	0.0072	0.0080	0.0044	0.0049	0.0064	0.0067	0.0022	0.0021
Nickel	mg/L	0.25-1.5 [b]	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00069	<0.0005	0.00068	0.00060	<0.0005	0.0013	0.00082	0.00069	<0.0005	0.0010	0.0039	0.0031	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.02	-	-	0.0011	0.0014	0.0013	0.0013	0.0013	<0.00005	<0.00005	0.000058	0.000066	0.00032	0.00027	<0.00005	<0.00005	<0.00005	<0.00005	0.000064	<0.00005	0.016	0.021	<0.00005	<0.00005	0.000052	<0.00005
Silicon	mg/L	-	9.6	8.1	7.8	8.0	7.8	7.8	11	11	10	5.1	6.0	2.8	5.1	6.0	6.0	8.7	8.5	3.5	4.5	7.8	8.5	9.3	9.8	7.8	7.1
Silver	mg/L	0.0005-0.015 [b]	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	0.17	0.070	0.070	0.068	0.070	0.83	0.81	0.90	0.94	0.099	0.34	0.67	0.64	0.26	0.34	0.76	0.97	0.88	0.83	0.44	0.46	1.3	1.2		
Thallium	mg/L	0.003	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00039	0.00017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.085	0.00068	0.000044	0.000039	0.000040	0.000043	0.00025	0.00020	0.00091	0.00084	0.00094	0.0016	0.0017	0.0015	0.00090	0.0016	0.0012	0.0013	0.0052	0.0046	0.0025	0.0025	0.00067	0.00069		
Vanadium	mg/L	-	0.0036	0.0016	0.0015	0.0016	0.0016	0.0048	0.0067	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0015	0.0016	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.075-2.4 [b, e]	<0.003	<0.003	<0.003	<0.003	<0.003	0.0035	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0078	0.0063	0.010	0.0072	0.0070	0.0054	0.0033	0.0050	<0.003	<0.003

BC Contaminated Sites Regulation (CSR), BC Reg 375/96, O.C. 1480/96, Deposited December 16, 1996; last amended ,
BC Approved Water Quality Guidelines (WQG): Aquatic Life, Wildlife and Agriculture - Guideline Summary. Water Quality
[a] = guideline is a minimum value, unless the background concentration or value is lowe
[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the datase
[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline
[d] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.4 to 12.0
[e] = zinc standards are not available for groundwater with a hardness greater than 400 mg/L
[f] = copper water quality guidelines are calculated using the BC Biotic Ligand Model, which take into account temperature
[g] = WQG is for total molybdenum.
[h] = guideline is chloride dependent. The guideline range shown is based on the chloride range observed in the dataset. The guideline is calculated based on the individual chloride v
[i] = guideline is temperature dependent. The guideline range shown is based on the temperature range observed in the d
[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalir
[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity
Bolded concentrations are higher than water quality guidelines.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi *after* ca
- = no guideline or no data.
Data Source: Analytical data provided by Mount Polley Mining Corporation.

(Mn) concentration is higher than the 30-day mean (chronic) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx) concentration is higher than the maximum (Acute) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx, Mn) concentration is higher than both the acute and chronic BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(F) concentration is higher than the British Columbia Contaminated Site Regulation for Protection of Fresh Water Aquatic Life (BC CSR AW-F) guideline.

Table 1: Water Quality Summary, 2022

Parameter	Unit	CSR AW-F	Water Quality Guideline - Aquatic Life		GW16-1a	GW16-1a	GW15-2b	GW15-2b	GW15-2b	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW14-1	GW14-1	GW14-1	GW14-1	GW14-1	GW12-5b	GW12-5b	GW12-5a	GW12-5a	GW12-4a	GW12-4a	GW12-4b	GW12-4b	GW12-3b
			Chronic (Mn)	Acute (Mx)	7-Jun-22	21-Sep-22	7-Jun-22	10-Aug-22	16-Nov-22	28-Feb-22	7-Jun-22	10-Aug-22	16-Nov-22	1-Mar-22	7-Jun-22	31-Aug-22	15-Nov-22	22-Nov-22	1-Jun-22	21-Sep-22	1-Jun-22	21-Sep-22	21-Jun-22	25-Jul-22	1-Jun-22	25-Jul-22	7-Jun-22
Field Measured																											
pH	-		6.5 - 9.0	6.5 - 9.0	8.7	8.7	7.9	8.0	7.8	8.6	8.7	8.7	8.4	7.8	7.7	7.8	7.3	7.6	7.4	7.5	7.5	7.5	7.7	7.4	7.5	7.5	7.9
Temperature	°C		-	-	5.5	8.6	5.3	8.1	5.7	6.1	5.3	7.3	5.2	16	16	23	15	14	7.9	6.1	6.7	6.6	7.2	15	7.9	9.3	2.0
Conductivity	µs/cm				737	634	3.2	462	494	200	205	208	208	279	285	251	290	285	462	427	319	308	300	315	372	441	293
Conventional Parameters																											
Hardness, as $CaCO_3$	mg/L		-		21	17	185	185	200	57	55	57	58	134	130	131	133	139	222	216	156	154	132	130	181	189	133
Total alkalinity, as $CaCO_3$	mg/L		20 [a]	-	353	240	97	92	94	63	67	66	64	157	158	154	148	-	188	193	152	153	144	137	180	185	98
Turbidity	NTU		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																											
Calcium	mg/L		-	-	5.4	4.5	58	58	64	18	17	18	18	36	35	36	37	38	79	76	53	52	31	32	55	56	38
Chloride	mg/L	1,500	150	600	6.3	<2.5	10	10	9.7	0.66	0.71	0.78	0.74	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1.3	0.57	0.54	4.4
Fluoride	mg/L	2-3 [b]	-	0.67 - 2.1 [b]	0.84 [Mx]	0.29	0.18	0.19	0.18	0.42	0.42	0.43	0.40	0.068	0.058	0.058	0.062	0.064	0.046	0.040	0.15	0.14	0.44	0.45	0.18	0.17	0.22
Magnesium	mg/L		-	-	1.8	1.5	9.6	9.5	10.0	3.1	3.1	3.1	3.2	11	10	9.7	9.7	11	6.3	6.4	5.5	5.7	13	12	11	12	9.0
Potassium	mg/L		-	-	0.72	0.66	0.44	0.41	0.56	0.80	0.71	0.72	0.81	1.9	1.8	1.9	1.9	1.8	0.40	0.39	0.45	0.45	1.4	1.3	1.2	1.2	1.7
Sodium	mg/L		-	-	162	141	20	20	19	23	21	21	19	7.9	7.2	7.4	7.3	7.8	4.6	4.6	4.2	4.0	12	12	5.9	6.5	10
Sulphate	mg/L	1280-4290 [b]	128 - 429 [b, c]	-	55	102	128	130	145	38	38	38	38	<0.3	<0.3	0.48	<0.3	<0.3	52	50	19	18	25	25	26	28	50
Ammonia, as N	mg-N/L		0.102 - 2.08 [d, i]	0.681 - 28.7 [d, i]	0.090	0.055	<0.005	<0.005	0.0098	<0.005	0.011	0.012	0.022	0.018	0.0055	0.029	<0.005	0.0078	<0.005	<0.005	0.0085	0.0072	0.025	0.023	<0.005	0.013	<0.005
Nutrients																											
Nitrate, as N	mg/L	400	3	32.8	<0.025	<0.025	0.038	0.038	0.085	0.037	<0.005	<0.005	0.042	<0.005	<0.005	<0.005	0.014	<0.005	0.046	0.038	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.83
Nitrite, as N	mg/L	0.2 - 2 [h]	0.02 - 0.20	0.06 - 0.60	<0.005	<0.005	0.0017	0.0077	0.019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0014	0.0010	0.0045	0.0022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total nitrogen	mg-N/L		-	-	0.67	0.14	0.099	0.099	0.24	0.044	0.036	0.040	0.20	<0.03	0.050	<0.03	<0.03	<0.03	0.058	0.067	15	<0.03	0.46	0.088	0.074	0.15	0.80
Total phosphorus	mg-P/L		-	-	0.44	0.14	0.11	0.061	0.012	0.031	0.039	0.050	0.061	0.0030	0.0075	0.0050	<0.002	0.0077	0.0043	0.0046	0.0042	0.0049	0.13	0.13	0.029	0.19	0.027
Dissolved phosphorus	mg-P/L		-	-	0.24	0.13	0.013	0.0065	0.026	0.033	0.045	0.051	0.044	0.0033	0.0030	0.0026	<0.002	<0.002	0.0021	0.0021	0.0035	<0.002	0.12	0.10	0.019	0.022	0.028
Nitrate + nitrite	mg-N/L	400	-	-	<0.0255	<0.0255	0.040	0.046	0.10	0.037	<0.0051	<0.0051	0.042	<0.0051	<0.0051	<0.0051	0.015	<0.0051	0.050	0.040	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	0.83
Dissolved Metals																											
Aluminum	mg/L		0.040 - 0.050 [e]	0.074 - 0.10 [e]	0.036	0.017	0.0043	0.0095	0.015	0.0048	0.0047	0.0050	0.0059	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0031	0.0048	<0.003	0.0031	<0.003
Antimony	mg/L	0.09	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00013
Arsenic	mg/L	0.05	-	-	0.0057	0.0056	0.0016	0.0018	0.0016	0.0043	0.0034	0.0033	0.0031	0.00032	0.00011	0.00045	<0.0001	<0.0001	0.00032	0.00041	0.0012	0.00099	0.0042	0.0042	0.00059	0.00079	0.0075
Barium	mg/L	10	-	-	0.014	0.0093	0.058	0.063	0.064	0.014	0.015	0.018	0.017	0.038	0.022	0.028	0.017	0.018	0.019	0.017	0.029	0.028	0.024	0.027	0.016	0.017	0.0024
Beryllium	mg/L	0.0015	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	12	-	-	0.34	0.36	0.21	0.22	0.18	0.49	0.49	0.54	0.50	0.012	0.018	0.012	0.016	0.012	0.017	0.016	0.016	0.014	0.25	0.25	0.14	0.13	0.30
Cadmium	mg/L	0.0005-0.0004 [b]	0.000058 - 0.00046 [b]	0.000097 - 0.0028 [b]	<0.00002	<0.000025	<0.000015	<0.000015	<0.000015	0.000017	<0.00001	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.000010	0.0000094	<0.000005	<0.000005	<0.00001	<0.000035	<0.00002	<0.00002	<0.000005
Chromium	mg/L	0.01	-	-	<0.0005	<0.0005	0.00073	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0013	<0.0005	0.0012	<0.0005
Cobalt	mg/L	0.04	-	-	0.00012	0.00014	<0.0001	0.00015	0.00014	<0.0001	<0.0001	<0.0001	0.00013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00012	0.00010	<0.0001	<0.0001	0.00028	0.00049	0.00034	0.00040	<0.0001
Copper	mg/L	0.02-0.09 [b]	(f)	(f)	0.00076	0.00064	0.00088	0.00088	0.00065	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00050	0.0014	0.0013	0.0021	0.0030	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	0.086	0.033	<0.03	<0.03	0.040	<0.03	<0.03	<0.03	<0.03	2.2 [Mx]	1.5 [Mx]	2.0 [Mx]	<0.03	<0.03	<0.03	<0.03	0.23	0.12	0.23	0.20	0.070	0.11	<0.03
Lead	mg/L	0.04-0.16 [b]	-	-	0.00015	0.00098	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.022	0.024	0.0031	0.0031	0.0030	0.0046	0.0048	0.0044	0.0041	0.0014	0.0012	0.0012	0.0012	0.0012	0.0029	0.0029	0.0024	0.0025	0.0018	0.0018	0.0011	0.0012	0.0015
Manganese	mg/L	-	-	-	0.029	0.012	0.046	0.18	0.12	0.020	0.065	0.077	0.020	0.18	0.095	0.13	0.011	0.079	0.024	0.023	0.036	0.028	0.43	0.73	0.19	0.25	0.00026
Molybdenum	mg/L	10	7.6 [g]	46 [g]	0.049	0.031	0.042	0.042	0.040	0.049	0.048	0.048	0.046	0.00040	0.00013	0.00034	0.00018	0.00012	0.0018	0.0018	0.011	0.010	0.070	0.071	0.037	0.036	0.027
Nickel	mg/L	0.25-1.5 [b]	-	-	0.0010	0.00094	0.00079	0.00076	0.00065	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0010	0.0022	0.00054	0.0014	<0.0005
Selenium	mg/L	0.02	-	-	0.00014	0.00011	0.00059	0.00066	0.00084	0.000064	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000065	<0.00005	0.00014	0.00017	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0030
Silicon	mg/L	-	-	-	3.7	3.1	7.1	6.9	6.9	8.7	8.5	8.3	8.2	6.8	8.1	6.7	6.8	6.4	7.3	7.4	7.7	7.8	14	13	5.8	5.9	12
Silver	mg/L	0.0005-0.015 [b]	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.10	0.090	0.22	0.22	0.25	0.048	0.052	0.049	0.054	1.4	1.2	1.2	1.2	1.3	0.17	0.16	0.20	0.20	0.35	0.36	0.16	0.19	0.20
Thallium	mg/L	0.003	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.001	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.085	-	-	0.00053	0.00054	0.00031	0.00030	0.00041	0.00014	0.00018	0.00018	0.00017	0.00015	0.00028	0.00025	0.00044	0.00023	0.00031	0.00028	0.00088	0.00085	0.00040	0.00041	0.00071	0.00077	0.00020
Vanadium	mg/L	-	-	-	0.0015	0.00066	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00053	0.00063	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.010
Zinc	mg/L	0.075-2.4 [b, e]	-	-	<0.003	<0.003	0.0072	0.0058	0.0065	0.0035	<0.003	<0.003	0.0099	0.0060	0.0056	0.015	0.036	0.012	<0.003	<0.003	0.0037	0.0076	0.0059	0.0054	0.0047	0.022	0.0031

BC Contaminated Sites Regulation (CSR), BC Reg 375/96, O.C. 1480/96, Deposited December 16, 1996; last amended ,
BC Approved Water Quality Guidelines (WQG): Aquatic Life, Wildlife and Agriculture - Guideline Summary. Water Quality
[a] = guideline is a minimum value, unless the background concentration or value is lowe
[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the datase
[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline
[d] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.4 to 12.0
[e] = zinc standards are not available for groundwater with a hardness greater than 400 mg/L
[f] = copper water quality guidelines are calculated using the BC Biotic Ligand Model, which take into account temperature
[g] = WQG is for total molybdenum.
[h] = guideline is chloride dependent. The guideline range shown is based on the chloride range observed in the dataset. The guideline is calculated based on the individual chloride v
[i] = guideline is temperature dependent. The guideline range shown is based on the temperature range observed in the d
[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalir
[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity
Bolded concentrations are higher than water quality guidelines.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi *after* c
- = no guideline or no data.
Data Source: Analytical data provided by Mount Polley Mining Corporation.

(Mn) concentration is higher than the 30-day mean (chronic) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx) concentration is higher than the maximum (Acute) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx, Mn) concentration is higher than both the acute and chronic BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(F) concentration is higher than the British Columbia Contaminated Site Regulation for Protection of Fresh Water Aquatic Life (BC CSR AW-F) guideline.

Table 1: Water Quality Summary, 2022

Parameter	Unit	CSR AW-F	Water Quality Guideline - Aquatic Life		GW12-3b	GW12-3a	GW12-3a	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-1b	GW12-1b	GW11-2a	GW11-2a	GW11-2b	GW11-2b	GW12-1a	GW12-1a	95-R5L	95-R5L	GW00-1a	GW00-1b
			Chronic (Mn)	Acute (Mx)	10-Aug-22	7-Jun-22	10-Aug-22	28-Feb-22	6-Jun-22	10-Aug-22	16-Nov-22	28-Feb-22	6-Jun-22	10-Aug-22	16-Nov-22	8-Jun-22	21-Sep-22	1-Jun-22	25-Jul-22	1-Jun-22	31-Aug-22	8-Jun-22	21-Sep-22	1-Jun-22	25-Jul-22	13-Sep-22	30-May-22
Field Measured																										
pH	-		6.5 - 9.0	6.5 - 9.0	8.0	7.1	7.3	7.5	7.4	7.5	7.3	8.0	8.1	8.1	7.9	7.3	7.2	12 (Mn, Mx)	12 (Mn, Mx)	7.7	7.6	7.7	7.5	6.4 (Mn, Mx)	6.5	9.0	6.9
Temperature	°C		-	-	6.7	2.5	7.1	7.3	5.5	11	7.7	7.1	5.8	8.9	8.2	6.3	6.3	7.3	8.2	8.2	10	6.3	6.2	6.8	7.5	9.0	8.1
Conductivity	µs/cm				299	2.6	419	485	511	561	533	228	215	236	234	793	788	1,970	1,996	517	511	531	506	1,014	1,131	818	1,067
Conventional Parameters																										
Hardness, as $CaCO_3$	mg/L		-	-	126	212	190	274	294	283	264	52	49	51	71	382	378	332	310	229	234	110	104	594	589	42	571
Total alkalinity, as $CaCO_3$	mg/L		20 (d)	-	95	86	86	260	230	286	266	48	52	48	47	145	146	259	242	290	313	43	44	454	451	179	393
Turbidity	NTU		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																										
Calcium	mg/L		-	-	36	57	51	71	77	74	68	19	17	18	22	122	121	133	124	61	63	35	33	200	194	11	120
Chloride	mg/L	1,500	150	600	4.5	1.4	1.5	1.4	1.1	1.3	1.4	0.93	0.97	0.96	0.95	<2.5	<2.5	<10	<5.0	<0.5	0.53	3.1	3.1	<2.5	<2.5	9.8	<2.5
Fluoride	mg/L	2-3 (b)	-	0.67 - 2.1 (b)	0.23	0.14	0.15	0.20	0.18	0.19	0.18	0.39	0.39	0.39	0.37	<0.1	<0.1	<0.4	<0.2	0.25	0.31	1.2	1.1	<0.1	<0.1	0.46	<0.1
Magnesium	mg/L		-	-	8.8	17	15	24	25	24	23	1.3	1.3	1.5	3.8	19	19	<0.1	<0.1	19	19	5.4	5.3	23	26	3.8	66
Potassium	mg/L		-	-	1.8	1.6	1.5	0.75	0.72	0.71	0.72	0.14	0.16	0.14	0.20	0.84	0.90	2.3	1.9	1.4	1.5	0.30	0.33	0.89	0.90	0.75	1.0
Sodium	mg/L		-	-	10	9.6	9.4	14	14	13	12	31	27	28	25	20	25	31	35	22	25	63	63	6.9	7.5	178	27
Sulphate	mg/L	1280-4290 (b)	128 - 429 (b, c)	-	50	146	122	20	24	24	23	63	63	62	63	307	306	<6.0	<3.0	<0.3	<0.3	196	194	155	151	231 (Mn)	100
Ammonia, as N	mg-N/L		0.102 - 2.08 (d, i)	0.681 - 28.7 (d, i)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0083	<0.005	<0.005	2.49 (Mn)	2.65 (Mn)	1.3	1.9	0.030	0.018	<0.005	<0.005	0.015	<0.005
Nutrients																										
Nitrate, as N	mg/L	400	3	32.8	0.91	2.5	2.3	0.57	0.57	0.57	0.56	0.046	0.038	0.034	0.043	0.11	<0.025	<0.1	<0.05	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025	<0.025	0.13
Nitrite, as N	mg/L	0.2 - 2 (h)	0.02 - 0.20	0.06 - 0.60	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.02	<0.01	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.88	2.4	2.2	0.56	0.56	0.57	0.55	0.049	0.040	0.056	0.058	0.14	0.098	3.2	3.0	1.4	2.1	0.055	0.056	<0.03	0.032	0.064	0.22
Total phosphorus	mg-P/L	-	-	-	0.027	0.033	0.036	0.014	0.011	0.017	0.027	0.033	0.031	0.030	0.029	0.012	0.022	0.0091	0.012	0.75	0.96	0.12	0.10	<0.002	<0.002	0.072	0.0046
Dissolved phosphorus	mg-P/L	-	-	-	0.028	0.030	0.034	0.013	0.011	0.0096	0.011	0.033	0.030	0.025	0.029	0.018	0.0067	<0.002	<0.002	0.77	0.84	0.11	0.084	<0.002	<0.002	0.056	0.0056
Nitrate + nitrite	mg-N/L	400	-	-	0.91	2.5	2.3	0.57	0.57	0.57	0.56	0.046	0.038	0.034	0.043	0.11	<0.0255	<0.102	<0.051	<0.0051	<0.0071	<0.0051	<0.0051	<0.0255	<0.0255	<0.0255	0.13
Dissolved Metals																										
Aluminum	mg/L		0.040 - 0.050 (e)	0.074 - 0.10 (b)	0.0065	<0.003	<0.003	<0.003	<0.003	0.026	0.0056	0.0072	0.0049	0.0054	0.0089	<0.003	<0.003	0.79 (Mn, Mx)	0.91 (Mn, Mx)	0.017	<0.003	0.0087	0.0052	<0.003	<0.003	0.0052	<0.003
Antimony	mg/L	0.09	-	-	0.00013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00039	0.00033	0.00089	0.00080	<0.0001	<0.0001	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	0.05	-	-	0.0077	0.0021	0.0025	0.00065	0.00057	0.00064	0.00059	0.0028	0.0027	0.0028	0.0023	0.00060	0.00068	0.00084	0.0010	0.0091	0.0090	0.0042	0.0043	0.0053	0.0060	0.014	0.00048
Barium	mg/L	10	-	-	0.0030	0.012	0.010	0.017	0.018	0.016	0.017	0.0051	0.0053	0.0048	0.0055	0.054	0.058	0.17	0.13	0.077	0.087	0.024	0.021	0.019	0.018	0.019	0.098
Beryllium	mg/L	0.0015	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	12	-	-	0.31	0.17	0.19	0.060	0.059	0.060	0.057	0.33	0.32	0.35	0.28	0.11	0.042	0.012	0.019	0.049	0.059	3.4	3.4	0.063	0.059	1.2	0.056
Cadmium	mg/L	0.0005-0.0004 (b)	0.000058 - 0.00046 (b)	0.000097 - 0.0028 (b)	<0.00001	<0.00001	<0.000015	0.000015	0.000019	<0.00001	<0.00001	0.000013	<0.000025	<0.00001	<0.000015	0.000067	<0.000015	<0.000015	<0.00002	0.0000072	<0.000005	<0.00001	<0.00001	<0.000005	<0.000005	<0.00001	0.000094
Chromium	mg/L	0.01	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.04	-	-	<0.0001	<0.0001	<0.0001	0.00028	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00014	0.00014	0.00011	<0.0001	<0.0002	<0.0002	0.00036	0.00066	<0.0001	0.00025
Copper	mg/L	0.02-0.09 (b)	(f)	(f)	0.00052	0.0010	0.00058	0.0015	0.0018	0.0017	0.0015	<0.0005	0.00092	<0.0005	0.0013	0.0019	0.00092	0.00098	0.0063	0.00086	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00099
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.30	0.14	<0.03	<0.03	3.2 (Mx)	4.1 (Mx)	0.30	0.22	1.5 (Mn)	1.6 (Mn)	<0.03	<0.03
Lead	mg/L	0.04-0.16 (b)	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0014	0.0016	0.0015	0.0036	0.0046	0.0039	0.0038	0.0037	0.0039	0.0036	0.0034	0.0064	0.0062	0.0082	0.0069	<0.001	<0.001	0.0067	0.0063	0.0077	0.0070	0.0070	0.0069
Manganese	mg/L	-	-	-	0.00095	0.0011	0.00055	0.00043	0.00040	0.0014	0.0021	0.00018	0.00055	0.00048	0.0037	0.0068	0.034	0.00013	0.00038	1.4	1.7	0.31	0.27	1.8	2.0	0.059	0.36
Molybdenum	mg/L	10	7.6 (g)	46 (g)	0.027	0.015	0.016	0.024	0.021	0.021	0.022	0.043	0.041	0.042	0.038	0.015	0.011	0.027	0.027	0.0016	0.00094	0.028	0.026	0.0075	0.0077	0.023	0.0079
Nickel	mg/L	0.25-1.5 (b)	-	-	<0.0005	<0.0005	<0.0005	0.00054	<0.0005	<0.0005	0.00084	<0.0005	<0.0005	<0.0005	0.00066	0.00078	0.0010	0.010	0.0097	<0.0005	<0.0005	<0.001	<0.001	<0.0005	0.00050	<0.0005	0.0020
Selenium	mg/L	0.02	-	-	0.0033	0.014	0.0091	0.0023	0.0023	0.0026	0.0028	<0.00005	<0.00005	0.000072	0.00030	0.0025	0.0015	0.00044	0.00038	0.000064	0.000084	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	0.00066
Silicon	mg/L	-	-	-	12	11	11	8.5	7.8	8.1	7.9	9.4	8.5	8.8	8.5	7.9	7.8	2.4	2.8	11	13	6.1	6.0	11	12	3.1	9.2
Silver	mg/L	0.0005-0.015 (b)	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.19	0.29	0.26	0.31	0.35	0.32	0.31	0.057	0.054	0.055	0.084	0.53	0.52	0.40	0.45	0.50	0.53	1.1	1.0	0.52	0.53	1.6	1.9
Thallium	mg/L	0.003	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00012	0.00012	0.00013	<0.0001	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.001	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.085	-	-	0.00021	0.00026	0.00026	0.00083	0.00093	0.00085	0.00081	0.00012	0.00011	0.00011	0.00017	0.0021	0.0024	<0.00001	<0.00001	0.000019	0.000014	0.00014	0.00013	0.00068	0.00065	0.00096	0.0078
Vanadium	mg/L	-	-	-	0.010	0.0054	0.0061	0.0026	0.0027	0.0027	0.0026	<0.0005	<0.0005	<0.0005	<0.0005	0.00051	<0.0005	0.0014	0.0017	0.00066	0.00081	<0.001	<0.001	<0.0005	<0.0005	<0.0005	0.00097
Zinc	mg/L	0.075-2.4 (b, e)	-	-	0.0034	0.0078	0.0048	0.011	0.0086	0.0095	0.0093	0.0053	0.0038	0.0042	0.024	0.0070	0.011	<0.003	0.0063	0.0032	<0.003	0.0050	0.010	0.017	0.015	<0.003	<0.003

BC Contaminated Sites Regulation (CSR), BC Reg 375/96, O.C. 1480/96, Deposited December 16, 1996; last amended ,
BC Approved Water Quality Guidelines (WQG): Aquatic Life, Wildlife and Agriculture - Guideline Summary. Water Quality
(a) = guideline is a minimum value, unless the background concentration or value is lowe
(b) = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the datase
(c) = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline
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(e) = zinc standards are not available for groundwater with a hardness greater than 400 mg/L
(f) = copper water quality guidelines are calculated using the BC Biotic Ligand Model, which take into account temperature
(g) = WQG is for total molybdenum.
(h) = guideline is chloride dependent. The guideline range shown is based on the chloride range observed in the dataset. The guideline is calculated based on the individual chloride v
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(Mx) = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity
Bolded concentrations are higher than water quality guidelines.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi *after* ca
- = no guideline or no data.
Data Source: Analytical data provided by Mount Polley Mining Corporation.

(Mn) concentration is higher than the 30-day mean (chronic) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx) concentration is higher than the maximum (Acute) BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx, Mn) concentration is higher than both the acute and chronic BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(F) concentration is higher than the British Columbia Contaminated Site Regulation for Protection of Fresh Water Aquatic Life (BC CSR AW-F) guideline.

Table 1: Water Quality Summary, 2022

Parameter	Unit	CSR AW-F	Water Quality Guideline - Aquatic Life		GW00-1b	GW00-3a	GW00-3b	GW00-3b	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW11-1a	GW11-1a	GW11-1b	GW11-1b
			Chronic (Mn)	Acute (Mx)	13-Sep-22	13-Sep-22	30-May-22	13-Sep-22	28-Feb-22	7-Jun-22	13-Oct-22	25-Oct-22	16-Nov-22	15-Dec-22	27-Dec-22	31-May-22	20-Sep-22	31-May-22	20-Sep-22
Field Measured																			
pH	-		6.5 - 9.0	6.5 - 9.0	7.1	11 (Mn, Mx)	7.5	7.5	7.4	7.6	7.5	7.6	7.5	6.9	7.4	7.8	8.0	7.9	8.0
Temperature	°C		-	-	9.2	7.5	7.8	7.5	8.0	6.3	8.6	7.5	6.0	7.5	7.4	8.4	9.0	8.1	9.2
Conductivity	µs/cm				1,007	203	586	567	563	561	589	588	582	555	582	464	411	335	321
Conventional Parameters																			
Hardness, as $CaCO_3$	mg/L		-	-	563	39	303	290	261	246	241	269	243	236	248	198	188	141	138
Total alkalinity, as $CaCO_3$	mg/L		20 (a)	-	385	62	221	264	146	137	144	133	140	135	142	144	148	159	157
Turbidity	NTU		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																			
Calcium	mg/L		-	-	116	15	80	72	94	88	85	96	86	84	87	62	58	46	44
Chloride	mg/L	1,500	150	600	<2.5	0.82	1.3	3.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.70	0.58	<0.5	<0.5
Fluoride	mg/L	2-3 (b)	-	0.67 - 2.1 (b)	<0.1	0.087	0.098	0.10	0.48	0.48	0.39	0.44	0.46	0.48	0.46	0.18	0.18	0.20	0.19
Magnesium	mg/L		-	-	66	0.26	25	27	6.6	6.7	6.7	6.8	7.1	6.5	7.1	11	11	6.8	6.7
Potassium	mg/L		-	-	1.2	0.21	0.63	0.76	0.50	0.48	0.57	0.52	0.54	0.56	0.55	0.33	0.39	0.85	0.91
Sodium	mg/L		-	-	26	16	10	11	21	21	22	23	21	22	22	21	21	18	19
Sulphate	mg/L	1280-4290 (b)	128 - 429 (b, c)	-	164	8.6	16	20	150	152	160	172	172	163	173	100	81	23	25
Ammonia, as N	mg-N/L		0.102 - 2.08 (d, i)	0.681 - 28.7 (d, i)	<0.005	0.013	0.020	0.018	<0.005	<0.005	0.0089	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.029	0.028
Nutrients																			
Nitrate, as N	mg/L	400	3	32.8	0.13	<0.005	<0.005	<0.005	0.068	0.066	0.020	0.027	0.027	0.021	0.021	0.27	0.17	0.011	0.0060
Nitrite, as N	mg/L	0.2 - 2 (h)	0.02 - 0.20	0.06 - 0.60	<0.005	0.0014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0043	0.0017
Total nitrogen	mg-N/L		-	-	0.19	0.058	0.058	0.039	0.085	0.088	0.032	0.059	0.035	0.045	0.035	0.28	0.18	0.045	<0.03
Total phosphorus	mg-P/L		-	-	<0.002	0.027	0.032	0.0094	0.031	0.033	0.0074	0.0082	0.013	0.029	0.010	0.022	0.026	0.081	0.096
Dissolved phosphorus	mg-P/L		-	-	0.0032	0.015	0.012	0.0073	0.0053	0.0064	0.0079	0.0059	0.0054	0.0048	0.0060	0.022	0.017	0.075	0.058
Nitrate + nitrite	mg-N/L	400	-	-	0.13	<0.0051	<0.0051	<0.0051	0.068	0.066	0.020	0.027	0.027	0.021	0.021	0.27	0.17	0.016	0.0077
Dissolved Metals																			
Aluminum	mg/L		0.040 - 0.050 (e)	0.074 - 0.10 (b)	0.012	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0092	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.09	-	-	<0.0001	0.00043	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00040	0.00039	<0.0001	0.00013
Arsenic	mg/L	0.05	-	-	0.00054	0.0018	0.0010	0.00076	0.00098	0.00091	0.00092	0.00095	0.00088	0.00083	0.00079	0.0028	0.0031	0.0021	0.0021
Barium	mg/L	10	-	-	0.100	0.021	0.034	0.033	0.012	0.011	0.014	0.014	0.013	0.013	0.013	0.0020	0.0020	0.012	0.012
Beryllium	mg/L	0.0015	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	12	-	-	0.059	0.097	0.016	0.016	0.22	0.24	0.25	0.29	0.26	0.28	0.24	0.37	0.30	0.20	0.19
Cadmium	mg/L	0.0005-0.0004 (b)	0.000058 - 0.00046 (b)	0.000097 - 0.0028 (b)	0.00014	0.0000070	0.000011	0.0000090	0.0000057	<0.000005	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005	<0.00004	<0.000025	<0.00002	<0.00001
Chromium	mg/L	0.01	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.04	-	-	0.00033	<0.0001	0.00030	0.00029	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.02-0.09 (b)	(f)	(f)	0.0026	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00061	<0.0005	<0.0005	<0.0005	0.00082	0.0012	<0.0005	<0.0005
Iron	mg/L	-	-	0.35	<0.03	<0.03	0.13	0.044	0.38 (Mx)	0.31	0.40 (Mx)	0.36 (Mx)	0.38 (Mx)	0.51 (Mx)	0.18	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.04-0.16 (b)	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0068	0.015	0.0021	0.0035	0.0016	0.0015	0.0014	0.0016	0.0014	0.0015	0.0015	0.0020	0.0020	<0.001	<0.001
Manganese	mg/L	-	-	-	0.64	0.00011	0.11	0.082	0.014	0.0098	0.0079	0.0069	0.0066	0.0076	0.0043	<0.0001	0.00011	0.19	0.19
Molybdenum	mg/L	10	7.6 (g)	46 (g)	0.011	0.0026	0.0032	0.0025	0.0066	0.0066	0.0060	0.0061	0.0060	0.0063	0.0059	0.041	0.044	0.038	0.042
Nickel	mg/L	0.25-1.5 (b)	-	-	0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.02	-	-	0.00095	<0.00005	<0.00005	<0.00005	0.0012	0.00093	0.00024	0.00033	0.00030	0.00028	0.00025	0.0040	0.0030	<0.00005	<0.00005
Silicon	mg/L	-	-	-	9.2	2.8	8.3	8.2	8.7	9.1	8.2	8.5	8.6	8.2	8.4	8.2	7.7	6.8	6.5
Silver	mg/L	0.0005-0.015 (b)	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	2.0	0.18	0.78	0.73	0.92	0.95	1.1	1.2	1.1	1.1	1.1	0.34	0.31	0.23	0.23
Thallium	mg/L	0.003	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.001	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.085	-	-	0.0082	<0.00001	0.0027	0.0029	0.00032	0.00029	0.00030	0.00029	0.00023	0.00022	0.00026	0.0013	0.0014	0.0013	0.0015
Vanadium	mg/L	-	-	-	0.0010	0.00083	<0.0005	<0.0005	0.0016	0.0015	0.0018	0.0016	0.0016	0.0014	0.0015	0.0033	0.0034	<0.0005	<0.0005
Zinc	mg/L	0.075-2.4 (b, e)	-	-	<0.003	<0.003	<0.003	<0.003	0.028	0.022	0.15	0.23	0.18	0.30	0.20	<0.003	<0.003	<0.003	<0.003

BC Contaminated Sites Regulation (CSR), BC Reg 375/96, O.C. 1480/96, Deposited December 16, 1996; last amended ,
BC Approved Water Quality Guidelines (WQG): Aquatic Life, Wildlife and Agriculture - Guideline Summary. Water Quality
(a) = guideline is a minimum value, unless the background concentration or value is lowe
(b) = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the datase
(c) = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline
(d) = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.4 to 12.0
(e) = zinc standards are not available for groundwater with a hardness greater than 400 mg/L
(f) = copper water quality guidelines are calculated using the BC Biotic Ligand Model, which take into account temperature
(g) = WQG is for total molybdenum.
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Bolded concentrations are higher than water quality guidelines.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi *after* c
- = no guideline or no data.
Data Source: Analytical data provided by Mount Polley Mining Corporation.

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(Mx, Mn) concentration is higher than both the acute and chronic BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(F) concentration is higher than the British Columbia Contaminated Site Regulation for Protection of Fresh Water Aquatic Life (BC CSR AW-F) guideline.

APPENDIX D

Wight Pit Technical Memorandum

TECHNICAL MEMORANDUM

DATE 29 March 2023 **Reference No.** 23590671-018-TM-Rev0-31491

TO Gabriel Holmes, Environmental Coordinator
Mount Polley Mining Corporation

FROM Olivia Kirby and Jacqueline Foley **EMAIL Olivia.Kirby@wsp.com; Jacqueline.Foley@wsp.com**

MPMC 2022 WIGHT PIT WATER LEVEL AND WATER CHEMISTRY REVIEW

1.0 INTRODUCTION

At the request of Mount Polley Mining Corporation (MPMC), WSP Canada Inc. (WSP) has reviewed water level and water chemistry data for surface water and groundwater in the area of Wight Pit, located in the northeast corner of the Mount Polley Mine (the Site). It is understood that Wight Pit is currently being used as a water storage facility in support of other site dewatering activities, and that increases in groundwater levels at monitoring wells GW16-7 and GW16-8 were observed in the late summer to fall of 2022. The direction of groundwater flow from Wight Pit is towards the east, towards Polley Lake. Monitoring wells GW16-7 and GW16-8 are located approximately halfway between Wight Pit and Polley Lake.

The purpose of this technical memorandum is to summarize the reviewed data.

2.0 WIGHT PIT AREA DATA REVIEW

Water level and water chemistry data was provided to WSP by MPMC. The data was compiled into several graphs to compare water elevation data and chemistry data for selected locations around Wight Pit, including Wight Pit, Polley Lake, and the two monitoring wells GW16-7 and GW16-8.

Groundwater and surface water elevation data was provided for Polley Lake, Wight Pit, GW16-7 and GW16-8, and is shown in Attachment 1 *(Mount Polley Water Elevations)*. Although historical data is limited for Wight Pit, and recent data is limited for Polley Lake, Attachment 1 shows that groundwater elevations at MW16-7 and MW16-8 were less than the elevation of Wight Pit in August 2022, and also inferred to be less than the elevation of Polley Lake. The increase in water levels at the two monitoring wells in August 2022 is inferred to coincide with, and may be a result of, the filling of Wight Pit.

Water chemistry data was provided by MPMC, and the parameters of interest were identified by Aaron Zwiebel of MPMC. Parameters of interest include total copper, total selenium, total zinc, sulfate, and dissolved cadmium (all reported in mg/L).

WSP reviewed analytical data based on the sampling locations proximity to Wight Pit, Polley Lake, and GW16-7 and GW16-8. The sampling locations are shown in Attachment 2 (*MPMC CEMP Monitoring Locations – Surface Water Monitoring Map*) and are outlined below:

- Polley Lake North Station – surface (**P1-surface**)
- Polley Lake North Station – middle (**P1-MID**)
- Polley Lake North Station – bottom (**P1-bottom**)
- Polley Lake North Station – above thermocline (**P1-AT**)
- Polley Lake North Station – below thermocline (**P1-BT**)
- "Wight Pit Sump", functionally representing effluent surface water from White Pit Lake (**E10**)
- Wight Pit Surface (**WIP-S**)
- Wight Pit – 10 m depth (**WIP-10m**)
- Wight Pit – 20 m depth (**WIP-20m**)
- Wight Pit – 2 metres off the bottom – approximately 27 m (**WIP-B**)
- **GW16-7**
- **GW16-8**

Analytical data has also been compared against the British Columbia (BC) Ministry of Environment and Climate Change Strategy Contaminated Site Regulation (CSR; BC Reg. 375/96, O.C. 1480/96, as updated [includes amendments up to BC Reg. 179/2021, updated to 7 July 2021]) for protection of freshwater aquatic life (BC CSR AW-F) standards (ENV 1996) and the BC Water Quality Guidelines for protection of aquatic life (ENV 2021). Note that there are limited chemistry results for the monitoring wells of interest (GW16-7 and GW16-8), with only one data sample from 24 November 2021, prior to the filling of Wight Pit. Therefore, we are unable to infer if the filling of Wight Pit is locally affecting the groundwater quality.

A brief summary of the chemistry plots in Attachment 3 (*Wight Pit-Polley Lake Chemistry*) identifies the following:

- **Total copper concentrations** are elevated in the Wight Pit sampling locations in comparison to the total copper concentrations in Polley Lake, and have decreased from the first sampling data point on 29 June 2022. Polley Lake total copper concentrations in 2022 are similar to those noted in 2021. The concentrations of total copper in the 24 November 2021 sample for GW16-7 and GW16-8 are approximately half an order of magnitude lower than the concentrations in Polley Lake. Comparison against BC WQGs for the protection of freshwater aquatic life requires additional parameter concentrations, including pH, hardness and dissolved organic carbon, the last of which is not available within the data set provided.
- **Total selenium concentrations** peaked in Wight Pit – S and Wight Pit - 10 m depth sampling locations in September 2022 before decreasing in the most recent samples collected in November 2022. In general, an increasing trend is noted in total selenium concentrations in the Wight Pit Sump since December 2021. Total selenium concentrations in the Polley Lake sample locations have remained stable since August 2021, with concentrations less than the BC WQGs for aquatic life. The concentrations of total selenium in the 24 November 2021 sample for GW16-7 and GW16-8 are similar to the concentrations in Polley Lake.

- **Total zinc concentrations** are stable in the Polley Lake sample locations, with concentrations inferred to be less than the BC WQGs for aquatic life (hardness dependant – calculations required). Total zinc concentrations have a general increasing trend in the Wight Pit - B and Wight Pit – 20 m sampling locations since data was available on 29 June 2022, and decreasing in the Wight Pit - S and Wight Pit – 10 m sampling locations. A peak concentration of total zinc was observed at the Wight Pit Sump location in June 2022, before decreasing in the fall samples collected in 2022. The concentration of total zinc in the 24 November 2021 sample for GW16-7 and GW16-8 is similar to the concentrations in Polley Lake.
- **Sulfate concentrations** are stable in the Polley Lake sample locations. Concentrations of sulfate in the Wight Pit Sump experienced a generally slight increasing trend from November 2021 to 16 November 2022. Concentrations have increased slightly in Wight Pit – B and Wight Pit – 20 m since 29 June 2022, and have generally decreased slightly in Wight Pit – S and Wight Pit – 10 m since 29 June 2022. The concentration of sulfate in the 11 November 2022 sample for GW16-8 (24.3 mg/L) is similar to the concentrations collected throughout the year. The sample for GW16-7 is slightly elevated compared to GW16-8, with a concentration of 183 mg/L during the 16 November 2022 sample, and has increased in concentration slightly over the last year compared to the 24 November 2021 sample (129 mg/L). Total sulphate concentrations in Polley Lake are inferred to be below the BC WQGs for aquatic life (hardness dependant – calculations required).
- **Dissolved cadmium concentrations** are stable in the Polley Lake sample locations and lower than those in Wight Pit. Dissolved cadmium concentrations in Polley Lake are inferred to be below the BC WQGs for aquatic life (hardness dependant – calculations required). Concentrations of dissolved cadmium in the Wight Pit locations is highest in Wight Pit – bottom, followed by Wight Pit – 20 m and Wight Pit – 10 m, with concentrations fluctuating since the first sample taken on 29 June 2022. Concentrations in the Wight Pit Sump appear to have an increasing trend from December 2021 to February 2022, before increasing during the fall 2022 sampling events. The concentration of dissolved cadmium from the 16 November 2022 sample for GW16-7 is the same as the sample collected on 24 November 2021 and is reported below the detection limit. GW16-8 is similar to the sample collected on 24 November 2021 (0.0000153 mg/L), but has increased slightly throughout the year as compared to the sampled collected on 16 November 2022 (0.0000254 mg/L).

Based on a review of the available information, the increased concentrations of the parameters of interest in the Wight Pit are not being observed in the Polley Lake sampling locations. Limited groundwater chemistry data is available for monitoring wells GW16-7 and GW16-8, and therefore short-term trends are not interpretable. However, in general, groundwater concentrations are less than concentrations in Wight Pit and similar to, or slightly greater than, concentrations in Polley Lake.

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We hope this technical memo provides MPMC with the information you require at this time. Should you require additional information or have any questions, please feel free to contact the undersigned at your convenience. Should MPMC wish to update the provided water level and/or chemistry data graphs for any additional sampling at Wight Pit, Polley Lake, or the two monitoring wells, please provide WSP the data and we can update the plots accordingly.

WSP Canada Inc.



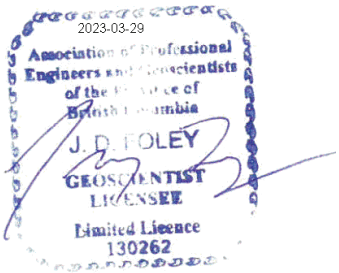

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Attachments: Attachment 1: Mount Polley Water Elevations
Attachment 2: MPMC CEMP Monitoring Locations – Surface Water Monitoring Map
Attachment 3: Wight Pit – Polley Lake Chemistry

https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/018-tm-31491-2022 wight pit water level and water chemistry review/23590671-018-tm-rev0-31491-wight pit chemistry 29mar_23.docx

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Engineers & Geoscientists BC

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ATTACHMENT 1

Mount Polley Water Elevations

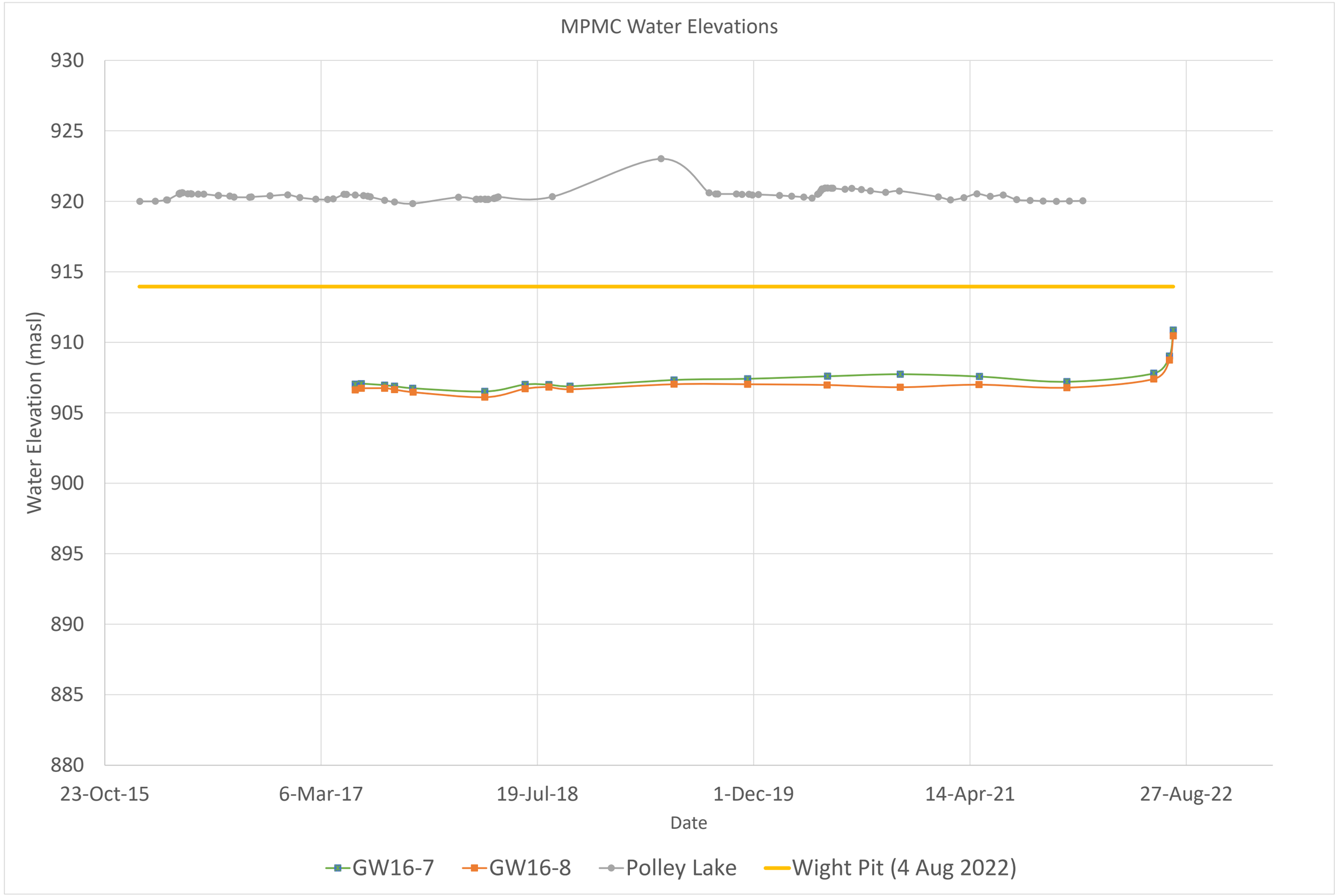
MPMC Water Elevations
930
925
920
915
910
905
900
895
890
885
880
Water Elevation (masl)
23-Oct-15
6-Mar-17
19-Jul-18
1-Dec-19
14-Apr-21
27-Aug-22
Date
GW16-7
GW16-8
Polley Lake
Wight Pit (4 Aug 2022)

ATTACHMENT 2

MPMC CEMP Monitoring Locations – Surface Water Monitoring Map

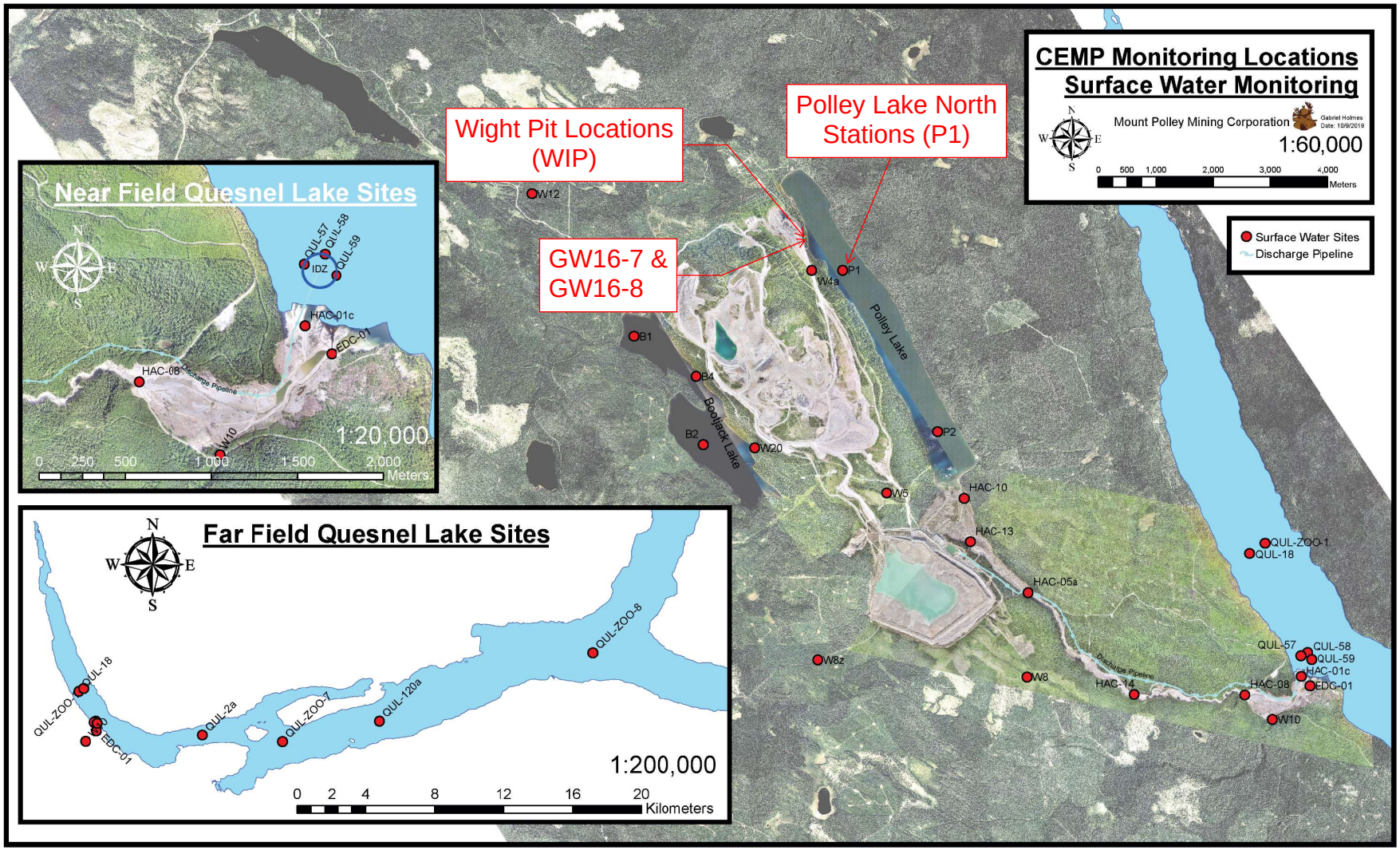

Figure 6.2 CEMP monitoring locations: Surface water monitoring

ATTACHMENT 3

Wight Pit – Polley Lake Chemistry

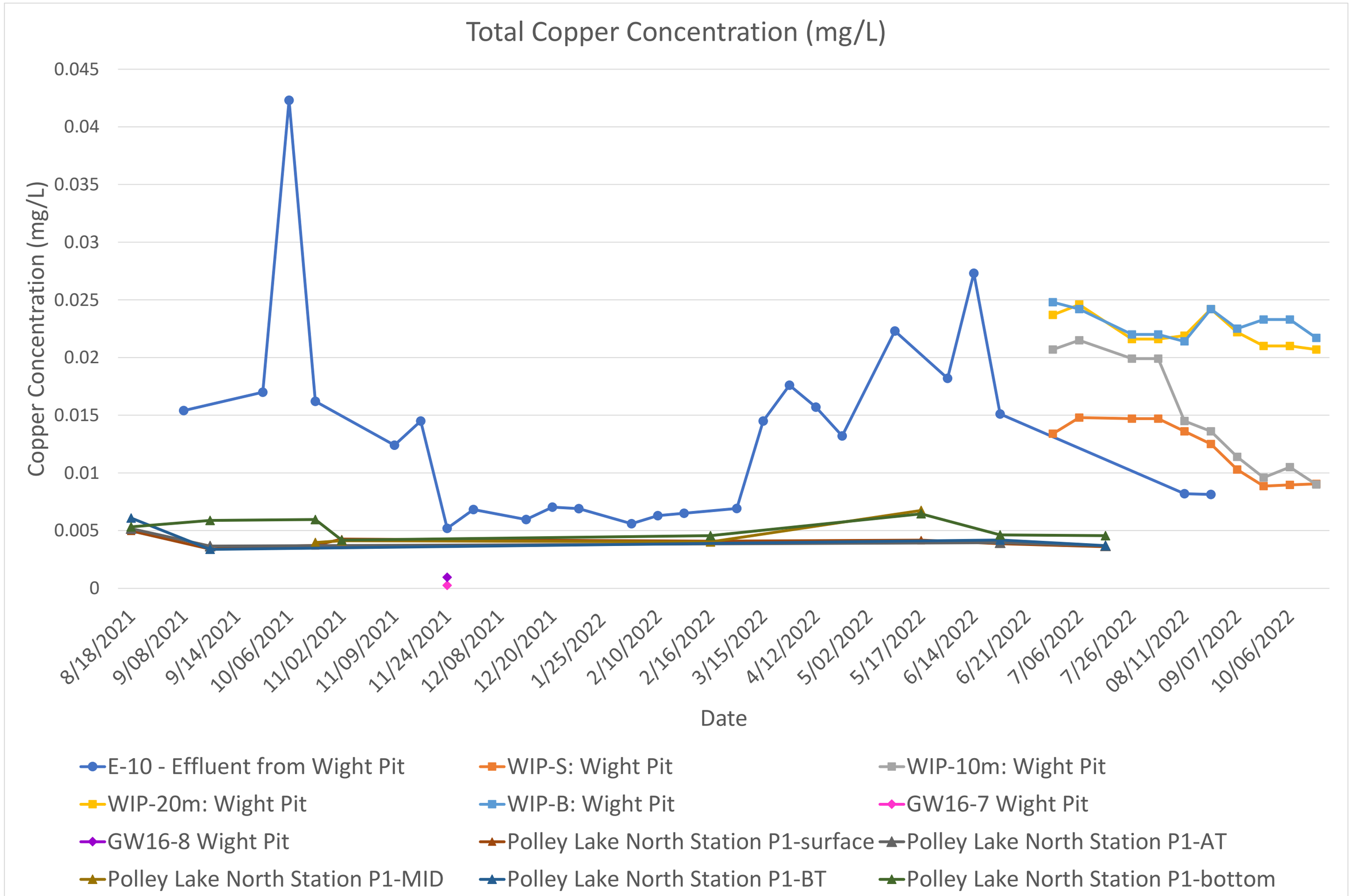
Total Copper Concentration (mg/L)
Copper Concentration (mg/L)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
8/18/2021
9/08/2021
9/14/2021
10/06/2021
11/02/2021
11/09/2021
11/24/2021
12/08/2021
12/20/2021
1/25/2022
2/10/2022
2/16/2022
3/15/2022
4/12/2022
5/02/2022
5/17/2022
6/14/2022
6/21/2022
7/06/2022
7/26/2022
08/11/2022
09/07/2022
10/06/2022
Date
E-10 - Effluent from Wight Pit
WIP-S: Wight Pit
WIP-10m: Wight Pit
WIP-20m: Wight Pit
WIP-B: Wight Pit
GW16-7 Wight Pit
GW16-8 Wight Pit
Polley Lake North Station P1-surface
Polley Lake North Station P1-AT
Polley Lake North Station P1-MID
Polley Lake North Station P1-BT
Polley Lake North Station P1-bottom

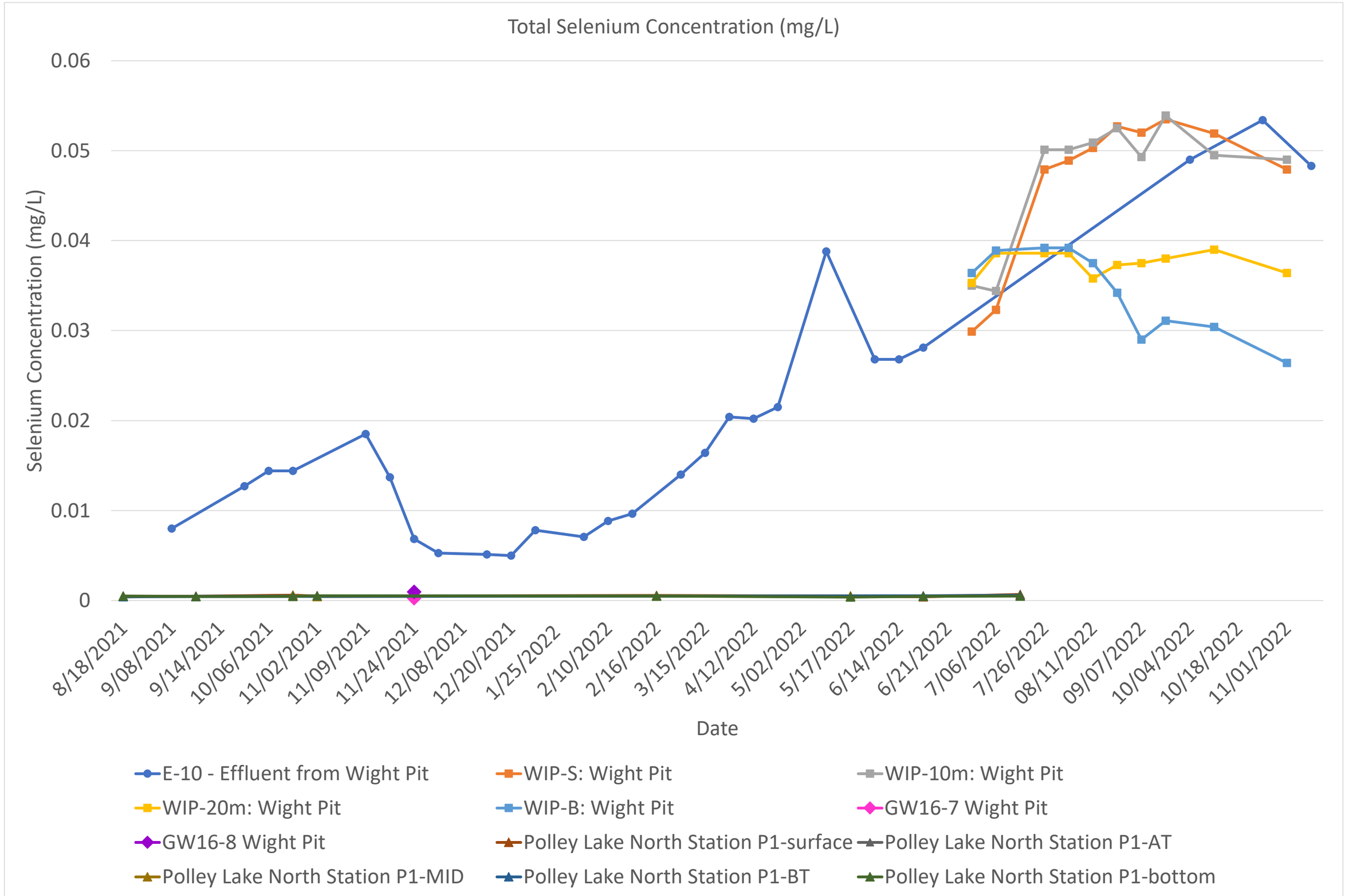
Total Selenium Concentration (mg/L)
Selenium Concentration (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
0
8/18/2021
9/08/2021
9/14/2021
10/06/2021
11/02/2021
11/09/2021
11/24/2021
12/08/2021
12/20/2021
1/25/2022
2/10/2022
2/16/2022
3/15/2022
4/12/2022
5/02/2022
5/17/2022
6/14/2022
6/21/2022
7/06/2022
7/26/2022
08/11/2022
09/07/2022
10/04/2022
10/18/2022
11/01/2022
Date
E-10 - Effluent from Wight Pit
WIP-S: Wight Pit
WIP-10m: Wight Pit
WIP-20m: Wight Pit
WIP-B: Wight Pit
GW16-7 Wight Pit
GW16-8 Wight Pit
Polley Lake North Station P1-surface
Polley Lake North Station P1-AT
Polley Lake North Station P1-MID
Polley Lake North Station P1-BT
Polley Lake North Station P1-bottom

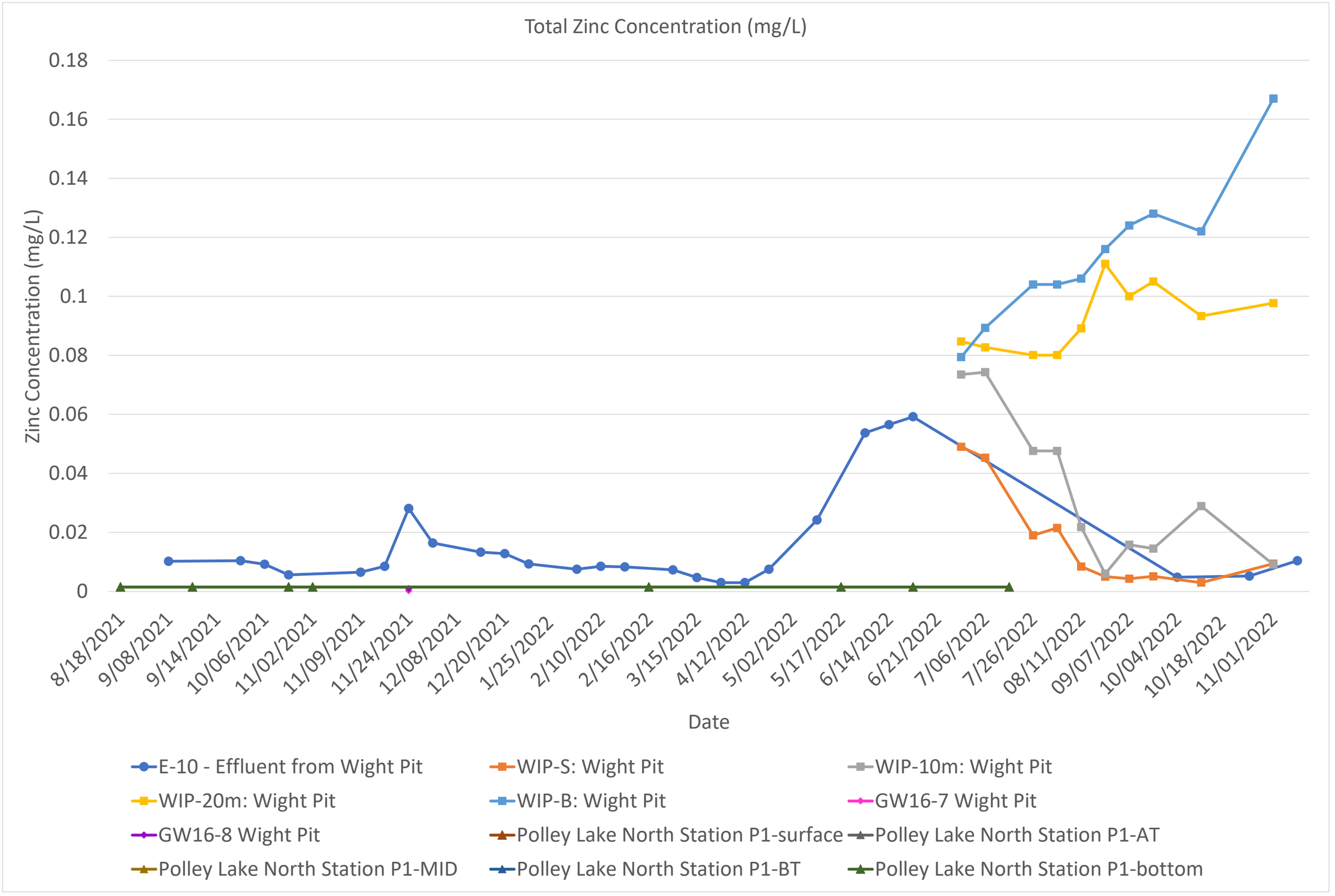
Total Zinc Concentration (mg/L)
Zinc Concentration (mg/L)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
8/18/2021
9/08/2021
9/14/2021
10/06/2021
11/02/2021
11/09/2021
11/24/2021
12/08/2021
12/20/2021
1/25/2022
2/10/2022
2/16/2022
3/15/2022
4/12/2022
5/02/2022
5/17/2022
6/14/2022
6/21/2022
7/06/2022
7/26/2022
08/11/2022
09/07/2022
10/04/2022
10/18/2022
11/01/2022
Date
E-10 - Effluent from Wight Pit
WIP-S: Wight Pit
WIP-10m: Wight Pit
WIP-20m: Wight Pit
WIP-B: Wight Pit
GW16-7 Wight Pit
GW16-8 Wight Pit
Polley Lake North Station P1-surface
Polley Lake North Station P1-AT
Polley Lake North Station P1-MID
Polley Lake North Station P1-BT
Polley Lake North Station P1-bottom

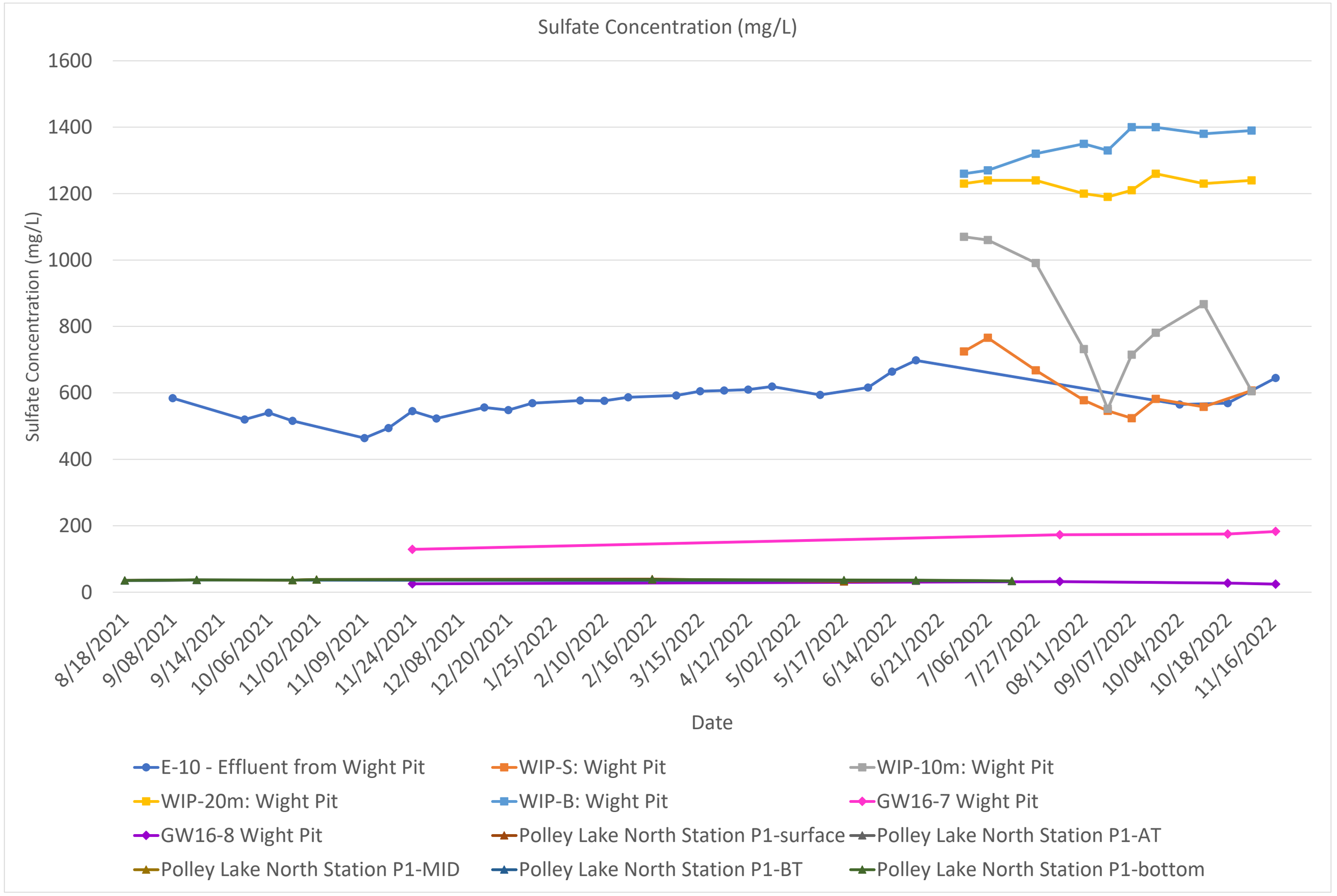
Sulfate Concentration (mg/L)
1600
1400
1200
1000
800
600
400
200
0
Sulfate Concentration (mg/L)
8/18/2021
9/08/2021
9/14/2021
10/06/2021
11/02/2021
11/09/2021
11/24/2021
12/08/2021
12/20/2021
1/25/2022
2/10/2022
2/16/2022
3/15/2022
4/12/2022
5/02/2022
5/17/2022
6/14/2022
6/21/2022
7/06/2022
7/27/2022
08/11/2022
09/07/2022
10/04/2022
10/18/2022
11/16/2022
Date
E-10 - Effluent from Wight Pit
WIP-S: Wight Pit
WIP-10m: Wight Pit
WIP-20m: Wight Pit
WIP-B: Wight Pit
GW16-7 Wight Pit
GW16-8 Wight Pit
Polley Lake North Station P1-surface
Polley Lake North Station P1-AT
Polley Lake North Station P1-MID
Polley Lake North Station P1-BT
Polley Lake North Station P1-bottom

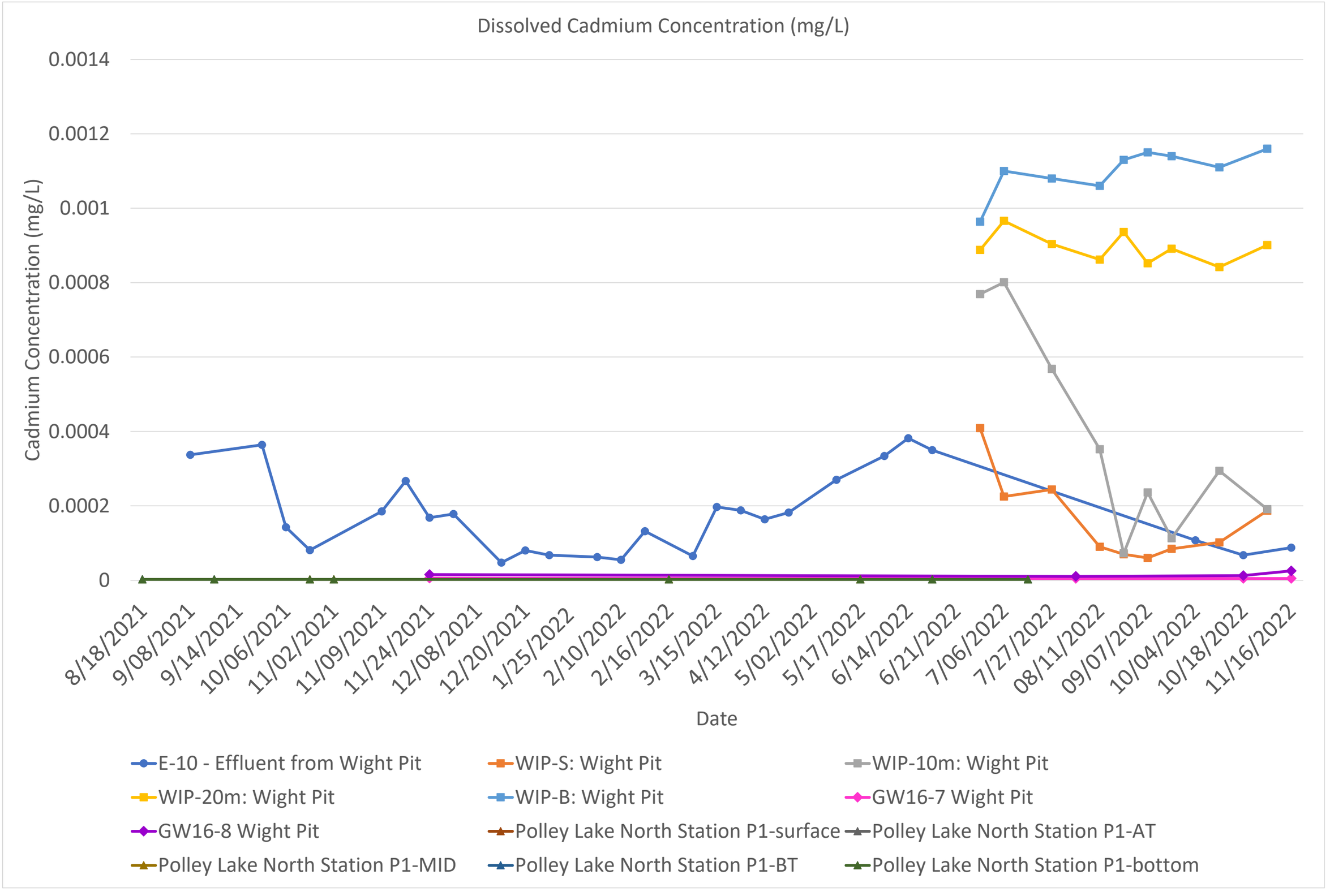
Dissolved Cadmium Concentration (mg/L)
Cadmium Concentration (mg/L)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
8/18/2021
9/08/2021
9/14/2021
10/06/2021
11/02/2021
11/09/2021
11/24/2021
12/08/2021
12/20/2021
1/25/2022
2/10/2022
2/16/2022
3/15/2022
4/12/2022
5/02/2022
5/17/2022
6/14/2022
6/21/2022
7/06/2022
7/27/2022
08/11/2022
09/07/2022
10/04/2022
10/18/2022
11/16/2022
Date
E-10 - Effluent from Wight Pit
WIP-S: Wight Pit
WIP-10m: Wight Pit
WIP-20m: Wight Pit
WIP-B: Wight Pit
GW16-7 Wight Pit
GW16-8 Wight Pit
Polley Lake North Station P1-surface
Polley Lake North Station P1-AT
Polley Lake North Station P1-MID
Polley Lake North Station P1-BT
Polley Lake North Station P1-bottom



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APPENDIX 2-8: Groundwater Quality Screening Tables

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a 1	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2015-07-23	2015-09-03	2015-09-03	2015-09-08	2015-09-09	2015-09-29
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	7.8	9.0	8.4	8.2	-
Specific conductivity	µS/cm	-	-	-	-	514	296	330	330	326
Temperature	°C	-	-	-	-	7.0	7.8	8.4	8.6	9.2
Conventional Parameters										
pH	mg/L	-	-	-	9.3	-	-	-	8.2	-
Specific conductivity	µS/cm	-	-	-	299	-	-	-	322	-
Hardness, as $CaCO_3$	mg/L	-	-	-	25	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	60	-	-	-	75	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	6.7	-	-	-	32	-
Chloride	mg/L	150	600	1,500	7.2	-	-	-	8.2	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	0.24	-	-	-	0.29	-
Magnesium	mg/L	-	-	-	2.0	-	-	-	2.9	-
Potassium	mg/L	-	-	-	14	-	-	-	2.3	-
Sodium	mg/L	-	-	-	42	-	-	-	31	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	65	-	-	-	71	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	-	-	-	<0.005	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	<0.001	-	-	-	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	-	-	-	<0.0051	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	<0.005	-	-	-	0.012	-
Total nitrogen	mg-N/L	-	-	-	0.066	-	-	-	0.083	-
Total phosphorus	mg-P/L	-	-	-	0.0072	-	-	-	0.013	-
Dissolved phosphorus	mg-P/L	-	-	-	0.0028	-	-	-	0.012	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0062	-	-	-	0.0037	-
Antimony	mg/L	0.0090	-	0.090	0.00052	-	-	-	0.00029	-
Arsenic	mg/L	-	0.0050	0.050	0.0049	-	-	-	**0.0059[Mx]**	-
Barium	mg/L	1.0	-	10	0.034	-	-	-	0.022	-
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	-	<0.0001	-
Bismuth	mg/L	-	-	-	<0.00005	-	-	-	<0.00005	-
Boron	mg/L	1.2	-	12	0.41	-	-	-	0.39	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	<0.000005	-	-	-	0.0000061	-
Chromium	mg/L	0.0010[h]	-	0.010	0.00070	-	-	-	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	-	-	-	0.00011	-
Copper	mg/L	-	-	0.020 - 0.060[b]	0.0011	-	-	-	0.00085	-
Iron	mg/L	-	0.35	-	<0.03	-	-	-	<0.03	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	<0.00005	-	-	-	<0.00005	-
Lithium	mg/L	-	-	-	0.032	-	-	-	0.0074	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	0.00056	-	-	-	0.053	-
Molybdenum	mg/L	7.6	46	-	0.028	-	-	-	0.022	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	<0.0005	-	-	-	0.00064	-
Selenium	mg/L	0.0020	-	0.020	0.00100	-	-	-	0.00040	-
Silicon	mg/L	-	-	-	9.1	-	-	-	8.4	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	<0.00001	-	-	-	<0.00001	-
Strontium	mg/L	-	-	-	0.28	-	-	-	0.17	-
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	-	<0.00001	-
Tin	mg/L	-	-	-	0.00054	-	-	-	0.00020	-
Titanium	mg/L	-	-	1.0	<0.01	-	-	-	<0.01	-
Uranium	mg/L	0.0085	-	0.085	0.00010	-	-	-	0.00060	-
Vanadium	mg/L	-	-	-	0.0013	-	-	-	0.00098	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	-	-	-	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2015-09-30	2015-10-01	2015-10-19	2015-10-20	2015-10-21	2015-11-16
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.1	8.4	-	9.0	8.0	8.3
Specific conductivity	µS/cm	-	-	-	320	312	302	320	296	301
Temperature	°C	-	-	-	8.6	8.9	8.1	8.1	8.1	5.6
Conventional Parameters										
pH	mg/L	-	-	-	-	8.1	-	-	8.1	-
Specific conductivity	µS/cm	-	-	-	-	303	-	-	296	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	93.2	-	-	93.5	-
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	-	72.4	-	-	69.3	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	-	33	-	-	33.4	-
Chloride	mg/L	150	600	1,500	-	7.96	-	-	7.51	-
Fluoride	mg/L	-	0.77 - 1.5[(b)]	2.0 - 3.0[(b)]	-	0.291	-	-	0.279	-
Magnesium	mg/L	-	-	-	-	2.61	-	-	2.47	-
Potassium	mg/L	-	-	-	-	0.991	-	-	0.43	-
Sodium	mg/L	-	-	-	-	31.5	-	-	27.1	-
Sulphate	mg/L	128 - 309[(b)]	-	1,280 - 2,180[(b)]	-	67.8	-	-	63.9	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	<0.005	-
Nitrite	mg-N/L	0.040 - 0.10[(c)]	0.12 - 0.30[(c)]	400[(c)]	-	<0.001	-	-	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	<0.0051	-
Total ammonia	mg-N/L	0.13 - 2.0[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	-	0.0093	-	-	0.0072	-
Total nitrogen	mg-N/L	-	-	-	-	0.053	-	-	0.047	-
Total phosphorus	mg-P/L	-	-	-	-	0.0113	-	-	0.0139	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0126	-	-	0.0143	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	-	0.0054	-	-	0.0031	-
Antimony	mg/L	0.0090	-	0.090	-	0.0002	-	-	0.00013	-
Arsenic	mg/L	-	0.0050	0.050	-	0.0065[(Mx)]	-	-	0.0056[(Mx)]	-
Barium	mg/L	1.0	-	10	-	0.0199	-	-	0.0161	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	-
Boron	mg/L	1.2	-	12	-	0.395	-	-	0.386	-
Cadmium	mg/L	0.000076 - 0.00027[(b)]	0.00014 - 0.00084[(b)]	0.00050 - 0.0015[(b)]	-	0.0000084	-	-	0.0000071	-
Chromium	mg/L	0.0010[(h)]	-	0.010	-	<0.0005	-	-	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	-	0.00011	-	-	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.060[(b)]	-	<0.0005	-	-	<0.0005	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	-
Lead	mg/L	0.0038 - 0.0082[(b)]	0.014 - 0.13[(b)]	0.040 - 0.060[(b)]	-	<0.00005	-	-	<0.00005	-
Lithium	mg/L	-	-	-	-	0.0047	-	-	0.0041	-
Manganese	mg/L	0.77 - 1.2[(b)]	0.82 - 2.1[(b)]	-	-	0.0493	-	-	0.0298	-
Molybdenum	mg/L	7.6	46	-	-	0.0259	-	-	0.0249	-
Nickel	mg/L	0.025 - 0.12[(b)]	-	0.25 - 1.1[(b)]	-	0.00059	-	-	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	-	0.000162	-	-	0.000116	-
Silicon	mg/L	-	-	-	-	8.95	-	-	9.27	-
Silver	mg/L	0.000050 - 0.0015[(b)]	0.00010 - 0.0030[(b)]	-	-	<0.00001	-	-	<0.00001	-
Strontium	mg/L	-	-	-	-	0.149	-	-	0.141	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	-
Tin	mg/L	-	-	-	-	0.00012	-	-	<0.0001	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	-
Uranium	mg/L	0.0085	-	0.085	-	0.000423	-	-	0.0003	-
Vanadium	mg/L	-	-	-	-	0.00092	-	-	0.00065	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	-	<0.003	-	-	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2015-11-17	2015-11-18	2015-12-14	2015-12-15	2015-12-17	2016-01-11	2016-01-12
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.1	8.6	8.2	8.3	8.5	7.9	-
Specific conductivity	µS/cm	-	-	-	305	299	298	294	294	292	330
Temperature	°C	-	-	-	6.4	6.8	4.9	6.0	6.3	5.1	3.9
Conventional Parameters											
pH	mg/L	-	-	-	-	8	-	-	8	-	-
Specific conductivity	µS/cm	-	-	-	-	304	-	-	292	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	94.5	-	-	86.7	-	-
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	-	73.4	-	-	66.1	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	-	33.5	-	-	31	-	-
Chloride	mg/L	150	600	1,500	-	7.36	-	-	7.48	-	-
Fluoride	mg/L	-	0.77 - 1.5[(b)]	2.0 - 3.0[(b)]	-	0.282	-	-	0.288	-	-
Magnesium	mg/L	-	-	-	-	2.65	-	-	2.26	-	-
Potassium	mg/L	-	-	-	-	0.441	-	-	0.325	-	-
Sodium	mg/L	-	-	-	-	27.7	-	-	26.4	-	-
Sulphate	mg/L	128 - 309[(b)]	-	1,280 - 2,180[(b)]	-	63.3	-	-	64.2	-	-
Nutrients											
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	<0.005	-	-
Nitrite	mg-N/L	0.040 - 0.10[(c)]	0.12 - 0.30[(c)]	400[(c)]	-	<0.001	-	-	<0.001	-	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	<0.0051	-	-
Total ammonia	mg-N/L	0.13 - 2.0[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	-	0.0098	-	-	0.0056	-	-
Total nitrogen	mg-N/L	-	-	-	-	0.049	-	-	<0.03	-	-
Total phosphorus	mg-P/L	-	-	-	-	0.0172	-	-	0.0156	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0176	-	-	0.015	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	-	0.004	-	-	0.0035	-	-
Antimony	mg/L	0.0090	-	0.090	-	0.00013	-	-	0.0001	-	-
Arsenic	mg/L	-	0.0050	0.050	-	0.0054[(Mx)]	-	-	0.0056[(Mx)]	-	-
Barium	mg/L	1.0	-	10	-	0.0184	-	-	0.0167	-	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	-	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	-	-
Boron	mg/L	1.2	-	12	-	0.382	-	-	0.376	-	-
Cadmium	mg/L	0.000076 - 0.00027[(b)]	0.00014 - 0.00084[(b)]	0.00050 - 0.0015[(b)]	-	0.0000241	-	-	0.000016	-	-
Chromium	mg/L	0.0010[(h)]	-	0.010	-	<0.0005	-	-	<0.0005	-	-
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	-	<0.0001	-	-
Copper	mg/L	-	-	0.020 - 0.060[(b)]	-	0.00058	-	-	<0.0005	-	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	-	-
Lead	mg/L	0.0038 - 0.0082[(b)]	0.014 - 0.13[(b)]	0.040 - 0.060[(b)]	-	<0.00005	-	-	<0.00005	-	-
Lithium	mg/L	-	-	-	-	0.0042	-	-	0.0038	-	-
Manganese	mg/L	0.77 - 1.2[(b)]	0.82 - 2.1[(b)]	-	-	0.0298	-	-	0.0259	-	-
Molybdenum	mg/L	7.6	46	-	-	0.0257	-	-	0.0249	-	-
Nickel	mg/L	0.025 - 0.12[(b)]	-	0.25 - 1.1[(b)]	-	0.00085	-	-	<0.0005	-	-
Selenium	mg/L	0.0020	-	0.020	-	0.000186	-	-	0.000115	-	-
Silicon	mg/L	-	-	-	-	9.56	-	-	9.32	-	-
Silver	mg/L	0.000050 - 0.0015[(b)]	0.00010 - 0.0030[(b)]	-	-	<0.00001	-	-	<0.00001	-	-
Strontium	mg/L	-	-	-	-	0.137	-	-	0.134	-	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	-	-
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	-	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	-	-
Uranium	mg/L	0.0085	-	0.085	-	0.000314	-	-	0.000229	-	-
Vanadium	mg/L	-	-	-	-	0.00085	-	-	0.00059	-	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	-	0.0078	-	-	<0.003	-	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

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Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-01-13	2016-02-16	2016-02-17	2016-02-18	2016-03-14	2016-03-15
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.3	8.3	8.3	8.5	8.4	8.3
Specific conductivity	µS/cm	-	-	-	290	299	320	302	287	287
Temperature	°C	-	-	-	6.5	6.4	6.2	6.4	7.1	7.5
Conventional Parameters										
pH	mg/L	-	-	-	8.1	-	-	8.1	-	-
Specific conductivity	µS/cm	-	-	-	290	-	-	293	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	84	-	-	79.5	-	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	64.2	-	-	63.6	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	30.1	-	-	28.4	-	-
Chloride	mg/L	150	600	1,500	7.27	-	-	7.34	-	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	0.278	-	-	0.274	-	-
Magnesium	mg/L	-	-	-	2.14	-	-	2.09	-	-
Potassium	mg/L	-	-	-	0.286	-	-	0.293	-	-
Sodium	mg/L	-	-	-	26.7	-	-	26.8	-	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	63	-	-	62	-	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	-	-	<0.005	-	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	<0.001	-	-	<0.001	-	-
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	-	-	<0.0051	-	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	0.0062	-	-	<0.005	-	-
Total nitrogen	mg-N/L	-	-	-	0.033	-	-	<0.03	-	-
Total phosphorus	mg-P/L	-	-	-	0.0153	-	-	0.0179	-	-
Dissolved phosphorus	mg-P/L	-	-	-	0.0135	-	-	0.012	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0033	-	-	0.0035	-	-
Antimony	mg/L	0.0090	-	0.090	<0.0001	-	-	<0.0001	-	-
Arsenic	mg/L	-	0.0050	0.050	0.0051[Mx]	-	-	0.0052[Mx]	-	-
Barium	mg/L	1.0	-	10	0.0166	-	-	0.0163	-	-
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	<0.0001	-	-
Bismuth	mg/L	-	-	-	<0.00005	-	-	<0.00005	-	-
Boron	mg/L	1.2	-	12	0.381	-	-	0.351	-	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	0.0000066	-	-	0.0000073	-	-
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	-	-	<0.0005	-	-
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	-	-	<0.0001	-	-
Copper	mg/L	-	-	0.020 - 0.060[b]	<0.0005	-	-	<0.0005	-	-
Iron	mg/L	-	0.35	-	<0.03	-	-	<0.03	-	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	<0.00005	-	-	<0.00005	-	-
Lithium	mg/L	-	-	-	0.0038	-	-	0.0033	-	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	0.0262	-	-	0.0256	-	-
Molybdenum	mg/L	7.6	46	-	0.0245	-	-	0.0256	-	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	<0.0005	-	-	<0.0005	-	-
Selenium	mg/L	0.0020	-	0.020	0.000131	-	-	0.00011	-	-
Silicon	mg/L	-	-	-	9.19	-	-	9.35	-	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	<0.00001	-	-	<0.00001	-	-
Strontium	mg/L	-	-	-	0.136	-	-	0.135	-	-
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	<0.00001	-	-
Tin	mg/L	-	-	-	<0.0001	-	-	<0.0001	-	-
Titanium	mg/L	-	-	1.0	<0.01	-	-	<0.01	-	-
Uranium	mg/L	0.0085	-	0.085	0.00019	-	-	0.000195	-	-
Vanadium	mg/L	-	-	-	<0.0005	-	-	<0.0005	-	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	-	-	<0.003	-	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-03-16	2016-04-12	2016-04-13	2016-04-14	2016-05-09	2016-05-10
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.4	8.3	8.3	8.4	8.4	8.4
Specific conductivity	µS/cm	-	-	-	282	284	281	283	282	282
Temperature	°C	-	-	-	6.1	7.5	8.1	8.1	7.3	7.9
Conventional Parameters										
pH	mg/L	-	-	-	8.1	-	-	8	-	-
Specific conductivity	µS/cm	-	-	-	291	-	-	281	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	80.9	-	-	82.1	-	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	66.1	-	-	62.9	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	29.1	-	-	29.5	-	-
Chloride	mg/L	150	600	1,500	6.94	-	-	6.91	-	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	0.268	-	-	0.285	-	-
Magnesium	mg/L	-	-	-	2.01	-	-	2.02	-	-
Potassium	mg/L	-	-	-	0.28	-	-	0.301	-	-
Sodium	mg/L	-	-	-	25.1	-	-	26.2	-	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	61.1	-	-	62.9	-	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	-	-	<0.005	-	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	<0.001	-	-	<0.001	-	-
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	-	-	<0.0051	-	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	<0.005	-	-	<0.005	-	-
Total nitrogen	mg-N/L	-	-	-	0.036	-	-	<0.03	-	-
Total phosphorus	mg-P/L	-	-	-	0.0172	-	-	0.0184	-	-
Dissolved phosphorus	mg-P/L	-	-	-	0.0138	-	-	0.0167	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0032	-	-	<0.003	-	-
Antimony	mg/L	0.0090	-	0.090	<0.0001	-	-	<0.0001	-	-
Arsenic	mg/L	-	0.0050	0.050	0.0051[Mx]	-	-	0.00473	-	-
Barium	mg/L	1.0	-	10	0.0162	-	-	0.0163	-	-
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	<0.0001	-	-
Bismuth	mg/L	-	-	-	<0.00005	-	-	<0.00005	-	-
Boron	mg/L	1.2	-	12	0.361	-	-	0.348	-	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	0.0000094	-	-	0.0000071	-	-
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	-	-	<0.0005	-	-
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	-	-	<0.0001	-	-
Copper	mg/L	-	-	0.020 - 0.060[b]	<0.0005	-	-	<0.0005	-	-
Iron	mg/L	-	0.35	-	<0.03	-	-	<0.03	-	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	<0.00005	-	-	<0.00005	-	-
Lithium	mg/L	-	-	-	0.004	-	-	0.0029	-	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	0.0329	-	-	0.0307	-	-
Molybdenum	mg/L	7.6	46	-	0.0259	-	-	0.0233	-	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	<0.0005	-	-	<0.0005	-	-
Selenium	mg/L	0.0020	-	0.020	0.000058	-	-	0.000057	-	-
Silicon	mg/L	-	-	-	9.25	-	-	9.44	-	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	<0.00001	-	-	<0.00001	-	-
Strontium	mg/L	-	-	-	0.136	-	-	0.126	-	-
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	<0.00001	-	-
Tin	mg/L	-	-	-	<0.0001	-	-	<0.0001	-	-
Titanium	mg/L	-	-	1.0	<0.01	-	-	<0.01	-	-
Uranium	mg/L	0.0085	-	0.085	0.000169	-	-	0.000124	-	-
Vanadium	mg/L	-	-	-	<0.0005	-	-	<0.0005	-	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	-	-	<0.003	-	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-05-11	2016-06-08	2016-07-11	2016-07-12	2016-07-13	2016-08-16
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.3	8.1	8.4	8.2	8.2	8.2
Specific conductivity	µS/cm	-	-	-	280	280	280	285	284	284
Temperature	°C	-	-	-	6.9	9.4	8.1	7.5	8.3	9.0
Conventional Parameters										
pH	mg/L	-	-	-	8	8.1	-	-	8.1	-
Specific conductivity	µS/cm	-	-	-	272	271	-	-	275	-
Hardness, as $CaCO_3$	mg/L	-	-	-	81.3	81	-	-	70.9	-
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	63.2	61	-	-	63.8	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	29.3	29.1	-	-	25.4	-
Chloride	mg/L	150	600	1,500	6.68	6.49	-	-	6.42	-
Fluoride	mg/L	-	0.77 - 1.5[(b)]	2.0 - 3.0[(b)]	0.266	0.267	-	-	0.266	-
Magnesium	mg/L	-	-	-	1.99	2.01	-	-	1.84	-
Potassium	mg/L	-	-	-	0.312	0.27	-	-	0.27	-
Sodium	mg/L	-	-	-	25.6	25.7	-	-	24.2	-
Sulphate	mg/L	128 - 309[(b)]	-	1,280 - 2,180[(b)]	62.5	61.6	-	-	62.6	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	-	-	<0.005	-
Nitrite	mg-N/L	0.040 - 0.10[(c)]	0.12 - 0.30[(c)]	400[(c)]	<0.001	<0.001	-	-	0.0018	-
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	-	-	<0.0051	-
Total ammonia	mg-N/L	0.13 - 2.0[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	<0.005	-	-	<0.005	-
Total nitrogen	mg-N/L	-	-	-	0.035	<0.03	-	-	0.033	-
Total phosphorus	mg-P/L	-	-	-	0.0215	0.0145	-	-	0.0179	-
Dissolved phosphorus	mg-P/L	-	-	-	0.0143	0.0126	-	-	0.0132	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	<0.003	<0.003	-	-	0.003	-
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	-	-	<0.0001	-
Arsenic	mg/L	-	0.0050	0.050	0.0046	0.00474	-	-	0.0045	-
Barium	mg/L	1.0	-	10	0.0162	0.0171	-	-	0.0165	-
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	-	-	<0.0001	-
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	-	-	<0.00005	-
Boron	mg/L	1.2	-	12	0.397	0.365	-	-	0.364	-
Cadmium	mg/L	0.000076 - 0.00027[(b)]	0.00014 - 0.00084[(b)]	0.00050 - 0.0015[(b)]	<0.000005	0.0000066	-	-	<0.000005	-
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	-	-	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	-	-	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.060[(b)]	<0.0005	<0.0005	-	-	<0.0005	-
Iron	mg/L	-	0.35	-	<0.03	<0.03	-	-	<0.03	-
Lead	mg/L	0.0038 - 0.0082[(b)]	0.014 - 0.13[(b)]	0.040 - 0.060[(b)]	<0.00005	<0.00005	-	-	<0.00005	-
Lithium	mg/L	-	-	-	0.0039	0.0033	-	-	0.0039	-
Manganese	mg/L	0.77 - 1.2[(b)]	0.82 - 2.1[(b)]	-	0.0289	0.0441	-	-	0.0341	-
Molybdenum	mg/L	7.6	46	-	0.0246	0.0258	-	-	0.0263	-
Nickel	mg/L	0.025 - 0.12[(b)]	-	0.25 - 1.1[(b)]	<0.0005	<0.0005	-	-	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	-	-	<0.00005	-
Silicon	mg/L	-	-	-	9.55	9.7	-	-	8.76	-
Silver	mg/L	0.000050 - 0.0015[(b)]	0.00010 - 0.0030[(b)]	-	<0.00002	<0.00001	-	-	<0.00001	-
Strontium	mg/L	-	-	-	0.122	0.134	-	-	0.133	-
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	-	-	<0.00001	-
Tin	mg/L	-	-	-	<0.0001	<0.0001	-	-	<0.0001	-
Titanium	mg/L	-	-	1.0	<0.01	<0.01	-	-	<0.01	-
Uranium	mg/L	0.0085	-	0.085	0.000134	0.000125	-	-	0.000148	-
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	-	-	<0.0005	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	<0.003	-	-	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-08-17	2016-08-18	2016-09-13	2016-09-14	2016-09-15	2016-10-22
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.0	8.2	8.3	8.3	8.2	8.3
Specific conductivity	µS/cm	-	-	-	280	285	282	285	284	286
Temperature	°C	-	-	-	10.0	6.0	9.0	8.9	7.7	8.6
Conventional Parameters										
pH	mg/L	-	-	-	-	8	-	-	8.1	-
Specific conductivity	µS/cm	-	-	-	-	279	-	-	277	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	70.5	-	-	72.7	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	65.2	-	-	63.1	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	-	25.3	-	-	25.9	-
Chloride	mg/L	150	600	1,500	-	6.29	-	-	6.34	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	-	0.263	-	-	0.275	-
Magnesium	mg/L	-	-	-	-	1.81	-	-	1.93	-
Potassium	mg/L	-	-	-	-	0.229	-	-	0.372	-
Sodium	mg/L	-	-	-	-	25.8	-	-	26.9	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	-	63.2	-	-	64.9	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	<0.005	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	-	<0.001	-	-	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	<0.0051	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	-	<0.005	-	-	<0.005	-
Total nitrogen	mg-N/L	-	-	-	-	<0.03	-	-	<0.03	-
Total phosphorus	mg-P/L	-	-	-	-	0.0148	-	-	0.0166	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0119	-	-	0.0125	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	-	0.0082	-	-	<0.003	-
Antimony	mg/L	0.0090	-	0.090	-	<0.0001	-	-	<0.0001	-
Arsenic	mg/L	-	0.0050	0.050	-	0.00404	-	-	0.0046	-
Barium	mg/L	1.0	-	10	-	0.0152	-	-	0.0169	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	-
Boron	mg/L	1.2	-	12	-	0.378	-	-	0.394	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	-	<0.000005	-	-	<0.000005	-
Chromium	mg/L	0.0010[h]	-	0.010	-	<0.0005	-	-	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	-	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.060[b]	-	<0.0005	-	-	<0.0005	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	-	<0.00005	-	-	<0.00005	-
Lithium	mg/L	-	-	-	-	0.0033	-	-	0.0039	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	-	0.0301	-	-	0.0294	-
Molybdenum	mg/L	7.6	46	-	-	0.0256	-	-	0.0256	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	-	<0.0005	-	-	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	-	<0.00005	-	-	0.000067	-
Silicon	mg/L	-	-	-	-	9.22	-	-	9.23	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	-	<0.00001	-	-	<0.00001	-
Strontium	mg/L	-	-	-	-	0.134	-	-	0.135	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	-
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	-
Uranium	mg/L	0.0085	-	0.085	-	0.000127	-	-	0.000115	-
Vanadium	mg/L	-	-	-	-	<0.0005	-	-	<0.0005	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	-	<0.003	-	-	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

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[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-10-23	2016-10-24	2016-11-07	2016-11-08	2016-11-09	2016-12-19
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.4	8.4	8.1	8.2	8.3	8.4
Specific conductivity	µS/cm	-	-	-	288	289	301	295	296	294
Temperature	°C	-	-	-	6.2	7.2	7.3	8.3	8.1	6.1
Conventional Parameters										
pH	mg/L	-	-	-	-	8	-	-	8	-
Specific conductivity	µS/cm	-	-	-	-	280	-	-	281	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	73.7	-	-	76.6	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	62.1	-	-	63.2	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	-	26.3	-	-	27	-
Chloride	mg/L	150	600	1,500	-	6.42	-	-	6.51	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	-	0.265	-	-	0.266	-
Magnesium	mg/L	-	-	-	-	1.93	-	-	2.23	-
Potassium	mg/L	-	-	-	-	0.248	-	-	0.249	-
Sodium	mg/L	-	-	-	-	27.6	-	-	27.4	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	-	66.3	-	-	68.2	-
Nutrients										
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	<0.005	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	-	<0.001	-	-	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	<0.0051	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	-	<0.005	-	-	<0.005	-
Total nitrogen	mg-N/L	-	-	-	-	<0.03	-	-	<0.03	-
Total phosphorus	mg-P/L	-	-	-	-	0.017	-	-	0.0133	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0151	-	-	0.0124	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	-	0.003	-	-	<0.003	-
Antimony	mg/L	0.0090	-	0.090	-	<0.0001	-	-	<0.0001	-
Arsenic	mg/L	-	0.0050	0.050	-	0.00432	-	-	0.00416	-
Barium	mg/L	1.0	-	10	-	0.0172	-	-	0.017	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	-
Boron	mg/L	1.2	-	12	-	0.382	-	-	0.372	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	-	0.0000099	-	-	<0.000005	-
Chromium	mg/L	0.0010[h]	-	0.010	-	<0.0005	-	-	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	-	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.060[b]	-	<0.0005	-	-	<0.0005	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	-	<0.00005	-	-	<0.00005	-
Lithium	mg/L	-	-	-	-	0.0033	-	-	0.0038	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	-	0.0228	-	-	0.0204	-
Molybdenum	mg/L	7.6	46	-	-	0.0259	-	-	0.0265	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	-	<0.0005	-	-	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	-	0.000065	-	-	<0.00005	-
Silicon	mg/L	-	-	-	-	9.55	-	-	9.09	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	-	<0.00001	-	-	<0.00001	-
Strontium	mg/L	-	-	-	-	0.138	-	-	0.141	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	-
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	-
Uranium	mg/L	0.0085	-	0.085	-	0.000107	-	-	0.00011	-
Vanadium	mg/L	-	-	-	-	<0.0005	-	-	<0.0005	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	-	<0.003	-	-	0.0049	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2016-12-20	2016-12-21	2017-01-16	2017-01-17	2017-01-18	2017-02-20	2017-02-21
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.4	8.3	8.3	8.3	8.3	8.3	8.2
Specific conductivity	µS/cm	-	-	-	292	286	289	284	281	277	282
Temperature	°C	-	-	-	6.9	6.0	7.0	7.3	8.2	9.1	7.7
Conventional Parameters											
pH	mg/L	-	-	-	-	8.1	-	-	8.1	-	-
Specific conductivity	µS/cm	-	-	-	-	284	-	-	279	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	75.7	-	-	74.3	-	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	63.7	-	-	62.2	-	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	-	27.3	-	-	26.5	-	-
Chloride	mg/L	150	600	1,500	-	6.48	-	-	6.65	-	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	-	0.259	-	-	0.261	-	-
Magnesium	mg/L	-	-	-	-	1.83	-	-	1.98	-	-
Potassium	mg/L	-	-	-	-	0.234	-	-	0.267	-	-
Sodium	mg/L	-	-	-	-	26.2	-	-	26.9	-	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	-	65.4	-	-	64.2	-	-
Nutrients											
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	<0.005	-	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	-	<0.001	-	-	<0.001	-	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	<0.0051	-	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	-	<0.005	-	-	<0.005	-	-
Total nitrogen	mg-N/L	-	-	-	-	<0.03	-	-	<0.03	-	-
Total phosphorus	mg-P/L	-	-	-	-	0.0148	-	-	0.02	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0154	-	-	0.0141	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	-	<0.003	-	-	<0.003	-	-
Antimony	mg/L	0.0090	-	0.090	-	<0.0001	-	-	<0.0001	-	-
Arsenic	mg/L	-	0.0050	0.050	-	0.00408	-	-	0.00444	-	-
Barium	mg/L	1.0	-	10	-	0.0165	-	-	0.0168	-	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	-	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	-	-
Boron	mg/L	1.2	-	12	-	0.403	-	-	0.402	-	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	-	<0.000005	-	-	<0.000005	-	-
Chromium	mg/L	0.0010[h]	-	0.010	-	<0.0005	-	-	<0.0005	-	-
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	-	<0.0001	-	-
Copper	mg/L	-	-	0.020 - 0.060[b]	-	<0.0005	-	-	<0.0005	-	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	-	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	-	<0.00005	-	-	<0.00005	-	-
Lithium	mg/L	-	-	-	-	0.0034	-	-	0.0036	-	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	-	0.0278	-	-	0.0279	-	-
Molybdenum	mg/L	7.6	46	-	-	0.0259	-	-	0.0249	-	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	-	<0.0005	-	-	<0.0005	-	-
Selenium	mg/L	0.0020	-	0.020	-	<0.00005	-	-	<0.00005	-	-
Silicon	mg/L	-	-	-	-	8.84	-	-	9.69	-	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	-	<0.00001	-	-	<0.00001	-	-
Strontium	mg/L	-	-	-	-	0.137	-	-	0.135	-	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	-	-
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	-	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	-	-
Uranium	mg/L	0.0085	-	0.085	-	0.000116	-	-	0.00011	-	-
Vanadium	mg/L	-	-	-	-	<0.0005	-	-	<0.0005	-	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	-	<0.003	-	-	<0.003	-	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2017-02-22	2017-03-20	2017-04-26	2017-05-22	2017-06-28	2017-08-21
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.2	8.2	8.3	8.3	8.2	8.1
Specific conductivity	µS/cm	-	-	-	278	283	345	293	302	304
Temperature	°C	-	-	-	5.8	8.0	10.3	11.2	9.9	13.2
Conventional Parameters										
pH	mg/L	-	-	-	8.1	7.9	8.1	8	8	8
Specific conductivity	µS/cm	-	-	-	274	281	281	284	292	285
Hardness, as $CaCO_3$	mg/L	-	-	-	74.8	72.9	72.4	74.6	78.1	82.4
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	64.9	60.1	64.6	64.9	67.3	65.8
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	27	26	25.9	26.2	27.2	28.6
Chloride	mg/L	150	600	1,500	6.84	6.61	6.73	7.09	7.48	7.61
Fluoride	mg/L	-	0.77 - 1.5[(b)]	2.0 - 3.0[(b)]	0.248	0.252	0.258	0.267	0.288	0.28
Magnesium	mg/L	-	-	-	1.79	1.91	1.9	2.26	2.5	2.69
Potassium	mg/L	-	-	-	0.285	0.245	0.268	0.332	0.41	0.441
Sodium	mg/L	-	-	-	25.1	25.3	25.1	28.3	28.2	31.8
Sulphate	mg/L	128 - 309[(b)]	-	1,280 - 2,180[(b)]	63.4	60.9	61.8	63.5	66.9	67.3
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.040 - 0.10[(c)]	0.12 - 0.30[(c)]	400[(c)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 2.0[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	<0.005	0.0056	<0.005	<0.005	0.0058
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	0.048	0.04
Total phosphorus	mg-P/L	-	-	-	0.0165	0.014	0.02	0.0179	0.0152	0.019
Dissolved phosphorus	mg-P/L	-	-	-	0.0173	0.0133	0.0163	0.0168	0.013	0.0173
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	<0.003	<0.003	0.0031	0.003	0.0041	0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00435	0.00444	0.00426	0.00451	0.00414	0.00443
Barium	mg/L	1.0	-	10	0.0176	0.0165	0.0177	0.0179	0.0246	0.0202
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.392	0.399	0.328	0.357	0.377	0.394
Cadmium	mg/L	0.000076 - 0.00027[(b)]	0.00014 - 0.00084[(b)]	0.00050 - 0.0015[(b)]	0.0000055	0.0000075	<0.00001	<0.00002	<0.00003	0.0000068
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	0.00082	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	0.00023	0.0002
Copper	mg/L	-	-	0.020 - 0.060[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	0.00068	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	0.048
Lead	mg/L	0.0038 - 0.0082[(b)]	0.014 - 0.13[(b)]	0.040 - 0.060[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0036	0.0031	0.0037	0.0043	0.0057	0.0048
Manganese	mg/L	0.77 - 1.2[(b)]	0.82 - 2.1[(b)]	-	0.0299	0.0253	0.0264	0.0289	0.0244	0.0372
Molybdenum	mg/L	7.6	46	-	0.0259	0.0276	0.0275	0.0288	0.0273	0.0245
Nickel	mg/L	0.025 - 0.12[(b)]	-	0.25 - 1.1[(b)]	<0.0005	<0.0005	0.00096	<0.0005	0.00307	0.00205
Selenium	mg/L	0.0020	-	0.020	0.000083	0.000063	0.000346	0.000434	0.000102	<0.00005
Silicon	mg/L	-	-	-	9.1	10	8.69	9	9.47	9.53
Silver	mg/L	0.000050 - 0.0015[(b)]	0.00010 - 0.0030[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.138	0.14	0.133	0.148	0.143	0.142
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.00011	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000135	0.000086	0.000123	0.000143	0.00014	0.000141
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	<0.003	<0.003	<0.003	0.0091[(Mn)]	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (25 to 141 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (3.7500 to 8.6300 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2017-09-12	2017-11-19	2017-12-13	2018-01-17	2018-02-27	2018-03-20
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.0	8.1	8.1	8.0	8.0	8.0
Specific conductivity	µS/cm	-	-	-	306	308	324	325	334	339
Temperature	°C	-	-	-	13.3	7.7	8.4	6.6	6.3	7.2
Conventional Parameters										
pH	mg/L	-	-	-	8	8	7.9	7.9	8.1	8
Specific conductivity	µS/cm	-	-	-	287	290	326	309	319	322
Hardness, as $CaCO_3$	mg/L	-	-	-	77.1	85.8	85.8	84.3	99.1	99.3
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	68.8	69.1	73.5	73.6	78.4	79.6
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	27.2	30.8	30.8	30.2	36.1	36
Chloride	mg/L	150	600	1,500	7.52	7.79	7.8	7.7	7.79	8.06
Fluoride	mg/L	-	0.77 - 1.5[(b)]	2.0 - 3.0[(b)]	0.263	0.282	0.274	0.265	0.258	0.265
Magnesium	mg/L	-	-	-	2.25	2.14	2.14	2.16	2.18	2.28
Potassium	mg/L	-	-	-	0.545	0.474	0.62	0.453	0.535	0.545
Sodium	mg/L	-	-	-	29.6	29.3	31.3	30.3	30.7	31.8
Sulphate	mg/L	128 - 309[(b)]	-	1,280 - 2,180[(b)]	66.4	68.1	68.4	68.6	68.9	71.1
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.040 - 0.10[(c)]	0.12 - 0.30[(c)]	400[(c)]	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 2.0[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	0.0352	0.181	0.123	0.236	0.227
Total nitrogen	mg-N/L	-	-	-	0.329	0.257	0.454	0.253	0.375	0.324
Total phosphorus	mg-P/L	-	-	-	0.0633	0.062	0.0707	0.0544	0.081	0.0793
Dissolved phosphorus	mg-P/L	-	-	-	0.0557	0.0459	0.0804	0.0331	0.067	0.0689
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	0.0031	0.0038	0.0049	0.0037	0.0036	0.004
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00438	0.00376	0.0038	0.00424	0.00407	0.00394
Barium	mg/L	1.0	-	10	0.0202	0.0208	0.0221	0.0219	0.0263	0.0231
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.403	0.417	0.386	0.379	0.401	0.402
Cadmium	mg/L	0.000076 - 0.00027[(b)]	0.00014 - 0.00084[(b)]	0.00050 - 0.0015[(b)]	<0.00002	<0.00002	0.0000111	0.0000059	0.0000097	<0.00002
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	<0.0005	0.001	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	0.00011	0.00011	0.0001	0.0002	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.060[(b)]	<0.0005	0.00104	0.00076	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	0.091	0.07	0.078	0.055	0.039
Lead	mg/L	0.0038 - 0.0082[(b)]	0.014 - 0.13[(b)]	0.040 - 0.060[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0042	0.0042	0.0037	0.0039	0.0042	0.0036
Manganese	mg/L	0.77 - 1.2[(b)]	0.82 - 2.1[(b)]	-	0.026	0.0487	0.0491	0.0398	0.0436	0.042
Molybdenum	mg/L	7.6	46	-	0.026	0.0268	0.0259	0.027	0.0238	0.0276
Nickel	mg/L	0.025 - 0.12[(b)]	-	0.25 - 1.1[(b)]	0.00239	0.00106	0.00087	0.00413	0.00129	0.00115
Selenium	mg/L	0.0020	-	0.020	0.000113	0.00124	0.00015	0.000242	0.00035	0.000107
Silicon	mg/L	-	-	-	9.04	8.89	8.52	9.12	9.3	7.96
Silver	mg/L	0.000050 - 0.0015[(b)]	0.00010 - 0.0030[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.142	0.154	0.165	0.162	0.192	0.187
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	0.00013	0.00011	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000164	0.00015	0.000167	0.000133	0.000144	0.000187
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	<0.003	0.051[(Mn, Mx)]	<0.003	<0.004	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites				
		Aquatic Life		BC CSR WQG	GW15-1a	GW15-1a	GW15-1a	GW15-1a	GW15-1a
		30-day mean	Maximum		2020-05-14	2020-08-24	2020-11-03	2021-02-16	2021-03-05
Field Measured									
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	-	-	7.5	7.5
Specific conductivity	µS/cm	-	-	-	-	-	-	319	399
Temperature	°C	-	-	-	-	-	-	5.5	7.3
Conventional Parameters									
pH	mg/L	-	-	-	8.2	7.6	8	8.1	-
Specific conductivity	µS/cm	-	-	-	425	218	406	420	-
Hardness, as $CaCO_3$	mg/L	-	-	-	141	58.2	129	138	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	124	50.7	90.4	94.2	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-
Major Ions									
Calcium	mg/L	-	-	-	51.6	21.3	46.5	49.7	-
Chloride	mg/L	150	600	1,500	8.56	3.75	8.57	8.63	-
Fluoride	mg/L	-	0.77 - 1.5[b]	2.0 - 3.0[b]	0.289	0.116	0.234	0.256	-
Magnesium	mg/L	-	-	-	2.87	1.21	3.01	3.29	-
Potassium	mg/L	-	-	-	24.5	1.52	0.81	1.07	-
Sodium	mg/L	-	-	-	37.8	15	39.8	37.7	-
Sulphate	mg/L	128 - 309[b]	-	1,280 - 2,180[b]	80.9	45.7	96.9	101	-
Nutrients									
Nitrate	mg-N/L	3.0	33	400	0.276	0.137	0.24	0.186	-
Nitrite	mg-N/L	0.040 - 0.10[c]	0.12 - 0.30[c]	400[c]	<0.001	<0.001	0.0012	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	0.276	0.137	0.241	0.186	-
Total ammonia	mg-N/L	0.13 - 2.0[d]	0.68 - 20[e]	1.3 - 19[f]	0.0073	<0.005	<0.005	<0.005	-
Total nitrogen	mg-N/L	-	-	-	0.395	0.563	0.252	0.255	-
Total phosphorus	mg-P/L	-	-	-	0.0857	0.0959	0.0454	0.0628	-
Dissolved phosphorus	mg-P/L	-	-	-	0.0835	0.0157	0.0632	0.0498	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-
Dissolved Metals									
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0039	0.0041	<0.003	<0.003	-
Antimony	mg/L	0.0090	-	0.090	0.00017	<0.0001	<0.0001	0.00011	-
Arsenic	mg/L	-	0.0050	0.050	0.00396	0.00126	0.00316	0.00303	-
Barium	mg/L	1.0	-	10	0.0478	0.0151	0.0338	0.0354	-
Beryllium	mg/L	0.00013	-	0.0015	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001	-
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	-
Boron	mg/L	1.2	-	12	0.38	0.143	0.392	0.423	-
Cadmium	mg/L	0.000076 - 0.00027[b]	0.00014 - 0.00084[b]	0.00050 - 0.0015[b]	0.0000428	0.0000298	<0.000035	0.0000399	-
Chromium	mg/L	0.0010[h]	-	0.010	0.00096	0.00093	0.00054	0.00078	-
Cobalt	mg/L	0.0040	0.11	0.040	0.00026	0.00022	<0.0001	0.00019	-
Copper	mg/L	-	-	0.020 - 0.060[b]	0.00265	0.0034	0.00238	0.00312	-
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	-
Lead	mg/L	0.0038 - 0.0082[b]	0.014 - 0.13[b]	0.040 - 0.060[b]	<0.00005	<0.00005	<0.00005	<0.00005	-
Lithium	mg/L	-	-	-	0.0061	0.0022	0.0046	0.0049	-
Manganese	mg/L	0.77 - 1.2[b]	0.82 - 2.1[b]	-	0.00323	0.00853	0.00079	0.00414	-
Molybdenum	mg/L	7.6	46	-	0.0276	0.00896	0.0239	0.0246	-
Nickel	mg/L	0.025 - 0.12[b]	-	0.25 - 1.1[b]	0.00581	0.00195	0.0042	0.00368	-
Selenium	mg/L	0.0020	-	0.020	0.000163	0.000102	0.000091	0.0001	-
Silicon	mg/L	-	-	-	8.4	3.12	8.03	8.3	-
Silver	mg/L	0.000050 - 0.0015[b]	0.00010 - 0.0030[b]	-	0.000925	0.000035	<0.00001	<0.00001	-
Strontium	mg/L	-	-	-	0.293	0.102	0.254	0.245	-
Thallium	mg/L	0.00080	-	-	0.000024	<0.00001	<0.00001	<0.00001	-
Tin	mg/L	-	-	-	0.00029	0.00046	0.00018	0.00016	-
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	-
Uranium	mg/L	0.0085	-	0.085	0.000321	0.000104	0.000332	0.000291	-
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	-
Zinc	mg/L	0.0075 - 0.046	0.033 - 0.071	0.075 - 0.90	0.0174	0.0088[Mn]	0.0076	0.0412	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (9.0) and water temperature (7.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg N/L) is based on field pH (9.0). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 9.0). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b
		30-day mean	Maximum		2015-07-23	2015-09-03	2015-09-08	2015-09-09	2015-09-29	2015-10-21	2015-11-17
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	7.8	7.8	7.7	7.7	7.7	7.1
Specific conductivity	µS/cm	-	-	-	-	514	559	575	561	571	573
Temperature	°C	-	-	-	-	7.0	7.2	7.7	8.2	7.0	5.8
Conventional Parameters											
pH	mg/L	-	-	-	8.2	-	-	8.0	7.9	8.1	8.1
Specific conductivity	µS/cm	-	-	-	520	-	-	559	543	568	577
Hardness, as $CaCO_3$	mg/L	-	-	-	231	-	-	-	249	272	260
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	117	-	-	139	135	146	140
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	75	-	-	83	81	88	83.7
Chloride	mg/L	150	600	1,500	17	-	-	21	20	22	21.4
Fluoride	mg/L	-	1.6 - 1.9[b]	3.0[b]	0.14	-	-	0.13	0.13	0.13	0.129
Magnesium	mg/L	-	-	-	11	-	-	12	12	13	12.3
Potassium	mg/L	-	-	-	0.70	-	-	0.61	0.57	0.51	0.625
Sodium	mg/L	-	-	-	21	-	-	23	23	22	22.8
Sulphate	mg/L	429[b, c]	-	4,290[b]	114	-	-	118	118	118	118
Nutrients											
Nitrate	mg-N/L	3.0	33	400	1.2	-	-	1.1	1.1	1.1	1.06
Nitrite	mg-N/L	0.20[d]	0.60[d]	2,000[d]	0.0086	-	-	0.0030	0.0034	0.0025	0.0065
Nitrate + nitrite	mg-N/L	-	-	-	1.2	-	-	1.1	1.2	1.1	1.06
Total ammonia	mg-N/L	0.93 - 1.9[e]	4.8 - 20[f]	3.7 - 19[g]	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	1.2	-	-	1.2	1.2	1.1	1.04
Total phosphorus	mg-P/L	-	-	-	0.014	-	-	0.012	0.012	0.013	0.0114
Dissolved phosphorus	mg-P/L	-	-	-	0.012	-	-	0.012	0.013	0.013	0.0104
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	-	-	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00013	-	-	0.00010	<0.0001	<0.0001	0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0013	-	-	0.0016	0.0016	0.0016	0.00157
Barium	mg/L	1.0	-	10	0.044	-	-	0.053	0.052	0.052	0.0525
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	-	-	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.25	-	-	0.25	0.24	0.25	0.24
Cadmium	mg/L	0.00036 - 0.00046[b]	0.0012 - 0.0028[b]	0.0015 - 0.0040[b]	0.0000054	-	-	<0.000005	0.0000050	<0.000005	0.0000057
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	0.00063	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	-	-	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.011 - 0.020[b]	0.20 - 0.42[b]	0.11 - 0.16[b]	<0.00005	-	-	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0039	-	-	0.0035	0.0040	0.0038	0.0032
Manganese	mg/L	1.5 - 2.6[b]	2.8 - 3.4[b]	-	0.0082	-	-	0.0042	0.0055	0.0032	0.00472
Molybdenum	mg/L	7.6	46	-	0.0054	-	-	0.0055	0.0053	0.0053	0.00531
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.017[Mn]**	-	-	**0.015[Mn]**	**0.013[Mn]**	**0.013[Mn]**	0.014[Mn]
Silicon	mg/L	-	-	-	7.8	-	-	8.0	8.0	8.3	8.08
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	-	-	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.23	-	-	0.24	0.25	0.24	0.234
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.0010	-	-	0.0011	0.0011	0.0012	0.00115
Vanadium	mg/L	-	-	-	0.00051	-	-	0.00068	0.00063	0.00065	0.00064
Zinc	mg/L	0.094 - 0.19	0.12 - 0.30	1.7 - 2.4	<0.003	-	-	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (205 to 447 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (11.0000 to 34.2000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.93 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (4.84 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (3.70 mg-N/L) is based on field pH (8.1). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.1). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b
		30-day mean	Maximum		2015-12-17	2016-01-12	2016-02-17	2016-03-16	2016-04-14	2016-05-11	2016-06-08
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.1	7.9	7.8	7.9	7.9	7.7	7.7
Specific conductivity	µS/cm	-	-	-	558	628	729	724	692	731	867
Temperature	°C	-	-	-	5.8	5.1	5.0	6.1	7.0	6.4	8.1
Conventional Parameters											
pH	mg/L	-	-	-	7.9	7.8	8	8.1	7.9	8	7.9
Specific conductivity	µS/cm	-	-	-	570	564	639	739	684	712	844
Hardness, as $CaCO_3$	mg/L	-	-	-	254	249	276	339	327	350	428
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	130	126	134	128	123	128	108
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	82.3	80.3	89.2	111	107	114	139
Chloride	mg/L	150	600	1,500	21.3	20.4	28.4	29.1	21.2	27.9	23.3
Fluoride	mg/L	-	1.6 - 1.9[b]	3.0[b]	0.136	0.133	0.122	0.107	0.11	<0.1	<0.1
Magnesium	mg/L	-	-	-	11.7	11.7	13	15	14.3	15.5	19.3
Potassium	mg/L	-	-	-	0.616	0.673	0.712	0.59	0.606	0.577	0.577
Sodium	mg/L	-	-	-	21.6	21.6	23	21.5	21.3	22.8	24.3
Sulphate	mg/L	429[b, c]	-	4,290[b]	125	127	141	205	201	217	298
Nutrients											
Nitrate	mg-N/L	3.0	33	400	1.11	1.14	0.86	0.387	0.259	0.664	1.74
Nitrite	mg-N/L	0.20[d]	0.60[d]	2,000[d]	0.0079	0.0048	0.0013	<0.001	<0.001	<0.005	0.0365
Nitrate + nitrite	mg-N/L	-	-	-	1.12	1.15	0.861	0.387	0.259	0.664	1.78
Total ammonia	mg-N/L	0.93 - 1.9[e]	4.8 - 20[f]	3.7 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	0.0107	<0.005
Total nitrogen	mg-N/L	-	-	-	1.11	1.13	0.872	0.394	0.279	0.674	1.86
Total phosphorus	mg-P/L	-	-	-	0.0154	0.0146	0.0141	0.0151	0.0191	0.0137	0.0126
Dissolved phosphorus	mg-P/L	-	-	-	0.0147	0.0137	0.0125	0.0134	0.01	0.0118	0.012
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	0.0079	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	0.0001	0.00011	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00164	0.00159	0.0015	0.00152	0.00163	0.00148	0.00156
Barium	mg/L	1.0	-	10	0.0531	0.0543	0.0589	0.0704	0.0685	0.0692	0.0863
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.233	0.27	0.201	0.179	0.163	0.181	0.182
Cadmium	mg/L	0.00036 - 0.00046[b]	0.0012 - 0.0028[b]	0.0015 - 0.0040[b]	0.000005	<0.000005	<0.000005	0.0000078	0.0000072	0.0000065	0.000011
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	0.00054	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	<0.0005	0.0006	<0.0005	0.00058	0.00062	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.011 - 0.020[b]	0.20 - 0.42[b]	0.11 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0036	0.0044	0.0034	0.004	0.0028	0.0039	0.0034
Manganese	mg/L	1.5 - 2.6[b]	2.8 - 3.4[b]	-	0.00399	0.00492	0.00162	0.00011	0.00013	0.00091	0.00136
Molybdenum	mg/L	7.6	46	-	0.0055	0.00511	0.00498	0.0051	0.00492	0.0048	0.00447
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.015[Mn]	0.018[Mn]	0.016[Mn]	0.014[Mn]	0.011[Mn]	0.0092[Mn]	0.011[Mn]
Silicon	mg/L	-	-	-	8.12	8.19	8.01	7.86	7.99	8.05	8.29
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.236	0.23	0.26	0.309	0.273	0.285	0.382
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	0.012	0.01	0.013	0.017	0.019
Uranium	mg/L	0.0085	-	0.085	0.00115	0.00108	0.00133	0.00116	0.00097	0.00112	0.00107
Vanadium	mg/L	-	-	-	0.00064	0.00062	0.00065	0.00068	0.00081	0.00078	0.00074
Zinc	mg/L	0.094 - 0.19	0.12 - 0.30	1.7 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (205 to 447 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (11.0000 to 34.2000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.93 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (4.84 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (3.70 mg-N/L) is based on field pH (8.1). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.1). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b
		30-day mean	Maximum		2016-07-12	2016-08-17	2016-09-15	2016-10-24	2016-11-08	2016-12-19	2017-01-16
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.7	7.8	7.7	7.8	7.8	7.9	7.9
Specific conductivity	µS/cm	-	-	-	923	878	844	771	731	659	606
Temperature	°C	-	-	-	7.2	8.4	7.2	7.0	7.4	6.1	6.1
Conventional Parameters											
pH	mg/L	-	-	-	7.8	8.2	8.1	8.2	8.2	8.1	8.1
Specific conductivity	µS/cm	-	-	-	902	866	820	740	703	648	577
Hardness, as $CaCO_3$	mg/L	-	-	-	447	404	379	338	322	274	256
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	106	123	125	128	134	134	113
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	145	129	124	110	104	88.5	83.5
Chloride	mg/L	150	600	1,500	25.3	32.4	34.2	28.9	26.4	19.4	15.1
Fluoride	mg/L	-	1.6 - 1.9[b]	3.0[b]	<0.1	<0.1	<0.1	<0.1	0.103	0.114	0.117
Magnesium	mg/L	-	-	-	20.7	19.6	17.1	15.4	14.8	13	11.5
Potassium	mg/L	-	-	-	0.567	0.639	0.711	0.589	0.574	0.592	0.574
Sodium	mg/L	-	-	-	24.6	25.6	24	24.2	23.3	22.8	20.4
Sulphate	mg/L	429[b, c]	-	4,290[b]	341	295	278	234	203	172	165
Nutrients											
Nitrate	mg-N/L	3.0	33	400	2.36	2.12	1.85	1.42	1.37	1.36	1.02
Nitrite	mg-N/L	0.20[d]	0.60[d]	2,000[d]	0.0327	0.0066	0.0072	<0.005	0.0021	0.0049	0.0014
Nitrate + nitrite	mg-N/L	-	-	-	2.4	2.12	1.85	1.42	1.38	1.37	1.02
Total ammonia	mg-N/L	0.93 - 1.9[e]	4.8 - 20[f]	3.7 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	2.39	2.1	1.78	1.45	1.45	1.36	1.02
Total phosphorus	mg-P/L	-	-	-	0.014	0.0103	0.0143	0.0132	0.012	0.012	0.0133
Dissolved phosphorus	mg-P/L	-	-	-	0.0122	0.0114	0.0125	0.0131	0.0131	0.012	0.0128
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00148	0.00149	0.00152	0.00149	0.00155	0.00156	0.00167
Barium	mg/L	1.0	-	10	0.0934	0.0903	0.0791	0.0728	0.0695	0.0608	0.0623
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.172	0.169	0.181	0.196	0.182	0.221	0.199
Cadmium	mg/L	0.00036 - 0.00046[b]	0.0012 - 0.0028[b]	0.0015 - 0.0040[b]	0.0000095	0.0000091	0.0000119	0.0000094	0.0000101	0.000006	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	0.00052	<0.0005	0.00072	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.011 - 0.020[b]	0.20 - 0.42[b]	0.11 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0046	0.003	0.0043	0.0035	0.0037	0.0039	0.0036
Manganese	mg/L	1.5 - 2.6[b]	2.8 - 3.4[b]	-	0.00155	0.00223	0.00309	0.00218	0.002	0.00211	0.00189
Molybdenum	mg/L	7.6	46	-	0.00457	0.00443	0.00461	0.00479	0.00488	0.0048	0.00472
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	0.00062	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.011[Mn]	0.0085[Mn]	0.0071[Mn]	0.0077[Mn]	0.0067[Mn]	0.0037[Mn]	0.0077[Mn]
Silicon	mg/L	-	-	-	8.22	8.18	7.84	8.16	7.91	5.89	7.26
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.406	0.367	0.359	0.321	0.298	0.268	0.236
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00116	0.00104	0.00117	0.00115	0.00114	0.00103	0.000761
Vanadium	mg/L	-	-	-	0.00073	0.00071	0.00072	0.00074	0.00076	0.00072	0.0007
Zinc	mg/L	0.094 - 0.19	0.12 - 0.30	1.7 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (205 to 447 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (11.0000 to 34.2000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.93 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (4.84 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (3.70 mg-N/L) is based on field pH (8.1). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.1). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Appendix 2-8
Table 2-8B: Groundwater Quality Screening at GW15-1b from 2015 to 2022
Mount Polley Mine

Table 1: Water Quality Summary, 2015 to 2022 - GW15-1b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites				
		Aquatic Life		BC CSR WQG	GW15-1b	GW15-1b	GW15-1b	GW15-1b	GW15-1b
		30-day mean	Maximum		2017-02-22	2017-03-20	2017-04-27	2017-05-22	2017-08-21
Field Measured									
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.8	7.8	7.8	7.9	7.8
Specific conductivity	µS/cm	-	-	-	540	510	1,761	524	497
Temperature	°C	-	-	-	7.2	8.1	10	9.0	13
Conventional Parameters									
pH	mg/L	-	-	-	8.2	8.1	8.2	8.2	8.1
Specific conductivity	µS/cm	-	-	-	532	508	549	508	469
Hardness, as $CaCO_3$	mg/L	-	-	-	232	207	226	214	205
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	114	111	119	116	106
Total suspended solids	mg/L	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-
Major Ions									
Calcium	mg/L	-	-	-	76.2	66	73	68	65
Chloride	mg/L	150	600	1,500	13.4	11.4	16	13	11
Fluoride	mg/L	-	1.6 - 1.9[b]	3.0[b]	0.111	0.13	0.12	0.13	0.14
Magnesium	mg/L	-	-	-	10.1	10.1	11	11	11
Potassium	mg/L	-	-	-	0.525	0.511	0.50	0.51	0.59
Sodium	mg/L	-	-	-	20	20.3	20	22	23
Sulphate	mg/L	429[b, c]	-	4,290[b]	146	123	136	125	125
Nutrients									
Nitrate	mg-N/L	3.0	33	400	0.861	0.709	0.27	0.76	0.72
Nitrite	mg-N/L	0.20[d]	0.60[d]	2,000[d]	0.0016	0.0018	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.863	0.711	0.27	0.76	0.72
Total ammonia	mg-N/L	0.93 - 1.9[e]	4.8 - 20[f]	3.7 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.907	0.748	0.30	0.77	0.71
Total phosphorus	mg-P/L	-	-	-	0.0133	0.012	0.019	0.010	0.016
Dissolved phosphorus	mg-P/L	-	-	-	0.0127	0.0124	0.013	0.011	0.012
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-
Dissolved Metals									
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	0.00011	0.00011	<0.0001	0.00012
Arsenic	mg/L	-	0.0050	0.050	0.0016	0.00163	0.0016	0.0018	0.0017
Barium	mg/L	1.0	-	10	0.0533	0.0457	0.053	0.048	0.051
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.235	0.249	0.18	0.23	0.25
Cadmium	mg/L	0.00036 - 0.00046[b]	0.0012 - 0.0028[b]	0.0015 - 0.0040[b]	0.0000072	0.0000056	0.0000076	0.0000054	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	0.00091	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	<0.0005	0.00066	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.011 - 0.020[b]	0.20 - 0.42[b]	0.11 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0033	0.0029	0.0034	0.0037	0.0034
Manganese	mg/L	1.5 - 2.6[b]	2.8 - 3.4[b]	-	0.00237	0.00404	0.00033	0.00036	0.0053
Molybdenum	mg/L	7.6	46	-	0.00525	0.00558	0.0069	0.0059	0.0049
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	0.0015	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.0070[Mn]	0.0073[Mn]	**0.018**[Mn]	**0.013**[Mn]	**0.016**[Mn]
Silicon	mg/L	-	-	-	8.03	8.02	7.5	7.8	8.1
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.234	0.216	0.22	0.23	0.20
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000839	0.000764	0.0012	0.00088	0.00072
Vanadium	mg/L	-	-	-	0.00072	0.00068	0.00077	0.00073	0.00063
Zinc	mg/L	0.094 - 0.19	0.12 - 0.30	1.7 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:
mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (205 to 447 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (11.0000 to 34.2000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.93 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (4.84 mg-N/L) is based on the combination of field pH (8.1) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (3.70 mg-N/L) is based on field pH (8.1). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.1). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2015-06-04	2015-07-22	2015-07-23	2015-07-27	2015-09-02	2015-09-03	2015-09-29
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.5	7.7	7.6	-	-	7.6	-
Specific conductivity	µS/cm	-	-	-	487	480	482	-	-	520	-
Temperature	°C	-	-	-	9.7	11	8.0	-	-	6.8	-
Conventional Parameters											
pH	mg/L	-	-	-	8.3	-	-	8.3	7.9	-	7.9
Specific conductivity	µS/cm	-	-	-	461	-	-	484	510	-	557
Hardness, as $CaCO_3$	mg/L	-	-	-	244	-	-	243	264	-	283
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	209	-	-	183	170	-	162
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	66	-	-	65	70	-	76
Chloride	mg/L	150	600	1,500	1.2	-	-	1.8	2.6	-	3.2
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.21	-	-	0.20	0.19	-	0.18
Magnesium	mg/L	-	-	-	19	-	-	20	22	-	22
Potassium	mg/L	-	-	-	0.66	-	-	0.66	0.69	-	0.69
Sodium	mg/L	-	-	-	13	-	-	13	13	-	14
Sulphate	mg/L	429[b, c]	-	4,290[b]	40	-	-	63	94	-	119
Nutrients											
Nitrate	mg-N/L	3.0	33	400	2.5	-	-	2.9	**3.5[Mn]**	-	**4.0[Mn]**
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	-	-	<0.001	<0.001	-	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	2.5	-	-	2.9	3.5	-	4.0
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	-	-	<0.005	<0.005	-	<0.005
Total nitrogen	mg-N/L	-	-	-	2.4	-	-	2.9	3.4	-	4.1
Total phosphorus	mg-P/L	-	-	-	0.023	-	-	0.012	0.0097	-	0.010
Dissolved phosphorus	mg-P/L	-	-	-	0.012	-	-	0.011	0.011	-	0.010
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	-	-	<0.003	0.0031	-	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00027	-	-	<0.0001	<0.0001	-	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00064	-	-	0.00051	0.00051	-	0.00051
Barium	mg/L	1.0	-	10	0.018	-	-	0.016	0.018	-	0.018
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	<0.0001	<0.0001	-	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	-	-	<0.00005	<0.00005	-	<0.00005
Boron	mg/L	1.2	-	12	0.070	-	-	0.079	0.089	-	0.10
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.000011	-	-	0.000011	0.0000076	-	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	-	-	<0.0001	<0.0001	-	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00052	-	-	<0.0005	0.0012	-	0.00066
Iron	mg/L	-	0.35	-	<0.03	-	-	<0.03	<0.03	-	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	-	-	<0.00005	<0.00005	-	<0.00005
Lithium	mg/L	-	-	-	0.0033	-	-	0.0034	0.0036	-	0.0041
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.0070	-	-	0.00010	0.00019	-	0.00013
Molybdenum	mg/L	7.6	46	-	0.024	-	-	0.025	0.024	-	0.024
Nickel	mg/L	0.15[b]	-	1.5[b]	0.00072	-	-	<0.0005	<0.0005	-	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0042[Mn]**	-	-	**0.0082[Mn]**	**0.012[Mn]**	-	**0.015[Mn]**
Silicon	mg/L	-	-	-	7.4	-	-	7.2	7.3	-	7.3
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	-	-	<0.00001	<0.00001	-	<0.00001
Strontium	mg/L	-	-	-	0.26	-	-	0.26	0.28	-	0.32
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	0.000011	<0.00001	-	<0.00001
Tin	mg/L	-	-	-	<0.0001	-	-	<0.0001	<0.0001	-	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	-	-	<0.01	<0.01	-	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00063	-	-	0.00067	0.00063	-	0.00069
Vanadium	mg/L	-	-	-	0.0023	-	-	0.0023	0.0023	-	0.0023
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	-	-	<0.003	<0.003	-	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2015-10-21	2015-11-17	2015-12-17	2016-01-12	2016-02-17	2016-03-16	2016-04-13
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.4	7.1	7.9	7.8	7.6	7.8	7.7
Specific conductivity	µS/cm	-	-	-	599	647	643	720	692	626	589
Temperature	°C	-	-	-	7.0	5.1	5.9	5.7	6.0	6.3	6.7
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.1	7.8	7.8	7.9	8.2	7.9
Specific conductivity	µS/cm	-	-	-	593	653	663	641	643	646	590
Hardness, as $CaCO_3$	mg/L	-	-	-	311	331	336	324	310	316	302
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	165	158	151	159	156	167	176
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	84	89	92	88	84	87	83
Chloride	mg/L	150	600	1,500	3.7	4.3	4.6	4.4	4.4	4.3	3.7
Fluoride	mg/L	-	1.6 - 1.8[(b)]	3.0[(b)]	0.18	0.17	0.18	0.18	0.18	0.18	0.20
Magnesium	mg/L	-	-	-	25	26	26	25	24	24	23
Potassium	mg/L	-	-	-	0.69	0.77	0.76	0.74	0.73	0.74	0.71
Sodium	mg/L	-	-	-	13	14	14	14	14	13	14
Sulphate	mg/L	429[(b, c)]	-	4,290[(b)]	137	160	169	158	151	148	123
Nutrients											
Nitrate	mg-N/L	3.0	33	400	**4.3[(Mn)]**	**4.7[(Mn)]**	**4.9[(Mn)]**	**4.6[(Mn)]**	**4.4[(Mn)]**	**4.3[(Mn)]**	**3.7[(Mn)]**
Nitrite	mg-N/L	0.020 - 0.060[(d)]	0.060 - 0.18[(d)]	200 - 400[(d)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	4.3	4.7	4.9	4.6	4.4	4.3	3.7
Total ammonia	mg-N/L	1.4 - 1.9[(e)]	7.3 - 20[(f)]	11 - 19[(g)]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	4.2	4.9	4.9	4.6	4.4	4.3	3.6
Total phosphorus	mg-P/L	-	-	-	0.0089	0.0079	0.0083	0.011	0.0095	0.010	0.0082
Dissolved phosphorus	mg-P/L	-	-	-	0.0099	0.0096	0.0061	0.0077	0.0084	0.0097	0.0068
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(h)]	0.10[(h)]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00047	0.00049	0.00051	0.00053	0.00052	0.00053	0.00053
Barium	mg/L	1.0	-	10	0.018	0.020	0.020	0.020	0.018	0.018	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001
Boron	mg/L	1.2	-	12	0.11	0.11	0.11	0.12	0.097	0.098	0.094
Cadmium	mg/L	0.00033 - 0.00046[(b)]	0.0011 - 0.0021[(b)]	0.0015 - 0.0040[(b)]	0.0000088	0.0000071	0.0000051	<0.000005	0.0000083	<0.000005	<0.000005
Chromium	mg/L	0.0010[(i)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[(b)]	0.0018	0.00074	0.00081	0.00070	0.00073	0.00075	0.00080
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[(b)]	0.17 - 0.39[(b)]	0.060 - 0.16[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0043	0.0036	0.0039	0.0047	0.0036	0.0039	0.0037
Manganese	mg/L	1.4 - 2.1[(b)]	2.5 - 3.4[(b)]	-	0.00013	<0.0001	0.00013	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	7.6	46	-	0.023	0.022	0.022	0.022	0.022	0.021	0.022
Nickel	mg/L	0.15[(b)]	-	1.5[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.015[(Mn)]**	**0.018[(Mn)]**	**0.016[(Mn)]**	**0.015[(Mn)]**	**0.014[(Mn)]**	**0.012[(Mn)]**	**0.010[(Mn)]**
Silicon	mg/L	-	-	-	7.5	7.5	7.5	7.7	7.6	7.5	7.7
Silver	mg/L	0.0015[(b)]	0.0030[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.33	0.34	0.35	0.35	0.34	0.34	0.33
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	0.011
Uranium	mg/L	0.0085	-	0.085	0.00074	0.00080	0.00085	0.00084	0.00084	0.00080	0.00080
Vanadium	mg/L	-	-	-	0.0022	0.0022	0.0023	0.0023	0.0023	0.0023	0.0025
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[(d)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(g)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(h)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[(i)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2016-05-11	2016-06-08	2016-07-12	2016-08-17	2016-09-15	2016-10-24	2016-11-08
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.7	7.7	7.2	7.7	7.7	7.7
Specific conductivity	µS/cm	-	-	-	612	649	679	673	653	653	633
Temperature	°C	-	-	-	6.8	8.6	8.0	8.2	7.4	6.9	7.0
Conventional Parameters											
pH	mg/L	-	-	-	8.0	8.0	7.8	8.3	8.2	8.2	8.2
Specific conductivity	µS/cm	-	-	-	598	631	660	668	638	617	606
Hardness, as $CaCO_3$	mg/L	-	-	-	324	331	343	324	312	305	291
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	177	169	167	173	166	163	165
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	89	90	91	86	84	82	78
Chloride	mg/L	150	600	1,500	3.8	3.9	4.3	4.3	4.2	4.3	4.1
Fluoride	mg/L	-	1.6 - 1.8[(b)]	3.0[(b)]	0.18	0.18	0.18	0.18	0.20	0.19	0.19
Magnesium	mg/L	-	-	-	25	26	28	27	25	24	24
Potassium	mg/L	-	-	-	0.67	1.9	0.79	0.74	0.81	0.73	0.73
Sodium	mg/L	-	-	-	13	14	14	14	14	14	14
Sulphate	mg/L	429[(b, c)]	-	4,290[(b)]	132	150	166	174	169	166	158
Nutrients											
Nitrate	mg-N/L	3.0	33	400	**3.3[(Mn)]**	**3.1[(Mn)]**	3.0	3.0	3.0	**3.1[(Mn)]**	3.0
Nitrite	mg-N/L	0.020 - 0.060[(d)]	0.060 - 0.18[(d)]	200 - 400[(d)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	3.3	3.1	3.0	3.0	3.0	3.1	3.0
Total ammonia	mg-N/L	1.4 - 1.9[(e)]	7.3 - 20[(f)]	11 - 19[(g)]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	3.3	6.2	3.0	3.0	2.9	3.0	3.0
Total phosphorus	mg-P/L	-	-	-	0.011	0.0075	0.0082	0.0082	0.013	<0.01	0.011
Dissolved phosphorus	mg-P/L	-	-	-	0.0067	0.0070	0.0091	0.0084	0.0082	0.010	0.0095
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(h)]	0.10[(h)]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00050	0.00058	0.00057	0.00052	0.00057	0.00052	0.00057
Barium	mg/L	1.0	-	10	0.016	0.018	0.020	0.019	0.019	0.018	0.018
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.083	0.079	0.087	0.085	0.087	0.096	0.092
Cadmium	mg/L	0.00033 - 0.00046[(b)]	0.0011 - 0.0021[(b)]	0.0015 - 0.0040[(b)]	<0.000005	<0.000005	0.0000073	0.0000052	<0.000005	0.0000074	0.0000066
Chromium	mg/L	0.0010[(i)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[(b)]	0.00077	0.00081	0.00081	0.00081	0.00081	0.00084	0.00077
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[(b)]	0.17 - 0.39[(b)]	0.060 - 0.16[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0038	0.0031	0.0036	0.0037	0.0041	0.0034	0.0034
Manganese	mg/L	1.4 - 2.1[(b)]	2.5 - 3.4[(b)]	-	0.00015	0.00022	<0.0001	0.00025	0.00024	0.00013	0.00017
Molybdenum	mg/L	7.6	46	-	0.021	0.019	0.022	0.021	0.021	0.021	0.021
Nickel	mg/L	0.15[(b)]	-	1.5[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.011[(Mn)]**	**0.012[(Mn)]**	**0.011[(Mn)]**	**0.011[(Mn)]**	**0.010[(Mn)]**	**0.0091[(Mn)]**	**0.0087[(Mn)]**
Silicon	mg/L	-	-	-	7.8	7.9	7.7	7.5	7.3	7.5	7.4
Silver	mg/L	0.0015[(b)]	0.0030[(b)]	-	<0.00001	0.00019	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.32	0.33	0.37	0.36	0.37	0.35	0.34
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	0.015	0.015	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00073	0.00072	0.00085	0.00076	0.00082	0.00080	0.00077
Vanadium	mg/L	-	-	-	0.0024	0.0024	0.0024	0.0024	0.0025	0.0024	0.0024
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

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[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(g)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(h)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[(i)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2016-12-19	2017-01-16	2017-02-22	2017-04-03	2017-04-26	2017-05-02	2017-05-22
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.7	7.7	7.6	-	7.8	7.6	7.7
Specific conductivity	µS/cm	-	-	-	630	611	579	-	650	626	596
Temperature	°C	-	-	-	6.0	6.0	6.3	-	8.5	7.8	8.7
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.1	8.2	8.2	8.3	-	8.3
Specific conductivity	µS/cm	-	-	-	612	591	578	580	629	-	576
Hardness, as $CaCO_3$	mg/L	-	-	-	271	298	280	302	297	-	285
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	168	167	185	178	187	-	205
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	72	83	78	79	81	-	74
Chloride	mg/L	150	600	1,500	4.1	3.7	3.4	3.4	3.4	-	2.7
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.19	0.20	0.18	0.18	0.19	-	0.20
Magnesium	mg/L	-	-	-	22	22	21	25	23	-	25
Potassium	mg/L	-	-	-	0.72	0.72	0.70	0.77	0.71	-	0.72
Sodium	mg/L	-	-	-	13	12	13	14	13	-	14
Sulphate	mg/L	429[b, c]	-	4,290[b]	150	137	126	129	138	-	100
Nutrients											
Nitrate	mg-N/L	3.0	33	400	2.8	2.5	2.4	2.5	2.8	-	2.2
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	0.0023	<0.001	<0.001	<0.001	<0.001	-	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	2.8	2.5	2.4	2.5	2.8	-	2.2
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005
Total nitrogen	mg-N/L	-	-	-	2.8	2.6	2.4	2.5	2.8	-	2.3
Total phosphorus	mg-P/L	-	-	-	0.0088	0.0086	0.0081	0.011	0.0090	-	0.0088
Dissolved phosphorus	mg-P/L	-	-	-	0.0092	0.010	0.0091	0.011	0.010	-	0.0092
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	-	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00055	0.00056	0.00053	0.00064	0.00058	-	0.00061
Barium	mg/L	1.0	-	10	0.017	0.018	0.017	0.019	0.020	-	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	<0.00005
Boron	mg/L	1.2	-	12	0.087	0.082	0.093	0.088	0.080	-	0.084
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.0000062	0.0000061	<0.000005	<0.000015	0.0000087	-	0.000011
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	0.00081	<0.0005	-	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00071	0.00069	0.00071	0.0010	0.00080	-	0.00075
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	-	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	<0.00005
Lithium	mg/L	-	-	-	0.0034	0.0039	0.0036	0.0033	0.0040	-	0.0040
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00020	0.00011	0.00026	0.00067	0.00024	-	0.00029
Molybdenum	mg/L	7.6	46	-	0.019	0.021	0.022	0.022	0.023	-	0.024
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	0.0012	0.00065	-	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0063[Mn]**	**0.0064[Mn]**	**0.0071[Mn]**	**0.0069[Mn]**	**0.0082[Mn]**	-	**0.0063[Mn]**
Silicon	mg/L	-	-	-	6.5	7.2	7.7	7.5	7.5	-	7.5
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00001
Strontium	mg/L	-	-	-	0.32	0.33	0.34	0.33	0.35	-	0.35
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00070	0.00069	0.00076	0.00076	0.00097	-	0.00088
Vanadium	mg/L	-	-	-	0.0023	0.0024	0.0024	0.0025	0.0024	-	0.0026
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	-	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2017-06-22	2017-08-22	2017-09-12	2017-10-17	2017-11-19	2017-12-13	2018-01-17
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.6	7.7	7.7	7.6	7.6	7.7
Specific conductivity	µS/cm	-	-	-	577	568	566	510	564	561	554
Temperature	°C	-	-	-	7.9	8.3	8.2	6.5	6.4	6.1	6.0
Conventional Parameters											
pH	mg/L	-	-	-	8.3	8.3	8.4	8.4	8.1	8.2	8.4
Specific conductivity	µS/cm	-	-	-	566	540	530	531	519	552	522
Hardness, as $CaCO_3$	mg/L	-	-	-	271	287	265	268	295	273	250
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	224	218	222	221	218	228	223
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	73	74	69	70	78	72	67
Chloride	mg/L	150	600	1,500	2.3	2.2	2.1	2.0	2.2	2.0	1.9
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.19	0.20	0.19	0.19	0.20	0.20	0.20
Magnesium	mg/L	-	-	-	21	25	23	23	25	23	20
Potassium	mg/L	-	-	-	0.66	0.75	0.75	0.70	0.65	0.67	0.70
Sodium	mg/L	-	-	-	13	15	14	14	13	14	14
Sulphate	mg/L	429[b, c]	-	4,290[b]	81	78	74	74	75	70	65
Nutrients											
Nitrate	mg-N/L	3.0	33	400	1.9	1.7	1.6	1.6	1.6	1.6	1.4
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	1.9	1.7	1.6	1.6	1.6	1.6	1.4
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	2.0	1.7	1.6	1.6	1.6	1.6	1.5
Total phosphorus	mg-P/L	-	-	-	0.011	0.011	0.0081	0.0092	0.011	0.0099	0.011
Dissolved phosphorus	mg-P/L	-	-	-	0.011	0.011	0.0098	0.010	0.011	0.010	0.013
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00058	0.00062	0.00059	0.00061	0.00054	0.00056	0.00055
Barium	mg/L	1.0	-	10	0.016	0.017	0.017	0.016	0.016	0.016	0.016
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.074	0.076	0.082	0.072	0.071	0.073	0.071
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.0000054	0.0000099	0.000012	<0.000025	0.000013	<0.000015	0.0000095
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00062	0.00067	0.00083	0.00062	0.00068	0.0011	0.00059
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0033	0.0037	0.0035	0.0044	0.0036	0.0032	0.0038
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00046	0.00016	0.0025	0.00066	0.00025	0.00044	0.00033
Molybdenum	mg/L	7.6	46	-	0.022	0.021	0.022	0.022	0.022	0.022	0.021
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0055[Mn]**	**0.0052[Mn]**	**0.0052[Mn]**	**0.0052[Mn]**	**0.0052[Mn]**	**0.0048[Mn]**	**0.0044[Mn]**
Silicon	mg/L	-	-	-	7.6	7.7	7.6	7.9	7.5	7.3	7.4
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.31	0.31	0.30	0.30	0.31	0.32	0.29
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00079	0.00077	0.00083	0.00088	0.00081	0.00076	0.00084
Vanadium	mg/L	-	-	-	0.0024	0.0027	0.0025	0.0025	0.0025	0.0023	0.0026
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	0.0041	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2018-02-28	2018-03-21	2018-04-10	2018-05-30	2018-06-19	2018-07-12	2018-08-15
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.9	7.7	7.8	7.6	7.4	7.7	7.6
Specific conductivity	µS/cm	-	-	-	539	546	596	618	595	554	536
Temperature	°C	-	-	-	5.7	6.5	2.0	7.3	13	8.8	8.9
Conventional Parameters											
pH	mg/L	-	-	-	8.3	8.4	8.5	8.4	8.3	8.4	8.3
Specific conductivity	µS/cm	-	-	-	498	512	522	535	426	507	515
Hardness, as $CaCO_3$	mg/L	-	-	-	272	280	265	269	267	272	255
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	225	219	226	245	171	242	236
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	75	74	71	71	71	73	67
Chloride	mg/L	150	600	1,500	1.9	1.9	1.9	1.7	1.6	1.5	1.5
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.20	0.20	0.19	0.20	0.21	0.21	0.21
Magnesium	mg/L	-	-	-	21	23	21	22	22	22	21
Potassium	mg/L	-	-	-	0.69	0.77	0.72	0.73	0.71	0.75	0.68
Sodium	mg/L	-	-	-	13	15	14	14	13	14	13
Sulphate	mg/L	429[b, c]	-	4,290[b]	62	63	63	60	52	48	40
Nutrients											
Nitrate	mg-N/L	3.0	33	400	1.3	1.4	1.5	1.5	1.2	1.1	0.83
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	1.3	1.4	1.5	1.5	1.2	1.1	0.83
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	1.3	1.4	1.4	1.4	1.3	1.1	0.88
Total phosphorus	mg-P/L	-	-	-	0.013	0.013	0.013	0.017	0.012	0.012	0.013
Dissolved phosphorus	mg-P/L	-	-	-	0.012	0.013	0.013	0.012	0.011	0.012	0.010
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	0.0040	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00061	0.00065	0.00060	0.00061	0.00063	0.00062	0.00061
Barium	mg/L	1.0	-	10	0.017	0.018	0.016	0.018	0.016	0.016	0.016
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.067	0.073	0.073	0.068	0.074	0.064	0.060
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.0000086	0.000015	0.000012	0.000019	0.000016	0.000014	0.0000098
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00067	0.00071	0.00060	0.00057	0.00061	0.00055	0.00057
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0033	0.0037	0.0037	0.0037	0.0038	0.0038	0.0037
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00033	0.00072	0.00030	0.00032	0.00050	0.00039	0.0025
Molybdenum	mg/L	7.6	46	-	0.020	0.023	0.024	0.024	0.023	0.022	0.022
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0048[Mn]**	**0.0048[Mn]**	**0.0048[Mn]**	**0.0045[Mn]**	**0.0039[Mn]**	**0.0037[Mn]**	**0.0031[Mn]**
Silicon	mg/L	-	-	-	7.6	7.9	7.6	7.5	7.9	7.2	7.0
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.31	0.29	0.29	0.32	0.32	0.28	0.29
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00081	0.00081	0.00084	0.00086	0.00083	0.00078	0.00072
Vanadium	mg/L	-	-	-	0.0026	0.0029	0.0025	0.0026	0.0026	0.0027	0.0025
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2018-09-25	2018-10-24	2018-11-13	2019-02-25	2019-06-05	2019-08-07	2019-11-20
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.7	7.6	7.5	7.6	7.7	7.7	7.6
Specific conductivity	µS/cm	-	-	-	523	515	523	505	502	524	501
Temperature	°C	-	-	-	6.9	6.8	6.6	5.7	8.0	12	7.0
Conventional Parameters											
pH	mg/L	-	-	-	8.4	8.2	8.0	8.3	8.2	8.4	8.2
Specific conductivity	µS/cm	-	-	-	485	515	519	496	473	498	518
Hardness, as $CaCO_3$	mg/L	-	-	-	257	251	245	246	261	245	260
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	247	247	234	244	216	241	272
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	0.27	-	<0.1
Major Ions											
Calcium	mg/L	-	-	-	68	65	62	66	69	62	67
Chloride	mg/L	150	600	1,500	1.5	1.5	1.6	1.5	1.3	1.2	1.2
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.20	0.19	0.21	0.22	0.21	0.19	0.20
Magnesium	mg/L	-	-	-	21	22	22	20	22	22	23
Potassium	mg/L	-	-	-	0.72	0.68	0.65	0.66	0.66	0.68	0.68
Sodium	mg/L	-	-	-	12	13	13	12	13	13	13
Sulphate	mg/L	429[b, c]	-	4,290[b]	43	40	43	36	38	33	24
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.94	0.84	1.1	0.83	0.91	0.72	0.83
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.94	0.84	1.1	0.83	0.91	0.72	0.83
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	0.011	0.012	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.95	0.84	1.1	0.83	0.87	0.79	0.81
Total phosphorus	mg-P/L	-	-	-	0.013	0.012	0.012	0.015	0.014	0.014	0.011
Dissolved phosphorus	mg-P/L	-	-	-	0.012	0.012	0.012	0.011	0.014	0.011	0.011
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	0.0031	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	0.00019	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00059	0.00061	0.00059	0.00053	0.00056	0.00062	0.00055
Barium	mg/L	1.0	-	10	0.016	0.016	0.018	0.015	0.015	0.015	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.067	0.068	0.064	0.067	0.058	0.061	0.062
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.0000078	0.000020	0.000022	0.0000096	0.000020	<0.00002	<0.00001
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00064	0.0015	0.0010	0.00060	0.00055	0.0012	0.00083
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0037	0.0037	0.0034	0.0036	0.0035	0.0032	0.0039
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00031	0.00069	0.0041	0.00012	0.00020	0.00035	0.00014
Molybdenum	mg/L	7.6	46	-	0.024	0.024	0.023	0.022	0.022	0.021	0.022
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0034[Mn]**	**0.0034[Mn]**	**0.0037[Mn]**	**0.0032[Mn]**	**0.0033[Mn]**	**0.0032[Mn]**	**0.0024[Mn]**
Silicon	mg/L	-	-	-	7.5	7.4	7.5	7.2	7.5	8.2	8.1
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.30	0.29	0.29	0.27	0.29	0.28	0.29
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00078	0.00073	0.00074	0.00074	0.00075	0.00079	0.00079
Vanadium	mg/L	-	-	-	0.0026	0.0026	0.0026	0.0025	0.0025	0.0025	0.0026
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	0.0066	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2020-02-26	2020-05-12	2020-08-24	2020-11-03	2021-02-16	2021-05-03	2021-08-16
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.8	-	-	-	7.4	7.6	7.4
Specific conductivity	µS/cm	-	-	-	519	-	-	-	416	572	502
Temperature	°C	-	-	-	6.5	-	-	-	6.6	7.1	8.8
Conventional Parameters											
pH	mg/L	-	-	-	7.8	8.4	8.2	8.3	8.3	8.3	8.3
Specific conductivity	µS/cm	-	-	-	525	532	562	569	530	545	534
Hardness, as $CaCO_3$	mg/L	-	-	-	247	294	281	303	182	277	286
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	272	280	283	283	273	311	284
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	68	77	76	79	58	73	77
Chloride	mg/L	150	600	1,500	1.3	1.1	1.8	1.1	1.2	1.0	1.2
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.20	0.18	0.19	0.18	0.20	0.18	0.19
Magnesium	mg/L	-	-	-	19	25	22	26	9.0	23	23
Potassium	mg/L	-	-	-	0.60	0.74	0.73	1.1	0.39	0.76	0.77
Sodium	mg/L	-	-	-	12	14	13	14	20	14	14
Sulphate	mg/L	429[b, c]	-	4,290[b]	30	35	29	35	28	28	27
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.67	0.98	0.62	0.79	0.59	0.76	0.57
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.67	0.98	0.62	0.79	0.59	0.76	0.57
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	0.0082	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.63	0.98	0.63	0.76	0.59	0.73	0.57
Total phosphorus	mg-P/L	-	-	-	0.020	0.0093	0.010	0.011	0.011	0.0093	0.012
Dissolved phosphorus	mg-P/L	-	-	-	0.011	0.018	0.011	0.012	0.011	0.011	0.0093
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	0.00012	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00049	0.00064	0.00057	0.00063	0.0021	0.00063	0.00058
Barium	mg/L	1.0	-	10	0.014	0.017	0.018	0.018	0.056	0.018	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.059	0.059	0.060	0.067	0.24	0.067	0.064
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	<0.00001	<0.000015	<0.000015	<0.00002	<0.000015	<0.00001	<0.00001
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.00077	0.00073	0.0010	0.0012	<0.0005	0.00084	0.0012
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00010	0.000062
Lithium	mg/L	-	-	-	0.0036	0.0038	0.0037	0.0038	0.0030	0.0038	0.0039
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00010	<0.0001	<0.0001	0.00018	0.030	0.00016	0.00013
Molybdenum	mg/L	7.6	46	-	0.022	0.022	0.021	0.021	0.042	0.021	0.023
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	**0.0030[Mn]**	**0.0039[Mn]**	**0.0025[Mn]**	**0.0038[Mn]**	0.00057	**0.0030[Mn]**	**0.0027[Mn]**
Silicon	mg/L	-	-	-	7.1	7.5	7.4	7.8	6.5	7.8	7.7
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	0.000013	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.29	0.32	0.33	0.34	0.20	0.32	0.33
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00078	0.00091	0.00092	0.00099	0.00025	0.00094	0.00093
Vanadium	mg/L	-	-	-	0.0023	0.0027	0.0027	0.0028	<0.0005	0.0027	0.0027
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	<0.003	<0.003	<0.003	<0.003	0.0044	0.0097	0.0082

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites				
		Aquatic Life		BC CSR WQG	GW12-2b	GW12-2b	GW12-2b	GW12-2b	GW12-2b
		30-day mean	Maximum		2021-12-01	2022-02-28	2022-06-06	2022-08-10	2022-11-16
Field Measured									
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.5	7.4	7.5	7.3
Specific conductivity	µS/cm	-	-	-	513	485	511	561	533
Temperature	°C	-	-	-	6.9	7.3	5.5	11	7.7
Conventional Parameters									
pH	mg/L	-	-	-	7.9	8.2	8.2	8.3	8.1
Specific conductivity	µS/cm	-	-	-	422	492	445	517	523
Hardness, as $CaCO_3$	mg/L	-	-	-	262	274	294	283	264
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	263	260	230	286	266
Total suspended solids	mg/L	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-
Major Ions									
Calcium	mg/L	-	-	-	68	71	77	74	68
Chloride	mg/L	150	600	1,500	1.3	1.4	1.1	1.3	1.4
Fluoride	mg/L	-	1.6 - 1.8[b]	3.0[b]	0.15	0.20	0.18	0.19	0.18
Magnesium	mg/L	-	-	-	23	24	25	24	23
Potassium	mg/L	-	-	-	0.68	0.75	0.72	0.71	0.72
Sodium	mg/L	-	-	-	13	14	14	13	12
Sulphate	mg/L	429[b, c]	-	4,290[b]	18	20	24	24	23
Nutrients									
Nitrate	mg-N/L	3.0	33	400	0.54	0.57	0.57	0.57	0.56
Nitrite	mg-N/L	0.020 - 0.060[d]	0.060 - 0.18[d]	200 - 400[d]	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.54	0.57	0.57	0.57	0.56
Total ammonia	mg-N/L	1.4 - 1.9[e]	7.3 - 20[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.62	0.56	0.56	0.57	0.55
Total phosphorus	mg-P/L	-	-	-	0.0063	0.014	0.011	0.017	0.027
Dissolved phosphorus	mg-P/L	-	-	-	0.0070	0.013	0.011	0.0096	0.011
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-
Dissolved Metals									
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	0.026	0.0056
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00063	0.00065	0.00057	0.00064	0.00059
Barium	mg/L	1.0	-	10	0.015	0.017	0.018	0.016	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.057	0.060	0.059	0.060	0.057
Cadmium	mg/L	0.00033 - 0.00046[b]	0.0011 - 0.0021[b]	0.0015 - 0.0040[b]	0.0000067	0.000015	0.000019	<0.00001	<0.00001
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	0.00028	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.080 - 0.090[b]	0.0011	0.0015	0.0018	0.0017	0.0015
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.010 - 0.019[b]	0.17 - 0.39[b]	0.060 - 0.16[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0037	0.0036	0.0046	0.0039	0.0038
Manganese	mg/L	1.4 - 2.1[b]	2.5 - 3.4[b]	-	0.00040	0.00043	0.00040	0.0014	0.0021
Molybdenum	mg/L	7.6	46	-	0.022	0.024	0.021	0.021	0.022
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	0.00054	<0.0005	<0.0005	0.00084
Selenium	mg/L	0.0020	-	0.020	**0.0028[Mn]**	**0.0023[Mn]**	**0.0023[Mn]**	**0.0026[Mn]**	**0.0028[Mn]**
Silicon	mg/L	-	-	-	7.7	8.5	7.8	8.1	7.9
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.30	0.31	0.35	0.32	0.31
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00071	0.00083	0.00093	0.00085	0.00081
Vanadium	mg/L	-	-	-	0.0025	0.0026	0.0027	0.0027	0.0026
Zinc	mg/L	0.077 - 0.19	0.10 - 0.22	0.90 - 2.4	0.0092	0.011	0.0086	0.0095	0.0093

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (182 to 343 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (1.0100 to 4.5800 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (5.9°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2015-06-02	2015-06-04	2015-07-22	2015-07-23	2015-07-27	2015-09-02	2015-09-03
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.0	7.9	8.1	8.2	-	-	8.2
Specific conductivity	µS/cm	-	-	-	224	223	221	223	-	-	219
Temperature	°C	-	-	-	9.2	9.3	8.6	7.9	-	-	7.0
Conventional Parameters											
pH	mg/L	-	-	-	-	8.0	-	-	8.0	8.0	-
Specific conductivity	µS/cm	-	-	-	-	213	-	-	226	219	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	46	-	-	47	47	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	55	-	-	52	49	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	-	16	-	-	17	17	-
Chloride	mg/L	150	600	1,500	-	0.70	-	-	0.67	0.64	-
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	-	0.43	-	-	0.44	0.44	-
Magnesium	mg/L	-	-	-	-	1.3	-	-	1.3	1.3	-
Potassium	mg/L	-	-	-	-	0.16	-	-	0.17	0.18	-
Sodium	mg/L	-	-	-	-	27	-	-	28	26	-
Sulphate	mg/L	218[b]	-	2,180[b]	-	50	-	-	53	54	-
Nutrients											
Nitrate	mg-N/L	3.0	33	400	-	<0.005	-	-	0.0068	<0.005	-
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	-	<0.001	-	-	<0.001	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	-	<0.0051	-	-	0.0068	<0.0051	-
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	-	<0.005	-	-	<0.005	<0.005	-
Total nitrogen	mg-N/L	-	-	-	-	<0.03	-	-	<0.03	<0.03	-
Total phosphorus	mg-P/L	-	-	-	-	0.045	-	-	0.042	0.045	-
Dissolved phosphorus	mg-P/L	-	-	-	-	0.053	-	-	0.047	0.048	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	-	0.0073	-	-	0.0085	0.0066	-
Antimony	mg/L	0.0090	-	0.090	-	0.00012	-	-	<0.0001	<0.0001	-
Arsenic	mg/L	-	0.0050	0.050	-	0.0023	-	-	0.0023	0.0022	-
Barium	mg/L	1.0	-	10	-	0.0070	-	-	0.0074	0.0079	-
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	<0.0001	-
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	<0.00005	-
Boron	mg/L	1.2	-	12	-	0.32	-	-	0.36	0.34	-
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	-	0.0000064	-	-	0.0000083	0.0000076	-
Chromium	mg/L	0.0010[h]	-	0.010	-	<0.0005	-	-	<0.0005	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	-	<0.0001	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.030[b]	-	<0.0005	-	-	<0.0005	0.00066	-
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	<0.03	-
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	-	<0.00005	-	-	<0.00005	<0.00005	-
Lithium	mg/L	-	-	-	-	0.0025	-	-	0.0028	0.0028	-
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	-	0.019	-	-	0.025	0.060	-
Molybdenum	mg/L	7.6	46	-	-	0.040	-	-	0.040	0.040	-
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	-	<0.0005	-	-	<0.0005	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	-	0.00020	-	-	0.000080	0.000075	-
Silicon	mg/L	-	-	-	-	8.2	-	-	8.5	8.4	-
Silver	mg/L	0.000050[b]	0.00010[b]	-	-	<0.00001	-	-	<0.00001	<0.00001	-
Strontium	mg/L	-	-	-	-	0.070	-	-	0.050	0.050	-
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	<0.00001	<0.00001	-
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	0.00012	-
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	<0.01	-
Uranium	mg/L	0.0085	-	0.085	-	0.00019	-	-	0.00017	0.00014	-
Vanadium	mg/L	-	-	-	-	<0.0005	-	-	<0.0005	<0.0005	-
Zinc	mg/L	0.0075	0.033	0.075	-	<0.003	-	-	<0.003	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2015-09-29	2015-10-21	2015-11-17	2015-12-17	2016-01-12	2016-02-17	2016-03-16
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	8.1	7.1	8.5	8.9	8.3	8.7
Specific conductivity	µS/cm	-	-	-	-	226	230	234	264	262	233
Temperature	°C	-	-	-	-	7.7	5.5	6.9	5.8	6.2	6.5
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.1	8.2	8.3	8.3	8.1	8.1
Specific conductivity	µS/cm	-	-	-	224	230	227	232	228	237	243
Hardness, as $CaCO_3$	mg/L	-	-	-	48	50	50	51	51	49	50
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	51	48	46	43	43	43	45
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	18	18	18	18	18	18
Chloride	mg/L	150	600	1,500	0.66	0.57	0.57	0.59	0.59	0.57	0.61
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.44	0.46	0.47	0.49	0.49	0.48	0.47
Magnesium	mg/L	-	-	-	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Potassium	mg/L	-	-	-	0.15	0.12	0.11	0.11	0.10	0.099	0.12
Sodium	mg/L	-	-	-	29	26	27	26	26	27	26
Sulphate	mg/L	218[b]	-	2,180[b]	56	60	61	64	64	64	64
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.053	0.022	0.016	0.019	0.022	0.019	0.021
Dissolved phosphorus	mg-P/L	-	-	-	0.059	0.026	0.019	0.023	0.021	0.018	0.022
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0072	0.0057	0.0056	0.0054	0.0054	0.0054	0.0067
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0023	0.0022	0.0022	0.0023	0.0023	0.0022	0.0023
Barium	mg/L	1.0	-	10	0.0073	0.0067	0.0066	0.0067	0.0066	0.0063	0.0066
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.36	0.38	0.38	0.36	0.42	0.33	0.34
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0031	0.0037	0.0030	0.0032	0.0041	0.0034	0.0034
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.062	0.040	0.034	0.034	0.033	0.031	0.032
Molybdenum	mg/L	7.6	46	-	0.039	0.040	0.040	0.040	0.039	0.040	0.039
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.5	9.0	8.9	9.0	9.2	9.0	8.9
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.048	0.050	0.049	0.050	0.050	0.051	0.051
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00015	0.000073	0.000062	0.000064	0.000062	0.000052	0.000055
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2016-04-14	2016-05-11	2016-06-08	2016-07-12	2016-08-18	2016-09-15	2016-10-24
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.7	8.6	8.6	8.6	8.6	8.6	8.7
Specific conductivity	µS/cm	-	-	-	237	234	239	236	235	235	239
Temperature	°C	-	-	-	8.1	7.3	9.8	8.4	9.4	7.8	7.4
Conventional Parameters											
pH	mg/L	-	-	-	8.2	8.0	8.2	8.0	7.9	8.0	8.0
Specific conductivity	µS/cm	-	-	-	233	230	229	232	231	230	232
Hardness, as $CaCO_3$	mg/L	-	-	-	50	49	51	51	46	49	48
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	43	44	42	43	46	45	46
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	18	18	18	18	17	17	17
Chloride	mg/L	150	600	1,500	0.63	0.61	0.59	0.66	0.64	0.67	0.71
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.51	0.48	0.49	0.49	0.49	0.51	0.50
Magnesium	mg/L	-	-	-	1.3	1.3	1.3	1.3	1.2	1.2	1.2
Potassium	mg/L	-	-	-	0.11	0.10	0.15	0.11	0.099	0.22	0.093
Sodium	mg/L	-	-	-	27	26	27	27	26	27	28
Sulphate	mg/L	218[b]	-	2,180[b]	66	66	65	64	63	64	65
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.016	0.018	0.014	0.017	0.013	0.016	0.015
Dissolved phosphorus	mg-P/L	-	-	-	0.013	0.018	0.016	0.018	0.012	0.015	0.017
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0059	0.0047	0.0070	0.0046	0.0040	0.0045	0.0046
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0022	0.0021	0.0024	0.0023	0.0022	0.0024	0.0022
Barium	mg/L	1.0	-	10	0.0064	0.0056	0.0063	0.0062	0.0047	0.0053	0.0052
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.33	0.31	0.37	0.39	0.37	0.35	0.37
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00031
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0027	0.0033	0.0034	0.0033	0.0033	0.0036	0.0029
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.028	0.026	0.027	0.026	0.044	0.031	0.026
Molybdenum	mg/L	7.6	46	-	0.037	0.039	0.040	0.041	0.039	0.039	0.040
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	0.00058	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	9.0	9.0	9.2	9.2	8.8	8.6	8.9
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.049	0.049	0.051	0.052	0.051	0.053	0.053
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	0.00031	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000043	0.000042	0.000043	0.000050	0.000040	0.000047	0.000048
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2016-11-08	2016-12-19	2017-01-16	2017-02-22	2017-04-03	2017-04-26	2017-05-02
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.7	8.6	8.7	8.6	-	8.7	8.3
Specific conductivity	µS/cm	-	-	-	237	242	240	232	-	245	241
Temperature	°C	-	-	-	7.8	6.8	6.6	7.0	-	9.0	8.1
Conventional Parameters											
pH	mg/L	-	-	-	7.9	8.1	7.9	8.0	8.0	8.0	-
Specific conductivity	µS/cm	-	-	-	228	238	236	232	225	241	-
Hardness, as $CaCO_3$	mg/L	-	-	-	47	47	51	49	50	49	-
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	45	45	42	44	44	44	-
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	17	18	18	18	18	-
Chloride	mg/L	150	600	1,500	0.69	0.75	0.72	0.68	0.73	0.69	-
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.49	0.49	0.49	0.47	0.45	0.48	-
Magnesium	mg/L	-	-	-	1.2	1.3	1.2	1.1	1.4	1.2	-
Potassium	mg/L	-	-	-	0.099	0.098	0.13	0.095	0.12	0.096	-
Sodium	mg/L	-	-	-	27	27	25	26	29	26	-
Sulphate	mg/L	218[b]	-	2,180[b]	66	66	66	66	66	65	-
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	-
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-
Total phosphorus	mg-P/L	-	-	-	<0.02	0.018	0.016	0.016	0.023	0.023	-
Dissolved phosphorus	mg-P/L	-	-	-	0.015	0.016	0.017	0.016	0.023	0.019	-
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0041	0.0048	0.0045	0.0053	0.0064	0.0044	-
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Arsenic	mg/L	-	0.0050	0.050	0.0024	0.0024	0.0024	0.0024	0.0025	0.0023	-
Barium	mg/L	1.0	-	10	0.0051	0.0054	0.0058	0.0053	0.0062	0.0053	-
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-
Boron	mg/L	1.2	-	12	0.36	0.35	0.34	0.37	0.37	0.36	-
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000015	<0.00001	-
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-
Lithium	mg/L	-	-	-	0.0031	0.0032	0.0035	0.0033	0.0029	0.0034	-
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.024	0.027	0.024	0.026	0.032	0.027	-
Molybdenum	mg/L	7.6	46	-	0.039	0.037	0.039	0.040	0.040	0.040	-
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	0.000063	<0.00005	<0.00005	-
Silicon	mg/L	-	-	-	8.7	8.2	8.4	8.6	8.9	8.1	-
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-
Strontium	mg/L	-	-	-	0.052	0.051	0.052	0.054	0.053	0.052	-
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Uranium	mg/L	0.0085	-	0.085	0.000041	0.000045	0.000042	0.000047	0.000052	0.000040	-
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2017-05-22	2017-06-22	2017-08-22	2017-09-12	2017-10-17	2017-11-19	2017-12-13
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.7	8.5	8.5	8.5	8.1	8.5	8.4
Specific conductivity	µS/cm	-	-	-	242	243	241	243	221	243	243
Temperature	°C	-	-	-	9.3	9.3	8.2	8.5	6.9	6.7	6.9
Conventional Parameters											
pH	mg/L	-	-	-	7.9	7.9	7.8	7.9	7.9	8.0	7.9
Specific conductivity	µS/cm	-	-	-	233	238	230	230	235	227	241
Hardness, as $CaCO_3$	mg/L	-	-	-	49	48	50	48	50	57	51
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	43	43	41	44	43	42	44
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	17	18	17	18	20	18
Chloride	mg/L	150	600	1,500	0.72	0.74	0.76	0.69	0.65	0.79	0.73
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.48	0.47	0.48	0.47	0.46	0.49	0.48
Magnesium	mg/L	-	-	-	1.3	1.2	1.4	1.3	1.3	1.3	1.3
Potassium	mg/L	-	-	-	0.090	0.093	0.10	0.095	0.099	0.097	0.093
Sodium	mg/L	-	-	-	27	28	29	28	27	29	30
Sulphate	mg/L	218[b]	-	2,180[b]	67	67	68	66	65	67	66
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	0.0067	0.0082
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.017	0.018	0.022	0.022	0.019	0.026	0.020
Dissolved phosphorus	mg-P/L	-	-	-	0.017	0.021	0.019	0.022	0.022	0.027	0.024
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0042	0.0039	0.0039	0.0042	0.0054	0.0045	0.0063
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0025	0.0023	0.0024	0.0024	0.0023	0.0024	0.0023
Barium	mg/L	1.0	-	10	0.0052	0.0053	0.0052	0.0052	0.0052	0.0056	0.0056
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.34	0.35	0.37	0.38	0.33	0.40	0.36
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.00002	<0.000005	<0.0000055	<0.00002	<0.00002	<0.00002	<0.000015
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0036	0.0029	0.0034	0.0032	0.0042	0.0034	0.0030
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.025	0.025	0.029	0.027	0.039	0.042	0.039
Molybdenum	mg/L	7.6	46	-	0.044	0.039	0.037	0.040	0.041	0.042	0.040
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	0.000057	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.5	8.5	8.4	8.7	8.7	8.6	8.3
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.057	0.052	0.053	0.052	0.053	0.055	0.056
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000052	0.000056	0.000052	0.000059	0.000065	0.000062	0.000059
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2018-01-17	2018-02-28	2018-03-20	2018-04-10	2018-05-30	2018-06-19	2018-07-12
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.6	8.7	8.6	8.7	8.3	8.4	8.6
Specific conductivity	µS/cm	-	-	-	244	243	243	263	254	249	235
Temperature	°C	-	-	-	6.6	6.5	7.2	2.3	8.0	9.7	9.0
Conventional Parameters											
pH	mg/L	-	-	-	7.7	7.9	7.9	7.9	8.0	8.0	7.9
Specific conductivity	µS/cm	-	-	-	231	232	236	235	232	230	222
Hardness, as $CaCO_3$	mg/L	-	-	-	50	54	55	53	47	48	49
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	45	45	44	45	47	46	47
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	18	20	20	19	17	17	18
Chloride	mg/L	150	600	1,500	0.72	0.76	0.75	0.69	0.70	0.67	0.66
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.47	0.47	0.47	0.45	0.45	0.47	0.45
Magnesium	mg/L	-	-	-	1.3	1.3	1.3	1.3	1.3	1.2	1.2
Potassium	mg/L	-	-	-	0.11	0.12	0.11	0.097	0.097	0.099	0.060
Sodium	mg/L	-	-	-	28	29	29	28	29	27	28
Sulphate	mg/L	218[b]	-	2,180[b]	66	66	67	65	63	62	59
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	0.0013	<0.001	0.0013	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	0.011	0.012	0.0071	0.0052	0.0057	0.0054	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.028	0.032	0.027	0.019	0.027	0.020	0.018
Dissolved phosphorus	mg-P/L	-	-	-	0.028	0.036	0.026	0.018	0.020	0.018	0.018
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0051	0.0054	0.0047	0.0044	0.0048	0.0041	0.0045
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0023	0.0025	0.0023	0.0024	0.0025	0.0024	0.0024
Barium	mg/L	1.0	-	10	0.0058	0.0063	0.0059	0.0054	0.0058	0.0053	0.0051
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.36	0.37	0.36	0.38	0.34	0.36	0.31
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	0.0000074	<0.000015	<0.00003	<0.00002	<0.00003	<0.00003	<0.00001
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0033	0.0029	0.0029	0.0036	0.0035	0.0034	0.0035
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.039	0.044	0.036	0.032	0.037	0.031	0.031
Molybdenum	mg/L	7.6	46	-	0.039	0.037	0.041	0.044	0.042	0.041	0.040
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.5	8.6	8.2	8.8	8.5	8.9	8.4
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.054	0.059	0.060	0.054	0.055	0.055	0.051
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000066	0.000075	0.000064	0.000054	0.000068	0.000064	0.000067
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2018-08-15	2018-09-25	2018-10-24	2018-11-13	2019-02-25	2019-06-05	2019-08-07
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.4	8.6	8.5	8.6	8.5	8.7	8.6
Specific conductivity	µS/cm	-	-	-	235	232	235	234	235	223	256
Temperature	°C	-	-	-	9.3	7.5	7.5	7.6	6.9	8.4	12
Conventional Parameters											
pH	mg/L	-	-	-	8.0	7.9	8.0	8.2	8.0	7.9	8.0
Specific conductivity	µS/cm	-	-	-	235	223	238	231	230	243	259
Hardness, as $CaCO_3$	mg/L	-	-	-	49	46	48	45	48	46	52
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	48	49	51	47	49	51	52
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	0.17	-
Major Ions											
Calcium	mg/L	-	-	-	18	17	17	16	17	17	19
Chloride	mg/L	150	600	1,500	0.69	0.69	0.73	0.74	0.81	0.86	0.94
Fluoride	mg/L	-	1.0 - 1.2[(b)]	2.0 - 3.0[(b)]	0.43	0.43	0.42	0.43	0.44	0.41	0.37
Magnesium	mg/L	-	-	-	1.2	1.2	1.3	1.3	1.2	1.2	1.4
Potassium	mg/L	-	-	-	0.088	0.11	0.096	0.072	0.087	0.092	0.079
Sodium	mg/L	-	-	-	29	26	27	27	26	28	29
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	59	59	60	58	59	60	64
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	0.034	0.041	0.039	0.069	0.14
Nitrite	mg-N/L	0.020[(c)]	0.060[(c)]	200[(c)]	0.0020	0.0026	0.0091	0.016	0.012	0.011	**0.021[(Mn)]**
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	0.043	0.057	0.051	0.080	0.16
Total ammonia	mg-N/L	0.16 - 1.9[(d)]	0.84 - 20[(e)]	1.3 - 19[(f)]	0.015	<0.005	0.014	0.018	<0.005	0.0061	<0.005
Total nitrogen	mg-N/L	-	-	-	0.061	<0.03	0.058	0.068	0.061	0.090	0.19
Total phosphorus	mg-P/L	-	-	-	0.025	0.025	0.019	0.0097	0.030	0.028	0.0072
Dissolved phosphorus	mg-P/L	-	-	-	0.027	0.026	0.022	0.011	0.022	0.026	0.0067
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	0.0048	0.0044	0.0040	0.0038	0.0042	0.0040	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0024	0.0025	0.0024	0.0024	0.0023	0.0023	0.0024
Barium	mg/L	1.0	-	10	0.0054	0.0056	0.0052	0.0057	0.0052	0.0052	0.0046
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.33	0.34	0.37	0.30	0.35	0.28	0.33
Cadmium	mg/L	0.00012 - 0.00016[(b)]	0.00026 - 0.00041[(b)]	0.0015[(b)]	<0.000015	<0.00002	<0.00003	<0.000015	<0.000015	<0.00003	<0.00002
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[(b)]	0.030 - 0.053[(b)]	0.040 - 0.050[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0034	0.0035	0.0035	0.0032	0.0033	0.0032	0.0034
Manganese	mg/L	0.80 - 0.92[(b)]	1.0 - 1.3[(b)]	-	0.034	0.036	0.029	0.023	0.033	0.029	0.019
Molybdenum	mg/L	7.6	46	-	0.041	0.043	0.042	0.040	0.040	0.039	0.037
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	0.000062	0.00015	0.00021	0.00027	0.00030	0.00066
Silicon	mg/L	-	-	-	8.1	8.3	8.3	8.5	8.5	8.3	9.2
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.053	0.053	0.055	0.054	0.053	0.057	0.060
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000082	0.000087	0.000090	0.000072	0.00010	0.00010	0.000097
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2019-11-20	2020-02-26	2020-05-12	2020-08-24	2020-11-03	2021-02-16	2021-05-03
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.6	8.4	-	-	-	7.9	8.3
Specific conductivity	µS/cm	-	-	-	242	261	-	-	-	1,851	235
Temperature	°C	-	-	-	7.7	7.6	-	-	-	7.3	7.1
Conventional Parameters											
pH	mg/L	-	-	-	8.0	7.9	8.0	8.0	7.9	7.9	7.9
Specific conductivity	µS/cm	-	-	-	242	264	277	257	243	237	230
Hardness, as $CaCO_3$	mg/L	-	-	-	55	58	63	63	51	54	49
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	50	58	60	51	46	46	51
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	<0.1	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	20	21	22	23	18	20	18
Chloride	mg/L	150	600	1,500	0.92	1.2	1.2	1.1	1.3	0.97	0.96
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.39	0.38	0.35	0.37	0.38	0.40	0.40
Magnesium	mg/L	-	-	-	1.4	1.5	1.7	1.4	1.3	1.3	1.2
Potassium	mg/L	-	-	-	0.086	0.069	0.088	1.2	0.11	0.12	0.12
Sodium	mg/L	-	-	-	29	30	31	29	30	28	28
Sulphate	mg/L	218[b]	-	2,180[b]	63	70	72	67	65	61	63
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.092	0.21	0.23	0.044	0.019	0.026	0.020
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	0.012	0.017	0.015	0.018	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.10	0.22	0.24	0.061	0.020	0.026	0.020
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	0.0093	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.15	0.20	0.24	0.073	0.044	<0.03	0.031
Total phosphorus	mg-P/L	-	-	-	0.015	0.0087	0.0068	0.011	0.023	0.036	0.030
Dissolved phosphorus	mg-P/L	-	-	-	0.014	0.0087	0.016	0.0066	0.023	0.036	0.033
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0040	<0.003	<0.003	<0.003	0.0049	0.0040	0.0051
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0025	0.0023	0.0024	0.0025	0.0025	0.0029	0.0028
Barium	mg/L	1.0	-	10	0.0059	0.0052	0.0055	0.0050	0.0042	0.0049	0.0044
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.34	0.30	0.30	0.36	0.34	0.38	0.37
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.000015	<0.00001	<0.000015	<0.00002	<0.000025	<0.000015	<0.00001
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00062	0.0018
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000078
Lithium	mg/L	-	-	-	0.0039	0.0038	0.0040	0.0043	0.0035	0.0035	0.0034
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.025	0.017	0.017	0.015	0.00085	0.021	0.00069
Molybdenum	mg/L	7.6	46	-	0.039	0.038	0.037	0.037	0.040	0.040	0.040
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00053	0.00082	0.0010	0.00048	0.00011	0.000055	0.000069
Silicon	mg/L	-	-	-	9.5	8.5	8.5	8.5	8.6	8.4	8.5
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	0.000022	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.059	0.065	0.070	0.066	0.058	0.057	0.052
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	0.00011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00012	0.00011	0.00013	0.000099	0.00010	0.00010	0.00011
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0033

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW12-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a	GW12-2a
		30-day mean	Maximum		2021-08-16	2021-12-01	2022-02-28	2022-06-06	2022-08-10	2022-11-16
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.0	8.2	8.0	8.1	8.1	7.9
Specific conductivity	µS/cm	-	-	-	234	240	228	215	236	234
Temperature	°C	-	-	-	7.7	6.8	7.1	5.8	8.9	8.2
Conventional Parameters										
pH	mg/L	-	-	-	7.9	7.8	7.7	7.9	7.8	7.9
Specific conductivity	µS/cm	-	-	-	232	196	232	231	227	234
Hardness, as $CaCO_3$	mg/L	-	-	-	50	48	52	49	51	71
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	47	48	48	52	48	47
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	18	17	19	17	18	22
Chloride	mg/L	150	600	1,500	0.92	0.86	0.93	0.97	0.96	0.95
Fluoride	mg/L	-	1.0 - 1.2[b]	2.0 - 3.0[b]	0.38	0.33	0.39	0.39	0.39	0.37
Magnesium	mg/L	-	-	-	1.2	1.2	1.3	1.3	1.5	3.8
Potassium	mg/L	-	-	-	1.4	0.12	0.14	0.16	0.14	0.20
Sodium	mg/L	-	-	-	28	28	31	27	28	25
Sulphate	mg/L	218[b]	-	2,180[b]	61	62	63	63	62	63
Nutrients										
Nitrate	mg-N/L	3.0	33	400	0.033	0.030	0.046	0.038	0.034	0.043
Nitrite	mg-N/L	0.020[c]	0.060[c]	200[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.033	0.030	0.046	0.038	0.034	0.043
Total ammonia	mg-N/L	0.16 - 1.9[d]	0.84 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	0.0083
Total nitrogen	mg-N/L	-	-	-	0.036	<0.05	0.049	0.040	0.056	0.058
Total phosphorus	mg-P/L	-	-	-	0.031	0.022	0.033	0.031	0.030	0.029
Dissolved phosphorus	mg-P/L	-	-	-	0.026	0.017	0.033	0.030	0.025	0.029
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0052	0.0060	0.0072	0.0049	0.0054	0.0089
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0026	0.0028	0.0028	0.0027	0.0028	0.0023
Barium	mg/L	1.0	-	10	0.0044	0.0043	0.0051	0.0053	0.0048	0.0055
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.35	0.33	0.33	0.32	0.35	0.28
Cadmium	mg/L	0.00012 - 0.00016[b]	0.00026 - 0.00041[b]	0.0015[b]	<0.00001	0.000010	0.000013	<0.000025	<0.00001	<0.000015
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.020 - 0.030[b]	0.0013	<0.0005	<0.0005	0.00092	<0.0005	0.0013
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0045 - 0.0054[b]	0.030 - 0.053[b]	0.040 - 0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0039	0.0035	0.0037	0.0039	0.0036	0.0034
Manganese	mg/L	0.80 - 0.92[b]	1.0 - 1.3[b]	-	0.00045	0.00038	0.00018	0.00055	0.00048	0.0037
Molybdenum	mg/L	7.6	46	-	0.044	0.042	0.043	0.041	0.042	0.038
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	0.0013	<0.0005	<0.0005	<0.0005	<0.0005	0.00066
Selenium	mg/L	0.0020	-	0.020	0.000056	<0.00005	<0.00005	<0.00005	0.000072	0.00030
Silicon	mg/L	-	-	-	8.4	8.4	9.4	8.5	8.8	8.5
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.053	0.054	0.057	0.054	0.055	0.084
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00011	0.000099	0.00012	0.00011	0.00011	0.00017
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	**0.0096**[Mn]	0.0040	0.0053	0.0038	0.0042	**0.024**[Mn]

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C =

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (45 to 71 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5700 to 1.2600 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.16 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.84 mg-N/L) is based on the combination of field pH (8.9) and water temperature (5.8°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.9). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2015-07-27	2015-09-03	2015-09-08	2015-09-09	2015-09-29	2015-10-21	2015-11-17
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.4	8.4	8.4	8.1	8.2	8.3	7.1
Specific conductivity	µS/cm	-	-	-	589	247	231	217	215	206	208
Temperature	°C	-	-	-	8.1	7.2	7.1	7.6	2.7	7.4	6.6
Conventional Parameters											
pH	mg/L	-	-	-	8.2	-	-	8.2	8.0	8.2	8.2
Specific conductivity	µS/cm	-	-	-	261	-	-	214	209	208	208
Hardness, as $CaCO_3$	mg/L	-	-	-	72	-	-	-	61	62	62
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	75	-	-	66	65	64	63
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	23	-	-	20	19	20	19
Chloride	mg/L	150	600	1,500	2.3	-	-	0.96	0.78	0.69	0.66
Fluoride	mg/L	-	1.1 - 1.2[(b)]	3.0[(b)]	0.48	-	-	0.44	0.43	0.43	0.43
Magnesium	mg/L	-	-	-	3.7	-	-	3.2	3.2	3.2	3.2
Potassium	mg/L	-	-	-	1.7	-	-	0.56	0.45	0.36	0.37
Sodium	mg/L	-	-	-	24	-	-	20	20	18	19
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	49	-	-	40	39	38	38
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[(c)]	0.060 - 0.12[(c)]	200 - 400[(c)]	<0.001	-	-	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	-	-	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.058	-	-	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.017	-	-	0.015	0.011	0.011	0.010
Dissolved phosphorus	mg-P/L	-	-	-	0.015	-	-	0.015	0.012	0.013	0.011
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	0.0047	-	-	0.0035	0.0034	0.0067	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00012	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0030	-	-	0.0033	0.0036	0.0033	0.0034
Barium	mg/L	1.0	-	10	0.015	-	-	0.010	0.0091	0.0077	0.0082
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	-	-	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.48	-	-	0.50	0.53	0.52	0.51
Cadmium	mg/L	0.00013 - 0.00017[(b)]	0.00029 - 0.00042[(b)]	0.0015[(b)]	<0.000005	-	-	<0.000005	<0.000005	0.000013	<0.000005
Chromium	mg/L	0.0010[(h)]	-	0.010	0.00059	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	0.00015	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[(b)]	<0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	-	-	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[(b)]	0.034 - 0.054[(b)]	0.050[(b)]	<0.00005	-	-	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0062	-	-	0.0033	0.0035	0.0031	0.0025
Manganese	mg/L	0.83 - 0.92[(b)]	1.1 - 1.3[(b)]	-	0.066	-	-	0.049	0.038	0.032	0.034
Molybdenum	mg/L	7.6	46	-	0.036	-	-	0.040	0.042	0.041	0.042
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	0.00084	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00017	-	-	0.000088	0.000056	<0.00005	0.000075
Silicon	mg/L	-	-	-	7.2	-	-	7.9	8.3	8.6	8.5
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	-	-	<0.00001	<0.00001	<0.00002	<0.00001
Strontium	mg/L	-	-	-	0.076	-	-	0.045	0.040	0.038	0.037
Thallium	mg/L	0.00080	-	-	<0.00001	-	-	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	0.00011	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00064	-	-	0.00031	0.00020	0.00016	0.00016
Vanadium	mg/L	-	-	-	<0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	-	-	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2015-12-17	2016-01-12	2016-02-17	2016-03-16	2016-04-13	2016-05-11	2016-06-08
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.6	8.8	8.4	8.6	8.5	8.5	8.6
Specific conductivity	µS/cm	-	-	-	211	234	228	203	201	201	205
Temperature	°C	-	-	-	6.9	5.2	6.7	6.6	7.3	7.1	8.2
Conventional Parameters											
pH	mg/L	-	-	-	8.3	8.2	8.2	8.2	8.2	8.1	8.4
Specific conductivity	µS/cm	-	-	-	210	208	211	211	201	200	201
Hardness, as $CaCO_3$	mg/L	-	-	-	62	62	59	58	58	58	60
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	63	60	60	62	60	62	62
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	20	20	19	18	18	18	19
Chloride	mg/L	150	600	1,500	0.65	0.62	0.55	0.54	0.54	0.51	<0.5
Fluoride	mg/L	-	1.1 - 1.2[(b)]	3.0[(b)]	0.45	0.44	0.42	0.41	0.44	0.41	0.41
Magnesium	mg/L	-	-	-	3.2	3.2	3.0	3.0	3.0	3.0	3.1
Potassium	mg/L	-	-	-	0.35	0.31	0.29	0.29	0.34	0.29	0.45
Sodium	mg/L	-	-	-	19	19	19	18	19	18	19
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	39	39	38	38	38	38	37
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[(c)]	0.060 - 0.12[(c)]	200 - 400[(c)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.011	0.014	0.014	0.015	0.016	0.015	0.017
Dissolved phosphorus	mg-P/L	-	-	-	0.0099	0.013	0.013	0.015	0.015	0.015	0.020
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0035
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0035	0.0036	0.0035	0.0037	0.0037	0.0035	0.0038
Barium	mg/L	1.0	-	10	0.0085	0.0086	0.0080	0.0084	0.0085	0.0077	0.010
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.48	0.57	0.45	0.46	0.46	0.43	0.50
Cadmium	mg/L	0.00013 - 0.00017[(b)]	0.00029 - 0.00042[(b)]	0.0015[(b)]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[(b)]	0.034 - 0.054[(b)]	0.050[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0028	0.0034	0.0024	0.0028	0.0026	0.0027	0.0040
Manganese	mg/L	0.83 - 0.92[(b)]	1.1 - 1.3[(b)]	-	0.035	0.033	0.032	0.030	0.029	0.025	0.027
Molybdenum	mg/L	7.6	46	-	0.042	0.041	0.042	0.043	0.042	0.043	0.043
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	0.000072	0.000073	0.000071	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.6	8.7	8.6	8.5	8.6	8.7	8.5
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.038	0.036	0.035	0.035	0.036	0.034	0.041
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00018
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00018	0.00016	0.00015	0.00013	0.00013	0.00012	0.00016
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites							
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2016-07-12	2016-08-17	2016-09-15	2016-10-24	2016-11-08	2016-12-19	2017-01-16	2017-02-21
Field Measured												
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.6	**11(Mn, Mx)**	8.6	8.7	8.6	8.6	8.6	8.6
Specific conductivity	µS/cm	-	-	-	203	200	201	207	201	203	203	194
Temperature	°C	-	-	-	7.6	8.2	7.6	7.2	7.8	6.7	6.6	7.0
Conventional Parameters												
pH	mg/L	-	-	-	8.1	8.1	8.1	8.1	8.1	8.2	8.0	8.2
Specific conductivity	µS/cm	-	-	-	200	200	200	200	197	201	194	202
Hardness, as $CaCO_3$	mg/L	-	-	-	59	55	57	56	54	52	55	55
Total alkalinity, as $CaCO_3$	mg/L	20(a)	-	-	62	66	65	63	62	61	59	62
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-
Major Ions												
Calcium	mg/L	-	-	-	18	17	18	18	17	17	18	17
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	0.51	<0.5	0.52	<0.5	<0.5
Fluoride	mg/L	-	1.1 - 1.2(b)	3.0(b)	0.40	0.39	0.42	0.42	0.41	0.42	0.42	0.42
Magnesium	mg/L	-	-	-	3.1	3.1	2.9	2.9	2.9	2.7	2.6	2.9
Potassium	mg/L	-	-	-	0.39	0.43	0.47	0.42	0.36	0.36	0.39	0.37
Sodium	mg/L	-	-	-	19	19	18	19	19	18	17	19
Sulphate	mg/L	218(b)	-	2,180(b)	36	36	36	37	37	37	37	37
Nutrients												
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040(c)	0.060 - 0.12(c)	200 - 400(c)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9(d)	0.68 - 20(e)	1.3 - 19(f)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.022	0.017	0.023	0.020	<0.2	0.016	0.018	<0.02
Dissolved phosphorus	mg-P/L	-	-	-	0.022	0.019	0.020	0.023	0.019	0.016	0.018	0.018
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals												
Aluminum	mg/L	0.050(g)	0.10(g)	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0040	0.0039	0.0040	0.0039	0.0041	0.0037	0.0041	0.0039
Barium	mg/L	1.0	-	10	0.010	0.0096	0.0093	0.010	0.0093	0.0088	0.011	0.0097
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.51	0.48	0.47	0.49	0.47	0.49	0.46	0.52
Cadmium	mg/L	0.00013 - 0.00017(b)	0.00029 - 0.00042(b)	0.0015(b)	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010(h)	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	0.00011	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030(b)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054(b)	0.034 - 0.054(b)	0.050(b)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0038	0.0024	0.0033	0.0026	0.0026	0.0030	0.0030	0.0031
Manganese	mg/L	0.83 - 0.92(b)	1.1 - 1.3(b)	-	0.025	0.024	0.026	0.025	0.025	0.024	0.024	0.026
Molybdenum	mg/L	7.6	46	-	0.043	0.043	0.043	0.043	0.042	0.041	0.043	0.043
Nickel	mg/L	0.025 - 0.074(b)	-	0.25 - 0.65(b)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.000054	<0.00005	0.000052	0.000074	0.000058	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.5	8.4	8.1	8.4	8.2	7.9	7.9	8.4
Silver	mg/L	0.000050(b)	0.00010(b)	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.039	0.037	0.038	0.039	0.036	0.036	0.035	0.036
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00016	0.00014	0.00015	0.00015	0.00013	0.00010	0.00011	0.00011
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

(a) = guideline is a minimum value, unless the background concentration or value is lower.

(b) = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

(c) = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

(d) = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

(e) = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

(f) = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

(g) = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

(h) = guideline is for chromium VI.

(Mn) = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(Mx) = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

(DL>Mn) = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2017-03-20	2017-04-27	2017-05-22	2017-06-22	2017-08-22	2017-09-12	2017-10-16
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.5	8.6	8.7	8.5	8.5	8.4	8.7
Specific conductivity	µS/cm	-	-	-	199	4.9	201	199	199	199	181
Temperature	°C	-	-	-	7.6	8.4	9.0	7.9	8.6	7.8	7.2
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.1	8.1	7.8	8.1	8.0	8.1
Specific conductivity	µS/cm	-	-	-	195	200	194	199	190	187	190
Hardness, as $CaCO_3$	mg/L	-	-	-	55	52	57	52	56	51	54
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	60	62	60	61	60	61	59
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	16	18	16	17	15	17
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.1 - 1.2[b]	3.0[b]	0.41	0.42	0.42	0.41	0.42	0.41	0.40
Magnesium	mg/L	-	-	-	3.1	2.7	3.1	2.8	3.2	2.9	2.9
Potassium	mg/L	-	-	-	0.36	0.38	0.39	0.37	0.41	0.31	0.29
Sodium	mg/L	-	-	-	19	18	20	20	21	20	19
Sulphate	mg/L	218[b]	-	2,180[b]	36	36	37	37	37	36	35
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[d]	0.68 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.015	0.021	0.0084	0.016	0.020	0.018	0.014
Dissolved phosphorus	mg-P/L	-	-	-	0.018	0.018	0.018	0.019	0.017	0.017	0.015
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0051	<0.003	<0.003	<0.003	0.0046	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0038	0.0038	0.0041	0.0040	0.0041	0.0039	0.0038
Barium	mg/L	1.0	-	10	0.0096	0.010	0.0099	0.0098	0.010	0.0093	0.0090
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.54	0.45	0.50	0.50	0.55	0.53	0.46
Cadmium	mg/L	0.00013 - 0.00017[b]	0.00029 - 0.00042[b]	0.0015[b]	<0.000015	<0.000015	<0.00002	<0.000005	<0.000007	<0.00002	<0.00002
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[b]	0.034 - 0.054[b]	0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0028	0.0034	0.0035	0.0029	0.0031	0.0025	0.0033
Manganese	mg/L	0.83 - 0.92[b]	1.1 - 1.3[b]	-	0.026	0.026	0.027	0.025	0.027	0.027	0.025
Molybdenum	mg/L	7.6	46	-	0.047	0.046	0.050	0.043	0.043	0.042	0.044
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	0.000099	0.000053	<0.00005	<0.00005	<0.00005	0.000062
Silicon	mg/L	-	-	-	8.4	8.2	8.4	8.7	8.3	8.4	8.4
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.036	0.036	0.040	0.034	0.037	0.033	0.033
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00011	0.00013	0.00013	0.00011	0.00010	0.00010	0.000099
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2017-11-16	2017-12-13	2018-01-17	2018-02-27	2018-03-20	2018-04-09	2018-05-30
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	8.4	8.6	8.6	8.6	8.7	8.5
Specific conductivity	µS/cm	-	-	-	-	198	198	198	195	215	212
Temperature	°C	-	-	-	-	6.5	6.4	6.6	6.6	2.6	8.7
Conventional Parameters											
pH	mg/L	-	-	-	8.0	8.1	8.0	8.2	8.0	7.9	8.2
Specific conductivity	µS/cm	-	-	-	197	199	191	193	191	196	197
Hardness, as $CaCO_3$	mg/L	-	-	-	57	55	53	56	61	52	52
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	61	59	61	59	59	59	60
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	17	17	17	19	17	16
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.1 - 1.2[(b)]	3.0[(b)]	0.42	0.42	0.41	0.41	0.41	0.40	0.41
Magnesium	mg/L	-	-	-	3.3	3.0	2.7	3.0	3.2	2.7	2.8
Potassium	mg/L	-	-	-	0.32	0.27	0.26	0.28	0.24	0.21	0.30
Sodium	mg/L	-	-	-	21	20	18	20	19	19	19
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	36	36	35	36	36	35	36
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[(c)]	0.060 - 0.12[(c)]	200 - 400[(c)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0051
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.016	0.014	0.013	0.016	0.017	0.014	0.018
Dissolved phosphorus	mg-P/L	-	-	-	0.017	0.015	0.016	0.016	0.016	0.011	0.015
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0040	0.0039	0.0038	0.0041	0.0038	0.0040	0.0040
Barium	mg/L	1.0	-	10	0.011	0.0096	0.0090	0.0096	0.0089	0.0081	0.0097
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.52	0.52	0.50	0.52	0.54	0.51	0.52
Cadmium	mg/L	0.00013 - 0.00017[(b)]	0.00029 - 0.00042[(b)]	0.0015[(b)]	<0.000005	0.000017	0.0000068	<0.000015	<0.00003	<0.00002	<0.00004
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[(b)]	0.034 - 0.054[(b)]	0.050[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0029	0.0022	0.0026	0.0021	0.0022	0.0024	0.0030
Manganese	mg/L	0.83 - 0.92[(b)]	1.1 - 1.3[(b)]	-	0.029	0.028	0.025	0.027	0.025	0.025	0.026
Molybdenum	mg/L	7.6	46	-	0.048	0.044	0.042	0.041	0.045	0.046	0.047
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.9	8.4	8.6	8.7	8.0	8.7	8.6
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.037	0.036	0.032	0.037	0.034	0.031	0.035
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000061	0.000088	0.000082	0.000087	0.000082	0.000071	0.000075
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2018-06-19	2018-07-12	2018-08-22	2018-09-25	2018-10-24	2018-11-13	2019-02-27
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.3	8.6	8.2	8.6	8.5	8.5	8.5
Specific conductivity	µS/cm	-	-	-	210	198	202	197	197	193	192
Temperature	°C	-	-	-	9.8	8.6	10	7.5	7.4	7.5	6.4
Conventional Parameters											
pH	mg/L	-	-	-	8.0	8.1	8.2	8.1	8.2	8.1	8.2
Specific conductivity	µS/cm	-	-	-	192	187	194	190	200	187	188
Hardness, as $CaCO_3$	mg/L	-	-	-	56	54	52	54	55	51	50
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	58	59	59	60	62	58	59
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	17	17	16	17	17	16	16
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.1 - 1.2[b]	3.0[b]	0.43	0.44	0.41	0.41	0.40	0.41	0.41
Magnesium	mg/L	-	-	-	3.1	3.0	3.0	2.9	3.0	2.9	2.8
Potassium	mg/L	-	-	-	0.26	0.24	0.40	0.29	0.25	0.17	0.16
Sodium	mg/L	-	-	-	20	20	20	18	19	19	18
Sulphate	mg/L	218[b]	-	2,180[b]	36	36	36	36	36	35	36
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[d]	0.68 - 20[e]	1.3 - 19[f]	<0.005	<0.005	<0.005	<0.005	0.015	0.0088	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.014	0.018	0.018	0.020	0.016	0.011	0.016
Dissolved phosphorus	mg-P/L	-	-	-	0.014	0.016	0.017	0.018	0.017	0.012	0.010
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0040	0.0039	0.0038	0.0037	0.0039	0.0038	0.0039
Barium	mg/L	1.0	-	10	0.0094	0.0093	0.010	0.010	0.0093	0.0077	0.0077
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.50	0.45	0.46	0.52	0.56	0.50	0.50
Cadmium	mg/L	0.00013 - 0.00017[b]	0.00029 - 0.00042[b]	0.0015[b]	0.000012	<0.00002	<0.000015	<0.00001	<0.00002	<0.000015	<0.000015
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[b]	0.034 - 0.054[b]	0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0027	0.0025	0.0030	0.0027	0.0026	0.0022	0.0022
Manganese	mg/L	0.83 - 0.92[b]	1.1 - 1.3[b]	-	0.027	0.026	0.027	0.027	0.026	0.024	0.023
Molybdenum	mg/L	7.6	46	-	0.048	0.043	0.045	0.048	0.047	0.044	0.044
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	9.0	8.4	8.4	8.2	8.4	8.4	8.1
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.034	0.032	0.036	0.034	0.034	0.031	0.032
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.000072	0.000074	0.00010	0.000097	0.000083	0.000052	0.000051
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

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[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2019-06-05	2019-08-21	2019-11-20	2020-02-25	2020-05-11	2020-08-24	2020-11-03
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.9	8.5	8.6	8.4	-	-	-
Specific conductivity	µS/cm	-	-	-	181	195	190	190	-	-	-
Temperature	°C	-	-	-	7.5	8.7	7.5	7.3	-	-	-
Conventional Parameters											
pH	mg/L	-	-	-	7.9	8.1	8.0	8.0	8.0	8.1	8.1
Specific conductivity	µS/cm	-	-	-	200	194	193	188	194	193	202
Hardness, as $CaCO_3$	mg/L	-	-	-	53	53	53	54	53	57	55
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	66	58	57	58	62	57	60
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	0.14	-	<0.1	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	16	17	17	17	17	18	17
Chloride	mg/L	150	600	1,500	0.59	<0.5	<0.5	<0.5	<0.5	<0.5	0.93
Fluoride	mg/L	-	1.1 - 1.2[(b)]	3.0[(b)]	0.42	0.38	0.41	0.40	0.40	0.40	0.40
Magnesium	mg/L	-	-	-	3.0	2.8	2.8	2.9	2.9	2.9	2.9
Potassium	mg/L	-	-	-	0.67	0.13	0.15	0.13	0.14	0.14	0.52
Sodium	mg/L	-	-	-	21	19	18	20	18	18	20
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	37	36	36	36	36	35	37
Nutrients											
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	0.0050	<0.005	<0.005
Nitrite	mg-N/L	0.020 - 0.040[(c)]	0.060 - 0.12[(c)]	200 - 400[(c)]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.05	<0.0051	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	<0.005	<0.005	<0.005	<0.005	0.0089	<0.005	0.011
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	0.056	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.028	0.0088	0.010	0.0087	0.0072	0.0086	0.025
Dissolved phosphorus	mg-P/L	-	-	-	0.028	0.0091	0.010	0.0084	0.015	0.0078	0.030
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	0.0031	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0035	0.0042	0.0040	0.0042	0.0042	0.0042	0.0036
Barium	mg/L	1.0	-	10	0.013	0.0075	0.0078	0.0067	0.0069	0.0074	0.012
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.001[(DL>Mn)]	<0.001[(DL>Mn)]	<0.001[(DL>Mn)]	<0.001[(DL>Mn)]
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.47	0.55	0.53	0.53	0.49	0.54	0.53
Cadmium	mg/L	0.00013 - 0.00017[(b)]	0.00029 - 0.00042[(b)]	0.0015[(b)]	<0.00003	<0.00002	<0.00002	<0.000015	<0.000015	<0.000015	<0.00003
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[(b)]	0.034 - 0.054[(b)]	0.050[(b)]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0040	0.0024	0.0024	0.0022	0.0022	0.0023	0.0035
Manganese	mg/L	0.83 - 0.92[(b)]	1.1 - 1.3[(b)]	-	0.024	0.023	0.024	0.023	0.022	0.022	0.025
Molybdenum	mg/L	7.6	46	-	0.045	0.047	0.045	0.046	0.045	0.044	0.047
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000068	0.00014
Silicon	mg/L	-	-	-	8.4	8.4	9.5	8.4	8.4	8.4	7.9
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.050	0.032	0.031	0.030	0.029	0.029	0.042
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00014	0.000046	0.000047	0.000035	0.000036	0.000040	0.00015
Vanadium	mg/L	-	-	-	<0.0005	0.00053	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a	GW15-2a
		30-day mean	Maximum		2021-02-16	2021-05-03	2021-08-16	2021-12-01	2022-02-28	2022-06-07
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.7	8.8	8.8	8.5	8.6	8.7
Specific conductivity	µS/cm	-	-	-	157	203	214	208	200	205
Temperature	°C	-	-	-	6.4	6.8	7.1	6.1	6.1	5.3
Conventional Parameters										
pH	mg/L	-	-	-	8.2	8.2	8.2	8.1	7.9	8.1
Specific conductivity	µS/cm	-	-	-	205	201	200	171	203	209
Hardness, as $CaCO_3$	mg/L	-	-	-	61	53	56	54	57	55
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	60	69	65	62	63	67
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	19	16	17	17	18	17
Chloride	mg/L	150	600	1,500	0.77	0.70	0.66	0.61	0.66	0.71
Fluoride	mg/L	-	1.1 - 1.2[b]	3.0[b]	0.43	0.42	0.42	0.35	0.42	0.42
Magnesium	mg/L	-	-	-	3.4	3.1	2.9	2.9	3.1	3.1
Potassium	mg/L	-	-	-	1.0	1.2	0.98	0.69	0.80	0.71
Sodium	mg/L	-	-	-	21	21	21	21	23	21
Sulphate	mg/L	218[b]	-	2,180[b]	38	39	37	37	38	38
Nutrients										
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	0.038	0.037	<0.005
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	0.038	0.037	<0.0051
Total ammonia	mg-N/L	0.13 - 1.9[d]	0.68 - 20[e]	1.3 - 19[f]	<0.005	<0.005	0.011	0.0055	<0.005	0.011
Total nitrogen	mg-N/L	-	-	-	0.058	<0.03	<0.03	<0.05	0.044	0.036
Total phosphorus	mg-P/L	-	-	-	0.025	0.019	0.032	0.015	0.031	0.039
Dissolved phosphorus	mg-P/L	-	-	-	0.021	0.021	0.025	0.013	0.033	0.045
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	0.0032	<0.003	0.0031	0.0037	0.0048	0.0047
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0037	0.0038	0.0035	0.0039	0.0043	0.0034
Barium	mg/L	1.0	-	10	0.013	0.014	0.014	0.012	0.014	0.015
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.56	0.53	0.55	0.52	0.49	0.49
Cadmium	mg/L	0.00013 - 0.00017[b]	0.00029 - 0.00042[b]	0.0015[b]	<0.000015	<0.000015	<0.00001	0.000013	0.000017	<0.00001
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.030[b]	<0.0005	<0.0005	<0.0005	0.00088	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[b]	0.034 - 0.054[b]	0.050[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0062	0.0072	0.0057	0.0043	0.0046	0.0048
Manganese	mg/L	0.83 - 0.92[b]	1.1 - 1.3[b]	-	0.0089	0.026	0.035	0.00050	0.020	0.065
Molybdenum	mg/L	7.6	46	-	0.045	0.046	0.049	0.047	0.049	0.048
Nickel	mg/L	0.025 - 0.074[b]	-	0.25 - 0.65[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.000063	0.000055	<0.00005	<0.00005	0.000064	<0.00005
Silicon	mg/L	-	-	-	8.5	8.6	8.3	8.5	8.7	8.5
Silver	mg/L	0.000050[b]	0.00010[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.057	0.062	0.054	0.046	0.048	0.052
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	0.00014	<0.0001	<0.0001	0.00010	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00012	0.00012	0.00015	0.00011	0.00014	0.00018
Vanadium	mg/L	-	-	-	0.00079	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	0.0050	0.0036	<0.003	0.0030	0.0035	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2a

Parameter	Unit	Guidelines for the protection of:			Sampling Sites	
		Aquatic Life		BC CSR WQG	GW15-2a	GW15-2a
		30-day mean	Maximum		2022-08-10	2022-11-16
Field Measured						
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.7	8.4
Specific conductivity	µS/cm	-	-	-	208	208
Temperature	°C	-	-	-	7.3	5.2
Conventional Parameters						
pH	mg/L	-	-	-	8.1	8.1
Specific conductivity	µS/cm	-	-	-	201	207
Hardness, as $CaCO_3$	mg/L	-	-	-	57	58
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	66	64
Total suspended solids	mg/L	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-
Major Ions						
Calcium	mg/L	-	-	-	18	18
Chloride	mg/L	150	600	1,500	0.78	0.74
Fluoride	mg/L	-	1.1 - 1.2[(b)]	3.0[(b)]	0.43	0.40
Magnesium	mg/L	-	-	-	3.1	3.2
Potassium	mg/L	-	-	-	0.72	0.81
Sodium	mg/L	-	-	-	21	19
Sulphate	mg/L	218[(b)]	-	2,180[(b)]	38	38
Nutrients						
Nitrate	mg-N/L	3.0	33	400	<0.005	0.042
Nitrite	mg-N/L	0.020 - 0.040[(c)]	0.060 - 0.12[(c)]	200 - 400[(c)]	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	0.042
Total ammonia	mg-N/L	0.13 - 1.9[(d)]	0.68 - 20[(e)]	1.3 - 19[(f)]	0.012	0.022
Total nitrogen	mg-N/L	-	-	-	0.040	0.20
Total phosphorus	mg-P/L	-	-	-	0.050	0.061
Dissolved phosphorus	mg-P/L	-	-	-	0.051	0.044
Orthophosphate	mg-P/L	-	-	-	-	-
Dissolved Metals						
Aluminum	mg/L	0.050[(g)]	0.10[(g)]	-	0.0050	0.0059
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0033	0.0031
Barium	mg/L	1.0	-	10	0.018	0.017
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.54	0.50
Cadmium	mg/L	0.00013 - 0.00017[(b)]	0.00029 - 0.00042[(b)]	0.0015[(b)]	<0.00001	<0.00001
Chromium	mg/L	0.0010[(h)]	-	0.010	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	0.00013
Copper	mg/L	-	-	0.030[(b)]	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03
Lead	mg/L	0.0046 - 0.0054[(b)]	0.034 - 0.054[(b)]	0.050[(b)]	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0044	0.0041
Manganese	mg/L	0.83 - 0.92[(b)]	1.1 - 1.3[(b)]	-	0.077	0.020
Molybdenum	mg/L	7.6	46	-	0.048	0.046
Nickel	mg/L	0.025 - 0.074[(b)]	-	0.25 - 0.65[(b)]	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005
Silicon	mg/L	-	-	-	8.3	8.2
Silver	mg/L	0.000050[(b)]	0.00010[(b)]	-	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.049	0.054
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00018	0.00017
Vanadium	mg/L	-	-	-	<0.0005	<0.0005
Zinc	mg/L	0.0075	0.033	0.075	<0.003	**0.0099**[(Mn)]

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (50 to 72 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 2.3200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(d)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.13 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.68 mg-N/L) is based on the combination of field pH (10.5) and water temperature (8.2°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(g)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 10.5). The guideline is calculated based on the individual pH for each sample.

[(h)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(Mx)] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2015-06-10	2015-07-27	2015-09-03	2015-09-08	2015-09-09	2015-09-29	2015-10-21
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.4	-	8.0	7.1	8.1	8.0	7.9
Specific conductivity	µS/cm	-	-	-	589	-	340	342	339	342	347
Temperature	°C	-	-	-	8.1	-	6.8	6.9	7.2	7.2	6.7
Conventional Parameters											
pH	mg/L	-	-	-	-	8.1	-	-	8.1	8.0	8.1
Specific conductivity	µS/cm	-	-	-	-	344	-	-	333	340	344
Hardness, as $CaCO_3$	mg/L	-	-	-	-	134	-	-	-	127	135
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	81	-	-	82	83	83
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	-	44	-	-	42	42	44
Chloride	mg/L	150	600	1,500	-	10	-	-	9.8	10	10
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	-	0.28	-	-	0.26	0.27	0.27
Magnesium	mg/L	-	-	-	-	6.0	-	-	5.8	5.7	6.0
Potassium	mg/L	-	-	-	-	0.84	-	-	0.54	0.48	0.43
Sodium	mg/L	-	-	-	-	23	-	-	21	22	20
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	-	73	-	-	68	69	70
Nutrients											
Nitrate	mg-N/L	3.0	33	400	-	0.023	-	-	0.14	0.10	0.23
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	-	0.0021	-	-	0.0065	0.0046	0.0092
Nitrate + nitrite	mg-N/L	-	-	-	-	0.025	-	-	0.15	0.11	0.24
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	-	<0.005	-	-	<0.005	0.0069	0.0061
Total nitrogen	mg-N/L	-	-	-	-	0.14	-	-	0.18	0.16	0.29
Total phosphorus	mg-P/L	-	-	-	-	0.016	-	-	0.012	0.012	0.011
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0079	-	-	0.0085	0.011	0.012
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	-	0.0038	-	-	0.0035	0.0032	<0.003
Antimony	mg/L	0.0090	-	0.090	-	0.00013	-	-	0.00010	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	-	0.0027	-	-	0.0026	0.0029	0.0026
Barium	mg/L	1.0	-	10	-	0.028	-	-	0.028	0.028	0.027
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	-	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	-	<0.00005	-	-	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	-	0.29	-	-	0.28	0.29	0.29
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	-	<0.000005	-	-	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	-	0.00066	-	-	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	-	0.00020	-	-	0.00012	0.00013	0.00011
Copper	mg/L	-	-	0.060 - 0.090[b]	-	<0.0005	-	-	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	-	<0.03	-	-	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	-	<0.00005	-	-	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	-	0.0037	-	-	0.0032	0.0035	0.0037
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	-	0.095	-	-	0.086	0.082	0.077
Molybdenum	mg/L	7.6	46	-	-	0.041	-	-	0.042	0.043	0.044
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	-	0.00066	-	-	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	-	0.00015	-	-	0.00013	0.000084	0.00012
Silicon	mg/L	-	-	-	-	6.4	-	-	6.6	6.6	6.7
Silver	mg/L	0.0015[b]	0.0030[b]	-	-	<0.00001	-	-	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	-	0.14	-	-	0.13	0.14	0.14
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	-	0.000018	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	<0.0001	-	-	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	-	<0.01	-	-	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	-	0.00054	-	-	0.00034	0.00030	0.00028
Vanadium	mg/L	-	-	-	-	<0.0005	-	-	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	-	<0.003	-	-	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2015-11-17	2015-12-17	2016-01-12	2016-02-17	2016-03-16	2016-04-13	2016-05-11
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.1	8.3	8.7	8.1	8.2	8.2	8.2
Specific conductivity	µS/cm	-	-	-	359	359	407	411	373	379	390
Temperature	°C	-	-	-	5.1	5.8	3.3	5.8	6.0	6.2	6.4
Conventional Parameters											
pH	mg/L	-	-	-	8.0	8.1	8.0	8.1	8.2	8.0	8.1
Specific conductivity	µS/cm	-	-	-	358	364	366	380	385	379	384
Hardness, as $CaCO_3$	mg/L	-	-	-	140	143	142	140	146	153	160
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	85	84	83	84	88	85	89
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	46	47	46	46	48	50	52
Chloride	mg/L	150	600	1,500	11	11	11	11	11	11	11
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.26	0.26	0.26	0.24	0.23	0.24	0.22
Magnesium	mg/L	-	-	-	6.4	6.4	6.5	6.5	6.5	6.7	7.1
Potassium	mg/L	-	-	-	0.44	0.42	0.91	0.39	0.41	0.41	0.41
Sodium	mg/L	-	-	-	21	20	20	20	19	21	20
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	73	78	78	79	79	82	84
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.44	0.57	0.59	0.63	0.75	0.95	1.0
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.016	0.020	0.019	0.019	0.013	0.023	0.023
Nitrate + nitrite	mg-N/L	-	-	-	0.46	0.59	0.61	0.65	0.76	0.98	1.0
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	0.0069	0.0072	0.0057	0.0081	0.0071	<0.005	0.0078
Total nitrogen	mg-N/L	-	-	-	0.46	0.57	0.68	0.68	0.80	0.99	1.1
Total phosphorus	mg-P/L	-	-	-	0.011	0.011	0.018	0.013	0.017	0.012	0.016
Dissolved phosphorus	mg-P/L	-	-	-	0.011	0.013	0.011	0.011	0.012	0.0091	0.0098
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	0.00010	0.00012	0.00013
Arsenic	mg/L	-	0.0050	0.050	0.0024	0.0024	0.0024	0.0022	0.0022	0.0021	0.0019
Barium	mg/L	1.0	-	10	0.030	0.031	0.033	0.033	0.034	0.036	0.035
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.27	0.22	0.29	0.22	0.23	0.23	0.21
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0028	0.0025	0.0038	0.0027	0.0032	0.0029	0.0030
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.075	0.075	0.073	0.072	0.068	0.063	0.060
Molybdenum	mg/L	7.6	46	-	0.044	0.038	0.042	0.043	0.044	0.041	0.043
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00019	0.00019	0.00024	0.00026	0.00023	0.00026	0.00029
Silicon	mg/L	-	-	-	6.7	6.7	6.8	6.8	6.6	6.8	6.9
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.14	0.13	0.15	0.15	0.16	0.15	0.16
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00028	0.00026	0.00028	0.00028	0.00027	0.00028	0.00028
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2016-06-08	2016-07-12	2016-08-17	2016-09-15	2016-10-24	2016-11-08	2016-12-19
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.2	8.2	8.0	8.2	8.2	8.2	8.3
Specific conductivity	µS/cm	-	-	-	401	397	387	386	382	373	364
Temperature	°C	-	-	-	8.1	7.3	7.3	7.0	6.6	2.2	5.9
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.0	8.1	8.1	8.1	8.1	8.1
Specific conductivity	µS/cm	-	-	-	386	386	384	375	368	358	353
Hardness, as $CaCO_3$	mg/L	-	-	-	160	155	143	142	138	133	125
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	90	91	96	95	90	91	87
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	52	50	46	46	45	43	40
Chloride	mg/L	150	600	1,500	11	10	9.8	10	10	10	10
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.22	0.22	0.21	0.23	0.23	0.22	0.23
Magnesium	mg/L	-	-	-	7.3	7.3	6.9	6.8	6.5	6.4	6.1
Potassium	mg/L	-	-	-	0.46	1.2	0.50	0.55	0.44	0.43	0.44
Sodium	mg/L	-	-	-	21	20	20	20	20	20	20
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	85	83	82	83	81	80	75
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.96	0.81	0.70	0.65	0.50	0.44	0.30
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.026	0.016	0.014	0.015	0.013	0.012	0.0032
Nitrate + nitrite	mg-N/L	-	-	-	0.99	0.82	0.71	0.66	0.51	0.45	0.30
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	0.0072	0.0063	0.0088	0.0094	0.0088	0.0081	0.0061
Total nitrogen	mg-N/L	-	-	-	1.0	0.86	0.74	0.68	0.51	0.50	0.36
Total phosphorus	mg-P/L	-	-	-	0.010	0.013	0.0077	0.012	0.013	<0.2	0.013
Dissolved phosphorus	mg-P/L	-	-	-	0.0071	0.0094	0.0076	0.0077	0.013	0.010	0.0098
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00014	0.00015	0.00014	0.00014	0.00014	0.00014	0.00013
Arsenic	mg/L	-	0.0050	0.050	0.0021	0.0021	0.0020	0.0021	0.0020	0.0022	0.0024
Barium	mg/L	1.0	-	10	0.041	0.041	0.041	0.041	0.039	0.038	0.037
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.23	0.24	0.22	0.22	0.23	0.23	0.24
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	0.00050	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0034	0.0040	0.0022	0.0033	0.0027	0.0027	0.0030
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.057	0.054	0.056	0.057	0.055	0.055	0.059
Molybdenum	mg/L	7.6	46	-	0.044	0.044	0.044	0.044	0.045	0.044	0.042
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	0.00054	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00034	0.00030	0.00035	0.00034	0.00031	0.00038	0.00024
Silicon	mg/L	-	-	-	7.0	6.9	6.7	6.6	6.6	6.5	5.4
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.17	0.17	0.16	0.17	0.16	0.16	0.15
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	0.00021	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00029	0.00033	0.00029	0.00031	0.00029	0.00029	0.00025
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2017-01-16	2017-02-21	2017-04-03	2017-04-27	2017-05-22	2017-06-22	2017-08-22
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.2	8.1	-	8.2	8.2	8.1	8.1
Specific conductivity	µS/cm	-	-	-	353	353	-	360	363	384	408
Temperature	°C	-	-	-	5.9	6.1	-	8.4	8.8	7.7	9.7
Conventional Parameters											
pH	mg/L	-	-	-	8.1	8.1	8.1	8.2	8.1	8.2	8.1
Specific conductivity	µS/cm	-	-	-	342	351	356	349	347	377	389
Hardness, as $CaCO_3$	mg/L	-	-	-	131	135	139	127	136	141	164
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	82	87	87	84	83	86	87
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	43	44	45	41	43	46	52
Chloride	mg/L	150	600	1,500	9.8	10	11	9.6	10	11	12
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.23	0.23	0.21	0.23	0.23	0.22	0.21
Magnesium	mg/L	-	-	-	5.7	6.3	6.9	6.0	7.1	6.5	8.2
Potassium	mg/L	-	-	-	0.39	0.36	0.37	0.31	0.34	0.33	0.39
Sodium	mg/L	-	-	-	18	20	20	18	21	20	22
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	73	76	80	73	77	85	94
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.26	0.35	0.34	0.25	0.35	0.48	0.56
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.0079	0.018	0.019	0.014	0.020	0.025	0.032
Nitrate + nitrite	mg-N/L	-	-	-	0.27	0.36	0.36	0.26	0.37	0.50	0.59
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	<0.005	<0.005	0.0078	0.0072	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.30	0.37	0.38	0.71	0.39	0.51	0.59
Total phosphorus	mg-P/L	-	-	-	0.012	<0.02	0.012	0.014	0.0083	0.0074	0.0076
Dissolved phosphorus	mg-P/L	-	-	-	0.011	0.010	0.0098	0.011	0.0096	0.0090	<0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00012	0.00012	0.00013	0.00014	0.00013	0.00010	0.00014
Arsenic	mg/L	-	0.0050	0.050	0.0024	0.0022	0.0022	0.0022	0.0025	0.0023	0.0021
Barium	mg/L	1.0	-	10	0.040	0.038	0.042	0.039	0.038	0.040	0.044
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.23	0.25	0.24	0.23	0.26	0.23	0.25
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.000005	<0.000005	<0.00001	<0.00001	<0.00002	<0.000005	<0.000015
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0030	0.0030	0.0025	0.0031	0.0033	0.0027	0.0031
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.053	0.056	0.058	0.052	0.056	0.052	0.057
Molybdenum	mg/L	7.6	46	-	0.045	0.044	0.044	0.046	0.049	0.042	0.042
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00029	0.00034	0.00039	0.00038	0.00035	0.00035	0.00055
Silicon	mg/L	-	-	-	6.4	6.7	6.6	6.7	6.7	6.7	6.9
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.14	0.15	0.15	0.14	0.16	0.16	0.18
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00024	0.00025	0.00025	0.00028	0.00027	0.00025	0.00029
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2017-09-12	2017-10-17	2017-11-19	2017-12-13	2018-01-17	2018-02-27	2018-04-09
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.1	8.6	-	8.0	8.2	-	8.1
Specific conductivity	µS/cm	-	-	-	415	380	-	421	421	418	425
Temperature	°C	-	-	-	7.1	6.3	-	6.0	5.5	5.9	7.3
Conventional Parameters											
pH	mg/L	-	-	-	8.2	8.1	8.1	8.1	8.1	8.2	8.2
Specific conductivity	µS/cm	-	-	-	390	394	395	417	407	405	406
Hardness, as $CaCO_3$	mg/L	-	-	-	149	161	173	164	157	165	157
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	89	90	87	88	91	88	88
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	47	52	56	53	51	54	51
Chloride	mg/L	150	600	1,500	12	11	12	12	12	12	12
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.20	0.20	0.22	0.21	0.21	0.20	0.20
Magnesium	mg/L	-	-	-	7.6	7.7	8.3	7.8	7.2	7.7	7.4
Potassium	mg/L	-	-	-	0.35	0.36	0.33	0.38	0.43	0.40	0.35
Sodium	mg/L	-	-	-	20	20	20	21	20	21	21
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	94	95	98	97	98	98	96
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.54	0.52	0.49	0.38	0.32	0.31	0.37
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.030	0.031	0.033	0.030	0.030	0.030	0.032
Nitrate + nitrite	mg-N/L	-	-	-	0.57	0.55	0.52	0.41	0.35	0.34	0.40
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.58	0.60	0.54	0.40	0.36	0.35	0.41
Total phosphorus	mg-P/L	-	-	-	0.0052	0.0066	0.0072	0.0064	0.0086	0.0090	0.0075
Dissolved phosphorus	mg-P/L	-	-	-	0.0080	0.0078	0.0064	0.0071	0.0092	0.0085	0.0067
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	0.0039	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00012	0.00015	0.00013	0.00014	0.00013	0.00013	0.00013
Arsenic	mg/L	-	0.0050	0.050	0.0022	0.0021	0.0020	0.0020	0.0019	0.0021	0.0023
Barium	mg/L	1.0	-	10	0.044	0.044	0.047	0.047	0.047	0.051	0.047
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.25	0.22	0.24	0.23	0.23	0.22	0.22
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	0.000013	<0.00002	<0.00003	0.000019	0.0000095	<0.000015	<0.00002
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0028	0.0039	0.0029	0.0025	0.0032	0.0026	0.0029
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.055	0.053	0.052	0.054	0.055	0.055	0.050
Molybdenum	mg/L	7.6	46	-	0.041	0.042	0.042	0.042	0.039	0.038	0.043
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00053	0.00056	0.00057	0.00049	0.00063	0.00066	0.00062
Silicon	mg/L	-	-	-	6.7	6.9	6.6	6.3	6.3	6.6	6.8
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.17	0.18	0.18	0.19	0.17	0.20	0.18
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00029	0.00031	0.00027	0.00028	0.00030	0.00028	0.00028
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2018-05-30	2018-06-19	2018-07-12	2018-08-22	2018-09-30	2018-10-24	2018-11-13
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.1	7.9	8.1	8.1	8.1	8.0	8.1
Specific conductivity	µS/cm	-	-	-	453	464	441	452	421	439	436
Temperature	°C	-	-	-	7.5	11	7.9	9.7	6.2	6.9	6.5
Conventional Parameters											
pH	mg/L	-	-	-	8.2	8.2	8.2	8.1	8.2	8.2	8.2
Specific conductivity	µS/cm	-	-	-	400	417	411	413	431	435	428
Hardness, as $CaCO_3$	mg/L	-	-	-	151	175	165	167	165	169	170
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	89	90	92	90	98	104	99
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	48	56	54	53	52	54	53
Chloride	mg/L	150	600	1,500	12	12	12	11	11	10	10
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.21	0.22	0.22	0.20	0.21	0.19	0.20
Magnesium	mg/L	-	-	-	7.3	8.6	7.6	8.5	8.4	8.5	8.9
Potassium	mg/L	-	-	-	0.39	0.39	0.34	0.42	0.45	0.36	0.33
Sodium	mg/L	-	-	-	21	22	20	21	21	21	21
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	93	99	101	102	100	101	101
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.27	0.47	0.59	0.44	0.25	0.42	0.43
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.023	0.031	0.037	0.033	0.028	0.029	0.029
Nitrate + nitrite	mg-N/L	-	-	-	0.29	0.50	0.62	0.48	0.28	0.44	0.46
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	<0.005	<0.005	<0.005	<0.005	0.0066	0.031	0.014
Total nitrogen	mg-N/L	-	-	-	0.27	0.50	0.60	0.52	0.33	0.47	0.49
Total phosphorus	mg-P/L	-	-	-	0.011	0.0082	0.0083	0.0096	0.016	0.0062	0.0057
Dissolved phosphorus	mg-P/L	-	-	-	0.0077	0.0070	0.0061	0.0077	0.0041	0.0063	0.0056
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00012	0.00013	0.00012	0.00013	0.00012	0.00012	0.00015
Arsenic	mg/L	-	0.0050	0.050	0.0023	0.0022	0.0020	0.0020	0.0019	0.0021	0.0021
Barium	mg/L	1.0	-	10	0.048	0.052	0.048	0.050	0.051	0.053	0.051
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.24	0.21	0.20	0.20	0.22	0.22	0.21
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.00003	0.000013	<0.000015	<0.000015	0.000015	<0.00003	<0.000015
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0031	0.0030	0.0030	0.0031	0.0032	0.0030	0.0029
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.053	0.056	0.050	0.054	0.059	0.051	0.054
Molybdenum	mg/L	7.6	46	-	0.044	0.044	0.040	0.042	0.041	0.045	0.045
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	0.00084	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00050	0.00052	0.00063	0.00064	0.00056	0.00070	0.00064
Silicon	mg/L	-	-	-	6.6	6.9	6.4	6.4	6.4	6.6	6.8
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.18	0.20	0.18	0.19	0.19	0.20	0.21
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00026	0.00029	0.00027	0.00031	0.00032	0.00033	0.00034
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2019-02-27	2019-06-05	2019-08-21	2019-11-20	2020-02-25	2020-05-11	2020-08-24
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.1	8.2	8.1	8.1	8.0	-	-
Specific conductivity	µS/cm	-	-	-	438	410	456	440	465	-	-
Temperature	°C	-	-	-	6.0	7.0	9.5	6.7	6.3	-	-
Conventional Parameters											
pH	mg/L	-	-	-	8.0	8.2	8.3	8.2	8.0	8.2	8.1
Specific conductivity	µS/cm	-	-	-	417	443	455	454	464	465	448
Hardness, as $CaCO_3$	mg/L	-	-	-	170	176	190	177	200	193	185
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	97	104	109	107	112	106	88
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	0.19	-	0.22	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	56	56	61	56	64	62	60
Chloride	mg/L	150	600	1,500	9.6	10	9.6	10	10	11	12
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.20	0.20	0.18	0.19	0.18	0.17	0.18
Magnesium	mg/L	-	-	-	7.7	8.8	8.9	9.0	9.8	9.5	8.2
Potassium	mg/L	-	-	-	0.29	0.38	0.28	0.31	0.33	0.34	0.32
Sodium	mg/L	-	-	-	19	20	21	20	22	21	19
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	102	109	111	112	117	116	113
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.33	0.23	0.36	0.39	0.43	0.21	0.13
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.031	0.028	0.026	0.030	0.033	0.024	0.014
Nitrate + nitrite	mg-N/L	-	-	-	0.36	0.26	0.39	0.42	0.46	0.24	0.15
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	0.0069	<0.005
Total nitrogen	mg-N/L	-	-	-	0.37	0.28	0.39	0.42	0.44	0.26	0.18
Total phosphorus	mg-P/L	-	-	-	0.017	0.0090	0.0042	0.0048	0.0081	0.0030	0.0086
Dissolved phosphorus	mg-P/L	-	-	-	0.0062	0.0084	0.0051	0.0048	0.0052	0.013	0.0040
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	0.00011	0.00014	0.00010	<0.0001	<0.0001	0.00011	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0020	0.0019	0.0022	0.0022	0.0021	0.0021	0.0022
Barium	mg/L	1.0	-	10	0.054	0.054	0.055	0.058	0.056	0.058	0.059
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.19	0.19	0.20	0.19	0.19	0.17	0.20
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.00002	<0.000035	<0.00002	<0.00002	<0.000015	<0.00002	<0.00002
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	<0.0005	<0.0005	0.00058	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0027	0.0029	0.0030	0.0030	0.0031	0.0029	0.0029
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.045	0.045	0.049	0.050	0.052	0.049	0.039
Molybdenum	mg/L	7.6	46	-	0.043	0.043	0.046	0.043	0.043	0.043	0.041
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00073	0.0011	0.00086	0.00085	0.00099	0.00092	0.00080
Silicon	mg/L	-	-	-	6.2	6.7	6.5	7.3	6.7	6.6	6.4
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.20	0.20	0.22	0.21	0.22	0.22	0.20
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	0.00025	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00035	0.00034	0.00035	0.00042	0.00041	0.00039	0.00031
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b	GW15-2b
		30-day mean	Maximum		2020-11-03	2021-02-16	2021-05-03	2021-08-16	2021-12-01	2022-06-07
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	7.9	8.0	7.9	8.0	7.9
Specific conductivity	µS/cm	-	-	-	-	322	437	465	457	3.2
Temperature	°C	-	-	-	-	5.9	6.8	7.8	6.1	5.3
Conventional Parameters										
pH	mg/L	-	-	-	8.1	8.1	8.2	8.1	7.9	8.2
Specific conductivity	µS/cm	-	-	-	437	425	424	442	382	459
Hardness, as $CaCO_3$	mg/L	-	-	-	177	288	167	184	182	185
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	85	82	93	91	93	97
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	56	76	53	59	59	58
Chloride	mg/L	150	600	1,500	13	12	11	10	9.3	10
Fluoride	mg/L	-	1.4 - 1.8[b]	3.0[b]	0.19	0.20	0.19	0.19	0.15	0.18
Magnesium	mg/L	-	-	-	9.0	24	8.2	8.9	8.7	9.6
Potassium	mg/L	-	-	-	0.43	0.74	0.37	0.42	0.44	0.44
Sodium	mg/L	-	-	-	21	14	20	20	21	20
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	117	113	119	118	120	128
Nutrients										
Nitrate	mg-N/L	3.0	33	400	0.0069	0.0094	0.058	0.089	0.057	0.038
Nitrite	mg-N/L	0.10 - 0.20[d]	0.30 - 0.60[d]	400 - 2,000[d]	0.0043	0.0031	0.011	0.017	0.0063	0.0017
Nitrate + nitrite	mg-N/L	-	-	-	0.011	0.013	0.068	0.11	0.063	0.040
Total ammonia	mg-N/L	0.25 - 1.9[e]	1.3 - 20[f]	1.3 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.058	0.039	0.079	0.12	0.17	0.099
Total phosphorus	mg-P/L	-	-	-	0.0064	0.014	0.0044	0.011	0.017	0.11
Dissolved phosphorus	mg-P/L	-	-	-	0.010	0.0078	0.0069	0.0058	0.0069	0.013
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	0.026	<0.003	0.0043
Antimony	mg/L	0.0090	-	0.090	0.00012	<0.0001	0.00012	0.00012	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0020	0.00059	0.0021	0.0019	0.0018	0.0016
Barium	mg/L	1.0	-	10	0.056	0.017	0.057	0.058	0.056	0.058
Beryllium	mg/L	0.00013	-	0.0015	<0.001[DL>Mn]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.22	0.063	0.22	0.23	0.23	0.21
Cadmium	mg/L	0.00025 - 0.00046[b]	0.00074 - 0.0017[b]	0.0015 - 0.0040[b]	<0.00003	<0.000015	<0.000015	<0.00001	0.000012	<0.000015
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00073
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.090[b]	<0.0005	0.0011	0.00074	<0.0005	<0.0005	0.00088
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0075 - 0.016[b]	0.11 - 0.31[b]	0.060 - 0.11[b]	<0.00005	0.00017	0.000056	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0028	0.0039	0.0029	0.0031	0.0032	0.0031
Manganese	mg/L	1.2 - 1.9[b]	1.9 - 3.4[b]	-	0.031	0.00011	0.043	0.038	0.044	0.046
Molybdenum	mg/L	7.6	46	-	0.042	0.022	0.043	0.044	0.041	0.042
Nickel	mg/L	0.11 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00079
Selenium	mg/L	0.0020	-	0.020	0.00068	**0.0027[Mn]**	0.00063	0.00088	0.00064	0.00059
Silicon	mg/L	-	-	-	6.4	7.6	6.7	6.7	6.6	7.1
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.21	0.32	0.20	0.21	0.22	0.22
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00030	0.00083	0.00028	0.00033	0.00029	0.00031
Vanadium	mg/L	-	-	-	<0.0005	0.0028	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	<0.003	0.022	0.0045	0.0038	0.0043	0.0072

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW15-2b

Parameter	Unit	Guidelines for the protection of:			Sampling Sites	
		Aquatic Life		BC CSR WQG	GW15-2b	GW15-2b
		30-day mean	Maximum		2022-08-10	2022-11-16
Field Measured						
pH	-	6.5 - 9.0	6.5 - 9.0	-	8.0	7.8
Specific conductivity	µS/cm	-	-	-	462	494
Temperature	°C	-	-	-	8.1	5.7
Conventional Parameters						
pH	mg/L	-	-	-	8.2	8.1
Specific conductivity	µS/cm	-	-	-	452	496
Hardness, as $CaCO_3$	mg/L	-	-	-	185	200
Total alkalinity, as $CaCO_3$	mg/L	20[(a)]	-	-	92	94
Total suspended solids	mg/L	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-
Major Ions						
Calcium	mg/L	-	-	-	58	64
Chloride	mg/L	150	600	1,500	10	9.7
Fluoride	mg/L	-	1.4 - 1.8[(b)]	3.0[(b)]	0.19	0.18
Magnesium	mg/L	-	-	-	9.5	10.0
Potassium	mg/L	-	-	-	0.41	0.56
Sodium	mg/L	-	-	-	20	19
Sulphate	mg/L	309 - 429[(b, c)]	-	2,180 - 4,290[(b)]	130	145
Nutrients						
Nitrate	mg-N/L	3.0	33	400	0.038	0.085
Nitrite	mg-N/L	0.10 - 0.20[(d)]	0.30 - 0.60[(d)]	400 - 2,000[(d)]	0.0077	0.019
Nitrate + nitrite	mg-N/L	-	-	-	0.046	0.10
Total ammonia	mg-N/L	0.25 - 1.9[(e)]	1.3 - 20[(f)]	1.3 - 19[(g)]	<0.005	0.0098
Total nitrogen	mg-N/L	-	-	-	0.099	0.24
Total phosphorus	mg-P/L	-	-	-	0.061	0.012
Dissolved phosphorus	mg-P/L	-	-	-	0.0065	0.026
Orthophosphate	mg-P/L	-	-	-	-	-
Dissolved Metals						
Aluminum	mg/L	0.050[(h)]	0.10[(h)]	-	0.0095	0.015
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0018	0.0016
Barium	mg/L	1.0	-	10	0.063	0.064
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.22	0.18
Cadmium	mg/L	0.00025 - 0.00046[(b)]	0.00074 - 0.0017[(b)]	0.0015 - 0.0040[(b)]	<0.000015	<0.000015
Chromium	mg/L	0.0010[(i)]	-	0.010	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	0.00015	0.00014
Copper	mg/L	-	-	0.060 - 0.090[(b)]	0.00088	0.00065
Iron	mg/L	-	0.35	-	<0.03	0.040
Lead	mg/L	0.0075 - 0.016[(b)]	0.11 - 0.31[(b)]	0.060 - 0.11[(b)]	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0031	0.0030
Manganese	mg/L	1.2 - 1.9[(b)]	1.9 - 3.4[(b)]	-	0.18	0.12
Molybdenum	mg/L	7.6	46	-	0.042	0.040
Nickel	mg/L	0.11 - 0.15[(b)]	-	1.1 - 1.5[(b)]	0.00076	0.00065
Selenium	mg/L	0.0020	-	0.020	0.00066	0.00084
Silicon	mg/L	-	-	-	6.9	6.9
Silver	mg/L	0.0015[(b)]	0.0030[(b)]	-	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.22	0.25
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00030	0.00041
Vanadium	mg/L	-	-	-	<0.0005	<0.0005
Zinc	mg/L	0.034 - 0.16	0.059 - 0.18	0.90 - 1.7	0.0058	0.0065

Notes:
mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[(a)] = guideline is a minimum value, unless the background concentration or value is lower.

[(b)] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (125 to 288 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[(c)] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes

[(d)] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (9.3200 to 12.5000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[(e)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (0.25 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(f)] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on the combination of field pH (8.7) and water temperature (3.3°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[(g)] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (1.31 mg-N/L) is based on field pH (8.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[(h)] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.1 to 8.7). The guideline is calculated based on the individual pH for each sample.

[(i)] = guideline is for chromium VI.

[(Mn)] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[(DL>Mn)] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW96-7

Parameter	Unit	Guidelines for the protection of:			Sampling Sites			
		Aquatic Life		BC CSR WQG	GW96-7	GW96-7	GW96-7	GW96-7
		30-day mean	Maximum		2015-06-02	2015-10-13	2016-05-09	2017-05-02
Field Measured								
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.8	7.8	7.4
Specific conductivity	µS/cm	-	-	-	358	363	374	401
Temperature	°C	-	-	-	10	7.6	8.5	8.2
Conventional Parameters								
pH	mg/L	-	-	-	8.1	8.0	8.1	8.2
Specific conductivity	µS/cm	-	-	-	342	346	369	404
Hardness, as $CaCO_3$	mg/L	-	-	-	179	185	190	191
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	160	164	157	179
Total suspended solids	mg/L	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-
Major Ions								
Calcium	mg/L	-	-	-	55	57	58	57
Chloride	mg/L	150	600	1,500	0.60	0.65	0.62	0.59
Fluoride	mg/L	-	1.5 - 1.7[b]	3.0[b]	0.21	0.21	0.21	0.18
Magnesium	mg/L	-	-	-	10	11	11	12
Potassium	mg/L	-	-	-	1.2	1.1	1.2	1.2
Sodium	mg/L	-	-	-	7.6	7.9	8.0	8.4
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	30	31	38	36
Nutrients								
Nitrate	mg-N/L	3.0	33	400	<0.005	0.014	<0.005	<0.005
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	0.0057	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	0.020	<0.0051	<0.0051
Total ammonia	mg-N/L	1.4 - 2.0[e]	7.3 - 15[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.03	<0.03	<0.03	<0.03
Total phosphorus	mg-P/L	-	-	-	0.014	0.0099	0.016	0.012
Dissolved phosphorus	mg-P/L	-	-	-	0.0081	0.0078	0.0062	0.0064
Orthophosphate	mg-P/L	-	-	-	-	-	-	-
Dissolved Metals								
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0014	0.0013	0.0014	0.0014
Barium	mg/L	1.0	-	10	0.021	0.020	0.019	0.020
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.015	0.015	0.015	0.014
Cadmium	mg/L	0.00030 - 0.00039[b]	0.00095 - 0.0014[b]	0.0015 - 0.0040[b]	0.0000097	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.070 - 0.090[b]	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	0.15	0.15	0.20	0.24
Lead	mg/L	0.0091 - 0.013[b]	0.15 - 0.24[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0069	0.0062	0.0063	0.0067
Manganese	mg/L	1.3 - 1.6[b]	2.3 - 3.1[b]	-	0.17	0.16	0.17	0.20
Molybdenum	mg/L	7.6	46	-	0.0049	0.0051	0.0051	0.0052
Nickel	mg/L	0.14 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	<0.00005	<0.00005	<0.00005	0.000063
Silicon	mg/L	-	-	-	12	12	13	12
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.14	0.14	0.14	0.15
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00013	0.00020	0.00013	0.00014
Vanadium	mg/L	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.059 - 0.11	0.085 - 0.14	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (159 to 233 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 0.8000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (6.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (6.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.4 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Appendix 2-8
Table 2-8G: Groundwater Quality Screening at GW96-7 from 2015 to 2022
Mount Polley Mine

Table 1: Water Quality Summary, 2015 to 2022 - GW96-7

Parameter	Unit	Guidelines for the protection of:			Sampling Sites				
		Aquatic Life		BC CSR WQG	GW96-7	GW96-7	GW96-7	GW96-7	GW96-7
		30-day mean	Maximum		2018-06-06	2019-11-19	2020-11-02	2021-12-06	2022-08-31
Field Measured									
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.8	7.9	-	7.7	7.6
Specific conductivity	µS/cm	-	-	-	382	399	-	454	421
Temperature	°C	-	-	-	11	6.4	-	5.2	11
Conventional Parameters									
pH	mg/L	-	-	-	8.3	8.3	7.9	8.2	7.8
Specific conductivity	µS/cm	-	-	-	314	402	480	463	436
Hardness, as $CaCO_3$	mg/L	-	-	-	183	194	233	226	220
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	140	175	196	195	186
Total suspended solids	mg/L	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	1.8	-	-	-
Major Ions									
Calcium	mg/L	-	-	-	55	56	71	69	65
Chloride	mg/L	150	600	1,500	0.62	0.68	0.80	0.73	0.72
Fluoride	mg/L	-	1.5 - 1.7[b]	3.0[b]	0.19	0.20	0.18	0.18	0.17
Magnesium	mg/L	-	-	-	11	13	13	13	14
Potassium	mg/L	-	-	-	1.7	1.4	1.4	1.3	1.4
Sodium	mg/L	-	-	-	15	9.7	9.3	9.8	9.4
Sulphate	mg/L	309 - 429[b, c]	-	2,180 - 4,290[b]	37	44	59	64	68
Nutrients									
Nitrate	mg-N/L	3.0	33	400	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Total ammonia	mg-N/L	1.4 - 2.0[e]	7.3 - 15[f]	11 - 19[g]	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	1.3	0.11	<0.03	<0.03	0.045
Total phosphorus	mg-P/L	-	-	-	0.027	0.014	0.0026	0.020	0.017
Dissolved phosphorus	mg-P/L	-	-	-	0.0088	0.013	0.012	0.013	0.011
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-
Dissolved Metals									
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	0.023
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.0010	0.0017	0.0015	0.0018	0.0017
Barium	mg/L	1.0	-	10	0.015	0.023	0.025	0.026	0.026
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.001[DL>Mn]	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.12	0.020	0.018	0.019	0.017
Cadmium	mg/L	0.00030 - 0.00039[b]	0.00095 - 0.0014[b]	0.0015 - 0.0040[b]	<0.000045	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	0.00033	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.070 - 0.090[b]	0.00064	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	0.24	0.26	0.27	0.27
Lead	mg/L	0.0091 - 0.013[b]	0.15 - 0.24[b]	0.060 - 0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	<0.001	0.0067	0.0077	0.0078	0.0075
Manganese	mg/L	1.3 - 1.6[b]	2.3 - 3.1[b]	-	0.27	0.22	0.24	0.24	0.24
Molybdenum	mg/L	7.6	46	-	0.030	0.0054	0.0047	0.0049	0.0054
Nickel	mg/L	0.14 - 0.15[b]	-	1.1 - 1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.0013	<0.00005	<0.00005	<0.00005	<0.00005
Silicon	mg/L	-	-	-	9.4	13	12	13	13
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.14	0.17	0.19	0.19	0.18
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00046	0.00018	0.00021	0.00021	0.00018
Vanadium	mg/L	-	-	-	0.0026	<0.0005	<0.0005	<0.0005	<0.0005
Zinc	mg/L	0.059 - 0.11	0.085 - 0.14	0.90 - 1.7	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter, °C = degrees celcius.

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (159 to 233 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 0.8000 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.39 mg-N/L) is based on the combination of field pH (7.9) and water temperature (6.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.25 mg-N/L) is based on the combination of field pH (7.9) and water temperature (6.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.7). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (7.4 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-8

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8
		30-day mean	Maximum		2017-05-24	2017-06-07	2017-08-22	2017-08-23	2017-10-05	2018-03-19	2018-06-20
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.1	7.6	7.1	-	7.2	7.1	7.1
Specific conductivity	µS/cm	-	-	-	347	342	344	-	349	335	364
Temperature	°C	-	-	-	7.5	9.9	10	-	8.9	7.8	12
Conventional Parameters											
pH	mg/L	-	-	-	-	8.1	-	7.9	8.3	8.0	8.4
Specific conductivity	µS/cm	-	-	-	-	333	-	316	318	317	323
Hardness, as $CaCO_3$	mg/L	-	-	-	-	155	-	159	153	177	153
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	135	-	126	135	133	138
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	-	53	-	55	53	61	52
Chloride	mg/L	150	600	1,500	-	0.77	-	0.80	0.89	0.80	0.72
Fluoride	mg/L	-	1.5 - 1.6[b]	3.0[b]	-	0.12	-	0.12	0.14	0.12	0.13
Magnesium	mg/L	-	-	-	-	5.4	-	5.3	5.4	5.9	5.5
Potassium	mg/L	-	-	-	-	0.45	-	0.46	0.45	0.54	0.48
Sodium	mg/L	-	-	-	-	6.8	-	6.9	7.0	7.9	7.9
Sulphate	mg/L	309[b]	-	2,180[b]	-	46	-	43	41	39	36
Nutrients											
Nitrate	mg-N/L	3.0	33	400	-	0.17	-	0.12	0.11	0.062	0.070
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	-	<0.001	-	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	-	0.17	-	0.12	0.11	0.062	0.070
Total ammonia	mg-N/L	1.5 - 2.0[d]	10 - 22[e]	11 - 19[f]	-	<0.005	-	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	-	0.22	-	0.14	0.15	0.097	0.095
Total phosphorus	mg-P/L	-	-	-	-	0.0045	-	0.012	0.012	0.0098	0.0053
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0029	-	0.0038	0.0080	0.0038	0.0046
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	-	0.00027	-	0.00028	0.00029	0.00027	0.00030
Barium	mg/L	1.0	-	10	-	0.011	-	0.011	0.0099	0.011	0.012
Beryllium	mg/L	0.00013	-	0.0015	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	-	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	-	-	-	0.044	0.043	0.046	0.045
Cadmium	mg/L	0.00026 - 0.00032[b]	0.00080 - 0.0011[b]	0.0015[b]	-	0.0000088	-	0.000018	0.000012	0.000017	0.000015
Chromium	mg/L	0.0010[h]	-	0.010	-	<0.0005	-	<0.0005	<0.0005	0.00060	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.060 - 0.080[b]	-	<0.0005	-	<0.0005	0.00074	<0.0005	0.00077
Iron	mg/L	-	0.35	-	-	<0.03	-	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0080 - 0.0099[b]	0.12 - 0.17[b]	0.060[b]	-	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	-	0.0012	-	0.0013	0.0011	<0.001	<0.001
Manganese	mg/L	1.2 - 1.4[b]	2.0 - 2.5[b]	-	-	0.0013	-	0.00098	0.00065	0.0021	0.0013
Molybdenum	mg/L	7.6	46	-	-	0.0026	-	0.0029	0.0028	0.0032	0.0033
Nickel	mg/L	0.12 - 0.15[b]	-	1.1[b]	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	-	0.00018	-	0.00013	0.00011	0.000063	0.000068
Silicon	mg/L	-	-	-	-	7.0	-	7.6	7.1	6.8	6.8
Silver	mg/L	0.0015[b]	0.0030[b]	-	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	-	0.26	-	0.27	0.26	0.28	0.25
Thallium	mg/L	0.00080	-	-	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	-	<0.01	-	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	-	0.00012	-	0.00013	0.00012	0.00015	0.00013
Vanadium	mg/L	-	-	-	-	0.00059	-	0.00067	0.00078	0.00074	0.00071
Zinc	mg/L	0.041 - 0.073	0.067 - 0.098	0.90	-	<0.003	-	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (135 to 177 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5300 to 2.0200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.53 mg-N/L) is based on the combination of field pH (7.2) and water temperature (16.7°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (10.10 mg-N/L) is based on the combination of field pH (7.7) and water temperature (5.1°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.9 to 7.7). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-8

Parameter	Unit	Guidelines for the protection of:			Sampling Sites						
		Aquatic Life		BC CSR WQG	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8
		30-day mean	Maximum		2018-08-14	2018-10-02	2019-06-04	2019-11-19	2020-05-19	2020-11-04	2021-05-05
Field Measured											
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.4	7.2	7.3	7.4	-	-	6.9
Specific conductivity	µS/cm	-	-	-	335	326	305	307	-	-	520
Temperature	°C	-	-	-	8.6	6.9	11	7.2	-	-	8.5
Conventional Parameters											
pH	mg/L	-	-	-	7.9	8.2	8.2	8.1	7.9	7.7	8.0
Specific conductivity	µS/cm	-	-	-	337	307	336	315	321	326	335
Hardness, as $CaCO_3$	mg/L	-	-	-	152	148	151	145	155	147	154
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	142	141	138	131	144	138	139
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	4.1	1.4	-	-	-
Major Ions											
Calcium	mg/L	-	-	-	52	50	52	49	56	50	53
Chloride	mg/L	150	600	1,500	0.75	0.80	0.79	0.96	1.0	2.0	0.77
Fluoride	mg/L	-	1.5 - 1.6[b]	3.0[b]	0.13	0.13	0.13	0.14	0.14	0.14	0.14
Magnesium	mg/L	-	-	-	5.5	5.6	5.3	5.6	3.8	5.3	5.6
Potassium	mg/L	-	-	-	0.53	0.46	0.51	0.51	1.4	0.52	0.51
Sodium	mg/L	-	-	-	8.4	8.4	8.0	8.1	16	8.4	7.5
Sulphate	mg/L	309[b]	-	2,180[b]	35	35	38	36	37	36	36
Nutrients											
Nitrate	mg-N/L	3.0	33	400	0.082	0.14	0.14	0.097	0.11	0.12	0.16
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.082	0.14	0.14	0.097	0.11	0.13	0.16
Total ammonia	mg-N/L	1.5 - 2.0[d]	10 - 22[e]	11 - 19[f]	<0.005	0.0063	<0.005	<0.005	0.0072	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.11	0.43	0.18	0.17	0.21	0.28	0.19
Total phosphorus	mg-P/L	-	-	-	0.0052	0.0045	0.0042	0.0088	0.047	0.012	0.0076
Dissolved phosphorus	mg-P/L	-	-	-	0.0046	0.0058	0.012	0.0031	0.0044	0.098	0.0038
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-
Dissolved Metals											
Aluminum	mg/L	0.050[g]	0.10[g]	-	<0.003	<0.003	<0.003	0.0036	**0.26**[Mn, Mx]	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	0.00020	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00029	0.00034	0.00027	0.00030	0.0014	0.00033	0.00028
Barium	mg/L	1.0	-	10	0.012	0.012	0.013	0.010	0.056	0.0097	0.010
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.045	0.046	0.047	0.047	0.041	0.044	0.043
Cadmium	mg/L	0.00026 - 0.00032[b]	0.00080 - 0.0011[b]	0.0015[b]	0.000012	0.000016	0.000012	0.000013	0.0000059	0.000011	0.000011
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	**0.0018**[Mn]	<0.0005	**0.0017**[Mn]	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00011	<0.0001
Copper	mg/L	-	-	0.060 - 0.080[b]	0.00070	0.00051	<0.0005	0.0010	0.0034	0.00058	0.00064
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0080 - 0.0099[b]	0.12 - 0.17[b]	0.060[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0012	0.0011	0.0012	0.0011	0.0022	0.0011	0.0010
Manganese	mg/L	1.2 - 1.4[b]	2.0 - 2.5[b]	-	0.00086	0.0013	0.0024	0.00078	0.00022	0.0012	<0.0001
Molybdenum	mg/L	7.6	46	-	0.0031	0.0034	0.0035	0.0036	0.0073	0.0038	0.0037
Nickel	mg/L	0.12 - 0.15[b]	-	1.1[b]	<0.0005	<0.0005	0.00080	<0.0005	0.0023	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.000080	0.000075	0.000075	0.000060	0.00021	0.00017	0.00016
Silicon	mg/L	-	-	-	7.2	7.3	7.9	7.6	6.5	7.7	7.1
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	0.000045	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.23	0.24	0.25	0.26	0.27	0.27	0.26
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	0.00074	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00013	0.00013	0.00015	0.00016	0.00015	0.00014	0.00016
Vanadium	mg/L	-	-	-	0.00074	0.00070	0.00060	0.00079	0.0023	0.00080	0.00080
Zinc	mg/L	0.041 - 0.073	0.067 - 0.098	0.90	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0064

Notes:
mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (135 to 177 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5300 to 2.0200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.53 mg-N/L) is based on the combination of field pH (7.2) and water temperature (16.7°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (10.10 mg-N/L) is based on the combination of field pH (7.7) and water temperature (5.1°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.9 to 7.7). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-8

Parameter	Unit	Guidelines for the protection of:			Sampling Sites					
		Aquatic Life		BC CSR WQG	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8	GW16-8
		30-day mean	Maximum		2021-11-24	2022-06-01	2022-07-28	2022-10-18	2022-11-16	2022-12-06
Field Measured										
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.7	7.0	7.2	6.9	7.0	7.5
Specific conductivity	µS/cm	-	-	-	330	319	384	306	326	338
Temperature	°C	-	-	-	5.1	8.8	17	8.7	7.8	5.3
Conventional Parameters										
pH	mg/L	-	-	-	7.9	7.8	8.1	8.3	7.7	7.7
Specific conductivity	µS/cm	-	-	-	299	332	321	306	328	337
Hardness, as $CaCO_3$	mg/L	-	-	-	155	150	138	152	141	135
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	143	141	141	142	146	143
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	-	-	54	51	47	52	49	47
Chloride	mg/L	150	600	1,500	0.64	0.70	0.53	0.73	0.61	0.71
Fluoride	mg/L	-	1.5 - 1.6[b]	3.0[b]	0.096	0.14	0.11	0.13	0.12	0.12
Magnesium	mg/L	-	-	-	5.0	5.4	4.8	5.1	4.6	4.3
Potassium	mg/L	-	-	-	0.55	0.53	0.50	0.44	0.45	0.46
Sodium	mg/L	-	-	-	7.8	7.9	7.4	7.0	8.2	9.4
Sulphate	mg/L	309[b]	-	2,180[b]	25	30	32	27	24	25
Nutrients										
Nitrate	mg-N/L	3.0	33	400	0.10	0.062	0.067	0.099	0.20	0.27
Nitrite	mg-N/L	0.020 - 0.040[c]	0.060 - 0.12[c]	200 - 400[c]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.10	0.062	0.067	0.099	0.20	0.27
Total ammonia	mg-N/L	1.5 - 2.0[d]	10 - 22[e]	11 - 19[f]	0.098	<0.005	0.0083	<0.005	0.0052	<0.005
Total nitrogen	mg-N/L	-	-	-	0.21	0.10	0.19	0.14	0.28	0.36
Total phosphorus	mg-P/L	-	-	-	0.033	0.016	0.0098	0.028	0.053	0.073
Dissolved phosphorus	mg-P/L	-	-	-	0.0037	0.0036	0.0052	0.0049	0.011	0.0054
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-
Dissolved Metals										
Aluminum	mg/L	0.050[g]	0.10[g]	-	<0.003	<0.003	0.044	<0.003	**0.12**[Mn, Mx]	0.019
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00029	0.00037	0.00033	0.00028	0.00041	0.00026
Barium	mg/L	1.0	-	10	0.0099	0.011	0.013	0.010	0.012	0.012
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.047	0.047	0.046	0.045	0.046	0.052
Cadmium	mg/L	0.00026 - 0.00032[b]	0.00080 - 0.0011[b]	0.0015[b]	0.000015	0.000018	0.000011	0.000013	0.000025	0.000011
Chromium	mg/L	0.0010[h]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	0.00012	<0.0001	0.00045	0.00012
Copper	mg/L	-	-	0.060 - 0.080[b]	0.00096	0.0040	0.00068	0.00084	0.0013	0.00056
Iron	mg/L	-	0.35	-	<0.03	<0.03	0.12	0.054	**0.81**[Mx]	0.12
Lead	mg/L	0.0080 - 0.0099[b]	0.12 - 0.17[b]	0.060[b]	<0.00005	0.00017	<0.00005	<0.00005	0.00012	<0.00005
Lithium	mg/L	-	-	-	0.0011	0.0010	0.0010	0.0010	0.0010	0.0011
Manganese	mg/L	1.2 - 1.4[b]	2.0 - 2.5[b]	-	0.00039	0.0012	0.018	0.015	0.077	0.030
Molybdenum	mg/L	7.6	46	-	0.0040	0.0043	0.0032	0.0034	0.0030	0.0033
Nickel	mg/L	0.12 - 0.15[b]	-	1.1[b]	<0.0005	<0.0005	0.0010	0.00054	0.0019	0.00077
Selenium	mg/L	0.0020	-	0.020	0.000085	0.000057	0.00013	<0.00005	<0.00005	0.000052
Silicon	mg/L	-	-	-	7.3	7.3	8.0	7.6	8.4	8.0
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.26	0.25	0.27	0.26	0.25	0.24
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	0.00023	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00016	0.00017	0.00015	0.00013	0.00014	0.00015
Vanadium	mg/L	-	-	-	0.00075	0.00075	0.00077	0.00071	0.0011	0.00058
Zinc	mg/L	0.041 - 0.073	0.067 - 0.098	0.90	0.0073	0.020	0.0056	0.0072	0.010	0.0076

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (135 to 177 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.5300 to 2.0200 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[d] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.53 mg-N/L) is based on the combination of field pH (7.2) and water temperature (16.7°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (10.10 mg-N/L) is based on the combination of field pH (7.7) and water temperature (5.1°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[g] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.9 to 7.7). The guideline is calculated based on the individual pH for each sample.

[h] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-7

Parameter	Unit	Guidelines for the protection of:			Sampling Sites								
		Aquatic Life		BC CSR WQG	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7
		30-day mean	Maximum		2017-05-24	2017-05-25	2017-06-07	2017-08-22	2017-08-23	2017-10-04	2018-03-19	2018-06-20	2018-08-14
Field Measured													
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.6	6.6	7.5	-	7.9	7.0	7.5	7.7
Specific conductivity	µS/cm	-	-	-	517	515	512	510	-	524	510	501	506
Temperature	°C	-	-	-	17	8.8	8.6	9.6	-	8.4	7.2	8.7	8.1
Conventional Parameters													
pH	mg/L	-	-	-	-	-	8.2	-	8.1	8.3	8.2	8.3	8.2
Specific conductivity	µS/cm	-	-	-	-	-	488	-	473	477	476	481	475
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	223	-	224	225	266	222	220
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	-	-	150	-	145	152	147	146	153
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions													
Calcium	mg/L	-	-	-	-	-	82	-	82	82	98	81	80
Chloride	mg/L	150	600	1,500	-	-	0.89	-	0.92	1.1	0.88	0.89	0.89
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	-	-	0.32	-	0.31	0.33	0.31	0.36	0.36
Magnesium	mg/L	-	-	-	-	-	4.6	-	4.7	4.8	5.2	4.9	4.9
Potassium	mg/L	-	-	-	-	-	0.34	-	0.36	0.35	0.37	0.36	0.39
Sodium	mg/L	-	-	-	-	-	13	-	13	13	13	13	14
Sulphate	mg/L	429[b, c]	-	4,290[b]	-	-	112	-	110	111	110	108	104
Nutrients													
Nitrate	mg-N/L	3.0	33	400	-	-	0.62	-	0.59	0.57	0.48	0.38	0.36
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	-	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	-	-	0.62	-	0.59	0.57	0.48	0.38	0.36
Total ammonia	mg-N/L	1.4 - 2.0[e]	7.1 - 25[f]	11 - 19[g]	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	-	-	0.65	-	0.60	0.63	0.50	0.38	0.35
Total phosphorus	mg-P/L	-	-	-	-	-	0.0026	-	0.0028	<0.002	0.0038	0.0074	0.0058
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0033	-	0.0032	0.0042	<0.002	0.0025	0.0024
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals													
Aluminum	mg/L	0.050[h]	0.10[h]	-	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	-	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	-	-	0.00069	-	0.00070	0.00074	0.00067	0.00069	0.00078
Barium	mg/L	1.0	-	10	-	-	0.0087	-	0.010	0.0073	0.0090	0.0088	0.0084
Beryllium	mg/L	0.00013	-	0.0015	-	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	-	-	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	-	-	0.19	-	0.19	0.19	0.20	0.18	0.20
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	-	-	0.0000062	-	0.0000085	0.0000065	0.0000071	<0.000005	0.0000064
Chromium	mg/L	0.0010[i]	-	0.010	-	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	-	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	-	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0006	0.00052
Iron	mg/L	-	0.35	-	-	-	<0.03	-	0.076	0.056	0.13	0.16	0.15
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	-	-	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	-	-	0.0013	-	0.0013	0.0013	0.0010	0.0011	0.0014
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	-	-	0.0065	-	0.013	0.0072	0.011	0.013	0.010
Molybdenum	mg/L	7.6	46	-	-	-	0.0068	-	0.0070	0.0068	0.0077	0.0073	0.0068
Nickel	mg/L	0.15[b]	-	1.5[b]	-	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	-	-	0.00096	-	0.0011	0.00087	0.00093	0.00089	0.00084
Silicon	mg/L	-	-	-	-	-	7.5	-	8.7	8.1	7.8	7.4	8.2
Silver	mg/L	0.0015[b]	0.0030[b]	-	-	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	-	-	0.50	-	0.51	0.49	0.55	0.53	0.46
Thallium	mg/L	0.00080	-	-	-	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	-	-	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	-	-	0.00032	-	0.00037	0.00034	0.00042	0.00031	0.00033
Vanadium	mg/L	-	-	-	-	-	0.00087	-	0.00080	0.00096	0.00092	0.00081	0.00098
Zinc	mg/L	0.11 - 0.15	0.13 - 0.18	1.7	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003	<0.003

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (220 to 280 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 1.0500 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.36 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.10 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-7

Parameter	Unit	Guidelines for the protection of:			Sampling Sites								
		Aquatic Life		BC CSR WQG	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7	GW16-7
		30-day mean	Maximum		2018-10-02	2019-06-04	2019-11-19	2020-05-20	2020-11-04	2021-05-06	2021-11-24	2022-06-01	2022-07-28
Field Measured													
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.6	7.7	7.8	-	-	7.6	7.6	7.5	7.7
Specific conductivity	µS/cm	-	-	-	484	462	404	-	-	540	535	541	599
Temperature	°C	-	-	-	6.7	9.0	5.5	-	-	9.5	6.8	8.8	9.8
Conventional Parameters													
pH	mg/L	-	-	-	8.3	8.3	8.2	7.9	8.0	8.0	8.1	8.0	8.3
Specific conductivity	µS/cm	-	-	-	458	498	493	506	522	573	523	570	593
Hardness, as $CaCO_3$	mg/L	-	-	-	220	227	235	232	247	259	255	251	267
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	153	161	159	160	153	150	159	152	148
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	27	0.74	-	-	-	-	-	-
Major Ions													
Calcium	mg/L	-	-	-	80	83	85	85	90	94	94	92	98
Chloride	mg/L	150	600	1,500	0.92	0.81	0.82	0.90	0.82	0.78	0.71	0.75	<0.5
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.36	0.40	0.46	0.46	0.48	0.51	0.34	0.47	0.72
Magnesium	mg/L	-	-	-	5.1	4.8	5.5	5.1	5.5	5.7	5.3	5.4	5.6
Potassium	mg/L	-	-	-	0.33	0.35	0.40	0.61	0.39	0.38	0.35	0.38	0.39
Sodium	mg/L	-	-	-	14	13	15	13	15	14	13	14	18
Sulphate	mg/L	429[b, c]	-	4,290[b]	102	108	113	117	130	140	129	139	173
Nutrients													
Nitrate	mg-N/L	3.0	33	400	0.34	0.21	0.18	0.15	0.13	0.12	0.096	0.078	0.037
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	0.0014	<0.001	<0.001	<0.001	0.0018	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.34	0.21	0.19	0.15	0.13	0.12	0.096	0.078	0.037
Total ammonia	mg-N/L	1.4 - 2.0[e]	7.1 - 25[f]	11 - 19[g]	0.011	<0.005	<0.005	0.0071	<0.005	<0.005	0.0084	<0.005	0.0065
Total nitrogen	mg-N/L	-	-	-	0.37	0.25	0.29	0.19	0.16	0.16	0.15	0.12	0.076
Total phosphorus	mg-P/L	-	-	-	0.0032	0.066	0.0048	0.026	<0.002	0.080	0.025	0.011	0.022
Dissolved phosphorus	mg-P/L	-	-	-	0.0040	0.0049	0.0035	0.0046	0.060	0.0030	0.0029	0.0083	0.0046
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals													
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	0.0062	<0.003	<0.003	<0.003	<0.003	0.0065
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00082	0.00092	0.00085	0.00094	0.00084	0.00080	0.00034	0.00091	0.00075
Barium	mg/L	1.0	-	10	0.0067	0.0071	0.0085	0.0094	0.0085	0.0075	0.0077	0.0083	0.0094
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.20	0.22	0.22	0.21	0.21	0.24	0.19	0.21	0.31
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	0.0000091	0.0000059	<0.00001	0.0000050	<0.000005	<0.00001	0.0000060	<0.00001	<0.00001
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	**0.0018[Mn]**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	<0.0005	<0.0005	0.00055	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	0.091	0.16	0.11	0.16	0.33	0.27	0.20	**0.53[Mx]**	0.14
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0013	0.0014	0.0014	0.0015	0.0014	0.0014	0.0014	0.0014	0.0019
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.0068	0.0065	0.0084	0.012	0.014	0.0073	0.011	0.013	0.0091
Molybdenum	mg/L	7.6	46	-	0.0073	0.0078	0.0081	0.0081	0.0083	0.0083	0.0080	0.0087	0.0085
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00089	0.0012	0.0012	0.0012	0.0018	**0.0029[Mn]**	**0.0031[Mn]**	**0.0027[Mn]**	0.0017
Silicon	mg/L	-	-	-	8.1	8.8	9.0	8.5	8.2	8.8	8.6	8.5	9.4
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.48	0.56	0.64	0.61	0.65	0.70	0.64	0.63	0.92
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	0.0010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00031	0.00033	0.00034	0.00033	0.00032	0.00035	0.00035	0.00036	0.00033
Vanadium	mg/L	-	-	-	0.0010	0.0011	0.0011	0.00090	0.00095	0.00097	<0.0005	0.00095	0.00080
Zinc	mg/L	0.11 - 0.15	0.13 - 0.18	1.7	<0.003	<0.003	<0.003	<0.003	<0.003	0.0055	0.010	0.0045	0.0065

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (220 to 280 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 1.0500 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.36 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.10 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW16-7

Parameter	Unit	Guidelines for the protection of:			Sampling Sites		
		Aquatic Life		BC CSR WQG	GW16-7	GW16-7	GW16-7
		30-day mean	Maximum		2022-10-18	2022-11-16	2022-12-06
Field Measured							
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.5	7.4	7.6
Specific conductivity	µS/cm	-	-	-	567	591	280
Temperature	°C	-	-	-	8.2	4.9	7.4
Conventional Parameters							
pH	mg/L	-	-	-	8.2	8.0	8.0
Specific conductivity	µS/cm	-	-	-	548	599	605
Hardness, as $CaCO_3$	mg/L	-	-	-	276	280	261
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	131	138	133
Total suspended solids	mg/L	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-
Major Ions							
Calcium	mg/L	-	-	-	101	102	95
Chloride	mg/L	150	600	1,500	0.56	0.50	0.53
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.58	0.53	0.55
Magnesium	mg/L	-	-	-	5.8	6.1	5.7
Potassium	mg/L	-	-	-	0.35	0.35	0.38
Sodium	mg/L	-	-	-	16	15	16
Sulphate	mg/L	429[b, c]	-	4,290[b]	175	183	185
Nutrients							
Nitrate	mg-N/L	3.0	33	400	0.073	0.061	0.038
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.073	0.061	0.038
Total ammonia	mg-N/L	1.4 - 2.0[e]	7.1 - 25[f]	11 - 19[g]	<0.005	0.0059	0.012
Total nitrogen	mg-N/L	-	-	-	0.11	0.092	0.060
Total phosphorus	mg-P/L	-	-	-	0.0063	0.0066	0.014
Dissolved phosphorus	mg-P/L	-	-	-	0.010	0.0052	0.0068
Orthophosphate	mg-P/L	-	-	-	-	-	-
Dissolved Metals							
Aluminum	mg/L	0.050[h]	0.10[h]	-	0.0073	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00088	0.00087	0.00078
Barium	mg/L	1.0	-	10	0.010	0.0093	0.0097
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.22	0.23	0.24
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	<0.00001	<0.000005	0.0000072
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	0.00055	<0.0005	0.0018
Iron	mg/L	-	0.35	-	**0.38[Mx]**	**0.48[Mx]**	**0.46[Mx]**
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0016	0.0016	0.0016
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.012	0.013	0.017
Molybdenum	mg/L	7.6	46	-	0.0081	0.0074	0.0077
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.0017	0.0016	0.0012
Silicon	mg/L	-	-	-	8.4	9.1	8.7
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.85	0.87	0.81
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00031	0.00032	0.00032
Vanadium	mg/L	-	-	-	0.00084	0.00086	0.00065
Zinc	mg/L	0.11 - 0.15	0.13 - 0.18	1.7	0.012	0.0086	0.0093

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (220 to 280 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 1.0500 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.36 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (7.10 mg-N/L) is based on the combination of field pH (7.9) and water temperature (8.4°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.6). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.

Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW05-01

Parameter	Unit	Guidelines for the protection of:			Sampling Sites								
		Aquatic Life		BC CSR WQG	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01
		30-day mean	Maximum		2015-02-04	2015-05-06	2015-08-06	2015-11-02	2016-02-02	2016-05-05	2016-08-18	2016-11-03	2017-02-16
Field Measured													
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	-	-	-	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Temperature	°C	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters													
pH	mg/L	-	-	-	8.1	8.4	8.1	8.1	7.8	8.0	8.2	8.1	8.0
Specific conductivity	µS/cm	-	-	-	524	546	551	562	567	560	569	563	554
Hardness, as $CaCO_3$	mg/L	-	-	-	238	246	263	260	261	258	248	254	254
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	142	126	142	143	144	139	146	147	139
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions													
Calcium	mg/L	-	-	-	86	90	96	95	95	94	90	92	92
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.37	0.38	0.39	0.40	0.41	0.43	0.43	0.44	0.44
Magnesium	mg/L	-	-	-	5.4	5.3	5.8	5.6	5.7	5.7	5.4	6.0	6.0
Potassium	mg/L	-	-	-	0.38	0.38	0.40	0.40	0.41	0.39	0.38	0.42	0.42
Sodium	mg/L	-	-	-	18	18	19	21	20	19	19	19	20
Sulphate	mg/L	429[b, c]	-	4,290[b]	137	145	149	149	150	153	157	160	159
Nutrients													
Nitrate	mg-N/L	3.0	33	400	0.018	<0.005	0.078	0.072	0.096	0.13	0.15	0.21	0.25
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.018	<0.0051	0.078	0.072	0.096	0.13	0.15	0.21	0.25
Total ammonia	mg-N/L	1.2 - 2.0[e]	6.8 - 23[f]	11 - 19[g]	0.035	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	<0.05	<0.03	0.085	0.088	0.12	0.14	0.16	0.20	0.25
Total phosphorus	mg-P/L	-	-	-	0.0036	<0.002	0.0027	<0.002	0.0035	0.0021	<0.002	<0.01	0.0032
Dissolved phosphorus	mg-P/L	-	-	-	<0.002	<0.002	<0.002	<0.002	0.0021	<0.002	<0.002	0.0026	0.0034
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals													
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	0.0084	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00026	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00032	0.00018	0.00030	0.00034	0.00036	0.00034	0.00033	0.00038	0.00061
Barium	mg/L	1.0	-	10	0.0076	0.0082	0.0083	0.0087	0.0084	0.0083	0.0079	0.0091	0.0090
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.0005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.29	0.28	0.30	0.33	0.31	0.31	0.31	0.26	0.30
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	0.0047	0.0029	0.0038	0.0034	0.0035	0.0068	0.0053	0.0029	0.0041
Iron	mg/L	-	0.35	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0014	0.0011	0.0017	0.0015	0.0015	0.0015	0.0011	0.0015	0.0015
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.0018	0.0046	0.0014	0.0018	0.0018	0.0017	0.0015	0.0019	0.0018
Molybdenum	mg/L	7.6	46	-	0.0082	0.0082	0.0082	0.0086	0.0078	0.0086	0.0081	0.0082	0.0079
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00062	0.00014	0.00078	0.00078	0.00089	0.00098	0.0010	0.00094	0.0011
Silicon	mg/L	-	-	-	8.1	8.1	8.6	8.2	8.4	8.3	8.4	8.1	8.3
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.68	0.71	0.74	0.79	0.74	0.79	0.80	0.81	0.78
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	0.020	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00028	0.00027	0.00029	0.00028	0.00028	0.00031	0.00029	0.00029	0.00030
Vanadium	mg/L	-	-	-	<0.001	<0.0005	0.00068	0.00074	0.00072	0.00071	0.00072	0.00071	0.00091
Zinc	mg/L	0.11 - 0.15	0.13 - 0.17	1.7	**0.58**[Mn, Mx]	**0.68**[Mn, Mx]	**0.30**[Mn, Mx]	**0.23**[Mn, Mx]	**0.24**[Mn, Mx]	**0.15**[Mn]	0.11	0.12	0.068

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (221 to 276 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 0.5100 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.22 mg-N/L) is based on the combination of field pH (6.6) and water temperature (24.7°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (6.79 mg-N/L) is based on the combination of field pH (7.9) and water temperature (14.0°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW05-01

Parameter	Unit	Guidelines for the protection of:			Sampling Sites								
		Aquatic Life		BC CSR WQG	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01
		30-day mean	Maximum		2017-05-23	2018-01-25	2018-05-10	2018-08-21	2018-10-02	2019-02-14	2019-05-09	2019-08-15	2019-11-14
Field Measured													
pH	-	6.5 - 9.0	6.5 - 9.0	-	-	7.7	7.4	6.6	7.6	7.6	7.4	7.0	7.3
Specific conductivity	µS/cm	-	-	-	-	578	565	629	575	592	584	626	624
Temperature	°C	-	-	-	-	6.4	24	25	5.4	6.5	10	12	7.7
Conventional Parameters													
pH	mg/L	-	-	-	8.1	8.1	8.3	8.2	8.1	7.9	8.3	8.3	8.2
Specific conductivity	µS/cm	-	-	-	559	568	561	584	529	582	576	586	615
Hardness, as $CaCO_3$	mg/L	-	-	-	253	264	276	256	240	267	257	258	276
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	138	139	137	138	133	135	141	138	141
Total suspended solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions													
Calcium	mg/L	-	-	-	92	95	100	92	86	97	92	92	98
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	0.51	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.44	0.47	0.48	0.50	0.53	0.54	0.53	0.52	0.53
Magnesium	mg/L	-	-	-	5.6	6.3	6.4	6.3	6.0	6.4	6.5	7.0	7.8
Potassium	mg/L	-	-	-	0.41	0.46	0.43	0.43	0.38	0.43	0.38	0.46	0.47
Sodium	mg/L	-	-	-	21	21	21	20	20	21	20	21	23
Sulphate	mg/L	429[b, c]	-	4,290[b]	158	155	158	162	162	183	161	183	181
Nutrients													
Nitrate	mg-N/L	3.0	33	400	0.22	0.24	0.092	<0.005	<0.005	0.12	0.12	0.074	0.077
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	0.0058	<0.001	**0.031[Mn]**	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.22	0.24	0.097	<0.0051	0.031	0.12	0.12	0.074	0.077
Total ammonia	mg-N/L	1.2 - 2.0[e]	6.8 - 23[f]	11 - 19[g]	<0.005	<0.005	0.019	<0.005	0.037	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.23	0.24	0.13	<0.03	0.12	0.12	0.16	0.14	0.091
Total phosphorus	mg-P/L	-	-	-	0.0033	0.012	0.026	0.0024	0.11	0.011	0.011	0.059	0.0090
Dissolved phosphorus	mg-P/L	-	-	-	0.0026	<0.002	<0.002	<0.002	0.0043	0.0032	0.0029	<0.002	<0.002
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals													
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	0.036	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00061	0.00061	0.00013	<0.0001	0.00060	0.00070	0.00013	0.00027	0.00029
Barium	mg/L	1.0	-	10	0.0090	0.011	0.013	0.0081	0.0097	0.0097	0.0083	0.011	0.011
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.29	0.28	0.31	0.32	0.28	0.33	0.29	0.31	0.33
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	0.0000060	<0.000005	<0.000005	<0.000005	0.0000063	0.0000081	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	0.00020	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	0.0097	<0.0005	<0.0005	<0.0005	0.0048	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	0.11	<0.03	<0.03	**5.8[Mx]**	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	<0.001	0.0016	0.0017	0.0016	0.0020	0.0016	0.0016	0.0016	0.0018
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.00087	0.0032	0.021	0.032	0.059	0.00088	0.027	0.0083	0.0030
Molybdenum	mg/L	7.6	46	-	0.0079	0.0086	0.0075	0.0060	0.0062	0.0080	0.0074	0.0078	0.0080
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.0010	0.0010	0.00063	0.00022	0.00038	0.00071	0.00062	0.00072	0.00081
Silicon	mg/L	-	-	-	8.6	8.6	7.3	6.0	6.1	8.3	6.6	8.8	9.5
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	0.81	0.90	0.89	0.91	0.80	1.1	0.92	1.2	1.2
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00028	0.00018	0.00023	0.00011	0.00016	0.00027	0.00022	0.00026	0.00028
Vanadium	mg/L	-	-	-	0.00092	0.00081	<0.0005	<0.0005	<0.0005	0.0011	<0.0005	0.00058	0.00067
Zinc	mg/L	0.11 - 0.15	0.13 - 0.17	1.7	0.046	0.018	0.096	0.094	**0.13[Mn]**	0.021	**0.17[Mn, Mx]**	**0.26[Mn, Mx]**	0.0098

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

[a] = guideline is a minimum value, unless the background concentration or value is lower.

[b] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (221 to 276 mg/L). The guideline is calculated based on the individual hardness value for each sample.

[c] = for some samples, water hardness was greater than 250 mg/L. At this hardness, no BC ENV water quality guideline has been established for sulphate; however, the observed data were screened against the guideline for very hard water (i.e., 429 mg/L) for comparative purposes.

[d] = guideline is chloride dependent. The guideline range shown is based on the chloride concentration range observed in the dataset (0.2500 to 0.5100 mg/L). The guideline is calculated based on the individual chloride concentration in each sample.

[e] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (1.22 mg-N/L) is based on the combination of field pH (6.6) and water temperature (24.7°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[f] = the ammonia guideline is pH and temperature dependent. The guideline that results in the minimum ammonia guideline (6.79 mg-N/L) is based on the combination of field pH (7.9) and water temperature (14.0°C). Guidelines calculated with temperature and pH values falling outside the defined range (i.e., pH 6.0 to 10.0 and temperature 0°C to 30°C) should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH and temperature extremes. The guideline is calculated based on the individual field pH and temperature measurements for each sample.

[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW05-01

Parameter	Unit	Guidelines for the protection of:			Sampling Sites								
		Aquatic Life		BC CSR WQG	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01
		30-day mean	Maximum		2020-06-16	2020-08-19	2020-11-11	2021-02-24	2021-05-10	2021-09-27	2021-12-09	2022-02-28	2022-06-07
Field Measured													
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.5	7.6	7.6	7.7	7.5	7.6	7.5	7.4	7.6
Specific conductivity	µS/cm	-	-	-	55	554	559	625	618	539	553	563	561
Temperature	°C	-	-	-	8.4	8.9	6.6	7.1	8.3	8.3	6.3	8.0	6.3
Conventional Parameters													
pH	mg/L	-	-	-	8.0	7.9	8.2	8.2	8.4	8.3	8.1	8.1	8.2
Specific conductivity	µS/cm	-	-	-	577	556	549	549	586	549	579	547	533
Hardness, as $CaCO_3$	mg/L	-	-	-	246	245	245	262	244	248	236	261	246
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	140	140	142	150	141	151	143	146	137
Total suspended solids	mg/L	-	-	-	-	391	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	2.8	3.1	4.1	2.8	-	-	-	-	-
Major Ions													
Calcium	mg/L	-	-	-	88	89	88	94	87	89	85	94	88
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.50	0.47	0.45	0.48	0.54	0.46	0.50	0.48	0.48
Magnesium	mg/L	-	-	-	6.6	5.8	6.3	6.7	6.3	6.1	6.1	6.6	6.7
Potassium	mg/L	-	-	-	0.47	0.46	0.50	0.55	0.53	0.50	0.49	0.50	0.48
Sodium	mg/L	-	-	-	21	19	21	22	21	20	20	21	21
Sulphate	mg/L	429[b, c]	-	4,290[b]	164	149	146	149	174	145	154	150	152
Nutrients													
Nitrate	mg-N/L	3.0	33	400	0.057	0.040	0.057	0.063	0.065	0.059	0.071	0.068	0.066
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.058	0.040	0.058	0.063	0.065	0.059	0.071	0.068	0.066
Total ammonia	mg-N/L	1.2 - 2.0[e]	6.8 - 23[f]	11 - 19[g]	0.0082	<0.005	<0.005	<0.005	<0.005	0.0098	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.097	0.076	0.079	0.092	0.075	0.078	0.091	0.085	0.088
Total phosphorus	mg-P/L	-	-	-	0.013	0.0071	<0.002	0.010	0.050	0.014	0.0061	0.031	0.033
Dissolved phosphorus	mg-P/L	-	-	-	<0.002	<0.002	0.019	0.0030	0.0028	<0.002	0.0043	0.0053	0.0064
Orthophosphate	mg-P/L	-	-	-	-	<0.001	-	-	-	-	-	-	-
Dissolved Metals													
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00021	0.00076	0.00093	0.00098	0.00095	0.00088	0.00081	0.00098	0.00091
Barium	mg/L	1.0	-	10	0.011	0.012	0.011	0.012	0.011	0.011	0.011	0.012	0.011
Beryllium	mg/L	0.00013	-	0.0015	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.001[DL>Mn]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.27	0.26	0.26	0.26	0.27	0.23	0.25	0.22	0.24
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	<0.000005	<0.00001	<0.000005	0.0000064	<0.00001	<0.00001	<0.000005	0.0000057	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	<0.0005	0.00061	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	<0.03	0.21	0.23	0.33	**0.46[Mx]**	0.30	**0.47[Mx]**	**0.38[Mx]**	0.31
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0016	0.0015	0.0016	0.0018	0.0016	0.0015	0.0015	0.0016	0.0015
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.010	0.0076	0.0073	0.0092	0.0094	0.0081	0.014	0.014	0.0098
Molybdenum	mg/L	7.6	46	-	0.0068	0.0067	0.0068	0.0066	0.0068	0.0064	0.0064	0.0066	0.0066
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00062	0.00061	0.00059	0.00085	0.00071	0.00089	0.00084	0.0012	0.00093
Silicon	mg/L	-	-	-	7.8	7.9	8.9	8.6	8.5	7.5	7.8	8.7	9.1
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	1.0	0.94	0.94	0.97	0.94	0.87	0.94	0.92	0.95
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00025	0.00028	0.00029	0.00030	0.00029	0.00030	0.00027	0.00032	0.00029
Vanadium	mg/L	-	-	-	0.00051	0.0014	0.0015	0.0016	0.0015	0.0014	0.0014	0.0016	0.0015
Zinc	mg/L	0.11 - 0.15	0.13 - 0.17	1.7	**0.16[Mn, Mx]**	0.11	0.038	0.016	0.012	0.012	0.020	0.028	0.022

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

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[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[Mx] = concentration is higher than the maximum BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

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- = no guideline or no data.

Source: [add source if not from Golder]

Table 1: Water Quality Summary, 2015 to 2022 - GW05-01

Parameter	Unit	Guidelines for the protection of:			Sampling Sites				
		Aquatic Life		BC CSR WQG	GW05-01	GW05-01	GW05-01	GW05-01	GW05-01
		30-day mean	Maximum		2022-10-13	2022-10-25	2022-11-16	2022-12-15	2022-12-27
Field Measured									
pH	-	6.5 - 9.0	6.5 - 9.0	-	7.5	7.6	7.5	6.9	7.4
Specific conductivity	µS/cm	-	-	-	589	588	582	555	582
Temperature	°C	-	-	-	8.6	7.5	6.0	7.5	7.4
Conventional Parameters									
pH	mg/L	-	-	-	8.4	8.2	8.1	8.3	8.0
Specific conductivity	µS/cm	-	-	-	571	608	585	589	586
Hardness, as $CaCO_3$	mg/L	-	-	-	241	269	243	236	248
Total alkalinity, as $CaCO_3$	mg/L	20[a]	-	-	144	133	140	135	142
Total suspended solids	mg/L	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-
Major Ions									
Calcium	mg/L	-	-	-	85	96	86	84	87
Chloride	mg/L	150	600	1,500	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	-	1.7 - 1.7[b]	3.0[b]	0.39	0.44	0.46	0.48	0.46
Magnesium	mg/L	-	-	-	6.7	6.8	7.1	6.5	7.1
Potassium	mg/L	-	-	-	0.57	0.52	0.54	0.56	0.55
Sodium	mg/L	-	-	-	22	23	21	22	22
Sulphate	mg/L	429[b, c]	-	4,290[b]	160	172	172	163	173
Nutrients									
Nitrate	mg-N/L	3.0	33	400	0.020	0.027	0.027	0.021	0.021
Nitrite	mg-N/L	0.020[d]	0.060[d]	200[d]	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate + nitrite	mg-N/L	-	-	-	0.020	0.027	0.027	0.021	0.021
Total ammonia	mg-N/L	1.2 - 2.0[e]	6.8 - 23[f]	11 - 19[g]	0.0089	<0.005	<0.005	<0.005	<0.005
Total nitrogen	mg-N/L	-	-	-	0.032	0.059	0.035	0.045	0.035
Total phosphorus	mg-P/L	-	-	-	0.0074	0.0082	0.013	0.029	0.010
Dissolved phosphorus	mg-P/L	-	-	-	0.0079	0.0059	0.0054	0.0048	0.0060
Orthophosphate	mg-P/L	-	-	-	-	-	-	-	-
Dissolved Metals									
Aluminum	mg/L	0.050[h]	0.10[h]	-	<0.003	0.0092	<0.003	<0.003	<0.003
Antimony	mg/L	0.0090	-	0.090	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	mg/L	-	0.0050	0.050	0.00092	0.00095	0.00088	0.00083	0.00079
Barium	mg/L	1.0	-	10	0.014	0.014	0.013	0.013	0.013
Beryllium	mg/L	0.00013	-	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	-	-	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	mg/L	1.2	-	12	0.25	0.29	0.26	0.28	0.24
Cadmium	mg/L	0.00038 - 0.00045[b]	0.0013 - 0.0017[b]	0.0040[b]	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005
Chromium	mg/L	0.0010[i]	-	0.010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0040	0.11	0.040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	-	-	0.090[b]	<0.0005	0.00061	<0.0005	<0.0005	<0.0005
Iron	mg/L	-	0.35	-	**0.40**[Mx]	**0.36**[Mx]	**0.38**[Mx]	**0.51**[Mx]	0.18
Lead	mg/L	0.012 - 0.015[b]	0.22 - 0.30[b]	0.11[b]	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	-	-	-	0.0014	0.0016	0.0014	0.0015	0.0015
Manganese	mg/L	1.6 - 1.8[b]	3.0 - 3.4[b]	-	0.0079	0.0069	0.0066	0.0076	0.0043
Molybdenum	mg/L	7.6	46	-	0.0060	0.0061	0.0060	0.0063	0.0059
Nickel	mg/L	0.15[b]	-	1.5[b]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	mg/L	0.0020	-	0.020	0.00024	0.00033	0.00030	0.00028	0.00025
Silicon	mg/L	-	-	-	8.2	8.5	8.6	8.2	8.4
Silver	mg/L	0.0015[b]	0.0030[b]	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium	mg/L	-	-	-	1.1	1.2	1.1	1.1	1.1
Thallium	mg/L	0.00080	-	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	-	1.0	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0085	-	0.085	0.00030	0.00029	0.00023	0.00022	0.00026
Vanadium	mg/L	-	-	-	0.0018	0.0016	0.0016	0.0014	0.0015
Zinc	mg/L	0.11 - 0.15	0.13 - 0.17	1.7	**0.15**[Mn]	**0.23**[Mn, Mx]	**0.18**[Mn, Mx]	**0.30**[Mn, Mx]	**0.20**[Mn, Mx]

Notes:

mg/L = milligrams per litre, mg-N/L = milligrams nitrogen per litre, mg-P/L = milligrams phosphorus per litre, BC CSR WQG = British Columbia Contaminated Sites Regulation Water Quality Guideline, NTU = nephelometric turbidity units, µS/cm = microseimens per centimeter,

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[g] = the ammonia guideline is pH dependent. The guideline that results in the minimum ammonia guideline (11.30 mg-N/L) is based on field pH (7.5). Guidelines calculated with temperature and pH values falling outside the defined range should be used with caution, as the WQG does not necessarily accurately reflect toxic effects at the low and high pH extremes. The guideline is calculated based on the individual pH value.

[h] = guideline is pH dependent. The guideline range shown is based on the pH range observed in the dataset (6.6 to 7.9). The guideline is calculated based on the individual pH for each sample.

[i] = guideline is for chromium VI.

[Mn] = concentration is higher than the 30-day mean BC ENV guideline or outside the recommended pH, DO or total alkalinity range.

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[DL>Mn] = analytical detection limit is higher than the 30-day mean BC ENV guideline.

Bolded concentrations are higher than water quality guidelines.

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or no data.

Source: [add source if not from Golder]

APPENDIX 2-9: Sediment Quality Screening Table

Appendix 2-9
Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)
Station				QUL-EXP-N	QUL-EXP-N	QUL-EXP-N	QUL-REF-1	QUL-EXP-N	QUL-EXP-N	QUL-EXP-T	QUL-EXP-T	QUL-EXP-T	QUL-REF-2	QUL-REF-3	QUL-REF-4	QUL-REF-5	QUL-EEMEXP
Date	Units			2016-04-27	2016-04-30	2016-04-30	2016-05-04	2016-05-06	2016-05-06	2016-05-06	2016-05-06	2016-05-06	2016-05-07	2016-05-07	2016-05-07	2016-05-07	2019-09-21
Sample ID		Lower	Upper	QUL-EXP-1N	QUL-EXP-2N	QUL-EXP-3N	QUL-REF-1	QUL-EXP-4N	QUL-EXP-5N	QUL-EXP-1T	QUL-EXP-2T	QUL-EXP-3T	QUL-REF-2	QUL-REF-3	QUL-REF-4	QUL-REF-5	QUL-EEMEXP-1
Physical Tests																	
Moisture	%	-	-	42.2	37.0	41.1	59.5	37.6	40.9	34.1	40.6	43.3	57.4	57.5	57.0	59.7	30.4
pH (1:2 soil:water)	pH units	-	-	7.53	7.61	7.99	6.81	8.08	8.02	8.31	8.46	8.27	6.77	6.72	6.78	6.79	8.26
Particle Size																	
Clay	%	-	-	9.34	9.3	12.9	10.2	17.3	16.0	15.0	24.1	14.1	9.72	10.2	9.31	9.44	15.0
Silt	%	-	-	49.7	50.1	62.8	75.8	56.8	61.4	53.1	54.7	56.3	74.9	75.8	75.0	76.0	52.4
Sand	%	-	-	41.0	40.6	24.3	14.0	25.7	22.5	31.9	21.2	29.7	15.3	14.1	15.7	14.6	32.7
Gravel	%	-	-	<0.10	<0.10	<0.10	<0.10	0.26	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.1	0.078	0.046	0.156	0.071	0.069	0.021	0.022	0.034	0.148	0.151	0.154	0.146	0.025
Organic Carbon																	
Total Organic Carbon	%	-	-	1.65	1.34	0.73	2.08	1.02	0.91	0.27	0.15	0.48	2.06	2.08	2.12	2.07	-
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31
Metals																	
Aluminum	mg/kg	-	-	16400.0	16200.0	15600.0	16800.0	16900.0	16700.0	18300.0	20000.0	20200.0	15500.0	14700.0	15100.0	17400.0	19300.0
Antimony	mg/kg	-	-	0.48	0.45	0.49	0.41	0.46	0.41	0.48	0.53	0.52	0.39	0.35	0.38	0.42	0.47
Arsenic	mg/kg	**5.9**	17.0	**11.4**	**9.71**	**14.9**	**9.6**	**8.59**	**9.37**	**12.3**	**13.4**	**13.2**	**8.87**	**8.88**	**8.86**	**8.43**	**13.0**
Barium	mg/kg	-	-	148.0	132.0	171.0	150.0	130.0	145.0	192.0	213.0	198.0	155.0	151.0	145.0	155.0	180.0
Beryllium	mg/kg	-	-	0.51	0.47	0.56	0.46	0.51	0.5	0.6	0.69	0.66	0.43	0.4	0.43	0.45	0.66
Bismuth	mg/kg	-	-	0.13	0.14	0.12	0.15	0.15	0.13	0.13	0.11	0.11	0.13	0.14	0.14	0.15	0.1
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	**0.60**	3.50	0.204	0.211	0.165	0.405	0.215	0.186	0.195	0.154	0.167	0.401	0.392	0.397	0.408	0.165
Calcium	mg/kg	-	-	14500.0	10600.0	20300.0	7880.0	12300.0	18700.0	19400.0	20500.0	24200.0	7500.0	7000.0	7850.0	8020.0	19500.0
Chromium	mg/kg	**37.3**	90.0	33.5	35.9	28.1	**55.3**	**39.5**	31.3	30.6	23.5	25.1	**54.9**	**52.3**	**53.0**	**56.6**	24.6
Cobalt	mg/kg	-	-	16.1	13.7	20.4	13.8	15.0	14.3	18.2	17.6	16.1	14.0	13.6	13.7	14.4	18.8
Copper	mg/kg	**35.7**	197.0	**303.0**	**206.0**	**469.0**	**50.5**	**193.0**	**282.0**	**462.0**	**546.0**	**463.0**	**49.0**	**49.5**	**47.2**	**48.3**	**525.0**
Iron	mg/kg	**21200**	43766	**55400.0**	**38200.0**	**82000.0**	**30400.0**	**31600.0**	**32500.0**	**58300.0**	**45000.0**	**33400.0**	**29800.0**	**29100.0**	**29000.0**	**30200.0**	**70600.0**
Lead	mg/kg	**35.0**	91.3	7.79	8.24	7.88	7.18	8.45	8.27	8.82	8.81	7.45	6.72	7.01	6.93	7.24	7.48
Lithium	mg/kg	-	-	17.3	18.0	16.1	14.2	20.2	20.7	21.0	20.4	19.8	13.6	12.7	13.7	14.0	18.5
Magnesium	mg/kg	-	-	8130.0	7910.0	8310.0	7620.0	9070.0	8800.0	9810.0	10300.0	10400.0	7850.0	7600.0	7430.0	8120.0	9990.0
Manganese	mg/kg	**460**	1100	**599.0**	**520.0**	**664.0**	**528.0**	**527.0**	**570.0**	**771.0**	**875.0**	**702.0**	**531.0**	**540.0**	**544.0**	**601.0**	**841.0**
Mercury	mg/kg	**0.17**	0.49	0.066	0.064	0.072	0.051	0.055	0.071	0.073	0.078	0.067	0.049	0.051	0.048	0.05	0.075
Molybdenum	mg/kg	**25**	23000	2.07	1.47	2.66	0.9	1.21	1.52	2.39	2.75	2.58	0.85	0.87	0.87	0.9	3.07
Nickel	mg/kg	**16**	75	**24.7**	**27.1**	**20.2**	**36.8**	**34.2**	**25.7**	**24.3**	**20.2**	**19.6**	**37.5**	**37.3**	**36.6**	**38.8**	**19.1**
Phosphorus	mg/kg	-	-	1440.0	1200.0	2020.0	1330.0	1090.0	1240.0	1350.0	1490.0	1680.0	1230.0	1220.0	1250.0	1290.0	1750.0
Potassium	mg/kg	-	-	1580.0	1470.0	1600.0	1450.0	1820.0	1760.0	2220.0	2430.0	2140.0	1380.0	1220.0	1360.0	1470.0	1810.0
Selenium	mg/kg	**2.0**	-	0.83	0.67	1.2	0.91	0.66	0.72	0.77	0.82	0.86	0.88	0.85	0.87	0.92	0.84
Silver	mg/kg	**0.5**	-	0.224	0.205	0.314	0.202	0.174	0.188	0.25	0.282	0.251	0.198	0.189	0.186	0.2	0.266
Sodium	mg/kg	-	-	560.0	450.0	720.0	460.0	500.0	670.0	880.0	1210.0	990.0	440.0	340.0	410.0	450.0	981.0
Strontium	mg/kg	-	-	100.0	86.7	123.0	78.2	96.9	138.0	141.0	158.0	167.0	71.4	69.1	73.1	77.4	144.0
Sulphur	mg/kg	-	-	1200.0	900.0	1700.0	1000.0	1000.0	800.0	1100.0	1100.0	1000.0	1000.0	900.0	1000.0	1000.0	600.0
Thallium	mg/kg	-	-	0.079	0.092	0.057	0.164	0.108	0.082	0.074	0.065	0.068	0.147	0.143	0.154	0.163	0.053
Tin	mg/kg	-	-	1.05	0.71	1.38	0.44	0.81	0.78	1.24	1.54	1.61	0.38	0.36	0.37	0.41	1.46
Titanium	mg/kg	-	-	1270.0	1060.0	1420.0	1180.0	1040.0	1060.0	1600.0	1730.0	1760.0	1130.0	941.0	1090.0	1210.0	1590.0
Uranium	mg/kg	-	-	1.42	1.32	1.35	1.38	1.26	1.21	1.16	1.2	1.33	1.29	1.35	1.32	1.44	1.16
Vanadium	mg/kg	-	-	188.0	115.0	308.0	66.0	81.4	89.6	210.0	160.0	119.0	65.3	60.7	63.3	68.2	270.0
Zinc	mg/kg	**123**	315	64.9	65.2	65.2	73.8	70.5	65.0	69.9	67.0	63.1	74.9	72.3	72.1	76.6	66.6
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)
Station				QUL-EEMEXP	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMREF2	QUL-EEMREF2	QUL-EEMREF2	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF2	QUL-EEMREF2	QUL-EEMREF1
Date	Units			2019-09-21	2019-09-21	2019-09-21	2019-09-21	2019-09-22	2019-09-22	2019-09-22	2019-09-23	2019-09-23	2019-09-23	2019-09-23	2019-09-23	2019-09-23	2019-09-24
Sample ID		Lower	Upper	QUL-EEMEXP-2	QUL-EEMEXP-3	QUL-EEMEXP-4	QUL-EEMEXP-5	QUL-EEMREF2-1	QUL-EEMREF2-2	QUL-EEMREF2-3	QUL-EEMREF1-1	QUL-EEMREF1-2	QUL-EEMREF1-3	QUL-EEMREF1-4	QUL-EEMREF2-4	QUL-EEMREF2-5	QUL-EEMREF1-5
Physical Tests																	
Moisture	%	-	-	35.4	26.1	43.6	36.2	36.7	48.7	63.0	56.0	57.8	57.0	53.4	50.4	46.7	56.5
pH (1:2 soil:water)	pH units	-	-	7.89	8.2	8.21	8.12	8.64	8.1	8.05	6.57	6.77	6.76	6.83	8.36	8.22	6.86
Particle Size																	
Clay	%	-	-	13.1	14.0	30.8	16.1	21.4	25.0	32.3	7.5	7.4	7.3	7.1	36.5	16.5	8.1
Silt	%	-	-	52.3	55.2	63.3	61.0	78.4	74.2	66.2	75.0	74.2	74.1	73.4	63.4	81.7	72.4
Sand	%	-	-	34.6	30.8	5.9	22.9	<1.0	<1.0	1.4	17.5	18.4	18.6	19.5	<1.0	1.8	19.5
Gravel	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.06	0.038	0.052	0.049	0.023	0.059	0.095	0.169	0.172	0.161	0.156	0.03	0.043	0.165
Organic Carbon																	
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon [< 63 um]	%	-	-	0.739	0.4	0.31	0.52	0.111	0.727	<0.050	1.99	2.05	1.75	1.88	0.29	0.33	1.92
Metals																	
Aluminum	mg/kg	-	-	18300.0	19000.0	23700.0	19100.0	20600.0	20800.0	21300.0	15900.0	16900.0	17500.0	17400.0	23800.0	17200.0	17400.0
Antimony	mg/kg	-	-	0.45	0.49	0.5	0.44	0.41	0.46	0.48	0.37	0.46	0.45	0.44	0.49	0.46	0.46
Arsenic	mg/kg	**5.9**	17.0	**10.1**	**13.7**	**13.1**	**8.91**	**10.7**	**11.7**	**12.9**	**8.42**	**10.2**	**8.86**	**9.61**	**12.1**	**12.0**	**9.11**
Barium	mg/kg	-	-	142.0	177.0	224.0	142.0	239.0	210.0	216.0	148.0	170.0	165.0	170.0	258.0	183.0	181.0
Beryllium	mg/kg	-	-	0.55	0.66	0.78	0.55	0.68	0.66	0.7	0.45	0.48	0.45	0.48	0.77	0.59	0.49
Bismuth	mg/kg	-	-	0.12	0.1	0.11	0.13	<0.10	0.11	0.12	0.13	0.16	0.15	0.16	0.11	0.1	0.17
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	**0.60**	3.50	0.183	0.156	0.15	0.194	0.103	0.165	0.208	0.387	0.488	0.466	0.488	0.136	0.162	0.52
Calcium	mg/kg	-	-	12800.0	22000.0	20100.0	17200.0	21700.0	19300.0	16400.0	7490.0	8500.0	8150.0	8410.0	19200.0	20700.0	8380.0
Chromium	mg/kg	**37.3**	90.0	34.6	24.1	21.9	35.7	14.4	20.4	25.6	**51.5**	**61.2**	**60.2**	**61.9**	18.9	22.1	**62.1**
Cobalt	mg/kg	-	-	15.5	18.7	16.7	14.6	13.4	16.2	17.6	13.1	15.2	15.5	15.3	17.4	13.7	15.7
Copper	mg/kg	**35.7**	197.0	**308.0**	**523.0**	**528.0**	**250.0**	**425.0**	**454.0**	**442.0**	**45.4**	**52.6**	**53.5**	**51.7**	**558.0**	**355.0**	**52.3**
Iron	mg/kg	**21200**	43766	**48700.0**	**69300.0**	**32400.0**	**33500.0**	**21600.0**	**27100.0**	**30000.0**	**28900.0**	**33700.0**	**32900.0**	**33200.0**	**25300.0**	**31100.0**	**34100.0**
Lead	mg/kg	**35.0**	91.3	7.91	7.52	8.12	8.52	5.45	7.27	8.35	6.54	7.39	7.25	7.44	8.05	6.72	7.67
Lithium	mg/kg	-	-	18.0	18.3	21.5	21.1	17.9	20.8	22.0	13.2	14.2	13.9	13.9	21.8	15.8	14.4
Magnesium	mg/kg	-	-	8840.0	10100.0	12000.0	9790.0	10100.0	11400.0	11700.0	7630.0	8340.0	8450.0	8260.0	12800.0	8610.0	8690.0
Manganese	mg/kg	**460**	1100	**665.0**	**766.0**	**810.0**	**681.0**	**711.0**	**1160.0**	**2160.0**	**501.0**	**634.0**	**584.0**	**583.0**	**865.0**	**744.0**	**587.0**
Mercury	mg/kg	**0.17**	0.49	0.07	0.08	0.078	0.074	0.061	0.08	0.092	0.051	0.065	0.063	0.062	0.077	0.066	0.064
Molybdenum	mg/kg	**25**	23000	1.87	2.93	2.51	1.39	2.14	2.28	2.29	0.9	1.17	1.11	1.14	2.12	1.91	1.15
Nickel	mg/kg	**16**	75	**26.4**	**18.5**	**19.1**	**29.3**	13.0	**19.0**	**23.8**	**35.5**	**41.5**	**41.3**	**41.4**	**18.0**	**18.1**	**42.7**
Phosphorus	mg/kg	-	-	1400.0	1760.0	1450.0	1210.0	1090.0	1120.0	1120.0	1280.0	1390.0	1250.0	1320.0	984.0	1610.0	1270.0
Potassium	mg/kg	-	-	1620.0	1770.0	2510.0	1940.0	1990.0	1830.0	1950.0	1210.0	1470.0	1460.0	1460.0	2370.0	1510.0	1520.0
Selenium	mg/kg	**2.0**	-	0.68	0.91	0.8	0.53	0.5	0.72	0.73	0.9	1.13	1.1	1.2	0.58	0.63	1.13
Silver	mg/kg	**0.5**	-	0.205	0.275	0.252	0.176	0.166	0.219	0.224	0.193	0.216	0.21	0.199	0.227	0.212	0.214
Sodium	mg/kg	-	-	649.0	886.0	1140.0	641.0	1390.0	912.0	921.0	373.0	403.0	397.0	399.0	1360.0	725.0	418.0
Strontium	mg/kg	-	-	108.0	148.0	194.0	142.0	205.0	173.0	162.0	73.2	81.6	82.4	80.7	223.0	148.0	80.7
Sulphur	mg/kg	-	-	700.0	700.0	700.0	<500	<500	500.0	600.0	1200.0	1200.0	1000.0	800.0	800.0	700.0	900.0
Thallium	mg/kg	-	-	0.082	0.053	0.064	0.094	<0.050	0.064	0.084	0.146	0.159	0.165	0.165	0.056	0.067	0.169
Tin	mg/kg	-	-	0.88	1.5	1.61	0.82	1.51	1.27	1.13	0.36	0.48	0.48	0.44	1.58	1.24	0.48
Titanium	mg/kg	-	-	1300.0	1670.0	1740.0	1220.0	1500.0	1360.0	1220.0	980.0	1090.0	1090.0	1100.0	1710.0	1350.0	1110.0
Uranium	mg/kg	-	-	1.15	1.25	1.19	1.08	0.97	1.1	1.18	1.33	1.42	1.49	1.46	1.1	1.31	1.49
Vanadium	mg/kg	-	-	166.0	260.0	109.0	86.1	76.1	83.8	83.9	59.5	70.1	70.2	70.4	85.1	108.0	72.1
Zinc	mg/kg	**123**	315	65.4	65.4	67.1	65.9	53.1	66.2	73.0	71.4	82.3	84.3	81.7	69.9	54.2	85.0
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)	Quesnel Lake (EEM)
Station				QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMREF1	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMEXP	QUL-EEMREF2	QUL-EEMREF2	QUL-EEMREF2	QUL-EEMREF2
Date	Units			2021-08-21	2021-08-21	2021-08-21	2021-08-21	2021-08-22	2021-08-24	2021-08-25	2021-08-25	2021-08-25	2021-08-25	2021-08-25	2021-08-26	2021-08-26	2021-08-26
Sample ID		Lower	Upper	QUL-EEMREF1-1	QUL-EEMREF1-2	QUL-EEMREF1-3	QUL-EEMREF1-4	QUL-EEMREF1-5	QUL-EEMEXP-1	QUL-EEMEXP-2	QUL-EEMEXP-3	QUL-EEMEXP-4	QUL-EEMEXP-5	QUL-EEMREF2-1	QUL-EEMREF2-2	QUL-EEMREF2-3	QUL-EEMREF2-4
Physical Tests																	
Moisture	%	-	-	55.9	53.8	52.8	53.5	54.6	47.5	45.4	34.9	36.8	42.2	50.5	52.8	57.6	56.7
pH (1:2 soil:water)	pH units	-	-	6.38	6.29	6.4	6.42	6.44	7.25	7.79	8.14	8.15	7.93	8.39	8.13	7.9	8.28
Particle Size																	
Clay	%	-	-	9.9	9.7	9.6	10.0	10.4	14.1	18.5	9.2	10.7	15.8	35.2	40.6	48.5	55.2
Silt	%	-	-	71.4	70.8	67.1	68.6	71.8	45.5	62.9	51.3	71.6	54.9	64.7	58.7	50.3	44.6
Sand	%	-	-	18.7	19.5	23.3	21.4	17.8	40.2	18.6	39.5	17.7	29.3	<1	<1	1.2	<1
Gravel	%	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.158	0.156	0.16	0.15	0.148	0.096	0.063	0.024	0.025	0.059	0.024	0.028	0.058	0.038
Organic Carbon																	
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon [< 63 um]	%	-	-	2.37	2.2	2.19	2.0	2.21	1.73	0.952	0.457	0.358	2.35	0.226	0.378	0.583	0.278
Metals																	
Aluminum	mg/kg	-	-	15800.0	17500.0	15700.0	14500.0	17300.0	19800.0	19700.0	17800.0	17200.0	20000.0	21900.0	24100.0	27800.0	30000.0
Antimony	mg/kg	-	-	0.42	0.45	0.41	0.4	0.44	0.5	0.49	0.47	0.47	0.5	0.5	0.53	0.63	0.63
Arsenic	mg/kg	**5.9**	17.0	**8.65**	**8.61**	**8.83**	**7.65**	**8.14**	**12.4**	**12.4**	**13.2**	**12.7**	**12.0**	**11.8**	**11.7**	**13.5**	**13.9**
Barium	mg/kg	-	-	149.0	160.0	154.0	142.0	157.0	172.0	170.0	166.0	170.0	168.0	215.0	227.0	255.0	277.0
Beryllium	mg/kg	-	-	0.45	0.47	0.46	0.41	0.45	0.64	0.62	0.62	0.61	0.61	0.75	0.79	0.88	0.96
Bismuth	mg/kg	-	-	0.12	0.14	0.12	0.12	0.13	0.12	0.11	<0.1	<0.1	0.11	<0.1	0.11	0.13	0.13
Boron	mg/kg	-	-	<5	<5	<5	<5	<5	8.0	7.2	8.2	8.9	7.6	9.2	8.5	8.9	10.6
Cadmium	mg/kg	**0.60**	3.50	0.381	0.435	0.371	0.367	0.379	0.192	0.19	0.154	0.149	0.2	0.123	0.152	0.2	0.152
Calcium	mg/kg	-	-	7490.0	8400.0	7910.0	7410.0	9240.0	12700.0	13300.0	21400.0	22200.0	15400.0	24500.0	21000.0	19700.0	21200.0
Chromium	mg/kg	**37.3**	90.0	**53.5**	**58.1**	**54.2**	**51.0**	**56.9**	31.9	30.7	21.7	19.0	30.5	16.3	21.1	27.2	23.4
Cobalt	mg/kg	-	-	13.4	14.3	13.6	12.9	13.9	17.5	17.0	18.6	13.9	15.8	15.6	17.8	21.2	21.2
Copper	mg/kg	**35.7**	197.0	**43.3**	**45.8**	**42.6**	**40.5**	**42.6**	**418.0**	**430.0**	**551.0**	**430.0**	**378.0**	**556.0**	**564.0**	**657.0**	**728.0**
Iron	mg/kg	**21200**	43766	**30300.0**	**31800.0**	**30600.0**	**29200.0**	**30900.0**	**49700.0**	**41300.0**	**71300.0**	**33600.0**	**33700.0**	**25000.0**	**27000.0**	**32700.0**	**30100.0**
Lead	mg/kg	**35.0**	91.3	6.2	6.81	6.01	6.13	6.74	7.88	7.89	6.09	5.66	7.55	7.22	8.3	10.0	10.3
Lithium	mg/kg	-	-	13.3	14.6	14.0	13.2	13.6	21.3	21.1	16.8	16.1	19.7	21.9	24.8	28.5	28.9
Magnesium	mg/kg	-	-	7910.0	8470.0	7790.0	7660.0	8940.0	10700.0	10500.0	9350.0	9640.0	10500.0	12100.0	13900.0	16200.0	16500.0
Manganese	mg/kg	**460**	1100	430.00	**464.0**	**566.0**	451.0	**539.0**	**702.0**	**755.0**	**661.0**	**698.0**	**755.0**	**861.0**	**1300.0**	**2010.0**	**1330.0**
Mercury	mg/kg	**0.17**	0.49	0.045	0.046	0.043	0.044	0.041	0.072	0.056	0.064	0.064	0.068	0.064	0.044	0.08	0.076
Molybdenum	mg/kg	**25**	23000	0.88	0.95	0.88	0.85	0.87	2.18	2.19	2.64	2.26	1.77	2.06	2.2	2.58	2.24
Nickel	mg/kg	**16**	75	**36.7**	**39.4**	**36.6**	**35.2**	**36.0**	**26.0**	**26.0**	**16.1**	15.3	**24.7**	14.5	**19.0**	**24.3**	**20.7**
Phosphorus	mg/kg	-	-	1380.0	1460.0	1380.0	1400.0	1220.0	1420.0	1410.0	1840.0	1800.0	1370.0	1120.0	1040.0	1090.0	1000.0
Potassium	mg/kg	-	-	1360.0	1490.0	1340.0	1190.0	1420.0	1530.0	1610.0	1360.0	1440.0	1690.0	1860.0	2130.0	2450.0	2640.0
Selenium	mg/kg	**2.0**	-	1.07	1.09	1.07	1.03	0.9	0.95	0.97	1.06	0.86	0.82	0.59	0.55	0.79	0.58
Silver	mg/kg	**0.5**	-	0.186	0.2	0.182	0.179	0.182	0.252	0.222	0.283	0.217	0.207	0.232	0.225	0.256	0.268
Sodium	mg/kg	-	-	416.0	468.0	417.0	371.0	445.0	627.0	646.0	733.0	758.0	671.0	1040.0	1050.0	1100.0	1330.0
Strontium	mg/kg	-	-	86.9	91.1	80.8	78.6	82.4	128.0	124.0	152.0	169.0	155.0	219.0	213.0	224.0	258.0
Sulphur	mg/kg	-	-	880.0	910.0	800.0	860.0	910.0	800.0	850.0	880.0	720.0	550.0	<500	<500	<500	<500
Thallium	mg/kg	-	-	0.142	0.152	0.133	0.136	0.149	0.073	0.071	<0.05	<0.05	0.074	<0.05	0.063	0.08	0.066
Tin	mg/kg	-	-	0.46	0.53	0.44	0.46	0.45	1.04	1.02	1.49	1.5	1.12	1.6	1.5	1.65	1.91
Titanium	mg/kg	-	-	995.0	1180.0	1030.0	943.0	1130.0	1100.0	1200.0	1380.0	1460.0	1320.0	1570.0	1540.0	1680.0	1900.0
Uranium	mg/kg	-	-	1.25	1.43	1.23	1.17	1.31	1.22	1.07	1.09	1.15	1.2	1.02	1.09	1.2	1.12
Vanadium	mg/kg	-	-	62.9	69.5	64.4	60.0	68.5	157.0	124.0	258.0	118.0	98.0	86.7	85.8	99.3	97.2
Zinc	mg/kg	**123**	315	77.2	82.5	77.6	74.1	76.2	78.9	77.2	64.8	56.2	72.1	61.6	72.6	88.0	83.8
Zirconium	mg/kg	-	-	4.2	4.4	3.9	4.1	4.3	4.1	4.6	5.3	5.2	4.7	6.8	5.7	5.8	6.8

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake (EEM)	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station				QUL-EEMREF2	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PNF	QUL-PNF	QUL-PNF
Date	Units			2021-08-26	2015-08-14	2015-08-15	2015-08-15	2015-08-16	2015-08-17	2015-08-18	2015-08-19	2015-08-24	2015-08-24	2015-08-24	2016-08-04	2016-08-04	2016-08-05
Sample ID		Lower	Upper	QUL-EEMREF2-5	QUL-PNF_SE_2_2015-08-14	QUL-PNF_SE_3_2015-08-15	QUL-PNF_SE_4_2015-08-15	QUL-PNF_SE_5_2015-08-16	QUL-PNF_SE_1_2015-08-17	QUL-PREF1_SE_1_2015-08-18	QUL-PREF1_SE_3_2015-08-19	QUL-PREF1_SE_2_2015-08-24	QUL-PREF1_SE_4_2015-08-24	QUL-PREF1_SE_5_2015-08-24	QUL-PNF_SE_1_2016-08-04	QUL-PNF_SE_2_2016-08-04	QUL-PNF_SE_3_2016-08-05
Physical Tests																	
Moisture	%	-	-	55.0	64.7	55.0	33.9	29.0	63.5	52.6	53.3	-	-	54.2	62.9	63.6	57.9
pH (1:2 soil:water)	pH units	-	-	7.95	8.38	8.51	8.55	8.53	8.26	7.36	6.69	-	-	7.01	8.42	8.45	8.47
Particle Size																	
Clay	%	-	-	30.7	49.9	43.5	16.4	13.1	54.5	11.2	11.8	9.34	9.64	11.4	55.6	53.8	43.1
Silt	%	-	-	62.3	48.5	54.7	81.7	58.7	44.1	67.7	73.0	62.5	71.7	74.3	43.4	43.9	53.0
Sand	%	-	-	7.0	1.67	1.83	1.9	28.2	1.41	21.1	15.2	28.1	18.7	14.3	1.04	2.3	3.92
Gravel	%	-	-	<1	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.10	<0.10	<0.10
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.061	0.055	0.043	0.027	0.028	0.064	0.169	0.158	-	-	0.182	0.041	0.042	0.032
Organic Carbon																	
Total Organic Carbon	%	-	-	-	0.52	0.25	<0.100	0.18	0.42	1.76	1.71	-	-	1.98	0.39	0.41	0.2
Total Organic Carbon [< 63 um]	%	-	-	0.771	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	24600.0	34500.0	28800.0	17700.0	18300.0	33300.0	16900.0	17300.0	-	-	15500.0	35900.0	36000.0	34600.0
Antimony	mg/kg	-	-	0.66	0.5	0.57	0.43	0.5	0.61	0.47	0.43	-	-	0.41	0.63	0.63	0.6
Arsenic	mg/kg	**5.9**	17.0	**15.2**	**17.0**	**16.1**	**13.4**	**14.1**	**16.2**	**8.64**	**8.98**	-	-	**9.02**	**17.9**	**18.4**	**19.4**
Barium	mg/kg	-	-	216.0	306.0	286.0	193.0	190.0	298.0	147.0	151.0	-	-	143.0	354.0	363.0	377.0
Beryllium	mg/kg	-	-	0.78	1.22	1.02	0.69	0.7	1.17	0.52	0.5	-	-	0.45	1.18	1.14	1.1
Bismuth	mg/kg	-	-	0.14	0.17	0.14	<0.100	<0.100	0.16	0.17	0.15	-	-	0.15	0.16	0.16	0.15
Boron	mg/kg	-	-	8.9	13.0	12.0	<10.0	<10.0	12.0	<10.0	<10.0	-	-	<10.0	12.0	12.0	11.0
Cadmium	mg/kg	**0.60**	3.50	0.23	0.244	0.21	0.144	0.156	0.23	0.475	0.422	-	-	0.364	0.278	0.269	0.251
Calcium	mg/kg	-	-	20400.0	34900.0	30700.0	28100.0	29100.0	33000.0	8780.0	8840.0	-	-	8620.0	32000.0	32500.0	33100.0
Chromium	mg/kg	**37.3**	90.0	30.5	25.0	22.5	14.3	19.1	23.5	**60.1**	**59.5**	-	-	**53.6**	24.0	23.7	23.2
Cobalt	mg/kg	-	-	18.8	35.0	26.1	15.9	17.8	32.7	15.2	15.0	-	-	13.4	35.3	35.3	33.8
Copper	mg/kg	**35.7**	197.0	**494.0**	**1190.0**	**904.0**	**536.0**	**557.0**	**1110.0**	**59.4**	**55.8**	-	-	**50.0**	**1230.0**	**1250.0**	**1180.0**
Iron	mg/kg	**21200**	43766	**38700.0**	**41200.0**	**38600.0**	**35100.0**	**49500.0**	**38700.0**	**32300.0**	**32700.0**	-	-	**28900.0**	**38500.0**	**38300.0**	**39400.0**
Lead	mg/kg	**35.0**	91.3	9.4	12.7	11.1	6.47	6.94	12.3	8.06	7.51	-	-	7.39	12.9	12.7	12.2
Lithium	mg/kg	-	-	24.7	41.2	30.5	18.2	19.2	39.7	15.5	15.2	-	-	12.6	39.2	38.5	34.6
Magnesium	mg/kg	-	-	13000.0	25000.0	17900.0	10200.0	10400.0	23100.0	8410.0	8660.0	-	-	7380.0	25800.0	25700.0	23600.0
Manganese	mg/kg	**460**	1100	**1550.0**	**1310.0**	**1090.0**	**716.0**	**801.0**	**1250.0**	**477.0**	**479.0**	-	-	**516.0**	**1360.0**	**1350.0**	**1330.0**
Mercury	mg/kg	**0.17**	0.49	0.073	0.114	0.094	0.075	0.078	0.116	0.063	0.052	-	-	0.059	0.102	0.103	0.091
Molybdenum	mg/kg	**25**	23000	2.22	4.82	4.15	3.17	3.47	4.64	1.2	1.02	-	-	1.01	4.46	4.45	4.4
Nickel	mg/kg	**16**	75	**25.4**	**25.5**	**22.1**	13.4	15.3	**24.6**	**41.2**	**40.1**	-	-	**36.1**	**27.3**	**25.5**	**24.5**
Phosphorus	mg/kg	-	-	1500.0	1180.0	1310.0	1650.0	1540.0	1080.0	1150.0	1190.0	-	-	1200.0	1330.0	1330.0	1580.0
Potassium	mg/kg	-	-	2180.0	3140.0	3150.0	1890.0	1830.0	3190.0	1550.0	1570.0	-	-	1430.0	3990.0	4220.0	4470.0
Selenium	mg/kg	**2.0**	-	0.82	1.61	1.29	0.82	0.87	1.54	1.1	0.93	-	-	0.88	1.59	1.57	1.38
Silver	mg/kg	**0.5**	-	0.248	0.462	0.378	0.269	0.295	0.441	0.238	0.216	-	-	0.189	0.445	0.468	0.431
Sodium	mg/kg	-	-	890.0	1650.0	1670.0	1050.0	1020.0	1590.0	470.0	520.0	-	-	500.0	1910.0	2010.0	2280.0
Strontium	mg/kg	-	-	186.0	242.0	231.0	172.0	172.0	241.0	82.0	84.5	-	-	88.9	236.0	238.0	239.0
Sulphur	mg/kg	-	-	<500	1700.0	1500.0	1400.0	1400.0	1800.0	1400.0	1300.0	-	-	800.0	1400.0	1300.0	1400.0
Thallium	mg/kg	-	-	0.094	0.065	0.066	<0.0500	<0.0500	0.067	0.194	0.171	-	-	0.158	0.072	0.067	0.067
Tin	mg/kg	-	-	1.54	2.47	2.01	1.41	1.76	2.31	0.49	0.46	-	-	0.41	2.38	2.4	2.14
Titanium	mg/kg	-	-	1670.0	2420.0	2070.0	1420.0	1760.0	2310.0	1160.0	1190.0	-	-	1040.0	2430.0	2420.0	2240.0
Uranium	mg/kg	-	-	1.48	1.59	1.42	1.13	1.27	1.54	1.57	1.43	-	-	1.39	1.62	1.61	1.57
Vanadium	mg/kg	-	-	118.0	136.0	132.0	127.0	189.0	128.0	73.0	72.3	-	-	64.9	139.0	139.0	147.0
Zinc	mg/kg	**123**	315	78.7	**131.0**	100.0	58.9	65.2	**125.0**	85.1	82.6	-	-	71.6	**131.0**	**132.0**	**125.0**
Zirconium	mg/kg	-	-	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station				QUL-PNF	QUL-PNF	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QULP-16	QULP-16
Date	Units			2016-08-05	2016-08-07	2016-08-08	2016-08-09	2016-08-09	2016-08-09	2016-08-09	2016-08-09	2016-08-10	2016-08-10	2016-08-10	2016-08-11	2016-08-24	2016-08-24
Sample ID		Lower	Upper	QUL-PNF_SE_4_2016-08-05	QUL-PNF_SE_5_2016-08-07	QUL-PFF1_SE_1_2016-08-08	QUL-PFF1_SE_2_2016-08-09	QUL-PFF1_SE_3_2016-08-09	QUL-PFF1_SE_4_2016-08-09	QUL-PFF1_SE_5_2016-08-09	QUL-PREF1_SE_1_2016-08-09	QUL-PREF1_SE_2_2016-08-10	QUL-PREF1_SE_3_2016-08-10	QUL-PREF1_SE_4_2016-08-10	QUL-PREF1_SE_5_2016-08-11	QULP-16_SE_1_2016-08-24	QULP-16_SE_11_2016-08-24
Physical Tests																	
Moisture	%	-	-	60.0	60.4	62.8	37.8	54.8	44.8	41.2	54.2	54.2	55.9	55.8	54.9	65.5	39.3
pH (1:2 soil:water)	pH units	-	-	8.45	8.35	8.2	8.43	8.48	8.47	8.48	6.52	6.49	6.53	6.52	6.56	7.92	8.08
Particle Size																	
Clay	%	-	-	52.9	50.2	55.9	13.8	52.5	25.5	15.3	10.1	10.1	10.6	10.1	13.4	4.96	12.2
Silt	%	-	-	46.1	49.3	43.2	85.6	47.5	74.3	84.5	60.8	66.4	69.2	76.4	73.9	62.9	36.0
Sand	%	-	-	0.97	0.5	0.94	0.64	<0.10	0.16	0.12	29.1	23.5	20.2	13.5	12.7	31.5	44.2
Gravel	%	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100	<0.100	<0.100	0.73	7.57
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.046	0.033	0.038	<0.020	0.023	<0.020	<0.020	0.164	0.17	0.162	0.146	0.146	0.186	0.063
Organic Carbon																	
Total Organic Carbon	%	-	-	0.38	0.35	0.21	<0.088	0.17	0.18	<0.089	2.02	2.01	2.03	1.67	1.89	3.26	<0.92
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	36800.0	33400.0	28400.0	17100.0	29300.0	20800.0	22500.0	16800.0	15800.0	16800.0	16200.0	14700.0	17300.0	16600.0
Antimony	mg/kg	-	-	0.65	0.63	0.56	0.34	0.56	0.41	0.46	0.46	0.44	0.44	0.44	0.4	0.38	0.31
Arsenic	mg/kg	**5.9**	17.0	**18.9**	**17.9**	**14.2**	**11.5**	**13.8**	**13.6**	**13.1**	**9.89**	**9.57**	**11.0**	**9.05**	**8.37**	4.54	**10.4**
Barium	mg/kg	-	-	369.0	344.0	376.0	192.0	350.0	242.0	276.0	167.0	164.0	172.0	169.0	142.0	94.6	102.0
Beryllium	mg/kg	-	-	1.14	1.05	0.87	0.59	0.92	0.69	0.72	0.47	0.43	0.48	0.45	0.45	0.6	0.44
Bismuth	mg/kg	-	-	0.17	0.15	0.14	<0.10	0.12	<0.10	<0.10	0.16	0.15	0.16	0.15	0.15	0.12	0.18
Boron	mg/kg	-	-	12.0	12.0	<10	<10	10.0	<10	<10	<10.0	<10.0	<10.0	<10.0	<10.0	19.0	<10
Cadmium	mg/kg	**0.60**	3.50	0.273	0.246	0.203	0.111	0.163	0.131	0.129	0.476	0.457	0.471	0.435	0.384	0.263	0.43
Calcium	mg/kg	-	-	31000.0	30600.0	19400.0	23200.0	23400.0	25800.0	24300.0	8130.0	7500.0	8080.0	7950.0	7840.0	11900.0	126000.0
Chromium	mg/kg	**37.3**	90.0	26.2	22.4	22.2	12.5	18.6	13.5	15.5	**59.8**	**57.6**	**59.4**	**56.3**	**50.3**	**127.0**	**40.7**
Cobalt	mg/kg	-	-	36.5	32.1	19.9	12.4	21.3	15.3	15.0	15.1	14.3	15.7	14.5	13.3	17.2	14.4
Copper	mg/kg	**35.7**	197.0	**1260.0**	**1130.0**	**706.0**	**384.0**	**744.0**	**498.0**	**502.0**	**61.1**	**56.4**	**59.4**	**56.3**	**47.5**	**63.2**	**41.3**
Iron	mg/kg	**21200**	43766	**39900.0**	**37000.0**	**27800.0**	19000.0	**25800.0**	**22500.0**	**24100.0**	**30900.0**	**29000.0**	**32100.0**	**30700.0**	**29400.0**	**38700.0**	**36800.0**
Lead	mg/kg	**35.0**	91.3	13.1	12.1	10.8	4.65	10.1	6.01	6.6	7.97	7.53	8.11	7.59	7.03	7.99	9.12
Lithium	mg/kg	-	-	37.5	33.2	20.4	15.2	23.7	17.7	17.9	13.7	12.8	14.4	13.2	13.6	18.7	24.7
Magnesium	mg/kg	-	-	25900.0	22700.0	13000.0	9190.0	14900.0	10900.0	10800.0	8450.0	7930.0	8510.0	8130.0	7390.0	13500.0	9670.0
Manganese	mg/kg	**460**	1100	**1450.0**	**1250.0**	**1030.0**	**533.0**	**924.0**	**670.0**	**678.0**	**469.0**	457.0	**495.0**	451.0	**480.0**	**554.0**	430.0
Mercury	mg/kg	**0.17**	0.49	0.108	0.102	0.079	0.059	0.08	0.061	0.063	0.052	0.056	0.054	0.057	0.057	**0.227**	0.036
Molybdenum	mg/kg	**25**	23000	4.65	4.22	2.79	2.44	3.06	2.92	2.61	1.08	0.98	1.07	0.99	0.93	0.53	1.64
Nickel	mg/kg	**16**	75	**27.4**	**23.8**	**22.2**	11.5	**18.3**	13.1	14.0	**41.2**	**38.9**	**42.3**	**39.3**	**35.1**	**52.6**	**43.1**
Phosphorus	mg/kg	-	-	1360.0	1400.0	975.0	1510.0	908.0	1620.0	1480.0	1350.0	1280.0	1400.0	1340.0	1200.0	1000.0	423.0
Potassium	mg/kg	-	-	4230.0	3790.0	5230.0	1920.0	5200.0	2570.0	3700.0	1580.0	1440.0	1560.0	1510.0	1370.0	1220.0	2380.0
Selenium	mg/kg	**2.0**	-	1.58	1.54	0.93	0.48	0.92	0.66	0.61	0.97	0.98	1.04	0.88	0.97	1.03	**3.73**
Silver	mg/kg	**0.5**	-	0.454	0.434	0.274	0.186	0.281	0.227	0.225	0.239	0.22	0.228	0.226	0.202	0.148	0.113
Sodium	mg/kg	-	-	2040.0	1850.0	2630.0	990.0	2800.0	1600.0	1910.0	480.0	420.0	440.0	430.0	410.0	490.0	200.0
Strontium	mg/kg	-	-	246.0	229.0	280.0	178.0	276.0	220.0	231.0	81.4	76.2	82.3	80.3	76.3	81.0	322.0
Sulphur	mg/kg	-	-	1400.0	1300.0	800.0	700.0	700.0	700.0	700.0	1400.0	1200.0	1100.0	900.0	1300.0	<500	1100.0
Thallium	mg/kg	-	-	0.072	0.066	0.082	<0.050	0.07	<0.050	0.054	0.17	0.162	0.175	0.159	0.166	0.101	0.169
Tin	mg/kg	-	-	2.33	2.36	1.61	1.33	1.89	1.63	1.67	0.66	0.39	0.45	0.42	0.41	0.34	0.31
Titanium	mg/kg	-	-	2440.0	2370.0	1660.0	1290.0	1890.0	1550.0	1640.0	1100.0	1050.0	1060.0	1080.0	954.0	884.0	733.0
Uranium	mg/kg	-	-	1.63	1.69	1.31	0.977	1.29	1.18	1.14	1.5	1.43	1.51	1.41	1.36	1.1	2.24
Vanadium	mg/kg	-	-	142.0	133.0	91.0	72.1	92.9	85.1	90.5	71.7	67.9	70.2	67.6	61.9	101.0	45.3
Zinc	mg/kg	**123**	315	**137.0**	119.0	81.3	48.9	82.5	59.2	59.1	84.4	80.6	87.7	80.7	68.4	60.6	65.3
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station				QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QULP-16	QUL-PNF	QUL-PNF
Date	Units			2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2016-08-24	2018-09-20	2018-09-20
Sample ID		Lower	Upper	QULP-16_SE_12_2016-08-24	QULP-16_SE_13_2016-08-24	QULP-16_SE_14_2016-08-24	QULP-16_SE_15_2016-08-24	QULP-16_SE_16_2016-08-24	QULP-16_SE_17_2016-08-24	QULP-16_SE_18_2016-08-24	QULP-16_SE_2_2016-08-24	QULP-16_SE_3_2016-08-24	QULP-16_SE_6_2016-08-24	QULP-16_SE_7_2016-08-24	QULP-16_SE_8_2016-08-24	QUL-PNF_SE_1_2018-09-20	QUL-PNF_SE_2_2018-09-20
Physical Tests																		
Moisture	%	-	-	74.5	79.1	74.9	72.5	77.0	71.1	78.6	75.3	59.5	61.7	76.8	68.8	59.1	62.6	
pH (1:2 soil:water)	pH units	-	-	7.32	7.54	7.36	7.35	7.35	7.54	7.42	7.82	7.02	8.49	7.28	7.38	8.24	8.22	
Particle Size																		
Clay	%	-	-	28.7	28.0	36.4	13.9	37.1	34.3	27.1	37.1	4.19	54.8	25.9	10.9	44.9	46.9	
Silt	%	-	-	58.0	71.6	62.7	51.3	59.4	63.2	65.5	62.4	21.5	45.0	72.7	46.1	52.7	51.6	
Sand	%	-	-	13.3	0.43	0.93	34.8	3.59	2.45	7.34	0.44	66.4	0.23	1.46	41.9	2.4	1.5	
Gravel	%	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	7.9	<0.10	<0.10	1.08	<1.00	<1.00	
Volatile Organics																		
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nutrients and Biological Indicators																		
Total Nitrogen	%	-	-	0.22	0.274	0.222	0.206	0.236	0.183	0.256	0.225	0.112	0.023	0.249	0.236	0.045	0.057	
Organic Carbon																		
Total Organic Carbon	%	-	-	2.45	2.68	2.1	2.5	2.16	1.63	2.22	1.99	3.04	0.34	2.3	2.78	0.37	0.42	
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Metals																		
Aluminum	mg/kg	-	-	23300.0	21500.0	25300.0	19300.0	24000.0	23400.0	20700.0	26100.0	24200.0	38200.0	20700.0	17600.0	31900.0	34700.0	
Antimony	mg/kg	-	-	0.77	0.64	0.73	0.9	0.75	0.68	0.62	0.74	0.55	0.7	0.62	0.52	0.56	0.59	
Arsenic	mg/kg	**5.9**	17.0	**57.2**	**52.9**	**20.8**	**16.0**	**40.4**	**53.4**	**16.2**	**47.7**	**13.4**	**18.5**	**32.0**	**6.92**	**15.6**	**16.7**	
Barium	mg/kg	-	-	249.0	234.0	208.0	141.0	200.0	191.0	147.0	230.0	120.0	359.0	207.0	106.0	312.0	321.0	
Beryllium	mg/kg	-	-	0.82	0.75	0.92	0.72	0.85	0.83	0.82	0.93	0.8	1.23	0.73	0.65	1.01	1.03	
Bismuth	mg/kg	-	-	0.27	0.27	0.27	0.25	0.29	0.28	0.3	0.26	0.2	0.17	0.24	0.19	0.16	0.14	
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	14.0	<10	<10	11.0	12.0	
Cadmium	mg/kg	**0.60**	3.50	0.599	0.559	0.547	0.446	0.54	0.48	0.41	0.508	**0.616**	0.279	0.546	0.483	0.243	0.243	
Calcium	mg/kg	-	-	10000.0	8220.0	11200.0	7700.0	10400.0	8760.0	7280.0	11600.0	9630.0	34000.0	8460.0	7090.0	22300.0	29100.0	
Chromium	mg/kg	**37.3**	90.0	**65.5**	**53.3**	**51.7**	**49.4**	**56.2**	**62.4**	**51.1**	**51.3**	**60.2**	27.8	**52.7**	**47.1**	31.4	26.4	
Cobalt	mg/kg	-	-	28.7	22.0	22.3	18.8	22.5	21.6	18.6	25.0	21.6	35.5	23.1	13.9	27.3	30.1	
Copper	mg/kg	**35.7**	197.0	**84.9**	**71.2**	**231.0**	**49.5**	**144.0**	**66.7**	**50.1**	**258.0**	**71.7**	**1230.0**	**54.8**	**46.5**	**881.0**	**1000.0**	
Iron	mg/kg	**21200**	43766	**64700.0**	**66700.0**	**43700.0**	**45300.0**	**46600.0**	**47800.0**	**47200.0**	**50200.0**	**41100.0**	**40700.0**	**73500.0**	**25300.0**	**43200.0**	**38300.0**	
Lead	mg/kg	**35.0**	91.3	15.3	15.0	16.6	12.8	16.5	14.1	14.1	16.0	11.5	12.6	12.1	9.83	12.1	11.4	
Lithium	mg/kg	-	-	26.8	26.4	29.2	25.2	28.5	26.9	26.9	29.3	25.0	39.4	25.0	21.6	30.6	33.5	
Magnesium	mg/kg	-	-	10700.0	9590.0	11400.0	8110.0	10500.0	10200.0	8530.0	12600.0	11200.0	25500.0	8700.0	7700.0	19500.0	21900.0	
Manganese	mg/kg	**460**	1100	**18400.0**	**10500.0**	**12300.0**	**1350.0**	**16900.0**	**8630.0**	**1230.0**	**14400.0**	**627.0**	**1460.0**	**4520.0**	385.0	**1420.0**	**1280.0**	
Mercury	mg/kg	**0.17**	0.49	0.151	0.144	0.162	**0.214**	0.158	0.123	0.097	0.166	0.089	0.116	0.114	0.074	-	-	
Molybdenum	mg/kg	**25**	23000	9.26	4.27	4.93	1.62	6.66	3.7	1.79	5.25	2.44	4.72	3.93	1.44	3.49	4.07	
Nickel	mg/kg	**16**	75	**62.5**	**57.9**	**51.7**	**51.4**	**55.2**	**55.5**	**51.4**	**51.9**	**63.9**	**28.6**	**58.5**	**43.5**	**28.6**	**25.4**	
Phosphorus	mg/kg	-	-	2310.0	2410.0	1240.0	1580.0	1390.0	1740.0	1470.0	1830.0	840.0	1300.0	3400.0	793.0	1160.0	1170.0	
Potassium	mg/kg	-	-	2660.0	2250.0	2910.0	2190.0	2850.0	2760.0	2520.0	2720.0	2060.0	4270.0	2390.0	1800.0	3020.0	3020.0	
Selenium	mg/kg	**2.0**	-	1.33	1.42	1.24	1.3	1.22	1.05	1.28	1.21	1.61	1.6	1.39	1.22	1.16	1.29	
Silver	mg/kg	**0.5**	-	0.289	0.255	0.32	0.236	0.326	0.313	0.269	0.312	0.208	0.483	0.235	0.191	0.358	0.41	
Sodium	mg/kg	-	-	460.0	380.0	710.0	380.0	560.0	510.0	340.0	730.0	390.0	2140.0	340.0	380.0	1400.0	1440.0	
Strontium	mg/kg	-	-	117.0	99.5	142.0	79.6	130.0	110.0	81.8	152.0	81.2	246.0	98.7	68.3	215.0	220.0	
Sulphur	mg/kg	-	-	800.0	<500	<500	1100.0	<500	<500	<500	<500	600.0	800.0	<500	<500	-	-	
Thallium	mg/kg	-	-	0.345	0.255	0.273	0.221	0.295	0.268	0.242	0.253	0.173	0.075	0.285	0.238	0.074	0.068	
Tin	mg/kg	-	-	0.48	0.43	0.78	0.39	0.62	0.48	0.42	0.86	0.46	2.37	0.4	0.35	1.9	2.18	
Titanium	mg/kg	-	-	813.0	594.0	1020.0	699.0	922.0	908.0	690.0	974.0	1250.0	2540.0	690.0	811.0	1990.0	2290.0	
Uranium	mg/kg	-	-	2.9	2.83	2.72	2.68	2.69	2.47	2.55	2.59	2.43	1.68	2.74	2.41	1.3	1.49	
Vanadium	mg/kg	-	-	79.8	69.3	82.4	60.0	75.4	76.2	59.1	86.7	101.0	145.0	68.5	62.4	132.0	126.0	
Zinc	mg/kg	**123**	315	92.3	89.5	93.2	76.6	91.8	92.1	83.0	94.5	108.0	121.0	82.6	75.5	105.0	110.0	
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.

% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Appendix 2-9
Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody				Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station		BC SQG Freshwater Aquatic Life[a]		QUL-PNF	QUL-PFF1	QUL-PNF	QUL-PNF	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1
Date	Units			2018-09-20	2018-09-21	2018-09-21	2018-09-21	2018-09-22	2018-09-22	2018-09-22	2018-09-22	2018-09-23	2018-09-24	2018-09-24	2018-09-24	2018-09-24	2019-08-26
Sample ID		Lower	Upper	QUL-PNF_SE_3_2018-09-20	QUL-PFF1_SE_1_2018-09-21	QUL-PNF_SE_4_2018-09-21	QUL-PNF_SE_5_2018-09-21	QUL-PFF1_SE_2_2018-09-22	QUL-PFF1_SE_3_2018-09-22	QUL-PFF1_SE_4_2018-09-22	QUL-PFF1_SE_5_2018-09-22	QUL-PREF1_SE_1_2018-09-23	QUL-PREF1_SE_2_2018-09-24	QUL-PREF1_SE_3_2018-09-24	QUL-PREF1_SE_4_2018-09-24	QUL-PREF1_SE_5_2018-09-24	QUL-PREF1_SE_1_2019-08-26
Physical Tests																	
Moisture	%	-	-	50.0	41.8	59.2	61.7	32.6	58.4	55.2	59.9	55.7	62.2	65.1	55.3	54.8	56.9
pH (1:2 soil:water)	pH units	-	-	8.48	8.38	8.09	8.23	8.56	8.39	8.41	8.24	6.8	6.79	6.85	6.67	6.78	6.45
Particle Size																	
Clay	%	-	-	33.8	17.7	21.4	54.8	20.5	51.8	33.8	34.3	9.7	8.5	9.3	9.1	9.1	9.5
Silt	%	-	-	58.3	79.4	55.1	44.6	79.4	48.1	66.1	65.4	75.2	73.7	77.2	75.6	76.8	80.4
Sand	%	-	-	8.0	2.9	23.5	<1.00	<1.00	<1.00	<1.00	<1.00	15.1	17.8	13.4	15.3	14.1	10.1
Gravel	%	-	-	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.031	0.023	0.121	0.061	<0.0200	0.041	0.029	0.035	0.191	0.18	0.17	0.181	0.164	0.182
Organic Carbon																	
Total Organic Carbon	%	-	-	0.2	0.16	1.44	0.41	0.107	0.138	0.127	0.185	2.07	2.22	2.13	2.26	1.92	2.07
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	28300.0	16800.0	27400.0	33000.0	17200.0	25800.0	17800.0	17600.0	14300.0	15800.0	15100.0	15100.0	14100.0	16300.0
Antimony	mg/kg	-	-	0.54	0.46	0.48	0.54	0.41	0.59	0.45	0.43	0.41	0.39	0.39	0.39	0.39	0.41
Arsenic	mg/kg	**5.9**	17.0	**15.6**	**14.5**	**12.9**	**16.0**	**10.0**	**13.2**	**11.1**	**10.8**	**8.47**	**8.47**	**7.99**	**7.5**	**7.39**	**8.49**
Barium	mg/kg	-	-	290.0	209.0	222.0	334.0	212.0	307.0	218.0	211.0	150.0	139.0	153.0	147.0	134.0	159.0
Beryllium	mg/kg	-	-	0.95	0.71	0.83	1.13	0.69	0.99	0.73	0.72	0.45	0.46	0.46	0.44	0.45	0.47
Bismuth	mg/kg	-	-	0.13	<0.100	0.15	0.17	<0.100	0.14	<0.100	<0.100	0.15	0.14	0.14	0.14	0.14	0.15
Boron	mg/kg	-	-	11.0	<10.0	<10	11.0	<10.0	12.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10
Cadmium	mg/kg	**0.60**	3.50	0.208	0.134	0.259	0.238	0.098	0.164	0.124	0.136	0.442	0.436	0.409	0.422	0.392	0.442
Calcium	mg/kg	-	-	29700.0	23700.0	17200.0	23500.0	21200.0	22800.0	19700.0	18400.0	7570.0	7850.0	8050.0	7720.0	7810.0	7320.0
Chromium	mg/kg	**37.3**	90.0	23.3	15.5	**41.0**	30.7	13.0	20.0	14.3	16.8	**53.4**	**55.9**	**53.9**	**53.9**	**51.6**	**54.9**
Cobalt	mg/kg	-	-	25.8	13.7	21.8	29.1	12.8	19.8	13.5	13.8	13.8	13.5	13.3	13.1	13.1	14.0
Copper	mg/kg	**35.7**	197.0	**850.0**	**450.0**	**533.0**	**964.0**	**406.0**	**706.0**	**491.0**	**477.0**	**48.9**	**46.8**	**45.3**	**46.7**	**43.2**	**49.7**
Iron	mg/kg	**21200**	43766	**44800.0**	**27300.0**	**38100.0**	**39900.0**	18700.0	**26600.0**	20600.0	**22400.0**	**29500.0**	**29200.0**	**28400.0**	**28100.0**	**28300.0**	**30700.0**
Lead	mg/kg	**35.0**	91.3	9.89	6.29	9.71	13.2	5.49	10.7	7.21	7.21	7.0	6.67	6.41	6.6	6.49	7.25
Lithium	mg/kg	-	-	27.7	16.2	24.8	33.4	17.8	25.0	17.4	17.2	13.8	13.2	13.5	13.2	13.2	14.9
Magnesium	mg/kg	-	-	17500.0	9060.0	14600.0	21100.0	9500.0	14000.0	9690.0	9470.0	7640.0	7560.0	7410.0	7250.0	7150.0	8250.0
Manganese	mg/kg	**460**	1100	**1170.0**	**1110.0**	**1070.0**	**1510.0**	**603.0**	**1020.0**	**701.0**	**683.0**	416.0	397.0	425.0	405.0	449.0	401.0
Mercury	mg/kg	**0.17**	0.49	-	0.073	-	-	0.062	0.09	0.08	0.079	0.055	0.058	0.053	0.056	0.052	0.049
Molybdenum	mg/kg	**25**	23000	3.85	2.69	2.47	4.13	2.23	3.01	2.45	2.09	1.05	0.91	0.89	0.85	0.88	1.06
Nickel	mg/kg	**16**	75	**21.1**	12.7	**31.0**	**28.0**	11.5	**18.2**	12.8	14.4	**37.1**	**36.2**	**35.6**	**35.4**	**34.6**	**38.4**
Phosphorus	mg/kg	-	-	1330.0	1600.0	1300.0	1030.0	937.0	878.0	1050.0	978.0	1260.0	1310.0	1220.0	1250.0	1140.0	1300.0
Potassium	mg/kg	-	-	2590.0	2040.0	2610.0	3370.0	2140.0	3250.0	2330.0	2170.0	1240.0	1300.0	1290.0	1290.0	1290.0	1290.0
Selenium	mg/kg	**2.0**	-	1.12	0.73	1.14	1.33	0.51	0.92	0.68	0.65	1.06	1.01	0.84	0.95	0.87	0.99
Silver	mg/kg	**0.5**	-	0.368	0.225	0.272	0.36	0.176	0.281	0.232	0.211	0.212	0.193	0.189	0.191	0.191	0.221
Sodium	mg/kg	-	-	1440.0	1100.0	1120.0	1600.0	1250.0	1740.0	1350.0	1220.0	339.0	379.0	390.0	378.0	364.0	373.0
Strontium	mg/kg	-	-	213.0	223.0	151.0	228.0	246.0	312.0	216.0	212.0	73.6	73.7	74.4	75.1	73.8	73.4
Sulphur	mg/kg	-	-	-	700.0	-	-	700.0	700.0	700.0	800.0	1200.0	1200.0	900.0	1000.0	900.0	1500.0
Thallium	mg/kg	-	-	0.054	<0.0500	0.109	0.077	<0.0500	0.066	<0.0500	<0.0500	0.149	0.148	0.145	0.146	0.144	0.156
Tin	mg/kg	-	-	1.95	1.57	1.33	1.79	1.53	1.86	1.46	1.37	0.35	0.41	0.51	0.37	0.37	0.37
Titanium	mg/kg	-	-	2030.0	1570.0	1620.0	1990.0	1540.0	1930.0	1490.0	1430.0	816.0	963.0	961.0	959.0	928.0	899.0
Uranium	mg/kg	-	-	1.34	1.29	1.71	1.43	1.03	1.39	1.18	1.1	1.3	1.34	1.25	1.27	1.26	1.41
Vanadium	mg/kg	-	-	153.0	94.8	116.0	120.0	66.9	89.9	72.1	75.5	59.8	63.5	61.9	62.2	59.9	62.9
Zinc	mg/kg	**123**	315	92.7	51.9	89.6	107.0	49.9	76.4	52.5	55.1	77.7	75.8	73.3	72.9	71.9	85.0
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station				QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF
Date	Units			2019-08-28	2019-08-28	2019-08-28	2019-08-29	2019-08-30	2019-08-30	2019-08-30	2019-08-31	2019-08-31	2020-08-28	2020-08-28	2020-08-28	2020-08-28	2020-08-29
Sample ID		Lower	Upper	QUL-PNF_SE_1_2019-08-28	QUL-PNF_SE_2_2019-08-28	QUL-PNF_SE_3_2019-08-28	QUL-PNF_SE_4_2019-08-29	QUL-PNF_SE_5_2019-08-30	QUL-PREF1_SE_2_2019-08-30	QUL-PREF1_SE_3_2019-08-30	QUL-PREF1_SE_4_2019-08-31	QUL-PREF1_SE_5_2019-08-31	QUL-PNF_SE_1_2020-08-28	QUL-PNF_SE_2_2020-08-28	QUL-PNF_SE_3_2020-08-28	QUL-PNF_SE_4_2020-08-28	QUL-PNF_SE_5_2020-08-29
Physical Tests																	
Moisture	%	-	-	60.0	61.3	46.7	65.1	66.5	53.7	57.2	56.5	56.0	54.0	59.3	53.3	56.2	64.9
pH (1:2 soil:water)	pH units	-	-	8.54	8.38	8.52	8.39	8.45	6.5	6.5	6.48	6.45	8.12	8.01	8.15	8.06	8.18
Particle Size																	
Clay	%	-	-	46.6	48.4	36.7	45.3	51.7	8.7	9.1	9.1	8.9	24.1	42.8	44.3	39.4	52.2
Silt	%	-	-	51.1	50.3	57.0	48.3	47.9	71.5	79.4	77.0	79.3	72.8	53.4	51.2	49.7	46.9
Sand	%	-	-	2.2	1.3	6.3	6.4	<1.0	19.8	11.5	13.9	11.8	3.1	3.8	4.5	10.9	<1.0
Gravel	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.042	0.054	0.034	0.057	0.048	0.148	0.155	0.164	0.157	0.068	0.089	0.061	0.078	0.075
Organic Carbon																	
Total Organic Carbon	%	-	-	0.55	0.6	0.36	0.65	0.43	1.78	1.56	1.71	1.88	0.424	0.606	0.415	0.546	0.543
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	35000.0	35900.0	24400.0	36300.0	31800.0	16100.0	15700.0	16200.0	15200.0	23700.0	29400.0	25800.0	26600.0	29600.0
Antimony	mg/kg	-	-	0.68	0.7	0.52	0.68	0.67	0.42	0.4	0.4	0.4	0.46	0.59	0.56	0.6	0.59
Arsenic	mg/kg	**5.9**	17.0	**17.0**	**17.3**	**14.7**	**17.5**	**15.9**	**8.18**	**7.74**	**7.86**	**7.23**	**14.6**	**15.6**	**14.3**	**14.8**	**15.3**
Barium	mg/kg	-	-	377.0	370.0	300.0	391.0	349.0	164.0	157.0	159.0	155.0	261.0	306.0	286.0	293.0	322.0
Beryllium	mg/kg	-	-	1.16	1.18	0.87	1.18	1.15	0.48	0.47	0.45	0.46	0.78	0.97	0.89	0.99	1.05
Bismuth	mg/kg	-	-	0.16	0.17	0.12	0.17	0.16	0.15	0.14	0.14	0.14	0.12	0.18	0.18	0.19	0.2
Boron	mg/kg	-	-	12.0	13.0	11.0	13.0	10.0	<10	<10	<10	<10	9.5	10.8	10.4	10.5	11.0
Cadmium	mg/kg	**0.60**	3.50	0.259	0.275	0.199	0.288	0.272	0.429	0.408	0.414	0.375	0.189	0.231	0.214	0.232	0.24
Calcium	mg/kg	-	-	31100.0	28600.0	24600.0	29500.0	28000.0	7590.0	7330.0	7400.0	7210.0	26000.0	20500.0	17600.0	18500.0	19400.0
Chromium	mg/kg	**37.3**	90.0	25.7	28.6	21.4	30.8	24.8	**56.4**	**53.4**	**54.4**	**52.3**	19.2	28.7	29.8	32.4	29.7
Cobalt	mg/kg	-	-	33.5	32.5	20.0	33.9	30.7	14.0	13.6	13.5	13.4	19.6	24.2	21.0	22.2	24.7
Copper	mg/kg	**35.7**	197.0	**1200.0**	**1140.0**	**706.0**	**1150.0**	**1100.0**	**50.2**	**48.8**	**49.4**	**46.9**	**700.0**	**854.0**	**735.0**	**743.0**	**888.0**
Iron	mg/kg	**21200**	43766	**42500.0**	**42500.0**	**38300.0**	**44300.0**	**38500.0**	**30700.0**	**29300.0**	**30600.0**	**28900.0**	**32100.0**	**38400.0**	**39400.0**	**49800.0**	**36600.0**
Lead	mg/kg	**35.0**	91.3	12.2	13.1	9.47	13.4	12.5	7.27	7.09	7.03	6.8	8.46	12.9	13.1	13.2	14.0
Lithium	mg/kg	-	-	39.1	38.4	23.6	39.3	36.9	14.5	14.5	14.3	14.0	24.3	30.7	27.1	26.3	31.2
Magnesium	mg/kg	-	-	24500.0	23500.0	13500.0	24100.0	22300.0	8180.0	7860.0	7840.0	7730.0	13900.0	17300.0	14300.0	13900.0	17100.0
Manganese	mg/kg	**460**	1100	**1390.0**	**1460.0**	**1030.0**	**1540.0**	**1370.0**	413.0	399.0	408.0	445.0	**1110.0**	**1250.0**	**1400.0**	**1430.0**	**1530.0**
Mercury	mg/kg	**0.17**	0.49	0.1	0.103	0.08	0.105	0.104	0.046	0.047	0.047	0.047	0.078	0.093	0.087	0.092	0.098
Molybdenum	mg/kg	**25**	23000	4.74	4.48	3.41	4.78	4.47	0.98	0.99	0.87	0.92	3.46	3.54	3.32	3.26	3.81
Nickel	mg/kg	**16**	75	**25.3**	**27.6**	**19.5**	**29.6**	**25.5**	**38.0**	**36.8**	**36.8**	**35.6**	**18.3**	**27.1**	**27.2**	**28.2**	**28.6**
Phosphorus	mg/kg	-	-	1280.0	1260.0	1510.0	1280.0	1130.0	1330.0	1230.0	1310.0	1200.0	1510.0	1190.0	1140.0	1230.0	1050.0
Potassium	mg/kg	-	-	3270.0	3500.0	2940.0	3620.0	2660.0	1260.0	1280.0	1280.0	1240.0	1890.0	2590.0	2500.0	2490.0	2780.0
Selenium	mg/kg	**2.0**	-	1.7	1.56	0.99	1.63	1.42	0.97	0.92	0.92	0.9	0.94	1.11	0.97	0.96	1.11
Silver	mg/kg	**0.5**	-	0.459	0.452	0.309	0.461	0.432	0.219	0.209	0.211	0.21	0.316	0.374	0.345	0.357	0.38
Sodium	mg/kg	-	-	1580.0	1520.0	1450.0	1670.0	1290.0	376.0	388.0	393.0	390.0	967.0	1130.0	1080.0	1100.0	1190.0
Strontium	mg/kg	-	-	249.0	250.0	196.0	262.0	236.0	78.9	78.6	75.3	77.7	208.0	226.0	219.0	226.0	236.0
Sulphur	mg/kg	-	-	1100.0	900.0	900.0	1000.0	900.0	1300.0	1300.0	1200.0	1100.0	850.0	910.0	730.0	700.0	760.0
Thallium	mg/kg	-	-	0.07	0.077	0.061	0.082	0.071	0.155	0.151	0.154	0.145	0.052	0.078	0.089	0.087	0.087
Tin	mg/kg	-	-	2.41	2.4	1.68	2.31	2.14	0.38	0.4	0.4	0.4	1.61	1.77	1.53	1.66	1.72
Titanium	mg/kg	-	-	2390.0	2400.0	1750.0	2380.0	2040.0	977.0	959.0	1000.0	944.0	1610.0	1880.0	1700.0	1760.0	1840.0
Uranium	mg/kg	-	-	1.56	1.63	1.26	1.69	1.47	1.4	1.4	1.39	1.37	1.36	1.54	1.4	1.59	1.54
Vanadium	mg/kg	-	-	141.0	136.0	131.0	139.0	124.0	65.1	62.6	63.2	61.3	106.0	118.0	124.0	165.0	114.0
Zinc	mg/kg	**123**	315	**130.0**	**128.0**	80.5	**133.0**	**125.0**	82.5	79.3	80.1	75.4	71.7	96.6	83.8	85.9	96.8
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	6.3	7.3	6.4	6.0	6.6

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Appendix 2-9
Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody				Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep
Station		BC SQG Freshwater Aquatic Life[a]		QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PFF1	QUL-PFF1	QUL-PFF1	QUL-PNF	QUL-PFF1	QUL-PFF1	QUL-PREF1	QUL-PREF1	QUL-PREF1	QUL-PREF1
Date	Units			2021-08-26	2021-08-27	2021-08-27	2021-08-27	2021-08-28	2021-08-28	2021-08-28	2021-08-28	2021-08-29	2021-08-29	2021-08-29	2021-08-29	2021-08-30	2021-08-30
Sample ID		Lower	Upper	QUL-PNF_SE_1_2021-08-26	QUL-PNF_SE_2_2021-08-27	QUL-PNF_SE_3_2021-08-27	QUL-PNF_SE_4_2021-08-27	QUL-PFF1_SE_1_2021-08-28	QUL-PFF1_SE_2_2021-08-28	QUL-PFF1_SE_3_2021-08-28	QUL-PNF_SE_5_2021-08-28	QUL-PFF1_SE_4_2021-08-29	QUL-PFF1_SE_5_2021-08-29	QUL-PREF1_SE_1_2021-08-29	QUL-PREF1_SE_2_2021-08-29	QUL-PREF1_SE_3_2021-08-30	QUL-PREF1_SE_4_2021-08-30
Physical Tests																	
Moisture	%	-	-	60.3	59.8	54.5	55.0	62.6	57.9	62.0	58.8	56.8	54.3	52.5	52.0	53.8	55.6
pH (1:2 soil:water)	pH units	-	-	8.09	7.92	8.42	8.07	7.83	8.16	8.07	8.05	8.17	8.18	6.52	6.44	6.5	6.4
Particle Size																	
Clay	%	-	-	45.1	38.1	47.1	37.0	69.3	64.0	72.3	47.1	48.4	58.9	12.1	10.7	11.7	10.6
Silt	%	-	-	51.3	54.3	50.9	56.9	29.7	35.7	27.2	45.4	47.1	40.2	67.9	66.5	68.2	71.5
Sand	%	-	-	3.6	7.6	2.0	6.1	1.0	<1.0	<1.0	7.5	4.5	<1.0	20.0	22.8	20.1	17.9
Gravel	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.064	0.079	0.022	0.067	0.045	0.034	0.048	0.058	0.038	<0.020	0.137	0.149	0.161	0.175
Organic Carbon																	
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon [< 63 um]	%	-	-	0.599	0.83	0.309	0.562	0.543	0.204	0.309	0.534	0.381	0.141	2.13	2.07	2.03	2.08
Metals																	
Aluminum	mg/kg	-	-	32200.0	29600.0	28800.0	25600.0	33100.0	29600.0	34000.0	27300.0	29100.0	27600.0	17100.0	15700.0	17100.0	15700.0
Antimony	mg/kg	-	-	0.67	0.64	0.58	0.66	0.67	0.6	0.65	0.66	0.63	0.59	0.47	0.44	0.44	0.44
Arsenic	mg/kg	**5.9**	17.0	**16.3**	**16.8**	**14.6**	**15.8**	**16.2**	**13.6**	**15.2**	**15.1**	**15.2**	**13.6**	**8.0**	**9.5**	**9.66**	**8.55**
Barium	mg/kg	-	-	305.0	264.0	292.0	242.0	354.0	315.0	370.0	268.0	294.0	297.0	158.0	152.0	166.0	146.0
Beryllium	mg/kg	-	-	1.0	0.98	0.97	0.85	1.07	0.97	1.11	0.93	0.94	0.92	0.48	0.44	0.5	0.42
Bismuth	mg/kg	-	-	0.17	0.15	0.14	0.12	0.19	0.14	0.18	0.15	0.14	0.12	0.13	0.12	0.14	0.12
Boron	mg/kg	-	-	10.7	10.8	10.6	10.1	10.2	10.8	11.6	9.5	11.0	10.8	<5.0	<5.0	<5.0	<5.0
Cadmium	mg/kg	**0.60**	3.50	0.242	0.235	0.185	0.214	0.251	0.17	0.22	0.255	0.228	0.155	0.432	0.392	0.418	0.387
Calcium	mg/kg	-	-	23600.0	23600.0	28400.0	23000.0	22700.0	22300.0	21300.0	17500.0	25000.0	24400.0	8030.0	7860.0	8350.0	7520.0
Chromium	mg/kg	**37.3**	90.0	32.0	28.6	21.8	24.8	29.4	22.0	28.8	32.4	25.0	20.6	**58.0**	**55.7**	**56.4**	**54.8**
Cobalt	mg/kg	-	-	27.1	25.6	22.7	19.4	24.9	20.1	23.4	24.0	20.3	18.3	14.4	13.9	14.4	13.4
Copper	mg/kg	**35.7**	197.0	**906.0**	**857.0**	**865.0**	**621.0**	**966.0**	**803.0**	**925.0**	**780.0**	**740.0**	**733.0**	**50.0**	**44.4**	**46.3**	**43.5**
Iron	mg/kg	**21200**	43766	**43300.0**	**42200.0**	**33400.0**	**34000.0**	**34500.0**	**27800.0**	**33100.0**	**41000.0**	**31000.0**	**27600.0**	**30400.0**	**30500.0**	**31000.0**	**29600.0**
Lead	mg/kg	**35.0**	91.3	13.0	11.0	10.5	9.09	14.6	11.3	14.3	11.7	10.6	10.1	6.8	6.43	6.7	6.52
Lithium	mg/kg	-	-	33.7	32.4	28.7	23.5	29.4	25.2	28.6	29.4	24.8	22.6	15.1	13.4	15.2	13.9
Magnesium	mg/kg	-	-	19700.0	19100.0	17400.0	13000.0	18400.0	15400.0	17400.0	15400.0	14900.0	13800.0	8330.0	7990.0	8500.0	7960.0
Manganese	mg/kg	**460**	1100	**1880.0**	**1270.0**	**1200.0**	**1220.0**	**1650.0**	**1150.0**	**1580.0**	**1420.0**	**1210.0**	**1100.0**	416.0	441.0	**485.0**	440.0
Mercury	mg/kg	**0.17**	0.49	0.098	0.1	0.088	0.072	0.106	0.077	0.102	0.097	0.086	0.081	0.048	0.044	0.056	0.097
Molybdenum	mg/kg	**25**	23000	4.06	3.56	3.26	3.56	3.29	2.6	2.99	3.37	2.55	2.69	1.11	0.99	1.01	0.99
Nickel	mg/kg	**16**	75	**28.6**	**25.3**	**20.0**	**22.4**	**27.4**	**20.1**	**26.1**	**29.3**	**22.1**	**18.0**	**39.4**	**37.5**	**38.9**	**37.4**
Phosphorus	mg/kg	-	-	1160.0	1220.0	1160.0	1680.0	816.0	817.0	751.0	1260.0	1220.0	974.0	1290.0	1460.0	1340.0	1320.0
Potassium	mg/kg	-	-	2780.0	2380.0	2530.0	2210.0	3200.0	2980.0	3560.0	2600.0	2820.0	2720.0	1440.0	1290.0	1430.0	1320.0
Selenium	mg/kg	**2.0**	-	1.33	1.38	1.03	1.11	1.06	0.68	0.83	1.06	0.97	0.62	1.25	1.07	1.44	1.28
Silver	mg/kg	**0.5**	-	0.375	0.369	0.331	0.322	0.357	0.292	0.34	0.348	0.302	0.285	0.231	0.191	0.196	0.201
Sodium	mg/kg	-	-	1170.0	1010.0	1330.0	992.0	1710.0	1640.0	1870.0	1120.0	1340.0	1620.0	449.0	421.0	461.0	400.0
Strontium	mg/kg	-	-	236.0	206.0	260.0	217.0	307.0	294.0	315.0	226.0	270.0	298.0	87.2	81.8	81.3	82.7
Sulphur	mg/kg	-	-	540.0	920.0	770.0	740.0	<500	<500	<500	<500	<500	<500	940.0	830.0	850.0	950.0
Thallium	mg/kg	-	-	0.086	0.074	0.056	0.073	0.082	0.066	0.085	0.086	0.074	0.058	0.157	0.139	0.152	0.145
Tin	mg/kg	-	-	1.93	2.01	1.9	1.9	1.92	1.94	2.01	1.68	2.04	1.89	0.49	0.44	0.46	0.45
Titanium	mg/kg	-	-	1930.0	1960.0	1860.0	1760.0	1850.0	1850.0	1900.0	1650.0	1940.0	1820.0	974.0	937.0	1000.0	934.0
Uranium	mg/kg	-	-	1.41	1.45	1.25	1.41	1.4	1.22	1.41	1.33	1.49	1.22	1.35	1.25	1.3	1.24
Vanadium	mg/kg	-	-	135.0	130.0	114.0	111.0	104.0	93.5	103.0	126.0	101.0	96.1	66.2	64.7	66.1	61.5
Zinc	mg/kg	**123**	315	108.0	101.0	88.5	81.0	101.0	81.7	97.8	98.8	81.9	72.6	84.9	78.2	81.7	76.9
Zirconium	mg/kg	-	-	6.9	8.1	7.9	6.0	7.8	7.8	7.1	5.8	8.0	8.2	4.2	4.0	3.6	3.9

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Deep	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Intermediate
Station				QUL-PREF1	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-PNF	QUL-I	QUL-I	QUL-I	QUL-I	QUL-I	QUL-I	QUL-I	QUL-I
Date	Units			2021-08-30	2022-08-26	2022-08-26	2022-08-27	2022-08-27	2022-08-27	2016-08-09	2016-08-11	2016-08-11	2016-08-12	2016-08-12	2016-08-12	2016-08-12	2016-08-12
Sample ID		Lower	Upper	QUL-PREF1_SE_5_2021-08-30	QUL-PNF_SE-1_2022-08	QUL-PNF_SE-2_2022-08	QUL-PNF_SE-3_2022-08	QUL-PNF_SE-4_2022-08	QUL-PNF_SE-5_2022-08	QUL-I_SE_6_2016-08-09	QUL-I_SE_1_2016-08-11	QUL-I_SE_5_2016-08-11	QUL-I_SE_10_2016-08-12	QUL-I_SE_2_2016-08-12	QUL-I_SE_3_2016-08-12	QUL-I_SE_4_2016-08-12	QUL-I_SE_7_2016-08-12
Physical Tests																	
Moisture	%	-	-	54.4	60.1	63.0	49.4	61.0	61.2	65.1	72.5	46.3	62.6	73.3	75.0	54.9	63.4
pH (1:2 soil:water)	pH units	-	-	6.64	8.01	8.02	8.22	8.07	8.16	8.18	7.62	8.21	8.48	7.47	7.7	7.93	8.2
Particle Size																	
Clay	%	-	-	11.1	41.8	46.4	33.4	49.6	47.6	49.0	31.2	25.7	51.2	33.4	35.1	19.3	47.6
Silt	%	-	-	69.4	45.4	50.5	43.6	42.9	47.7	50.4	67.2	74.3	48.4	65.2	64.3	79.2	52.3
Sand	%	-	-	19.5	12.8	3.1	23.0	7.5	4.7	0.6	1.68	<0.10	0.4	1.42	0.61	1.5	<0.10
Gravel	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.15	0.08	0.103	0.056	0.084	0.07	0.088	0.21	0.037	0.028	0.208	0.232	0.111	0.095
Organic Carbon																	
Total Organic Carbon	%	-	-	-	-	-	-	-	-	0.83	1.99	0.37	0.29	1.91	1.92	1.11	0.83
Total Organic Carbon [< 63 um]	%	-	-	2.17	0.622	0.695	0.456	0.736	0.559	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	16800.0	31900.0	29900.0	26800.0	31700.0	32500.0	31100.0	22700.0	20200.0	28200.0	22200.0	27400.0	18700.0	25900.0
Antimony	mg/kg	-	-	0.44	0.5	0.5	0.5	0.5	0.53	0.66	0.66	0.48	0.58	0.64	0.79	0.49	0.64
Arsenic	mg/kg	**5.9**	17.0	**9.38**	**15.8**	**15.3**	**15.1**	**15.5**	**16.3**	**17.2**	**16.4**	**12.6**	**15.5**	**22.3**	**28.1**	**14.8**	**15.1**
Barium	mg/kg	-	-	165.0	279.0	265.0	244.0	280.0	286.0	334.0	188.0	216.0	293.0	199.0	243.0	190.0	263.0
Beryllium	mg/kg	-	-	0.44	1.04	0.97	0.88	1.05	1.08	1.02	0.78	0.76	1.06	0.77	0.94	0.65	0.96
Bismuth	mg/kg	-	-	0.13	0.15	0.16	0.15	0.17	0.16	0.18	0.25	0.11	0.14	0.25	0.28	0.14	0.16
Boron	mg/kg	-	-	<5.0	11.1	9.8	9.3	9.9	11.3	10.0	<10	<10	12.0	<10	<10	<10	10.0
Cadmium	mg/kg	**0.60**	3.50	0.381	0.246	0.242	0.241	0.251	0.25	0.304	0.486	0.166	0.23	0.474	0.559	0.253	0.266
Calcium	mg/kg	-	-	8310.0	24800.0	20300.0	21200.0	19700.0	24200.0	26300.0	11200.0	24700.0	31300.0	9850.0	12900.0	19400.0	26000.0
Chromium	mg/kg	**37.3**	90.0	**56.7**	27.1	30.5	28.7	32.0	28.9	29.5	**48.0**	18.6	19.7	**50.7**	**52.5**	27.1	24.6
Cobalt	mg/kg	-	-	13.8	27.8	24.9	23.4	25.5	27.6	27.1	20.9	16.1	29.7	22.1	26.5	16.4	23.8
Copper	mg/kg	**35.7**	197.0	**42.4**	**925.0**	**794.0**	**745.0**	**797.0**	**915.0**	**851.0**	**219.0**	**476.0**	**1040.0**	**166.0**	**297.0**	**360.0**	**712.0**
Iron	mg/kg	**21200**	43766	**30800.0**	**46100.0**	**43100.0**	**50600.0**	**42000.0**	**43700.0**	**35600.0**	**44300.0**	**26500.0**	**35900.0**	**50400.0**	**52400.0**	**33900.0**	**33100.0**
Lead	mg/kg	**35.0**	91.3	6.46	11.8	12.0	11.2	12.6	12.4	13.5	14.7	7.84	11.6	14.5	18.3	9.09	11.8
Lithium	mg/kg	-	-	14.1	32.6	29.0	26.6	30.3	32.1	31.0	25.2	21.6	35.7	25.7	31.0	21.6	29.7
Magnesium	mg/kg	-	-	8080.0	20100.0	17600.0	15300.0	18100.0	19800.0	18400.0	10900.0	11300.0	21000.0	10700.0	13800.0	10300.0	16100.0
Manganese	mg/kg	**460**	1100	**572.0**	**1190.0**	**1360.0**	**1220.0**	**1320.0**	**1370.0**	**1310.0**	**6930.0**	**722.0**	**1150.0**	**7140.0**	**13500.0**	**2050.0**	**1090.0**
Mercury	mg/kg	**0.17**	0.49	0.045	0.1	0.1	0.092	0.1	0.103	0.116	0.133	0.075	0.11	0.145	0.154	0.1	0.116
Molybdenum	mg/kg	**25**	23000	0.99	3.61	3.35	3.19	3.24	3.66	4.11	3.68	2.77	4.41	3.98	5.25	2.5	3.49
Nickel	mg/kg	**16**	75	**37.5**	**25.7**	**28.3**	**25.9**	**29.6**	**27.2**	**29.1**	**46.7**	**17.8**	**22.1**	**50.3**	**54.2**	**25.5**	**24.9**
Phosphorus	mg/kg	-	-	1370.0	1280.0	1200.0	1310.0	1180.0	1330.0	1100.0	1250.0	1290.0	1100.0	1420.0	1480.0	1270.0	1000.0
Potassium	mg/kg	-	-	1470.0	2780.0	2620.0	2420.0	2910.0	2950.0	3860.0	2420.0	2100.0	2860.0	2410.0	2800.0	1980.0	2740.0
Selenium	mg/kg	**2.0**	-	1.23	1.23	1.08	1.02	1.1	1.22	1.43	1.29	0.85	1.52	1.27	1.53	0.96	1.38
Silver	mg/kg	**0.5**	-	0.2	0.363	0.351	0.334	0.343	0.372	0.406	0.321	0.263	0.426	0.289	0.37	0.254	0.357
Sodium	mg/kg	-	-	478.0	1150.0	1110.0	1030.0	1190.0	1230.0	1660.0	600.0	1100.0	1430.0	550.0	800.0	770.0	1290.0
Strontium	mg/kg	-	-	90.0	211.0	207.0	195.0	224.0	228.0	241.0	125.0	199.0	224.0	121.0	171.0	153.0	228.0
Sulphur	mg/kg	-	-	760.0	1190.0	880.0	900.0	860.0	870.0	1400.0	1100.0	700.0	1600.0	800.0	900.0	800.0	1400.0
Thallium	mg/kg	-	-	0.149	0.077	0.085	0.076	0.096	0.084	0.098	0.223	0.062	0.057	0.253	0.258	0.1	0.09
Tin	mg/kg	-	-	0.5	1.86	1.68	1.62	1.66	1.87	1.96	0.81	1.46	2.12	0.65	0.97	1.04	1.78
Titanium	mg/kg	-	-	1100.0	1920.0	1690.0	1660.0	1720.0	1940.0	1940.0	1010.0	1390.0	1940.0	857.0	1040.0	1120.0	1740.0
Uranium	mg/kg	-	-	1.33	1.53	1.44	1.32	1.52	1.59	1.65	2.37	1.28	1.53	2.55	2.9	1.42	1.56
Vanadium	mg/kg	-	-	67.1	142.0	130.0	166.0	125.0	137.0	111.0	88.4	82.5	117.0	77.9	93.6	90.2	98.6
Zinc	mg/kg	**123**	315	78.6	106.0	99.6	90.4	103.0	107.0	108.0	92.0	61.7	104.0	89.5	109.0	66.8	88.2
Zirconium	mg/kg	-	-	3.8	5.6	4.8	5.3	4.7	5.5	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Intermediate	Quesnel Lake Intermediate	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station				QUL-I	QUL-I	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LREF1	QUL-LFF	QUL-LFF	QUL-LFF	QUL-LREF1	QUL-LREF1	QUL-LFF
Date	Units			2016-08-12	2016-08-12	2015-08-17	2015-08-17	2015-08-17	2015-08-17	2015-08-17	2015-08-24	2015-08-25	2015-08-25	2015-08-25	2015-08-25	2015-08-25	2015-08-26
Sample ID		Lower	Upper	QUL-I_SE_8_2016-08-12	QUL-I_SE_9_2016-08-12	QUL-LNF1_SE_1_2015-08-17	QUL-LNF1_SE_2_2015-08-17	QUL-LNF1_SE_3_2015-08-17	QUL-LNF1_SE_4_2015-08-17	QUL-LNF1_SE_5_2015-08-17	QUL-LREF1_SE_1_2015-08-24	QUL-LFF_SE_1_2015-08-25	QUL-LFF_SE_2_2015-08-25	QUL-LFF_SE_5_2015-08-25	QUL-LREF1_SE_3_2015-08-25	QUL-LREF1_SE_4_2015-08-25	QUL-LFF_SE_3_2015-08-26
Physical Tests																	
Moisture	%	-	-	43.4	30.4	21.9	20.8	26.6	35.7	21.9	43.5	59.7	35.9	48.3	42.4	36.5	37.0
pH (1:2 soil:water)	pH units	-	-	8.32	8.42	6.7	8.21	8.28	8.16	8.39	7.02	7.14	6.68	7.19	7.17	6.71	6.87
Particle Size																	
Clay	%	-	-	26.8	14.2	0.4	0.85	0.47	1.42	0.79	4.62	2.84	0.97	4.93	6.3	2.99	1.56
Silt	%	-	-	61.9	56.0	2.87	7.0	16.7	39.4	7.93	35.8	37.2	18.6	38.4	36.3	29.6	32.1
Sand	%	-	-	11.3	29.8	95.9	91.7	82.8	51.9	89.9	57.8	59.5	79.6	55.6	56.8	65.3	64.9
Gravel	%	-	-	<0.10	<0.10	0.84	0.48	<0.10	7.32	1.37	1.78	0.47	0.81	1.05	0.6	2.08	1.36
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.031	<0.020	0.027	0.029	0.031	0.042	0.029	0.115	0.171	0.074	0.164	0.101	0.097	0.062
Organic Carbon																	
Total Organic Carbon	%	-	-	0.33	0.14	0.65	0.21	0.14	0.35	0.4	1.64	5.03	2.04	2.87	1.23	1.54	0.78
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	18200.0	15900.0	14500.0	12900.0	8470.0	13000.0	12700.0	13600.0	10300.0	16600.0	12900.0	12300.0	13500.0	11400.0
Antimony	mg/kg	-	-	0.46	0.44	0.46	0.46	0.37	0.39	0.47	0.33	0.3	0.24	0.25	0.3	0.3	0.24
Arsenic	mg/kg	**5.9**	17.0	**12.2**	**13.3**	**14.3**	**16.1**	**16.3**	**13.1**	**15.4**	5.37	3.02	2.75	2.77	3.82	4.43	4.82
Barium	mg/kg	-	-	187.0	191.0	128.0	105.0	71.8	113.0	107.0	117.0	58.1	54.5	61.1	107.0	122.0	65.3
Beryllium	mg/kg	-	-	0.65	0.62	0.56	0.56	0.41	0.54	0.52	0.4	0.29	0.38	0.31	0.33	0.37	0.36
Bismuth	mg/kg	-	-	0.12	0.11	0.1	<0.10	0.11	<0.10	0.1	0.12	<0.10	<0.10	0.11	<0.10	0.11	<0.10
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	**0.60**	3.50	0.196	0.181	0.261	0.268	0.18	0.165	0.214	0.345	0.318	0.239	0.183	0.287	0.358	0.107
Calcium	mg/kg	-	-	19400.0	23600.0	20000.0	22300.0	19500.0	20400.0	19300.0	8170.0	10200.0	12000.0	8640.0	7040.0	7240.0	9470.0
Chromium	mg/kg	**37.3**	90.0	25.0	22.6	33.0	33.9	**44.0**	23.1	**39.3**	**51.4**	31.4	**47.8**	35.2	**45.5**	**52.2**	**46.5**
Cobalt	mg/kg	-	-	18.9	18.0	20.4	20.1	33.9	19.4	23.9	11.6	7.74	14.7	10.1	9.78	11.0	9.32
Copper	mg/kg	**35.7**	197.0	**521.0**	**518.0**	**890.0**	**634.0**	**593.0**	**539.0**	**583.0**	33.8	**39.0**	**51.8**	32.7	27.9	33.0	**69.0**
Iron	mg/kg	**21200**	43766	**49400.0**	**62000.0**	**83000.0**	**92300.0**	**213000.0**	**89100.0**	**122000.0**	**24800.0**	18400.0	**29900.0**	**22200.0**	**21400.0**	**23400.0**	**28900.0**
Lead	mg/kg	**35.0**	91.3	8.77	8.08	7.16	6.68	6.01	5.47	6.66	6.29	5.23	7.02	6.06	5.04	6.02	4.44
Lithium	mg/kg	-	-	21.1	18.1	15.1	13.3	10.8	13.6	13.0	11.8	10.9	12.8	14.8	10.1	11.0	10.5
Magnesium	mg/kg	-	-	10900.0	9210.0	8230.0	7010.0	5190.0	7420.0	6770.0	6800.0	4900.0	9800.0	5870.0	5860.0	6600.0	5490.0
Manganese	mg/kg	**460**	1100	**892.0**	**814.0**	**852.0**	**756.0**	**671.0**	**628.0**	**842.0**	370.0	227.0	351.0	260.0	299.0	298.0	298.0
Mercury	mg/kg	**0.17**	0.49	0.083	0.08	0.123	0.102	0.094	0.082	0.105	0.048	0.067	0.06	0.044	0.036	0.047	0.045
Molybdenum	mg/kg	**25**	23000	2.97	3.17	3.26	3.64	3.97	3.04	3.0	0.99	0.49	0.68	0.31	0.69	0.82	0.84
Nickel	mg/kg	**16**	75	**21.8**	**18.0**	**20.5**	**19.2**	**18.6**	14.6	**20.9**	**32.2**	**23.9**	**33.5**	**26.8**	**27.5**	**32.3**	**21.2**
Phosphorus	mg/kg	-	-	1300.0	1610.0	1730.0	2030.0	2410.0	1810.0	1750.0	1110.0	711.0	869.0	755.0	1130.0	1190.0	1180.0
Potassium	mg/kg	-	-	1960.0	1900.0	1140.0	960.0	530.0	1020.0	950.0	1300.0	830.0	760.0	1180.0	1070.0	1270.0	940.0
Selenium	mg/kg	**2.0**	-	0.97	0.86	1.15	1.07	1.44	1.01	1.12	0.71	0.98	0.59	0.5	0.53	0.67	0.23
Silver	mg/kg	**0.5**	-	0.296	0.297	0.405	0.36	0.392	0.32	0.361	0.158	0.125	0.099	0.087	0.135	0.152	0.073
Sodium	mg/kg	-	-	870.0	860.0	630.0	540.0	330.0	620.0	510.0	480.0	260.0	330.0	250.0	440.0	460.0	410.0
Strontium	mg/kg	-	-	149.0	150.0	122.0	110.0	69.7	119.0	110.0	76.0	55.9	76.5	53.9	63.9	66.9	88.2
Sulphur	mg/kg	-	-	800.0	800.0	1000.0	1000.0	1500.0	1500.0	1100.0	<500	2100.0	600.0	600.0	<500	<500	600.0
Thallium	mg/kg	-	-	0.071	0.052	<0.050	<0.050	<0.050	<0.050	0.05	0.135	0.06	0.057	0.083	0.106	0.118	<0.050
Tin	mg/kg	-	-	1.27	1.28	1.46	1.23	1.25	1.34	1.29	0.38	0.32	0.43	0.32	0.37	0.39	0.46
Titanium	mg/kg	-	-	1310.0	1260.0	1430.0	1270.0	1150.0	1300.0	1480.0	945.0	786.0	1490.0	808.0	897.0	965.0	1020.0
Uranium	mg/kg	-	-	1.2	1.14	0.999	1.05	1.08	1.07	1.21	1.25	1.42	1.02	0.901	0.985	1.18	0.903
Vanadium	mg/kg	-	-	160.0	218.0	310.0	350.0	839.0	335.0	470.0	59.0	45.6	98.5	46.5	52.7	59.4	107.0
Zinc	mg/kg	**123**	315	69.6	61.2	68.5	65.8	86.0	61.3	72.5	64.3	41.5	61.2	46.9	57.2	65.3	43.6
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station				QUL-LFF	QUL-LFF	QUL-LFF	QUL-LFF	QUL-LFF	QUL-LFF	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LNF1	QUL-LNF1	QUL-LNF1
Date	Units			2015-08-26	2016-08-12	2016-08-13	2016-08-13	2016-08-13	2016-08-13	2016-08-14	2016-08-14	2016-08-14	2016-08-14	2016-08-14	2016-08-23	2016-08-23	2016-08-23
Sample ID		Lower	Upper	QUL-LFF_SE_4_2015-08-26	QUL-LFF_SE_3_2016-08-12	QUL-LFF_SE_1_2016-08-13	QUL-LFF_SE_2_2016-08-13	QUL-LFF_SE_4_2016-08-13	QUL-LFF_SE_5_2016-08-13	QUL-LREF1_SE_1_2016-08-14	QUL-LREF1_SE_2_2016-08-14	QUL-LREF1_SE_3_2016-08-14	QUL-LREF1_SE_4_2016-08-14	QUL-LREF1_SE_5_2016-08-14	QUL-LNF1_SE_2_2016-08-23	QUL-LNF1_SE_4_2016-08-23	QUL-LNF1_SE_5_2016-08-23
Physical Tests																	
Moisture	%	-	-	42.6	21.5	40.6	40.6	34.0	47.6	39.7	30.6	33.7	32.5	30.7	17.5	30.7	24.0
pH (1:2 soil:water)	pH units	-	-	7.57	6.32	7.56	6.35	7.74	7.0	6.16	5.98	6.46	6.42	5.69	8.5	8.63	8.55
Particle Size																	
Clay	%	-	-	1.95	1.26	7.62	1.74	2.96	5.09	5.85	1.84	3.99	3.14	2.12	0.64	0.8	0.66
Silt	%	-	-	56.0	19.9	35.1	16.3	55.4	36.0	59.5	24.1	22.7	18.9	28.9	6.15	12.6	4.67
Sand	%	-	-	42.0	78.7	46.8	82.0	41.7	58.9	33.9	73.1	69.7	76.8	66.5	88.1	86.6	83.9
Gravel	%	-	-	<0.10	0.15	10.5	<0.10	<0.10	<0.10	0.73	0.99	3.59	1.16	2.57	5.1	<0.10	10.8
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.091	0.023	0.106	0.052	0.045	0.112	0.073	0.045	0.053	0.046	0.05	<0.020	<0.020	<0.020
Organic Carbon																	
Total Organic Carbon	%	-	-	0.75	0.395	1.83	2.1	0.528	2.22	1.07	1.12	1.31	1.36	1.08	0.067	<0.056	0.215
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	15500.0	12500.0	10800.0	12700.0	14800.0	11500.0	10700.0	9570.0	10500.0	14100.0	11600.0	8980.0	9450.0	14200.0
Antimony	mg/kg	-	-	0.27	0.27	0.17	0.18	0.25	0.25	0.25	0.23	0.26	0.29	0.25	0.3	0.34	0.45
Arsenic	mg/kg	**5.9**	17.0	**6.83**	**6.92**	3.96	2.19	**5.91**	2.28	3.47	3.47	4.13	4.99	3.67	**13.3**	**14.7**	**16.0**
Barium	mg/kg	-	-	104.0	80.4	77.5	39.2	94.2	58.3	100.0	104.0	104.0	111.0	124.0	71.7	69.2	151.0
Beryllium	mg/kg	-	-	0.41	0.41	0.3	0.31	0.4	0.31	0.3	0.3	0.33	0.38	0.31	0.4	0.48	0.59
Bismuth	mg/kg	-	-	<0.10	<0.10	0.12	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	0.11
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	**0.60**	3.50	0.123	0.1	0.334	0.153	0.113	0.151	0.282	0.273	0.286	0.344	0.297	0.14	0.142	0.199
Calcium	mg/kg	-	-	12800.0	12000.0	98900.0	10100.0	12300.0	8290.0	6780.0	5770.0	6490.0	7100.0	5960.0	19000.0	24100.0	21500.0
Chromium	mg/kg	**37.3**	90.0	**48.7**	**43.4**	28.8	35.4	**56.6**	31.4	**43.2**	**43.0**	**44.4**	**52.9**	**55.4**	35.5	29.1	**38.7**
Cobalt	mg/kg	-	-	12.6	11.9	10.3	11.1	12.8	9.47	9.63	8.66	9.79	11.1	8.82	24.8	25.2	22.5
Copper	mg/kg	**35.7**	197.0	**136.0**	**155.0**	33.4	**37.8**	**91.9**	30.6	26.7	25.8	28.8	32.1	25.8	**531.0**	**556.0**	**674.0**
Iron	mg/kg	**21200**	43766	**37000.0**	**42700.0**	**28300.0**	**23800.0**	**37100.0**	**21200.0**	20200.0	20800.0	**22700.0**	**24800.0**	**22700.0**	**142000.0**	**155000.0**	**105000.0**
Lead	mg/kg	**35.0**	91.3	4.74	4.17	6.67	5.02	5.1	6.12	4.82	4.58	5.3	5.58	5.0	5.23	5.23	6.69
Lithium	mg/kg	-	-	12.7	11.8	16.5	10.6	15.4	15.8	10.2	9.8	10.8	13.6	10.9	10.7	11.0	15.2
Magnesium	mg/kg	-	-	7700.0	7100.0	7880.0	7870.0	8180.0	5840.0	5600.0	5300.0	5790.0	6980.0	5790.0	5500.0	5320.0	8030.0
Manganese	mg/kg	**460**	1100	405.0	413.0	416.0	276.0	395.0	221.0	252.0	233.0	263.0	287.0	234.0	**562.0**	**563.0**	**752.0**
Mercury	mg/kg	**0.17**	0.49	0.112	0.04	0.032	0.039	0.041	0.04	0.032	0.036	0.038	0.045	0.027	0.077	0.092	0.145
Molybdenum	mg/kg	**25**	23000	1.02	1.27	5.48	0.49	0.7	0.29	0.65	0.69	0.83	0.88	0.93	2.52	3.45	2.94
Nickel	mg/kg	**16**	75	**25.7**	**22.8**	**30.6**	**25.3**	**31.4**	**25.6**	**26.5**	**25.1**	**28.1**	**31.8**	**29.7**	**17.8**	13.6	**21.1**
Phosphorus	mg/kg	-	-	1340.0	1550.0	510.0	747.0	1270.0	715.0	1100.0	955.0	1090.0	1050.0	1080.0	2120.0	2420.0	1810.0
Potassium	mg/kg	-	-	1320.0	1000.0	1280.0	550.0	1150.0	1070.0	990.0	900.0	1000.0	1160.0	910.0	610.0	570.0	1090.0
Selenium	mg/kg	**2.0**	-	0.3	0.34	**3.23**	0.4	0.23	0.48	0.51	0.52	0.61	0.62	0.55	0.91	1.12	1.03
Silver	mg/kg	**0.5**	-	0.11	0.125	0.082	0.068	0.087	0.091	0.134	0.138	0.144	0.151	0.125	0.315	0.463	0.46
Sodium	mg/kg	-	-	680.0	480.0	200.0	230.0	560.0	200.0	350.0	320.0	350.0	380.0	340.0	380.0	370.0	600.0
Strontium	mg/kg	-	-	122.0	102.0	289.0	58.8	119.0	51.1	57.8	50.9	56.8	64.1	49.1	74.4	81.1	120.0
Sulphur	mg/kg	-	-	700.0	1000.0	11300.0	2400.0	1200.0	1100.0	1000.0	700.0	600.0	<500	600.0	<500	<500	600.0
Thallium	mg/kg	-	-	<0.050	<0.050	0.105	<0.050	<0.050	0.08	0.1	0.095	0.103	0.118	0.101	<0.050	<0.050	0.057
Tin	mg/kg	-	-	0.67	0.63	0.27	0.36	0.48	0.29	0.3	0.27	0.32	0.55	0.32	0.82	1.16	1.22
Titanium	mg/kg	-	-	1320.0	1170.0	655.0	1200.0	1090.0	706.0	862.0	743.0	770.0	1020.0	927.0	741.0	989.0	1340.0
Uranium	mg/kg	-	-	1.04	0.922	1.68	0.869	0.864	0.826	0.981	0.996	1.08	1.15	0.971	0.789	1.27	1.13
Vanadium	mg/kg	-	-	129.0	147.0	39.7	78.8	122.0	42.5	50.6	48.1	51.6	61.8	54.7	571.0	602.0	408.0
Zinc	mg/kg	**123**	315	52.2	47.0	50.6	42.8	48.9	40.8	51.4	50.1	54.8	62.3	52.9	64.2	65.5	67.2
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

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Mount Polley Mine

Waterbody		BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station				QUL-LNF1	QUL-LNF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LREF5	QUL-LREF5
Date	Units			2016-08-24	2016-08-24	2019-08-27	2019-08-27	2019-08-27	2019-08-27	2019-08-27	2019-08-30	2019-08-30	2019-08-30	2019-08-30	2019-08-30	2019-08-30	2019-08-30
Sample ID		Lower	Upper	QUL-LNF1_SE_1_2016-08-24	QUL-LNF1_SE_3_2016-08-24	QUL-LREF1_SE_1_2019-08-27	QUL-LREF1_SE_2_2019-08-27	QUL-LREF1_SE_3_2019-08-27	QUL-LREF1_SE_4_2019-08-27	QUL-LREF1_SE_5_2019-08-27	QUL-LNF1_SE_1_2019-08-30	QUL-LNF1_SE_2_2019-08-30	QUL-LNF1_SE_3_2019-08-30	QUL-LNF1_SE_4_2019-08-30	QUL-LNF1_SE_5_2019-08-30	QUL-LREF5_SE_1_2019-08-30	QUL-LREF5_SE_2_2019-08-30
Physical Tests																	
Moisture	%	-	-	22.1	19.9	46.3	44.9	44.4	43.1	37.5	29.7	23.8	31.2	25.1	20.7	36.2	48.6
pH (1:2 soil:water)	pH units	-	-	8.51	8.5	6.71	6.96	6.48	6.44	5.92	8.78	8.73	8.77	8.69	8.45	6.32	6.3
Particle Size																	
Clay	%	-	-	0.44	0.6	3.6	1.6	2.7	3.0	4.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silt	%	-	-	3.36	6.55	43.5	41.2	36.9	31.0	58.1	6.1	3.3	2.9	1.7	2.7	9.7	19.5
Sand	%	-	-	95.4	91.9	52.3	57.2	57.0	60.6	37.0	93.8	96.5	96.9	97.8	90.4	80.3	79.4
Gravel	%	-	-	0.76	0.92	<1.0	<1.0	3.5	5.4	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	9.6	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	<0.020	<0.020	0.088	0.059	0.075	0.083	0.091	<0.020	<0.020	<0.020	<0.020	<0.020	0.072	0.113
Organic Carbon																	
Total Organic Carbon	%	-	-	0.072	0.201	1.48	0.86	1.26	1.69	1.05	0.41	0.36	0.818	0.793	1.16	2.7	3.84
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																	
Aluminum	mg/kg	-	-	9030.0	11500.0	13700.0	10800.0	12800.0	12400.0	12500.0	12600.0	13700.0	15300.0	16700.0	16500.0	11900.0	14900.0
Antimony	mg/kg	-	-	0.37	0.36	0.28	0.22	0.29	0.26	0.27	0.51	0.45	0.56	0.61	0.63	<0.10	<0.10
Arsenic	mg/kg	**5.9**	17.0	**16.1**	**12.8**	4.12	3.16	3.55	3.72	3.24	**18.6**	**17.0**	**19.4**	**19.2**	**19.2**	1.45	1.6
Barium	mg/kg	-	-	84.2	110.0	114.0	85.5	111.0	107.0	151.0	141.0	119.0	154.0	201.0	165.0	68.4	79.2
Beryllium	mg/kg	-	-	0.46	0.51	0.34	0.3	0.3	0.32	0.36	0.55	0.54	0.63	0.6	0.65	0.35	0.45
Bismuth	mg/kg	-	-	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	0.12	0.17	0.14	0.15	0.24	0.38
Boron	mg/kg	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	mg/kg	**0.60**	3.50	0.205	0.156	0.309	0.237	0.27	0.295	0.283	0.322	0.231	0.419	0.341	0.419	0.129	0.196
Calcium	mg/kg	-	-	19800.0	20200.0	6940.0	6990.0	6810.0	6500.0	6490.0	24000.0	20100.0	26100.0	24300.0	19200.0	5270.0	5970.0
Chromium	mg/kg	**37.3**	90.0	**51.6**	24.8	**49.0**	**52.8**	**48.6**	**46.7**	**48.3**	**75.2**	**45.6**	**45.4**	**55.6**	**40.8**	32.2	**38.7**
Cobalt	mg/kg	-	-	35.1	18.3	10.8	8.68	10.4	9.77	9.58	40.8	25.8	26.4	24.7	22.9	9.58	11.3
Copper	mg/kg	**35.7**	197.0	**1020.0**	**512.0**	28.5	20.7	26.5	27.2	29.9	**1640.0**	**1150.0**	**2340.0**	**1520.0**	**1570.0**	15.0	18.7
Iron	mg/kg	**21200**	43766	**216000.0**	**92100.0**	**22800.0**	**22500.0**	**22100.0**	**21400.0**	**21500.0**	**242000.0**	**125000.0**	**103000.0**	**90200.0**	**89500.0**	**22300.0**	**25200.0**
Lead	mg/kg	**35.0**	91.3	7.3	5.13	5.03	3.77	4.45	4.6	4.82	9.27	7.13	9.56	9.57	9.26	4.87	6.76
Lithium	mg/kg	-	-	12.3	12.5	11.1	8.0	10.1	10.6	11.0	15.8	14.1	17.7	18.5	15.9	14.6	18.0
Magnesium	mg/kg	-	-	5900.0	6300.0	6520.0	5440.0	6070.0	5950.0	6630.0	8690.0	8090.0	10200.0	11000.0	9020.0	6690.0	7480.0
Manganese	mg/kg	**460**	1100	**716.0**	**555.0**	310.0	260.0	333.0	262.0	241.0	**993.0**	**877.0**	**1050.0**	**972.0**	**1140.0**	198.0	223.0
Mercury	mg/kg	**0.17**	0.49	0.096	0.09	0.032	0.025	0.028	0.031	0.029	0.111	0.107	0.165	0.117	0.137	0.013	0.017
Molybdenum	mg/kg	**25**	23000	3.94	2.98	0.81	0.55	0.82	0.8	0.76	5.59	5.08	6.02	6.68	3.85	0.74	0.82
Nickel	mg/kg	**16**	75	**22.0**	13.7	**29.0**	**23.1**	**26.6**	**26.7**	**28.3**	**28.1**	**24.7**	**25.9**	**34.1**	**24.7**	**34.5**	**39.7**
Phosphorus	mg/kg	-	-	1790.0	1980.0	1070.0	1290.0	1160.0	1020.0	1110.0	1730.0	1760.0	1750.0	1780.0	1810.0	1190.0	1180.0
Potassium	mg/kg	-	-	630.0	780.0	1110.0	910.0	1060.0	1050.0	1000.0	790.0	910.0	1010.0	1120.0	1130.0	1290.0	1670.0
Selenium	mg/kg	**2.0**	-	1.49	0.8	0.57	0.31	0.5	0.63	0.52	**2.14**	1.68	**2.63**	1.59	1.93	0.25	0.35
Silver	mg/kg	**0.5**	-	**0.528**	0.306	0.139	0.091	0.122	0.136	0.147	**0.82**	**0.618**	**1.07**	**0.673**	**0.707**	<0.050	0.057
Sodium	mg/kg	-	-	360.0	510.0	402.0	364.0	395.0	355.0	386.0	391.0	491.0	526.0	596.0	608.0	389.0	474.0
Strontium	mg/kg	-	-	73.8	108.0	67.3	58.2	67.3	62.0	57.8	88.2	100.0	114.0	122.0	126.0	42.2	50.8
Sulphur	mg/kg	-	-	<500	<500	600.0	500.0	<500	<500	700.0	700.0	700.0	600.0	600.0	1100.0	1000.0	1000.0
Thallium	mg/kg	-	-	<0.050	<0.050	0.106	0.083	0.095	0.1	0.106	<0.050	<0.050	<0.050	0.064	0.067	0.08	0.108
Tin	mg/kg	-	-	1.13	1.02	0.36	0.32	0.39	0.34	0.34	1.58	1.13	1.62	1.02	1.21	0.45	0.47
Titanium	mg/kg	-	-	1230.0	1070.0	1020.0	975.0	1010.0	890.0	930.0	1890.0	1340.0	1360.0	1370.0	1480.0	1060.0	1310.0
Uranium	mg/kg	-	-	0.962	0.958	1.03	0.925	1.01	0.963	0.862	1.14	0.896	0.983	0.971	1.09	1.29	1.81
Vanadium	mg/kg	-	-	869.0	354.0	56.6	57.8	56.6	51.1	55.2	969.0	491.0	385.0	329.0	331.0	26.2	38.0
Zinc	mg/kg	**123**	315	84.5	53.5	61.5	48.2	57.7	58.0	61.3	**126.0**	80.4	96.4	106.0	82.1	46.2	60.1
Zirconium	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody	Units	BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station				QUL-LREF5	QUL-LREF5	QUL-LREF5	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LREF1
Date				2019-08-30	2019-08-30	2019-08-30	2020-08-26	2020-08-26	2020-08-26	2020-08-26	2020-08-26	2020-08-29	2020-08-29	2020-08-29	2020-08-29	2020-08-29	2021-08-29
Sample ID		Lower	Upper	QUL-LREF5_SE_3_2019-08-30	QUL-LREF5_SE_4_2019-08-30	QUL-LREF5_SE_5_2019-08-30	QUL-LREF1_SE_1_2020-08-26	QUL-LREF1_SE_2_2020-08-26	QUL-LREF1_SE_3_2020-08-26	QUL-LREF1_SE_4_2020-08-26	QUL-LREF1_SE_5_2020-08-26	QUL-LNF1_SE_1_2020-08-29	QUL-LNF1_SE_2_2020-08-29	QUL-LNF1_SE_3_2020-08-29	QUL-LNF1_SE_4_2020-08-29	QUL-LNF1_SE_5_2020-08-29	QUL-LREF1_SE_1_2021-08-29
Physical Tests																	
Moisture	%	-	-	38.0	36.1	34.6	40.3	41.1	42.1	40.4	43.2	26.6	35.6	30.0	27.2	27.3	37.1
pH (1:2 soil:water)	pH units	-	-	6.56	6.71	6.37	6.52	6.2	6.62	6.56	6.23	8.76	7.04	8.39	8.71	8.63	6.73
Particle Size																	
Clay	%	-	-	<1.0	<1.0	<1.0	2.7	2.8	2.1	2.5	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	3.3
Silt	%	-	-	9.4	5.2	6.6	23.9	38.4	22.4	22.7	23.5	4.0	24.0	3.8	2.8	2.7	28.6
Sand	%	-	-	90.2	94.6	87.7	71.6	58.8	74.9	74.3	52.1	95.5	70.8	96.2	96.6	96.7	63.9
Gravel	%	-	-	<1.0	<1.0	5.3	1.8	<1.0	<1.0	<1.0	22.2	<1.0	5.2	<1.0	<1.0	<1.0	4.2
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.054	0.039	0.046	0.079	0.076	0.072	0.075	0.081	<0.020	0.042	0.02	0.023	<0.020	0.062
Organic Carbon																	
Total Organic Carbon	%	-	-	1.81	2.59	2.47	1.6	1.12	1.51	1.98	1.37	0.704	1.04	1.06	0.618	0.601	-
Total Organic Carbon [< 63 um]	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.86
Metals																	
Aluminum	mg/kg	-	-	12700.0	18300.0	15000.0	14200.0	12800.0	16000.0	14600.0	13200.0	15500.0	10900.0	16300.0	14900.0	16700.0	17100.0
Antimony	mg/kg	-	-	<0.10	<0.10	<0.10	0.31	0.27	0.35	0.31	0.28	0.66	0.34	0.53	0.6	0.59	0.34
Arsenic	mg/kg	**5.9**	17.0	1.51	2.36	1.77	4.61	3.86	5.4	5.49	4.33	**18.2**	**8.88**	**16.4**	**16.0**	**18.1**	**6.01**
Barium	mg/kg	-	-	67.5	109.0	84.6	113.0	118.0	149.0	129.0	136.0	195.0	76.0	163.0	168.0	171.0	144.0
Beryllium	mg/kg	-	-	0.38	0.57	0.46	0.38	0.34	0.45	0.41	0.35	0.59	0.34	0.55	0.55	0.62	0.41
Bismuth	mg/kg	-	-	0.23	0.28	0.25	0.11	<0.10	0.14	0.13	0.1	0.18	<0.10	0.16	0.15	0.15	0.12
Boron	mg/kg	-	-	<10	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	8.4	<5.0	8.1	7.6	10.1	<5.0
Cadmium	mg/kg	**0.60**	3.50	0.143	0.164	0.137	0.31	0.276	0.408	0.368	0.281	0.304	0.181	0.342	0.261	0.338	0.357
Calcium	mg/kg	-	-	5460.0	6990.0	5590.0	7510.0	7110.0	8150.0	7660.0	6800.0	26000.0	10400.0	17700.0	19200.0	22800.0	9400.0
Chromium	mg/kg	**37.3**	90.0	**37.8**	**56.8**	**43.4**	**52.9**	**51.7**	**60.5**	**57.2**	**51.3**	**94.9**	**40.0**	**48.3**	**61.9**	**49.4**	**60.3**
Cobalt	mg/kg	-	-	11.1	16.0	13.3	11.2	9.76	13.3	11.8	10.1	32.4	13.6	25.0	25.2	20.3	13.3
Copper	mg/kg	**35.7**	197.0	15.0	18.1	15.1	30.9	30.7	35.2	**35.8**	34.0	**1650.0**	**221.0**	**1810.0**	**1150.0**	**1810.0**	35.0
Iron	mg/kg	**21200**	43766	**22500.0**	**33000.0**	**27200.0**	**23000.0**	**23400.0**	**27100.0**	**25800.0**	**24300.0**	**172000.0**	**57800.0**	**106000.0**	**123000.0**	**70800.0**	**28200.0**
Lead	mg/kg	**35.0**	91.3	5.14	7.36	5.62	5.75	4.86	6.72	6.02	5.37	11.5	5.56	10.3	9.3	9.2	6.08
Lithium	mg/kg	-	-	15.6	22.9	17.6	12.1	10.4	13.8	12.8	11.5	17.8	11.4	16.6	15.4	17.2	12.7
Magnesium	mg/kg	-	-	7340.0	9370.0	7760.0	6830.0	6490.0	7590.0	7410.0	6700.0	9870.0	6200.0	9290.0	8290.0	9610.0	8360.0
Manganese	mg/kg	**460**	1100	231.0	324.0	257.0	330.0	292.0	443.0	409.0	290.0	**1090.0**	**559.0**	**1110.0**	**970.0**	**1190.0**	**498.0**
Mercury	mg/kg	**0.17**	0.49	0.012	0.015	0.016	0.034	0.029	0.036	0.036	0.032	0.102	0.067	0.128	0.095	0.122	0.034
Molybdenum	mg/kg	**25**	23000	0.67	0.88	0.76	0.94	0.75	0.98	1.13	0.95	9.14	1.56	4.98	5.31	6.2	1.1
Nickel	mg/kg	**16**	75	**40.4**	**57.4**	**47.3**	**30.6**	**27.7**	**34.6**	**33.4**	**29.1**	**42.7**	**21.7**	**29.1**	**31.6**	**30.5**	**33.6**
Phosphorus	mg/kg	-	-	1120.0	1110.0	1140.0	1090.0	1240.0	1210.0	1200.0	1180.0	1800.0	1340.0	1620.0	1430.0	1670.0	1220.0
Potassium	mg/kg	-	-	1270.0	1720.0	1410.0	1160.0	1020.0	1330.0	1220.0	1100.0	1000.0	850.0	1040.0	1030.0	1220.0	1470.0
Selenium	mg/kg	**2.0**	-	0.23	0.29	0.24	0.7	0.71	0.93	0.97	0.82	1.86	0.61	1.85	1.58	1.96	0.88
Silver	mg/kg	**0.5**	-	0.057	0.075	0.06	0.15	0.129	0.174	0.167	0.139	**0.744**	0.175	**0.752**	**0.623**	**0.765**	0.165
Sodium	mg/kg	-	-	456.0	635.0	509.0	403.0	393.0	445.0	414.0	408.0	470.0	328.0	624.0	479.0	608.0	514.0
Strontium	mg/kg	-	-	42.5	62.0	51.0	73.1	64.8	78.6	74.7	68.0	117.0	79.8	132.0	107.0	134.0	86.6
Sulphur	mg/kg	-	-	600.0	<500	600.0	720.0	610.0	540.0	500.0	600.0	710.0	730.0	660.0	820.0	710.0	<500
Thallium	mg/kg	-	-	0.082	0.106	0.098	0.119	0.102	0.138	0.123	0.1	<0.050	<0.050	0.056	0.058	0.067	0.131
Tin	mg/kg	-	-	0.46	0.71	0.64	0.36	0.33	0.48	0.41	0.34	1.63	0.7	1.21	1.27	1.47	0.57
Titanium	mg/kg	-	-	1490.0	2480.0	1860.0	1070.0	1060.0	1180.0	1050.0	966.0	2080.0	999.0	1190.0	1720.0	1570.0	1210.0
Uranium	mg/kg	-	-	1.96	1.85	1.44	1.32	1.06	1.41	1.34	1.14	1.37	0.997	1.01	1.1	1.23	1.3
Vanadium	mg/kg	-	-	28.3	38.5	31.5	59.9	59.6	68.7	62.8	58.3	699.0	209.0	427.0	509.0	264.0	70.1
Zinc	mg/kg	**123**	315	46.1	66.3	52.9	58.9	55.1	70.4	64.7	58.1	102.0	53.5	83.0	83.5	77.0	71.2
Zirconium	mg/kg	-	-	-	-	-	3.8	4.2	4.1	3.5	3.5	7.4	3.8	5.0	6.7	6.8	4.1

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Table 2-9A: Sediment Quality Screening at Quesnel Lake from 2016 to 2022
Mount Polley Mine

Waterbody				Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station		BC SQG Freshwater Aquatic Life[a]		QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1	QUL-LNF1
Date	Units			2021-08-29	2021-08-29	2021-08-29	2021-08-29	2021-08-30	2021-08-30	2021-08-30	2021-08-30	2021-08-30	2022-08-23	2022-08-23	2022-08-23	2022-08-23
Sample ID		Lower	Upper	QUL-LREF1_SE_2_2021-08-29	QUL-LREF1_SE_3_2021-08-29	QUL-LREF1_SE_4_2021-08-29	QUL-LREF1_SE_5_2021-08-29	QUL-LNF_SE_1_2021-08-30	QUL-LNF_SE_2_2021-08-30	QUL-LNF_SE_3_2021-08-30	QUL-LNF_SE_4_2021-08-30	QUL-LNF_SE_5_2021-08-30	QUL-LNF1_SE-1_2022-08	QUL-LNF1_SE-2_2022-08	QUL-LNF1_SE-3_2022-08	QUL-LNF1_SE-4_2022-08	QUL-LNF1_SE-5_2022-08
Physical Tests																	
Moisture	%	-	-	43.8	32.3	37.6	30.6	23.3	27.2	26.6	21.4	18.9	22.2	25.8	24.7	23.5	23.1
pH (1:2 soil:water)	pH units	-	-	6.16	6.4	6.28	5.92	8.57	8.28	8.68	8.74	8.26	8.38	8.19	8.54	8.06	8.56
Particle Size																	
Clay	%	-	-	3.2	3.6	4.1	2.8	<1.0	1.6	<1.0	<1.0	<1.0	1.1	1.1	<1.0	1.4	<1.0
Silt	%	-	-	40.0	33.5	33.2	37.2	4.6	8.9	6.6	5.4	5.8	8.9	7.7	7.8	2.9	2.8
Sand	%	-	-	56.8	58.8	60.9	60.0	95.4	89.5	93.4	94.6	80.5	90.0	90.6	92.2	94.5	96.7
Gravel	%	-	-	<1.0	4.1	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	13.7	<1.0	<1.0	<1.0	1.2	<1.0
Volatile Organics																	
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients and Biological Indicators																	
Total Nitrogen	%	-	-	0.048	0.057	0.074	0.044	<0.020	<0.020	<0.020	<0.020	<0.020	0.033	<0.020	<0.020	<0.020	0.025
Organic Carbon																	
Total Organic Carbon	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon [< 63 um]	%	-	-	0.998	1.42	1.82	1.06	0.609	0.714	0.343	0.385	0.59	0.483	1.03	0.452	1.25	0.917
Metals																	
Aluminum	mg/kg	-	-	12000.0	14500.0	14300.0	11300.0	11900.0	17100.0	9820.0	14400.0	14600.0	10400.0	15800.0	11400.0	16500.0	15800.0
Antimony	mg/kg	-	-	0.25	0.31	0.31	0.25	0.62	0.49	0.42	0.57	0.52	0.48	0.45	0.43	0.47	0.56
Arsenic	mg/kg	**5.9**	17.0	3.56	4.68	5.08	3.45	**17.4**	**15.1**	**15.0**	**18.1**	**16.3**	**14.3**	**13.3**	**14.4**	**14.7**	**20.4**
Barium	mg/kg	-	-	115.0	130.0	128.0	124.0	113.0	149.0	83.7	138.0	133.0	83.2	104.0	85.6	138.0	146.0
Beryllium	mg/kg	-	-	0.3	0.37	0.36	0.3	0.48	0.59	0.42	0.56	0.52	0.41	0.53	0.43	0.55	0.56
Bismuth	mg/kg	-	-	<0.10	<0.10	0.11	<0.10	0.15	0.11	0.11	0.13	0.11	0.12	0.11	0.12	0.14	0.16
Boron	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	7.1	7.9	5.6	8.4	8.7	6.4	7.8	6.5	7.0	8.8
Cadmium	mg/kg	**0.60**	3.50	0.245	0.308	0.352	0.273	0.302	0.275	0.207	0.332	0.291	0.183	0.349	0.248	0.477	0.456
Calcium	mg/kg	-	-	7380.0	8660.0	7100.0	6820.0	20700.0	19600.0	19800.0	24300.0	19900.0	15800.0	16700.0	17900.0	14000.0	19500.0
Chromium	mg/kg	**37.3**	90.0	**50.8**	**56.9**	**54.3**	**49.1**	**82.2**	32.4	**59.6**	**51.9**	**46.3**	**68.6**	**38.0**	**57.0**	**46.0**	**47.3**
Cobalt	mg/kg	-	-	9.29	12.0	12.5	8.52	42.4	21.4	37.8	27.9	22.6	40.8	18.5	34.1	19.8	26.7
Copper	mg/kg	**35.7**	197.0	25.1	31.0	34.5	25.3	**1310.0**	**903.0**	**854.0**	**1270.0**	**1050.0**	**693.0**	**900.0**	**938.0**	**1080.0**	**2000.0**
Iron	mg/kg	**21200**	43766	**22200.0**	**25900.0**	**24800.0**	20900.0	**260000.0**	**79900.0**	**241000.0**	**135000.0**	**95800.0**	**291000.0**	**74300.0**	**218000.0**	**67300.0**	**112000.0**
Lead	mg/kg	**35.0**	91.3	4.25	5.38	5.58	4.54	8.77	7.12	6.76	7.91	6.96	6.46	7.48	6.97	9.56	10.3
Lithium	mg/kg	-	-	8.7	11.4	11.7	9.1	13.4	15.4	11.0	14.0	13.3	11.8	14.2	12.2	15.6	15.8
Magnesium	mg/kg	-	-	6500.0	7700.0	7940.0	6420.0	8190.0	10100.0	6840.0	9490.0	9250.0	5690.0	8370.0	6610.0	9020.0	9330.0
Manganese	mg/kg	**460**	1100	277.0	366.0	354.0	241.0	**1200.0**	**1010.0**	**889.0**	**1290.0**	**1310.0**	**945.0**	**1030.0**	**927.0**	**1280.0**	**1550.0**
Mercury	mg/kg	**0.17**	0.49	0.025	0.03	0.04	0.026	0.136	0.106	0.09	0.14	0.108	0.084	0.126	0.109	0.143	**0.184**
Molybdenum	mg/kg	**25**	23000	0.6	0.83	0.92	0.74	4.54	2.97	2.6	4.9	5.1	2.23	2.5	2.47	2.37	3.82
Nickel	mg/kg	**16**	75	**25.3**	**30.5**	**32.3**	**24.5**	**29.7**	**20.2**	**22.5**	**25.6**	**25.7**	**25.6**	**23.3**	**23.5**	**29.6**	**25.8**
Phosphorus	mg/kg	-	-	1000.0	1200.0	1130.0	1190.0	1520.0	1830.0	1910.0	1880.0	1650.0	1500.0	1470.0	1770.0	1410.0	1560.0
Potassium	mg/kg	-	-	1100.0	1280.0	1290.0	940.0	850.0	1230.0	680.0	1070.0	1060.0	710.0	1180.0	740.0	1210.0	1110.0
Selenium	mg/kg	**2.0**	-	0.51	0.66	0.77	0.5	**2.07**	1.37	1.41	1.77	1.44	1.18	1.2	1.31	1.22	**2.15**
Silver	mg/kg	**0.5**	-	0.104	0.197	0.164	0.118	**0.637**	0.414	0.425	**0.602**	0.495	0.391	0.402	0.46	0.448	**0.906**
Sodium	mg/kg	-	-	462.0	468.0	406.0	380.0	410.0	646.0	379.0	546.0	554.0	365.0	540.0	389.0	517.0	530.0
Strontium	mg/kg	-	-	64.5	78.1	68.8	57.9	91.4	148.0	77.6	117.0	122.0	78.1	116.0	83.3	112.0	113.0
Sulphur	mg/kg	-	-	<500	<500	<500	<500	830.0	950.0	880.0	860.0	730.0	810.0	720.0	790.0	690.0	730.0
Thallium	mg/kg	-	-	0.092	0.111	0.116	0.089	<0.050	0.055	<0.050	0.051	0.055	<0.050	0.066	<0.050	0.08	0.064
Tin	mg/kg	-	-	0.39	0.51	0.48	0.37	1.87	1.36	1.35	1.67	1.59	1.83	1.2	1.42	1.17	1.58
Titanium	mg/kg	-	-	1070.0	1160.0	981.0	934.0	2150.0	1320.0	1350.0	1760.0	1530.0	1870.0	1380.0	1510.0	1110.0	1480.0
Uranium	mg/kg	-	-	0.936	1.18	1.07	0.852	1.08	1.03	0.898	1.1	1.01	1.45	1.18	1.04	1.0	1.02
Vanadium	mg/kg	-	-	58.8	65.3	60.8	55.8	1080.0	322.0	1020.0	557.0	388.0	1140.0	266.0	831.0	227.0	409.0
Zinc	mg/kg	**123**	315	54.2	65.8	68.7	53.2	110.0	70.7	92.3	86.8	76.4	94.2	64.5	86.1	77.4	85.3
Zirconium	mg/kg	-	-	4.0	4.3	4.2	4.0	7.4	5.7	5.0	7.3	6.7	5.6	5.1	5.1	4.0	4.8

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

Waterbody	Units	BC SQG Freshwater Aquatic Life[a]		Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow	Quesnel Lake Shallow
Station				QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1	QUL-LREF1
Date				2022-08-23	2022-08-23	2022-08-23	2022-08-23	2022-08-23
Sample ID		Lower	Upper	QUL-LREF1_SE-1_2022-08	QUL-LREF1_SE-2_2022-08	QUL-LREF1_SE-3_2022-08	QUL-LREF1_SE-4_2022-08	QUL-LREF1_SE-5_2022-08
Physical Tests								
Moisture	%	-	-	30.6	26.6	30.6	34.9	29.6
pH (1:2 soil:water)	pH units	-	-	6.19	5.97	6.07	6.38	6.01
Particle Size								
Clay	%	-	-	4.1	2.6	3.9	3.6	4.4
Silt	%	-	-	33.6	29.0	32.3	22.5	44.9
Sand	%	-	-	60.3	64.4	60.4	73.3	48.6
Gravel	%	-	-	2.0	4.0	3.4	<1.0	2.1
Volatile Organics								
Acid Volatile Sulphides	µmol/g	-	-	-	-	-	-	-
Nutrients and Biological Indicators								
Total Nitrogen	%	-	-	0.078	0.058	0.093	0.074	0.087
Organic Carbon								
Total Organic Carbon	%	-	-	-	-	-	-	-
Total Organic Carbon [< 63 um]	%	-	-	1.55	0.984	1.48	1.87	1.12
Metals								
Aluminum	mg/kg	-	-	15600.0	14200.0	16300.0	17800.0	15100.0
Antimony	mg/kg	-	-	0.29	0.25	0.34	0.3	0.26
Arsenic	mg/kg	**5.9**	17.0	4.68	4.14	5.08	5.71	3.97
Barium	mg/kg	-	-	128.0	108.0	130.0	138.0	124.0
Beryllium	mg/kg	-	-	0.43	0.38	0.41	0.45	0.39
Bismuth	mg/kg	-	-	0.11	<0.10	0.1	0.13	<0.10
Boron	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	mg/kg	**0.60**	3.50	0.358	0.268	0.328	0.388	0.289
Calcium	mg/kg	-	-	7790.0	7970.0	8230.0	8680.0	7680.0
Chromium	mg/kg	**37.3**	90.0	**53.9**	**58.0**	**55.6**	**59.0**	**52.6**
Cobalt	mg/kg	-	-	11.8	10.1	12.2	12.9	10.5
Copper	mg/kg	**35.7**	197.0	34.1	26.9	33.0	**36.6**	29.7
Iron	mg/kg	**21200**	43766	**25300.0**	**25000.0**	**27200.0**	**28500.0**	**24200.0**
Lead	mg/kg	**35.0**	91.3	5.96	4.88	5.69	6.47	5.14
Lithium	mg/kg	-	-	12.6	10.0	12.1	13.7	10.9
Magnesium	mg/kg	-	-	7570.0	6770.0	7670.0	8320.0	7350.0
Manganese	mg/kg	**460**	1100	353.0	306.0	430.0	407.0	320.0
Mercury	mg/kg	**0.17**	0.49	0.037	0.029	0.036	0.044	0.031
Molybdenum	mg/kg	**25**	23000	0.86	0.61	0.85	0.94	0.62
Nickel	mg/kg	**16**	75	**32.7**	**28.2**	**32.3**	**34.8**	**29.6**
Phosphorus	mg/kg	-	-	1090.0	1160.0	1210.0	1110.0	1120.0
Potassium	mg/kg	-	-	1360.0	1150.0	1510.0	1630.0	1300.0
Selenium	mg/kg	**2.0**	-	0.71	0.52	0.7	0.88	0.58
Silver	mg/kg	**0.5**	-	0.159	0.127	0.14	0.167	0.128
Sodium	mg/kg	-	-	463.0	496.0	546.0	560.0	515.0
Strontium	mg/kg	-	-	74.3	70.2	77.2	83.7	72.0
Sulphur	mg/kg	-	-	530.0	<500	<500	<500	510.0
Thallium	mg/kg	-	-	0.13	0.105	0.129	0.147	0.112
Tin	mg/kg	-	-	0.49	0.51	0.49	0.57	0.45
Titanium	mg/kg	-	-	991.0	1090.0	1140.0	1080.0	1080.0
Uranium	mg/kg	-	-	1.2	1.19	1.3	1.39	1.06
Vanadium	mg/kg	-	-	61.6	65.5	65.1	67.8	61.8
Zinc	mg/kg	**123**	315	66.4	56.2	65.0	70.3	61.2
Zirconium	mg/kg	-	-	3.2	3.6	3.4	3.0	3.5

Notes:

(a) = Concentrations equal to the guideline values were not identified as exceedances. Concentrations were screened against British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Working Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

Value = value is greater than the Lower SQG.

Value = value is greater than the Upper SQG.

BC SQG = British Columbia sediment quality guideline; CaCO3 = calcium carbonate; "-" = no guideline, no data available, or not applicable; < = less than; TOC = total organic carbon.
% = percent; µm = micrometre; m = metres; mm = millimetres; mg/kg = milligrams per kilogram

Source: Minnow Environmental Inc., 2023

APPENDIX 2-10: Species at Risk

Scientific Name	Common Name	Name Category	Global	Provincial	BC List	COSEWIC	SARA
Acipenser transmontanus	White Sturgeon	Vertebrate Animal	G4	S2	No Status	Endangered / Threatened	Endangered
Acipenser transmontanus pop. 5	White Sturgeon (Upper Fraser River Population)	Vertebrate Animal	G4T1Q	S2	Red	Endangered	Endangered
Oncorhynchus clarkii lewisi	Cutthroat Trout, *lewisi* subspecies	Vertebrate Animal	G5T4	S2S3	Blue	Special Concern	Special Concern
Salvelinus confluentus	Bull Trout	Vertebrate Animal	G5	S3S4	Blue	Special Concern	
Anaxyrus boreas	Western Toad	Vertebrate Animal	G4	S4	Yellow	Special Concern	Special Concern
Spea intermontana	Great Basin Spadefoot	Vertebrate Animal	G5	S3S4	Blue	Threatened	Threatened
Chrysemys picta	Painted Turtle	Vertebrate Animal	G5	S3	No Status	Threatened / Special	Threatened / Special
Chrysemys picta pop. 2	Painted Turtle - Intermountain - Rocky Mountain Population	Vertebrate Animal	G5T2T3Q	S3?	Blue	Special Concern	Special Concern
Charina bottae	Northern Rubber Boa	Vertebrate Animal	G5	S4	Yellow	Special Concern	Special Concern
Coluber constrictor	North American Racer	Vertebrate Animal	G5	S2S3	Blue	Threatened	Threatened
Pituophis catenifer	Gophersnake	Vertebrate Animal	G5	S3	No Status	Extirpated / Threatened	Extirpated / Threatened
Pituophis catenifer deserticola	Gophersnake, *deserticola* subspecies	Vertebrate Animal	G5T5	S3	Blue	Threatened	Threatened
Branta bernicla	Brant	Vertebrate Animal	G5	S3M	Blue		
Melanitta perspicillata	Surf Scoter	Vertebrate Animal	G5	S3B,S4N	Blue		
Tympanuchus phasianellus columbianus	Sharp-tailed Grouse, *columbianus* subspecies	Vertebrate Animal	G5T3	S2S3	Blue		
Aechmophorus occidentalis	Western Grebe	Vertebrate Animal	G5	S1B,S2N	Red	Special Concern	Special Concern
Podiceps nigricollis	Eared Grebe	Vertebrate Animal	G5	S3B	Blue		
Patagioenas fasciata	Band-tailed Pigeon	Vertebrate Animal	G4	S3S4	Blue	Special Concern	Special Concern
Chordeiles minor	Common Nighthawk	Vertebrate Animal	G5	S3S5B	Blue	Special Concern	Special Concern
Aeronautes saxatalis	White-throated Swift	Vertebrate Animal	G5	S3S4B	Blue		
Cypseloides niger	Black Swift	Vertebrate Animal	G4	S2S4B	Blue	Endangered	Endangered
Pluvialis dominica	American Golden-Plover	Vertebrate Animal	G5	S3S4B	Blue		
Recurvirostra americana	American Avocet	Vertebrate Animal	G5	S2S3B	Blue		
Bartramia longicauda	Upland Sandpiper	Vertebrate Animal	G5	S2B	Red		
Limnodromus griseus	Short-billed Dowitcher	Vertebrate Animal	G5	S2S3B	Blue		
Numenius americanus	Long-billed Curlew	Vertebrate Animal	G5	S4B	Yellow	Special Concern	Special Concern
Phalaropus lobatus	Red-necked Phalarope	Vertebrate Animal	G4G5	S3S4B	Blue	Special Concern	Special Concern
Hydroprogne caspia	Caspian Tern	Vertebrate Animal	G5	S3B	Blue	Not at Risk	
Larus californicus	California Gull	Vertebrate Animal	G5	S1B,SNRN	Red		
Nannopterum auritum	Double-crested Cormorant	Vertebrate Animal	G5	S3S4	Blue	Not at Risk	
Pelecanus erythrorhynchos	American White Pelican	Vertebrate Animal	G4	S1B	Red	Not at Risk	
Ardea herodias herodias	Great Blue Heron, *herodias* subspecies	Vertebrate Animal	G5T5	S3?	Blue		
Botaurus lentiginosus	American Bittern	Vertebrate Animal	G5	S3B,SNRN	Blue		
Butorides virescens	Green Heron	Vertebrate Animal	G5	S3S4B	Blue		
Nycticorax nycticorax	Black-crowned Night-heron	Vertebrate Animal	G5	S1	Red		
Accipiter gentilis atricapillus	Northern Goshawk, *atricapillus* subspecies	Vertebrate Animal	G5T5	S3S4	Blue	Not at Risk	
Buteo lagopus	Rough-legged Hawk	Vertebrate Animal	G5	S3N	Blue	Not at Risk	
Buteo swainsoni	Swainson's Hawk	Vertebrate Animal	G5	S2B	Red		
Tyto alba	Barn Owl	Vertebrate Animal	G5	S3	Blue	Threatened	Threatened
Asio flammeus	Short-eared Owl	Vertebrate Animal	G5	S3B,S1N	Blue	Threatened	Special Concern
Athene cunicularia	Burrowing Owl	Vertebrate Animal	G4	S1B	Red	Endangered	Endangered
Megascops kennicottii macfarlanei	Western Screech-Owl, *macfarlanei* subspecies	Vertebrate Animal	G4G5T4	S3	Blue	Threatened	Threatened
Psiloscops flammeolus	Flammulated Owl	Vertebrate Animal	G4	S3B	Blue	Special Concern	Special Concern
Melanerpes lewis	Lewis's Woodpecker	Vertebrate Animal	G4	S2S3B	Blue	Threatened	Threatened
Falco mexicanus	Prairie Falcon	Vertebrate Animal	G5	S1	Red	Not at Risk	
Falco peregrinus	Peregrine Falcon	Vertebrate Animal	G4	S3	No Status	Special Concern	Special Concern
Falco peregrinus anatum	Peregrine Falcon, *anatum* subspecies	Vertebrate Animal	G4T4	S2?	Red	Not at Risk	
Falco rusticolus	Gyrfalcon	Vertebrate Animal	G5	S3S4B,SNRN	Blue	Not at Risk	
Contopus cooperi	Olive-sided Flycatcher	Vertebrate Animal	G4	S4B	Yellow	Special Concern	Special Concern
Eremophila alpestris merrilli	Horned Lark, *merrilli* subspecies	Vertebrate Animal	G5T4	S1S3	Red		
Hirundo rustica	Barn Swallow	Vertebrate Animal	G5	S4B	Yellow	Special Concern	Threatened
Oreoscoptes montanus	Sage Thrasher	Vertebrate Animal	G4	S1B	Red	Endangered	Endangered
Coccothraustes vespertinus	Evening Grosbeak	Vertebrate Animal	G5	S5	Yellow	Special Concern	Special Concern
Dolichonyx oryzivorus	Bobolink	Vertebrate Animal	G5	S2?B	Red	Special Concern	Threatened
Euphagus carolinus	Rusty Blackbird	Vertebrate Animal	G4	S3S4B	Blue	Special Concern	Special Concern

Scientific Name	Common Name	Name Category	Global	Provincial	BC List	COSEWIC	SARA
Icteria virens	Yellow-breasted Chat	Vertebrate Animal	G5	S2B	Red	Endangered	Endangered
Chondestes grammacus	Lark Sparrow	Vertebrate Animal	G5	S2S4B	Blue		
Calcarius pictus	Smith's Longspur	Vertebrate Animal	G4G5	S3S5B	Blue		
Eptesicus fuscus	Big Brown Bat	Vertebrate Animal	G5	S5	Yellow		
Lasionycteris noctivagans	Silver-haired Bat	Vertebrate Animal	G3G4	S4S5	Yellow		
Lasiurus cinereus	Hoary Bat	Vertebrate Animal	G3G4	S3S4	Blue		
Myotis californicus	Californian Myotis	Vertebrate Animal	G5	S4S5	Yellow		
Myotis evotis	Long-eared Myotis	Vertebrate Animal	G5	S4?	Yellow		
Myotis lucifugus	Little Brown Myotis	Vertebrate Animal	G3G4	S3S4	Blue	Endangered	Endangered
Myotis septentrionalis	Northern Myotis	Vertebrate Animal	G2G3	S2S3	Blue	Endangered	Endangered
Myotis volans	Long-legged Myotis	Vertebrate Animal	G4G5	S4?	Yellow		
Myotis yumanensis	Yuma Myotis	Vertebrate Animal	G5	S3	Blue		
Gulo gulo	Wolverine	Vertebrate Animal	G4	S3	No Status	Special Concern	Special Concern
Gulo gulo luscus	Wolverine, *luscus* subspecies	Vertebrate Animal	G4T4	S3	Blue	Special Concern	Special Concern
Pekania pennanti	Fisher	Vertebrate Animal	G5	S3	No Status		
Taxidea taxus	American Badger	Vertebrate Animal	G5	S2	Red	Endangered	Endangered
Ursus arctos	Grizzly Bear	Vertebrate Animal	G4	S3?	Blue	Special Concern	Special Concern
Rangifer tarandus pop. 1	Caribou (Southern Mountain Population)	Vertebrate Animal	G5TNRQ	S1	Red	Endangered	Threatened
Rangifer tarandus pop. 15	Caribou (Northern Mountain Population)	Vertebrate Animal	G5T4T5Q	S2S3	Blue	Special Concern	Special Concern
Oreamnos americanus	Mountain Goat	Vertebrate Animal	G5	S3	Blue		
Ovis canadensis	Bighorn Sheep	Vertebrate Animal	G4	S3?	Blue		
Calopteryx aequabilis	River Jewelwing	Invertebrate Animal	G5	S3	Blue		
Enallagma civile	Familiar Bluet	Invertebrate Animal	G5	SH	Red		
Enallagma clausum	Alkali Bluet	Invertebrate Animal	G5	S3	Blue		
Ophiogomphus occidentis	Sinuous Snaketail	Invertebrate Animal	G5	S3	Blue		
Somatochlora brevicincta	Quebec Emerald	Invertebrate Animal	G4	S3	Blue		
Somatochlora forcipata	Forcipate Emerald	Invertebrate Animal	G5	S3?	Blue		
Cicindela hirticollis	Hairy-necked Tiger Beetle	Invertebrate Animal	G5	S2S4	Blue		
Hesperia nevada	Nevada Skipper	Invertebrate Animal	G5	S3S4	Blue		
Colias meadii	Mead's Sulphur	Invertebrate Animal	G5	S3	Blue		
Boloria alberta	Albert's Fritillary	Invertebrate Animal	G3	S3	Blue		
Erebia magdalena	Magdalena Alpine	Invertebrate Animal	G5	S2S3	Blue		
Oeneis jutta chermocki	Jutta Arctic, *chermocki* subspecies	Invertebrate Animal	G5T4Q	S3	Blue		
Sphaerium occidentale	Herrington Fingernailclam	Invertebrate Animal	G5	S2S3	Blue		
Sphaerium striatinum	Striated Fingernailclam	Invertebrate Animal	G5	S3S4	Blue		
Valvata tricarinata	Threeridge Valvata	Invertebrate Animal	G5	S1S2	Red		
Galba obrussa	Golden Fossaria	Invertebrate Animal	G5	S2S3	Blue		
Stagnicola traski	Widelip Pondsnail	Invertebrate Animal	G3G4	S3S4	Blue		
Physella propinqua	Rocky Mountain Physa	Invertebrate Animal	G5Q	S3S4	Blue		
Physella virginea	Sunset Physa	Invertebrate Animal	G5	S3S5	Blue		
Gyraulus crista	Star Gyro	Invertebrate Animal	G5	S3S4	Blue		
Planorbella columbiensis	Caribou Rams-horn	Invertebrate Animal	GH	SH	Red		
Planorbula campestris	Meadow Rams-horn	Invertebrate Animal	G4G5	S3S4	Blue		
Vertigo arthuri	Callused Vertigo	Invertebrate Animal	G5	S3S4	Blue		
Magnipelta mycophaga	Magnum Mantleslug	Invertebrate Animal	G3	S2S3	Blue	Special Concern	Special Concern
Pinus albicaulis	whitebark pine	Vascular Plant	G3G4	S2S3	Blue	Endangered	Endangered
Draba ventosa	Wind River draba	Vascular Plant	G3	S2S3	Blue		
Potentilla glaucophylla var. *perdissecta*	diverse-leaved cinquefoil	Vascular Plant	G5T4	S4S5	Yellow		
Bartramia halleriana	Haller's apple moss	Bryophyte	G4G5	S2	Red	Threatened	Threatened
Pterygoneurum kozlovii	alkaline wing-nerved moss	Bryophyte	G3	S3	Blue	Threatened	Threatened
Betula nana / *Carex* spp. / *Sphagnum* spp.	scrub birch / sedges / peat-mosses	Ecological Community	GNR	S2	Red		
Cladonia cyanipes	blue-footed pixie	Lichen	G5	S2S4	Blue		
Cladonia decorticata	strip-tease pixie	Lichen	G5	S3	Blue		
Cladonia parasitica	fence-rail pixie	Lichen	G4G5	S2	Red		
Collema coniophilum	crumpled tarpaper	Lichen	G2	S2	Red	Threatened	Threatened

Scientific Name	Common Name	Name Category	Global	Provincial	BC List	COSEWIC	SARA
Evernia divaricata	mountain oakmoss	Lichen	G4G5	S3	Blue		
Leptogium cyanescens	blue-blue vinyl	Lichen	G5	S1S2	Red		
Nephroma isidiosum	pebbled paw	Lichen	G3G5	S3	Blue		
Nephroma occultum	cryptic paw	Lichen	G4	S3	Blue	Threatened	Special Concern
Peltigera gowardii	northwest waterfan	Lichen	G3G4	S2	Red	Special Concern	Special Concern
Pinus contorta / Carex aquatilis / Sphagnum	lodgepole pine / water sedge / peat-mosses	Ecological Community	G3	S3	Blue		
Pseudotsuga menziesii - Thuja plicata /	Douglas-fir - western redcedar / wavy-leaved moss	Ecological Community	GNR	S3	Blue		
Salix sitchensis - Salix lasiandra var.	Sitka willow - Pacific willow / skunk cabbage	Ecological Community	G2	S3	Blue		
Scheuchzeria palustris / Sphagnum spp.	scheuchzeria / peat-mosses	Ecological Community	G3	S3	Blue		
Thuja plicata / Gymnocarpium dryopteris /	western redcedar / oak fern / electrified cat's-tail moss	Ecological Community	GNR	S3	Blue		
Thuja plicata / Paxistima myrsinites	western redcedar / falsebox	Ecological Community	GNR	S3	Blue		

APPENDIX 3-1: LOM Sequencing



5-Year Sequencing

Current Status – April 2024

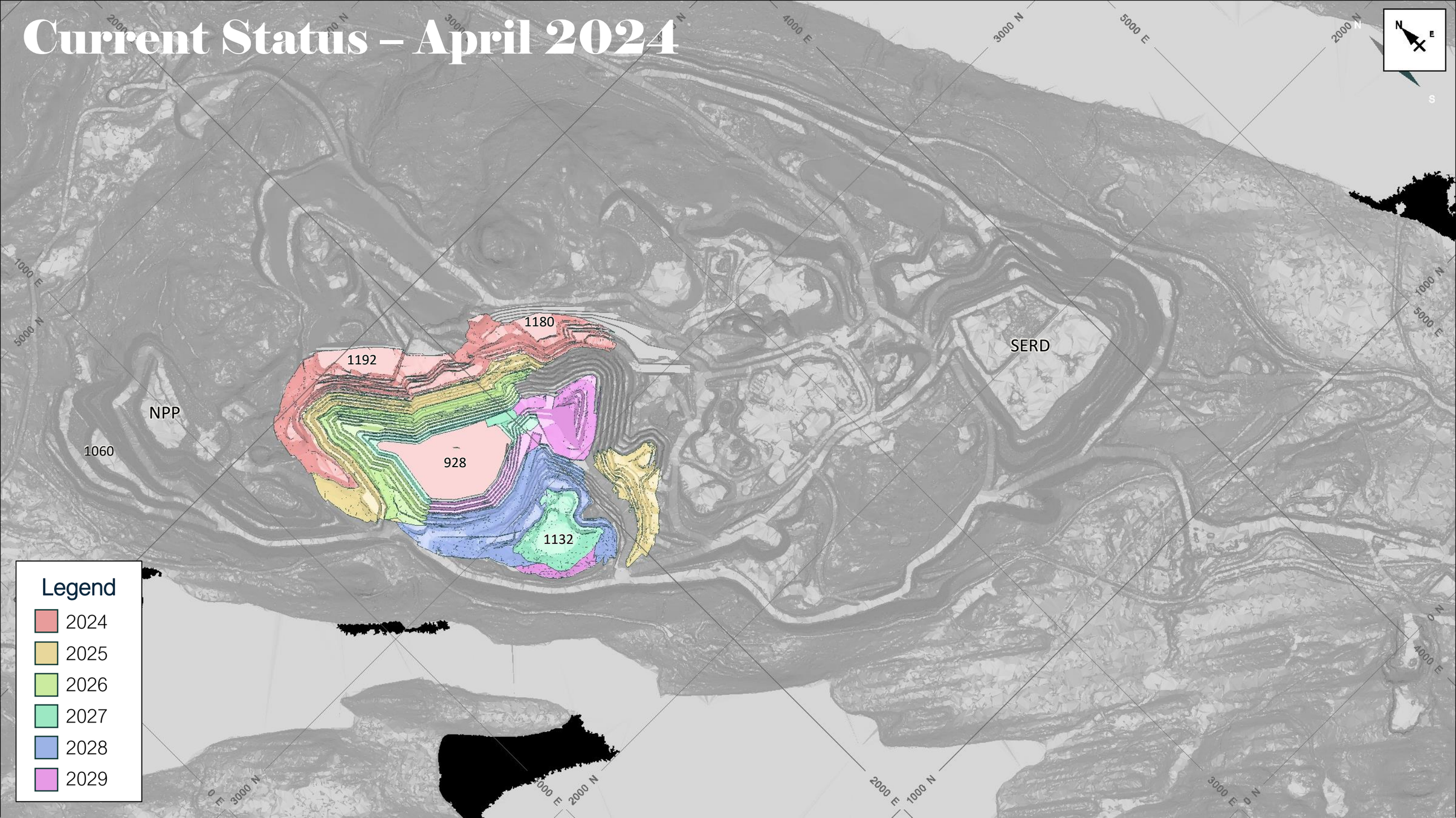

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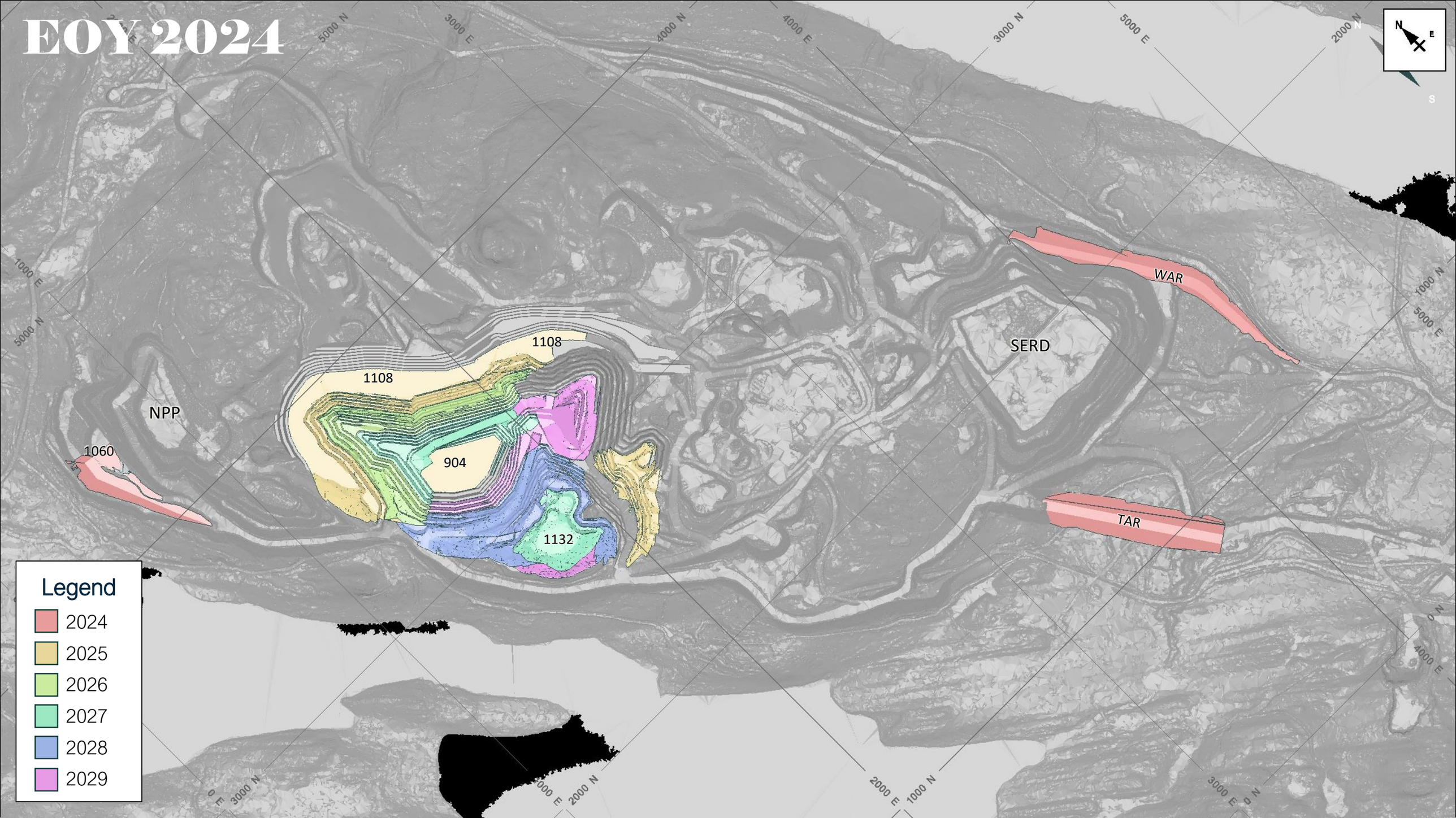
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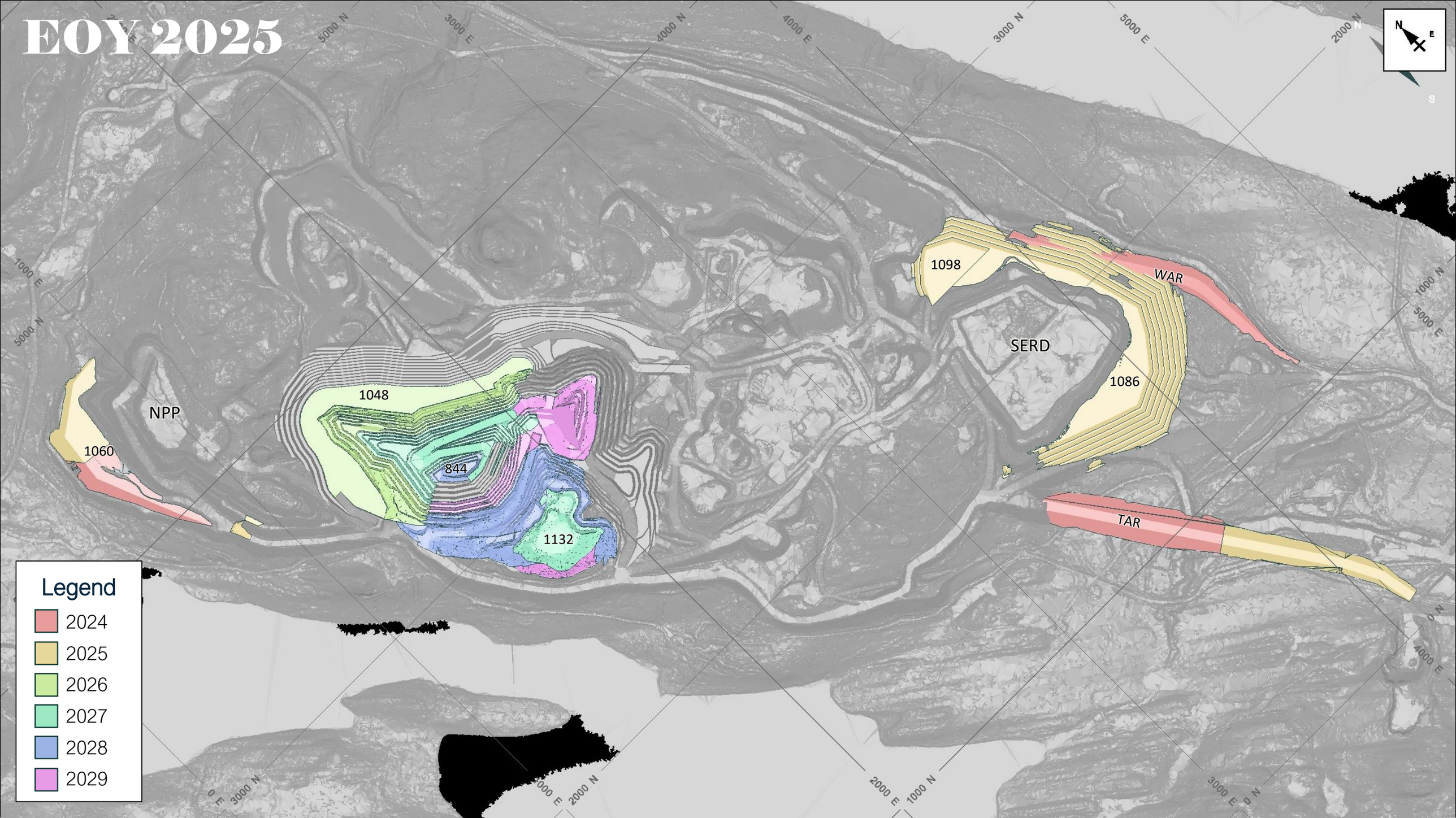
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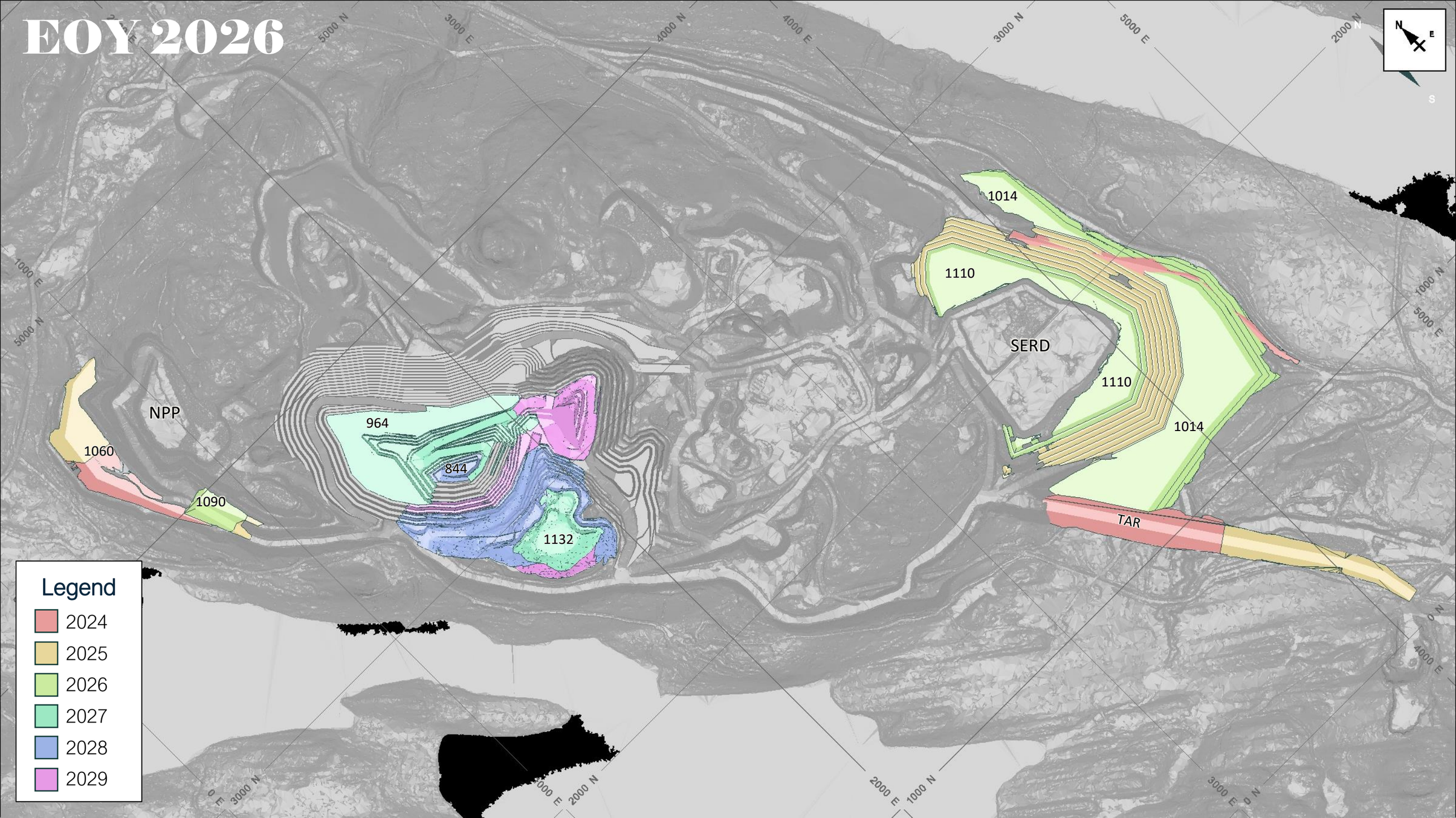
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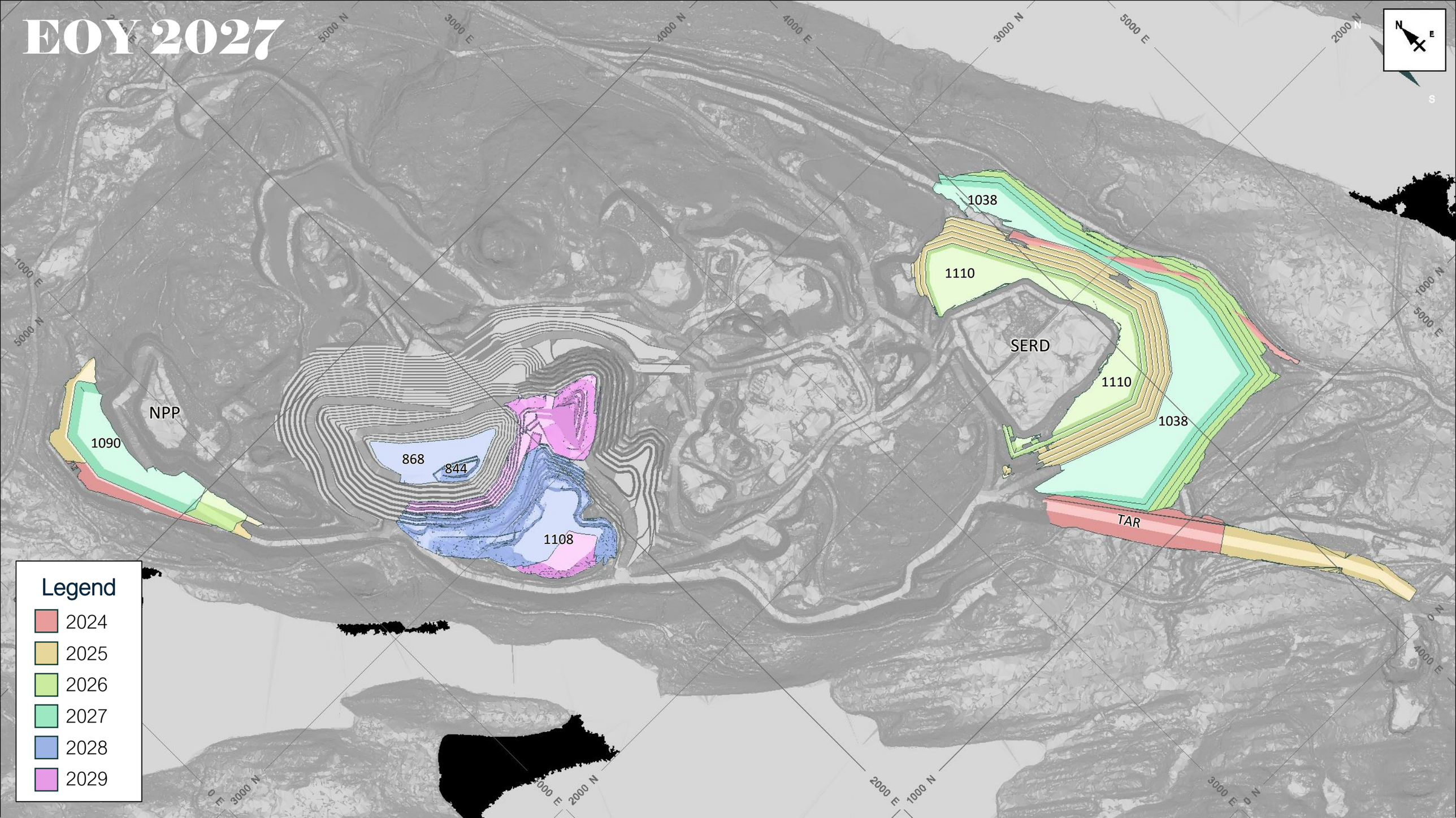
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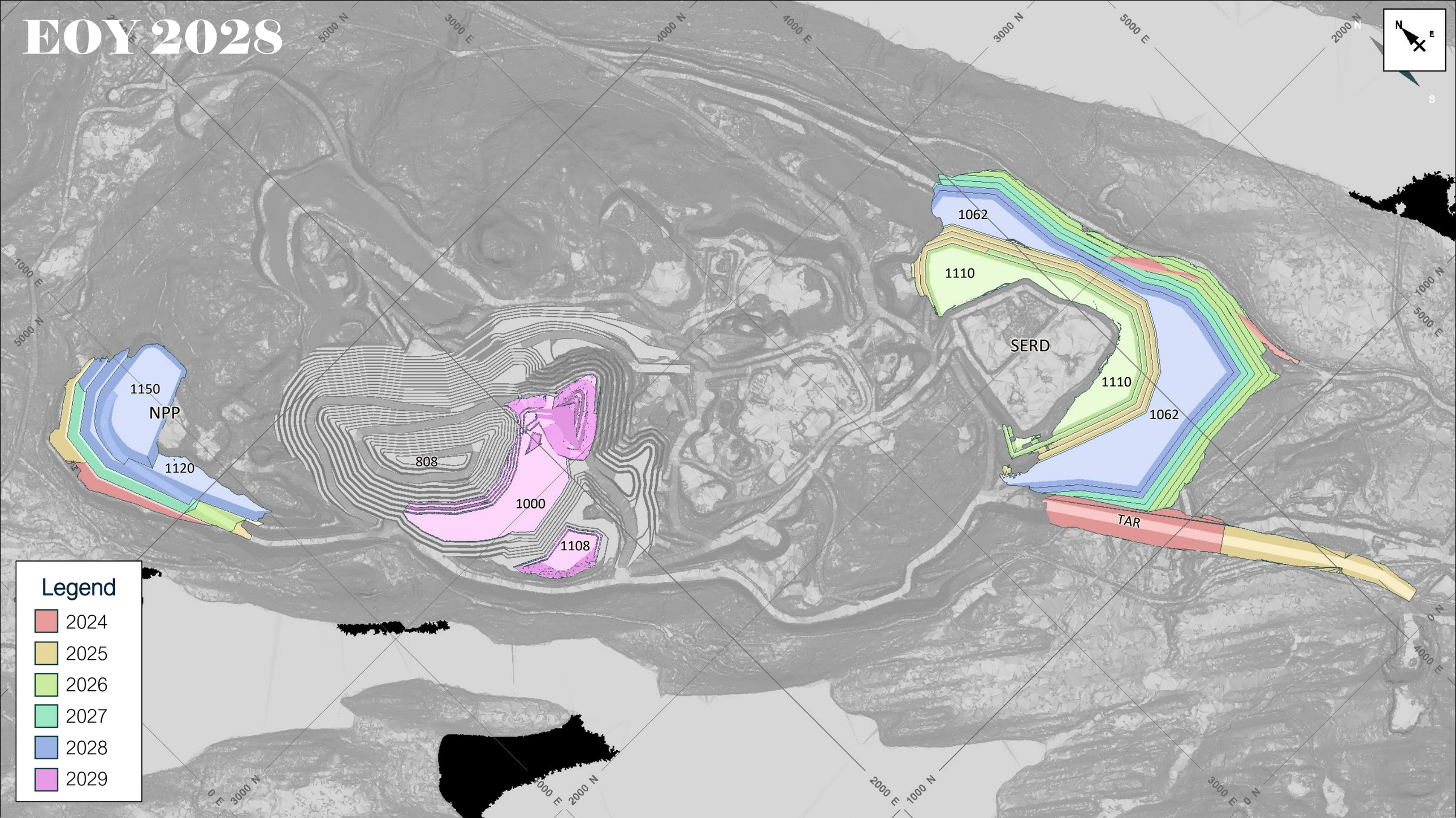
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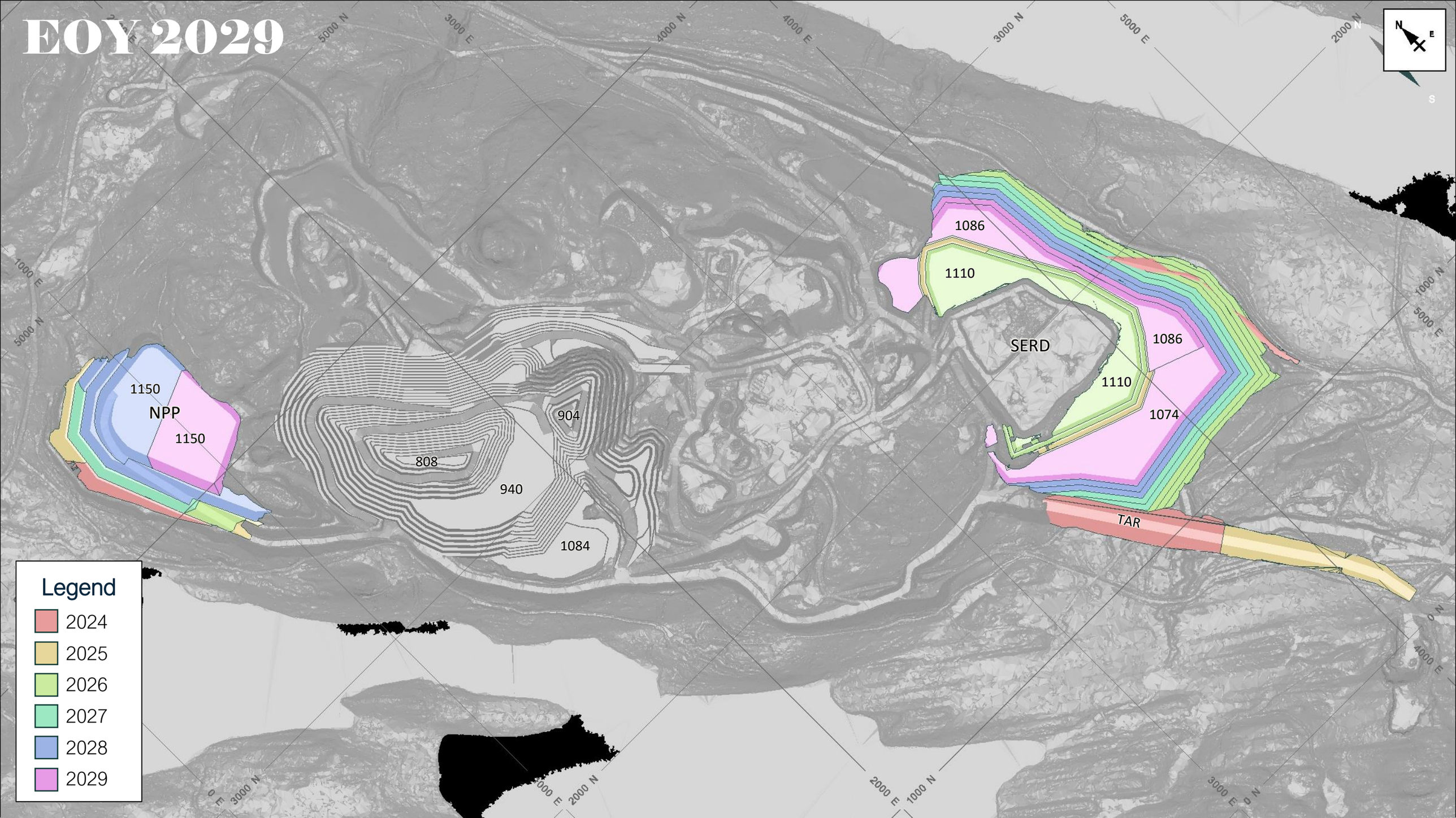
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APPENDIX 3-2: Northwest Potentially Acid Generating Dump Geotechnical Assessment

REPORT

Northwest Potentially Acid Generating Dump Geotechnical Assessment

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely, BC
V0L 1N0

Attention: Richard Tuohey, Chief Engineer

Submitted by:

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Reference No. CA0020527.4505-037-R-Rev0-75192

May 7, 2024



Distribution List

Electronic Copy: Mount Polley Mining Corporation

Electronic Copy: WSP Canada Inc.

Executive Summary

Mount Polley Mining Corporation (MPMC) operates a copper/gold open pit mining operation located 8 km southwest of the town of Likely and 56 km northeast of Williams Lake in central British Columbia. Mining is currently being carried out in the Springer Pit, and non-acid generating (NAG) and potentially acid generating (PAG) waste rock excavated from the pit will be consigned to the Northwest PAG Dump (NW PAG Dump).

MPMC retained WSP Canada Inc. (WSP) to carry out a geotechnical assessment of an updated proposed ultimate design of the NW PAG Dump. In September 2023, December 2023, and January 2024, WSP carried out a test pit and drilling program for foundation investigations within and around the proposed footprint of the ultimate NW PAG Dump. A summary of the 2023/2024 investigation and laboratory testing results is presented in a field data report (WSP 2024b).

This report provides:

- a description of the existing NW PAG Dump and previous slope stability performance
- a description of the proposed ultimate NW PAG Dump
- a summary of previous geotechnical field investigations
- a description of the site foundation conditions, and of engineering geology of the expected foundation materials and waste rock
- the factors that are expected to control the stability of the proposed ultimate NW PAG Dump
- discussion of the results of the slope stability analyses
- discussion of the results of the runout analyses
- discussion of the results of the rollout assessment
- a summary of recommendations regarding construction and operational procedures that are intended to enhance the short and long-term stability of the proposed ultimate NW PAG Dump

Current Performance

The NW PAG Dump has been reviewed for slope stability performance annually since 2012 during the annual slope stability reviews completed by Golder/ WSP. In general, the NW PAG Dump has exhibited good slope stability performance over the years with minor areas of deformation that have been managed by MPMC.

Proposed Development

The proposed NW PAG Dump development includes construction of three 40 to 50 m lifts above the current north lobe of the NW PAG Dump. The NW PAG Dump will be constructed from the bottom-up with angle of repose waste rock lift faces, 10 m wide catch-benches, and an overall slope angle of 28 degrees. The ultimate haul ramp will enter the NW PAG Dump from the southern portion of the dump and ascend across the slope face.

Geotechnical Field Investigations

To date, five foundation investigation programs have been completed within and around the footprint of the NW PAG Dump. Test pits were excavated for geotechnical programs completed in 1999, 2010, and 2023, and boreholes drilled for geotechnical programs were completed in 2023 and 2024. Geotechnical laboratory testing was completed on samples from the 1999, 2023, and 2024 geotechnical field investigations.

Site Characterization and Engineering Geology

The local surficial geology consists of Quaternary glacial deposits overlain by fill/anthropogenic deposits. Based on the foundation materials and cross-section review the following summarizes the surficial geology interpretation:

- Colluvium is interpreted to be a thin veneer underlying the eastern slope of the NW PAG Dump, with localized areas of thicker colluvium layers to the southwest of the dump footprint.
- Till is interpreted to cover the majority of the NW PAG Dump footprint, with variable thickness.
- Glaciofluvial deposits are located in isolated areas at the north end of the dump and near the center. Till typically overlies the glaciofluvial deposits.
- Fine-grained material is interpreted to be present in an isolated area on the west side of the NW PAG Dump at depth and is overlain by till. This material has been modeled as part of the till. It is possible that fine-grained material could be located in other parts of the foundation of the NW PAG Dump that were not investigated.
- Clay material is interpreted to be present in an isolated area on the northeast side of the NW PAG Dump about 0.9 m below original ground surface and is discontinuous (interbedded with silty clay). This material has been modeled as a separate unit as a sensitivity analysis.

Summary and Recommendations

Based on the Hawley and Cunning (2017) waste rock dump slope stability rating and hazard classification system, the proposed ultimate NW PAG Dump is classified as presenting a moderate potential for instability and is therefore considered to be a moderate hazard waste rock dump (Class III).

The slope stability analyses results for the proposed ultimate NW PAG Dump design indicate that the dump will meet the design acceptance criteria for slope stability under static and pseudo-static conditions, with the exception of analyses completed with low clay material strength parameters (a phi less than about 27 degrees). The clay material was encountered in an isolated “pocket” north of the current toe of the dump in DH-NW-02 and was not found in the adjacent boreholes and test pits (DH-NW-03, DH-NW-03A, TP-NW-01, TP-NW-02, and TP-NW-03). No investigations have been completed immediately beneath the toe of the NW PAG Dump in this area as access is limited. The material was inferred to be discontinuous/interbedded with silty clay. The area of the current NW PAG Dump near where the clay material was encountered is stable, and has been since construction, indicating that at least a FOS of 1.0 is being achieved. Recommendations for construction near the clay material include:

- Remove the clay material prior to dumping in this area (even though the toe of the proposed ultimate NW PAG Dump does not cover the area where DH-NW-02 was drilled). The clay material was encountered in an old borrow area, therefore, more material could be removed from the borrow area to key into the till material below.

- Use low lift heights (about 5 m) when constructing the lower NAG lift in this area to limit development of potential excess pore pressures and not rapidly load the clay material if it does exist further south beneath the proposed ultimate NW PAG Dump design toe.
    - When constructing the low lifts, advancement could be such that the borrow area is encapsulated (where the potential clay material exists if it extends as far south as the proposed ultimate NW PAG Dump footprint). Once the area is encapsulated, waste rock can then be dumped into the encircled area. This method provides lateral support from the surrounding topography and the dump prior to dumping on top of the borrow area.

The runout analyses results indicate that under wet foundation conditions, it is likely that failure debris would impact the Bootjack Access Road and settling ponds. Based on the slope stability performance of the NW PAG Dump over the past 12 years, and on the slope stability analyses carried out for the proposed ultimate NW PAG Dump design, there is a low probability that a failure would occur in the NW PAG Dump due to the relatively high FOS indicated by the slope stability analyses.

Rock rollout could impact the Bootjack Access Road.

Settlement of the NW PAG Dump is expected to be limited and manageable.

Recommendations for the proposed ultimate NW PAG Dump construction include:

- Controlled loading rates
    - Prism and VWP data along with visual inspections and daily loading rates can all be used to understand if loading rates are having an adverse affect on dump construction.
- While constructing the NW PAG Dump, dumping operations should avoid concentrated dumping at a single location and should use as wide a strike length along the slope face as possible while advancing a lift.
- Construct berms at the edge of each catch-bench and free dump along the entire lift prior to constructing the next lift to limit rock rollout.
- Follow Standard Operating Procedures at Mount Polley Mine for:
    - Grading the dump and avoid ponding water on platforms.
    - Controlling the placement of waste rock being used for construction. The waste rock type should be discussed and planned in collaboration with geology and short-range engineering, as required.
      The material consigned to the NW PAG Dump should be good quality waste rock that is hard, coarse rock. Poor-quality material such as fault or overburden materials should be dumped in a central location of the dump such that it can be encapsulated and covered with good quality waste rock.

The stability of the NW PAG Dump slopes is being monitored by prisms (MPMC 2021). The prisms should be measured by the MPMC survey team on approximately a monthly basis for the active NW PAG Dump. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceeds a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data.

A key component to the safe operation of the proposed ultimate NW PAG Dump to mitigate instability will be regular visual inspections. The following operational procedures are recommended for the proposed ultimate NW PAG Dump:

- The proposed ultimate NW PAG Dump should be visually inspected and photo-documented on a regular basis during construction, on approximately a weekly basis. The pit shifter or the geotechnical engineer should be completing the formal visual inspections. The following information should be investigated and recorded:
  - The crests of the NW PAG Dump lifts should be examined for signs of cracking and localized settlement and ponding water.
  - The faces of the NW PAG Dump lifts should be examined for signs of oversteepening, bulging in the middle, seepage, erosion, and the toe of the dump if it can be observed for signs of deformation.
  - The type of material being placed on the NW PAG Dump lifts and the loading rates should be documented.
- Dozer and haul truck operators should be continuously observing the construction of the NW PAG Dump lifts for signs of instability and reporting their observations to their pit shifter.

Study Limitations

WSP Canada Inc. (WSP) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

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Runout Analyses

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) operates a copper/gold open pit mining operation located 8 km southwest of the town of Likely and 56 km northeast of Williams Lake in central British Columbia (BC). Mining is currently being carried out in the Springer Pit, and non-acid generating (NAG) and potentially acid generating (PAG) waste rock excavated from the pit will be consigned to the Northwest PAG Dump (NW PAG Dump).

A waste rock dump on the west side of the property was originally permitted in 1995 (Imperial 1995). In 2012, MPMC submitted a permit amendment for this waste rock dump (at the time called the temporary West Stockpile for PAG waste), requesting an increase in capacity from 15 Mt to 45 Mt (MPMC 2012). In 2013, Golder Associates Ltd. (Golder) conducted a geotechnical review of an updated design provided by MPMC for the Northwest Dump (Golder 2013a). After Golder submitted the geotechnical review of the Northwest Dump, MPMC modified the configuration of the dump. Golder provided an addendum technical memorandum summarizing updated slope stability analyses of the modified dump configuration (Golder 2013b).

MPMC retained WSP Canada Inc. (WSP) to carry out a geotechnical assessment of an updated proposed ultimate design of the NW PAG Dump. In September 2023, December 2023, and January 2024, WSP carried out a test pit and drilling program for foundation investigations within and around the proposed footprint of the ultimate NW PAG Dump. A summary of the 2023/2024 investigation and laboratory testing results is presented in a field data report (WSP 2024b).

This report provides:

- a description of the existing NW PAG Dump and previous slope stability performance
- a description of the proposed ultimate NW PAG Dump
- a summary of previous geotechnical field investigations
- a description of the site foundation conditions, and of engineering geology of the expected foundation materials and waste rock
- the factors that are expected to control the stability of the proposed ultimate NW PAG Dump
- discussion of the results of the slope stability analyses
- discussion of the results of the runout analyses
- discussion of the results of the rollout assessment
- a summary of recommendations regarding construction and operational procedures that are intended to enhance the short and long-term stability of the proposed ultimate NW PAG Dump

This report is to be read with the Study Limitations Section, which precedes the text and forms an integral part of this report.

2.0 EXISTING NORTHWEST POTENTIALLY ACID GENERATING DUMP AND PREVIOUS SLOPE STABILITY PERFORMANCE

The NW PAG Dump is located at the northwest end of the mine property to the west of the Springer Pit (Figure 1). Figure 2 shows the October 2023 configuration of the NW PAG Dump.

Golder/WSP has not provided construction quality assurance for the NW PAG Dump, rather Golder/WSP has provided geotechnical slope stability reviews of proposed ultimate designs provided by MPMC and slope stability reviews as construction has progressed during annual inspections.

The dump is separated into two areas, the south and north lobes. The south lobe was constructed between 2012 and 2013. MPMC indicated that trees were logged, and the topsoil was stripped from the foundation prior to construction of three lifts of NAG rock (each approximately 5 m high) which were advanced to the north (Golder 2013c). PAG rock was end-dumped on top of the NAG lifts in four 25 m high lifts from the bottom up to elev. 1,135 m. The south lobe is founded on gently to moderately sloping terrain that is inclined at approximately 20 to 30 degrees to the southwest and west. The north lobe began construction in 2013 and is ongoing. Again, MPMC indicated that trees were logged, and the topsoil was stripped from the foundation prior to construction of three lifts of NAG rock (each about 5 m high), which were advanced to the north (Golder 2015c). PAG rock has been end-dumped on top of the NAG lifts in four to five 25 m high lifts from the bottom up to elev. 1,138 m.

The NW PAG Dump has been reviewed for slope stability performance annually since 2012 during the annual slope stability reviews completed by Golder/WSP. Slope stability performance observations and previous recommendations are summarized in Table 1 and photographs are presented in Appendix A. In general, the NW PAG Dump has exhibited good slope stability performance over the years with minor areas of deformation that have been managed by MPMC.

Table 1: Previous Slope Stability Performance of the NW PAG Dump

Year	Slope Stability Review Performance Observations	Recommendations Provided at Time of Observation	Recommendations Addressed by MPMC	Report	Appendix A, Figure No.
2012	▪ NW PAG Dump was being advanced towards the north over natural topography and the lower NAG lift (south lobe). ▪ Settlement cracks observed on the southwest side of the first NAG lift. Bulging in the toe area was also evident.	▪ Cracks should be filled with fine-grained material and continue visual inspections and monitoring, particularly during spring and fall when precipitation rates are higher.	Yes	Golder 2013c	A-1
2013	▪ North lobe of NW PAG Dump was being constructed to the north of the south lobe. ▪ No cracks along the crest or bulging in the toe area were observed.	▪ Continue visual inspections and monitoring, particularly during spring and fall when precipitation rates are higher.	Ongoing	Golder 2015c	A-2
2014/2015	▪ A portion of a NAG lift was being placed adjacent to a soil stockpile at the base of the slope. ▪ Minor settlement cracks along some portions of the crest.	▪ Avoid advancing portions of the toe of the dump over the soil stockpiles and if required, move/remove the soil stockpiles.	Yes	Golder 2016b	A-3
2016	▪ Cracks observed near the crest of the lower lift and some bulging in the waste dump face and toe was observed suggesting displacement in the foundation soils. ▪ Ponded water was observed at the toe of the lower lifts towards the north end of the dump. Was noted to be seeping from the toe of the dump.	▪ The cracks should be filled with fine-grained material and continue visual inspection and monitoring. ▪ Ditches should be excavated to drain the ponded water away from the toe of the dump. ▪ Stability of the dump in the area of seepage to be visually monitored.	Yes	Golder 2017	A-4
2017	▪ No cracks along the crest or bulging in the toe area were observed.	▪ Continue visual inspections and monitoring, particularly during spring and fall when precipitation rates are higher.	Ongoing	Golder 2018	A-5
2018	▪ No cracks along the crest or bulging in the toe area were observed.	▪ Continue visual inspections and monitoring, particularly during spring and fall when precipitation rates are higher.	Ongoing	Golder 2019	A-6
2019	▪ No cracks along the crest or bulging in the toe area were observed.	▪ Continue visual inspections and monitoring, particularly during spring and fall when precipitation rates are higher.	Ongoing	Golder 2020	A-7

Table 1: Previous Slope Stability Performance of the NW PAG Dump

Year	Slope Stability Review Performance Observations	Recommendations Provided at Time of Observation	Recommendations Addressed by MPMC	Report	Appendix A, Figure No.
2020	▪ Haul road along the north of the dump showing erosion channels. ▪ Evidence of water ponding along the lower lift haul road.	▪ A ditch should be maintained on the sides of the haul ramp and water bars can be implemented along the edges of the road to promote water moving into the ditches. ▪ The lower lift haul road should be graded with fill material to divert water away from the crest of the road.	Yes	Golder 2021	A-8
2021	▪ Evidence of water ponding along the lower lift haul road.	▪ The lower lift haul road should be graded with fill material to divert water away from the crest of the road.	Yes	Golder 2022a	A-9
2022	▪ Minor settlement cracks developing in lower lifts. ▪ Evidence of water ponding along the lower lift haul road.	▪ Monitor settlement cracks and doze to limit water infiltration into the dump crest. ▪ The lower lift haul road should be graded with fill material to divert water away from the crest of the road.	Yes	WSP 2023a	A-10
2023	▪ An area of the lower lift near the access road entrance was observed to be settling with about 30 to 40 cm of vertical displacement possibly due to foundation soil movement at the toe and ponding water at the crest.	▪ Windrow material at the toe should be removed and a low lift buttress should be advanced to limit further movement. The lower lift should be dozed and brought to grade such that water cannot pond at the crest of the lift.	To be addressed in 2024	WSP 2023c	A-11

3.0 PROPOSED ULTIMATE NORTHWEST POTENTIALLY ACID GENERATING DUMP DESIGN

MPMC have proposed a revised ultimate NW PAG Dump design shown in Figure 3. The development includes construction of three 40 to 50 m high lifts above the current north lobe of the NW PAG Dump. The dump will measure approximately 1,000 m in a north-south direction and will vary in width from 620 to 745 m. The top of the NW PAG Dump will be located at elev. 1,140 m. The elevation of the foundation topography (below the current north lobe of the NW PAG Dump) is approximately elev. 1,118 m along the east side to elev. 1,006 m along the west side. The maximum height of the NW PAG Dump will be approximately 140 m toe to crest. The NW PAG Dump will be constructed from the bottom-up with angle of repose waste rock lift faces, 10 m wide catch-benches, and an overall slope angle of 28 degrees. The ultimate haul ramp will enter the NW PAG Dump from the southern portion of the dump and ascend across the slope face.

The majority of the material to be placed on the NW PAG Dump will be on the north and west sides of the current NW PAG Dump north lobe. The footprint of the NW PAG Dump has already been stripped and the lower NAG lift has been constructed with approximately six PAG lifts at varying elevations above.

Cross-sections through the proposed ultimate NW PAG Dump design are shown in Appendix B and described in Section 5.8.

4.0 SUMMARY OF GEOTECHNICAL FIELD INVESTIGATIONS

To date, five foundation investigation programs have been completed within and around the footprint of the NW PAG Dump. Test pit locations for geotechnical programs completed in 1999, 2010, and 2023 as well as borehole locations for geotechnical programs completed in 2023 and 2024 are presented on Figure 4. The results of these geotechnical programs and their applicability to the proposed ultimate NW PAG Dump are discussed in the following sub-sections.

4.1 1999 Geotechnical Field Investigation

The 1999 field investigation program included nine test pit locations, four of which were within the proposed ultimate NW PAG Dump design footprint (Figure 4). The results of the field investigation indicate that the most consistent soil horizon encountered is a well-graded, silty sand till with some gravel and trace fines (Golder 2010b). A number of localized silt clay-rich deposits were encountered in TP14, TP15, and TP16. These deposits could correspond to localized wet to swampy areas (Golder 2010a).

Results of the 1999 test pit program are summarized in Table 2 and further detailed results are presented in Golder (2010a).

Table 2: 1999 Field Investigation Summary (after Golder 2010a)

Test Pit ID	Northing (m)[(a)]	Easting (m)[(a)]	Ground Elevation (m)	Excavation Depth (m)	Bedrock Encountered	Within Footprint of Proposed Ultimate NW PAG Dump	Foundation Soil Description
TP10	3,178	1,344	1,053	2.5	No	No	Clayey SILT with some sand and gravel (TILL)
TP11	3,368	1,205	1,042	2.4	Yes	No	Silty GRAVEL with some sand and cobbles (TILL)
TP12	3,199	1,181	1,034	3.3	No	No	Clayey-SILT with some sand, gravel, and cobbles (TILL)
TP13 (road cut)	3,504	994	1,023	1.0	No	No but near south lobe NW PAG Dump footprint	Silty GRAVEL with some sand and cobbles (TILL)
TP14	4,043	769	1,041	1.5	No	Yes	CLAY with some silt, sand, and gravel Clayey SILT with some sand, gravel, and cobbles (TILL)
TP15	3,920	928	1,062	1.5	No	Yes	CLAY with some silt, sand, and gravel Clayey SILT with some sand and gravel (TILL)
TP16	3,853	784	1,035	2.5	No	Yes	CLAY with some silt, sand, and gravel

Table 2: 1999 Field Investigation Summary (after Golder 2010a)

Test Pit ID	Northing (m)[(a)]	Easting (m)[(a)]	Ground Elevation (m)	Excavation Depth (m)	Bedrock Encountered	Within Footprint of Proposed Ultimate NW PAG Dump	Foundation Soil Description
TP16A	3,927	766	1,040	N/A	No	Yes	Clayey SILT with some sand, gravel, and cobbles
TP17	4,279	871	1,048	1.6	Yes	Yes	Clayey SILT with some sand and gravel Silty SAND with some gravel and cobbles (TILL)

(a) Test pit locations are presented in local mine grid.

4.2 2010 Geotechnical Field Investigation

The 2010 field investigation program included a total of two test pit locations that were both near the proposed ultimate NW PAG Dump footprint (Figure 4). Although these test pits are located outside the NW PAG Dump footprint they provide useful information regarding the interpretation of subsurface conditions for the general area of the NW PAG Dump. Both test pits encountered till overlying bedrock (Golder 2010b).

Results of the 2010 test pit program are presented in Table 3 and further detailed results are presented in Golder (2010b).

Table 3: 2010 Field Investigation Summary (after Golder 2010b)

Test Pit ID	Northing (m)[(a)]	Easting (m)[(a)]	Ground Elevation (m)	Excavation Depth (m)	Bedrock Encountered	Within Footprint of Proposed Ultimate NW PAG Dump	Foundation Soil Description
TP1	3,742	940	1,062	1.2	Yes	No but near south lobe NW PAG Dump footprint	TILL
TP2	3,304	1,158	992	2.0	Yes	No	Sand SILT SAND and GRAVEL (TILL)

(a) Test pit locations are presented in local mine grid.

4.3 2023 and 2024 Geotechnical Field Investigations

The 2023 and 2024 geotechnical field investigations for the NW PAG Dump included six test pits and 11 boreholes in and around the proposed ultimate NW PAG Dump design footprint (Figure 4). The following general stratigraphic units were encountered during the 2023 and 2024 investigations (WSP 2024b):

- Waste rock – 0.9 m to 33.4 m thick
- Colluvium – 0.8 m to 5.0 m thick

- Till – 3.2 m to 15.5 m thick
- Glaciofluvial deposits – 0.2 m to 3.5 m thick
- Fine-grained material – 1.4 m to 4.8 m thick
  - This material was initially interpreted as a Glaciolacustrine unit (GLU) during the 2023 geotechnical field investigation (WSP 2024b).
  - Clay material
    - 2.5 m thick interbedded material encountered during the 2023/2024 geotechnical field investigation.
- Bedrock – to depth

The results of the 2023 and 2024 geotechnical field investigations for the NW PAG Dump are summarized in Table 4 and further detailed results are presented in WSP (2024b).

Table 4: Depth to Bedrock Logged During 2023 and 2024 Field Investigations (after WSP 2024b)

Test Pit or Borehole ID	Northing (m)[(a)]	Easting (m)[(a)]	Ground Elevation (m)[(a)]	Thickness of Waste Rock (m)	Thickness of Colluvium (m)	Maximum Thickness of Glaciofluvial Deposits (m)[(b)]	Maximum Thickness of Fine-grained Material (m)[(b)]	Maximum Thickness of Till (m)[(b)]	Overall Thickness of Overburden (m)	Elevation of Bedrock surface (masl)
TP-NW-01	4,724.0	1,084.0	1,066.0	-	0.80	-	-	-	0.80	1,065.20
TP-NW-02[(d)]	4,745.0	894.0	1,055.0	-	-	1.50	-	4.00[(c)]	Bedrock not reached	
TP-NW-03[(d)]	4,737.0	738.0	1,023.0	-	2.00	-	-	4.00[(c)]	Bedrock not reached	
TP-NW-04[(d)]	4,645.0	572.0	1,003.0	-	1.00	-	-	4.00	5.00	998.00
TP-NW-09	3,831.0	753.0	1,030.0	-	2.30	-	-	3.20[(c)]	Bedrock not reached	
TP-NW-10	3,878.0	719.0	1,030.0	-	5.0[(c)]	-	-	-	Bedrock not reached	
DH-NW-02	4,745.4	893.6	1,051.8	-	-	3.53	-	5.08	8.61	1,043.19
DH-NW-03	4,750.1	709.5	1,021.7	-	1.98	-	-	4.06[(c)]	Bedrock not reached	
DH-NW-03A	4,755.7	703.8	1,021.6	0.91	-	2.44	-	13.34	15.78	1,004.91
DH-NW-05	3,920.0	774.1	1,055.1	12.55	-	1.16	-	5.49	6.65	992.17
DH-NW-06	4,496.2	530.1	1011.4	15.34	-	-	-	8.92	8.92	993.74
DH-NW-07	4,340.3	538.0	1,018.0	14.78	1.83	0.91	4.73	10.36	18.60	996.22
DH-NW-07B	4,219.8	604.8	1,029.6	14.81	1.95	-	4.84[(c)]	12.83	Bedrock not reached	
DH-NW-07C	4,224.3	604.0	1029.5	15.54	2.44	0.23	1.43[(c)]	9.66	Bedrock not reached	
DH-NW-08	4,217.1	603.7	1029.8	10.55	4.63	-	-	6.10	6.10	1,017.72
DH-NW-09	4,075.1	676.0	1,039.0	13.56	-	-	-	15.49	15.49	1,026.05
DH-NW-11	4,277.5	708.1	1059.7	33.38	0.80	0.84	-	8.59	24.02	1,002.30

(a) Test pit and borehole locations are presented in local mine grid
(b) Maximum logged thickness recorded in logs; thinner layers not included.
(c) End of unit not reached.
(d) Seepage observed in these test pits.

4.4 Geotechnical Laboratory Testing of Foundation Soils

Geotechnical laboratory testing was completed on samples from the 1999, 2023, and 2024 geotechnical field investigations. The testing was carried out at the WSP Burnaby and Calgary Laboratories, and included the following geotechnical tests:

- Water content
- Particle size distribution (sieve and hydrometer)
- Atterberg Limits
- Specific gravity
- Modified Proctor
- Large direct shear

Laboratory testing was completed on one sample collected in the area of the NW PAG Dump in 1999 (Golder 2010a); no samples were tested from the area of the NW PAG Dump in 2010 (Golder 2010b), and 41 samples were tested from the area of the NW PAG Dump in 2023 and 2024 (WSP 2024b).

A review of the laboratory test results for each material type encountered in and around the NW PAG Dump is described in Section 5.4.

5.0 SITE CHARACTERIZATION AND ENGINEERING GEOLOGY

The following sections provide:

- A summary of a literature review of the glacial history and the surficial geology of the Mount Polley Mine and NW PAG Dump area, including the topography setting.
- Descriptions of the foundation soils and bedrock observed in the area of the proposed ultimate NW PAG Dump based on the field investigations and laboratory testing results.
- A description of the waste rock to be consigned to the NW PAG Dump.
- A summary of the groundwater conditions around the NW PAG Dump.
- A discussion of the site seismicity.
- A summary of the surficial geology interpretation for the area of the proposed ultimate NW PAG Dump design.

5.1 Regional Geomorphological Setting

The terrain and geomorphology of the area consists of low mountains and hummocky bedrock exposures dissected by a network of streams and lakes (Holland 1976; McAndless and Taylor 2006). Surface drainage patterns are influenced by bedrock topography; most of the stream valleys in the region have a northwest orientation and drain southward toward the lowland area north of the western arm of Quesnel Lake (Bichler and Bobrowsky 2003).

During the late Pleistocene, the area of Mount Polley Mine was covered by the Cordilleran Ice Sheet (Clague 1987 and 1988). The gently undulating topography and surface expression of the lowland area at the head of the west arm of Quesnel Lake is the result of glacial erosion and deposition of Quaternary sediments in an environment that evolved initially as a result of glacial advance followed by glacial retreat and inundation by meltwater, creating a glacial lake environment (Bichler and Bobrowsky 2003). The glacial landforms within the region indicate a predominantly northwesterly ice flow direction for the Cordilleran Ice Sheet in the Quesnel region (Clague 1988; Bichler and Bobrowsky 2003; Hashmi et al 2015).

5.2 Topography

The NW PAG Dump is located on the west flank of Mount Polley ridge between Polley Lake and Bootjack Lake. A foundation slope map is presented in Figure 5. At the north end of the NW PAG Dump the foundation is near elev. 1,004 m and slopes towards the south to approximately elev. 1,050 m. The eastern portion of the NW PAG Dump is founded on ground with slopes of 18 to 29 degrees. The western portion of the NW PAG Dump is founded on ground with slopes of 5 to 13 degrees.

Prior to construction in 2012, there were no identified major streams or drainage courses within the footprint of the NW PAG Dump. The footprint area was well drained by small, ephemeral streams that flowed in the spring and late fall. However, localized wet and swampy flat-lying areas occurred within localized depressions.

5.3 Regional Surface Geology

The regional surficial geology in the area of Mount Polley Mine is dominantly the result of erosion and deposition associated with the late Pleistocene (Wisconsinan) glacial episode referred to as the Fraser Glaciation (Clague 1987 and 1988).

The regional surficial geology is dominated by till, glaciofluvial, and glaciolacustrine sediments of the Fraser Glaciation (Bichler and Bobrowsky 2003; McAndless and Taylor 2006). The glacial stratigraphy locally contains colluvial deposits derived from landslides initiated on valley walls during the late Pleistocene and Holocene. Holocene fluvial deposits overlie the glacial deposits in areas local to watercourses and water bodies throughout the region (Bichler and Bobrowsky 2003). A generalized interpretation of the local Quaternary stratigraphy is presented in Figure 6.

Morainal till deposits more than 1 m thick are widespread and typically comprise poorly sorted, moderately to well-compacted silty clay diamicton.

Glaciofluvial deposits are common within the major valleys, deposited in a succession of well-defined terraces (Clague 1988; Bichler and Bobrowsky 2003). Glaciofluvial sediments typically comprise moderately sorted, weakly to moderately compacted cobbles or boulder gravel with a sand matrix. Gravel is also present locally in the form of hummocky blankets at higher elevations. Glaciofluvial fan deposits occur within valleys, with a similar composition to that of the glaciofluvial sediments, but typically with a greater sand content (Bichler and Bobrowsky 2003).

5.4 Local Surficial Geology

The local surficial geology consists of Quaternary glacial deposits overlain by fill/anthropogenic deposits. Based on the geotechnical field investigations completed to date in the area of the NW PAG Dump, a simplified stratigraphic sequence with estimated thicknesses based on site observations is summarized as follows:

- Topsoil
- Colluvium – 1 m to 5 m
- Glacial deposits
  - Till: 3 m to at least 16 m
  - Glaciofluvial deposits: up to 4 m
  - Fine-grained material
    - One unit 5 m thick encountered during the 2023/2024 geotechnical field investigation
    - This material was initially interpreted as a GLU during the 2023 geotechnical field investigation (WSP 2024b)
  - Clay material
    - One unit 2.5 m thick encountered during the 2023/2024 geotechnical field investigation
- Bedrock (Mount Polley Intrusive Complex) – to depth

Topsoil has not been considered in this assessment as WSP understands that topsoil materials have been stripped from the foundation and stockpiled for reclamation purposes.

The local surficial geology is based on information at test pit and borehole locations only. Conditions between test pits/boreholes and the extents of geologic units are unknown and are subject to uncertainty. The local surficial geology has been interpreted based on the field observations, and further interpreted based on the laboratory

testing completed on select samples. Some units may differ from what was presented in the factual report for the 2023/2024 geotechnical field investigations based on the laboratory testing (WSP 2024b).

Further details on each material type are described in the following sub-sections.

5.4.1 Colluvium

Colluvium in the area of the NW PAG Dump ranged in thickness from 0.8 m to 5 m, and locally exhibits greater thickness along the lower slopes of the west flank of Mount Polley ridge. The colluvium is expected to be the foundation soil directly underlying the east side of the proposed ultimate NW PAG Dump design.

The results of index tests completed on colluvium samples collected in the area of the NW PAG Dump are summarized in Table 5 and in Appendix C, Figures C-1 and C-2.

Table 5: Summary of Index Test Results for Colluvium (after WSP 2024b)

Test	Average	Minimum	Maximum	Number of Tests
Water Content (%)	11.8	9.0	16.9	4
Liquid Limit	32.0	26.0	42.0	4
Plastic Limit	17.5	12.0	28.0	4
Plasticity Index	14.5	14.0	16.0	4
Specific Gravity	-	-	-	0
% Gravel	43.8	33.0	56.0	4
% Sand	32.8	31.0	34.0	4
% Fines	23.5	13.0	33.0	4

The natural water content test results indicated an average of 12% and a range of 9% to 17%. It is noted that some samples were not tested immediately at the WSP Laboratory, therefore, the natural water contents may not reliably represent actual in-situ moisture conditions of the colluvium.

The particle size distribution test results indicated sand and gravel sized particles are present in all colluvium samples, with fines content raging from 13% to 33%. As indicated by the Atterberg Limit results, the fines component is generally intermediate plasticity, and range from silt to silty clay. The colluvium was typically described as very soft to stiff, and well-graded with trace organics.

Large direct shear testing was completed on a colluvium sample (WSP 2024b). The peak friction angle obtained was 35 degrees, with a cohesion of 30 kPa. The residual friction angle was 34.5 degrees, with a cohesion of 0 kPa.

5.4.2 Till

Till encountered in the area of the NW PAG Dump ranged in thickness from 3.2 m to 15.5 m. The till is expected to be the foundation soil underlying the majority of the west side of the proposed ultimate NW PAG Dump design.

The results of index tests completed on till samples collected in the area of the NW PAG Dump are summarized in Table 6 and in Appendix C, Figures C-3 and C-4.

Table 6: Summary of Index Test Results for Till (after WSP 2024b)

Test	Average	Minimum	Maximum	Number of Tests
Water Content (%)	12.3	6.8	23.0	2
Liquid Limit[(a)]	26.7	19.0	54.0	20
Plastic Limit[(a)]	14.1	12.0	17.0	20
Plasticity Index[(a)]	12.6	5.0	37.0	20
Specific Gravity	2.73	2.68	2.76	4
% Gravel	29.4	7.0	61.5	19
% Sand	33.5	10.0	57.4	19
% Fines	37.1	11.3	83.0	19

(a) One “non-plastic” test included in test count but not test results statistics.

The natural water content results indicated an average of 12% and a range of 7% to 23%. It is noted that some samples were not tested immediately at the WSP Laboratory, therefore, the natural water contents may not reliably represent actual in-situ moisture conditions of the till. The ranges and average moisture content are similar to values observed for till samples collected at the Southeast Rock Disposal Site (SERDS) and the Tailings Storage Facility (TSF) (WSP 2023 and 2024a).

The particle size distribution test results indicated sand and gravel sized particles are present in all till samples, the fines content ranging from 11% to 83%. As indicated by the Atterberg Limit results, the fines component is generally low to medium plasticity, and ranges from clays to silty clays. The ranges and averages for the particle size distribution and Atterberg Limit tests are similar to values observed for till samples collected from the SERDS and the TSF (WSP 2023 and 2024a). The till was typically described as loose to very stiff, and well-graded.

One sample from the 2023/2024 geotechnical field investigation, TP-NW-04-03, appears to be an outlier in regard to test results for water content, particle size distribution, and Atterberg Limits. The water content for the till sample was the highest at 23%; however, this value is considered unreliable due to the method of sampling and the extended period of time between when sampling and testing were carried out. The fines content was 83% and behaved like a high plasticity clay. This sample was a grab sample from a test pit at the northwest corner of the current NW PAG Dump (Figure 4) and there was no indication in the test pit log as to where this high fines material may have occurred. It is possible that within the till there was a depositional period where materials with more fines were deposited in this localized area; however, this was not observed during the test pit logging as the sample was a similar colour to the surrounding till and the depositional area may have been relatively small

Large direct shear testing was completed on a till sample (WSP 2024b). The peak friction angle is 32.5 degrees with a cohesion of 55 kPa. The residual friction angle is 32.5 degrees with a cohesion of 0 kPa. Direct shear testing of samples of till collected from near the SERDS and the TSF were also completed on remoulded grab samples, and those results were compared to the current test results for till in the area of the NW PAG Dump. Direct shear test results for samples of till collected near the SERDS indicated an average residual friction angle of 34 degrees with a cohesion of 0 kPa (WSP 2024a). Direct shear test results for samples of till collected near the TSF indicate an average peak friction angle of 34.6 degrees with a cohesion of 0 kPa (WSP 2023).

The results of index testing and direct shear testing of till samples collected near the NW PAG Dump are similar to the test results for till encountered near the SERDS and TSF, with the exception of the direct shear testing. This is likely due to the sample size used for the direct shear testing. For the purposes of this geotechnical assessment, the results of the large direct shear test completed for the till sample collected in the area of the NW PAG Dump in 2023 may be considered to represent a lower bound.

5.4.3 Glaciofluvial Deposits

Glaciofluvial deposits encountered in the area of the NW PAG Dump ranged in thickness from 0.2 m to 3.5 m. The glaciofluvial deposits were typically interbedded with the till on the north end of the dump and on the western portion near the centre of the NW PAG Dump footprint.

A summary of index testing completed on glaciofluvial material in the area of the NW PAG Dump is presented in Table 7 and in Appendix C, Figures C-5 and C-6.

Table 7: Summary of Index Test Results for Glaciofluvial Deposits

Test	Average	Minimum	Maximum	Number of Tests
Water Content (%)	7.1	5.2	9.7	5
Liquid Limit[(a)]	21.0	19.0	25.0	5
Plastic Limit[(a)]	13.8	12.0	17.0	5
Plasticity Index[(a)]	7.3	7.0	8.0	5
Specific Gravity	2.74	2.73	2.75	2
% Gravel	49.7	20.1	67.4	5
% Sand	38.2	21.0	65.4	5
% Fines	12.1	7.1	15.0	5

(a) One “non-plastic” test included in test count but not test results statistics.

The natural water content results indicated an average of 7% and a range of 5% to 10%. It is noted that some samples were not tested immediately at the WSP Laboratory, therefore, the natural water contents may not reliably represent actual in-situ moisture conditions of the glaciofluvial material. The ranges and average moisture contents were similar to values observed for glaciofluvial deposits encountered at the TSF (WSP 2023).

The particle size distribution testing indicated sand and gravel sized particles were present in all glaciofluvial samples and a fines content that ranged from 7% to 15%. The fines from these samples were generally identified as non-plastic to low plasticity. The glaciofluvial deposits were typically described as very loose to firm, low plasticity fines, and well-graded, which was generally supported by the laboratory test results. In general, the glaciofluvial deposits had a more granular nature and were less firm than the till. The ranges and averages for the particle size distribution tests and Atterberg Limits were similar to values obtained for samples of the glaciofluvial deposits collected at the TSF (WSP 2023).

No direct shear testing was completed on samples of glaciofluvial deposits collected near the NW PAG Dump. Shear strength testing was completed on samples of glaciofluvial deposits from the TSF and indicated a peak shear strength of 35 to 36 degrees with a cohesion of 0 kPa (WSP 2023).

5.4.4 Fine-Grained Material

Fine-grained material was encountered in what is inferred to be a localized “pocket” near DH-NW-07 in the central toe area on the west side of the NW PAG Dump footprint. The fine-grained material was encountered directly overlying bedrock at elev. 1,000 m. The vertical interval over which the fine-grained material was encountered was approximately 4.8 m.

A summary of index testing completed on the fine-grained material in the area of the NW PAG Dump is presented in Table 8 and in Appendix C, Figures C-7 and C-8.

Table 8: Summary of Index Test Results for the Fine-Grained Material

Test	Average	Minimum	Maximum	Number of Tests
Water Content (%)	18.2	14.7	23.0	8
Liquid Limit	27.5	22.0	30.0	8
Plastic Limit	18.3	17.0	20.0	8
Plasticity Index	9.3	4.0	11.0	8
Specific Gravity	2.8	2.8	2.8	3
% Gravel	8.8	1.0	28.2	8
% Sand	13.6	5.0	24.3	8
% Fines	77.7	58.2	94.0	8

The natural water content results indicated an average of 18% and a range of 15% to 23%. It is noted that samples were not tested immediately at the WSP Laboratory, therefore, the natural water contents may not reliably represent actual in-situ moisture conditions of the fine-grained material.

The particle size distribution test results indicated minimal gravel and sand sized particles and a fines content that ranged from 58% to 94%. Atterberg Limit results indicated the fines component was generally low plasticity, and silty clays. The fine-grained material was typically described as stiff to hard, and well-graded. This was supported by the laboratory testing results. The ranges and averages from the particle size distribution and Atterberg Limit results were similar to values observed for samples of the fine-grained material collected at the SERDS and from the south embankment of the TSF (WSP 2023 and 2024a). The low plasticity and relatively low water content of the silty clay layer (index testing) encountered at this location was not considered representative of the intermediate or high plasticity GLU encountered within the footprint of the TSF (WSP 2023).

One Cone Penetration Test (CPT) was advanced in the fine-grained material at DH-NW-07B, which was located in the vicinity of DH-NW-07 where the fine-grained material was first encountered. Pore pressure dissipation testing (PPDT) was completed at three elevations within the CPT column. A report was prepared by Gregg Drilling and Testing Canada Ltd. (Gregg), which included a summary of the CPT and PPDT results along with test details (WSP 2024b).

Results of the CPT analysis carried out for the fine-grained layer in DH-NW-07B are presented as a series of depth profiles in Appendix D, Figure D-1, including profiles of the following parameters:

- Total cone tip resistance, q_t.
- Sleeve friction, fs.
- Porewater pressure that includes the penetration porewater pressure u_2, hydrostatic porewater pressure, piezometer data of vwp-07 at dh-nw-07, and the end of two PPDTs performed at a depth of 31.0 m and 31.42 m.
- Undrained shear strength, S_u. S_u was estimated from CPT data using Mayne (2001):

$$s_u = \frac{(q_t - \sigma_{v0})}{N_{KT}}$$

Where N_{KT} = 15 is a constant, σ_{v0} is the total stress acting on the soil layer.

- Preconsolidation stress, σ'_p, from the CPT data was estimated from Mayne (2001):

$$\sigma'_p = 0.33\ (q_t - \sigma_{v0})$$

- Over consolidation ratio, OCR, that is the ratio of σ'_p to the effective stress, σ'_V.

The peak undrained shear strength ratio (S_u-peak ratio) was calculated based on qc_{1Ncs} as recommended by Idriss and Boulanger (2008). Appendix D, Figure D-2 presents the S_u-peak ratio determined by the Idriss and Boulanger (2008) method. The 33rd percentile of the peak undrained shear strength ratio for the fine-grained layer is 0.83. The fine-grained layer is highly over consolidated with an average OCR equal to 17 as shown in Appendix D, Figure D-1. Robertson (2016) presents the CPT soil behaviour type (SBT) chart for liquefaction and cyclic softening potential. Appendix D, Figure D-3 presents the CPT SBT chart for the fine-grained layer. The material exhibits a sand-like dilative and transitional dilative behavior.

The proposed ultimate NW PAG Dump design will have approximately 5 to 10 m of additional material placed in the vertical column in the area of the fine-grained material. This is a minimal amount of vertical effective stress that will be applied to the fine-grained material.

Despite this material being interpreted as having deposited in a glaciolacustrine environment (WSP 2024b), the results of the laboratory testing and CPT indicate that it does not behave as the intermediate or high plasticity GLU encountered within the footprint of the TSF. The fine-grained material is interpreted to be a component of the till, generally lacking the clastic component of sand, gravel and cobbles that is present in other portions of the till unit. For the purposes of the slope stability analyses, this material will be assessed combined with the till material parameters.

5.4.5 Clay Material

Clay material was encountered in what was inferred to be a localized “pocket” near DH-NW-02 on the northeast side of the NW PAG Dump footprint. The clay material was encountered 0.9 m below original ground surface. The vertical interval over which the clay material was encountered was approximately 2.6 m.

A summary of index testing completed on clay material in the area of the NW PAG Dump is presented in Table 9 and in Appendix C, Figures C-9 and C-10.

Table 9: Summary of Index Test Results for Clay Material

Test	Average	Minimum	Maximum	Number of Tests
Water Content (%)	48.4	38.4	58.3	2
Liquid Limit[(a)]	44.5	38.0	51.0	2
Plastic Limit[(a)]	18.5	16.0	21.0	2
Plasticity Index	26.0	22.0	30.0	2
Specific Gravity	2.69	2.69	2.69	1
% Gravel	5.3	1.6	8.9	2
% Sand	13.7	13.1	14.2	2
% Fines	81.1	76.9	85.3	2

The natural water content results indicated an average of 48% and a range of 38% to 58%. It is noted that samples were not tested immediately at the WSP Laboratory, therefore, the natural water contents may not reliably represent actual in-situ moisture conditions of the clay material.

The particle size distribution test results indicated minimal gravel and sand sized particles and a fines content that ranged from 77% to 85%. Atterberg Limit results indicated the fines component was generally intermediate to high plastic, silty clay to clay. The clay material was typically described as very soft to firm. The higher fines content in samples collected from the northeast side of the NW PAG Dump (DH-NW-02) may be indicative of an interval of lower energy deposition within the overall glaciofluvial environment.

No direct shear or advanced geotechnical laboratory testing has been completed on the clay material. The material was inferred to be interbedded (not continuous) and isolated to one borehole (DH-NW-02). The clay material was not encountered in TP-NW-01, TP-NW-02, DH-NW-03 or DH-NW-03A which are nearby (Figure 4). No test pit excavations or borehole drilling has been completed below the toe (within the footprint) of the NW PAG Dump near where the clay material was encountered due to the dump having already been constructed to the footprint extents in this area.

5.4.6 Bedrock

Bedrock in the area of the NW PAG Dump footprint is part of the Mount Polley Intrusive Complex, which is composed of several intrusive units including diorite, monzodiorite-monzonite, K-feldspar monzonite, and late dykes (Rees 2013). All of these rock types are considered to be medium strong to strong, with estimated uniaxial compressive strengths ranging from 25 to 100 MPa.

Bedrock was encountered in two test pits in 1999, two test pits in 2010, two test pits in 2023, and eight boreholes in 2023/2024. The test pits completed did not describe the bedrock other than observations indicating that it was weathered. Bedrock encountered in the sonic boreholes was typically pulverised and difficult to determine its particular compositional characteristics. The rock pieces were typically grey with brown staining (WSP 2024b).

5.5 Waste Rock

Waste rock from the Mount Polley pits generally consists of blasted intrusive rock that are observed to be hard and competent. Gradations of waste rock from the Mount Polley pits have not been assessed, but have been generally observed over a period of several years. Waste rock particle sizes are generally expected to range from a few centimetres up to 1 m, and consist predominantly of boulders and cobbles, with some gravel and sand based on observations of waste rock in the current NW PAG Dump and experience at the Mount Polley Mine.

From previous experience, waste rock at Mount Polley Mine has been observed to be good quality (with the exception of material from faulted areas and the upper bench in overburden). Slope stability performance at the current NW PAG Dump and in other waste rock dumps on site has been favorable in part due to the material quality. The existing waste rock dump slopes are generally at angle of repose (37 degrees) with no apparent indication of slope face or overall instability.

Waste rock fills typically exhibit a non-linear shear strength behaviour that is largely dependent upon the gradation, angularity, and degree of compaction of the particles (Leps 1970; Barton and Kjaernsli 1981). Research results from testing of rockfill shows that the measured friction angles are a function of applied normal stress for various rockfill gradations and densities. Figure 7 presents the non-linear shear strength of rockfill from triaxial tests after Leps (1970), which includes an upper bound for the shear strength behaviour for high density, well-graded strong particles and a lower bound for low density, poorly graded weak particles.

Selection of the appropriate shear strength function for waste rock is related to the material type to be placed. Table 10 presents a summary of the non-linear shear strength functions after Leps (1970) and Hawley and Cunning (2017) and provides recommended shear strength functions.

Table 10: Shear Strength Functions for Waste Rock (after Hawley and Cunning 2017)

Particle Strength – Based on Leps (1970) Curve (Graph 3)	Shear Strength Function
Lower bound – low density, poorly graded, weak particles.	$\tau = 1.446\sigma^{0.898}$
Lower quartile – between low and average rockfill.	$\tau = 1.576\sigma^{0.899}$
Average rockfill	$\tau = 1.726\sigma^{0.899}$
Upper quartile – between average and high rockfill.	$\tau = 1.899\sigma^{0.898}$
Upper bound – high density, well-graded, strong particles, generally not suitable for sedimentary rockfill.	$\tau = 2.067\sigma^{0.899}$

τ=$shear\ strength$; $\sigma = normal\ stress$.

5.6 Groundwater

Groundwater levels around the NW PAG Dump are generally expected to be at or near the contact between the waste rock and the underlying foundation soil and can be expected to fluctuate seasonally due to variations in precipitation and runoff from Mount Polley ridge.

During the December 2023 geotechnical investigation, artesian conditions were encountered in DH-NW-03A at 14.25 m depth in a layer of glaciofluvial deposits. Flow from the borehole was measured at approximately 0.1 gallon per second (about 0.4 L/s), with approximately 3.5 m of hydraulic head above ground surface before the borehole was grouted. No seepage from the borehole has been observed since grouting and the cause of the artesian conditions has not been investigated further. There is an area to the northeast of the NW PAG Dump and DH-NW-03A along Bootjack Road where MPMC staff have noted water flows continuously throughout the year indicating a potential seep in the area (an exact location was not provided to WSP).

Seeps and ponding water have also been observed along the toe of the current NW PAG Dump (Appendix E, Figures E-1 to E-3). This is likely due to the fine-grained material that has been stripped from the footprint of the dump and piled near the toe of the dump. Seepage from the NW PAG Dump is collected in a sump near the south end of the dump via a seepage collection pipe (Appendix E, Figure E-4) and in seepage collection ponds on the west side of the NW PAG Dump (Appendix E, Figure E-5).

A total of four vibrating wire piezometers (VWP) were installed in four boreholes during the 2023 geotechnical investigation to monitor the hydraulic heads in the different subsurface units. Seven rounds of hydraulic head readings have been collected by MPMC since installation of the VWPs to monitor the groundwater table in the dump area. A summary of the VWP installation details and latest reading of the corresponding hydraulic heads are presented in Table 11. Due to the relatively shallow depths of the piezometers, it has been assumed that the hydraulic head readings represent water table elevations at those locations. Cross-sections and graphs of hydraulic head data over time are presented in Appendix E.

Table 11: Summary of Vibrating Wire Piezometers and Approximate Groundwater Elevations for NW PAG Dump

Borehole ID	VWP Serial No.	Unit	Tip Elevation (m)	Original Ground Elevation (m)	Reading Date	Hydraulic Head (m)	Groundwater Elevation (m)
DH-NW-02	VW165268	Glaciofluvial	1,048.6	1,051.7	April 8, 2024	2.3	1,050.8
DH-NW-06	VW170541	Till/bedrock contact	994.0	1,002.6		10.7	1,004.7*
DH-NW-07	VW162321	Fine-grained material	998.5	1,014.8		19.7	1,018.2*
DH-NW-09	VW169440	Bedrock	1,025.9	1,041.5		14.0	1,040.0

*Hydraulic head is reading above original ground elevation.

Observations from the VWPs installed in the NW PAG Dump area are as follows:

- DH-NW-02 (Appendix E, Figures E-7 and E-8)
  - The VWP is installed in glaciofluvial material at the northeast toe of the NW PAG Dump, and the hydraulic head data collected fluctuate from elev. 1,050 to 1,051 m below original ground elevation.
- DH-NW-06 (Appendix E, Figures E-9 and E-10)
  - The VWP is installed at the till/bedrock contact below the current northwest toe of the NW PAG Dump, and the hydraulic head has been steadily reading about 2 m above original ground elevation.
- DH-NW-07 (Appendix E, Figures E-11 and E-12)
  - The VWP is installed in fine-grained material below the current west toe of the NW PAG Dump, and the hydraulic head has been steadily reading about 3 m above original ground elevation.
- DH-NW-09 (Appendix E, Figures E-13 and E-14)
  - The VWP is installed in bedrock below the current toe of the NW PAG Dump on the south end, and the hydraulic head has remained below original ground elevation around elev. 1,040 m.

During the 2023 test pit investigation, seepage was observed in the following test pits and depths:

- TP-NW-02 at a depth of 1 m in glaciofluvial material
- TP-NW-03 at a depth of 1 m in colluvium
- TP-NW-04 at a depth of 1.4 m in till

All of these test pits are located at the north to northwest end of the current NW PAG Dump.

Groundwater information collected to date indicates the following conceptual flow regime:

- Groundwater in the area of the NW PAG Dump flows largely from east to west with recharge at the Mount Polley ridge and discharge to the Bootjack Lake.

- The data collected during the field investigation indicate the groundwater below the NW PAG Dump is relatively shallow varying from about 1 m below ground surface up to 3 m above ground surface.
- Water ponding has been observed near the toe of the NW PAG Dump in the area of fine-grained material piles that likely limit infiltration.

Artesian conditions have been encountered in the fine-grained materials in DH-NW-07 (hydraulic head is 3 m above original ground in the dump). The localized condition could be the result of an elevated water table within the dump and poor drainage of the underlying fine-grained materials. No seepage face on the lower lift of the dump in this area has been observed.

The artesian conditions encountered in borehole DH-NW-06 at the till - bedrock contact may be the result of a regional flow within the bedrock aquifer under confined conditions due to the overlying till “capping” and preventing the upward flow of groundwater across the till – bedrock contact.

Assumptions regarding groundwater for the slope stability assessment are described further in Section 6.5.

5.7 Site Seismicity

Mount Polley Mine is located in an area of relatively low seismicity in British Columbia. WSP developed a site-specific seismic hazard model for the Mount Polley Mine based on historical seismicity and a review of geological and paleo-seismological features (WSP USA 2023). Earthquake ground motion parameters calculated from the site-specific hazard model are presented in Table 12.

Table 12: Mount Polley Mine Seismic Hazard Values (after WSP USA 2023)

Exceedance Probability	Return Period (years)	Peak Ground Acceleration (g)
5% in 50 years	1,000	0.026
2% in 50 years	2,475	0.048
1% in 50 years	5,000	0.076
0.5% in 50 years	10,000	0.116

Return periods are not exact representations of annual exceedance probabilities.

These values were compared to the National Building Code (NBC) of Canada seismic hazard tool for the latitude and longitude location of the NW PAG Dump. The peak ground acceleration (PGA) values are similar, therefore, the assessment completed by WSP USA (2023) were used for the pseudo-static slope stability analyses.

5.8 Cross-Section Review

The original topography in the area of the NW PAG Dump (from 2006), a LiDAR drone scan of the dump completed in October 2023, and the proposed NW PAG Dump design provided by MPMC were reviewed using the Seequent 3D modelling software Leapfrog Works (© 2023 Seequent). Several cross-sections were cut through the surfaces of the 3D model to identify critical cross-sections for the slope stability and runout analyses.

A description of each of the cross-sections is provided below:

- Cross-section A (Appendix B, Figure B-2): This cross-section was cut to review topography below the southern portion of the NW PAG Dump and through DH-NW-09, TP-NW-09, and TP-NW-10. The topography slopes at about 20 degrees on the east side, to a shallow slope of about 8 degrees below the majority of the NW PAG Dump and steepens past the toe of the dump to Bootjack Lake. The cross-section indicates that the NW PAG Dump is near its ultimate configuration in this area with an overall height of 107 m (toe to crest). The field investigation information indicates colluvium in the area with till at depth over bedrock. The bedrock elevation at the south end of the dump is typically around elev. 1,026 m or higher towards the south.
- Cross-sections B and C (Appendix B, Figures B-3 and B-4): These cross-sections were cut to review topography below the southern portion of the NW PAG Dump and through DH-NW-08 and DH-NW-09. The topography is shallow to moderate in this area, sloping at approximately 8 degrees. The cross-sections indicate that the NW PAG Dump is at its ultimate height in this area with an overall height of 111 m (toe to crest) and available storage to the west. The field investigation information indicates colluvium overlying till with bedrock between elev. 1,017 m and elev. 1,026 m.
- Cross-sections D, E, and F (Appendix B, Figures B-5 to B-7): These cross-sections were cut to review topography below the central portion of the NW PAG Dump and through DH-NW-06, DH-NW-07, DH-NW-07B, DH-NW-07C, DH-NW-08, and DH-NW-11. The topography is moderately sloping at approximately 22 degrees on the east side, to a shallow slope of about 7 degrees below the majority of the NW PAG Dump. The cross-sections indicate that the NW PAG Dump is at its ultimate height in this area with an overall height of 133 m (toe to crest) and available storage to the west. The field investigation information indicates a thin veneer of colluvium over till interbedded with some glaciofluvial material, with a pocket of fine-grained material near the toe of the dump (interpreted to be a component of the till), overlying bedrock between elev. 993 m to elev. 1,002 m.
- Cross-sections G and H (Appendix B, Figures B-8 to B-9): These cross-sections were cut to review topography below the northwest portion of the NW PAG Dump and through DH-NW-05 and DH-NW-06. The topography is moderately sloping at approximately 25 degrees on the east side, to a shallow slope of about 9 degrees below the majority of the NW PAG Dump. The cross-sections indicate that the NW PAG Dump is at its ultimate height in this area with an overall height of 141 m (toe to crest) and available storage to the west. The field investigation information indicates till interbedded with some glaciofluvial material overlying bedrock around elev. 992 m.
- Cross-section I (Appendix B, Figure B-10): This cross-section was cut to review topography below the northern portion of the NW PAG Dump and through TP-NW-04. The cross-section is oblique to the slope of the topography and indicates a shallow slope of about 6 degrees on the north side, to a steep slope of about 17 degrees on the south end where the dump ties into original topography. The cross-section indicates that the NW PAG Dump is at its ultimate configuration in this area with an overall height of 128 m (toe to crest) with available storage to the north. The field investigation information indicates colluvium in the area with till at depth over bedrock.

- Cross-section J (Appendix B, Figure B-11): This cross-section is two separate sections with different orientations stitched together to review topography below the northeast portion of the NW PAG Dump and through DH-NW-03A and TP-NW-03. The topography is moderately sloping at approximately 16 degrees on the east side, to a shallow slope of about 5 degrees below the majority of the NW PAG Dump. The cross-section indicates that the NW PAG Dump is not at its ultimate configuration in this area with approximately 19 m of height for storage. The field investigation information indicates a thin veneer of colluvium in the area with till interbedded with glaciofluvial material overlying bedrock at about elev. 1,004 m.
  - This cross-section is near DH-NW-03 where artesian conditions were encountered when drilling intersected the glaciofluvial deposits at depth.
  - This cross-section is near DH-NW-02 where clay material was encountered near the toe of the dump, outside the footprint of the proposed ultimate NW PAG Dump design in what is interpreted to be an isolated area.

5.9 Surficial Geology Interpretation

Based on the foundation materials and cross-section review, a surficial geology interpretation is shown in Figure 8 for the area of the proposed ultimate NW PAG Dump design. The following summarizes the interpretation:

- Colluvium is interpreted to be a thin veneer underlying the eastern slope of the NW PAG Dump, with localized areas of thicker colluvium layers to the southwest of the dump footprint.
- Till is interpreted to cover the majority of the NW PAG Dump footprint, with variable thickness.
- Glaciofluvial deposits are located in isolated areas at the north end of the dump and near the center. Till typically overlies the glaciofluvial deposits.
- Fine-grained material is interpreted to be present in an isolated area on the west side of the NW PAG Dump at depth and is overlain by till. This material has been modeled as part of the till. It is possible that fine-grained material could be located in other parts of the foundation of the NW PAG Dump that were not investigated.
- Clay material is interpreted to be present in an isolated area on the northeast side of the NW PAG Dump about 0.9 m below original ground surface and is discontinuous (interbedded with silty clay). This material has been modeled as a separate unit as a sensitivity analysis.

6.0 SLOPE STABILITY ASSESSMENT

The following sections provide:

- A description of the slope stability rating and hazard classifications for the proposed ultimate NW PAG Dump using the Waste Dump Stockpile Stability Rating and Hazard Classification (WSRHC) system (Hawley and Cunning 2017).
- Rationale used to select the design acceptance criteria (BCMWRPRC 1991 and Hawley and Cunning 2017).
- Identification of the potential instability mechanisms for the proposed ultimate NW PAG Dump design.
- A discussion regarding the slope stability modeling methodology and assumptions.
- A description of the selected material strength parameters and assumptions.
- A discussion of the slope stability model scenarios and slope stability results.

6.1 Slope Stability Rating and Hazard Classification

The WSRHC system is based on Hawley and Cunning (2017) and incorporates many concepts that were used in the B.C. Mines Ministry 1991 dump slope stability classification guidelines (BCMWRPRC 1991). The WSRHC system requires evaluation of 22 key factors or attributes that affect slope stability of a waste rock dump. Numerical ratings are assigned to each factor, and the sum of these ratings defines the waste rock dump slope stability rating.

The WSRHC results for the proposed ultimate NW PAG Dump design are summarized in Table 13 and presented in Illustration 1.

Table 13: NW PAG Stability Rating and Hazard Classification Results

WSRHC Factors	Rating
Engineering Geology Index	26.5
Design Performance Index	30.5
Waste Rock and Stockpile Stability Rating	57
Waste Rock and Stockpile Hazard Class	III
Instability Hazard	Moderate Hazard

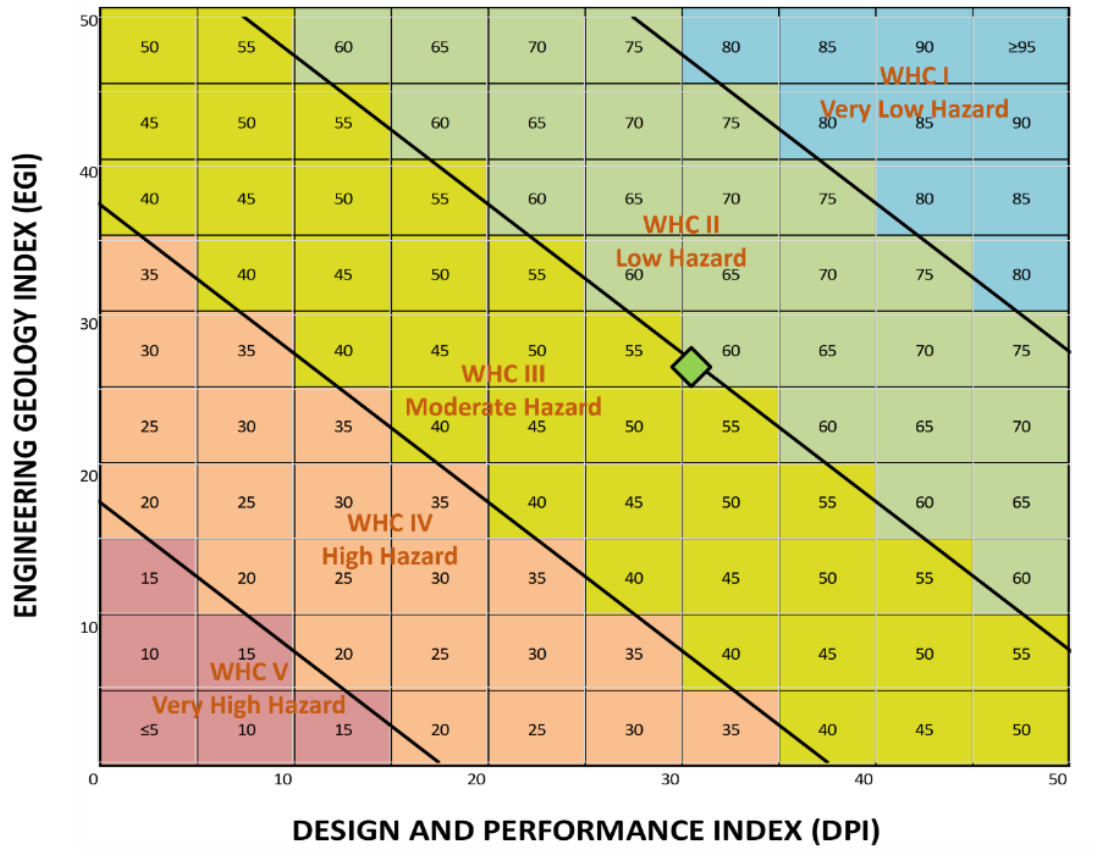

Illustration 1: Proposed Ultimate NW PAG Dump Design Slope Stability Rating and Hazard Classification

The proposed ultimate NW PAG Dump design is classified as presenting a moderate potential for instability and is therefore considered to be a moderate hazard waste rock dump (Class III). Further details of the WSRHC are presented in Appendix F.

6.2 Instability Mechanisms

The site topography was reviewed with respect to the proposed ultimate NW PAG Dump design to identify areas with adverse combinations of foundation slope angles, foundation soils, and overall waste rock dump height. The cross-section review presented in Section 5.8 and Appendix B supported the selection of cross-sections for slope stability analyses.

The following two potential slope failure mechanisms were assessed in the slope stability analyses:

- **Dump lift/face stability (shallow-seated):** Failure surfaces either pass through the NW PAG Dump face, or local failure occurs at the toe (no effect on overall slope stability of the dump).
- **Overall stability (deep-seated):** Deep failure surfaces pass through the NW PAG Dump body and/or the foundation contact and affect the overall slope stability of the dump.

6.3 Potential Liquefaction

Soils that are susceptible to static or dynamic liquefaction are generally loose, uniform to poorly graded clean sands that are susceptible to collapse of structure under rapid loading. The proposed ultimate NW PAG Dump design is underlain by colluvium, till, glaciofluvial, fine-grained material, and clay material deposits. The particle size distribution curves and Atterberg Limit results from laboratory testing for these materials are presented in Appendix C. A uniformity coefficient can be calculated from the particle size distribution curves to determine whether the soil is well-graded or uniform, as shown by Equation 1.0 (Budhu 2009).

$$C_u = \frac{D_{60}}{D_{10}} \quad (1.0)$$

A soil that has a uniformity coefficient less than 4 contains particles of uniform size and a uniformity coefficient greater than 4 indicates a wider assortment of particles sizes and is described as well-graded soil. This relationship has been used to support justification as to whether or not the materials are susceptible to liquefaction.

Colluvium in the area of the NW PAG Dump consists of well-graded gravels, sands, and fines in varying proportions with trace cobbles. The colluvium is typically very soft to stiff with trace organics. The particle size distribution curve (Appendix C, Figure C-11) indicates a high coefficient of uniformity (above 4) which aligns with descriptions of the material being well-graded. Due to voids being filled with fines, the well-graded colluvium is typically not susceptible to structure collapse and liquefaction upon loading.

Till in the area of the NW PAG Dump is typically a loose to stiff, well-graded material with abundant fines based on observations and laboratory testing completed. The particle size distribution curve (Appendix C, Figure C-12) indicates a high coefficient of uniformity (above 4) which aligns with descriptions of the material being well-graded. Due to the voids between the coarser fraction of the till being filled with fines, based on the descriptions of the till and the resulting particle size distribution curves, the till is not susceptible to liquefaction.

Glaciofluvial deposits in the area of the NW PAG Dump are typically a thin layer (interbedded with till) composed of gravels and sands, with lower percentages of fines. The glaciofluvial deposits were described as loose to stiff. The glaciofluvial deposits were observed and tested to be more granular and less firm than the till found in the area of the NW PAG Dump. There is one sample of glaciofluvial material from DH-NW-11 (GS-08) that has a particle size distribution curve that lies within a potential liquefiable soils envelope (Appendix C, Figure C-13). However, this sample has a high uniformity coefficient (above 4) and is considered to be a well-graded soil. Based on the descriptions of the glaciofluvial deposits, the majority of the resulting particle size distribution curves (Appendix C, Figure C-13), the uniformity coefficients, and the proposed construction methodology for the proposed ultimate NW PAG Dump (low lift heights over a large area), the glaciofluvial material is unlikely to be susceptible to liquefaction.

A pocket of fine-grained material was encountered near the toe of the current NW PAG Dump on the west side in DH-NW-07. The material was logged as clay with trace gravel and sand, and generally stiff to hard. The uniformity coefficients based on the particle size distribution curves (Appendix C, Figure C-14) of the fine-grained material are high (above 4). Due to the voids between the coarser fraction of the fine-grained materials being filled with fines, based on the descriptions of the material and the resulting particle size distribution curves, the fine-grained material is not susceptible to structure collapse and liquefaction.

Clay material was found interbedded with coarser glaciofluvial deposits in DH-NW-02 and was described as very soft to firm with a high fines content. Uniformity coefficients were not calculated for the clay material as a D_{10} value is not achieved in the laboratory testing (the material has a very high fines content). However, based on the descriptions of the material and the particle size distribution curves (Appendix C, Figure C-15), the clay material is not susceptible to liquefaction.

The Mount Polley Mine area is in a low seismicity area. The likelihood of dynamic loading due to an earthquake is relatively low for the area.

Based on experience at Mount Polley Mine, the waste rock is typically coarse grained and free-draining. It will exist in a relatively loose state due to the construction methodology (bottom-up construction) and is unlikely to exhibit a significant loss of shear strength when subject to cyclical external forces. The waste rock will generally be unsaturated and would be expected to settle during earthquakes, but not be susceptible to liquefaction due to absence of water. Fine-grained material that could be mined (i.e. overburden, weathered, or altered rock, or fault gouge) should be placed within the center or east side of the NW PAG Dump such that it can be encapsulated with better quality material. This construction methodology will contain any potentially liquefiable material within the dump such that it is unlikely to cause slope stability issues near the face/edges of the dump.

6.4 Design Factors of Safety

In keeping with the current state of practice, WSP has used Hawley and Cunning (2017) in conjunction with the British Columbia Mine Rock and Overburden Piles Research Committee (BCMWRPRC) Investigation and Design Manual, Interim Guidelines (BCMWRPRC 1991) to determine the slope stability design acceptability criteria for the proposed ultimate NW PAG Dump design.

The BCMWRPRC (1991) recommended factors of safety (FOS) are presented in Table 14.

Table 14: BCMWRPRC (1991) Recommended Factors of Safety for Waste Rock Dumps

Stability Condition	Factor of Safety	
Stability of Dump Face	**Case A**	**Case B**
Short-term	1.0	1.0
Long-term	1.2	1.1
Overall Stability (Deep-seated Stability)		
Short-term (Static)	1.3–1.5	1.1–1.3
Long-term (Static)	1.5	1.3
Long-term (Pseudo-static)	1.1–1.3	1.0
Case A ▪ low level of confidence in critical analysis parameters ▪ possibly unconservative interpretation of conditions, assumptions ▪ severe consequences of failure ▪ simplified stability analyses method (chart, simplified method of slices) ▪ stability analyses method poorly simulates physical conditions ▪ poor understanding of potential failure mechanisms		
Case B ▪ high level of confidence in critical analyses parameters ▪ conservative interpretation of conditions, assumptions ▪ minimal consequences of failure ▪ rigorous stability analysis method ▪ stability analysis method simulates physical conditions well ▪ high level of confidence in critical failure mechanism(s)		

The Hawley and Cunning (2017) suggested FOS based on the consequence of failure and the confidence in the factors that will control stability are shown in Table 15.

Table 15: Suggested Stability Criteria Factors of Safety (Hawley and Cunning 2017)

Consequence	Confidence	Minimum Static FOS	Minimum Pseudo-static FOS
Low	Low	1.3–1.4	1.05–1.1
	Moderate	1.2–1.3	1.0–1.05
	High	1.1–1.2	1.0
Moderate	Low	1.4–1.5	1.1–1.15
	Moderate	1.3–1.4	1.05–1.1
	High	1.2–1.3	1.0–1.05
High	Low	≥ 1.5	1.15
	Moderate	1.4–1.5	1.1–1.15
	High	1.3–1.4	1.05–1.1

FOS = factor of safety.

Notes (abridged; for the complete stability acceptance criteria, refer to Hawley and Cunning 2017).

Consequence:

Low—Waste rock dumps and stockpiles with overall fill slopes less than 25 degrees and less than 100 m high and repose angle slopes less than 50 m high. No critical infrastructure or unrestricted access within potential runout shadow. Limited potential for environmental impact. Long-term (more than 5 years) exposure for sites subject to very low to low (less than 250 mm) annual precipitation.

Moderate— Waste rock dumps with overall fill slopes less than 30 degrees and less than 250 m high or response angle slopes less than 100 m high. No critical infrastructure or unrestricted access, or robust containment/mitigative measures to protect critical infrastructure and access within potential runout shadow. Potential for moderate environmental impact, but manageable. Long-term (more than 5 years) exposure for sites subject to moderate (less than 250-1000 mm) annual precipitation.

High— Waste rock dumps with overall fill slopes more than 30 degrees and more than 250 m high, or with repose angle slopes more than 200 m high. Critical infrastructure or unrestricted access within potential runout shadow with limited runout mitigation/containment measures. Potential for high environmental impact that would be difficult to manage. Long-term (more than 5 years) exposure for sites subject to high (1000-2000 mm) annual precipitation or intensive rainy season(s).

Confidence:

Low—limited confidence in foundation conditions, waste rock properties, piezometric pressures, analyses technique or potential instability mechanism(s). Poorly defined or optimistic input parameters; high data variability.

Moderate—moderate confidence in foundation conditions, waste rock properties, piezometric pressures, analyses technique or potential instability mechanism(s). Input parameters adequately defined, moderate data variability.

High—high confidence in foundation conditions, waste rock properties, piezometric pressures, analyses technique or potential instability mechanism(s). Well-defined, conservative input parameters adequately defined, low data variability.

The choice of a design FOS involves consideration of the level of confidence in the understanding of the factors that will control slope stability, the input parameters, the analysis methods, and the consequences of failure. The guidelines summarized in Table 14 and Table 15 provide a range of suggested FOS to account for the consideration of these various factors. The following observations are provided regarding considerations and assumptions for consequence and confidence of the proposed ultimate NW PAG Dump design:

Consequence:

- The proposed ultimate NW PAG Dump design height is moderate (140 m toe to crest at its highest point) with angle of repose waste rock lift faces about 40 m high, 10 m wide catch-benches, and an overall slope angle of 28 degrees. A low consequence (Hawley and Cunning 2017) criterion with respect to waste rock dump construction is considered appropriate.
- MPMC have a monitoring plan (MPMC 2021) and access requirements when entering the runout zone and active mining area of the NW PAG Dump. There is signage in place and gates such that public access is also

restricted. A low consequence (Hawley and Cunning 2017) criterion with respect to access in and around the NW PAG Dump is considered appropriate.

- The NW PAG Dump is located near the Bootjack Access Road to the north (public access road and access road to Mount Polley Mine), near Bootjack Lake to the west, and settling ponds to the west. If failure were to occur on the NW PAG Dump slopes, a runout could impact one of these areas and has a severe consequence of failure. This presents a high consequence (Hawley and Cunning 2017) and Case A (BCMWRPRC 1991) criterion.
- Long-term exposure (over five years) for the NW PAG Dump will be subject to moderate annual precipitation at 612 mm/year. This presents a moderate consequence (Hawley and Cunning 2017).

Confidence:

- Past experience with waste rock dump construction at the Mount Polley Mine has provided a good understanding of the geologic and hydrogeologic conditions at the mine site, and the probable range of foundation material strength parameters. Consequently, there is a reasonable degree of confidence in the design strength parameters used in the analyses. Several field investigations and laboratory testing programs have been carried out for the property which also increases the degree of confidence in the foundation conditions and the design strength parameters. A high confidence (Hawley and Cunning 2017) and Case B (BCMWRPRC 1991) criterion with respect to material properties is considered appropriate since laboratory testing has been completed on the foundation materials and field investigations have been completed in the NW PAG Dump footprint area.
- Good quality waste rock is expected to be prioritized in the NW PAG Dump, with poorer quality waste rock being contained within the center of the dump or close to the eastern edge. No laboratory testing has been completed on waste rock at Mount Polley Mine; however, the behaviour of waste rock on site is well understood due to the favorable slope stability performance of other waste rock dumps at Mount Polley Mine and the observed gradations of the material. It has been assumed that the material is similar to other good quality waste rock encountered on site. Based on the gradations observed on site of the waste rock, the average rockfill Leps shear strength function applied to the slope stability analyses is appropriate (Table 10). A high confidence (Hawley and Cunning 2017) and Case B (BCMWRPRC 1991) criterion with respect to material properties for the waste rock is considered appropriate.
- Groundwater conditions are currently being monitored by VWPs in four locations in different geologic units. Readings from the VWPs and an understanding of the conceptual groundwater model satisfies a moderate confidence criterion from Hawley and Cunning (2017) and Case B from BCMWRPRC (1991).
- Limit equilibrium analyses methods have been used for the slope stability assessment and are considered to be sufficiently rigorous. This satisfies a high confidence criterion from Hawley and Cunning (2017) and Case B from BCMWRPRC (1991).
- Past mining and construction experience at the Mount Polley Mine and other mines in British Columbia has provided many opportunities to observe and understand the types of failure mechanism that develop at the mines. Consequently, there is a reasonable to high level of confidence in the understanding of the potential failure mechanisms. This satisfies a high confidence criterion from Hawley and Cunning (2017) and Case B from BCMWRPRC (1991).

Following the suggested design criteria by BCMWRPRC (1991) and Hawley and Cunning (2017), the proposed ultimate NW PAG Dump design is considered to have a moderate to high consequence of failure and high confidence of understanding the factors that control slope stability. On this basis, Table 16 presents the design FOS selected for the slope stability assessment.

Table 16: Recommended Design Acceptance Criteria Factors of Safety for Proposed Ultimate NW PAG Dump

Stability Condition	Static or Pseudo-static Condition	Minimum Design Factor of Safety	Source
Shallow-Seated Slope Stability of Dump Face	Static – short-term	1.0	BCMWRPRC (1991) Case A
	Static – long-term	1.2	BCMWRPRC (1991) Case A
	Pseudo-static – long-term	1.0	BCMWRPRC (1991) Case A
Overall Deep-Seated Stability	Static – short-term	1.4	Hawley and Cunning (2017) and BCMWRPRC (1991) Case A
	Static – long-term	1.5	BCMWRPRC (1991) Case A
	Pseudo-static – long-term	1.3	Hawley and Cunning (2017)

6.5 Slope Stability Methodology and Assumptions

The 2D slope stability analyses were carried out using the Slope/W limit equilibrium analysis software (© 2023 Seequent). The Morgenstern-Price method of slices was employed to find potential failure surfaces and their corresponding FOS. The slope stability of the NW PAG Dump was assessed for both static and pseudo-static (seismic) loading conditions, with fully saturated foundation soils.

The following methodology and assumptions were considered for the slope stability analyses:

- Based on the cross-section review completed (Appendix B and Section 5.8) the following cross-sections were selected for the slope stability analyses:
  - Cross-section E
    - representing the isolated fine-grained material identified in DH-NW-07/DH-NW-07B/DH-NW-07C which has been interpreted to be a component of the till.
  - Cross-section G
    - representing the highest overall waste rock dump height from the cross-section review.
  - Cross-section J
    - representing artesian conditions encountered at the north end of the proposed ultimate NW PAG Dump design in the glaciofluvial unit. Based on field observations a +3.5 m hydraulic head above the foundation soils was modelled, only applying to the glaciofluvial material.
    - representing the isolated clay material identified in DH-NW-02. Based on field observations, the unit has been modeled as a 2.5 m thick layer.

- The existing and new waste rock at the NW PAG Dump are considered free-draining and likely will not have excess pore pressures build up within the blasted rock. This is based on observations of other waste rock dumps on site, the performance to date of the NW PAG Dump, the proposed construction methodology of 40 m lifts bottom-up, the relatively small increase in overall height of the proposed ultimate NW PAG Dump, and on the conditions of the waste rock consigned to the dump.
- Organics and topsoil were not considered in the slope stability models as this material has been stripped from the foundation footprint of the NW PAG Dump (WSP 2023b).
- The foundation materials generally consist of colluvium, till, and glaciofluvial deposits, in addition to the pocket of fine-grained material and clay material in the area of the proposed ultimate NW PAG Dump design. The laboratory testing indicates that the till and colluvium have similar geotechnical properties, and these materials comprise the majority of the foundation materials. As such, for the purposes of slope stability modeling, till/colluvium was assumed as the major foundation material. Based on the 2023 and 2024 field investigations, the following approximate till/colluvium thicknesses were assumed:
  - Cross-section E: approximately 12 m thick till/colluvium layer at the NW PAG Dump toe, transitioning to a 29 m thick layer below the second and third lifts of the dump.
  - Cross-section G: approximately 9 m thick till/colluvium layer below the NW PAG Dump.
  - Cross-section J
    - approximately 14 m thick till/colluvium layer with a 7 m thick glaciofluvial layer below.
    - approximately 2.5 m thick clay layer near the toe of the dump, into a 11.5 m thick layer of till/colluvium, then a 7 m thick glaciofluvial layer.
- Due to no advance testing having been completed on the clay material to be modeled along cross-section J, a sensitivity analysis was completed for the isolated pocket of material by varying the shear strength to understand its impact on slope stability.
- The foundation materials were assumed to be saturated to original ground surface for the slope stability analyses. To model saturated conditions, a water table was included at the top of the foundation soils. These groundwater conditions are considered to be representative of periods of heavy precipitation, as occurs in the spring and fall. The proposed model conditions are also consistent with the VWP readings which indicate that groundwater is likely near or above original ground surface (Section 5.6), and are based on observations of water seepage at the toe of the current NW PAG Dump (Appendix E, Figures E-4 and E-5).
  - A sensitivity analysis was completed for cross-section J with an elevated hydraulic head applied to the glaciofluvial deposit to assess artesian conditions.
- The bedrock below the foundation soils within the area of the proposed ultimate NW PAG Dump consists of hard and competent intrusive rock. The bedrock is expected to exhibit sufficient strength to prevent a foundation failure through the bedrock. As well, the bedrock has not been characterized for faults or weak layers at orientations that could result in instability. Therefore, the bedrock has been modeled as a hard, infinite strength layer in the slope stability analyses, which prevents the automated search routine from searching for potential failure surfaced below this hard layer.

- To model seismic conditions, the pseudo-static method of analysis was used. This method of analysis applies a horizontal force to the failure mass proportional to the design horizontal acceleration. To account for the non-rigid response of the foundation soils and waste rock, the horizontal seismic loading considered in the assessment was one-half the peak ground acceleration (Hynes-Griffin and Franklin 1984). A 2% in 50 years or a 1-in-2,475-year return period earthquake event was used to assess long-term stability of the NW PAG Dump, to satisfy guidelines provided in industry (Hawley and Cunning 2017, BCMWRPRC 1991). The design PGA is 0.048 for the 2,745-year return period.
- No reduction has been applied to the strength parameters for the foundation materials. The foundation materials are expected to generally be dense. Due to the relatively low lift heights proposed to be constructed, pore water pressure generation is not anticipated (Hynes-Griffin and Franklin 1984), and the waste rock is expected to be free-draining.
    - Due to the uncertainty regarding the strength of the clay material, the sensitivity analysis was deemed sufficient to review strength reduction for the material.

6.6 Material Strength Properties

The material strength properties used in the slope stability analyses of the proposed ultimate NW PAG Dump are based on the glacial deposit review, previous field investigations and laboratory testing, and previous experience at the Mount Polley Mine. The material strength properties for the slope stability assessment of the proposed ultimate NW PAG Dump design are summarized in Table 17.

Table 17: Material Strength Properties Selected for Slope Stability Analyses

Material	Unit Weight (kN/m^3)	Strength Model Type	Strength Parameters	Reference
Waste Rock	19.6	Non-linear strength curve	$\tau = 1.726\sigma^{0.899}$	Strength function of Leps (1970) for average quality rockfill which matches observations of waste rock placed in the NW PAG Dump to date.
Colluvium/Till	22	Mohr-Coulomb	Cohesion = 0 kPa Friction angle = 34º	Average peak and residual shear strength parameters from laboratory testing on till and colluvium material at Mount Polley Mine (WSP 2023b and 2024a)
			Cohesion = 0 kPa Friction angle = 32.5º	Lower bound of direct shear testing on till near the NW PAG Dump (WSP 2024b).
Glaciofluvial	22	Mohr-Coulomb	Cohesion = 0 kPa Friction angle = 34º	Triaxial testing of undisturbed glaciofluvial samples (Golder 2015b)
Fine-grained Material	20	Mohr-Coulomb	Same parameters as colluvium/till	Discussed in Section 5.4.4
Clay Material	20	Mohr-Coulomb	Cohesion = 0 kPa Friction angle = varied from 20 to 35º	Discussed in Section 5.4.5
Bedrock	26	Impenetrable		Did not model failure surfaces through bedrock

τ=*shear strength*; σ = *normal stress*.

6.7 Slope Stability Analyses Results

The following slope stability modelling scenarios were completed for the proposed ultimate NW PAG Dump cross-sections:

- Base Case – Lower lift configuration slope stability (static and pseudo-static)
- Base Case – Ultimate configuration slope stability (static and pseudo-static)
- Sensitivity analyses (static and pseudo-static)
  - Cross-section G – till lower bound strength
  - Cross-section J – artesian conditions
  - Cross-section J – clay material strength varied

The results of the slope stability analyses are presented in Appendix G and are summarized in Table 18.

Table 18: Results of Slope Stability Analyses for the Proposed Ultimate NW PAG Dump Design

Cross-section	Slope Stability Condition	Target Static FOS (short- and long-term)	Indicated FOS	Target Pseudo-Static FOS (long-term)	Indicated FOS	Appendix G, Figure No.
Cross-section E	Overall	1.4 - 1.5	1.6	1.3	1.5	G-1
	Lower Lift	1.0 - 1.2	1.4	1.0	1.3	G-2
Cross-section G	Overall	1.4 - 1.5	1.6	1.3	1.5	G-3
	Lower Lift	1.0 - 1.2	1.5	1.0	1.4	G-4
Cross-section G (*till sensitivity*)	Overall	1.4 - 1.5	1.6	1.3	1.5	G-5
	Lower Lift	1.0 - 1.2	1.4	1.0	1.3	G-6
Cross-section J (*artesian conditions*)	Overall	1.4 - 1.5	1.6	1.3	1.5	G-7
	Lower Lift	1.0 - 1.2	1.5	1.0	1.5	G-8
Cross-section J *Clay material: phi = 35 degrees*	Overall	1.4 - 1.5	1.7	Did not complete pseudo-static analyses for sensitivity analysis		G-9 and G-10
	Lower Lift	1.0 - 1.2	1.5			
Cross-section J *Clay material: phi = 30 degrees*	Overall	1.4 - 1.5	1.7			
	Lower Lift	1.0 - 1.2	1.3			
Cross-section J *Clay material: phi = 25 degrees*	Overall	1.4 - 1.5	1.5			
	Lower Lift	1.0 - 1.2	1.1			
Cross-section J *Clay material: phi = 20 degrees*	Overall	1.4 - 1.5	1.5			
	Lower Lift	1.0 - 1.2	1.0			

The results of the slope stability analyses indicate that the proposed ultimate NW PAG Dump design is expected to exhibit adequate stability with respect to shallow-seated rock lift face and overall deep-seated foundation instability for short and long-term, static and pseudo-static conditions. This is largely due to the good quality foundation soil material (well-graded, generally dense material), the angle of repose waste rock lift faces with wide catch-benches at each lift (giving an overall slope of 28 degrees), and the good quality waste rock that is expected to be placed in the NW PAG Dump.

Sensitivity analyses were completed for the following scenarios:

- **Lower bound till strength parameters:** the results for the slope stability analyses indicate that for a lower bound till strength, the NW PAG Dump is expected to exhibit adequate slope stability.
- **Artesian conditions:** the results for the slope stability analyses indicate that for artesian conditions in the glaciofluvial deposits, the NW PAG Dump is expected to exhibit adequate slope stability.
- **Clay material strength parameters:** the results for the slope stability analyses indicate that when varying the strength of the clay material, the NW PAG Dump is expected to exhibit adequate overall slope stability for a phi ranging from 20 to 35 degrees for the clay material. The results of the lower lift clay strength sensitivity analyses indicate that the design criteria is met for a phi of 35 and 30 degrees; however, for a phi of 25 and 20 degrees the design criteria is not met. Graphs of the results for the overall and lower lift slope stability comparing FOS and strength (phi) are presented in Illustrations 2 and 3.

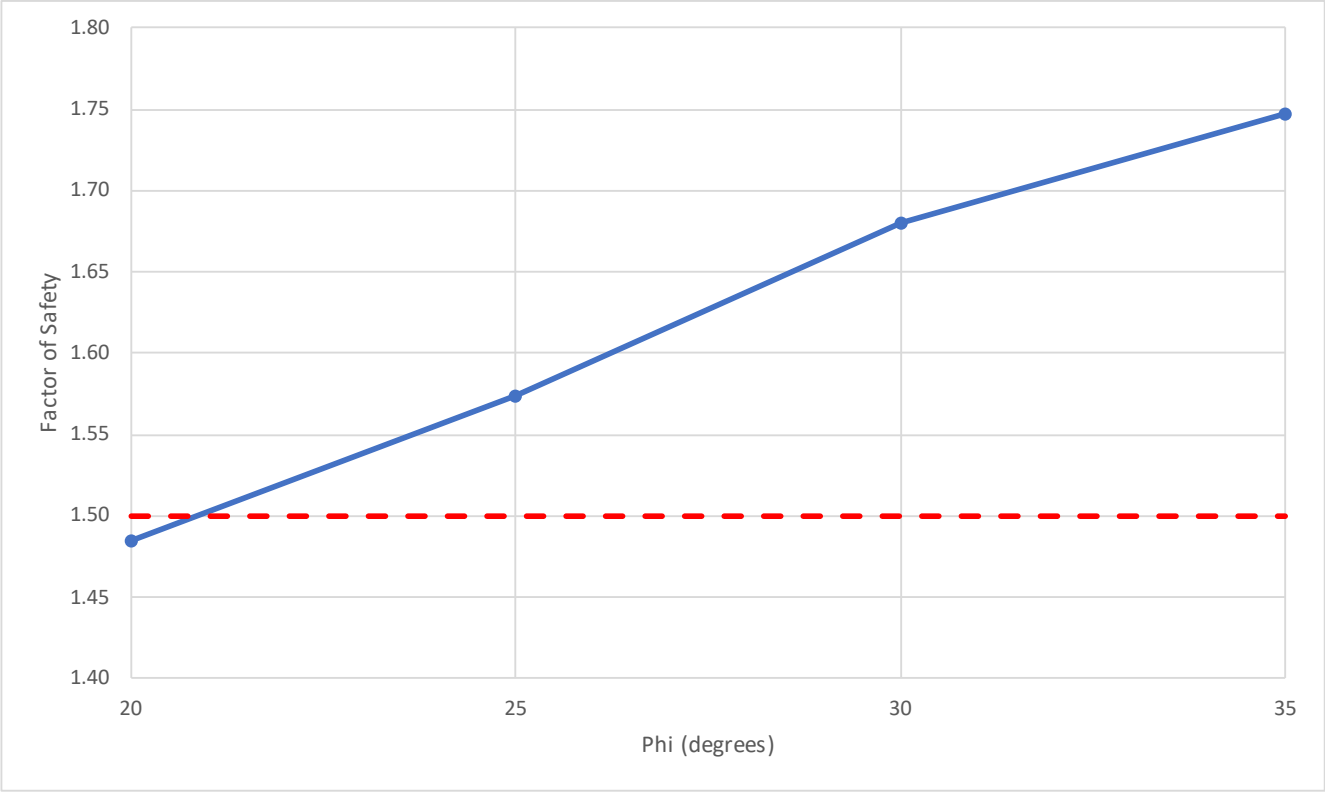

Illustration 2: Factor of Safety vs. Phi (degrees) for Clay Material Strength Sensitivity Analysis - Overall

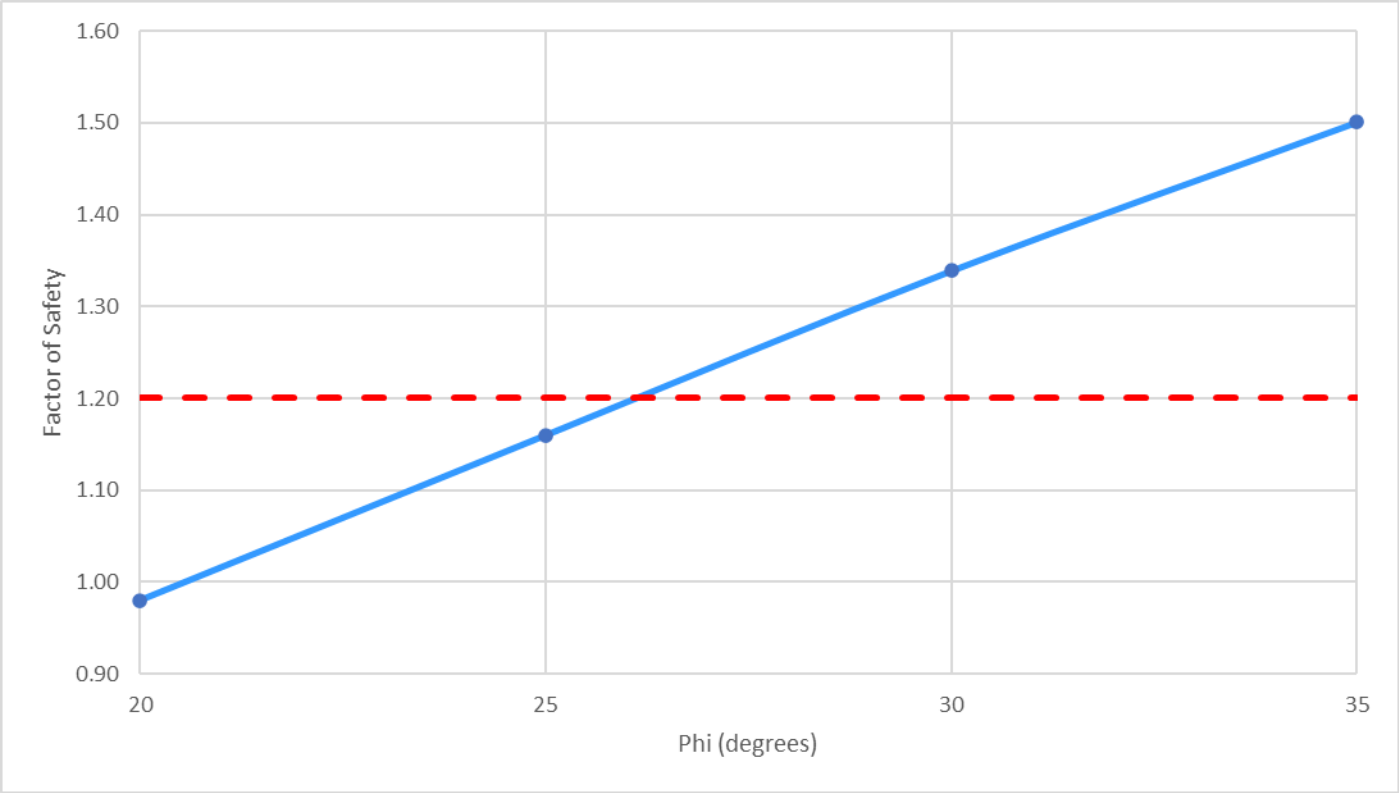

Illustration 3: Factor of Safety vs. Phi (degrees) for Clay Material Strength Sensitivity Analysis - Lower Lift

7.0 PREDICTIVE RUNOUT ASSESSMENT

Predictive runout analyses have been carried out for the proposed ultimate NW PAG Dump design to determine if potential failure debris may reach infrastructure around the dump. The following sections detail the methodology and results of the predictive runout analyses, including the rationale for the selected failure surfaces modelled based on hazards and consequences of failure identified.

7.1 Predictive Runout Assessment Methodology

The predictive runout assessments for the proposed waste rock dumps were completed using the 2D software DAN-W (Release 8) (Hungr Geotechnical Research Inc. 2008). This software is based on solving hydrodynamic equations which are applied to conservation of momentum for thin slices of a flowing mass.

The runout models considered a frictional rheology for the foundation soils beneath the proposed ultimate NW PAG Dump. With a frictional rheology, the analysis results are dictated primarily by the dynamic friction angle between the failed waste rock mass and the foundation material the failed mass is moving over. The dynamic friction angle comprises the basal friction angle that is modified by pore pressure, which can reach values much lower than the static friction angle of the material (as measured in direct shear or triaxial type tests). The dynamic friction angle is used in calculating the flow resistance term in the frictional model, in which the flow is controlled by the effective normal stress on the base of the sliding mass.

An internal friction angle is used in the models which defines the internal friction acting within the waste rock dump.

The waste rock within the proposed ultimate NW PAG Dump was modelled using a frictional rheology given that the waste rock is relatively well-drained and composed of generally good quality material.

The 2D DAN-W runout models are run with 50 elements (default), no energy loss in the failed material, and with vertical slices.

7.2 Predictive Runout Assessment Failure Surfaces

Predictive runout models have been constructed to represent critical failure surfaces for potential deep-seated (overall) and shallow-seated (toe) failures through the proposed ultimate NW PAG Dump. By analyzing both failure mechanisms, the predictive runout assessment will provide a hazard area for the NW PAG Dump and determine if potential failure debris could runout and reach infrastructure around the dump.

The predictive runout assessment failure surfaces are based on the slope stability assessment results. The failure surfaces have been chosen based on the slip surfaces generated in the Slope/W software for the slope stability models, and a best-fit failure surface was created in DAN-W to represent shallow and deep-seated failures for each scenario.

The predictive runout models and their corresponding slope stability models are presented in Table 19.

Table 19: Summary of Predictive Runout Models and Corresponding Slope Stability Models

Cross-Section	Scenario	Slope Stability Model	Cross-Section Appendix B, Figure No.	Slope Stability Appendix G, Figure No.	Runout Analyses Appendix H, Figure No.
E	Overall	Overall failure through till/colluvium and fine-grained material, saturated	B-6	G-1	H-2
	Lower Lift	Lower lift failure through till/colluvium and fine-grained material, saturated		G-2	H-3
G	Overall	Overall failure through till/colluvium, saturated	B-8	G-3	H-4
	Lower Lift	Lower lift failure through till/colluvium, saturated		G-4	H-5

Runout modelling was not completed on cross-section J since this cross-section does not represent a critical geometry for the dump. The stability modeling was completed on cross-section J to investigate the slope stability of the potential clay material at the toe. The results of the stability assessment indicated that a potential failure through the clay material would likely develop in the lower lift and, therefore, would not have a significant runout distance.

7.3 Predictive Runout Assessment Material Properties

Material properties for the predictive runout analyses were determined using typical values based on previous runout analyses on waste rock failures and typical values determined from case studies compiled by Golder & Hungr (1994).

An internal friction angle of 37 degrees for the waste rock is used in the analyses based on the results of a review of shear strength data of the material. The internal friction angle is only applied to the slide mass. A dynamic or basal friction angle of 33.5 degrees was assigned for the waste rock and is based on back analyses of waste rock dump failures (Golder & Hungr 1994, Hawley and Cunning 2017).

For the foundation materials, two conditions were considered in the runout analyses:

- Dry conditions – typical friction value of 19 degrees (Golder & Hungr 1994).
- Wet conditions – typical friction value of 14 degrees (Golder & Hungr 1994).

Frictional material properties considered for the NW PAG runout assessment are summarized in Table 20.

Table 20: Material Properties for the Predictive Runout Analyses of the NW PAG Dump

Material	Rheology Type	Model Condition	Unit Weight (kN/m^3)	Dynamic Friction Angle (degrees)	Internal Friction Angle (degrees)
Waste Rock	Frictional	Dry (internal)	19.6	33.5	37
Foundation Soils		Dry (basal)	22	19	N/A
		Wet (basal)		14	

N/A = Internal friction angle is only applied to the failed mass.

7.4 Predictive Runout Assessment Results

The overall and lower lift failure models were run with a frictional rheology for the waste rock and foundation materials. The model was run under both dry and wet foundation conditions to determine a hazard zone for potential runout towards infrastructure. The results of the runout analyses are presented in Appendix H and summarized in Table 21.

Table 21: Summary of Predictive Runout Analyses Results for the NW PAG Dump

Cross-section ID	Failure Mode	Runout Distance (m)	Appendix H, Figure No.
Cross-section E	Overall	Dry: 55	H-2
		Wet: 115 (reaches settling ponds and Bootjack Access Road)	
	Lower Lift	Dry: 35	H-3
		Wet: 55	
Cross-section G	Overall	Dry: 50	H-4
		Wet: 80 (reaches Bootjack Access Road)	
	Lower Lift	Dry: 15	H-5
		Wet: 30	

The results of the runout analyses indicate that failure debris from an overall slope failure under wet foundation conditions is likely to reach the settling ponds and access road used by MPMC personnel on the west side of the NW PAG Dump.

Based on the slope stability performance of the waste rock dumps at the Mount Polley Mine over the past 25 years, and on the slope stability analyses carried out for the proposed ultimate NW PAG Dump design, there is a low probability that a failure would occur in the dump due to the relatively high FOS indicated by the slope stability analyses. The results of the runout analyses indicate that if a failure were to occur, there is a high likelihood that a runout would reach the settling ponds and access road under wet conditions. To help reduce the potential for failure debris to runout to infrastructure, it is recommended that only good quality rock be placed on the outside face of the dump, and that all poor-quality material be placed in the centre of the dump. While constructing the NW PAG Dump there should be two areas of operation at all times, the center of the dump for poor-quality material and the outside edge of the active dump lift faces for good quality material. Another way to help reduce the potential for failure to occur is to control loading rates such that excess pore pressure generation is minimized in the foundation materials.

8.0 ROCK ROLLOUT ASSESSMENT

The rock rollout assessment was completed for the proposed ultimate NW PAG Dump design along the west and north sides located above infrastructure such as the Bootjack Access Road, the settling ponds, and Bootjack Lake. The rock rollout assessment calculation considers rocks originating from the crest of the lower lift of the dump. It is expected that rock rollout will not be an issue for the subsequent lifts as free dump piles will be established along the top of each lift. Experience has shown that free dump piles are likely to contain rocks that roll down the face of subsequent lifts as they are constructed.

The predicted rollout distances are based on projecting a 23-degree shadow from the crest of the lowest lift to the topography below the lift (Golder & Hungr 1994). The rollout shadow for the proposed ultimate NW PAG Dump design is plotted over topography in Figure 9.

The rock rollout assessment for the proposed ultimate NW PAG Dump design indicates the Bootjack Access Road in the northwest corner of the dump is at risk of being struck by rock rollout during construction/advance of the first lower PAG lift over the smaller NAG lift. It is recommended that during the construction of the lowest PAG lift that access to the Bootjack Access Road in this area be restricted/closed.

Experience with the other waste rock dumps at the mine indicate that free dump piles on the top of each lift will retain rock rollout from the lift above, and that the infrastructure will not be at risk from the lifts located above the first lift.

The rock rollout potential of the proposed ultimate NW PAG Dump should be monitored as the dump is being constructed. If rocks reach the Bootjack Access Road or other infrastructure despite the efforts of constructing free dump piles and crest berms on the benches of the individual lifts, it may be necessary to consider additional rock rollout mitigation structures or to adjust the design of the dump.

9.0 SETTLEMENT

Potential settlement issues related to site conditions include:

- Settlement of the foundation materials resulting in potential slope failure.
  - Materials in the foundation may consolidate in response to loading by waste rock, resulting in settlement of the foundation.
    - The foundation materials below the existing waste rock in the NW PAG Dump have been loaded with 30 to 140 m of waste rock for several years, and by glaciers prior to that.
    - Loading by the proposed ultimate NW PAG Dump will induce further settlement, but settlements are anticipated to be small, because no soft or unconsolidated deposits were encountered in the footprint of the NW PAG Dump. Preconsolidation pressures in the isolated fine-grained material were estimated at over 5,000 kPa (Appendix D, Figure D-1).
    - Loading of the NW PAG Dump will induce settlement that will be taken up by successive placement of lifts of waste rock by the bottom-up method. The rate of loading is controlled by operational procedures.
  - Differential settlement may occur due to the presence of existing waste rock in the NW PAG Dump, due to differences in soil thickness and compressibility, and due to changes in loading across the dump.
    - The design does not include a liner or filter, or other elements that are sensitive to differential settlements.
  - Settlements of bedrock that would impact the performance of the NW PAG Dump are not considered credible. There are no known underground workings below the NW PAG Dump that could result in subsidence.

10.0 CONSTRUCTION AND OPERATIONAL CONSIDERATIONS

10.1 Construction Recommendations

The proposed ultimate NW PAG Dump is expected to exhibit adequate slope stability during construction. To help reduce the potential for failure material to runout as far as the Bootjack Access Road if failure of the proposed ultimate NW PAG Dump were to occur, it is recommended that only good quality rock be placed on the outside face of the waste dump, and that all poor-quality material be placed in the center or east side of the NW PAG Dump. While constructing the NW PAG Dump there should be two areas of operation at all times, the center or eastern side of the dump for poor-quality material and the outside edge of the active dump lift faces for good quality material.

The wide catch-benches around the proposed ultimate NW PAG Dump should be free-dumped on prior to constructing the next lift to help contain rock rollout as the dump is constructed higher. As well, berms should be constructed at the edge of each lift to help contain rock rollout.

10.2 Topsoil Management

WSP understands that all topsoil and reclamation suitable materials have been stripped from the footprint of the proposed ultimate NW PAG Dump. Windrow material that has been stockpiled at the toe of the current NW PAG Dump should be relocated such that it does not affect the overall slope stability of the dump or impede drainage from the dump.

10.3 Slope Stability Monitoring

The waste rock that will be consigned to the proposed ultimate NW PAG Dump will be an essentially cohesionless material. When a cohesionless material is at its angle of repose, the FOS of shallow potential failure surfaces in the face of a lift is close to 1.0. Under these conditions, shear strains occur within the zone located at shallow depths below the face of the dump, which results in down-slope displacement of the crest. Compaction settlement of material in the bottom of the dump also contributes to this downward displacement of the face of the dump. Displacement of the face and the crest of the dump can also occur when the dump face is advanced over weak foundation materials that can initiate somewhat deeper-seated instability along the waste rock/foundation interface.

If the down-slope movements occur rapidly, they can pose a hazard to people and equipment operating at the crest and near the toe of the dump. However, such shear failures at the crest of dumps do not occur without warning. Rather, they are preceded by the development of cracks, deformation and a period of accelerating displacement rates. Furthermore, larger failures that involve shear strains along or within the foundations are preceded by deep-seated displacements at the dump crest. These crest displacements can be monitored to provide advance warning of impending crest failures and deeper-seated overall failures.

The stability of the NW PAG Dump slopes is being monitored by prisms (MPMC 2021). The prisms should be measured by the MPMC survey team on approximately a monthly basis for the active NW PAG Dump. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceeds a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data.

The following general guidelines should be used in collecting and interpreting the monitoring data (MPMC 2021):

- Slope distance should be recorded in the waste rock dump monitoring spreadsheets.
  - Slope distance data should be used with caution. It is possible for a portion of the slope to move a significant distance perpendicular to the line of sight with very little change in the slope distance measurement. Therefore, the 3D displacements must also be reviewed for signs of long-term displacement.
- Velocity threshold criteria have been established for the waste rock dumps based on previous experience. However, these data must also be reviewed for signs of acceleration. If a prism is showing acceleration—regardless of the measured velocity—access should be restricted to the area and the source of the displacement should be investigated (Figure 10).
- If prisms are moved or reset, the prism should be renamed, and a new data collection sheet should be completed. The old prism should become inactive in the data collection sheet.

A major part of the slope stability monitoring program will be the regular visual inspections of the waste rock dump crests, platforms, and slope faces for early evidence of slope instability. The waste rock dumps should be inspected once per quarter and during periods of high precipitation that may cause additional infiltration into the dump or additional erosion. These regular inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded so that a record of the stability performance is available should it be required in the event of instability.

The visual reviews should include the following:

- inspecting the crests for signs of cracking and localized settlement and ponding water
- inspecting the faces of the waste rock dumps for signs of over-steepening, bulging in the middle or at the toe of the face, seepage, and erosion
- inspecting the foundation, or toe of the waste rock dump, for signs of deformation

Visual observations should be documented on inspection forms.

11.0 SUMMARY AND RECOMMENDATIONS

Based on the Hawley and Cunning (2017) WSRHC system, the proposed ultimate NW PAG Dump design is classified as presenting a moderate potential for instability and is therefore considered to be a moderate hazard waste rock dump (Class III).

The slope stability analyses results for the proposed ultimate NW PAG Dump design indicate that the dump will meet the design acceptance criteria for slope stability under static and pseudo-static conditions, with the exception of analyses completed with low clay material strength parameters (a phi less than about 27 degrees). The clay material was encountered in an isolated “pocket” north of the current toe of the dump in DH-NW-02 and was not found in the adjacent boreholes and test pits (DH-NW-03, DH-NW-03A, TP-NW-01, TP-NW-02, and TP-NW-03). No investigations have been completed immediately beneath the toe of the NW PAG Dump in this area as access is limited. The material was also interpreted to be discontinuous/interbedded with silty clay. The area of the current NW PAG Dump near where the clay material was encountered is stable, and has been since construction, indicating that at least a FOS of 1.0 is being achieved. Recommendations for construction near the clay material include:

- Remove the clay material prior to dumping in this area (even though the toe of the proposed ultimate NW PAG Dump does not cover the area where DH-NW-02 was drilled). The clay material was encountered in an old borrow area, therefore, more material could be removed from the borrow area to key into the till material below.
- Use low lift heights (about 5 m) when constructing the lower NAG lift in this area to limit development of potential excess pore pressures and not rapidly load the clay material if it does exist further south beneath the proposed ultimate NW PAG Dump design toe.
    - When constructing the low lifts, advancement could be such that the borrow area is encapsulated (where the potential clay material exists if it extends as far south as the proposed ultimate NW PAG Dump footprint). Once the area is encapsulated, waste rock can then be dumped into the encircled area. This method provides lateral support from the surrounding topography and the dump prior to dumping on top of the borrow area.

The runout analyses results indicate that under wet foundation conditions, it is likely that failure debris would impact the Bootjack Access Road and settling ponds. Based on the slope stability performance of the NW PAG Dump over the past 12 years, and on the slope stability analyses carried out for the proposed ultimate NW PAG Dump design, there is a low probability that a failure would occur in the NW PAG Dump due to the relatively high FOS indicated by the slope stability analyses.

Rock rollout could impact the Bootjack Access Road.

Settlement of the NW PAG Dump is expected to be limited and manageable.

Recommendations for the proposed ultimate NW PAG Dump construction include:

- Controlled loading rates
    - Prism and VWP data along with visual inspections and daily loading rates can all be used to understand if loading rates are having an adverse affect on dump construction.

- While constructing the NW PAG Dump, dumping operations should avoid concentrated dumping at a single location and should use as wide a strike length along the slope face as possible while advancing a lift.
- Construct berms at the edge of each catch-bench and free dump along the entire lift prior to constructing the next lift to limit rock rollout.
- Follow Standard Operating Procedures at Mount Polley Mine for:
  - Grading the dump and avoid ponding water on platforms.
  - Controlling the placement of waste rock being used for construction. The waste rock type should be discussed and planned in collaboration with geology and short-range engineering, as required. The material consigned to the NW PAG Dump should be good quality waste rock that is hard, coarse rock. Poor-quality material such as faults or overburden materials should be dumped in a central location of the dump such that it can be encapsulated and covered with good quality waste rock.

The stability of the NW PAG Dump slopes is being monitored by prisms (MPMC 2021). The prisms should be measured by the MPMC survey team on approximately a monthly basis for the active NW PAG Dump. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceeds a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data.

A key component to the safe operation of the proposed ultimate NW PAG Dump to mitigate instability will be regular visual inspections. The following operational procedures are recommended for the proposed ultimate NW PAG Dump:

- The proposed ultimate NW PAG Dump should be visually inspected and photo-documented on a regular basis during construction, on approximately a weekly basis. The pit shifter or the geotechnical engineer should be completing the formal visual inspections. The following information should be investigated and recorded:
  - The crests of the NW PAG Dump lifts should be examined for signs of cracking and localized settlement and ponding water.
  - The faces of the NW PAG Dump lifts should be examined for signs of oversteepening, bulging in the middle, seepage, erosion, and the toe of the dump, if it can be observed, for signs of deformation.
  - The type of material being placed on the NW PAG Dump lifts and the loading rates should be documented.
- Dozer and haul truck operators should be continuously observing the construction of the NW PAG Dump lifts for signs of instability and reporting their observations to their pit shifter.

12.0 CLOSURE

We trust this report satisfies your current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

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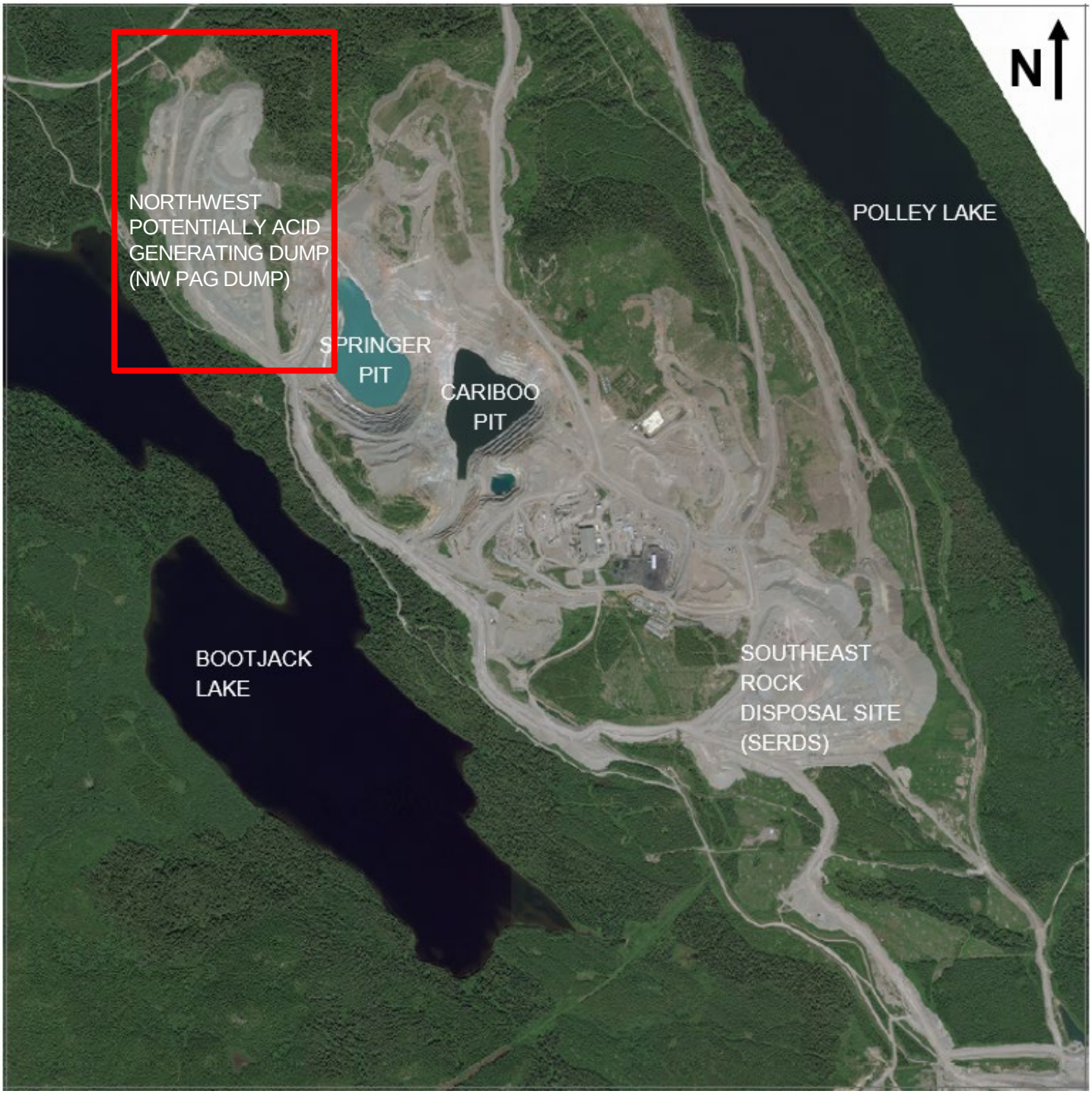

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CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
MOUNT POLLEY MINE
NW PAG DUMP
SITE LOCATION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
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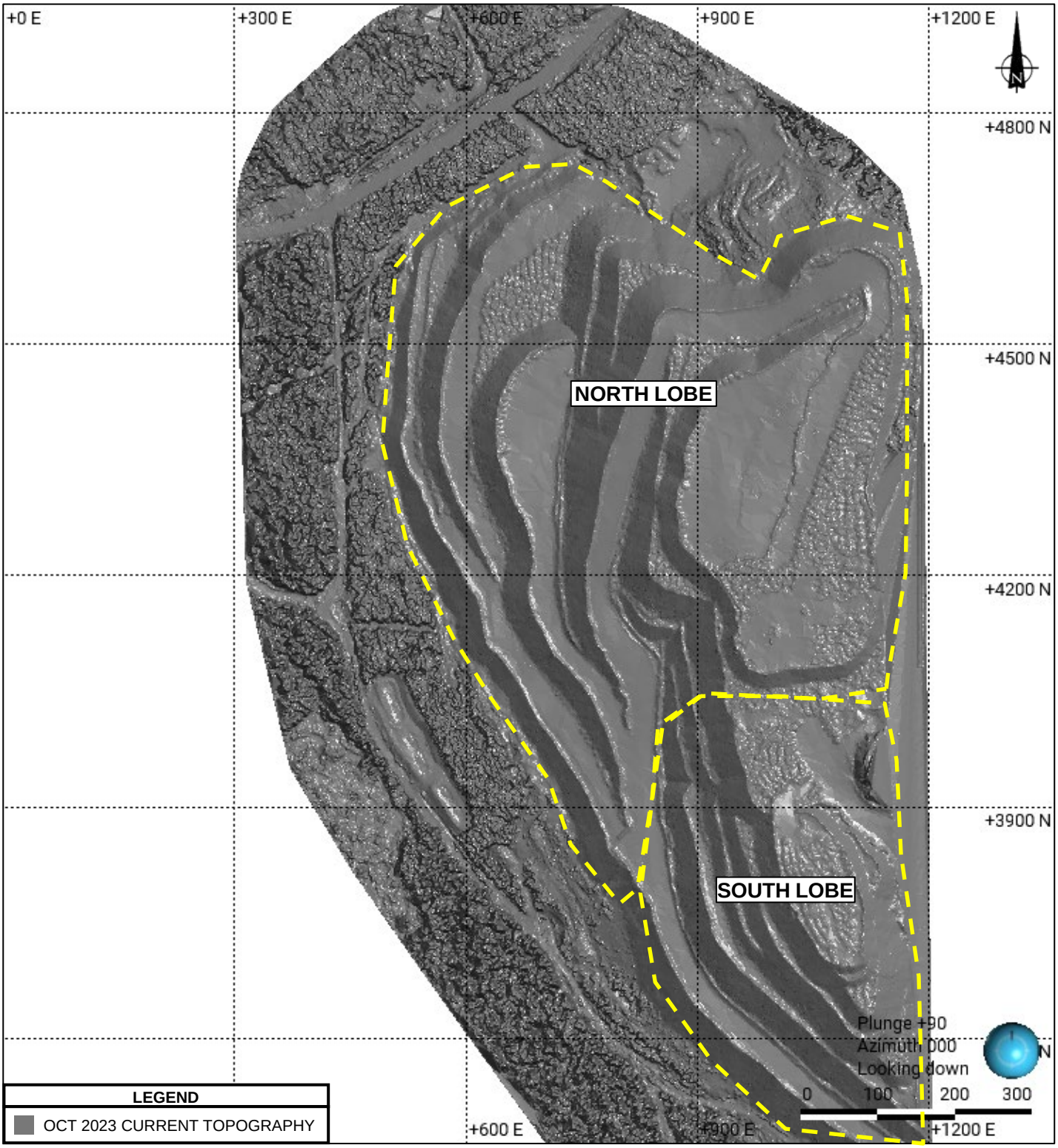

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CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
OCTOBER 2023 TOPOGRAPHY OF NW PAG DUMP

PROJECT NO.	PHASE/TASK	REV.	FIGURE
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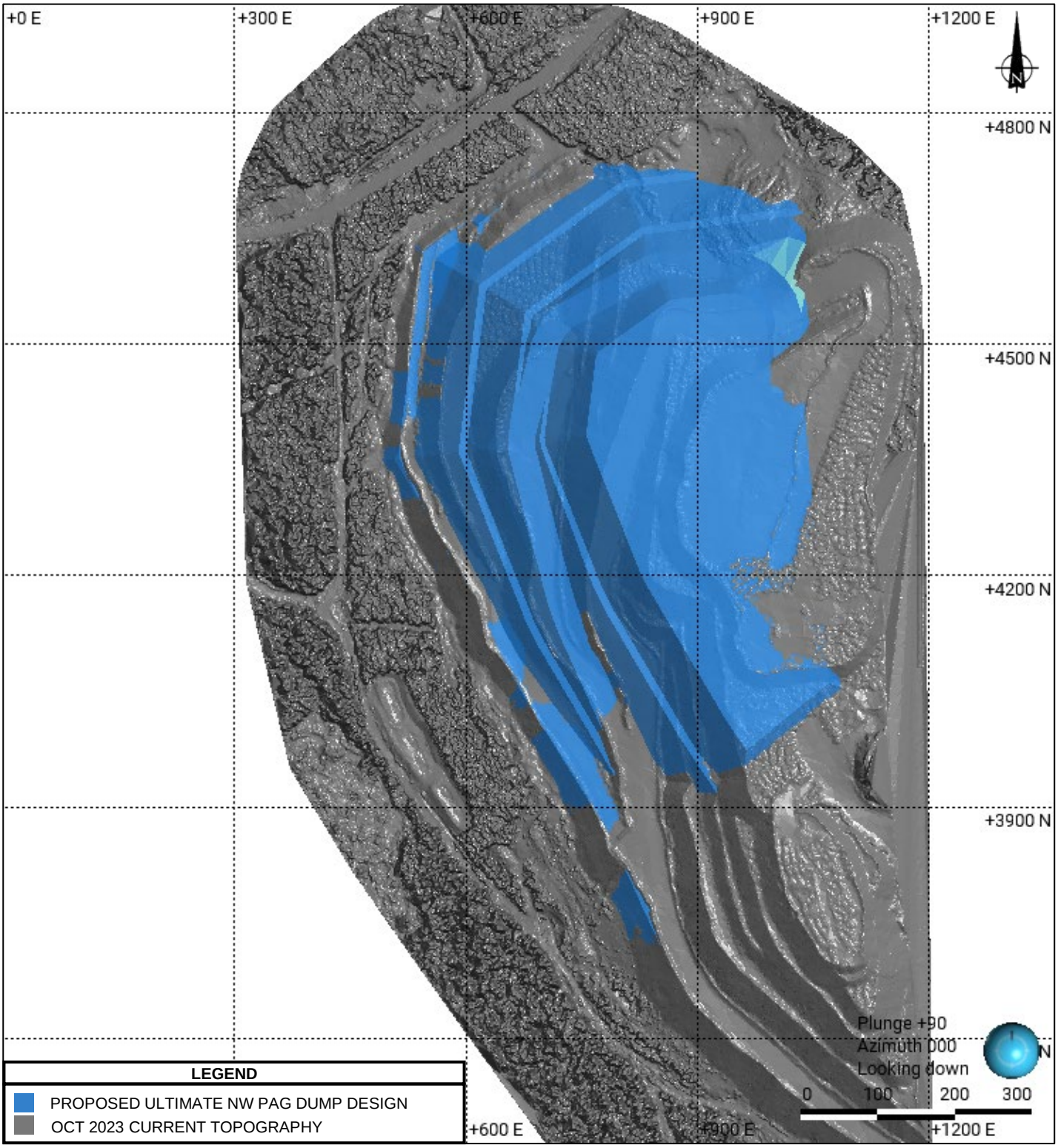

LEGEND

- PROPOSED ULTIMATE NW PAG DUMP DESIGN
- OCT 2023 CURRENT TOPOGRAPHY

REFERENCES AND NOTES

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CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

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YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
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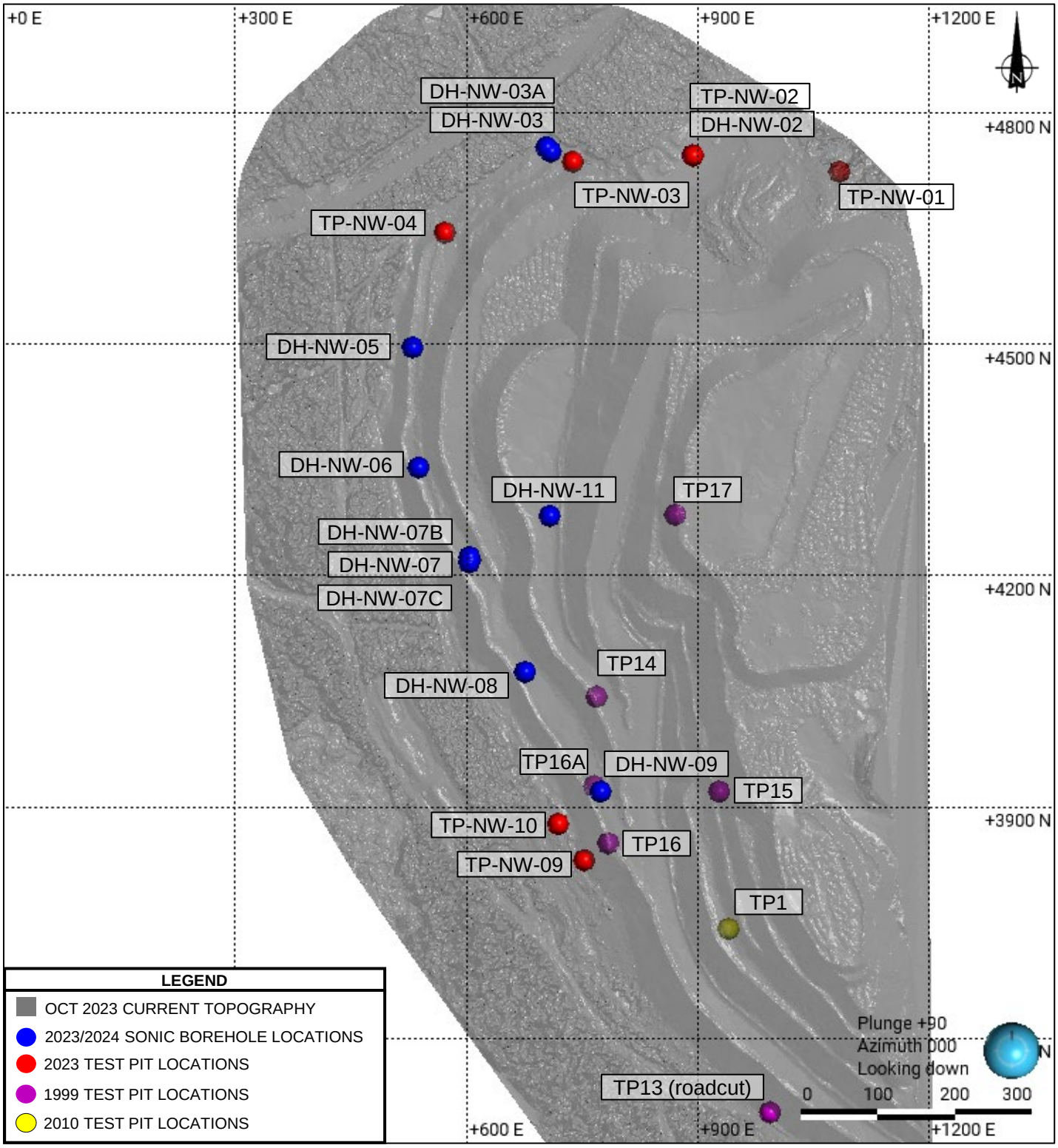

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PREPARED	MVK
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REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
OCTOBER 2023 TOPOGRAPHY
FIELD INVESTIGATION LOCATIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
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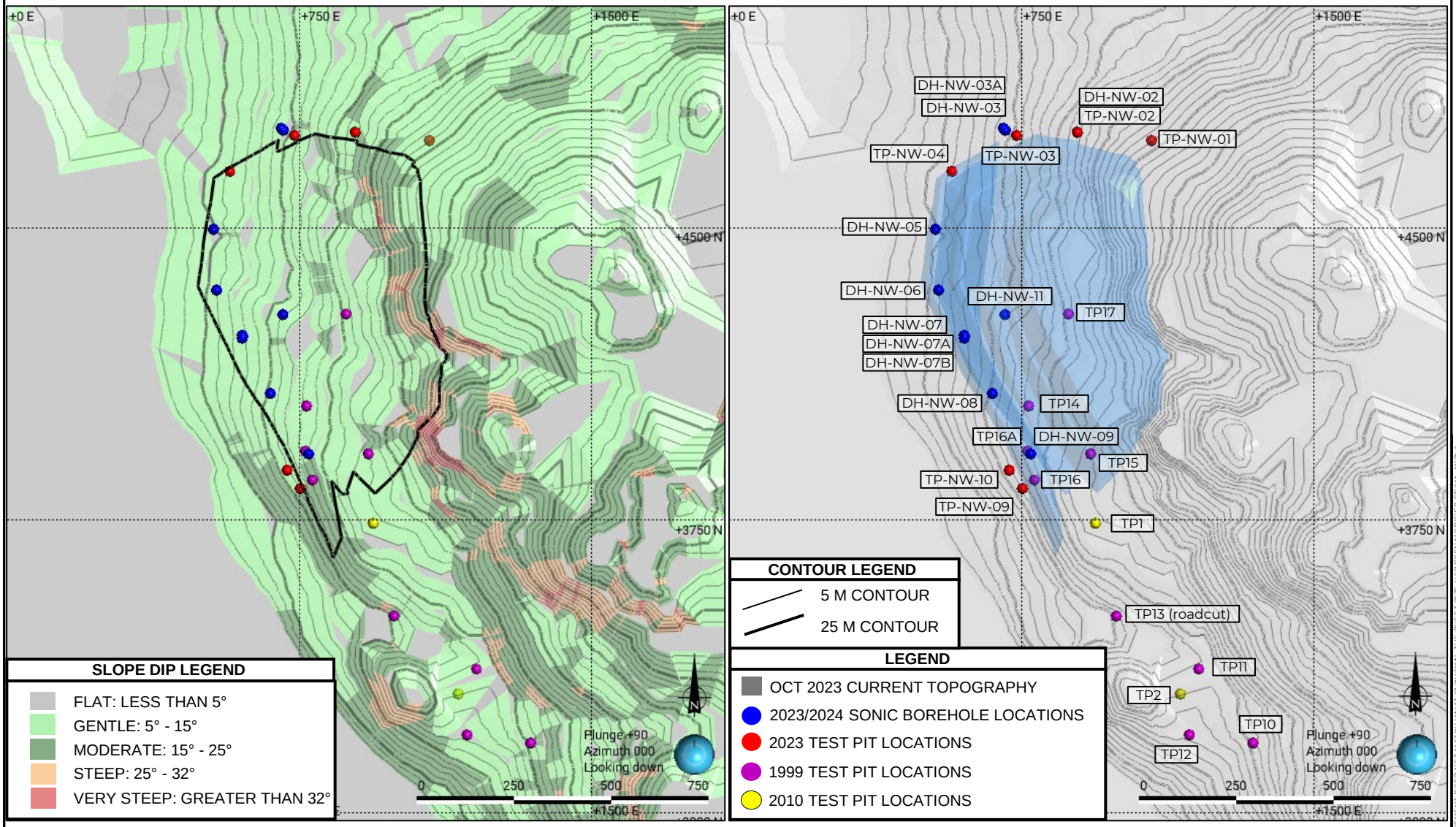

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CLIENT
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YYYY-MM-DD	2024-04-11
PREPARED	MVK
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APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
FOUNDATION SLOPE DIP
SHOWING PROPOSED ULTIMATE NW PAG DUMP FOOTPRINT
AND FIELD INVESTIGATION LOCATIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

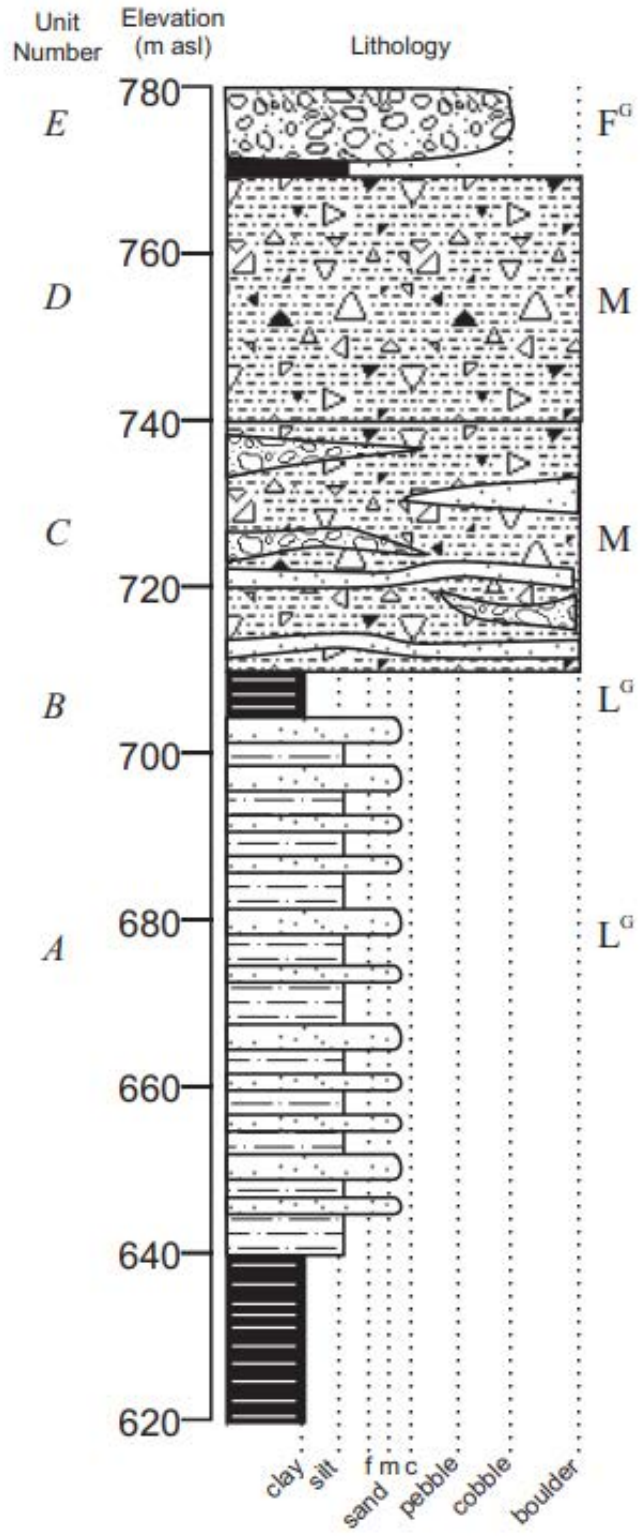

asl = above sea level; F^G = glaciofluvial deposits; M = basal till; L^G = glaciolacustrine deposits.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
STRATIGRAPHIC COLUMN
MOUNT POLLEY MINE AREA
SOURCE: BICHLER AND BOBROWSKY 2003

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**6**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> Deliverables> Issued | File Name: Figures 1 and 7.pptx

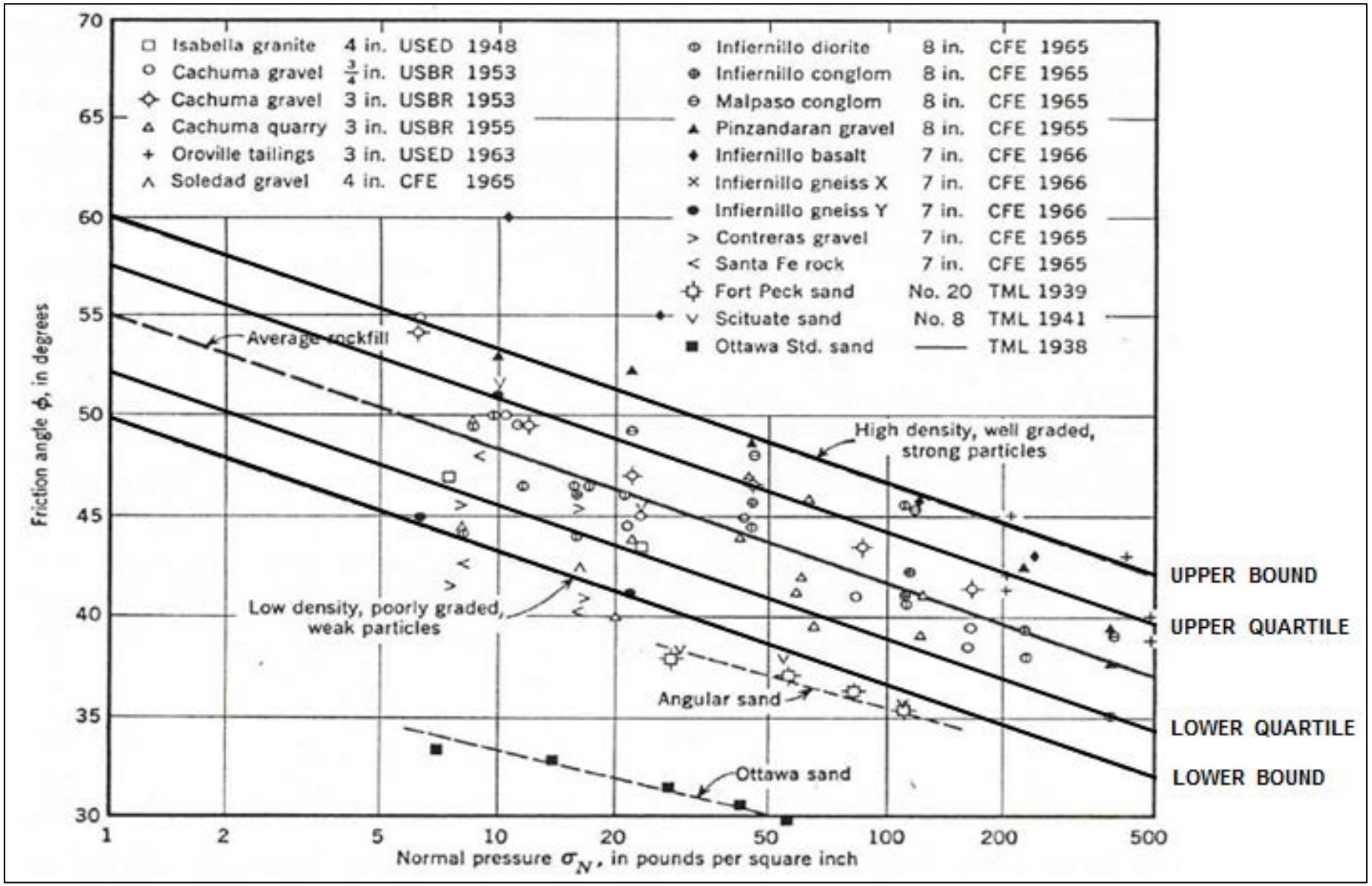

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
NON-LINEAR SHEAR STRENGTH OF ROCKFILL FROM TRIAXIAL TESTS AFTER LEPS (1970)

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	7

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

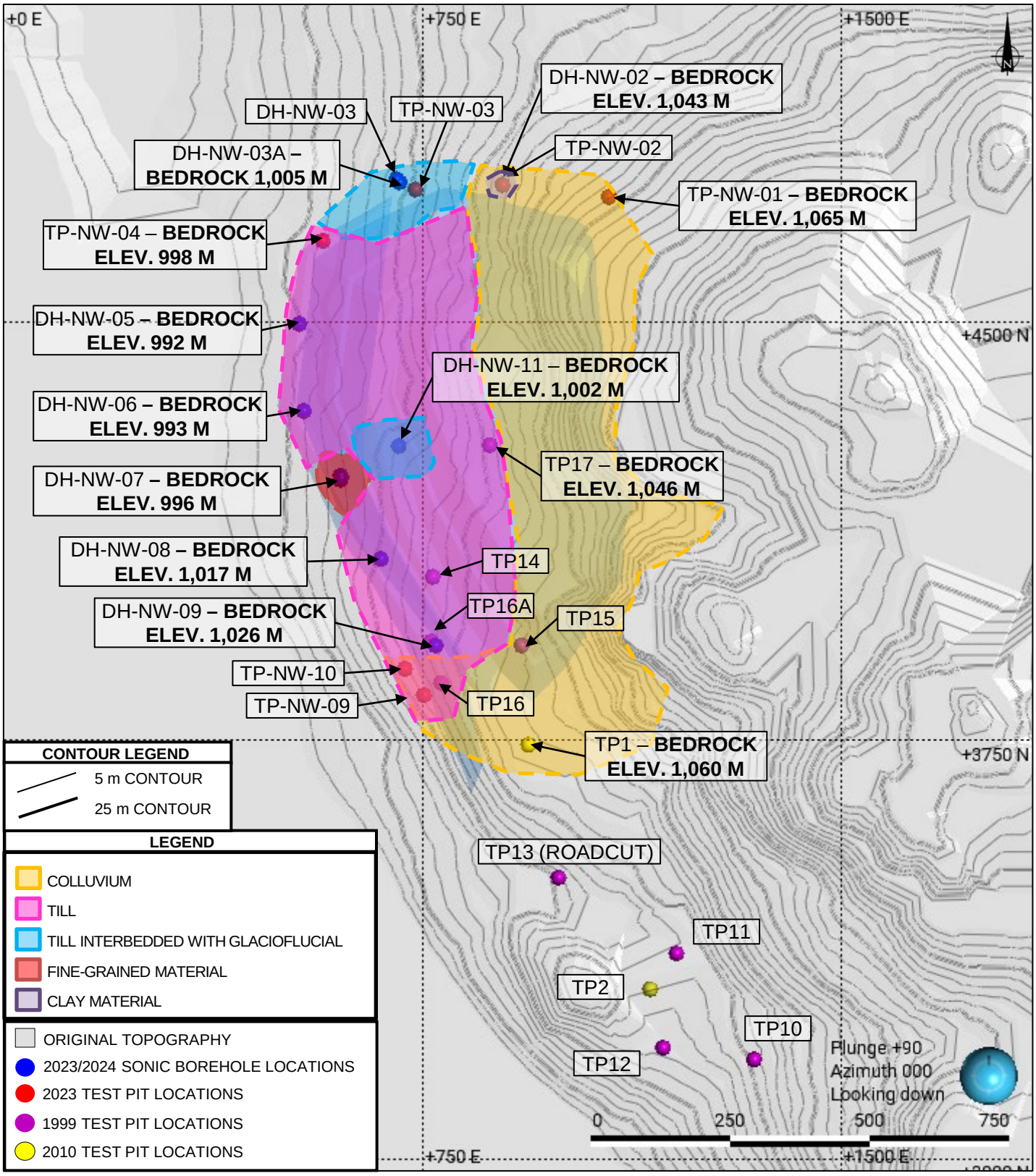

REFERENCES AND NOTES

1. ORIGINAL TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2008-01-25. FILE NAME: Mt.Polley Asbuilt Aug 16 2006_2007 Springer and C2 Design Pits_LP.dwg.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

CONSULTANT

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

TITLE
SURFICIAL GEOLOGY INTERPRETATION FOR PROPOSED ULTIMATE NW PAG DUMP DESIGN AREA

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	8

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> Deliverables> Issued | File Name: Figures 1 and 7.pptx

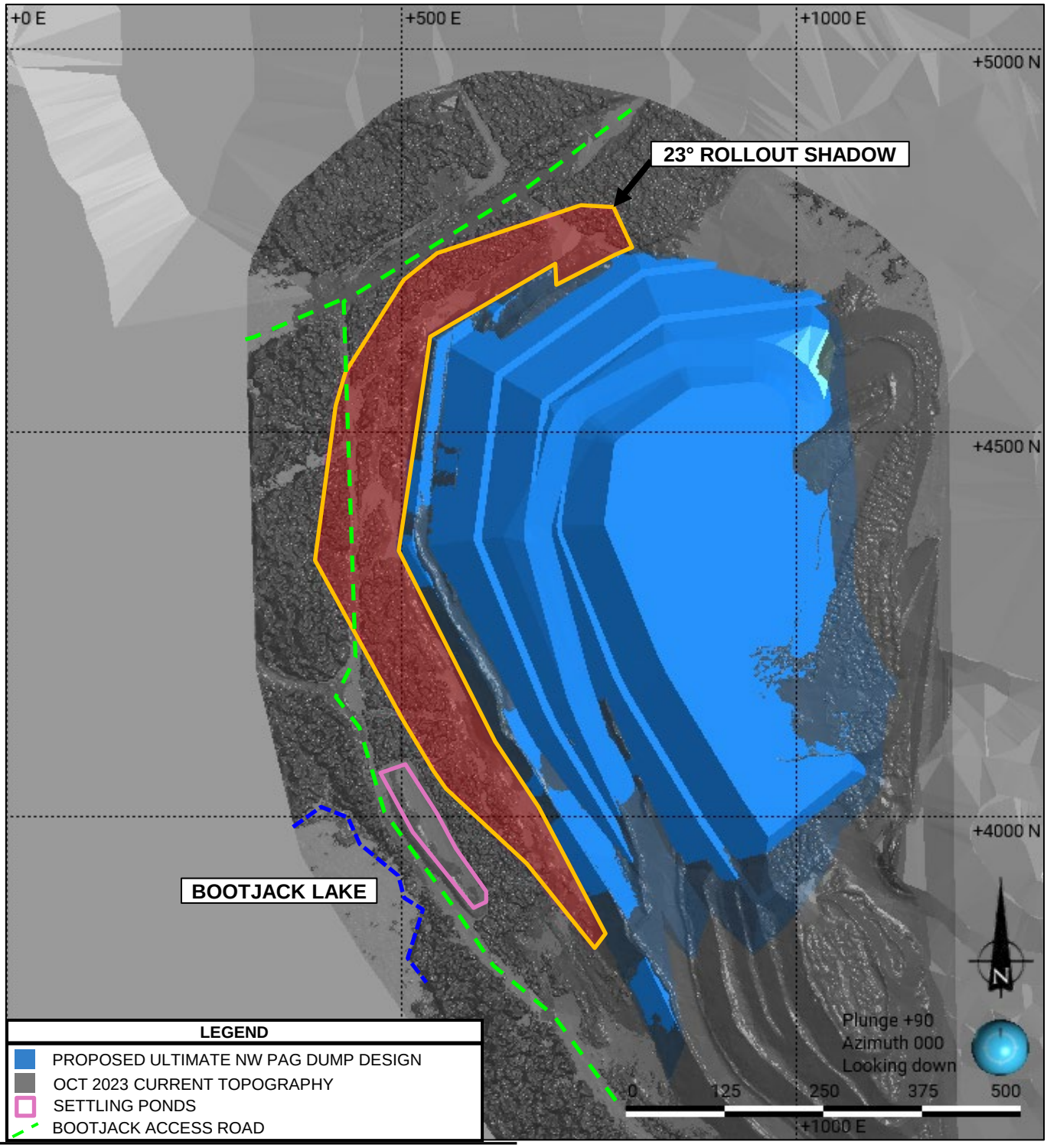

REFERENCES AND NOTES

1. ORIGINAL TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2008-01-25. FILE NAME: Mt.Polley Asbuilt Aug 16 2006_2007 Springer and C2 Design Pits_LP.dwg.
2. OCT 2023 CURRENT TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2023-10-18. FILE NAME: 231008-NPP.dxf.
3. PROPOSED ULTIMATE NW PAG DUMP DESIGN PROVIDED BY MPMC, RECEIVED 2023-04-06. FILE NAME: z - NWPAG_PAGlifts-v3.dxf.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

CONSULTANT

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

TITLE
ROCK ROLLOUT SHADOW FOR PROPOSED ULTIMATE NW PAG DUMP DESIGN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	9

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> Deliverables> Issue4 | File Name: Figures 1 and 7.pptx

Prism Data Interpretation Procedures

A) Daily displacement (mm)
(How many millimetres did it move? Was this less than or more than the monitoring system accuracy?)

B) Daily velocity (mm/day)
(How fast is it moving?)

C) Direction of movement (azimuth)
(Does the direction of movement make sense? Is it moving away from the dump face, parallel to the dump face, or into the dump?)

D) Direction of movement (vertical)
(Are all of the psirms moving upward? If so, is it possible that the base station or back-sight is settling?)

E) Total displacement graph
(Is it accelerating?)

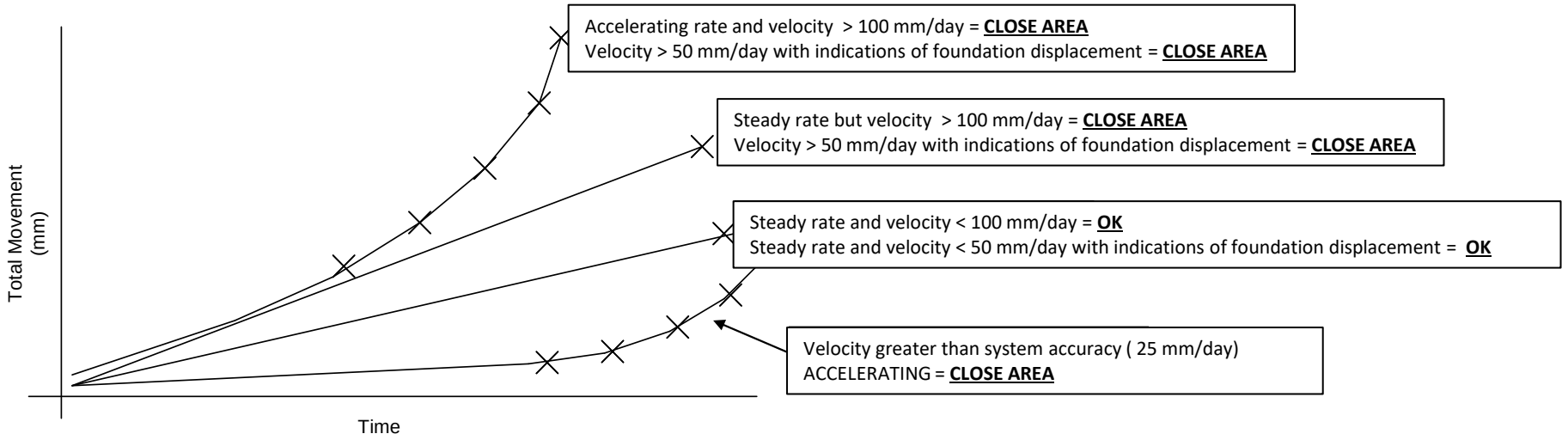

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-11
PREPARED	MVK
DESIGNED	AGH
REVIEWED	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
WASTE ROCK DUMP PRISM MONITORING DATA INTERPRETATION CRITERIA

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	10

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX A

Slope Stability Performance Photographs



REFERENCES AND NOTES

1. PHOTOGRAPH FROM GOLDER 2013C.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2012 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-1

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



REFERENCES AND NOTES

1. PHOTOGRAPH FROM GOLDER 2015B.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2013 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2016.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2014 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING WEST AND NORTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-3

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A





REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2017.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2016 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING WEST AND NORTHWEST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-4

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

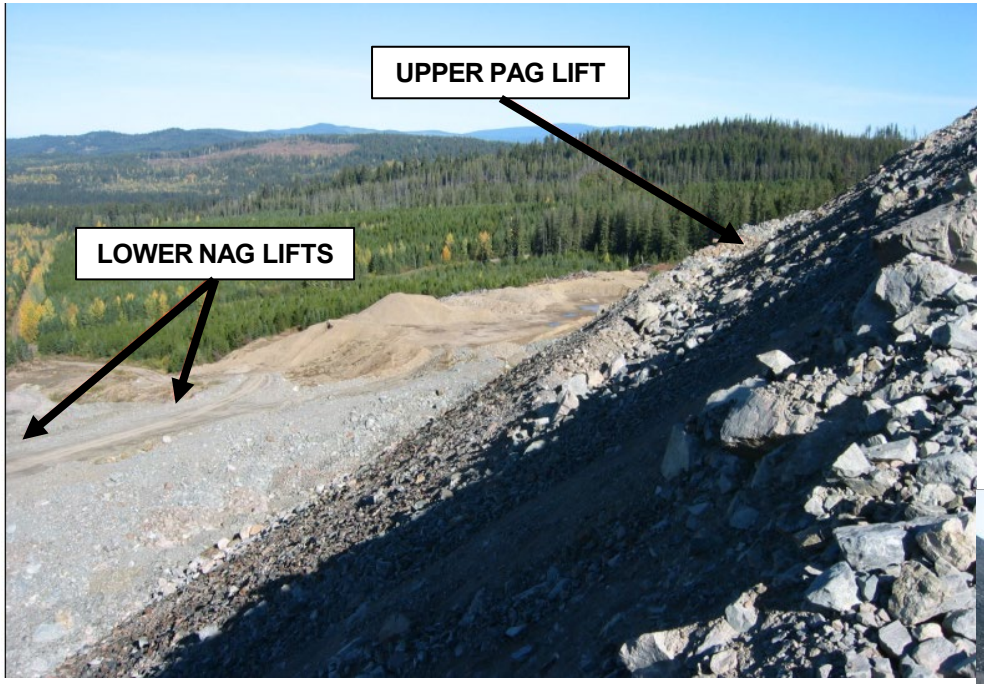



REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2018.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2017 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTH AND SOUTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2019.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2018 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTH AND SOUTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-6

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



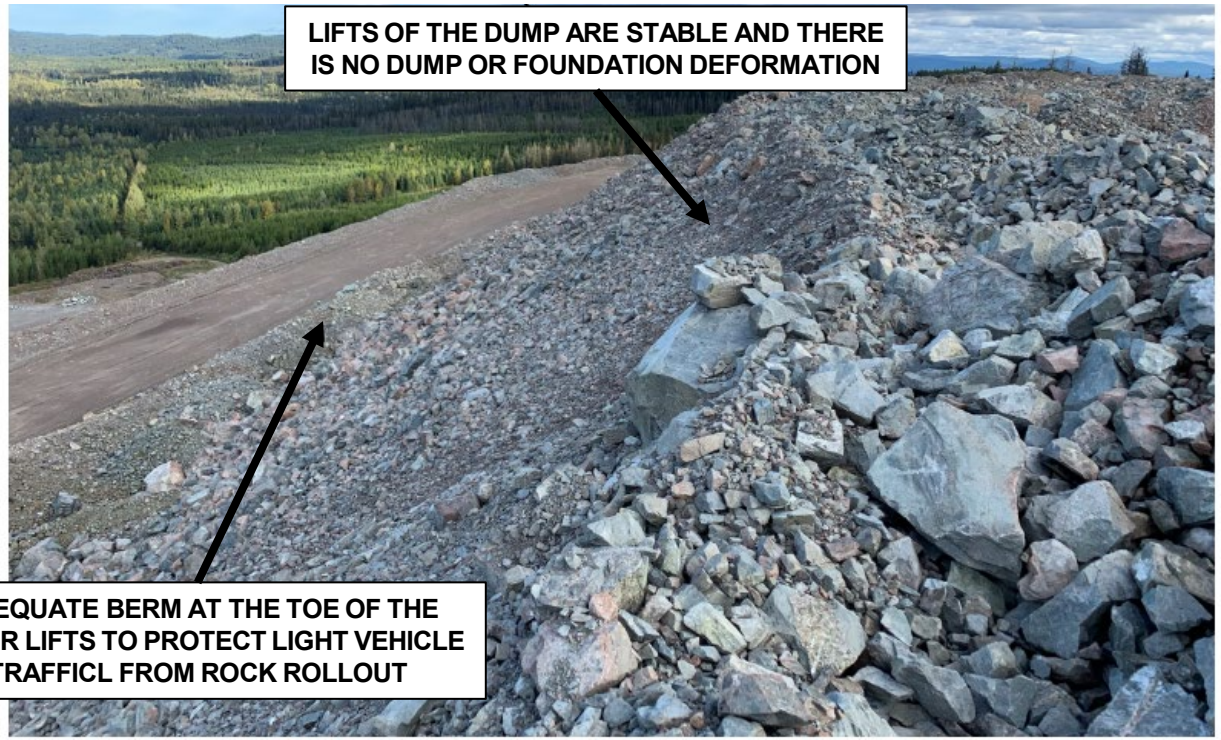

REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2019 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING SOUTH AND NORTHWEST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-7

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



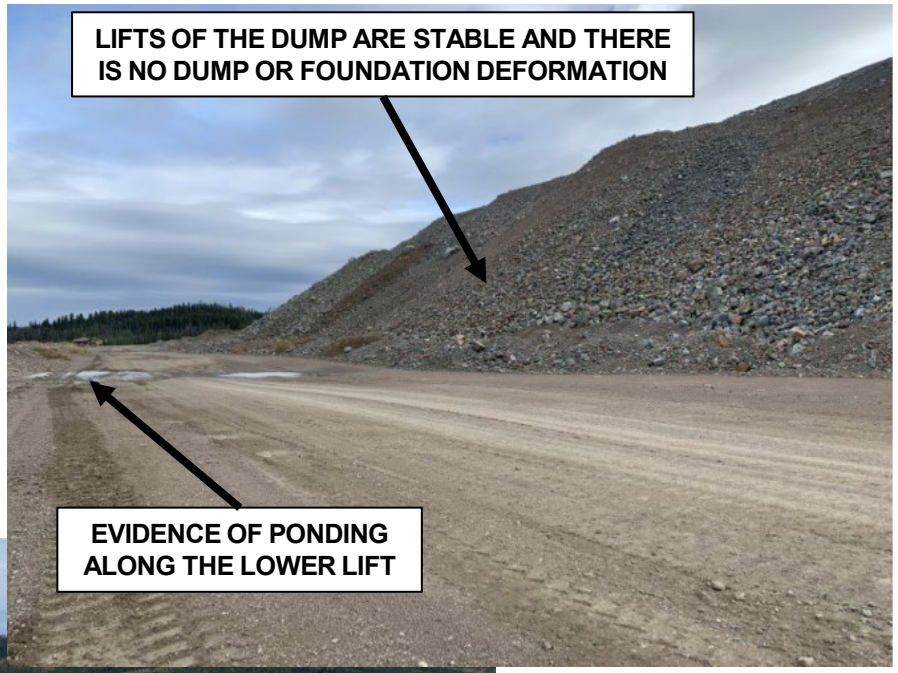



REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2020 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTHWEST, SOUTHEAST AND SOUTHWEST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

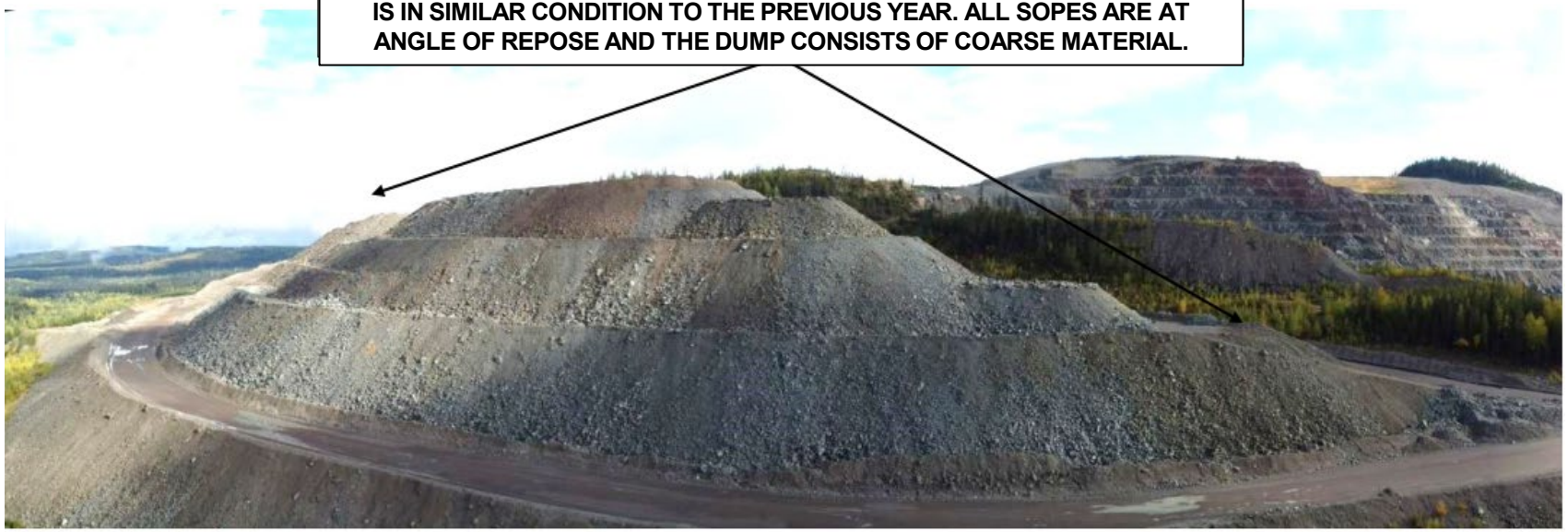



REFERENCES AND NOTES

1. PHOTOGRAPHS FROM GOLDER 2022.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2021 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTHEAST AND WEST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS FROM WSP 2023A.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2022 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTH AND SOUTHWEST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-10

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



AREA OF SETTLEMENT ON LOWER LIFT LIKELY INFLUENCED BY WATER AND THE FOUNDATION SOILS.

LOWER LIFT ON NORTH END OF DUMP PERFORMING ADEQUATELY FOR SLOPE STABILITY.



REFERENCES AND NOTES

1. PHOTOGRAPHS FROM WSP 2023C.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-03
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
2023 SLOPE STABILITY REVIEW
NORTHWEST POTENTIALLY ACID GENERATING DUMP
PHOTOGRAPHS LOOKING NORTH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	A-11

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX B

Cross-Section Review

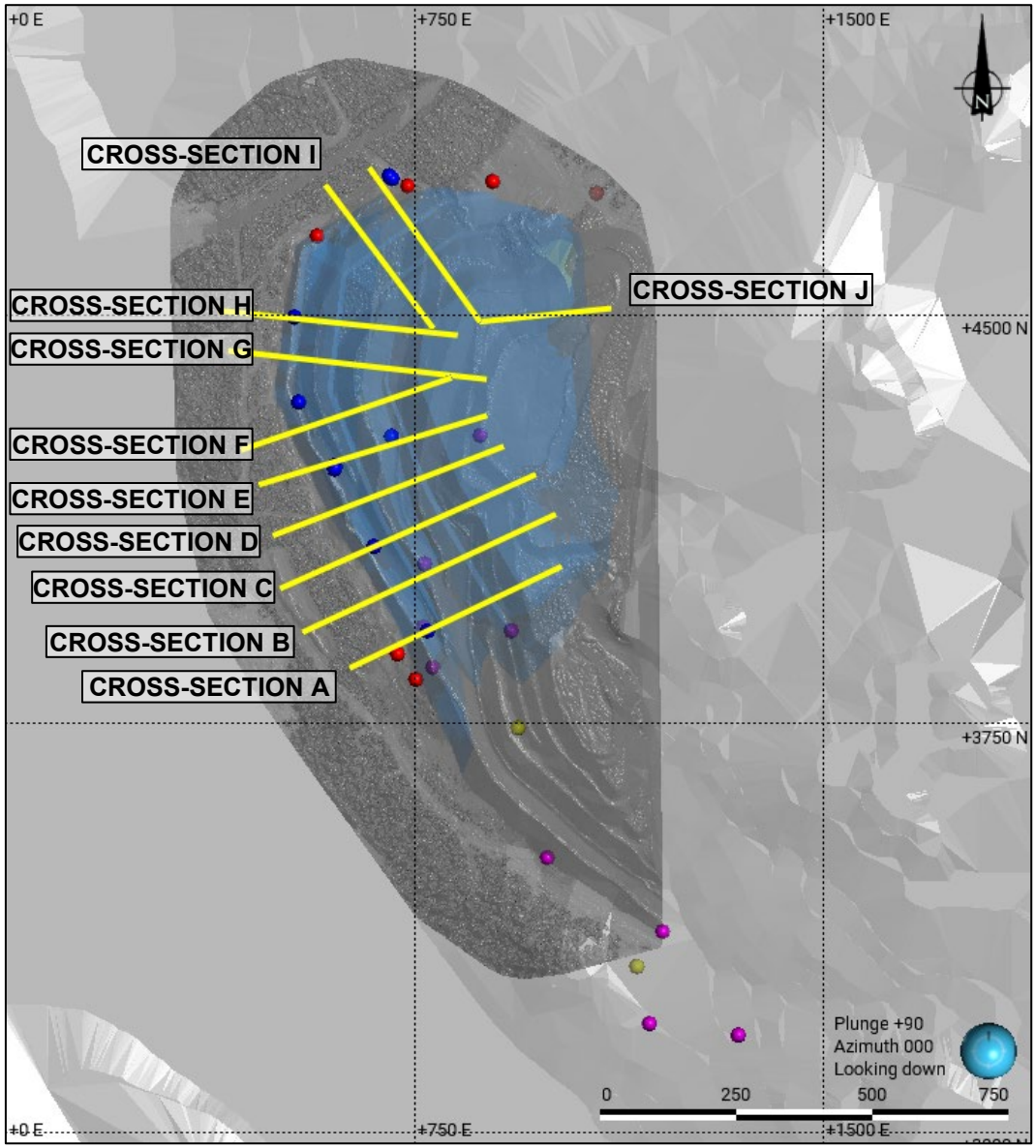

LEGEND

- ORIGINAL TOPOGRAPHY
- PROPOSED ULTIMATE NW PAG DUMP DESIGN
- OCT 2023 CURRENT TOPOGRAPHY
- 2023/2024 SONIC BOREHOLE LOCATIONS
- 2023 TEST PIT LOCATIONS
- 1999 TEST PIT LOCATIONS
- 2010 TEST PIT LOCATIONS

REFERENCES AND NOTES

1. ORIGINAL TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2008-01-25. FILE NAME: Mt.Polley Asbuilt Aug 16 2006_2007 Springer and C2 Design Pits_LP.dwg.
2. OCT 2023 CURRENT TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2023-10-18. FILE NAME: 231008-NPP.dxf.
3. PROPOSED ULTIMATE NW PAG DUMP DESIGN PROVIDED BY MPMC, RECEIVED 2023-04-06. FILE NAME: z - NWPAG_PAGlifts-v3.dxf.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION LOCATIONS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-1**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

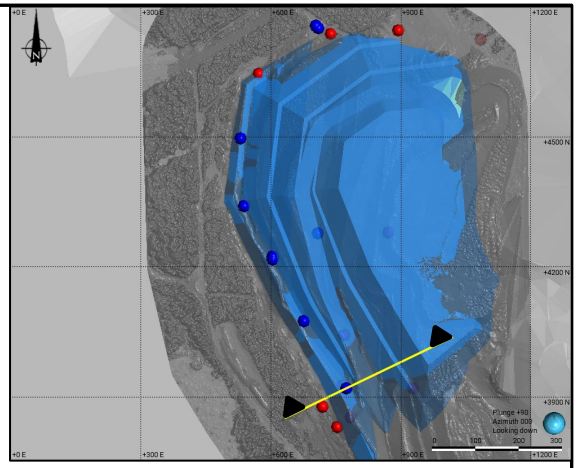

CROSS-SECTION LOCATION

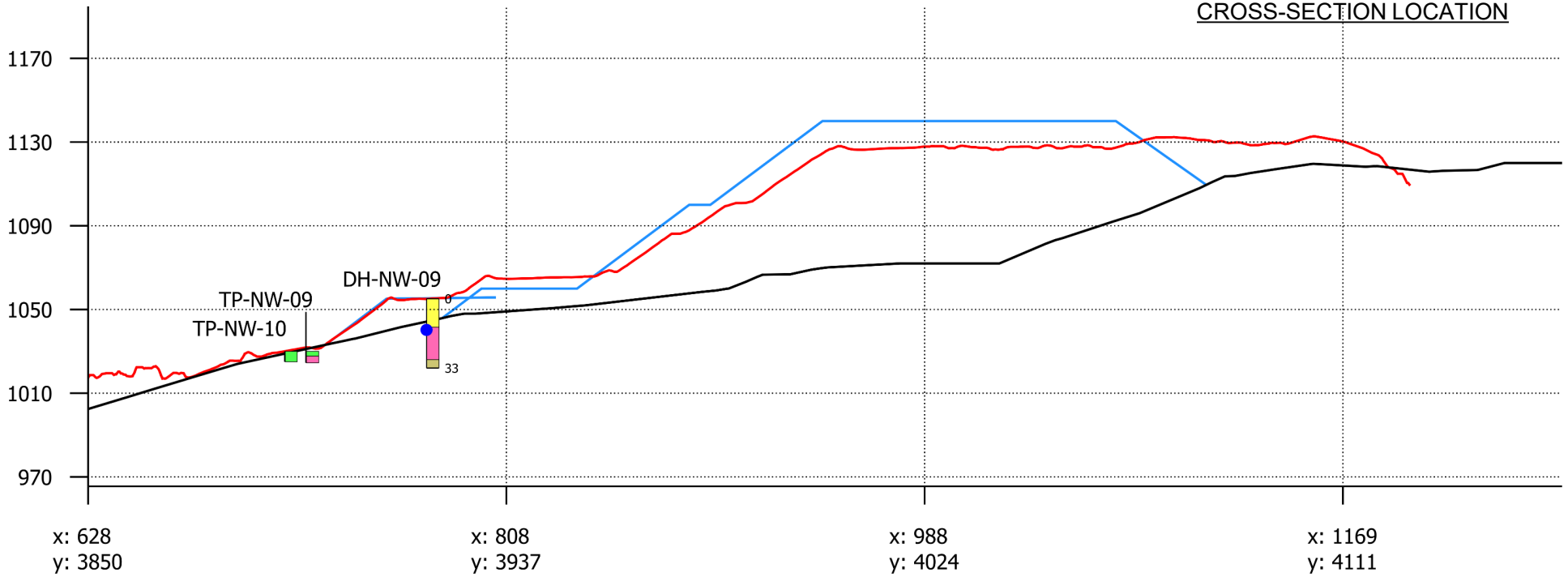

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION A

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-2**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

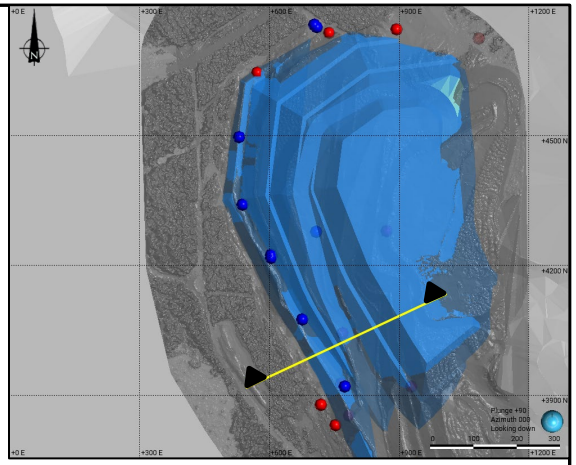

CROSS-SECTION LOCATION

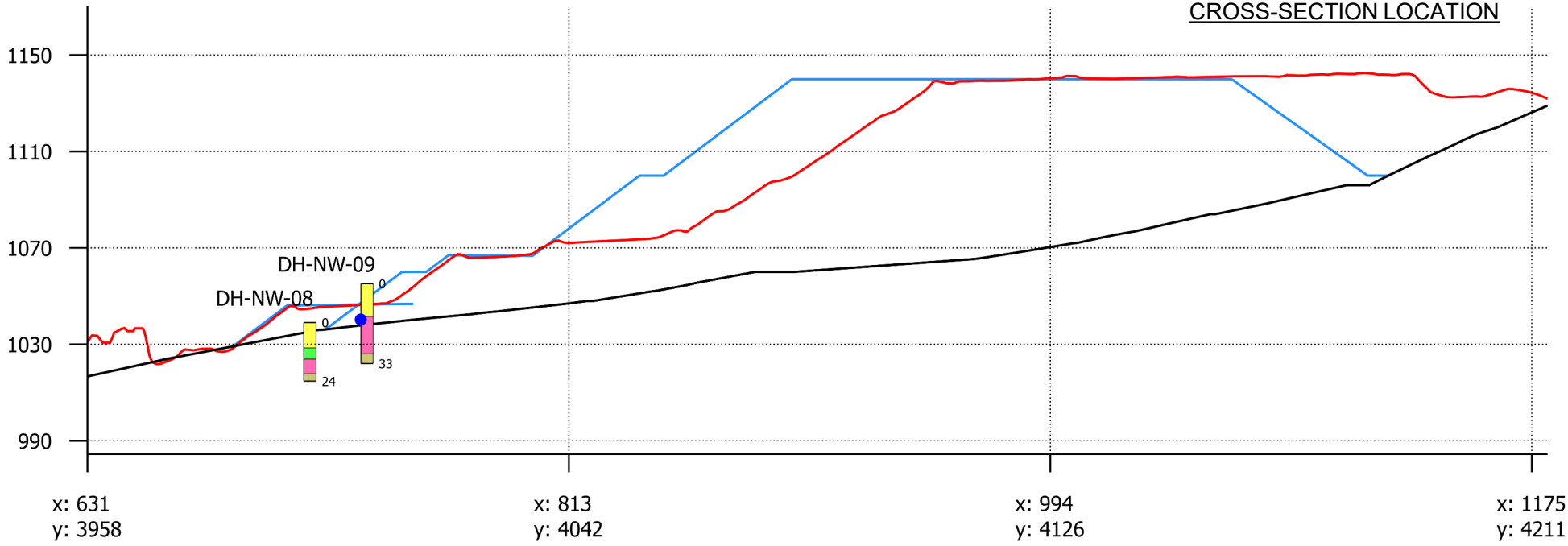

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION B

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-3**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

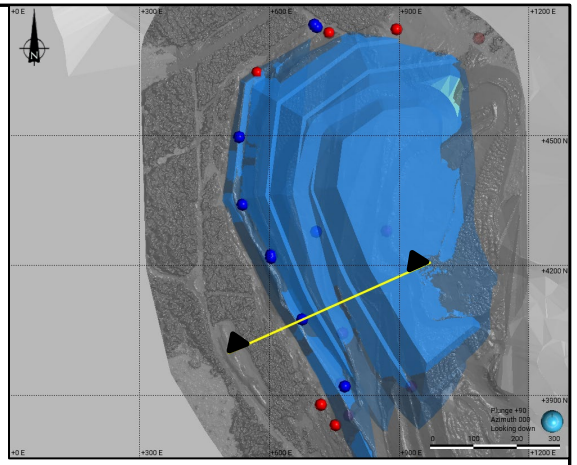

CROSS-SECTION LOCATION

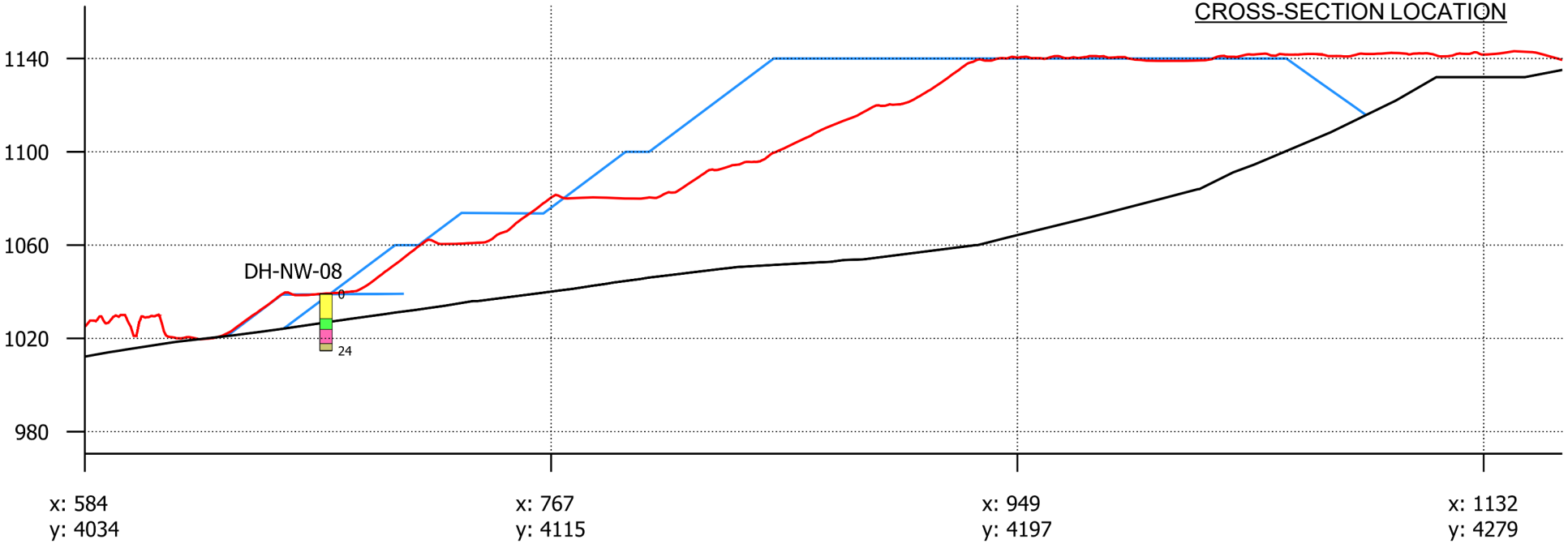

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION C

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-4**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

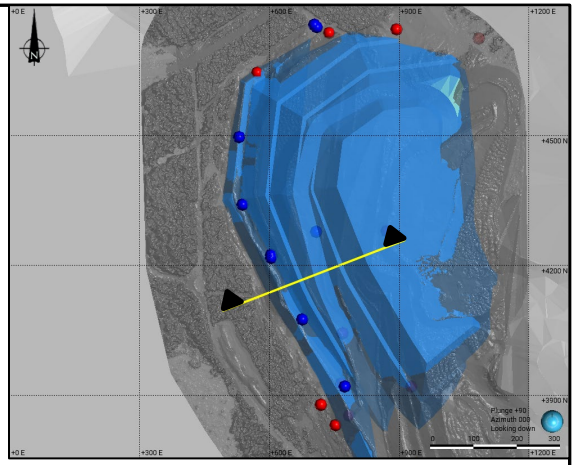

CROSS-SECTION LOCATION

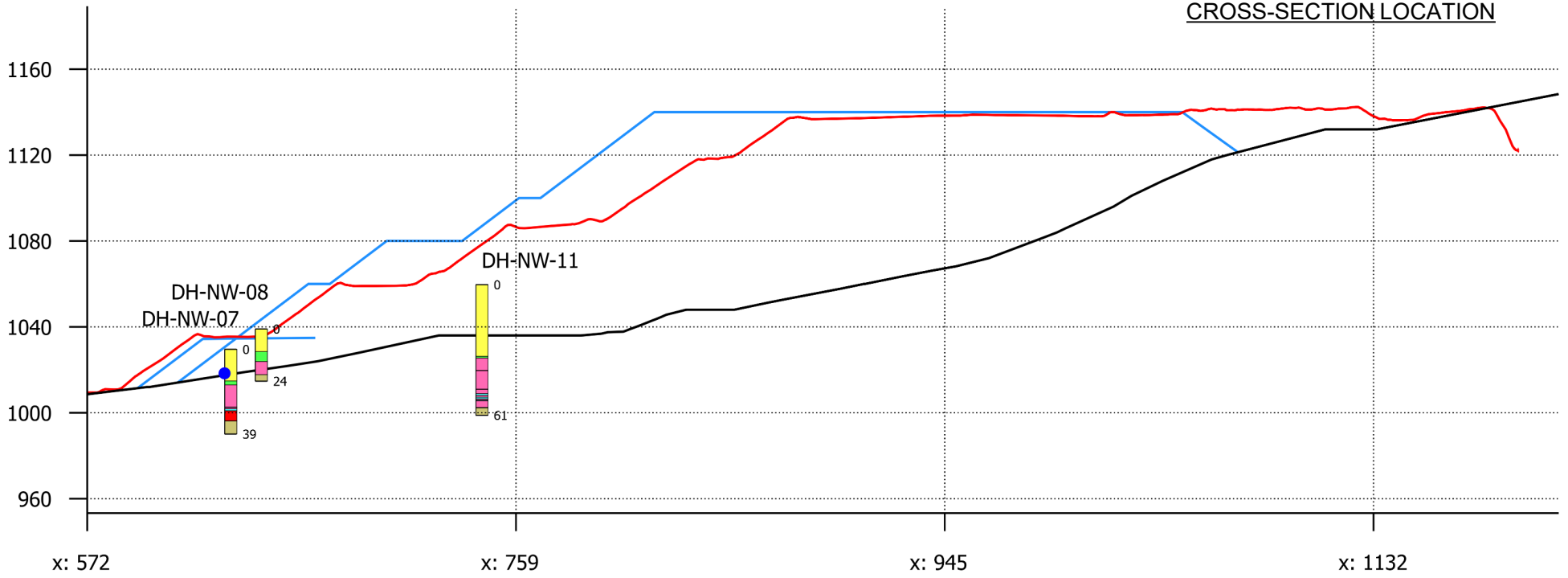

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION D

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-5**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

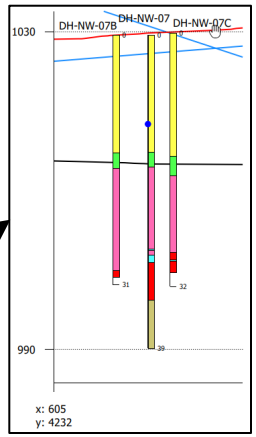

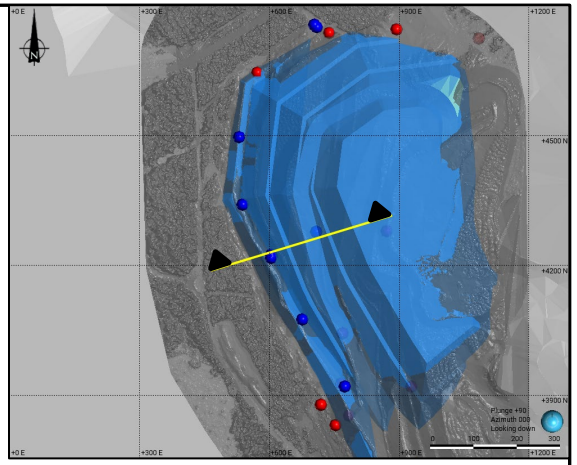

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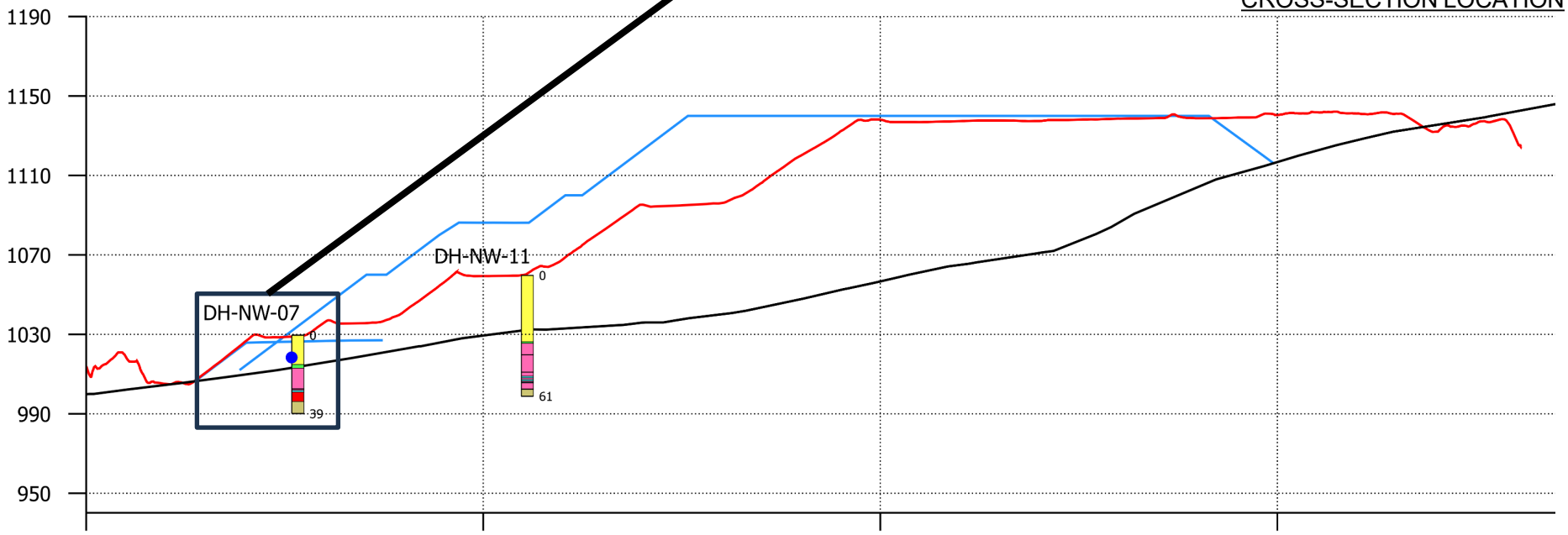

x: 503
y: 4199

x: 694
y: 4257

x: 886
y: 4316

x: 1077
y: 4374

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION E

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-6**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

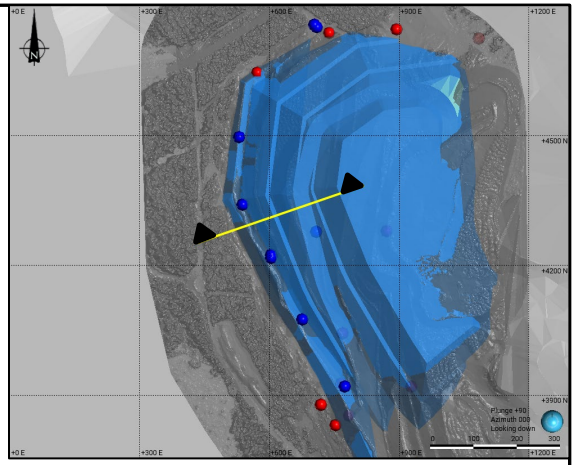

CROSS-SECTION LOCATION

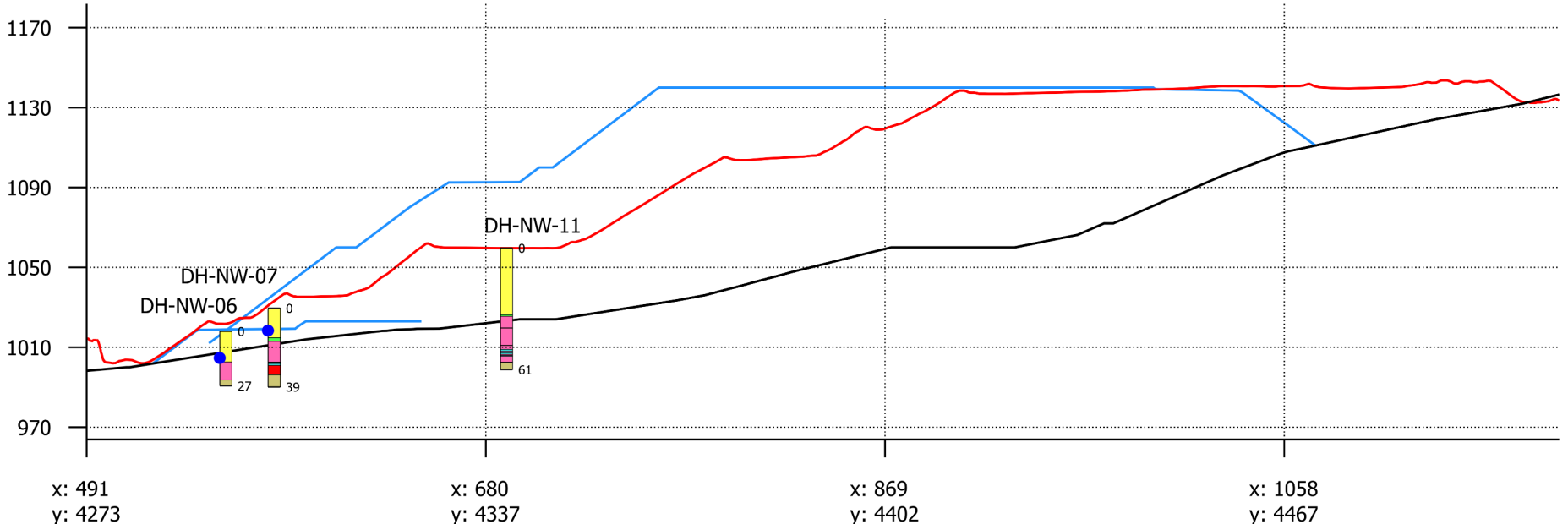

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION F

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-7**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP - Water Table

- VWP - Water Table

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

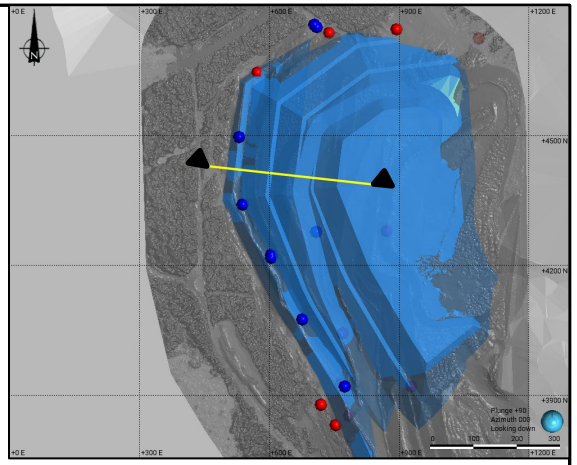

CROSS-SECTION LOCATION

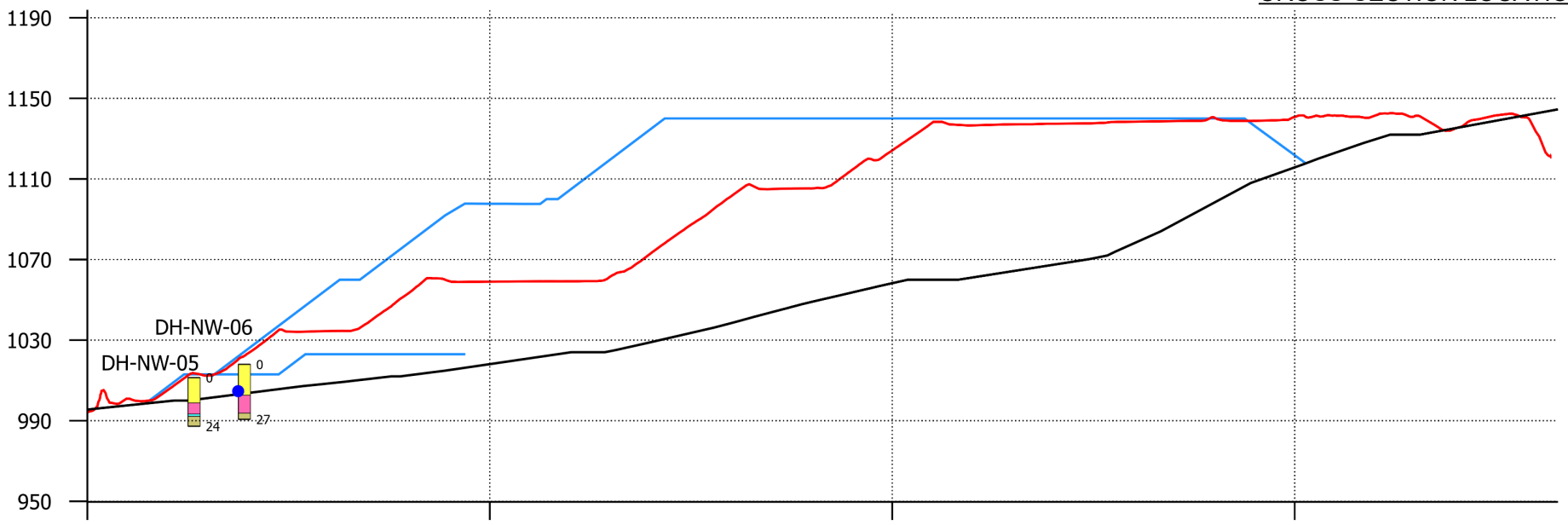

x: 472
y: 4427

x: 671
y: 4405

x: 870
y: 4383

x: 1069
y: 4361

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION G

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-8**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

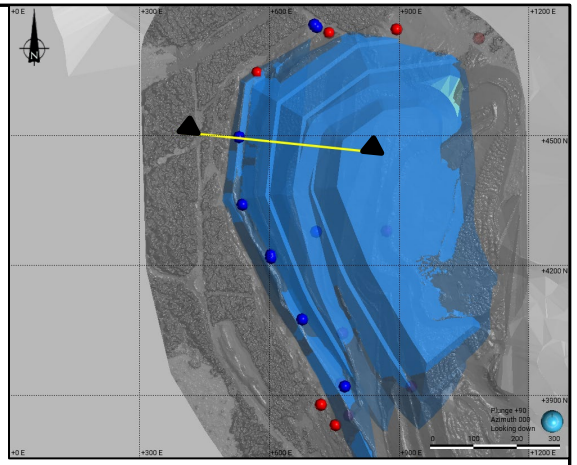

CROSS-SECTION LOCATION

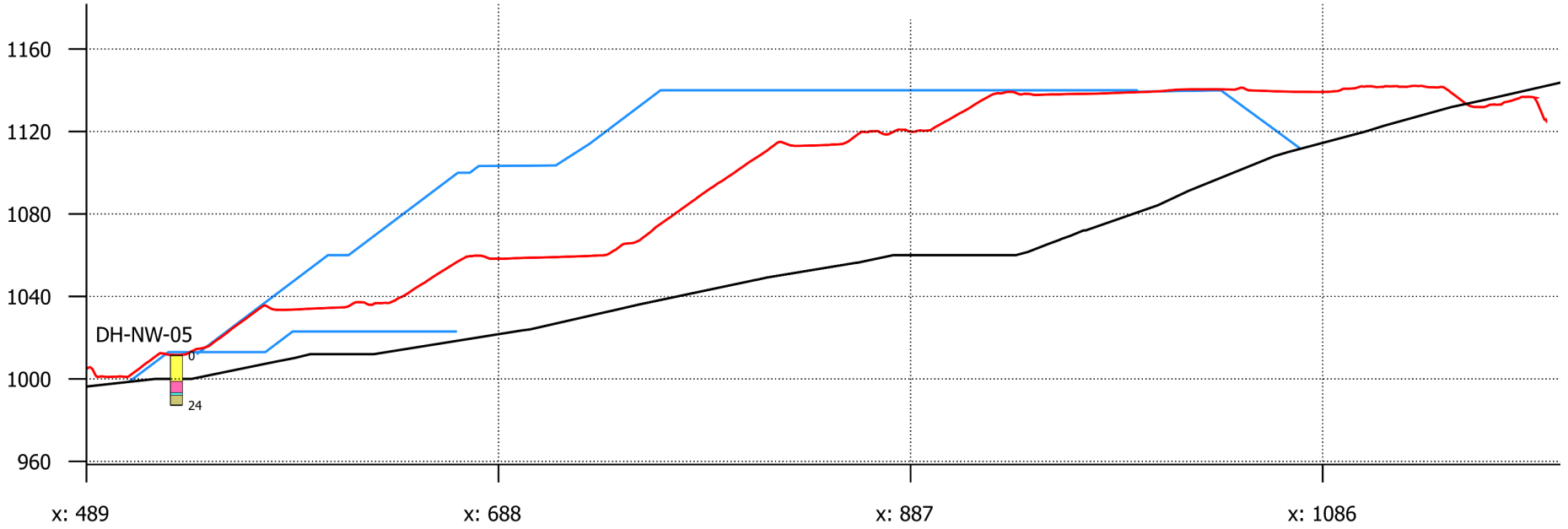

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION H

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-9**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

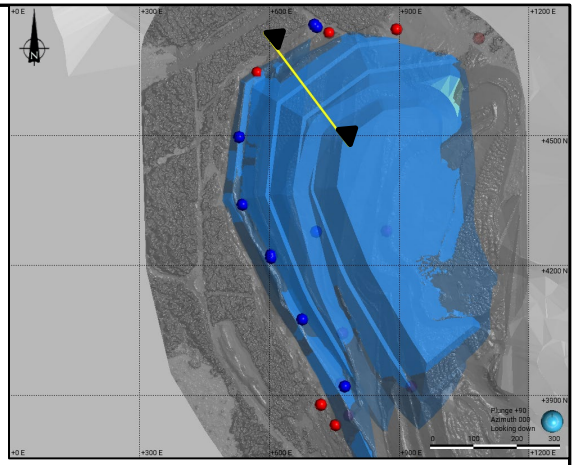

CROSS-SECTION LOCATION

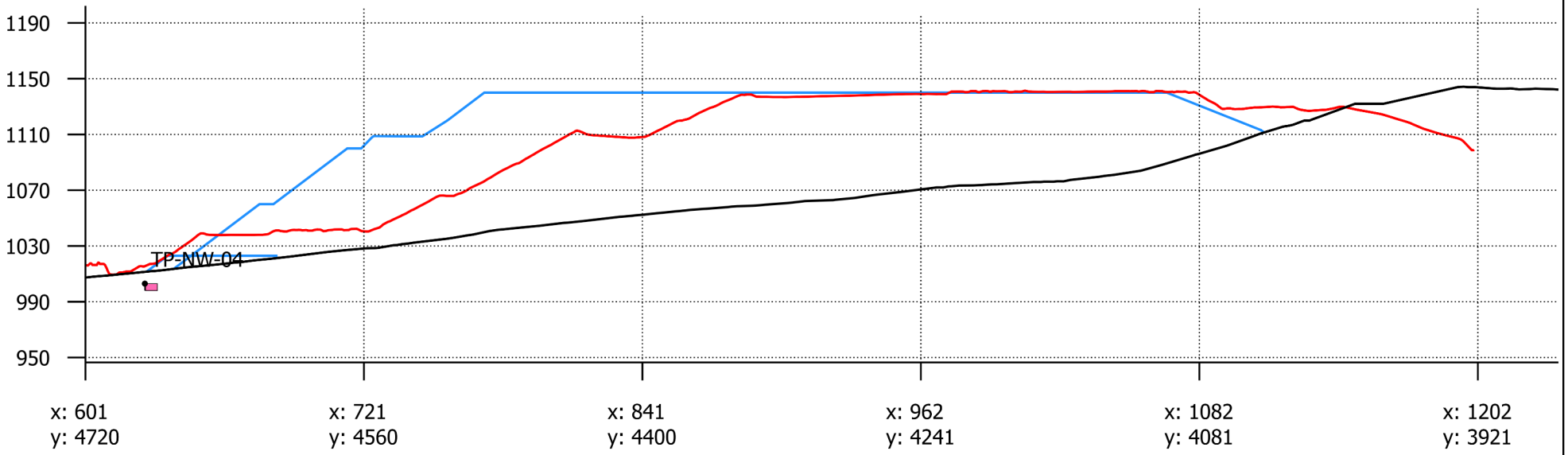

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION I

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-10**

Legend

Surfaces

- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

BH_Unit

- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Scale: 1:3,000
Vertical exaggeration: 1x
0m 100m

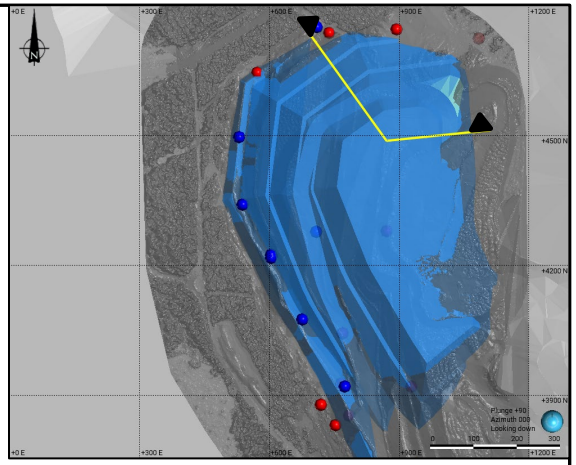

CROSS-SECTION LOCATION

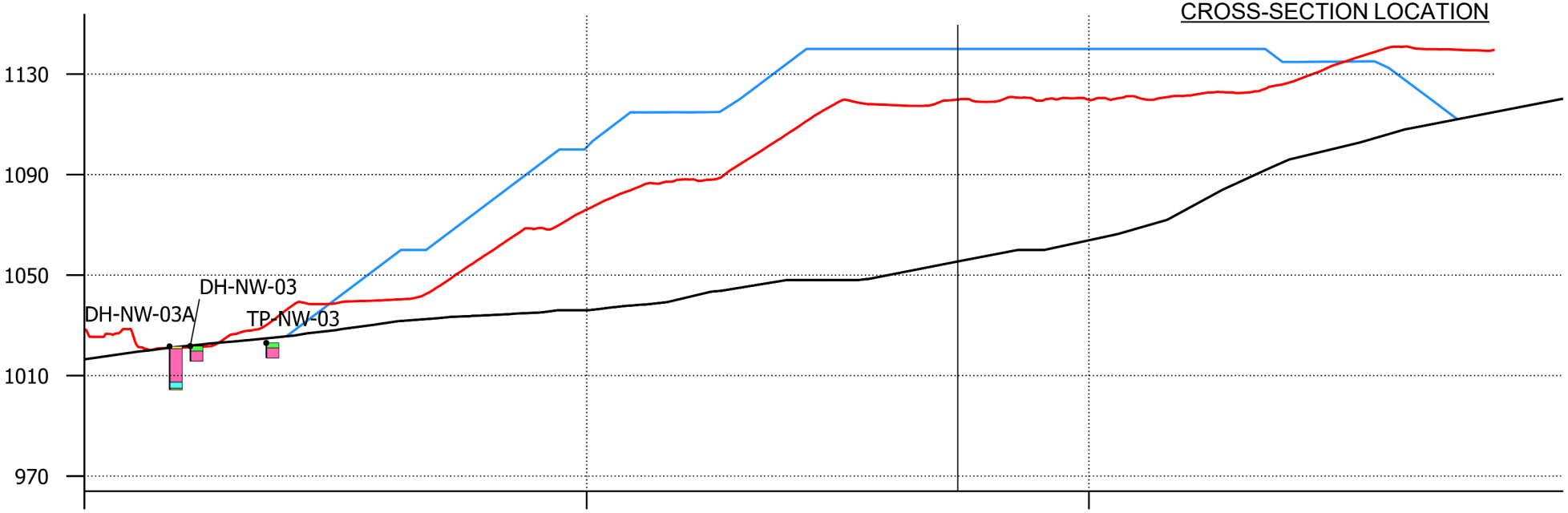

x: 668
y: 4770

x: 784
y: 4608

x: 923
y: 4493

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 100 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION J

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**B-11**

APPENDIX C

Particle Size Distribution and Atterberg Limits Summary

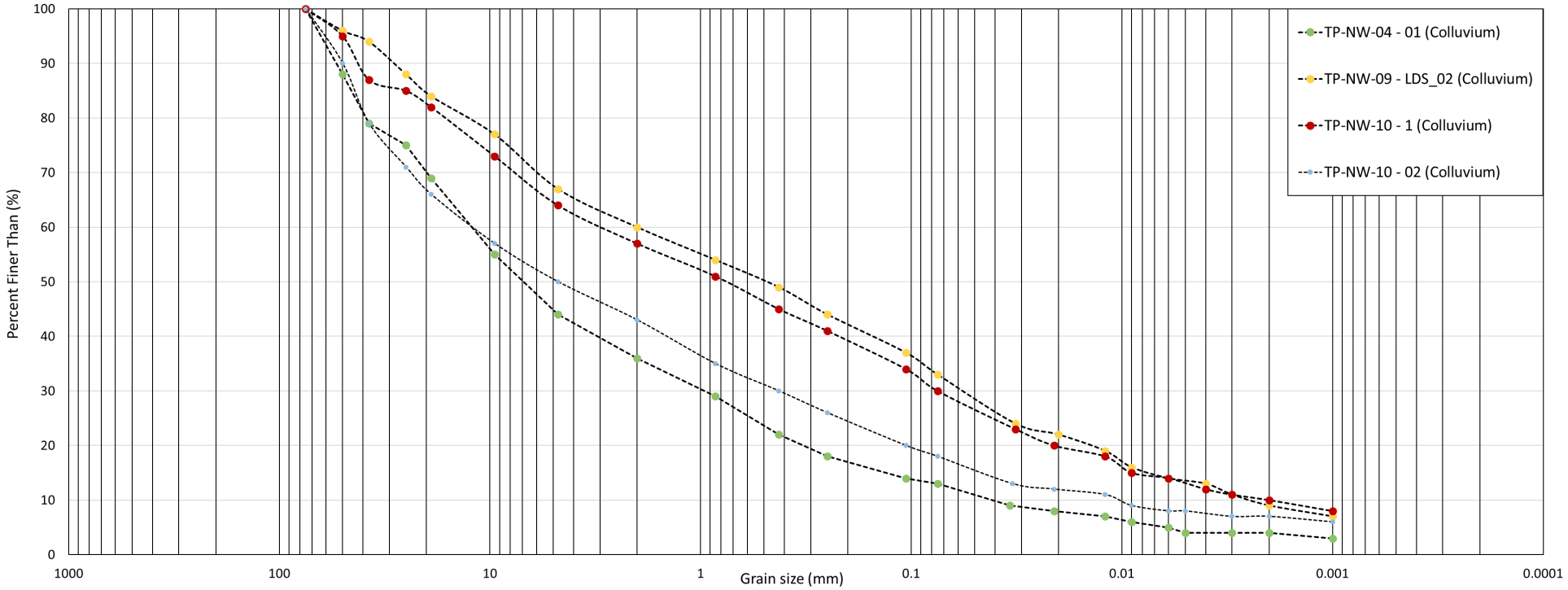

Cobble size	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay size
	Gravel size		Sand size			

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
COLLUVIUM RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-1**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

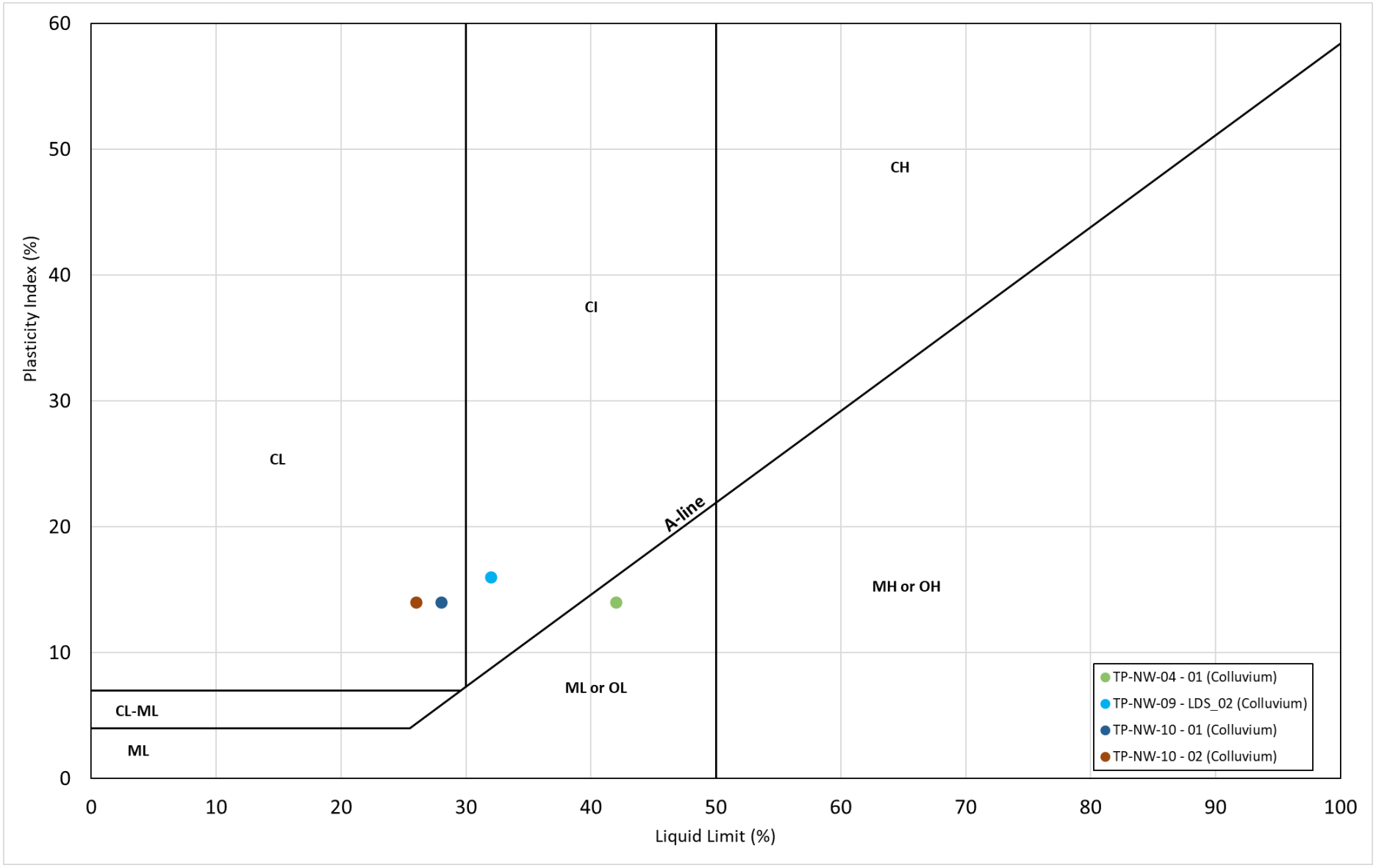

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
ATTERBERG LIMITS GRAPH
COLLUVIUM RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

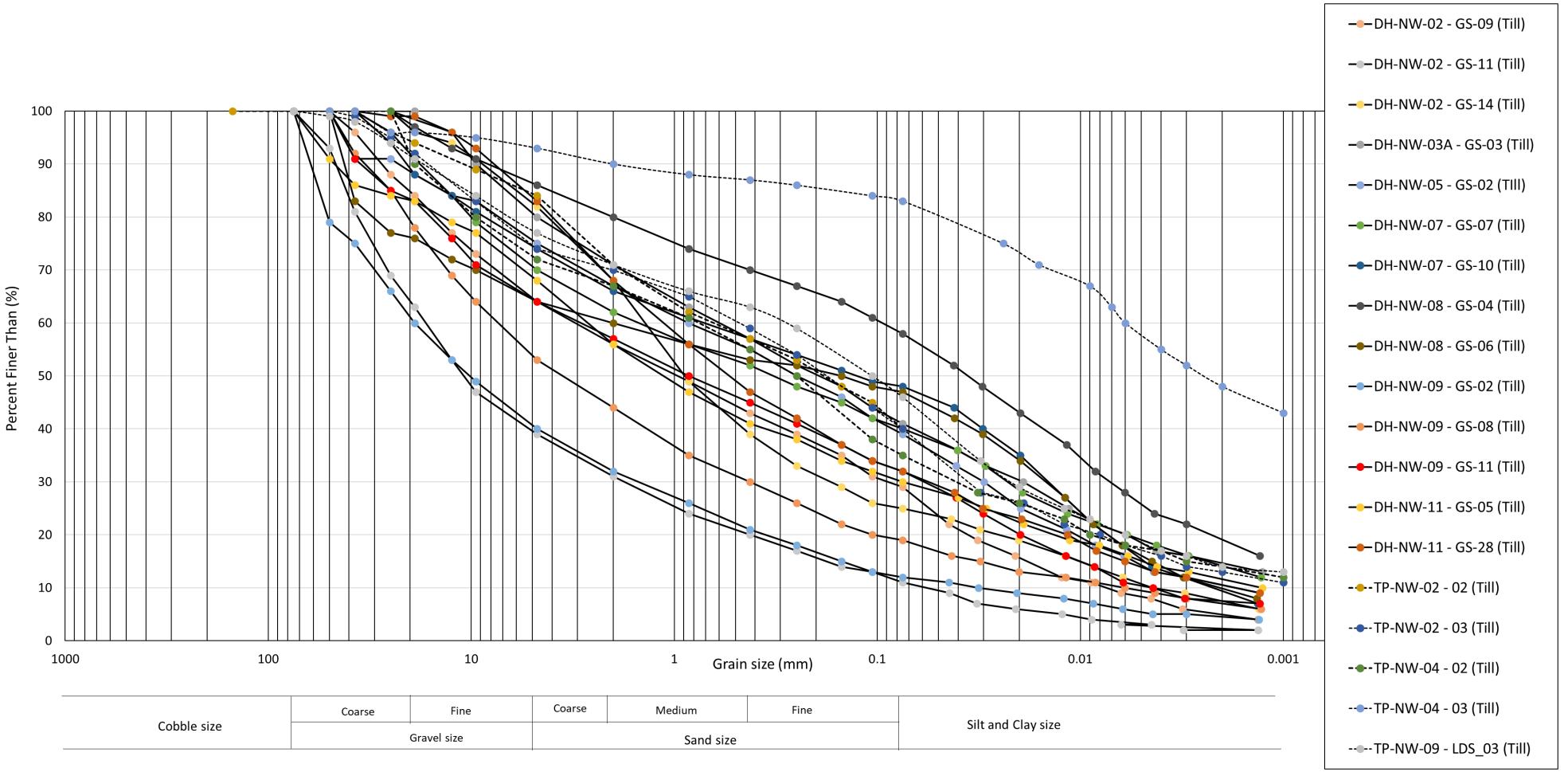

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
TILL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-3

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

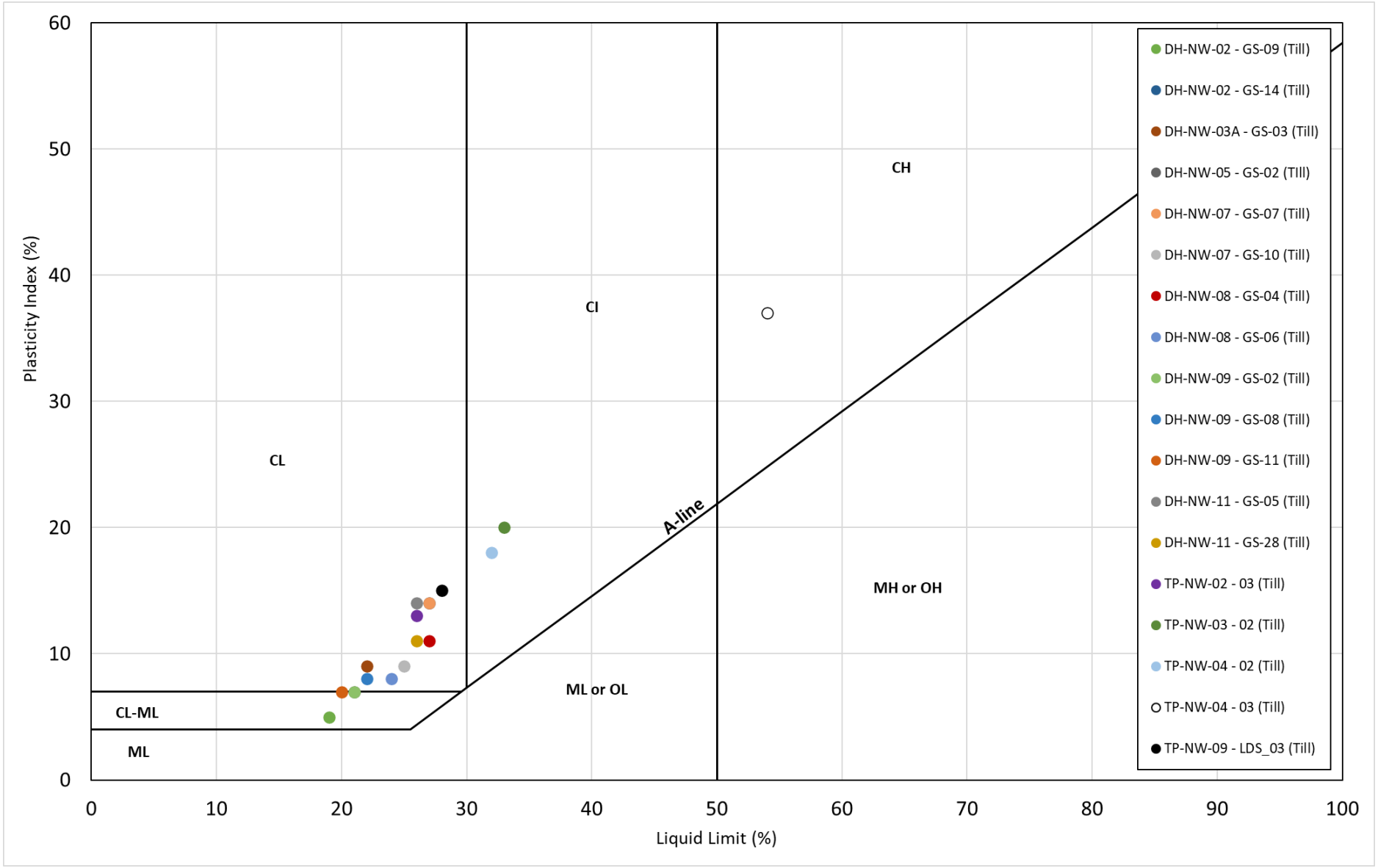

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
ATTERBERG LIMITS GRAPH
TILL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

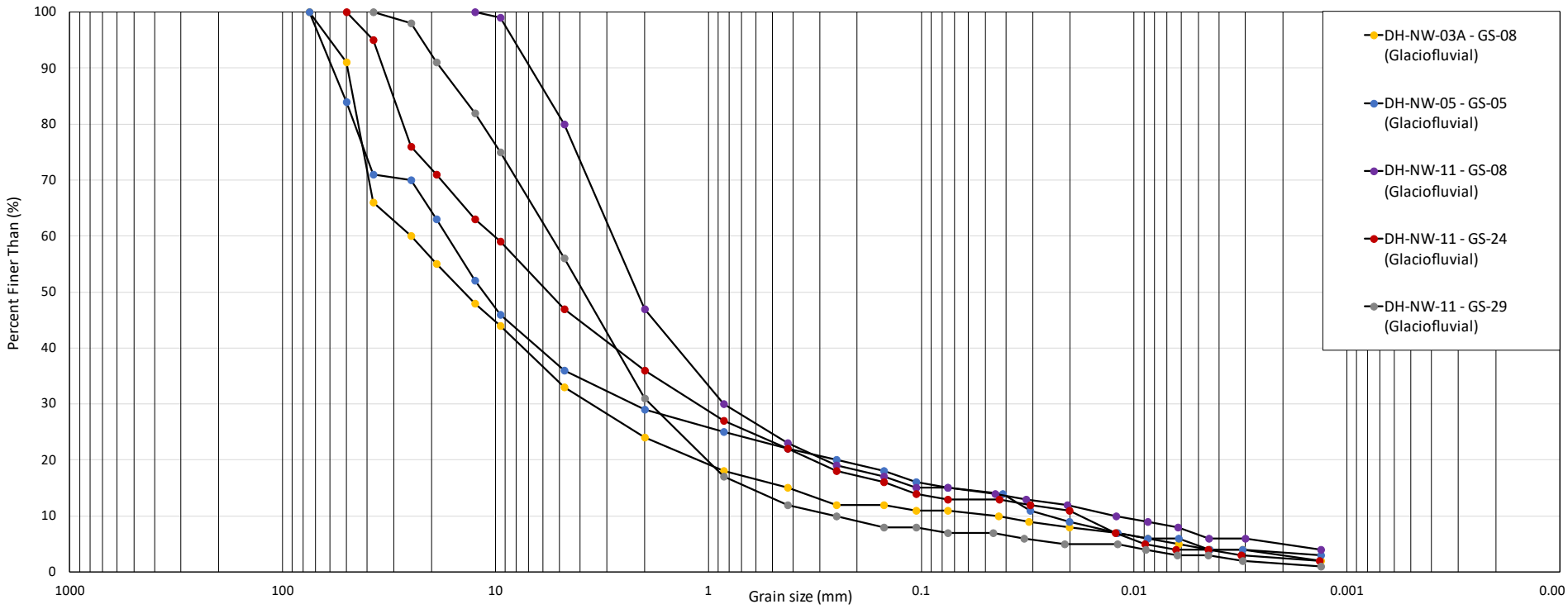

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
GLACIOFLUVIAL DEPOSITS RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

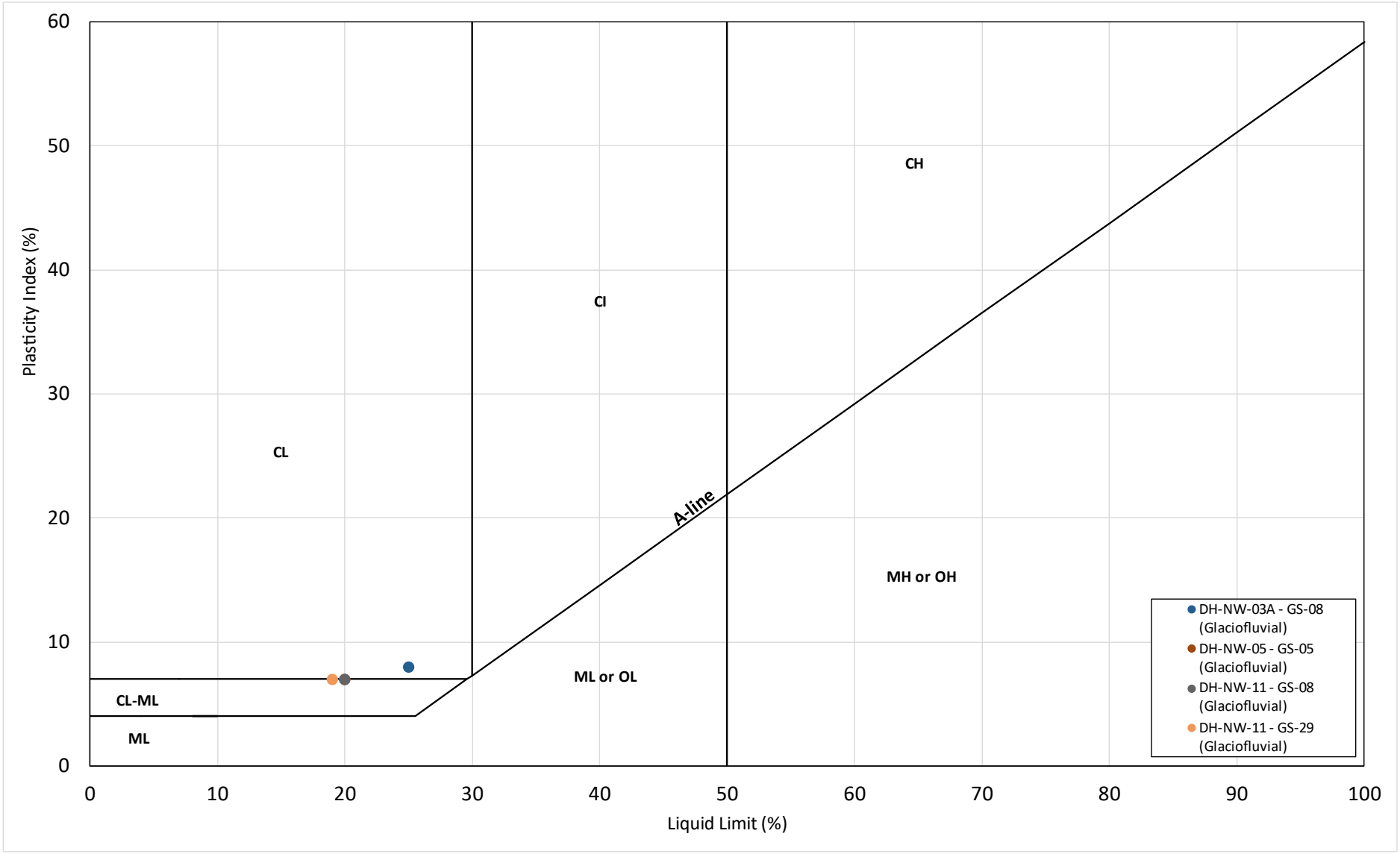

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
ATTERBERG LIMITS GRAPH
GLACIOFLUVIAL DEPOSITS RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

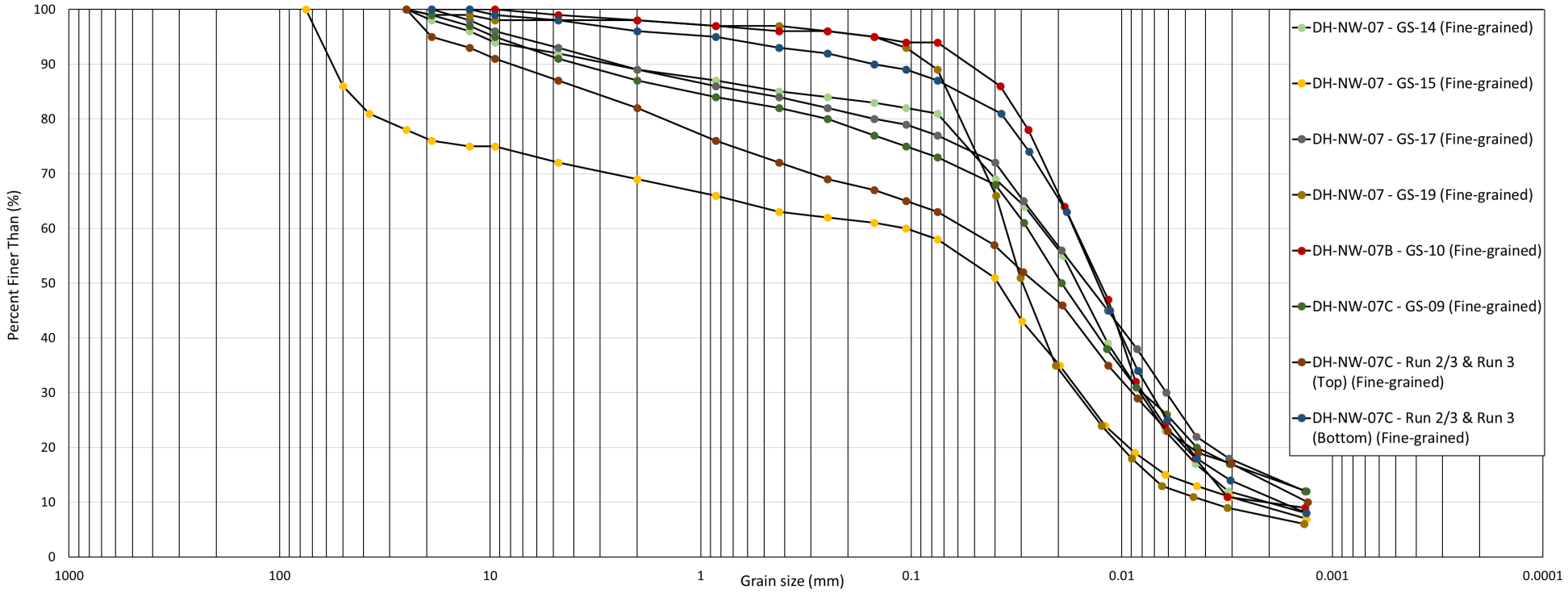

Cobble size	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay size
	Gravel size		Sand size			

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
FINE-GRAINED MATERIAL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

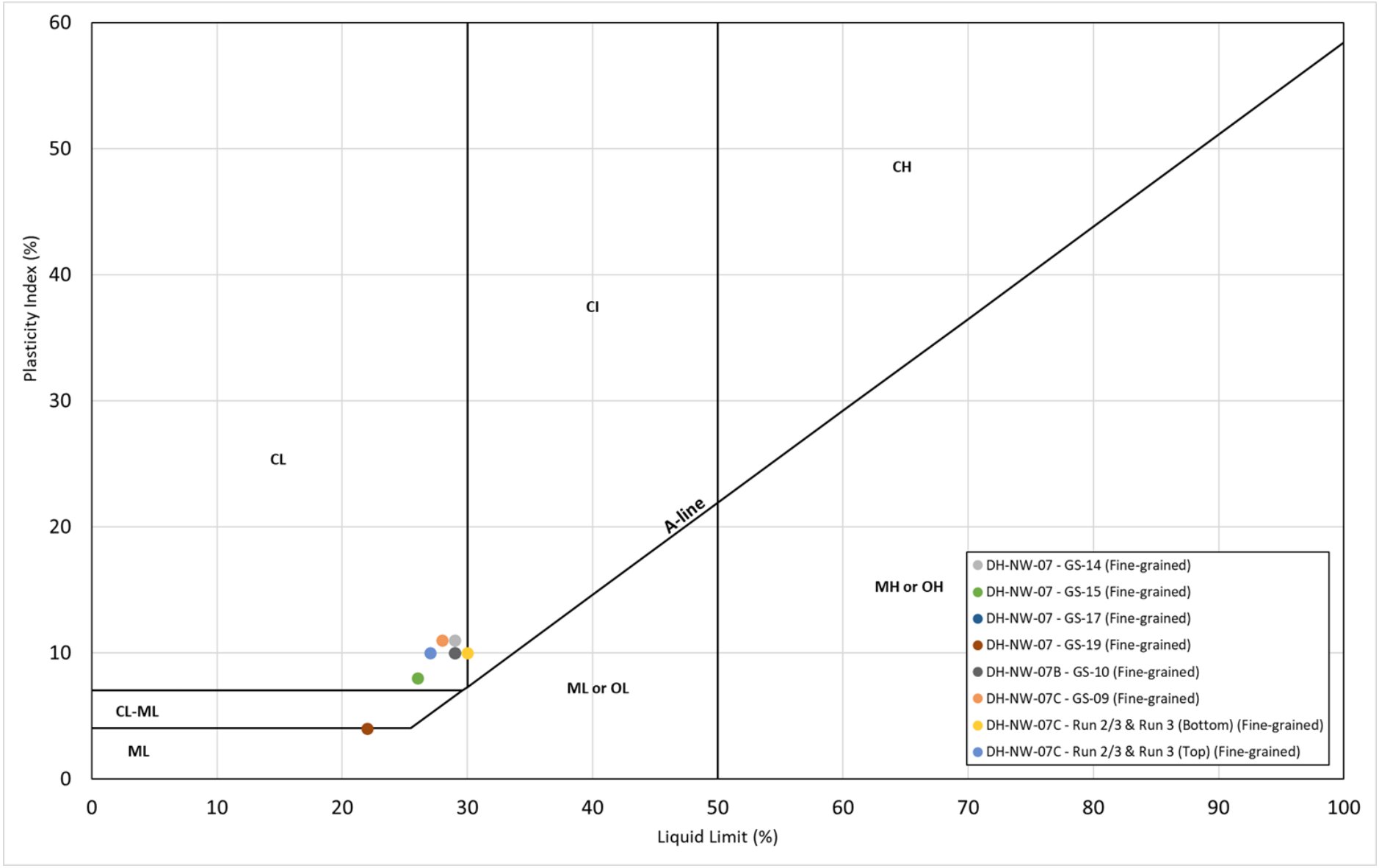

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
ATTERBERG LIMITS GRAPH
FINE-GRAINED MATERIAL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

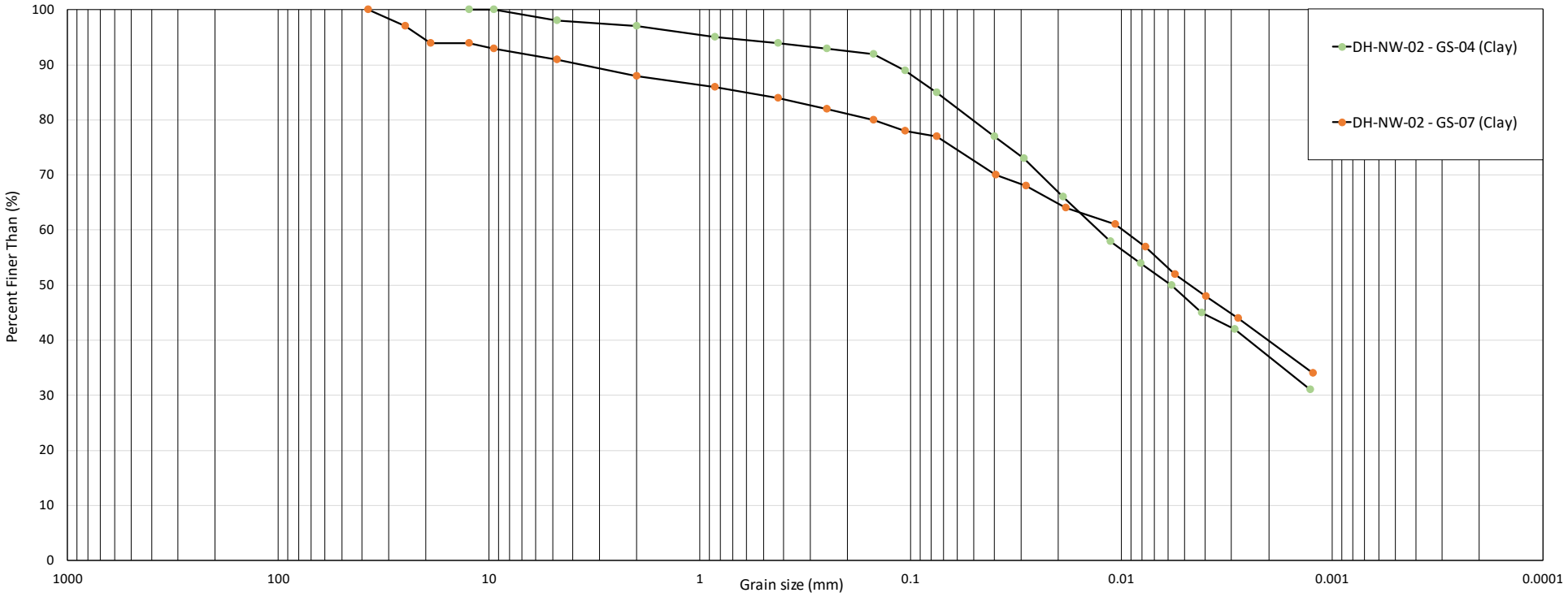

Cobble size	Gravel size		Sand size			Silt and Clay size
	Coarse	Fine	Coarse	Medium	Fine	

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
CLAY MATERIAL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

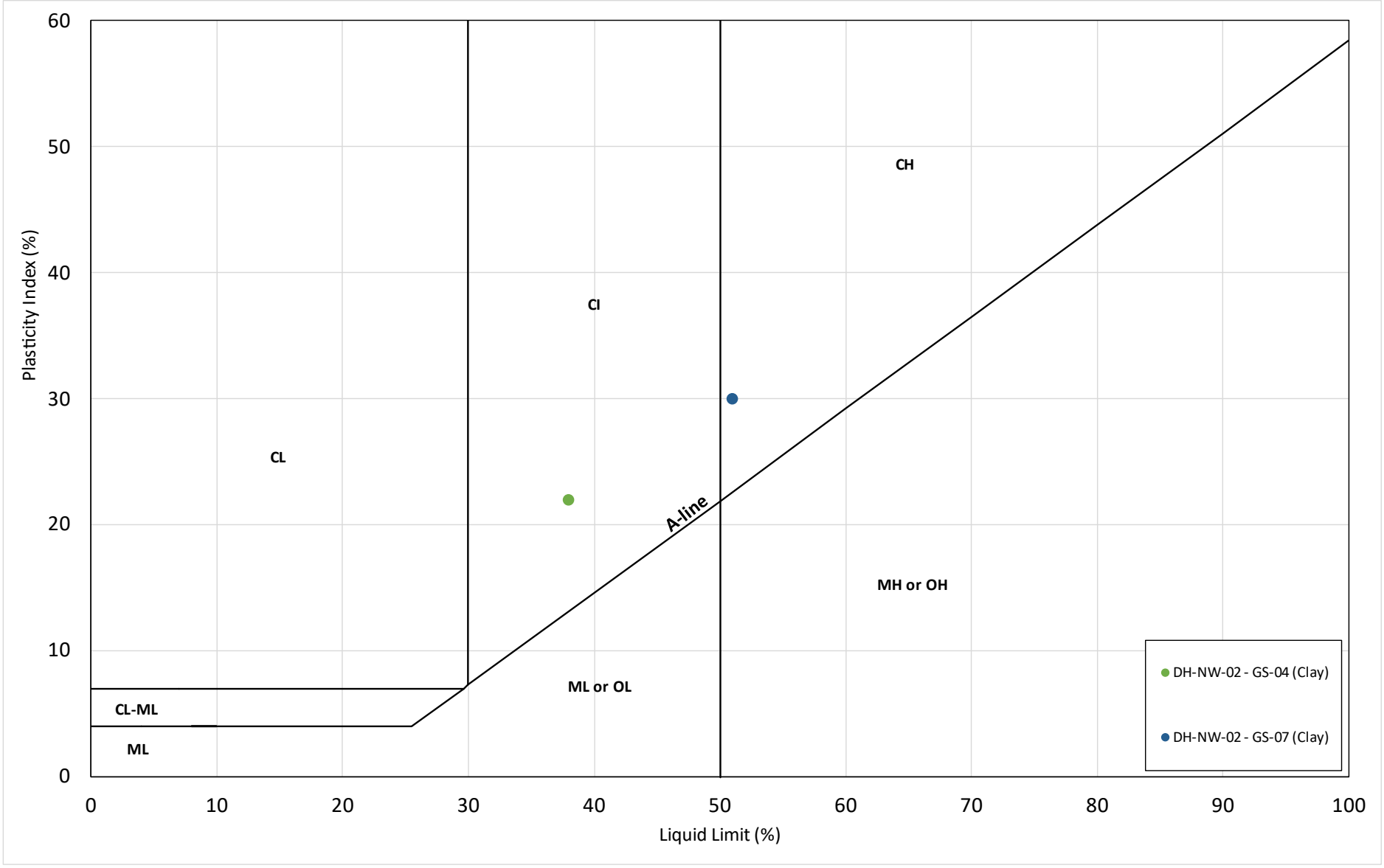

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
ATTERBERG LIMITS GRAPH
CLAY MATERIAL RESULTS SUMMARY

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

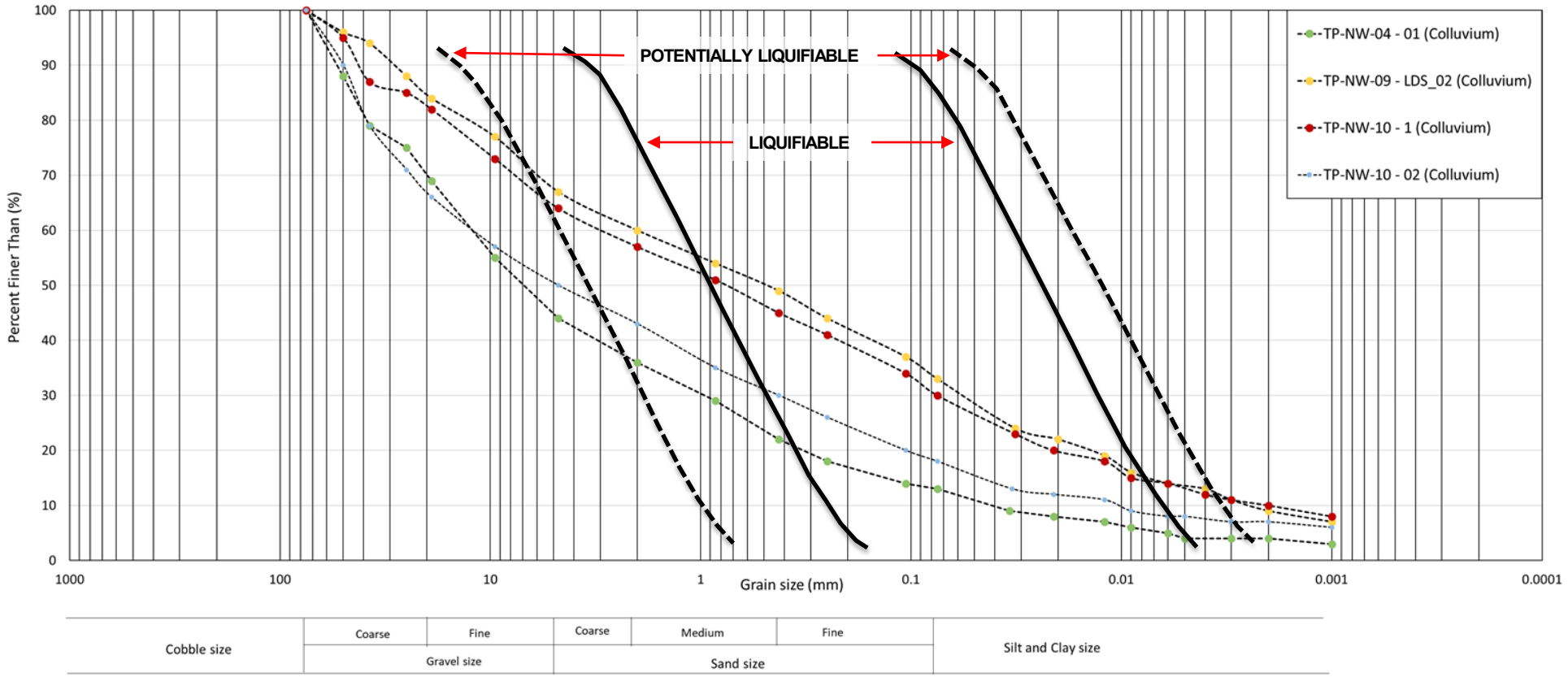

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
COLLUVIUM RESULTS SUMMARY
LIQUEFACTION POTENTIAL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-11**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

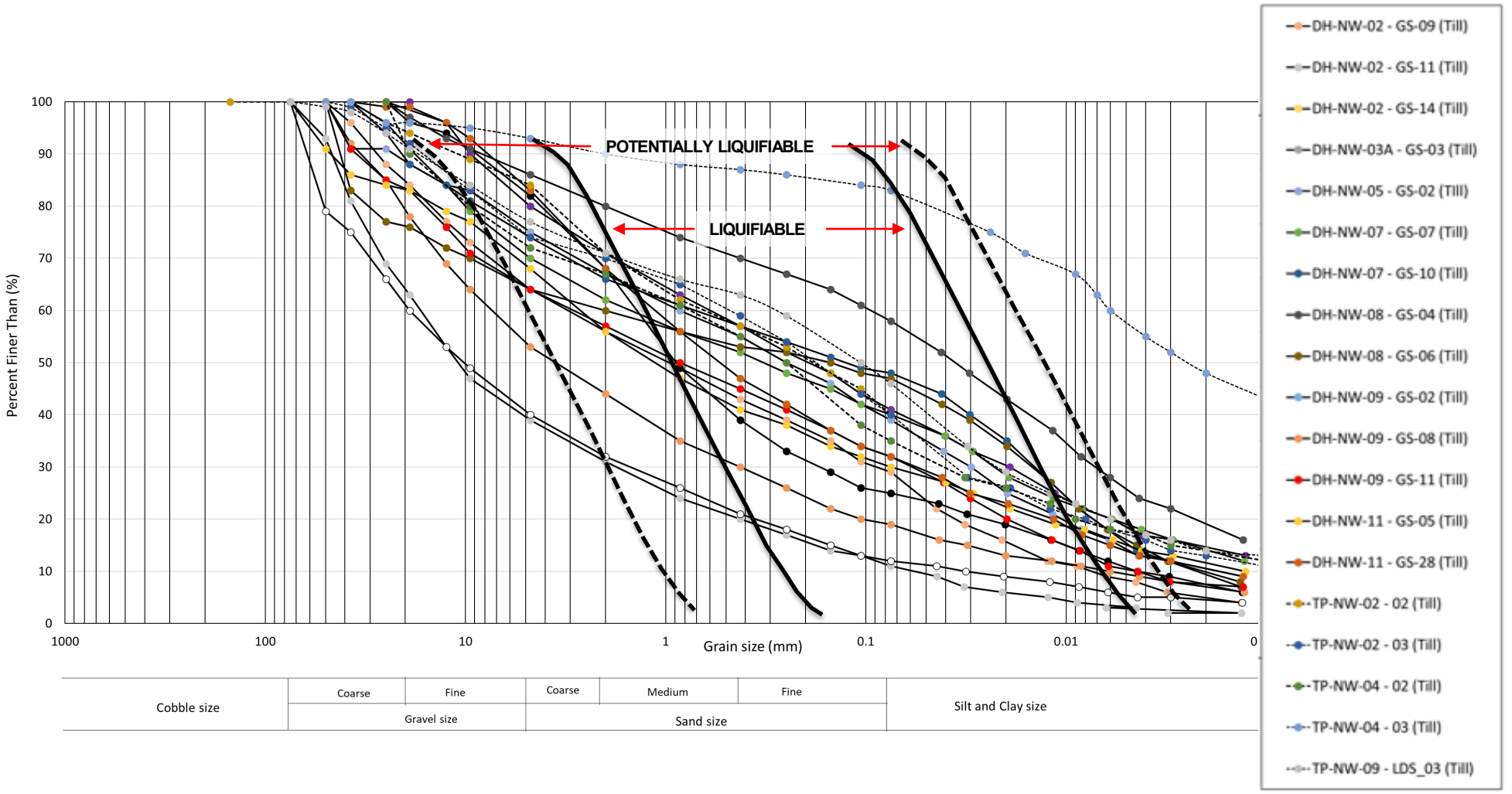

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
TILL RESULTS SUMMARY
LIQUEFACTION POTENTIAL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

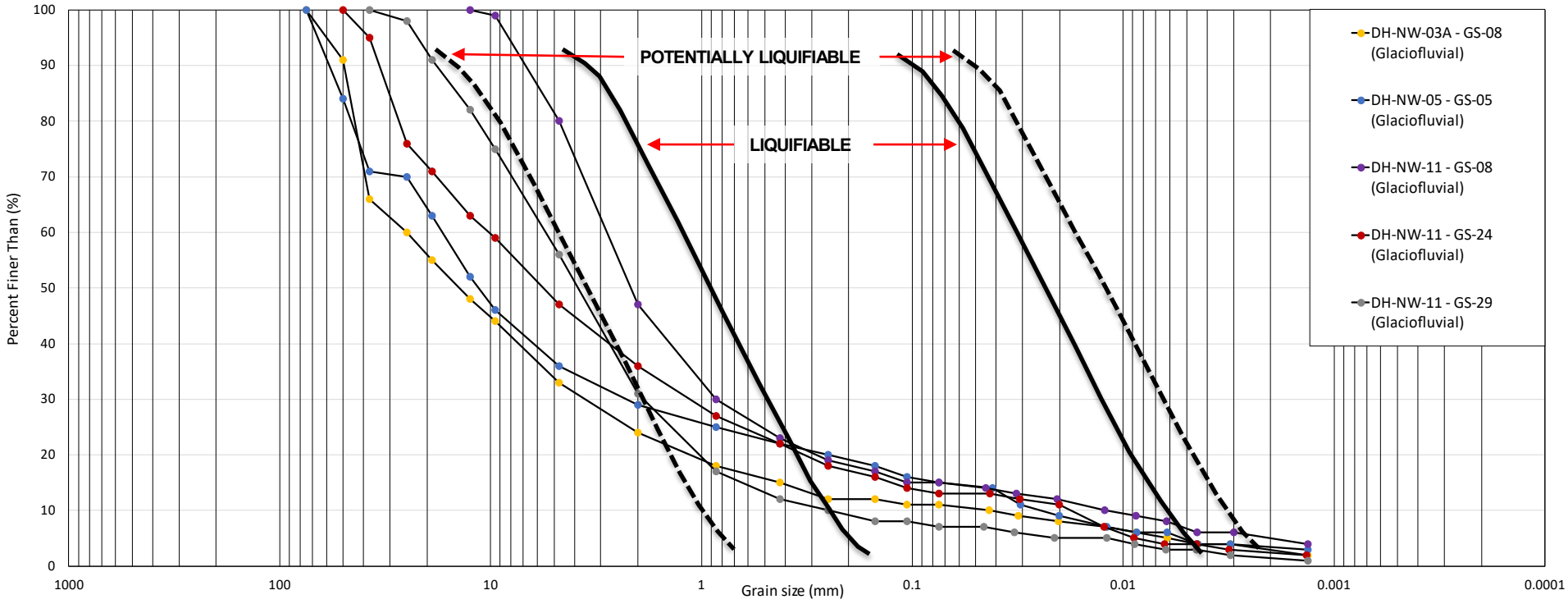

Cobble size	Gravel size		Sand size			Silt and Clay size
	Coarse	Fine	Coarse	Medium	Fine	

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
GLACIOFLUVIAL DEPOSITS RESULTS SUMMARY
LIQUEFACTION POTENTIAL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	C-13

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

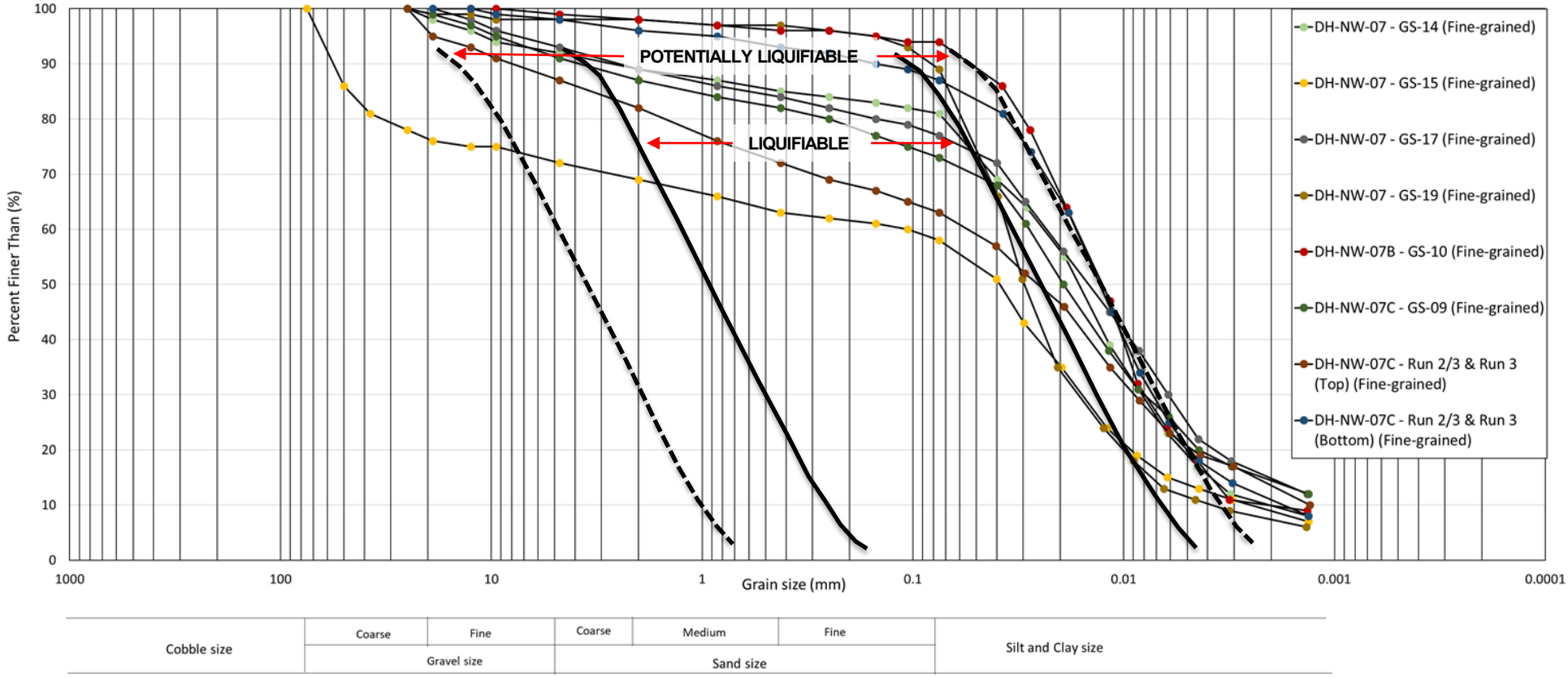

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
WSP

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
FINE-GRAINED MATERIAL RESULTS SUMMARY
LIQUEFACTION POTENTIAL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-14**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

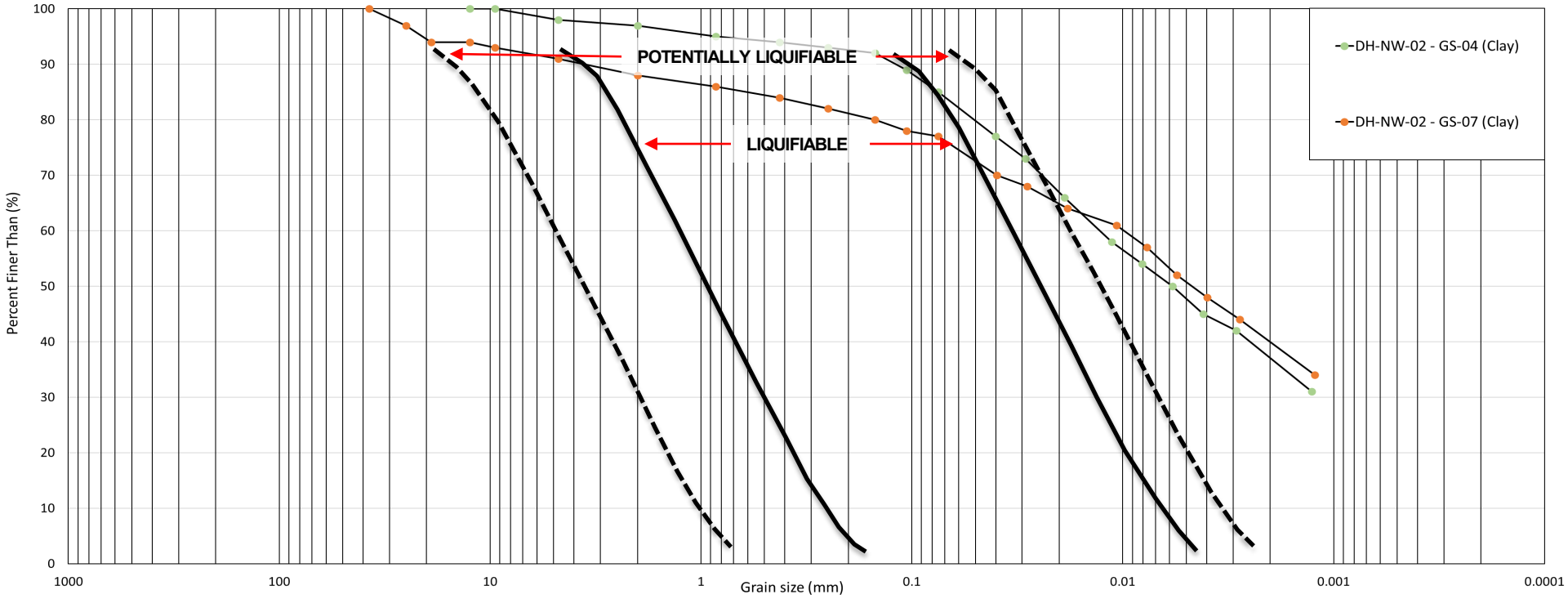

REFERENCES AND NOTES

1. LABORATORY TESTING RESULTS PRESENTED IN WSP 2024B.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-01
PREPARED	MVK
DESIGNED	MVK
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PARTICLE SIZE DISTRIBUTION GRAPH
CLAY MATERIAL RESULTS SUMMARY
LIQUEFACTION POTENTIAL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**C-15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

APPENDIX D

Cone Penetration Testing Data Review

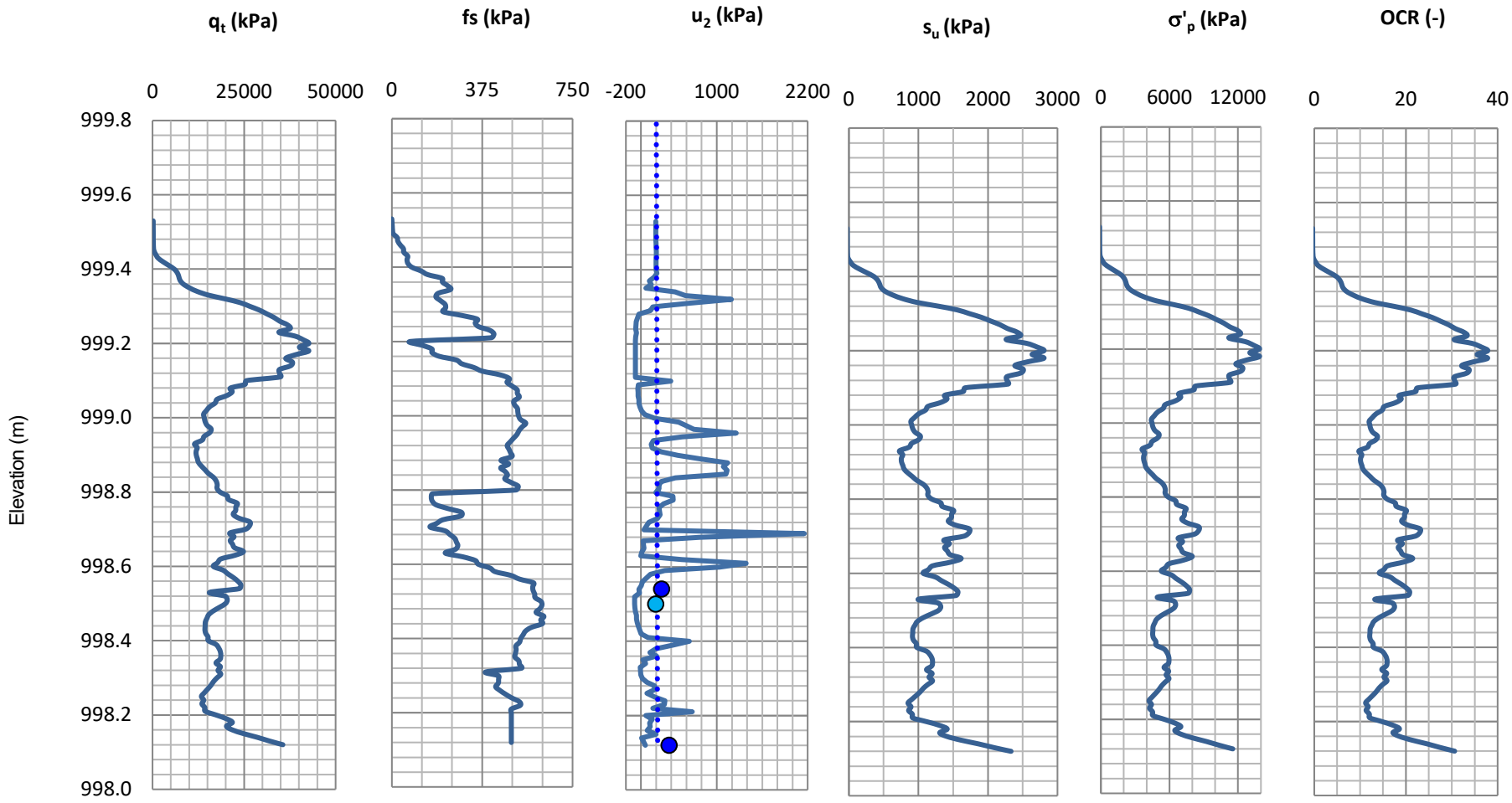

Piezometer Data Points
End of Dissipation Test (Extrapolated)
Hydrostatic Pore Pressure

$$S_u = \frac{q_t - \sigma_0}{N_{kt}}$$

$$\sigma'_p = 0.33\,(q_t - \sigma_{v0})$$

REFERENCES/NOTES

Notes:
1- q_t = Tip Resistance
2- f_s = Sleeve Friction
3- U_2 = Pore Pressure
4- S_u =Undrained Shear Strength
5- σ'_p= Preconsolidation Stress
6- OCR= Overconsolidation Ratio
7- σ'_v = Effective Stress

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINELIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-05
PREPARED	AB
DESIGNED	AB
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-07B CPT INTERPRETATION
FINE-GRAINED MATERIAL LAYER

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**D-1**

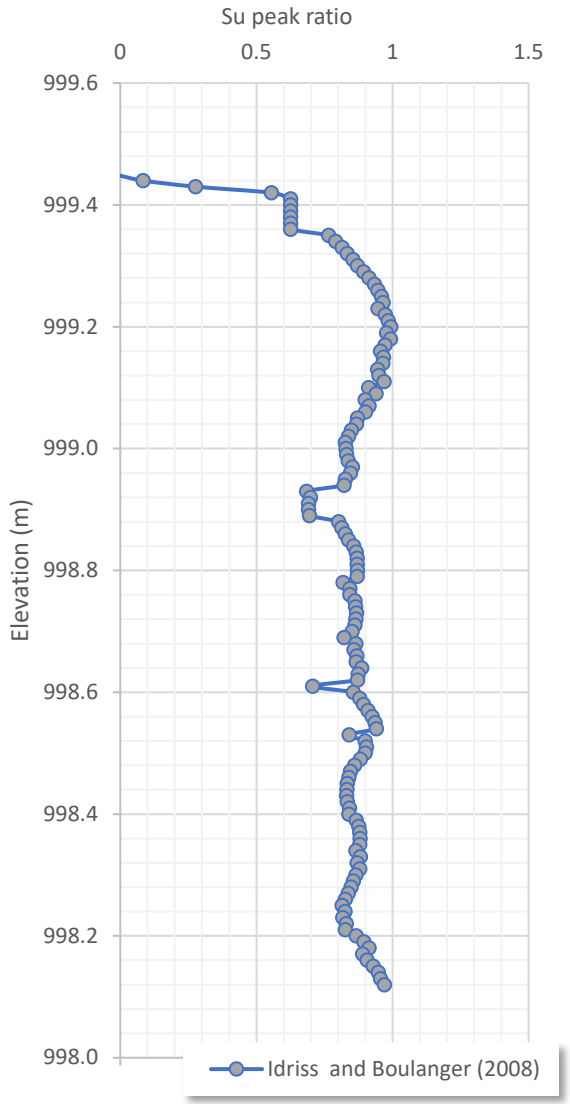

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINELIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-05
PREPARED	AB
DESIGNED	AB
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PEAK UNDRAINED SHEAR STRENGTH RATIO (S_U PEAK) DETERMINED USING IDRISS AND BOULANGER (2008) METHOD

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**D-2**

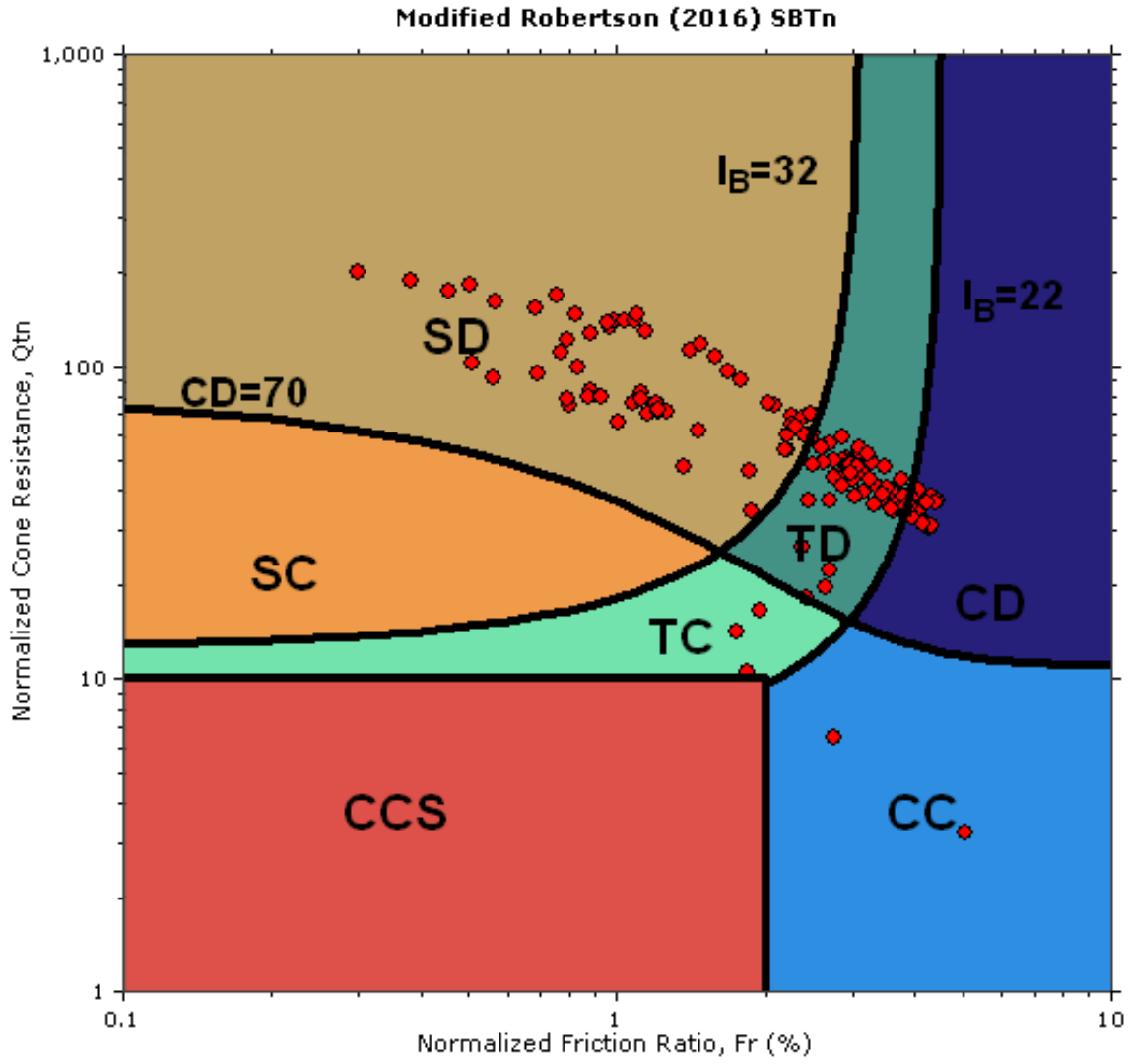

Soil Behaviour Type

CCS Clay-like - Contractive - Sensitive
CC Clay-like - Contractive
CD Clay-like - Dilative
TC Transitional - Contractive
TD Transitional - Dilative
SC Sand-like - Contractive
SD Sand-like - Dilative

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINELIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-05
PREPARED	AB
DESIGNED	AB
REVIEWED	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP GEOTECHNICAL ASSESSMENT

TITLE
SOIL BEHAVIOUR TYPE
DH-NW-07B CHART

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**D-3**

APPENDIX E

Hydrogeology Summary and Vibrating Wire Piezometer Data



REFERENCES AND NOTES

1. PHOTOGRAPH FROM 2023 SLOPE STABILITY REVIEW, WSP 2023C.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
SEEPAGE LOCATION AT TOE OF DUMP
PHOTOGRAPH LOOKING WEST

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-1**



REFERENCES AND NOTES

1. PHOTOGRAPH FROM 2023 SLOPE STABILITY REVIEW, WSP 2023C.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
SEEPAGE/PONDING LOCATION AT TOE OF DUMP
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-2**

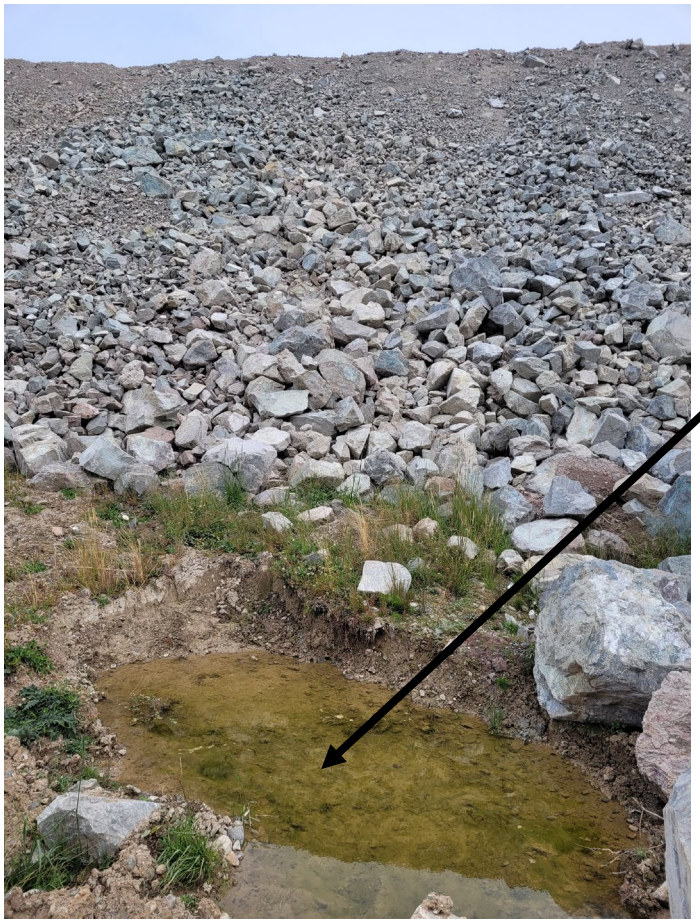



REFERENCES AND NOTES

1. PHOTOGRAPH FROM 2023 SLOPE STABILITY REVIEW, WSP 2023C.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
SEEPAGE/PONDING LOCATION AT TOE OF DUMP
PHOTOGRAPHS LOOKING EAST

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-3**



REFERENCES AND NOTES

1. PHOTOGRAPH FROM 2023 SLOPE STABILITY REVIEW, WSP 2023C.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
SEEPAGE COLLECTION LOCATION AT SOUTH END OF DUMP
PHOTOGRAPHS LOOKING SOUTHEAST

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-4**



REFERENCES AND NOTES

1. GOOGLE EARTH IMAGE FROM 2022.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
GOOGLE EARTH IMAGE OF NORTHWEST PAG DUMP SEEPAGE COLLECTION SUMP AND SETTLING PONDS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-5**

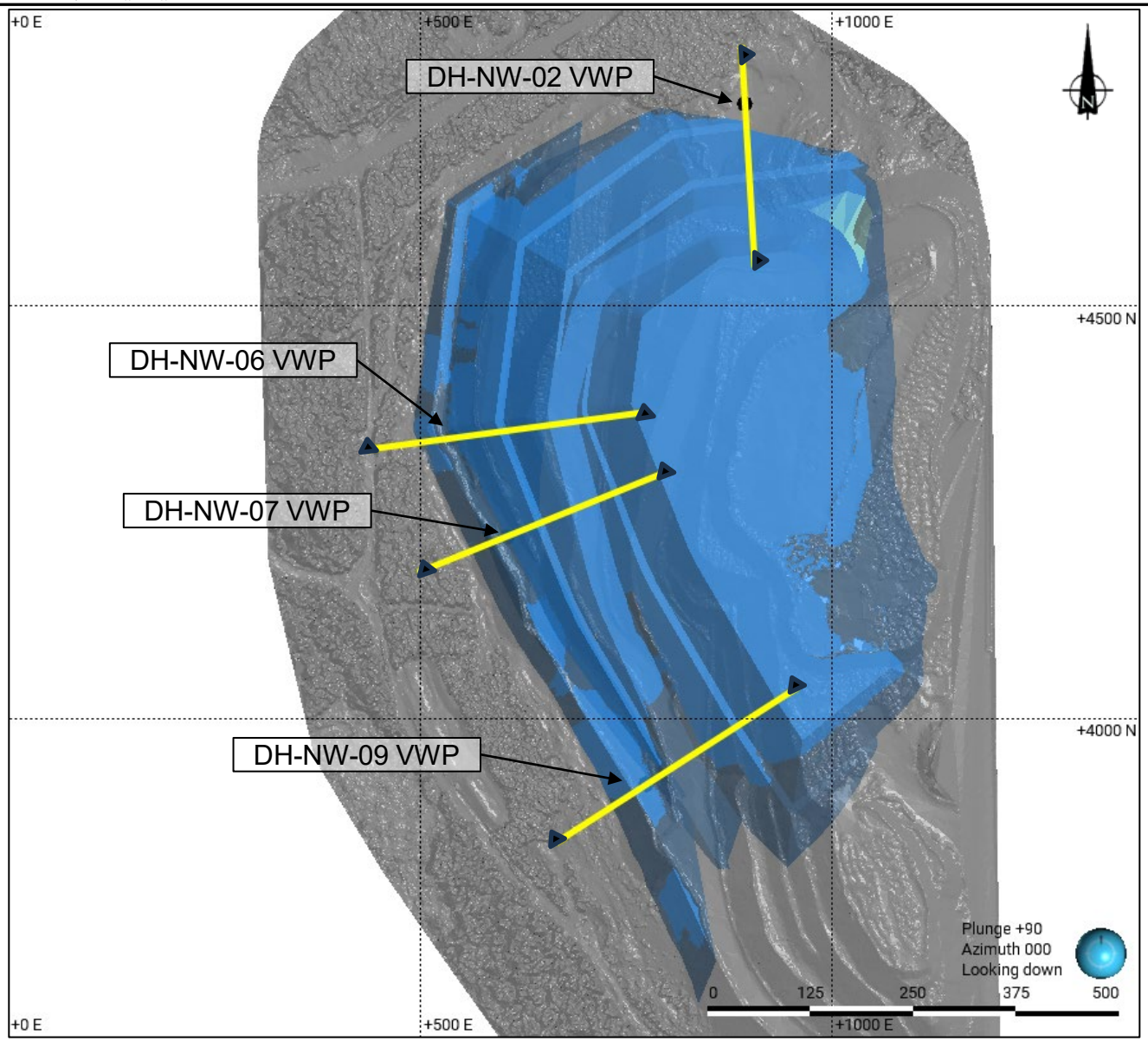

REFERENCES AND NOTES

1. OCT 2023 CURRENT TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2023-10-18. FILE NAME: 231008-NPP.dxf.
2. PROPOSED ULTIMATE NW PAG DUMP DESIGN PROVIDED BY MPMC, RECEIVED 2023-04-06. FILE NAME: z - NWPAG_PAGlifts-v3.dxf.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
ULTIMATE NORTHWEST PAG DUMP DESIGN
CROSS-SECTION OVERVIEW
VIBRATING WIRE PIEZOMETER LOCATIONS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-6**

Legend

BH_Unit
- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Surfaces
- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP Data
- Head Elevation

VWP Install Elevation
- VWP Install Elevation

Scale: 1:1,300
Vertical exaggeration: 1x

0m 100m

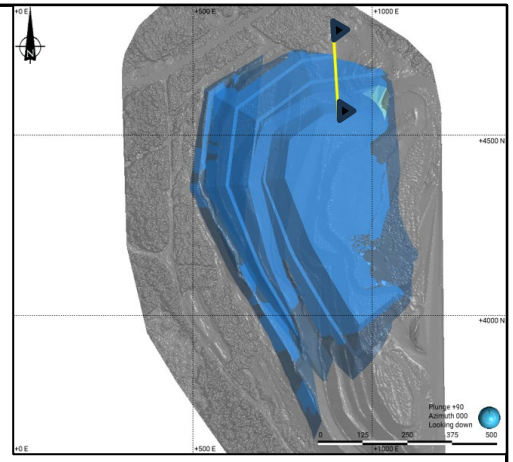

CROSS-SECTION LOCATION

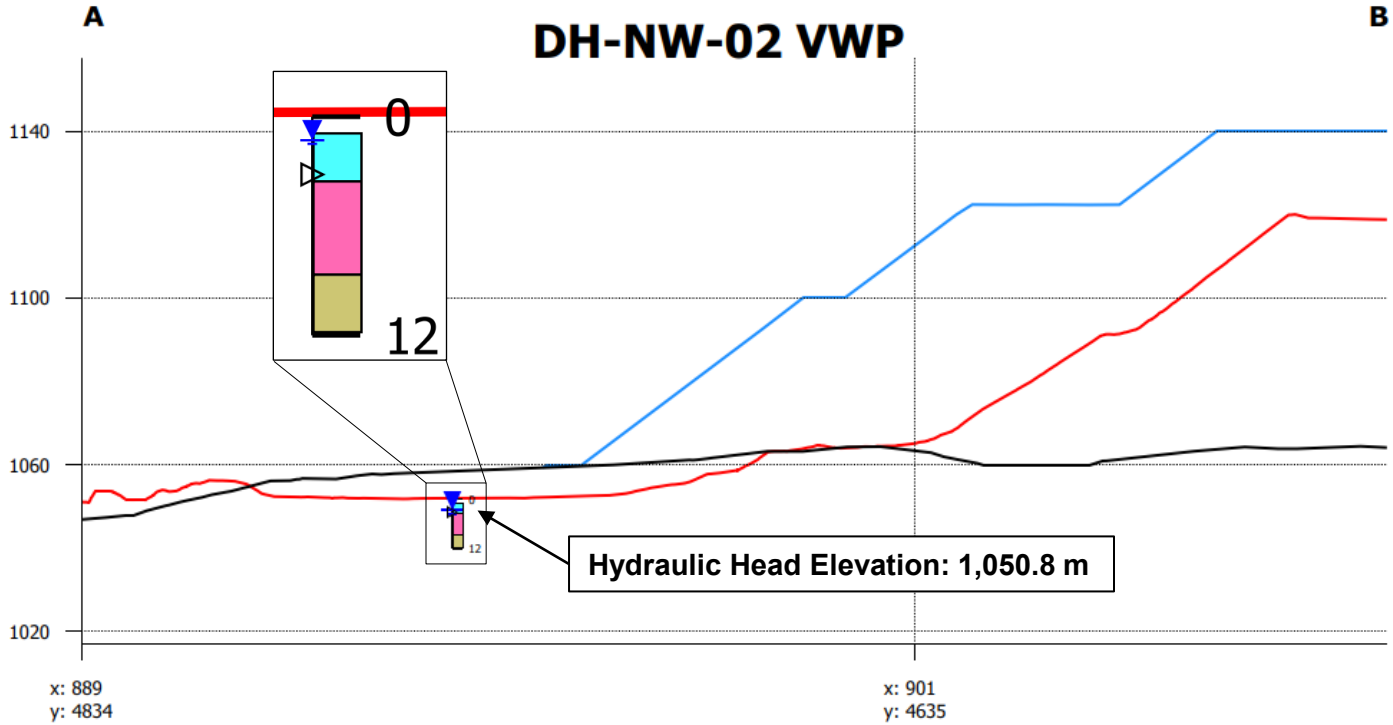

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 20 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.
3. HYDRAULIC HEAD ELEVATION READING FROM APRIL 8, 2024 BY MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-02 CROSS-SECTION
VIBRATING WIRE PIEZOMETER HYDRAULIC HEAD ELEVATION

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-7**

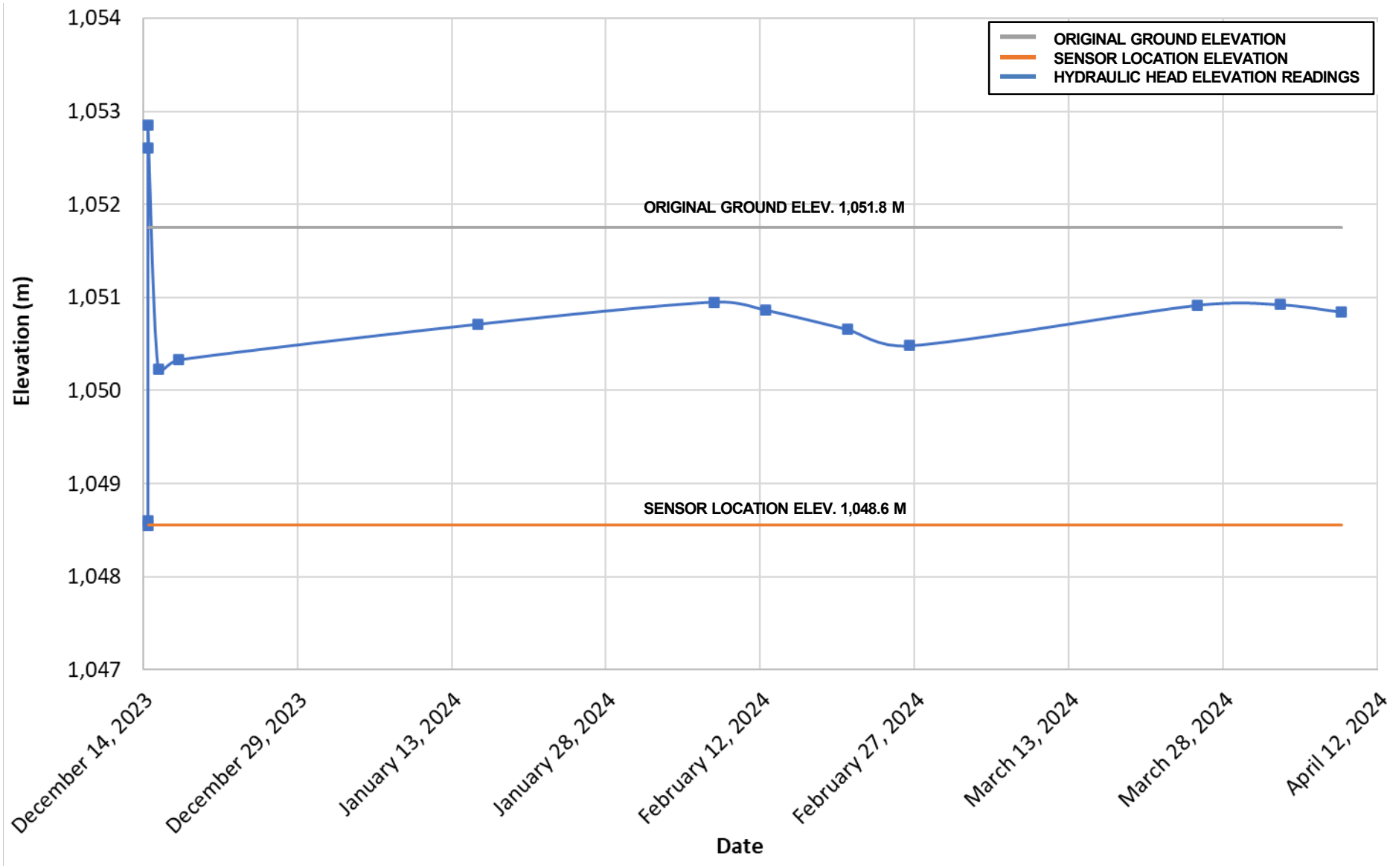

REFERENCES AND NOTES

1. HYDRAULIC HEAD READINGS FROM MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-02 VIBRATING WIRE PIEZOMETER
HYDRAULIC HEAD ELEVATION READINGS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-8**

Legend

BH_Unit
- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Surfaces
- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP Data
- Head Elevation

VWP Install Elevation
- VWP Install Elevation

Scale: 1:1,300
Vertical exaggeration: 1x

0m 100m

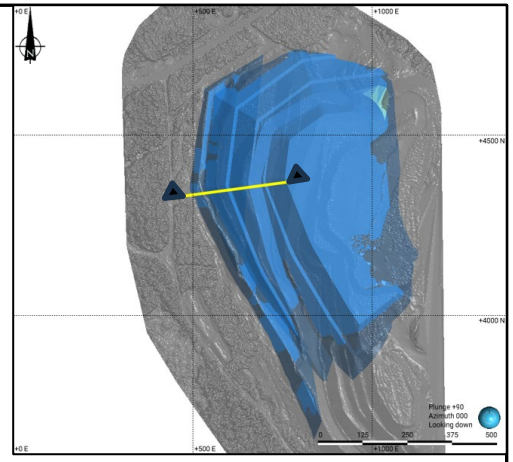

CROSS-SECTION LOCATION

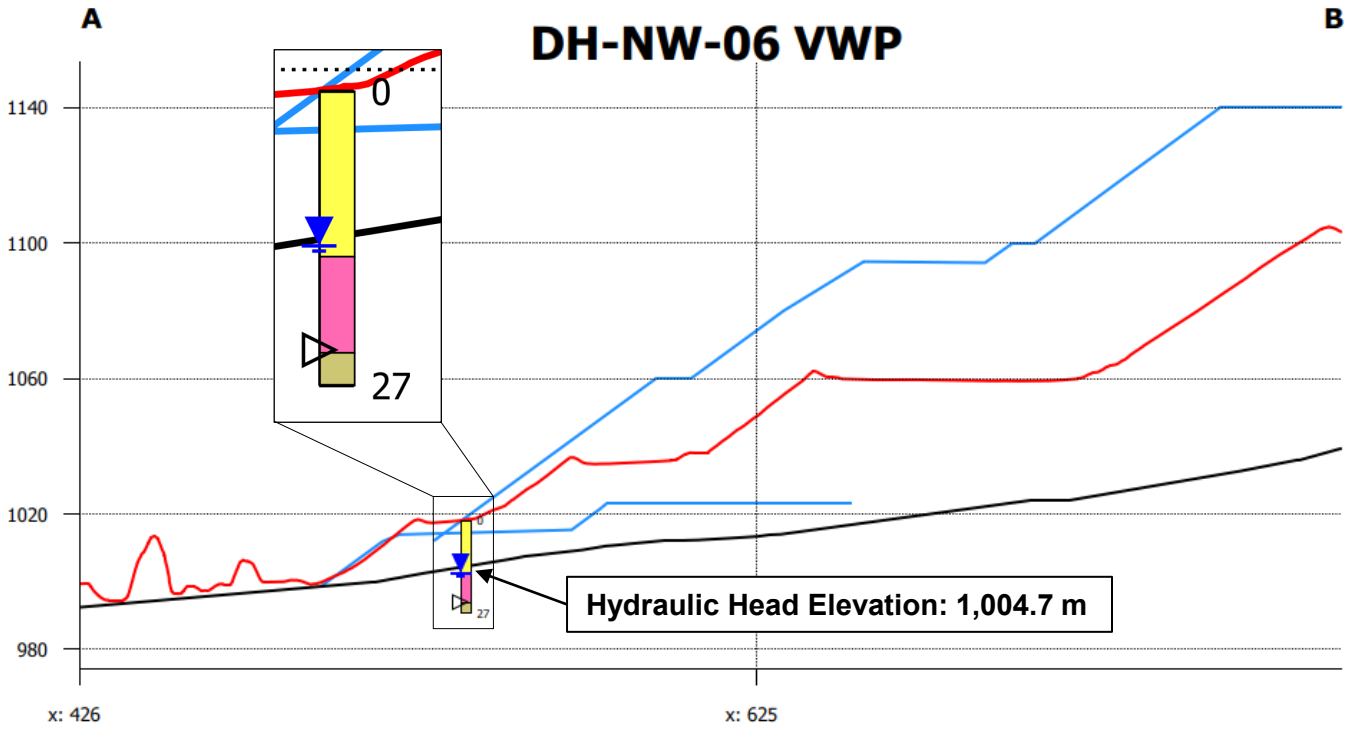

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 20 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.
3. HYDRAULIC HEAD ELEVATION READING FROM APRIL 8, 2024 BY MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-06 CROSS-SECTION
VIBRATING WIRE PIEZOMETER HYDRAULIC HEAD ELEVATION

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-9**

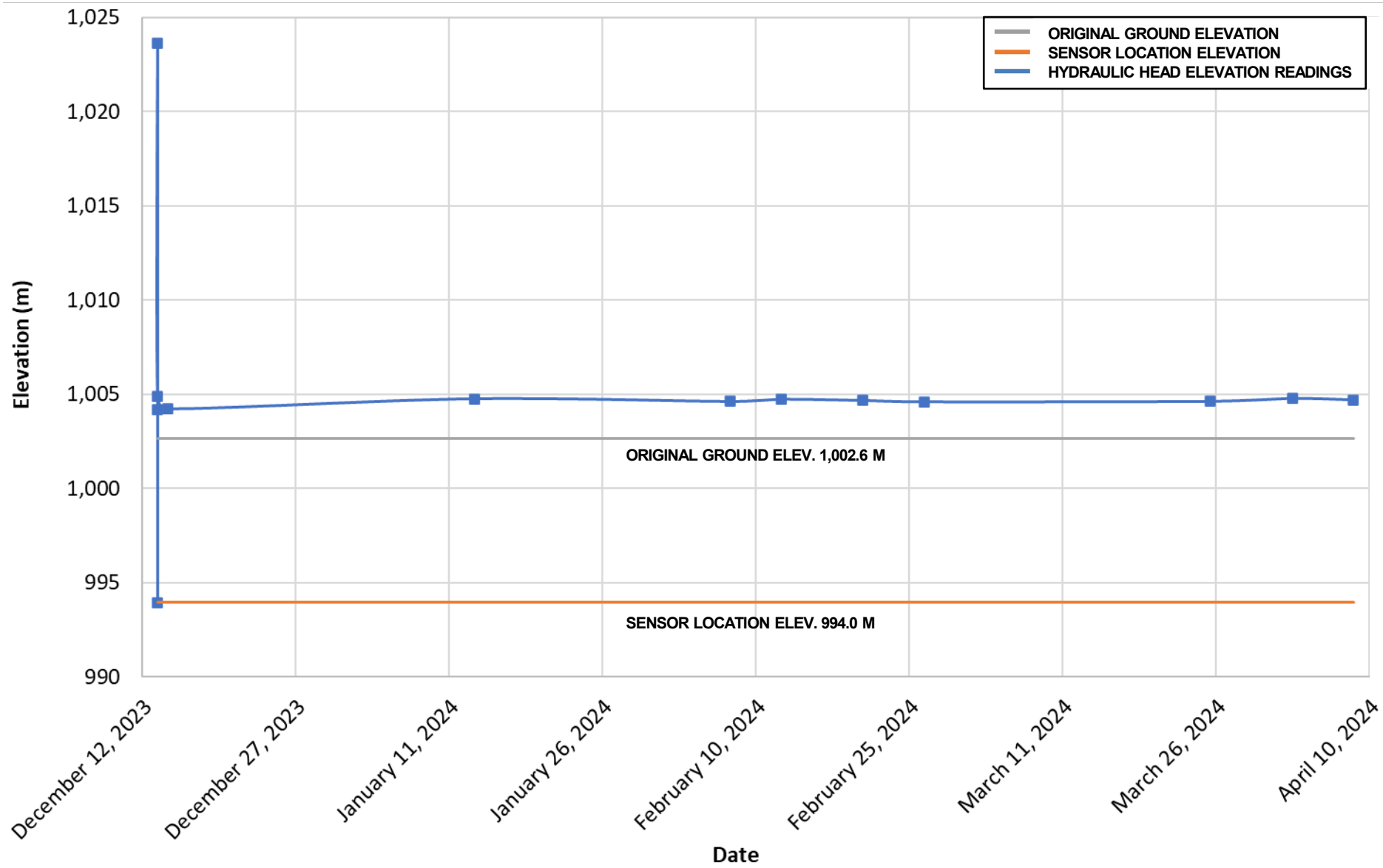

REFERENCES AND NOTES

1. HYDRAULIC HEAD READINGS FROM MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-06 VIBRATING WIRE PIEZOMETER
HYDRAULIC HEAD ELEVATION READINGS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-10**

Legend

BH_Unit
- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Surfaces
- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP Data
- Head Elevation

VWP Install Elevation
- VWP Install Elevation

Scale: 1:1,300

Vertical exaggeration: 1x

0m 100m

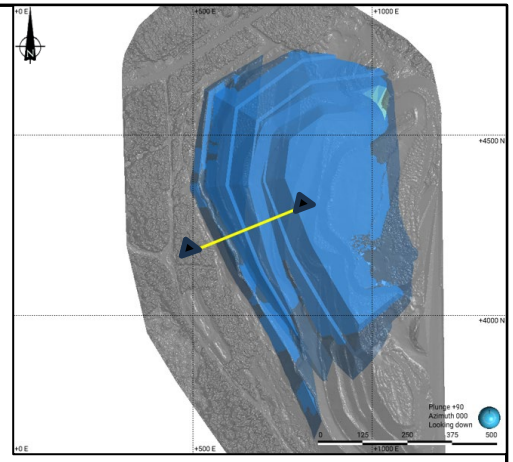

CROSS-SECTION LOCATION

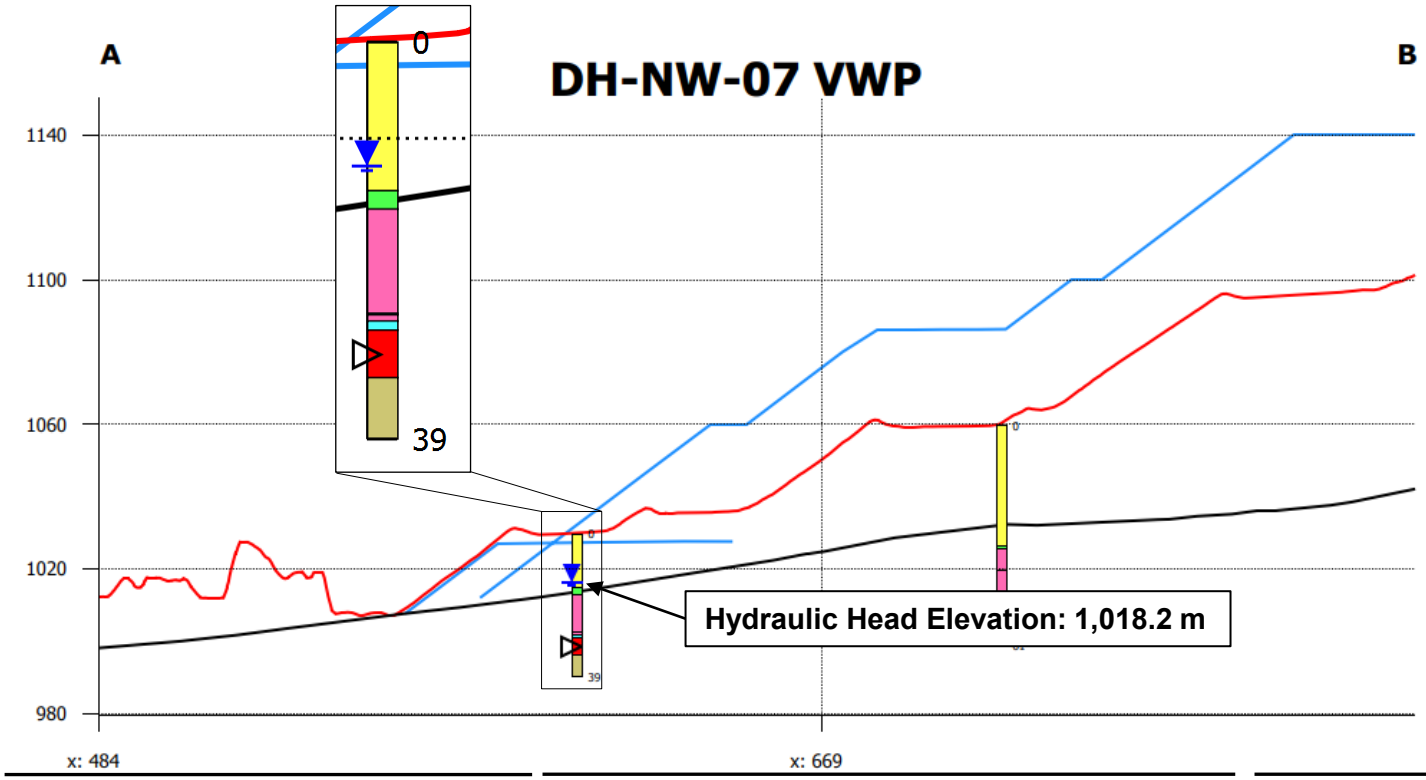

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 20 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.
3. HYDRAULIC HEAD ELEVATION READING FROM APRIL 8, 2024 BY MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-07 CROSS-SECTION
VIBRATING WIRE PIEZOMETER HYDRAULIC HEAD ELEVATION

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-11**

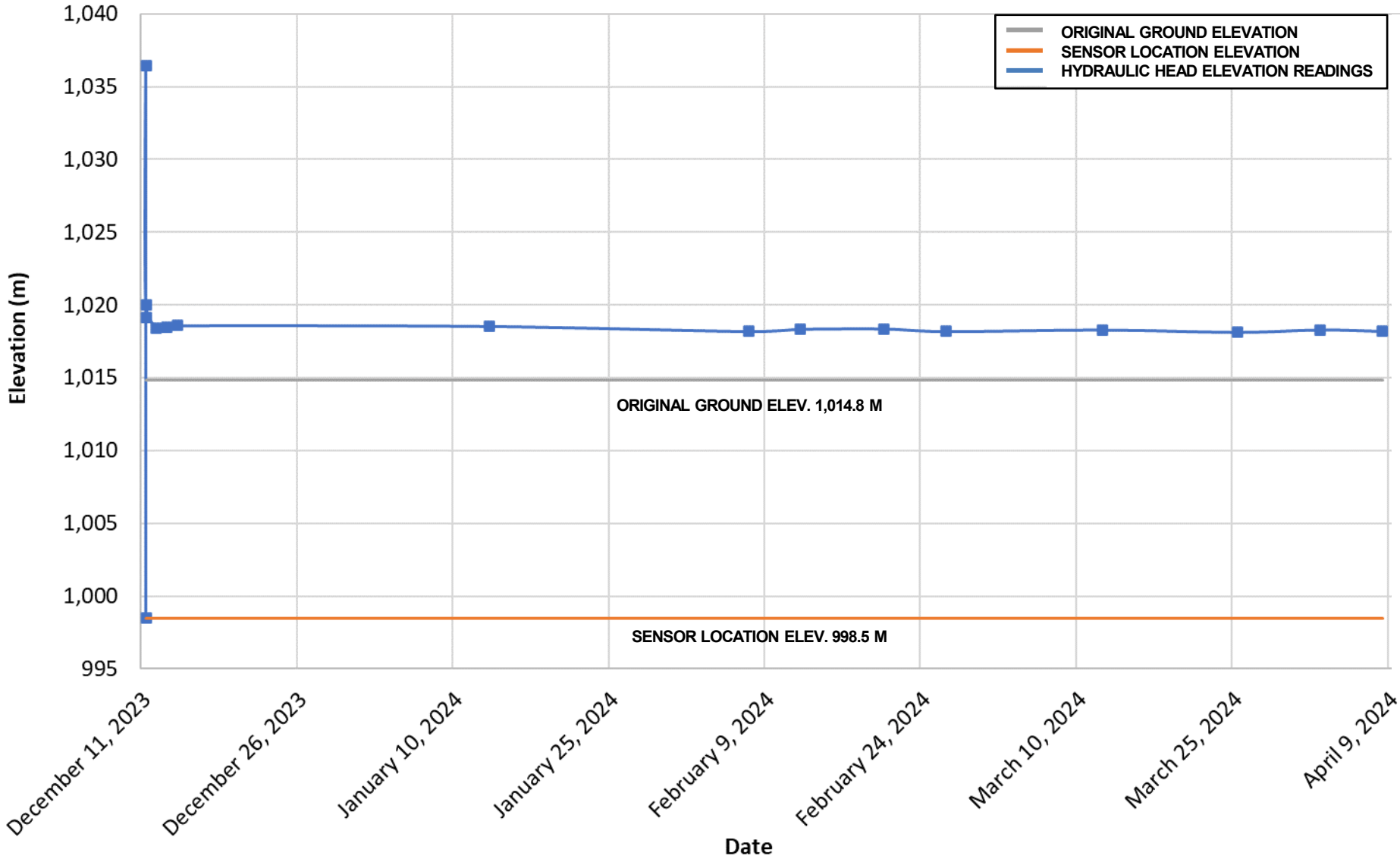

REFERENCES AND NOTES

1. HYDRAULIC HEAD READINGS FROM MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

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PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-07 VIBRATING WIRE PIEZOMETER
HYDRAULIC HEAD ELEVATION READINGS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-12**

Legend

BH_Unit
- Waste Rock
- Till
- Glaciolacustrine
- Colluvium
- Glaciofluvial
- Bedrock

Surfaces
- Ultimate NW PAG Dump Design
- October 2023 Current Topography
- Original Ground

VWP Data
- Head Elevation

VWP Install Elevation
- VWP Install Elevation

Scale: 1:1,300

Vertical exaggeration: 1x

0m 100m

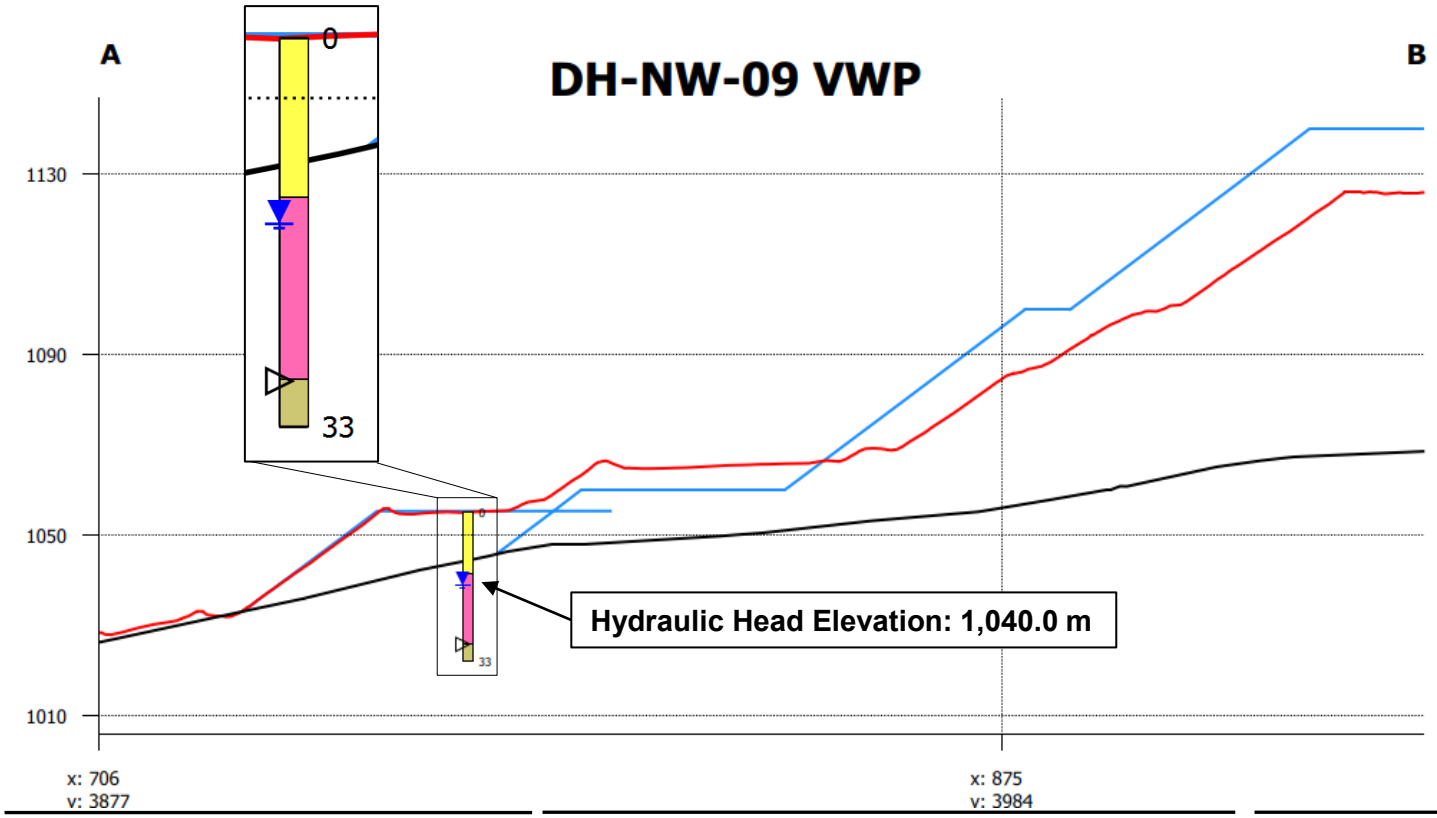

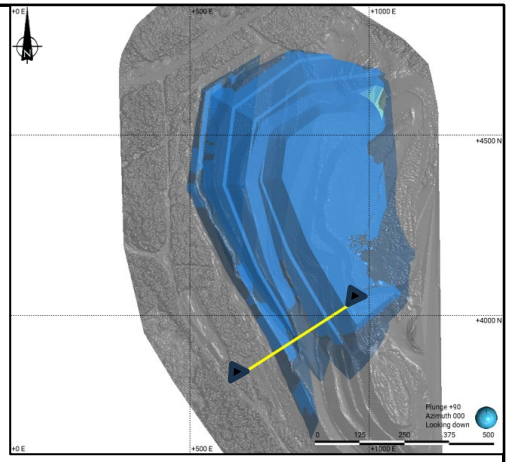

CROSS-SECTION LOCATION

REFERENCES AND NOTES

1. BOREHOLES SHOWN AT +/- 20 M OF CROSS-SECTION.
2. NOTE THAT THE ORIGINAL GROUND SURFACE MAY BE DIFFERENT THAN THE CURRENT TOPOGRAPHY SURFACE. THIS COULD BE DUE TO DIFFERING SCAN METHODOLOGIES OR SUBSURFACE MANIPULATION.
3. HYDRAULIC HEAD ELEVATION READING FROM APRIL 8, 2024 BY MPMC STAFF.

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MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-09 CROSS-SECTION
VIBRATING WIRE PIEZOMETER HYDRAULIC HEAD ELEVATION

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-13**

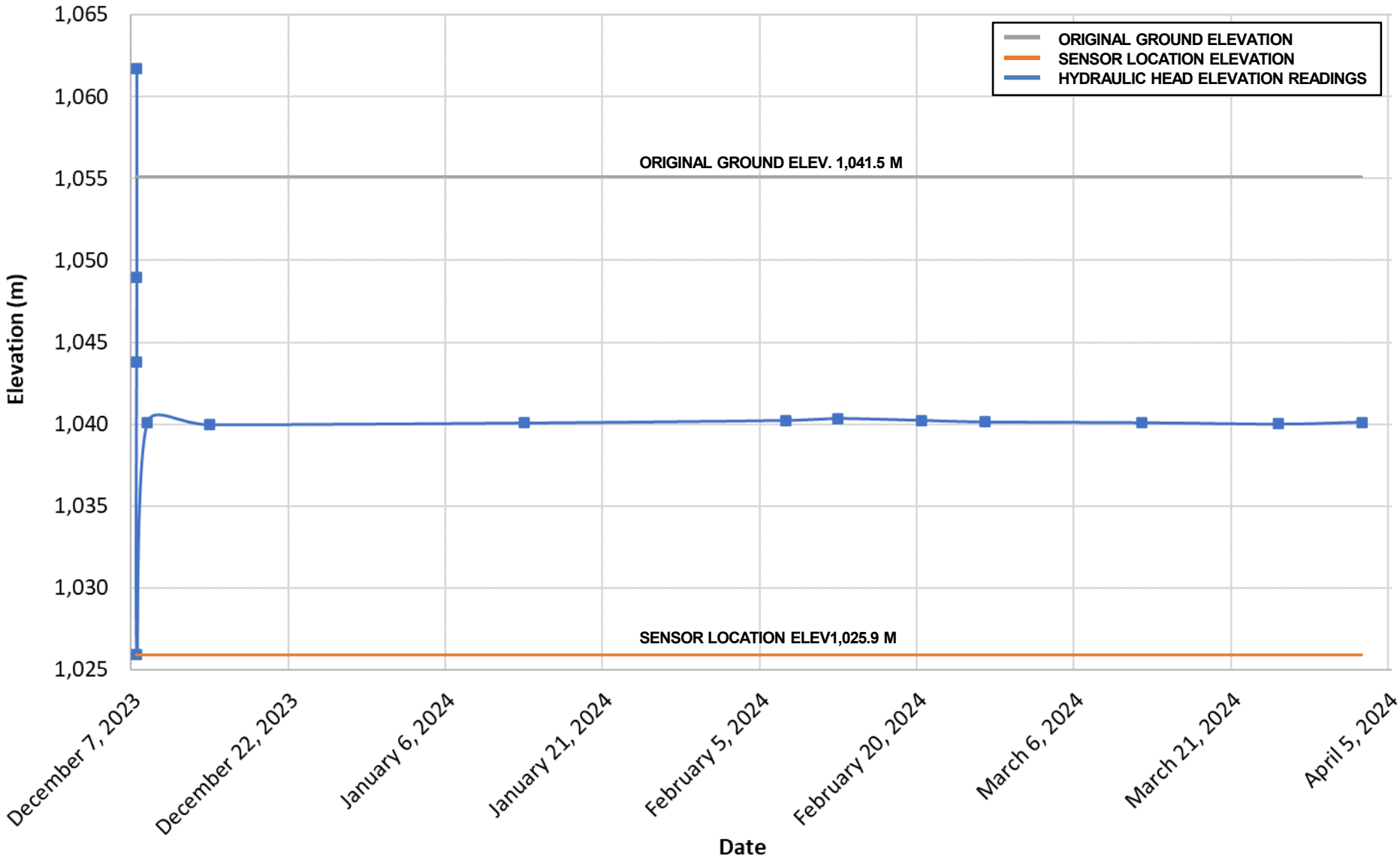

REFERENCES AND NOTES

1. HYDRAULIC HEAD READINGS FROM MPMC STAFF.

CLIENT
MOUNT POLLEY MINE CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

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PREPARED	CF
DESIGN	CF
REVIEW	AGH
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
DH-NW-09 VIBRATING WIRE PIEZOMETER
HYDRAULIC HEAD ELEVATION READINGS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**E-14**

APPENDIX F

Hazard Classification

Waste Rock Dump Stability Rating and Hazard Classification

A stability rating and hazard classification for the proposed ultimate NW PAG Dump was carried out using the Waste Dump and Stockpile Stability Rating and Hazard Classification (WSRHC) method (Hawley and Cunning 2017). This system evaluates 22 factors and attributes that are thought to affect waste dump and stockpile stability. The following general steps are carried out in a WSRHC assessment:

1) The regional setting, foundation conditions, and material quality of the stockpile are assessed and assigned values. The individual values are summed, and a numerical Engineering Geology Index (EGI) is determined.

2) The geometry and mass, stability analyses, construction, and performance attributes are assessed and assigned values. The values are summed, and a Design and Performance Index (DPI) is determined.

Table F-1: Waste Dump and Stockpile Stability Rating Breakdown (Hawley and Cunning 2017)

Engineering Geology Index (EGI)	Design and Performance Index (DPI)
Regional setting (max 10 pts.) ▪ Seismicity (0-2) ▪ Precipitation (0-8)	Geometry and mass (max 10 pts.) ▪ Height (0-4) ▪ Slope (0-4) ▪ Volume and mass (0-2)
Foundation conditions (max 20 pts.) ▪ Foundation slope (0-5) ▪ Foundation shape (0-2) ▪ Overburden type (0-4) ▪ Overburden thickness (0-2) ▪ Undrained failure potential (-20-0) ▪ Foundation liquefaction potential (-20-0) ▪ Bedrock (0-4) ▪ Groundwater (0-3)	Stability Analysis (max 10 pts.) ▪ Static stability (0-7) ▪ Dynamic stability (0-3) Construction (max. 15 pts.) ▪ Construction method (0-8) ▪ Loading rate (0-7)
Material quality (max 20 pts.) ▪ Gradation (0-7) ▪ Intact strength and durability (0-8) ▪ Material liquefaction potential (-20-0) ▪ Chemical stability (-5 to +5)	Performance (max 15pts.) ▪ Stability performance (-15 to +15)

3) The EGI and DPI are summed to establish a Waste Rock and Stockpile Stability Rating (WSR). The WSR is then classified within one of five Waste Rock and Stockpile Hazard Classes (WHC). Higher values of WSR indicate relatively low instability hazards.

Table F-2: Summary of Waste Dump and Stockpile Stability Rating and Hazard Classification System (Hawley and Cunning 2017)

Waste Rock and Stockpile Stability Rating (WSR)	Waste Rock and Stockpile Hazard Class (WHC)	Instability Hazard
80 – 100	I	Very Low Hazard
60 – 80	II	Low Hazard
40 – 60	III	Moderate Hazard
20 – 40	IV	High Hazard
0 – 20	V	Very High Hazard

Additional details on the WSRHC methodology, including a detailed explanation of each of the indices and the sub-parameters can be found in Chapter 3 of Hawley and Cunning (2017).

The classification for the proposed ultimate NW PAG Dump is presented in Table F-3.

Table F-3: Waste Dump and Stockpile Stability Rating and Hazard Classification Rating Summary for the Proposed Ultimate NW PAG Dump

Index	Group	Factor	Rating	Description	Notes	Source
Engineering Geology Index (EGI)	Regional Setting	Seismicity	1.5	Low	Maximum Credible Earthquake PGA=0.116g, based on 1 in 10,000 return period	WSP USA 2023
		Precipitation	4	350-1000 mm	Average precipitation = 612 mm	Golder 2022b
	Foundation Conditions	Foundation Slope	4	5 – 15 º (Gentle)	Based on topographic assessment	Original site topography
		Foundation Shape	1	Gentle slope	Planar slope with no lateral confinement	Original site topography
		Overburden Type	3	Type IV	Variable till	WSP 2024b
		Overburden Thickness	0	>5 m	Overburden thicknesses measured up to approximately 24 m deep	WSP 2024b
		Undrained Failure Potential	-2.5	Low	Based on dense till foundation	WSP 2024b
		Foundation Liquefaction Potential	0	Negligible	Dense till	Assessment in this geotechnical report for the foundation soils.
		Bedrock	2	Type C	Moderately competent; GSI/RMR 40-60	WSP 2024b
		Groundwater	0	High	Groundwater table at surface; artesian conditions encountered	WSP 2024b
	Material Quantity	Gradation	5	Coarse	Based on SERDS and expectation of fines mixed in waste rock	WSP 2024a
		Intact Strength and Durability	6	Type 4	Strong to very strong rock	Golder 2016a
		Material Liquefaction Potential	0	Negligible	Well graded materials	WSP 2024b
		Chemical Stability	2.5	Mildly reactive	PAG rock	-
Design and Performance Index (DPI)	Geometry & Mass	Height	2.5	Low-Moderate	25 to 50 m high lifts	Based on proposed ultimate NW PAG Dump design and October 2023 current topography
		Slope Angle	2	Moderate	27-degree slope	Based on proposed ultimate NW PAG Dump design
		Volume and Mass	1	Medium	2.07e7	Based on proposed ultimate NW PAG Dump design
	Stability Analysis	Static Stability	5	1.3 – 1.5	Slope Stability Analyses Results	-
		Dynamic Stability	3	>1.15	Slope Stability Analyses Results	-
	Construction	Construction Method	6	Method IV	Lifts are at a maximum height of 40 m	Based on proposed ultimate NW PAG Dump design
		Loading Rate	3.5	Moderate	Assumed	-
	Performance	Stability Performance	7.5	Good	Minor settlement has occurred along access haul ramp to lifts	Golder 2013c, Golder 2016a, Golder 2017, WSP 2023a, WSP 2023c
Engineering Geology Index Subtotal			**26.5**			
Design and Performance Index Subtotal			**30.5**			
Waste Dump Stability Rating (WSR)			**57**			
Waste Dump Hazard Class (WHC)			**III**			

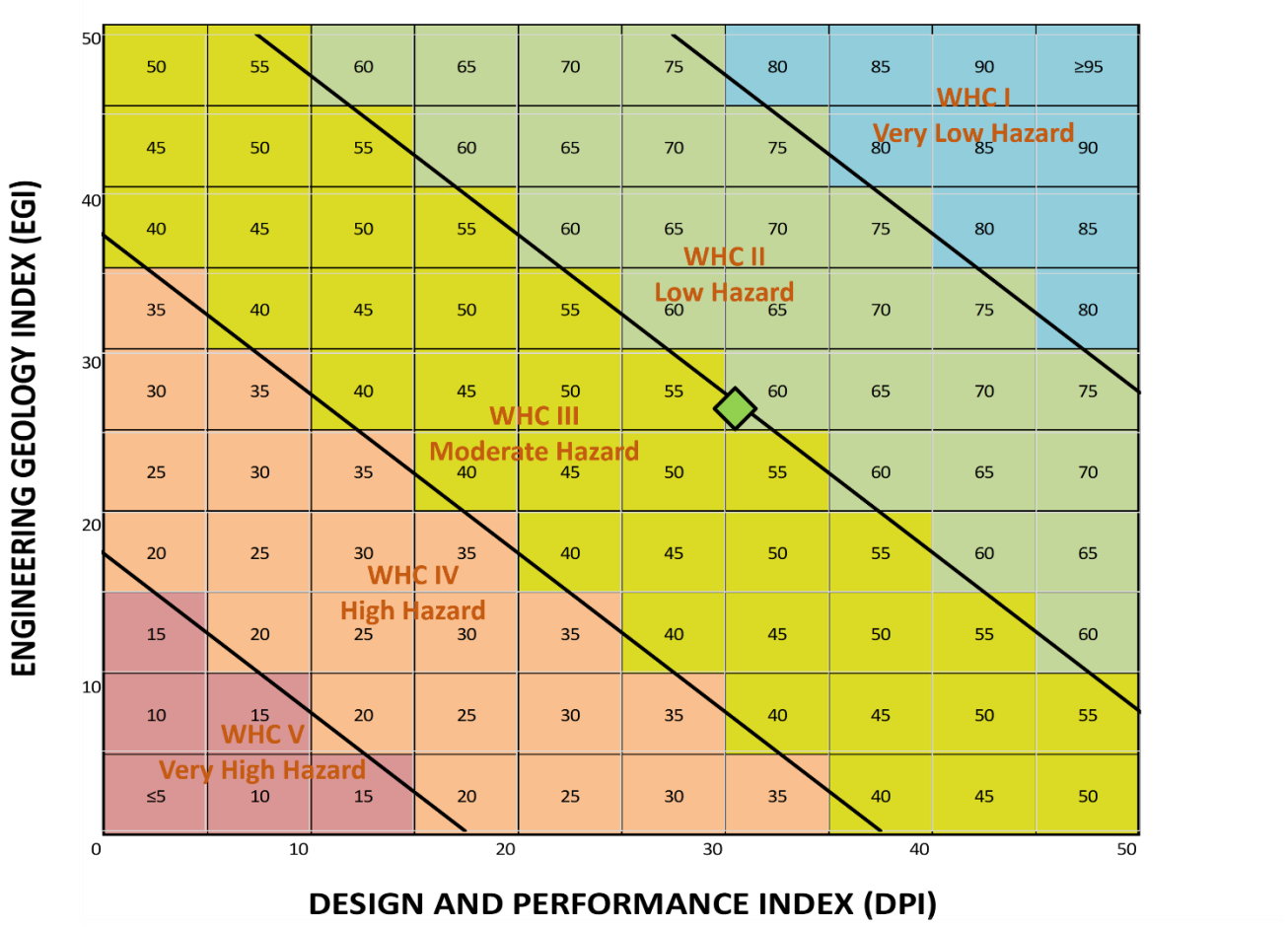

Illustration F-1: Proposed Ultimate NW PAG Dump WSRHC Chart

APPENDIX G

Slope Stability Analyses

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m^3)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL/COLLUVIUM		22	MOHR-COULOMB: $\phi = 34°$; $c = 0$ kPa
BEDROCK		IMPENETRABLE	

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.4-1.5	**1.6**
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.3	**1.5**

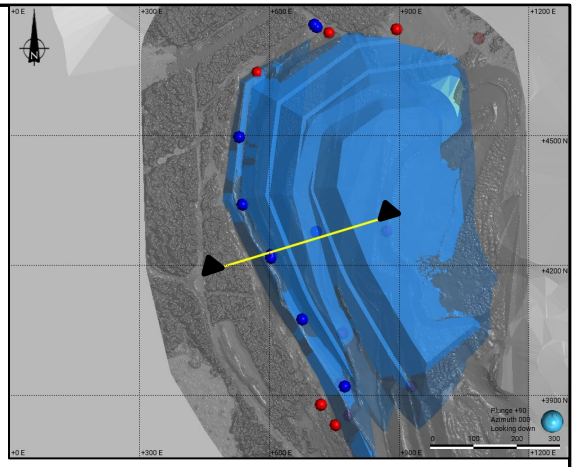

CROSS-SECTION LOCATION

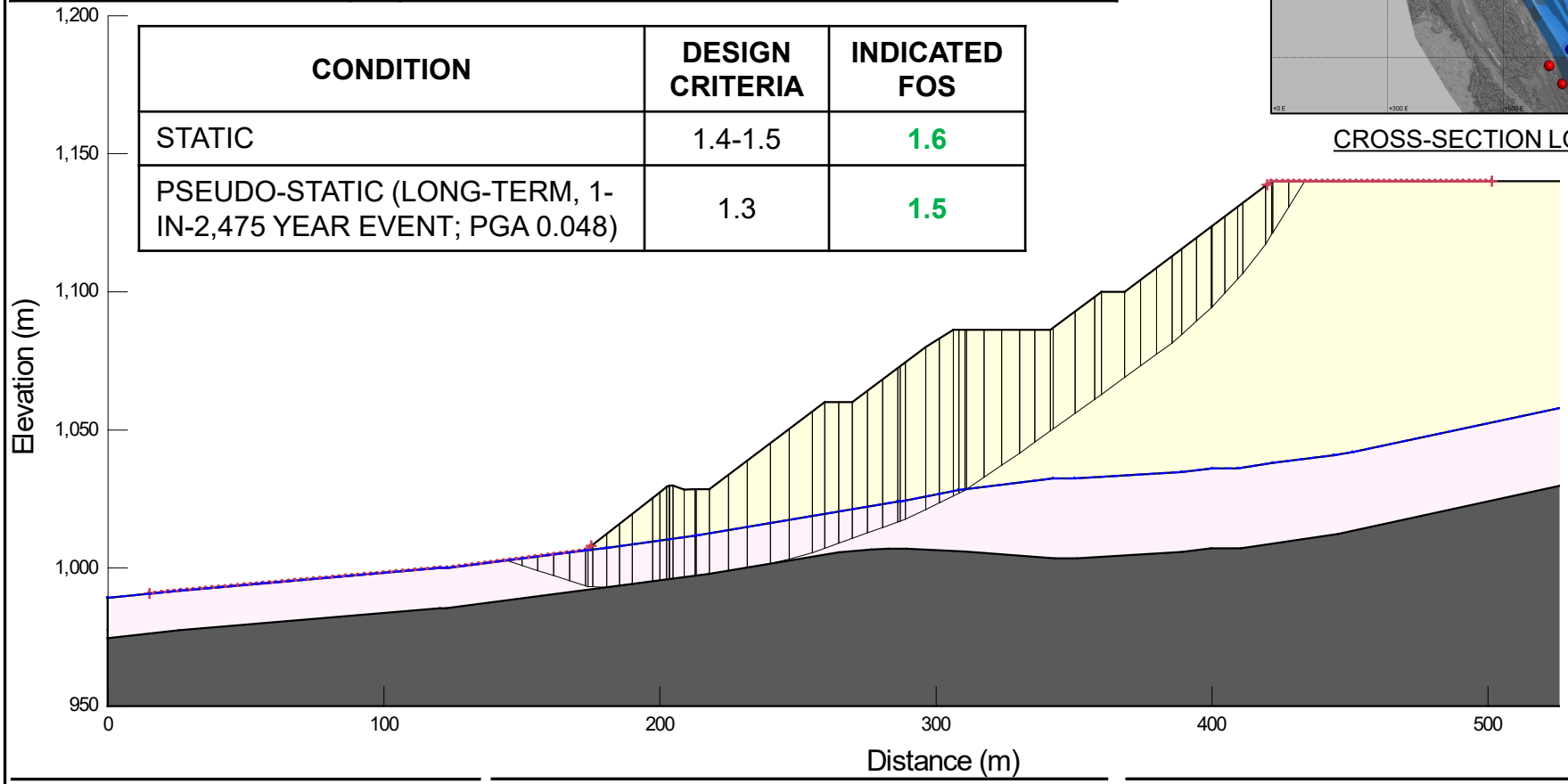

REFERENCES AND NOTES

1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION E OVERALL SLOPE STABILITY MODEL
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-1**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL/COLLUVIUM		22	MOHR-COULOMB: $\phi = 34°$; c = 0 kPa
BEDROCK		IMPENETRABLE	

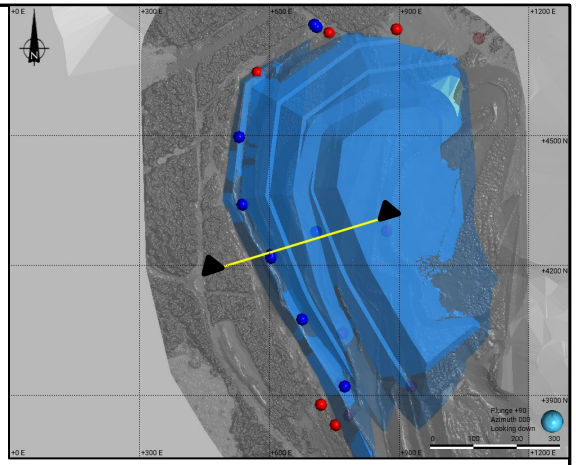

CROSS-SECTION LOCATION

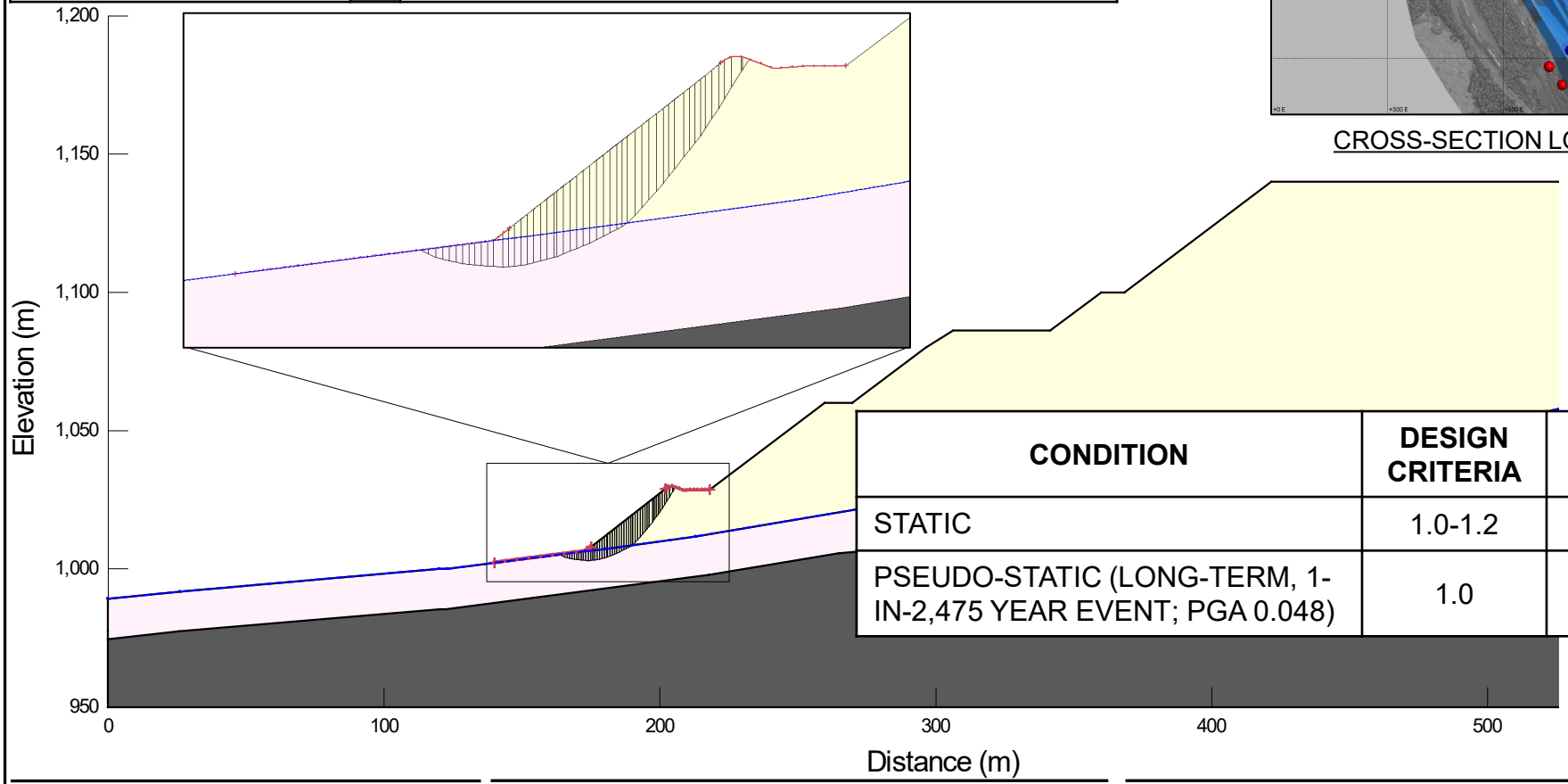

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.0-1.2	1.4
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.0	1.3

REFERENCES AND NOTES

1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.

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PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION E LOWER LIFT SLOPE STABILITY MODEL
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-2**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL/COLLUVIUM		22	MOHR-COULOMB: $\phi = 34°$; $c = 0$ kPa
BEDROCK		IMPENETRABLE	

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.4-1.5	**1.6**
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.3	**1.5**

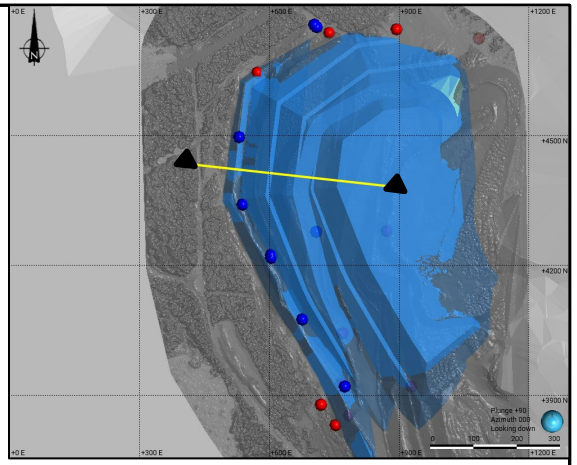

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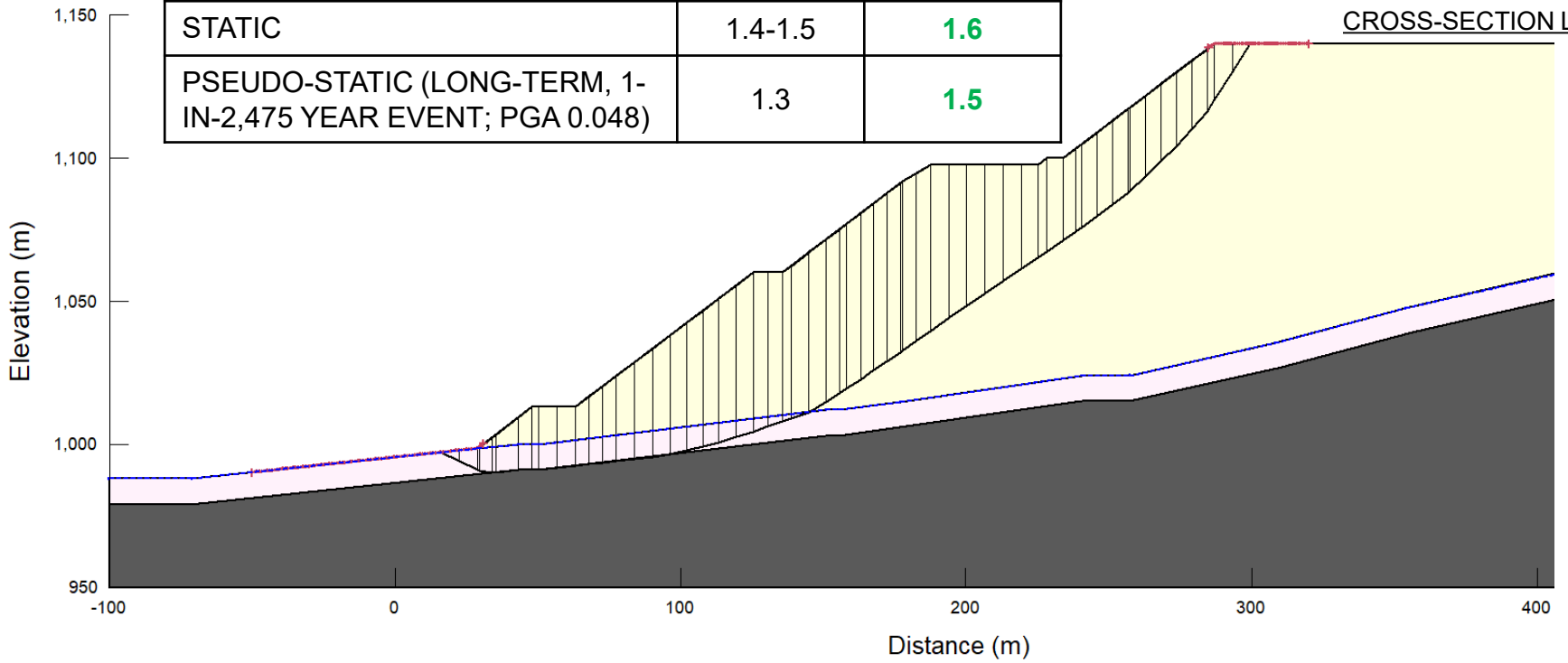

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2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.

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MOUNT POLLEY MINE
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PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION G OVERALL SLOPE STABILITY MODEL
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-3**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL/COLLUVIUM		22	MOHR-COULOMB: $\phi = 34°$; $c = 0$ kPa
BEDROCK		IMPENETRABLE	

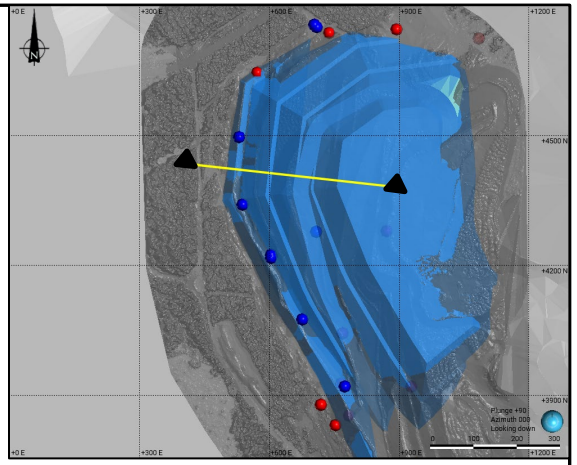

CROSS-SECTION LOCATION

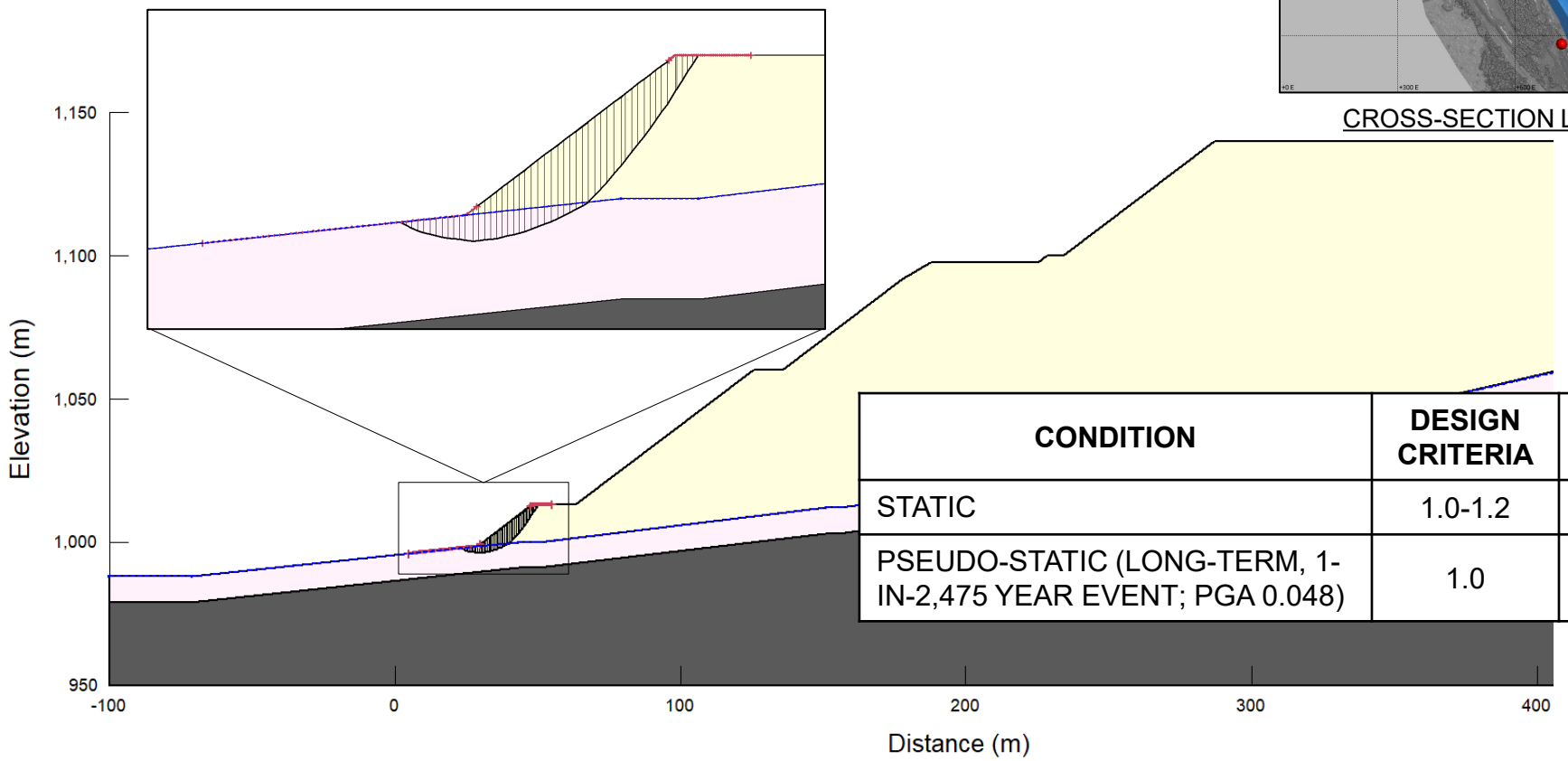

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.0-1.2	1.5
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.0	1.4

REFERENCES AND NOTES

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PREPARED	AJB
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REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION G LOWER LIFT SLOPE STABILITY MODEL
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-4**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m^3)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL (LOWER BOUND)		22	MOHR-COULOMB: $\phi = 32.5°$; $c = 0$ kPa
BEDROCK		IMPENETRABLE	

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.4-1.5	1.6
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.3	1.5

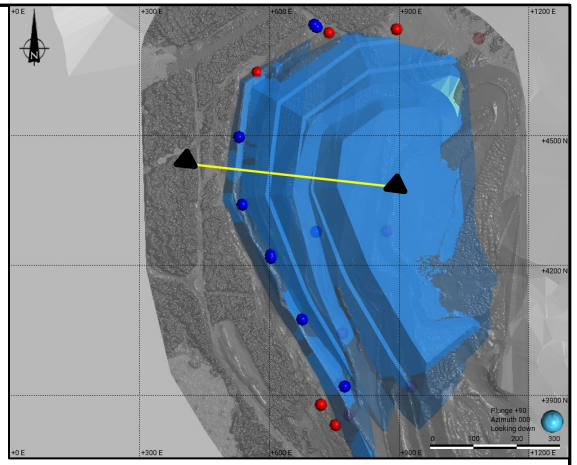

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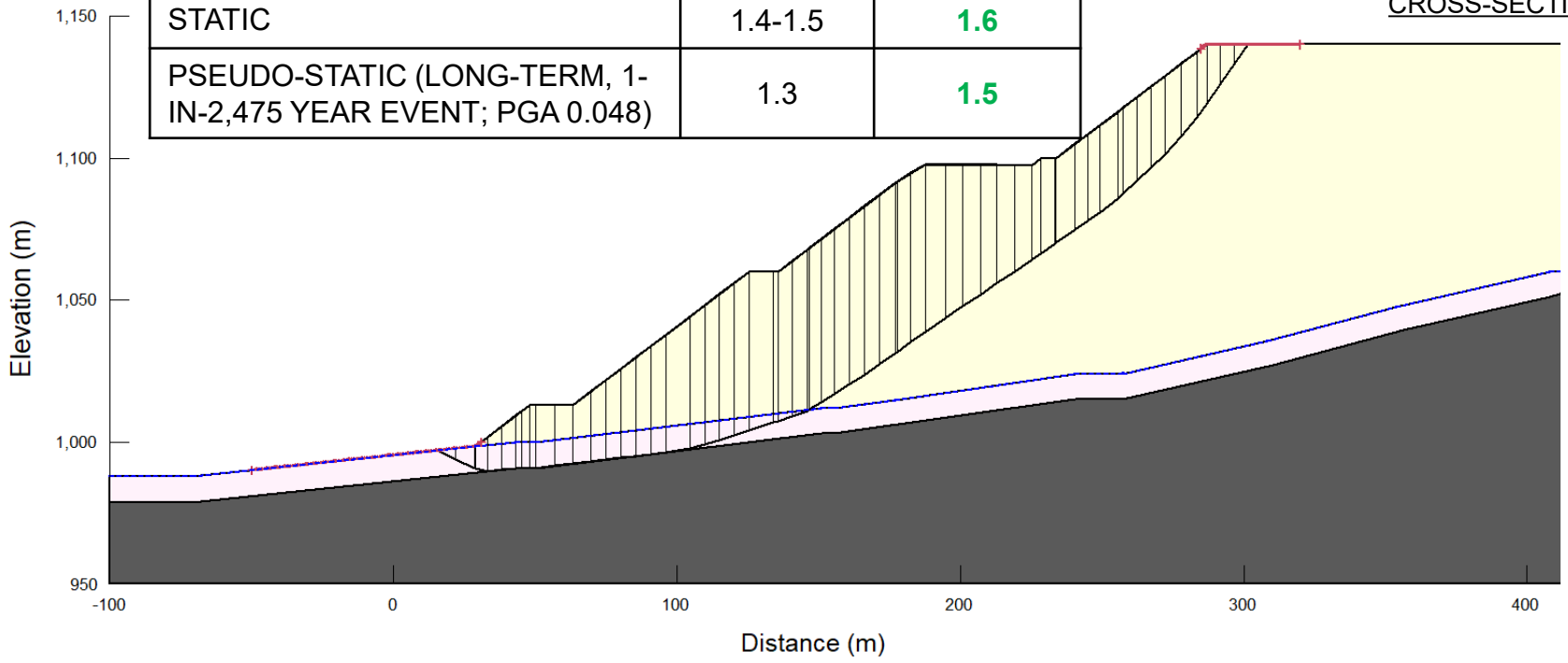

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1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION G OVERALL SLOPE STABILITY MODEL
LOWER BOUND TILL STRENGTH PROPERTIES
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-5**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL (LOWER BOUND)		22	MOHR-COULOMB: $\phi = 32.5°$; $c = 0$ kPa
BEDROCK		IMPENETRABLE	

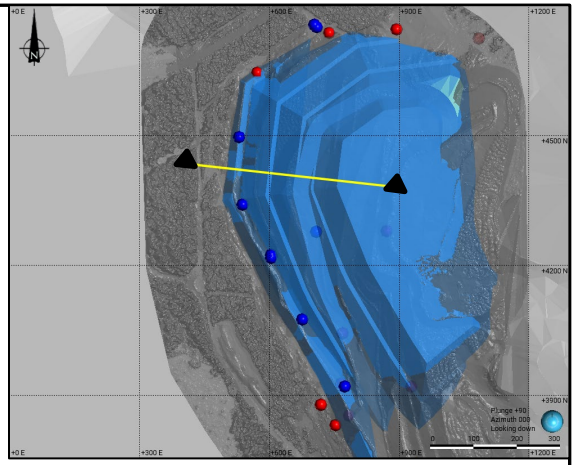

CROSS-SECTION LOCATION

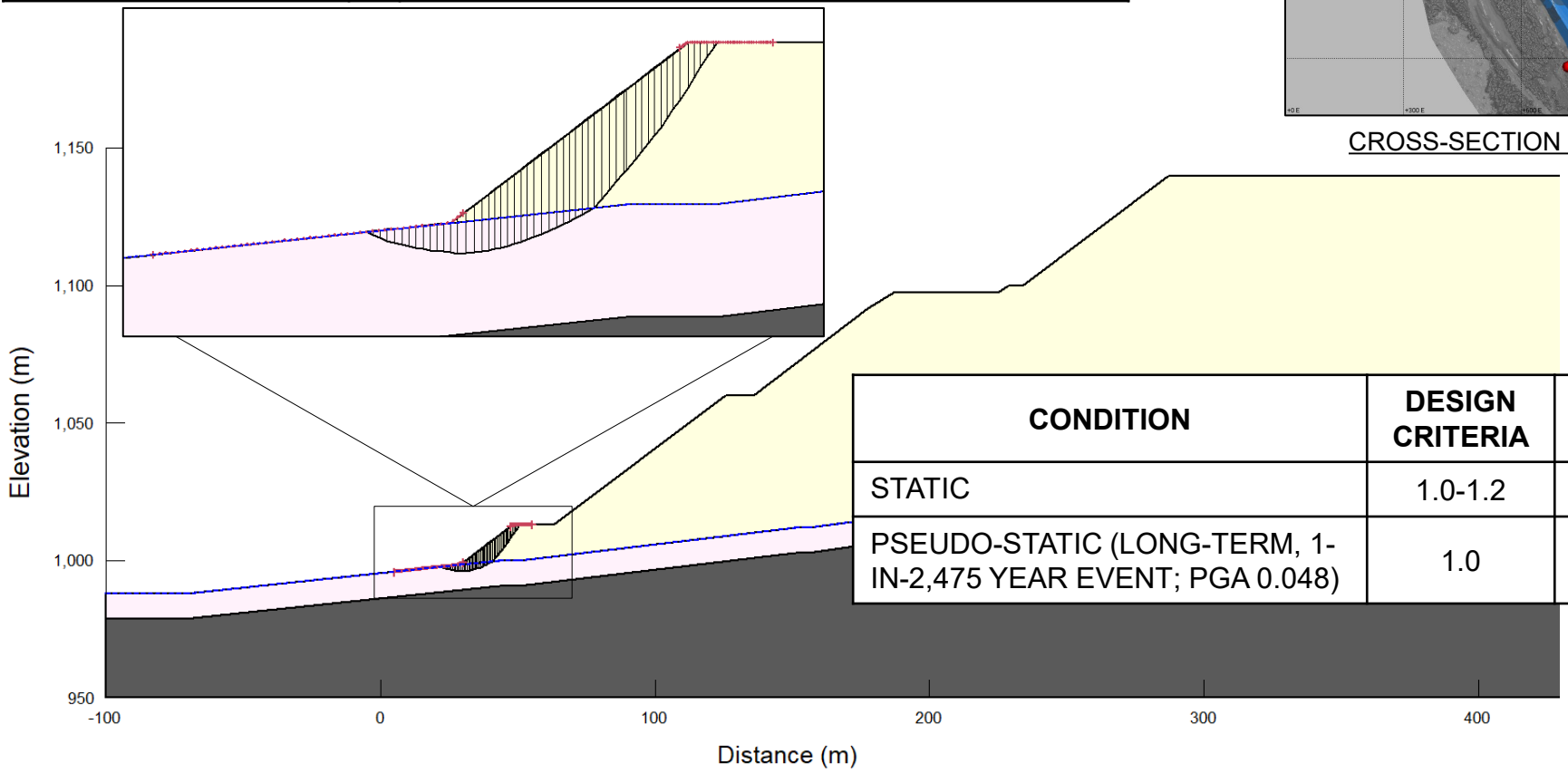

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.0-1.2	**1.4**
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.0	**1.3**

REFERENCES AND NOTES

1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION G LOWER LIFT SLOPE STABILITY MODEL
LOWER BOUND TILL STRENGTH PROPERTIES
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-6**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL (LOWER BOUND)		22	MOHR-COULOMB: $\phi = 32.5°$; c = 0 kPa
GLACIOFLUVIAL		22	MOHR-COULOMB: $\phi = 34°$; c = 0 kPa
BEDROCK		IMPENETRABLE	

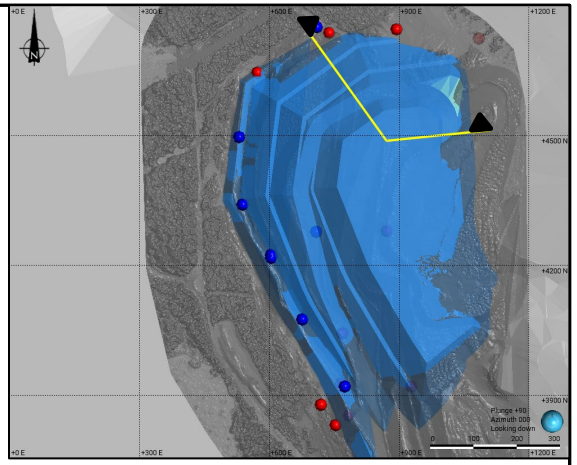

CROSS-SECTION LOCATION

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.4-1.5	**1.6**
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.3	**1.5**

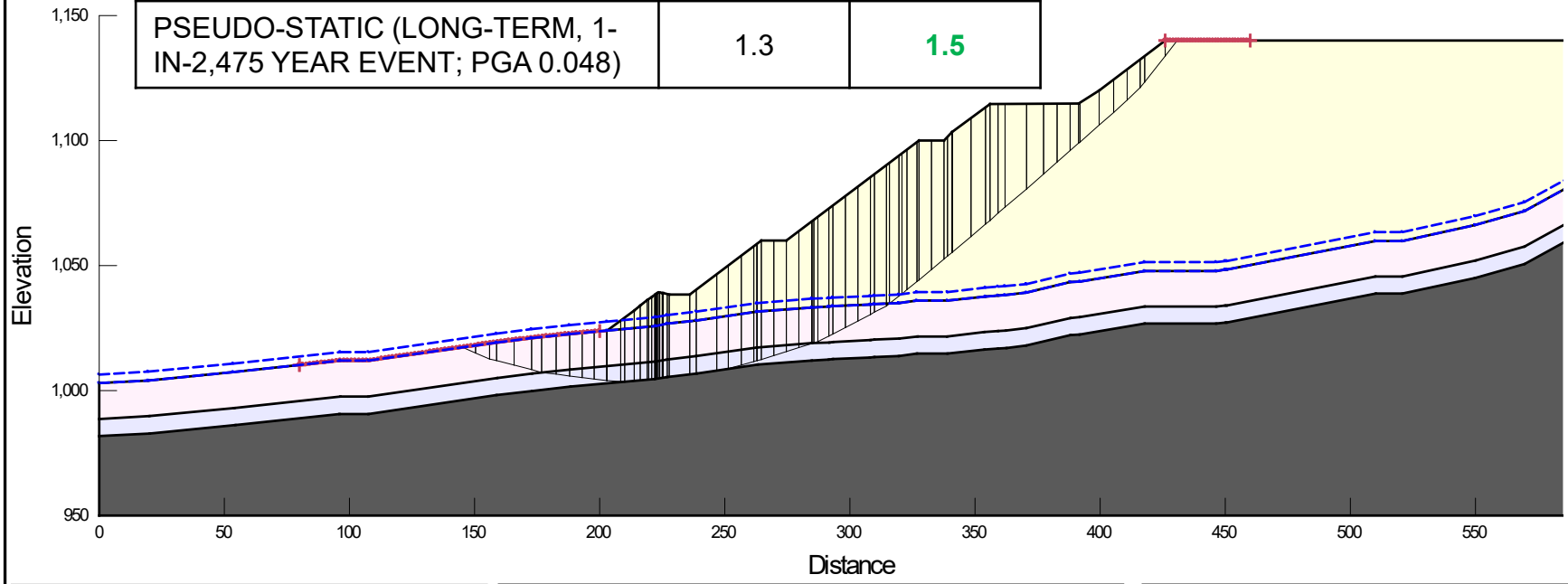

REFERENCES AND NOTES

1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.
4. ARTESIAN CONDITIONS MODELLED BY APPLYING WATER TABLE 3.5 M ABOVE FOUDNATION SOILS. APPLIED TO GLACIOFLUVIAL MATERIAL ONLY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION J OVERALL SLOPE STABILITY MODEL
ARTESIAN CONDITIONS FOR GLACIOFLUVIAL DEPOSITS
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-7**

MATERIAL PROPERTIES		
MATERIAL TYPE	**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK	19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
TILL (LOWER BOUND)	22	MOHR-COULOMB: $\phi = 32.5°$; c = 0 kPa
GLACIOFLUVIAL	22	MOHR-COULOMB: $\phi = 34°$; c = 0 kPa
BEDROCK	IMPENETRABLE	

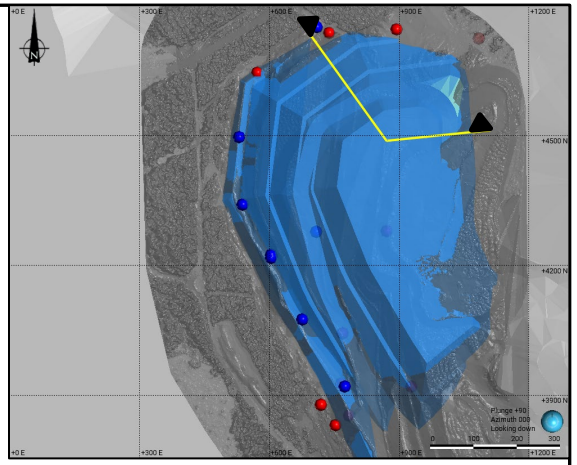

CROSS-SECTION LOCATION

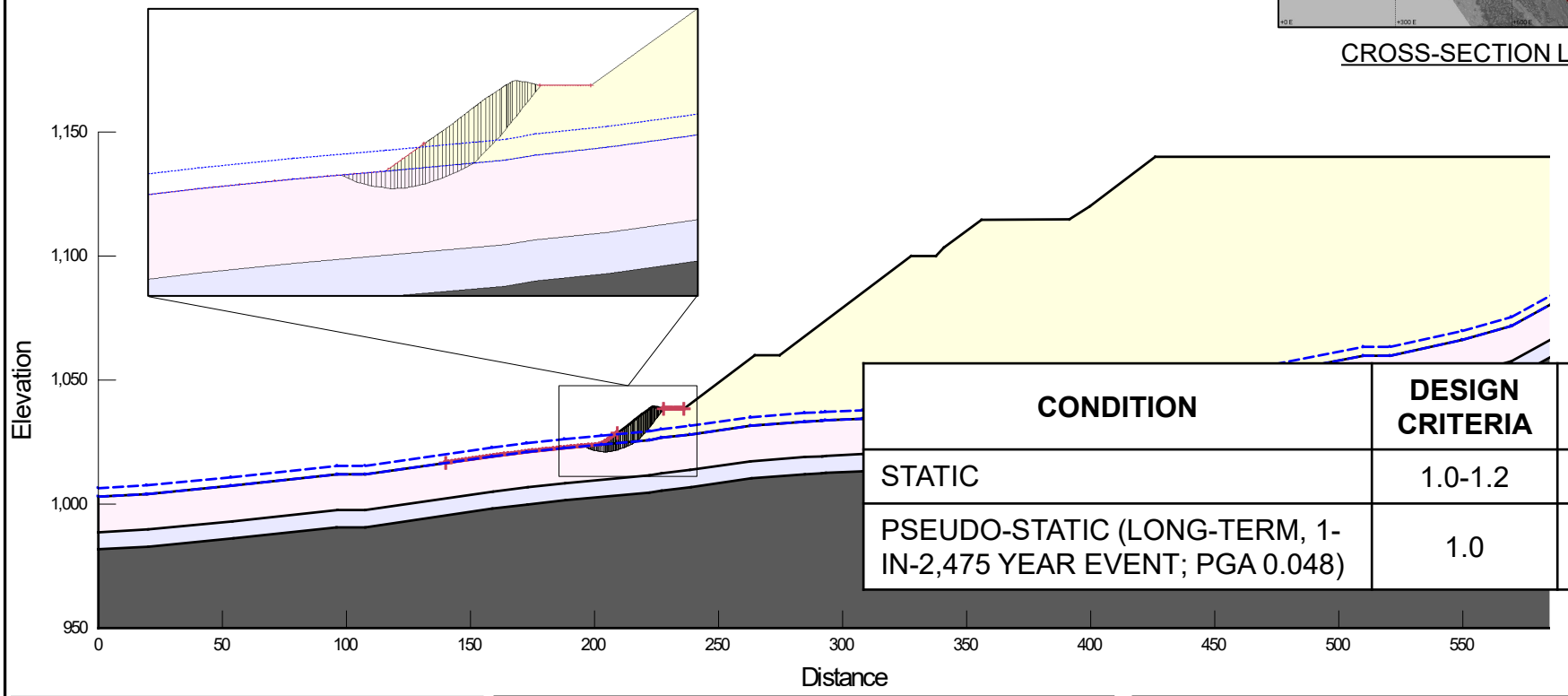

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.0-1.2	1.5
PSEUDO-STATIC (LONG-TERM, 1-IN-2,475 YEAR EVENT; PGA 0.048)	1.0	1.5

REFERENCES AND NOTES

1. FOR PSEUDO-STATIC ANALYSIS, ONE-HALF THE PEAK GROUND ACCELERATION IS USED (½ X 0.048g = 0.024g) (HYNES-GRIFFIN AND FRANKLIN 1984).
2. SLIP SURFACES PRESENTED ARE STATIC ANALYSIS RESULTS.
3. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.
4. ARTESIAN CONDITIONS MODELLED BY APPLYING WATER TABLE 3.5 M ABOVE FOUDNATION SOILS. APPLIED TO GLACIOFLUVIAL MATERIAL ONLY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
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YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION J LOWER LIFT SLOPE STABILITY MODEL
ARTESIAN CONDITIONS FOR GLACIOFLUVIAL DEPOSITS
STATIC AND PSEUDO-STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-8**

MATERIAL PROPERTIES			
MATERIAL TYPE		**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK		19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
CLAY MATERIAL		20	MOHR-COULOMB: ϕ = 20 TO 35°; c = 0 kPa
TILL/COLLUVIUM		22	MOHR-COULOMB: ϕ = 34°; c = 0 kPa
GLACIOFLUVIAL		22	MOHR-COULOMB: ϕ = 34°; c = 0 kPa
BEDROCK		IMPENETRABLE	

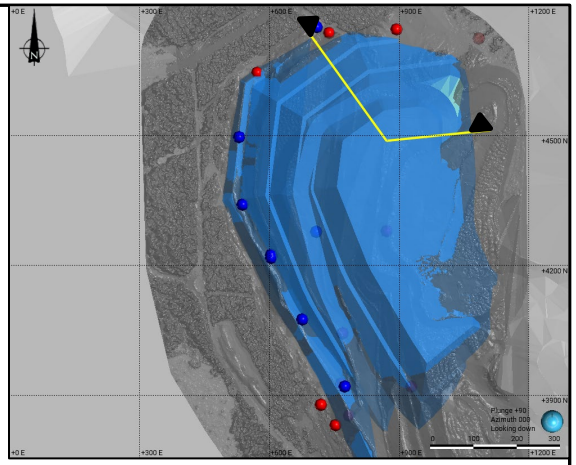

CROSS-SECTION LOCATION

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.4-1.5	**1.5-1.7**

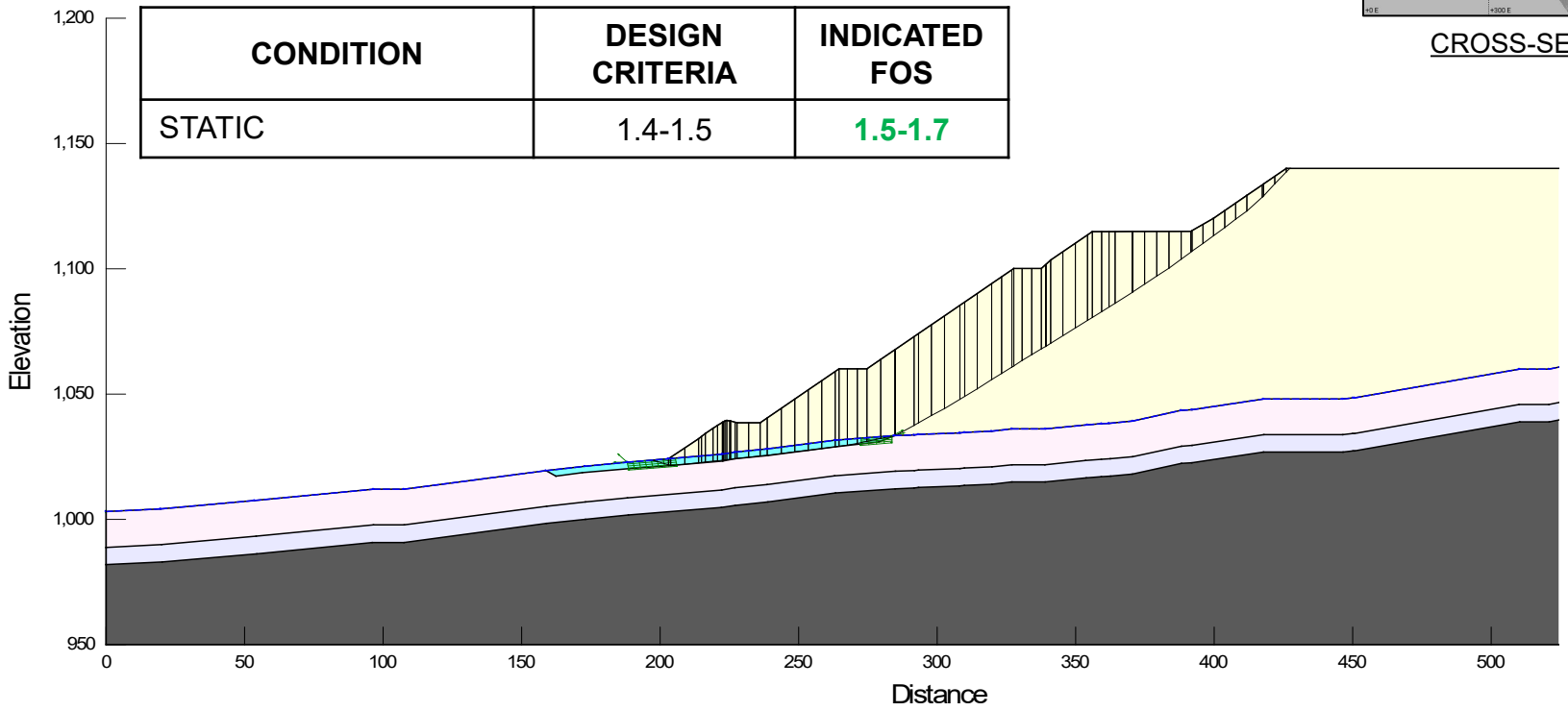

REFERENCES AND NOTES

1. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.
2. SLIP SURFACE FOR CLAY MATERIAL PRESENTED IS ϕ = 30°.

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LIKELY, BC

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PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION J OVERALL SLOPE STABILITY MODEL
SENSITIVITY ANALYSIS FOR STRENGTH OF CLAY MATERIAL
STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-9**

MATERIAL PROPERTIES		
MATERIAL TYPE	**UNIT WEIGHT (kN/m³)**	**STRENGTH PARAMETERS**
WASTE ROCK	19.6	SHEAR STRENGTH: $\tau = 1.726\sigma^{0.899}$
CLAY MATERIAL	20	MOHR-COULOMB: ϕ = 20 TO 35°; c = 0 kPa
TILL/COLLUVIUM	22	MOHR-COULOMB: ϕ = 34°; c = 0 kPa
GLACIOFLUVIAL	22	MOHR-COULOMB: ϕ = 34°; c = 0 kPa
BEDROCK	IMPENETRABLE	

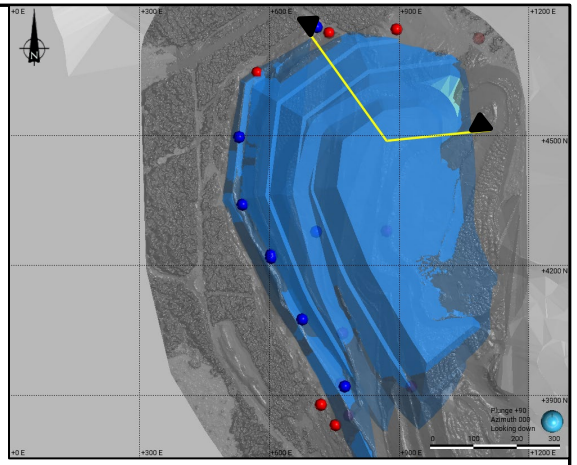

CROSS-SECTION LOCATION

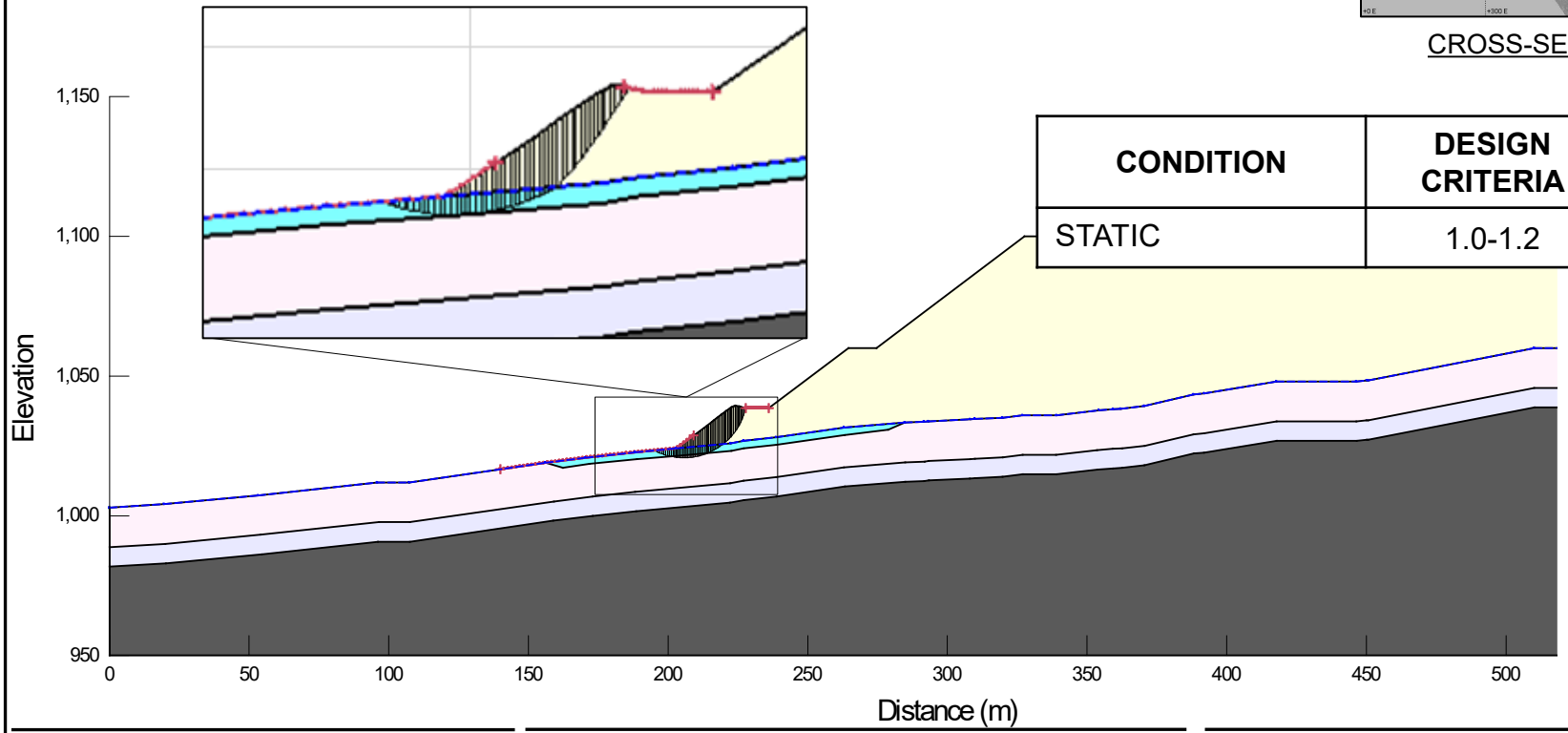

CONDITION	DESIGN CRITERIA	INDICATED FOS
STATIC	1.0-1.2	1.0-1.5

REFERENCES AND NOTES

1. WASTE ROCK ASSUMED FREE-DRAINING. WATER TABLE MODELLED AT FOUNDATION SOILS SURFACE.
2. SLIP SURFACE FOR CLAY MATERIAL PRESENTED IS ϕ = 30°.

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MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CROSS-SECTION J LOWER LIFT SLOPE STABILITY MODEL
SENSITIVITY ANALYSIS FOR STRENGTH OF CLAY MATERIAL
STATIC SLOPE STABILITY RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**G-10**

APPENDIX H

Runout Analyses

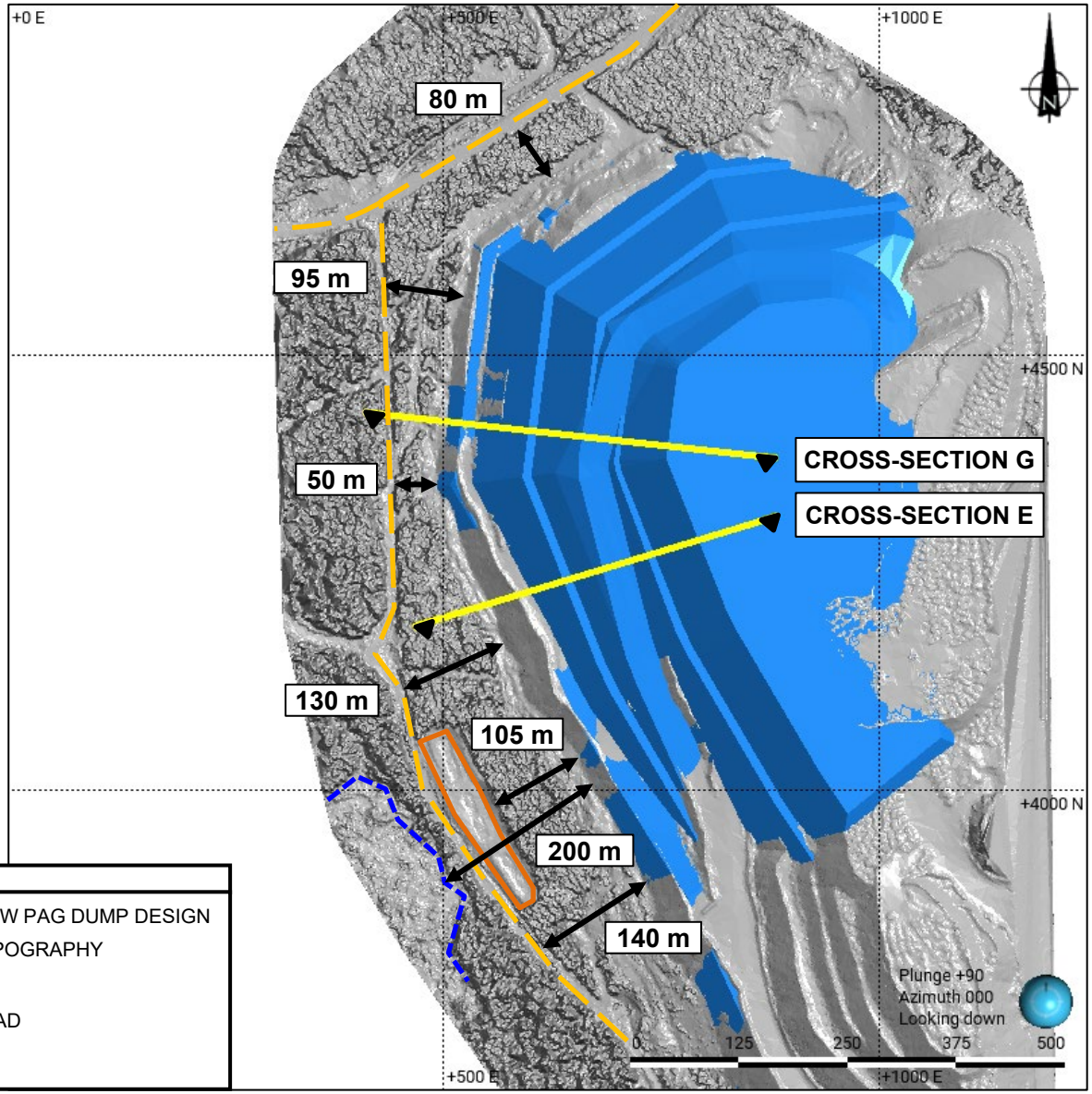

LEGEND

- PROPOSED ULTIMATE NW PAG DUMP DESIGN
- OCT 2023 CURRENT TOPOGRAPHY
- SETTLING PONDS
- BOOTJACK ACCESS ROAD
- BOOTJACK LAKE

REFERENCES AND NOTES

1. OCT 2023 CURRENT TOPOGRAPHY PROVIDED BY MPMC, RECEIVED 2023-10-18. FILE NAME: 231008-NPP.dxf.
2. PROPOSED ULTIMATE NW PAG DUMP DESIGN PROVIDED BY MPMC, RECEIVED 2023-04-06. FILE NAME: z - NWPAG_PAGlifts-v3.dxf.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
PROPOSED ULTIMATE NW PAG DUMP DESIGN
CRITICAL INFRASTRUCTURE

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**H-1**

MATERIAL		MODEL CONDITION	UNIT WEIGHT (kN/m³)	DYNAMIC FRICTION ANGLE (DEGREES)	INTERNAL FRICTION ANGLE (DEGREES)
WASTE ROCK		DRY (INTERNAL)	19.6	33.5	37
FOUNDATION SOIL		DRY (BASAL)	22	19	N/A
		WET (BASAL)		14	

LEGEND

- PREDICTED RUNOUT DISTANCE - DRY
- PREDICTED RUNOUT DISTANCE - WET
- KEY INFRASTRUCTURE (SEE NOTES IN PRE-RUNOUT SURFACE)

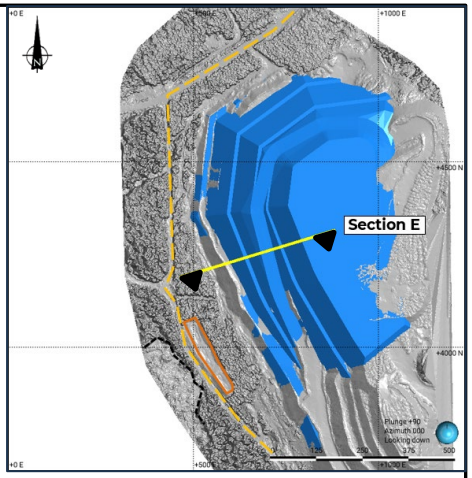

CROSS-SECTION LOCATION

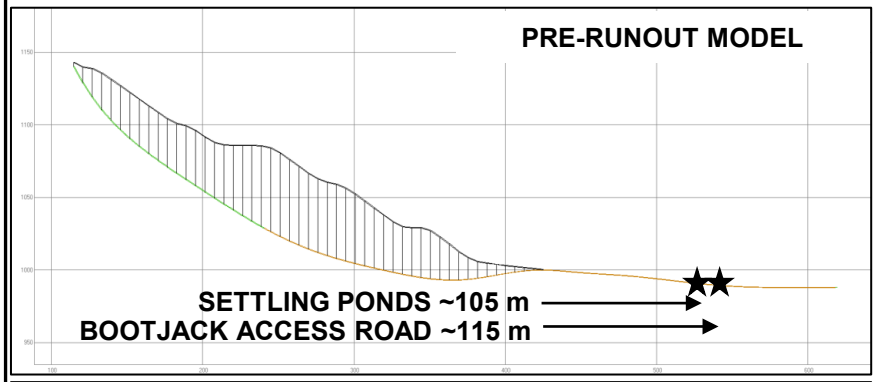

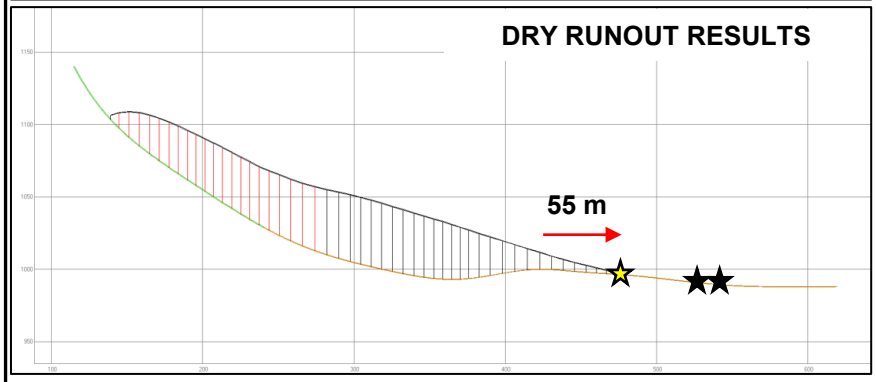

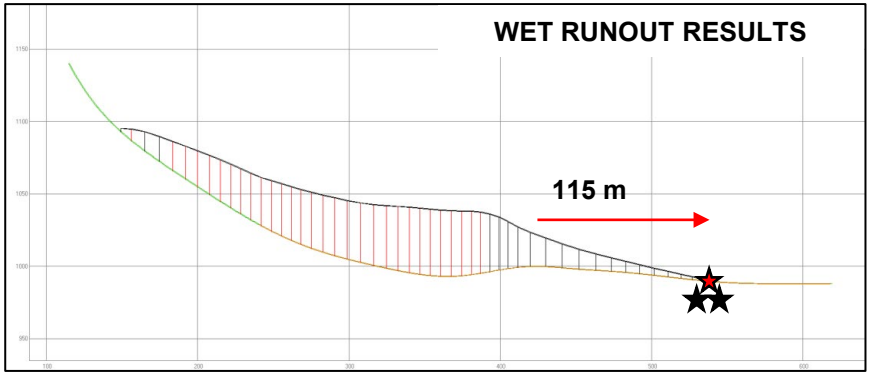

REFERENCES AND NOTES

1. SIMPLIFIED (SMOOTHED) GEOMETRY USED FOR THE RUNOUT PATH OVER THE DOWNSTREAM TOPOGRAPHY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION E
RUNOUT MODEL OVERALL SLOPE FAILURE
RUNOUT RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	H-2

MATERIAL		MODEL CONDITION	UNIT WEIGHT (kN/m³)	DYNAMIC FRICTION ANGLE (DEGREES)	INTERNAL FRICTION ANGLE (DEGREES)
WASTE ROCK		DRY (INTERNAL)	19.6	33.5	37
FOUNDATION SOIL		DRY (BASAL)	22	19	N/A
		WET (BASAL)		14	

LEGEND

- PREDICTED RUNOUT DISTANCE - DRY
- PREDICTED RUNOUT DISTANCE - WET
- KEY INFRASTRUCTURE (SEE NOTES IN PRE-RUNOUT SURFACE)

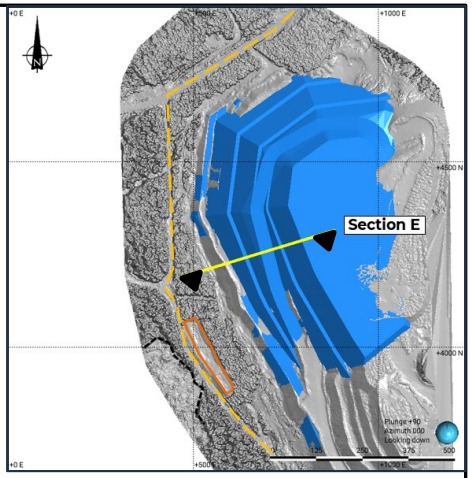

CROSS-SECTION LOCATION

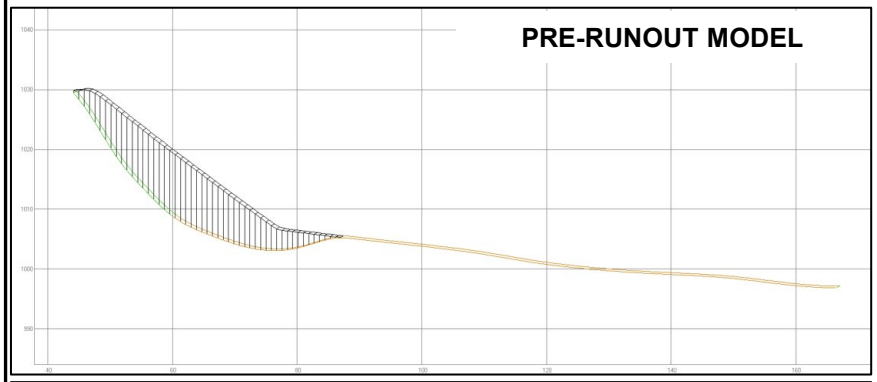

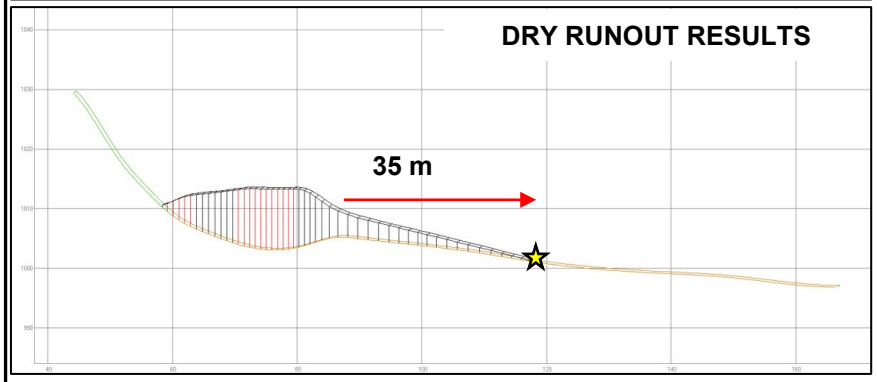

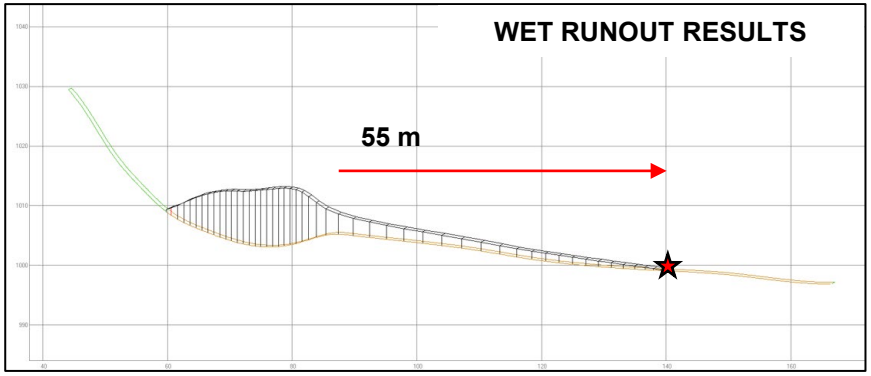

REFERENCES AND NOTES

1. SIMPLIFIED (SMOOTHED) GEOMETRY USED FOR THE RUNOUT PATH OVER THE DOWNSTREAM TOPOGRAPHY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION E
RUNOUT MODEL LOWER LIFT SLOPE FAILURE
RUNOUT RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	H-3

MATERIAL		MODEL CONDITION	UNIT WEIGHT (kN/m³)	DYNAMIC FRICTION ANGLE (DEGREES)	INTERNAL FRICTION ANGLE (DEGREES)
WASTE ROCK		DRY (INTERNAL)	19.6	33.5	37
FOUNDATION SOIL		DRY (BASAL)	22	19	N/A
		WET (BASAL)		14	

LEGEND

- PREDICTED RUNOUT DISTANCE - DRY
- PREDICTED RUNOUT DISTANCE - WET
- KEY INFRASTRUCTURE (SEE NOTES IN PRE-RUNOUT SURFACE)

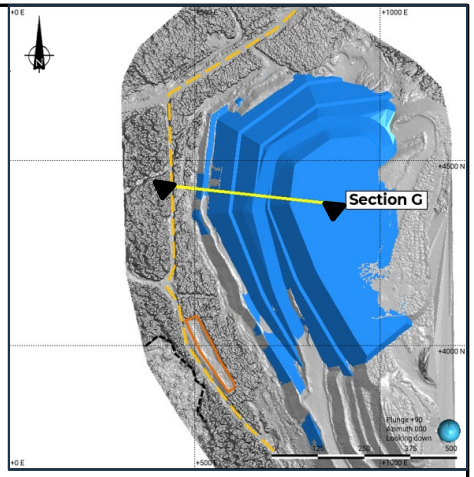

CROSS-SECTION LOCATION

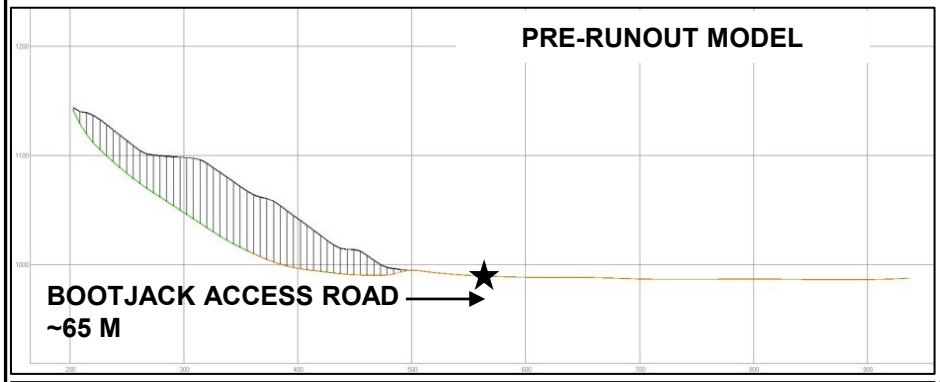

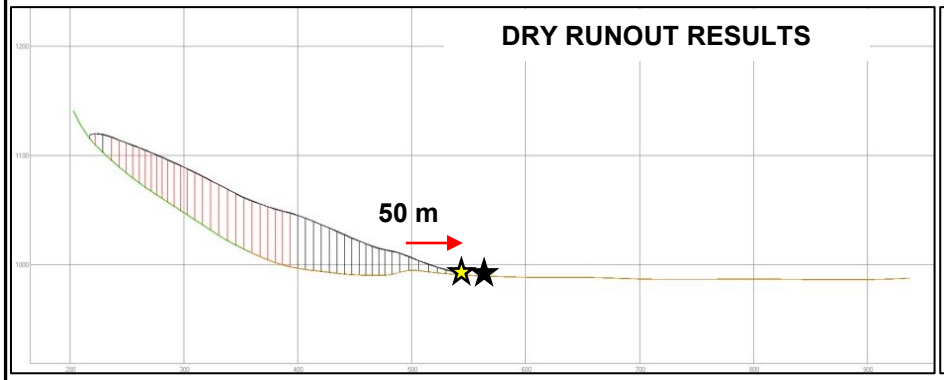

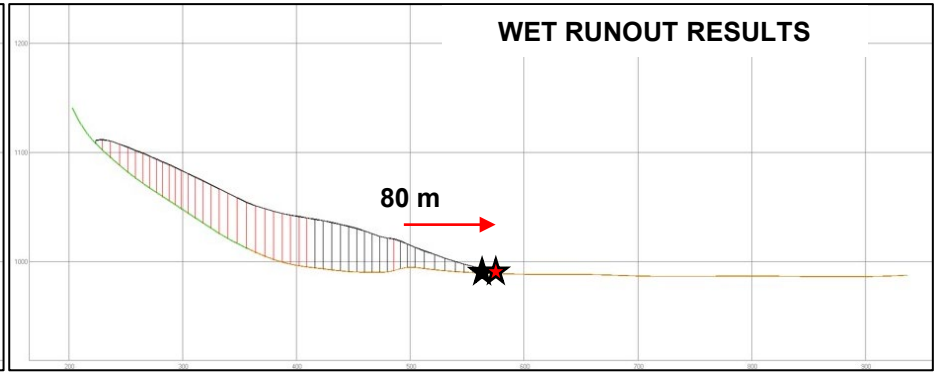

REFERENCES AND NOTES

1. SIMPLIFIED (SMOOTHED) GEOMETRY USED FOR THE RUNOUT PATH OVER THE DOWNSTREAM TOPOGRAPHY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION G
RUNOUT MODEL OVERALL SLOPE FAILURE
RUNOUT RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	75100/75192	0	H-4

MATERIAL		MODEL CONDITION	UNIT WEIGHT (kN/m³)	DYNAMIC FRICTION ANGLE (DEGREES)	INTERNAL FRICTION ANGLE (DEGREES)
WASTE ROCK		DRY (INTERNAL)	19.6	33.5	37
FOUNDATION SOIL		DRY (BASAL)	22	19	N/A
		WET (BASAL)		14	

LEGEND

- PREDICTED RUNOUT DISTANCE - DRY
- PREDICTED RUNOUT DISTANCE - WET
- KEY INFRASTRUCTURE (SEE NOTES IN PRE-RUNOUT SURFACE)

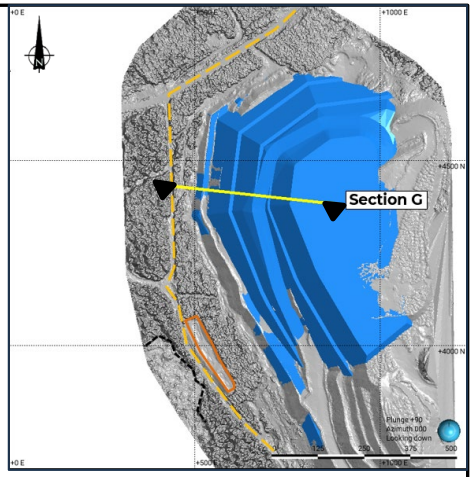

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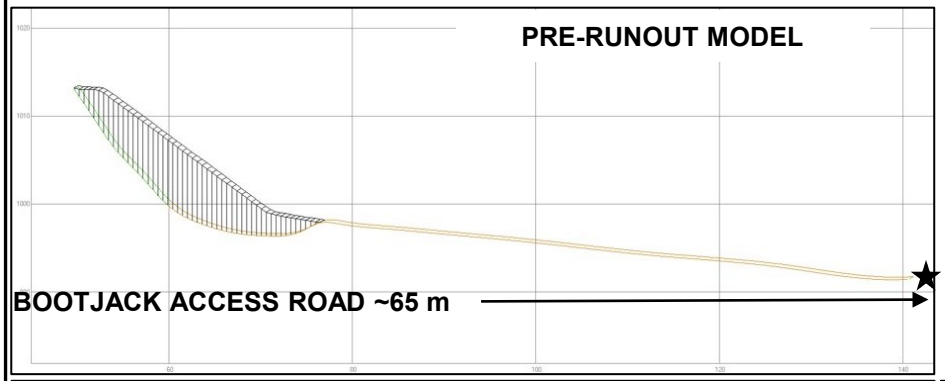

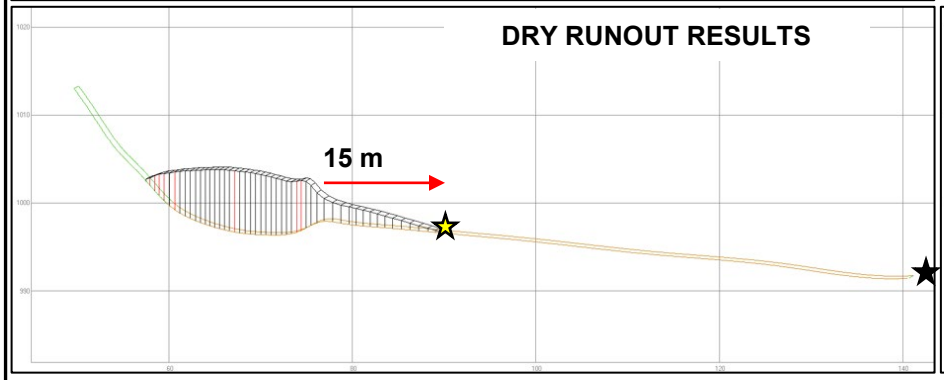

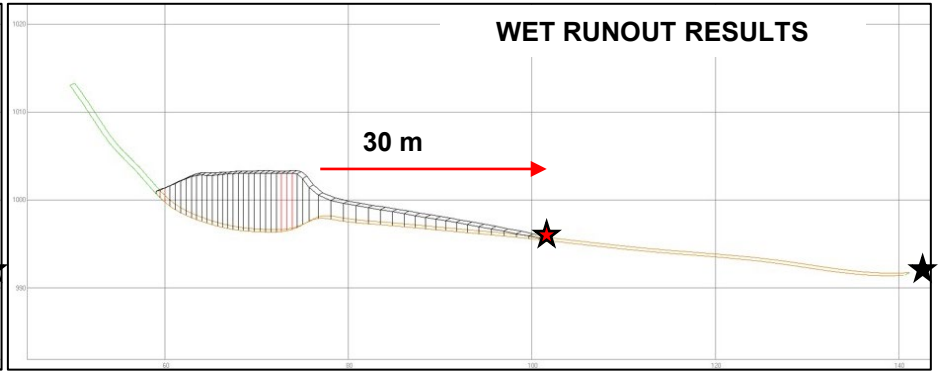

REFERENCES AND NOTES

1. SIMPLIFIED (SMOOTHED) GEOMETRY USED FOR THE RUNOUT PATH OVER THE DOWNSTREAM TOPOGRAPHY.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-04-08
PREPARED	AJB
DESIGN	AJB
REVIEW	MVK
APPROVED	AGH

PROJECT
NORTHWEST POTENTIALLY ACID GENERATING DUMP
GEOTECHNICAL ASSESSMENT

TITLE
CROSS-SECTION G
RUNOUT MODEL LOWER LIFT SLOPE FAILURE
RUNOUT RESULTS

PROJECT No.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**75100/75192**	**0**	**H-5**



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APPENDIX 3-3: Life of Mine Open Pit Design Review

REPORT

Mount Polley Mine

Life of Mine Open Pit Design Review

Submitted to:

Mount Polley Mining Corporation

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Reference No. CA0020527.4505-035-R-Rev0-81115

May 29, 2024

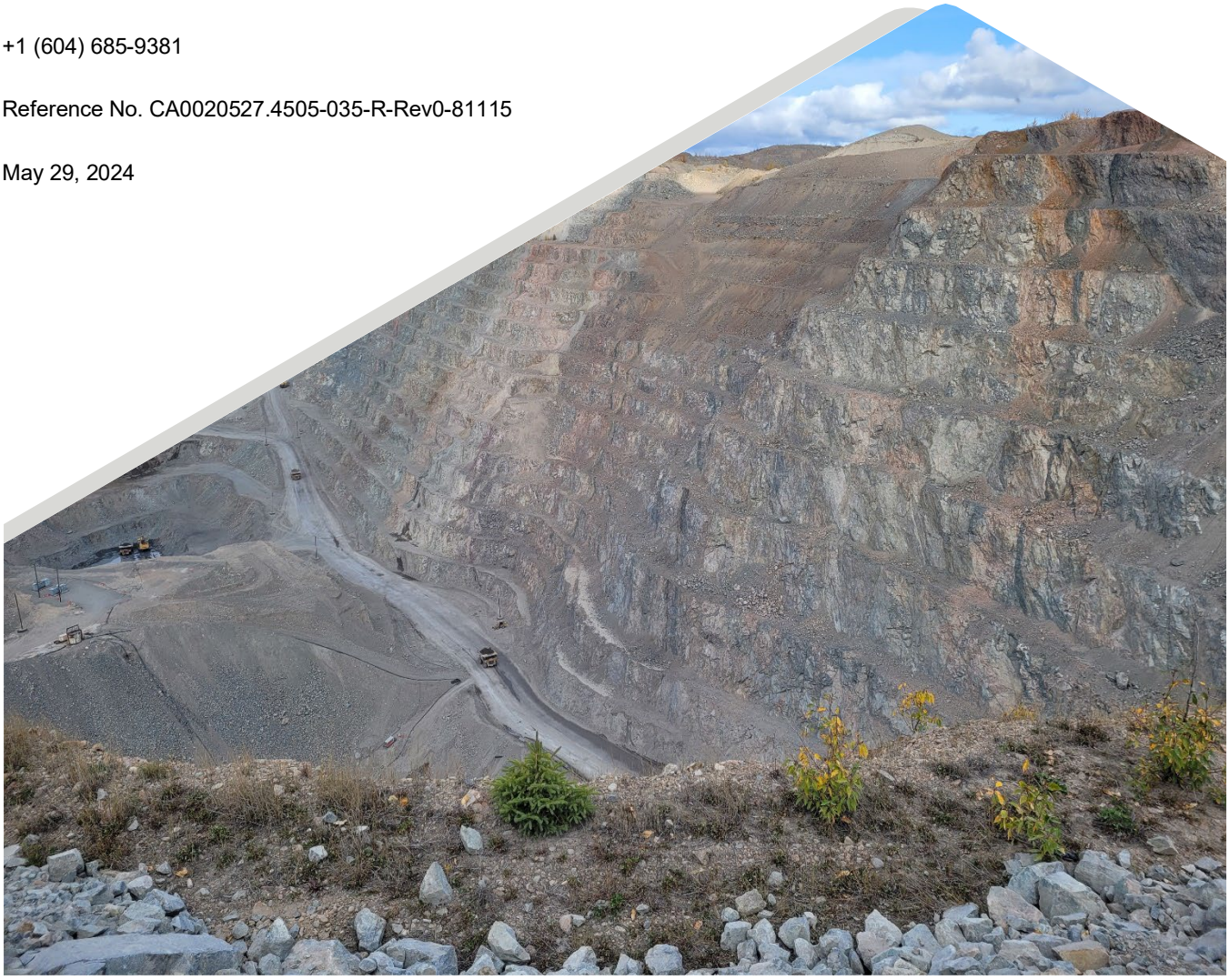

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Executive Summary

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to support a Life of Mine (LOM) geotechnical assessment for the open pits at the Mount Polley Mine which is located approximately 56 km northeast of the town of Williams Lake, British Columbia. The proposed ultimate pit design was provided by MPMC in October 2023. MPMC are currently mining copper and gold ore from the Springer Pit at the Mount Polley Mine, and are planning to expand the Springer, Cariboo, C2, and WX Pits through 2032.

This report presents the following:

- A review of the mine layout and geology.
- A summary of the current status of the open pits and the pit wall slope stability performance.
- A description of the proposed pit wall pushbacks, the interim, and the ultimate open pit designs.
- A discussion of the engineering geology.
- A discussion of the factors that are expected to control the slope stability of the proposed ultimate pit design.
- A discussion of the kinematics analyses methodology and results. Slope design recommendations are provided based on the kinematic analyses results.
- A summary of overall slope stability analyses for the open pits.
- A review of the proximity of the proposed ultimate pit design crest to the Northwest Potentially Acid Generating (NW PAG) Dump.
- A discussion of operational considerations while mining the proposed ultimate pit design.
- A summary of conclusions and recommendations.

Current Performance

The pit wall slope stability performance of the Springer, Cariboo, C2, and WX Pits has been documented by WSP during annual slope stability reviews of the open pits. The most recent slope stability review was completed in September 2023 (WSP 2023). In general, the Springer, Cariboo, C2, and WX Pits are exhibiting good slope stability performance with no signs of overall slope instability. Many benches have broken back to discontinuous moderately dipping structures; however, adequate catchment remains on the majority of the benches.

Proposed Open Pit Development

MPMC are proposing five expansions to the open pits at Mount Polley Mine including Springer Phase 5 (Sp-5), Springer Phase 6 (Sp-6), Springer Phase 6 Ramp Retreat (Sp-6-RR), WX, C-2-B, and the Cariboo Ramp Retreat (Car-RR). These expansions create the proposed ultimate pit design (SP-6/WX).

Engineering Geology

Based on the current geological interpretation, the proposed ultimate pit design will be excavated through similar rock types as have been observed in the current pit walls. The following rock types are expected to be exposed on the various ultimate open pit design walls:

- Springer Pit
  - The west and south walls will be excavated through monzonite.
  - The north nose and northeast walls of the ultimate pit will be excavated through diorite and hydrothermal breccias (mineralized zone).
  - The upper part of the south end of the northeast wall will be excavated through the Bell Pit rehandle waste rock slope.
- Cariboo Pit
  - The east wall of the pushback will be excavated through monzonite.
  - The pit bottom will be mined further into breccia (mineralized zone) and monzonite.
- C2 Pit will be mined through mineralized breccias.
- WX Pit will be mined through monzonite and hydrothermal breccias (mineralized zone).

Several major continuous faults are interpreted to exist in the area of the open pits and have been exposed along the current pit walls.

In addition to the major faults, the rocks in the open pits also contain other geologic structures in the form of faults, dykes, and joint sets. The orientations of these structures have been determined through the following campaigns:

- Geotechnical mapping programs that have been carried out on an annual basis between 2008 and 2016, as well as 2023.
- Televiewer surveys carried out in boreholes that were drilled in the C2 Pit area in 2006.
- Photogrammetry carried out in 2014 and 2024.

In general, the structural sets identified in the 2016 LOM assessment (Golder 2016) remain similar to the sets identified in this 2024 LOM assessment.

Data from select exploration boreholes drilled by MPMC between 2004 and 2012 in the areas of the Springer, Cariboo, C2, and WX Pits were reviewed. The field estimate rock strengths from the exploration borehole review are comparable to the field estimate rock strengths presented in the 2016 LOM assessment which were based on 1997, 2008, 2009, 2010, 2011, and 2014 geotechnical mapping programs (Golder 2016). Overall, the RMR_{76} values calculated using the updated 2024 dataset are comparable to those calculated for the 2016 LOM assessment.

Based on the current understanding of the hydrogeology in the area of the open pits, some water pressures are expected to exist within the pit walls during excavation of the proposed ultimate pit design.

The geotechnical domains for the 2024 LOM assessment of the proposed ultimate pit design are presented in Figure 10 and have been determined based on pit area and geology.

Summary of Conclusions and Recommendations

Kinematic stability analyses have been carried out to assess the potential for single bench, double bench, and inter-ramp scale planar, wedge, and toppling instability of the proposed ultimate pit design provided by MPMC. Bench design configurations are presented in Table E-1 and Table E-2, and Figure 14.

Table E-1: Summary of Springer/WX Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Bench Width (m)	Rationale
Monzodiorite	280	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	330	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	056	24	65	46.5	11.5	Double benching in southwest wall acceptable with shallower BFA controlled by Set 5A.
Breccia	035	24	70	50	11.5	Double benching in breccia (particularly in the WX Pit) in the southwest and west walls.
	085	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	097	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	220	12	70	43	8.5	Single benches recommended due to confluence of several faults in the northeast wall in the breccia. Transition from double to single benches will be in the north corner of the Springer Pit.
Diorite	220	12	70	43	8.5	Single bench in the diorite to control raveling from Polley and Springer Faults.

Table E-2: Summary of Cariboo/C2 Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Bench Width (m)	Rationale
Monzodiorite	195	12	70	43	8.5	Single benches in Polley Fault.
	238	12	70	43	8.5	Single benches due to toppling along East Cariboo Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA. Double benches acceptable along southeast wall of Cariboo/C2 Pits.
Breccia	188	24	70	49	12	Double benches in C2 Pit.
	195	12	70	43	8.5	Single benches in Polley Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA.

The following slope design considerations are based on the proposed ultimate pit bench design recommendations:

- The proposed SP-5 design will mine through the inactive Bell Dump along the northeast wall of the ultimate pit in two areas (Figure 17). Single benching with an overall slope angle of 37 degrees will be required through the waste rock rehandle slopes in these areas.
- The proposed Sp-5 design indicates double benches in the Cariboo Pit east wall where toppling failure is likely to occur in the weathered monzodiorite, east of the East Cariboo Fault, due to closely jointed/faulted rock (Figure 17). Previous toppling failure occurred in the area in 2017 and, as such, single benches have previously been recommended to the east of the East Cariboo Fault (the hangingwall). The Phase 5 pushback design is limited by the Bootjack mine access road which is located at the crest of the proposed double-benched east wall, increasing the consequence of a failure. Double benching in this area could impact the slope stability of the Bootjack mine access road and interfere will access to site due to the higher potential for toppling failure. Using a single bench configuration would require a reduction in the inter-ramp slope angle. Single benches are recommended in walls that are excavated in the East Cariboo Fault and to the east of the fault based on previous pit wall performance and proximity to the access road to Mount Polley Mine.
- The proposed Sp-6/WX design has at least two double benches at the bottom of the south/southeast wall, where single benches are recommended due to adverse structural conditions experienced in this wall previously (Figure 17).
- The proposed Sp-6/WX design contains a triple bench (36 m high bench) at the bottom of the southwest wall of the WX Pit below the ramp (Figure 17). A triple bench at the bottom of WX Pit would allow MPMC to access additional high-grade ore at the bottom of the pit. The achievability of the triple bench excavation should be evaluated once mining has progressed into the WX Pit to confirm rock type and structure in the area.
- When mining through the Polley Fault on any pit walls, single benching is recommended based on previous experience and performance (Figure 17).
- When mining through the C-2-B Pit, single benches may be required through the Polley Fault along the southeast wall (Figure 17). Previous slope performance in the area of the Polley Fault along this wall has included increased ravel due to the poor rock quality and catch-benches have become infilled over time. Since only two double benches are proposed in this area, it is possible that ravel from the fault can be contained on the wider catch-benches. As mining progresses through the area with double benches, regular inspections of the wall performance should be completed and if catchment becomes limited, a step out or rock rollout berm may be required.

Several major continuous faults are interpreted to exist in the area of the open pits and have been exposed along the current pit walls (described in Section 5.1). The influence that these faults are expected to have limited impact on the proposed ultimate pit walls due to the steep nature of the majority of the faults (Section 6.5.1), with the exception of the Polley and East Cariboo Faults which have slope design considerations described in the above bullets.

Upon review of previous slope stability analyses completed for Springer Pit (Golder 2015b and 2016), these analyses were determined to be adequate for the current proposed ultimate pit design based on the following:

- Similar overall wall heights (with the exception of the southwest wall).
- Similar overall slope angles.
- Similar groundwater conditions.
- Similar rock mass strengths expected.

Due to the proximity of the NW PAG Dump to the crest of the proposed ultimate pit design MPMC should consider specific monitoring equipment and plans, as well as single benches within the first one to two benches below the dump (Section 7.0)

Operational controls should be implemented during the excavation of the proposed ultimate pit design, and include blasting practices, bench cleaning, slope monitoring, and geologic mapping (Section 8.0).

Study Limitations

WSP Canada Inc. (WSP) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

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1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to support a Life of Mine (LOM) geotechnical assessment for the open pits at the Mount Polley Mine which is located approximately 56 km northeast of the town of Williams Lake, British Columbia. The proposed ultimate pit design was provided by MPMC in October 2023. MPMC are currently mining copper and gold ore from the Springer Pit at the Mount Polley Mine, and are planning to expand the Springer, Cariboo, C2, and WX Pits through 2032.

This report presents the following:

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- A summary of the current status of the open pits and the pit wall slope stability performance.
- A description of the proposed pit wall pushbacks, the interim, and the ultimate open pit designs.
- A discussion of the engineering geology.
- A discussion of the factors that are expected to control the slope stability of the proposed ultimate pit design.
- A discussion of the kinematics analyses methodology and results. Slope design recommendations are provided based on the kinematic analyses results.
- A summary of overall slope stability analyses for the open pits.
- A review of the proximity of the proposed ultimate pit design crest to the Northwest Potentially Acid Generating (NW PAG) Dump.
- A discussion of operational considerations while mining the proposed ultimate pit design.
- A summary of conclusions and recommendations.

2.0 MOUNT POLLEY MINE LAYOUT AND GEOLOGY

2.1 Mine Layout

The Mount Polley Mine site is shown in Figure 1. The Springer Pit is located to the northwest of the Cariboo Pit and to the southwest of the mined out North Bell Pit (now backfilled). The Cariboo Pit is located to the southwest of the Springer Pit. The C2 Pit is located to the south of Cariboo Pit and the WX Pit is located south of Springer Pit and southwest of Cariboo Pit.

2.2 Geology of Open Pits

The Mount Polley deposits are located within an alkalic intrusive complex within the northwest–southeast trending Quesnel Trough, a 35 km wide, northwest trending volcanic sedimentary belt (Figure 2) (Rees 2013). The copper and gold mineralization are contained predominately within north–south trending, elongated intrusive breccia stocks that have intruded diorites and monzonite porphyries. Later-stage north–south trending dykes have been intruded along the regional structural trend.

The country rock are Nicola Group volcanic rocks, and intrusive rocks of Mount Polley that were emplaced into the Nicola Group in the very late Triassic. Mount Polley lies in the core of a broad regional, northwest-trending syncline at the western limit of the Middle Jurassic folding. The Mount Polley Intrusive Complex (MPIC) consists of silica-saturated and -undersaturated intermediate intrusions and related magmatic-hydrothermal breccias that host the mineralization. Country rocks of the Nicola Group flank the MPIC on most sides except to the north where the MPIC is unconformably overlapped by younger post-Nicola deposits. The Nicola Group is a diverse package of fine- to medium grained basaltic to andesitic volcanic and hypabyssal coherent rocks or breccias, breccia or conglomerate of undifferentiated igneous-hydrothermal or volcaniclastic origin, volcanogenic sandstone and siltstone, and rare massive limestone. The MPIC is made up of several intrusive units such as diorite, monzodiorite-monzonite, K-feldspar monzonite, and late dykes (Rees 2013).

The mineralized hydrothermal breccia in the Springer Pit occurs along a north-northwest–south-southeast trend. To the west, the mineralized breccia zone is bounded by a “mix” of breccia and intrusive rocks, which are then bounded by monzonite rocks. Intrusive diorite rocks bound the mineralized breccia to the north and northeast. Finally, a series of younger north–south trending augite porphyry dykes are observed to exist throughout the pit area. These dykes are often chlorite and calcite-altered, and commonly faulted. These younger dykes intersect the different rock types and the major faults.

In general, the rocks in the Cariboo Pit consist of monzonite intrusion breccias that have intruded the host monzonite rocks. Monzonite is exposed in the majority of the pit walls, while breccias are exposed in the centre of the pit. However, localized blocks of diorite are exposed in the northeast and east walls, while plagioclase porphyry is exposed along the southeast wall.

The rocks in the C2 Pit are hydrothermal breccias. The rocks in the WX Pit are hydrothermal breccias and monzonite.

Based on the current geological interpretation, the proposed ultimate pit design will be excavated through similar rock types as have been observed in the current pit walls. The following rock types are expected to be exposed on the various ultimate open pit design walls:

- Springer Pit
  - The west and south walls will be excavated through monzonite.

  - The north nose and northeast walls of the ultimate pit will be excavated through diorite and hydrothermal breccias (mineralized zone).
  - The upper part of the south end of the northeast wall will be excavated through the Bell Pit rehandle waste rock slope.
- Cariboo Pit
  - The east wall of the pushback will be excavated through monzonite.
  - The pit bottom will be mined further into the breccia (mineralized zone) and monzonite.
- C2 Pit will be mined through mineralized breccias.
- WX Pit will be mined through monzonite and hydrothermal breccias (mineralized zone).

3.0 MOUNT POLLEY MINE OPEN PIT CURRENT STATUS AND SLOPE STABILITY PERFORMANCE

The pit wall slope stability performance of the Springer, Cariboo, C2, and WX Pits has been documented by WSP during annual slope stability reviews of the open pits. The most recent slope stability review was completed in September 2023 (WSP 2023). In general, the Springer, Cariboo, C2, and WX Pits are exhibiting good slope stability performance with no signs of overall slope instability. Many benches have broken back to discontinuous moderately dipping structures; however, adequate catchment remains on the majority of the benches.

A summary of each pit's slope stability performance is presented in the sub-sections below. Select photographs from the 2023 slope stability review are presented in Appendix A.

3.1 Springer Pit

3.1.1 Current Status

The status of the Springer Pit as of October 2023 is shown in Figure 3. Springer Pit is approximately 1,000 m long and approximately 650 m wide. The pit floor at the south end of the pit had been excavated to elev. 950 m. Access to the Springer Pit is via the Cariboo Ramp from the southeast side of the pit where Springer and Cariboo Pits meet. The ramp runs along the northeast wall of Springer Pit and gains access to various benches within the pit where mining is occurring.

Table 1 summarizes the approximate geometry of the walls in the Springer Pit as of October 2023. Note that overall wall heights are approximate.

Table 1: Springer Pit Wall Geometry

Wall	Approximate Wall Geometry	Approximate Crest Elevation (m)	Approximate Toe Elevation (m)	Approximate Overall Slope Height (m)
South	16 single benches	1,130	933	197
West – South Portion	Three double benches and one single bench (half a double bench)	1,061	975	86
West – North Portion	Five double benches and one single bench (half a double bench)	1,120	975	145
North Nose	Seven double benches and one single bench (half a double bench)	1,155	975	180
Northeast – North Portion	16 single benches	1,170	975	195
Northeast – Central Portion	18 single benches	1,168	950	218

3.1.2 Slope Stability Performance

The overall rock mass quality in the monzonite, diorite, and breccias in Springer Pit is good, and the slopes continue to exhibit favourable overall and bench-scale slope stability (Appendix A, Photograph A-1). Large-scale geological structures are favourably oriented with respect to the north and northeast walls. Along the west and south walls bench faces have broken back to moderately dipping joints in some of the benches. There are some steeply dipping north-south striking dykes in the south wall that are causing minor bench-scale raveling (Appendix A, Photograph A-2). A faulted dyke is exposed over three double benches in the south portion of the west wall. Raveling of clay, gouge, and broken rock has created small talus slopes at the base of the exposure (Appendix A,

Photograph A-3). The south wall catch-benches have some ravel infilling in localized areas, but there continues to be adequate catchment along the wall. The west wall catch-benches have some ravel infilling in localized areas, but there continues to be adequate catchment along the wall.

The catch-benches have limited catchment available in the following two areas within Springer Pit:

1) The nose area on the northeast wall where the saddle was mined down between 2021 and 2023. The benches have been filled with from rock overspill while mining down the saddle between the Cariboo and Springer Pits. Catchment on the benches is limited in this localized area (Appendix A, Photograph A-4).

2) Where the Polley Fault intersects the northeast wall. The single benches are gradually being infilled with ravel material due to the poor quality rock within the fault zone (Appendix A, Photograph A-5). Catchment is still available on the single benches where the Polley Fault intersects the wall.

The north and northeast walls are otherwise exhibiting adequate bench-scale slope stability performance, and there is adequate catchment on the walls.

3.2 Cariboo Pit

3.2.1 Current Status

The status of the Cariboo Pit as of October 2023 is shown in Figure 3. Mining of the Cariboo and Springer Pits re-started in late 2022 after being in care and maintenance since 2019. There is water accumulated at the bottom of the Cariboo Pit to elev. 951 m.

The main open pit access haul ramp, called the Cariboo Ramp, enters the Cariboo Pit from the south, descends along the southeast wall, wraps around the east and northeast walls, and descends west into the Springer Pit.

Table 2 summarizes the approximate geometry of the walls in the Cariboo Pit as of October 2023. Note that overall wall heights are approximate.

Table 2: Cariboo Pit Wall Geometry

Wall	Approximate Bench Geometry	Approximate Crest Elevation (m)	Approximate Toe Elevation (m)	Approximate Overall Slope Height (m)
Northeast	Rehandle waste rock slope – six to seven single benches	1,165	1,060	105
	Nine to ten single benches below rehandle slope	1,060	955	105
	Three single benches and six double benches	1,170	963	207
East	Four single benches above unload zone	1,181	1,120	61
	Seven double benches below unload zone and above Cariboo Ramp	1,120	975	200
	Three double benches below Cariboo Ramp (note benches are below the in-pit reservoir)	975	920	55
Southeast	One single bench and six double benches above Cariboo Ramp	1,130	990	140
	Three double benches below Cariboo Ramp	990	920	70
Cariboo Ramp	West side - three to seven single benches	1,094	1,012	82
	East side – six to three single benches	1,082	1,006	76

3.2.2 Slope Stability Performance

Slope stability continues to be favourable in the Cariboo Pit, and the pit walls have not exhibited any signs of large, multi-bench instability (Appendix A, Photograph A-1). Bench-scale stability continues to be favourable and adequate catchment remains on the slopes. The overall rock mass quality in the monzonite and breccias in Cariboo Pit is generally good.

Most of the major geological structures are favourably oriented with respect to the northeast wall. North-south trending augite porphyry dykes are exposed in the wall and dip favourably to the east at steep angles. Localized back-break has occurred along moderately dipping structures; however, the overall catchment on the benches is still adequate.

The Bell Pit rehandle waste rock slope in the northeast wall is exhibiting good overall slope stability with no signs of bulging or instability in the face of the slope and no cracking behind the crest of the slope (Appendix A, Photograph A-6). South-southeasterly dipping structures strike sub-parallel to the northeast wall below the rehandle slope, and the bench faces are breaking back to these moderately dipping structures. Some of the benches mined below the rehandle slope are partially infilled with ravel material from the rehandled slope above. Overall, the benches currently have adequate catchment to contain the ongoing ravel material.

In April 2017, topping failure occurred at the crest of the east wall of the Cariboo Pit (Appendix A, Photograph A-7). The failure zone occurred due to toppling along closely spaced joints and faults that dip steeply to the east-northeast in the hangingwall of the East Cariboo Fault (Golder 2017). The toppling failure was contained in the weathered monzodiorite. The toppling failure zone was unloaded by excavating three to five single benches in 2017. The area has remained stable since it was unloaded with minor raveling continuing to occur in the weaker monzodiorite rock.

The Cariboo Pit southeast wall continues to exhibit adequate slope stability performance. There are bench-scale wedge failures that continue to ravel on the north side of the southeast wall. Adequate catchment remains along most of the wall, and the benches have not been significantly infilled by ravel debris.

3.3 C2 Pit

3.3.1 Current Status

The C2 Pit is a west-facing alcove that is located at the southwest end of the Cariboo Pit above the east side of the Cariboo Ramp (Figure 3). The crest of the wall is at elev. 1,159 m, and the pit floor is located at elev. 1,062 m. Three to four double benches have been excavated in the C2 Pit, to form a maximum wall height of approximately 90 m. Water has accumulated at the bottom of the C2 Pit to elev. 1,078 m.

3.3.2 Slope Stability Performance

The overall rock mass quality in the breccia mined in the C2 Pit is good, and the slopes continue to exhibit adequate overall and bench-scale slope stability (Appendix A, Photograph A-8). The walls have not exhibited signs of large, multi-bench instability. The major structures in the C2 Pit area appear to be north-south trending, moderate to steep easterly dipping joints and faults. Several steeply dipping north-south striking augite porphyry dykes are visible in the C2 Pit walls.

3.4 WX Pit

3.4.1 Current Status

The WX Pit is a small pit that was mined out immediately west of the C2 Pit, above the west side of the Cariboo Ramp (Figure 3). The crest of the ridge is at approximately elev. 1,156 m, and the floor of the WX Pit is at elev. 1,053 m. Three double benches were excavated to form a maximum wall height of approximately 80 m.

3.4.2 Slope Stability Performance

The overall rock mass quality in the monzonite in the WX Pit is fair, and the slopes are exhibiting adequate slope stability (Appendix A, Photograph A-9). Some of the double benches had wedge failures due to the intersection of northeast and north moderately dipping joints, that plunged out of the southwest wall. Since excavation, the walls have not exhibited any signs of large, multi-bench instability.

4.0 PROPOSED MOUNT POLLEY MINE OPEN PIT DEVELOPMENT

The pit configuration as of October 2023 is shown in Figure 3. MPMC are currently mining Springer Phase 4 (Sp-4) to a depth of elev. 848 m and access into the pit is via the Cariboo Ramp. The Cariboo Ramp runs from the south side of Cariboo Pit, then along the east and northeast walls to the current mining areas in Springer Pit. Single benches are 12 m high and double benches are 24 m high. MPMC are proposing five expansions to the open pits at Mount Polley Mine including Springer Phase 5 (Sp-5), Springer Phase 6 (Sp-6), Springer Phase 6 Ramp Retreat (Sp-6-RR), WX, C-2-B, and the Cariboo Ramp Retreat (Car-RR) (Appendix B, Figure B-1). These expansions create the proposed ultimate pit design (SP-6/WX) (Figure 4). The expansions are described in further detail below.

The surfaces provided by MPMC for each of the proposed year end designs are provided in Table 3.

Table 3: Proposed Mining Phase Files

Mining Phase Name	MPMC Surface Name	Date Provided by MPMC
2023 Year End Design	Period1 – 2023 ye	October 27, 2023
2024 Year End Design	Period2 – 2024 ye	
2025 Year End Design	Period3 – 2025 ye	
2026 Year End Design	Period4 – 2026 ye	
2027 Year End Design	Period5 – 2027 ye	
2028 Year End Design	Period6 – 2028 ye	
2029 Year End Design	Period7 – 2029 ye	
2030 Year End Design	Period8 – 2030 ye	
2031 Year End Design	Period9 – 2031 ye	
2032 Year End Design/ Ultimate Pit Design	Period10 – 2032 ye/ sp-6_rr_merged_srface	

Sp-5 will expand the Springer Pit along the west, north, northeast, and east walls, as well as the northeast and east walls of Cariboo Pit (Appendix B, Figure B-2). The Springer Pit will be mined to elev. 808 m during this pushback, with wall heights ranging between 275 m on the west wall to about 400 m on the northeast wall. The upper northeast and east walls of the Cariboo Pit will be pushed back during Sp-5, but the pit bottom will not be excavated deeper (remains at elev. 920 m). Ten double benches are proposed along the west wall of Springer Pit. Twelve double benches are proposed along the north wall of Springer Pit. Twenty-six to thirty single benches are proposed along the northeast wall of Springer Pit. Four benches with bench face angles of 37 degrees and an overall slope of 30 degrees will be excavated in the Bell Pit rehandle waste rock slope in the middle of the northeast wall. Twelve single benches are proposed below the Bell Pit rehandle waste rock slope with a large alcove at elev. 1,012 m. Southeast of the Bell Pit rehandle waste rock slope, eight single benches will be excavated for a strike length of 150 m in the northeast wall of Cariboo Pit. Three double benches are proposed in the east wall of Cariboo Pit, in the previous east wall unload area of the Cariboo Pit. Initial access into the pit will be from the west wall of Springer Pit along the north and northeast walls until it meets the existing Cariboo Ramp approximately mid-way along the northeast wall of Springer Pit. The initial access ramp will be narrowed as the pit deepens to become light vehicle access and a geotechnical step-out. The current Cariboo Ramp into the pit will become the main access to the pit bottom.

Sp-6 and WX pushbacks will mine the west, south, and east walls of Springer Pit and expand the WX Pit (Appendix B, Figure B-3). The Springer Pit will be mined to elev. 760 m during Sp-6 with wall heights ranging from 200 m on the south wall to about 300 m on the west wall of Springer Pit. The Springer Pit wall height on the northeast wall will range between 390 to 410 m high (only the bottom five benches are being excavated in the northeast wall making the pit deeper). The west wall will mine about 14 double benches, the south wall will mine 11 single benches and two double benches. Five single benches will be excavated along the northeast wall to the pit bottom as part of the Sp-6 pushback. The WX Pit will be mined from elev. 1,053 m to elev. 856 m with wall heights ranging from 150 m on the east wall to 225 m on the west wall. Nine double benches are proposed in the west wall and 14 single benches are proposed in the southeast wall of the WX Pit. Access to the Sp-6 and WX pushback will be via the Cariboo Ramp which will travel along the east, south, then west walls of Springer Pit and deepen in WX Pit. The western portion of the ramp will narrow to become single access once the pushback wall reaches the same elevation as the North Springer Ramp from the previous Phase 5 pushback.

Sp-6-RR is proposed in the north wall of Springer Pit and will be a small retreat from elev. 890 to 820 m (Appendix B, Figure B-4). A ramp will be widened towards the south to connect to the pit bottom. Sp-6-RR will include three double benches in the north wall and seven single benches in the east wall. Wall heights for the SP-6-RR will be 72 m and 84 m. The area will be accessed via a backfilled ramp along the west wall of Springer Pit which will link to the main haul ramp which will run along the west and south walls of Springer Pit to the Cariboo Ramp.

C-2-B Pit is an expansion of the C2 Pit on the southeast side of the mining area (Appendix B, Figure B-5). The current C2 Pit will be mined from elev. 1,062 m to elev. 1,000 m. Three double benched are proposed for the expansion. Wall heights will vary from approximately 105 to 130 m. The benches will all be accessed from the existing Cariboo Ramp with the exception of the bottom two benches which will have a small ramp that is pushed from north to south.

The Car-RR will include mining of the Cariboo Pit bottom (Appendix B, Figure B-6). The retreat will include mining of four double benches in the southeast wall and nine single benches along the south wall and four single benches along the west wall. The pit bottom will be mined from elev. 921 m to elev. 904 m. Wall heights will range from 50 m in the west wall to about 290 m in the northeast wall. Upon completion, the Cariboo Ramp will be replaced with a waste rock backfill ramp from the south side of the pit to the north end.

Table 4 provides a summary of the proposed open pit development.

Table 4: Summary of Proposed Open Pit Development

Expansion Phase	Description	Pit Floor Elevation
Sp-5	Springer Pit will be expanded along the west, north, northeast, and east walls, as well as the upper northeast and east walls of Cariboo Pit. Wall heights will range from 275 m on the Springer Pit west wall to about 400 m on the Springer Pit northeast wall.	Springer Pit – elev. 808 m Cariboo Pit – unchanged
Sp-6 & WX	Sp-6 and WX pushbacks will mine the west, south, and east walls of Springer Pit and expand the WX Pit. Wall heights ranging from 200 m on the south wall to about 300 m on the west wall of Springer Pit. The Springer Pit wall height on the northeast wall will range between 390 to 410 m high (only the bottom five benches are being excavated in the northeast wall making the pit deeper). Wall heights in the WX Pit will range from 150 m on the east wall to 225 m on the west wall.	Springer Pit – elev. 760 m WX Pit – elev. 856 m

Table 4: Summary of Proposed Open Pit Development

Expansion Phase	Description	Pit Floor Elevation
Sp-6-RR	Proposed in the north wall of Springer Pit and will be a small retreat from elev. 890 to 820 m. Wall heights for the SP-6-RR will be 72 m and 84 m.	Unchanged
C-B-2	C-B-2 is an expansion of the C2 Pit on the southeast side of the mining area. Three double benched are proposed for the expansion. Wall heights will vary from approximately 105 to 130 m.	C2 Pit – elev. 1,000 m
Car-RR	The Car-RR will include mining of the Cariboo Pit bottom. Wall heights will range from 50 m in the west wall to about 290 m in the northeast wall. Upon completion, the Cariboo Ramp will be replaced with a waste rock backfill ramp from the south side of the pit to the north end.	Cariboo Pit – elev. 904 m

MPMC propose the following mining sequence by year from end of 2023 to 2032:

- End of 2023 (Appendix B, Figures B-7 to B-8): mining will continue in the Springer Pit bottom in Sp-4 and mining of the upper benches of the northeast wall of Springer and Cariboo Pits will begin (Sp-5).
- End of 2024 (Appendix B, Figures B-9 to B-10): mining will continue at the Springer Pit bottom in Sp-4 and mining of the upper benches of the north, northeast, walls of Springer Pit, and northeast and east walls of Cariboo will be mined (Sp-5).
- End of 2025 (Appendix B, Figures B-11 to B-12): Sp-4 will continue at the Springer Pit bottom, Sp-5 will continue in the upper benches and the C-2-B pushback will begin.
- End of 2026 (Appendix B, Figures B-13 to B-14): By 2026 Sp-4 will be complete to the Springer Pit bottom (elev. 845 m) and mining will continue in Sp-5 along the west, north, and northeast walls of Springer Pit.
- End of 2027 (Appendix B, Figures B-15 to B-16): mining will continue in Sp-5 and mining will begin in WX.
- End of 2028 (Appendix B, Figures B-17 to B-18): mining will continue in Sp-5 and WX, and Springer Phase 6 will begin in the south wall of Springer Pit.
- End of 2029 (Appendix B, Figures B-19 to B-20): mining will continue in WX and Sp-6, and the Car-RR will also begin. The Car-RR material will be removed from the area via the north Springer Pit ramp which will be widened using the width of the ramp below. A waste rock backfill ramp will be constructed after the retreat to re-establish access to the Springer and WX Pit bottoms.
- End of 2030 (Appendix B, Figures B-21 to B-22): mining will continue in WX and Sp-6.
- End of 2031 (Appendix B, Figures B-23 to B-24): mining will continue in WX and Sp-6, and the Sp-6 retreat will be mined in the north wall of Springer Pit.
- End of 2032 (Appendix B, Figures B-25 to B-26): mining will continue in WX.

5.0 MOUNT POLLEY MINE ENGINEERING GEOLOGY

The engineering geology model is supported by a literature review, the current structural geology model provided by MPMC, structural mapping data that have been collected from various mapping campaigns by WSP and MPMC, exploration drilling data collected by MPMC, and WSP's experience at the Mount Polley Mine.

Geotechnical domains have been developed on the basis of the data review. The development of the engineering geology model is described in the following sub-sections.

5.1 Major Faults in Open Pits

Several major continuous faults are interpreted to exist in the area of the open pits and have been exposed along the current pit walls. The major structures projected on the current pit are shown in Figure 5.

A brief description of the major fault structures in the area of the pits are as follows:

- The South Wishbone Fault is a vertical, northeast/southwest trending fault that truncates the mineralized breccia zone to the northwest (Figure 5). The Springer Pit wall has performed adequately in the area of the South Wishbone Fault previously with minor raveling along the fault (Figure 6).
- The Springer Fault is a steep, north-south trending, easterly-dipping fault with a dip of approximately 77 degrees. The fault zone has been intruded by a number of late-stage dykes. This fault is shown to terminate at the South Wishbone Fault and the Southwest Boundary Fault, to the northwest and southeast, respectively. The fault intersects the northeast wall of the Springer Pit at an oblique angle (Figure 5). The Springer Pit wall has performed adequately in the area of the Springer Fault previously with limited impact on the overall wall slope stability (Figure 6).
- The Springer South Boundary Fault is a steep, northeast-southwest trending, northwesterly-dipping fault with a dip of approximately 73 degrees. This fault is interpreted to terminate on the Springer Fault to the north and the Southwest Boundary Fault to the southwest. The fault intersects the northeast wall of the Springer Pit at a near perpendicular angle and intersects the west wall at an oblique angle (Figure 5). It is difficult to determine an exact fault trace in the current pit walls, however, the walls have performed adequately in the interpreted area of the fault (Figure 6).
- The Cariboo South Boundary Fault is a northeast-southwest trending fault that dips to the southwest at approximately 73 degrees. The fault is pervasive throughout the entire Springer Pit and does not truncate on any other faults (Figure 5). It is difficult to determine an exact fault trace in the current northeast and west walls of Springer Pit (Figures 6 and 7).
- The Polley Fault is a wide, steep, north/south trending, easterly-dipping zone of poor quality rock that dips at approximately 73 degrees (Figure 5). The Polley Fault is a broad zone that raveling has occurred in as mining has progressed (Figure 8).
- The Polley South Boundary Fault is a northeast-southwest trending fault. This fault offsets the mineralized breccia zone and is shown to terminate at the Southwest Boundary Fault to the south (Figure 5). It is difficult to determine an exact fault trace in the current pit walls, however, the walls have performed adequately in the interpreted area of the fault (Figure 8).

- The Polley Secondary Fault is a steep northeast/southwest trending fault that is dipping at approximately 66 degrees to the northwest (Figure 5). It is difficult to determine an exact fault trace in the current pit wall, however, the walls have performed adequately in the interpreted area of the fault (Figure 8).
- The Southwest Boundary Fault is a steep northwest/southeast trending fault that is dipping at approximately 62 degrees to the northeast (Figure 5). The fault truncates the mineralized breccia zone to the south. It terminates on the South Wishbone fault to the northwest and on the Polley Fault to the southeast. It is difficult to determine an exact fault trace in the current pit walls, however, the walls have performed adequately in the interpreted area of the fault.
- The East Cariboo Fault is a northwest-southeast striking fault that dips steeply to the northeast at approximately 86 degrees. The East Cariboo Fault is anticipated to intersect the ultimate pit in the east corner (Figure 5). Toppling instability has been observed to occur along the easterly dipping faults and joints in the upper weathered monzonite which is in the hangingwall of the East Cariboo Fault (Figure 9).
- A number of very continuous, north-south trending augite porphyry dykes have also been identified the Springer and Cariboo Pits (Figure 5). In general, these structures define a pervasive, penetrative fabric that dips to the east at steep inclinations (Figure 7).

5.2 Rock Fabric

In addition to the major faults, the rocks in the open pits also contain other geologic structures in the form of faults, dykes, and joint sets. The orientations of these structures have been determined through the following campaigns:

- Geotechnical mapping programs that have been carried out on an annual basis between 2008 and 2016, as well as 2023.
- Televiewer surveys were carried out in boreholes that were drilled in the C2 Pit area in 2006.
- Photogrammetry carried out in 2014 and 2024.

The structural data collection and compilation is described in the following sub-sections.

5.2.1 Structural Data Collection and Compilation

Structural data collected by various geotechnical campaigns between 2006 and 2024 were reviewed and compiled. Historical data had previously been reviewed based on feature type and pit only. For the purposes of this design review, approximate coordinates were assigned to the structural measurements using the 3D geological modeling software Leapfrog Works 2023.2.3 (Sequent 2023). For many of the traverses, specific locations and mapping directions were not provided. It was assumed that the location for the traverse was the centre of the traverse. Orientations of traverses were approximated using a topography surface from a similar timeframe to the mapping program. The current geologic interpretation map (Figure 2, Rees 2013) was then used in plan view to apply lithology to each measurement. The structural data by year is described in further detail in the following sub-sections and in Appendix C.

5.2.1.1 2006 Televiewer Structural Data

Televiewer data was collected from three boreholes in the east wall of the Cariboo Pit and the north wall of the C2 Pit (Appendix C, Figure C-2). A total of 118 structure orientation data points were collected including joints and faults. Table 5 summarizes the borehole information.

Table 5: Summary of 2006 Borehole ATV Information

Borehole ID	Location	Number of Structural Data Points	Assigned Lithology
C2-06-47	Cariboo Pit, East Wall	22	Breccia (Rees, 2013), BX1)
C2-06-51	C2 Pit, North Wall	46	
C2-06-57	C2 Pit, North Wall	50	

Lithology was assigned to the borehole ATV data based on the plan view collar location on the geology map (Rees, 2013).

5.2.1.2 2008 Structural Mapping Data

Mapping data collected by Golder Associates Ltd. (Golder) in 2008 were digitized by overlaying the traverse locations map on a February 2008 open pit plan polyline file (Appendix C, Figure C-3). Excel mapping sheets from 2008 were used to assign structural features to each of the mapped locations. A total of 125 structural data points were included from the 2008 mapping dataset.

5.2.1.3 2009 Structural Mapping Data

Mapping data collected by Golder in 2009 were digitized by importing an open pit plan mapping stations figure from 2009 (Appendix C, Figure C-4). Field mapping sheets were used to obtain traverse lengths and distances along traverses for each measurement. The orientation of the traverses was estimated from the orientation of the bench at that location using a topography surface from August 2012. A total of 635 structure data points were included from the 2009 mapping dataset.

5.2.1.4 2010 & 2011 Structural Mapping Data

Mapping data collected by Golder in 2010 and 2011 were digitized using a 2010 topography surface. The data was mapped in the west, northwest, and north walls of Springer Pit in 2010 and the south wall of Springer Pit in 2011 (Appendix C, Figure C-5). No station or elevations were not provided for the structural mapping data. Elevations were assigned based on the lowest operating bench at the time of mapping. A total of 77 structural data points were included from the 2010/2011 mapping dataset.

5.2.1.5 2014 Structural Mapping and Photogrammetry Mapping Data

Mapping data collected by Golder in 2014 were digitized using station coordinates obtained from a 2014 stations location drawing (Appendix C, Figure C-6). Field mapping sheets contained traverse lengths and distances along the traverses which were used to estimate coordinates for each structural measurement. Where traverse locations were not provided, coordinates were estimated. It was assumed that the location for the station was the middle of the traverse. The orientation of the traverse was estimated from the orientation of the bench at that location using a December 2015 topography surface. A total of 349 structural data points were included from the 2014 mapping dataset.

Photogrammetry completed in the Springer Pit in 2014 by Golder was reviewed and compiled (Appendix C, Figure C-7). The dataset included structural measurements for the south and northeast walls of the Springer Pit. Structural data collected for the northeast wall were reviewed during completion of the 2016 LOM design review (Golder 2016). The south wall structural data was reviewed in Point Studio (Maptek 2023). A total of 620 structural data points were included from the 2014 photogrammetry dataset.

5.2.1.6 2015 Structural Mapping Data

Mapping data was collected by Golder in 2015 along the north, northeast, and east walls of the C2 Pit (Appendix C, Figure C-8). The locations of the structural measurements were assigned to the bottom bench (lowest operating elevation) of the C2 Pit using a December 2015 topography surface. A total of 56 structural data points were included from this the 2015 mapping dataset.

5.2.1.7 2016 Structural Mapping Data

Mapping data was collected by Golder in 2016 along the south wall of the WX Pit (Appendix C, Figure C-9). The locations of the structural measurements were assigned to the bottom bench (lowest accessible elevation) of the WX Pit using an October 2016 topography surface. The structural mapping was noted as being within the monzonite. A total of 12 structural data points were included from the 2016 mapping dataset.

5.2.1.8 2023 Structural Mapping Data

Mapping data was collected from four areas of the Springer Pit during the 2023 slope stability review in September 2023 by WSP (WSP 2023) and an additional area in October 2023 by MPMC staff (Appendix C, Figure C-10). Coordinates were assigned to features based on locations in field notes and the use of an October 2023 topography surface. Traverses completed in September 2023 were along the south wall ramp (elev. 987 m bench), west wall south portion (elev. 988 m bench), west wall north portion (elev. 988 m bench), northeast wall (elev. 976 m bench), and northeast wall ramp (elev. 950 m). The traverse completed in November 2023 by MPMC was along the crest of the northeast wall of Springer Pit along the elev. 1,169 m bench. A total of 77 structural mapping points were included from the 2023 dataset.

5.2.1.9 2024 Photogrammetry Mapping Data

Structural mapping was completed on a photogrammetry scan of WX Pit, along Cariboo Ramp, and along the south wall of Springer Pit (Appendix C, Figure C-11). The photogrammetry scan was provided by MPMC on November 28, 2023, and the structural mapping of the surface was completed by WSP in January 2024.

The following limitations were noted during the mapping data collection from the photogrammetry scan:

- In some instances, it was difficult to differentiate between joints and talus slopes. The WX Pit and Cariboo Ramp in particular have been exposed for over five years and ravel has made the bench faces difficult to see limiting the amount of mapping data collected.
- Very few structures were observed to be longer than a single bench (12 m).

A total of 94 structural mapping points were collected from the 2024 photogrammetry mapping.

5.2.2 Structural Data Review

The structural data from the various collection campaigns were combined, the locations were overlaid on the geologic map (Rees 2013) to be flagged for lithology and assigned to a pit. Magnetic declination was applied to the mapping data (not the televiewer and photogrammetry data as it is automatically applied while collecting this data) by year (Appendix C, Figure C-12).

The structural data was first filtered by rock type by overlaying the geologic map (Rees 2013) with the mapping data. The following rock types were assigned to structural data within the mine area:

- Breccia and mineralized breccia (BX1, BX2, and BX1m)

- Diorite
- K-feldspar Monzonite
- Monzodiorite

A stereographic projection of the structural data by rock type is presented in Appendix C, Figure C-13.

Next the data was filtered by pit area. The following pit areas were separated:

- Springer Pit
- Cariboo Pit
- WX Pit
- C2 Pit

Stereographic projects by pit and rock type are presented in in Appendix C, Figure C-14.

Next the data was separated on the basis of continuity by feature type as presented in Table 6 and Appendix C, Figure C-15.

Table 6: Geologic Strcuture Continuity on the Basis of Structure Type

Discontinuous Structures	Continuous Structures
Joints	Fault
Veins	Dyke
Photogrammetry features (minimal features mapped were greater than a single bench (12 m))	Major structures

The mapping and photogrammetry data was further reviewed for continuity. Histograms of continuity for mapped structures are presented in Appendix C, Figures C-16 to C-18. The data show that most structures exhibit a continuity less than a single bench height (12 m). These data have been considered for the discontinuous structures (as presented in Table 6). The data also indicate that continuous structures have a range of continuity which is typically greater than a single bench height (12 m). The continuity information supports the separation of discontinuous and continuous data for further assessment in the kinematics (Section 6.4).

Structure set nomenclature from the 2016 LOM structural feature sets has been applied to the 2024 structural dataset. A summary of the structural sets observed in the 2016 data set are presented in Table 7.

Table 7: Structural Sets for 2016 LOM Pit Slope Design Review (after Golder 2016)

Set	Description
Sets 1A and 1B	Include structures that strike parallel to the major northwest-southeast striking structural trend on site, and that dip to the northeast and southwest, respectively. These include structures that are related to and oriented sub-parallel to the Polley and the East Cariboo Faults.
Set 2	Includes east-northeast--west-southwest striking structures that dip steeply toward the southeast. These structures are likely related to recent strike-slip faulting (Wafforn 2013), and to the Wishbone, Springer South Boundary, and similarly oriented faults.
Set 3	Includes northeast-southwest to east-west striking structures that dip steeply toward the northwest. These structures may also be related to recent strike-slip faulting, and to the Wishbone, Springer South Boundary, and similarly oriented faults.

Table 7: Structural Sets for 2016 LOM Pit Slope Design Review (after Golder 2016)

Set	Description
Set 4	Includes northeast-southwest striking structures that dip at a moderate inclination toward the northwest. These structures are likely related to the recent strike-slip faulting. These structure are well defined along the south side of the Cariboo Pit, and in the C2 and WX Pits.
Sets 5A and 5B	Include north-south striking structures that exhibit steep dips, and that dip toward the east and west, respectively.
Sets 6A and 6B	Includes structures that strike northeast-southwest and that dip toward the southwest and the northwest, respectively.

A summary of the structural data review is presented in Table 8.

Table 8: Structural Data Review Summary of Proposed Sets

Pit	Lithology	Scale	Set	Dip (degrees)	Dip Direction (degrees)	Set Description	Appendix C, Figure No.
Springer and WX	Monzodiorite	Discontinuous	Set 5A	68	88	Steep easterly dipping joint set	C-19
			Set 5B	80	275	Steep west dipping joint set	
			Set 4	34	304	Moderate northwesterly dipping set	
			Set 4/3	51	352	Moderate to steep north to northwesterly dipping joint set	
		Continuous	Set 5A/6A	74	100	Moderate to steep east to southeasterly dipping set	C-20
			Set 3	71	345	Steep west dipping set	
			Set 5B	87	272	Steep northwest dipping set	
Springer	Diorite	Discontinuous	Set 5A	70	92	Steep easterly dipping joint set	C-21
			Set 4	34	309	Shallow to moderate northwesterly dipping joint set	
			Set 1B	78	201	Steep southwesterly dipping joint set	
		Continuous	Set 6A	67	117	Steep southeasterly dipping	C-22
			Set 5A	77	74	Steep northeasterly dipping	
			Set 6B	73	302	Steep northwesterly dipping	
			Set 3	69	341	Moderate northwesterly dipping	
	Breccia	Discontinuous	Set 5A	69	86	Steep easterly dipping joint set	C-23
			Set 4	39	286	Moderate northwesterly dipping joint set	
			Set 2/1B	77	180	Steep south dipping joint set	
			Set 3	83	354	Steep north dipping joint set	
		Continuous	Set 5A	68	91	Steep east dipping set	C-24
			Set 1B	63	215	Moderate southwesterly dipping set	
			Set 4	43	295	Moderate northwesterly dipping set	
			Set 3	85	331	Steep northwesterly dipping set	

Table 8: Structural Data Review Summary of Proposed Sets

Pit	Lithology	Scale	Set	Dip (degrees)	Dip Direction (degrees)	Set Description	Appendix C, Figure No.
Cariboo	Monzodiorite	Discontinuous	Set 5A	67	86	Steep east dipping joint set	C-25
			Set 4	62	22	Moderate northeast dipping joint set	
			Set 1A	38	350	Moderate north dipping joint set	
		Continuous	Set 5A/6A	69	97	Moderate to steep east to southeast dipping set	C-26
			Set 3	61	349	Moderate north dipping set	
Cariboo & C2	Breccia	Discontinuous	Set 5A	70	85	Moderate east dipping set	C-27
			Set 5B	87	268	Steep west dipping set	
			Set 6A	69	145	Moderate southeast dipping set	
			Set 2	72	178	Steep south dipping set	
			Set 3	69	357	Moderate north dipping set	
			Set 4	27	268	Shallow west dipping set	
		Continuous	Set 5A	64	93	Moderate east dipping set	C-28
			Set 3	80	13	Steep north dipping set	
			Set 3	82	334	Steep northwest dipping set	
			Set 6A	80	140	Steep southeast dipping set	
			Set 1B	86	206	Steep southwest dipping set	

In general, the structural sets identified in the 2016 LOM assessment remain similar to the sets identified in the 2024 LOM assessment.

5.2.3 Discontinuity Strength

In the absence of laboratory testing, discontinuity strength can be estimated using field recorded discontinuity parameters. The Barton-Bandis relationship between joint roughness coefficient (JRC), intact rock strength or joint contact strength (JCS), and slope height was used (Barton1976) to estimate discontinuity shear strengths. Details of the relationship are documented in Appendix C, Figures C-29 to C-32.

Field estimates of feature shape and roughness recorded during geotechnical mapping programs in 2008, 2009, 2010, 2011, 2014, 2015, and 2023 were compiled and statistically reviewed for both shape and roughness, separated into discontinuous and continuous feature scales. The dominant feature shape and roughness are undulating and rough, respectively. This combination makes up the majority of features in both discontinuous and continuous features.

From the feature combinations, JRC values can be estimated, and a weighted average is calculated for both the discontinuous and continuous structures (Appendix C, Figure C-30).

In the absence of laboratory unconfined compressive strength (UCS) testing, ISRM values logged for intervals in the exploration boreholes were compiled and averaged for each of the major lithologies. Table 9 presents the average minimum UCS used for the major lithologies (Appendix C, Figure C-31).

Table 9: Summary of Average Minimum UCS Corresponding to Interval ISRM Value from Exploration Boreholes

Lithology	Average Minimum ISRM Strength	Corresponding Strength Range to Minimum (MPa)	Average Minimum Unconfined Compressive Strength, σ_c (MPa)
Monzodiorite	R3	25-50	**50**
Diorite	R4	50-100	**60**
Breccia	R3	25-50	**50**

These values were used to calculate JCS. To account for minimal weathering on the features surfaces, the JCS was calculated as 75% of the average UCS estimation.

The Barton-Bandis relationship was assessed using RSData (RocScience 2022) and details are presented in Appendix C, Figure C-32. Strength parameters are extrapolated from RSData for varying slope heights and friction angles.

The following strength parameters were selected for the discontinuity data:

- Discontinuous structure surface strength parameters:
  - Cohesion: 0 kPa
  - Friction angle: 42 degrees
- Continuous structure surface strength parameters:
  - Cohesion: 40 kPa
  - Friction angle: 28 degrees

5.3 Exploration Borehole Review

Data from exploration boreholes drilled by MPMC between 2004 and 2012 in the areas of the Springer, Cariboo, C2, and WX Pits were reviewed. A database of 65 boreholes provided by MPMC was used in the review of rock mass ratings (RMR_{76}) for the 2016 LOM assessment (Golder 2016). Seventeen additional holes were provided by MPMC in late 2023 and early 2024 and were added to the database. Note that two of the boreholes, SD-07-22 and SD-04-16, had previously been reviewed during the 2016 LOM assessment (Golder 2016). The additional boreholes were selected to fill data gaps in the area of the WX Pit due to the large pushback in the pit, as well as capture additional geologic information through the proposed ultimate pit walls.

A summary of the boreholes reviewed is presented in Table 10 and Appendix D, Figures D-1 to D-3.

Table 10: Summary of Additional Exploration Boreholes Reviewed for 2024 LOM Assessment (Data Provided by MPMC in 2023 and 2024)

Borehole ID	Easting (m)(1)	Northing (m)(1)	Elevation (masl)	Total Depth Along Hole (m)	Year
C2-11-86	1,997.0	2,719.5	1,102.9	409.3	2011
CB-11-05	2,540.8	3,286.4	1,162.7	1,083.9	2011
SD-04-16(2)	1,959.4	3,151.9	1,135.6	730.61	2004
SD-07-22(2)	1,408.0	3,278.5	1,072.9	459.3	2007
SD-11-107	1,490.5	4,054.1	1,164.7	1,233.0	2011
SD-12-142	1,225.4	3,658.9	1,090.0	492.25	2012
SD-12-133	1,801.6	3,377.2	1,035.9	599.24	2012
WX-09-02	2,010.8	2,727.5	1,104.8	242.9	2009
WX-10-07	1,823.2	2,771.6	1,141.0	418.4	2010
WX-10-14	1,999.6	2,679.5	1,097.7	601.1	2010
WX-10-16	1,746.6	2,630.6	1,074.2	532.5	2010
WX-10-35	1,901.9	2,724.5	1,113.1	819.0	2010
WX-10-37	1,600.0	2,725.0	1,064.0	730.6	2010
WX-11-49	1,957.4	2,674.5	1,094.5	510.2	2011
WX-11-50	1,554.8	3,078.2	1,093.0	630.0	2011
WX-11-53	1,703.7	2,630.4	1,064.7	721.5	2011
WX-11-55	1,998.7	2,578.4	1,084.5	663.5	2011

1) Coordinates are referenced to Mount Polley Mine Grid.

2) Boreholes were previously reviewed during the 2016 LOM assessment (Golder 2016).

Core photos, logged lithologies, total core recovery (TCR), rock quality designation (RQD), fracture count, rock strength data, and in four cases fracture condition were provided for the 17 exploration boreholes provided in 2023 and 2024. Downhole plots of the digital information provided are presented in Appendix E.

Only four of the 17 boreholes provided in 2023/2024 included sufficient information to calculate RMR_{76}, therefore, only four boreholes were added to the lithology statistics and RMR_{76} database. The logged lithologies of 69 exploration boreholes were grouped according to Appendix D, Figure D-4. Lithological statistics are summarized in Table 11 and presented in Appendix D, Figure D-5.

Table 11: Summary of Lithologic Units Intersected by Exploration Boreholes

Grouped Lithology	Total Meters Logged	% of Total Meterage
Breccia	14,240.75	48.00%
Diorite	1,489.58	5.02%
Monzodiorite	8,831.77	29.77%
Dyke	743.716	2.51%
Fault	142.46	0.48%
Unknown	4,126.54	13.91%
Other	79.24	0.27%
Ignore	15.38	0.05%
TOTAL	**29,669.43**	**100.00%**

Most of the lithology intervals logged were within the monzodiorite and breccia. Core photos of typical lithologies are presented in Appendix D, Figures D-6 to D-10.

5.4 Rock Strength

5.4.1 Intact Rock Strength

Intact rock strength is generally expressed as the uniaxial compressive strength (UCS) of the rock, which is a laboratory compression test carried out on intact rock core cylinders. The intact strength of the rocks can also be estimated qualitatively using the International Society of Rock Mechanics (ISRM) (ISRM 2015) rock strength measurement system.

Previous estimates for breccia and monzonite rock exposed in the walls of the Springer Pit have been consistently Medium Strong to Strong (R3 to R4). Historical rock hardnesses from mapping programs indicate that rocks in the Springer Pit area are expected to be predominantly Strong (50 -100 MPa) in terms of intact rock strength (Golder 2016).

For the 2024 LOM assessment, rock strengths and corresponding UCS for each lithology was reviewed as part of the exploration borehole review (Section 5.3). The qualitative estimates of rock strength carried out during logging of the exploration boreholes indicate that the rocks in the open pit areas are Medium Strong to Strong (R3 to R4). The exception to this is the faults which are weak having an ISRM field intact rock strength average of R1. Table 12 summarizes the rock strength statistics based on the exploration borehole review of 69 boreholes.

Table 12: Intact Rock Strength Estimates from Exploration Borehole Review

Lithology	Average Field Estimated Rock Strength (ISRM)	Description	Corresponding UCS Range (MPa)
Monzodiorite	R3	Medium Strong Rock	25 – 50
Diorite	R4	Strong Rock	50 – 100
Breccia	R3	Medium Strong Rock	25 – 50
Dyke	R4	Strong Rock	50 – 100
Fault	R1	Weak Rock	1.0 – 5.0

The field estimate rock strengths from the exploration borehole review are comparable to the field estimate rock strengths presented in the 2016 LOM assessment which were based on 1997, 2008, 2009, 2010, 2011, and 2014 geotechnical mapping programs (Golder 2016).

5.4.2 Rock Mass Strength

Rock mass classification systems are used to assess the various factors that influence the overall strength of a rock mass, including the influence of the intact rock strength and the fractures, to essentially grade the quality of the rock mass to determine its overall strength and deformation characteristics. For the purpose of this assessment, the RMR_{76} system (Bieniawski 1976) has been used to assess the rock mass quality in the open pits.

A summary of the Rock Mass Rating (RMR_{76}) method is presented in Table 13.

Table 13: RMR_{76} Classification Parameters and Ratings (Bieniawski 1976)

Parameter			Ranges of Values						
1	Strength of intact rock material	Point load strength index	>8 MPa	4 – 8 MPa	2 – 4 MPa	1 – 2 MPa	For this low range – uniaxial compressive test is preferred		
		Uniaxial compressive strength	>200 MPa	100 – 200 MPa	50 – 100 MPa	25 – 50 MPa	10 – 25 MPa	3 – 10 MPa	1 – 3 MPa
	Rating		15	12	7	4	2	1	0
2	Drill Core Quality RQD		90%–100%	75%–90%	50%–75%	25%–50%	<25%		
	Rating		20	17	13	8	3		
3	Spacing of Joints		>3 m	1 – 3 m	0.3 – 1 m	50 – 300 mm	<50 mm		
	Rating		30	25	20	10	5		
4	Condition of Joint		Very rough surfaces Not continuous No separation Hard joint wall rock	Slightly rough surfaces Separation <1 mm Hard joint wall rock	Slightly rough surfaces Separation <1 mm Soft joint wall rock	Slickensided surfaces OR gouge <5 mm thick OR joints open 1 -5 mm Continuous joints	Soft gouge >5 mm thick OR joints open >5 mm Continuous joints		
	Rating		25	20	12	6	0		

Table 13: RMR_{76} Classification Parameters and Ratings (Bieniawski 1976)

Parameter			Ranges of Values			
5	Groundwater	Inflow per 10 m per tunnel length	None	<25 litres/min	25-125 litres/min	>125 litres/min
		Ratio joint waste pressure / major principal stress	0	0.0 – 0.2	0.2 – 0.5	>0.5
		General Conditions	Completely dry	Moist only (interstitial water)	Water under moderate pressure	Severe water problems
	Rating		10	7	4	0

In order to obtain RMR_{76} estimates, the rating for each parameter is assessed and the individual rating values are summed. RMR_{76} varies from 0 to 100, i.e., from very poor to very good rock; the rock mass classes, and corresponding rating ranges are summarized in Table 14.

Table 14: Rock Mass Rating System

RMR_{76} Rating	Rock Mass Class
81 to 100	Very Good Rock
61 to 80	Good Rock
41 to 60	Fair Rock
21 to 40	Poor Rock
20 or less	Very Poor Rock

A summary of the data review is presented in Appendix F. MPMC previously provided 65 exploration boreholes to WSP that were used to calculate RMR_{76} (Golder 2016). MPMC then provided the additional 17 boreholes, four of which were included in the RMR_{76} database. The locations of the new exploration boreholes is presented in Appendix F, Figure F-2.

The RMR_{76} for the major lithologies was calculated using the following assumptions:

- Intervals for geotechnical and geological data provided by MPMC do not always match. Geological logging was completed at a higher level of detail, including smaller dykes and geological intervals less than 25 cm thick. Contacts were also more accurate than those recorded in the geotechnical logging. Intervals less than 25 cm thick are not considered in the RMR_{76} calculations as there are no unique geotechnical parameters logged for them.
- There are some differences in the depths of some lithologies. In these instances, the geotechnical intervals were assigned based on the major lithology logged in the geological data.

- **Parameter 1 – Strength of intact rock material**
  - For some intervals in the geotechnical data, multiple values were recorded for ISRM intact rock strength. The average of the *minimum* value recorded and the corresponding UCS range estimates for each lithology were used to assign a strength rating.
- **Parameter 2 – Drill core quality RQD**
  - The logged RQD was used to assign this rating for each interval.
- **Parameter 3 – Spacing of joints**
  - Average fracture count per meter for each lithology was used to determine a rating for approximate joint spacing.
- **Parameter 4 – Condition of joint**
  - The joint condition rating logged for each interval was used as recorded by MPMC for each interval.
- **Parameter 5 – Groundwater**
  - The slope was assumed to be dry.

Histograms of the RMR_{76} by total length logged of each lithology type are presented in Appendix F, Figure F-6. A summary of the RMR_{76} assessment for 2016 compared to 2024 is presented in Table 15.

Table 15: Summary of RMR_{76} Assessment of Exploration Borehole Geotechnical Data Comparing 2016 Results and 2024 Results

Lithology Group	Average RMR from Exploration Boreholes 2016 LOM Assessment	Average Minimum RMR 2024 LOM Assessment
Monzodiorite	53 (Fair Rock)	49 (Fair Rock)
Diorite	57 (Fair Rock)	53 (Fair Rock)
Breccia	55 (Fair Rock)	49 (Fair Rock)
Dykes	Not Reviewed	53 (Fair Rock)
Faults	Not Reviewed	24 (Poor Rock)

Overall, the RMR_{76} values calculated using the updated 2024 dataset are comparable to those calculated for the 2016 LOM assessment.

Interpretation of the RMR_{76} assessment indicates the following:

- The monzodiorite rocks exhibit poor to good rock mass quality (Appendix F, Figure F-6). Although the average RMR_{76} value calculated for the monzodiorite rocks is lower in the 2024 LOM assessment as compared to the 2016 LOM assessment, the lithology group is still within the Fair Rock quality range.

- The diorite rocks exhibit poor to good rock mass quality (Appendix F, Figure F-6). Although the average RMR_{76} value calculated for the diorite rocks was lower in the 2024 LOM assessment as compared to the 2016 LOM assessment, the lithology group is still within the Fair Rock quality range.
- The breccia rocks exhibit poor to good rock mass quality (Appendix F, Figure F-6). Although the average RMR_{76} value calculated for the breccia rocks was lower in the 2024 LOM assessment as compared to the 2016 LOM assessment, the lithology group is still within the Fair Rock quality range.
- The dyke rocks exhibit poor to good rock mass quality (Appendix F, Figure F-6). The average RMR_{76} value calculated for the dyke rocks is within the Fair Rock quality range.
- The faults rocks exhibit very poor to poor rock mass quality (Appendix F, Figure F-6). The average RMR_{76} value calculated for the fault rocks is within the Poor Rock quality range.

Geotechnical logging of exploration boreholes can often not include an evaluation of natural versus drill induced fractures. Hence, all fractures are logged, even if they are drill induced. This tends to overestimate fracture count and underestimate RQD, which in turn underestimates overall rock mass quality. Therefore, the rock mass quality estimates for the rock types in the area of the pits are likely slightly conservative.

5.5 Hydrogeology

The Springer, Cariboo, C2, and WX Pits are located on a ridge between the Bootjack and Polley Lakes (Figure 1). Groundwater flow direction is assumed from the topographic high in the area of the ridge towards low-lying areas and major natural drainage features such as the Bootjack and Polley Lakes to the west and east, respectively. The Bootjack Lake is at approximately elev. 992 m and the Polley Lake is at approximately elev. 929 m. In the area of the open pits, it is assumed that groundwater flows approximately from north to south and east to west based on the original topography in the area.

There are no piezometers or other hydrogeological instrumentation that have been installed in the vicinity of the open pits to monitor hydraulic heads. A hydrogeological investigation was conducted by Golder Associates Ltd. (Golder) in June 2015 near the Springer Pit for short-term water management. Collections of data between Springer Pit and Bootjack Lake was the objective of the investigation to understand seepage conditions. Overall, the data collected indicated that it is unlikely that seepage from the Springer Pit towards Bootjack Lake has occurred (Golder 2015a).

Water accumulation has been present in the Springer and Cariboo Pits dependent on where mining activities were occurring prior to 2019 when mining operations paused for care and maintenance. Since operations resumed in 2021, water accumulation to elev. 951 m has remained in Cariboo Pit as mining activities have focused on Springer Pit. Water accumulation to elev. 1,078 m has been present in the C2 Pit since mining was completed in 2016. No seepage has been visible in the walls below the C2 Pit along the Cariboo Ramp. The pit walls in the Springer and Cariboo Pits have exhibited limited, localized seepage in the following areas:

- Cariboo Pit
  - East wall near the East Cariboo Fault (elev. 1,123 m). Seepage was noted between 2019 and 2021, and again in 2023 in the upper benches of the unload area.
  - Lower east wall below the unload area on the southeast side (elev. 1,084 m to 976 m). Seepage has been noted since 2019. The amount of seepage has been variable.

- Springer Pit
  - Northeast wall along the Polley Fault. Minor seepage has been noted along the major fault for several years.
  - South wall near current mining activities at elev. 931 m. Minor seepage was noted during the 2023 slope stability review in September 2023. It is possible the seepage is due to tailings excavation in the area (water from the tailings seeping to the low point in the pit) or infiltration from the ridge along the top of the south wall.

Based on the current understanding of the hydrogeology in the area of the open pits, some water pressures are expected to exist within the pit walls during excavation of the proposed ultimate pit.

5.6 Geotechnical Domains

Geotechnical domains are generally defined as having four components: the geological, structural, rock mass, and hydrological models. Based on the current pit wall performance and engineering geology information compiled for the open pits at Mount Polley Mine, the following can be determined:

- **Geological:** The geology or lithologic units varies throughout the open pits. For the purposes of the 2024 LOM assessment, geology is considered the main divide for the geotechnical domains.
- **Structural:** The structural geology is controlled largely by the lithologic units encountered in the open pits and the Polley Fault (pervasive northwest-southeast striking structural trend that dips to the northeast and southwest). For the purposes of the 2024 LOM assessment, the structural trends are considered within each lithological unit, however, the geotechnical domains have not been subdivided further for structure.
- **Rock mass:** The rock strengths and rock mass characteristics are generally similar for the various rock types proposed to be exposed in the ultimate pits.
- **Hydrogeological:** There is limited hydrogeology information for the open pits and does not implicate the geotechnical domains.

The geotechnical domains for the 2024 LOM assessment of the proposed ultimate pit design are presented in Figure 10 and have been determined based on pit area and geology.

6.0 OPEN PIT SLOPE STABILITY ASSESSMENT

6.1 Rock Slope Design Terminology

A pit slope has four major components: the catch-bench, the bench face, the inter-ramp slope, and the overall slope (Figure 11). Bench configuration is defined by the vertical bench separation (bench height), catch-bench width (bench width), and bench face angle (BFA). The inter-ramp slope is formed by a series of uninterrupted benches, and the overall slope is formed by a series of inter-ramp slopes separated by haul roads or wide geotechnical benches.

The bench height is a function of the type of excavation equipment used, while BFA is normally a function of geotechnical factors such as material strength or structural discontinuities in the rock mass. However, where no such geological controls exist, it may be a function of the blasting damage, or the type of excavation equipment used.

It is common practice to establish catch-benches on a pit slope to retain loose material that may fall from either the immediate bench face above or from the upper part of the slope. Where conditions are suitable, it is also common practice to place benches at vertical intervals of two (or occasionally more) bench heights, creating a multi-bench slope configuration.

The inter-ramp angle (IRA) corresponds to the angle subtended by a line joining the toes of the benches on the wall and the horizontal. The overall slope angle corresponds to the angle formed by the line joining the toe of the lowest bench with the pit crest and the horizontal. The incorporation of ramps onto a wall will result in a slope that has a shallower overall slope angle than the IRA.

6.2 Rock Slope Failure Mechanisms

Rock slope design procedures are intended to establish pit wall design criteria based on the expected failure mechanisms, as determined by analyzing the engineering geology model. In this context, instability in rock slopes can generally be classified according to the following principal failure mechanisms:

- failures due to rock mass fabric and structural discontinuities (kinematic failures)
- failures due to rock mass strength
- failures due to a combination of kinematic failures and rock mass strength failures

The stability of slopes excavated in competent rock is normally a function of structurally controlled failure mechanisms. In high rock slopes or slopes excavated in incompetent rock, overall slope failure mechanisms that involve the development of failure surfaces through intact rock and along pre-existing geologic surfaces are also a concern. These two principal failure mechanisms are discussed in further detail in the following sections.

6.2.1 Structurally Controlled Failure Mechanisms

The three basic mechanisms of structurally controlled failure in rock slopes are plane failures, wedge failures, and toppling failures, as described below. These mechanisms are shown schematically in Figure 12.

Planar failure may occur when a geological discontinuity dips out of a rock slope at an angle that is shallower than the inclination of the slope but steeper than the effective angle of friction along the discontinuities. Planar failures will only develop to a significant extent if the strike of the geological discontinuity is within ±20 to 30 degrees of the strike of the rock slope.

Wedge failure may occur when two or more geological discontinuities intersect to form an unstable block. For wedge failure to occur, the line of intersection of the wedge must dip out of the slope at an inclination that is shallower than the inclination of the slope but steeper than the effective angle of friction along the discontinuities. Wedge failures will only develop to a significant extent if the azimuth of the line of intersection of the wedge is within ±45 degrees of the azimuth of the slope face.

Toppling failure may develop when a rock mass contains multiple, parallel, steeply in-dipping, continuous geologic structures, such as bedding or continuous joints or foliation planes, that strike nearly parallel to the strike of the face of the rock slope. Toppling failures will generally only develop when the strike of the structures is within ± 20 degrees of the strike of the slope face. Kinematically, the potential for toppling failure is determined by the slope angle, and by the spacing, inclination, and continuity of the toppling blocks. Widely spaced and/or discontinuous structures mitigate the potential for toppling, while closely spaced, continuous structures have the potential to develop into multi-bench, shallow-seated failures, which could result in overall wall failure.

All structurally controlled failure modes are influenced by groundwater pressure within the slope, and toppling failures are particularly sensitive to groundwater pressure. The magnitude and frequency of structurally controlled failures are directly related to the continuity of the structures along which sliding can occur. Rock mass structures that exhibit limited continuity, such as joints, may result in small bench-scale failures that are rarely of consequence to overall slope stability, but may adversely affect access ramps or equipment installations. Conversely, larger-scale failures can occur along continuous, through-going structures, such as regional faults and dykes. Therefore, it is these more continuous structures that are of primary concern for pit slope design.

6.2.2 Overall Rock Mass Strength Failure Mechanisms

Slopes excavated in weak or heavily fractured rock masses, or extremely high slopes, can be susceptible to overall rock mass failure, which involves the development of pseudo-circular type failure zones through intact rock (Figure 13). Where major structures are present with an appropriate orientation, these structures may be partially involved in a more complex failure mechanism by creating release planes for the rock mass failure.

6.3 Rock Slope Design Acceptance Criteria

Typical design acceptance criteria (DAC) (i.e., factor of safety and probability of failure acceptance criteria) for large open pit slopes are summarized in Table 16.

Table 16: Typical Factor of Safety and Probability of Failure for Consequence of Failure Acceptance Criteria Values (after Read and Stacey 2009)

Slope Scale	Consequence of Failure[(a)]	Acceptance Criteria	
		Minimum FOS	Maximum POF, P[FOS ≤ 1] (%)
Bench	Low to High	1.1	25 to 50
Inter-ramp	Low	1.15–1.2	25
	Medium	1.2	20
	High	1.2–1.3	10
Overall	Low	1.2–1.3	15–20
	Medium	1.3	5–10
	High	1.3–1.5	≤5

(a) Consequence of failure semi-quantitatively evaluated.

FOS = factor of safety; POF = probability of failure.

No critical infrastructure is located near the proposed ultimate pit walls. Failure of a significant portion of one of the pit walls could impact mining production by limiting access to the pit floor and temporarily limit production from mining operations. The (NW PAG Dump is near the crest of the west wall of Springer Pit and if failure of this wall were to occur could impact the dump. Taking these factors into considerations, the open pits have a medium consequence of failure. The proposed design acceptance criteria for the proposed ultimate pit design are presented in Table 17.

Table 17: Proposed Design Acceptance Criteria for the Proposed Ultimate Pit Design

Slope Scale	Minimum FOS	Maximum POF (%)
Bench	N/A	50
Double Bench		50
Inter-ramp		20
Overall	1.3	N/A

6.4 Kinematic Stability Assessment

A kinematic stability assessment has been carried out to determine optimum bench and inter-ramp configurations for the various pit wall sectors in the proposed ultimate pit design. The following sub-sections describe the methodology for the kinematic assessment and the kinematic stability assessment results.

6.4.1 Methodology

Kinematic stability analyses have been carried out to assess the potential for bench-scale (single and double bench) and inter-ramp scale planar, wedge, and toppling instability of the proposed ultimate pit design.

In porphyry deposits, discontinuous structures are typically closely spaced and pervasive. These structures typically impact the slope stability of the individual benches. However, due to their limited continuity they typically do not impact the slope stability at the inter-ramp scale. The majority of the mapped structures in the open pits exhibit a continuity of less than a single bench height (12 m). In contrast, continuous faults and dykes are usually widely spaced and typically do not affect bench-scale stability, except locally where the structure is exposed in the bench face. However, due to their greater continuity, continuous structures can affect the performance at the inter-ramp scale due to the ability of these structures to form potential large-scale planar or wedge structures. It would be conservative to apply the discontinuous structures to the assessment of the double benches or the inter-ramp scale slopes since the kinematic analyses assume that the structures extend the full height of the slope. Therefore, the single benches were assessed for discontinuous structures, and double bench and inter-ramp slopes were assessed for continuous structures. The discontinuous and continuous structural sets are presented in Table 8 by pit area and lithology, and the continuity of the structures was presented in Section 5.2.2.

Since the major structures in the open pits are generally steeply dipping and at favourable orientations with respect to the pit walls, slope-scale kinematic analyses were not completed for these structures, and a discussion of how the major structures will interact with the pit walls is provided in Section 6.5.1.

The kinematic analyses were performed for specific wall orientations based on the proposed ultimate pit design provided by MPMC (Section 4.0) and for each lithologic unit that is encountered in each wall orientation based on the geologic interpretation (Rees 2013). The stability of the pit walls and the optimum design bench configurations will depend on the orientations of the walls with respect to the structural sets that are expected to be exposed in the pit walls for each lithologic unit. Therefore, recommendations regarding optimum design bench configurations are provided in terms of pit area, wall orientations, and lithology. The wall orientations are expressed in terms of the wall "dip-direction", *i.e.,* the direction the wall faces.

The kinematic slope stability analyses have been carried out in two stages:

1) Screening level assessment using the Dips software (RocScience 2023c).

2) Deterministic analyses using RocPlane and SWedge analyses software (RocScience 2023a and 2023b) based on the screening level assessment.

6.4.2 Kinematic Screening Level Assessment

The screening level assessment was carried out to identify which structural sets or combination of sets, if any, could result in planar, wedge, or toppling instability. Specific design sets or combination of sets were highlighted by the screening level assessment if the results indicated the percentage of sliding exceed the probability of failure (PoF) design acceptance criteria (Table 17).

The following criteria were used for the screening level kinematic stability assessment (Appendix F, Figures F-2 to F-37):

- A lateral limit of 90°, ±20° from the dip direction of the slope, was used for planar and toppling analyses.
- A kinematic window of 90˚, ±45° from the dip direction of the slope, was used for wedge analyses.
- Wedges will not be formed by two structures within the same structural set.
- Structures that are not interpreted to be part of a defined structural set (i.e., random structures) have not been included in the analyses.
- Strength parameters presented in Section 5.2.2 for discontinuous and continuous structures were used for the screening level assessment.

Deterministic analyses using RocPlane and SWedge were subsequently carried out on sets or combination of sets which were identified to exceed the design acceptance criteria during the screening level assessment. These analyses produce a series of statistics which are plotted as cumulative frequency (CF) curves.

The following considerations have been made for the deterministic analyses:

- Planar, wedge, and toppling failure analyses were carried out with respect to closely spaced and relatively discontinuous features.
- Slope heights:
  - Single benches: a slope height of 12 m was used. Discontinuous structures were considered.
  - Double benches: a slope height of 24 m was used. Continuous structures were considered.
  - Inter-ramp: a slope height of 72 m was used. Continuous structures were considered.

- Recent observations from the 2023 slope stability review indicate minimal wall seepage in all of the current open pits. Groundwater pressures are expected to dissipate at the bench-scale. Therefore, all bench-scale kinematic models (single and double bench) were completed under dry conditions. Groundwater pressures were assumed at 33% of the slope height for the inter-ramp kinematic models due to the larger and deeper failure mechanisms that could intersect the water table behind the slope. 33% was selected based on the Bootjack Lake elevation in relation to the proposed pit bottom and observations of seepage over the years of excavating the pits.

6.4.3 Kinematic Deterministic Analyses

6.4.3.1 Single Bench

Single bench kinematic deterministic assessments were carried out for the proposed ultimate pit design using the discontinuous structural sets presented in Table 8. A summary of all reviewed set combinations by structural domain are presented in Appendix G.

The deterministic review presented in Appendix G indicates there are three single bench planar failure mechanisms and three single bench wedge failure mechanisms that are expected to exceed the design acceptance criteria for the proposed ultimate pit design. These failure mechanisms have been further investigated with probabilistic analyses using cumulative frequency plots (Appendix G, Figures C-39 to G-40).

One single bench potential toppling failure mechanism was identified in the breccia rock in the east wall of the Cariboo Pit during the screening process. The wall orientation and rock type are near the East Cariboo Fault. The potential toppling mechanism is likely to be contained/mitigated by the current design in this area (i.e., single benches). Toppling is known to have occurred near the East Cariboo Fault and single benches have been used to mitigate this failure mechanism in this area. Therefore, the toppling potential in this area has not been investigated further since the design proposed for the east wall direction (i.e. single benches) is expected to be adequate.

6.4.3.2 Double Bench

Double bench kinematic deterministic assessments were carried out for the proposed ultimate pit design using the continuous structural sets presented in Table 8. A summary of all reviewed set combinations by structural domain are presented in Appendix G.

The deterministic review presented in Appendix G indicates there are six double bench planar failure mechanisms and six double bench wedge failure mechanisms that are expected to exceed the design acceptance criteria for the proposed ultimate pit design. These failure mechanisms have been further investigated with probabilistic analyses using cumulative frequency plots (Appendix G, Figures C-41 to G-42).

6.4.3.3 Inter-ramp Slope

Inter-ramp slope kinematic deterministic assessments were carried out for the proposed ultimate pit design using critical wall directions from the double bench deterministic assessment. There are two inter-ramp planar failure mechanisms and one inter-ramp wedge failure mechanism that are expected to exceed the design acceptance criteria for the proposed ultimate pit design. These failure mechanisms have been further investigated with probabilistic analyses using cumulative frequency plots (Appendix G, Figures C-43 to G-44).

6.4.4 Kinematic Slope Stability Analyses Results

6.4.4.1 Single Bench

Single bench kinematic stability assessments were carried out for the proposed ultimate pit design using the structural sets identified in the screening level assessment. A summary of the modelled, kinematically admissible planes and wedges (FOS less than 1.0) for the proposed ultimate pit design by wall direction for single benches are presented in Table 18.

Table 18: Summary of Kinematic Results for Single Bench Analyses

Pit	Lithology	Wall Direction (Degrees)	Bench Height (m)	Structure Scale	Critical Mechanism	Set(s)	BFA @ P[FOS<1]=50%
Springer / WX	Monzodiorite	330	12	Discontinuous	Planar	Set 4/3	**61**
					Wedge	Set 4/3 & Set 5B	62
	Diorite	220	12	Discontinuous	Planar	Set 1B	**80**
Cariboo / C2	Breccia	195	12	Discontinuous	Planar	Set 2	**74**
					Wedge	Set 5B & Set 6A	90
					Wedge	Set 5B & Set 2	75

Bold BFAs indicate critical BFAs for the wall direction.

Some of the results of the planar analyses indicate low BFAs in comparison to the wedge analyses for the same slope angles. These results are not consistent with observed performance to date in the open pit areas. This typically occurs where structures exhibit a continuity that is significantly less than the bench heights. Set 4/3 exposed on the southeast wall of the Springer Pit is an example of this. Consequently, the recommended BFAs used to develop the pit slope design recommendations are in part based on WSP's previous experience in the open pits.

6.4.4.2 Double Bench Probability of Failure Assessment

Double bench kinematic stability assessments were carried out for the proposed ultimate pit design using the structural sets identified in the screening level assessment. A summary of the modelled, kinematically admissible planes and wedges (FOS less than 1.0) for the proposed ultimate pit design by wall direction for double benches are presented in Table 19.

Table 19: Summary of Kinematic Results for Double Bench Analyses

Pit	Lithology	Wall Direction (Degrees)	Bench Height (m)	Structural Scale	Critical Mechanism	Set(s)	BFA @ P[FOS<1]=50%
Springer/WX	Monzodiorite	56	24	Continuous	Wedge	Set 5A/6A & Set 3	90
		97	24	Continuous	Planar	Set 5A/6A	**82**
		330	24	Continuous	Planar	Set 3C	**80**
				Continuous	Wedge	Set 5B & Set 3C	90
	Breccia	35	24	Continuous	Planar	Set 5A	90
				Continuous	Wedge	Set 5A & Set 3	90
		85	24	Continuous	Planar	Set 5A	**77**
				Continuous	Wedge	Set 5A & Set 3	90
Cariboo/C2	Breccia	195	24	Continuous	Planar	Set 1B	90
		317	24	Continuous	Planar	Set 3	90
				Continuous	Wedge	Set 3 & Set 3	90
				Continuous	Wedge	Set 3 & Set 1B	90

Bold BFAs indicate critical BFAs for the wall direction.

6.4.4.3 Inter-ramp Probability of Failure Assessment

Inter-ramp kinematic stability assessments were carried out for the proposed ultimate pit design using the continuous structural sets identified in the screening level assessment. Inter-ramp models were created for the structural sets with the lowest results for continuous features for the double bench assessment. The results for inter-ramp slopes are presented in Table 20.

Table 20: Summary of Kinematic Results for Inter-ramp Analyses

Pit	Lithology	Wall Direction (Degrees)	Bench Height (m)	Structural Scale	Critical Mechanism	Set(s)	Dry IRA @ P[FOS<1]=20%	33% Saturation IRA @ P[FOS<1]=20%
Springer/WX	Monzodiorite	56	72	Continuous	Wedge	Set 5A/6A & Set 3	74	73
		97	72	Continuous	Planar	Set 5A/6A	**68**	**65**
	Breccia	85	72	Continuous	Planar	Set 5A	**63**	**60**

6.4.5 Springer/WX Pit Recommended Bench Design Configurations

Bench design recommendations for walls to be excavated in the Springer/WX Pits are presented in Table 21 and Figure 14. The resulting BFAs were reviewed based on the critical case (i.e., the shallower indicated BFA) between the planar and wedge analyses and were selected based on the analyses, engineering judgement, and past performance of the pit area.

Table 21: Summary of Springer/WX Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Catch-Bench Width (m)	Rationale
Monzodiorite	280	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	330	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	056	24	65	46.5	11.5	Double benching in southwest wall acceptable with shallower BFA controlled by Set 5A.
Breccia	035	24	70	50	11.5	Double benching in breccia (particularly in the WX Pit) in the southwest and west walls.
	085	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	097	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	220	12	70	43	8.5	Single benches recommended due to confluence of several faults in the northeast wall in the breccia. Transition from double to single benches will be in the north corner of the Springer Pit.
Diorite	220	12	70	43	8.5	Single bench in the diorite to control raveling from Polley and Springer Faults.

The recommended bench design configuration for the Springer/WX Pits is similar to what has previously been proposed (Golder 2016) and to the proposed ultimate pit design that MPMC provided.

6.4.6 Cariboo/C2 Pit Recommended Bench Design Configurations

Bench design recommendations for walls to be excavated in the Cariboo/C2 Pits are presented in Table 22 and Figure 14. The resulting BFAs were reviewed based on the critical case (i.e., the shallower indicated BFA) between the planar and wedge analyses and were selected based on the analyses, engineering judgement, and past performance of the pit area.

Table 22: Summary of Cariboo/C2 Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Catch-Bench Width (m)	Rationale
Monzodiorite	195	12	70	43	8.5	Single benches in Polley Fault.
	238	12	70	43	8.5	Single benches due to toppling along East Cariboo Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA. Double benches acceptable along southeast wall of Cariboo/C2 Pits.
Breccia	188	24	70	49	12	Double benches in C2 Pit.
	195	12	70	43	8.5	Single benches in Polley Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA.

The recommended bench design configuration for the Cariboo/C2 Pits is similar to what has previously been proposed (Golder 2016) and to the proposed ultimate pit design that MPMC provided.

6.5 Overall Slope Stability Assessment

This section outlines the results of previous slope stability assessments that have been completed for ultimate pit walls, and the overall slope stability assessment for the 2024 LOM assessment.

6.5.1 Overall Slope Stability – Major Faults Assessment

Figures 5 and 15 show the projected location of the major faults with respect to the existing and the proposed ultimate pit walls, respectively.

Several major continuous faults are interpreted to exist in the area of the open pits and have been exposed along the current pit walls (described in Section 5.1). The influence that these faults are expected to have on the proposed ultimate pit walls are discussed below and the major structures projected on the proposed ultimate pit design are shown in Figure 15:

- The South Wishbone Fault is interpreted to intersect the ultimate pit through the north nose of the Springer Pit with about six double benches on the northwest side. The South Wishbone Fault does not create any adverse, large-scale wedges that could plunge out of the slope. Because the South Wishbone Fault is a vertical fault, is favorably oriented in the proposed ultimate pit wall, and has performed adequately in the previous pit wall (Figure 6), the fault is not expected to be a slope stability issue in the proposed ultimate pit design.
- The Springer Fault is interpreted to intersect the ultimate pit through the north end of the northeast wall through the entire pit wall at an oblique angle. The Springer Fault creates wedge intersections with the Springer South Boundary Fault and the Cariboo South Boundary Faults, however, both wedges are either into the pit wall or do not daylight on the overall slope. Due to the favorable orientation of the Springer Fault and the adequate performance of the pit wall in the area of the fault (Figure 6), the Springer Fault is not expected to be a slope stability concern in the ultimate pit design.

- The Springer South Boundary Fault is interpreted to intersect the northeast and west ultimate pit walls at similar angles as currently exposed in the Springer Pit. The Springer South Boundary Fault intersects the Springer Fault and they create an undaylighted wedge in the northeast wall. As a result, the Southwest Boundary Fault is not expected to be a slope stability issue in the ultimate pit due to the favorable orientation and adequate slope stability performance in the current pit walls (Figure 6).
- The Cariboo South Boundary Fault is interpreted to intersect the ultimate pit northeast wall near the Polley and Polley South Boundary Faults. Based on current performance in the northeast wall at the confluence of these faults, ongoing raveling is occurring (Figure 8). This is being managed by single benching and bench cleaning. The confluence of these faults may cause an area of raveling in the northeast wall of the ultimate pit but are unlikely to affect the overall slope stability due to the oblique angles at which the faults intersect the wall. The Cariboo South Boundary Fault will also intersect the ultimate pit west wall of the Springer Pit at an oblique angle. It is difficult to determine where the intersection of the Cariboo South Boundary Fault is in the current pit, however, the west wall has been performing adequately (Figure 7). Based on the fault model review there are no adverse wedges that intersect the ultimate pit wall with the Cariboo South Boundary Fault.
- The Polley South Boundary Fault is interpreted to intersect the ultimate pit near the Polley and Cariboo South Boundary Faults in the northeast wall of the Springer Pit. Based on current performance in the northeast wall at the confluence of these faults, ongoing raveling is occurring (Figure 8). This is being managed by single benching and bench cleaning. The confluence of these faults may cause an area of raveling in the northeast wall of the ultimate pit but are unlikely to affect the overall slope stability due to the oblique angles at which the faults intersect the wall. Based on the fault model review there are no adverse wedges that intersect the ultimate pit wall with the Polley South Boundary Fault.
- The Polley Fault is interpreted to intersect the proposed ultimate pit design along the central portion of the northeast wall towards the lower northeast corner of the wall, then along the northeast corner of the WX Pit, and along the southeast corner of the C2 Pit. The current northeast wall is experiencing ongoing ravel in the area of the fault which is being managed by the single benches in the fault zone (Figure 8). It is anticipated that similar behaviour will occur in the ultimate pit northeast wall. As benches are excavated in the Polley Fault zone, each bench will need to be cleaned prior to excavating the following bench to maintain adequate catchment for the ravel material. The southern end of the Polley Fault intersects the southeast corner near the C2 Pit and raveling is occurring along the intersection (Figure 7). It is anticipated that similar behaviour will occur in the ultimate pit southeast wall and single benching will be required.
- The Polley Secondary Fault is interpreted to intersect the lower portion of the northeast wall of the ultimate pit below the Polley Fault, the lower east wall of Springer Pit, and the west wall of the WX Pit. It is difficult to determine intersections on the current pit walls (Figures 7 and 8). It is anticipated that due to the oblique orientation the Polley Secondary Fault intersects the until pit wall, it should not affect the overall slope stability.
- The Southwest Boundary Fault is interpreted to intersect the ultimate pit west and east walls of Springer Pit. The Southwest Boundary Fault and Cariboo South Boundary Fault create a wedge in the west wall that plunges into the slope, therefore, this is unlikely to be a slope stability concern. There may be increased ravel between the two faults on the west wall of Springer Pit during excavation. Due to the orientation the Southwest Boundary Fault is interpreted to intersect the ultimate pit walls and based on previous performance of the pit walls in the area of the fault, it is not expected to be a slope stability concern in the ultimate pit.

- The East Cariboo Fault is anticipated to intersect the ultimate pit in the east corner. Toppling instability has been observed to occur along the easterly dipping faults and joints in the upper weathered monzonite which is in the hangingwall of the East Cariboo Fault (Figure 9). Similar rock mass behavior is anticipated in the area of the ultimate pit as new benches are excavated and single benching is recommended on the east side of the East Cariboo Fault.

6.5.2 Summary of Previous Slope Stability Assessments

6.5.2.1 2015 Overall Slope Stability Assessment – Springer Pit Southwest Wall

In 2015 a slope stability assessment was completed for the southwest wall of the Springer Pit. Circular type failure through overall rock mass was assessed (Golder 2015b). The 2015 assessment was carried out to demonstrate the long-term slope stability of the pit wall located between the Springer Pit and Bootjack Lake. Long-term slope stability conditions were assessed for the ultimate southwest wall pit design at the time, which at the time was proposed to be approximately 180 m high.

The walls in the October 2015 Springer Pit have exhibited adequate overall stability to date. The monzonite rocks excavated along the southwest wall are considered to exhibit competent rock mass quality. Structural mapping carried out in 2009, 2010, and 2014 were reviewed to determine their impact on slope stability. The joint surfaces were typically mapped as discontinuous and restricted to the bench faces. The intersections of these joints had formed wedges resulting in rockfall and raveling of the exposed bench faces in the southwest wall at the time. The mapped faults were determined to be continuous and observed over several of the exposed bench faces. However, the majority of the faults in the southwest wall are steeply dipping and are not expected to affect the overall slope stability conditions.

Slope stability analyses were carried out for dry and saturated pit walls, and for flooded pit conditions (Golder 2015b). The overall slope stability of the southwest wall was assessed using two-dimensional limit equilibrium methods for the ultimate pit through the most critical cross-section in the wall (Golder 2015b). The results of the slope stability analyses indicated that the proposed slope would exhibit FOS of between 2.8 and 1.3 with respect to potential circular failure through the near surface blast damaged rock mass for dry and saturated conditions, respectively.

6.5.2.2 2016 Overall Slope Stability Assessment – Springer Pit Northeast Wall

In 2016, Golder performed a slope stability assessment of the northeast wall in Springer Pit based on an updated proposed ultimate pit design at the time. The stability of the northeast wall in the Springer Pit was assessed with respect to potential circular type failure through the rock mass. The northeast wall was selected for analyses as it exhibited the most adverse combination of slope height and overall slope angle with an overall wall height of about 400 m. Field observations found localized seepage occurring into the pit through the northeast wall. Consequently, some water pressures were expected to exist within the wall (Golder 2016).

The overall slope stability of the northeast wall was assessed using two-dimensional limit equilibrium methods. To account for uncertainty in the groundwater conditions, a sensitivity analysis was carried out. The r_u method was used to model groundwater pressures within the pit slopes. The r_u method evaluates groundwater pressure as the ratio of the weight of the water pressure to the weight of the corresponding overburden pressure above a given point in the rock slope.

The following three groundwater scenarios were modeled:

- dry slope conditions
- some natural drainage of groundwater pressures within the rock slope, with r_u values of 0.1 and 0.2

The results of the slope stability analyses indicated that the proposed slope would exhibit FOS of between 3.4 and 2.6 with respect to potential circular failure through the near surface blast damaged rock mass for dry conditions and for a r_u of 0.2, respectively. Consequently, the slope is expected to exhibit adequate stability with respect to these two mechanisms. In summary, the results of the slope stability analyses indicated that the northeast wall of the Springer Pit was expected to exhibit adequate stability performance for the proposed mining scenario. Given that the other pit walls are expected to exhibit either lower wall heights or lower overall slope angles, and similar overall rock mass strengths are expected, the remaining pit walls are also expected to exhibit adequate overall slope stability (Golder 2016).

6.5.3 Overall Slope Stability Methodology and Assumptions for the 2024 LOM Assessment

Overall slope stability analyses were considered for the 2024 LOM assessment. After reviewing the previous slope stability analyses completed in 2015 and 2016 the following summary table was compiled to compare wall heights and overall slope angles between proposed pit designs for the given year (Table 23).

Table 23: Summary of Previous Slope Stability Analyses Designs for Springer Pit Compared to 2024 Design

Year	Pit	Wall	Wall Height (m)	Overall Slope Angle (degrees)	Elevation of Pit Bottom (m)
2015 Assessment	Springer	Southwest	180	40	932
2016 Assessment		Northeast	400	40	778
2024 Assessment		Southwest	300	40	760
		Northeast	408	40	

The northeast wall height, overall slope angle, and pit bottom elevation presented for the proposed ultimate pit design for the 2024 LOM assessment are similar to the 2016 design (Golder 2016). As well, rock mass strengths are expected to be similar between both the 2016 and 2024 LOM assessments. The 2016 assessment considered dry and partially saturated conditions for the overall slope stability analyses which, based on a review of the Bootjack and Polley Lake elevations (elev. 992 m and elev. 929 m, respectively) in relation to the proposed ultimate pit bottom (elev. 760 m), and past experience with groundwater seepage into the pit, are considered appropriate for the overall slope stability of the proposed ultimate pit design. The FOS also range between 2.6 and 3.4 which is above the design acceptance criteria. Therefore, the analyses completed on the northeast wall of Springer Pit in 2016 are considered adequate for the current proposed ultimate pit design of the Springer northeast wall.

The southwest wall height for the proposed ultimate pit design for the 2024 LOM assessment is higher than the 2015 assessment (Golder 2015b). The overall slope angle is the same. Given that the rock mass strengths used in the 2015 assessment are similar to what has been presented in the 2024 LOM assessment (Section 5.4) and the FOS meet design criteria for dry and saturated conditions, it is expected that for a higher wall height and partially saturated conditions (approximately 1/3 to 2/3 the wall height), the southwest wall would continue to exhibit adequate slope stability and meet the design acceptance criteria.

The northeast wall is the highest wall in the proposed ultimate pit design; the remainder of the pit walls are lower with similar overall slope angles. Given that the other pit walls are expected to exhibit similar overall rock mass strengths in conjunction with lower wall heights and similar overall slope angles, the remaining pit walls are also expected to exhibit adequate overall slope stability

Pseudo-static seismic analyses for open pit slopes are typically considered overly conservative, and therefore, analyses are not common to be completed on large rock slopes. Read and Stacey (2009) state that there are no recorded case histories of large-scale earthquake-induced mine slope failures having disrupted mining operations. Due to the large size of open pit slopes, topographical amplification effects and scale related averaging effects results in quite different dynamic characteristics to soil slopes. A key limitation of earthquake stability of large open pit rock slopes is that accelerations in a high slope within a slip surface extending from the crest to ¼ of the slope depth are relatively constant, but average accelerations within a slip surface over the entire slope height is much lower than the maximum acceleration (at the crest) (Toh et al. 2013). Based on findings from Read and Stacey (2009) and Toh et al. (2013) no seismic analyses have been completed for the proposed ultimate pit design.

7.0 PROXIMITY TO NORTHWEST POTENTIALLY ACID GENERATING DUMP

The crest of northwest wall of the proposed ultimate pit design will be located approximately 8 m to 100 m away from the toe of the south lobe of the NW PAG Dump (Figure 16).

The south lobe of the NW PAG Dump was constructed between 2012 and 2013, MPMC indicated that trees were logged and the topsoil was stripped from the foundation of the dump prior to construction (Golder 2013). The NW PAG Dump is interpreted to be founded on a thin veneer of colluvium underlain by till in this area (WSP 2024). The south lobe is founded on gently to moderately sloping terrain that is inclined at approximately 20 to 30 degrees to the southwest and west. The south lobe has been inactive for approximately 10 years and has exhibited adequate slope stability performance during this time.

The northwest wall in Springer Pit below the NW PAG Dump is expected to exhibit similar overall rock mass strengths to other walls in the Springer Pit and expose monzodiorite and breccia rock types (Section 5.4). Double benching is proposed in this area of the ultimate pit design (Figure 16).

The following considerations should be made regarding the proximity of the NW PAG Dump to the crest of the proposed ultimate pit design:

- Blasting induced vibrations
  - Blasting induced vibrations due to mining near surface in the proposed ultimate pit near the NW PAG Dump could lead to localized slope instability or rockfall and rock rollout. To mitigate this risk the following should be considered:
    - A geophone could be installed in the area to monitor blast vibrations and how they impact the NW PAG Dump.
    - Smaller blast patterns for the first few benches could be considered to control wall blasting and limit vibrations that could impact the NW PAG Dump.
    - Visual inspections should be completed after a blast. Inspections should include review of the crest and toe of the NW PAG Dump to identify any cracking, raveling, or loose material that could pose a risk to workers and equipment below.
- Construction of a rock rollout catchment berm could be considered along the toe of the NW PAG Dump (if access is manageable prior to excavation of the upper benches in this area). As well, an additional catchment berm could be constructed along the inside edge of the haul road that will enter the proposed ultimate pit from the west side of the pit to provide additional catchment.
- Removal of unconsolidated materials
  - The Health, Safety and Reclamation Code (HSRC) for mines in BC indicates that all unconsolidated material within 2 m of the rim of a working face or wall in a surface mine shall be removed, and beyond this distance all unconsolidated material shall be sloped to an angle less than the natural angle of repose (EMLI 2024, Section 6.23.1). It is recommended that the first one to two benches (depending on the overburden depth) be single benched before double benching in bedrock. The single benches should be sloped to an overall slope of angle of repose (37 degrees) to satisfy the HSRC requirements.

- Development of a safe access plan below an inactive dump
  - As required by HSRC (EMLI 2024, Section 6.10.1) a procedure for controlling access to areas within the potential runout zone of all dumps should be prepared. This includes a monitoring program to allow work below inactive and dormant dumps. As well the procedure should include provisions for signage, working under adverse conditions, and should be reviewed annually.
- Potential for foundation soils to be susceptible to liquefaction under dynamic loading (i.e., earthquake loading) causing a potential failure and runout of the NW PAG Dump into the pit.
  - Based on laboratory testing of the colluvium and till in the footprint of the NW PAG Dump and several other areas on site, these materials are not susceptible to liquefaction. The particle grain size distribution curves indicate a high coefficient of uniformity which aligns with descriptions of the materials being well-graded. As well, due to the voids between the coarser fraction of the colluvium and till being filled with fines, the material are typically not susceptible to structure collapse and liquefaction upon loading.

8.0 OPERATIONAL CONSIDERATIONS

The following operational controls should be implemented during the excavation of the proposed ultimate pit design:

- Blasting practices:
  - Mining is going to occur concurrently during several phases of mining (for example on the northeast wall, at the Springer Pit bottom in Phase 4 and at the Springer Pit crest in the Phase 5 pushback). To limit overspill onto existing pit walls and to mitigate risk to personnel who may be working below, consider blasting the upper pushback design starting with a drop shot into the bench and work to the outer limits of the bench using the inner free face rather than the outer free face for energy release. This will help move material towards the pit wall rather than over the pit crest and onto benches below where personnel are mining below.
  - MPMC have been having good success with pre-shear blasting and limiting damage to the bench faces, as observed during the 2023 slope stability review (WSP 2023). Discussions with the mine planning team indicate that they have been successfully achieving design toes by completing a vertical pre-shear row, a trim row about 2.5 m offset from the pre-shear row (with about 0.5 m sub-drill), a buffer row about 6.5 m offset from the trim row (with about -0.5 m sub-drill), into production blasting with an 8 m by 7 m spacing. Continue to use the observational approach to decide if varying spacings for blasting need to be used based on rock type/rock quality to minimize damage to the bench faces.
- Bench cleaning:
  - When cleaning a bench, make sure equipment is pulling material inwards and not pushing debris over the pit wall, as this will decrease catchment and create hazardous work conditions at the pit bottom. Controlled blasting practices and cleaning material away from the crest of the pit will help maintain catchment on the benches below.
- Springer Pit nose area:
  - The nose area on the Springer Pit northeast wall is of particular concern while concurrently mining above and below (Figure 18). The area does not have any wider catch benches along the wall for additional catchment, and the benches are already limited in available catchment due to overspill from previous mining activities. A 3 to 4 m high rock berm should be constructed with a 15 m offset from the toe of the Phase 4 highwall while mining of the Phase 5 pushback is occurring at the crest to mitigate any rock rollout that may occur during mining operations (Figure 17). When mining operations need to access the area within the 15 m offset (i.e., blasting and mucking an ultimate Phase 4 bench), mining in the Phase 5 pushback should be stopped or diverted away from the nose. Once operations are finished in the 15 m offset area, the rock berm should be re-established and mining in the Phase 5 pushback may resume near the crest.
  - If catchment along the wall in the nose area becomes a slope stability concern, a step out may be required.
- Slope stability monitoring (i.e., prisms, LiDAR surveys, radar, etc.)
  - Complete slope stability monitoring of the excavated benches with slope stability monitoring equipment.
  - Follow the MO26 Pit Wall Stability Monitoring SOP (MPMC 2021b)

- Regular visual inspection (MPMC 2021a and 2021b)
  - Visual inspections of the bench faces and crest areas for early evidence of slope instability should be completed. The crest and benches should be examined for signs of cracking or instability at least once every two weeks, and more frequently during the spring runoff and heavy rainfall events. These regular inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded digitally so that a record of the slope stability performance is available should it be required in the event of instability.
- Geologic mapping
  - Mapping should be carried out the pit is excavated, in order to confirm the design assumptions, and if required, to modify the pit wall designs in a timely manner. The orientation and character of the rock fabric and continuous structures should be collected. The mapping data collected should be reviewed in comparison to previous mapping data and the existing slope design recommendations. Major faults and geologic structures are best identified through routine manual geologic wall mapping. Geotechnical mapping techniques or photogrammetry techniques can be used to carry out the mapping of the fault and joint sets.
- Piezometer installation
  - Currently there are no piezometers installed around the proposed ultimate pit design. Various assumptions regarding pore water pressures for slope stability analyses have been used. To confirm pore water pressure assumptions, a vibrating wire piezometer could be installed in an exploration borehole that intersects the proposed ultimate pit design through the highest wall, i.e. the northeast wall of Springer Pit.

9.0 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The pit wall performance of the Springer, Cariboo, C2, and WX Pits has been documented by WSP during annual slope stability reviews of the open pits. The most recent slope stability review was completed in September 2023 (WSP 2023). In general, the Springer, Cariboo, C2, and WX Pits are exhibiting good slope stability performance with no signs of overall slope instability. Many benches have broken back to discontinuous moderately dipping structures; however, adequate catchment remains on the majority of the benches.

MPMC are proposing five expansions to the open pits at Mount Polley Mine including Springer Phase 5 (Sp-5), Springer Phase 6 (Sp-6), Springer Phase 6 Ramp Retreat (Sp-6-RR), WX, C-2-B, and the Cariboo Ramp Retreat (Car-RR) (Appendix B, Figure B-1). These expansions create the proposed ultimate pit design (SP-6/WX) (Figure 4).

The geotechnical domains for the 2024 LOM assessment of the proposed ultimate pit design are presented in Figure 10 and have been determined based on pit area and geology.

Kinematic stability analyses have been carried out to assess the potential for single bench, double bench, and inter-ramp scale planar, wedge, and toppling instability of the proposed ultimate pit design. Bench design configurations are presented in Table 24 and Table 25, and Figure 14.

Table 24: Summary of Springer/WX Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Bench Width (m)	Rationale
Monzodiorite	280	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	330	12	70	43	8.5	Single bench in the monzodiorite in the south and southeast walls of Springer/WX Pits due to planar failure along Set 4/3 and proximity to Polley Fault. Current single bench wall exposures indicate the recommended design is performing adequately.
	056	24	65	46.5	11.5	Double benching in southwest wall acceptable with shallower BFA controlled by Set 5A.
Breccia	035	24	70	50	11.5	Double benching in breccia (particularly in the WX Pit) in the southwest and west walls.
	085	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	097	24	70	50	11.5	Set 5A will likely control BFA for double benches in the breccia.
	220	12	70	43	8.5	Single benches recommended due to confluence of several faults in the northeast wall in the breccia. Transition from double to single benches will be in the north corner of the Springer Pit.
Diorite	220	12	70	43	8.5	Single bench in the diorite to control raveling from Polley and Springer Faults.

Table 25: Summary of Cariboo/C2 Pits Recommended Bench Design Configurations

Lithology	Wall Dip Direction (°)	Bench Height (m)	BFA (°)	IRA (°)	Bench Width (m)	Rationale
Monzodiorite	195	12	70	43	8.5	Single benches in Polley Fault.
	238	12	70	43	8.5	Single benches due to toppling along East Cariboo Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA. Double benches acceptable along southeast wall of Cariboo/C2 Pits.
Breccia	188	24	70	49	12	Double benches in C2 Pit.
	195	12	70	43	8.5	Single benches in Polley Fault.
	317	12/24	70	43/49	8.5/12	Single benches in proximity to Polley Fault. Otherwise double benches at 70 degree BFA.

The following slope design considerations are based on the proposed ultimate pit bench design recommendations:

- The proposed SP-5 design will mine through the inactive Bell Dump along the northeast wall of the ultimate pit in two areas (Figure 17). Single benching with an overall slope of 37 degrees will be required through the waste rock rehandle slopes in these areas.
- The proposed Sp-5 design indicates double benches in the Cariboo Pit east wall where toppling failure is likely to occur in the weathered monzodiorite, east of the East Cariboo Fault, due to closely jointed/faulted rock (Figure 17). Previous toppling failure occurred in the area in 2017 and, as such, single benches have previously been recommended to the east of the East Cariboo Fault (the hangingwall). The Phase 5 pushback design is limited by the Bootjack mine access road which is located at the crest of the proposed double-benched east wall, increasing the consequence of a failure. Double benching in this area could impact the slope stability of the Bootjack mine access road and interfere will access to site due to the higher potential for toppling failure. Using a single bench configuration would require a reduction in the inter-ramp slope angle. Single benches are recommended in walls that are excavated in the East Cariboo Fault and to the east of the fault. based on previous pit wall performance and proximity to the access road to Mount Polley Mine.
- The proposed Sp-6/WX design has at least two double benches at the bottom of the south/southeast wall, where single benches are recommended due to adverse structural conditions experienced in this wall previously (Figure 17).
- The proposed Sp-6/WX design contains a triple bench (36 m high bench) at the bottom of the southwest wall of the WX Pit below the ramp (Figure 17). A triple bench at the bottom of WX Pit would allow MPMC to access additional high-grade ore at the bottom of the pit. The achievability of the triple bench excavation should be evaluated once mining has progressed into the WX Pit to confirm rock type and structure in the area.
- When mining through the Polley Fault on any pit walls, single benching is recommended based on previous experience and performance (Figure 17).

- When mining through the C-2-B Pit, single benches may be required through the Polley Fault along the southeast wall (Figure 17). Previous slope performance in the area of the Polley Fault along this wall has included increased ravel due to the poor rock quality and catch-benches have become infilled over time. Since only two double benches are proposed in this area, it is possible that ravel from the fault can be contained on the wider catch-benches. As mining progresses through the area with double benches, regular inspections of the wall performance should be completed and if catchment becomes limited, a step out or rock rollout berm may be required.

Several major continuous faults are interpreted to exist in the area of the open pits and have been exposed along the current pit walls (described in Section 5.1). These faults are expected to have limited impact on the proposed ultimate pit walls due to the steep nature of the majority of the faults (Section 6.5.1), with the exception of the Polley and East Cariboo Faults which have slope design considerations described in the above bullets.

Upon review of previous slope stability analyses completed for Springer Pit (Golder 2015b and 2016), these analyses were determined to be adequate for the current proposed ultimate pit design based on the following:

- Similar overall wall heights (with the exception of the southwest wall).
- Similar overall slope angles.
- Similar groundwater conditions.
- Similar rock mass strengths expected.

Due to the proximity of the NW PAG Dump to the crest of the proposed ultimate pit design MPMC should consider specific monitoring equipment and plans, as well as single benches within the first one to two benches below the dump (Section 7.0)

Operational controls should be implemented during the excavation of the proposed ultimate pit design, and include blasting practices, bench cleaning, slope monitoring, and geologic mapping (Section 8.0).

10.0 CLOSURE

The reader is referred to the Study Limitations, which precedes the text and forms an integral part of this report. We trust this report satisfies your current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

WSP Canada Inc.

2024-05-30

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https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/035-r-81115-lom open pit design review/rev0/ca0020527.4505-035-r-rev0-81115-life of mine open pit design review 29may_24.docx

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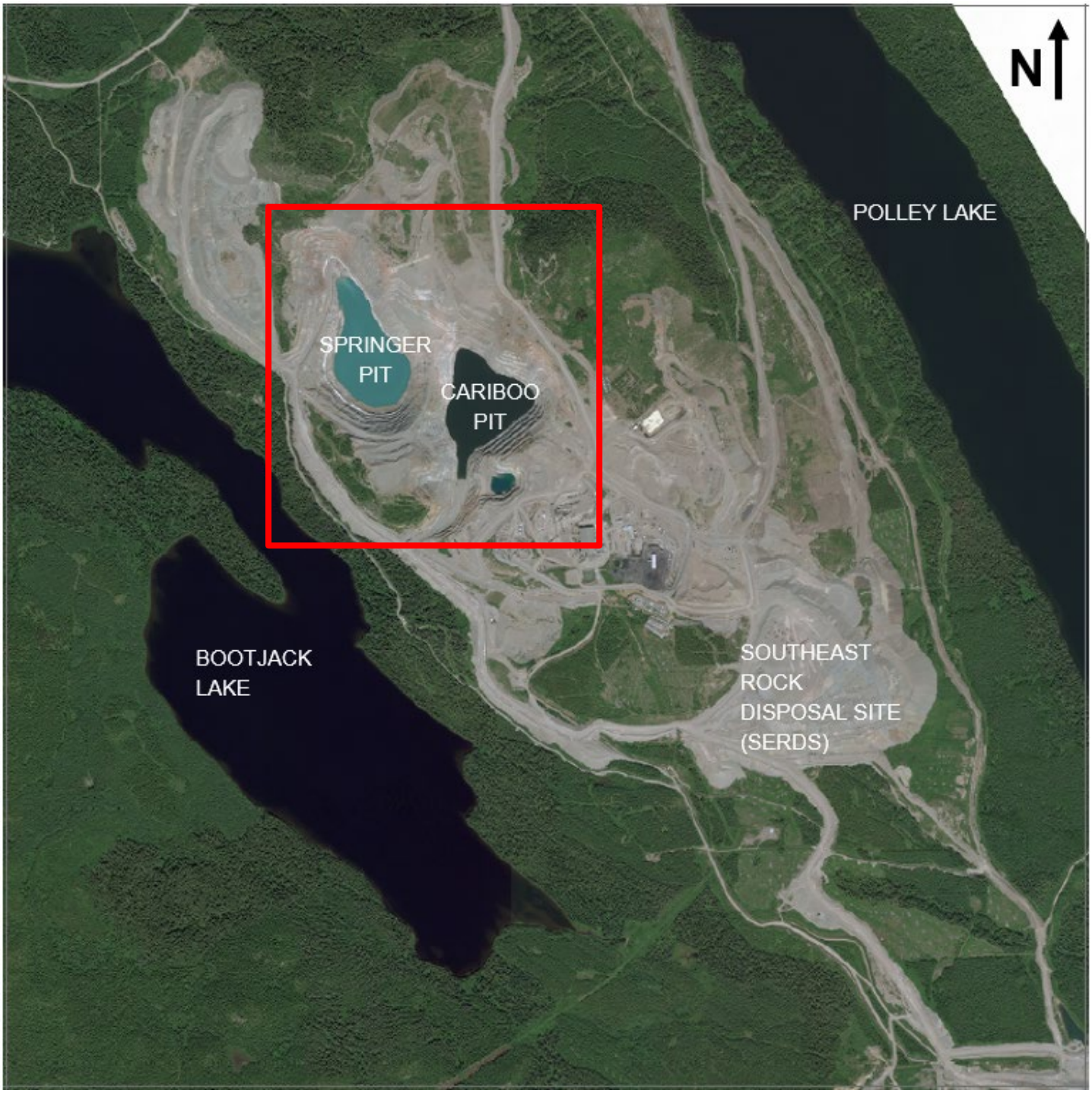

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1. SATELLITE ORTHOPHOTO PROVIDED BY MPMC JUNE 21, 2021.

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CONSULTANT

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
MOUNT POLLEY MINE LAYOUT

PROJECT NO.	PHASE	REV.	FIGURE
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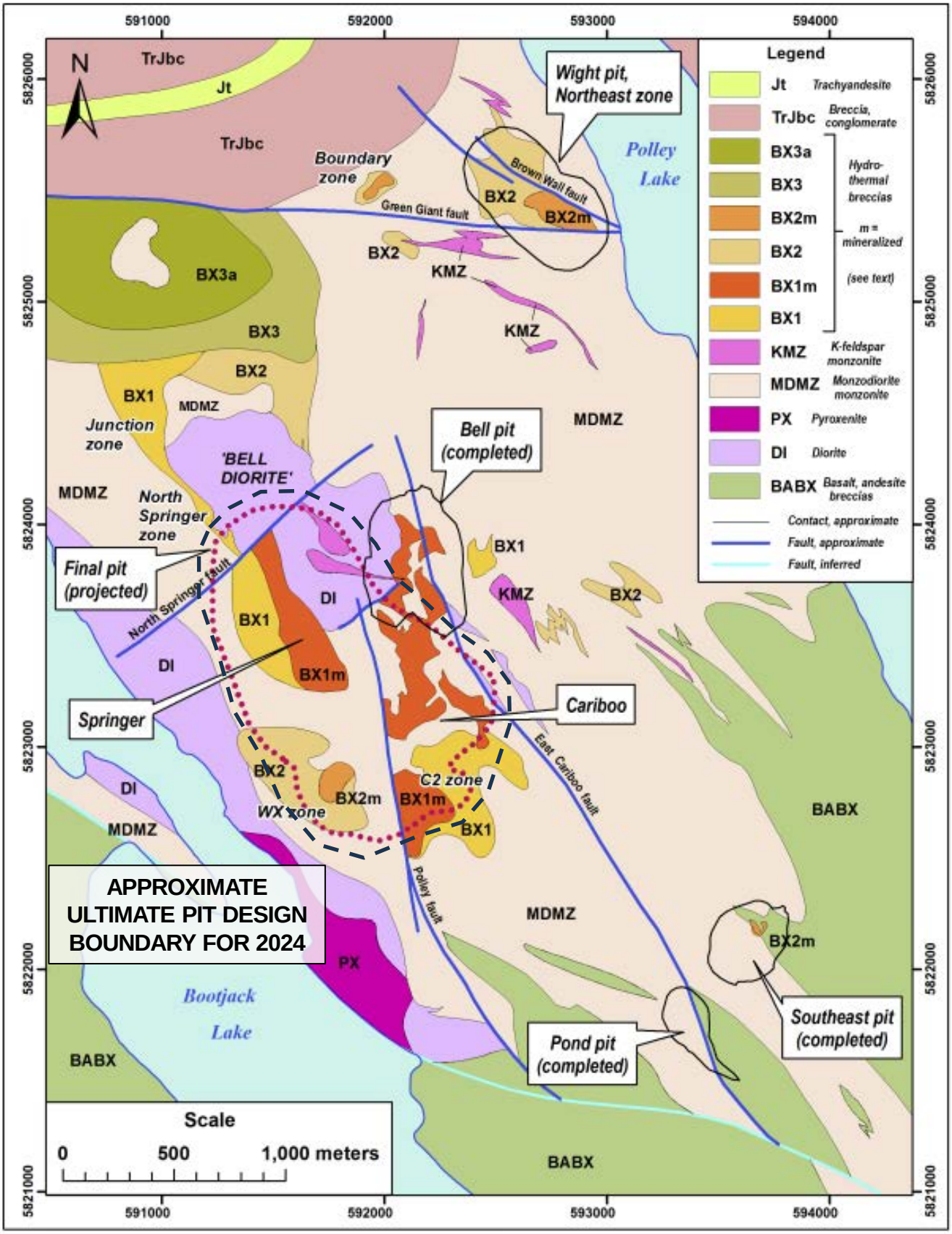

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APPROVED	AGH

TITLE
SIMPLIFIED GEOLOGY OF THE MOUNT POLLEY COMPLEX AFTER REES 2013

PROJECT NO.	PHASE	REV.	FIGURE
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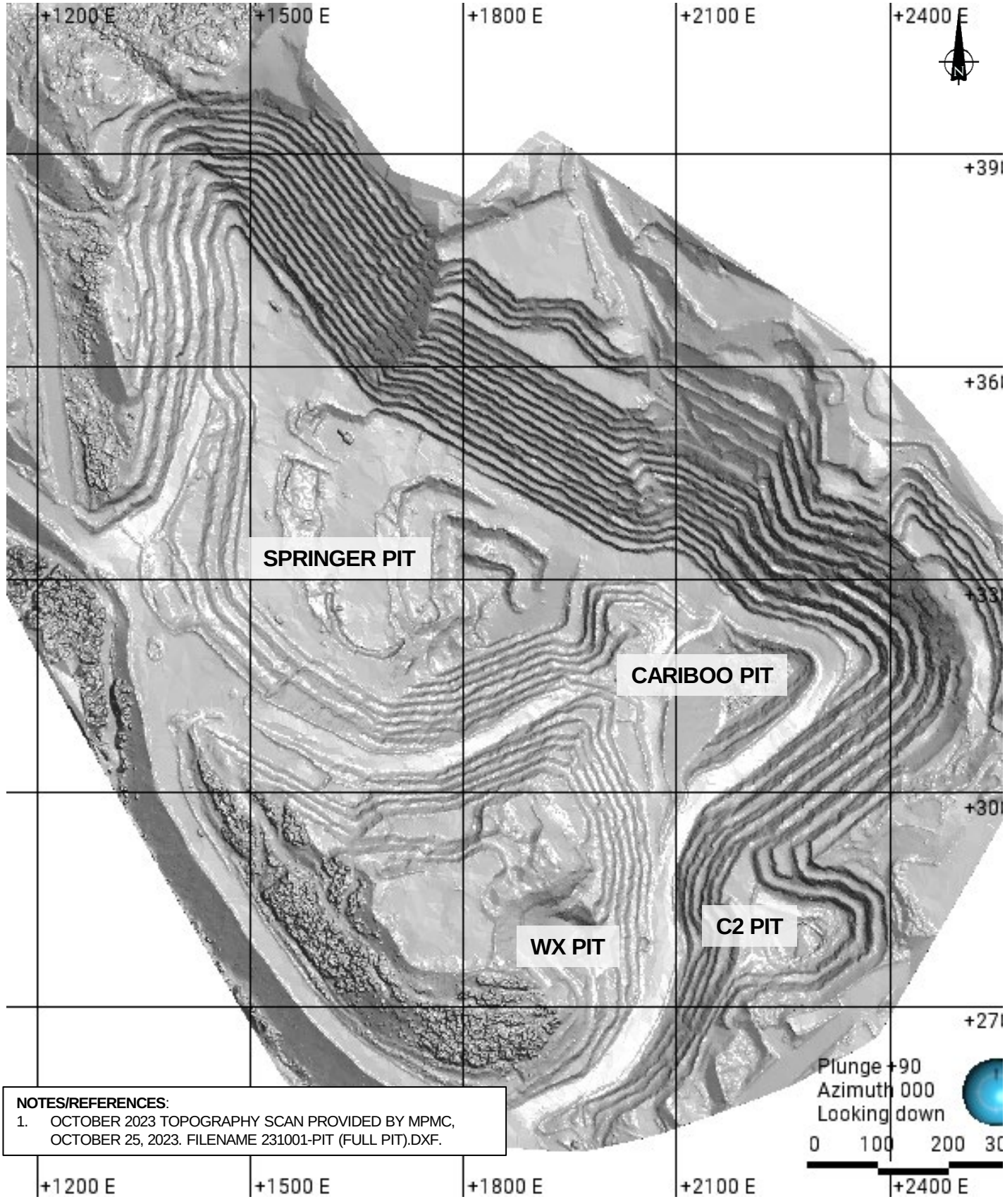

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1. OCTOBER 2023 TOPOGRAPHY SCAN PROVIDED BY MPMC, OCTOBER 25, 2023. FILENAME 231001-PIT (FULL PIT).DXF.

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PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
OCTOBER 2023 TOPOGRAPHY
SPRINGER, CARIBOO, WX, AND C2 PITS

PROJECT NO.	PHASE	REV.	FIGURE
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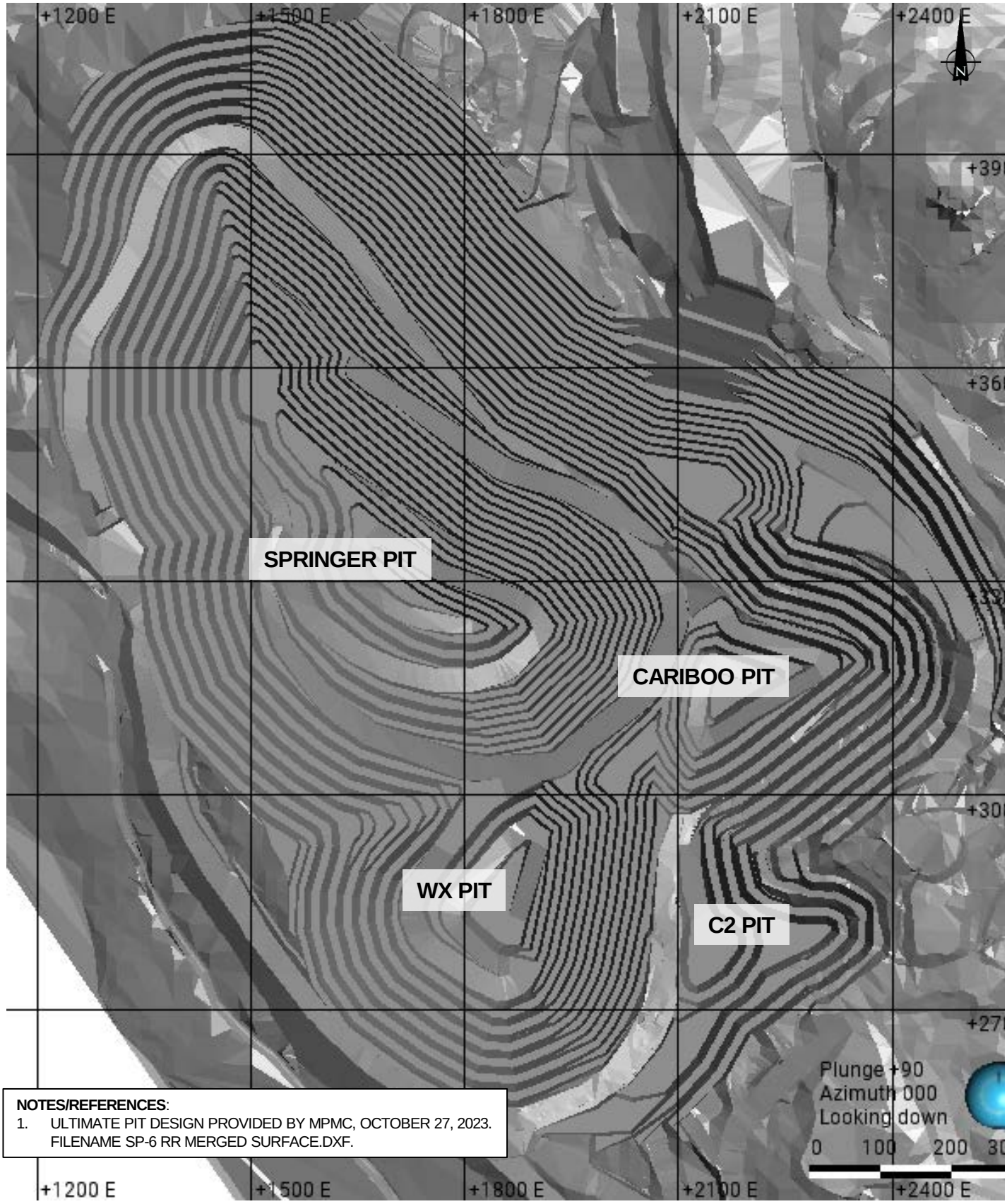

NOTES/REFERENCES:

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PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED ULTIMATE OPEN PIT DESIGN
SPRINGER, CARIBOO, WX, AND C2 PITS

PROJECT NO.	PHASE	REV.	FIGURE
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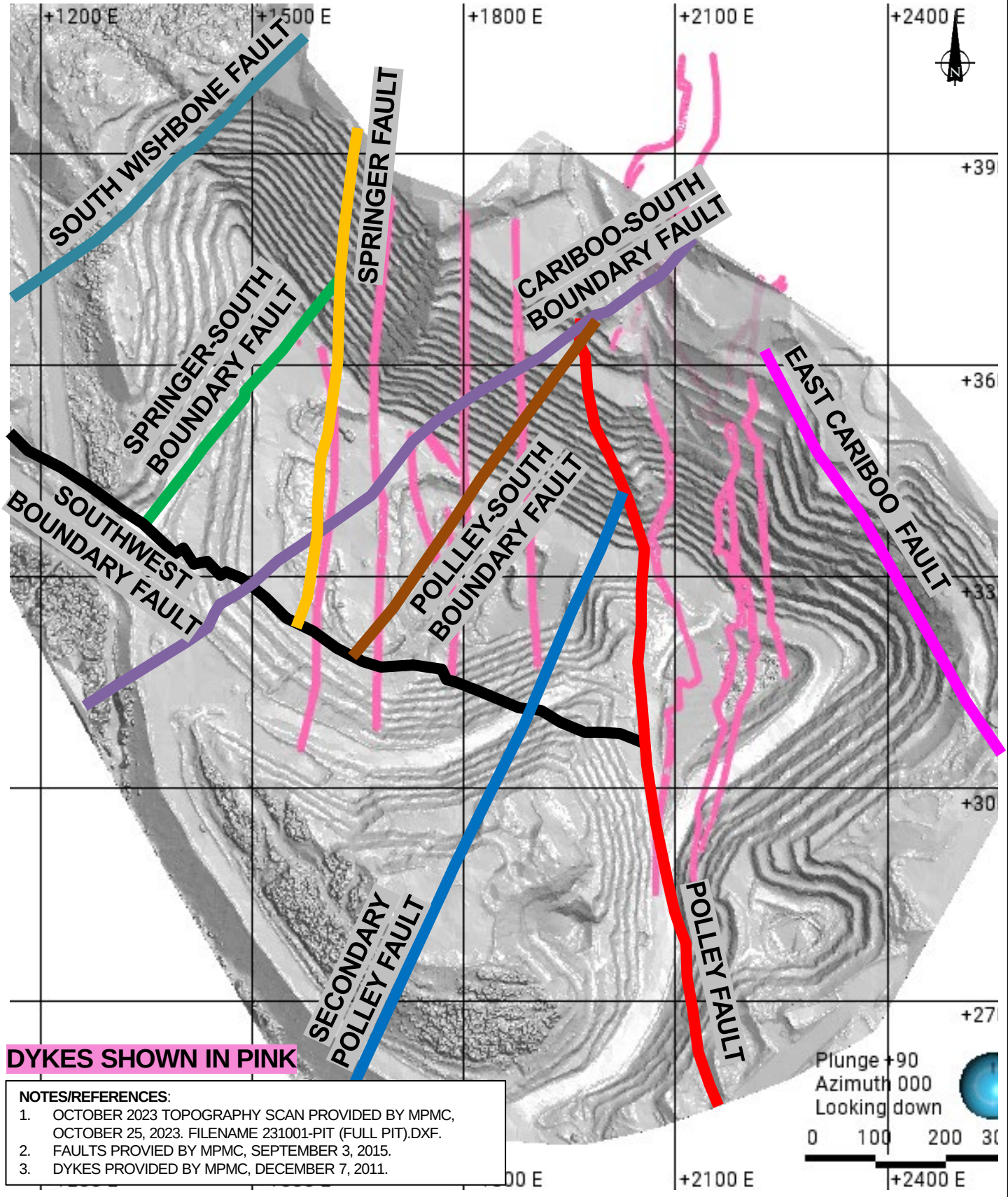

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NOTES/REFERENCES:

1. OCTOBER 2023 TOPOGRAPHY SCAN PROVIDED BY MPMC, OCTOBER 25, 2023. FILENAME 231001-PIT (FULL PIT).DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

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REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
OCTOBER 2023 TOPOGRAPHY OF OPEN PITS WITH FAULT AND DYKE INTERSECTIONS

PROJECT NO.	PHASE	REV.	FIGURE
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1. PHOTOGRAPH TAKEN BY WSP SEPTEMBER 27, 2023.

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DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
NORTH AND NORTHEAST WALLS
SPRINGER PIT - FAULTS
LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	FIGURE
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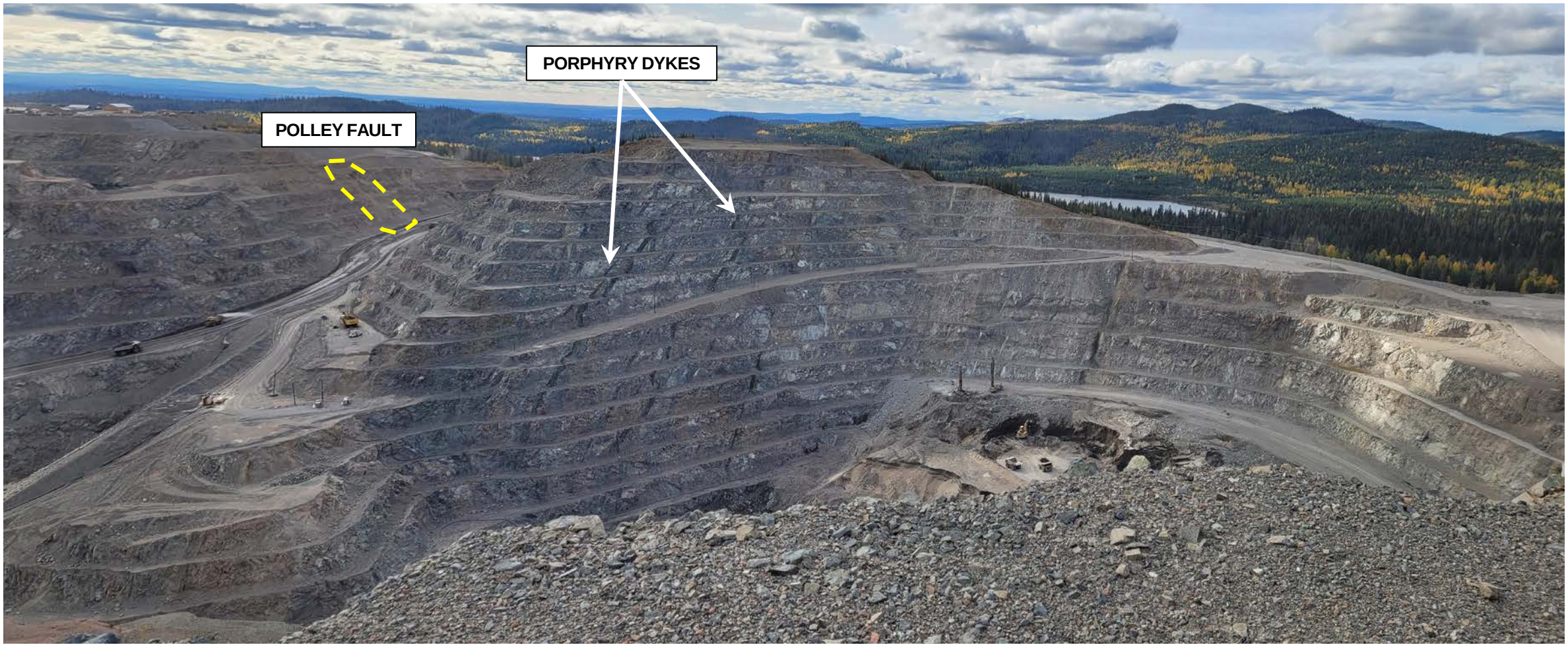

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REVIEWED	AGH
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PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
WEST AND SOUTH WALLS
SPRINGER PIT - FAULTS
LOOKING WEST

PROJECT NO.	PHASE	REV.	FIGURE
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DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
NORTHEAST WALL
SPRINGER PIT - FAULTS
LOOKING EAST

PROJECT NO.	PHASE	REV.	FIGURE
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1. PHOTOGRAPH TAKEN BY WSP SEPTEMBER 27, 2023.

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PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
EAST WALL
CARIBOO PIT - FAULT
LOOKING EAST

PROJECT NO.	PHASE	REV.	FIGURE
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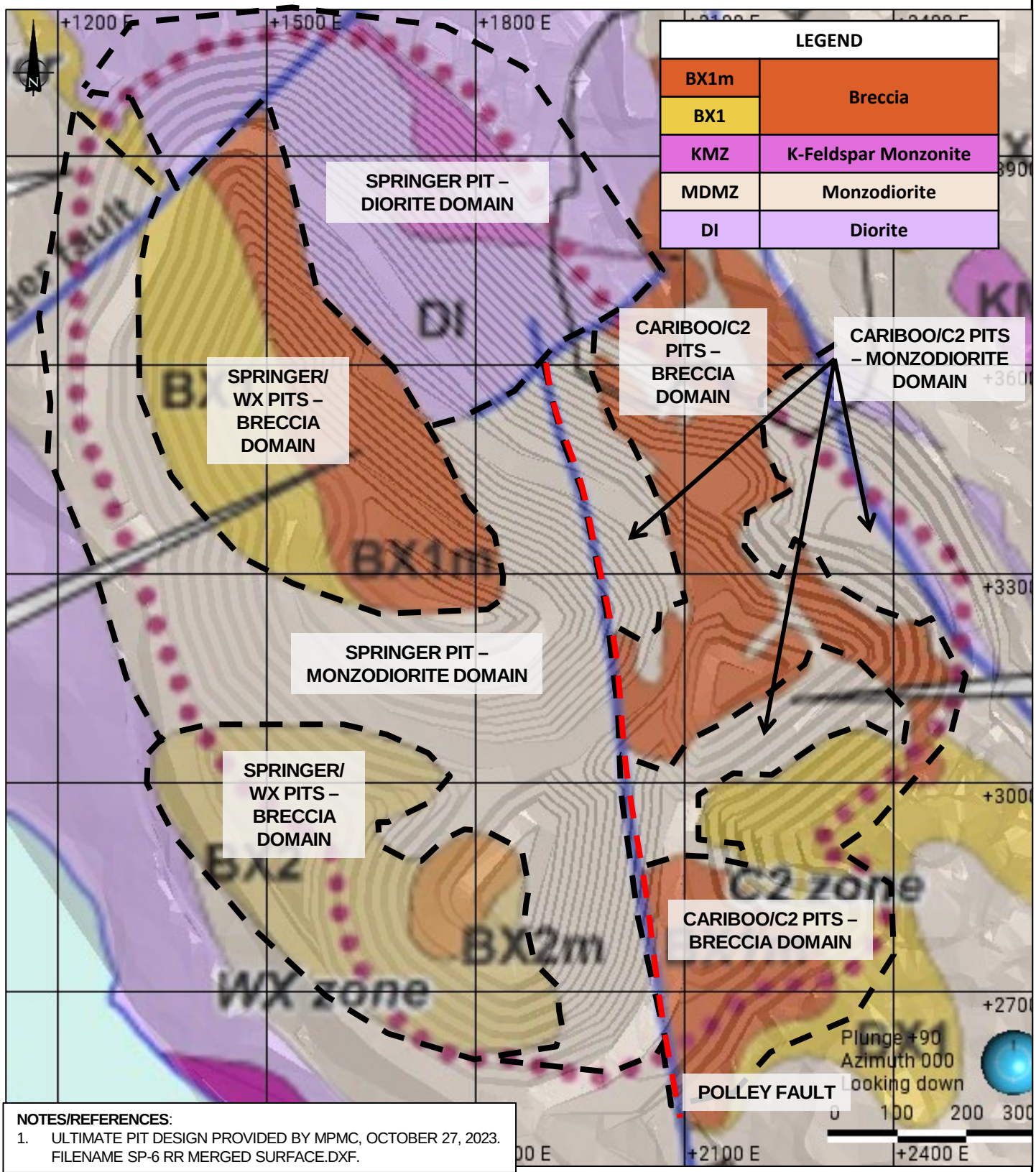

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LIFE OF MINE OPEN PIT DESIGN REVIEW

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PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
OCTOBER 2023 TOPOGRAPHY OF OPEN PITS WITH REES (2013) GEOLOGY MAP OVERLAY GEOTECHNICAL DOMAINS

PROJECT NO.	PHASE	REV.	FIGURE
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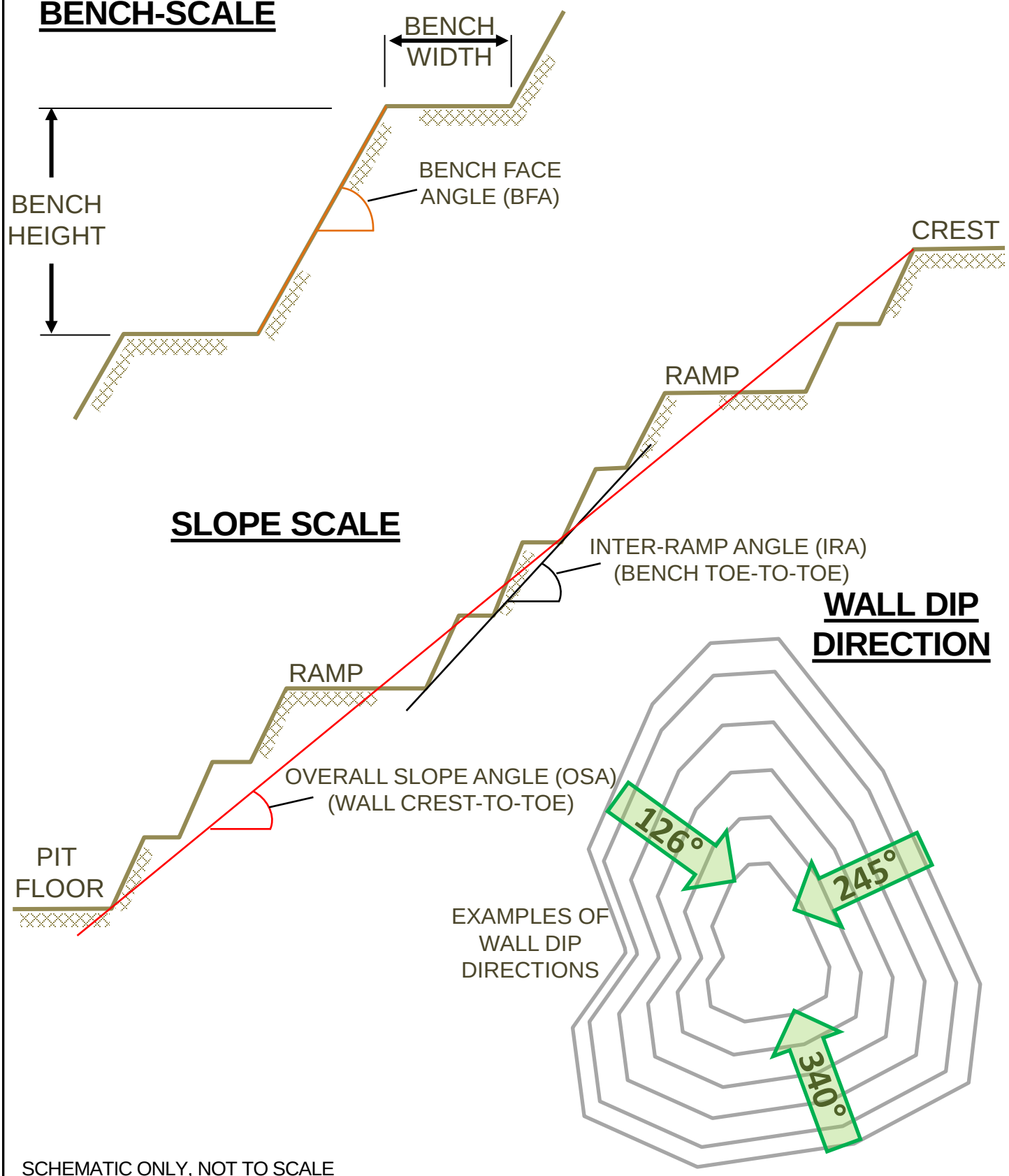

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LIFE OF MINE OPEN PIT DESIGN REVIEW

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PREPARED	KMM
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TITLE
SLOPE DESIGN ELEMENTS

PROJECT NO.	PHASE	REV.	FIGURE
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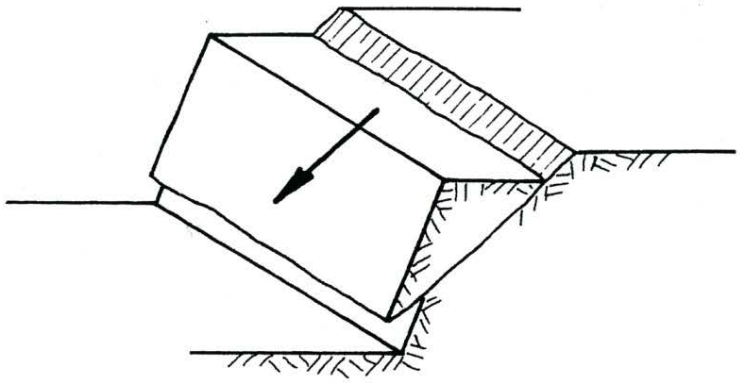

a) Plane Failure on Through Going Discontinuities

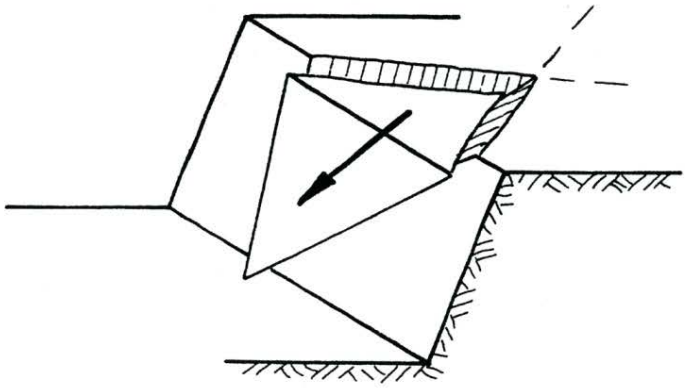

b) Wedge Failure Along Line of Intersection of Discontinuities

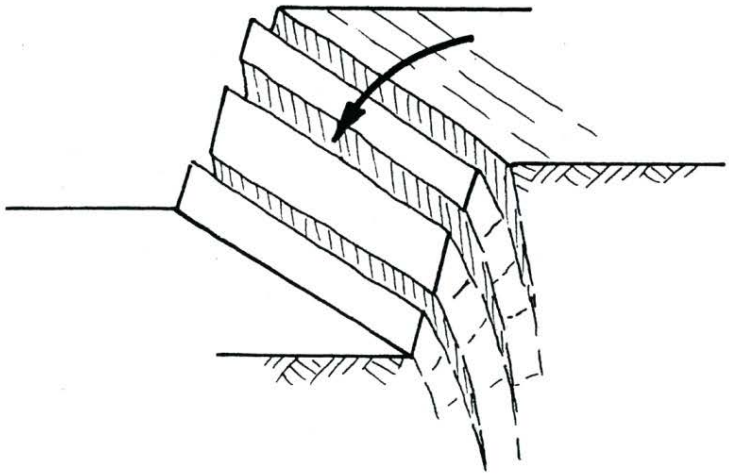

c) Toppling Failure in Hard Rock with Steeply Dipping Joints

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
STRUCTURALLY CONTROLLED INSTABILITY MECHANISMS IN ROCK SLOPES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**12**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

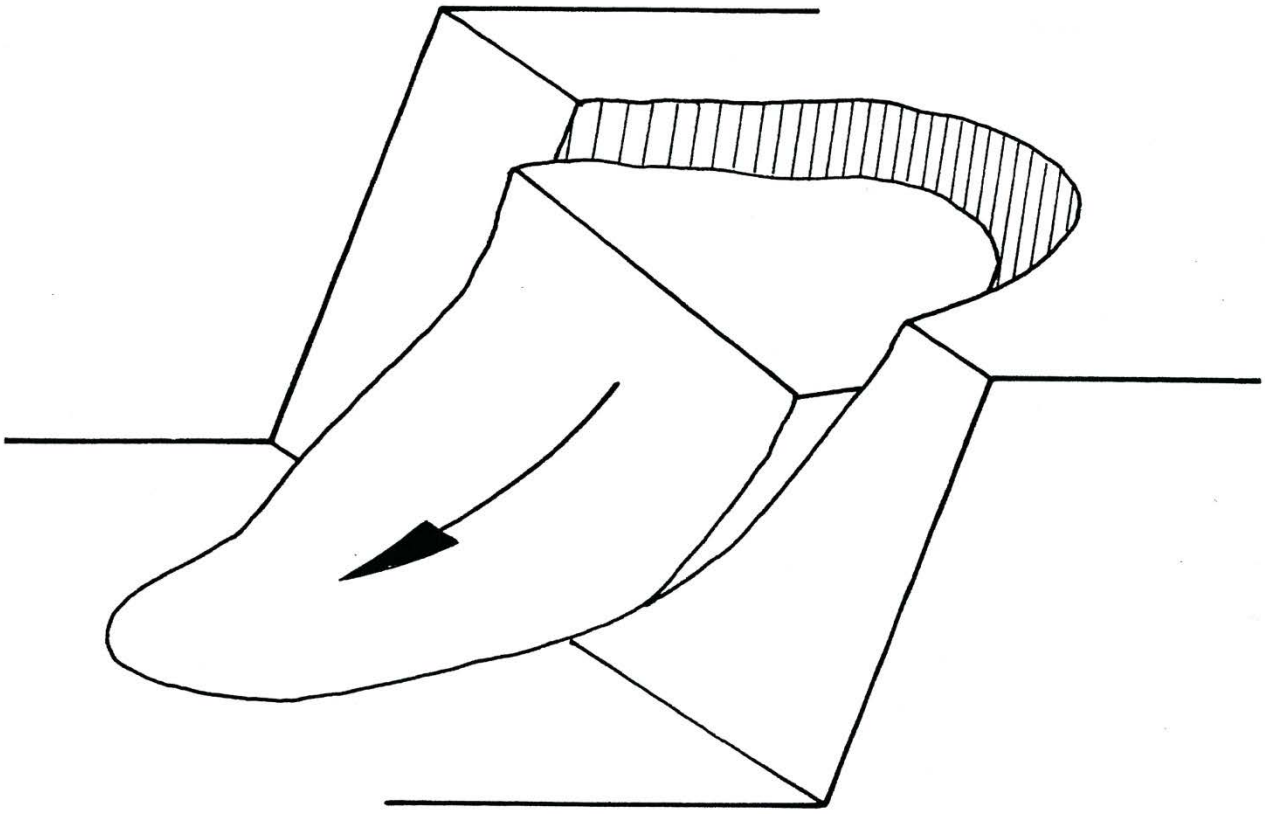

Quasi-Circular Failure in Weak or Heavily Fractured Rock

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
OVERALL ROCK MASS FAILURE MECHANISM

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**13**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

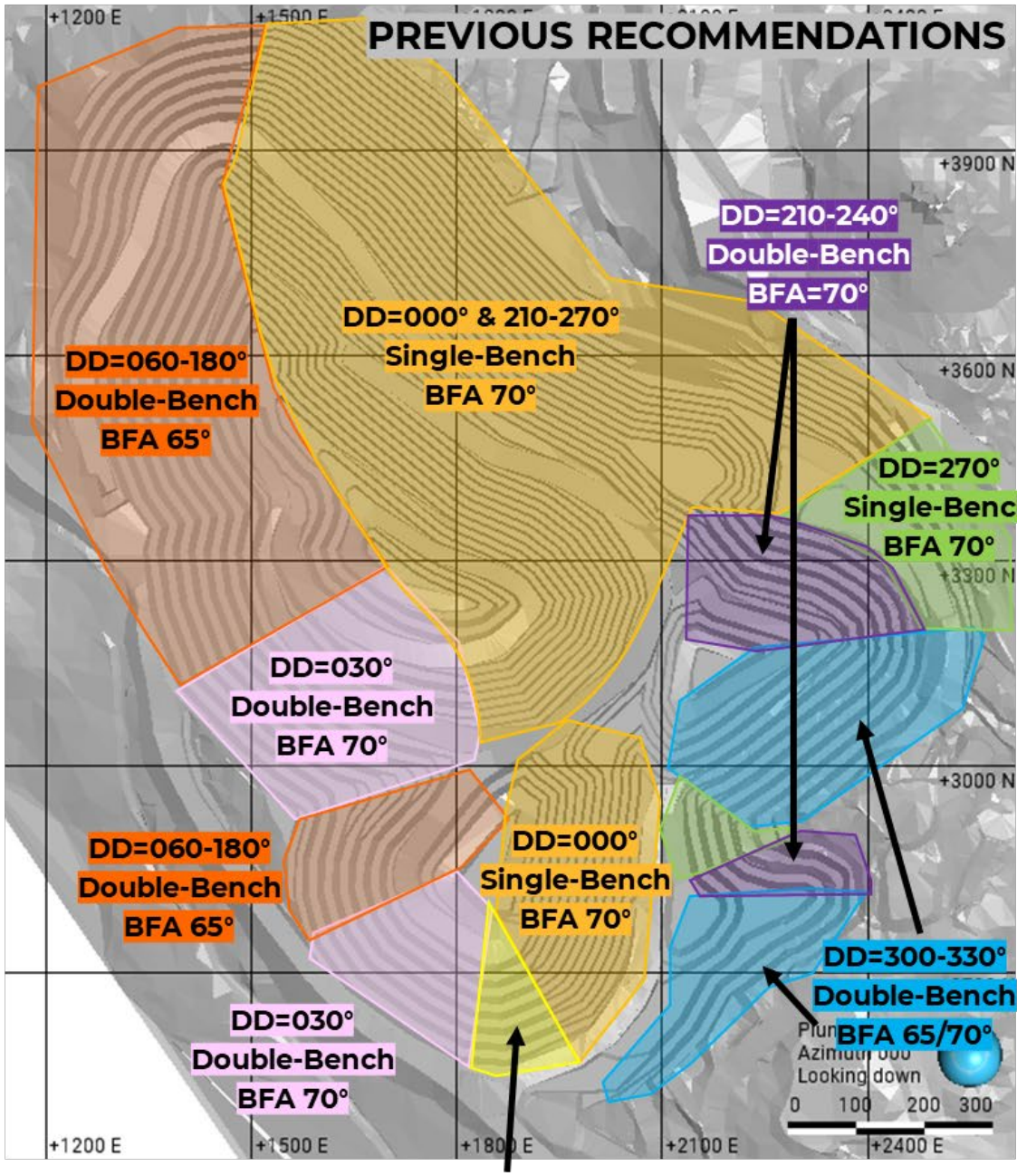

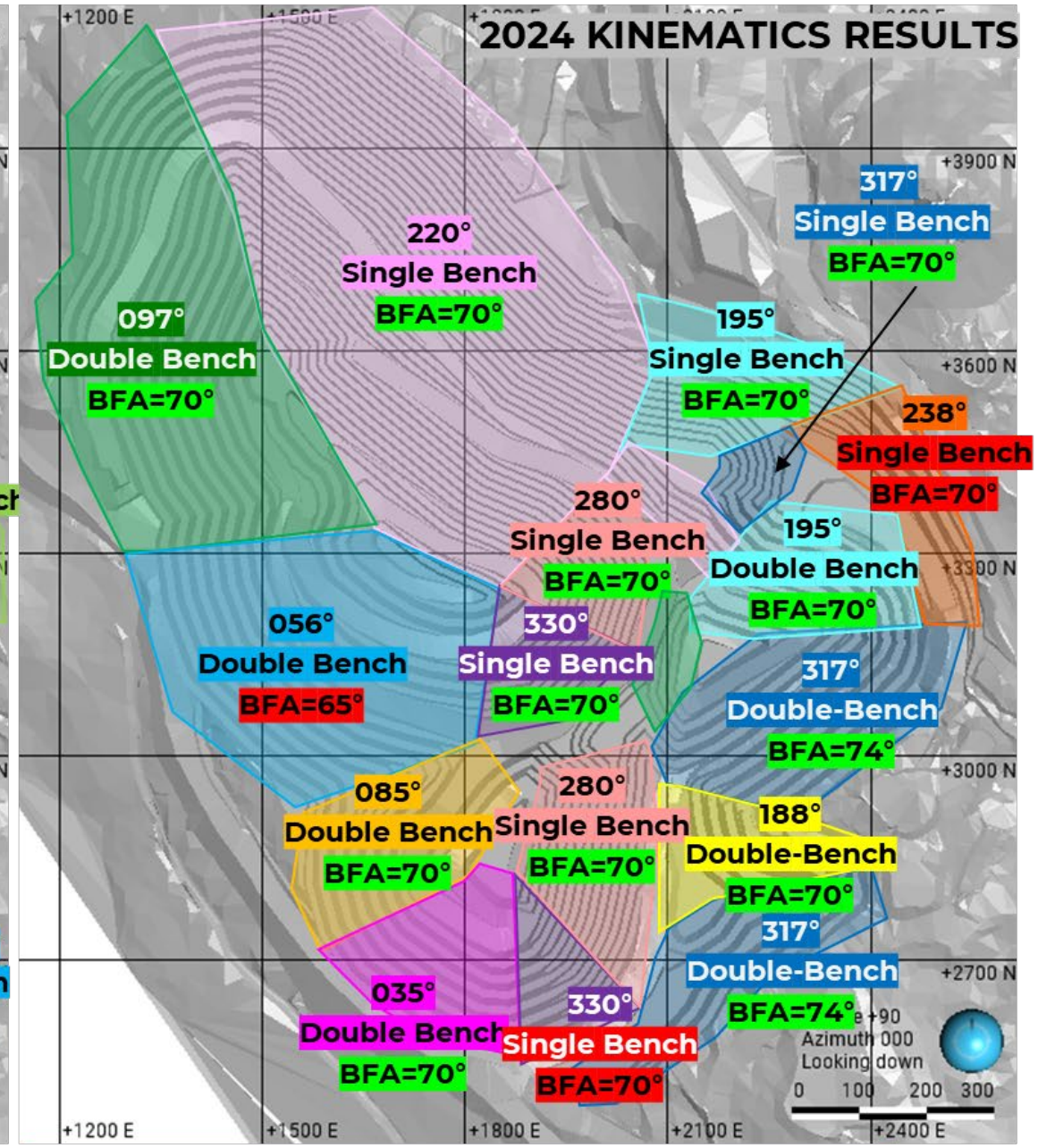

Within 000 Single-Bench orientation but appears double benched.

SAME OR GREATER THAN PREVIOUS RECCOMMENDATION

LESS THAN PREVIOUS RECCOMMENDATION OR INCORRECT DESIGN

NOTES/REFERENCES

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2023-11-08
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PREVIOUS BENCH DESIGN RECOMMENDATIONS (GOLDER 2016) AND 2024 BENCH DESIGN RECOMMENDATIONS

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	81115	0	14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25 mm
0

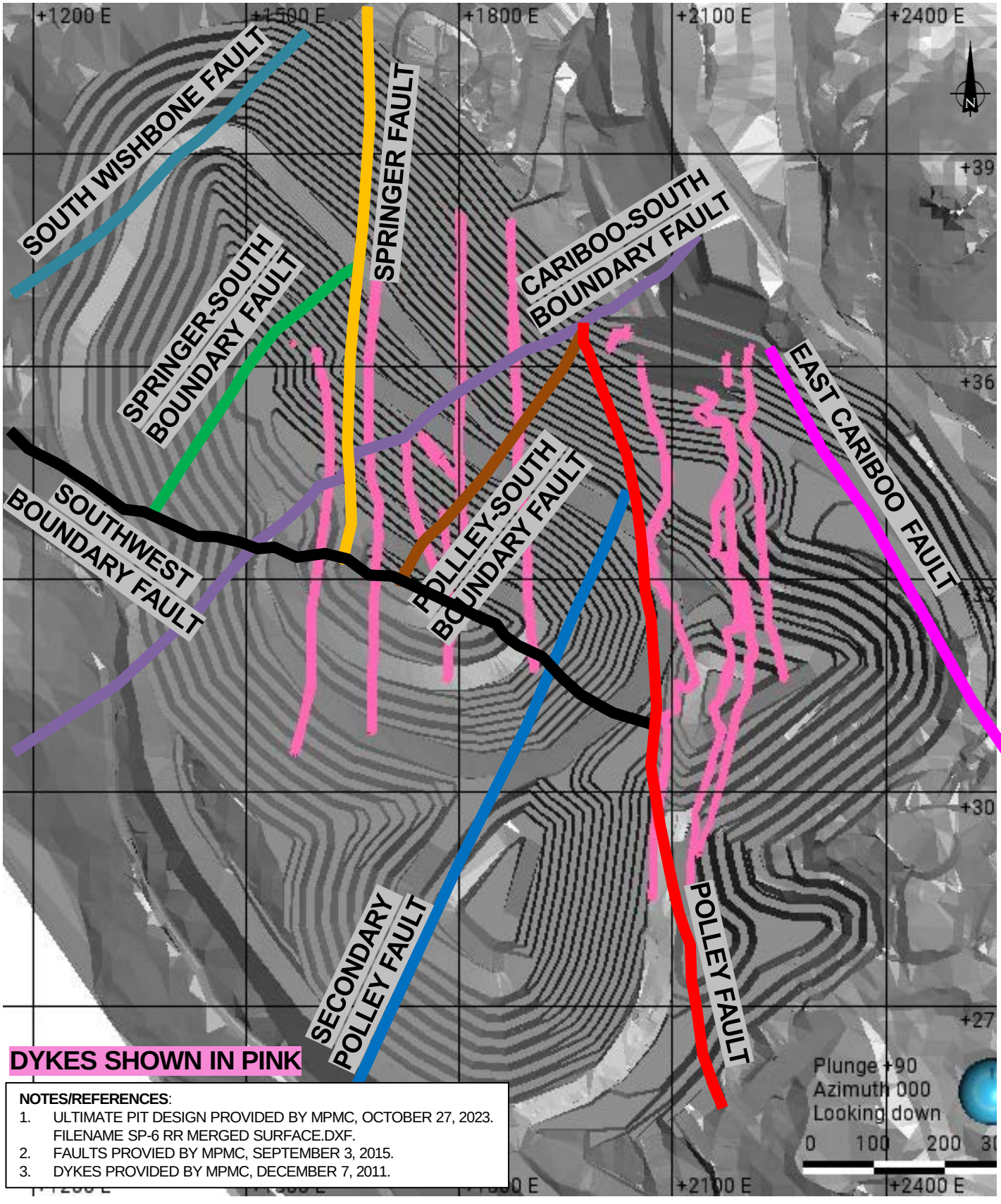

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED ULTIMATE PIT DESIGN WITH FAULT AND DYKE INTERSECTIONS

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	81115	0	15

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

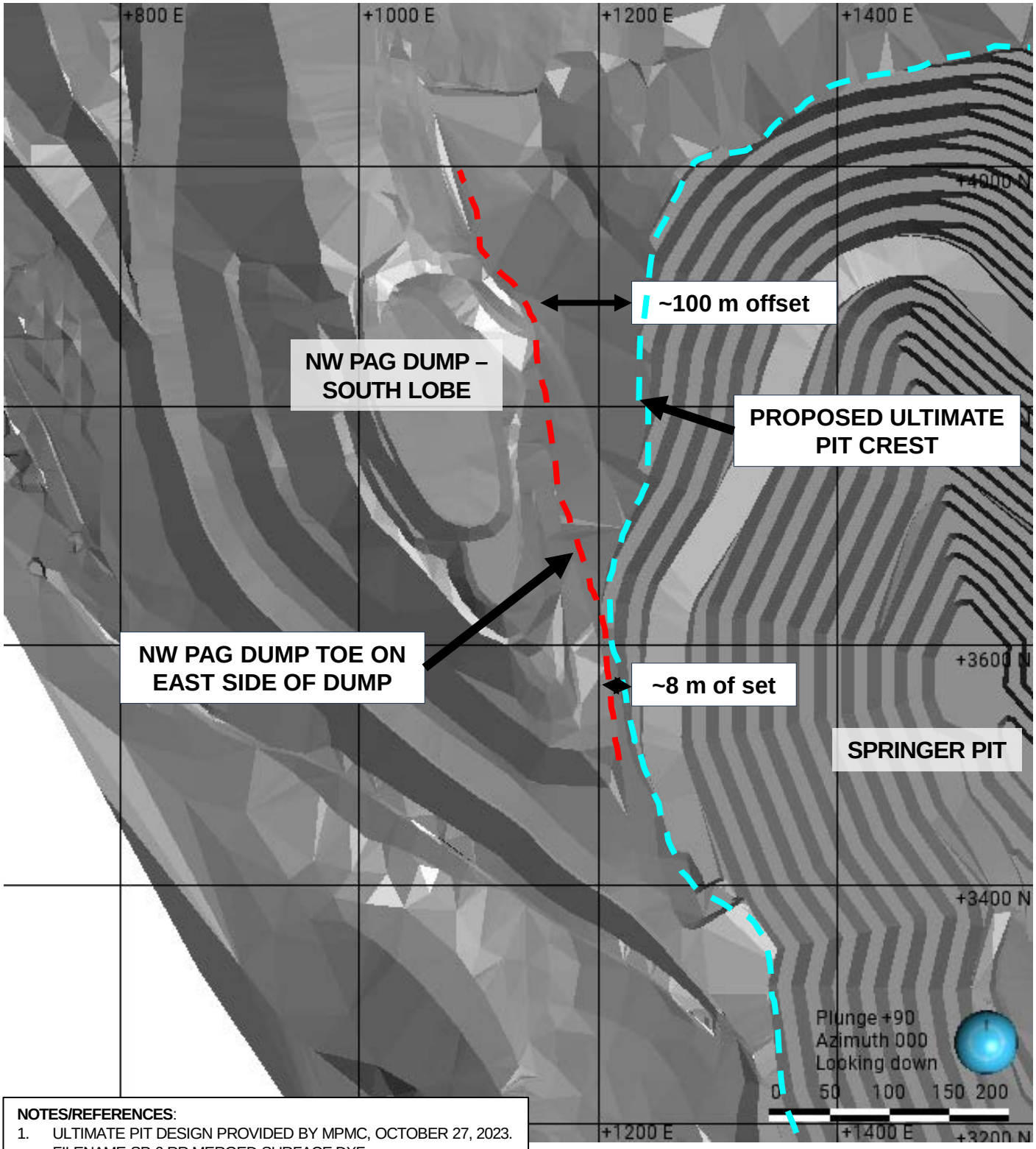

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
PROPOSED ULTIMATE PIT DESIGN AND NORTHWEST POTENTIALLY ACID GENERATING DUMP INTERACTION

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	81115	0	16

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

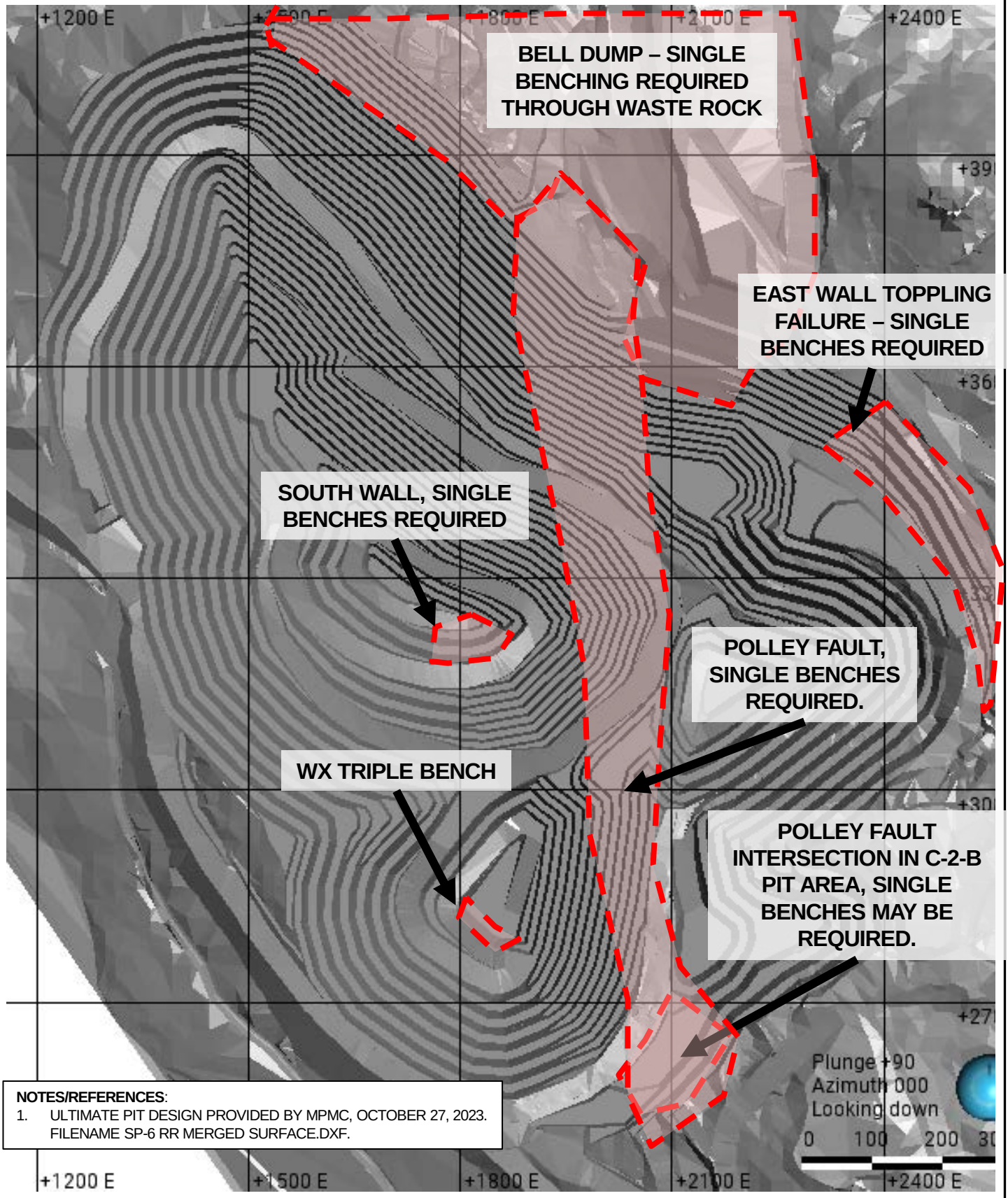

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.

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MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2023-11-10
PREPARED	KMM
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
SLOPE DESIGN CONSIDERATIONS

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	81115	0	17

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Figures.pptx



NOTES/REFERENCES

1. PHOTOGRAPH TAKEN BY WSP SEPTEMBER 27, 2023.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

wsp

YYYY-MM-DD	2023-11-08
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
NORTHEAST WALL
SPRINGER PIT NOSE AND POLLEY FAULT
LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	81115	0	18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25 mm

APPENDIX A

Current Slope Stability Performance of the Open Pits

Photograph A-1 – Cariboo And Springer Pits Overview

Photographs Taken Looking North (Top) And South (Bottom)

Photographs Taken By WSP on September 27, 2023.

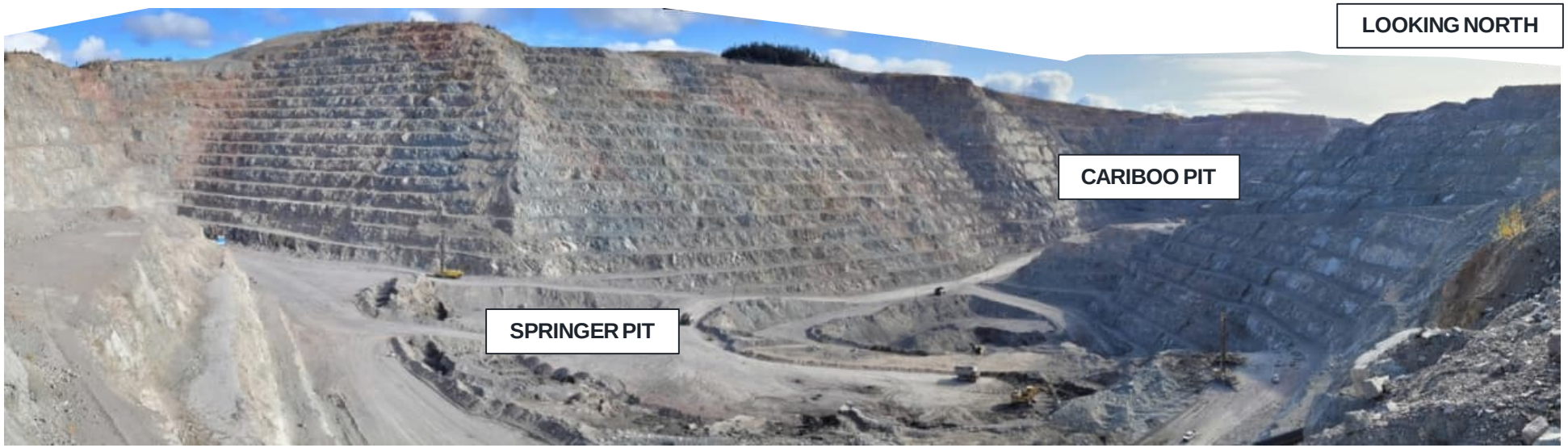



Photograph A-2 – Springer Pit South Wall

Photograph Looking South

Photographs Taken By WSP on September 27, 2023.

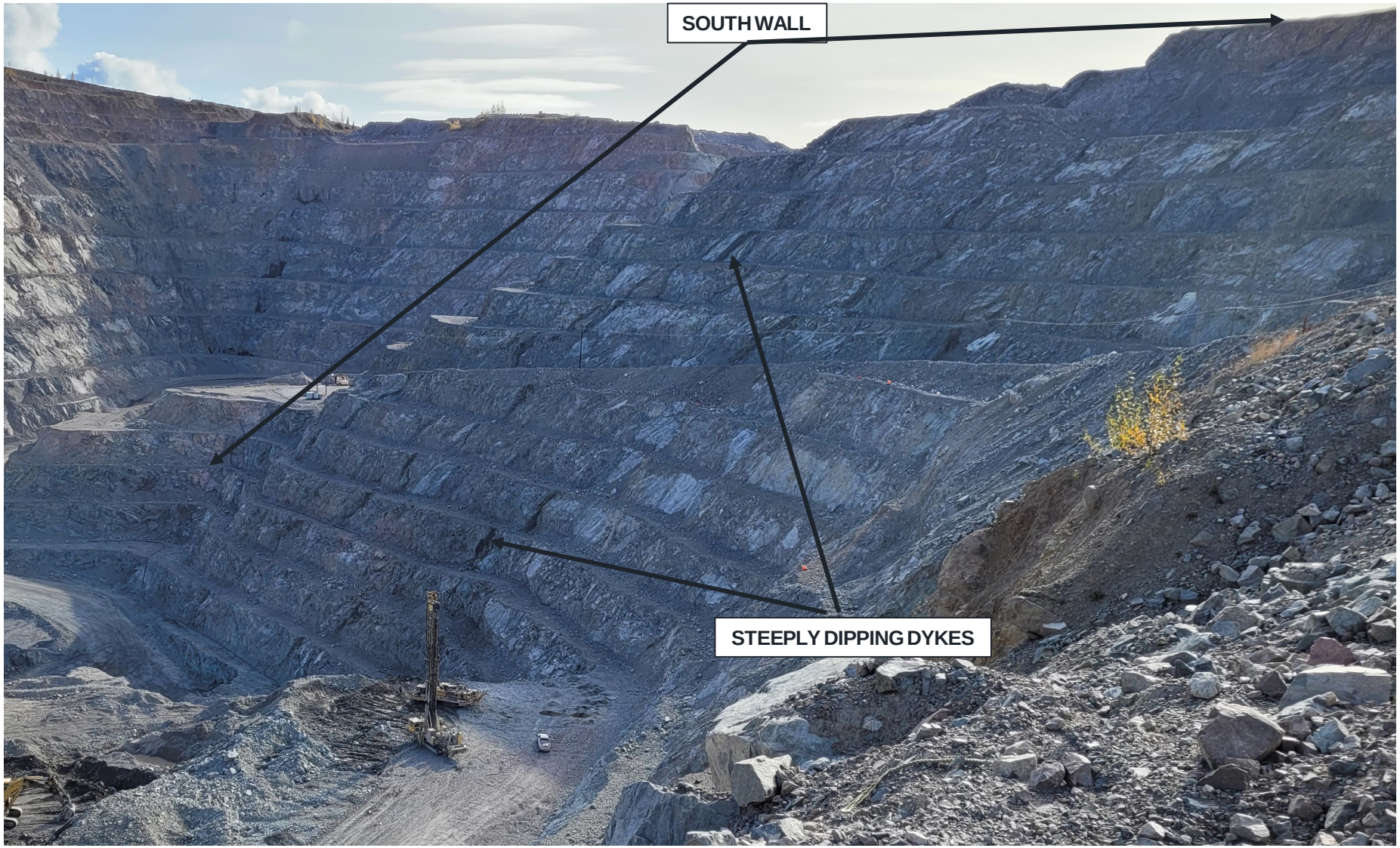

Photograph A-3 – Springer Pit West Wall

Photograph Looking South

A faulted dyke is exposed over three double benches in the south portion of the west wall . Ravelling of clay, gouge, and broken rock has created small talus slopes at the base of the exposure.

Photograph Taken By WSP on September 27, 2023.



Photograph A-4 – Springer Pit Northeast Wall Nose

Photograph Looking South

Photographs Taken By WSP on September 27, 2023.



Photograph A-5 – Springer Pit Northeast Wall

Photograph Looking South

Photograph Taken By WSP on September 27, 2023.



Photograph A-6 – Cariboo Pit Northeast Wall

Photograph Looking South

Photograph Taken By WSP on September 27, 2023.

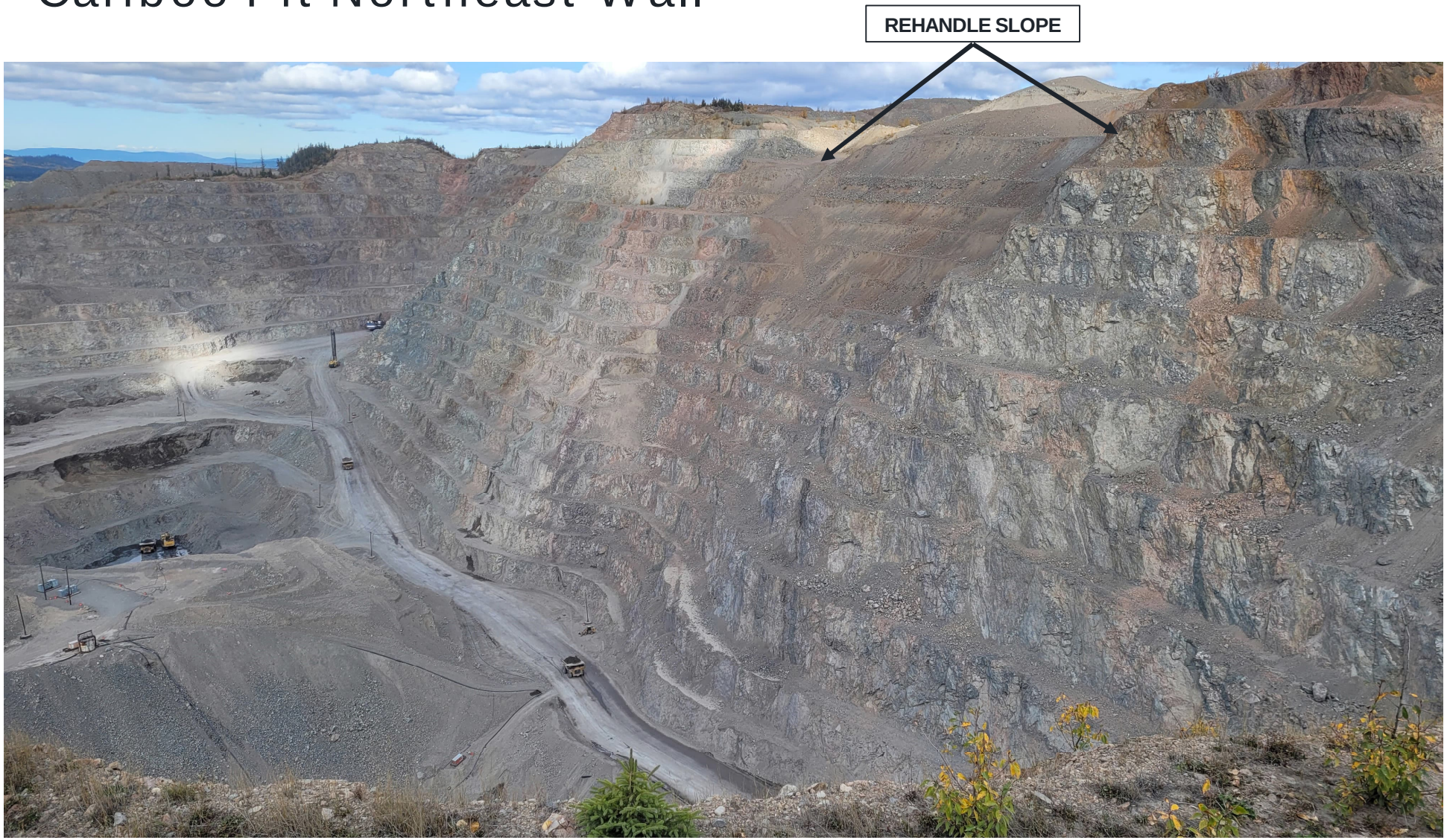

Photograph A-7 – Cariboo East Wall Unload Area

Photograph Looking East

Photograph Taken By WSP on September 27, 2023.

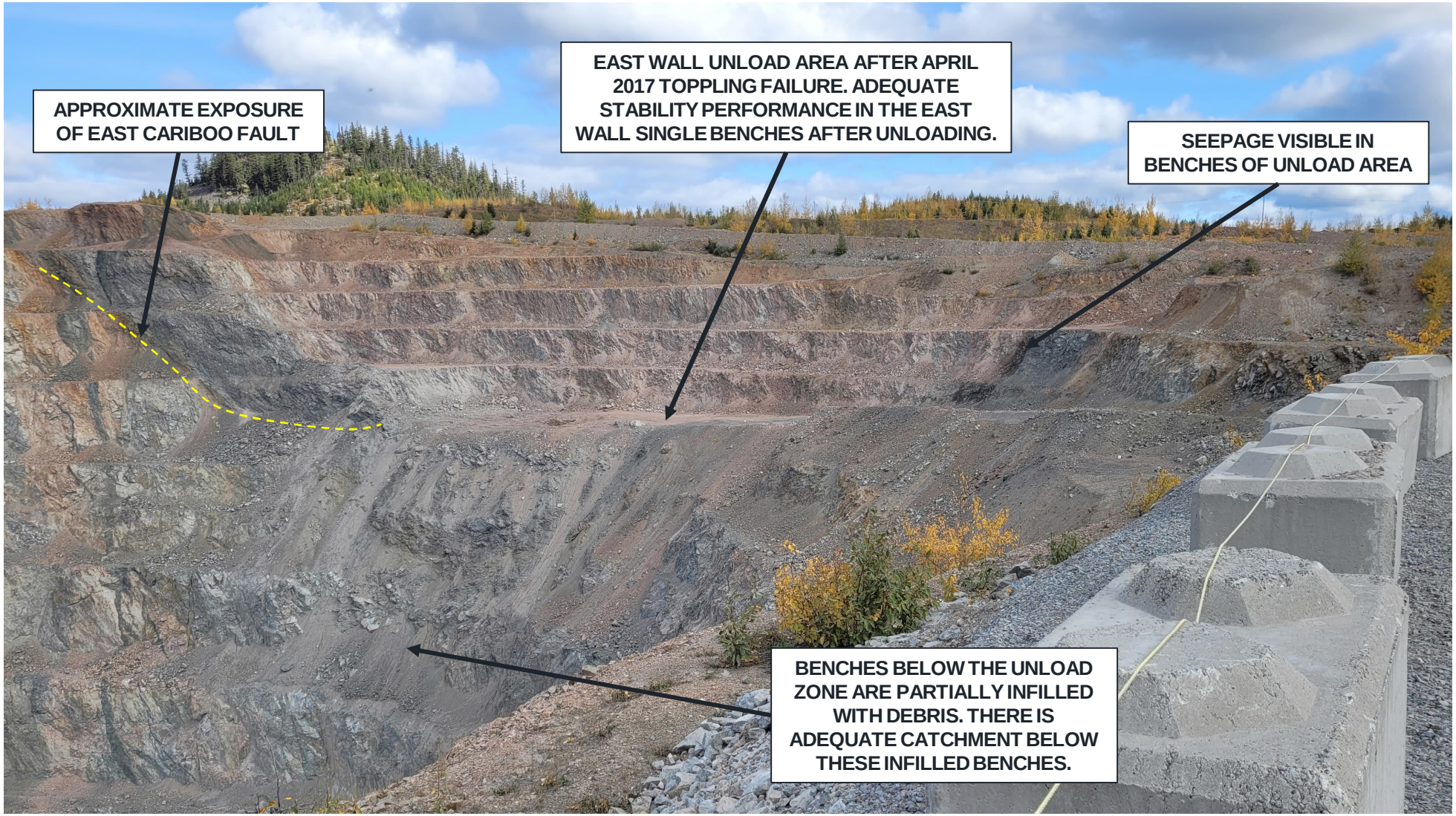

Photograph A-8 – C2 Pit Overview

Photograph Looking South

Photographs Taken By WSP on September 27, 2023.



Photograph A-9 – WX Pit Overview

Photograph Looking West

Photographs Taken By WSP on September 27, 2023.



APPENDIX B

Pushback Phases and Year End Maps

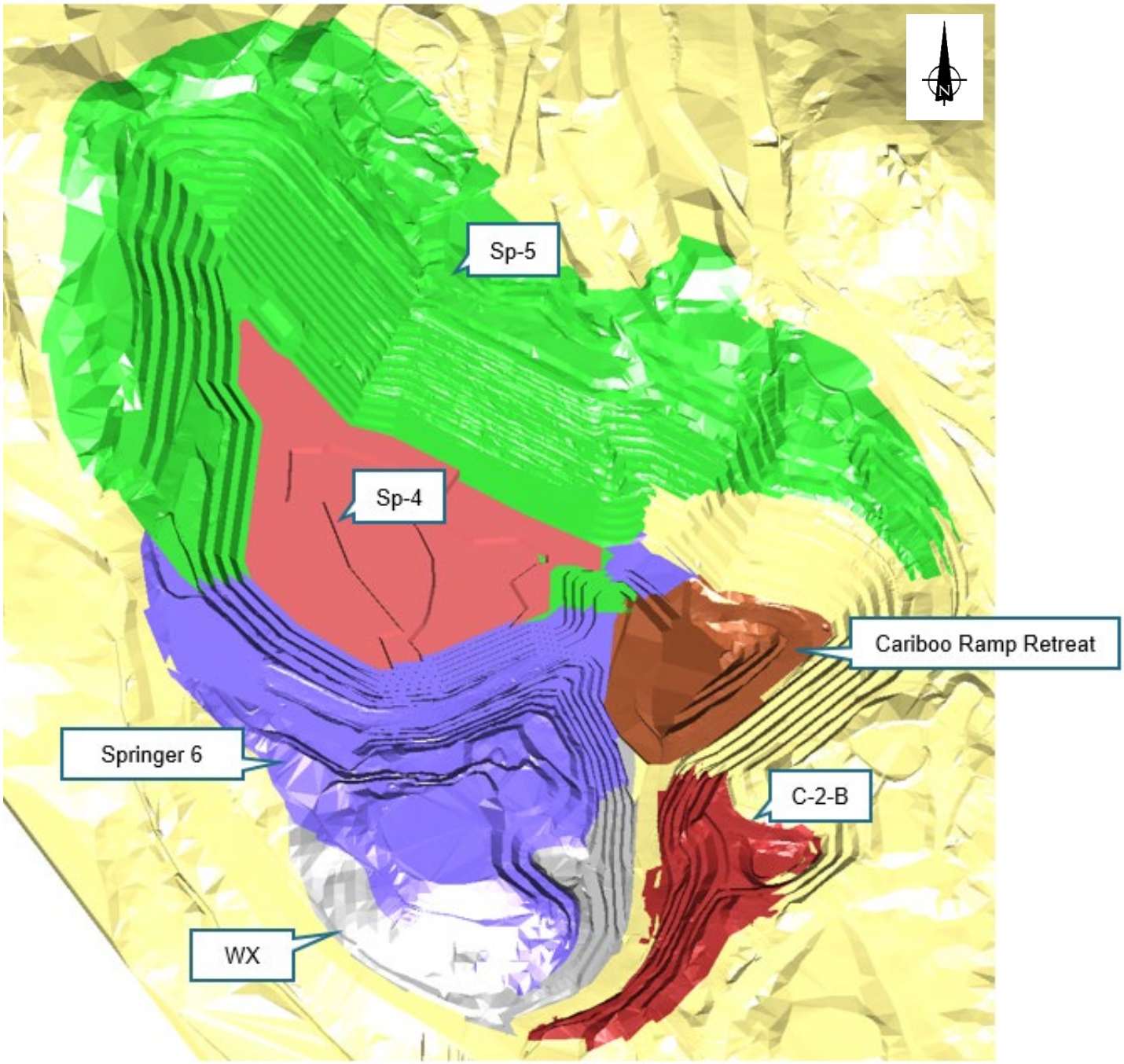

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC OCTOBER 2023.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
MOUNT POLLEY MINE
PROPOSED LIFE OF MINE EXPANSION
PUSHBACK PHASES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-1**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

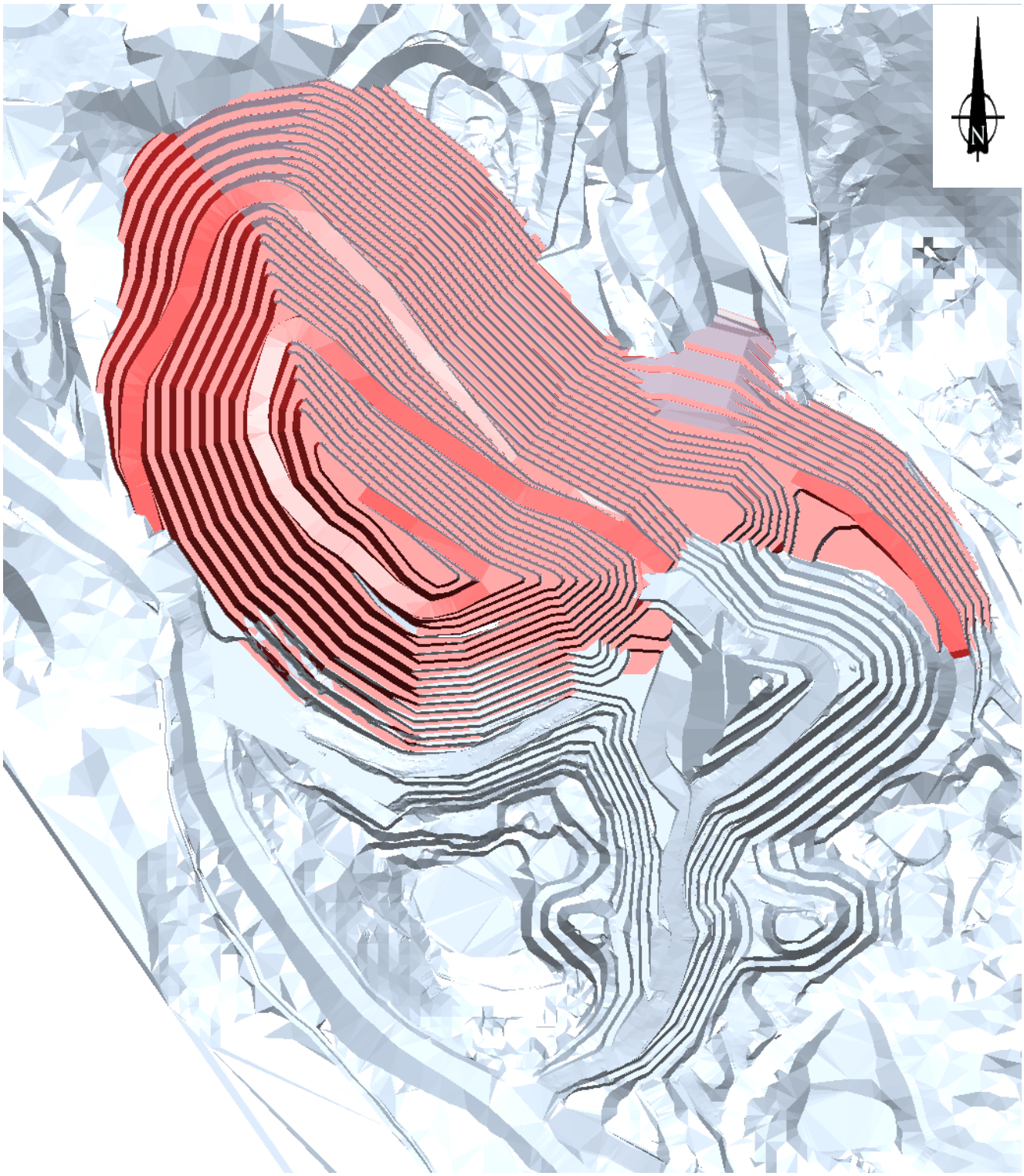

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC MAY 2024.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED SPRINGER PHASE 5 PUSHABCK (SP-5)

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-2**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

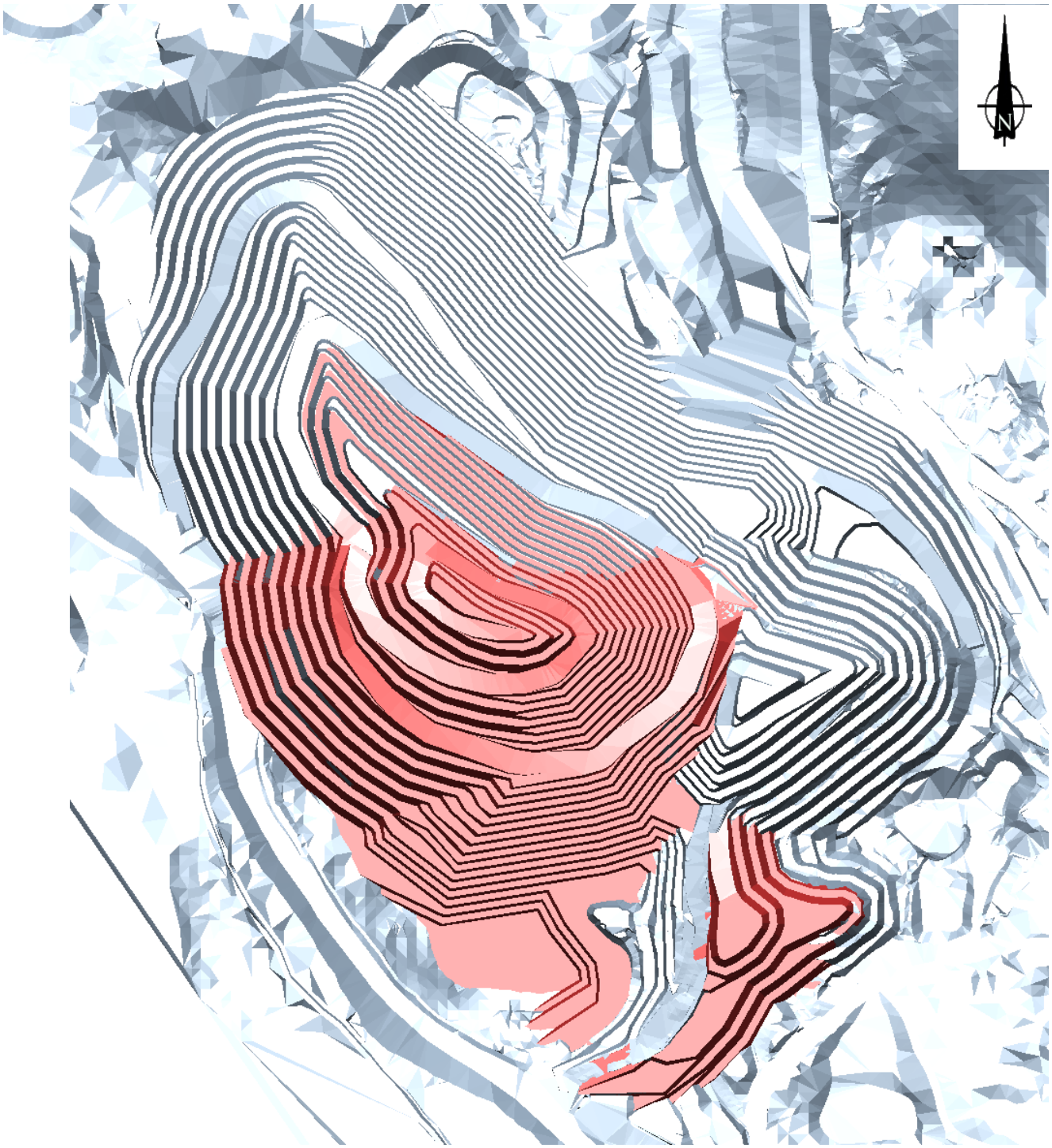

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC MAY 2024.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED SPRINGER PHASE 6 AND WX PUSHABCKS

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-3**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

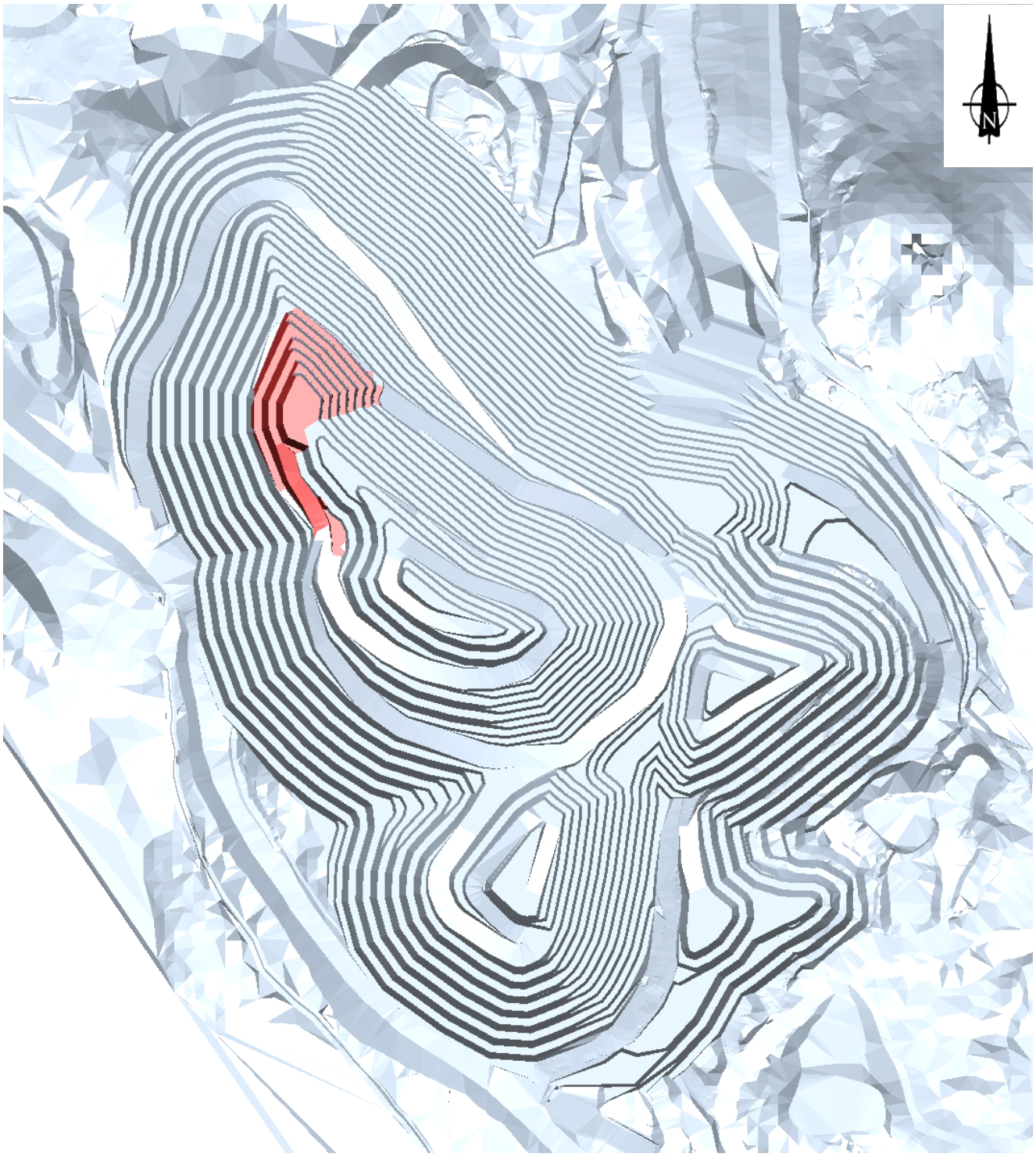

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC MAY 2024.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED PHASE 6 RAMP RETREAT

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-4**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

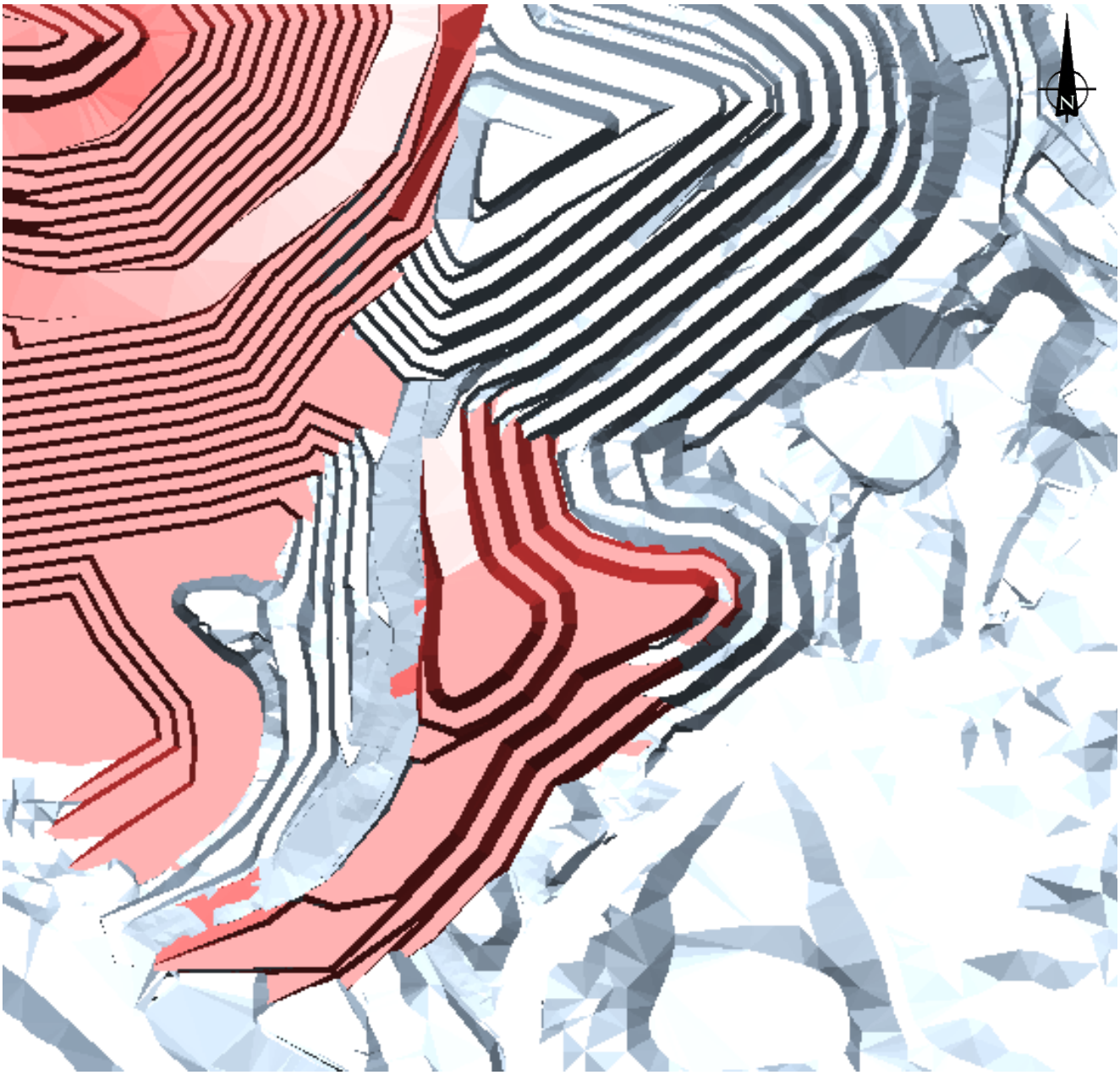

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC MAY 2024.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED C-2-B PIT PUSHBACK

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-5**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

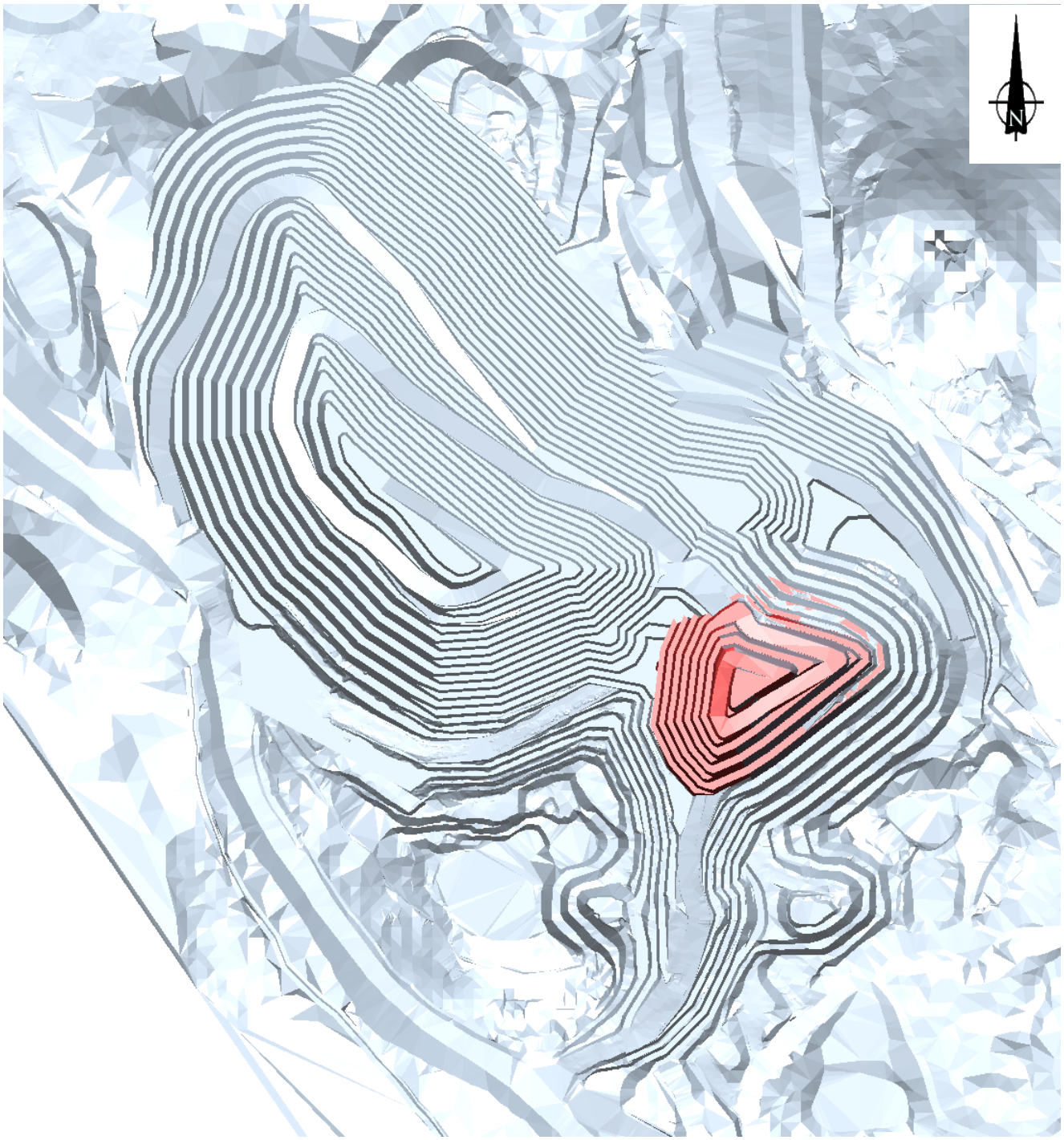

NOTES/REFERENCES:
1. IMAGE RECEIVED FROM MPMC MAY 2024.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
PROPOSED CARIBOO RAMP RETREAT

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-6**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

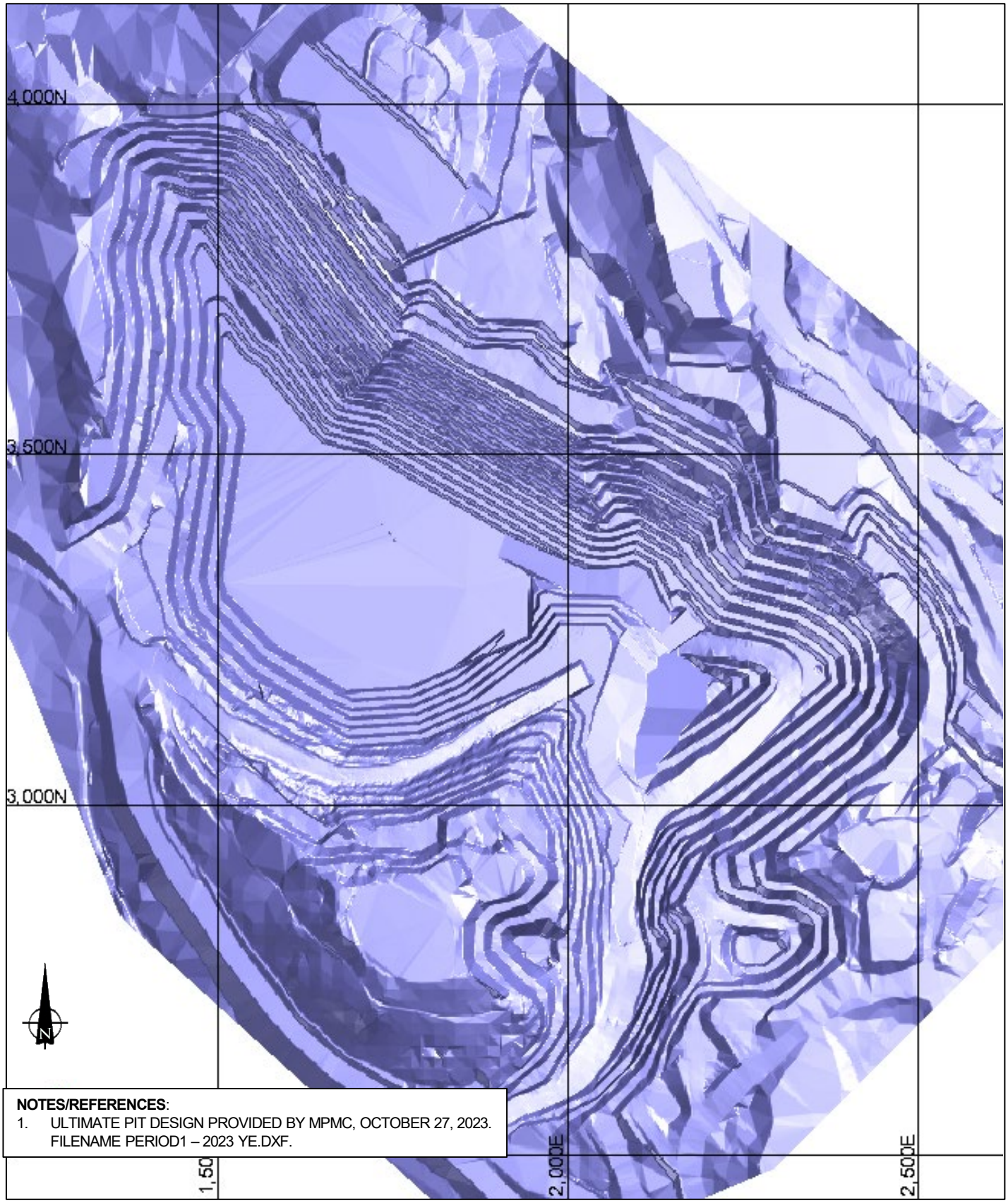

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD1 – 2023 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
YEAR END 2023 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-7**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

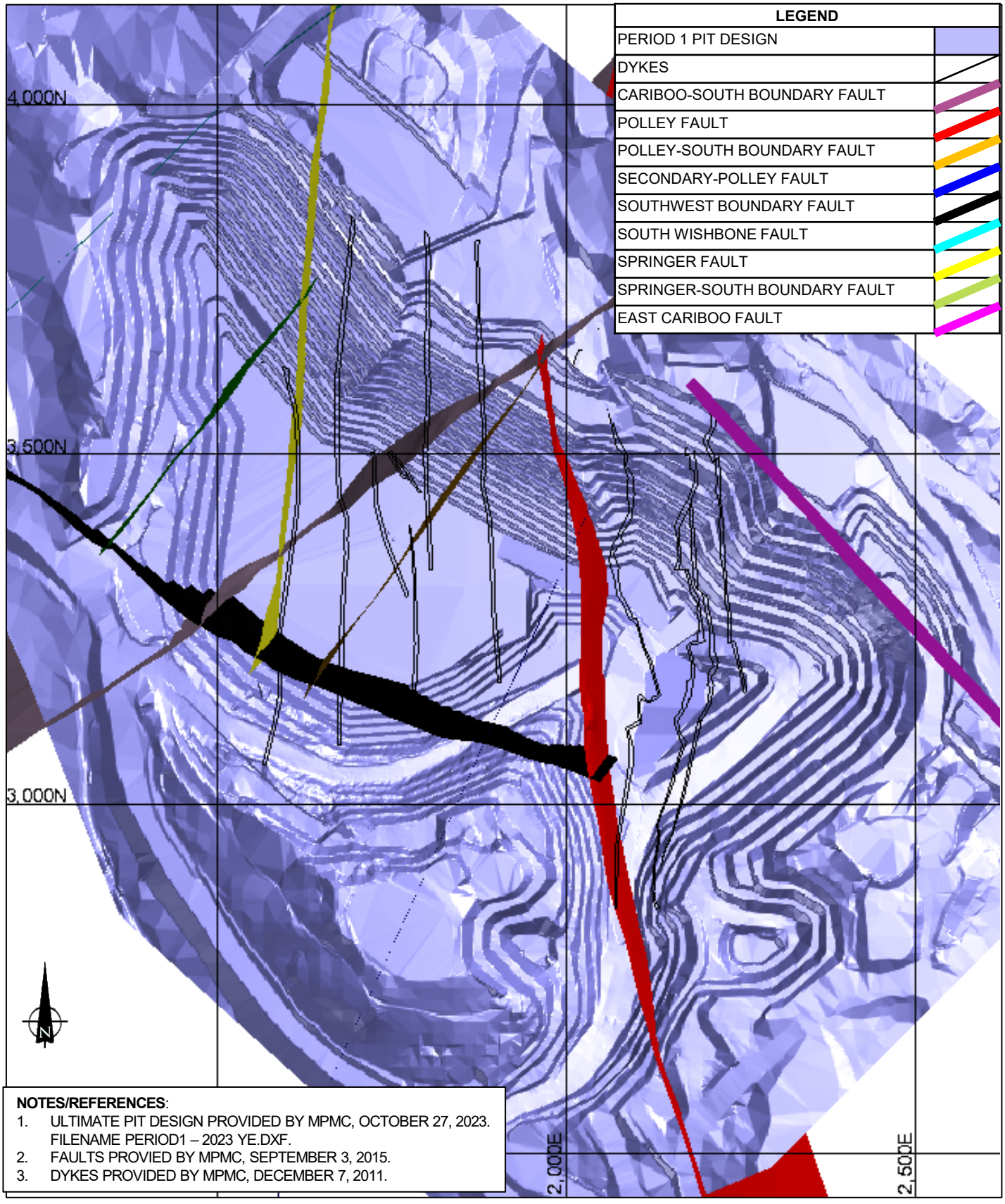

LEGEND
PERIOD 1 PIT DESIGN
DYKES
CARIBOO-SOUTH BOUNDARY FAULT
POLLEY FAULT
POLLEY-SOUTH BOUNDARY FAULT
SECONDARY-POLLEY FAULT
SOUTHWEST BOUNDARY FAULT
SOUTH WISHBONE FAULT
SPRINGER FAULT
SPRINGER-SOUTH BOUNDARY FAULT
EAST CARIBOO FAULT

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD1 – 2023 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2023 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-8**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

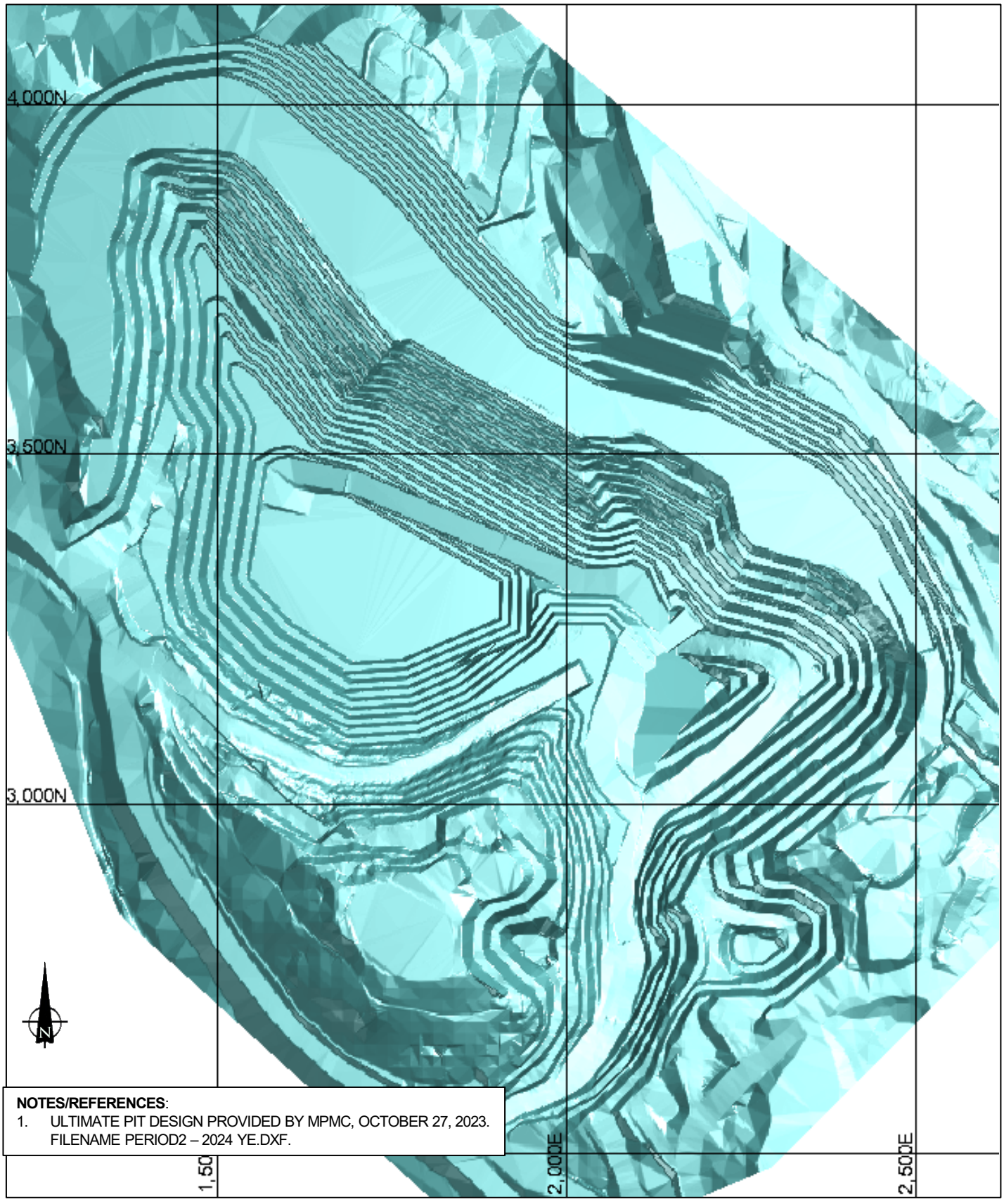

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD2 – 2024 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2024 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-9**

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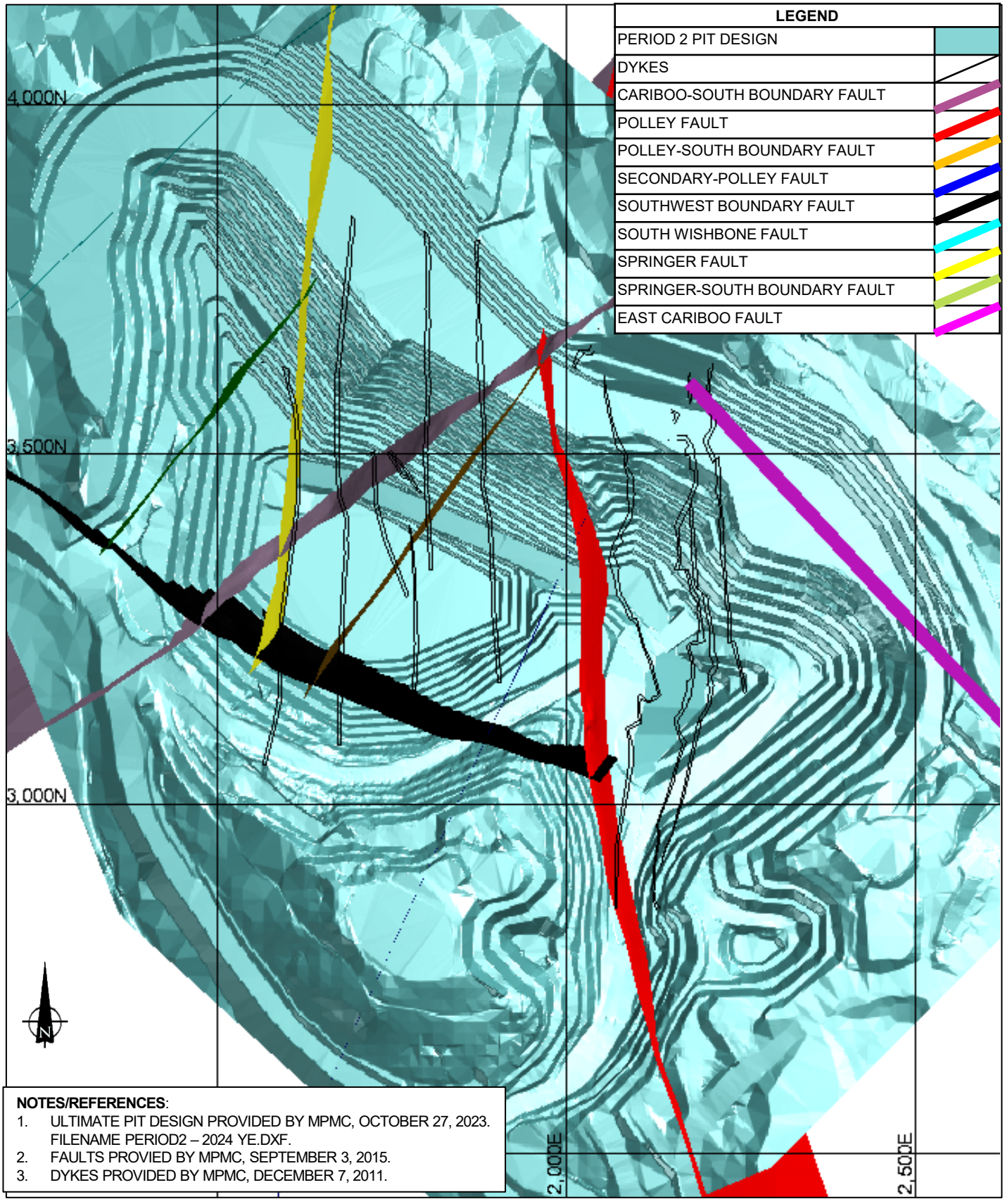

LEGEND
PERIOD 2 PIT DESIGN
DYKES
CARIBOO-SOUTH BOUNDARY FAULT
POLLEY FAULT
POLLEY-SOUTH BOUNDARY FAULT
SECONDARY-POLLEY FAULT
SOUTHWEST BOUNDARY FAULT
SOUTH WISHBONE FAULT
SPRINGER FAULT
SPRINGER-SOUTH BOUNDARY FAULT
EAST CARIBOO FAULT

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD2 – 2024 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2024 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-10**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

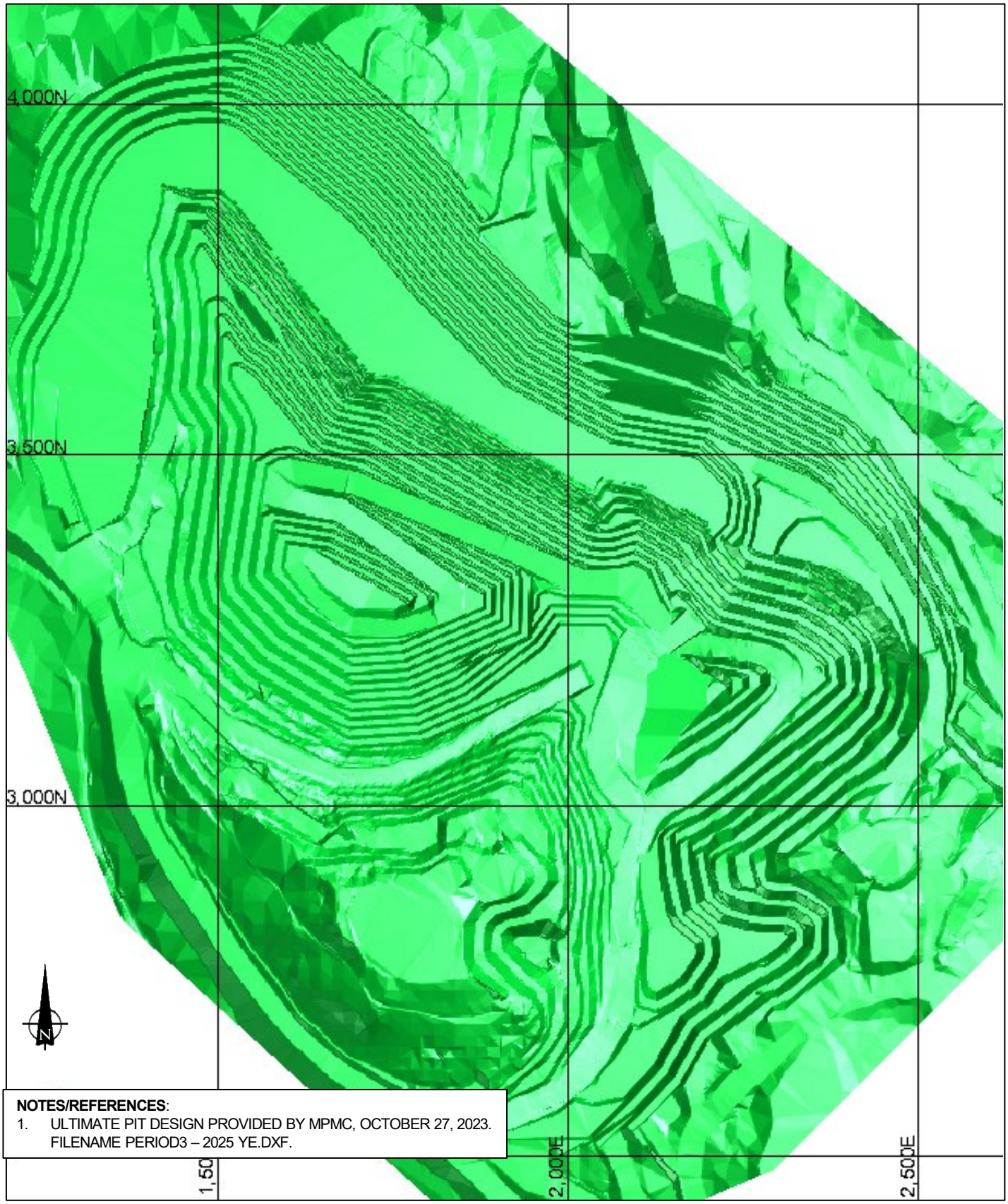

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD3 – 2025 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2025 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-11**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

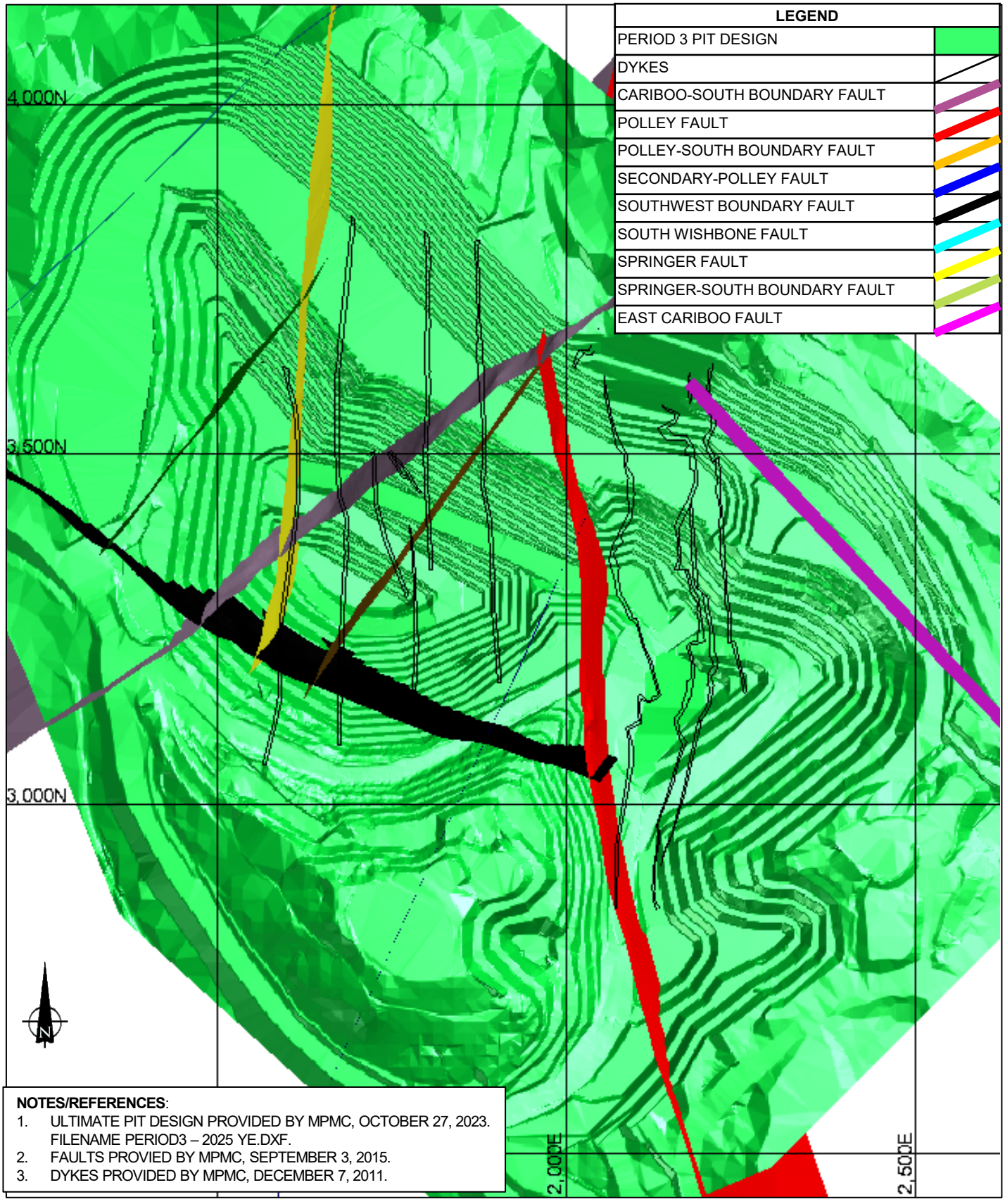

LEGEND
PERIOD 3 PIT DESIGN
DYKES
CARIBOO-SOUTH BOUNDARY FAULT
POLLEY FAULT
POLLEY-SOUTH BOUNDARY FAULT
SECONDARY-POLLEY FAULT
SOUTHWEST BOUNDARY FAULT
SOUTH WISHBONE FAULT
SPRINGER FAULT
SPRINGER-SOUTH BOUNDARY FAULT
EAST CARIBOO FAULT

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD3 – 2025 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2025 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-12**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

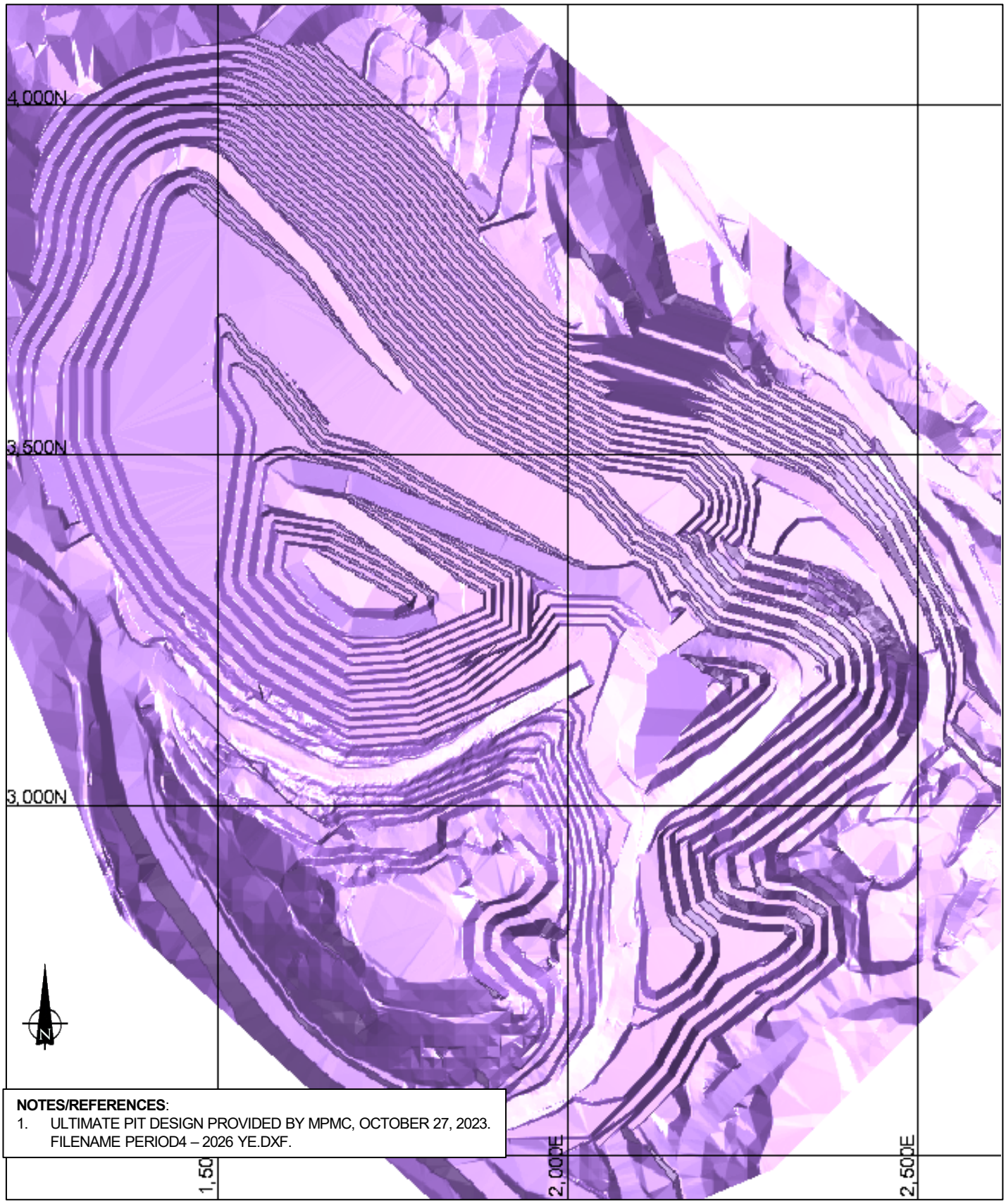

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD4 – 2026 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2026 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-13**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

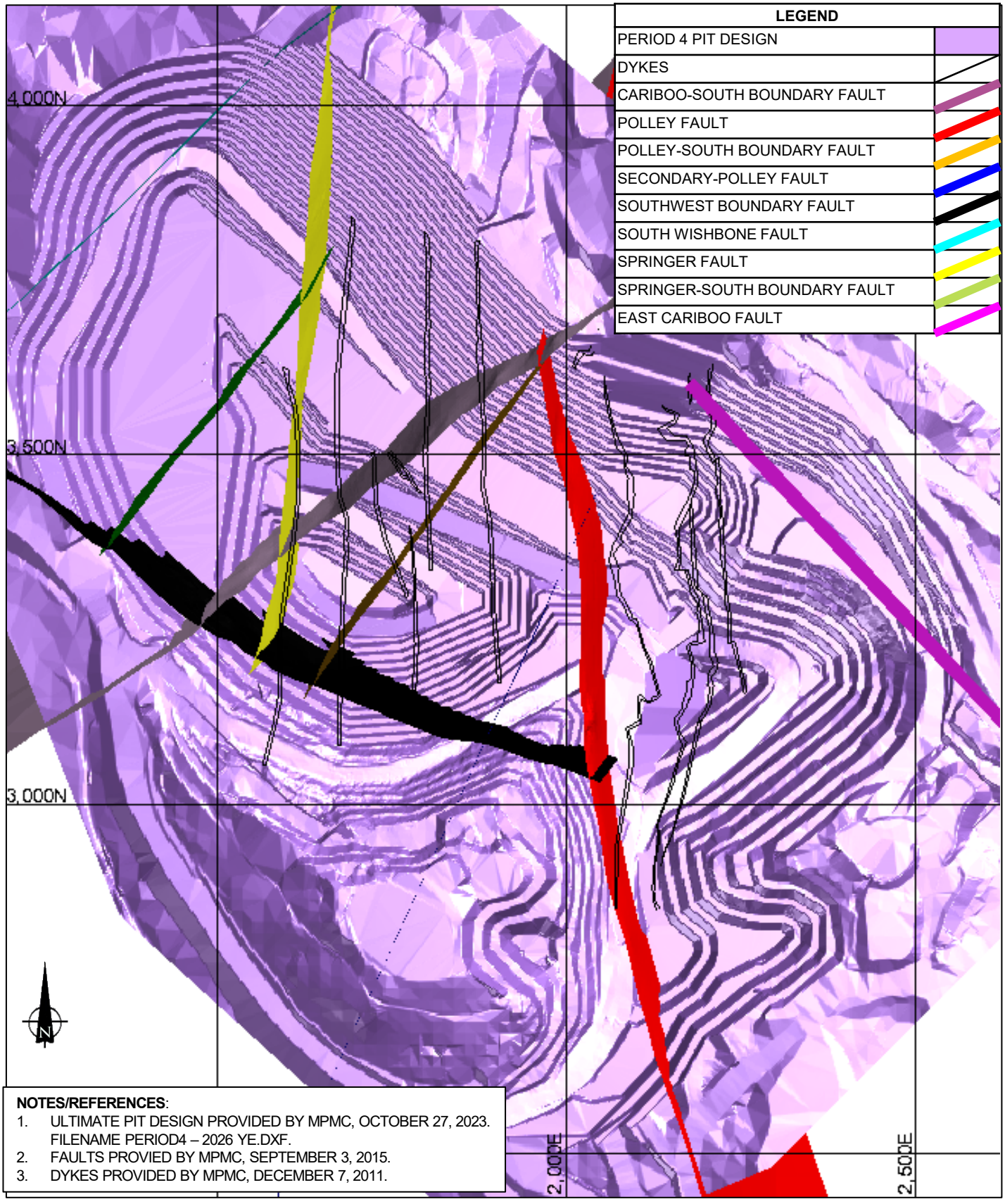

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD4 – 2026 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2026 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-14**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

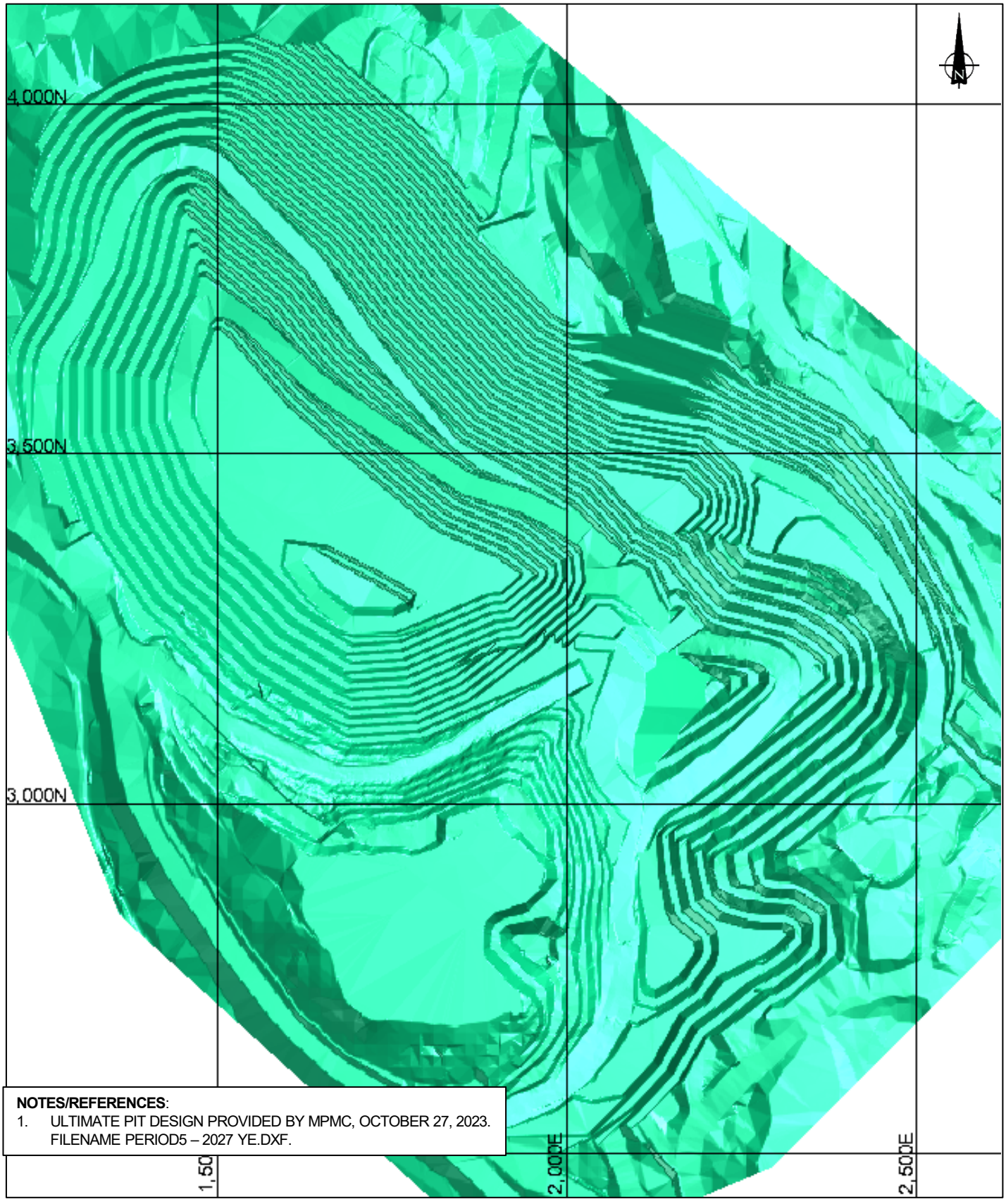

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD5 – 2027 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2027 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-15**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

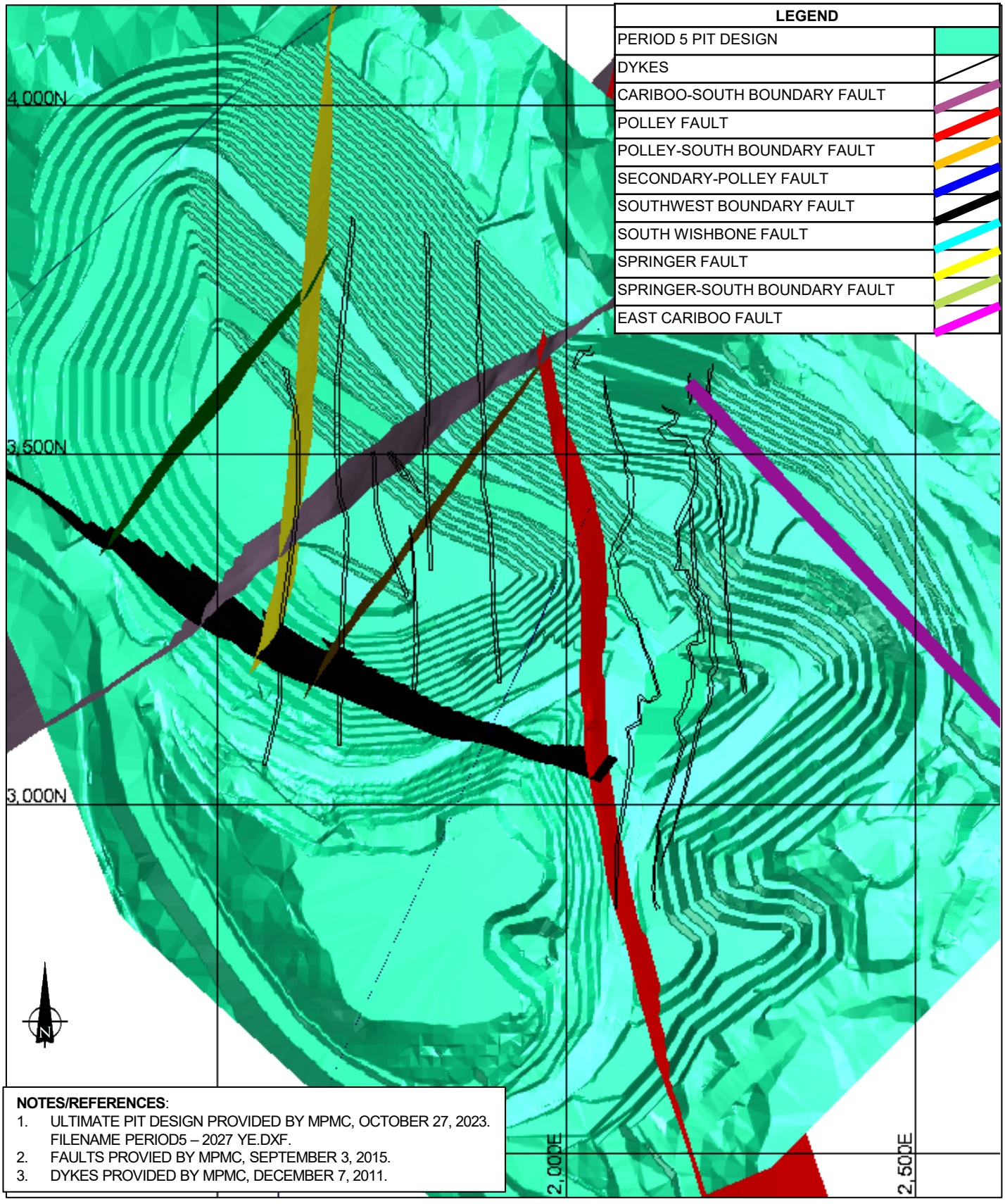

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD5 – 2027 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2027 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-16**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

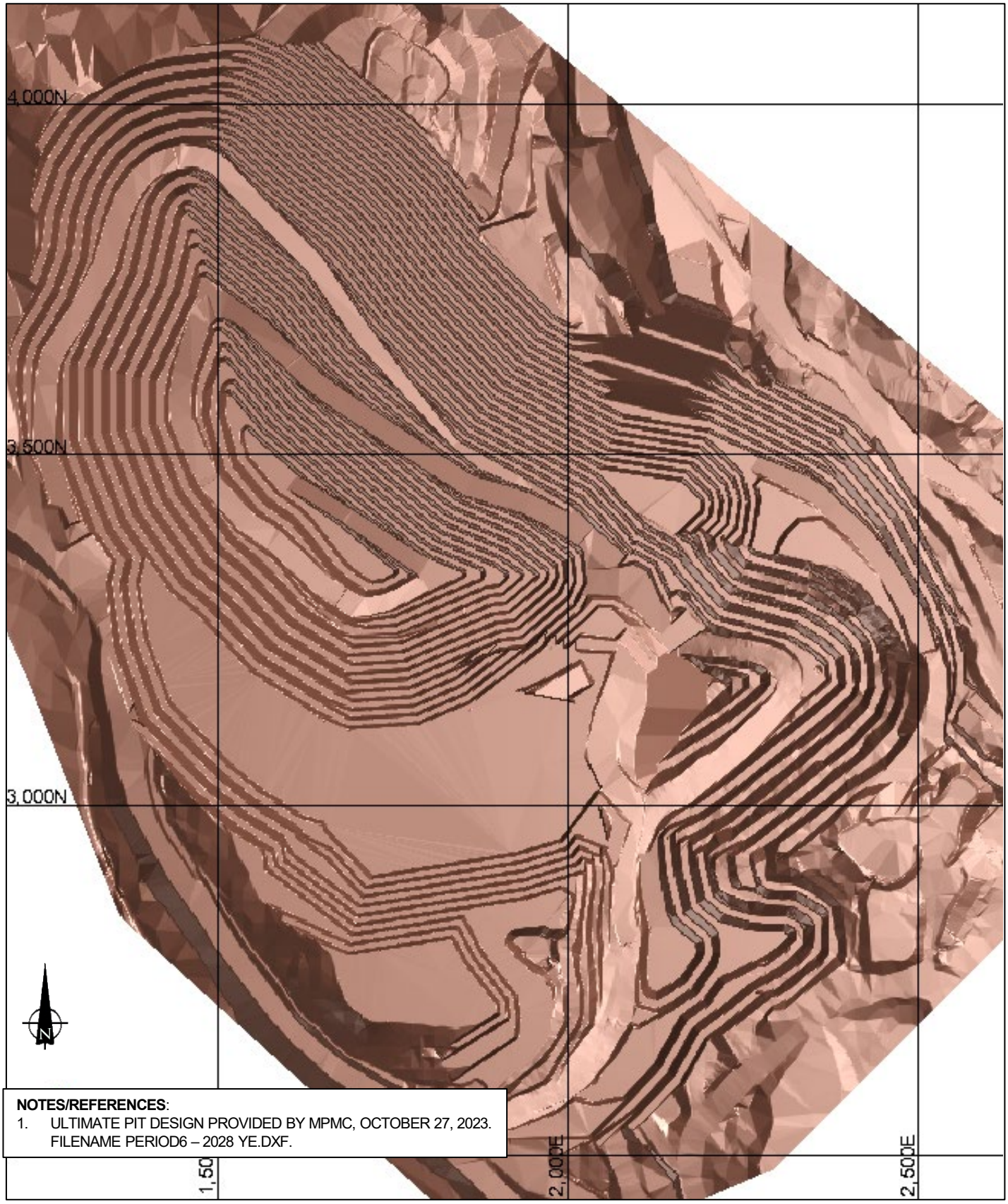

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD6 – 2028 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2028 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-17**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

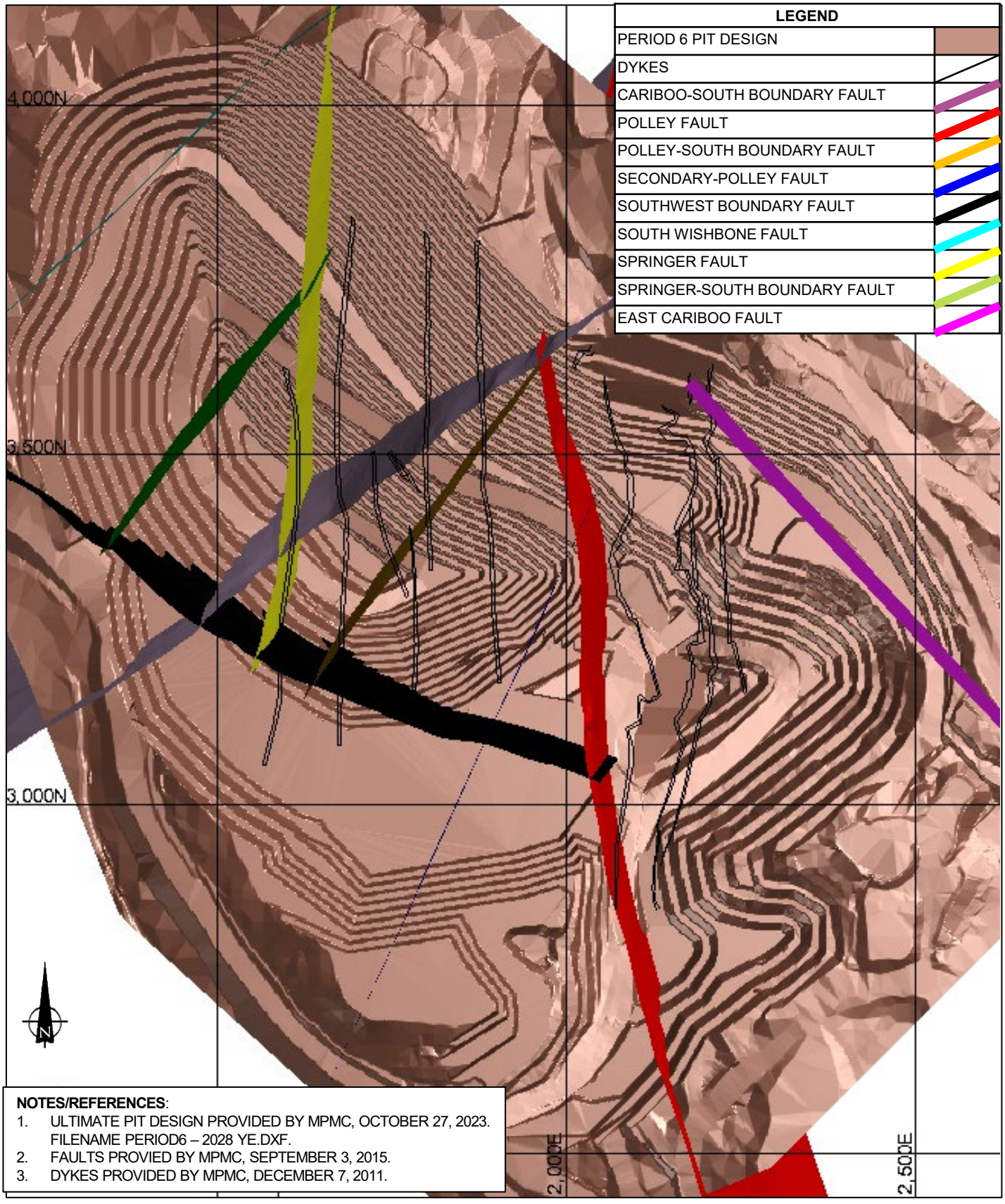

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD6 – 2028 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2028 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-18**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

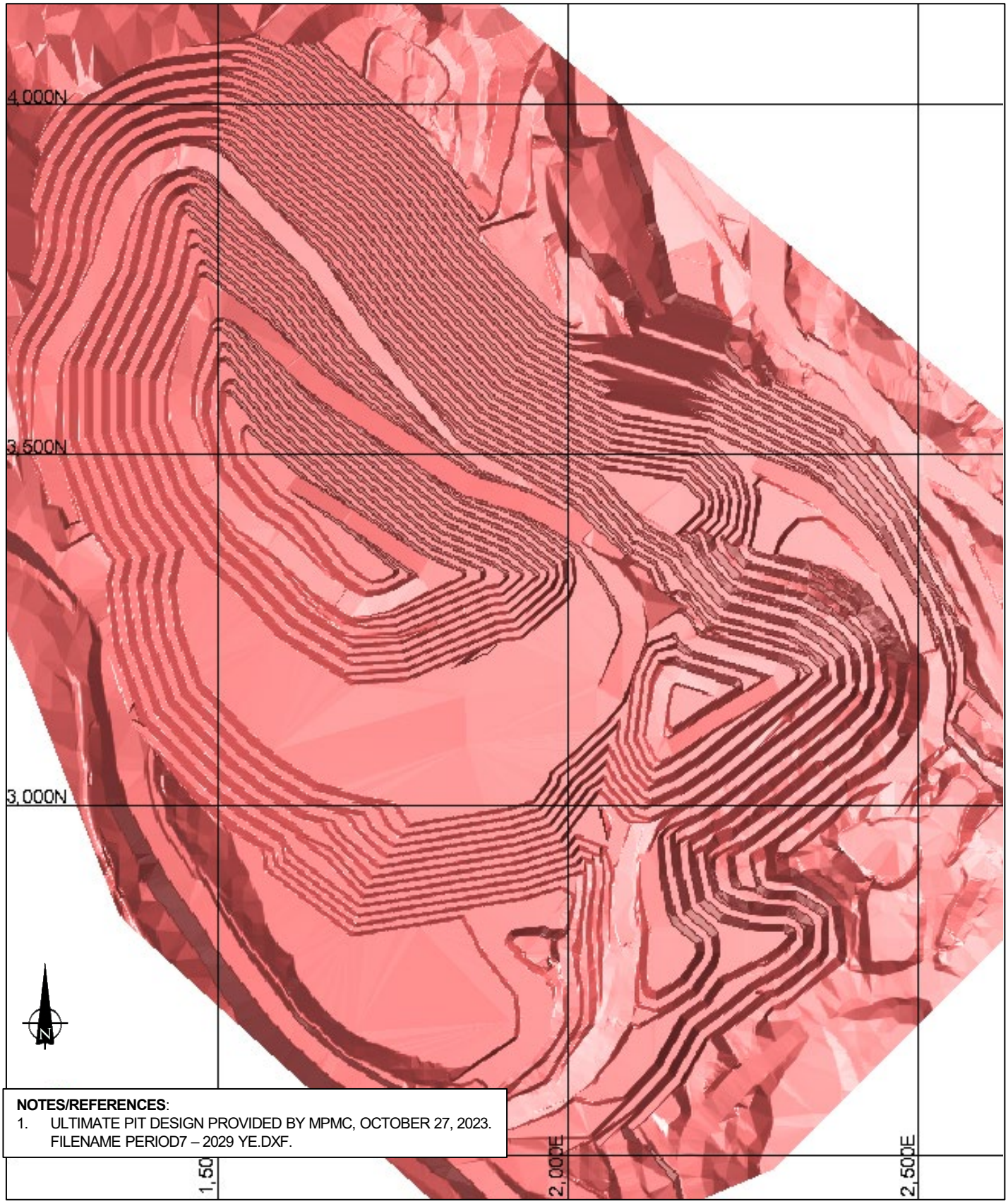

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD7 – 2029 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2029 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-19**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

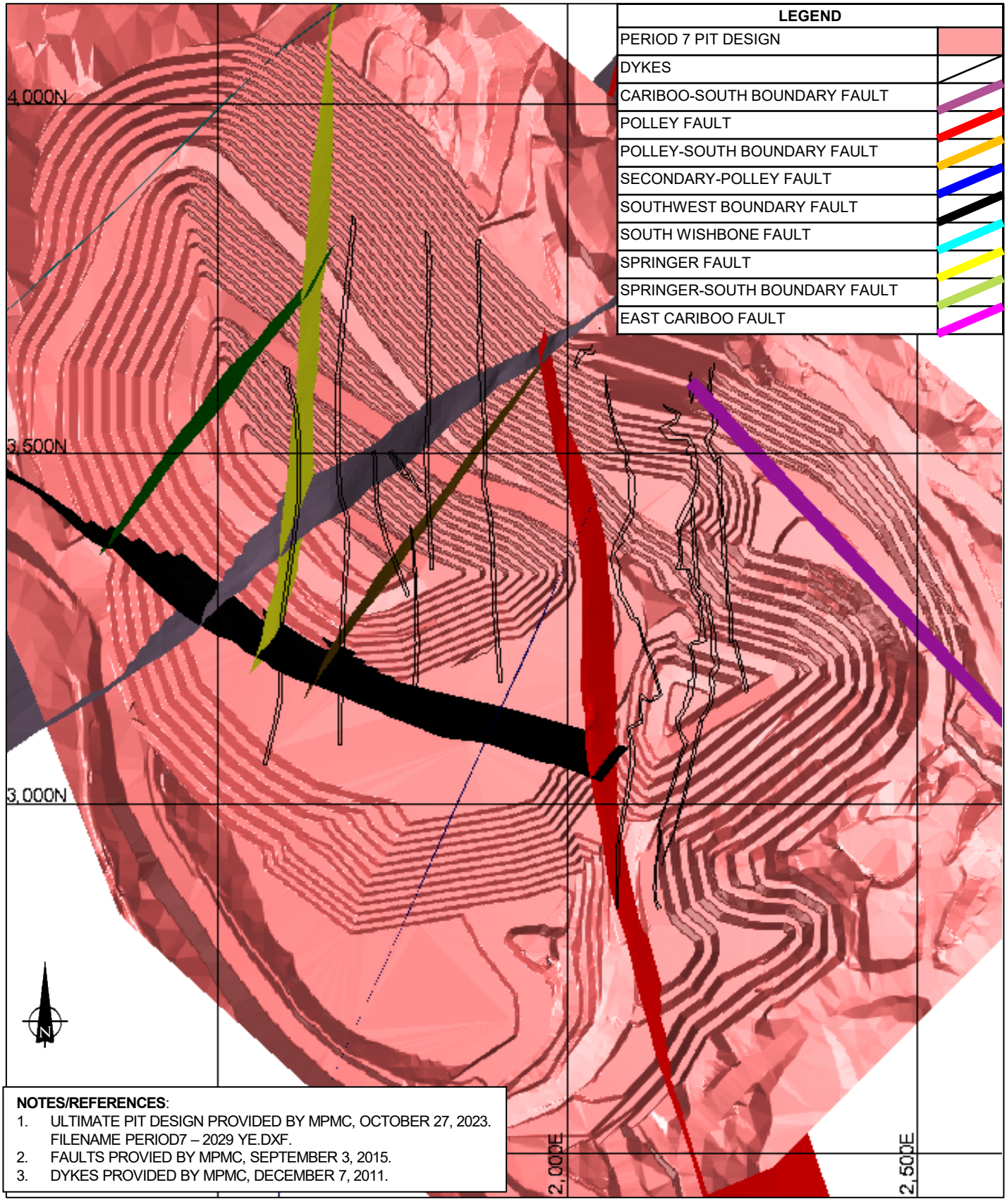

LEGEND
PERIOD 7 PIT DESIGN
DYKES
CARIBOO-SOUTH BOUNDARY FAULT
POLLEY FAULT
POLLEY-SOUTH BOUNDARY FAULT
SECONDARY-POLLEY FAULT
SOUTHWEST BOUNDARY FAULT
SOUTH WISHBONE FAULT
SPRINGER FAULT
SPRINGER-SOUTH BOUNDARY FAULT
EAST CARIBOO FAULT

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD7 – 2029 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2029 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-20**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

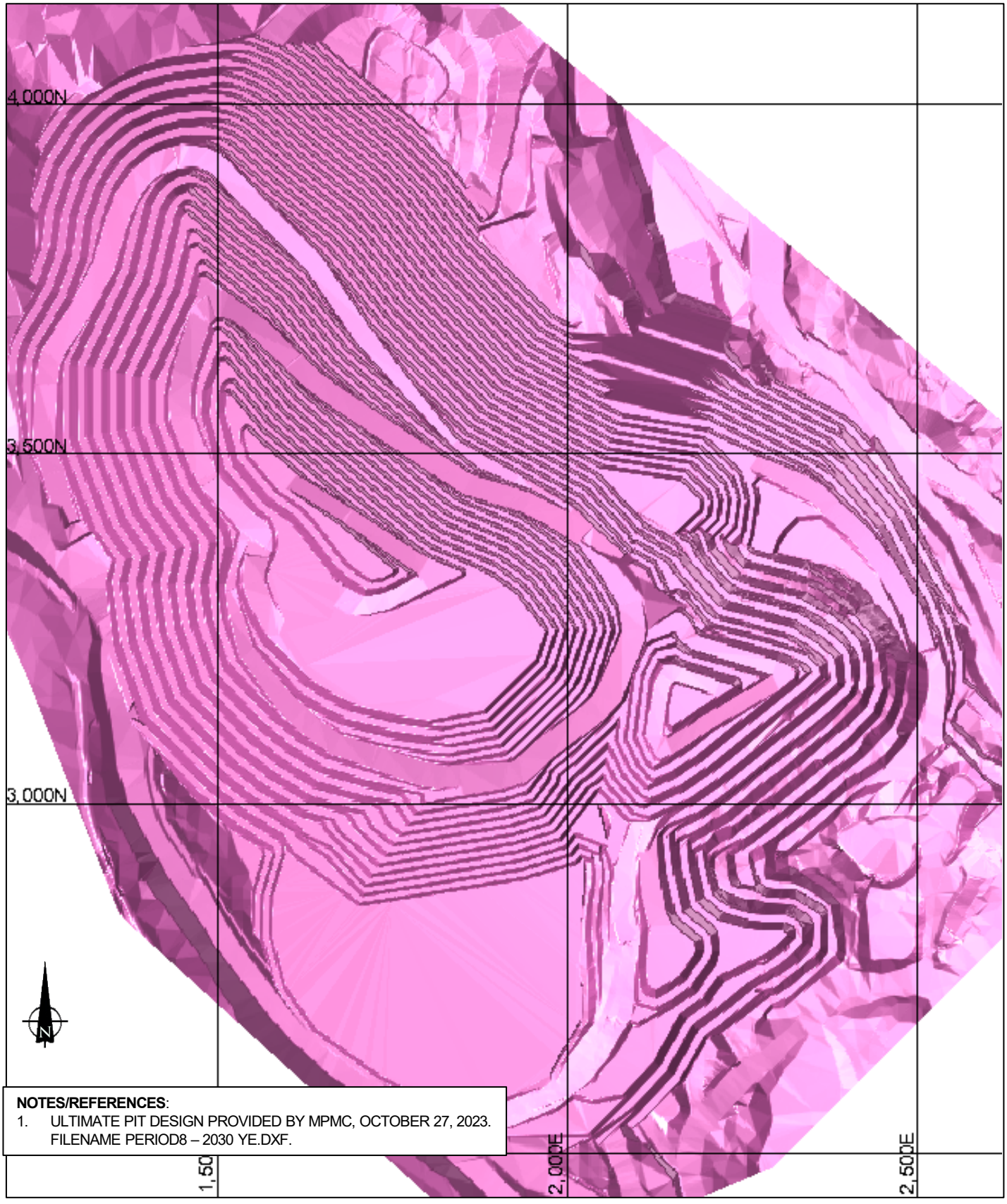

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD8 – 2030 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2030 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-21**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

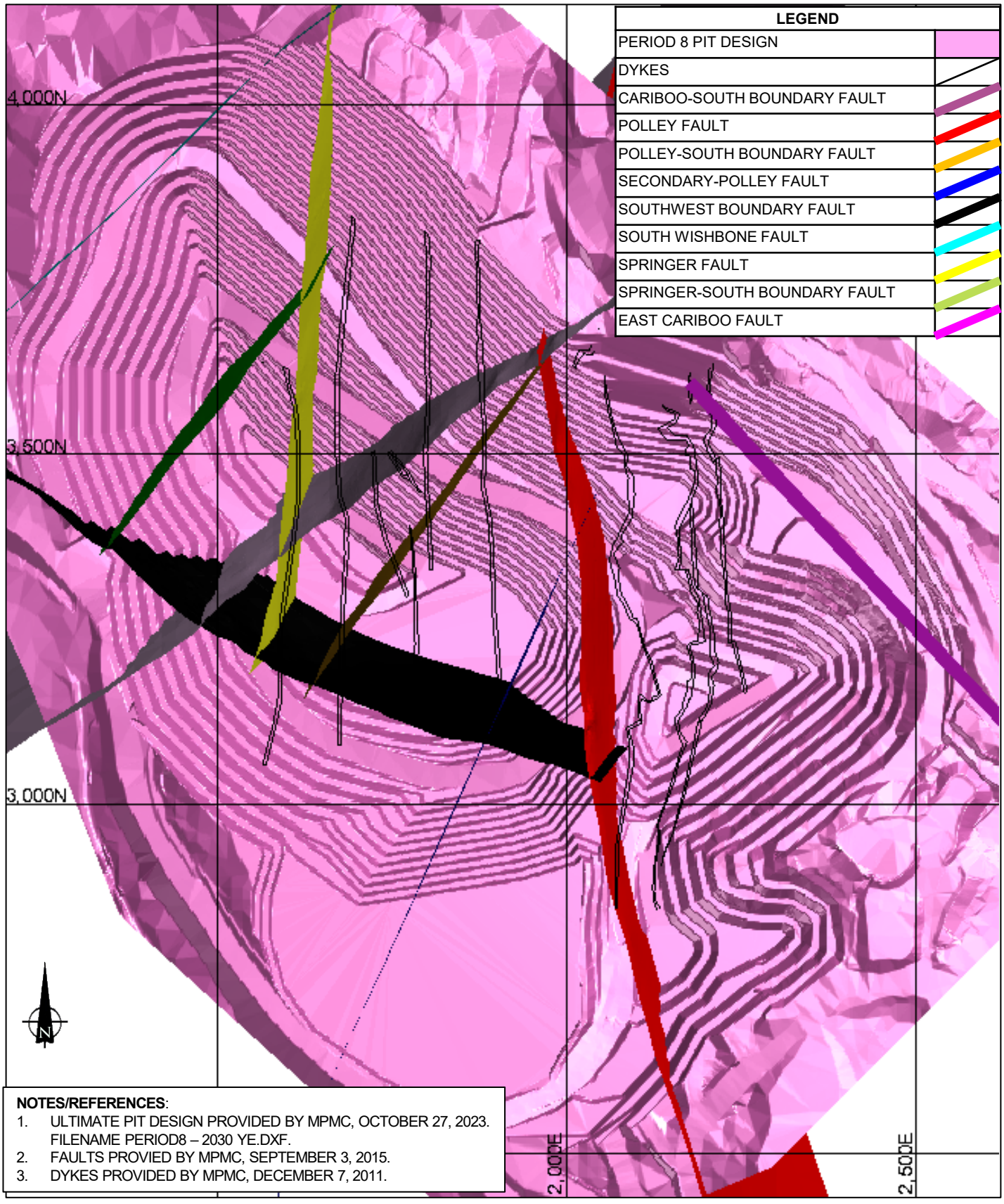

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD8 – 2030 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2030 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-22**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

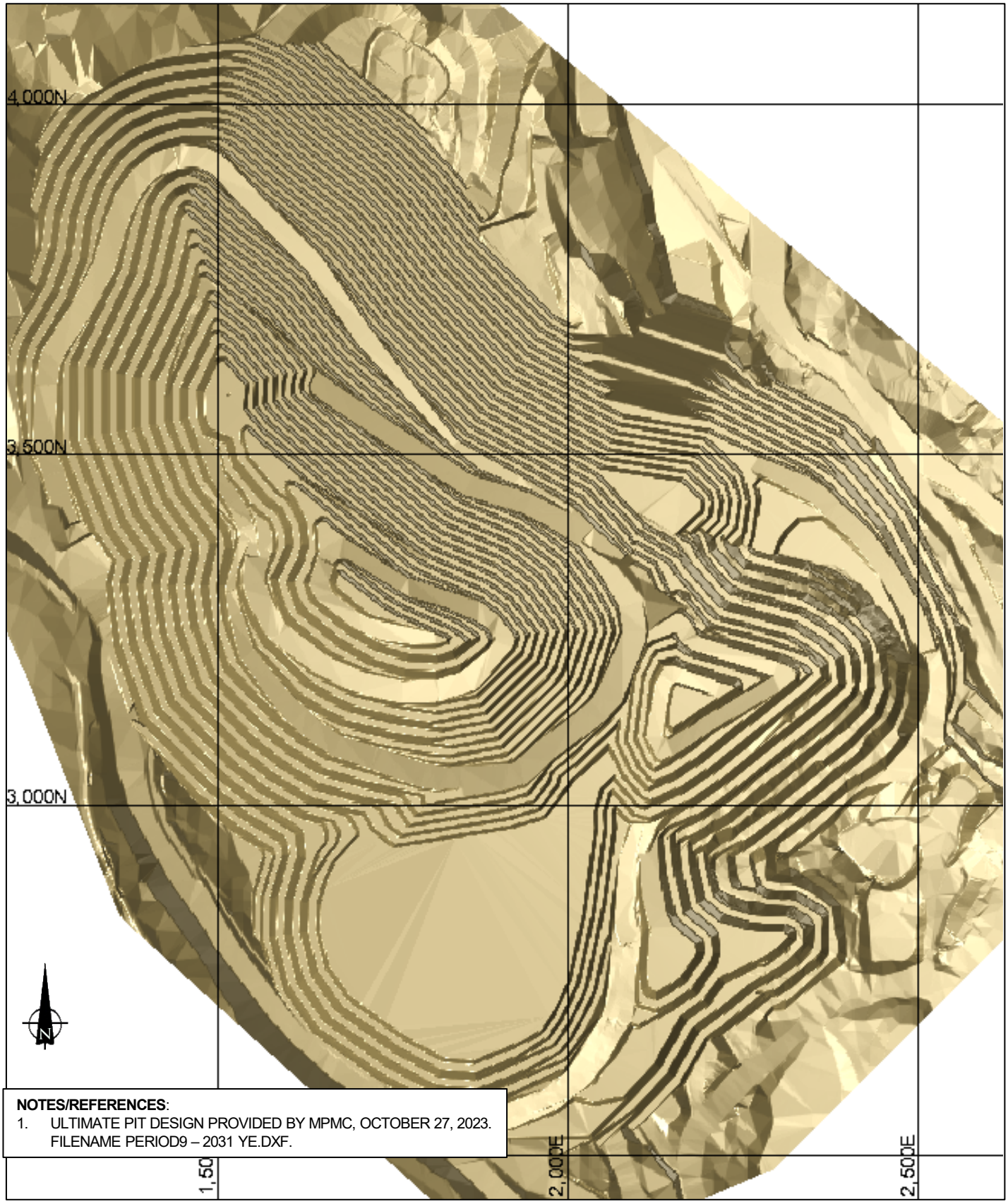

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD9 – 2031 YE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
YEAR END 2031 PIT DESIGN

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-23**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

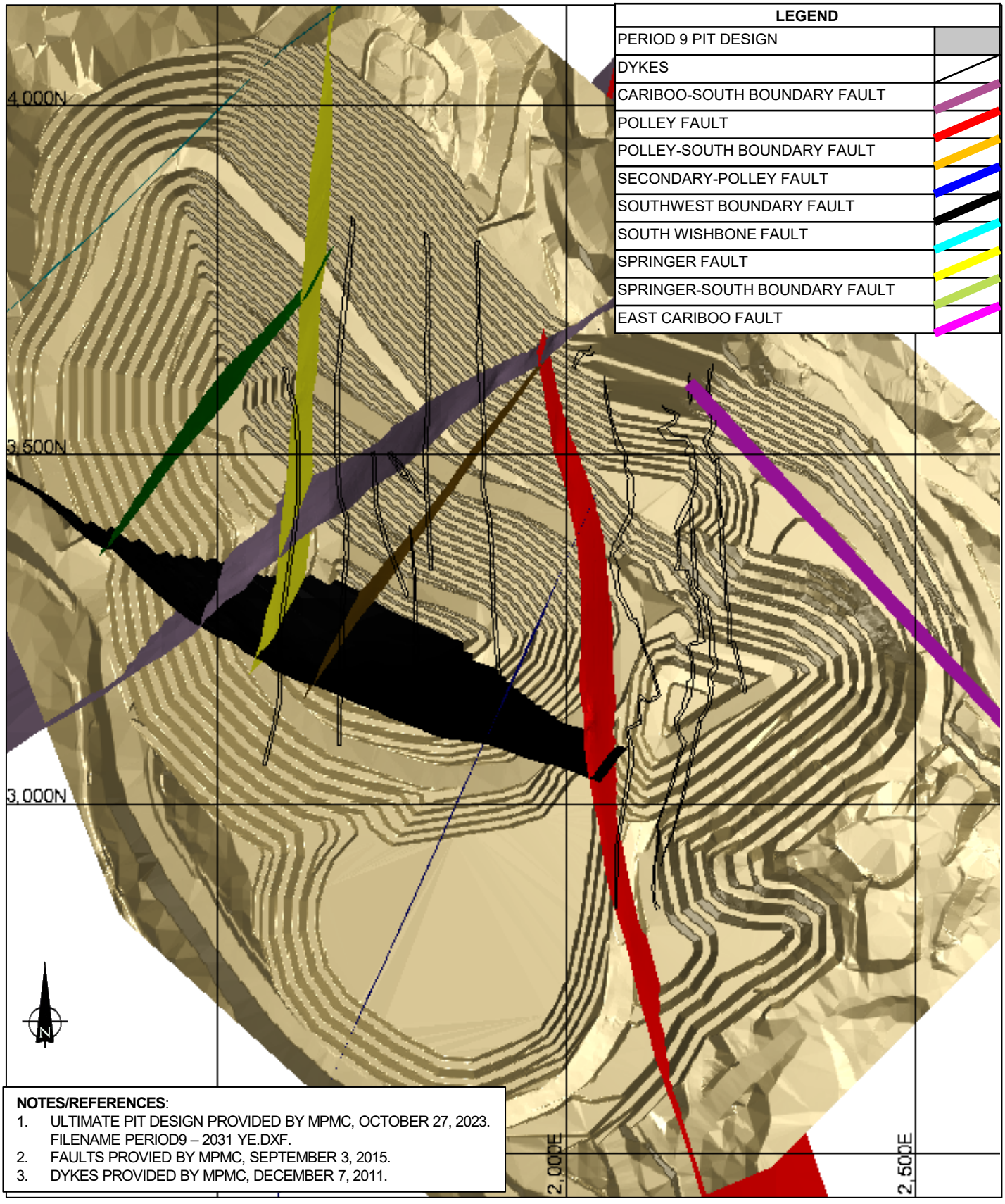

LEGEND
PERIOD 9 PIT DESIGN
DYKES
CARIBOO-SOUTH BOUNDARY FAULT
POLLEY FAULT
POLLEY-SOUTH BOUNDARY FAULT
SECONDARY-POLLEY FAULT
SOUTHWEST BOUNDARY FAULT
SOUTH WISHBONE FAULT
SPRINGER FAULT
SPRINGER-SOUTH BOUNDARY FAULT
EAST CARIBOO FAULT

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME PERIOD9 – 2031 YE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
YEAR END 2031 PIT DESIGN WITH FAULTS AND DYKES

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-24**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

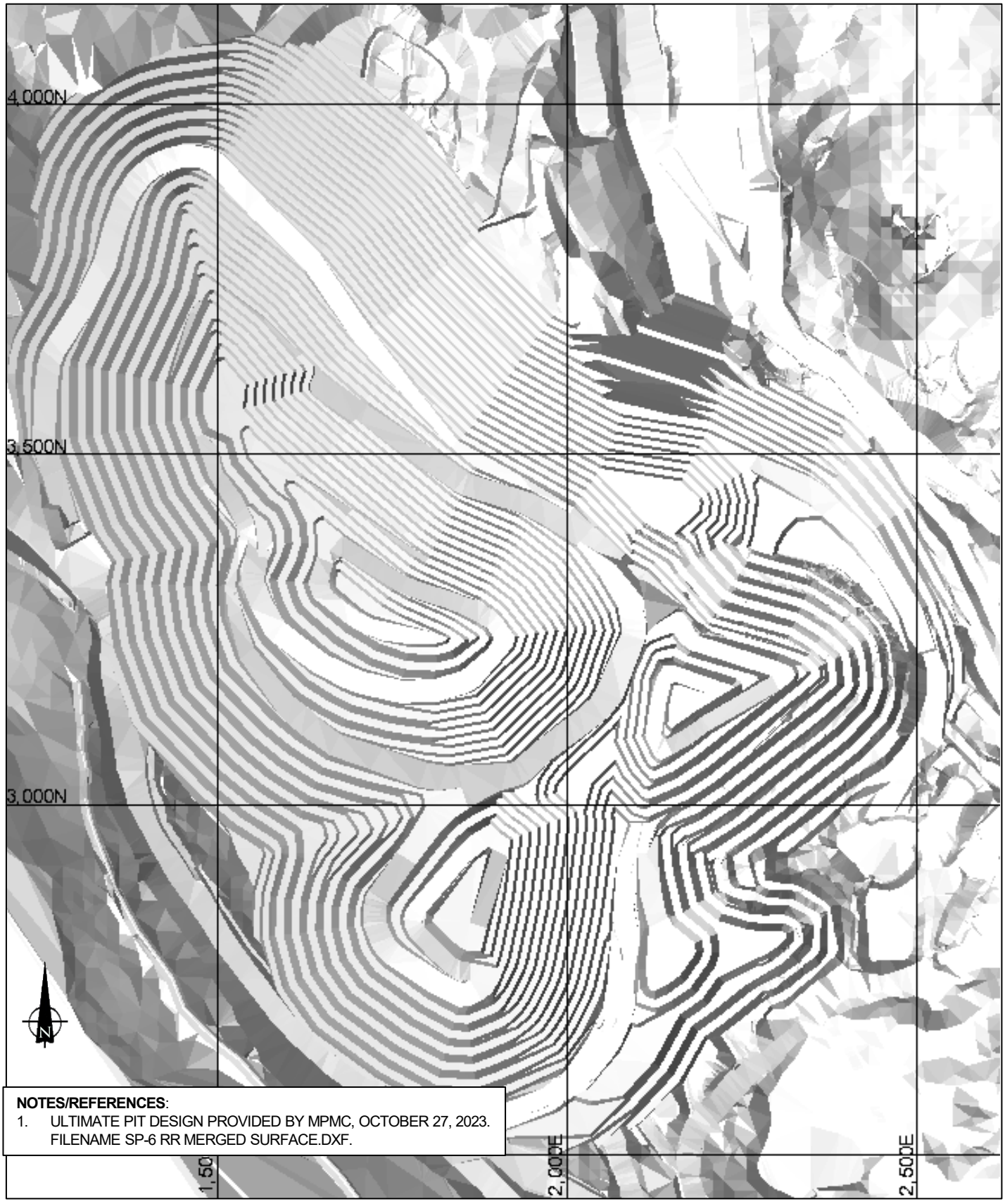

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

TITLE
ULTIMATE PIT DESIGN (YEAR END 2032)
SPRINGER, CARIBOO, WX, AND C2 PIT

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-25**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

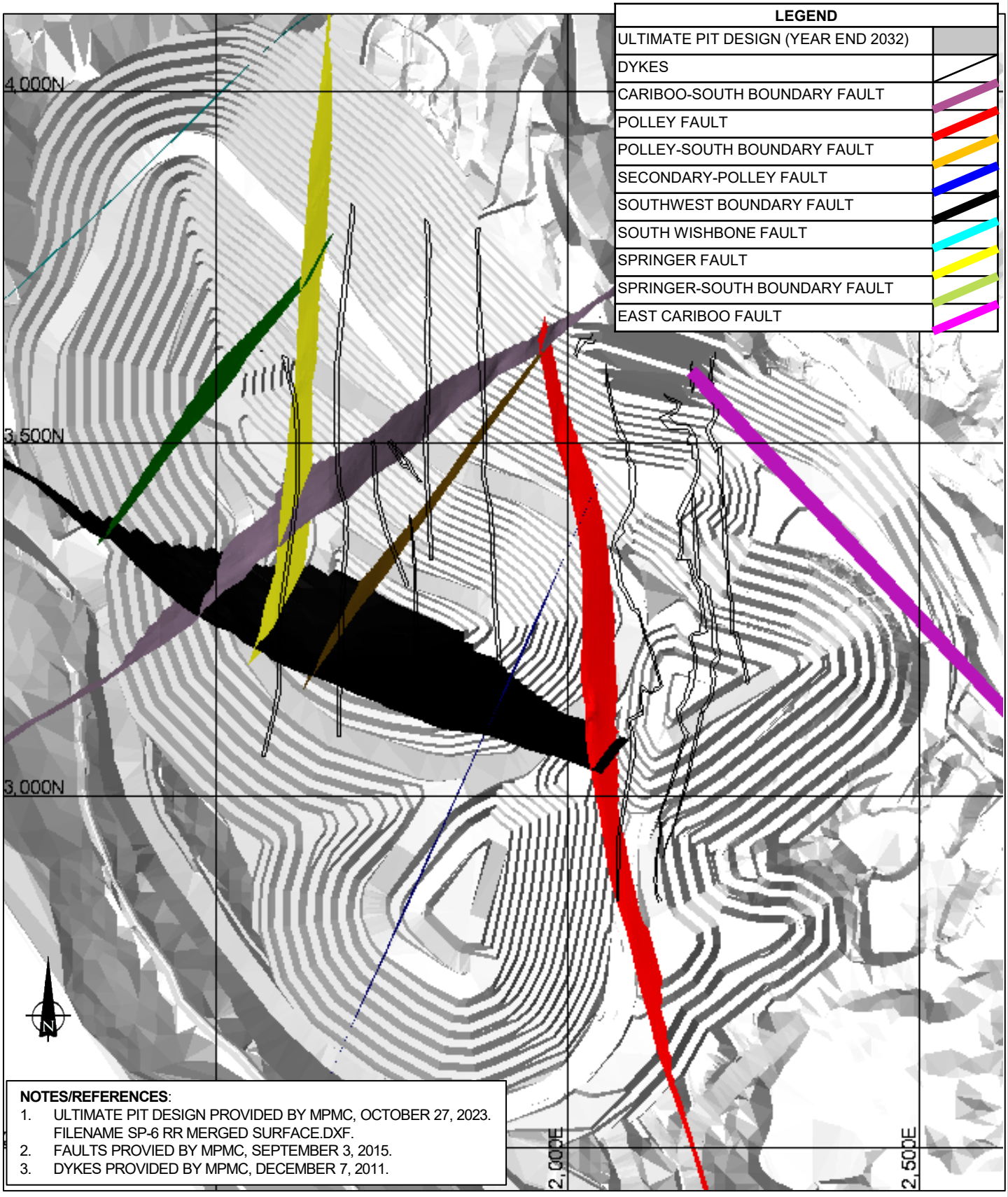

LEGEND	
ULTIMATE PIT DESIGN (YEAR END 2032)	
DYKES	
CARIBOO-SOUTH BOUNDARY FAULT	
POLLEY FAULT	
POLLEY-SOUTH BOUNDARY FAULT	
SECONDARY-POLLEY FAULT	
SOUTHWEST BOUNDARY FAULT	
SOUTH WISHBONE FAULT	
SPRINGER FAULT	
SPRINGER-SOUTH BOUNDARY FAULT	
EAST CARIBOO FAULT	

NOTES/REFERENCES:

1. ULTIMATE PIT DESIGN PROVIDED BY MPMC, OCTOBER 27, 2023. FILENAME SP-6 RR MERGED SURFACE.DXF.
2. FAULTS PROVIED BY MPMC, SEPTEMBER 3, 2015.
3. DYKES PROVIDED BY MPMC, DECEMBER 7, 2011.

CLIENT
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE
LIKELY, BC

CONSULTANT
wsp

YYYY-MM-DD	2024-05-08
PREPARED	MEW
DESIGNED	KMM
REVIEWED	AGH
APPROVED	AGH

PROJECT
LIFE OF MINE OPEN PIT DESIGN REVIEW

TITLE
ULTIMATE PIT DESIGN (YEAR END 2032)
WITH FAULTS AND DYKES
SPRINGER, CARIBOO, WX, AND C2 PIT

PROJECT NO.	PHASE	REV.	FIGURE
CA0020527.4505	**81115**	**0**	**B-26**

Path: WSP SharePoint>CA0020527.4505, Mount Polley Mine> 6 Deliverables> 3.0 Issued | File Name: Appendix B.pptx

APPENDIX C

Structural Data Review

All Structural Data Included in the 2024 LOM Review

2006 ATV and 2008 to 2024 Mapping & Photogrammetry Data

The 2013 Rees Geology Map is shown overlain on the October 2023 topography to the right.

A total of 2,163 structure orientation datapoints were digitized and compiled for this structural review. The datapoints are represented by the blue discs.

Year	Data Type	Number of Data Points
2006	ATV	118
2008	Mapping	125
2009	Mapping	635
2010	Mapping	66
2011	Mapping	11
2014	Mapping & Photogrammetry	349 & 620
2015	Mapping	56
2016	Mapping	12
2023	Mapping	77
2024	Photogrammetry	94

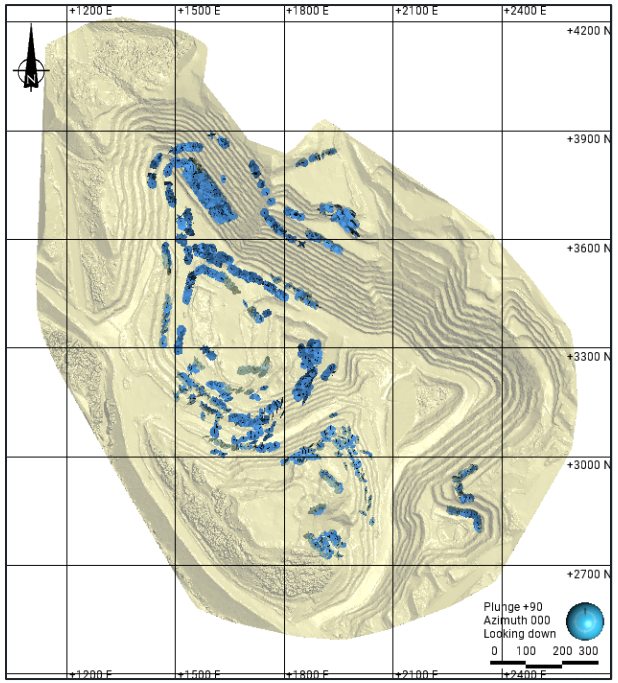

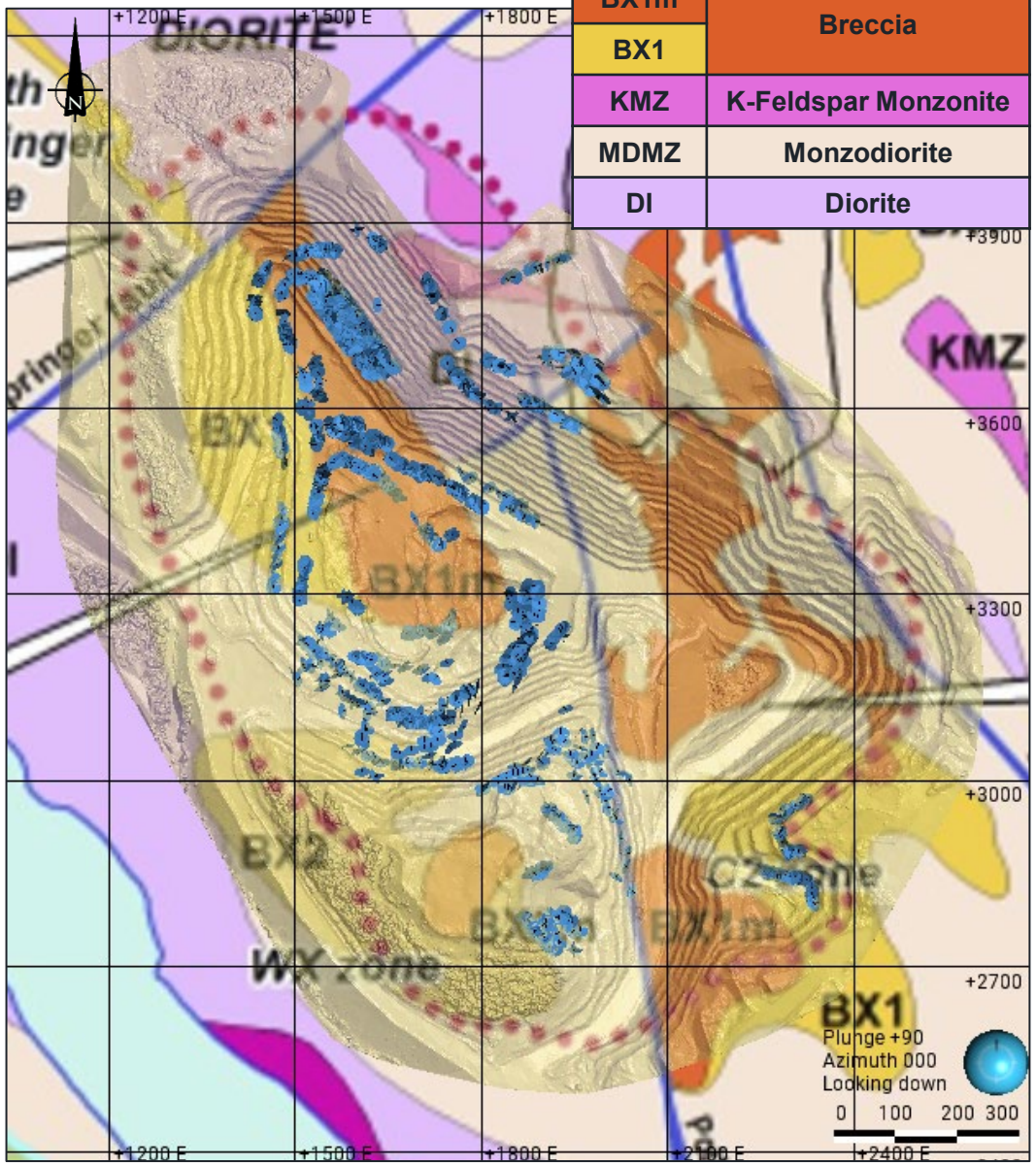

2006 Televiewer Data

Three boreholes were drilled in 2006 around the planned C2 Pit extents.

Televiewer data was collected from all three holes.

All hole collars are within breccia (BX1) and the length of the boreholes are assumed to be in breccia as well.

Symbol	TYPE	Quantity
▲	FLT	13
◆	JN	105

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 <

Contour Data	Pole Vectors
Maximum Density	7.93%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count (Weighted)	118 (118 Entries)
Terzaghi Weighting	Minimum Bias Angle 15°
Hemisphere	Lower
Projection	Equal Area

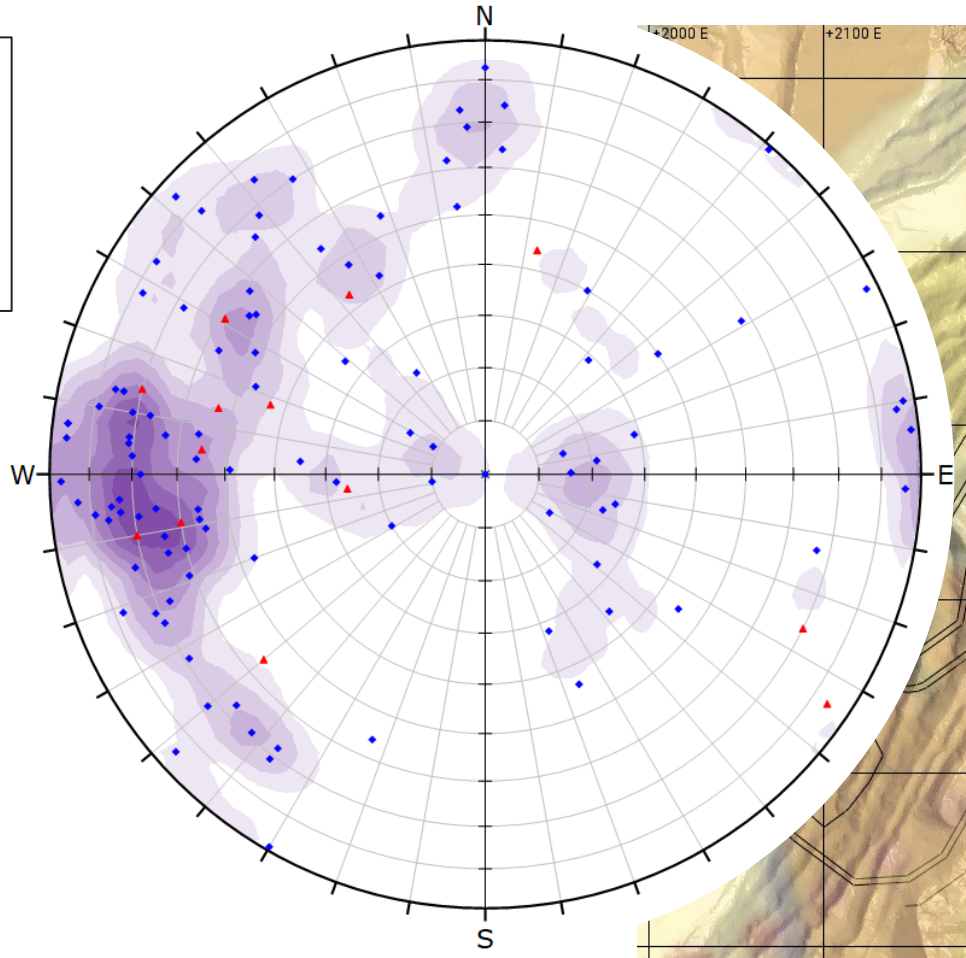

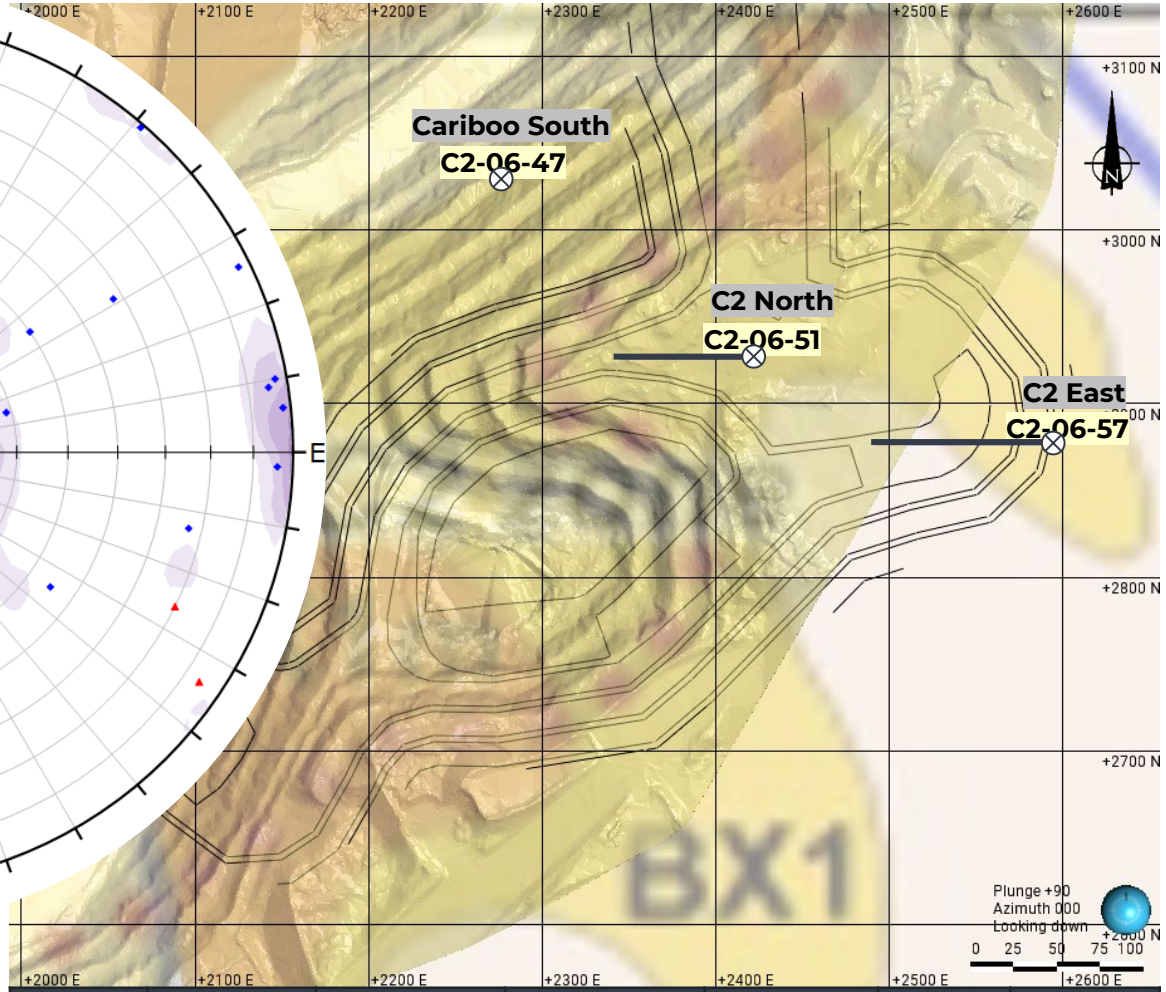

BHID	Easting (m)	Northing (m)	Elevation (m)	Azimuth (°)	Dip (°)	Depth (m)
C2-06-47	2277.8	3027.7	1147.7	2	90	76.2
C2-06-51	2425.62	2925.83	1145.38	270	60	160.02
C2-06-57	2598.11	2876.69	1137.61	270	60	212.5

2008 Mapping Data

Coordinates for 2008 mapping data were estimated using an open pit plan from 2008:

- Mt.Polley_PitPlan_7Feb2008 (polylines)

With the following map overlain:

- 2008 Mapping Locations Map – "05-1413-027-fig-6 2008 Mapping locations.pdf"

Single point mapping locations (no traverse length provided) and line mapping locations were estimated in Leapfrog.

Structural mapping data points (yellow) are shown in the insets.

Some point mapping locations included more than one measurement; they have been given the same coordinates.

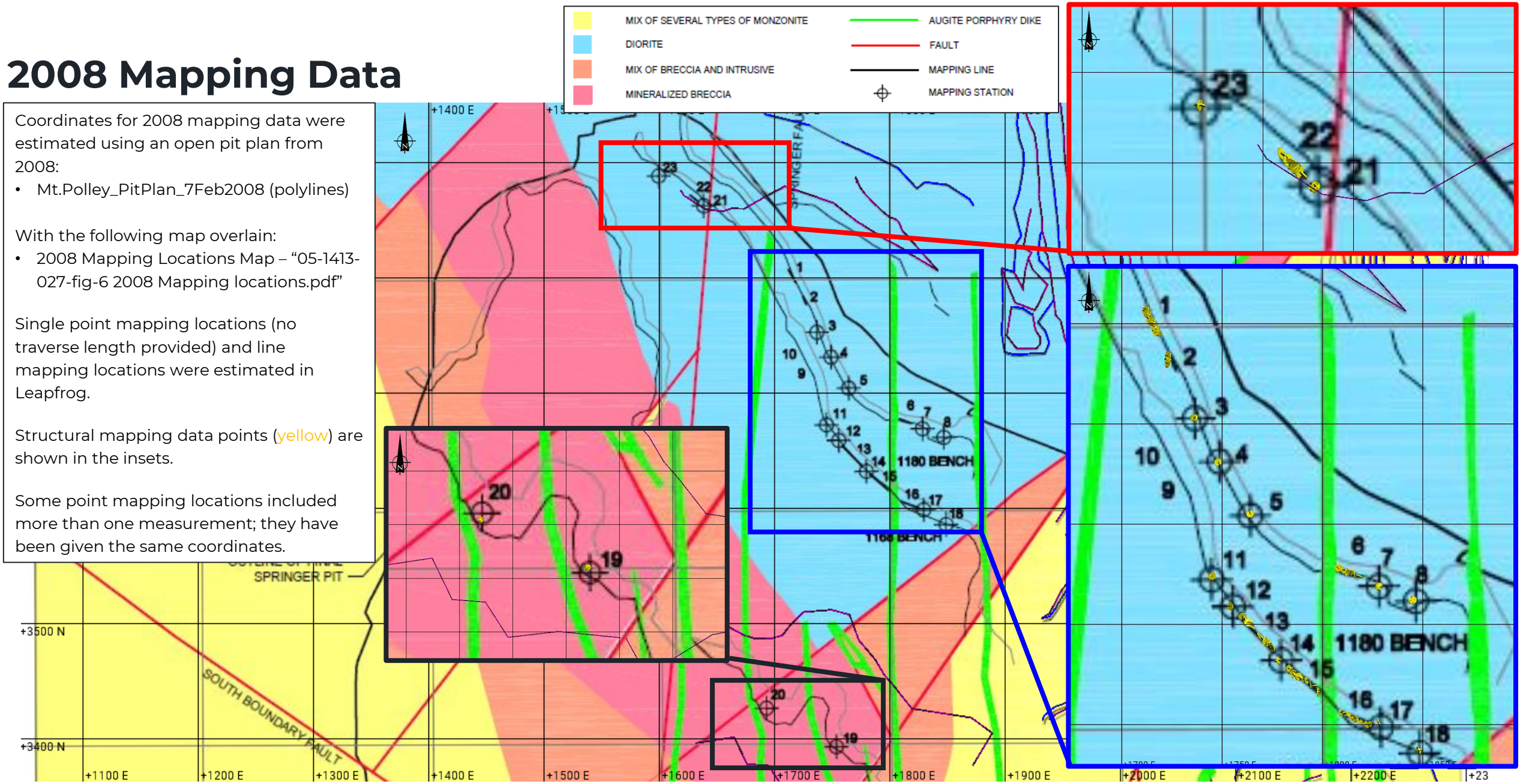

2009 Mapping Data

Coordinates for 2009 mapping data were estimated using the station locations on the following drawings:

- Figure 2 - 2009 Springer Pit and Mapping Stations.dwg

Field mapping sheets were used to obtain traverse lengths and distances along traverses for each measurement. The following assumptions were required to estimate these locations:

- The coordinate for the station was assumed to be the middle of the traverse
- The orientation of the traverse was estimated from the orientation of the bench at that location using the following open pit design:
    - topo_surface_clean.dxf from Aug 2012

2009 structural mapping data is shown over the August 2012 topography at right.

Figure 2 - 2009 Springer Pit and Mapping Stations

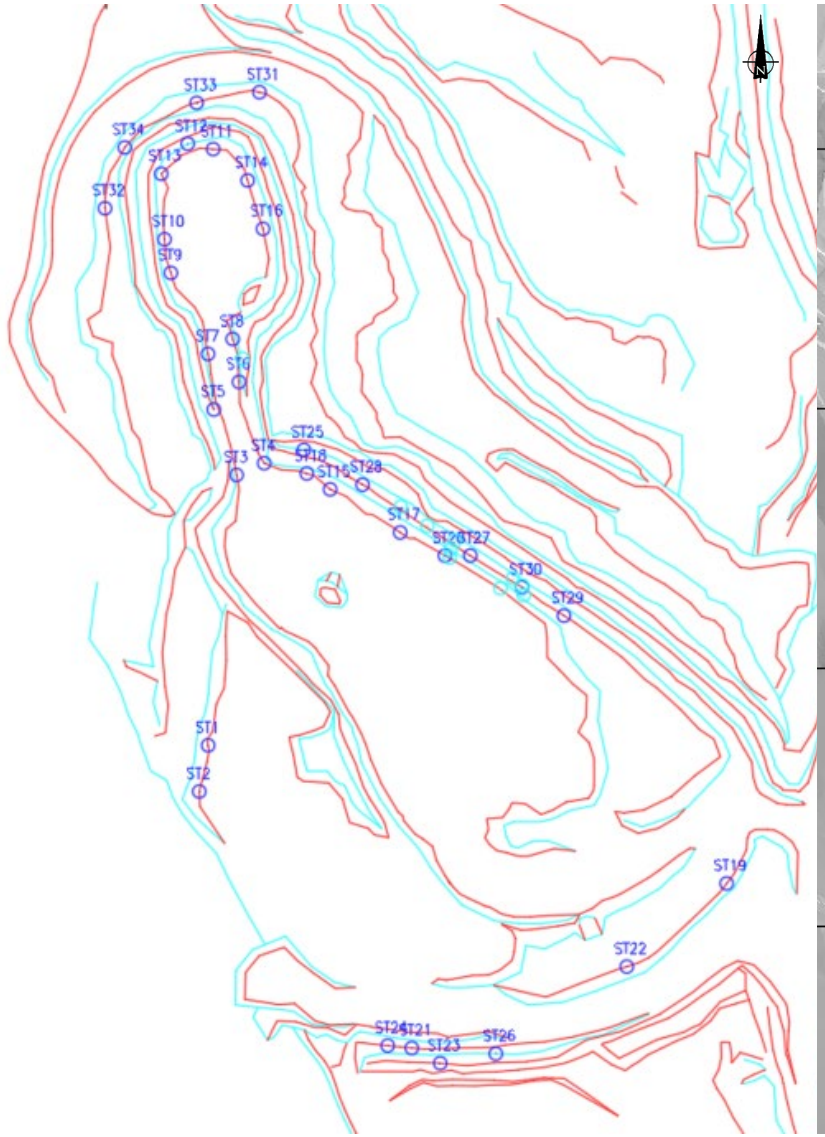

2009 Mapping on Aug 2012 topography

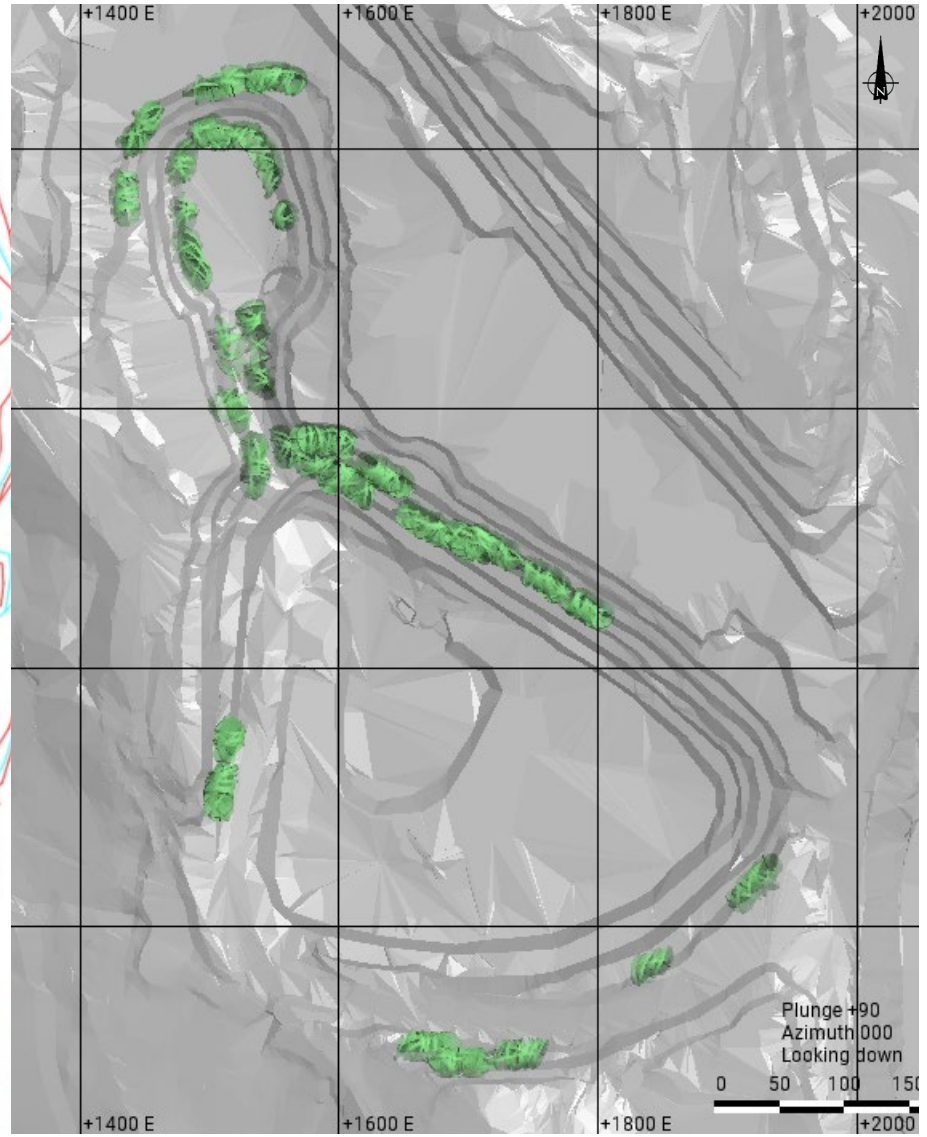

2010 & 2011 Mapping Data

Coordinates for 2010 and 2011 mapping data were estimated using a topography surface from 2010:

- Surface Springer Bell Apr 2010.dxf

Wall locations were assigned to structures in the dataset, but no coordinates were provided for the traverses. Elevations were assigned based on the lowest operating bench at the time of mapping.

A total of 77 structural data points are included from the 2010 & 2011 mapping dataset.

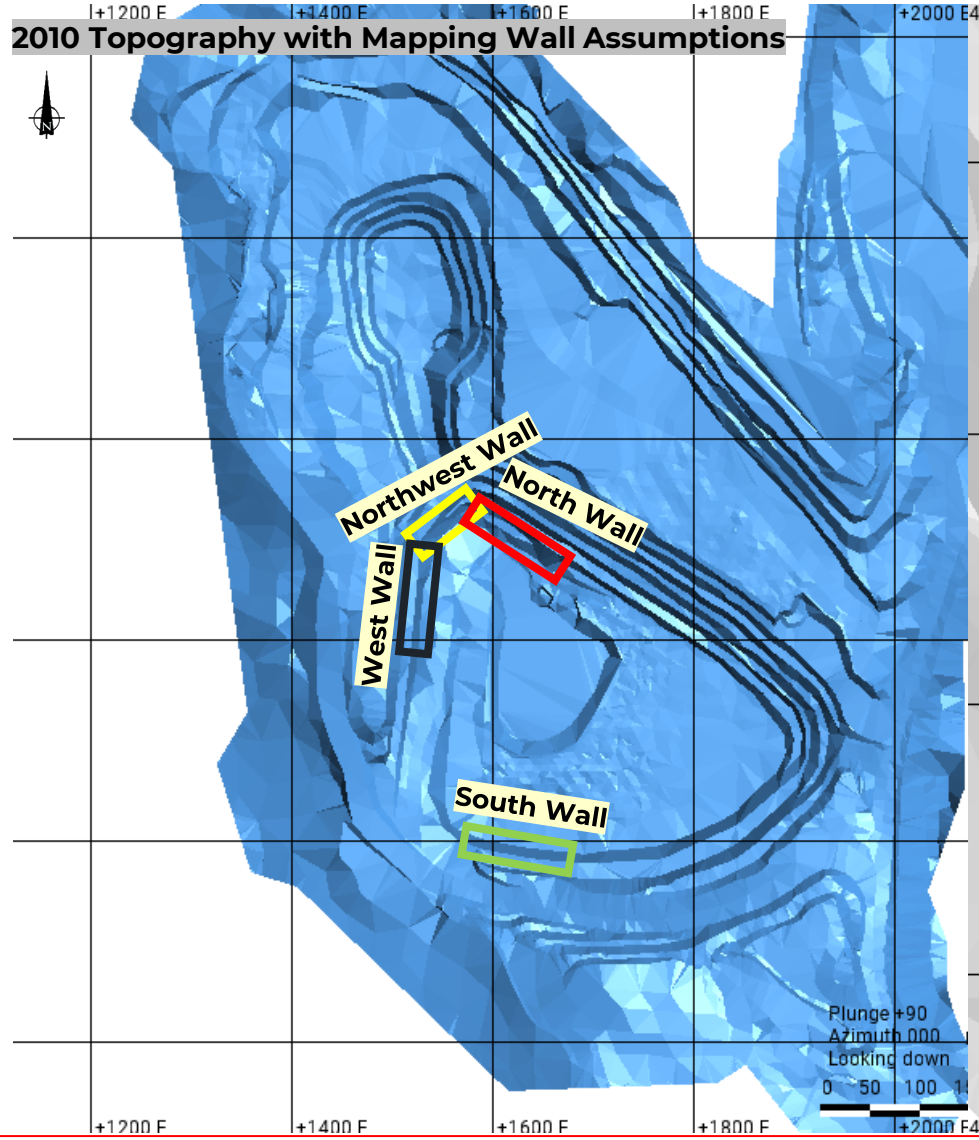

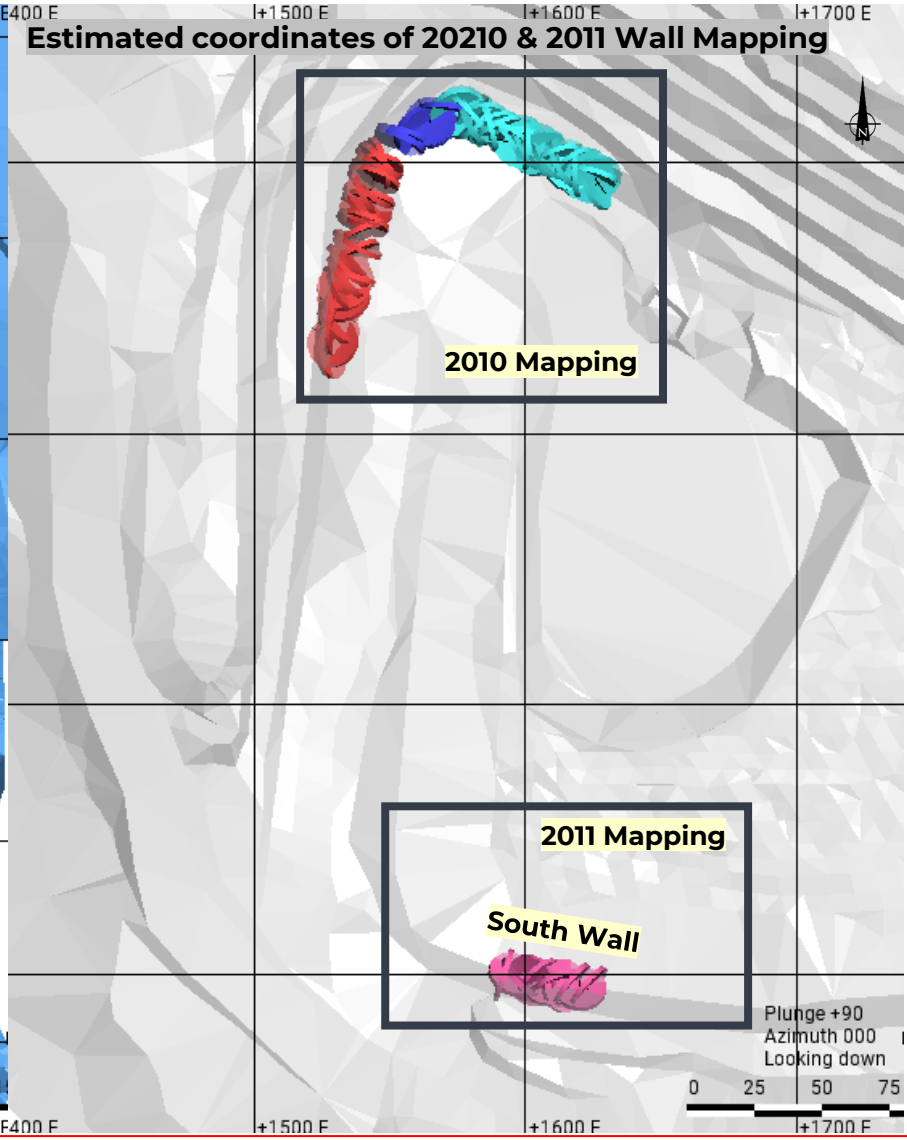

2014 Mapping Data

Coordinates for 2014 mapping data were estimated using station coordinates obtained from:

- Location of 2014 Mapping stations.dwg

Field mapping sheets contained traverse lengths and distances along traverses for each measurement. Traverse locations were not provided for every structure; coordinates for these structures were estimated.

Assumptions were required to estimate locations as follows:

- The coordinate for the station was assumed to be the middle of the traverse
- The orientation of the traverse was estimated from the orientation of the bench at that location using the following pit design:
    - Fig 1 - Dec 31, 2015 Topo

The 2014 structural mapping data is shown over the December 2015 topography.

2014 Mapping on Dec 2015 Topography Surface

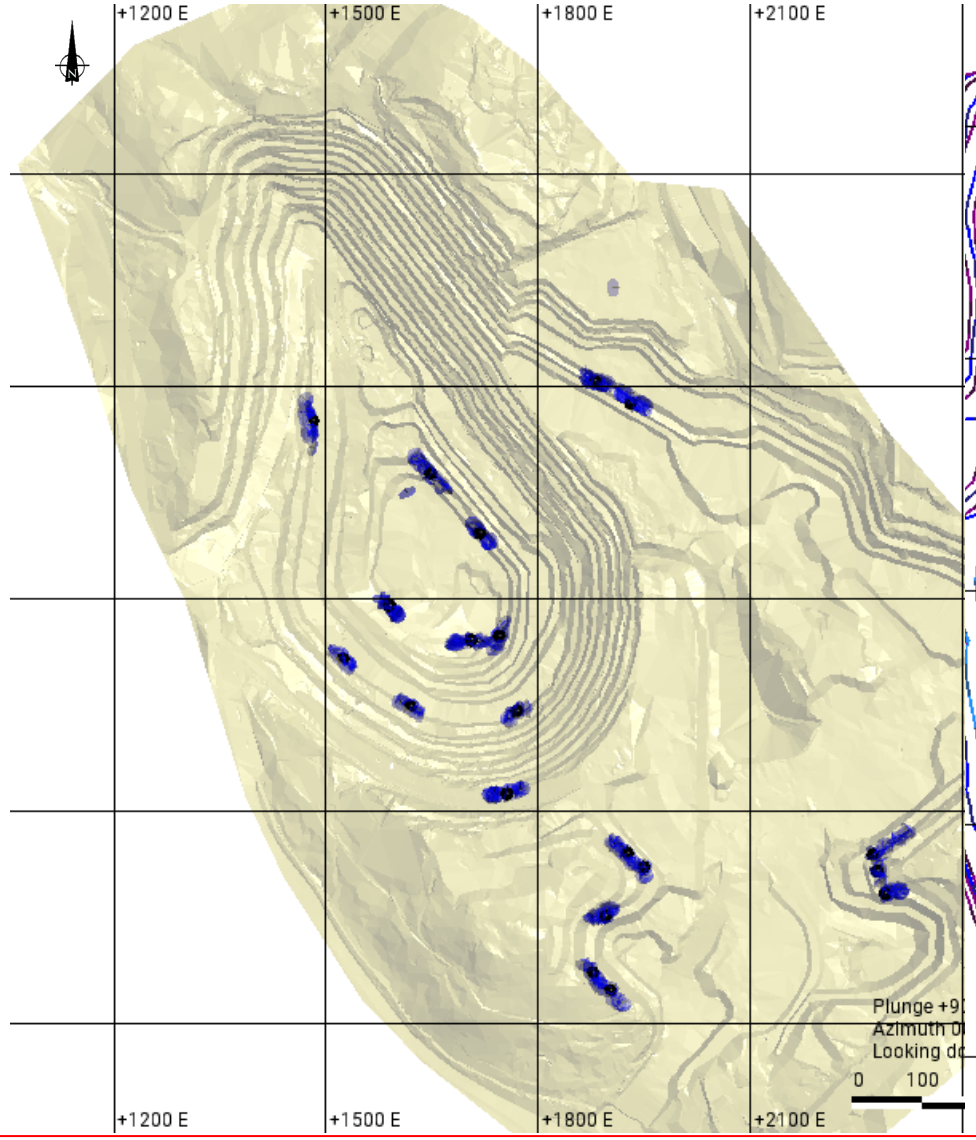

Location of 2014 Mapping stations.dwg

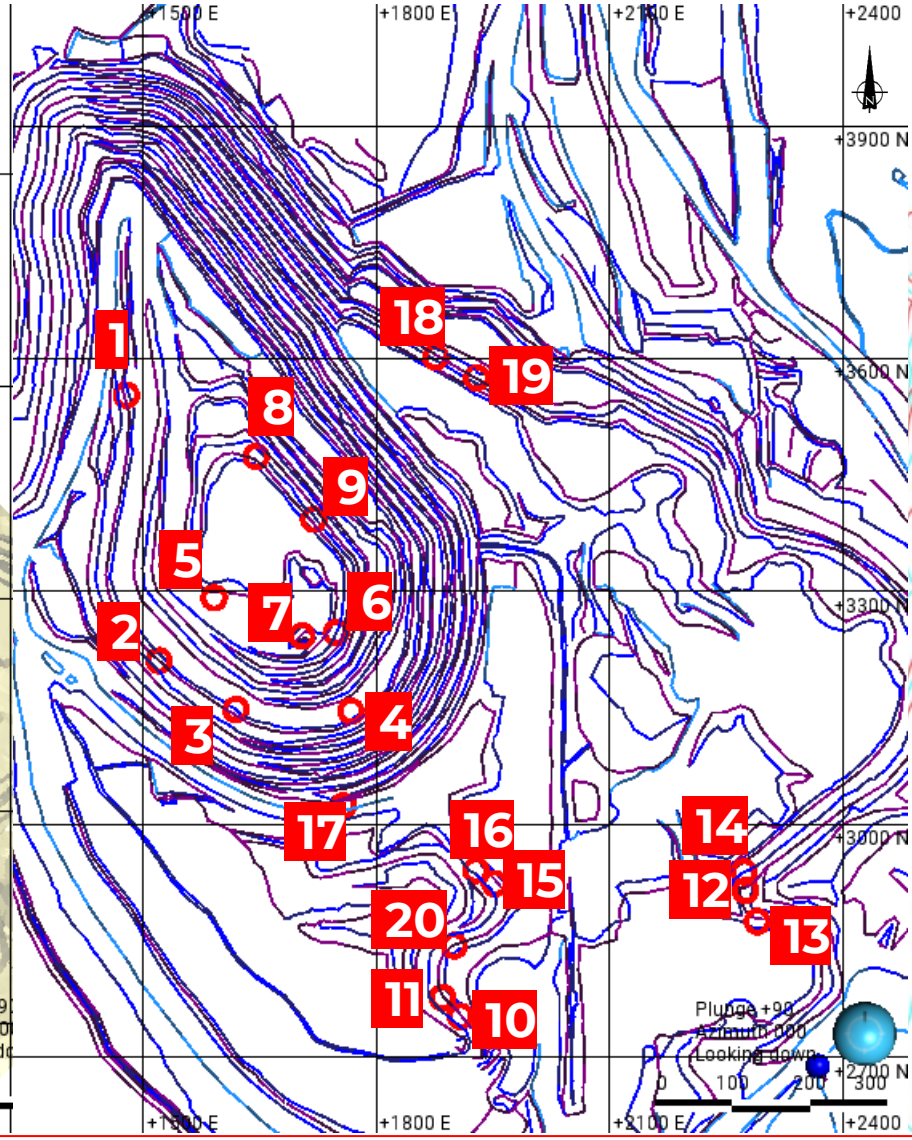

2014 Photogrammetry Data

Photogrammetry was completed in 2014 by Golder for 12 locations around Springer Pit (shown with different colours on the figure). The south and northeast walls of the Springer Pit were mapped. The 2014 photogrammetry features are shown on the December 2015 topography surface.

NOTE: The data (522 points) labeled N_####, S_####, and NE_#### were assigned as 2012 data in the 2016 LOM review (Golder 2016). They have been corrected to 2014 data for the 2024 LOM review.

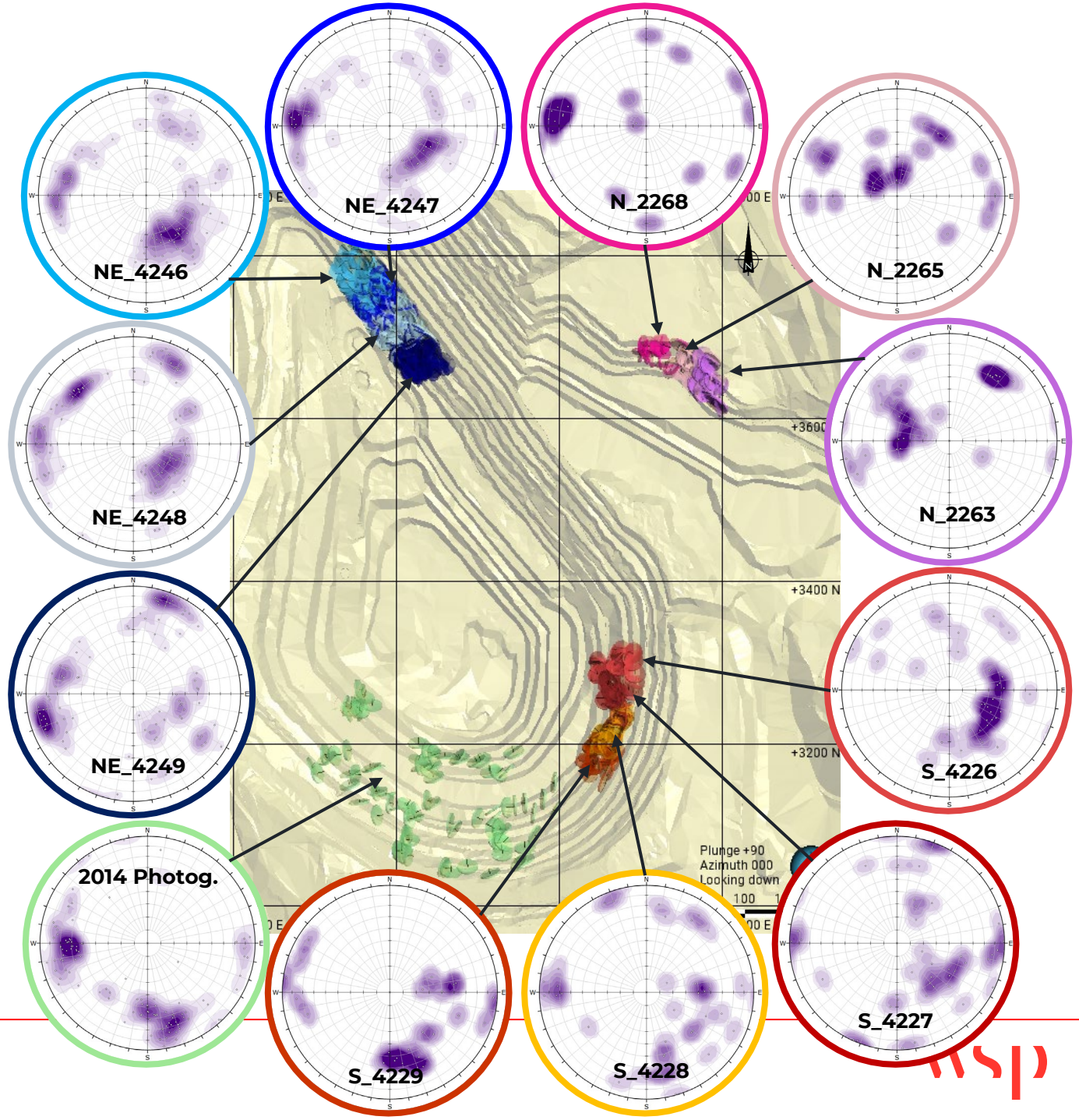

2015 C2 Mapping Data

Mapping data was collected by Golder in 2015 along the north, northeast, and east walls of C2 Pit.

The location of mapping data was assigned to the bottom bench of the C2 Pit using the topography surface available for 2015.

Approximate locations of the 2015 structural mapping data is presented on the December 2015 topography surface and with geology map (Rees 2013).

Estimated coordinates of 2015 Structural Mapping on December 2015 Topography Surface

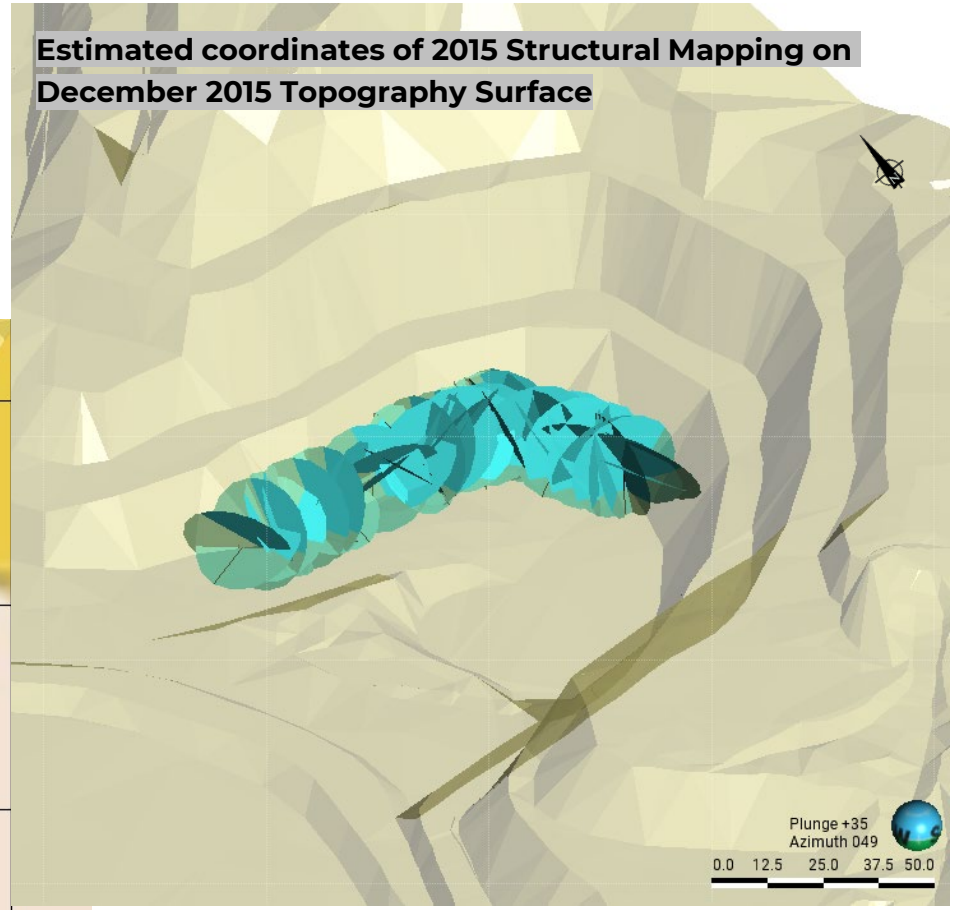

2015 Topography Surface, 2015 Structural Mapping Data, and Geology Map (Rees 2013)

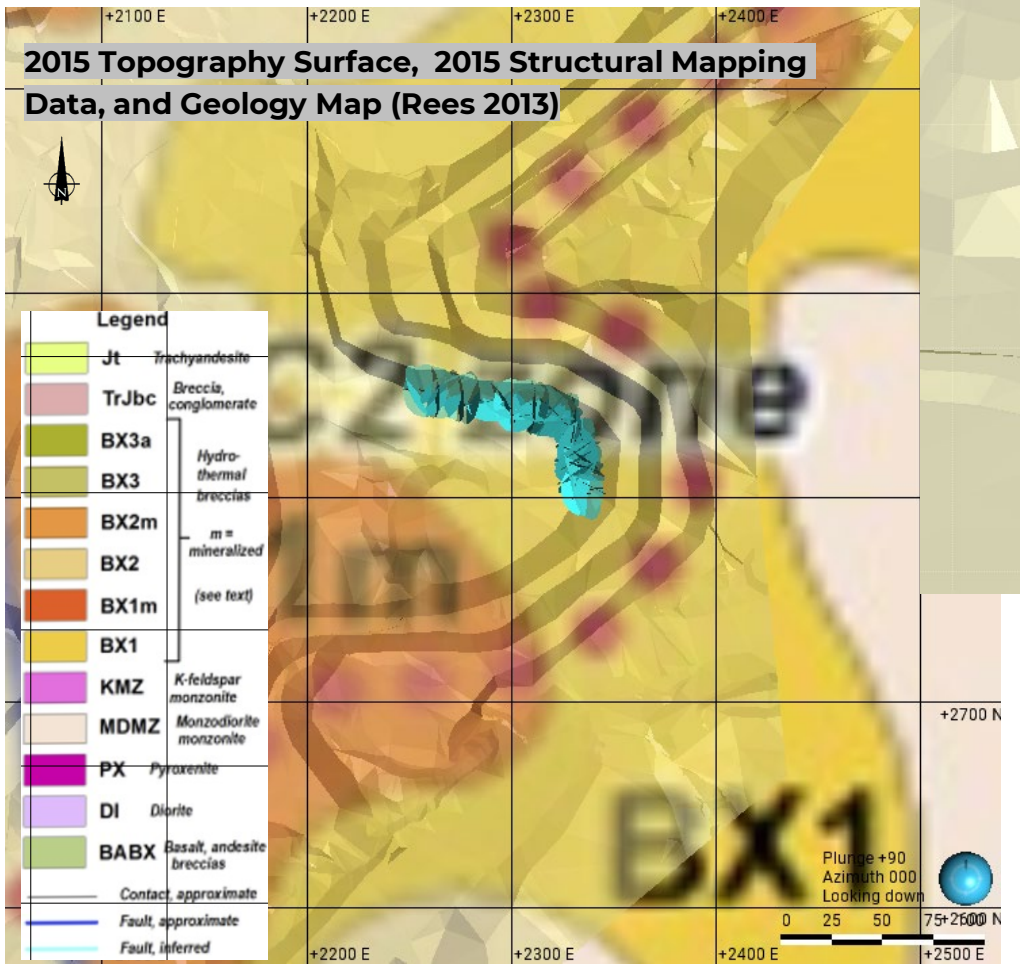

2016 Mapping Data

The 2016 mapping was conducted on October 12, 2016 by Golder. The measurements were taken on the south wall. The rock type was noted as monzonite with a field estimated intact rock strength of R3 to R4 (ISRM strength). The rock mass was also noted as fresh and dry.

The coordinates of the mapping data were assigned to the bottom bench of the south wall in the WX Pit based on topography surface:

- 161017_mp_current_status_map.dxf

Photograph Taken by Golder in WX Pit – October 12, 2016

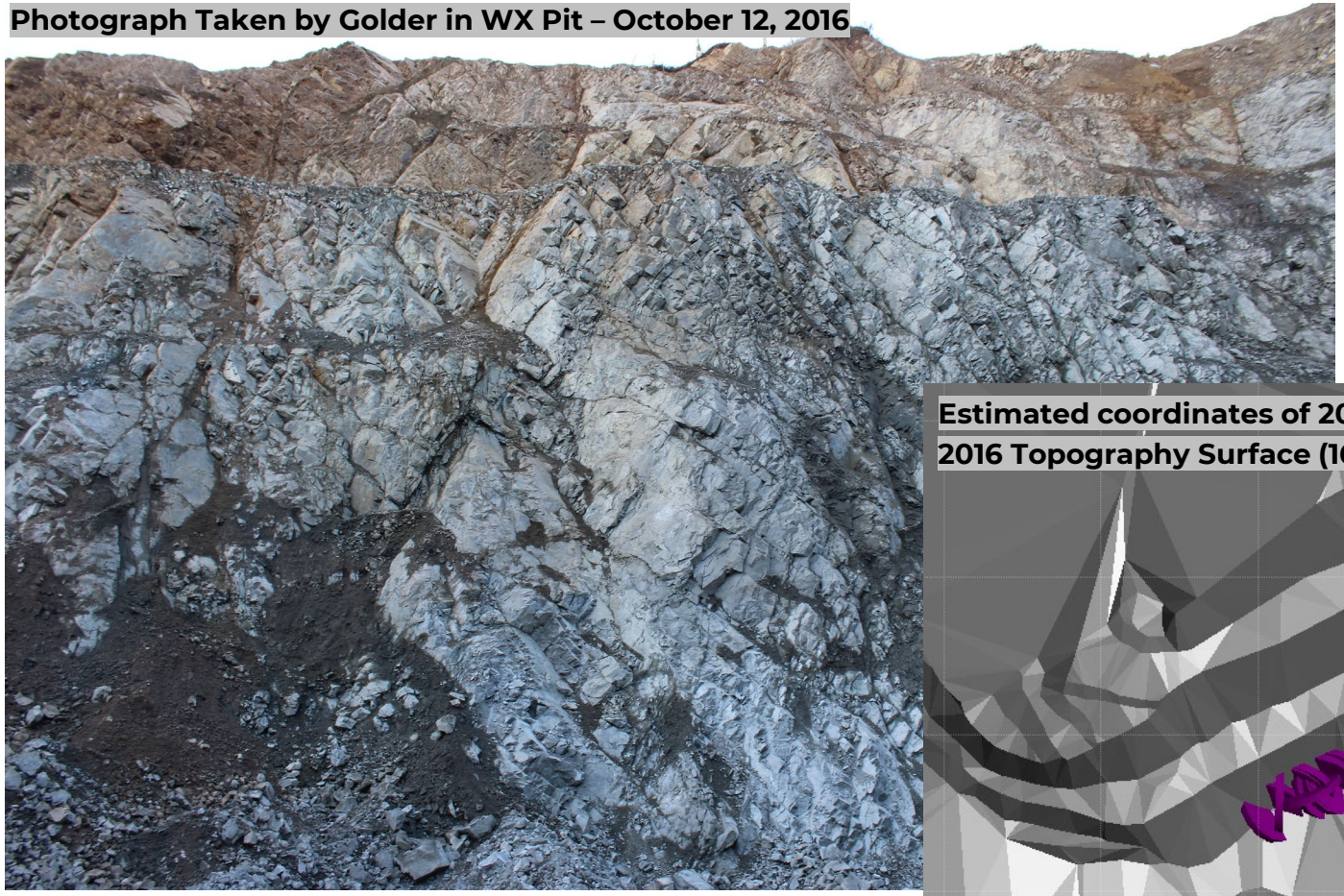

Estimated coordinates of 2016 Mapping over 2016 Topography Surface (161017 Status Map)

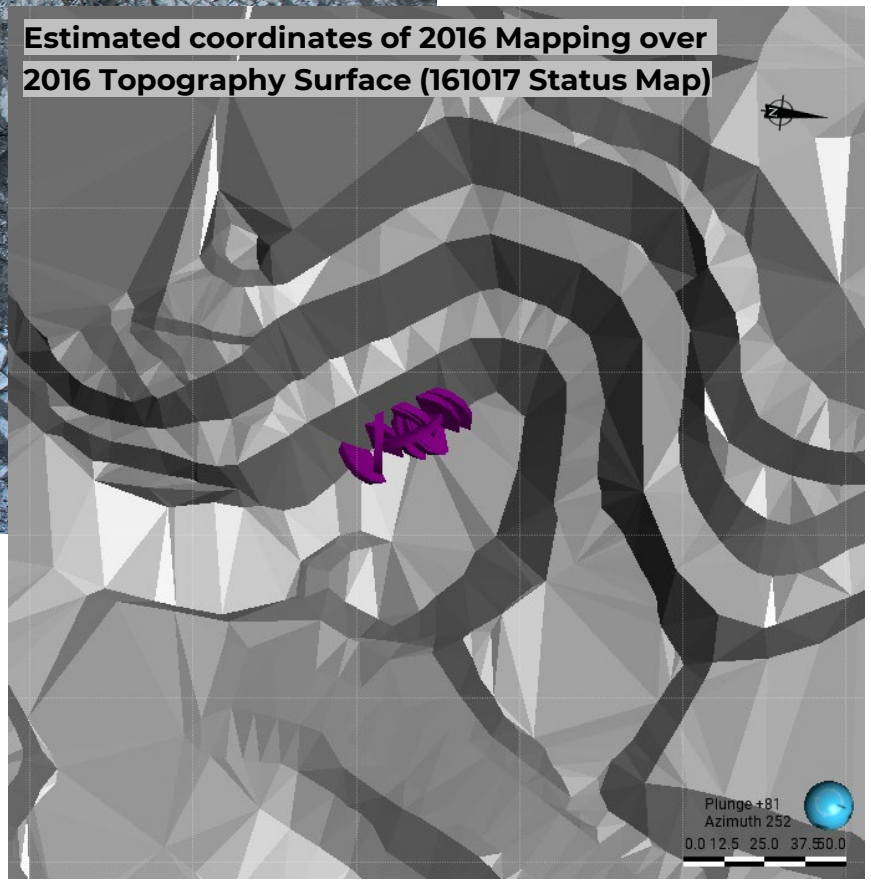

2023 Mapping Data

Mapping data collected by WSP during the September 2023 slope stability review. Approximate coordinates of structures estimated based on wall orientations and position along the traverse.

Approximate locations of the 2023 structural mapping data is presented on the October 2023 topography surface.

MPMC data collected in November 2023 is presented in **teal** in the red circle.

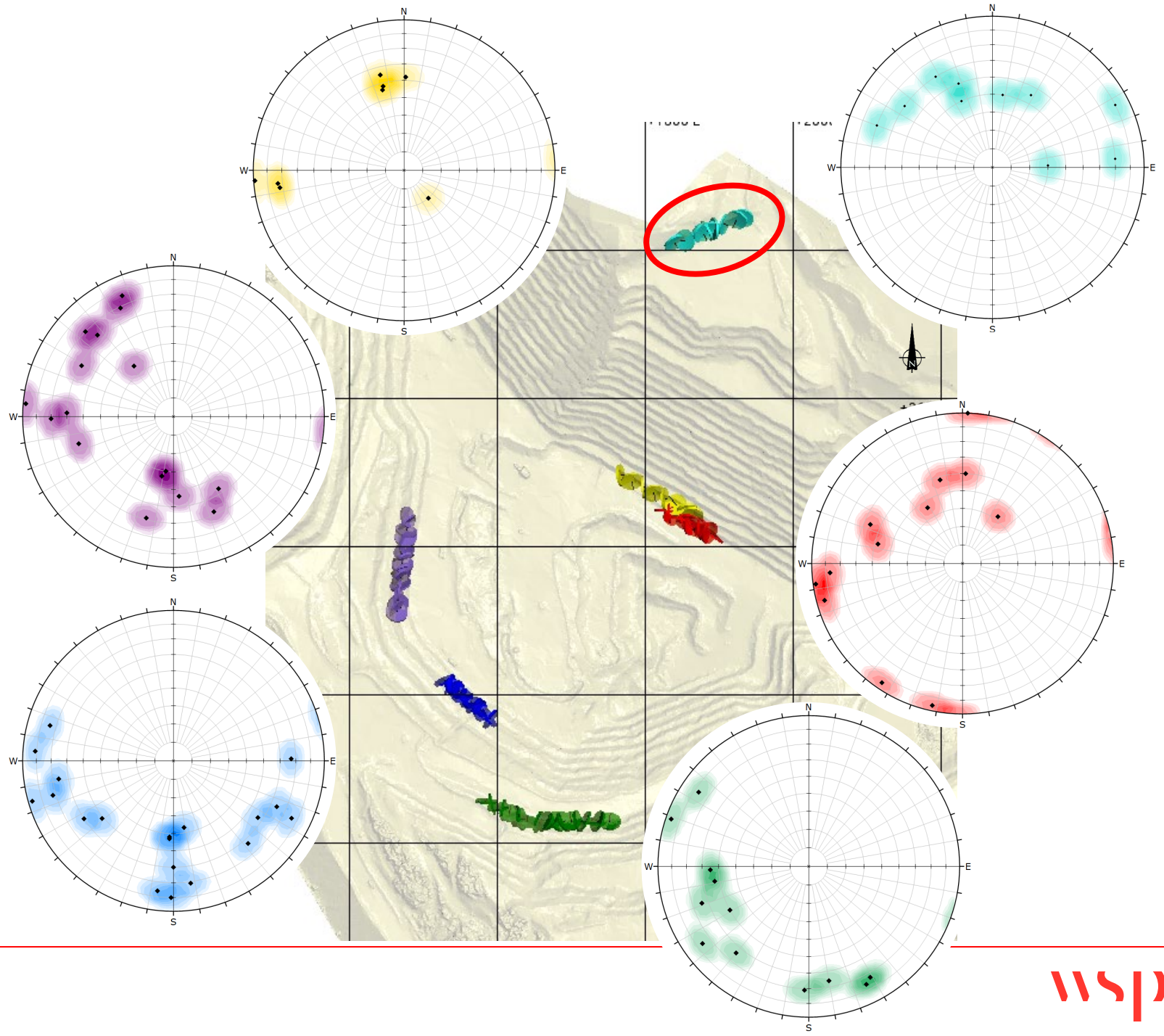

2024 Photogrammetry Data

Photogrammetry mapping completed within WX Pit, along Cariboo Ramp, and along the south wall of Springer Pit completed in January 2024. Structural orientations were picked using “230801-Full Pit_group1_densified_point_cloud” topographical surface scan provided by MPMC November 28, 2023.

A total of 94 structural mapping points were collected. Features picked are shown on the October 2023 topography in **blue**.

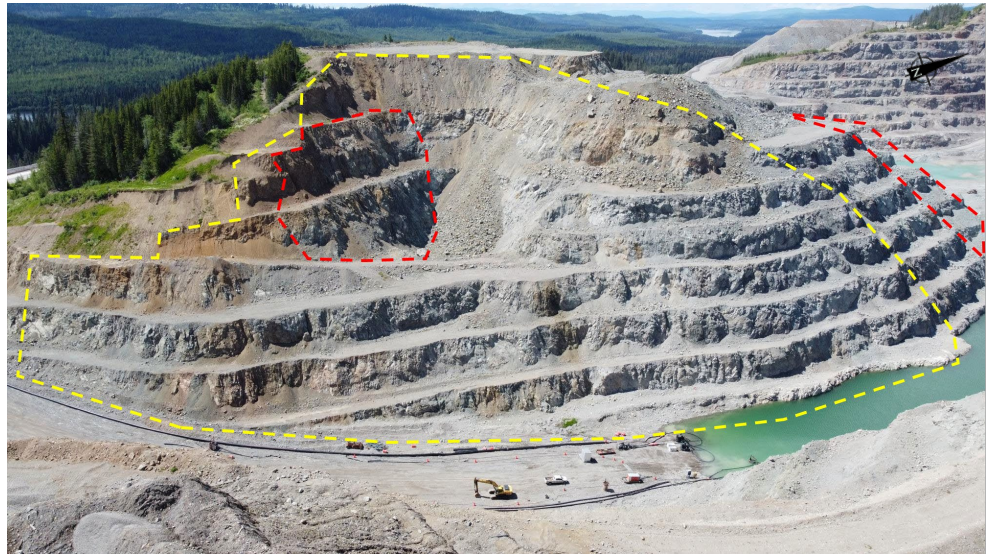

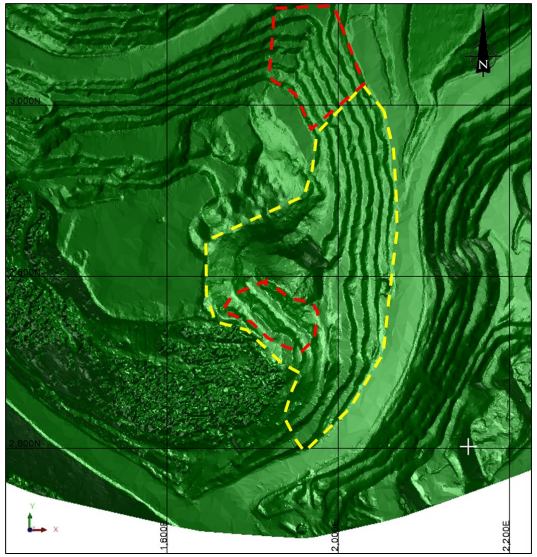

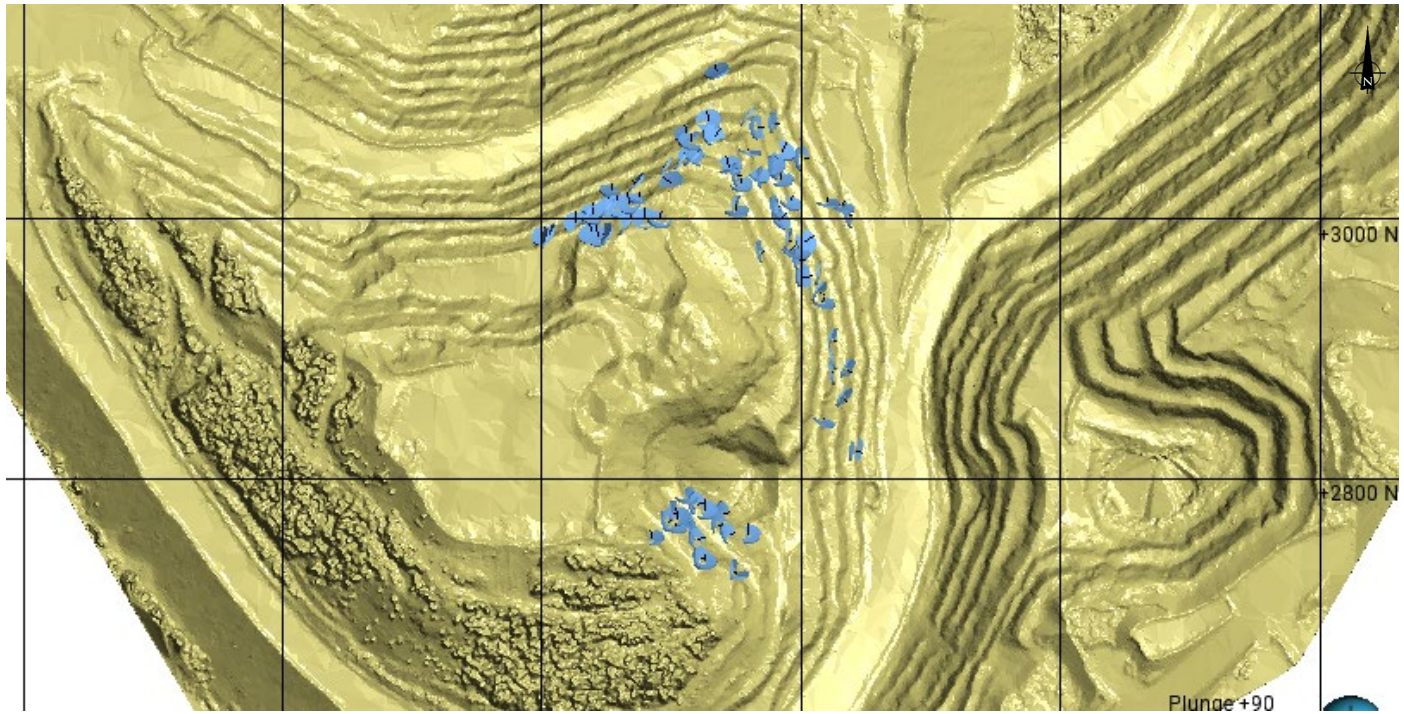

Application of Magnetic Declination to Mapping Data

Magnetic declination was applied to the dip direction of mapped data based on the date they were collected. Magnetic declination was only applied to structural mapping data, not the televiewer or photogrammetry data.

The website Historical Declination Viewer (noaa.gov) was used to review the changes in declination with time.

LEGEND	
★	Approximate Location of Mount Polley Mine
	19° East of North
	18° East of North
	17° East of North
	16° East of North

Year	Magnetic Declination	Year	Magnetic Declination
2008	18° East of North	2014	17° East of North
2009	18° East of North	2015	17° East of North
2010	18° East of North	2016	17° East of North
2011	18° East of North	2023	16° East of North
2012	17° East of North	2024	16° East of North

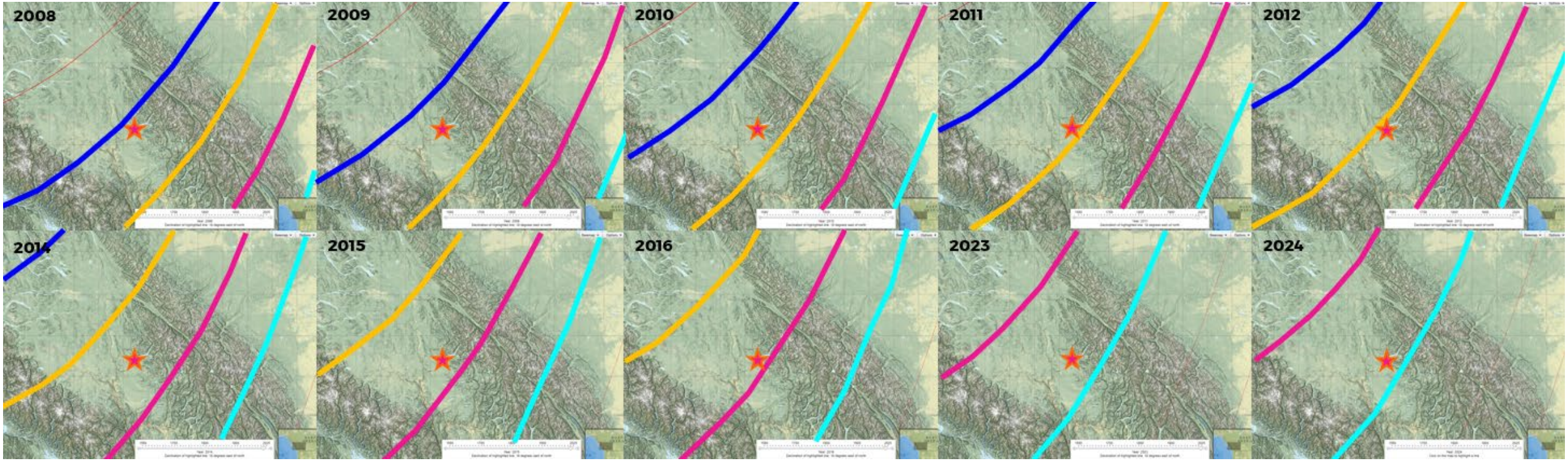

All Structural Data Included in the 2024 LOM Review

2006 ATV and 2008 to 2024 Mapping & Photogrammetry Data

The geologic map (Rees 2013) was used to assign rock type to the mapping and photogrammetry data.

Note that rock type was assigned in plan view without taking changes in topography throughout the years into account. Consequently, these assigned rock types are approximate.

Symbol	2013 REES GEO	Quantity
	BX1	347
	BX1m	471
	BX2	43
	DI	594
	KMZ	3
	MDMZ	713

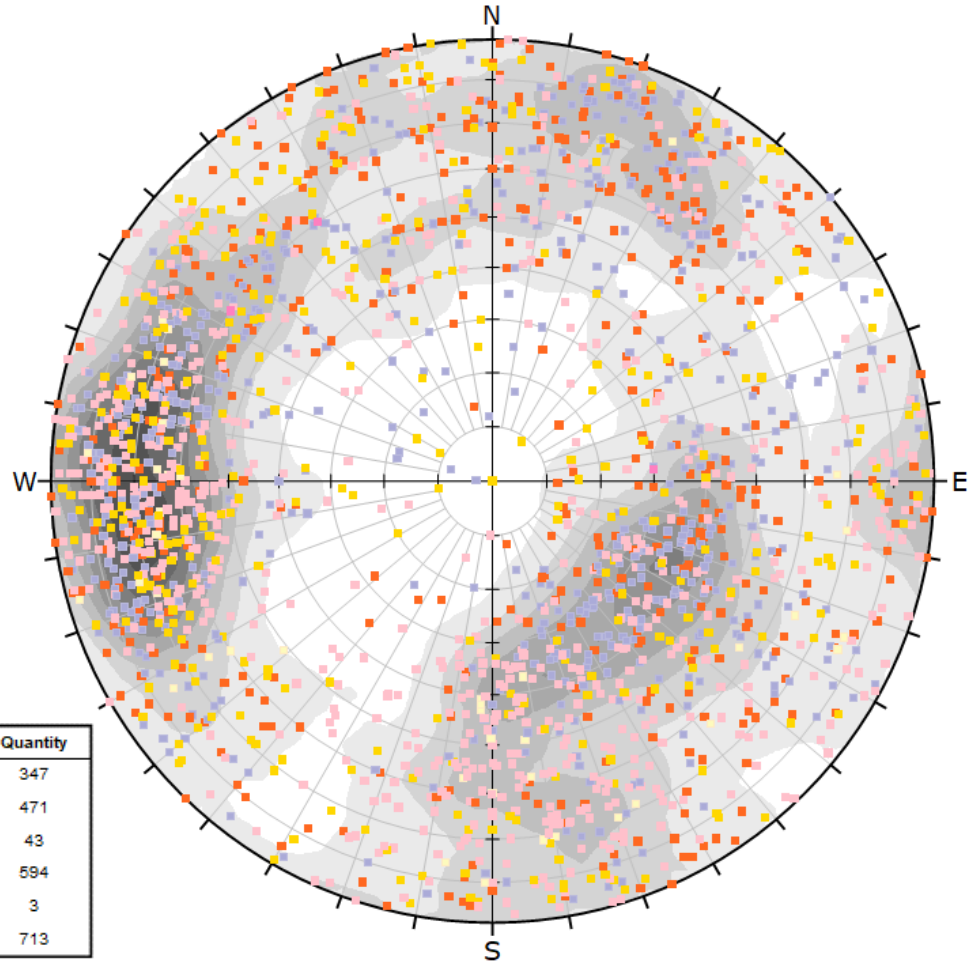

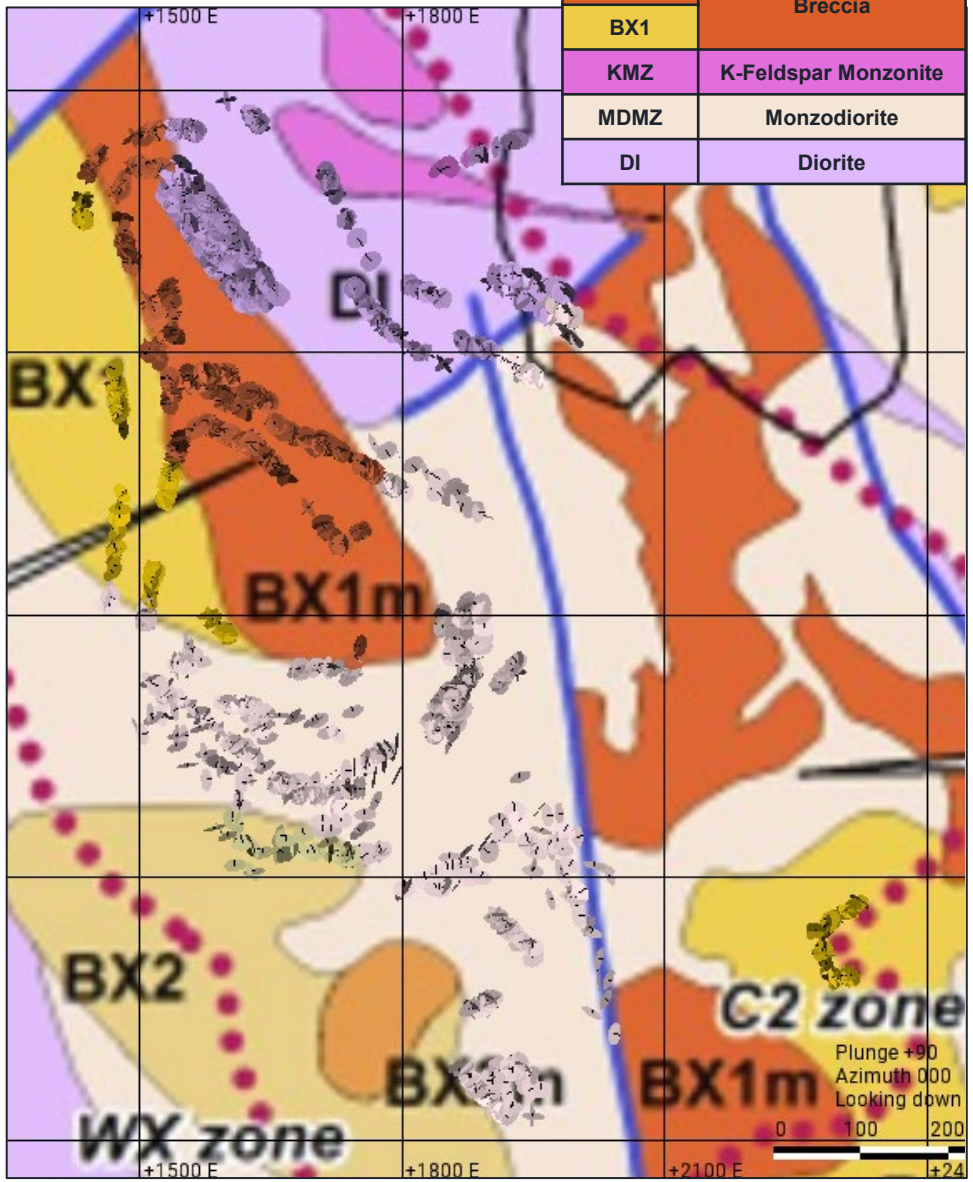

Mapping, Photogrammetry, & ATV Data Presented By Pit

Compiled Structural Data Presented by Pit

The 2013 Rees Geology map was used in plan view to assign lithology to the mapping, photogrammetry and ATV data.

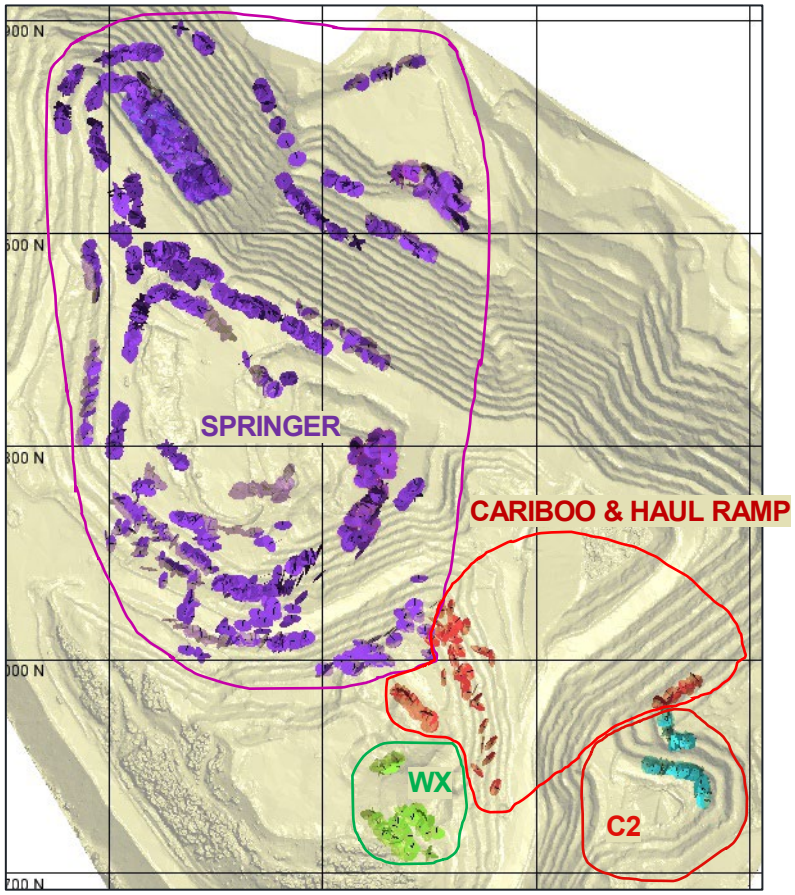

DIPS LEGEND
BX1m
BX1
BX2
KMZ
MDMZ
DI

Springer

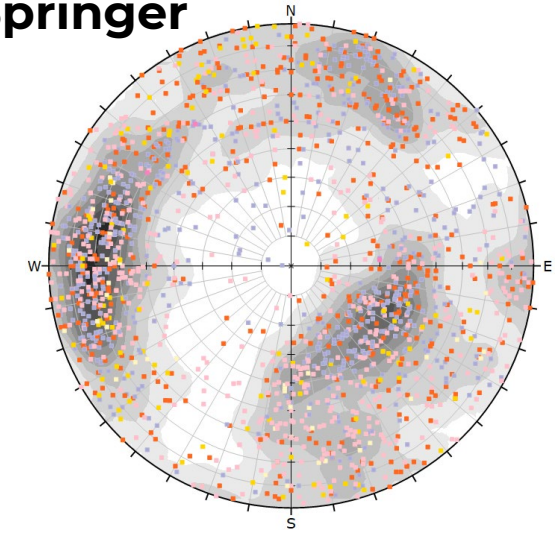

WX

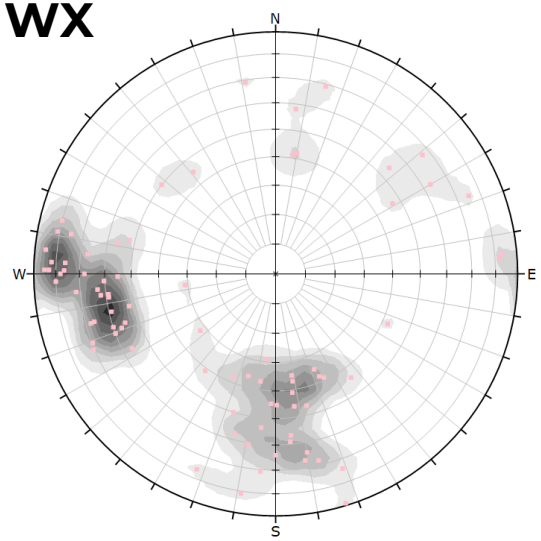

Cariboo

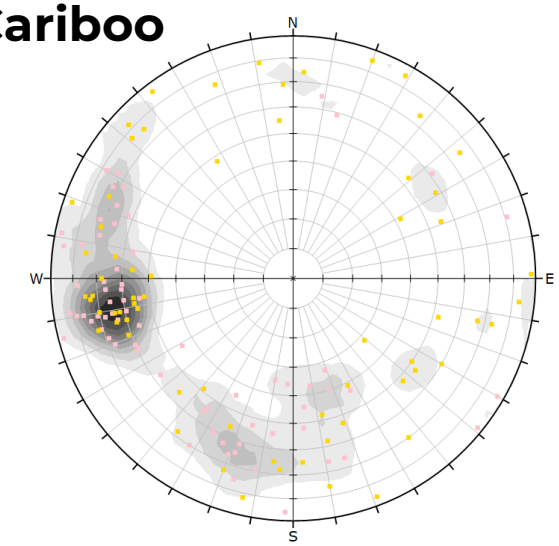

C2

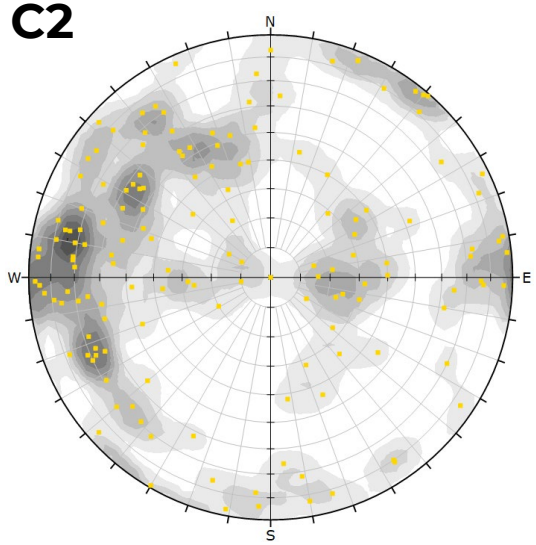

Discontinuous and Continuous Features

Feature Scale

Structural data was then filtered by discontinuous and continuous features.

Discontinuous Features:

- Joints
- Veins
- Photogrammetry (minimal features greater than one bench-height)

Continuous Features:

- Faults
- Dykes
- Major Structures

Discontinuous Features

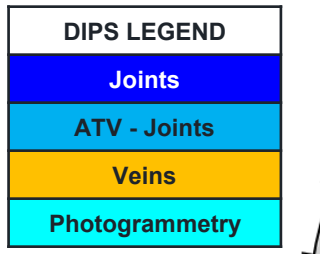

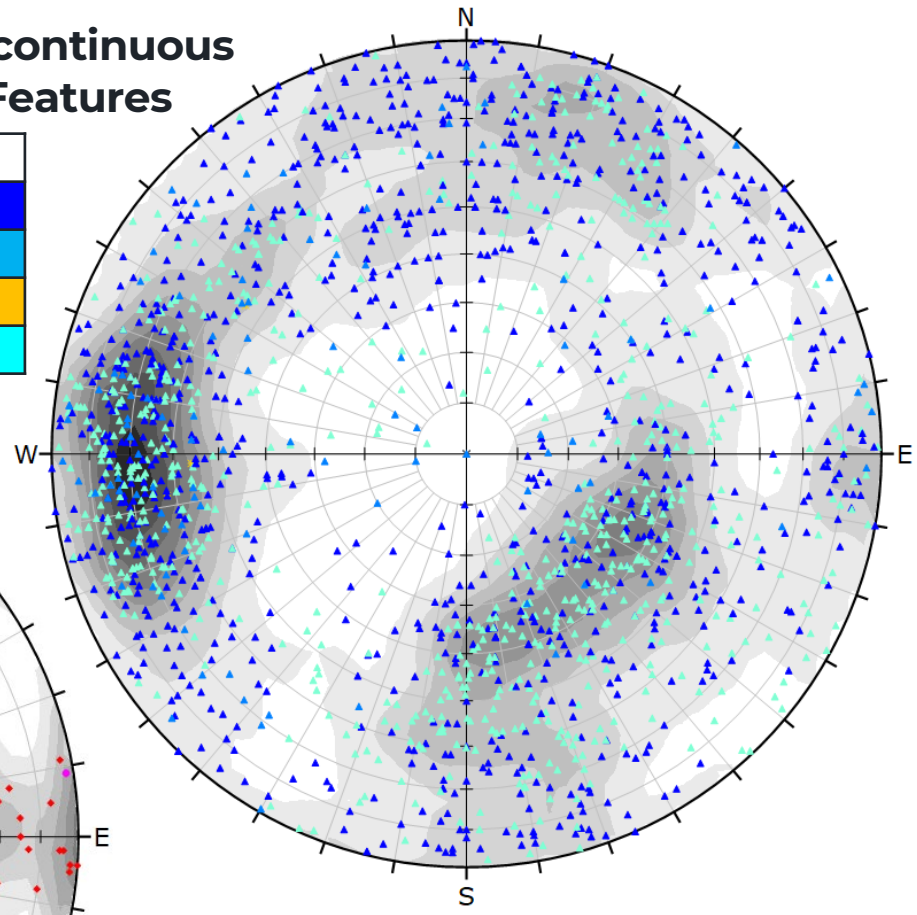

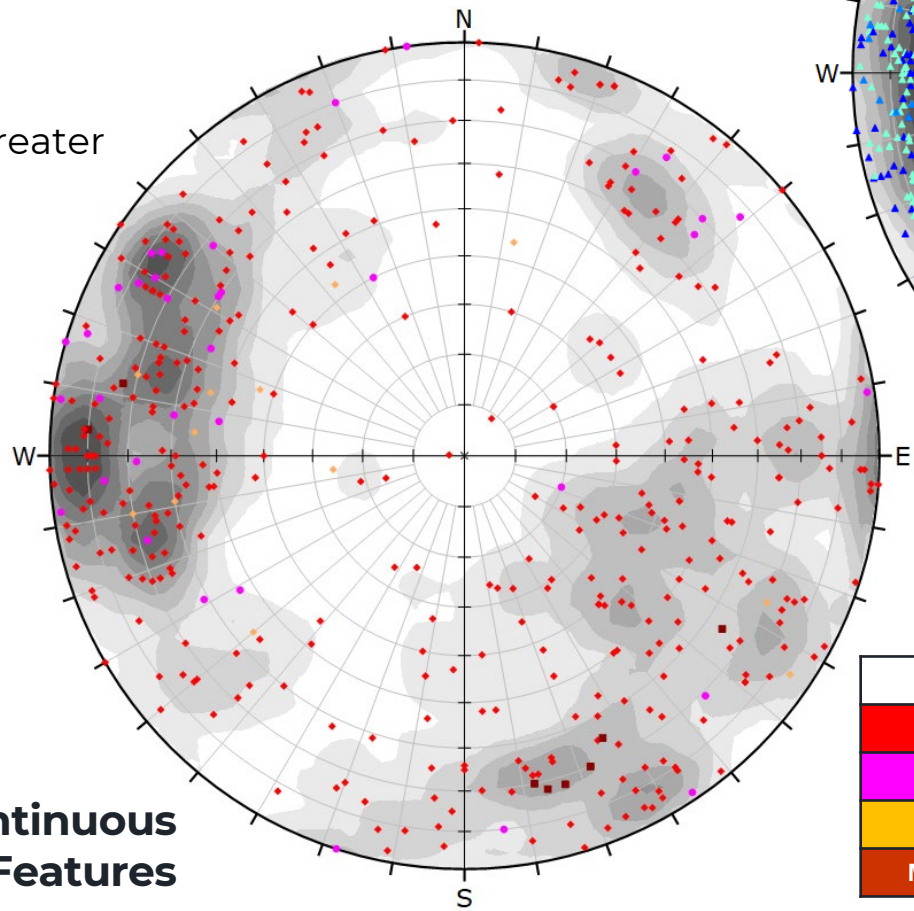

Continuous Features

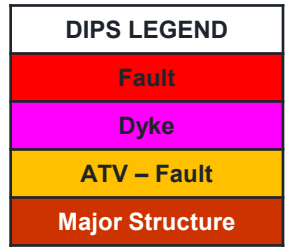

Continuous & Discontinuous Features

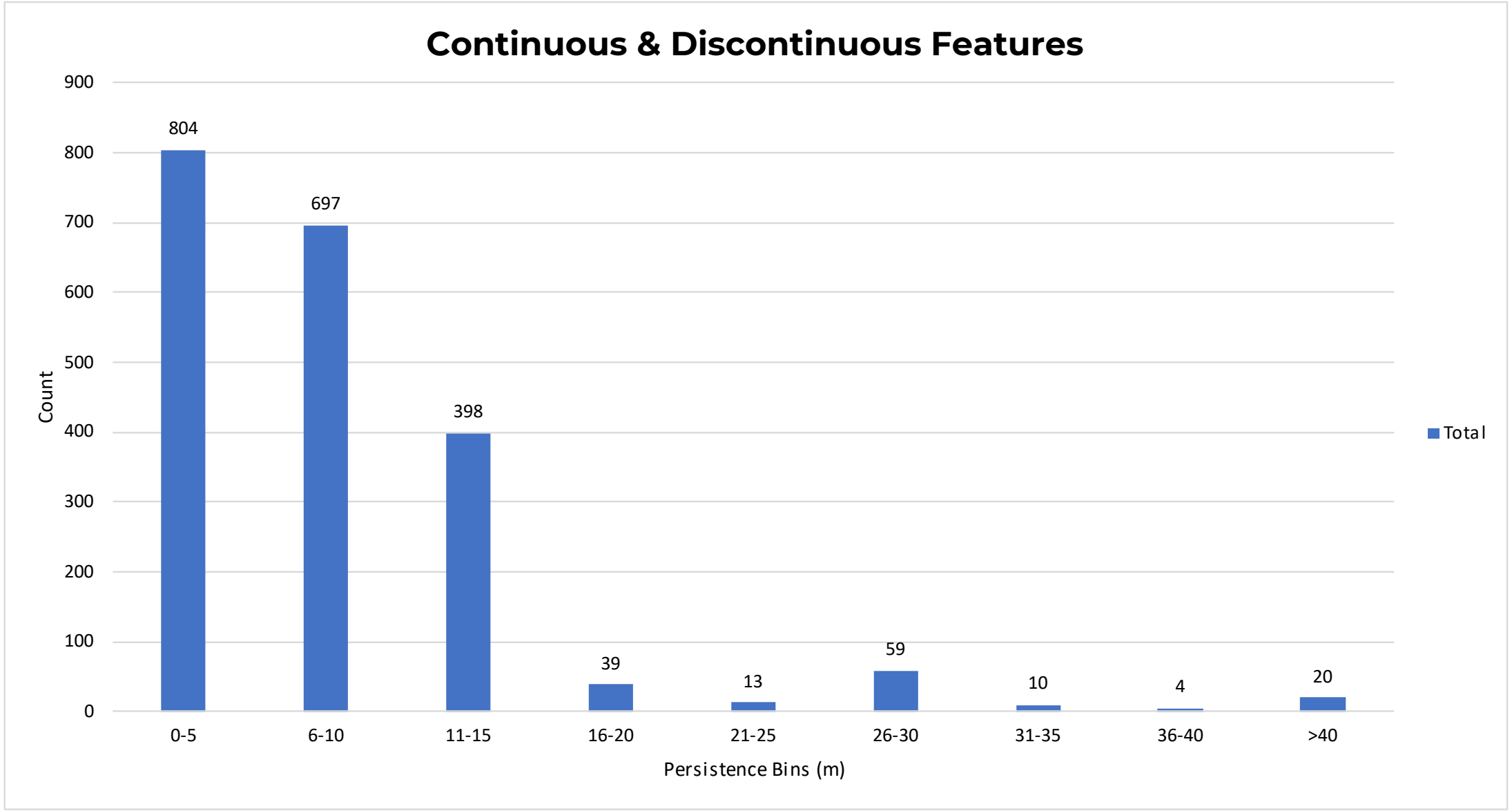

Discontinuous Features

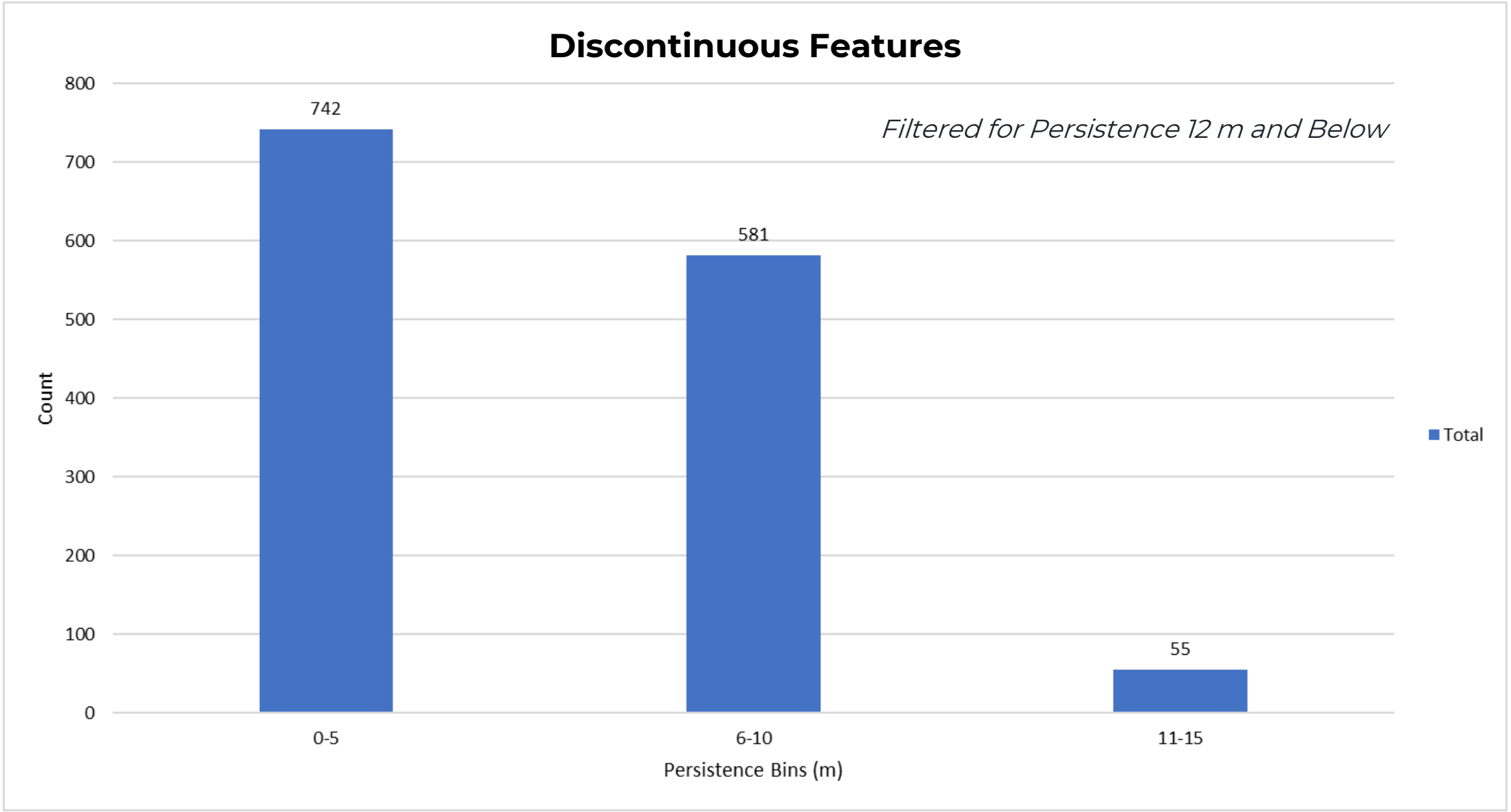

Continuous Features

XXX

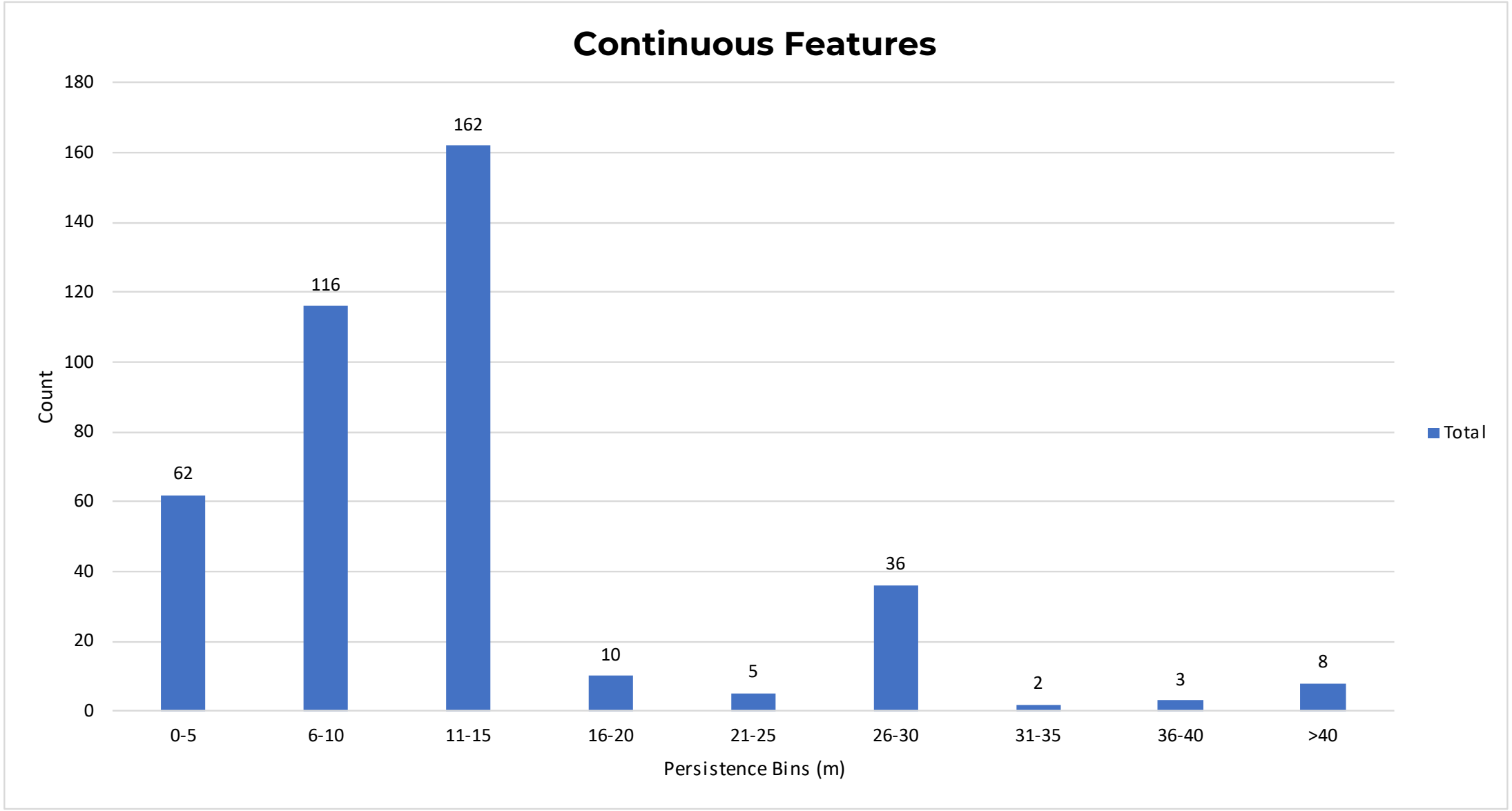

Springer & WX Pits

Monzodiorite Discontinuous

Set selection approximately following the 3% density for sets with minor variations to capture more data.

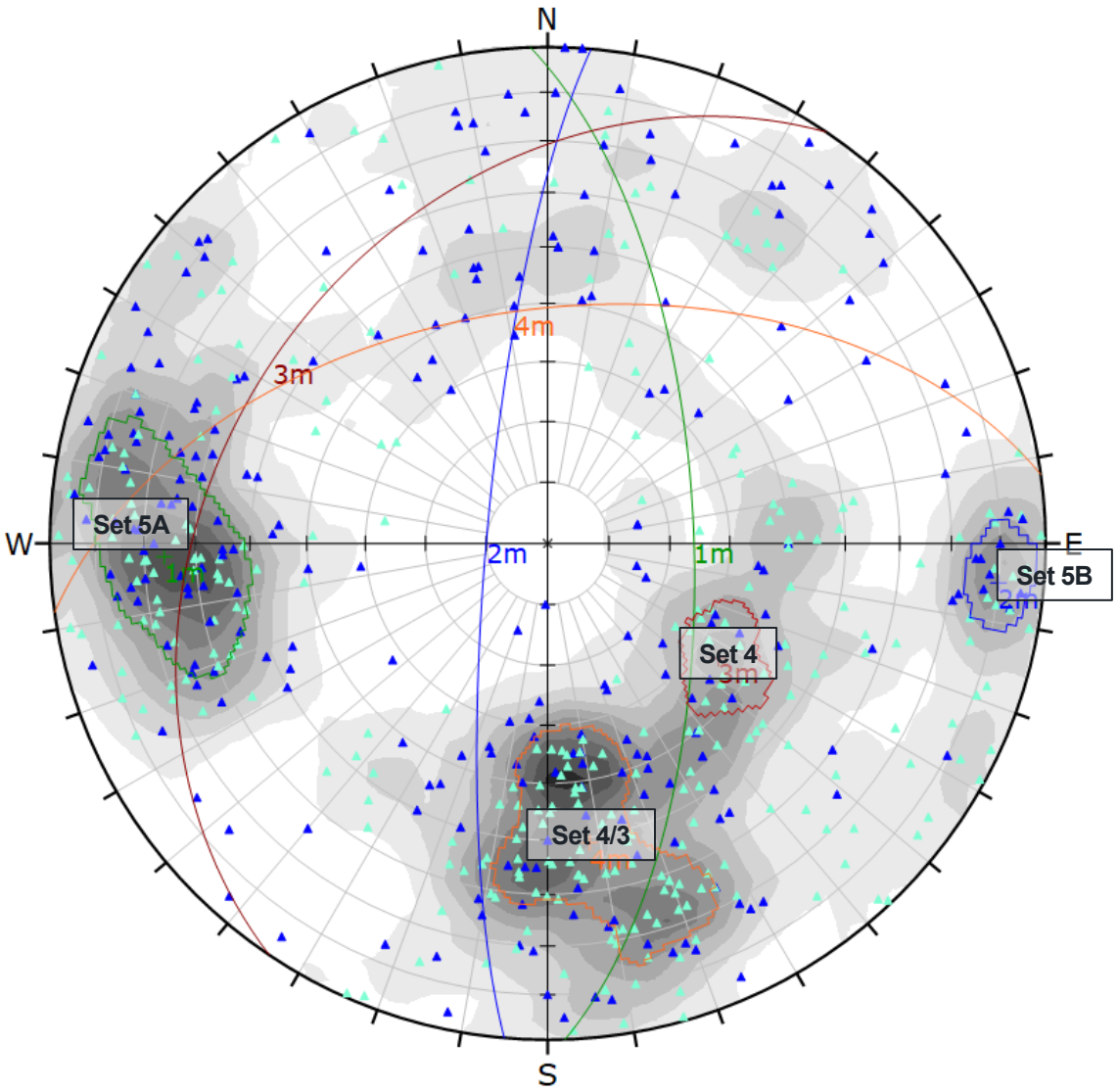

Symbol	GROUPED TYPE	Quantity
▲	Joint	243
▲	Photogrammetry	296

Color	Density Concentrations
	0.00 - 0.50
	0.50 - 1.00
	1.00 - 1.50
	1.50 - 2.00
	2.00 - 2.50
	2.50 - 3.00
	3.00 - 3.50
	3.50 - 4.00
	4.00 - 4.50
	4.50 - 5.00

Contour Data	Pole Vectors
Maximum Density	4.68%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		66	88	SP_WX_MZD_D_1
2m		80	275	SP_WX_MZD_D_2
3m		34	304	SP_WX_MZD_D_3
4m		51	352	SP_WX_MZD_D_4

Plot Mode	Pole Vectors
Vector Count	539 (539 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.
3. Monzodiorite includes Monzonite and K-Feldspar Monzonite

Springer & WX Pits

Monzodiorite Continuous

Set selection approximately following the 4% density for sets with minor variations to capture more data.

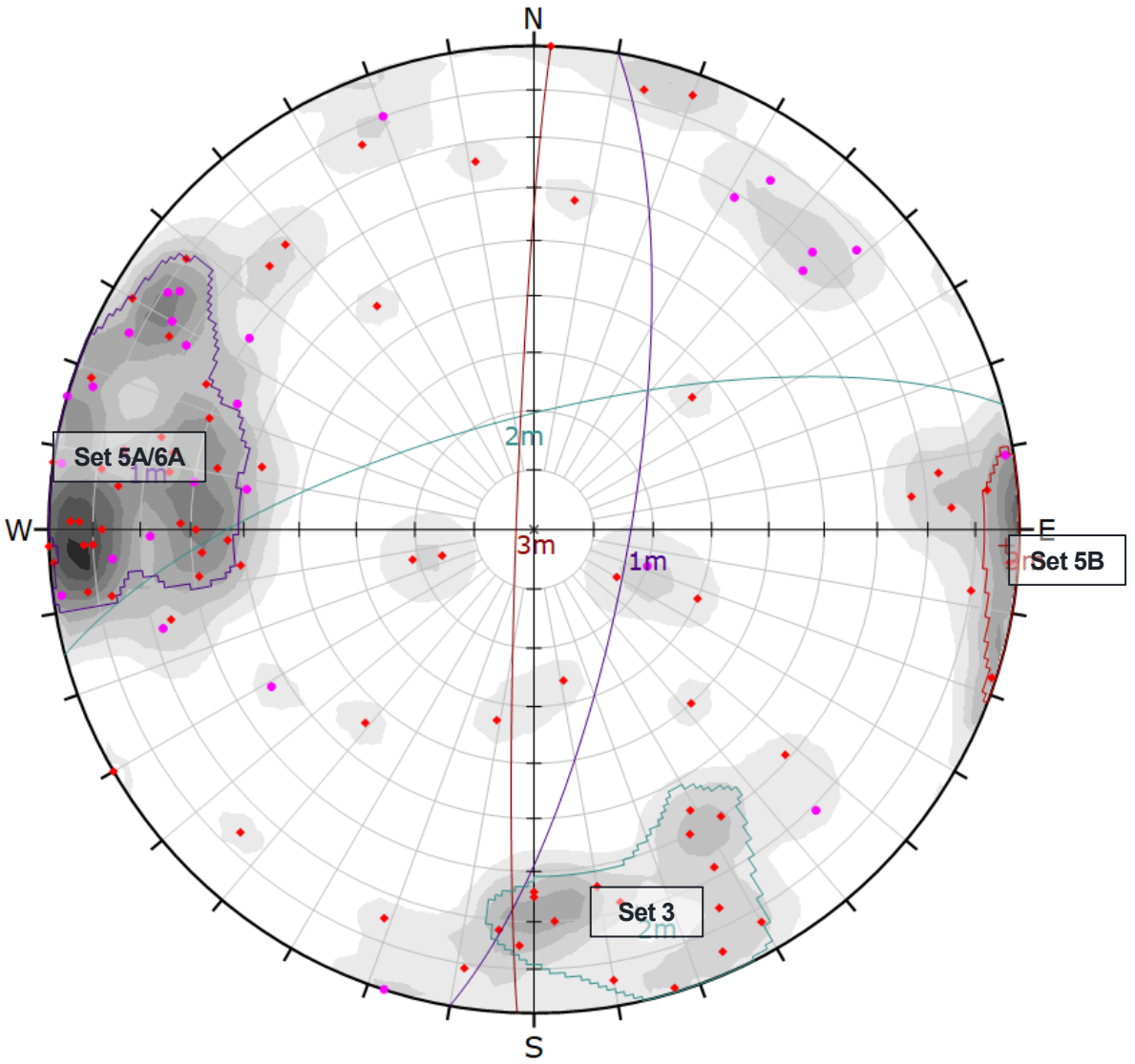

Symbol	GROUPED TYPE	Quantity
●	Dyke	27
◆	Fault	77

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.20%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		74	100	SP_WX_MZD_C_1
2m		71	345	SP_WX_MZD_C_2
3m		87	272	SP_WX_MZD_C_3

Plot Mode	Pole Vectors
Vector Count	104 (104 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.
3. Monzodiorite includes Monzonite and K-Feldspar Monzonite

Springer Pit

Diorite Discontinuous

Set selection approximately following the 3 - 4% density for sets with minor variations to capture more data.

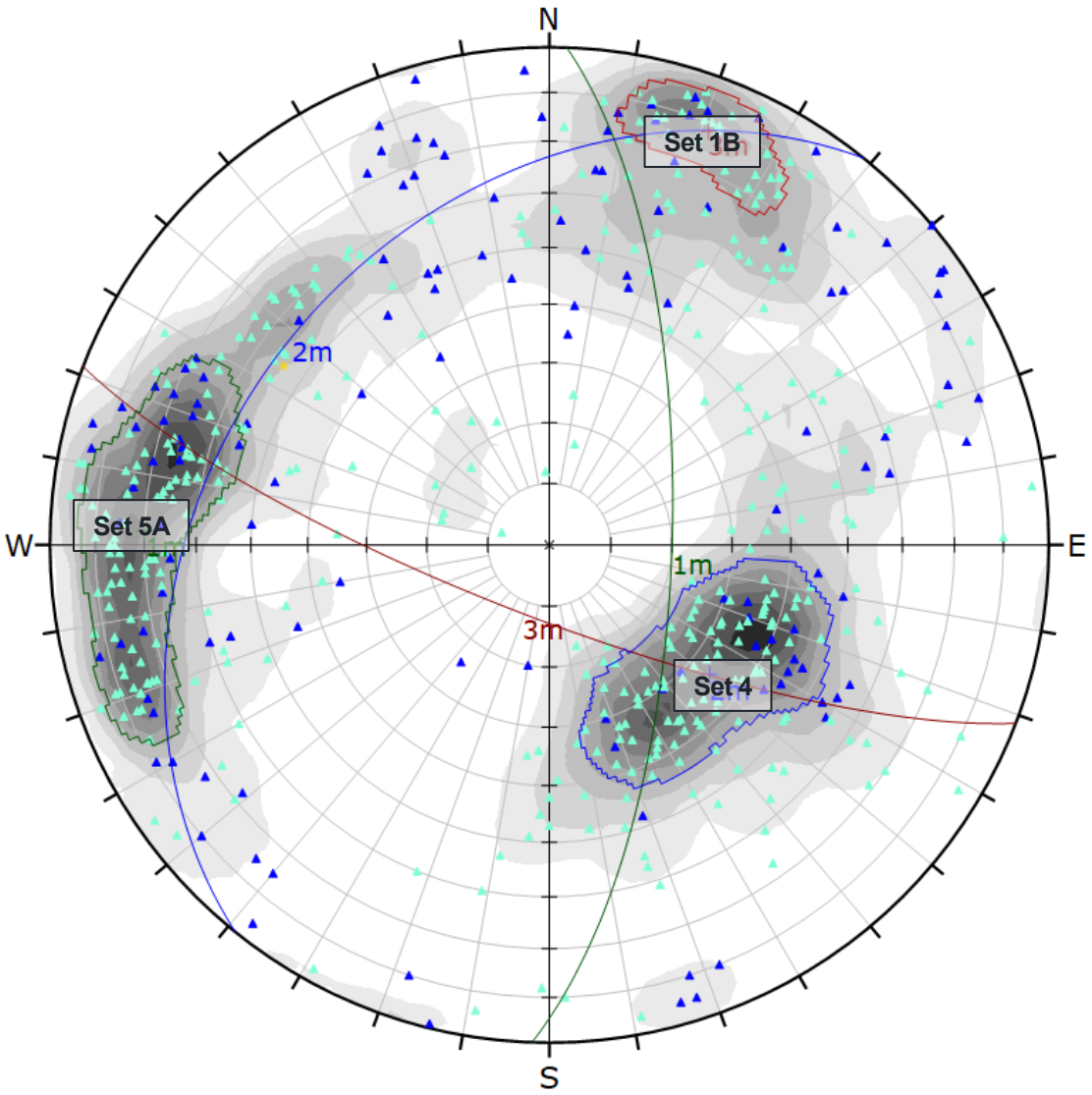

Symbol	GROUPED TYPE	Quantity
▲	Joint	135
▲	Photogrammetry	374
✳	Vein	1

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.70%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		70	92	SP_DI_D_1
2m		34	309	SP_DI_D_2_L
3m		78	201	SP_DI_D_3

Plot Mode	Pole Vectors
Vector Count	510 (510 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Springer Pit

Diorite Continuous

Set selection approximately following the 4% density for sets with minor variations to capture more data.

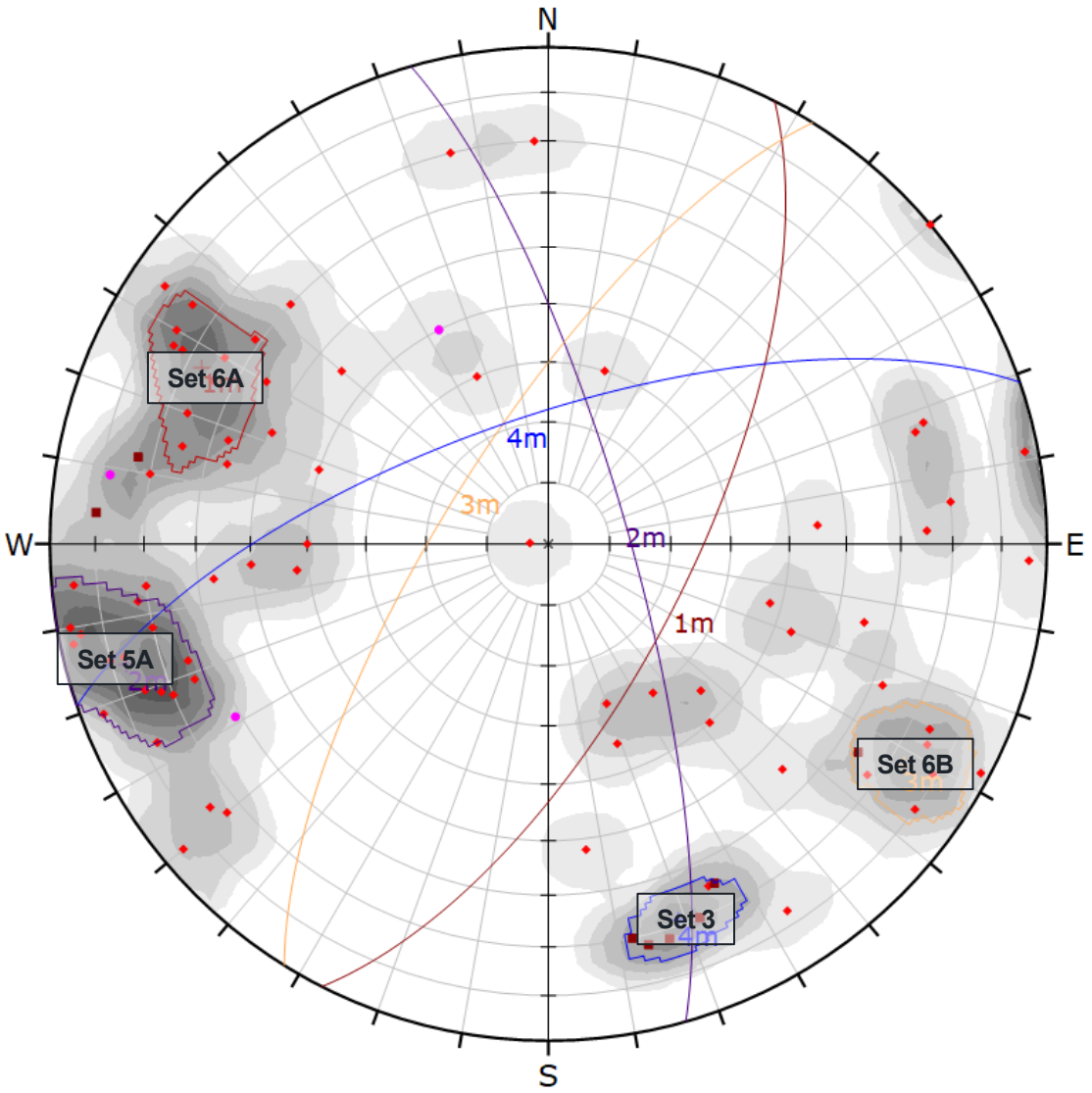

Symbol	GROUPED TYPE	Quantity
	Dyke	3
	Fault	73
	Major Structure	8

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.86%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		67	117	SP_DI_C_1
2m		77	74	SP_DI_C_2
3m		73	302	SP_DI_C_3
4m		69	341	SP_DI_C_4

Plot Mode	Pole Vectors
Vector Count	84 (84 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Springer Pit

Breccia Discontinuous

Set selection approximately following the 3% density for sets with minor variations to capture more data.

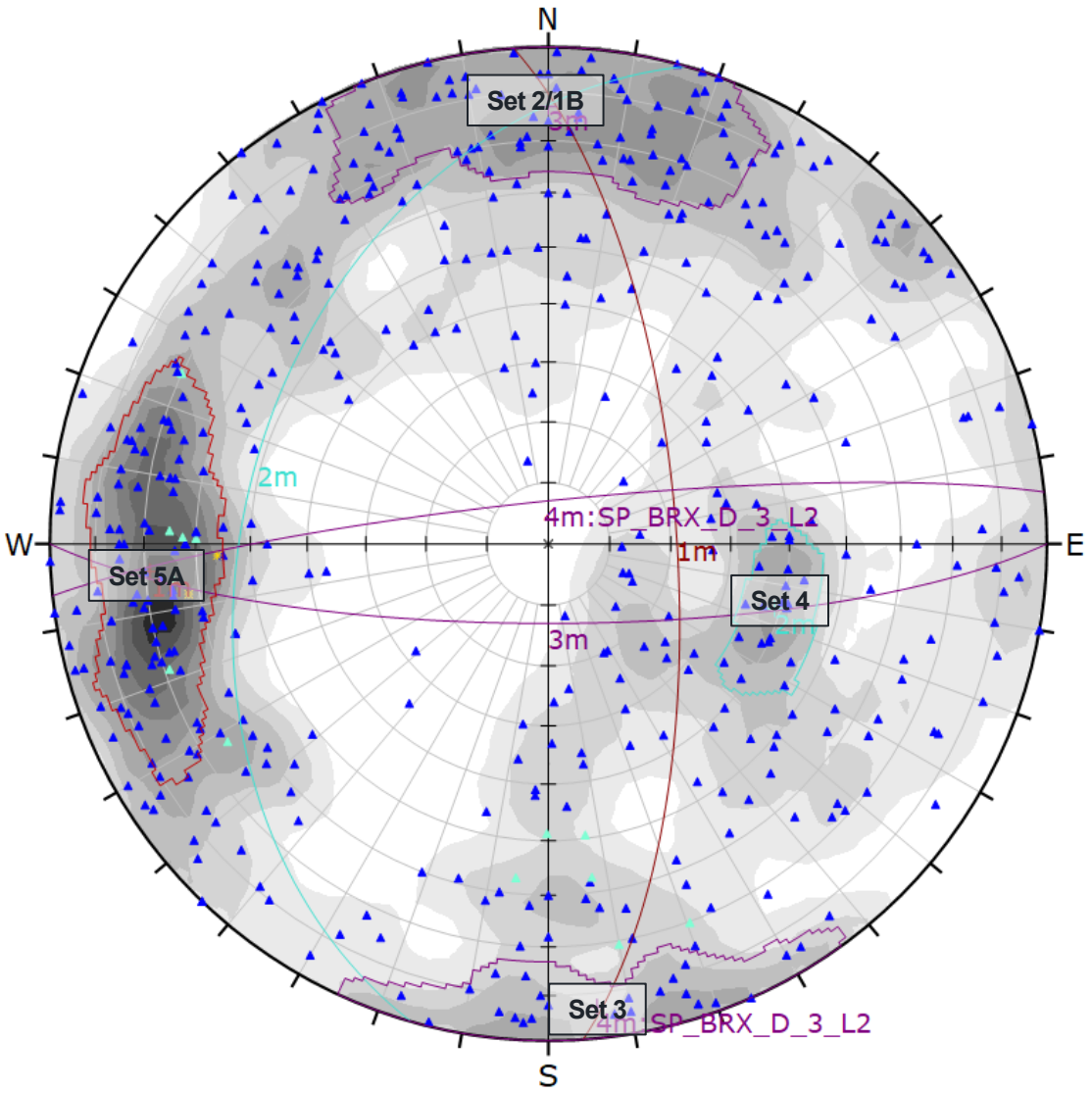

Symbol	GROUPED TYPE	Quantity
▲	Joint	462
▲	Photogrammetry	14
✳	Vein	2

Color	Density Concentrations
	0.00 - 0.45
	0.45 - 0.90
	0.90 - 1.35
	1.35 - 1.80
	1.80 - 2.25
	2.25 - 2.70
	2.70 - 3.15
	3.15 - 3.60
	3.60 - 4.05
	4.05 - 4.50

Contour Data	Pole Vectors
Maximum Density	4.30%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		69	86	SP_BRX_D_1
2m		39	286	SP_BRX_D_2
3m		77	180	SP_BRX_D_3_L
4m		83	354	SP_BRX_D_3_L2

Plot Mode	Pole Vectors
Vector Count	478 (478 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Springer Pit

Breccia Continuous

Set selection approximately following the 3% density for sets with minor variations to capture more data.

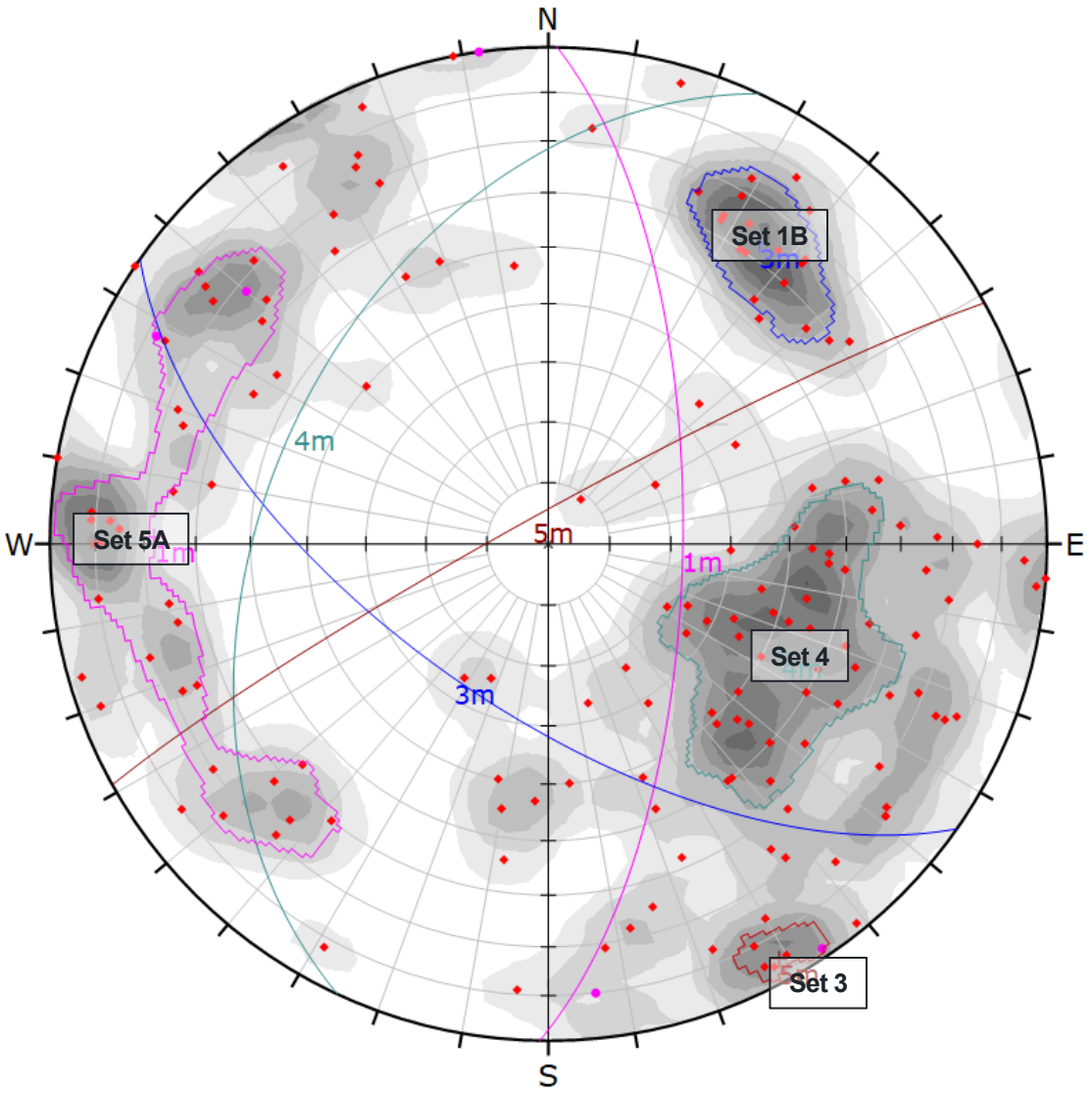

Symbol	GROUPED TYPE	Quantity
●	Dyke	5
◆	Fault	159

Color	Density Concentrations
	0.00 - 0.55
	0.55 - 1.10
	1.10 - 1.65
	1.65 - 2.20
	2.20 - 2.75
	2.75 - 3.30
	3.30 - 3.85
	3.85 - 4.40
	4.40 - 4.95
	4.95 - 5.50

Contour Data	Pole Vectors
Maximum Density	5.07%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		68	91	SP_BRX_C_1_L
3m		63	215	SP_BRX_C_2
4m		43	295	SP_BRX_C_3
5m		85	331	SP_BRX_C_4

Plot Mode	Pole Vectors
Vector Count	164 (164 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Cariboo Pit

Monzodiorite Discontinuous

Set selection approximately following the 4.5% density for sets with minor variations to capture more data.

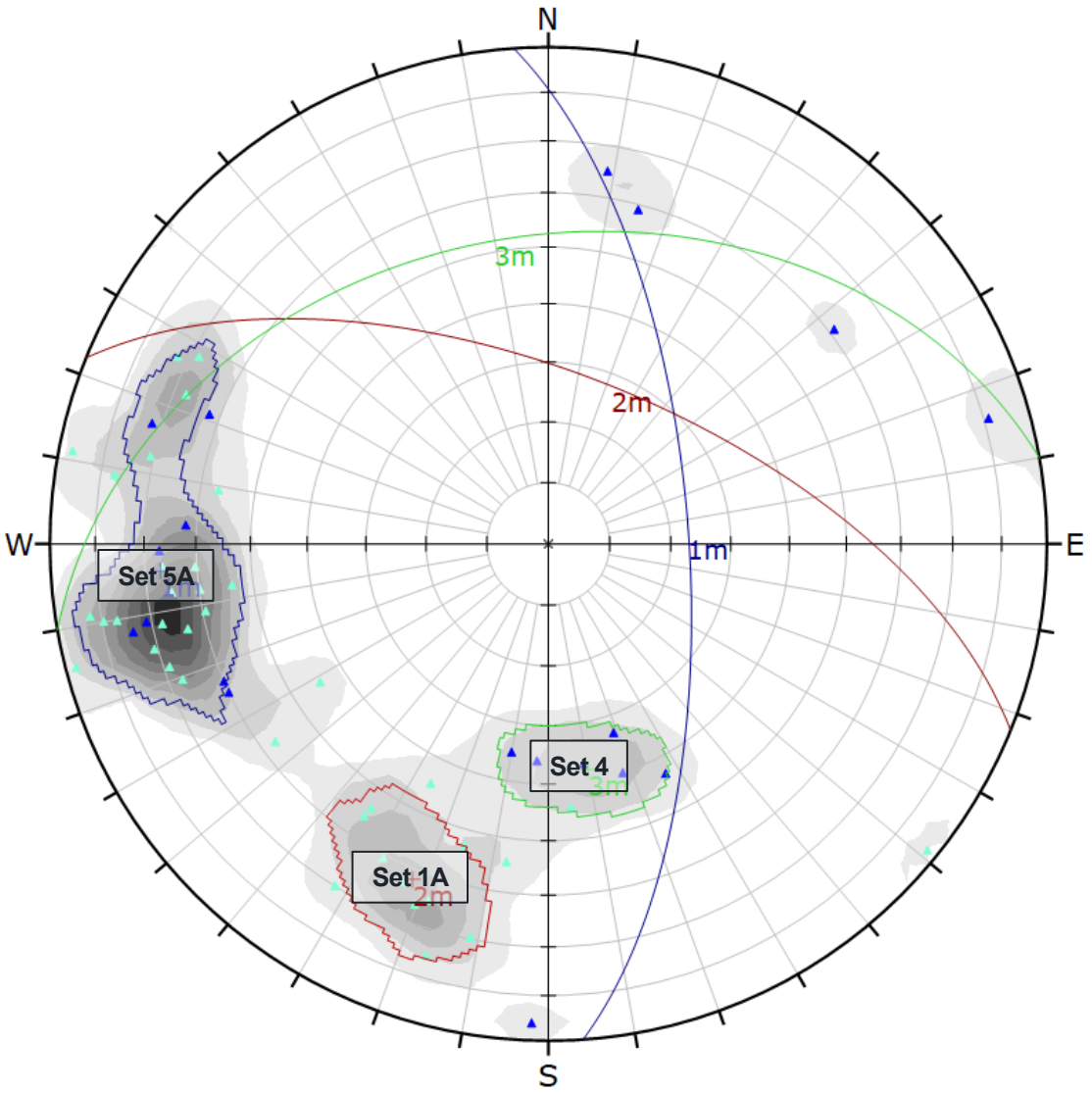

Symbol	GROUPED TYPE	Quantity
▲	Joint	19
▲	Photogrammetry	38

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.59%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		67	86	C_MZD_D_1
2m		62	22	C_MZD_D_2
3m		38	350	C_MZD_D_3

Plot Mode	Pole Vectors
Vector Count	57 (57 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.
3. Monzodiorite includes Monzonite and K-Feldspar Monzonite

Cariboo Pit

Monzodiorite Continuous

Very limited data for monzodiorite continuous structures (13 features). Set selection approximately following the 6% density for sets with minor variations to capture more data.

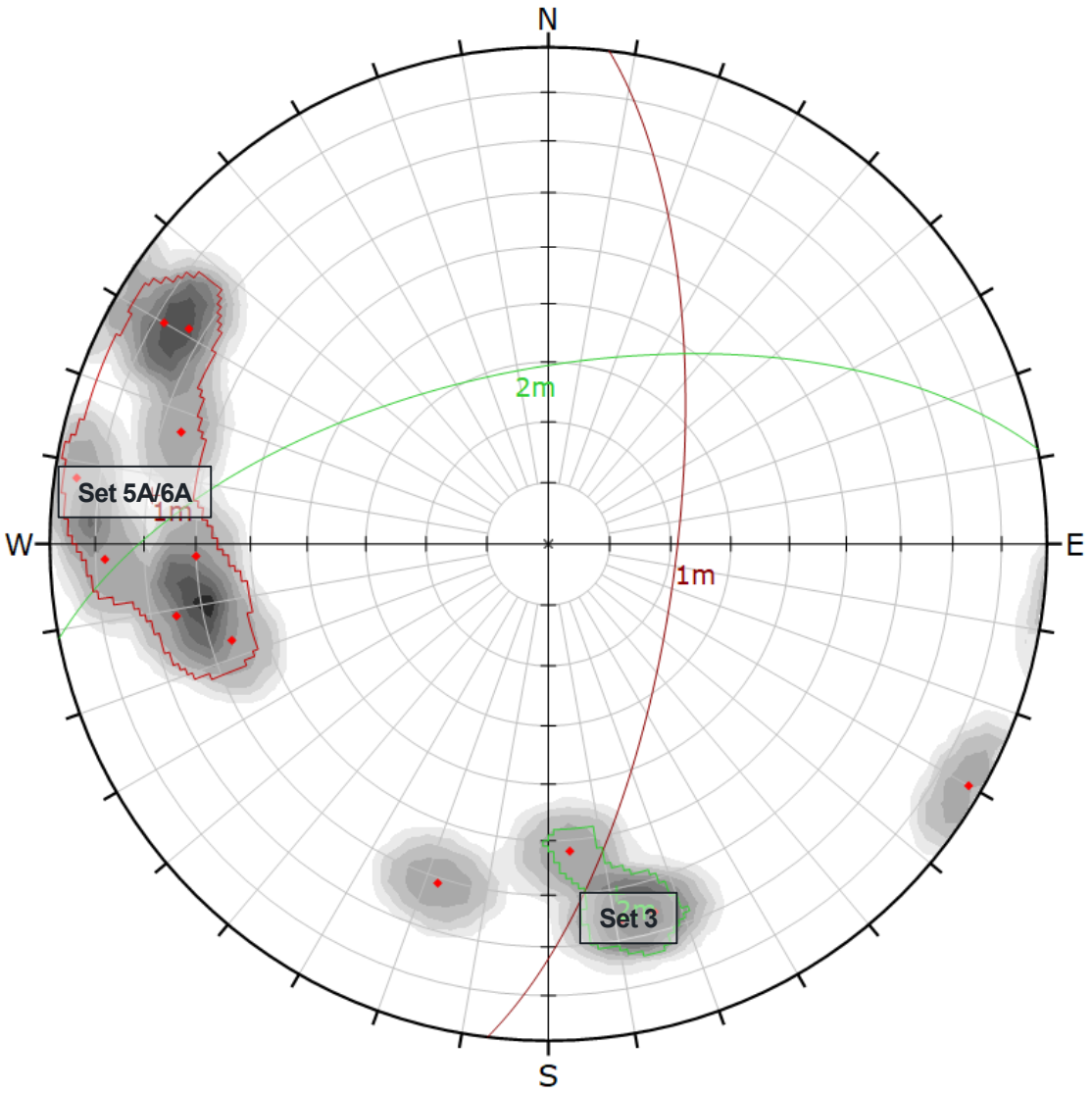

Symbol	GROUPED TYPE	Quantity
◆	Fault	13

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.95%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		69	97	C_MZD_C_1
2m		61	349	C_MZD_C_2

Plot Mode	Pole Vectors
Vector Count	13 (13 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.
3. Monzodiorite includes Monzonite and K-Feldspar Monzonite

Cariboo & C2 Pits

Breccia Discontinuous

Set selection approximately following the 3% density for sets with minor variations to capture more data.

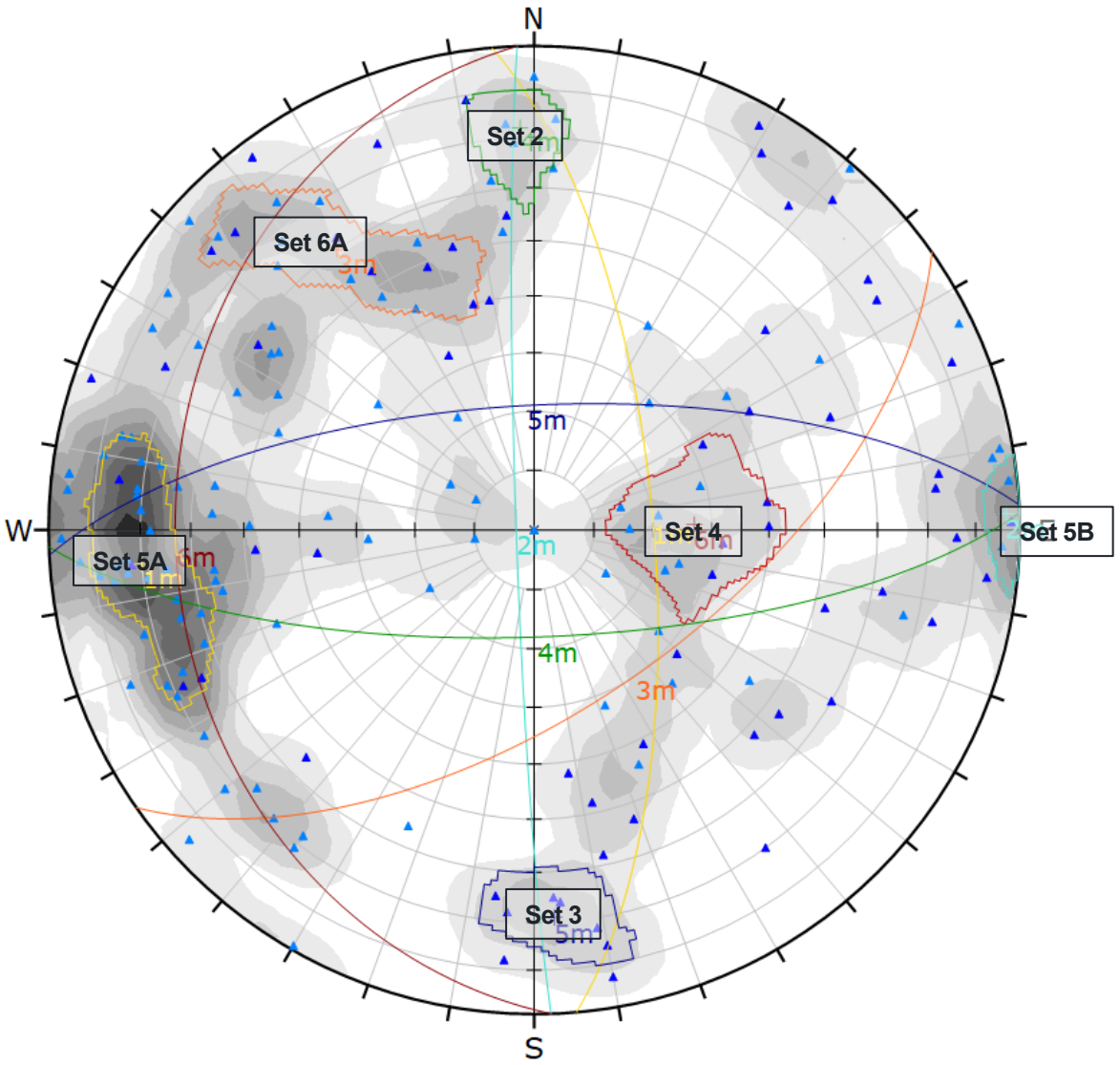

Symbol	GROUPED TYPE	Quantity
▲	ATV - Joint	105
▲	Joint	64

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.89%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		70	85	C_C2_BRZ_C_1
2m		87	268	C_C2_BRZ_C_2
3m		60	145	C_C2_BRZ_C_3
4m		72	178	C_C2_BRZ_C_4
5m		69	357	C_C2_BRZ_C_5
6m		27	268	C_C2_BRZ_C_6

Plot Mode	Pole Vectors
Vector Count	169 (169 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Cariboo & C2 Pits

Breccia Continuous

Set selection approximately following the 4% density for sets with minor variations to capture more data.

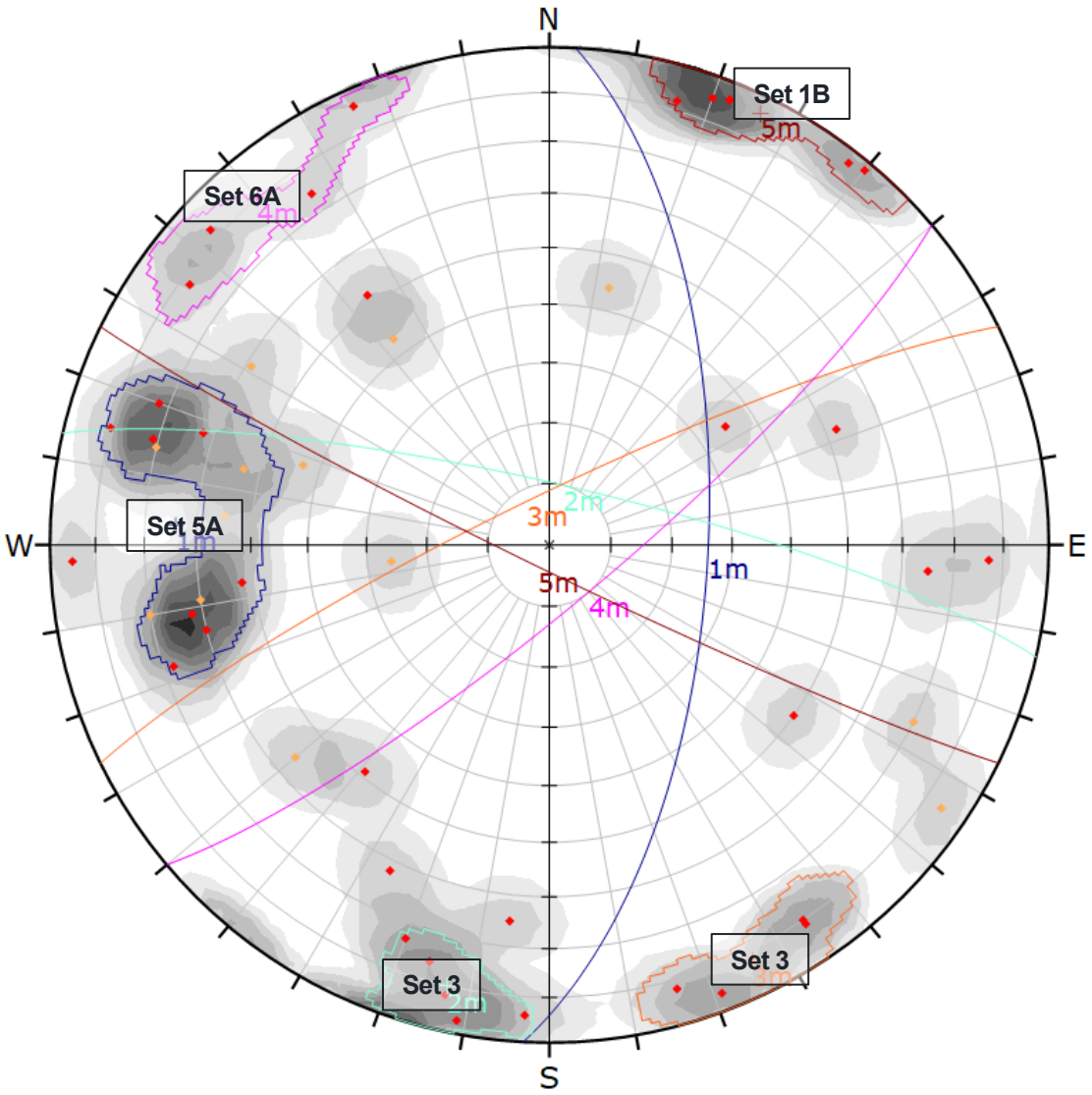

Symbol	GROUPED TYPE	Quantity
	ATV - Fault	13
	Fault	37

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.41%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		64	93	C_C2_BRX_C_1
2m		80	13	C_C2_BRX_C_2
3m		82	334	C_C2_BRX_C_3
4m		80	140	C_C2_BRX_C_4
5m		86	206	C_C2_BRX_C_5

Plot Mode	Pole Vectors
Vector Count	50 (50 Entries)
Hemisphere	Lower
Projection	Equal Area

NOTES:

1. Declination applied to mapping data only.
2. Automatic contouring applied.

Barton-Bandis

Relationship for Strength Parameters

Linear models of peak friction angle vs peak dilation angle indicate the following:

$$\tau = \sigma_n \tan(20 \log(\frac{\sigma_c}{\sigma_n}) + 30°)$$

σ_c = unconfined compressive strength

σ_n = effective normal strength

τ = peak shear strength

The generalized form of the equation above is shown below:

$$\tau = \sigma_n \tan(JRC \log(\frac{JCS}{\sigma_n}) + \varphi_b°)$$

φ_b = residual shear strength

The *joint roughness coefficient* (JRC) represents a sliding scale of roughness which varies from approximately 20 to 0, from roughest to the smoothest end of the spectrum.

The *joint contact strength* (JCS) can replace σ_c of the rock if the joint is unweathered but may reduce to approximately ¼ σ_c if the joint walls are weathered.

Rock Mass Classification: A Practical Approach in Civil Engineering

Relation Between Jr and JRCn Subscripts Refer to Block Size (cm)		Jr	JRC_{20}	JRC_{100}
I	Rough	4	20	11
II	Smooth	3	14	9
III	Slickensided	2	11	8
	Stepped			
IV	Rough	3	14	9
V	Smooth	2	11	8
VI	Slickensided	1.5	7	6
	Undulating			
VII	Rough	1.5	2.5	2.3
VIII	Smooth	1.0	1.5	0.9
IX	Slickensided	0.5	0.5	0.6
	Planar			

Figure 14.3: Suggested methods for the quantitative description of different classes of joints using J_r and JRC. Subscript refer to block size in cms.

Barton, Nick & Bandis, S.. (1976). The shear strength of rock and rock joints. International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts 13(9):255-279.

Singh, Bhawani & Goel, R.K. (1999). Rock Mass Classification, A Practical Approach in Civil Engineering.

Barton-Bandis

JRC Workflow

All completed mapping data collected from Mount Polley Mine were compiled and statistically reviewed for both shape and roughness, separated by continuity.

The tables below present a statistical summary of the discontinuous feature surfaces.

Feature Shape	Count	Shape % of Total
Undulating	532	59.0%
Curved	58	6.5%
Planar	270	29.9%
Stepped & Irregular	41	4.5%
Total Count	**902**	**100.0%**

Feature Roughness	Count	Roughness % of Total
Smooth	237	26.3%
Polished	6	0.7%
Slickensided	27	3.0%
Rough	473	52.4%
Very Rough	159	17.6%
Total Count	**902**	**100.0%**

Combinations for feature roughness and shape were then reviewed together based on the quantitative description presented in the table on Figure C-29. JRC for 100 cm blocks were reviewed for both continuous and discontinuous feature surfaces. The table below presents a summary of the process for discontinuous and continuous features.

Feature Combination	Discontinuous			Continuous		
	Count	% of Total	Est. JRC 100cm block (Singh)	Count	% of Total	Est. JRC 100cm block (Singh)
Stepped & Irregular AND Rough or Very Rough	35	4%	11	2	1%	11
Undulating or Curved AND Rough or Very Rough, Smooth and Stepped	474	53%	9	128	36%	9
Undulating or Curved AND Smooth, or Stepped and Slickensided	91	10%	8	63	18%	8
Undulating or Curved AND Polished or Slickensided	32	4%	6	65	18%	6
Planar AND Rough or Very Rough	129	14%	2.3	45	13%	2.3
Planar AND Smooth	140	16%	0.9	43	12%	0.9
Planar AND Polished or Slickensided	1	0%	0.6	13	4%	*0.6*
Count			***902***	**Count**		***359***
Weighted Average JRC Values			**6.65**	**Weighted Average**		***6.18***

Barton-Bandis

JCS Workflow

Interval ISRM values logged for intervals in the exploration boreholes were compiled and averaged for each of the major lithologies. Where multiple ISRM values were recorded for one interval, the *minimum* value was selected.

Lithology	Average ISRM Strength	Corresponding Strength Range (MPa)	Estimation of Unconfined Compressive Strength, σ_c (MPa)
Monzodiorite	R3	25-50	**50**
Diorite	R4	50-100	**60**
Breccia	R3	25-50	**50**

Minimum UCS values from the corresponding interval ISRM range were averaged, providing an estimation of compressive strength for each of the major lithologies.

As features were not separated by lithology, an average compressive strength estimation for all lithologies was used for JCS calculations.

To account for minimal weathering on the features surfaces, the JCS was calculated as 75% of the average compressive strength estimation.

Barton-Bandis Inputs into RSData		Units
Material Type	Plastic	
Assumed JRC Values (Continuous and Discontinuous)	*6.18 and 6.65*	unitless
Assume JCS to be 75% of intact rock strength	41.7	MPa
Slope Heights	48, 18, 12	m
Assumed Residual Friction Angle	20, 30	degrees
Unit Weight	26	kN/m3

Discontinuous features typically affect bench-scale slopes, while continuous features extend over greater heights. For calculation of JRC values, 12 and 18 m high benches (one bench height and 1 ½ bench heights, respectively) were chosen for discontinuous features, and 48 m was chosen for continuous features.

As bench-scale features are typically opened by blasting and have less alteration, rough surfaces are assumed, and a 30-degree residual friction angle was used in calculations.

Continuous feature surfaces typically have more alteration or smoothing from movement, a residual friction angle of 20 degrees was used in calculations.

Summary of Results

Results of the Barton-Bandis analysis using RSData are presented below.

JCS 100cm	Assumed JCS @ 75% of UCS (MPa)	41.7
DISCONTINUOUS FEATURES		
Discontinuous Fractures	Assumed JRC Value:	6.65
Assumed Residual Friction Angle (degrees)	Slope Height (m)	12	18
30	Cohesion (kPa)	19	26
	Friction Angle (degrees)	42	41
CONTINUOUS FEATURES		
Continuous Fractures	Assumed JRC Value:	6.18
Assumed Residual Friction Angle (degrees)	Slope Height (m)	48
20	Cohesion (kPa)	40
	Friction Angle (degrees)	28

For continuous features, 40 kPa cohesion and a friction angle of 28 degrees were selected for modeling.

A friction angle of 42 degrees was selected for discontinuous features. Due to the open nature of these features, a cohesion of 0 kPa was applied for modeling.

APPENDIX D

Exploration Borehole Review

Historical Exploration Boreholes

MPMC provided WSP with borehole logs from historical exploration campaigns in the mine area.

The data provided was used as provided. Minimal QAQC, such as removing duplicates and blanks, was completed.

The table below summarizes the data provided by MPMC for the 17 boreholes. Note that two boreholes, SD-07-22 and SD-04-16, had previously been provided for the 2016 Life of Mine assessment (Golder 2016).

Borehole ID	Year	Geology Data Included?	Geotechnical* Data Included?	JCon Included?
SD-04-16	2004	Yes	Yes	No
SD-07-22	2007	Yes	Yes	No
WX-09-02	2009	Yes	Yes	Yes
WX-10-07	2010	Yes	No	No
WX-10-14	2010	Yes	Yes	Yes
WX-10-16	2010	Yes	Yes	Yes
WX-10-35	2010	Yes	Yes	Yes
WX-10-37	2010	Yes	No	No
WX-11-49	2011	Yes	Yes	No
WX-11-50	2011	Yes	Yes	No
WX-11-53	2011	Yes	Yes	No
WX-11-55	2011	Yes	Yes	No
C2-11-86	2011	Yes	Yes	No
SD-11-107	2011	Yes	Yes	No
CB-11-05	2011	Yes	Yes	No
SD-12-142	2012	Yes	Yes	No
SD-12-133	2012	Yes	Yes	No

* Geotechnical data includes Total Core Recovery (TCR), Rock Quality Designation (RQD), and Field Estimated Rock Strength.

Summary of Boreholes Reviewed

A total of 17 exploration boreholes were reviewed, 15 of the reviewed boreholes included geological intervals.

Borehole ID	Easting (m) [1]	Northing (m) [1]	Elevation (masl)	Total Depth Along Hole (m)	Year
SD-04-16	1959.4	3151.9	1135.6	730.61	2004
SD-07-22	1408.0	3278.5	1072.9	459.3	2007
WX-09-02	2010.8	2727.5	1104.8	242.9	2009
WX-10-07	1823.2	2771.6	1141.0	418.4	2010
WX-10-14	1999.6	2679.5	1097.7	601.1	2010
WX-10-16	1746.6	2630.6	1074.2	532.5	2010
WX-10-35	1901.9	2724.5	1113.1	819.0	2010
WX-10-37	1600.0	2725.0	1064.0	730.6	2010
WX-11-49	1957.4	2674.5	1094.5	510.2	2011
WX-11-50	1554.8	3078.2	1093.0	630.0	2011
WX-11-53	1703.7	2630.4	1064.7	721.5	2011
WX-11-55	1998.7	2578.4	1084.5	663.55	2011
C2-11-86	1997.0	2719.5	1102.9	409.3	2011
SD-11-107	1490.5	4054.1	1164.7	1233.06	2011
CB-11-05	2540.8	3286.4	1162.7	1083.87	2011
SD-12-142	1225.4	3658.9	1090.0	492.25	2012
SD-12-133	1801.6	3377.2	1035.9	599.24	2012

1. Coordinates are referenced to Mount Polley Mine Grid.

Collar Locations for Exploration Boreholes Provided in 2023 and 2024

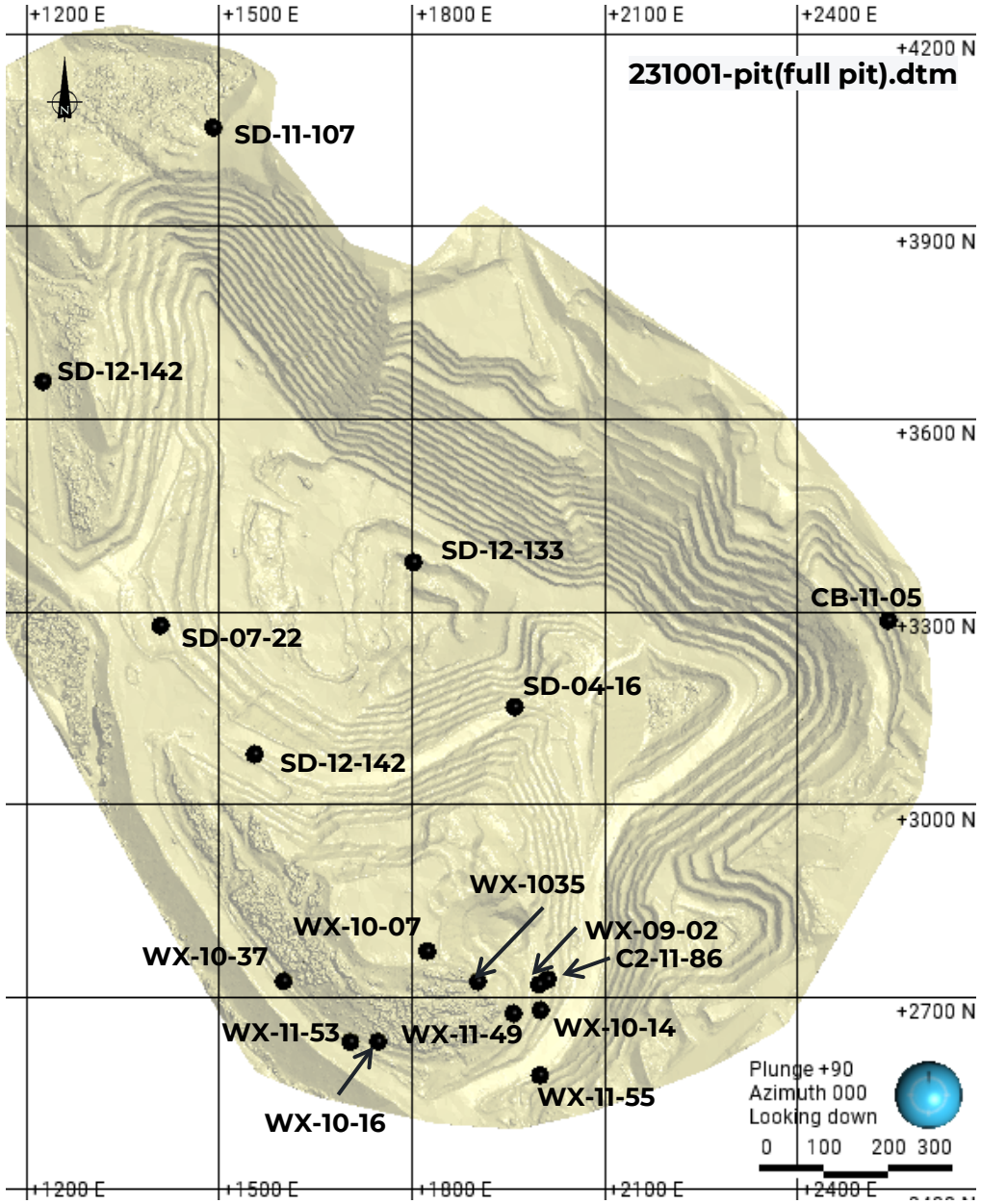

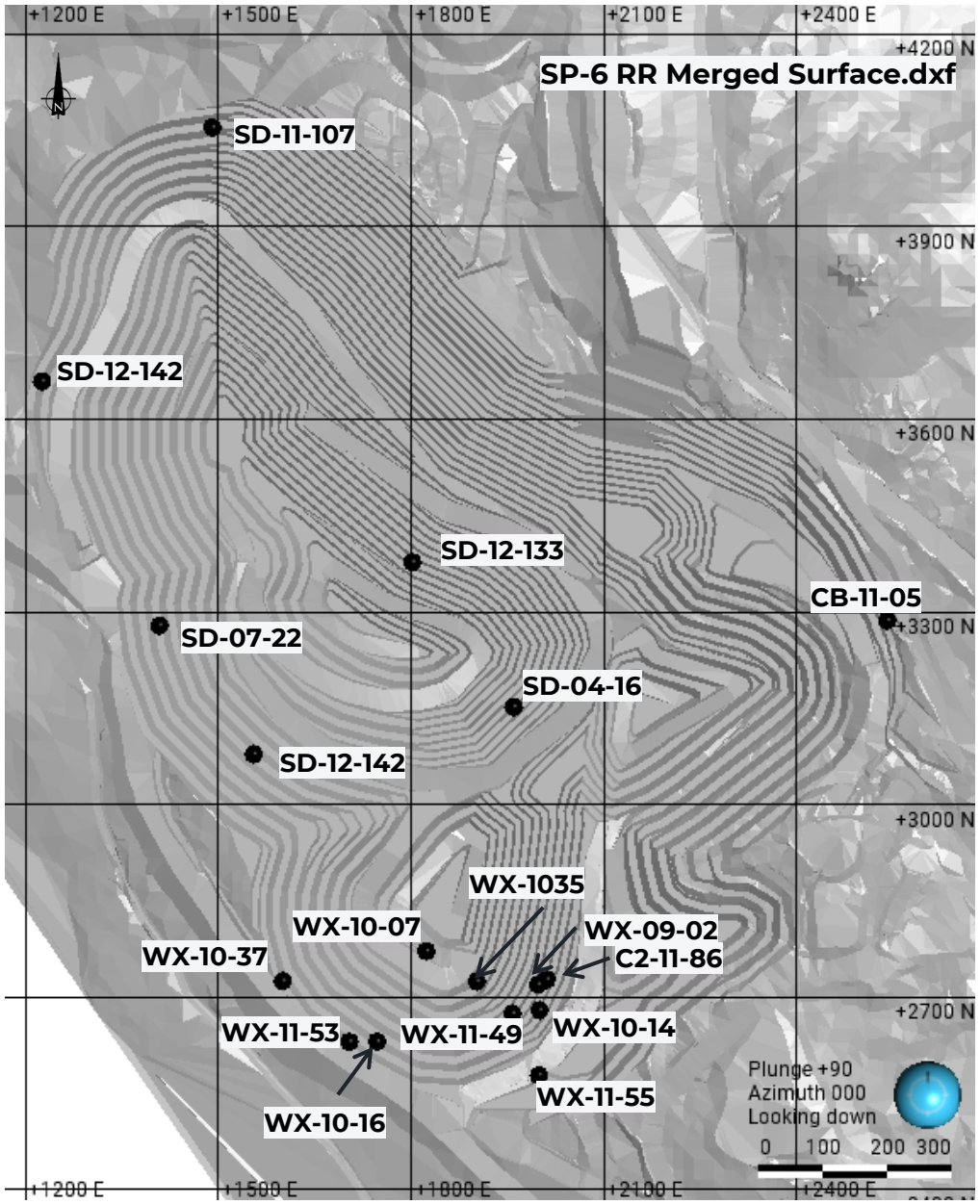

Lithological Groupings

Lithologies logged within the exploration boreholes were grouped according the major lithologic units identified in the geologic map by Rees 2013.

Description	Lithology Grouping (based on Rees 2013)	Description	Lithology Grouping (based on Rees 2013)
Breccia	**Breccia**	Diorite Dyke	**Dyke**
Magnetite Breccia		Quartzite	
Volcanic Breccia		Altered Diorite or Quartz Diorite	
Intrusive Breccia		Monzodiorite Dyke	
Jigsaw Breccia		Plagioclase Porphry Intrusive	
Polymictic Breccia		Plagioclase Porphry Intrusive	
Fragment Breccia		Granite	
Intrusive Breccia		Volcanic	
Brecciated Monzonite			
Brecciated Monzodiorite		Basalt	
Diorite	**Diorite**	Fault	**Fault**
		Fault Breccia	
Quartz Diorite		Overburden	**Ignore**
		Casing	
		End of Hole	
Vein	**Dyke**	Monzonite	**Monzodiorite**
Dyke			
Mafic Dyke		Monzodiorite	
White granite dyke (Alaskite)			
Augite Porphyry Dyke			
Plagioclase Porphry Intrusive		Quartz Monzonite	
Mafic Dyke		Limestone	**Other**
Dyke		Skarn	
Monzonite Dyke		Tuff	
No Lithology Available	**Unknown**	Unknown	**Unknown**

Summary Table of Drilled Lithologic Units

A database of 65 boreholes provided by MPMC was used in the review of rock mass ratings (RMR) for the 2016 LOM assessment (Golder 2016) (blue collars in image to the right). Seventeen additional holes were provided by MPMC in late 2023 and early 2024, and added to the database (red collars in image to the right). Note that two of the boreholes, SD-07-22 and SD-04-16, had previously been reviewed during the 2016 LOM assessment.

Lithological intersections and statistics are summarized below. Most of the lithology intervals logged were within the Breccia group (mineralization).

Grouped Lithology	Total Meters Logged	% of Total Meterage
Breccia	14,240.75	48.00%
Diorite	1,489.58	5.02%
Monzodiorite	8,831.77	29.77%
Dyke	743.716	2.51%
Fault	142.46	0.48%
Unknown	4,126.54	13.91%
Other	79.24	0.27%
Ignore	15.38	0.05%
TOTAL	29,669.43	100.00%

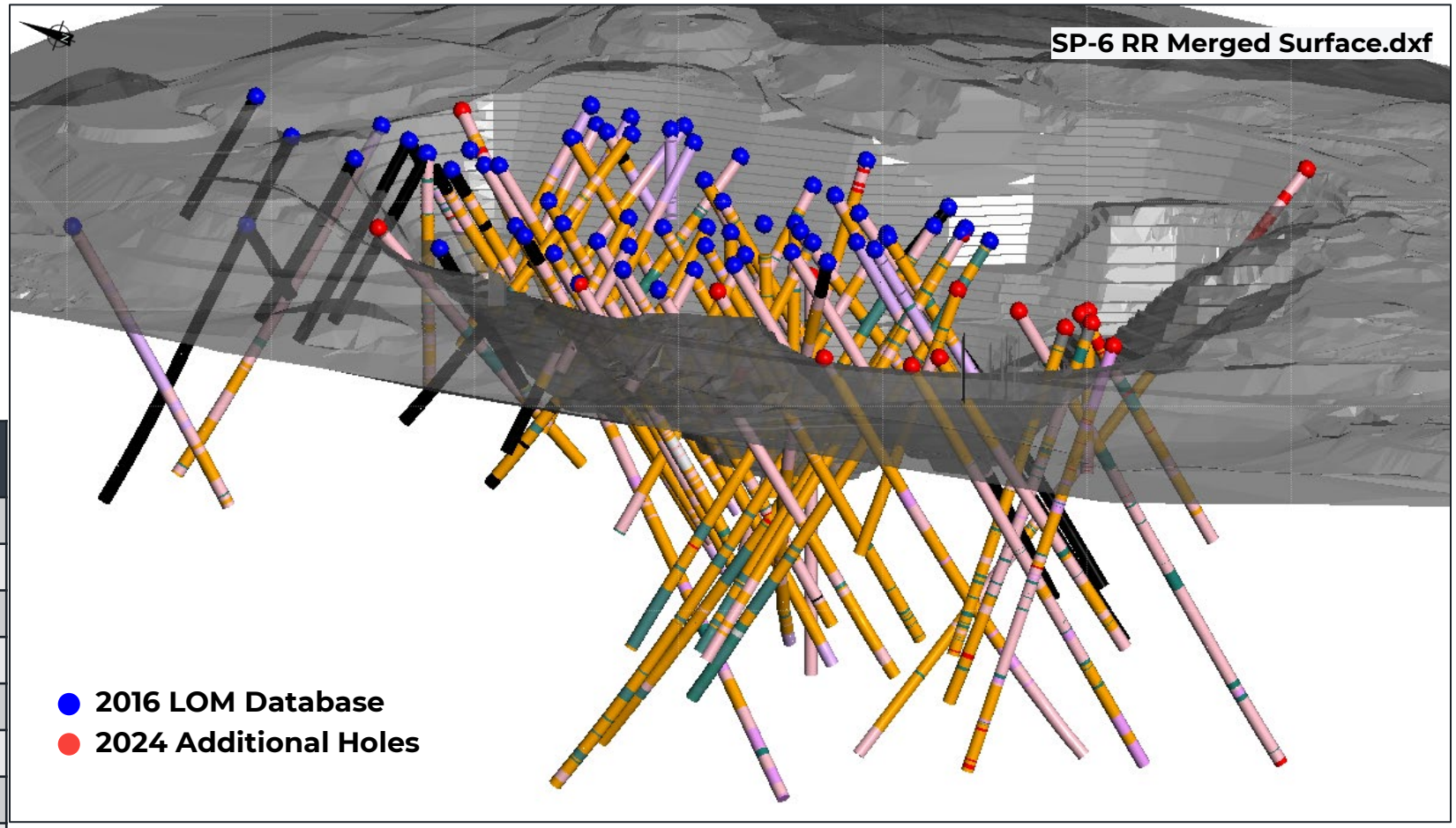

Lithology Examples

Fragment Breccia, Polymictic Breccia, Intrusive Breccia



Fragment Breccia, WX-10-37: 319.71 m to 324.24 m



Fragment Breccia, WX-10-14: 64 m to 68.03 m



Polymictic Breccia, WX-11-50: 144.25 m to 148.62 m

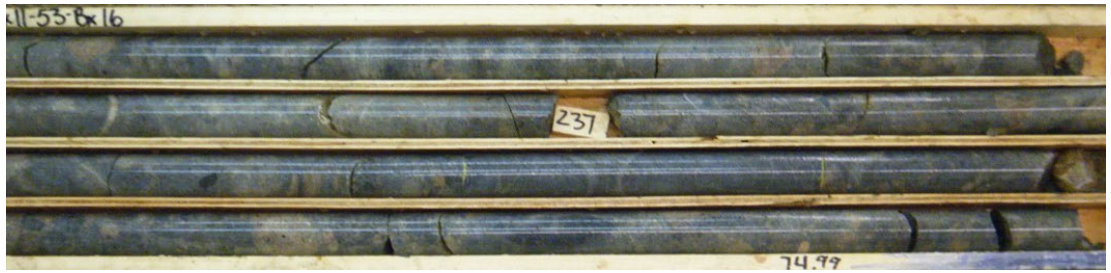

Polymictic Breccia, WX-11-53: 70.57 m to 74.99 m



Intrusive Breccia, WX-10-35: 91.85m to 95.81 m



Intrusive Breccia, WX-11-55: 225.85m to 230.30 m

Lithology Examples

Monzonite, Brecciated Monzonite, Brecciated Monzodiorite



Monzonite, WX-11-53: 202.15 m to 206.67 m

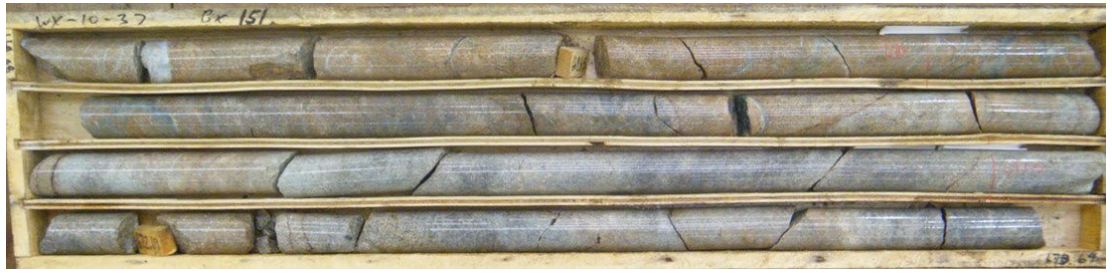

Monzonite, WX-10-37: 669.08 m to 678.69 m



Brecciated Monzonite, WX-10-16: 419.23 m to 423.56 m



Brecciated Monzonite, WX-10-14: 79.95 m to 84.32 m



Brecciated Monzodiorite, WX-11-49: 79.22 m to 83.52 m

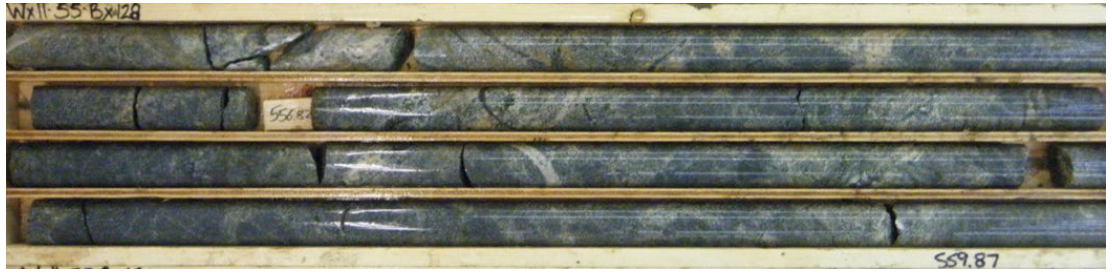

Brecciated Monzodiorite, WX-11-55: 555.53 m to 559.87 m

Lithology Examples

Monzodiorite, Monzonite Dyke, Diorite

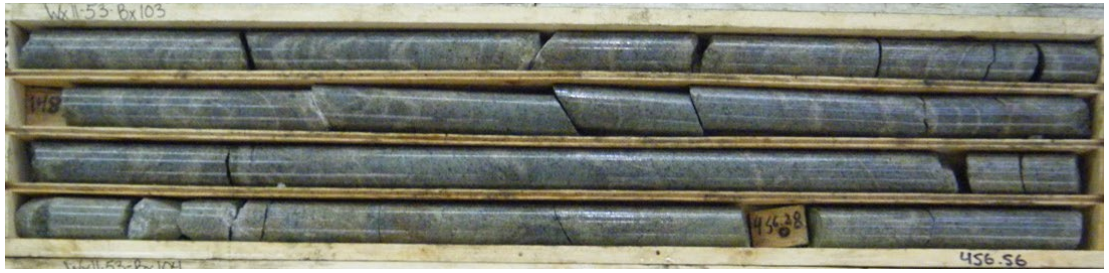

Monzodiorite, WX-11-53: 452.09 m to 456.56 m



Monzodiorite, WX-11-53: 452.09 m to 456.56 m



Monzonite Dyke, WX-11-50: 279.88 m to 282.90 m

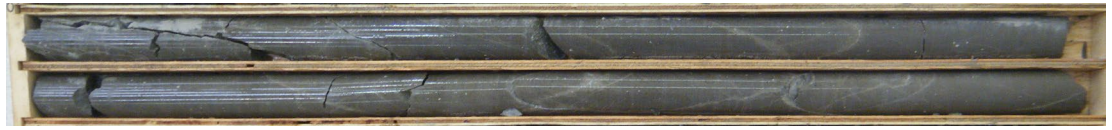

Monzonite Dyke, WX-10-16: 377.85 m to 380.08 m

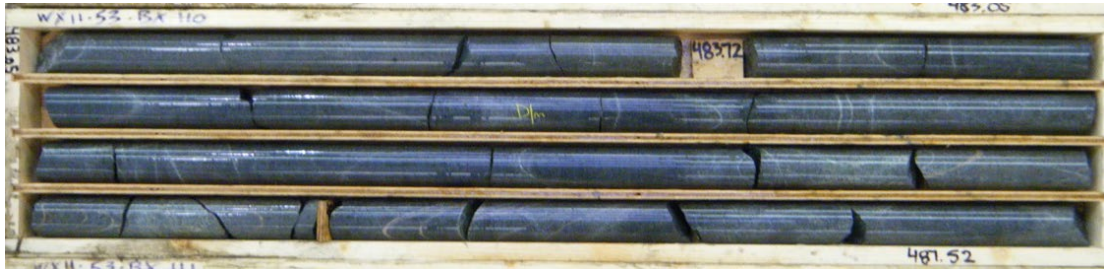

Diorite, WX-11-53: 483.05 m to 487.52 m



Diorite, WX-10-37: 537.27 m to 541.63 m

Typical Mafic Dyke

C2-11-86: 153.76 m to 158.04 m

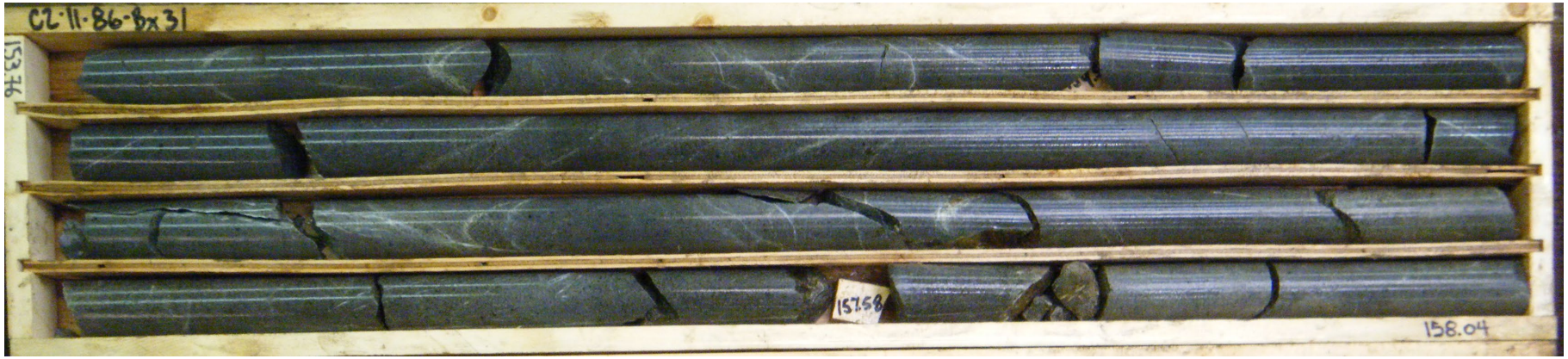

WX-11-49: 173.79 m to 176.06 m



WX-10-35: 90.52 m to 93.57 m

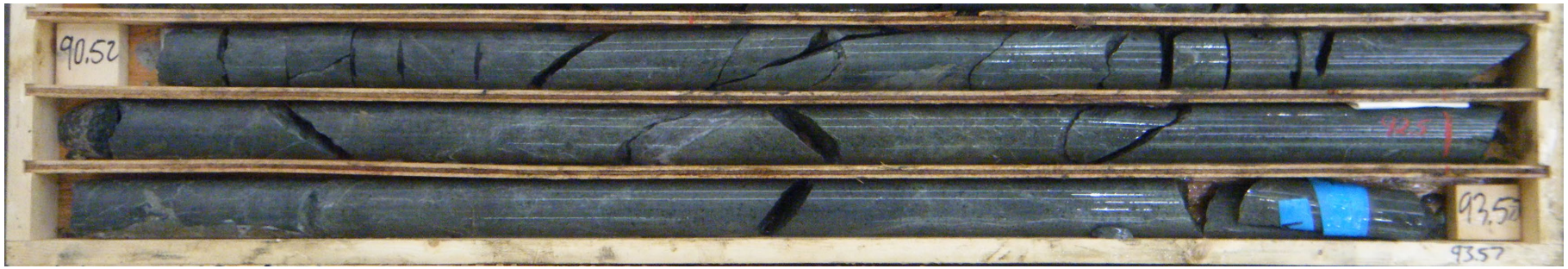

Typical Faults

WX-11-55: 342.41 m to 345.66 m



WX-11-49: 502.35 m to 504.26 m



WX-10-35: 146.10 m to 148.99 m



APPENDIX E

Exploration Borehole Downhole Plots

Drillhole ID: C2-11-86

Northing (m):	5822719	Drill Size:	NQ	Dip (º):	-60
Easting (m):	591997				
Elevation (m):	1103	Length (m):	409.35	Azimuth (º):	090

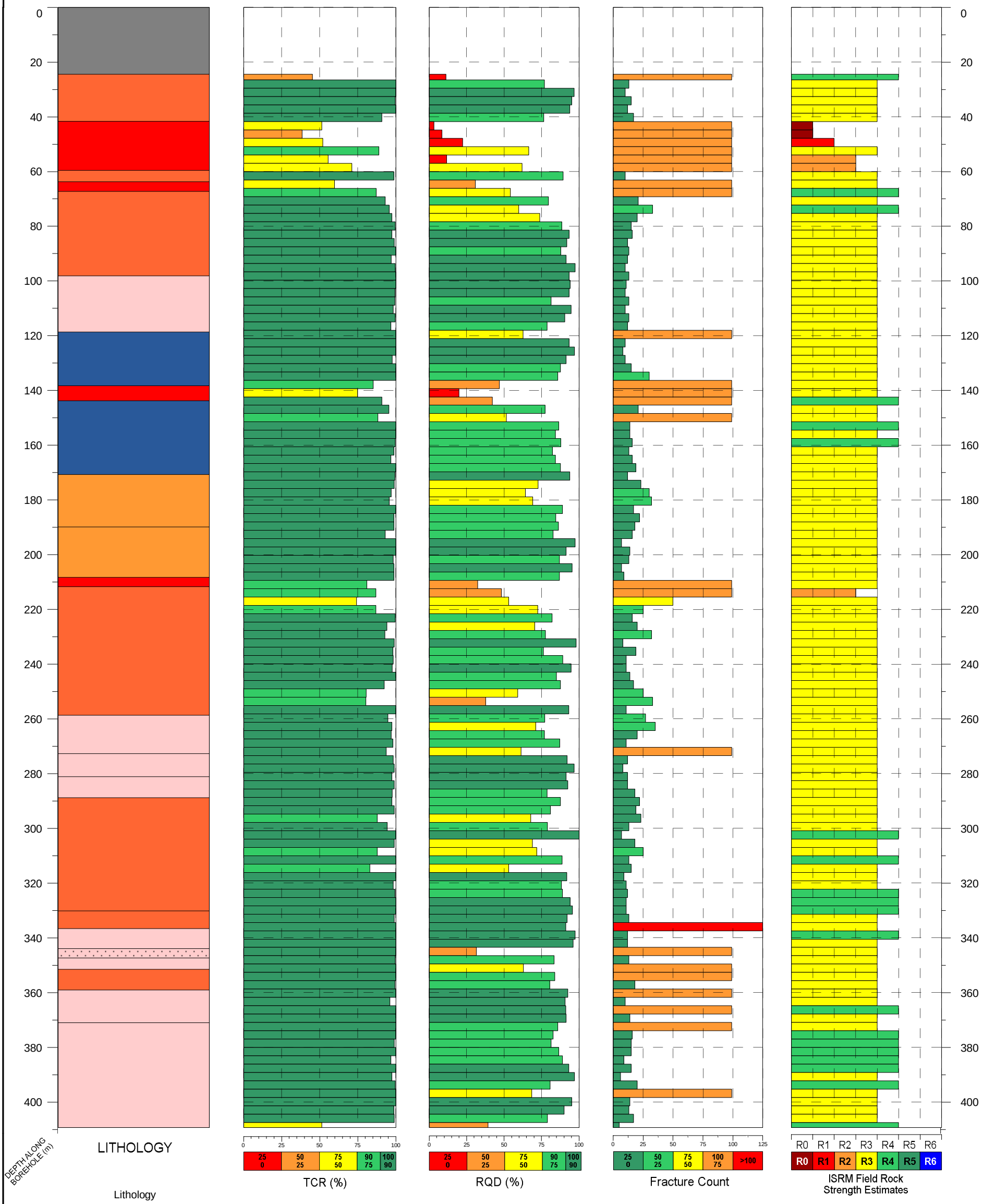

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TITLE

DOWNHOLE PLOT
C2-11-86

PROJECT NO.
CA0020527.4505/81100

REV
0

FIGURE
E-1

0 1 cm 2 cm

Drillhole ID: CB-11-05

Northing (m):	5823286.35	Drill Size:	HQ	Dip (º):	-50
Easting (m):	592540.786				
Elevation (m):	1162.693	Length (m):	1083.87	Azimuth (º):	270

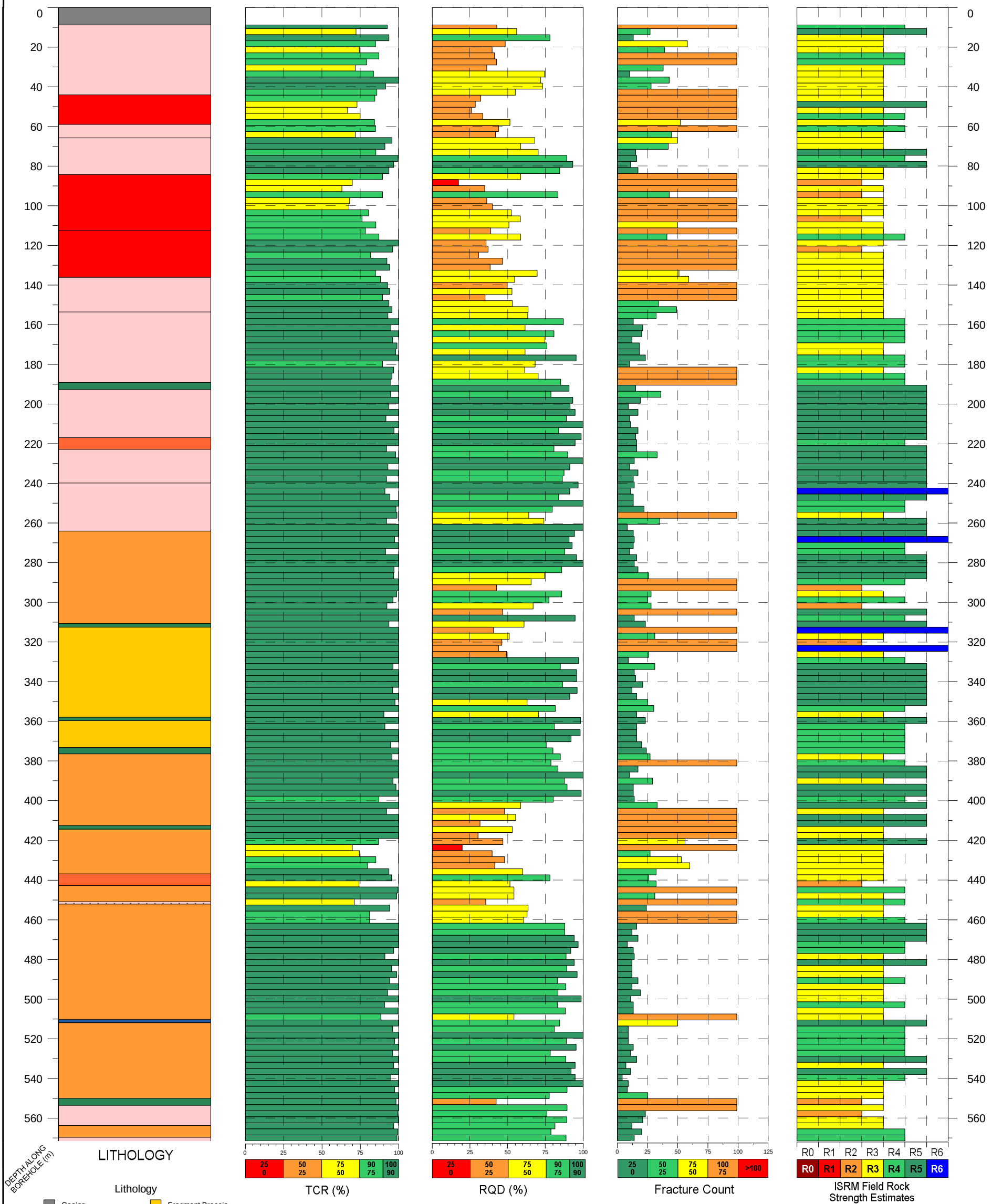

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DOWNHOLE PLOT
CB-11-05

PROJECT NO. CA0020527.4505/81100

REV 0

FIGURE E-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

0 1 cm 2 cm

Drillhole ID: CB-11-05

Northing (m):	5823286.35	Drill Size:	HQ	Dip (º):	-50
Easting (m):	592540.786				
Elevation (m):	1162.693	Length (m):	1083.87	Azimuth (º):	270

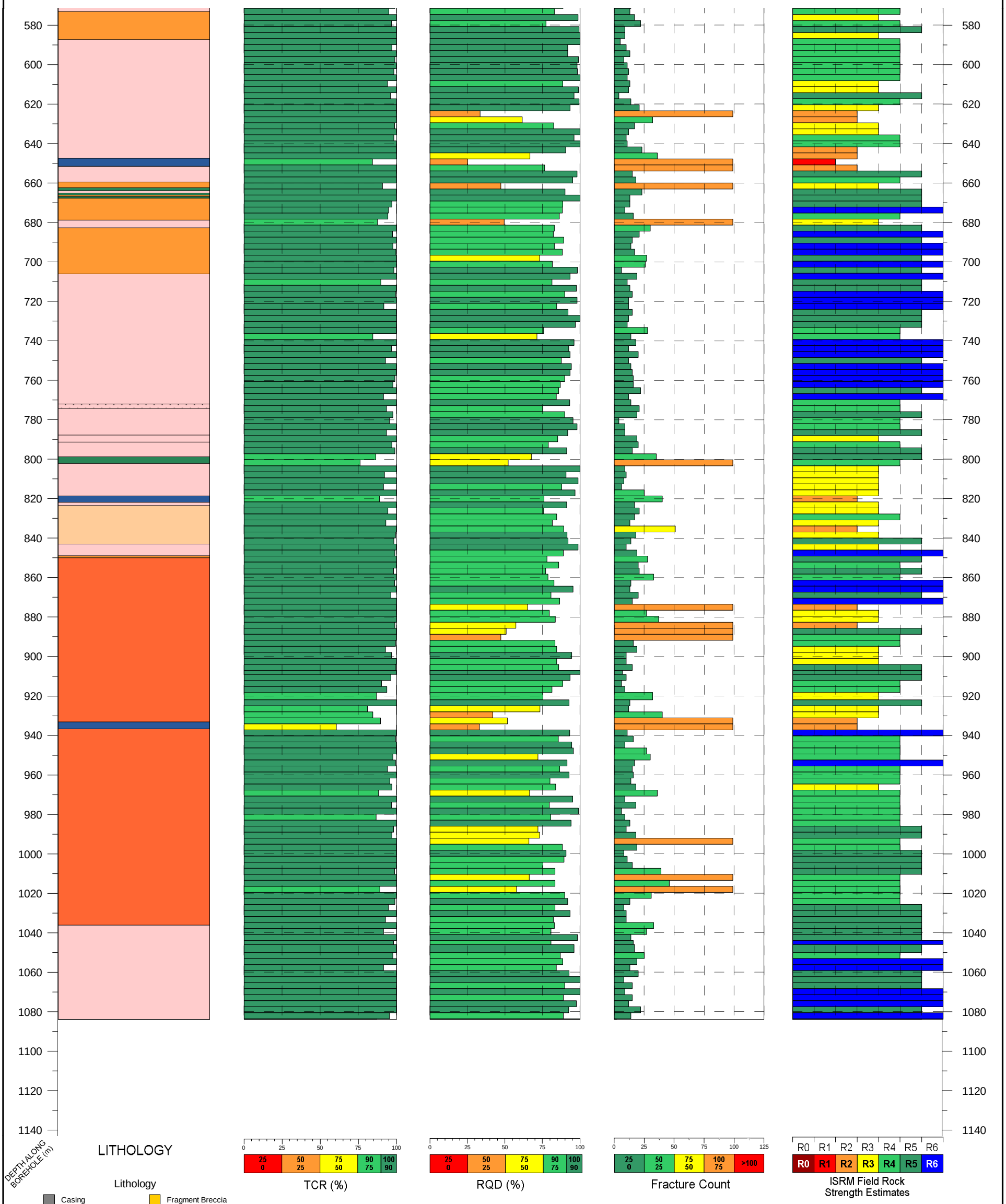

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DOWNHOLE PLOT
CB-11-05

PROJECT NO.
CA0020527.4505/81100

REV
0

FIGURE
E-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN ADJUSTED FROM ANSI B
0 1 cm 2 cm

Drillhole ID: SD-04-16

Northing (m):	3151.89	Drill Size:	HQ - NQ2	Dip (º):	-57
Easting (m):	1959.37				
Elevation (m):	1135.62	Length (m):	730.61	Azimuth (º):	270

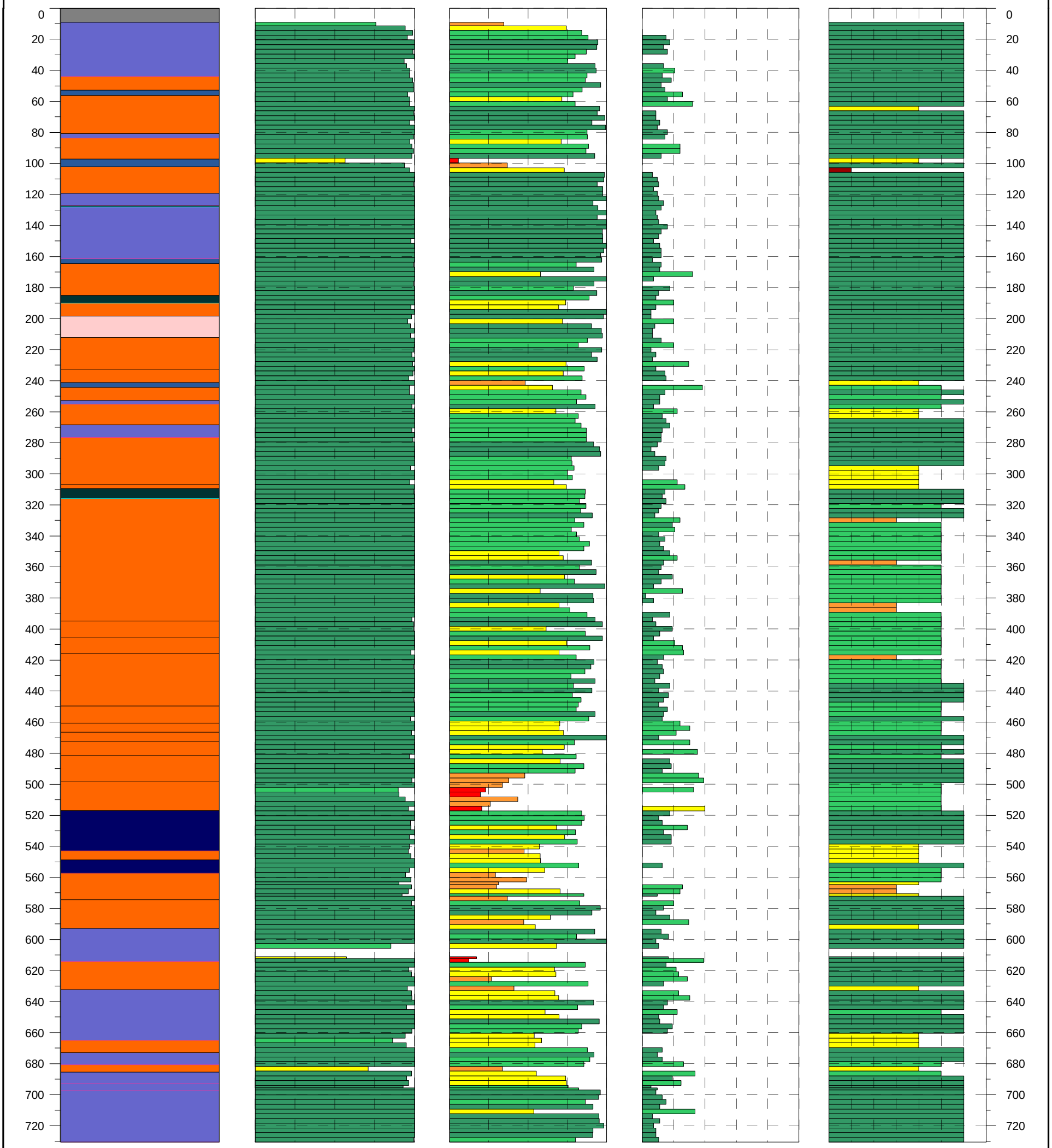

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DOWNHOLE PLOT
SD-04-16

PROJECT NO. CA0020527.4505/81100

REV 0

FIGURE E-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
0 1 cm 2 cm

Drillhole ID: SD-07-22

Northing (m):	3278.526	Drill Size:	NQ2	Dip (º):	-60
Easting (m):	1407.977				
Elevation (m):	1072.918	Length (m):	459.33	Azimuth (º):	090



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TITLE

DOWNHOLE PLOT
SD-07-22

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-4

If this measurement does not match what is shown, the sheet size has been altered from ANSI B

0 1 cm 2 cm

Drillhole ID: SD-11-107

Northing (m):	5824054.118	Drill Size:	HQ	Dip (º):	-45
Easting (m):	591490.472				
Elevation (m):	1164.694	Length (m):	1233.06	Azimuth (º):	166

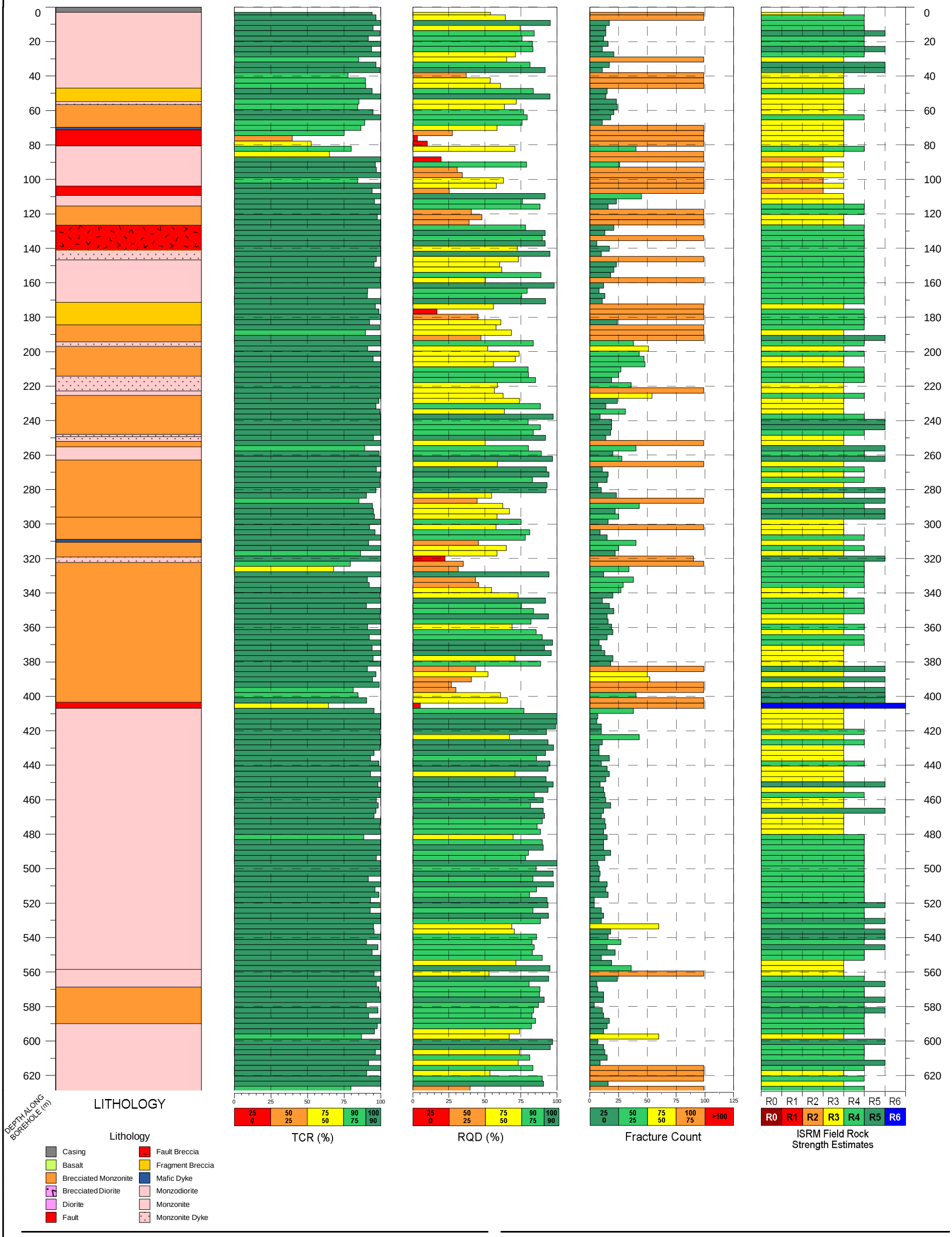

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TITLE

DOWNHOLE PLOT
SD-11-107

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-5

This document does not serve as a scale. The sheet size was adjusted since drawing.

Drillhole ID: SD-11-107

Northing (m):	5824054.118	Drill Size:	HQ	Dip (º):	-45
Easting (m):	591490.472				
Elevation (m):	1164.694	Length (m):	1233.06	Azimuth (º):	166

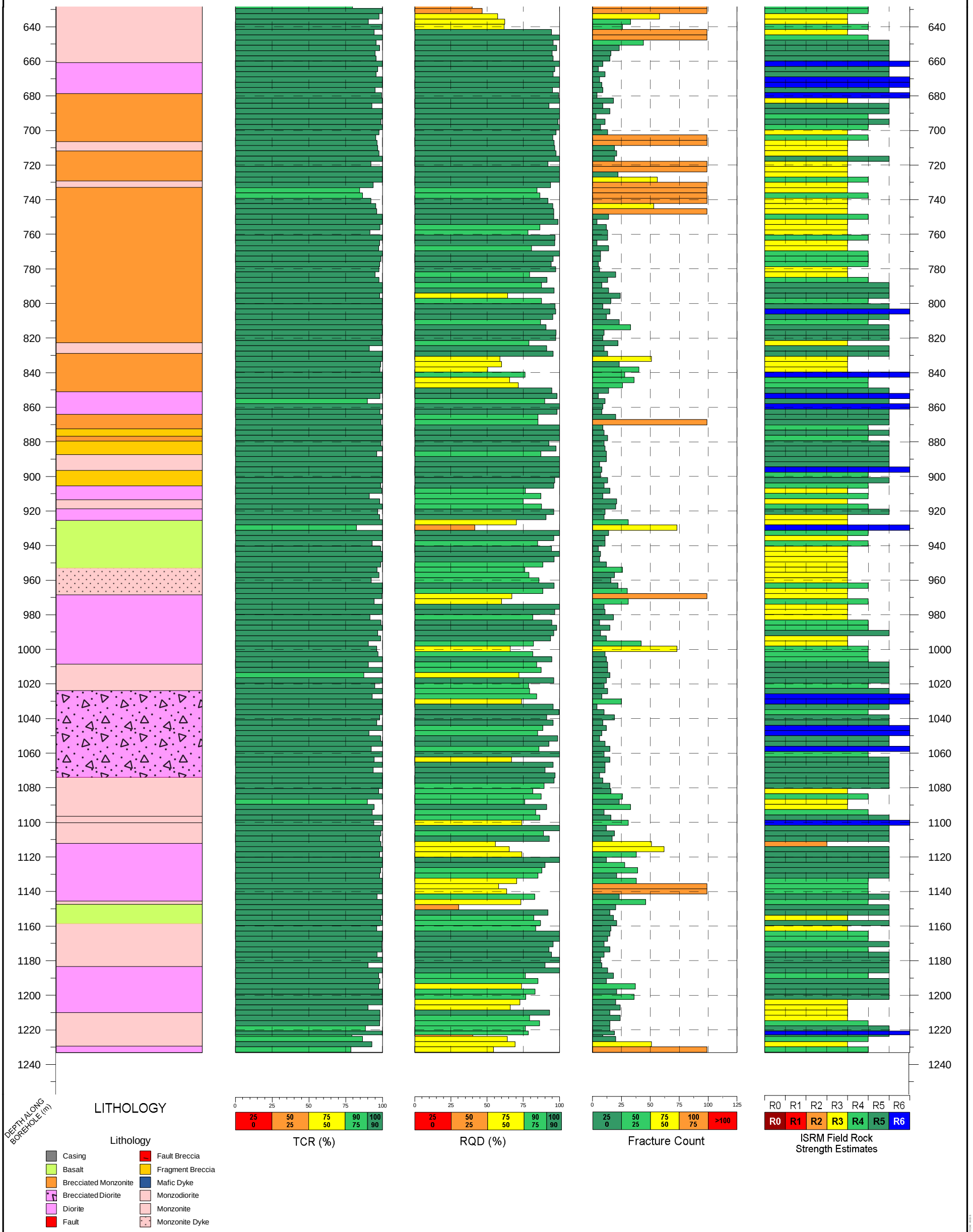

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TITLE

DOWNHOLE PLOT
SD-11-107

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-5

0 1 cm 2 cm

Drillhole ID: SD-12-133

Northing (m):	5823377.189	Drill Size:	NQ	Dip (º):	-90
Easting (m):	591801.570				
Elevation (m):	1035.934	Length (m):	599.24	Azimuth (º):	000



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DOWNHOLE PLOT
SD-12-133

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-6

This document does not replace signed & sealed. This sheet was plotted on ANSI B size

0 1 cm 2 cm

Drillhole ID: SD-12-142

Northing (m):	5823658.94	Drill Size:	NQ	Dip (º):	-50
Easting (m):	591225.43				
Elevation (m):	1090.0	Length (m):	492.25	Azimuth (º):	90

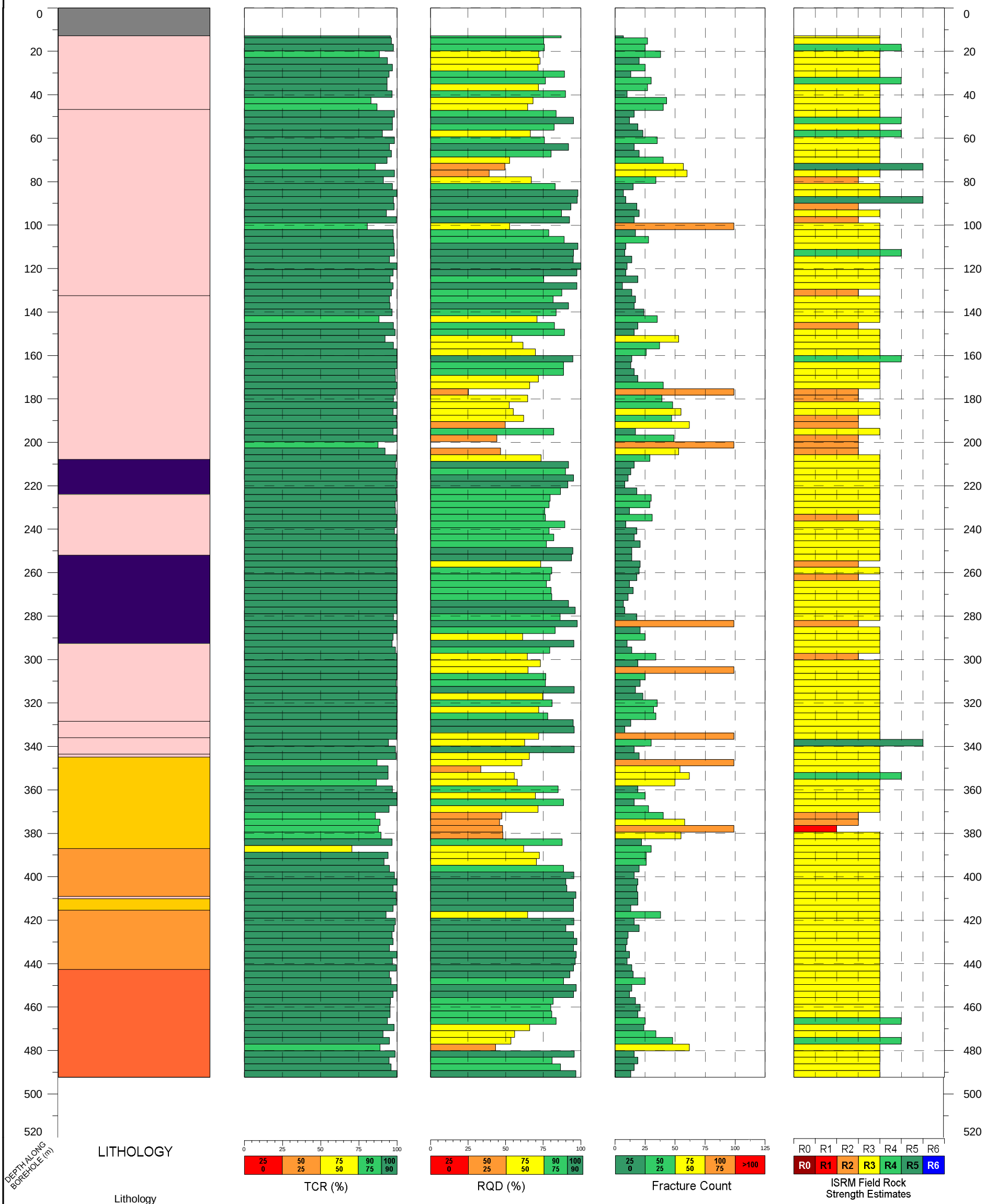

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DOWNHOLE PLOT
SD-12-142

PROJECT NO. CA0020527.4505/81100

REV 0

FIGURE E-7

0 1 cm 2 cm

Drillhole ID: WX-09-02

Northing (m):	2728	Drill Size:	NQ2	Dip (º):	-90
Easting (m):	2011				
Elevation (m):	1105	Length (m):	242.93	Azimuth (º):	000

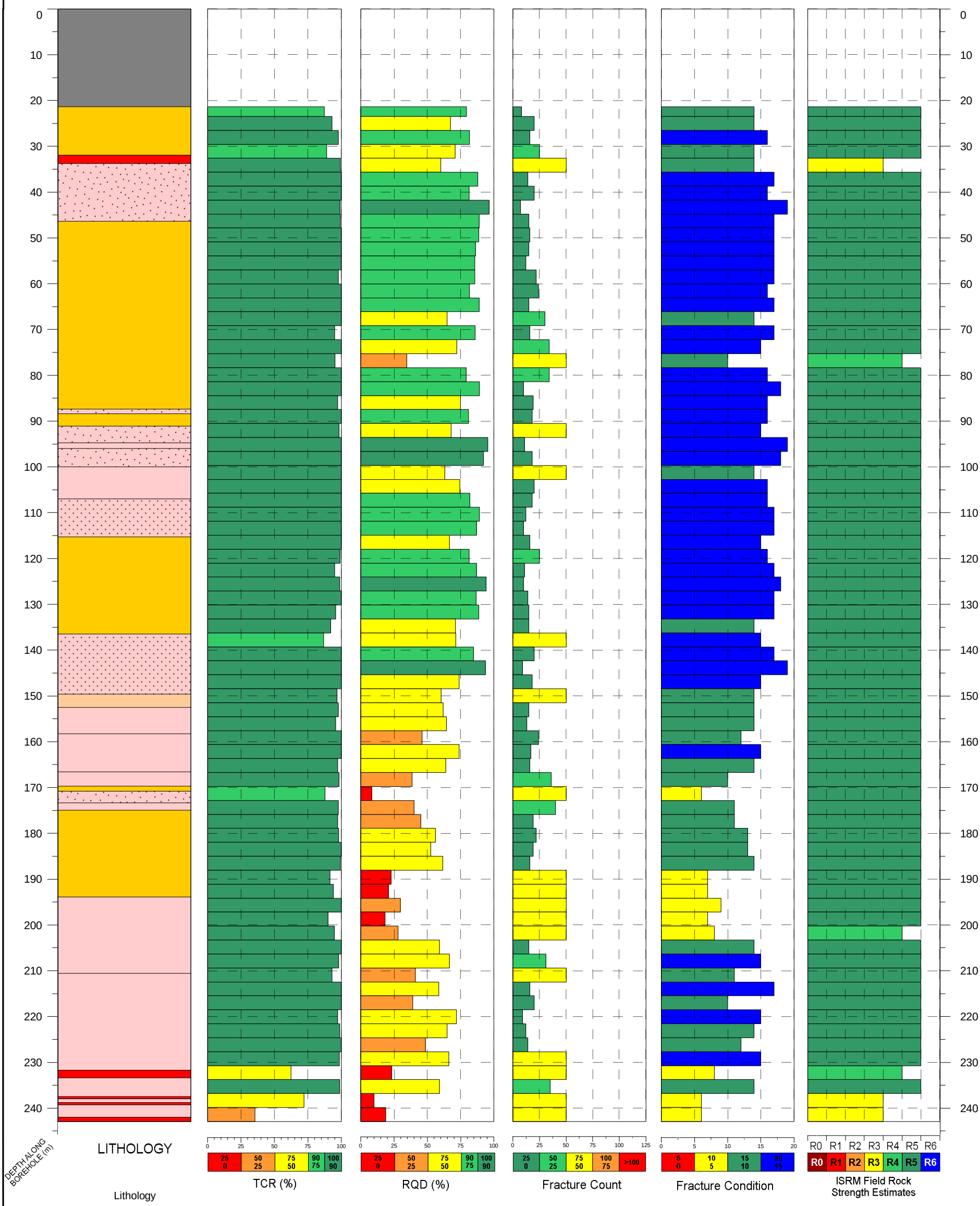

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DOWNHOLE PLOT
WX-10-14

PROJECT NO. CA0020527.4505/81100

REV 0

FIGURE E-8

This reproduction does not match what is shown. The sheet size was determined from area in model space.

0 1 cm 2 cm

Drillhole ID: WX-10-07

Northing (m):	2772	Drill Size:	NQ	Dip (º):	-70
Easting (m):	1823				
Elevation (m):	1141	Length (m):	418.43	Azimuth (º):	270

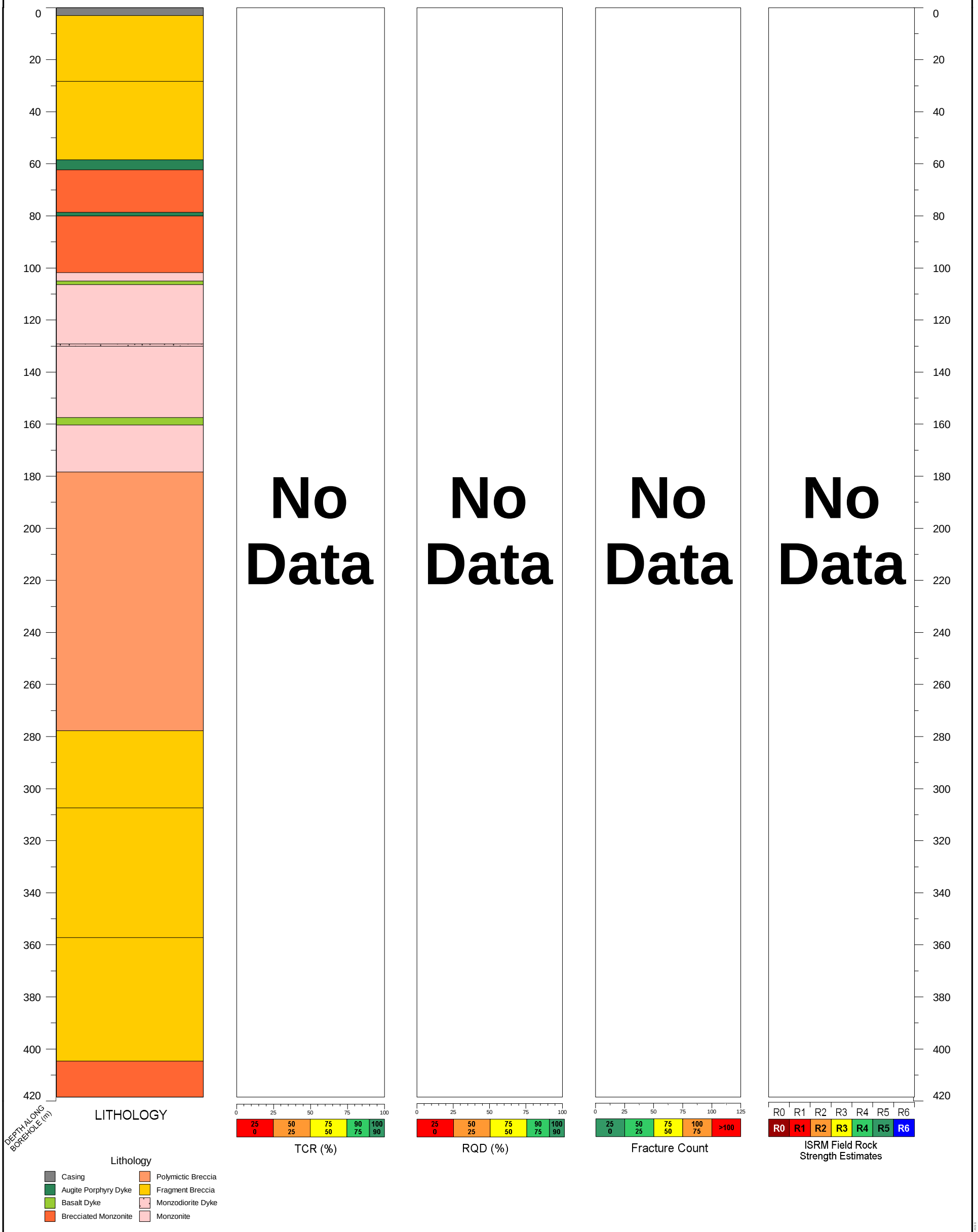

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DOWNHOLE PLOT
WX-10-07

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-9

0 1 cm 2 cm

Drillhole ID: WX-10-14

Northing (m):	2679	Drill Size:	NQ	Dip (º):	-70
Easting (m):	2000				
Elevation (m):	1098	Length (m):	601.10	Azimuth (º):	270

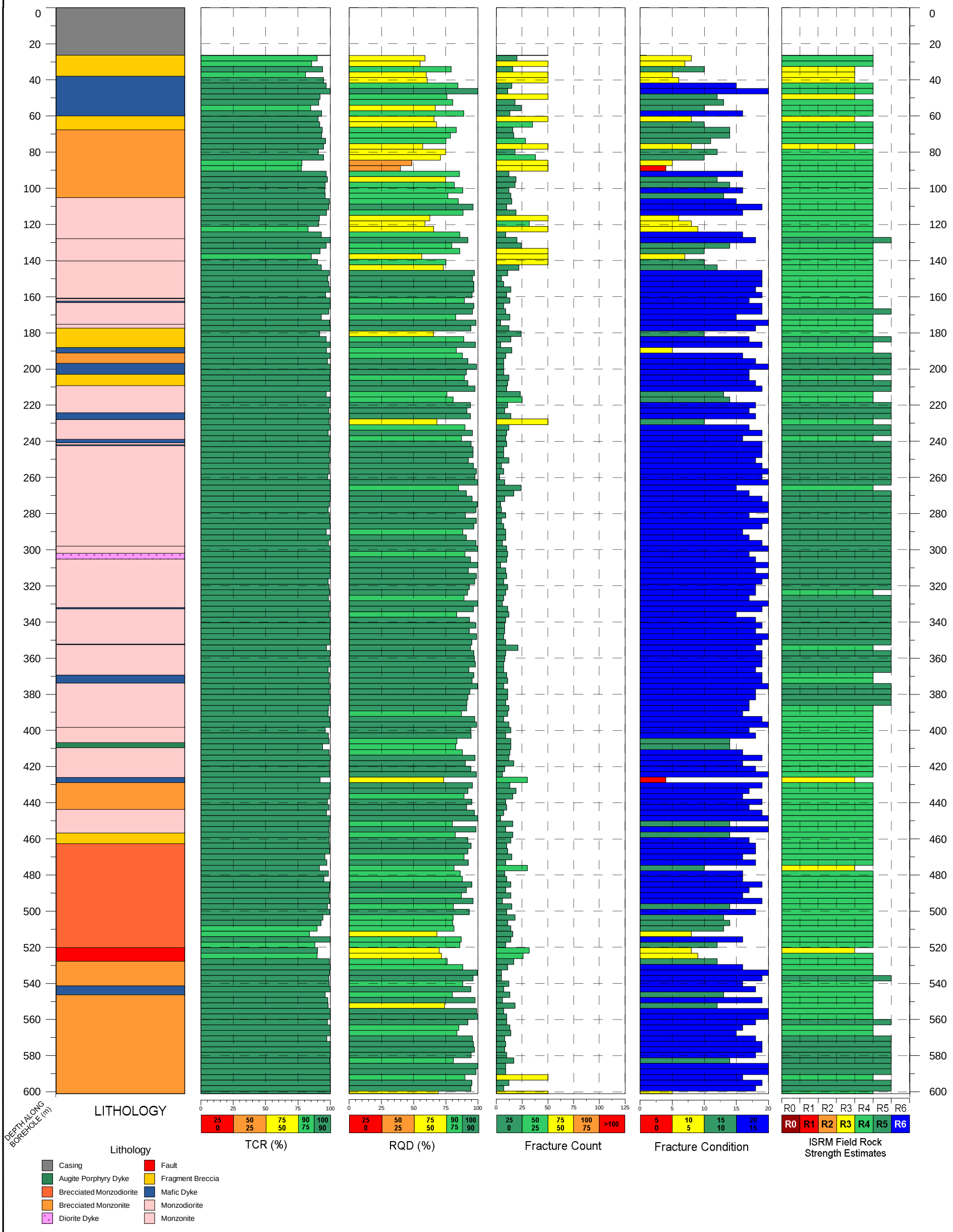

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DOWNHOLE PLOT
WX-10-14

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-10

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0 1 cm 2 cm

Drillhole ID: WX-10-16

Northing (m):	2631	Drill Size:	NQ	Dip (º):	-60
Easting (m):	1747				
Elevation (m):	1074	Length (m):	532.49	Azimuth (º):	090

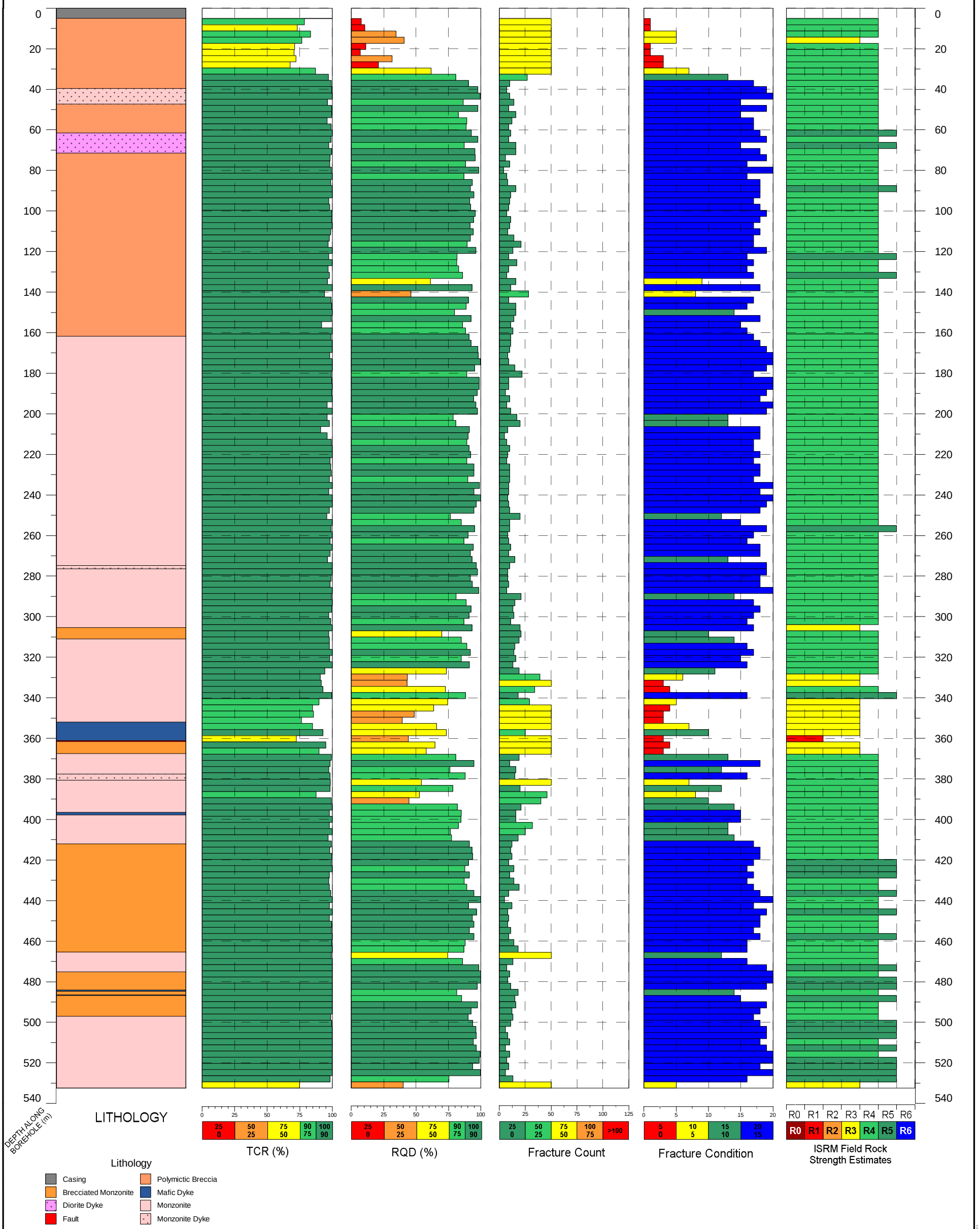

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DOWNHOLE PLOT
WX-10-16

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-11

0 1 cm 2 cm

Drillhole ID: WX-10-35

Northing (m):	2725	Drill Size:	NQ	Dip (º):	-60
Easting (m):	1902				
Elevation (m):	1113	Length (m):	819.01	Azimuth (º):	090

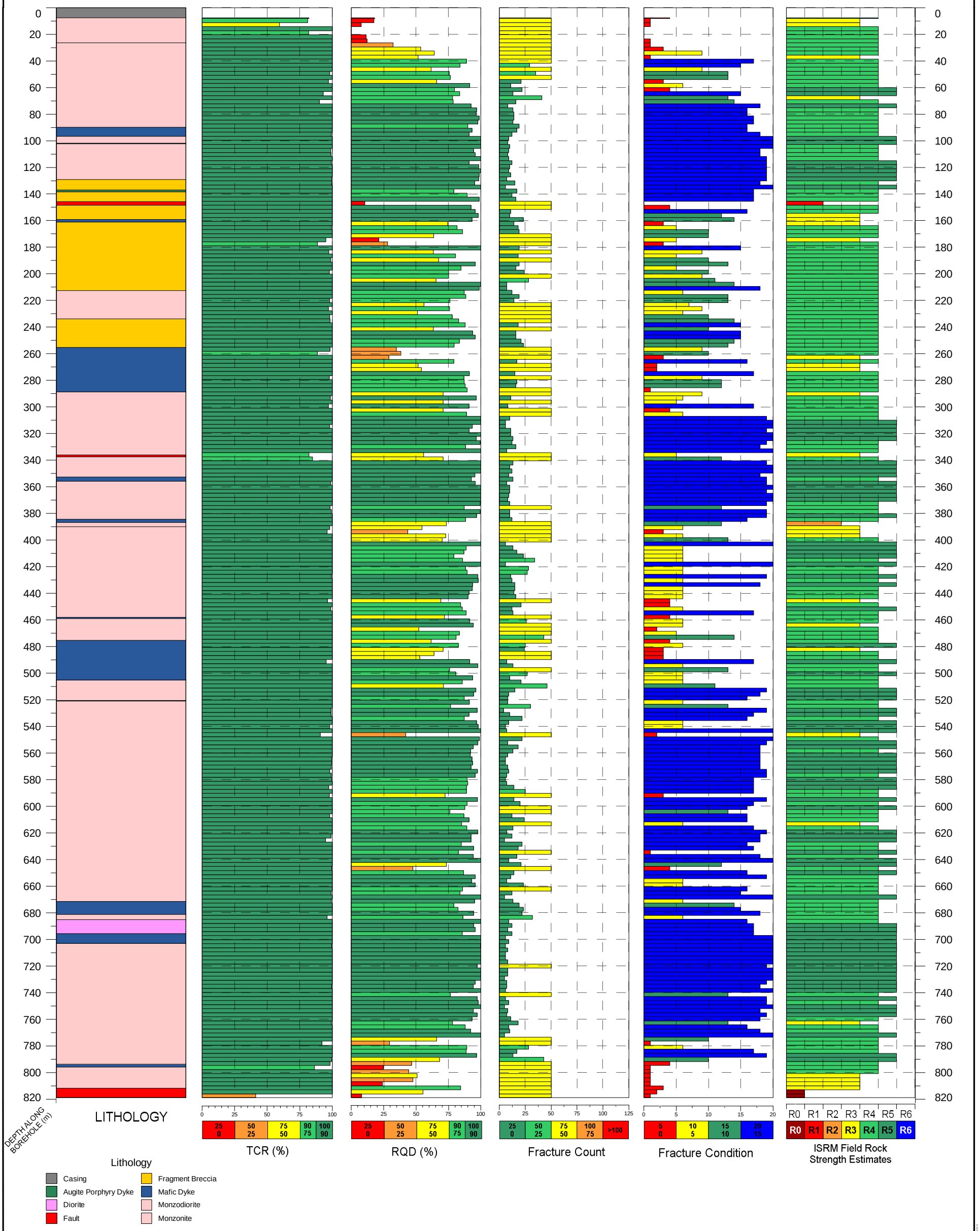

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DOWNHOLE PLOT
WX-10-35

PROJECT NO. CA0020527.4505/81100

REV 0

FIGURE E-12

THIS REPRODUCTION DOES NOT MATCH WHAT IS SHOWN. THE SHEET SIZE HAS BEEN ALTERED FROM ANSI B

0 1 cm 2 cm

Drillhole ID: WX-10-37

Northing (m):	2725	Drill Size:	NQ	Dip (º):	-60
Easting (m):	1600				
Elevation (m):	1064	Length (m):	730.61	Azimuth (º):	090

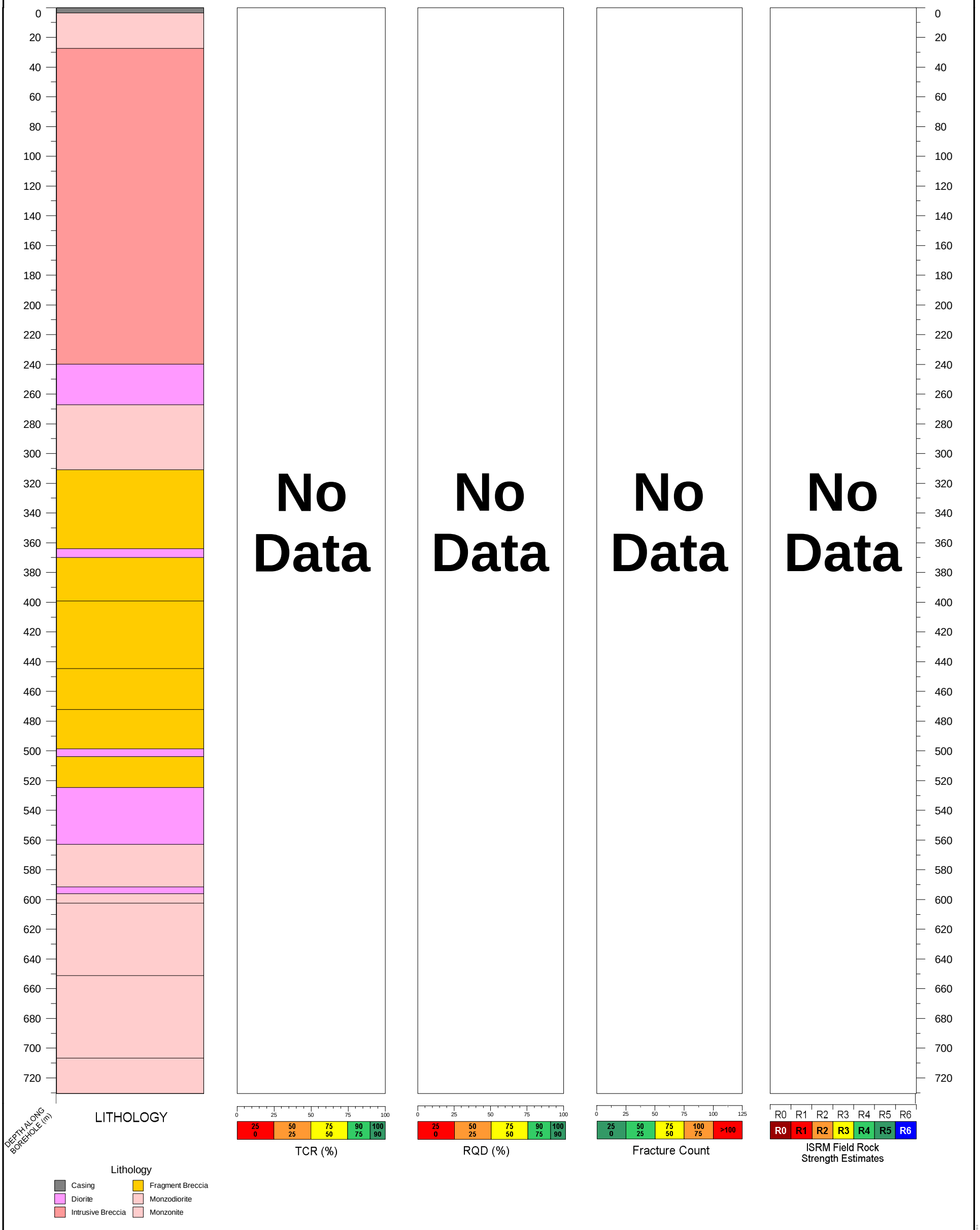

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DOWNHOLE PLOT
WX-10-37

PROJECT NO.
CA0020527.4505/81100

REV
0

FIGURE
E-13

0 1 cm 2 cm

Drillhole ID: WX-11-49

Northing (m):	5822674	Drill Size:	NQ	Dip (º):	-70
Easting (m):	591957				
Elevation (m):	1095	Length (m):	510.24	Azimuth (º):	260



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DOWNHOLE PLOT
WX-11-49

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-14

0 1 cm 2 cm

Drillhole ID: WX-11-50

Northing (m):	5823078	Drill Size:	NQ	Dip (º):	-60
Easting (m):	591555				
Elevation (m):	1093	Length (m):	630.03	Azimuth (º):	090

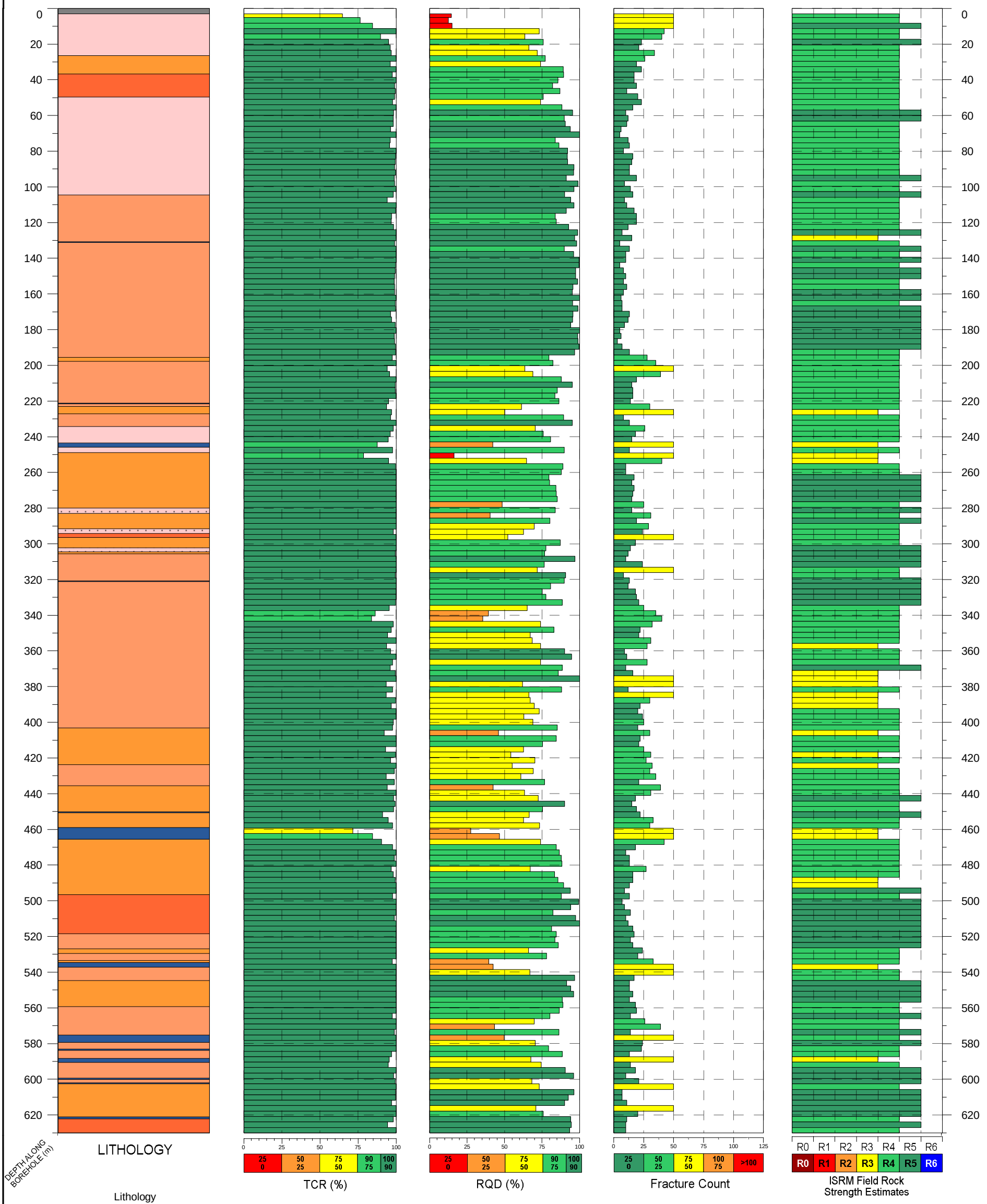

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DOWNHOLE PLOT
WX-11-50

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-15

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0 1 cm 2 cm

Drillhole ID: WX-11-53

Northing (m):	5822630	Drill Size:	NQ	Dip (º):	-60
Easting (m):	591704				
Elevation (m):	1065	Length (m):	721.46	Azimuth (º):	090

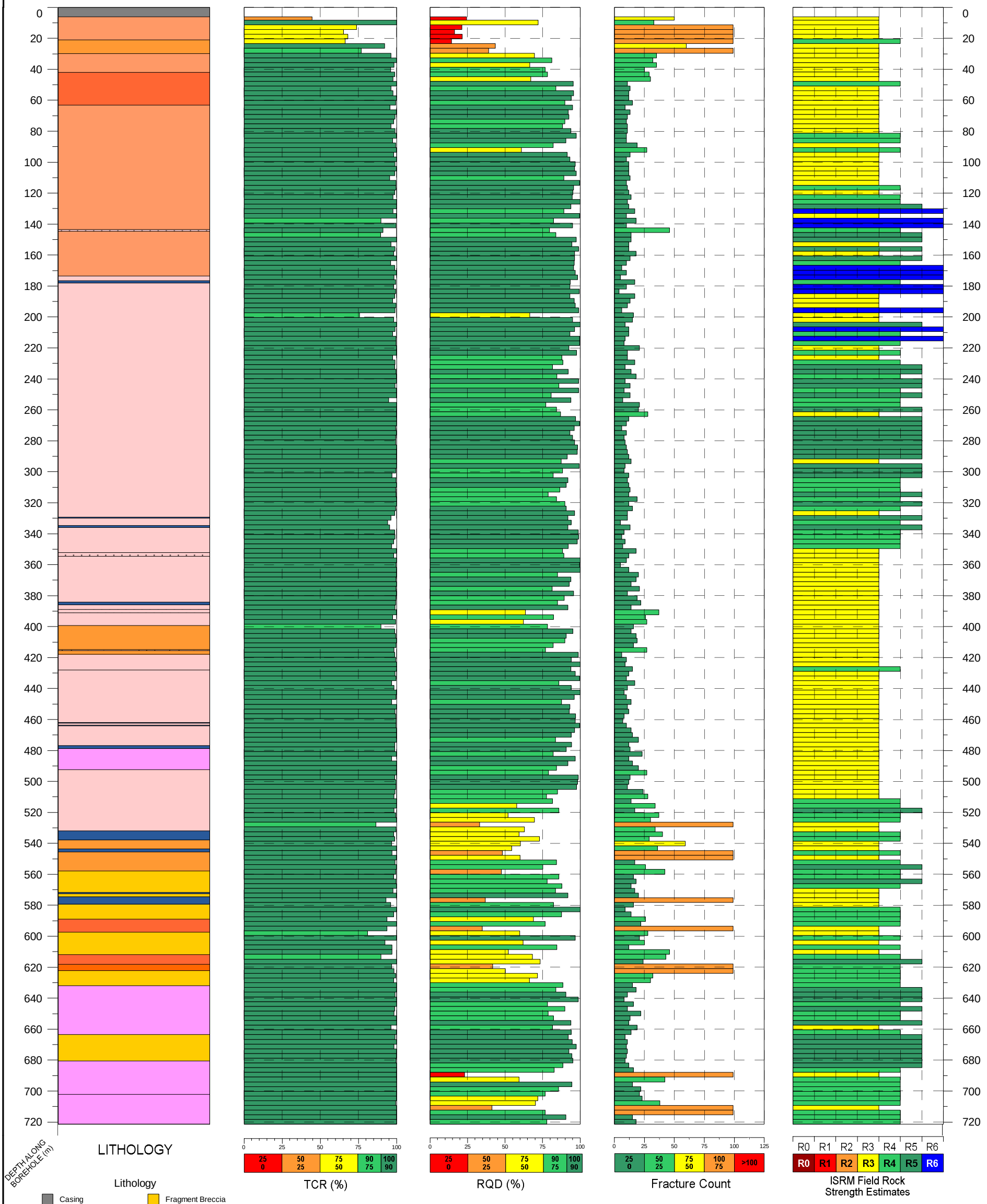

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DOWNHOLE PLOT
WX-11-53

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-16

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0 1 cm 2 cm

Drillhole ID: WX-11-55

Northing (m):	5822578	Drill Size:	NQ	Dip (º):	-70
Easting (m):	591999				
Elevation (m):	1085	Length (m):	663.55	Azimuth (º):	270

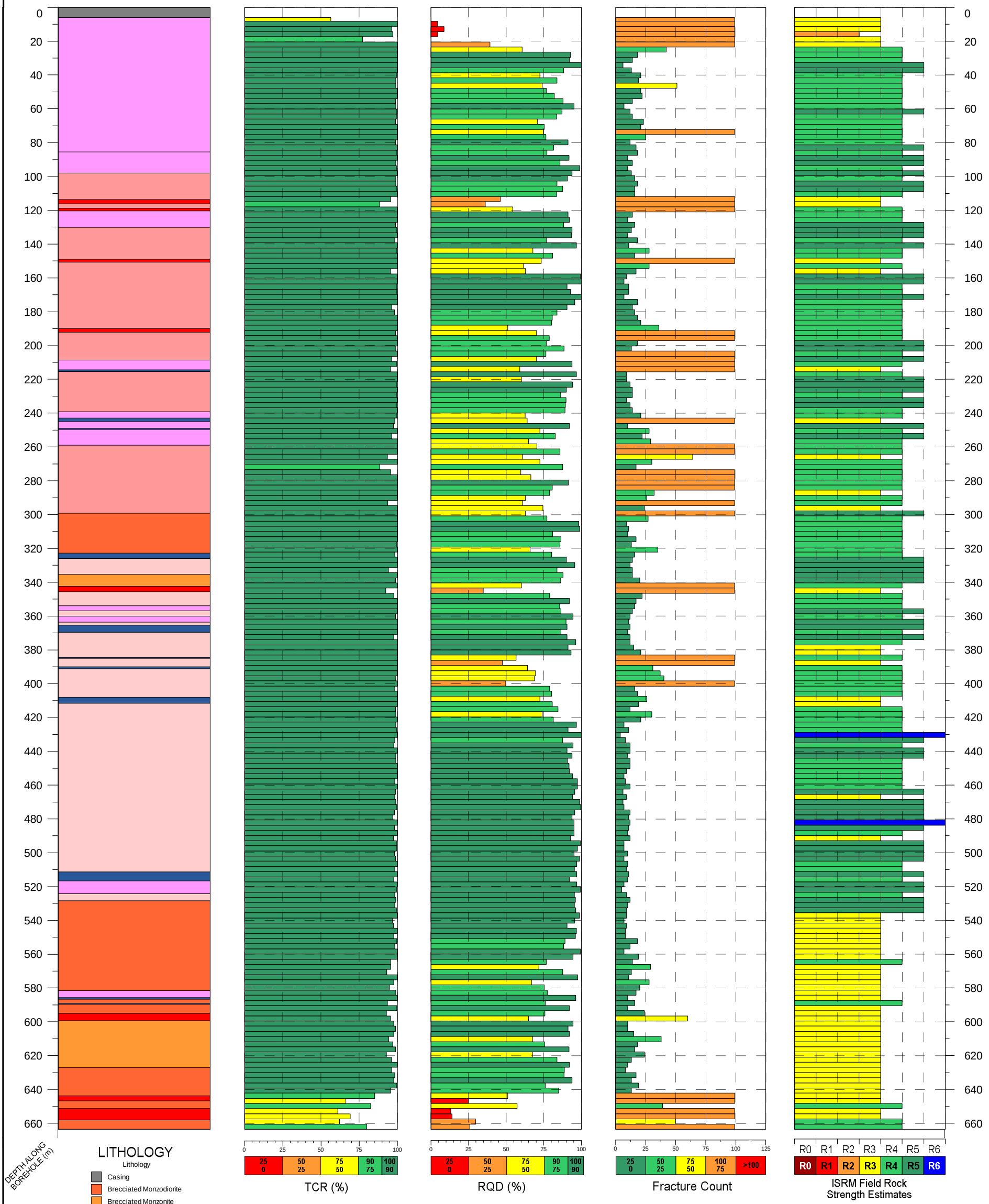

CLIENT

MOUNT POLLEY MINE
MOUNT POLLEY MINING CORPORATION
LIKELY, BC

PROJECT

LIFE OF MINE OPEN PIT DESIGN REVIEW

CONSULTANT

wsp

YYYY-MM-DD	2024-01-19
PREPARED	NV
DESIGNED	NV
REVIEWED	AGH
APPROVED	AGH

TITLE

DOWNHOLE PLOT
WX-11-55

PROJECT NO.	REV	FIGURE
CA0020527.4505/81100	0	E-17

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APPENDIX F

Rock Quality and Strength Review

RMR_{76} Review Summary

A database, including 65 boreholes, provided by MPMC was used in the review of Rock Mass Rating (RMR_{76}) for the 2016 LOM assessment (Golder 2016). Seventeen additional holes were provided by MPMC in late 2023 and early 2024. Of the 17 boreholes provided, 15 boreholes were added to the overall database (two were the same as the 2016 LOM assessment database). Four of the new boreholes included enough information to calculate RMR.

Minimal QAQC was completed on the dataset, i.e., duplicates and blanks were removed.

This presentation summarizes the review of exploration borehole logging data used to calculate RMR_{76}.

A total of 69 borehole logs were used to review the following:

- Differences in geology and RMR_{76} defined zones
- RMR of all lithology groups by length
- RMR of individual lithology groups by percent

Downhole plots of the exploration borehole logs provided in late 2023 and early 2024 are presented in Appendix E.

2016 LOM Exploration Borehole Database vs. New 2024 LOM Exploration Boreholes Provided

Plan Views

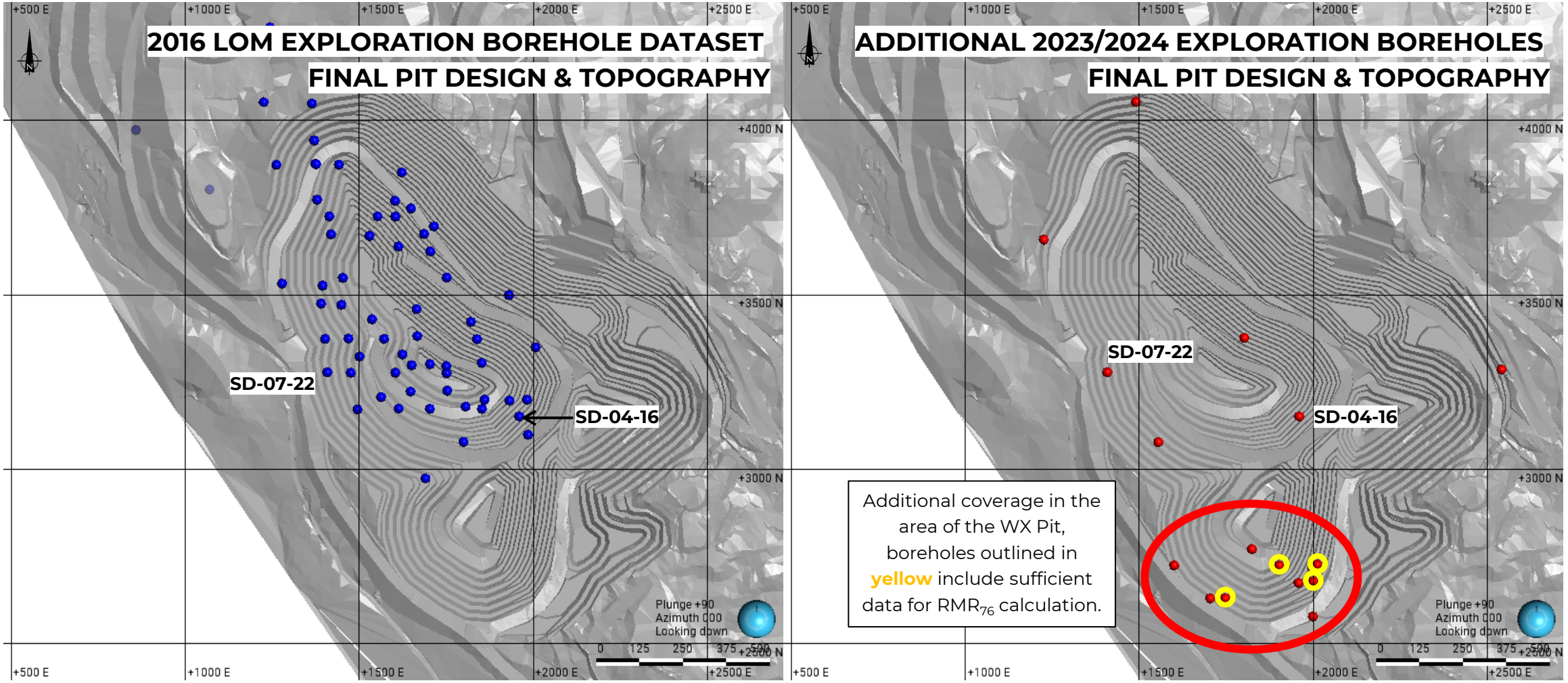

Comparison of Geotechnical and Geological Intervals

Application of Geology to Geotechnical Units

- Intervals logged geotechnically and geologically do not always match.
- Geological logging was completed at a higher level of detail, including smaller dykes and geological intervals less than 25 cm thick. Contacts were also more accurate than those recorded in the geotechnical logging.
- Intervals less than 25 cm thick are not considered in the RMR_{76} calculation as there are no unique geotechnical parameters logged for them.
- There are slight differences in the depths of some lithologies.

Geological Intervals

Hole ID	Fro		GE	L
SD-04-10	50	50.3	Monz	Monzonite
SD-04-10	50.3	52.5	Monz	Monzonite
SD-04-10	52.5	55	Monz	Monzonite
SD-04-10	55	56.4	Monz	Monzonite
SD-04-10	56.4	57.5	Monz	Monzonite
SD-04-10	57.5	60	Monz	Monzonite
SD-04-10	60	62.5	Monz	Monzonite
SD-04-10	62.5	65	Monz	Monzonite
SD-04-10	65	66.11	Monz	Monzonite
SD-04-10	66.11	67.26	Monz	Monzonite
SD-04-10	67.26	67.5	Monz	Monzonite
SD-04-10	67.5	68.6	Monz	Monzonite
SD-04-10	68.6	70	Monz	Monzonite
SD-04-10	70	70.27	Monz	Monzonite
SD-04-10	70.27	71.06	Flt	Fault
SD-04-10	71.06	72.5	Monz	Monzonite
SD-04-10	72.5	74.7	Monz	Monzonite
SD-04-10	74.7	75	Monz	Monzonite
SD-04-10	75	77.5	Monz	Monzonite
SD-04-10	77.5	80	Monz	Monzonite
SD-04-10	80	80.8	Monz	Monzonite
SD-04-10	80.8	82.5	Monz	Monzonite
SD-04-10	82.5	85	Monz	Monzonite
SD-04-10	85	85.55	Monz	Monzonite
SD-04-10	85.55	85.74	Monz	Monzonite
SD-04-10	85.74	86.9	Monz	Monzonite
SD-04-10	86.9	87.5	Monz	Monzonite
SD-04-10	87.5	90	Monz	Monzonite
SD-04-10	90	91.94	Monz	Monzonite
SD-04-10	91.94	92.5	AP	Augite Porphyry Dyke
SD-04-10	92.5	93	AP	Augite Porphyry Dyke
SD-04-10	93	95	AP	Augite Porphyry Dyke
SD-04-10	95	95.82	AP	Augite Porphyry Dyke
SD-04-10	95.82	97.5	Monz	Monzonite
SD-04-10	97.5	99.1	Monz	Monzonite
SD-04-10	99.1	100	Monz	Monzonite
SD-04-10	100	102.5	PPp	Plagioclase Porphry Intrusive
SD-04-10	102.5	105	PPp	Plagioclase Porphry Intrusive
SD-04-10	105	105.2	PPp	Plagioclase Porphry Intrusive
SD-04-10	105.2	105.63	PPp	Plagioclase Porphry Intrusive
SD-04-10	105.63	107.5	AP	Augite Porphyry Dyke
SD-04-10	107.5	108.96	AP	Augite Porphyry Dyke
SD-04-10	108.96	110	Bx	Breccia
SD-04-10	110	111.3	Bx	Breccia

Geotechnical Intervals

BH ID	From (m)	To (m)	Length (m)	Lithology
SD-04-10	13.72	16.76	3.04	Monzonite
SD-04-10	16.76	19.81	3.05	Monzonite
SD-04-10	19.81	22.86	3.05	Monzonite
SD-04-10	22.86	25.91	3.05	Monzonite
SD-04-10	25.91	28.96	3.05	Monzonite
SD-04-10	28.96	32.00	3.04	Monzonite
SD-04-10	32.00	35.10	3.10	Monzonite
SD-04-10	35.10	38.10	3.00	Monzonite
SD-04-10	38.10	41.15	3.05	Monzonite
SD-04-10	41.15	44.20	3.05	Monzonite
SD-04-10	44.20	47.24	3.04	Monzonite
SD-04-10	47.24	50.29	3.05	Monzonite
SD-04-10	50.29	53.34	3.05	Monzonite
SD-04-10	53.34	56.39	3.05	Monzonite
SD-04-10	56.39	59.44	3.05	Monzonite
SD-04-10	59.44	62.48	3.04	Monzonite
SD-04-10	62.48	65.53	3.05	Monzonite
SD-04-10	65.53	68.58	3.05	Monzonite
SD-04-10	68.58	71.63	3.05	Monzonite
SD-04-10	71.63	74.68	3.05	Monzonite
SD-04-10	74.68	77.72	3.04	Monzonite
SD-04-10	77.72	80.77	3.05	Monzonite
SD-04-10	80.77	83.82	3.05	Monzonite
SD-04-10	83.82	86.87	3.05	Monzonite
SD-04-10	86.87	89.92	3.05	Monzonite
SD-04-10	89.92	92.96	3.04	Monzonite
SD-04-10	92.96	96.01	3.05	Augite Porphyry Dyke
SD-04-10	96.01	99.06	3.05	Monzonite
SD-04-10	99.06	102.11	3.05	Plagioclase Porphry Intrusive
SD-04-10	102.11	105.16	3.05	Plagioclase Porphry Intrusive
SD-04-10	105.16	108.20	3.04	Augite Porphyry Dyke
SD-04-10	108.20	111.25	3.05	Breccia
SD-04-10	111.25	114.30	3.05	Breccia
SD-04-10	114.30	117.35	3.05	Breccia
SD-04-10	117.35	120.40	3.05	Breccia
SD-04-10	120.40	123.44	3.04	Breccia
SD-04-10	123.44	126.49	3.05	Breccia
SD-04-10	126.49	129.54	3.05	Breccia

ISRM Strengths from Exploration Borehole Logs

Minimum and Average Strength Values

In some boreholes, there are instances where the geotechnical interval was assigned more than one ISRM value (see example below).

The lower value ISRM strength was selected and applied to each interval.

BH ID	From (m)	To (m)	Length (m)	Lithology	Lithology Group	Recover (m)	Recovery - Length (m)	Percent Recovery (%)	Recovery > 100%?	RQD (m)	Percent RQD (%)	RQD > 100% ?	Fracters (per run)	Fractures (per run) corrected	Fracture Spacing (m)	Strength	empty	Alteraation	Comments	Fracture Condition	R0	R1	R2
SD-04-11	87.17	90.22	3.05	Breccia	Breccia	3.04		99.67%		2.60	85.25		25	25	0.1216	R5				5			
SD-04-11	90.22	93.27	3.05	Breccia	Breccia	2.90		95.08%		2.63	86.23		13	13	0.223077	R5				10			
SD-04-11	93.27	96.32	3.05	Plagioclase Porphry Intrusive	Dyke	3.05		100.00%		2.73	89.51		35	35	0.087143	R2/R5				12			2
SD-04-11	96.32	99.36	3.04	Plagioclase Porphry Intrusive	Dyke	2.80		92.11%		2.18	71.71		>50	63.84	0.04386	R1/R2/R5			R1 98.20-98.26	0		1	2
SD-04-11	99.36	102.41	3.05	Plagioclase Porphry Intrusive	Dyke	3.04		99.67%		2.41	79.02		>50	64.05	0.047463	R5			WEATHERING	5			
SD-04-11	102.41	105.46	3.05	Plagioclase Porphry Intrusive	Dyke	2.70		88.52%		2.53	82.95		20	20	0.135	R5				18			
SD-04-11	105.46	108.51	3.05	Plagioclase Porphry Intrusive	Dyke	3.01		98.69%		2.73	89.51		20	20	0.1505	R5				18			
SD-04-11	108.51	111.56	3.05	Plagioclase Porphry Intrusive	Dyke	2.92		95.74%		2.82	92.46		15	15	0.194667	R5				14			
SD-04-11	111.56	114.60	3.04	Plagioclase Porphry Intrusive	Dyke	2.75		90.46%		2.10	69.08		30	30	0.091667	R5				14			
SD-04-11	114.60	117.65	3.05	Plagioclase Porphry Intrusive	Dyke	3.05		100.00%		2.88	94.43		14	14	0.217857	R5				20			
SD-04-11	117.65	120.70	3.05	Plagioclase Porphry Intrusive	Dyke	2.98		97.70%		2.73	89.51		18	18	0.165556	R5				20			
SD-04-11	120.70	123.75	3.05	Plagioclase Porphry Intrusive	Dyke	2.84		93.11%		2.38	78.03		25	25	0.1136	R5				10			
SD-04-11	123.75	126.80	3.05	Plagioclase Porphry Intrusive	Dyke	2.91		95.41%		2.68	87.87		21	21	0.138571	R5				14			
SD-04-11	126.80	129.84	3.04	Plagioclase Porphry Intrusive	Dyke	3.01		99.01%		2.56	84.21		24	24	0.125417	R5				18			
SD-04-11	129.84	132.89	3.05	Plagioclase Porphry Intrusive	Dyke	2.88		94.43%		2.50	81.97		44	44	0.065455	R5				16			
SD-04-11	132.89	135.94	3.05	Plagioclase Porphry Intrusive	Dyke	3.05		100.00%		2.77	90.82		13	13	0.234615	R5				17			
SD-04-11	135.94	138.99	3.05	Plagioclase Porphry Intrusive	Dyke	2.95		96.72%		2.82	92.46		14	14	0.210714	R5				16			
SD-04-11	138.99	142.04	3.05	Plagioclase Porphry Intrusive	Dyke	3.05	0.00	100.00%		2.73	89.51		9	9	0.338889	R5				17			
SD-04-11	142.04	145.08	3.04	Plagioclase Porphry Intrusive	Dyke	2.99		98.36%		2.52	82.89		>50	63.84	0.046836	R5				16			
SD-04-11	145.08	148.13	3.05	Plagioclase Porphry Intrusive	Dyke	2.95		96.72%		2.52	82.62		22	22	0.134091	R5				15			
SD-04-11	148.13	151.18	3.05	Plagioclase Porphry Intrusive	Dyke	3.05		100.00%		2.56	83.93		35	35	0.087143	R5				17			
SD-04-11	151.18	154.23	3.05	Plagioclase Porphry Intrusive	Dyke	3.05	0.00	100.00%		2.78	91.15		>50	64.05	0.047619	R5				18			
SD-04-11	154.23	157.28	3.05	Plagioclase Porphry Intrusive	Dyke	3.05		100.00%		2.43	79.67		>50	64.05	0.047619	R5/R0			SM AMT OF GOU	0	0		

Lithological Groupings

Lithologies logged within the exploration boreholes were grouped according the major lithologic units identified in the geologic map by Rees 2013.

Description	Lithology Grouping (based on Rees 2013)	Description	Lithology Grouping (based on Rees 2013)
Breccia	**Breccia**	Diorite Dyke	**Dyke**
Magnetite Breccia		Quartzite	
Volcanic Breccia		Altered Diorite or Quartz Diorite	
Intrusive Breccia		Monzodiorite Dyke	
Jigsaw Breccia		Plagioclase Porphry Intrusive	
Polymictic Breccia		Plagioclase Porphry Intrusive	
Fragment Breccia		Granite	
Intrusive Breccia		Volcanic	
Brecciated Monzonite			
Brecciated Monzodiorite		Basalt	
Diorite	**Diorite**	Fault	**Fault**
		Fault Breccia	
Quartz Diorite		Overburden	**Ignore**
		Casing	
		End of Hole	
Vein	**Dyke**	Monzonite	**Monzodiorite**
Dyke			
Mafic Dyke		Monzodiorite	
White granite dyke (Alaskite)			
Augite Porphyry Dyke			
Plagioclase Porphry Intrusive		Quartz Monzonite	
Mafic Dyke		Limestone	**Other**
Dyke		Skarn	
Monzonite Dyke		Tuff	
No Lithology Available	**Unknown**	Unknown	**Unknown**

Minimum RMR_{76} Displayed by Total Length Logged

Filtered by Lithology Group

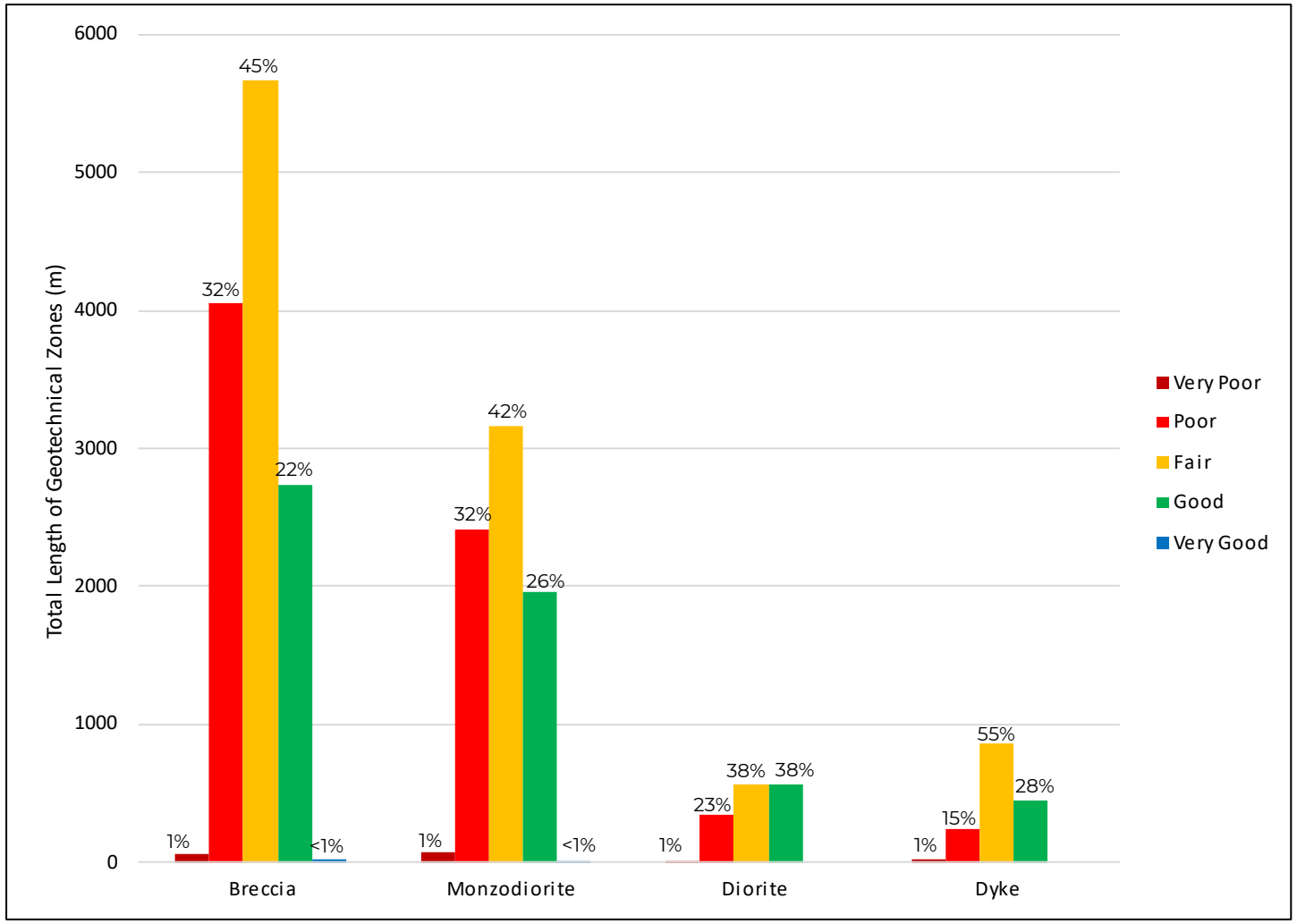

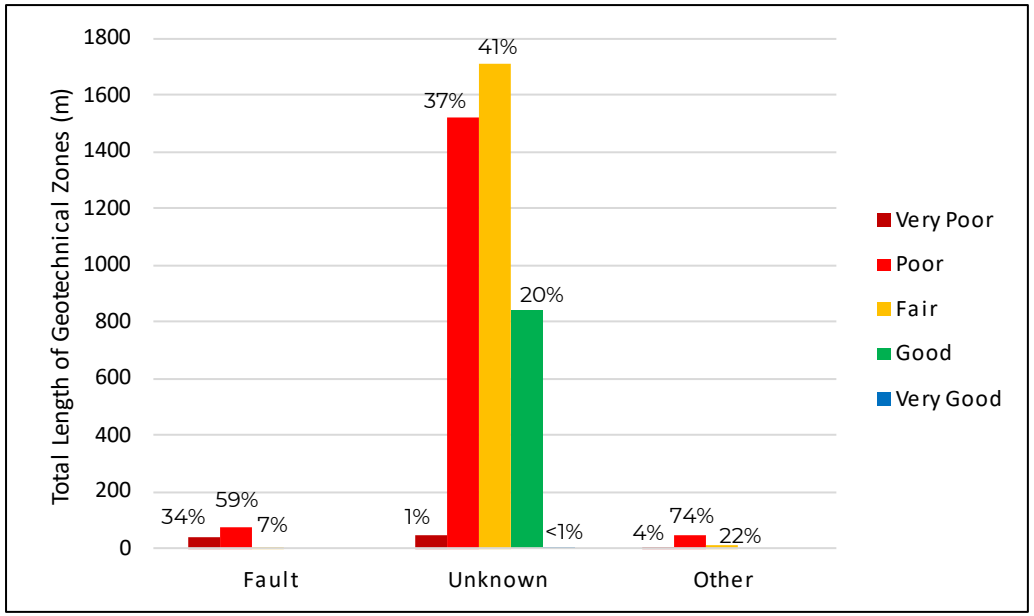

RMR_{76} Description and Corresponding Value Range
Very Poor Rock (0 - 20)
Poor Rock (21 – 40)
Fair Rock (41 – 60)
Good Rock (61 – 80)
Very Good Rock (81 – 100)

Minimum RMR_{76} Displayed by Percent Lithology Recovered

Shown by each Lithology Group

Values using the minimum field estimate rock strength indicate that rock strength is Poor to Good quality.

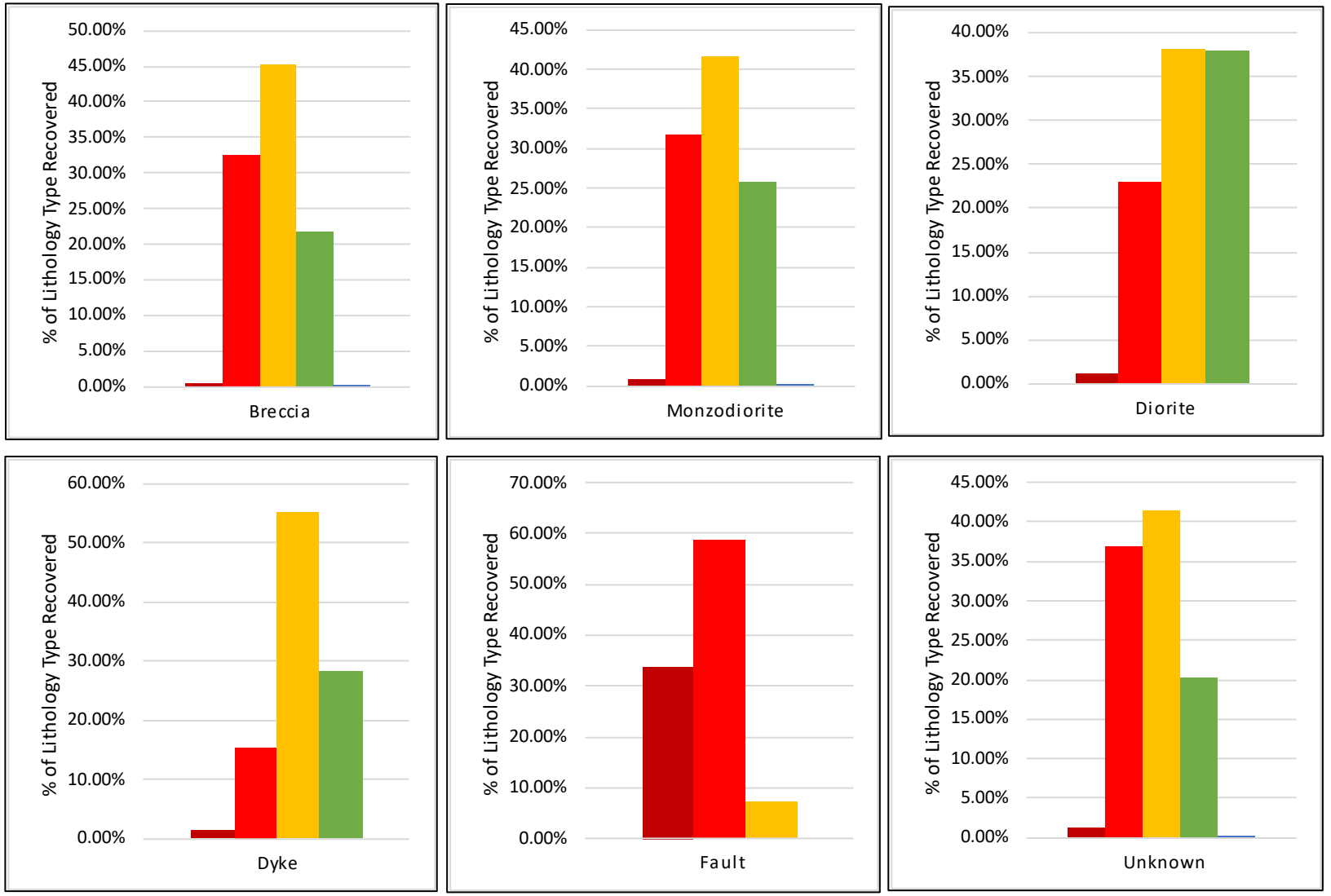

2016 LOM vs. 2024 LOM Assessment of RMR_{76}

Overall, the RMR_{76} values calculated using the updated dataset are similar to those calculated for the 2016 review (Golder 2016).

Rock Group	Average RMR from Exploration Boreholes 2016 LOM	Average Minimum RMR 2024 LOM
Breccia	55 (Fair Rock)	49 (Fair Rock)
Diorite	57 (Fair Rock)	53 (Fair Rock)
Monzodiorite	53 (Fair Rock)	49 (Fair Rock)
Dykes	Not Reviewed	53 (Fair Rock)
Faults	Not Reviewed	24 (Poor Rock)

The review and comparison of the RMR_{76} assessment indicated the following.

- The Breccia group exhibits poor to good rock mass quality.
  - Although the average value calculated for Breccia was lower in the 2024 review, the rock group is still within the fair rock quality range.
- The Diorite rock exhibits fair and good rock mass quality.
  - Although the average value calculated for Diorite was lower in the 2024 review, the rock group is still within the fair rock quality range.
- The Monzodiorite group exhibits poor to good rock mass quality.
  - Although the average value calculated for Diorite was lower in the 2024 review, the rock group is still within the fair rock quality range.

The results of the RMR_{76} assessment indicate a similar distribution of RMR_{76} values between the major rock groups, i.e., ranging between poor to good rock mass quality with fair rock quality being dominant. However, data from the Diorite and Dyke rocks indicate mostly fair to good quality, and therefore indicating a comparatively better rock mass quality. As expected, the faults exhibit poor rock quality.

APPENDIX G

Kinematic Analyses

Presentation Summary

Kinematics Workflow

- Mapping data was compiled and flagged for feature scale (discontinuous versus continuous) and lithology.
- Sets were chosen using DIPS (RocScience) as presented in Appendix C.
- The DIPS software was then used to review the kinematic admissibility of planar, wedge, and toppling failure mechanisms for each of the lithology and wall orientation combinations.
- Admissible mechanisms were selected then modelled using RocScience's Swedge and RocPlane.
- As there are no available laboratory tests completed on structural features at Mount Polley Mine, the Barton-Bandis relationship for discontinuity strength was used based on the compiled mapping data from 2008, 2009, 2010, 2014, 2015, and 2023.
- Single and double bench configurations were reviewed for the proposed ultimate pit design.
- Modelling structural set names were assigned as follows:

Key:

Rock Type_Pit_Set Differentiator_Feature Scale (Discontinuous or Continuous)

Example:

MZD_SP/WX_1A_D

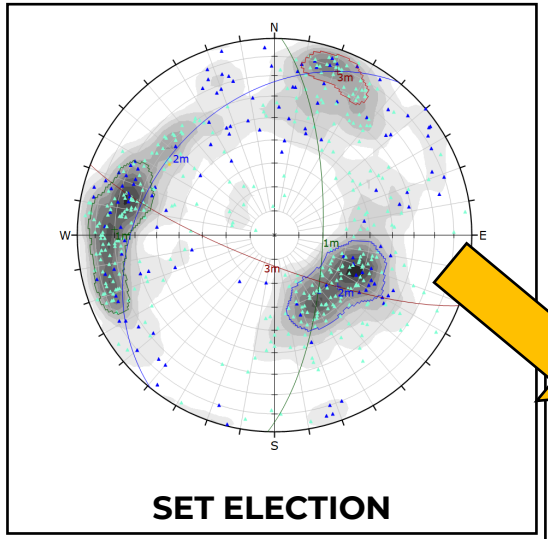

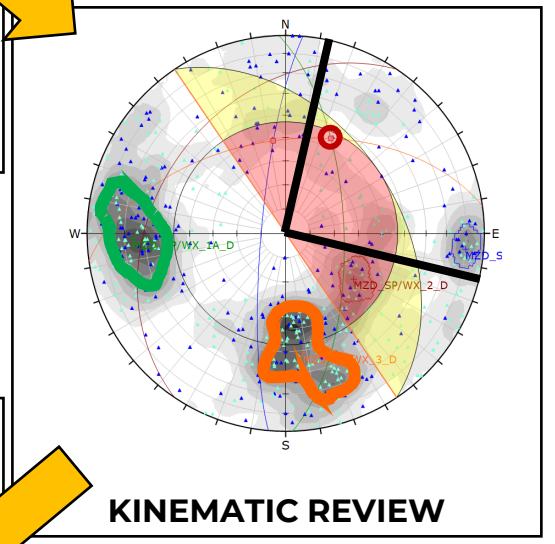

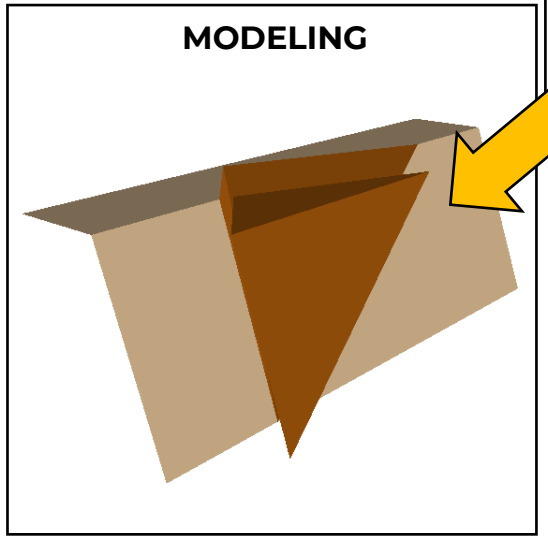

Springer & WX Pits

Monzodiorite Discontinuous

Discontinuous sets within the Monzodirite for the WX and Springer Pits are moderate to steeply dipping.

There are 4 wall orientations within the Springer and WX Pits that will be reviewed kinematically for these sets.

Based on the data available, planar, wedge, and toppling failures are possible.

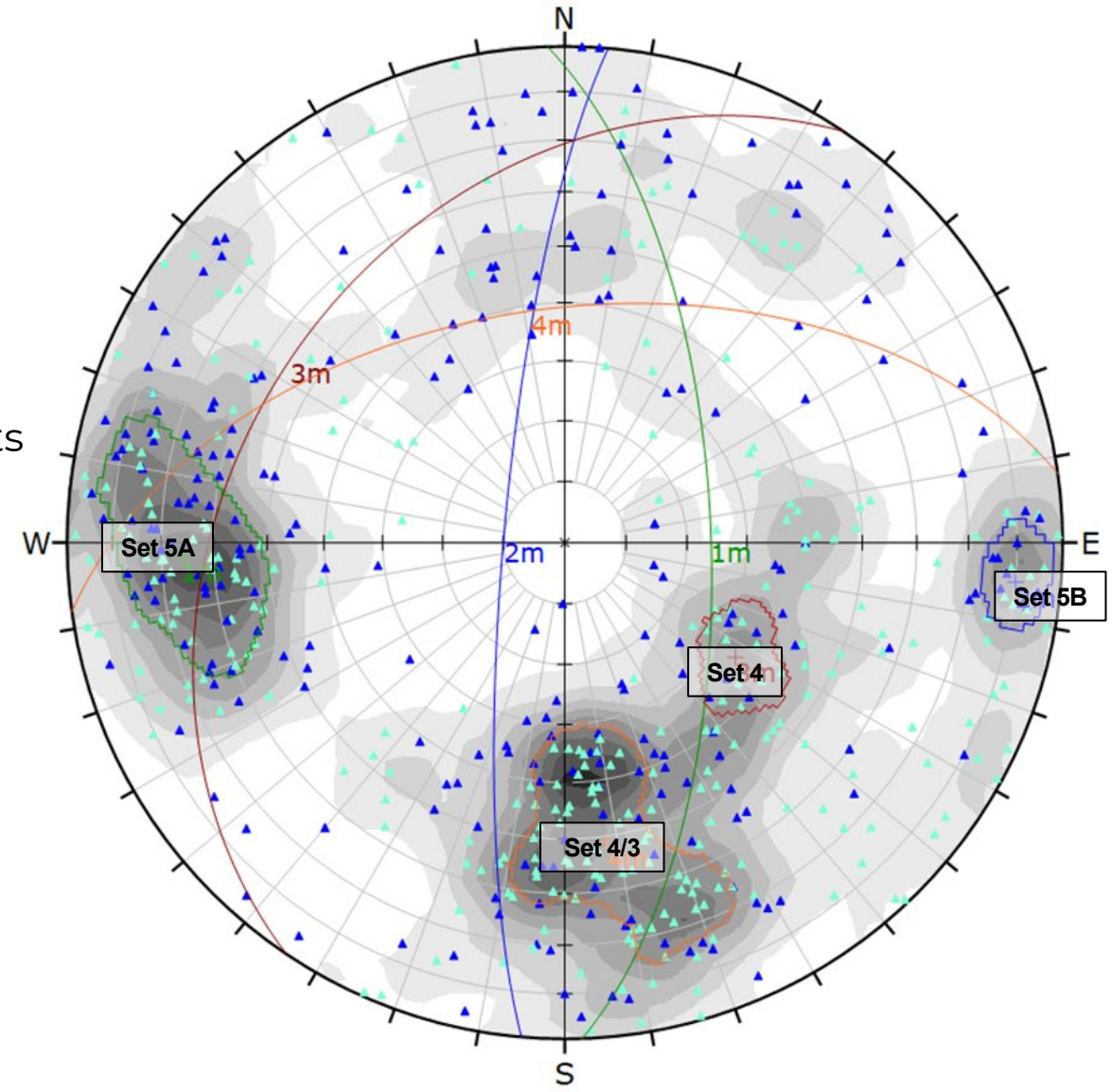

Symbol	GROUPED TYPE	Quantity
▲	Joint	243
△	Photogrammetry	296

Color	Density Concentrations
	0.00 - 0.50
	0.50 - 1.00
	1.00 - 1.50
	1.50 - 2.00
	2.00 - 2.50
	2.50 - 3.00
	3.00 - 3.50
	3.50 - 4.00
	4.00 - 4.50
	4.50 - 5.00

Contour Data	Pole Vectors
Maximum Density	4.68%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		66	88	SP_WX_MZD_D_1
2m		80	275	SP_WX_MZD_D_2
3m		34	304	SP_WX_MZD_D_3
4m		51	352	SP_WX_MZD_D_4

Plot Mode	Pole Vectors
Vector Count	539 (539 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer & WX Pits – Monzodiorite Discontinuous

Planar Review

Friction Angle (°)	42	Lateral Limit (°)	20

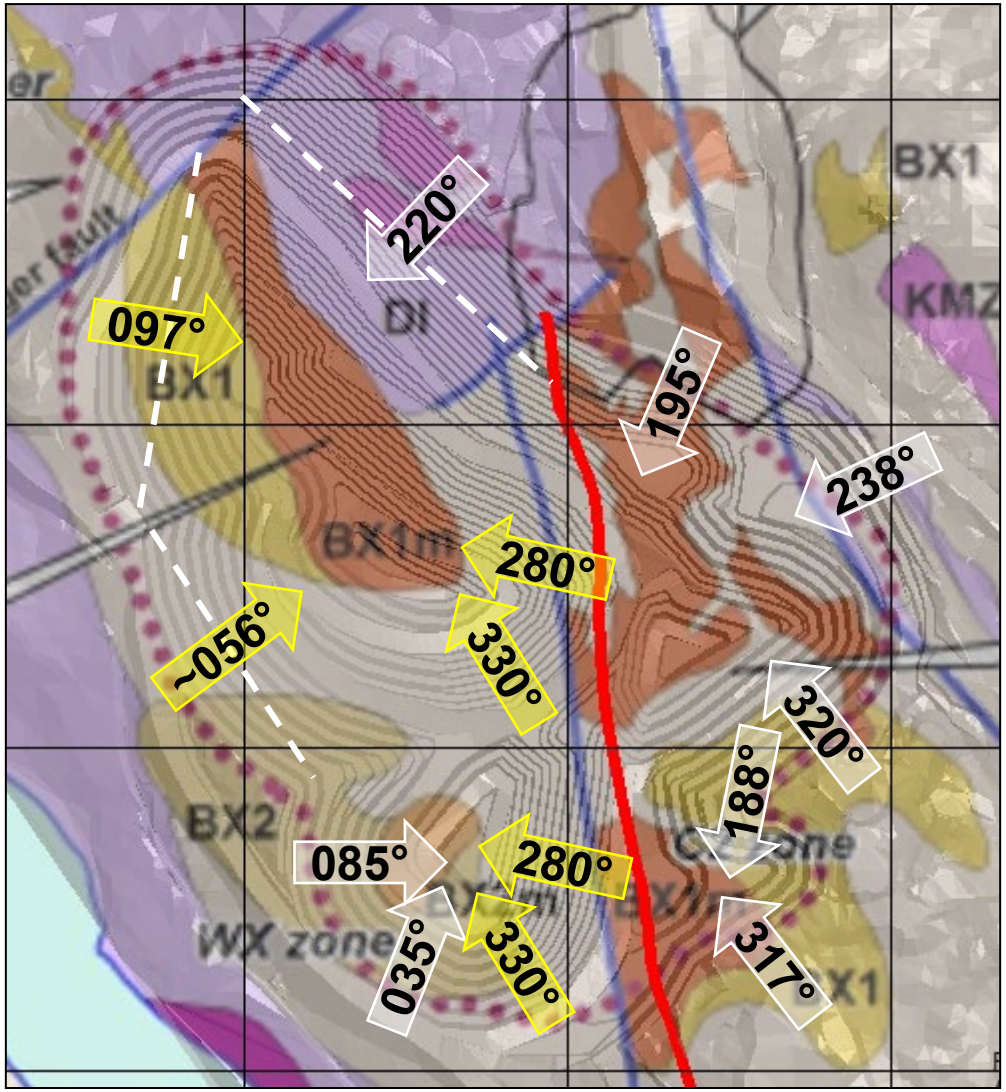

Wall Orientation: 056	Wall Orientation: 097
MZD_SP/WX_1A_D	*MZD_SP/WX_1A_D*
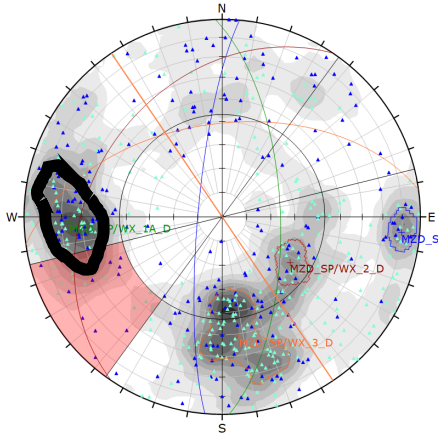	Chosen for Modeling 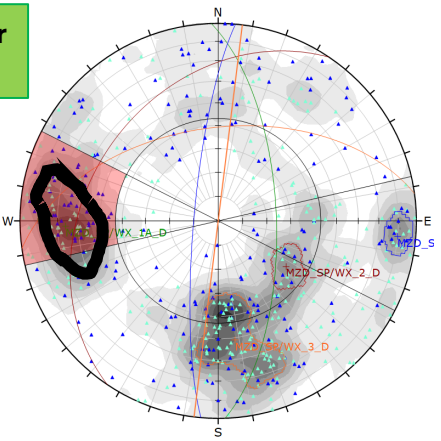
Wall Orientation: 280	**Wall Orientation: 330**
MZD_SP/WX_1B_D	*MZD_SP/WX_3_D*
Chosen for Modeling 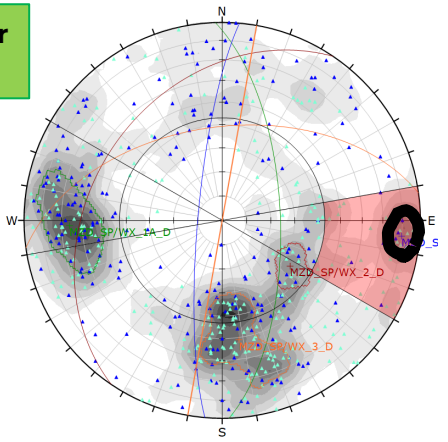	Chosen for Modeling 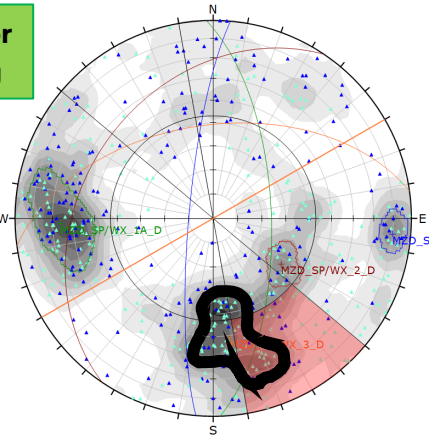

Springer & WX Pits – Monzodiorite Discontinuous

Wedge Review

Friction Angle (°)	42	Kinematic Window (°)	45

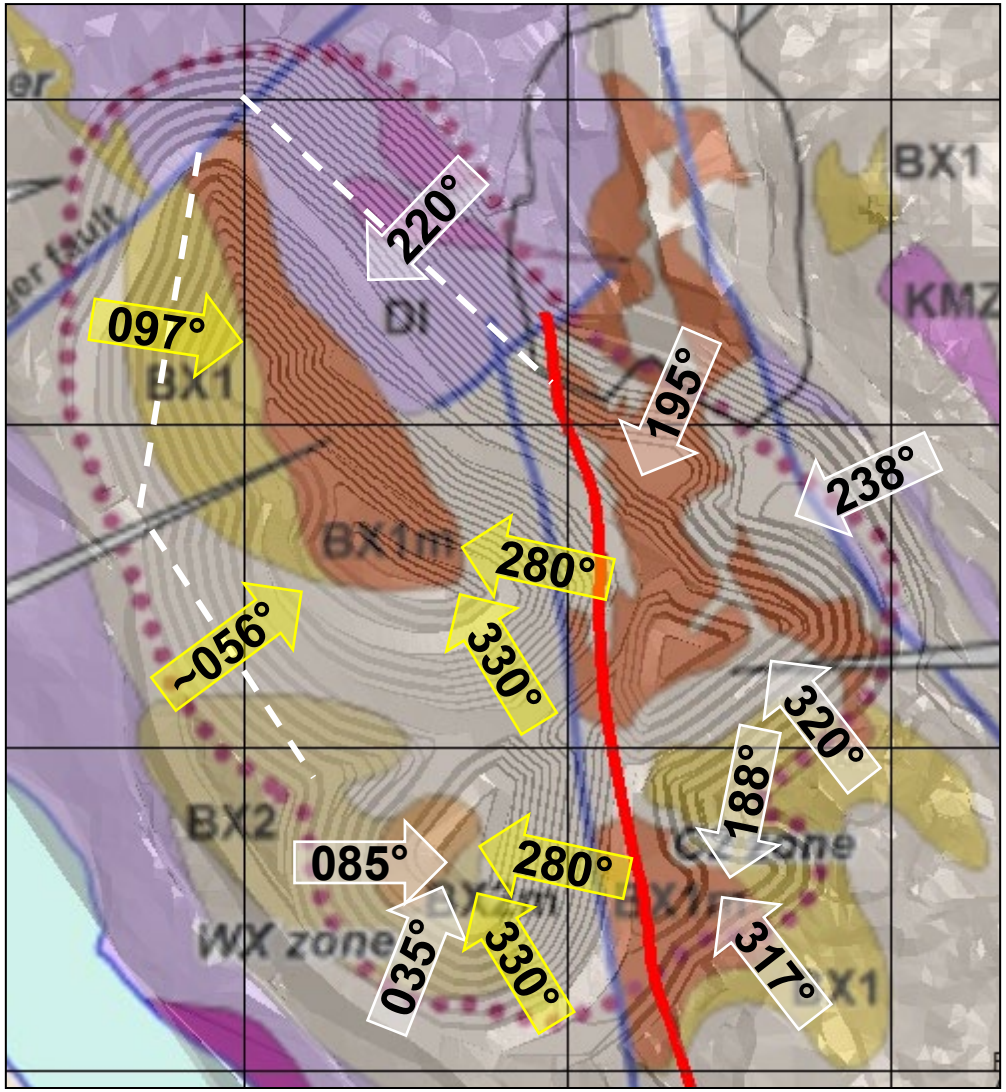

Wall Orientation: 056

MZD_SP/WX_1A_D & MZD_SP/WX_3_D

Chosen for Modeling

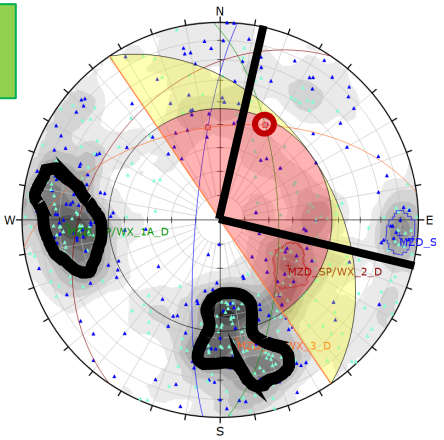

45° Admissibility Window

Wall Orientation: 097

No Sets.

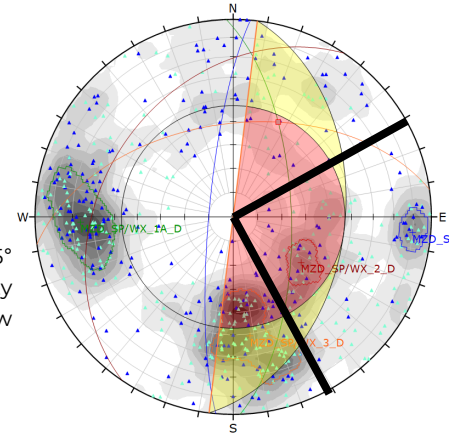

45° Admissibility Window

Wall Orientation: 280

No Sets.

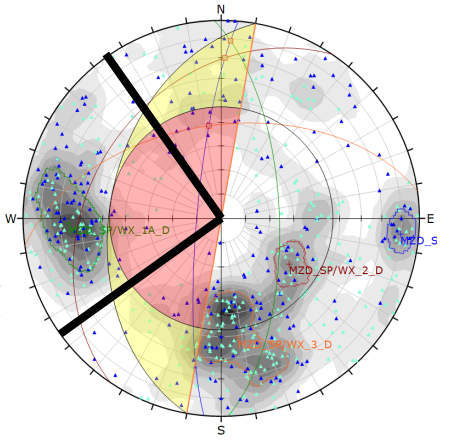

45° Admissibility Window

Wall Orientation: 330

MZD_SP/WX_1B_D & MZD_SP/WX_3_D

Chosen for Modeling

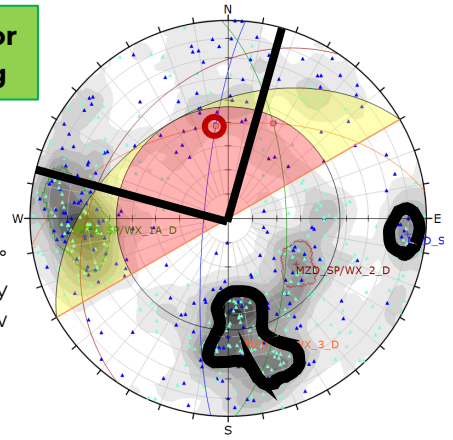

45° Admissibility Window

Springer & WX Pits – Monzodiorite Discontinuous

Toppling Review

Friction Angle (°)	42	Lateral Limit (°)	20

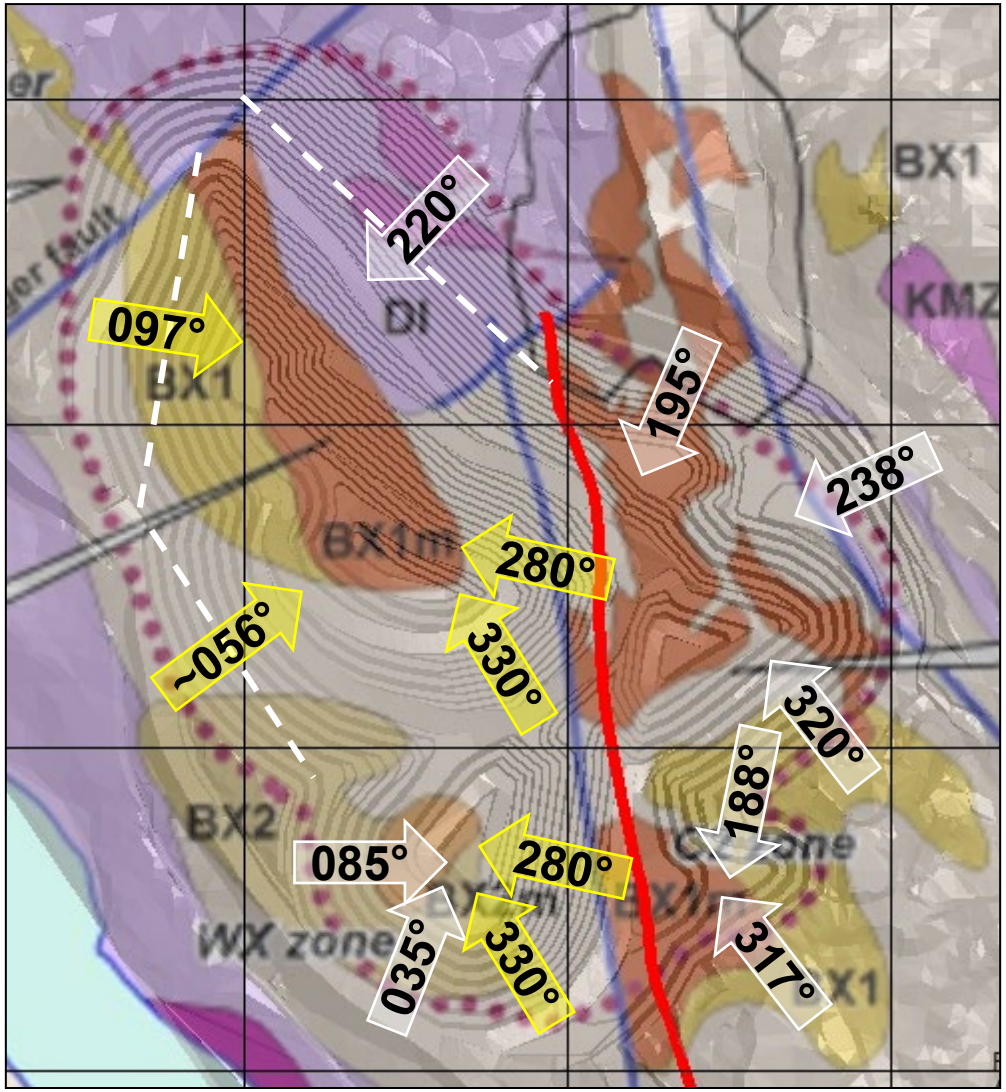

Wall Orientation: 056	Wall Orientation: 097
MZD_SP/WX_1A_D (Direct), MZD_SP/WX_3_D (Oblique)	*No Sets.*
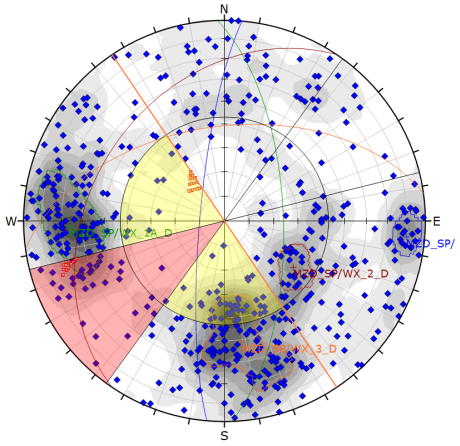	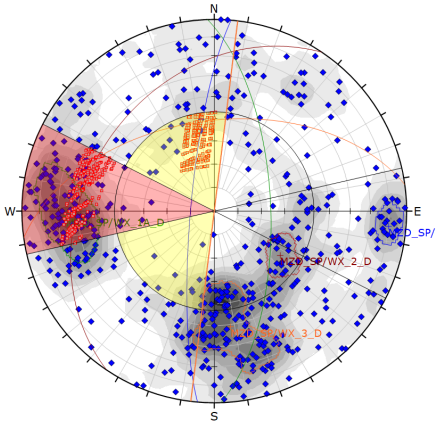
Wall Orientation: 280	**Wall Orientation: 330**
No Sets.	*No Sets.*
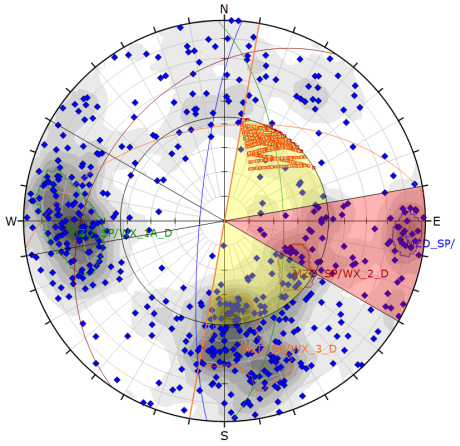	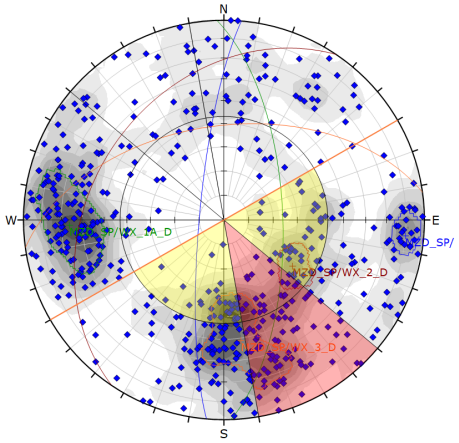

Springer & WX Pits

Monzodiorite Continuous

Continuous sets within the Monzodirite for the WX and Springer Pit are steeply dipping.

There are 4 wall orientations within the Springer and WX Pits that will be reviewed kinematically for these sets.

Based on the data available, planar, wedge, and toppling failures are possible.

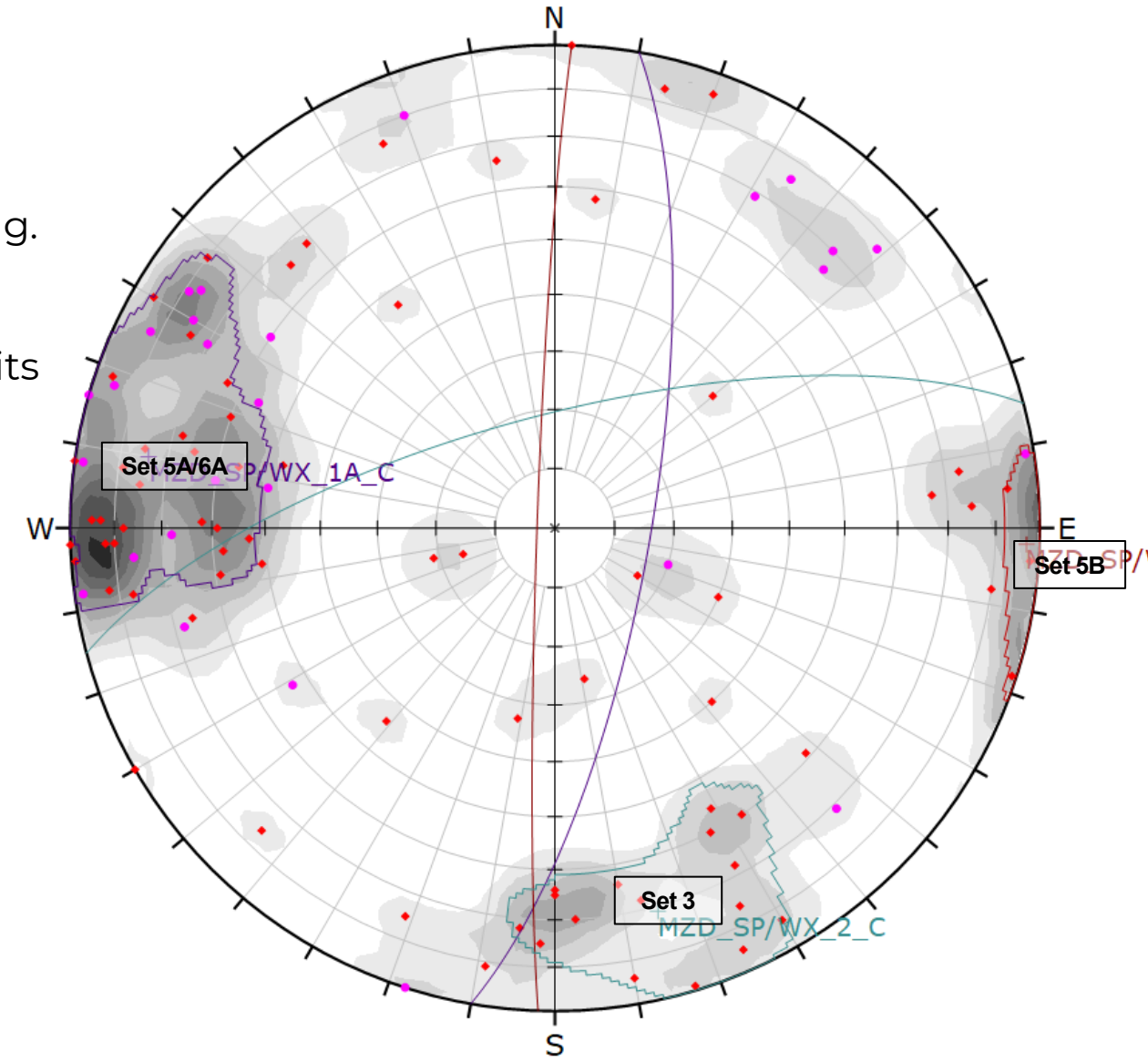

Symbol	GROUPED TYPE	Quantity
	Dyke	27
	Fault	77

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.20%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		74	100	MZD_SP/WX_1A_(
2m		71	345	MZD_SP/WX_2_C
3m		87	272	MZD_SP/WX_1B_(

Plot Mode	Pole Vectors
Vector Count	104 (104 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer & WX Pits – Monzodiorite Continuous

Planar Review

Friction Angle (°)	28	Lateral Limit (°)	20

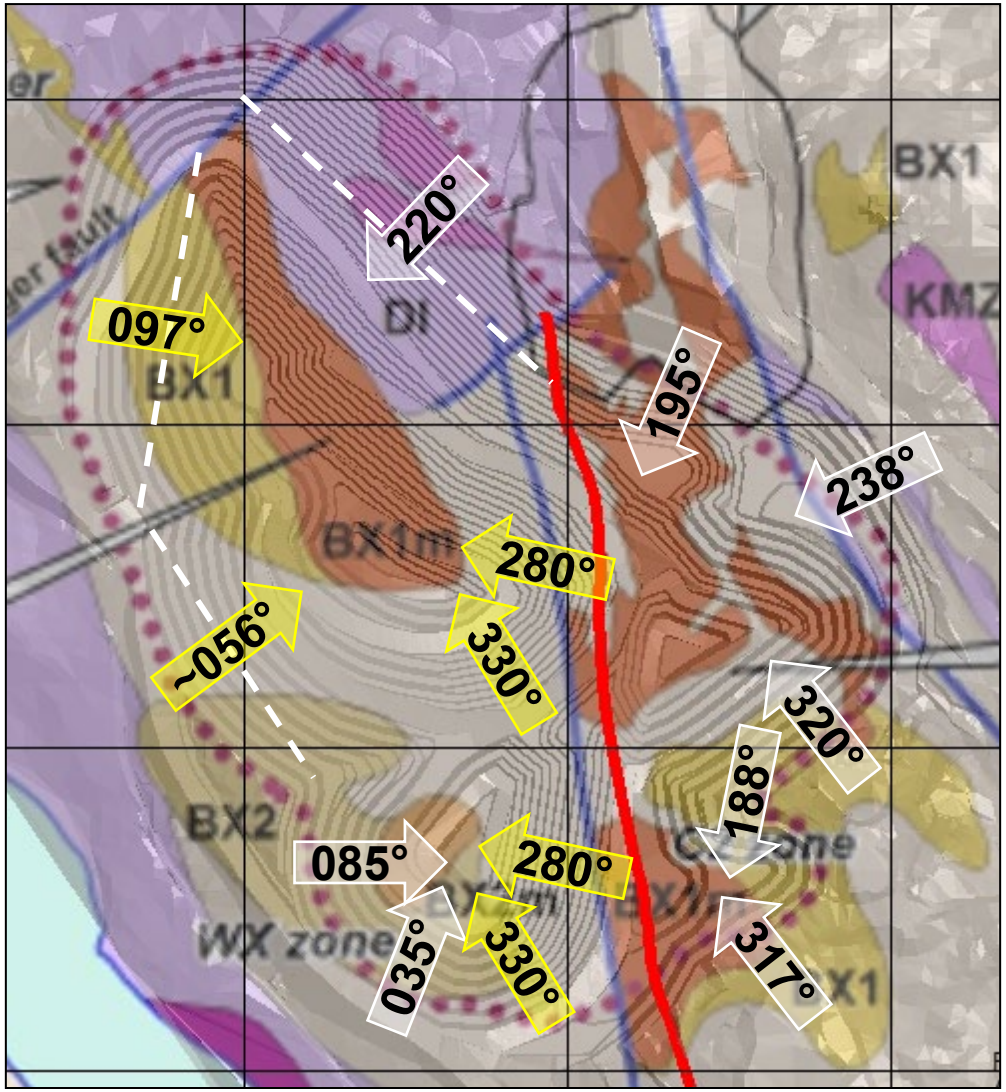

Wall Orientation: 056

No Sets.

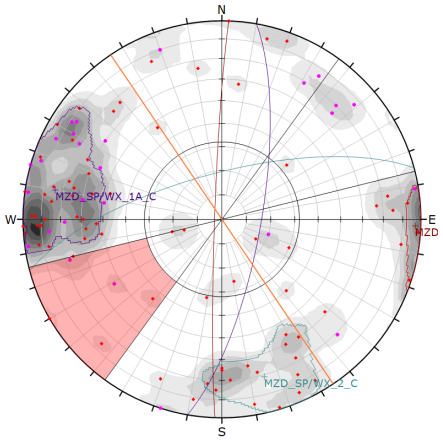

Wall Orientation: 097

MZD_SP/WX_1A_C

Chosen for Modeling

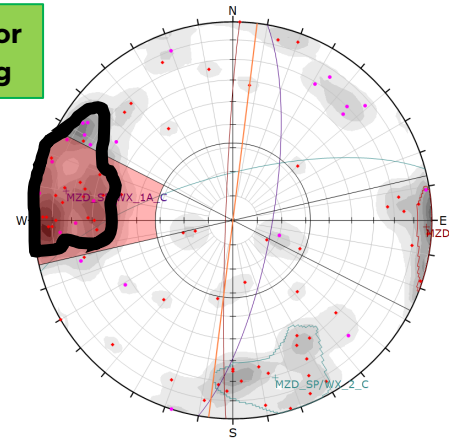

Wall Orientation: 280

MZD_SP/WX_1B_C

Chosen for Modeling

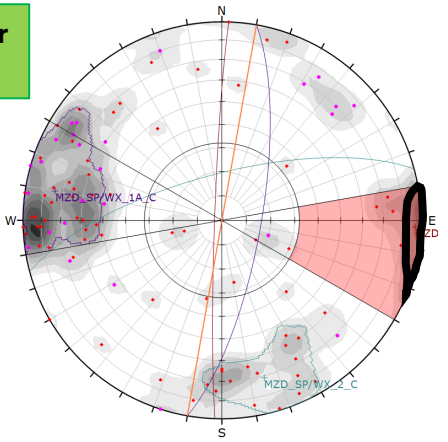

Wall Orientation: 330

MZD_SP/WX_2_C

Chosen for Modeling

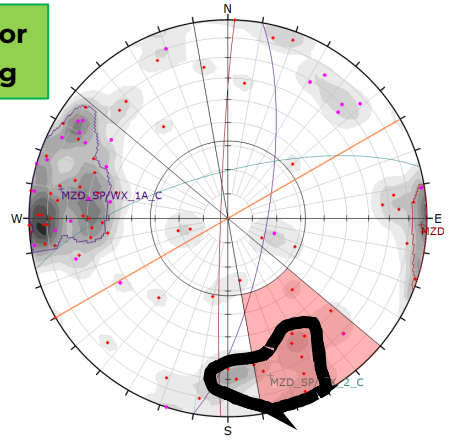

Springer & WX Pits – Monzodiorite Continuous

Wedge Review

Friction Angle (°)	28	Kinematic Window (°)	45

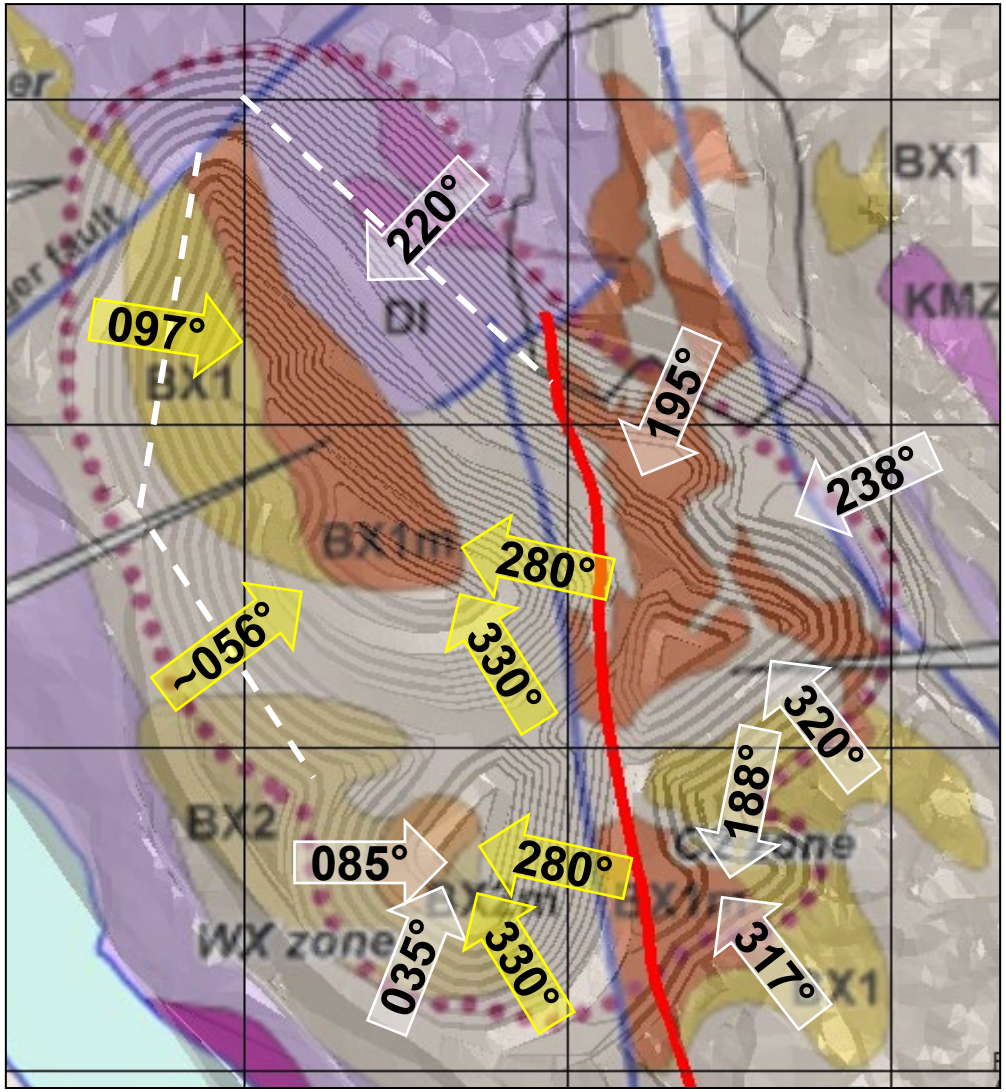

Wall Orientation: 056

MZD_SP/WX_1A_C & MZD_SP/WX_2_C

Chosen for Modeling

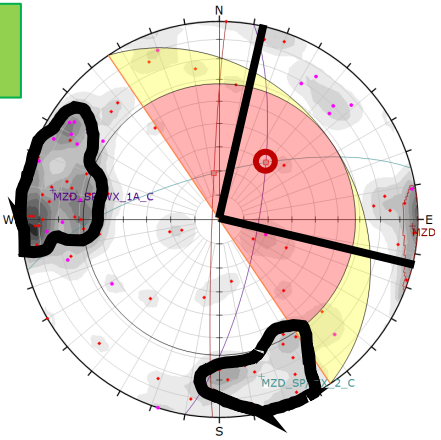

45° Admissibility Window

Wall Orientation: 097

No Sets.

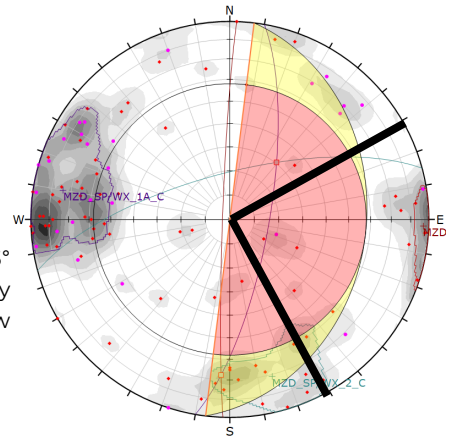

45° Admissibility Window

Wall Orientation: 280

No Sets.

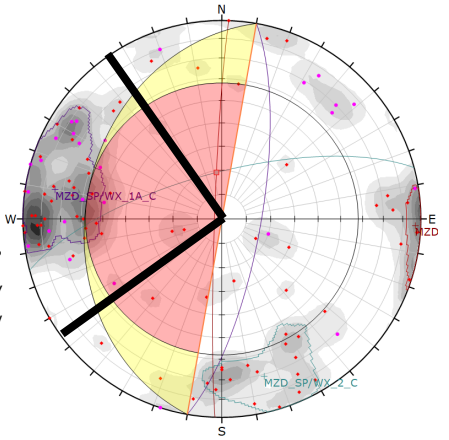

45° Admissibility Window

Wall Orientation: 330

MZD_SP/WX_1B_C & MZD_SP/WX_2_C

Chosen for Modeling

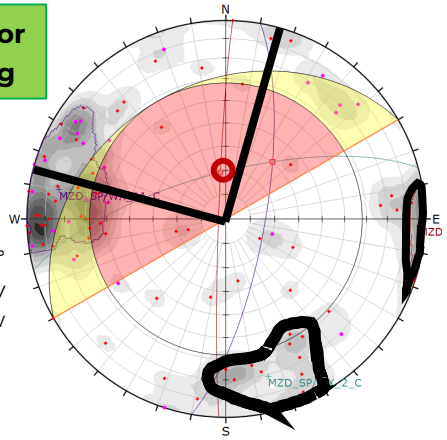

45° Admissibility Window

Springer & WX Pits – Monzodiorite Continuous

Toppling Review

Friction Angle (°)	28	Lateral Limit (°)	20

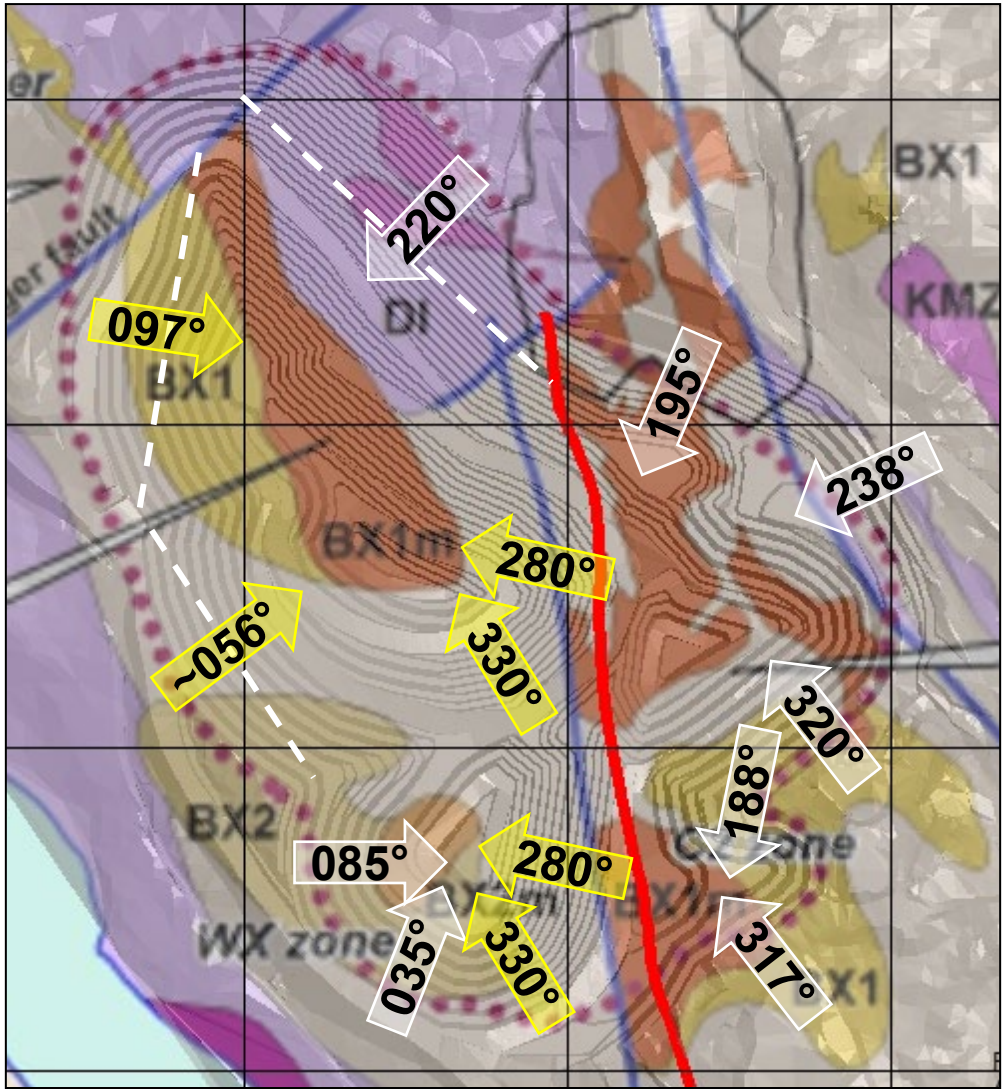

Wall Orientation: 056

No Sets.

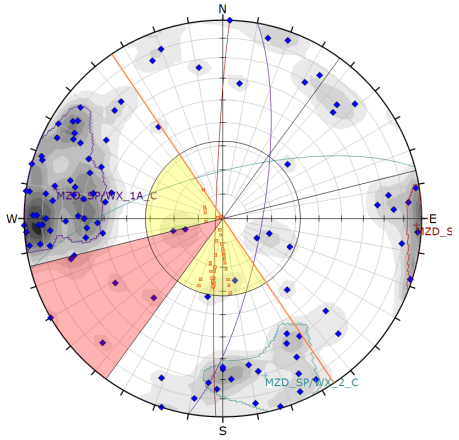

Wall Orientation: 097

No Sets.

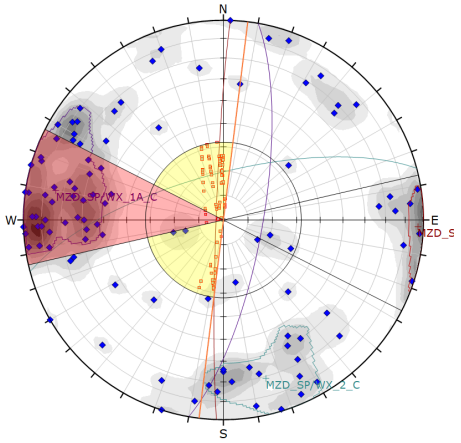

Wall Orientation: 280

No Sets.

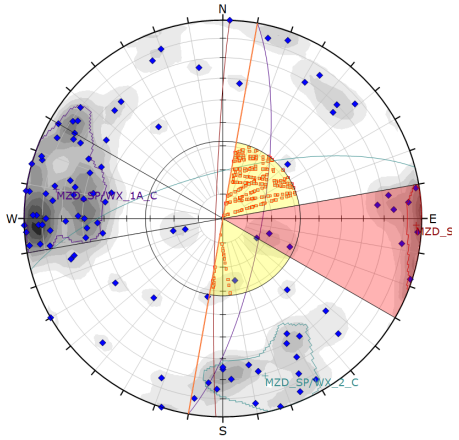

Wall Orientation: 330

No Sets.

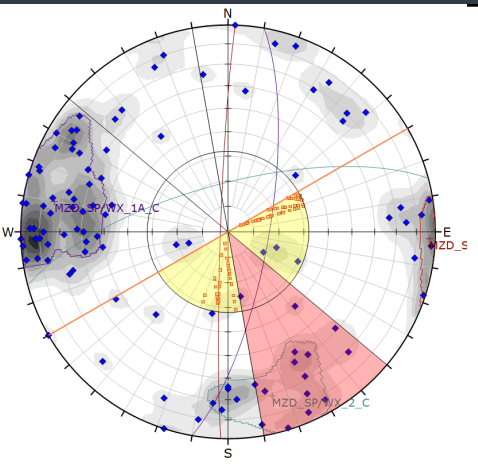

Springer Pit

Diorite Discontinuous

Discontinuous sets within the Diorite for the North Wall of Springer Pit have variable orientations.

Based on the data available, wedge failures are likely not of concern.

There is a steep southwest dipping set that may be of concern for planar and toppling failures.

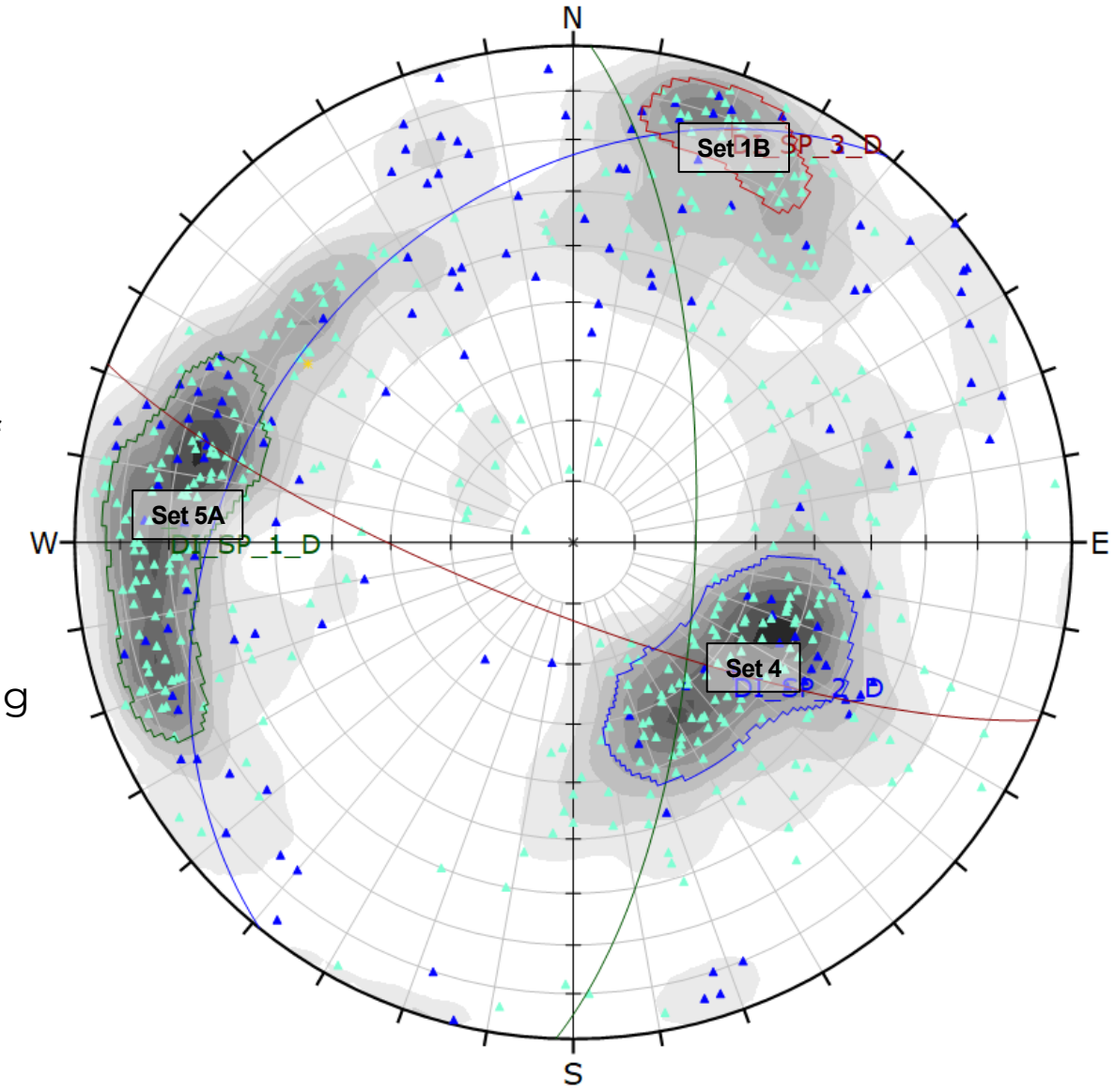

Symbol	GROUPED TYPE	Quantity
▲	Joint	135
▲	Photogrammetry	374
✳	Vein	1

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.70%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		70	92	DI_SP_1_D
2m		34	309	DI_SP_2_D
3m		78	201	DI_SP_3_D

Plot Mode	Pole Vectors
Vector Count	510 (510 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer Pit – Diorite Discontinuous

Northeast Wall – 220°

Friction Angle (°)	42
Planar Lateral Limit (°)	20
Wedge Kinematic Window (°)	45

Planar & Toppling Review

DI_SP_3_D (Planar) & No Sets (Toppling)

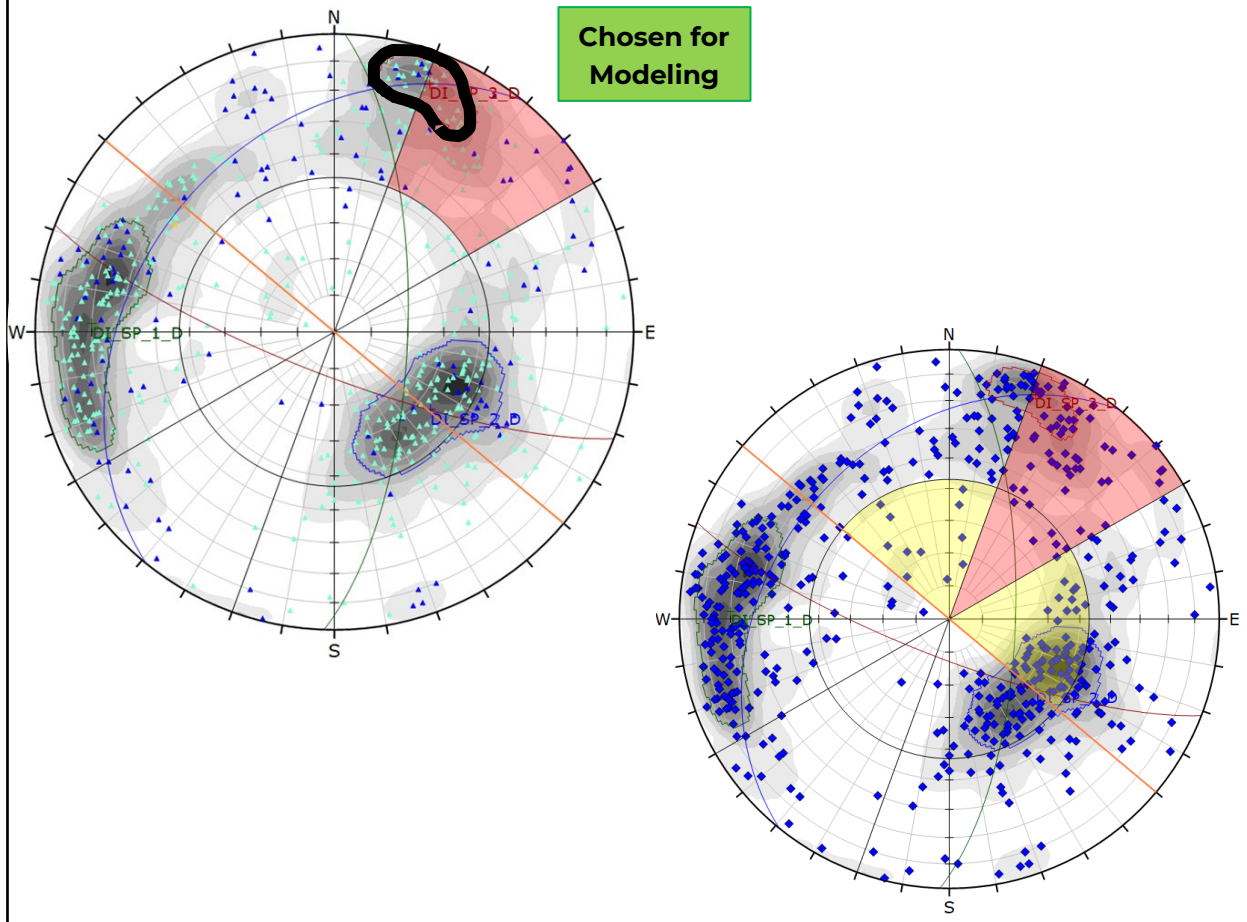

Wedge Review

No Sets.

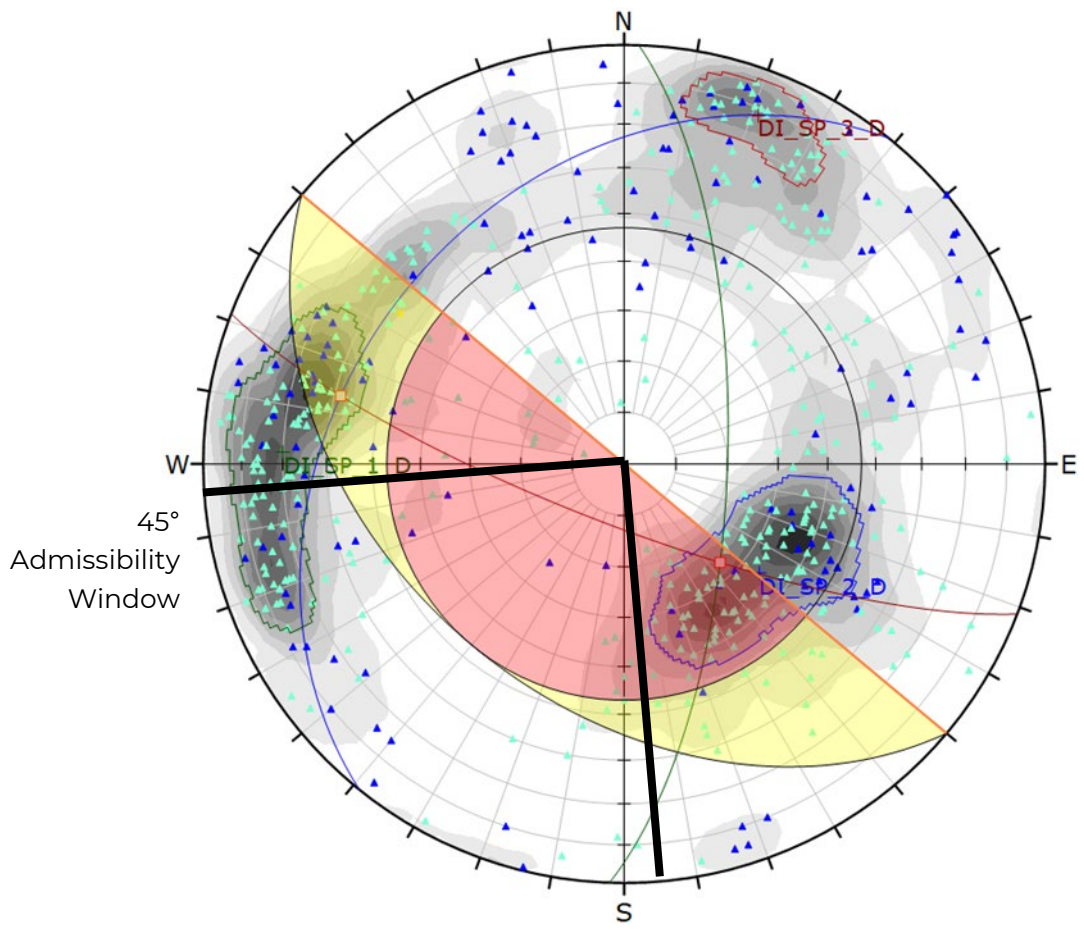

Springer Pit

Diorite Continuous

Continuous sets within the Diorite for the North Wall of Springer Pit are dipping into or oblique to the wall.

Based on the data available, planar failures are likely not of concern.

There is one wedge mechanism that may be of concern.

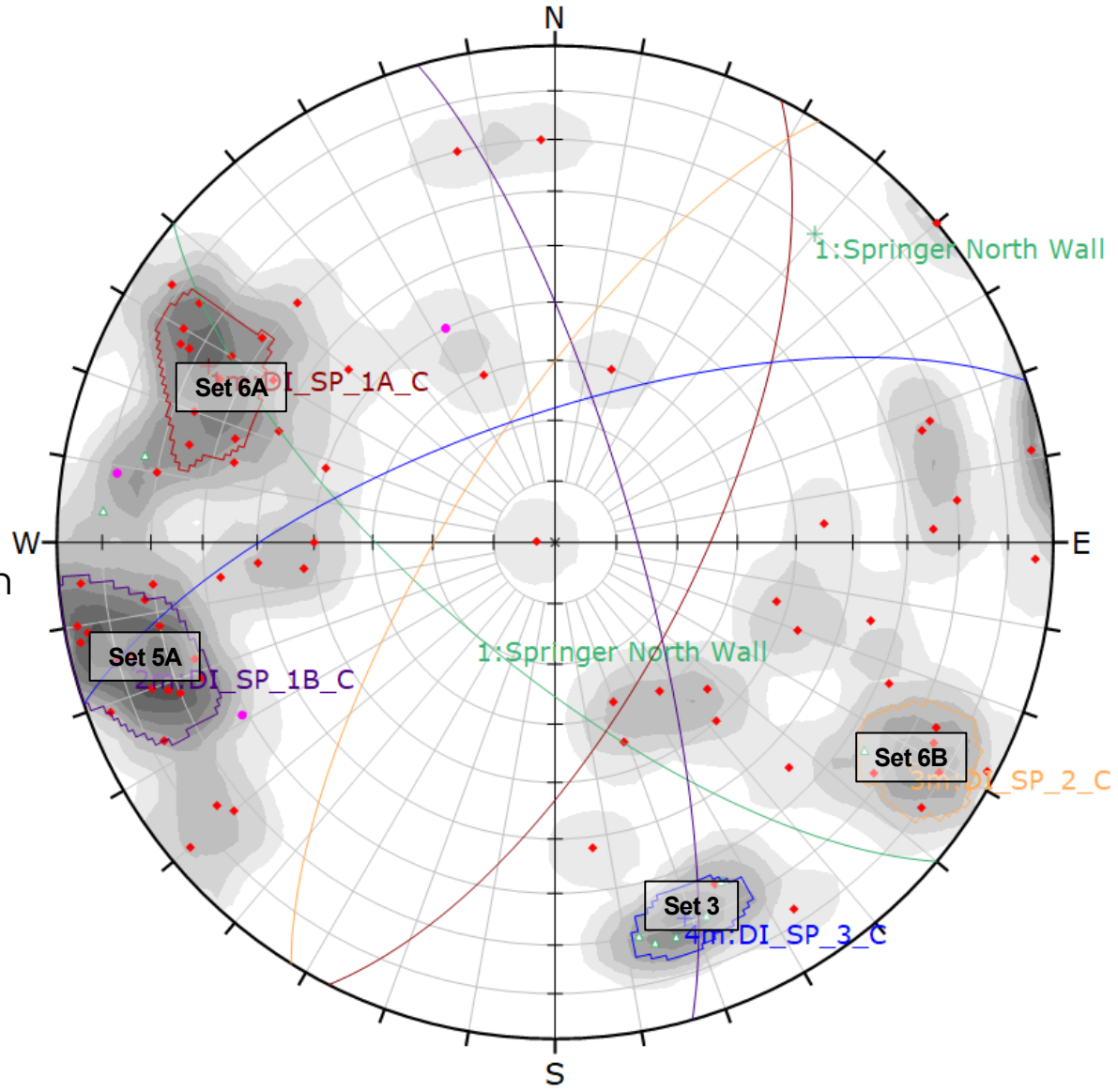

Symbol	GROUPED TYPE	Quantity
	Dyke	3
	Fault	73
	Major Structure	8

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.86%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
User Planes				
1		70	220	Springer North Wa
Mean Set Planes				
1m		67	117	DI_SP_1A_C
2m		77	74	DI_SP_1B_C
3m		73	302	DI_SP_2_C
4m		69	341	DI_SP_3_C

Plot Mode	Pole Vectors
Vector Count	84 (84 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer Pit – Diorite Continuous

Northeast Wall – 220°

Friction Angle (°)	28
Planar Lateral Limit (°)	20
Wedge Kinematic Window (°)	45

Planar & Toppling Review

No Sets (Planar or Toppling).

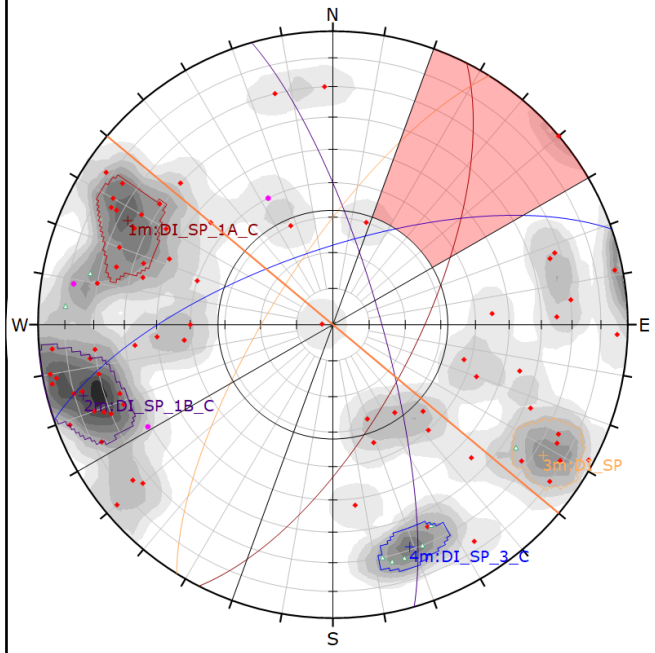

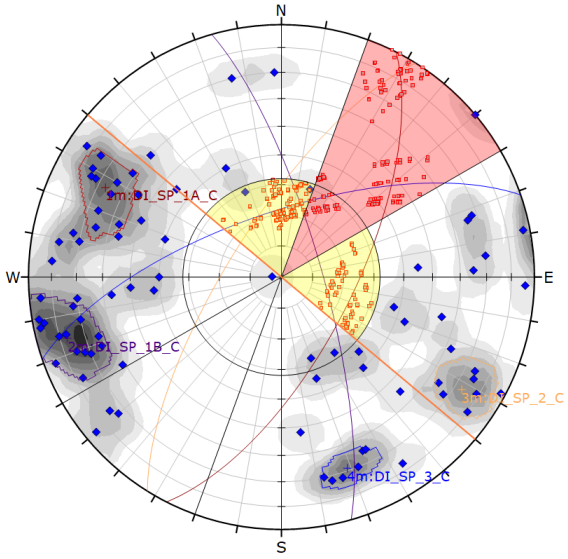

Wedge Review

No Sets.

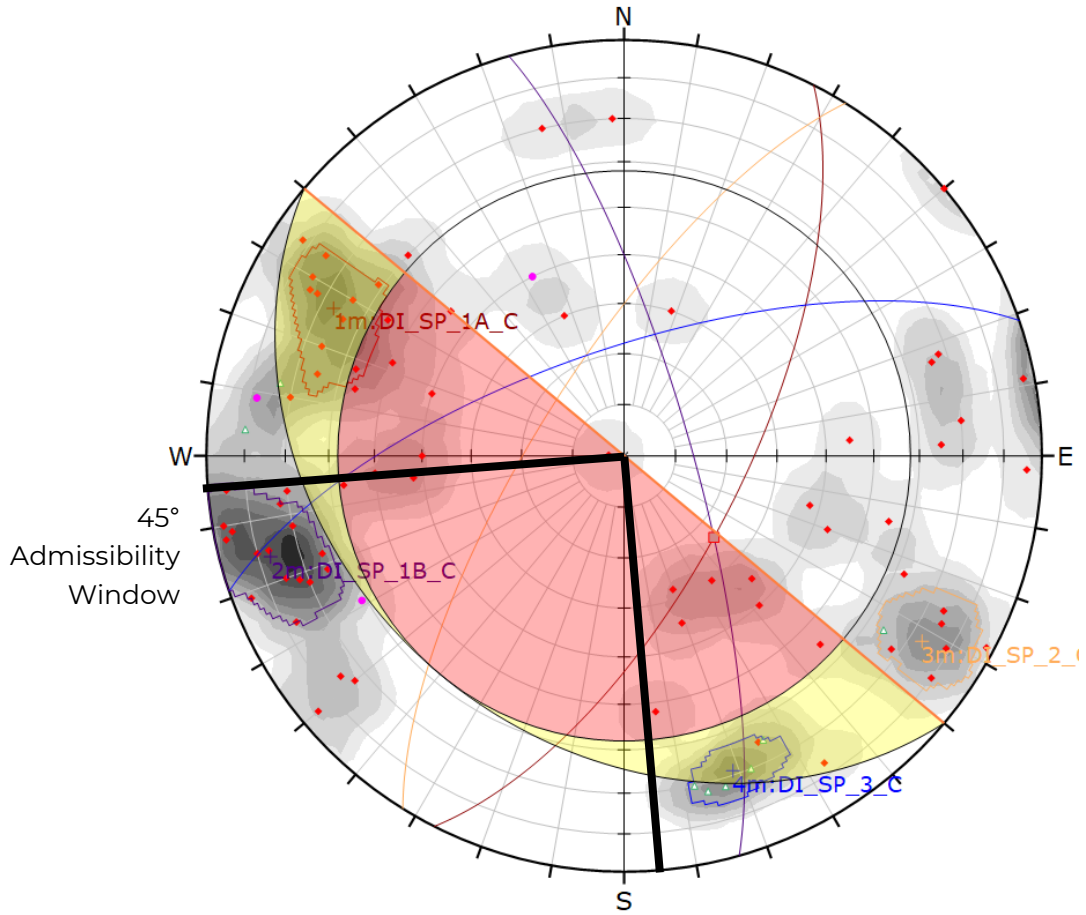

Springer & WX Pits

Breccia Discontinuous

Discontinuous sets within the Breccia for the WX and Springer Pit are variable.

There are 4 wall orientations within the Springer and WX Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge, planar, and toppling failures are possible.

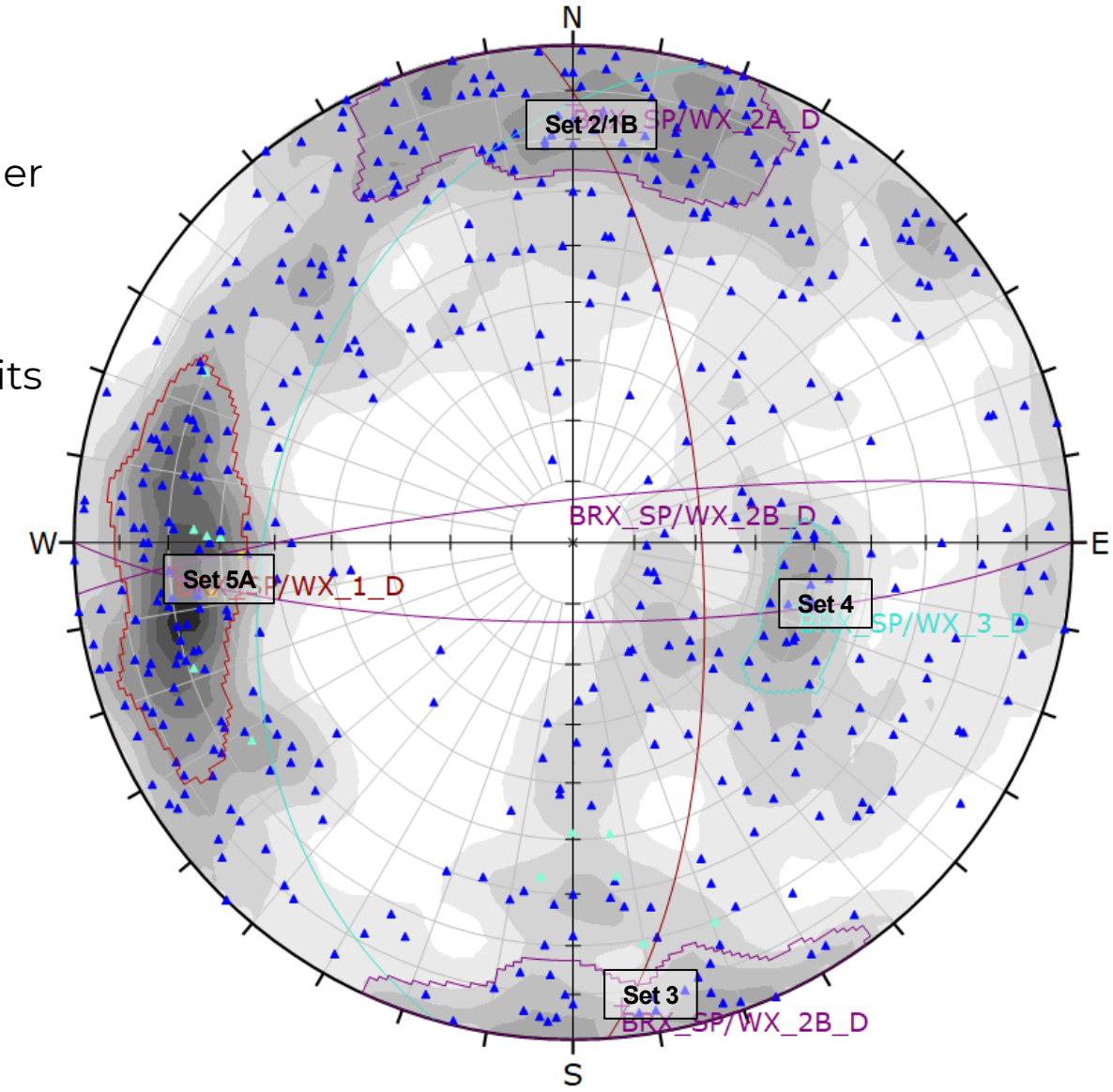

Symbol	GROUPED TYPE	Quantity
▲	Joint	462
▲	Photogrammetry	14
✳	Vein	2

Color	Density Concentrations
	0.00 - 0.45
	0.45 - 0.90
	0.90 - 1.35
	1.35 - 1.80
	1.80 - 2.25
	2.25 - 2.70
	2.70 - 3.15
	3.15 - 3.60
	3.60 - 4.05
	4.05 - 4.50

Contour Data	Pole Vectors
Maximum Density	4.30%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		69	86	BRX_SP/WX_1_D
2m		39	286	BRX_SP/WX_3_D
3m		77	180	BRX_SP/WX_2A_[
4m		83	354	BRX_SP/WX_2B_[

Plot Mode	Pole Vectors
Vector Count	478 (478 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer & WX Pits – Breccia Discontinuous

Planar Review

Friction Angle (°)	42	Lateral Limit (°)	20

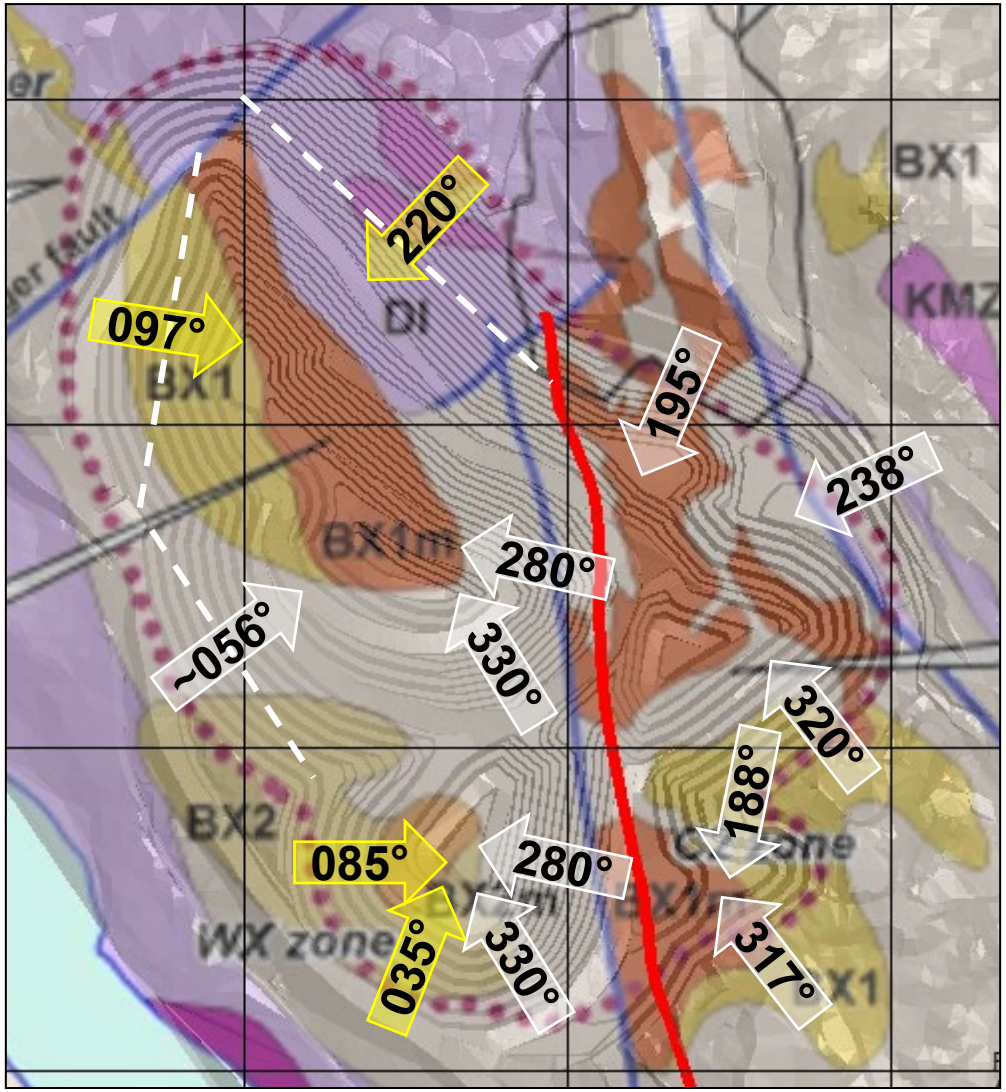

Wall Orientation: 035	Wall Orientation: 085
No Sets.	*BRX_SP/WX_1_D*
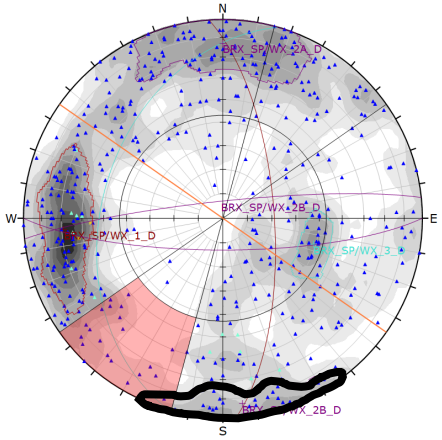	Chosen for Modeling 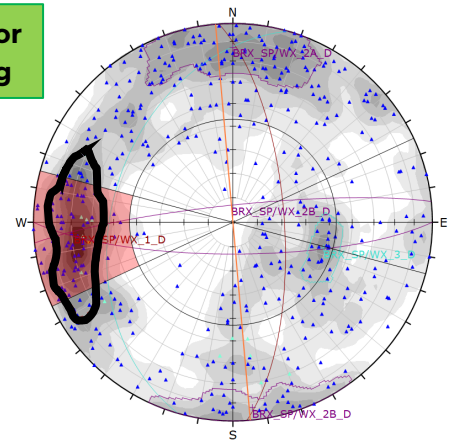
Wall Orientation: 097	**Wall Orientation: 220**
BRX_SP/WX_1_D	*No Sets.*
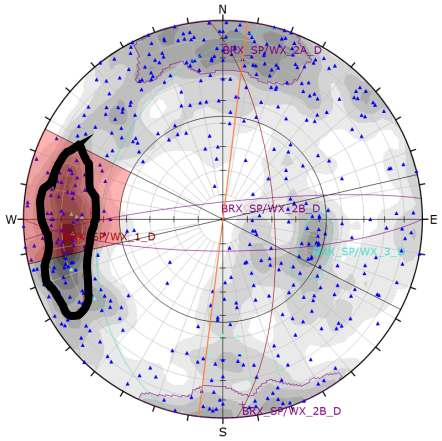	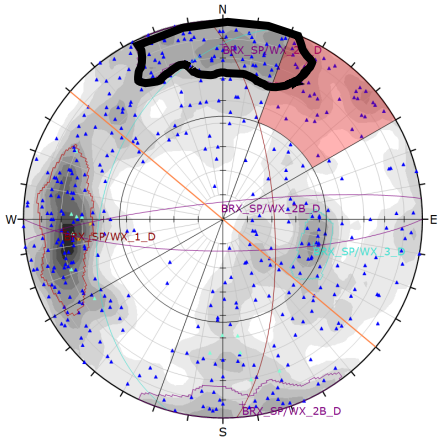

WX & Springer Pits – Breccia Discontinuous

Wedge Review

Friction Angle (°)	42	Kinematic Window (°)	45

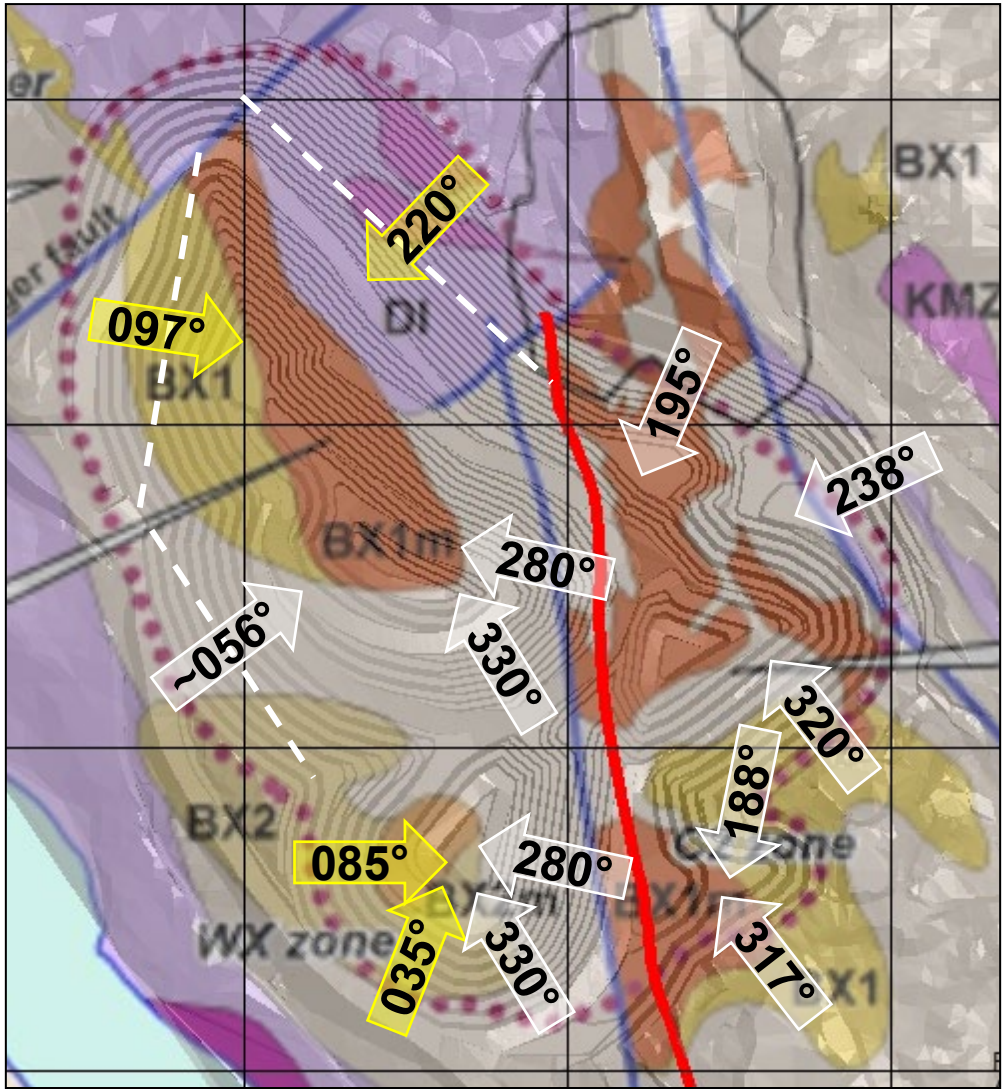

Wall Orientation: 035

BRX_SP/WX_1_D & BRX_SP/WX_2B_D

Chosen for Modeling

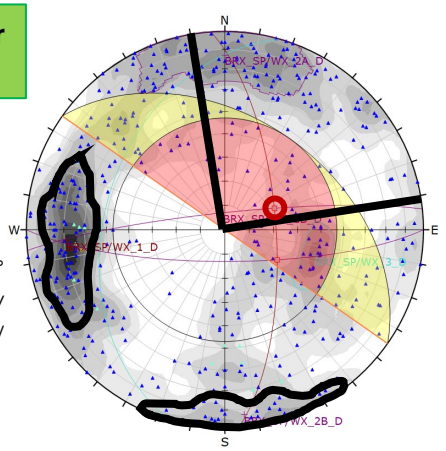

Wall Orientation: 085

BRX_SP/WX_1_D & BRX_SP/WX_2A_D & BRX_SP/WX_1_D & BRX_SP/WX_2B_D

Chosen for Modeling

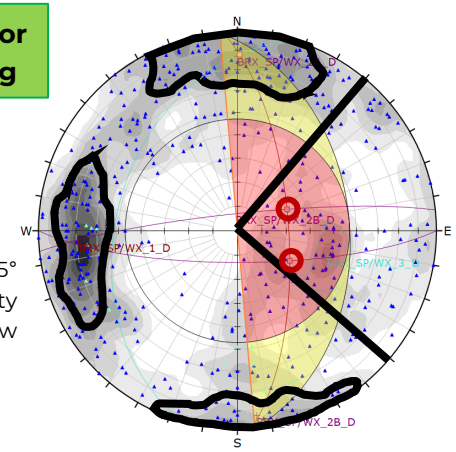

Wall Orientation: 097

BRX_SP/WX_1_D & BRX_SP/WX_2A_D & BRX_SP/WX_1_D & BRX_SP/WX_2B_D

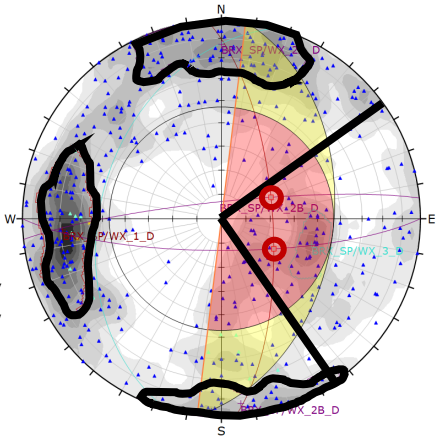

Wall Orientation: 220

No Sets.

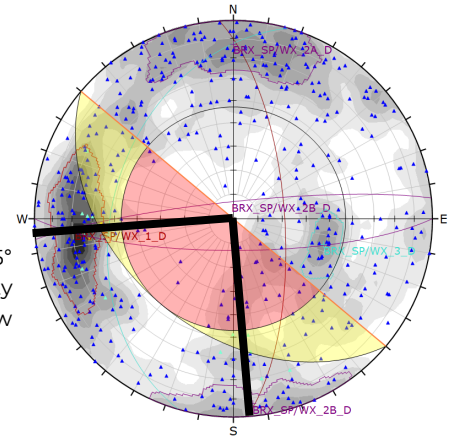

Springer & WX Pits – Breccia Discontinuous

Toppling Review

Friction Angle (°)	42	Lateral Limit (°)	20

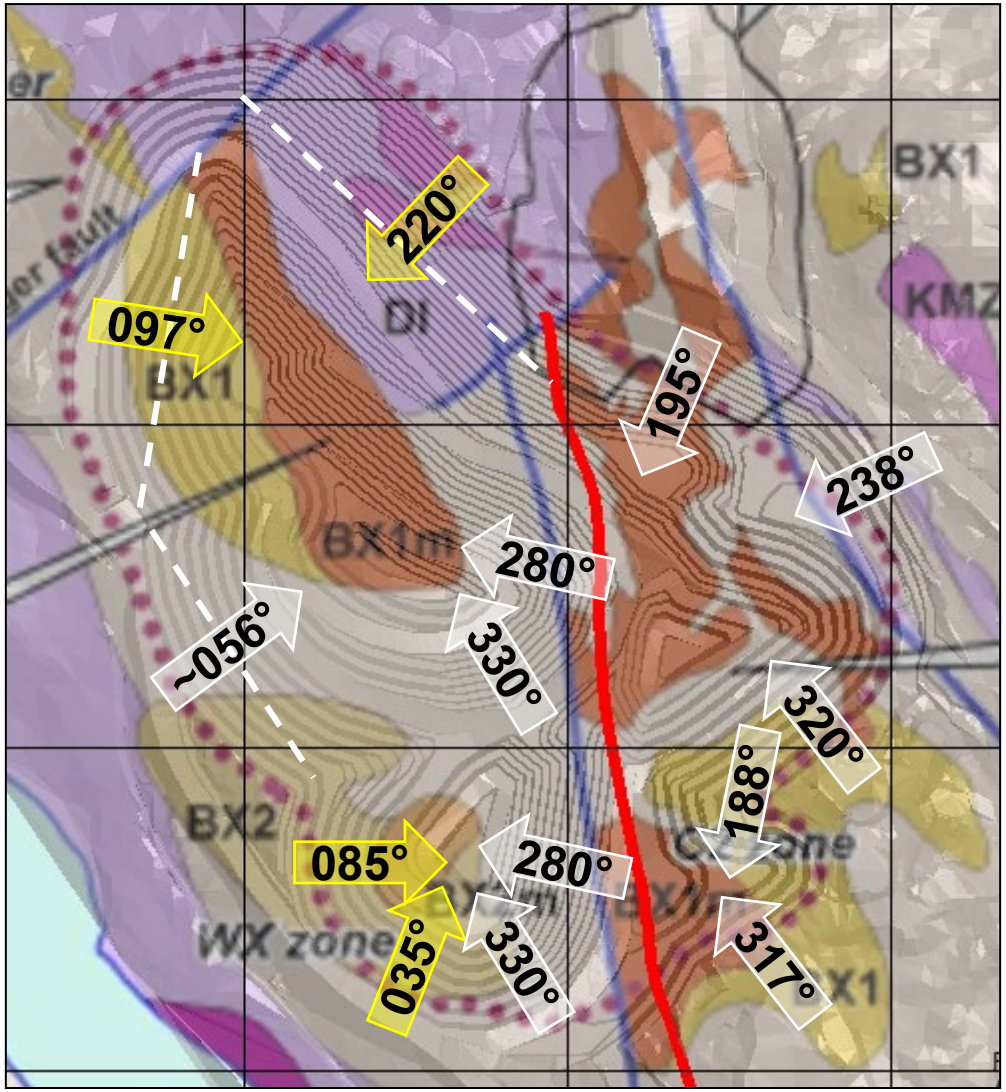

Wall Orientation: 035	Wall Orientation: 085
No Sets.	*No Sets.*
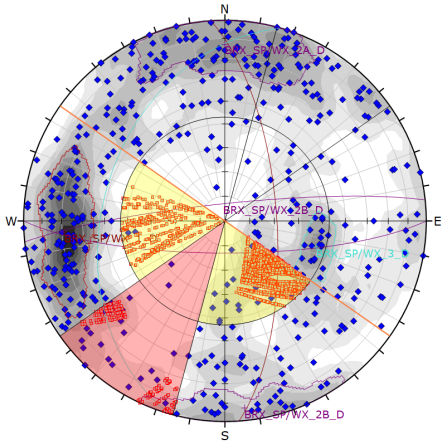	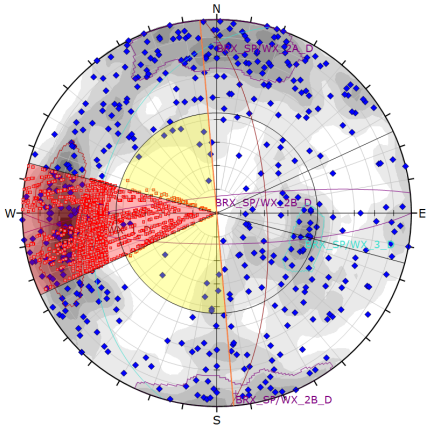
Wall Orientation: 097	**Wall Orientation: 220**
No Sets.	*No Sets.*
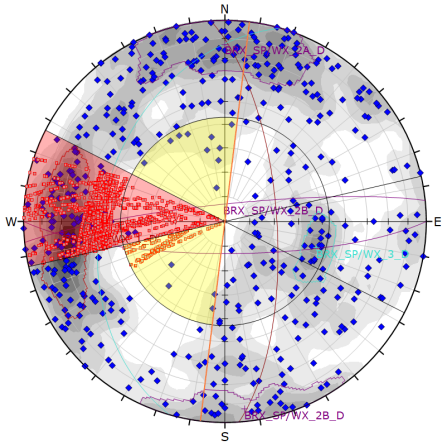	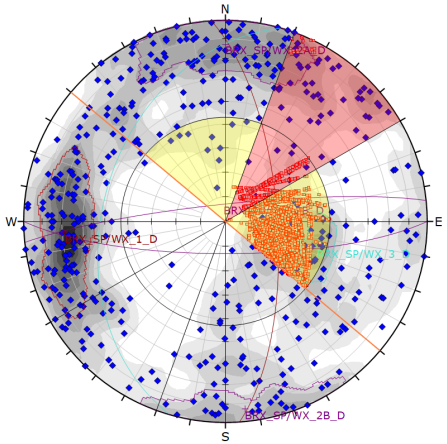

Springer & WX Pits

Breccia Continuous

Continuous sets within the Breccia for the WX and Springer Pit are steeply dipping.

There are 4 wall orientations within the Springer and WX Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge, planar, and toppling failures are possible.

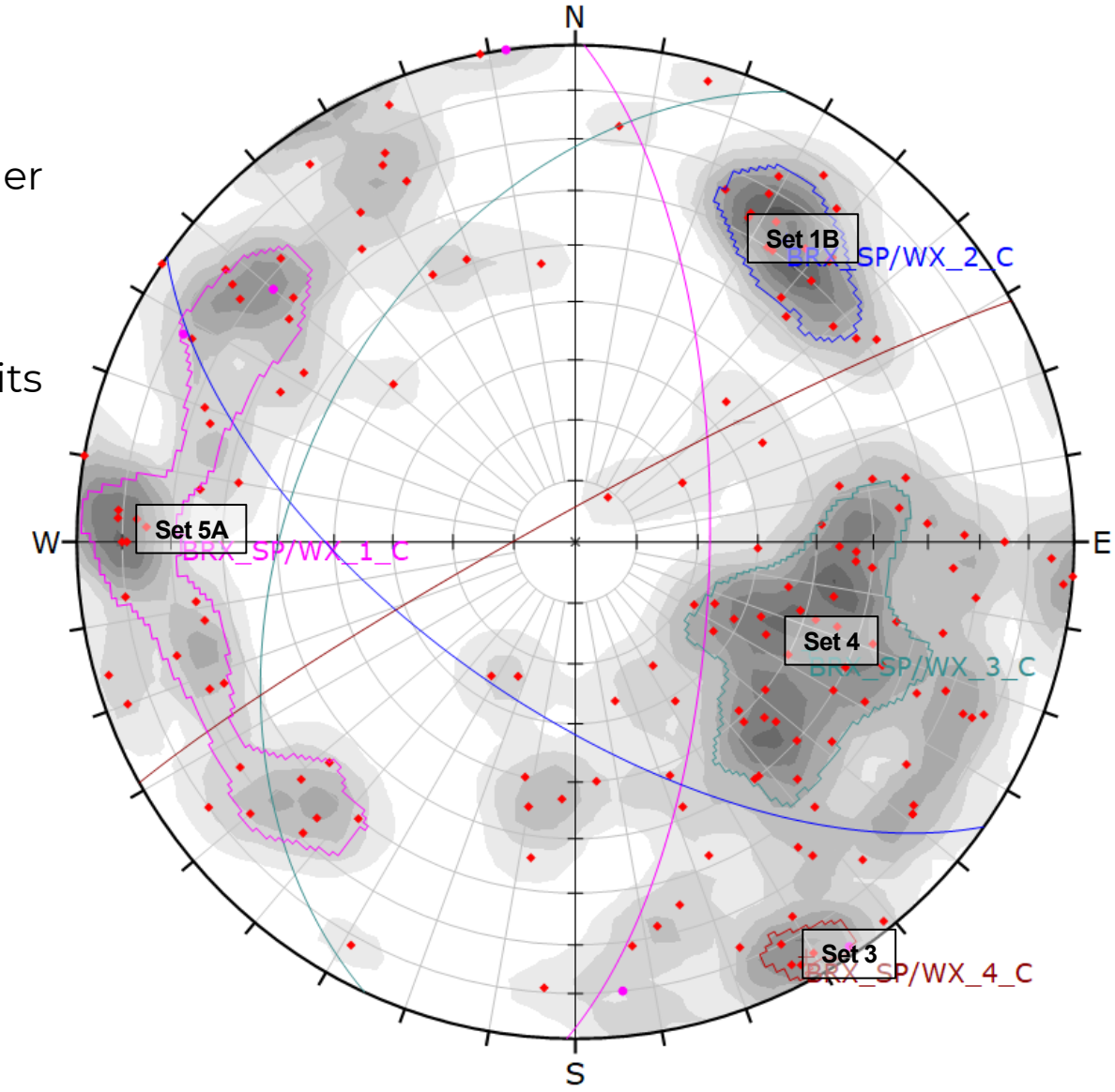

Symbol	GROUPED TYPE	Quantity
●	Dyke	5
◆	Fault	159

Color	Density Concentrations
	0.00 - 0.55
	0.55 - 1.10
	1.10 - 1.65
	1.65 - 2.20
	2.20 - 2.75
	2.75 - 3.30
	3.30 - 3.85
	3.85 - 4.40
	4.40 - 4.95
	4.95 - 5.50

Contour Data	Pole Vectors
Maximum Density	5.07%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		68	91	BRX_SP/WX_1_C
3m		63	215	BRX_SP/WX_2_C
4m		43	295	BRX_SP/WX_3_C
5m		85	331	BRX_SP/WX_4_C

Plot Mode	Pole Vectors
Vector Count	164 (164 Entries)
Hemisphere	Lower
Projection	Equal Area

Springer & WX Pits – Breccia Continuous

Planar Review

Friction Angle (°)	28	Lateral Limit (°)	20

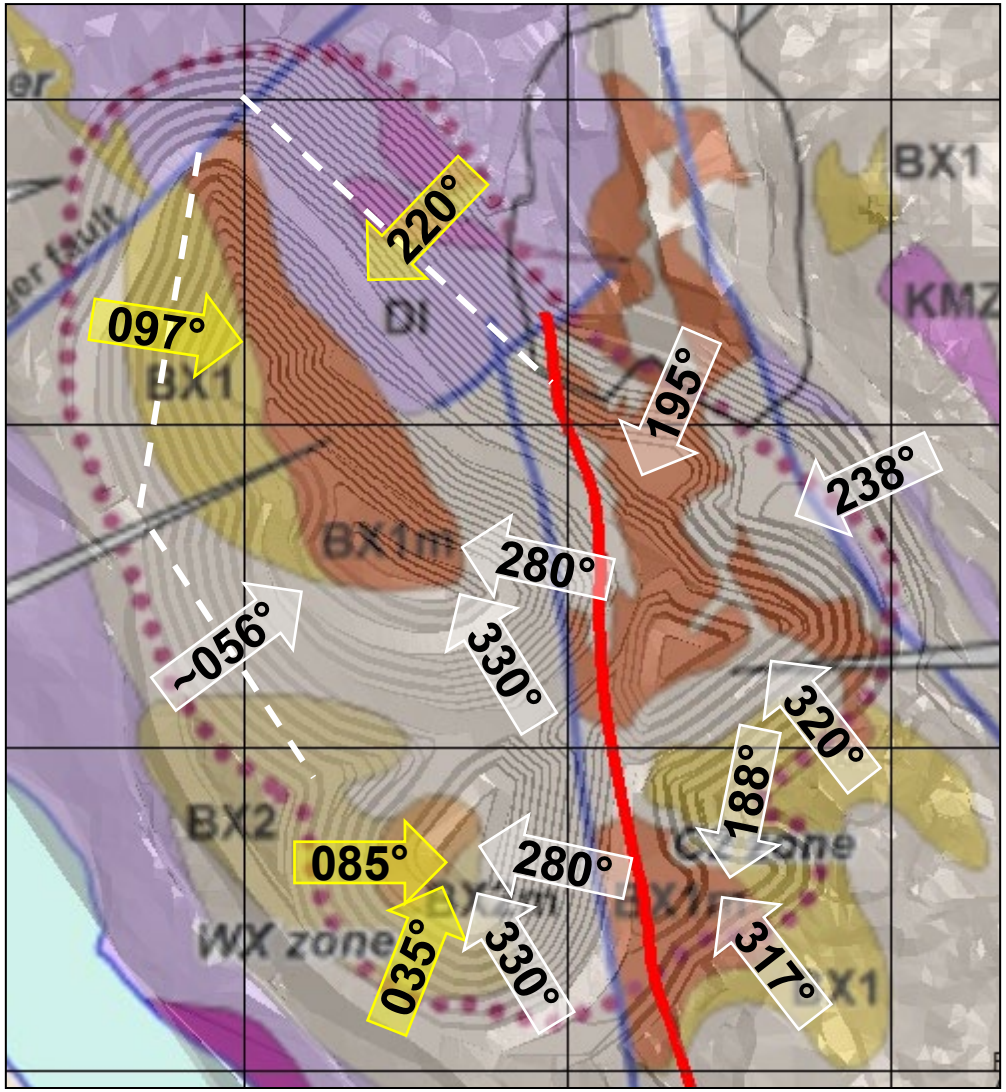

Wall Orientation: 035

BRX_SP/WX_1_C

Chosen for Modeling

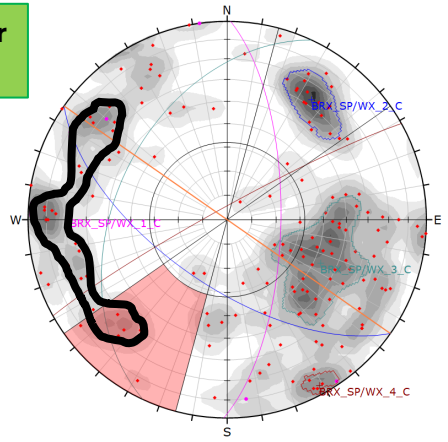

Wall Orientation: 085

BRX_SP/WX_1_C

Chosen for Modeling

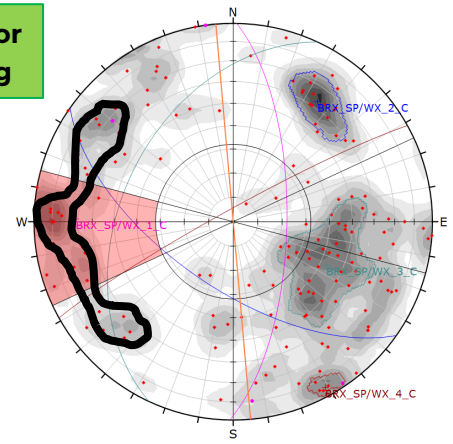

Wall Orientation: 097

BRX_SP/WX_1_C

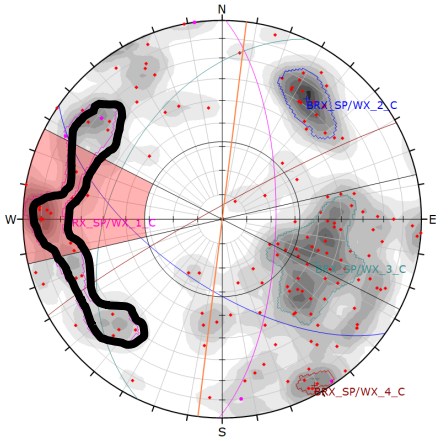

Wall Orientation: 220

BRX_SP/WX_2_C

Chosen for Modeling

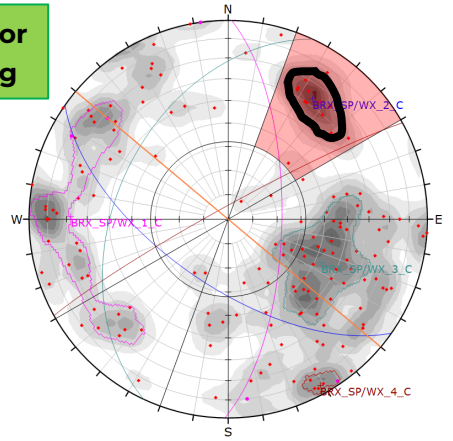

Springer & WX Pits – Breccia Continuous

Wedge Review

Friction Angle (°)	28	Kinematic Window (°)	45

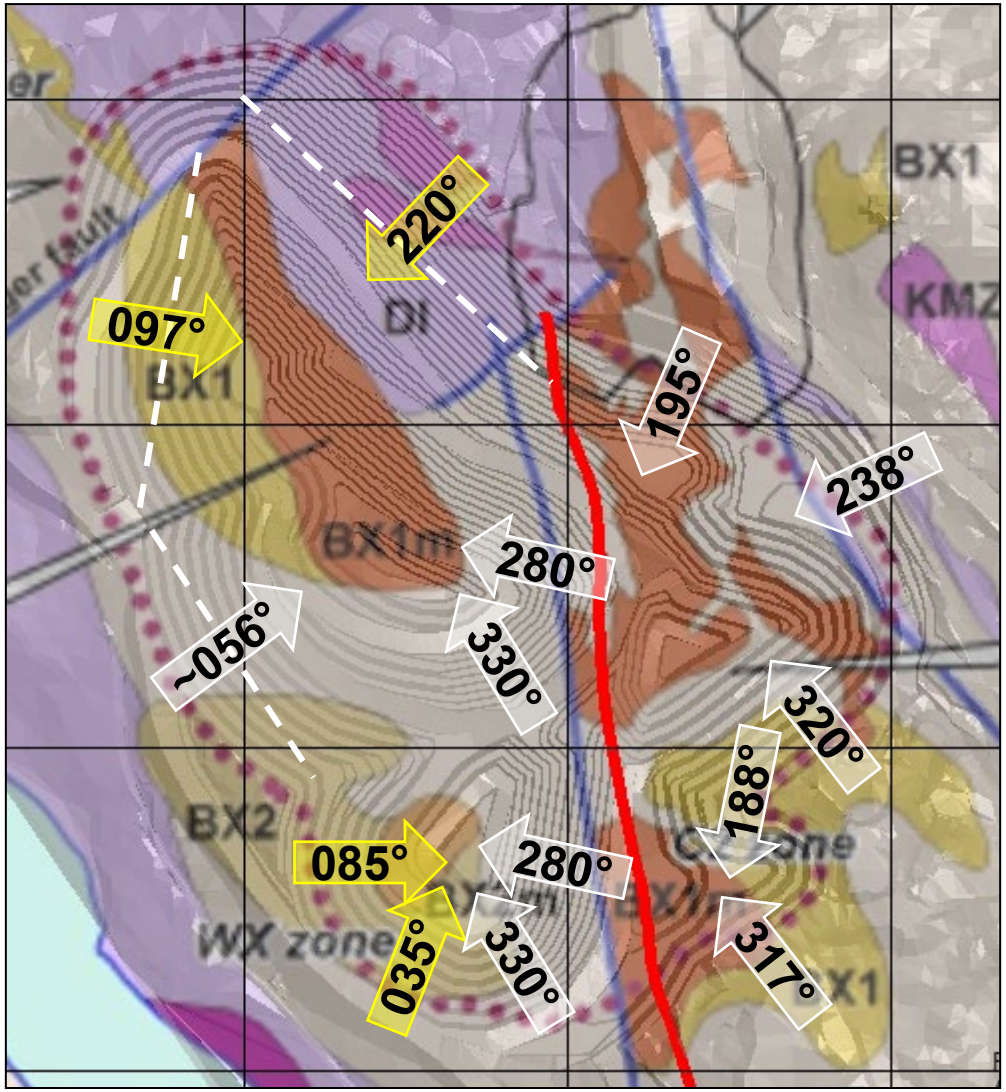

Wall Orientation: 035

BRX_SP/WX_1_C & BRX_SP/WX_4_C

Chosen for Modeling

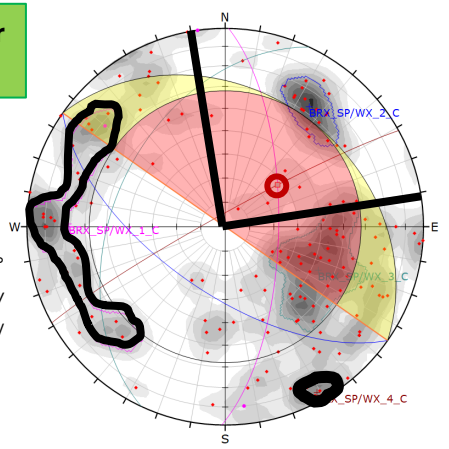

45° Admissibility Window

Wall Orientation: 085

BRX_SP/WX_1_C & BRX_SP/WX_4_C

Chosen for Modeling

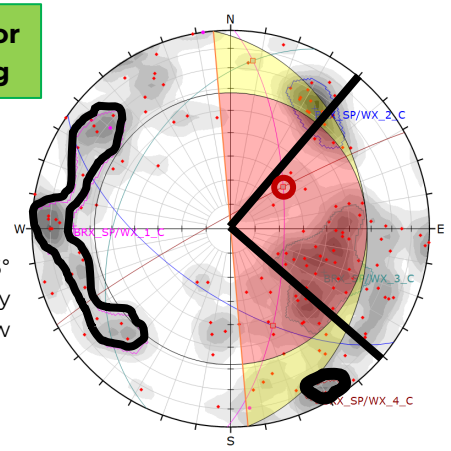

45° Admissibility Window

Wall Orientation: 097

No Sets.

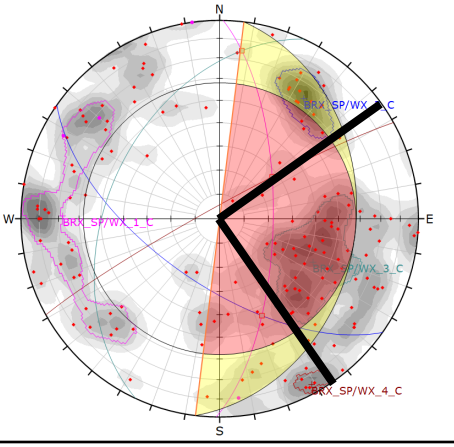

45° Admissibility Window

Wall Orientation: 220

No Sets.

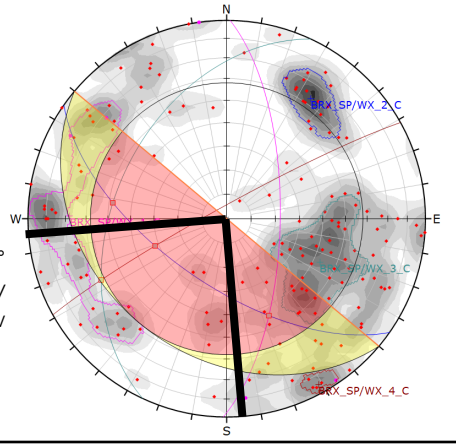

45° Admissibility Window

Springer & WX Pits – Breccia Continuous

Toppling Review

Friction Angle (°)	28	Lateral Limit (°)	20

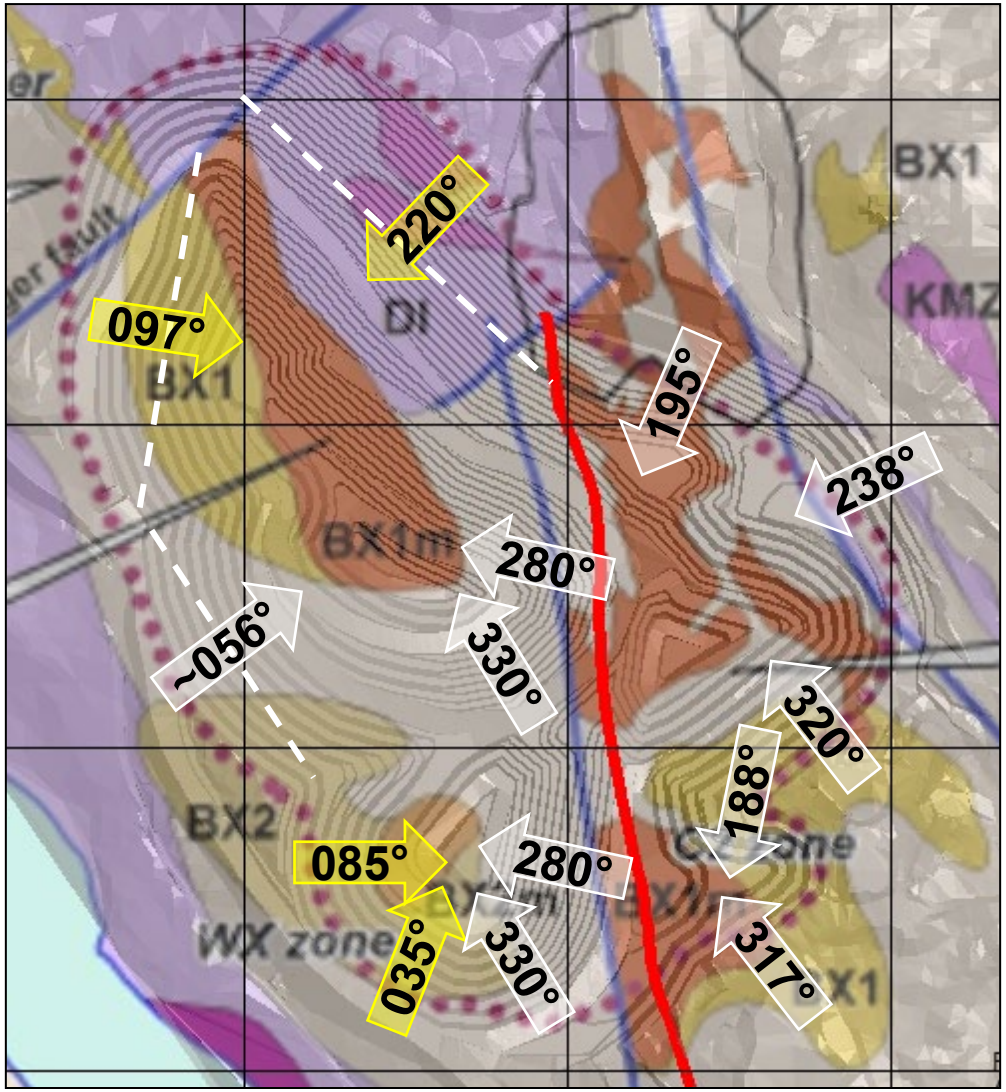

Wall Orientation: 035

No Sets.

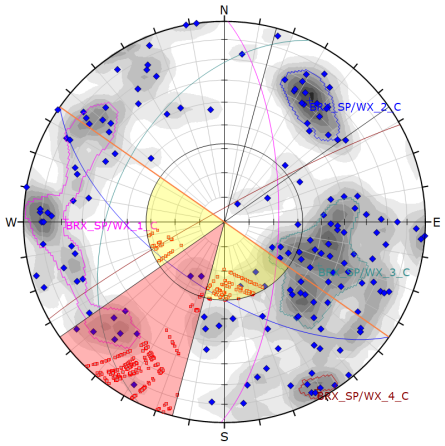

Wall Orientation: 085

No Sets.

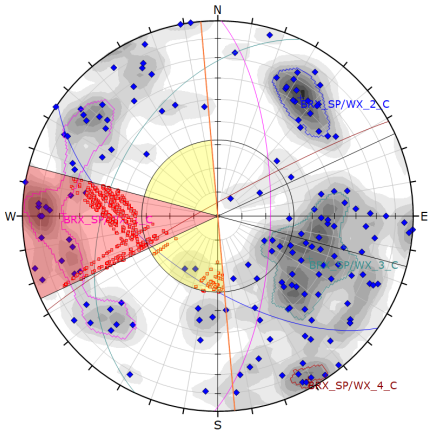

Wall Orientation: 097

No Sets.

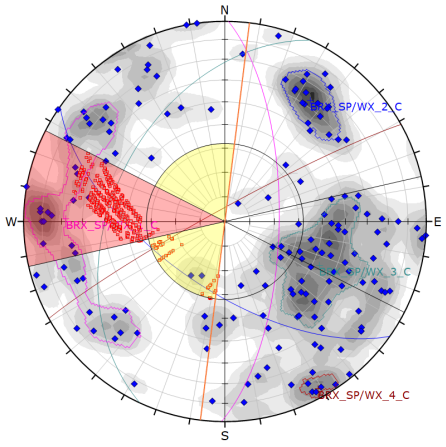

Wall Orientation: 220

No Sets.

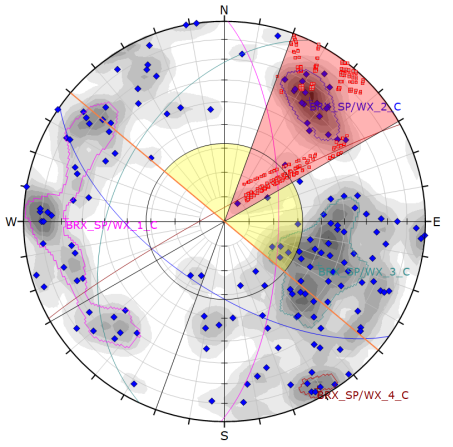

Cariboo & C2 Pits

Monzodiorite Discontinuous

Discontinuous sets within the Monzodirite for the C2 and Cariboo Pits are steeply dipping.

There are 3 wall orientations within the C2 and Cariboo Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge & planar mechanisms are not likely to be problematic. Toppling failures may be possible for the 320-degree wall direction.

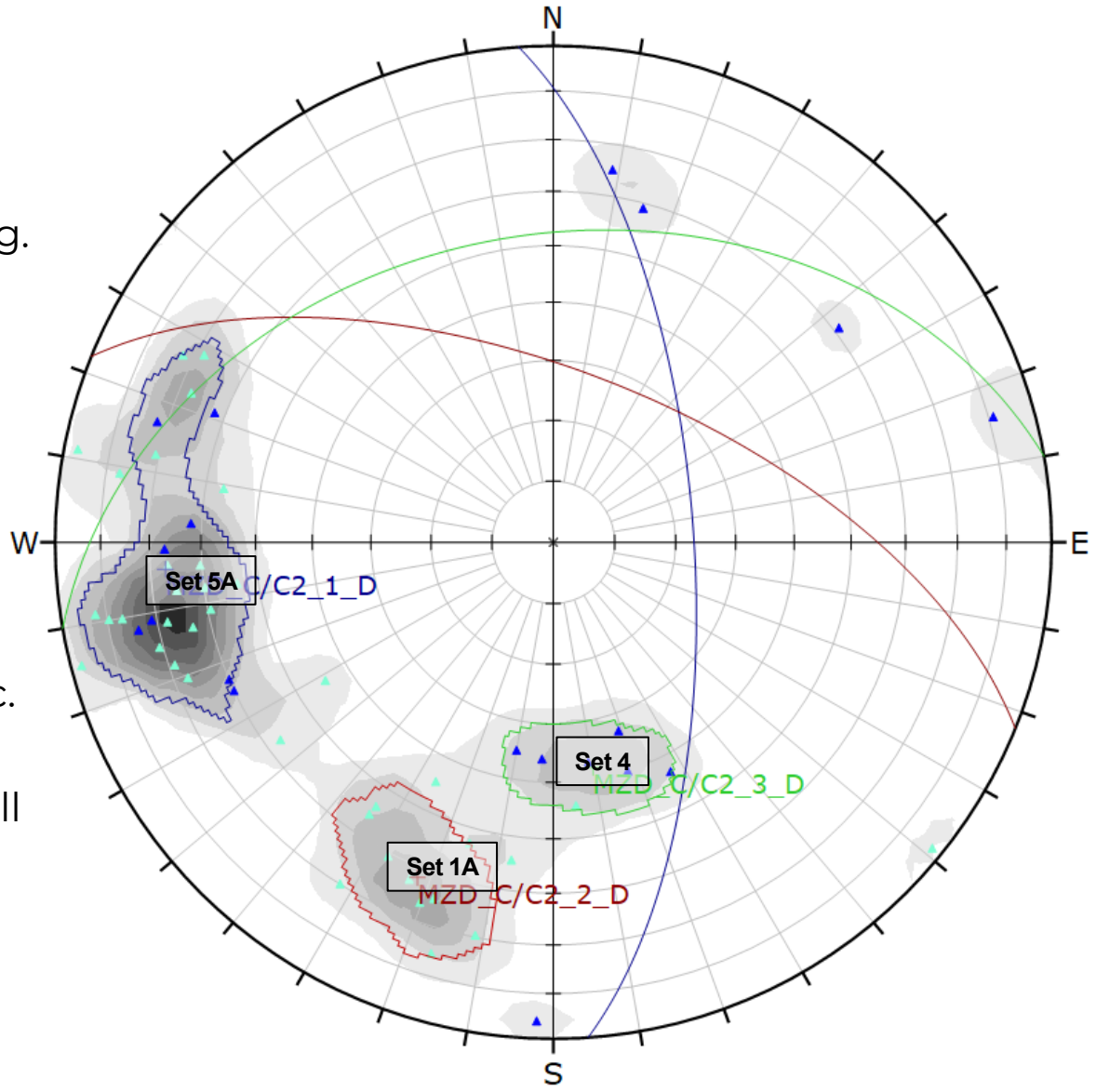

Symbol	GROUPED TYPE	Quantity
▲	Joint	19
▲	Photogrammetry	38

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.59%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		67	86	MZD_C/C2_1_D
2m		62	22	MZD_C/C2_2_D
3m		38	350	MZD_C/C2_3_D

Plot Mode	Pole Vectors
Vector Count	57 (57 Entries)
Hemisphere	Lower
Projection	Equal Area

Cariboo & C2 Pits – Monzodiorite Discontinuous

Planar Review

Friction Angle (°)	42	Lateral Limit (°)	20

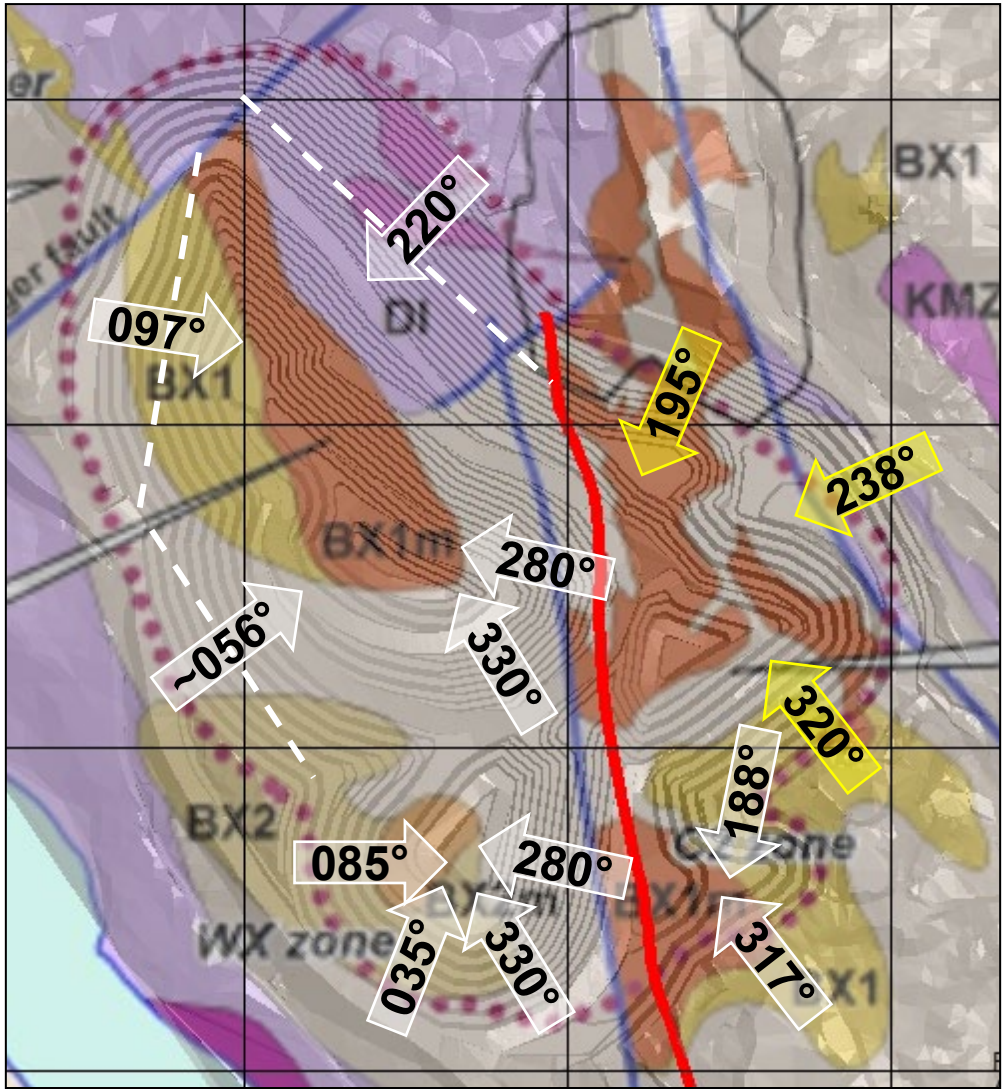

Wall Orientation: 195

No Sets.

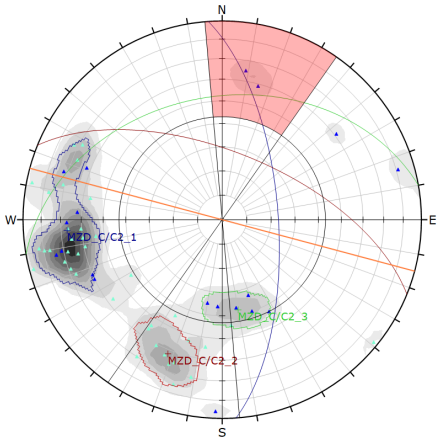

Wall Orientation: 238

No Sets.

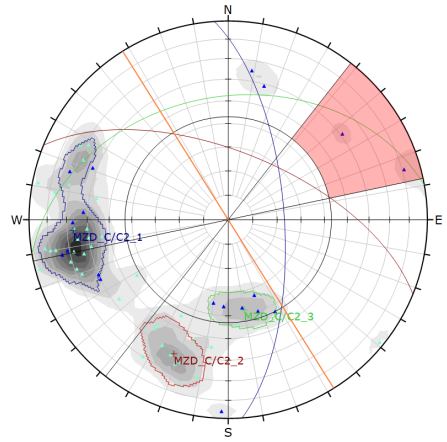

Wall Orientation: 320

No Sets.

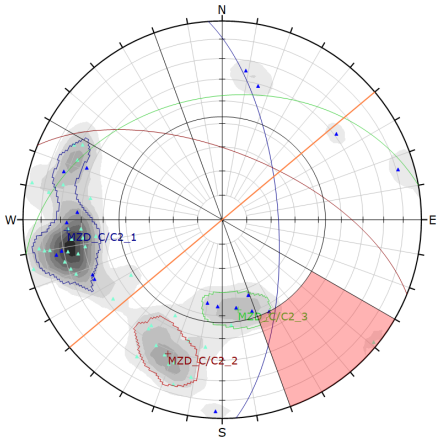

Cariboo & C2 Pits – Monzodiorite Discontinuous

Wedge Review

Friction Angle (°)	42	Kinematic Window (°)	45

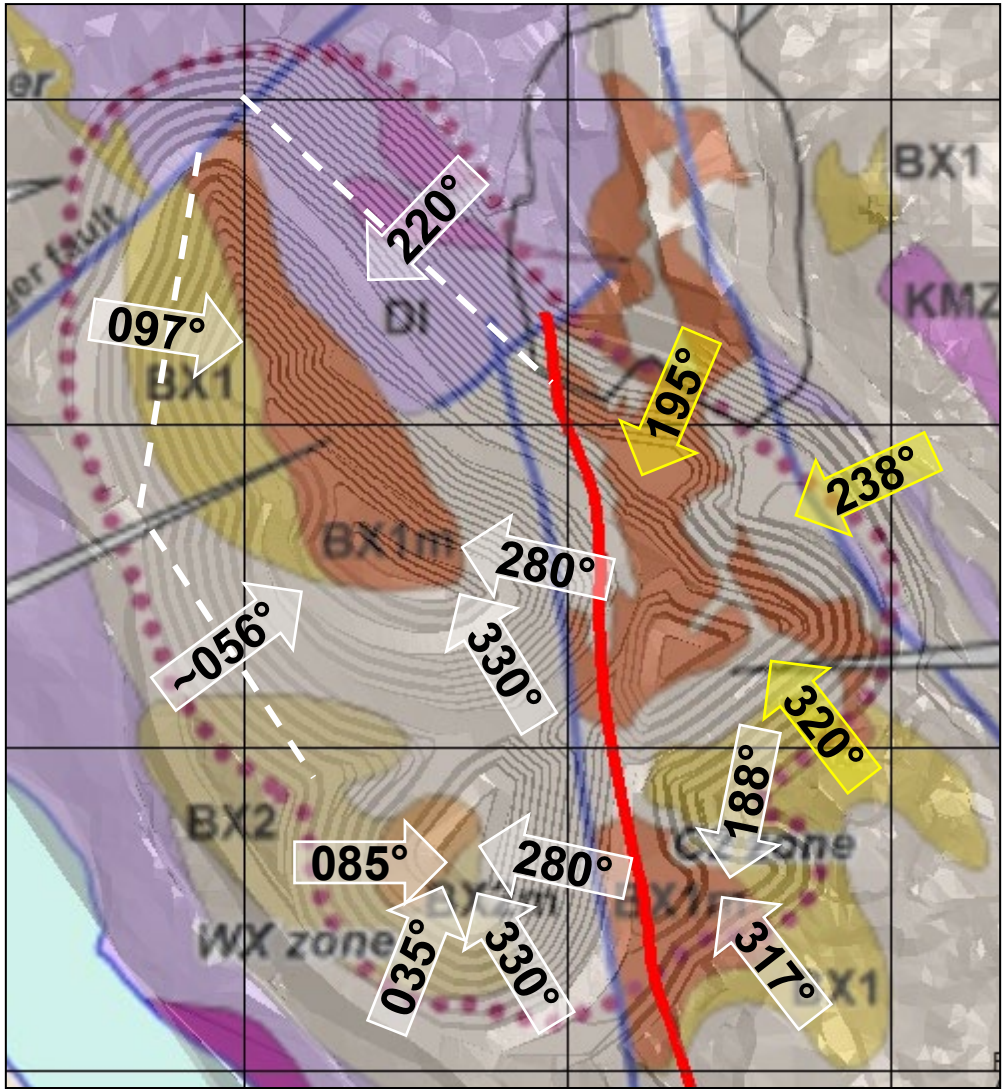

Wall Orientation: 195

No Sets.

45° Admissibility Window

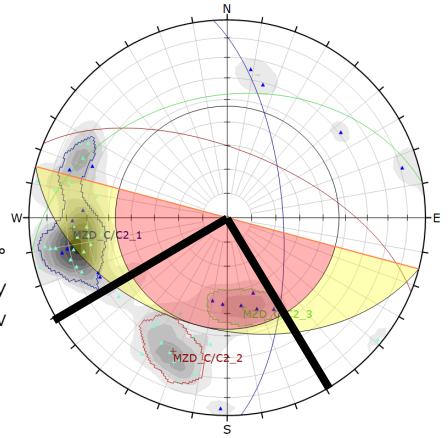

Wall Orientation: 238

No Sets.

45° Admissibility Window

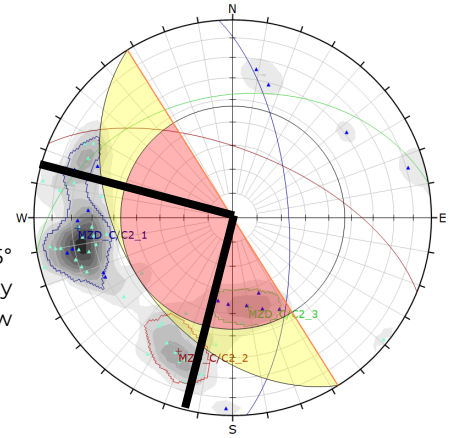

Wall Orientation: 320

No Sets.

45° Admissibility Window

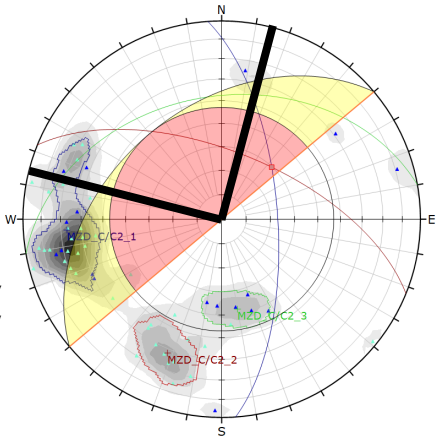

Cariboo & C2 Pits – Monzodiorite Discontinuous

Toppling Review

Friction Angle (°)	42	Lateral Limit (°)	20

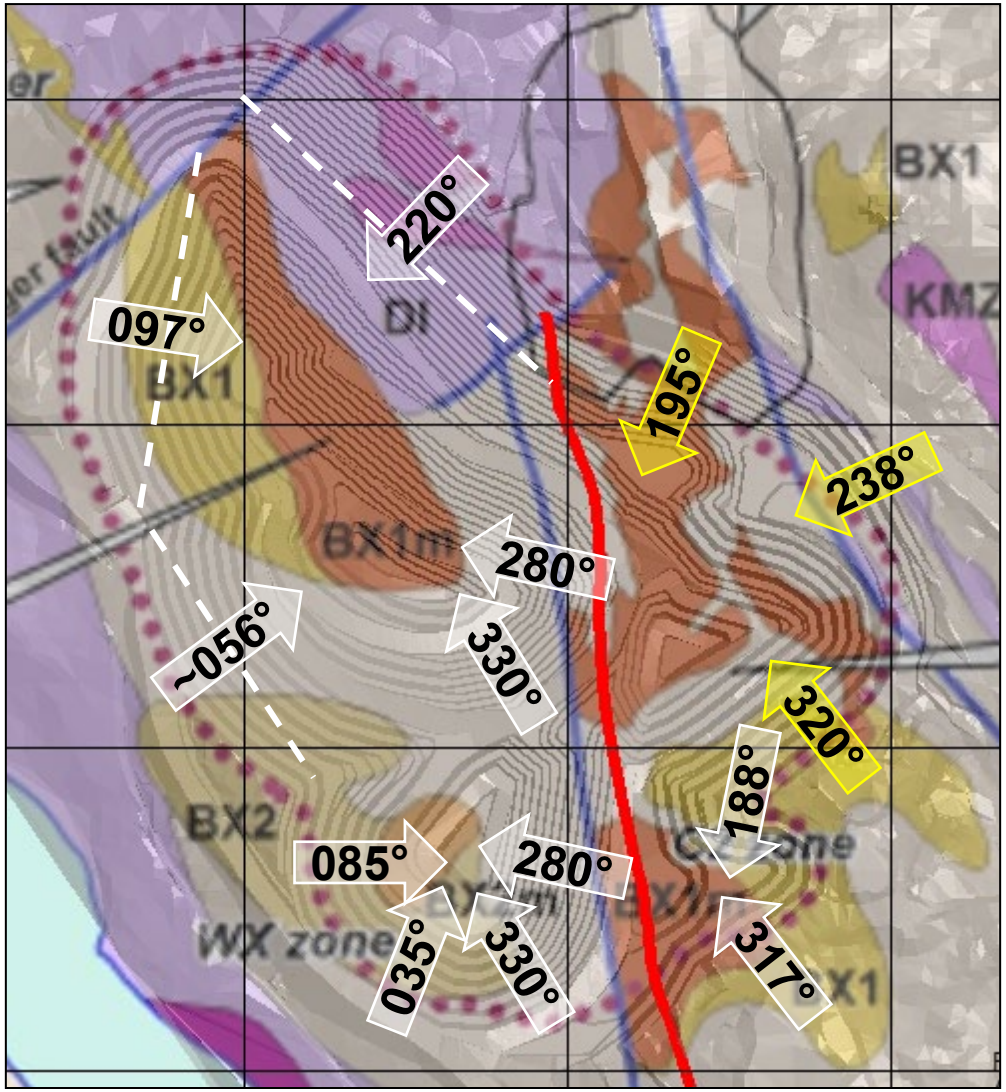

Wall Orientation: 195	Wall Orientation: 238
MZD_C/C2_1_D & MZD_C/C2_3_D	*No Sets.*
Chosen for Review 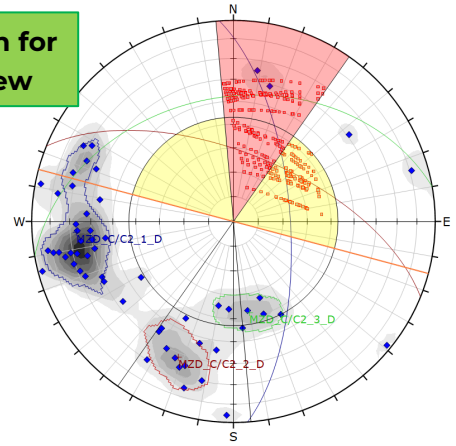	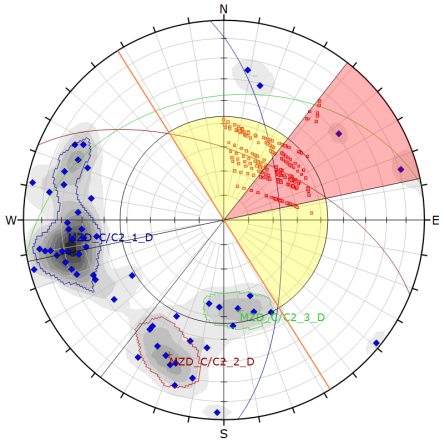
Wall Orientation: 320	
No Sets.	
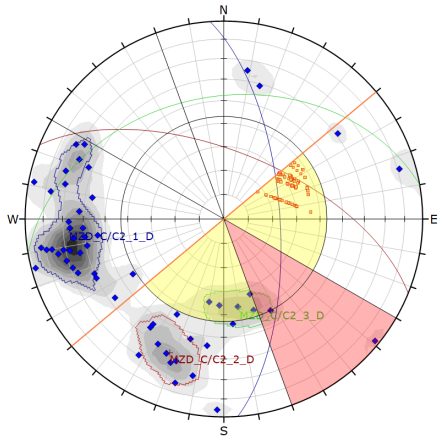	

Cariboo & C2 Pits

Monzodiorite Continuous

Continuous sets within the Monzodirite for the C2 and Cariboo Pits are moderately dipping.

There are 2 wall orientations within the C2 and Cariboo Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge, planar, and toppling mechanisms are not likely to be problematic.

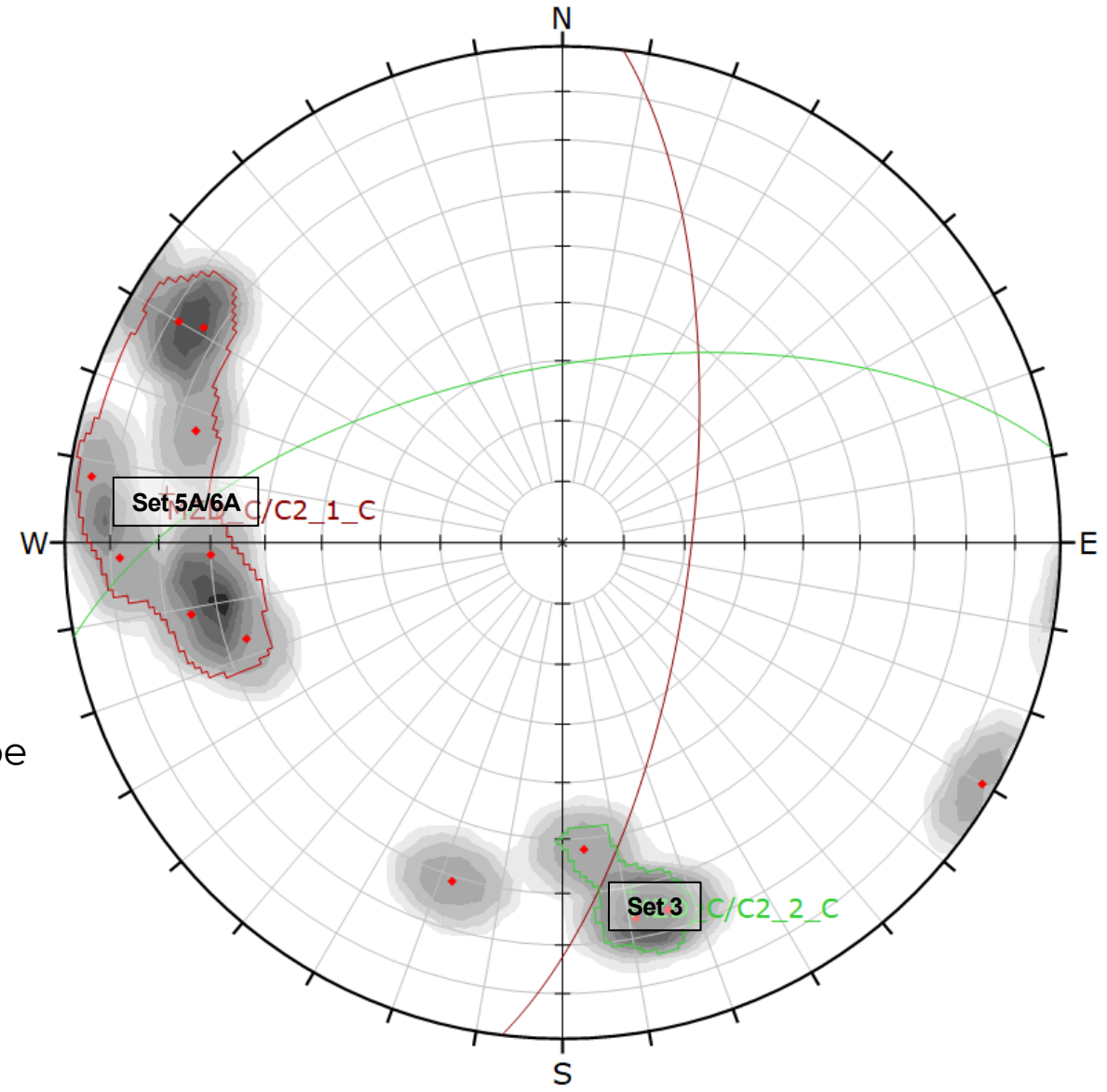

Symbol	GROUPED TYPE	Quantity
◆	Fault	13

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.95%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		69	97	MZD_C/C2_1_C
2m		61	349	MZD_C/C2_2_C

Plot Mode	Pole Vectors
Vector Count	13 (13 Entries)
Hemisphere	Lower
Projection	Equal Area

Cariboo & C2 Pits – Monzodiorite Continuous

Planar Review

Friction Angle (°)	28	Lateral Limit (°)	20

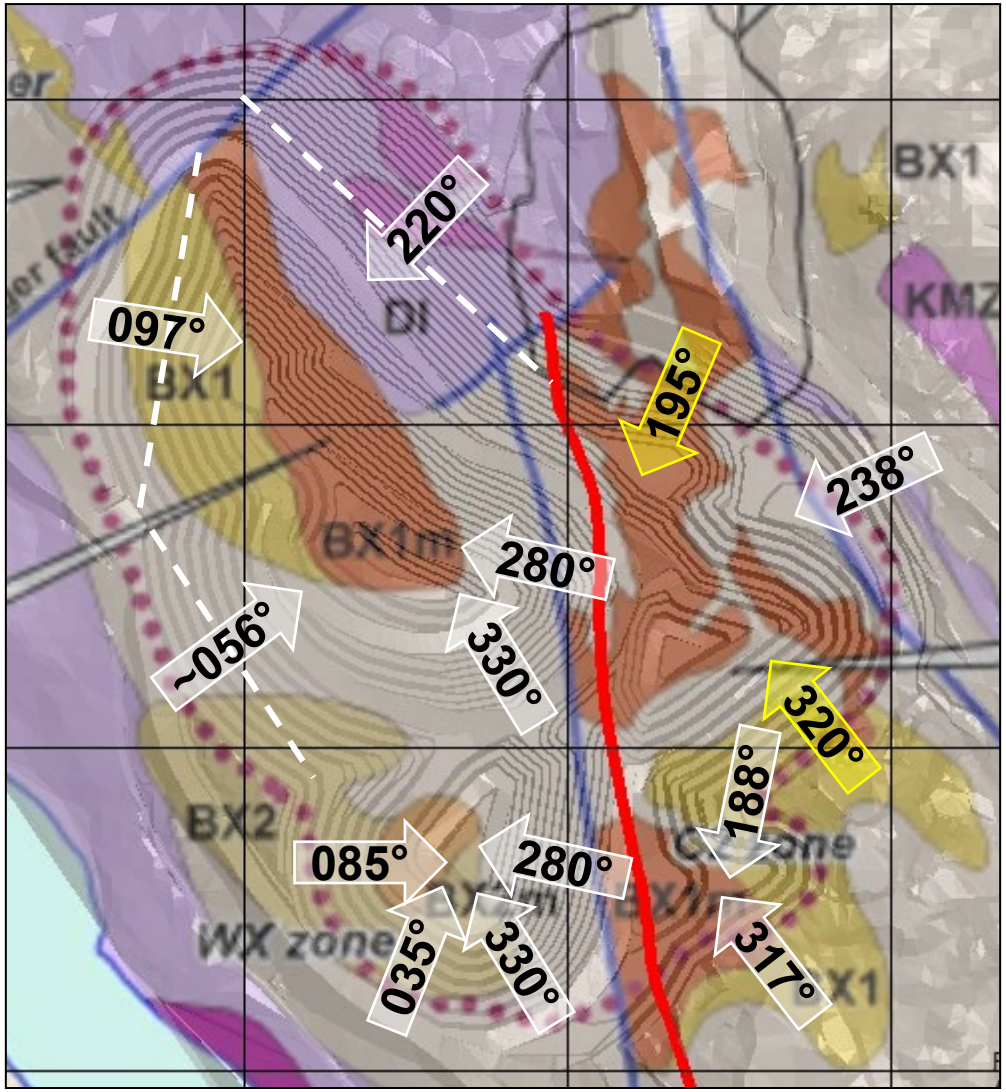

Wall Orientation: 195	Wall Orientation: 320
No Sets.	*No Sets.*
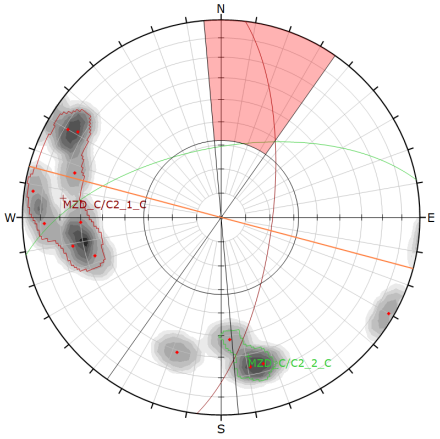	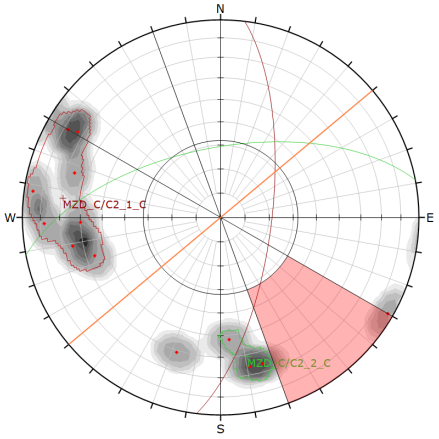

Cariboo & C2 Pits – Monzodiorite Continuous

Wedge Review

Friction Angle (°)	28	Kinematic Window (°)	45

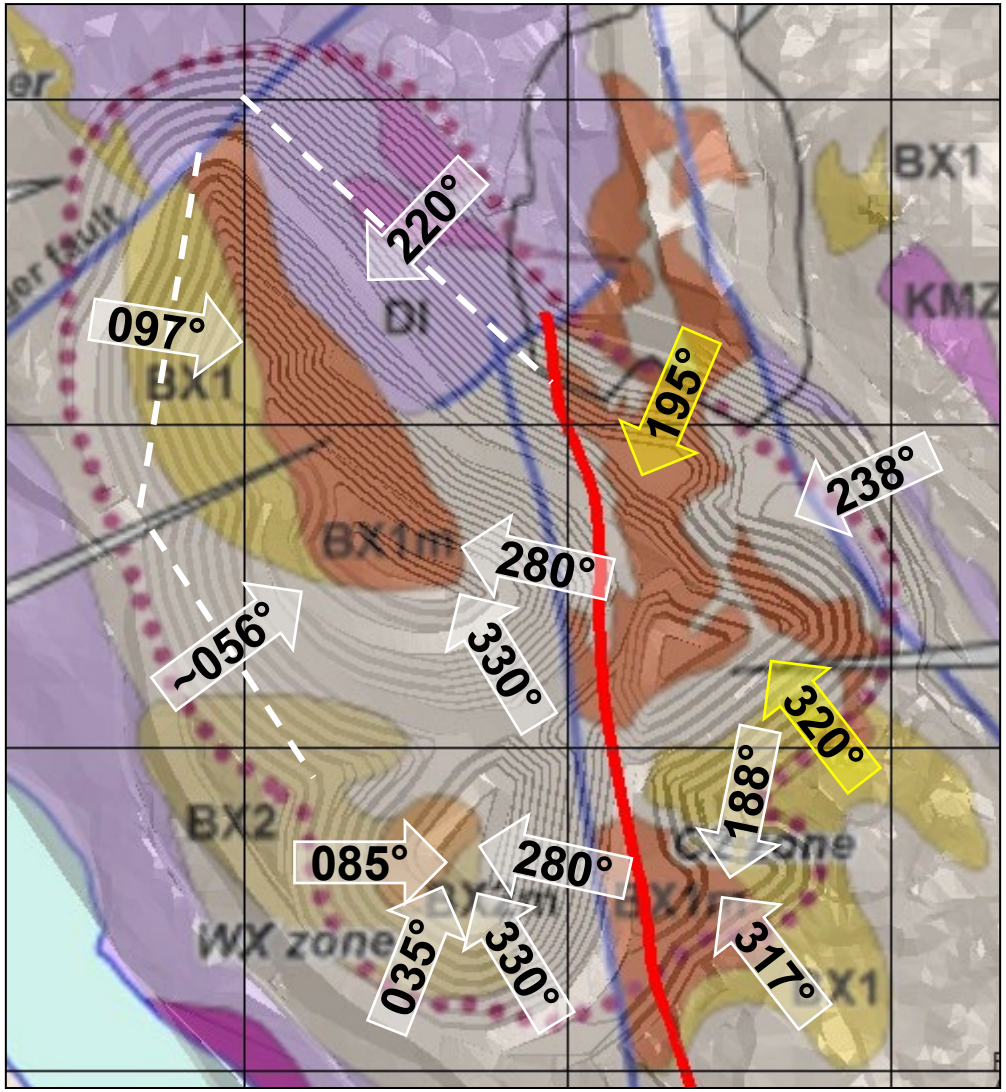

Wall Orientation: 195	Wall Orientation: 320
No Sets.	*No Sets.*
45° Admissibility Window	45° Admissibility Window

Cariboo & C2 Pits – Monzodiorite Continuous

Toppling Review

Friction Angle (°)	28	Lateral Limit (°)	20

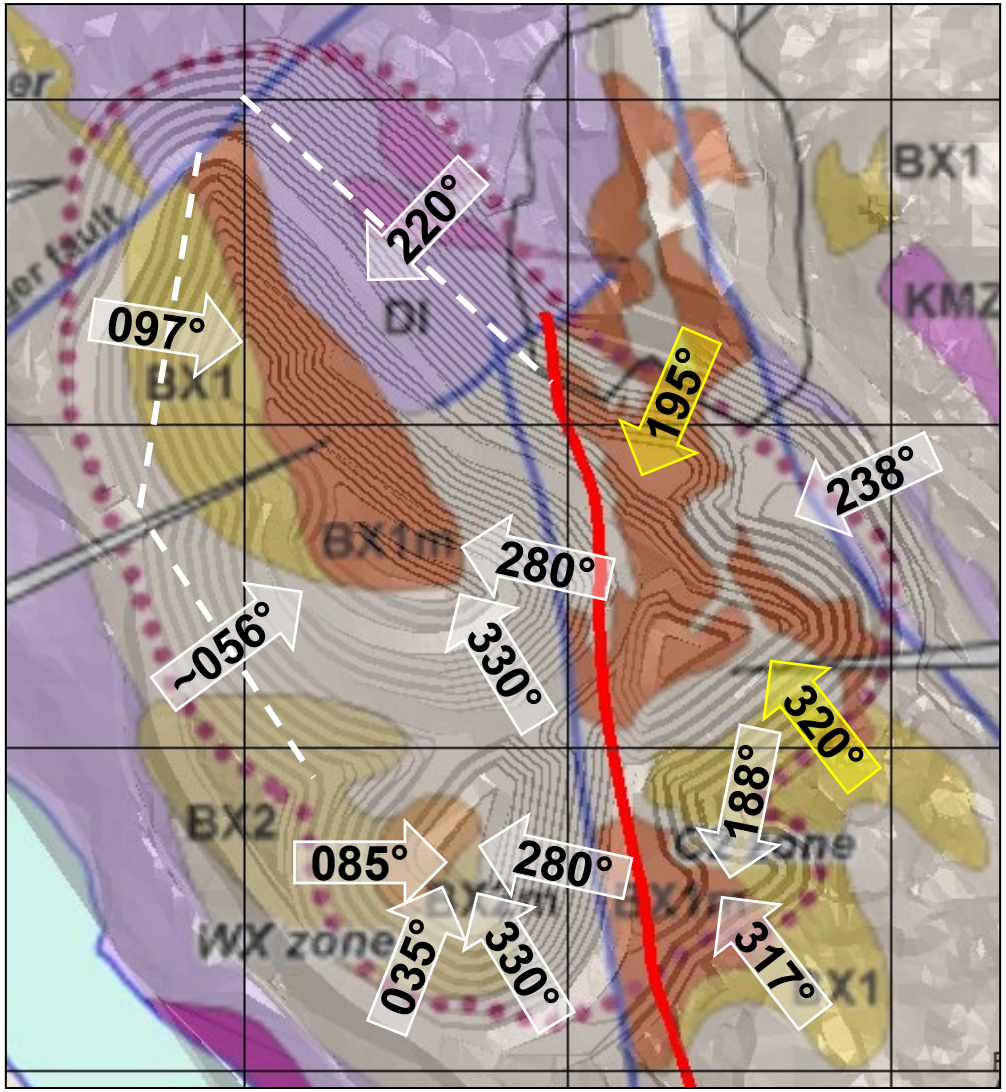

Wall Orientation: 195	Wall Orientation: 320
No Sets.	*No Sets.*
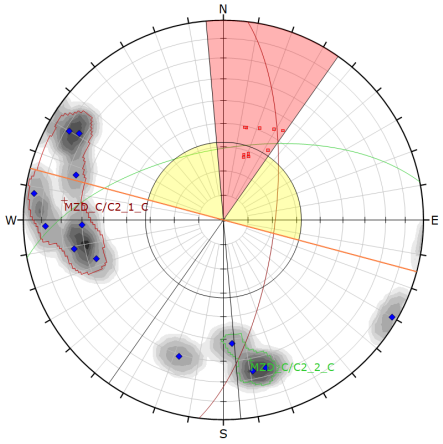	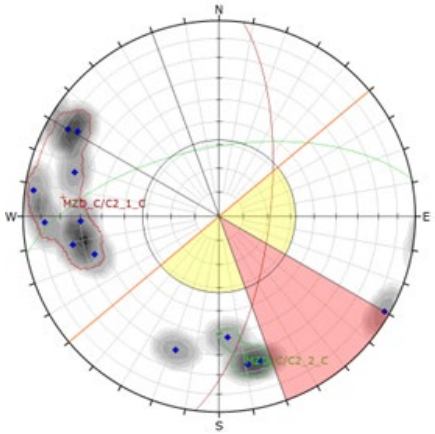

Cariboo & C2 Pits

Breccia Discontinuous

Discontinuous sets within the Breccia for the C2 and Cariboo Pits are moderately to steeply dipping.

There are 4 wall orientations within the C2 and Cariboo Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge, planar, and toppling failures are possible.

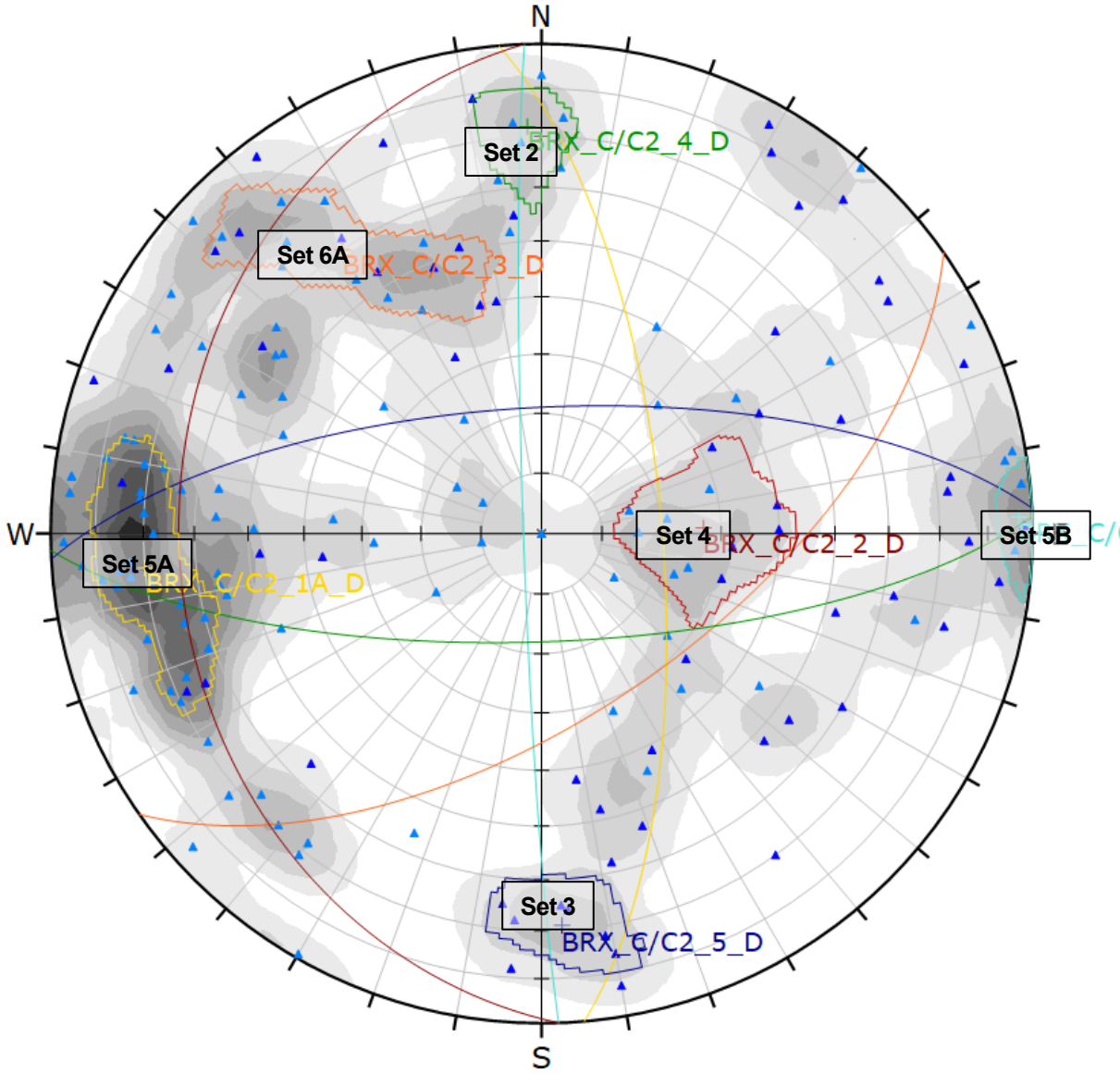

Symbol	GROUPED TYPE	Quantity
▲	ATV - Joint	105
▲	Joint	64

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.89%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		70	85	BRX_C/C2_1A_D
2m		87	268	BRX_C/C2_1B_D
3m		60	145	BRX_C/C2_3_D
4m		72	178	BRX_C/C2_4_D
5m		69	357	BRX_C/C2_5_D
6m		27	268	BRX_C/C2_2_D

Plot Mode	Pole Vectors
Vector Count	169 (169 Entries)
Hemisphere	Lower
Projection	Equal Area

Cariboo & C2 Pits – Breccia Discontinuous

Planar Review

Friction Angle (°)	42	Lateral Limit (°)	20

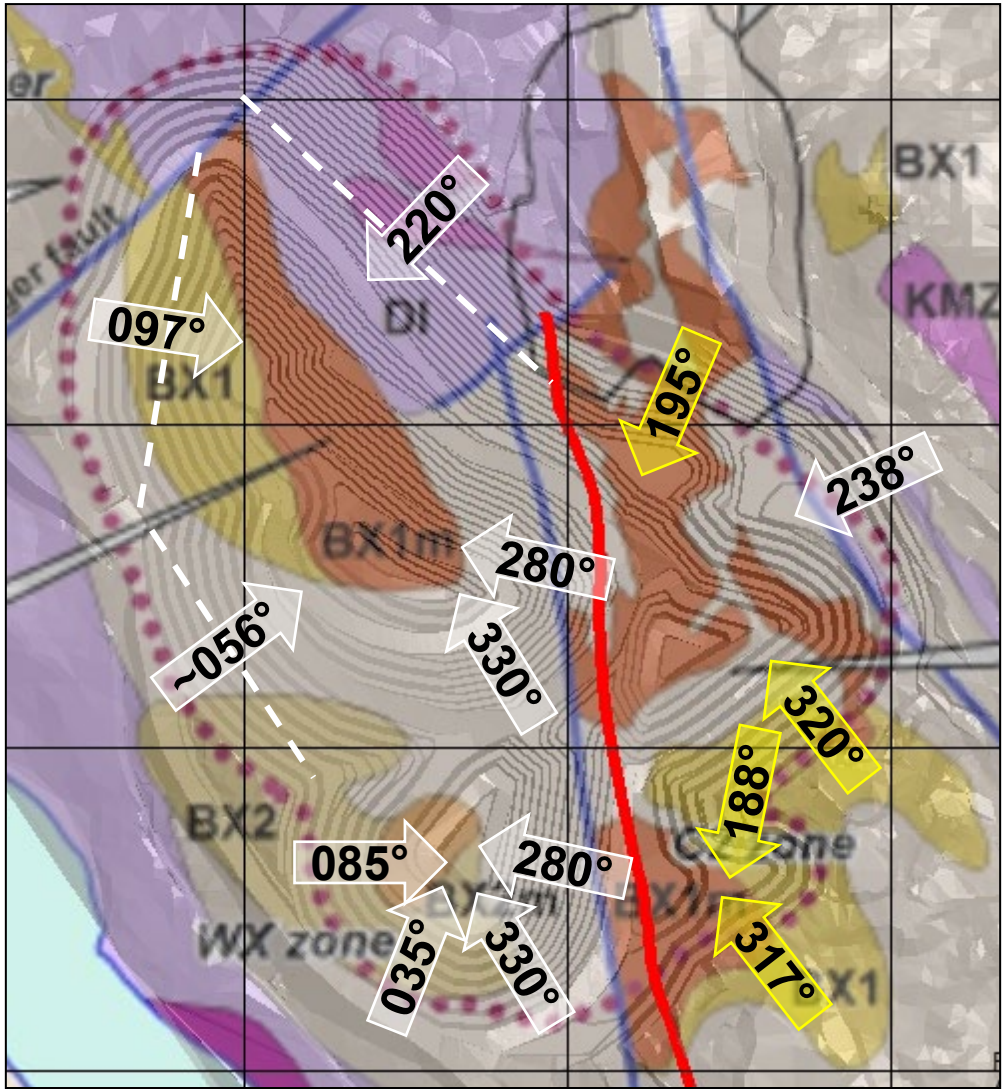

Wall Orientation: 188	Wall Orientation: 195
BRX_C/C2_4_D	*Possible BRX_C/C2_4_D*
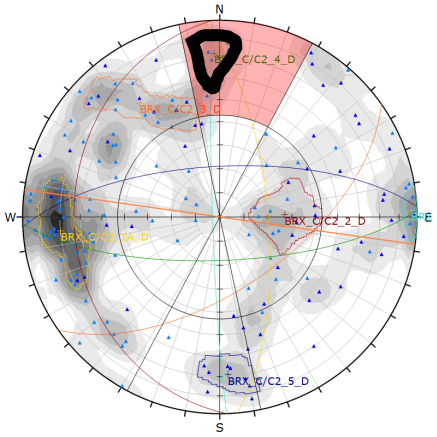	Chosen for Modeling 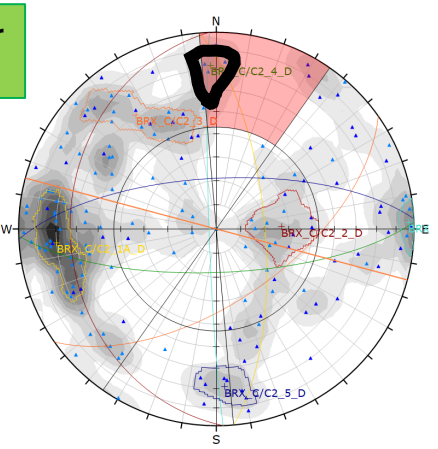
Wall Orientation: 317	**Wall Orientation: 320**
No Sets.	*No Sets.*
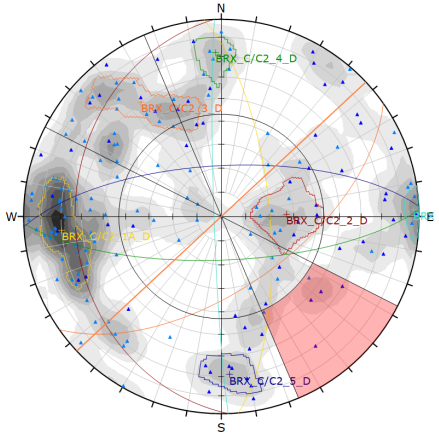	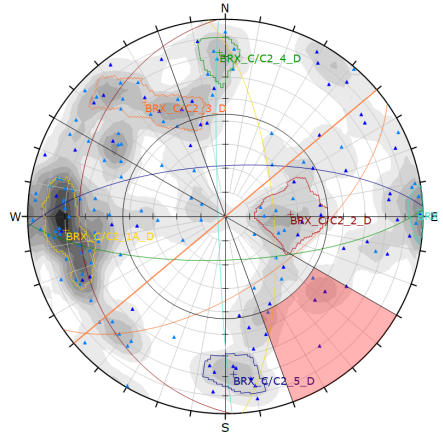

Cariboo & C2 Pits – Breccia Discontinuous

Wedge Review

Friction Angle (°)	42	Kinematic Window (°)	45

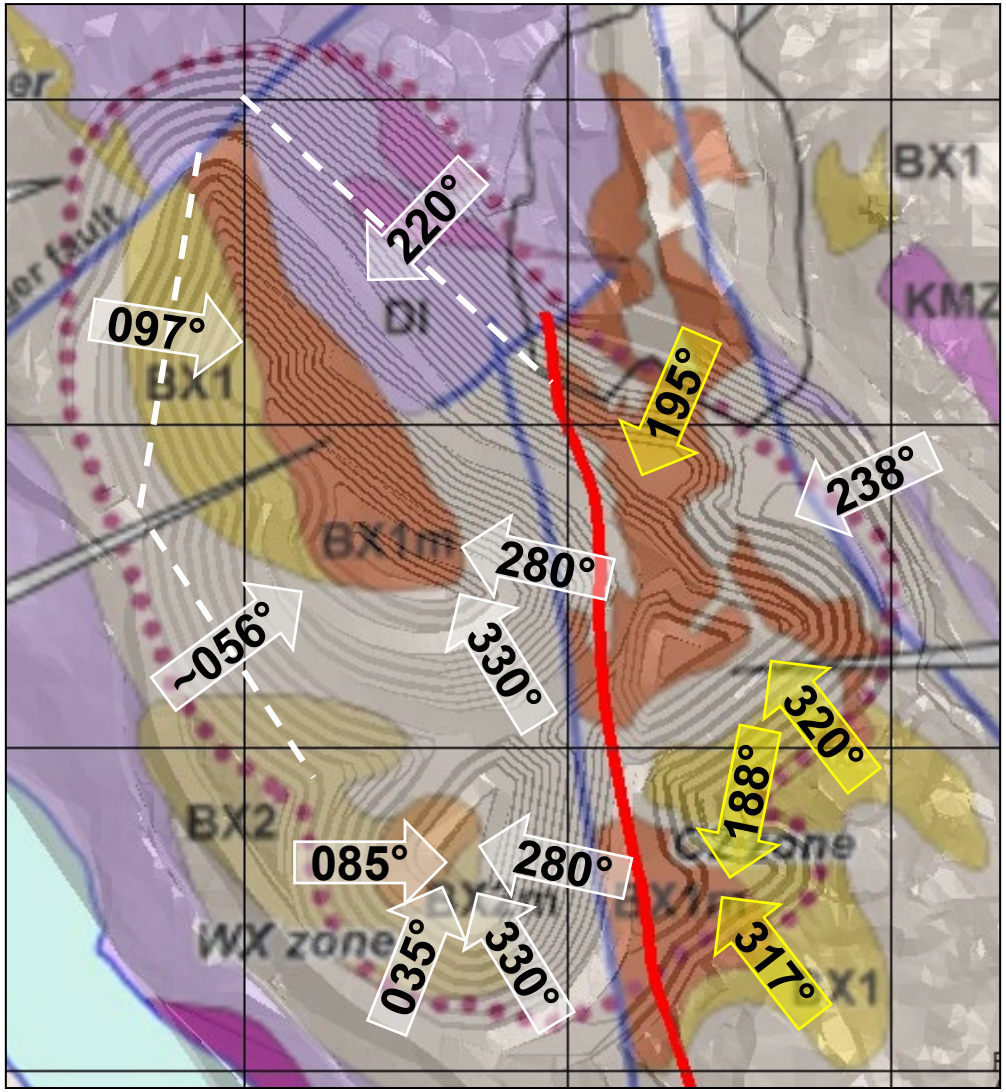

Wall Orientation: 188

BRX_C/C2_1B_D & BRX_C/C2_3_D
BRX_C/C2_1B_D & BRX_C/C2_4_D

45° Admissibility Window

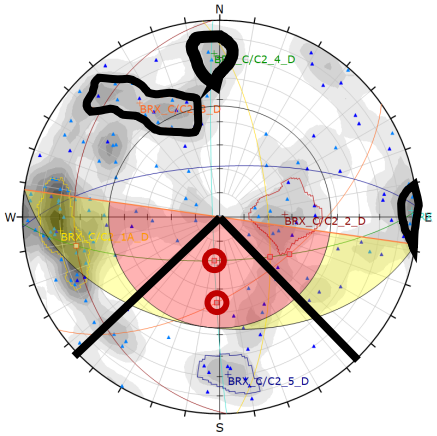

Wall Orientation: 195

BRX_C/C2_1B_D & BRX_C/C2_3_D
BRX_C/C2_1B_D & BRX_C/C2_4_D

Chosen for Modeling

45° Admissibility Window

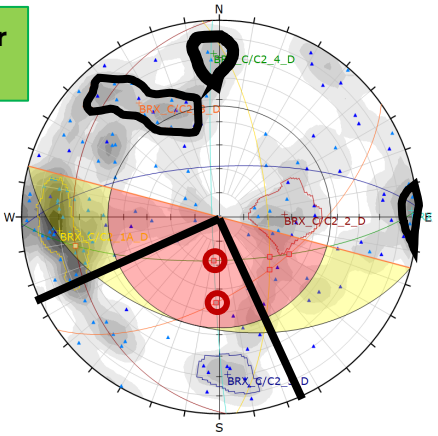

Wall Orientation: 317

BRX_C/C2_1B_D & BRX_C/C2_5_D

Chosen for Modeling

45° Admissibility Window

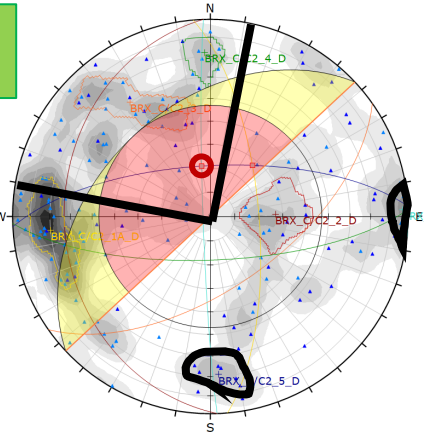

Wall Orientation: 320

BRX_C/C2_1B_D & BRX_C/C2_5_D

45° Admissibility Window

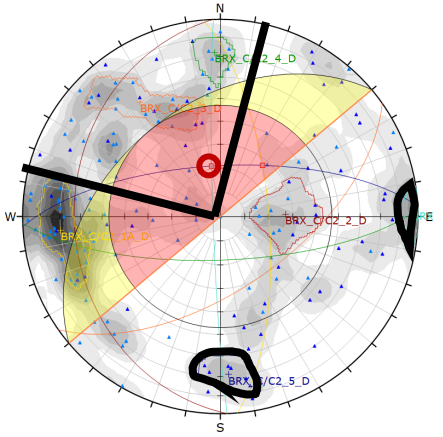

Cariboo & C2 Pits – Breccia Discontinuous

Toppling Review

Friction Angle (°)	42	Lateral Limit (°)	20

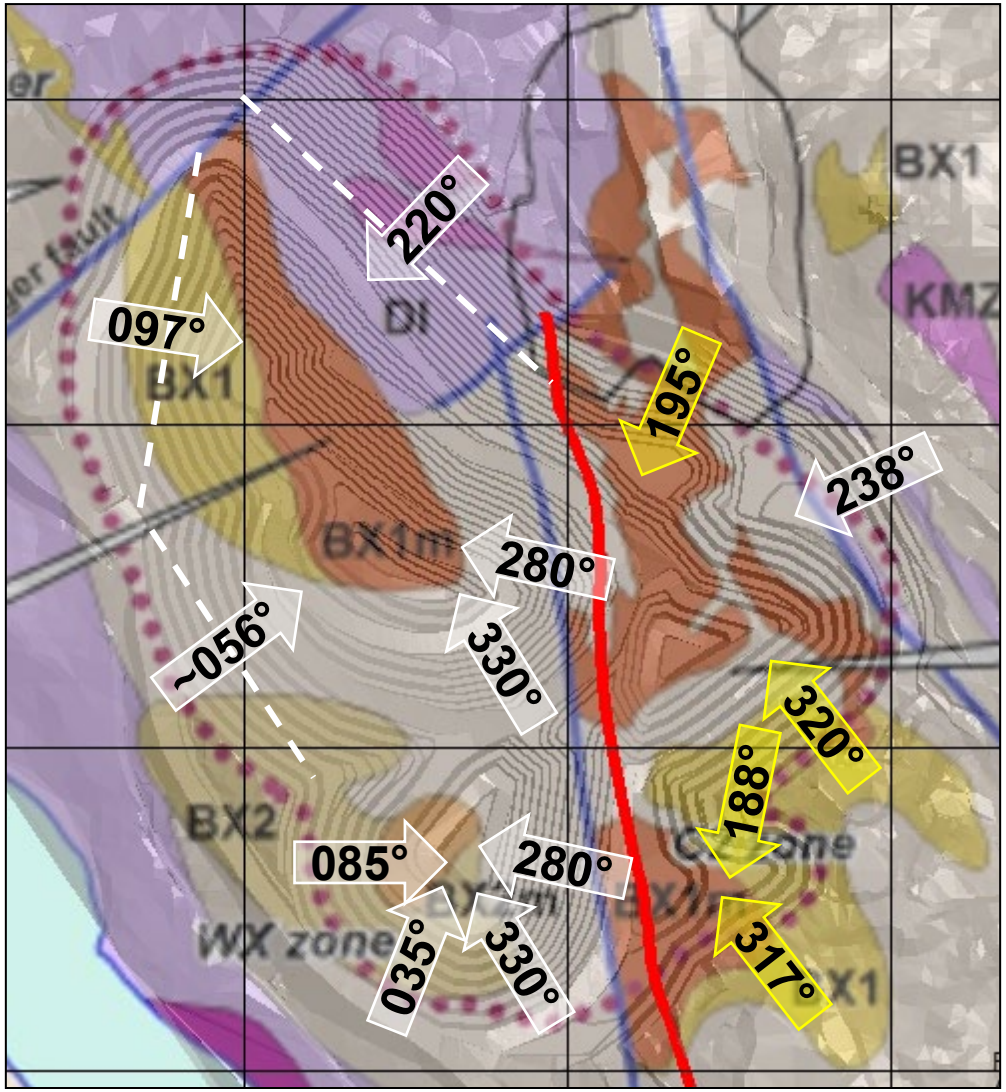

Wall Orientation: 188	Wall Orientation: 195
No Sets.	*No Sets.*
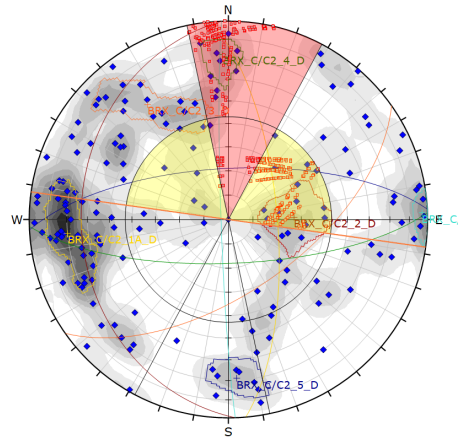	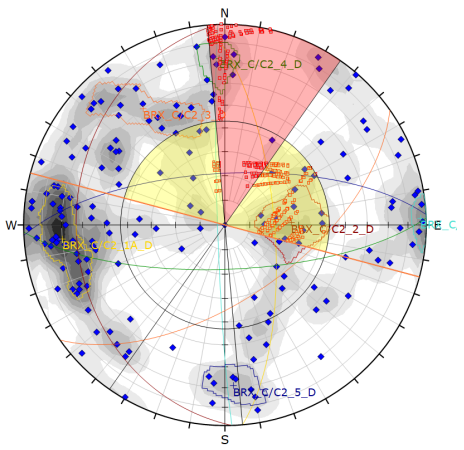
Wall Orientation: 317	**Wall Orientation: 320**
No Sets.	*No Sets.*
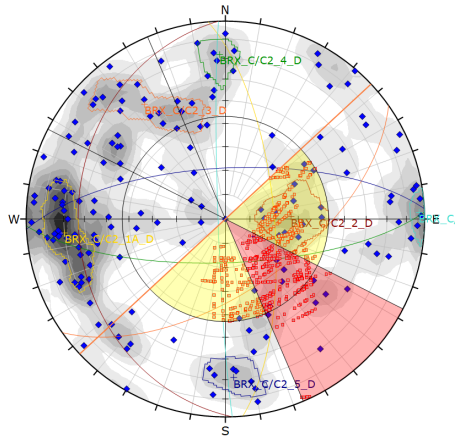	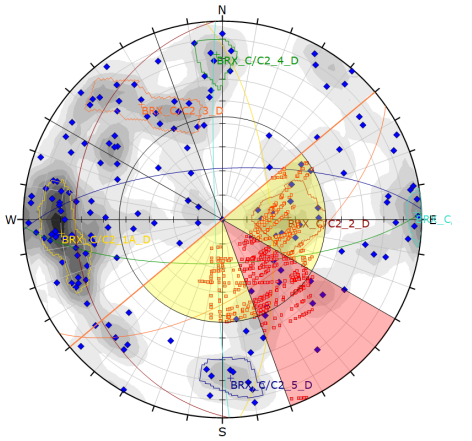

Cariboo & C2 Pits

Breccia Continuous

Continuous sets within the Breccia for the C2 and Cariboo Pits are moderately to steeply dipping.

There are 4 wall orientations within the C2 and Cariboo Pits that will be reviewed kinematically for these sets.

Based on the data available, wedge, planar, and toppling failures are possible.

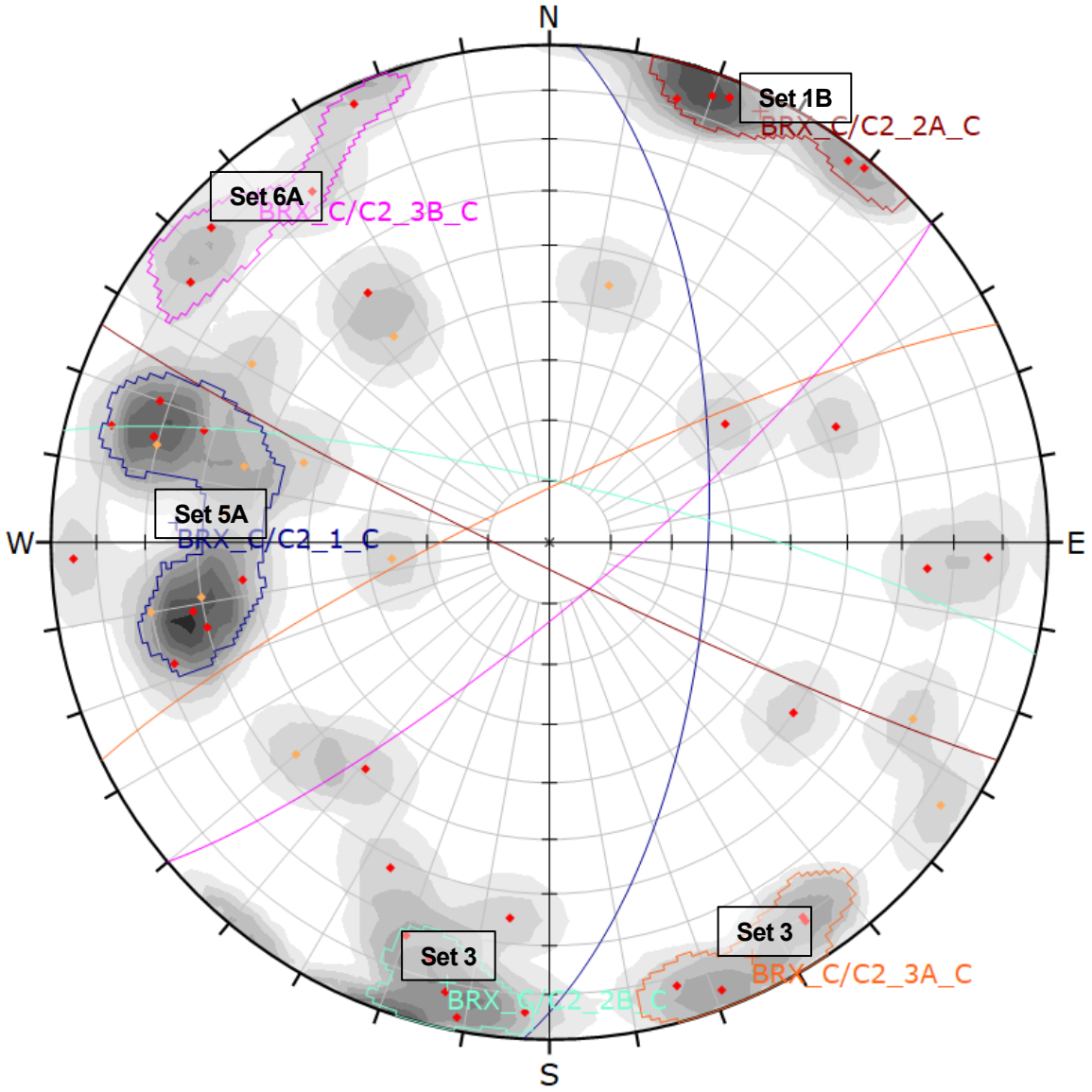

Symbol	GROUPED TYPE	Quantity
	ATV - Fault	13
	Fault	37

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.41%
Contour Distribution	Fisher
Counting Circle Size	1.0%

	Color	Dip	Dip Direction	Label
Mean Set Planes				
1m		64	93	BRX_C/C2_1_C
2m		80	13	BRX_C/C2_2B_C
3m		82	334	BRX_C/C2_3A_C
4m		80	140	BRX_C/C2_3B_C
5m		86	206	BRX_C/C2_2A_C

Plot Mode	Pole Vectors
Vector Count	50 (50 Entries)
Hemisphere	Lower
Projection	Equal Area

Cariboo & C2 Pits – Breccia Continuous

Planar Review

Friction Angle (°)	28	Lateral Limit (°)	20

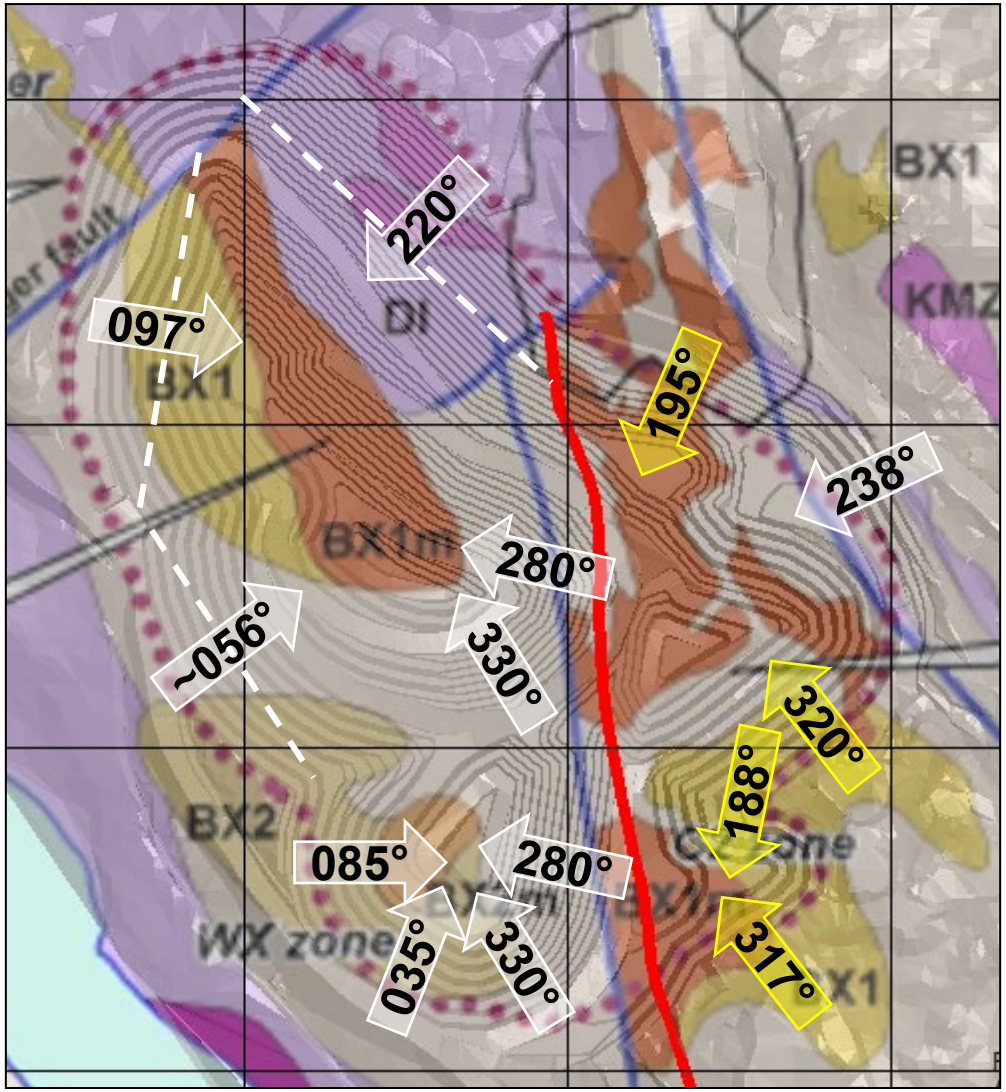

Wall Orientation: 188	Wall Orientation: 195
BRX_C/C2_2A_C	*BRX_C/C2_2A_C*
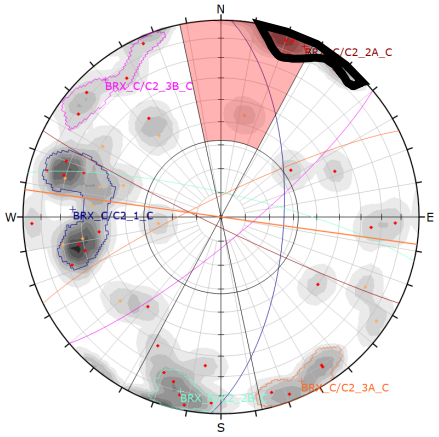	Chosen for Modeling 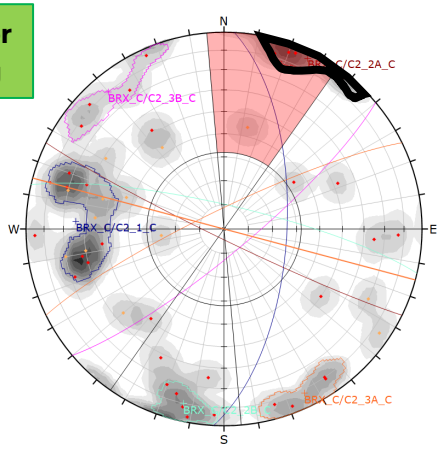
Wall Orientation: 317	**Wall Orientation: 320**
BRX_C/C2_3A_C	*BRX_C/C2_3A_C*
Chosen for Modeling 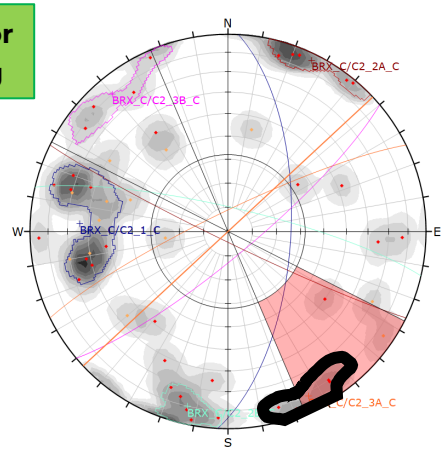	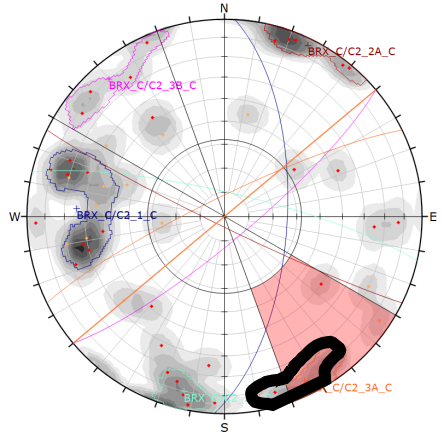

Cariboo & C2 Pits – Breccia Continuous

Wedge Review

Friction Angle (°)	28	Kinematic Window (°)	45

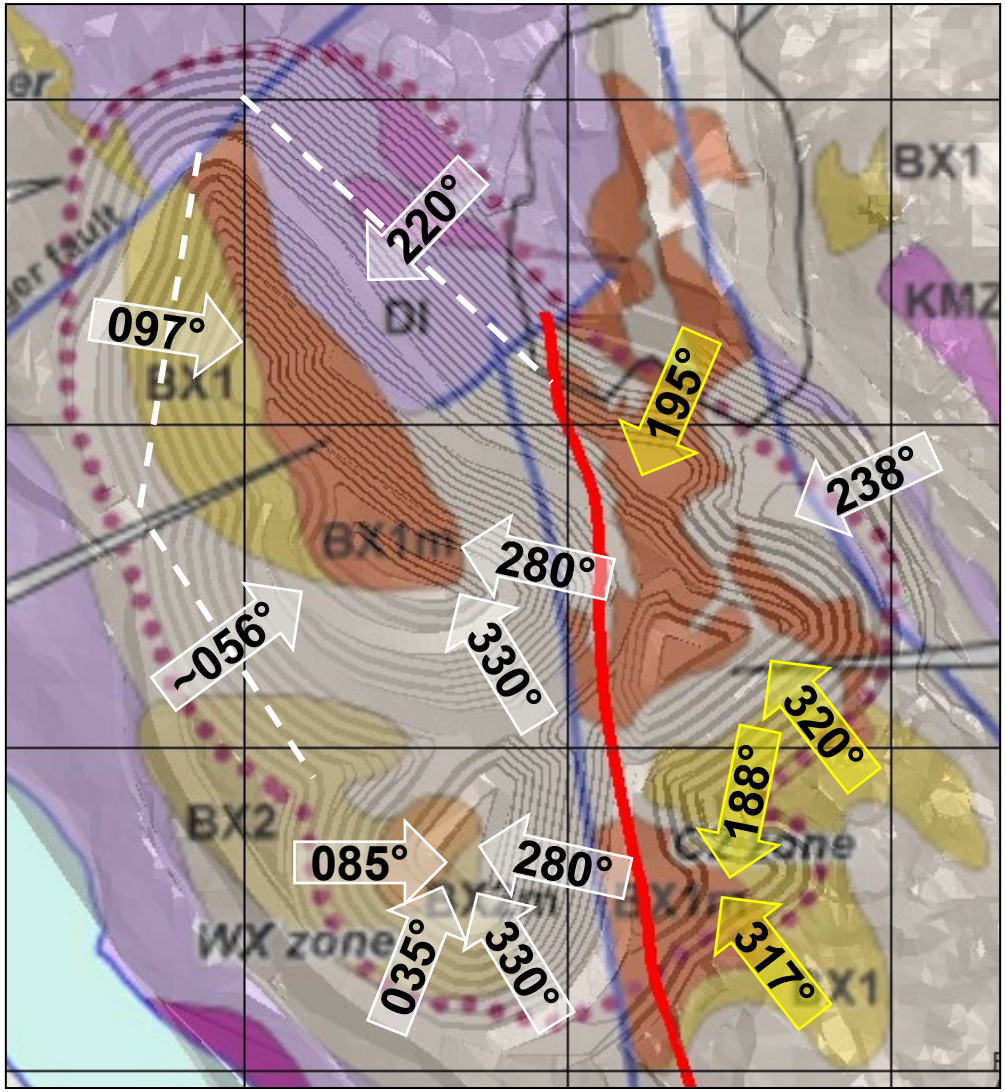

Wall Orientation: 188

No Sets.

45° Admissibility Window

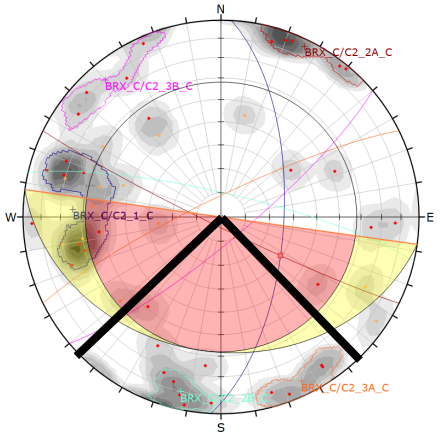

Wall Orientation: 195

No Sets.

45° Admissibility Window

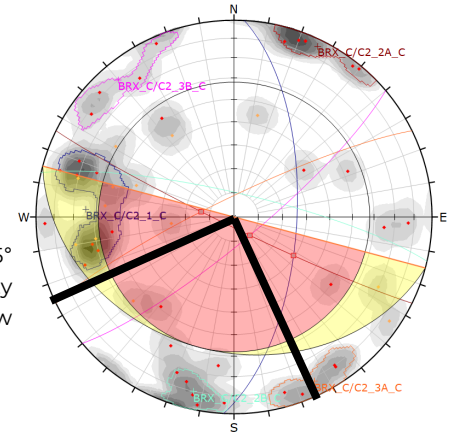

Wall Orientation: 317

BRX_C/C2_2A_C & BRX_C/C2_2B_C
BRX_C/C2_2A_C & BRX_C/C2_3A_C

Chosen for Modeling

45° Admissibility Window

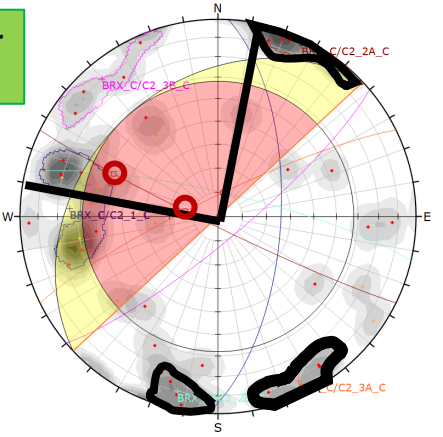

Wall Orientation: 320

BRX_C/C2_2A_C & BRX_C/C2_2B_C

45° Admissibility Window

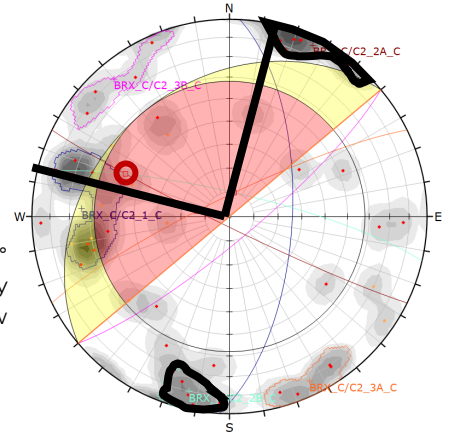

Cariboo & C2 Pits – Breccia Continuous

Toppling Review

Friction Angle (°)	28	Lateral Limit (°)	20

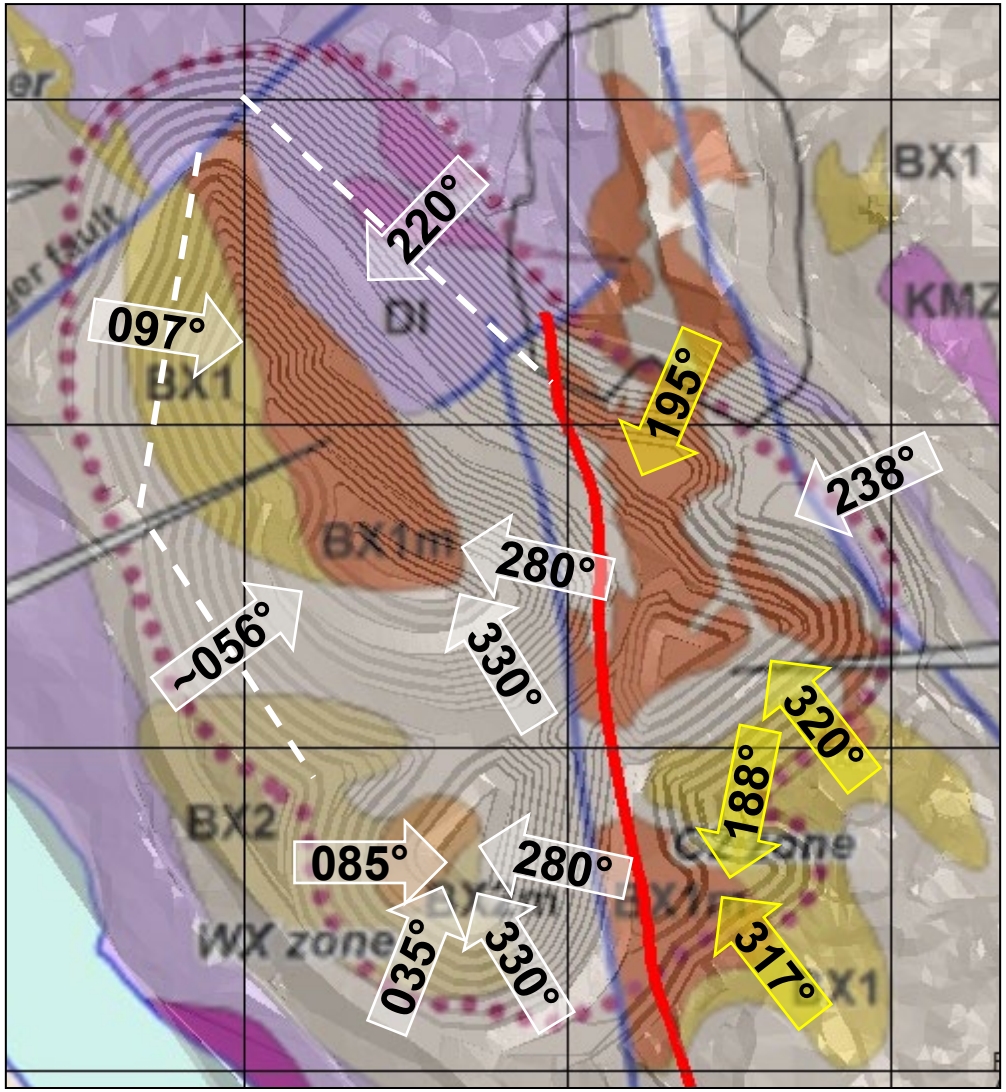

Wall Orientation: 188	Wall Orientation: 195
No Sets.	*No Sets.*
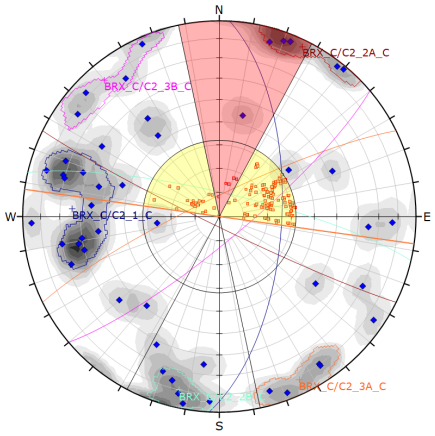	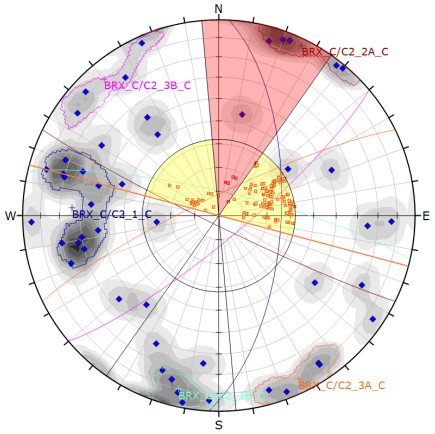
Wall Orientation: 317	**Wall Orientation: 320**
No Sets.	*No Sets.*
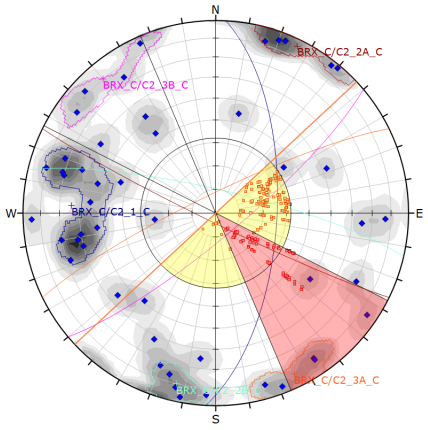	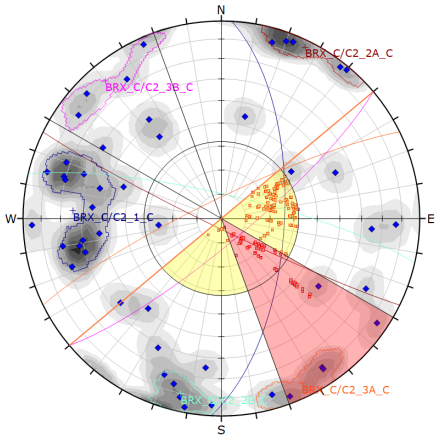

Kinematic Analyses

Model Inputs

Rocscience SWedge, RocPlane, and RocTopple were used for probabilistic kinematic analysis.

Model inputs are summarized in the tables at right.

Unit weight, bench widths, and bench heights were used from the 2016 LOM assessment and proposed ultimate pit design provided by MPMC.

As a conservative approach, small (ubiquitous) spacing was used for all features.

As it is expected that pore water pressures will dissipate at the bench-scale, all models were analyzed under dry conditions.

Model Inputs	
Bench Height (m)	12 or 24
Bench Width (m)	8.5, 11.5, or 12
Bench Length (m)	3 x bench height
Unit Weight (MN/m³)	0.026
Minimum Wedge Size (MN)	0.104
Feature Persistence	Small (Ubiquitous)
Models were assessed under dry conditions.	

Discontinuous Features	
Cohesion (kPa)	0
Friction Angle (degrees)	42
Continuous Features	
Cohesion (kPa)	40
Friction Angle (degrees)	28

Single-Bench Kinematic Results Summary

Critical limiting mechanisms affecting single bench configurations for each of the analyzed wall directions are summarized.

All models have been run with small (ubiquitous) feature spacing.

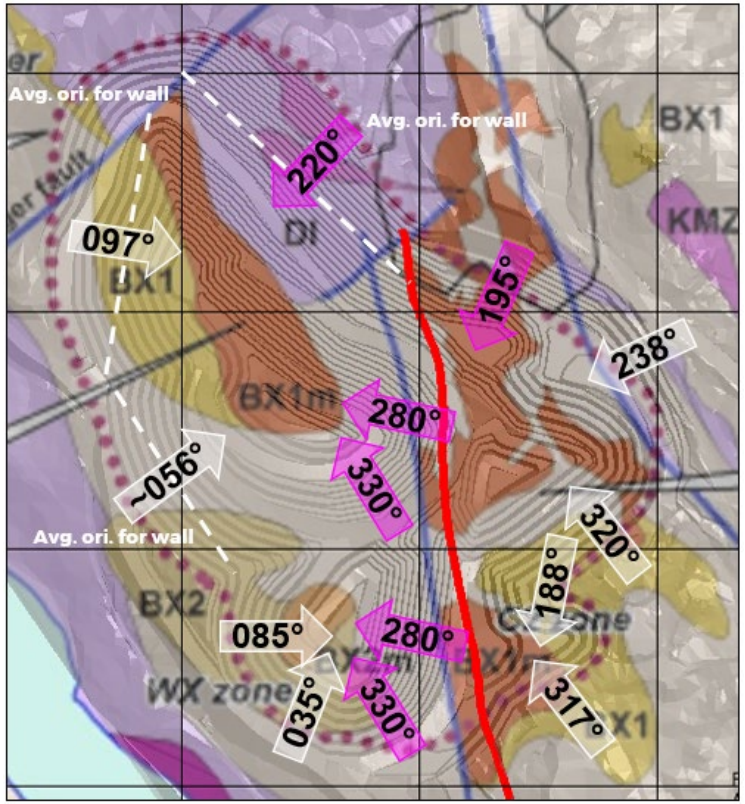

Pit	Lithology	Wall Direction (Degrees)	Bench Height (m)	Structure Scale	Critical Mechanism	Set(s)	BFA @ P[FOS<1]=50%
Springer/WX	Monzodiorite	330	12	Discontinuous	Planar	Set 4/3	**61**
					Wedge	Set 4/3 & Set 5B	62
	Diorite	220	12	Discontinuous	Planar	Set 1B	**80**
Cariboo	Breccia	195	12	Discontinuous	Planar	Set 2	**74**
					Wedge	Set 5B & Set 6A	90
					Wedge	Set 5B & Set 2	75

Single-Bench Kinematic Results Summary

Discontinuous Cumulative Frequency Plots

Cariboo & C2 Pits, Breccia, Wedge, Probability of Failure CFA Plot

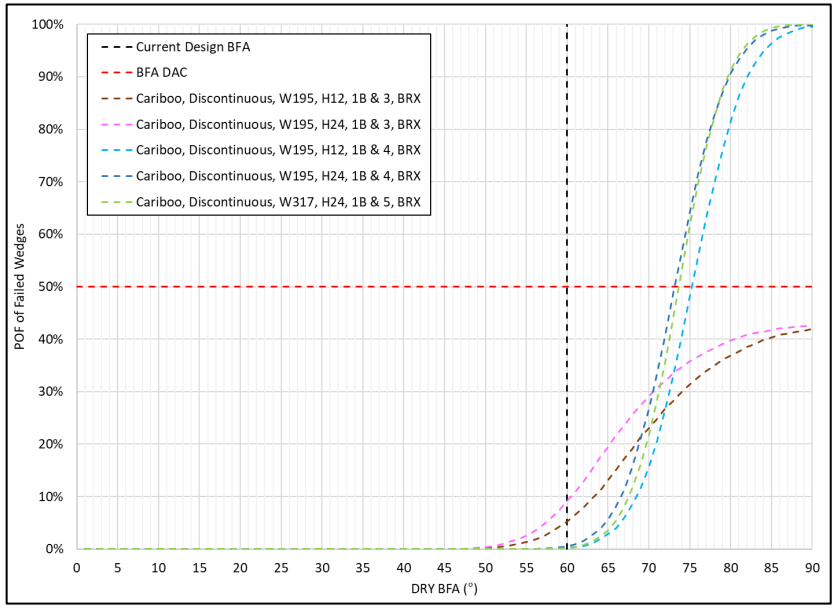

Springer & WX Pits, Monzodiorite, Planar, Probability of Failure CFA Plot

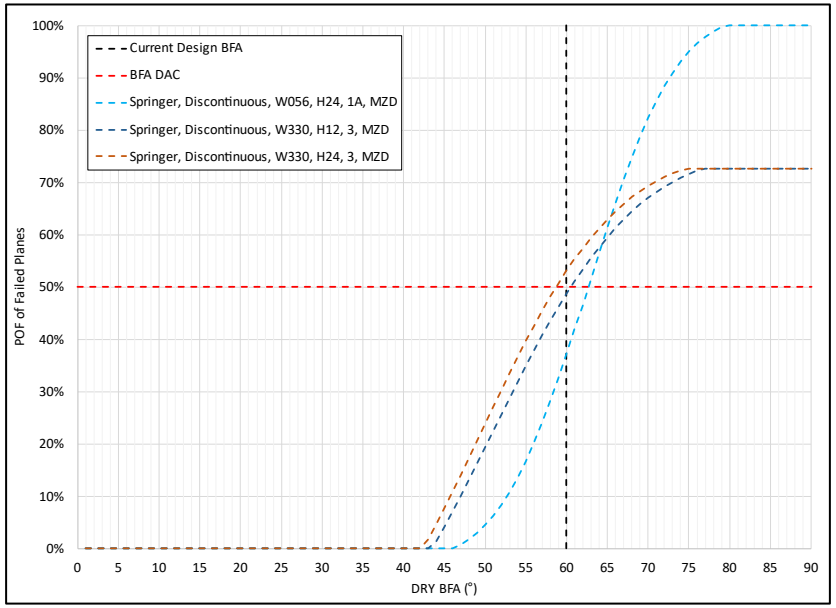

Springer & WX Pits, Diorite, Planar, Probability of Failure CFA Plot

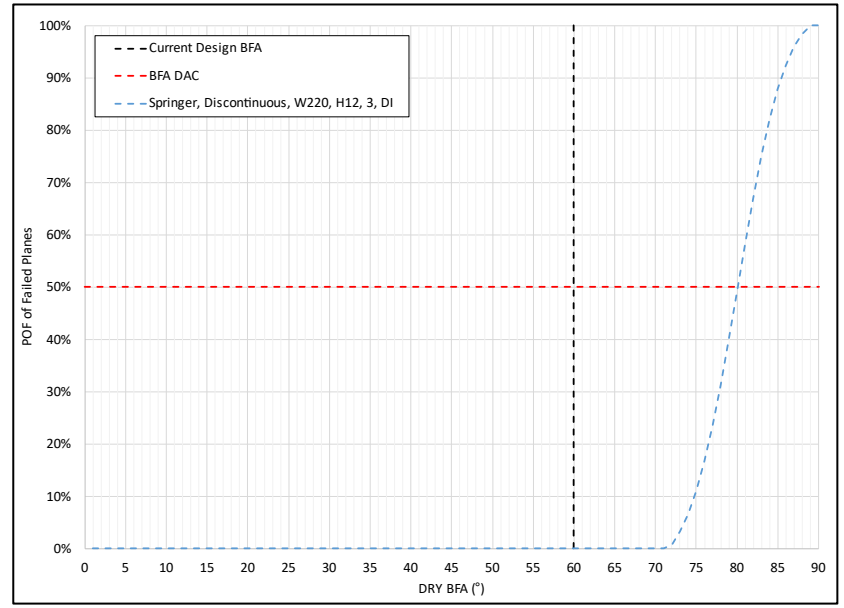

Double-Bench Kinematic Results Summary

Critical limiting mechanisms affecting double-bench configurations for each of the analyzed wall dip directions have been highlighted in the table at right.

All models have been run with small (ubiquitous) feature spacing.

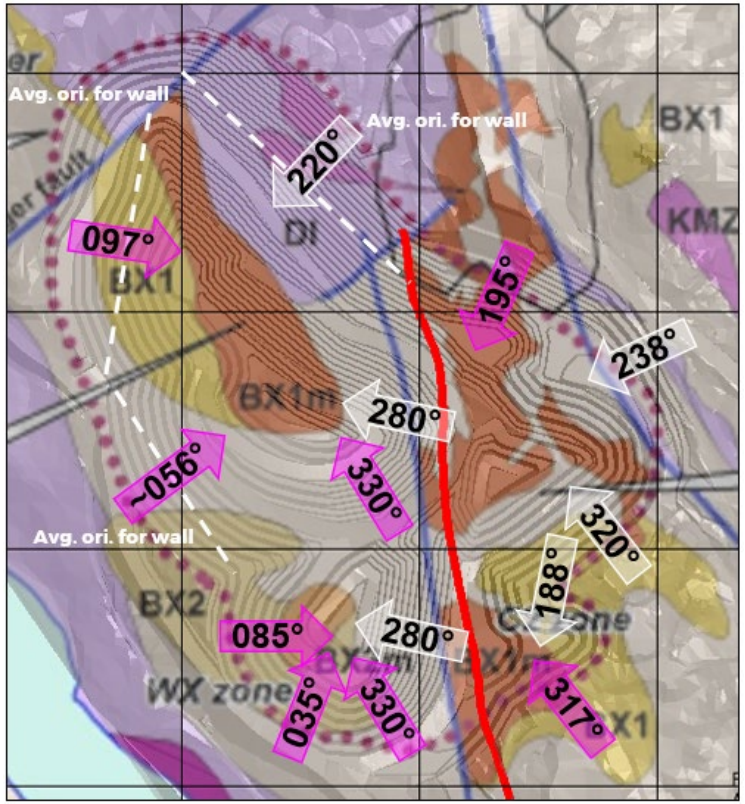

Pit	Lithology	Wall Direction (Degrees)	Bench Height (m)	Structural Scale	Critical Mechanism	Set(s)	BFA @ P[FOS<1]=50%
Springer/WX	Monzodiorite	56	24	Continuous	Wedge	Set 5A/6A & Set 3	90
		97	24	Continuous	Planar	Set 5A/6A	**82**
		330	24	Continuous	Planar	Set 3C	**80**
				Continuous	Wedge	Set 5B & Set 3C	90
	Breccia	35	24	Continuous	Planar	Set 5A	90
				Continuous	Wedge	Set 5A & Set 3	90
		85	24	Continuous	Planar	Set 5A	**77**
				Continuous	Wedge	Set 5A & Set 3	90
Cariboo/C2	Breccia	195	24	Continuous	Planar	Set 1B	90
		317	24	Continuous	Planar	Set 3	90
				Continuous	Wedge	Set 3 & Set 3	90
				Continuous	Wedge	Set 3 & Set 1B	90

Double-Bench Kinematic Results Summary

Continuous Cumulative Frequency Plots

Cariboo & C2 Pits, Breccia, Wedge, Probability of Failure CFA Plot

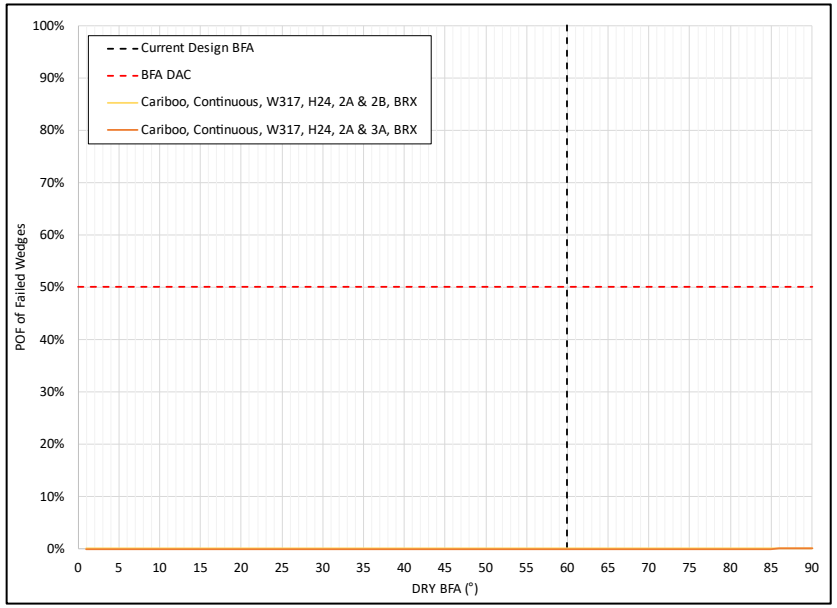

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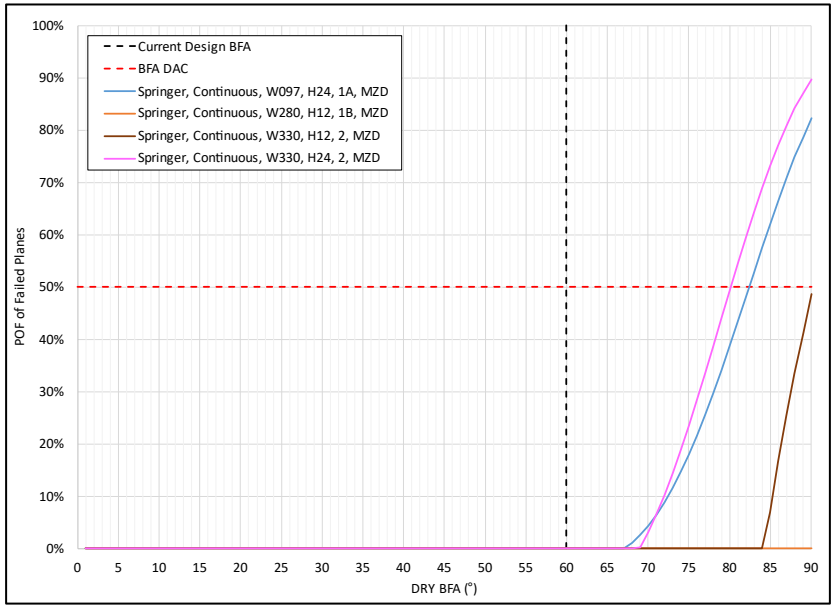

Springer & WX Pits, Monzodiorite, Wedge, Probability of Failure CFA Plot

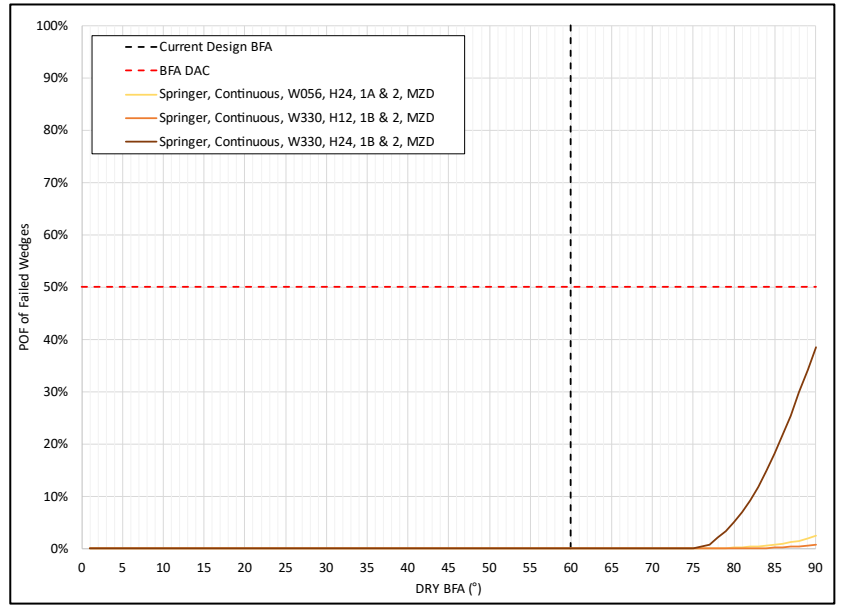

Inter-ramp Kinematic Results Summary

Saturated models in RocPlane were completed using plane water, 33% filled slopes, with peak pressure applied at the toe of the slope.

All models have been run with small (ubiquitous) feature spacing.

Pit	Lithology	Wall Direction (°)	Bench Height (m)	Structural Scale	Critical Mechanism	Set(s)	DRY IRA @ P[FOS<1]=20%	33%Saturated IRA @ P[FOS<1]=20%
Springer /WX	Monzodiorite	56	72	Continuous	Wedge	Set 5A/6A & Set 3	74	73
		97	72	Continuous	Planar	Set 5A/6A	68	65
	Breccia	85	72	Continuous	Planar	Set 5A	63	60

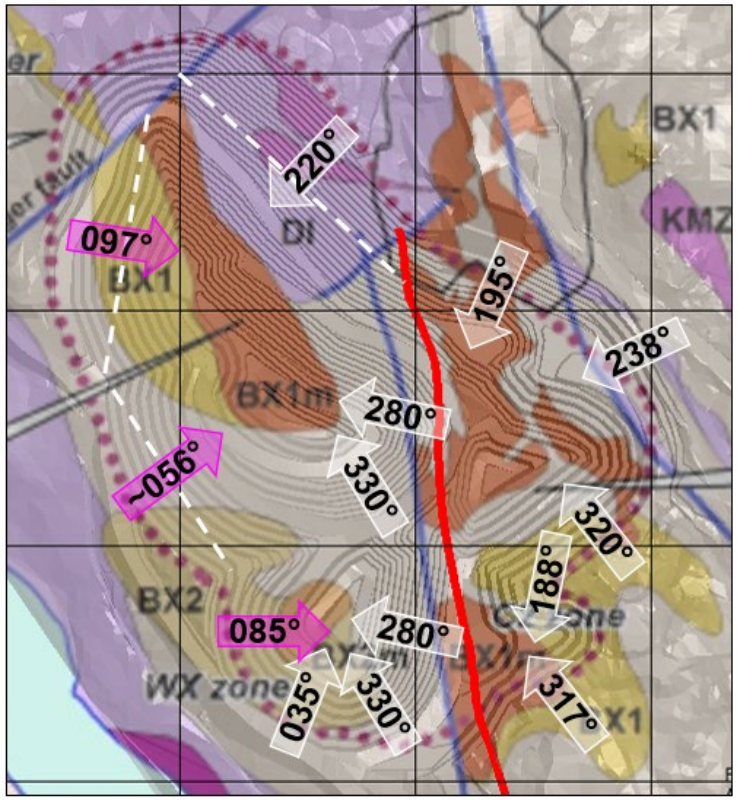

Inter-ramp Kinematic Results Summary

Continuous Cumulative Frequency Plots

Springer & WX Pits, Monzodiorite, Wedge, Probability of Failure CFA Plot

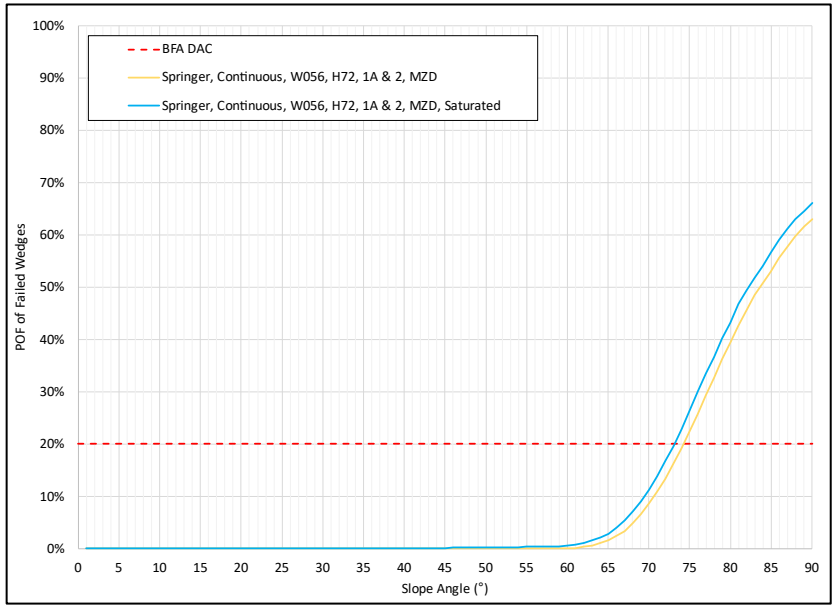

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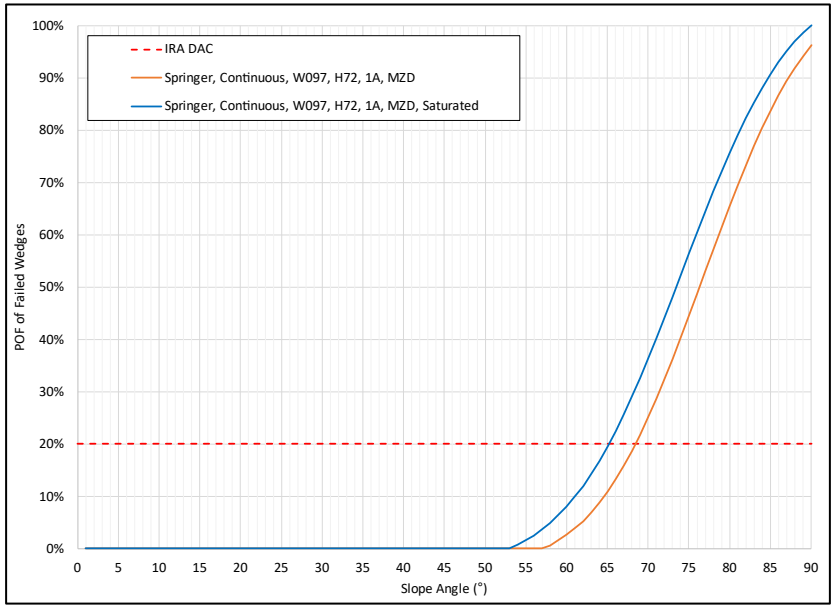

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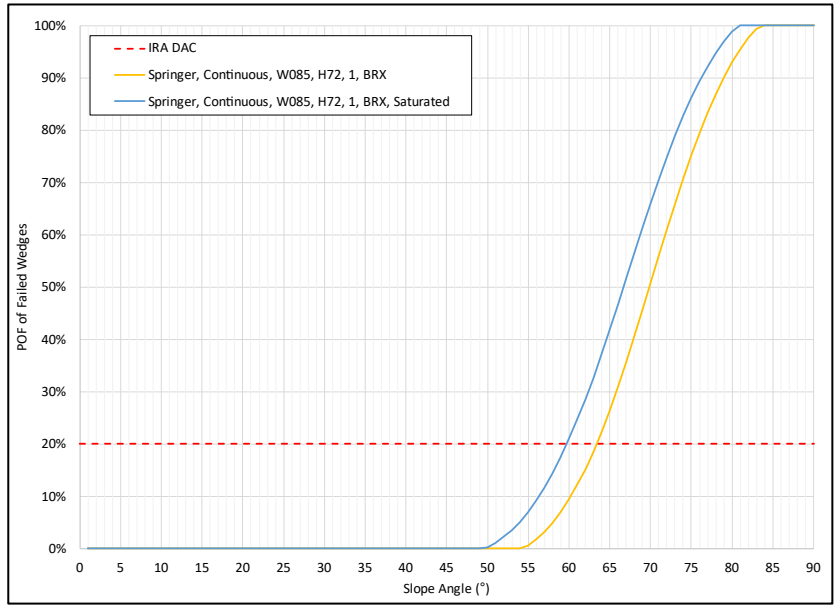

Summary of Previous Recommendations by Wall Orientation

The figure on the left presents deign recommendations from the 2016 LOM assessment (Golder 2016).

The figure on the right presents results from kinematic analyses completed for the 2024 LOM assessment.

- Values from the 2024 kinematic analyses resulting in BFAs lower than the 2016 recommendations or are incorrect are highlighted in red, BFAs equal to or above the 2016 recommendations are highlighted in green.

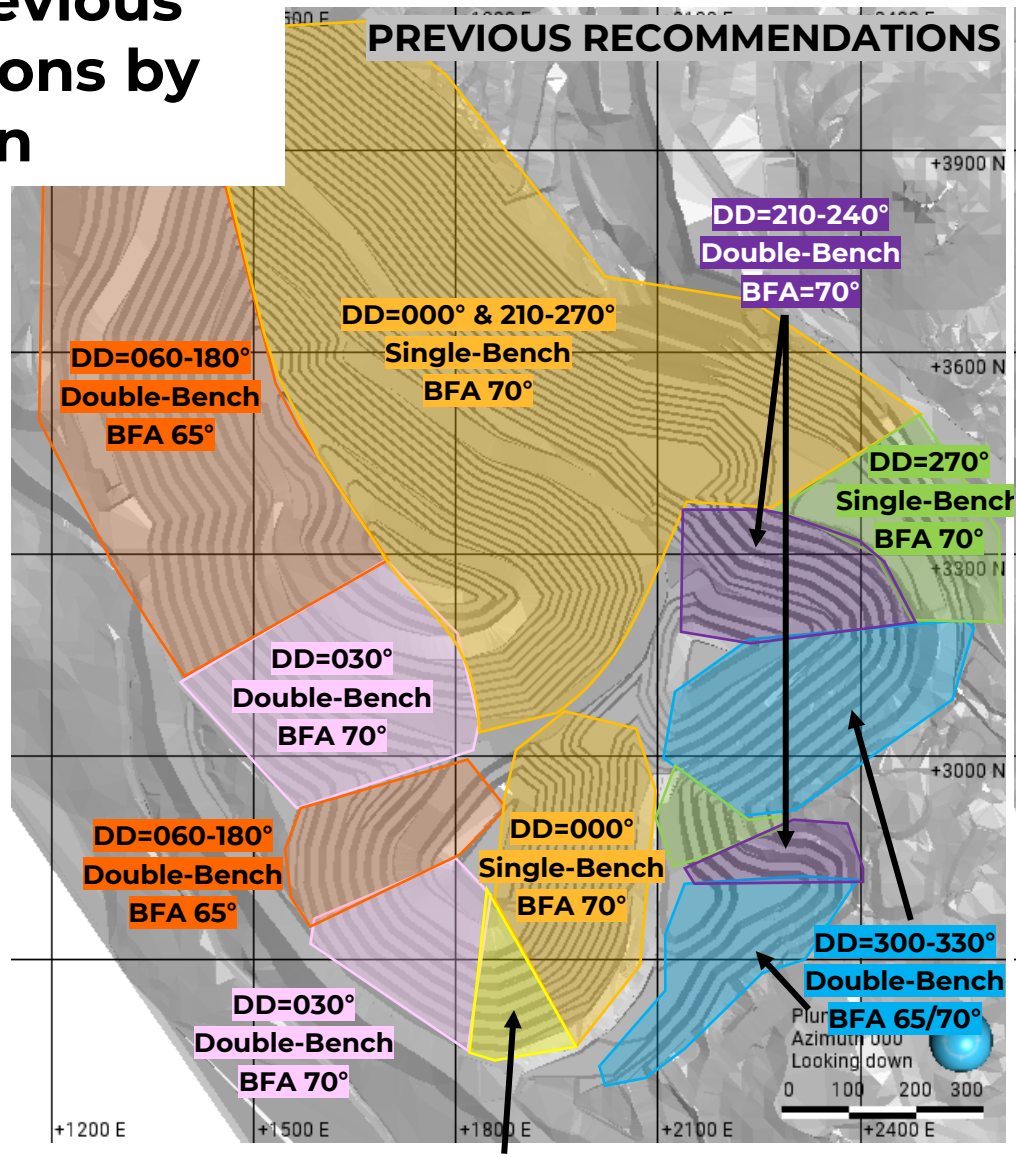

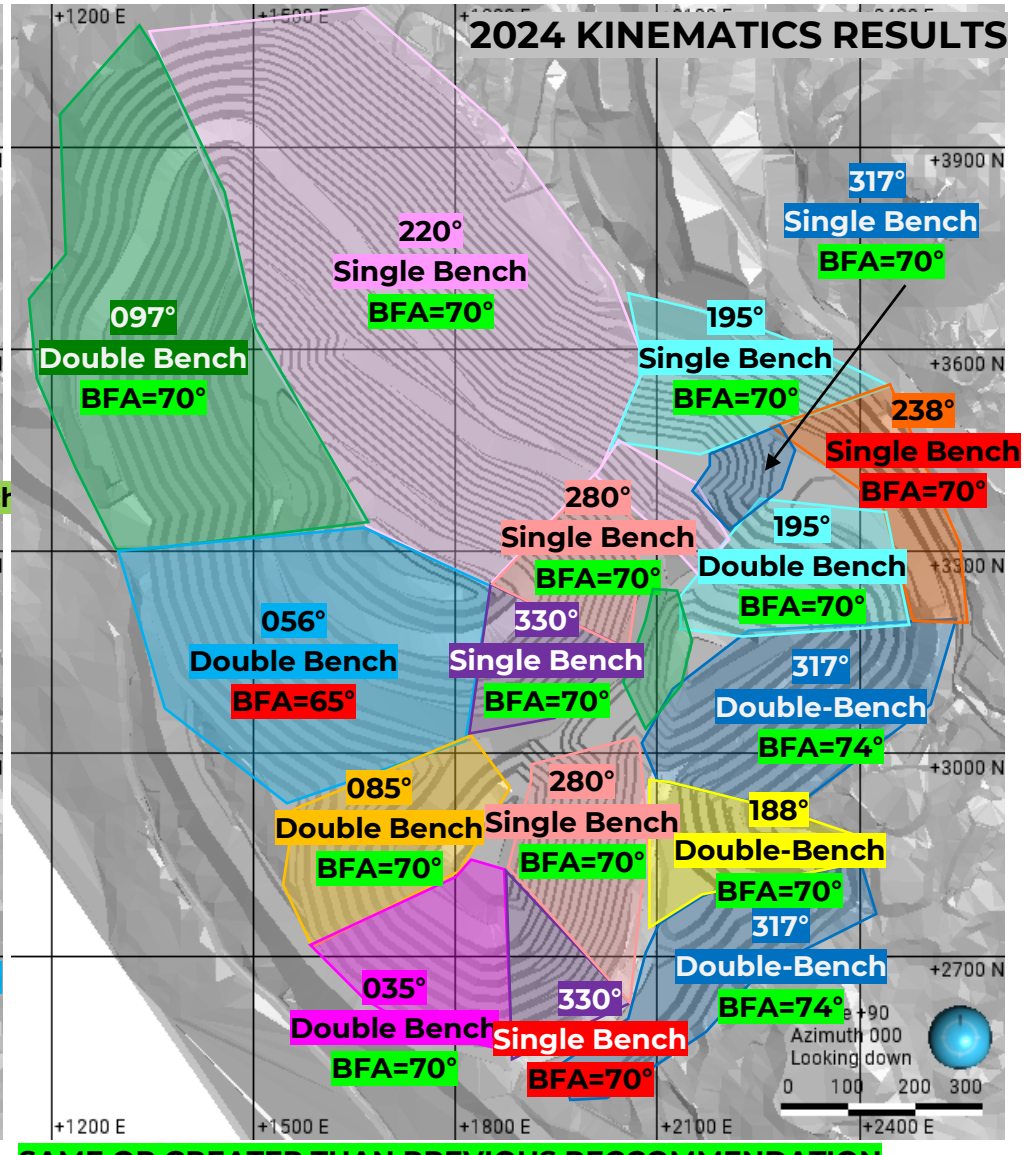

Within 000 Single-Bench orientation but appears double benched.

SAME OR GREATER THAN PREVIOUS RECCOMMENDATION

LESS THAN PREVIOUS RECCOMMENDATION OR INCORRECT DESIGN



wsp.com

APPENDIX 4-1A: Mine Plan and Reclamation Program

Mount Polley Mining Corporation

an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

MINE PLAN AND RECLAMATION PROGRAM UPDATE 2022

PREPARED FOR:

THE MINISTRY OF ENERGY, MINES, AND LOW CARBON INNOVATION

PREPARED BY:

MOUNT POLLEY MINING CORPORATION

BOX 12, LIKELY, BC V0L 1N0

(250) 790-2215

MINES ACT PERMIT: M-200

22 DECEMBER 2022

DOCUMENT REVISIONS

DATE	TITLE
March 1995	Mount Polley Mine Project Interim Reclamation Plan (Hallam Knight Piésold Ltd.)
April 1996	Mount Polley Mine Project Reclamation Plan (Hallam Knight Piésold Ltd.)
March 1998	Reclamation Plan – Mount Polley Mines – Tailings Area (Inland Timber Management Ltd.)
March 2005	Reclamation and Closure Plan Update 2004 Mount Polley Project (Greg Smyth and MPMC)
14 January 2013	Mine Reclamation and Closure Plan Update 2012 (MPMC)
30 September 2015	Mine Reclamation and Closure Plan Update September 2015 (MPMC)
4 November 2015	Mine Reclamation and Closure Plan Update November 2015 (MPMC)
15 January 2017	Mine Reclamation and Closure Plan Update January 2017 (MPMC and Golder Associates Ltd.)
22 December 2022	Mine Plan and Reclamation Program Update 2022 (MPMC and Golder Associates Ltd.)

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ABA	Acid-base accounting
AER	Annual Environmental Report
ARD	Acid rock drainage
ARR	Annual Reclamation Report
BAT	Best Achievable Technology
BCR	Biochemical Reactor
BEC	Biogeoclimatic Ecosystem Classification
CCME	Canadian Council of Ministers of the Environment
CCS	Central Collection Sump
CDA	Canadian Dam Association
CEMP	Comprehensive Environmental Monitoring Plan
cm	centimetre(s)
d	Day(s)
DFO	Fisheries and Oceans Canada
dm^2	Square decimetre(s)
dt/ha	Dry tonnes per hectare
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EMA	Environmental Management Act
EMLI	Ministry of Energy and Mines and Low Carbon Innovation
ENV	Ministry of Environment and Climate Change Strategy
EOR	Engineer of Record
FoS	Factor of safety
FSR	Forest Service Road
GIS	Geographic information system
Golder	Golder Associates Ltd.
g/t	Gram(s) per ton
ha	Hectare(s)
HQ	Hazard Quotient
IERP	Independent Engineering Review Panel
ITRB	Independent Tailings Review Board
kg/ha	Kilograms per hectare
km	Kilometre(s)
km^2	Square kilometre(s)
LFH	Litter, Folic, Humic – varying degrees of decay of the forest floor layer of a soil profile; collectively referred to as LFH
LTWMP	Long-Term Water Management Plan
m	Metre(s)
m^3	Cubic metre(s)
m/s	Metre(s) per second
masl	Metre(s) above sea level
MDMER	Metal and Diamond Mining Effluent Regulations
ME	Main Embankment
MEM	Ministry of Energy and Mines
MESCP	Main Embankment Seepage Collection Pond

Abbreviation	Definition
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
mg	Milligram(s)
mg/dm^2/d	Milligrams per decimetre squared per day
mg/kg	Milligrams per kilogram
ML	Metal leaching
mm	Millimetre(s)
MPMC	Mount Polley Mining Corporation
MRP	Mine Reclamation Plan
Mt	Million tonne(s)
MoTI	Ministry of Transportation and Infrastructure
NAG	Non-acid generating
NBD	North Bell Dump
NEZ	Northeast Zone
NW	Northwest
OG	Original Ground
OMS	Operation, maintenance, and surveillance
OSA	On-stream analyzer
PAG	Potentially acid-generating
PAO	Pollution Abatement Order
PAR	Plug Access Road
PBR	Packed bed reactor
PESCP	Perimeter Embankment Seepage Collection Pond
PETBP	Perimeter Embankment
PLC	Programmable logic controller
POPC	Parameter of Potential Concern
ppm	Parts per million
QA/QC	Quality assurance quality control
QP	Qualified Professional
RDS	Rock disposal site
SCIB	Soda Creek Indian Band
SERDS	Southeast Rock Disposal Site
SEZ	Southeast Zone
sph	Stems per hectare
SRK	SRK Consulting Ltd.
SWE	Snow-water equivalent
t	Tonne(s)
TAR	Technical Assessment Report
TDAR	Tailings Dam Access Road
TEM	Terrestrial Ecosystem Mapping
TERA	Terrestrial ecological risk assessment
tpd	Tonne(s) per day
TSF	Tailings Storage Facility
TSIP	Toxicity to soil invertebrates and plants
TSM	Towards Sustainable Mining
WLIB	Williams Lake Indian Band

1. INTRODUCTION

1.1. Report Overview

This Mine Plan and Reclamation Program Update 2022 (2022 MRP) is submitted to the Ministry of Energy, Mines, and Low Carbon Innovation (EMLI) in compliance with condition E.13 of *Mines Act* Permit M-200 amendment "*Approving Return to Full Operations and Use of Tailings Storage Facility*" for the Mount Polley Mining Corporation (MPMC) Mount Polley Mine (Mine Site). This document is an update to the "*Mine Reclamation and Closure Plan Update November 2017*" (2017 MRP) dated 15 November 2017.

The first year of mining and milling at the Mine Site occurred in 1998. Following approximately three years of operations, the Mine Site went into care and maintenance in October 2001 due to low metal prices, and subsequently resumed operations in 2004. The Mine Site operated without interruption until August 2014. On 4 August 2014, a Tailings Storage Facility (TSF) embankment breach caused MPMC to suspend operations. Following this, the Mine Site returned to restricted operations from 2015 to 2016. Full operations resumed in the latter portions of 2016, and occurred uninterrupted until 2019, when the Mine Site was again placed in care and maintenance due to poor commodity prices. In recent years, prices have improved, and the Mine is now actively preparing to come out of care and maintenance. Activities related to resuming operations include dewatering the Cariboo-Springer Pit and preparations for mining and milling ore. Further details of MPMC's historical and planned operations are outlined in Section 1.2 and Section 2.

The Mine Site's currently permitted mine plan was originally approved in 2016, and was scheduled to continue until 2022. However, given the delays due to temporary shutdown, operations under the mine plan are now expected to conclude in September 2024. As such, the 2022 MRP incorporates the planned disturbance and corresponding reclamation requirements for disturbances created to Q3 2024. MPMC is approved for tailings deposition in the Mine Site's TSF to the 970 metre (m) elevation. Conditions set on the current mine plan are provided in the corresponding *Mines Act* Permit M-200 amendment application submitted to EMLI on 6 November 2015 (MPMC 2015a).

This 2022 MRP provides an overview of planned mine operations and reclamation and closure objectives and strategies for all permitted Mine units, and associated liability cost estimates for their execution. The MPMC reclamation program is designed to meet the environmental protection and reclamation requirements of all applicable provincial and federal legislation, including:

- the *British Columbia (BC) Mines Act*
- the *Health, Safety and Reclamation Code for Mines and British Columbia*
- the *Environmental Management Act* (EMA)
- the *Canadian Fisheries Act* (including the annexed *Metal and Diamond Mining Effluent Regulations*; MDMER).

Included in the 2022 MRP and presented in the subsequent sections are:

- a summary of the project background, permits, and biophysical setting (Section 1)
- an overview of mining and milling operations and site water management (Section 2)
- a description of the designated end land uses and capability objectives (Section 3)
- an overview of MPMC's reclamation approach and update on progressive reclamation and reclamation research (Section 4)
- descriptions of MPMC's reclamation strategies and management plans for achieving their reclamation objectives (Section 5)
- reclamation plans for the major disturbance units at the Mine Site (Section 6);
- projected post-closure monitoring requirements (Section 7)
- the conceptual Mine Site reclamation schedule (Section 8)
- reclamation liability costing (Section 9)
- an overview of relevant consultation and engagement activities since the last Mine Plan and Reclamation Program update (Section 10)

The three main phases in the Mines life cycle used in this MRP are defined as follows:

- **Operations:** The phase when mining, milling, and tailings deposition are occurring. The mine is actively producing finished products (e.g., concentrate) or is working towards this overarching goal. Reclamation activities are those required for erosion prevention (e.g., temporary reclamation), or are conducted in areas that are no longer required for mine operations (e.g., progressive reclamation).
- **Active Closure:** The phase when all operational (e.g., mining and milling) activities have ceased, and efforts to return disturbed areas to the proposed end land uses are in progress. Mine infrastructure not required for post-closure is removed, the landscape is recontoured to blend with the surrounding landscape, where possible, and coversoil placement and revegetation occurs.
- **Post-Closure:** The phase immediately following the conclusion of all active closure activities. The Mine Site is in its final configuration. Monitoring and maintenance activities continue to confirm the receiving environment is protected and vegetation communities on the disturbed areas are on a growth trajectory towards meeting end land use goals.

1.2. Project Summary

The Mine Site, operated by MPMC (a wholly owned subsidiary of Imperial Metals Corporation, is an open pit copper/gold mine with an underground component located in south-central British Columbia. It is located eight kilometres (km) southwest of Likely and 56 km (100 km by road) northeast of Williams Lake, British Columbia (BC; Figure 1-1). The Mine Site has the capacity to process 20,000 to 22,000 tonnes per day (tpd) of ore when in normal operations. The mine property covers 24,077 hectares (ha), consisting of seven mining leases totaling 2,007 ha, and 51 mineral claims encompassing 22,070 ha (Figure 1-2; MPMC 2022a). Concentrates from the Mine Site are trucked to facilities at the Port of Vancouver, then shipped to overseas smelters or transported by rail to smelters in North America.

1.2.1. *Project History*

Clearing of the site and construction of the facility began in 1995, with the mill commissioned in June 1997. In May 1997, the Mine received a British Columbia Ministry of the Environment, and Climate Change Strategy (ENV) Effluent Permit, Environmental Management Act (EMA) Permit 11678, issued under the provisions of the provincial EMA. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a TSF, from where limited volumes of dam filtered water could be discharged to Hazeltine Creek (MPMC 2014). Approval of the original Mine Site Reclamation and Closure Plan by the EMLI resulted in the issuance of *Mines Act* Permit M-200 in July 1997 (Hallam Knight Piesold 1996; EMLI 2020). The first full year of mining and milling at the Mine Site took place in 1998. The Mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004, with mill production commencing in March 2005. Between 1999 and 2009 the Wight Pit was mined (excluding the 2001 care and maintenance period). Following this, the pit was backfilled with potentially acid generating (PAG) rock from the Southeast Zone Pit (SEZ Pit). Mining of the Cariboo and Springer Pits also occurred during this time, until 4 August 2014.

On 4 August 2014, a breach occurred in the Perimeter Embankment of the TSF. The TSF embankment breach released tailings, water, and embankment construction materials to the downstream environments of Polley Lake, Hazeltine Creek, and Quesnel Lake. As a result, ENV issued MPMC a Pollution Abatement Order (PAO) 107461, dated 5 August 2014, ordering MPMC to attend to the environmental impacts of the TSF embankment breach. Mining and milling operations at the Mine were immediately suspended, along with previously authorized water discharge to Hazeltine Creek through EMA Permit 11678.

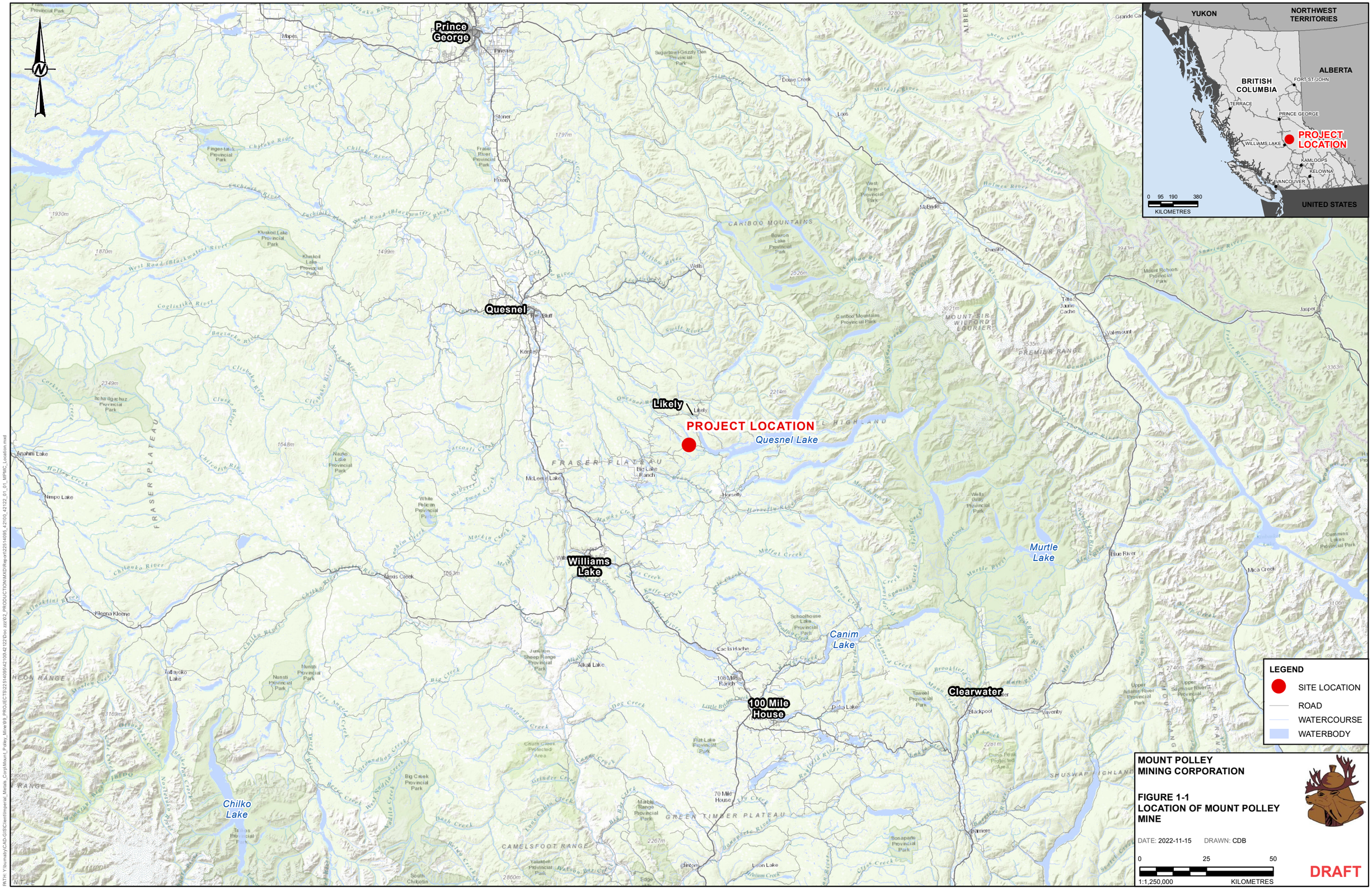

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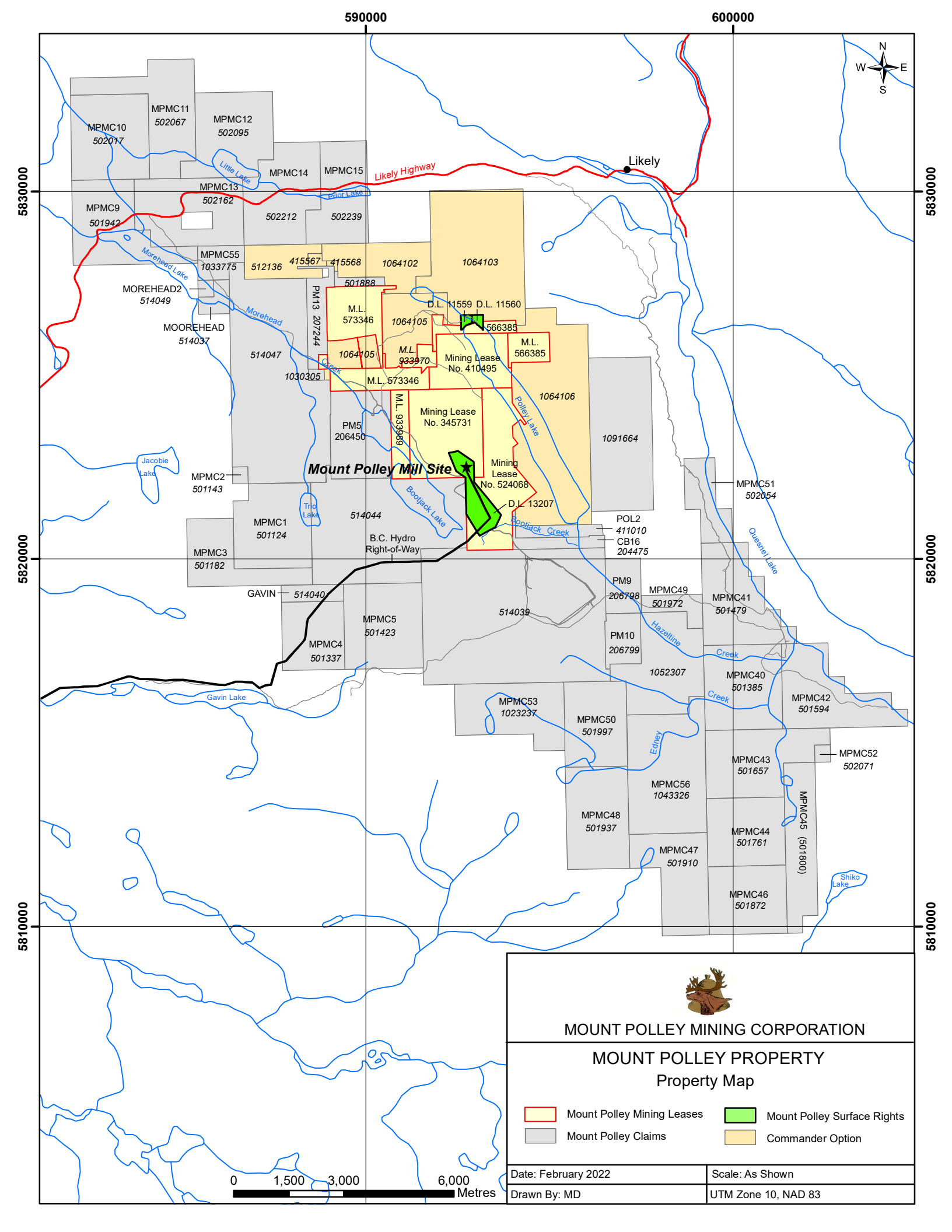
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Trio Lake
Bootjack Lake
Bootjack Creek
Polley Lake
Gavin Lake
Hazeltine Creek
Edney Creek
Quesnel Lake
Shiko Lake
MPMC10 502017
MPMC11 502067
MPMC12 502095
MPMC13 502162
MPMC14
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MPMC2 501143
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MPMC56 1043326
MPMC48 501937
MPMC44 501761
MPMC47 501910
MPMC45 (501800)
MPMC46 501872
MOREHEAD2 514049
MOOREHEAD 514037
GAVIN 514040
PM13 207244
PM5 206450
PM9 206798
PM10 206799
POL2 411010
CB16 204475
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502239
M.L. 573346
M.L. 933970
M.L. 566385
D.L. 11559
D.L. 11560
D.L. 13207
Mining Lease No. 410495
Mining Lease No. 345731
Mining Lease No. 524068
Mount Polley Mill Site
B.C. Hydro Right-of-Way
0
1,500
3,000
6,000
Metres
MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY PROPERTY
Property Map
Mount Polley Mining Leases
Mount Polley Claims
Mount Polley Surface Rights
Commander Option
Date: February 2022
Scale: As Shown
Drawn By: MD
UTM Zone 10, NAD 83

Following the issuance of PAO 107461, the focus of the Mine Site's operations shifted to monitoring and remediation work at the TSF, around Polley Lake, and down the Hazeltine Creek corridor to Quesnel Lake. Immediately following the TSF embankment breach, MPMC implemented a remediation strategy that focused on stabilization and containment of the breach and the tailings that remained in the TSF (approximately 75 to 80% of pre-breach volume). As part of this effort, a temporary upstream rock fill berm was constructed to retain tailings solids during low flow conditions. The short-term emergency response to the TSF embankment breach included:

- addressing health and safety concerns
- containment to prevent further release of materials from the TSF
- water quality monitoring
- removal of woody debris on Quesnel Lake
- lowering of the Polley Lake water level (which had been increased by the event)
- assessment of the physical stability of the sediment deposited at the outlet of Polley Lake
- implementation of sediment and erosion control measures in the Hazeltine Creek corridor.

Detailed information of work undertaken is provided in the 2019 Remediation Plan (Appendix A).

After initial containment of the breach, an alternative method was required to contain mine-affected materials, water, and sediment for the 2015 freshet event. MPMC applied for, and received an amendment to their *Mines Act* M-200 Permit titled "*Approving TSF Breach Repair and Perimeter Embankment Buttress Design for 2015 Freshet*" which was issued on 17 December 2014 (EMLI 2014). Through the winter of 2014/2015, MPMC constructed a breach repair incorporating a cut-off wall, under the design, engineering, and construction monitoring services of Golder Associates Ltd. (Golder). Other remediation activities included the construction of sediment control ponds, construction of a new creek channel, implementation of erosion control measures, and ecological remediation work. Then, MPMC applied for a joint *Mines Act* Permit M-200 and *EMA* Permit 11678 amendment on 12 January 2015 to allow the Mine to return to restricted operations, with tailings being deposited in the Springer Pit. The corresponding permit amendments were received in 2015, and allowed for restricted restart (including milling) for a period of one year, up to a maximum throughput of 4,000,000 t of ore.

Restricted operations commenced on 4 August 2015, with tailings being deposited in the Springer Pit. While restricted operations were authorized for a one-year period, ore reserves indicated approximately 10 more years of viable mine life. Additionally, as Springer Pit had a finite storage capacity, and a water discharge authorization was not in place at that time, MPMC applied to ENV to amend *EMA* Permit 11678 to allow short-term (maximum two years) discharge of treated Mine contact water to Quesnel Lake via the Hazeltine Creek channel, which was not fish bearing and was undergoing rehabilitation. MPMC installed all required infrastructure for water treatment and temporary discharge. On 23 June 2016, authorizations allowing return to full operations and deposition of tailings in the TSF were issued by EMLI and ENV. As such, the Phase 4 Cariboo-Springer Pit mine plan was adopted and implemented by MPMC.

The Mine Site continued operating and executing the Phase 4 Cariboo-Springer Pit mine plan from 23 June 2016 onwards to 31 May 2019. On 31 May 2019, the Mine Site again entered care and maintenance citing poor metal prices. During care and maintenance, MPMC committed to continue environmental monitoring and sampling, and other commitments as required in the permits and Comprehensive Environmental Monitoring Plan (CEMP; MPMC 2019).

1.2.2. *The Test Heap Leach*

From 2006 to 2008, approximately 11,000 m^3 of sulphur was procured to generate sulphuric acid for the heap leach trial (SRK 2022a). Between 2007 and 2012, different layering and blending techniques of ore and sulphur were tested to optimize leaching and collection of metals from low grade ore. In 2012, the Test Heap Leach Facility was placed into care and maintenance due to economic considerations, but was not fully decommissioned prior to shut down, and approximately 7,000 m^3 of ore mixed with elemental sulphur remain on the leach pad (SRK 2022a). A sulphur stockpile (approximately 23,000 t of sulphur) also remains within the footprint, along with an estimated 30,000 t of contaminated soil. Full details of materials present within the leach pad footprint can be found in SRK (2022b), and within Appendix B (B-3: Test Heap Leach Decommissioning), along with details regarding its partial decommissioning.

Currently, leachate from within the lined heap leach pad facility is managed by treatment with lime at the plant and subsequent conveyance to the TSF. A copper recovery system using Sodium Hydrosulfide (NaHS) to precipitate copper sulfide in the tailings thickener is being developed by MPMC within the concentrator building. Details related to steps required for active closure of the Test Heap Leach can be found in Section 6.3.

1.2.3. *Current Project Status*

In the years following the Mine Site's 2019 care and maintenance status, metal prices have improved significantly. On 25 August 2021, MPMC provided a Mine Restart Notice to EMLI to return to operations and resume the 2016 mine plan. Currently, the Mine Site is authorized for:

- open pit mining of the Phase 4 Cariboo-Springer Pit
- milling of up to a maximum of 8,200,000 t of ore per year with deposition of tailings in the TSF
- construction and operation of the TSF up to an elevation of 970 m

Existing project infrastructure consists of the mill site and two active rock disposal sites (RDSs) – the SERDS and the Temporary Northwest (NW) PAG Stockpile, as well as a TSF. Ancillary infrastructure includes access roads, powerlines, drainage collection systems, sediment/seepage control ponds, and a water discharge system (Figure 1-3).

While the Mine Site is permitted for full operations, activities have been primarily focused on restarting production. Due to initial mill maintenance, there was an early lack of processing capacity, and the discharge of tailings has only been resumed recently (July 2022). As part of water management, treated mine water is discharged into Quesnel Lake through two underwater diffusers, as permitted under EMA Permit 11678.

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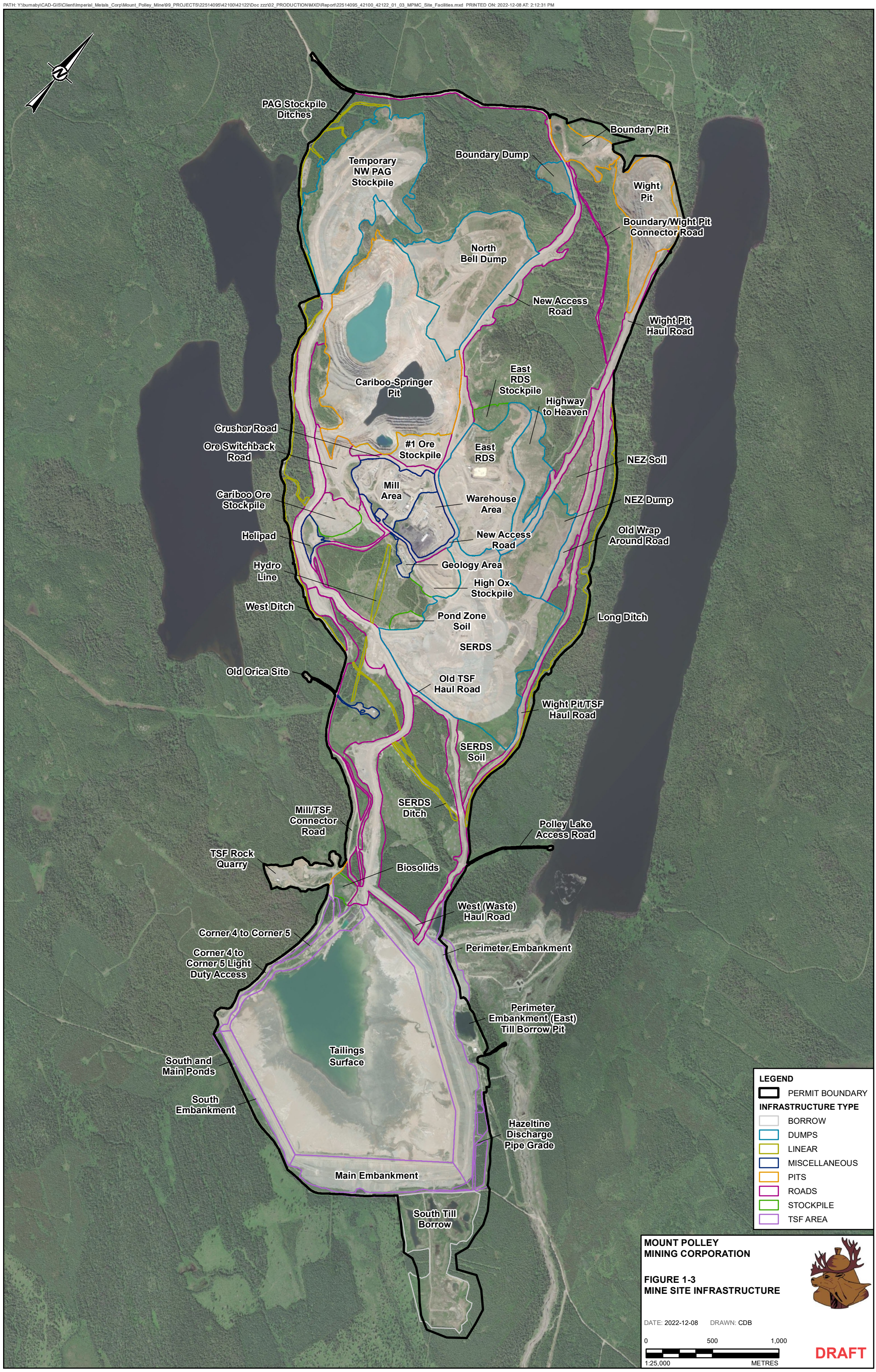

MPMC resumed mining production in November 2021, mining the saddle between Springer Pit and Cariboo Pit. The Cariboo Pit contains water which will be removed during mining of Phase 4. The crusher and concentrator were refurbished, milling operations began June 2022.

MPMC is currently pursuing further operational permits, and is progressing towards lowering the phreatic surface within the tailings that were deposited in the Springer Pit in 2015/2016. Ore reserves are located beneath the tailings, which are expected to provide an additional 2 years of production.

Since the initial method of tailings removal (e.g., dredging) was only successful in removing 1/3 of the tailings, MPMC is exploring the use of a truck and shovel method to remove the remaining tailings from Springer Pit. As part of these efforts, a causeway was constructed, and three dewatering wells were installed in Springer Pit that are currently dewatering the tailings. This dewatering activity in combination with plating the tailings with waste rock is expected to facilitate movement of the material using haul trucks in 2023. Tailgates are not currently anticipated to be needed to support this process; however, the possibility may be revisited during operations based on conditions.

The Wight Pit is no longer in production and is being used to temporarily store mine contact water. The Wight Pit Portal (located within the pit) was partially secured with loc-blocks prior to flooding; a small amount of PAG waste rock backhauled into the pit is submerged. The current elevation of the Wight Pit Lake is at 915.97 m. Prior to flooding, the underground infrastructure and equipment were removed, however, some power cables, piping, and part of the lift are still in place (G. Holmes, pers. comm. 2022).

1.3. Summary of Regulatory Permits and Requirements

Provincially, all phases of the mine life (construction, operation, decommissioning, and reclamation) are regulated under the *EMA* and the *Mines Act*, as well as the *Water Sustainability Act* and other legislation implemented by the BC Ministry of Land, Water, and Resource Stewardship (MLWRS). A summary of existing Mine Site permits under these regulations is presented in Table 1-1. Table 1-2 provides a list of amendments to *Mines Act* Permit M-200 (issued by EMLI [formerly MEM]) that have been received throughout the mine life.

Permit 11678, issued by the ENV, authorizes discharge of effluent under the *EMA*. Table 1-3 lists amendments to *EMA* Permit 11678 that have been issued over the course of the mine life.

Federal regulation is primarily through the *Fisheries Act*, which is to protect fish habitat by prohibiting the entry of deleterious substances into fish-bearing waters, as well as the disruption or disturbance of fish habitat without the necessary approvals. Protection of fish habitat also includes the MDMER (annexed under the *Fisheries Act*) which regulate deposition of mining waste (effluent) into fish-bearing waters.

Table 1-1 Current Mine Site Permits

Ministry	License/Permit/Approval No. (Date Issued)	Project Component/ Activity Approved
Interior Health	Drinking Water Permit Facility No 14-098-00199 (March 31, 2009)	Permit to operate drinking water system 14 or less connections.
ENV	Approval AE-14591 (June 21, 1996)	Discharge treated mine water runoff from sediment ponds between 1 July 1996 and 30 September 1997.
ENV	Conditional Water License 111741 (Dec 6, 1996)	Diversion of water from Polley Lake for dust suppression and industrial purposes.
ENV	Conditional Water License 101763 (Original: December 6, 1996) (Amended: January 17, 1997; June 14, 2002)	Diversion of water from Polley Lake to the tailings pond for storage and use in mining (processing of ore) purposes.
ENV	License BCG-01559 (Original: July 16, 1997) (Amended: Oct 23, 2012)	Special waste consignor, in accordance with Section 44 of Special Waste Regulation.
ENV	Permit PR 14590 (Original: March 18, 1997) (Amended: June 26, 2007; June 21, 2019)	Discharge of refuse to the land (landfill operation on site) from a copper-gold mine and mill.
ENV	Permit PA 15087 (Original: August 7, 1997) (Amended: June 26, 2007)	Discharge of air contaminants from mill and crusher.
ENV	Approval AE 15554 (May 29, 1998)	Discharge effluent (biosolids) to the land for the purposes of establishing reclamation test plots.
ENV	Permit PE 15968 (Original: December 13, 1999) (Amended: June 26, 2007) (Active Version: July 3, 2014)	Current major authorization components: Discharge of biosolids to tailings and waste rock disposal locations for the purpose of reclamation.
ENV	Permit PE 11678 (Multiple Received)	See Table 1-2.
Fisheries and Oceans Canada (DFO)	File No 8450-10 (September 25, 1996)	Authorization for works or undertakings affecting fish habitat from development and operation of a copper/gold open pit mine, as outlined in the Habitat Compensation Agreement dated 25 September 1996.
DFO	Habitat Compensation Agreement (September 25, 1996)	Construction of a dam on the southeast end of Bootjack Lake.
DFO	File No A54120 (February 17, 2005)	Culvert installation at North Drainage Creek and diversion of unnamed drainage north of the Wight Pit.
DFO	File No 8450-10 (October 5, 2005)	Removal of existing culvert and installation of bottomless log culvert.
DFO	Authorization 13-HPAC-PA7-00276 (Original: August 8, 2013) (Amended: February 27, 2014)	Authorization for works, undertakings or activities affecting fish habitat near Mine Drainage Creek.

Table 1-1 Current Mine Site Permits

Ministry	License/Permit/Approval No. (Date Issued)	Project Component/ Activity Approved
DFO	License WL14-154619 (September 5, 2014)	Authorization concerning the movement of live fish (Bootjack Creek to Bootjack Lake).
DFO	License XHAB 125 2015 (September 21, 2015)	Authorization for fish salvage in Hazeltine Creek sediment ponds prior to draining.
Ministry of Agriculture and Lands	License No 515696 (July 7, 2007)	Electrical distribution to supply power to adjacent properties to Mount Polley.
Ministry of Agriculture and Lands	License No 515696 (November 30, 2015)	Construct outfall structures along shoreline and land covered by water at Quesnel Lake.
MFLNRO	Road Use Permit 01-5654-96 (June 1, 1996)	Construct, modify, use and maintain Morehead-Bootjack Road.
MFLNRO	License to Cut (Multiple Received)	Timber harvesting.
MFLNRO	*Water Act* File A5004120 (February 21, 2005)	Changes in and about a stream on unnamed watercourses in the vicinity of Mineral Lease 41095 near Polley Lake; instream work to be completed by 31 March 2005.
MFLNRO	*Water Act* File A5004119 (March 18, 2005)	Changes in and about a stream, to install a discharge pipe into Polley Lake.
MFLNRO	*Water Act* File A5-4397 (August 8, 2012)	Changes in and about a stream, to install a discharge pipe into Hazeltine Creek.
MFLNRO	License No 516031 (October 2, 2012)	Construct pipeline for Hazeltine Creek discharge system.
MFLNRO	License No 516186 (April 25, 2014)	Construct impoundment to install a small generator and propane tank to operate water monitoring and communication system at Hazeltine Creek.
MFLNRO	License No 516217 (June 25, 2014)	Construct pipeline from water treatment plant to discharge structure in Polley Lake.
MFLNRO	Conditional Water License C132360 (August 10, 2015)	Storage of water from Hazeltine Creek and its tributaries.
MFLNRO	License of Occupation 516364 File No. 5407795 (November 30, 2015)	Improvements necessary for pipeline and diffuser and for telecommunications equipment necessary for the operation of the system in Quesnel Lake.
MFLNRO	Occupation of Crown Land Permit No 28205	Occupation of a portion of Crown Land and the disturbed area along Hazeltine Creek; for works and flooding having a total area of 134.8 hectares.

Table 1-1 Current Mine Site Permits

Ministry	License/Permit/Approval No. (Date Issued)	Project Component/ Activity Approved
MFLNRO	*Water Act* File 76930-40/Mount Polley order 006 variance 3 (September 28, 2016)	1. Collect and remove such debris from Hazeltine Creek, Quesnel Lake and Polley Lake, resulting from the Mt Polley tailings pond failure. 2. Maintain the Lake level of Polley Lake in a manner that prevents further mass movement of material from Polley Lake and Hazeltine Creek. 3. Undertake habitat remediation work on Edney Creek, Hazeltine Creek, Quesnel Lake, and Polley Lake.
MFLNRO	*Water Act* File No. 76910-20/5002485 (October 15, 2015)	Section 9 Approval for discharge pipeline into Quesnel Lake.
MFLNRO	*Wildlife Act* Permit (Multiple Received)	Fish collection and amphibian removal.
Ministry of Transportation and Infrastructure (MoTI)	Permit No 04-017-12194 (1996)	Access of Morehead-Bootjack Road to Likely Highway.
Municipal Affairs	File No 1700-5 (June 19, 1996)	Fuel storage
MEM	Permit No 1697 (Original: July 9, 2007) (Amended: October 22, 2007)	Magazine Explosives Storage P-1020: 10,000 detonators P-1019: 7,500 kg explosives W-1921: 7,500 kg explosives
MEM	Permit No M-200 (Multiple Received)	See Table 1-2.
Environmental Assessment Office	EA Certificate #M96-07 (November 23, 2015)	Minister of Environment and Minister of Energy and Mines consent to material alteration for Short-Term Water Discharge.
Environmental Assessment Office	EA Certificate #M96-07 (May 16, 2016)	The rate of milling must not exceed 8.2 million tonnes of ore per year.
Nuclear Substance Radiation Devices Licensing Division	License No 14524-1-20.0 (October 22, 2015)	Nuclear device use – details confidential per licensing division
Radio Licensing Canada	Radio Frequency Permit No 080116784	Radio frequency use.
Transport Canada	Approval 2014-500047 (March 31, 2014)	Approval for submerged pipeline in Polley Lake.

Table 1-2 Mines Act Permit M-200 Amendments

Date	Amendment Title
13-Jun-1996	Name Change
23-Sep-1996	Approval to Construct Tailings Storage Facility to Elevation 934 m
11-Jul-1997	Amended Reclamation Permit, Approval to Construct Open Pits and Waste Dumps, and Traffic Control Plan
7-Apr-1998	Approval to Construct Tailings Storage Facility to Elevation 940 m
13-Jun-2000	Approval to Construct Tailings Storage Facility to Elevation 944 m
2-Aug-2000	Approving Tailings Storage Facility and Amended Metal Leaching and Acid Rock Drainage Conditions
30-May-2001	Approval to Construct Tailings Storage Facility to Elevation 945 m
16-Feb-2004	Approving Milling of Ore and Tailings Deposition from the International Wayside Bulk Sample
1-Nov-2004	Approving Mining and Reclamation Program for the Northeast Zone and Approving Mine Restart
25-May 2005	Approving Tailings Storage Facility Stage 4 Construction
2-Aug-2005	Approving Haulage Road Construction from the Northeast Zone to TSF
24-Nov-2005	Approving Mining of Southeast Zone
2-Aug-2006	Approving Change of Name and Deletion of Requirement to Monitor Blasting
2-Aug-2006	Approving Tailings Storage Facility Stage 5 Construction
29-Mar-2007	Approving Northeast Zone Dump Expansion
29-Mar-2007	Approving Copper Oxide Test Heap Leach Facility
31-Aug-2007	Approving Boundary Road
5-Dec-2007	Approving Wight Pit High Wall Rehabilitation
19-Feb 2008	Approving Tailings Storage Facility Stage 6 Construction
6-Mar-2008	Approving Transfer of Road Use, Maintenance, and Reclamation
8-Jul-2009	Approving Pond Zone
15-Aug-2011	Approving Mining of C2 and Boundary Zone Pits
29-Jun-2012	Approving Tailings Storage Facility Stage 8 Construction
15-Oct-2012	Approving Tailings Storage Facility Stage a Construction
25-Mar-2013	Approving Boundary Zone Underground
22-Apr-2013	Approving Processing of 15,000 Tonnes of Ore from Dome Mountain
25-Jul-2013	Approving Northwest PAG Dump Expansion and South Haul Road
9-Aug-2013	Approving Tailings Storage Facility Stage 9 Construction
17-Mar-2014	Approving Cariboo Phase 4 Expansion
27-Mar-2014	Approving Change to Reclamation Security Schedule
24-Jun-2014	Approving Waste Rock and Tailings Comingling Research Project
17-Dec-2014	Approving TSF Breach Repair and Perimeter Embankment Buttress Design for 2015 Freshet
9-Jul-2015	Approving Return to Restricted Restart of Operations
22-Oct-2015	Approving Main Embankment Buttress
25-Feb-2016	Approving Upstream TSF Construction and 2016 Freshet Water Management
26-Mar-2016	Approving Springer Pit Lake Elevation Increase
29-Apr-2016	Approving Extension to Restricted Operations and Corner 1 Buttressing
23-Jun-2016	Approving Return to Full Operations and Use of Tailings Storage Facility

Table 1-2 Mines Act Permit M-200 Amendments

Date	Amendment Title
22-Jul-2016	Approving TSF Upstream Drain Design Modification
29-Jun-2017	Approving Security Schedule
10-Dec-2020	Approving Reclamation and Closure Plan
18-Mar-2022	NoD for Water Storage in Wight Pit
02-Nov-2022	NoD for C2 Backfill

Table 1-3 EMA Permit 11678 Amendments

Date	Scope of Amendment
30-May-1997	Original permit
20-Oct-1997	Amended authorized tailings discharge rate (10,000 tpd increase)
12-Jun-1998	Amended reporting requirements
8-Sep-1999	Amended monitoring requirements
1-Feb-2000	Amended authorized tailings discharge rate (4,500 tpd increase)
7-Feb-2002	Approval to discharge effluent from the Perimeter Embankment Seepage Collection Pond (PESCP) and MESCP; approval to store TSF supernatant and Mine contact water in the Cariboo and Bell Pits
4-May-2005	Amended authorized tailings discharge rate (5,000 tpd increase); discharge of groundwater to Polley Lake; updates to reference analytical procedures and monitoring program
17-Apr-2009	Amended monitoring, water level and supernatant characteristic requirements for the Cariboo and Bell Pits
7-Nov-2012	Approval to discharge to Hazeltine Creek
7-Jun-2013	Sulphate guidelines and milling of contaminated soils
9-Jul-2015	Tailings discharge to the Springer Pit
29-Nov-2015	Approval to discharge to Hazeltine Creek
4-Apr-2016	Discharge of additional tailings to the Springer Pit
9-Sep-2016	Hazeltine Creek discharge total suspended solids limit change
7-Apr-2017	Direct pipeline from water treatment plant to Quesnel Lake
2-Oct-2018	Amendment to Sections 1.2.3, 1.2.6 and 2.7 of existing 11678 permit
14-Mar-2019	Amendment to revisions for November 9, 2018, CEMP approval letter conditions including 3, 4, 8, 9, 11, 14 and 15
15-Jul-2019	Amendment to Section 6.14 of the approved August 15, 2018, CEMP
1-Feb-2020	Amendment to Sections 1.2, 1.2.5, 1.2.6, 2.7, 2.8, 2.8.1, 2.8.3, 2.9 2.10, 3.3, 3.5, 3.5.5 and 4.1.4 of existing 11678 permit
18-Sep-2020	Consent Order amendments to Sections 2.8, 2.9, 2.10, and 4.2.1 of existing 11678 permit
31-Dec-2020	Approved and amended Permit 11678
10-Feb-2021	Conditional approval received for the October 31, 2019, CEMP, replacing the 2018 CEMP and introducing several conditions which are in effect regulatory requirements
01-Dec-2022	Quesnel Lake Interim Discharge Extension to 30 July 2025

1.4. Biophysical Setting

1.4.1. *Physiography*

The Mine Site is located near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976). Within the Mine Site, the plateau has somewhat stronger relief, with the Mine Site rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Mine Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 masl at Polley Lake to 1,266 masl at the top of Polley Mountain. The area is within the Quesnel Highlands Ecosection as described by Demarchi et al. (1990), and the area has been previously glaciated, which has resulted in the over-deepened Polley and Bootjack lakes.

1.4.2. *Geological Characterization*

The Mine Site is located within the Quesnel Terrane, a belt of mafic to intermediate volcanic rocks, which are mostly of Upper Triassic to Lower Jurassic age. The Mine Site's mineral body is hosted within an alkali intrusive complex. Most of the Mine Site is covered by blankets and veneers of glacial tills, but there are also small inclusions of alluvial, lacustrine, colluvial, and organic landforms.

The Mount Polley deposit is classified as a porphyry copper gold deposit (BC MINFILE No. 093A 008) hosted within Jurassic – Triassic Polley Stock that intrudes the Nicola Group volcanic rocks. The Polley Stock is a northwesterly elongated body approximately 5 km long and extends from Bootjack Lake to Polley Lake in the east–west direction. The Polley Stock is a multi-phase pluton with composition ranging from diorite to monzodiorite to monzonite. It is variably altered and brecciated. Felsic (plagioclase phyric) and mafic (augite phyric) dykes occur as late-stage intrusive phases. Late brittle faults offset lithologies, alteration, and mineralization.

The Mount Polley deposit has been mined from several different mineralized zones, which have common features (SRK 2015):

- The host rocks for porphyry mineralization are intrusions into the Nicola Volcanics varying in composition from diorite to syenite;
- Alteration is potassic (secondary biotite and pink orthoclase) and propylitic (calcite-epidote-chlorite-pyrite);
- Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5);
- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$). Iron carbonates have not been reported; and
- Oxidized copper mineralization is present at approximately 50% of the 0.3% total copper in the upper portions of the ore body, primarily as the silicate chrysocolla ($(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$) and the carbonate malachite ($Cu_2CO3(OH)_2$) in equal proportions (Henry 2009).

1.4.2.1. Lithologies

The following lithologies are present at the MPMC Mine Site:

- **Volcanics:** These volcanic and volcaniclastic rocks are the oldest on the Mine Site, form part of the Nicola Group, and are Upper Triassic in age. They consist mainly of andesitic basalt or augite phyric alkali basalt, and volcanic breccias. Volcanic rocks do not make up a significant component of material from the pits.

- **Diorite:** The diorite occurs mainly in the eastern section of the Springer Pit and is bluish grey, fine to medium grained, and equigranular to weakly porphyritic. Phenocrysts are plagioclase, minor augite, and occasional magnetite, biotite, calcite, and apatite.

- **Monzonite:** The monzonite unit is brown to pinkish grey or greenish grey, medium to coarse-grained, and equigranular to weakly feldspar phyric. Predominate feldspars are orthoclase and albite. Accessory minerals include magnetite, augite, biotite, calcite, apatite, and epidote. This unit is variably flooded with potassic alteration, and is variably brecciated with copper/gold mineralization.

- **Potassium feldspar phyric dykes:** These dykes are pinkish orange to orangish grey. The matrix is fine to medium grained, orangish grey and composed largely of potassium feldspar. The phenocrysts are elongated subhedral to euhedral plagioclase laths up to 10 millimetres (mm) long. These dykes are often planar, occurring in various orientations and filling fractures of the brecciated monzonite. They vary in width from fractions of 1 m to 5 m wide.

- **Augite phyric dykes:** These dykes are distinctive dark green with a fine- to medium-grained mafic matrix and scattered up to 3 mm augite phenocrysts (up to 8% of rock) and occasionally up to 2% euhedral magnetite phenocrysts. Dykes are generally planar in form and tend to fill fractures and faults. They occasionally exhibit orange potassic alteration.

1.4.2.2. Alteration and Mineralization

Brecciation and hydrothermal alteration variably affected the Polley Stock and the surrounding Nicola Group volcanics. Alteration can be described in terms of a potassic core enveloped by a propylitic zone. In the core of the system, intense potassic alteration is accompanied by variable strong albite, magnetite and actinolite alteration. Propylitic alteration (calcite – chlorite – minor pyrite) occurs near the perimeter of the system. In the Springer Pit, alteration is generally characterized by veins of actinolite, epidote, and magnetite, which cut across the earlier potassium feldspar and albite flooding in the breccia.

Mineralization is variable, but strongly associated with brecciation and alteration. In the Springer Pit, chalcopyrite is the dominant copper sulphide, with local accumulations of bornite in the higher-grade areas. Sulphides occur disseminated to finely blebbed within potassium feldspar, albite, magnetite, and actinolite alteration. In the southern portion of the Springer Pit, pyrite occurs strongly disseminated in both ore and waste rock. The pyritic waste generally constitutes PAG rock, with sulphur values up to 3%. This pyritic zone extends south to encompass the neighbouring WX Zone, where gold values are typically higher.

1.4.2.3. Structures

Faults recognized to date are late and brittle. Two dominant fault sets have been recognized. One is a north-northeast trending, steeply dipping set. The other is a west-northwest trending, also steeply dipping set. Both fault sets offset and terminate the ore.

1.4.3. *Soils*

The following description is based on Meister (2010). Most soils at the Mine Site are derived from morainal deposits overlying bedrock. The soils are typically loam to sandy loam in texture and contain 15% to 35% (by volume) coarse fragment content (>2 mm diameter). The pH of the parent material ranges from 6.0 to 7.5 ($CaCl_2$ solution). This reflects the calcareous nature of the underlying bedrock. The calcareous horizon occurs generally at 120 to 150 centimetres (cm) in depth. The organic matter content of the mineral soil is low. The dominant soil development process is the downward translocation of clay particles, resulting in a Bt horizon (characterized by the accumulation of clay) and the development of Brunisolic Gray Luvisol soils. In areas where the Luvisolic soil development is weak, soils are therefore classified as Orthic or Eluviated Eutric Brunisols, reflecting a weaker rate of soil formation. In more acidic areas, the soils are classed as Dystric Brunisols.

Detailed soil descriptions and terrain classification from inventories carried out for the Mine Site are provided in Appendix C.

1.4.4. *Vegetation and Wildlife*

Biogeoclimatic maps of the Cariboo Forest Region indicate that the Mount Polley site is located within the Horsefly Moist Cool variant of the Interior Cedar-Hemlock Biogeoclimatic Zone (BEC zone; ICHmk3), which occurs between Quesnel and Horsefly Lakes, in the valley of McKinley Creek, and near Canim Lake. ICHmk3 site series are provided in Appendix C. The dominant trees on upland sites in the ICHmk3 BEC zone are Douglas-fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), hybrid spruce (*Picea glauca x engelmannii)*, and subalpine fir (*Abies lasiocarpa*). Lodgepole pine (*Pinus contorta*), trembling aspen (*Populus tremuloides*), and paper birch (*Betula papyrifera*) are also present in the early stages of forest succession. The forests in lower valley bottoms are often dominated by hybrid spruce and black cottonwood (*Populus trichocarpa*). Field surveys of the Mount Polley site have found that the dominant trees in mature and old growth stands are Western red cedar, Douglas-fir, and subalpine fir. Subalpine fir usually dominates the seedling regeneration in mid-seral, mature, and old forests. Black cottonwood dominates the early stages of forest succession after logging, while trembling aspen and paper birch are usually secondary species. Western hemlock (*Tsuga heterophylla*) is present in the area, but rare. Large portions of the project area have been selectively logged to remove the largest Douglas-firs and Western red-cedars, and some clearcut sites have been replanted with lodgepole pine seedlings. Hybrid spruce occur sparingly on lower, middle and upslope positions in the Mount Polley site area, and is most common near streams and lakeshores.

Wildlife species present are listed in Appendix C, and include species such as Western toad (*Anaxyrus boreas*), common nighthawk (*Chordeiles minor*), and grizzly bear (*Ursus arctos*), which are identified as species at risk.

1.4.5. *Watersheds*

The Mine Site is located on the divide of two sub-watersheds within the Quesnel Lake watershed. The western watershed, which includes drainage from Bootjack Lake, discharges to the Quesnel River via Morehead Creek and drained approximately 60% of the Mine Site area prior to Mine construction. The eastern watershed includes Polley Lake, which discharges to the east via Hazeltine Creek, Edney Creek, and the West Arm of Quesnel Lake. The Hazeltine Creek and Edney Creek watershed areas at Quesnel Lake are approximately 30.2 square km (km^2) and 87.4 km^2, respectively (Figure 1-4). Approximately 10.5 km^2 that historically reported to this watershed is now within the Mine contact water runoff collection system catchment.

Bootjack Creek is a small tributary of Hazeltine Creek downstream of Polley Lake. Historically, Bootjack Lake discharged into Hazeltine Creek via Bootjack Creek. However, in 1913 a dam was constructed at the south end of Bootjack Lake and the flow direction was reversed to direct water into Morehead Lake for hydraulic mining of Bullion Pit and recently hydropower production. This resulted in 14 km^2 being diverted from the Hazeltine Creek catchment. The old Bootjack Lake Dam was upgraded by MPMC in 1997 as fulfillment of a Fish Habitat Compensation Agreement signed between MPMC and the regulating federal and provincial agencies. The Bootjack Lake watershed area is 11.2 km^2. Approximately 2.3 km^2 that historically reported to this watershed is now within the Mine contact water runoff collection catchment. Currently, Bootjack Creek reports to Polley Lake.

The regional topography, water bodies, and pre-mining watersheds are shown in Figure 1-4. Refer to Section 2.4.2 for more information on Mine Site water collection systems and catchment areas.

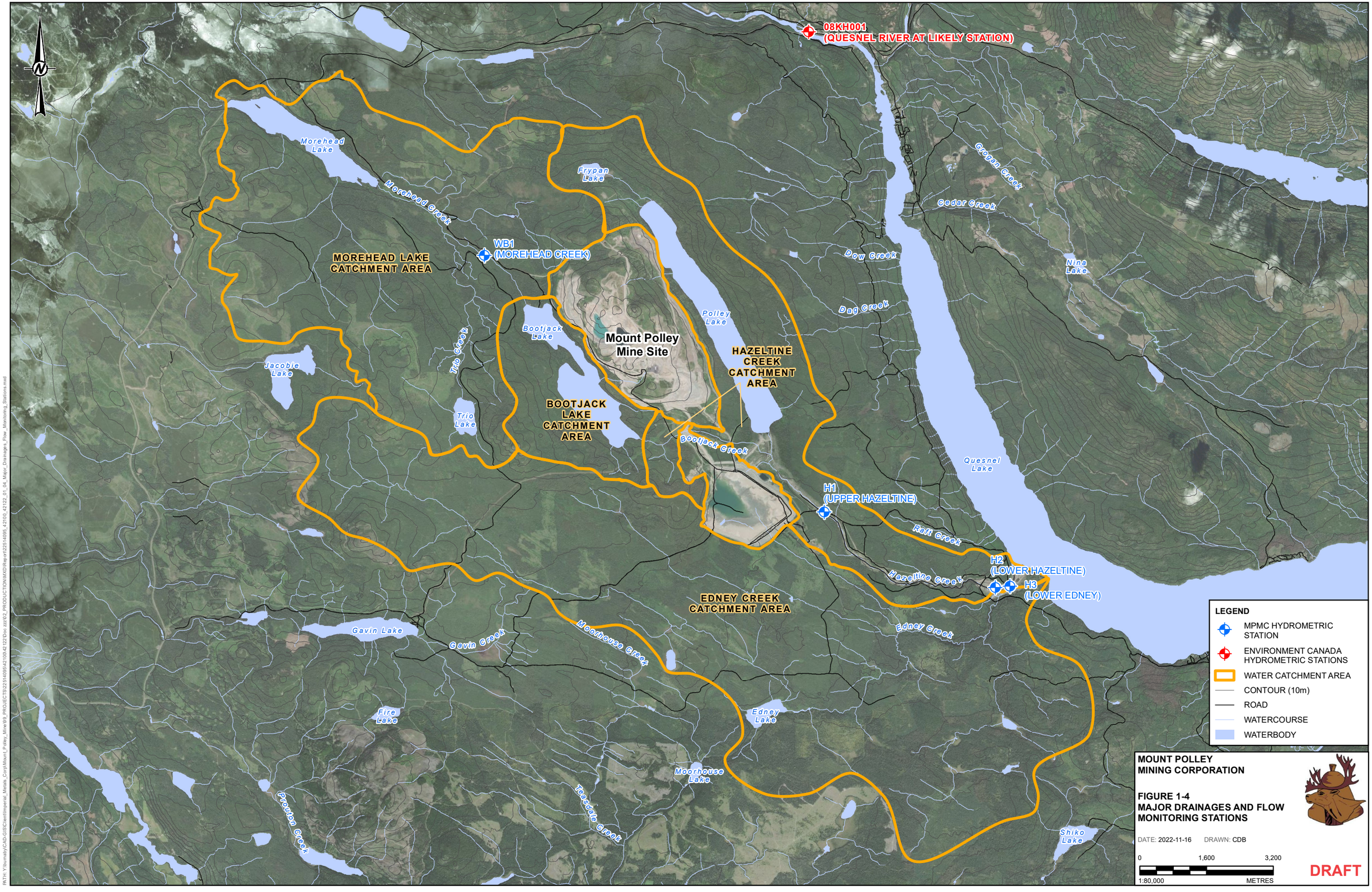

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1.4.6. *Climate*

The following is a summary of the climate characteristics in the area of the Mine; additional details can be found in the climate baseline update (Appendix D).

Local climate characterization for the Site was completed using climatic data recorded at the Mine and nearby Environment and Climate Change Canada (ECCC) climate stations. The ECCC climate stations included Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, and were selected for their proximity to the Site, length of record, elevation range, and concurrent time period with Site records. In addition, the ECCC Prince George climate station was added to support the characterization of expected incoming solar radiation at the Site. Table 1-4 summarizes the station metadata used in the local climate characterization.

Table 1-4 The Mine Site and Regional Climate Stations

Station Name	Northing (m N)[1]	Easting (m N)[1]	Elevation (masl)	Sensors	Period of Record[2]
Mill site	5822420	592495	1,181	R, T	1995 – 2012
Station #1 (near mill)	5822420	592792	1,171	R, T, RH, SR, E, WS, WD	2012 – 2021[4]
Station #2 (TSF)	5819955	594059	964	R, T, RH, SR, E, WS, WD	2012 – 2021[4]
Likely	5828785	599332	724	P, R, S, T	1974 - 1993
Williams Lake A	5781820	564666	940	P, R, S, T, RH, SR	1961 - 2021[4]
Spokin Lake 4E	5782274	589827	1,033	P, R, S, T	1983 - 2021[4]
Barkerville	5880996	599515	1,283	P, R, S, T	1888 - 2021[3,4]
Quesnel A[5]	5873987	546720	545	P, R, S, T, RH	1953 - 2021[4]
Prince George A	5971423	521103	691	P, R, S, T, RH, SR	1973 - 1995

1) UTM Coordinate system – Zone 10U

2) Length of record from start year to end year may not reflect the number of complete years of data

3) ECCC provided provisional data only for the period between January 2016 and December 2021

4) Station still in operation

5) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

masl = metres above sea level

P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation; E = evaporation; WS = wind speed; WD = wind direction.

In winter, snow course surveys are carried out at the Mine Site to generate snowpack depth measurements, with higher frequencies during heavy snowfall months. A summary of the snow course survey station locations and periods of record is provided in Table 1-5. A map of the weather station and snow course locations is provided in Figure 1-5.

Table 1-5 The Mine Site Snow Courses

Station Name	Northing (m N)[1]	Easting (m N)[1]	Elevation (masl)	Period of Record[2]
#1 (near mill)	5823182	592792	724	1997 – 2010, 2015 – 2021[3]
#2 (near TSF)	5819976	594092	1,181	1997 – 2021[3]
#3	5823895	593632	1,171	2012 – 2021[3]
#4	5823537	590835	964	2015-2021[3]

1) UTM Coordinate system – Zone 10U.

2) Length of record from start year to end year may not reflect the number of complete years of data.

3) Station still in operation.

masl = metres above sea level.

Wright Pit / Underground
Joe's Creek Coffer Dam
9km Sump
NW Sump
Snowcourse 4
Springer Pit
Cariboo Pit Sump
Weather Station #1
Snowcourse 1
Snowcourse 3
Polley Lake
Mill
Mill Site Weather Station
Mill Site Sump
Mine Drainage Creek Sump
Long Ditch
Boojack Lake
SERDS Ditch
Bootjack Creek Sump
Central Collection Sump
Snowcourse 2
Weather Station #2
Perimeter Embankment Till Borrow Pit
Tailings Storage Facility
South Seepage Pond
Main Embankment Seepage Pond

LEGEND

- CLIMATE STATION
- WATER COLLECTION DITCH
- CONTOUR (10m)

MOUNT POLLEY MINING CORPORATION

FIGURE 1-5
METEOROLOGICAL MONITORING LOCATIONS

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1.4.6.1. Temperature

Air temperature statistics for the MPMC Mine Site were developed using historical data from the nearby ECCC climate station in Likely, approximately 9 km northeast of the Site. The historical Likely data set was adjusted to the average elevation of the Mine Site by applying a regional monthly lapse rate. Data gaps were infilled using data from the regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between -6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set for the Site was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively. Mean monthly air temperatures generally turn positive in April and negative in November. Monthly and annual air temperature statistics for the MPMC Mine Site (1974 to 2021) are presented in Table 1-6.

Table 1-6 Monthly Average, Minimum, and Maximum Temperatures for the Mine Site (1974 to 2021)

Month	Average Temperature (°C)	Minimum Temperature (°C)	MaximumTemperature (°C)
January	-6.7	-16.0	-0.3
February	-4.8	-13.0	0.7
March	-1.0	-6.7	3.2
April	3.7	-0.7	12.0
May	8.5	5.2	13.1
June	12.2	8.6	15.5
July	15.1	11.8	21.2
August	14.6	11.0	17.1
September	10.0	6.8	14.2
October	4.1	0.8	8.7
November	-2.4	-13.7	2.6
December	-6.6	-13.7	-1.2
Annual	**3.9**	**1.7**	**6.3**

1.4.6.2. Precipitation

Long-term precipitation time series representative of the climate conditions at the Mine Site was derived using the long-term regional data from the ECCC Likely station (1974 to 1993) and available local data from the three on-site climate stations (1995 to 2021; Golder 2022). The data set was infilled using historical data from the regional climate stations and adjusted for orographic effect. The Mine Site experiences high summer precipitation due to summer storms, with the lowest precipitation occurring in February. Precipitation typically occurs as snowfall starting in November, and accumulates until March. Average annual precipitation at the Mine Site is estimated to be 692 mm. A frequency analysis of the long-term precipitation time series was undertaken to estimate the variability in monthly and annual precipitation of the Mine. Estimated wet and dry values for 1-in-25-year and 1-in-200-year return periods are shown in Table 1-7.

The average monthly snowpack for the winter months from data collected at the Mine Site and recorded as snow-water equivalent (SWE) since 1995 is shown in Table 1-8.

Table 1-7 Long-term Monthly and Annual Precipitation Frequency Analysis for the Mine Site (1974 to 2021)

Month	Precipitation (mm)				
	1:200-Year Dry	1:25 Year Dry	Average	1:25 Year Wet	1:200-Year Wet
January	12.4	17.5	49.4	117	207
February	4.7	8.3	35.8	101	185
March	5.0	9.6	29.7	57	71
April	4.3	8.7	44.7	118	199
May	9.4	17.8	49.9	88	104
June	7.7	18.9	70.8	131	152
July	2.4	7.7	63.6	172	254
August	5.7	11.8	50.6	120	178
September	3.1	9.5	52.3	111	133
October	10.7	19.6	58.1	111	141
November	4.7	11.0	49.8	110	146
December	14.3	20.5	57.6	135	232
Annual	**349**	**421**	**612**	**836**	**960**

Table 1-8 Month End Average Snowpack Levels Recorded as SWE at the Mine Site (1995 to April 2021)

Month	Snowpack [SWE] (mm)
November	17
December	102
January	147
February	182
March	185
April	33

1.4.6.3. Wind

Prevailing winds are from the north-northeast and the south-southwest near the TSF, and from the northwest (and to a lesser extent from the southeast) near the mill site, with a predominance of winds designated as calm (below 3 metres per second [m/s]; Golder 2015).

1.4.6.4. Relative Humidity

Relative humidity data are available for the Mine Site (from 2019 to 2021), Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). Relative humidity data from the MPMC climate stations are insufficient for characterizing relative humidity at the Mine Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative long-term relative humidity data set for the MPMC Mine Site.

Statistics for the derived historical relative humidity time series (1974 to 2021) are presented in Table 1-9. Mean annual relative humidity is 68.1%. Monthly values vary between 57.7% in April to 82.2% in December.

Table 1-9: Derived Monthly and Annual Relative Humidity Statistics for The Mine Site (1974 to 2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

1.4.6.5. Solar Radiation

Solar radiation data are available from MPMC climate stations from 2001 to 2003 and 2019 to 2021, and ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data from the MPMC climate stations is insufficient for characterizing incoming solar radiation at the Mine Site due incomplete data. In addition, the data are not concurrent with either ECCC climate station as the data recorded in 2001 is incomplete. Solar radiation statistics for the Mine Site area were determined from the ECCC Williams Lake data. Missing values were infilled with adjusted Prince George records.

Table 1-10 presents the results and statistics of the long-term solar radiation time series (1974 to 2001) representative of the Mine Site. Mean annual solar radiation is 136 watts per metre squared (W/m^2), with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July.

Table 1-10: Estimated Solar Radiation Statistics for The Mine Site Based on Infilled Williams Lake Records (1974 to 2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

1.4.6.6. Evaporation

Evaporation monitoring data are available from the MPMC climate stations from 2019 to 2021, although the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Mine Site. Therefore, a mathematical model (Morton 1983) was applied to calculate evaporation and evapotranspiration (actual and potential) based on long-term synthetic records for air temperature, relative humidity, and solar radiation. The calculated evaporation rates are reflective of potential shallow lake evaporation rates; that is, there is no thermal impact of deeper water volumes on evaporation.

Calculated evaporation at the Mine Site shows a typical seasonal profile, with little to no evaporation in the winter months and maximum evaporation in the summer months. Table 1-11 to Table 1-13 present the long-term mean annual and monthly statistics for shallow lake evaporation, potential evapotranspiration, and actual evapotranspiration, respectively, for 1974 to 2001 as calculated using the Morton Model. The mean annual evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates varies between 0 mm in December to 138 mm in July.

Table 1-11: Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Mine Site Based on Infilled Williams Lake ECCC Records (1974 to 2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**670**	**699**

Table 1-12: Estimated Monthly and Annual Potential Evapotranspiration Statistics for the Mine Site Based on Infilled Williams Lake ECCC Records (1974 to 2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

Table 1-13: Estimated Monthly and Annual Actual Evapotranspiration Statistics for The Mine Site Based on Infilled Williams Lake ECCC Records (1974 to 2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

1.4.6.7. Air Quality

The location of the Mine Site is remote, but the air quality is subject to impacts from seasonal pollen, as well as fugitive dust and particulate matter from the logging industry, forest fires, recreational traffic, and nearby wood-burning stoves. The slightly undulating terrain around the Mine Site permits unobstructed atmospheric exchanges and prolonged inversions. Major storm tracks are from the west off the Pacific Ocean. A monthly dust fall monitoring program was initiated at the Mine Site in 1995 to establish baseline dust fall data on total deposition amounts of fugitive dust (particles) during the non-winter months (June to September). The dust fall collectors were set up at seven locations on the Mine Site and collected monthly. Monitoring results did not exceed 3.95 milligrams per decimetre squared per day (mg/dm^2/d) (Hallam Knight Piesold 1996b).

2. MINE OPERATIONS

2.1. Access and Transportation

Primary access to the Mine Site is via the Likely Highway. The route from Williams Lake involves driving 14 km south on Highway 97 to the Horsefly/Likely Road turnoff and continuing on this road 4.3 km, then turning left onto the Likely Road and continuing 66 km to the Bootjack Forest Service Road (FSR). Shortly after the Morehead Lake Resort, a turnoff to the right connects the Likely Road to the Bootjack FSR. The Bootjack FSR is a radio controlled (frequency RR-25) industrial road operated and maintained by MPMC. All Mine personnel, supplies, and concentrate trucks use this access road, with additional use by the forest industry and recreational users. Most non-mine traffic is related to people accessing the Bootjack Lake forestry campsite, which is located at 8.5 km along the Bootjack FSR. There are also several private properties that are accessed via the Bootjack FSR. After the turnoff to the Bootjack Lake forestry campsite at 8.5 km, the road continues, and the remaining 6 km of road to the Mine Site are private. There is a gatehouse at the entrance to the Mine Site that controls access. All other access points to the Mine Site are controlled by locked gates.

To access the Mine Site, MPMC personnel use the Likely Highway from areas north and south of the Bootjack FSR. Employees live in many communities along this secondary highway, including 150 Mile House, Big Lake, Beaver Valley, Morehead Lake, Little Lake, Hydraulic, Likely, and Horsefly.

The Likely Highway has seasonal load restrictions imposed in springtime by the MoTI. The Bootjack FSR is monitored by the MLWRS and loads are seldom restricted. Concentrate and other supplies are hauled year-round. MPMC is responsible for the maintenance of the Bootjack FSR year-round, including grading, repairs, dust suppression, and clearing of snow. The Likely Highway is maintained under contract by the MoTI.

2.2. Mill and Processing Plant Description

The flow sheets outlining the processes of the Mount Polley mill and processing plant are included in Appendix E.

2.2.1. *Primary, Secondary, Tertiary Crushing and Ore Handling*

Ore is crushed in three stages to produce a 16 mm product for the grinding circuit, which is stored in a 60,000 t stockpile. Sized rock for the pebble mill is removed from the secondary crusher feed and stored in a 10,000 t surge pile.

2.2.2. *Grinding*

Rod mills receive the crusher product from storage and reduce it to ball mill feed size at a rate of approximately 915 t per hour. Product from the ball mills is fed to the pebble mills, where it is reduced to flotation feed sized (65% passing 200 mesh). Slurry is pumped to hydrocyclone packs and classified to the required product size.

2.2.3. *Flotation*

A combination of column and mechanical cells recover rougher and scavenger concentrates for regrinding and subsequent cleaning to produce high-grade concentrates. The circuit has been designed with sufficient flexibility to accommodate operational variations in the head grade and oxidation of the ore.

2.2.4. *Concentrate Dewatering*

The concentrate from the flotation circuit is thickened and stored in a stock tank that provides surge capacity between thickening and filtering. Two pressure filters reduce the moisture content of the final concentrate to 8% for shipment. A conveyor deposits the filtered concentrate in a concentrate storage shed accessible to a front-end loader in the truck loading area. A new horizontal filter will be installed in 2023 to increase concentrate dewatering reliability.

2.2.5. *Concentrate Handling and Transport*

The Mine's concentrate is transported to the Port of Vancouver by Arrow Transportation Systems Inc. and shipped to overseas smelters. The principal market for the Mine Site concentrate is Asia. Concentrate has also been trucked to rail for delivery to smelters in North America.

2.2.6. *Mill Reagents*

Table 2-1 summarizes the types and estimated amounts of reagents currently used in mill processing. Depending on the type, mill reagents are shipped to the Mine Site in bags or drums as solids or as liquids. Mixing and storage tanks, which are heated as necessary, provide up to 48 hours of supplies of reagent ready for feeding by metering pumps. A spare system is provided for trials of experimental reagents. A ventilation system ensures that there is no build-up of noxious fumes in the area.

Table 2-1 Reagent Types and Quantities Used in the Mount Polley Mill

Reagent	Rate of Use (g/t)
Potassium amyl xanthate collector	12
W22C frother	20
Flocculant	0.13
Lime	70

2.2.7. *Instrumentation and Control Philosophy*

The entire processing operation is controlled through a central programmable logic controller (PLC). This PLC and its principal auxiliary components are in a control room in the concentrator building and it communicates with the remote input/output stations at the freshwater pump house, the water head tanks, the reclaim water pump barge, and the reclaim water booster pump house, among other components, by way of an overhead data highway cable.

An on-stream analyzer (OSA) provides up-to-date information on the ore feed and operating results by measuring assays for five streams. This enables flotation operators to control recovery and concentrate grades. The OSA minimizes the requirements for personnel who would otherwise be required to provide these control assays. The OSA package includes an X-ray analyzer (which has an X-ray tube and spectrometer) and computer hardware and software for data collection and analysis. The sample streams to the OSA are used for shift composite samples for metallurgical accounting purposes, along with five other hand-cut samples from other streams.

2.2.8. *Processing History*

A summary of the history of processing at the Mine Site is provided in Table 2-2.

Table 2-2 History of Mill Processing at the Mine Site

Year of Production	Ore Processed (t)	Tailings Produced (t)	Grinding Circuit	Sources of Tailings	Changes and Geochemical Considerations
Mine Start (1997)	2,346,829	2,333,186	2 rod, 2 ball, 3 pebble mills.	Three tailings streams: (1) sand scavenger; (2) oxide; and (3) cleaner tails from cyclone overflow. All streams combined for disposal in the impoundment.	NaHS used to float copper oxide minerals.
1998	5,828,358	5,788,498			
1999	7,051,212	6,986,932			
2000	6,948,339	6,883,317			
2001	5,385,796	5,328,581			
5-year shutdown					Consolidation of the tailings in the impoundment.
2005	4,814,083	4,758,757	2 rod, 2 ball, 3 pebble mills	Two streams; rougher and scavenger tails. Both streams combined for disposal in the impoundment.	Higher proportion of sulphide ore and lower NaHS addition.
2006	6,235,221	6,133,088			
2007	6,444,112	6,346,640	2 rod, 3 ball, 3 pebble mills.		Addition of third ball mill to increase production from 6.4 to 7 million t per year.
2008	6,848,983	6,735,444			
2009	7,045,737	6,977,681			
2010	7,894,596	7,825,178	2 rod, 3 ball, 3 pebble mills and flash flotation.		Addition of flash flotation for remainder of operations to date with the potential to lower sulphide content in the tailings.
2011	7,716,856	7,663,577		One stream combined.	More oxidized ore and higher NaHS addition.
2012	8,121,878	8,056,496		One flotation stream and addition of circuit to remove magnetite.	Addition of magnetite removal circuit. Tailings produced after 2012 would contain lower amounts of magnetite.
2013	7,956,738	7,882,625			
2014 (to 4 August 2014)	4,486,121	4,440,700			

Table 2-2 History of Mill Processing at the Mine Site

Year of Production	Ore Processed (t)	Tailings Produced (t)	Grinding Circuit	Sources of Tailings	Changes and Geochemical Considerations
1 year shutdown					
2015 (5 August to December 31)	1,781,799	1,765,955	2 rod, 3 ball, 3 pebble mills and flash flotation.	One flotation stream and addition of circuit to remove magnetite.	Tailings deposition in the Springer Pit.
2016 (up to June 26)	3,240,819	3,214,965			
2016 (June 27 to December 31)	3,444,005	3,420,710			Tailings deposition in the TSF.
2017	6,723,188	6,686,158			
2018	6,195,760	6,166,566			
2019 (January 1 to May 31)	2,231,119	2,224,146			
2019 (May 31 to December 31)	0	0	Care and maintenance .	No Deposition of Tailings.	
2020	0	0			
2021	0	0			

2.3. Current Permitted Mine Plan

The current mine plan accounts for the existing operational period of the mine, as well as a one-year restricted operating period which was completed in 2016. Because of the delays in its execution (Section 1.2.1), the current mine plan will complete the mining of Phase 4 Springer Pit by 2024. Under the currently authorized mine plan, approximately 16,900,000 t of material will be mined over the next two years, which will yield 17,500,000 t of tailings; the bulk of which will report to the TSF (MPMC 2022b). Currently the TSF has a minimum elevation of 968 m and does not have the capacity to accommodate all of the tailings that will be generated through the remainder of the authorized mine plan (MPMC 2022b). To help alleviate this, MPMC is in the process of executing work to raise the TSF elevation to that currently approved under the M-200 *Mines Act* permit (970 m). When complete, the associated work will provide an additional 14,000,000 t of tailings capacity to the TSF (MPMC 2022b). As this additional capacity is not enough to accommodate all of the tailings generated from the mining of Phase 4, MPMC is also pursuing permitting to raise the TSF to 984 m; however, as this raise has not been approved, the 2022 MRP (e.g., this document) excludes discussion on the use of the additional capacity related to the 984 m TSF.

The active closure period will occur after completion of mining of the Phase 4 Cariboo-Springer Pit. Prior to this, stockpiled ore will be processed, to prepare the Mine Site for active closure. The exact volume of stockpiled ore to mill during this period will depend on the volume of ore generated prior to this point and space available in the 970 m TSF.

Following the processing of ore stockpiles, approximately 33,920,000t of PAG rock from the Temporary NW PAG Stockpile will be rehandled into the Cariboo-Springer Pit for long-term subaqueous disposal (MPMC 2015b). This will occur as haulage capacity allows, over a period of at least two years. Generation of acid rock drainage (ARD) from the PAG rock is not a concern during the rehandling phase, or prior to completion of mine closure, as the onset times for potential acid generation are in the order of 100 years and greater due to its inherently high carbonate content (MPMC 2015b).

2.3.1. *Material Handling*

A summary of expected quantities of different material types generated and handled during the current mine plan (including those associated with the restricted operation period) is provided in Table 2-3. Referenced locations are shown in Figure 2-1, which shows their expected footprints during active closure. Of note, underground mining has been removed from the approved mine plan.

During active closure, non-acid generating (NAG) waste rock will be placed at the SERDS or, alternatively, used for on-site projects. PAG rock will continue to be characterized according to the current acid-base accounting (ABA) sampling regime, and placed on the Temporary NW PAG Stockpile before being rehandled into the pits for final subaqueous disposal. Section 5.2.2 provides additional details on metal leaching (ML) and ARD characterization and associated material management, including handling of PAG material.

Table 2-3 Mine Plan Material Tonnages (Including the Restricted Operations Interval)

Material Type	Quantity (t)
NAG waste rock	51,700,000
Tailing to be moved from the Springer Pit to the TSF or for co-disposal at SERDs[1]	4,000,000[2]
Phase 4 PAG waste rock stockpiled	8,170,000
Total PAG waste rock rehandled during active closure	33,920,000
Ore directed to mill from pits	24,600,000
Phase 4 ore stockpiled	3,550,000
Stockpiled ore processed over entire period	5,310,000[2]
Total ore processed	**29,910,000**

Notes:

1) contingent on approval of SERDS co-disposal application.

2) denotes material to be deposited in the TSF for the 970 m configuration.

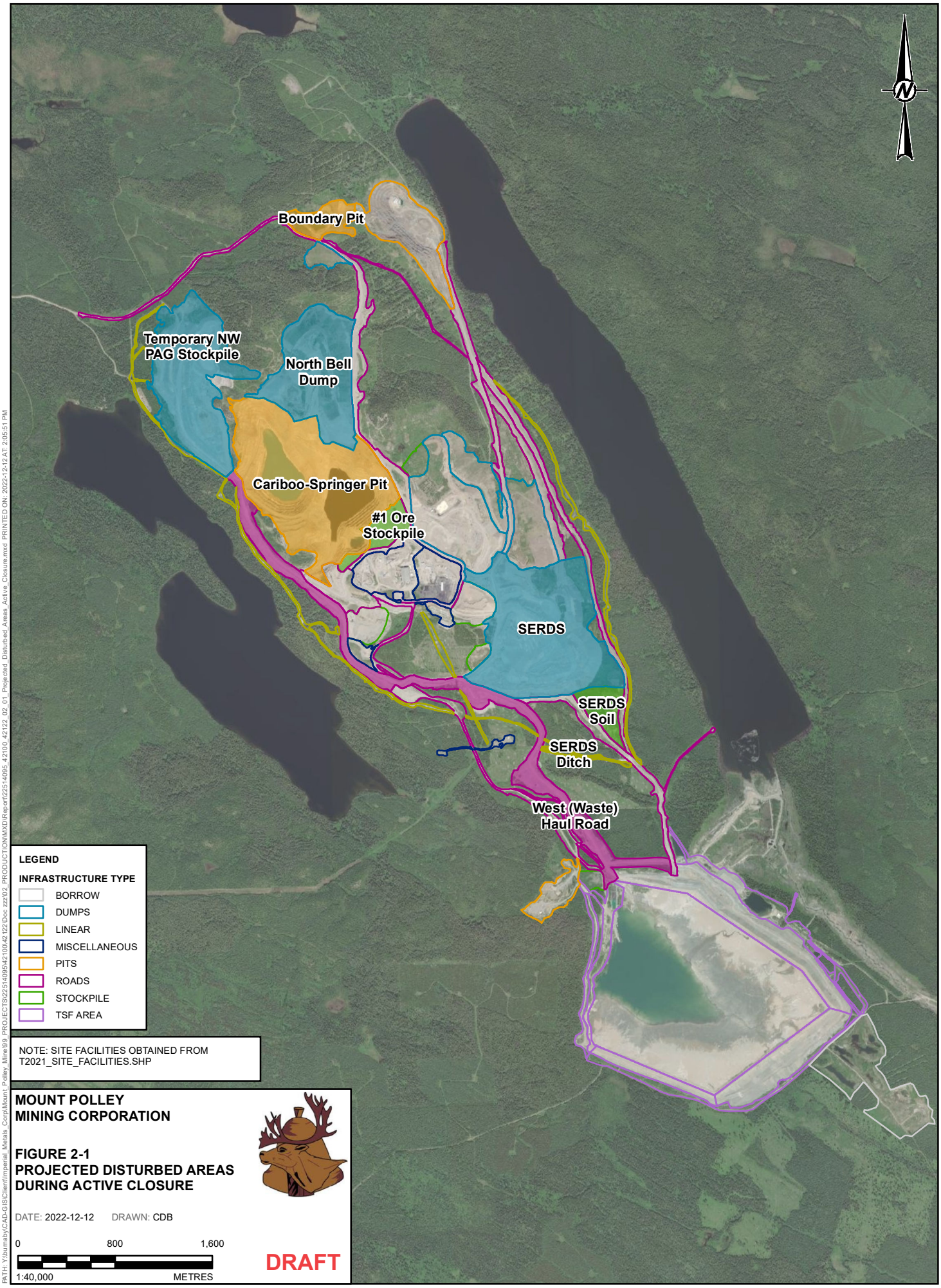

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2.3.3. *Area of Disturbance*

The current area of disturbance at the Mine Site is 1,219.49 ha as reported in the 2021 Annual Reclamation Report (MPMC 2022a). The areas are organized by mine features and disturbance type (Table 2-4). These disturbed areas are shown in Figure 2-1 in their final configuration. Areas designated as undergoing progressive reclamation are discussed and shown on a map in Section 4.2.

The projected disturbance footprint that will be reclaimed is 1,311.06 ha; this is an anticipated increase of 91.57 ha from the December 2021 disturbance footprint. This increase in disturbance is the result of the development of components under the authorized mine plan, including pits, SERDS and Temporary NW PAG Stockpile development, and projected development of the West Haul Road; construction of the West Haul Road will depend on haulage efficiencies and economics to be determined by MPMC. Area changes in specific features associated with the approved mine plan are summarized in Table 2-5 and the projected disturbance footprint is shown in Figure 2-1.

Table 2-4 also includes the area that will require reclamation following the execution of the approved mine plan (1,131.94 ha). Areas shown in Table 2-4 represent the final configurations of these components prior to material rehandling, and inform reclamation activities (e.g., placement of coversoil) in active closure.

Table 2-4 The Mine Site Existing and Projected Disturbed Areas[1]

Area	End Land Use	Existing Area (ha)	Projected Disturbance Area (ha)	Existing Reclaimed Area (ha)	Lake Area (ha)	Projected Reclamation Area (ha)
Dumps						
~~Bell Dump~~	~~N/A~~		-		-	-
Boundary Dump	Wildlife/Forestry	4.84	-	4.70	-	0.14
East RDS	Wildlife/Forestry	50.95	-	6.37	-	44.58
Highway to Heaven	Wildlife/Forestry	16.24	-	9.47	-	6.77
NEZ Dump	Wildlife/Forestry	22.90	-	5.13	-	17.77
North Bell Dump	Wildlife/Forestry	62.08	61.70	26.97	-	34.73
SERDS	Wildlife/Forestry	108.50	117.69	-	-	117.69
Temporary NW PAG Stockpile	Wildlife/Agroforestry	76.34	82.55	-	-	82.55
	Dumps Subtotal	***341.85***	***356.87***	***52.64***	***-***	***304.23***
Pits						
Boundary Pit	Pit Walls/Lake	12.10	19.21	-	2.74	16.47
~~C2 Pit~~	~~N/A~~		-	-	-	
~~Cariboo Pit~~	~~N/A~~		-	-	-	
~~Pond Zone Pit~~	~~N/A~~		-	-	-	
TSF Quarry	Pit Walls/Lake	11.04	-	-	-	11.04
~~SEZ Pit~~	~~N/A~~		-	-	-	
Cariboo-Springer Pit	Pit Walls/Lake	133.84	162.14	-	49.70	112.44
Wight Pit	Pit Walls/Lake	38.70		-	14.61	24.09
	Pits Subtotal	***195.68***	***231.09***	***-***	***67.05***	***164.04***

Table 2-4 The Mine Site Existing and Projected Disturbed Areas[1]

Area	End Land Use	Existing Area (ha)	Projected Disturbance Area (ha)	Existing Reclaimed Area (ha)	Lake Area (ha)	Projected Reclamation Area (ha)
Stockpiles						
#1 Stockpile	Wildlife/Forestry	10.91	10.58	-	-	10.58
Biosolids	Wildlife/Forestry	2.84		-	-	2.84
High Ox Stockpile	Wildlife/Forestry	10.23		-	-	10.23
Mount Polley Soil	Wildlife/Forestry	4.06		-	-	4.06
NEZ Soil	Wildlife/Forestry	9.41		-	-	9.41
Cariboo Ore Stockpile	Wildlife/Forestry	8.83		-	-	8.83
Pond Zone	Wildlife/Forestry	2.83	-	-	-	2.83
SERDS Soil Stockpile	Wildlife/Forestry	11.66	10.97	-	-	10.97
Tailings Soil	Wildlife/Forestry	2.95	-	-	-	2.95
	Stockpiles Subtotal	***63.72***	***62.70***	***-***	***-***	***62.70***
Roads						
Boundary/Wight Pit Connector Road	Wildlife/Forestry	1.67	-	-	-	1.67
Crusher Road	Wildlife/Forestry	2.29	-	-	-	2.29
Mill/TSF Connector Road	Wildlife/Forestry	17.27	-	-	-	17.27
New Access Road	Wildlife/Forestry	26.90	-	-	-	26.90
~~Old Mine Access Road (Bootjack) - Mine Component~~	~~N/A~~		-	-	-	-
~~Old Pond Zone Road~~	~~N/A~~		-	-	-	-
Old Tailings Haul Road	Wildlife/Forestry	12.35	-	-	-	12.35
Old Wraparound Road	Wildlife/Forestry	11.00	-	-	-	11.00
Ore Switchback Road	Wildlife/Forestry	12.12	-	-	-	12.12
Polley Lake Access Road	Access Road	0.72	-	-	-	0.72
West Haul Road	Access Road	60.73	104.81	1.81	-	103.00
Wight Pit Haul Road	Access Road	14.33	-	-	-	14.33
Wight Pit/Tailings Road	Access Road	17.37	-	-		17.37
	Roads Subtotal	***176.75***	***220.83***	***1.81***	***-***	***219.02***

Table 2-4 The Mine Site Existing and Projected Disturbed Areas[1]

Area	End Land Use	Existing Area (ha)	Projected Disturbance Area (ha)	Existing Reclaimed Area (ha)	Lake Area (ha)	Projected Reclamation Area (ha)
TSF						
Corner 4 to Corner 5	Wildlife	11.34	-	-	-	11.34
Corner 4 to Corner 5 Light Duty Access Road	Access Road	6.31	-	-	-	6.31
East Till Borrow	Wildlife/Agroforestry	12.81	-	-	-	12.81
Hazeltine Discharge Pipe Grade	Wildlife/Forestry	2.92	-		-	2.92
Main Embankment	Access Road	30.36	-		-	30.36
Perimeter Embankment	Access Road	46.93	-		-	44.61
South Embankment	Access Road	9.17	-		-	9.17
Southeast Till Borrow	Wildlife/Agroforestry	26.27	-	23.95	-	2.32
~~Tailings Pipe Grade~~	~~N/A~~		-		-	-
TSF - South and Main Ponds	Wildlife/Agroforestry	9.40	-		-	9.40
TSF - Southwest Pond	Wildlife/Agroforestry	3.83	-		-	3.83
TSF Surface	Wildlife - Forested Wetland	214.28			32.14	182.14
	TSF Subtotal	***373.62***	***373.62***	***23.95***	***32.14***	***317.53***

Table 2-4 The Mine Site Existing and Projected Disturbed Areas[1]

Area	End Land Use	Existing Area (ha)	Projected Disturbance Area (ha)	Existing Reclaimed Area (ha)	Lake Area (ha)	Projected Reclamation Area (ha)
Miscellaneous						
Geology Area	Wildlife/Forestry	2.75	-			2.75
Helipad	Wildlife/Forestry	3.13	-	1.53		1.60
Hydro Line	Wildlife/Forestry	3.21	-	-	-	3.21
Long Ditch	Watercourse	7.94	-	-	-	7.94
Mill Area	Wildlife/Forestry	20.19	-	-	-	20.19
~~Northwest PAG Ditch~~	~~N/A~~		-	-	-	-
~~Old Dispatch~~	~~N/A~~		-	-	-	-
Old Orica Sites	Wildlife/Forestry	1.79	0.81	-	-	0.81
South SERDS Ditch	Watercourse	2.65	2.21	-	-	2.21
Warehouse Area	Wildlife/Forestry	13.64	-	-	-	13.64
Constructed Wetland Treatment System	Watercourse	1.05	0.55	-	-	0.55
West Ditch	Watercourse	11.52	-	-	-	11.52
Miscellaneous Subtotal		***67.87***	***65.95***	***1.53***	**-**	***64.42***
TOTAL		**1,2,19.49**	**1,311.06**	**79.93**	**99.19**	**1,131.94**

1) crossed out fields indicate areas that have their disturbance footprint fully captured by other facilities presented on this table. e.g., Bell Dump resides within the North Bell Dump.
N/A = While there was a footprint created by the line item, a new disturbance now exists within the same footprint.

Table 2-5 Changes in Disturbed Areas with the Projected Active Closure Footprint

Area Type	Current Area (ha)	Closure Area* (ha)	Change in Area (ha)	Description
Dumps				
North Bell Dump	62.47	62.07	-0.40	Cariboo-Springer Pit Expansion
SERDS	109.97	110.27	0.30	Final-resloped footprint
Temporary NW PAG Stockpile	80.48	77.93	-2.25	Final-resloped footprint
Pits				
Boundary Pit	12.26	19.41	7.15	Boundary Pit Development
Cariboo-Springer Pit	145.77	163.57	17.80	Cariboo-Springer Pit Development
Stockpiles				
#1 Stockpile	10.76	10.06	-0.70	Cariboo-Springer Pit Expansion
SERDS Soil Stockpile	12.76	12.09	-0.67	SERDS Expansion
Roads				
West Haul Road	59.21	103.72	44.51	Assumes completion of TDAR; if not, no additional disturbance
Miscellaneous				
Old Orica Sites	1.73	0.76	-0.97	TDAR Construction (West Haul Road)
South SERDS Ditch	2.61	0.40	-2.21	TDAR Construction (West Haul Road)
Constructed Wetland Treatment System	1.05	1.05	-	CWTS Construction 9k Sump

* Areas for the SERDS and Temporary NW PAG Stockpile represent final configurations prior to PAG subaqueous disposal and resloping; areas for the Boundary Pit and Cariboo-Springer Pit represent areas prior to flooding.

** Not all areas are new disturbance; some are transfers of areas between site components.

2.4. Water Management

2.4.1. *Water Discharge Background*

The Mine Site has a positive water balance, (i.e., an accumulation of water year over year). As the Mine Site footprint has expanded, the annual surplus water has increased over the life of the project. During the early 2000s, the Mine was in care and maintenance due to low metal prices, and excess water accumulated in the TSF, and was subsequently discharged to Edney Creek under *EMA* Permit 11678. In November 2011, MPMC received an amendment to *EMA* Permit 11678 that allowed for discharge of dam-filtered water into Hazeltine Creek. However, permit restrictions on the quality and quantity, water source, and season of discharge prevented the Mine from fully discharging the surplus water that was accumulating in the TSF. At the time of the TSF embankment breach, the Mine was actively pursuing permit amendments for a short-term discharge system to manage the surplus water, while a long-term plan for water management was developed.

Following the TSF embankment breach, MPMC had no permitted discharge due to a PAO (issued by ENV), and all Mine contact water was stored in the Springer Pit. However, the Mine Site continued to have a positive water balance, and Springer Pit possessed a finite storage capacity (overflow elevation of 1,050 masl; Golder 2015b). Modelling by Golder following the breach indicated that once the pit water elevation reached approximately 1,030 masl, water would exfiltrate to groundwater and discharge towards Bootjack Lake (Appendix F). Therefore, there was a need to develop a system for treatment and discharge of Mine contact water. In July 2015, after the development of a long-term water management strategy, MPMC was provided approval by EMLI to return to restricted operations for a one-year period using the Springer Pit for tailings deposition. The Springer Pit received tailings and contact water until 2016 when the TSF was repaired and authorized for use under *Mines Act* Permit M-200 and *EMA* Permit 11678.

In 2016, a Technical Assessment Report (TAR) was submitted to British Columbia Ministry of Environment and Climate Change Strategy (ENV). The main objective of the TAR was to identify water management practices that would limit further accumulation of contact water at the Mine Site and prevent unplanned discharge to the environment. The TAR included an assessment of the effluent discharge during operations, and recommended using an active treatment system and a pipeline to discharge treated mine water at depth in Quesnel Lake. These recommendations were implemented, and in May 2016, a direct pipeline from the Springer Pit to the Water Treatment Plant (WTP) was installed. Work towards water discharge continued, with a pipeline and diffusers installed at depth in Quesnel Lake. On 23 June 2016, MPMC was approved by EMLI to return to normal operations and discharge treated water to Quesnel Lake. This discharge is currently permitted until 30 June 2025 under *EMA* Permit 11678.

Following the 2016 *EMA* Permit 11678 approval, normal operations resumed, including the continued dewatering of Springer Pit and the transferring of 5,000,000 t of tailings from Cariboo-Springer Pit to the TSF. From 2016 to 2019, the Mine Site operated at full capacity, but was again placed in care and maintenance due to slumping metal prices. Currently, dewatering of the Springer Pit has been completed, and the tailings removal is expected to be finished by the end of 2022. Dewatering of the Cariboo Pit is still ongoing, with approximately 1,000,000 m^3 of water remaining.

2.4.2. *Current Water Management System Overview*

As with most mines, water management at the Mine Site is integral to limiting potential impacts on the environment. Currently on the Mine Site, a network of channels, ponds, and pumps are used for managing surface water. Contact and non-contact (e.g., clean) water systems are managed with the objective of avoiding the mixing of these two types of water sources. Because of the extensive infrastructure and the multiple sources of water that require management (e.g., precipitation inputs, seepage, runoff), water management at the Mine Site is complex. Figure 2-2 provides an overview of water management systems at the Mine Site for existing and future operations. Figure 2-3 provides a detailed breakdown on how water is managed and treated at the Mine Site, while Figure 2-4 shows environmental monitoring locations that are associated with mine operations.

In general, non-contact water management systems consist of channels to divert runoff (originating from undisturbed areas) away from the Mine Site; thus, preventing the generation of additional contact water. Conversely, contact water from within the Mine Site is actively managed using the infrastructure shown in Figure 2-2, with the contact water ultimately destined for one of the following:

- use in operations (e.g., milling) or dust management
- conveyance to the TSF
- transport to the Perimeter Embankment Till Borrow Pond (PETBP), which functions as the influent pond for the WTP
- transmission to the WTP for treatment, and then subsequent release to the surrounding environment

For information on existing water treatment, see Section 2.4.2.5.

Currently, most contact water at the Mine Site is collected along two collection-ditch systems that run north to south along the western and eastern edges of the site: namely, the West Ditch system and the Long Ditch system (Figure 2-2). The contact water is conveyed to the TSF or the PETBP for re-use as part of mine operations or for treatment and subsequent discharge.

Site water management is designed to meet the TSF quantitative performance objectives set by the TSF engineer of record (Golder 2020a), including TSF pond size, freeboard, and beach width. Due to large freshet water volumes, it is necessary to utilize the TSF for temporary detention of contact water. However, the fundamental basis of the water management plan is to not accumulate water on site by treating and discharging water, and to not carry over surplus water inventory year-to-year even under extreme weather conditions.

A summary of the water management infrastructure is provided in the following subsections (Sections 2.4.2.1 to 2.4.2.5). See Figure 2-2 for clarity, as infrastructure is discussed in detail within the following sections.



MOUNT POLLEY MINING CORPORATION

FIGURE 2-2
SITE WATER MANAGEMENT

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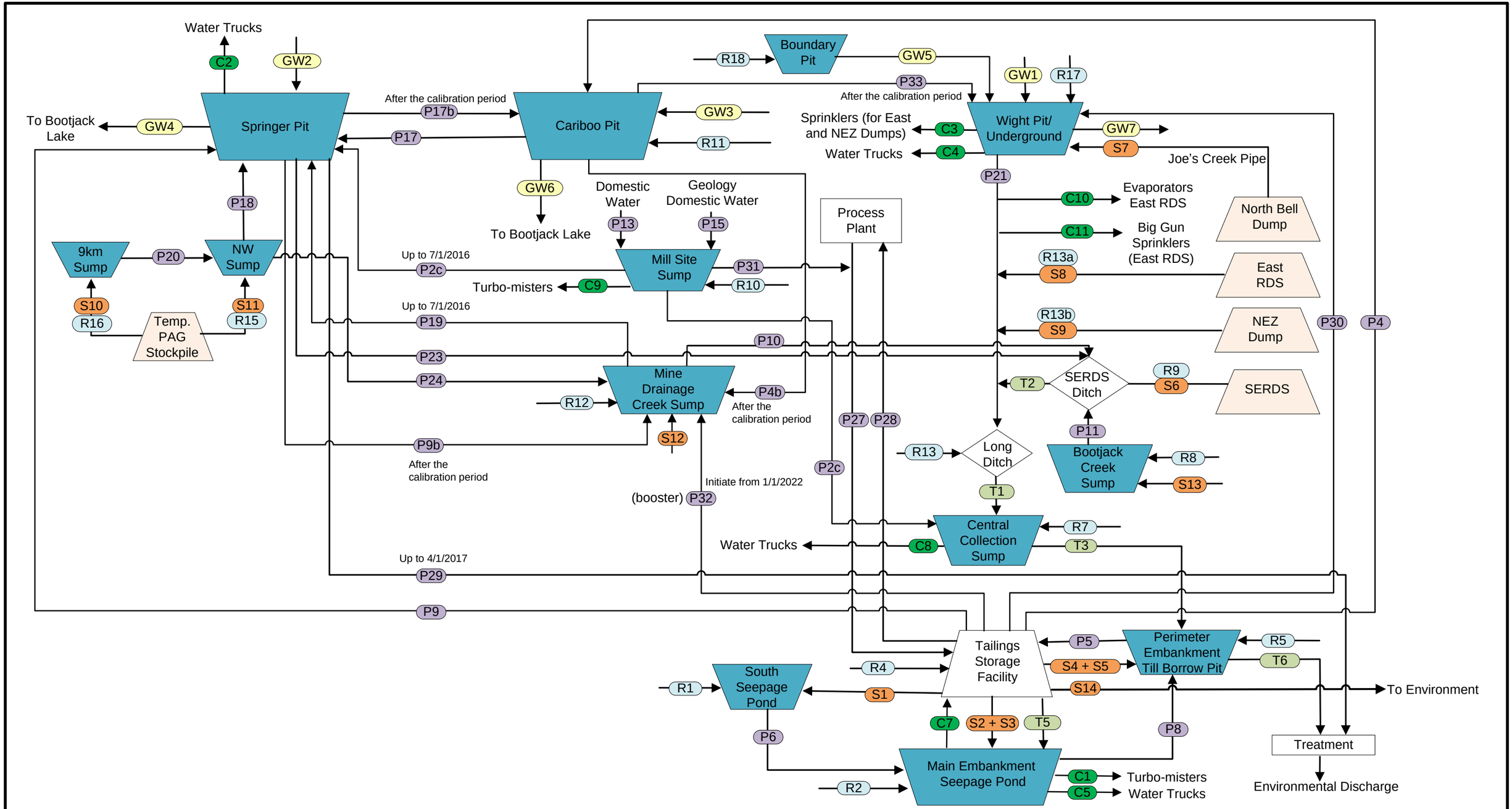

Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	7 December 2022
CHECKED	GD
DATE	7 December 2022
SCALE	Not to Scale
PROJECT No	22514095/31500
FIGURE No	1
REV No	A

TITLE

Site Wide Water Balance
Operations
Up to 31 August 2024

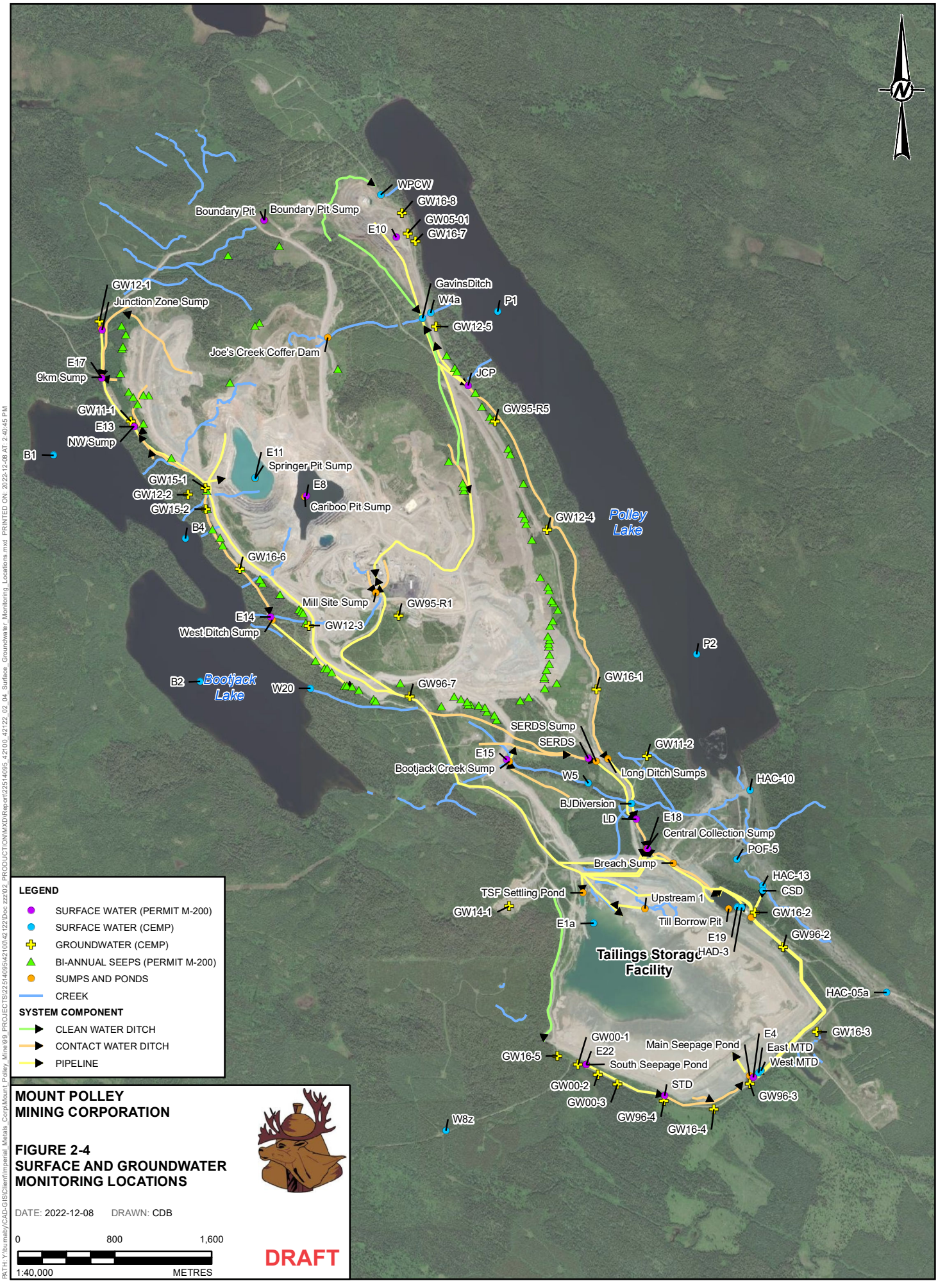
WPCW
GW16-8
GW05-01
GW16-7
Boundary Pit
Boundary Pit Sump
E10
GW12-1
Junction Zone Sump
GavinsDitch
W4a
P1
GW12-5
Joe's Creek Coffer Dam
E17
9km Sump
JCP
GW95-R5
GW11-1
E13
NW Sump
B1
E11
Springer Pit Sump
GW15-1
GW12-2
GW15-2
E8
Cariboo Pit Sump
B4
GW12-4
Polley Lake
GW16-6
Mill Site Sump
GW95-R1
E14
GW12-3
West Ditch Sump
P2
B2
Bootjack Lake
W20
GW96-7
GW16-1
SERDS Sump
SERDS
GW11-2
E15
Bootjack Creek Sump
W5
Long Ditch Sumps
HAC-10
BJDiversion
LD
E18
Central Collection Sump
POF-5
Breach Sump
HAC-13
CSD
TSF Settling Pond
GW14-1
Upstream 1
GW16-2
E1a
Till Borrow Pit
E19
GW96-2
HAD-3
Tailings Storage Facility
HAC-05a
GW16-3
GW00-1
E4
GW16-5
E22
Main Seepage Pond
East MTD
South Seepage Pond
West MTD
GW00-2
STD
GW96-3
GW00-3
GW96-4
GW16-4
W8z
LEGEND
SURFACE WATER (PERMIT M-200)
SURFACE WATER (CEMP)
GROUNDWATER (CEMP)
BI-ANNUAL SEEPS (PERMIT M-200)
SUMPS AND PONDS
CREEK
SYSTEM COMPONENT
CLEAN WATER DITCH
CONTACT WATER DITCH
PIPELINE
MOUNT POLLEY
MINING CORPORATION
FIGURE 2-4
SURFACE AND GROUNDWATER
MONITORING LOCATIONS
DATE: 2022-12-08
DRAWN: CDB
0
800
1,600
1:40,000
METRES
DRAFT
PATH: Y:\Burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\225140954210042122\Doc zzz\02_PRODUCTION\MXD\Report\225140954_42100_42122_02_04_Surface_Groundwater_Monitoring_Locations.mxd PRINTED ON: 2022-12-08 AT: 2:40:45 PM

2.4.2.1. West Ditch System

The West Ditch system collects contact water from the west side of the Mine Site and extends from the Junction Zone Seepage Collection to SERDS Sump (as shown on Figure 2-2). The West Ditch system comprises the following (from upstream to downstream) series of open-flow ditches and sumps:

- **Junction Zone Seepage Sump** collects seepage from the Temporary NW PAG Stockpile and is pumped into Junction Zone Ditch
- **Junction Zone Ditch** collects contact water runoff from the Temporary NW PAG Stockpile and flows by gravity to the 9K Sump
- **9K Sump** collects contact water from Junction Zone Ditch and runoff from the Temporary NW PAG Stockpile, and is pumped to the NW Sump
- **NW Sump** collects contact water from 9K Sump and runoff from the Temporary NW PAG Stockpile. There are two pumping options for NW Sump:
    - the primary option is to pump to the north portion of Mine Drainage Creek Ditch
    - the secondary option is to pump to Springer Pit
- **Mine Drainage Creek Sump and Ditch** collects contact water runoff from the West Haul Road and Mill Site Area, and at times pumps flow from the NW Sump. Mine Drainage Creek Sump is pumped to the south branch of Mine Drainage Creek Ditch and flows by gravity into Lower West Ditch.
- **Lower West Ditch** collects contact water runoff from the West Haul Road and flows by gravity into SERDS Ditch.
- **Bootjack Creek Sump** collects contact water from the east side of the Tailing Access Road and pumps into SERDS Ditch.
- **SERDS Ditch** collects contact water runoff from the SERDS Catchment and conveys water by gravity from Lower West Ditch and Bootjack Creek Sump to SERDS Sump.
- **SERDS Sump** is the terminus of the West Ditch system. Water collected at SERDS Sump flows by gravity feed pipeline to the Central Collection Sump (CCS). An overflow system consisting first of a 24” HDPE pipeline conveys flow to Lower Long Ditch Sump, and then overflowing water is conveyed over the haul road to Upper Long Ditch Sump.

2.4.2.2. Long Ditch System

The Long Ditch system collects contact water from the east side of the Mine Site and extends from below the site access road to the Long Ditch Sump (as shown on Figure 2-2). The Long Ditch system comprises the following (from upstream to downstream) series of open-flow ditches and sumps:

- **Joe's Creek Coffer Dam** collects seepage from North Bell Dump and conveys flow by gravity feed pipeline to the north end of Long Ditch, or directs it to Wight Pit
- **Wight Pit** is currently being dewatered. Water from Wight Pit is pumped via a series of pumps and booster tanks to the north end of Long Ditch
- **Long Ditch** collects contact water from Joe's Creek Coffer Dam and Wight Pit Dewatering, and conveys it by gravity to Upper Long Ditch Sump
- **Northeast Zone (NEZ) Sump** collects contact water from NEZ Seep 1 and NEZ Seep 2 and conveys water by gravity feed pipeline to the Booster tank where it is then pumped to the mill for treatment. Overflow from this booster tank flows into the Wight Pit
- **Upper Long Ditch Sump** collects contact water from Long Ditch and is conveyed by gravity feed pipeline to the CCS

2.4.2.3. Central Collection Sump (CCS)

The CCS receives water from the Long Ditch and West Ditch systems, as well as contact water from local runoff. Depending on water management needs, water may be pumped to the TSF or allowed to overflow into the PETBP.

2.4.2.4. Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP receives contact water from the immediate area via runoff and seepage. The PETBP also serves as a storage pond for the West Ditch and Long Ditch systems with overflow coming from the CCS. Water from the PETBP provides influent for the WTP or is recirculated (via pumps) for use in other areas of the site.

2.4.2.5. Mill Process Water

Mill process water is currently, and will continue to be, primarily sourced from the TSF. The TSF will receive water from a variety of locations depending upon the season and site water management considerations. Any required mill water will be pumped from the TSF to the booster station and from the booster station to the mill process water tank. From the mill process water tank, water will then be directed to the mill, with surplus water returned to the TSF. A TSF free water (pond) volume between 1.0 and 1.7 Mm^3 will be targeted for processing requirements. This volume range also allows for adequate tailings beaches (operating objective of a minimum of 100 m) to be maintained. Appendix E includes mill process flow diagrams that detail mill water use.

2.4.2.6. Water Treatment and Discharge

Currently, the Mine Site's water management infrastructure allows for the cycling of water through the mill and back to the TSF or PETBP, which allows for mill components to provide lime pre-treatment (as needed) to precipitate metals (mainly high instances of copper). The Mine Site operates with an existing WTP design capacity of 0.23 m^3/s. Additional temporary treatment capacity of 0.07 m^3/s has been recently added in 2022 to assist in treating and discharging surplus contact water currently on-site. Under *EMA* Permit 11678, the allowable maximum annual discharge volume from site is currently 10.59 Mm^3/year (which equates to an average of 0.33 m^3/s), while the design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate). Modeling predictions for total copper, total selenium, and total suspended solids (TSS) indicates that these parameters will require treatment during the remainder of operations; however, actual monitoring data over several years shows that selenium treatment has not been required during operations. Operation of the WTP has been shown to effectively treat both TSS and total copper for the majority of operating conditions.

In preparation for closure of the Mine Site, MPMC has been proceeding with a program of evaluating and developing passive, semi-passive, and active water treatment technologies for their possible use during mine closure to support the goal of distributing discharge back into the pre-mining configuration. Two treatment options are considered the BAT for treatment during closure and post-closure: Option A - distributed passive/semi-passive treatment systems (applied to select sources), and Option B – pit-lake treatment followed by the centralized Actiflo WTP. Option B is the current assumption for water treatment during closure/post-closure, but MPMC has also been progressing technology evaluations to support Option A. Further detail on research conducted to further progress BAT water treatment is provided in Section 4.4, while the most recent information on water treatment is provided in Appendix G.

3. LAND USE AND CAPABILITY OBJECTIVES

Prior to the development of the Mine Site, the key land uses within the Mine Site footprint were commercial forestry and wildlife habitat. Portions of the Mine Site footprint were also used for cattle grazing, recreational activities, hunting, and trapping. There was no agriculture in the area, and in baseline assessments, the Mine Site was determined to have poor agricultural capability. Detailed baseline land capability and historical land use information is provided in Appendix C, and summarized in Section 1.4.

3.1. Reclamation Objectives

3.1.1. *End Land Use Objectives*

The main objective of the reclamation program is to return all areas that have been disturbed by mining operations (except pit walls) to equivalent or greater land capability than existed prior to mining, on an average property basis. To help achieve this overarching goal, an End Land Use Plan (Section 5.3) has been developed, which focusses on ecosystem rehabilitation as the main goal with a target towards ecosystems that occurred prior to disturbance (Section 1.4).

The End Land Use Plan also estimates shifts in the end land use objectives over time as the ecological trajectories of the ecosystem evolve. This allows for end land use planning to be considered over the long-term and considers that a variety of end land uses can occur on the landscape over different temporal scales. To achieve successful closure of the Mine Site, the following objectives must be achieved:

- long-term stability of engineered structures, including the RDSs, TSF and open pits, as well as all exposed erodible materials
- removal and proper disposal of access roads, structures, and equipment not required after the Mine Site closes
- sufficient coversoil (e.g., reclamation material) to achieve the desired target ecosystems on the post-closure landscape
- geochemical stability of WRDs, open pits, the TSF, and all other major components of the Mine Site in the post-closure landscape
- long-term preservation of water quality within and downstream of decommissioned operations
- a water balance that meets the requirements for a functional landscape that aligns with the targeted end land use
- natural integration of disturbed lands into surrounding landscape, and restoration of the natural appearance of the area after mining ends, to the extent practicable

- self-sustaining vegetation covers established, consistent with the end land uses and desired ecosystems

- use of reclaimed ecosystems by their desired stakeholders (e.g., recreational users, wildlife, and traditional use practitioners)

Once these aspects are in place, flexibility exists to modify ecosystem composition, patch size, and vegetation mosaic and to provide additional structural components, as desired. By reclaiming disturbed land to stable, functioning, and locally appropriate ecosystems that can reasonably be expected to thrive on a specific landform or location, a variety of end land use objectives can also be met.

3.1.2. *Success Criteria*

To track progress towards closure objectives and overall adherence with the End Land Use Plan, Success criteria, which are more specific than closure objectives, were developed. These success criteria are used as milestones that indicate progress to achieving specific land use objectives. The success criteria include parameters such as:

- landform stability

- erosion control

- visual and functional integration into the surrounding environment

- establishment of self-sustaining native vegetation consistent with target site series

- vegetation quality

- presence of culturally important and rare or listed species

The general approach for measuring reclamation success is described in Section 7.4.

3.1.3. *Towards Sustainable Mining Program*

As a member of the Mining Association Canada, Imperial Metals Corporation is a participant in the Towards Sustainable Mining (TSM) program. TSM is a set of guiding principles and performance elements that address key activities of companies in all sectors of the mining and mineral-processing industry, and the program works to promote corporate social responsibility. Protocols of relevance to reclamation and closure are Aboriginal and Community Outreach, Tailings Management, and Biodiversity Conservation Management.

Historically, Imperial Metals Corporation has worked to advance TSM objectives for the MPMC Mine Site. TSM activities were postponed during care and maintenance, but Imperial Metals Corporation intends to resume TSM activities in the future.

4. RECLAMATION APPROACH

4.1. Reclamation Approach

To achieve the closure and end land use objectives outlined in Section 3, MPMC has developed strategies to promote physical stability, water quality and watercourse protection, sediment retention and erosion control, appropriate soil handling, suitable revegetation, and invasive species management.

Mine Site reclamation and active closure is still partially in the conceptual phase. Reclamation and closure strategies are designed to be adaptable and evolve based on findings from progressive reclamation, site monitoring and research, and advancements in engineering and science. The following sections outline progressive reclamation and research activities MPMC is currently undertaking, the results of which will continue to influence active closure and post-closure. Section 5 describes MPMC's reclamation strategies and prescriptions in detail.

4.2. Progressive Reclamation

4.2.1. *Geomorphic Design*

One key strategy used in MPMC's reclamation approach is the concept of geomorphic design. A geomorphic design attempts to replicate natural conditions in engineered environments. The objective is to construct a dynamic system of landforms and watercourses that is adaptable and does not erode more than natural systems or cause unacceptable environmental impacts. An engineered landscape based on the geomorphic approach can be subject to periodic changes without accelerated erosion characteristic of many constructed systems. Because of this, geomorphically designed systems more closely resemble natural systems than traditional engineered landforms, improving post-closure aesthetics and replication of natural ecosystems. As part of progressive reclamation and overall closure efforts, MPMC employs geomorphic designs for various post-closure landforms (namely RDSs). To assist in geomorphic design of post-closure landforms (e.g., reclaimed RDSs), two geomorphic guidance documents were created (Golder 2017a; Golder 2019). Best management practices and information from these guidance documents will be used in realizing a reclaimed landscape that meets the end land use objectives outlined in Section 3.

4.2.2. *Current Progressive Reclamation Status*

Currently, progressive reclamation sites at the Mine Site are treated as large-scale research projects, with outcomes influencing future reclamation plans and prescriptions. Much of the progressive reclamation achieved at the Mine Site occurred in the 2010's. Many of the monitoring programs associated with progressive reclamation have been executed as planned or have been put on hold due to the Mine Site's recent care and maintenance status. Detailed information on historical results of these trials can be found in the 2017 MRP (MPMC 2017).

More recent progressive reclamation included salvage of approximately 7,838 m^3 of soil from Cariboo Pit Access and subsequent placement of the salvaged soil at SEZ-1 and Mill Site 1 in 2017. In 2018, approximately 3,691 m^3 of till was placed in the Breach Zone (Lower SERDS-1 to Corner 1 Buttress), the NEZ Dump, and the 9 km Wetland. Tree planting also occurred in 2018 on the North Bell Dump (MPMC 2018).

Table 4-1 and Figure 4-1 shows the areas that have been re-contoured, received fertilizer or biosolids, and have been seeded and/or planted as of 2021 (MPMC 2022a). Detailed reclamation prescriptions for all reclamation and research sites within the Mine Site are also provided in Table 4-2 , and their locations are shown in Figure 4-1. Areas that were seeded for sediment retention and prevention of invasive species establishment are not included in Table 4-2 and Figure 4-1 as these are temporary reclamation areas, and may later be disturbed.

Table 4-1 Summary of Completed Progressive Reclamation at the Mine Site (as of 31 December 2021; (MPMC 2022a)

Area	Parcel	Re-contoured (ha)	Coversoil Applied (ha)	Seeded (ha)	Fertilizer/Biosolids (ha)	Tree Planted (ha)
		Total	Total	Total	Total	Total
NEX Dump	2a, 2b1, 2b2	5.13	5.13	5.13	5.13	5.13
	Beside 2a/2b	2.47	0.00	0.00	0.00	0.00
NBD	Parcels 1-10	9.45	11.59	11.59	11.59	11.59
	South Triangle	1.30	1.30	1.30	1.30	1.30
	Phase 1	2.21	2.21	2.21	2.21	2.21
	Phase 2	2.87	2.87	2.87	2.87	2.87
	Metro Van Research 1	2.81	2.81	1.87	2.34	2.34
	Wrap Around Toe	0.00	2.20	2.20	0.00	0.00
	Beside Research 1	4.76	1.99	0.00	0.00	0.00
	Metro Van Research 2	2.00	2.00	1.33	1.66	2.00
	Beside Research 2	2.73	0.00	0.00	0.00	0.00
	Beside BJ FSR	0.90	0.00	0.00	0.00	0.00
Boundary Zone	Dump	4.70	4.70	0.00	0.00	4.70
East RDS	Above Access Road	3.42	4.06	4.06	0.00	2.75
	Highway to Heaven	11.53	9.47	6.58	0.00	9.47
	Tree Plots	2.31	2.31	2.31	1.20	2.31
Waste Haul Road	Above WHR	1.81	1.81	1.81	0.00	0.00
	Below Helipad	1.53	1.53	1.53	1.53	1.53
South Till Borrow		23.25	0.00	14.75	12.00	0.00
	TOTAL	**85.18**	**55.98**	**59.54**	**41.83**	**48.20**

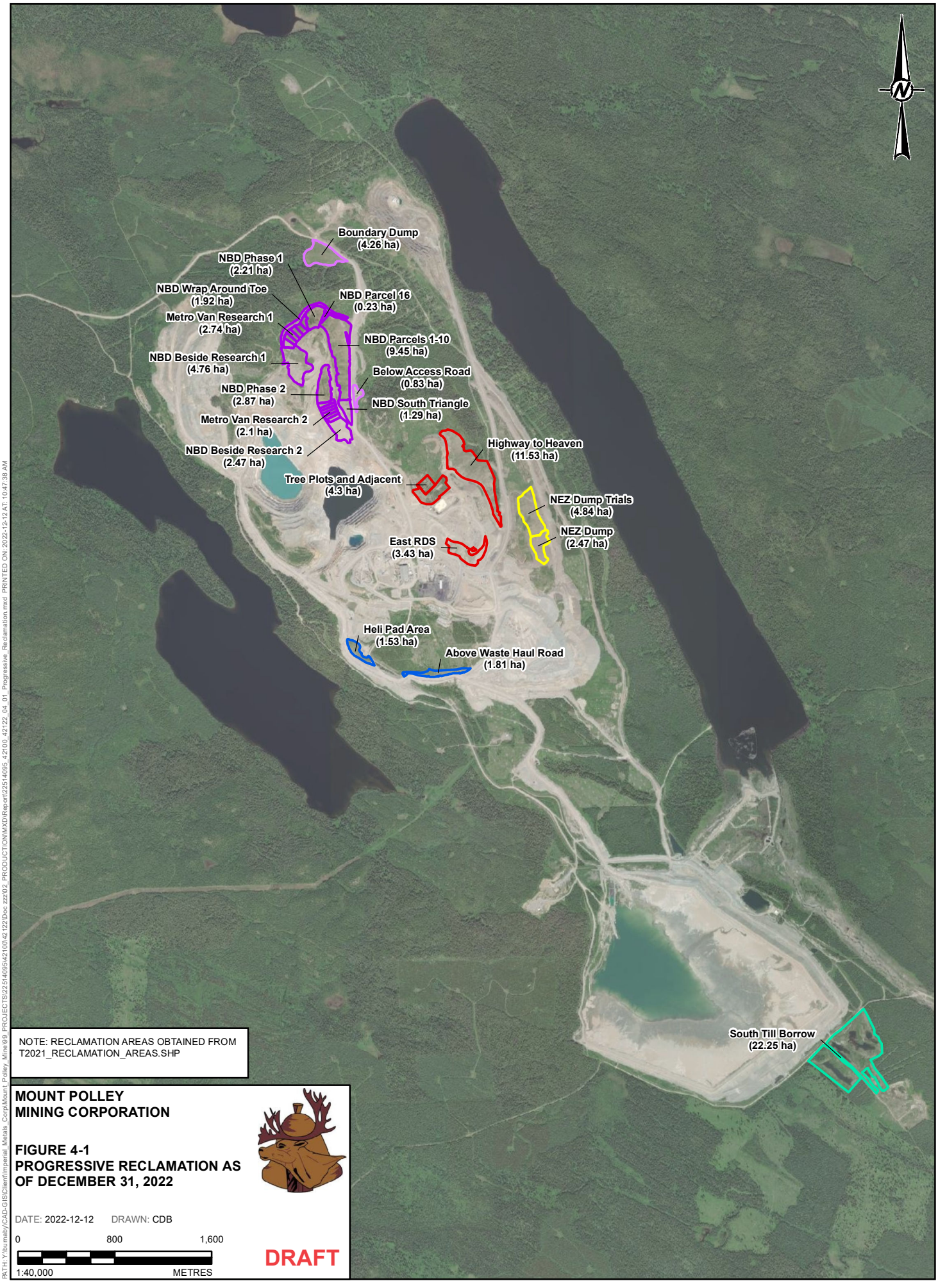

NOTE: RECLAMATION AREAS OBTAINED FROM T2021_RECLAMATION_AREAS.SHP

MOUNT POLLEY MINING CORPORATION

FIGURE 4-1
PROGRESSIVE RECLAMATION AS OF DECEMBER 31, 2022

DATE: 2022-12-12 DRAWN: CDB

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Table 4-2 Detailed Progressive Reclamation Prescriptions

Site Specifications				Coversoil				Revegetation			Schedule						
Site	**Parcel(s)**	**Area**	**End Land Use Objectives**	**Coversoil Stockpile Source**	**Volume (m^3)**	**Application Depth (cm)**	**Amendments**	**Grass Seed Mix**	**Shrub & Deciduous Tree Planting**	**Conifer Tree Planting**	**Re-Contour**	**Coversoil Application**	**Coversoil Amendment Application**	**Coarse Woody Debris Application**	**Grass Seeding**	**Shrub & Deciduous Tree Planting**	**Conifer Planting**
North Bell Dump	Parcels 1-10	11.59	Wildlife, forestry	Wight Till	10,600	20	Biosolids (122 dt/ha)	Native grasses (30 kg/ha) (hydroseeded with fibre mulch, except southern-most Parcel 10 hand seeded at 35 kg/ha)	Black cottonwood - 60 sph[1] Paper birch - 34 sph Trembling aspen - 34 sph Sitka alder - 172 sph Saskatoon - 34 sph Scoulers willow - 79 sph Soopolalie - 100 stem trial plot	Lodgepole pine – 1,075 sph Douglas fir - 451 sph Western red cedar - 54 sph Hybrid spruce - 54 sph Consider underplanting with later successional species in future.	2011	2011	2011	2011	2011	2013 - poor survival 2014 - re-plant	2014
	South Triangle	1.30	Wildlife, forestry	Wight Till	1,733	30	18-19-18 Fertilizer (75 kg/ha)	Native grasses (35 kg/ha) (hydroseeded with fibre mulch)	2013 Black cottonwood - 1000 sph Stika alder - 800 sph 2014 Soopolalie - 100 stem trial plot	Lodgepole pine – 1,400 sph Douglas fir - 600 sph Consider underplanting with later successional species in future.	2011	2011	2011	-	2011/2012	2013/2014	2014
	Phase 1	2.21	Wildlife, forestry	North Bell Dump Till	3,920	20	Biosolids (138 dt/ha)	Native grasses/ forbs (35 kg/ha) (hand seeded)			2012	2012	2012	-	2012		
	Phase 2	2.87	Wildlife, forestry	North Bell Dump Top	4,680	20	Biosolids (135 dt/ha)	Native grasses + lupine (35 kg/ha) (hand seeded)			2012	2012	2012	-	2012		
	Metro Van Research Parcel 1	2.81	Wildlife, forestry	North Bell Dump Till	4,680	20	Biosolids (107 dt/ha) (on 2.34 ha)	1) No seed 2) Forbes mixture (75 g/ha fireweed, 1 kg/ha lupine, 113 g/ha *Dryas drummondii*, 4.9 kg/ha June grass, yarrow, pearly everlasting mix) 3) Fireweed (75 g/ha) 4) No seed 5) Native grasses/ forbs (5kg/ha) 6) Native grasses/ forbs (10 kg/ha)	Black cottonwood – 200 sph Paper birch – 50 sph Trembling aspen - 50 sph Sitka alder – 200 sph Saskatoon - 50 sph Prickly rose – 50 sph Scouler's willow - 50 sph Huckleberry – 50 sph	Lodgepole pine – 1,120 sph Douglas fir - 480 sph Consider underplanting with later successional species in future.	2012	2013	2013	-	2014	2014	2014
North Bell Dump (cont'd)	Wrap Around Toe	2.20	Wildlife	North Bell Dump Till	14,418	6	None	Native grasses (~15 kg/ha) (hand seeded)	Monitor natural vegetation ingress		-	2012	-	-	2012	TBD – monitor ingress	
	Beside Research	2.00	Wildlife, forestry	Direct Placement: SEZ Stripping	4,000	20	None	Monitor natural growth from direct placement			2012	2013	-	TBD – monitor ingress			

Table 4-2 Detailed Progressive Reclamation Prescriptions

Site Specifications				Coversoil				Revegetation			Schedule						
Site	**Parcel(s)**	**Area**	**End Land Use Objectives**	**Coversoil Stockpile Source**	**Volume (m^3)**	**Application Depth (cm)**	**Amendments**	**Grass Seed Mix**	**Shrub & Deciduous Tree Planting**	**Conifer Tree Planting**	**Re-Contour**	**Coversoil Application**	**Coversoil Amendment Application**	**Coarse Woody Debris Application**	**Grass Seeding**	**Shrub & Deciduous Tree Planting**	**Conifer Planting**
	Metro Van Research Parcel 2 (in Beside Phase 2 parcel 4.79 ha area)	2.00	Wildlife, forestry	North Bell Dump Top	4,000	20	Biosolids (107 dt/ha)	1) No seed 2) Forbes mixture (75 g/ha fireweed, 1 kg/ha lupine, 113 g/ha *Dryas drummondii*, 4.9 kg/ha June grass, yarrow, pearly everlasting mix) 3) Fireweed (75 g/ha) 4) No seed 5) Native grasses/ forbs (5kg/ha) 6) Native grasses/ forbs (10 kg/ha)	Black cottonwood – 200 sph Paper birch – 50 sph Trembling aspen – 50 sph Sitka alder – 200 sph Saskatoon – 50 sph Prickly rose – 50 sph Scouler's willow – 50 sph Huckleberry – 50 sph	Lodgepole pine – 1,190 sph Douglas fir - 510 sph Consider underplanting with later successional species in future.	2012	2014	2014	-	2014	2015	2015
Waste Haul Road	Heli Pad Area	1.53	Wildlife, forestry	Old Cariboo Stockpile/Springer Pit	3,825	28	18-19-18 Fertilizer (170 kg/ha)	Aggressive seed mix (26 kg/ha) (hydroseeded)	Monitor natural vegetation ingress	Douglas fir - 216 sph	-	2013	-	TBD – monitor ingress	2014		2015
	Above WHR (Pond Zone)	1.81	Wildlife, forestry	Old Cariboo Stockpile/Springer Pit	5,456	30	None	Native grasses/ forbs (22 kg/ha)	Monitor natural vegetation ingress		-	2013	-	TBD – monitor ingress	2013		
East RDS	Highway to Heaven	11.52	Wildlife, forestry	<u>2014:</u> Direct Placement: Cariboo Ore Stockpile, WX Zone Stripping <u>2015:</u> Highway to Heaven	<u>2014:</u> 26,700 <u>2015:</u> 8,200	40	None	Native grasses/forbs (30 kg/ha)			2014 – 9.47 ha	2014 – 6.58 ha	-	TBD – monitor ingress	2014		
	Tree Plots[2]	2.13	Wildlife, forestry	Bell Pit Stockpile	Not Calculated	0-65	<u>Amendment Tested:</u> Fertilizer (RTI Bio Pack's, 10g/bag) Biosolids (50 - dt/ha) Tailings (20cm)	Domestic grasses (20 kg/ha - 40 kg/ha) Native grasses/forbs (40 kg/ha) – two different mixtures	-	Lodgepole pine – 1,400 sph Douglas fir - 600 sph	2000	1998 - 2000	1998-2000	-	1998 - 2000	-	1998 - 2000
East RDS (cont'd)	Above Access Road	3.78	Wildlife, forestry	Direct Placement: TSF Rd Stripping (Bootjack Creek), Cariboo Ore Stockpile, WX Zone	9,000	25	None	~0.75 kg/ha lupine ~2 kg/ha June grass, yarrow, pearly everlasting mix ~35 g/ha Fireweed (~1 ha on eastern side only) Remaining area: Native grasses/forbs (30 kg/ha)			2011	2014	-	TBD – monitor ingress	2014		
TSF		23.95	Wildlife, forestry, livestock	South Till Borrow	N/A	N/A	biosolids - 12.00 ha	Unknown			Unknown	N/A	Unknown	-	Unknown		

Table 4-2 Detailed Progressive Reclamation Prescriptions

Site Specifications				Coversoil				Revegetation			Schedule						
Site	**Parcel(s)**	**Area**	**End Land Use Objectives**	**Coversoil Stockpile Source**	**Volume (m^3)**	**Application Depth (cm)**	**Amendments**	**Grass Seed Mix**	**Shrub & Deciduous Tree Planting**	**Conifer Tree Planting**	**Re-Contour**	**Coversoil Application**	**Coversoil Amendment Application**	**Coarse Woody Debris Application**	**Grass Seeding**	**Shrub & Deciduous Tree Planting**	**Conifer Planting**
NEZ Dump	Parcel 2 (a/b)	5.13	Wildlife, forestry	Wight Till	20,000	40	2a: fertilizer (238 kg/ha) 2b1: biosolids 2b2: fertilizer (71 ka/ha), biosolids	Native grasses/forbs (handseeded) 2a: 45 kg/ha 2b: 34 kg/ha	Paper birch – 100 sph Trembling aspen – 100 sph Sitka alder – 200 sph Saskatoon – 100 sph Prickly rose – 100 sph Scouler's willow - 100 sph Huckleberry - 40 sph	Lodgepole pine – 1,300 sph Douglas fir – 700 sph	2010	2010	2010	-	2011	2012	2012
Boundary Zone	Boundary Dump	4.70	Wildlife, forestry	PAG Dump Stripping	12,000	28	None	Monitor growth from direct placement and natural ingress (monitor invasive species establishment)			2011	2014	-	TBD – monitor ingress	Monitor growth from direct placement and natural ingress		
South Till Borrow	-	22.25	Wildlife, forestry	Unknown	Unknown	Unknown	Unknown	Native grasses (rate unknown)	Ingress	Ingress	2010-2011	2010-2011	2010-2011	-	2010-2011		

Notes: 1= stems per hectare.

4.3. Reclamation Research Program Update (Terrestrial Reclamation)

In addition to decommissioning portions of the Mine Site, progressive reclamation also acts as a research tool. The reclamation research program at the Mine Site commenced in 1998. Since this time, many research trials have been established at various locations around the Mine Site. Progressive reclamation sites provide monitoring results and information on which treatments and vegetation strategies are most successful, and provide insight into considerations for scaling up reclamation prescriptions for large-scale implementation. Historically, reclamation research focused on improving coversoil quality (e.g., using biosolids). However, since the TSF embankment breach, most research has focused on post-closure water quality.

The Mine Site has an extensive record of reclamation research experience that was presented in the 2017 MRP Update (MPMC 2017). The following subsections provide a summary of findings of historical research conducted at the Mine Site, along with ongoing reclamation research (mainly water treatment technologies).

4.3.1. *East RDS, NEZ Dump, and North Bell Dump Trials*

The East RDS Reclamation Research Trial was established between 1998 and 2000 and has since concluded. The trial was designed to test the effect of coversoil placement thickness on grass and conifer seedling performance, while amending coversoil with biosolids. The NEZ Dump Trial also investigated the amendment of coversoil (biosolids and fertilizer “tea bags”) and revegetation prescriptions. The North Bell Dump trial also investigated coversoil amendment with biosolids sourced from Metro Vancouver (see Figure 4-1 for application areas, and a general overview of reclamation trial areas). Key findings from these trials have been used to inform current reclamation prescriptions.

Coversoil Placement Findings:

- direct placement of stripped soil is an effective way to maintain soil nutrients
- placement of 15 cm of coversoil is adequate for tree survival and growth
- trees at the Mine Site require a minimum rooting depth of 25 to 30 cm for normal root development and this can be provided by overburden (till) or a combination of overburden (15 cm or greater) and waste rock
- tailings combined with overburden and biosolids provide a suitable root growing medium, equivalent to overburden
- a rate of 50 dt/ha of biosolids provided a similar degree of rooting enhancement as 15 to 30 cm of overburden
- 20 cm of overburden with ~100 dt/ha of biosolids is sufficient for establishment of vigorous conifer seedlings

- biosolids in combination with 15 cm of overburden substantially increased the rooting depth on plots located on upper slopes and crests (McDougall 2015)
- biosolids accelerated LFH development on reclaimed sites (McDougall 2015)
- amendment of soil with biosolids improved tree growth, but has a limited period of effect (less than 15 years)
- sites that received biosolids demonstrated soil chemistry to be within acceptable ranges for plant growth

Revegetation Findings:

- native species will grow from the seed bank within directly placed soil; fully or partially negating the need for seeding of ground cover
- plant growth is improved on reclamation areas with surface roughening and coarse woody debris
- seedling mortality on reclaimed areas is high, likely due to the exposed locale and harsh climate and should be mitigated through overplanting
- selection of trees and shrubs should consider site-specific conditions, specifically hot, dry conditions on south and west facing slopes
- timely establishment of overstory vegetation (primary successional trees and shrubs) is important for preventing establishment of invasive and non-native species
- natural ingress of diverse native species is occurring in reclaimed areas, including shrubs/trees such as raspberry (*Rubus idaeus*), elderberry (S*ambucus spp.*), cottonwood (*Populus trichocarpa*), and willow (*Salix* spp.)
- lodgepole pine (*Pinus contorta*) had greater survival than Douglas fir (*Pseudotsuga menziesii*) in most treatments
- other species, such as woods rose (*Rosa woodsia*), black cottonwood (*Populus trichocarpa*), willow (*Salix spp.*) and alder (*Alnus glutinosa*), performed more successfully than paper birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*) and saskatoon (*Amelanchier alnifolia*)
- the application of biosolids can increase grass growth leading to competition with woody species and forbs (McDougall 2015)
- increased grass layers can provide habitat for rodents who can impact tree survival through girdling of seedlings

- The growth of conifers was higher on the parcels amended with biosolids compared to control parcels

- the understory on biosolids-amended soils should be seeded at low seeding rates with native forbs to promote the highest conifer survival rate while still providing erosion and invasive plant control

4.3.2. *Tailings Beaches*

At many mine sites throughout Canada and elsewhere, the growth of vegetation directly on tailings has been observed, either because of direct planting programs, or through the propagation of volunteer species over the tailings. While tailings are variable in grain size, they typically have moisture-retaining properties that can attract vegetation growth. They are, however, commonly limited in nutrients, which may limit the initial propagation of vegetation. Observations and informal trials at the Mine Site in the early 2000s have demonstrated that tailings can support plant growth and revegetation efforts, and that tailings are NAG and non-toxic to plant growth (SRK 2017).

4.3.3. *Trace Elements in Soils and Uptake in Vegetation*

Reclamation research led by MPMC has included an ongoing series of interrelated studies that address concerns related to the possible presence of trace elements in soils above background concentrations. This research also investigated trace element uptake into vegetation, with the possible risk scenario of the concentrations in vegetation leading to impacts on human health or the environment. Additionally, vegetation metal uptake monitoring at the Mine Site has included baseline monitoring programs in 1989, 1995, and 1996, complemented by monitoring of reclaimed areas in 2007, 2012, and 2014. The purpose of this monitoring is to evaluate if vegetation growing on reclaimed areas at the Mine Site has different levels of metal uptake when compared with baseline and reference site data, and to assess if elevated metal concentrations (if encountered) are of concern for grazing and wildlife species or humans. Monitoring of metal concentrations in natural soils stockpiled for reclamation use, and monitoring of trace element concentrations in soil/biosolid mixtures have also been evaluated. More recently, as part of the Hazeltine Creek environmental impact assessment, a formal terrestrial ecological risk assessment (TERA) was conducted for metal uptake into vegetation that grows directly in the tailings (Golder 2017b). In 2022, an ecological risk assessment was also conducted and investigated metal uptake in revegetated areas. Of the metals analyzed, only copper was shown to have higher than reference site concentrations; however, hazard quotients (HQs) were less than 1, indicating that risks to ungulates was low (Golder 2022b).

4.3.4. *Geomorphic Landform Design*

Geomorphic landform designs (defined in Section 4.2.1) improves long-term physical stability, landform aesthetics, and promotes greater biodiversity than traditional approaches to closure (Toy and Hadley 1989; Hopkinson et al. 2014). A geomorphic reclamation design guidance document was produced that provided guidance for specific channel characteristics, which related

stream slope, terrain type, bankfull width and depth, and stream density to basin area (Golder 2017b; MPMC 2017). Results of the geomorphology assessment include the following:

- The stream networks on the Mine Site were observed to contain both radial and rectilinear drainage patterns. Organization of streams into similar radial and rectilinear patterns should be followed in line with the stream.
    - Drainage from residual high spots should be organized with streams radiating away from the high spot.
    - Drainage from approximately planar terrain surfaces should be rectilinearly organized with streams oriented approximately parallel to each other.
- Since terrain type influences stream gradient, it should be considered during stream reclamation:
    - In a typical, natural, stream channel, elevation drops can be managed in the upper reaches of the watershed.
    - In a regionally significant flat-over-steep terrain, the catchment areas should be kept small in the upstream, lower gradient regions to prevent high volumes of water passing through the downstream steeper portions of the channel or an engineered conveyance channel should be considered if catchment areas cannot be kept small.
- Results of the assessment indicate that bankfull width and bankfull mean depth increase with increasing basin area.
- Analyzing the relationship of stream density to drainage area indicates that surface drainage should form at least one stream per approximately 10 to 20 ha of drained area.

A slope guidance document was also developed in 2019 (Golder 2019), while additional research on geomorphic landform design was conducted as part of the 2020 Water Management Plan (Mine Operations) (Golder 2020). The purpose of this work was to develop a definition for a landform at the Mine Site so that contact water volumes could be reduced; contact water is defined as any water that encounters mine infrastructure (e.g., WRDs). This landform definition work involved:

- a literature review, which looked at how landforms are classified globally
- a review of erosion rates
- development of criteria for the proposed landform definition
- numerical modeling to estimate new contact water generation rates

4.4. Reclamation Research Program Update (Water Treatment)

To facilitate the transition from centrally managed and treated water (as envisioned by the LTWMP) to distributed, passive or semi-passive systems, additional studies for water treatment have been identified by MPMC as an important component of reclamation and closure planning optimization.

Like terrestrial reclamation, MPMC has evaluated various water treatment technologies. Some of these studies have been concluded, and are not discussed herein. Details regarding historical water treatment research are outlined in the 2021 ARR (MPMC 2022a) and the 2017 MRP Update (MPMC 2017). A summary of technology being actively researched is provided Appendix G. Currently passive treatment research is being advanced in parallel across multiple fronts.

Table 4-3 provides a summary of the technologies that have been researched and tested for active-closure and post-closure water treatment. Further information on the respective water treatment technologies can be found in Appendix G.

Table 4-3: Treatment Technology Inventory and Stage of Development

Technology / Stage of Development	Targeted COCs	Proof-of-Concept Bench-Scale Testing	Detailed Bench-Scale Testing	Pilot-Scale Testing	Demo-Scale Testing	Full-Scale Execution	Work Completed
Actiflo	TSS, total copper					→	Bench and full-scale testing.
Lime Treatment	Dissolved copper					→	N/A
TMT Treatment	Dissolved copper	→	→	→	→		Bench and full-scale testing. Toxicity evaluation.
Pit-Lake Treatment	Selenium, nitrate	→	→	→			Preliminary concept design and proof-of-concept bench-scale testing. Pilot-scale testing workplan.
Saturated Rock Fill (SRF)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, detailed bench-scale testing workplan (in progress), and long-term substrate leach testing. Wight Pit SRF assessments.
Packed Bed Reactor (PBR)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, and detailed bench scale testing workplan (in progress).
Biochemical Reactor (BCR)	Selenium, nitrate	—	—				Concept design and proof-of-concept bench-scale testing.
Submerged Sand Reactor (SSR)	Selenium, nitrate	—					Screening analysis.
Constructed Wetland Treatment (CWT)	Selenium, nitrate	→	→	→			Concept design, bench-scale testing, and on-site pilot scale testing (by others).

Implemented → Under Consideration → — Eliminated/Paused

N/A = not applicable.

5. RECLAMATION STRATEGIES

To promote successful reclamation and closure of the Mine Site (i.e., achieve the reclamation objectives outlined in Section 3.1), MPMC has developed protocols and plans related to the following topics:

- physical stability
- water quality and watercourse protection
- soil management
- revegetation prescriptions
- invasive plant management
- fugitive particulate management
- waste management
- contingency plans

These plans and protocols are discussed in detail in the following subsections (e.g., Section 5.1 through to Section 5.10)

5.1. Physical Stability

Physical stability is a fundamental building block of terrestrial reclamation and mine closure. This section describes the methods used by MPMC to promote physical stability of Mine Site landforms for reclamation.

5.1.1. *Waste Dump Stability*

Consideration of physical long-term stability of RDSs begins prior to dumping of waste rock, continues through the construction phase, and is completed after reclamation activities are implemented and the revegetated plant community is on a trajectory to meet the target end land use. A chronology of events to support RDS stability for reclamation is as follows:

- A Qualified Professional (QP) conducts a footprint stability assessment to determine if any special construction techniques are required to promote the long-term stability of the RDS. This includes a review of available information on the foundation soils beneath the planned RDS.
- The salvageable soil (e.g., coversoil) within the footprint of the RDS is removed and stockpiled for use in future reclamation. Soil salvage prior to dumping improves the stability of the waste dump by being constructed on competent ground, such as till and bedrock.

- When the RDS is under construction, a QP conducts annual (at a minimum) visits to determine if the construction technique being used is consistent with long-term stability objectives.

- When the RDS is complete, it is re-sloped from an angle of 37° to 26.5° (from the angle-of-repose to a slope ratio of 2H:1V).

- Implementation of geomorphic design features (e.g., Section 4.3.4) on RDSs.

- Final reassessment of the stability of the completed RDS, and possible modifications to final dump configuration, as needed.

Examples of geomorphic design being used at the Mine Site are the North Bell Dump over top of the Bell Pit, and the SERDS over top of the Pond Zone. Greater long-term physical stability can be achieved at locations where excavated pits are backfilled with waste as compared to RDSs being constructed exclusively on flat to gently sloping terrain. Following the implementation of the geomorphic design, the surface will be prepared for coversoil placement, and revegetated.

5.1.2. *Pit Wall Stability*

During the excavation of the pits, stability of the surrounding surfaces and pit walls is a priority, as this is necessary for the safety of workers. Pit stability (physical and geochemical) is also desirable for terrestrial reclamation and mine closure. A chronology of events to promote long-term stability is as follows:

- The pit walls are excavated with overall slope angles that have been recommended by a qualified professional engineer. The selected overall slope angles are chosen to ensure the stability of the pit walls throughout the excavation phase, as well as for their long-term stability.

- Routine inspection of pit walls and benches is conducted, and maintenance is continued as required (i.e., wall scaling and bench cleaning). A formal annual (at minimum) stability review of the pit walls is conducted by a registered professional engineer.

- Prior to the excavation of benches below the top surfaces, soil and till materials are removed and pulled away from the area immediately surrounding the maximum boundary of the pits. This is conducted to prevent the sloughing of loose materials down onto the pit walls.

- During active closure, pits are backfilled with PAG waste rock from the Temporary PAG Stockpile for subaqueous disposal, as outlined in Section 6. Backfilling of the pits will promote geochemical stability of the deposited PAG rock, and effectively buttress the pit walls, further promoting long-term physical stability.

- Pits that are not intended to receive PAG waste rock are converted into pit lakes or other post-closure infrastructure (e.g., in-situ pit lake treatment facility). Access to inactive pits is restricted.

Currently, pits at the Mine Site will yield pit lakes during active and post-closure. Terrestrial reclamation is not expected, except around the shores of some pit lakes, like those of the Boundary Pit.

5.1.3. *Road Stability*

The large access roads and haul roads at the Mine Site are constructed with NAG waste rock and are essentially RDSs. During active closure, their long-term stability will be achieved using techniques like those employed for the RDSs. A chronology of events to achieve long-term stability objectives is as follows:

- prior to development, the salvageable soil (e.g., coversoil) from within the footprint of roads is stripped to create adequate foundation conditions for stability; salvaged soil is later used in reclamation

- culverts that were used in the construction of the road and have potential to affect fish-bearing streams will be removed and water bars will be dug across the roads to continue to facilitate the movement of water past the structure to the downstream slopes

- when roads are no longer needed, if possible (without encroaching on watercourses or sensitive undisturbed areas), road edges will be re-sloped from an angle of 37° to 26.5° (e.g., from the angle-of-repose to a slope ratio of 2H:1V)

5.1.4. *TSF Reclamation Stability*

During active closure, the TSF embankment slopes will be recontoured from angle of repose to 2H:1V slopes. Achieving 2H:1V slopes may require additional material placement. After recontouring, and prior to coversoil placement, an assessment will be conducted to determine which species can successfully revegetate the TSF embankments without penetrating the till core, filter, or transition zone, as root penetration of these components may negatively affect TSF stability. This assessment will also investigate which species and revegetation/reclamation techniques will maximize overall coversoil stability and minimize erosion and future maintenance requirements. Following recontouring and coversoil placement, the TSF will be revegetated (projected to be an ICHmk3_01 site series). A spillway, sized with capacity for the probable maximum flood, will also be constructed during active closure, so that a desirable long-term pond level will be maintained.

5.1.4.1. TSF Reclamation Stability Monitoring

Ongoing monitoring through operations and active closure will be conducted. Visual inspections will be performed at regular intervals (e.g., seasonally), with additional inspections following major rainfall events (e.g., those defined with return intervals). Inspections will note signs of pedestalling stones, rilling, gullying, slope creep/failure of the coversoil, and sheet erosion. Should poor stability of the placed coversoil be observed, contingencies such as rough mounding, placement of coarse woody debris, use of cover crops, and evaluation and subsequent amendment of the coversoil will be implemented.

5.1.5. *Underground Stability*

For the overall successful closure of underground mine works, stability and potential for subsidence are a key concern. At some mine sites, subsidence may be caused by the collapse of underground mine voids, leading to movement of the ground surface. As documented in the MPMC analysis in Appendix J, the risk of subsidence at the Mine Site is minimal due to the depth and size of the voids below ground surface and the quality of the rock. The only additional closure work planned for the active closure of the underground mine will be backfilling of the Alimak Raise, which will be done primarily for access control, and is described in Section 6.11.2. Given the stability of the underground, and because underground mining has been removed from the life of mine, underground stability issues are unlikely to develop during the remaining operation period of the Mine Site or during post-closure.

5.2. Water Quality and Watercourse Protection

To protect water quality and watercourses in the receiving environment, MPMC uses the following approaches, which are described in further detail in subsequent sections:

- prevention of erosion and sediment into watercourses
- waste rock characterization and management
- collection of contact water (previously described in Section 2.4)
- monitoring of seep and contact water chemistry and flows to improve the understanding of site geochemistry and hydrology
- water quality and quantity monitoring of downstream environments to verify if water management strategies are working, and to support water discharge planning
- overall closure water management planning based on a predictive water quality and quantity model

5.2.1. *Sediment Retention and Erosion Control*

Development of an open pit mine and associated works creates surface disturbances that may result in erosion. Erosion prevention strategies for construction activities and active closure are outlined in MPMC's Sediment and Erosion Control Management Plan (Appendix K).

Erosion control is key to preventing sediment transport and negative impacts on the environment, and promoting geotechnical stability of structures. Revegetation is a highly effective and permanent erosion control measure; thus, disturbed areas are seeded and planted at the earliest opportunity. Re-sloping is another important erosion control measure used by MPMC. Typically, re-sloping involves site preparation and creation of microtopography and the direction of surface flow away from slope faces to minimize surface water erosion, where possible.

In addition to the measures described in the Sediment and Erosion Control Management Plan, a geomorphic approach is incorporated, where practicable, as an overall strategy for active closure design.

5.2.2. *Material Characterization and Placement*

In a mine setting, ML/ARD can have negative and lasting effects on water quality if not properly monitored and managed. Active monitoring of ML/ARD potential in Mine Site waste rock is part of an established protocol, and is detailed in MPMC's ML/ARD Management Procedure Manual (Appendix L). This is a "live" document that is routinely updated to reflect changes in Mine Site conditions or protocols. The manual encompasses procedures for material characterization, segregation, disposal (including subaqueous disposal of PAG waste rock in pits during active closure), and monitoring.

Prior to placement, material at the Mine Site, including ore that will be stockpiled, is sampled. In 2015, MPMC retained SRK to conduct an assessment of ML/ARD potential from ore stockpiles (SRK 2015). Findings indicate that the ore stockpiles have low ARD potential and that contact water chemistry from the stockpiles is expected to be similar to waste rock, although selenium may be more leachable, depending on the mineralogical association (Appendix B-2). In 2022, the Mine Site's geochemical source terms were reviewed by SRK, as a basis for extending MPMC's *EMA* 11678 permitted discharge period. SRK found that no update to the source terms was required (Appendix B-4). The SRK memo indicated that seepage from RDSs has been mostly stable for key parameters over the monitoring period, except for localized influences from sulphuric acid water likely originating from the Test Heap Leach.

5.2.3. *Water Quantity and Quality Monitoring*

Two important components of determining the overall chemical stability of a mine are water balance (quantity) and water quality. Water balance modeling is used to determine the amount of mine contact water that is generated, and informs overall water management and water treatment strategies at the Mine Site. To this end, hydrological and meteorological monitoring are conducted.

The Comprehensive Environmental Monitoring Plan (CEMP), required under *EMA* Permit 11678, encompasses chemistry and flow monitoring of receiving environment waters, groundwater, and meteorological monitoring. Biological monitoring of aquatic receiving environments (primarily associated with effluent discharge points) is also included in the CEMP, and is consistent with federal MDMER (Canada 2022) requirements. The 2019 CEMP (MPMC 2019) outlines monitoring program details including locations, frequency, parameters, and QA/QC procedures. Results are presented each year in the Annual Environmental Report (AER; MPMC 2022c) and ARR Report (MPMC 2022a).

Updates to the CEMP occur every three years at minimum, and are based on the results of detailed three-year monitoring program interpretive reports. As per the mechanisms described in the CEMP, written notice of proposed CEMP changes will be provided to ENV. First Nations and stakeholders will also be notified, as per MPMC's Communication Plan, should the CEMP change.

While some effluent monitoring sites are included in the CEMP, more comprehensive monitoring of mine contact water chemistry and flow is conducted under *Mines Act* Permit M-200 through sampling of waste dump seeps and runoff collection infrastructure. The more comprehensive mine contact water monitoring program is included as part of the OMS Manual (MPMC 2021), which is a "live" document that is routinely updated to reflect Mine Site conditions. The OMS Manual provides sample locations, frequencies, parameters, and QA/QC procedures. Similarly, monitoring results associated with OMS Manual sample collection are also presented each year in the AER.

Figure 2-4 provides an overview of monitoring conducted at the Mine Site, reflective of the plans outlined in the CEMP and OMS Manual. Note that some far-field monitoring sites are not included in the Figure 2-4, as to provide a high-resolution overview of monitoring conducted within, and in the immediate vicinity of, the Mine Site.

5.2.4. *Closure Water Management*

The Mine Site's water management system for runoff from RDSs, roads, and other disturbed areas is presented in Section 2.4. Current and planned methods of treating and discharging the water from the Mine Site are detailed in Section 2.4.2.5. Appendix H discusses active and post-closure water management in detail, while Appendix I provides comprehensive information on water quality for the same mine life cycle intervals.

The post-closure water quality modeling to date indicates that most parameters of concern (e.g., metals) are not anticipated to negatively affect water quality when water is released to the environment (Appendix G and Appendix I). This is due to the relatively low abundance of PAG rock at the Mine Site as indicated by Golder and SRK (Golder 2016b; SRK 2016; SRK 2022a). However, copper and selenium are predicted to exceed water quality guidelines, and require treatment during active and post-closure. Appendix G, Table 2 provides further detail on active closure and post-closure water quality. Given that water treatment will be required during active and post-closure, MPMC is working towards the development of water treatment technologies that will meet their overall closure needs.

Currently, one objective for the active and post-closure phases of the Mine Site's life cycle is the development and implementation of a decentralized passive/semi-passive water treatment system. Given that the Mine Site was developed on a watershed divide, it is desired that such a system returns water to its respective pre-development watersheds – an objective consistent with the Environmental Assessment and input from local communities and First Nations. Ultimately, this decentralized system will be achieved using passive/semi-passive technologies developed through bench scale and pilot testing. The status of current research towards this end is discussed in Section 4.4.

While a distributed system is desired for active and post-closure, there are several challenges that will need to be overcome. For instance, the ability of the receiving environment to accommodate the post-closure flows needs to be carefully assessed. Given that runoff from disturbed areas is higher than runoff from forested areas (the pre-mine case), the flow volumes during early post-closure may be too great to be accommodated without damaging the existing receiving environment and their associated habitats. Further, water quality receiving environment targets are likely to become more stringent, given the lower assimilative capacity of these receiving environment. Although distributed passive/semi-passive treatment and discharge is a desired closure outcome, these technologies have not yet been fully developed to full scale and face permitting uncertainty. The assumed treatment configuration for active and post-closure is pit lake pre-treatment followed by centralized Actiflo treatment (one the closure BAT options identified (Golder 2016c). Figure 5-1 and Figure 5-2 provide the current models for active closure and post-closure water management. Appendix H and Appendix I provide discussion on predicted water balance, water management, and water quality at closure. Figure 5-3 shows the anticipated catchments for the post-closure environment.

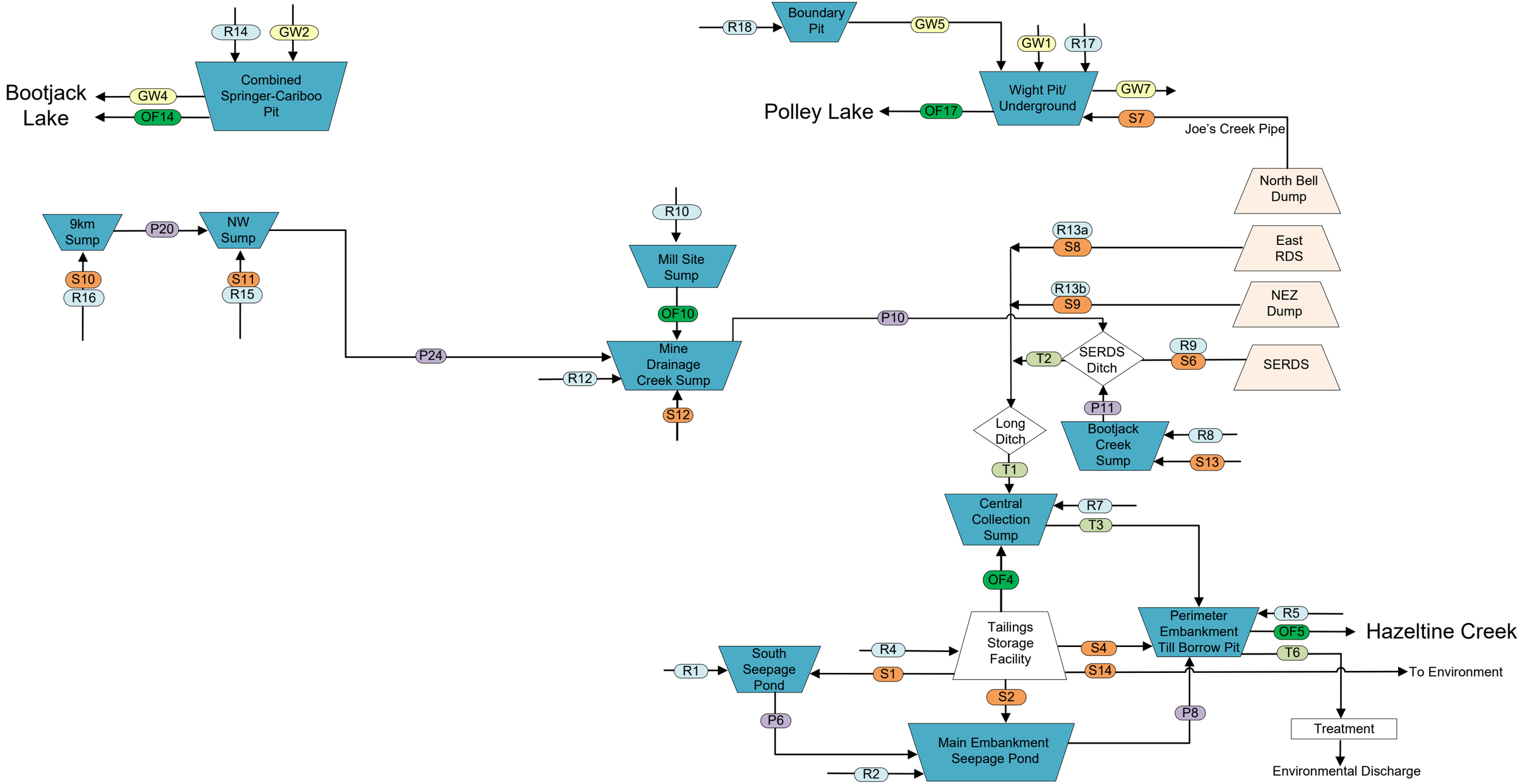

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	7 December 2022
CHECKED	GD
DATE	7 December 2022
SCALE	Not to Scale
PROJECT No	22514095/31700
FIGURE No	1
REV No	A

TITLE

Site Wide Water Balance
Active Closure Phase
1 September 2024 – 31 August 2034

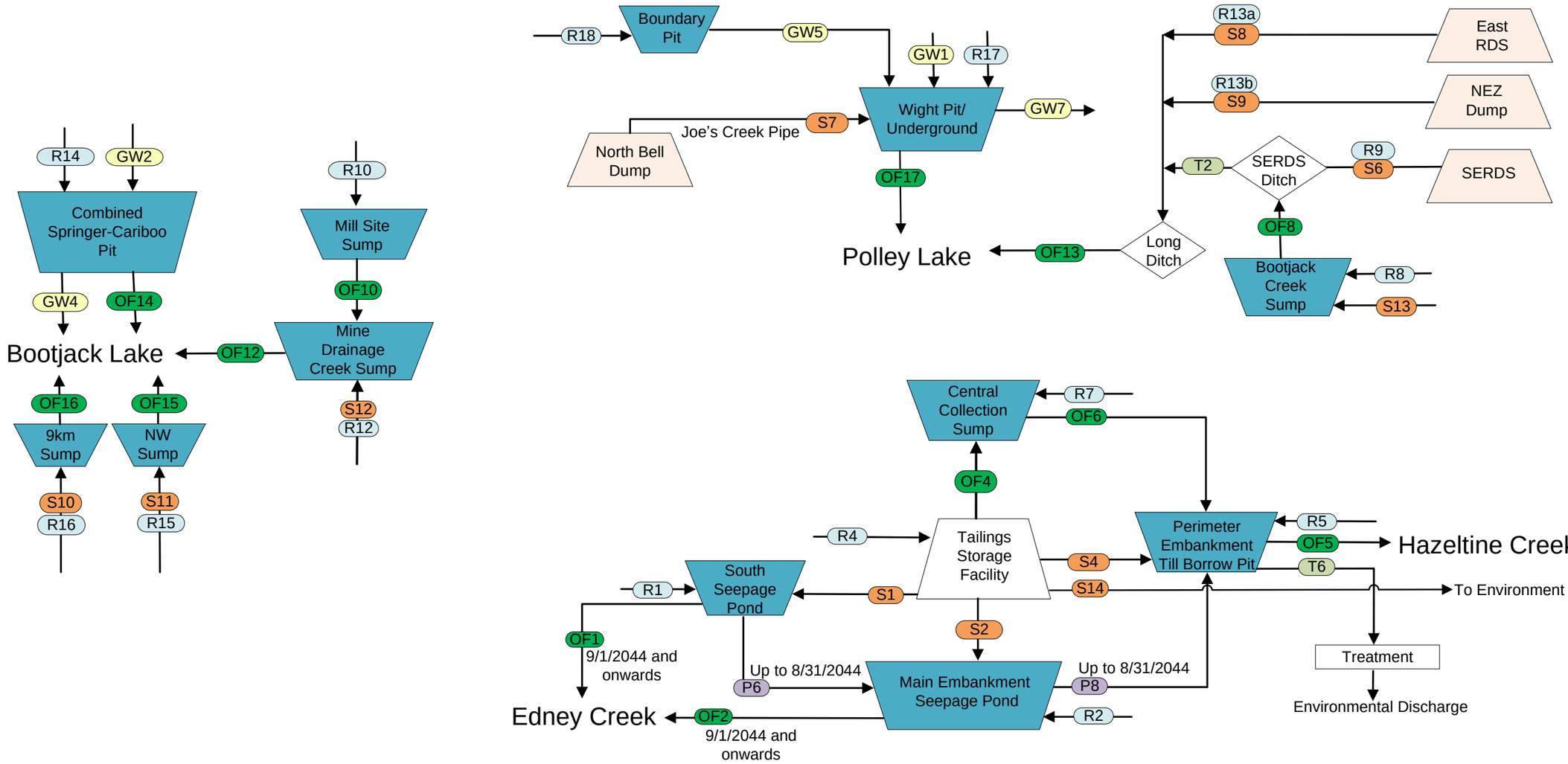

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)

Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 7 December 2022

CHECKED: GD
DATE: 7 December 2022

SCALE: Not to Scale
PROJECT No: 22514095/31700

TITLE

Site Wide Water Balance
Post-Closure Phase
1 September 2034 Onwards

FIGURE No: 2
REV No: A

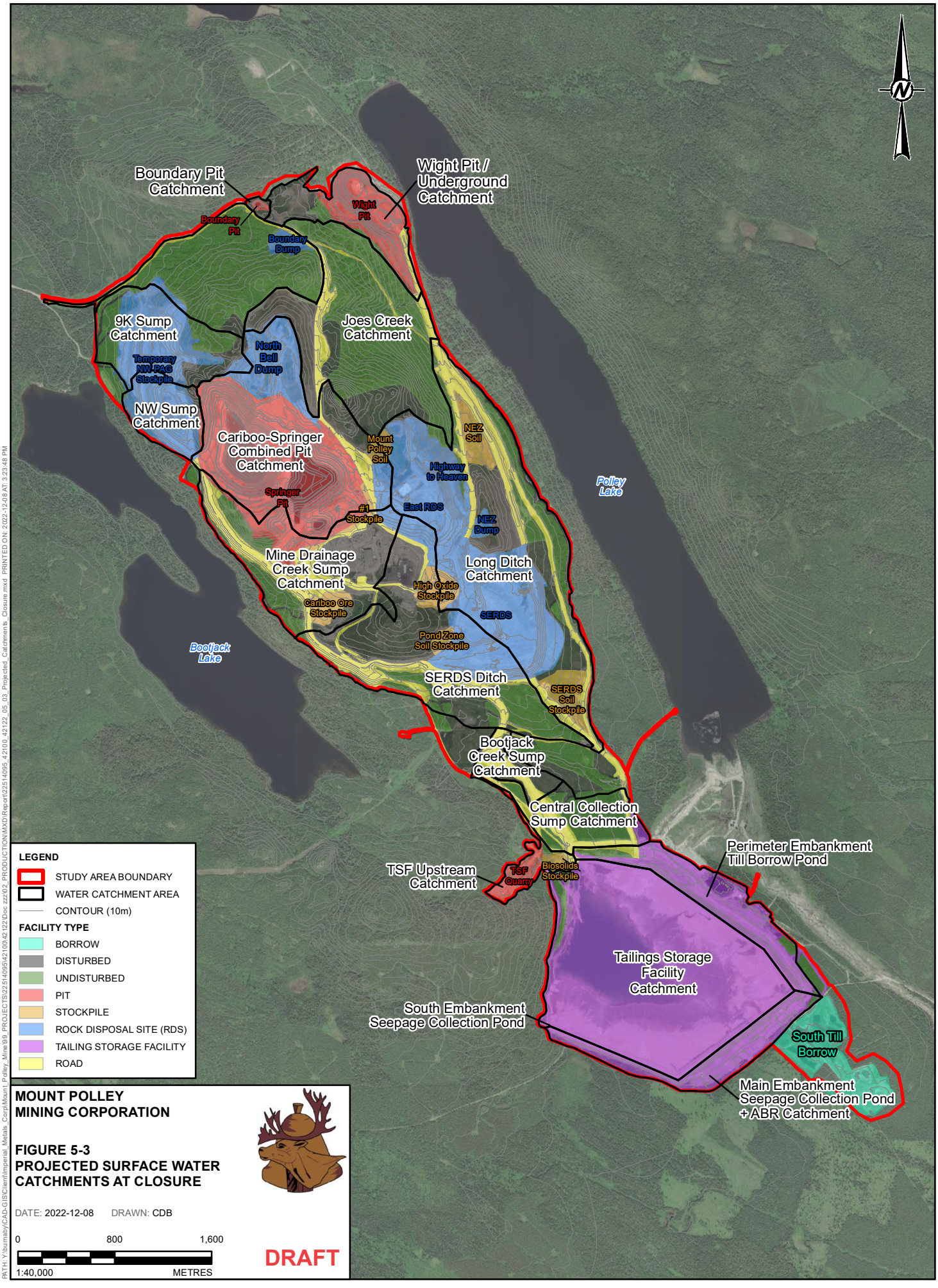

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5.2.5. *Closure Water Management Planning*

A key component for overall successful closure water management lies in planning. Specifically, the projections of active and post-closure water quality and quantity. To this end, MPMC has retained Qualified Professionals to project long-term water chemistry and quantity for the Mine Site during operation, active closure, and into post-closure The Site Wide Water Balance Model (SWWBM) and the Site Wide Water Quality Model (SWWQM) were both created in GoldSim, in 2017 for the 2017 MRP Update, and have been revised to project water quality and quantity from 2024 to 2124.

The updated SWWBM simulates the site water circuitry (the logic driving water transfers and flows on site) during the closure and post-closure phases. The closure phase will commence on 1 September 2024 and will include closure and reclamation activities as identified in the Mine Reclamation and Closure Plan Update. The post-closure phase will commence on 1 September 2034 and extends to September 2124. In updating the model, Springer-Caribou Pit was added with its stage-storage curve as Springer Pit and Caribou Pit combined into one pit in the closure phase. New inflows including direct precipitation, runoff and groundwater flow have been created based on the Springer-Caribou Pit closure design surface provide by MPMC and will be going into the Springer-Caribou Pit from 1 September 2024. A TSF configuration was also added to reflect a 970 m dam crest elevation for the closure phase modelling. Deterministic and stochastic climate inputs, as described in Mount Polley Mine Climate Baseline Update (Appendix D), were used to account for climate change in the closure model.

The SWWQM was updated with the latest RCP and water balance (base case and climate change scenarios) to reflect the closure and post-closure conditions on the mine site from 2024 to 2124. The model was also updated with additional monitoring data for assigned water quality inputs to refine the distribution inputs into the model. The updated model was calibrated against monitoring data from the mine site. During closure and post-closure, discharges from the mine will preferably be returned to their natural watersheds, to the extent possible. Specifically, nine potential mine discharge locations are expected to drain to Polley Lake, Bootjack Lake, Edney Creek, and Hazeltine Creek. Model results were generated for each potential discharge to inform treatment planning for closure and post-closure.

5.3. End Land Use Plan

The End Land Use Plan for the Mine is presented in Table 5-1. The table shows how ecosystems are grouped into ecosystem categories. End land use objectives are then assigned for each ecosystem and are defined across a range of structural stages. The end land use objectives are predicted for structural stages, such as mature and old growth forests, with these stages occurring as far out as 250 years in some ecosystems.

The End Land Use Plan is a long-term plan that is designed to adapt to the changing conditions in vegetation communities for the different ecosystems that are targeted. While it will be difficult to remove all uncertainty when working with long timelines, the long-term ecological trajectories that will guide the end land use objectives into the future can be evaluated.

Figure 5-4 shows how the target ecosystems are planned to be distributed over the post-closure landscape. These ecosystems were distributed using GIS to divide the landscape into polygons that are separated by slope, aspect, elevation, slope position, and substrate type. Table 5-2 shows the predicted distribution of vegetation types on the post-closure landscape as compared to pre-disturbance conditions, while Table 5-3 provides methods for recreating wildlife habitat on the post-closure landscape.

The specific strategies for achieving end land use objectives are outlined in Sections 5.4 and the detailed reclamation objectives and plans for each mine unit are outlined in Section 6.

Table 5-1 End Land Uses by Site Series and Structural Stage

Ecosystem	TEM/BEC Site Series	Structural Stage 1 to 3 (Sparse – Shrub/Herb)	Structural Stage 4 to 5 (Young Forest)	Structural Stage 6 (Mature Forest)	Structural Stage 7 (Old Growth Forest)
Dry Forest	ICHmk3_02 ICHmk3_03	Recreation FN Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Black Bear) Livestock Grazing	Recreation FN Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Lynx)	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent)	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Winter Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat
Mesic Forest	ICHmk3_01 ICHmk3_04 ICHmk3_05	Recreation FN Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Black Bear) Livestock Grazing	Recreation FN Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Lynx)	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent)	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Summer Range - Ungulate) Wildlife Habitat (Birds) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat
Wet Forest	ICHmk3_06 ICHmk3_07	Recreation FN Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) High Biodiversity Value Rare and Listed Plant Habitat	Recreation FN Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Lynx) High Biodiversity Value Rare and Listed Plant Habitat	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat	Commercial Forestry Recreation FN Cultural Use Wildlife Habitat (Winter Range - Moose) Wildlife Habitat (Birds, amphibians) Wildlife Habitat (Cavity Dependent) High Biodiversity Value Rare and Listed Plant Habitat
Grassland/Brushland	Non-Forested	Recreation FN Cultural Use Wildlife Winter Range (Ungulate Focus) Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Black Bear) Livestock Grazing	n/a	n/a	n/a
Rocky Talus Cliffs	Rocky Outcrop	Recreation FN Cultural Use Wildlife Habitat (Birds, Small Mammals) Wildlife Habitat (Escape Terrain) Rare and Listed Plant Habitat	n/a	n/a	n/a

n/a – not applicable, as these ecosystems do not progress to forests

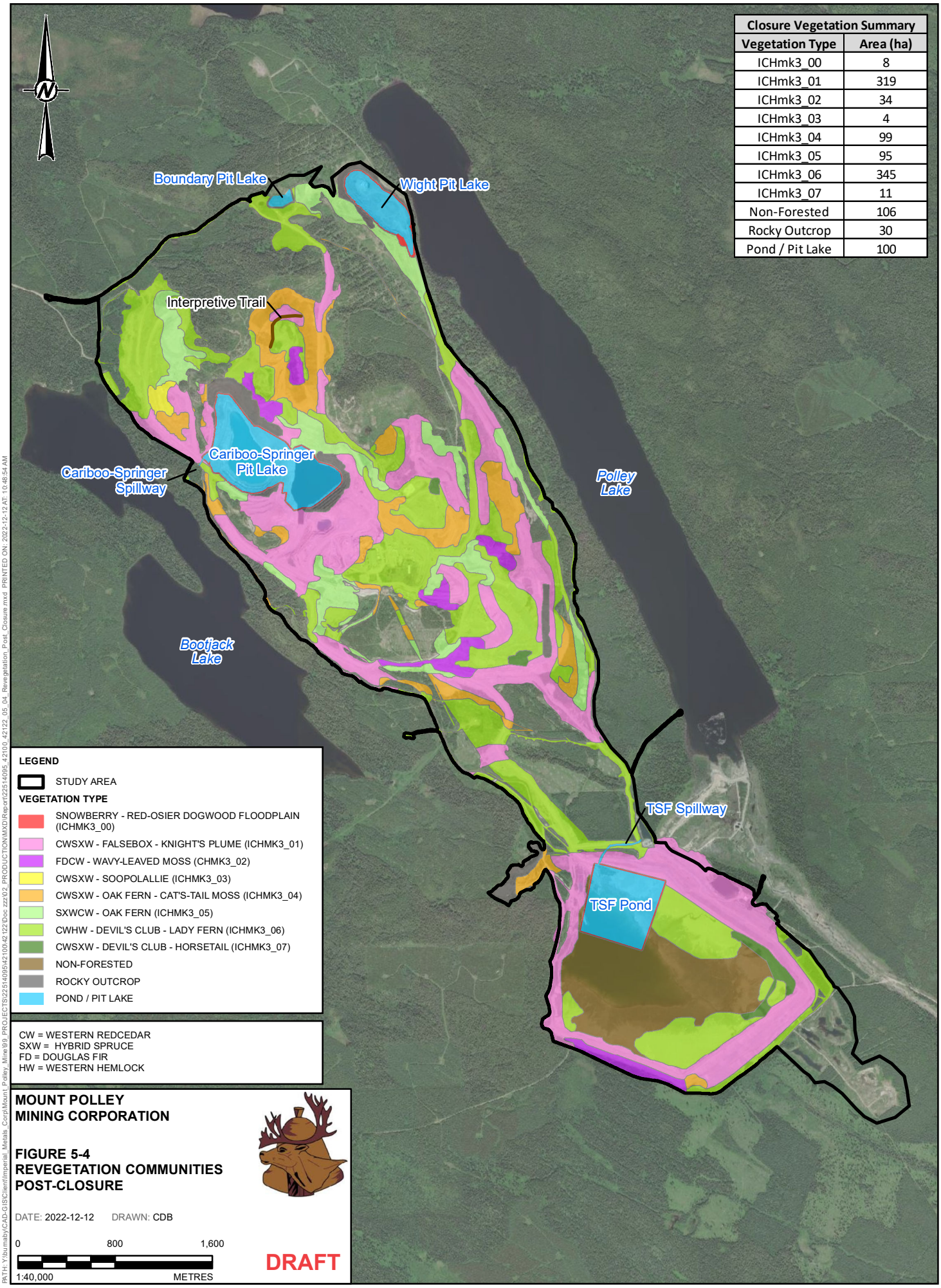

Closure Vegetation Summary	
Vegetation Type	Area (ha)
ICHmk3_00	8
ICHmk3_01	319
ICHmk3_02	34
ICHmk3_03	4
ICHmk3_04	99
ICHmk3_05	95
ICHmk3_06	345
ICHmk3_07	11
Non-Forested	106
Rocky Outcrop	30
Pond / Pit Lake	100

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Table 5-2 Predicted Change in Vegetation Site Series from Pre-disturbance to Post-Closure

Site Series	Description Area [ha]	Pre-disturbance		Post-closure		Difference	
		Area [ha]	%	Area [ha]	%	Area [ha]	%
ICHmk3_00	Non-forested wetland	27	2	8	1	-19	-70
ICHmk3_01	CwSxw - Falsebox - Knight's plume	546	47	319	28	-228	-42
ICHmk3_02	FdCw - Wavy-leaved moss	1	0	34	3	33	3,300
ICHmk3_03	CwSxw - Soopolallie	6	1	4	0	-2	-33
ICHmk3_04	CwSxw - Oak fern - Cat's-tail moss	116	10	99	9	-17	-15
ICHmk3_05	SxwCw - Oak fern	45	4	95	8	50	111
ICHmk3_06	CwHw - Devil's club - Lady fern	92	8	345	30	253	275
ICHmk3_07	CwSxw - Devil's club - Horsetail	31	3	11	1	-20	-65
Non-Forested	Grassland / Shrubland	4	0	106	9	102	2,550
Rocky Outcrop	Exposed Rocky Slopes	0	0	30	3	30	100
Water	Lakes and Rivers	<1	<1	100	9	100	99
Disturbed	Clearcuts / Burns / Development	284	25	0	0	-284	-100
	TOTAL	**1,152**	100	**1,152**	100		

Note: According to Table 2-4 current disturbance = 1,219 ha. This Table 5-2 does not include areas of existing reclamation such as the Southeast Till Borrow (~40 ha). The additional 27 ha of area is likely due to overlapping facilities. Numbers may not add exactly due to rounding.

Table 5-3 Method of Habitat Creation for Target Wildlife Species in Waste Dump Reclamation

Target Wildlife Species	Habitat Creation	Game Species
Deer mouse	Application of rock piles/boulders and coarse woody debris will provide cover and denning areas.	-
Bushy-Tailed woodrat		-
Northwestern chipmunk		-
Marten		Trapping
Long-Tailed weasel		Trapping
Ermines		Trapping
Snowshoe hare		Trapping
Red squirrel		Trapping
Coyote	Will be attracted to reclaimed waste dumps when ungulates and small mammals occupy the area.	Trapping
Gray wolf		Trapping
Cougar		Hunting
Red fox	Will be attracted to reclaimed waste dumps when small mammals occupy the area, and grasses/berries are present. They may den if soft substrates are available.	Trapping
Fisher	Eventual creation of continuous forest habitats, with the availability of carrion, small mammals, insects, berries, and mushrooms will attract fishers.	Trapping
Lynx	Will be attracted to area as snowshoe hare population increases, as they are very dependent on hares as a food source.	Hunting/Trapping

Table 5-3 Method of Habitat Creation for Target Wildlife Species in Waste Dump Reclamation

Target Wildlife Species	Habitat Creation	Game Species
Black bear	As vegetation is established, they will be attracted to food sources including berries (saskatoon, raspberries), buds, grasses, shoots and shrubs. Bears will also be attracted by the presence of mammals for prey and carrion.	Hunting
Mule deer	Planting native shrubs and woody species including willows, red elderberry, Douglas-fir, western redcedar, and trembling aspen will provide ungulate forage.	Hunting
Moose		Hunting

5.4. Soil Management

MPMC has developed a Soil Management Plan which includes protocols for soil salvaging, stockpiling, and use in reclamation (Appendix M). To collect information for developing the Soil Management Plan, and to guide future reclamation practices, a comprehensive soil quality assessment of Mine Site soil stockpiles was conducted in September 2013. Results are appended to the Soil Management Plan.

5.4.1. *Soil Use in Reclamation*

5.4.1.1. Soil Application

MPMC's Soil Management Plan describes coversoil application methods in detail, including strategies for reducing compaction. Figure 5-5 shows the proposed soil profiles to be used in reclamation prescriptions based on slope, aspect, substrate, and target site series. Pre-disturbance soil depths ranged from 0 cm to up to 1 m of salvageable surface soil (i.e., LFH + A Horizon + B Horizon[s]).

The soil profiles in Figure 5-5 are meant to allow for successful ecosystem development using the resources available on site. Trials have indicated that overburden (till) is an effective growth medium for plant roots (McDougall 2015). In addition, initial trials have indicated that tailings can be mixed with till and perform as an effective growth medium. Actual coversoil placement depths will vary based on material availability, landscape, site preparation techniques used, and equipment used for application. Additional soil amendments may be added to the profiles, if required (Section 5.4.1.2). Site preparation of coversoil to create microtopography will be conducted to reduce erosion and promote more diverse microsites, including microsites with improved moisture retention. A variety of site-specific site preparation methods are described in the Soil Management Plan.

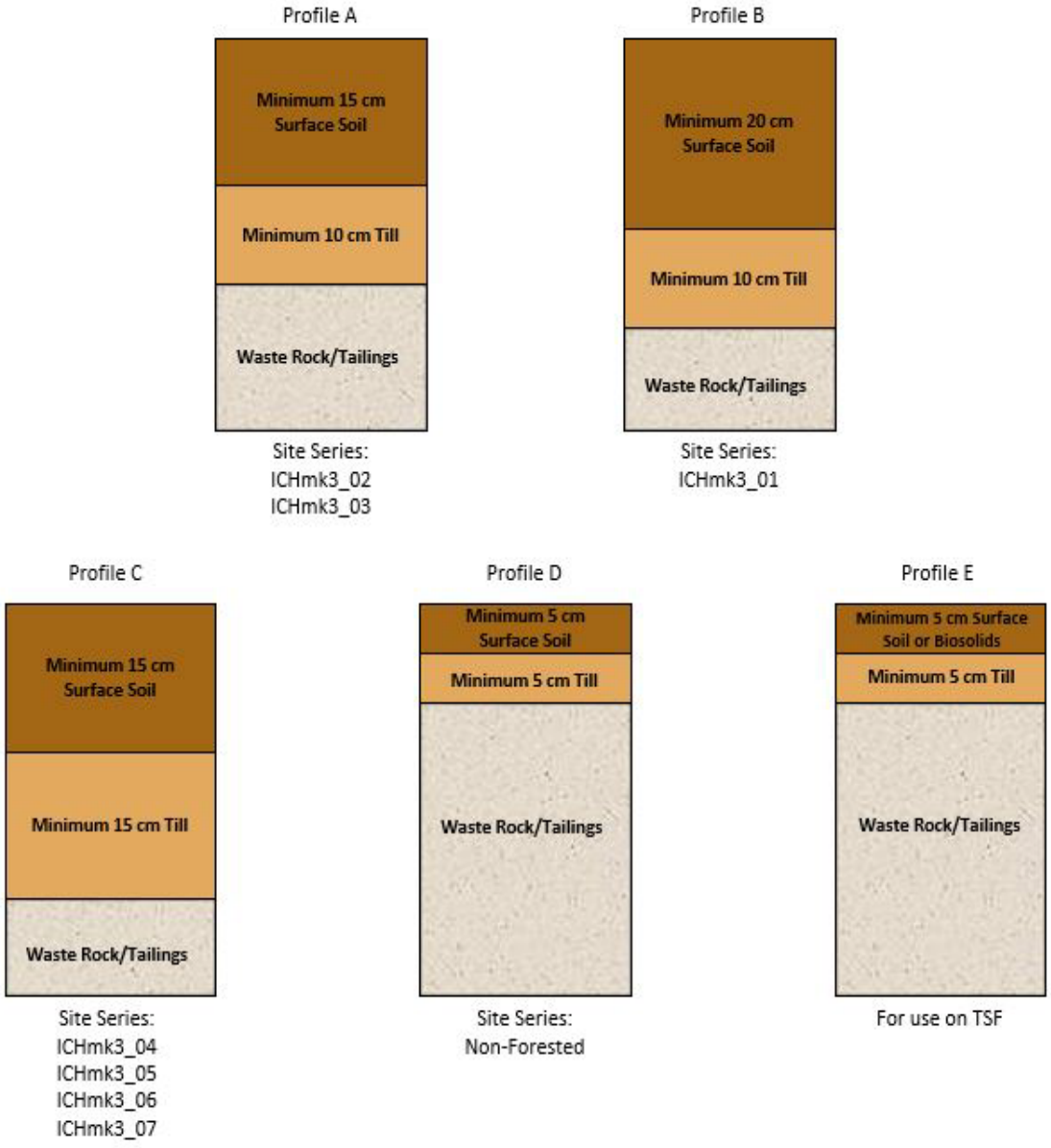

Figure 5-5 Proposed Coversoil Profiles

5.4.1.2. Soil Amendments

Soil amendments can be any additional materials that are added to reclamation sites to increase soil fertility, improve soil structure, provide better growing conditions for vegetation, or provide enhanced habitat features for target wildlife species.

Soil amendments may be used if there is a shortage of surface soil, if there are insufficient nutrients to support plant growth, or if the soil texture requires modification. Where possible, on-site soil amendments will be used to reduce costs, make use of waste, and prevent potential ingress of non-native species through importing soil from off site. Researched soil amendments are detailed comprehensively in the 2017 MRP Update (Section 4.3.2**;** MPMC 2017) and summarized within this MRP (Section 4.3) as well as below. Results from ongoing site-specific research will continue to provide guidance on when soil amendments are necessary, and what types and quantities to use. This will include long-term considerations, as soil amendments are typically only a short-term nutrient source.

Biosolids

Biosolids have been studied on research plots since 1998. Biosolids are available in large quantities for use on the Mine Site. The overall findings are that biosolids can be effective in encouraging initial tree establishment and root development. Biosolids can even act as a replacement for standard growth mediums in some cases. Overall, biosolids have been shown to be an effective soil amendment, at least with regards to establishing desirable vegetation.

Tailings

Initial trials have been conducted into seeding grasses directly into tailings and mixing tailings with till as a growth medium. Seeding grasses into tailings has generally been successful, and initial trials to combine tailings with till and biosolids have been successful (McMahen and Simard 2018). However, evidence from the TSF embankment breach terrestrial ecosystem assessment has indicated that in some cases tailings can be too fine, resulting in poor drainage, excess water retention, and decreased oxygen in the rooting zone, resulting in die off of vegetation.

Fertilizer

Contrasting with biosolids, fertilizer has not been found to be an effective soil amendment. “Tea bag” packages planted with trees were actually found to reduce long-term growth, and broadcast fertilizer can result in heavy ground cover (grass) development, which provides competition for target tree and shrub species . Results from ongoing site-specific research will continue to provide guidance on when soil amendments are necessary, and what types and quantities to use. This will include long-term considerations, as soil amendments are typically only a short-term nutrient source.

Woody Debris

Following soil application, woody debris (if not already incorporated into soil) should be placed, if available, to enhance microsite diversity and habitats, retain moisture, contribute to long-term soil organic matter, and improve catch of native seeds. If woody debris is not available, boulders or rock fragments can be placed in piles and individually. Although rocks are not a source of nutrients, over time, like woody debris, they can increase moisture retention, promote plant microsite diversity, provide habitat, and reduce soil erosion. Application of boulders or small rock piles will also continue to be carried out as a method of creating varied habitats on reclamation sites. Coarse woody debris and/or rock piles and boulders are important in creating wildlife habitats (Table 5-3) and contribute to meeting wildlife-related end land use objectives.

5.4.2. *Estimated Soil Balance*

No stockpiling occurred from 2017 to 2020. In 2021, 18,100 m^3 of reclamation material was salvaged at Springer Pit and stockpiled in the SERD-3 and Upper Cariboo Stockpiles (G. Holmes, pers. comm.). Table 5-4 provides the estimated soil balance for the site. Additionally, Table 5-5 provides the site soil stockpile inventory (updated as of December 2021), and Figure 5-6 provides the locations of all site stockpiles. The estimated soil volumes required for reclamation are based on the coversoil profiles (Figure 5-5) developed for the site. Currently, there is 1,219 ha of disturbed land; 1,020 ha of which will require coversoil placement either through progressive reclamation or at the time of active closure. The current soil balance estimates indicate that there is 1,694,010 m^3 of coversoil available to complete effective reclamation for all disturbed areas on the Mine Site (a surplus of 47,490 m^3). Additionally, there is a 1,101,330 m^3 shortage of till material. These calculations were developed using the soil and landform data as shown in Appendix C, with the soil stockpile inventory and disturbed areas provided from MPMC.

MPMC acknowledges that coversoil volumes may not be exactly as indicated due to losses through handling and erosion, as well as changes in bulk density. If it is found that there is insufficient coversoil available to implement the planned reclamation prescriptions contingencies will be explored such as:

- using soil amendments (Section 5.4.1.2); biosolids present on site (Table 5-4) are enough to address the coversoil shortage discussed above, and have had good results in reclamation trials
- borrowing additional till material from the borrow areas around the TSF, and/or
- mixing tailings in with till if further research shows it is a viable growth medium

Table 5-4 Coversoil Balance as of December 2021

Vegetation Type	Area Requiring Coversoil[(1)] [ha]	Average Coversoil Placement Depth [cm]	Required Coversoil Volume [m^3]	Average Till Placement Depth [cm]	Required Till Volume [m^3]	Available Biosolids Volume[(2)] [m^3]	Available Coversoil [m^3]	Available Till [m^3]
ICHmk3_00	8.36	5	4,182	10	8,364	0	**1,694,010**	**140,895**
ICHmk3_01	318.96	20	637,911	10	318,955	0		
ICHmk3_02	33.66	15	50,486	10	33,657	0		
ICHmk3_03	4.16	15	6,241	10	4,160	0		
ICHmk3_04	98.90	15	148,345	15	148,345	0		
ICHmk3_05	94.91	15	142,364	15	142,364	0		
ICHmk3_06	344.93	15	517,402	15	517,402	0		
ICHmk3_07	10.81	15	16,213	15	16,213	0		
Non-Forested / TSF	105.53	5	52,764	5	52,764	164,000		
TOTAL	**1,020.21**	**-**	**1,575,907**	**-**	**1,242,225**	**164,000**		

Note: The sum of each column may not add exactly due to rounding.

Volumes are estimated and may vary based on site conditions and handling. Excess material will be spread on site, shortages will be handled as detailed in Section 5.4.2.

1) Excludes areas that have already had coversoil placed or do not require coversoil placement (e.g., watercourses, rocky outcrops).

2) Biosolids may be used on other areas of the Mine and will be acquired in volumes sufficient to meet reclamation targets.

Table 5-5 Coversoil Stockpile Inventory (as of December 2021)

Stockpile Name	Location	Coversoil Volumes (m^3)	Year Established	Source of Stockpiled Soils
TSF Corner 1 - Windrow	TSF Corner 1	5,100	1995	New Corner 1 construction
Upper Plug Access Road (PAR) - Windrow	Along upper PAR	1,700	2015	Plug Access Road stripping
Plug - Stockpiles	Polley Lake Plug	127,017	2015/2016	Perimeter Embankment construction/expansion
Perimeter Pond - Stockpile	Bottom of Corner One (near old Perimeter Pond)	4,700	2013	Perimeter Embankment construction/expansion
Till Borrow - Windrow	North of (Perimeter) Till Borrow	42,800	1995 2013 - 2016	North American Laydown, Perimeter Embankment construction/expansion
Perimeter Embankment - Windrow	Edge of Perimeter Embankment	3,800	2013/2015	Perimeter Embankment construction/expansion
Main Embankment - Stockpile	SE of Main Embankment	94,900	1995	Main Embankment, Main Till Borrow (portion of material pushed out 2016)
South Till Borrow - Stockpile 1	NW stockpile in South Till Borrow	11,600	2014	Hazeltine Creek Rehabilitation
South Till Borrow - Stockpile 2	S stockpile in South Till Borrow	65,300	2000	Main Embankment Till Core Waste
South Till Borrow - Stockpile 3	NE stockpile in South Till Borrow	9,600	2016	Main Embankment expansion, ABR decommissioning
Gavin Lake Road - Windrow	Gavin Lake Road (along South/Main Embankment)	24,200	1995	Bootjack - Morehead Connector
TSF Access Road (TAR) - Windrow	Adjacent to TAR	43,500	2013/2014	Tailings Access Road Stripping
Tailings Reclaim Road - Windrow	Tailings Reclaim Road	44,300	1995	Tailings Reclaim Road
Cariboo Stockpile - Stockpile	Below Cariboo Stockpile	33,967	2015/2016	Cariboo Stockpile stripping
Upper Cariboo Stockpile	Upslope from Cariboo Stockpile	3,300	2021	Entrance to Springer Pit
Mill Site – Stockpile	East of Mill/Admin Building (includes berms)	10,700	1995	Mill Site Area (concentrator & crusher)
Access Road km 11.5 - Stockpile	Across from NBD Reclamation Parcels 1 – 10	8,200	Unknown	Unknown
Access Road km 12 - Stockpile	S-SW of Mount Polley Peak (by km 12 on Access Rd)	83,700	1995	Cariboo Pit stripping
East RDS - Stockpile	Top of East RDS	58,500	2000	Cariboo Pit Stripping
Leach Pad - Stockpile	Top of East RDS	4,800	2015	Till deposit below Cariboo Access Road
Highway to Heaven - Windrow	Highway to Heaven Access Road	21,500	2010/2015/2016	Unknown/Till deposit below Cariboo Access Road/Cariboo Pit stripping
NEZ Dump Top - Stockpile	Top of NEZ Dump	6,500	Unknown	Unknown
		25,000	2014	WX Zone, Cariboo Ore Stockpile, Temporary NW PAG Stockpile

Table 5-5 Coversoil Stockpile Inventory (as of December 2021)

Stockpile Name	Location	Coversoil Volumes (m^3)	Year Established	Source of Stockpiled Soils
NEZ Dump Lower - Stockpile	Off Wight Pit Haul Road	71,300	2005 - 2008/ 2014/2015	Wight Pit/Cariboo Pit Expansion, Cariboo Ore Stockpile, Temporary NW PAG Stockpile, WX Zone, TSF Settling Pond, Cariboo Access Road construction
Wight Pit Till - Stockpile	Bottom of Wight Pit Haul Rd	135,100	2005 - 2008	Wight Pit
Wrap Around Road - Windrow	Wight Pit - TSF Connector Road (below NEZ Dump)	101,600	2010	Moved from M1 Stockpile
North Bell Dump Till - Stockpile	North Bell Dump	164,000	2007 - 2012	Springer Pit
North Bell Dump Top - Stockpile	Top of North Bell Dump	8,500	2012	SEZ Expansion
Springer North	Between North Bell Dump and Springer Pit	20,000	Unknown	Unknown (early project phase)
Northwest Sump Road - Windrow	Northwest Sump Road	7,500	2012	Temporary NW PAG Stockpile stripping
PAG Dump - Windrow	Below PAG Dump	39,300	2014	Temporary NW PAG Stockpile stripping
SEZ 1 - Stockpile	Top of Old Pond Zone Pit	108,687	2012/2013/ 2015/2016	Old Cariboo Pit Stockpile/Cariboo Pit expansion/Till deposit below Cariboo Access
SEZ 2 - Stockpile	Top of SERDS (near SEZ - 1)	14,000	2012-2014	Old Cariboo Pit Stockpile/Cariboo Pit expansion
SEZ-3	Below Co-mingling Project	65,700	2009	SEZ Expansion
SEZ-4	Below Co-mingling Project / SERDS	22,600	2009	SEZ Expansion
SERDS - Stockpile	Below SERDS Dump	58,000	2012/2013	SERDS expansion
Old TSF Haul Road	Along old TSF Haul Road (SERDS)	27,200	2016	TSF buttress stripping
Lower SERDS - Stockpile 1	Below SERDS Dump	27,870	1995/2014	Perimeter Embankment Stockpiles/CCS and TSF settling pond/ TSF breach abutments and foundation
Lower SERDS - Stockpile 2	Below SERDS Dump	27,539	2015	Perimeter Embankment Stockpiles/TSF breach abutments and foundation
Lower SERDS - Stockpile 3	Below SERDS Dump	140,100	1995/2014	Perimeter Embankment Stockpiles/Central Collection Sump and TSF settling pond/ TSF breach abutments and foundation
SERDS – 3	Edge of SERD near old Pond Zone	14,800	2021	Entrance to Springer Pit
TDAR Sand/Soil Stockpile	Tailings Dam Access Road	46,425	2017	Polley Flats sand and soil
	TOTAL	**1,834,905**	-	-

-= not applicable.

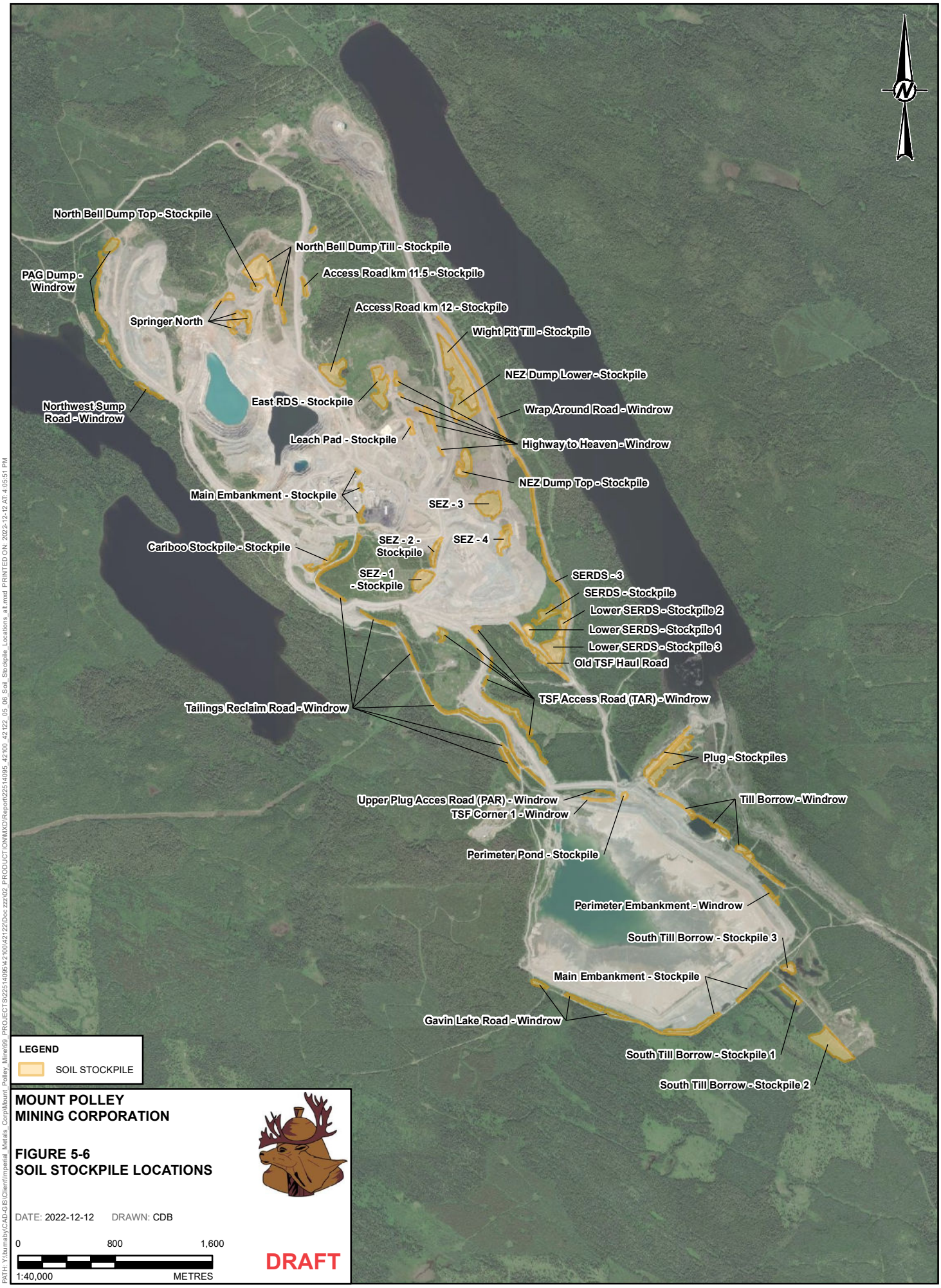

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5.5. Revegetation Prescriptions

Ingress of native species has been observed at the Mine Site (e.g., South Till Borrow), and is expected to continue. To support natural colonization, active planting of native vegetation is conducted to promote development of desirable post-closure ecosystems. Planting vegetation prevents erosion, avoids establishment of invasive species, and initiates the process of natural succession. Vegetative growth increases soil organic matter, provides native seed sources, and begins to create microsites that will, in time, be appropriate for growth of secondary successional species. For instance, early seral stage conifers used in the logging industry (lodgepole pine and Douglas-fir) are planted at the Mine Site, with climax woody species such as Western red cedar, subalpine fir, and hybrid spruce expected to ingress naturally when microsite conditions are appropriate. Ultimately, revegetation efforts promote end land use and closure objectives, such as wildlife values and biodiversity.

5.5.1. *Species Selection*

Development of MPMC's revegetation prescriptions for the Mine Site are discussed herein, while Section 5.5.2 provides discussion on planting strategies for the revegetation prescriptions. Appendix C describes the BEC zone and site series that were present on the Mine Site prior to development.

Historically, MPMC has planted diverse native species across the Mine Site. To this end, MPMC has developed a method for refining vegetation selection to identify species best suited for revegetation on the different site series that are targeted for reclamation. The species identified generally have a high potential to meet the conditions present in the various reclamation prescriptions (e.g., Figure 5-4), and are easy to procure through collection or purchase.

The approach for revegetative species selection is based on the BEC system. Identification of the site series of a specific area considers slope, elevation, and aspect assessed using a GIS model. This is further informed by site-specific substrate characteristics that suggest soil moisture and nutrient conditions. A generalized GIS matrix is used to aid in identifying the most appropriate treatment for an area. This approach is not designed to be rigid, and flexibility will be maintained to allow for alternative treatments or trials on designated sites, as well as based on professional discretion in localized areas. Table 5-6 shows general prescriptions by target site series for reclamation of disturbed surfaces on the Mine Site, which includes the mill and explosive sites, RDSs, roads, and the TSF embankments. The respective site series are shown in Figure 5-4. Specific reclamation considerations for specialized areas, including riparian and wetland areas, are described in Section 6, which individually discusses each reclamation unit at the Mine Site.

Table 5-6 Reclamation Prescriptions

Site Series		Moisture	Gradient (%)	Slope Position	Aspect	Soil Profile Type[7]	Grasses/Forbs[1,2]	Deciduous Trees[3]	Coniferous Trees[4]	Shrubs[5] 200 – 500 sph
Zonal	ICHmk3/01	Mesic/submesic	0 to 20	Middle	Variable	B	native grasses/forbs (30 kg/ha)	black cottonwood – 200sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph hybrid spruce[e] Western redcedar[e] alpine fir[e]	Sitka alder, saskatoon, prickly rose, willow, huckleberry, blueberry, common juniper [8], soopolallie
Xeric to Subxeric	ICHmk3/02	Xeric, subxeric	0 to 10	Crest	South or west facing	A		trembling aspen – 200 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph hybrid spruce	
	ICHmk3/03		50 to 70	Upper	Variable	A		trembling aspen – 200 sph	Douglas fir – 1400 sph lodgepole pine – 600 sph Western redcedar[e] hybrid spruce[e]	
Mesic to Moist Nutrient Rich	ICHmk3/04	Subhygric, mesic	10 to 35	Lower, middle	Variable	C		black cottonwood – 200 sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph hybrid spruce – 600 sph alpine fir[e] Western redcedar[e] lodgepole pine[e]	
	ICHmk3/05	Subhygric		Middle, lower	Variable			black cottonwood – 200 sph trembling aspen – 50 sph	hybrid spruce – 1400 sph lodgepole pine – 600 sph Western redcedar[e] alpine fir[e]	
Moist, Very Rich	ICHmk3/06	Subhygric, mesic	0 to 25	Lower, middle	Variable	C		black cottonwood – 200 sph trembling aspen – 50 sph paper birch – 50 sph	Douglas fir – 1400 sph hybrid spruce – 600 sph Western redcedar[e] alpine fir[e] lodgepole pine[e]	
	ICHmk3/07	Hygric	0	Toe of long slopes or depression	Level			black cottonwood – 200 sph	hybrid spruce – 1400 sph western redcedar – 600 sph alpine fir[e] lodgepole pine[e]	
Organic non-Forested	Non-forested	Subhygric	0	Depression	Level	D		n/a	n/a	
TSF		Hygric	0	Lower	Level	0		black cottonwood – 500 sph	n/s	

Notes:
1) Grass and forb seeding rate should be reduced (5 to 10 kg/ha) if amendments such as biosolids or fertilizer are used.
2) Grass and forb mixture shown in Table 5-8.
3) Species chosen based on BC Forest Development Stocking Standards (ICHmk3 biogeoclimatic subzone).
4) Species chosen based on BC Forest Development Stocking Standards (ICHmk3 biogeoclimatic subzone).
5) Later successional species to be considered for underplanting after primary canopy is established.
6) Shrub species to be selected appropriate for each site based on research and availability.
7) Refer to Figure 5-5, Section 5.4.1.1 for profile descriptions.
8) Juniper will be targeted for drier sites.
sph = stems per hectare.

MPMC's method goes through several steps to determine the species selected. In general, candidate species are assessed based on ecological conditions and then are further evaluated for social and economic considerations. As such, input from First Nations consultation and vegetation documented in a traditional use study of the area (Table 5-7) are also used to aid in species selection. To date, three species of traditional importance have been tested in small-scale trials at the Mine Site:

- huckleberry (Vaccinium ovatum)
- common juniper (Juniperus)
- soopolallie (Shepherdia canadensis)

Due to promising results, these species are now new additions to the general site reclamation prescription.

MPMC's selection process is iterative, and refinement is ongoing. Further, MPMC has had the opportunity to reclaim several areas on the Mine Site and continues to use the learnings from those reclaimed areas to refine and adjust reclamation prescriptions. The steps included in this process are:

1. determine which species are locally common to each site series and those that existed on the landscape prior to development
2. review government regulations for reforestation guidelines and dominant overstory and understorey species for each target site series
3. determine which species are commercially available, or easily harvested on the Mine Site
4. work with First Nations and local communities to determine species that are important for traditional use and support target wildlife species
5. add selected species to the newly reclaimed sites (e.g., immediately after coversoil placement)
6. monitor the progress of reclamation sites to determine which species (or combination of species) are performing well and at which locations (site series)
7. adapt reclamation prescriptions to incorporate learnings from monitoring results
8. incorporate refined prescriptions into progressive reclamation and reclamation research activities to further develop best practices for establishment of high priority target species
9. continue to adapt prescriptions and research trials as new information is gathered and additional target species are identified

Table 5-7 Incorporation of Traditionally Important Species into Reclamation Prescriptions

Species Common Name	Species Scientific Name	MPMC Comment
Lodgepole pine	*Pinus contorta*	Incorporated into revegetation prescriptions.
Western redcedar	*Thuja plicata*	A later successional species – underplanting of reclamation sites may be required if natural ingress is not observed.
Balsam fir	*Abies balsamea*	This species is only present east of the Rocky Mountains.
Paper birch	*Betula papyrifera*	Incorporated into revegetation prescriptions. Moderate performance to date.
Chamomile	*Matricaria* sp.	Not native to the area (species introduced and is only found to naturally occur in southwestern BC).
Black huckleberry	*Vaccinium membranaceum*	Difficult to establish, but a trial was planted in 2014. Poor performance to date.
Blueberry	*Vaccinium myrtilloides*	Difficult to establish, consider based on outcome of huckleberry trial.
Highbush cranberry	*Viburnum edule*	Not documented in the baseline vegetation survey – consider in future reclamation of wet areas.
Raspberry	*Rubus idaeus*	Strong natural ingress observed on reclamation sites.
Saskatoon	*Amelanchier alnifolia*	Incorporated into revegetation prescriptions. Moderate performance to date.
Red elderberry	*Sambucus racemosa*	Natural ingress into reclamation areas observed; incorporation into revegetation prescriptions being considered.
Wild strawberry	*Fragaria virginiana*	Incorporation into revegetation prescriptions to be considered if a seed or plant source is found.
Soapberry	*Shepherdia canadensis*	A trial plot was planted in 2014. Has performed well in trials to date.
Cow parsnip	*Heracleum lanatum*	Expected to naturally ingress at late stages of natural succession in moist areas.
Common juniper	*Juniperus communis*	Not native to the area; however, a trial plot was planted in 2015 on a hot dry reclamation site. Has performed well in trials to date.
Kinnikinnick	*Arctostaphylos uva-ursi*	Not documented in the baseline vegetation survey – a trial is being considered for a dry site if a seed or plant source is found.
Falsebox	*Paxistima myrsinites*	Expected to naturally ingress at late stages of natural succession in moist areas.
Labrador tea	*Ledum groenlandicum*	Consider in future reclamation of non-forested organic site (wet areas).
Devil's club	*Oplopanax horridus*	Expected to naturally ingress at late stages of natural succession in established conifer forests.
Yarrow	*Achilles millefolium*	Included in the forb mixture used in Metro Vancouver trial plots.
Tiger lily	*Lilum columbianum*	Not documented in the baseline vegetation survey – lake margins reported to grow this species in the traditional use study will not be disturbed by the Mine.
Wild potatoes[(a)]	-	Not documented in the baseline vegetation survey.
Mosses	Moss spp.	Expected to naturally ingress at late stages of natural succession in moist areas.
Fiddlehead ferns	Fern spp.	Expected to naturally ingress at late stages of natural succession in moist areas.

(a) Additional consultation regarding this species is planned.

5.5.2. *Planting Strategies*

To achieve desired ecosystems on the post-closure landscape, conifer species are planted at a roughly uniform density, while targeting ideal, moist, protected microsites. In turn, deciduous tree and shrub species are planted in a similar manner. Variable land surfaces with diverse macro- and microtopography are important to improve vegetation establishment and biodiversity. Land features, such as depressions, on recontoured landscapes, may be supported through targeted plantings, such as densely planted biodiversity islands of deciduous trees and shrubs, or possibly collection and spreading of seeds of more diverse species. Additionally, timing of planting has been shown to affect overall revegetation success. Fall seeding of grass species has been successful on the Mine Site, while tree and shrub planting in the spring is more favourable than during other seasons. The seeding method used also influences revegetation success, with hand seeding being more cost-effective compared to hydroseeding with equally successful results.

Revegetation prescriptions will be slightly adapted in areas identified to be reclaimed with livestock grazing as a secondary end land use objective (Table 5-1). As such, these areas will be seeded with the native grasses/forbs mixture and provide grazing areas during earlier successional stages before a closed canopy is established (Table 5-8). Roadsides will act as long-term grazing areas. In selected agroforestry areas, lower densities of deciduous trees and shrubs will be planted, and conifers will be planted at minimum reforestation stocking targets (500 to 700 stems per hectare [sph]) using techniques such as cluster or corridor planting. This will allow for up to 30 years of good forage production (Forest Renewal BC 2001). Precautionary measures will be taken, including planting trees adjacent to obstacles to prevent seedlings from being trampled.

Table 5-8 Mount Polley Native Species Grasses and Forbs Seed Mix

Species	% (by weight)	% (by seed count)
Mountain brome (*Bromus carinatus*)	20	8.61
Native red rescue (*Festuca rubra)*	10	17.81
Rocky mountain fescue[1] (*Festuca saximontana*)	15	28.94
Bluebunch wheatgrass[1] (*Pseudoroegneria spicata*)	25	10.76
Blue wildrye[1] (*Elymus glaucus*)	25	3.34
Junegrass[1] (*Koeleria macrantha*)	3	17.81
Ticklegrass (*Agrostis scabra*)	1	11.87
Big leaf lupine (*Lupinus polyphyllus*)	0.97	0.07
Fireweed (*Chamaenerion angustifolium*)	0.03	0.81

Reclamation materials are locally sourced where possible. Current sources are:

- **Seed:** Premier Pacific Seed and on-site collection (alder, elderberry, cow parsnip)
- **Seedlings:** Peel's Nurseries (deciduous), NATS Nursery (deciduous), and PRT growing services (coniferous)
- **Soil amendments:** Metro Vancouver (biosolids); 153 Mile Fertilizer (fertilizer)

In case of emergency, alternative local (provincial) suppliers are available for seed and seedlings, such as Tipi Mountain Native Plants. In addition to the biosolids currently stockpiled on site, Metro Vancouver has verified their continued interest in providing biosolids for reclamation activities, if they are selected for use. Fertilizer is also readily available in commercial quantities, as it is routinely used in the agriculture industry. However, the natural succession approach applied to reclamation at the Mine Site does not rely on these amendments and suppliers. After the TSF embankment breach, MPMC was able to use a variety of sources to get large quantities of native trees and shrubs at short notice with little difficulty. In addition, MPMC is experimenting with local seed collection of high priority target species and commercially less available species to ensure a more secure source of reclamation materials in the future.

5.5.3. *Alignment with End Land Use*

Because the end land use objectives selected for the Mine Site align with pre-mining land uses, species used in revegetation promote wildlife use and the development of conifer species for commercial forestry in the area (Table 5-9; BC Ministry of Forests, Forest Development Plan 2021). Additionally, to incorporate a secondary land use of livestock grazing (Section 3.1), a native grasses and forbs seed mix was developed for use at the Mine Site by consultant Moss Giasson, P.Ag., (Montane Environmental Services) and was based on recommended native grazing forage species for the area in the British Columbia Rangeland Seeding Manual (Dobb and Burton 2012; Table 5-8). MPMC is considering the use of an annual groundcover species (for example, fall rye) for future use at the Mine Site. This approach aims to provide erosion control and organic matter inputs in the short-term while trees and shrubs are being developed, without being competitive to the trees and shrubs in the long-term, thus promoting natural revegetation succession.

Table 5-9 BC Forest Development Plan Stocking Standards (ICHmk3 biogeoclimatic zone; BC Ministry of Forests 2021)

BGC Classification			*Ecological Suitability for a Timber Objective*				*Regeneration and Free Growing Stocking Standard*									
			Conifer Species			Broadleaf Species	RESULTS Stocking Standards ID	Preferred (p) Species	Acceptable (a) Species	Density			Regen. Delay (max yrs)	Free Growing Assessment Period		Minimum Height at Free Growing
										Target	MIN pa	MIN p				
Zone/SZ	Site Series	Site Series Name	Primary	Secondary	Tertiary					(well-spaced/ha)				Earliest (yrs)	Latest (yrs)	Species-Height (m)
ICHmk3	01	CwSxw - Falsebox - Knight's plume	Fd Pl Sx	Bl Cw^{37}		Act^{a} At^{a} Ep^{a}	80056	Fd Pl Sx	Bl Cw^{37}	1200	700	600	4	9	15	Pl-2.0, Fd-1.4, Others-1.0
ICHmk3	02*	FdCw - Wavy-leaved moss	Fd Pl		Bl Sx^{28}	At^{b}	80057	Fd Pl	Sx^{28}	1000	500	400	7	12	15	Pl-1.4, Fd-1.0, Others-0.8
ICHmk3	03	CwSxw - Soopolallie	Fd Pl		Bl ^{28} Cw^{28} Sx^{28}	At^{b}	80058	Fd Pl	Cw^{28} Sx^{28}	1000	500	400	7	12	15	Pl-1.4, Fd-1.0, Others-0.8
ICHmk3	04	CwSxw - Oak fern - Cat's-tail moss	Fd^{32} Sx	Bl $Cw^{32,37}$ Pl		Act^{a} At^{a} Ep^{a}	80059	Fd^{32} Sx	Bl $Cw^{32,37}$ Pl	1200	700	600	4	9	15	Pl-2.0, Fd-1.4, Others-1.0
ICHmk3	05	SxwCw - Oak fern	Sx^{32} Pl	$Cw^{32,37}$ Bl^{32}		Act^{a} At^{b}	80060	Sx^{32} Pl	$Cw^{32,37}$ Bl^{32}	1200	700	600	4	9	15	Pl-2.0, Others-1.0
ICHmk3	06	CwHw - Devil's club - Lady fern	$Fd^{32,34}$ Sx^{34}	Bl^{34} $Cw^{32,34,37}$ Pl^{34}		Act^{a} At^{b} Ep^{a}	80061	$Fd^{32,34}$ $Sx^{34,}$ $Cw^{32,34,37}$	Bl^{34} Pl^{34}	1200	700	600	4	9	15	Pl-2.0, Fd-1.4, Others-1.0
ICHmk3	07	CwSxw - Devil's club - Horsetail	$Sx^{1,32}$	$Bl^{1,32}$ $Cw^{1,32,37}$ Pl^{1}		Act^{a}	80062	$Sx^{1,32}$ $Cw^{1,32,37}$	$Bl^{1,32}$ Pl^{1}	1000	500	400	4	9	15	Pl-1.4, Others-0.8

FOOTNOTES

*	Avoid Logging	01	suitable on elevated microsites	34	risk of snow damage
a	productive, reliable, and feasible regeneration option	28	limited by moisture deficit	37	retired November 2010; Risk of heart rots
b	limited in productivity, reliability and/or feasibility	32	limited by growing-season frosts		

SPECIES CODES

Bl – subalpine fir	Hw – western hemlock	Sxw – hybrid white spruce
Cw – western red cedar	Pl – lodgepole pine	
Fd – Douglas-fir	Sx – hybrid spruce or interior spruce	

5.6. Environmental Risk Assessment

To address *Mines Act* permit M-200 condition D.15, MPMC conducted an environmental risk assessment (ERA; Appendix N). Eighteen sampling locations were selected within the Mine Site's permit boundary. Twelver were selected in areas that were revegetated and six were selected in undisturbed reference locations. Paired soil and vegetation samples were collected between 13 and 16 September 2022 and submitted to ALS Environmental (ALS) for analysis of nutrient, physical and chemical parameters (soil only), metals, and moisture content. Plant parts that are edible to wildlife were selected to allow the assessment of the potential risk to ecological receptors from ingestion of terrestrial vegetation. The sampling program targeted the main vegetative lifeforms (e.g., grass, forb, tree, and shrub [e.g., berry]), based on availability at each sampling location.

The results of the ERA are summarized below:

- The initial step of the ERA involved screening soil concentrations against soil screening criteria protective of lower-trophic-level receptors (i.e., plants and soil invertebrates) (BC CSR standards) and wildlife (Canadian Council of Ministers of the Environment Soil Quality Guidelines [CCME SQGE]).
    - Measured concentrations of parameters of potential concern (POPCs; selenium, sodium, copper) in coversoils exceeded soil screening criteria and in some cases were also elevated compared to reference soil concentrations
    - Selenium concentrations in coversoils were marginally elevated at 2 of 18 sampling locations, which were spatially separated across the Mine Site. The average selenium concentration met the CSR screening criterion for toxicity to soil invertebrates and plants (TSIP) and none of the coversoils exceeded the CCME SQGE. Given the isolated exceedances, impacts to plant communities are not expected and, on this basis, selenium was not retained as a POPC for further evaluation in the ERA.
    - Sodium soil concentrations at 14 of 18 stations were elevated compared to the CSR screening criterion for TSIP. Adverse effects from the salinity levels at the Mine Site were not expected, as other parameters (electrical conductivity [EC] and sodium adsorption ratio [SAR]) which are indicators of sodicity were low. Therefore, sodium was not retained as a POPC for further evaluation in the ERA.
    - Copper was retained as a POPC for further evaluation in the ERA for both plants and wildlife as concentrations within coversoils exceeded ecological screening criteria across the Mine Site and exceeded reference concentrations.

- Copper is an essential element in both plants and animals. Detrimental effects can be observed in plants and animals with copper deficiency as well as with excess copper. No signs of plant distress were observed by field staff during the tissue sampling event. Measured tissue concentrations of copper in reclaimed area grass, forbs, berries, and leaves were generally within the "normal" range of concentrations required to meet the nutritional needs of a plant (4-20 mg/kg dry weight reported by Hochmuth et al. 2015).

- Plant tissue concentrations were generally lower across the southern sites compared to the northern sites, where a select number of samples at northern sites were reported at copper concentrations greater than 20 mg/kg dry weight.

- Hochmuth et al. (2015) reports that copper is not highly mobile in plants, but some copper can be translocated from older to newer leaves. Fresh growth was targeted during tissue sampling, representing what would be considered areas of highest copper within the tissues.

- The isolated, elevated concentrations of copper within plant tissues at northern sample sites on the mine are not expected to impact the viability of the plant community.

- With respect to potential risk to birds and mammals through soil and food (plant) consumption, the ERA concluded that there is negligible risk to plant-eating wildlife based on the conservative food chain assessment, which considered that receptors of concern (ROCs) feed exclusively from the Mine Site, in the area of maximum copper concentrations. Hazard quotients (HQs) for ruffed grouse, meadow vole, and deer were all equal to or below 1, indicating minimal risk.

5.7. Invasive Plant Management

To promote natural succession, invasive plants on the Mine Site must be managed such that they do not inhibit growth of native species (both planted and naturally encroaching). To address this issue, MPMC maintains and implements an Invasive Plant Management Plan (Appendix O). Invasive plants found on the Mine Site are managed in accordance with the Cariboo Chilcotin Coast Invasive Plant Council Regional Strategic Plan and the BC *Weed Control Act* (RSBC 1996).

5.8. Fugitive Particulate Management

Under *EMA* Air Permit 15087, MPMC is required to suppress fugitive dust from the operations area and monitor dust fall in areas adjacent to the Mine Site. MPMC's regulatory threshold is 2.9 mg/dm^2/d (milligrams per decimetre square per day). To meet these requirements, MPMC has a Dust Management Plan (Appendix P) for the Mine and TSF areas which uses a "Plan, Do, Check, Act" management approach. The plan includes:

- identification of sources of fugitive dust emissions associated with the Mine

- a description of how fugitive dust can be controlled from each significant source and the best management practices in place or planned
- a description of how the plan will be implemented, including the training of personnel
- a description of inspection and maintenance procedures
- a description of methods of monitoring and appropriate response actions to feed back into refining management actions, as needed, based on monitoring and inspection results

This program will continue to be implemented through the operations and active closure of the mine, until monitoring results indicate that further mitigation measures and monitoring are no longer necessary.

5.9. Waste Management

The Mine Site operations uses potentially hazardous chemicals, reagents, and other products that are subject to waste disposal procedures. From 2019 to 2021, limited hazardous waste was generated. In 2019, Sumas Environmental routinely removed and disposed of waste products compliant with relevant regulations. Waste from 2020 was stored on site temporarily due to the small quantities produced during the Mine Site's care and maintenance status. Starting 2021 and continuing to the present, Sumas Environmental Services Ltd. resumed the disposal of waste products, as waste production picked up in conjunction with the ramp-up to operations. Materials that are routinely segregated and removed include aerosol cans; contaminated gasoline and diesel; waste oil (in drums); waste oil filters; waste grease fuel or oil-soaked rags, debris; and leachable liquid toxic waste, such as glycol/anti-freeze mix. The bulk waste oil tanks are emptied, and the oil removed from site by GFL Environmental. MPMC is registered with ENV under the Hazardous Waste Regulation (BC 1988) for generation and temporary storage of these materials.

A summary of current on-site waste management segregation practices and disposal locations is provided in Table 5-10. MPMC Environmental Department staff conduct routine (typically weekly) inspections of waste management disposal areas at the Mine Site to verify that correct waste segregation is being conducted. These practices will continue to be carried out through the operating and active closure phases of the mine life until such a time when these materials are not used or present at the Mine Site. Discussions on removal of fuels, reagents, and toxic materials, and removal of structures and equipment during active closure are provided in Section 6.1.3 and Section 6.1.4, respectively.

Table 5-10 MPMC Waste Management Matrix

Item	Correct Disposal Location(s)
Food waste	Lunchroom garages, bear-proof garbage cans (fuel islands, parking lot), and Admin Building entrance garbage cans
Drink containers	Recycling bins: lunchrooms, Admin Building entrances/2nd floor/ 3rd floor, Warehouse, Purchasing and Planning Trailers, Control Room, and Fuel Island (Proceeds from returns donated to local charities)
Cardboard	Warehouse, Pit Shop (east side), front of Admin Building
Paper	Small blue bins in offices/big bin outside Admin Building
5-gallon pails (oily)	Warehouse 5-gallon pail disposal bin (beside Light Vehicle Fuel Island)
Oily/greasy rags, used spill pads, motor oil containers, etc.	Black enviro barrels designated for oily waste at the fuel islands, pit shop, crusher, and maintenance laydowns.
Scrap metal	Warehouse scrap metal disposal site (separate according to signs)
Aerosol cans (including brake clean)	Black enviro barrels designated for aerosols at the Warehouse (beside light vehicle fuel island), pit shop, crusher, and maintenance laydowns
Large batteries	Warehouse bin (beside Light Vehicle Fuel Island)
Small batteries	Box inside Warehouse at counter, Admin Building 3rd floor hallway
Paint cans (not empty)	Warehouse disposal bin
Lamps, ballasts, and fixtures	Bin on Mill second floor (near electrical shop)
Engine oil	Waste oil tank at Pit Shop or black enviro barrels at laydowns (to be emptied into waste oil tank)
Engine coolant	Black enviro barrels in maintenance areas
Electronic waste	Bin under stairs on 1st floor of the Admin Building (mill side)
Wood, plastic, rages (not oily), and any other products not listed above	Landfill

5.10. Contingency Plans

Risks to successful closure will be partially mitigated through adaptive planning and decision-making. Reclamation is an important piece of the mining life cycle and is critical to the overall closure planning process. The underlying strategy for reclamation is that it is founded on a management approach that is iterative based on monitoring results, research findings, and changes to best practice and regulation (Figure 5-7).

Progressive reclamation activities allow opportunities to test, monitor, and adapt reclamation strategies where required. MPMC will use ground-based sampling programs as an effective method to measure success of reclamation (see Section 7). The goal is to establish a means to determine parameters and criteria for monitoring and judging the success of reclamation efforts. The monitoring program can be used to help support an adaptive management approach to reclamation by identifying areas for mitigation and improvement in reclamation design.

Results may highlight areas for improvement or indicate aspects of the design that are working well and may be implemented elsewhere on the landscape.

Maintenance is planned for, and is included, in MPMC's long-term reclamation planning. Long-term monitoring and maintenance will be conducted until the Mine Site is ready for certification. If, during monitoring, sites are found that are not performing as expected, mitigations may be applied, including: infill planting, fertilization, mulching, weed control, pest control, watering, and, where required, further investigation into soil and foliar chemistry. Where uncertainty remains about the performance of reclamation activities, adaptive management strategies will be used to formulate an appropriate response.

As part of adaptive management, results from research programs will be incorporated where opportunities exist. MPMC relies upon experience, topic specific experts, and research findings to identify methods for achieving reclamation and closure objectives.

Specific contingency plans can be found throughout this document, including:

- contingencies for coversoil shortages (Section 5.4.2)
- contingencies for acquiring revegetation materials in large volumes and/or with short notice (Section 5.5.2)
- contingency options if Springer Pit seepage is adversely affecting the receiving environment (Section 6.4.2)
- contingencies for the ore stockpiles (condition D.3.(c)(iv) of M-200) (Section 6.7)

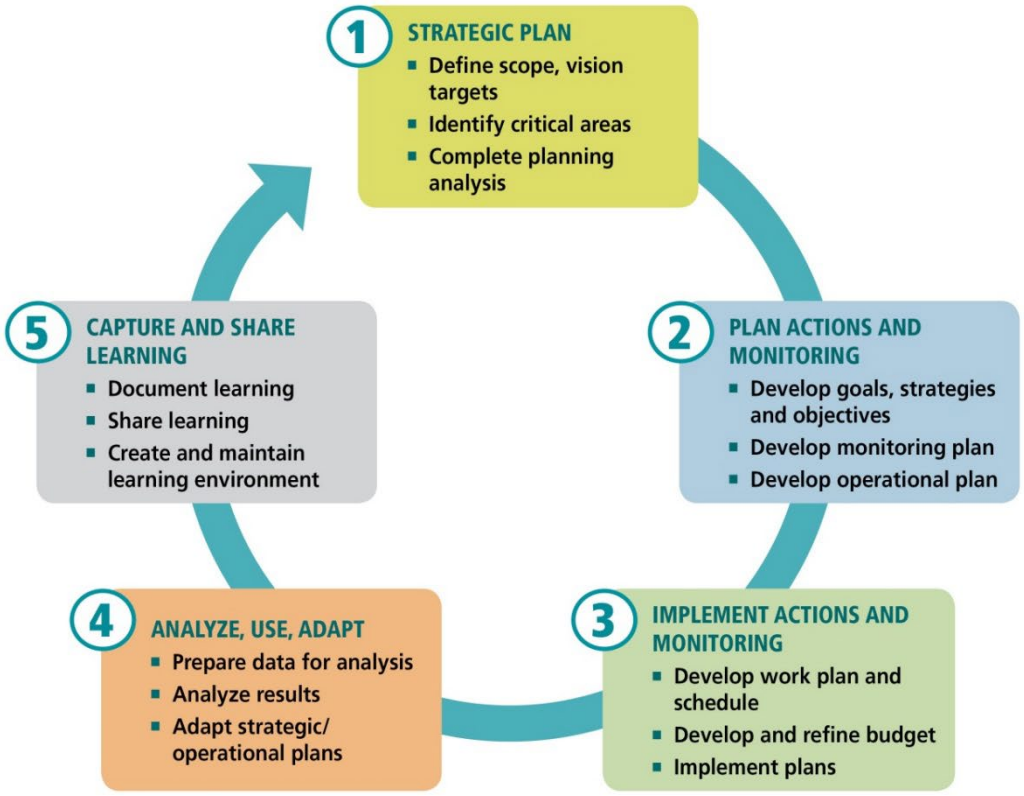

Figure 5-7 Adaptive Management Cycle

6. RECLAMATION UNITS

Reclamation units represent the various mine features that will be reclaimed once mining ends. A description of the reclamation units and specific considerations are provided in the subsequent subsections. Reclamation prescriptions for areas scheduled to be reclaimed in the latter portion of the active closure phase, as per the conceptual schedule (Section 8), may be refined based on results from progressive reclamation.

6.1. Mill and Plant Area

The mill and plant site area will comprise 36.58 ha at the onset of active closure, and will encompass nearly all the structures and equipment that exist at the Mine Site, including the:

- crusher and stockpile facilities
- mill
- magnetite recovery plant (operated by Craigmont Industries Ltd.)
- concentrator
- electrical substation
- maintenance shops
- warehouse
- offices
- assay laboratory
- fuel storage facilities
- potable water systems
- exploration geology buildings and core shacks

6.1.1. *Mill Reclamation Plan*

MPMC owns the surface rights to most of the mill and plant area, and interest has been expressed from local stakeholders for leaving some of the buildings and associated infrastructure (i.e., power supply) in place during the decommissioning of the Mine Site. This approach is supported by MPMC for all non-salvageable components of interest. In this scenario, MPMC would transfer ownership of the facilities to a third party, if an interested group can be identified at the time of active closure. During the first operation period from 1997 through 2001, the potential to convert the mill building into a truck repair shop or other industrial complex was discussed with ENV officials. The mill building has offices, electricity, telephones and all the other requirements of an industrial complex, and is located near forest industry activity in the surrounding areas, as well as communities that are connected to the industry.

For the purposes of scheduling in this MRP, it assumed that all mill and plant area infrastructure will be demolished and decommissioned, with the former plant area fully reclaimed. Careful planning of activities will be needed so that site services are not disrupted prematurely, and are available to support other overall closure and reclamation activities. Offices, power, sewage, and domestic water systems will be required for employees overseeing overall closure activities. During the active closure, the mill and plant area footprint will be decompacted (as needed), and coversoil will be placed in accordance with the reclamation and revegetation strategies shown in Figure 5-4, Figure 5-5, and discussed in Sections 5.4 and 5.5.

6.1.2. *Decommissioning Work Sequence*

All buildings, overhead structures, water management infrastructure, and pipelines will be catalogued, and their potential for salvage or other uses will be determined. Any infrastructure not required for future use will be dismantled and removed from the site. Core shacks may be left on site pending a decision that will be made in collaboration with EMLI.

Water intake systems and all above-ground pipework will be lifted and removed from the site. Underground pipework, such as fire, sewage and communication lines, will remain buried. Groundwater wells, both potable and monitoring, will be decommissioned when they are no longer required.

The proposed decommissioning and demolition approach for all buildings and infrastructure follows the same basic sequence of events. This sequence is summarized in Table 6-1.

Table 6-1 Decommissioning and Demolition Sequence

Item	Task	Description
1	Hoarding	Installation of hoarding (fast fence) around the work site to provide a working environment delineated from other operations at the site.
2	Cut and remove all utilities from the building	Electrical, fuel lines from tanks, water, sanitary sewer, storm sewer, data cables, telephone.
3	Removal of interior contents	Clean demolition: removal of all contents from inside the building without damaging any designated substances identified.
4	Abatement of hazardous building materials or process substances	Recovery, removal and recycling of products that may be hazardous to the environment and a Contaminated Sites Assessment (Section 6.1.3). Prior to demolition of any building, all hazardous building materials or process substances will be removed from the building. Upon completion of the removals, access to be restricted to those trades involved in the demolition.
5	Structural demolition to grade	Structural demolition of buildings and structures using excavators equipped with tools in a top-down, out-in approach. It is assumed that the fleet of heavy equipment will be brought to site to perform the demolition (if equipment on site is not suitable) and process the waste streams for shipment to designated waste disposal facility or facilities. Waste streams will be segregated.
6	Removal of slabs and foundations	Breakup and removal of concrete slabs and foundations, footings, and floor slabs of buildings with basements. Foundations to be demolished to ground surface, or a maximum of 600 mm below grade surface if needed to allow for backfilling and grading of the site to a self-draining condition. Floor slabs to be processed and hauled to a RDS or another designated site for final disposal.
7	Backfilling/site grading	Backfilling of basements with inert waste rock or overburden from the site in 300 mm lifts, nominally compacted to approximately 95% standard Proctor maximum dry density. Bulldoze and grade all site areas to a self-draining condition, with re-contouring of site to mimic surrounding natural landscape and restore drainage patterns towards Mine Drainage Creek (the Mill Site Sump and Ditch will be removed when no longer required and when water quality meets discharge guidelines).
8	Final cleanup	Removal of any final small debris (75 mm or larger) such that reclamation activities can be undertaken so the area can naturalize.
9	Reclamation	Site preparation and re-distribution of stockpiled overburden, incorporating amendments as per Section 5.4.1. Revegetation using early successional species and diverse habitat enhancements for wildlife and forestry values as per the prescriptions in Section 5.5.
10	Post-reclamation monitoring	Monitoring of reclamation success, as per Section 7.

6.1.3. *Removal of Fuels, Reagents, and Toxic Materials*

All tanks and fuel storage facilities will be emptied of their contents before they are removed from their foundations. Tank residues will be transferred by a proven and reputable waste oil reprocessing company or waste recycling company, as appropriate. This will follow similar procedures that have been in place throughout the operating period of the Mine (Section 5.9). Unused reagents and laboratory chemicals will be repackaged and shipped to other authorized users, or to an appropriate waste disposal facility. Any contaminated soils will be collected and stockpiled for treatment or disposed of in an approved manner.

A conceptual plan for a Contaminated Sites Assessment under the BC Contaminated Sites Regulation has been developed for the Mine Site (Appendix Q). The conceptual plan focussed on areas that stored or dispensed hydrocarbons, chemicals, blasting products (the Orica Site), and stockpiled materials (ore and PAG). Associated cost estimates have been incorporated into the liability bond costing calculations.

6.1.4. *Waste Streams*

All waste streams resulting from the decommissioning and demolition of the Mine Site will be recycled where possible, or landfilled. Given the complexity of the Mine Site, and the diversity of the associated waste generated, waste has been classified into 11 different waste streams. These waste streams are presented in Table 6-2.

Table 6-2 Typical Waste Classifications

Item	Name	Description
1	Total metal (recyclable)	Structural steel (heavy, light, shred), non-ferrous (copper, aluminum).
2	Wood/plywood/mixed wood	Interior wall partitions, wood structures and sheds, exterior wood cladding, shelving, core boxes, interior finishes.
3	Painted/laminated/wood	Counters, wooden and laminate office furniture and lab installations, cabinets, etc.
4	Plastic	Anything plastic within contents of buildings. A significant portion of the contents were observed to have plastics as the primary material.
5	Particle board/tile	Interior finishes and bathrooms.
6	Concrete	Steel reinforced cast in place concrete structures, foundations, footings, interior and exterior slabs, core slabs, cast in place structure elements.
7	Concrete Masonry Units	Concrete masonry units – block walls, etc.
8	Brick (clay based)	Terracotta block, speed block, clay-based exterior brick veneers.
9	Mixed debris/demolition waste	Mixed waste generated from the demolition of the structures, and is combination of small pieces of recyclables, concrete, wood, insulation, and other demolition debris.
10	Interior contents	Interior contents of buildings which are removed prior to structural demolition, and segregated from demolition waste and building debris. Recyclables will be removed from this waste stream as practical.
11	Sulphur stockpiles	Excess elemental sulphur stockpiled before use as sulphuric acid in copper ore leaching process

Near the date of mine closure, detailed estimates of waste stream volumes and corresponding landfill capacity and design will be prepared. Details on the disposal of various waste categories are provided below:

- **Non-salvageable, non-combustible, and non-recyclable materials:** these materials will be buried within the onsite landfill, covered with waste rock, and reclaimed to match the end land use of the surrounding area(s), as per the BEC site series. Any materials that would require the landfill to have an engineered cover will be disposed of offsite.

- **Combustible, non-salvageable materials**: these materials will be burned pending receipt of a refuse permit, and the burned residues will be buried in the onsite landfill.

- **Structural steel, heavy gauge, shred, ferrous, and non-ferrous metals:** these will all be segregated and sheared to scrap metal industry sizing.

- **Concrete rubble:** this material may be used for filling in basements and regrading surfaces in the mill area. For the entire Mine Site, it is assumed that concrete rubble will be pulverized using a heavy excavator equipped with a pulverizing jaw attachment. The pulverized concrete rubble collected from each area will be stockpiled until the end of the demolition phase of the overall closure work. Once the demolition phase is complete, the pulverized concrete rubble can be placed in an RDS or other suitable location. Alternatively, it may be preferable to process the concrete rubble through a crushing plant to obtain a 2-inch (50 mm) minus crushed material. This material can be used as cover material for other aspects of demolition (e.g., cover material for foundations) during active closure.

6.2. Power Lines

Removal of power infrastructure will depend upon the power requirements for post-closure (particularly water treatment) and on other potential power users in the region. When no longer required, overhead power lines and infrastructure on the Mine Site will be removed by a specialty contractor. Salvageable materials will be sold, recycled, or disposed of using an approved method. Buried cables will remain in the ground, as they do not pose a risk to humans or the environment. Postholes will be backfilled, and reclamation will be carried out in a manner consistent with adjacent reclamation units. As a ground cover already exists in power line rights of way, revegetation will only include planting of trees and shrubs, if not already naturally regenerating.

6.3. Test Heap Leach

The Test Heap Leach Facility is located on top of the East RDS and includes the lined heap leach pad, operations building, and former sulphur stockpile footprint (see Section 1.2.2). Remaining materials and their volumes are presented in Table 6-3.

Table 6-3 Test Heap Leach Materials Estimates (SRK 2022a)

Material	Location	Estimated Tonnage (t, m^3)[1]
Ore mixed with elemental sulphur	Stored on the leach pad	7,000 m^3
Elemental sulphur	Stored on top of leached ore on leach pad Stored in layers between ore on leach pad	23,000 t Unknown amount
Leached waste rock from below the sulphur stockpile	Stored on top of leached ore on leach pad	9,200 t
Leached ore	Stored on top of leach pad	19,000 t
Crushed rock (waste rock)	Stored on leach pad (surrounding and underneath contaminated soils)	20,000 t[1]
Metal contaminated soils	Stored on top of leached ore on leach pad	30,000 t
Anchor rock (for liner)	Outside of leach heap footprint	5,400 t[1,2]
Berm	Around leached ore on leach pad	22,000 t[1]
Drainage material	Drainage rock above and between liner layers	Unknown
Till liner	Underneath heap leach facility	Unknown
Liner[3]	Bottom of heap leach pad	-

1) Estimated based on volume.

2) Stored outside of leach pad footprint.

3) Liner comprises of two plastic liners that are 19,000 m^2, with one geonet placed between them.

The Mount Polley Heap Leach Decommissioning Plan (SRK 2022a) determined that submergence of stockpiled elemental sulphur, leached waste rock, leached ore, crush rock, contaminated soils, and berm materials in the TSF was the best option for the disposal of these items. Submerged disposal is expected to arrest oxidation but will rapidly leach the soluble acidity. This acidity may be neutralized by contact with tailings or with the addition of lime during disposal. The method of disposal of anchor rock will depend on its ML/ARD classification. If surface disposal is desired the anchor rock may require amendment. Alternatively, this material could also be disposed of within the TSF. To allow sufficient time for generation of tailings to cover the anchor rock in the TSF and sufficient blending with neutralizing amendments, disposal is recommended to be started during operations and completed before the last year of processing (SRK 2022a).

6.4. Open Pits

6.4.1. *General*

Approximately 231 ha of the Mine Site is projected to be open pits at the onset of active closure, which includes the Boundary Pit, the Wight Pit, the Cariboo-Springer Pit, and the TSF Rock Quarry. Once pit lakes form in the Boundary, Wight, and Cariboo Pits, approximately 164 ha is projected to remain above the elevation of the pit lakes. The total area of the pit lakes at active closure is expected to be approximately 67 ha. The balance of the pit area is lost in the flooded pits.

Public safety is paramount during the reclamation of the open pits. When mining of the pits is complete, berms and signage will be installed around the perimeter of the pits. Efforts will be made to revegetate the rims of pits visible from Bootjack Lake and Polley Lake to minimize visual impact. Remaining exposed pit walls will have a slope ranging between 40° and 50° and are exempt from reclamation pursuant to Section 10.7.13 of the *Health, Safety and Reclamation Code for Mines in British Columbia* (EMLI 2021). The unvegetated pit walls have potential to add to the post-closure landscape's biodiversity by providing microhabitats that did not exist prior to the Mine Site's development. Cliff faces, particularly those with ledges, boulder piles, crevices, and overhangs, may provide nest sites for a variety of cliff nesting birds, such as the common raven (*Corvus corax*), birds of prey, cliff swallows (*Petrochelideon pyrrhonota*), barn swallows (*Hirundo rustica*), and Say's phoebe (*Sayornis saya*). Cavities in boulder piles can provide nesting and denning habitat for bats (*Chiroptera*), the bushy-tailed woodrat (*Neotoma cinerea*), deer mice (*Peromyscus* spp.), the northwestern chipmunk (*Tamias minimus*), and other small mammals.

Ramps down to the level of flooding will be decompacted with heavy equipment and reclamation will occur as outlined for ICHmk3_02 BEC series (Table 5-6 and Figure 5-4). Flooded pits will create isolated water bodies that have little potential as fish habitat. The surface waters of the ponds have potential to support aquatic invertebrates, and may provide useable spawning habitat for western toad and spotted frog. To promote aquatic habitat, species including duckweed (*Lemna spp.*), pond weed (*Potamogeton spp.*), yellow pond lily (*Nuphar variegata*), water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), common cattail (*Typha latifolia*), and river horsetail (*Equisetum fluviatile*) will be considered in revegetation. Floating species help build up organic matter, creating potential habitats for riparian species to be introduced over time. Such plants may also help remediate pit water quality through microbial activity, while the pit lakes may have the potential to act as a drinking water source for wildlife, depending on water quality and access.

Water quality modelling indicates that the water in pit lakes will be suitable for wildlife and livestock; predicted concentrations are below applicable guidelines. Predicted concentrations (Section 5.2.4) are below the screening level for livestock and wildlife of 10 mg/L for molybdenum, and selenium will be managed in response to measured water quality, through measures such as carbon addition to reduce selenate and precipitate selenite, if necessary. The need for this mitigation will be confirmed by monitoring the actual water quality observed in the active closure and post-closure periods.

6.4.2. *Cariboo-Springer Pit*

6.4.2.1. Post-Closure Water Balance

At the onset of active closure, PAG material will be placed in the Cariboo-Springer Pit to an elevation of 1,004 masl (Appendix H). The active closure and post-closure water balance model assumes uniform deposition across the Cariboo-Springer Pit. Under the mean condition, the combined Springer-Cariboo Pit Lake is estimated to start overflowing in 2054. Under the 90th percentile condition, the combined Springer-Cariboo Pit Lake is estimated to start overflowing in 2050. Under the 99.5th percentile condition, the combined Springer-Cariboo Pit Lake is estimated to start overflowing in 2049. It is expected that the pit overflow for the 99.5th percentile condition will occur the soonest compared to the mean and 90th percentile conditions. Peak daily discharge and annual discharge volume to Bootjack Lake is expected to remain constant from 2051 to 2124.

The post-closure water balance (Appendix H) Indicates that, under natural accumulation conditions, the Cariboo-Springer Pit will fill to an elevation of 1,030 masl in January 2038 (following drawdown for mining and subsequent placement of PAG material) and an elevation of 1,050 masl in 2050. The post-closure surface area of the combined pit lake is projected to be 50 ha at 1,050 masl. Depending on water management requirements and Mine Site objectives, water may be directed (i.e., pumped) to the Cariboo-Springer Pit to advance this filling schedule. A summary of projected long-term water chemistry for the Cariboo-Springer Pit during active closure and post-closure is provided in Appendix I. This projected chemistry will determine treatment requirements and inform selection of treatment options for development of the closure water management plan.

A geotechnical assessment of the slope stability of the southwest wall of the Springer Pit (the wall between the Springer Pit and Bootjack Lake) was conducted (Appendix S). Findings from the assessment indicate that adequate long-term slope stability conditions are expected to be achieved, as results of the analyses exceeded the minimum recommended factor of safety (FoS) of 1.3.

6.4.2.2. Cariboo-Springer Pit Spillway

As part of the post-closure design for the Cariboo-Springer Pit, a conceptual level spillway design was prepared (Appendix R). The spillway is intended to operate after the active closure of the Cariboo-Springer Pit and its purpose is to safely discharge overflow caused by storm water runoff and other inflows from the surrounding catchment. The spillway channel has also been sized with constructability and vehicle passage along the existing haul road as main considerations. The wide channel base and gradually sloped banks allow for vehicles using the existing haul road to cross the spillway channel safely when no water is flowing. The spillway channel has been sloped towards the Cariboo-Springer Pit to eliminate the risk of normal runoff from the haul road discharging into the environment. Design flows for several, rainfall scenarios were considered at regular intervals, with the spillway invert at 1050.5 masl.

6.4.2.3. Hydrogeology

A hydrogeological assessment of the Cariboo-Springer Pit is provided in Appendix F. This assessment predicts the formation of a pit lake at closure and potential exfiltration of pit lake water to groundwater (flowing in the direction of Bootjack Lake). Currently, modeling, which assumes no mining of the inter-pit saddle, indicates that once pit lake elevations are above approximately 1,028 masl, the pit lakes in the Springer Pit and Cariboo Pit merge and form a single pit lake. Results indicate that seepage to groundwater will occur when the lake level reaches 1,030 masl, with seepage at the spillover elevation (1,050 masl) projected to be approximately 420 m^3/d (combined seepage of 400 m^3/day from the Springer Pit and 20 m^3/day from the Cariboo Pit; (Golder 2016b).

In 2016, an additional well was installed downgradient of the Cariboo Pit, to monitor both water quantity and quality during operations, active closure, and post-closure. Groundwater quantity and quality modeling evaluated conditions during active closure and post-closure with the spillway elevation at 1,050 masl. Seepage water data was fed into a three-dimensional lake model that considered an initial dilution zone within Bootjack Lake. The model results were considered in an aquatic effects assessment, which concluded there would be no likely adverse effects on Bootjack Lake as a result of pit lake seepage (Golder 2016c). The assessment was carried forward to an application to the ENV for an *EMA* Permit 11678 amendment that would allow the seepage to occur under a “no discharge” contingency scenario. These results are also applicable to closure of the Cariboo-Springer Pit.

Despite these predictions, if results from ongoing groundwater and receiving environment monitoring indicate that seepage to groundwater is negatively impacting the receiving environment, mitigation options include decreasing the spillover elevation, installing a low-permeability barrier, and/or constructing a passive seepage collection system.

6.4.3. *Wight Pit*

The Wight Pit is no longer actively mined and is being used to store mine contact water. An adit to the former underground operations located within the pit is below the flood level. MPMC plans to construct a spillway toward Polley Lake This spillway will follow the same concept and design basis as the Springer Pit spillway, with an invert elevation of 926 masl. The Mine Site’s closure water balance modelling (Appendix H) indicates that Wight Pit Lake is projected to start overflowing in 2027, at which point the PAG the PAG material currently deposited in the pit will be entirely submerged. Overflow from the Wight Pit Lake will discharge to Polley Lake. Annual discharge volume to Polley Lake is expected to remain constant from 2029 through 2124. The reader is directed to Appendix H for more detailed information, including discharge rates. Once filled, the pit lake is expected to have a surface area 14.61 ha.

A hydrogeological assessment by Golder (Appendix T) projects that at spillover elevation (926 masl), seepage to groundwater towards Polley Lake will occur at approximately 500 m^3/d, with groundwater seepage into the pit lake of approximately 600 m^3/s. The hydrogeological assessment recommended that old borehole wells be reconditioned, or new wells installed to collect data to refine the model. MPMC conducted investigations associated with the recommendation, and two dewatering wells near the Wight Pit were converted into monitoring wells in 2016.

6.4.4. *Boundary Pit*

The Boundary Pit is a small pit, and observations through the operating period of the Mine Site indicate that the water within the pit exists in a roughly steady state (i.e., does not overflow). Modelling indicates that a seasonal pond will develop in the Boundary Pit, and the pond is not expected to overflow during the modelling period of 1 September 2024 to 1 September 2124. Seepage from the Boundary Pit is assumed to contribute to inflow to the Wight Pit. During post-closure, the Boundary Pit is expected to have a water elevation of approximately 1,070 masl and a projected surface area of 2.74 ha.

A groundwater characterization and modelling assessment (Appendix U) indicates that the water level in the Boundary Pit could rise to 1,073 masl, resulting in a pit lake with a maximum depth of 5 m. The modelling indicates that groundwater seepage from this area would flow towards the Wight Pit at a rate of 59 m^3/d. Accessible disturbed areas of the pit's footprint will be reclaimed as outlined in Section 6.4.1, and the reclamation prescriptions shown in Table 5-6.

6.4.5. *TSF Rock Quarry*

When the TSF rock quarry is no longer active and available for reclamation (e.g., following recontouring efforts associated with the TSF's closure prescription), coversoils will be applied to accessible areas and revegetation will take place as outlined in Section 5.5, and the reclamation prescriptions shown in Table 5-6 and Figure 5-4, with the pit walls remaining in their current state.

6.4.6. *Water Management Infrastructure*

Water management in post-closure is crucial to overall success of the closure of the Mine Site. Pit lake post-closure conditions are discussed in Section 6.4.; however, other components are accounted for within this section. Table 6-4 shows a summary of details related to estimated overflow dates. Table 6-5 shows projected discharge locations. Figure 5-1 and Figure 5-2 provide detail on water management infrastructure and how water will be managed in active and post-closure.

Table 6-4 Overflow/Discharge Dates of Post-Closure Water Management Components

Component	Projected Date of Overflow/Discharge
PETBP	2024
SESCP	2044
MESCP	2045
9K Sump	2034
NW Sump	2025
Mine Drainage Creek Sump	2025
Long Ditch/SERDs Ditch	2034

Note: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment.

Table 6-5 Discharge Locations for Post-Closure Water Management Components

Water Management Infrastructure	Discharge Destination
Wight Pit	Polley Lake
SERDS/ Long Ditch	
Perimeter Embankment Till Borrow Pond	Hazeltine Creek
Main Embankment	
South Seepage Pond	Edney Creek
9K Sump	Bootjack Lake
NW Sump	
Springer-Cariboo Pit	
Mine Drainage Creek Sump	

As the mine moves into closure and post-closure, the objectives of water management in the closure plan for the mine are to return the impacted land to pre-mining land functions. As the mine is constructed across a watershed divide, it is desired that during the post-closure period, drainages will be distributed back to their natural watersheds (i.e., to Bootjack Lake, Polley Lake, and Hazeltine Creek), provided that this can be achieved in an environmentally appropriate and permittable manner. No additional water infrastructure will be constructed for closure and post-closure.

Overall, water management infrastructure in active closure will be a more simplistic version of that currently in place during operations. Notable differences in active closure include that the Cariboo-Springer pit will no longer be connected to the rest of the water management system, and that a passive/semi-passive treatment system will be in place. During post-closure, water management infrastructure will be broken up into segments (e.g., decentralized), and main site features (e.g., TSF) will not receive water from other segments of the mine. For instance, water from the East RDS will no longer ultimately reach the PETPB, but will report to the Long Ditch, and then overflow to Polley Lake.

6.5. Waste Dump Reclamation

The Mine Site is projected to have 356.87 ha of waste dumps prior to active closure (Figure 2-1), including areas that are currently undergoing progressive reclamation. All RDSs that will remain as permanent structures at closure contain NAG rock. The reclamation and closure approach for the NAG RDSs is focused on creating geotechnically stable landforms that not only support revegetation and reclamation efforts but also reduce the visual impacts from Bootjack and Polley lakes, in compliance with condition E.9.(b) of M-200 permit. PAG waste rock generated during operations (which has not already been backhauled into exhausted pits) will be segregated and temporarily stored in the Temporary NW PAG Stockpile. The reclamation of that stockpile is discussed separately in Section 6.6.

6.5.1. *Reclamation Approach*

During active closure, RDS slopes will be recontoured to 2H:1V or less, to promote long-term physical stability (Section 5.1.1). Recontouring efforts at closure will consider landform design and aesthetics to promote natural integration of reclamation sites into the surrounding landscapes. Landform design will also consider the pre-mining drainage pathways shown in and conceptual closure drainages discussed in Section 5.2.4. Additionally, designs for the RDSs will consider scales ranging from micro-topography to regional landscapes, and minimize erosion and the long-term visual impact from Polley and Bootjack lakes.

Engineering design guidelines for RDS closure morphology were prepared in 2019 (Golder 2019). This work evaluated the design approach for drainage over the surface of the RDSs, with the intent of developing a reclaimed landform that conveys surface runoff in a form that is analogous to the drainage on surrounding landforms.

Following recontouring, RDSs will be covered with coversoil, and revegetated with early successional species and wildlife habitat enhancements to promote forest establishment and encourage wildlife usage. Agroforestry practices will be implemented in select areas to allow for livestock forage in young forests and open canopy forests. Procedures for soil handling and application to reduce compaction and create microsites, along with placement of coarse woody debris and other habitat features on the RDSs, are outlined in Section 5.4.

End land uses are discussed in Section 5.3, and revegetation prescriptions are provided in Section 5.5. The recreation end land use could potentially include interpretive walking trails and picnic areas to promote outdoor recreation and public education. A possible location is the North Bell Dump, which overlooks the Mine Site and Polley and Bootjack lakes. This location would offer views over the reclaimed mill and Temporary NW PAG Stockpile sites, as well as over the pit lake that will form in the Cariboo-Springer Pit.

6.5.2. *Visual Assessment*

The closure design of the RDSs was assessed for aesthetic value and visual impact from Bootjack and Polley lakes to comply with condition E.9 in *Mines Act* permit M-200. The visual simulations of the RDSs were created as panoramic photocompositions. Panoramic images consist of multiple photos stitched together to create a wide field of view, allowing the resulting image to depict a large site. Photocompositions are combinations of site photos taken in the field and modelled views of the closure landscape, which are superimposed onto the site photos.

The visual simulations were created for four viewpoints, two located on Bootjack Lake and two located on Polley Lake (Appendix V.1). A series of photos were taken on 18 August 2022 at each viewpoint, covering a field of view large enough to encompass the entire Mine Site. The GPS location of each viewpoint and the specifications of the photos taken (i.e., height above ground, direction, focal length) were recorded.

A 3D model of the current landscape in and around the Mine Site was created in a 3D software suite (Autodesk 3ds Max 2021 with the Forest Pack extension). A digital elevation model (DEM) of the Mine Site and surrounding area (topography as of 2019) was added to the 3D landscape model. The changes to the landscape at closure were then modelled by applying textures to the

DEM (e.g., to represent grassland at closure where currently no visible vegetation exists) and by adding trees (to represent the growth of forest where currently none exist). The height, density, and species composition of the post-closure vegetation communities was modelled for the individual site series as presented on Figure 5-4.

For each of the viewpoints, a series of cameras were added to the 3D landscape model, each representing the parameters (e.g., location, direction, field of view) of one of the photos taken from the viewpoint. The closure landscape was then rendered in the 3D model from these cameras, allowing for the closure landscape features to be depicted exactly as they would appear from the viewpoints on Bootjack and Polley lakes (i.e., position and size of the closure landscape). The rendered post-closure landscape (including grasslands and forests) was then superimposed onto the site photos in Adobe Photoshop 2022. Rendered post-closure landscape features that were blocked by foreground elements visible in the photos (e.g., existing trees along the shoreline) were removed. The resulting photocompositions were then stitched together into panoramic images (Appendix V.2).

The photocompositions demonstrate that following reclamation and closure of RDSs, the dumps will appear as revegetated hills similar to the surrounding undisturbed landscape. The aesthetic values held by recreational users of Bootjack and Polley lakes will be protected. The only visible feature post-closure will be the Springer-Cariboo Pit high wall.

6.6. Temporary NW PAG Stockpile

At the end of mine life, all PAG material from the Temporary NW PAG Stockpile will be relocated to the bottom of the Cariboo-Springer Pit and submerged. This will reduce the risk of these materials generating acid in the long-term. Subaqueous disposal of PAG materials is considered an effective methods for limiting ARD generation at sites where it is possible to comply with key design constraints, such as positive water balance, satisfactory physical stability of the final storage facility, and sufficient long-term water depth (INAP 2009; MEND 2015). The disposal of the PAG waste rock will be physically stable, as no buttressing, berms, or dams will be needed to maintain water cover over the pit-disposed waste rock. As referenced in the Cariboo-Springer Pit hydrogeological assessment (Appendix F), sufficient space will exist after mining ends such that PAG waste rock at maximum elevation 1028 masl will be covered by 22 m of water when the pit lake reaches the spillover elevation of 1050 masl after closure. Water quality in the Cariboo-Springer Pit has been modelled with the submerged PAG material, as described in Sections 5.2.4, and Appendix I. Accelerated filling of the Springer Pit to meet water management (quantity or quality) objectives is an option by directing additional flow (i.e., pumping) to the Cariboo-Springer Pit. The accelerated filling scenario was also assessed.

A sampling program will be developed prior to closure, and submitted to the EMLI Chief Inspector at least 60 days prior to the commencement of material rehandling. Waste rock will be excavated to a minimum of 1 m beyond the surveyed PAG/NAG boundary. Once PAG waste rock is removed, the underlying NAG pad will be sampled and analyzed to confirm removal was complete. If any PAG waste rock remains, additional rock will be removed, and this process will continue until only NAG waste rock remains. The NAG pad will then be re-sloped and revegetated following reclamation prescriptions outlined in Section 5.5.2.

6.7. Ore Stockpiles

Once ore is removed, decompaction of the stockpile footprints may be necessary, and will occur prior to the placement of coversoil on the footprints of #1 Ore Stockpile and Cariboo Ore Stockpile. Revegetation efforts will target a revegetated mosaic of forested site types that tie into the surrounding post-closure landscape (Figure 5-4 and Table 5-6).

6.8. Road Reclamation

Two types of roads exist at the Mine Site: light vehicle roads (often old forestry roads that pre-date mine operations) and large haul roads made from NAG waste rock (often built up, and are essentially linear RDSs). Roads scheduled for reclamation will be reclaimed to target the adjacent end land uses (generally wildlife habitat and forestry), as shown in Figure 5-4 and Table 5-6. A total of 220.83 ha of roads are projected to exist at closure, with 104.81 ha of this reflecting the potential additional West Haul Road construction.

6.8.1. *Light Vehicle Roads*

Roads required for monitoring reclamation success and geotechnical stability will be retained. Additional roads may be preserved for logging and forestry use, for ranchers to reach their grazing cattle, and for recreation, guide-outfitting, hunting, and trapping. These roads and roadsides will be seeded with the native grasses and forb mixture in Table 5-8 to provide forage for wildlife and livestock.

Roads not necessary for access will be identified and reclaimed. Culverts will be removed and replaced with cross-drainages where required to minimize long-term maintenance and re-establish natural surface drainage patterns. Surface runoff channels will be improved to accommodate closure design capacity flows, and cleared of debris, to prevent new channels from interfering with newly reclaimed areas.

Roads that will not be required post-closure will be “ripped” (scarified) to a minimum depth of 30 cm, and side-cast material and cutbanks will be recovered and spread over the road surface. This material can be supplemented with stockpiled soil to reach an appropriate depth for vegetation. Cutbanks will be re-contoured to below the angle of repose to reduce future slumping. Surface preparation will be carried out as per Section 5.4.1. The surface will then be planted according to the prescriptions in Section 5.5, with any adjustments made to match the end land uses designated in Figure 5-4 and Table 5-6.

6.8.2. *Haul Roads*

Site haul roads include the Waste Haul Road, Tailings Access Road, New Access Road, Wight Pit Haul Road, Wight Pit TSF Haul Road, and the Old TSF Haul Road. These roads are essentially linear NAG waste dumps, and the sides will be sloped to 2H:1V or flatter, to the extent possible. There are some limitations to achieving this slope related to water body crossings (for example the Tailings Access Road crossing of Bootjack Creek) and proximity to sensitive undisturbed land. Re-sloping will incorporate landform design and geomorphic considerations, consistent with those described for RDSs, with wildlife passage pathways being a key feature. Culverts will be removed and replaced with cross-drainages as appropriate. Surface runoff channels will be improved to accommodate design capacity flows, and cleared of debris, to prevent new channels from interfering with newly reclaimed areas.

Roads not required for access during closure will be fully reclaimed to match their end land use designations following the coversoil application and revegetation approaches for waste dumps, as described in Sections 5.4.1 and Section 5.5, respectively. Roads required for access will be partially reclaimed (edges re-sloped and revegetated as discussed above), with light vehicle and/or equipment access maintained.

6.9. Watercourses

Consistent with the closure water management plan (Section 5.2.4), contact water will be collected and treated prior to discharge to the receiving environment, as required to avoid adverse effects on the receiving aquatic environments. Collection system ditches that remain in perpetuity (e.g., the SERDS Ditch and Long Ditch as per the conceptual long-term plan) will be further armoured as required, with the banks and adjacent areas revegetated with riparian species, such as black cottonwood, willow (plugs or wattles and live stakes), and Sitka alder. At closure, habitats for riparian species and aquatic life will be established that will also provide forage for wildlife in wetland and riparian areas.

6.10. TSF Area Reclamation

The TSF contains NAG tailings and will remain as a permanent structure post-closure and will be reclaimed to productive land use. The post-closure ecosystems are shown in Figure 5-4, and their corresponding land uses are provided in Table 5-6. The final configuration of the TSF will include a small permanent pond and wetland area on the surface, with maximum 2H:1V embankment slopes, and a spillway for pond water level control.

The principal activities for the reclamation of the TSF will be as follows:

- removal of all infrastructure (Section 6.10.1)
- re-sloping and reclamation of embankments (Section 6.10.2)
- spillway construction (Section 6.10.3)
- revegetation of tailings surface (beach and pond; Section 6.10.4)
- reclamation of till borrow pits, as required (Section 6.10.5)

6.10.1. *TSF Infrastructure*

Upon Mine closure, surface facilities on the TSF will be removed in stages, salvaged, and sold or disposed of as per the procedure outlined in Section 6.1.4. The tailings conveyance systems will be removed and sold or disposed of following the end of tailings production. The seepage collection infrastructure and recycle pumps will be retained after closure until monitoring results indicate that the water quality from the TSF is suitable for direct release to the environment. The monitoring piezometers in the TSF will be maintained as long-term monitoring devices. Water management infrastructure will be maintained or decommissioned and removed in accordance with the closure water management plan (Section 5.4.2).

6.10.2. *TSF Embankments*

The TSF embankment consists of a till core with filter and transition layers and a free-draining rock shell (made up of NAG run-of-mine waste rock) on the downstream side. The TSF includes one embankment that is approximately 4.8 km in length. The embankment is subdivided into three sections, referred to as the Perimeter, Main, and South Embankments (Figure 1-3) that reach a maximum elevation of 970 m at closure. At the end of construction and long-term, each of these embankments will have a minimum static FoS of 1.5, and pseudo-static FoS of 1.0 (as per Canadian Dam Association [CDA] 2013, *Mines Act* Permit M-200 and *Health, Safety, and Reclamation Code for Mines in BC* [EMLI 2022]), meeting closure criteria requirements.

At closure, the downstream embankment slopes will be sloped to a maximum 2H:1V ratio, which will not negatively affect overall stability. It is anticipated that additional material will be required to achieve the desired slope design because cut-and-fill cannot be used in all areas of the embankment. The re-sloped embankments and the 2H:1V buttress slopes will then be reclaimed and revegetated as per Section 5.4.1, Section 5.5, respectively and target an ICHmk3_01 site series, which will be planted over 20 cm coversoil underlain by 10 cm of till.

At some closed sites, there are concerns with volunteer tree species growing on reclaimed TSF embankment slopes. These concerns center on the possibility that mature trees may fall over at some point, lifting soil associated with the root ball, which could in turn concentrate erosion with possible impacts on embankment stability. As the resloping for the MPMC TSF embankment will result in the placement of excess material to infill and create the 2H:1V slope, it is unlikely that erosion generated locally by such a mechanism could impact the deeper rockfill that is needed to maintain long-term embankment stability. While having the TSF align with the surrounding ecosystems and landscape is desirable, its overall post-closure stability and function are the priority.

6.10.3. *TSF Spillway*

Prior to active closure, the TSF pond will be reduced to about 250,000 m^3 of water. During the active closure and post-closure phases, the TSF pond will vary seasonally, but will be limited by the spillway invert (which occurs at 965.7 m) to a maximum volume of approximately 260,000 m^3 during passage of water through the spillway (Appendix H). As part of active closure, the spillway will be constructed at the north abutment near Corner 5 (Figure 1-3) Detailed information is provided in Appendix R. This spillway will consist of a riprap lined channel sized with sufficient capacity to handle the probable maximum flood considering storm water runoff and other inflows from the surrounding catchment, with considerations for maintaining appropriate freeboard. The spillway will be designed to limit the maximum pond size so that it does not exceed approximately 15% of the tailings surface area. Discharge from the spillway will be directed towards CCS water management channels. The final tailings surface will provide a positive gradient towards the spillway invert (Golder 2015c). The positive gradient will be achieved by management of the deposition of tailings slurry prior to closure.

6.10.4. *TSF Tailings Surface*

The largest component of the TSF disturbance is the TSF basin (approximately 214 ha). The Mine Site's tailings have been characterized to be NAG (SRK 2015), thus issues associated with PAG tailings are not a concern.

During operations, tailings have been deposited in the TSF basin from spigot points located along the embankment crest and form an average subaerial beach slope of approximately 1% and a subaqueous slope of approximately 3% (Golder 2015c). During normal operations, a minimum beach length of 100 m is to be maintained between the TSF pond and the embankment (Golder 2015c). In the final year of operation prior to active closure, the TSF pond will be pushed against the north abutment (Corner 5; Figure 1-3; Golder 2015c). The tailings deposition points will be moved out onto the tailings beach to reduce the tailings beach slope to about 0.5% (Golder 2015c). Discharge of tailings directly into the pond may be required to reduce the pond depth. The total area of the pond will fluctuate with seasonal and annual climate variations, but as indicated in Section 6.10.3 the pond has been designed to occupy a maximum of 15% of the total tailings surface, with the maximum elevation controlled by the spillway invert (Golder 2015c).

The NAG tailings will have variable levels of saturation during active and post-closure. Geochemical source terms were developed for both saturated and unsaturated tailings in the TSF (Appendix B-1). These source terms were included in the 2022 water quality model, as well as active closure and post-closure predictions (Appendix I). The source terms were reviewed in 2022 (Appendix B-4) by SRK, who found that an update of the source terms was not required.

Ongoing seepage from the TSF is expected following the active closure of the facility, and predictions of seepage direction, quantity, and quality have been developed (Appendix F). Seepage control measures during active closure and post-closure will consist of passive capture and collection in drainage sumps, which are presently routed through the WTP. Plans are progressing toward a distributed system with passive treatment (Section 4.4) that will subsequently return these waters to Hazeltine Creek and/or Edney Creek.

Overall, the target of reclamation of the TSF surface is to create a patchy mosaic of deciduous trees and shrub thickets with a gradual transition towards a wetland and pond near Corner 5 (Figure 1-3 and Figure 5-4), with dominant focus on the ICHmk3_06 and ICHmk3_07 site series. The end land use target consists of multiple uses as the ecosystem matures, including wildlife habitat and traditional use (Section 5.5.3).

The drier upland portions of the TSF will be covered with 5 cm of till and overlain with 5 cm of coversoil and/or a layer of biosolids at 65 dt/ha (currently in storage at the TSF biosolids stockpile). This cover material and fast-growing vegetation will assist in minimizing wind erosion. Artificial refuges (rock piles) will be created to allow for a more diffuse transition to the pond area, and provide diversity in wildlife habitat (e.g., edge effects). Unused woody debris (e.g., logs from log decks) may be scattered on the surface or placed as standing debris on the TSF beaches to create perching habitat for raptors.

Areas closer to the pond may not be immediately accessible due to low trafficability of the saturated tailings. As pond size reduces over time, till will be placed closer to the pond and revegetated. Land closer to the pond will be revegetated with deciduous species, including black cottonwood, willow (plugs or wattles and live stakes), and Sitka alder. Red osier dogwood may also be considered. Turfs, offsets, stolons, cuttings, and winter buds of aquatic plants will be collected from local sources, such as the wetland adjacent to the Mine Site, and planted in the pond. Water sedge, beaked sedge, common cattail, river horsetail, yellow pond lily, and narrow-leaved bur-reed are all present in Bootjack Lake, Polley Lake, and small wetlands in the surrounding area.

The key wildlife species anticipated to use the reclaimed TSF tailings surface include:

- Columbia spotted frog
- Pacific northwestern toad
- mallard
- green-winged teal
- bufflehead
- common snipe
- common yellowthroat
- Lincoln's sparrow
- muskrat
- moose

6.10.5. *TSF Till Borrow Pits*

The till borrow pits adjacent to the TSF were mined to obtain material for constructing the embankments' core. After reclamation, this landscape will include low-lying wetlands surrounded by riparian habitats and upland vegetation. This combination of ecosystems will provide a variety of habitat requirements for a diverse group of wildlife species including birds, small mammals, ungulates, and carnivores. The access to water and open riparian areas could also provide good grazing conditions for cattle. Additionally, this area should be well suited to traditional use activities and recreation (Table 5-1).

At the Southeast Till Borrow area, 22.25 ha has been re-contoured, treated with applied biosolids (12 ha), and revegetated. The wetland areas that have developed in low-lying depressions have several emergent grasses, bull rush, and beaked sedge growing. The dry land areas have a robust grasses and forb cover, with some early successional species (black cottonwood) encroaching. The cover of grasses forbs have been observed to provide range lands for the livestock that currently graze in this area. Monitoring is ongoing to determine requirements for additional planting. If additional tree and shrub planting is required, it will occur, as per Section 5.5, with consideration for agroforestry.

Some till borrow areas still require recontouring. Revegetation will follow the prescriptions in Section 5.5 for upland areas (ICHmk3_02 and ICHmk3_03 BEC series). Low-lying areas (ICHmk3_01, ICHmk3_05, and ICHmk3_07 site series) will focus on planting of deciduous species, including black cottonwood, willow (plugs or wattles and live stakes), Sitka alder, and potentially red osier dogwood. Potential transplants and seeding of wetland species could be carried out using vegetation already growing in the Southeast Till Borrow area, or from Bootjack Lake, Polley Lake, and neighbouring areas where species such as water sedge, beaked sedge, common cattail, river horsetail, yellow pond lily, and narrow-leaved bur-reed are found. Like the TSF tailings surface, this will be done through collection of turfs, offsets, stolons, cuttings, and winter buds of aquatic plants from local sources, and similar wildlife species are anticipated for post-closure use.

6.11. Underground Reclamation

As discussed in Section 1.2.3, the underground workings at the Mine Site are closed, and the Wight Pit Portal is secure. The following subsections describe the final decommissioning and active closure of the underground workings and mine openings.

6.11.1. *Decommissioning*

Due to the Mine Site's 2019 care and maintenance status, the underground was allowed to flood. Prior to flooding, most equipment and infrastructure were removed, along with fuels and reagents. Currently, only inert materials remain underground, thus, no further decommissioning of the underground is required at this time. MPMC may consider re-opening the underground in the future to access additional mineral resources.

6.11.2. *Mine Openings*

There are two openings associated with the underground mine, the Wight Pit Portal, and the Alimak Raise. The Wight Pit Portal was secured with loc-blocks, and then submerged under water as the Wight Pit flooded.

At the Alimak Raise, various capping options have been considered, including the construction of a simple concrete slab cap, and construction of a locked steel gate cover. To minimize long-term needs for monitoring and maintenance, and to minimize the risk of access to the raise, the raise will be backfilled with unconsolidated waste fill. The fill will be selected with from NAG material that is sufficiently coarse that drainage can pass through the rock if needed, and to not be at risk of liquefaction (which could theoretically cause the loss of fill material into the underground openings). An estimated 18 m^3 of ready-mix concrete will be used to seal the top of this backfill with a permanent cap. The ground surface in the immediate area of the former raise will be reclaimed following the coversoil and vegetation prescriptions applicable for the surrounding areas, as described in Section 5.

Little or no maintenance is anticipated to be required for the reclaimed areas after active closure, beyond what is planned for monitoring at the Wight Pit and other reclaimed areas. Periodic inspections of the closed Alimak Raise will include visual checks to confirm the integrity of the raise cap and surrounding ground surface, and that there are no signs of subsidence. As discussed in Section 5.1.6, there is little risk of subsidence caused by the collapse of underground voids at this site.

7. POST-CLOSURE MONITORING

Post-closure monitoring is an important aspect in achieving successful closure and includes:

- inspections and maintenance of geotechnical structures
- monitoring water chemistry and aquatic effects
- water treatment and discharge
- reclamation monitoring
- final decommissioning of site infrastructure that was left in place to support monitoring efforts

Requirements associated with these activities are described in the following subsections.

7.1. Inspections and Maintenance of Geotechnical Structures

The inspection and monitoring of the TSF will be aligned with the recommendations of the CDA for tailings facilities that cannot be decommissioned (CDA 2014). For the purposes of the 2022 MRP, it has been assumed that the TSF will undergo a dam safety inspection, carried out annually following mine closure by a qualified geotechnical engineer, with additional extra inspections possible after extreme events (such as rainfall exceeding a selected design return period). The inspections will focus on any conditions that could adversely impact the long-term function and stability of the structure. Annual inspection reports will be submitted to EMLI for review. TSF management in active closure will continue to follow the procedures outlined in the OMS Manual (Appendix W). Post-closure (approximately 10 years following end of operations), it is anticipated that the monitoring frequency may be reduced, potentially supplemented by remote monitoring of site instrumentation.

7.2. Water Quality and Aquatic Effects Monitoring

7.2.1. *Surface Water Quality Monitoring*

Surface water quality monitoring will continue during active closure for the same parameters monitored during operations (total and dissolved metals, nutrients, physical parameters, ions, and dissolved organic carbon), with QA/QC sampling procedures to continue. Sampling locations are shown in Figure 2-4.

Mine contact water will continue to be produced while reclamation is occurring (e.g., 10 years into active closure). During this time, and at ENV permit locations, water quality will be analyzed to understand changes in geochemistry of the Mine Site waste dumps and to confirm the accuracy of the long-term effluent quality predictions. Monitoring frequencies will follow the CEMP and the OMS Manual. Following the 10-year active closure phase sampling frequency can be reduced to annually or an alternative approved frequency if the receiving environment and mine contact water results are stable and meet applicable water quality

guidelines. Water quality monitoring stations are shown in Figure 2-4 and a summary of the monitoring schedule is provided in Table 7-1. Monitoring at some stations may be more frequent if water discharge is occurring, as discussed in the next section. During water quality sampling events, the associated water management infrastructure will be visually inspected. Current water quality modeling indicates that discharge at nine potential mine discharge locations, higher water quality concentrations are anticipated during the active closure phase compared to the post-closure period (Appendix I).

Table 7-1 Conceptual Closure Water Quality Monitoring Schedule (MPMC 2017)

Site Type	Site Name	Active Closure (Years 1-10)[1]	Post-Closure (Years 10-15) [1]	Post-Closure (Years 15+)[1]	Notes
Receiving Environment	North Dump Creek (W4a)	Quarterly	Annually	Annually	
	Bootjack Creek (W5)	Quarterly	Annually	Annually	
	Upper Edney Creek (W8)	Quarterly	Monthly	Quarterly	Downstream passive discharge to SESCP and MESCP
	Hazeltine Creek (W7/HAC-05)	Quarterly	Monthly	Quarterly	Downstream of Polley Lake (multiple inputs)
	W20 Creek (W20)	Quarterly	Annually	Annually	
	Mine Drainage Creek (W3a)	Quarterly	Monthly	Quarterly	Downstream of passive discharge from Mine Drainage Creek Sump
	Morehead Creek (W1)	Quarterly	Monthly	Quarterly	Downstream of Bootjack Lake (multiple inputs)
	6 km Creek (W12)	Quarterly	Annually	Annually	
	Bootjack Lake (B1, B2)	Bi-annually	Bi-annually	Bi-annually	Multiple passive discharge inputs
	Polley Lake (P1, P2)	Bi-annually	Bi-annually	Bi-annually	Multiple passive discharge inputs
Mine Water Collection System	TSF (E1)	Quarterly	Annually	Annually	
	MESCP (E4)	Quarterly	Monthly	Quarterly	Passive discharge to Edney Creek
	Cariboo Pit (E8)	N/A	N/A	N/A	Cariboo and Springer Pits will merge during operations, and passively discharge to Bootjack Lake
	Springer Pit (E11)	Quarterly	Monthly	Quarterly	
	Boundary Pit	Quarterly	Annually	Annually	No surface discharge; groundwater flow towards Bootjack Lake
	Wight Pit	Quarterly	Monthly	Quarterly	Passive discharge to Polley Lake
	NW Sump (E13)	Quarterly	Monthly	Quarterly	Passive Discharge to Bootjack Lake
	Mine Drainage Creek Sump (E14)	Quarterly	Monthly	Quarterly	Passive Discharge to Bootjack Lake
	Bootjack Creek Sump (E15)	Quarterly	Annually	Annually	
	9 km Sump (E17)	Quarterly	Monthly	Quarterly	Passive discharge to 6 km Creek
	CCS (E18)	Quarterly	Monthly (at PETBP)	Quarterly (at PETBP)	Passive discharge to Hazeltine Creek
	SESCP	Quarterly	Monthly	Quarterly	Passive discharge to Edney Creek

1) Sampling frequency increases to align with anticipated implementation of full-scale passive treatment and discharge systems; frequency to be decreased over time, when water quality becomes more stable.

7.2.2. *Groundwater Monitoring and Characterization*

A review of the groundwater monitoring program at the Mine Site was conducted (Golder 2016b). The outcomes of this review, found that monitoring during active closure and post-closure will likely consist of:

- sampling of the Springer Pit wells quarterly and measurements of water levels daily until conditions are stable and appropriately characterized, and then reducing monitoring frequency to annual monitoring for approximately five years
- sampling of a nested pair of monitoring wells near the Cariboo Pit, which would follow a similar monitoring pattern as described for the Springer Pit wells
- sampling of reconditioned wells adjacent to the Wight Pit, which would follow a similar monitoring pattern as described for the Springer Pit wells
- continued bi-annual (i.e., every six months) monitoring of wells adjacent to other facilities until trends are stable and the water chemistry and flow patterns are appropriately characterized, at which point the monitoring frequency will be reduced

Existing groundwater monitoring wells are shown in Figure 2-4. Contingency measures, such as lowering pit lake levels, installation of low-permeability barriers, treatment, and/or implementation of passive interception systems will be used if it is determined that the water quality in the pit lakes and associated seepage quantities are of concern. Detailed evaluations of these options will be developed as part of the ongoing water quality and water balance assessments for long-term water management planning.

7.2.3. *Water Discharge Aquatic Effects Monitoring*

Until the passive/semi-passive treatment system (Section 4.4) has been demonstrated to be able to be scaled up and implemented (and permitted), mine contact water will continue to be managed through the centralized system (e.g., WTP) with a single discharge to Quesnel Lake. Monitoring of this discharge will occur according to a monitoring plan (the CEMP) that will require ENV approval, and will likely be similar to the monitoring plan for operational water discharge. As the Mine Site transitions to distributed discharges, each point of discharge will be subject to monitoring requirements under *EMA* Permit 11678, and these requirements are anticipated to continue into post-closure.

During post-closure, the monitoring plan will consist of weekly water quality samples of the effluent at the discharge points (described in the water balance report; Appendix H), which over time will decrease to monthly samples. Routine (likely monthly) sampling in the receiving environment is also anticipated, along with biological monitoring (fish population and fish tissues, sediment chemistry, and benthic invertebrate monitoring). Biological monitoring will continue every three years as per the MDMER (Canada 2022), with the frequency of all monitoring decreasing as results stabilize (for example quarterly sampling and biological monitoring every six years), until such time when treatment of Mine Site runoff is not required, or passive systems are deemed to be sufficiently effective and not requiring long-term monitoring. MPMC will apply to become a closed mine under the MDMER (Canada 2022), which includes conducting a final biological monitoring study.

7.3. Hydrological Monitoring

The existing hydrometric stations (Figure 1-4) on receiving water creeks (Table 7-2) will continue operations during active closure and post-closure. Continuous water level monitoring equipment (pressure transducer and data logger) will continue to be operated at each site during non-freezing periods, and the rating curves will be updated and maintained, as required.

While hydrometric stations are only currently present at receiving locations, water levels will be measured quarterly in the TSF pond, and the Cariboo-Springer, Wight, and Boundary pits during post-closure.

Table 7-2 Conceptual Closure Hydrology Monitoring Schedule (MPMC 2017)

Station	Parameter	Type
Upper Hazeltine (H1)	Water Level/Flow	Continuous
Lower Hazeltine (H2)	Water Level/Flow	Continuous
Lower Edney (H3)	Water Level/Flow	Continuous
Morehead Creek (W1b)	Water Level/Flow	Continuous
6 km Creek (W12)	Water Level/Flow	Continuous
TSF Pond	Water Level	Quarterly
Cariboo-Springer Pit	Water Level	Quarterly
Wight Pit	Water Level	Quarterly
Boundary Pit	Water Level	Quarterly

7.4. Revegetation Monitoring

7.4.1. *Revegetation Assessments*

Reclamation monitoring and inspections of progressive reclamation sites will continue into closure. Monitoring is typically completed in the summer or early fall when plants are most easily identifiable. A general schedule for reclamation assessments is as follows:

- post-application visual inspections (e.g., soil test pits) after placement of coversoil to assess placement depth and to verify if recommended reclamation methods described Section 5.4.1 and the Soil Management Plan (Appendix M) were appropriately implemented
- assessment of revegetated areas following the first growing season to determine species composition (including presence of invasive species) and cover, as well as documentation of any areas of erosion
- observations of wildlife or grazing occurrences and usage;
- survival surveys of planted trees and shrubs immediately after planting (for quality control purposes)

- survival surveys of planted trees and shrubs following their first growing season
- periodic assessments of tree survival/growth and ground cover vegetation, decreasing in frequency over time (e.g., years two, five, and ten)

Monitoring will continue with additional reclamation activities occurring in an adaptive management process until performance criterion for these assessments provided in Table 7-3 have been met.

The proposed post-closure monitoring program for determining terrestrial reclamation success, is divided into a Goal-Objective-Criterion-Indicator hierarchy (Table 7-3). Each indicator consists of a measure, measurement method and a threshold value. Each objective (e.g., those presented in Section 3.1) has a set of criteria with measurable indicators associated with them as a means of determining whether the objective has been met. The premise is that if the criteria and objectives are achieved, the reclamation is trending towards meeting the goal, and subsequently, fulfilling the regulatory requirements of equivalent land capability. Where possible, reclaimed sites will be compared against pre-disturbance conditions or a comparable ecological benchmark in the natural landscape as part of post-closure monitoring. Additionally, this framework is designed to allow for continuous improvement through ongoing incorporation of new knowledge, technology, and stakeholder input.

Table 7-3 Reclamation Monitoring Criteria

Criteria	Indicator	Measure
Landform Function		
Landforms have geotechnical stability	Geotechnical stability	Visual inspection for the presence/absence of subsidence, erosion, deposition of sediment in low lying areas, ponding, gullying, rilling or slumping, including bank stability round watercourses and waterbodies
Landscape enhancements are appropriate to the ecosystem and increase the diversity of the landscape	Landscape enhancements	Presence of rocks, coarse woody debris, brush piles, snags, bird/bat boxes, etc.
Water		
The Mine Site's water balance meets the needs of the post-closure landscape	Successful function of the TSF and Cariboo-Springer Pit Spillways	Assessment of water levels in the TSF and Cariboo-Springer Pit No signs of instability of the TSF, or the TSF and Cariboo-Springer Spillways
	Water quality parameters	Water quality parameters support discharge of water to the receiving environment
	Pit lake elevation	Pit lake elevations align with projected modeling Pit lake elevations successfully cover PAG material
Soil		
Reclamation materials are placed appropriate to the landform	Soil depth	Average placement depth (m)
	Soil pH	Soil pH
	Soil moisture regime	Soil texture/particle size analysis (percent sand, percent silt, percent clay), placement depth, topography
Vegetation		

Table 7-3 Reclamation Monitoring Criteria

Criteria	Indicator	Measure
Terrestrial and aquatic vegetation common to the surrounding area is established	Plant community composition (terrestrial, riparian and, marsh/aquatic)	Presence, percent cover, distribution of noxious and prohibited noxious weeds
		Species inventory and percent cover by layer and species. Include damage codes (e.g., insect, browse)
The reclaimed landscape provides commercial forest (where designated as an end land use within the reclamation plan)	Regeneration of trees (commercial stocking)	Stocking (the percentage of a polygon that contains acceptable tree regeneration) (Information gathered to support this includes height, diameter at breast height (DBH) and age for potentially commercial tree species)
	Mortality of trees	Percent mortality between planting and ten years after planting
	Insects and disease	Percent of trees with signs of chewing, spots, eggs, nests or galls
	Browsing pressure	Percent of trees with signs of browsing on new shoots, bark damage
	Limitations to vegetation growth	Percent of trees with signs of chlorosis, stunting, unusual formations
Emergent Properties		
The reclaimed landscape provides for biodiversity	Patch size and shape	Patch sizes (ha)
	Food vegetation species	Food species for target wildlife species are present
	Plant community composition – diversity, richness, evenness and abundance	Species inventory, percent cover and density (stems/ha)
Traditional Ecological Value	Wildlife habitat that supports traditional use	Derived from Plant Community Composition
	Biodiversity that supports traditional use	Derived from Plant Community Composition and incidental wildlife observations
	Vegetation that supports traditional use	Derived from Plant Community Composition

7.4.2. *Soil and Vegetation Metal Uptake*

Section 5.6 and Appendix N discuss the 2022 ERA program for evaluating potential pathways for uptake of metals by ecological receptors at the Mine Site. Preliminary results indicate that there is minimal risk of metal uptake from reclaimed soil into vegetation and wildlife. However, copper was identified as a potential parameter of concern, and retained for further evaluation. MPMC plans to continue consultation with the Williams Lake Indian Band, Xatśūll First Nation, and ENV.

8. RECLAMATION AND CLOSURE SCHEDULE

MPMC's conceptual schedule for the Mine Site's active closure and post-closure periods are presented in Table 8-1, including the schedule for research leading up to the implementation of closure and reclamation works. This schedule is indicative and can be expected to evolve based on findings of reclamation research and progressive reclamation projects. It is also subject to change in accordance with changes to the mine plan.

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Operations and Research**	**1034 days**	**Mon 17-01-1**	**Thu 20-12-31**
2		Reclamation research	48 mons	Fri 17-04-28	Thu 20-12-31
3		**Water Treatment Studies**	**654 days**	**Mon 17-01-1**	**Thu 19-07-18**
4		Bench-scale test	6 mons	Mon 17-01-1	Fri 17-06-30
5		Passive pilot det design	3 mons	Sat 17-04-01	Thu 17-06-22
6		Pilot construction/startup	3 mons	Fri 17-06-23	Thu 17-09-14
7		Pilot operation and monitoring	24 mons	Fri 17-09-15	Thu 19-07-18
8		Full scale detailed design (passive system)	6.45 mons	Tue 19-01-01	Mon 19-07-01
9		**Geomorphic Design Studies**	**240 days**	**Mon 17-01-16**	**Fri 17-12-15**
10		Desktop stream review	3 mons	Mon 17-01-1	Fri 17-04-07
11		Field Investigation	6 mons	Mon 17-04-1	Fri 17-09-22
12		Design Document	3 mons	Mon 17-09-2	Fri 17-12-15
13		Risk Assessment	9 mons	Mon 17-01-1	Fri 17-09-22
14		**Cover Studies**	**718 days**	**Sat 17-04-01**	**Wed 20-01-0**
15		Laboratory/Simulation Studies	6 mons	Sat 17-04-01	Thu 17-09-14
16		Field Trials (if needed)	18 mons	Thu 18-03-01	Wed 19-07-1
17		Detailed Design	6 mons	Thu 19-07-18	Wed 20-01-0
18		**Pre Closure**	**326 days**	**Fri 19-03-01**	**Fri 20-05-29**
19		End of Mining Cariboo Springer	0 days	Fri 19-03-01	Fri 19-03-01
20		Stockpile Processing	16.3 mons	Fri 19-03-01	Fri 20-05-29
21		End of Milling	0 days	Fri 20-05-29	Fri 20-05-29
22		**Waste Dumps**	**780 days**	**Fri 19-03-01**	**Thu 22-02-24**
23		PAG Rehandling	24 mons	Fri 19-03-01	Thu 20-12-31
24		Temporary NW Stockpile Resloping	3 mons	Fri 21-01-01	Thu 21-03-25
25		Temporary NW Stockpile Substrate and Vegetation	12 mons	Fri 21-03-26	Thu 22-02-24
26		North Bell Dump Resloping	3 mons	Fri 19-03-01	Thu 19-05-23
27		North Bell Dump Substrate and Vegetation	12 mons	Fri 19-05-24	Thu 20-04-23
28		Boundary Dump Resloping	3 mons	Fri 19-05-24	Thu 19-08-15
29		Boundary Dump Substrate and Vegetation	12 mons	Fri 19-08-16	Thu 20-07-16
30		East RDS Resloping	3 mons	Fri 19-08-16	Thu 19-11-07

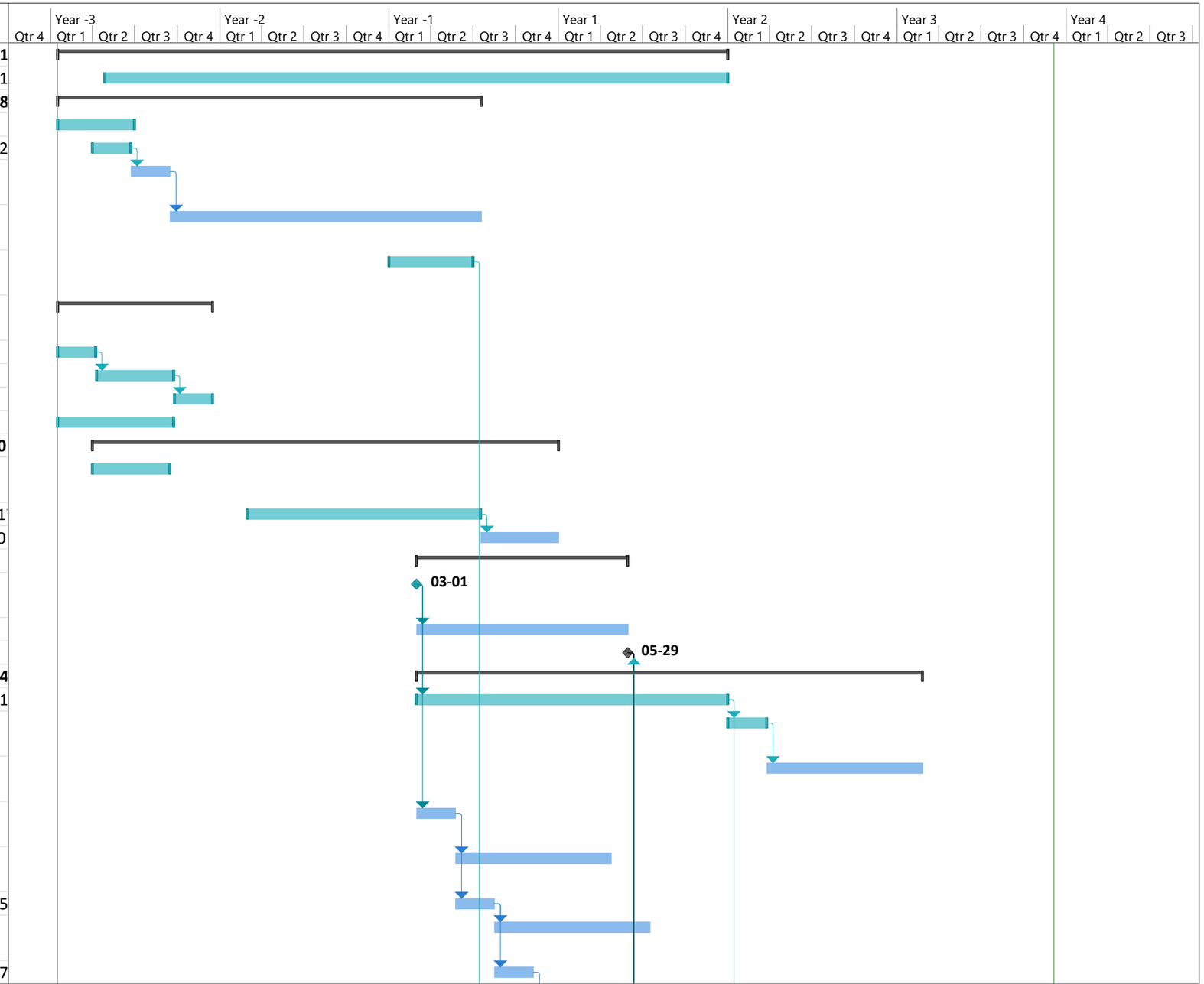

Project: Closure Schedule
Date: Mon 22-12-05

Task	Project Summary	Manual Task	Start-only	Deadline			
Split	Inactive Task	Duration-only	Finish-only	Progress			
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress			
Summary	Inactive Summary	Manual Summary	External Milestone				

9. RECLAMATION COST ESTIMATE

The reclamation cost estimate was prepared by MPMC and provided under separate cover.

10. CONSULTATION AND ENGAGEMENT

In 2012, MPMC implemented Participation Agreements with both First Nations groups that have interest in the area: Xat'sull Cm'etem (Soda Creek/Deep Creek First Nation) and the T'exelc (Williams Lake First Nation). Through these respective Participation Agreements, Implementation Committees were formed to facilitate open dialogue between both Nations and MPMC for discussing environmental, social and economic matters related to Mine development, operation, reclamation and closure (i.e., Mine updates, permitting, environmental protection, reclamation, employment opportunities, and potential joint ventures).

Consultation and engagement activities were reduced while the mine was on care and maintenance status. Mine restart activities in 2021 renewed interest in renegotiation of expired Participation Agreements. Williams Lake First Nation and MPMC signed the Revised Participation Agreement in April 2022. Talks are advancing between Xat'sull First Nation and MPMC at time of writing.

11. CLOSURE

This MRP reflects the planned mining, construction, environmental monitoring, and reclamation activities for the Mine Site. Consultants and Qualified Professionals were retained to conduct work considered outside the expertise of in-house personnel, as outlined in Table 11-1. Work by consultants to MPMC is primarily included as appended reports or technical memos. The information presented in this MRP is consistent with the level of care and skill normally exercised by professional scientists and engineers, or similar, currently practicing under similar conditions. Results, conclusions, and recommendations are based on information known at the point of report publication, and are based on any described assumptions. These results, conclusions, and recommendations may change with the availability of additional information.

Table 11-1 Qualified Professionals (retained and in house) Responsible for Completing Components of MPMC's Mine Plan and Reclamation Program 2022

Report Component	Qualified Professional(s)
Geotechnical stability (Open pits and RDSs)	J. Kelly Hood, B.A.Sc., P.Eng. (WSP Golder)
Spillway designs	James Ogilvie, P.Eng. (WSP Golder) Allan Bronsro, MCIP, M.Sc., P.Eng. (WSP Golder)
Effluent source term development Ore stockpile geochemistry	Stephen Day, M.Sc, P.Geo. (SRK) Chris Kennedy, Ph.D., P.Geo. (SRK)
Effluent modelling	Lee Nikl, M.Sc., R.P.Bio (WSP Golder)
Water balance modelling Water management planning Water quality modelling Water treatment	Gonzalo Donoso, M.Sc., P.Eng. (WSP Golder) John Diiwu, Ph.D, P.Eng. (WSP Golder) Steve Mitchell B.Sc Alison Snow, M.Sc. Jesse Maddaloni, MA Sc., P.Eng. (WSP Golder)
Hydrogeology	Jacqueline Foley, M.Sc., P.L.Geo. (WSP Golder) Don Chorley, P.Geo. (WSP Golder)
Reclamation – revegetation and soil management	Moss Giasson, P.Ag. (Montane Environmental Services) Ruth McDougall, M.Sc, P.Ag. (Consulting Agrologist) Ronald Meister, P.Ag., RPF (Forestmeister Services) Lisa May P.Biol, M.Sc (WSP Golder)
Closure planning	Loretta Ford, MSc, PAg (WSP Golder) Jorden Laskosky, M.Sc., P.Ag.
Contaminated Sites Assessment	Trish Miller, M.Sc, R.P.Bio. (WSP Golder)
Baseline Terrestrial Ecosystem Assessment	Trish Miller, M.Sc, R.P.Bio. (WSP Golder) Arainn Atkinson, R.B.Tech (WSP Golder)
Environmental Risk Assessment	Melissa Paliouras B.Sc., EP, QPRA Jorden Laskosky, M.Sc., P.Ag Samantha Lundquist, B.Sc., B.I.T Lindsay Furtado, M.Sc., R.P. Bio.
Fugitive dust management Particulate monitoring	Jeffrey Ramkellawan, M.Sc., P.Eng. (WSP Golder) Sean Capstick, P.Eng. (WSP Golder) Rachel Wyles, M.Eng., P.Eng. (WSP Golder) Shauna Litke, EIT (MPMC)

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Appendix A
2019 Remediation Plan

REPORT

Remediation Plan

Mount Polley Mine Perimeter Embankment Breach

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Executive Summary

This executive summary provides a high-level overview of the Remediation Plan (RP); however, because it is a brief summary, it should not be read in isolation of the full report.

Overview

The Mount Polley Mine, located in south-central British Columbia, 56 km northeast of Williams Lake near Likely, BC is an open-pit and underground copper and gold mine. On 4 August 2014, the failure of a glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility (TSF; "the breach") resulted in the release of a slurry of water, tailings, and dam construction material. The material released from the breach and the resulting debris flow resulted in physical impact to Hazeltine and Edney Creeks, Polley Lake, and Quesnel Lake. Approximately 1.36 km^2 of the breach area was scoured of forest and topsoil (floodplain zone). Tailings were also deposited on top of relatively undisturbed forest floor across an additional 100 hectares (ha; equivalent to 1.0 km^2) at the breach area. It is estimated that approximately 12.8 million m^3 (M m^3) of tailings was discharged to Quesnel Lake (plus an additional 5.8 M m^3 of native soil and TSF water) where some of that material settled in the West Basin over an area of approximately 1.81 km^2; and that an additional 1.6 M m^3 of tailings were deposited in the Polley Flats area and the Hazeltine Creek corridor.

Following the TSF breach an adaptive remediation framework was developed to guide and communicate the process of investigation, pollution abatement measures and remediation of areas affected by the breach. The strategy used a phased approach, focusing first on the immediate needs of establishing safe work conditions and controlling the further release of the tailings. To control turbidity, considerable erosion control work was carried out involving construction of a new foundational channel in Hazeltine Creek, designed with the foresight of re-establishing the creek as an aquatic and riparian habitat and planting adjacent soils. Habitat features have been installed on top of that foundational channel and though not yet complete, many of these habitat construction works have been advanced considerably and planning for them has been carried out through direct collaboration with environmental agencies and First Nations as well as their respective technical advisors for example, through the Habitat Remediation Working Group (HRWG).

The RP identifies the proposed remedial options and it outlines the rationale to select the preferred options where those have not already been selected during previous or ongoing work (e.g., by the HRWG). The RP is a requirement of the Ministry of Environment & Climate Change Strategy (ENV) Pollution Abatement Order (107461) which requires a RP that:

- Summarizes the remedial planning basis.
- Summarizes remedial actions that have already been carried out, including a description of the process and criteria that were used to evaluate options for remedial work that has been undertaken.
- Identifies the proposed remedial actions based on the results, conclusions and recommendations from the detailed site investigation, the human health risk assessment, and ecological risk assessment as delineated by area as defined in the Update Report: Post-Event Environmental Impact Assessment Report.

- Summarizes consultation on the remedial objectives and how the feedback received from that consultation has been accommodated within the remedial planning basis.
- Provides an implementation schedule.
- Provides a monitoring and reporting framework that will be integrated into the Comprehensive Environmental Monitoring Plan (CEMP) that is required in accordance with Permit 11678.

The remedial plan brings together agency requirements and commitments made by the Mount Polley Mining Corporation (MPMC), studies carried out to identify remedial needs and a roadmap towards compliance with the *Fisheries Act*, the *Environmental Management Act* and the *Water Sustainability Act*.

Remedial Planning Basis

The remedial planning basis provides a summary of the findings of previous studies that informed the evaluation of human and ecological risks, which in turn form the basis of the remediation that is needed to manage defined risks.

All scientific studies have uncertainties that are part of any scientific measurement. While uncertainty is not a basis for active remediation, such uncertainties do inform the need for monitoring and, if the monitoring results indicate that the objectives are not being met then they are used to identify further remedial actions as appropriate.

The remedial planning basis comes primarily from the human health and ecological risk assessments. The remedial planning basis is detailed by remediation area in the report; however, the impacts that require remediation are physical ones associated with scour and deposition of the breach-impacted water bodies and riparian areas. These physical impacts resulted in ecological effects in the form of fragmentation of water corridors in Edney and Hazeltine Creeks, loss of riparian vegetation, and the effects of those losses on aquatic organisms and riparian wildlife. Transient effects on water quality, mostly due to or associated with turbidity also occurred but these effects have subsided in most water bodies except for occasional increases in Hazeltine Creek, thought to be associated with remedial construction works. Changes to soil in the impacted area (such as a loss of organic carbon, soil nutrients and soil fauna), and changes to sediment (primarily low organic carbon content) particularly in the 1.81 km^2 of deposited outwash materials in Quesnel Lake, are also associated with risks for which remediation (or offsets) needs to be considered.

The remedial design basis comes from five outcomes that have connection to remediation. These are:

- Human health risks are acceptable and remediation for that purpose is not required.
- Some ecological risks are acceptable and remediation for that purpose is not required.
- Some ecological risks are acceptable but there is scientific uncertainty in that determination. Remediation is not identified for such risks, but monitoring is a requirement to address that uncertainty. Verification and, if data show it is necessary, then remedial work plans to address those risks would be developed.

- Some ecological risks are uncertain – neither an absence nor clear conclusion regarding risk can be made with current data. In such cases, a specific focused study/monitoring program is carried out as an addendum to the CEMP process. The results of that study will either identify the need for more detailed assessment, identify that risks are absent (compliance) or identify that remediation is required. For the latter finding, a remedial work plan would be developed.
- Remediation is clearly required (e.g., where an environmental effect has been identified without need for clarifying study). Remediation approaches are recommended in later sections of this plan. Because the remediation work is focused on habitat remediation, this includes identifiable physical work that has been completed, in progress, or to be carried out on site and habitat offsets to address impacts and productivity losses (including losses due to the passage of time) resulting from the breach.

Remediation Plan

Remediation Plan Components and Linkages

The remediation plan has been developed as information has been obtained from the numerous studies that have been carried out. The plan has connections to those studies, regulatory requirements, outcomes, and specific actions to be taken (e.g., habitat remediation and habitat offsets, monitoring). Figure ES-1 is a process diagram that outlines how risks and residual effects are managed: It outlines:

- The RP components that are identified for specific remedial actions.
- How remedial work is monitored and adjusted (either through repairs or adjustments to offset amounts) based on verification monitoring.
- How risks from tailings constituents in the environment are managed within the context of the various components of the remediation plan and how uncertainty, whether normal scientific uncertainty or uncertainty in whether a risk exists are addressed through the CEMP.
- How the RP is linked to compliance. In addition to standing regulatory requirements under both federal and provincial law, formal and specific regulatory requirements were invoked by ENV through the PAO and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR) through an Engineer's Order issued pursuant to the *Water Sustainability Act*. Fisheries and Oceans Canada (DFO) has referred to the general provisions contained in the *Fisheries Act*.

Figure ES-1 is an overview-level diagram and the plan, its components, and specific approaches are detailed in the report itself.

Because the tailings constituent risks are currently being addressed through the CEMP, most of the remediation plan addresses remediation primarily for physical impacts. Additional remedial work plans to address tailings constituent risks may be necessary should monitoring demonstrate such need.

Creek Habitats

The overall remedial objective for impacted stream habitats is to restore the life history functions of fish, in particular salmonids, by constructing an engineered stream base in the otherwise erodible glacial lacustrine native soils below Hazeltine Creek, with habitat features to support an aquatic ecosystem. Design features will also restore life history functions for wildlife associated with small streams and their riparian environments. Based on the remedial planning basis for the creek habitat, remedial needs for creek habitat are associated with the physical impacts of the breach event.

Creek remediation has been ongoing since it was safe to access the area downstream of the TSF. The process of creek remediation is:

- Habitat objectives for each reach of stream habitat were determined by the HRWG.
- Based on these objectives, channel morphology and habitat characteristics are designed and reviewed with the HRWG before being constructed.
- Following the construction of habitat based on reach-specific objectives, the habitat is evaluated based on pre-determined criteria and residual effects of the TSF breach on fish habitat. The functionality and value of that habitat is evaluated to determine whether habitat offsetting measures to address residual effects is warranted. DFO policy is followed to evaluate, rank and select appropriate offsetting measures.
- All construction and repair is documented and record drawings are produced. Post-construction evaluation may result in adjustments or repair to installed habitat features resulting in another round of implementation and evaluation.

Lake Habitats

The residual effects in Quesnel and Polley Lakes arise from the physical impacts of the breach outflow and associated materials as well as the low organic carbon content of the tailings and scoured glacial soils underlying the Hazeltine Creek alignment. The ecological risk assessment indicated that altered water quality is no longer an operable pathway of effect and thus the focus of the identification of potential lake remediation needs was on physical effects.

Physical habitat remediation (e.g., of the shoreline) and offsets will be addressed by the HRWG whereas options for remediation of the bed of Quesnel Lake were evaluated in this report. The options considered were dredging, amendment with organic carbon (because addition of organic carbon improved test performance in sediment tests) and monitored natural recovery (MNR). Quesnel Lake benthic organisms are showing signs of recovery but do not yet have similar organism abundance or diversity as the reference location. An evaluation of the net environmental benefits of each of these three options identified MNR as the clearly preferred option because it retains the recovery that has already occurred to date and does not result in new disruption of the lake bed or various other effects from the disturbance associated with the other options. Productivity losses are addressed through offsets.

For Polley Lake sediments, the options evaluation was based on similar considerations although the circumstances of Polley Lake are different in terms of its stage of benthic community recovery (it is already similar in diversity and abundance to the reference lake) making MNR a clearly preferred option for similar reasons. An additional issue, unique to Polley Lake is the age class structure of Rainbow Trout which shows a decreased abundance of juvenile trout, inferred to be the result of the post-breach separation of Polley Lake from the outlet stream (Hazeltine Creek), the location of much of the spawning habitat that supported trout recruitment pre-breach. To help address the reduction in available spawning habitat a trout hatchery was developed. The construction of in-stream spawning habitat in upper Hazeltine Creek occurred in 2017 and Polley Lake trout were re-introduced to the upper reaches of Hazeltine Creek in 2018. The hatchery and re-introduction were both successful with an estimated 4,890 adults spawning in the constructed habitat and producing and estimated 40,000 juvenile trout while the hatchery produced an estimated 18,084 juvenile trout that were also released into Polley Lake.

Terrestrial Habitats

Terrestrial ecosystems include riparian areas, floodplains and upland areas that are at a higher elevation than even the highest water levels. The residual risks to terrestrial habitats are from the physical impacts of the breach outflow and because the tailings lack the heterogeneity and nutrient processing that is part of a healthy soil or sediment ecosystem. The physical impacts (e.g., undercutting of banks, scour) have in part been addressed through the re-contouring of the slopes along Hazeltine Creek; however, the loss of forest soils is part of the needed remediation.

The terrestrial remediation strategy takes a managed successional trajectory approach to remediation, based on the principles of ecological succession. Site preparation methods can be used to A) mix forest floor, mineral soils and any residual tailings to increase soil porosity, B) create raised microsites that have aerated root zones, and C) create plantable microsites. These approaches have been applied in the breach-impacted terrestrial areas. If monitoring indicates it to be necessary, soil fertility can be further improved in areas with nutrient deficiencies by applying soil amendments such as imported soils, microbial inoculum and fertilizer in planting zones or in each planting hole. In the areas where site preparation has yet to be applied, it is important to preserve the organic matter in situ as much as possible and avoid soil compaction during site work. Effort was made to retain existing forest soil to provide organic carbon and nutrients and, in particular, to provide a source of inoculum for beneficial soil microbes.

Once soil conditions are amenable to seed germination and growth, early successional species will establish, and late successional species will slowly colonize through dispersal from nearby seed sources. To assist this process, extensive planting efforts have been undertaken to establish early-mid successional native species in the TSF breach area.

Residual Effects and Offsetting

It is expected that additional habitat will need to be provided to offset for the loss of habitat use following the breach and before habitat remediation has been undertaken. The HRWG will have the role of evaluating and prioritizing offsetting options to be constructed. To assist the HRWG in prioritizing offsetting options, residual effects and preliminary offsetting estimates were prepared, and potential offsetting opportunities were identified.

Where possible the residual effects of the breach were estimated for aquatic habitats by first comparing the before and after condition of the Ecological Units (EU) defined by the HRWG to quantify spatial and temporal losses of productive use of the habitat. Habitat Equivalency Analysis (HEA) was then used to calculate the area of habitat that would be required to offset the lost productivity of a given ecological unit from the time it was damaged to the time it was reconstructed. This allows for an accounting of productivity lost over the time since the breach and allows a mechanism to make adjustments based on habitat verification monitoring of remedial or offset habitat construction. A similar approach was also followed for upland terrestrial habitat.

This evaluation resulted in one of the following determinations for each EU:

- No offsetting required: this category was applied to ecological units that were: 1) not physically affected by the breach; 2) access to the habitat was restored before it affected a given ecological function (e.g., spawning, rearing); or 3) the quantum reconstructed habitat was greater than the damaged habitat and lost productivity.
- Offsetting required: this category was applied to EUs for which a spatial or temporal deficit in productivity was quantified. For some EUs this is considered a preliminary determination because further reconstruction activities are either being planned or are underway. The HEA will need to be re-run when the remediation activities are completed to finalize the offsetting requirement.
- To be determined: this category was applied to EUs for which the losses in productivity cannot yet be quantified or where traditional offsetting approaches may not be suitable.

Monitoring

Monitoring at Mount Polley is carried out under the CEMP which has been approved with conditions and must be updated every three years. The CEMP, which is a required part of MPMC's permits provides an adaptive framework and process for identifying monitoring needs and results across the whole of the mine. The main goal of RP monitoring is to support the successful implementation of the remediation plan and to verify that the remedial objectives have been met. In the event that the objectives have not been met, specific workplans focused on those areas will be developed with the benefit of the data obtained from the monitoring program. Because the technical backgrounds of specialists in monitoring programs that target chemical constituents and those that are focused on habitat construction success are different, the RP proposes that habitat success monitoring and adjustments be carried out through the HRWG. However, a single monitoring program could also work, provided that the necessary components were captured.

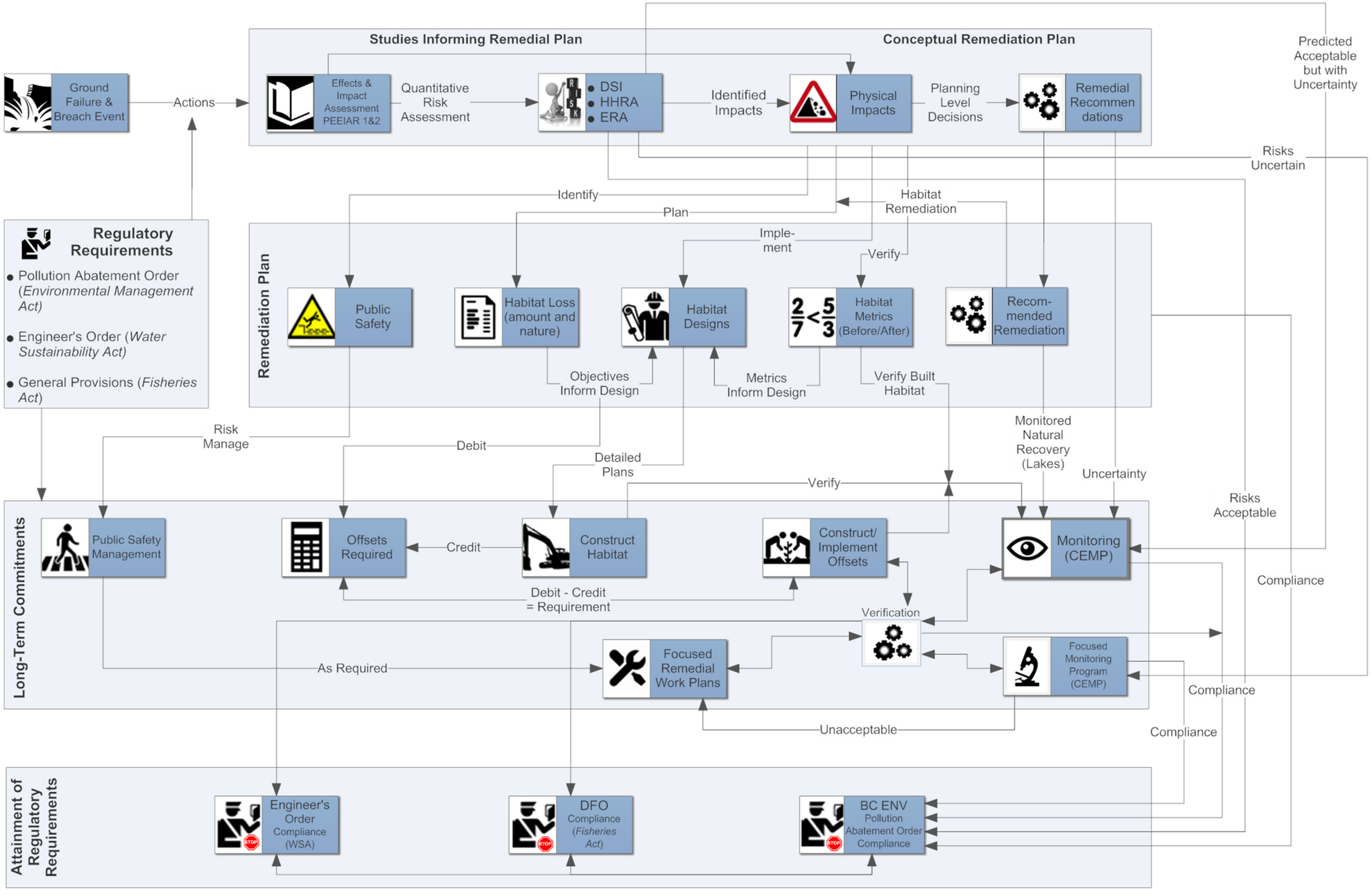

Figure ES-1: Diagrammatic Representation of Remediation Plan Component Linkages

Study Limitations

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List of Abbreviations and Acronyms

%	percent
ATV	all-terrain vehicle
BC	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
BLM	biotic ligand model
CCHMC	
CEMP	Comprehensive Environmental Monitoring Plan
COPC	contaminant of primary concern
CPUA	catch per unit area
CPUE	catch per unit effort
CRA	commercial, recreational, and Aboriginal fishery
CSD	cutter suction dredge
CSR	Contaminated Sites Regulation
CWD	coarse woody debris
DBH	diameter at breast height
DCP	Dynamic Cone Penetrometer
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
DSI	detailed site investigation
EC1	Upper Edney Creek
EC2	Middle Edney Creek
EC3	Lower Edney Creek
EMA	*Environmental Management Act*
EMPR	Ministry of Energy, Mines and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy (formerly Ministry of Environment)
EO	
EPT	Ephemeroptera, Plecoptera, Trichoptera taxa
ERA	Ecological Risk Assessment
EU	ecological unit
FLNR	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FPP	Fisheries Protection Plan
Golder	Golder Associates Ltd.
H1	Upper Hazeltine Creek
H2	Lower Hazeltine Creek
ha	hectare
HEA	Habitat Equivalency Analysis
HHRA	human health risk assessment
HRWG	Habitat Remediation Working Group
IC	Implementation Committees
ICH	Interior Cedar Hemlock
ICHmk3	Interior Cedar Hemlock Horsefly Moist Cool subzone variant

ICHwk2 ..... Interior Cedar Hemlock Quesnel Wet Cool subzone variant
IERP ..... Independent Expert Review Panel
km ..... kilometer
LWD ..... large woody debris
mg ..... milligrams
m ..... meter
MAF ..... mean annual flood
mm ..... millimeter
MDMER ..... Metal and Diamond Mining Effluent Regulations
MOE ..... Ministry of Environment (now Ministry of Environment and Climate Change Strategy)
MMER ..... Metal Mining Effluent Regulations
MNA ..... Monitored Natural Attenuation
MNR ..... monitored natural recovery
MPMC ..... Mount Polley Mining Corporation
NAG ..... non-potentially acid generating
NEBA ..... net environmental benefit analysis
NTU ..... nephelometric turbidity unit
PAO ..... Pollution Abatement Order
PBET ..... physiologically based extraction test
PEEIAR ..... Post-event Environmental Impact Assessment Report
PLC ..... Public Liaison Committee
QL ..... Quesnel Lake
QP ..... Qualified Professional
ROV ..... remote operated vehicle
RP ..... Remediation Plan
SBEB ..... science-based environmental benchmark
SCIB .....
SOD ..... small organic debris
TBD ..... to be determined
TOC ..... total organic carbon
TRV ..... toxicity reference value
TSF ..... Tailings Storage Facility
UBC ..... University of British Columbia
Wbf ..... bankfull width
WLIB .....
WQG ..... water quality guidelines
WSA ..... *Water Sustainability Act*
YOY ..... Young of Year

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1.0 INTRODUCTION

1.1 Background

The Mount Polley Mine, located in south-central British Columbia, 56 km northeast of Williams Lake near Likely, British Columbia (BC) is an open-pit and underground copper and gold mine operating at a deposit formed approximately 200 million years ago and classified as an alkalic copper-gold porphyry. Primary ore minerals are chalcopyrite and bornite (copper sulfide minerals). Mining commenced in 1997, and produces approximately 22,000 tonne per day and employs approximately 350 persons when fully operational.

On 4 August 2014, the failure of a glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility (TSF; “the breach”), that was not appropriately characterized in initial geotechnical site investigations, resulted in the release of a slurry of water, tailings, and dam construction material. The TSF for the Mount Polley Mine is located on the east side of the mine site (Figure 1).

The material released from the breach and the resulting debris flow resulted in physical impact to Hazeltine and Edney Creeks, Polley Lake and Quesnel Lake. Approximately 1.36 km^2 of the breach-impacted area was scoured of forest and topsoil (floodplain zone). Tailings were also deposited on top of relatively undisturbed forest floor across an additional 100 hectares (ha; equivalent to 1.0 km^2) of the breach area. It is estimated that approximately 12.8 million m^3 (M m^3) of tailings was discharged to Quesnel Lake (plus an additional 5.8 M m^3 of native soil and TSF water), and that 1.6 M m^3 of tailings were deposited in the Polley Flats area and the Hazeltine Creek corridor. In areas where the tailings covered the forest floor, air exchange for plant roots and the soil microbial community was impeded causing a hypoxic or anaerobic environment for the plant roots, resulting in tree mortality.

The deposited breach materials exceeded some regulatory standards for soils and sediments (Golder 2016a), though it is noted that some of these standards were also exceeded in non-impacted soils and sediments. In the early post-breach stages, ambient water quality guidelines (WQG) in affected waters were also exceeded. Water quality has since returned to meeting WQG in most water, although exceedances of those guidelines still occur in parts of Hazeltine Creek. The WQG exceedances in Hazeltine Creek may be due to ongoing remediation-related construction activity and are being monitored to confirm expectations from geochemical studies (Kennedy et al. 2016).

Extensive environmental impact studies (MPMC 2015a; Golder 2016a; Nikl et al. 2016; Kennedy et al. 2016; Golder 2017a, b, c) and environmental remediation works (Bronsro et al. 2016; Ogilvie et al. 2018) have been undertaken since the breach. Immediately after the breach, Mount Polley Mining Corporation (MPMC) implemented a remediation strategy (Figure 1, described further below). That strategy included stabilization and containment of the breach and the tailings remaining in the TSF (estimated to be on the order of 75 to 80%), removal of the bulk of the spilled tailings, construction of sediment control ponds, construction of a new creek channel and other erosion control measures as well as ecological remediation (which included applying soil improvement and revegetation techniques to improve functional environmental values in the impacted areas). This work is ongoing and continues to improve the site conditions.

MPMC also developed a strategy following the breach to assist in the process of investigation and remediation of areas affected by the breach. The strategy followed a phased approach, focusing first on the immediate needs of establishing safe work conditions and controlling the release of the tailings. Many of these works have been advanced considerably and planning for them has been carried out through direct collaboration with government agencies and First Nations as well as their respective technical advisors; for example, through the Habitat Remediation Working Group (HRWG).

The original framework for the TSF breach response framework consists of four main phases (Figure 2) and nine identified remediation areas (Figure 1) that break up the breach-impacted areas into smaller management units. Ideally, the remediation framework phases are presented sequentially with the information generated or decisions made in one phase feeding into the planning, actions or definition of information needs for a subsequent phase. However, given the dynamic nature of the response and the environmental and regulatory conditions under which it was implemented, some of the actions required adaptive sequencing, but are nevertheless consistent with the intent of the framework (see for example Nikl et al. 2016). Some changes to the framework have occurred during implementation; for instance, the performance verification plan was replaced by the Comprehensive Environmental Monitoring Plan (CEMP).

Government and MPMC recognized that an adaptive response was required for an incident of this nature. The regulatory instruments (e.g., Pollution Abatement Order [PAO] 107461 [the Order], and the instructions issued pursuant to the Order) were themselves adaptive. Amended orders were issued by government during the response as physical works progressed, more data became available and government identified the need to adjust/update the contents of the order. The Remediation Plan (RP) lays out the basis for remediation such that the breach area is on a trajectory of self-sustaining ecological processes that result in productive and connected habitats for aquatic and terrestrial species.

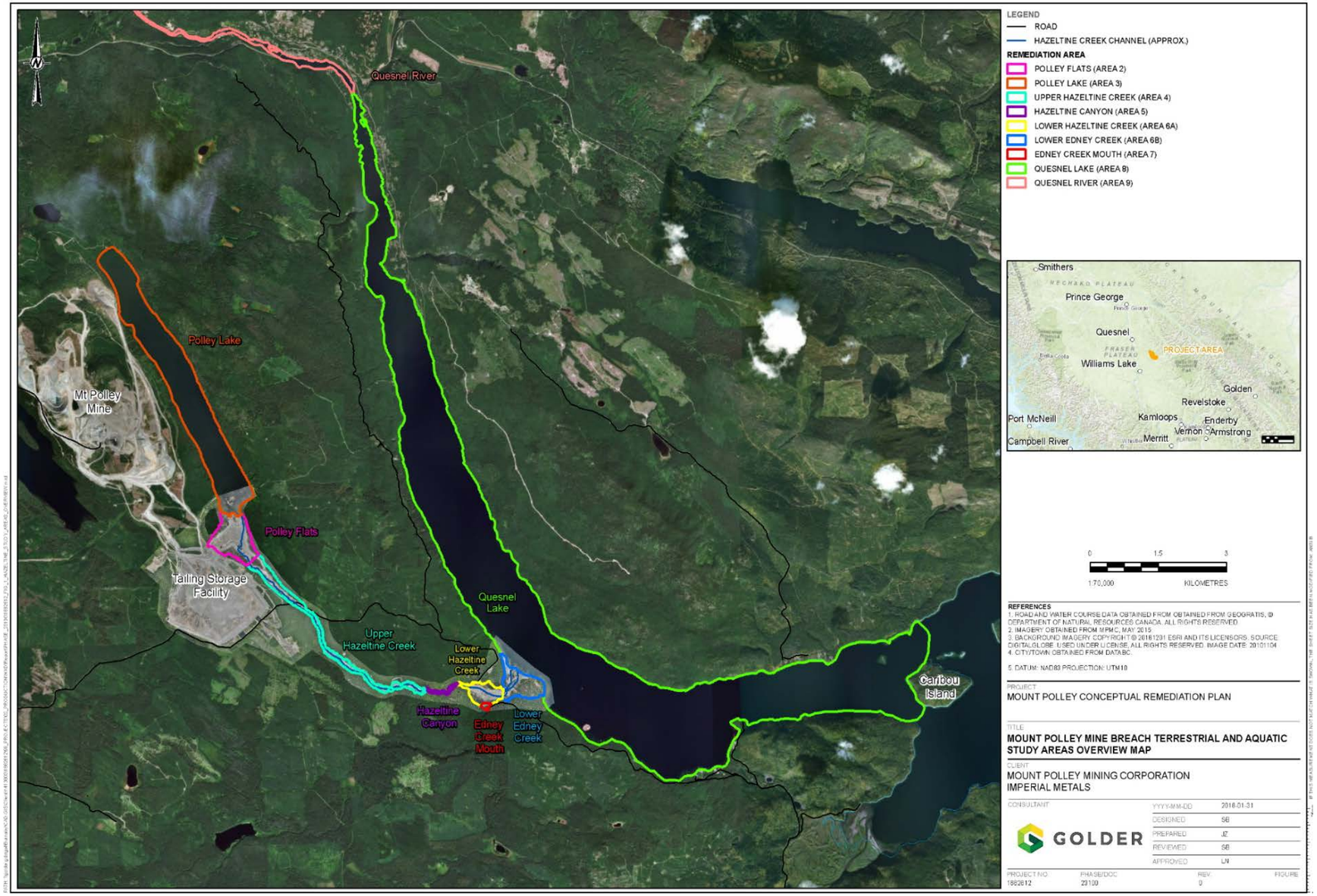

Figure 1: Mount Polley Mine Breach Terrestrial and Aquatic Remediation Areas Overview Map

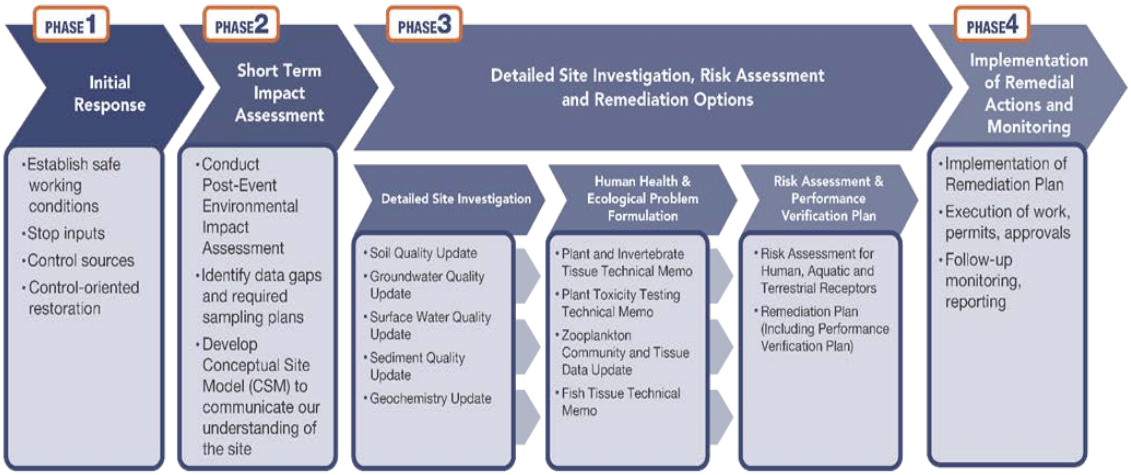

Figure 2: Mount Polley Tailings Storage Facility Breach Response Remediation Framework (this report represents the last element in Phase 3)

This RP was prepared for application to the area impacted by the 2014 TSF breach. Currently, remedial actions related to the breach are in the implementation or planning stages, depending on the specific area. This document describes the RP for the TSF breach-impacted area and identifies important issues that need to be considered so that further remediation can be undertaken in an efficient and compatible manner to maximize improvement of local ecosystems and fish habitat. Monitoring is an important part of the RP to assess the success of remediation and minimize risks and uncertainty. The verification monitoring program identified in this RP will become part of the CEMP. which includes breach-related monitoring carried forward to address uncertainties identified in the Ecological Risk Assessment (ERA) (Golder 2017c) and monitoring relating to permit conditions and other mine activities.

The RP follows common remediation practice as adapted for the specific circumstances of this site, though certain steps have necessarily been asynchronous, due to the adaptive response required (see above). Therefore, there are some differences in the report structure for each of the remediation areas because for some areas, remedial decisions were developed and implemented early in the breach response program (e.g., Upper Hazeltine Channel reconstruction), with options evaluations having taken place through the HRWG during the design-build process. In other areas, such as the profundal zone of Quesnel Lake where tailings material was deposited, an evaluation of remediation options is provided in this document.

1.2 Goals and Objectives

The scope of the RP considers the following requirements as contained in Section 3.0 of PAO 107461 (dated 9 June 2017):

i) A summary of the remedial planning basis (Section 3.0).

ii) A summary of remedial actions that have already been carried out, including a description of the process and criteria that were used to evaluate options for remedial work that has been undertaken (Section 4.0).

iii) The proposed remedial actions based on the results, conclusions and recommendations from the detailed site investigation (DSI), the human health risk assessment (HHRA), ERA, delineated by area as illustrated in Figure 1.

iv) A description of consultation completed with local First Nations and with stakeholders on the remedial objectives and how remedial objectives have been refined considering the outcome of such consultation (Section 3.4).

v) An implementation schedule (Section 6.0).

vi) Monitoring and reporting are a common expectation of a remediation plan; however, a monitoring and reporting framework will be integrated into the comprehensive environmental monitoring plan (CEMP) required in Permit 11678 and is therefore not included in this plan. A discussion on the implementation of monitoring for habitat remediation is provided in Section 6.0.

The definition of remedial actions as used here is adopted from the common definition provided by MOE (2015) and which means "…action to eliminate, limit, correct, counteract, mitigate or remove any contaminant or the adverse effects on the environment or human health of any contaminant". In this report, we have adopted remediation to also mean rehabilitation which has been used in the breach response program to refer primarily to the rehabilitation of ecological function due to physical impacts from the breach event. These definitions are sufficiently similar to expectations of Fisheries and Oceans Canada (DFO) and Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (FLNR) such that this remedial plan is intended to provide a plan suitable for all environmental agencies. The regulatory and policy framework is further described in Section 2.0.

The remedial planning basis, which draws on the DSI, the HHRA and the ERA and outlines linkages between chemical and physical stressors, how these are being remediated and linkages to regulatory compliance requirements is provided in Section 4.0. Section 5.0 sets out specific remedial objectives and actions for each remediation area and identifies the impacts in need of remediation and offsetting amounts, based on available information at time of writing. Environmental remediation actions described in the RP integrate a range of technical disciplines including geotechnical and river engineering, geochemistry, aquatic and terrestrial ecology and ecological and human health risk assessment. The remediation actions described here incorporate input from the HRWG which includes representatives of MPMC and its consulting team, government and the local First Nations. The HRWG were also involved in the development of the reports that form the remedial planning basis.

This RP seeks to:

- Outline the remediation activities that MPMC have conducted and outline how those remedial decisions were made.
- Outline the basis (rationale) for remedial planning and decisions.
- Outline the components of the remedial plan and their linkages between physical remedial works such as for damaged habitats and how metal contaminants are addressed through risk management, additional study where risks are uncertain or monitoring where there is uncertainty and, where monitoring studies show that risk management is insufficient, the development of focused remedial work plans to address those.
- Identify areas and amounts where further remediation is needed.

- Identify options for remediation where applicable.
- Discuss advantages/limitations of remediation options.
- Make recommendations for remediation where needed.
- Develop a plan and schedule for remediation of additional areas where needed.
- Identify monitoring components that are applicable to the RP such that there is a logical linkage between the RP and the CEMP (also as noted above to address uncertainties in risk assessments).

Detailed workplans and designs are not typically provided within a RP. The detailed workplans will be developed within the context of the RP but external to the RP, for instance as guided by the outputs of the HRWG (see Section 3.3).

1.3 Remediation Areas

Remediation areas were defined early in the breach response. The areas were numbered approximately in the order of the event propagation and were defined based on distinct physical and biotic differences in the downstream area when compared to the upstream area. These remediation areas start at the TSF (Area 1), and continue on to Polley Flats (Area 2, which includes the previously named “Polley Plug” area), Polley Lake (Area 3), Upper Hazeltine Creek (Area 4), Hazeltine Canyon (Area 5), Lower Hazeltine Creek (Area 6 – which includes Lower Edney Creek), Edney Creek Mouth (Area 7), Quesnel Lake (Area 8) and Quesnel River (Area 9) (Figure 1). The areas were defined to better manage interim assessment and remediation efforts, and to define knowledge gaps to be addressed by subsequent studies. The remediation areas and interim remediation plan, originally produced as a table, were also developed to enable communication of the work and direction of future work to agencies, the local community and First Nations. Detailed descriptions of these areas are provided in Section 4.0.

For planning and execution of the habitat remediation work, Hazeltine Creek is further described by six stream reaches based on several attributes including dominant valley and stream types, stream order and tributary confluences, major infrastructure, and vegetation characteristics. Stream reaches are delineated in Figure 3 and described in the Section 4.0.

Aquatic habitat has also been divided into aquatic ecological units (EUs), based on fish community and the nature of disturbance, as part of the outputs of the HRWG (Figure 4). Edney Creek was split into three ecological units (E1 to E3), Hazeltine Creek was split into two EUs (H1 and H2), Quesnel Lake was split into three EUs (Limnetic, Littoral, and Benthic[1] zones), and Polley Lake and Quesnel River are each their own ecological unit (similar to the remediation area definitions). Additional information on these ecological units and how they are used is provided in Section 4.0. The ecological units approximately correspond to the remedial areas. The assessment and delineation of tailings and tailings constituent contamination has been delineated using the remedial areas (Figure 1 and Figure 3) whereas the EU delineations are more directly applicable to the remediation of aquatic habitats (Figure 4). In the text descriptions, we have attempted to cross reference each of these approaches to remedial areas.

[1] Also known as the “profundal” zone

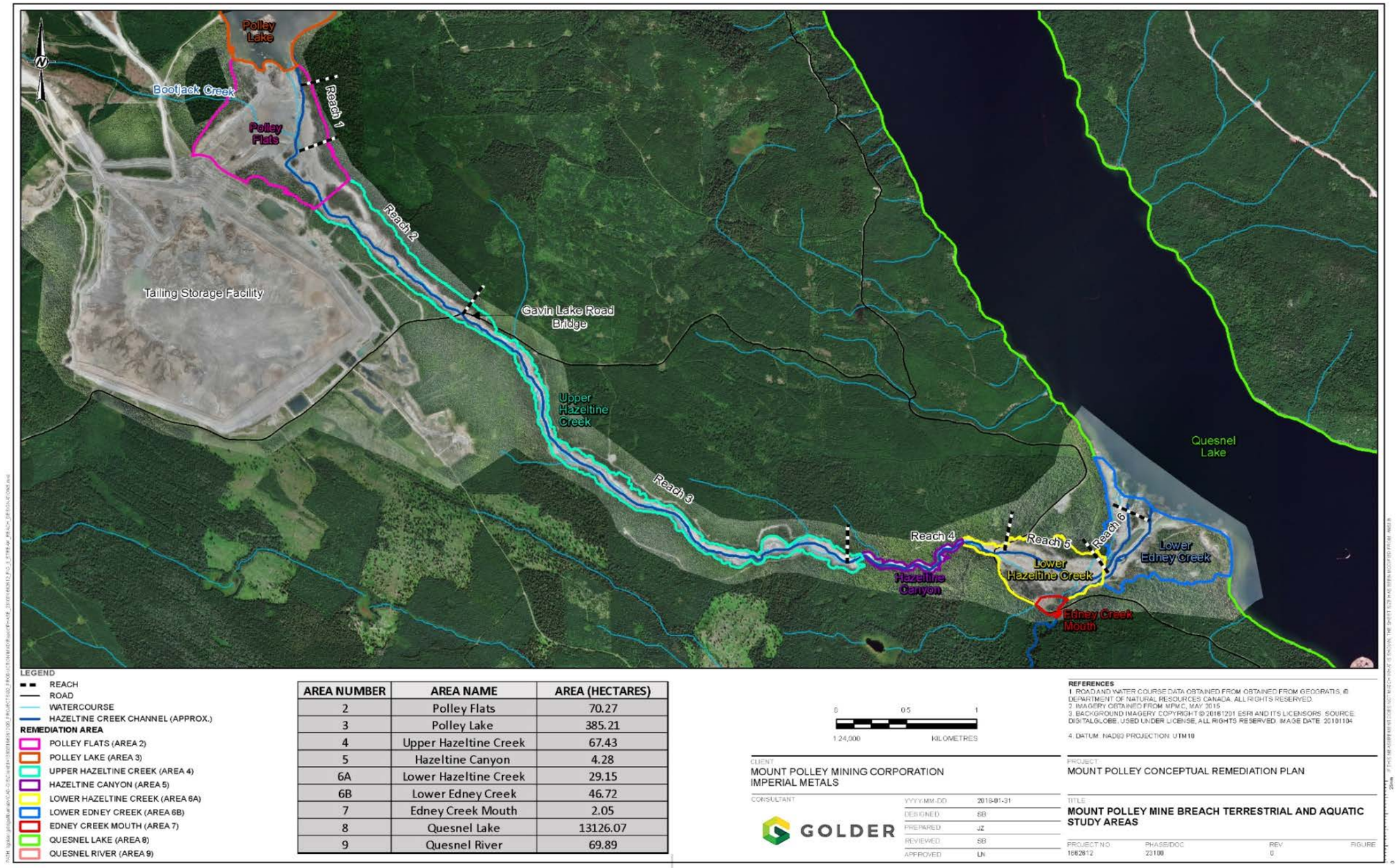

Figure 3: Overview of Stream Reach Designations

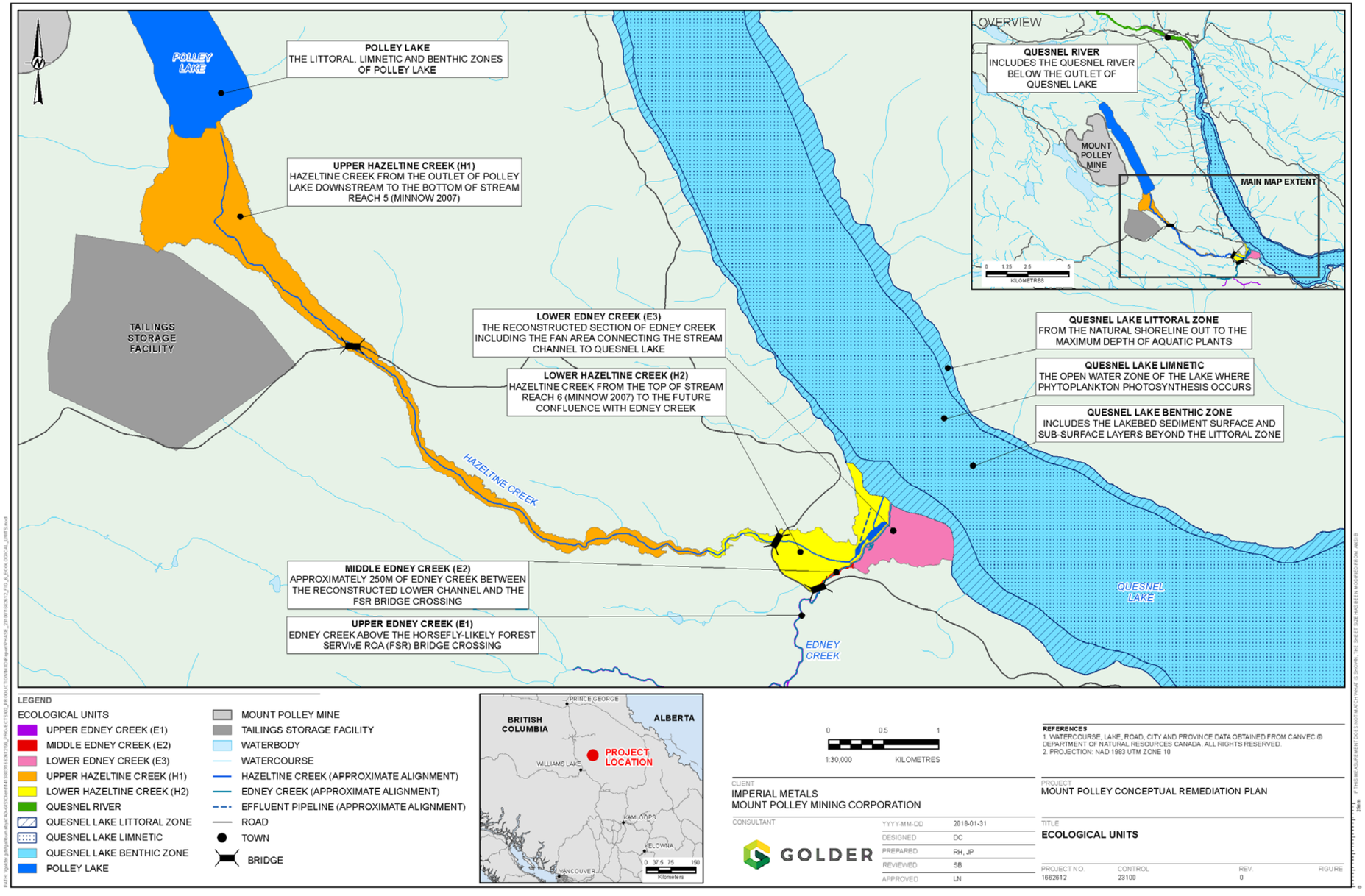

Figure 4: Map Showing the Ecological Units as Used by the Habitat Remediation Working Group

2.0 REGULATORY AND POLICY FRAMEWORK

This section articulates the regulatory requirements that form the basis of this RP. MPMC has obligations under PAO 107461 issued on 9 June 2017 (amending and consolidating previous Orders) pursuant to Section 83 (1c) of the *Environmental Management Act* (EMA). This overview is limited to remediation of the breach response event which is the subject of this RP; however, it is noted that the Mount Polley Mine is subject to other regulatory and policy drivers such as various operational permits, and the federal Metal and Diamond Mining Effluent Regulation (MDMER)[2].

While the repairs to the damaged portion of the perimeter embankment was part of breach response, those repairs, while ultimately environmental in outcomes, are of an engineering nature and have been regulated externally to PAO 107461 by BC Ministry of Energy, Mines and Petroleum Resources (EMPR). The breach repair and additional subsurface investigations and structural upgrade work has been completed and has been reviewed and inspected by government and by an Independent Expert Review Panel (IERP). It is not the subject of the RP which primarily deals with environmental matters.

2.1 Federal

Federal legislation and policy that applies to the breach response and remediation comes from the general provisions of the *Fisheries Act* regarding “Fisheries Protection and Pollution Prevention” (Sections 35 through 38). Early in the response, it was determined by DFO that an Authorization under the *Fisheries Act* was not required to remediate Hazeltine Creek (DFO 2014); however, that determination came with recommendations by DFO and reciprocal desire by MPMC to develop a framework for establishing habitat remediation objectives for each of the impacted areas and a recommendation that provincial agencies and First Nations be included in the development of such objectives. The resulting process was the establishment of what is presently called the HRWG that provides a collaborative process including federal and provincial agencies and First Nations that collectively contribute to the establishment of remedial objectives, an evaluation of the habitat design options to deliver those objectives and monitoring to verify objectives attainment. This collaborative process also provides a means by which agency mandates are met (e.g., *Fisheries Act* – S.38, BC *Water Sustainability Act* – Engineer’s Order (EO), see below).

It is noted that while the Mount Polley Mine is subject to the MDMER because it is an operating metal mine, the remedial plan addresses the breach response and not mine operations which are addressed separately by MPMC.

The Fisheries Protection Program (FPP) of DFO administers the fisheries protection provisions of the *Fisheries Act*. The FPP manage impacts to commercial, recreational, and Aboriginal (CRA) fish and fish habitat through a set of policies that include the general guidance provided by the Fisheries Protection Policy Statement and the guiding principles related to the creation or enhancement of fish habitat provided by the Fisheries Productivity Investment Policy. DFO is a member of the HRWG and this is currently the main vehicle through which fish habitat remediation is provided direction and has linkages to the provincial requirements as described in the following section.

[2] The MDMER replaced the Metal Mining Effluent Regulations (MMER) in 2018.

2.2 Provincial

The main provincial regulatory mechanism applicable to the breach response has been PAO 107461. This PAO and its supporting legislation provides the BC Ministry of Environment and Climate Change Strategy (ENV) with broad powers to compel, among other actions, studies that quantify the impacts of the breach, measures to stop further discharges, identify and implement remediation works and to provide reports related to those measures. The documents that form the remedial planning basis (e.g., Post-event environmental impact assessment reports [PEEIAR], DSI, HHRA, and ERA) were requirements of the PAO and this RP also became a requirement of that PAO. A PAO is issued when ENV believe that "pollution" (as defined in EMA) has occurred, or is occurring, and that measures are needed to abate (decrease) pollution. An example of pollution abatement measures carried out by MPMC included stopping the discharge of turbid flows into Quesnel Lake along Hazeltine Creek. By agreement with the local First Nations, the provincial government exercises its authorities with the participation of the First Nations through a government-to-government (G2G) relationship and full information sharing has been a part of that agreement.

A provincial permit for the discharge of treated water (Permit 11678) primarily deals with matters of mine operation and not breach response; however, a condition of that permit is for an updated CEMP. The CEMP includes not only monitoring related to the permit but also includes monitoring related to the breach. Its inclusion as a permit condition provides ENV with an enduring means to compel breach-related monitoring. The CEMP is a key component of the RP as it is the main vehicle to address scientific uncertainty and situations where risks are uncertain. The CEMP also provides a suitable mechanism to adjust (adapt) the monitoring program to data that are collected in the future.

The *Water Sustainability Act* (WSA), which replaced the recently repealed *Water Act*, governs several activities related to habitat remediation, most directly so with regards to the remediation of Hazeltine Creek where there are works in and about a stream. The FLNR are responsible for the WSA and have issued an Engineer's Order under that Act, dated 31 October 2014, amended 10 August 2015 and varied by way of letter. The underlying premise behind the Engineer's Order arises from Section 46 of the WSA which prohibits the introduction of foreign material into a stream in such quantities that cause adverse impacts to the stream, existing water users, property owners aquifers or the aquatic ecosystem and Section 47 of that Act which sets out the authorities of the Engineer to order works in respect of Section 46.

The authorities available under this order also include consideration of impacts to physical and chemical conditions in the aquatic habitat in the streams, rivers and lakes. That order enabled and required several remedial actions such as Quesnel and Polley Lake debris removal from the lake surface and shorelines, management of Polley Lake water levels for safety purposes (when there was concern about the "Polley Plug"), bridge replacement work (Gavin Lake Road Bridge and Ditch Road Bridge), and habitat remediation work. Additionally, the Order is an enabling document in that the necessary "works in and about a stream", particularly the habitat remediation work can lawfully proceed in accordance with the WSA.

The Engineer's Order contains 3 requirements, which, as noted in the cover letter, are to have works carried out consistent with instructions from other provincial ministries and federal agencies. The 3 requirements are:

- Collect and remove such debris from Hazeltine Creek, Quesnel Lake, and Polley Lake that threaten public safety, road infrastructure and stream channel stability.
- Maintain the lake level of Polley Lake in a manner that prevents further mass movement of material from Polley Lake and Hazeltine Creek.

- In accordance with direction of the Provincial and Federal government officials: undertake habitat remediation work on Edney Creek, Hazeltine Creek, Quesnel Lake, and Polley Lake.

There is an expectation under the WSA that the natural functioning state of the impacted environment be returned (Section 47 (1) (c)). In situations where that is not feasible, or the functioning condition of the environment has been impaired, additional compensatory measures (offsetting) may be ordered by the Engineer as per section 47(2) of the WSA. A temporary water license (5002-458) was also issued by FLNR and this license enables habitat remediation work to be carried out outside of the mine area.

While there are differences between the various federal and provincial environmental requirements and agency specialization, in all cases a return to productive function of the impacted environment, and offsets for the residual effects are shared commonalities. While there may be some minor policy differences in how these requirements could be operationalized, these operational differences can be resolved through dialogue with MPMC and the three main agencies involved (ENV, FLNR, and DFO). At present, the forum for such discussions is the HRWG and the PAO. Although the HRWG primarily has a technical function, its membership includes those with agency authorities. This group will help to determine the point at which the impacts from the breach have been sufficiently remediated and/or offset and the Engineer may choose to accept their advice as a basis for compliance with the Engineer's Order.

3.0 REMEDIAL PLANNING BASIS

The remedial planning basis provides a brief review of the various studies (and compilations of studies) that identified the impacts of the TSF breach event and that evaluated the chemical and physical risks to human and ecological receptors, including physical risks affecting aquatic and terrestrial habitats and public safety. For detailed information on those study findings, the reader is referred to those studies directly. Human and ecological risk assessment quantifies whether changed conditions are (or are not) safe for people, plants, and animals. If they are clearly unsafe, those residual effects must be remediated, or the risks must be managed so that following such management, they are no longer a risk.

In addition to identified risks, there are uncertainties associated with all risk assessments. An uncertainty is not a risk that requires remediation, but the delineation of those uncertainties identifies issues that should form part of a monitoring program to verify risk where conclusions may lack adequate certainty. Such components of a monitoring program do not directly trigger a need for physical remediation work but do form part of verification monitoring, in this case carried out through the CEMP, and are part of risk management for those areas where the main concerns are tailings-related contaminants (e.g., copper exceeding soil standards). There may also be circumstances where risks are uncertain and where further study is necessary to resolve a possible risk. The remediation plan (Section 4.0) addresses both types of uncertainty and includes a feedback step for the development of focused remedial work plans should monitoring indicate that action is necessary (Figure 8).

3.1 Overview

A detailed description of the physical, chemical, and biological alterations observed following the TSF breach was provided in the 2015 PEEIAR and the 2016 update (MPMC 2015a; Golder 2016a), and in various other publications (Nikl et al. 2016, Bronsro et al. 2016, Kennedy et al. 2016). These information sources provide a quantification of the physical, chemical and biological impacts resulting from the breach. The significance of those impacts, in the specific context of the health of people and ecological impacts, were evaluated in the HHRA (Golder 2017b) and the ERA (Golder 2017c). The assessment of risks identifies the significance of impacts in the form of residual risks that may require remediation. Such residual effects form the basis of the resulting RP.

In summary, the TSF breach resulted in water, tailings and perimeter embankment construction materials (collectively referred to as outwash materials) to be released to Polley Lake, Hazeltine Creek, and Quesnel Lake. This release also eroded the slopes adjacent to Hazeltine Creek, removing the forest vegetation and native soil over an area of approximately 1.36 km^2, and depositing outwash material above relatively undisturbed forest floor across an additional approximately 1 km^2. Several hundred meters of lower Edney Creek was eroded which led to the lower portion of that creek being incised with a step of a few meters drop, preventing migration of fish from Quesnel Lake to Edney Creek. However, the middle and upper reaches of Edney Creek were unaffected by the breach, and the reconnection of middle and upper Edney Creek with Quesnel Lake was made a priority (Bronsro et al., 2016). A mixture of tailings and scoured native material was transported to Polley and Quesnel Lakes. Approximately 12.8 M m^3 of tailings (plus an additional 5.8 M m^3 of native soil and TSF water) was deposited to Quesnel Lake (MPMC 2015a). The chemical composition of sediments at the bottom of Quesnel and Polley Lakes and along the Hazeltine Creek corridor, reflect the composition of those tailings and other outwash materials. In particular, copper, was elevated above numeric sediment quality guidelines.

A high-level remediation framework was developed early in the breach response program (Figure 2) and that framework continues to be followed. Although that framework implies sequential steps, some of the impacts described above required early actions (e.g., the mouth of Edney Creek as noted above) and options were considered and evaluated with the input of government, First Nations and stakeholders. As of the time of writing, the status of the remediation framework is as follows:

- Phase I (Initial Response) involved the initial Hazeltine channel reconstruction and armouring to stabilize the channel (Bronsro et al. 2016), and the repair and upgrading of the TSF embankment.
- Phase II (Short-Term Impact Assessment) outputs were included in the PEEIAR (MPMC 2015a) and an update to that report based on subsequently collected data (Golder 2016a).
- Phase III of the remediation strategy, which is an active stage, included the preparation of a DSI, an HHRA and an ERA. This phase of the remediation framework focuses on the long-term conditions that remain following the initial impact and implementation of short-term remedial measures (e.g., channel for Hazeltine Channel/Edney Creek re-constructed and conveying water from the Mine Site to Quesnel Lake). This phase identified that unacceptable risks to human health were not present. The ERA identified either that risks were acceptable, acceptable with uncertainty or, in a few instances, risks were uncertain. Uncertainty is addressed through monitoring activities outlined in the CEMP and uncertain risks are addressed through separate, specific studies designed to answer those questions (as illustrated in Figure 8, Section 4.1). Known risks that require remediation (residual effects) are identified (Section 5.0) and these included physical impacts. The RP provides a quantification of the impacts that require remediation and/or may require offsets, a means to risk manage areas contaminated by tailings, a means to address uncertainty, and a process to verify the adequacy of remediation as it progresses.
- Phase IV of the remediation framework is the implementation of the RP. This will remain an active phase as part of MPMC's Long Term Commitments (Figure 8, Section 4.1) and is expected to draw on the input of the HRWG to address DFO and FLNR requirements and on the CEMP process to address risk management and uncertainty. Linkages contained within the remediation plan are further detailed in Section 4.1.

3.2 Previous Reports: Summary of Findings

Numerous reports and studies have been prepared following the TSF breach that discuss the current conditions and proposed remedial actions. A few of these recent reports, which are key background reports to the Remediation Plan are listed below:

- Post Event Environmental Impact Assessment Report (MPMC 2015a).
- Post Event Environmental Impact Assessment Report: Update Report (Golder 2016a).
- Detailed Site Investigation and DSI Addendum (Golder 2017a).
- Human Health Risk Assessment (Golder 2017b).
- Ecological Risk Assessment (Golder 2017c).
- Book of Appendices (used for both the HHRA and the ERA) (Golder 2017b, c).

High level summaries of these reports are provided below, with focus on aspects related to remedial planning. However, the reader should refer to those reports for specific details and data. In some cases, additional work has been conducted and monitoring data have been collected since these reports were submitted to government. It is not the intention of this section to update the reports and studies summarized in this section with newer data. Where relevant to remediation planning, newer data are provided in Section 4.0. The most current data are available in the annual data reports prepared by MPMC.

3.2.1 Post Event Environmental Impact Assessment Reports

The objective of the PEEIAR was to provide an assessment of the physical, chemical, and biological impacts of the tailings spill on terrestrial and aquatic environments. Because of the effects of season and studies that were in progress at the time of writing of the PEEIAR in 2015, an update document was produced with additional data collected subsequent to the 2015 PEEIAR. The update document was also intended to address comments from reviewers of the first PEEIAR. These documents also provided data that were used in the subsequent DSI, HHRA and ERA reports and, consistent with the adaptive nature of the breach response, the information developed in the two PEEIAR reports were also used to structure subsequent data collection and the study design of those subsequent reports.

The PEEIAR and its update concluded that the tailings spill resulted in physical impacts to Polley Lake, Hazeltine Creek, the mouth of Edney Creek, and the benthic environment in the West Basin of Quesnel Lake and the communities in those environments (MPMC 2015a, 2016). It also provided an initial delineation of tailings constituent (e.g., copper) concentrations, their distribution in the impacted areas and provided and estimate of the volume of material spilled and toxicity and other testing results. The data contained within the PEEIAR and its update formed part of the dataset used to guide subsequent studies and evaluate human and ecological risks, the results of which form the basis of remedial planning.

3.2.2 Summary of Detailed Site Investigation (DSI) and DSI Update

Golder (2016a) carried out a DSI and DSI update to characterize and delineate contamination associated with the TSF breach. A DSI is commonly used to define areas of contaminant concentration and, where concentrations exceed standards, the data are used to support the assessment of those risks in the form of an HHRA or ERA.

The impacted physical environment around Polley Lake, Edney Creek and Hazeltine Creek included approximately 136 ha (1.36 m^2) where topsoil was removed and an additional area of approximately 100 ha (1 km^2) where tailings were deposited overlying intact topsoil.

In some areas, the tailings settled out in two distinct layers: a grey fine silt and a black-orange sand. The two layers settled out according to particle size and density, generally with the finer material overlying the coarser sand. As the debris flow moved down the Hazeltine Creek alignment, it picked up and mixed with native till and other glacial sediments (fluvial and lacustrine) as well as native organic soils. Approximately 20 M m^3 of tailings, native soil, water and debris were deposited into Quesnel Lake where a very fine-grained turbidity plume formed and persisted below the thermocline at approximately 20 to 30 m below surface. The plume is interpreted to have included a significant amount of fine-grained natural lake sediment that became suspended by the debris flow from Hazeltine Creek. Turbidity in Quesnel Lake persisted into December 2014 but decreased over the winter.

Together, the soil, sediment, groundwater and surface water results indicate that while tailings-related metals are present above Contaminated Sites Regulations (CSR) standards in these media, research on impacted site materials has indicated that the leachability and migration potential of metals in these materials is low and that there are secondary geochemical controls on the materials which together suggest the bioavailable phase to be low (Kennedy et al. 2016). However, sampling of seeps has indicated elevated copper and monitoring of the geochemical predictions remains an appropriate component of the CEMP.

Section 7.0 of the DSI Update provides the following information:

- identification of areas of potential environmental concern
- determination of the potential contaminants of concern based on the applicable CSR standards
- delineation of the horizontal and vertical extent of contamination
- confirmation that the contamination at the site is stable or decreasing in concentration and extent over time

Because the remediation of the TSF breach is determined based on risks, the DSI/DSI Update does not directly provide a remedial planning basis (particularly for habitat damage) but does provide some of the information to support the assessment of risks (i.e., HHRA and ERA) and the identification of residual effects which are the drivers for the remediation plan.

3.2.3 Summary of Human Health Risk Assessment Findings

The HHRA (Golder 2017b) was conducted based on provincial guidance on the conduct of human health risk assessments and was externally reviewed by consultants retained by government and by First Nations and who have specific experience in the conduct of HHRAs. In response to requests by reviewers, the selection of contaminants of primary concern (COPCs) for the risk assessment was expanded beyond the methods outlined in guidance in order to consider substances not typically regulated under the CSR (i.e., aluminum). No COPCs were identified in soil; however, aluminum, copper and vanadium were conservatively[3] retained for the assessment of the ingestion of berries, traditional plants, wild game fish tissue and cattle pathways as part of a multi-media evaluation.

Risks to the subsistence and traditional land user, hiker/camper, all-terrain vehicle (ATV)/snowmobile user, boater/kayaker, sport fisher, hunter/trapper, Quesnel Lake resident, logger and mine/remediation worker from exposure to aluminum, copper and vanadium were evaluated in the HHRA. Specifically, the following exposure pathways were evaluated:

- Subsistence and Traditional Land User: incidental sediment and soil ingestion, dermal contact with sediment, soil and surface water, inhalation of soil particulates, ingestion of surface water and ingestion of berries, traditional plants, deer meat, deer liver, moose meat, moose liver, fish and grouse.
- Hiker/Camper: incidental sediment and soil ingestion, dermal contact with sediment, soil and surface water, inhalation of soil particulates, ingestion of surface water and ingestion of berries.
- ATV User: incidental soil ingestion, dermal contact with soil, inhalation of soil particulates, ingestion of surface water and ingestion of berries.

[3] Reference to conservatism or conservative approach in this report mean that the approach taken was a cautionary one.

- Boater/Kayaker: incidental sediment ingestion, dermal contact with sediment, ingestion of surface water and ingestion of fish.
- Sport Fisher: ingestion of surface water and ingestion of fish.
- Hunter/Trapper: incidental soil ingestion, dermal contact with soil, inhalation of soil particulates, ingestion of surface water and ingestion of deer, moose, fish and grouse.
- Quesnel Lake Resident: incidental sediment ingestion, dermal contact with sediment and surface water, ingestion of surface water and ingestion of berries, deer, moose, fish, grouse and cattle.
- Logger: incidental soil ingestion, dermal contact with soil, inhalation of soil particulates, ingestion of surface water, and ingestion of fish.
- Mine/Remediation Worker: incidental soil ingestion, dermal contact with soil, inhalation of soil particulates, ingestion of surface water and ingestion of berries and fish.

The hazard indices for these receptors were below the threshold of 1.0. This means that the dose that receptors are exposed to is less than the toxicity reference value, indicating that the conditions are not a risk to human health.

3.2.4 Summary of Ecological Risk Assessment Findings

An Ecological Risk Assessment was conducted to evaluate the ecological significance of the altered environmental conditions (physical, chemical, biological) that are present in the study area because of the TSF breach (Golder 2017c). Risk management and remediation activities have been underway since the TSF breach occurred and the physical impacts associated with the initial release are being addressed through a broad and consultative habitat remediation program through the HRWG. The breach response has been an adaptive program in which data collection and evaluation have been conducted on an ongoing basis since the breach to address a wide variety of investigation needs, regulatory requirements and information requests from First Nations and the Public. The data collected have been used to inform the design of subsequent stages of study. The risk assessment evaluates the available data considering the long-term management goal of successfully reintroducing a biologically diverse, functional, self-sustaining, and inter-dependent ecosystem.

The risk assessment was intentionally conservative in its approaches, assumptions, and decision criteria, consistent with relevant guidance and common practice in BC. A problem formulation identified the extent of the study, established the objectives of the risk assessment and formed the basis of the conceptual site model. The conceptual site model articulates the risk assessors understanding of the system under study including the ecological stressors and their sources, receptors of interest, and potentially significant exposure pathways. The conceptual site model considers the site investigation data and the understanding of the physicochemical properties and fate of the COPCs. The ERA drew extensively on not only the DSI and DSI Update but also the PEEIAR and its update and various studies carried out as part of the breach response program. An exposure and effects assessment was conducted using a weight of evidence approach that evaluated different types of data such as chemical measurements, toxicity testing and community structure data as would be present in an integrated assessment. The weight of evidence assessment enabled the articulation of the magnitude of risks for each of the major ecosystem components. The conclusions for individual ecosystem components are provided in Sections 3.5 and 4.9 of the ERA (Golder 2017c) for the terrestrial and aquatic risk assessments, respectively. The following are the main findings of the ERA:

- Copper is the primary contaminant of primary concern (COPC) associated with tailings, irrespective of whether tailings were deposited to land or water. There were no other chemical constituents that were found to be a significant ecological risk that was attributable to the TSF breach. The tailings also have deficiencies in terms of soil structure or nutrient/organic carbon that are important non-contaminant stressors.
- Numerous lines of evidence showed that the copper associated with tailings has low bioavailability. This finding was consistent in sediment, water, and soil. However, some copper uptake was noted in sample results (discussed in more detail in Section 4.7.3 of the ERA) though toxicity testing did not indicate that the degree of bioavailability/exposure was harmful. The relative influence of copper versus physical factors will need to be confirmed through monitoring.
- Assessment of several ecosystem components was made with the benefit of laboratory-based toxicity testing or other tools that allowed for experimental verification that the structural and nutrient deficiencies in the tailings are a cause of reduced performance. The specific attributes contributing to the deficiency varied somewhat by media (e.g., total organic carbon in sediment; plant available nutrients and bulk density in soil) but were broadly related to the fact that the tailings lack the heterogeneity and nutrient processing that is part of a healthy soil or sediment ecosystem. This deficiency is expected to decrease over time as organic carbon and biological function returns to the system (Frouz et al. 2008).
- The balance of evidence from the laboratory studies and experimentation, field observations, and inferences based on case studies or relevant literature is that the adverse effects associated with the structural and nutrient deficiencies in tailings, whether as sediment or as soil will have a larger influence on the speed of recovery/recolonization than the influence of copper. The risks associated with copper are low; where ecological risk levels were considered moderate, these were primarily associated with disruption to the physical substrate. For some components of the risk assessment, the findings were uncertain (e.g., risks to amphibians) and these have been carried forward to specific studies designed to address the uncertainties (see for example Figure 8).

The risk assessment findings by area are further summarized in the following sections and key uncertainties or areas of uncertain risk, as well as monitoring considerations for the CEMP, are summarized in Table 1. The RP is structured around known risks. However, the plan also includes feedback mechanisms from the CEMP and related focused studies (to address uncertain risks). Should monitoring or the results of those studies identify that there is a risk that requires remediation, then specific work plans would be developed to address those risks.

Delineation of areas physically damaged from the TSF breach were provided at a high level in the PEEIAR reports; however, environmental damages specific to the Ecological Units as applicable to quantification of habitat losses and potential offset requirements (of particular relevance to DFO and FLNR requirements) are detailed in Section 5.0.

Table 1: Key Uncertainties in the Ecological Risk Assessment and Monitoring Considerations (adapted from Golder 2017c)

Receiving Environment and Area	Receptor Group	Risk Conclusion	Key Uncertainty	Monitoring to Address Uncertainties (detailed in the CEMP)
Terrestrial – All areas	Plants	Low to moderate	Field observations of the plant community re-establishment is positive but in an early state of plant succession.	Field monitoring of plant performance will be incorporated as part of the remediation plan monitoring.
			Plant growth under-performed in soil tests, but the relative contribution of copper versus physical and structural limitations of the soil has not been confirmed.	Field monitoring of plant performance (see above). Focused investigations to determine relative contribution of copper versus physical limitations may be added, but only if needed based on findings from field monitoring.
	Soil invertebrates	Low to moderate	The early successional nature of soil conditions means limited soil invertebrates were available for sampling.	Field monitoring of soil invertebrate community will be incorporated as part of the remediation plan monitoring; Focused investigations to determine relative contribution of copper versus physical limitations may be added, but only if needed based on findings from field monitoring.
	Wildlife	Low	Existing mathematical relationships between soil and tissue concentrations are based on currently available data. This results in uncertainty in how risk estimates are being applied to smaller areas.	Field monitoring of plants and soil invertebrate (see above) will include sampling for tissue chemistry to supplement the currently available data.
			Understanding of copper bioavailability was informed by available PBET data and literature values, resulting in uncertainty in the HQ.	Field monitoring (see above) will include collection of soil samples for PBET analysis to increase spatial coverage and diversity of soil types covered by PBET. Targeted study to expand PBET analysis to determine relative bioavailability (e.g., include additional types of items in the PBET analysis).
			Toxicity Reference Values (denominator in the HQ calculation) were based on screening level benchmarks.	No specific field activities. Desktop refinement to develop a site-specific toxicity reference value to replace the default TRVs.
Terrestrial – Riparian Habitats	Amphibians	Indeterminate	Amphibians have not been formally assessed beyond the qualitative observations described in the risk assessment.	Existing data (potentially with a targeted supplemental program) to be used to determine a screening-level estimate of hazards to amphibians exposed to soil, sediment and water.
Aquatic – Hazeltine Channel	Benthic invertebrates and fish	Indeterminate – effects-based lines of evidence were deferred while restoration was in progress	Concentrations of copper exceed water quality guidelines.	Monitoring (post-habitat rehabilitation) to evaluate benthic invertebrate re-colonization. Ongoing monitoring of Hazeltine Creek water chemistry to evaluate trends.
Aquatic – Quesnel Lake	Benthic invertebrates	Low to moderate	Toxicity test performance was reduced but relative contribution of copper versus physical and structural limitations of the sediment has not been confirmed. Diversity metrics show improvement, transplant studies show positive recolonization potential but abundance remains reduced.	Monitoring of benthic community recovery to confirm that recolonization is progressing and that copper concentrations are not a barrier.
Aquatic – Polley Lake	Fish	Low	Clarification of the cause of Trout age-class structure alteration in Polley Lake.	Evaluate age class frequency of fish species in Polley Lake. Monitor copper concentrations in water samples from Polley Lake.

PBET - physiologically based extraction test; TRV – toxicity reference value.

3.2.4.1 Risks to the Terrestrial Environment

Overall, while certain metal concentrations are elevated over background risks to the terrestrial environment from tailings constituents were moderate; however, considerable physical impacts occurred. The physical nature of the tailings is expected to be an issue because tailings lack the heterogeneity and nutrient processing that is fundamental to a healthy soil ecosystem. This deficiency would be expected to decrease over time (Frouz et al. 2008), as organic carbon and biological function returns to the system, but currently, the magnitude of the effect is such that a conclusion of moderate risk is considered an appropriate characterization. Active intervention to enhance the return of such soil function is part of the ongoing remediation activities and is an identified residual effect for management under the RP.

There was no evidence that copper would act as an additional stressor over and above the influence of the physical and nutrient deficiency. Accumulation of copper in the food chain is considered to be low risk, based on the findings of the food chain model. The food chain model considered a wide variety of wildlife receptors with varying feeding strategies and dietary items and the general conclusion regarding low risks associated with copper bioaccumulation is therefore considered to be applicable to all wildlife species occupying the study area. Further information is contained in the ERA (Golder, 2017c).

Areas of uncertainty identified in the ERA have been carried through to the CEMP and additional assessment is underway as follows:

- Diversity of soil ecosystem: Field-based monitoring of the diversity or abundance of plants, soil invertebrates or other parts of the soil ecosystem is valuable in an ERA but was not practical to address at the time the ERA was prepared due to the variability associated with natural successional changes. Through the CEMP, a tiered program has been planned to further evaluate the potential for effects on the soil ecosystem (Golder 2018a).
- Copper bioaccumulation in plants and soil invertebrates: The ability to quantify the relative influence of copper versus the physical limitations of the soil is important from a theoretical perspective. This would typically be evaluated using controlled experiments. However, further experiment-based studies are not warranted unless there is evidence (from field monitoring) that natural succession is not progressing. It is reasonable to continue refining the site-specific understanding of copper bioaccumulation in plants and soil invertebrates in lieu of further experimental studies while the long-term field monitoring is conducted. Through the CEMP, a tiered program has been planned to further evaluate the relative influence of copper on soil invertebrates and plants (Golder 2018a).
- Wildlife: Risks to wildlife were assessed with a single technique (a food chain model). Conservative assumptions were used in the model, resulting in hazard quotients of less than one for 11 of the 15 receptor species evaluated in the model. Further refinement of the food chain model is being conducted for the four receptor species that had an HQ > 1 (Golder 2018a).
- Amphibians: Only a limited amount of direct measurement of exposure or effects relevant to amphibians was available at the time the ERA was undertaken. From a practical perspective, rehabilitation of the riparian areas, and restoration of Hazeltine Creek was ongoing throughout the risk assessment process and therefore the habitat suitability for amphibians was considered low. Moreover, completion of the ERA for other major groups of receptors (e.g., mammals, plants) was needed to determine if further remediation activities, which would further disrupt habitat suitability, was needed to address the residual concentrations of copper in the deposited material. Through the CEMP, a tiered program has been planned to further evaluate the potential for effects of metals on amphibians (Golder 2018a).

3.2.4.2 Risks to Polley Lake

In Polley Lake, no parameters were identified as stressors or COPCs in surface water based on comparisons of chemistry data collected between March and August 2015 with BC WQG. In terms of effects-based measures, there are multiple indications of recovery:

- Plankton - no adverse effects were observed in toxicity tests (acute or chronic tests with cladocerans) conducted in representative water samples, and no apparent change in biomass relative to background areas. The median concentration of copper in zooplankton collected from Polley Lake is lower than the upper limit of the normal range of samples collected from reference areas.
- Benthic Invertebrates - Polley Lake locations, in both deep and mid-depth locations, exhibited signs of biological recovery following the first year of sampling. Copper concentrations in benthic invertebrate tissue samples from Polley Lake, were significantly elevated relative to reference, but had lower concentrations than profundal Quesnel Lake benthic invertebrate tissues. The benthic organism species richness and abundance was not significantly different from Bootjack Lake, which has been used by MPMC as the reference location in their monitoring work (CEMP). A more detailed discussion of benthic invertebrate tissues is provided in Section 4.9.4 of the ERA.
- Fish - Median concentrations of copper in benthic invertebrate tissue were less than the dietary threshold for adverse effects to fish and water quality now meets guidelines. The fish population structure indicates a reduction in recruitment for Rainbow Trout (*Oncorhynchus mykiss*) (Minnow 2017a) which was inferred to be the result of precluded spawning access to upper Hazeltine Creek while it was being reconstructed. In 2018, following an evaluation of the suitability of the reconstructed habitat (water quality and temperature) for juvenile Trout (Golder 2018b), it was decided by the HRWG that fish would be re-introduced to upper Hazeltine Creek (discussed further in Section 4.5.1) and this resulted in successful spawning and recruitment of juveniles to Polley Lake (Connors et al. 2018). Additionally, MPMC established a temporary hatchery to supplement the population structure in Polley Lake as a contingency to the production from Hazeltine Creek.
- Physical effects to Polley Lake included deposition of settled outwash materials in the nearest approximately one third to one half of Polley Lake. Unlike Quesnel Lake, sediments in Polley Lake were mixed with existing Polley Lake sediments and organic material in the outwash area of Polley Flats. Lakeshore vegetation adjacent to Polley Flats was also damaged by the breach event and several logs/trees were washed into Polley Lake. Following observations that these logs and trees were providing cover for fish and fish were utilizing that area, a decision was made by the HRWG to leave those logs and trees in Polley Lake.
- The available data does not show a detectable impact on fish productivity of Polley Lake. However, the fish population structure does show signs of change as a result of the loss of their main outlet spawning area (upper Hazeltine Creek). Steps were taken in 2018 by MPMC to mitigate the population structure effects; however, monitoring is necessary to identify whether there may be productivity impairment using the metrics developed by the HRWG. While the benthos appears to have recovered quickly in Polley Lake, some impacts would have inevitably occurred, even if they could not be reflected in the monitoring data.

3.2.4.3 Risks to Hazeltine Channel and Lower Edney Creek

The assessment of risks for Hazeltine Channel was impeded by the coincidence in timing of when data would need to be collected and the timing of active remediation works which are a source of physical disturbance that would affect the data obtained. Given that the extensive construction and remediation efforts (see for example Bronsro et al. 2016) have modified the site conditions, the ERA report identified the risks in Hazeltine Creek as "indeterminate" (i.e., risks uncertain). The RP focuses on the current, post-remediation (where remediation has occurred) conditions. The RP is predicated on the present understanding of those conditions but is subject to the implementation of an acceptable CEMP to quantitatively validate that understanding and expectations regarding risks in Hazeltine Creek. Some relevant qualitative observations provided within the above context are outlined below. It should be noted that Hazeltine and to a lesser extent Edney Creek have been subject to physical disturbances from ongoing habitat remedial works. Quantitative sampling using accepted methodologies are required to provide a reliable basis to form risk management conclusions as well as to verify the performance of constructed habitats; however, such methods do not apply well to systems under physical disturbance. Qualitative observations are provided for context and are intended to be indicative but not confirmatory.

- Algae – Periphyton can be seen growing on the substrate in Hazeltine and Edney Creek and quantitative assessments are expected to occur when creek remediation has concluded, as part of the CEMP. Periphyton sampling was carried out in Edney and Hazeltine Creeks in 2017 but the data were not available for inclusion in the ERA.
- Benthic Invertebrates - There were statistically significant reductions (greater than 20% reduction) in diversity at upstream and downstream locations relative to reference for samples collected with Surber sampler or a kicknet. Data were limited to 2015, and creek remediation was subsequently initiated. It is worth noting that Edney Creek already shows clear evidence of recolonization, and similar recovery for Hazeltine Channel is anticipated in response to the remediation based on proximity to upstream organisms that provide a continued source of colonization and based on visual examination of substrates for macroinvertebrates which have shown the presence of EPT taxa[4]. Additional sampling was conducted in 2017 but the data were not available for inclusion in the ERA. This is an area of uncertainty that can best be addressed following the conclusions of construction activities and the physical disturbance associated with those activities.
- Fish - Direct assessment of fish in Hazeltine Creek could not be undertaken as part of the ERA because fish had been excluded over the course of the creek remediation with a series of fish fences near the Polley Lake outlet and the Quesnel Lake inlet. A partial (upper Hazeltine Creek) re-introduction of fish took place during the 2018 spawning season and Rainbow Trout successfully spawning (4,890 adults) and producing juvenile trout (an estimated 18,084 juveniles) that have since moved into Polley Lake (Connors et al. 2018). Monitoring of that age class within Polley Lake is ongoing by MPMC. MPMC's sampling (Minnow 2018a) has found that all of the species of fish previously making use of Edney Creek are again present in Edney Creek, including the reconstructed portion. In addition, Kokanee (*Oncorhynchus nerka* freshwater variant) spawners were observed in the reconstructed portion of the channel. Detailed assessments of productivity will be required as part of the long-term commitments of MPMC with regards to verification of monitoring of habitat.

[4] EPT taxa are those organisms that are members of the orders Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). EPT taxa are considered to be sensitive to aquatic pollution making their presence a positive indication of good water quality.

- Water quality in Hazeltine Creek shows an improving trend for dissolved copper concentrations (Golder 2018b) which are below the 30-day average BC WQG[5] (at higher values of water hardness) and have been below the biotic ligand model (BLM) site specific target values developed as part of the setting of treatment targets (Golder 2016b). The BLM used does not represent an accepted science-based environmental benchmark (SBEB; MOE 2016) or policy-based screening benchmark. Rather, it was used to provide context to the water quality data and an indication that development of an SBEB, should it be required in the future, may be feasible. Some of the earlier data was collected prior to the removal of tailings in the Polley Flats area and further monitoring of Hazeltine Creek water quality as well as seeps in Polley Flats remains a part of the CEMP. Dissolved copper has been used for planning purposes rather than total copper (for which the water quality guidelines apply) because it is more closely related to effects and because total copper would be affected by construction activities. Updated water quality data, including a broader suite of parameters (aluminum, copper, selenium, temperature, and dissolved oxygen), were also compiled as part of planning for re-introduction of fish into the upper portion of Hazeltine Creek (Golder 2018b). Those data were used to support the decision to re-introduce the fish. Water quality conditions in upper Hazeltine Creek do show an influence from construction activities related to remedial work (Golder 2018b).

The RP for Hazeltine Creek is focused on habitat reconstruction, subject to monitoring data confirming that copper and other parameters either meet the BC WQG or, alternatively, an SBEB derived following ENV policy (MOE 2016). An SBEB has not been developed for Hazeltine Creek at this time. If risks associated with changing water quality are identified through ongoing monitoring, additional remediation may be planned (vis-à-vis Section 4.1 and Figure 8).

3.2.4.4 Risks to Quesnel Lake

Risks are low for organisms associated with the water column (plankton, pelagic fish). Water chemistry shows that copper and turbidity are unlikely to present hazards to aquatic life especially after turbidity decreased over the first several months following the TSF breach (MPMC 2015b; Nikl et al. 2016). However, impairment to the benthic community remains in the profundal (deep lake bottom) environment where tailings deposited, and also in shallow portions of the lake close to Hazeltine Channel. These signs of impairment are associated with the physical burial of benthic communities and associated changes to substrates, in particular a low organic carbon content which is characteristic of the tailings material. The profundal areas are recovering, but the rate of recovery appears to be slower than in Polley Lake.

- Plankton - There were no significant reductions in chronic water algal growth tests or vascular plant growth toxicity tests on field collected water samples, or apparent change in primary productivity. There was no chronic toxicity to cladocerans in representative non-turbid waters, and no discernable difference in copper concentrations of zooplankton tissue samples between the exposed area and the reference areas of Quesnel Lake. There was also no discernable response in total zooplankton biomass or abundance, or in the relative biomass or abundance of dominant taxa, relative to reference.

[5] The 30-day average WQG is intended to be used in conjunction with the average of five samples collected weekly. In some cases, the monitoring data were not collected on this frequency; however, the values are conservative and where individual receiving environment concentrations are lower than the 30-day average guidelines, effects would not be expected.

- Benthic Invertebrates - The results of toxicity tests with two species indicate potential risk, based on the observation of greater than 20% responses in several samples; however, results were likely influenced by physical factors, particularly organic carbon. The responses were higher in sediments characteristic of tailings (elevated copper and low organic carbon). The addition of organic carbon or mixing samples (1:1 ratio) with reference sediment that contained higher organic carbon eliminated those observed growth effects in toxicity tests using the near field sediments. In terms of benthic community alterations, several Quesnel Lake assemblages remain impaired but data indicate that they are improving. Species richness in 2015 was not significantly different from reference areas but invertebrate abundance was lower in the impact area. A study in which breach-impacted sediments were transplanted to a reference area shows that recolonization of breach-impacted sediments is not impaired (these data are discussed further in Section 4.11.3). The main factors that are making recolonization slower is the need to accumulate organic carbon in the lake bed and the large (approximately 1.8 km^2) impact zone which makes in-migration of benthic invertebrates slower than when the transplanted sediments were surrounded by colonized sediments. Overall, recovery at these stations is slower than what has been observed in Polley Lake.
- Fish - No meaningful impairment from water quality was observed (i.e., performance is not inhibited by more than 25% relative to control samples) in fish toxicity tests that included the 7-d Rainbow Trout survival and growth test and the 7-d Fathead Minnow (*Pimephales promelas*) survival and growth toxicity tests in field collected water samples. The concentrations of copper in field-collected samples of representative fish diet (benthic invertebrates) are below the dietary threshold for adverse effects by consumption as derived in the ERA (Golder 2017c). Information available on the microscopic structure of fish tissues (histology) does not indicate ongoing water quality-induced stress associated with the presence of the tailings in the lake (unpublished DFO study). The condition factors of juvenile Sockeye Salmon (*Oncorhynchus nerka*) collected from different sampling zones in Quesnel Lake do not indicate a negative tailings influence – the fish were larger and more numerous in the West Basin of Quesnel Lake (DFO data, unpublished). Fish have also been observed using the profundal zone of the West Basin during an ROV inspection of the outfall (Figure 5); however, these are coincidental observations during an ROV survey of the outfall structure and not quantitative surveys.
- Physical effects to Quesnel Lake were summarized in the PEEIAR (MPMC 2015a). Material volumes estimated to have been transported to Quesnel Lake include 12.8 M m^3 of tailings and interstitial water, 1.2 M m^3 of native soils scoured along Hazeltine Creek and 4.6 M m^3 of overlying water in the TSF. The entry of this material resulted in water quality impacts, most notably/visibly on turbidity, particularly in the deeper parts of Quesnel Lake at first and throughout the water column following lake overturn in November 2014. The breach outwash materials settled onto the bottom of Quesnel Lake, covering an estimated 1.81 km^2 of lake bed. Although the depth of settling was variable, it was estimated to be up to 10 m deep in some locations (Figure 6). Physical changes to the lakeshore area, including scour and vegetation loss adjacent to Hazeltine and Edney Creeks also occurred.

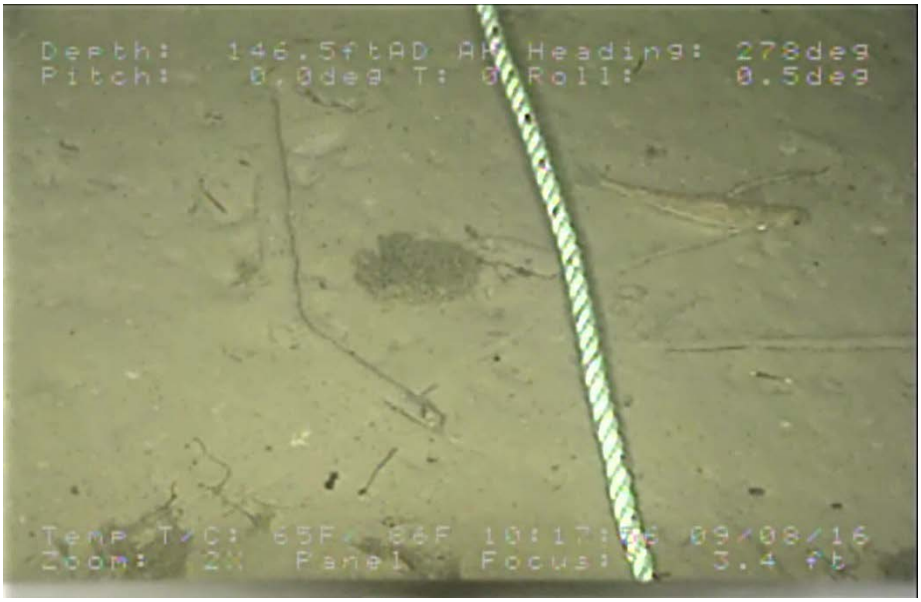

Figure 5: Image extracted from an ROV video (coincident observations, not a quantitative fish survey) recorded during an outfall inspection, showing that the lakebed is being used by fish in Quesnel Lake, near the outlet of Hazeltine Creek (fish is in the upper right quadrant of the image, the rope was temporarily placed to set the course for the ROV).

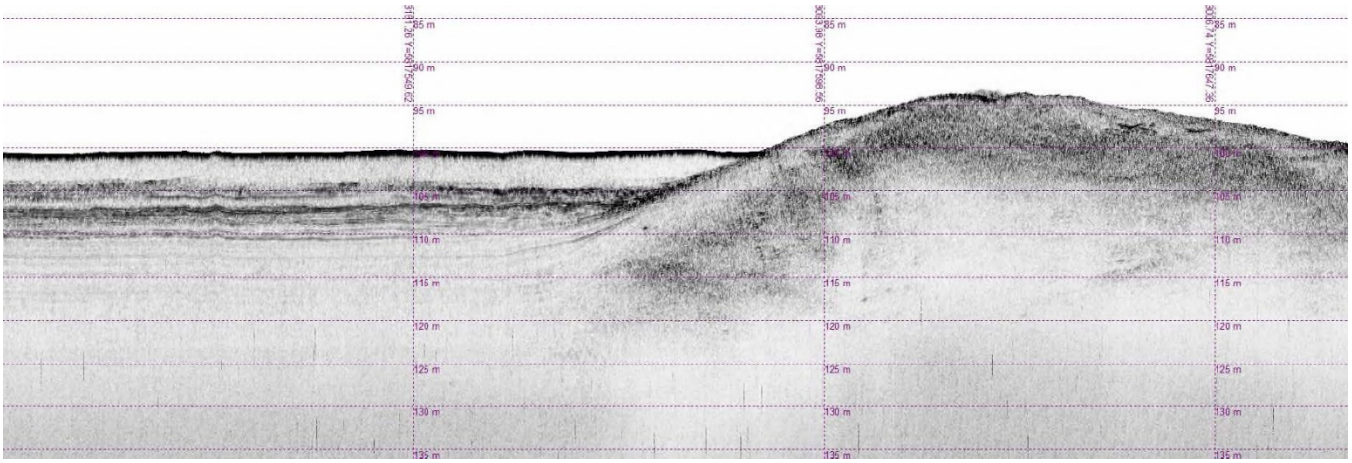

Figure 6: A sub-bottom profile image of a section of Quesnel Lake showing fine-grained sediments settled along a flat section (left of image) and an underwater lake side slope along the rise on the right half of the image.

3.2.4.5 Risks to Quesnel River

The available evidence indicates a low magnitude of risk comparable to reference conditions:

- Plankton - No significant reductions in chronic water algal growth tests or vascular plant growth toxicity tests on field-collected water samples. No chronic toxicity to cladocerans in representative non-turbid waters.
- Benthic Invertebrates - Benthic invertebrate samples collected from Quesnel River and the corresponding reference area in Cariboo River had concentrations of COPCs similar to reference conditions.
- Fish – Significant effects were not observed for fish toxicity tests including 7-d Rainbow Trout survival and growth, 30-d Rainbow Trout survival and development, and 7-d Fathead Minnow survival and growth toxicity tests on field collected water samples.

3.3 Habitat Remediation Working Group

The HRWG (previously called the Habitat Objectives Working Group) was formed to provide a forum that would enable collaborative input from agencies and First Nations on the remediation of fish habitat based on objectives developed for each area or ecological unit of fish habitat affected by the TSF breach. These objectives are based on physical conditions (e.g., gradient), constructability, life history requirements of the fish species and a broader ecosystem context (e.g., amount of spawning or rearing habitat available). DFO (2014) determined that a S. 35 Authorization under the *Fisheries Act* was not required to carry out the remediation work and that the field design and build approach was a prudent means of advancing such remediation. DFO further recommended the development of a framework to guide the designs where restoration objectives were set for each of the ecological units. The HRWG is composed of DFO, ENV, FLNR, Soda Creek and Williams Lake Indian Bands and their representatives, and MPMC and their representatives. The group has provided input and independent external review of designs to MPMC and its river engineering and habitat ecology Qualified Professionals (QPs).

The HRWG has been the forum in which remedial options for breach-impacted sections of Hazeltine and Edney Creeks are considered and evaluated and become the aquatic remedial plan for that area. The detailed implementation of the remediation plan then becomes the responsibility of MPMC who coordinate equipment and construction materials and the QPs who engineer river work, design habitat elements and oversee their construction. Members of the HRWG carry out site visits either in a regulatory or contributory capacity.

Areas of Hazeltine Creek, Edney Creek, Quesnel Lake and Polley Lake were categorized into EU by the HRWG based on the nature of disturbance and the fish species known to use that area (Figure 4). These EUs are somewhat different from the Remediation Areas or Reaches described in Section 1.3, but are devised to help guide the development of habitat objectives, evaluation of the effects and compare pre-breach and post-remediation conditions. The Working Group developed a habitat remediation framework (separate from the broader remediation framework and specific to habitat) that identified the fish community within each EU, the ecological function of the EU, the pathway, magnitude, and duration of the breach effects, the life history component affected by the breach, available baseline data for pre-breach conditions, and potential indicators that may be used to quantify effects and evaluate the success of remediation.

3.4 Input to the RP Through Consultation

The PAO requires:

> *A description of consultation completed with local First Nations and with stakeholders on the remedial objectives and how remedial objectives have been refined taking into account the outcome of such consultation.*

Public and First Nations consultation has occurred prior to the Remediation Plan. In 2011 and 2012, MPMC executed Participation Agreements with the Williams Lake Indian Band (WLIB) and the Soda Creek Indian Band (SCIB), respectively. In August 2016 and April 2017, MPMC and WLIB and SCIB (respectively) renewed these agreements. Through these respective Participation Agreements, Implementation Committees (IC) were formed to facilitate open dialogue between each of the First Nations and MPMC, providing a formalized, regular venue to discuss environmental, social and economic matters related to mine development, operation, reclamation, and closure (e.g., mine updates, permitting, environmental protection, reclamation, employment opportunities, and potential joint ventures). In addition, First Nations have been providing extensive technical input into habitat remediation work through the HRWG and as reviewers of the various documents that form part of the remedial planning basis and habitat remedial designs.

Numerous and varied public and First Nations comments have been received by MPMC before and particularly following the breach. The input subject matter has varied widely. With specific regard to this RP, the following public meetings took place:

- Mount Polley Public Liaison Committee (PLC) on 16 November 2017.
- Williams Lake Public Meeting on 16 November 2017.
- Town of Likely Community Meeting on 17 November 2017 on the Human Health and Ecological Risk Assessments that form part of the remedial planning basis.
- Public Webinar using GoToMeeting™ to project slides via the web and voice via web or telephone on 10 January 2017.
- Public Meetings During December 2018 at: Quesnel, Williams Lake, and Likely.
- A web-based meeting for the Public Liaison Committee on 25 February 2019.

At the above meetings, a number of questions were asked and answers were provided. With regards to questions or concerns raised that may relate specifically to the remedial planning basis, the following items were identified:

- Concerns were expressed by a local resident about potential resuspension of the breach outwash materials that have settled on the bottom of the lake, particularly during lake overturn.
- Concerns have been expressed by some residents who have occasionally observed a green-coloured tinge to the water (this has at times been connected to the preceding bullet), plugging of water intake filters with organic material and local observations that algae growth on rocks appears to be greater than it was before the breach.
- A question was posed by another local resident (and Professional Biologist) about the potential for predation on Trout by birds upon trout re-introduction to upper Hazeltine Creek in 2018.

Resuspension of Lake Bed Materials

This concern stems from the clear (low turbidity) water characteristics of Quesnel Lake, which local residents and vacationers value and the effect of lake overturn in November 2014 which resulted in the mixing of deeper, post-breach turbid waters with surface waters making the Quesnel Lake surface water cloudy in appearance (turbidity of ~ 15 NTU; MPMC 2014a) over a period of several months until turbidity measurements showed dissipation in the summer of 2015. These concerns have been previously raised as have those of an intermittent cloudiness and greenish hue to the lake. This occasional cloudiness has not been observed by all residents in the area.

The possibility of resuspension of breach outwash materials was identified as a strategic information need to inform remedial decisions and was part of early evaluations carried out as part of the Post-Event Environmental Impact Assessment (MPMC 2015a). Tetra Tech EBA (Tetra Tech 2015a) carried out a study of Quesnel Lake water column quality and evaluations based on a 3-dimensional hydrodynamic model that they constructed. The model predicted that mixing, flushing and settling of the fine-grained breach-related materials suspended in Quesnel Lake would occur but it predicted that resuspension would not occur once these materials had settled. In response to the public concerns noted above and as a cautionary step, MPMC retained Tetra Tech to carry out an updated evaluation using additional information not available in 2015 to re-examine whether re-suspension was likely. The new information available included water column profiling data, data on the rate of sediment deposition, contemporary grain size distribution data from the bed of Quesnel Lake and observations regarding the extent to which settled materials are consolidated, computational analysis of critical bed shear stress forces that would be needed to initiate erosion and the near bed hydraulic loading that could be expected, and remote operated vehicle (submersible) video analysis. Based on the abundant additional observational and computational lines of evidence, Tetra Tech concluded that the tailings would remain on the lake bed (Tetra Tech 2017).

The observations of some, though not all residents, of an occasional mildly cloudy-green hue to the lake that they feel was not there pre-breach cannot be reconciled against the extensive turbidity data set and the observational and computational analyses noted above. Public perception of water colour can, under circumstances be accurate but can also be prone to interference by a variety of factors (Smith et al. 1995). The remedial planning basis adopts the findings based on multiple lines of evidence regarding the physical stability (i.e., that they are not re-suspending) of the tailings (Tetra Tech 2017).

We are aware of subsequent work by university researchers that suggests some turbidity near the lake bed; however, this information is based on a hypothesis. Details of methods and findings have not been published or provided to Golder as of writing.

Lake Colour, Water Filters and Algal Growth on Rocks

The potential influence of resuspension has formed part of studies as noted above. Regarding the potential for increased organic production in the water column and increased algal growth on the rocks, data are not available to directly address these observations. However, chlorophyll *a* data are available for a period of time before mining at Mount Polley Mine (Nidle et al. 1994) as well as for the years following the breach (Figure 7).
A comparison of whole lake averages over the period for which pre-impact data are available (1985 to 1990) with chlorophyll *a* concentrations in the years following the breach indicates that the algal biomass of Quesnel Lake may have been higher prior to mining at Mount Polley than has been the case following the breach. This suggests that the conditions favouring algal growth are not higher post-breach.

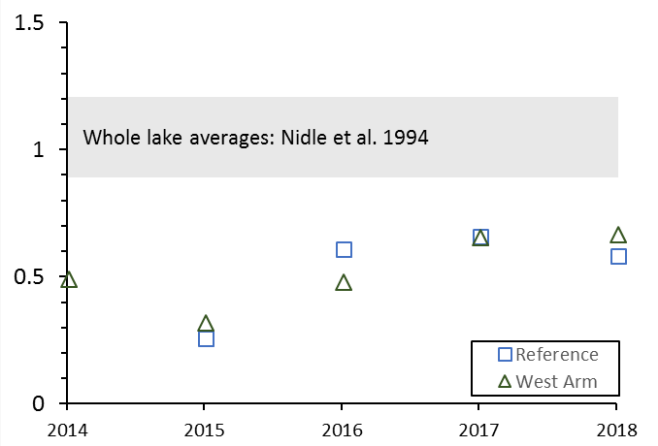

Figure 7: A comparison of pre-mining (1985-1990) chlorophyll *a* whole lake averages (grey band) concentrations and post-breach chlorophyll *a* concentrations in the West Arm and reference area.

Predation by Birds on Fish Re-Introduced to Hazeltine Creek

A question was asked whether consideration had been given to use of anti-avian predator netting upon the re-introduction of fish to Hazeltine Creek. The revegetation along Hazeltine Creek, following habitat build-out will take several years to provide over-story vegetative cover of Hazeltine Creek which, in a natural system provides some cover from predation of fish by birds – though not against all species of piscivorous birds or other piscivorous wildlife. The potential effect of predation on fish re-introduced into Hazeltine Creek was identified in a Golder memorandum (Golder 2017d). The re-introduction took place and while some small numbers of fish were taken by predators, as is natural, there were nevertheless an estimated 18,084 juvenile trout that returned to Polley Lake (Connors et al. 2018). Instream cover installed as part of the second phase of creek remediation provided sufficient protection from predators based on numbers of fish enumerated. MPMC are monitoring the population structure of Polley Lake fish to quantify the adequacy of these steps vis-à-vis fish productivity of Polley Lake Trout.

3.4.1 Remediation Plan Implementation – Future Consultation

Implementation of the remedial plan will require consultation with regulators, First Nations and the local community. The purpose of this consultation is to inform, listen to concerns and provide answers, identify whether revisions to the CEMP are needed, take input to enhance the outcomes of remedial work and to comply with statutory/permit requirements. Some of the bodies with whom beneficial consultation would occur are:

- BC ENV, FLNR, DFO – regulatory oversight, technical expertise from the respective agency).
- MPMC Public Liaison Committee – community representatives who are expected to bring community concerns to the table from the community and to facilitate the dissemination of information provided by MPMC and a forum to discuss concerns, concepts, ideas and community aspirations.
- HRWG – technical input from local knowledge of First Nations and their staff, technical input and oversight by agency specialists.
- First Nations Implementation Committee – a forum that includes environmental remediation topics but also includes broader First Nations/MPMC relations, opportunities and concerns.
- Public meetings/field tours – direct engagement of the broader community (i.e., beyond the public liaison committee) to provide information updates and opportunities to directly observe remedial works.

4.0 REMEDIATION PLAN

This RP identifies the proposed actions to remediate residual effects from the TSF breach identified by the preceding assessments (Golder 2016a, 2017b,c). This report provides a consideration of options for remediation of those risks and an evaluation and recommendation of the selected remedial option. Where remediation has already started or is substantially advanced in certain areas, the RP describes the process under which the remedial options were developed and selected. An example of the latter situation was the initiation of Hazeltine and Edney Creek remediation, on an expedited basis, to control erosion and turbid water discharge and, in the case of Edney Creek to reconnect unaffected habitat in the upstream portions of Edney Creek with Quesnel Lake to allow access to the watershed by fish returning to spawn. In this case, various remedial options were identified and considered as the work progressed, with oversight and input provided by the HRWG.

The RP is presented by area with a presentation of the generalized approach applicable to the main habitat types (creek, terrestrial and lake). Quantification of habitat losses and identification of potential remedial/offset requirements in each EU is provided in Section 5.0.

4.1 Remediation Plan Components and Linkages

The remediation plan has been developed as information has been obtained from the numerous studies that have been carried out. The plan has connections to those studies, regulatory requirements, outcomes, and specific actions to be taken (e.g., habitat remediation and habitat offsets, monitoring). Figure 8 shows various components of the remediation plan and how those components are linked to information obtained as part of preceding studies, actions that have been taken, still need to be taken and how those actions lead to compliance with regulatory requirements. It should be noted that compliance is expected to be part of an ongoing compliance program by MPMC and that there are several long-term commitments for MPMC. Figure 8 is a process diagram that represents how remediation plan components turn into specific work, how that work is monitored and adjusted based on verification monitoring as part of MPMC's long-term commitments and how the remediation plan is linked to compliance when concluded.

The RP linkages start with the breach event. In addition to standing regulatory requirements under both federal and provincial law, formal and specific regulatory requirements were invoked by ENV and FLNR the following day (PAO, EO). DFO relied on the general provisions contained in the *Fisheries Act*. The remedial design basis, summarized in Section 3.0, results in five outcomes that have connection to remediation. These are:

- Human health risks are acceptable and remediation for that purpose is not required.
- Some ecological risks are acceptable and remediation for that purpose is not required.
- Some ecological risks are acceptable but there is scientific uncertainty in that determination. Remediation is not identified for such risks, but monitoring is a requirement to address that uncertainty. Verification and, if data show it is necessary, then remedial work plans to address those risks would be developed.
- Some ecological risks are uncertain – neither an absence nor clear conclusion regarding risk can be made with current data. In such cases, a specific focused study/monitoring program is carried out as an addendum to the CEMP process. The results of that study will either identify the need for more detailed assessment, identify that risks are absent (compliance) or identify that remediation is required. For the latter finding, a remedial work plan would be developed.

- Remediation is clearly required (e.g., where an environmental effect has been identified without need for clarifying study). Remediation approaches are recommended in later sections of this plan. Because the remediation work is focused on habitat remediation, this includes identifiable physical work that has been completed, in progress, or to be carried out on site and habitat offsets to address impacts and productivity losses (including time) resulting from the breach.

The areas where physical remediation work was required are those involving physical damage to aquatic and terrestrial habitats and those involving public safety risks. The focus of the RP is therefore on planning out the amounts of habitat that are needed to offset the losses from the TSF breach event. Some of those offset "credits" have been and will be constructed at the location where the damage took place. However, additional offset habitat will be needed, and the amounts are set out in subsequent section of the RP. Figure 8 outlines a high-level process flow for evaluating habitat losses, identifying habitat designs, quantifying habitat "debits" and "credits" and quantifying offset requirements. That process has been set out in general by the HRWG, is described quantitatively in the RP and remains part of MPMC's long-term commitments. These long-term commitments include monitoring of remediated habitats (including for contaminant endpoints), quantification of "credits" and "debits" and outstanding "balance" of offsets owing. The specific offsetting projects will be determined by the HRWG, as they have been since the early stages of breach response. Habitat verification will include maintaining a ledger of offsets completed, credits "made good" and habitat work still owed.

Habitat monitoring is a necessary component of the RP because uncertainty exists when habitat is constructed. When uncertainties are known and anticipated, they can form part of the design process and calculations, but verification monitoring of physical habitat stability and function remain necessary. Some of the common means of addressing uncertainty in habitat remediation is using arbitrary compensation ratios *a priori*. Such ratios are typically reduced or eliminated when habitat is constructed in advance of a loss because structure and function can be verified, thereby addressing the uncertainty of outcome. Given the scale of the TSF breach event, we have proposed the use of Habitat Equivalency Analysis (HEA; Section 4.2.4) and performance verification to address uncertainty. Offsets can therefore be scaled to provide a reasonable amount of offset habitat and can be scaled upwards should actual habitat function fall short of expectations. MPMC's long-term commitments are underlain by attainment of regulatory requirements.

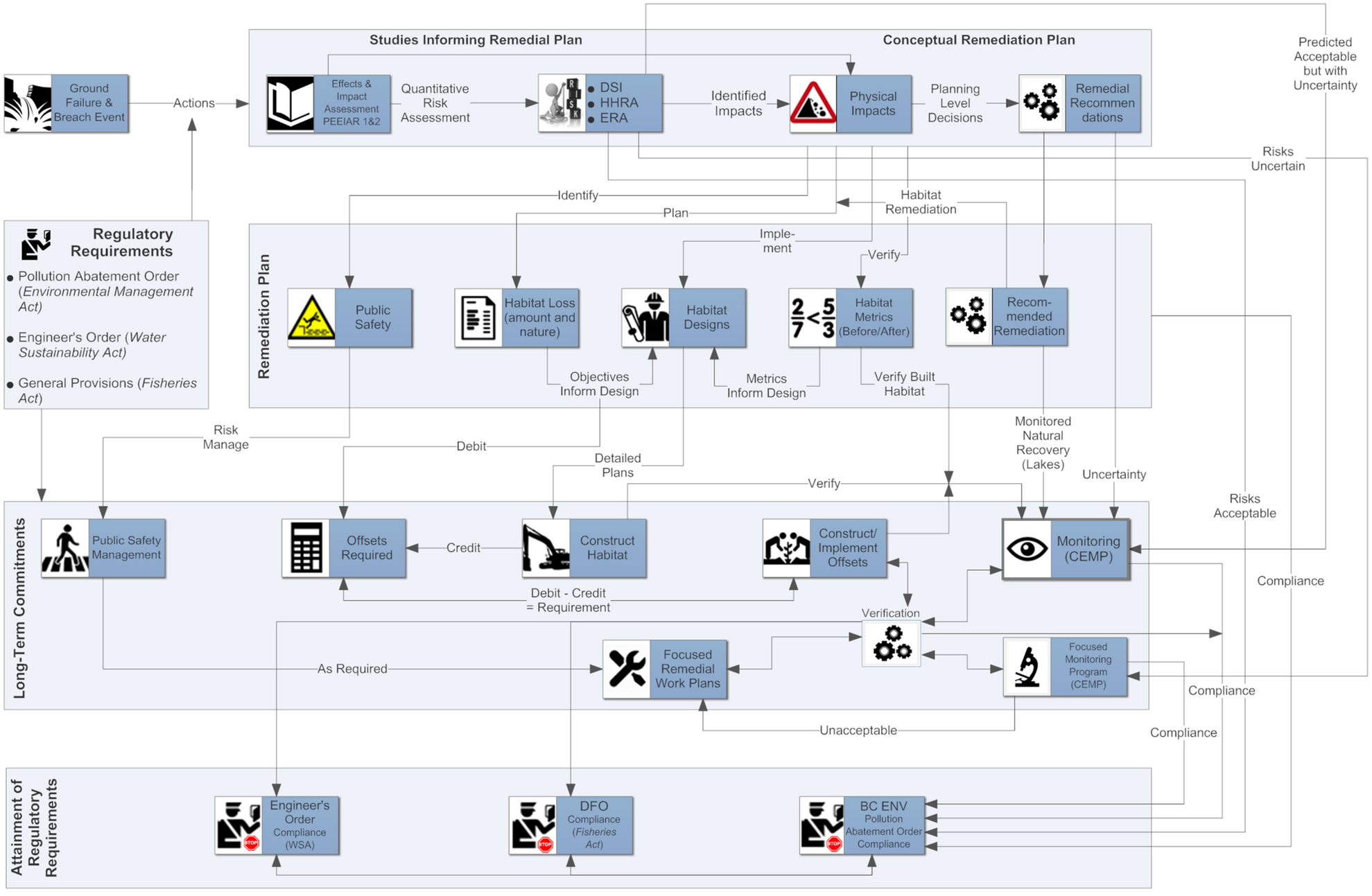

Figure 8: Diagrammatic Representation of Remediation Plan Component Linkages

4.2 Remediation and Offsetting Approach

4.2.1 Remediation of Creek Habitats

Based on the remedial planning basis for the creek habitat, remedial needs for creek habitat are associated with the physical impacts of the breach event. The overall remedial objective for impacted stream habitats is to restore the life history functions of fish, particularly salmonids, by constructing an engineered stream base in the otherwise erodible (fluvial and lacustrine) native sediments below Hazeltine Creek, with habitat features to support an aquatic ecosystem. Design features will also restore ecological functions for wildlife associated with small streams and their riparian environments. For the purposes of developing habitat objectives for creek remediation, the HRWG defined ecological units and potential pathways of effects in a manner guided by DFO (2012) (Table 2).

Table 2: Potential Pathways of Effect Associated with Creek Ecological Functions and Indicator Fish Species (DFO 2012)

Remediation Area / Ecological Unit	Ecological Function	Potential Pathway of Effect				Indicator Fish Species
		Deposition of Material	Alteration or Removal of Structure	Alteration of Riparian Habitat	Exclusion from Habitat by Temporary Fences or Blockages	
Upper Hazeltine (H1)	Spawning	●	●		●	Rainbow Trout
	Rearing	●	●	●		
	Overwintering	●	●			
	Migration	●			●	
Lower Hazeltine Creek (H2)	Spawning	●	●			Rainbow Trout Coho, Chinook and Sockeye Salmon Kokanee Mountain Whitefish Burbot
	Rearing	●	●	●		
	Overwintering	●	●			
	Migration	●				
Upper Edney Creek (E1)	Spawning				●	Rainbow Trout
	Migration				●	
Lower Edney Creek (E2 and E3)	Spawning	●	●			Rainbow Trout Coho, Chinook and Sockeye Salmon Kokanee Mountain Whitefish Burbot
	Rearing	●	●	●		
	Overwintering	●	●			
	Migration	●				

● - pathway of effect potentially operable.

Pre-disturbance morphology of Hazeltine Creek is relatively well known due to previous stream assessment work done in the area (Bruce and Slaney 1991, MPMC 2009). An important aspect of the remedial design of fish habitat is the integration of three specific channel meander patterns. Each pattern is associated with features of the overall channel of Hazeltine Creek, specifically the lower floodplain, the mean annual flood (MAF) channel, and the low flow channel. The primary meander pattern is exhibited by the lower floodplain; this part of the overall floodplain will be engaged by flows associated with freshet. The second meander pattern is displayed by the MAF channel. This channel can convey the average peak discharge of Hazeltine Creek throughout the year; flows overtop the channel during freshet and enter the lower floodplain. The MAF channel meanders off the centre line of the lower floodplain. The tertiary meander pattern is associated with the low flow channel. This channel meanders off the centre line of the MAF channel. It will concentrate low flows during late summer, fall and winter.

The process of creek habitat remediation that has been carried out is as follows:

- Habitat objectives for each reach of stream habitat were determined by the HRWG and in some cases (detailed in the sections below) habitat that fits those objectives has been constructed.
- Based on these objectives, channel morphology and habitat characteristics are designed and reviewed with the HRWG before being constructed.
- Following the construction of the habitat based on reach-specific objectives, the habitat is evaluated based on pre-determined criteria (set by HRWG; Table 3) and residual effects of the TSF breach on fish habitat and the functionality and value of the habitat is evaluated to determine whether habitat offsetting measures to address residual effects are warranted. In addition, the HRWG will follow DFO policy (DFO 2013) to developed criteria for evaluating, ranking and selecting appropriate offsetting measures.
- All construction and repair is documented, and record drawings are produced. Once the initial habitat meets the design specifications, monitoring based on the evaluation criteria (Table 3) continues annually until the habitat has reached project objectives. Post-construction evaluation may result in adjustments or repair to installed habitat features resulting in another round of implementation and evaluation.

A list of design and record drawings issued for Hazeltine Creek remediation is provided in Appendix A.

Creek habitat remediation by remediation area / reach is described in further detail in the following sections for each of the areas.

Table 3: Metric Criteria for Defining Poor, Fair, and Good Quality Stream Habitat and Channel Structure and Form

Habitat Parameter	Quality Rating		
	Poor	Fair	Good
Bankfull width-to-depth ratio	>25:1	16-25:1	≤15:1
Entrenchment ratio	<1.4	1.4 to 2.2	>2.2
Channel complexity	<2 mesohabitat units/10xWbf	2-3 mesohabitat units/10xWbf	3 mesohabitat units/10xWbf
Percent pool (by area)*	<15	15 to 40	40 to 60
Pool frequency (mean pool spacing)*	>10 channel widths/pool	>8-10 channel widths/pool	<8 channel widths/pool
Holding pools (adult migration)	<1 pool/km >1 m deep with good cover (30% of pool area)	1 to 2 pools/km >1 m deep with good cover (30% of pool area)	>2 pools/km >1 m deep with good cover (30% of pool area)
LWD pieces per channel length, measured as bankfull width*	<1	1 to 2	>2
Percent wood cover in pools* (i.e., wood cover as a percent of pool area)	pools in reach average 0 to 5% LWD cover	pools in reach average 6 to 20% LWD cover	pools in reach average >20% LWD cover
Spawning substrate size, quality and area	size mostly <6 or >60 mm; >25% fines (<2 mm); <10% spawning gravel area within wetted area of all habitats surveyed	size 6-60 mm; 15 to 25% fines (<2 mm); ≤25% spawning gravel area within wetted area of all habitats surveyed	size 6-60 mm; ≤15% fines (<2 mm); >25% spawning gravel area within wetted area of all habitats surveyed

Modified after Johnston and Slaney 1996, Slaney and Zaldokas 1997, Newbury and Gabourey 1993 and Hickman and Raleigh 1982.

Note: For riffle-pool streams with mean gradient <2%, bankfull widths <15 m, and for summer/winter rearing use.

LWD - Large woody debris; Wbf – bankfull width.

The quality ratings are specific to the habitat parameters identified by the HRWG and are not intended to imply quality of remediation.

4.2.2 Remediation of Lake Habitats

The residual effects that require remediation in Quesnel and Polley Lakes are risks that arise from the physical impacts of the breach outflow and associated materials and the low organic carbon content which is characteristic of the tailings material. The size and profile of a lake results in distinct ecological components that have implications for habitat types and fish usage, and ultimately the influence that the event had on Polley Lake and Quesnel Lake. These components are illustrated in Figure 9 and described below:

- Benthic – associated with the lake bottom.
- Emerging insects – insects that have a water-based larval stage and a flying adult stage.
- Epilimnion – the water column above the thermocline.

- Hypolimnion – the water column below the thermocline.
- Limnetic zone – the portion of the water column through which light penetrates.
- Littoral zone – the area of the lakeshore where aquatic plants grow. In Quesnel Lake, this area is variable but approximately 4 to 6 m deep.
- Phytoplankton – free-floating plants/algae and photosynthetic bacteria.
- Profundal zone – the portion of the water column that light does not reach and as a result does not support plant growth. Elsewhere in this report, this may also be referred to as the “benthic” zone.
- Thermocline – a sharp density gradient in the water column that limits mixing of the water column which is caused by differences in temperature between the upper and lower water column. In the summer, the surface of the water column is warmer and the water at depth is cooler.
- Zooplankton – free-floating invertebrates.

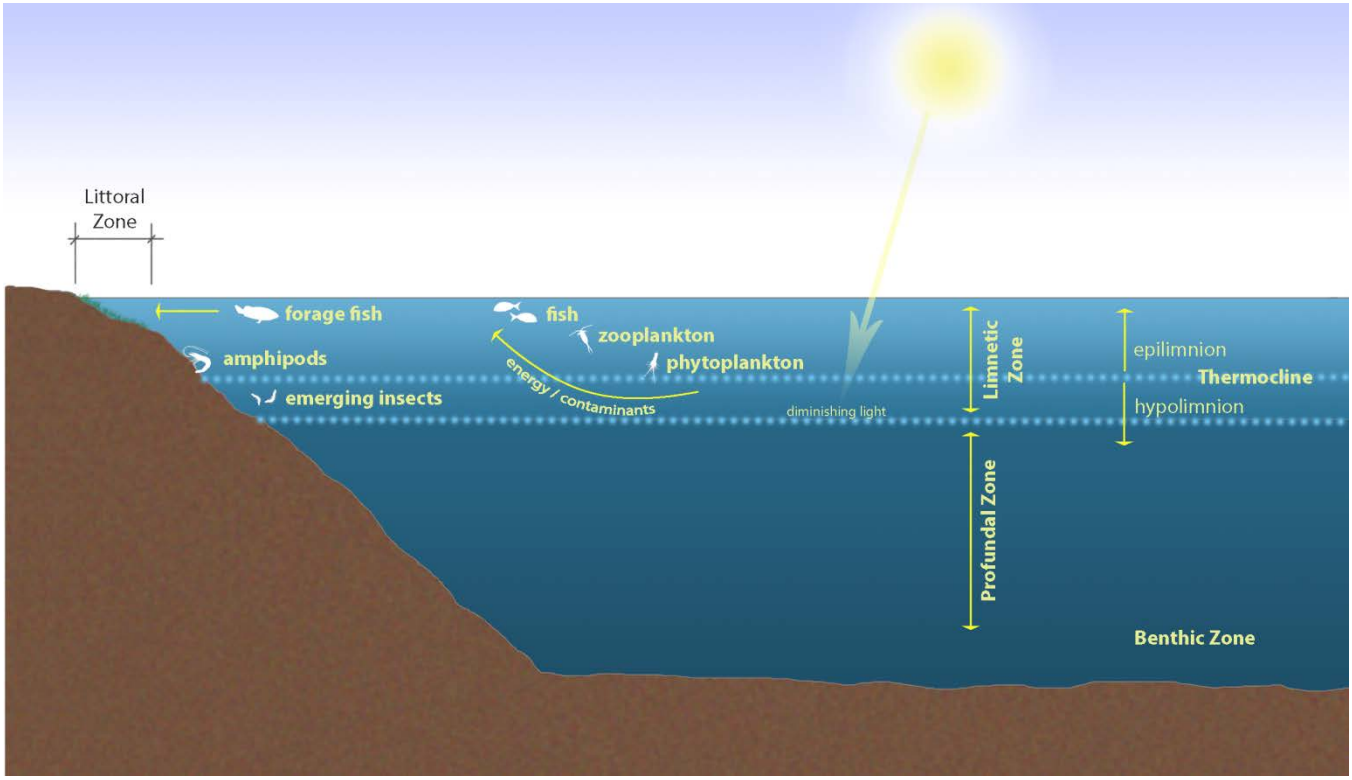

Figure 9: Generalized Conceptual Ecological Model for a Lake

Golder (2015c) reviewed life history and feeding requirements for the 20 fish species identified in Quesnel Lake and developed a conceptual ecological model for fish-habitat-food assemblages in Quesnel Lake, of which three general assemblages were identified:

- Littoral zone and benthic habitats – Fish associated with the littoral zone and benthic habitats are oriented to the near-shore environment and feed largely on benthic prey, periphyton, or in some cases crustacean zooplankton in the water column (McPhail 2007, Scott and Crossman 1973). Fish in this group include juvenile stages of salmon (*Oncorhynchus* spp.) and adult and juvenile Mountain Whitefish (*Prosopium williamsoni*) which eat plankton, Lake Whitefish (*Coregonus clupeaformis*) and Pygmy Whitefish (*Prosopium coulterii*), and juvenile Burbot (*Lota lota*), which are benthivores (i.e., their food comes from benthic substrates), and forage fish such as sucker, sculpin, chub, shiner and Northern Pikeminnow (*Ptychocheilus oregonensis*). The forage fish have a range of feeding habits and may consume primarily benthic invertebrates or periphyton, or in the case of Northern Pikeminnow, eat other fish (i.e., they are piscivorous). Other fish considered in this assemblage are adult Burbot, which are also piscivorous, and make vertical migrations in the summer to feed on Trout, minnow, sucker and sculpin.
- Open-water habitat and fish that feed on emerging insects – Fish that are associated with open-water habitat and feed on emerging insects include Mountain Whitefish, which typically inhabit the upper 20 m of the water column, and smaller Rainbow Trout, which undertake a diel (i.e., daily) vertical migration (McPhail 2007, Scott and Crossman 1973). Larger adult Rainbow Trout in Quesnel Lake may consume juvenile Sockeye Salmon and Kokanee (Parkinson et al. 1989).
- Open-water habitat and fish that feed on crustacean zooplankton - The assemblage of fish that is associated with open-water habitat and that feed on crustacean zooplankton consists of juvenile Sockeye Salmon which undertake a diel vertical migration, orienting to the lower boundary of the thermocline at night (Levy et al. 1991) and descending to 60 to 80 m depth at night (McPhail 2007; Morton and Williams 1990; Scott and Crossman 1973). Kokanee also undertake a vertical migration, generally feeding near surface at dawn and dusk, and staying below the thermocline during the day and at night. During the summer, this assemblage may also include Lake Trout (*Salvelinus namaycush*).

The conceptual ecological model for Polley Lake is a simplified version of that of Quesnel Lake. Rainbow Trout is the only CRA fish species present and other fish in the lake include Longnose Sucker and Redside Shiner. The conceptual model for open-water habitat and fish that feed on emerging insects is applicable to Rainbow Trout.

For the purposes of developing habitat objectives for lake remediation, the HRWG refined the conceptual ecological model for Quesnel Lake into three ecological units and selected ecological functions and indicator fish species for each unit (Table 4) in a manner guided by DFO (2012). Polley Lake is considered one ecological unit.

As described in previous sections, the breach event resulted in scouring and deposition of material in and along Polley Lake and Quesnel Lake and temporarily altered water quality. The ERA indicated that altered water quality is no longer an operable pathway of effect and thus the focus of the identification of potential lake remediation needs was on physical effects. Physical habitat remediation and offsets will be addressed by the HRWG. An analysis of the remedial options for Quesnel Lake is provided in Section 4.11. For Polley Lake, the options evaluation would be based on similar considerations although the circumstances of Polley Lake are different in terms of its stage of benthic community recovery and it has specific issues with regards to the age class structure of Rainbow Trout in Polley Lake.

Table 4: Potential Pathways of Effect Associated with Lake Ecological Functions and Indicator Fish Species (DFO 2012)

Ecological Unit	Ecological Function	Potential Pathway of Effect				Indicator Fish Species
		Deposition of material	Alteration or Removal of structure	Alteration of Riparian Habitat	Exclusion from Habitat by Temporary Fences	
Polley Lake	Spawning	●	●		●	Rainbow Trout
	Rearing	●	●	●		
	Overwintering	●	●			
	Migration	●			●	
Quesnel Lake Limnetic Zone	Rearing					Rainbow Trout, Coho Salmon, Chinook Salmon, Sockeye Salmon, Mountain Whitefish, Bull Trout, Kokanee, Lake Trout, Lake Whitefish, Pygmy Whitefish, Burbot
	Migration					
Quesnel Lake Littoral Zone	Spawning	●	●			Rainbow Trout, Coho Salmon, Chinook Salmon, Sockeye Salmon, Mountain Whitefish, Bull Trout, Kokanee, Lake Trout, Lake Whitefish, Pygmy Whitefish, Burbot
	Rearing	●	●	●		
	Migration					
Quesnel Lake Benthic Zone	Rearing	●	●			Rainbow Trout, Bull Trout, Lake Trout, Mountain Whitefish, Pygmy Whitefish, Lake Whitefish, Burbot

● - pathway of effect potentially operable.

4.2.3 Remediation of Terrestrial Habitats

Aquatic ecosystems are linked to adjacent terrestrial ecosystems by transitional riparian zones and wetland areas (Gregory et al. 1991). For the purposes of this report, terrestrial ecosystems include riparian areas, floodplains and upland areas that may escape even the highest water levels. The residual effects to terrestrial habitats that need to be remediated are from the physical impacts of the breach outflow and because the tailings lack the heterogeneity and nutrient processing that is part of a healthy soil or sediment ecosystem. The physical impacts (e.g., undercutting of banks, scour) have in part been addressed through the re-contouring of the slopes along Hazeltine Creek; however, the loss of forest soils is part of the needed remediation.

Terrestrial conditions after the TSF breach consisted of a general absence of original vegetation in the Hazeltine Creek corridor and floodplain. The force of the debris flow diminished at the edges of the floodplain, such that the trees in the “halo” zone were not uprooted, but the forest floor was covered by a variable thickness layer of mixed tailings, soil and debris. Where the tailings cover was thicker, it led to anoxic conditions in the location of the tree root causing root death and eventually the trees died (Golder 2015a). Further summary of the impacts to the forest community within the halo area is provided in Golder (2016a, 2017c).

The general forest successional process, as observed in natural disturbances, can be emulated, with enhancement, when re-establishing functional ecosystems on disturbed sites. Successful remediation will put reclaimed ecosystems onto a trajectory that will eventually lead to successional processes similar to natural systems. Deliberate actions such as mixing in natural soils which contain soil fauna and local seed banks, selecting and planting appropriate species that accelerate restored soil structure and making the soil more “rough and loose” to enable seed and oxygen penetration and root formation will accelerate the speed with which that trajectory can progress. The goal is to establish naturally diverse and functional communities on the ecosystem, landform, and landscape scales. These ecosystems will provide services similar to undisturbed ones. The establishment of this trajectory will develop conditions that allow a self-sustaining ecologically diverse community in the affected riparian and adjacent forest areas. Part of developing this trajectory is to establish key pioneering species which are typically tolerant of difficult growing conditions, contribute to the re-establishment of soil organic content and soil fauna, and establish suitable growing conditions for later-successional seedlings by creating shade and increasing relative humidity in the understory (Walker and del Moral 2003).

The terrestrial remediation strategy applied by MPMC takes a managed successional trajectory approach to remediation, based on the principles of ecological succession, and relies on the assisted auto-regeneration capacities of vegetation and natural processes of soil renewal. Site preparation methods can be used to A) mix forest floor, mineral soils and any residual tailings to increase soil porosity, B) create raised microsites that have aerated root zones, and C) create plantable microsites. These approaches have been applied in the breach-impacted terrestrial areas. If monitoring indicates it to be necessary, soil fertility can be further improved in areas with nutrient deficiencies by applying soil amendments such as imported soils, microbial inoculum and fertilizer in planting zones or in each planting hole. In the areas where site preparation has yet to be applied, it is important to preserve the organic matter in situ as much as possible and avoid soil compaction during site work.

Once soil conditions are amenable to seed germination and growth, early successional species will establish and late successional species will slowly colonize through dispersal from nearby seed sources. To assist this process, various planting efforts have been undertaken to establish early-mid successional native species in the TSF breach area.

The choice of the remediation target for terrestrial ecosystems is based on the types of habitats and ecological parameters of a given area, according to local ecosystem classification and end land use. The goal of remediation in this case is to assist the establishment of as many functional elements as possible relative to target ecosystems. MPMC is currently in the process of implementing terrestrial remediation and revegetation actions in the TSF breach area and these efforts are detailed for each Remedial Area in the report sections that follow.

Target ecosystems are based on the BC Biogeoclimatic Ecosystem Classification (BEC) system, which categorizes ecosystems using a hierarchical system. Landscapes are divided into zones, subzones, and variants based on climate (Pojar et al. 1987). BEC subzones are further divided into site series, which are ecosystems that are classified on the basis of site, soil, and vegetation characteristics, resulting in sites capable of producing the same basic mature or “near-climax” plant communities (Meidinger and Pojar 1991). The TSF breach area falls within the Interior Cedar Hemlock biogeoclimatic zone (ICH) and the Quesnel Wet Cool (ICHwk2) and Horsefly Moist Cool (ICHmk3) subzone variants.

Revegetation as part of the RP uses the BEC system to identify appropriate ecosystem targets (i.e., late succession ecosystems) by matching site conditions of areas to be rehabilitated to predicted site series in the ICH-wk2 and -mk3. Vegetation communities present in the TSF breach area were primarily riparian and wetland communities along Hazeltine Creek consisting of forested, shrub-dominated or meadow vegetation communities. The distribution of pre-breach mapped ecosystems is shown in the PEEIAR, (Appendix G: Terrestrial Wildlife and Vegetation; MPMC 2015a).

Considerable planting has occurred under the direction of MPMC, by experienced contractors, in the breach outwash area. Planting data provided by MPMC are broken down as follows:

- all of Hazeltine Creek
  - shrubs (355,112)
  - conifers (192,480)
  - wattles (10,498 meters)
  - ground cover by seeding (136 ha)
- lower floodplains and Quesnel Lake shoreline
  - willow and cottonwood wattles and stakes (1 stem per 0.5 to 1m spacing, planted along shorelines and creek edges)
  - plug stock comprised of Prickly Rose, Red Oiser Dogwood, and Black Twinberry planted (planting density of 15,000 to 20,000 stems/ha)
- Ground Cover Seed – Mixed species
  - 25% Mountain Brome
  - 25% Bluebunch Wheatgrass
  - 25% Blue Wildrye
  - 14.31% Rocky Mountain Fescue
  - 10% Native Red Fescue
  - 0.014% Fireweed
  - 0.68% Big Leaf Lupine

4.2.4 Offsetting Approach

As discussed in Section 4.1, it is expected that additional habitat will need to be provided to offset for the temporal loss of habitat use following the breach and before habitat remediation has been undertaken. This section presents the approach that is being taken to estimate the quantity of offsetting that will be needed, specifically, habitat equivalency analysis (HEA). Examples of these calculations are provided in Section 5.0. In some cases, the available data may not support an offsetting calculation, or it may not be feasible to construct in-kind habitat (e.g., deep lake benthic habitat) and therefore alternative approaches to deriving offsetting estimates are also provided in Section 5.0. Concepts for potential offsetting options are also discussed in Section 5.0.

HEA is a procedure initially developed by NOAA (1995) and provides a framework for determining the area required for compensatory restoration (i.e., offsetting) for temporary habitat disturbances (Kohler and Dodge 2006). The main assumption underlying HEA is that the losses of habitat resources can be compensated for (offset) by habitat replacement projects that provide additional resources of a similar type. The more commonly used methods apply subjective offsetting ratios. A key difference in this application of such ratios in land development scenarios is that the habitat loss is complete and permanent (e.g., where a shoreline area is filled in for construction of a land-backed wharf or a stream is covered by a structure), whereas the nature of habitat impact resulting from the breach event is a temporary disturbance and / or reduction in function (e.g., productivity, organism movement), provided that the loss has been rehabilitated. The HEA approach is thus a more appropriate means of estimating the amount of habitat that would offset such impacts because it recognizes the temporary nature of the “injury”. An illustration of the concepts behind HEA is provided in Figure 10.

1. **Productive capacity** - the maximum natural capability of a habitat to produce fish or to support aquatic organisms upon which fish depend, or in other words the physical area of substrate. Productive capacity remains even in the absence of an ecosystem function or productivity (see note 2), such as may result from contamination or temporary disruption to or alteration of physical habitat. For the purposes of this conceptual model, productive capacity is defined as the area of habitat available (m^2).
2. **Productivity** –the sum of production rates in a given area. Productivity integrates the contribution of primary production, food, cover and other habitat variables to producing fishery resources. For the purposes of this conceptual model, productivity is considered to be a nominal "output" per area (output/m^2). In the context of HEA, productivity may also be termed as "ecosystem services".
3. **Disturbance –** a disturbance to productivity, in the case of the Project involves changes to physical habitat or introduction of contaminants that affect productivity.
4. **Recovery –** recovery refers to a return of productivity and occurs where productive capacity (physical habitat) remains. The period of recovery is dependent on the ecosystem type. For example, lakebed sediments will recolonize with benthic organisms relatively rapidly, whereas replanted riparian vegetation make take multiple years to reach expected productivity.
5. **Lost productivity** – the production or ecosystem service lost following a temporary disturbance of the habitat. The productive capacity is assumed to remain.
6. **Habitat Equivalency Analysis** – HEA converts lost productivity (or ecosystem services) accumulated over time (if applicable) into an equivalent area (potential productive capacity)
7. **Equivalent compensatory habitat** – the area of habitat that can be constructed to offset lost productivity during a temporary disturbance.
8. **Compensatory habitat construction –** will increase productive capacity and in turn contribute productivity to offset losses experienced during a temporary disturbance.

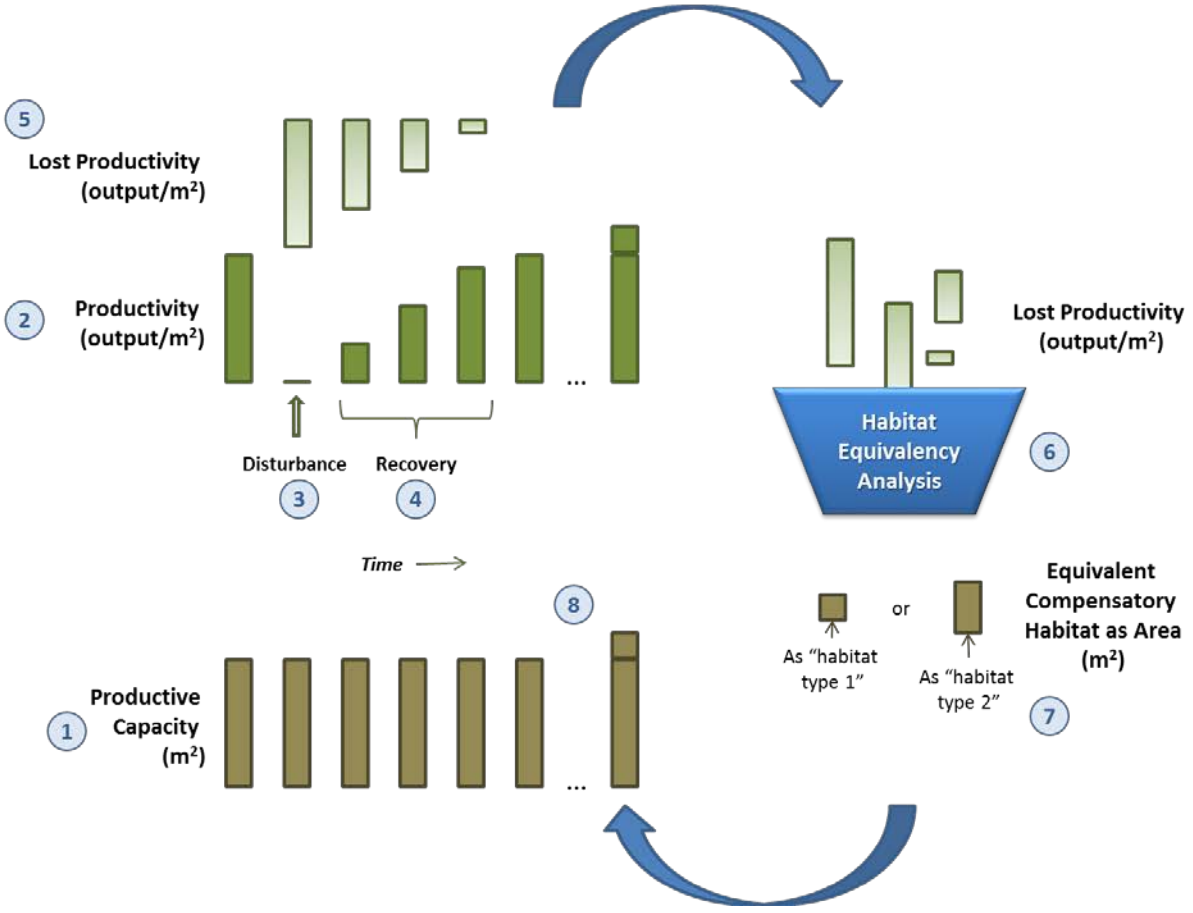

Figure 10: Illustration of Habitat Equivalency Analysis Concept

The HEA concept developed by NOAA (1995) is expressed as a complex equation:

$$J * V_j * \sum_{t=0}^{N+1}\left[(1+r)^{C-t} * \frac{b^j - 0.5\left(x_{t-1}^j + x_t^j\right)}{b^j}\right] + \left[\left(\frac{b^j - x_{t=N+1}^j}{b^j}\right) * \frac{1}{r} * (1+r)^{C-(N+1)}\right] =$$

$$P * V_p * \sum_{t=I}^{M+1}\left[(1+r)^{C-t} * \frac{0.5\left(x_{t-1}^p + x_t^p\right) - b^p}{b^j}\right] + \left[\left(\frac{x_{t=M+1}^p - b^p}{b^j}\right) * \frac{1}{r} * (1+r)^{C-(M+1)}\right]$$

Kohler and Dodge (2006) translated NOAA's equation into user-friendly software, Visual_HEA (with updates per Pioch et al. 2017), that requires the following input parameters:

- **Year of "claim".** This is the year in which the habitat damages/harmful disruption are made. The "claim" is an anchor point in time. The HEA calculations use the claim year as the reference point in calculating discounted service levels. The discount level at the time at which the damages were incurred is 1.0.
- **Service loss parameters from the habitat disruption.** This includes the size of the habitat damages/harmfully disrupted area and the time history of the loss of services at the disrupted site. In other words, it identifies the duration and level of service loss from time of disruption through habitat compensation.
- **Compensation ratio.** This parameter is the ratio of the area of disrupted habitat to the area of compensatory habitat. In this formulation of the Visual_HEA program, the compensation ratio is held constant throughout the analysis and was assumed to be 1:1 because of the system of monitoring and offset adjustment. The compensation ratio required by DFO for a given project is intended to qualitatively consider the length of time it takes for the habitat to become functional and/or for potential uncertainty in the habitat functioning as anticipated (DFO 2010). When there is uncertainty in the success of the new habitat, variance in the quality of habitat being replaced, and the lag time required for the new habitat to become functional DFO may request a higher ratio. HEA replaces arbitrary ratios with scientifically supportable estimates of recovery duration and in this RP, uncertainty in those estimates is accounted for through verification monitoring and adjustment of offsets owing.
- **Discount rate.** This default parameter incorporates the assumption that services provided sooner are more highly valued than those provided later. Because service losses and gains occur at different times, they should be adjusted to be compared. This adjustment is accomplished using a "discount factor" which decreases the value of future services and increases the value of past services to reflect the service benefits today. The incorporation of a discount factor therefore rewards the early construction of habitat and penalizes delays in constructing habitat. This discount rate is specified as a percentage rate per time unit; a default of 3% is commonly used as this is analogous to the common default inflation rate used for evaluating financial costs into the future. The discount rate does not consider potential short term economic fluctuations that may influence inflation.

- **Baseline levels of services.** These percentage values indicate the level of services being provided by the injury site prior to the habitat disruption and the level of services provided by the compensation site prior to any compensatory action. That is, in the case of the damaged or disrupted site, the baseline represents the level of services that would have been provided by the site had the disruption not occurred. For example, the baseline level of services of a habitat prior to disruption might be 100% (full services) or at some lower value depending upon the condition of the habitat. Conversely, the services level provided by the restoration site immediately upon restoration action might be 0% (no services such as would be the case upon immediate placement of a new substrate).
- **Pre-restoration service level**: This is the service level provided by the habitat during the period of disruption. In the case of Hazeltine Creek, this service level would be zero prior to build-out of a reach.
- **Service gain parameters from the compensatory action (restoration).** This includes the time history of service levels of the compensatory action.

4.3 Overview of Remedial Objectives by Area

Table 5 provides a summary of the remediation objectives by area and the work that has been carried out in those areas is summarized in Table 6. The focus of these objectives is to define the design basis for physical (structural) habitat that delivers the functions defined in those objectives. Protection of water and sediment quality is an overarching objective for the aquatic components of the project area and soil quality for the terrestrial components. As described in Section 4.1, water, sediment and soil quality are being risk managed and addressed through the CEMP as appropriate and, if monitoring demonstrates it to be needed, site-specific remediation work plans may be developed in the future to address potential risks to organisms from chemical stressors.

Table 5: Habitat Remediation Objectives by Area

Area	Area Name	Reach	Fish Habitat EU	Aquatic Objectives	Terrestrial Objectives
1	Tailings Storage Facility	NA	NA	NA	NA
2	Polley Flats	1	H1	■ Create rearing habitat for juvenile Rainbow Trout (primary objective) ■ Create spawning habitat for Rainbow Trout ■ Create overwintering habitat for Rainbow Trout	■ Establish self-sustaining riparian revegetation that provides cover, insect drop and eventually LWD to Hazeltine Creek ■ Establish riparian and adjacent forest vegetation that provides resistance of soils to erosion ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
3	Polley Lake	NA	Polley Lake	■ Restored benthic invertebrate community that contributes food organisms to fish that prey on emerging insects	■ Establish riparian revegetation along impacted shoreline of Polley Lake ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
4	Upper Hazeltine Creek	2	H1	■ Create spawning habitat for Rainbow Trout (primary objective) ■ Create rearing habitat for juvenile Rainbow Trout	■ Establish self-sustaining riparian revegetation that provides cover, insect drop and eventually LWD to Hazeltine Creek ■ Establish riparian and adjacent forest vegetation that provides resistance of soils to erosion ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
		3		■ Create spawning habitat for Rainbow Trout ■ Create rearing habitat for Rainbow Trout	
5	Hazeltine Canyon	4	NA	■ Rearing habitat for Rainbow Trout (minor)	■ Promote natural successional processes
6	Lower Hazeltine Creek	5	H2	■ Create spawning habitat for Coho, Sockeye and Kokanee ■ Create rearing habitat for Rainbow Trout and juvenile Coho Salmon ■ Create overwintering habitat for Rainbow Trout and juvenile Coho Salmon ■ Construct a stream channel that is connected to the floodplain and maintains natural flow of surface water and sediment ■ Identify post-remediation uses (objectives) for the sediment control ponds (HRWG)	■ Establish self-sustaining riparian revegetation that provides cover, insect drop and eventually LWD to Hazeltine Creek ■ Establish riparian and adjacent forest vegetation that provides resistance of soils to erosion ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
6	Lower Edney Creek	6	E2, E3	■ Restore and maintain passage from Quesnel Lake to Edney Creek watershed ■ Create spawning and rearing habitat for Coho Salmon and other species (including other salmonids) ■ Create rearing habitat for Rainbow Trout and Coho Salmon	■ Establish self-sustaining riparian revegetation that provides cover, insect drop and eventually LWD to Hazeltine Creek ■ Establish riparian and adjacent forest vegetation that provides resistance of soils to erosion ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
7	Edney Creek Mouth	6	E3	■ Maintain passage to and from the confluence of the two watercourses from and to the reaches of Edney Creek unaffected by the dam breach ■ Create rearing habitat for Rainbow Trout and Coho Salmon ■ Create shallow gravel shoal habitat	■ Establish self-sustaining riparian revegetation that provides cover, insect drop and eventually LWD to Hazeltine Creek ■ Establish riparian and adjacent forest vegetation that provides resistance of soils to erosion ■ Increase oxygen exchange with native soil ■ Create micro sites with suitable growing conditions for regenerating plants ■ Increase habitat complexity for riparian wildlife including amphibians
8	Quesnel Lake	Limnetic Zone	QL - Limnetic	NA	NA
		Littoral Zone	QL - Littoral	■ Restored access to Lower Edney Creek for spawning and rearing fish ■ Restored use of littoral zone for shoreline spawning and rearing ■ Create shallow shoreline habitat with conditions that promote the establishment of emergent and submergent vegetation.	■ Planting and assisting recovery of suitable riparian vegetation
		Benthic Zone	QL – Benthic	■ Restored benthic invertebrate community that contributes food organisms to fish that prey on emerging insects (e.g., Lake Whitefish)	NA
9	Quesnel River	NA	NA	NA	NA

HRWG – Habitat Remediation Working Group; LWD – large woody debris; NA – not applicable; QL – Quesnel Lake.

Table 6: Summary of Remediation Strategies and Treatments for Impacted Stream Reaches To 2018

Actions to Date	Remediation Area						
	1 (Polley Flats)	2 (Upper Hazeltine)	3 (Upper Hazeltine)	4 (Hazeltine Canyon)	5 (Lower Hazeltine)	6 (Lower Edney Creek)	NA (Edney Creek Mouth)
Site preparation (creating access, opening borrow areas, installing erosion-protection, etc.)	✓	✓	✓	✓	✓	✓	✓
Rough grading (filling in depressions and gullies, removing deposits of tailings, roughing in floodplain, stabilizing cut-banks, excavating channel)	✓	✓	✓	NA	✓	✓	✓
Initial armouring to stabilize channel and allow flows to be released from Polley Lake	✓	✓	✓	NA	✓	✓	✓
Placement of spawning gravels, woody debris, etc.	✓ (Oct 2016)[2]	✓ (Sep 2017)[3]	⊙	NA	⊙	✓ (Sep 2015)	✓ (Sep 2015)
Slope Grading	✓ (Oct 2015)	✓ (Oct 2015)	✓ (Oct 2015)	NA	✓ (Oct 2015)	✓ (Oct 2015)	✓ (Oct 2015)
Riparian planting[1]	✓ (Oct 2016)[2]	✓ (Oct 2017)[3]	⭘	NA	⭘	✓ (Oct 2015)	✓ (Oct 2015)
Re-grading of cut-banks	✓	✓	⭘	NA	✓	✓	✓
Construction of Settling Ponds	NA	NA	NA	NA	✓	NA	NA
Soil placed with coarse woody debris	✓	✓	⭘	×	✓	×	×
Recontour with topsoil and coarse woody debris	✓	✓	✓	×	✓	✓	*
Floodplain mounded with coarse woody debris	✓	✓	⊙	×	✓	✓	×
Floodplain ripped with coarse woody debris	✓	✓	✓	×	✓	×	×
Grass seeding	✓	✓	✓	✓	✓	✓	✓
Wood chip mulch with coarse woody debris	×	×	×	×	✓	×	×

✓Complete; ⭘ Partially Complete (see notes below); ⊙ To Be Completed; × Not Planned; NA Not Applicable.

Notes:

Reach 4 - Created access only.

Reach 3 - Some seeding and some planting has been done; however, more work will need to be done. Habitat work (placement of spawning gravels, woody debris, etc.) still to be completed and will disturb some of the planted areas.

- Regrading at cut banks complete except for the big blowout at 5,800 m.

Reach 5 - Some seeding and some planting has been done; however, more work will need to be done. Habitat work (placement of spawning gravels, woody debris, etc.) still to be completed and will disturb some of the planted areas.

[1]Riparian planting consisted of planting staked live wattles of willow and black cottonwood, prickly rose, black twinberry, red osier dogwood, Sitka alder and conifers as well as a custom locally collected multispecies seed blend.

[2] Parts of Polley Flats remediated in 2017

[3] Remediation work completed in Reach 1 in 2016 extended down into Reach 2 to chainage 1+265 m in progress October 2017.

4.4 Remedial Approach by Area

The following sections present background on the physical characteristics requiring remediation, the work that has already been carried out, the options considered, and the preferred conceptual remediation approach.
The options analysis for work that has already proceeded (e.g., in Hazeltine Creek) was undertaken at the time the work was being planned and implemented and those options included the input of external advice through the HRWG. The resulting work incorporated that advice.

The focus of the following section is on aquatic habitat remediation because the objectives differ by reach. Terrestrial remediation is also necessary but the objectives have some commonalities such as riparian function along all reaches (and lakeshores), provision of habitat complexity for riparian wildlife, including amphibians and regeneration of soil structure. These are outlined in Table 5.

4.4.1 Tailings Storage Facility / Area 1 (Dam Breach Re-engineering)

The TSF breach in the perimeter embankment has been repaired and considerably upgraded with buttressing as described below and MPMC has since received permits enabling the operation of the TSF within the parameters of those permits.

- The 4 August 2014 breach of the TSF Perimeter Embankment was about 100 m long, although damage occurred to an approximately 400 m length of the embankment. A temporary upstream rockfill berm was constructed between August and September 2014 to control the release of tailings.
- A Freshet Management Embankment was constructed at the breach zone between November 2014 and June 2015 to allow capture and temporary storage of the 2015 freshet flows and prevent release of tailings to the downstream environment. The Freshet Management Embankment was constructed with rock-fill, crushed rock aggregate and sandy tailings to an elevation of 950 m. A cut-off wall was then constructed through the Freshet Management Embankment by mixing the crushed rock aggregate with cement and bentonite slurry.
- The Freshet Management Embankment was raised in 2016 and 2017 to elevation 963 and 966 m, respectively. A compacted till core was used as the low permeability element to raise the cut-off wall of the Freshet Management Embankment. Rock-fill, crushed rock aggregate and sandy tailings were placed upstream and downstream to support the till core. A buttress was built downstream of the Freshet Management Embankment in 2016 and 2017. The Freshet Management Embankment, raises and buttress were constructed using non-potentially acid generating (NAG) materials.
- A Perimeter Embankment Buttress was constructed downstream of the Perimeter Embankment in 2015, and the Main Embankment Buttress was constructed downstream of the Main Embankment in 2016. The Buttresses were constructed using NAG rockfill. The buttresses were constructed with a downstream slope of 3H:1V. The Perimeter Embankment Buttress was extended in 2016.

4.4.2 Polley Flats / Area 2 (Reach 1)

Using the classification system of the HRWG, this area corresponds to Ecological Unit H1. Polley Flats / Reach 1 represents the outlet channel of Polley Lake and encompasses approximately 70 ha of the TSF breach area. The natural stream alignment flowing out of Polley Lake had been historically (late 1800s to early 1900s) directed into a manmade, diversion channel for the first 775 m (Golder 2015b) as part of the water supply for hydraulic mining in the area (Figure 11). This channelized outlet ran along the east side of what was historically a vegetated, meandering flood plain. The pre-breach channel connected with a beaver pond which also received input from Bootjack Creek. Polley Flats and Area 2 extended a short distance (~300 m) past this stream convergence, part way into Reach 2 where the stream channel became better defined but still incorporated some beaver dam ponds and side channel meanders (Golder 2015b).



Figure 11: Historic Photo of Polley Lake Cut for Hydraulic Mining (CCHMC, undated, ca. 1900)

Channel, floodplain and vegetation characteristics in Area 2 were significantly altered by the TSF breach. However, with active channel and floodplain remediation integrated with a comprehensive revegetation strategy, there is a high potential for recovery. Limiting factors for Area 2 included large deposits of tailings and associated material, along with scouring and poor, post-breach soil substrate fertility. Overall ecological risk was considered low-moderate for Area 2 (Golder 2017b). As of the end of 2018, approximately 350,000 metric tonnes of tailings have been removed from Polley Flats and a small area in Reach 2. Area 2 aquatic remediation efforts have advanced considerably, with initial armoured channel and creation of complex aquatic habitat completed in 2017. Planting in the riparian zone has also occurred. Remediation activities in Reach 2 are further described in Section 4.6.

A summary of the current remediation actions conducted to date in Area 2 (Reach 1) is summarized in Figure 12 and Table 6.

Primary objectives for aquatic habitat in Area 2 (Reach 1 or Ecological Unit 1) are to provide rearing, spawning and overwintering habitat for rainbow trout. This includes establishing a moderate sinuosity, moderately entrenched, and confined stream type with coarse gravel and small cobble substrate. The channel bed morphology includes riffle-pool morphology with irregularly spaced scour pools. Pools are formed and maintained by large woody debris structures associated with outside meander bends, boulders and eventually, vegetation. Aquatic habitat objectives also include providing a heterogeneous mix of components such as depth, velocity substrate, cover, and pools that support populations of trout and other aquatic organisms. Aquatic habitat construction in Area 2 was carried out in 2017 with ongoing monitoring.

Objectives for terrestrial sites in Area 2 include rehabilitating the floodplain to target ecosystems representing a diverse mosaic of shrubs and trees of varying age classes. Hydrogeomorphic and other disturbance processes will affect the development of the riparian and floodplain ecosystem, ultimately determining the spatial pattern and successional development of riparian vegetation. A mosaic of riparian conifer forest, cottonwoods, aspen and riparian shrubs would be present within the future floodplain depending on topography, disturbance patterns, and morphology. Terrestrial habitat objectives also aim to provide shade, nutrients and small organic debris (SOD) to support riparian ecological functions (Koning and Wendell, 1999). This in turn would support wildlife use in Area 2 and maximise the wildlife habitat features present in the system.

Terrestrial remediation efforts are ongoing with a focus on site preparation and planting. Mounding and ripping as a site preparation method, has helped alleviate compaction and helped liberate the original topsoil over 14.5 ha (20%) of Area 2. This site preparation also creates atmospheric connectivity which increases oxygen exchange and promotes soil fauna and microbial communities. Additional site preparation methods include placing imported soil over 19 ha to bring in needed nutrients and improve growing medium structure. Woody debris has been placed over all the site preparation areas to promote structural heterogeneity and to provide microsites for establishing plants. Remediation efforts such as these, improve the physical and structural properties of the soil, and facilitate re-establishment of vegetation. Upland and riparian plantings have been initiated over 35.6 ha (50%) of the disturbance zone in Area 2.





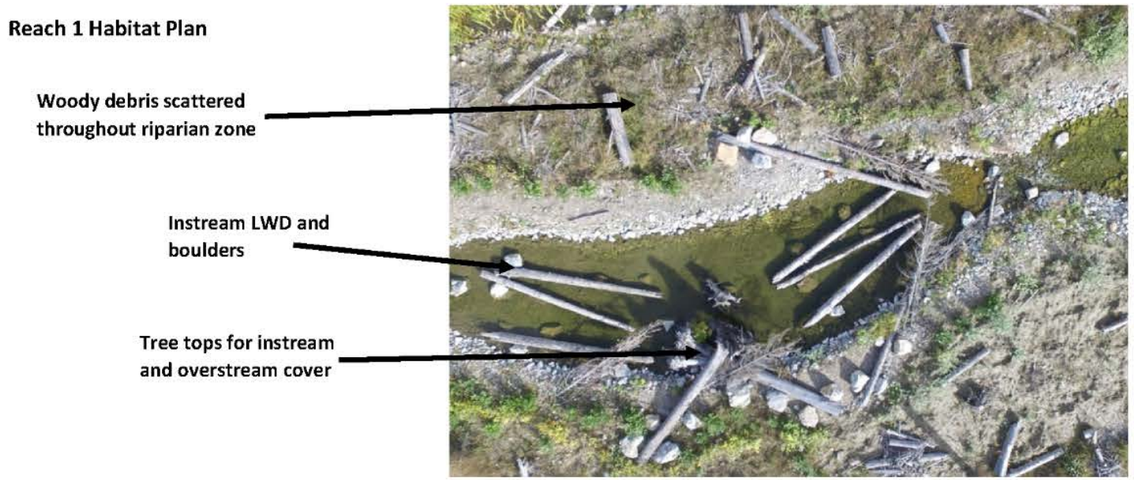

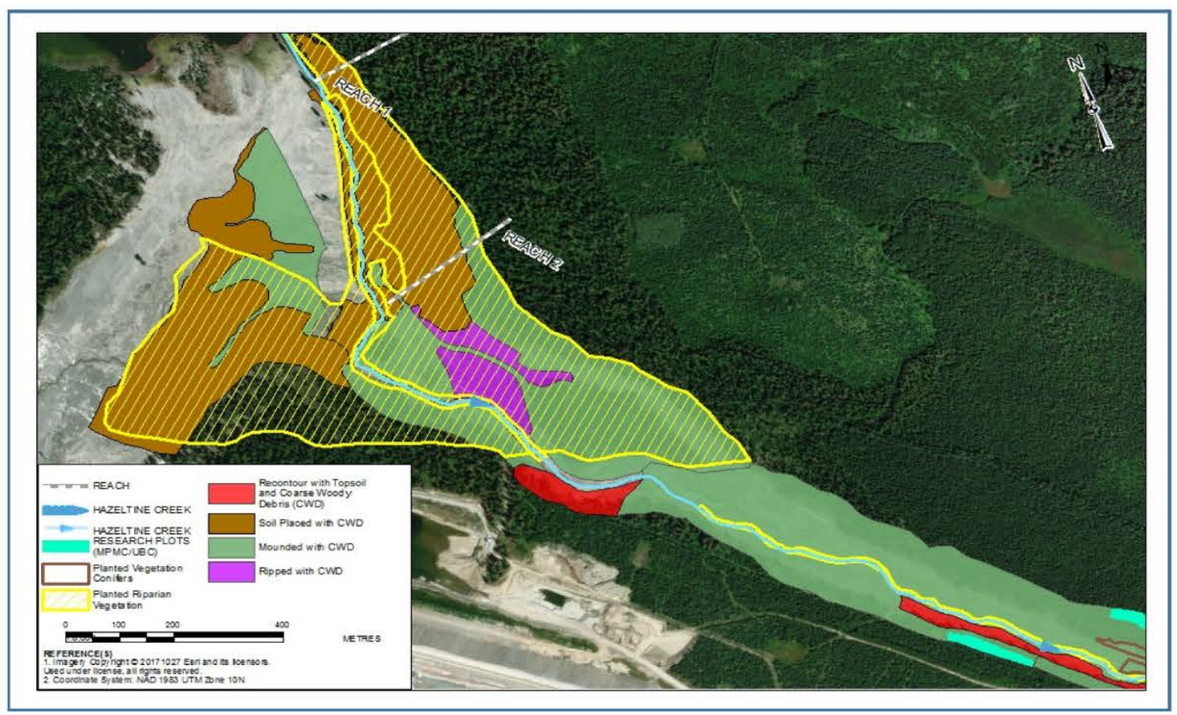

Figure 12: Polley Flats / Area 2 (Reach 1) Description and Current Remediation and Rehabilitation Status

4.5 Polley Lake / Area 3

Using the classification system of the HRWG, this area is one EU – Polley Lake. Polley Lake is situated adjacent to the Mount Polley Mine and has a long (6.17 km), narrow (0.65 km) configuration. The lake has a pre-breach mean depth of 18 m and maximum depths of 35 m in the south basin and 33 m in the north basin. The main inflow to the lake is from the Frypan Lake sub-watershed to the northwest and the estimated hydraulic residence time of the lake is approximately 16.2 years (MPMC 2015a). The lake was previously used to supply water for hydraulic placer operations (see for example Figure 11). Polley Lake is dimictic and mixes from the surface to the lake bottom twice each year. Thermal stratification occurs in summer with the thermocline typically forming at a depth between 5 and 15 m (Minnow 2014). Hypoxic (low oxygen) conditions generally occur at depths greater than 20 m, with dissolved oxygen (DO) concentrations less than 5 mg/L, including before the breach (Minnow 2014). The trophic status of the lake reportedly changed from oligotrophic/mesotrophic prior to mine development (1995/1996) to mesotrophic/ eutrophic in 2012 (Minnow 2014).

Water and tailings released during the spill were deposited directly into Polley Lake. Tailings inundated a wetland at the outlet of Polley Lake and deposited heterogeneously throughout the lake itself (MPMC 2015a). As well, a thick deposit of tailings and other debris (known as the “Plug”), blocked water from flowing out of Polley Lake and into Hazeltine Creek. Immediately following the event, the water level in Polley Lake increased by approximately 1.7 m and turbidity increased in the deeper waters of the lake below the thermocline. In mid-October 2014, turnover occurred causing mixing of shallow and deep water in the lake; during that period, turbidity and DO were uniform throughout the water column. In mid-November 2014, turbidity and DO concentrations in the lake returned to pre-event conditions and have remained consistent since (Golder 2016a).

The deposit of material at the outlet of Polley Lake affected spawning and rearing areas for Rainbow Trout and Longnose Sucker both in the lake as well as downstream of the outlet in Upper Hazeltine Channel. In addition, shortly after the TSF breach a fish fence and flow control structure was installed at the outlet of Polley Lake to Hazeltine Channel. This fish fence had (until April 2018) prevented Rainbow Trout in Polley Lake from accessing historical spawning habitat in Upper Hazeltine Creek during ongoing reconstruction and remediation of Hazeltine Creek. As demonstrated in the age frequency distribution for Rainbow Trout, in 2016 there were a greater number of older fish and an apparent absence of year-1 and -2 individuals compared to the distribution for 2014 (Minnow 2017a).

The deposit of tailings and outwash material in Polley Lake temporarily reduced the density (number of individuals per a given area) of benthic invertebrates. Benthic invertebrates, such as chironomids (the aquatic larvae of midges) and oligochaetes (freshwater worms), are eaten by fish and their abundance provides an indication of habitat quality for rearing and overwintering fish. Chironomid density is particularly relevant to the fish population of Polley Lake as both Rainbow Trout and Longnose Sucker feed on the aquatic stage of this insect group, although they can also be opportunistic and feed on other taxa (MPMC 2015a).

Figure 13 shows the density of chironomids and oligochaetes in deep areas of the lake and Figure 14 shows the density in mid-depth areas of the lake in Polley Lake and in the reference area, Bootjack Lake, for 2014, 2015, and 2016. No benthic invertebrates were found in the deep area of Polley Lake in 2014 and in the mid-depth zone, the numbers were lower than found in Bootjack Lake. In the year after the breach, the deep benthic community was recolonizing the substrate and chironomid density in all but two replicates was within the range observed in reference Bootjack Lake. By 2016, the mid-depth benthic community had a higher density than that of Bootjack Lake (Figure 14). Subsequent sampling of Polley Lake has not been undertaken.

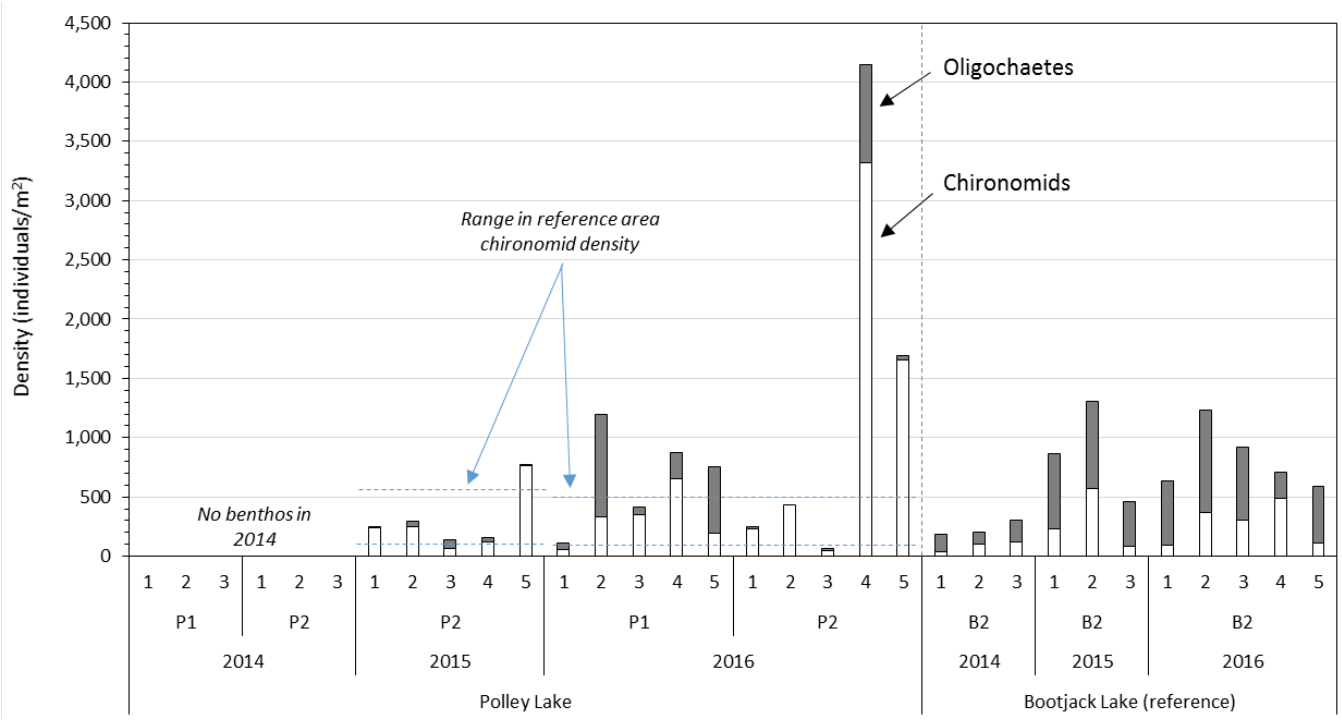

Note: Bars show individual replicates. Source of data: Golder (2017c).

Figure 13: Spatial and Temporal Variability in Benthic Invertebrate Density in Polley Lake Deep Areas, 2014, 2015, and 2016

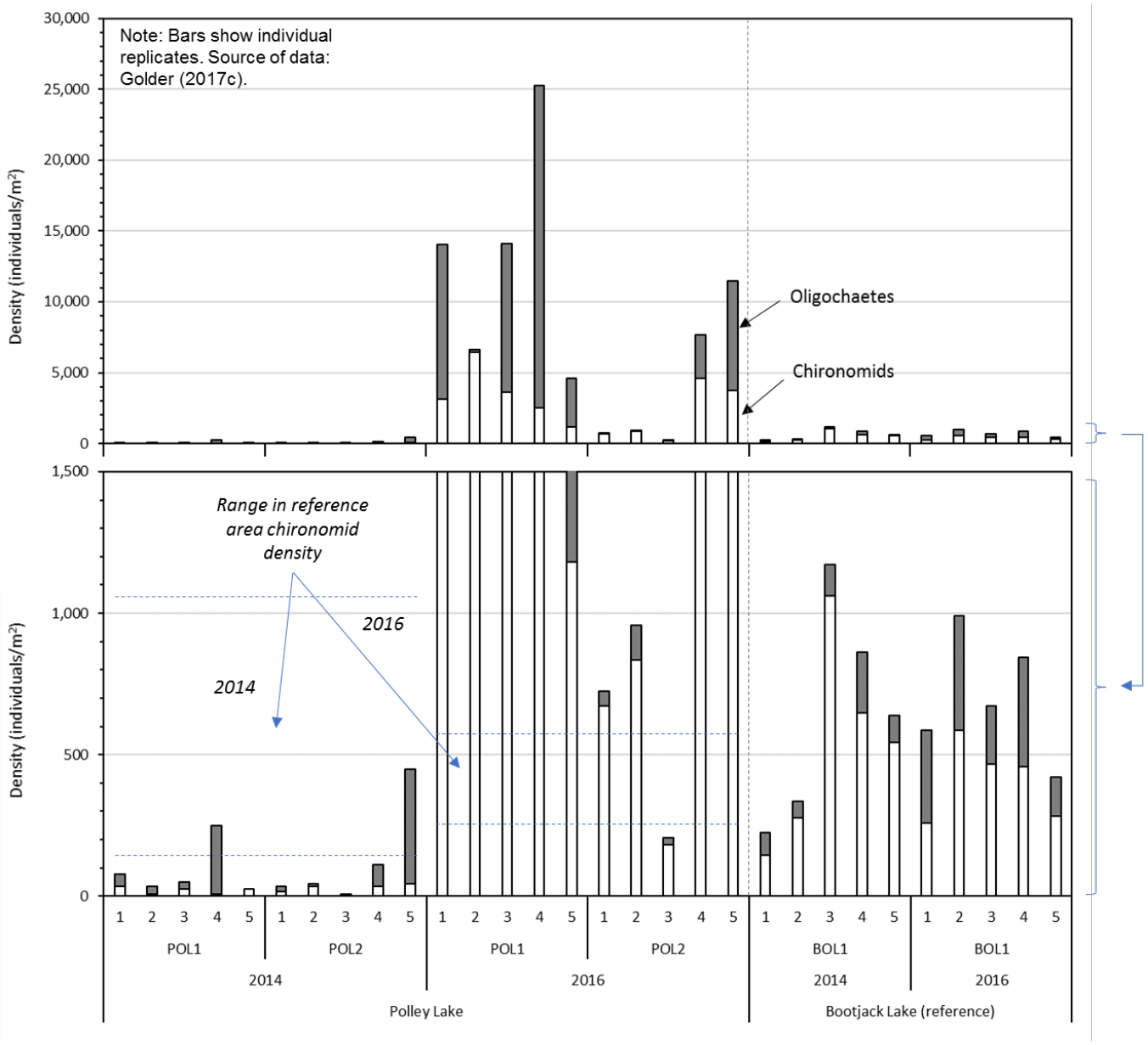

Figure 14: Spatial and Temporal Variability in Benthic Invertebrate Density in Polley Lake Mid-depth Areas, 2014 and 2016

There is some uncertainty regarding the suitability of Bootjack Lake as a reference over the longer term given a recent amendment to the waste discharge authorization which now allows the discharge of seep water to Bootjack on a contingency basis. As of writing, there has not been a discharge. Nonetheless the Polley Lake monitoring data show a trend in increasing abundance of benthic invertebrates and the temporary disruption to this food source for these species did not appear to have affected either Rainbow Trout or Longnose Sucker, as measured by condition factor (calculated from fish length and weight) which was similar for both species between 2014 and 2016. Should the permitted Springer Pit seep discharge be utilized, the study design will need to be re-evaluated as part of the CEMP update process.

4.5.1 Remediation Activities to Date

Reconstruction of the Hazeltine Creek channel has largely restored the connection between Polley Lake and upper Hazeltine Creek, except for a flow control structure which was constructed at the mouth of Polley Lake to control flows during reconstruction of the Hazeltine Creek channel. The outflow control structure (or weir) can impound water in the lake, for example during freshet or at times when water flows would impede habitat construction works. The weir also allows for the discharge of water at a controlled rate to control erosion as reconstructed areas of Hazeltine Creek stabilize as planted vegetation grows. An additional benefit of the weir is that it can allow for a more moderate hydrograph, providing extended flow durations in Hazeltine Creek which have historically (pre-breach) been low in the summer months. While it has yet to be decided by the HRWG, the weir may form part of habitat offsets. The weir was recently (2018) also equipped with a fish ladder allowing fish to successfully move between Polley Lake and upper Hazeltine Creek.

From the time the weir was constructed until April 2018, Polley Lake Rainbow Trout, which use upper Hazeltine Creek for spawning and rearing, were excluded by a fish fence from using that habitat while the channel reconstruction was underway. Based on the findings of an evaluation of flows, habitat availability, and water quality (Golder 2018b), a fish bypass structure was installed beside the flow control structure which will remain in place, and Rainbow Trout now have access to Upper Hazeltine Creek. Monitoring of the re-introduction effort demonstrated high utilization by Polley Lake Rainbow Trout adults, estimated to number 4,890 and an estimated recruitment of 18,064 juvenile Trout were produced in this lake outlet. The adults returned to Polley Lake following spawning and most of the juveniles also returned to Polley Lake as new recruitment to that population (Connors et al., 2018).

Planting of the riparian area adjacent to Hazeltine Creek was also carried out by MPMC (see details in Table 6).

4.5.2 Remediation Plan

The potential pathways of effect for the identified ecological functions for Polley Lake (rearing, overwintering, spawning, migration) were deposition of material, alteration of habitat structure, loss of riparian vegetation and exclusion from habitat by temporary fencing (Table 3). The remediation objectives for this area are summarized in Table 5.

As illustrated above (Figure 13 and Figure 14), the deposition of material initially caused a reduction in the benthic invertebrate community (e.g., a reduction in food organisms for fish) which, based on more current data appears to be approaching recovery. In Polley Lake, unlike Quesnel Lake, the TSF Breach outwash materials mixed with soils and sediments of Polley Lake which retained organic carbon in the settled material. As discussed in Section 4.11.3.3, potential remediation options identified for deposited material in Quesnel Lake were: dredging, addition of organic carbon (unlikely to provide benefit for Polley Lake), thin-layer capping, and monitored natural recovery (MNR). The evaluation of those options is considered in detail in the remedial options evaluation for Quesnel Lake. Some of the principles of that evaluation for Quesnel Lake have similarities to the situation of Polley Lake. While dredging in Polley Lake would have less logistical implications than Quesnel Lake (see below), dredging would be similarly disruptive and would not provide a clear benefit given the signs of recovery observed in Polley Lake, which has similar abundance and diversity of benthic organisms when compared with the reference lake (Figure 14). For the bottom of Polley Lake, the selected remedial option is therefore MNR, which is described in further detail in Section 4.11.3.4, in the context of Quesnel Lake.

Polley Lake benthic invertebrate monitoring study design will be addressed in the CEMP so that consistent and appropriate techniques are used to support MNR.

4.6 Upper Hazeltine Creek / Area 4 (Reach 2 & 3)

The EU for aquatic habitat in the area are provided in Table 2, remediation objectives for Upper Hazeltine Creek are in Table 5, and the current remediation actions conducted to date in Area 4 (Reaches 2 and 3) are summarized in Figure 15 and Table 6. Using the classification system of the HRWG, this area corresponds to EU H1. Section 4.5 describes how the breach event affected the area.

Reach 2 extends downstream from Polley Flats to the Gavin Lake road crossing. This reach is a relatively low gradient with a wide floodplain between Hazeltine Creek flows from Polley Lake to the start of Hazeltine Canyon. The habitat objectives for Reach 2 are to provide both rearing and spawning habitat for Rainbow Trout (Table 4). The hydraulic grade of Reach 2 is modest, with an average grade of approximately 0.9%. Typical flow velocities at this grade are conducive to spawning by Trout. Primary, secondary and tertiary meanders occur throughout Reach 2. The channel was designed to facilitate spawning by Trout at points of downwelling and upwelling along the meanders of both the low flow and MAF channels. Spawning habitat was also provided within gravel platforms associated with the upstream end of v-notch weirs constructed to create pools within the design alignment of the MAF channel. These weirs are fish passable. The upstream ends of the pools are fitted with boulder weirs to facilitate scour of the pools (to minimize the accumulation of sediments) and to mitigate head-cutting. The channel (apart from the weirs) and the pools have been complexed with boulders, logs and tree tops to provide instream and overstream cover for fish. The interaction of flows with these features will sustain and/or create runs, small riffles and small pools along the design alignment of the low flow channel and will facilitate mixing throughout the water column of the pools. It is this complexity that will sustain rearing habitat for juvenile Trout.

Provision of spawning habitat for Rainbow Trout and rearing habitat for juvenile Rainbow Trout are the primary objectives for Reach 3 (Table 4). The hydraulic grade of Reach 3 is relatively steep, with an average grade of approximately 2.3%. Flow velocities are at about the upper limit of those associated with spawning by Trout. The secondary meander represented by the MAF channel is absent. It is expected that spawning by Trout will occur at points of downwelling and upwelling along the meanders of the low flow channel. Boulders weirs are a common feature of the MAF channel due to the steepness of the channel; they will mitigate head-cutting. They are also instrumental in maintaining the meander of the low flow channel; without the weirs, the low flow channel would eventually straighten due to the relatively high flow velocities, facilitating laminar flow and hindering downwelling and upwelling, and decreasing habitat values for Trout. Large v-notch weirs occur within the design alignment of the MAF channel to create ponds. These weirs are at about the steepest grade associated with passage by Trout; passage is facilitated (through turbulent flow) by a meander in the v-notch and a dense aggregation of boulders orientated in a haphazard pattern. The upstream ends of the pools are fitted with boulder weirs to facilitate scour of the pools (to minimize the accumulation of sediments) and to mitigate head-cutting.

The remainder of Reach 3 and the pools have been complexed with boulders, logs and tree tops to provide instream and overstream cover for fish. It is expected that the pools will provide rearing habitat for juvenile Trout. The interaction of flows with complexing features will enhance turbulence, important in creating hydraulic refugia for both adult and juvenile Trout. This will mitigate the ‘flushing’ and downstream ‘losses’ of Polley Lake fish through the canyon and into Quesnel Lake.

Trout access into upper Hazeltine Creek was facilitated by removing the fish fencing between Polley Lake and Hazeltine Creek. At the same time, new fish fences were installed at the lower range of constructed habitat in Hazeltine Creek. The recent use of the area by Rainbow Trout is described in Section 4.5.1. Monitoring carried out (Connors et al. 2018) identified that the desired habitat functions appear to have been achieved. Habitat monitoring will continue as the remainder of Hazeltine Creek habitat is built-out.

Monitoring data collected in 2015 and 2017 indicated that the reconstructed streambed has been colonizing with benthic invertebrates and periphyton (Minnow 2018c). In 2017, the abundance of invertebrates (collected by kicknetting for a specified time) was in the range of 10,000 organisms per sample, comprised of mayflies (Ephemeroptera), caddisflies (Trichoptera), chironomids (Chironomidae), and oligochaetes (Oligochaeta). Periphyton biomass (as chlorophyll *a*) ranged from 5 to 21 mg/m^2.

Overall, remedial activities to date appear to be successful. Monitoring for attainment of intended ecological functions and water quality monitoring will need to continue as part of MPMC's long term commitments (Figure 8).

Reach 2 and 3, Upper Hazeltine Creek (Area 4) receives input from Polley Lake via Polly Flats and flows into the start of Hazeltine Canyon. It consists of a 60 to 200 m disturbance zone surrounded by second growth hybrid white spruce forest stands. The rehabilitation strategy involves creating a stable channel morphology with an armored base lined with a 75mm minus spawning gravel. Mean Annual Flow (MAF) channel width varies between 4.5 m and 7.7 m and the lower floodplain averages 20 m wide.

Primary aquatic habitat objectives for this area are to provide rearing and spawning habitat for Rainbow Trout by creating step pool channels with interspersed riffles and rapids. Large woody debris and boulders have been added to meander points and channel margins to introduce aquatic habitat and cover for trout and other aquatic organisms. These weirs are fish passable and while they are not intended for spawning they help maintain spawning substrate in other areas. The upstream ends of the ponds are fitted with boulder weirs to facilitate scour of the ponds (to minimize the accumulation of sediments) and to mitigate head-cutting. In 2018, upper Hazeltine Creek supported spawning by and estimated 4,890 adult trout.

Terrestrial objectives in Reach 2 and 3 include improving soil conditions and reducing long term sediment load into Hazeltine Creek, as well as improving structure and function of habitat by introducing coarse woody debris and surface roughness via mounding and ripping. Revegetation efforts to date consist of grass seeding with an erosion mix and allowing natural ingress from nearby seed sources. The establishment of shrubs and deciduous trees mature is expected to be gradual and be replaced by dense stands of conifers. Channel conditions should continue to evolve into productive trout habitat with nutrient inputs from the surrounding vegetation.

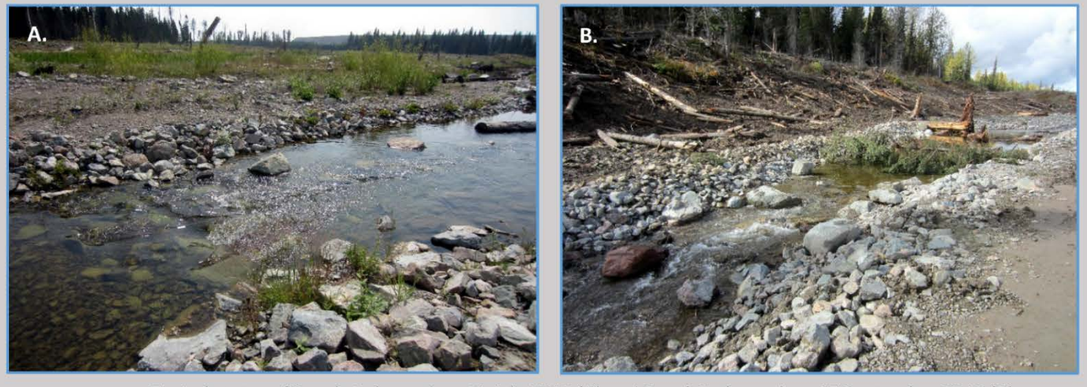

Typical status of Reach 2 channel on 31 July 2018 (A) and Reach 3 channel on 17 September 2018 (B)

Upper Hazeltine Creek Plan



Aerial View of Reach 2 (17 October 2018)



Figure 15: Reach 2 and 3, Upper Hazeltine Creek (Area 4) Description and Current Remediation and Rehabilitation Status

4.7 Hazeltine Canyon / Area 5 (Reach 4)

Hazeltine Canyon has not been assigned an EU and remediation work for the canyon is not prescribed. The remediation objectives for the area are summarized in Table 5 and the current remediation actions conducted to date in Area 5 are summarized in Table 6.

Reach 4, Hazeltine Canyon (Area 5) is approximately 1.3 km in length and extends from the lower end of Upper Hazeltine Creek, at chainage 6+600 m, to the upper end of Lower Hazeltine Creek, at chainage 7+900 m. The canyon averages 50 m wide, with incised channel walls, and is the steepest reach with an average slope of 5%. The steep banks and the high longitudinal gradient create a narrow, structurally controlled valley or canyon that prevents upstream passage of fish. The upper edge of the canyon is lined with coniferous forest and there is limited floodplain development within this section. Some rearing (minor) of Trout is expected to occur in the Hazeltine Canyon area.

The high flows associated with the canyon provides little potential for fish habitat, therefore, remediation of fish habitat was not planned for Reach 4. Site preparation in the area has consisted of creating access and limiting erosion potential only. The fish habitat objective for this reach is controlling erosion and maintaining water quality for downstream habitats.

Terrestrial objectives in Reach 4 were limited to promoting natural successional processes. Remediation to date in Hazeltine Canyon has consisted of grass seeding to provide short term erosion protection and assist natural ingress of local vegetation.

4.8 Lower Hazeltine Creek / Area 6A (Reach 5)

Using the classification system of the HRWG, this area corresponds to EU H2. The EU and potential pathway of effects for aquatic habitat in Lower Hazeltine Creek are provided in Table 2 and the remediation objectives for the area are summarized in Table 5. The current remediation actions conducted to date in Area 6A (Reach 5) are provided in Figure 17 and Table 6.

Lower Hazeltine Creek / Reach 5 extends from the downstream end of Hazeltine Canyon to the Edney Creek confluence. The reach crosses over an alluvial fan that has formed at the outlet of the canyon (including pre-breach). The streambed in this reach has a low gradient of approximately 1.8%.

The lower Hazeltine Creek Area, extending to the shore of Quesnel Lake has been the location of considerable site preparation, addition of organic carbon (wood mulch) and multispecies planting as part of both habitat remediation work and erosion control. The physical habitat construction of Hazeltine Creek in Reach 5 has not yet concluded and additional planting is expected after the physical remediation and erosion control works are finished. Stream remediation designs for lower Hazeltine Creek have not yet been developed. However, a number of design concepts were discussed at November 2018 HRWG meeting. The consensus view was that the preferred option was that Hazeltine Creek and Edney Creek would be joined into a single creek, as it was pre-breach (Figure 16). The ponds will be decommissioned though specific details of that decommissioning have not yet been decided. However, their connection to the creek was not viewed as a desired design element.

Monitoring data collected in 2015 and 2017 indicated that the reconstructed foundational stream channel has been colonizing with benthic invertebrates and periphyton (Minnow 2018c). In 2017, the abundance of invertebrates (collected by surber sampling) was on the order of 5,000 organisms per m^2. This density is lower than observed in 2007; however, the community in 2017 was comprised of similar taxa as observed previously (i.e., mayflies, stoneflies (Plecoptera), caddisflies, non- chironomids (Chironomidae), true files (Diptera)). Periphyton biomass (as chlorophyll *a*) was on average 5 mg/m^2. Creek habitat substrates and habitat complexity features have not yet been constructed in lower Hazeltine Creek and the final creek alignment will differ from that assessed.

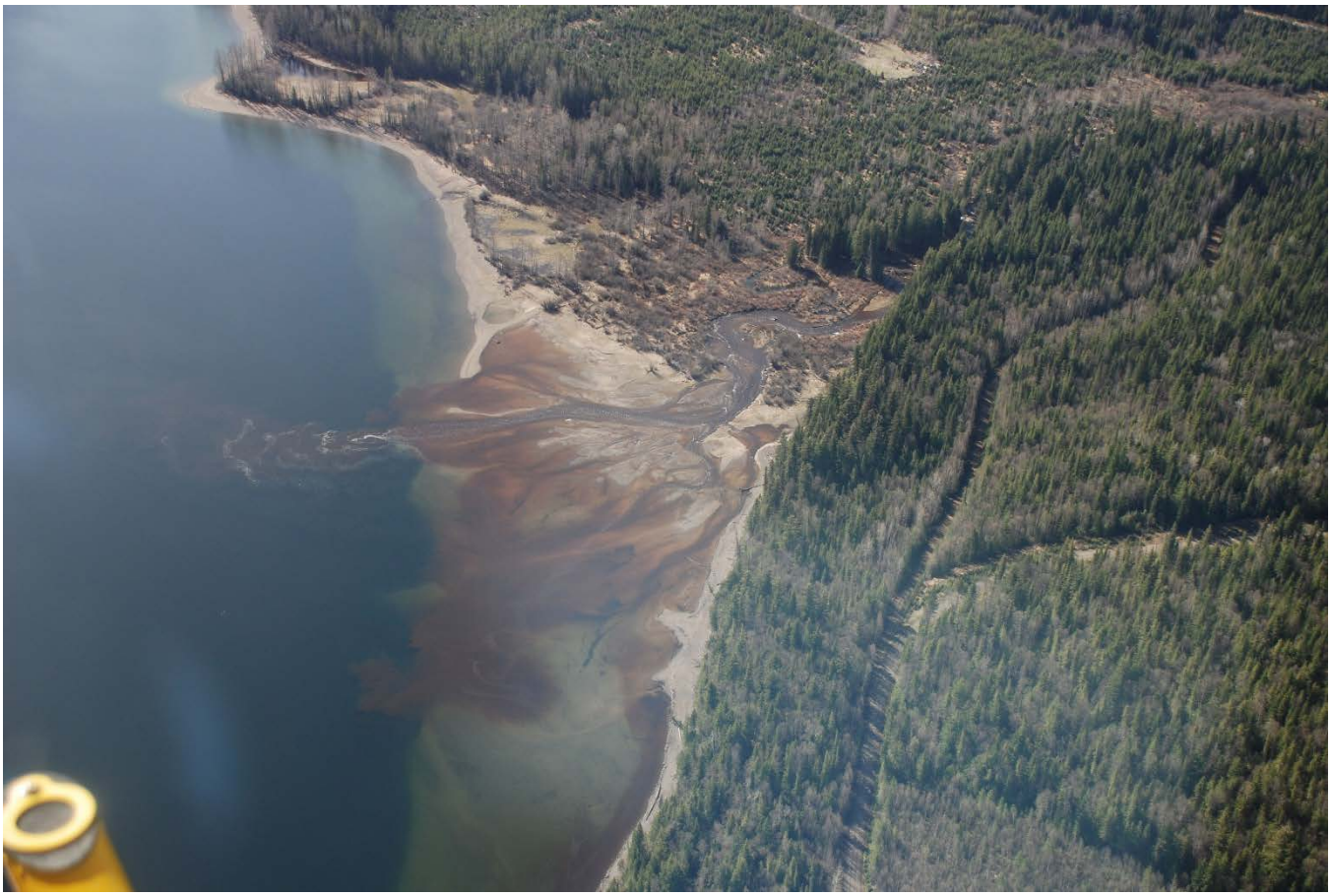

Figure 16: A 2008 Photo of the mouth of Hazeltine and Edney Creeks. Prior to the breach, these streams were combined in a single channel. (Photo Courtesy MPMC).

The primary aquatic objective for Reach 5 (Area 6a) is to provide both rearing and spawning habitat for Sockeye salmon Rainbow Trout and Coho salmon. The overall channel remediation of Hazeltine Creek includes the lower floodplain, the Mean Annual Flow (MAF) channel, and the low flow channel. The primary meander pattern is exhibited by the lower floodplain; this part of the overall floodplain is engaged by flows associated with freshet. Armouring was undertaken to minimize erosion of the materials underlying the channel. Pockets of tailings and breach outwash materials were removed from the footprint of the constructed channel and from the footprint of any fill materials placed in the floodplain. Flow velocities in Reach 5 are conducive to spawning by both rainbow trout and Coho salmon. Grades were deeply incised by the release event and cuts into adjacent slopes to achieve relatively elaborate meanders were minimized as this would exacerbate existing cuts, resulting in further impacts to treed woodlands.

Instream habitat features resemble those defined for Reach 2. The v-notch weirs constructed to create ponds within the design alignment of the MAF channel are slightly steeper than those of Reach 2, at about 3.0 percent compared to 2.5% for Reach 2. These weirs are fish passable. The upstream ends of the ponds are fitted with boulder weirs to facilitate scour of the ponds (to minimize the accumulation of sediments) and to mitigate head-cutting.

The remainder of Reach 5 will be complexed with boulders, logs and tree tops to provide instream and overstream cover for fish. The interaction of flows with these features will sustain and/or create runs, small riffles and small ponds along the design alignment of the low flow channel and will facilitate mixing throughout the water column of the ponds. The features will enhance turbulence, important in creating hydraulic refugia for both adult and juvenile fish. It is this complexity that will sustain rearing habitat for juvenile trout. To date, soil rehabilitation efforts have reduced long-term sediment load flow into Hazeltine Creek by removing tailings and increased oxygen exchange with native soil. Ripping and mounding, along with Coarse Woody Debris (CWD) placement, have created micro sites that foster regenerating plants increase habitat complexity in this reach. Of the 29 ha in this area, 22 ha have been roughened and planted with riparian species while over 6 ha have been recontoured with imported soil and complexed with CWD. In addition, wood chip mulch has been spread over 5 ha to control erosion and reduce soil moisture loss.



Reach 5 on 17 September 2018 (A) and 31 July 2018 (B)

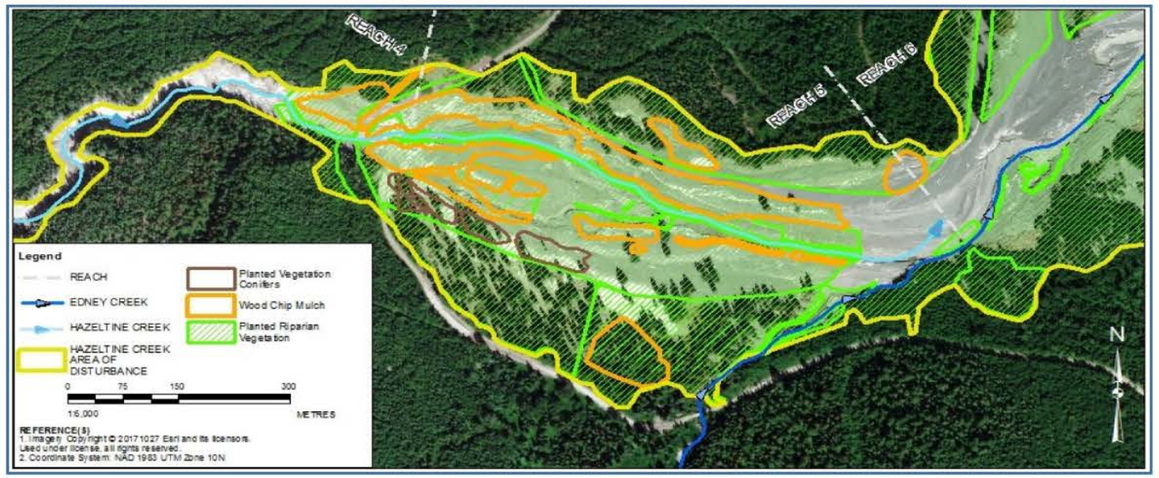

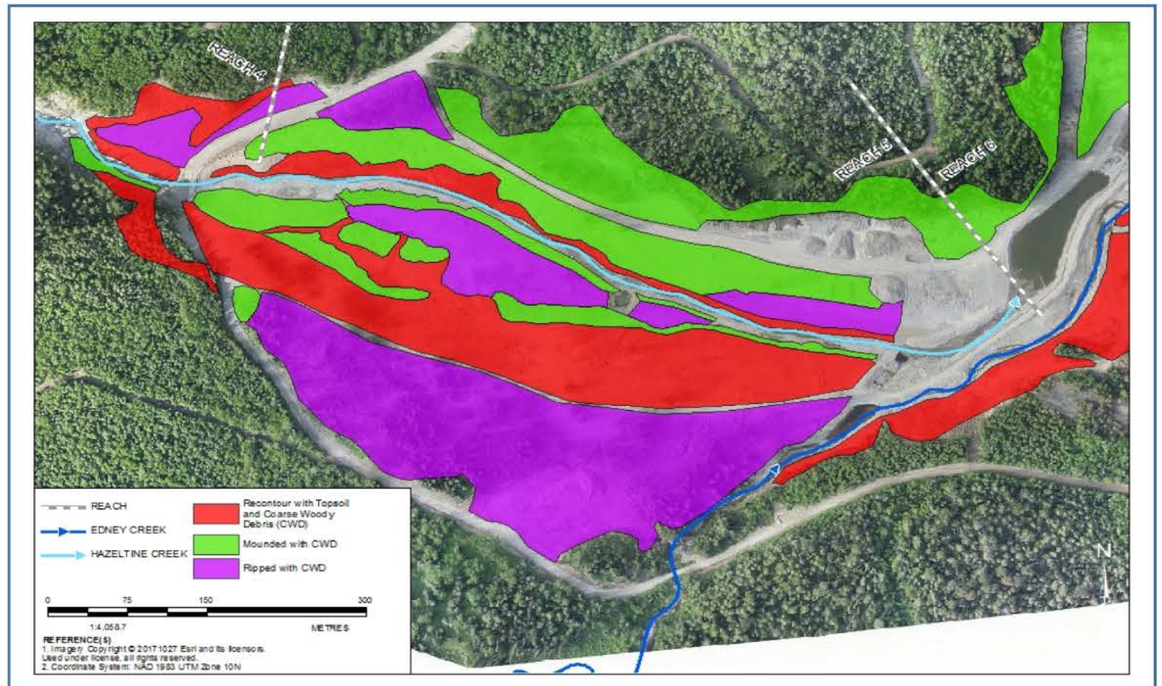

Figure 17: Reach 5, Lower Hazeltine Creek (Area 6a) Description and Current Remediation and Rehabilitation Status

4.9 Lower Edney Creek / Area 6b (Reach 6)

Using the classification system of the HRWG, this area corresponds to EU E3. The ecological units and potential pathway of effects for aquatic habitat in Lower Edney Creek are provided in Table 2 and the remediation objectives for the area are provided in Table 5. The current remediation actions conducted to date in Area 6b (Reach 6) are summarized in Figure 18 and Table 6.

This section is the furthest downstream reach and extends from the confluence of Hazeltine Creek and Edney Creek to the outlet into Quesnel Lake. Currently (as of fall 2017), the two creeks were separated in order to control outflow from Hazeltine Creek and facilitate fish passage and habitat remediation in Edney Creek. Hazeltine Creek now flows into two temporary settling ponds before discharging into the lake through a temporary diversion. Edney Creek follows its natural route with a secondary overflow channel that splits from the main channel less than 100 m from Quesnel Lake. Typical MAF channel width is approx. 7.1 m with a minimum lower floodplain width of 35 m. The hydraulic grade of Reach 6 is approximately 1.0%.

Sampling carried out (Minnow 2018a) has found that the habitat constructed is being used by the same species as were documented in the creek before the breach. Twelve fish species were captured from Edney Creek in 2016, including juvenile Rainbow Trout, and Coho and Chinook Salmon, confirming that the connection between Edney Creek and Quesnel Lake is functioning. Other species observed were: Kokanee, Mountain Whitefish, Northern Pikeminnow, Burbot, Largescale Sucker, Longnose Sucker, Bridgelip Sucker, Longnose Dace, Peamouth Chub, and Redside Shiner. Rainbow Trout and Longnose Dace were the most abundant fish.

Monitoring data collected in 2015 and 2017 indicated that the reconstructed streambed has been colonizing with benthic invertebrates and periphyton (Minnow 2018c). In 2017, the abundance of invertebrates (collected by surber sampling) was on the order of 5,000 organisms per m^2, comprised of mayflies, stoneflies (Plecoptera), caddisflies, non- chironomids (Chironomidae), true files (Diptera), and oligochaetes (Oligochaeta). Periphyton biomass (as chlorophyll *a*) was on average 5 mg/m^2.

4.10 Edney Creek Mouth / Area 7

Using the classification system of the HRWG, this area corresponds to EU E3. At the pre-breach confluence of Edney Creek and Hazeltine Creek, Edney Creek channel was scoured resulting in a drop of approximately 2 m in elevation, resulting in a barrier to the free movement of fish from Quesnel Lake to Edney Creek. The upper reaches of Edney Creek provided good fish habitat that was not impacted by the breach event and restoration of its connectivity to Quesnel Lake was identified as a priority action and was the first section of habitat to be constructed as part of the breach response program (Bronsro et al. 2016). The connection of Edney Creek to Quesnel Lake was constructed by February 14, 2015.

The mouth of Edney Creek was designed to distribute flow from the mouth of Edney Creek and create two channels. The low flow channel connects to Quesnel Lake under all flow conditions while the higher flow channel distributes the flow during moderate and higher flows. The shoreline design at the mouth of Edney Creek incorporates a large area of shallow gravel shoal habitat that is accessible to fish under a wide range of lake levels. The installation of the habitat features for the lower section of Edney Creek were constructed September 2015. Modification of portions of lower Edney Creek are expected as the flows of Hazeltine Creek and Edney Creek will be combined per consensus reached at the November 2018 HRWG meeting.

Primary aquatic habitat objectives for Area 6b (Reach 6) are to provide spawning habitat for Sockeye Salmon, Kokanee Salmon, Coho Salmon and Rainbow Trout, and rearing habitat for Coho salmon and rainbow trout. This will be achieved by re-establishing a non-erodible engineered channel, and re-establishing fish and riparian habitat.

In 2015, boulder weirs were placed throughout the MAF channel. Strategically placed boulders were placed to work with the weirs to 'train' the low flow channel such that it did not straighten during high flows. Off channel ponds were constructed to associate with the secondary channel. Channels and ponds were complexed with boulders, logs and tree tops to provide instream and overstream cover for fish. These features were placed such that the interaction of flows with these features will sustain and/or create runs, small riffles and small ponds along the design alignment of the low flow channel, and will facilitate mixing throughout the water column of the ponds. The features will enhance turbulence, important in creating hydraulic refugia for both adult and juvenile fish. It is this complexity that will sustain important rearing habitat for juvenile trout.

In 2017, over 31 ha of the Lower Edney Creek area has been planted and plots indicate >10,000 stems/ha of *Populous trichocarpa* in some areas. MPMC have also collected a custom seed mix from the site that includes Sitka Alder, Red Elderberry, Willow Spp., Pink Spirea, Yarrow and Cow Parsnip. . Terrestrial objectives in Reach 6 include improving soil conditions, creating micro sites with suitable growing conditions for regenerating plants, providing habitat structure and increased habitat complexity by incorporating Coarse Woody Debris (CWD), and assisting recovery of plant communities appropriate for the local conditions. Sections of Reach 6 were re-contoured with topsoil and CWD (3.7 ha) and mounded with CWD (9.9 ha).

In 2018, a tree planting program for ongoing revegetation include live staking with willow and poplar in riparian areas to assist ingress of conifer seedlings and establish an erosion control grass cover in the upper floodplain was put down.

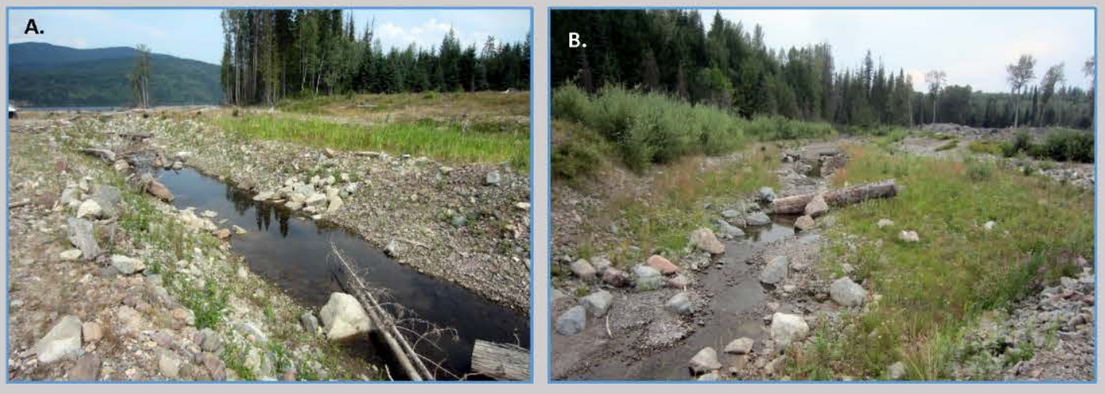

Reach 6 on 31 July 2018 (A and B)

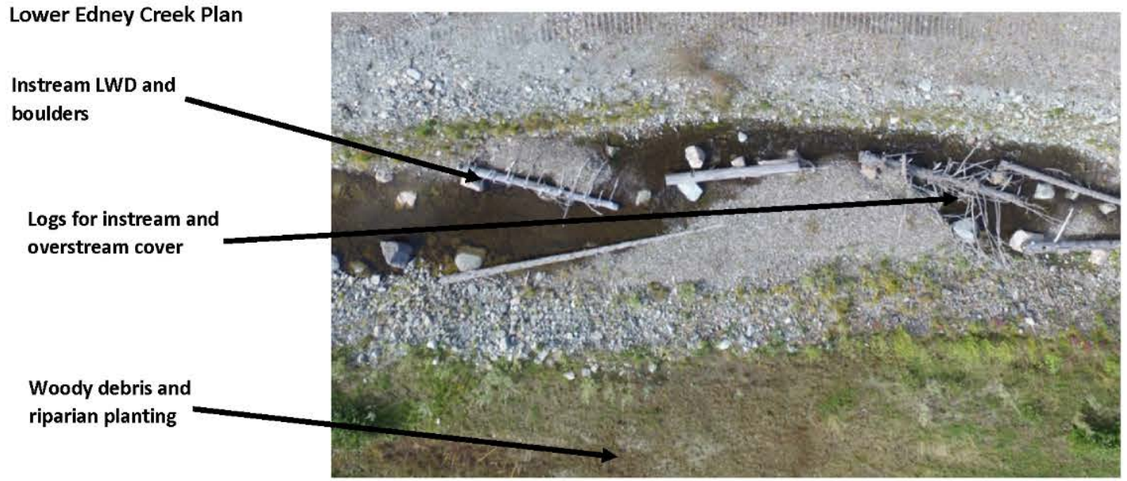



Figure 18: Lower Edney Creek /Area 6b (Reach 6) Description and Current Remediation and Rehabilitation Status

4.11 Quesnel Lake / Area 8

4.11.1 Lake Characteristics

Quesnel Lake is a large, deep fjord lake reaching from the Cariboo Mountains into the Interior Plateau of BC. The lake has a surface area of 266 km^2 and is comprised of West, East, and North Arms. The average and maximum depths of the lake are 157 and 511 m, making Quesnel Lake one of the deepest fjord-type lakes in the world (Laval et al. 2008). The Quesnel Lake remediation area consists of the West Basin area between Cariboo Island and the Quesnel River, a relatively shallow (pre-breach, 113 m maximum depth) portion of the lake that is separated from the rest of the lake by an approximately 35 m deep sill near Cariboo Island (Laval et al. 2008).

The West Basin has vertical mixing that is typical of temperate lakes, with thermal stratification for most of the year interrupted by brief turnover periods in the spring and the fall when vertical density gradients are weakest. In the deeper portions of the lake, seasonal overturn events only occur in the upper 100 to 200 m of the water column due to changes in temperature-density relationships with increased pressure at greater depths (Laval et al. 2008). Water chemistry data indicate that the lake is slightly alkaline, has low sensitivity to acid inputs, and is oligotrophic, with phosphorus being the limiting nutrient (Nidle et al. 1994; Shortreed et al. 2001).

As summarized in Section 3.2.4, the ecological risk assessment found that residual effects due to alteration of water quality for organisms associated with the water column (plankton, pelagic fish) were low. In comparison, physical habitat and benthic invertebrate communities were altered from the effect of scouring along the lake side wall adjacent to the outlet of Hazeltine Creek and deposition of that scoured material as well as material from the Hazeltine corridor and the TSF on to the lake bed below the 100-m contour. The remainder of this section focusses on physical/benthic habitat in the littoral and benthic zones of the lake.

4.11.2 Littoral Zone

4.11.2.1 Overview of Effects

Using the classification system of the HRWG, this area corresponds to Ecological Unit QL-Littoral. The littoral zone in the Hazeltine Creek delta was scoured by the debris flow, affecting approximately 2.1 km and 94 ha of shoreline (approximately 5.8% of the shoreline length and 6.5% of the littoral area in the West Arm). The effect of the event was a reduction in the benthic invertebrate community and the alteration of shoreline rearing and spawning habitat. The event also blocked access to unimpacted upper reaches of Edney Creek, which is discussed above in Section 4.10.

The scouring of the Quesnel Lake shoreline also temporarily reduced the density (number of individuals per a given area) of benthic invertebrates. Benthic invertebrates such as chironomids (the aquatic larvae of midges), non-chironomid Diptera (e.g., the aquatic larvae of black flies), oligochaetes (freshwater worms), amphipods, EPT taxa (the aquatic larvae of mayflies, stoneflies, and caddisflies), and molluscs (snails and clams) are found in the littoral zone and can be eaten by fish. The abundance of these types of benthic invertebrates provides an indication of habitat quality for rearing and overwintering fish. Chironomid, amphipod, and EPT taxa density is particularly relevant to the fish population of Quesnel Lake as the fish that occupy the littoral zone feed on these groups.

Benthic invertebrate community sampling in September 2014 showed that the density of organisms in the West Arm of the lake adjacent to the mouth of Hazeltine Creek was significantly lower than observed at a reference area in the North Arm of the lake and at a far-field station in the West Arm near the outlet to Quesnel River (Figure 18). Reference areas of the lake were dominated by chironomids, amphipods, molluscs, and EPT taxa and these taxonomic groups were affected primarily in the immediate vicinity of the Hazeltine Creek mouth. The data also show that the density of benthic invertebrates is variable in Quesnel Lake and the degree of effect was variable through the West Arm. For example, chironomid, amphipod and EPT density was lowest at the stations immediately adjacent to Hazeltine Creek whereas the station closest to the Quesnel River had a greater density of chironomids than at Horsefly, suggesting lesser effect there.

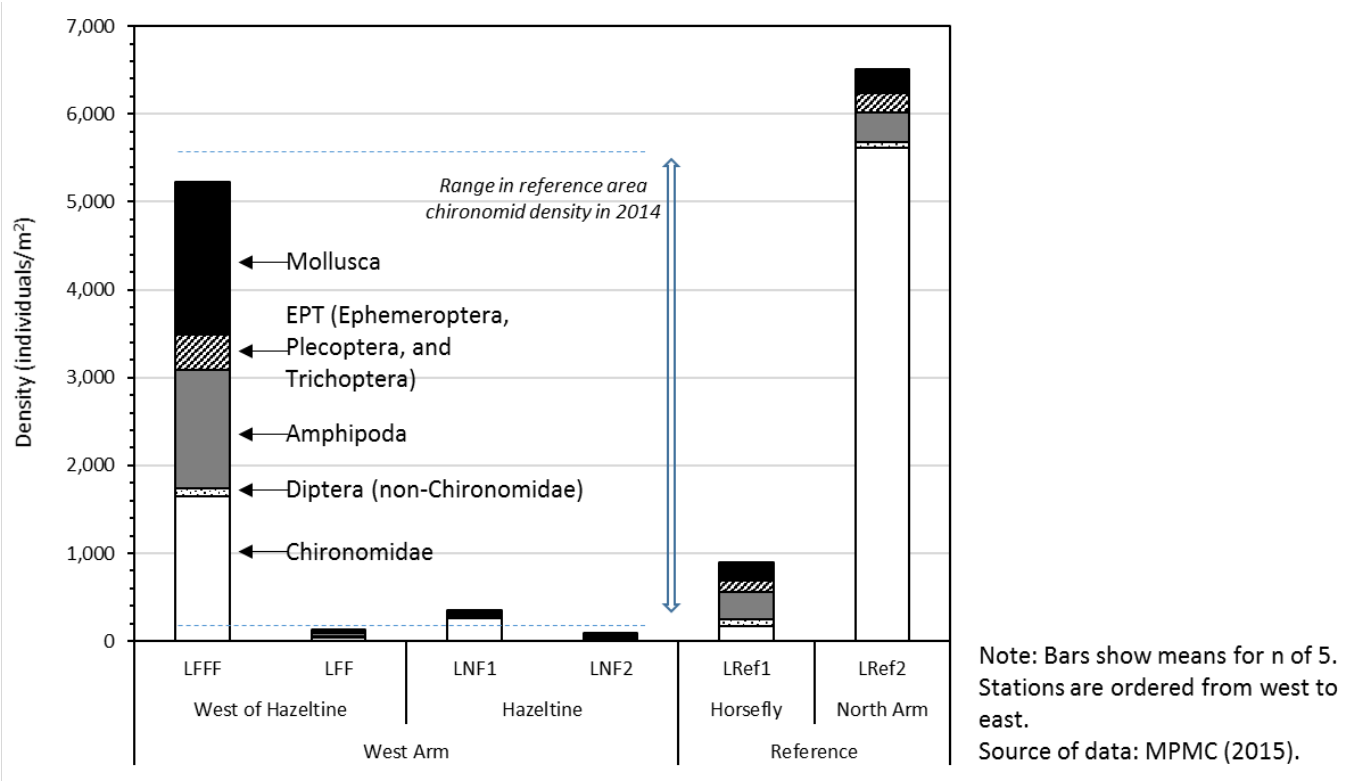

Figure 19: Spatial Variability in Benthic Invertebrate Abundance in the Quesnel Lake Littoral Zone in September 2014

Data from subsequent sampling indicate that benthic invertebrate density of the Hazeltine shoreline was still lower in 2016 than observed at the far-field station in the West Arm and in the reference area at Horsefly (Figure 20). A follow-up sampling event was undertaken in 2017, but the sampling methods were changed between 2016 and 2017 and it is therefore not possible to undertake a quantitative comparison of the data (Minnow 2018c). As well, additional habitat reconstruction activities are planned, which may disrupt the recovery of the benthic community.

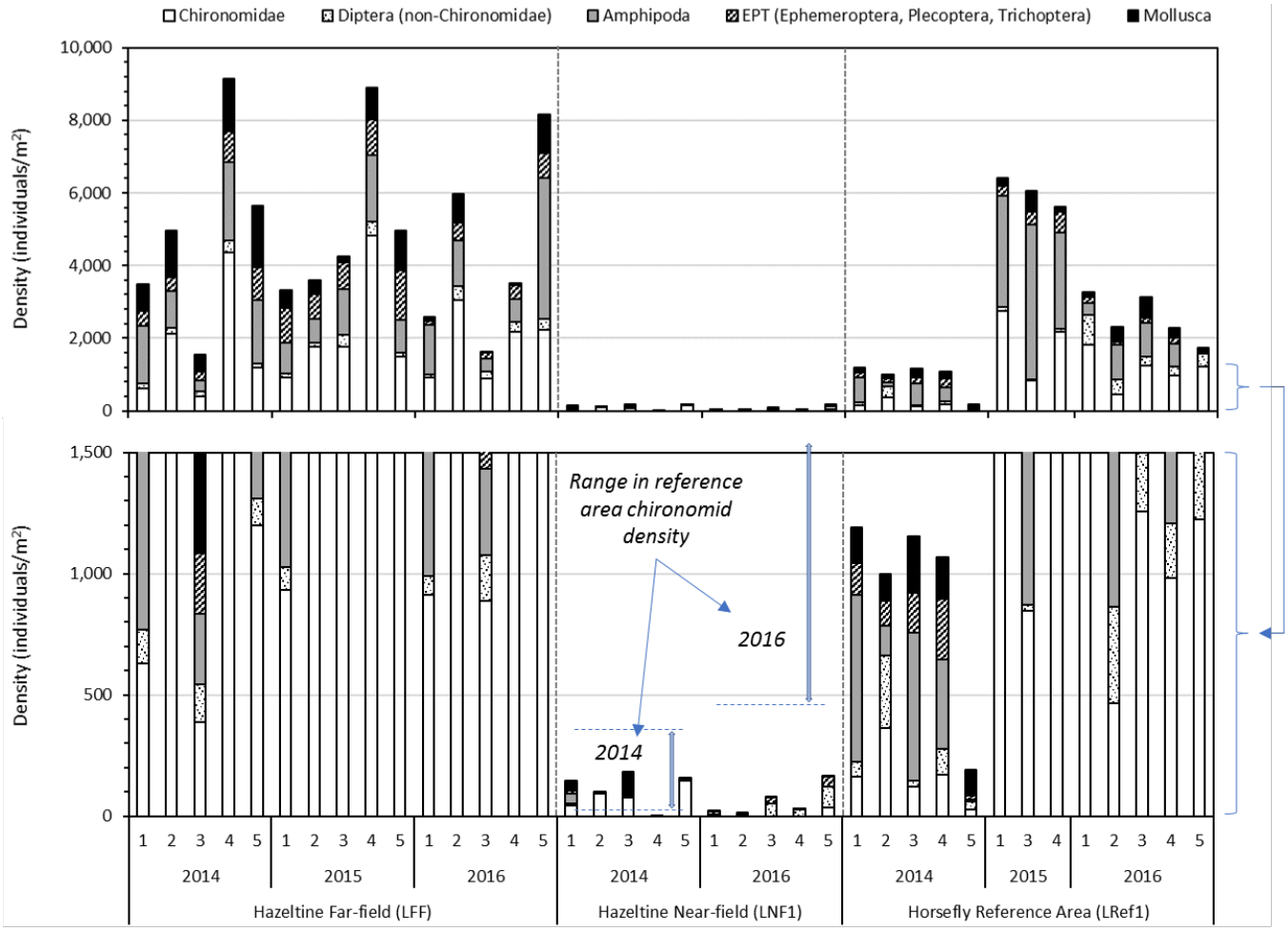

Note: Bars show results for individual replicates (numbered from 1 to 5 except where noted). LNF1 not sampled in 2015.
Source of data: Golder (2017c).

Figure 20: Spatial and Temporal Variability in Benthic Invertebrate Density in the Quesnel Lake Littoral Zone, 2014 and 2015

The actual contribution of the affected area of littoral zone to fish productivity is not known; however, the available data suggest that the decrease in benthic invertebrate prey items have not resulted in a decrease in condition factor of forage fish, Lake Trout, or Burbot captured in the littoral zone (Figure 21).

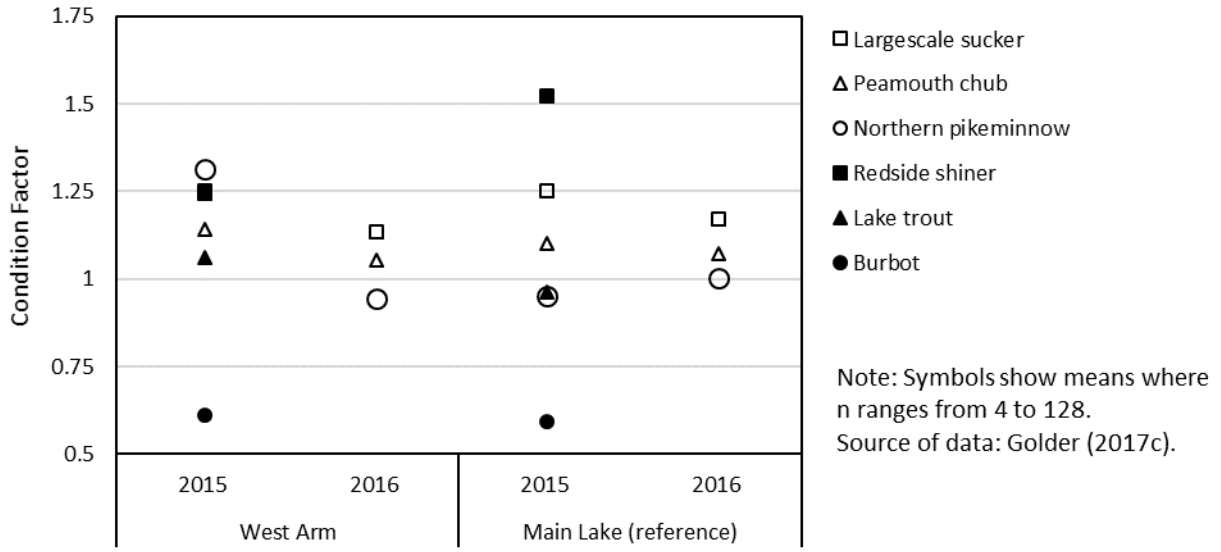

Figure 21: Spatial and Temporal Variability in Condition Factor for Fish Species Potentially Using Littoral Zone Habitat, 2015 and 2016

4.11.2.2 Remediation Activities to Date

MPMC has been implementing a remediation strategy over the last two years that resulted in the removal of tailings from the Hazeltine Channel bed and surrounding areas, reconstruction of the Hazeltine and Edney Creek channels, and restoration of the connection of Edney Creek with Quesnel Lake through the littoral zone (Section 4.10). The lower area of Edney Creek was reconstructed on a prioritized basis to stop erosion and restore fish access (completed February 2015), with instream habitat features subsequently added (initial work August 2015). In the littoral areas adjacent to the Edney Creek channel, material has also been placed to help manage erosion.

Fish access to Hazeltine Creek from Quesnel Lake is still restricted at this time due to ongoing remediation activities but Quesnel Lake is connected to Edney Creek.

4.11.2.3 Remediation Plan

The HRWG has not finalized the remediation objectives for the littoral zone of Quesnel Lake; however, based on the pathways of effect (Table 4) that are still considered operable, it is expected that the objectives will focus on habitat suitability for spawning and rearing, in particular around structure and riparian vegetation. This remediation work will tie into work that is underway in Lower Hazeltine Creek or has already been completed in Edney Creek.

The Quesnel Lake littoral zone benthic invertebrate monitoring study design will need to reflect the requirements to monitor recovery using consistent (over time) techniques to support the evaluation of the efficacy of the remediation to address uncertainties in the risks associated with residual sediment contamination. The monitoring study design will be included in an updated CEMP.

It is anticipated that productivity losses during the period of loss will be addressed through the development of habitat offsets as noted in Section 5.3.1.8.

4.11.3 Benthic Zone

4.11.3.1 Overview of Effects

Using the classification system of the HRWG, this area corresponds to Ecological Unit QL-benthic. The benthic zone[6] below the 100 m contour was impacted by outwash materials across an area of 1.81 km^2. This material covered benthic substrate and invertebrate organisms, and as demonstrated by benthic invertebrate community sampling in September 2014, the density of benthic invertebrates in the West Arm of the lake adjacent to the mouth of Hazeltine Creek was significantly lower than observed at a reference area near Horsefly River as well as other reference areas of the lake (Figure 22). Reference areas of the lake were dominated by chironomids and oligochaetes and both of these taxonomic groups were affected in the West Arm, primarily in the vicinity of Hazeltine. The data also show that the density of benthic invertebrates is variable in Quesnel Lake and the degree of effect was variable through the West Arm. For example, chironomid density was lowest at the stations immediately adjacent to Hazeltine Creek whereas the station closest to the Quesnel River had a similar density of chironomids as observed at the North Arm reference station, suggesting lesser effect there. The density of chironomids is particularly relevant to fish such as Mountain Whitefish and Lake Trout as these fish tend to eat these insects as they hatch and rise up through the water column to the surface of the lake.

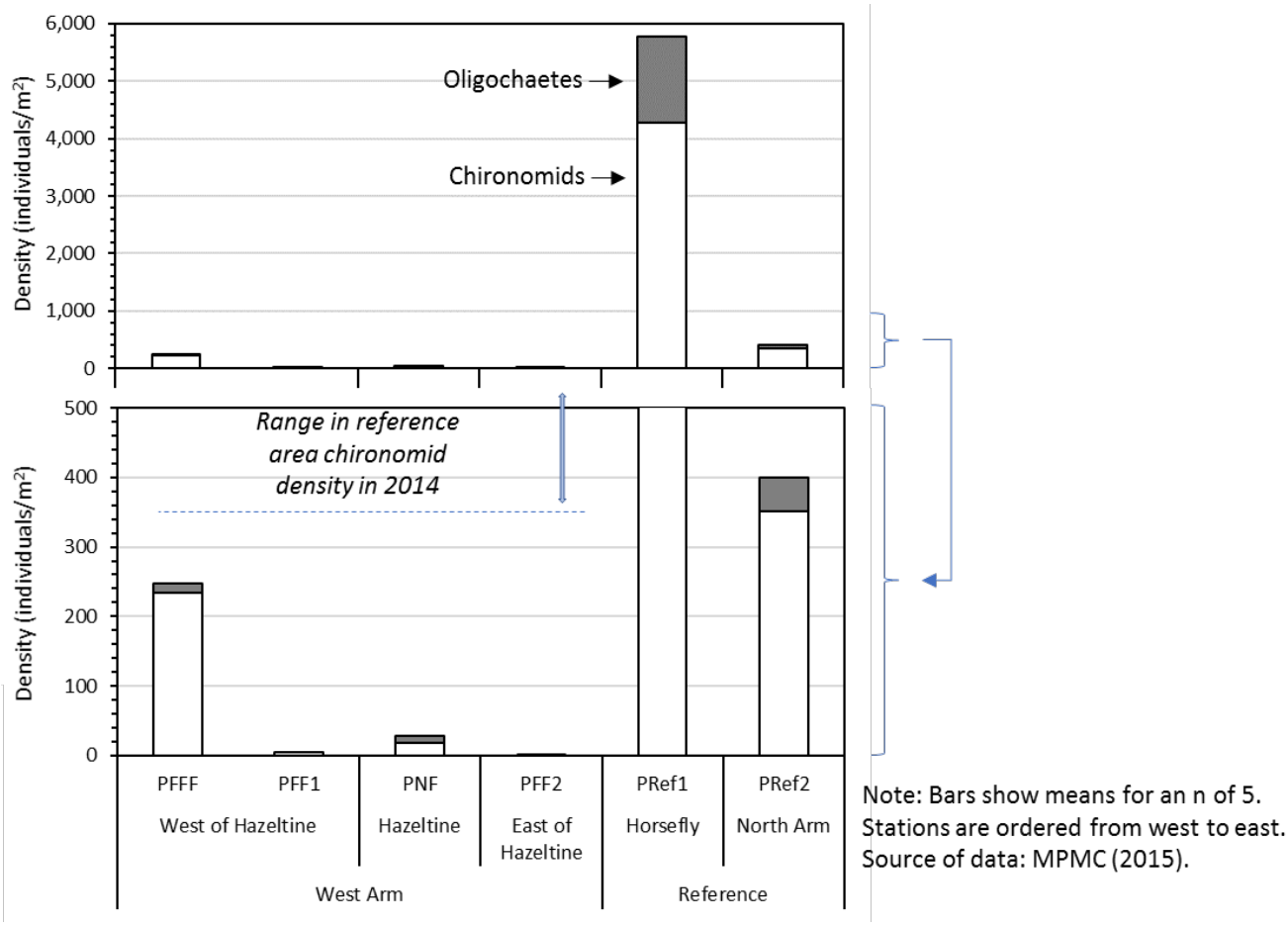

Figure 22: Spatial Variability in Benthic Invertebrate Abundance in Quesnel Lake Benthic Zone in September 2014

[6] also called the “profundal” zone in some of the Quesnel Lake studies

Benthic invertebrate data collected in 2015 and 2016 show that the benthic invertebrate community has started to recover in the vicinity of Hazeltine Creek (Section 3.2.4). Samples were also collected in 2017 but as of the time of writing, results are not yet available. Figure 23 shows the density of chironomids and oligochaetes in individual replicates for the Horsefly reference station and the Hazeltine affected station for 2014, 2015, and 2016.
The communities were dominated by oligochaetes and chironomids, and spatially variable at both stations.
The significantly higher number of oligochaetes at the reference station in 2015 appears to be related to an influx of tubificids (one of the types of oligochaete worms in that area), potentially from the Horsefly River itself or the shorelines of the lake. Although a positive (increasing) trajectory of recolonization is apparent in the data (Figure 23), those data are based on only three seasons of sampling events and verification of such a trajectory is required. As only three annual sampling events (2014 to 2016) have been conducted to date and in limited areas of the lake bottom, the trajectory of recolonization requires confirmation.

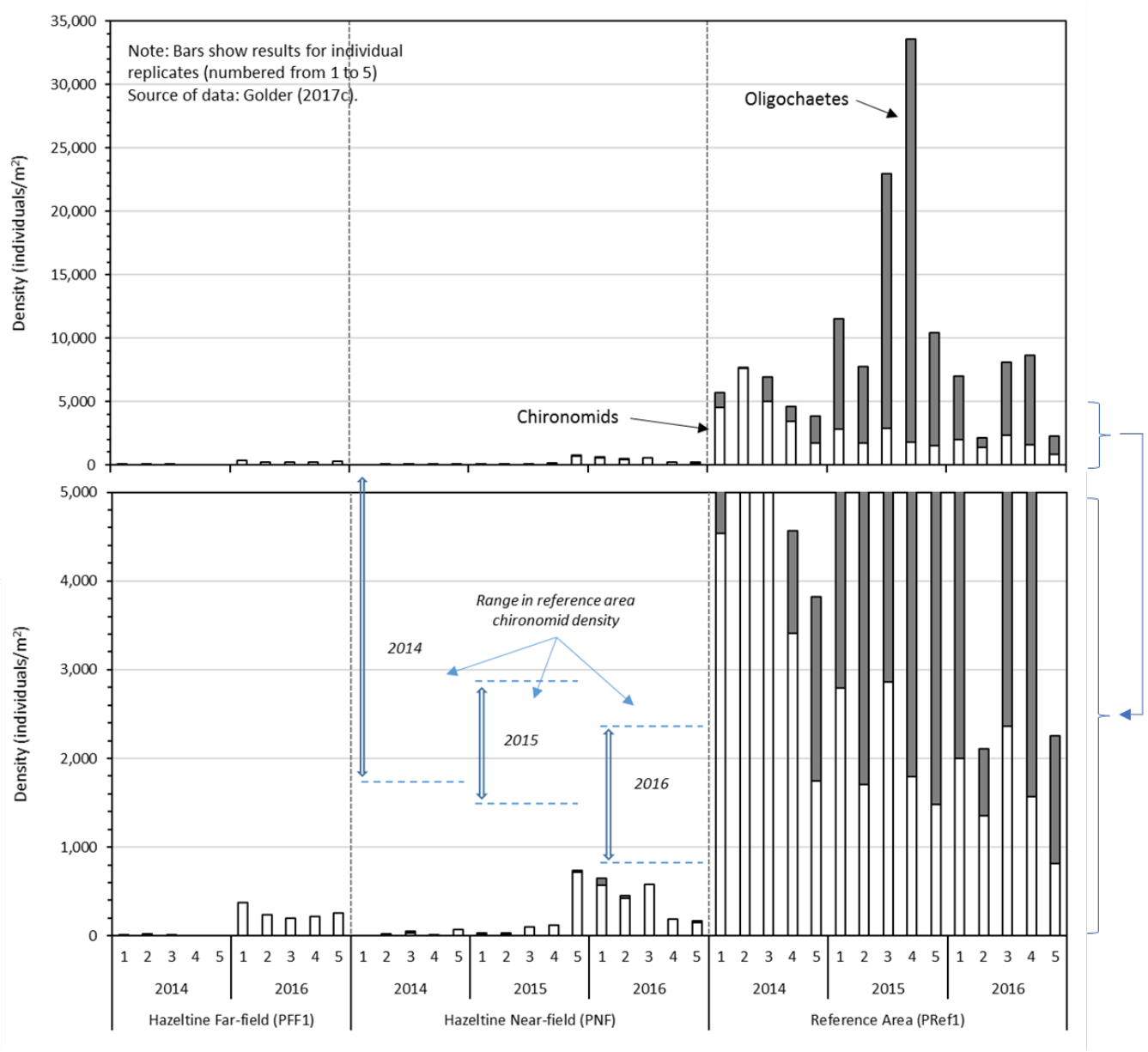

Figure 23: Spatial and Temporal Variability in Benthic Invertebrate Abundance in Quesnel Lake Benthic Zone in 2014, 2015, and 2016

The ERA suggested that the physical structure, more specifically the low organic carbon content of the sediments, is affecting the recolonization of those sediments. In laboratory-based sediment tests, it was found that in low organic carbon sediments dominated by outwash materials that are low in organic carbon, growth was reduced. However, adding organic carbon to those sediments resulted in normal organism growth. Figure 24 illustrates the spatial and temporal variability of total organic carbon (TOC) in the sediments of the West Arm and in references areas at Horsefly and in the North Arm. In 2014, sediments collected adjacent to Hazeltine had relatively low TOC (<0.5%). Subsequent sampling indicated that TOC was higher in 2015 and 2016, and while not at the average TOC content observed in the reference areas, TOC was within the range of reference samples. Thus, it appears that natural processes are contributing organic carbon to the sediments. This is a reasonable inference based on the TOC content of sediments collected in sediment traps at the West Arm far field station (towards Quesnel River; 2.3 to 4.3%) and the Horsefly reference station (2 to 3.5%) between 2014 and 2015. The increasing TOC in the sediments at Hazeltine could in turn be related to the increasing density of benthic invertebrates observed in the West Arm.

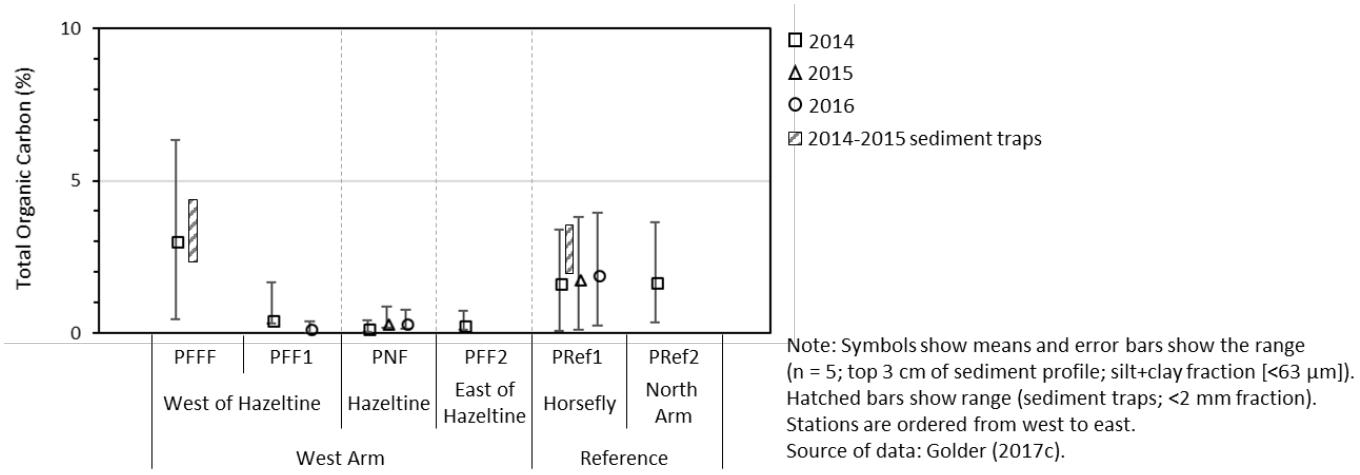

Figure 24: Spatial Variability in Total Organic Carbon in Quesnel Lake Benthic Sediments in 2014, 2015, and 2016

A literature review was undertaken to identify factors that influence succession and recolonization of disturbed sediments in lake environments. Little useful information was found as studies regarding succession and recolonization of disturbed benthic substrates have focussed on marine areas which are:

- dredged or received disposal of dredged material (e.g., Oliver et al. 1977, Van Dolah et al. 1984, Bolam and Rees 2003, Cruz-Motta and Collins 2004)
- have become organically enriched (e.g., Holte and Oug 1996; Norkko and Bonsdorff 1996; Nilsson and Rosenberg 2000)
- have received tailings (e.g., Kathman et al. 1984; Ellis and Hoover 1990; Olsgard and Hasle 1993; Burd 2002; Hughes et al. 2015)

The literature review also sought studies of British Columbia lakes that are known to have received operational (i.e., deliberate and permitted) deposits of tailings (Table 7). For these locations, studies were either only done prior to the commencement of tailings deposits, or, where post-discharge studies were available, they were conducted decades after the fact and therefore did not provide an indication of either recovery rates or recovery of benthic invertebrate communities in the near-term (e.g., MEMPR 1991; Mudroch et al. 1993). The potential use of data from the available studies is also confounded by the fact that the tailings from the mines studied were acid generating, unlike Mount Polley tailings (Kennedy et al. 2016), and the contaminants of primary concern were different (e.g., mercury, arsenic, zinc). Nonetheless, although the profundal (deep) zone of Benson Lake was devoid of benthic invertebrates when the Benson Lake Coast Copper Mine stopped discharging tailings in 1973, the follow-up study, which wasn't undertaken until some 17 years later "found that Benson Lake showed little evidence of the fact that it was the recipient of mine waste" (MEMPR 1991). The authors of that study suggested that the organic layer that had accumulated on the lake bed may have prevented the further flux of metals (e.g., zinc) from the underlying tailings.

Table 7: Mines in British Columbia That Deposited Tailings to Lakes

Area	Waterbody	Mine	Type	Active Period
Central BC	Jack of Clubs Lake	Cariboo Gold Quartz Mine	gold	1933 to 1964
Vancouver Island	Benson Lake	Benson Lake Coast Copper Mine	copper	1962 to 1973
	Buttle Lake	Myra Falls/Lynx Mine	zinc, copper, gold	1966 to 1984
Northwest BC	Tom MacKay Lake Albino Lake	Eskay Creek Mine	gold	2002 to 2008
	Brucejack Lake	Brucejack Mine	gold	Commenced in 2017

Although studies from the marine environment provide a positive indication that disturbed sediments can and will start to recolonize relatively quickly after the initial disturbance, they are not direct analogues for deep lakes. This is because dispersal of organisms is influenced by movement of the water column, which is typically greater in the tidal marine environment than in lakes where water movement at the bed of deep lakes tends to be relatively low by comparison. However, the principle that colonization sequence and speed are dependent on dispersal mode/abilities (i.e., how they move) of a given taxonomic group and size of area disturbed are also true for freshwater environments (e.g., Cañedo-Argüelles and Rieradevall 2011).

The primary taxonomic groups found in the profundal area of Quesnel Lake are chironomids and oligochaetes. The predominant chironomid species found in Quesnel Lake tend to be clingers or burrowers/tube dwellers that feed on detritus (e.g., *Phaenopsectra* sp., *Heterotrissocladius* sp.; Merritt and Cummins 1978). *Procladius* sp. is another chironomid species present that "sprawls" or stays on the surface of the sediment. Regardless of the mode of existence (burrower versus sprawler), because benthic in-faunal chironomids are the aquatic larval stage of flying insects, they reach the lake bed as eggs deposited on the surface of the lake or eggs/larvae flushed from the littoral zone or tributary streams rather than via lateral "migration" at the lake bed. Once in deep lakes, chironomid development can take a longer period of time than for the same species in shallower areas (Wallace and Anderson 1995). This suggests the possibility (but not certainty) that in the initial year after disturbance of a deep lake bed, a majority of the organisms in the sediments may be small enough that they are not retained in a sediment sieve. In subsequent years, the retained organisms may be the more developed larvae that were deposited in prior years.

In comparison, the oligochaete species present in Quesnel Lake (Lumbriculidae and Tubificidae) spend their entire life cycle in the aquatic environment. They therefore colonize lake bed sediments either by *in situ* reproduction or via discharge from tributary streams (Pennak 1978). Aquatic oligochaetes tend to burrow into the sediments and lateral movement would be slow relative to the dispersion of a species that does not burrow.

That the dispersal processes described above are naturally successful is supported by the fact that sediment in other areas of Quesnel Lake are colonized by chironomids and oligochaetes. The hypothesis that the sediments in the West Arm will recolonize naturally is also supported by data from a sediment transplant study conducted in 2015 with the objective of identifying potential constraints to recolonization of the West Arm sediments (Minnow 2016a). The study involved collection and taxonomic analysis (identification and enumeration) of sediment from:

- The lakebed near Hazeltine and transplant of that material to the reference area in buckets that were retrieved after seven weeks ("transplanted exposed sediment").[7]
- The profundal zone in the West Arm and reference areas in August and October ("*in-situ* sediment"). These data illustrate the change in the benthic community during the transplant period.
- The littoral zone in the West Arm and reference areas in August ("littoral sediment"). These data provide an indication of the benthic invertebrate community in adjacent shallow areas which may be a source of colonizing organisms.

Figure 25 shows the density (number of organisms per m^2) for the dominant taxonomic groups that occur in the deep lake sediments: three chironomid taxa (*Phaenopsectra* sp., *Procladius* sp., and *Heterotrissocladius* sp.) and two oligochaete taxa (Tubificidae and Lumbriculidae). The upper graphs show the full range of density (up to 35,000 organisms/m^2) and the lower graph shows density up to 7,500 organisms/m^2 to highlight the dominant taxa in the Hazeltine sediments. The stations are organized to show the littoral zone results next to the *in situ* benthic zone results for the West Arm location, and the littoral zone, *in situ* benthic zone, and transplanted West Arm sediments at the reference location.

As shown in Figure 25, sediment from the benthic zone of Quesnel Lake adjacent to the mouth of Hazeltine Creek transplanted to the reference area had a greater density of benthic invertebrates than did the sediments *in situ* at Quesnel Lake near Hazeltine. The benthic invertebrate density and composition in two of the transplanted sediment replicates was also similar to that observed in two of the in situ reference sediments as of October when the sediment buckets were retrieved. The benthic community in the transplanted sediments after the seven-week deployment was dominated by the oligochaete Tubificidae and the chironomids *Phaenopsectra* sp. and *Procladius* sp., which were also observed in the littoral zone at Horsefly. In comparison, the *in situ* sediments at Hazeltine were dominated by the chironomid *Heterotrissocladius* sp., which was the dominant chironomid in the littoral zone. These data suggest that the recolonization of the sediments in the West Arm may be more dependent on proximity to a source of colonizing organisms than on the quality of the sediment itself.

[7] The sediments were transplanted with and without a carbon amendment. The results for the amended sediments were not significantly different from the un-amended sediments therefore the data for the amended sediments are not shown here.

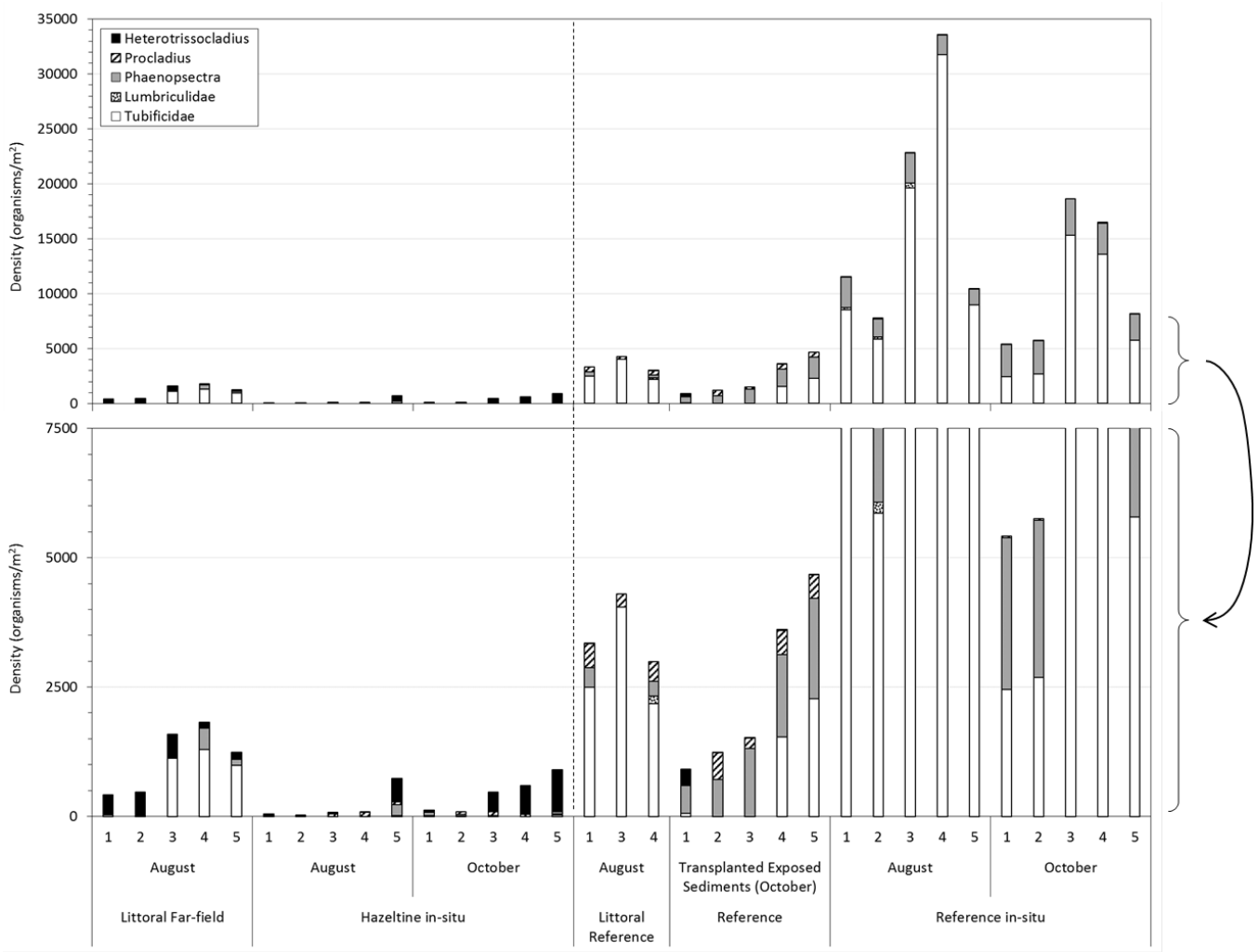

Note: Bars show results for individual replicates (numbered from 1 to 5 except where noted).
The upper graph shows the full range of density and the lower graph shows density up to 7,500 organisms/m².
The month indicates when the samples were collected for taxonomic analysis. The transplanted sediments were deployed for seven weeks.
Source of data: Golder (2017c).

Figure 25: Chironomid and Oligochaete Density in Transplanted and *In Situ* Sediments (2015)

4.11.3.2 Remediation Activities to Date

To date, the focus on the Quesnel Lake benthic zone has been testing, monitoring and evaluation of data through the aquatic ecological risk assessment to identify appropriate remedial decisions. Remedial actions with regards to the Quesnel Lake benthic zone have consisted of actions to stop the further release of particulate materials into the lake from erosion of Hazeltine Creek (Bronsro et al. 2016).

4.11.3.3 Remediation Plan

Based on the identified ecological function of rearing (Table 4) and the effect of the event on the benthic invertebrate community as illustrated above, the remediation objective for the Quesnel Lake benthic zone is a benthic invertebrate community that is similar to that occurring in other, unaffected areas of the lake, and which contributes food organisms to fish. The benthic community would be used as an indicator for fish productivity because there is a poor understanding of the contribution from profundal benthic communities to fish productivity (for example Figure 23) whereas the density of benthic organisms can be directly measured.

Overview of Net Environmental Benefit Analysis

Net environmental benefit analysis (NEBA) is a method developed to identify and compare alternative site management options, often for contaminated sites or for oil spill clean-up (Efroymson et al. 2003). The focus of this methodology is net environmental benefit, which is the balance of the environmental benefit achieved from a management option with the environmental costs associated with the option (e.g., habitat disruption). "Environmental benefit" addresses a range of natural resource "services" from habitat that supports ecological function (water quality, fish habitat, bird nesting), direct human uses (e.g., recreation, fisheries), and passive values (e.g., existence value, aesthetic value). Environmental costs and benefits are therefore considered in a broad context. NEBA was undertaken for the Quesnel Lake portion of the RP because (unlike Hazeltine Creek) the remedial options have not been evaluated by the HRWG. NEBA provides context for the evaluation of those options.

As a result of physical smothering from the settled breach outwash materials, the environmental services of the lakebed have been disrupted and low organic carbon content has been identified as a potentially limiting factor for benthic invertebrate community recovery. NEBA is therefore, conceptually, a useful tool for identifying and comparing potential management options for addressing the Quesnel Lake remediation area. A framework for undertaking NEBA is illustrated in Figure 26.

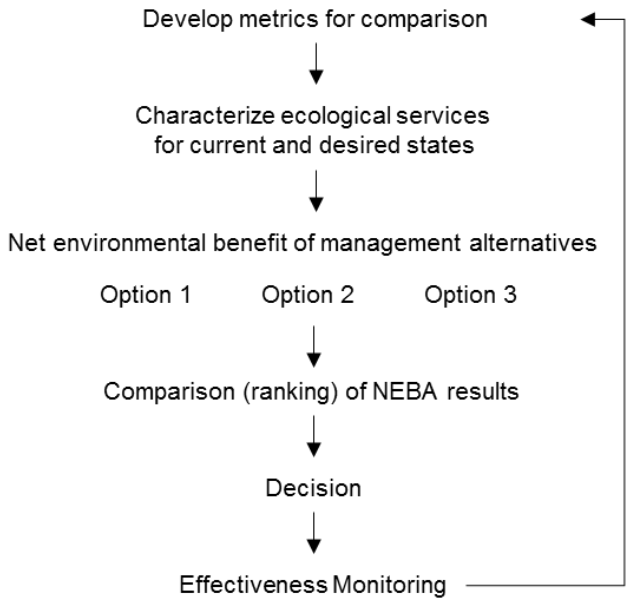

Figure 26: Framework for Net Environmental Benefit Analysis (adapted from Efroymson et al. 2003)

The focus of the remainder of this section is to identify alternative remediation (action) options, selection of metrics for comparing those options, and the ranking of the options based on their respective net environmental benefit in the context of the remedial objectives of (re) establishing a benthic invertebrate community that is similar to that occurring in other, unaffected areas of the lake, and which contributes food organisms to fish.

Identification of Conceptual Remedial Options for Quesnel Lake

The three general remedial options typically considered in a NEBA are (Efroymson et al. 2003):

- Monitored Natural Recovery
- physically, chemically, or biologically remediate the site – this may mean, in the context of sediments, physical dredging of the material or the addition of materials to amend the sediment (e.g., organic carbon)
- improve the ecological value of the site through remediation and restoration

A combination of the above may also be appropriate depending on site specific considerations. For the Quesnel Lake remediation area, the more specific remedial options that could be applied are as follows:

- monitored natural recovery (MNR), together with productivity offsets for interim losses
- physical remediation in the form of dredging
- chemical/biological remediation in the form of sediment amendment with organic carbon
- chemical/biological remediation in the form of thin-layer capping

The options evaluation starts by considering each of these four options and considering, at a conceptual level (i.e., not including engineering design, costing), how each of these options might be implemented under the a priori assumption that the options are technically and financially feasible. Given these implementation scenarios, factors that would influence environmental costs and benefits, in the broad sense described above, are considered so that there is a basis for evaluating the remedial options on that basis. Simple categorical ranks were applied to those variables to evaluate the net environmental benefits.

Table 8 provides an overview of each of these remediation options as well as variables that need to be taken into consideration in the planning and implementation of the options. Habitat offsets are not included in Table 8, however, they are recognized in environmental policy as a remedial method and offsets are the proposed means of addressing service losses over the period of recovery and are discussed further in Section 5.4.2.

Table 8: Overview of Considerations for Remediation Options for Quesnel Lake Profundal Benthic Zone

Variable	Dredging	Amendment or Chemical Stabilization	Thin-layer Capping	Monitored Natural Recovery
Description				
Overview	Physical removal of lakebed substrates that were contributed by the deposit of outwash material, debris and tailings during the event. Estimated volumes to be removed are 1.81 km^2 x 10 m in depth (some consolidation of those materials will have occurred making the consolidated thickness of deposits less). Although depth would be variable and this may overestimate deposit, it is a plausible planning basis to account for over-dredging and bulking of dredged materials. Deposited material is at water depths greater than conventional dredging equipment, which is designed for enabling vessel navigation. Clam shell dredging would be feasible but turbidity would be very difficult to control and material handling would involve heavy truck traffic throughout the area. Depths exceed conventional suction dredging depths though unconventional equipment may be modifiable. Dredged material would need to be dewatered at a rate proportional to production and with suction dredging, large water volumes would be involved.	Involves (in this case) the addition of organic matter into lakebed substrates to provide an initial food source to enhance recovery of benthic invertebrate community. This approach has been proposed, though not operationalized, for submarine tailings placement areas in Norway (Kvassnes et al. 2009). Possible sources of organic carbon include: ■ bio char (e.g., burned wood) – may not have organic carbon in a form that is metabolically accessible by benthic organisms ■ unburned coal – may not have organic carbon in a form that is metabolically accessible by benthic organisms ■ compost or biosolids – likely to have organic carbon in a bioaccessible form This option is considered experimental at the scale necessary. Research has been conducted at other locations on the delivery mechanism, different types of organic carbon, and thickness of the layer of amendment material needed to be successful. These studies have been conducted in relatively shallow water and most commonly for remediation of organic contaminants such as petroleum hydrocarbons and PCBs over limited spatial scales. Reports on studies regarding a lack of organic carbon at water depths similar to that of Quesnel Lake were not found; therefore, the success of organic carbon amendment as a remediation tool is uncertain, and a site-specific trial study would be needed to develop an appropriate design. Quesnel Lake is used as a drinking water source, thereby limiting the forms of organic carbon that would be acceptable and this may include most commercially sourceable forms that are also bioaccessible for benthic organisms.	Involves the addition of a thin layer (e.g., 1 to 10 cm depth) of material to the surface of the lakebed substrates to separate the colonizing biota from the deposited tailings. The material may be inert geological material (e.g., sand, clay) or may be composed of a mixture of geological material and components intended to bind with contaminants, such as activated carbon, as described for the amendment/chemical stabilization option. Where capping material consists of an inert geological material and is not amended with a carbon source such as activated carbon, capping may not address the lack of carbon that has been identified in toxicity testing as a potential limitation to re-colonization. Conversely, when a carbon source is included, a greater impact on the existing benthic community may occur that if an inert geologic material is used (e.g., Samuelsson et al. 2017). Depending on the area to be capped and the desired depth of the capping layer, the volume of material that would need to be imported and placed on the lake bottom could range from 150,000 to 1,500,000 m^3.	Involves allowing natural processes (e.g., sinking of diatoms and plankton, particulate organic matter from tributary streams) to contribute organic carbon to sediments. There is no specific provincial guidance but parallels can be drawn to Monitored Natural Attenuation (MNA) of groundwater contaminants which is addressed by Technical Guidance 22 (MOE 2014), which identifies specific factors that must be in place for MNA to be considered feasible.
Constructability				
Equipment availability	Deep-sea mining has been done at 200 m depth by purpose-built vessels with cutter suction dredge (CSD) heads that cannot be transported intact to Quesnel Lake. A shipyard would be needed on the shore of Quesnel Lake to assemble and/or construct vessels and dredge units. Suction dredging units with proven capability at -70 m are available; it is possible that they could be custom-modified to work at the ~110-m depth that would required Clam-shell dredging through 110 m of water column could be conducted but would require the construction of a work platform on site. A fleet of dredge scows would need to be constructed on site. The required equipment is not readily available and would need to be procured, fabricated, and assembled.	Different methods for amending sediments have been used: ■ surface dumping from a split-hull barge ■ pumping a mixture of sand and carbon through a down pipe to a few meters above the substrate – usually in waters shallower than 100 m ■ “Injection” and rotor-tilling directly into the bedded sediment usually in waters shallower than 100 m The selection of the equipment would dictate the precision of the placement of the organic carbon material. For any of the scenarios listed above, the required equipment is not readily available or not easily transportable to the site; it could take years to procure/fabricate/assemble.	Different methods for amending sediments have been used: ■ surface dumping from a split-hull barge ■ pumping a mixture of sand and carbon through a down pipe to a few meters above the substrate – usually in waters shallower than 100 m The selection of the equipment would dictate the precision of the placement of the capping material. For any of the scenarios listed above, the required equipment is not readily available or not easily transportable to the site; it could take years to procure/fabricate/assemble.	N/A

Variable	Dredging	Amendment or Chemical Stabilization	Thin-layer Capping	Monitored Natural Recovery
Staging/work areas	A work area would be needed to: ■ Construct dredge platforms and scows. ■ Launch equipment into the lake and for offloading of dredged material from the dredger to a pump station or trucks, which would then transfer the material to the disposal site (notionally a disused pit or enlarged TSF. ■ If suction dredged, a floating umbilical with booster stations at 700 to 1,000,m intervals would extend from dredging unit to a single shore point (several km depending on the location of the dredge assembly). ■ If materials to be pumped, a pipeline would need to be constructed. An additional pipeline would need to be constructed for dewatering in the case of suction dredging.	A work area would be needed to launch equipment into the lake and for loading of the vessel that would place the amendment material on the lake bed. This may require the construction of a ramp and/or jetty along the lake shore as well as removal of trees.	A work area would be needed to launch equipment into the lake and for loading of the vessel that would place the amendment material on the lake bed. This may require the construction of a ramp and/or jetty along the lake shore as well as removal of trees.	N/A
Water management (treatment and disposal)	Hydraulic dredging produces volumes of water at a 1:6 to 1:10 ratio of solids to water that would require management. For a dredged material volume of 32.4 M m^3, 194 approximately to 324 M m^3 of dredged slurry would be generated. This water would need to be conveyed from the lake bottom, across the lake and up to the disposal location where solids would be removed. The clarified water would then need to be returned to the lake. Clam-shell dredging re-suspends sediments into the water column. For typical, nearshore construction dredging projects, this type of work is conducted with in a turbidity curtain. A turbidity curtain would be operationally infeasible deeper than about 10 m. Therefore, if this type of equipment were used, active turbidity control would not be possible. Clam shell dredged material would need to be loaded to a barge and dewatered at that location, in Quesnel Lake.	N/A – Water requiring treatment would not be handled.	N/A – Water requiring treatment would not be handled.	N/A
Safety Considerations	Health and safety planning to address operation of: ■ water-based equipment ■ transport of equipment ■ potential interaction with recreational users of Forest Service Roads Navigational risks to recreational boaters from a 24/7 operation and potentially several km long “umbilical” slurry line on the water surface – even with navigational lights, this would pose a risk, particularly to non-local boaters	Health and safety planning to address operation of: ■ water-based equipment ■ transport of equipment ■ potential interaction with recreational users of Forest Service Roads and Quesnel Lake boaters	Health and safety planning to address operation of: ■ water-based equipment ■ transport of equipment ■ potential interaction with recreational users of Forest Service Roads and Quesnel Lake boaters	Health and safety planning to address operation of a sampling vessel similar to a typical recreational vessel as operated on Quesnel Lake
Access to Site	Potential need to upgrade access roads to accommodate size of equipment that would need to be brought to the lakeshore Clearing of staging area(s) along Quesnel Lake shoreline	Potential need to upgrade access roads to accommodate size of equipment that would need to be brought to the lakeshore	Potential need to upgrade access roads to accommodate size of equipment that would need to be brought to the lakeshore	N/A. Existing infrastructure can be used.
In-water footprint	Estimated at a minimum of 1.81 km^2 with additional allowance for over-dredging (controllability of suction dredging unit at 110m depth may be a challenge).	Up to 1.81 km^2	Up to 1.81 km^2	No incremental amounts beyond the initial impact

Variable	Dredging	Amendment or Chemical Stabilization	Thin-layer Capping	Monitored Natural Recovery
Conceptual Schedule				
Planning, Engineering and Permitting	2 to 4 years	2 to 4 years + study durations for small scale trials	2 to 4 years + study durations for small scale trials	N/A. Available data indicates that the process of natural recovery is already occurring (Section 4.11.3)
Procurement and/or construction of equipment	5+ years	5 years	5 years	N/A
Implementation	At 4,000 m^3/day (convention clam-shell dredging using four spreads) to 6,000 m^3/day (deep-sea cutter suction dredging, assuming that it were feasible) and assuming 6-months of production during ice-free season and suitable weather conditions, dredging of 32.4 million m^3 would take 30+ years.	One to two open water seasons (depending on method of placement) with potential need to repeat application of amendments	One to two open water seasons (depending on method of placement) with potential need to repeat application of amendments	N/A
Certainty in Outcome	Dredging would remove the deposited material, but there is uncertainty as to whether the material at the dredge cut depth would have sufficient organic carbon to support benthic invertebrate recolonization. It would not be possible to have a dredge cut that is at the former mud line and therefore, it is unlikely that the newly exposed material would have organic carbon levels similar to reference conditions. There is not a clear risk reduction benefit that would occur by removing the deposited materials.	Option is experimental, based on benchtop laboratory testing; there is low certainty that application to a large area on the lake bed would improve recolonization over and above MNR, given that mechanisms of colonization (Section 4.11.3) would be the same as for MNR.	Option is experimental, based on laboratory and field-scale testing to determine the applicable material type and layer thickness. There is low certainty that application to a large area on the lake bed would improve recolonization over and above MNR, given that mechanisms of colonization (Section 4.11.3) would be the same as for MNR.	Recolonization by benthic invertebrates has already been observed *in situ* in the West Arm and in transplanted sediment to other parts of Quesnel Lake. Natural processes are expected to be successful. Monitoring is required to verify this expectation and attainment of diversity and abundance similar to other areas in Quesnel Lake.
Considerations				
Geotechnical				
Slumping of lake walls	■ Removal of material at toe of lake wall could destabilize the submerged slope and cause further scouring and deposition of material, and subsequent effects to water quality.	■ The mass of material anticipated for placement is unlikely to affect slopes.	■ The mass of material anticipated for placement is unlikely to affect slopes.	N/A
Compaction of lake bed	■ Depending on the removal method, the remaining sediment at the dredge cut depth could be compacted, thus creating additional conditions that affect benthic invertebrate recolonization or would require more “aggressive” dredging equipment.	■ Placement of a layer of material could potentially result in compaction of underlying materials, thus creating additional conditions that affect benthic invertebrate recolonization. However, it is expected that organic carbon amendment would be a thin layer.	■ Placement of a layer of material could potentially result in compaction of underlying materials, thus creating additional conditions that affect benthic invertebrate recolonization. However, it is expected that the cap would be a thin layer.	N/A
Aquatic Habitat				
Fish	■ Dredging for a long time frame would continually displace fish from the area of work and disrupt food sources for benthic-feeding fish as they are disturbed while the work progresses.	■ Application of amendment may temporarily displace fish in the immediate work area. ■ Food sources during implementation would be disrupted, to the extent that those sources come from the benthos.	■ Application of capping material may temporarily displace fish in the immediate work area. ■ Food sources during implementation would be disrupted, to the extent that those sources come from the benthos.	N/A

Variable	Dredging	Amendment or Chemical Stabilization	Thin-layer Capping	Monitored Natural Recovery
Offsetting/rehabilitation costs	■ Additional offsetting might be needed to address time lag in benthic habitat recovery as a result of the ongoing disturbance.	■ Additional offsetting might be needed to address time lag in benthic habitat recovery; however, both the extent of loss and the time lag would be expected to be smaller than the initial impacts of the event.	■ Additional offsetting might be needed to address time lag in benthic habitat recovery; however, both the extent of loss and the time lag would be expected to be smaller than the initial impacts of the event.	N/A
Terrestrial Habitat				
Riparian vegetation	■ Creation of sufficiently large staging area(s) might require removal of shoreline vegetation.	■ Creation of sufficiently large staging area might require removal of riparian vegetation.	■ Creation of sufficiently large staging area might require removal of riparian vegetation.	N/A
Birds	■ Creation of staging area could disrupt bird habitat, although site selection and timing would likely be able to address such disruption.	■ Creation of staging area could disrupt bird habitat, although site selection and timing would likely be able to address such disruption.	■ Creation of staging area could disrupt bird habitat, although site selection and timing would likely be able to address such disruption.	N/A
Wildlife	■ Creation of staging area could disrupt wildlife habitat.	■ Creation of staging area could disrupt wildlife habitat.	■ Creation of staging area could disrupt wildlife habitat.	N/A
Water Quality				
Induced turbidity	■ Clam shell dredging would induce turbidity. Given the clear water characteristics of Quesnel Lake, it is likely that this would result in visible turbidity in the lake. A clamshell would move turbid waters across the thermocline. ■ Hydraulic dredging would have much reduced turbidity generation compared to mechanical (clamshell) dredging, but some induced turbidity would occur. ■ With depths involved it would not be possible to have a barrier/turbidity curtain in place to contain induced turbidity using either method.	■ Where application of amendment is via surface or near surface dumping, amendment material would cause turbidity. ■ Bottom substrates may be disturbed as amendment material reaches lake bed; computational or empirical approaches could assist in quantifying whether that would be significant. ■ With depths involved it would not be possible to have a barrier/turbidity curtain in place to contain induced turbidity.	■ Where application of capping material is via surface or near surface dumping, the material would cause turbidity. ■ Bottom substrates may be disturbed as capping material reaches lake bed; computational or empirical approaches could assist in quantifying whether that would be significant. ■ With depths involved it would not be possible to have a barrier/turbidity curtain in place to contain induced turbidity.	N/A
Contaminant dispersion	N/A	■ N/A, although the organic carbon may disperse into the water column during application.	■ N/A, although the capping material may disperse into the water column during application.	N/A
Introduction of foreign substances and potential breakdown products	■ N/A. Dredging does not involve introduction of foreign materials. ■ As with the use of machinery around water generally, there is always some risk of loss of fuel and lubricants to the water, despite exercise of precaution.	■ The addition of an organic carbon amendment would be experimental and the optimal application rate is unknown at this time. If too much organic carbon was added to the lake bed, breakdown products such as sulphides and ammonia could be released, and dissolved oxygen could be consumed, creating anaerobic conditions in the sediment, which would retard colonization by communities compared to reference locations.	■ Depends on the material selected for the cap. A geologically inert material would not be expected to contain foreign substances.	N/A.
Navigation / Recreation				
Boat passage	■ Large work platform (50 x 100 m) and safety zone (100-m radius) around work area would restrict usage of portions of lake. ■ With suction dredging, a floating slurry pipeline would have an uninterrupted span of potentially up to 10 km or more depending on dredged material disposal location and dredging rigs. Diesel booster pumps would operate every 0.5 to 1 km.	■ Potentially large work platform and safety zone (100 m radius) around work area would restrict usage of portions of lake although that would likely be minor.	■ Potentially large work platform and safety zone (100 m radius) around work area would restrict usage of portions of lake although that would likely be minor.	N/A. Typical recreational boat operation.

Variable	Dredging	Amendment or Chemical Stabilization	Thin-layer Capping	Monitored Natural Recovery
Fisheries	■ Large work platform (50 x 100 m) and safety zone (100 m radius) around work area would restrict usage of portions of lake for fishing.	■ Potentially large work platform and safety zone (100 m radius) around work area would restrict usage of portions of lake by fishermen although that would likely be minor.	■ Potentially large work platform and safety zone (100 m radius) around work area would restrict usage of portions of lake by fishermen although that would likely be minor.	N/A. Typical recreational boat operation.
Noise and Air Quality / Nuisance				
Construction noise and lighting	■ Some noise generated through operation of equipment (motors, metal upon metal, vessels, verbal communication). ■ During seasonally allowable periods, the operation would likely operate 24/7, necessitating lights in the work zones, booster stations would have lights and diesel-powered pumps.	■ Some noise generated through operation of equipment (motors, metal upon metal).	■ Some noise generated through operation of equipment (motors, metal upon metal).	N/A.
Air quality	■ Typical emissions from construction equipment and from trucks transporting dredged material to the mine site. ■ If the material is dewatered near the lake and transported by truck, local dust could be an issue.	■ Typical emissions from construction equipment. ■ Potential dust generation from stockpiles. ■ Nuisance odors may be associated with the organic carbon amendment.	■ Typical emissions from construction equipment. ■ Potential dust generation from stockpiles.	N/A.
Traffic				
Import of equipment and materials	■ Additional traffic through adjacent communities to bring equipment and construction materials to site. ■ Municipal and regional by-laws may have restrictions on truck routes and schedules, which may have an influence on the overall schedule.	■ Additional traffic through adjacent communities to bring equipment and construction materials to site. ■ Municipal and regional by-laws may have restrictions on truck routes and schedules, which may have an influence on the overall schedule.	■ Additional traffic through adjacent communities to bring equipment and construction materials to site. ■ Municipal and regional by-laws may have restrictions on truck routes and schedules, which may have an influence on the overall schedule.	N/A. Typical recreational boat operation.
Export of dredged material	■ Not expected with suction dredging and hydraulic transport of slurry. ■ If clamshell dredging is used, material would need to be brought to shore, dewatered sufficiently for safe truck transport. ■ Municipal and regional by-laws may have restrictions on truck routes and schedules, which may have an influence on the overall schedule.	N/A	N/A	N/A.

Studies Needed to Support Remediation Planning

Depending on the remediation option selected, additional studies may be required to support the planning and assessment of the remediation, for example, if the option of dredging were selected:

- Geotechnical evaluation (e.g., to support design of shoreline infrastructure such as ramps and docks; to understand the potential for dredging to destabilize the lakeshore) for the dredging option.
- Evaluation of mine roads to determine if upgrades would be necessary to support additional truck traffic that may be required to transfer dredged material to the mine site for disposal, if trucks are selected for this purpose.
- Evaluation of a new pipeline route and detailed pipeline engineering to support engineering of a new pipeline to transfer dredged material if direct pumping is selected for this purpose.
- Dredged material dewatering and dewatering effluent treatment and disposal; location selection for dredged material and volumes of water that can be practicably treated, which would govern dredging production rates.
- Optimal dredging methods, equipment availability, vessel sizing requirements.
- Bench-scale and in situ pilot testing to evaluate the potential efficacy of a remediation option (e.g., tests to determine the preferred material for carbon amendment and dosing rates, or material for thin-layer capping).

NEBA Metrics

Table 8 identified a number of considerations regarding potential options that could be implemented to meet the remediation goals for the benthic zone of Quesnel Lake. The primary indicator metrics selected from those considerations for inclusion in comparing the net environmental benefit of the potential remediation options (i.e., gains versus losses) are as follows and discussed further below. “Environmental Benefit” is considered broadly. While the main biological measure of gains and losses is invertebrate production, environmental benefits in this case also include use of the environment of Quesnel Lake and effects on the human environment (aesthetics).

- net benthic invertebrate productivity – gains from the action less the losses from those actions
- effects on water quality – including all uses of Quesnel Lake water (e.g., aquatic life, drinking water, etc.)
- effects on adjacent terrestrial areas
- effects on air quality
- effects on recreational activities (e.g., boating, swimming)
- effects on aesthetics (noise, traffic)

Net Benthic Invertebrate Productivity

The ultimate remediation goal is that the benthic invertebrate community recover to a level that is similar to adjacent areas. As the data show, this recovery has started (Section 4.11.3) and therefore this variable is intended to capture how physical or other perturbations associated with a remediation option may affect productivity over time due to that additional disturbance. This means that if an additional perturbation is to be beneficial, the productivity gain needs to be greater than the loss from the perturbation for there to be a net benefit. Net benthic invertebrate productivity is thus defined as follows: Productivity of desired stated minus the initial loss from TSF breach and the incremental additional loss or gain from implementation of a remediation activity.

Although the data are not sufficient at this time to quantify the overall recovery trajectory and when the density of chironomids, in particular, will be consistently within the range of natural variability of reference areas, a qualitative comparison of potential additional productivity loss can be identified. For example, Figure 27 illustrates the conceptual time scale at which recovery reaches the range of natural variability. The amendment and dredging options are expected to result in a second disruption to the benthic community and therefore additional lost productivity, following a period of detailed planning, site preparation, and procurement of equipment. The dredging option is expected to take the longest time to implement with continual disruption to the lake bed where dredging is occurring at a given time. The amendment option is expected to take less time than dredging and cause a lesser effect on productivity initially than dredging because the sediments are not being “excavated”. In comparison, monitored natural recovery allows for the recolonization of the sediments to continue its current trajectory without a second disruption to productivity. Based on the timeline illustrated in Figure 27, the net benthic productivity of the three remediation options is therefore ranked from highest to lowest as:
MNR > amendment > dredging.

It should be noted that Figure 27 is a conceptual figure and the dotted lines are notional projections. It is possible that the impacts of dredging, in particular, could be reduced somewhat through project planning with recovery starting as the dredge works its way across Quesnel Lake. However, given the depth of the design dredge cut being upwards of 10 m, it is possible that such a depth would need to be achieved through multiple passes. A 10 m deep cut would be filled by inwards collapse of the uncut sidewalls and such events would generate turbidity at depth which may be available for surface water turbidity at lake overturn. Therefore, while the absolute losses notionally depicted in Figure 27 may be greater than achievable in a well-designed dredging program, in relative terms, the figure nevertheless depicts the concept of extended duration perturbations to the benthic community should the dredging option be pursued. There is no evidence available to suggest that following dredging, benthic productivity would be higher than it would otherwise be with MNR. Accordingly, dredging scores poorly on net environmental benefits, whether considered in the broad context as described above or in the narrower context of non-human biological metrics.

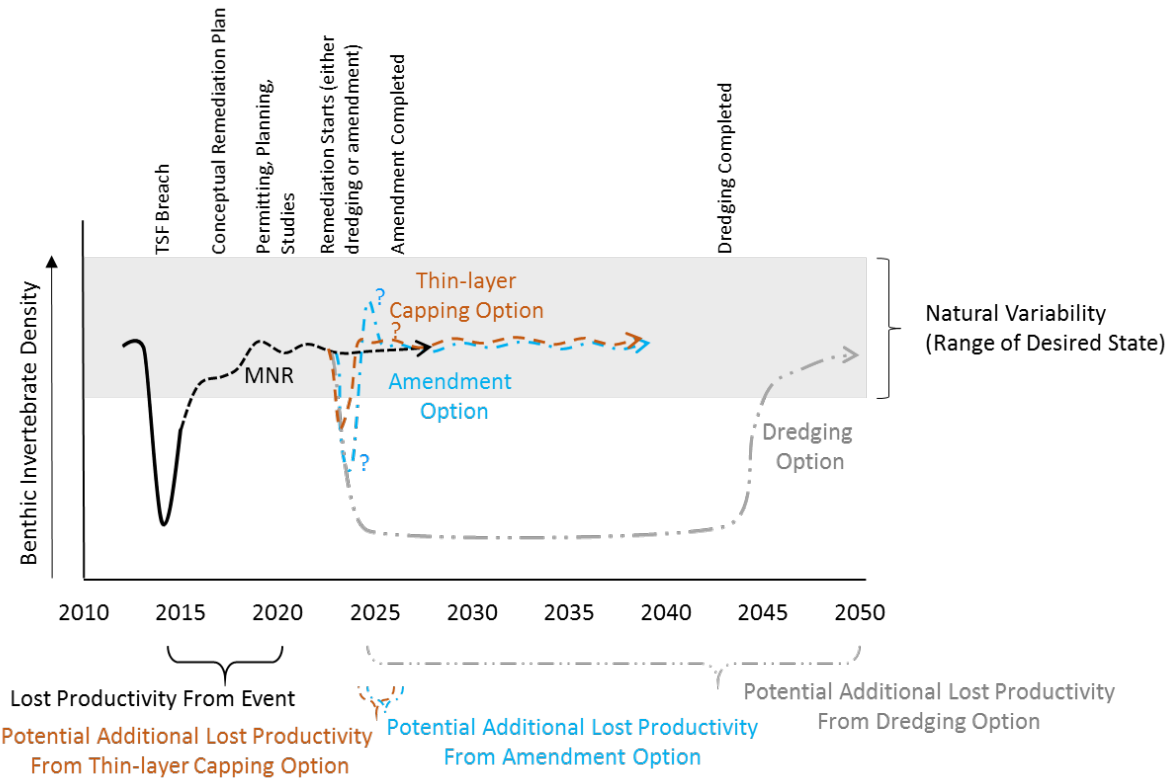

Figure 27: Conceptual Comparison of Influence of Remediation Option on Net Benthic Invertebrate Productivity (Not Based on Actual Data from Quesnel Lake)

Effects on Water Quality

Two of the remediation options (dredging and carbon addition) may have an effect on water quality, which may in turn affect productivity of the water column or the safety of the water for human consumption, specifically:

- Dredging has the potential to introduce suspended sediments into the water column. This re-suspension of sediments would occur throughout the duration of dredging, which is estimated to be six months per year for > 30 years. The degree to which sediment may be re-suspended during dredging is dependent on the equipment used. Mechanical dredging (i.e., with a clam shell bucket) introduces a considerably greater amount of solids into the water column than hydraulic dredging. As well, a temporary water treatment system with effluent discharge back to the lake may be needed, depending on the dredging method selected. For example, hydraulic dredging generates six parts of water to each part of solids. At a dredging rate of 6,000 m^3 solids per day and assuming an 8:1 water:solids ratio (the middle of the notionally expected range), 48,000 m^3 of dewatering effluent would need to be treated to remove solids and this treated effluent would then be discharged back into the lake. Additional turbidity may be generated using either method depending on the depth of the dredge cut at a given location. A dredge cut with a 10 m mud wall adjacent to that cut would be infilled by slumping and the force of that slumping would generate considerable turbidity at depth. To prevent this, dredging would need to be carried out as “shaved” layers, which would then result in further delays to recovery over a wider area.

- Capping the sediments would necessarily involve introducing a substance to the lake (inorganic sediment), which may become entrained in the water column depending on the placement method. This water quality effect is expected to be relatively short-term compared to dredging. None of the data so far suggest a benefit or need for thin-layer capping.
- Amending the sediments would necessarily involve introducing a substance to the lake (organic carbon), which may become entrained in the water column depending on the placement method, or may result in degradation products being released as the carbon breaks down on the lake bed. These water quality effects are expected to be relatively short-term compared to dredging.

In comparison, monitored natural recovery is not expected to have any water quality effects because the sediments are both physically (Tetra Tech 2017) and chemically (Kennedy at al. 2016) stable at the bottom of the lake. Physical stability will be re-evaluated if and when university data and methods become available for review.

In summary, from least to greatest negative impact on water quality, the remediation options are ranked as follows: MNR < capping < amendment < dredging.

Effects on Terrestrial Areas

Given the magnitude of the lakebed area that would need to be actively remediated, considerable infrastructure and staging areas may be needed for the following logistic needs for the dredging and, to a lesser extent, capping and carbon addition methods:

- Constructing and storing equipment – the type and size of equipment (e.g., barges) that would be needed are not readily available in the Cariboo Region and/or may not be transportable to the site due to physical size and weight. Therefore, it may be necessary to transport raw materials (e.g., sheet metal) or sections to the site and construct the needed equipment along the Quesnel Lake shore.
- Operation of booster pumps if the transfer of dredged sediment from the lake to the pit is done via direct pumping. The booster pumps would be needed approximately every 0.5 to 1 km and would need to be placed in a relatively flat area that is easily accessible for maintenance. Several booster pumps would be needed for the section of slurry pipeline that would be floating on Quesnel Lake.
- Construction of ramps and wharves for launching equipment and facilitating trans-loading of materials. For example, material to be applied to the lake bed would need to be transferred from trucks to the floating platform from which it will be placed on the lake bed. In the event that dredged sediment is transferred to the disposal area via truck, the material would need to be transferred from a dredge scow to a processing area for dewatering and then to trucks.

The area required for staging is not yet defined, but it would likely involve the removal of vegetation and reconfiguration of land forms along the shoreline and adjacent upland areas. Following completion of the remediation, these areas would then also need to be remediated.

In comparison, monitoring of natural recovery can be done using a vessel that can be trailered and launched at an existing ramp.

In summary, from least to greatest effect on terrestrial areas, the remediation options are ranked as follows: MNR < capping < amendment < dredging.

Effects on Air Quality, Light, and Noise

Air quality and light and noise levels may be affected by the operation of equipment (e.g., engines on excavators, generators, metal on metal contact):

- The duration of dredging is conceptually estimated to be, in aggregate, six months per year for approximately 30 years, with operations occurring 24 hours per day. The dredging could potentially occur at a faster rate by having more dredge rigs deployed to the lake; however, production rates may be limited based on the ability to dewater the slurry and treat the return water to acceptable levels. Further engineering design would be required, should this option be selected. The dredging season would coincide with the greatest period of recreational use of Quesnel Lake because weather windows suitable for dredging would occur over the spring to fall timeframe. Noise and light effects would occur during this time on a 24/7 basis. Additional booster pumps (lights and noise) would be needed at the shoreline and potentially every 0.5 to 1 km to direct pump dredged material to the mine if that is the transfer option selected. The other potential transfer method would be the use of heavy haul trucks, which could be loaded by excavator and introduces the possibility of metal-on-metal contact which induces noise.
- The application of capping or amendment material to the lake bed would also involve heavy machinery, although it is expected that less equipment would be operating at a given time and the duration is expected to be considerably shorter.
- Monitored natural recovery would involve the intermittent operation of a recreational-type boat, during daylight hours only

In summary, from least to greatest effect, the remediation options are ranked as follows: MNR < capping < amendment < dredging.

Effects to Recreational Activities

Recreational use on Quesnel Lake could include boating (power boats, canoes), fishing, and swimming. These activities could be affected as follows:

- During dredging, the work would be done from one or more mobile “spreads” consisting of a dredge barge and potentially hopper barges which could impede lake and shoreline-based activities. As noted previously, this equipment could be on the lake 6 months per year for >30 years. For mechanical dredging, the hopper barges would transit between the dredge barge and the shore-based trans-loading area. For hydraulic dredging, the most efficient delivery method is via direct piping from the dredging location to the shore. This is done via a floating pipe with booster pump stations potentially every 1 km. For health and safety purposes, exclusion zones would be established around the equipment. Shoreline work areas would also have exclusion zones set around them.

- The carbon addition option would also involve the use of relatively large work platforms with exclusion zones, but for a lesser amount of time, potentially within a single season depending on the specific requirements of such application.

In summary, from least to greatest effect, the remediation options are ranked as follows:
MNR < capping < amendment < dredging.

Effects to Aesthetics (Visual)

As described above, dredging and carbon amendment involve large work platforms that would be on the lake and visible from the shoreline. This would be ongoing potentially for 6 months per year for >30 years if the dredging option were selected, and a lesser period of time if the carbon amendment option is selected. Both options may also involve construction of shoreline staging areas and thus temporary loss of treed areas.

Quesnel Lake is a clear water system and in numerous public and other meetings, the local community has been clear about how much they value this (and other) aspects of Quesnel Lake. If turbidity induced by dredging were to come to the surface either through seasonal overturn or through clamshell dredging, even a minor increase in turbidity of a few NTUs would likely be noticeable by local community members.

In comparison, monitored natural recovery would involve sampling from a vessel similar to those used by recreational boaters and would not involve the installation of shoreline facilities or the generation of turbidity. Carbon addition could potentially result in some minor turbidity but with further design efforts may not result in significant (visible) turbidity.

In summary, from least to greatest effect, the remediation options are ranked as follows:
MNR < capping < amendment < dredging.

4.11.3.4 Recommended Remediation Option

The options were categorically ranked relative to one another without weighting one variable more strongly than the other (Figure 28). Based on the metrics for comparison of the net environmental benefits associated with each conceptual remediation option, dredging has the greatest potential to have higher environmental costs and would result in the lowest net environmental benefits (benthic invertebrate productivity) because dredging would result in extended perturbations at the bed of Quesnel Lake. Given the observations of a recovering lake bed – species richness is similar to the unimpacted lake bed station and abundance is increasing though not yet within the range of natural variability – the time benefit of recovery between the initial impact of the event and the initiation of dredging would be reversed. There is also no basis from which to expect that the post-dredged lake bed would be more highly productive. The addition of carbon is a concept that comes from laboratory tests where carbon was added and restored growth to pre-impact conditions. This does not mean that it would result in certainty of benefit if scaled up from lab to field, especially given that organic carbon in the sediments is increasing as a result of natural processes (Figure 24) and there would be a time delay to develop this remedial option from concept to final design.

Monitored natural recovery is expected to result in the greatest net benthic invertebrate productivity and is not expected to cause further environmental effects (beyond those caused by the event itself). As with all three options, performance verification of MNR would be a necessary component of the CEMP.

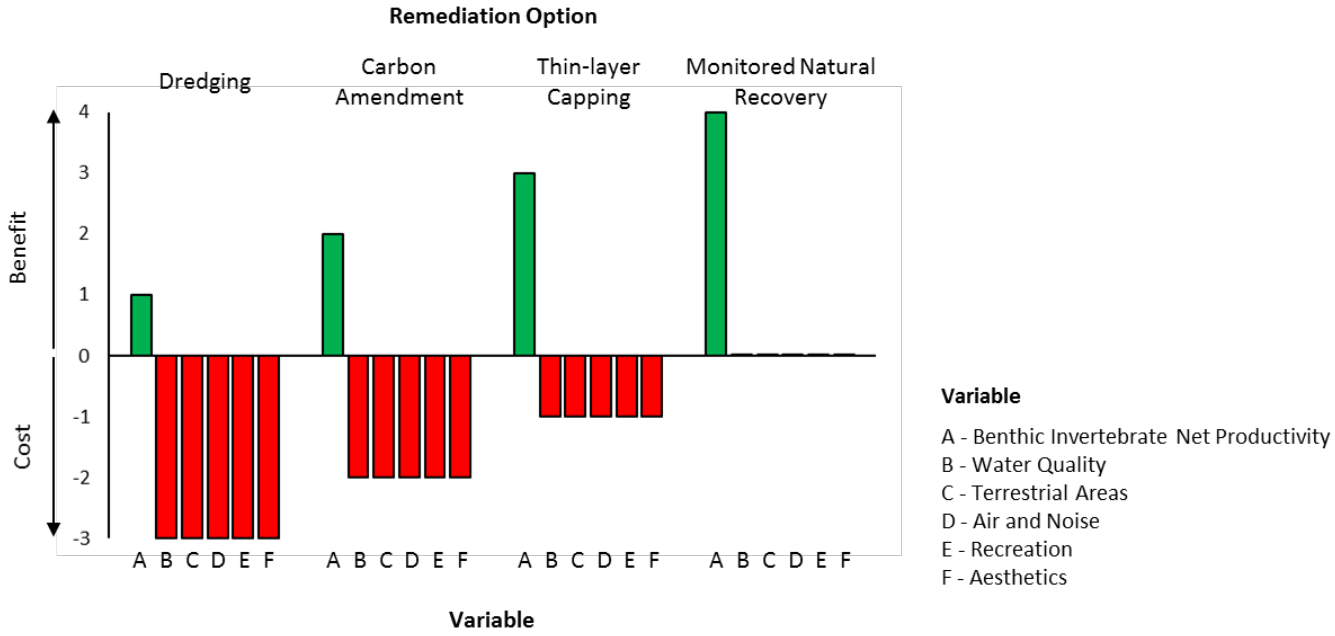

Figure 28: Net Environmental Benefit Analysis of Dredging Versus Carbon Amendment versus Thin-layer Capping versus Monitored Natural Recovery

The recommended remedial option is MNR. As noted in Table 6, there is no specific provincial guidance but parallels can be drawn to guidance respecting Monitored Natural Attenuation of groundwater contaminants (Technical Guidance 22; TG-22; MOE 2014). Table 9 provides an adaption of factors from TG-22 that are applicable to the Quesnel Lake benthic zone and how the conditions are met. Based on this guidance, MNR is feasible as a remediation option.

Table 9: Overview of Factors for Monitored Natural Recovery to be Feasible (Adapted from TG-22 [MOE 2014])

Factor	How this Condition is Met
1) MNR is to be performed in the context of a risk assessment that indicates an absence of significant risks to human health or the environment.	The human health risk assessment did not identify risks. The aquatic ecological risk assessment showed that although abundance of benthic invertebrates was lower in the West Arm, species richness was similar between the West Arm and reference areas and that recolonization in sediment from a reference area transplanted to the West Arm was not impaired. The main risks are associated with the nutrient (organic carbon) poor nature of the sediment and organism growth was restored with its addition. Sediment organic carbon has increased (Figure 24) and while it is within the range of reference stations, the average concentration is still reduced.

Factor	How this Condition is Met
2) A long term performance monitoring and validation program can be and will be put in place	MPMC conducts regular monitoring in accordance with their CEMP. Monitoring components to validate that the benthic invertebrate community is continuing to recover are part of the CEMP. The CEMP is part of MPMC's permit and the execution of the CEMP is therefore compelled by regulatory instrument.
3) The use of MNR will result in the remediation goals being met within a reasonable time.	Based on the currently available data (i.e., from 2014 through 2016), the benthic invertebrate community is continuing to recover. Species richness and diversity is already similar between the West Arm and reference areas. In 2016, the density of benthic invertebrates was still lower in the West Arm than in the reference area; however, the trajectory is one of continuous improvement. Based on the current trajectory, it is expected that the benthic community in the West Arm will be similar to that in reference areas within a reasonable time frame. An additional round of sampling was conducted in 2017 and once the data are available, this trajectory can be verified. Monitoring in future years (frequency to be determined based on data) is an expected part of MNR.
4) A contingency plan that includes defined implementation triggers for identifying when the remedial goals are not being met.	The CEMP will include a response framework that identifies triggers for potential additional remediation activities.

4.11.3.5 Addressing Residual Impacts Post-remediation

Even with the selected remediation option for Quesnel Lake benthic zone remediation (MNR), as a result of the event there was a loss of benthic invertebrate productivity and quantifying that lost productivity is part of the objective of identifying and quantifying productivity offsets. Figure 29 illustrates the conceptual offsetting requirements for the initial impact with MNR (and other options). Estimated remediation duration for MNR is approximately 5 years based on estimates from literature plus a reduced rate of colonization in year one as turbid materials were settling out. There is uncertainty in this estimate. Residual impacts and offsets for Quesnel Lake are discussed in Section 5.4.2.

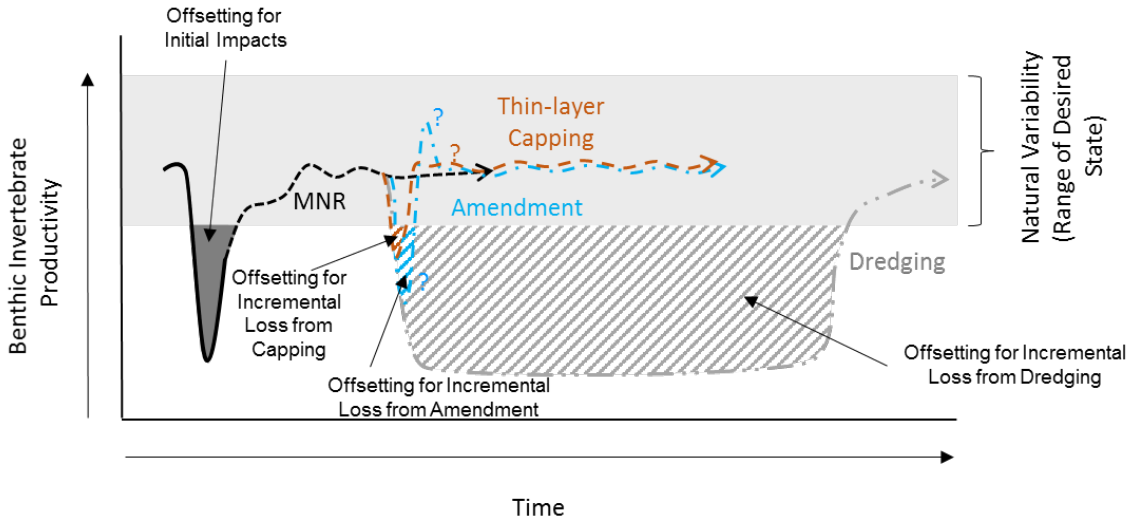

Figure 29: Conceptual Illustration of Offsetting Needs Post-Remediation

4.12 Quesnel River / Area #9

Using the classification system of the HRWG, this area corresponds to EU-Quesnel River. Quesnel River is the major drainage from Quesnel Lake and is located at the north end of the lake's West Basin. The river is located approximately 13 km north of where Hazeltine Creek discharges into Quesnel Lake. Following the TSF breach, turbidity concentrations in Quesnel River were generally below the long-term BC WQG, with the exception of measurements from late November 2014 to late January 2015 following the fall turnover of Quesnel Lake and mixing of the deep turbid water. Modelling predicted that by summer 2015, between 15 and 20% of the original amount of suspended material in Quesnel Lake from the tailings spill would have been discharged into Quesnel River (MPMC 2015a). That amount of material represents 12% or less of the river's annual sediment load. Daily average and *in situ* turbidity concentrations in Quesnel River have shown an overall progressive decrease over time throughout 2015 (Golder 2017c). Turbidity measurements continue to be low.

Objectives for Quesnel River are directly related to stability of benthic sediments in the West Basin of Quesnel Lake and maintenance of downstream water quality (related to the breach).

4.13 Public Safety Risks

4.13.1 "Edney Flats"

Potential public safety risks were identified in the flat sediment area near the mouth of Edney Creek as well as general risks along the Hazeltine Creek corridor.

The WSA Engineer requested that a safety evaluation be carried out of the deposited materials with regard to persons or human occupied vehicles becoming stuck. A geotechnical evaluation was carried out (Golder 2019) using hand augers and Dynamic Cone Penetrometer (DCP) testing at 5 stations across the area of concern. Hand augers were advanced to depth ranging from 0.4 to 2.9 m below ground surface and DCP tests were advanced between 1.3 and 2.9 m below ground surface. Soil cuttings collected from the hand auger were visually logged and classified in the field and representative samples were collected for further visual classification and geotechnical index testing in Golder's laboratory, including moisture content determinations, gradation analyses and Atterberg limits. Field observations indicated that groundwater level is hydraulically connected to and controlled by the water level of Quesnel Lake and seasonal fluctuation, including inundation can therefore be expected.

Based on findings of the study and the strength gain since deposition, the loose/soft ground hazard at Edney Flats was concluded to not present a life safety concern. Observations of vehicle tracks were also noted. However, given the variable nature of the material and inferred fluctuations in groundwater level, especially at times of flooding, the area may become untrafficable. For this reason, Golder recommended that signage be erected around the perimeter of the site, cautioning users of the potential soft ground conditions and MPMC will be erecting that signage in 2019 once weather and ground conditions allow. No additional remediation for safety purposes was recommended.

4.13.2 Sediment Ponds, Lower Hazeltine Creek

The sediment ponds at lower Hazeltine Creek were built as temporary structures with relatively steep side walls and, if retained in their present form, would present a public safety hazard. Life rings are placed near the ponds and signage is in place indicating the steep slope and open water at present. However, remediation of Hazeltine Creek habitat will involve the decommissioning of those ponds based on the consensus decision reached at the HRWG meeting in November 2018. While current habitat design concepts do not include the ponds in whole or in part, should they be retained, public safety considerations will need to form part of engineering design.

4.13.3 Public Safety Issues Along Hazeltine Creek

Some of the changes that occurred because of the TSF breach included a steepening of the banks of Hazeltine Creek and deposition of tailings material among the trees along the Hazeltine Creek corridor. The deposited tailings resulted in conditions that caused a die-back of some of the affected trees (Golder 2015a). A danger tree assessment was carried out by MPMC in 2018 and most danger trees in any area where the public would access were removed. MPMC crews also re-sloped most of the steep banks so that they were not a drop off. There remains an area above Hazeltine Canyon that has not been re-sloped as this slope provides habitat for bank swallows in its current form. MPMC will need to consider whether bank swallow habitat is to remain (in consultation with wildlife specialists) and means of restricting access to the tops of those slopes.

5.0 RESIDUAL EFFECTS, OFFSETS AND COMPENSATION

This section describes the residual effects (current to March 2019) to fish populations, instream fish habitat, riparian habitat, and upland terrestrial habitat from the event (Section 5.3), as well as the current determination of compensation and offsets required to counterbalance these residual effects (Section 5.4). Proposed and potential on-site and off-site offset and compensation options are also described in Section 5.4. Some local opportunities are tabulated in Appendices B and C; however, projects will be evaluated and prioritized by the HRWG.

5.1 Ecological Units, Ecological Functions, and Indicators

DFO guidance on offsetting (DFO 2013) articulates the view that effective offsets are those that prioritize benefit for the specific fish populations and areas that were affected. In that context, the HRWG divided the affected areas from the event into ten EUs, identified the CRA fish species present pre-event, and described the ecological functions for each of these fish species (Table 10). The HRWG then developed indicators and metrics (vis-à-vis Loughlin and Clark 2014) for each EU to compare the difference between pre- and post-event effects to fish and fish habitat and to use these comparisons to estimate the residual effects and determine whether offsets are required.

Increasing fisheries productivity is the key objective of offsetting activities under the *Fisheries Act* (Bradford et al. 2016). Fisheries productivity can be measured directly through measurement of production rates of fish species of interest, or indirectly through measurement such as catch per unit effort, biomass, or fishing yield (Minns 1997). Fish population indicators (i.e., fish abundance, fish age class structure, fish condition factor) are the HRWG's preferred indicators for estimating residual effect. Fish habitat suitability and availability indicators (e.g., habitat function metrics, mesohabitat type, microhabitat features) are a less direct surrogate for assessing fisheries productivity - they measure productive capacity – which does not directly translate to fish abundance, community structure or health (Bradford et al. 2016). As such, the HRWG put greater weight on fish population indicators compared to fish habitat suitability and availability indicators. Indicators are listed in priority order against each EU in Table 10.

Table 10: Ecological Units, Ecological Functions, and Indicators Selected to Determine Residual Effect

Ecological Unit (EU)	CRA Species	Ecological Functions	Indicator (in Priority Order) *
Upper Edney Creek (E1)	Rainbow Trout	S; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure
Middle Edney Creek (E2)	Rainbow Trout; Coho Salmon; Chinook Salmon; Sockeye Salmon; Mountain Whitefish; Burbot	S; R; O; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure ■ Habitat Function Metrics**
Polley Lake	Rainbow Trout	S; R; O; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure ■ Rainbow Trout Condition Factor

Ecological Unit (EU)	CRA Species	Ecological Functions	Indicator (in Priority Order) *
Upper Hazeltine Creek (H1)	Rainbow Trout	S; R; O; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure ■ Habitat Function Metrics**
Lower Hazeltine Creek (H2)	Rainbow Trout; Coho Salmon; Chinook Salmon; Sockeye Salmon; Kokanee; Mountain Whitefish; Burbot	S; R; O; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure ■ Habitat Function Metrics**
Lower Edney Creek (E3)	Rainbow Trout; Coho Salmon; Chinook Salmon; Sockeye Salmon; Mountain Whitefish; Burbot	S; R; O; M	■ Rainbow Trout Abundance ■ Rainbow Trout Age Class Structure ■ Habitat Function Metrics**
Quesnel Lake – Limnetic Zone	Rainbow Trout; Coho Salmon; Chinook Salmon; Sockeye Salmon; Mountain Whitefish; Bull Trout; Kokanee; Lake Trout; Lake Whitefish; Pygmy Whitefish; Burbot	R; M	■ Limnetic Zone Fish Relative Abundance ■ Limnetic Zone Fish Condition Factor ■ Turbidity ■ Phytoplankton and Zooplankton Biomass
Quesnel Lake - Littoral Zone	Rainbow Trout; Coho Salmon; Chinook Salmon; Sockeye Salmon; Mountain Whitefish; Bull Trout; Kokanee; Lake Trout; Lake Whitefish; Pygmy Whitefish; Burbot	S; R; M	■ Littoral Zone Fish Relative Abundance ■ Littoral Zone Fish Condition Factor ■ Littoral Habitat Area ■ Potential Shoreline Spawning Habitat Area ■ Habitat Features by Area ■ Submergent and Emergent Vegetation by Area ■ Benthic Invertebrate Relative Abundance and Diversity
Quesnel Lake - Benthic Zone	Rainbow Trout; Bull Trout; Lake Trout; Mountain Whitefish; Pygmy Whitefish; Lake Whitefish; Burbot	R	■ Total Benthic Area Smothered ■ Benthic Zone Fish Relative Abundance ■ Benthic Zone Fish Condition Factor ■ Benthic Invertebrate Relative Abundance and Diversity
Quesnel River	Coho Salmon; Chinook Salmon; Sockeye Salmon; Rainbow Trout; Bull Trout; Mountain Whitefish; Burbot; Kokanee	S; R; O; M	■ Turbidity

S = Spawning; R = Rearing; O = Overwintering; M = Migration.

*FHWRG Habitat Objectives Tables 2015 ** Metric criteria for diagnostics of habitat function are outlined in reference Table 1, adapted from Johnston and Slaney 1996 Technical Circular.

5.2 Pathway of Effect

Pathways of Effects are used in DFO's Fisheries Protection Policy Statement (DFO 2013) to describe the types of cause-effect relationships that are known to exist for specific activities or events and the mechanisms by which these actions ultimately lead to effects in the aquatic environment. Each cause-and-effect relationship is represented as a pathway, connecting the activity to a potential stressor, and the stressor to an effect on fish or fish habitat. Each pathway represents connections where mitigation measures could be applied to break the connection and reduce or eliminate the effect. When mitigation measures are not or can not be applied or are not fully effective, the remaining effect is referred to as a residual effect that will require offsetting to balance the impact on fisheries productivity.

Because the event affected fish populations and fish habitat differently among the EUs, the HWRG developed Habitat Objectives Tables that included the main "pathways of effect" associated with the event for each EU and these are presented against each EU by ecological function in Table 11. For example, the HWRG identified one "pathway of effect" to Upper Edney Creek (E1) – the potential effect to spawning and migration functions from the "potential downstream disruption of access for returning adult spawners". While, the HWRG recognized a greater number and different types of "pathways of effect" of the event on Middle Edney Creek (E2) – for example, the potential effect to spawning, rearing, overwintering and migration functions from the "deposition of material", and "instream streambed scour and removal of structure".

Table 11: Pathway of Effect of the Event on each Ecological Unit by Ecological Function

Pathway of Effect	Ecological Unit (EU)									
	E1	E2	E3	H1	H2	Polley Lake	QL - Benthic	QL - Limnetic	QL - Littoral	Quesnel River
Potential downstream disruption of access for returning adult spawners	S; M									
Deposition of material		S; R; O; M	S; R; O; M	S; R; O; M	S; R; O; M	S; R; O; M	R		S; R	
Instream streambed scour and removal of structure		S; R; O; M	S; R; O; M	S; R; O; M	S; R; O; M					
Riparian habitat alteration associated with deposition of material		S; R	S; R	S; R	S; R	R			R	
Riparian clearing associated with channel remediation work		S; R	S; R		S: R					
Removal of natural channel morphology, mesohabitat proportions		S; O; M	S; O; M	S; O; M	S; O; M					
Removal of critical and important fish habitat		S; O	S; O	R	S; R; O					
Removal of spawning gravel and hydraulic features that create and maintain high quality spawning gravels		S	S	S	S					
Instream removal of structure		R	O		R					
Removal of structure						S; O				
Alteration of structure						S; O	R		S; R	
Decrease in channel length and sinuosity		R	R	R	R					
Alteration of natural channel morphology (width, depth, gravel/boulder substrates), and mesohabitat proportions		R	R		R					
Alteration of Water Quality (pH, hardness, TDS, metals)		O	R; O	R; O	R; O	R; O	R	R; M	S; R; M	
Alteration of Water Quality (turbidity)		R; O	R; O	R; O	R; O	O				S; R; O; M
Alteration of flow (Hazeltine not connected)			R; O							
Reduction of hydraulic features (riffles, instream LWD, meander helical flows) that create and maintain high habitat			R	R	R; O					

Source: Habitat Objectives Tables HRWG 2015. S = Spawning; R = Rearing; O = Overwintering; M = Migration.

5.3 Residual Effects, Compensation and Offset Determination

Effects to each EU have been quantified both spatially (i.e., geographical area) and temporally (i.e., the time lag between the event occurrence [August 2014] and remediation). This is because the event has caused different effects to each area, and for different periods of time. For example, Lower Edney Creek remediation work was conducted within nine months of the event, whereas Lower Hazeltine Creek remains in the design stage, with no habitat remediation (beyond the foundational channel for erosion control) undertaken since the event (i.e., as of writing, approximately 4.5 years).

Residual effects have been determined for each indicator, for each EU, using pre- and post-event monitoring data (Sections 5.3.1.1 to 5.3.1.10 and Table 12 to Table 21). Residual effects from the event have also been quantified for riparian habitat (Section 5.3.1.11;Table 22) and upland terrestrial habitat (Section 5.3.2).

Residual effect values have been used to calculate the requirement for offsets for each EU (Sections 5.3.1.1 to 5.3.1.10). The residual affected area (i.e., the “spatial balance”), and the time lag to remediation (i.e., the “temporal balance”), for each EU represents a specified loss of habitat productivity. The spatial and temporal balances for each indicator have been incorporated into offset calculations for each EU and the riparian habitat, and compensation for upland terrestrial habitat (Sections 5.3.1.1 to 5.3.2).

5.3.1 Aquatic Habitat

5.3.1.1 Upper Edney Creek (E1)

In Upper Edney Creek (E1), no habitat was directly altered, and therefore there was no spatial loss of Rainbow Trout productivity. There was potential for the event to cause a blockage in the lower sections of Edney Creek that could have obstructed access for spawning Rainbow Trout migrating from Quesnel Lake to Upper Edney Creek. The event occurred in August of 2014 after the spawning migration of Rainbow Trout. Remediation work in the lower sections of Edney Creek restored access to Upper Edney Creek (E1) from Quesnel Lake prior to the 2015 spawning migration of Rainbow Trout and therefore it is not expected that there was a temporal loss of Rainbow Trout productivity in Upper Edney Creek (E1; Table 12).

Abundance of Rainbow Trout in Upper Edney Creek was higher post-event compared to pre-event conditions and the age class structure of Rainbow Trout in Upper Edney Creek (E1) was similar pre-and post-event (Table 12). Based on these indicators, negative effects on the functionality of habitat in Upper Edney Creek (E1) were not likely.

As the event caused no direct physical effects to Upper Edney Creek (E1), and there were no measured negative effects to the indicators, no offsetting is required for Upper Edney Creek (E1).

Determination**: No Offsetting**

Table 12: Upper Edney Creek (E1)

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	Spawning; Migration	Rainbow Trout CPUE (# fish per minute by electrofishing) in 2007 (August) was **0.67** in Upper Edney Creek (UEC-1) (Minnow 2016b).	Average CPUE (# fish per minnow trap day) for Rainbow Trout in 2016 (April to October) was **0.429** (Minnow 2016b) and in 2017 (May to November) was **1.09** (Minnow 2018a).	Rainbow Trout CPUE was higher in 2017 than 2016 indicating they successfully migrated upstream to E1 (Minnow 2016b, 2018). Overall spatial balance **= Positive**	(-) 9 months Fish passage from Quesnel Lake to Edney Creek watershed was restored 9 months post-event (i.e., prior to Rainbow Trout migration) Overall temporal balance **= Neutral**
Rainbow Trout Age Class Structure	Spawning; Migration	Rainbow Trout age class structure data for 2007 (August) show **79%** of Rainbow Trout were **Young of Year** (YOY [age "0"]; Minnow 2007; SNC 2015a). There is limited pre-event juvenile salmon abundance data. There is no pre-event salmon spawner escapement data (except some limited observations).	Rainbow Trout age class structure data for 2016 (April; August/September; October) and 2017 (April; October; November) show most Rainbow Trout were **YOY** (i.e., <3.5 to 12 cm), with some **Age 1 or 2** fish, in both years (Minnow 2018a). No Rainbow Trout spawners were observed in spring 2016 or 2017 (Minnow 2018a).	Rainbow Trout age class structure post-event (2016/2017) and pre-event (2007) were comparable (Minnow 2007, 2018a; SNC 2015a). Overall spatial balance **= Neutral**	(-) 9 months Fish passage from Quesnel Lake to Edney Creek watershed was restored 9 months post-event (i.e., prior to Rainbow Trout migration) Overall temporal balance **= Neutral**

Sources: Minnow 2007, 2016b, 2018a; SNC 2015a.

5.3.1.2 Middle Edney Creek (E2)

In Middle Edney Creek (E2), approximately 1,350 m^2 of high-quality spawning, rearing, overwintering, and migratory habitat was altered for one year, resulting in a temporal loss of fish productivity. Approximately 1,553 m^2 of instream habitat was remediated, resulting in a spatial net gain of high-quality habitat (Table 13).

The reconstructed habitat features were assessed and rated good (Table 3) for the following metrics: bankfull-width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency, and holding pools (Table 13). A higher abundance of Rainbow Trout was observed in 2017 compared to 2016, as was a similar age class structure pre- and post-event. Based on these indicators, negative effects on the functionality of habitat in Middle Edney Creek (E2) were not likely.

HEA calculations were undertaken for Middle Edney Creek (E2; Appendix D). The HEA calculation resulted in a required offset of units (Table 23). Because a greater amount of habitat has been remediated (1,553 m^2) than needed for offsetting (1,499 m^2), no further offsetting is required.

Determination: **No Offsetting**

Table 13: Middle Edney Creek (E2)

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	Spawning; Rearing; Overwintering; Migration	1,350 m^2 of total instream habitat was altered.	1,553 m^2 of total instream habitat was remediated.	Balance of +203 m^2 total instream habitat. Overall spatial balance **= Positive**	1 to 2 years Overall temporal balance **= Negative**
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	Spawning; Migration	There is no pre-event Rainbow Trout CPUE data for Middle Edney Creek.	Average CPUE for Rainbow Trout in Lower and Middle Edney in 2016 (21 April to 22 October) was **0.119** CPUE (# fish per trap day) with minnow traps and **0.054** CPUE (# fish per minute) with electrofishing (Minnow 2016b; Minnow 2018a). Average CPUE (# fish per trap day) for Rainbow Trout in Lower and Middle Edney in 2017 (28 May to 4 November) was **0.419** (Minnow 2018a). Survey method was minnow trapping (Minnow 2018a). Rainbow Trout CPUE in Lower and Middle Edney increased between 2016 and 2017 (Minnow 2016b, 2018).	The different in Rainbow Trout abundance in Middle Edney Creek pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of pre-event data; this indicator has not been used in determination of residual effects.**	1 to 2 years (spawning) <9 months (migration) Overall temporal balance **= Negative**
Rainbow Trout Age Class Structure	Spawning; Migration	The size and age of Rainbow Trout in Middle and Lower Edney Creek have been related historically, with reported mean/median fork lengths during August sampling events of 5.4 to 5.8 cm for **YOY**, 9.1 to 11.3 cm for **Age 1** fish and 12.1 to 13.6 cm for **Age 2** fish (HKP 1997; Minnow 2009). Rainbow Trout age class structure in Middle and Lower Edney in 2007 (21 to 28 August) ranged from **YOY to Age 3** fish (Minnow 2007; SNC 2015a). There is limited juvenile salmon abundance data. There is no salmon spawner escapement data (except some limited observations).	Most Rainbow Trout individuals measured in Middle and Lower Edney in 2016 were **YOY** (i.e., between 5 and 8 cm; Minnow 2018a). No Rainbow Trout spawners were observed in spring (21 April to 24 April), summer (28 August to 1 September), and fall (19 to 22 October) of 2016 (Minnow 2018a); however, the 2016 data indicates successful spawning in spring 2016. Rainbow Trout individuals measured in Middle and Lower Edney Creek in 2017 ranged from **YOY to Age 2** fish (i.e., between 7 and 13 cm; Minnow 2018a). No Rainbow Trout spawners were observed in spring (5 April) and fall (24 to 29 October and 4 November) 2017 (Minnow 2018a); however, the 2017 data indicates successful overwintering of the 2016 juveniles and successful spawning in spring 2017.	Rainbow Trout age class structure in Middle Edney Creek post-event (i.e., 2017) and pre-event (i.e., 2007) were comparable (Minnow 2007, 2018a; SNC 2015a). Overall spatial balance = **Neutral**	1 to 2 years (spawning) <9 months (migration) Overall temporal balance **= Negative**
Habitat Function Metrics*	Spawning; Rearing (Mesohabitat Type by Area) Overwintering (Mesohabitat Type by Area and Quality) (Microhabitat Features)	Pederson (1998) classified Middle and Lower Edney Creek as having a cascade-pool morphology dominated by cobble substrates, with functioning LWD as the most prevalent aquatic cover type. Fish habitat value was rated as high (SNC 2015a). Middle Edney Creek was observed to be ponded just upstream from its confluence with Hazeltine Creek due to the presence of a beaver dam (SNC 2015a).	Habitat functionality of Middle and Lower Edney Creek were assessed together. The habitat objectives for E2 was to create access and rearing habitat for juvenile salmonids including rainbow trout. Habitat parameters achieving quality ratings of good were: bankfull width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency (mean pool spacing), and holding pools (adult migration). Habitat parameters achieving quality ratings of fair were: LWD pieces per channel length and percent wood cover in pools (Golder 2017e). The habitat was not designed to prioritize spawning habitat and as such the substrate was more suitable for rearing but less so for spawning. Evaluation of habitat preferences and suitability criteria for the spawning / incubation life stage indicated the presence of some functional spawning habitat. Evaluation of habitat preferences and suitability criteria for the juvenile/rearing life stage indicated that habitat is suitable (relative to the reference site). However, dissolved oxygen was identified as being less suitable to Rainbow Trout. Additional cover (additional of large woody debris) could help moderate temperatures in the area (Golder 2017e). Current length of channel and channel configuration are different from prior to the event. Beaver activity near confluence had increased pool habitat (dynamic system; Golder 2017e).	Habitat function metrics in Middle Edney Creek was rated as high quality both pre-event and post-event Overall temporal balance = **Neutral**	1 to 2 years (spawning, rearing and overwintering) Overall temporal balance **= Negative**

Sources: HKP 1997; Golder 2017e; Minnow 2007, 2009, 2016b, 2018a; Pederson 1998; SNC 2015a.

* Metric criteria for diagnostics of habitat function are outlined in reference Table 1, adapted from Johnston and Slaney 1996 Technical Circular.

5.3.1.3 Lower Edney Creek (E3)

In Lower Edney Creek (E3), approximately 1,158 m^2 of high-quality spawning, rearing, overwintering, and migratory habitat was destroyed, with remediation occurring over the span of one year, resulting in a temporal loss of fish productivity. Approximately 3,795 m^2 of instream habitat was remediated, resulting in a spatial gain of high-quality habitat (Table 14).

Other indicators to suggest a recovering functional creek habitat for Rainbow Trout include an increase in abundance of Rainbow Trout between 2016 and 2017, and a similar age class structure pre- and post-event. The reconstructed habitat features were assessed and rated good for the following metrics: bankful-width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency, and holding pools (Table 14).

An HEA was not undertaken for Lower Edney Creek (E3) because this section of stream did not exist prior to the event. The construction of this section of creek contributes 2,643 m^2 of habitat credit.

Determination**: No Offsetting**

Table 14: Lower Edney Creek (E3)

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	Spawning; Rearing; Overwintering; Migration	1,158 m^2 of total instream habitat was destroyed.	3,795 m^2 of total instream habitat was remediated.	Balance of +2,637 m^2 total instream habitat. Overall spatial balance **= Positive**	1 to 2 years Overall temporal balance **= Negative**
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	Spawning; Migration	There is no pre-event Rainbow Trout CPUE data for Lower Edney Creek.	Average CPUE for Rainbow Trout in Middle and Lower Edney in 2016 (21 April to 22 October) was **0.119** CPUE (# fish per trap day) with minnow traps and **0.054** CPUE (# fish per minute) with electrofishing (Minnow 2016b; Minnow 2018a). Average CPUE (# fish per trap day) for Rainbow Trout in Middle and Lower Edney in 2017 (28 May to 4 November) was **0.419** (Minnow 2018a). Survey method was minnow trapping (Minnow 2018a). Rainbow Trout CPUE in Middle and Lower Edney increased between 2016 and 2017 (Minnow 2016b, 2018).	The difference in Rainbow Trout abundance in Lower Edney Creek pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of pre-event data; this indicator has not been used in determination of residual effects.**	1 to 2 years (spawning) <1 year (migration) Overall temporal balance **= Negative**
Rainbow Trout Age Class Structure	Spawning; Migration	The size and age of Rainbow Trout in Middle and Lower Edney Creek have been related historically, with reported mean/median fork lengths during August sampling events of 5.4 to 5.8 cm for **YOY**, 9.1 to 11.3 cm for **Age 1** fish and 12.1 to 13.6 cm for **Age 2** fish (HKP 1997; Minnow 2009). Rainbow Trout age class structure in Middle and Lower Edney Creek in 2007 (21 to 28 August) ranged from **YOY to Age 3** fish (Minnow 2007; SNC 2015a). Limited juvenile salmon abundance data. There is no salmon spawner escapement data (except some limited observations).	Most Rainbow Trout individuals measured in Middle and Lower Edney Creek in 2016 were **YOY** (i.e., between 5 and 8 cm; Minnow 2018a). No Rainbow Trout spawners were observed in spring (21 April to 24 April), summer (28 August to 1 September), and fall (19 to 22 October) of 2016 (Minnow 2018a); however, the data indicates successful spawning in spring 2016. Rainbow Trout individuals measured in Middle and Lower Edney Creek in 2017 ranged from **YOY to Age 2** fish (i.e., between 7 and 13 cm; Minnow 2018a). No Rainbow Trout spawners were observed in spring (5 April) and fall (24 to 29 October and 4 November) 2017 (Minnow 2018a); however, the 2017 data indicates successful overwintering of the 2016 juveniles and successful spawning in spring 2017.	Rainbow Trout age class structure in Lower Edney Creek post-event (i.e., 2017) and pre-event (i.e., 2007) were comparable (Minnow 2007, 2018a; SNC 2015a). Overall spatial balance = **Neutral**	1 to 2 years (spawning) <1 year (migration) Overall temporal balance **= Negative**
Habitat Function Metric*	Spawning; Rearing (Mesohabitat Type by Area) Overwintering (Mesohabitat Type by Area and Quality) (Microhabitat Features)	Pederson (1998) classified Middle and Lower Edney Creek as having a cascade-pool morphology dominated by cobble substrates, with functioning LWD as the most prevalent aquatic cover type. Fish habitat value was rated as high.	Habitat functionality of Middle and Lower Edney Creek were assessed together. The habitat objectives for E2 was to create access and rearing habitat for juvenile salmonids including rainbow trout. Habitat parameters achieving quality ratings of good were: bankfull width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency (mean pool spacing), and holding pools (adult migration). Habitat parameters achieving quality ratings of fair were: LWD pieces per channel length and percent wood cover in pools (Golder 2017e). The habitat was not designed to prioritize spawning habitat and as such the substrate was more suitable for rearing but less so for spawning. Evaluation of habitat preferences and suitability criteria for the spawning / incubation life stage indicated the presence of some functional spawning habitat. Evaluation of habitat preferences and suitability criteria for the juvenile/rearing life stage indicated that habitat is suitable (relative to the reference site). However, dissolved oxygen was identified as being less suitable to Rainbow Trout. Additional cover (additional of large woody debris) could help moderate temperatures in the area (Golder 2017e). Current length of channel and channel configuration are different from prior to the event. Beaver activity near confluence had increased pool habitat (dynamic system; Golder 2017e).	Habitat function metrics in Lower Edney Creek was rated as high quality both pre-event and post-event Overall temporal balance = **Neutral**	1 to 2 years (spawning) 1 year (rearing and overwintering) Overall temporal balance **= Negative**

Sources: HKP 1997; Golder 2017e; Minnow 2007, 2009, 2016b, 2018a; Pederson 1998; SNC 2015a.

* Metric criteria for diagnostics of habitat function are outlined in reference Table 3, adapted from Johnston and Slaney 1996 Technical Circular.

5.3.1.4 Upper Hazeltine Creek (H1)

Rainbow Trout in Upper Hazeltine Creek (H1) is an important contributing population/stock to overall Rainbow Trout recreational fishery in Polley Lake (Lirette 2015).

In Upper Hazeltine Creek (H1), 44,650 m^2 of fair quality fish habitat was destroyed. The pre-event habitat was rated as fair due to well documented anthropogenic alteration of Reach 1, ponding associated with beaver dams in Reaches 1 and 2, reasonable rearing habitat, and poor spawning substrate (comprising mostly fines) in Reaches 1 and 2. Overall, Reach 3 was rated as high-quality habitat pre-event.

In the fall of 2015 and 2017, remediation work within Reaches 1, 2, and 3 resulted in the creation of 15,266 m^2 of high-quality habitat. In Reaches 1 and 2, habitat was improved from its pre-event state by the addition of spawning gravels, course woody debris, and enhancing the channel complexity. Remediation work on Reach 3, is not complete. The reconstructed habitat features in Reaches 1 and 2 were assessed and rated good for the following metrics: bankful-width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency, LWD pieces per channel length, percent wood cover, and spawning substrate. Reaches 3, 4 and 5 of upper Hazeltine Creek have not been remediated and are thus lacking many habitat features (e.g., spawning gravels, course woody debris; Table 15). The continued remediation of Upper Hazeltine Creek (H1) is expected to be completed during 2019.

Other indicators to suggest a recovering functional creek habitat for Rainbow Trout include preliminary spawner survey data showing 4,890 adult spawners using Reaches 1 and 2 in May 2018, and 40,250 YOY were estimated to be recruited to Polley Lake from Upper Hazeltine Creek (H1) in August 2018 (Minnow unpublished). Abundance (CPUA) for juvenile Rainbow Trout is similar pre-event (i.e., 258 to 612 CPUA in August 2007) and post-event (i.e., 310 to 640 CPUA in August 2018; Table 15). This data appears to indicate a level of recruitment that should support a stable Rainbow Trout population in Polley Lake.

A HEA was undertaken for Upper Hazeltine Creek (H1; Appendix D). The HEA calculation results in a negative balance of 53,314 m^2 units that require offsetting (Table 23). The current offsetting deficit will be adjusted as continued remediation in Upper Hazeltine Creek (H1) occurs and the remediated habitat is monitored and determined to be functioning. If there are residual productivity losses following remediation (i.e., due to time lags or changes in habitat area), additional offsetting options for Upper Hazeltine Creek (H1) are discussed in Section 5.4.1.

Determination**: Offsetting Required**

Table 15: Upper Hazeltine Creek (H1)

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	Spawning; Rearing; Overwintering; Migration	44,650 m^2 of total instream habitat was lost through scour and deposition of material (Reaches 1 to 5).	15,266 m^2 of total instream habitat was remediated. Reaches 1 to 3 have been remediated (approximately 3 km) - designed, constructed and monitored. The design has been approved for the remainder of Upper Hazeltine Creek (approximately 3 km).	Balance of -29,384 m^2 total instream habitat. Fish access to the remediated sections was restored in spring 2018. Overall spatial balance **= Negative**	(-) >4.5 years Overall temporal balance **= Negative**
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	Spawning; Migration	Rainbow Trout CPUE (# fish per minute) in Upper Hazeltine Creek in 2007 (21 to 28 August) in UHC-1 was **3.90**; in UHC-2 was **7.04**; and in UHC-3 was **3.64** (Minnow 2007).	There is no officially published post-event CPUE monitoring data available for Rainbow Trout in Upper Hazeltine Creek. Initial surveys of Upper Hazeltine Creek recorded 4,890 adult spawners using Reaches 1 and 2 of Upper Hazeltine Creek between 10 and 25 May 2018. Electrofishing stations in August 2018 suggest recruitment of 40,250 YOY to Polley Lake from Upper Hazeltine Reaches 1 and 2 combined (Minnow unpublished).	The different in Rainbow Trout CPUE in Upper Hazeltine Creek post-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years (spawning and migration) Overall temporal balance **= Negative**
Rainbow Trout Abundance (Catch Per Unit Area [CPUA])	Spawning; Migration	Rainbow Trout CPUA (# fish per 100 m^2) in Upper Hazeltine Creek in 1991 ranged from **188** to **554** (Bruce and Slaney 1991). Rainbow Trout CPUA (# fish per 100 m^2) in 2007 (21 to 28 August) in UHC-1 was **258**; in UHC-2 was **612**; and in UHC-3 was **467** (Minnow 2007).	Rainbow Trout CPUA (# fish per 100 m^2) in Upper Hazeltine Creek in August 2018 ranged from **310** to **640** (Minnow unpublished).	Rainbow Trout CPUA in Upper Hazeltine Creek is lower post-event (2018) compared to pre-event (1991 and 2007). Overall spatial balance **= Neutral**	(-) >4.5 years (spawning and migration) Overall temporal balance = **Negative**
Rainbow Trout Age Class Structure	Spawning; Migration	Rainbow Trout age class structure in Upper Hazeltine Creek in 1990 ranged from **YOY to Age 2** fish and in 2007 ranged from **YOY to Age 1** fish (Minnow 2007; SNC 2015a). In 1990, 99.4% of Rainbow Trout caught were YOY (Bruce and Slaney 1991). In 2007, 97% of Rainbow Trout caught were YOY (Minnow 2007; SNC 2015a).	There is no officially published post-event age class structure monitoring data available for Rainbow Trout in Upper Hazeltine Creek.	The different in Rainbow Trout age class structure in Upper Hazeltine Creek pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years (spawning and migration) Overall temporal balance **= Negative**

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Habitat Function Metric*	Spawning; Rearing (Mesohabitat Type by Area) Overwintering (Mesohabitat Type by Area and Quality) (Microhabitat Features)	The habitat for Upper Hazeltine Creek was described in 1991 by Bruce and Slaney (Reaches 3-5) and in 2006 by Minnow (Reaches 1-5). Habitat Parameters for Reach 1 of Upper Hazeltine Creek was described as a low gradient run habitat with gravel-sand substrate. Percent wood cover achieved a quality rating of good. Reach 1 habitat parameters with ratings of fair were: bankfull width-to-depth ratio, channel complexity, percent pool, and spawning substrate (Minnow 2007). Reach 2 of Upper Hazeltine Creek was described as a large ponded area associated with beaver activity. The area was roughly 210 m by 45 m and greater than 100 cm deep (Minnow 2007). Reach 2 habitat parameters that achieved quality ratings of good were: percent pool, holding pools, percent wood cover in pools. Reach 2 habitat parameters with ratings of fair were: channel complexity and spawning substrate. A comparison of composite probability-of-use values suggests that Hazeltine Creek contained a fair quantity of suitable rearing habitat for Rainbow Trout fry, but very little for yearling or older fish. Stream depth appears to be the main factor limiting habitat capability for older fish and may in part explain the exodus of yearling and older fish from the system (Bruce and Slaney 1991). Upper Hazeltine Creek provided important spawning habitat for Rainbow Trout from Polley Lake with adults migrating to spawn in the creek between early May and early June (SNC 2015a). Overall, Hazeltine Creek was dominated by shallow riffle/run mesohabitat with some limited pool habitat. Functional aquatic cover was provided mainly by LWD, overhanging vegetation, and pool depth. The proportion of functional aquatic cover, particularly deep pool habitat, was relatively low in Hazeltine Creek. As such, suitable overwintering habitat for sub-adult/adult salmonids was limited (SNC 2015a).	Habitat functionality of Reaches 1 and 2 of Upper Hazeltine Creek were assessed in 2016 (Golder 2017c). Habitat parameters that achieved quality ratings of good were: bankfull width-to-depth ratio, entrenchment ratio, channel complexity, percent pool (by area), pool frequency (mean pool spacing), LWD pieces per channel length, percent wood cover in pools, and spawning substrate size, quality and area (in Reach 2). Holding pools (adult migration) achieved a fair quality rating. Reach I was designed to emphasize juvenile rearing habitat and as such spawning substrate size, quality and area had a lower rating (Golder 2017c). However initial surveys indicate that spawning habitat structures are being used as designed (e.g., redds were observed in 2018; Connors 2018).	Habitat function metrics in Upper Hazeltine Creek pre-event in reaches 1, 2 and 3 were rated as poor, fair, and good respectively. Habitat function metrics in Upper Hazeltine Creek post-event in reaches 1, 2, and 3 were rated as good, good, and not remediated respectively. Overall temporal balance **Reach 1 = Positive** **Reach 2 = Positive** **Reach 3 = Negative**	(-) >4.5 years (spawning, rearing and overwintering) Overall temporal balance **= Negative**

Source: Bruce and Slaney 1991; Golder 2017c; Minnow 2007; Minnow unpublished; SNC 2015a.

* Metric criteria for diagnostics of habitat function are outlined in reference Table 1, adapted from Johnston and Slaney 1996 Technical Circular.

5.3.1.5 Lower Hazeltine Creek (H2)

In Lower Hazeltine Creek (H2), approximately 17,966 m^2 of high-quality spawning, rearing, overwintering, and migratory habitat was destroyed. Lower Hazeltine Creek is currently inaccessible to fish and has been temporarily converted into settling ponds, resulting in an ongoing spatial and temporal loss to fish productivity. Instream habitat remediation has not yet occurred (Table 16).

A HEA was undertaken for Lower Hazeltine Creek (H2; Appendix D). The HEA calculation results in a negative balance of 26,046 m^2 that require remediation and offsetting (Table 23). Once habitat remediation in Lower Hazeltine Creek (H2) is completed and the habitat has been monitored and determined to be functional the residual habitat offset deficit will be recalculated. Offsetting options for Lower Hazeltine Creek (H2) are discussed in Section 5.4.1.

Determination: **Offsetting Required**

Table 16: Lower Hazeltine Creek (H2)

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	S; R; O; M	17,966 m^2 of total instream habitat was destroyed.	0 m^2 of total instream habitat was remediated. Remediation of H2 is currently in the design process. H2 is currently two settling ponds.	Balance of -17,966 m^2 total instream habitat. Overall spatial balance **= Negative**	(-) >4.5 years Overall spatial balance **= Negative**
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	S	Rainbow Trout CPUE (# fish per minute) in Lower Hazeltine Creek in 2007 (21 to 28 August) in LHC-1 was **0.83**; in LHC-2 was **0.55**; and in LHC-3 was **0.56** (Minnow 2007; SNC 2015a).	No remediation has occurred post-event. There is no post-event CPUE monitoring data available for Rainbow Trout in Lower Hazeltine Creek.	The different in Rainbow Trout CPUE in Lower Hazeltine Creek pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years Overall temporal balance **= Negative**
Rainbow Trout Age Class Structure	S	There is no available pre-event Rainbow Trout age class structure data for Lower Hazeltine Creek.	No remediation has occurred post-event. There is no post-event age class structure data for Rainbow Trout in Lower Hazeltine Creek.	The different in Rainbow Trout age class structure in Lower Hazeltine Creek pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years Overall temporal balance **= Negative**
Habitat Function Metric*	R; O (Mesohabitat Type by Area and Quality) (Microhabitat Features)	A comparison of composite probability-of-use values suggests that Hazeltine Creek contains a fair quantity of suitable rearing habitat for Rainbow Trout fry, but very little for yearling or older fish. Stream depth appears to be the main factor limiting habitat capability for older fish and may in part explain the exodus of yearling and older fish from the system (Bruce and Slaney 1991). Pederson (1998) described Lower Hazeltine Creek as meandering through a small floodplain characterized by riffle pool habitat containing some debris and cobble. The riparian areas experienced harvesting from forestry into the riparian areas. Overall fish habitat value was rated as high.	No remediation has occurred post-event. There is no post-event mesohabitat or microhabitat data for Lower Hazeltine Creek.	Habitat function metrics in Lower Hazeltine Creek was rated as high-quality pre-event. Lower Hazeltine Creek temporarily unavailable as habitat for Rainbow Trout. Overall temporal balance = **Negative**	(-) >4.5 years Overall temporal balance **= Negative**

Sources: Bruce and Slaney 1991; Minnow 2007; SNC 2015a.

5.3.1.6 Polley Lake

Other than lakeshore habitat (Riparian) alteration, no permanent physical habitat loss occurred in Polley Lake during the event. A habitat disruption occurred; however, the overall area of Polley Lake remained the same during the event. Habitat alterations to Polley Lake caused by the event included depth changes where shallower shoals were created and the deposition of woody debris occurred. These alterations may serve to increase spring and fall fish habitat (i.e., by providing cover and other beneficial attributes for fish), while reducing available summer habitat (i.e., deeper water). The benthic invertebrate community was smothered in part of the lake through smothering with sediment; however, the benthic invertebrate community is naturally regenerating (Golder 2017c). Elevated copper levels in Polley Lake water were recorded post-event; however, the levels were chemically similar to natural conditions (Minnow 2015). The event caused a spatial and temporal loss to Rainbow Trout productivity due to the blockage of adults from Polley Lake unable to spawn in Upper Hazeltine Creek (H1; Table 17). This resulted in the disruption of the age class structure of Rainbow Trout as juveniles from Hazeltine Creek did not enter Polley Lake for over 4 years (Table 17). Polley Lake was stocked in the fall of 2018 to help address the age class structure of Rainbow Trout and to account for potential mortality of adults entering the Upper Hazeltine Creek (H1). Considering the high abundance, re-stabilizing age class structure and good condition factor of Rainbow Trout and the recovering benthic invertebrate community the productivity of Polley Lake may not require additional offsetting.

Additional monitoring will be necessary to verify that effects on productivity of Rainbow Trout have been addressed, in particular age class structure is identified as productivity indicator by the HRWG (Table 10). Data on measures to address age class structure will be collected and these data will inform the need for offsets. Offsets are therefore to be determined for Polley Lake.

Determination**: To be determined (TBD)**

Table 17: Polley Lake

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Rainbow Trout Abundance (Catch Per Unit Effort [CPUE])	S; R; O; M	Rainbow Trout CPUE (# fish per square foot per hour) in 1973 was **0.0008**, in 1995 was **0.0006**, and in 2012 was **0.0006** (Lirette 2017; Minnow 2018b; SNC 2015a). Survey method was seine netting for the 1973, 1995 and 2012 surveys.	Rainbow Trout CPUE (# fish per square foot per hour) was very similar in September 2014 (**0.0028**) and September 2016 (**0.0036**), and higher than previously documented in 1973, 1995, and 2012 (Lirette 2017; Minnow 2018b). Survey method was overnight gillnet sets.	Rainbow Trout CPUE was higher post-event (**0.0028** and **0.0036** in September 2014 and 2016 respectively), compared to pre-event data (1973, 1995, and 2012; Lirette 2017; Minnow 2018b; SNC 2015a). However, the survey methods used were different pre- and post-event, so it cannot be conclusively determined that the increase in CPUE is related to an actual increase in Rainbow Trout abundance. Overall spatial balance **= Neutral**	(-) >4.5 years (spawning and migration) (-) <1 year (rearing and overwintering) Overall temporal balance **= Negative**
Rainbow Trout Abundance (Population Estimate)	S; R; O; M	Bruce and Slaney (1991) estimated in August 1991 that approximately **54,500** Rainbow Trout fry and parr migrate to Polley Lake from Hazeltine Creek after hatching (SNC 2015a).	In 2016, the Rainbow Trout population was estimated as **42,388** in the **spring** and **21,635** in the **fall**. It is likely that the fall estimate is lower than the actual Rainbow Trout population size (Minnow 2017a).	There is a decrease in Rainbow Trout population in Polley Lake post-event. Overall spatial balance **= Negative**	(-) >4.5 years (spawning and migration) (-) <1 year (rearing and overwintering) Overall temporal balance **= Negative**
Rainbow Trout Age Class Structure	S	Rainbow Trout age class structure have been collected before and after the event (1990 to 2014). Age range of Rainbow Trout in 1990 was **Ages 2 to 6** fish; in 1995 was **Ages 3 to 4** fish; in 2009 was **Ages 3 to 6** fish; and in 2014 was **Ages 1 to 6** fish (SNC 2015a).	There was 3 years of blockage of the Upper Hazeltine Creek for adult passage to spawn; therefore, it was 3 years when no new juveniles were entering Polley Lake. Overall juvenile numbers in the lake declined in this timeframe. This affected age class structure in the lake. Fewer **Ages 1 and 2** fish were captured in 2016 than in 2014 (Minnow 2017a). In 2017, **Ages 1 to 3+** fish were absent from Polley Lake, confirming the limited recruitment associated with no access to Hazeltine Creek for spawning and rearing (Minnow 2018b).	A brood stock of Rainbow Trout was collected and put into a hatchery established on the Mount Polley site in 2014. Approximately 15,000 juveniles from the hatchery were released into Polley Lake in fall 2018 to help readdress the age class structure. Age class structure of the Rainbow Trout population in Polley Lake was less diverse post-event (i.e., 2016 and 2017). Overall spatial balance **= Negative**	(-) >4.5 years (spawning and migration) (-) <1 year (rearing and overwintering) Overall temporal balance **= Negative**
Rainbow Trout Condition Factor	R	Rainbow Trout condition factor (weight/length) was collected between 1973 and 2014. Mean condition of Rainbow Trout in 1973 was **1.341**; in 1995 was **1.253**; in 2012 was **0.993**; in 2007 was **1.06**; and in 2014 was **1.103** (Minnow 2007; SNC 2015a).	Examination of 2016 data relative to 2014 indicated that females were lighter at length, males were not significantly different, and immatures were heavier and longer than those measured in 2014 (Minnow 2017a). In 2017, there appeared to be a general shift towards longer and heavier fish, particularly for female Rainbow Trout, indicative of a demographic shift to older, larger fish (Minnow 2018b).	The condition factor of Rainbow Trout population in Polley Lake is increasing. This is most likely reflective of a shift in the age-class structure instead of being reflective of a positive change in the health of the population. Because of this uncertainty, the positive change in condition factor indicator is not applicable. Overall spatial balance **= Neutral**	(-) <1 year Overall temporal balance **= N/A**

Sources: Lirette 2017; Minnow 2007, 2016b, 2017a, 2017b, 2018b; SNC 2015a.

5.3.1.7 Quesnel Lake – Limnetic Zone

No permanent physical alteration occurred in the limnetic zone of Quesnel Lake during the event. The event likely caused an unquantifiable temporary disturbance to fish communities during the event, resulting in a temporal loss of fish productivity (Table 18).

Other indicators on habitat function include limnetic fish relative abundance and condition factor (Table 18). The event introduced a large volume of fines into the water column. Monitoring data suggests a benefit to fish in the limnetic zone as measured both by abundance and condition factor. The fines released into Quesnel Lake contained nutrients and may have acted as fertilizer in the West Arm. With the addition of these nutrients, zooplankton bloomed, providing more forage for fish communities. Abundance (CPUE) was higher in exposed areas (the West Arm) of Quesnel Lake compared to reference areas. Juvenile Sockeye collected in the West Arm were larger than those caught in reference areas of the lake (DFO, unpublished data).

Laboratory testing of water suggested that the changes in water quality from the event is unlikely to present hazards to aquatic life.

There are no quantifiable negative effects to Quesnel Lake - Limnetic Zone, and there appears to have been a temporary increase in fish abundance and condition. No further offsetting is proposed.

Determination**: No Offsetting**

Table 18: Quesnel Lake - Limnetic Zone

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Limnetic Zone Fish Relative Abundance (CPUE)	R	There is no pre-event data available on relative abundance of limnetic zone fish.	Hoop-net monitoring was conducted in 2015 to 2017. Similar fish communities were observed at the West Arm and in other parts of the lake east of Cariboo Island. Eight fish species were captured from both exposed and reference areas in Quesnel Lake (Minnow 2016b). CPUE (# fish per hour) was higher at exposed areas (calculated by Golder based on Minnow 2016b data).	The difference in limnetic zone Rainbow Trout abundance pre-event and post-event cannot be determined. Comparing post-event relative abundance of limnetic zone Rainbow Trout from reference areas to the West Arm shows CPUE was higher in the West Arm in 2016 (calculated by Golder based on Minnow 2016b data). Overall spatial balance = **Neutral**	(-) < 1 year Overall temporal balance **= Neutral**
Limnetic Zone Fish Condition Factor	R	There is no pre-event data available on condition factor of limnetic zone fish.	Juvenile Sockeye collected from the West Arm west of Cariboo Island in 2014 were notably larger than those collected from reference areas in other parts of the lake east of Cariboo Island (Golder 2015c). Acute lethality (96 h) and 7-d survival and growth testing indicated that water collected from Quesnel Lake, during September and November 2014, was not acutely lethal for Rainbow Trout and survival and growth of Fathead Minnow was not affected (Golder 2017c)	The difference in limnetic zone fish condition factor pre-event and post-event cannot be determined. Comparing post-event condition factors of limnetic zone fish from reference areas to the West Arm shows condition factor for juvenile Sockeye Salmon was higher in the West Arm in 2014. In 2015, condition factor was similar across all regions of the lake (Golder 2017c). Overall spatial balance **= Neutral**	(-) <1 year Overall temporal balance **= Negative**
Turbidity	R	Between May 1995 and July 2014, the mean, minimal, and maximum turbidity (NTU) were 1.3, 0.35 and 4.8 respectively (MPMC 2014b).	By mid-November 2014, measurements of temperature, turbidity and specific conductivity were uniform throughout most of the water column. Turbidity at depth decreased to less than 10 NTU, which corresponded with an increase in turbidity in surface waters. This relatively small change in turbidity at the surface compared to deeper waters resulted in a cloudy appearance within the West Basin of the lake throughout the late fall and winter. By early spring (March and April 2015), turbidity at surface and depth decreased and was below 24-h (9 NTU) and 30-d (3 NTU) BC aquatic life WQGs. (Golder 2015a). In 2014, Juvenile Sockeye did not appear to move out of the West Arm to avoid turbidity. Effects to limnetic fish foraging efficiency did not appear to have occurred (Golder 2015c).	Water chemistry shows that turbidity and total metals concentrations in the limnetic zone of the West Arm are unlikely to present hazards to aquatic life (Golder 2017c). Overall spatial balance = **Neutral**	(-) <1 year Overall temporal balance **= Negative**
Phytoplankton and Zooplankton Biomass	R	There is pre-event zooplankton abundance and biomass data presented in Hume et al. (2005) and MacLellan et al. (1993); however, due differences in resolution of taxonomic identification and units, these data cannot be compared to post-event data (Golder 2015c).	Chlorophyll *a* assessments were undertaken annually between 2014 and 2017, and results indicate that there is no discernable difference in biomass (chlorophyll *a*) in the West Arm relative to the east of Cariboo Island (i.e., the reference site; Golder 2017c), and chlorophyll *a* concentrations were within the range of historical values (Golder 2017c). There is no discernable difference in total zooplankton biomass or abundance, or in the relative biomass or abundance of dominant taxa, relative to the reference (Golder 2017c). Water from Quesnel Lake was not acutely lethal for *Daphnia* and survival of *Ceriodaphnia* was not impaired lab tests from post-event water samples (Golder 2017c).	The differences in phytoplankton and zooplankton biomass in the limnetic zone pre-event and post-event cannot be determined. Comparing post-event data from the West Arm to reference areas shows that no changes in phytoplankton and zooplankton biomass were observed in the limnetic zone (Golder 2017c). Overall spatial balance = **Neutral**	(-) <1 year Overall temporal balance **= Neutral**

Sources: Golder 2015a, 2015c, 2017c; Minnow 2016b; MPMC 2014b; SNC 2015a.

5.3.1.8 Quesnel Lake – Littoral Zone

In the littoral zone of Quesnel Lake, approximately 94,394 m^2 of rearing, spawning, and migratory habitat was permanently altered through the smothering of sediment from the event. Approximately 6,350 m^2 has been remediated, so there is currently a spatial loss of shoreline habitat. The event also caused a temporal loss to fish productivity as previous habitat was altered for approximately 4.5 years (Table-19). Additional monitoring information is required to evaluate the functionality of the remediated littoral habitat.

Determination**: TBD**

Table-19: Quesnel Lake - Littoral Zone

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	R; S; M	94,394 m^2 of littoral area was affected (SNC 2015a).	6,350 m^2 of total shoreline habitat was remediated. This includes the areas of remediated habitat at the mouth of Edney Creek and the gravel shoals created along the shoreline.	Balance of -88,044 m^2 total instream habitat. Overall spatial balance **= Negative**	(-) >4.5 years Overall temporal balance **= Negative**
Littoral Zone Fish Relative Abundance	R	There is no pre-event data available on littoral fish abundance.	The actual contribution of the affected area of littoral zone to fish productivity is not known; however, the available data suggest that the decrease in benthic invertebrate prey items have not resulted in a decrease in condition factor of forage fish, Lake Trout, or Burbot captured in the littoral zone (Golder 2018c). Similar fish communities observed at effluent-exposed and reference areas. Eight different fish species were captured from both exposed and reference areas in Quesnel Lake (Minnow 2016b). CPUE was higher in exposed areas (calculated by Golder based on Minnow 2016b data).	The different in littoral zone fish abundance pre-event and post-event cannot be determined. Comparing post-event fish abundance of littoral zone fish from reference areas to the West Arm shows similar fish communities with higher CPUE were observed Overall spatial balance **= Neutral**	(-) >4.5 years Overall temporal balance **= Negative**
Littoral Zone Fish Condition Factor	R	There is no pre-event data available on littoral zone fish condition factor.	Mean condition factors were similar both across years and regions for sentinel fish and the data do not suggest a difference in body condition for sentinel fish residing in the West Basin compared to those in the reference areas (Golder 2017c).	The different in littoral zone fish condition factor pre-event and post-event cannot be determined. Comparing post-event fish condition factors of littoral zone fish from reference areas to the West Arm shows similar fish conditions were observed Overall spatial balance **= Neutral**	(-) >4.5 years Overall temporal balance **= Negative**
Littoral Habitat Quality	R	In 2012, 51% of littoral habitat of Quesnel Lake was ranked as “Very High” and “High”; 48% was ranked “moderate; and 2% was ranked “Low” and “Very Low” (SNC 2015a). The shoreline next to Hazeltine Creek Mouth was ranked “Very High” (SNC 2015a). 15% of “Very High” ranked juvenile fish habitat at the mouth of Hazeltine Creek was permanently altered (SNC 2015a).	Natural recovery is in progress.	The different in littoral habitat area pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years Overall temporal balance **= Negative**
Potential Shoreline Spawning Habitat Area	S	2 km of shoreline was affected by the event. Approximately 1.2 km of shoreline near the mouth of Hazeltine Creek was rated “Very High”, and the remainder was rated “High” (SNC 2015a).	The shoreline design at the mouth of Edney Creek incorporates shallow gravel shoal habitat that is accessible to fish under a wide range of lake levels (Golder 2018c).	Most of the potential shoreline spawning habitat area has not been remediated. Overall spatial balance **= Negative**	(-) >4.5 years Overall temporal balance **= Negative**
Habitat Features by Area	R	In 2012, the littoral habitat of Quesnel Lake comprised: gravel beach (49%); rocky shore (35%), and 36% had aquatic vegetation (SNC 2015a).	There is no post-event habitat features data available for the littoral zone of Quesnel Lake.	The different in habitat features pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years Overall temporal balance **= Negative**
Submergent and Emergent Vegetation by Area	R	In 2012, 36% of the shoreline area of Quesnel Lake had aquatic vegetation, predominantly emergent vegetation (SNC 2015a).	There is no official monitoring data available.	The different in submerged and emergent vegetation pre-event and post-event cannot be determined. Overall spatial balance = **Unable to determine due to the absence of post-event data; this indicator has not been used in determination of residual effects.**	(-) >4.5 years Overall temporal balance **= Negative**
Benthic Invertebrate Relative Abundance and Diversity	R	In 2007, the depositional benthic invertebrate community at the mouth of Hazeltine Creek at Quesnel Lake had a density of 21,000 organisms per m^2 and a richness of 30 taxa, comprised of chironomids (midges; 26.5%), ostracods (seed shrimp; 14.5%), and oligochaetes (aquatic worms; 10.4% (Minnow 2007).	The 2014, 2015, and 2016 data indicated that far-field littoral areas did not show reductions in density or diversity. However, the near-field littoral areas exhibited statistically significant reductions in mean density and diversity, and recovery was not yet evident in 2016 (Minnow 2015, 2016a, 2018b). The 2017 data are not directly comparable to the data collected earlier because the methods used were changed (Minnow 2018c).	Benthic invertebrate abundance and diversity is still recovering to pre-event levels. Overall spatial balance **= Negative**	(-) >4.5 years Overall temporal balance **= Negative**

Sources: Golder 2017c, 2018c; Minnow 2015, 2016b, 2018c; SNC 2015a.

5.3.1.9 Quesnel Lake – Benthic Zone

In the benthic zone of Quesnel Lake, about 1.8 km^2 of benthic habitat was altered with the smothering of tailings. No anthropogenic remediation work has been conducted in the Quesnel Lake benthic zone, resulting in a spatial and temporal loss (Table 20). Natural recolonization has been occurring over the last 4.5 years.

There is limited data to compare benthic fish abundance or condition factor pre and post-event. Preliminary benthic invertebrate monitoring suggests the recovery process is starting, but density and diversity are still significantly lower post-event compared to pre-event (Table 20).

A HEA has not been undertaken for Quesnel Lake – Benthic Zone. However, impacts did occur, and the approach will be to provide out-of-kind offsets. Offsetting options for Quesnel Lake - Benthic Zone are discussed in Section 5.4.2.

Determination**: Offsetting Required**

Table 20: Quesnel Lake - Benthic Zone

Indicator	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Area	R	The area of breach-related infill within the estimated depositional zone is approximately 1.8 km^2 (Tetra Tech 2015b).	0 m^2 of total benthic habitat was remediated. Potential remediation options are discussed in Section 4.11.3; MNR was selected as the preferred option.	Overall spatial balance **= TBD**	(-) >1 year Overall temporal balance **= TBD**
Total Benthic Area Smothered	R	The deposition of material initially caused a reduction in the benthic invertebrate community (e.g., a reduction in food organisms for fish) which, based on more current data appears to be recovering (Figure 22; Minnow 2015, 2016b, 2017c).	Preliminary data suggests natural recovery of the benthic community is in progress (Figure 22; Minnow 2015, 2016b, 2017c).	The density of benthic invertebrates in the Quesnel Lake – Benthic Zone is lower than pre-event. Overall spatial balance **= Negative**	(-) >1 year Overall temporal balance **= Negative**
Benthic Zone Fish Relative Abundance	R	Based on the available information, relatively little is known about the specific distribution of fish species within Quesnel Lake, particularly benthic and pelagic, non-salmonid species (SNC 2015a).	Fish have been observed in the profundal zone of the West Basin during a remote operated vehicle (ROV) inspection of the outfall in 2018.	The different in benthic fish relative abundance pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of both pre-event and post-event data; this indicator has not been used in determination of residual effects.**	(-) >1 year Overall temporal balance **= Negative**
Benthic Zone Fish Condition Factor	R	There is no pre-event benthic zone fish condition factor data available.	There is no post-event benthic zone fish condition factor data available.	The different in benthic fish condition factor pre-event and post-event cannot be determined. Overall spatial balance **= Unable to determine due to the absence of pre-event data; this indicator has not been used in determination of residual effects.**	(-) >1 year Overall temporal balance **= Negative**
Benthic Invertebrate Relative Abundance and Diversity	R	There is limited data on the abundance and diversity of the benthic invertebrate community pre-event. In 2007, the mean density (organisms per m^2) was approximately 31,000, the number of taxa was approximately 30 (Minnow 2007).	Early sampling indicates some recovery, but additional benthic sampling will be necessary to determine the current status of the benthic community and its current trajectory to recover.	Benthic invertebrate relative abundance and diversity post-event is lower compared to pre-event conditions. Overall spatial balance **= Negative**	TBD Overall temporal balance **= Negative**

Sources: Golder 2017c; Minnow 2015, 2016a, 2016b, 2017b; Tetra Tech 2015b.

5.3.1.10 Quesnel River

No permanent physical alteration of habitat occurred in Quesnel River and benthic invertebrate abundance and diversity were similar in Quesnel River and reference stations. As there was no significant physical alteration of habitat in Quesnel River and no measurable residual effects, no offsetting is proposed.

Determination: **No Offsetting**

Table 21: Quesnel River

Metric	Habitat Function	Pre-Event Data	Post Event Data	Spatial Balance	Temporal Balance
Turbidity	S; R; O; M	No permanent physical alteration of habitat has occurred in the Quesnel River (SNC 2015a). The available evidence indicates a low magnitude of risk comparable to reference conditions: ■ Plankton - No significant reductions in chronic water algal growth tests or vascular plant growth toxicity tests on field-collected water samples. No chronic toxicity to cladocerans in representative non-turbid waters. ■ Benthic Invertebrates - Benthic invertebrate samples collected from Quesnel River and the corresponding reference area in Cariboo River had concentrations of COPCs similar to reference conditions. ■ Fish – Significant effects were not observed for fish toxicity tests including 7-d Rainbow Trout survival and growth, 30-d Rainbow Trout survival and development, and 7-d Fathead Minnow survival and growth toxicity tests on field collected water samples.	Monitoring results of Quesnel River conducted in 2014, 2015, 2016, and 2017 show no indications of further effects post-event (Golder 2017c).	Turbidity of Quesnel River pre-event and post-event are comparable (Golder 2017c). Overall spatial balance **= Neutral**	(-) <1 year Overall temporal balance **= Negative**

Sources: Golder 2015d, 2017c; SNC 2015a.

5.3.1.11 Riparian Habitat

Riparian areas are important fish habitat because they link terrestrial and aquatic ecosystems and provide ecological functions such as improving water quality, providing bank stability, contributing organic matter (e.g., leaf litter and large woody debris) to waterbodies, and providing habitat complexity.

For the purposes of quantifying riparian area losses, we have defined the riparian zone as the Riparian Management Zone as described in Part 4 of the Forest Planning and Practices Regulation under the *Forest and Range Practices Act*.

SNC (2015a) estimated that the event altered 737,464 m^2 of riparian habitat along Hazeltine and Edney Creek. Altered riparian habitat for Polley Lake and Quesnel Lake - Riparian Zone were estimated using the application of a 10 m Riparian Reserve Zone to the affected area. In total, 765,574 m^2 of riparian habitat are estimated to be altered by the event. A breakdown of the riparian habitat altered by EU, and riparian habitat replanted to-date by EU, is provided in Table 23. The estimated area of replanted riparian habitat (i.e., 285,689 m^2) was calculated based on the assumptions in Section 5.3.12.1. An estimated 479,885 m^2 of riparian habitat still requires replanting.

To-date, riparian planting consists of staking live wattles of willow and planting black cottonwood, prickly rose, black twinberry, red osier dogwood, sitka alder, and coniferous trees species. In addition, riparian areas have been seeded using a locally sources multispecies seed blend.

Table 22: Riparian Habitat

Ecological Unit	Altered Riparian Habitat (m^2)	Remediated Riparian Habitat (m^2)	Spatial Balance (m^2)
Edney Creek	20,215	26,771	+6,556 Overall spatial balance **= Gain**
Upper Hazeltine Creek (H1)	530,094[2]	265,047	-265,047 Overall spatial balance **= Negative**
Lower Hazeltine Creek (H2)	187,155[2]	0	-187,155 Overall spatial balance **= Negative**
Polley Lake	7,300[3]	7,300	0 Overall spatial balance **= Neutral**
Quesnel Lake - Littoral Zone	20,810[4]	0	-20,810 Overall spatial balance **= Negative**
Total	**765,574**	**285,689**	**-479,885**

[1]Based on Edney Creek being in Riparian Class S3, with a Riparian Management Area width of 40 m (Section 47 (1) of the Forest Planning and Practices Regulation, SNC 2015a). Altered riparian habitat estimate based on SNC (2015a).

[2]Based on Hazeltine Creek being in Riparian Classes S2, S3 and L1-B (reach-dependent), with a Riparian Management Area width of 40 m (S2), 50 m (S3), and 70 m (L1-B) (Section 47 (1) of the Forest Planning and Practices Regulation; SNC 2015a). Altered riparian habitat estimate based on SNC (2015a).

[3]Based on Polley Lake being in Riparian Class L1-B, with a Riparian Reserve Zone width of 10 m (Section 49 (1) of the Forest Planning and Practices Regulation).

[4]Quesnel Lake is in Riparian Class L1-A (i.e., lakes greater than 1,000 ha). Lakes of Riparian Class L1-A have a Riparian Reserve Zone of 0 m; however, to be conservative, a 10 m width was applied to Quesnel Lake (Section 49 (1) of the Forest Planning and Practices Regulation).

A HEA was undertaken for riparian habitat and results in a current negative balance of 774,069 m^2 that require offsetting Table 23. The current riparian habitat offset balance will need to be adjusted as ongoing habitat remediation continues to restore areas of riparian habitat. Riparian remediation will be ongoing through remediation of the remaining sections of the aquatic EUs.

Offsetting is required to compensate for the temporal loss of functional riparian fish habitat between the date of the event, and the time it will take for riparian habitat to reach a state similar to pre-event conditions, which Mallik et al. (2011) estimates to be approximately 18 years. Offsetting options for riparian habitat are discussed in Section 5.4.3.

Determination**: Offsetting Required**

5.3.1.12 Offsetting for Aquatic and Riparian Habitat - Habitat Equivalency Analysis

HEA is a means to determine the amount of compensatory restoration required to provide services that are equivalent to the interim loss of natural resource services following an “injury” (Kohler and Dodge 2006). Further background on HEA is provided in Section 4.2.4 and for convenience a brief summary is provided here.

HEA is used to determine the nature and degree to which a restoration project might provide adequate replacement for an injured resource. HEA uses a discounting algorithm to value a natural resource asset which is equal to all future services of that asset after degradation due to injury. The formula to calculate the level of ecological services gained and lost is a percent increase from a baseline level for each year of assessed losses and potential gains are added for the duration of years loss over the compensatory action period. A discount rate is applied each year to actualize the losses or gains as a percentage rate and per time services provided sooner are more highly valued that those provided later. These calculations were made using the software Visual_HEA (Kohler and Dodge 2006, Pioch et al. 2017).

A formal HEA assessment was conducted on EUs: Middle Edney Creek, Upper Hazeltine Creek, Lower Hazeltine Creek. HEA was conducted on these EUs due to insufficient data for pre- and / or post-event fish abundance (CPUE) and / or fish age class structure data for the injured sites. HEA was not conducted on Polley Lake, Quesnel Lake - Benthic Zone, and Quesnel Lake - Littoral Zone yet, due to the nature of the EUs as described in Sections 5.3.1.6, 5.3.1.8 and 5.3.1.9, respectively. The results of the HEA for each EU are presented in Table 23. EU-specific assumptions used to determine the input parameters are described in Table 24.

Table 23: Summary of Habitat Equivalency Analysis Results

Ecological Unit (EU)	Area (m^2)			
	Impacted	Calculated HEA Units Required for Offsetting	Remediated (to date)	Remaining for Remediation or Offsetting (to date)
Polley Lake	TBD	TBD	TBD	TBD See Section 5.3.1.6
Upper Hazeltine Creek	44,650	53,314	15,266	38,048
Lower Hazeltine Creek	17,966	26,046	0	26,046
Middle Edney Creek	1,350	1,499	1,553	0
Quesnel Lake – Littoral Zone	94,394	TBD	6,350	TBD See Section 5.3.1.8
Quesnel Lake – Benthic Zone	1,800,000	TBD	TBD	TBD See Section 5.3.1.9
Riparian Areas	765,372	1,059,767	285,698	774,069

Note: Habitat remediation remains underway in a number of EU. Additional habitat credits are expected to result when that habitat has been constructed (e.g., Reach 3 of Hazeltine Creek).

5.3.1.13 HEA Calculation (Long Term Commitments)

This Remediation Plan sets out the proposed components to be used in the calculation of habitat offsets. The time loss functions are based on estimates obtained from the literature which will have uncertainty associated with those estimates. Attainment of the offsets “owing” will be verified as part of habitat verification monitoring (see Figure 8) and it is expected that parameters used in the HEA calculations may be adjusted based on the findings of that monitoring. This could also result in adjustments to the amount of offsets. The HRWG provides a suitable forum for oversight of the delivery of sufficient habitat offset amounts and while the group is intended as a collaborative group, representatives of the HRWG include those with regulatory authority for such oversight. The RP sets out the initial amounts of habitat owing and provides a mechanism whereby accounting for offsets remains part of MPMC’s long term commitments.

The continuum of monitoring, assessment and recalculation of offsets “owing” provides a direct measurement and accounting for uncertainty in the success of habitat offset projects.

Table 24: Habitat Equivalency Assessment (HEA) Per Site Using Assumptions for Natural Recovery Detailing the Parameters Used and Assumptions

Site	Injured Area (m^2)	Pre-Injury (Base-line) Service Level (%)	Pre-Restoration Service Level (%)	Time for 100% Natural Baseline Recovery	Natural Recovery Level (%)	Time for Baseline to Return from Restorations (years)	Size of Compensatory Replacement Habitat (m^2)	Area Remediated (m^2)	Remaining Area for Remediation or Offsetting (m^2)	Assumptions
Polley Lake	TBD	100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD See Section 5.3.1.6
Upper Hazeltine Creek	44,650	100	0	Infinite (will never reach natural baseline services without restoration Service)	0	7	53,314	15,266	38,048	Restoration of physical construction was completed in 2017. For Reaches 1 and 2, remediation construction restored access and in-stream habitat function in 2017. Fish utilization occurred starting in 2018: four years post-event. For Reaches 1 and 2, after remediation activities, in-channel habitat features achieved a quality rating of "good" based on Table 1 habitat function metrics. This is as good, if not better, than the habitat was pre-event. Full recovery of Reaches 1 and 2 is anticipated six years post-event due to benthic invertebrate community recovery and unknown variables. This accounts for four years of blocked access and two years for recovery. Density of juvenile Rainbow Trout and YOY production is roughly equal pre- and post-event suggesting food supply is available and the benthic invertebrate community is recovering. For Reach 3, it is anticipated that remediation construction will restore access and in-stream habitat function in 2019. Fish utilization is expected to occur starting in 2020: six years post-event. For Reach 3, after remediation activities, it is anticipated that in-channel habitat features will achieve a quality rating of "good" based on Table 1 habitat function metrics. Full recovery of Reach 3 is anticipated eight years post-event due to benthic invertebrate community recovery and unknown variables. This comes from six years of blocked access and two years for recovery. Times for recovery for Reaches 1 and 2 and Reach 3 are averaged together. This results in a value of seven years used.
Lower Hazeltine Creek	17,966	100	0	Infinite	0	10	26,046	0	26,046	Post-event service levels provided by the habitat were rated at 0%. For Lower Hazeltine Creek, it is anticipated that remediation construction will restore access and in-stream habitat function in 2020. Fish utilization is anticipated to occur in 2021: seven years post-event. Full recovery of Lower Hazeltine Creek is anticipated 10 years post-event due to benthic invertebrate community recovery and unknown variables. This account for six years of blocked access and 4 years for recovery.
Middle Edney Creek	1,350	100	50	Infinite	0	3	1,499	1,5532	0	Productivity of Middle Edney Creek post-event is assumed to be 50%, as the channel was altered (i.e., not destroyed). The physical construction was completed in less than one year. Access to Middle Edney Creek was restored in less than one year, assuming no spawning productivity was lost. After two years of remediation activities, in-channel habitat features achieved a quality rating of "good" based on Table 1 habitat function metrics. A full recovery of in-stream habitat function will take three years. Abundance (CPUE) numbers pre-event and post-event is roughly equal, suggesting food supply is available for Rainbow Trout and the benthic invertebrate community is recovering. and some habitat features remained.
Quesnel Lake – Littoral Zone	94,394	100	0	Infinite	NA	5	TBD	6,350	TBD	TBD See Section 5.3.1.8

Site	Injured Area (m^2)	Pre-Injury (Base-line) Service Level (%)	Pre-Restoration Service Level (%)	Time for 100% Natural Baseline Recovery	Natural Recovery Level (%)	Time for Baseline to Return from Restorations (years)	Size of Compensatory Replacement Habitat (m^2)	Area Remediated (m^2)	Remaining Area for Remediation or Offsetting (m^2)	Assumptions
Quesnel Lake – Benthic Zone	1,800,000	100	0	Infinite	0	5	TBD	1,800,000	TBD	TBD See Section 5.3.1.9
Riparian	765,372	100	0	Infinite	0	18	1,059,767	285,698	774,069	For riparian areas, some remediation activities began in 2015 with planting and some are ongoing. An assumed average value of remediation occurring three years post-event is used for the HEA calculation. For riparian areas, it is anticipated that natural recovery would restore habitat function in 20 years. The riparian area for Hazeltine and Edney Creeks estimated by SNC (2015a) and the riparian area estimated by the HHWG for Polley Lake and Quesnel Lake littoral zone do not overlap. Riparian habitat in Upper Edney Creek (E1) and Quesnel River were not affected by the event (HRWG 2015). Riparian habitat was altered in the following EUs: Middle Edney Creek (E2); Lower Edney Creek (E3); Upper Hazeltine Creek (H1); Lower Hazeltine Creek (H2); Polley Lake; and Quesnel Lake - Littoral Zone (SNC 2015a; HRWG 2015). There is no riparian habitat in the following EUs: Quesnel Lake – Benthic Zone; and Quesnel Lake – Limnetic Zone. Riparian habitat in Middle Edney Creek (E2) and Quesnel Lake - Littoral Zone has not been replanted (Table 6). Riparian habitat in Lower Edney Creek (E3) has been replanted (Table 6). 50% of Upper Hazeltine Creek (H1) riparian habitat has been replanted (approximately 3 km); leaving 50% (approximately 3 km) yet to be replanted. Riparian habitat in Reach 5 of Lower Hazeltine Creek (H2) has been partially planted and seeded (Table 6); however, the majority of H2 has not been replanted; therefore, this area is considered 0% revegetated. The revegetated riparian habitat completed at Polly Flats includes all the affected riparian at Polly Lake (Table 6).

Note: Reach 4 (Hazeltine Canyon) was not included in the HEA calculations because that section is not accessible to fish, and was not accessible pre-breach.

5.3.2 Upland Terrestrial Habitat

Areas of upland terrestrial habitat affected by the event occur in the Interior Cedar Hemlock (ICH) BEC zone. Site series within affected areas include the Quesnel Wet Cool (ICH wk2) and Horsefly Moist Cool (ICH mk3).

SNC estimated the event altered 2,374,700 m^2 of total terrestrial habitat, which includes 737,464 m^2 riparian habitat (Section 5.3.1.11; SNC 2015a, b). An additional 28,110 m^2 of riparian habitat was estimated by the HRWG for Polley Lake and Quesnel Lake - Littoral Zone leaving an estimated 1,609,328 m^2 of affected upland terrestrial habitat.

The remediation plan for the altered upland terrestrial habitat includes:

- **Site preparation and soil amendments**. Site preparation methods are described in Section 4.2.3 and include mixing natural soil with the tailings soil and creating microsites across the upland terrestrial area. Soil inoculation and using topsoil borrowed from donor natural sites may be added to some areas with large volumes of deposited material to bolster soil microbial communities, soil nutrient levels, soil structural properties, and to provide a local seed bank (Ohsowski et al. 2012).
- **Revegetation program**. The revegetation program aims to re-establish a natural trajectory of succession within the upland terrestrial area, using natural pioneer species that are tolerant of difficult growing conditions and early-mid successional species (Section 4.2.3). To-date, 90% (approximately 1,448,395 m^2) of upland terrestrial habitat has been replanted based on advice from University of British Columbia (UBC) Forest Ecology, First Nations wishes, and generally based on standard BC silviculture stocking standards (Province of British Columbia 2019), leaving approximately 10% (approximately 160,933 m^2) of upland terrestrial habitat to be replanted. Based on the *Reference Guide for Forest Development Stocking Standards* (Province of British Columbia 2019), the delay to establish regeneration ranges from four- to seven- years dependent on the site series for the ICH wk2 and mk3. Where short regeneration delay periods are indicated (i.e., four years), planting is the preferred reforestation method (MOF 2002). The regeneration date is defined as the date at which the minimum number of healthy well-spaced trees of the preferred and acceptable species are established and the minimum number of preferred trees are established, which must be maintained until the sites is determined to be free growing (MOF 2002).

Possible offsetting options for upland terrestrial habitat are described in Section 5.4.4.

Determination**: TBD monitoring required**

5.3.2.1 Assumptions

- The total upland terrestrial habitat affected is equivalent to the estimated affected terrestrial habitat reported by SNC (2015b) minus the riparian habitat area estimated by SNC (2015a) and the riparian habitat area estimated by the HRWG.
- Planting of the upland terrestrial area completed to-date follows the BC silviculture stocking standards for the appropriate BEC subzone and site series (Province of British Columbia 2019).
- Soil amendments completed to-date will be conducive to the growth of vegetation that has been planted in the upland terrestrial area.

5.3.3 Uncertainties in Residual Effects, Offset, and Compensation Determination

There are uncertainties associated with the determination of residual effects, offsets and compensation for the EUs, riparian habitat and upland terrestrial habitat. This section describes the key uncertainties accounted for in the determination of residual effects and offset / compensation determination for each area. Accounting for uncertainties allows for adaptive management of habitat offsets and better satisfies the “no-net-loss” outcome of fish productivity.

Upper Edney Creek (E1)

- Uncertainties from the limited pre-event data, including the lack of salmon spawner escapement data, and limited juvenile salmon abundance data.
- Uncertainties from inconsistencies between pre- and post-event survey methodologies. In 2007, the survey methodology used for calculating abundance (CPUE) of Rainbow Trout was electrofishing, while in 2016 and 2017 it was minnow trapping.
- Timing of surveys was also inconsistent in Upper Edney Creek (E1). Pre-event surveys were conducted in late August of 2007, while 2016 and 2017 surveys were conducted from April to October and May to November respectively.

Middle Edney Creek (E3)

- Uncertainties from the limited pre-event data, including the lack of pre-event Rainbow Trout abundance (CPUE) and salmon spawner escapement data, and limited juvenile salmon abundance data.
- Uncertainties from possible inconsistencies in the collection of fish for determining Rainbow Trout age class structure pre- and post-event, and possible different month of fish collection.

Lower Edney Creek (E2)

- Uncertainties from the limited pre-event data, including the lack of pre-event Rainbow Trout abundance (CPUE) and salmon spawner escapement data, and limited juvenile salmon abundance data.
- Uncertainties from possible inconsistencies in the collection of fish for determining Rainbow Trout age class structure pre- and post-event, and possible different month of fish collection.

Upper Hazeltine Creek

- Uncertainties due to the lack of post-event Rainbow Trout abundance (CPUE) and age class structure data.

Lower Hazeltine Creek

- Uncertainties due to the lack of post-event Rainbow Trout abundance age class structure data.

Polley Lake

- Uncertainties from inconsistencies between pre- and post-event survey methodologies. In 1973, 1995, and 2012, the survey methodology used for calculating abundance (CPUE) of Rainbow Trout was seine netting, while in 2014 and 2016 it was gillnet sets.
- Uncertainties from possible inconsistencies in the collection of fish for determining Rainbow Trout age class structure and condition factor pre- and post-event, and possible different month of fish collection.

Quesnel Lake – Benthic Zone

- Uncertainties from the lack of pre-event data, including the lack of pre-event benthic zone fish relative abundance (CPUE), pre-event benthic zone fish condition factor and consistent pre- and post-event benthic invertebrate community data.

Quesnel Lake – Limnetic Zone

- Uncertainties from the lack of pre- and post- event data, including the lack of pre-event limnetic zone fish relative abundance (CPUE), pre-event limnetic zone fish condition factor and official submergent and emergent vegetation monitoring data.

Quesnel Lake – Littoral Zone

- Uncertainties from the lack of pre-event data, including the lack of pre-event littoral zone fish relative abundance (CPUE), littoral zone fish condition factor and zooplankton abundance and biomass data.

Riparian Habitat

- Uncertainties associated with natural vegetation species growing and establishing on affected sites (so far monitoring has shown that replanted areas are growing).
- Uncertainties associated with natural infilling by propagules from the surrounding area leading to a natural trajectory for succession.
- Uncertainty in the loss of wetland areas adjacent with Edney and Hazeltine Creeks.

Upland Terrestrial Habitat

- Uncertainties associated with site preparation techniques making soils conducive to native plant establishment and growth.
- Uncertainties associated with the success of planting of pioneering species and natural infilled by propagules from the surrounding area leading to a natural trajectory for succession.

- Loss of wetlands in the upland terrestrial habitat will have effects on availability of amphibian breeding habitat. The compensation is not encompassed by only following the silviculture stocking guidelines as this does not replace loss wetland habitat.
- Uncertainties associated with the effect the event had, and continues to have, on amphibians. Further monitoring in the CEMP or a focused amphibian study may be required.

5.4 Proposed Offsets and Compensation

There are no proposed offsets for six EUs: Upper Edney Creek (E1), Middle Edney Creek (E2), Lower Edney Creek (E3), Polley Lake, Quesnel Lake – Limnetic Zone, and Quesnel River. The rationale for no proposed offset for these EUs is provided in Sections 5.3.1.1, 5.3.1.2, 5.3.1.3, 5.3.1.6, 5.3.1.7 and 5.3.1.9 respectively.

Offsets are proposed for riparian habitat and four EUs: Upper Hazeltine Creek (H1), Lower Hazeltine Creek (H2), Quesnel Lake – Benthic Zone, and Quesnel Lake – Littoral Zone. The rationale for proposing offsets for riparian habitat and these EUs is provided in Sections 5.3.1.11, 5.3.1.4, 5.3.1.5, 5.3.1.9 and 5.3.1.8 respectively. Proposed offset options for H1, H2 and Quesnel Lake – Littoral Zone are described in Section 5.4.1, for Quesnel Lake – Benthic Zone is described in Section 5.4.2, and for riparian habitat is described in Section 5.4.3. Proposed offsets are common approaches known to have the potential to increase fish productivity (Loughlin and Clarke 2014).

Compensation is proposed for upland terrestrial habitat. The rationale for proposing compensation for upland terrestrial habitat is provided in Section 5.3.2, and proposed compensation is described in Section 5.4.4.

The HRWG will provide input into a decision for the most appropriate offset to meet productivity effects/shortfalls for each EU, the riparian habitat and the upland terrestrial habitat.

5.4.1 Potential Offset Options for Hazeltine Creek (H1 and H2) and Quesnel Lake – Littoral Zone

5.4.1.1 On-Site Off-Channel Habitat Creation

Habitat creation is considered offset to serious harm to fish under the federal *Fisheries Act* (Loughlin and Clarke 2014) and has been common practice since the 1980s. Hazeltine Creek (H1 and H2) was destroyed and Quesnel Lake – Littoral Zone was altered as a result of the event. Pre-event, Upper Hazeltine Creek (H1) provided spawning and rearing habitat for a single species (i.e., Rainbow Trout), while Lower Hazeltine Creek (H2) provided spawning and rearing habitat for multiple species (e.g., Rainbow Trout and other salmonid species such as sockeye salmon). A potential offset option for H1, H2 and Quesnel Lake – Littoral Zone is the construction of small off-channel streams to provide additional spawning and rearing habitat, or to improve access to H1 from Polley Lake, and from Quesnel Lake to H2.

Habitat creation should be undertaken using a watershed approach to identify and remove potential stressors that will affect the created habitat prior to undertaking habitat enhancement and creation (Loughlin and Clarke 2014). Off-channel habitat can be created using different techniques such as groundwater fed off-channels, overflow channels that become wetted during flood events, and surface-fed channels (Lister and Finnigan 1997). Selection of the type of off-channel habitat created will depend on the characteristics of the site and the spawning and rearing requirements of the species the off-channel habitat is designed for (Lister and Finnigan 1997). Design of off-channel habitat for spawning and rearing must consider riparian vegetation, substrate type suitable for spawning for target species, the macroinvertebrate community, physical design of the habitat (e.g., channel width, channel depth, riffle / pool structure), and cover features available such as large woody debris (Loughlin and Clarke 2014). Monitoring and follow-up programs are necessary to determine the productivity provided by created off-channel habitat (Loughlin and Clarke 2014). For offsetting programs this will require data on the productivity prior to the disturbance event, productivity after the disturbance event, and productivity after habitat creation and enhancement projects are constructed.

5.4.1.2 Off-Site Off-Channel Habitat Creation

DFO (2013) prefer offsets that occur within the vicinity of the Project, or within the same watershed; therefore, a potential offset option for H1, H2 and / or Quesnel Lake – Littoral Zone is the construction of off-site off-channel habitat within the Quesnel Lake watershed. Off-channel habitat creation can provide spawning, rearing, and overwintering habitat for target fish species to increase fish productivity. Off-channel habitat can be created using different techniques such as groundwater fed off-channel habitat, overflow channels that become wetted during flood events, and surface-fed channels (Lister and Finnigan 1997). Selection of the type of off-channel habitat created will depend on the characteristics of the site and the spawning and rearing requirements of the fish species for which off-channel creation is being designed (Lister and Finnigan 1997). The design of off-channel habitat for spawning and rearing needs to consider riparian vegetation, substrate type suitable for spawning for target species, the macroinvertebrate community, physical design of the habitat (e.g., channel width, channel depth, riffle / pool structure), and cover features available such as large woody debris (Loughlin and Clarke 2014). The input of First Nations, local biologists and streamkeeper volunteers can provide considerable benefit to accelerating such concepts with locally informed ideas.

5.4.1.3 Removal of Barriers and Reconnection of Fish Habitat

Damaged and incorrectly installed culverts, fords and bridges can prevent the passage of fish. Perched culverts can reduce the chance a fish can access the culvert. Culverts can affect the flow of water which can affect fish passage. If there is not enough flow, the water can be too shallow for fish to pass. Alternatively, too much flow can make it too difficult for a fish to swim up the culvert. The chances of debris getting trapped and blocking the culvert is increased when the upstream opening is too narrow. The lack of proper habitat features, such as resting pools below the outfall of a culvert, can also create a barrier to fish passage (MOTI 2013; Votapka 1991).

There are 1,123 culverts (i.e., round culverts, oval culvert, wood box culverts, or pipe arch), fords, and bridges in the Quesnel River watershed identified as barriers to fish passage (Government of BC 2019; Pedersen 1998 Appendix C). The location of each fish barrier and the associated stream / tributary is provided in Appendix C. Where the length and channel width of the fish barrier is known, the potential offset area (m^2) is provided in Appendix C. A potential offset option for H1, H2 and / or Quesnel Lake – Littoral Zone is to maintain, remove or replace fish barriers to regain passage for fish to access spawning and rearing areas.

Numerous examples exist of the success of removing fish barriers and promoting habitat connectivity (DFO 2016). Culvert restoration and upgrades have shown, when completed properly, to increase passage success, fish biomass and species richness (Favaro et al. 2014; Goerig et al. 2015).

5.4.1.4 Streambank Stabilization and Riparian Planting

A potential offset option for H1, H2 and / or Quesnel Lake – Littoral Zone is to stabilize banks and revegetated riparian areas within the Quesnel Lake to Edney Creek watershed. Anthropogenic activities such as forest harvesting and infrastructure construction has increased exposure to streams, resulting in increased water temperature, sediment, and channelization (Pedersen 1998). Restoration activities such as bank stabilization and revegetation of riparian areas, both of which are needed on a variety of watercourses throughout the watershed (Pedersen 1998), can contribute to the overall health of a stream, increasing the quality of salmonid habitat.

5.4.1.5 Invasive Fish Eradication

DFO (2013) consider offsets that are undertaken outside of the Project site, or for fish species other than those affected, provided the offsets are supported by clear fisheries management objectives or regional restoration priorities. Therefore, a potential offset option for H1, H2 and / or Quesnel Lake – Littoral Zone is to provide funds to support the eradication of invasive smallmouth bass (*Micropterus dolomieu*) in the Beaver Creek watershed.

Smallmouth bass is an invasive fish species, occurring in reservoirs, ponds, rivers, and streams. It is an efficient predator, feeding on invertebrates as juveniles and then fish after the age of two (Bobrowski 2017). This has a negative effect on native fish species by reducing prey availability and through direct predation. Predation may have an impact on salmonid species in particular; juvenile salmonids can make up over 50% of smallmouth bass diet where they overlap (Tabor et al. 1993; 2007). Smallmouth bass is also able to reproduce faster and more often than most native fish, adding additional competition onto native fish populations (Bobrowski 2017). This species occurs in watersheds throughout southern BC as well as Vancouver Island (Government of BC 2019). A population was also illegally introduced into Beaver Creek, which drains into the Quesnel River, in 2003 (Bobrowski 2017). By 2007, smallmouth bass had moved downstream as far as the confluence of Beaver Creek and Quesnel River and upstream of Beaver Lake. It is expected to continue to spread throughout central BC (Bobrowski 2017).

Population control efforts can be focused through eradication and containment. Eradication focuses on removing populations of smallmouth bass through a variety of methods. Containment seeks to stop the spread of smallmouth bass through the installation of artificial barriers.

Eradication and control programs for smallmouth bass has shown some success in both reducing smallmouth bass population numbers and increasing native fish abundance; however, a multi-year approach is needed to avoid bass populations rebounding (Biron et al. 2014; Weidel et al. 2007).

5.4.2 Proposed Offset Option for Quesnel Lake - Benthic Zone

5.4.2.1 Lake Fertilization

The offset of Quesnel Lake benthic habitat with new deep lake habitat (like for like offset) is not a practical offsetting option because an ecologically viable lake with a depth of approximately 100 m would require construction of a water dam and would alienate considerable land. Given that desired outcomes for offsetting are to increase productivity, we have considered lake fertilization to be an appropriate means of directly increasing productivity of Quesnel Lake.

Nutrient addition can be used to enhance fish food production in lakes where food may be a limiting factor (Gerwing and Plate 2018; Basset et al. 2016; Envirowest 1990). It is well established that nutrient addition can compensate for the loss in productivity resulting from dam construction and operation (Ashley and Slaney 1997; Stockner and Shortreed 1985) by increasing productivity of edible phytoplankton and, in turn, increasing zooplankton biomass, such as *Daphnia spp*. which is a key forage item for planktivorous fish (Perrin and Stables 2001; Perrin and Stables 2000; Thompson 1999). The stimulation of the lower trophic levels, when done right can play a key role in increasing the productivity of fish populations (Hebert et al. 2013). Inorganic nutrients are added to the lake to enhance primary trophic levels (e.g., plants and phytoplankton), which in turn increases secondary trophic levels (e.g., zooplankton and benthic invertebrates) that are important food sources for juvenile Salmon (Envirowest 1990). Nutrient additions are particularly viable for oligotrophic lakes (Loughlin and Clarke 2014).

During habitat assessment in the late 1980s and early 1990s, Quesnel Lake was assessed to have excellent physical characteristics (e.g., temperature, thermocline and euphotic zone depth) for rearing habitat for juvenile Sockeye Salmon. However, nutrient concentrations and phytoplankton productivity was low relative to other interior Fraser lakes (Shortreed et al. 2001). *Daphnia* was abundant during years of lower fry density but during years of high fry density its abundance declined to levels where sockeye diet shifted to less efficient prey items (Shortreed et al. 2001). Quesnel Lake is a potentially suitable candidate for fertilization during dominant and subdominant brood years. Fertilization of Quesnel Lake was estimated to have the potential to produce several million additional adult Sockeye returns in each dominant and subdominant brood year (Stockner and Shortreed 1994).

Nutrient enrichment programs have been undertaken with measurable success. In 1999 The BC Ministry of Environment undertook a 5-year program, and nutrient addition to a limnetic area of 1,400 ha^2 in the Alouette Reservoir starting (Harris et al. 2010). Monitoring from the initial research phase from 1999 to 2002 indicated lake fertilization was meeting the established goals (Harris et al. 2010). Monitoring results from this program indicate increase in the density of phytoplankton, increase in zooplankton biomass and density, and increase in fish abundance during the nutrient addition program in comparison to pre-fertilization baseline conditions (Harris et al. 2010). Recently, BC Hydro undertook a 10-year program nutrient enrichment program to a 4.1 km^2 reservoir area in Wahleach Reservoir, BC (Hebert et al. 2013; BC Hydro 2005). Results from the monitoring program report increased phytoplankton and zooplankton abundance and biomass as a result of nutrient addition (Hebert et al. 2013). Increased phytoplankton and zooplankton productivity have translated into increased fish abundance and biomass since the program's inception. Assessments of Wahleach Reservoirs' fish populations indicate a significant increase in abundance and overall biomass since the start of nutrient enhancement (Hebert et. al. 2013).

Gerwing and Plate (2018) provide a contemporary review of the effectiveness of nutrient enhancement as a remediation or compensation strategy for salmonid fisheries from several such efforts. Their review provides important considerations in use of this offsetting method so that increased primary producer and invertebrate populations will transfer into increases in fishery productivity. A fertilization program needs to be coupled with appropriate monitoring. Anecdotally, following the year of the breach, DFO observed that sockeye salmon juveniles in the West Arm were more abundant and larger in size than sockeye juveniles in other parts of Quesnel Lake and water quality measurements in Quesnel Lake found that nutrient levels were increased as a result of forest nutrients being washed into the lake from the debris flow. This and experience elsewhere (Gerwing and Plate 2018) suggests that there is merit in considering this as a practical offset measure.

When done correctly, increased fishery productivity of Quesnel Lake does appear to be a likely outcome to such an offsetting measure. The estimate of 5 years of productivity impacts from the breach to Quesnel Lake benthos provides a suitable period over which the offset would involve MPMC funding a lake fertilization program for the Quesnel Lake west arm as an offset to the impacts of the breach on the West Arm of Quesnel Lake. Consultation with DFO would also be needed for conclusion of lake fertilization as the productivity increase from fertilization is largely transient, occurring for the duration of fertilization (Gerwing and Plate 2018; Envirowest 1990).

Through consultation for this RP (and more broadly), MPMC are aware that lake fertilization may be a controversial proposal for certain area residents and lake users. Consultation would be a required part of implementing lake fertilization. Based on expectations from what was heard through consultation to date and some of the concerns identified, it was felt that a contingent offset option was appropriate.

5.4.2.2 Contingency Option for Quesnel Lake - Benthic Zone Offset

A suitable contingency option was tabled by FLNR at a November 2018 HRWG meeting. A known negative impact on local fish productivity from invasive species has been identified as a conservation priority for action and it was suggested that contributions towards an invasive species eradication program could be a suitable form of productivity offsets.

The quantification of an appropriate dollar amount for that offset could be based on a costing exercise for 5 years of a lake fertilization program with that amount paid into invasive species control programs over that period of 5 years. The technical and managerial leadership of the invasive species program are already in place so MPMC would be a funding contributor towards a program seen by fishery managers as an important regional program. Additional information on such a program is provided in Section 5.4.1.5 above.

5.4.3 Proposed Offset Options for Riparian Habitat

Riparian habitat offsetting will be used to account for the time lag required for riparian plantings to become ecologically functional. To achieve riparian habitat offsetting a combination of options can be employed and are discussed below. Riparian enhancement and restoration within the watershed.

- **Riparian habitat creation:** through the creation of off-channel fish habitat (Sections 5.4.1.1 and 5.4.1.2) additional riparian areas will also be created.
- **Removal of barriers to fish passage:** removing fish barriers will enable fish to access areas that may contain suitable habitat for spawning and rearing including areas with intact functional riparian areas (Section 5.4.1.3).

- **Riparian enhancement or restoration:** identifying important areas for fish spawning, rearing, or overwintering in the Quesnel Lake and Edney Creek Watershed and the surrounding area may identify locations that would benefit from riparian enhancement or restoration due to degradation from natural (e.g., wildfire) or anthropogenic (e.g., road creation) events.

5.4.4 Proposed Offsets for Upland Terrestrial Habitat

For the purposes of this RP upland terrestrial habitat means those areas damaged that are not within the streamside riparian zone as defined by the province of BC. Those riparian zone areas are being handled as they would with other aquatic habitat disturbances in the riparian zone.

The remedial objectives for terrestrial habitat are to reforest those areas such that the terrestrial area provides forest on a successional trajectory and associated wildlife habitat. Offsets for the interim losses are based BC forestry model wherein reforestation of clear-cut areas is required. Additionally, for the “use” of the timber values, stumpage fees would be paid to BC. It is proposed that offsets therefore be based on the stumpage fee formula used by BC.

6.0 IMPLEMENTATION AND SCHEDULE

The RP is an integrated plan (Figure 8) that is developed to address both physical damages through direct remediation work and through risk management measures for the introduction of tailings constituents. The implementation of risk management requires ongoing monitoring (e.g., in the case of MNR) to confirm risk expectations and to verify identified areas of scientific uncertainty. In those instances where risks are uncertain (e.g., where conditions at the time of the ERA did not allow such a determination to be reached), MPMC are carrying out specific studies that are adjunct studies to the CEMP. The regulatory oversight for these studies is carried out through the CEMP process. The implementation of habitat remediation work will continue through the HRWG. This group is the logical group for confirmation of habitat credits as verified through monitoring, re-evaluation of offsets owing as monitoring data confirm habitats are functioning as intended. The HRWG will also have the role of evaluating and prioritizing offsetting options to be constructed. MPMC recognize that while the HRWG provides these inputs, the presentation of information and data to that working group remains part of MPMC's long term commitments. It is anticipated that the HRWG may wish to review their TOR for the implementation of the RP.

The implementation of the RP and the scheduling of resources is carried out by MPMC who direct either their own crews or the crews of locally contracted construction firms. Schedules and other matters are determined with greater clarity as the work plans become finalized with the HRWG. A conceptual schedule is provided below in Table 25. It will be subject to change as finalized work plans are concluded, monitoring is carried out and habitat offset balances are recalculated based on survey findings.

The schedule below was developed by MPMC.

Table 25: Conceptual Schedule for Implementation of Remediation

Item	Anticipated Schedule
Remediation Plan	29 March submission
Hazeltine Creek Reach 3	Plans submitted agreed 2018, construction to +3100, remainder summer 2019
Hazeltine Creek Reach 5	2020
Hazeltine Creek/Edney Mouth Re-alignment	2020-2021
Sediment Control Ponds decommissioning designs	2021
Polley Lake Shoreline	2020
Comprehensive Environmental Monitoring Plan (CEMP)	Conditionally Approved 2018, and as updated every 3 years
HRWG Terms of Reference Review (to identify if changes needed for implementation of RP)	2019

We note that the implementation of a remediation plan will normally require monitoring of the outcome of remedial works and adjustments to provide attainment of remedial objectives. A monitoring plan has not been included in this RP because monitoring will be carried out in accordance with the CEMP. The CEMP is currently designed as a tool for permit monitoring and risk management components of the RP. It is proposed that the HRWG develop a habitat-specific monitoring plan because risk management monitoring and habitat function monitoring are typically different technical areas that persons with appropriate technical backgrounds would provide feedback on. This will also fit with the main regulatory oversight for habitat remediation being within the *Fisheries Act* and the *Water Sustainability Act* and regulatory oversight over permit and risk management monitoring being overseen under the *Environmental Management Act*. There are logical linkages that exist within these two technical areas such as construction of habitat and water quality in that habitat. However, those linkages functioned well in making habitat decisions as water quality considerations were a substantial part of decisions on, for example, fish re-introduction into upper Hazeltine Creek (see for instance scope of information provided in Golder 2018b).

7.0 CLOSURE

We trust that this report provides sufficient information for your present needs. If you have any questions, please do not hesitate to contact the undersigned at 604-296-4200.

Signature Page

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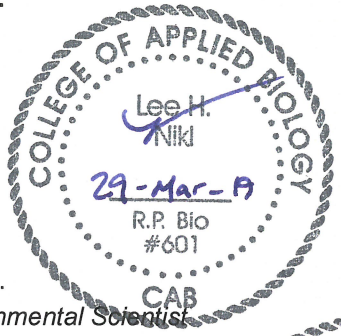

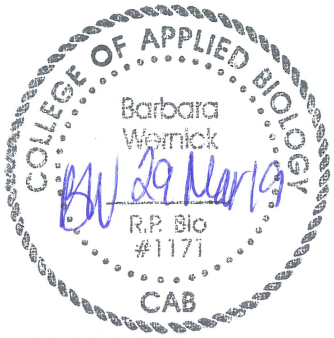

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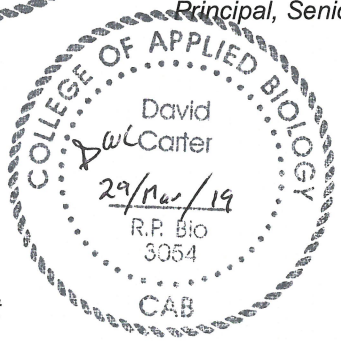

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APPENDIX A

List of Design and Record Drawings Issued for Hazeltine Creek Habitat Remediation

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
001	General Cover Sheet and Drawing List	1	15 June 2017	ISSUED FOR CONSTRUCTION	Golder
010	General General Notes	1	15 June 2017	ISSUED FOR CONSTRUCTION	Golder
050	General Hazeltine Creek Access Roads	1	15 June 2017	ISSUED FOR CONSTRUCTION	Golder
100	Channel Work Alignment and Profile Full Alignment	0	19 November 2015	ISSUED FOR RECORD	Golder
101	Channel Work Alignment and Profile Chainage 0+000 to 1+200	0	19 November 2015	ISSUED FOR RECORD	Golder
102	Channel Work Alignment and Profile Chainage 1+200 to 2+400	0	19 November 2015	ISSUED FOR RECORD	Golder
103	Channel Work Alignment and Profile Chainage 2+400 to 3+600	0	19 November 2015	ISSUED FOR RECORD	Golder
104	Channel Work Alignment and Profile Chainage 3+600 to 4+800	0	19 November 2015	ISSUED FOR RECORD	Golder
105	Channel Work Alignment and Profile Chainage 4+800 to 6+000	0	19 November 2015	ISSUED FOR RECORD	Golder
106	Channel Work Alignment and Profile Chainage 6+000 to 6+600	0	19 November 2015	ISSUED FOR RECORD	Golder
106A	Channel Work Alignment and Profile Chainage 7+775 to 9+068	0	19 November 2015	ISSUED FOR RECORD	Golder
107	Channel Work Typical Meander Pattern Geometry Plan	0	19 November 2015	ISSUED FOR RECORD	Golder

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No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
108	Channel Work Reach 1 Typical Civil Section	0	19 November 2015	ISSUED FOR RECORD	Golder
109	Channel Work Reach 2 Typical Civil Section	0	19 November 2015	ISSUED FOR RECORD	Golder
110	Channel Work Reach 3 Typical Civil Section	0	19 November 2015	ISSUED FOR RECORD	Golder
111	Channel Work Reach 5 Typical Civil Section	0	19 November 2015	ISSUED FOR RECORD	Golder
112	Channel Work Reach 6 (Edney Creek) Typical Civil Section	0	19 November 2015	ISSUED FOR RECORD	Golder
120	Channel Work Hazeltine Creek Temporary Overflow Plan and Profile	0	19 November 2015	ISSUED FOR RECORD	Golder
121	Channel Work Hazeltine Creek Temporary Overflow Sections and Details	0	19 November 2015	ISSUED FOR RECORD	Golder
130	Channel Work Reach 6 (Edney Creek) Shoreline Restoration Plan	0	19 November 2015	ISSUED FOR RECORD	Golder
131	Channel Work Reach 6 (Edney Creek) Shoreline Restoration Sections and Details	0	19 November 2015	ISSUED FOR RECORD	Golder
140	Channel Work Reach 1 Habitat Construction Full Alignment and Profile	1	09 February 2017	ISSUED FOR RECORD	Golder
141	Channel Work Reach 1 Habitat Construction Alignment and Profile (0+200 to 0+600)	1	09 February 2017	ISSUED FOR RECORD	Golder
142	Channel Work Reach 1 Habitat Construction Alignment and Profile (0+600 to 1+000)	1	09 February 2017	ISSUED FOR RECORD	Golder

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
143	Channel Work Reach 1 Habitat Construction Alignment and Profile (1+000 to 1+400)	1	09 February 2017	ISSUED FOR RECORD	Golder
150	Channel Work Reach 2 Habitat Construction Full Alignment and Profile	3	15 December 2017	ISSUED FOR RECORD	Golder
151	Channel Work Reach 2 Habitat Construction Alignment and Profile 1+100 to 1+500	3	15 December 2017	ISSUED FOR RECORD	Golder
152	Channel Work Reach 2 Habitat Construction Alignment and Profile 1+500 to 1+900	3	15 December 2017	ISSUED FOR RECORD	Golder
153	Channel Work Reach 2 Habitat Construction Alignment and Profile 1+900 to 2+300	3	15 December 2017	ISSUED FOR RECORD	Golder
154	Channel Work Reach 2 Habitat Construction Alignment and Profile 2+300 to 2+700	3	15 December 2017	ISSUED FOR RECORD	Golder
155	Channel Work Reach 2 Habitat Construction Detailed Survey, Typical Construction	3	15 December 2017	ISSUED FOR RECORD	Golder
160	Channel Work Reach 3 Habitat Construction Full Alignment and Profile	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
161	Channel Work Reach 3 Habitat Construction Alignment and Profile 2+600 to 3+000	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
162	Channel Work Reach 3 Habitat Construction Alignment and Profile 3+000 to 3+400	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
163	Channel Work Reach 3 Habitat Construction Alignment and Profile 3+400 to 3+800	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
164	Channel Work Reach 3 Habitat Construction Alignment and Profile 3+800 to 4+200	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
165	Channel Work Reach 3 Habitat Construction Alignment and Profile 4+200 to 4+600	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
166	Channel Work Reach 3 Habitat Construction Alignment and Profile 4+600 to 5+000	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
167	Channel Work Reach 3 Habitat Construction Alignment and Profile 5+000 to 5+400	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
168	Channel Work Reach 3 Habitat Construction Alignment and Profile 5+400 to 5+800	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
169	Channel Work Reach 3 Habitat Construction Alignment and Profile 5+800 to 6+200	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
170	Channel Work Reach 3 Habitat Construction Alignment and Profile 6+200 to 6+450	0	31 May 2018	ISSUED FOR CONSTRUCTION	Golder
180	Channel Work Reach 5 Habitat Construction Full Alignment and Profile	A		ISSUED FOR DISCUSSION	Golder
181	Channel Work Reach 5 Habitat Construction Alignment and Profile 7+700 to 8+100	A		ISSUED FOR DISCUSSION	Golder
182	Channel Work Reach 5 Habitat Construction Alignment and Profile 8+100 to 8+500	A		ISSUED FOR DISCUSSION	Golder
201	Channel Work Conceptual Section 5 Years After Planting	0	19 November 2015	ISSUED FOR USE	Envirowest
210	Channel Work Reach 1 Typical Plan Habitat Detail Without Woody Debris	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
211	Channel Work Reach 1 Typical Profile Habitat Detail Weir and Bedload Stabilizer	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
211A	Channel Work Reach 1 Typical Profile Habitat Detail Weir and Bedload Stabilizer	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
212	Channel Work Reach 1 Typical Profile Habitat Detail	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
213	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 1	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
214	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 2	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
215	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 3	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
216	Channel Work Reach 1 Typical Plan Habitat Detail With Woody Debris	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
217	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 1	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
218	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 2	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
219	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 3	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
219A	Channel Work Reach 1 Typical Sections Habitat Detail Sheet 4	0	08 October 2016	ISSUED FOR CONSTRUCTION	Envirowest
220	Channel Work Reach 2 Typical Plan Habitat Detail Without Woody Debris	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
221	Channel Work Reach 2 Typical Plan Habitat Detail Without Woody Debris	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
222	Channel Work Reach 2 Typical Profile Habitat Detail Weir	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
222A	Channel Work Reach 2 Typical Profile Habitat Detail Weir	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
223	Channel Work Reach 2 Typical Profile Habitat Detail Weir	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
223A	Channel Work Reach 2 Typical Profile Habitat Detail Weir and Bedload Stabilizer	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
224	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 1	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
225	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 2	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
226	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 3	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
227	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 4	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
228	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 5	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
229	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 6	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
230	Channel Work Reach 2 Typical Plan Habitat Detail With Woody Debris	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
231	Channel Work Reach 2 Typical Plan Habitat Detail With Woody Debris	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
232	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 1	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
233	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 2	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
234	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 3	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
235	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 4	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
236	Channel Work Reach 2 Typical Sections Habitat Detail Sheet 5	2	15 June 2017	ISSUED FOR CONSTRUCTION	Envirowest
240	Channel Work Reach 3 Typical Plan Habitat Detail Off-Line Pool Weir Without Woody Debris	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
241	Channel Work Reach 3 Typical Profile Habitat Detail Off-Line Pool Weir	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
242	Channel Work Reach 3 Typical Profile Habitat Detail Off-Line Pool Weir	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
243	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 1	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
244	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 2	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
245	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 3	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
246	Channel Work Reach 3	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
	Typical Plan Habitat Detail Off-Line Pool Weir With Woody Debris				
247	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 1	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
248	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 2	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
249	Channel Work Reach 3 Typical Sections Habitat Detail Off-Line Pool Weir Sheet 3	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
250	Channel Work Reach 3 Typical Plan Habitat Detail In-Line Pool Weir Without Woody Debris	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
251	Channel Work Reach 3 Typical Plan Habitat Detail Glide Without Woody Debris	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
252	Channel Work Reach 3 Typical Profile Habitat Detail In-Line Pool Weir	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
253	Channel Work Reach 3 Typical Profile Habitat Detail In-Line Pool Weir and Bedload Stabilizer	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
254	Channel Work Reach 3 Typical Sections Habitat Detail In-Line Pool	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
	Weir Sheet 1				
255	Channel Work Reach 3 Typical Sections Habitat Detail In-Line Pool Weir and Glide Sheet 2	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
256	Channel Work Reach 3 Typical Sections Habitat Detail Glide Sheet 3	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
257	Channel Work Reach 3 Typical Plan Habitat Detail In-Line Pool Weir With Woody Debris	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
258	Channel Work Reach 3 Typical Plan Habitat Detail Glide With Woody Debris	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
259	Channel Work Reach 3 Typical Sections Habitat Detail In-Line Pool Weir Sheet 1	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
260	Channel Work Reach 3 Typical Sections Habitat Detail	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
261	Channel Work Reach 3 Typical Wetland Plan, Profile And Section	1	31 May 2018	ISSUED FOR CONSTRUCTION	Envirowest
262	Channel Work Reach 6 Typical Profile Habitat Detail	0	19 November 2015	ISSUED FOR USE	Envirowest
263	Channel Work Reach 6	0	19 November 2015	ISSUED FOR USE	Envirowest

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
	Typical Sections Habitat Detail Sheet 1				
264	Channel Work Reach 6 Typical Sections Habitat Detail Sheet 2	0	19 November 2015	ISSUED FOR USE	Envirowest
280	Polley Lake Outlet Structure Fish Exclusion at Polley Lake Plan	0	19 November 2015	ISSUED FOR RECORD	Golder
281	Polley Lake Outlet Structure Fish Exclusion at Polley Lake Details (1 of 2)	0	19 November 2015	ISSUED FOR RECORD	Golder
282	Polley Lake Outlet Structure Fish Exclusion at Polley Lake Details (2 of 2)	0	29 September 2015	ISSUED FOR CONSTRUCTION	Golder
283	Fish Exclusion at Reach 2 Reach 2 Plan Sheet 1	1	09 May 2018	ISSUED FOR RECORD	Golder
284	Fish Exclusion at Reach 2 Reach 2 Details (1 of 2) Sheet 2	1	09 May 2018	ISSUED FOR RECORD	Golder
285	Fish Exclusion at Reach 2 Reach 2 Details (2 of 2) Sheet 3	1	09 May 2018	ISSUED FOR RECORD	Golder
290	Polley Lake Outlet Structure Overall General Arrangement Plan	1	08 April 2015	ISSUED FOR RECORD	Golder
300	Polley Lake Outlet Structure Existing Geotechnical Conditions Plan, Elevation, Section	2	08 April 2015	ISSUED FOR RECORD	Golder
301	Polley Lake Outlet Structure General Arrangement and Notes Plan, Elevation, Section	3	08 April 2015	ISSUED FOR RECORD	GEA

No.	Drawing Title	Rev	Issue Date	Issue Purpose	Lead
302	Polley Lake Outlet Structure Weir Structure Plan, Elevation, Section	1	08 April 2015	ISSUED FOR RECORD	GEA
303	Polley Lake Outlet Structure Weir Structure Details	1	08 April 2015	ISSUED FOR RECORD	GEA
304	Polley Lake Outlet Structure Access Walkway Plan, Elevation, Section	2	08 April 2015	ISSUED FOR RECORD	GEA
305	Polley Lake Outlet Structure Access Walkway Details	1	08 April 2015	ISSUED FOR RECORD	GEA
306	Polley Lake Outlet Structure Flashboards Detail	1	08 April 2015	ISSUED FOR RECORD	GEA
310	Polley Lake Outlet Structure Pool-Weir Fishway General Arrangement Plan	0	04 May 2018	ISSUED FOR CONSTRUCTION	Golder
311	Polley Lake Outlet Structure Pool-Weir Fishway Plan and Section	0	04 May 2018	ISSUED FOR CONSTRUCTION	Golder
312	Polley Lake Outlet Structure Pool-Weir Fishway Sections and Detail	0	04 May 2018	ISSUED FOR CONSTRUCTION	Golder

APPENDIX B

Offsetting Ideas Discussion

Appendix C: Offsetting Ideas Tabulated by Rank, Source, Location and Project Description (assembled by MPMC)

Rank	Source	Location	Project Description
1	Richard Holmes	Horsefly River	Various creeks through out the Horsefly watershed can be addressed. Detailed info is available in the FRBC data bank (this is paper copy only). See Appendix D.
2	Richard Holmes	Quesnel River	DFO rearing channels downstream of the Likely Bridge in Likely, BC.
3	Judy Hillaby	Horsefly River	Erosion near Mitchell Bay has high potential to under cut the access road. Would also effect fish passage.
4	Steve Hoxquard	Moffat Creek	Improve bank and channel stability. Preliminary Assessments have been done.
5	Colleen Hughes	Horsefly Spawning Channel	https://www.wltribune.com/community/horsefly-salmon-festival-creates-hopeful-future-for-run/ https://www.wltribune.com/community/horsefly-river-celebrates-sockeye-salmon-run-with-festival-sept-15-to-16/
6	Colleen Hughes	Future	River watcher Camera system (Lee Williston agreed this has potential offset value).

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APPENDIX C

Offsetting Activities - Barrier Removal

Table 1: Potential Habitat Offsetting Activities

UTM V10 Easting	UTM V10 Northing	Stream Name	Potential OffsetArea m²	Habitat Value	Barrier Type	Potential Actions
629036	5790127	Tributary to Tisdal Creek	0.4	Low habitat value	Round Culvert	Remove / Deactivate Crossing
608521	5789299	Tributary to Deerhorn Creek	0.7072	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667223	5788229	Tributary to McKusky	1.8	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
644448	5782473	Tributary to Gifford Creek	1.845	Low habitat value	Round Culvert	Remove / Deactivate Crossing
619736	5804825	Tributary to Horsefly Lake	2.32	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
644343	5782524	Gifford Creek	2.337	Low habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
647524	5802450	Tributary to Horsefly River	2.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667778	5812480	Tributary to Horsefly River	2.45	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619627	5804861	Tributary to Horsefly Lake	2.646	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
623777	5804692	Tributary to Horsefly Lake	2.72	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655477	5791032	Tributary to Crooked Lake	2.775	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
652165	5804957	Tributary to Horsefly River	2.79	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616578	5789961	Tributary to Deerhorn Creek	2.79	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
613736	5804540	Tributary to Little Horsefly Lake	2.79	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604944	5803419	Tributary to Horsefly River	2.85	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
649298	5811275	Tributary to Archie Creek	2.88	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
632935	5787249	Tributary to Tisdall Lake	2.945	Low habitat value	Round Culvert	Remove / Deactivate Crossing
651668	5793449	Tributary to McKee Lake	3.2	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
635892	5786487	Tributary to Tisdall Lake	3.33	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653381	5796283	Tributary to McKusky	3.3425	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
609874	5804163	Tributary to Horsefly River	3.35	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614755	5780375	Tributary to Moffat Creek	3.36	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
613146	5787564	Tributary to Deerhorn Creek	3.395	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607607	5781786	Tributary to Moffat Creek	3.4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607954	5781983	Tributary to Moffat Creek	3.42	Low habitat value	Round Culvert	
612506	5802698	Tributary to Gruhs Lake	3.422	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653814	5816150	Tributary to Horsefly Lake	3.45	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659676	5789476	Tributary to Crooked Lake	3.471	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604727	5791045	Tributary to Moffatt Creek	3.48	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
610978	5797871	Tributary to Horesfly River	3.485	Low habitat value	Round Culvert	Remove / Deactivate Crossing
620355	5794680	Tributary to Horsefly River	3.5	Low habitat value	Round Culvert	Replace with new open bottom structure
601709	5782629	Tributary to Moffat Creek	3.6	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
666828	5813435	Tributary to Horsefly River	3.608	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667377	5796996	Tributary to MacKay River	3.63	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633971	5810567	Tributary to Horsefly Lake	3.65	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
634461	5811949	Tributary to Melissa Lake	3.65	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611137	5797750	Tributary to Horesfly River	3.66	Low habitat value	Round Culvert	Remove / Deactivate Crossing
606438	5794411	Trib to Moffat Creek	3.76	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
605426	5807405	Tributary to Horsefly River	3.76	Low habitat value	Round Culvert	
636152	5787883	Tributary to Tisdall Lake	3.78	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604027	5803249	Tributary to Horsefly River	3.78	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
645561	5787717	Tributary to McKinley Creek	3.8	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
666759	5813368	Tributary to Horsefly River	3.8425	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
620241	5778962	Tributary to Moffat Creek	3.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
642960	5791191	Tributary to McKinley Creek	3.96	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
604682	5791178	Tributary to Moffatt Creek	3.965	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667412	5796996	Tribuatry to Mackay River	3.995	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
666649	5797782	Tributary to MacKay River	3.995	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655839	5790234	Tributary to McKusky	4	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS

651270	5789930	Tributary to McKee Lake	4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616791	5781243	Tributary to Moffat Creek	4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655965	5794049	Tributary to Crooked Lake	4.03	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617102	5778452	Tributary to Moffat Creek	4.04	Medium habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
613455	5781273	Tributary to Moffat Creek	4.05	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614339	5788920	Tributary to Deerhorn Creek	4.068	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
627041	5785630	Trib to Moffat Creek	4.095	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
633877	5786741	Tributary to Tisdall Lake	4.14	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
621804	5803734	Tributary to Horsefly Lake	4.2	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
643441	5814754	Tributary to Viewland Creek	4.24	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611271	5810434	Tributary to Horsefly River	4.24	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
657110	5808270	Tributary to Horsefly River	4.275	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633922	5811033	Tributary to Horsefly Lake	4.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617343	5794652	Tributary to Horsefly River	4.32	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
615557	5812875	Tributary to Niquidet Lake	4.32	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
624689	5792394	Trib to Horsefly River	4.32	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608775	5773518	Tributary to McIntosh Lake	4.35	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
657223	5808382	Tributary to Horsefly River	4.35	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614221	5804599	Tributary to Little Horsefly Lake	4.4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
634950	5787953	Tributary to Tisdall Lake	4.41	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
632849	5780375	Tributary to Moffat Lakes	4.455	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607984	5798591	Tributary to Horsefly River	4.48	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
666477	5813261	Tributary to Horsefly River	4.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622806	5803932	Tributary to Horsefly Lake	4.512	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616229	5802922	Tributary to Horsefly Lake	4.556	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628474	5810503	Tributary to Viewland Creek	4.56	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618340	5777578	Tributary to Moffat Creek	4.56	Medium habitat value	Round Culvert	
651556	5787456	Tributary to Bassett Creek	4.6	Low habitat value	Round Culvert	Remove / Deactivate Crossing
642227	5796891	Tributary to Doreen Creek	4.6	High habitat value	Round Culvert	Remove / Deactivate Crossing
605776	5799058	Tributary to Horsefly River	4.62	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633093	5788858	Tributary to Tisdall Lake	4.68	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
610721	5797864	Tributary to Horesfly River	4.68	Low habitat value	Round Culvert	Remove / Deactivate Crossing
621680	5798179	Tributary to Sucker Creek	4.698	Low habitat value	Round Culvert	Remove / Deactivate Crossing
645095	5790160	Triburtary to McKinley	4.77	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
621190	5795749	Sucker Creek	4.77	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
615651	5808419	Tributary to Niquidet Creek	4.77	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619927	5793997	Trib to Horsefly River	4.774	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
636747	5806200	Prairie Creek	4.8	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
652140	5809944	Tributary to Archie Creek	4.8	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
634582	5781549	Tributary to Moffat Creek	4.838	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
636052	5788298	Tributary to Tisdall Lake	4.845	Low habitat value	Round Culvert	Remove / Deactivate Crossing
612801	5782409	Tributary to Moffat Creek	4.876	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604076	5772518	Tributary to McIntosh Lake	4.902	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607593	5798249	Tributary to Horsefly River	4.928	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
632939	5784170	Tributary to Tisdall Lake	4.95	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
650873	5810243	Tributary to Archie Creek	4.95	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619943	5793571	Trib to Horsefly River	4.95	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
652458	5784933	Tributary to Cruiser Lake	5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
649689	5781316	Tributary to Bosk Lake	5	High habitat value	Round Culvert	Remove / Deactivate Crossing
617598	5792454	Tributary to Woodjam Creek	5	High habitat value	Round Culvert	Replace with new open bottom structure
633086	5787063	Tributary to Tisdall Lake	5.04	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608753	5790556	Tributary to Deerhorn Creek	5.043	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
605513	5788128	Tributary to Mussel Creek	5.044	Low habitat value	Round Culvert	Remove / Deactivate Crossing

616127	5789789	Tributary to Deerhorn Creek	5.096	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
632054	5791857	Tributary to Tisdall Lake	5.1	Low habitat value	Round Culvert	
660144	5802387	Tributary to Mackay River	5.13	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
622291	5792697	Tributary to Horsefly River	5.13	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611747	5784072	Tributary to Mussel Creek	5.15	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628044	5783929	Tributary to Moffat Creek	5.15	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656833	5787257	Tributary to Bassett Creek	5.16	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
601963	5772656	Tributary to McIntosh Lake	5.208	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
649348	5805647	Tributary to Horsefly River	5.225	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630078	5790182	Tributary to Tisdal Creek	5.225	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
637528	5790388	Tributary to Tisdall Creek	5.25	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604467	5793007	Tributary to Moffatt Creek	5.25	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648284	5799690	Tributary to McKusky	5.28	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656180	5809194	Archie Creek	5.28	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611362	5806270	Tributary to Alah Creek	5.3	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
657132	5806304	Tributary to Horsefly River	5.301	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
601577	5782301	Tributary to Moffat Creek	5.31	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611793	5809141	Tributary to Horsefly River	5.36	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
614120	5788477	Tributary to Deerhorn Creek	5.365	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
612676	5781839	Tributary to Moffat Creek	5.4	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
625299	5800295	Tributary to Sucker Creek	5.4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
635478	5780368	Tributary to Moffat Lakes	5.4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651585	5792399	Tributary to McKee Lake	5.46	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
653395	5786311	Tributary to McKinley	5.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630271	5783381	Tributary to Moffat Creek	5.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
613272	5781899	Tributary to Moffat Creek	5.52	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
635354	5780326	Tributary to Moffat Lakes	5.52	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625401	5800274	Tributary to Sucker Creek	5.6	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647577	5799314	Tributary to McKusky	5.67	High habitat value	Round Culvert	Remove / Deactivate Crossing
609384	5802469	Tributary to Little Horsefly River	5.67	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611452	5809767	Tributary to Horsefly River	5.67	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
626132	5790354	Trib to Horsefly River	5.67	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
615201	5808459	Tributary to Douglas Lake	5.67	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659373	5803746	Tributary to Mckay	5.7	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619772	5793798	Trib to Horsefly River	5.723	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
644896	5790646	Triburtary to McKinley	5.796	Low habitat value	Round Culvert	Remove / Deactivate Crossing
609722	5806663	Tributary to Horsefly River	5.82	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630761	5799325	Tributary to Black Creek	5.8275	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607938	5800954	Tributary to Horsefly River	5.83	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
643497	5815129	Tributary to Viewland Creek	5.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
640779	5816295	Tributary to Horsefly Lake	5.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607599	5805267	Tributary to Horselfy River	5.85	Medium habitat value	Round Culvert	
615684	5781465	Tributary to Moffat Creek	5.91	Low habitat value	Round Culvert	Remove / Deactivate Crossing
651115	5781072	Tributary to Bosk Lake	5.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
649587	5805478	Tributary to Horsefly River	5.94	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628876	5790063	Tributary to Tisdal Creek	5.945	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
652707	5788790	Tributary to McKee Lake	6	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
608499	5801347	Tributary to Horsefly River	6	Low habitat value	Oval Culvert	Replace structure with streambed simulation CBS
615487	5811229	Tributary to Niquidet Creek	6.03	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
614506	5789132	Tributary to Deerhorn Creek	6.032	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
650584	5805642	Tributary to Horsefly River	6.11	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
627964	5776525	Tributary to Moffat Creek	6.144	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
621821	5793787	Trib to Horsefly River	6.15	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS

626601	5792471	Trib to Horsefly River	6.18	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651553	5802229	Tributary to Horsefly River	6.24	Low habitat value	Round Culvert	Remove / Deactivate Crossing
617586	5811080	Tributary to Dillabough Lake	6.3	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
614691	5790286	Trib to Deerhorn Creek	6.3	Medium habitat value	Round Culvert	Replace with new open bottom structure
615397	5784794	Tributary to Woodjam Creek	6.3945	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
631035	5789455	Tributary to Tisdal Lake	6.45	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
627329	5786241	Tributary to Moffat Creek	6.461	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651752	5801411	Tributary to Horsefly River	6.468	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
635691	5792423	Tributary to Horsefly River	6.48	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626543	5801380	Tributary to horsefly Lake	6.5	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
608200	5793772	Tributary to Moffat Creek	6.534	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
666897	5787931	Tributary to McKusky	6.57	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
640893	5815702	Tributary to Horsefly Lake	6.57	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
658559	5803967	Tributary to Horsefly River	6.6	Low habitat value	Round Culvert	Remove / Deactivate Crossing
664343	5798983	Tributary to Eureka Creek	6.6	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
635139	5812792	Tributary to Melissa Lake	6.64	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
643506	5805287	Tributary to Sawley	6.66	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
651693	5810171	Tributary to Archie Creek	6.66	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
638271	5787802	Tributary to Tisdall Lake	6.665	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633249	5782877	Tributary to Moffat Creek	6.6825	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
609905	5804157	Tributary to Horsefly River	6.7	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
609972	5801787	Tributary to Little Horsefly River	6.72	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
624837	5804931	Tributary to Horsefly Lake	6.745	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
632927	5785411	Tributary to Tisdall Lake	6.75	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
656513	5807890	Tributary to Horsefly River	6.75	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
612263	5812747	Tributary to Murdock Lakes	6.79	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
637437	5802701	Tributary to Prarie Creek	6.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617602	5810715	Tributary to Dillabough Lake	6.93	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
621506	5778799	Tributary to Moffat Creek	6.935	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
610905	5797857	Tributary to Horesfly River	6.96	Low habitat value	Round Culvert	Remove / Deactivate Crossing
618001	5807650	Tributary to Horsefly Lake	6.96	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611747	5788176	Unnamed	7	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629213	5790375	Tributary to Tisdal Creek	7	Low habitat value	Round Culvert	Remove / Deactivate Crossing
610409	5809128	Tributary to Horsefly River	7	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
633896	5779180	Tributary to Moffat Lakes	7.0125	Medium habitat value	Round Culvert	Add substrate to further imbed the CBS
638559	5804941	Tributary to Prairie Creek	7.015	High habitat value	Round Culvert	Remove / Deactivate Crossing
634383	5792524	Unnamed	7.084	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
658173	5777617	Tributary to Gotchen Lake	7.1	Low habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
600396	5773939	Tributary to McIntosh Lakes	7.1175	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
625933	5800502	Tributary to Sucker Creek	7.2	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625026	5800412	Tributary to Sucker Creek	7.2	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
628170	5776356	Tributary to Moffat Creek	7.221	Low habitat value	Round Culvert	Remove / Deactivate Crossing
658888	5789803	Tributary to McKusky	7.25	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618207	5777567	Tributary to Moffat Creek	7.259	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
613425	5781675	Tributary to Moffat Creek	7.26	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
644173	5784045	Tributary to McKinley Creek	7.28	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667315	5797115	Tributary to MacKay River	7.304	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
621756	5787932	Trib to Moffat Creek	7.315	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
607560	5806115	Tributary to Horselfy River	7.35	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
627084	5784153	Tributary to Moffat Creek	7.36	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656042	5791348	Tributary to Crooked Lake	7.41	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
643327	5806203	Tributary to Sawley	7.41	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
622805	5776303	Tributary to Moffat Creek	7.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS

632225	5779257	Tributary to Moffat Lakes	7.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653421	5810659	Tributary to Teapot Creek	7.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608496	5783337	Tributary to Moffat Creek	7.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617944	5811678	Tributary to Dillabough Lake	7.47	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629766	5809172	Tributary to Horsefly Lake	7.56	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
612706	5808843	Tributary to Horsefly River	7.56	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
638731	5809353	Tributary to Horsefly Lake	7.6	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
645369	5777884	Tributary to Molybdenite Creek	7.622	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
643343	5804994	Tributary to Sawley	7.65	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
626223	5792750	Trib to Horsefly River	7.65	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
640107	5808952	Tributary to horsefly Lake	7.6725	Low habitat value	Round Culvert	Remove / Deactivate Crossing
641403	5809401	Tributary to horsefly Lake	7.68	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
665341	5813548	Tributary to Horsefly River	7.719	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604811	5803964	Tributary to Horsefly River	7.76	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
642992	5782234	Tributary to Molybdenite Creek	7.79	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629005	5782064	Tributary to Moffat Creek	7.82	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
637684	5809301	Tributary to Horsefly Lake	7.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
639214	5809341	Tributary to Horsefly Lake	7.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641490	5809289	Tributary to horsefly Lake	7.84	Low habitat value	Round Culvert	Remove / Deactivate Crossing
614004	5788239	Tributary to Deerhorn Creek	7.904	Medium habitat value	Round Culvert	
657131	5806598	Tributary to Horsefly River	7.912	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622803	5776314	Tributary to Moffat Creek	7.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647777	5806814	Tributary to Harvie	7.98	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625460	5802424	Tributary to Horsefly Lake	7.99	Low habitat value	Round Culvert	Remove / Deactivate Crossing
620262	5798490	Tributary to Sucker Creek	8.16	Low habitat value	Round Culvert	Remove / Deactivate Crossing
658944	5773648	Tributary to McKinley	8.178	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608337	5790289	Tributary to Deerhorn Creek	8.22	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648041	5804065	Tributary to Horsefly River	8.24	Low habitat value	Round Culvert	Remove / Deactivate Crossing
623163	5792763	Trib to Horsefly River	8.24	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
612383	5808019	Tributary to Horsefly River	8.24	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
653490	5811223	Tributary to Teapot Creek	8.277	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
654343	5794079	Tributary to Crooked Lake	8.28	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604913	5781258	Tributary to Moffat Creek	8.28	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
632699	5785715	Tributary to Tisdall Lake	8.28	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
606509	5777506	Tributary to McIntosh Lake	8.357	High habitat value	Round Culvert	
643758	5780633	Gifford Creek	8.36	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655847	5790190	Tributary to McKusky	8.385	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
652427	5804959	Tributary to Horsefly River	8.4	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608287	5789585	Tributary to Deerhorn Creek	8.466	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
644817	5789933	Tributary to McKinley Creek	8.5	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
657953	5779549	Tributary to Gotchen Lake	8.536	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633324	5782704	Tributary to Moffat Creek	8.55	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641814	5804710	Tributary to Sawley	8.55	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
628528	5810959	Tributary to Viewland Creek	8.56	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
616685	5810002	Tributary to Niquidet Creek	8.58	Medium habitat value	Round Culvert	Replace with new open bottom structure
626256	5790533	Trib to Horsefly River	8.64	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
602494	5774688	Tributary to McIntosh Lks	8.664	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
636422	5787030	Tributary to Tisdall Lake	8.68	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616145	5787092	Tributary to Woodjam Creek	8.73	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608929	5799803	Tributary to Horsefly River	8.76	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
668092	5812063	Tributary to Horsefly River	8.815	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608119	5786280	Tributary to Walters Lake	8.82	Medium habitat value	Round Culvert	
619177	5800460	Tributary to Sucker Creek	8.827	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS

658276	5777332	Tributary to Gotchen Lake	8.874	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
605995	5811984	Tributary to Horsefly River	8.906	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633335	5782647	Tributary to Moffat Creek	8.925	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656806	5807936	Tributary to Horsefly River	8.925	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641583	5808845	Tributary to horsefly Lake	8.97	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
648968	5782114	Tributary to Bosk Lake	9	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616235	5789821	Tributary to Deerhorn Creek	9	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630292	5783430	Tributary to Moffat Creek	9	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626341	5792334	Trib to Horsefly River	9	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608424	5806512	Tributary to Horsefly River	9	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
617435	5806636	Tributary to Horsefly Lake	9.04	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
644153	5790411	Tributary to McKinley Creek	9.12	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
604963	5792297	Tributary to Moffatt Creek	9.13	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
631247	5787266	Tributary to Tisdall Lake	9.145	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622610	5803340	Tributary to Horsefly Lake	9.1575	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656725	5806652	Tributary to Horsefly River	9.174	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
618047	5798831	Tributary to Gibbons Creek	9.18	Medium habitat value	Round Culvert	Add substrate to further imbed the CBS
612328	5802688	Tributary to Gruhs Lake	9.23	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
638422	5790905	Tributary to McKinley	9.24	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618917	5802895	Tributary to Horsefly Lake	9.28	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
667590	5812480	Tributary to Horsefly River	9.28	Low habitat value	Round Culvert	
626118	5784256	Trib to Moffat Creek	9.317	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
666546	5813542	Tributary to Horsefly River	9.36	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
608943	5799801	Tributary to Horsefly River	9.38	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648037	5798134	Tributary to McKusky	9.405	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
611465	5807716	Tributary to Horsefly River	9.42	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
620662	5799955	Tributary to Gibbons Creek	9.4905	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653181	5780783	Tributary to Gotchen Lake	9.5	Low habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
646528	5788581	Tributary to Elbow Lake	9.5	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
608404	5785218	Tributary to Cossack Lake	9.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614738	5786302	Tributary to Woodjam Creek	9.5	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
655516	5805017	Tributary to Mackay River	9.6	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656963	5806646	Tributary to Horsefly River	9.646	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
609132	5791625	Tributary to Deerhorn Creek	9.682	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
643914	5786800	Tributary to Molybdenite	9.69	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
658718	5789865	Tributary to Crooked Lake	9.702	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
615284	5787557	Tributary to Deerhorn Creek	9.72	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
640457	5795733	Tributary to Doreen Creek	9.785	High habitat value	Round Culvert	Remove / Deactivate Crossing
646234	5807795	Tributary to Fritz	9.81	High habitat value	Round Culvert	Remove / Deactivate Crossing
627014	5784209	Tributary to Moffat Creek	9.828	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
601943	5775045	Tributary to McIntosh Lake	9.84	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
653176	5785847		9.8875	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
641151	5791406	Tributary to McKinley Lake	9.96	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
640719	5786312	Tributary to Molybdenite	9.975	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629505	5784153	Tributary to Moffat Creek	9.991	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628797	5777961	Tributary to Moffat Creek	10.074	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
642098	5799338	Tributary to Horsefly	10.08	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
615339	5785119	Tributary to Woodjam Creek	10.1505	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
627355	5779542	Tributary to Moffat Creek	10.16	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617213	5795326	Tributary to Gibbons Creek	10.24	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622158	5786182	Tributary to Moffat Creek	10.248	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
649337	5796686	Tributary to McKusky	10.26	Low habitat value	Round Culvert	Remove / Deactivate Crossing
646807	5806842	Tributary to Horsefly River	10.266	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS

613947	5782455	Tributary to Moffat Creek	10.269	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
634227	5786612	Tributary to Tisdall Lake	10.285	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
610031	5801728	Tributary to Little Horsefly River	10.336	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619053	5799568	Tributary to Gibbons Creek	10.35	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
623988	5805297	Tributary to Horsefly Lake	10.395	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641300	5809182	Tributary to horsefly Lake	10.4	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
650994	5805609	Tributary to Horsefly River	10.44	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
614615	5780840	Tributary to Moffat Creek	10.545	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
659563	5809601	Tributary to Horsefly River	10.56	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656640	5779766	Tributary to Gotchen Lake	10.56	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629395	5795569	Tributary to Horsefly River	10.584	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619520	5779044	Tributary to Moffat Creek	10.584	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630531	5777019	Tributary to Moffat Creek	10.584	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
607312	5789951	Tributary to Mussel Creek	10.653	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647908	5800744	Tributary to McKusky	10.67	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
615246	5779685	Tributary to Moffat Creek	10.68	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641415	5808968	Tributary to horsefly Lake	10.72	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
668502	5811416	Tributary to Horsefly River	10.725	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
637550	5802695	Tributary to Prarie Creek	10.8	Low habitat value	Round Culvert	Remove / Deactivate Crossing
637681	5777019	Tributary to Moffat Creek	10.8	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
644497	5802491	Tributary to Horsefly River	10.8	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
606233	5791344	Mussel Creek	10.807	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
644830	5779666	Tributary to Molybdenite Creek	10.812	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
634959	5786457	Tributary to Tisdall Lake	10.85	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
643927	5786878	Tributary to Molybdenite	10.92	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
632511	5799948	Tributary to Black Creek	10.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629491	5783146	Tributary to Moffat Creek	10.925	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651517	5810189	Tributary to Archie Creek	11.005	High habitat value	Round Culvert	Remove / Deactivate Crossing
647419	5806601	Tributary to Harvie Creek	11.02	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
631931	5779355	Tributary to Moffat Lakes	11.0295	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
660015	5802485	Tributary to Mackay River	11.07	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
648988	5801722	Tributary to McKusky Creek	11.07	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
658255	5808939	Tributary to Horsefly River	11.0825	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
646376	5807665	Tributary to Fritz	11.115	High habitat value	Round Culvert	Remove / Deactivate Crossing
620034	5777444	Tributary to Moffat Creek	11.115	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
627479	5784155	Tributary to Moffat Creek	11.118	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
613963	5779014	Tributary to Moffat Creek	11.2	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
665276	5799149	Tributary to MacKay River	11.234	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
644413	5790971	Triburtary to McKinley	11.27	High habitat value	Round Culvert	Remove / Deactivate Crossing
661189	5803163	Tributary to Hawkley Creek	11.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647082	5804651	Tributary to Horsefly River	11.303	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
637037	5794361	Tributary to McKinley	11.31	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
630182	5776998	Tributary to Moffat Creek	11.31	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619060	5778643	Tributary to Moffat Creek	11.316	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625643	5790895	Trib to Horsefly River	11.34	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
612617	5787662	Trib to Deerhorn Creek	11.376	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626897	5809176	Tributary to Viewland Creek	11.43	Medium habitat value	Round Culvert	Replace with new open bottom structure
652527	5804878	Tributary to Horsefly River	11.475	Low habitat value	Round Culvert	Remove / Deactivate Crossing
654573	5779137	Tributary to Gotchen Lake	11.48	Low habitat value	Round Culvert	Remove / Deactivate Crossing
641165	5809994	Tributary to horsefly Lake	11.52	High habitat value	Round Culvert	Remove / Deactivate Crossing
628801	5804381	Tributary to Horsefly Lake	11.55	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
623796	5802640	Tributary to Horsefly Lake	11.56	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
652711	5777872	Tributary to Bosk Lake	11.57	High habitat value	Round Culvert	Remove / Deactivate Crossing

653082	5780751	Tributary to Gotchen Lake	11.61	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653395	5811136	Tributary to Teapot Creek	11.7	Medium habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
651178	5795339	Tributary to McKusky	11.76	Low habitat value	Round Culvert	Remove / Deactivate Crossing
629751	5784537	Tributary to Moffat Creek	11.78	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
627394	5786212	Tributary to Moffat Creek	11.817	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
603855	5791643	Tributary to Moffatt Creek	11.82	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641772	5804411	Tributary to Sawley	11.875	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
650821	5795260	Tributary to McKusky	11.88	Low habitat value	Round Culvert	Remove / Deactivate Crossing
644258	5780185	Gifford Creek	11.88	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
602493	5784058	Tributary to Moffat Creek	11.88	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
619847	5794484	Tributary to Horsefly River	11.89	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
610128	5788772	Tributary to Deerhorn Creek	11.9	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
613138	5776689	Tributary to McIntosh Lake	11.9	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
657136	5806355	Tributary to Horsefly River	11.904	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
607128	5811971	Tributary to Horsefly River	11.931	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
628381	5785020	Tributary to Moffat Creek	11.979	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
613452	5781283	Tributary to Moffat Creek	12	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651997	5809900	Tributary to Archie Creek	12.04	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614535	5781376	Tributary to Moffat Creek	12.1	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
631805	5787567	Tributary to Tisdal Lake	12.103	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
618021	5801759	Tributary to Lemon Lake	12.12	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651981	5802007	Tributary to Horsefly River	12.155	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
648552	5797518	Tributary to McKusky	12.16	High habitat value	Round Culvert	Remove / Deactivate Crossing
654740	5805841	Tributary to Mackay River	12.21	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
640486	5809412	Tributary to Horsefly Lake	12.24	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
652858	5809184	Tributary to Archie Creek	12.2705	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
625134	5776952	Tributary to Moffat Creek	12.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653885	5780009	Tributary to Gotchen Lake	12.42	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
649828	5805660	Tributary to Horsefly River	12.43	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633502	5782466	Tributary to Moffat Creek	12.445	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
630785	5776880	Tributary to Moffat Creek	12.446	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
606647	5791208	Tributary to Mussel Creek	12.462	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625788	5794645	Tributary to Horsefly River	12.474	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626973	5804385	Tributary to Horsefly Lake	12.495	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
665789	5813999	Tributary to Horsefly River	12.5125	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
647702	5805969	Tributary to Harvie Creek	12.6	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
635974	5785627	Tributary to Tisdal Lake	12.6175	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
606864	5799306	Tributary to Harpers Lake	12.665	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
664344	5813694	Tributary to Horsefly River	12.76	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647438	5799902	Tributary to McKusky	12.825	High habitat value	Round Culvert	Remove / Deactivate Crossing
647282	5781573	Tributary to Bosk Lake	12.825	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
654261	5786606	Tributary to Bassett Creek	12.84	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
611182	5793974	Tributary to Deerhorn Creek	12.84	Low habitat value	Round Culvert	Replace with new open bottom structure
632104	5776282	Tributary to Moffat Creek	12.87	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
621154	5787478	Trib to Moffat Creek	12.87	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
647781	5798373	Tributary to McKusky	12.92	High habitat value	Round Culvert	Remove / Deactivate Crossing
667893	5812347	Tributary to Horsefly River	12.972	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622293	5778943	Tributary to Moffat Creek	12.993	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
625576	5788954	Tributary to Horsefly River	13.038	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
603381	5791291	Tributary to Moffatt Creek	13.05	Medium habitat value	Round Culvert	
668276	5811836	Tributary to Horsefly River	13.064	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
622967	5776329	Tributary to Moffat Creek	13.08	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
602392	5783381	Tributary to Moffat Creek	13.108	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS

639842	5787235	Tributary to Molybdenite	13.14	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
605603	5789463	Mussel Creek	13.14	Medium habitat value	Round Culvert	Replace with new open bottom structure
648175	5803944	Tributary to Harvie Creek	13.16	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
652852	5806140	Tributary to Horsefly River	13.2	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
637467	5776965	Tributary to Moffat Creek	13.2	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
642642	5804164	Tributary to Sawley	13.2	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
637924	5800374	Tributary to Prarie Creek	13.23	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648613	5787969	Tributary to Elbow Lake	13.248	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
604547	5805159	Tributary to Horsefly River	13.36	High habitat value	Round Culvert	Replace with new open bottom structure
647599	5798667	Tributary to McKusky	13.39	High habitat value	Round Culvert	Remove / Deactivate Crossing
631419	5789290	Tributary to Tisdal Lake	13.39	High habitat value	Round Culvert	Add substrate to further imbed the CBS
659798	5802876	Tributary to Mckay	13.42	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
621951	5786007	Tributary to Moffat Creek	13.5	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
653941	5811337	Tributary to Teapot Creek	13.53	Low habitat value	Round Culvert	Remove / Deactivate Crossing
623447	5780605	Tributary to Moffat Creek	13.68	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
616978	5778442	Tributary to Moffat Creek	13.68	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
608339	5794926	Tributary to Moffat Creek	13.72	Low habitat value	Round Culvert	Replace with new open bottom structure
615945	5778592	Tributary to Moffat Creek	13.802	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
608128	5800143	Tributary to Horsefly River	13.804	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618040	5798813	Tributary to Gibbons Creek	13.855	Medium habitat value	Round Culvert	Add substrate to further imbed the CBS
625131	5801761	Tributary to Horsefly Lake	13.855	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
661025	5801286	Tributary to Mackay River	13.86	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
643479	5773806	Tributary to Molybdenite Cr	13.865	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
634598	5786480	Tributary to Tisdall Lake	13.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
611178	5806280	Alah Creek	14	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626452	5794687	Tributary to Horsefly River	14.04	Low habitat value	Round Culvert	Add substrate to further imbed the CBS
636944	5803720	Tributary to Prarie Creek	14.08	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
630892	5776926	Tributary of Moffat Lake	14.2	Low habitat value	Round Culvert	Replace with new open bottom structure
649318	5789318	Tributary to Elbow Lake	14.268	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
655466	5786956	Tributary to Bassett Creek	14.3	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
598272	5780372	Trib to Moffat Creek	14.3	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
628315	5777931	Tributary to Moffat Creek	14.31	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
633620	5782493	Tributary to Moffat Creek	14.35	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
651274	5805582	Tributary to Horsefly River	14.375	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
636562	5791025	Tributary to McKinley	14.7	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
620704	5778932	Tributary to Moffat Creek	14.7	Medium habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
649940	5796340	Tributary to McKusky	14.725	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
626423	5801336	Tributary to horsefly Lake	14.76	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
654849	5802982	Tributary to Horsefly River	14.775	High habitat value	Round Culvert	Remove / Deactivate Crossing
649650	5781829	Tributary to Bosk Lake	14.84	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
622256	5778894	Tributary to Moffat Creek	14.931	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628656	5777950	Tributary to Moffat Creek	15.015	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
652284	5802048	Tributary to Horsefly River	15.045	High habitat value	Round Culvert	Remove / Deactivate Crossing
659859	5811417	Tributary to Horsefly River	15.08	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628221	5784799	Tributary to Moffat Creek	15.096	High habitat value	Round Culvert	
638968	5804841	Tributary to Prairie Creek	15.12	High habitat value	Round Culvert	Remove / Deactivate Crossing
630293	5777040	Tributary to Moffat Creek	15.21	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618550	5779135	Tributary to Moffat Creek	15.228	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
618296	5800980	Tributary to Gibbons Creek	15.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659775	5802786	Tributary to Mackay River	15.3	High habitat value	Round Culvert	Replace with new open bottom structure
639729	5806171	Tributary to Prairie Creek	15.375	High habitat value	Round Culvert	Remove / Deactivate Crossing
649196	5798426	Tributary to McKusky	15.375	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
627299	5779621	Tributary to Moffat Creek	15.45	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS

652292	5809932	Tributary to Archie Creek	15.51	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
623528	5780398	Tributary to Moffat Creek	15.58	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
660461	5802710	Tributary to Mckay	15.6	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
635645	5786545	Tributary to Tisdall Lake	15.6	Medium habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
666168	5813865	Tributary to Horsefly River	15.655	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
611493	5807617	Tributary to Horsefly River	15.76	High habitat value	Round Culvert	Replace with new open bottom structure
656947	5787353	Tributary to Bassett Creek	15.84	Low habitat value	Round Culvert	Remove / Deactivate Crossing
603069	5789462	Tributary to Moffat Creek	15.95	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
652357	5799946	Tributary to McKusky Creek	15.975	High habitat value	Round Culvert	Remove / Deactivate Crossing
614361	5791193	Tributary to Woodjam Creek	16	Medium habitat value	Round Culvert	Replace with new open bottom structure
610828	5792938	Tributary to Deerhorn Creek	16.15	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
640584	5779607	Tributary to Buster Lake	16.15	Medium habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
654281	5810055	Tributary to Archie Creek	16.2345	High habitat value	Round Culvert	Remove / Deactivate Crossing
654761	5802945	Tributary to Horsefly River	16.2525	Low habitat value	Round Culvert	Remove / Deactivate Crossing
653287	5811023	Tributary to Teapot Creek	16.32	Medium habitat value	Round Culvert	Replace with new open bottom structure
652922	5792060	Tributary to Elbow Lake	16.32	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
651775	5805610	Tributary to Horsefly River	16.33	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
649419	5805318	Tributary to Horsefly River	16.43	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
622339	5794751	Tributary to Horsefly River	16.48	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659665	5803565	Tributary to Mckay	16.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
609435	5787922	Trib to Deerhorn Creek	16.544	Medium habitat value	Round Culvert	Replace with new open bottom structure
650094	5796195	Tributary to McKusky	16.56	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
639728	5808887	Tributary to Horsefly Lake	16.64	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
631390	5787079	Tributary to Tisdall Lake	16.66	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
607200	5812578	Tributary to Horsefly River	16.728	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
651813	5810236	Tributary to Archie Creek	16.7825	High habitat value	Round Culvert	Remove / Deactivate Crossing
661661	5813429	Tributary to Horsefly River	16.8	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
625466	5790459	Trib to Horsefly River	16.8	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
641000	5786263	Tributary to Molybdenite	16.8025	High habitat value	Round Culvert	Add substrate to further imbed the CBS
609831	5785813	Tributary to Mussel Creek	16.892	High habitat value	Oval Culvert	Replace structure with streambed simulation CBS
613468	5780731	Tributary to Moffat Creek	16.92	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
629019	5804336	Tributary to Horsefly Lake	17.01	High habitat value	Round Culvert	Remove / Deactivate Crossing
608969	5797126	Tributary to Moffatt Creek	17.1	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648721	5805641	Tributary to Horsefly River	17.145	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655375	5778465	Tributary to Gotchen Lake	17.16	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
641246	5796094	Tributary to Doreen Creek	17.28	High habitat value	Round Culvert	Remove / Deactivate Crossing
645200	5778731	Tributary to Molybdenite Creek	17.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648164	5782761	Tributary to Bosk Lake	17.324	Medium habitat value	Round Culvert	Replace with new open bottom structure
647340	5781736	Tributary to Bosk Lake	17.43	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
643338	5784209	Tributary to Molybdenite Creek	17.5175	High habitat value	Round Culvert	Remove / Deactivate Crossing
607279	5789952	Tributary to Mussel Creek	17.536	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
602804	5776395	Tributary to McIntosh Lakes	17.6175	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
642185	5799929	Tributary to Horsefly	17.64	High habitat value	Round Culvert	Remove / Deactivate Crossing
652774	5782653	Tributary to Bosk Lake	17.68	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
621594	5776459	Tributary to Moffat Creek	17.856	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
613942	5804690	Tributary to Little Horsefly Lake	17.92	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
655630	5807114	Tributary to Horsefly River	17.98	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
655189	5806371	Tributary to Horsefly River	18	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
647333	5781641	Tributary to Bosk Lake	18.1	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
617234	5793109	Tributary to Woodjam Creek	18.18	High habitat value	Round Culvert	Replace with new open bottom structure
643919	5780393	Gifford Creek	18.231	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
620606	5803381	Tributary to Horsefly Lake	18.24	Medium habitat value	Round Culvert	Replace with new open bottom structure
636291	5786993	Tributary to Tisdall Lake	18.46	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS

619670	5781027	Tributary to Woodjam Creek	18.59	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641149	5809596	Tributary to horsefly Lake	18.59	High habitat value	Round Culvert	Remove / Deactivate Crossing
651834	5777534	Tributary to Bosk Lake	18.7	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
654477	5787540	Tributary to Bassett Creek	18.7	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
667293	5812403	Tributary to Horsefly River	18.72	Medium habitat value	Round Culvert	
651889	5792771	Tributary to McKee Lake	18.8	High habitat value	Round Culvert	
647207	5801739	Tributary to McKusky	19.065	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
666792	5797511	Tributary to MacKay River	19.074	High habitat value	Oval Culvert	Replace structure with streambed simulation CBS
647834	5803433	Tributary to Horsefly River	19.2	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
656565	5791046	Tributary to Crooked Lake	19.203	High habitat value	Oval Culvert	Replace with new open bottom structure
655169	5786917	Tributary to Bassett Creek	19.21	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
647183	5806885	Tributary to Harvie Creek	19.44	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
640601	5783358	Tributary to Molybdenite Creek	19.475	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
643365	5801380	Tributary to Horsefly River	19.5	Medium habitat value	Round Culvert	
612010	5811556	Tributary to Niquidet Creek	19.5	Medium habitat value	Round Culvert	Replace with new open bottom structure
641293	5789800	Tributary to McKinley	19.63	High habitat value	Round Culvert	Remove / Deactivate Crossing
649542	5790833	Tributary to Elbow Lake	19.8	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
654957	5791788	Tributary to Crooked Lake	20	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
665435	5813565	Tributary to Horsefly River	20.28	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
645547	5778025	Tributary to Molybdenite Creek	20.44	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
645948	5808112	Tributary to Fritz	20.58	High habitat value	Round Culvert	Replace with new open bottom structure
664324	5799030	Tributary to Eureka Creek	20.7	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
636357	5785019	Tributary to Tisdal Lake	20.875	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
653703	5788766	Tributary to Bassett Creek	21	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
599516	5781563	Trib to Moffat Creek	21.07	High habitat value	Round Culvert	Replace with new open bottom structure
608478	5802353	Vedder Creek	21.122	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
658880	5775882	Tributary to Gotchen Lake	21.42	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
654869	5789630	Tributary to Bassett Creek	21.45	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
645518	5783040	Gifford Creek	21.84	Medium habitat value	Round Culvert	Replace with new open bottom structure
631308	5800923	Tributary to Horsefly Lake	21.8925	High habitat value	Round Culvert	Remove / Deactivate Crossing
631478	5779402	Tributary to Moffat Lakes	21.9375	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
641489	5800227	Tributary to Horsefly River	21.97	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
658562	5779131	Tributary to Gotchen Lake	22.2	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
629550	5795681	Tributary to Black Creek	22.532	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
608198	5789597	Tributary to Deerhorn Creek	22.54	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
647667	5801073	Tributary to McKusky	22.61	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
653820	5811284	Tributary to Teapot Creek	22.61	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
629014	5804701	Tributary to Horsefly Lake	22.655	High habitat value	Round Culvert	Remove / Deactivate Crossing
635607	5776367	Tributary to Moffat Creek	22.839	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
652548	5777874	Tributary to Bosk Lake	23	High habitat value	Round Culvert	Remove / Deactivate Crossing
658375	5779464	Tributary to Gotchen Lake	23.068	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
614618	5811897	Niquidet Creek	23.1	Medium habitat value	Round Culvert	Replace with new open bottom structure
624953	5801570	Tributary to Horsefly Lake	23.2375	High habitat value	Round Culvert	Remove / Deactivate Crossing
602448	5783636	Tributary to Moffat Creek	23.415	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
655130	5791788	Tributary to Crooked Lake	23.76	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
654356	5789113	Tributary to Bassett Creek	24	High habitat value	Round Culvert	Replace with new open bottom structure
628426	5779070	Tributary to Moffat Creek	24.03	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
627079	5804358	Tributary to Horsefly Lake	24.1875	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
650817	5797473	Tributary to McKusky	24.3	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
620227	5803222	Tributary to Horsefly Lake	24.32	Medium habitat value	Round Culvert	Replace with new open bottom structure
653426	5780516	Tributary to Gotchen Lake	24.7	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
628494	5804487	Tributary to Horsefly Lake	24.96	High habitat value	Round Culvert	Remove / Deactivate Crossing
652026	5799353	Tributary to McKusky Creek	24.97	High habitat value	Round Culvert	Remove / Deactivate Crossing

656672	5790969	Tributary to Crooked Lake	24.975	High habitat value	Oval Culvert	Replace with new open bottom structure
641366	5788836	Tributary to McKinley	25	Low habitat value	Round Culvert	Remove / Deactivate Crossing
644494	5782322	Gifford Creek	25.06	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
666644	5813094	Tributary to Horsefly River	25.071	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
636834	5804280	Tributary to Prarie Creek	25.3	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
651672	5799818	Tributary to McKusky Creek	25.65	High habitat value	Round Culvert	Remove / Deactivate Crossing
616873	5794727	Tributary to Horsefly River	25.92	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
619757	5780972	Tributary to Woodjam Creek	26.1775	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
652188	5803660	Tributary to Horsefly River	26.3	High habitat value	Round Culvert	Remove / Deactivate Crossing
608077	5800781	Tributary to Horsefly River	26.46	High habitat value	Round Culvert	Replace with new open bottom structure
648099	5800144	Tributary to McKusky	26.474	High habitat value	Round Culvert	Replace with new open bottom structure
607651	5813531	Tributary to Horsefly River	26.564	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
623210	5775749	Tributary to Moffat Creek	26.586	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
627696	5804086	Tributary to Horsefly Lake	26.825	High habitat value	Round Culvert	Remove / Deactivate Crossing
631948	5786864	Tributary to Tisdall Lake	26.88	High habitat value	Round Culvert	Remove / Deactivate Crossing
642191	5796817	Tributary to Doreen Creek	27.12	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
640017	5779083	Tributary to Buster Lake	27.5625	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
653122	5792097	Tributary to Elbow Lake	27.68	High habitat value	Round Culvert	Replace with new open bottom structure
617864	5785563	Tributary to Woodjam Creek	27.69	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
632761	5798158	Tributary to Black Creek	28.16	Low habitat value	Round Culvert	Remove / Deactivate Crossing
651795	5805651	Tributary to Horsefly River	28.175	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
627680	5779042	Tributary to Moffat Creek	28.56	Low habitat value	Round Culvert	Replace with new open bottom structure
643945	5774311	Tributary to Molybdenite Creek	28.9	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
635417	5797479	Tributary to Horsefly River	28.98	High habitat value	Round Culvert	Replace with new open bottom structure
653042	5809353	Tributary to Archie Creek	29	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
654914	5787559	Tributary to Bassett Creek	29.25	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
641889	5808563	Tributary to horsefly Lake	29.415	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
655552	5790561	Tributary to Crooked Lake	29.575	High habitat value	Round Culvert	Replace with new open bottom structure
651807	5777454	Tributary to Divan Creek	30	Medium habitat value	Round Culvert	Replace with new open bottom structure
658600	5776456	Tributary to Gotchen Lake	30	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
637997	5786455	Tributary to Molybdenite Creek	30.52	High habitat value	Round Culvert	Remove / Deactivate Crossing
655538	5777458	Tributary to McKinley Creek	30.523	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
623886	5786538	Tributary to Moffat Creek	31.2	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
644959	5802661	Unnamed	31.2	Medium habitat value	Round Culvert	
627037	5776826	Tributary to Moffat Creek	31.35	Medium habitat value	Round Culvert	Add substrate to further imbed the CBS
639797	5787982	Tributary to Molybdenite	31.45	High habitat value	Oval Culvert	
641986	5808479	Tributary to horsefly Lake	32.22	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
648254	5798026	Tributary to McKusky	32.24	High habitat value	Round Culvert	Remove / Deactivate Crossing
628788	5779613	Tributary to Moffat Creek	32.34	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
646393	5785277	Tributary to McKinley	32.375	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
640450	5783131	Tributary to Molybdenite Creek	32.4	High habitat value	Round Culvert	Replace with new open bottom structure
620347	5794693	Tributary to Horsefly River	32.5	Low habitat value	Round Culvert	Replace with new open bottom structure
647100	5806662	Tributary to Harvie Creek	32.76	High habitat value	Round Culvert	Replace with new open bottom structure
641828	5786280	Tributary to Molybdenite	32.89	Medium habitat value	Round Culvert	Replace with new open bottom structure
597618	5777423	Blue Moon Creek	33.18	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
647783	5807025	Tributary to Harvie Creek	33.3	High habitat value	Round Culvert	Remove / Deactivate Crossing
655521	5779282	Tributary to Gotchen Lake	33.46	Medium habitat value	Round Culvert	Replace with new open bottom structure
654345	5793723	Tributary to Crooked Lake	33.84	High habitat value	Round Culvert	Replace with new open bottom structure
627844	5804470	Tributary to Horsefly Lake	33.88	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
621475	5776952	Tributary to Moffat Creek	34.344	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
623522	5776516	Tributary to Moffat Creek	34.76	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
648109	5762678	Tributary to Bosk Lake	35.28	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
654361	5809922	Archie Creek	35.62	High habitat value	Round Culvert	Remove / Deactivate Crossing

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642745	5788825	Tributary to McKinley	35.815	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
654794	5779227	Tributary to Gotchen Lake	35.84	Medium habitat value	Round Culvert	Replace with new open bottom structure
633423	5775985	Tributary to Moffat Creek	36.3	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
650203	5796033	Tributary to McKusky	37.05	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
652383	5804459	Tributary to Horsefly River	37.2	High habitat value	Round Culvert	Replace with new open bottom structure
621240	5785485	Tributary to Moffat Creek	37.4	High habitat value	Round Culvert	Replace with new open bottom structure
623284	5804264	Tributary to Horsefly Lake	37.8	Low habitat value	Round Culvert	Replace with new open bottom structure
645604	5807444	Tributary to Fritz	37.94	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
636131	5776468	Tributary to Moffat Creek	37.944	High habitat value	Round Culvert	Replace with new open bottom structure
652653	5784070	Cruiser Creek	37.9475	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
648563	5804582	Harvie Creek	38.08	High habitat value	Wood Box Culvert	
652950	5809966	Tributary to Archie Creek	38.2	High habitat value	Round Culvert	Replace with new open bottom structure
617897	5804542	Tributary to Horsefly Lake	39.26	Medium habitat value	Oval Culvert	Replace with new open bottom structure
656593	5779753	Tributary to Gotchen Lake	39.375	High habitat value	Round Culvert	Replace with new open bottom structure
650818	5785556	Tributary to Cruiser Lake	40.08	Medium habitat value	Round Culvert	Replace with new open bottom structure
664138	5799079	Imperial Creek	40.6	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
609915	5804389	Tributary to Horsefly River	40.95	Medium habitat value	Round Culvert	Replace with new open bottom structure
662651	5801197	Tributary to Mackay River	41.21	High habitat value	Round Culvert	Replace with new open bottom structure
623645	5787770	Trib to Moffat Creek	41.4	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
637255	5776941	Tributary to Moffat Creek	42	Medium habitat value	Round Culvert	Replace with new open bottom structure
607754	5799142	Tributary to Horsefly River	42.18	Medium habitat value	Round Culvert	Replace with new open bottom structure
649257	5781263	Tributary to Bosk Lake	42.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
638489	5804969	Tributary to Prairie Creek	42.72	High habitat value	Round Culvert	Remove / Deactivate Crossing
618269	5796653	Sucker Creek	44.52	Medium habitat value	Round Culvert	Replace with new open bottom structure
656414	5779677	Tributary to Gotchen Lake	44.73	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659032	5779400	Tributary to Gotchen Lake	45.346	High habitat value	Round Culvert	Remove / Deactivate Crossing
653349	5806394		45.7405	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
611078	5809212	Tributary to Horsefly River	46	Low habitat value	Round Culvert	Replace with new open bottom structure
656380	5786958	Tributary to Bassett Creek	46.3	High habitat value	Round Culvert	Replace with new open bottom structure
602615	5781929	Blue Moon Creek	46.4	Medium habitat value	Round Culvert	Replace with new open bottom structure
659688	5803516	Tributary to Mckay	47.25	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
612544	5796650	Sucker Creek	47.4	Medium habitat value	Round Culvert	Replace with new open bottom structure
656367	5818523	Tributary to Horsefly Lake	48.9	High habitat value	Round Culvert	Install downstream weir(s) to backwater CBS
629052	5795454	Wilmot Creek	49.2	Medium habitat value	Round Culvert	Replace with new open bottom structure
652884	5788712	Tributary to McKee Lake	50.15	High habitat value	Round Culvert	Replace with new open bottom structure
656744	5787058	Tributary to Bassett Creek	50.895	High habitat value	Round Culvert	Remove / Deactivate Crossing
645843	5808175	Tributary to Fritz	51.909	High habitat value	Round Culvert	Replace with new open bottom structure
652389	5804443	Tributary to Horsefly River	52.08	High habitat value	Round Culvert	Replace with new open bottom structure
640724	5799547	Tributary to Horsefly	54.34	High habitat value	Round Culvert	Remove / Deactivate Crossing
617294	5808677	Tributary to Dillabough Lake	55.44	Medium habitat value	Round Culvert	Replace with new open bottom structure
642815	5773511	Tributary to Molybdenite Cr	56.5	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
659939	5802526	Tributary to Mackay River	56.658	High habitat value	Round Culvert	Replace with new open bottom structure
640360	5784443	Tributary to Molybdenite Creek	57.66	High habitat value	Round Culvert	Replace with new open bottom structure
625983	5804692	Tributary to Horsefly Lake	58.5	High habitat value	Round Culvert	Replace with new open bottom structure
613541	5795762	Tributary to Horsefly River	58.65	Low habitat value	Round Culvert	Replace with new open bottom structure
655721	5791508	Tributary to Crooked Lake	63	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
646000	5774554	Tributary to Molybdenite Creek	63	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
662631	5800267	Tributary to Imperial Creek	63.41	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
648164	5781102	Tributary to Bosk Lake	63.7	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
609766	5801977	Tributary to Little Horsefly River	64	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
660042	5802684	Tributary to Imperial Creek	64	Medium habitat value	Round Culvert	Replace with new open bottom structure
631736	5779321	Tributary to Moffat Lakes	70.08	High habitat value	Round Culvert	Replace with new open bottom structure
611230	5793832	Deerhorn Creek	71.004	High habitat value	Round Culvert	

GOLDER

640502	5783895	Tributary to Molybdenite Creek	71.46	High habitat value	Round Culvert	Replace with new open bottom structure
665442	5787644	Tributary to McKusky	72.756	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
629989	5795673	Tributary to Black Creek	72.8	High habitat value	Round Culvert	Replace with new open bottom structure
624767	5802148	Tributary to Horsefly Lake	76.08	Low habitat value	Round Culvert	Replace with new open bottom structure
649764	5790198	Bassett Creek	79.5	High habitat value	Oval Culvert	Replace with new open bottom structure
661274	5801438	Tributary to Imperial Creek	80.75	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
643841	5806143	Tributary to Sawley	85.785	Low habitat value	Round Culvert	Replace structure with streambed simulation CBS
626175	5802440	Tributary to Horsefly Lake	87.885	Medium habitat value	Round Culvert	Remove / Deactivate Crossing
647936	5783359	Gifford Creek	90	Medium habitat value	Round Culvert	Replace with new open bottom structure
652005	5784148	Tributary to Bosk Lake	90	Medium habitat value	Round Culvert	Replace with new open bottom structure
652667	5810000	Tributary to Archie Creek	100	Low habitat value	Round Culvert	Replace with new open bottom structure
614280	5802574	Tributary to Horsefly Lake	101.616	Medium habitat value	Round Culvert	Replace with new open bottom structure
647571	5799069	Tributary to McKusky	106.2	High habitat value	Round Culvert	Remove / Deactivate Crossing
659655	5801754	Tributary to MacKay River	107.25	High habitat value	Round Culvert	Remove / Deactivate Crossing
653524	5786240	Tributary to Cruiser Lake	108	Low habitat value	Round Culvert	
648599	5780135	Tributary to Bosk Lake	117.75	High habitat value	Round Culvert	Remove / Deactivate Crossing
653892	5816009	Tributary to Horsefly Lake	119.25	High habitat value	Round Culvert	Replace structure with streambed simulation CBS
638231	5800280	Prairie Creek	122.4	High habitat value	Wood Box Culvert	
618902	5796880	Tributary to Sucker Creek	139.2	Medium habitat value	Round Culvert	Replace structure with streambed simulation CBS
		Total	11944.1397			

APPENDIX D

Habitat Equivalency Assessment Calculations

VISUAL_HEA HABITAT EQUIVALENCY ANALYSIS

Sitename: Middle Edney

Date: 2019-03-11 10:26:46 AM
Datafile: C:\\Users\\mbenrabah\\Desktop\\HEA\\HEA Lower Hazeltine H2.hea

Units: sq. m
Time units: year

Claim year: 2014
Amount of affected units: 1350
Pre-injury service level (%): 100.00%
Pre-restoration service level (%): 50.00%
Value ratio injured/restored: 1.00
Discount rate per unit of time(%): 3.000

Service losses at the Injury Area

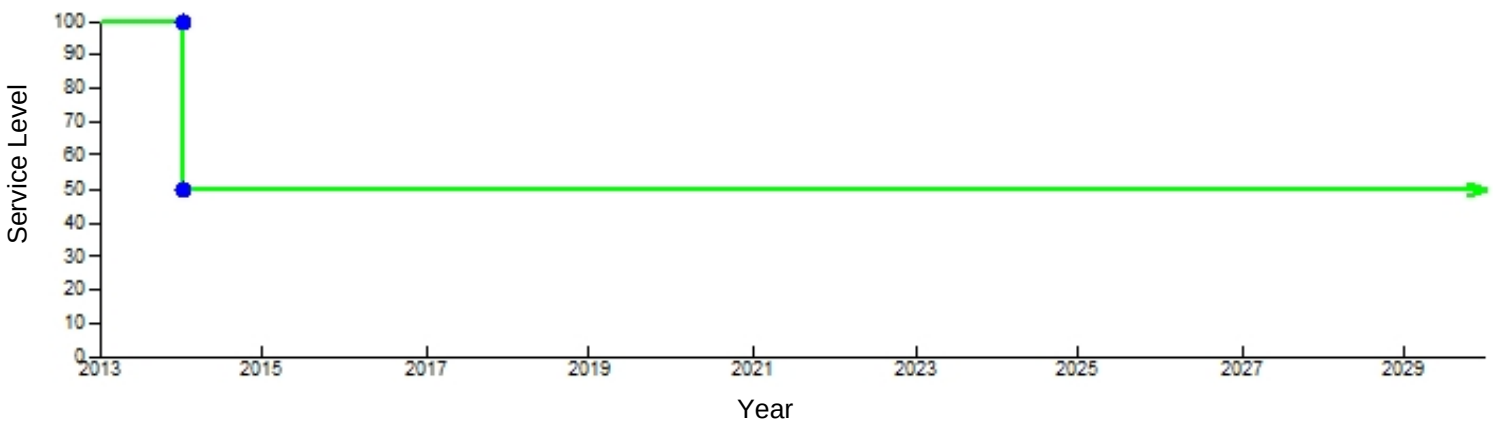

Service Gains at the Compensatory Area

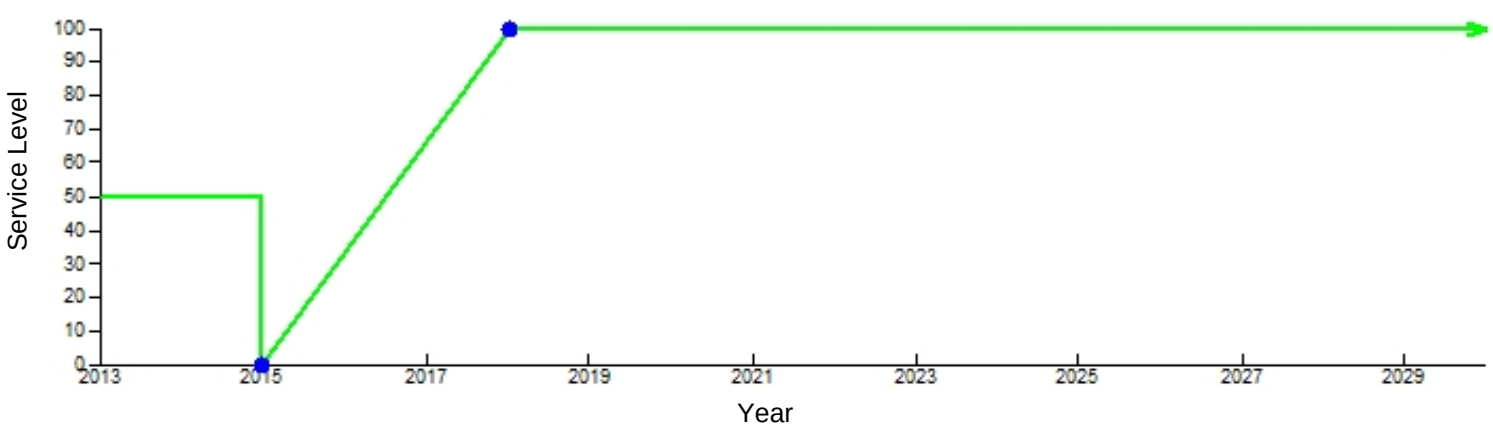

Service losses at the Injury Area

Year	% Services lost					
	Beginning	End	Mean	Raw SUYs lost	Discount Factor	Discounted SUYs lost
2014	.00%	50.00%	25.00%	337.500	1.000	337.500
2015	50.00%	50.00%	50.00%	675.000	0.971	655.340
2016	50.00%	50.00%	50.00%	675.000	0.943	636.252
2017	50.00%	50.00%	50.00%	675.000	0.915	617.721
2018	50.00%	50.00%	50.00%	675.000	0.888	599.729
2019	50.00%	50.00%	50.00%	675.000	0.863	582.261
2020	50.00%	50.00%	50.00%	675.000	0.837	565.302
2021	50.00%	50.00%	50.00%	675.000	0.813	548.837
2022	50.00%	50.00%	50.00%	675.000	0.789	532.851
2023	50.00%	50.00%	50.00%	675.000	0.766	517.331
2024	50.00%	50.00%	50.00%	675.000	0.744	502.263
2025	50.00%	50.00%	50.00%	675.000	0.722	487.634
2026	50.00%	50.00%	50.00%	675.000	0.701	473.431
2027	50.00%	50.00%	50.00%	675.000	0.681	459.642
2028	50.00%	50.00%	50.00%	675.000	0.661	446.255
2029	50.00%	50.00%	50.00%	675.000	0.642	433.257
2030	50.00%	50.00%	50.00%	675.000	0.623	420.638
Beyond						14021.256

Total Discounted Service Unit Years (DSUYs) lost: 22837.500

Service Gains at the Compensatory Area

Year	% Services gained					
	Beginning	End	Mean	Raw SUYs lost	Discount Factor	Discounted SUYs gained
2015	.00%	33.33%	-33.33%	-450.000	0.971	-436.893
2016	33.33%	66.67%	0.00%	0.000	0.943	0.000
2017	66.67%	100.00%	33.33%	450.000	0.915	411.814
2018	100.00%	100.00%	50.00%	675.000	0.888	599.729
2019	100.00%	100.00%	50.00%	675.000	0.863	582.261
2020	100.00%	100.00%	50.00%	675.000	0.837	565.302
2021	100.00%	100.00%	50.00%	675.000	0.813	548.837
2022	100.00%	100.00%	50.00%	675.000	0.789	532.851
2023	100.00%	100.00%	50.00%	675.000	0.766	517.331
2024	100.00%	100.00%	50.00%	675.000	0.744	502.263
2025	100.00%	100.00%	50.00%	675.000	0.722	487.634
2026	100.00%	100.00%	50.00%	675.000	0.701	473.431
2027	100.00%	100.00%	50.00%	675.000	0.681	459.642
2028	100.00%	100.00%	50.00%	675.000	0.661	446.255
2029	100.00%	100.00%	50.00%	675.000	0.642	433.257
2030	100.00%	100.00%	50.00%	675.000	0.623	420.638
Beyond						14021.256

Total Discounted Service Unit Years (DSUYs) Gained: 20565.608

Discounted SUYs gained per unit: 15.234

Replacement habitat size (sq. m): 1.00 * 22837.5/15.234 1499.135

VISUAL_HEA HABITAT EQUIVALENCY ANALYSIS

Sitename: Upper Hazeltine (H1)

Date: 2019-03-11 10:29:54 AM
Datafile: C:\\Users\\mbenrabah\\Desktop\\HEA\\HEA Lower Hazeltine H2.hea

Units: sq. m
Time units: year

Claim year: 2014
Amount of affected units: 44650
Pre-injury service level (%): 100.00%
Pre-restoration service level (%): 0.00%
Value ratio injured/restored: 1.00
Discount rate per unit of time(%): 3.000

Service losses at the Injury Area

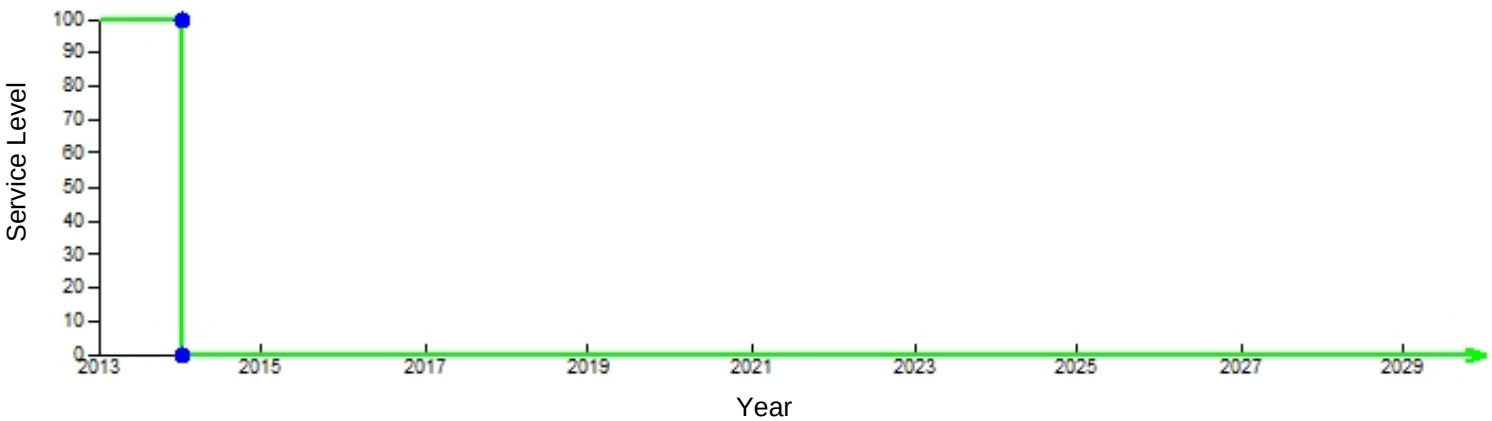

Service Gains at the Compensatory Area

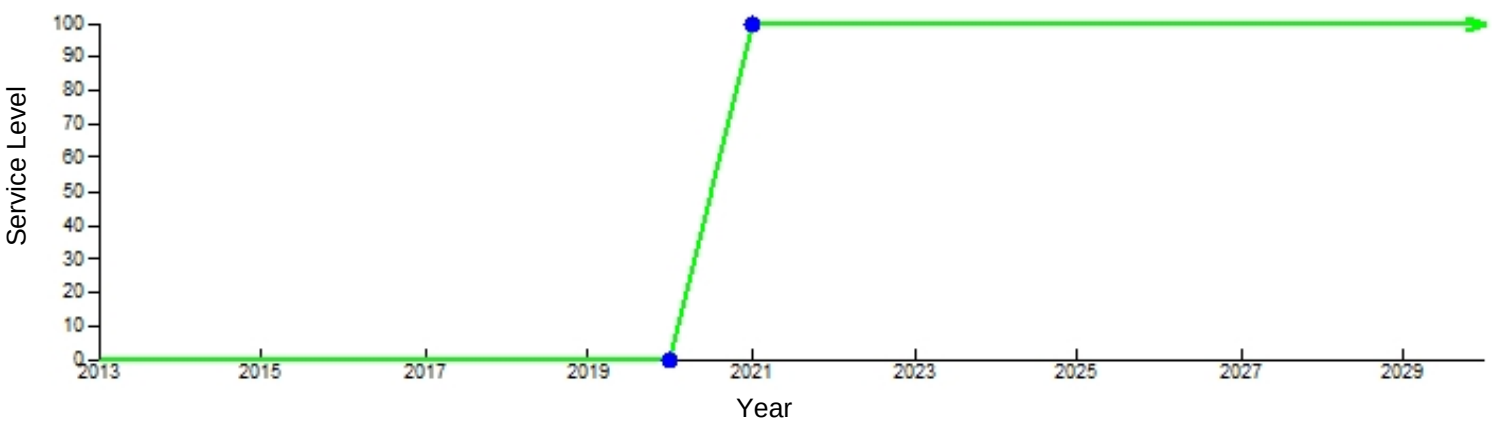

Service losses at the Injury Area

Year	% Services lost					
	Beginning	End	Mean	Raw SUYs lost	Discount Factor	Discounted SUYs lost
2014	.00%	100.00%	50.00%	22325.000	1.000	22325.000
2015	100.00%	100.00%	100.00%	44650.000	0.971	43349.515
2016	100.00%	100.00%	100.00%	44650.000	0.943	42086.907
2017	100.00%	100.00%	100.00%	44650.000	0.915	40861.075
2018	100.00%	100.00%	100.00%	44650.000	0.888	39670.947
2019	100.00%	100.00%	100.00%	44650.000	0.863	38515.482
2020	100.00%	100.00%	100.00%	44650.000	0.837	37393.672
2021	100.00%	100.00%	100.00%	44650.000	0.813	36304.536
2022	100.00%	100.00%	100.00%	44650.000	0.789	35247.122
2023	100.00%	100.00%	100.00%	44650.000	0.766	34220.507
2024	100.00%	100.00%	100.00%	44650.000	0.744	33223.793
2025	100.00%	100.00%	100.00%	44650.000	0.722	32256.110
2026	100.00%	100.00%	100.00%	44650.000	0.701	31316.612
2027	100.00%	100.00%	100.00%	44650.000	0.681	30404.477
2028	100.00%	100.00%	100.00%	44650.000	0.661	29518.910
2029	100.00%	100.00%	100.00%	44650.000	0.642	28659.136
2030	100.00%	100.00%	100.00%	44650.000	0.623	27824.404
Beyond						927480.128

Total Discounted Service Unit Years (DSUYs) lost: 1510658.333

Service Gains at the Compensatory Area

Year	% Services gained			Raw SUYs lost	Discount Factor	Discounted SUYs gained
	Beginning	End	Mean			
2020	.00%	100.00%	50.00%	22325.000	0.837	18696.836
2021	100.00%	100.00%	100.00%	44650.000	0.813	36304.536
2022	100.00%	100.00%	100.00%	44650.000	0.789	35247.122
2023	100.00%	100.00%	100.00%	44650.000	0.766	34220.507
2024	100.00%	100.00%	100.00%	44650.000	0.744	33223.793
2025	100.00%	100.00%	100.00%	44650.000	0.722	32256.110
2026	100.00%	100.00%	100.00%	44650.000	0.701	31316.612
2027	100.00%	100.00%	100.00%	44650.000	0.681	30404.477
2028	100.00%	100.00%	100.00%	44650.000	0.661	29518.910
2029	100.00%	100.00%	100.00%	44650.000	0.642	28659.136
2030	100.00%	100.00%	100.00%	44650.000	0.623	27824.404
Beyond						927480.128

Total Discounted Service Unit Years (DSUYs) Gained: 1265152.571

Discounted SUYs gained per unit: 28.335

Replacement habitat size (sq. m): 1.00 * 1510658.333/28.335 53314.435

VISUAL_HEA HABITAT EQUIVALENCY ANALYSIS

Sitename: Lower Hazeltine (H2)

Date: 2019-03-11 10:18:23 AM
Datafile: C:\\Users\\mbenrabah\\Desktop\\HEA\\HEA Lower Hazeltine H2.hea

Units: sq. m
Time units: year

Claim year: 2014
Amount of affected units: 17966
Pre-injury service level (%): 100.00%
Pre-restoration service level (%): 0.00%
Value ratio injured/restored: 1.00
Discount rate per unit of time(%): 3.000

Service losses at the Injury Area

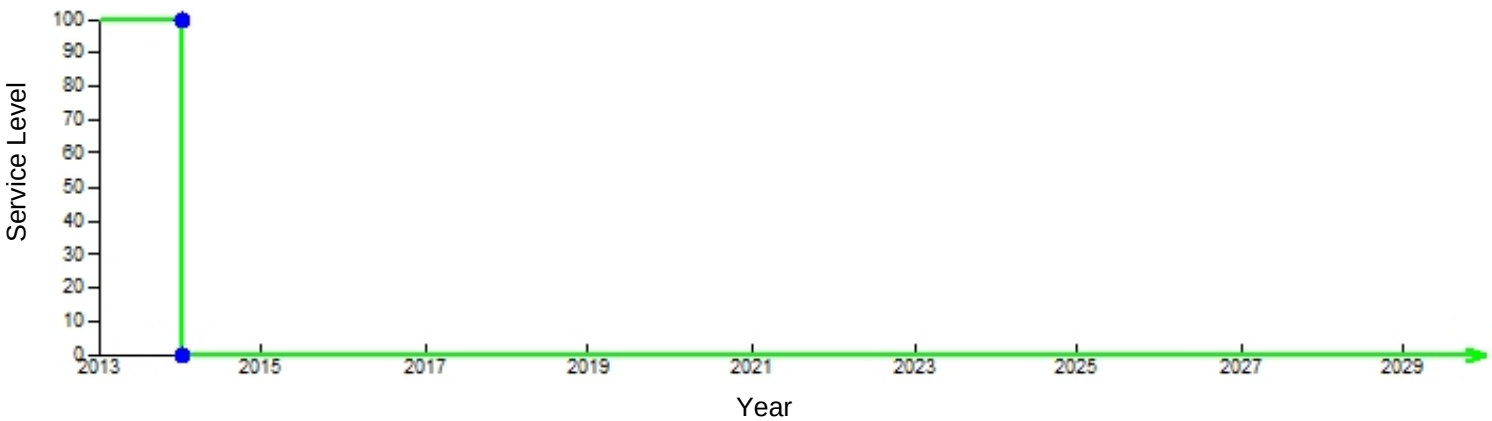

Service Gains at the Compensatory Area

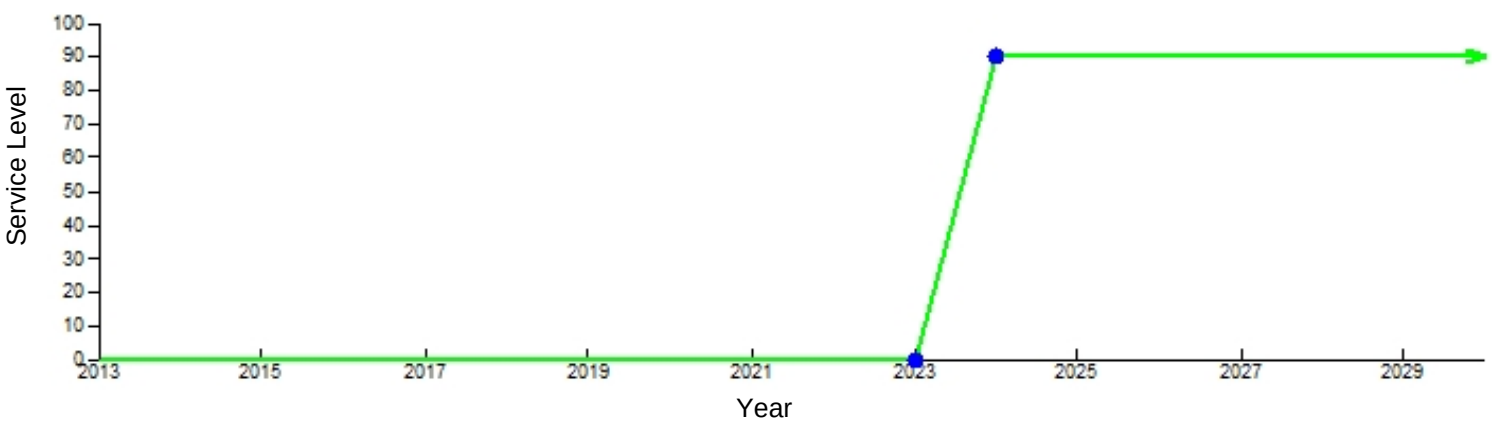

Service losses at the Injury Area

Year	% Services lost			Raw SUYs lost	Discount Factor	Discounted SUYs lost
	Beginning	End	Mean			
2014	.00%	100.00%	50.00%	8983.000	1.000	8983.000
2015	100.00%	100.00%	100.00%	17966.000	0.971	17442.718
2016	100.00%	100.00%	100.00%	17966.000	0.943	16934.678
2017	100.00%	100.00%	100.00%	17966.000	0.915	16441.435
2018	100.00%	100.00%	100.00%	17966.000	0.888	15962.558
2019	100.00%	100.00%	100.00%	17966.000	0.863	15497.629
2020	100.00%	100.00%	100.00%	17966.000	0.837	15046.242
2021	100.00%	100.00%	100.00%	17966.000	0.813	14608.002
2022	100.00%	100.00%	100.00%	17966.000	0.789	14182.526
2023	100.00%	100.00%	100.00%	17966.000	0.766	13769.443
2024	100.00%	100.00%	100.00%	17966.000	0.744	13368.391
2025	100.00%	100.00%	100.00%	17966.000	0.722	12979.021
2026	100.00%	100.00%	100.00%	17966.000	0.701	12600.991
2027	100.00%	100.00%	100.00%	17966.000	0.681	12233.972
2028	100.00%	100.00%	100.00%	17966.000	0.661	11877.642
2029	100.00%	100.00%	100.00%	17966.000	0.642	11531.692
2030	100.00%	100.00%	100.00%	17966.000	0.623	11195.817
Beyond						373193.908

Total Discounted Service Unit Years (DSUYs) lost: 607849.667

Service Gains at the Compensatory Area

Year	% Services gained			Raw SUYs lost	Discount Factor	Discounted SUYs gained
	Beginning	End	Mean			
2023	.00%	90.00%	45.00%	8084.700	0.766	6196.250
2024	90.00%	90.00%	90.00%	16169.401	0.744	12031.553
2025	90.00%	90.00%	90.00%	16169.401	0.722	11681.119
2026	90.00%	90.00%	90.00%	16169.401	0.701	11340.892
2027	90.00%	90.00%	90.00%	16169.401	0.681	11010.575
2028	90.00%	90.00%	90.00%	16169.401	0.661	10689.879
2029	90.00%	90.00%	90.00%	16169.401	0.642	10378.523
2030	90.00%	90.00%	90.00%	16169.401	0.623	10076.236
Beyond						335874.530

Total Discounted Service Unit Years (DSUYs) Gained: 419279.556

Discounted SUYs gained per unit: 23.337

Replacement habitat size (sq. m): 1.00 * 607849.667/23.337 26046.171

VISUAL_HEA HABITAT EQUIVALENCY ANALYSIS

Sitename: Middle Edney

Date: 2019-03-11 10:33:37 AM
Datafile: C:\\Users\\mbenrabah\\Desktop\\HEA\\HEA Riparian 20yr.hea

Units: sq. m
Time units: year

Claim year: 2014
Amount of affected units: 765372
Pre-injury service level (%): 100.00%
Pre-restoration service level (%): 0.00%
Value ratio injured/restored: 1.00
Discount rate per unit of time(%): 3.000

Service losses at the Injury Area

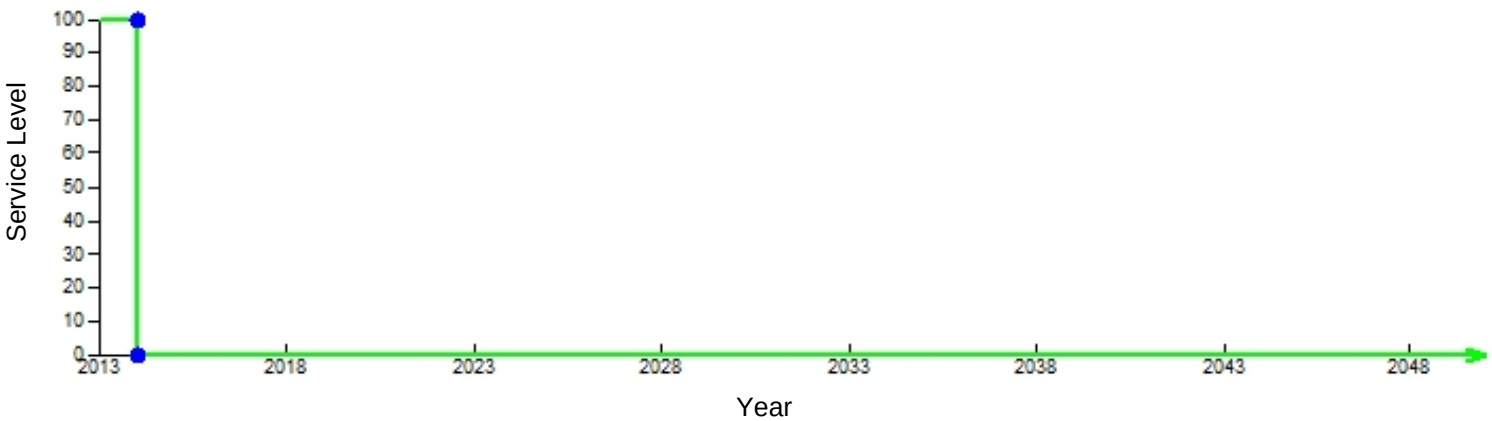

Service Gains at the Compensatory Area

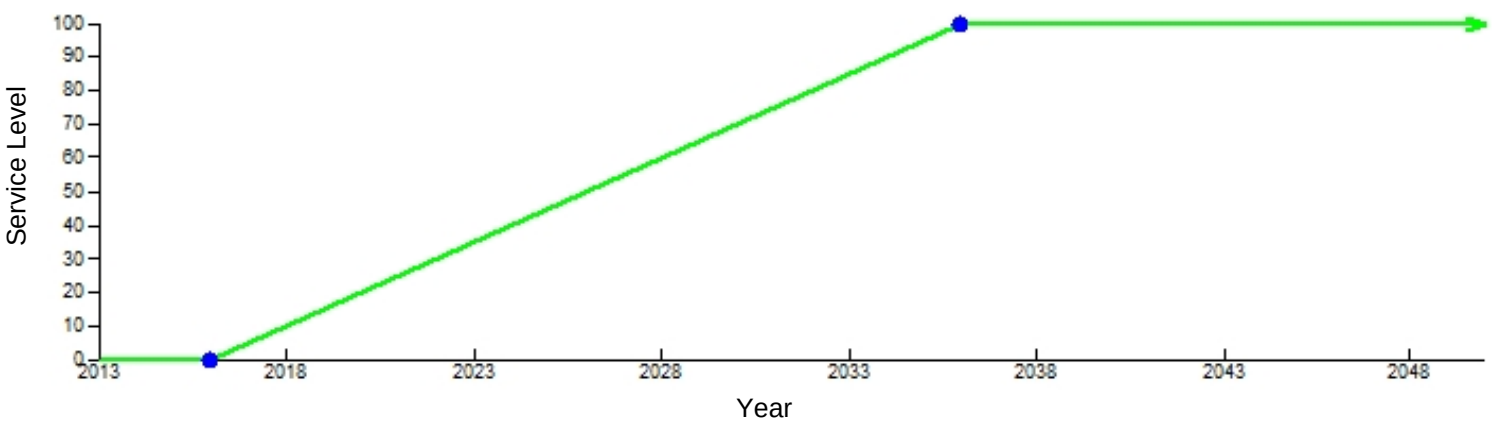

Service losses at the Injury Area

Year	% Services lost					
	Beginning	End	Mean	Raw SUYs lost	Discount Factor	Discounted SUYs lost
2014	.00%	100.00%	50.00%	382686.000	1.000	382686.000
2015	100.00%	100.00%	100.00%	765372.000	0.971	743079.612
2016	100.00%	100.00%	100.00%	765372.000	0.943	721436.516
2017	100.00%	100.00%	100.00%	765372.000	0.915	700423.802
2018	100.00%	100.00%	100.00%	765372.000	0.888	680023.109
2019	100.00%	100.00%	100.00%	765372.000	0.863	660216.611
2020	100.00%	100.00%	100.00%	765372.000	0.837	640987.001
2021	100.00%	100.00%	100.00%	765372.000	0.813	622317.476
2022	100.00%	100.00%	100.00%	765372.000	0.789	604191.724
2023	100.00%	100.00%	100.00%	765372.000	0.766	586593.907
2024	100.00%	100.00%	100.00%	765372.000	0.744	569508.648
2025	100.00%	100.00%	100.00%	765372.000	0.722	552921.017
2026	100.00%	100.00%	100.00%	765372.000	0.701	536816.522
2027	100.00%	100.00%	100.00%	765372.000	0.681	521181.089
2028	100.00%	100.00%	100.00%	765372.000	0.661	506001.057
2029	100.00%	100.00%	100.00%	765372.000	0.642	491263.162
2030	100.00%	100.00%	100.00%	765372.000	0.623	476954.527
2031	100.00%	100.00%	100.00%	765372.000	0.605	463062.647
2032	100.00%	100.00%	100.00%	765372.000	0.587	449575.386
2033	100.00%	100.00%	100.00%	765372.000	0.570	436480.957
2034	100.00%	100.00%	100.00%	765372.000	0.554	423767.919
2035	100.00%	100.00%	100.00%	765372.000	0.538	411425.164
2036	100.00%	100.00%	100.00%	765372.000	0.522	399441.907
2037	100.00%	100.00%	100.00%	765372.000	0.507	387807.677
2038	100.00%	100.00%	100.00%	765372.000	0.492	376512.308
2039	100.00%	100.00%	100.00%	765372.000	0.478	365545.930
2040	100.00%	100.00%	100.00%	765372.000	0.464	354898.961
2041	100.00%	100.00%	100.00%	765372.000	0.450	344562.098
2042	100.00%	100.00%	100.00%	765372.000	0.437	334526.309
2043	100.00%	100.00%	100.00%	765372.000	0.424	324782.824
2044	100.00%	100.00%	100.00%	765372.000	0.412	315323.130
2045	100.00%	100.00%	100.00%	765372.000	0.400	306138.961
2046	100.00%	100.00%	100.00%	765372.000	0.388	297222.292
2047	100.00%	100.00%	100.00%	765372.000	0.377	288565.333
2048	100.00%	100.00%	100.00%	765372.000	0.366	280160.517
2049	100.00%	100.00%	100.00%	765372.000	0.355	272000.502
2050	100.00%	100.00%	100.00%	765372.000	0.345	264078.157
Beyond						8802605.241

Total Discounted Service Unit Years (DSUYs) lost: 25895086.000

Service Gains at the Compensatory Area

Year	% Services gained			Raw SUYs lost	Discount Factor	Discounted SUYs gained
	Beginning	End	Mean			
2016	.00%	5.00%	2.50%	19134.300	0.943	18035.913
2017	5.00%	10.00%	7.50%	57402.900	0.915	52531.785
2018	10.00%	15.00%	12.50%	95671.500	0.888	85002.889
2019	15.00%	20.00%	17.50%	133940.100	0.863	115537.907
2020	20.00%	25.00%	22.50%	172208.700	0.837	144222.075
2021	25.00%	30.00%	27.50%	210477.300	0.813	171137.306
2022	30.00%	35.00%	32.50%	248745.900	0.789	196362.310
2023	35.00%	40.00%	37.50%	287014.500	0.766	219972.715
2024	40.00%	45.00%	42.50%	325283.100	0.744	242041.175
2025	45.00%	50.00%	47.50%	363551.700	0.722	262637.483
2026	50.00%	55.00%	52.50%	401820.300	0.701	281828.674
2027	55.00%	60.00%	57.50%	440088.900	0.681	299679.126
2028	60.00%	65.00%	62.50%	478357.500	0.661	316250.661
2029	65.00%	70.00%	67.50%	516626.100	0.642	331602.635
2030	70.00%	75.00%	72.50%	554894.700	0.623	345792.032
2031	75.00%	80.00%	77.50%	593163.300	0.605	358873.552
2032	80.00%	85.00%	82.50%	631431.900	0.587	370899.693
2033	85.00%	90.00%	87.50%	669700.500	0.570	381920.837
2034	90.00%	95.00%	92.50%	707969.100	0.554	391985.325
2035	95.00%	100.00%	97.50%	746237.700	0.538	401139.535
2036	100.00%	100.00%	100.00%	765372.000	0.522	399441.907
2037	100.00%	100.00%	100.00%	765372.000	0.507	387807.677
2038	100.00%	100.00%	100.00%	765372.000	0.492	376512.308
2039	100.00%	100.00%	100.00%	765372.000	0.478	365545.930
2040	100.00%	100.00%	100.00%	765372.000	0.464	354898.961
2041	100.00%	100.00%	100.00%	765372.000	0.450	344562.098
2042	100.00%	100.00%	100.00%	765372.000	0.437	334526.309
2043	100.00%	100.00%	100.00%	765372.000	0.424	324782.824
2044	100.00%	100.00%	100.00%	765372.000	0.412	315323.130
2045	100.00%	100.00%	100.00%	765372.000	0.400	306138.961
2046	100.00%	100.00%	100.00%	765372.000	0.388	297222.292
2047	100.00%	100.00%	100.00%	765372.000	0.377	288565.333
2048	100.00%	100.00%	100.00%	765372.000	0.366	280160.517
2049	100.00%	100.00%	100.00%	765372.000	0.355	272000.502
2050	100.00%	100.00%	100.00%	765372.000	0.345	264078.157
Beyond						8802605.241

Total Discounted Service Unit Years (DSUYs) Gained: 18701625.775

Discounted SUYs gained per unit: 24.435

Replacement habitat size (sq. m): 1.00 * 25895086/24.435 1059767.423



golder.com

Appendix B
Geochemistry and Source Terms

Derivation of Geochemical Source Terms, Mount Polley Mine - DRAFT

Prepared for

Mount Polley Mining Corporation



Prepared by

SRK Consulting (Canada) Inc.
1CI008.007
June 2016

Derivation of Geochemical Source Terms, Mount Polley Mine - DRAFT

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Executive Summary

Mount Polley Mining Corporation is submitting a Technical Assessment Report as part of a permit amendment application to discharge water from the site which includes modelling of water quality at the site and in the receiving environment. Inputs to this model are geochemical source terms which are predictions of the chemistry of water in contact with materials and surfaces exposed by mining activity. Source terms mainly consider the potential for metal leaching and acid rock drainage (ML/ARD). This report describes the derivation and use of the source terms.

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit. With the exception of the distinctive small Pond Zone skarn deposit, it has been mined from several mineralized zones (Springer, Cariboo, Bell, Southeast, Northeast, Boundary) with common geological features including mainly a monzonitic plutonic host rock, association with breccia bodies in the intrusion, dominantly potassic hydrothermal alteration, lack of pronounced pyrite haloes, enrichment in copper and selenium relative to global norms, pervasive calcite, and natural oxide alteration. As a result, geochemical characteristics are consistent between zones, allowing a site-wide approach to geochemical characterization.

Potentially ARD generating (PAG) and non-PAG waste rock materials occur locally as pyrite zones but non-PAG dominates. ARD potential was used to segregate waste rock, with non-PAG waste rock being placed in several waste rock dumps and PAG waste rock either deposited in completed pits that are projected to flood at the closure of the mine (in accordance with the management practice of subaqueous disposal) or placed in a temporary stockpile for final disposal in the Springer Pit. Based on review of operational processes and data, non-PAG waste rock is expected to be non-acidic in perpetuity because the classification approach tended to result in non-PAG waste rock reporting to PAG waste rock disposal locations rather than the reverse.

Tailings are classified as non-PAG based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014.

Major geochemical sources were identified as waste rock stockpiles and the tailings. Other sources include backfilled waste rock, ore processing, pit walls, ore stockpiles, the sulphur stockpile and magnetite stockpiles. Source terms were mainly developed from conceptual geochemical models then interpretation of rock geochemical characteristics and seepage data rather than scale-up of laboratory kinetic test data. Pit wall source terms (including PAG walls) were obtained by scaling of kinetic test data. Source terms were not specifically developed for the magnetite and sulphur stockpiles because they are small sources and assumed to influence seep data used as a basis for waste rock source terms.

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Appendix I – Tailings Source Terms

List of Abbreviations

ABA	acid-base accounting
AP	acid potential
ARD	acid rock drainage
CGM	conceptual geochemical model
Golder	Golder Associates Ltd.
HCT	humidity cell test
LSW	low sulphur waste
ML	metal leaching
MPIC	Mount Polley Intrusive Complex
MPMC	Mount Polley Mining Corporation
MPM	Mount Polley Mine
NAG	non-ARD generating
NP	neutralization potential
NPR	neutralizing potential ratio
PAG	potentially ARD generating
SFE	shake flask extraction
TAR	Technical Assessment Report
TIC	total inorganic carbon
TSF	Tailings Storage Facility

1 Introduction

1.1 Background

1.1.1 General

Mount Polley Mining Corporation (MPMC), a wholly owned subsidiary of Imperial Metals Corporation, has been operating the Mount Polley Mine (MPM), located approximately 56 km northeast of Williams Lake and approximately 15 km southwest of the community of Likely in British Columbia, Canada, since 1996. MPMC recovers copper and gold from porphyry-style mineralization by open pit and underground mining. The plant is capable of processing 22,000 t/d of ore using standard mineral flotation technology.

As a condition of *Environmental Management Act* Permit 11678, MPMC is submitting a Technical Assessment Report (TAR) for a long-term water management plan, which includes modelling of water quality at the site and in the receiving environment. Inputs to this model are geochemical source terms which are predictions of the chemistry of water in contact with materials and surfaces exposed by mining activity. Source terms mainly consider the potential for metal leaching and acid rock drainage (ML/ARD). The purpose of this report is to describe the derivation and use of the source terms.

1.1.2 Geological Setting

Understanding of the geological setting is provided below for context in the consideration of ML/ARD potential.

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008). With the exception of the distinctive small Pond Zone, it has been mined from several mineralized zones which have the following common features:

- The host rock for porphyry mineralization is the Mount Polley Intrusive Complex (MPIC) which intruded into Nicola Group Volcanics (Figure 1). The intrusion is primarily monzonite to monzo-diorite in composition. Smaller phases vary in composition from diorite to syenite.
- Mineralization is associated with magmatic-hydrothermal breccias. Alteration and mineralization occurs in the matrix of the breccias, and in veins and swarms distributed around the breccias. BX1 is the main host for the bulk of the mineralization at MPM which is mined in the Cariboo and Springer Pits (Figure 1). BX1 is characterized by alteration which resulted in the strongest destruction of both primary and breccia textures. Breccia bodies BX2 host satellite mineralization in the Southeast Zone, Wight Pit and Boundary Zone. BX2 is less intensively altered and original textures are more apparent. BX3 is unmineralized and has not been mined.
- Alteration at MPM is classified as potassic (sodic and calcic) with salmon pink potassium feldspar as the main alteration mineral. Biotite is less common. Sodic alteration is defined by albite and calcic alteration (actinolite, diopside, epidote, clinozoisite, and sporadic andraditic garnet). Calcite is pervasive. Alteration is zoned with the strongest calcic-potassic alteration

in the core associated with BX1. Nicola Group rocks and fringing MPIC rocks are propylitically-altered and characterized by stronger epidote and pyrite.

- Like other alkalic porphyry deposits (e.g. Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g. Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPM geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit (Figure 2). Samples from Bell Pit blast holes collected in the early years of operations were identified as being from a Pyrite Zone but the location of this feature is not known.

- Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5). Bornite is relatively more abundant in the Northeast and Boundary Zones.

- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$) formed as a natural weathering product; iron carbonates have not been reported.

- A significant portion of the copper at the MPM is not associated with sulphides (upwards of 50% in the upper portions of each pit). This fraction has been termed ‘copper oxide’ by MPM personnel and is associated primarily with chrysocolla ($(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$) and malachite ($Cu_2CO_3(OH)_2$) in equal proportions (Henry 2009). Recent investigations (SRK 2015a) have shown that chlorite is a significant host for copper. It is assumed that chlorite formed hydrothermally and incorporated copper as part of the mineralizing event rather than due to weathering. Suarez et al. (2009) found that the form of copper in chlorite at the Aguablanca Ni-Cu-PGE Sulfide Deposit was native copper between silicate layers rather than as a substitution in the crystal lattice. The mineral is suspected to have formed during hydrothermal alteration rather than by natural weathering processes. It is not known whether this same form of copper is also present at MPM.

The small Pond Zone is andradite-clinopyroxene-magnetite skarn mineralization occurring at the contact between a diorite to monzodiorite intrusion and Nicola Group volcanic rocks of andesite to basalt composition. It appears to be linked to the presence of a limestone unit in the Nicola Group.

From an ML/ARD perspective, a significant feature of the Mount Polley mineralization is the lack of reported arsenic, lead and zinc minerals which are commonly associated with porphyry deposits elsewhere in British Columbia and globally. Since arsenic, zinc, and associated cadmium are relatively mobile under non-acidic conditions, the lack of the minerals hosting these elements indicates that potential for leaching concerns is lower than other porphyries. Based on the copper sulphide and copper oxide dominated mineralogy, the primary metal leaching concern is expected to be for copper.

In addition, the lack of a distinctive pyrite halo means that pyrite abundance is lower than other porphyry deposits and ARD potential is expected to be lower.

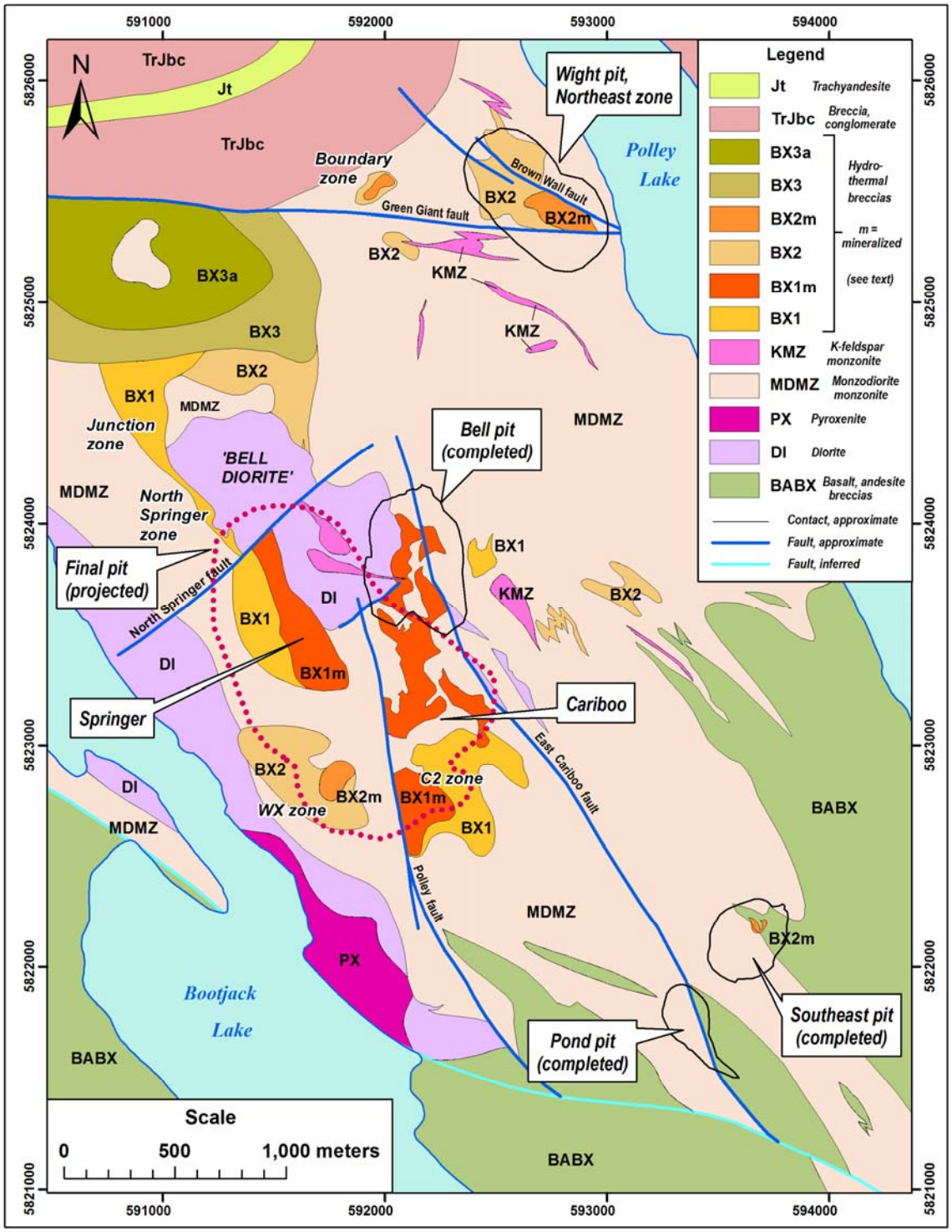

Figure 1. Geological Map of the Mount Polley Mine (Rees 2013)

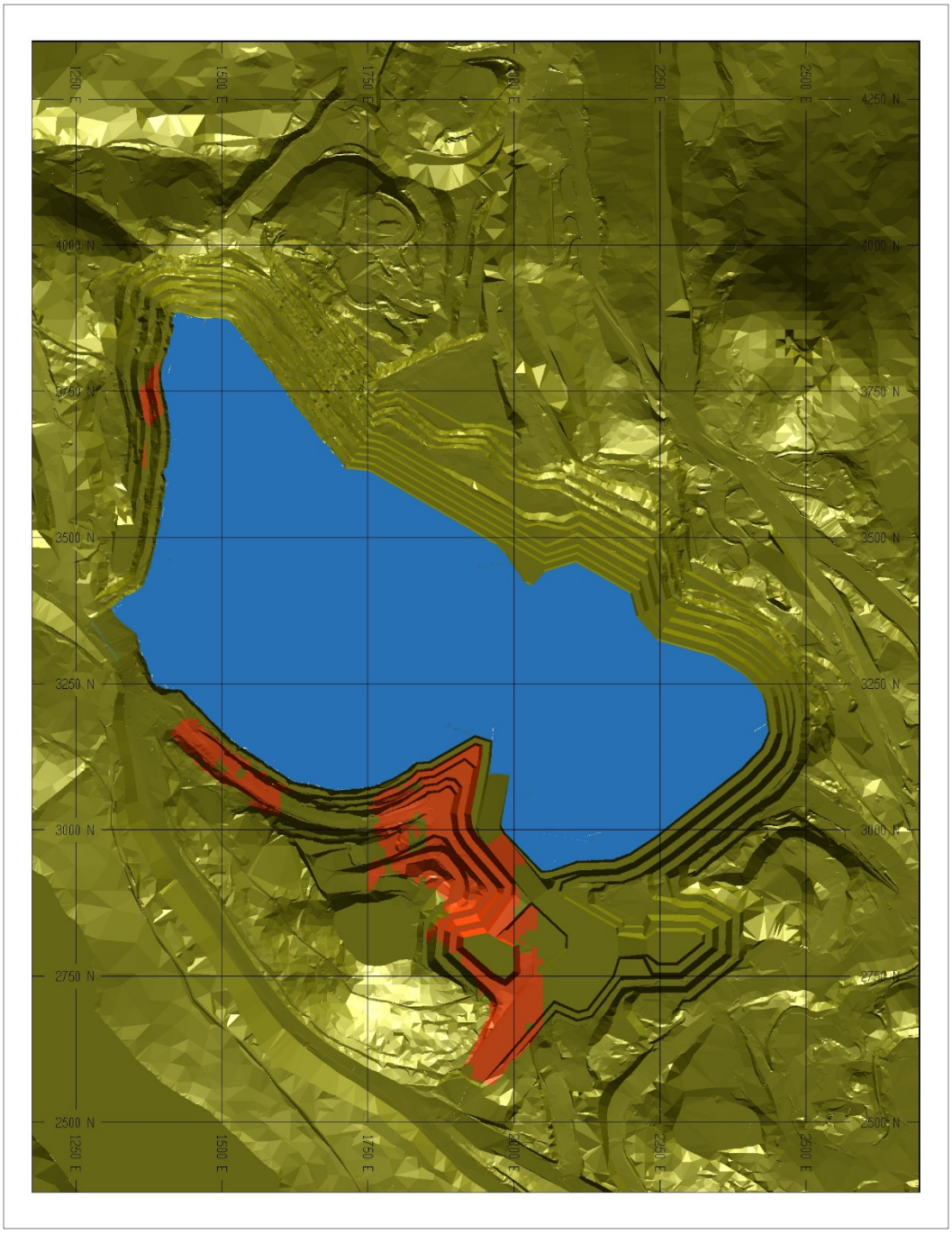

Source: MPM

Figure 2. Pyritic Zones in the South and West Walls of the Springer Pit

1.1.3 Mining History and Closure

Full scale mining began in the Cariboo Pit by mining high oxide and high gold parts of the ore body then transitioning to the Bell Pit in 1999. Mining was suspended in 2001 due to unfavorable market conditions. The mine re-opened in 2005 after a 3½ year care-and-maintenance period. The following zones have been mined since 2005:

- Completed mining and backfilling of the Bell Pit.
- Completed mining and backfilling of the small Southeast Zone and Pond Zone Pits.
- Completed mining of the Wight Pit (Northeast Zone).

Active mining is focussed on the Cariboo and Springer Pits (which will merge to a single pit), Northeast Zone underground (access from the Wight Pit) and Boundary Pit.

Upon completion of mining, the Springer-Cariboo Pit will be backfilled by rock from the Temporary Northwest (NW) PAG Stockpile (the NAG/PAG Pad) and allowed to flood. The Wight Pit and underground workings will also flood. The Tailings Storage Facility (TSF) will be decommissioned with a minimal water cover.

1.1.4 Waste Rock Management

Mining at MPM is primarily by open pit. As of the end of 2015, about 95 million tonnes of ore had been processed.

Mines Act Permit M-200 issued on July 11, 1997 specified that waste rock is to be segregated according to ARD potential using a neutralization potential ratio (NPR) of 2. Rock with NPR greater than 2 is to be considered non-ARD generating (NAG). Rock with NPR less than 2 was to be considered potentially ARD generating (PAG). The definition of NPR is assumed to be neutralization potential (NP)/acid potential (AP) where NP is determined by a neutralization potential method and AP is acid potential determined from sulphide sulphur.

The procedure used by MPMC to identify and segregate PAG waste rock is attached in Appendix A.

To support the TAR, MPMC personnel developed a thorough inventory of the quantities of waste rock in each category and determined that about 167 million tonnes of waste rock were classified as NAG, and 19 million tonnes were classified as PAG. Development of the inventory showed the source of NAG and PAG materials and their disposal locations. Appendix B provides the inventory and Table 1 summarizes major disposal locations (Figure 3).

The primary NAG rock disposal locations are the North Bell Dump (which includes backfill in the Bell Pit), the South East Rock Dump Site (which also includes the backfilled Southeast Zone and Pond Zone Pits), and the Northeast Zone Dump[1]. NAG rock has been used for construction purposes (Waste Haul Road and the TSF). The inventory indicates that NAG rock from the open pits has been disposed at a variety of different locations resulting in waste rock dumps containing non-unique source materials. The exception is that the Northeast Zone and East Rock Dumps received waste primarily from the Wight Pit.

Prior to 2005 (i.e. before operations were re-started), limited PAG waste rock was mined and was dumped into the bottom of the Bell Pit (C. Hughes, MPMC, pers. comm.). A small amount was

[1] Also referred to as Wight Pit waste rock dumps.

dumped over the north end of the Cariboo Pit, but it was re-handled to the bottom of the Cariboo Pit. Acid-base accounting (ABA) analyses were performed by an external lab.

Since 2005, PAG waste rock has primarily been disposed in the Temporary NW PAG Stockpile (the NAG/PAG Pad; Ex-pit PAG in Figure 3) which is planned to be backhauled to the Springer Pit at closure for subaqueous disposal. PAG rock has also been disposed subaqueously in the Cariboo Pit backfill and Southeast Zone Pit. PAG rock mainly originates from the Cariboo Pit and Springer Pit. The PAG waste rock in the North Bell Dump originated from the Southeast Zone Pit which was dominated by PAG waste rock.

An amendment to *Mines Act* Permit M-200 in July 8, 2009 allowed the placement of low sulphur (less than 0.3%) waste (LSW) as 2 m layers with Springer Zone NAG waste rock to create a NAG waste rock blend. The quantity of PAG rock mined from the Pond Zone was 6,615 t, which was disposed in a portion of the Northeast Zone Dump referred to as the Sandwich Dump.

Table 1. Major Waste Rock Disposal Locations

Placement Location	NAG		PAG	
	Mass (tonnes)	Percent of NAG	Mass (tonnes)	Percent of PAG
Bell Pit Rock Dump	80,878,729	48.6%	187,573	1%
Cariboo PAG Dump	999,750	0%	1,573,456	8%
Dam	9,871,313	5.9%	0	0%
NAG/PAG Pad	3,991,967	2.4%	16,091,498	86%
South East NAG Dump	32,271,810	19.4%	3,105	0%
South East PAG Dump	5,971	0%	886,665	5%
Waste Haul Road	6,915,893	4.2%	1,290	0%
Northeast Zone Dump	14,770,426	8.9%	9,855	0%

Source: P:\01_SITES\Mt_Polley\1CI008.007_Se_Source_Evaluation\Task 100_Evaluate Significance of Sources\2.Interpretation\[SourcesReview_1CI008007_SJD_REV04.xlsx]

8 Mt of ore was stockpiled to the north of the ore processing plant and has served as a source of ore during limited operations following the tailings dam failure in August 2014. The current remaining quantity of rock in the stockpiles is 2 Mt. The waste rock inventory also indicated that about 110,000 tonnes of ore has been placed at twelve other locations around the site. The largest disposal location is the South East Rock Dump (34,000 tonnes). Stockpiled ore is not classified by ARD potential but the quantities are insignificant relative to waste rock.

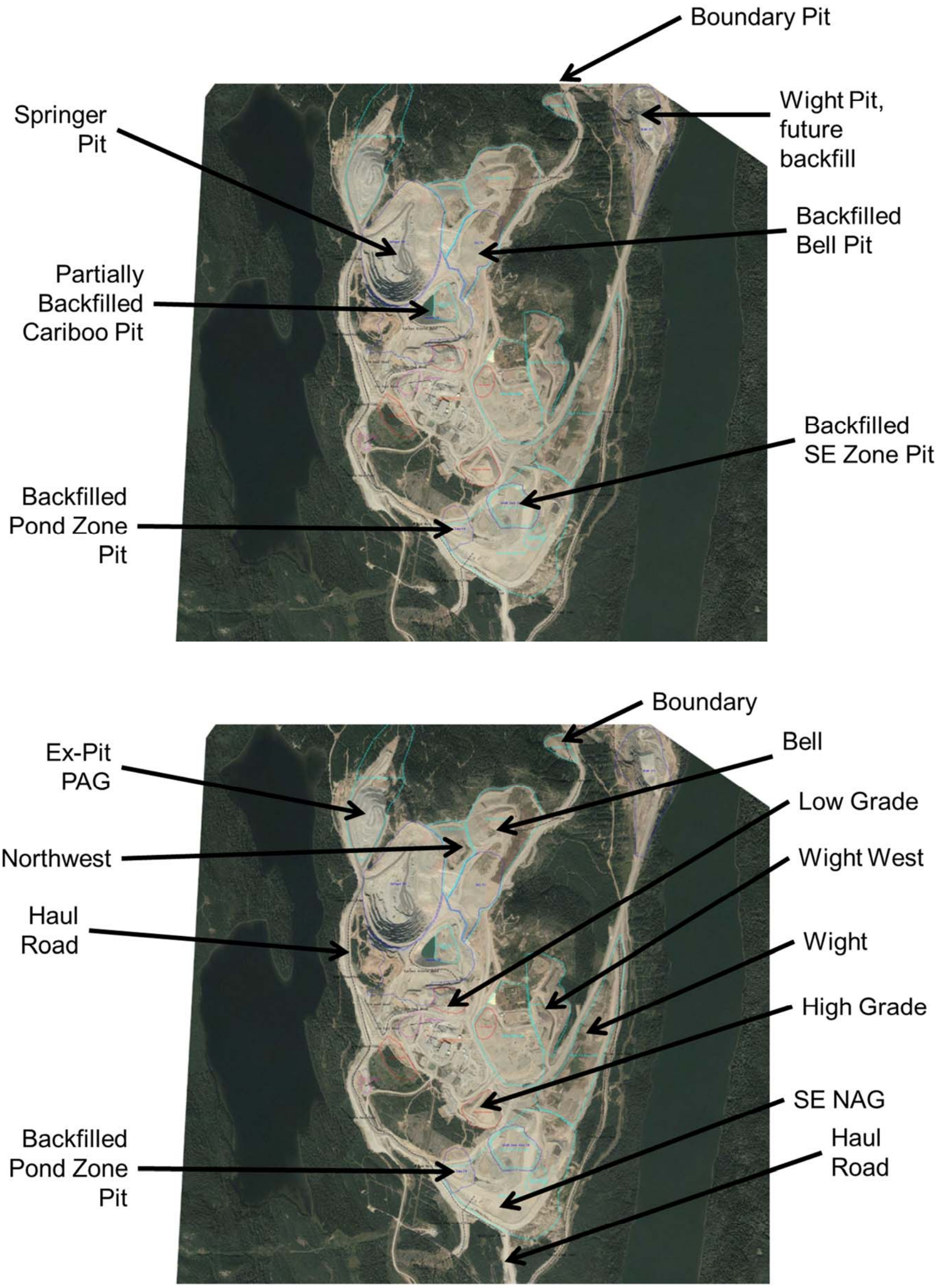

Figure 3. Pits and Waste Rock Dump Features

1.1.5 Rock Geochemical Characteristics

1.1.5.1 Introduction

Understanding of waste rock geochemical characteristics has been accumulated from a variety of sources including diamond drill core tested prior to mining, blast hole cuttings to inform waste rock management operations in the pit during operations and post-depositional monitoring (Table 2). The database is dominated by the data gathered to operationally characterize waste rock in the Springer Pit which is the main source of PAG rock at the MPM. However, the database is incomplete because some of the earlier data were lost and blast hole data are lacking for Cariboo Pit and Wight Pit. For Cariboo Pit and Wight Pit, confirmatory post-depositional data partly address this gap.

The inventory primarily contains static ARD potential data though trace element scans are also available for all zones except the Boundary Pit.

Table 2. Static Test Inventory

Source	Drill Core	Blast Hole	Confirmatory	Total
Bell Pit and North Bell Dump	0	78	52	130
Cariboo Pit	0	0	43	43
Pond and Sandwich Dump	27	174	5	206
SE Zone Pit and Dump	37	0	101	138
Springer Pit and PAG Dump	101	3789	20	3910
Wight Pit	102	0	0	102
Boundary Pit and Dump	16	123	5	144
Other PAG	0	0	29	29
Roads	0	0	37	37
Dam	0	0	31	31
Total	283	4164	323	4770

Source: P:\01_SITES\Mt_Polley\1CI008.007_Se_Source_Evaluation\Task 100_Evaluate Significance of Sources\2.Interpretation\[Confirmatry_Grabs_1CI008007_SJD_REV01.xlsx]

Drill core analyses were primarily performed by off-site laboratories and included total sulphur, sulphate, sulphide by difference, total carbonate, neutralization potential, and paste pH. For some samples, a trace element scan was performed. On-site tests were total sulphur and total carbon (see Appendix A). The former is assumed to be a proxy for sulphide sulphur because other forms of sulphur (including sulphate) are not common at MPM. The latter is assumed to be a proxy for reactive carbonate minerals. The assumption is supported by the observed dominance of calcite, the lack of reported iron carbonate and the strong correlation and equivalence of total carbon and total carbonate (Figure 4). The dominant plutonic geological setting supports the lack of non-carbonate carbon.

The following sections compare ARD and trace element characteristics of the various mineralized zones at MPM.

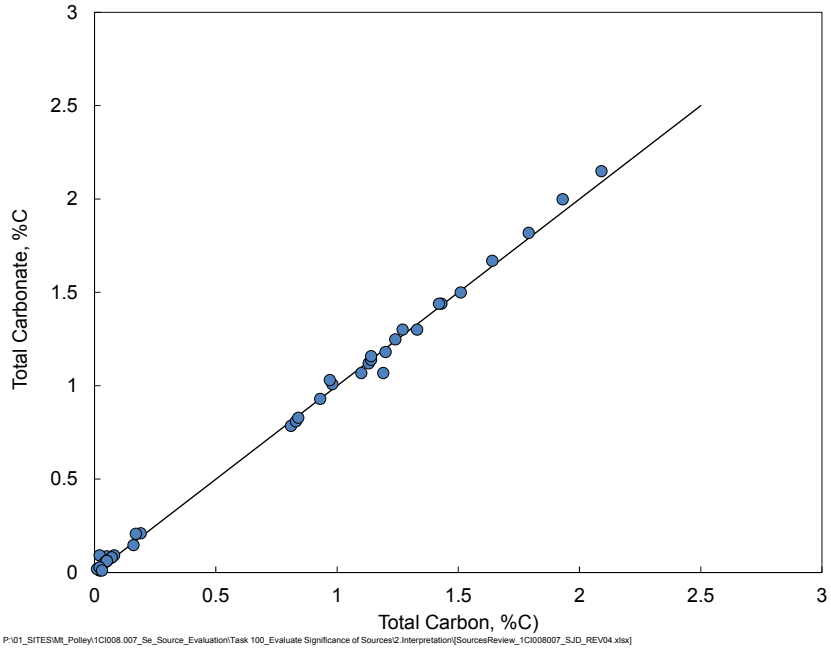

Figure 4. Comparison of Total Carbon and Total Carbonate. The Diagonal Line Shows Equivalence.

1.1.5.2 ARD Potential

Figure 5 (top) shows the distribution of total sulphur and sulphate by zone. Sulphate concentrations are uniformly low (averages near the detection limit of 0.01%) with no apparent differences between zones. Total sulphur, which therefore provides an approximation of sulphide content, shows some differences by zone though there is also considerable overlap and higher end concentrations vary over a narrow range (95th percentiles 1.1% to 2.0%). The Southeast Zone and the Wight Pit have the highest mean sulphur concentrations at 0.78% whereas Cariboo Pit has the lowest at 0.47%.

Comparison of carbonate content with NP shows that, except for a few samples, NP exceeds carbonate. This reflects the digestion of silicates for the NP determination. The difference between NP and total inorganic carbon (TIC) varies by zone. The skarn mineralization of the Pond Zone shows the greatest NP relative to carbonate reflecting the presence of epidote that digests more readily in acid than feldspars which dominate in the other rock types. The Springer Pit, the Cariboo Pit and the Southeast Zone show the next greatest difference followed by the Wight Pit and the Bell Pit. The difference between NP and TIC at MPM led to the adoption of total carbon as a proxy for carbonate content rather than relying on NP. Comparison of AP and TIC shows that the Southeast Zone is dominantly PAG whereas the Wight Pit and the Cariboo Pit are dominantly NAG. Oher zones show characteristics overlapping the NAG and PAG.

Figure 6 shows results of blast hole sampling for comparison. The complete dataset is provided in Appendix C. Bell Pit blast hole data are presented as part of the above descriptions because pre-mining ABA data were not available. The presence of PAG rock in all zones is apparent and resulted in segregation. This figure illustrates that for the most part PAG rock has higher sulphide content than NAG rock because NP is relatively consistent regardless of sulphide content.

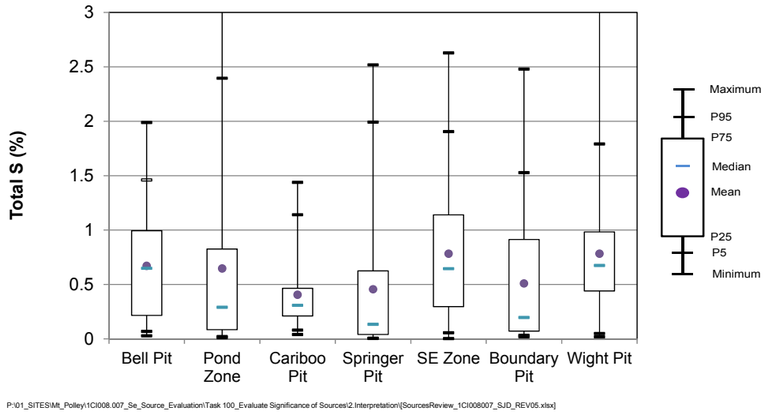

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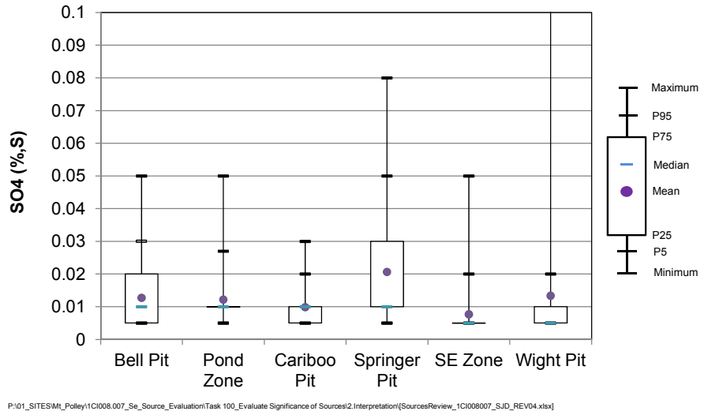

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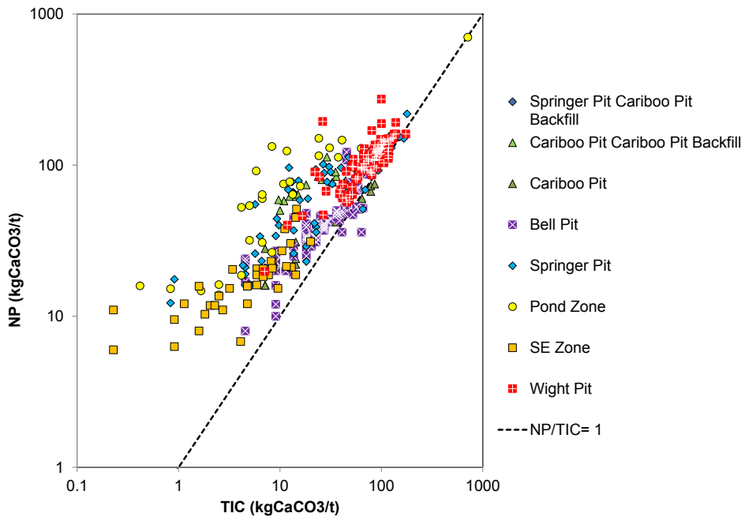

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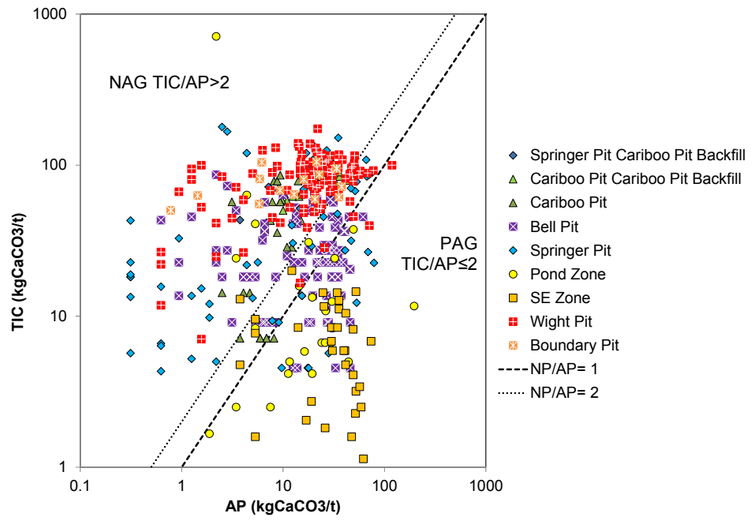

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Figure 5. Sulphur Forms (top), NP Compared to Carbonate (bottom left) and ARD Potential (bottom right) by Zone

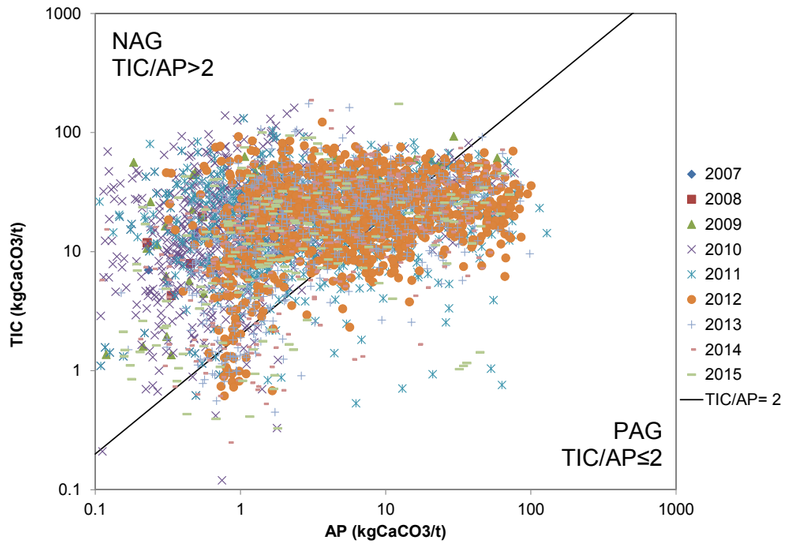

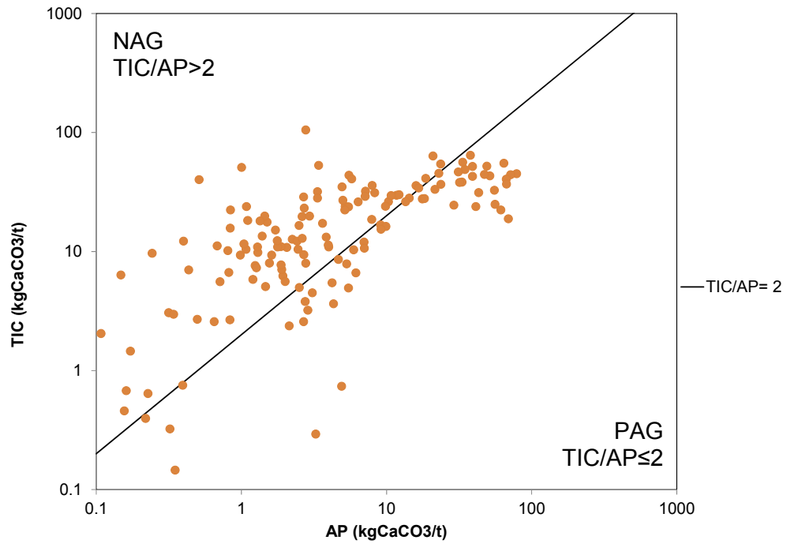

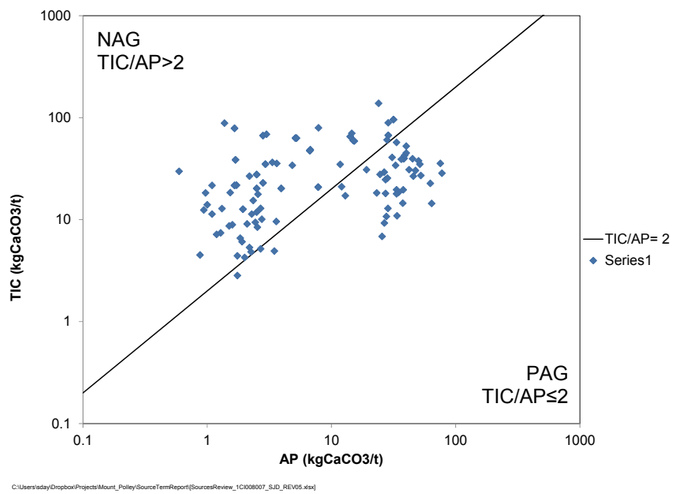

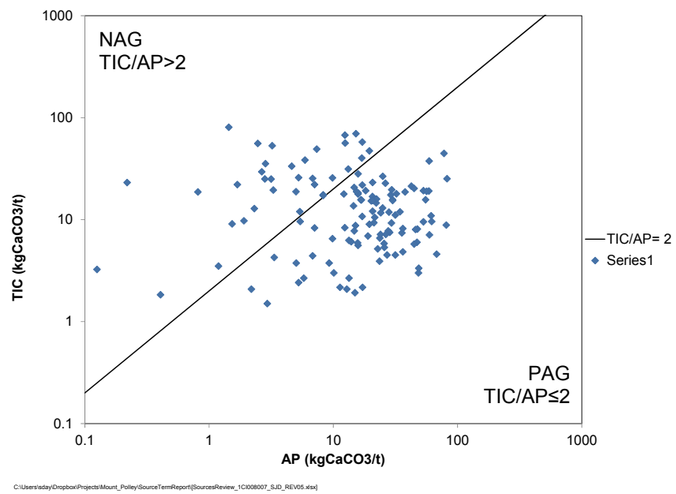

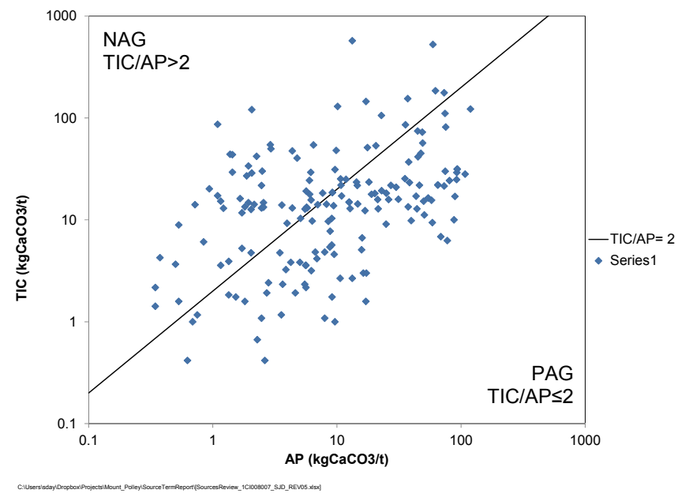

Figure 6. Blast Hole ABA Results for Springer (top left), Cariboo (top right), Boundary (bottom left), Southeast (bottom middle) and Pond Zones (bottom right)

1.1.5.3 Trace Element Content

When compared to global average for igneous rocks (Price 1997), some of the rocks at MPM have concentrations an order of magnitude higher for arsenic, copper, selenium, and mercury (Southeast Zone and Wight Pit) though median concentrations only slightly pass this threshold. Arsenic concentrations weakly correlate with sulphur, and copper correlates with selenium.

Within the site, selenium concentrations were elevated in the Cariboo Pit rocks and lowest at the Wight Pit (Figure 7). Selenium-to-sulphur ratios were examined because selenium is typically released by oxidation of sulphide and the ratios can be indicative of differences in selenium release. The ratio is notably higher for the Cariboo and Springer Pits, intermediate for the Bell Pit and lowest for the Southeast Zone and Wight Pits. The distributions imply spatial zoning of selenium relative to sulphide possibly with selenium enrichment associated with the more intensive alteration of BX1.

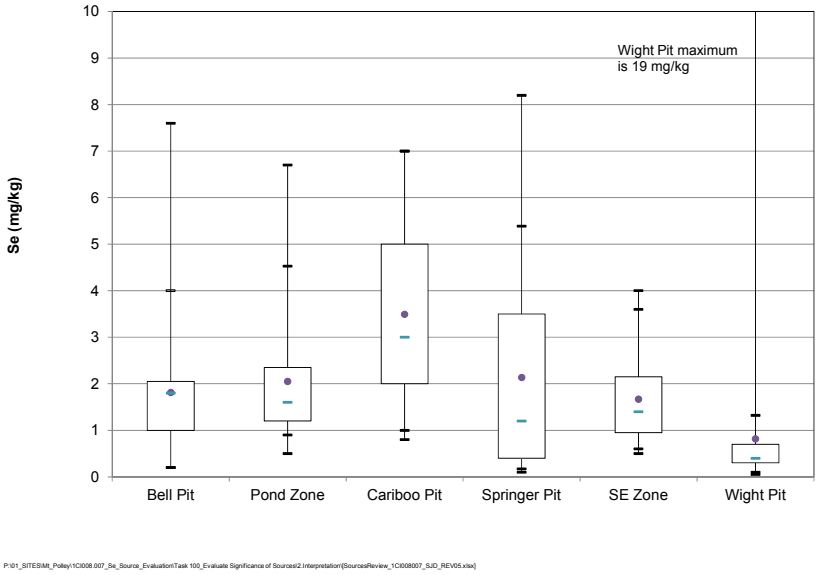

Figure 7. Box-and-Whisker Plots for Selenium and Selenium-to-Sulphur Ratios

1.1.5.4 Extraction Tests

Mines Act Permit M-200 required that “oxidized” samples be tested for solubility using the Shake Flask Extraction (SFE) method of Price (1998). The definition of oxidized was not provided in the verbiage of the permit. Nine samples of the -2 mm fraction of blasted rock were submitted for the procedure in 2001. Eight samples of ore stockpile rock were tested in 2015 as part of a *Mines Act* Permit M-200 requirement to evaluate closure requirements for the stockpiles (SRK 2015b).

Leachates from all extraction tests were non-acidic with leachate chemistry dominated by sulphate, alkalinity and calcium. The 2015 tests were more useful than the 2001 tests for understanding trace element leachability due to the use of lower detection limits and testing of stockpiled waste rock. A number of trace elements were not detected or yielded concentrations close to detection limits including cadmium (0.05 µg/L), chromium (0.5 µg/L), cobalt (0.1 µg/L), lead (0.1 µg/L), mercury (0.05 µg/L), nickel (0.5 µg/L) and zinc (10 µg/L). Average arsenic, copper, molybdenum and selenium concentrations were 4, 5, 29 and 15 µg/L, respectively.

1.1.5.5 Kinetic Testing

Laboratory kinetic (humidity cell) tests were performed on fifteen samples in support of geochemical characterization for permitting of mining of the Wight Pit (Northeast Zone), Southeast Zone, Boundary Zone, Pond Zone and expansion of the Springer Pit . Results have been reported annually as part of *Mines Act* Permit M-200 requirements. The samples were generally selected to evaluate oxidation rates for typical and elevated sulphide concentrations.

Samples from the Pond Zone were submitted for an acid-leaching procedure to remove carbonate and evaluate the reactivity of silicate minerals.

Table 3. Characteristics of Samples in Waste Rock Humidity Cells

HCT	Sample ID	Zone	Rock Type	Date Started	Date Stopped	Paste pH	TIC %C	Total S %	SO_4-S %S	AP kg $CaCO_3$/t	NP kg $CaCO_3$/t	NP/AP	TIC/AP	Ag ppm	As ppm	Ca %	Cd ppm	Co ppm	Cu ppm	Hg ppm	Mg %	Mn ppm	Mo ppm	Ni ppm	Pb ppm	Sb ppm	Se ppm	Zn ppm
HC2	31576	NE	PPp	7/21/2004	1/7/2013	8	0.79	1.4	<0.01	44	83	1.9	1.5	0.4	19	3	1.1	8.7	330	0.57	0.59	1400	13	1.2	38	0.3	0.7	170
HC3	32491	NE	Bx	7/21/2004	8/11/2008	8.3	1.1	0.45	<0.01	14	140	10	6.4	1.1	12	4.4	0.6	19	1700	0.39	1.3	1900	5.8	3.3	17	0.2	1	150
HC4	31943	NE	Bx	7/21/2004	8/11/2008	8.4	1.1	0.99	<0.01	31	130	4.1	2.9	1.2	10	4.2	0.9	20	1300	0.25	0.72	2000	7.6	4.2	21	0.3	1.4	170
HC5	32519	NE	PPp	7/21/2004	8/11/2008	8.6	0.62	0.54	<0.01	17	88	5.2	3.1	0.7	18	3.4	0.1	14	1700	0.19	1.2	1400	1.9	4.1	13	0.5	1.3	100
HC6	SE-05-17 Comp #1	SE	Monzonite	9/26/2005	1/7/2013	8.4	0.12	0.72	<0.01	23	21	0.91	0.43	0.3	17	0.87	<0.1	8.1	710	0.1	0.57	420	170	1.7	7.6	0.7	0.9	34
HC7	SE-05-30 Comp #1	SE	Monzonite	9/26/2005	1/7/2013	8.7	0.12	0.37	<0.01	12	40	3.5	0.85	<0.1	15	1.7	0.1	11	180	0.02	0.86	480	6.1	12	10	0.4	0.5	30
HC8	SE-07-66-72.5-75.13	SE		8/11/2008	1/7/2013	9.2	0.082	1	0.01	32	19	0.59	0.21	0.12	10	1.3	0.1	7.9	160	0.018	0.89	460	6	2.7	7.5	0.92	1.5	40
HC9	476111	Springer		8/11/2008	10/6/2009	7.9	0.011	0.04	0.01	0.94	18	19	0.97	0.34	11	1.7	0.42	21	710	0.077	1.3	1100	1.1	9.3	7.8	0.21	0.5	89
HC10	146677	Boundary		8/11/2008	10/6/2009	8.4	2	0.1	0.01	2.8	150	53	59	0.13	14	6.3	0.21	30	510	0.036	1.5	2800	1.4	12	7.8	0.64	0.7	110
HC11	146794	Boundary		8/11/2008	10/6/2009	8.4	1.4	0.15	0.01	4.4	160	35	27	0.17	17	4.7	0.37	23	250	0.12	1.2	2300	3	9.2	10	0.54	1.3	110
HC12	50033-1; Composite-4	Pond	MZ	4/20/2009	6/8/2009	6.6	<0.005	0.51	<0.01	16	8.4	0.53	<0.03	0.48	14	1.2	0.15	10	340	0.015	0.65	610	4.9	4.7	5.7	0.37	1.9	47
HC13	50033-1; Composite-5	Pond	DI	4/20/2009	ongoing	7.7	<0.005	0.19	<0.01	5.9	7.9	1.3	<0.08	0.25	12	0.89	0.11	8.8	250	0.01	0.59	520	3.5	4.1	6	0.4	1.2	49
HC14	465240; SD-07-23	Springer	BX	10/12/2009	1/7/2013	8.1	0.48	0.39	#N/A	12	96	7.9	3.3	0.62	34	2.6	0.98	14	720	0.4	0.95	1500	6	2.8	10	0.28	4.3	86
HC15	475695; SD-07-48	Springer	DI	10/12/2009	1/7/2013	8.1	0.27	2.5	#N/A	79	94	1.2	0.29	0.88	18	2.3	0.09	20	780	0.015	1	500	18	5	11	0.07	8.2	41
HC16	480684; SD-07-57	Springer	MZ	10/12/2009	1/7/2013	8.9	0.14	0.06	#N/A	1.9	69	37	6.4	0.52	13	2.2	0.43	14	360	0.14	0.67	730	3.5	2.4	10	0.16	0.5	92

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One Pond Zone test is continuing. The other tests ran for 1 to 9 years. General findings were as follows:

- Except for the Pond Zone tests which were artificially depleted of carbonate, no other tests generated acid. Six samples were classified as PAG from ABA but carbonate content prevented acid generation for the duration of the test.
- Sulphate release was strongly correlated with sulphur content regardless of zone (Figure 8).
- There was a lack of correlation between trace element content and trace element release rates, and sulphide content and trace element content.
- Comparison of relative utilization of carbonate minerals to oxidation rates indicated that an NPR of 2 or lower is appropriate for classification of ARD potential.

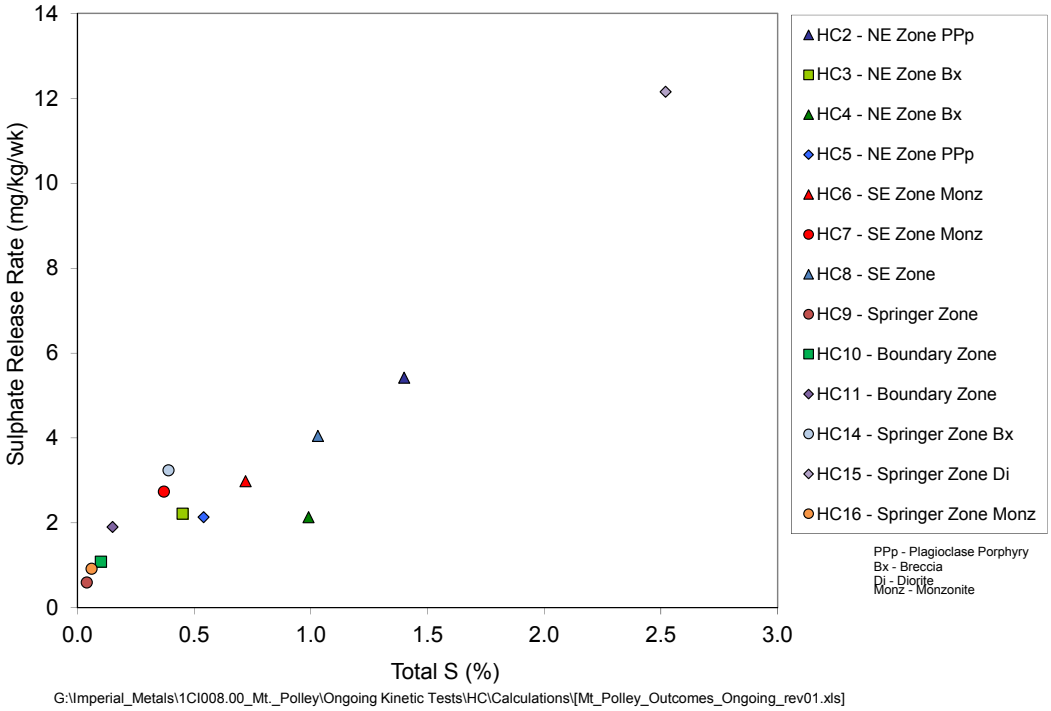

Figure 8. Correlation of Sulphur Content with Oxidation Rate

The strong relationship between sulphur content and oxidation rate yields the following predictive relationship for the onset of acidification (t_{onset}) in years at room temperature for waste rock with an initial (i.e., at time = 0) NP/AP of $\left(\frac{NP}{AP}\right)_0$:

$$t_{onset} = 70 \times \left(\frac{NP}{AP}\right)_0$$

A previous assessment using earlier humidity cell data (Appendix D) yielded a coefficient for this equation of 60 years and a confidence range of 42 to 100 years.

The equation indicates that waste rock with an initial NP/AP of 1 would become acidic in 70 years at room temperature. The general finding from the kinetic testing is that acidification of PAG materials at MPM will take decades to develop. This is consistent with the widespread pH neutral weathering conditions at MPM in both natural and mined materials.

1.1.6 Tailings Geochemical Characteristics

1.1.6.1 Static Characteristics

SRK (2015) reviewed tailings geochemical characteristics as part of submissions following up on the tailings dam failure in August 2014 (Figure 9). The principal finding from this review was that the tailings are not PAG. Compared to crustal normal concentrations, copper and selenium were present in the tailings at order of magnitude higher concentrations. Copper is partially deported as silicate minerals. Selenium is associated with the sulphide component of the tailings and is also correlated with copper content. Kinetic testing on tailings samples has to-date confirmed they are non-acid generating. The tests are continuing.

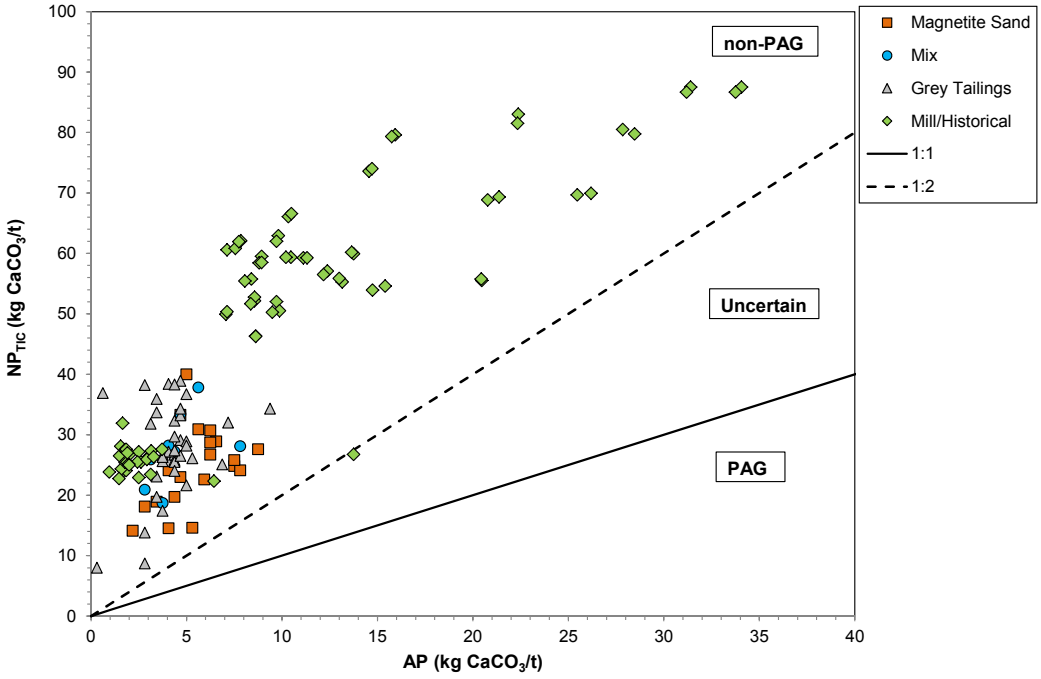

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Figure 9. Static Geochemical Characteristics of Tailings (SRK 2015)

1.1.6.2 Kinetic Characteristics

Six samples of tailings collected from Hazeltine Creek following the dam failure are being tested in humidity cells. Three of the samples are also being tested in columns using a trickle leach applied at less than 0.1 L/kg/week (compared to flood leach of 0.5 L/kg/week for humidity cells).

The samples were selected to represent visually distinctive tailings materials (magnetite sand and grey tailings). The samples are dominated by tailings solids but also contained native materials (mineral and organic soils, and glacial sediments entrained in the debris flow). The samples characterize weathering behaviour for a range of sulphur concentrations which align with typical characteristics of tailings in the impoundment.

The humidity cell tests (HCTs) have been running for about one year while the columns have operated for about 35 weeks. All tests have yielded leachate pHs typically between 8.0 and 8.2. Sulphate concentrations were initially near 1000 mg/L for humidity cells and above 1000 mg/L for columns. Both types of tests showed decreasing sulphate concentrations which have stabilized at lower concentrations. Humidity cells have generally reached stable concentrations for humidity cells while column test leachates continue to stabilize for some parameters. For parameters considered enriched in the tailings solids (copper and selenium):

- Highest copper concentration in one HCT was 0.15 mg/L but typical maximum copper concentrations were 0.02 mg/L in HCT leachates and 0.05 mg/L in column test leachates.
- Highest selenium concentrations were 0.01 mg/L in HCT leachates and 0.06 mg/L in column test leachates.

For other parameters, notable results were initial molybdenum concentrations between 2 and 3 mg/L in column leachates.

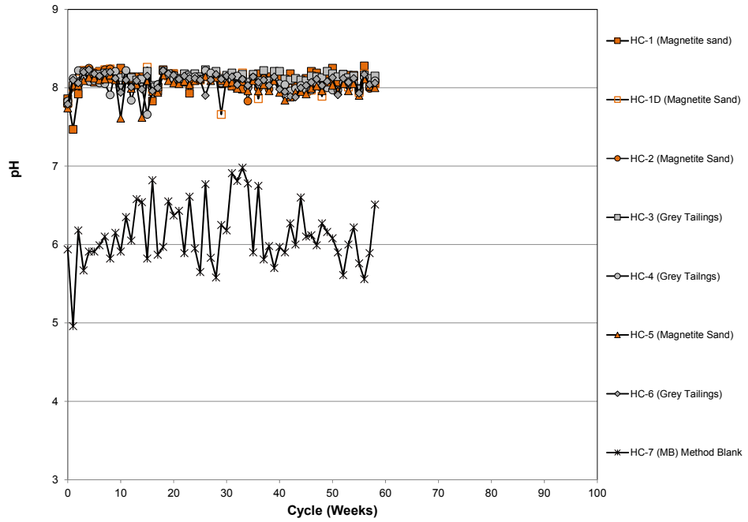

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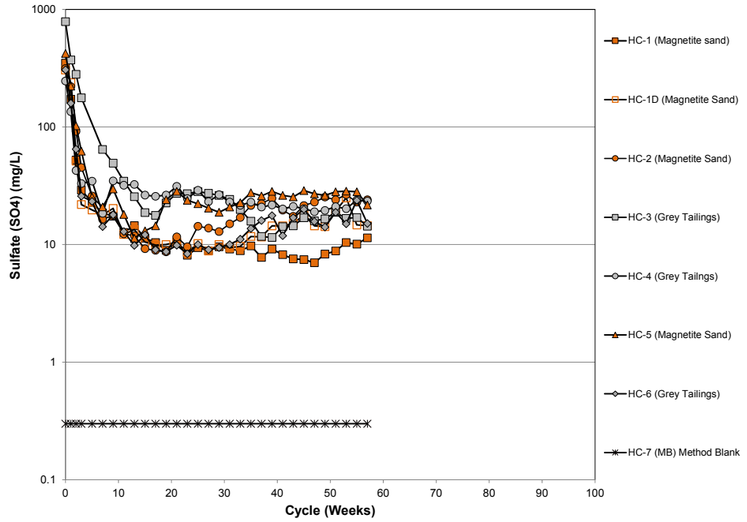

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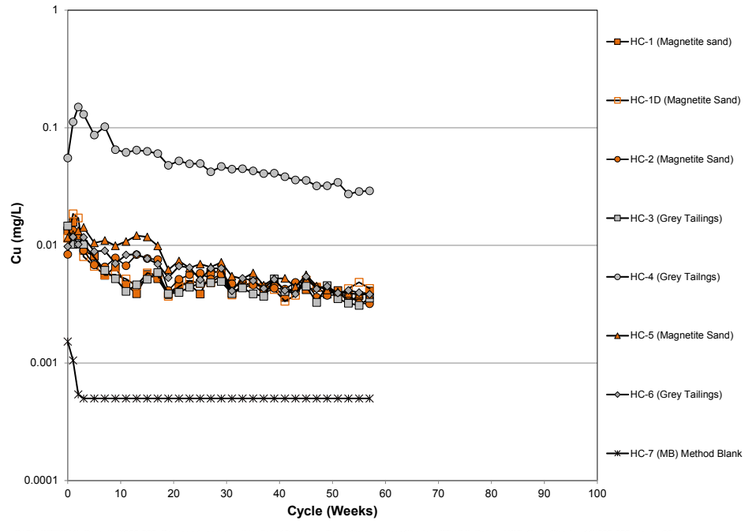

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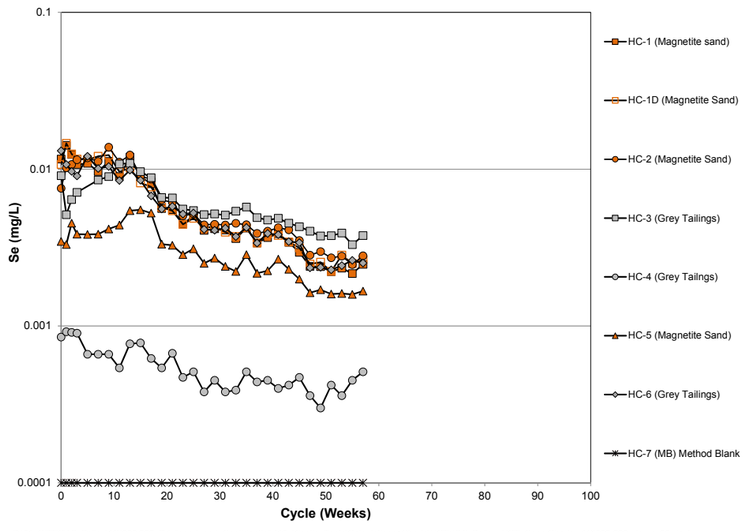

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Figure 10. Selected Leachate Chemistry for Tailings Humidity Cells

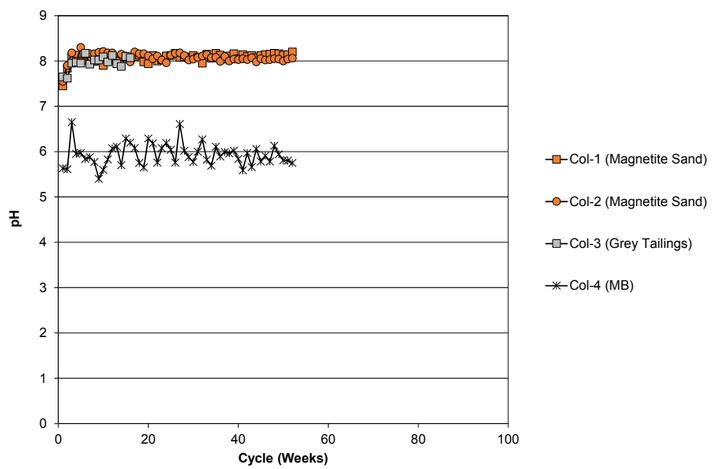

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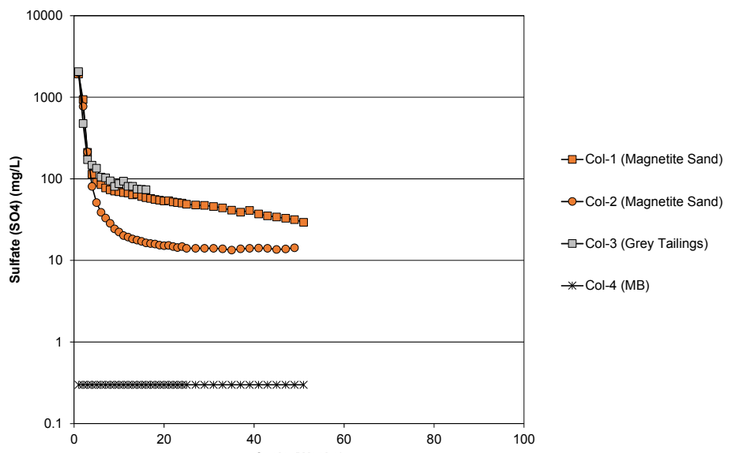

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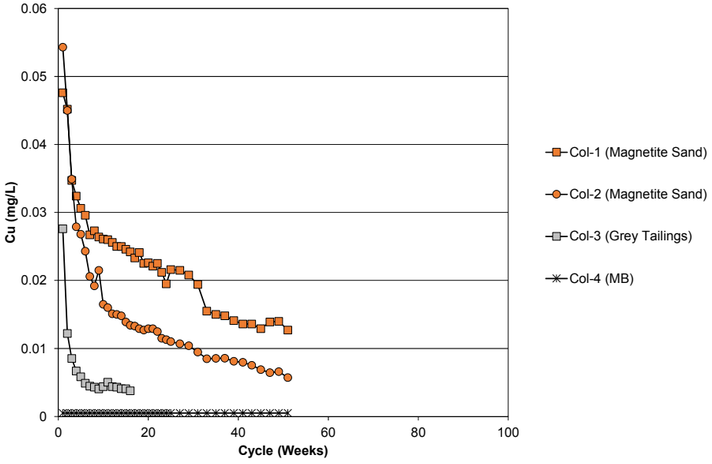

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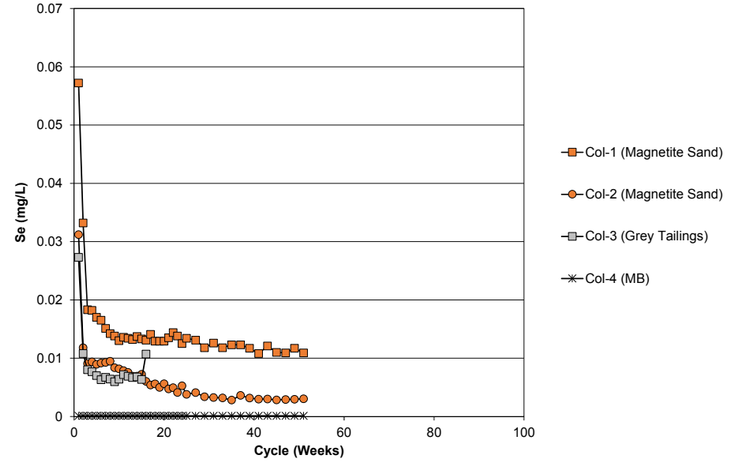

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Figure 11. Selected Leachate Chemistry for Tailings Columns

1.1.7 Other Sources

Two other sources were identified as potentially requiring geochemical source terms.

Sulphur was imported in 2004 as part of evaluations of recovery of copper present as oxide. The stockpiles are located between the East Rock Dump and Ore Stockpile (Figure 3). Composition data for these stockpiles are not available but the stockpiles are expected to be composed of approaching 100% sulphur in elemental form. Neutralization potential is expected to be negligible and elemental sulphur generates acid through oxidation to sulphate.

Magnetite was recovered from MPM tailings to generate a concentrate for use as a dense medium in coal processing. The magnetite stockpiles are located adjacent to the ore processing plant. No geochemical data are available for the magnetite.

1.2 Scope

The scope of this work is to generate geochemical source terms that can be used as an input to operational and closure water quality models for MPM produced by Golder Associates Ltd. (Golder).

1.3 Acknowledgements

This work was performed by SRK using data collected and collated by MPM site personnel (primarily Katie McMahen, Colleen Hughes, Luke Moger, Ryan Brown and Art Frye).

2 Conceptual Geochemical Models

2.1 Purpose

The purpose of conceptual geochemical models (CGMs) is to describe the anticipated geochemical performance of each source at MPM which is then implemented as a numerical model to generate source terms. CGMs consider the current understanding of geochemical characteristics (as described in Sections 1.1.5 and 1.1.6).

2.2 Sources

The following sources were evaluated:

- NAG waste rock.
- Ex-Pit PAG waste rock.
- Ore stockpiles.
- Pit backfills.
- Pit walls.
- Ore processing.

- Tailings.

CGMs for each source are described below.

2.3 Ex-Pit NAG Waste Rock and Construction Fills

Ex-pit NAG waste rock is produced by operational segregation of waste rock into PAG and NAG components using an NP/AP of 2. NAG rock was primarily placed in ex-pit subaerial dumps but has and continues to be used for construction of fills at the TSF.

Nominally, NAG waste rock contains an excess of acid neutralizing minerals over acid generating sulphide minerals and will generate pH basic water for perpetuity. General weathering processes will include:

- Oxidation of sulphides (pyrite, chalcopyrite and bornite) to release iron, acidity, sulphate and trace elements contained in the sulphides. Copper is expected to be primarily released by oxidation of chalcopyrite and bornite.
- Weathering of silicates by dissolved carbon dioxide in infiltrating waters. This process results in release of alkali earth and alkali metals, silicon and bicarbonate. Copper (whether incorporated in the mineral structure at the ionic scale, or native, see Section 1.1.2) could conceivably be released from chlorite by this process but chlorite has relatively low susceptibility to weathering by meteoric waters compared to sulphides and carbonates.
- Neutralization of acidity by reaction with calcium carbonate minerals or mixing with alkaline waters resulting in basic pHs, and precipitation of metals as various secondary minerals, including gypsum, metal oxides and metal carbonates. From observation of natural weathering, copper may form malachite and chrysocolla and be sorbed with iron oxides.
- Dissolution of secondary minerals produced by weathering processes. The more soluble forms are expected to be copper oxides.
- Dissolution of rock components independent of acid generation and neutralization (for example, natural secondary minerals such as malachite and chrysocolla).
- Control of trace elements forming cations by lower mobility at high pH (e.g. copper).
- Higher mobility of trace elements forming anions at high pH (e.g. selenium, molybdenum, arsenic).

Due to the solubility control exerted by secondary minerals, contact water chemistry is expected to be constrained so that chemical loadings are directly proportional to infiltrating water volume. Therefore, loadings will tend to increase as footprint area increases rather than as total mass increases. The exceptions are parameters that do not readily form secondary minerals such as selenium which may therefore leach in proportion to the mass of waste rock.

Operationally, the NAG waste rock can be expected to contain PAG components due to inefficiencies in segregation. Potential for ARD or accelerated metal leaching due to the presence of PAG would be controlled partly by the mass balance of AP and NP, but also the extent of contiguous PAG rock placed in the waste rock dumps. If the PAG rock is well-distributed through

the dump, the potential for water quality effect is reduced. The absence of minerals hosting metals that remain somewhat mobile at carbonate-buffered pHs (such a cadmium and zinc) also limits the potential for water quality effects at MPM.

2.4 Ex-Pit PAG Waste Rock

Segregated and exposed ex-pit PAG waste rock is present in the Temporary NW PAG Stockpile located adjacent to the Springer Pit. The distinguishing feature of PAG rock at MPM is that it contains an excess of sulphide over carbonate minerals (in terms of ABA units) rather than being from a particular rock type. Sulphide content is higher than NAG waste rock.

Due to the higher sulphide content of PAG waste rock, the overall oxidation rate of PAG waste rock is expected to be greater than NAG waste rock. However, before acidification occurs, PAG and NAG weathering conditions are expected to be similar with secondary minerals exerting solubility controls. For example, the solubility of sulphate is expected to be controlled by gypsum which will be similar regardless of the sulphide oxidation rate. The source terms for NAG and PAG waste rock are not expected to be sufficiently different to warrant developing different terms.

Acidification is expected to take decades to progress with early contact waters remaining basic and having metal concentrations controlled by the solubility of secondary minerals.

As higher proportions of the rock acidify, the drainage can be expected to become acidic. Metal concentrations will increase as secondary minerals formed at higher pHs dissolve. In the longer term, metal concentrations will decrease due to depletion of acid soluble secondary minerals and reduction in the available sulphide.

The timeframe for acidification effects is expected to be of the order of decades (See Section 1.1.5.5) and therefore will be avoided by timely (i.e., at the end of the currently anticipated life of mine) re-handling back to the Springer-Cariboo Pit.

2.5 Ore Stockpiles

Ore stockpiles will perform the same as NAG and PAG waste rock depending on composition. The presence of more copper sulphides than waste rock will result in more leachable copper being generated but similar solubility controls are expected for the elements of interest.

2.6 Pit Backfill

Existing backfilled pits are the Bell Pit (completely full), the Southeast Zone Pit (completely full), the Pond Zone Pit (completely full), the Wight Pit (partially full), and Cariboo Pit (partially full). PAG rock from Temporary NW PAG Stockpile will be backfilled into the Springer-Cariboo Pit at completion of mining. Backfilling of currently filled pits occurred during operation so that run-of-mine waste rock was directed immediately to a backfill location. The water level has risen in most of these pits resulting in complete submergence of PAG rock and partial submergence of NAG rock. PAG rock in the Cariboo Pit and Wight Pit remains unsubmerged due to drawdown of the water table as operations continue in these pits.

Waste rock in backfilled pits will behave the same as waste rock in external waste rock dumps until it is submerged by rising pit waters after which oxidation will effectively occur very slowly due to low oxygen concentrations in the backfill. During submergence, flushing of weathering products formed while the rock is exposed will likely occur but concentrations will be constrained by the same secondary minerals formed under subaerial conditions. Pore water will equilibrate with the secondary minerals in the waste rock.

Leaching effects due to low oxygen conditions such as reductive dissolution of oxides is not likely to occur because reactive carbon needed to provide electrons for reducing processes does not occur in the rock.

2.7 Pit Walls

Exposed pit walls will remain in the Springer-Cariboo Pit, Wight Pit and Boundary Pit. All other pits have been backfilled resulting in pit wall reactive surfaces becoming part of the backfill.

Pit walls are composed of fractured walls and rubble resulting from over-blast and physical weathering. Localized wall failures will contribute additional talus. Reactive surface area for pit walls is contained primarily in the broken rock rather than fractured walls.

For source terms, pit walls are assumed to perform the same as waste rock dumps composed of PAG and NAG waste but flow paths are much shorter.

During flooding of pit walls, accumulated soluble weathering products will be flushed into pit walls. Following submergence, oxidation of walls will effectively be stopped due to reduction in availability of oxygen. Highwalls above final flood levels will continue to weather.

2.8 Ore Processing

Ore processing results in crushing and grinding of ore in contact water. Soluble components of the ore are dissolved and become part of the process water. Modification of process water chemistry may occur in the cleaner circuit where lime is added to increase pH. The change in pH may cause copper to precipitate.

The ore source term is expressed as mass leached per mass of ore. Except for the possible effects of pH adjustment described above, process water concentrations are expected to be too low to be controlled by secondary minerals.

The ore processing terms will depend on the degree of oxidation of the ore. Freshly blasted ore will contribute less load than ore re-handled from stockpiles, and deep fresh ore will contribute less load than near surface ore that has been naturally oxidized.

2.9 Tailings Solids

During operations, tailings are deposited by spigotting from the TSF embankments, resulting in tailings beaches and slimes migrating to the centre of TSF. Cycloned tailings were also used for dam construction.

Under normal operational conditions, slimes in the centre would be fully saturated and below the process pond. Due to the finger drains in the dam, the water table drops from surface at the edge of the pond in the centre of the facility to the finger drains. As a result, tailings near the embankments are partially saturated. Oxygen enters the unsaturated tailings in the beaches and embankments by diffusion resulting in near surface tailings oxidizing most rapidly and consuming oxygen. An oxygen concentration profile will be present in the tailings which decreases most rapidly near surface and eventually results in negligible oxygen concentrations at depth. It is probable that active oxidation at this stage extends no more than a few metres into the tailings.

Due to the acid-consuming characteristics of the tailings, the weathering environment is pH-basic and overall processes are comparable to NAG waste rock (Section 2.3). Pore water chemistry during operations is dominated by process water with less effect from weathering processes because tailings are continually deposited, resulting in re-setting of the oxidation profile.

Process water contains low levels of dissolved organic carbon from flotation process reagents (e.g., methyl isobutyl carbinol). These compounds may act as a source of reduced carbon to facilitate reductive dissolution processes in the saturated components of the tailings such as dissolution of iron oxides and release of contained trace elements. SRK (2015a) assessed this susceptibility and concluded the tailings were stable under chemically-reducing conditions.

Following the tailings dam failure in August 2014, the water table dropped, allowing more of the tailings to become unsaturated than under operational conditions. Draindown of pore waters will have occurred allowing oxidation processes to influence pore water chemistry.

Reactivation of the tailings pond will result in the water table rising again into the tailings. As the water table rises, oxidation products formed following partial draindown will be dissolved by process waters. Pore waters can therefore be expected to reflect a mixture of process water effects and flushing of oxidation products, though, due to the limited penetration of oxygen into the tailings, process water will dominate.

After operations cease, the process pond will decrease and the water table will again drop resulting in more tailings becoming unsaturated. Draindown of the tailings will result in a transition from process water dominated chemistry to oxidation effects becoming dominant. Eventual pore water chemistry will be controlled by equilibration of water chemistry with tailings weathering products which will include oxides and sulphates.

2.10 Sulphur Stockpile

Elemental sulphur (S^0) oxidizes to yield sulphuric acid through the following reaction:

$$S^0 + H_2O + 3/2O_2 \rightarrow H_2SO_4$$

Since the sulphur stockpile contains no neutralizing minerals, infiltration from the stockpile is expected to be acidic. Metal content of the pile is expected to be low relative to rock at the site resulting in acidic drainage carrying lower metal concentrations than would be expected for ARD. The foundation of the stockpile is NAG waste rock. It is expected that neutralization potential in the waste rock is neutralizing acid generated by the stockpile leading to non-acidic drainage with

chemistry comparable to weathering of waste rock. It is possible that depletion of neutralizing minerals in the NAG rock will result in the NAG rock becoming acid generating leading to a localized acidic plume in this area of the pile.

2.11 Magnetite Stockpiles

The magnetite stockpiles consist of sand-sized magnetite recovered magnetically from tailings. The separation process will have resulted in entrainment of non-magnetic components of the tailings.

Magnetite is resistant to oxidation under atmospheric conditions and therefore will not contribute significantly to the chemistry of drainage from the stockpiles. Drainage chemistry will be determined by the entrained minerals and will therefore be pH neutral having similar characteristics to NAG waste rock and tailings.

2.12 Nitrogen Leaching

Nitrogen leaching is covered separately from the foregoing conceptual models because it originates from explosives residuals rather than mineral weathering. Since the rock does not generate leachable nitrogen, the leaching of residuals provides a flush of nitrogen which occurs with water contact. It is expected that the load of nitrogen flushed is greatest initially then decaying in proportion to the remaining soluble nitrogen. The commonly used model of Ferguson and Leask (1988) assumes that all residual nitrogen is flushed in the year following placement of waste. This means that nitrogen leaching exactly tracks with waste rock placed and stops two years after placement stops. In fact, it can be expected that nitrogen leaching continues after the rock is first placed. In terms of cumulative leaching, a newly constructed waste rock dump would be expected to show increasing loads for several years then stable loads as the volume of rock added each year becomes small relative to the total volume. “Tailing off” at closure will occur. Delays and lag effects may be expected due to hydrological factors.

For a mature site such as MPM, active and long closed waste rock dumps indicate nitrogen release under operational and closed conditions. Sump waters from open pits indicate leaching from pit walls.

Leaching of explosive residual from ore will occur due to flushing in the milling process. Tailings solids themselves will not leach nitrogen because flushing during processing is very efficient. Nitrogen leaching from the TSF will reflect the influence of process water.

3 Source Terms

3.1 General Approach

MPM operations started in 1997, resulting in generation of waste rock and tailings. These full-scale waste facilities provide a more appropriate basis for predicting current and future water chemistry than scaling laboratory tests to full-scale conditions, provided that near source monitoring locations are available and appropriate allowance for local dilution effects at

monitoring locations are included. The general approach for MPM has been to use interpreted full scale monitoring data to develop source terms supplemented by laboratory data where needed. This approach removes most of the uncertainty related to predicting source term chemistry.

3.2 Incorporating Uncertainty

The CGMs described in Section 2 indicate that geochemical processes reflected in source terms consist of weathering of primary minerals, which is determined by rates of mineral conversions, and dissolution processes which combine rates and solubility constraints. The latter consists of the rate at which minerals dissolve and the eventual concentrations achieved when equilibrium with the contact water is reached. For example, chalcopyrite oxidizes at some rate to produce copper sulphate. The copper sulphate then dissolves at a rate adding copper and sulphate to the water until copper and sulphate concentrations in the water are in equilibrium with the solid copper sulphate.

As described in Section 3.1, the general methodology used to develop the source terms relies mainly on site monitoring data which reflects the end product of weathering and dissolution of weathering products. The assumption is that the monitoring data contain indications of the end-point solubility of the weathering products with the proviso that dilution needs to be considered. Higher end concentrations in the dataset are used as the starting point to develop source terms because these are most likely to be closest to a solubility limit. To represent uncertainty in the underlying solubility limits, the statistics from water chemistry databases used are the 95th and 99th percentile concentrations. Maximum concentrations are not used to eliminate the bias caused by spurious concentrations resulting from sampling and analytical errors. The two (2) high end percentiles are used because concentrations constrained by the solubility of minerals are not fixed but dependent on total solution chemistry including, particularly, pH.

Other approaches to incorporating uncertainty are described in the following sections.

3.3 NAG Waste Rock

3.3.1 Method

The method for the NAG waste rock source terms is as follows:

- Evaluate partitioning of reactive minerals during blasting.
- Evaluate potential for acidification due to included PAG rock.
- Evaluate seepage chemistry for geochemical controls.
- Prepare statistical summaries for seeps from major rock dumps.
- Scale-up maximum concentrations to account for dilution effects to yield source terms.

The basis for the latter step is that seepage chemistry may be diluted from true contact water and therefore needs to be scaled to remove dilution effects. Scaling was approached by assuming that gypsum is likely to exert a strong solubility control on major ion chemistry due to the interaction between oxidizing sulphides (yielding sulphate) and dissolving carbonates (yielding

calcium). It also has well-defined behaviour in which chemistry matches thermodynamic models, and is expected to be one of the most soluble secondary minerals in this setting. The high solubility indicates that it will likely be the last to reach equilibrium with contact water compared to other major primary minerals

Scaling is therefore achieved using the following equation:

$$[M]_{corrected} = \left(\frac{[SO_{4,Theoretical}]}{[SO_{4,Observed}]} \right) \cdot [M]_{observed}$$

$[SO_{4,theoretical}]$ is the maximum sulphate concentration indicated by the solubility of gypsum.

$[SO_{4,observed}]$ and $[M]_{observed}$ are the observed sulphate and element concentrations. $[M]_{corrected}$ is the scaled element concentration. $[SO_{4,observed}]$ values are the 95th and 99th percentile seep concentrations selected to be at the upper end of the distribution so that the need for correction is minimized.

$[SO_{4,theoretical}]$ depends on bulk chemistry being lowest for waters containing only calcium as the balancing cation. As other major ions (K, Mg and Na) increase in significance, $[SO_{4,theoretical}]$ increases. The ratio (Mg+K+Na)/Ca shows significant variation within MPM (Figure 12). The ratio is lowest for the Boundary Zone and highest for seeps from the two haul roads. For the purpose of determining a range of $[SO_{4,theoretical}]$s, the 50th and 95th percentiles for each dump group were used. The 50th percentile indicates median predicted sulphate whereas the 95th percentile is a conservative limit. The actual range of the ratio is fairly narrow. For the Boundary Zone, the resulting range is 1510 to 1540 mg/L whereas for the South East Dump the range is 1610 to 1670 mg/L.

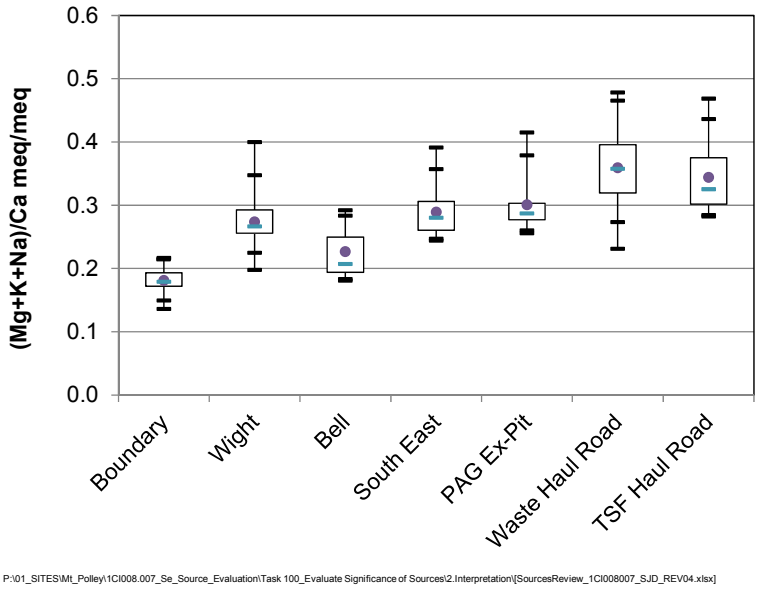

Figure 12. Box and Whisker Distributions for the Cation Ratio

3.3.2 Inputs

3.3.2.1 Mineral Partitioning During Blasting

Mineral partitioning during blasting was evaluated using blast hole cuttings because this can have an effect on the classification of waste for ARD potential (Day et al. 2015). If carbonate minerals preferentially partition into the blast fines, the use of a bulk NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially classify to the fines.

In 2001, blast muck samples from the Bell and Cariboo Pits were collected and the +2 mm and -2 mm fractions were tested separately for acid-base accounts. The +2 mm provides an indication of “bulk” characteristics because it contains larger rock fragments.

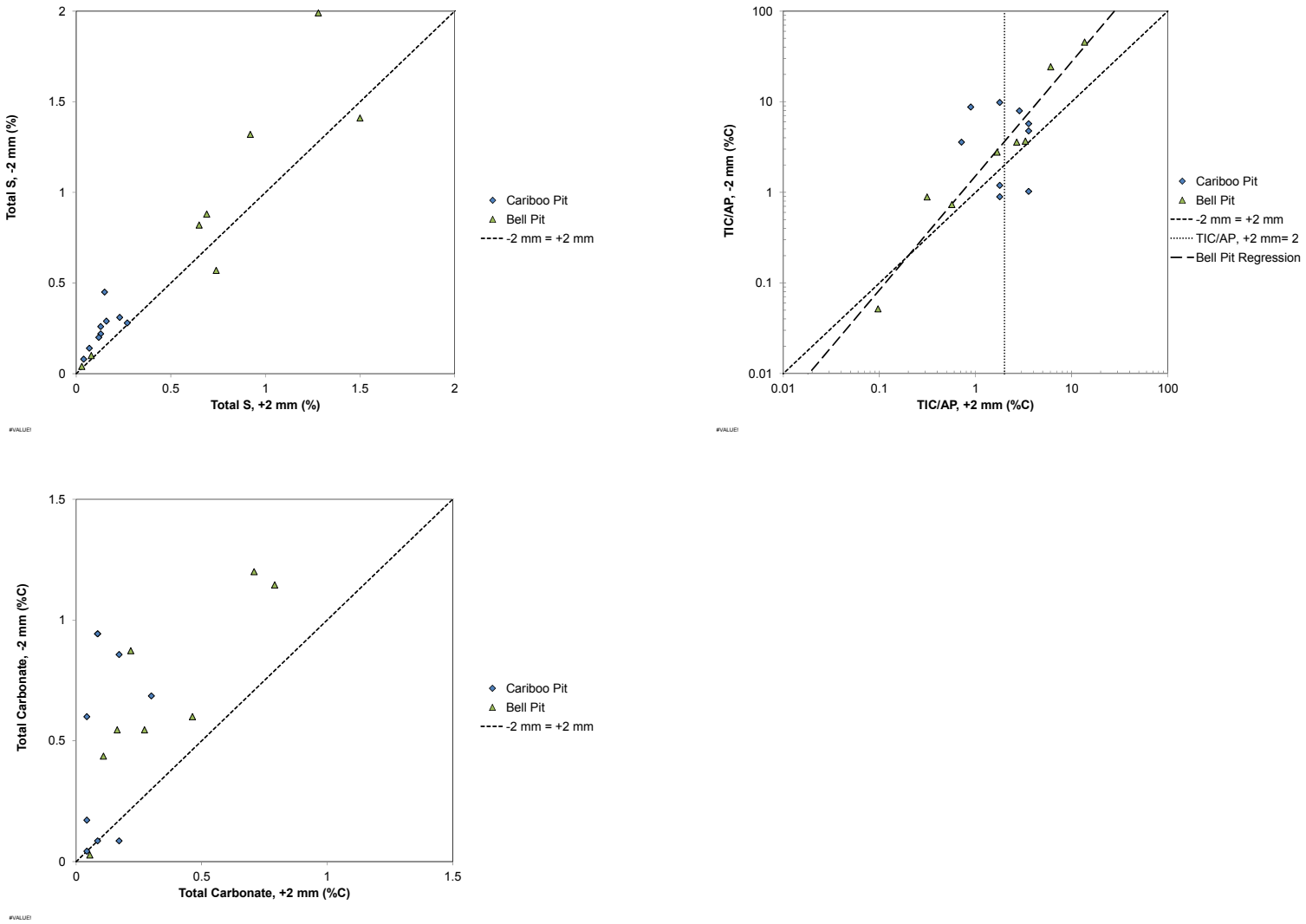

Figure 13. Results of Testing of Blast Rock Size Fractions

Both sulphur and carbonate preferentially partitioned into the -2 mm fraction but the effect was much stronger for carbonate (Figure 13). While there was good correlation between sulphur in the two size fractions, the correlation was absent for Cariboo Pit samples and weak for Bell Pit samples. The result of the difference in partitioning was that TIC/AP in the fine fractions was greater than in the +2 mm fractions for all but four samples. Again, for the Cariboo Pit there was no correlation between the fractions so the observed partitioning is qualitative only. For the Bell Pit, a regression equation could be derived:

$$\text{Log (TIC/AP, -2 mm)} = 1.3 \times \text{Log(TIC/AP, +2 mm)} + 0.18, r=0.97$$

The regression equation indicates that TIC/AP of 2.0 in the +2 mm fraction (i.e., approximately equivalent to bulk analysis determined in blast hole cuttings) is equivalent to 3.6 in the fines.

The equivalent regression equation:

$$\text{Log (TIC/AP, +2 mm)} = 0.75 \times \text{Log(TIC/AP, -2 mm)} - 0.10, r=0.97$$

shows that if it is assumed that the TIC/AP segregation criterion of 2 should be applied to the blast fines, the respective bulk criterion is 1.3. Based on the characteristics of NAG rock throughout MPM, about 22% of samples have TIC/AP between 1.3 and 2.

The findings of this assessment is that the classification of PAG using TIC/AP of 2 in blast hole cuttings has probably led to misclassification of some NAG rock as PAG. This finding was not used directly but primarily to confirm that under-classification of PAG rock (i.e., increased likelihood of PAG rock in NAG rock) is not a concern for MPM.

3.3.2.2 Potential for Acidification

The potential for acidification of NAG rock considers:

- the likelihood that misclassified PAG waste rock occurs as large segregated volumes (resulting in hotspots); and
- the mass balance ABA resulting from misclassified PAG rock.

From operating experience, MPM geological staff have determined that PAG rock is correlated with well-defined pyritic zones (see Section 1.1.2) but also occasionally as isolated pockets. The current main pyritic zone being exposed by mining is on the southeast wall of the Springer-Cariboo Pit. A similar zone was encountered in the Bell Pit and was managed appropriately by segregation and disposal in the Cariboo Pit. The Southeast Zone was classified entirely as PAG. The Wight Pit and Boundary Zone do not appear to have distinctive pyritic zones.

Sampling effort during operations focusses the defining dig limits around the pyritic zone in Cariboo-Springer Pit and a confirmatory-type approach outside the areas of known PAG occurrence. Due to the well-defined nature of the pyritic zones, the potential for PAG rock being included with NAG rock is largely expected to be due to isolated PAG occurrences outside the known pyritic zones. MPM target for sampling is one blast hole sample per 30,000 tonnes

meaning that a PAG quantity up to this amount could be missed if surrounded by NAG blast holes. An average PAG amount in this scenario would be 15,000 tonnes which on a 15 m bench would be a 20 m x 20 m area. At the scale of mining, a PAG area this size would become mixed with surrounding NAG rock as a result of digging and placement in a rock storage area.

The acid base balance for mixing of PAG and NAG rock is shown in Figure 14. The mixing lines were calculated using average characteristics for the whole site and are based on PAG defined as TIC/AP>2 in the bulk rock. The “Best” and “Worst” envelopes were derived by combining the 95% confidence limits on the means. The “Worst Case” is the upper confidence limits for AP combined with the lowest confidence limits on NP. The “Best Case” combines the reversed limits. The overall percent PAG accounted for at MPM is 11% of the total rock mass of which 9% is in the Temporary NW PAG Stockpile located next to Springer Pit for re-handle to Springer-Cariboo Pit at closure. The remaining 2% is stored elsewhere at the site in pit backfills. As there is a good understanding of the occurrence of PAG rock based on geological controls, it is expected that unaccounted for PAG rock is probably not more than a few percent, resulting in mass balance TIC/AP exceeding 3 and probably exceeding 4.

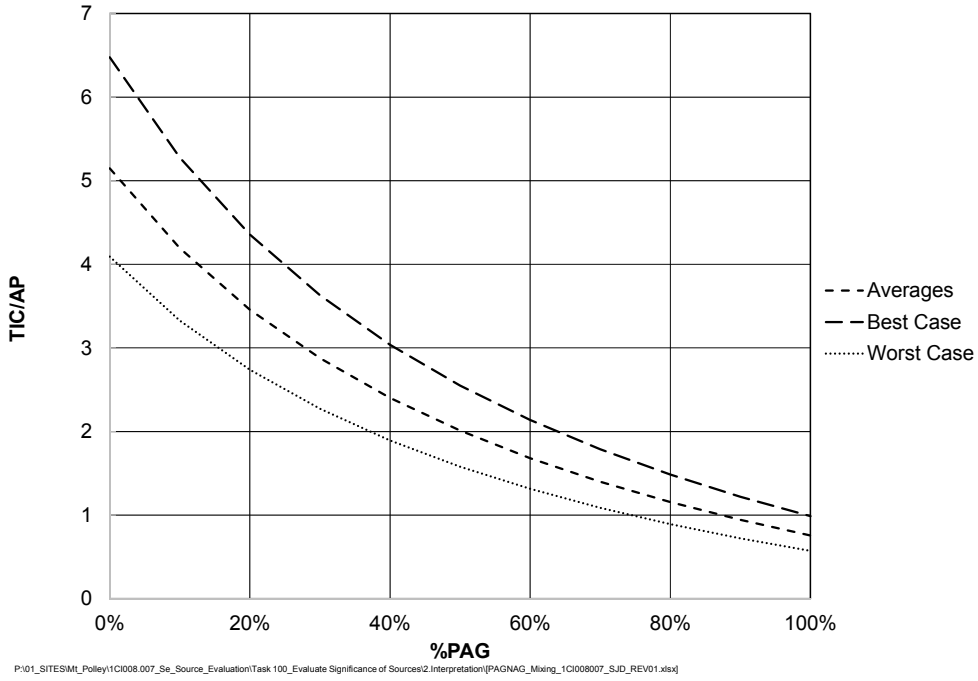

Figure 14. Acid-Base Account for PAG-NAG Mixing

Acidification of NAG waste rock at more than a very local scale is not expected because the percentage of PAG rock that could have been inadvertently included in the NAG waste risk is likely no more than a few percent. It was therefore concluded that NAG rock can be expected to remain permanently non-acidic and that long term changes in the NAG rock source term do not need to be considered.

3.3.2.3 Waste Rock Seepage Database

The seepage database (Appendix E) was interpreted to understand what mineralogical controls may be constraining water chemistry, determine if seasonal variations are apparent, and derive statistics for input into source term derivation.

As a general interpretation effort, relationships between rock composition and seepage chemistry were evaluated. However, except for the Wight Pit (East Rock Dump and Northeast Zone Dump) and Boundary Pit waste rock dumps, waste rock from all pits has been placed in several different locations limiting the opportunity to link rock composition to seepage chemistry.

Description of the Database

The current database contains 314 water analyses for seeps located as shown in Figure 15. Seeps have been sampled biannually since 2013. Filtering of samples occurs at the analytical laboratory unless hold times cannot be met. Samples are analysed for a full range of major and trace ions.

General Description of Water Chemistry

Water chemistry statistics grouped according to the areas indicated are provided in Table 4.

All seeps are non-acidic with medians above 7 and more typically nearer 8. The major anion is sulphate followed by bicarbonate (indicated by alkalinity) which is balanced mainly by calcium and magnesium. As discussed with reference to Figure 12, some differences in major ion chemistry were reflected in the cation ratio but differences in seepage chemistry were generally absent reflecting consistencies with the geological setting and placement of waste rock from the pits at multiple locations.

Selenium to sulphate ratios were examined for comparison with ratios in the rocks (Figure 7). Rock chemistry showed some distinctive variations in the ratio with typical ratios between 0.0001 and 0.001 mgSe/mgS. Likewise, the ratio was in the same range for seeps (Figure 16). Wight Pit extended to lower ratios in both the rock and seeps. It was concluded that selenium leaching is due to oxidation of sulphides and that leaching effects are similar throughout the site.

Nitrate concentrations varied significantly by source area (Figure 17). Distinctively higher concentrations were found for the Southeast Dump, the Temporary NW PAG Stockpile and TSF Haul Road. Lower concentrations were indicated for the North Bell Dump, Wight Pit Dumps (East Rock Dump and Northeast Zone Dump) and the small Boundary Dump. The differences are linked to placement activity with lowest concentrations for dumps less recently active.

Interpretation of Water Chemistry

Water chemistry was interpreted by using PHREEQC to calculate mineral saturation indices thereby providing an indication possible constraining minerals.

Saturations indices for sulphate were consistent with gypsum as a strong solubility control. At higher sulphate concentrations, gypsum saturation indices approached 0. Most seeps had

sulphate concentrations well below those required to be at gypsum indicating possible dilution effects, lack of gypsum, or incomplete equilibration. Regardless, the general observation is gypsum likely controls major ion (calcium and sulphate) chemistry with pH control by carbonate. Saturation indices greater than 0 for calcite were consistent with its dissolution and partial pressures for CO_2 were above -3.4.



Figure 15. Seep Sampling Locations

Table 4. Waste Rock Seepage Statistics

Statistic	Zone	pH -	Alkalinity mg/L	Cl mg/L	F mg/L	NO_3 mgN/L	NO_2 mg/L	SO_4 mg/L	Al-D mg/L	As-D mg/L	Cd-D mg/L	Ca-D mg/L	Co-D mg/L	Cu-D mg/L	Fe-D mg/L	Mg-D mg/L	Mn-D mg/L	Mo-D mg/L	Ni-D mg/L	Se-D mg/L	Zn-D mg/L
P95	Boundary	8.3	210	2.5	0.29	0.96	0.014	640	0.0093	0.002	0.000067	260	0.0011	0.0089	0.038	40	0.41	0.047	0.00025	0.0048	0.0037
	Wight	8.3	200	9.3	0.71	7.2	0.01	1200	0.056	0.00061	0.00031	370	0.0033	0.19	0.015	82	0.43	0.31	0.0048	0.19	0.034
	All Non-PAG	8.3	210	15	0.49	74	0.45	1200	0.029	0.0024	0.00016	420	0.0056	0.026	0.015	85	2.4	0.3	0.0021	0.29	0.007
	All PAG - Pre-Acid	8.2	330	14	0.29	50	2.1	1100	0.067	0.0018	0.00035	420	0.017	0.021	0.034	71	7.8	0.29	0.0017	0.24	0.008
P99	Boundary	8.3	220	2.5	0.3	0.99	0.021	650	0.024	0.0027	0.000073	260	0.0014	0.0094	0.038	40	0.48	0.054	0.00057	0.0064	0.004
	Wight	8.3	240	13	0.78	14	0.01	1300	0.061	0.00074	0.0006	400	0.008	0.3	0.015	90	1.1	0.42	0.0081	0.21	0.083
	All Non-PAG	8.4	240	21	0.68	130	5.5	1400	0.039	0.0032	0.00027	510	0.01	0.055	0.015	95	5.1	0.56	0.0032	0.41	0.0091
	All PAG - Pre-Acid	8.3	370	18	0.45	54	3.7	1100	0.28	0.0027	0.00044	430	0.024	0.024	0.034	76	8.9	0.48	0.0028	0.26	0.02

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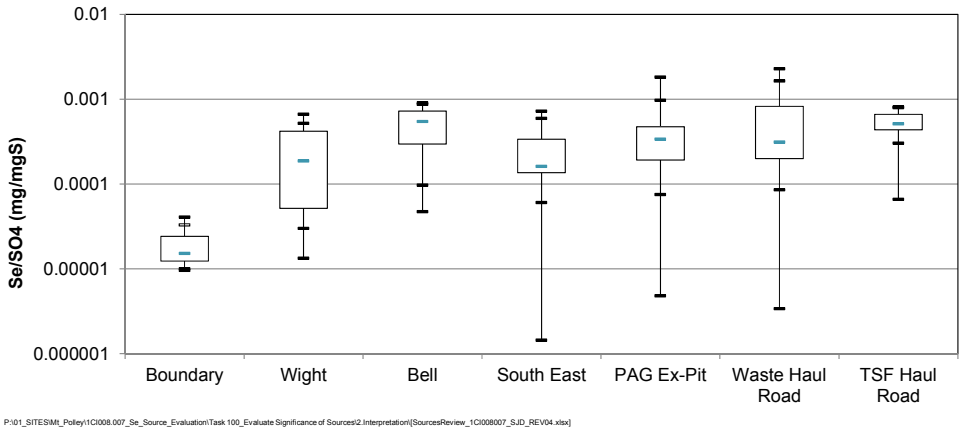

Figure 16. Se/SO_4 Ratios in Seepage

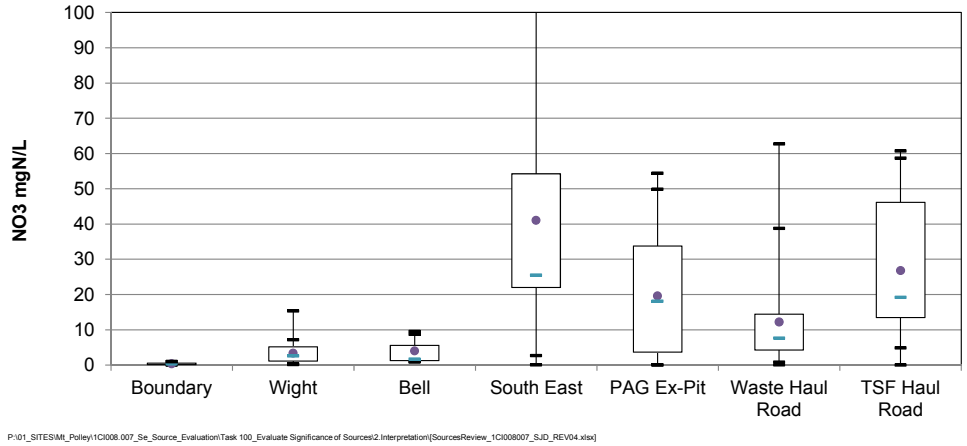

Figure 17. NO_3 in Seepage

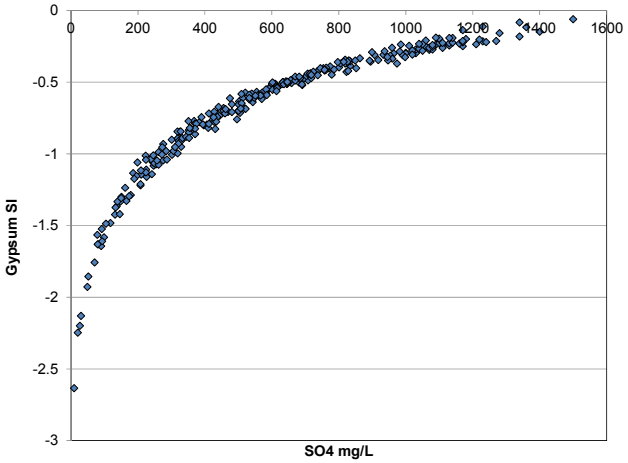

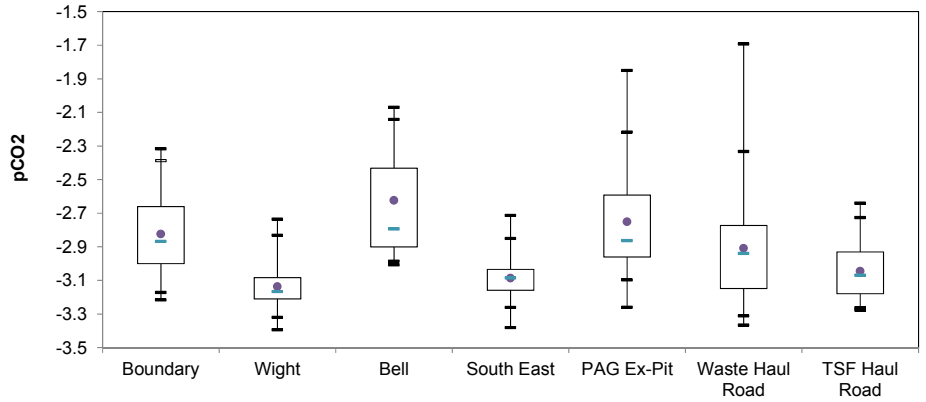

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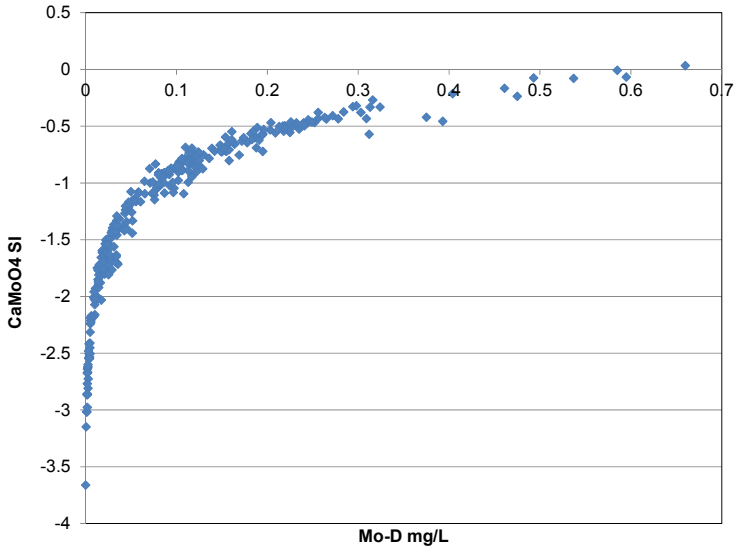

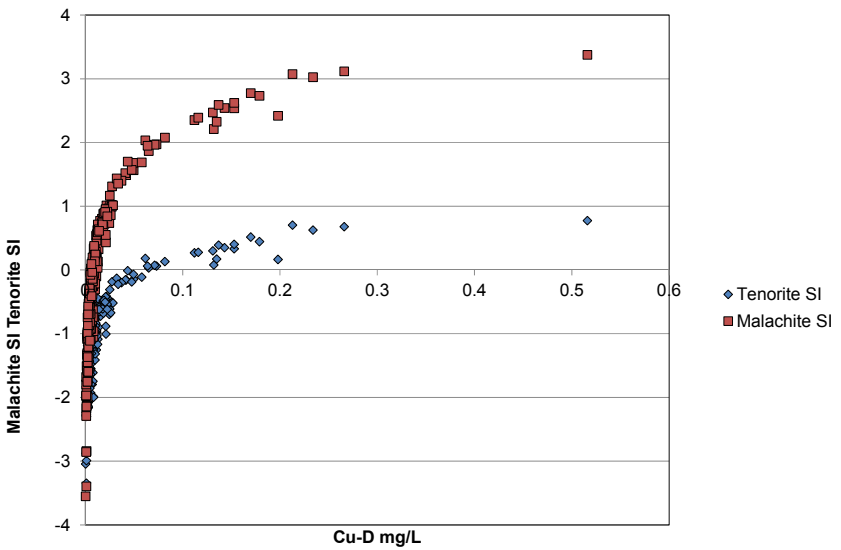

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Figure 18. Selected Saturation Indices

Saturation indices for malachite were well above 0 showing that copper concentrations were higher than would be predicted if malachite is controlling copper. Tenorite saturations indices were between 0 and 1 at higher copper concentrations indicating that it is more likely that a copper oxide is controlling copper concentrations. The finding that malachite does not appear to be controlling copper concentration is not consistent with the observed presence of malachite which formed by natural oxidation of the orebody. The likely controls on copper concentrations are secondary minerals resulting from oxidation of the waste rock following mining.

Other indications that higher end concentrations indicate mineral saturation included molybdenum which may be controlled by calcium molybdate (Figure 18) and barium by barite. Trace elements occurring at concentrations well below saturation in indices of 0 for their discrete minerals are probably adsorbed or co-precipitated with major secondary minerals (for example, iron oxyhydroxides).

Like the majority of trace elements, saturation indices for selenium minerals were well below 0, reflecting that discrete selenium minerals are not likely to be forming. Relationships between selenium concentrations and saturation indices for major ions that do appear to be controlling solution chemistry were examined (Figure 19). Upper limits to selenium concentrations were correlated with increasing saturation indices for gypsum and barite which may indicate co-precipitation with these minerals. The relationship with tenorite saturation indices showed that selenium concentrations appear to be constrained as copper concentrations were constrained. This may indicate that selenium is co-precipitating or adsorbing with an oxide or that the conditions resulting in copper oxide precipitation also result in selenium removal from solution. These interpretations do not provide a conclusive mechanism for constraining selenium concentrations but jointly show that higher selenium concentrations in the dataset are probably constrained. On this basis, seepage concentrations were used as the basis to calculate source terms.

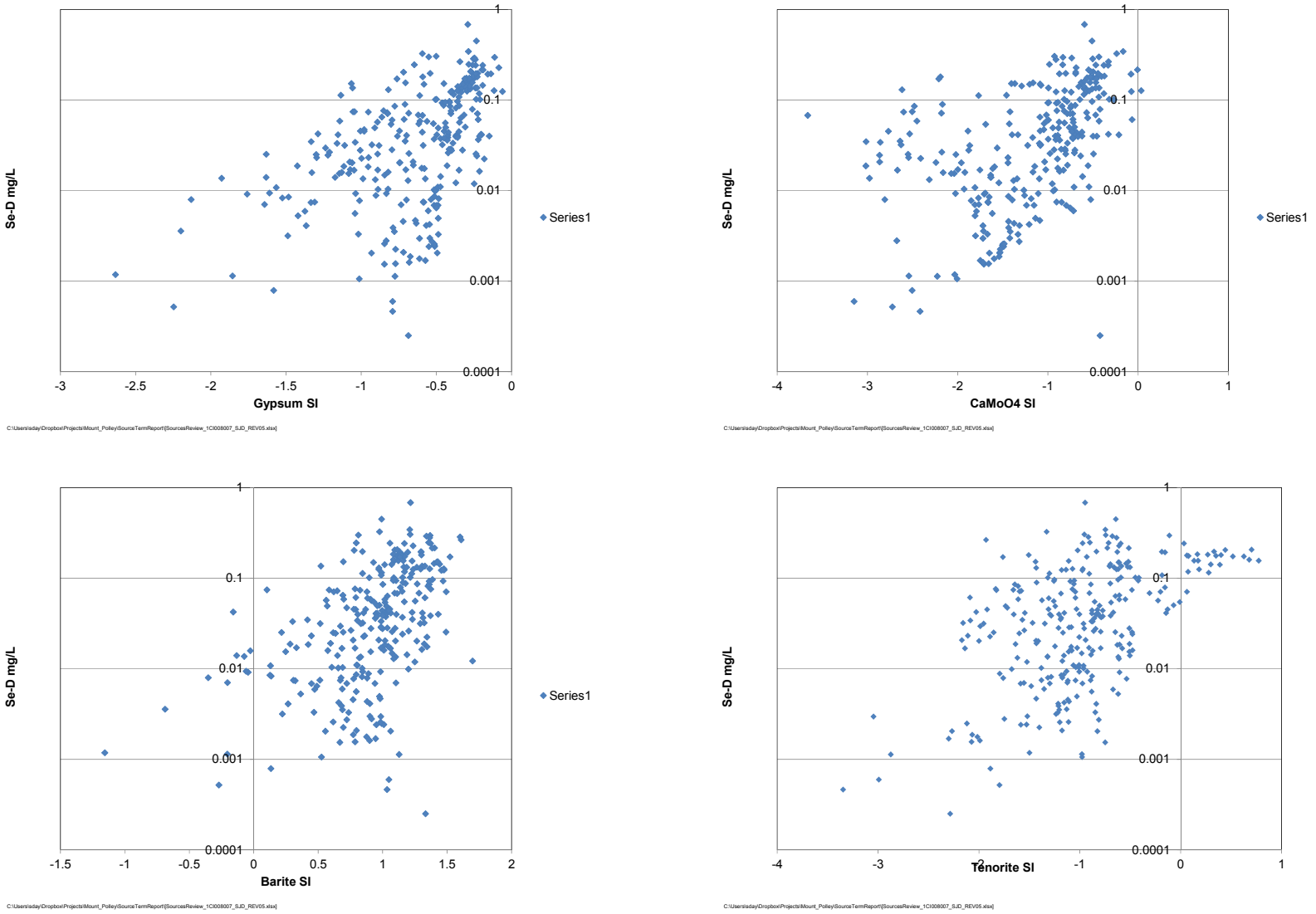

Figure 19. Relationships between Selenium Concentrations and Saturation Indices for Gypsum, $CaMoO_4$, Barite and Tenorite

Seasonal Variations

The seepage database was inspected for seasonal variations but none were identified. This may indicate that seepage chemistry does not respond to climatic variation or that the current size of the database does not allow seasonal effects to be resolved.

3.3.3 Results

Source terns for NAG waste rock are provided in Appendix F.

3.4 Ex-Pit PAG Waste Rock

Since ex-pit PAG waste rock will be re-handled to the Springer-Cariboo Pit at closure before acidification is predicted to occur, and the same solubility controls are expected as NAG, no separate PAG waste rock term was generated. The PAG waste rock term is that shown as “All-PAG Pre-acid shown in Table 4.

Acidification of PAG walls is discussed subsequently in Section 3.7.

3.5 Ore Stockpiles

Ore stockpiles are composed of rock with similar composition to waste rock with the exception of higher copper concentrations. Overall controls on water chemistry are expected to be similar to NAG waste rock and no separate term was developed. The effects of processing oxidized ore are considered separately in Section 3.8.

3.6 Pit Backfill

Exposed components of pit backfill are assigned the same source term as NAG waste rock. Following submergence, the same source term is assigned to the pore water chemistry assuming that pore waters equilibrate with the same previously formed secondary minerals. Over time, leaching of these minerals will result in decreasing concentrations; however, this process has not been quantified and it is conservatively assumed that constant pore water chemistry will be maintained in perpetuity.

3.7 Pit Walls

3.7.1 Method

Pit wall source terms prior to flooding consider the loading from weathering of rubble in exposed walls. Walls covered by waste rock backfill are not assigned a loading because the reactive surface area in waste rock far exceeds that in the rubble on pit walls.

The process of flushing walls by rising water levels was not considered because the relative volume water involved and flushing of pit walls weathering under non-acidic conditions will be small relative to ongoing flushing of exposed walls and flushing of backfilled waste rock.

Pit walls covered by water are also assumed to yield negligible loading because oxidation processes are effectively altered by a water cover. Ongoing leaching may occur (as described for waste rock backfill) but the volume involved is relatively small.

The load of parameter i released by weathering of rubble on pit benches (W_i) is calculated from:

$$W_i = M \cdot R_i \cdot k_O \cdot k_T \cdot k_p$$

R_i is the rate of release indicated by HCTs scaled to allow for oxygen availability (k_O), differences in temperature (k_T), and differences in reactive surface area (k_p) and applied to a mass M. Mass is calculated on a per m^2 planar wall basis, using rock density (ρ) and an assumed reacting thickness (h):

$$M = 1 \cdot h \cdot \rho$$

The load leached (L_i) is calculated from:

$$L_i = W_i \cdot k_c$$

k_c is a factor to account for incomplete leaching of weathering products.

The resulting concentration [M_i] in runoff from the wall area is obtained:

$$[M_i] = \frac{L_i}{I}$$

I is the infiltration over the area. Concentrations obtained for non-acidic walls are compared to those developed for NAG waste rock and constrained to the NAG waste rock if concentrations greater than for NAG waste rock are obtained. For PAG walls, concentrations were not constrained assuming that low pHs will result in high solubility of secondary minerals.

3.7.2 Inputs

R_is for non-acidic conditions were estimated from three humidity cells (HC14, HC15 and HC16) performed on Springer Pit rock (Table 3). The average of the three tests was used to estimate R. Scaling factors used for k_O, k_T, k_p and k_c respectively were 1, 0.3, 0.1, and 1, and assume that oxygen is not limited, temperatures are lower under site conditions, rock is coarser than humidity cells and weathering products are completely leached.

No naturally progressing humidity cells have yielded acidic leachate for MPM but rates obtained from HCTs on Pond Zone rock forced to generate acid by stripping of carbonate (HC12 and HC13, Table 3) were used to estimate an acidic source term. Since these samples were selected to evaluate oxidation rates following carbonate depletion for samples containing lower sulphide in the Pond Zone, the HCT weathering rates $R_{i,HCT}$ were scaled to sulphide concentrations in the acidic Springer Pit walls ($S_{i,Wall}$) using:

$$R_{i,acid} = R_{i,HCT}\left(\frac{S_{acid,wall}}{S_{HCT}}\right)$$

$S_{acid,wall}$ was estimated from the blast hole cuttings database from the Springer Pit. For each PAG sample in the database, the sulphur remaining following depletion of all NP was calculated from the measured sulphide content (S_0) and carbonate content ($NP_{TIC,0}$) and the rate ratio for depletion of carbonate (R_{ratio}):

$$S_{acid,wall} = S_0 - \left(\frac{NP_{TIC,0}}{R_{ratio} \cdot 31.25}\right)$$

R_{ratio} is equivalent to the PAG/NAG segregation criterion of 2. The 95th percentile of the resulting distribution of $S_{acid,wall}$ was calculated to be 1.7% compared to the 95th percentile of measured values of 2.1%. The resulting rates are shown in Table 5.

Table 5. Humidity Cell Rates (mg/kg/week) Used for Pit Wall Terms

HCT	Zone	Alkalinity	SO_4	Al	As	Cd	Ca	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	U	Zn
HC-12	Pond	0	27	0.062	0.0016	0.000073	2.5	0.0034	0.065	0.036	0.0001	0.48	0.17	0.00046	0.0013	0.0028	0.00005	0.053
HC-13	Pond	0	4.7	0.025	0.000044	0.000037	1.2	0.0057	0.099	0.0047	0.000014	0.22	0.13	0.000029	0.0012	0.0001	0.0000022	0.012
HC-14	Springer	18	3.2	0.022	0.00068	0.000029	7.2	0.000031	0.0024	0.018	0.000037	1	0.002	0.0067	0.000052	0.0064	0.000068	0.0014
HC-15	Springer	6.3	12	0.17	0.00013	0.0000048	7.2	0.00013	0.0061	0.063	0.00014	0.12	0.0028	0.0042	0.000054	0.00017	0.000035	0.0013
HC-16	Springer	13	0.92	0.068	0.00063	0.0000051	4	0.000013	0.00089	0.0039	0.000028	0.38	0.00034	0.0022	0.000046	0.00019	0.000032	0.001

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The weathering thickness (h) was set to 2 m to be equivalent to typical over-blast thickness. ρ was used as 2.65 t/m^3.

Total annual precipitation of 670 mm/year was used to estimate infiltration of 603 mm/year assuming that 90% of precipitation contacts wall rocks.

3.7.3 Results

Pit wall source terms of non-acidic and acidic walls are shown in Appendix G.

3.8 Ore Processing

3.8.1 Method

The mass leached from ore as it is processed was calculated from shake flask extraction test data. Concentrations in the shake flask tests (in mg/L) were converted to mass leached as (mg/t) by multiplying by factors of 3 L/kg which is the leach ratio in the test, and 1000 kg/t. The mass leached is used to determine the load added to the process water from each t of rock processed.

3.8.2 Inputs

Shake flask data from characterization of eight samples from four ore stockpiles were used (SRK 2015b). The data were used to calculate 5th, 50th and 95th percentile of the loads leached. Since the rock in the stockpiles varied in age from one to nine years, they were not representative of freshly blasted ore. To account for this, the 5th percentile was used to indicate leaching of freshly blasted ore and the 95th percentile was used for processing of the stockpiles.

3.8.3 Results

The resulting source terms are provided in Appendix I.

3.9 Tailings

3.9.1 Method

Tailings source terms were developed for operating conditions (i.e., when tailings are being discharged) and closure conditions when contact waters are assumed to represent oxidation of tailings following draindown of process waters. Re-flooding resulting from reactivation of the impoundment would result in seepage chemistry intermediate between these conditions.

For operational conditions, observed seepage chemistry from tailings dam drains (see Appendix **H**) was assumed to be representative of future tailings contact water. Seepage chemistry is assumed to reflect mainly the influence of entrained process water with less influence from oxidation of tailings. Since localized influence from groundwater and non-contact surface can be expected, the range of concentrations assumed was the 95th and 99th percentiles.

For closure conditions, the preferred approach was to obtain direct chemistry from contact waters in the current unsaturated zone because these would likely represent the conditions when the

tailings are fully drained down. Site personnel identified two groundwater monitoring locations (Breach-1 and Upstream-1) which were felt to possibly represent the influence of tailings; however, sulphate concentrations were not different from the tailings dam drains, and higher end dissolved element concentrations were strongly influenced by suspended matter (for example, aluminum concentrations on filtered samples ranged up to 33 mg/L). It was therefore not known with confidence whether the data indicated contact water chemistry.

Interpretation of leach column data (see below) indicated that early chemistry provide a good indication of contact water chemistry reflecting the influence of oxidation processes. The following method was used to estimate contact water chemistry for drained down tailings:

- The 95th and 99th percentile concentrations of column data were calculated.
- For the majority of parameters, drain down chemistry was characterized by the column data percentiles.
- For selenium, interpretation of the column data resulted in the conclusion that attenuation of selenium may be occurring in the early stages of testing as a result of reductive process converting selenate to selenite. To address this possible effect, selenium concentrations were calculated using the sulphate statistics and the range of Se/SO_4 ratios indicated by later data:

$$[\mathrm{Se}] = \left(\frac{\mathrm{Se}}{\mathrm{SO_4}} \right)_{\mathrm{ratio}} \times [\mathrm{SO_4}] .$$

- The equivalent dam drain percentile was used for ammonia because it was not measured in column leachates.
- Manganese concentrations were markedly lower in column leachates compared to seepage. This difference may reflect that conditions in desaturated tailings favour lower mobility of manganese, but the seepage data were selected.

3.9.2 Inputs

Seepage data statistics were calculated for all seepage collection points collected between 1998 and 2015.

Seepage and column data were evaluated for solubility controls using the same approach as waste rock (see Section 3.3.2.3). Sulphate concentrations in all column data were close to 2000 mg/L and found to yield gypsum saturation indices near 0, and therefore consistent with solubility control by gypsum. Seepage saturation indices tended to be well below 0. Other parameters showing possible secondary mineral controls were copper (tenorite), molybdenum (calcium molybdate), and barium (barium sulphate). Based on similar reasoning as waste rock, the early column data appear to indicate secondary mineral solubility controls for these elements and provide a good indication of the solubility of other elements.

Figure 21 shows the ratio of Column to Seepage for the two statistics. The columns showed higher concentrations than seepage for most parameters including those linked to acid generation and neutralization processes (SO_4, Ca, Mg) and related heavy elements (Cu, As, Mo, Sb, Se).

Those lower in column data include nitrogen forms (which would be introduced by leaching in the process plant), and Al, Mn and Fe. Manganese and iron may be higher in seepage due to reducing conditions in drains but also may be influenced by colloidal matter. The latter may also explain why aluminum concentrations were higher in seepage compared to the column tests, and exceeded theoretical solubility of aluminum hydroxides (Figure 22).

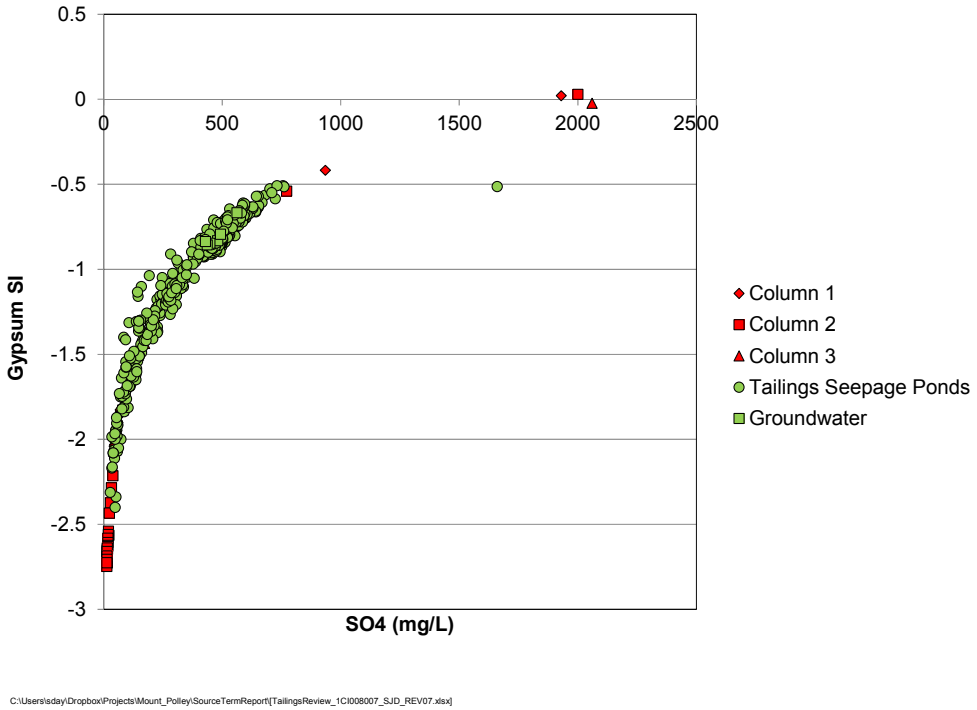

Figure 20. Gypsum Saturation Indices for Tailings Seepage and Column Data

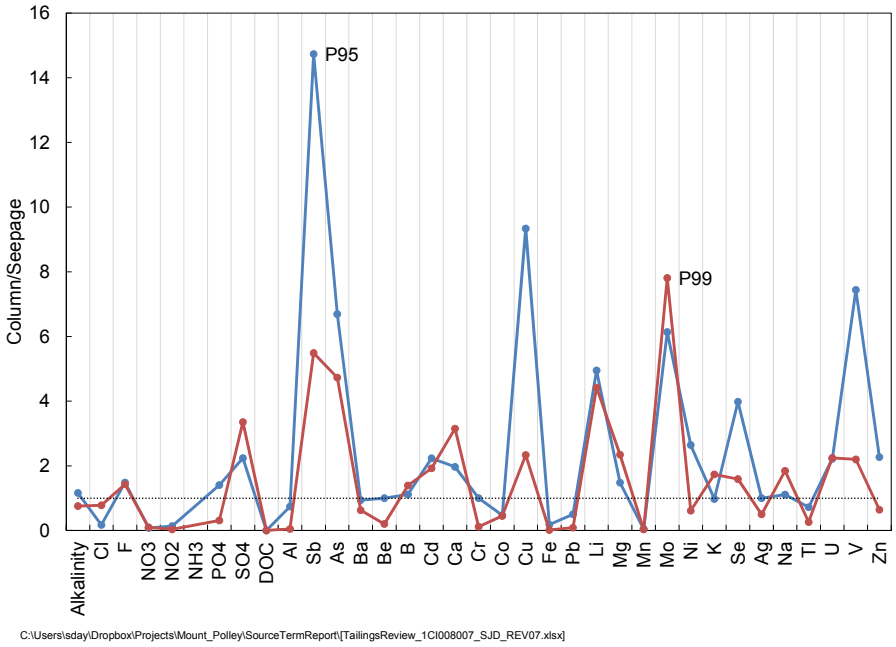

Figure 21. Comparison of P95 and P99 Statistics for Ratio of Column/Seepage

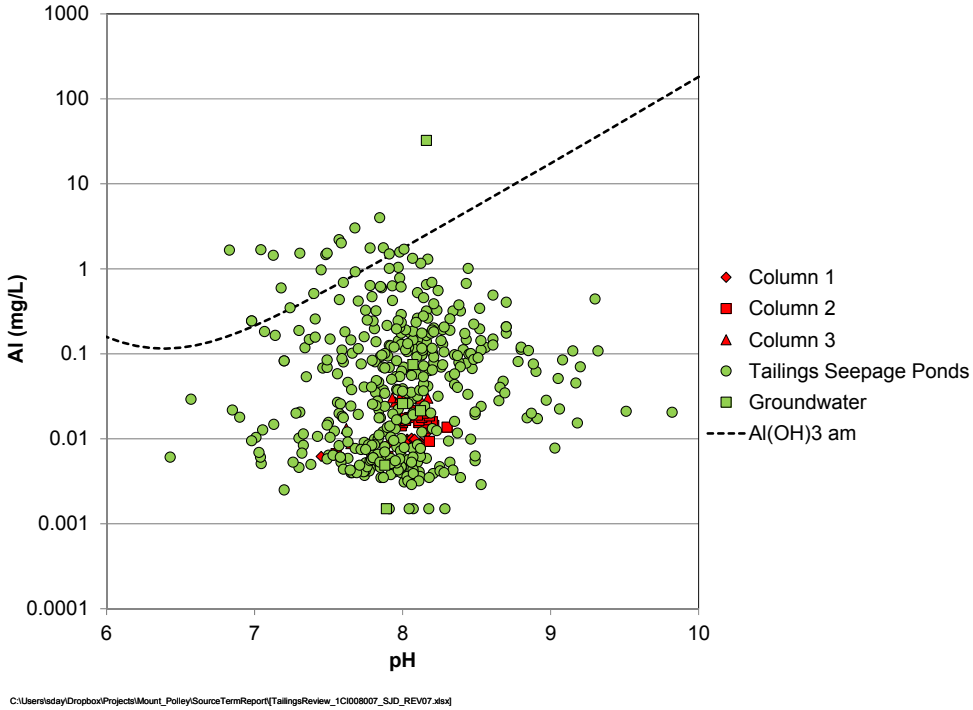

Figure 22. Tailings Aluminum Concentrations on Log Scale Compared to pH. Ideal Solubility of Amorphous Aluminum Hydroxide is Shown

3.9.3 Results

Tailings source terms are provided in Appendix I.

3.10 Sulphur Stockpile

No separate source term was developed for the spatially limited sulphur stockpile. As indicated in the conceptual model, it is likely that the stockpile is leaching sulphuric acid. It is assumed that the leaching effect of the stockpile is reflected in other site seeps and is therefore reflected in the NAG waste rock source terms.

3.11 Magnetite Stockpiles

No separate source term was developed for the magnetite stockpiles. Relative to other sources, these stockpiles are not expected to be significant sources.

3.12 Nitrogen Leaching

Nitrogen leaching was included for each source term as follows:

- Waste Rock. Nitrogen sources terms were developed from existing seepage by grouping waste rock dumps into active (PAG Ex-Pit and Southeast Dump), and inactive (Bell Pit and Wight Pit). For each group, mean concentrations and 95% confidence limits on the means were calculated to consider uncertainty (Table 6).

- Pit Walls. Pit walls were assumed to have zero contribution due to the small mass involved and expected results of meteoric leaching which is expected to result in any leaching effects having short duration and being insignificant relative to waste rock reporting to pit water sumps. B. Mattson, Lorax (pers. comm.), indicated that a non-zero source term should be applied but supporting data were not available.
- Backfill. Backfill source terms are the same as those for waste rock (Table 6).
- Ore Processing. Leaching of nitrogen forms by processing were based on the shake flask extraction data (Appendix I).
- Tailings. Tailings source terms are based on the observed seepage for operational conditions and column data for draindown conditions (Appendix I).

Table 6. Waste Rock Nitrogen Source Terms

Phase	Statistic	Ammonia mgN/L	Nitrate mgN/L	Nitrite mgN/L
Inactive	Lower 95% Confidence Limit	0	1.7	0
	Mean	0.053	3.4	0.51
	Upper 95% Confidence Limit	0.18	5.2	1.9
Active	Lower 95% Confidence Limit	0.034	11	0
	Mean	0.15	28	0.29
	Upper 95% Confidence Limit	0.27	45	0.61

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4 Conclusions

This report presents source term geochemical predictions that are inputs into the site wide water quality model. The main conclusions that provided input into the source terms are:

- While several ore zones at MPM have been mined since 1997, all except the relatively small Pond Zone are alkalic porphyry mineralization centred on magmatic-hydrothermal breccia bodies with similar geological characteristics. The host rock for the mineralization is the MPIC which is mainly monzonite. The similarities of the mineralized zones, including their host rocks, indicate that source terms can appropriately be developed on a site-wide basis rather than considering significant differences between the zones.
- As a result of geochemical segregation of waste rock based on ARD potential through the mine life, PAG waste rock has been or will be placed in open pits where it will be permanently flooded thereby preventing ARD from developing.
- It is expected that operational inefficiencies will have resulted in PAG waste being incorporated into the NAG waste rock but the segregation approach was conservative and mass balance excess of acid neutralizing minerals over acid generating minerals means that future development of ARD is very unlikely. Weathering conditions are predicted to be pH-basic in perpetuity.
- Tailings are non-PAG.
- As a result of the pH-basic weathering conditions, chemistry of seepage from the existing full scale facilities reflects solubility limits for weathering minerals. Chemistry is affected by dilution which was corrected using the solubility limit of gypsum.

This report, Derivation of Geochemical Source Terms, Mount Polley Mine - DRAFT, was prepared by

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A – ML/ARD Management Procedure Manual

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

ML/ARD MANAGEMENT PROCEDURE MANUAL

OBJECTIVE

The objective of this Metal Leaching/Acid Rock Drainage (ML/ARD) Management Procedure Manual is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). This document summarizes all the various procedures and considerations related to ML/ARD potential through mine life processes.

DOCUMENT REVISION HISTORY

This document replaces earlier versions of similar documents that directed ML/ARD Management at MPM in response to *Mines Act* Permit M-200 issued on August 3, 1995. The procedures as described have been in the place since that date.

Document Update Summary

Revision Date	Author	Comment
June 30, 2016	Chad Cameron Ben Harding Katie McMahen Luke Moger Ryan Brown Stephen Day (SRK)	Original Document

BACKGROUND

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of: weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulphur (e.g. sulphide and elemental sulphur) are exposed to the weathering effects of oxygen and water. In iron sulphide minerals (e.g. pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid. ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at MPM is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due to the potential consequences of acid generation for long term management of the site, Mount Polley Mining Corporation (MPMC) actively manages waste rock based on its ARD potential as described in the following sections.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for ML. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at MPM).

UNDERSTANDING OF THE DISTRIBUTION OF ARD POTENTIAL

Like other alkalic porphyry deposits (e.g. Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g. Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPMC geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit.

This ML/ARD Management Procedure Manual applies to waste rock and ore stockpiles. Tailings are consistently NAG due to removal of copper sulphides by ore processing.

MANAGEMENT OF PAG ROCK

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored subaqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit
- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo-Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

DETERMINATION OF ML/ARD POTENTIAL

Waste rock on site is separated into two categories, NAG and PAG, using Neutralizing Potential Ratio (NPR) defined as:

$$NPR = NP/AP.$$

Acid Potential (AP) (in kg $CaCO_3$/t) is measured from:

- Total sulphur (%) x 31.25

Neutralizing Potential (NP) (in kg $CaCO_3$/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate.

As required by *Mines Act* Permit M-200, PAG is defined as:

- NPR≤2 and total S>0.1%.

This *Mines Act* Permit M-200 requirement was specified in terms of NP determined by a whole-rock acid extraction and titration method; however, MPMC chose to use total carbonate which yields lower NP than the titration methods.

MATERIAL CHARACTERIZATION OVERVIEW

This section provides an overview of characterization procedures.

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument , allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries, and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Millfeed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

As a QA/QC measure required by *Mines Act* Permit M-200, the Environmental Department takes random weekly grab samples from the NAG waste dump when PAG is being mined to verify that waste is being appropriately characterized and handled.

Water chemistry monitoring of seepage from rock dumps and of contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third party laboratory for metals analysis as an additional source of data for site geochemical models.

IN-PIT SEGREGATION

Blasthole Samples:

1. After the production drill has completed and moved away from the hole, the sample may be taken.
2. Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3. Samples are to be collected in a clean plastic sample bag.
4. The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5. The sample bag is to be tied off using ribbon.
6. In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7. Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1. Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2. The sample is to be dried at 105°C.
3. The sample is then to be crushed in the Primary Crusher.
4. The sample is then to be crushed in the Fine Crusher.
5. The sample is to be split until the sample size is approximately 200 g.
    a. Reject from the sample is to be wasted.
6. The sample is then to be pulverized for 75 seconds.
7. The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.
8. If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1. The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the LIMS database.
2. The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3. The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1. Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.

2. Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is included as Figure 1.

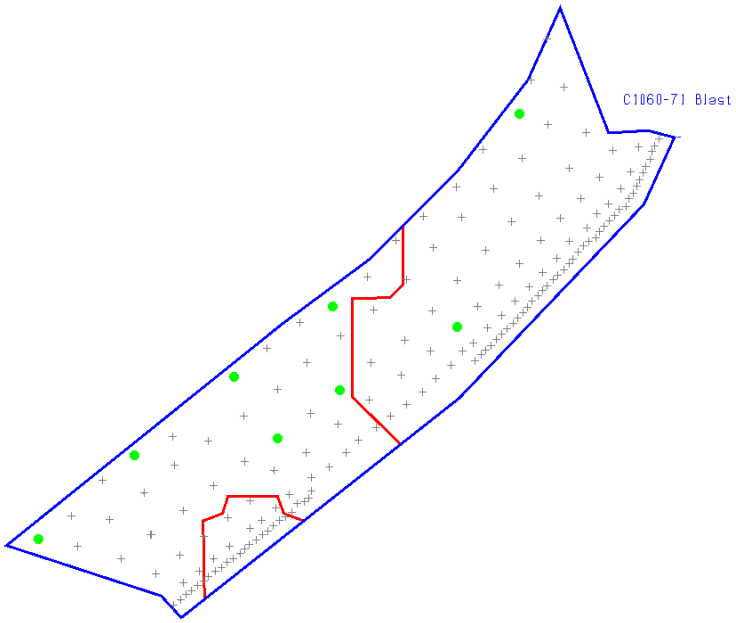

Figure 1: Location of ABA samples (green dots) within a blast. Red polygons denote mill feed ore, remainder is waste. The Ore Control Technician focuses sampling on areas which are designated waste and/or stockpile ore by the blasthole model. Reference blast = 149,173 t.

3. The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1. If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2. The Assay Lab will run the sample through the LECO CS230 Carbon Sulphur Analyzer.
3. Once analyzed, the machine transfers the carbon percentage (C%) and the sulphur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4. The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5. The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1. Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2. Modeling the blast

a. The software used is MineSight.
b. The model is based on a 5 metre (m) x 5 m x 12 m block system.
c. The block closest to the ABA sample will closely match the sample.
d. The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.
e. Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
f. Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.

3. The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor. An example of a sample layout is included as Figure 2.

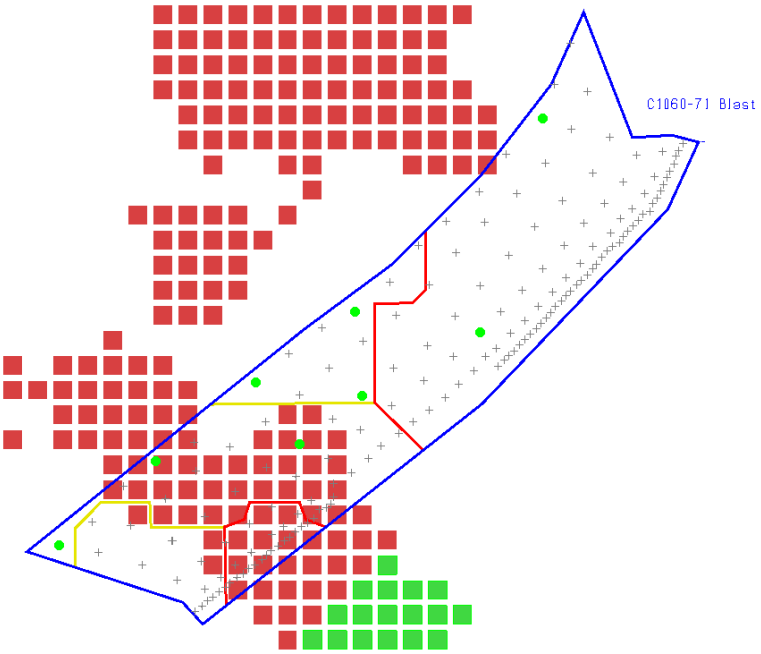

Figure 2. ABA results from samples shown in Figure 1 are used to update the blasthole PAG model item which identifies blocks which meet PAG criteria (red). The Ore Control Technician then marks up the PAG waste (yellow polygon) and the complete ore/waste markup is released to the Surveyor.

Surveyor:

1. The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.

2. Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.
   a. Red Placard = Mill Feed Ore
   b. Green Placard = Hi-Ox Ore
   c. Yellow Placard = PAG
   d. Blue Placard = NAG
   e. Pink Ribbon = High Grade Mill Feed Ore

f. Green Ribbon = Cariboo Stockpile Ore

3. Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

MATERIAL HANDLING

Shovel/Haul Truck Operators:

1. The Shovel Operator will mine the rock, following the contacts laid out by the Surveyor.
2. The Shovel Operator will ensure that all material contained within the contact stakes is routed as described by the markup and that any uncertainty in material classification is resolved by seeking the assistance of either the Pit Supervisor or the Engineering Department.
3. Upon loading a haul truck, the Shovel Operator shall direct the Haul Truck Driver as to the material type being hauled, and destination, using a horn sequence. The Haul Truck Driver will then take the material to the designated area.

IN-PIT MONITORING

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC ABA'ed to a third party laboratory (typically ALS Environmental in

Burnaby, BC) for metals analysis as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are included in the Operation, Maintenance, and Surveillance Manual.

TAILINGS MONITORING

Mill Metallurgy

1. The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    - Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    - The shift composite is then to be added to a monthly composite.
    - At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for an ABA sample.
2. The Environmental Department is to send the monthly tailings composite sample to a third party laboratory (typically ALS Environmental in Burnaby, BC) for metals analysis to provide data for site geochemical modelling.

WASTE DUMP MONITORING

Environment Department

1. The Environmental Department is to take ABA grab samples on a weekly basis as per MPMC-SOP-016: ABA and Soil Sampling.
2. Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site and can be found in the Operation, Maintenance and Surveillance Manual.

REVIEW OF RESULTS AND PROGRAM EFFICACY

Data collected and corresponding interpretation regarding the ML/ARD program are included in the Annual Environmental and Reclamation Report (AERR), due annually to the British Columbia Ministry of Environment and Ministry of Energy and Mines on March 31 of each year, reflective of the previous calendar year. The AERR includes sections on: waste rock characterization and disposal; drainage water quality monitoring; and, updates to long-term predictions (kinetic testing).

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

MPMC – SOP – 002:

Surface Water Quality Monitoring

Purpose

To monitor surface water quality in accordance with Permit11678, the Mount Polley QA/QC Binder, and the *BC Field Sampling Manual* and 2016 Comprehensive Environmental Monitoring Plan.

Scope

This procedure outlines the surface water quality monitoring requirements that are the responsibility of MPMC Environmental Department staff.

Introduction

All surface water sampling must be carried out in accordance with the *BC Field Sampling Manual*. This SOP outlines the procedure required to maintain compliance with the Manual and Permit 11678, including who is responsible for the sampling, and when monitoring needs to occur. A comprehensive list of all required sampling is available under Permit 11678 and 2016 Comprehensive Environmental Monitoring Plan. The specific work methods are found in *MPMC-WORK-002: Surface Water Quality Monitoring*.

Samples must be taken on or before Thursday, as they must be shipped to the laboratory in Burnaby by Thursday afternoon at the latest. Monthly and quarterly water quality samples are collected the first week of the month when possible.

At least one duplicate surface sample is taken per month along with either a field or a trip blank. The second mandatory duplicate may be taken at a far-field or groundwater site depending on sampling schedule.

Responsibilities

Environmental Superintendent/Coordinator:

- Ensure that the results of samples required under Permit11678 are reported in quarterly reports to MOE, in the Annual Environmental and Reclamation Report, which is submitted to MOE and MEM.
- Review sample results regularly to identify any QA/QC issues or water quality concerns.
- If a Permit 11678 or MMER discharge water quality guideline is exceeded, follow the reporting and follow-up monitoring requirements in MMER, Permit 11678, and the First Nations Communication Plan.

Environmental Technologist/Technician:

- Coordinate the sampling schedule in accordance with the Annual Monitoring Plan (the Annual Monitoring Plan 2016 is provided in Appendix X).
- Ensure that samples are collected and handled in accordance with the *BC Field Sampling Manual*, the *MPMC-WORK-002: Surface Water Sampling*, and this document.
- Ensure samples are preserved, packed, and shipped according to *MPMC-WORK-004: Sample Preservation and Shipping*.
- Enter field data into the MP-5 database and/or spreadsheets on the Environmental network drive.

Preparation

Two Weeks Before Sampling:

- Make sure there is a sufficient sampling supplies and ice (for shipping) on site (refer to Appendix X – Sample Supplies Inventory Checklist).

One Week Before Sampling:

- Arrange for second person to assist with sampling, as required.
- Plan for shipping of samples to ensure there is not a conflict with statutory holidays.

On the Day of Sampling:

- Label all bottles and place in clear sample bags.
- Place sample bags in cooler(s) and label coolers accordingly.
- Place ice in the coolers along with the field blank set (if planned).
- Check all equipment required for sampling is functioning correctly and has sufficient battery life.
- Carry out any necessary equipment maintenance and calibrations as required by *MPMC-WORK-00:5 Data Collection Equipment*.
- Review the associated sampling Job Hazard Assessment, and complete and FLRA if necessary.
- Review safety concerns at individual sites if needed.
- Follow *MPMC-SOP-011: Check In and Check Out Procedure.*

Procedure

Collection:

- Collect all bottles and equipment necessary for sampling.
- Locate sampling locations using the Sample Locations Map (Appendix I), the Sample Site UTMs (Appendix II), and the Site Matrix (Appendix IV). Documents are also available in the Environmental Management System folder on the Environmental network drive.
- Carry out the in situ tests (as per *MPMC-WORK-005-1: WTW pH and Conductivity Meter* and *MPMC-WORK-005-7: NTU Meter*), preserve the samples and record keeping at each sample location in accordance with *MPMC-SOP-17: Record Keeping*.
- For each sample follow the guidelines as presented in the *BC Field Sampling Manual*.
- Place the samples in a cooler with ice.
- Upon returning to the lab, create a COC, and pack the coolers for shipping as per *MPMC-WORK-004: Water Sample Preservation and Shipping*.
- Ensure samples are collected on or before Thursday so that they may be shipped out to the lab in a timely manner.
- Enter field data into the MP-5 database and/or necessary spreadsheets on the Environmental network drive.
- Results from surface water samples required by Permit 11678 are to be submitted to MOE quarterly and annually (as part of the Annual Environmental and Reclamation Report).

For more specific surface water sample collection procedures, refer to *MPMC-WORK-002: Surface Water Sampling*.

Documents and Records

- Surface water sample results are stored in the MP-5 database and on the Environmental network drive.
- Surface water sample results are to be submitted to MOE on a quarterly and annual basis.

References

- Permit 11678
- *BC Field Sampling Manual*
- 2016 Comprehensive Environmental Monitoring Plan

Related Documents

- *MPMC-SOP-005: Data Collection Equipment*
- *MPMC-SOP-011: Check In and Check Out Procedure*
- *MPMC-SOP-017: Record Keeping*
- *MPMC-WORK-002: Surface Water Quality Monitoring*
- *MPMC-WORK-004: Water Sample Preservation and Shipping*
- *MPMC-WORK-005-1: WTW pH and Conductivity Meter*
- *MPMC-WORK-005-7: NTU Meter*
- Sampling Locations Map (Appendix I)
- Sample Site UTMs (Appendix II)
- Site Matrix (Appendix IV)
- Sample Supplies Inventory Checklist (Appendix X)

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

MPMC – SOP – 016:
ABA and Soil Sampling

Purpose

To monitor the operational MPMC ARD/ML sampling and segregation program by collecting weekly waste rock samples (when PAG material is being mined), as per Permit M-200, and to assess the variability and suitability of reclamation materials on site, as per Permit M-200 and the *MPMC Soil Management Plan*.

Scope

This procedure outlines the ABA and soil sampling requirements that are the responsibility of MPMC Environmental Department staff.

Introduction

ABA grab samples are taken from active rock dumping sites; typical sample sites include, but are not limited to, active rock disposal sites, new road construction and road surfaces, and TSF construction. These samples are a randomized audit of detailed geological mapping done by MPMC geologists to ensure proper segregation and management of acid generating, PAG, and NAG materials. While Permit M-200 requires weekly samples only when PAG material is being mined, MPMC takes ABA grab sample weekly, regardless of the material being mined.

Soil samples are taken from stockpiles to monitor soil degradation and for characterization purposes prior application of soil to reclamation sites. All new soil stockpiles are to be sampled upon creation, and a site wide soil stockpile sampling program is to be carried out every 5 years. Additional soil sampling may be completed on progressive reclamation sites to monitor soil development.

Site specific soil surveys must be completed by a qualified professional for areas schedule to be disturbed by mine expansion. This is discussed in the *MPMC Soil Management Plan* and is beyond the scope of this document.

Responsibilities

Environmental Superintendent/Coordinator:

- Ensure that sampling is completed on a regular schedule, as required.
- Ensure that results are reported in the Annual Environmental and Reclamation Report, which is to be submitted to MOE and MEM.

Environmental Technologist/Technician:

- Coordinate sampling schedule.
- Ensure that samples are collected and handled in accordance with *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling*, and this document.

Preparation

On the Day of Sampling:

- Pre-select area(s) for soil samples to be taken (refer to *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling* for details).
- Call Pit-Shifter and ask if any rock waste is being hauled, its location and if it is safe to enter the area (refer to *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling* for details).
- Review the associated Job Hazard Assessment, and completed a FLRA if necessary.
- Ensure all workers have appropriate PPE and are fit for the task.
- Follow *MPMC-SOP-011: Check In and Check Out Procedure*.

Procedure

ABA Grab Sampling:

- Take a composite sample of a minimum of 1 kg of randomly selected material, as described in *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling*, and place in clean sample bag.
- Record the GPS Coordinates, elevation and sample information in the field notebook as per *MPMC-SOP-17: Record Keeping.*
- Enter sample information into the spreadsheet on the Environmental Network Drive and submit an analysis request in LIMS.
- Tag and date sample bag.
- Deliver sample(s) to the Bucking Room.

Soil Stockpile Sampling:

- Take a photo of the stockpile to document characteristics, including size and vegetative cover.
- Collect a composite sample from a minimum of three sub-sample locations in a clean, labelled, plastic sample bag, taking soil from the surface and at depth at each subsample location.
- Record the sample location GPS coordinates and record sample information in the field notebook as per *MPMC-SOP-17: Record Keeping.*
- Store samples in the refrigerator until they can be shipped to the analytical laboratory.

The detailed procedure is outlined in *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling*.

Soil Sampling of Reclamation Sites:

- Pre-select soil sample locations and record GPS coordinates.
- Collect a composite sample from minimum three locations at each site in a clean, labelled plastic sample bag, taking a representative sample from the entire soil profile at each location.
- Record sample information in the field notebook as per *MPMC-SOP-17: Record Keeping.*
- Store samples in the refrigerator until they can be shipped to the analytical laboratory.

A detailed procedure is outlined in *MPMC-WORK-016: Acid-Base Accounting and Soil Sampling;* however, it may need to be adapted for specific sampling objectives.

Documents and Records

- ABA analysis results are recorded in the MPMC LIMS and into the spreadsheet on the Environmental Network Drive.
- All soil sample results are recorded on the Environmental network drive.
- ABA and Soil results are reported to MOE and MEM in the Annual Environmental and Reclamation Report.

References

- *MPMC Soil Management Plan*
- Permit M-200

Related Documents

- *MPMC-SOP-011: Check In and Check Out Procedure*
- *MPMC-WORK-016: Acid Base Accounting and Soil Sampling*

Appendix B – Waste Rock Inventory

1.000%	Bell Pit Rock Dump	Boundary Dump	Boundary Zone Haul Road	Cariboo Access Road	Cariboo Nag Dump	Cariboo Pag Dump	Cariboo Pit Dump	Central Collection Sump	Dyke around Tailings Breach	East Cariboo Extension	East Rock Dump	Heli Pad	Low Sulphur Waste Dump	NAG/PAG Pad	Not sure. From old DB	NutriFor Dump	Ore Haul Road	Plug Access Road	Polley Lake Road Upgrade	South Abutment	South East Nag Dump	South East PAG Dump	Springer Tailings Line	Sump Access Dyke in Tailings	Surface Crew Yard	Waste Haul Road	Water Treatment Plant	Wight Pit Connector	Wight Pit Rock Dump	Wight Pit West Rock Dump	Dam	Tailings Dam quarry material	Polley Lake Weir	Main Embankment East	Tailings Dam - upstream	Main Embankment Central	Ditch Armouring 1 (SERD SUMP)	Tailings Dam - Barge	Ditch Armouring 3	Armouring 2 (North of Orica)	Gavin's Ditch	Grand Total
#1: Below 0.6% CU	12,193			2,666										135	525						4,455								1,032		1,350											22,356
#2: Above 0.6% CU	1,720			539																									86													2,345
#3: Non-Mill Feed	258																																								258
#4: 0.3 - 0.5% CU																													2,064												2,064
#5: Springer Mill Feed	344			172																									602												1,118
Bell Pit	824,969	405	8,581			965,799	172			253,022	1,329,220				153,975				2,700										2,480,226	99,813	24,380										6,143,262
Bell Pit Rock Dump	103,898										1,215										2,430										1,350											108,893
Bootjack Access Road														320																											320
Borrow Pit																													1,142		11,373										12,515
Boundary Dump			10,750																																						10,750
Boundary Pit	481	132,754	1,720																		2,150																					137,105
Boundary Zone Haul Road		17,778	237,742																																							255,520
Breach Zone									114												1,691			5,870		2,025					424											10,124
Cariboo Access Road	430		385	2,931																	270				121						121											4,258
Cariboo Access Stockpile			236	2,050																	405										11,339											14,030
Cariboo Pit	25,143,252			171,076	6,427	3,105			1,217,616		61,555	135		1,742,822	164,175		68,409	371,857			16,089,509			287,799		124,992	540	416	51,810		1,819,010	135	258	92,475								47,397,373
Contaminated Soil Stockpile	29,756																																									29,756
Crushed Stockpiles	205			605																	151					135	109				6,846			242								8,293
Crusher waste stockpile	20,533	883	13,333	41,158				71	154		330	54,657		1,555			4,672	502			13,032		748	71	358	21,306		484	19,893		217,729											411,469
Crusher Waste Stockpile Node				270		443					207	135		1,215							20,520					1,620			9,614	803	6,705											41,532
Cut-Off Wall Aggregate Stockpile								627																134																		761
Dam								984	3,535									2,417			38,229			-							272,563				2,580							320,308
Dirt East											7,125																															7,125
Dyke around Tailings Breach									7,419												540																					7,959
East Rock Dump	3,450														7,050														2,075													12,575
Filter Blanket Stockpile								48																130																		178
Haul Roads (maintenance)	24,799			27,025		1,221	1,200							12,764							189,755					1,204			4,984		405											263,357
Hazeltine Creek																		1,399						11,026							118,830											131,255
Hazeltine Gravel Sorter Stockpile																		656																								656
High Grade stockpile	17,073										1,271																		13,485													31,829
Leach Pad	774																														1,118											1,892
Leach Pad High Grade Stockpile																													258													258
Low Grade stockpile	1,634					688					1,874																		4,742													8,938
Magnetite Stockpile	263	414																																								677
Nag Stockpile Node																					1,452																					1,452
NAG/PAG Pad														1,681																												1,681
No specific location	3,010					-			-				4,128	121							2,409								124		10,360											20,152
North Abutment																															584											584
PAR Rock Stockpile								492										82						2,829							8,918											12,321
Peterson Stockpile 2																					3,915																					3,915
Peterson's Sorter																															9,413											9,413
Plug Access Road																		56,797			347			-			164				5,173											62,481
Polley Lake Road Upgrade																			3,440																							3,440
Pond Zone Pit	25,967												402,227			172													204,588		503,053											1,136,007
Primary Crusher						1,056																		77							10,256											11,389
Sand Dump WP Rd	791																												308	462	1,023											2,584
South Abutment																				8,954				675																		9,629
South East Nag Dump	1,890							1,646	1,379,782									29,912			53,834			306,352		6,815					146,959											1,927,190
South East Pit	87,599		561										3,526																		62,147											166,466
Springer Pit	54,456,811	32,718	541,227	1,132,908	63,284	15,552	605,354		-	4,248	9,458	6,492	269,655	2,222,984		19,710	1,052,422			-	15,821,548	5,971			254,824	6,741,277		2,566,315	792,184	13,169	4,882,929											91,511,040
Springer Pit Wall Relief	60,009																																								60,009
Sulphur Storage	344																																								344
Surface Crew Yard														4,185																												4,185
Tailings Dam - Buttress																		1,776			1,090					16,519	49,897				7,995						2,870					80,147
Tailings Dam Access Road								3,239	3,799					135				943			684			892			1,725				111,093						1,476		369			124,355
Till Stockpile																													3,612												3,612
Upstream Rockfill Berm																				2,870	13,646			2,275							1,048				1,558							21,397
Water Treatment Plant																											1,476															1,476
Wight Pit	49,292	654,985	62,730	1,376		3,455	810		1,485	3,240	233,915							753	10,568		10,102								10,746,717	1,946,628	1,466,049											15,192,105
Wight Pit Haul Road	2,535			2,390		172					19,871																		362,351	79,096	430										1,845	468,690
Wight Pit Rock Dump																					2,025								4,028		128,177											132,205
Wight Pit Underground																																										2,025
Yard	4,449			495		8,259								4,050			3,100				17,621								2,354		11,105											51,433
1.5" Stockpile																															5,214											5,214
Main Embankment Central																																				123						123
Main Embankment East																																		2,706								2,706
None																															-											-
Rock Quarry																															55,256							2,240				57,496
Temporary Rock Stockpile																																					9,594			9,922		19,516
Transition Rock Stockpile																															102											102
TSF Rock Stockpile																																					7,831					7,831
Grand Total	80,878,729	839,937	877,265	1,385,661	69,711	999,750	607,536	7,107	2,613,904	260,510	1,666,041	61,419	679,536	3,991,967	325,725	19,882	1,128,603	467,094	16,708	11,824	32,271,810	5,971	748	618,130	255,303	6,915,893	53,911	2,567,215	14,770,426	2,139,971	9,871,313	135	258	95,423	4,138	123	21,771	2,240	369	9,922	1,845	166,515,224

1.000%	Bell Pit Rock Dump	Cariboo Pag Dump	NAG/PAG Pad	NutriFor Dump	South East Nag Dump	South East PAG Dump	Waste Haul Road	Wight Pit Connector	Wight Pit Rock Dump	Grand Total
Bell Pit		615,177								**615,177**
Cariboo Pit			8,454,652			1,350				**8,456,002**
Haul Roads (maintenance)			800							**800**
NAG/PAG Pad			258							**258**
No specific location			270							**270**
Pond Zone Pit	1,485								5,130	**6,615**
South East Pit	184,112	37,332							945	**222,389**
Springer Pit	1,976		7,620,803	832	3,105	885,315	1,290	5,891	3,780	**9,442,743**
Surface Crew Yard			11,070							**11,070**
Yard		1,196	3,645							**4,841**
Grand Total	**187,573**	**1,573,456**	**16,091,498**	**832**	**3,105**	**886,665**	**1,290**	**5,891**	**9,855**	**18,760,165**

Appendix C – Operational Waste Rock Monitoring Database

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP	Ag	Al
											%C	%C		ppm	%
1	SD 1 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	7.4	7.6	#N/A	-0.05	15.00	0.7	8.41
2	SD 1 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	7.4	7.7	#N/A	-0.05	16.00	0.7	7.89
3	SD 2 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	6.8	7.2	#N/A	-0.05	12.00	0.8	8.34
4	SD 2 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	6.9	7.3	#N/A	-0.05	14.00	0.7	7.73
5	SD 3 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.25	0.02	7.9	8.1	#N/A	0.86	100.00	1	8.33
6	SD 3 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.13	0.01	7.9	7.9	#N/A	0.52	65.00	1	9.02
7	SD 3 - 3	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.23	0.01	8.3	8.1	#N/A	0.50	67.00	0.9	8.8
8	SD 3 - 4	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.53	0.02	8	8	#N/A	1.01	114.00	1	8.42
9	SD 3 - 5	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.58	0.01	7.9	8	#N/A	1.12	114.00	1.6	8.82
10	CPD 1	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.32	-0.01	8.1	8.2	#N/A	0.48	50.00	1	8.93
11	CPD 2	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.44	0.02	8	8	#N/A	0.71	79.00	1.2	9.06
12	CPD 3	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.17	0.02	8	8	#N/A	0.85	84.00	1.3	9.37
13	CPD 4	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.41	0.01	8.2	8.2	#N/A	0.54	62.00	0.9	9.47
14	CPD 5	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.78	0.02	8	8.2	#N/A	0.72	84.00	1.1	9.23
15	CPD 6	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.84	0.01	8.1	8	#N/A	0.75	80.00	1.2	9.23
16	CPD 7	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.36	0.01	8.2	8.2	#N/A	0.52	58.00	0.9	9.05
17	CPD 8	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.47	0.01	8.1	8.2	#N/A	0.55	62.00	1.1	9.32
18	CPD 9	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.49	0.01	8.2	8.2	#N/A	0.52	64.00	0.6	8.26
19	CPD 10	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.32	0.01	8.1	8.1	#N/A	0.50	59.00	0.9	8.15
20	CPD 11	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.07	0.02	8	8	#N/A	0.67	77.00	0.8	8.23
21	CPD 12	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.15	0.02	7.8	7.9	#N/A	0.85	90.00	0.8	8.29
22	CPD 13	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.6	0.02	8	8.1	#N/A	0.64	74.00	0.9	8.54
23	CPD 14	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.96	0.03	7.9	8	#N/A	1.02	113.00	0.7	8.35
24	HWD 1	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.44	0.02	7.7	7.8	#N/A	0.46	61.00	0.5	7.84
25	HWD 2	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.08	0.02	8.1	8.2	#N/A	0.82	104.00	-0.5	8.43
26	HWD 3	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.28	0.03	7.9	7.8	#N/A	0.41	57.00	0.5	7.88
27	HWD 4	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.19	0.02	7.8	8	#N/A	0.38	52.00	0.6	8.48
28	HWD 5	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.13	-0.01	8	8.1	#N/A	0.55	67.00	0.6	8.65
29	HWD 6	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.25	0.01	8	8	#N/A	0.78	92.00	-0.5	8.36
30	HWD 7	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.17	0.02	7.9	8	#N/A	1.21	122.00	0.7	7.64
31	63 DP6 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.2	0.01	8.3	0	#N/A	1.31	139.00	#N/A	#N/A
32	64 DP7 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.01	-0.01	8.5	0	#N/A	0.22	31.00	#N/A	#N/A
33	65 DP8 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.05	0.01	8.6	0	#N/A	0.71	101.00	#N/A	#N/A
34	66 DP9 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.23	0.02	8.1	0	#N/A	1.75	171.00	#N/A	#N/A
35	67 DP10 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.12	0.01	8.2	0	#N/A	1.09	102.00	#N/A	#N/A
36	Jan 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 1-2 mm	LG Breccia	0.26	-0.01	8	#N/A	0.94	#N/A	67.00	0.2	7.82
37	Jan 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 2-2 mm	0	0.39	-0.01	not/ss	#N/A	0.34	#N/A	not/ss	0.2	7.65
38	Feb 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 1-2 mm	LG Breccia	0.35	-0.01	not/ss not/ss	#N/A	0.34	#N/A	not/ss 64	0.6	7.3
39	Feb 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 2-2 mm	0	0.29	-0.01	0	#N/A	0.86	#N/A	0.00	-0.2	7.39
40	Mar 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 2-2 mm	LG Breccia	0.14	-0.01	7.8	#N/A	-0.09	#N/A	16.00	0.2	7.96
41	May 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 1-2 mm	0	0.33	-0.01	7.9	#N/A	0.77	#N/A	60.00	0.2	8.05
42	Mar 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 1-2 mm	0	0.1	-0.01	7.9	#N/A	0.69	#N/A	53.00	0.2	7.44
43	Apr 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 1-2 mm	0	0.28	-0.01	8	#N/A	0.43	#N/A	42.00	0.4	6.75
44	Apr 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 2-2 mm	Monzonite	0.08	-0.01	7.9	#N/A	0.17	#N/A	31.00	0.2	6.54
45	May 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 2-2 mm	0	0.24	-0.01	not/ss	#N/A	0.51	#N/A	not/ss	0.2	8.17
46	Jun 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 1-2 mm	Monzonite	0.45	-0.01	not/ss not/ss	#N/A	0.60	#N/A	not/ss 47	0.4	7.93
47	Jun 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 2-2 mm	0	0.48	-0.01	0	#N/A	0.51	#N/A	0.00	0.6	7.49
48	July 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 1-2 mm	0	0.28	-0.01	7.9	#N/A	0.94	#N/A	73.00	0.4	7.88
49	July 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 2-2 mm	0	0.3	-0.01	not/ss 8.8	#N/A	1.03	#N/A	75.00	0.6	7.42
50	Aug 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Aug 2001 Sample - 1-2 mm	Monzonite	0.22	-0.01	8.6	#N/A	0.09	#N/A	16.00	-0.5	6.34
51	Aug 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Aug 2001 Sample - 2+2 mm	0	0.28	0.03	0	#N/A	0.69	#N/A	96.00	0.5	6.52
52	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	0	0.2	0.01	8.6	#N/A	0.09	#N/A	16.00	-0.5	6.5
53	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	0	0.31	0.01	8.7	#N/A	0.69	#N/A	90.00	0.5	6.83
54	Oct 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 1+2 mm	Monzonite	0.22	-0.01	8.5	#N/A	0.09	#N/A	19.00	0.5	6.38
55	Oct 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 2+2 mm	0	0.46	0.01	8.4	#N/A	0.94	#N/A	94.00	-0.5	6.53
56	Jan 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jan 2001 Sample - 2+2 mm	LG Breccia	0.13	0.01	9.1	#N/A	0.09	#N/A	21.00	-0.2	8.67
57	Feb 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Feb 2001 Sample - 2+2 mm	0	0.16	0.01	9	#N/A	0.17	#N/A	22.00	0.2	8.49
58	Mar 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Mar 2001 Sample - 2+2 mm	LG Breccia	0.07	-0.01	8.8	#N/A	-0.09	#N/A	14.00	-0.2	8.21
59	Apr 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Apr 2001 Sample - 2+2 mm	Monzonite	0.04	-0.01	8.9	#N/A	-0.09	#N/A	13.00	0.4	7.97
60	May 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	May 2001 Sample - 2+2 mm	0	0.15	-0.01	8.9	#N/A	-0.09	#N/A	20.00	0.4	8.34
61	Jun 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jun 2001 Sample - 2+2 mm	Monzonite	0.27	0.01	9	#N/A	0.09	#N/A	28.00	-0.2	7.99
62	July 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	July 2001 Sample - 2+2 mm	Monzonite	0.13	-0.01	8.9	#N/A	0.17	#N/A	24.00	0.2	8.91
63	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	0	0.2	0.01	8.6	#N/A	0.09	#N/A	16.00	-0.5	6.5
64	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	0	0.31	0.01	8.7	#N/A	0.69	#N/A	90.00	0.5	6.83
65	BD 1 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 1	0	0.23	#N/A	7.4	7.7	#N/A	#N/A	106.00	1.2	9.38
66	BD 1 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 2	0	0.18	#N/A	7.6	7.7	#N/A	#N/A	95.00	1	9.36
67	BD 1 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 3	0	0.14	#N/A	7.5	7.6	#N/A	#N/A	103.00	0.9	8.91
68	BD 1 - 4	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 4	0	0.39	#N/A	7.7	7.6	#N/A	#N/A	100.00	0.8	9.06
69	BD 1 - 5	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 5	0	0.46	#N/A	8.1	8.1	#N/A	#N/A	119.00	1.1	8.58
70	BD 1 - 6	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 6	0	0.4	#N/A	8.1	8.2	#N/A	#N/A	110.00	1	8.68
71	BD 1 - 7	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 7	0	0.32	#N/A	8.2	8.3	#N/A	#N/A	72.00	1	9.59
72	BD 1 - 8	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 8	0	0.45	#N/A	8.1	8.2	#N/A	#N/A	72.00	1.1	9.33
73	BD 1 - 9	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 9	0	0.47	#N/A	8	8.1	#N/A	#N/A	60.00	1.2	9.51
74	BD 1 - 10	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 10	0	0.44	#N/A	7.9	7.9	#N/A	#N/A	66.00	1.1	9.39
75	BD 2 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 1	0	0.51	#N/A	8.1	8.1	#N/A	#N/A	107.00	1.2	8.93
76	BD 2 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 2	0	0.41	#N/A	7.8	7.9	#N/A	#N/A	135.00	0.8	8.72
77	BD 3 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 1	0	0.06	#N/A	7.9	8	#N/A	#N/A	31.00	0.8	9.93
78	BD 3 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 2	0	0.05	#N/A	7.8	8.1	#N/A	#N/A	28.00	1	9.62
79	BD 4 -1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 -1	0	0.07	#N/A	7.8	8	#N/A	#N/A	46.00	0.9	8.58
80	BD 4 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 2	0	0.08	#N/A	7.6	7.8	#N/A	#N/A	35.00	0.8	9.29
81	BD 4 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 3	0	0.03	#N/A	7.8	8	#N/A	#N/A	73.00	0.7	9.58
160	Feb 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.11	-0.01	8.1	8	#N/A	0.60	70.00	0.2	5.63
161	Mar 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.1	0.01	8.2	8	#N/A	0.87	87.00	-0.2	5.24
162	Apr 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.05	-0.01	7.7	7.1	#N/A	-0.05	15.00	-0.2	9.08
163	May 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.04	-0.01	8.1	8.1	#N/A	0.55	70.00	-0.2	5.11
164	Jun 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	East Breccia waste	1.32	0.02	7.6	not/ss	#N/A	0.44	49.00	1	7.23
165	Jun 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	East Breccia waste	1.41	0.05	6.7	not/ss	#N/A	-0.05	10.00	1	8.71
166	Jul 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic West Wall Diorite	0.93	-0.01	7.8	7.9	#N/A	0.71	71.00	0.6	8.1
167	Jul 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	0.07	-0.01	8	8	#N/A	1.04	112.00	-0.2	7.96
168	Aug 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic West Wall Diorite East Breccia waste	0.86	0.02	8	0	#N/A	1.15	113.00	0.5	6.54
169	Aug 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	0.44	0.01	8.2	0	#N/A	0.55	122.00	-0.5	6.25
170	Aug 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.45	0.02	8	0	#N/A	0.55	73.00	2	6.71
171	Sep 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.82	0.02	8	0	#N/A	1.15	130.00	#N/A	#N/A
172	Sep 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.57	0.02	8.1	0	#N/A	0.60	103.00	#N/A	#N/A
173	Sep 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.99	0.03	8.6	0	#N/A	0.55	108.00	#N/A	#N/A
174	Oct 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.88	0.03	8.1	0	#N/A	1.20	134.00	#N/A	#N/A
175	Oct 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.45	0.01	8.1	0	#N/A	0.60	77.00	#N/A	#N/A
176	Oct 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.64	0.02	8.1	0	#N/A	1.15	117.00	#N/A	#N/A
177	Mar 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.08	-0.01	8.7	8	#N/A	0.22	48.00	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
						ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
1	SD 1 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	10	2130	1	-2	3.76	-0.5	28	77	1745	0.061	5.74	6	3.34	2.19	1420	-1	2.14	33	1820	4	-5	-1	374	0.31	174	10	84
2	SD 1 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	7	2130	1.1	-2	4.46	-0.5	33	126	1560	0.063	6.42	6	3.4	2.92	1530	1	1.75	51	1850	8	-5	-1	398	0.27	190	10	99
3	SD 2 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	16	2340	1.1	-2	3.54	-0.5	35	102	2570	0.093	7.13	9	3.9	2.62	1225	-1	1.49	39	1710	5	-5	-1	402	0.31	239	10	88
4	SD 2 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	15	1850	1	-2	4.46	-0.5	36	146	1415	0.052	6.77	9	3.06	3.22	1410	1	1.83	59	1450	7	-5	-1	427	0.32	214	10	89
5	SD 3 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	32	1420	1.1	-2	5.59	-0.5	25	46	1965	0.06	5.53	20	2.71	1.86	916	16	2.26	23	1330	4	-5	3	452	0.34	198	10	67
6	SD 3 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	34	1710	1.1	-2	4.88	-0.5	26	28	1885	0.07	6.23	13	2.76	1.52	1070	8	2.55	9	1460	6	-5	2	539	0.38	208	10	73
7	SD 3 - 3	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	38	1570	1.1	-2	4.61	-0.5	30	43	2090	0.079	6.18	13	2.97	1.81	958	16	2.51	22	1520	-2	-5	3	506	0.35	219	10	66
8	SD 3 - 4	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	29	1410	1.2	-2	6.24	-0.5	29	61	1675	0.035	6.29	13	2.67	1.98	1270	19	2.04	32	1530	3	-5	3	468	0.34	207	10	84
9	SD 3 - 5	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	48	1160	1.2	-2	5.7	-0.5	27	19	4760	0.063	6.81	22	3.53	1.36	1000	14	2.07	6	1350	5	-5	5	424	0.3	224	10	75
10	CPD 1	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	21	1520	1.1	2	3.82	-0.5	24	31	2470	0.08	5.9	13	3.56	1.53	705	15	2.65	14	1350	3	-5	5	501	0.36	202	10	64
11	CPD 2	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	46	260	1.2	2	4.59	-0.5	36	30	2820	0.057	7	20	3.77	1.42	645	55	2.52	9	1380	-2	-5	6	468	0.33	205	10	61
12	CPD 3	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	38	330	1.3	2	4.55	-0.5	33	22	3200	0.046	7.28	22	4.39	1.23	584	41	2.46	6	1370	5	-5	7	499	0.32	196	10	59
13	CPD 4	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	21	1630	1.1	2	4.92	-0.5	27	36	1885	0.042	6.41	10	3.64	1.69	897	23	2.77	14	1540	3	-5	3	546	0.36	225	10	78
14	CPD 5	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	36	1130	1.2	2	6.07	-0.5	31	23	1975	0.037	7.02	14	3.23	1.67	1045	27	2.39	7	1550	2	-5	4	544	0.39	217	10	85
15	CPD 6	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	32	730	1.1	2	5.21	-0.5	31	30	1985	0.043	6.89	15	3.31	1.58	972	30	2.63	11	1480	5	-5	4	528	0.37	217	10	91
16	CPD 7	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	31	1640	1	2	4.28	-0.5	24	37	1875	0.046	6.07	11	3.7	1.53	826	16	2.64	16	1460	2	-5	2	525	0.37	214	10	73
17	CPD 8	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	43	1690	1.1	2	4.24	-0.5	25	54	2470	0.055	6.26	15	4.24	1.7	803	32	2.71	23	1390	5	6	4	523	0.37	231	10	75
18	CPD 9	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	30	1420	1.4	2	3.85	-0.5	21	38	1945	0.057	5.64	14	3.85	1.54	825	38	2.64	21	1280	11	-5	3	465	0.33	207	-10	83
19	CPD 10	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	23	1470	1.4	2	3.9	-0.5	22	30	1800	0.067	5.92	15	3.55	1.46	964	16	2.48	14	1260	11	-5	3	514	0.33	196	-10	79
20	CPD 11	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	32	1100	1.5	2	4.26	-0.5	26	19	2200	0.049	6.27	19	3.64	1.3	741	35	2.53	6	1190	9	-5	5	470	0.32	185	-10	69
21	CPD 12	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	45	830	1.6	2	4.55	-0.5	28	18	2250	0.046	6.43	24	3.59	1.35	757	43	2.51	6	1240	13	-5	7	440	0.32	192	-10	64
22	CPD 13	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	23	1380	1.6	2	4.35	1.1	26	19	2160	0.071	6.33	15	3.57	1.5	998	31	2.47	7	1390	11	-5	3	508	0.35	202	-10	105
23	CPD 14	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	36	800	1.6	2	5.18	-0.5	23	14	1880	0.033	5.89	19	2.88	1.29	770	32	2.73	6	1190	11	-5	5	398	0.31	194	-10	62
24	HWD 1	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	28	1700	1.5	-2	4.03	-0.5	28	31	2390	0.086	6.28	12	3.86	1.56	1095	25	1.84	13	1540	7	-5	4	439	0.31	212	-10	72
25	HWD 2	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	13	1920	1.5	-2	7.86	-0.5	20	12	617	0.014	5.75	10	2.01	2.05	1415	3	1.83	4	1560	13	5	-1	567	0.39	216	-10	96
26	HWD 3	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	23	1730	1.5	-2	4.24	-0.5	25	28	1980	0.084	5.84	14	3.12	1.58	1170	13	2.08	13	1610	11	-5	2	434	0.31	190	-10	76
27	HWD 4	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	34	1460	1.8	-2	3.2	0.6	28	40	2490	0.138	5.73	13	3.98	1.65	821	27	2.42	22	1360	12	-5	3	400	0.32	218	-10	60
28	HWD 5	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	14	1470	1.5	-2	4.7	-0.5	16	44	2040	0.064	4.61	7	3.06	1.57	825	4	2.87	25	1190	11	-5	4	580	0.37	177	-10	65
29	HWD 6	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	11	1440	1.6	-2	5.25	0.7	21	61	1975	0.057	5.27	18	3.41	1.99	937	11	2.49	42	1290	10	-5	3	470	0.33	213	-10	73
30	HWD 7	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	28	1300	1.4	-2	5.45	-0.5	13	31	2610	0.039	3.75	10	3.84	1.58	728	3	2.24	18	1040	8	-5	3	373	0.31	246	-10	48
31	63 DP6 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32	64 DP7 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33	65 DP8 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34	66 DP9 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35	67 DP10 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36	Jan 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 1-2 mm	16	1360	0.5	-2	6.16	0.5	26	134	3580	0.07	6.07	70	2.73	3.02	845	67	2.17	53	1220	8	1	2.8	492	0.37	355	-10	74
37	Jan 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 2-2 mm	9	1900	1	-2	4.1	1	21	220	3630	#N/A	6.79	160	2.96	2.08	890	6	2.31	128	1240	24	#N/A	#N/A	831	0.42	314	20	120
38	Feb 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 1-2 mm	11	1360	0.5	-2	3.83	-0.5	19	123	3510	0.023	6.36	90	2.58	1.81	780	5	2.29	63	1290	22	0	0	698	0.38	276	10	96
39	Feb 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 2-2 mm	16	1210	0.5	-2	4.68	-0.5	16	102	2870	0	4.79	50	1.44	1.77	605	48	2.58	43	990	8	0	0	574	0.37	247	10	42
40	Mar 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 2-2 mm	12	1290	1	-2	2.81	-0.5	19	20	5300	0.212	7.57	160	1.9	1.75	665	5	2.96	7	1810	6	0.2	1.6	463	0.35	378	20	40
41	May 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 1-2 mm	16	1350	1	2	5.13	-0.5	22	86	3480	0.03	5.2	60	2.77	2.53	735	150	2.37	33	1150	10	0.6	3	475	0.36	276	-10	58
42	Mar 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 1-2 mm	11	1480	0.5	-2	4.51	-0.5	16	20	1475	0.018	4.83	30	2.37	1.67	715	-1	2.04	10	1200	14	0.2	0.8	494	0.33	246	10	58
43	Apr 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 1-2 mm	10	1060	1	-2	2.84	-0.5	12	30	2240	0.014	4	150	4.01	1.14	550	5	1.87	11	640	14	1.8	2.2	366	0.23	227	10	100
44	Apr 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 2-2 mm	9	1090	0.5	-2	2.72	-0.5	22	53	4780	0.251	6.67	130	1.52	2.09	1685	-1	1.5	22	1720	8	0.8	1.6	400	0.39	261	10	64
45	May 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 2-2 mm	11	980	0.5	-2	4.76	-0.5	20	190	2990	not/ss	6.88	140	2.66	1.94	635	54	2.4	99	1260	10	#N/A	#N/A	556	0.36	319	-10	62
46	Jun 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 1-2 mm	13	1200	0.5	-2	4.44	-0.5	23	219	4690	not/ss 0.041	6.72	150	3.69	2.17	715	12	2.24	76	1370	10	#N/A	#N/A	553	0.39	299	-10	66
47	Jun 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 2-2 mm	27	960	0.5	12	3.82	-0.5	20	121	4610	0	6.76	130	3.4	2	625	6	2.12	61	1340	8	0	0	470	0.36	322	-10	60
48	July 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 1-2 mm	24	1170	1	-2	5.78	-0.5	20	103	2890	0.018	5.29	150	2.36	2.49	740	3	1.69	58	1600	8	0.8	3	557	0.38	245	-10	60
49	July 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 2-2 mm	27	1260	0.5	-2	5.52	-0.5	21	88	2510	0.018	5.43	140	2.36	2.46	745	4	1.61	47	1640	8	0.2	2.2	499	0.38	247	-10	58
50	Aug 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Aug 2001 Sample - 1-2 mm	5	1140	2	-2	2.9	-0.5	17	54	6830	0.298	7.96	100	4.21	1.48	700	3	2.41	6	980	10	5	7	419	0.33	340	-10	80
51	Aug 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Aug 2001 Sample - 2+2 mm	5	2730	2	-2	4.8	-0.5	19	65	3010	0.026	5.75	100	2.84	1.95	785	7	3.04	34	1490	16	15	3	746	0.39	208	-10	76
52	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	5	1110	2	-2	2.8	-0.5	17	47	6470	0.299	7.78	70	4.29	1.48	690	8	2.43	6	990	8	5	7	401	0.34	336	-10	72
53	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	5	2730	2	-2	4.8	-0.5	19	59	3350	0.028	5.94	100	3	1.97	800	9	3.18	33	1510	12	5	3	746	0.4	214	-10	78
54	Oct 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 1+2 mm	5	1150	2	-2	3	-0.5	16	26	6580	0.285	7	90	4.26	1.42	680	6	2.53	2	990	10	10	7	422	0.32	307	-10	68
55	Oct 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 2+2 mm	15	2120	2	-2	5	-0.5	18	41	5300	0.045	6.26	200	3.11	1.59	755	11	3.14	11	1090	14	5	4	547	0.35	232	-10	82
56	Jan 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jan 2001 Sample - 2+2 mm	6	1640	0.5	2	2.86	-0.5	14	47	1160	0.005	4.29	40	3.62	1.44	775	3	3.3	15	1490	4	-0.2	1	632	0.36	175	10	58
57	Feb 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Feb 2001 Sample - 2+2 mm	9	1220	0.5	-2	2.62	-0.5	14	34	1440	0.009	4.35	30	3.1	1.31	440	9	3.54	4	1130	4	-0.2	2	574	0.32	233	-10	30
58	Mar 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Mar 2001 Sample - 2+2 mm	9	1250	1	-2	2.16	-0.5	15	20	2040	0.076	5.17	70	2.98	1.25	415	5	3.42	3	1490	2	-0.2	2	486	0.29	261	-10	26
59	Apr 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Apr 2001 Sample - 2+2 mm	6	1080	0.5	-2	2.02	-0.5	15	32	2340	0.162	6.04	50	4.41	1.23	395	2	2.63	7	1080	4	0.2	1	391	0.3	239	-10	40
60	May 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	May 2001 Sample - 2+2 mm	7	860	0.5	-2	2.83	-0.5	19	18	1745	0.026	7.28	70	2.67	1.88	495	2	3.03	5	1250	2	-0.2	1	561	0.38	272	-10	48
61	Jun 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jun 2001 Sample - 2+2 mm	13	890	0.5	-2	3.08	-0.5	18	21	2300	0.01	6.12	90	3.02	1.63	535	2	3.08	7	1300	2	-0.2	2	582	0.35	253	-10	44
62	July 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	July 2001 Sample - 2+2 mm	13	1190	0.5	-2	3.86	-0.5	16	20	1255	0.006	5.66	50	2.76	1.8	570	1	2.98	7	1280	2	-0.2	1	665	0.38	243	-10	44
63	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	5	1110	2	-2	2.8	-0.5	17	47	6470	0.299	7.78	70	4.29	1.48	690	8	2.43	6	990	8	5	7	401	0.34	336	-10	72
64	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	5	2730	2	-2	4.8	-0.5	19	59	3350	0.028	5.94	100	3	1.97	800	9	3.18	33	1510	12	5	3	746	0.4	214	-10	78
65	BD 1 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 1	25	1940	1	-2	6.98	-0.5	24	23	1995	0.047	6.1	10	2.59	1.55	1375	2	2.43	4	1540	6	-5	2	642	0.36	197	10	93
66	BD 1 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 2	28	2000	1	-2	7.24	-0.5	23	23	876	0.019	6.18	8	2.24	1.82	1405	6	2.53	6	1700	4	-5	1	647	0.41	216	10	89
67	BD 1 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 3	18	1770	0.9	-2	7.62	-0.5	26	18	602	0.009	6.48	7	2.12	1.96	1510	3	2.23	5	1650	8	-5	1	594	0.38	230	10	96
68	BD 1 - 4	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 4	22	1580	1.1	-2	5.21	-0.5	23	28	2480	0.033	6.12	12	3.66	1.37	738	26	2.69	9	1350	4	-5	4	524	0.34	206	10	58
69	BD 1 - 5	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 5	28	1570	1.1	-2	6.07	-0.5	24	27	2190	0.034	6.12	17	3.41	1.73	773	32	2.31	11	1460	-2	-5	2	544	0.35	233	10	52
70	BD 1 - 6	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 6	26	1560	1.1	-2	6.26	-0.5	26	31	2300	0.046	6.05	14	3.56	1.78	823	23	2.27	10	1440	9	-5	4	532	0.32	234	10	58
71	BD 1 - 7	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 7	26	1580	1.1	-2	4.76	-0.5	24	26	2500	0.068	6.05	10	3.59	1.44	753	17	2.94	8	1380	4	6	2	560	0.37	206	10	63
72	BD 1 - 8	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 8	21	1570	1.1	-2	4.39	-0.5	26	35	2770	0.054	6.26	11	3.8	1.44	679	30	2.78	9	1470	6	-5	3	527	0.37	215	10	59
73	BD 1 - 9	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 9	23	1570	1.2	-2	3.7	-0.5	30	26	3140	0.087	6.57	14	3.97	1.32	684	28	2.81	9	1380	3	-5	5	529	0.33	215	10	56
74	BD 1 - 10	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 10	21	1390	1.3	-2	3.73	-0.5	33	24	2740	0.099	6.68	14	3.73	1.37	776	39	2.74	7	1380	6	-5	5	458	0.32	217	10	54
75	BD 2 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 1	24	1330	1.2	-2	5.37	-0.5	27	19	2900	0.075	5.89	12	3.16	1.37	631	25	2.47	7	1330	7	-5	5	477	0.32	198	10	50
76	BD 2 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 2	12	1540	1.1	-2	6.1	-0.5	24	19	2580	0.036	5.74	9	3	1.19	596	19	2.17	4	1290	-2	-5	3	406	0.31	191	10	45
77	BD 3 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 1	33	2190	1	-2	6.84	-0.5	27	18	428	0.014	6.47	10	1.95	1.79	1605	1	2.47	7	1870	5	-5	-1	579	0.37	222	10	118
78	BD 3 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 2	31	2490	1	-2	6.59	-0.5	26	23	488	0.019	6.37	13	2.01	1.74	1595	-1	2.34	5	1850	7	-5	-1	599	0.38	211	10	115
79	BD 4 -1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 -1	19	2040	1	-2	5.9	-0.5	26	58	776	0.025	5.9	13	2.14	2.25	1210	1	2.14	46	1610	7	-5	1	667	0.39	211	10	78
80	BD 4 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 2	15	2130	0.9	-2	5.73	-0.5	28	43	827	0.018	6.33	11	2.39	1.99	1305	1	2.39	24	1710	4	-5	-1	632	0.4	224	10	87
81	BD 4 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 3	14	2620	1	-2	6.9	-0.5	27	21	458	0.013	6.28	7	2.2	1.79	1445	1	2.55	10	1750	4	-5	-1	616	0.41	229	10	82
160	Feb 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	10	690	1	-2	4.88	-0.5	39	388	453	#N/A	4.85	160	1.4	7.19	965	1	1.55	335	1320	8	0.2	-0.2	374	0.34	168	-10	58
161	Mar 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	13	1070	1	-2	5.14	-0.5	40	354	878	#N/A	5.24	160	1.2	7.03	960	3	1.26	381	1190	8	-0.2	0.2	381	0.32	159	-10	58
162	Apr 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	78	1820	0.5	-2	5.44	-0.5	31	58	1095	#N/A	5.78	90	1.43	1.75	1355	8	2.72	12	1490	14	1.4	0.2	626	0.38	220	-10	80
163	May 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	4	440	1

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP	Ag	Al
											%C	%C		ppm	%
178	May 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	West Wall Diorite	0.03	-0.01	8.6	8.1	#N/A	0.16	45.00	#N/A	#N/A
179	Jun 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	East Breccia waste	0.92	0.02	8.7	not/ss	#N/A	0.11	23.00	#N/A	#N/A
180	Jun 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	East Breccia waste	1.5	0.03	8.2	8.1	#N/A	0.05	17.00	#N/A	#N/A
181	Sep 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.65	-0.01	8.3	0	#N/A	0.79	52.00	#N/A	#N/A
182	Sep 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.74	0.01	8.7	0	#N/A	0.46	47.00	#N/A	#N/A
183	Sep 2001 Sample 3+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	0	1.28	0.03	8.7	0	#N/A	0.27	31.00	#N/A	#N/A
184	Oct 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.69	-0.01	8.4	0	#N/A	0.71	51.00	#N/A	#N/A
185	102 - 10 - 100	Springer Pit	Springer Pit	DD Core	102 - 10 - 100	#N/A	0.04	0.04	8.8	#N/A	#N/A	#N/A	10.10	#N/A	#N/A
186	102 - 100 - 200	Springer Pit	Springer Pit	DD Core	102 - 100 - 200	#N/A	0.05	0.03	8.8	#N/A	#N/A	#N/A	16.80	#N/A	#N/A
187	102 - 200 - 300	Springer Pit	Springer Pit	DD Core	102 - 200 - 300	#N/A	0.05	0.04	8.8	#N/A	#N/A	#N/A	25.10	#N/A	#N/A
188	102 - 300 - 400	Springer Pit	Springer Pit	DD Core	102 - 300 - 400	#N/A	0.13	0.03	8.8	#N/A	#N/A	#N/A	27.80	#N/A	#N/A
189	102 - 400 - 500	Springer Pit	Springer Pit	DD Core	102 - 400 - 500	#N/A	0.21	0.05	9	#N/A	#N/A	#N/A	25.20	#N/A	#N/A
190	102 - 500 - 600	Springer Pit	Springer Pit	DD Core	102 - 500 - 600	#N/A	0.16	0.04	8.9	#N/A	#N/A	#N/A	45.60	#N/A	#N/A
191	103 - 10 - 100	Springer Pit	Springer Pit	DD Core	103 - 10 - 100	#N/A	0.01	0.01	8.9	#N/A	#N/A	#N/A	17.20	#N/A	#N/A
192	103 - 100 - 200	Springer Pit	Springer Pit	DD Core	103 - 100 - 200	#N/A	0	0	8.9	#N/A	#N/A	#N/A	22.50	#N/A	#N/A
193	103 - 200 - 300	Springer Pit	Springer Pit	DD Core	103 - 200 - 300	#N/A	0	0	8.9	#N/A	#N/A	#N/A	24.80	#N/A	#N/A
194	103 - 300 - 400	Springer Pit	Springer Pit	DD Core	103 - 300 - 400	#N/A	0.05	0.03	8.8	#N/A	#N/A	#N/A	25.30	#N/A	#N/A
195	103 - 400 - 500	Springer Pit	Springer Pit	DD Core	103 - 400 - 500	#N/A	0.04	0.04	9	#N/A	#N/A	#N/A	15.00	#N/A	#N/A
196	103 - 500 - 600	Springer Pit	Springer Pit	DD Core	103 - 500 - 600	#N/A	0.34	0.04	8.7	#N/A	#N/A	#N/A	23.10	#N/A	#N/A
197	105 - 10 - 100	Springer Pit	Springer Pit	DD Core	105 - 10 - 100	#N/A	0.08	0.03	9.2	#N/A	#N/A	#N/A	19.40	#N/A	#N/A
198	105 - 100 - 200	Springer Pit	Springer Pit	DD Core	105 - 100 - 200	#N/A	0.03	0.03	9	#N/A	#N/A	#N/A	29.40	#N/A	#N/A
199	105 - 200 - 300	Springer Pit	Springer Pit	DD Core	105 - 200 - 300	#N/A	0.06	0.06	9.1	#N/A	#N/A	#N/A	22.30	#N/A	#N/A
200	105 - 300 - 400	Springer Pit	Springer Pit	DD Core	105 - 300 - 400	#N/A	0.03	0.03	9.1	#N/A	#N/A	#N/A	20.00	#N/A	#N/A
201	105 - 400 - 500	Springer Pit	Springer Pit	DD Core	105 - 400 - 500	#N/A	0.08	0.03	9.2	#N/A	#N/A	#N/A	29.20	#N/A	#N/A
202	105 - 500 - 600	Springer Pit	Springer Pit	DD Core	105 - 500 - 600	#N/A	0.09	0.05	9.3	#N/A	#N/A	#N/A	42.70	#N/A	#N/A
203	106 - 10 - 100	Springer Pit	Springer Pit	DD Core	106 - 10 - 100	#N/A	0.06	0.02	8.9	#N/A	#N/A	#N/A	24.30	#N/A	#N/A
204	106 - 100 - 200	Springer Pit	Springer Pit	DD Core	106 - 100 - 200	#N/A	0.02	0.02	8.8	#N/A	#N/A	#N/A	16.40	#N/A	#N/A
205	106 - 200 - 300	Springer Pit	Springer Pit	DD Core	106 - 200 - 300	#N/A	0.04	0.02	8.9	#N/A	#N/A	#N/A	23.60	#N/A	#N/A
206	106 - 300 - 400	Springer Pit	Springer Pit	DD Core	106 - 300 - 400	#N/A	0.07	0.01	8.9	#N/A	#N/A	#N/A	24.20	#N/A	#N/A
207	106 - 400 - 500	Springer Pit	Springer Pit	DD Core	106 - 400 - 500	#N/A	0.03	0.01	9.3	#N/A	#N/A	#N/A	44.20	#N/A	#N/A
208	106 - 500 - 600	Springer Pit	Springer Pit	DD Core	106 - 500 - 600	#N/A	0.05	0.03	9.3	#N/A	#N/A	#N/A	8.80	#N/A	#N/A
209	108 - 10 - 100	Springer Pit	Springer Pit	DD Core	108 - 10 - 100	#N/A	0.01	0.01	8.2	#N/A	#N/A	#N/A	11.00	#N/A	#N/A
210	108 - 100 - 200	Springer Pit	Springer Pit	DD Core	108 - 100 - 200	#N/A	0.04	0.03	8.7	#N/A	#N/A	#N/A	16.50	#N/A	#N/A
211	108 - 200 - 300	Springer Pit	Springer Pit	DD Core	108 - 200 - 300	#N/A	0.02	0.01	8.7	#N/A	#N/A	#N/A	33.20	#N/A	#N/A
212	108 - 300 - 400	Springer Pit	Springer Pit	DD Core	108 - 300 - 400	#N/A	0.04	0.02	8.7	#N/A	#N/A	#N/A	23.50	#N/A	#N/A
213	108 - 400 - 500	Springer Pit	Springer Pit	DD Core	108 - 400 - 500	#N/A	0.04	0.04	9	#N/A	#N/A	#N/A	21.50	#N/A	#N/A
214	108 - 500 - 600	Springer Pit	Springer Pit	DD Core	108 - 500 - 600	#N/A	0.13	0.08	9.1	#N/A	#N/A	#N/A	37.50	#N/A	#N/A
215	150 - 10 - 100	Springer Pit	Springer Pit	DD Core	150 - 10 - 100	#N/A	0.06	0.04	8.8	#N/A	#N/A	#N/A	19.60	#N/A	#N/A
216	150 - 100 - 200	Springer Pit	Springer Pit	DD Core	150 - 100 - 200	#N/A	0.06	0.02	8.7	#N/A	#N/A	#N/A	29.40	#N/A	#N/A
217	150 - 200 - 300	Springer Pit	Springer Pit	DD Core	150 - 200 - 300	#N/A	0.84	0.02	8.8	#N/A	#N/A	#N/A	84.20	#N/A	#N/A
218	150 - 300 - 400	Springer Pit	Springer Pit	DD Core	150 - 300 - 400	#N/A	0.67	0.03	8.8	#N/A	#N/A	#N/A	29.10	#N/A	#N/A
219	150 - 400 - 500	Springer Pit	Springer Pit	DD Core	150 - 400 - 500	#N/A	0.34	0.01	8.9	#N/A	#N/A	#N/A	26.30	#N/A	#N/A
220	150 - 500 - 600	Springer Pit	Springer Pit	DD Core	150 - 500 - 600	#N/A	0.47	0.01	8.8	#N/A	#N/A	#N/A	25.90	#N/A	#N/A
221	73093	Springer Pit	Springer Pit	DD Core	73093	#N/A	-0.01	-0.01	9	0	0.22	#N/A	23.00	#N/A	#N/A
222	73113	Springer Pit	Springer Pit	DD Core	73113	#N/A	-0.01	-0.01	8.4	0	0.22	#N/A	29.00	#N/A	#N/A
223	73233	Springer Pit	Springer Pit	DD Core	73233	#N/A	0.01	-0.01	8.4	0	0.27	#N/A	39.00	#N/A	#N/A
224	73253	Springer Pit	Springer Pit	DD Core	73253	#N/A	0.49	-0.01	8	0	0.16	#N/A	37.00	#N/A	#N/A
225	73273	Springer Pit	Springer Pit	DD Core	73273	#N/A	0.8	-0.01	8.1	0	0.55	#N/A	66.00	#N/A	#N/A
226	73293	Springer Pit	Springer Pit	DD Core	73293	#N/A	0.29	-0.01	8	0	0.11	#N/A	34.00	#N/A	#N/A
227	73488	Springer Pit	Springer Pit	DD Core	73488	#N/A	0.31	-0.01	8.3	0	0.05	#N/A	19.00	#N/A	#N/A
228	74333	Springer Pit	Springer Pit	DD Core	74333	#N/A	0.56	-0.01	8.3	0	0.05	#N/A	21.00	#N/A	#N/A
229	74478	Springer Pit	Springer Pit	DD Core	74478	#N/A	0.57	-0.01	8.5	0	0.05	#N/A	16.00	#N/A	#N/A
230	74498	Springer Pit	Springer Pit	DD Core	74498	#N/A	0.18	-0.01	8.7	0	0.27	#N/A	36.00	#N/A	#N/A
231	MP-66	Springer Pit	Springer Pit	DD Core	MP-66	#N/A	0.25	-0.05	9.3	0	0.11	#N/A	44.20	#N/A	#N/A
232	MP-67	Springer Pit	Springer Pit	DD Core	MP-67	#N/A	0.51	0.02	8.2	8.6	0.16	#N/A	26.00	#N/A	#N/A
233	476111	Springer Pit	Springer Pit	DD Core	476111	#N/A	0.04	0.01	7.92	#N/A	0.01	0.03	17.58	#N/A	#N/A
234	146670	Springer Pit	Springer Pit	DD Core	146670	#N/A	1.74	0.04	8.07	#N/A	0.93	0.93	102.24	#N/A	#N/A
235	146671	Springer Pit	Springer Pit	DD Core	146671	#N/A	2.15	0.01	7.93	#N/A	1.01	0.98	116.58	#N/A	#N/A
236	146672	Springer Pit	Springer Pit	DD Core	146672	#N/A	0.84	0.01	8.21	#N/A	1.12	1.13	92.27	#N/A	#N/A
237	146673	Springer Pit	Springer Pit	DD Core	146673	#N/A	0.96	0.01	8.22	#N/A	0.79	0.81	51.12	#N/A	#N/A
238	146674	Springer Pit	Springer Pit	DD Core	146674	#N/A	2.13	0.02	8.01	#N/A	1.30	1.33	145.89	#N/A	#N/A
239	146675	Springer Pit	Springer Pit	DD Core	146675	#N/A	0.66	0.01	8.34	#N/A	1.18	1.20	114.71	#N/A	#N/A
240	146676	Springer Pit	Springer Pit	DD Core	146676	#N/A	0.09	0.01	8.43	#N/A	2.15	2.09	218.20	#N/A	#N/A
241	146677	Springer Pit	Springer Pit	DD Core	146677	#N/A	0.1	0.01	8.39	#N/A	2.00	1.93	150.25	#N/A	#N/A
242	146678	Springer Pit	Springer Pit	DD Core	146678	#N/A	0.62	0.01	8.27	#N/A	1.67	1.64	155.86	#N/A	#N/A
243	146679	Springer Pit	Springer Pit	DD Core	146679	#N/A	1.58	0.02	8.14	#N/A	1.14	1.14	139.65	#N/A	#N/A
244	146680	Springer Pit	Springer Pit	DD Core	146680	#N/A	0.86	0.01	8.45	#N/A	1.07	1.10	128.43	#N/A	#N/A
245	146790	Springer Pit	Springer Pit	DD Core	146790	#N/A	2.49	0.08	7.91	#N/A	1.07	1.19	127.18	#N/A	#N/A
246	146791	Springer Pit	Springer Pit	DD Core	146791	#N/A	2.29	0.05	7.98	#N/A	1.03	0.97	112.84	#N/A	#N/A
247	146794	Springer Pit	Springer Pit	DD Core	146794	#N/A	0.15	0.01	8.42	#N/A	1.44	1.43	155.24	#N/A	#N/A
248	146795	Springer Pit	Springer Pit	DD Core	146795	#N/A	1.66	0.02	8.05	#N/A	0.81	0.83	92.27	#N/A	#N/A
249	146796	Springer Pit	Springer Pit	DD Core	146796	#N/A	0.69	0.01	8.39	#N/A	1.25	1.24	132.17	#N/A	#N/A
250	146797	Springer Pit	Springer Pit	DD Core	146797	#N/A	0.88	0.02	8	#N/A	1.50	1.51	129.68	#N/A	#N/A
251	146798	Springer Pit	Springer Pit	DD Core	146798	#N/A	1.1	0.02	8.39	#N/A	1.16	1.14	127.81	#N/A	#N/A
252	146799	Springer Pit	Springer Pit	DD Core	146799	#N/A	0.55	0.01	8.36	#N/A	1.44	1.42	118.45	#N/A	#N/A
253	146922	Springer Pit	Springer Pit	DD Core	146922	#N/A	1.13	0.01	8.18	#N/A	1.82	1.79	153.37	#N/A	#N/A
254	146923	Springer Pit	Springer Pit	DD Core	146923	#N/A	0.64	0.01	8.45	#N/A	1.30	1.27	123.44	#N/A	#N/A
255	146926	Springer Pit	Springer Pit	DD Core	146926	#N/A	0.52	0.01	8.51	#N/A	0.83	0.84	68.58	#N/A	#N/A
256	465229	Springer Pit	Springer Pit	DD Core	465229	#N/A	0.01	#N/A	8.62	#N/A	0.23	0.22	60.00	0.393	1.84
257	470445	Springer Pit	Springer Pit	DD Core	470445	#N/A	0.05	#N/A	8.84	#N/A	0.18	0.18	78.75	0.186	2.85
258	465244	Springer Pit	Springer Pit	DD Core	465244	#N/A	0.47	#N/A	8.37	#N/A	0.62	0.59	105.00	0.345	1.41
259	465240	Springer Pit	Springer Pit	DD Core	465240	#N/A	0.39	#N/A	8.1	#N/A	0.48	0.45	96.25	0.619	1.83
260	470436	Springer Pit	Springer Pit	DD Core	470436	#N/A	1.1	#N/A	8.06	#N/A	0.57	0.56	112.50	0.367	2.33
261	470423	Springer Pit	Springer Pit	DD Core	470423	#N/A	1.31	#N/A	8.38	#N/A	0.33	0.31	88.75	0.284	2.87
262	480754	Springer Pit	Springer Pit	DD Core	480754	#N/A	0.9	#N/A	8.62	#N/A	0.07	0.07	55.00	0.25	2.7
263	480757	Springer Pit	Springer Pit	DD Core	480757	#N/A	0.4	#N/A	8.75	#N/A	0.37	0.37	97.50	0.189	2.38
264	475695	Springer Pit	Springer Pit	DD Core	475695	#N/A	2.52	#N/A	8.1	#N/A	0.27	0.27	93.75	0.88	3.09
265	475682	Springer Pit	Springer Pit	DD Core	475682	#N/A	1.7	#N/A	8.43	#N/A	0.15	0.16	96.25	0.452	3.4
266	475668	Springer Pit	Springer Pit	DD Core	475668	#N/A	2.2	#N/A	8.12	#N/A	0.32	0.33	101.25	0.796	3.34
267	480746	Springer Pit	Springer Pit	DD Core	480746	#N/A	1.49	#N/A	8.26	#N/A	0.84	0.83	128.75	0.348	2.23
268	475493	Springer Pit	Springer Pit	DD Core	475493	#N/A	0.14	#N/A	9.13	#N/A	0.26	0.27	41.25	0.151	0.33
269	475466	Springer Pit	Springer Pit	DD Core	475466	#N/A	0.06	#N/A	8.94	#N/A	0.12	0.12	40.00	0.211	0.43
270	475479	Springer Pit	Springer Pit	DD Core	475479	#N/A	0.04	#N/A	9.34	#N/A	0.06	0.10	16.00	0.135	0.52
271	481100	Springer Pit	Springer Pit	DD Core	481100	#N/A	0.01	#N/A	8.78	#N/A	0.16	0.17	66.25	0.563	2.37
272	474152	Springer Pit	Springer Pit	DD Core	474152	#N/A	0.07	#N/A	9.15	#N/A	0.06	0.09	16.25	0.117	0.39
273	470040	Springer Pit	Springer Pit	DD Core	470040	#N/A	0.02	#N/A	8.71	#N/A	0.19	0.19	58.75	0.27	2.17
274	470063	Springer Pit	Springer Pit	DD Core	470063	#N/A	0.01	#N/A	8.57	#N/A	0.52	0.51	76.25	0.122	1.13
275	480677	Springer Pit	Springer Pit	DD Core	480677	#N/A	0.04	#N/A	8.89	#N/A	0.16	0.14	65.00	0.312	2.31
276	470050	Springer Pit	Springer Pit	DD Core	470050	#N/A	0.03	#N/A	8.6	#N/A	0.39	0.40	75.00	0.291	1.62
277	480664	Springer Pit	Springer Pit	DD Core	480664	#N/A	0.16	#N/A	8.48	#N/A	0.16	0.15	77.50	0.834	1.74
278	471271	Springer Pit	Springer Pit	DD Core	471271	#N/A	0.02	#N/A	9.23	#N/A	0.08	0.09	23.25	0.095	2.14
279	480684	Springer Pit	Springer Pit	DD Core	480684	#N/A	0.06	#N/A	8.9	#N/A	0.14	0.15	68.75	0.521	2.8
280	474261	Springer Pit	Springer Pit	DD Core	474261	#N/A	0.01	#N/A	8.71	#N/A	-0.01	-0.02	12.25	0.236	1.43
281	480178	Springer Pit	Springer Pit	DD Core	480178	#N/A	0.02	#N/A	8.39	#N/A	0.08	0.08	33.75	0.335	3.22
282	471262	Springer Pit	Springer Pit	DD Core	471262	#N/A	0.01	#N/A	9.07	#N/A	0.07	0.07	26.00	0.118	2.42
283	471269	Springer Pit	Springer Pit	DD Core	471269	#N/A	0.02	#N/A	9.29	#N/A	0.05	0.05	21.75	0.064	2.37
284	470298	Springer Pit	Springer Pit	DD Core	470298	#N/A	1.5	#N/A	8.32	#N/A	0.38	0.37	90.00	0.448	2.56
285	470279	Springer Pit	Springer Pit	DD Core	470279	#N/A	0.61	#N/A	8.61	#N/A	0.35	0.34	77.50	0.403	2.46
286	262761	Pond Zone	East Wall	DD Core	262761	Volcanic	6.33	0.05	7.66	#N/A	0.14	0.17	124.06	0.763	2.02
287	262775	Pond Zone	East Wall	DD Core	262775	Volcanic	1.06	0.03	8.2	#N/A	0.29	0.29	150.38	0.158	2.77
288	275422	Pond Zone	East Wall	DD Core	275422	Volcanic	0.98	0.01	8.29	#N/A	0.10	0.12	132.83	0.221	2.38
289	482023	Pond Zone	East wall South Ramp	DD Core	482023	Skarn/Vol	0.63	0.01	7.88	#N/A	0.16	0.17	63.91	0.898	1.06
290	482021	Pond Zone	East wall South Ramp	DD Core	482021	Skarn/Vol	0.38	0.01	8.47	#N/A	0.06	0.07	53.88	0.84	1.07
291	482034	Pond Zone	South Ramp	DD Core	482034	Skarn/Vol	0.63	0.01	8.7	#N/A	0.05	0.09	52.63	1.062	0.91
292	482042	Pond Zone	South Ramp	DD Core	482042	Skarn/Vol	0.47	0.01	8.51	#N/A	0.19	0.20	72.68	0.728	1.15
293	482032	Pond Zone	South Ramp	DD Core	482032	Skarn/Vol	0.85	0.01	8.42	#N/A	0.13	0.13	75.19	1.01	1.01
294	482041	Pond Zone	South Ramp	DD Core	482041	Skarn/Vol	0.78	0.01	8.58	#N/A	0.08	0.08	30.81	0.616	0.91

Index	Sample ID	Source	Location	Sample Type	Sample ID	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
						ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
178	May 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
179	Jun 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
180	Jun 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
181	Sep 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
182	Sep 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
183	Sep 2001 Sample 3+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
184	Oct 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
185	102 - 10 - 100	Springer Pit	Springer Pit	DD Core	102 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
186	102 - 100 - 200	Springer Pit	Springer Pit	DD Core	102 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
187	102 - 200 - 300	Springer Pit	Springer Pit	DD Core	102 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
188	102 - 300 - 400	Springer Pit	Springer Pit	DD Core	102 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
189	102 - 400 - 500	Springer Pit	Springer Pit	DD Core	102 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
190	102 - 500 - 600	Springer Pit	Springer Pit	DD Core	102 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
191	103 - 10 - 100	Springer Pit	Springer Pit	DD Core	103 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
192	103 - 100 - 200	Springer Pit	Springer Pit	DD Core	103 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
193	103 - 200 - 300	Springer Pit	Springer Pit	DD Core	103 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
194	103 - 300 - 400	Springer Pit	Springer Pit	DD Core	103 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
195	103 - 400 - 500	Springer Pit	Springer Pit	DD Core	103 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
196	103 - 500 - 600	Springer Pit	Springer Pit	DD Core	103 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
197	105 - 10 - 100	Springer Pit	Springer Pit	DD Core	105 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
198	105 - 100 - 200	Springer Pit	Springer Pit	DD Core	105 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
199	105 - 200 - 300	Springer Pit	Springer Pit	DD Core	105 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
200	105 - 300 - 400	Springer Pit	Springer Pit	DD Core	105 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
201	105 - 400 - 500	Springer Pit	Springer Pit	DD Core	105 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
202	105 - 500 - 600	Springer Pit	Springer Pit	DD Core	105 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
203	106 - 10 - 100	Springer Pit	Springer Pit	DD Core	106 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
204	106 - 100 - 200	Springer Pit	Springer Pit	DD Core	106 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
205	106 - 200 - 300	Springer Pit	Springer Pit	DD Core	106 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
206	106 - 300 - 400	Springer Pit	Springer Pit	DD Core	106 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
207	106 - 400 - 500	Springer Pit	Springer Pit	DD Core	106 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
208	106 - 500 - 600	Springer Pit	Springer Pit	DD Core	106 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
209	108 - 10 - 100	Springer Pit	Springer Pit	DD Core	108 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
210	108 - 100 - 200	Springer Pit	Springer Pit	DD Core	108 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
211	108 - 200 - 300	Springer Pit	Springer Pit	DD Core	108 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
212	108 - 300 - 400	Springer Pit	Springer Pit	DD Core	108 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
213	108 - 400 - 500	Springer Pit	Springer Pit	DD Core	108 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
214	108 - 500 - 600	Springer Pit	Springer Pit	DD Core	108 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
215	150 - 10 - 100	Springer Pit	Springer Pit	DD Core	150 - 10 - 100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
216	150 - 100 - 200	Springer Pit	Springer Pit	DD Core	150 - 100 - 200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
217	150 - 200 - 300	Springer Pit	Springer Pit	DD Core	150 - 200 - 300	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
218	150 - 300 - 400	Springer Pit	Springer Pit	DD Core	150 - 300 - 400	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
219	150 - 400 - 500	Springer Pit	Springer Pit	DD Core	150 - 400 - 500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
220	150 - 500 - 600	Springer Pit	Springer Pit	DD Core	150 - 500 - 600	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
221	73093	Springer Pit	Springer Pit	DD Core	73093	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
222	73113	Springer Pit	Springer Pit	DD Core	73113	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
223	73233	Springer Pit	Springer Pit	DD Core	73233	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
224	73253	Springer Pit	Springer Pit	DD Core	73253	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
225	73273	Springer Pit	Springer Pit	DD Core	73273	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
226	73293	Springer Pit	Springer Pit	DD Core	73293	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
227	73488	Springer Pit	Springer Pit	DD Core	73488	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
228	74333	Springer Pit	Springer Pit	DD Core	74333	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
229	74478	Springer Pit	Springer Pit	DD Core	74478	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
230	74498	Springer Pit	Springer Pit	DD Core	74498	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
231	MP-66	Springer Pit	Springer Pit	DD Core	MP-66	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
232	MP-67	Springer Pit	Springer Pit	DD Core	MP-67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
233	476111	Springer Pit	Springer Pit	DD Core	476111	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
234	146670	Springer Pit	Springer Pit	DD Core	146670	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
235	146671	Springer Pit	Springer Pit	DD Core	146671	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
236	146672	Springer Pit	Springer Pit	DD Core	146672	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
237	146673	Springer Pit	Springer Pit	DD Core	146673	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
238	146674	Springer Pit	Springer Pit	DD Core	146674	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
239	146675	Springer Pit	Springer Pit	DD Core	146675	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
240	146676	Springer Pit	Springer Pit	DD Core	146676	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
241	146677	Springer Pit	Springer Pit	DD Core	146677	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
242	146678	Springer Pit	Springer Pit	DD Core	146678	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
243	146679	Springer Pit	Springer Pit	DD Core	146679	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
244	146680	Springer Pit	Springer Pit	DD Core	146680	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
245	146790	Springer Pit	Springer Pit	DD Core	146790	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
246	146791	Springer Pit	Springer Pit	DD Core	146791	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
247	146794	Springer Pit	Springer Pit	DD Core	146794	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
248	146795	Springer Pit	Springer Pit	DD Core	146795	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
249	146796	Springer Pit	Springer Pit	DD Core	146796	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
250	146797	Springer Pit	Springer Pit	DD Core	146797	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
251	146798	Springer Pit	Springer Pit	DD Core	146798	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
252	146799	Springer Pit	Springer Pit	DD Core	146799	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
253	146922	Springer Pit	Springer Pit	DD Core	146922	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
254	146923	Springer Pit	Springer Pit	DD Core	146923	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
255	146926	Springer Pit	Springer Pit	DD Core	146926	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
256	465229	Springer Pit	Springer Pit	DD Core	465229	20	64.3	#N/A	0.05	2.12	0.57	14.7	11.4	960.62	#N/A	3.64	147	0.11	0.89	1479	2.5	0.071	3.7	0.18	7.83	0.17	0.4	439.1	0.06	117	0.7	146.1
257	470445	Springer Pit	Springer Pit	DD Core	470445	11	143.8	#N/A	0.03	2.41	0.6	17.7	9.4	522.51	#N/A	4.36	379	0.25	1.03	791	3.18	0.439	5.6	0.226	17.35	0.1	0.6	990.9	0.097	194	0.2	177.4
258	465244	Springer Pit	Springer Pit	DD Core	465244	33.3	62	#N/A	0.08	3.1	0.22	11.5	12.2	517.73	#N/A	4.44	120	0.06	0.91	1663	11.29	0.012	2.3	0.115	4.8	0.38	1.2	153.8	0.058	113	0.8	70.8
259	465240	Springer Pit	Springer Pit	DD Core	465240	33.5	82.1	#N/A	0.14	2.58	0.98	13.6	11.5	715.44	#N/A	3.57	401	0.07	0.95	1546	5.97	0.016	2.8	0.147	10.04	0.28	4.3	89.6	0.021	125	0.3	85.8
260	470436	Springer Pit	Springer Pit	DD Core	470436	14.9	31.5	#N/A	0.12	3.18	0.19	18.9	13.5	1108.5	#N/A	4.84	105	0.19	1.35	662	18.19	0.119	5.1	0.176	9.13	0.24	3.5	646.3	0.131	169	0.4	61.4
261	470423	Springer Pit	Springer Pit	DD Core	470423	16.8	34.6	#N/A	0.07	2.48	0.09	13.7	9.1	979.52	#N/A	3.87	139	0.15	1.16	611	8.07	0.534	4.5	0.182	7.71	0.22	3.7	962.6	0.089	133	0.4	43.3
262	480754	Springer Pit	Springer Pit	DD Core	480754	10.2	56.1	#N/A	0.03	1.63	0.28	19.7	6.9	509.8	#N/A	4.6	91	0.25	0.82	576	18.17	0.856	4.2	0.155	10.48	0.12	3.5	274.6	0.124	139	0.5	95.8
263	480757	Springer Pit	Springer Pit	DD Core	480757	12.1	60.1	#N/A	0.02	2.38	0.24	13.8	6.9	287.3	#N/A	5.39	79	0.2	0.86	868	16.65	0.68	3.8	0.146	9.57	0.15	2.5	254	0.107	178	0.7	111.9
264	475695	Springer Pit	Springer Pit	DD Core	475695	18	66.6	#N/A	0.2	2.31	0.09	20.2	11.7	778.79	#N/A	5.14	15	0.22	1	495	18.35	1.008	5	0.166	10.7	0.07	8.2	338.9	0.13	150	0.6	40.5
265	475682	Springer Pit	Springer Pit	DD Core	475682	19.4	64.8	#N/A	0.08	1.78	0.62	17

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP	Ag	Al
											%C	%C		ppm	%
295	499413	Pond Zone	North Wall (Skarn)	DD Core	499413	Skarn	0.58	0.01	8.37	#N/A	0.37	0.39	130.33	0.893	1.63
296	499431	Pond Zone	North Wall (Skarn)	DD Core	499431	Skarn	0.08	0.01	8.42	#N/A	8.54	8.59	701.75	0.77	0.56
297	499502	Pond Zone	Lower North Wall (Skarn)	DD Core	499502	Skarn	0.15	0.01	8.29	#N/A	0.76	0.76	129.07	0.118	1.7
298	499521	Pond Zone	Lower North Wall (Skarn)	DD Core	499521	Skarn	1.59	0.01	8.34	#N/A	0.45	0.46	112.78	1.333	1.05
299	483866	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	483866	Diorite	1.42	0.01	8.48	#N/A	0.06	0.07	31.82	0.337	1.11
300	273110	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	273110	Diorite	0.99	0.02	8.32	#N/A	0.15	0.16	77.69	0.822	0.92
301	273120	Pond Zone	West wall(North 1/2),same rock as above	DD Core	273120	Diorite	0.84	0.01	8.1	#N/A	0.08	0.08	60.15	0.681	0.84
302	483849	Pond Zone	West wall(North 1/2),same rock as below	DD Core	483849	Diorite	0.37	0.01	8.5	#N/A	0.05	0.06	18.69	0.397	0.84
303	464304	Pond Zone	West Wall of South Ramp	DD Core	464304	Diorite	0.11	-0.01	7.99	#N/A	0.00	0.03	16.21	0.152	1.21
304	499406	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	499406	Diorite	0.02	0.01	8.27	#N/A	-0.01	0.01	15.91	0.205	0.91
305	464317	Pond Zone	Upper North Wall (monz above Skarn)	DD Core	464317	Monzonite	0.31	-0.01	8.87	#N/A	0.01	0.04	15.21	0.512	1.02
306	464308	Pond Zone	West wall(south 1/2), same rock as above	DD Core	464308	Monzonite	0.25	0.01	8	#N/A	0.03	0.03	13.84	0.201	1.03
307	464315	Pond Zone	West wall(south 1/2),same rock as below	DD Core	464315	Monzonite	0.17	-0.01	8.83	#N/A	0.10	0.11	26.43	0.411	0.98
308	464314	Pond Zone	West Wall of South Ramp	DD Core	464314	Monzonite	0.06	-0.01	8.45	#N/A	0.02	0.05	14.71	0.503	1.08
309	464306	Pond Zone	Ore Zone	DD Core	464306	Fault zone	0.13	0.02	8.62	#N/A	0.29	0.30	115.29	1.186	1.33
310	468311	Pond Zone	Ore Zone	DD Core	468311	Fault zone	0.53	0.01	8.46	#N/A	0.07	0.10	91.48	3.229	1.81
311	468316	Pond Zone	Ore Zone	DD Core	468316	Fault zone	0.18	0.01	8.37	#N/A	0.49	0.49	146.62	2.166	1.28
312	468323	Pond Zone	Ore Zone	DD Core	468323	Monz Dyke	0.96	0.01	8.24	#N/A	0.08	0.09	63.91	0.71	1.23
313	241931	SE Zone	SE Zone	DD Core	241931	KP	1.67	-0.01	8.4	#N/A	0.17	#N/A	51.20	0.2	1.22
314	241932	SE Zone	SE Zone	DD Core	241932	KP	0.17	-0.01	9	#N/A	0.09	#N/A	18.80	0.1	1.3
315	241933	SE Zone	SE Zone	DD Core	241933	KP	0.45	-0.01	9	#N/A	0.10	#N/A	21.40	0.1	1.31
316	241941	SE Zone	SE Zone	DD Core	241941	KP	0.61	-0.01	9.4	#N/A	0.03	#N/A	11.00	0.2	1.14
317	241943	SE Zone	SE Zone	DD Core	241943	KP	0.83	-0.01	9.2	#N/A	0.02	#N/A	10.30	0.2	0.94
318	255935	SE Zone	SE Zone	DD Core	255935	KP	0.04	-0.01	8.7	#N/A	0.00	#N/A	6.00	-0.1	1
319	255936	SE Zone	SE Zone	DD Core	255936	KP	0.17	-0.01	9	#N/A	0.02	#N/A	8.00	0.1	1.11
320	256192	SE Zone	SE Zone	DD Core	256192	KP	1.99	0.01	7.9	#N/A	0.01	#N/A	12.10	0.1	1.81
321	256194	SE Zone	SE Zone	DD Core	256194	KP	1.58	0.01	8	#N/A	0.05	#N/A	6.80	0.1	1.3
322	241232	SE Zone	SE Zone	DD Core	241232	Mz	0.98	-0.01	9.2	#N/A	0.07	#N/A	20.60	0.1	1.58
323	241234	SE Zone	SE Zone	DD Core	241234	Mz	1.09	-0.01	8.6	#N/A	0.17	#N/A	45.00	0.2	1.47
324	241392	SE Zone	SE Zone	DD Core	241392	Mz	0.54	-0.01	8.8	#N/A	0.02	#N/A	11.80	0.2	1.77
325	241394	SE Zone	SE Zone	DD Core	241394	Mz	1.31	0.01	8.6	#N/A	0.07	#N/A	18.80	0.1	1.86
326	241416	SE Zone	SE Zone	DD Core	241416	Mz	0.96	-0.01	8.7	#N/A	0.10	#N/A	22.60	0.1	1.55
327	241419	SE Zone	SE Zone	DD Core	241419	Mz	1.32	-0.01	8.8	#N/A	0.06	#N/A	15.80	0.1	1.46
328	256208	SE Zone	SE Zone	DD Core	256208	Mz	1.67	-0.01	8.5	#N/A	0.04	#N/A	15.30	0.1	1.24
329	256210	SE Zone	SE Zone	DD Core	256210	Mz	0.96	0.01	8.9	#N/A	0.08	#N/A	18.30	0.1	1.52
330	256319	SE Zone	SE Zone	DD Core	256319	Mz	0.49	0.05	6.7	#N/A	0.01	#N/A	6.30	0.1	1.2
331	256321	SE Zone	SE Zone	DD Core	256321	Mz	1.91	0.02	7.05	#N/A	0.00	#N/A	11.00	0.2	1.23
332	256331	SE Zone	SE Zone	DD Core	256331	Mz	1.65	-0.01	8.7	#N/A	0.03	#N/A	11.80	0.4	1.75
333	256332	SE Zone	SE Zone	DD Core	256332	Mz	1.57	-0.01	8.6	#N/A	0.10	#N/A	23.10	0.2	1.31
334	258583	SE Zone	SE Zone	DD Core	258583	Mz	2.36	-0.01	8.6	#N/A	0.08	#N/A	20.60	0.1	1.12
335	258585	SE Zone	SE Zone	DD Core	258585	Mz	1.1	-0.01	9	#N/A	0.10	#N/A	20.80	0.1	1.24
336	259062	SE Zone	SE Zone	DD Core	259062	Mz	1.27	-0.01	8.8	#N/A	0.07	#N/A	16.10	0.1	1.52
337	259065	SE Zone	SE Zone	DD Core	259065	Mz	1.82	-0.01	8.5	#N/A	0.04	#N/A	20.40	0.1	1.4
338	259250	SE Zone	SE Zone	DD Core	259250	Mz	1.15	0.01	8.2	#N/A	0.13	#N/A	37.90	0.1	2.77
339	259253	SE Zone	SE Zone	DD Core	259253	Mz	1.15	0.01	8.3	#N/A	0.15	#N/A	30.40	0.1	2.28
340	259502	SE Zone	SE Zone	DD Core	259502	Mz	1.62	0.02	7.5	#N/A	0.01	#N/A	9.50	0.2	1.33
341	259505	SE Zone	SE Zone	DD Core	259505	Mz	1.88	-0.01	8.5	#N/A	0.03	#N/A	13.60	0.1	1.46
342	259795	SE Zone	SE Zone	DD Core	259795	Mz	0.17	-0.01	9.5	#N/A	0.11	#N/A	15.30	0.2	0.57
343	259796	SE Zone	SE Zone	DD Core	259796	Mz	0.12	-0.01	9.5	#N/A	0.16	#N/A	21.10	0.2	0.49
344	260569	SE Zone	SE Zone	DD Core	260569	Mz	0.12	-0.01	9.4	#N/A	0.06	#N/A	12.10	-0.1	1.31
345	260573	SE Zone	SE Zone	DD Core	260573	Mz	1.52	0.01	9	#N/A	0.02	#N/A	15.80	0.1	1.37
346	261763	SE Zone	SE Zone	DD Core	261763	Mz	0.39	-0.01	9	#N/A	0.24	#N/A	31.20	0.1	1.57
347	261765	SE Zone	SE Zone	DD Core	261765	Mz	0.81	-0.01	9.2	#N/A	0.14	#N/A	21.40	-0.1	0.87
348	261775	SE Zone	SE Zone	DD Core	261775	Mz	1.33	-0.01	8.8	#N/A	0.13	#N/A	27.10	0.2	1.43
349	261776	SE Zone	SE Zone	DD Core	261776	Mz	0.79	-0.01	9	#N/A	0.17	#N/A	18.80	0.1	1.35
350	31929	Wight Pit	WB-03-06	DD Core	31929	AP	0.04	0.01	8.15	#N/A	1.13	#N/A	136.00	1.2	1.2
351	32550	Wight Pit	WB-03-11	DD Core	32550	AP	0.05	-0.01	8.57	#N/A	0.63	#N/A	97.00	-0.3	2.43
352	31636	Wight Pit	WB-03-03	DD Core	31636	BX	0.67	-0.01	8.53	#N/A	1.56	#N/A	151.10	1.1	1.58
353	31598	Wight Pit	WB-03-03	DD Core	31598	BX	3.79	-0.01	8	#N/A	1.20	#N/A	119.60	0.9	1.1
354	31943	Wight Pit	WB-03-06	DD Core	31943	BX	0.88	-0.01	8.3	#N/A	1.08	#N/A	113.40	1.1	0.82
355	31998	Wight Pit	WB-03-06	DD Core	31998	BX	0.3	0.02	8.27	#N/A	1.18	#N/A	148.60	1.4	2.01
356	32491	Wight Pit	WB-03-11	DD Core	32491	BX	0.47	-0.01	8.4	#N/A	1.19	#N/A	127.20	1.2	1.88
357	32539	Wight Pit	WB-03-11	DD Core	32539	BX	0.49	0.02	8.39	#N/A	1.06	#N/A	113.40	0.7	1.49
358	32727	Wight Pit	WB-03-14	DD Core	32727	BX	0.86	0.17	7.86	#N/A	1.46	#N/A	146.10	0.5	1.86
359	32635	Wight Pit	WB-03-14	DD Core	32635	BXm	0.76	-0.01	8.16	#N/A	1.40	#N/A	115.90	0.8	1.52
360	31557	Wight Pit	WB-03-03	DD Core	31557	PP	1.51	-0.01	7.63	#N/A	1.14	#N/A	108.30	0.6	1.14
361	31945	Wight Pit	WB-03-06	DD Core	31945	PPg	0.05	-0.01	8.21	#N/A	0.08	#N/A	19.80	-0.3	1.44
362	32561	Wight Pit	WB-03-11	DD Core	32561	PPg	0.07	-0.01	8.51	#N/A	0.50	#N/A	60.50	0.3	2.53
363	32640	Wight Pit	WB-03-14	DD Core	32640	PPg	2.18	-0.01	8.09	#N/A	1.06	#N/A	122.20	1.5	1.47
364	32729	Wight Pit	WB-03-14	DD Core	32729	PPg	0.81	0.28	7.97	#N/A	1.06	#N/A	120.90	0.8	1.61
365	31603	Wight Pit	WB-03-03	DD Core	31603	PPp	0.83	0.01	8.24	#N/A	0.95	#N/A	93.20	1	1.21
366	31576	Wight Pit	WB-03-03	DD Core	31576	PPp	1.57	-0.01	8.07	#N/A	0.94	#N/A	90.70	-0.3	0.88
367	31973	Wight Pit	WB-03-06	DD Core	31973	PPp	0.66	-0.01	8.54	#N/A	0.78	#N/A	93.20	0.4	1.49
368	32519	Wight Pit	WB-03-11	DD Core	32519	PPp	0.51	-0.01	8.42	#N/A	0.62	#N/A	71.80	0.7	1.86
369	32702	Wight Pit	WB-03-14	DD Core	32702	PPp	1.57	0.02	8.32	#N/A	1.17	#N/A	117.10	0.9	1.26
370	1	Wight Pit	WB-03-01	DD Core	1	#N/A	1.85	0.01	8.4	#N/A	1.10	#N/A	121.20	#N/A	#N/A
371	2	Wight Pit	WB-03-01	DD Core	2	#N/A	0.47	0.01	8.3	#N/A	1.60	#N/A	160.40	#N/A	#N/A
372	3	Wight Pit	WB-03-02	DD Core	3	#N/A	-0.02	<0.01	8.1	#N/A	0.14	#N/A	40.10	#N/A	#N/A
373	4	Wight Pit	WB-03-02	DD Core	4	#N/A	1.79	0.01	8.3	#N/A	1.04	#N/A	118.70	#N/A	#N/A
374	5	Wight Pit	WB-03-03	DD Core	5	#N/A	1.55	0.01	8.4	#N/A	1.03	#N/A	107.30	#N/A	#N/A
375	6	Wight Pit	WB-03-03	DD Core	6	#N/A	1.33	0.01	8.1	#N/A	0.98	#N/A	108.60	#N/A	#N/A
376	7	Wight Pit	WB-03-04	DD Core	7	#N/A	0.51	<0.01	8.6	#N/A	0.97	#N/A	88.40	#N/A	#N/A
377	8	Wight Pit	WB-03-04	DD Core	8	#N/A	-0.02	<0.01	8.1	#N/A	0.32	#N/A	46.90	#N/A	#N/A
378	9	Wight Pit	WB-03-05	DD Core	9	#N/A	1.62	0.01	8.5	#N/A	1.23	#N/A	130.10	#N/A	#N/A
379	10	Wight Pit	WB-03-05	DD Core	10	#N/A	0.65	0.02	8.7	#N/A	1.26	#N/A	137.60	#N/A	#N/A
380	11	Wight Pit	WB-03-06	DD Core	11	#N/A	0.2	<0.01	8.2	#N/A	1.51	#N/A	149.00	#N/A	#N/A
381	12	Wight Pit	WB-03-06	DD Core	12	#N/A	2.37	0.1	6.2	#N/A	0.48	#N/A	68.90	#N/A	#N/A
382	13	Wight Pit	WB-03-07	DD Core	13	#N/A	0.98	0.01	8.6	#N/A	0.95	#N/A	89.60	#N/A	#N/A
383	14	Wight Pit	WB-03-08	DD Core	14	#N/A	0.69	<0.01	8.8	#N/A	0.85	#N/A	97.70	#N/A	#N/A
384	15	Wight Pit	WB-03-08	DD Core	15	#N/A	1.59	0.01	9	#N/A	0.55	#N/A	56.80	#N/A	#N/A
385	16	Wight Pit	WB-03-09	DD Core	16	#N/A	0.7	<0.01	8.9	#N/A	1.18	#N/A	130.10	#N/A	#N/A
386	17	Wight Pit	WB-03-09	DD Core	17	#N/A	0.9	0.01	8.4	#N/A	1.30	#N/A	142.70	#N/A	#N/A
387	18	Wight Pit	WB-03-10	DD Core	18	#N/A	1.04	0.01	9	#N/A	1.11	#N/A	121.20	#N/A	#N/A
388	19	Wight Pit	WB-03-11	DD Core	19	#N/A	0.99	0.01	8.7	#N/A	1.03	#N/A	109.80	#N/A	#N/A
389	20	Wight Pit	WB-03-12	DD Core	20	#N/A	1.13	0.01	9.2	#N/A	0.81	#N/A	93.40	#N/A	#N/A
390	21	Wight Pit	WB-03-12	DD Core	21	#N/A	1.47	0.01	8.4	#N/A	0.69	#N/A	80.80	#N/A	#N/A
391	22	Wight Pit	WB-03-13	DD Core	22	#N/A	0.08	<0.01	8.7	#N/A	1.01	#N/A	127.50	#N/A	#N/A
392	23	Wight Pit	WB-03-13	DD Core	23	#N/A	1.46	0.01	8.4	#N/A	1.05	#N/A	121.20	#N/A	#N/A
393	24	Wight Pit	WB-03-14	DD Core	24	#N/A	0.49	<0.01	8.3	#N/A	1.42	#N/A	130.10	#N/A	#N/A
394	25	Wight Pit	WB-03-15	DD Core	25	#N/A	0.94	0.01	8.5	#N/A	0.80	#N/A	102.30	#N/A	#N/A
395	26	Wight Pit	WB-03-16	DD Core	26	#N/A	0.16	<0.01	8.7	#N/A	1.06	#N/A	123.40	#N/A	#N/A
396	27	Wight Pit	WB-03-16	DD Core	27	#N/A	0.65	0.01	8.7	#N/A	1.10	#N/A	132.20	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
						ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
295	499413	Pond Zone	North Wall (Skarn)	DD Core	499413	22.9	26.3	#N/A	1.29	4	0.12	26.7	35.3	646.85	#N/A	3.14	69	0.03	1.63	2540	5.09	0.012	13.7	0.129	5.47	0.44	3.4	70.1	0.153	90	0.8	60.6
296	499431	Pond Zone	North Wall (Skarn)	DD Core	499431	17.2	12.6	#N/A	1.23	27.67	20.9	7.3	5.5	144.09	#N/A	1.28	1835	0.02	0.25	1182	6.78	0.003	2.4	0.045	265.69	0.58	3.9	347.7	0.022	30	0.9	1970.7
297	499502	Pond Zone	Lower North Wall (Skarn)	DD Core	499502	16.7	7.1	#N/A	0.27	6.73	1.14	7.3	19.5	53.54	#N/A	2.35	205	0.06	0.99	3039	12.3	0.007	6.5	0.125	2.85	0.67	0.5	56	0.091	62	1.4	194.4
298	499521	Pond Zone	Lower North Wall (Skarn)	DD Core	499521	16	18.8	#N/A	0.34	2.83	0.19	23.3	39.6	595.05	#N/A	2.56	32	0.15	1.1	1502	7	0.004	15.8	0.12	13.98	0.42	4.8	55.3	0.132	62	0.6	66.8
299	483866	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	483866	20.7	27	#N/A	0.18	1.12	0.09	26.8	21.9	214.77	#N/A	2.82	38	0.23	1.14	637	3.66	0.027	6.9	0.094	2.71	0.38	2.4	105.6	0.132	55	0.4	53.7
300	273110	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	273110	11	42.3	#N/A	0.18	1.48	0.1	17.5	26.8	624.86	#N/A	3.01	23	0.06	0.75	633	4.48	0.034	6.6	0.127	6.9	0.7	2.9	87.9	0.094	71	0.5	55.6
301	273120	Pond Zone	West wall(North 1/2),same rock as above	DD Core	273120	9.3	16.8	#N/A	0.24	1.46	0.19	10.9	20.7	760.22	#N/A	1.72	12	0.06	0.59	724	5.89	0.022	4.7	0.106	13.9	0.22	2.3	50.6	0.074	40	0.4	40
302	483849	Pond Zone	West wall(North 1/2),same rock as below	DD Core	483849	17.5	47.4	#N/A	0.08	0.85	0.44	9.4	14.8	363.92	#N/A	1.9	46	0.03	0.89	487	2.92	0.018	3.9	0.097	3.32	0.35	0.9	70.1	0.068	55	0.3	97.8
303	464304	Pond Zone	West Wall of South Ramp	DD Core	464304	17.6	106.1	#N/A	0.14	1.05	0.2	14.3	24.1	271.04	#N/A	2.85	19	0.06	0.6	736	2.55	0.06	5.2	0.145	5.5	0.64	2.2	186.3	0.132	75	0.6	70
304	499406	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	499406	13.4	16.3	#N/A	0.33	0.98	0.06	11.7	24	18	#N/A	1.85	17	0.02	0.58	712	2.82	0.049	3.3	0.127	4.05	0.45	1.8	147.2	0.13	49	0.6	33.2
305	464317	Pond Zone	Upper North Wall (monz above Skarn)	DD Core	464317	10.7	40.9	#N/A	0.1	1	0.12	11.4	43.6	393.49	#N/A	2.65	11	0.1	0.78	644	2.02	0.06	6.1	0.128	6.22	0.58	1.4	147.4	0.138	80	0.6	45
306	464308	Pond Zone	West wall(south 1/2), same rock as above	DD Core	464308	18.8	67.8	#N/A	0.19	0.97	0.12	11	30.9	160.65	#N/A	2.5	19	0.07	0.47	552	2.5	0.075	3.6	0.126	9.32	0.68	2.2	176.6	0.15	76	0.5	33.8
307	464315	Pond Zone	West wall(south 1/2),same rock as below	DD Core	464315	11.8	70.1	#N/A	0.1	1.48	0.14	10.9	43.3	330.67	#N/A	2.03	18	0.08	0.69	692	2.27	0.063	5.4	0.129	4.29	0.69	0.9	211.7	0.139	65	0.5	46.4
308	464314	Pond Zone	West Wall of South Ramp	DD Core	464314	13.2	53	#N/A	0.17	1.44	0.09	14.3	34.9	397.99	#N/A	2.5	12	0.08	0.74	831	2.54	0.055	5.4	0.129	5.53	0.59	1.8	161.7	0.131	73	0.5	60.3
309	464306	Pond Zone	Ore Zone	DD Core	464306	43.3	15.3	#N/A	0.61	4.67	1	8	43.4	955.42	#N/A	1.23	52	0.15	0.59	1178	5.56	0.009	3.4	0.198	3.45	0.38	0.9	17.9	0.102	47	0.5	168.8
310	468311	Pond Zone	Ore Zone	DD Core	468311	30.1	8.2	#N/A	0.14	4.32	0.95	19	26.4	2646.24	#N/A	2.72	147	0.22	1.39	2218	12.43	0.005	5	0.223	9.88	0.4	1.2	24.5	0.122	91	1.2	160.6
311	468316	Pond Zone	Ore Zone	DD Core	468316	37.8	5.5	#N/A	0.27	5.9	0.65	6.7	32.3	1479.66	#N/A	1.75	82	0.03	0.48	1394	4.81	0.005	3.2	0.159	6.2	0.32	1.2	36.9	0.088	51	0.9	103.6
312	468323	Pond Zone	Ore Zone	DD Core	468323	10.9	17.7	#N/A	0.14	1.67	0.29	19.8	17.7	695.19	#N/A	2.48	58	0.08	0.7	617	4.84	0.114	3.9	0.123	7.32	0.13	3.1	45.5	0.032	43	0.4	75.1
313	241931	SE Zone	SE Zone	DD Core	241931	15.8	21	#N/A	0.8	1.5	0.1	34.3	17.8	307.6	#N/A	2.95	310	0.08	0.95	645	6.6	0.015	2.7	0.104	4.9	0.6	1.4	159	0.119	72	0.6	46
314	241932	SE Zone	SE Zone	DD Core	241932	12.2	24	#N/A	0.2	1.51	0.1	5.6	28.8	37.8	#N/A	1.89	80	0.07	0.76	534	2.4	0.032	2.7	0.081	4	0.6	-0.5	232	0.123	78	0.5	38
315	241933	SE Zone	SE Zone	DD Core	241933	18.1	12	#N/A	0.2	1.56	0.1	8.7	18.8	57.9	#N/A	2.2	50	0.06	1.06	768	2.2	0.015	3.3	0.107	5.2	0.5	0.5	144	0.117	70	0.7	47
316	241941	SE Zone	SE Zone	DD Core	241941	11.7	21	#N/A	0.3	1.31	0.1	9.2	29.1	130.5	#N/A	1.85	220	0.06	0.55	507	2.6	0.036	1.8	0.061	7.1	0.7	0.7	221	0.119	69	0.4	39
317	241943	SE Zone	SE Zone	DD Core	241943	11.8	15	#N/A	0.7	1.04	0.1	13.9	21.2	79.9	#N/A	1.66	340	0.05	0.58	513	4.2	0.023	2	0.057	9.9	0.6	0.7	163	0.094	57	0.4	41
318	255935	SE Zone	SE Zone	DD Core	255935	7.3	16	#N/A	0.1	0.84	0.1	4.3	25.6	336.4	#N/A	1.57	50	0.05	0.58	531	1.8	0.029	2.6	0.053	5.4	0.6	-0.5	234	0.103	61	0.4	38
319	255936	SE Zone	SE Zone	DD Core	255936	9.1	18	#N/A	0.2	0.99	0.1	7.2	26.3	258.5	#N/A	1.78	70	0.05	0.63	516	2	0.03	2.5	0.068	5	0.6	-0.5	235	0.122	68	0.4	41
320	256192	SE Zone	SE Zone	DD Core	256192	13.7	88	#N/A	0.4	1.34	0.1	9.8	18	121.9	#N/A	2.53	130	0.08	0.66	347	5.2	0.287	2.2	0.074	11.3	0.4	3	96	0.098	80	0.6	34
321	256194	SE Zone	SE Zone	DD Core	256194	13.5	33	#N/A	0.4	1.2	-0.1	11.6	20.9	148.9	#N/A	2.5	220	0.08	0.65	362	11	0.03	2.3	0.078	8.6	0.7	2.4	142	0.119	87	0.8	33
322	241232	SE Zone	SE Zone	DD Core	241232	13.6	27	#N/A	0.3	1.86	0.1	11.2	31.8	345.3	#N/A	3.07	120	0.1	0.82	511	9.5	0.045	2.4	0.106	7.1	0.4	1.7	210	0.162	121	1	31
323	241234	SE Zone	SE Zone	DD Core	241234	10.2	36	#N/A	0.3	1.96	0.1	11.9	17	392.1	#N/A	3.18	70	0.09	0.77	518	2.7	0.076	2.7	0.104	7	0.3	1.4	112	0.146	119	0.7	31
324	241392	SE Zone	SE Zone	DD Core	241392	11.4	110	#N/A	0.3	1.78	0.1	10.3	30	56.4	#N/A	3.03	30	0.09	0.9	743	3.5	0.031	2.8	0.107	5.1	0.5	0.6	201	0.142	118	1	41
325	241394	SE Zone	SE Zone	DD Core	241394	14	47	#N/A	0.5	2.07	0.1	9.8	29.2	122.3	#N/A	3.47	40	0.1	1.04	676	3.3	0.044	2.8	0.127	4.2	0.5	1.3	183	0.174	121	1.4	41
326	241416	SE Zone	SE Zone	DD Core	241416	10.7	142	#N/A	0.2	1.7	0.1	13.2	14.8	229.8	#N/A	3.54	60	0.13	0.97	580	2.3	0.038	3.2	0.13	3.4	0.3	1.3	120	0.169	140	0.7	36
327	241419	SE Zone	SE Zone	DD Core	241419	12.8	100	#N/A	0.2	1.57	0.1	15	17	145.7	#N/A	3.5	90	0.11	0.95	490	1.9	0.035	3.3	0.126	3.1	0.4	1.7	152	0.164	120	0.6	34
328	256208	SE Zone	SE Zone	DD Core	256208	14.7	17	#N/A	0.2	1.28	0.1	19.6	21.3	310.1	#N/A	2.69	160	0.06	0.89	451	6.1	0.024	1.9	0.102	2.9	0.9	2.4	236	0.136	94	0.7	35
329	256210	SE Zone	SE Zone	DD Core	256210	18.6	23	#N/A	0.2	1.77	0.1	10.5	22.7	229.5	#N/A	2.96	40	0.07	0.98	543	27.1	0.025	2.5	0.109	3.3	0.8	1.6	188	0.134	108	0.9	37
330	256319	SE Zone	SE Zone	DD Core	256319	10.5	26	#N/A	0.3	0.85	0.1	5.6	28.2	89.5	#N/A	3.21	220	0.06	0.68	240	7.8	0.032	2.6	0.098	3.1	0.5	2.7	190	0.195	95	0.7	31
331	256321	SE Zone	SE Zone	DD Core	256321	17.7	12	#N/A	0.3	0.98	0.1	13	22.2	228.6	#N/A	3.57	250	0.03	0.95	310	11.6	0.025	4.4	0.123	4.2	0.7	3.9	302	0.18	80	0.9	37
332	256331	SE Zone	SE Zone	DD Core	256331	12.2	11	#N/A	0.2	2.03	-0.1	13.8	26	276.1	#N/A	3	100	0.03	0.85	427	135.8	0.036	2.7	0.103	9.7	0.5	4	218	0.153	93	0.9	35
333	256332	SE Zone	SE Zone	DD Core	256332	13.2	13	#N/A	0.2	1.72	-0.1	13.9	18.7	232.1	#N/A	3.13	100	0.03	0.76	361	65.6	0.026	3	0.115	5.7	0.3	3.3	108	0.118	90	0.6	31
334	258583	SE Zone	SE Zone	DD Core	258583	13.3	20	#N/A	0.5	1.05	0.1	11.3	23.7	124.4	#N/A	3.14	100	0.06	1.04	409	2.7	0.027	3.5	0.114	2.5	0.7	1.5	191	0.134	68	0.9	39
335	258585	SE Zone	SE Zone	DD Core	258585	9.4	23	#N/A	0.2	1.18	-0.1	9.6	24.8	121.6	#N/A	3.01	60	0.06	1.08	518	1.9	0.026	3	0.112	2	0.8	0.9	234	0.141	85	0.6	43
336	259062	SE Zone	SE Zone	DD Core	259062	11.9	24	#N/A	0.2	1.86	-0.1	15.3	21.2	219.7	#N/A	3	40	0.06	0.8	401	4.5	0.02	2.3	0.124	3.3	0.2	1.9	124	0.128	85	0.6	29
337	259065	SE Zone	SE Zone	DD Core	259065	10.7	21	#N/A	0.2	1.28	-0.1	12.4	19.1	248.1	#N/A	3.73	40	0.06	1.26	428	2.1	0.022	5.7	0.124	2	0.2	2.1	176	0.141	108	0.7	38
338	259250	SE Zone	SE Zone	DD Core	259250	13.2	55	#N/A	0.3	1.94	0.2	18.4	18.1	142.3	#N/A	3.39	140	0.3	1.88	915	2.3	0.39	4	0.156	9.7	0.4	1.4	304	0.147	141	0.5	70
339	259253	SE Zone	SE Zone	DD Core	259253	11.1	73	#N/A	0.4	1.55	0.2	12.2	16.6	87.2	#N/A	3.42	90	0.16	1.29	834	1.9	0.396	3.7	0.144	7.1	0.3	1	317	0.145	126	1.2	65
340	259502	SE Zone	SE Zone	DD Core	259502	13.2	30	#N/A	0.7	1.11	0.1	14	18.2	299.7	#N/A	2.82	330	0.08	0.96	502	4.2	0.027	3.2	0.111	6.4	0.4	2.2	216	0.162	89	1.1	41
341	259505	SE Zone	SE Zone	DD Core	259505	14.7	18	#N/A	0.7	1.64	0.2	13.5	20.9	191.5	#N/A	2.71	330	0.07	0.94	699	2.9	0.025	2.6	0.105	6.4	0.5	1.3	171	0.139	89	1	57
342	259795	SE Zone	SE Zone	DD Core	259795	6.2	21	#N/A	0.1	1.09	0.2	3.3	27.2	317.6	#N/A	1.7	70	0.08	0.21	257	4.1	0.029	1.5	0.068	6.9	0.3	0.6	27	0.11	100	0.4	29
343	259796	SE Zone	SE Zone	DD Core	259796	7.6	38	#N/A	0.1	1.2	0.2	4.4	45.4	625.4	#N/A	4.84	130	0.1	0.26	291	6.3	0.048	4	0.141	5.6	0.3	-0.5	65	0.119	228	0.4	34
344	260569	SE Zone	SE Zone	DD Core	260569	9	22	#N/A	0.5	1.4	0.1	7.7	22.9	30	#N/A	2.62	190	0.06	0.95	701	3.2	0.029	2.6	0.099	6.1	0.6	-0.5	256	0.157	100	0.6	47
345	260573	SE Zone	SE Zone	DD Core	260573	12.5	19	#N/A	0.9	1.52	0.1	14.6	48.2	70.5	#N/A	2.56	300	0.07	0.97	692	6.9	0.033	3.6	0.103	3.6	0.4	0.7	199	0.158	84	1	46
346	261763	SE Zone	SE Zone	DD Core	261763	20.7	22	#N/A	0.1	2.41	0.1	11.2	34	203.9	#N/A	3.29	60	0.06	0.78	485	6.7	0.026	4.1	0.114	4.7	0.7	-0.5	186	0.17	121	1.4	34
347	261765	SE Zone	SE Zone	DD Core	261765	11.5	10	#N/A	0.1	1.2	-0.1	11.4	27	124.2	#N/A	2.79	20	0.04	0.58	311	2.9	0.026	2.3	0.101	3	0.4	0.7	103	0.134	88	1	27
348	261775	SE Zone	SE Zone	DD Core	261775	15	25	#N/A	0.3	1.77	0.1	15.5	26.4	304.5	#N/A	3.68	160	0.08	0.86	550	5.5	0.026	2.4	0.117	3	0.5	1.6	166	0.148	123	1	38
349	261776	SE Zone	SE Zone	DD Core	261776	14.6	35	#N/A	0.2	1.88	0.1	13.1	27.4	252	#N/A	3.58	40	0.07	0.63	578	8.9	0.042	2.9	0.097	3.9	0.5	1.2	122	0.147	110	0.8	37
350	31929	Wight Pit	WB-03-06	DD Core	31929	5	64	#N/A	-3	3.77	1	13	3	0.05	#N/A	4.22	#N/A	0.2	0.82	1965	2	0.03	3	0.145	7	-3	-3	#N/A	96	0.09	156	-2	152
351	32550	Wight Pit	WB-03-11	DD Core	32550	24	102	#N/A	-3	2.97	-0.5	29	125	0.03	#N/A	7.11	#N/A	0.18	2.39	2821	-1	0.03	52	0.155	-3	4	#N/A	205	0.27	250	-2	123
352	31636	Wight Pit	WB-03-03	DD Core	31636	9	61	#N/A	-3	5.58	0.5	21	10	0.108	#N/A	6.04	#N/A	0.18	1.41	3027	4	0.04	4	0.155	7	-3	#N/A	172	0.13	270	-2	199
353	31598	Wight Pit	WB-03-03	DD Core	31598	20	62	#N/A	-3	4.25	0.9	13	4	0.068	#N/A	4.16	#N/A	0.21	0.85	1545	10	0.04	3	0.126	15	-3	#N/A	125	0.14	128	-2	115
354	31943	Wight Pit	WB-03-06	DD Core	31943	7	51	#N/A	-3	4.33	0.7	19	11	0.118	#N/A	4.93	#N/A	0.13	0.71	2070	5	0.03	5	0.122	5	-3	#N/A	106	0.14	229	-2	164
355	31998	Wight Pit	WB-03-06	DD Core	31998	17	45	#N/A	-3	5.9	0.7	16	4	0.154	#N/A	4.76	#N/A	0.13	1.05	2371	5	0.46	1	0.543	7	-3	#N/A	368	0.11	184	-2	157
356	32491	Wight Pit	WB-03-11	DD Core	32491	9	70	#N/A	-3	4.65	0.5	18	5	0.15	#N/A	5.37	#N/A	0.17	1.41	1799	5	0.03	4	0.181	10	3	#N/A	140	0.13	270	-2	145
357	32539	Wight Pit	WB-03-11	DD Core	32539	7	184	#N/A	-3	4.32	-0.5	13	9	0.069	#N/A	4.14	#N/A	0.21	0.97	1435	4	0.04	5	0.139	7	-3	#N/A	874	0.1	216	-2	113
358	32727	Wight Pit	WB-03-14	DD Core	32727	7	61	#N/A	-3	6.29	-0.5	15	8	0.062	#N/A	4.31	#N/A	0.11	0.96	1477	77	0.06	3	0.145	9	-3	#N/A	144	0.15	209	-2	123
359	32635	Wight Pit	WB-03-14	DD Core	32635	10	56	#N/A	-3	4.7	-0.5	17	6	0.016	#N/A	4.34	#N/A	0.15	1.14	1959	3	0.03	3	0.178	18	3	#N/A	137	0.07	165	-2	121
360	31557	Wight Pit	WB-03-03	DD Core	31557	12	79	#N/A	-3	4.12	0.6	12	5	0.097	#N/A	3.47	#N/A	0.16	0.87	1393	5	0.03	3	0.128	10	-3	#N/A	130	0.02	115	-2	111
361	31945	Wight Pit	WB-03-06	DD Core	31945	13	124	#N/A	-3	3.62	-0.5	15	8	0.023	#N/A	4.52	#N/A	0.23	1.22	1642	4	0.06	4	0.159	-3	-3	#N/A	108	0.11	167	-2	80
362	32561	Wight Pit	WB-03-11	DD Core	32561	30	140	#N/A	-3	4.06	-0.5	12	7	0.033	#N/A	3.96	#N/A	0.27	0.86	1442	1	0.04	4	0.113	4	-3	#N/A	294	0.16	199	-2	98
363	32640	Wight Pit	WB-03-14	DD Core	32640	21	37	#N/A	-3	3.99	-0.5	16	5	0.133	#N/A	3.97	#N/A	0.22	1.16	2274	11	0.03	4	0.124	19	-3	#N/A	114	0.1	129	2	123
364	32729	Wight Pit	WB-03-14	DD Core	32729	7	103	#N/A	-3	4.46	-0.5	13	2	0.012	#N/A	4.41	#N/A	0.19	1.14	1421	2	0.06	1	0.164	8	-3	#N/A	178	0.17	167	-2	71
365	31603	Wight Pit	WB-03-03	DD Core	31603	12	67	#N/A	4	3.56	0.6	11	5	0.14	#N/A	3.8	#N/A	0.24	0.92	1707	5	0.04	2	0.125	11	-3	#N/A	155	0.11	183	-2	139
366	31576	Wight Pit	WB-03-03	DD Core	31576	15	111	#N/A	3	3.28	0.8	7	3	0.01	#N/A	2.5	#N/A	0.2	0.46	1412	13	0.05	1	0.078	29	-3	#N/A	115	-0.01	71	-2	133
367	31973	Wight Pit	WB-03-06	DD Core	31973	10	104	#N/A	-3	3.62	-0.5	14	6	0.02	#N/A	4.26	#N/A	0.14	1.12	1730	6	0.11	1	0.141	6	-3	#N/A	149	0.17	172	-2	75
368	32519	Wight Pit	WB-03-11	DD Core	32519	20	60	#N/A	-3	3.25	-0.5	13	8	0.152	#N/A	4.2	#N/A	0.15	1.09	1264	1	0.04	4	0.126	8	3	#N/A	125	0.17	193	2	93
369	32702	Wight Pit	WB-03-14	DD Core	32702	21	71	#N/A	-3	4.68	-0.5	14	6	0.021	#N/A	4.6	#N/A	0.11	1.08	1356	13	0.03	3	0.166	11	-3	#N/A	420	0.17	174	-2	80
370	1	Wight Pit	WB-03-01	DD Core	1	#N/A	901	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	419	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
371	2	Wight Pit	WB-03-01	DD Core	2	#N/A	1817	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	170	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
372	3	Wight Pit	WB-03-02	DD Core	3	#N/A	1517	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
373	4	Wight Pit	WB-03-02	DD Core	4	#N/A	1758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	421	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
374	5	Wight Pit	WB-03-03	DD Core	5	#N/A	1545	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	544	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
375	6	Wight Pit	WB-03-03	DD Core	6	#N/A	1548	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	334	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
376	7	Wight Pit	WB-03-04	DD Core	7	#N/A	1847	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	156	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
377	8	Wight Pit	WB-03-04	DD Core	8	#N/A	1480	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
378	9	Wight Pit	WB-03-05	DD Core	9	#N/A	1467	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	593	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
379	10	Wight Pit	WB-03-05	DD Core	10	#N/A	1754	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	285	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	#N/A
380	11	Wight Pit	WB-03-06	DD Core	11	#N/A	1457	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	146	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
381	12	Wight Pit	WB-03-06	DD Core	12	#N/A	1465	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2394	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	18.6	#N/A	#N/A	#N/A	#N/A	#N/A
382	13	Wight Pit	WB-03-07	DD Core	13	#N/A	1391	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	523	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.8	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP	Ag	Al
											%C	%C		ppm	%
397	28	Wight Pit	WB-03-17	DD Core	28	#N/A	0.86	0.01	8.6	#N/A	1.26	#N/A	144.60	#N/A	#N/A
398	29	Wight Pit	WB-03-17	DD Core	29	#N/A	0.73	<0.01	8.6	#N/A	0.69	#N/A	108.50	#N/A	#N/A
399	30	Wight Pit	WB-03-18	DD Core	30	#N/A	1.03	0.01	8.6	#N/A	1.20	#N/A	273.50	#N/A	#N/A
400	31	Wight Pit	WB-03-18	DD Core	31	#N/A	0.47	<0.01	9.2	#N/A	0.20	#N/A	46.10	#N/A	#N/A
401	32	Wight Pit	WB-03-18	DD Core	32	#N/A	0.67	0.01	8.8	#N/A	0.70	#N/A	97.30	#N/A	#N/A
402	33	Wight Pit	WB-03-19	DD Core	33	#N/A	0.26	0.01	8.6	#N/A	0.54	#N/A	91.00	#N/A	#N/A
403	34	Wight Pit	WB-03-19	DD Core	34	#N/A	0.1	<0.01	8.7	#N/A	0.53	#N/A	61.10	#N/A	#N/A
404	37	Wight Pit	WB-03-20	DD Core	37	#N/A	0.26	0.02	7.8	#N/A	0.81	#N/A	128.40	#N/A	#N/A
405	38	Wight Pit	WB-03-20	DD Core	38	#N/A	0.3	<0.01	9.1	#N/A	0.50	#N/A	74.80	#N/A	#N/A
406	39	Wight Pit	WB-03-21	DD Core	39	#N/A	0.13	<0.01	8.7	#N/A	0.71	#N/A	83.50	#N/A	#N/A
407	40	Wight Pit	WB-03-22	DD Core	40	#N/A	0.51	<0.01	8.8	#N/A	0.77	#N/A	96.00	#N/A	#N/A
408	41	Wight Pit	WB-03-22	DD Core	41	#N/A	0.05	0.01	8	#N/A	0.96	#N/A	169.60	#N/A	#N/A
409	42	Wight Pit	WB-03-22	DD Core	42	#N/A	1	-0.01	8.5	#N/A	1.12	#N/A	125.90	#N/A	#N/A
410	44	Wight Pit	WB-03-23	DD Core	44	#N/A	0.59	-0.01	8.3	#N/A	1.66	#N/A	192.00	#N/A	#N/A
411	46	Wight Pit	WB-03-24	DD Core	46	#N/A	1.24	0.01	8.8	#N/A	1.30	#N/A	142.10	#N/A	#N/A
412	47	Wight Pit	WB-03-25	DD Core	47	#N/A	0.35	-0.01	8.8	#N/A	0.82	#N/A	102.20	#N/A	#N/A
413	48	Wight Pit	WB-03-25	DD Core	48	#N/A	0.05	-0.01	8	#N/A	1.20	#N/A	188.30	#N/A	#N/A
414	49	Wight Pit	WB-03-25	DD Core	49	#N/A	0.04	0.01	9.2	#N/A	0.60	#N/A	117.20	#N/A	#N/A
415	50	Wight Pit	WB-03-26	DD Core	50	#N/A	0.25	0.01	8.9	#N/A	1.07	#N/A	124.70	#N/A	#N/A
416	51	Wight Pit	WB-03-26	DD Core	51	#N/A	0.11	-0.01	9.3	#N/A	0.86	#N/A	111.00	#N/A	#N/A
417	53	Wight Pit	WB-03-27	DD Core	53	#N/A	0.65	-0.01	9.4	#N/A	0.59	#N/A	63.60	#N/A	#N/A
418	54	Wight Pit	WB-03-27	DD Core	54	#N/A	0.38	0.01	8.7	#N/A	0.63	#N/A	109.70	#N/A	#N/A
419	55	Wight Pit	WB-03-27	DD Core	55	#N/A	0.78	0.01	8.6	#N/A	0.66	#N/A	81.00	#N/A	#N/A
420	56	Wight Pit	WB-03-28	DD Core	56	#N/A	0.75	-0.01	8.3	#N/A	0.62	#N/A	98.50	#N/A	#N/A
421	57	Wight Pit	WB-03-28	DD Core	57	#N/A	0.98	0.01	8.4	#N/A	0.89	#N/A	117.20	#N/A	#N/A
422	58	Wight Pit	WB-03-28	DD Core	58	#N/A	0.71	-0.01	8.8	#N/A	0.62	#N/A	63.90	#N/A	#N/A
423	59	Wight Pit	WB-03-29	DD Core	59	#N/A	0.94	0.01	7.9	#N/A	1.39	#N/A	149.60	#N/A	#N/A
424	62	Wight Pit	WB-03-31	DD Core	62	#N/A	0.62	0.01	8.2	#N/A	0.96	#N/A	86.00	#N/A	#N/A
425	63	Wight Pit	WB-03-31	DD Core	63	#N/A	1.13	0.01	8.1	#N/A	1.15	#N/A	124.70	#N/A	#N/A
426	64	Wight Pit	WB-03-32	DD Core	64	#N/A	2.49	0.01	8	#N/A	1.10	#N/A	125.90	#N/A	#N/A
427	65	Wight Pit	WB-03-32	DD Core	65	#N/A	1.14	0.01	8.3	#N/A	0.76	#N/A	94.80	#N/A	#N/A
428	67	Wight Pit	WB-03-33	DD Core	67	#N/A	0.28	0.01	7.9	#N/A	1.57	#N/A	150.90	#N/A	#N/A
429	69	Wight Pit	WB-03-35	DD Core	69	#N/A	0.78	-0.01	8.7	#N/A	1.27	#N/A	103.50	#N/A	#N/A
430	70	Wight Pit	WB-03-35	DD Core	70	#N/A	0.66	-0.01	8.5	#N/A	1.25	#N/A	137.20	#N/A	#N/A
431	71	Wight Pit	WB-03-35	DD Core	71	#N/A	0.97	0.01	8.6	#N/A	1.07	#N/A	96.00	#N/A	#N/A
432	74	Wight Pit	WB-03-37	DD Core	74	#N/A	0.56	0.01	8.1	#N/A	0.46	#N/A	64.80	#N/A	#N/A
433	75	Wight Pit	WB-03-37	DD Core	75	#N/A	1.64	0.02	8.4	#N/A	1.39	#N/A	123.40	#N/A	#N/A
434	76	Wight Pit	WB-03-38	DD Core	76	#N/A	0.63	-0.01	8.7	#N/A	0.87	#N/A	92.30	#N/A	#N/A
435	77	Wight Pit	WB-03-38	DD Core	77	#N/A	0.07	-0.01	8.4	#N/A	0.30	#N/A	83.50	#N/A	#N/A
436	79	Wight Pit	WB-03-39	DD Core	79	#N/A	0.52	-0.01	8.3	#N/A	1.21	#N/A	135.90	#N/A	#N/A
437	81	Wight Pit	WB-03-40	DD Core	81	#N/A	0.79	0.01	8.7	#N/A	1.19	#N/A	148.40	#N/A	#N/A
438	82	Wight Pit	WB-03-41	DD Core	82	#N/A	0.7	-0.01	8.5	#N/A	2.09	#N/A	160.80	#N/A	#N/A
439	83	Wight Pit	WB-03-41	DD Core	83	#N/A	0.65	-0.01	8.8	#N/A	1.02	#N/A	98.50	#N/A	#N/A
440	84	Wight Pit	WB-03-42	DD Core	84	#N/A	0.02	-0.01	8.7	#N/A	0.26	#N/A	90.20	#N/A	#N/A
441	85	Wight Pit	WB-03-42	DD Core	85	#N/A	1.15	0.01	8.5	#N/A	1.41	#N/A	111.00	#N/A	#N/A
442	87	Wight Pit	WB-03-43	DD Core	87	#N/A	0.68	-0.01	8.4	#N/A	1.21	#N/A	128.40	#N/A	#N/A
443	88	Wight Pit	WB-03-44	DD Core	88	#N/A	0.78	0.01	8.2	#N/A	1.42	#N/A	137.20	#N/A	#N/A
444	89	Wight Pit	WB-03-44	DD Core	89	#N/A	0.56	-0.01	8.1	#N/A	0.90	#N/A	106.00	#N/A	#N/A
445	91	Wight Pit	WB-03-46	DD Core	91	#N/A	0.51	-0.01	8.7	#N/A	0.58	#N/A	58.60	#N/A	#N/A
446	92	Wight Pit	WB-03-47	DD Core	92	#N/A	0.13	-0.01	7.8	#N/A	0.32	#N/A	194.50	#N/A	#N/A
447	93	Wight Pit	WB-03-47	DD Core	93	#N/A	0.83	0.01	8.2	#N/A	0.34	#N/A	67.30	#N/A	#N/A
448	94	Wight Pit	WB-03-48	DD Core	94	#N/A	0.37	-0.01	8.4	#N/A	1.04	#N/A	135.90	#N/A	#N/A
449	95	Wight Pit	WB-03-48	DD Core	95	#N/A	0.48	-0.01	8.8	#N/A	1.26	#N/A	145.90	#N/A	#N/A
450	96	Wight Pit	WB-03-49	DD Core	96	#N/A	0.46	0.01	8.6	#N/A	1.67	#N/A	160.80	#N/A	#N/A
451	97	Wight Pit	WB-03-49	DD Core	97	#N/A	0.97	-0.01	8.5	#N/A	1.13	#N/A	124.70	#N/A	#N/A
575	320198	Boundary Pit	ND-06-05 6.1-7.5	DD Core	320198	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	0.74	61.50	#N/A	#N/A
576	320302	Boundary Pit	ND-06-06 17.5-20	DD Core	320302	#N/A	0.197	#N/A	#N/A	#N/A	#N/A	1.25	104.17	#N/A	#N/A
577	320380	Boundary Pit	ND-06-07 30-32.5	DD Core	320380	#N/A	0.685	#N/A	#N/A	#N/A	#N/A	1.26	105.00	#N/A	#N/A
578	320447	Boundary Pit	ND-06-08 22.5-25	DD Core	320447	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.86	72.00	#N/A	#N/A
579	320534	Boundary Pit	ND-06-09 4.57-5	DD Core	320534	#N/A	0.41	#N/A	#N/A	#N/A	#N/A	0.77	63.83	#N/A	#N/A
580	320735	Boundary Pit	ND-06-10 5-7.5	DD Core	320735	#N/A	0.511	#N/A	#N/A	#N/A	#N/A	0.97	80.42	#N/A	#N/A
581	320855	Boundary Pit	ND-06-11 18.75-20	DD Core	320855	#N/A	0.025	#N/A	#N/A	#N/A	#N/A	0.60	50.17	#N/A	#N/A
582	320880	Boundary Pit	ND-06-11 67.5-70	DD Core	320880	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	1.14	95.00	#N/A	#N/A
583	215305	Boundary Pit	ND-06-14 45-47.5	DD Core	215305	#N/A	0.298	#N/A	#N/A	#N/A	#N/A	0.82	67.92	#N/A	#N/A
584	215401	Boundary Pit	ND-06-15 15-15.24	DD Core	215401	#N/A	0.659	#N/A	#N/A	#N/A	#N/A	0.71	59.50	#N/A	#N/A
585	265862	Boundary Pit	ND-06-16 45-47.5	DD Core	265862	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.75	62.83	#N/A	#N/A
586	265988	Boundary Pit	ND-06-17 12.5-15	DD Core	265988	#N/A	0.729	#N/A	#N/A	#N/A	#N/A	1.04	86.67	#N/A	#N/A
587	400129	Boundary Pit	ND-06-18 15-17.5	DD Core	400129	#N/A	0.188	#N/A	#N/A	#N/A	#N/A	0.97	80.92	#N/A	#N/A
588	400251	Boundary Pit	ND-06-19 7.5-10	DD Core	400251	#N/A	0.186	#N/A	#N/A	#N/A	#N/A	0.66	55.33	#N/A	#N/A
589	320856	Boundary Pit	ND-06-11 20-22.5	DD Core	320856	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	1.14	95.00	#N/A	#N/A
590	320881	Boundary Pit	ND-06-11 70-72.5	DD Core	320881	#N/A	0.025	#N/A	#N/A	#N/A	#N/A	0.60	50.17	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
						ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
397	28	Wight Pit	WB-03-17	DD Core	28	#N/A	2080	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	555	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
398	29	Wight Pit	WB-03-17	DD Core	29	#N/A	1689	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	373	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
399	30	Wight Pit	WB-03-18	DD Core	30	#N/A	1341	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1110	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	#N/A
400	31	Wight Pit	WB-03-18	DD Core	31	#N/A	820	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	115	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
401	32	Wight Pit	WB-03-18	DD Core	32	#N/A	713	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	470	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.4	#N/A	#N/A	#N/A	#N/A	#N/A
402	33	Wight Pit	WB-03-19	DD Core	33	#N/A	2351	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	199	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	#N/A
403	34	Wight Pit	WB-03-19	DD Core	34	#N/A	1514	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	264	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
404	37	Wight Pit	WB-03-20	DD Core	37	#N/A	1397	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	388	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
405	38	Wight Pit	WB-03-20	DD Core	38	#N/A	758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
406	39	Wight Pit	WB-03-21	DD Core	39	#N/A	1665	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	217	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
407	40	Wight Pit	WB-03-22	DD Core	40	#N/A	1487	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	199	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
408	41	Wight Pit	WB-03-22	DD Core	41	#N/A	665	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	95	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
409	42	Wight Pit	WB-03-22	DD Core	42	#N/A	1286	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	566	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
410	44	Wight Pit	WB-03-23	DD Core	44	#N/A	1384	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	437	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	#N/A
411	46	Wight Pit	WB-03-24	DD Core	46	#N/A	1613	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	448	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
412	47	Wight Pit	WB-03-25	DD Core	47	#N/A	1798	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	564	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
413	48	Wight Pit	WB-03-25	DD Core	48	#N/A	56	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
414	49	Wight Pit	WB-03-25	DD Core	49	#N/A	841	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
415	50	Wight Pit	WB-03-26	DD Core	50	#N/A	1537	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	284	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
416	51	Wight Pit	WB-03-26	DD Core	51	#N/A	1726	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	221	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
417	53	Wight Pit	WB-03-27	DD Core	53	#N/A	1241	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	424	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	#N/A	#N/A	#N/A	#N/A
418	54	Wight Pit	WB-03-27	DD Core	54	#N/A	1907	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	305	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.3	#N/A	#N/A	#N/A	#N/A	#N/A
419	55	Wight Pit	WB-03-27	DD Core	55	#N/A	2121	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	425	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
420	56	Wight Pit	WB-03-28	DD Core	56	#N/A	865	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	382	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
421	57	Wight Pit	WB-03-28	DD Core	57	#N/A	1356	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	792	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	#N/A
422	58	Wight Pit	WB-03-28	DD Core	58	#N/A	1124	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	251	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
423	59	Wight Pit	WB-03-29	DD Core	59	#N/A	1811	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
424	62	Wight Pit	WB-03-31	DD Core	62	#N/A	1935	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	113	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
425	63	Wight Pit	WB-03-31	DD Core	63	#N/A	1758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	250	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
426	64	Wight Pit	WB-03-32	DD Core	64	#N/A	1213	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	948	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
427	65	Wight Pit	WB-03-32	DD Core	65	#N/A	1996	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	523	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	#N/A
428	67	Wight Pit	WB-03-33	DD Core	67	#N/A	1623	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
429	69	Wight Pit	WB-03-35	DD Core	69	#N/A	1056	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	163	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
430	70	Wight Pit	WB-03-35	DD Core	70	#N/A	1592	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	207	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
431	71	Wight Pit	WB-03-35	DD Core	71	#N/A	1559	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	193	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
432	74	Wight Pit	WB-03-37	DD Core	74	#N/A	2159	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.9	#N/A	#N/A	#N/A	#N/A	#N/A
433	75	Wight Pit	WB-03-37	DD Core	75	#N/A	1644	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	325	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
434	76	Wight Pit	WB-03-38	DD Core	76	#N/A	1716	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	128	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
435	77	Wight Pit	WB-03-38	DD Core	77	#N/A	1745	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
436	79	Wight Pit	WB-03-39	DD Core	79	#N/A	1524	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	143	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
437	81	Wight Pit	WB-03-40	DD Core	81	#N/A	1307	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	329	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
438	82	Wight Pit	WB-03-41	DD Core	82	#N/A	1069	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	163	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
439	83	Wight Pit	WB-03-41	DD Core	83	#N/A	1633	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	82	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
440	84	Wight Pit	WB-03-42	DD Core	84	#N/A	1515	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-0.1	#N/A	#N/A	#N/A	#N/A	#N/A
441	85	Wight Pit	WB-03-42	DD Core	85	#N/A	1738	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
442	87	Wight Pit	WB-03-43	DD Core	87	#N/A	1324	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	230	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
443	88	Wight Pit	WB-03-44	DD Core	88	#N/A	1514	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	419	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
444	89	Wight Pit	WB-03-44	DD Core	89	#N/A	1304	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	162	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
445	91	Wight Pit	WB-03-46	DD Core	91	#N/A	1459	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
446	92	Wight Pit	WB-03-47	DD Core	92	#N/A	260	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	304	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
447	93	Wight Pit	WB-03-47	DD Core	93	#N/A	1190	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	302	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.3	#N/A	#N/A	#N/A	#N/A	#N/A
448	94	Wight Pit	WB-03-48	DD Core	94	#N/A	1423	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	#N/A	#N/A	#N/A	#N/A
449	95	Wight Pit	WB-03-48	DD Core	95	#N/A	1421	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	422	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
450	96	Wight Pit	WB-03-49	DD Core	96	#N/A	1469	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	144	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
451	97	Wight Pit	WB-03-49	DD Core	97	#N/A	1371	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	293	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
575	320198	Boundary Pit	ND-06-05 6.1-7.5	DD Core	320198	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
576	320302	Boundary Pit	ND-06-06 17.5-20	DD Core	320302	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
577	320380	Boundary Pit	ND-06-07 30-32.5	DD Core	320380	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
578	320447	Boundary Pit	ND-06-08 22.5-25	DD Core	320447	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
579	320534	Boundary Pit	ND-06-09 4.57-5	DD Core	320534	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
580	320735	Boundary Pit	ND-06-10 5-7.5	DD Core	320735	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
581	320855	Boundary Pit	ND-06-11 18.75-20	DD Core	320855	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
582	320880	Boundary Pit	ND-06-11 67.5-70	DD Core	320880	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
583	215305	Boundary Pit	ND-06-14 45-47.5	DD Core	215305	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
584	215401	Boundary Pit	ND-06-15 15-15.24	DD Core	215401	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
585	265862	Boundary Pit	ND-06-16 45-47.5	DD Core	265862	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
586	265988	Boundary Pit	ND-06-17 12.5-15	DD Core	265988	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
587	400129	Boundary Pit	ND-06-18 15-17.5	DD Core	400129	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
588	400251	Boundary Pit	ND-06-19 7.5-10	DD Core	400251	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
589	320856	Boundary Pit	ND-06-11 20-22.5	DD Core	320856	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
590	320881	Boundary Pit	ND-06-11 70-72.5	DD Core	320881	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Pit	HoleID	Bench	Year	AP	NP	C	S	STARTDATE	NP/AP
Springer	S1180-52228	1180	2007	0.233	7.01			10/27/2007	30.09
Springer	S1180-54145	1180	2007	2.038	9.5			11/1/2007	4.66
Springer	S1180-54244	1180	2007	5.125	13.75			11/1/2007	2.68
Springer	S1180-55153	1180	2007	1.866	21.83			11/1/2007	11.70
Springer	S1144-41503	1144	2008	0.453	7.93			4/14/2008	17.51
Springer	S1156-41024	1156	2008	0.334	4.28			7/7/2008	12.81
Springer	S1156-41030	1156	2008	0.228	11.92			7/7/2008	52.28
Springer	S1132-57121	1132	2008	0.547	19.75			12/19/2008	36.11
Springer	S1072-22004	1072	2009	9.125	20			12/19/2009	2.19
Springer	S1072-22012	1072	2009	58.75	61.08			12/19/2009	1.04
Springer	S1072-22016	1072	2009	5.406	26.83			12/19/2009	4.96
Springer	S1072-22020	1072	2009	3.531	34.33			12/19/2009	9.72
Springer	S1072-22024	1072	2009	2.375	36.83			12/19/2009	15.51
Springer	S1072-22028	1072	2009	1.709	26.67			12/19/2009	15.61
Springer	S1072-22032	1072	2009	4.25	12.5			12/19/2009	2.94
Springer	S1072-22036	1072	2009	1.928	21.17			12/19/2009	10.98
Springer	S1072-22040	1072	2009	0.466	22.58			12/19/2009	48.45
Springer	S1072-22044	1072	2009	0.304	16.42			12/19/2009	54.01
Springer	S1072-22048	1072	2009	0.553	19.58			12/19/2009	35.41
Springer	S1072-22052	1072	2009	1.259	28			12/19/2009	22.24
Springer	S1072-22056	1072	2009	1.375	20.25			12/19/2009	14.73
Springer	S1072-22060	1072	2009	3.75	20.67			12/19/2009	5.51
Springer	S1072-22062	1072	2009	3.906	40.25			12/19/2009	10.30
Springer	S1072-22065	1072	2009	2.156	41.25			12/19/2009	19.13
Springer	S1072-22068	1072	2009	1.409	53.5			12/19/2009	37.97
Springer	S1072-22072	1072	2009	1.269	46.92			12/19/2009	36.97
Springer	S1072-22075	1072	2009	0.487	46.58			12/19/2009	95.65
Springer	S1072-22077	1072	2009	0.469	44.17			12/19/2009	94.18
Springer	S1072-22080	1072	2009	0.24	26.25			12/19/2009	109.38
Springer	S1072-22084	1072	2009	4.562	61.17			12/19/2009	13.41
Springer	S1072-22088	1072	2009	29.406	93.33			12/19/2009	3.17
Springer	S1072-22092	1072	2009	15.844	59.5			12/19/2009	3.76
Springer	S1072-22095	1072	2009	24.187	54.58			12/19/2009	2.26
Springer	S1072-22098	1072	2009	31.562	53.33			12/19/2009	1.69
Springer	S1072-22202	1072	2009	0.267	11.42			12/19/2009	42.77
Springer	S1072-22205	1072	2009	0.184	56.17			12/19/2009	305.27
Springer	S1072-22209	1072	2009	1.069	63			12/19/2009	58.93
Springer	S1072-22217	1072	2009	1.856	54.42			12/19/2009	29.32
Springer	S1072-22220	1072	2009	22.969	52.92			12/19/2009	2.30
Springer	S1072-22223	1072	2009	20.5	59.67			12/19/2009	2.91
Springer	S1156-32005	1156	2009	0.334	1.36			12/29/2009	4.07
Springer	S1156-32007	1156	2009	0.311	1.94			12/29/2009	6.24
Springer	S1156-32010	1156	2009	0.227	10.67			12/29/2009	47.00
Springer	S1156-32013	1156	2009	0.444	5.68			12/29/2009	12.79
Springer	S1156-32016	1156	2009	0.308	6.22			12/29/2009	20.19
Springer	S1156-32039	1156	2009	0.119	1.37			12/29/2009	11.51
Springer	S1156-32042	1156	2009	0.214	1.6			12/29/2009	7.48
Springer	S1156-32045	1156	2009	0.559	4.46			12/29/2009	7.98
Springer	S1156-32049	1156	2009	1.297	8.17			12/29/2009	6.30
Springer	S1060-11024	1060	2009	24.719	44.08			12/31/2009	1.78
Springer	S1060-11044	1060	2009	8.938	43.58			12/31/2009	4.88
Springer	S1060-11048	1060	2009	9.031	29.08			12/31/2009	3.22
Springer	S1060-11058	1060	2009	17.562	37.67			12/31/2009	2.14
Springer	S1060-11060	1060	2009	24.844	53.75			12/31/2009	2.16
Springer	S1156-33157	1156	2010	3.312	37.75			1/3/2010	11.40
Springer	S1156-33161	1156	2010	3.312	18.67			1/3/2010	5.64
Springer	S1156-33167	1156	2010	3.375	17.83			1/3/2010	5.28
Springer	S1156-33172	1156	2010	3.594	23.83			1/3/2010	6.63
Springer	S1144-48012	1144	2010	0.117	1.57			1/7/2010	13.42
Springer	S1144-48015	1144	2010	0.4	11.92			1/7/2010	29.80
Springer	S1144-48018	1144	2010	0.109	1.1			1/7/2010	10.09
Springer	S1144-48026	1144	2010	0.126	1.42			1/7/2010	11.27
Springer	S1144-48050	1144	2010	2.109	8.83			1/7/2010	4.19
Springer	S1144-48059	1144	2010	0.534	27.92			1/7/2010	52.28
Springer	S1144-48063	1144	2010	0.236	10.08			1/7/2010	42.71
Springer	S1144-48066	1144	2010	0.156	1.32			1/7/2010	8.46
Springer	S1060-11519	1060	2010	11.063	42.33			1/10/2010	3.83
Springer	S1060-11522	1060	2010	35.625	60.67			1/10/2010	1.70
Springer	S1060-11525	1060	2010	53.438	33.25			1/10/2010	0.62
Springer	S1060-11528	1060	2010	11	21.42			1/10/2010	1.95
Springer	S1060-11531	1060	2010	4.688	20.58			1/10/2010	4.39
Springer	S1060-11545	1060	2010	32.187	13.67			1/10/2010	0.42
Springer	S1060-11548	1060	2010	24.906	15.92			1/10/2010	0.64
Springer	S1060-11551	1060	2010	54.063	37.42			1/10/2010	0.69
Springer	S1060-11572	1060	2010	12	34.75			1/10/2010	2.90
Springer	S1060-11575	1060	2010	2.559	17.83			1/10/2010	6.97
Springer	S1156-34005	1156	2010	0.791	9			1/10/2010	11.38
Springer	S1156-34014	1156	2010	0.284	3.05			1/10/2010	10.74
Springer	S1156-34023	1156	2010	0.344	1.41			1/10/2010	4.10
Springer	S1156-34035	1156	2010	0.249	1.3			1/10/2010	5.22
Springer	S1156-34079	1156	2010	0.288	2.65			1/10/2010	9.20
Springer	S1156-34085	1156	2010	0.331	31.08			1/10/2010	93.90
Springer	S1156-34091	1156	2010	0.338	2.6			1/10/2010	7.69
Springer	S1156-34097	1156	2010	0.438	10.5			1/10/2010	23.97
Springer	S1156-34103	1156	2010	0.728	26.92			1/10/2010	36.98
Springer	S1156-34111	1156	2010	0.375	4.45			1/10/2010	11.87
Springer	S1156-35115	1156	2010	0.394	9.33			1/13/2010	23.68
Springer	S1156-35124	1156	2010	0.109	2.89			1/13/2010	26.51
Springer	S1156-35136	1156	2010	0.088	14.58			1/13/2010	165.68
Springer	S1156-35148	1156	2010	0.257	1.99			1/13/2010	7.74
Springer	S1156-35308	1156	2010	0.138	4.6			1/13/2010	33.33
Springer	S1156-35316	1156	2010	0.094	8.07			1/13/2010	85.85
Springer	S1156-35326	1156	2010	0.287	4.14			1/13/2010	14.43
Springer	S1060-13003	1060	2010	0.199	45.08			1/15/2010	226.53
Springer	S1060-13007	1060	2010	0.869	24.5			1/15/2010	28.19
Springer	S1060-13011	1060	2010	5.375	25			1/15/2010	4.65
Springer	S1060-13015	1060	2010	2.944	54.33			1/15/2010	18.45
Springer	S1060-13019	1060	2010	1.881	27.08			1/15/2010	14.40
Springer	S1060-13023	1060	2010	2.606	31.33			1/15/2010	12.02
Springer	S1060-13027	1060	2010	2.1	50.58			1/15/2010	24.09
Springer	S1060-13030	1060	2010	0.969	23.75			1/15/2010	24.51
Springer	S1060-13034	1060	2010	4.812	18.17			1/15/2010	3.78
Springer	S1060-13053	1060	2010	0.937	38.67			1/15/2010	41.27
Springer	S1060-13056	1060	2010	1.372	16.58			1/15/2010	12.08
Springer	S1060-13058	1060	2010	2.263	25.42			1/15/2010	11.23
Springer	S1144-49008	1144	2010	0.894	20.83			1/18/2010	23.30
Springer	S1144-49011	1144	2010	0.331	23.25			1/18/2010	70.24
Springer	S1144-49014	1144	2010	3.187	36.5			1/18/2010	11.45
Springer	S1144-49017	1144	2010	0.316	14.75			1/18/2010	46.68
Springer	S1144-49031	1144	2010	0.509	68.25			1/18/2010	134.09
Springer	S1144-49034	1144	2010	0.256	46.92			1/18/2010	183.28
Springer	S1144-49037	1144	2010	0.175	15.33			1/18/2010	87.60
Springer	S1144-49042	1144	2010	0.691	29.17			1/18/2010	42.21
Springer	S1144-49069	1144	2010	0.083	49.42			1/18/2010	595.42
Springer	S1144-49073	1144	2010	0.147	19.67			1/18/2010	133.81
Springer	S1144-49076	1144	2010	0.178	17			1/18/2010	95.51
Springer	S1144-49099	1144	2010	0.628	44.75			1/18/2010	71.26
Springer	S1144-49113	1144	2010	0.096	16.58			1/18/2010	172.71
Springer	S1156-36010	1156	2010	3.969	9			1/18/2010	2.27
Springer	S1156-36025	1156	2010	2.456	8.5			1/18/2010	3.46
Springer	S1156-36034	1156	2010	2.309	12.83			1/18/2010	5.56
Springer	S1156-36046	1156	2010	0.304	6.19			1/18/2010	20.36
Springer	S1156-36099	1156	2010	0.519	47.25			1/18/2010	91.04
Springer	S1156-36109	1156	2010	0.289	6.88			1/18/2010	23.81
Springer	S1156-36117	1156	2010	0.516	12.83			1/18/2010	24.86
Springer	S1156-36131	1156	2010	0.575	8.75			1/18/2010	15.22
Springer	S1156-36132	1156	2010	0.188	27.67			1/18/2010	147.18
Springer	S1156-37002	1156	2010	0.397	12.5			1/19/2010	31.49
Springer	S1156-37043	1156	2010	0.124	6.08			1/19/2010	49.03
Springer	S1156-37061	1156	2010	0.141	9.08			1/19/2010	64.40
Springer	S1156-37067	1156	2010	0.153	7.39			1/19/2010	48.30
Springer	S1060-12062	1060	2010	3.156	28.42			1/25/2010	9.01
Springer	S1060-12070	1060	2010	6.25	24.58			1/25/2010	3.93
Springer	S1060-12076	1060	2010	23.563	39.33			1/25/2010	1.67
Springer	S1060-12080	1060	2010	13.562	73.58			1/25/2010	5.43
Springer	S1060-12084	1060	2010	0.972	17.75			1/25/2010	18.26
Springer	S1060-12089	1060	2010	49.375	21.17			1/25/2010	0.43
Springer	S1060-12094	1060	2010	36.875	61.08			1/25/2010	1.66
Springer	S1156-30133	1156	2010	0.24	16.08			1/27/2010	67.00
Springer	S1156-30136	1156	2010	0.27	31.42			1/27/2010	116.37
Springer	S1156-30143	1156	2010	0.49	4.78			1/27/2010	9.76
Springer	S1156-30251	1156	2010	0.33	9.33			1/27/2010	28.27
Springer	S1156-30254	1156	2010	0.09	25.25			1/27/2010	280.56
Springer	S1156-30321	1156	2010	0.13	12.33			1/27/2010	94.85
Springer	S1156-30324	1156	2010	0.18	41.25			1/27/2010	229.17
Springer	S1156-42006	1156	2010	0.297	25.67			1/29/2010	86.43
Springer	S1156-42010	1156	2010	0.491	30.42			1/29/2010	61.96
Springer	S1156-42015	1156	2010	0.277	24.25			1/29/2010	87.55
Springer	S1156-42018	1156	2010	0.719	32.5			1/29/2010	45.20
Springer	S1144-51007	1144	2010	0.981	16.08			2/2/2010	16.39
Springer	S1144-51025	1144	2010	0.509	12.33			2/2/2010	24.22
Springer	S1144-51028	1144	2010	0.644	4.83			2/2/2010	7.50
Springer	S1144-51031	1144	2010	0.447	1.44			2/2/2010	3.22
Springer	S1144-51067	1144	2010	0.353	4.28			2/2/2010	12.12
Springer	S1144-51070	1144	2010	0.306	30.83			2/2/2010	100.75
Springer	S1144-51082	1144	2010	0.866	14.42			2/2/2010	16.65
Springer	S1144-51085	1144	2010	0.656	2.24			2/2/2010	3.41
Springer	S1144-50032	1144	2010	0.459	18.42			2/3/2010	40.13
Springer	S1144-50042	1144	2010	1.219	29.92			2/3/2010	24.54
Springer	S1144-50045	1144	2010	0.362	37.08			2/3/2010	102.43
Springer	S1144-50048	1144	2010	0.312	5.51			2/3/2010	17.66
Springer	S1144-50078	1144	2010	0.322	30.67			2/3/2010	95.25
Springer	S1144-50081	1144	2010	0.362	14.67			2/3/2010	40.52
Springer	S1144-50084	1144	2010	0.223	42.67			2/3/2010	191.35
Springer	S1144-50117	1144	2010	0.384	8.42			2/3/2010	21.93
Springer	S1144-50120	1144	2010	0.416	32.5			2/3/2010	78.13
Springer	S1144-50123	1144	2010	0.494	0.62			2/3/2010	1.26
Springer	S1144-50126	1144	2010	0.264	30.75			2/3/2010	116.48
Springer	S1144-50156	1144	2010	0.487	29.92			2/3/2010	61.44
Springer	S1144-50159	1144	2010	0.403	46.17			2/3/2010	114.57
Springer	S1144-50162	1144	2010	0.544	38.92			2/3/2010	71.54
Springer	S1144-50165	1144	2010	0.544	1.15			2/3/2010	2.11
Springer	S1144-52117	1144	2010	0.356	13.83			2/3/2010	38.85
Springer	S1144-52123	1144	2010	0.307	18.08			2/3/2010	58.89
Springer	S1144-52133	1144	2010	0.328	17.67			2/3/2010	53.87
Springer	S1144-52137	1144	2010	0.394	93.33			2/3/2010	236.88
Springer	S1060-14005	1060	2010	8	50.83			2/4/2010	6.35
Springer	S1060-14008	1060	2010	3.122	56.42			2/4/2010	18.07
Springer	S1060-14026	1060	2010	0.816	50.5			2/4/2010	61.89

Springer	S1060-14048	1060	2010	24.344	55.58			2/4/2010	2.28
Springer	S1060-14092	1060	2010	11.781	32.42			2/4/2010	2.75
Springer	S1060-14104	1060	2010	4.031	56.42			2/4/2010	14.00
Springer	S1060-14106	1060	2010	67.188	53.42			2/4/2010	0.80
Springer	S1144-51073	1144	2010	0.706	4.28			2/5/2010	6.06
Springer	S1144-54145	1144	2010	0.249	14.25			2/8/2010	57.23
Springer	S1144-54160	1144	2010	1.131	4.61			2/8/2010	4.08
Springer	S1156-41119	1156	2010	0.562	1.71			2/8/2010	3.04
Springer	S1156-41201	1156	2010	0.231	4.26			2/8/2010	18.44
Springer	S1156-41207	1156	2010	0.112	0.21			2/8/2010	1.88
Springer	S1156-41244	1156	2010	0.275	1			2/8/2010	3.64
Springer	S1156-41503	1156	2010	0.453	7.93			2/8/2010	17.51
Springer	S1156-41523	1156	2010	0.114	6.09			2/8/2010	53.42
Springer	S1144-56101	1144	2010	1.125	19.33			2/11/2010	17.18
Springer	S1144-56110	1144	2010	0.966	17.33			2/11/2010	17.94
Springer	S1144-56119	1144	2010	0.334	4.27			2/11/2010	12.78
Springer	S1144-56128	1144	2010	0.134	34.75			2/11/2010	259.33
Springer	S1144-56137	1144	2010	0.163	4.99			2/11/2010	30.61
Springer	S1144-56226	1144	2010	0.328	5.83			2/11/2010	17.77
Springer	S1144-56301	1144	2010	0.666	24.08			2/11/2010	36.16
Springer	S1144-56309	1144	2010	0.625	10.08			2/11/2010	16.13
Springer	S1144-56315	1144	2010	1.187	9.58			2/11/2010	8.07
Springer	S1144-56321	1144	2010	0.403	23.17			2/11/2010	57.49
Springer	S1144-53111	1144	2010	0.559	8.28			2/13/2010	14.81
Springer	S1144-53131	1144	2010	0.375	8.16			2/13/2010	21.76
Springer	S1144-53138	1144	2010	0.647	7.65			2/13/2010	11.82
Springer	S1144-53143	1144	2010	0.425	12.17			2/13/2010	28.64
Springer	S1144-53170	1144	2010	0.258	15.25			2/13/2010	59.11
Springer	S1144-53301	1144	2010	0.494	15.17			2/13/2010	30.71
Springer	S1144-53310	1144	2010	0.416	19.83			2/13/2010	47.67
Springer	S1144-53337	1144	2010	0.466	2.31			2/13/2010	4.96
Springer	S1144-53356	1144	2010	0.791	13.75			2/13/2010	17.38
Springer	S1060-16021	1060	2010	25.156	33.17			2/15/2010	1.32
Springer	S1060-16024	1060	2010	14.969	31.08			2/15/2010	2.08
Springer	S1060-16027	1060	2010	4.594	74.08			2/15/2010	16.13
Springer	S1060-16030	1060	2010	3.25	50.5			2/15/2010	15.54
Springer	S1060-16033	1060	2010	0.516	45.17			2/15/2010	87.54
Springer	S1060-16036	1060	2010	0.997	32.5			2/15/2010	32.60
Springer	S1060-16039	1060	2010	0.788	35.5			2/15/2010	45.05
Springer	S1060-16042	1060	2010	3.813	40.17			2/15/2010	10.54
Springer	S1060-16069	1060	2010	16	25.08			2/15/2010	1.57
Springer	S1060-16078	1060	2010	19.344	36.5			2/15/2010	1.89
Springer	S1060-16084	1060	2010	11.781	59.08			2/15/2010	5.01
Springer	S1060-16086	1060	2010	2.591	50.08			2/15/2010	19.33
Springer	S1060-16088	1060	2010	1.428	76.75			2/15/2010	53.75
Springer	S1060-16090	1060	2010	1.222	34.67			2/15/2010	28.37
Springer	S1060-16092	1060	2010	2.247	34.58			2/15/2010	15.39
Springer	S1060-16094	1060	2010	0.631	59.5			2/15/2010	94.29
Springer	S1132-42009	1132	2010	1.778	12.83			2/22/2010	7.22
Springer	S1132-42019	1132	2010	1.688	87.5			2/22/2010	51.84
Springer	S1132-42035	1132	2010	1.056	20.08			2/22/2010	19.02
Springer	S1132-42049	1132	2010	0.562	3.11			2/22/2010	5.53
Springer	S1132-42053	1132	2010	0.237	1.47			2/22/2010	6.20
Springer	S1132-42063	1132	2010	1.231	15.67			2/22/2010	12.73
Springer	S1132-42088	1132	2010	1.881	41.92			2/22/2010	22.29
Springer	S1132-42091	1132	2010	1.812	1.23			2/22/2010	0.68
Springer	S1132-42101	1132	2010	0.878	32.92			2/22/2010	37.49
Springer	S1132-42111	1132	2010	0.981	2.69			2/22/2010	2.74
Springer	S1144-57000	1144	2010	0.192	8.28			2/22/2010	43.13
Springer	S1144-57008	1144	2010	0.322	10.75			2/22/2010	33.39
Springer	S1144-57017	1144	2010	0.331	7.71			2/22/2010	23.29
Springer	S1144-57026	1144	2010	0.669	6.83			2/22/2010	10.21
Springer	S1144-57035	1144	2010	0.497	12			2/22/2010	24.14
Springer	S1144-57044	1144	2010	0.734	24.83			2/22/2010	33.83
Springer	S1144-57053	1144	2010	0.298	64.83			2/22/2010	217.55
Springer	S1144-57200	1144	2010	1.091	7.87			2/22/2010	7.21
Springer	S1144-57205	1144	2010	0.522	14.92			2/22/2010	28.58
Springer	S1144-57211	1144	2010	0.316	10			2/22/2010	31.65
Springer	S1144-57217	1144	2010	0.556	23.58			2/22/2010	42.41
Springer	S1144-57223	1144	2010	0.397	17			2/22/2010	42.82
Springer	S1144-57229	1144	2010	0.659	71.5			2/22/2010	108.50
Springer	S1144-58003	1144	2010	0.631	2.54			2/22/2010	4.03
Springer	S1144-58012	1144	2010	1.037	32.33			2/22/2010	31.18
Springer	S1144-58021	1144	2010	0.822	26.5			2/22/2010	32.24
Springer	S1144-58030	1144	2010	0.406	15.75			2/22/2010	38.79
Springer	S1144-58039	1144	2010	0.4	11.42			2/22/2010	28.55
Springer	S1144-58049	1144	2010	0.791	64.58			2/22/2010	81.64
Springer	S1144-58202	1144	2010	0.381	2.92			2/22/2010	7.66
Springer	S1144-58210	1144	2010	1.016	22.67			2/22/2010	22.31
Springer	S1144-58216	1144	2010	0.366	4.92			2/22/2010	13.44
Springer	S1144-58222	1144	2010	0.541	9.17			2/22/2010	16.95
Springer	S1144-58228	1144	2010	0.4	7.68			2/22/2010	19.20
Springer	S1060-15007	1060	2010	1.753	15.17			2/24/2010	8.65
Springer	S1060-15050	1060	2010	3.187	14.83			2/24/2010	4.65
Springer	S1060-15080	1060	2010	1.387	101.67			2/24/2010	73.30
Springer	S1060-15118	1060	2010	8.375	25.83			2/24/2010	3.08
Springer	S1060-15128	1060	2010	10.688	28.58			2/24/2010	2.67
Springer	S1060-15135	1060	2010	3.531	49.67			2/24/2010	14.07
Springer	S1060-15146	1060	2010	5.719	105			2/24/2010	18.36
Springer	S1060-15153	1060	2010	4.656	39.42			2/24/2010	8.47
Springer	S1060-15156	1060	2010	14	26.83			2/24/2010	1.92
Springer	S1060-15159	1060	2010	15.781	25.33			2/24/2010	1.61
Springer	S1060-15175	1060	2010	25.781	41.67			2/24/2010	1.62
Springer	S1060-15178	1060	2010	10.031	20.83			2/24/2010	2.08
Springer	S1060-15181	1060	2010	1.544	83.33			2/24/2010	53.97
Springer	S1060-15184	1060	2010	3.844	18.67			2/24/2010	4.86
Springer	S1132-43119	1132	2010	0.675	0.42			2/24/2010	0.62
Springer	S1132-43123	1132	2010	0.312	12.5			2/24/2010	40.06
Springer	S1132-43169	1132	2010	0.928	7.89			2/24/2010	8.50
Springer	S1132-43312	1132	2010	1.041	33.58			2/24/2010	32.26
Springer	S1132-43335	1132	2010	0.666	55.5			2/24/2010	83.33
Springer	S1132-43338	1132	2010	0.513	20.17			2/24/2010	39.32
Springer	S1132-43365	1132	2010	0.394	33.42			2/24/2010	84.82
Springer	S1132-43368	1132	2010	1.509	24.33			2/24/2010	16.12
Springer	S1132-43371	1132	2010	0.806	34.58			2/24/2010	42.90
Springer	S1132-43374	1132	2010	1.175	28.58			2/24/2010	24.32
Springer	S1144-58056	1144	2010	0.25	4.85			2/26/2010	19.40
Springer	S1144-58065	1144	2010	0.195	27.42			2/26/2010	140.62
Springer	S1048-3510	1048	2010	1.853	14.67			2/27/2010	7.92
Springer	S1048-3519	1048	2010	1.256	10.75			2/27/2010	8.56
Springer	S1048-3545	1048	2010	6	16.5			2/27/2010	2.75
Springer	S1048-3569	1048	2010	2.384	20.33			2/27/2010	8.53
Springer	S1048-3578	1048	2010	5.125	23.75			2/27/2010	4.63
Springer	S1048-3585	1048	2010	1.478	12.67			2/27/2010	8.57
Springer	S1048-3588	1048	2010	21.063	10.25			2/27/2010	0.49
Springer	S1048-3597	1048	2010	6.031	21.33			2/27/2010	3.54
Springer	S1048-3600	1048	2010	9.031	36.92			2/27/2010	4.09
Springer	S1132-43189	1132	2010	0.484	44			3/7/2010	90.91
Springer	S1132-43197	1132	2010	0.238	4.62			3/7/2010	19.41
Springer	S1132-43375	1132	2010	1.441	26.42			3/7/2010	18.33
Springer	S1132-44017	1132	2010	0.759	28.17			3/7/2010	37.11
Springer	S1132-44019	1132	2010	0.731	12.5			3/7/2010	17.10
Springer	S1132-44022	1132	2010	0.922	23.25			3/7/2010	25.22
Springer	S1132-44025	1132	2010	1.275	36.5			3/7/2010	28.63
Springer	S1132-44028	1132	2010	0.775	29.75			3/7/2010	38.39
Springer	S1132-44033	1132	2010	0.597	2.26			3/7/2010	3.79
Springer	S1132-44043	1132	2010	0.784	17.25			3/7/2010	22.00
Springer	S1132-44083	1132	2010	0.7	14.92			3/7/2010	21.31
Springer	S1132-44086	1132	2010	1.278	28.92			3/7/2010	22.63
Springer	S1132-44089	1132	2010	0.603	8.19			3/7/2010	13.58
Springer	S1132-44092	1132	2010	0.497	22.08			3/7/2010	44.43
Springer	S1132-44095	1132	2010	0.641	21.83			3/7/2010	34.06
Springer	S1132-44098	1132	2010	1.444	31.5			3/7/2010	21.81
Springer	S1132-44141	1132	2010	0.606	4.86			3/7/2010	8.02
Springer	S1132-44144	1132	2010	25.781	13.5			3/7/2010	0.52
Springer	S1132-44147	1132	2010	0.716	15.75			3/7/2010	22.00
Springer	S1132-44150	1132	2010	0.675	17.08			3/7/2010	25.30
Springer	S1132-44153	1132	2010	0.981	30			3/7/2010	30.58
Springer	S1132-44163	1132	2010	0.641	13.83			3/7/2010	21.58
Springer	S1132-44202	1132	2010	0.731	6.98			3/7/2010	9.55
Springer	S1132-44205	1132	2010	8.594	23.67			3/7/2010	2.75
Springer	S1132-44208	1132	2010	0.703	16.25			3/7/2010	23.12
Springer	S1132-44211	1132	2010	0.794	2.69			3/7/2010	3.39
Springer	S1132-44214	1132	2010	0.778	75.83			3/7/2010	97.47
Springer	S1060-17104	1060	2010	1.391	55			3/9/2010	39.54
Springer	S1060-17113	1060	2010	0.759	27.58			3/9/2010	36.34
Springer	S1060-17122	1060	2010	0.784	33.42			3/9/2010	42.63
Springer	S1060-17134	1060	2010	1.009	10.25			3/9/2010	10.16
Springer	S1060-17143	1060	2010	4.125	39.67			3/9/2010	9.62
Springer	S1060-17152	1060	2010	15.125	29.67			3/9/2010	1.96
Springer	S1060-17182	1060	2010	0.797	50.67			3/9/2010	63.58
Springer	S1060-17188	1060	2010	2.541	30.42			3/9/2010	11.97
Springer	S1060-17194	1060	2010	1.294	26.33			3/9/2010	20.35
Springer	S1060-17200	1060	2010	0.669	28.17			3/9/2010	42.11
Springer	S1060-17206	1060	2010	19.5	40.33			3/9/2010	2.07
Springer	S1048-4057	1048	2010	2.58	18.33			3/11/2010	7.10
Springer	S1048-4500	1048	2010	2.55	21.17			3/11/2010	8.30
Springer	S1048-4512	1048	2010	2.37	29.25			3/11/2010	12.34
Springer	S1048-4529	1048	2010	5.09	18.42			3/11/2010	3.62
Springer	S1048-4532	1048	2010	7.75	15.67			3/11/2010	2.02
Springer	S1048-4541	1048	2010	1.67	8.15			3/11/2010	4.88
Springer	S1144-59105	1144	2010	0.487	1.4			3/13/2010	2.87
Springer	S1144-59108	1144	2010	0.719	0.93			3/13/2010	1.29
Springer	S1144-59111	1144	2010	0.675	1.3			3/13/2010	1.93
Springer	S1144-59122	1144	2010	0.394	70.25			3/13/2010	178.30
Springer	S1144-59124	1144	2010	1.603	67.08			3/13/2010	41.85
Springer	S1144-59173	1144	2010	0.219	2.07			3/13/2010	9.45
Springer	S1144-59179	1144	2010	1.019	10.42			3/13/2010	10.23
Springer	S1144-59182	1144	2010	1.05	131.67			3/13/2010	125.40
Springer	S1144-59199	1144	2010	0.928	2.78			3/13/2010	3.00
Springer	S1144-59223	1144	2010	0.606	7.98			3/13/2010	13.17
Springer	S1144-59261	1144	2010	0.691	44.42			3/13/2010	64.28
Springer	S1144-59301	1144	2010	1.672	93.33			3/13/2010	55.82
Springer	S1144-59350	1144	2010	0.6	13.92			3/13/2010	23.20
Springer	S1144-60007	1144	2010	0.672	22.5			3/19/2010	33.48
Springer	S1144-60009	1144	2010	0.619	20.67			3/19/2010	33.39
Springer	S1144-60033	1144	2010	0.478	1.89			3/19/2010	3.95
Springer	S1144-60062	1144	2010	0.378	7.91			3/19/2010	20.93
Springer	S1144-60066	1144	2010	0.444	5.05			3/19/2010	11.37
Springer	S1144-60070	1144	2010	0.594	1.31			3/19/2010	2.21

Springer	S1144-60088	1144	2010	0.634	24.33			3/19/2010	38.38
Springer	S1144-60119	1144	2010	0.438	25.92			3/19/2010	59.18
Springer	S1144-60128	1144	2010	0.784	139.17			3/19/2010	177.51
Springer	S1144-60134	1144	2010	0.325	8.83			3/19/2010	27.17
Springer	S1144-60170	1144	2010	0.222	4.67			3/19/2010	21.04
Springer	S1144-60185	1144	2010	0.391	5.2			3/19/2010	13.30
Springer	S1144-60194	1144	2010	0.481	1.85			3/19/2010	3.85
Springer	S1132-45158	1132	2010	2.641	4.72			3/22/2010	1.79
Springer	S1132-45161	1132	2010	2.263	18.5			3/22/2010	8.17
Springer	S1132-45603	1132	2010	1.494	12.17			3/22/2010	8.15
Springer	S1132-45659	1132	2010	1.753	34.92			3/22/2010	19.92
Springer	S1132-45673	1132	2010	1.134	15.92			3/22/2010	14.04
Springer	S1132-45676	1132	2010	0.257	4.32			3/22/2010	16.81
Springer	S1132-45728	1132	2010	0.193	3.58			3/22/2010	18.55
Springer	S1132-45731	1132	2010	0.158	8.75			3/22/2010	55.38
Springer	S1132-45761	1132	2010	0.319	1.8			3/22/2010	5.64
Springer	S1132-45767	1132	2010	0.117	12.33			3/22/2010	105.38
Springer	S1132-45787	1132	2010	0.284	7.52			3/22/2010	26.48
Springer	S1060-18010	1060	2010	5.719	33.67			3/24/2010	5.89
Springer	S1060-18019	1060	2010	31.25	37.83			3/24/2010	1.21
Springer	S1060-18028	1060	2010	20.25	26.42			3/24/2010	1.30
Springer	S1060-18037	1060	2010	32.5	17.17			3/24/2010	0.53
Springer	S1060-18046	1060	2010	2.3	12.42			3/24/2010	5.40
Springer	S1060-18093	1060	2010	3.047	35.67			3/24/2010	11.71
Springer	S1060-18099	1060	2010	21.531	53.67			3/24/2010	2.49
Springer	S1060-18105	1060	2010	6.156	14.67			3/24/2010	2.38
Springer	S1060-18111	1060	2010	9.531	30.58			3/24/2010	3.21
Springer	S1132-46016	1132	2010	0.803	21			3/28/2010	26.15
Springer	S1132-46023	1132	2010	0.566	6.43			3/28/2010	11.36
Springer	S1132-46026	1132	2010	1.056	16.42			3/28/2010	15.55
Springer	S1132-46029	1132	2010	0.794	7.57			3/28/2010	9.53
Springer	S1132-46032	1132	2010	0.516	15.67			3/28/2010	30.37
Springer	S1132-46063	1132	2010	0.569	29.92			3/28/2010	52.58
Springer	S1132-46066	1132	2010	0.962	16.33			3/28/2010	16.98
Springer	S1132-46081	1132	2010	0.809	33.75			3/28/2010	41.72
Springer	S1132-47067	1132	2010	0.628	14.42			3/29/2010	22.96
Springer	S1132-47073	1132	2010	0.641	2.93			3/29/2010	4.57
Springer	S1132-47079	1132	2010	1.194	17.25			3/29/2010	14.45
Springer	S1132-47085	1132	2010	0.666	55.33			3/29/2010	83.08
Springer	S1132-47091	1132	2010	0.622	27.33			3/29/2010	43.94
Springer	S1132-47097	1132	2010	0.928	23.42			3/29/2010	25.24
Springer	S1132-47103	1132	2010	0.316	5.16			3/29/2010	16.33
Springer	S1132-50102	1132	2010	0.894	6.58			4/1/2010	7.36
Springer	S1132-50105	1132	2010	1.016	26.92			4/1/2010	26.50
Springer	S1132-50108	1132	2010	1.209	17.33			4/1/2010	14.33
Springer	S1132-50111	1132	2010	2.184	4.9			4/1/2010	2.24
Springer	S1132-50114	1132	2010	1.244	1.73			4/1/2010	1.39
Springer	S1132-50117	1132	2010	0.669	3.95			4/1/2010	5.90
Springer	S1132-50120	1132	2010	0.394	9			4/1/2010	22.84
Springer	S1132-50123	1132	2010	0.853	4.36			4/1/2010	5.11
Springer	S1132-50126	1132	2010	0.544	6.06			4/1/2010	11.14
Springer	S1132-50129	1132	2010	0.534	4.9			4/1/2010	9.18
Springer	S1132-50132	1132	2010	0.706	13.33			4/1/2010	18.88
Springer	S1132-50301	1132	2010	0.719	32.83			4/1/2010	45.66
Springer	S1132-50304	1132	2010	0.469	0.89			4/1/2010	1.90
Springer	S1132-50310	1132	2010	0.322	5.51			4/1/2010	17.11
Springer	S1132-50314	1132	2010	1.156	14.67			4/1/2010	12.69
Springer	S1132-49001	1132	2010	0.878	14.67			4/2/2010	16.71
Springer	S1132-49007	1132	2010	0.8	5.68			4/2/2010	7.10
Springer	S1132-49013	1132	2010	0.274	2.36			4/2/2010	8.61
Springer	S1132-49026	1132	2010	0.406	3.11			4/2/2010	7.66
Springer	S1132-49027	1132	2010	0.841	3.93			4/2/2010	4.67
Springer	S1132-49039	1132	2010	0.494	13.92			4/2/2010	28.18
Springer	S1132-49044	1132	2010	0.295	5.54			4/2/2010	18.78
Springer	S1132-49058	1132	2010	0.631	3.3			4/2/2010	5.23
Springer	S1132-49065	1132	2010	0.19	2.93			4/2/2010	15.42
Springer	S1132-49071	1132	2010	0.628	2.8			4/2/2010	4.46
Springer	S1132-49087	1132	2010	1.5	19.17			4/2/2010	12.78
Springer	S1132-49119	1132	2010	1.338	28.67			4/2/2010	21.43
Springer	S1132-49122	1132	2010	0.55	7.81			4/2/2010	14.20
Springer	S1132-49128	1132	2010	0.238	4.7			4/2/2010	19.75
Springer	S1132-49138	1132	2010	0.269	3.74			4/2/2010	13.90
Springer	S1132-51104	1132	2010	0.775	4.12			4/4/2010	5.32
Springer	S1132-51108	1132	2010	0.359	42			4/4/2010	116.99
Springer	S1132-51111	1132	2010	0.816	46.83			4/4/2010	57.39
Springer	S1132-51125	1132	2010	1.563	21.08			4/4/2010	13.49
Springer	S1132-51127	1132	2010	2.934	92.5			4/4/2010	31.53
Springer	S1132-51132	1132	2010	1.766	90			4/4/2010	50.96
Springer	S1132-51142	1132	2010	0.791	76.58			4/4/2010	96.81
Springer	S1132-51150	1132	2010	0.444	62.58			4/4/2010	140.95
Springer	S1048-5520	1048	2010	7.594	22.5			4/9/2010	2.96
Springer	S1048-5525	1048	2010	3.781	21			4/9/2010	5.55
Springer	S1048-5528	1048	2010	5.219	22.83			4/9/2010	4.37
Springer	S1048-5534	1048	2010	6.031	22.75			4/9/2010	3.77
Springer	S1048-5538	1048	2010	4.656	14			4/9/2010	3.01
Springer	S1048-5546	1048	2010	2.919	24.17			4/9/2010	8.28
Springer	S1048-5564	1048	2010	2.744	19.25			4/9/2010	7.02
Springer	S1048-5574	1048	2010	8.469	33.25			4/9/2010	3.93
Springer	S1132-52078	1132	2010	0.984	25.42			4/12/2010	25.83
Springer	S1132-52081	1132	2010	0.716	36			4/12/2010	50.28
Springer	S1132-52091	1132	2010	1.028	9.92			4/12/2010	9.65
Springer	S1132-52096	1132	2010	2.087	144.17			4/12/2010	69.08
Springer	S1132-52113	1132	2010	1.081	2.28			4/12/2010	2.11
Springer	S1132-52116	1132	2010	1.1	1.13			4/12/2010	1.03
Springer	S1132-52119	1132	2010	0.806	59.92			4/12/2010	74.34
Springer	S1132-52509	1132	2010	0.422	14.83			4/12/2010	35.14
Springer	S1132-52517	1132	2010	1.053	1.54			4/12/2010	1.46
Springer	S1132-52520	1132	2010	0.453	40.5			4/12/2010	89.40
Springer	S1132-52541	1132	2010	1.119	12.58			4/12/2010	11.24
Springer	S1132-52544	1132	2010	1.684	15.08			4/12/2010	8.95
Springer	S1132-52564	1132	2010	1.069	36.92			4/12/2010	34.54
Springer	S1132-52567	1132	2010	0.734	23.92			4/12/2010	32.59
Springer	S1132-53748	1132	2010	0.578	68.92			4/20/2010	119.24
Springer	S1132-53754	1132	2010	1.213	81.58			4/20/2010	67.25
Springer	S1132-53760	1132	2010	0.684	11.5			4/20/2010	16.81
Springer	S1132-53767	1132	2010	0.788	20.83			4/20/2010	26.43
Springer	S1132-53773	1132	2010	1.338	31.17			4/20/2010	23.30
Springer	S1132-48601	1132	2010	3.219	8.92			4/24/2010	2.77
Springer	S1132-48608	1132	2010	4.281	16.08			4/24/2010	3.76
Springer	S1132-48637	1132	2010	0.249	0.75			4/24/2010	3.01
Springer	S1132-48647	1132	2010	0.269	0.67			4/24/2010	2.49
Springer	S1132-48673	1132	2010	1.516	7.86			4/24/2010	5.18
Springer	S1132-48690	1132	2010	3.875	13.33			4/24/2010	3.44
Springer	S1132-48700	1132	2010	3.406	9.33			4/24/2010	2.74
Springer	S1132-48702	1132	2010	0.503	10			4/24/2010	19.88
Springer	S1132-48720	1132	2010	2.925	20.5			4/24/2010	7.01
Springer	S1132-48816	1132	2010	0.135	27.67			4/24/2010	204.96
Springer	S1132-48831	1132	2010	0.093	1.79			4/24/2010	19.25
Springer	S1132-48832	1132	2010	0.223	0.7			4/24/2010	3.14
Springer	S1048-8011	1048	2010	9.281	22.58			4/28/2010	2.43
Springer	S1048-8047	1048	2010	9.75	35.25			4/28/2010	3.62
Springer	S1048-8095	1048	2010	10.781	18.75			4/28/2010	1.74
Springer	S1048-8099	1048	2010	5.094	49.17			4/28/2010	9.65
Springer	S1048-8107	1048	2010	16.094	32.25			4/28/2010	2.00
Springer	S1048-8115	1048	2010	13.312	16.83			4/28/2010	1.26
Springer	S1132-54421	1132	2010	0.311	10.33			5/6/2010	33.22
Springer	S1132-54427	1132	2010	0.223	11.25			5/6/2010	50.45
Springer	S1132-54445	1132	2010	0.297	9.75			5/6/2010	32.83
Springer	S1120-51026	1120	2010	0.759	12.17			5/7/2010	16.03
Springer	S1120-51029	1120	2010	0.687	6.81			5/7/2010	9.91
Springer	S1120-51060	1120	2010	1.328	8.92			5/7/2010	6.72
Springer	S1120-51079	1120	2010	0.447	34.5			5/7/2010	77.18
Springer	S1120-51106	1120	2010	0.541	17.92			5/7/2010	33.12
Springer	S1120-51110	1120	2010	0.391	16.92			5/7/2010	43.27
Springer	S1120-51133	1120	2010	0.525	24.5			5/7/2010	46.67
Springer	S1120-51140	1120	2010	0.516	14.83			5/7/2010	28.74
Springer	S1120-51145	1120	2010	0.678	17.25			5/7/2010	25.44
Springer	S1120-51200	1120	2010	0.277	21.67			5/7/2010	78.23
Springer	S1120-51203	1120	2010	1.347	16.83			5/7/2010	12.49
Springer	S1120-51224	1120	2010	1.159	32.67			5/7/2010	28.19
Springer	S1120-51228	1120	2010	1.194	23.42			5/7/2010	19.61
Springer	S1120-51232	1120	2010	0.375	9.42			5/7/2010	25.12
Springer	S1048-9011	1048	2010	30.906	41.5			5/10/2010	1.34
Springer	S1048-9043	1048	2010	1.262	36			5/10/2010	28.53
Springer	S1048-9108	1048	2010	0.132	7.88			5/10/2010	59.70
Springer	S1048-9116	1048	2010	0.114	32			5/10/2010	280.70
Springer	S1132-54351	1132	2010	0.362	11.92			5/10/2010	32.93
Springer	S1132-54372	1132	2010	0.003	30.92			5/10/2010	10306.67
Springer	S1132-54461	1132	2010	0.003	13.67			5/10/2010	4556.67
Springer	S1132-54473	1132	2010	0.125	18.75			5/10/2010	150.00
Springer	S1132-54483	1132	2010	0.003	8.22			5/10/2010	2740.00
Springer	S1132-55271	1132	2010	0.003	3.62			5/10/2010	1206.67
Springer	S1048-10034	1048	2010	9	22.42			5/18/2010	2.49
Springer	S1048-10095	1048	2010	9.156	15.08			5/18/2010	1.65
Springer	S1048-10138	1048	2010	6.313	13.92			5/18/2010	2.20
Springer	S1048-10142	1048	2010	5.75	19.83			5/18/2010	3.45
Springer	S1120-52120	1120	2010	0.806	18.33			5/19/2010	22.74
Springer	S1120-52124	1120	2010	1.006	11.58			5/19/2010	11.51
Springer	S1120-52160	1120	2010	0.647	18.83			5/19/2010	29.10
Springer	S1120-52178	1120	2010	0.625	9.42			5/19/2010	15.07
Springer	S1120-52218	1120	2010	0.062	4.32			5/19/2010	69.68
Springer	S1120-52222	1120	2010	0.459	6.31			5/19/2010	13.75
Springer	S1120-52225	1120	2010	0.694	5.57			5/19/2010	8.03
Springer	S1132-57104	1132	2010	1.103	2.38			5/20/2010	2.16
Springer	S1132-57307	1132	2010	0.288	2.2			5/20/2010	7.64
Springer	S1132-57315	1132	2010	3.344	38.25			5/20/2010	11.44
Springer	S1048-11100	1048	2010	5.375	35			5/21/2010	6.51
Springer	S1048-11104	1048	2010	27.406	54.25			5/21/2010	1.98
Springer	S1048-11108	1048	2010	10.844	18.75			5/21/2010	1.73
Springer	S1048-11220	1048	2010	6.406	28.5			5/21/2010	4.45
Springer	S1048-11224	1048	2010	25.313	40.83			5/21/2010	1.61
Springer	S1120-55017	1120	2010	0.675	36.17			5/23/2010	53.59
Springer	S1120-55023	1120	2010	0.029	52.08			5/23/2010	1795.86
Springer	S1120-55029	1120	2010	1.019	23.75			5/23/2010	23.31
Springer	S1120-55042	1120	2010	0.129	33.25			5/23/2010	257.75
Springer	S1120-55096	1120	2010	0.074	40.25			5/23/2010	543.92
Springer	S1120-55102	1120	2010	1.409	0.7			5/23/2010	0.50
Springer	S1120-55109	1120	2010	0.497	36.33			5/23/2010	73.10
Springer	S1120-55116	1120	2010	0.097	45.17			5/23/2010	465.67
Springer	S1048-10064	1048	2010	1.659	21			5/24/2010	12.66

Springer	S1048-10154	1048	2010	2.647	32.33			5/24/2010	12.21
Springer	S1048-12024	1048	2010	16	45			5/24/2010	2.81
Springer	S1048-12055	1048	2010	10.125	18.08			5/24/2010	1.79
Springer	S1048-12059	1048	2010	49.375	40.08			5/24/2010	0.81
Springer	S1048-13001	1048	2010	10.531	29.25			5/24/2010	2.78
Springer	S1048-13019	1048	2010	1.603	47.58			5/24/2010	29.68
Springer	S1048-13034	1048	2010	1.197	48.75			5/24/2010	40.73
Springer	S1048-13069	1048	2010	1.753	114.17			5/24/2010	65.13
Springer	S1048-13077	1048	2010	0.544	50.67			5/24/2010	93.14
Springer	S1048-13085	1048	2010	79.687	30.25			5/24/2010	0.38
Springer	S1120-55071	1120	2010	0.037	11.75			5/28/2010	317.57
Springer	S1120-55077	1120	2010	0.037	61.08			5/28/2010	1650.81
Springer	S1120-56034	1120	2010	0.037	7.71			5/28/2010	208.38
Springer	S1120-56052	1120	2010	0.074	32			5/28/2010	432.43
Springer	S1120-56080	1120	2010	0.037	10.08			5/28/2010	272.43
Springer	S1120-56099	1120	2010	1.659	12.33			5/28/2010	7.43
Springer	S1120-56120	1120	2010	1.009	14.08			5/28/2010	13.95
Springer	S1120-56125	1120	2010	1.763	22.25			5/28/2010	12.62
Springer	S1120-57112	1120	2010	0.4719768	13.4134912			5/30/2010	28.42
Springer	S1120-57176	1120	2010	1.3530002	3.08260357			5/30/2010	2.28
Springer	S1120-57184	1120	2010	0.0314651	1.83289942			5/30/2010	58.25
Springer	S1120-57193	1120	2010	0.0314651	7.41491129			5/30/2010	235.65
Springer	S1120-58153	1120	2010	2.359884	27.1602369			5/30/2010	11.51
Springer	S1120-58161	1120	2010	0.0314651	46.4056808			5/30/2010	1474.83
Springer	S1120-58170	1120	2010	0.0314651	16.8293492			5/30/2010	534.86
Springer	S1120-58057	1120	2010	0.097	11.33			6/3/2010	116.80
Springer	S1120-58075	1120	2010	0.003	8.02			6/3/2010	2673.33
Springer	S1120-58175	1120	2010	0.21	23.17			6/3/2010	110.33
Springer	S1120-58185	1120	2010	0.003	5.43			6/3/2010	1810.00
Springer	S1120-60051	1120	2010	0.003	18.83			6/7/2010	6276.67
Springer	S1120-60067	1120	2010	0.881	23.25			6/7/2010	26.39
Springer	S1120-60071	1120	2010	0.003	33.58			6/7/2010	11193.33
Springer	S1120-60098	1120	2010	0.831	23.33			6/7/2010	28.07
Springer	S1120-60112	1120	2010	1.769	26.67			6/7/2010	15.08
Springer	S1120-60120	1120	2010	1.094	16.5			6/7/2010	15.08
Springer	S1120-60137	1120	2010	2.209	28.58			6/7/2010	12.94
Springer	S1120-60154	1120	2010	6.688	31.67			6/7/2010	4.74
Springer	S1120-60165	1120	2010	3.656	25.08			6/7/2010	6.86
Springer	S1120-60182	1120	2010	10.719	42.92			6/7/2010	4.00
Springer	S1120-61408	1120	2010	12.25	46.5			6/14/2010	3.80
Springer	S1120-61435	1120	2010	3.75	34.33			6/14/2010	9.15
Springer	S1120-61482	1120	2010	0.192	48.17			6/14/2010	250.89
Springer	S1120-61492	1120	2010	0.347	76.17			6/14/2010	219.51
Springer	S1120-61502	1120	2010	0.003	16.5			6/14/2010	5500.00
Springer	S1036-2014	1036	2010	18.125	16.83			6/15/2010	0.93
Springer	S1036-2015	1036	2010	7.312	11.75			6/15/2010	1.61
Springer	S1036-2018	1036	2010	0.666	17.25			6/15/2010	25.90
Springer	S1036-2051	1036	2010	5.031	14.33			6/15/2010	2.85
Springer	S1036-3088	1036	2010	28.937	11.92			6/18/2010	0.41
Springer	S1036-3093	1036	2010	16.719	23.33			6/18/2010	1.40
Springer	S1036-3096	1036	2010	8.375	20.58			6/18/2010	2.46
Springer	S1048-15050	1048	2010	26.187	43.67			6/18/2010	1.67
Springer	S1048-15054	1048	2010	64.687	37.58			6/18/2010	0.58
Springer	S1048-15058	1048	2010	35.625	30.92			6/18/2010	0.87
Springer	S1048-15062	1048	2010	18.844	43.33			6/18/2010	2.30
Springer	S1048-15066	1048	2010	9.219	33.58			6/18/2010	3.64
Springer	S1048-15070	1048	2010	28.188	55.67			6/18/2010	1.97
Springer	S1048-15074	1048	2010	77.188	45.42			6/18/2010	0.59
Springer	S1048-16009	1048	2010	13.469	16.67			6/21/2010	1.24
Springer	S1048-16018	1048	2010	5.094	9.58			6/21/2010	1.88
Springer	S1048-16027	1048	2010	2.522	19.92			6/21/2010	7.90
Springer	S1048-16062	1048	2010	1.097	20.67			6/21/2010	18.84
Springer	S1048-16066	1048	2010	13.594	11.83			6/21/2010	0.87
Springer	S1048-16076	1048	2010	12.438	27.25			6/21/2010	2.19
Springer	S1048-16078	1048	2010	31.25	36.92			6/21/2010	1.18
Springer	S1036-3075	1036	2010	3.813	22.17			6/23/2010	5.81
Springer	S1036-3111	1036	2010	3.469	19.17			6/23/2010	5.53
Springer	S1036-4011	1036	2010	6.594	17.58			6/23/2010	2.67
Springer	S1120-62444	1120	2010	1.05	24.42			6/24/2010	23.26
Springer	S1120-62466	1120	2010	0.944	87.5			6/24/2010	92.69
Springer	S1120-62483	1120	2010	0.631	6.44			6/24/2010	10.21
Springer	S1120-62507	1120	2010	1.003	2.76			6/24/2010	2.75
Springer	S1120-62508	1120	2010	1.309	2.3			6/24/2010	1.76
Springer	S1120-62526	1120	2010	2.347	161.67			6/24/2010	68.88
Springer	S1120-62540	1120	2010	1.084	3.7			6/24/2010	3.41
Springer	S1120-62581	1120	2010	1.266	27.17			6/24/2010	21.46
Springer	S1120-62601	1120	2010	0.691	8.11			6/24/2010	11.74
Springer	S1120-62626	1120	2010	2.128	79.5			6/24/2010	37.36
Springer	S1120-64001	1120	2010	1.025	4.95			6/29/2010	4.83
Springer	S1120-64008	1120	2010	0.609	33.42			6/29/2010	54.88
Springer	S1120-64012	1120	2010	1.609	130			6/29/2010	80.80
Springer	S1120-64016	1120	2010	0.036	1.34			6/29/2010	37.22
Springer	S1120-64024	1120	2010	0.003	0.26			6/29/2010	86.67
Springer	S1120-64032	1120	2010	0.012	1.3			6/29/2010	108.33
Springer	S1120-64047	1120	2010	1.353	9.58			6/29/2010	7.08
Springer	S1120-64062	1120	2010	1.216	2.14			6/29/2010	1.76
Springer	S1120-64073	1120	2010	0.747	0.12			6/29/2010	0.16
Springer	S1120-64084	1120	2010	2.713	52.58			6/29/2010	19.38
Springer	S1120-64095	1120	2010	0.769	3.29			6/29/2010	4.28
Springer	S1120-63106	1120	2010	0.906	12.42			7/6/2010	13.71
Springer	S1120-63116	1120	2010	0.944	15.08			7/6/2010	15.97
Springer	S1120-63122	1120	2010	1.144	13			7/6/2010	11.36
Springer	S1120-63130	1120	2010	1.325	8.75			7/6/2010	6.60
Springer	S1120-65107	1120	2010	3.437	10.42			7/15/2010	3.03
Springer	S1120-65113	1120	2010	1.391	6.26			7/15/2010	4.50
Springer	S1120-65121	1120	2010	2.316	18.08			7/15/2010	7.81
Springer	S1120-65130	1120	2010	1.744	9.58			7/15/2010	5.49
Springer	S1120-66007	1120	2010	3.531	19.5			7/19/2010	5.52
Springer	S1120-66029	1120	2010	1.009	11.17			7/19/2010	11.07
Springer	S1120-66031	1120	2010	1.028	3			7/19/2010	2.92
Springer	S1120-66037	1120	2010	2.472	8.58			7/19/2010	3.47
Springer	S1120-66043	1120	2010	2.256	15.67			7/19/2010	6.95
Springer	S1120-66049	1120	2010	4.344	7.99			7/19/2010	1.84
Springer	S1120-66087	1120	2010	1.5	5.55			7/19/2010	3.70
Springer	S1108-48021	1108	2010	1.419	0.01			7/20/2010	0.01
Springer	S1108-48027	1108	2010	2.522	20			7/20/2010	7.93
Springer	S1108-48031	1108	2010	2.447	15.58			7/20/2010	6.37
Springer	S1108-48038	1108	2010	2.469	11.5			7/20/2010	4.66
Springer	S1108-48086	1108	2010	4.344	16.75			7/20/2010	3.86
Springer	S1108-48091	1108	2010	1.694	14.33			7/20/2010	8.46
Springer	S1108-48215	1108	2010	1.959	15.08			7/20/2010	7.70
Springer	S1108-48220	1108	2010	1.422	3.46			7/20/2010	2.43
Springer	S1108-48225	1108	2010	1.784	0.33			7/20/2010	0.18
Springer	S1036-7001	1036	2010	25	26.58			7/22/2010	1.06
Springer	S1036-7004	1036	2010	43.125	38.17			7/22/2010	0.89
Springer	S1036-7016	1036	2010	25.281	23.5			7/22/2010	0.93
Springer	S1036-7022	1036	2010	37.188	81.83			7/22/2010	2.20
Springer	S1036-7031	1036	2010	1.4	59.58			7/22/2010	42.56
Springer	S1036-7037	1036	2010	2.072	43.5			7/22/2010	20.99
Springer	S1036-7071	1036	2010	10.688	20.25			7/22/2010	1.89
Springer	S1036-7086	1036	2010	7.25	51.08			7/22/2010	7.05
Springer	S1108-47000	1108	2010	2.259	23.33			7/22/2010	10.33
Springer	S1108-47009	1108	2010	1.806	30			7/22/2010	16.61
Springer	S1108-47037	1108	2010	0.747	19.33			7/22/2010	25.88
Springer	S1108-47115	1108	2010	1.406	18			7/22/2010	12.80
Springer	S1108-47165	1108	2010	1.291	39			7/22/2010	30.21
Springer	S1036-6000	1036	2010	27.219	58.42			7/25/2010	2.15
Springer	S1036-6001	1036	2010	40	40.42			7/25/2010	1.01
Springer	S1036-6030	1036	2010	18.156	47.67			7/25/2010	2.63
Springer	S1120-69045	1120	2010	1.209	7.51			7/27/2010	6.21
Springer	S1120-69075	1120	2010	0.553	4.02			7/27/2010	7.27
Springer	S1120-69079	1120	2010	0.925	7.47			7/27/2010	8.08
Springer	S1120-69102	1120	2010	0.85	0.94			7/27/2010	1.11
Springer	S1120-69114	1120	2010	1.097	5.06			7/27/2010	4.61
Springer	S1036-8071	1036	2010	3.25	29			7/31/2010	8.92
Springer	S1036-8119	1036	2010	4.312	9.42			8/1/2010	2.18
Springer	S1036-10003	1036	2010	4.688	26.58			8/5/2010	5.67
Springer	S1036-10017	1036	2010	30.562	57			8/5/2010	1.87
Springer	S1036-10023	1036	2010	6.281	36.67			8/5/2010	5.84
Springer	S1036-10065	1036	2010	14.156	44.25			8/5/2010	3.13
Springer	S1036-10078	1036	2010	13.281	43.17			8/5/2010	3.25
Springer	S1036-10033	1036	2010	17.938	46.25			8/9/2010	2.58
Springer	S1036-10045	1036	2010	46.875	44.5			8/9/2010	0.95
Springer	S1036-10092	1036	2010	28.031	38			8/9/2010	1.36
Springer	S1036-10096	1036	2010	24	61.42			8/9/2010	2.56
Springer	S1036-10102	1036	2010	28.75	28.5			8/9/2010	0.99
Springer	S1108-49070	1108	2010	1.928	33.33			8/11/2010	17.29
Springer	S1108-49076	1108	2010	0.947	9.5			8/11/2010	10.03
Springer	S1108-49107	1108	2010	1.631	23.58			8/11/2010	14.46
Springer	S1108-49120	1108	2010	0.616	11.25			8/11/2010	18.26
Springer	S1108-49147	1108	2010	0.319	15.25			8/11/2010	47.81
Springer	S1108-49158	1108	2010	0.841	10.67			8/11/2010	12.69
Springer	S1108-49209	1108	2010	1.231	13.42			8/11/2010	10.90
Springer	S1108-49216	1108	2010	0.694	10.58			8/11/2010	15.24
Springer	S1108-49313	1108	2010	1.072	6.52			8/11/2010	6.08
Springer	S1108-49342	1108	2010	0.719	13.25			8/11/2010	18.43
Springer	S1108-49346	1108	2010	0.362	9.67			8/11/2010	26.71
Springer	S1108-52102	1108	2010	0.021	12.08			8/12/2010	575.24
Springer	S1108-52120	1108	2010	0.153	26.5			8/12/2010	173.20
Springer	S1108-52202	1108	2010	1.016	34.83			8/12/2010	34.28
Springer	S1108-52228	1108	2010	0.233	7.01			8/12/2010	30.09
Springer	S1108-53015	1108	2010	2.619	13.83			8/14/2010	5.28
Springer	S1108-53066	1108	2010	1.003	45.33			8/14/2010	45.19
Springer	S1108-53072	1108	2010	1.247	17.08			8/14/2010	13.70
Springer	S1108-53078	1108	2010	0.869	16.92			8/14/2010	19.47
Springer	S1108-53090	1108	2010	0.5	25.25			8/14/2010	50.50
Springer	S1108-50008	1108	2010	0.422	28.33			8/15/2010	67.13
Springer	S1108-50023	1108	2010	1.728	21.75			8/15/2010	12.59
Springer	S1108-50037	1108	2010	3.594	34.08			8/15/2010	9.48
Springer	S1108-50049	1108	2010	1.075	25.75			8/15/2010	23.95
Springer	S1108-50063	1108	2010	0.538	2.53			8/15/2010	4.70
Springer	S1108-50082	1108	2010	3.019	9.75			8/15/2010	3.23
Springer	S1036-11000	1036	2010	1.056	20.58			8/30/2010	19.49
Springer	S1036-11034	1036	2010	1.797	25.58			8/30/2010	14.23
Springer	S1036-11040	1036	2010	3.375	21.83			8/30/2010	6.47
Springer	S1036-11069	1036	2010	2.803	14.67			8/30/2010	5.23
Springer	S1036-11091	1036	2010	1.766	26.33			8/30/2010	14.91
Springer	S1036-11099	1036	2010	2.1	24.67			8/30/2010	11.75
Springer	S1036-11103	1036	2010	1.706	26.83			8/30/2010	15.73
Springer	S1036-11110	1036	2010	1.744	14.5			8/30/2010	8.31

Springer	S1108-54089	1108	2010	1.006	24.08			8/31/2010	23.94
Springer	S1108-54120	1108	2010	2.059	12.58			8/31/2010	6.11
Springer	S1108-54145	1108	2010	2.038	9.5			8/31/2010	4.66
Springer	S1108-54192	1108	2010	2.091	18.83			8/31/2010	9.01
Springer	S1108-54244	1108	2010	5.125	13.75			8/31/2010	2.68
Springer	S1108-51237	1108	2010	1.591	11.75			9/6/2010	7.39
Springer	S1108-51254	1108	2010	0.331	14.67			9/6/2010	44.32
Springer	S1108-51263	1108	2010	1.334	35.83			9/6/2010	26.86
Springer	S1108-51289	1108	2010	3.5	28.08			9/6/2010	8.02
Springer	S1108-51297	1108	2010	0.341	45.83			9/6/2010	134.40
Springer	S1108-51325	1108	2010	0.822	61.33			9/6/2010	74.61
Springer	S1108-57029	1108	2010	3.056	12			9/11/2010	3.93
Springer	S1108-57035	1108	2010	0.834	10.33			9/11/2010	12.39
Springer	S1108-57043	1108	2010	1.703	10.08			9/11/2010	5.92
Springer	S1108-57062	1108	2010	3.219	19.58			9/11/2010	6.08
Springer	S1036-14055	1036	2010	3.312	26.5			9/13/2010	8.00
Springer	S1036-14110	1036	2010	1.722	19			9/13/2010	11.03
Springer	S1108-55026	1108	2010	2.787	67.92			9/13/2010	24.37
Springer	S1108-55153	1108	2010	1.866	21.83			9/13/2010	11.70
Springer	S1108-55196	1108	2010	5.844	30.42			9/13/2010	5.21
Springer	S1108-55200	1108	2010	9.375	34.08			9/13/2010	3.64
Springer	S1108-55236	1108	2010	4.594	18.25			9/13/2010	3.97
Springer	S1108-55242	1108	2010	3.075	30.25			9/13/2010	9.84
Springer	S1108-57080	1108	2010	0.497	8.12			9/13/2010	16.34
Springer	S1108-56137	1108	2010	0.497	14			9/16/2010	28.17
Springer	S1108-56143	1108	2010	1.031	13.33			9/16/2010	12.93
Springer	S1108-56157	1108	2010	0.325	3.62			9/16/2010	11.14
Springer	S1108-55122	1108	2010	0.794	61.75			9/22/2010	77.77
Springer	S1108-55128	1108	2010	0.434	17			9/22/2010	39.17
Springer	S1108-55157	1108	2010	6.75	26.25			9/22/2010	3.89
Springer	S1108-55162	1108	2010	9.406	74.5			9/22/2010	7.92
Springer	S1108-59109	1108	2010	2.547	100			9/22/2010	39.26
Springer	S1108-60318	1108	2010	0.469	12.5			9/22/2010	26.65
Springer	S1108-60483	1108	2010	0.681	14.92			9/22/2010	21.91
Springer	S1108-60615	1108	2010	0.226	3.33			9/22/2010	14.73
Springer	S1108-60627	1108	2010	0.594	67.67			9/22/2010	113.92
Springer	S1108-60708	1108	2010	0.459	64.42			9/22/2010	140.35
Springer	S1108-60201	1108	2010	0.597	19.67			9/24/2010	32.95
Springer	S1108-60205	1108	2010	0.344	8.75			9/24/2010	25.44
Springer	S1108-60209	1108	2010	0.525	14.25			9/24/2010	27.14
Springer	S1108-60905	1108	2010	0.428	10.17			9/24/2010	23.76
Springer	S1108-60913	1108	2010	0.372	11			9/24/2010	29.57
Springer	S1108-60921	1108	2010	0.341	8.33			9/24/2010	24.43
Springer	S1108-61047	1108	2010	0.478	13.67			9/27/2010	28.60
Springer	S1108-61051	1108	2010	0.641	30.83			9/27/2010	48.10
Springer	S1108-61054	1108	2010	0.753	5.04			9/27/2010	6.69
Springer	S1108-61085	1108	2010	0.28	18.58			9/27/2010	66.36
Springer	S1108-61089	1108	2010	0.459	7.13			9/27/2010	15.53
Springer	S1108-61110	1108	2010	0.491	14.67			9/27/2010	29.88
Springer	S1108-63022	1108	2010	0.308	1.45			9/28/2010	4.71
Springer	S1108-63035	1108	2010	0.625	80.75			9/28/2010	129.20
Springer	S1108-63081	1108	2010	0.241	11.08			9/28/2010	45.98
Springer	S1108-63098	1108	2010	0.209	1.65			9/28/2010	7.89
Springer	S1036-15110	1036	2010	2.706	20			10/3/2010	7.39
Springer	S1036-15117	1036	2010	1.819	31			10/3/2010	17.04
Springer	S1096-42006	1096	2010	0.297	25.67			10/5/2010	86.43
Springer	S1108-64104	1108	2010	0.35	28.92			10/7/2010	82.63
Springer	S1108-64116	1108	2010	1.953	39.83			10/7/2010	20.39
Springer	S1108-64128	1108	2010	3.037	18.25			10/7/2010	6.01
Springer	S1108-64140	1108	2010	3.531	11.42			10/7/2010	3.23
Springer	S1108-67011	1108	2010	0.853	10.83			10/7/2010	12.70
Springer	S1108-67046	1108	2010	0.95	73.75			10/7/2010	77.63
Springer	S1108-67074	1108	2010	0.243	18.17			10/7/2010	74.77
Springer	S1096-43020	1096	2010	1.297	20.75			10/10/2010	16.00
Springer	S1096-43028	1096	2010	0.208	6.17			10/10/2010	29.66
Springer	S1096-43060	1096	2010	0.956	19.58			10/10/2010	20.48
Springer	S1096-43064	1096	2010	0.262	4.16			10/10/2010	15.88
Springer	S1108-68530	1108	2010	0.428	18.75			10/14/2010	43.81
Springer	S1108-68541	1108	2010	0.463	2			10/14/2010	4.32
Springer	S1108-68588	1108	2010	1.228	12.67			10/14/2010	10.32
Springer	S1108-68620	1108	2010	0.653	8.01			10/14/2010	12.27
Springer	S1096-44016	1096	2010	0.678	20.17			10/15/2010	29.75
Springer	S1096-44044	1096	2010	1.669	11.83			10/15/2010	7.09
Springer	S1096-44051	1096	2010	0.284	13.08			10/15/2010	46.06
Springer	S1096-44098	1096	2010	1.794	15.42			10/15/2010	8.60
Springer	S1096-44113	1096	2010	2.316	7.29			10/15/2010	3.15
Springer	S1096-44164	1096	2010	0.463	26.75			10/15/2010	57.78
Springer	S1108-68565	1108	2010	0.609	11.83			10/16/2010	19.43
Springer	S1096-45000	1096	2010	2.419	15.58			10/18/2010	6.44
Springer	S1096-45075	1096	2010	1.181	4.25			10/18/2010	3.60
Springer	S1096-45094	1096	2010	1.356	11.5			10/18/2010	8.48
Springer	S1096-45119	1096	2010	0.149	37.42			10/18/2010	251.14
Springer	S1108-65030	1108	2010	0.391	10.67			10/18/2010	27.29
Springer	S1108-65077	1108	2010	0.697	69.5			10/18/2010	99.71
Springer	S1108-65100	1108	2010	0.366	9.58			10/18/2010	26.17
Springer	S1108-65130	1108	2010	0.472	35.67			10/18/2010	75.57
Springer	S1108-70039	1108	2010	0.484	6.48			10/23/2010	13.39
Springer	S1108-70143	1108	2010	0.441	21.17			10/23/2010	48.00
Springer	S1108-70210	1108	2010	0.344	19.08			10/23/2010	55.47
Springer	S1108-70226	1108	2010	0.519	8.13			10/23/2010	15.66
Springer	S1096-46019	1096	2010	1.197	12.75			10/26/2010	10.65
Springer	S1096-46065	1096	2010	0.884	10.92			10/26/2010	12.35
Springer	S1108-70057	1108	2010	0.372	4.6			10/26/2010	12.37
Springer	S1108-70232	1108	2010	0.347	4.46			10/26/2010	12.85
Springer	S1108-71001	1108	2010	0.381	9.5			10/26/2010	24.93
Springer	S1108-71010	1108	2010	0.528	9.83			10/26/2010	18.62
Springer	S1096-46128	1096	2010	0.759	12.58			11/1/2010	16.57
Springer	S1096-46202	1096	2010	0.691	27.67			11/1/2010	40.04
Springer	S1096-46224	1096	2010	1.159	16.08			11/1/2010	13.87
Springer	S1096-46246	1096	2010	0.962	13			11/1/2010	13.51
Springer	S1096-46257	1096	2010	0.344	11.75			11/1/2010	34.16
Springer	S1108-72141	1108	2010	0.122	69.33			11/2/2010	568.28
Springer	S1108-72147	1108	2010	0.463	81.17			11/2/2010	175.31
Springer	S1108-72107	1108	2010	0.603	96.67			11/4/2010	160.32
Springer	S1108-72125	1108	2010	0.316	10			11/4/2010	31.65
Springer	S1108-72135	1108	2010	0.124	47.33			11/4/2010	381.69
Springer	S1108-72177	1108	2010	0.481	11.33			11/4/2010	23.56
Springer	S1024-6121	1024	2010	4	36.67			11/6/2010	9.17
Springer	S1024-6218	1024	2010	22.219	36.25			11/6/2010	1.63
Springer	S1096-48036	1096	2010	2.275	10.42			11/7/2010	4.58
Springer	S1096-48042	1096	2010	3.469	22.58			11/7/2010	6.51
Springer	S1096-48047	1096	2010	1.903	75.92			11/7/2010	39.89
Springer	S1096-48063	1096	2010	1.059	87.5			11/7/2010	82.63
Springer	S1096-48079	1096	2010	2.391	20.83			11/7/2010	8.71
Springer	S1096-48129	1096	2010	1.672	10.17			11/7/2010	6.08
Springer	S1096-48160	1096	2010	0.794	12.17			11/7/2010	15.33
Springer	S1096-49014	1096	2010	1.472	24.58			11/14/2010	16.70
Springer	S1096-49042	1096	2010	0.831	17.92			11/14/2010	21.56
Springer	S1096-49049	1096	2010	2.119	27.67			11/14/2010	13.06
Springer	S1096-49086	1096	2010	0.725	1.63			11/14/2010	2.25
Springer	S1096-49115	1096	2010	1.825	9.25			11/14/2010	5.07
Springer	S1096-49121	1096	2010	0.575	1.59			11/14/2010	2.77
Springer	S1096-49155	1096	2010	0.822	20.42			11/14/2010	24.84
Springer	S1096-50129	1096	2010	4.062	7.91			11/21/2010	1.95
Springer	S1096-50141	1096	2010	0.731	4.23			11/21/2010	5.79
Springer	S1096-50190	1096	2010	1.312	23.83			11/21/2010	18.16
Springer	S1096-50311	1096	2010	0.409	7.86			11/21/2010	19.22
Springer	S1096-50345	1096	2010	0.966	36.67			11/21/2010	37.96
Springer	S1096-54021	1096	2010	0.453	8.67			11/30/2010	19.14
Springer	S1096-54033	1096	2010	1.291	8.83			11/30/2010	6.84
Springer	S1024-7027	1024	2010	28.937	25.17			12/2/2010	0.87
Springer	S1024-7030	1024	2010	24.312	20.58			12/2/2010	0.85
Springer	S1024-7045	1024	2010	11.937	7.98			12/2/2010	0.67
Springer	S1024-7049	1024	2010	32.812	12.25			12/2/2010	0.37
Springer	S1024-7051	1024	2010	54.688	21			12/2/2010	0.38
Springer	S1024-7053	1024	2010	24.406	43.58			12/2/2010	1.79
Springer	S1024-7055	1024	2010	32.812	51			12/2/2010	1.55
Springer	S1096-51028	1096	2010	2.294	34.5			12/3/2010	15.04
Springer	S1096-51145	1096	2010	1.625	98.33			12/3/2010	60.51
Springer	S1096-51154	1096	2010	4.438	50.67			12/3/2010	11.42
Springer	S1096-51187	1096	2010	3.688	19.42			12/3/2010	5.27
Springer	S1096-51200	1096	2010	2.372	32.92			12/3/2010	13.88
Springer	S1096-51206	1096	2010	1.262	65.75			12/3/2010	52.10
Springer	S1096-54114	1096	2010	1.125	18.83			12/3/2010	16.74
Springer	S1096-54124	1096	2010	0.713	6.15			12/3/2010	8.63
Springer	S1096-54129	1096	2010	1.353	3.93			12/3/2010	2.90
Springer	S1024-7043	1024	2010	6.625	31.5			12/4/2010	4.75
Springer	S1096-56092	1096	2010	1.438	42			12/7/2010	29.21
Springer	S1096-56104	1096	2010	2.766	27.92			12/7/2010	10.09
Springer	S1096-52112	1096	2010	1.1	7.25			12/8/2010	6.59
Springer	S1096-52225	1096	2010	0.274	8.33			12/8/2010	30.40
Springer	S1096-52230	1096	2010	1.209	42.58			12/8/2010	35.22
Springer	S1096-52476	1096	2010	1.812	11.92			12/8/2010	6.58
Springer	S1096-52494	1096	2010	1.353	3.93			12/8/2010	2.90
Springer	S1096-61046	1096	2010	1.081	10.08			12/12/2010	9.32
Springer	S1096-61124	1096	2010	1.825	10.17			12/12/2010	5.57
Springer	S1096-61157	1096	2010	1.35	25.33			12/12/2010	18.76
Springer	S1096-60009	1096	2010	0.972	15.08			12/16/2010	15.51
Springer	S1096-60039	1096	2010	0.519	24.83			12/16/2010	47.84
Springer	S1096-60057	1096	2010	0.669	39.83			12/16/2010	59.54
Springer	S1096-60203	1096	2010	1.425	42.67			12/16/2010	29.94
Springer	S1096-60211	1096	2010	0.21	28.17			12/16/2010	134.14
Springer	S1096-60229	1096	2010	2.028	38.92			12/16/2010	19.19
Springer	S1096-60235	1096	2010	0.419	12.5			12/16/2010	29.83
Springer	S1096-62020	1096	2010	1.116	19.08			12/18/2010	17.10
Springer	S1096-62024	1096	2010	0.481	52.17			12/18/2010	108.46
Springer	S1096-62031	1096	2010	2.362	10.17			12/18/2010	4.31
Springer	S1096-62039	1096	2010	0.447	7.32			12/18/2010	16.38
Springer	S1096-62067	1096	2010	1.966	9.25			12/18/2010	4.70
Springer	S1096-62071	1096	2010	0.412	27.08			12/18/2010	65.73
Springer	S1096-62113	1096	2010	2.694	14			12/18/2010	5.20
Springer	S1084-37044	1084	2010	2.669	44.67	0.536	0.085	12/22/2010	16.74
Springer	S1084-37072	1084	2010	2.394	10.67	0.128	0.077	12/22/2010	4.46
Springer	S1084-37084	1084	2010	1.544	28.83	0.346	0.049	12/22/2010	18.67
Springer	S1096-58108	1096	2010	27.563	67.58			12/23/2010	2.45
Springer	S1096-58122	1096	2010	0.869	15.67			12/23/2010	18.03
Springer	S1096-58135	1096	2010	1.525	14.42			12/23/2010	9.46
Springer	S1096-59104	1096	2010	0.953	126.67			12/29/2010	132.92
Springer	S1096-59116	1096	2010	0.744	17.25			12/29/2010	23.19
Springer	S1096-59128	1096	2010	1.641	102.5			12/29/2010	62.46

Springer	S1096-63111	1096	2010	2.906	31.17			12/29/2010	10.73
Springer	S1096-63114	1096	2010	2.594	30.75			12/29/2010	11.85
Springer	S1084-38011	1084	2010	1.191	9.83	0.118	0.038	12/31/2010	8.25
Springer	S1084-38030	1084	2010	1.138	10.92	0.131	0.036	12/31/2010	9.60
Springer	S1084-38047	1084	2010	0.972	29.25	0.351	0.031	12/31/2010	30.09
Springer	S1084-38068	1084	2010	1.831	15.75	0.189	0.059	12/31/2010	8.60
Springer	S1084-38084	1084	2010	3.281	9.92	0.119	0.105	12/31/2010	3.02
Springer	S1084-38100	1084	2010	3.281	12.08	0.145	0.105	12/31/2010	3.68
Springer	S1084-38522	1084	2010	1.75	13.17	0.158	0.056	12/31/2010	7.53
Springer	S1084-38545	1084	2010	1.347	11.67	0.14	0.043	12/31/2010	8.66
Springer	S1084-38584	1084	2010	0.6	16.08	0.193	0.019	12/31/2010	26.80
Springer	S1084-38590	1084	2010	2.694	26.58	0.319	0.086	12/31/2010	9.87
Springer	S1096-662287	1096	2011	4.781	39.75			1/9/2011	8.31
Springer	S1096-662298	1096	2011	1.722	39.92			1/9/2011	23.18
Springer	S1096-662315	1096	2011	1.509	31.17			1/9/2011	20.66
Springer	S1084-39010	1084	2011	2.5	16	0.192	0.08	1/10/2011	6.40
Springer	S1084-39022	1084	2011	2.231	13.83	0.166	0.071	1/10/2011	6.20
Springer	S1084-39037	1084	2011	1.197	15	0.18	0.038	1/10/2011	12.53
Springer	S1084-39052	1084	2011	1.347	39.08	0.469	0.043	1/10/2011	29.01
Springer	S1084-39067	1084	2011	1.272	16.5	0.198	0.041	1/10/2011	12.97
Springer	S1084-39084	1084	2011	2.597	31.83	0.382	0.083	1/10/2011	12.26
Springer	S1084-39097	1084	2011	2.353	49.42	0.593	0.075	1/10/2011	21.00
Springer	S1084-40033	1084	2011	3.531	14	0.168	0.113	1/10/2011	3.96
Springer	S1084-40094	1084	2011	3.875	16.33	0.196	0.124	1/10/2011	4.21
Springer	S1084-40098	1084	2011	4.281	25.67	0.308	0.137	1/10/2011	6.00
Springer	S1084-40102	1084	2011	3.019	14.83	0.178	0.097	1/10/2011	4.91
Springer	S1084-40105	1084	2011	2.344	22.67	0.272	0.075	1/10/2011	9.67
Springer	S1096-64052	1096	2011	0.775	18.5			1/10/2011	23.87
Springer	S1096-64141	1096	2011	1.028	7.22			1/10/2011	7.02
Springer	S1096-65001	1096	2011	1.669	104.17			1/12/2011	62.41
Springer	S1096-65023	1096	2011	1.916	43.33			1/12/2011	22.61
Springer	S1096-65048	1096	2011	1.034	4.32			1/12/2011	4.18
Springer	S1096-65074	1096	2011	1.103	6.37			1/12/2011	5.78
Springer	S1096-65098	1096	2011	0.584	25			1/12/2011	42.81
Springer	S1096-65104	1096	2011	0.878	24.67			1/12/2011	28.10
Springer	S1096-65110	1096	2011	0.356	6.32			1/12/2011	17.75
Springer	S1084-41003	1084	2011	1.225	32.17	0.386	0.039	1/18/2011	26.26
Springer	S1084-41006	1084	2011	1.662	31.33	0.376	0.053	1/18/2011	18.85
Springer	S1084-41053	1084	2011	2.716	24.58	0.295	0.087	1/18/2011	9.05
Springer	S1084-41058	1084	2011	2.463	22.75	0.273	0.079	1/18/2011	9.24
Springer	S1084-41119	1084	2011	1.65	21.25	0.255	0.053	1/18/2011	12.88
Springer	S1108-74004	1108	2011	1.203	10.58			1/21/2011	8.79
Springer	S1108-74221	1108	2011	1.841	16.67			1/21/2011	9.05
Springer	S1084-42019	1084	2011	4.938	15.33	0.184	0.158	1/23/2011	3.10
Springer	S1084-42024	1084	2011	3.016	44	0.528	0.097	1/23/2011	14.59
Springer	S1084-42054	1084	2011	2.741	25	0.3	0.088	1/23/2011	9.12
Springer	S1084-42059	1084	2011	1.903	12.25	0.147	0.061	1/23/2011	6.44
Springer	S1096-68505	1096	2011	0.866	7.73			1/25/2011	8.93
Springer	S1096-68515	1096	2011	1.269	5.82			1/25/2011	4.59
Springer	S1084-44016	1084	2011	0.878	24.42	0.293	0.028	1/30/2011	27.81
Springer	S1084-44020	1084	2011	0.017	9.92	0.119	0.001	1/30/2011	583.53
Springer	S1084-44040	1084	2011	0.369	36.33	0.436	0.012	1/30/2011	98.46
Springer	S1084-44057	1084	2011	0.107	26.33	0.316	0.003	1/30/2011	246.07
Springer	S1084-44071	1084	2011	1.869	14.58	0.175	0.06	1/30/2011	7.80
Springer	S1084-44118	1084	2011	1.897	15.08	0.181	0.061	1/30/2011	7.95
Springer	S1096-69101	1096	2011	2.722	92.5			1/31/2011	33.98
Springer	S1096-69123	1096	2011	1.5	23.92			1/31/2011	15.95
Springer	S1096-69139	1096	2011	2.759	28			1/31/2011	10.15
Springer	S1084-45014	1084	2011	0.759	4.48	0.054	0.024	2/4/2011	5.90
Springer	S1084-45024	1084	2011	2.541	41.67	0.5	0.081	2/4/2011	16.40
Springer	S1084-45055	1084	2011	4.281	8.92	0.107	0.137	2/4/2011	2.08
Springer	S1084-45064	1084	2011	1.469	21.33	0.256	0.047	2/4/2011	14.52
Springer	S1084-45093	1084	2011	4.281	31.83	0.382	0.137	2/4/2011	7.44
Springer	S1084-45099	1084	2011	1.138	6.83	0.082	0.036	2/4/2011	6.00
Springer	S1084-45117	1084	2011	0.613	30.08	0.361	0.02	2/4/2011	49.07
Springer	S1084-45127	1084	2011	2.994	23	0.276	0.096	2/4/2011	7.68
Springer	S1144-64081	1144	2011	3.281	2.62			2/5/2011	0.80
Springer	S1144-64110	1144	2011	4.5	3.95			2/5/2011	0.88
Springer	S1144-65050	1144	2011	5.375	2.48			2/5/2011	0.46
Springer	S1084-47009	1084	2011	0.484	29.07	0.349	0.015	2/10/2011	60.06
Springer	S1084-47030	1084	2011	1.841	3.95	0.047	0.059	2/10/2011	2.15
Springer	S1084-47075	1084	2011	1.578	2.18	0.026	0.051	2/10/2011	1.38
Springer	S1084-47089	1084	2011	11.688	19.75	0.237	0.374	2/10/2011	1.69
Springer	S1084-47201	1084	2011	1.753	2.18	0.026	0.056	2/10/2011	1.24
Springer	S1084-48059	1084	2011	0.888	21.42	0.257	0.028	2/10/2011	24.12
Springer	S1084-48087	1084	2011	1.756	15.89	0.191	0.056	2/10/2011	9.05
Springer	S1084-48095	1084	2011	1.862	11.22	0.135	0.06	2/10/2011	6.03
Springer	S1084-49067	1084	2011	8.938	69.67	0.836	0.286	2/14/2011	7.79
Springer	S1084-49090	1084	2011	1.475	19.67	0.236	0.047	2/14/2011	13.34
Springer	S1084-49104	1084	2011	3.281	9.17	0.11	0.105	2/14/2011	2.79
Springer	S1084-49111	1084	2011	3.281	16.92	0.203	0.105	2/14/2011	5.16
Springer	S1084-49121	1084	2011	4.062	36.58	0.439	0.13	2/14/2011	9.01
Springer	S1084-50113	1084	2011	3.625	10.5	0.126	0.116	2/20/2011	2.90
Springer	S1084-52001	1084	2011	1.569	7	0.084	0.05	2/20/2011	4.46
Springer	S1084-52019	1084	2011	1.856	9.92	0.119	0.059	2/20/2011	5.34
Springer	S1084-52037	1084	2011	0.606	37.17	0.446	0.019	2/20/2011	61.34
Springer	S1084-52043	1084	2011	1.559	17.67	0.212	0.05	2/20/2011	11.33
Springer	S1084-50118	1084	2011	2.078	24.92	0.299	0.067	2/21/2011	11.99
Springer	S1084-54036	1084	2011	0.762	41.75	0.501	0.024	2/23/2011	54.79
Springer	S1084-54076	1084	2011	0.641	16.17	0.194	0.021	2/23/2011	25.23
Springer	S1084-50021	1084	2011	0.928	31.08	0.373	0.03	2/24/2011	33.49
Springer	S1084-50028	1084	2011	2.25	40	0.48	0.072	2/24/2011	17.78
Springer	S1084-50083	1084	2011	0.984	11.5	0.138	0.032	2/24/2011	11.69
Springer	S1012-5027	1012	2011	4.375	19			2/26/2011	4.34
Springer	S1012-5036	1012	2011	1.225	37.17			2/26/2011	30.34
Springer	S1084-55137	1084	2011	0.891	29.58	0.355	0.029	2/28/2011	33.20
Springer	S1084-55181	1084	2011	1.109	25.58	0.307	0.036	2/28/2011	23.07
Springer	S1084-56016	1084	2011	1.169	19.33	0.232	0.037	3/3/2011	16.54
Springer	S1084-56068	1084	2011	0.6	12.5	0.15	0.019	3/3/2011	20.83
Springer	S1084-53012	1084	2011	0.412	39	0.468	0.013	3/4/2011	94.66
Springer	S1084-53034	1084	2011	0.362	8.5	0.102	0.012	3/4/2011	23.48
Springer	S1084-53039	1084	2011	8.656	19.5	0.234	0.277	3/4/2011	2.25
Springer	S1084-53079	1084	2011	1.009	22.67	0.272	0.032	3/4/2011	22.47
Springer	S1084-53106	1084	2011	1.55	12.33	0.148	0.05	3/4/2011	7.95
Springer	S1084-53113	1084	2011	4.219	62.33	0.748	0.135	3/4/2011	14.77
Springer	S1084-58030	1084	2011	0.775	18	0.216	0.025	3/6/2011	23.23
Springer	S1084-57046	1084	2011	0.713	12.5	0.15	0.023	3/10/2011	17.53
Springer	S1084-57051	1084	2011	1.147	19.75	0.237	0.037	3/10/2011	17.22
Springer	S1084-57066	1084	2011	1.181	5.11	0.061	0.038	3/10/2011	4.33
Springer	S1084-57115	1084	2011	1.375	7.63	0.092	0.044	3/10/2011	5.55
Springer	S1084-57152	1084	2011	1.163	7.53	0.09	0.037	3/10/2011	6.47
Springer	S1072-24013	1072	2011	5.719	13.42			3/14/2011	2.35
Springer	S1072-24042	1072	2011	2.428	12.92			3/14/2011	5.32
Springer	S1072-24046	1072	2011	0.984	8.92			3/14/2011	9.07
Springer	S1072-24073	1072	2011	2.237	7.98			3/14/2011	3.57
Springer	S1072-24102	1072	2011	2.269	9.58			3/14/2011	4.22
Springer	S1084-59033	1084	2011	3.375	23.42	0.281	0.108	3/14/2011	6.94
Springer	S1084-59069	1084	2011	1.378	23.75	0.285	0.044	3/14/2011	17.24
Springer	S1084-60007	1084	2011	2.022	61.25	0.735	0.065	3/16/2011	30.29
Springer	S1084-60019	1084	2011	2.075	53.67	0.644	0.066	3/16/2011	25.87
Springer	S1144-48012	1144	2011	0.117	1.57			3/17/2011	13.42
Springer	S1144-48015	1144	2011	0.4	11.92			3/17/2011	29.80
Springer	S1144-48018	1144	2011	0.109	1.1			3/17/2011	10.09
Springer	S1144-48026	1144	2011	0.126	1.42			3/17/2011	11.27
Springer	S1144-48050	1144	2011	2.109	8.83			3/17/2011	4.19
Springer	S1144-48059	1144	2011	0.534	27.92			3/17/2011	52.28
Springer	S1144-48063	1144	2011	0.236	10.08			3/17/2011	42.71
Springer	S1144-48066	1144	2011	0.156	1.32			3/17/2011	8.46
Springer	S1144-49008	1144	2011	0.894	20.83			3/17/2011	23.30
Springer	S1144-49011	1144	2011	0.331	23.25			3/17/2011	70.24
Springer	S1144-49014	1144	2011	3.187	36.5			3/17/2011	11.45
Springer	S1144-49017	1144	2011	0.316	14.75			3/17/2011	46.68
Springer	S1144-49031	1144	2011	0.509	68.25			3/17/2011	134.09
Springer	S1144-49034	1144	2011	0.256	46.92			3/17/2011	183.28
Springer	S1144-49037	1144	2011	0.175	15.33			3/17/2011	87.60
Springer	S1144-49042	1144	2011	0.691	29.17			3/17/2011	42.21
Springer	S1144-49069	1144	2011	0.083	49.42			3/17/2011	595.42
Springer	S1144-49073	1144	2011	0.147	19.67			3/17/2011	133.81
Springer	S1144-49076	1144	2011	0.178	17			3/17/2011	95.51
Springer	S1144-49099	1144	2011	0.628	44.75			3/17/2011	71.26
Springer	S1144-49113	1144	2011	0.096	16.58			3/17/2011	172.71
Springer	S1144-50032	1144	2011	0.459	18.42			3/17/2011	40.13
Springer	S1144-50042	1144	2011	1.219	29.92			3/17/2011	24.54
Springer	S1144-50045	1144	2011	0.362	37.08			3/17/2011	102.43
Springer	S1144-50048	1144	2011	0.312	5.51			3/17/2011	17.66
Springer	S1144-50078	1144	2011	0.322	30.67			3/17/2011	95.25
Springer	S1144-50081	1144	2011	0.362	14.67			3/17/2011	40.52
Springer	S1144-50084	1144	2011	0.223	42.67			3/17/2011	191.35
Springer	S1144-50117	1144	2011	0.384	8.42			3/17/2011	21.93
Springer	S1144-50120	1144	2011	0.416	32.5			3/17/2011	78.13
Springer	S1144-50123	1144	2011	0.494	0.62			3/17/2011	1.26
Springer	S1144-50126	1144	2011	0.264	30.75			3/17/2011	116.48
Springer	S1144-50156	1144	2011	0.487	29.92			3/17/2011	61.44
Springer	S1144-50159	1144	2011	0.403	46.17			3/17/2011	114.57
Springer	S1144-50162	1144	2011	0.544	38.92			3/17/2011	71.54
Springer	S1144-50165	1144	2011	0.544	1.15			3/17/2011	2.11
Springer	S1144-51007	1144	2011	0.981	16.08			3/17/2011	16.39
Springer	S1144-51025	1144	2011	0.509	12.33			3/17/2011	24.22
Springer	S1144-51028	1144	2011	0.644	4.83			3/17/2011	7.50
Springer	S1144-51031	1144	2011	0.447	1.44			3/17/2011	3.22
Springer	S1144-51067	1144	2011	0.353	4.28			3/17/2011	12.12
Springer	S1144-51070	1144	2011	0.306	30.83			3/17/2011	100.75
Springer	S1144-51073	1144	2011	0.706	4.28			3/17/2011	6.06
Springer	S1144-51082	1144	2011	0.866	14.42			3/17/2011	16.65
Springer	S1144-51085	1144	2011	0.656	2.24			3/17/2011	3.41
Springer	S1144-59105	1144	2011	0.487	1.4			3/17/2011	2.87
Springer	S1144-59108	1144	2011	0.719	0.93			3/17/2011	1.29
Springer	S1144-59111	1144	2011	0.675	1.3			3/17/2011	1.93
Springer	S1144-59122	1144	2011	0.394	70.25			3/17/2011	178.30
Springer	S1144-59124	1144	2011	1.603	67.08			3/17/2011	41.85
Springer	S1144-59173	1144	2011	0.219	2.07			3/17/2011	9.45
Springer	S1144-59179	1144	2011	1.019	10.42			3/17/2011	10.23
Springer	S1144-59182	1144	2011	1.05	131.67			3/17/2011	125.40
Springer	S1144-59199	1144	2011	0.928	2.78			3/17/2011	3.00
Springer	S1144-59223	1144	2011	0.606	7.98			3/17/2011	13.17
Springer	S1144-59261	1144	2011	0.691	44.42			3/17/2011	64.28
Springer	S1144-59301	1144	2011	1.672	93.33			3/17/2011	55.82

Springer	S1144-59350	1144	2011	0.6	13.92			3/17/2011	23.20
Springer	s1084-63011	1084	2011	1.125	20.33	0.244	0.036	3/20/2011	18.07
Springer	s1084-63031	1084	2011	0.959	10.08	0.121	0.031	3/20/2011	10.51
Springer	s1084-65004	1084	2011	3.019	18.08	0.217	0.097	3/22/2011	5.99
Springer	S1084-46072	1084	2011	2.2	37.33	0.448	0.07	3/24/2011	16.97
Springer	S1084-46077	1084	2011	0.975	22.58	0.271	0.031	3/24/2011	23.16
Springer	S1084-46089	1084	2011	0.675	20.33	0.244	0.022	3/24/2011	30.12
Springer	S1084-46148	1084	2011	0.778	18.67	0.224	0.025	3/24/2011	24.00
Springer	S1084-61014	1084	2011	0.897	13.92	0.167	0.029	3/24/2011	15.52
Springer	S1084-61018	1084	2011	0.928	8.58	0.103	0.03	3/24/2011	9.25
Springer	S1072-25015	1072	2011	1.294	9.67			3/25/2011	7.47
Springer	S1072-25063	1072	2011	1.244	23.17			3/25/2011	18.63
Springer	S1072-25077	1072	2011	1.488	18.42			3/25/2011	12.38
Springer	S1072-25120	1072	2011	1.278	29.92			3/25/2011	23.41
Springer	S1084-65014	1084	2011	0.597	8.09	0.097	0.019	3/25/2011	13.55
Springer	S1084-62016	1084	2011	1.466	40.08	0.481	0.047	3/28/2011	27.34
Springer	S1084-62040	1084	2011	1.688	25.25	0.303	0.054	3/28/2011	14.96
Springer	S1084-62065	1084	2011	1.034	15.42	0.185	0.033	3/28/2011	14.91
Springer	S1084-62150	1084	2011	1.278	38.08	0.457	0.041	3/28/2011	29.80
Springer	S1084-62181	1084	2011	0.653	13.42	0.161	0.021	3/28/2011	20.55
Springer	S1084-66008	1084	2011	0.566	22.58	0.271	0.018	3/28/2011	39.89
Springer	S1084-66038	1084	2011	0.656	19.92	0.239	0.021	3/28/2011	30.37
Springer	S1072-26017	1072	2011	0.218	19.67			3/30/2011	90.23
Springer	S1072-26026	1072	2011	0.566	12.92			3/30/2011	22.83
Springer	S1072-26072	1072	2011	0.252	11.58			3/30/2011	45.95
Springer	S1084-67007	1084	2011	0.616	15.33	0.184	0.02	3/31/2011	24.89
Springer	S1084-67027	1084	2011	1.775	90.83	1.09	0.057	3/31/2011	51.17
Springer	S1072-27006	1072	2011	0.572	33.67			4/1/2011	58.86
Springer	S1072-27042	1072	2011	1.784	28.5			4/1/2011	15.98
Springer	S1072-27075	1072	2011	2.128	33.17			4/1/2011	15.59
Springer	S1072-27098	1072	2011	3.109	46.08			4/1/2011	14.82
Springer	S1072-27108	1072	2011	0.937	7.77			4/1/2011	8.29
Springer	s1072-28017	1072	2011	0.644	16			4/4/2011	24.84
Springer	s1072-28054	1072	2011	2.091	23			4/4/2011	11.00
Springer	s1072-28062	1072	2011	5.406	21.83			4/4/2011	4.04
Springer	s1072-28090	1072	2011	5.719	33.92			4/4/2011	5.93
Springer	s1072-28110	1072	2011	5.219	38.67			4/4/2011	7.41
Springer	s1072-28135	1072	2011	0.572	24.33			4/4/2011	42.53
Springer	s1084-68038	1084	2011	0.956	17.17	0.206	0.031	4/4/2011	17.96
Springer	s1084-68052	1084	2011	1.662	33.5	0.402	0.053	4/4/2011	20.16
Springer	s1084-68062	1084	2011	0.903	24.25	0.291	0.029	4/4/2011	26.85
Springer	S1072-30019	1072	2011	1.953	32.42			4/11/2011	16.60
Springer	S1072-30061	1072	2011	1.731	8.42			4/11/2011	4.86
Springer	S1072-30066	1072	2011	1.05	10.92			4/11/2011	10.40
Springer	S1072-30071	1072	2011	3.469	39.42			4/11/2011	11.36
Springer	S1072-30125	1072	2011	0.466	13.33			4/11/2011	28.61
Springer	S1072-30132	1072	2011	2.669	13.75			4/11/2011	5.15
Springer	S1072-29034	1072	2011	0.731	47.5			4/12/2011	64.98
Springer	S1072-29037	1072	2011	7.031	19.25			4/12/2011	2.74
Springer	S1072-29126	1072	2011	1.537	8.83			4/12/2011	5.74
Springer	S1072-29129	1072	2011	2.459	24.67			4/12/2011	10.03
Springer	S1072-29166	1072	2011	3.563	16.83			4/12/2011	4.72
Springer	S1072-29169	1072	2011	3.187	19.67			4/12/2011	6.17
Springer	S1072-31018	1072	2011	0.456	6.71			4/16/2011	14.71
Springer	S1072-31033	1072	2011	1.016	19.58			4/16/2011	19.27
Springer	S1072-31058	1072	2011	9.719	23.25			4/16/2011	2.39
Springer	S1072-31066	1072	2011	1.653	27.67			4/16/2011	16.74
Springer	S1072-31091	1072	2011	3.281	29.42			4/16/2011	8.97
Springer	S1084-69006	1084	2011	0.453	10.42	0.125	0.014	4/19/2011	23.00
Springer	S1084-69024	1084	2011	0.359	16.92	0.203	0.012	4/19/2011	47.13
Springer	S1072-37008	1072	2011	1.741	15.92			4/22/2011	9.14
Springer	S1072-37038	1072	2011	0.819	18.83			4/22/2011	22.99
Springer	S1072-37063	1072	2011	1.222	50.17			4/22/2011	41.06
Springer	S1072-37098	1072	2011	0.597	35.75			4/22/2011	59.88
Springer	S1072-37118	1072	2011	1.206	17			4/22/2011	14.10
Springer	S1072-36010	1072	2011	1.497	38.83			4/23/2011	25.94
Springer	S1072-36035	1072	2011	2.116	14.33			4/23/2011	6.77
Springer	S1072-36070	1072	2011	0.659	24.25			4/23/2011	36.80
Springer	S1072-36077	1072	2011	0.397	12.5			4/23/2011	31.49
Springer	s1072-40014	1072	2011	2.169	24.67			4/27/2011	11.37
Springer	s1072-40039	1072	2011	2.844	11			4/27/2011	3.87
Springer	s1072-40051	1072	2011	1.953	52.08			4/27/2011	26.67
Springer	S1072-45005	1072	2011	5.187	15.17			5/4/2011	2.92
Springer	S1072-45024	1072	2011	1.2	12.67			5/4/2011	10.56
Springer	S1072-45050	1072	2011	3.25	23.67			5/4/2011	7.28
Springer	S1072-45078	1072	2011	3.187	10.58			5/4/2011	3.32
Springer	S1072-45093	1072	2011	1.066	8.42			5/4/2011	7.90
Springer	S1072-39101	1072	2011	1.175	8.92			5/6/2011	7.59
Springer	S1072-46060	1072	2011	6.25	29.83			5/6/2011	4.77
Springer	S1072-46117	1072	2011	0.888	19.08			5/6/2011	21.49
Springer	S1072-39132	1072	2011	1.187	13.42			5/9/2011	11.31
Springer	S1072-39137	1072	2011	1.822	18.75			5/9/2011	10.29
Springer	S1072-39152	1072	2011	1.303	9.33			5/9/2011	7.16
Springer	S1072-46070	1072	2011	3.437	29.75			5/9/2011	8.66
Springer	S1072-46165	1072	2011	0.722	8.5			5/9/2011	11.77
Springer	S1072-46187	1072	2011	0.406	7.53			5/9/2011	18.55
Springer	S1072-46136	1072	2011	1.559	10.25			5/10/2011	6.57
Springer	S1072-39187	1072	2011	0.587	7.35			5/11/2011	12.52
Springer	S1072-39192	1072	2011	0.609	9			5/11/2011	14.78
Springer	S1072-46015	1072	2011	2.009	23.92			5/16/2011	11.91
Springer	S1072-46042	1072	2011	19.125	32.17			5/16/2011	1.68
Springer	S1072-50027	1072	2011	1.647	23.67			5/16/2011	14.37
Springer	S1072-50034	1072	2011	1.984	20			5/16/2011	10.08
Springer	S1072-50020	1072	2011	2.45	19.67			5/17/2011	8.03
Springer	S1072-48010	1072	2011	0.697	3.78			5/19/2011	5.42
Springer	S1072-48035	1072	2011	1.138	17.58			5/19/2011	15.45
Springer	S1072-48040	1072	2011	0.359	13.25			5/19/2011	36.91
Springer	S1072-48103	1072	2011	0.766	34.17			5/19/2011	44.61
Springer	S1072-48117	1072	2011	0.133	14.5			5/19/2011	109.02
Springer	S1072-48127	1072	2011	0.469	27.58			5/19/2011	58.81
Springer	S1072-52003	1072	2011	3.156	8.75			5/20/2011	2.77
Springer	S1072-52018	1072	2011	1.203	8.08			5/20/2011	6.72
Springer	S1072-51030	1072	2011	1.834	27.33			5/23/2011	14.90
Springer	S1072-51040	1072	2011	0.003	6.07			5/23/2011	2023.33
Springer	S1072-51048	1072	2011	0.013	25.67			5/23/2011	1974.62
Springer	S1072-51056	1072	2011	0.003	13.75			5/23/2011	4583.33
Springer	S1072-47016	1072	2011	2.169	66.08			5/26/2011	30.47
Springer	S1072-47045	1072	2011	0.888	29.08			5/26/2011	32.75
Springer	S1072-47090	1072	2011	0.622	69.75			5/26/2011	112.14
Springer	S1072-47115	1072	2011	0.666	60.33			5/26/2011	90.59
Springer	S1072-47165	1072	2011	1.213	11.67			5/26/2011	9.62
Springer	S1060-21002	1060	2011	2.684	60.92			5/30/2011	22.70
Springer	S1060-21017	1060	2011	0.513	28.08			5/30/2011	54.74
Springer	S1060-20087	1060	2011	1.047	8.92			6/2/2011	8.52
Springer	S1060-20136	1060	2011	0.894	28.08			6/2/2011	31.41
Springer	S1072-54014	1072	2011	1.256	36.08			6/3/2011	28.73
Springer	S1072-54047	1072	2011	0.146	20.33			6/3/2011	139.25
Springer	S1072-54133	1072	2011	0.956	9.08			6/3/2011	9.50
Springer	S1072-54157	1072	2011	0.466	13.17			6/3/2011	28.26
Springer	S1132-60061	1132	2011	3.5	19.75			6/4/2011	5.64
Springer	S1132-60106	1132	2011	4.719	27.25			6/4/2011	5.77
Springer	S1132-60159	1132	2011	5.063	42.42			6/4/2011	8.38
Springer	S1132-60310	1132	2011	6.781	26.17			6/4/2011	3.86
Springer	S1132-60322	1132	2011	5	32.17			6/4/2011	6.43
Springer	S1132-59003	1132	2011	19.562	6.5			6/5/2011	0.33
Springer	S1132-59036	1132	2011	16.75	8.92			6/5/2011	0.53
Springer	S1132-59057	1132	2011	16.531	6.74			6/5/2011	0.41
Springer	S1132-59061	1132	2011	55.312	3.92			6/5/2011	0.07
Springer	S1132-59114	1132	2011	51.875	16.58			6/5/2011	0.32
Springer	S1132-59123	1132	2011	33.438	16.83			6/5/2011	0.50
Springer	S1132-59143	1132	2011	23.031	5.48			6/5/2011	0.24
Springer	s1060-20160	1060	2011	1.203	36.25			6/9/2011	30.13
Springer	s1060-23024	1060	2011	0.267	11.67			6/9/2011	43.71
Springer	s1060-23028	1060	2011	0.238	80.33			6/9/2011	337.52
Springer	s1060-23056	1060	2011	0.766	54.5			6/9/2011	71.15
Springer	s1060-23066	1060	2011	3.312	15.42			6/9/2011	4.66
Springer	s1060-23121	1060	2011	1.453	11.75			6/9/2011	8.09
Springer	s1060-23131	1060	2011	0.459	35.42			6/9/2011	77.17
Springer	s1060-23166	1060	2011	0.196	13.25			6/9/2011	67.60
Springer	s1060-23170	1060	2011	4.219	19.17			6/9/2011	4.54
Springer	s1060-23198	1060	2011	0.242	15.33			6/9/2011	63.35
Springer	S1132-62032	1132	2011	34.063	27.83			6/12/2011	0.82
Springer	S1132-62035	1132	2011	63.75	21.33			6/12/2011	0.33
Springer	S1132-62110	1132	2011	61.563	20.08			6/12/2011	0.33
Springer	S1132-62118	1132	2011	5.219	8.21			6/12/2011	1.57
Springer	S1132-62152	1132	2011	14.719	9.17			6/12/2011	0.62
Springer	S1060-24010	1060	2011	1.984	60.08			6/13/2011	30.28
Springer	S1060-24043	1060	2011	2.269	6.07			6/13/2011	2.68
Springer	S1060-24074	1060	2011	3.813	5.43			6/13/2011	1.42
Springer	S1132-60022	1132	2011	5.937	18.17			6/13/2011	3.06
Springer	S1132-60077	1132	2011	5.187	32.33			6/13/2011	6.23
Springer	S1132-60117	1132	2011	15.25	22.25			6/13/2011	1.46
Springer	S1132-60426	1132	2011	5.406	30.67			6/13/2011	5.67
Springer	S1060-22015	1060	2011	1.484	20.75			6/14/2011	13.98
Springer	S1060-22057	1060	2011	1.028	25.83			6/14/2011	25.13
Springer	S1060-22093	1060	2011	0.756	12.42			6/14/2011	16.43
Springer	S1060-22218	1060	2011	6.125	11			6/14/2011	1.80
Springer	S1060-22227	1060	2011	0.531	7.88			6/14/2011	14.84
Springer	S1060-22284	1060	2011	5.406	11.92			6/14/2011	2.20
Springer	S1060-22298	1060	2011	14	45.92			6/14/2011	3.28
Springer	S1060-22314	1060	2011	0.312	27.67			6/14/2011	88.69
Springer	S1072-55051	1072	2011	0.659	18			6/20/2011	27.31
Springer	S1072-55067	1072	2011	0.497	40.25			6/20/2011	80.99
Springer	S1072-56081	1072	2011	4.188	25.08			6/20/2011	5.99
Springer	S1072-56093	1072	2011	0.431	50.42			6/20/2011	116.98
Springer	S1060-24022	1060	2011	1.778	20.25			6/21/2011	11.39
Springer	S1060-24055	1060	2011	2.256	46.42			6/21/2011	20.58
Springer	S1060-24102	1060	2011	0.516	18.25			6/21/2011	35.37
Springer	s1072-57071	1072	2011	1.403	31.75			6/27/2011	22.63
Springer	s1072-57083	1072	2011	1.303	17.08			6/27/2011	13.11
Springer	S1120-71010	1120	2011	114.688	23.25			6/29/2011	0.20
Springer	S1120-71033	1120	2011	128.75	14.33			6/29/2011	0.11
Springer	S1132-60412	1132	2011	11.437	21.58			6/29/2011	1.89
Springer	S1132-60434	1132	2011	5.219	11.75			6/29/2011	2.25
Springer	S1132-60666	1132	2011	13.375	14.83			6/29/2011	1.11
Springer	S1132-60672	1132	2011	6.406	7.43			6/29/2011	1.16
Springer	S1132-60684	1132	2011	44.375	8.83			6/29/2011	0.20
Springer	S1060-26044	1060	2011	21.085	0.934			6/30/2011	0.04
Springer	S1132-63019	1132	2011	23.281	12.75			6/30/2011	0.55
Springer	S1132-63044	1132	2011	16.375	8.09			6/30/2011	0.49

Springer	S1132-63071	1132	2011	14.375	10.83			6/30/2011	0.75
Springer	S1132-63110	1132	2011	8.562	17.5			6/30/2011	2.04
Springer	S1132-63163	1132	2011	4.406	31			6/30/2011	7.04
Springer	S1132-63178	1132	2011	6.25	19.75			6/30/2011	3.16
Springer	S1132-63203	1132	2011	5.25	13.92			6/30/2011	2.65
Springer	S1060-26011	1060	2011	16.834	6.406			7/3/2011	0.38
Springer	S1060-26050	1060	2011	63.171	0.759			7/3/2011	0.01
Springer	S1060-26193	1060	2011	4.425	1.406			7/6/2011	0.32
Springer	S1060-25038	1060	2011	1	23.83			7/7/2011	23.83
Springer	S1060-25046	1060	2011	0.85	16.67			7/7/2011	19.61
Springer	S1060-25062	1060	2011	2.075	24.33			7/7/2011	11.73
Springer	S1120-71054	1120	2011	27.25	17			7/8/2011	0.62
Springer	S1060-28026	1060	2011	26.002	2.547			7/9/2011	0.10
Springer	S1060-28034	1060	2011	53.17	1.041			7/9/2011	0.02
Springer	S1132-64048	1132	2011	64.062	24.5			7/9/2011	0.38
Springer	S1060-30002	1060	2011	13.001	0.709			7/13/2011	0.05
Springer	S1060-30038	1060	2011	52.754	18.438			7/13/2011	0.35
Springer	S1060-30048	1060	2011	21.418	52.188			7/13/2011	2.44
Springer	S1060-30106	1060	2011	27.335	5.344			7/13/2011	0.20
Springer	S1060-30116	1060	2011	27.252	3.344			7/13/2011	0.12
Springer	S1060-31001	1060	2011	0.566	12.251			7/14/2011	21.64
Springer	S1060-31006	1060	2011	1.072	13.418			7/14/2011	12.52
Springer	S1060-31026	1060	2011	2.825	10.417			7/14/2011	3.69
Springer	S1060-35055	1060	2011	3.781	19.835			7/20/2011	5.25
Springer	S1060-35136	1060	2011	3.156	11.501			7/20/2011	3.64
Springer	S1060-32012	1060	2011	3.25	25.835			7/21/2011	7.95
Springer	S1060-32046	1060	2011	1.075	7.659			7/21/2011	7.12
Springer	S1060-32058	1060	2011	0.994	15.834			7/21/2011	15.93
Springer	S1060-32073	1060	2011	0.578	13.168			7/21/2011	22.78
Springer	S1060-32098	1060	2011	1.119	6.609			7/21/2011	5.91
Springer	S1060-32122	1060	2011	0.859	29.502			7/21/2011	34.34
Springer	S1120-72063	1120	2011	70.938	12.417			7/21/2011	0.18
Springer	S1120-72091	1120	2011	83.438	33.169			7/21/2011	0.40
Springer	S1120-72111	1120	2011	74.375	18.085			7/21/2011	0.24
Springer	S1120-72123	1120	2011	28.656	13.668			7/21/2011	0.48
Springer	S1120-72141	1120	2011	67.5	22.585			7/21/2011	0.33
Springer	S1120-72153	1120	2011	81.25	29.835			7/21/2011	0.37
Springer	S1120-72169	1120	2011	51.25	38.503			7/21/2011	0.75
Springer	S1060-39002	1060	2011	7.938	78.672			7/28/2011	9.91
Springer	S1060-39018	1060	2011	0.466	15.418			7/28/2011	33.09
Springer	S1060-39106	1060	2011	1.422	66.171			7/28/2011	46.53
Springer	s1060-37151	1060	2011	2.394	3.842			7/30/2011	1.60
Springer	s1060-37164	1060	2011	1.984	8.126			7/30/2011	4.10
Springer	s1060-37172	1060	2011	1.912	0.875			7/30/2011	0.46
Springer	S1060-40011	1060	2011	1.525	6.91722			8/1/2011	4.54
Springer	S1060-40032	1060	2011	0.991	2.83356			8/1/2011	2.86
Springer	S1120-73022	1120	2011	52.812	24.502			8/4/2011	0.46
Springer	S1120-73071	1120	2011	35	20.251			8/4/2011	0.58
Springer	S1120-73082	1120	2011	21.844	19.418			8/4/2011	0.89
Springer	S1120-73105	1120	2011	63.125	19.418			8/4/2011	0.31
Springer	S1060-40087	1060	2011	1.409	6.75054			8/7/2011	4.79
Springer	S1060-40109	1060	2011	0.628	0			8/7/2011	0.00
Springer	S1060-40127	1060	2011	1.934	14.25114			8/9/2011	7.37
Springer	S1060-40164	1060	2011	0.819	12.00096			8/11/2011	14.65
Springer	S1060-40168	1060	2011	2.844	7.58394			8/11/2011	2.67
Springer	S1060-43017	1060	2011	1.488	9.709			8/15/2011	6.52
Springer	S1060-43024	1060	2011	6.25	0.533			8/15/2011	0.09
Springer	S1060-43058	1060	2011	1.544	0.833			8/15/2011	0.54
Springer	S1060-43069	1060	2011	3.344	26.418			8/15/2011	7.90
Springer	S1060-43099	1060	2011	15.906	34.752			8/15/2011	2.18
Springer	S1060-43107	1060	2011	5.781	30.335			8/15/2011	5.25
Springer	S1060-43139	1060	2011	1.581	7.117			8/15/2011	4.50
Springer	S1060-43144	1060	2011	3.438	20.835			8/15/2011	6.06
Springer	S1120-74011	1120	2011	50.312	29.252			8/16/2011	0.58
Springer	S1120-74014	1120	2011	31.875	49.67			8/16/2011	1.56
Springer	S1120-74046	1120	2011	22.844	18.668			8/16/2011	0.82
Springer	S1120-74053	1120	2011	14.531	50.42			8/16/2011	3.47
Springer	S1120-74057	1120	2011	36.25	13.501			8/16/2011	0.37
Springer	S1120-74093	1120	2011	9.969	19.918			8/16/2011	2.00
Springer	S1120-74097	1120	2011	14.625	33.919			8/16/2011	2.32
Springer	S1120-74089	1120	2011	7.531	10.584			8/17/2011	1.41
Springer	S1048-20099	1048	2011	1.628	25.502			8/22/2011	15.66
Springer	S1132-67066	1132	2011	1.972	12.918			8/27/2011	6.55
Springer	S1132-67093	1132	2011	0.922	7.976			8/27/2011	8.65
Springer	S1132-67142	1132	2011	1.088	12.668			8/27/2011	11.64
Springer	S1132-67145	1132	2011	3.25	32.335			8/27/2011	9.95
Springer	S1048-20166	1048	2011	3.094	18.501			8/29/2011	5.98
Springer	S1048-20362	1048	2011	1.322	55.254			8/29/2011	41.80
Springer	S1048-20380	1048	2011	2.406	40.253			8/29/2011	16.73
Springer	S1048-20388	1048	2011	1.234	43.003			8/29/2011	34.85
Springer	S1120-74117	1120	2011	11.656	15.584			8/29/2011	1.34
Springer	S1120-75020	1120	2011	8.562	22.418			8/29/2011	2.62
Springer	S1120-75022	1120	2011	8.094	14.334			8/29/2011	1.77
Springer	S1120-75043	1120	2011	9.812	10.834			8/29/2011	1.10
Springer	S1120-75071	1120	2011	7.438	21.918			8/29/2011	2.95
Springer	S1120-75108	1120	2011	6.625	4.917			8/29/2011	0.74
Springer	S1048-20054	1048	2011	4.844	23.502			9/1/2011	4.85
Springer	S1060-45029	1060	2011	0.756	47.503			9/7/2011	62.83
Springer	S1060-45034	1060	2011	0.759	23.835			9/7/2011	31.40
Springer	S1060-45103	1060	2011	0.425	3.234			9/7/2011	7.61
Springer	S1060-45123	1060	2011	0.866	10.167			9/7/2011	11.74
Springer	S1060-45136	1060	2011	0.506	84.172			9/7/2011	166.35
Springer	S1060-45171	1060	2011	1.138	38.836			9/7/2011	34.13
Springer	S1060-45181	1060	2011	3.281	9.001			9/7/2011	2.74
Springer	s1048-21064	1048	2011	1.003	32.752			9/10/2011	32.65
Springer	s1048-21068	1048	2011	3.594	25.668			9/10/2011	7.14
Springer	s1048-21072	1048	2011	4	14.334			9/10/2011	3.58
Springer	s1048-21077	1048	2011	0.638	14.834			9/10/2011	23.25
Springer	s1048-21099	1048	2011	4.219	69.588			9/10/2011	16.49
Springer	s1048-21171	1048	2011	3.097	18.751			9/12/2011	6.05
Springer	s1048-21179	1048	2011	4.469	30.752			9/12/2011	6.88
Springer	s1048-21183	1048	2011	3.531	25.918			9/12/2011	7.34
Springer	s1048-21187	1048	2011	1.394	2.65			9/12/2011	1.90
Springer	s1048-21212	1048	2011	3.844	34.669			9/12/2011	9.02
Springer	S1120-75026	1120	2011	8.062	17.084			9/16/2011	2.12
Springer	S1120-75029	1120	2011	10.469	6.8			9/16/2011	0.65
Springer	S1120-75051	1120	2011	7.281	25.918			9/16/2011	3.56
Springer	S1120-75100	1120	2011	1.766	16.334			9/16/2011	9.25
Springer	S1120-76008	1120	2011	8.125	21.751			9/16/2011	2.68
Springer	S1120-76038	1120	2011	1.256	5.867			9/16/2011	4.67
Springer	S1120-76041	1120	2011	2.584	25.418			9/16/2011	9.84
Springer	S1120-76119	1120	2011	9.625	4.05			9/16/2011	0.42
Springer	S1120-76302	1120	2011	1.688	18.668			9/16/2011	11.06
Springer	S1120-76339	1120	2011	1.459	13.251			9/16/2011	9.08
Springer	S1120-75074	1120	2011	13.719	36.586			9/18/2011	2.67
Springer	S1120-76045	1120	2011	6.031	20.418			9/18/2011	3.39
Springer	S1120-76048	1120	2011	8.688	31.585			9/18/2011	3.64
Springer	S1120-76050	1120	2011	6.219	60.171			9/18/2011	9.68
Springer	S1120-76058	1120	2011	16.25	31.919			9/18/2011	1.96
Springer	S1120-76103	1120	2011	10.719	50.837			9/18/2011	4.74
Springer	S1120-76109	1120	2011	26.938	67.088			9/18/2011	2.49
Springer	S1120-76114	1120	2011	20.812	59.171			9/18/2011	2.84
Springer	S1060-46087	1060	2011	1.116	5.009			9/22/2011	4.49
Springer	S1060-46103	1060	2011	1.072	10.334			9/22/2011	9.64
Springer	S1048-23047	1048	2011	2.966	23.002			9/26/2011	7.76
Springer	S1048-23087	1048	2011	6.031	25.918			9/26/2011	4.30
Springer	S1048-21291	1048	2011	1.469	22.668			9/27/2011	15.43
Springer	S1048-24106	1048	2011	2.509	18.751			9/27/2011	7.47
Springer	S1048-24122	1048	2011	1.356	33.836			9/27/2011	24.95
Springer	S1048-24126	1048	2011	6.406	21.835			9/27/2011	3.41
Springer	S1048-24153	1048	2011	11	11.751			9/27/2011	1.07
Springer	S1048-24203	1048	2011	1.631	26.085			9/27/2011	15.99
Springer	S1048-24252	1048	2011	3.625	20.501			9/27/2011	5.66
Springer	S1108-75014	1108	2011	2.791	3.825			9/29/2011	1.37
Springer	S1108-75026	1108	2011	1.378	65.421			9/29/2011	47.48
Springer	S1108-75038	1108	2011	1.559	6.717			9/29/2011	4.31
Springer	S1108-75044	1108	2011	7.875	6.925			9/29/2011	0.88
Springer	S1108-75063	1108	2011	31.031	26.252			9/29/2011	0.85
Springer	S1108-75067	1108	2011	8.75	9.001			9/29/2011	1.03
Springer	S1108-75093	1108	2011	12.531	20.585			9/29/2011	1.64
Springer	S1108-75130	1108	2011	23.406	21.668			9/29/2011	0.93
Springer	S1060-48011	1060	2011	0.222	18.335			10/1/2011	82.59
Springer	S1060-48044	1060	2011	0.366	18.418			10/1/2011	50.32
Springer	S1060-48086	1060	2011	0.612	27.168			10/1/2011	44.39
Springer	S1060-48104	1060	2011	0.462	26.002			10/1/2011	56.28
Springer	S1108-75008	1108	2011	6.812	1.817			10/1/2011	0.27
Springer	S1108-75030	1108	2011	2.566	14.751			10/1/2011	5.75
Springer	S1108-75054	1108	2011	4.25	28.252			10/1/2011	6.65
Springer	S1108-75086	1108	2011	6.969	10.584			10/1/2011	1.52
Springer	S1108-75083	1108	2011	7.906	5			10/2/2011	0.63
Springer	S1108-75114	1108	2011	9.281	14.418			10/2/2011	1.55
Springer	S1108-75136	1108	2011	6.812	9.917			10/2/2011	1.46
Springer	S1108-76021	1108	2011	1.3	6.984			10/8/2011	5.37
Springer	S1108-76048	1108	2011	2.034	29.002			10/8/2011	14.26
Springer	S1108-76078	1108	2011	6.719	37.336			10/8/2011	5.56
Springer	S1108-76108	1108	2011	13.062	76.505			10/8/2011	5.86
Springer	S1108-77020	1108	2011	18.688	39.169			10/8/2011	2.10
Springer	S1108-77027	1108	2011	8.75	21.168			10/8/2011	2.42
Springer	S1108-77030	1108	2011	6.062	11.084			10/8/2011	1.83
Springer	S1108-77033	1108	2011	4.125	24.918			10/8/2011	6.04
Springer	S1108-77044	1108	2011	4.75	17.001			10/8/2011	3.58
Springer	S1108-77065	1108	2011	18.719	41.003			10/8/2011	2.19
Springer	S1108-77073	1108	2011	35.625	49.837			10/8/2011	1.40
Springer	S1108-77081	1108	2011	9	32.002			10/8/2011	3.56
Springer	S1108-77095	1108	2011	47.188	28.669			10/8/2011	0.61
Springer	S1048-27090	1048	2011	2.653	10.251			10/9/2011	3.86
Springer	S1048-27110	1048	2011	1.022	9.334			10/9/2011	9.13
Springer	S1048-27167	1048	2011	0.251	20.501			10/9/2011	81.68
Springer	s1060-49117	1060	2011	0.675	18.418			10/13/2011	27.29
Springer	s1060-49129	1060	2011	2.647	13.751			10/13/2011	5.19
Springer	S1108-78106	1108	2011	6.75	35.252			10/15/2011	5.22
Springer	S1108-78110	1108	2011	6.344	27.418			10/15/2011	4.32
Springer	S1108-78114	1108	2011	18.969	15.334			10/15/2011	0.81
Springer	S1108-78119	1108	2011	2.222	22.085			10/15/2011	9.94
Springer	S1108-78151	1108	2011	6.156	32.669			10/15/2011	5.31
Springer	S1108-78154	1108	2011	4.75	15.751			10/15/2011	3.32
Springer	S1108-78158	1108	2011	4.125	18.835			10/15/2011	4.57
Springer	S1108-78162	1108	2011	4.656	20.751			10/15/2011	4.46
Springer	S1108-78166	1108	2011	2.019	5.575			10/15/2011	2.76
Springer	s1060-49145	1060	2011	2.684	38.419			10/17/2011	14.31

Springer	s1060-49163	1060	2011	0.794	24.252			10/17/2011	30.54
Springer	S1048-29005	1048	2011	0.741	28.502			10/18/2011	38.46
Springer	S1048-29022	1048	2011	0.903	34.336			10/18/2011	38.02
Springer	S1048-29033	1048	2011	1.256	4.259			10/18/2011	3.39
Springer	S1048-29051	1048	2011	1.041	15.084			10/18/2011	14.49
Springer	S1048-29067	1048	2011	1.781	29.085			10/18/2011	16.33
Springer	S1048-29138	1048	2011	2.025	6.584			10/18/2011	3.25
Springer	S1048-29143	1048	2011	0.859	3.3			10/18/2011	3.84
Springer	S1048-29181	1048	2011	0.734	33.502			10/18/2011	45.64
Springer	S1048-29189	1048	2011	4.719	17.084			10/18/2011	3.62
Springer	S1048-29209	1048	2011	1.75	26.752			10/18/2011	15.29
Springer	S1048-29242	1048	2011	4.719	6.175			10/18/2011	1.31
Springer	S1108-80003	1108	2011	16.312	46.42			10/18/2011	2.85
Springer	S1108-80030	1108	2011	45	56.67			10/18/2011	1.26
Springer	S1108-79050	1108	2011	36.562	26.085			10/21/2011	0.71
Springer	S1108-79067	1108	2011	19.125	36.669			10/21/2011	1.92
Springer	S1108-79069	1108	2011	25.438	27.502			10/21/2011	1.08
Springer	S1108-79097	1108	2011	54.062	19.585			10/21/2011	0.36
Springer	S1108-79127	1108	2011	27	15.918			10/21/2011	0.59
Springer	S1108-79138	1108	2011	15.125	42.419			10/21/2011	2.80
Springer	S1108-79170	1108	2011	40.938	30.752			10/21/2011	0.75
Springer	S1108-79000	1108	2011	20.312	50.17			10/22/2011	2.47
Springer	S1108-79025	1108	2011	24.938	22.001			10/22/2011	0.88
Springer	S1108-82003	1108	2011	77.812	31.252			10/26/2011	0.40
Springer	S1108-81012	1108	2011	47.812	20.168			10/28/2011	0.42
Springer	S1108-81026	1108	2011	47.812	19.835			10/28/2011	0.41
Springer	S1108-81054	1108	2011	53.75	13.918			10/28/2011	0.26
Springer	s1120-79120	1120	2011	53.75	21.168			10/28/2011	0.39
Springer	s1108-85007	1108	2011	40.63	37.75			10/29/2011	0.93
Springer	S1048-29081	1048	2011	3.75	13.168			10/31/2011	3.51
Springer	S1048-29149	1048	2011	2.722	6.459			10/31/2011	2.37
Springer	S1048-29176	1048	2011	2.056	18.001			10/31/2011	8.76
Springer	S1048-29220	1048	2011	3.281	14.501			10/31/2011	4.42
Springer	S1048-29249	1048	2011	3.156	14.501			10/31/2011	4.59
Springer	s1096-71006	1096	2011	8.594	9.251			11/3/2011	1.08
Springer	s1096-71012	1096	2011	3.219	23.668			11/3/2011	7.35
Springer	s1096-71014	1096	2011	6.156	10.667			11/3/2011	1.73
Springer	s1096-71020	1096	2011	9.188	15.668			11/3/2011	1.71
Springer	s1096-71027	1096	2011	15.031	10.167			11/3/2011	0.68
Springer	s1096-71042	1096	2011	1.709	30.419			11/3/2011	17.80
Springer	s1096-71047	1096	2011	11.531	10.417			11/3/2011	0.90
Springer	s1096-71052	1096	2011	13.531	29.335			11/3/2011	2.17
Springer	s1096-71057	1096	2011	11.625	8.751			11/3/2011	0.75
Springer	s1096-71063	1096	2011	12.156	8.584			11/3/2011	0.71
Springer	s1096-71072	1096	2011	3.531	5.067			11/3/2011	1.44
Springer	s1096-71084	1096	2011	16.719	6.084			11/3/2011	0.36
Springer	s1096-71088	1096	2011	4.906	4.85			11/3/2011	0.99
Springer	S1048-33078	1048	2011	2.659	8.667			11/4/2011	3.26
Springer	S1048-33100	1048	2011	1.922	11.084			11/4/2011	5.77
Springer	S1048-33175	1048	2011	1.847	11.917			11/4/2011	6.45
Springer	S1096-73009	1096	2011	5.5	5.9			11/6/2011	1.07
Springer	S1096-73023	1096	2011	5.688	46.836			11/6/2011	8.23
Springer	S1096-73035	1096	2011	10.031	37.836			11/6/2011	3.77
Springer	S1096-73048	1096	2011	8.969	13.668			11/6/2011	1.52
Springer	S1108-84008	1108	2011	45.94	11			11/7/2011	0.24
Springer	S1108-84012	1108	2011	72.81	46.34			11/7/2011	0.64
Springer	S1108-84017	1108	2011	63.44	16			11/7/2011	0.25
Springer	S1108-84025	1108	2011	41.56	24.59			11/7/2011	0.59
Springer	S1108-84051	1108	2011	82.19	32.25			11/7/2011	0.39
Springer	S1108-84062	1108	2011	12.38	62.17			11/7/2011	5.02
Springer	S1108-84118	1108	2011	9.09	41.84			11/7/2011	4.60
Springer	S1108-84139	1108	2011	38.44	11.5			11/7/2011	0.30
Springer	S1108-84145	1108	2011	31	17.17			11/7/2011	0.55
Springer	S1048-32030	1048	2011	1.169	5.959			11/13/2011	5.10
Springer	S1048-32035	1048	2011	1.294	6.317			11/13/2011	4.88
Springer	S1048-32055	1048	2011	0.922	2.333			11/13/2011	2.53
Springer	S1048-32077	1048	2011	0.684	6.3			11/13/2011	9.21
Springer	S1048-32084	1048	2011	1.294	11.751			11/13/2011	9.08
Springer	S1048-32117	1048	2011	2.106	4.425			11/13/2011	2.10
Springer	S1048-32131	1048	2011	1.062	3.534			11/13/2011	3.33
Springer	S1096-72002	1096	2011	16.781	14.168			11/15/2011	0.84
Springer	S1096-72013	1096	2011	11.031	10.917			11/15/2011	0.99
Springer	S1096-72019	1096	2011	10.156	13.084			11/15/2011	1.29
Springer	S1096-72029	1096	2011	7.906	11.501			11/15/2011	1.45
Springer	S1096-72040	1096	2011	9.188	16.001			11/15/2011	1.74
Springer	S1096-72052	1096	2011	10.062	20.001			11/15/2011	1.99
Springer	S1096-72054	1096	2011	7.812	13.251			11/15/2011	1.70
Springer	S1096-72060	1096	2011	8.188	10.834			11/15/2011	1.32
Springer	S1096-72064	1096	2011	4.781	7.234			11/15/2011	1.51
Springer	S1096-72076	1096	2011	9.844	14.584			11/15/2011	1.48
Springer	S1096-72080	1096	2011	5.125	7.601			11/15/2011	1.48
Springer	S1096-72084	1096	2011	16.969	41.586			11/15/2011	2.45
Springer	S1096-72086	1096	2011	11.781	36.086			11/15/2011	3.06
Springer	S1096-72096	1096	2011	17.469	29.002			11/15/2011	1.66
Springer	S1096-72100	1096	2011	23.812	18.835			11/15/2011	0.79
Springer	S1096-72102	1096	2011	3.625	28.835			11/15/2011	7.95
Springer	S1096-72110	1096	2011	13.344	20.001			11/15/2011	1.50
Springer	S1096-72115	1096	2011	5.281	20.501			11/15/2011	3.88
Springer	S1096-72119	1096	2011	7.531	18.668			11/15/2011	2.48
Springer	S1096-72123	1096	2011	7.25	32.335			11/15/2011	4.46
Springer	S1096-72127	1096	2011	6.406	18.001			11/15/2011	2.81
Springer	S1096-72131	1096	2011	14.5	16.084			11/15/2011	1.11
Springer	S1096-72135	1096	2011	10.031	20.335			11/15/2011	2.03
Springer	S1096-72138	1096	2011	3.088	6.992			11/15/2011	2.26
Springer	s1036-16003	1036	2011	3.438	13.334			11/17/2011	3.88
Springer	s1036-16060	1036	2011	3.009	14.751			11/17/2011	4.90
Springer	s1048-33123	1048	2011	1.478	47.003			11/17/2011	31.80
Springer	s1048-33135	1048	2011	5.906	30.002			11/17/2011	5.08
Springer	s1048-33219	1048	2011	1.291	15.834			11/17/2011	12.26
Springer	s1048-33232	1048	2011	1.081	21.168			11/17/2011	19.58
Springer	S1036-18069	1036	2011	2.322	10.167			11/22/2011	4.38
Springer	s1096-74000	1096	2011	15.625	82.505			11/23/2011	5.28
Springer	s1096-74008	1096	2011	28.781	52.67			11/23/2011	1.83
Springer	s1096-74017	1096	2011	36.562	58.004			11/23/2011	1.59
Springer	s1096-74023	1096	2011	17.125	54.254			11/23/2011	3.17
Springer	S1048-34009	1048	2011	1.191	6.409			11/24/2011	5.38
Springer	S1048-34021	1048	2011	1.397	12.668			11/24/2011	9.07
Springer	S1048-34106	1048	2011	1.081	8.501			11/24/2011	7.86
Springer	S1048-34163	1048	2011	0.922	6.775			11/24/2011	7.35
Springer	S1048-34242	1048	2011	1.969	5.809			11/24/2011	2.95
Springer	S1048-34248	1048	2011	1.703	19.001			11/24/2011	11.16
Springer	s1108-82039	1108	2011	39.688	15.501			11/26/2011	0.39
Springer	s1108-83001	1108	2011	31.562	22.335			11/26/2011	0.71
Springer	s1108-83013	1108	2011	15.906	31.085			11/26/2011	1.95
Springer	s1108-83025	1108	2011	2.034	23.002			11/26/2011	11.31
Springer	S1108-87100	1108	2011	34.688	19.418			11/27/2011	0.56
Springer	S1108-87123	1108	2011	12.625	16.834			11/27/2011	1.33
Springer	S1108-87130	1108	2011	74.688	13.834			11/27/2011	0.19
Springer	S1108-87167	1108	2011	45.625	23.752			11/27/2011	0.52
Springer	S1108-87177	1108	2011	28.281	26.085			11/27/2011	0.92
Springer	S1108-87207	1108	2011	30.156	32.919			11/27/2011	1.09
Springer	S1036-17011	1036	2011	3.5	27.335			12/2/2011	7.81
Springer	S1036-17039	1036	2011	2.078	4.525			12/2/2011	2.18
Springer	S1036-17101	1036	2011	2.019	12.918			12/2/2011	6.40
Springer	S1096-75029	1096	2011	43.75	66.004			12/4/2011	1.51
Springer	S1096-75035	1096	2011	7.094	34.669			12/4/2011	4.89
Springer	S1096-75052	1096	2011	26.906	52.003			12/4/2011	1.93
Springer	S1096-75070	1096	2011	39.688	10.584			12/4/2011	0.27
Springer	S1096-75078	1096	2011	22.906	37.836			12/4/2011	1.65
Springer	S1096-75086	1096	2011	6.375	49.42			12/4/2011	7.75
Springer	S1096-75091	1096	2011	8.562	32.752			12/4/2011	3.83
Springer	S1096-75096	1096	2011	21.219	46.336			12/4/2011	2.18
Springer	S1096-75108	1096	2011	13.125	16.668			12/4/2011	1.27
Springer	S1096-75115	1096	2011	7	9.584			12/4/2011	1.37
Springer	S1096-75121	1096	2011	13.75	21.918			12/4/2011	1.59
Springer	S1096-75505	1096	2011	10.844	22.501			12/4/2011	2.07
Springer	S1096-75526	1096	2011	69.062	57.587			12/4/2011	0.83
Springer	S1036-22115	1036	2011	1.606	3.3			12/14/2011	2.05
Springer	S1036-22140	1036	2011	2.25	14.001			12/14/2011	6.22
Springer	S1036-22154	1036	2011	2.144	27.168			12/14/2011	12.67
Springer	S1036-22170	1036	2011	1.2	20.251			12/14/2011	16.88
Springer	S1036-22185	1036	2011	6.531	6.284			12/14/2011	0.96
Springer	S1036-22211	1036	2011	2.934	40.503			12/14/2011	13.80
Springer	S1096-76022	1096	2011	38.75	14.668			12/22/2011	0.38
Springer	S1096-76056	1096	2011	21.418	31.562			12/22/2011	1.47
Springer	S1096-76089	1096	2011	15.918	70.938			12/22/2011	4.46
Springer	S1096-76229	1096	2011	11.094	41.669			12/22/2011	3.76
Springer	S1036-26281	1036	2011	0.809	12.501			12/28/2011	15.45
Springer	S1048-36097	1048	2011	3.05	13.334			12/28/2011	4.37
Springer	S1048-36162	1048	2011	1.516	14.668			12/28/2011	9.68
Springer	S1048-36192	1048	2011	1.081	7.075			12/28/2011	6.54
Springer	S1096-77283	1096	2012	43.438	39.336			1/1/2012	0.91
Springer	S1096-77290	1096	2012	66.25	14.084			1/1/2012	0.21
Springer	S1096-77297	1096	2012	4.719	8.417			1/1/2012	1.78
Springer	S1096-77301	1096	2012	1.266	39.586			1/1/2012	31.27
Springer	S1096-77344	1096	2012	72.5	13.001			1/1/2012	0.18
Springer	S1096-77351	1096	2012	85.625	13.251			1/1/2012	0.15
Springer	S1096-77357	1096	2012	7.375	56.587			1/1/2012	7.67
Springer	S1048-36202	1048	2012	1.175	28.085			1/4/2012	23.90
Springer	S1048-36206	1048	2012	0.738	57.42			1/4/2012	77.80
Springer	S1048-36224	1048	2012	2.078	18.251			1/4/2012	8.78
Springer	S1036-28107	1036	2012	2.244	13.751			1/5/2012	6.13
Springer	S1036-28132	1036	2012	2.447	33.752			1/5/2012	13.79
Springer	S1036-28212	1036	2012	2.65	14.918			1/5/2012	5.63
Springer	s1096-77276	1096	2012	25.312	43.92			1/7/2012	1.74
Springer	s1096-77338	1096	2012	48.75	54.837			1/7/2012	1.12
Springer	s1096-77386	1096	2012	45	24.418			1/7/2012	0.54
Springer	s1096-77401	1096	2012	35.938	24.668			1/7/2012	0.69
Springer	S1084-71013	1084	2012	5.656	2.317	0.028	0.181	1/11/2012	0.41
Springer	S1084-71027	1084	2012	16.469	30.002	0.36	0.527	1/11/2012	1.82
Springer	S1084-71030	1084	2012	9.719	19.085	0.229	0.311	1/11/2012	1.96
Springer	S1084-71032	1084	2012	7.312	12.251	0.147	0.234	1/11/2012	1.68
Springer	S1084-71034	1084	2012	6.375	39.419	0.473	0.204	1/11/2012	6.18
Springer	S1084-71044	1084	2012	17.531	14.418	0.173	0.561	1/11/2012	0.82
Springer	S1084-71048	1084	2012	5.969	13.584	0.163	0.191	1/11/2012	2.28
Springer	S1084-71058	1084	2012	11.469	7.634	0.092	0.367	1/11/2012	0.67
Springer	S1084-71067	1084	2012	7.75	7.901	0.095	0.248	1/11/2012	1.02
Springer	S1084-71072	1084	2012	8.344	20.335	0.244	0.267	1/11/2012	2.44
Springer	S1084-71089	1084	2012	4.625	9.167	0.11	0.148	1/11/2012	1.98
Springer	S1084-71092	1084	2012	9.688	10.917	0.131	0.31	1/11/2012	1.13

Springer	s1036-30188	1036	2012	4.312	34.502			1/12/2012	8.00
Springer	s1036-30221	1036	2012	4.406	17.668			1/12/2012	4.01
Springer	S1084-70000	1084	2012	12.688	56.17	0.674	0.406	1/15/2012	4.43
Springer	S1084-70303	1084	2012	9.062	57.837	0.694	0.29	1/15/2012	6.38
Springer	S1084-70306	1084	2012	17.938	47.253	0.567	0.574	1/15/2012	2.63
Springer	S1084-70331	1084	2012	13.562	29.419	0.353	0.434	1/15/2012	2.17
Springer	S1084-70336	1084	2012	7.312	16.918	0.203	0.234	1/15/2012	2.31
Springer	S1084-70403	1084	2012	5.781	45.503	0.546	0.185	1/15/2012	7.87
Springer	S1084-70405	1084	2012	5.031	6.134	0.074	0.161	1/15/2012	1.22
Springer	S1084-70407	1084	2012	8.094	8.584	0.103	0.259	1/15/2012	1.06
Springer	S1084-70409	1084	2012	5.594	15.251	0.183	0.179	1/15/2012	2.73
Springer	S1084-70411	1084	2012	8.656	29.085	0.349	0.277	1/15/2012	3.36
Springer	S1084-70415	1084	2012	5.562	22.668	0.272	0.178	1/15/2012	4.08
Springer	S1084-70454	1084	2012	2.206	18.335	0.22	0.071	1/15/2012	8.31
Springer	S1084-70458	1084	2012	3.969	39.253	0.471	0.127	1/15/2012	9.89
Springer	S1084-70462	1084	2012	10.438	21.751	0.261	0.334	1/15/2012	2.08
Springer	S1084-70466	1084	2012	5.031	19.668	0.236	0.161	1/15/2012	3.91
Springer	S1084-70522	1084	2012	7.188	8.326	0.1	0.23	1/15/2012	1.16
Springer	S1084-70537	1084	2012	5.469	8.417	0.101	0.175	1/15/2012	1.54
Springer	S1036-30109	1036	2012	2.266	33.252			1/16/2012	14.67
Springer	S1036-30118	1036	2012	2.856	13.668			1/16/2012	4.79
Springer	S1036-30148	1036	2012	6	18.418			1/16/2012	3.07
Springer	S1036-30152	1036	2012	16	42.503			1/16/2012	2.66
Springer	S1036-30180	1036	2012	0.55	14.918			1/16/2012	27.12
Springer	S1036-33000	1036	2012	2.809	25.502			1/22/2012	9.08
Springer	S1036-33089	1036	2012	1.306	5.117			1/22/2012	3.92
Springer	S1036-33102	1036	2012	2.253	3.525			1/22/2012	1.56
Springer	S1036-33109	1036	2012	1.172	12.417			1/22/2012	10.59
Springer	S1036-35041	1036	2012	7.375	17.585			1/22/2012	2.38
Springer	S1036-35045	1036	2012	1.306	10.917			1/22/2012	8.36
Springer	S1024-17014	1024	2012	0.875	37.669			1/26/2012	43.05
Springer	S1024-17055	1024	2012	2.147	41.169			1/26/2012	19.18
Springer	S1036-34101	1036	2012	4.125	26.168			1/29/2012	6.34
Springer	S1084-72015	1084	2012	10.75	19.418	0.233	0.344	1/30/2012	1.81
Springer	S1084-72025	1084	2012	0.844	57.254	0.687	0.027	1/30/2012	67.84
Springer	S1084-72035	1084	2012	2.841	22.418	0.269	0.091	1/30/2012	7.89
Springer	S1084-72045	1084	2012	28.062	20.418	0.245	0.898	1/30/2012	0.73
Springer	S1084-72052	1084	2012	18.438	21.001	0.252	0.59	1/30/2012	1.14
Springer	S1084-72063	1084	2012	6.375	27.669	0.332	0.204	1/30/2012	4.34
Springer	S1084-72074	1084	2012	39.062	10.917	0.131	1.25	1/30/2012	0.28
Springer	S1084-72156	1084	2012	2.697	10.917	0.131	0.086	1/30/2012	4.05
Springer	S1084-72159	1084	2012	2.819	11.167	0.134	0.09	1/30/2012	3.96
Springer	S1084-72176	1084	2012	1.366	5	0.06	0.044	1/30/2012	3.66
Springer	S1084-72179	1084	2012	1.131	8.667	0.104	0.036	1/30/2012	7.66
Springer	S1084-72191	1084	2012	1.353	13.834	0.166	0.043	1/30/2012	10.22
Springer	S1084-72194	1084	2012	6.406	15.584	0.187	0.205	1/30/2012	2.43
Springer	S1084-72207	1084	2012	6.344	17.418	0.209	0.203	1/30/2012	2.75
Springer	S1084-72210	1084	2012	3.938	41.419	0.497	0.126	1/30/2012	10.52
Springer	S1084-72223	1084	2012	8.062	40.586	0.487	0.258	1/30/2012	5.03
Springer	S1084-72226	1084	2012	16.719	22.335	0.268	0.535	1/30/2012	1.34
Springer	S1084-72231	1084	2012	17.438	15.001	0.18	0.558	1/30/2012	0.86
Springer	S1084-72251	1084	2012	11	18.085	0.217	0.352	1/30/2012	1.64
Springer	S1084-72254	1084	2012	11.438	29.169	0.35	0.366	1/30/2012	2.55
Springer	S1084-72264	1084	2012	11.031	8.751	0.105	0.353	1/30/2012	0.79
Springer	S1084-72282	1084	2012	14.438	12.501	0.15	0.462	1/30/2012	0.87
Springer	S1036-34052	1036	2012	2.288	13.418			1/31/2012	5.86
Springer	S1084-73006	1084	2012	70.625	13.418	0.161	2.26	2/5/2012	0.19
Springer	S1084-73033	1084	2012	62.5	22.835	0.274	2	2/5/2012	0.37
Springer	S1084-73057	1084	2012	39.688	11.417	0.137	1.27	2/5/2012	0.29
Springer	S1036-37115	1036	2012	3.066	7.859			2/6/2012	2.56
Springer	S1036-37152	1036	2012	3.078	6.6			2/6/2012	2.14
Springer	S1036-37163	1036	2012	1.472	8.009			2/6/2012	5.44
Springer	S1036-37189	1036	2012	1.45	6.067			2/6/2012	4.18
Springer	S1036-37196	1036	2012	0.878	9.917			2/6/2012	11.29
Springer	S1084-72101	1084	2012	36.562	30.585	0.367	1.17	2/8/2012	0.84
Springer	S1084-74019	1084	2012	9.625	20.251	0.243	0.308	2/8/2012	2.10
Springer	S1084-74022	1084	2012	19.75	16.334	0.196	0.632	2/8/2012	0.83
Springer	S1084-74032	1084	2012	68.438	29.252	0.351	2.19	2/8/2012	0.43
Springer	S1084-74037	1084	2012	49.688	17.084	0.205	1.59	2/8/2012	0.34
Springer	S1084-74049	1084	2012	12.031	20.585	0.247	0.385	2/8/2012	1.71
Springer	S1084-74079	1084	2012	26.844	21.668	0.26	0.859	2/8/2012	0.81
Springer	S1084-74083	1084	2012	50	14.501	0.174	1.6	2/8/2012	0.29
Springer	S1084-74087	1084	2012	62.188	11.584	0.139	1.99	2/8/2012	0.19
Springer	S1084-74110	1084	2012	9.969	20.751	0.249	0.319	2/8/2012	2.08
Springer	S1084-74116	1084	2012	8.781	14.584	0.175	0.281	2/8/2012	1.66
Springer	S1084-76015	1084	2012	49.688	17.751	0.213	1.59	2/10/2012	0.36
Springer	S1084-76096	1084	2012	2.425	23.002	0.276	0.078	2/10/2012	9.49
Springer	S1084-75220	1084	2012	45.625	13.418	0.161	1.46	2/13/2012	0.29
Springer	S1084-75225	1084	2012	43.438	20.168	0.242	1.39	2/13/2012	0.46
Springer	S1084-75254	1084	2012	83.125	30.335	0.364	2.66	2/13/2012	0.36
Springer	S1084-75283	1084	2012	78.75	36.919	0.443	2.52	2/13/2012	0.47
Springer	S1072-59008	1072	2012	7.719	5.925			2/15/2012	0.77
Springer	S1072-59016	1072	2012	3.109	7.1			2/15/2012	2.28
Springer	S1072-59090	1072	2012	5.062	3.317			2/15/2012	0.66
Springer	S1072-59097	1072	2012	8.156	13.084			2/15/2012	1.60
Springer	S1072-59148	1072	2012	11.344	15.834			2/15/2012	1.40
Springer	S1084-75004	1084	2012	19.781	22.251	0.267	0.633	2/15/2012	1.12
Springer	S1084-75123	1084	2012	75.312	69.838	0.838	2.41	2/15/2012	0.93
Springer	S1084-75128	1084	2012	20.406	20.001	0.24	0.653	2/15/2012	0.98
Springer	S1024-19101	1024	2012	8.438	40.419			2/18/2012	4.79
Springer	S1024-19117	1024	2012	16.781	22.668			2/18/2012	1.35
Springer	S1024-19129	1024	2012	21.969	49.753			2/18/2012	2.26
Springer	S1024-19202	1024	2012	2.556	24.918			2/18/2012	9.75
Springer	S1024-19300	1024	2012	2.006	20.001			2/18/2012	9.97
Springer	S1024-23022	1024	2012	3.406	24.585			2/22/2012	7.22
Springer	S1024-23038	1024	2012	1.566	29.669			2/22/2012	18.95
Springer	S1036-39021	1036	2012	0.709	4.167			2/23/2012	5.88
Springer	S1036-39030	1036	2012	2.131	13.501			2/23/2012	6.34
Springer	S1036-39091	1036	2012	1.459	20.918			2/23/2012	14.34
Springer	S1072-60000	1072	2012	3.312	14.751			2/24/2012	4.45
Springer	S1072-60013	1072	2012	3.438	22.001			2/24/2012	6.40
Springer	S1072-60019	1072	2012	0.319	18.501			2/24/2012	58.00
Springer	S1072-60034	1072	2012	0.469	16.584			2/24/2012	35.36
Springer	S1072-60038	1072	2012	0.853	42.92			2/24/2012	50.32
Springer	S1072-60058	1072	2012	1.362	16.918			2/24/2012	12.42
Springer	S1072-60061	1072	2012	3.875	16.751			2/24/2012	4.32
Springer	S1072-60069	1072	2012	3.156	32.252			2/24/2012	10.22
Springer	S1072-60084	1072	2012	4.438	41.753			2/24/2012	9.41
Springer	S1072-60090	1072	2012	1.241	54.17			2/24/2012	43.65
Springer	S1072-60110	1072	2012	0.844	45.086			2/24/2012	53.42
Springer	S1072-60122	1072	2012	19.25	31.169			2/24/2012	1.62
Springer	S1072-60125	1072	2012	7.062	13.418			2/24/2012	1.90
Springer	S1072-60133	1072	2012	2.431	42.419			2/24/2012	17.45
Springer	S1036-40106	1036	2012	0.356	15.251			2/26/2012	42.84
Springer	S1036-40113	1036	2012	0.334	45.586			2/26/2012	136.49
Springer	S1036-40149	1036	2012	0.809	8.667			2/26/2012	10.71
Springer	S1036-40220	1036	2012	0.606	11.751			2/26/2012	19.39
Springer	S1036-40227	1036	2012	0.819	16.251			2/26/2012	19.84
Springer	S1060-52021	1060	2012	34.062	12.167			3/2/2012	0.36
Springer	S1060-52026	1060	2012	5.219	10.334			3/2/2012	1.98
Springer	S1060-52030	1060	2012	7.969	43.753			3/2/2012	5.49
Springer	S1060-52045	1060	2012	4.531	51.67			3/2/2012	11.40
Springer	S1060-52049	1060	2012	3.938	48.337			3/2/2012	12.27
Springer	S1072-60167	1072	2012	5.969	14.918			3/3/2012	2.50
Springer	S1072-60188	1072	2012	7.281	30.335			3/3/2012	4.17
Springer	S1072-60211	1072	2012	1.653	8.751			3/3/2012	5.29
Springer	S1072-60214	1072	2012	4.688	17.668			3/3/2012	3.77
Springer	S1072-60239	1072	2012	1.416	8.334			3/3/2012	5.89
Springer	S1072-60242	1072	2012	7.312	11.501			3/3/2012	1.57
Springer	S1072-60259	1072	2012	3.406	8.334			3/3/2012	2.45
Springer	S1072-60266	1072	2012	1.712	5.909			3/3/2012	3.45
Springer	S1072-60288	1072	2012	1.212	20.001			3/3/2012	16.50
Springer	S1072-60295	1072	2012	6.219	35.336			3/3/2012	5.68
Springer	S1072-60316	1072	2012	5.062	14.751			3/3/2012	2.91
Springer	S1072-60319	1072	2012	6.781	61.171			3/3/2012	9.02
Springer	S1024-22069	1024	2012	8.938	20.751			3/6/2012	2.32
Springer	S1024-22120	1024	2012	2.431	20.668			3/6/2012	8.50
Springer	S1024-22299	1024	2012	1.194	23.918			3/6/2012	20.03
Springer	S1024-26004	1024	2012	2.15	34.252			3/9/2012	15.93
Springer	S1024-26062	1024	2012	3.656	25.918			3/9/2012	7.09
Springer	S1024-26066	1024	2012	4.031	25.668			3/9/2012	6.37
Springer	S1072-61008	1072	2012	9.625	23.335			3/17/2012	2.42
Springer	S1072-61014	1072	2012	15.656	41.836			3/17/2012	2.67
Springer	S1072-61032	1072	2012	6.031	34.086			3/17/2012	5.65
Springer	S1072-61045	1072	2012	12.094	15.584			3/17/2012	1.29
Springer	S1072-61047	1072	2012	17.844	18.501			3/17/2012	1.04
Springer	S1072-61069	1072	2012	3.875	19.668			3/17/2012	5.08
Springer	S1072-61073	1072	2012	9.938	32.002			3/17/2012	3.22
Springer	S1072-61082	1072	2012	15.25	15.834			3/17/2012	1.04
Springer	S1072-61107	1072	2012	28.938	27.919			3/17/2012	0.96
Springer	S1072-61119	1072	2012	13.156	11.251			3/17/2012	0.86
Springer	S1072-61123	1072	2012	23.594	16.001			3/17/2012	0.68
Springer	S1072-62027	1072	2012	40.938	12.501			3/17/2012	0.31
Springer	S1072-62028	1072	2012	66.25	6.184			3/17/2012	0.09
Springer	S1072-62078	1072	2012	8.688	63.838			3/17/2012	7.35
Springer	S1072-62082	1072	2012	70.938	24.168			3/17/2012	0.34
Springer	S1072-62108	1072	2012	65.312	17.334			3/17/2012	0.27
Springer	S1072-62120	1072	2012	45.938	7.609			3/17/2012	0.17
Springer	S1072-62150	1072	2012	76.562	19.835			3/17/2012	0.26
Springer	S1072-62166	1072	2012	50.312	18.835			3/17/2012	0.37
Springer	S1072-62171	1072	2012	2.159	53.837			3/17/2012	24.94
Springer	S1072-63024	1072	2012	8.625	18.918			3/19/2012	2.19
Springer	S1072-63045	1072	2012	1.997	12.668			3/19/2012	6.34
Springer	S1060-53044	1060	2012	12.25	6.017			3/22/2012	0.49
Springer	S1060-53069	1060	2012	10.812	15.834			3/22/2012	1.46
Springer	S1060-53099	1060	2012	1.491	4.75			3/22/2012	3.19
Springer	S1060-53126	1060	2012	12.062	23.335			3/22/2012	1.93
Springer	S1060-53901	1060	2012	6.875	18.335			3/22/2012	2.67
Springer	S1060-53908	1060	2012	7.062	20.001			3/22/2012	2.83
Springer	S1060-53914	1060	2012	19.281	17.835			3/22/2012	0.93
Springer	S1048-40023	1048	2012	2.891	34.086			3/23/2012	11.79
Springer	S1048-40045	1048	2012	4.312	66.588			3/23/2012	15.44
Springer	S1048-40060	1048	2012	3.469	18.585			3/23/2012	5.36
Springer	S1048-40074	1048	2012	8.875	26.668			3/23/2012	3.00
Springer	S1048-40096	1048	2012	2.219	52.503			3/23/2012	23.66
Springer	S1048-40126	1048	2012	3.781	45.253			3/23/2012	11.97
Springer	S1048-40149	1048	2012	3.562	36.586			3/23/2012	10.27
Springer	S1048-40156	1048	2012	4.375	13.918			3/23/2012	3.18
Springer	S1072-66103	1072	2012	3.5	26.002			3/24/2012	7.43
Springer	S1072-66106	1072	2012	0.775	17.001			3/24/2012	21.94

Springer	S1072-66110	1072	2012	33.75	16.584			3/24/2012	0.49
Springer	S1072-66115	1072	2012	76.25	27.168			3/24/2012	0.36
Springer	S1072-66120	1072	2012	62.188	27.335			3/24/2012	0.44
Springer	S1072-66155	1072	2012	12.281	19.501			3/24/2012	1.59
Springer	S1072-66158	1072	2012	52.188	26.668			3/24/2012	0.51
Springer	S1072-66162	1072	2012	60.938	22.001			3/24/2012	0.36
Springer	S1072-66167	1072	2012	76.25	36.502			3/24/2012	0.48
Springer	S1072-67100	1072	2012	7.812	39.586			4/1/2012	5.07
Springer	S1072-67106	1072	2012	22.062	37.086			4/1/2012	1.68
Springer	S1072-67112	1072	2012	29.812	35.252			4/1/2012	1.18
Springer	S1072-67144	1072	2012	10.312	14.084			4/1/2012	1.37
Springer	S1072-67149	1072	2012	23.875	40.669			4/1/2012	1.70
Springer	S1072-67156	1072	2012	57.812	16.668			4/1/2012	0.29
Springer	S1072-68018	1072	2012	8.406	20.418			4/1/2012	2.43
Springer	S1072-68026	1072	2012	4.812	15.834			4/1/2012	3.29
Springer	S1072-68103	1072	2012	8.875	25.668			4/1/2012	2.89
Springer	S1072-68107	1072	2012	5.656	36.919			4/1/2012	6.53
Springer	S1072-68110	1072	2012	9.969	72.755			4/1/2012	7.30
Springer	S1072-68127	1072	2012	9.25	17.168			4/1/2012	1.86
Springer	S1072-68132	1072	2012	6	13.584			4/1/2012	2.26
Springer	S1072-68134	1072	2012	7.406	8.301			4/1/2012	1.12
Springer	S1072-68137	1072	2012	9.625	7.642			4/1/2012	0.79
Springer	S1072-68144	1072	2012	10.25	10.834			4/1/2012	1.06
Springer	S1072-68149	1072	2012	9.688	36.586			4/1/2012	3.78
Springer	S1072-65021	1072	2012	29.656	35.252			4/2/2012	1.19
Springer	S1072-65048	1072	2012	25.844	32.252			4/2/2012	1.25
Springer	S1072-65075	1072	2012	5.219	18.668			4/2/2012	3.58
Springer	S1072-65102	1072	2012	5.406	31.335			4/2/2012	5.80
Springer	S1048-41104	1048	2012	7.312	6.642			4/3/2012	0.91
Springer	S1048-41112	1048	2012	37.188	61.337			4/3/2012	1.65
Springer	S1048-41131	1048	2012	8.375	37.586			4/3/2012	4.49
Springer	S1048-41151	1048	2012	3.406	13.751			4/3/2012	4.04
Springer	S1048-41167	1048	2012	2.569	13.834			4/3/2012	5.38
Springer	S1048-41179	1048	2012	5.719	47.587			4/3/2012	8.32
Springer	S1048-41192	1048	2012	3.625	36.252			4/3/2012	10.00
Springer	S1048-41198	1048	2012	2.319	35.586			4/3/2012	15.35
Springer	S1048-41219	1048	2012	1.972	74.588			4/3/2012	37.82
Springer	S1048-41223	1048	2012	13.188	32.502			4/3/2012	2.46
Springer	S1048-43035	1048	2012	8.781	18.335			4/8/2012	2.09
Springer	S1048-43041	1048	2012	4.156	23.085			4/8/2012	5.55
Springer	S1048-43053	1048	2012	2.753	77.672			4/8/2012	28.21
Springer	S1048-43060	1048	2012	2.034	13.418			4/8/2012	6.60
Springer	S1048-43104	1048	2012	17.406	18.418			4/8/2012	1.06
Springer	S1048-43109	1048	2012	4.219	25.002			4/8/2012	5.93
Springer	S1048-43112	1048	2012	12.969	37.336			4/8/2012	2.88
Springer	S1048-43134	1048	2012	24.875	9.501			4/8/2012	0.38
Springer	S1060-54001	1060	2012	1.094	0.942			4/14/2012	0.86
Springer	S1060-54007	1060	2012	5.25	18.751			4/14/2012	3.57
Springer	S1060-54019	1060	2012	4.844	21.918			4/14/2012	4.52
Springer	S1060-54022	1060	2012	5.781	6.025			4/14/2012	1.04
Springer	S1060-54025	1060	2012	6.188	24.585			4/14/2012	3.97
Springer	S1060-54038	1060	2012	1.566	15.084			4/14/2012	9.63
Springer	S1060-54042	1060	2012	3.719	8.584			4/14/2012	2.31
Springer	S1060-54045	1060	2012	5.438	38.586			4/14/2012	7.10
Springer	S1060-54048	1060	2012	3.281	6.909			4/14/2012	2.11
Springer	S1060-54050	1060	2012	4.062	11.334			4/14/2012	2.79
Springer	S1060-54068	1060	2012	2.806	26.002			4/14/2012	9.27
Springer	S1060-54075	1060	2012	3.969	12.834			4/14/2012	3.23
Springer	S1060-54079	1060	2012	13.219	35.836			4/14/2012	2.71
Springer	S1060-54082	1060	2012	25.312	44.92			4/14/2012	1.77
Springer	S1060-54086	1060	2012	4.344	14.084			4/14/2012	3.24
Springer	S1060-54089	1060	2012	3.122	10.167			4/14/2012	3.26
Springer	S1060-54093	1060	2012	4.375	8.417			4/14/2012	1.92
Springer	S1060-54095	1060	2012	3.312	21.501			4/14/2012	6.49
Springer	S1060-54109	1060	2012	1.319	13.668			4/14/2012	10.36
Springer	S1060-54115	1060	2012	2.241	28.835			4/14/2012	12.87
Springer	S1060-54118	1060	2012	3.875	11.084			4/14/2012	2.86
Springer	S1060-54126	1060	2012	1.681	2.25			4/14/2012	1.34
Springer	S1060-54133	1060	2012	3.969	7.734			4/14/2012	1.95
Springer	S1060-54518	1060	2012	2.544	13.668			4/14/2012	5.37
Springer	S1060-54603	1060	2012	23.938	28.502			4/14/2012	1.19
Springer	S1024-30108	1024	2012	3.688	19.251			4/20/2012	5.22
Springer	S1024-30117	1024	2012	2.234	9.834			4/20/2012	4.40
Springer	S1024-30129	1024	2012	1.222	13.501			4/20/2012	11.05
Springer	S1024-30141	1024	2012	0.856	5.834			4/20/2012	6.82
Springer	S1024-30179	1024	2012	1.575	4.625			4/20/2012	2.94
Springer	S1024-30192	1024	2012	1.097	16.084			4/20/2012	14.66
Springer	S1024-30206	1024	2012	1.091	8.292			4/20/2012	7.60
Springer	S1024-30212	1024	2012	1.003	9.501			4/20/2012	9.47
Springer	S1060-55003	1060	2012	4.219	43.086			4/20/2012	10.21
Springer	S1060-55014	1060	2012	1.55	28.252			4/20/2012	18.23
Springer	S1060-55031	1060	2012	2.972	48.42			4/20/2012	16.29
Springer	S1060-55037	1060	2012	2	17.418			4/20/2012	8.71
Springer	S1060-55042	1060	2012	9.25	27.085			4/20/2012	2.93
Springer	S1060-55069	1060	2012	7.844	25.918			4/20/2012	3.30
Springer	S1060-55074	1060	2012	8.906	33.836			4/20/2012	3.80
Springer	S1060-55082	1060	2012	1.631	41.419			4/20/2012	25.39
Springer	S1060-55086	1060	2012	0.309	46.086			4/20/2012	149.15
Springer	S1060-55098	1060	2012	7.188	21.751			4/20/2012	3.03
Springer	S1060-55113	1060	2012	0.562	52.087			4/20/2012	92.68
Springer	S1060-55126	1060	2012	12.562	29.002			4/20/2012	2.31
Springer	S1060-55137	1060	2012	2.269	31.252			4/20/2012	13.77
Springer	S1060-55140	1060	2012	8.062	21.585			4/20/2012	2.68
Springer	S1060-55143	1060	2012	11.969	11.501			4/20/2012	0.96
Springer	S1060-55156	1060	2012	9.75	10.834			4/20/2012	1.11
Springer	S1060-55201	1060	2012	12.344	17.751			4/20/2012	1.44
Springer	S1060-55204	1060	2012	9.125	16.418			4/20/2012	1.80
Springer	S1060-55225	1060	2012	8.031	19.668			4/20/2012	2.45
Springer	S1060-55228	1060	2012	13.125	25.418			4/20/2012	1.94
Springer	S1060-55060	1060	2012	10.594	49.92			4/23/2012	4.71
Springer	s1060-56009	1060	2012	6	12.167			4/23/2012	2.03
Springer	s1060-56021	1060	2012	10.375	11.584			4/23/2012	1.12
Springer	s1060-56036	1060	2012	5.031	23.502			4/23/2012	4.67
Springer	s1060-56048	1060	2012	9.25	13.418			4/23/2012	1.45
Springer	s1060-56060	1060	2012	12.5	9.001			4/23/2012	0.72
Springer	S1060-56088	1060	2012	4.625	25.752			4/26/2012	5.57
Springer	S1060-58008	1060	2012	18.125	38.503			4/26/2012	2.12
Springer	S1060-58029	1060	2012	35.625	40.253			4/26/2012	1.13
Springer	S1060-58047	1060	2012	32.5	54.587			4/26/2012	1.68
Springer	S1060-58083	1060	2012	43.438	23.835			4/26/2012	0.55
Springer	S1060-57202	1060	2012	5.5	15.584			4/28/2012	2.83
Springer	S1060-57206	1060	2012	5.281	5.125			4/28/2012	0.97
Springer	S1060-57210	1060	2012	3.969	15.918			4/28/2012	4.01
Springer	S1060-57215	1060	2012	6.656	23.252			4/28/2012	3.49
Springer	S1060-57219	1060	2012	10.344	39.003			4/28/2012	3.77
Springer	S1060-57243	1060	2012	0.922	2.759			4/28/2012	2.99
Springer	S1060-57246	1060	2012	11.688	30.252			4/28/2012	2.59
Springer	S1060-57250	1060	2012	11.062	17.668			4/28/2012	1.60
Springer	S1060-57254	1060	2012	6.469	12.251			4/28/2012	1.89
Springer	S1060-57258	1060	2012	6.906	32.335			4/28/2012	4.68
Springer	S1060-57302	1060	2012	9.031	6.809			4/28/2012	0.75
Springer	S1060-57324	1060	2012	8.094	6.625			4/28/2012	0.82
Springer	S1060-57344	1060	2012	8.469	18.001			4/28/2012	2.13
Springer	S1060-57387	1060	2012	14.5	9.751			4/28/2012	0.67
Springer	S1060-57400	1060	2012	33.125	14.751			4/28/2012	0.45
Springer	S1060-57425	1060	2012	29.875	13.334			4/28/2012	0.45
Springer	S1060-57428	1060	2012	13.062	9.167			4/28/2012	0.70
Springer	S1060-57437	1060	2012	28.062	14.084			4/28/2012	0.50
Springer	S1060-57450	1060	2012	20.688	47.837			4/28/2012	2.31
Springer	S1060-60009	1060	2012	100.312	35.836			4/30/2012	0.36
Springer	S1060-60018	1060	2012	33.125	20.585			4/30/2012	0.62
Springer	S1060-60030	1060	2012	4.188	17.751			4/30/2012	4.24
Springer	S1060-60042	1060	2012	5.125	22.918			4/30/2012	4.47
Springer	S1060-60054	1060	2012	2.719	21.168			4/30/2012	7.79
Springer	S1036-42006	1036	2012	2.034	27.168			5/1/2012	13.36
Springer	S1036-42019	1036	2012	1.762	42.086			5/1/2012	23.89
Springer	S1036-42026	1036	2012	5.906	19.668			5/1/2012	3.33
Springer	S1036-42050	1036	2012	2.559	18.585			5/1/2012	7.26
Springer	S1036-42054	1036	2012	5.344	27.669			5/1/2012	5.18
Springer	S1036-42085	1036	2012	3.375	21.501			5/1/2012	6.37
Springer	S1036-42090	1036	2012	1.962	16.751			5/1/2012	8.54
Springer	S1036-42102	1036	2012	6.125	26.585			5/1/2012	4.34
Springer	S1036-42126	1036	2012	2.025	33.752			5/1/2012	16.67
Springer	S1036-42130	1036	2012	2.834	27.919			5/1/2012	9.85
Springer	S1060-57315	1060	2012	14.844	9.501			5/5/2012	0.64
Springer	S1060-57318	1060	2012	9.562	14.084			5/5/2012	1.47
Springer	S1060-57339	1060	2012	34.062	14.084			5/5/2012	0.41
Springer	S1060-57342	1060	2012	14.719	8.917			5/5/2012	0.61
Springer	S1060-57370	1060	2012	18.688	13.084			5/5/2012	0.70
Springer	S1060-57382	1060	2012	15.281	11.751			5/5/2012	0.77
Springer	S1060-61109	1060	2012	62.188	18.168			5/5/2012	0.29
Springer	S1060-61112	1060	2012	4.344	5.642			5/5/2012	1.30
Springer	S1060-61115	1060	2012	72.812	23.502			5/5/2012	0.32
Springer	S1060-61219	1060	2012	57.188	18.251			5/5/2012	0.32
Springer	S1060-61276	1060	2012	35.625	40.003			5/5/2012	1.12
Springer	S1060-61279	1060	2012	30.562	30.502			5/5/2012	1.00
Springer	S1036-43110	1036	2012	1.294	22.918			5/7/2012	17.71
Springer	S1036-43114	1036	2012	5.406	35.252			5/7/2012	6.52
Springer	S1036-44029	1036	2012	3.625	49.587			5/14/2012	13.68
Springer	S1036-44042	1036	2012	1.841	32.919			5/14/2012	17.88
Springer	S1036-44071	1036	2012	4.281	28.085			5/14/2012	6.56
Springer	S1060-61015	1060	2012	58.44	48.25			5/14/2012	0.83
Springer	S1060-61035	1060	2012	55.625	44.086			5/14/2012	0.79
Springer	S1060-61051	1060	2012	17.094	6.892			5/14/2012	0.40
Springer	S1060-61061	1060	2012	4.938	21.918			5/14/2012	4.44
Springer	S1060-61136	1060	2012	95	30.502			5/14/2012	0.32
Springer	S1060-61172	1060	2012	52.188	9.751			5/14/2012	0.19
Springer	S1060-61260	1060	2012	83.438	22.835			5/14/2012	0.27
Springer	S1060-61193	1060	2012	67.5	20.418			5/17/2012	0.30
Springer	S1060-61196	1060	2012	38.438	18.335			5/17/2012	0.48
Springer	S1060-61247	1060	2012	7.781	13.584			5/17/2012	1.75
Springer	S1060-61250	1060	2012	2.078	23.752			5/17/2012	11.43
Springer	S1036-45009	1036	2012	1.509	19.835			5/19/2012	13.14
Springer	S1036-45013	1036	2012	2.303	39.419			5/19/2012	17.12
Springer	S1036-45046	1036	2012	6.688	29.085			5/19/2012	4.35
Springer	S1036-45056	1036	2012	1.316	34.586			5/19/2012	26.28
Springer	S1048-44015	1048	2012	10.812	46.42			5/20/2012	4.29
Springer	S1048-44019	1048	2012	8.812	23.085			5/20/2012	2.62
Springer	S1048-44024	1048	2012	2.969	9.584			5/20/2012	3.23
Springer	S1048-44036	1048	2012	2.866	2.942			5/20/2012	1.03

Springer	S1048-44039	1048	2012	4.75	18.918			5/20/2012	3.98
Springer	S1048-44066	1048	2012	2.006	10.501			5/20/2012	5.23
Springer	S1048-44069	1048	2012	5.125	40.919			5/20/2012	7.98
Springer	S1048-44081	1048	2012	3.656	55.754			5/20/2012	15.25
Springer	S1048-44084	1048	2012	26	38.586			5/20/2012	1.48
Springer	S1048-44086	1048	2012	44.375	12.334			5/20/2012	0.28
Springer	S1048-44097	1048	2012	41.875	52.003			5/20/2012	1.24
Springer	S1048-44100	1048	2012	15.438	17.835			5/20/2012	1.16
Springer	S1048-44108	1048	2012	27.281	26.668			5/20/2012	0.98
Springer	S1048-45013	1048	2012	1.328	35.252			5/24/2012	26.55
Springer	S1048-45016	1048	2012	2.228	13.668			5/24/2012	6.13
Springer	S1048-45019	1048	2012	1.575	26.335			5/24/2012	16.72
Springer	S1048-45023	1048	2012	3.812	10.834			5/24/2012	2.84
Springer	S1048-45036	1048	2012	1.684	22.668			5/24/2012	13.46
Springer	S1048-45052	1048	2012	1.328	9.334			5/24/2012	7.03
Springer	S1048-45055	1048	2012	4.031	12.001			5/24/2012	2.98
Springer	S1048-45079	1048	2012	2.447	30.002			5/24/2012	12.26
Springer	S1048-45095	1048	2012	1.309	37.669			5/24/2012	28.78
Springer	S1048-45098	1048	2012	1.784	36.752			5/24/2012	20.60
Springer	S1048-45101	1048	2012	1.966	20.251			5/24/2012	10.30
Springer	S1048-45104	1048	2012	1.472	18.501			5/24/2012	12.57
Springer	S1048-45146	1048	2012	4.062	27.418			5/24/2012	6.75
Springer	S1048-45149	1048	2012	9.688	57.754			5/24/2012	5.96
Springer	S1048-45152	1048	2012	0.675	75.338			5/24/2012	111.61
Springer	S1048-45155	1048	2012	1.269	69.505			5/24/2012	54.77
Springer	S1048-45158	1048	2012	7.062	32.419			5/24/2012	4.59
Springer	S1048-45185	1048	2012	5.75	25.085			5/24/2012	4.36
Springer	S1048-45188	1048	2012	7.125	32.752			5/24/2012	4.60
Springer	S1048-45191	1048	2012	9.906	52.253			5/24/2012	5.27
Springer	S1048-45194	1048	2012	1.962	59.837			5/24/2012	30.50
Springer	S1048-45198	1048	2012	9.406	46.253			5/24/2012	4.92
Springer	S1024-33021	1024	2012	0.991	14.751			5/28/2012	14.88
Springer	S1024-33029	1024	2012	1.588	50.253			5/28/2012	31.65
Springer	S1024-33058	1024	2012	0.978	15.501			5/28/2012	15.85
Springer	S1024-33083	1024	2012	3.25	20.335			5/28/2012	6.26
Springer	S1048-45216	1048	2012	0.675	5.65			5/30/2012	8.37
Springer	S1048-47028	1048	2012	4.344	11.334			5/30/2012	2.61
Springer	S1048-47030	1048	2012	4.062	16.584			5/30/2012	4.08
Springer	S1048-47033	1048	2012	0.325	25.168			5/30/2012	77.44
Springer	S1048-47036	1048	2012	6.938	29.502			5/30/2012	4.25
Springer	S1048-47039	1048	2012	6.5	72.505			5/30/2012	11.15
Springer	S1048-47042	1048	2012	12.125	28.585			5/30/2012	2.36
Springer	S1048-47072	1048	2012	10.938	27.502			5/30/2012	2.51
Springer	S1048-47075	1048	2012	11.281	8.309			5/30/2012	0.74
Springer	S1048-47078	1048	2012	9.781	28.585			5/30/2012	2.92
Springer	S1048-47081	1048	2012	8.719	31.919			5/30/2012	3.66
Springer	S1048-47102	1048	2012	6.594	8.584			5/30/2012	1.30
Springer	S1048-47106	1048	2012	10.781	26.252			5/30/2012	2.44
Springer	S1048-47113	1048	2012	9.031	13.918			5/30/2012	1.54
Springer	S1180-25301	1180	2012	1.869	8.751			5/31/2012	4.68
Springer	S1180-25317	1180	2012	1.997	5.042			5/31/2012	2.52
Springer	S1180-25319	1180	2012	1.434	3.167			5/31/2012	2.21
Springer	S1180-25331	1180	2012	1.306	9.584			5/31/2012	7.34
Springer	S1180-25358	1180	2012	1.297	30.419			5/31/2012	23.45
Springer	S1180-25362	1180	2012	2.1	56.42			5/31/2012	26.87
Springer	S1180-25369	1180	2012	0.8	8.584			5/31/2012	10.73
Springer	S1180-25372	1180	2012	0.956	7.5			5/31/2012	7.85
Springer	S1180-25410	1180	2012	0.775	1.283			5/31/2012	1.66
Springer	S1048-46084	1048	2012	7.75	17.835			6/3/2012	2.30
Springer	S1048-46108	1048	2012	3.5	25.585			6/3/2012	7.31
Springer	S1048-46135	1048	2012	8.469	14.584			6/3/2012	1.72
Springer	S1048-46153	1048	2012	13.562	15.751			6/3/2012	1.16
Springer	S1180-25394	1180	2012	0.881	2.233			6/4/2012	2.53
Springer	S1180-25406	1180	2012	1.234	17.001			6/4/2012	13.78
Springer	S1180-25424	1180	2012	1.094	1.292			6/4/2012	1.18
Springer	S1180-25434	1180	2012	0.756	5.6			6/4/2012	7.41
Springer	S1180-25448	1180	2012	0.944	2.458			6/4/2012	2.60
Springer	S1180-25452	1180	2012	1.278	7.701			6/4/2012	6.03
Springer	S1180-25473	1180	2012	0.662	4.092			6/4/2012	6.18
Springer	S1180-25482	1180	2012	0.809	21.085			6/4/2012	26.06
Springer	S1180-25485	1180	2012	0.403	4.65			6/4/2012	11.54
Springer	S1180-25499	1180	2012	0.847	4.25			6/4/2012	5.02
Springer	S1180-25629	1180	2012	0.8	4.284			6/4/2012	5.36
Springer	S1180-25646	1180	2012	0.928	2.5			6/4/2012	2.69
Springer	S1180-25649	1180	2012	1.056	6.35			6/4/2012	6.01
Springer	S1180-25684	1180	2012	2.484	26.002			6/4/2012	10.47
Springer	S1180-25690	1180	2012	1.4	2.842			6/4/2012	2.03
Springer	S1048-48009	1048	2012	4.344	9.751			6/5/2012	2.24
Springer	S1048-48039	1048	2012	5.094	13.001			6/5/2012	2.55
Springer	S1048-49018	1048	2012	26.906	25.502			6/7/2012	0.95
Springer	S1048-49029	1048	2012	10.188	31.252			6/7/2012	3.07
Springer	S1048-49032	1048	2012	22.469	23.585			6/7/2012	1.05
Springer	S1048-49035	1048	2012	20.594	15.168			6/7/2012	0.74
Springer	S1048-49066	1048	2012	33.125	17.585			6/7/2012	0.53
Springer	S1048-49071	1048	2012	41.25	21.251			6/7/2012	0.52
Springer	S1048-49078	1048	2012	41.562	40.003			6/7/2012	0.96
Springer	S1048-49086	1048	2012	21.031	20.501			6/7/2012	0.97
Springer	S1048-49110	1048	2012	34.375	7.5			6/7/2012	0.22
Springer	S1048-49120	1048	2012	32.188	15.918			6/7/2012	0.49
Springer	S1048-49142	1048	2012	54.688	16.668			6/7/2012	0.30
Springer	S1024-34135	1024	2012	1.231	41.919			6/8/2012	34.05
Springer	S1024-34209	1024	2012	2	22.668			6/8/2012	11.33
Springer	S1024-34228	1024	2012	3.969	26.335			6/8/2012	6.64
Springer	S1024-34231	1024	2012	1.103	33.836			6/8/2012	30.68
Springer	S1012-7229	1012	2012	1.372	21.918			6/10/2012	15.98
Springer	S1012-7286	1012	2012	0.625	7.159			6/10/2012	11.45
Springer	S1012-7292	1012	2012	1.197	34.752			6/10/2012	29.03
Springer	S1048-50030	1048	2012	1.181	9.751			6/13/2012	8.26
Springer	S1048-50100	1048	2012	11.031	39.753			6/13/2012	3.60
Springer	S1048-50108	1048	2012	5.094	12.918			6/13/2012	2.54
Springer	S1048-50114	1048	2012	7.344	9.251			6/13/2012	1.26
Springer	S1048-50119	1048	2012	6.031	12.251			6/13/2012	2.03
Springer	S1048-50122	1048	2012	1.656	6.384			6/13/2012	3.86
Springer	S1048-50134	1048	2012	4.406	22.001			6/13/2012	4.99
Springer	S1048-50150	1048	2012	14.281	42.003			6/13/2012	2.94
Springer	S1048-50155	1048	2012	13.219	15.251			6/13/2012	1.15
Springer	S1048-50166	1048	2012	7.156	15.918			6/13/2012	2.22
Springer	S1012-10216	1012	2012	2.566	17.418			6/15/2012	6.79
Springer	S1012-10219	1012	2012	2.294	27.835			6/15/2012	12.13
Springer	S1012-10228	1012	2012	4.188	21.335			6/15/2012	5.09
Springer	S1048-51019	1048	2012	10.688	34.419			6/20/2012	3.22
Springer	S1048-51103	1048	2012	4.281	10.917			6/20/2012	2.55
Springer	S1048-51110	1048	2012	7.344	12.751			6/20/2012	1.74
Springer	S1048-51112	1048	2012	10.906	6.592			6/20/2012	0.60
Springer	S1048-51115	1048	2012	5.875	14.918			6/20/2012	2.54
Springer	S1048-51127	1048	2012	9.812	26.585			6/20/2012	2.71
Springer	S1048-51139	1048	2012	6.906	26.252			6/20/2012	3.80
Springer	S1048-51144	1048	2012	11.719	13.834			6/20/2012	1.18
Springer	S1048-51147	1048	2012	7.344	7.384			6/20/2012	1.01
Springer	S1048-51150	1048	2012	6.688	11.334			6/20/2012	1.69
Springer	S1048-52048	1048	2012	32.812	40.753			6/22/2012	1.24
Springer	S1048-52083	1048	2012	83.75	34.419			6/22/2012	0.41
Springer	S1048-52140	1048	2012	20.125	17.168			6/22/2012	0.85
Springer	S1048-52146	1048	2012	6.062	24.918			6/22/2012	4.11
Springer	S1048-52152	1048	2012	7	19.418			6/22/2012	2.77
Springer	S1048-52170	1048	2012	3.281	28.002			6/22/2012	8.53
Springer	S1048-53101	1048	2012	4.531	15.834			6/26/2012	3.49
Springer	S1048-53103	1048	2012	6.156	21.501			6/26/2012	3.49
Springer	S1048-53105	1048	2012	3.938	14.501			6/26/2012	3.68
Springer	S1048-53106	1048	2012	2.488	25.835			6/26/2012	10.38
Springer	S1048-53109	1048	2012	48.438	35.336			6/26/2012	0.73
Springer	S1048-53113	1048	2012	60.312	22.418			6/26/2012	0.37
Springer	S1048-53117	1048	2012	67.188	8.834			6/26/2012	0.13
Springer	S1048-53121	1048	2012	49.375	15.751			6/26/2012	0.32
Springer	S1048-53125	1048	2012	46.875	55.587			6/26/2012	1.19
Springer	S1048-53131	1048	2012	9.375	9.334			6/26/2012	1.00
Springer	S1048-53136	1048	2012	27.375	37.836			6/26/2012	1.38
Springer	S1048-53165	1048	2012	5.656	12.501			6/26/2012	2.21
Springer	S1048-53167	1048	2012	1.616	19.001			6/26/2012	11.76
Springer	S1048-53169	1048	2012	65	25.918			6/26/2012	0.40
Springer	S1048-53177	1048	2012	33.125	19.085			6/26/2012	0.58
Springer	S1048-53186	1048	2012	42.188	20.501			6/26/2012	0.49
Springer	S1048-53203	1048	2012	70.312	31.919			6/26/2012	0.45
Springer	S1048-53214	1048	2012	49.375	39.419			6/26/2012	0.80
Springer	S1036-46013	1036	2012	6.688	24.252			7/2/2012	3.63
Springer	S1036-46031	1036	2012	4.125	17.835			7/2/2012	4.32
Springer	S1036-46037	1036	2012	8.125	10.917			7/2/2012	1.34
Springer	S1036-46042	1036	2012	20.969	36.169			7/2/2012	1.72
Springer	S1036-46045	1036	2012	23.688	25.252			7/2/2012	1.07
Springer	S1036-46057	1036	2012	20.031	18.085			7/2/2012	0.90
Springer	S1036-46060	1036	2012	14.875	30.419			7/2/2012	2.04
Springer	S1036-46063	1036	2012	39.688	12.584			7/2/2012	0.32
Springer	S1036-46073	1036	2012	1.2	21.918			7/2/2012	18.27
Springer	S1036-46084	1036	2012	3.719	15.251			7/2/2012	4.10
Springer	S1036-46087	1036	2012	1.403	5			7/2/2012	3.56
Springer	S1036-46105	1036	2012	15.375	30.419			7/2/2012	1.98
Springer	S1036-46202	1036	2012	12.125	11.917			7/2/2012	0.98
Springer	S1036-46205	1036	2012	1.828	11.167			7/2/2012	6.11
Springer	S1036-46218	1036	2012	24.312	29.252			7/2/2012	1.20
Springer	S1036-46224	1036	2012	3.5	18.835			7/2/2012	5.38
Springer	S1036-46230	1036	2012	18.594	40.836			7/2/2012	2.20
Springer	S1036-46231	1036	2012	5.906	47.503			7/2/2012	8.04
Springer	S1036-46245	1036	2012	11.375	53.254			7/2/2012	4.68
Springer	S1036-46251	1036	2012	1.347	21.835			7/2/2012	16.21
Springer	S1036-46260	1036	2012	16.156	32.419			7/2/2012	2.01
Springer	S1036-46269	1036	2012	19.75	37.502			7/2/2012	1.90
Springer	S1036-46273	1036	2012	28.625	35.419			7/2/2012	1.24
Springer	S1036-46278	1036	2012	3.844	20.501			7/2/2012	5.33
Springer	S1036-46292	1036	2012	6.438	55.17			7/2/2012	8.57
Springer	S1024-35149	1024	2012	14.469	17.918			7/5/2012	1.24
Springer	S1024-36106	1024	2012	3.119	30.419			7/5/2012	9.75
Springer	S1024-36124	1024	2012	8.469	19.835			7/5/2012	2.34
Springer	S1024-36132	1024	2012	4.438	23.585			7/5/2012	5.31
Springer	S1024-36146	1024	2012	10.781	19.751			7/5/2012	1.83
Springer	S1024-36148	1024	2012	1.828	15.418			7/5/2012	8.43
Springer	S1024-36151	1024	2012	30.781	20.585			7/5/2012	0.67
Springer	S1024-36207	1024	2012	7.062	46.836			7/5/2012	6.63
Springer	S1024-36210	1024	2012	15.344	26.418			7/5/2012	1.72
Springer	S1024-36219	1024	2012	14.406	57.671			7/5/2012	4.00
Springer	S1024-36229	1024	2012	2.484	28.335			7/5/2012	11.41

Springer	S1024-36241	1024	2012	4.875	38.169			7/5/2012	7.83
Springer	S1024-36258	1024	2012	22.875	30.085			7/5/2012	1.32
Springer	S1024-36273	1024	2012	2.441	29.919			7/5/2012	12.26
Springer	S1024-36277	1024	2012	1.141	27.502			7/5/2012	24.10
Springer	S1024-38104	1024	2012	1.119	5.917			7/11/2012	5.29
Springer	S1024-38110	1024	2012	1.188	17.835			7/11/2012	15.01
Springer	S1024-38133	1024	2012	1.019	15.001			7/11/2012	14.72
Springer	S1024-38137	1024	2012	1.391	24.252			7/11/2012	17.43
Springer	S1024-38178	1024	2012	2.544	18.335			7/11/2012	7.21
Springer	S1024-38188	1024	2012	1.003	42.419			7/11/2012	42.29
Springer	S1024-38204	1024	2012	1.022	28.002			7/11/2012	27.40
Springer	S1024-38228	1024	2012	4.625	29.669			7/11/2012	6.41
Springer	S1024-38230	1024	2012	1.972	22.251			7/11/2012	11.28
Springer	S1036-47048	1036	2012	8.188	42.169			7/11/2012	5.15
Springer	S1036-47072	1036	2012	5.406	14.834			7/11/2012	2.74
Springer	S1036-47093	1036	2012	2.497	11.167			7/11/2012	4.47
Springer	S1036-49017	1036	2012	3.781	18.751			7/11/2012	4.96
Springer	S1036-49038	1036	2012	13	13.251			7/11/2012	1.02
Springer	S1036-49062	1036	2012	6.156	11.084			7/11/2012	1.80
Springer	S1024-38008	1024	2012	0.866	18.251			7/12/2012	21.08
Springer	S1036-48005	1036	2012	4.531	38.503			7/13/2012	8.50
Springer	S1036-48007	1036	2012	2.181	34.586			7/13/2012	15.86
Springer	S1036-48009	1036	2012	22.344	27.252			7/13/2012	1.22
Springer	S1036-48017	1036	2012	10.75	42.336			7/13/2012	3.94
Springer	S1036-48025	1036	2012	1.444	20.751			7/13/2012	14.37
Springer	S1036-48028	1036	2012	1.947	81.339			7/13/2012	41.78
Springer	S1036-48047	1036	2012	2.078	41.586			7/13/2012	20.01
Springer	S1036-48051	1036	2012	1.203	17.585			7/13/2012	14.62
Springer	S1036-48063	1036	2012	1.422	38.169			7/13/2012	26.84
Springer	S1036-48066	1036	2012	1.216	36.919			7/13/2012	30.36
Springer	S1036-48077	1036	2012	3.375	42.253			7/13/2012	12.52
Springer	S1036-48089	1036	2012	6.781	42.67			7/13/2012	6.29
Springer	S1036-48093	1036	2012	2.162	71.171			7/13/2012	32.92
Springer	S1036-48096	1036	2012	2.369	41.086			7/13/2012	17.34
Springer	S1036-48099	1036	2012	58.438	52.42			7/13/2012	0.90
Springer	S1036-48218	1036	2012	1.544	19.085			7/13/2012	12.36
Springer	S1036-48224	1036	2012	1.588	44.92			7/13/2012	28.29
Springer	S1036-48228	1036	2012	4.062	40.586			7/13/2012	9.99
Springer	S1036-48233	1036	2012	1.206	85.006			7/13/2012	70.49
Springer	S1036-48241	1036	2012	6.188	22.835			7/13/2012	3.69
Springer	S1036-48255	1036	2012	3.188	52.503			7/13/2012	16.47
Springer	S1036-48259	1036	2012	1.259	30.169			7/13/2012	23.96
Springer	S1036-48262	1036	2012	6.75	44.086			7/13/2012	6.53
Springer	S1036-50004	1036	2012	5.438	27.752			7/20/2012	5.10
Springer	S1036-50016	1036	2012	5.219	44.42			7/20/2012	8.51
Springer	S1036-50019	1036	2012	8.344	50.17			7/20/2012	6.01
Springer	S1036-50022	1036	2012	23.062	46.42			7/20/2012	2.01
Springer	S1036-50029	1036	2012	4.438	74.172			7/20/2012	16.71
Springer	S1036-50032	1036	2012	10.156	47.336			7/20/2012	4.66
Springer	S1036-50035	1036	2012	3.625	46.253			7/20/2012	12.76
Springer	S1036-50041	1036	2012	6.875	23.002			7/20/2012	3.35
Springer	S1036-50064	1036	2012	14.031	45.086			7/20/2012	3.21
Springer	S1036-50066	1036	2012	7.531	32.586			7/20/2012	4.33
Springer	S1036-50078	1036	2012	2.069	34.919			7/20/2012	16.88
Springer	S1036-50086	1036	2012	7.25	37.252			7/20/2012	5.14
Springer	S1036-50092	1036	2012	11.125	53.837			7/20/2012	4.84
Springer	S1036-50100	1036	2012	22.906	31.002			7/20/2012	1.35
Springer	S1036-50107	1036	2012	9.5	14.751			7/20/2012	1.55
Springer	S1036-50116	1036	2012	6.25	35.169			7/20/2012	5.63
Springer	S1036-50119	1036	2012	5.656	36.419			7/20/2012	6.44
Springer	S1036-50135	1036	2012	6.969	11.834			7/20/2012	1.70
Springer	S1036-50138	1036	2012	13.156	26.335			7/20/2012	2.00
Springer	S1036-52012	1036	2012	8.969	9.584			7/20/2012	1.07
Springer	S1036-52021	1036	2012	6.719	11.667			7/20/2012	1.74
Springer	S1036-52042	1036	2012	27.031	25.002			7/20/2012	0.92
Springer	S1036-51070	1036	2012	1.666	36.752			7/24/2012	22.06
Springer	S1036-51109	1036	2012	3.906	72.838			7/24/2012	18.65
Springer	S1036-51114	1036	2012	5.156	40.003			7/24/2012	7.76
Springer	S1036-51120	1036	2012	5.656	26.002			7/24/2012	4.60
Springer	S1036-51125	1036	2012	4.062	12.918			7/24/2012	3.18
Springer	S1036-51129	1036	2012	8.562	65.421			7/24/2012	7.64
Springer	S1036-51134	1036	2012	5.844	25.002			7/24/2012	4.28
Springer	S1036-51138	1036	2012	11.719	20.585			7/24/2012	1.76
Springer	S1036-51151	1036	2012	6.344	24.585			7/24/2012	3.88
Springer	S1036-51158	1036	2012	7.094	10.167			7/24/2012	1.43
Springer	S1036-51163	1036	2012	4.406	38.919			7/24/2012	8.83
Springer	S1036-51167	1036	2012	5.75	31.835			7/24/2012	5.54
Springer	S1036-51189	1036	2012	6.438	19.085			7/24/2012	2.96
Springer	S1036-51194	1036	2012	1.888	35.752			7/24/2012	18.94
Springer	S1036-51201	1036	2012	8.688	27.669			7/24/2012	3.18
Springer	S1036-51215	1036	2012	2.669	19.751			7/24/2012	7.40
Springer	S1036-51219	1036	2012	5.531	18.335			7/24/2012	3.31
Springer	S1036-51222	1036	2012	3.103	61.171			7/24/2012	19.71
Springer	S1036-51227	1036	2012	2.669	34.419			7/24/2012	12.90
Springer	S1036-51232	1036	2012	2.053	49.503			7/24/2012	24.11
Springer	S1180-27002	1180	2012	1.266	35.419			7/30/2012	27.98
Springer	S1180-27012	1180	2012	0.784	7.576			7/30/2012	9.66
Springer	S1180-27104	1180	2012	0.788	5.409			7/30/2012	6.86
Springer	S1180-27107	1180	2012	1.034	3.584			7/30/2012	3.47
Springer	S1180-27134	1180	2012	1.547	32.252			7/30/2012	20.85
Springer	S1180-27140	1180	2012	0.941	3.275			7/30/2012	3.48
Springer	S1180-27143	1180	2012	0.769	0.892			7/30/2012	1.16
Springer	S1180-27154	1180	2012	1.184	70.755			7/30/2012	59.76
Springer	S1180-27183	1180	2012	0.791	1.742			7/30/2012	2.20
Springer	S1180-27190	1180	2012	0.891	1.967			7/30/2012	2.21
Springer	S1180-27193	1180	2012	0.897	1.783			7/30/2012	1.99
Springer	S1180-27196	1180	2012	1.1	16.751			7/30/2012	15.23
Springer	S1180-27210	1180	2012	2.191	85.006			7/30/2012	38.80
Springer	S1180-27236	1180	2012	0.897	1.267			7/30/2012	1.41
Springer	S1180-27239	1180	2012	1.003	2.033			7/30/2012	2.03
Springer	S1036-53001	1036	2012	11.844	30.169			7/31/2012	2.55
Springer	S1036-53005	1036	2012	13.188	17.501			7/31/2012	1.33
Springer	S1036-53010	1036	2012	58.438	24.002			7/31/2012	0.41
Springer	S1036-53019	1036	2012	45.938	24.668			7/31/2012	0.54
Springer	S1036-53026	1036	2012	18.844	18.168			7/31/2012	0.96
Springer	S1036-53039	1036	2012	48.75	25.585			7/31/2012	0.52
Springer	S1036-53061	1036	2012	27.219	29.335			7/31/2012	1.08
Springer	S1036-53064	1036	2012	21.75	24.502			7/31/2012	1.13
Springer	S1036-53074	1036	2012	20.188	28.002			7/31/2012	1.39
Springer	S1036-53076	1036	2012	15	27.752			7/31/2012	1.85
Springer	S1036-53079	1036	2012	8.875	28.252			7/31/2012	3.18
Springer	S1036-53082	1036	2012	39.688	52.003			7/31/2012	1.31
Springer	S1036-53092	1036	2012	37.5	48.337			7/31/2012	1.29
Springer	S1036-53094	1036	2012	37.5	37.502			7/31/2012	1.00
Springer	S1036-53097	1036	2012	11.094	20.418			7/31/2012	1.84
Springer	S1036-53105	1036	2012	18.938	52.087			7/31/2012	2.75
Springer	S1036-52063	1036	2012	47.812	67.755			8/1/2012	1.42
Springer	S1024-39247	1024	2012	3.25	6.942			8/3/2012	2.14
Springer	S1024-39298	1024	2012	2.2	11.667			8/3/2012	5.30
Springer	S1036-55108	1036	2012	8.469	22.001			8/9/2012	2.60
Springer	S1036-55115	1036	2012	12.406	10.501			8/9/2012	0.85
Springer	S1036-55120	1036	2012	4.75	8.834			8/9/2012	1.86
Springer	S1036-55124	1036	2012	5.938	15.418			8/9/2012	2.60
Springer	S1036-55135	1036	2012	7.562	13.168			8/9/2012	1.74
Springer	S1036-55139	1036	2012	7.188	28.669			8/9/2012	3.99
Springer	S1036-55166	1036	2012	70	21.001			8/9/2012	0.30
Springer	S1036-55173	1036	2012	32.812	14.001			8/9/2012	0.43
Springer	S1036-55178	1036	2012	35.312	20.335			8/9/2012	0.58
Springer	S1036-55206	1036	2012	4.969	5.934			8/9/2012	1.19
Springer	S1036-55209	1036	2012	7.75	24.418			8/9/2012	3.15
Springer	S1036-55213	1036	2012	6.625	8.142			8/9/2012	1.23
Springer	S1036-55216	1036	2012	5.906	11.834			8/9/2012	2.00
Springer	S1036-55218	1036	2012	4.938	5.584			8/9/2012	1.13
Springer	S1036-55222	1036	2012	6.156	11.417			8/9/2012	1.85
Springer	S1036-55227	1036	2012	31.562	29.335			8/9/2012	0.93
Springer	S1024-40028	1024	2012	7.5	41.419			8/14/2012	5.52
Springer	S1024-40059	1024	2012	4.375	29.919			8/14/2012	6.84
Springer	S1024-40086	1024	2012	8.5	21.668			8/14/2012	2.55
Springer	S1024-40114	1024	2012	5.906	8.917			8/14/2012	1.51
Springer	S1024-40118	1024	2012	8.188	20.168			8/14/2012	2.46
Springer	S1024-40145	1024	2012	10.438	25.835			8/14/2012	2.48
Springer	S1024-40201	1024	2012	22.406	36.836			8/14/2012	1.64
Springer	S1024-40206	1024	2012	3.969	34.252			8/14/2012	8.63
Springer	S1024-40218	1024	2012	2.947	43.586			8/14/2012	14.79
Springer	S1024-40221	1024	2012	12.125	13.918			8/14/2012	1.15
Springer	S1024-40230	1024	2012	5.469	20.418			8/14/2012	3.73
Springer	S1024-40232	1024	2012	5.531	31.669			8/14/2012	5.73
Springer	S1024-40239	1024	2012	40	20.585			8/14/2012	0.51
Springer	S1024-40244	1024	2012	1.441	26.752			8/14/2012	18.56
Springer	S1024-40249	1024	2012	18.625	25.668			8/14/2012	1.38
Springer	S1024-40253	1024	2012	5.031	14.001			8/14/2012	2.78
Springer	S1024-40263	1024	2012	50	21.085			8/14/2012	0.42
Springer	S1024-40273	1024	2012	6.531	22.668			8/14/2012	3.47
Springer	S1168-35022	1168	2012	1.322	17.835			8/19/2012	13.49
Springer	S1168-35038	1168	2012	1.312	4.5			8/19/2012	3.43
Springer	S1168-35045	1168	2012	2.075	10.001			8/19/2012	4.82
Springer	S1168-35070	1168	2012	1.081	3.742			8/19/2012	3.46
Springer	S1168-35080	1168	2012	0.875	0.808			8/19/2012	0.92
Springer	S1168-35092	1168	2012	0.866	7.517			8/19/2012	8.68
Springer	S1168-35104	1168	2012	0.762	13.084			8/19/2012	17.17
Springer	S1168-35138	1168	2012	0.838	15.251			8/19/2012	18.20
Springer	S1168-35149	1168	2012	0.672	14.918			8/19/2012	22.20
Springer	S1012-19009	1012	2012	1.812	36.919			8/23/2012	20.37
Springer	S1012-19042	1012	2012	1.8	16.084			8/23/2012	8.94
Springer	S1012-19082	1012	2012	3.688	39.003			8/23/2012	10.58
Springer	S1168-34003	1168	2012	2.334	35.669			8/23/2012	15.28
Springer	S1168-34007	1168	2012	0.978	0.817			8/23/2012	0.84
Springer	S1168-34043	1168	2012	0.725	76.755			8/23/2012	105.87
Springer	S1168-34047	1168	2012	1.044	9.251			8/23/2012	8.86
Springer	S1168-34051	1168	2012	1.091	23.335			8/23/2012	21.39
Springer	S1168-34090	1168	2012	1.059	14.668			8/23/2012	13.85
Springer	S1168-34094	1168	2012	0.606	1.408			8/23/2012	2.32
Springer	S1168-34149	1168	2012	0.556	14.834			8/23/2012	26.68
Springer	S1168-35178	1168	2012	0.781	11.501			8/23/2012	14.73
Springer	S1168-35193	1168	2012	0.822	6.684			8/23/2012	8.13
Springer	S1024-42027	1024	2012	2.097	25.085			8/28/2012	11.96
Springer	S1024-42045	1024	2012	8.281	27.752			8/28/2012	3.35
Springer	S1024-42069	1024	2012	18.781	60.337			8/28/2012	3.21
Springer	S1024-42090	1024	2012	4.75	19.585			8/28/2012	4.12
Springer	S1036-56202	1036	2012	13.562	11.084			8/29/2012	0.82

Springer	S1036-56207	1036	2012	2.262	13.334			8/29/2012	5.89
Springer	S1036-56214	1036	2012	66.25	42.086			8/29/2012	0.64
Springer	S1036-56216	1036	2012	13.094	18.335			8/29/2012	1.40
Springer	S1036-56219	1036	2012	14.584	3.781			8/29/2012	0.26
Springer	S1036-56227	1036	2012	11.469	13.918			8/29/2012	1.21
Springer	S1036-56235	1036	2012	37.812	34.252			8/29/2012	0.91
Springer	S1036-56239	1036	2012	7.469	10.167			8/29/2012	1.36
Springer	S1036-56006	1036	2012	11.562	21.835			8/30/2012	1.89
Springer	S1036-56015	1036	2012	7.312	30.835			8/30/2012	4.22
Springer	S1036-56024	1036	2012	3.125	21.085			8/30/2012	6.75
Springer	S1024-41004	1024	2012	2.434	10.667			9/1/2012	4.38
Springer	S1024-41030	1024	2012	28.188	15.584			9/1/2012	0.55
Springer	S1024-41036	1024	2012	12.375	18.585			9/1/2012	1.50
Springer	S1024-41042	1024	2012	25.219	19.835			9/1/2012	0.79
Springer	S1024-41070	1024	2012	11.469	6.834			9/1/2012	0.60
Springer	S1024-41076	1024	2012	5.094	17.668			9/1/2012	3.47
Springer	S1024-41085	1024	2012	15.25	13.668			9/1/2012	0.90
Springer	S1024-41109	1024	2012	5.594	18.501			9/1/2012	3.31
Springer	S1024-41115	1024	2012	18.562	18.168			9/1/2012	0.98
Springer	S1024-41118	1024	2012	9.781	25.502			9/1/2012	2.61
Springer	S1024-41129	1024	2012	3.156	21.168			9/1/2012	6.71
Springer	S1024-41204	1024	2012	1.684	47.17			9/1/2012	28.01
Springer	S1012-21066	1012	2012	2.219	22.001			9/2/2012	9.91
Springer	S1012-21092	1012	2012	1.247	7.817			9/2/2012	6.27
Springer	S1012-21157	1012	2012	5.062	20.585			9/2/2012	4.07
Springer	S1012-21177	1012	2012	1.991	6.142			9/2/2012	3.08
Springer	S1012-21221	1012	2012	2.153	25.252			9/2/2012	11.73
Springer	S1012-23103	1012	2012	2.028	53.587			9/5/2012	26.42
Springer	S1012-23108	1012	2012	6.188	76.422			9/5/2012	12.35
Springer	S1012-23116	1012	2012	1.519	35.086			9/5/2012	23.10
Springer	S1168-36028	1168	2012	0.484	11.417			9/6/2012	23.59
Springer	S1168-36131	1168	2012	1.594	25.835			9/6/2012	16.21
Springer	S1168-36162	1168	2012	1.481	23.918			9/6/2012	16.15
Springer	S1168-36171	1168	2012	0.769	20.751			9/6/2012	26.98
Springer	S1168-36178	1168	2012	0.988	45.586			9/6/2012	46.14
Springer	S1168-36187	1168	2012	1.072	22.668			9/6/2012	21.15
Springer	S1168-36214	1168	2012	0.809	1.792			9/6/2012	2.22
Springer	S1168-36236	1168	2012	0.859	5.092			9/6/2012	5.93
Springer	S1168-36243	1168	2012	1.159	24.168			9/6/2012	20.85
Springer	S1168-36263	1168	2012	0.797	1.067			9/6/2012	1.34
Springer	S1168-36290	1168	2012	0.734	0.739			9/6/2012	1.01
Springer	S1168-36293	1168	2012	5.375	9.917			9/6/2012	1.85
Springer	S1168-36301	1168	2012	1.088	34.086			9/6/2012	31.33
Springer	S1168-36320	1168	2012	0.878	0.942			9/6/2012	1.07
Springer	S1024-43002	1024	2012	0.966	59.837			9/9/2012	61.94
Springer	S1024-43005	1024	2012	7.969	39.253			9/9/2012	4.93
Springer	S1024-43028	1024	2012	13.031	45.42			9/9/2012	3.49
Springer	S1024-43039	1024	2012	7.375	47.17			9/9/2012	6.40
Springer	S1024-43043	1024	2012	54.375	32.085			9/9/2012	0.59
Springer	S1024-43046	1024	2012	2.225	51.087			9/9/2012	22.96
Springer	S1024-43049	1024	2012	3.084	48.42			9/9/2012	15.70
Springer	S1024-43054	1024	2012	3.875	50.587			9/9/2012	13.05
Springer	S1024-43057	1024	2012	13.875	48.587			9/9/2012	3.50
Springer	S1024-43074	1024	2012	4.312	51.587			9/9/2012	11.96
Springer	S1024-43077	1024	2012	5.531	44.253			9/9/2012	8.00
Springer	S1024-43080	1024	2012	7.125	39.419			9/9/2012	5.53
Springer	S1024-44101	1024	2012	2.25	37.252			9/9/2012	16.56
Springer	S1024-44104	1024	2012	2.319	38.253			9/9/2012	16.50
Springer	S1024-44107	1024	2012	6.156	23.502			9/9/2012	3.82
Springer	S1024-44110	1024	2012	8.594	45.586			9/9/2012	5.30
Springer	S1024-44137	1024	2012	3.281	45.586			9/9/2012	13.89
Springer	S1024-44140	1024	2012	5.656	54.92			9/9/2012	9.71
Springer	S1024-44143	1024	2012	4.812	40.503			9/9/2012	8.42
Springer	S1024-44146	1024	2012	9.625	21.251			9/9/2012	2.21
Springer	S1024-44149	1024	2012	10.125	27.168			9/9/2012	2.68
Springer	S1012-24101	1012	2012	0.947	6.842			9/11/2012	7.22
Springer	S1012-24107	1012	2012	1.097	7.667			9/11/2012	6.99
Springer	S1012-24145	1012	2012	2.416	13.584			9/11/2012	5.62
Springer	S1012-24151	1012	2012	0.712	7.567			9/11/2012	10.63
Springer	S1024-45201	1024	2012	1.212	20.001			9/11/2012	16.50
Springer	S1024-45205	1024	2012	3.125	22.501			9/11/2012	7.20
Springer	S1024-45214	1024	2012	2.834	12.501			9/11/2012	4.41
Springer	S1024-45218	1024	2012	4.656	43.42			9/11/2012	9.33
Springer	S1024-45221	1024	2012	36.875	21.835			9/11/2012	0.59
Springer	S1024-45282	1024	2012	7.625	47.92			9/11/2012	6.28
Springer	S1024-43110	1024	2012	48.125	45.003			9/14/2012	0.94
Springer	S1024-43113	1024	2012	49.688	50.587			9/14/2012	1.02
Springer	S1024-43201	1024	2012	33.438	31.752			9/14/2012	0.95
Springer	S1024-43218	1024	2012	17.406	29.169			9/14/2012	1.68
Springer	S1024-43224	1024	2012	12	25.335			9/14/2012	2.11
Springer	S1024-43231	1024	2012	18.906	51.17			9/14/2012	2.71
Springer	S1024-43300	1024	2012	15.438	25.418			9/14/2012	1.65
Springer	S1024-43305	1024	2012	35.312	29.252			9/14/2012	0.83
Springer	S1024-43311	1024	2012	40.312	24.502			9/14/2012	0.61
Springer	S1024-46006	1024	2012	4.594	14.751			9/19/2012	3.21
Springer	S1024-46021	1024	2012	7.688	13.501			9/19/2012	1.76
Springer	S1024-46039	1024	2012	8.25	27.168			9/19/2012	3.29
Springer	S1024-46060	1024	2012	5.969	12.668			9/19/2012	2.12
Springer	S1024-46078	1024	2012	7.406	21.668			9/19/2012	2.93
Springer	S1024-46093	1024	2012	9.219	30.169			9/19/2012	3.27
Springer	S1024-47105	1024	2012	2.231	22.501			9/22/2012	10.09
Springer	S1024-47109	1024	2012	12.688	75.422			9/22/2012	5.94
Springer	S1024-47113	1024	2012	2.422	22.168			9/22/2012	9.15
Springer	S1024-47121	1024	2012	5.938	41.169			9/22/2012	6.93
Springer	S1024-47140	1024	2012	3.047	14.584			9/22/2012	4.79
Springer	S1024-47142	1024	2012	1.416	16.001			9/22/2012	11.30
Springer	S1024-47145	1024	2012	7.531	49.587			9/22/2012	6.58
Springer	S1024-47160	1024	2012	3.125	25.585			9/22/2012	8.19
Springer	S1024-47163	1024	2012	7.5	27.585			9/22/2012	3.68
Springer	S1024-47177	1024	2012	3.906	21.251			9/22/2012	5.44
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Springer	S1024-47182	1024	2012	27.719	28.252			9/22/2012	1.02
Springer	S1024-47204	1024	2012	2.609	29.419			9/22/2012	11.28
Springer	S1012-26054	1012	2012	0.991	10.251			9/26/2012	10.34
Springer	S1012-26061	1012	2012	1.15	16.168			9/26/2012	14.06
Springer	S1024-50001	1024	2012	2.572	8.267			10/4/2012	3.21
Springer	S1024-50006	1024	2012	2.616	24.668			10/4/2012	9.43
Springer	S1024-50016	1024	2012	9.031	13.001			10/4/2012	1.44
Springer	S1024-50026	1024	2012	9.656	20.918			10/4/2012	2.17
Springer	S1024-50104	1024	2012	3.219	70.421			10/4/2012	21.88
Springer	S1024-50109	1024	2012	5.281	46.253			10/4/2012	8.76
Springer	S1024-50120	1024	2012	11.438	29.169			10/4/2012	2.55
Springer	S1024-50124	1024	2012	8.469	22.085			10/4/2012	2.61
Springer	S1024-50144	1024	2012	45	34.586			10/4/2012	0.77
Springer	S1024-50147	1024	2012	40.938	23.585			10/4/2012	0.58
Springer	S1024-50151	1024	2012	16.625	18.585			10/4/2012	1.12
Springer	S1024-50154	1024	2012	16.469	18.835			10/4/2012	1.14
Springer	S1024-50157	1024	2012	20.844	32.169			10/4/2012	1.54
Springer	S1024-50171	1024	2012	4.312	25.585			10/4/2012	5.93
Springer	S1024-50185	1024	2012	3.781	9.251			10/4/2012	2.45
Springer	S1024-50206	1024	2012	3.125	47.17			10/4/2012	15.09
Springer	S1024-50234	1024	2012	8.75	21.168			10/4/2012	2.42
Springer	S1024-50245	1024	2012	5.188	35.502			10/4/2012	6.84
Springer	S1024-50249	1024	2012	2.484	50.67			10/4/2012	20.40
Springer	S1024-50253	1024	2012	1.262	30.085			10/4/2012	23.84
Springer	S1024-50260	1024	2012	4.031	29.419			10/4/2012	7.30
Springer	S1024-50277	1024	2012	5.844	45.836			10/4/2012	7.84
Springer	S1024-50291	1024	2012	1.975	49.003			10/4/2012	24.81
Springer	S1024-50299	1024	2012	15.281	17.251			10/4/2012	1.13
Springer	S1024-50303	1024	2012	2.038	21.835			10/4/2012	10.71
Springer	S1024-50307	1024	2012	1.006	41.669			10/4/2012	41.42
Springer	S1024-50311	1024	2012	3.719	31.669			10/4/2012	8.52
Springer	S1012-27007	1012	2012	1.922	19.168			10/8/2012	9.97
Springer	S1012-27087	1012	2012	2.078	8.751			10/8/2012	4.21
Springer	S1012-27123	1012	2012	1.459	48.837			10/8/2012	33.47
Springer	S1012-28053	1012	2012	4.031	19.918			10/9/2012	4.94
Springer	S1012-28075	1012	2012	3.125	22.251			10/9/2012	7.12
Springer	S1012-28125	1012	2012	5.75	17.168			10/9/2012	2.99
Springer	S1012-28130	1012	2012	6.469	16.918			10/9/2012	2.62
Springer	S1024-49013	1024	2012	6.938	29.169			10/9/2012	4.20
Springer	S1024-49022	1024	2012	6.125	16.751			10/9/2012	2.73
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Springer	S1024-49040	1024	2012	14.844	27.252			10/9/2012	1.84
Springer	S1024-49049	1024	2012	24.375	21.335			10/9/2012	0.88
Springer	S1024-49058	1024	2012	28.062	17.001			10/9/2012	0.61
Springer	S1024-50023	1024	2012	7.188	32.419			10/12/2012	4.51
Springer	S1024-50028	1024	2012	10.969	17.918			10/12/2012	1.63
Springer	S1024-50030	1024	2012	13.812	15.501			10/12/2012	1.12
Springer	S1024-50032	1024	2012	17.938	14.668			10/12/2012	0.82
Springer	S1024-50040	1024	2012	38.438	25.418			10/12/2012	0.66
Springer	S1024-50047	1024	2012	60.938	15.834			10/12/2012	0.26
Springer	S1024-50054	1024	2012	51.562	23.335			10/12/2012	0.45
Springer	S1024-50061	1024	2012	25.5	10.334			10/12/2012	0.41
Springer	S1024-52041	1024	2012	6.406	17.501			10/23/2012	2.73
Springer	S1024-52042	1024	2012	5.531	26.335			10/23/2012	4.76
Springer	S1024-52046	1024	2012	8.156	5.575			10/23/2012	0.68
Springer	S1024-52048	1024	2012	8.781	10.501			10/23/2012	1.20
Springer	S1024-52051	1024	2012	8.656	21.251			10/23/2012	2.46
Springer	S1024-52056	1024	2012	11.812	46.336			10/23/2012	3.92
Springer	S1024-52061	1024	2012	6.625	13.584			10/23/2012	2.05
Springer	S1024-52066	1024	2012	3.719	17.668			10/23/2012	4.75
Springer	S1012-30033	1012	2012	14.75	40.419			10/31/2012	2.74
Springer	S1012-30036	1012	2012	2.978	33.836			10/31/2012	11.36
Springer	S1012-30039	1012	2012	3.5	25.502			10/31/2012	7.29
Springer	S1012-30066	1012	2012	6.625	13.668			10/31/2012	2.06
Springer	S1012-30084	1012	2012	1.191	34.752			10/31/2012	29.18
Springer	S1012-30087	1012	2012	4.406	7.734			10/31/2012	1.76
Springer	S1012-30090	1012	2012	1.194	28.835			10/31/2012	24.15
Springer	S1012-30110	1012	2012	2.972	20.418			10/31/2012	6.87
Springer	S1012-30125	1012	2012	1.65	8.584			10/31/2012	5.20
Springer	S1012-30128	1012	2012	57.812	23.418			10/31/2012	0.41
Springer	S1012-30131	1012	2012	23.531	25.668			10/31/2012	1.09
Springer	S1012-30157	1012	2012	4.156	19.335			10/31/2012	4.65
Springer	S1012-30159	1012	2012	18.031	13.501			10/31/2012	0.75
Springer	S1012-30162	1012	2012	12.656	32.752			10/31/2012	2.59
Springer	S1012-30165	1012	2012	12.5	24.835			10/31/2012	1.99
Springer	S1012-30170	1012	2012	17.5	36.002			10/31/2012	2.06
Springer	S1012-30173	1012	2012	1.481	14.584			10/31/2012	9.85
Springer	S1156-43020	1156	2012	1.356	11.917			10/31/2012	8.79
Springer	S1156-43024	1156	2012	0.853	8.276			10/31/2012	9.70

Springer	S1156-43066	1156	2012	1.197	3.092			10/31/2012	2.58
Springer	S1156-43070	1156	2012	1.769	39.086			10/31/2012	22.09
Springer	S1156-43082	1156	2012	0.891	5.417			10/31/2012	6.08
Springer	S1156-43127	1156	2012	0.869	9.917			10/31/2012	11.41
Springer	S1156-43173	1156	2012	1.659	0.679			10/31/2012	0.41
Springer	S1156-43177	1156	2012	1.825	5.425			10/31/2012	2.97
Springer	S1156-43195	1156	2012	0.831	11.084			10/31/2012	13.34
Springer	S1156-43250	1156	2012	0.816	10.001			10/31/2012	12.26
Springer	S1024-54038	1024	2012	26.562	17.668			11/7/2012	0.67
Springer	S1024-54047	1024	2012	5.906	9.751			11/7/2012	1.65
Springer	S1024-54050	1024	2012	6.031	8.417			11/7/2012	1.40
Springer	S1024-54052	1024	2012	9.281	12.918			11/7/2012	1.39
Springer	S1024-54055	1024	2012	9.188	31.585			11/7/2012	3.44
Springer	S1024-54058	1024	2012	10.75	30.169			11/7/2012	2.81
Springer	S1024-54061	1024	2012	0.584	48.003			11/7/2012	82.20
Springer	S1000-9215	1000	2012	1.475	8.201			11/11/2012	5.56
Springer	S1000-9240	1000	2012	4.688	22.001			11/11/2012	4.69
Springer	S1156-44001	1156	2012	0.953	4.417			11/15/2012	4.63
Springer	S1156-44005	1156	2012	0.872	1.317			11/15/2012	1.51
Springer	S1156-44009	1156	2012	0.897	0.728			11/15/2012	0.81
Springer	S1156-44043	1156	2012	1.928	50.003			11/15/2012	25.94
Springer	S1156-44058	1156	2012	0.775	0.614			11/15/2012	0.79
Springer	S1156-44062	1156	2012	0.978	0.992			11/15/2012	1.01
Springer	S1024-53009	1024	2012	26	57.337			11/18/2012	2.21
Springer	S1024-53140	1024	2012	18.594	15.334			11/18/2012	0.82
Springer	S1024-53147	1024	2012	36.25	21.668			11/18/2012	0.60
Springer	S1012-32005	1012	2012	17.188	31.002			11/21/2012	1.80
Springer	S1012-32008	1012	2012	15.656	15.668			11/21/2012	1.00
Springer	S1012-32011	1012	2012	15.125	5.742			11/21/2012	0.38
Springer	S1012-32014	1012	2012	7.906	20.918			11/21/2012	2.65
Springer	S1012-32046	1012	2012	13.125	24.668			11/21/2012	1.88
Springer	S1012-32049	1012	2012	6.875	19.751			11/21/2012	2.87
Springer	S1012-32052	1012	2012	10.281	14.834			11/21/2012	1.44
Springer	S1012-32080	1012	2012	4.719	11.667			11/21/2012	2.47
Springer	S1012-32083	1012	2012	5	15.168			11/21/2012	3.03
Springer	S1012-32086	1012	2012	2.075	15.334			11/21/2012	7.39
Springer	S1012-32112	1012	2012	12.344	19.001			11/21/2012	1.54
Springer	S1012-32122	1012	2012	6.594	13.418			11/21/2012	2.03
Springer	S1012-32125	1012	2012	24.469	25.085			11/21/2012	1.03
Springer	S1012-32136	1012	2012	33.125	53.004			11/21/2012	1.60
Springer	S1012-32150	1012	2012	23.156	19.085			11/21/2012	0.82
Springer	S1012-32163	1012	2012	8.5	29.002			11/21/2012	3.41
Springer	S1012-32180	1012	2012	4.062	9.334			11/21/2012	2.30
Springer	S1012-32214	1012	2012	10.406	16.001			11/21/2012	1.54
Springer	S1012-32241	1012	2012	1.297	19.501			11/21/2012	15.04
Springer	S1012-32265	1012	2012	1.106	45.753			11/21/2012	41.37
Springer	S1012-32269	1012	2012	2.384	25.585			11/21/2012	10.73
Springer	S1012-32300	1012	2012	3.656	122.508			11/21/2012	33.51
Springer	S1012-32305	1012	2012	1.834	29.169			11/21/2012	15.90
Springer	S1012-33328	1012	2012	1.866	25.252			11/27/2012	13.53
Springer	S1012-33334	1012	2012	20.281	66.838			11/27/2012	3.30
Springer	S1012-33009	1012	2012	1.55	24.002			11/28/2012	15.49
Springer	S1012-33028	1012	2012	1.372	40.253			11/28/2012	29.34
Springer	S1012-33040	1012	2012	5.031	43.67			11/28/2012	8.68
Springer	S1012-33055	1012	2012	6.094	31.335			11/28/2012	5.14
Springer	S1012-33072	1012	2012	3.188	34.252			11/28/2012	10.74
Springer	S1012-33218	1012	2012	2.156	36.586			11/28/2012	16.97
Springer	S1012-33240	1012	2012	8.219	26.335			11/28/2012	3.20
Springer	S1144-66006	1144	2012	0.531	30.085			11/30/2012	56.66
Springer	S1144-66018	1144	2012	1.409	18.501			11/30/2012	13.13
Springer	S1144-66030	1144	2012	3.344	28.419			11/30/2012	8.50
Springer	S1144-66053	1144	2012	0.616	6.534			11/30/2012	10.61
Springer	S1144-66062	1144	2012	2.566	46.003			11/30/2012	17.93
Springer	S1144-66070	1144	2012	0.669	8.417			11/30/2012	12.58
Springer	S1144-66090	1144	2012	0.778	1.85			11/30/2012	2.38
Springer	S1144-66115	1144	2012	1.444	25.835			11/30/2012	17.89
Springer	S1144-66125	1144	2012	0.809	1.325			11/30/2012	1.64
Springer	s1012-34048	1012	2012	5.25	65.421			12/2/2012	12.46
Springer	s1012-34053	1012	2012	11.688	37.669			12/2/2012	3.22
Springer	s1012-34058	1012	2012	8.156	33.752			12/2/2012	4.14
Springer	S1012-34101	1012	2012	5.594	27.502			12/2/2012	4.92
Springer	S1012-34105	1012	2012	14.781	27.085			12/2/2012	1.83
Springer	S1012-34120	1012	2012	3.906	15.501			12/2/2012	3.97
Springer	S1012-34123	1012	2012	0.969	92.506			12/2/2012	95.47
Springer	S1012-34126	1012	2012	2.909	18.501			12/2/2012	6.36
Springer	S1012-34128	1012	2012	6.656	13.001			12/2/2012	1.95
Springer	S1012-34130	1012	2012	41.25	23.918			12/2/2012	0.58
Springer	S1012-34134	1012	2012	12.469	60.504			12/2/2012	4.85
Springer	S1012-34141	1012	2012	5.625	23.502			12/2/2012	4.18
Springer	S1012-34155	1012	2012	5.125	17.168			12/2/2012	3.35
Springer	S1012-34159	1012	2012	4.969	16.584			12/2/2012	3.34
Springer	S1012-34163	1012	2012	1.688	53.504			12/2/2012	31.70
Springer	S1012-34165	1012	2012	4.75	19.751			12/2/2012	4.16
Springer	S1012-34167	1012	2012	41.875	33.169			12/2/2012	0.79
Springer	S1012-34171	1012	2012	8.594	35.502			12/2/2012	4.13
Springer	S1012-35036	1012	2012	2.497	44.67			12/6/2012	17.89
Springer	S1012-35253	1012	2012	2.791	12.918			12/6/2012	4.63
Springer	S1012-37093	1012	2012	18.438	34.586			12/9/2012	1.88
Springer	S1012-37095	1012	2012	14.219	24.835			12/9/2012	1.75
Springer	S1012-37120	1012	2012	32.812	46.503			12/9/2012	1.42
Springer	S1012-37131	1012	2012	23.688	45.586			12/9/2012	1.92
Springer	S1012-37141	1012	2012	46.25	41.086			12/9/2012	0.89
Springer	S1156-45107	1156	2012	1.038	10.251			12/9/2012	9.88
Springer	S1156-45118	1156	2012	1.284	3.559			12/9/2012	2.77
Springer	S1156-45122	1156	2012	0.959	23.002			12/9/2012	23.99
Springer	S1156-45126	1156	2012	1.247	32.169			12/9/2012	25.80
Springer	S1012-36021	1012	2012	2.497	26.002			12/12/2012	10.41
Springer	S1012-36042	1012	2012	25.531	60.254			12/12/2012	2.36
Springer	S1012-36063	1012	2012	5.219	21.085			12/12/2012	4.04
Springer	S1012-36081	1012	2012	7.219	17.835			12/12/2012	2.47
Springer	S1012-36100	1012	2012	3.281	19.251			12/12/2012	5.87
Springer	S1012-39025	1012	2012	14.938	30.669			12/14/2012	2.05
Springer	S1012-39042	1012	2012	3.097	20.835			12/14/2012	6.73
Springer	S1012-39056	1012	2012	23.219	15.668			12/14/2012	0.67
Springer	S1012-39030	1012	2012	62.188	34.752			12/28/2012	0.56
Springer	S1012-40003	1012	2012	1.709	13.334			12/28/2012	7.80
Springer	S1012-40106	1012	2012	2.375	12.251			12/28/2012	5.16
Springer	S1012-40110	1012	2012	5.406	18.751			12/28/2012	3.47
Springer	S1012-40119	1012	2012	15.438	34.752			12/28/2012	2.25
Springer	S1012-40130	1012	2012	3.75	17.918			12/28/2012	4.78
Springer	S1012-40137	1012	2012	7.469	29.335			12/28/2012	3.93
Springer	S1012-40140	1012	2012	55	24.835			12/28/2012	0.45
Springer	S1012-40142	1012	2012	29.469	50.92			12/28/2012	1.73
Springer	S1012-40147	1012	2012	6.719	23.918			12/28/2012	3.56
Springer	S1012-40156	1012	2012	3.906	16.668			12/28/2012	4.27
Springer	S1012-40162	1012	2012	16.031	25.752			12/28/2012	1.61
Springer	S1012-41102	1012	2012	3.5	17.585			12/28/2012	5.02
Springer	S1012-41114	1012	2012	1.15	30.335			12/28/2012	26.38
Springer	S1012-41126	1012	2012	2.131	34.919			12/28/2012	16.39
Springer	S1012-41135	1012	2012	3.219	24.002			12/28/2012	7.46
Springer	S1012-41139	1012	2012	1.341	32.169			12/28/2012	23.99
Springer	S1012-41144	1012	2012	2.516	23.585			12/28/2012	9.37
Springer	S1144-67164	1144	2012	0.853	3.184			12/28/2012	3.73
Springer	S1144-67518	1144	2012	0.709	2.183			12/28/2012	3.08
Springer	S1144-67534	1144	2012	0.812	1.008			12/28/2012	1.24
Springer	S1144-67544	1144	2012	0.806	23.252			12/28/2012	28.85
Springer	S1144-67573	1144	2012	2.397	29.585			12/28/2012	12.34
Springer	S1144-67577	1144	2012	0.859	9.667			12/28/2012	11.25
Springer	S1144-67603	1144	2012	1.453	20.918			12/28/2012	14.40
Springer	S1144-67608	1144	2012	1.009	9.751			12/28/2012	9.66
Springer	S1012-38031	1012	2012	14.312	31.419			12/29/2012	2.20
Springer	S1012-38034	1012	2012	4.781	44.42			12/29/2012	9.29
Springer	S1012-38044	1012	2012	7	65.504			12/29/2012	9.36
Springer	S1012-38063	1012	2012	18.906	48.587			12/29/2012	2.57
Springer	S1012-38064	1012	2012	8.062	36.752			12/29/2012	4.56
Springer	S1012-38078	1012	2012	5.906	48.337			12/29/2012	8.18
Springer	S1012-38085	1012	2012	58.438	32.669			12/29/2012	0.56
Springer	S1012-38094	1012	2012	49.688	35.586			12/29/2012	0.72
Springer	S1012-38099	1012	2012	4.875	59.254			12/29/2012	12.15
Springer	S1012-38105	1012	2012	6.188	28.419			12/29/2012	4.59
Springer	S1012-38112	1012	2012	8.125	55.004			12/29/2012	6.77
Springer	S1012-38125	1012	2012	6.469	36.919			12/29/2012	5.71
Springer	S1012-38127	1012	2012	8.438	47.753			12/29/2012	5.66
Springer	S1012-38133	1012	2012	4	38.336			12/29/2012	9.58
Springer	S1012-38139	1012	2012	5.219	43.753			12/29/2012	8.38
Springer	S1012-38167	1012	2012	9.5	32.169			12/29/2012	3.39
Springer	S1000-11152	1000	2012	1.391	16.001			12/30/2012	11.50
Springer	S1000-11168	1000	2012	1.938	68.921			12/30/2012	35.56
Springer	S1012-43003	1012	2012	7.031	25.668			12/31/2012	3.65
Springer	S1012-43021	1012	2012	5	9.834			12/31/2012	1.97
Springer	S1012-38090	1012	2013	21.625	35.002			1/1/2013	1.62
Springer	S1012-38096	1012	2013	39.688	29.752			1/1/2013	0.75
Springer	S1012-38119	1012	2013	6.031	61.837			1/1/2013	10.25
Springer	S1012-38121	1012	2013	25.344	56.087			1/1/2013	2.21
Springer	S1012-38149	1012	2013	5.688	47.587			1/1/2013	8.37
Springer	S1012-38151	1012	2013	4.406	36.336			1/1/2013	8.25
Springer	S1012-38153	1012	2013	15.844	39.669			1/1/2013	2.50
Springer	S1012-38173	1012	2013	4.156	38.836			1/1/2013	9.34
Springer	S1012-38175	1012	2013	12.188	36.919			1/1/2013	3.03
Springer	S1012-38176	1012	2013	31.25	41.003			1/1/2013	1.31
Springer	S1012-38183	1012	2013	18.219	49.087			1/1/2013	2.69
Springer	S1012-38184	1012	2013	11.094	41.086			1/1/2013	3.70
Springer	S1144-68510	1144	2013	0.506	1.183			1/3/2013	2.34
Springer	S1144-68517	1144	2013	0.891	1.3			1/3/2013	1.46
Springer	S1144-68526	1144	2013	0.775	0.812			1/3/2013	1.05
Springer	S1144-68529	1144	2013	0.516	13.251			1/3/2013	25.68
Springer	S1144-68532	1144	2013	0.65	12.918			1/3/2013	19.87
Springer	S1144-68550	1144	2013	0.934	1			1/3/2013	1.07
Springer	S1144-68574	1144	2013	1.381	1.758			1/3/2013	1.27
Springer	S1144-68579	1144	2013	0.55	2.475			1/3/2013	4.50
Springer	S1012-42021	1012	2013	9.438	27.252			1/7/2013	2.89
Springer	S1012-42029	1012	2013	7.75	31.835			1/7/2013	4.11
Springer	S1012-42037	1012	2013	9.906	17.168			1/7/2013	1.73
Springer	S1012-42041	1012	2013	11.906	13.584			1/7/2013	1.14
Springer	S1012-42046	1012	2013	11.062	16.584			1/7/2013	1.50
Springer	S1012-42051	1012	2013	3.188	37.753			1/7/2013	11.84
Springer	S1012-42056	1012	2013	8.562	10.667			1/7/2013	1.25
Springer	S1012-42061	1012	2013	8.875	10.084			1/7/2013	1.14
Springer	S1012-42066	1012	2013	10.844	32.752			1/7/2013	3.02
Springer	S1012-42102	1012	2013	6.25	24.002			1/7/2013	3.84

Springer	S1012-42106	1012	2013	6.469	37.502			1/7/2013	5.80
Springer	S1012-42109	1012	2013	9.188	19.918			1/7/2013	2.17
Springer	S1012-42113	1012	2013	8.281	20.168			1/7/2013	2.44
Springer	S1012-42117	1012	2013	7.969	17.251			1/7/2013	2.16
Springer	S1012-42138	1012	2013	4.344	34.419			1/7/2013	7.92
Springer	S1012-42141	1012	2013	7.594	33.836			1/7/2013	4.46
Springer	S1012-42144	1012	2013	6.719	33.086			1/7/2013	4.92
Springer	S1012-42147	1012	2013	5.438	36.586			1/7/2013	6.73
Springer	S1012-42150	1012	2013	5.75	34.502			1/7/2013	6.00
Springer	S1012-42153	1012	2013	23.281	45.67			1/7/2013	1.96
Springer	S1012-42155	1012	2013	11.875	28.252			1/7/2013	2.38
Springer	S1000-12101	1000	2013	1.116	5.084			1/11/2013	4.56
Springer	S1000-12105	1000	2013	1.234	2.042			1/11/2013	1.65
Springer	S1000-12101	1000	2013	1.116	5.084			1/11/2013	4.56
Springer	S1000-12105	1000	2013	1.234	2.042			1/11/2013	1.65
Springer	S1000-12198	1000	2013	3.719	24.418			1/14/2013	6.57
Springer	S1012-44106	1012	2013	37.812	30.169			1/14/2013	0.80
Springer	S1012-44110	1012	2013	53.438	30.252			1/14/2013	0.57
Springer	S1012-44112	1012	2013	44.062	38.586			1/14/2013	0.88
Springer	S1012-44114	1012	2013	9.812	17.751			1/14/2013	1.81
Springer	S1012-44123	1012	2013	35	39.503			1/14/2013	1.13
Springer	S1012-44127	1012	2013	14.375	32.169			1/14/2013	2.24
Springer	S1012-44129	1012	2013	27.875	25.668			1/14/2013	0.92
Springer	S1012-44136	1012	2013	21.812	36.836			1/14/2013	1.69
Springer	S1012-44138	1012	2013	26.656	37.502			1/14/2013	1.41
Springer	S1012-44140	1012	2013	8.906	28.169			1/14/2013	3.16
Springer	S1012-44142	1012	2013	10.719	25.335			1/14/2013	2.36
Springer	S1012-44146	1012	2013	16.438	33.252			1/14/2013	2.02
Springer	S1012-44149	1012	2013	20.5	37.336			1/14/2013	1.82
Springer	S1012-44152	1012	2013	15.562	31.252			1/14/2013	2.01
Springer	S1132-69009	1132	2013	0.228	23.168			1/14/2013	101.61
Springer	S1132-69012	1132	2013	1.072	35.586			1/14/2013	33.20
Springer	S1132-69030	1132	2013	15.594	18.418			1/14/2013	1.18
Springer	S1132-69033	1132	2013	0.5	8.417			1/14/2013	16.83
Springer	S1132-69037	1132	2013	0.975	6.9			1/14/2013	7.08
Springer	S1012-44006	1012	2013	12.156	14.834			1/15/2013	1.22
Springer	S1012-44044	1012	2013	48.438	28.919			1/15/2013	0.60
Springer	S1012-44056	1012	2013	20.281	32.836			1/15/2013	1.62
Springer	S1012-44062	1012	2013	45.312	35.419			1/15/2013	0.78
Springer	S1012-44066	1012	2013	17.812	17.751			1/15/2013	1.00
Springer	S1000-12158	1000	2013	2.109	24.085			1/16/2013	11.42
Springer	S1000-13150	1000	2013	4.094	44.67			1/19/2013	10.91
Springer	S1000-13162	1000	2013	4.5	21.168			1/19/2013	4.70
Springer	S1000-15024	1000	2013	1.838	10.084			1/21/2013	5.49
Springer	S1000-15029	1000	2013	1.138	10.001			1/21/2013	8.79
Springer	S1000-15037	1000	2013	1.278	8.667			1/21/2013	6.78
Springer	S1000-15067	1000	2013	1.706	10.084			1/21/2013	5.91
Springer	S1000-15105	1000	2013	2.988	19.501			1/21/2013	6.53
Springer	S1132-69062	1132	2013	0.734	5.425			1/21/2013	7.39
Springer	S1132-69065	1132	2013	0.541	3.75			1/21/2013	6.93
Springer	S1132-69082	1132	2013	1.172	16.668			1/21/2013	14.22
Springer	S1132-69094	1132	2013	1.088	7.626			1/21/2013	7.01
Springer	S1132-69109	1132	2013	0.659	6.642			1/21/2013	10.08
Springer	S1000-14124	1000	2013	0.662	15.334			1/25/2013	23.16
Springer	S1000-14135	1000	2013	2.766	21.501			1/25/2013	7.77
Springer	S1000-14241	1000	2013	1.85	25.668			1/25/2013	13.87
Springer	S1000-14086	1000	2013	1.403	9.334			1/26/2013	6.65
Springer	S1132-70004	1132	2013	0.853	55.754			2/2/2013	65.36
Springer	S1132-70008	1132	2013	0.519	6.675			2/2/2013	12.86
Springer	S1132-70011	1132	2013	0.666	0.917			2/2/2013	1.38
Springer	S1132-70028	1132	2013	1.144	1.425			2/2/2013	1.25
Springer	S1132-70032	1132	2013	1.003	1.9			2/2/2013	1.89
Springer	S1132-70092	1132	2013	0.712	4.375			2/2/2013	6.14
Springer	S1132-70096	1132	2013	1.612	28.335			2/2/2013	17.58
Springer	S1132-70108	1132	2013	1.194	13.084			2/2/2013	10.96
Springer	S1132-70148	1132	2013	1.775	45.253			2/2/2013	25.49
Springer	S1000-16015	1000	2013	1.691	10.501			2/3/2013	6.21
Springer	S1000-16038	1000	2013	6.156	28.585			2/3/2013	4.64
Springer	S1000-16065	1000	2013	4.25	22.501			2/3/2013	5.29
Springer	S1000-16090	1000	2013	1.478	22.501			2/3/2013	15.22
Springer	S1000-16145	1000	2013	0.966	55.004			2/3/2013	56.94
Springer	S1000-14178	1000	2013	1.941	51.42			2/7/2013	26.49
Springer	S1000-14299	1000	2013	0.756	29.585			2/7/2013	39.13
Springer	S1132-73101	1132	2013	0.838	0.967			2/16/2013	1.15
Springer	S1132-73106	1132	2013	0.584	2.642			2/16/2013	4.52
Springer	S1132-73111	1132	2013	0.619	6.034			2/16/2013	9.75
Springer	S1132-73118	1132	2013	0.469	11.501			2/16/2013	24.52
Springer	S1132-73155	1132	2013	0.092	7.442			2/16/2013	80.89
Springer	S1132-73162	1132	2013	0.791	19.918			2/16/2013	25.18
Springer	S1132-73182	1132	2013	0.969	6.784			2/16/2013	7.00
Springer	S1000-21035	1000	2013	6.844	34.919			2/19/2013	5.10
Springer	S1000-21105	1000	2013	1.238	34.836			2/19/2013	28.14
Springer	S1000-21112	1000	2013	15.062	28.919			2/19/2013	1.92
Springer	S1132-71204	1132	2013	0.872	3.15			2/19/2013	3.61
Springer	S1132-71217	1132	2013	0.784	1.175			2/19/2013	1.50
Springer	S1132-71223	1132	2013	0.872	10.834			2/19/2013	12.42
Springer	S1132-71246	1132	2013	1.094	24.752			2/19/2013	22.63
Springer	S1132-71251	1132	2013	0.741	1.558			2/19/2013	2.10
Springer	S1132-71263	1132	2013	0.684	0.557			2/19/2013	0.81
Springer	S1132-74037	1132	2013	0.575	13.084			2/19/2013	22.75
Springer	S1132-74073	1132	2013	0.641	0.942			2/19/2013	1.47
Springer	S1132-74080	1132	2013	0.834	11.084			2/19/2013	13.29
Springer	S1132-74094	1132	2013	0.5	4.459			2/19/2013	8.92
Springer	S1132-74101	1132	2013	1.1	1.292			2/19/2013	1.17
Springer	S1132-74113	1132	2013	0.734	3.442			2/19/2013	4.69
Springer	S1132-74123	1132	2013	0.931	1.233			2/19/2013	1.32
Springer	S1132-74135	1132	2013	0.566	0.842			2/19/2013	1.49
Springer	S1000-19190	1000	2013	10.469	20.418			2/21/2013	1.95
Springer	S1000-19250	1000	2013	6.531	20.251			2/21/2013	3.10
Springer	S1000-19256	1000	2013	4.625	22.335			2/21/2013	4.83
Springer	S1000-19295	1000	2013	4.438	24.502			2/21/2013	5.52
Springer	S1000-19311	1000	2013	7.062	23.252			2/21/2013	3.29
Springer	S1000-19338	1000	2013	9	23.085			2/21/2013	2.57
Springer	S1000-19342	1000	2013	5.719	15.084			2/21/2013	2.64
Springer	S1132-76041	1132	2013	0.666	38.419			2/25/2013	57.69
Springer	S1132-76065	1132	2013	1.281	19.751			2/25/2013	15.42
Springer	S1000-22009	1000	2013	1.916	56.087			2/26/2013	29.27
Springer	S1000-22030	1000	2013	4.406	16.668			2/26/2013	3.78
Springer	S1000-22054	1000	2013	2.95	15.834			2/26/2013	5.37
Springer	S1000-22072	1000	2013	6.312	28.252			2/26/2013	4.48
Springer	S1000-22093	1000	2013	24.906	20.668			2/26/2013	0.83
Springer	S1132-75018	1132	2013	3.219	18.251			2/28/2013	5.67
Springer	S1132-75051	1132	2013	0.481	14.334			2/28/2013	29.80
Springer	S1132-75066	1132	2013	0.6	4.959			2/28/2013	8.27
Springer	S1132-75089	1132	2013	1.141	3.417			2/28/2013	2.99
Springer	S1132-75121	1132	2013	0.419	3.342			2/28/2013	7.98
Springer	S1132-75133	1132	2013	0.978	40.586			2/28/2013	41.50
Springer	S1132-75167	1132	2013	1.016	9.917			2/28/2013	9.76
Springer	S1000-19346	1000	2013	12.781	22.168			3/2/2013	1.73
Springer	S1000-23008	1000	2013	12.312	42.586			3/4/2013	3.46
Springer	S1000-23022	1000	2013	3.406	22.501			3/4/2013	6.61
Springer	S1000-23038	1000	2013	3.625	24.252			3/4/2013	6.69
Springer	S1000-23056	1000	2013	2.697	32.169			3/4/2013	11.93
Springer	S1000-23074	1000	2013	9.938	35.919			3/4/2013	3.61
Springer	s1120-81026	1120	2013	1.069	16.501			3/6/2013	15.44
Springer	s1120-81056	1120	2013	0.916	13.834			3/6/2013	15.10
Springer	s1120-81086	1120	2013	0.953	5.167			3/6/2013	5.42
Springer	s1120-80010	1120	2013	0.781	13.834			3/9/2013	17.71
Springer	s1120-80030	1120	2013	0.853	18.918			3/9/2013	22.18
Springer	s1120-80037	1120	2013	0.778	17.334			3/9/2013	22.28
Springer	s1120-80070	1120	2013	0.447	18.418			3/9/2013	41.20
Springer	s1120-80082	1120	2013	0.647	3.292			3/9/2013	5.09
Springer	s1120-80092	1120	2013	0.459	6.617			3/9/2013	14.42
Springer	s1120-80099	1120	2013	0.912	13.251			3/9/2013	14.53
Springer	s1120-80124	1120	2013	0.894	2.308			3/9/2013	2.58
Springer	s1120-80129	1120	2013	0.678	11.917			3/9/2013	17.58
Springer	s1120-80155	1120	2013	0.666	4.917			3/9/2013	7.38
Springer	s1120-80162	1120	2013	0.491	8.151			3/9/2013	16.60
Springer	s1120-80189	1120	2013	0.819	5.575			3/9/2013	6.81
Springer	S1000-24014	1000	2013	8.625	19.835			3/10/2013	2.30
Springer	S1000-24016	1000	2013	7.062	23.502			3/10/2013	3.33
Springer	S1000-24018	1000	2013	25.094	42.836			3/10/2013	1.71
Springer	S1000-24020	1000	2013	13.219	28.335			3/10/2013	2.14
Springer	S1000-24022	1000	2013	9.094	18.835			3/10/2013	2.07
Springer	S1000-24039	1000	2013	8.719	19.501			3/10/2013	2.24
Springer	S1000-24041	1000	2013	11.344	26.502			3/10/2013	2.34
Springer	S1000-24043	1000	2013	6.25	19.001			3/10/2013	3.04
Springer	S1000-24045	1000	2013	10.656	29.335			3/10/2013	2.75
Springer	S1000-24047	1000	2013	15.688	24.085			3/10/2013	1.54
Springer	S1000-24060	1000	2013	1.456	22.752			3/10/2013	15.63
Springer	S1000-24062	1000	2013	1.75	16.751			3/10/2013	9.57
Springer	S1000-24064	1000	2013	4.062	18.251			3/10/2013	4.49
Springer	S1000-24066	1000	2013	13.594	17.001			3/10/2013	1.25
Springer	S1000-24077	1000	2013	4.125	18.335			3/10/2013	4.44
Springer	S1000-24079	1000	2013	4.906	17.084			3/10/2013	3.48
Springer	S1000-24081	1000	2013	20.875	29.502			3/10/2013	1.41
Springer	S1000-24086	1000	2013	6.844	40.253			3/10/2013	5.88
Springer	S1000-24092	1000	2013	2.231	25.585			3/10/2013	11.47
Springer	S1000-24105	1000	2013	19	17.418			3/10/2013	0.92
Springer	S1000-24107	1000	2013	6.844	12.334			3/10/2013	1.80
Springer	S1000-24109	1000	2013	13.969	26.335			3/10/2013	1.89
Springer	S1000-24111	1000	2013	12.812	13.751			3/10/2013	1.07
Springer	s1132-77198	1132	2013	1.238	3.584			3/10/2013	2.89
Springer	s1132-77255	1132	2013	1.444	10.667			3/10/2013	7.39
Springer	S1120-81320	1120	2013	1.331	39.836			3/11/2013	29.93
Springer	S1120-81339	1120	2013	1.009	3.509			3/11/2013	3.48
Springer	S1120-81370	1120	2013	0.888	1.808			3/11/2013	2.04
Springer	S1120-82011	1120	2013	0.469	7.826			3/14/2013	16.69
Springer	S1120-82043	1120	2013	0.55	0.782			3/14/2013	1.42
Springer	S1120-82057	1120	2013	0.947	0.992			3/14/2013	1.05
Springer	S1120-82061	1120	2013	1.144	26.502			3/14/2013	23.17
Springer	S1120-82116	1120	2013	0.319	5.175			3/14/2013	16.22
Springer	S1120-82126	1120	2013	0.688	22.418			3/14/2013	32.58
Springer	S1120-82141	1120	2013	1.634	2.242			3/14/2013	1.37
Springer	S1000-24131	1000	2013	10.938	24.502			3/17/2013	2.24
Springer	S1000-24133	1000	2013	21.375	20.251			3/17/2013	0.95
Springer	S1000-24135	1000	2013	8.969	7.375			3/17/2013	0.82
Springer	S1000-24157	1000	2013	32.188	13.251			3/17/2013	0.41
Springer	S1000-24159	1000	2013	11.125	11.917			3/17/2013	1.07
Springer	S1000-24161	1000	2013	23.406	21.335			3/17/2013	0.91

Springer	S1000-24173	1000	2013	6.688	28.169			3/17/2013	4.21
Springer	S1000-24186	1000	2013	38.125	27.002			3/17/2013	0.71
Springer	S1000-24188	1000	2013	7.312	25.418			3/17/2013	3.48
Springer	S1000-24214	1000	2013	23.844	18.251			3/17/2013	0.77
Springer	S1000-24216	1000	2013	24.188	33.586			3/17/2013	1.39
Springer	S1120-82107	1120	2013	0.709	12.417			3/17/2013	17.51
Springer	S1150-1140	1150	2013	1.538	9.334			3/22/2013	6.07
Springer	S1150-1150	1150	2013	2.025	69.671			3/22/2013	34.41
Springer	S1150-1161	1150	2013	8.719	67.921			3/22/2013	7.79
Springer	S1150-1185	1150	2013	0.875	36.502			3/22/2013	41.72
Springer	S1132-78008	1132	2013	0.853	1.325			3/23/2013	1.55
Springer	S1132-78013	1132	2013	0.744	1.142			3/23/2013	1.53
Springer	S1132-78077	1132	2013	1.469	30.419			3/23/2013	20.71
Springer	S1132-78083	1132	2013	0.806	1.267			3/23/2013	1.57
Springer	S1132-78087	1132	2013	0.512	7.017			3/23/2013	13.71
Springer	S1132-78091	1132	2013	0.734	2.292			3/23/2013	3.12
Springer	S1132-78095	1132	2013	1.041	22.168			3/23/2013	21.29
Springer	S1132-78128	1132	2013	0.853	1.333			3/23/2013	1.56
Springer	S1132-78133	1132	2013	1.372	25.585			3/23/2013	18.65
Springer	S1132-78192	1132	2013	0.509	1.117			3/23/2013	2.19
Springer	S1132-78196	1132	2013	0.531	1.25			3/23/2013	2.35
Springer	S1132-78209	1132	2013	0.856	18.918			3/23/2013	22.10
Springer	S1132-78213	1132	2013	0.962	1.558			3/23/2013	1.62
Springer	S1000-26171	1000	2013	10.031	29.835			3/25/2013	2.97
Springer	S1000-26195	1000	2013	3.594	74.005			3/27/2013	20.59
Springer	S1000-26200	1000	2013	2.194	57.921			3/27/2013	26.40
Springer	S1000-26202	1000	2013	4.25	30.085			3/27/2013	7.08
Springer	S1000-26204	1000	2013	9.562	10.417			3/27/2013	1.09
Springer	S1000-26219	1000	2013	2.4	42.336			3/27/2013	17.64
Springer	S1000-26224	1000	2013	1.444	42.503			3/27/2013	29.43
Springer	S1000-26226	1000	2013	1.722	43.836			3/27/2013	25.46
Springer	S1000-26243	1000	2013	2.441	105.007			3/27/2013	43.02
Springer	S1000-26248	1000	2013	0.984	41.919			3/27/2013	42.60
Springer	S1000-26250	1000	2013	1.431	41.669			3/27/2013	29.12
Springer	S1000-26252	1000	2013	24.812	24.418			3/27/2013	0.98
Springer	S1000-26255	1000	2013	9.812	19.668			3/27/2013	2.00
Springer	S1000-26259	1000	2013	6.281	24.918			3/27/2013	3.97
Springer	S1150-2129	1150	2013	1.291	40.669			3/27/2013	31.50
Springer	S1150-2136	1150	2013	7.344	27.585			3/27/2013	3.76
Springer	S1150-2142	1150	2013	3.594	32.419			3/27/2013	9.02
Springer	S1150-2192	1150	2013	4.281	58.087			3/27/2013	13.57
Springer	S1150-2205	1150	2013	5.688	48.503			3/27/2013	8.53
Springer	S1000-25003	1000	2013	1.944	20.835			3/30/2013	10.72
Springer	S1000-25005	1000	2013	19.281	23.752			3/30/2013	1.23
Springer	S1000-25017	1000	2013	3.5	26.335			3/30/2013	7.52
Springer	S1000-25023	1000	2013	3.812	32.335			3/30/2013	8.48
Springer	S1000-25031	1000	2013	5.562	39.503			3/30/2013	7.10
Springer	S1000-25033	1000	2013	2.903	23.502			3/30/2013	8.10
Springer	S1000-25048	1000	2013	4.281	32.169			3/30/2013	7.51
Springer	S1000-25100	1000	2013	8.188	21.501			3/30/2013	2.63
Springer	S1000-25102	1000	2013	5.281	21.335			3/30/2013	4.04
Springer	S1000-25104	1000	2013	4.688	22.501			3/30/2013	4.80
Springer	S1000-25111	1000	2013	1.6	28.252			3/30/2013	17.66
Springer	S1150-1231	1150	2013	2.956	175.012			4/3/2013	59.21
Springer	S1000-27017	1000	2013	27.844	42.253			4/5/2013	1.52
Springer	S1000-27023	1000	2013	59.375	42.753			4/5/2013	0.72
Springer	S1000-27026	1000	2013	39.062	46.17			4/5/2013	1.18
Springer	S1000-27036	1000	2013	50.312	43.836			4/5/2013	0.87
Springer	S1000-27038	1000	2013	10.875	49.92			4/5/2013	4.59
Springer	S1000-27042	1000	2013	5.312	37.919			4/5/2013	7.14
Springer	S1000-27043	1000	2013	12.688	55.754			4/5/2013	4.39
Springer	S1000-27053	1000	2013	21.156	40.753			4/5/2013	1.93
Springer	S1000-27057	1000	2013	4.531	44.753			4/5/2013	9.88
Springer	S1000-27065	1000	2013	45.938	28.752			4/5/2013	0.63
Springer	S1000-27070	1000	2013	17.094	32.002			4/5/2013	1.87
Springer	S1000-27073	1000	2013	10.344	42.67			4/5/2013	4.13
Springer	S1000-27078	1000	2013	24.062	24.002			4/5/2013	1.00
Springer	S1000-27083	1000	2013	19.031	38.419			4/5/2013	2.02
Springer	S1000-27085	1000	2013	12.531	43.003			4/5/2013	3.43
Springer	S1000-27090	1000	2013	27.125	39.836			4/5/2013	1.47
Springer	S1000-27097	1000	2013	8.531	33.586			4/5/2013	3.94
Springer	S1000-27104	1000	2013	10.469	42.169			4/5/2013	4.03
Springer	S1000-27110	1000	2013	7.469	31.502			4/5/2013	4.22
Springer	S1000-27112	1000	2013	7.5	44.086			4/5/2013	5.88
Springer	S1000-27118	1000	2013	8.75	52.67			4/5/2013	6.02
Springer	S1000-27123	1000	2013	11.688	15.668			4/5/2013	1.34
Springer	S1000-27125	1000	2013	13.188	27.919			4/5/2013	2.12
Springer	S1000-27131	1000	2013	1.647	73.088			4/5/2013	44.38
Springer	S1000-27135	1000	2013	13.688	45.836			4/5/2013	3.35
Springer	S1000-27137	1000	2013	29.688	25.002			4/5/2013	0.84
Springer	S1000-27143	1000	2013	8.281	41.086			4/5/2013	4.96
Springer	S1000-27146	1000	2013	7.188	39.503			4/5/2013	5.50
Springer	S1120-82124	1120	2013	5.062	90.006			4/6/2013	17.78
Springer	S1120-83190	1120	2013	0.588	8.176			4/6/2013	13.90
Springer	S1120-83196	1120	2013	0.631	7.484			4/6/2013	11.86
Springer	S1120-83304	1120	2013	0.478	19.668			4/6/2013	41.15
Springer	S1120-83310	1120	2013	0.512	28.252			4/6/2013	55.18
Springer	S1120-83329	1120	2013	0.709	1.425			4/6/2013	2.01
Springer	S1120-83338	1120	2013	0.453	2.183			4/6/2013	4.82
Springer	S1120-83359	1120	2013	0.29	4.842			4/6/2013	16.70
Springer	S1000-30006	1000	2013	30.438	49.503			4/13/2013	1.63
Springer	S1000-30008	1000	2013	46.875	34.669			4/13/2013	0.74
Springer	S1000-30024	1000	2013	14.812	23.418			4/13/2013	1.58
Springer	S1000-30047	1000	2013	58.438	21.168			4/13/2013	0.36
Springer	S1000-30049	1000	2013	20.906	15.168			4/13/2013	0.73
Springer	S1140-1212	1140	2013	1.312	16.334			4/20/2013	12.45
Springer	S1140-1222	1140	2013	2.378	101.673			4/20/2013	42.76
Springer	S1140-1305	1140	2013	3.091	12.751			4/20/2013	4.13
Springer	S1140-1324	1140	2013	3.531	27.752			4/20/2013	7.86
Springer	C1108-1019	1108	2013	0.981	21.751			5/12/2013	22.17
Springer	C1108-1037	1108	2013	1.697	27.669			5/12/2013	16.30
Springer	C1108-1041	1108	2013	2.7	14.084			5/12/2013	5.22
Springer	C1108-1067	1108	2013	1.153	21.585			5/12/2013	18.72
Springer	C1108-1088	1108	2013	1.441	57.921			5/12/2013	40.20
Springer	C1108-1105	1108	2013	1.5	30.752			5/12/2013	20.50
Springer	C1108-1109	1108	2013	1.562	28.669			5/12/2013	18.35
Springer	C1108-1120	1108	2013	0.547	36.669			5/12/2013	67.04
Springer	C1108-1143	1108	2013	0.744	37.669			5/12/2013	50.63
Springer	S1108-88010	1108	2013	1.338	36.919			5/12/2013	27.59
Springer	S1108-88041	1108	2013	1.906	26.668			5/12/2013	13.99
Springer	S1108-88082	1108	2013	0.331	8.417			5/12/2013	25.43
Springer	S1130-1315	1130	2013	10.812	59.837			5/14/2013	5.53
Springer	S1130-1337	1130	2013	5.625	162.511			5/14/2013	28.89
Springer	S1130-1345	1130	2013	4.469	9.584			5/14/2013	2.14
Springer	S988-5027	988	2013	2.078	18.835			5/15/2013	9.06
Springer	S988-5030	988	2013	2.522	16.751			5/15/2013	6.64
Springer	S988-5058	988	2013	2.897	12.167			5/15/2013	4.20
Springer	S1130-1070	1130	2013	9.219	29.085			5/17/2013	3.15
Springer	S1130-1130	1130	2013	4.344	52.087			5/17/2013	11.99
Springer	S988-7010	988	2013	1.378	10.834			5/20/2013	7.86
Springer	S988-7045	988	2013	2.394	37.669			5/20/2013	15.73
Springer	S1120-85010	1120	2013	0.753	20.251			6/3/2013	26.89
Springer	S1120-85021	1120	2013	0.594	9.084			6/3/2013	15.29
Springer	S1120-85099	1120	2013	0.641	6.517			6/3/2013	10.17
Springer	S1120-85117	1120	2013	2.069	21.835			6/3/2013	10.55
Springer	S1120-85506	1120	2013	0.566	19.918			6/3/2013	35.19
Springer	S1120-85545	1120	2013	0.697	1.8			6/3/2013	2.58
Springer	S988-6180	988	2013	0.466	4.292			6/3/2013	9.21
Springer	S988-6374	988	2013	0.481	11.084			6/3/2013	23.04
Springer	S988-9014	988	2013	1.641	34.419			6/4/2013	20.97
Springer	S988-9089	988	2013	3.75	22.835			6/4/2013	6.09
Springer	S988-9131	988	2013	5.594	23.918			6/4/2013	4.28
Springer	S1000-31050	1000	2013	6.406	11.667			6/5/2013	1.82
Springer	S1000-31056	1000	2013	20.031	10.167			6/5/2013	0.51
Springer	S1000-31062	1000	2013	7.25	33.669			6/5/2013	4.64
Springer	S1000-31075	1000	2013	4.406	27.335			6/5/2013	6.20
Springer	S1000-31078	1000	2013	5.875	17.751			6/5/2013	3.02
Springer	S1130-2030	1130	2013	3.281	13.834			6/5/2013	4.22
Springer	S1130-2300	1130	2013	2.006	3.842			6/5/2013	1.92
Springer	S1130-2306	1130	2013	1.078	11.501			6/5/2013	10.67
Springer	S1130-2310	1130	2013	5.344	17.251			6/5/2013	3.23
Springer	S1130-2317	1130	2013	1.909	22.085			6/5/2013	11.57
Springer	S1130-2332	1130	2013	3.05	5.117			6/5/2013	1.68
Springer	S1130-2348	1130	2013	1.809	6.934			6/5/2013	3.83
Springer	S1130-2355	1130	2013	4.812	9.917			6/5/2013	2.06
Springer	S1000-31028	1000	2013	4.25	13.834			6/7/2013	3.26
Springer	S1000-31038	1000	2013	3	30.752			6/7/2013	10.25
Springer	S1120-86082	1120	2013	1.159	21.751			6/12/2013	18.77
Springer	S1120-86090	1120	2013	0.312	1.833			6/12/2013	5.88
Springer	S1120-86149	1120	2013	0.997	6.7			6/12/2013	6.72
Springer	S1120-86156	1120	2013	0.444	4.759			6/12/2013	10.72
Springer	S1120-86177	1120	2013	2.056	3.942			6/12/2013	1.92
Springer	S1120-86200	1120	2013	0.691	21.251			6/12/2013	30.75
Springer	S1120-86207	1120	2013	0.991	5.117			6/12/2013	5.16
Springer	S988-10050	988	2013	5.219	27.168			6/16/2013	5.21
Springer	S988-10105	988	2013	1.216	26.585			6/16/2013	21.86
Springer	S988-10131	988	2013	1.794	38.003			6/16/2013	21.18
Springer	S1000-28002	1000	2013	5.969	30.169			6/17/2013	5.05
Springer	S1000-28020	1000	2013	8.844	13.001			6/17/2013	1.47
Springer	S1000-28038	1000	2013	9.438	22.668			6/17/2013	2.40
Springer	S1000-28056	1000	2013	5.594	22.668			6/17/2013	4.05
Springer	S1000-28074	1000	2013	6.594	15.751			6/17/2013	2.39
Springer	S1000-28092	1000	2013	8.656	18.835			6/17/2013	2.18
Springer	S1120-87006	1120	2013	20.562	28.919			6/19/2013	1.41
Springer	S1120-87009	1120	2013	22.062	12.001			6/19/2013	0.54
Springer	S1120-87012	1120	2013	63.75	66.754			6/19/2013	1.05
Springer	S1120-87015	1120	2013	15.719	11.667			6/19/2013	0.74
Springer	S1120-87018	1120	2013	35.625	20.418			6/19/2013	0.57
Springer	S1120-87031	1120	2013	17.844	8.142			6/19/2013	0.46
Springer	S1120-87040	1120	2013	31.25	15.918			6/19/2013	0.51
Springer	S1120-87051	1120	2013	43.125	12.334			6/19/2013	0.29
Springer	S1120-87054	1120	2013	35	9.917			6/19/2013	0.28
Springer	S1120-87057	1120	2013	40.938	16.334			6/19/2013	0.40
Springer	S1120-87060	1120	2013	42.188	37.919			6/19/2013	0.90
Springer	S1120-87063	1120	2013	1.606	3.392			6/19/2013	2.11
Springer	S1120-87072	1120	2013	14.094	9.834			6/19/2013	0.70
Springer	S1120-87104	1120	2013	2.366	34.919			6/19/2013	14.76
Springer	S1120-87107	1120	2013	14.25	15.334			6/19/2013	1.08
Springer	S1120-87110	1120	2013	59.375	15.251			6/19/2013	0.26
Springer	S1120-87113	1120	2013	40.625	15.251			6/19/2013	0.38

Springer	S1120-87116	1120	2013	25.906	17.835			6/19/2013	0.69
Springer	S1120-87127	1120	2013	4.156	3.742			6/19/2013	0.90
Springer	S1120-87153	1120	2013	49.062	35.502			6/19/2013	0.72
Springer	S1120-87156	1120	2013	26.812	15.834			6/19/2013	0.59
Springer	S1120-87159	1120	2013	25.969	7.659			6/19/2013	0.29
Springer	S1120-87162	1120	2013	1.062	1.375			6/19/2013	1.29
Springer	S1120-87182	1120	2013	1.978	1.25			6/19/2013	0.63
Springer	S1120-87184	1120	2013	24.188	5.375			6/19/2013	0.22
Springer	S1120-87187	1120	2013	33.75	5.734			6/19/2013	0.17
Springer	S1120-87190	1120	2013	98.438	9.584			6/19/2013	0.10
Springer	S1120-87207	1120	2013	23.375	16.418			6/19/2013	0.70
Springer	S1120-87209	1120	2013	40.312	21.751			6/19/2013	0.54
Springer	S988-11203	988	2013	2.078	18.585			6/20/2013	8.94
Springer	S988-11208	988	2013	1.962	42.419			6/20/2013	21.62
Springer	S988-11321	988	2013	1.719	16.834			6/20/2013	9.79
Springer	S1000-28113	1000	2013	19.625	27.669			6/22/2013	1.41
Springer	S1000-28131	1000	2013	18.906	25.585			6/22/2013	1.35
Springer	S1000-28149	1000	2013	19.719	34.002			6/22/2013	1.72
Springer	S1000-28164	1000	2013	65	37.502			6/22/2013	0.58
Springer	S1000-28179	1000	2013	35	21.835			6/22/2013	0.62
Springer	S1120-88004	1120	2013	1.078	3			7/4/2013	2.78
Springer	S1120-88010	1120	2013	0.778	9.751			7/4/2013	12.53
Springer	S1120-88016	1120	2013	0.847	29.085			7/4/2013	34.34
Springer	S1120-88073	1120	2013	0.994	17.918			7/4/2013	18.03
Springer	S1120-88128	1120	2013	1.272	9.667			7/4/2013	7.60
Springer	S1120-88136	1120	2013	0.594	1.283			7/4/2013	2.16
Springer	S1120-88161	1120	2013	1.278	11.251			7/4/2013	8.80
Springer	S988-15201	988	2013	2.162	14.918			7/8/2013	6.90
Springer	S988-15211	988	2013	1.969	20.668			7/8/2013	10.50
Springer	S1000-33003	1000	2013	8.219	62.004			7/10/2013	7.54
Springer	S1000-33025	1000	2013	15.938	41.003			7/10/2013	2.57
Springer	S1000-33056	1000	2013	1.156	22.752			7/10/2013	19.68
Springer	S1000-33063	1000	2013	2.034	26.252			7/10/2013	12.91
Springer	S1000-33078	1000	2013	3.25	18.918			7/10/2013	5.82
Springer	S1000-33112	1000	2013	2.9	38.669			7/10/2013	13.33
Springer	S1000-33115	1000	2013	1.622	17.751			7/10/2013	10.94
Springer	S1000-33119	1000	2013	13.281	27.335			7/10/2013	2.06
Springer	S1000-33121	1000	2013	2.612	40.586			7/10/2013	15.54
Springer	S1000-33123	1000	2013	35.938	43.253			7/10/2013	1.20
Springer	S1000-33132	1000	2013	4.875	12.584			7/10/2013	2.58
Springer	S1000-33137	1000	2013	11.438	30.252			7/10/2013	2.64
Springer	S1000-33145	1000	2013	1.481	48.253			7/10/2013	32.58
Springer	S988-15106	988	2013	3.438	37.836			7/10/2013	11.01
Springer	S1120-89006	1120	2013	1.459	2.625			7/18/2013	1.80
Springer	S1120-89023	1120	2013	1.272	1.408			7/18/2013	1.11
Springer	S1120-89027	1120	2013	1.553	3.334			7/18/2013	2.15
Springer	S1120-89059	1120	2013	5.562	4.634			7/18/2013	0.83
Springer	S1120-89062	1120	2013	2.369	7.175			7/18/2013	3.03
Springer	S1120-89096	1120	2013	0.912	2.158			7/18/2013	2.37
Springer	S1120-89104	1120	2013	1.422	6.042			7/18/2013	4.25
Springer	S1120-89108	1120	2013	2.056	5.884			7/18/2013	2.86
Springer	S1120-89140	1120	2013	1.956	1.85			7/18/2013	0.95
Springer	S1120-89143	1120	2013	2.112	5.817			7/18/2013	2.75
Springer	S1120-90300	1120	2013	0.797	11.584			7/30/2013	14.53
Springer	S1120-90308	1120	2013	0.834	3.425			7/30/2013	4.11
Springer	S1120-90317	1120	2013	1.675	2.609			7/30/2013	1.56
Springer	S1120-90323	1120	2013	0.622	28.419			7/30/2013	45.69
Springer	S1120-90446	1120	2013	2.097	17.251			7/30/2013	8.23
Springer	S1120-90453	1120	2013	1.253	3.167			7/30/2013	2.53
Springer	S1120-90459	1120	2013	0.997	1.342			7/30/2013	1.35
Springer	S1120-90465	1120	2013	1.391	2.442			7/30/2013	1.76
Springer	S1120-90469	1120	2013	0.959	17.835			7/30/2013	18.60
Springer	S1132-80082	1132	2013	0.647	3.292			7/31/2013	5.09
Springer	S1108-89024	1108	2013	1.394	14.001			8/5/2013	10.04
Springer	S1108-89072	1108	2013	1.259	1.533			8/5/2013	1.22
Springer	S1108-89091	1108	2013	1.562	9.251			8/5/2013	5.92
Springer	S1108-89146	1108	2013	0.6	12.918			8/5/2013	21.53
Springer	S1120-91300	1120	2013	5.562	33.669			8/8/2013	6.05
Springer	S1120-91319	1120	2013	5.688	14.334			8/8/2013	2.52
Springer	S1120-91329	1120	2013	6.625	74.838			8/8/2013	11.30
Springer	S1120-91338	1120	2013	3.25	15.001			8/8/2013	4.62
Springer	S1120-91356	1120	2013	10.5	77.589			8/8/2013	7.39
Springer	S1120-91361	1120	2013	6.75	25.168			8/8/2013	3.73
Springer	S1120-91378	1120	2013	3.188	7.817			8/8/2013	2.45
Springer	S1120-91006	1120	2013	1.262	56.42			8/13/2013	44.71
Springer	S1120-91033	1120	2013	2.897	68.088			8/13/2013	23.50
Springer	S1120-91054	1120	2013	18.781	22.335			8/13/2013	1.19
Springer	S1120-91072	1120	2013	12.438	61.671			8/13/2013	4.96
Springer	S1144-69084	1144	2013	1.006	14.168	0.17	0.032	8/20/2013	14.08
Springer	S1144-69252	1144	2013	1.934	14.751	0.177	0.062	8/20/2013	7.63
Springer	S1144-69276	1144	2013	1.572	14.918	0.179	0.05	8/20/2013	9.49
Springer	S1144-69328	1144	2013	1.059	11.667	0.14	0.034	8/20/2013	11.02
Springer	S1144-69442	1144	2013	1.669	31.002	0.372	0.053	8/20/2013	18.58
Springer	S1144-69470	1144	2013	2.347	35.002	0.42	0.075	8/20/2013	14.91
Springer	S1144-69520	1144	2013	1.241	9.834	0.118	0.04	8/20/2013	7.92
Springer	S1144-69620	1144	2013	1.691	49.753	0.597	0.054	8/20/2013	29.42
Springer	S1144-69650	1144	2013	1.141	24.502	0.294	0.036	8/20/2013	21.47
Springer	S1120-92011	1120	2013	3.75	25.502			8/21/2013	6.80
Springer	S1120-92029	1120	2013	0.538	15.834			8/21/2013	29.43
Springer	S1120-92047	1120	2013	2.825	7			8/21/2013	2.48
Springer	S1120-92616	1120	2013	1.738	4.942			8/21/2013	2.84
Springer	S1120-92629	1120	2013	3.969	7.059			8/21/2013	1.78
Springer	S1120-92635	1120	2013	3.531	5.984			8/21/2013	1.69
Springer	S1108-90604	1108	2013	1.347	5.934			8/25/2013	4.41
Springer	S1108-90611	1108	2013	0.822	14.751			8/25/2013	17.95
Springer	S1108-90617	1108	2013	0.997	16.084			8/25/2013	16.13
Springer	S1108-90652	1108	2013	0.312	1.575			8/25/2013	5.05
Springer	S1108-90658	1108	2013	0.151	4.5			8/25/2013	29.80
Springer	S1108-90661	1108	2013	0.638	1.45			8/25/2013	2.27
Springer	S1108-90665	1108	2013	0.466	25.168			8/25/2013	54.01
Springer	S1108-90676	1108	2013	0.169	1.5			8/25/2013	8.88
Springer	S1108-90701	1108	2013	0.491	10.334			8/25/2013	21.05
Springer	S988-22046	988	2013	23.156	29.085			9/2/2013	1.26
Springer	S988-22601	988	2013	85.312	36.336			9/2/2013	0.43
Springer	S988-22607	988	2013	6.625	41.753			9/2/2013	6.30
Springer	S988-22617	988	2013	5.125	41.169			9/2/2013	8.03
Springer	S988-22674	988	2013	12.312	30.002			9/2/2013	2.44
Springer	S988-22679	988	2013	3.022	46.253			9/2/2013	15.31
Springer	S988-24606	988	2013	2.238	43.586			9/2/2013	19.48
Springer	S988-24616	988	2013	4.844	17.251			9/2/2013	3.56
Springer	S988-24627	988	2013	7.125	25.335			9/2/2013	3.56
Springer	S988-25600	988	2013	5.812	34.252			9/6/2013	5.89
Springer	S988-25604	988	2013	4.25	35.169			9/6/2013	8.28
Springer	S988-25606	988	2013	1.422	43.42			9/6/2013	30.53
Springer	S988-25608	988	2013	15.531	14.084			9/6/2013	0.91
Springer	S988-25616	988	2013	19.344	7.2			9/6/2013	0.37
Springer	S988-25637	988	2013	1.075	28.835			9/6/2013	26.82
Springer	S988-25640	988	2013	7.156	61.921			9/6/2013	8.65
Springer	S988-25671	988	2013	17.656	32.752			9/6/2013	1.86
Springer	S1144-69124	1144	2013	2.047	4.359	0.052	0.066	9/7/2013	2.13
Springer	S1144-69174	1144	2013	1.662	4.359	0.052	0.053	9/7/2013	2.62
Springer	S1144-69355	1144	2013	1.15	6.809	0.082	0.037	9/7/2013	5.92
Springer	S1144-69435	1144	2013	1.253	40.419	0.485	0.04	9/7/2013	32.26
Springer	S1144-69574	1144	2013	1.206	35.919	0.431	0.039	9/7/2013	29.78
Springer	S1144-69768	1144	2013	8.656	10.417	0.125	0.277	9/9/2013	1.20
Springer	S1144-69792	1144	2013	2.353	8.159	0.098	0.075	9/9/2013	3.47
Springer	S1144-69796	1144	2013	3.812	18.501	0.222	0.122	9/9/2013	4.85
Springer	S1144-69859	1144	2013	5.375	9.001	0.108	0.172	9/9/2013	1.67
Springer	S1144-69863	1144	2013	2.988	14.418	0.173	0.096	9/9/2013	4.83
Springer	S1144-69867	1144	2013	2.706	18.001	0.216	0.087	9/9/2013	6.65
Springer	S988-25000	988	2013	26.812	18.168			9/13/2013	0.68
Springer	S988-25034	988	2013	3.875	23.085			9/13/2013	5.96
Springer	S988-25049	988	2013	1.381	106.674			9/13/2013	77.24
Springer	S988-25302	988	2013	28.438	30.252			9/13/2013	1.06
Springer	S988-25305	988	2013	12.031	25.585			9/13/2013	2.13
Springer	S988-26051	988	2013	5.125	21.168			9/18/2013	4.13
Springer	S988-26063	988	2013	19.75	28.669			9/18/2013	1.45
Springer	S988-26206	988	2013	7.906	11.501			9/18/2013	1.45
Springer	S988-26226	988	2013	9.281	16.001			9/18/2013	1.72
Springer	S988-26605	988	2013	11.219	10.084			9/18/2013	0.90
Springer	S988-26608	988	2013	6.625	13.668			9/18/2013	2.06
Springer	S988-26611	988	2013	6.312	19.918			9/18/2013	3.16
Springer	S988-26624	988	2013	3.781	10.751			9/18/2013	2.84
Springer	S988-26629	988	2013	7.875	22.668			9/18/2013	2.88
Springer	S988-26648	988	2013	4.094	24.002			9/18/2013	5.86
Springer	S988-26652	988	2013	6.406	25.752			9/18/2013	4.02
Springer	S988-26655	988	2013	1.922	16.334			9/18/2013	8.50
Springer	S988-26657	988	2013	4.969	21.168			9/18/2013	4.26
Springer	S988-26638	988	2013	11.375	18.418			9/20/2013	1.62
Springer	S1132-81005	1132	2013	1.316	40.086			10/2/2013	30.46
Springer	S1132-81021	1132	2013	2.647	37.086			10/2/2013	14.01
Springer	S1132-81024	1132	2013	3.25	37.669			10/2/2013	11.59
Springer	S1132-81028	1132	2013	2.722	48.42			10/2/2013	17.79
Springer	S1132-81061	1132	2013	3.25	43.67			10/2/2013	13.44
Springer	S1132-81089	1132	2013	3.594	25.585			10/2/2013	7.12
Springer	S1132-81109	1132	2013	4.75	12.751			10/2/2013	2.68
Springer	S1132-81145	1132	2013	5.125	50.92			10/2/2013	9.94
Springer	S1132-81147	1132	2013	3.688	18.585			10/2/2013	5.04
Springer	S1132-81151	1132	2013	14.375	27.752			10/2/2013	1.93
Springer	S1132-81159	1132	2013	5.156	32.836			10/2/2013	6.37
Springer	S1132-81177	1132	2013	3	11.917			10/2/2013	3.97
Springer	S1132-81188	1132	2013	7.062	13.501			10/2/2013	1.91
Springer	S1132-81194	1132	2013	10.719	39.086			10/2/2013	3.65
Springer	S1132-81224	1132	2013	6.719	25.668			10/2/2013	3.82
Springer	s1132-82612	1132	2013	28.906	26.002	0.312	0.925	10/20/2013	0.90
Springer	s1132-82628	1132	2013	20.656	9.751	0.117	0.661	10/20/2013	0.47
Springer	s1132-82639	1132	2013	46.25	91.673	1.1	1.48	10/20/2013	1.98
Springer	s1132-82658	1132	2013	9.406	2.659	0.032	0.301	10/20/2013	0.28
Springer	s1132-82664	1132	2013	23.125	9.251	0.111	0.74	10/20/2013	0.40
Springer	s1132-82674	1132	2013	11.625	15.668	0.188	0.372	10/20/2013	1.35
Springer	s1132-82678	1132	2013	24.844	8.417	0.101	0.795	10/20/2013	0.34
Springer	s1132-82684	1132	2013	1.659	7.809	0.094	0.053	10/20/2013	4.71
Springer	s1132-82704	1132	2013	7.094	25.168	0.302	0.227	10/20/2013	3.55
Springer	s1132-82708	1132	2013	15.062	2.559	0.031	0.482	10/20/2013	0.17
Springer	s1132-82711	1132	2013	1.653	4.325	0.052	0.053	10/20/2013	2.62
Springer	S1108-91610	1108	2013	0.791	27.835	0.334	0.025	10/22/2013	35.19
Springer	S1108-91613	1108	2013	0.419	5.025	0.06	0.013	10/22/2013	11.99
Springer	S1108-91637	1108	2013	1.178	4.109	0.049	0.038	10/22/2013	3.49
Springer	S1108-91654	1108	2013	3.003	54.17	0.65	0.096	10/22/2013	18.04
Springer	S1108-91659	1108	2013	1.031	4.667	0.056	0.033	10/22/2013	4.53

Springer	S1108-91687	1108	2013	1.256	2.4			10/22/2013	1.91
Springer	S1108-91706	1108	2013	1.191	34.586			10/22/2013	29.04
Springer	S1108-91737	1108	2013	3.562	15.918	0.191	0.114	10/22/2013	4.47
Springer	S1108-91743	1108	2013	0.7	37.836	0.454	0.022	10/22/2013	54.05
Springer	S1108-91748	1108	2013	2.969	8.667			10/22/2013	2.92
Springer	S1132-83034	1132	2013	1.956	20.585	0.247	0.063	10/27/2013	10.52
Springer	S1132-83038	1132	2013	2.759	21.085	0.253	0.088	10/27/2013	7.64
Springer	S1132-83053	1132	2013	1.338	4.467	0.054	0.043	10/27/2013	3.34
Springer	S1132-83080	1132	2013	1.503	38.669	0.464	0.048	10/27/2013	25.73
Springer	S1132-83087	1132	2013	2.478	15.584	0.187	0.079	10/27/2013	6.29
Springer	S1132-83108	1132	2013	3.156	20.001	0.24	0.101	10/27/2013	6.34
Springer	S1132-83115	1132	2013	1.669	11.501	0.138	0.053	10/27/2013	6.89
Springer	S1132-83134	1132	2013	3.25	7.776	0.093	0.104	10/27/2013	2.39
Springer	S1132-83137	1132	2013	1.928	18.835	0.226	0.062	10/27/2013	9.77
Springer	S1132-83174	1132	2013	1.712	9.751	0.117	0.055	10/27/2013	5.70
Springer	S1108-92631	1108	2013	1.659	33.169	0.398	0.053	10/30/2013	19.99
Springer	S1108-92634	1108	2013	0.559	3.05	0.037	0.018	10/30/2013	5.46
Springer	S1108-92664	1108	2013	1.981	13.001	0.156	0.063	10/30/2013	6.56
Springer	S1120-93623	1120	2013	0.928	1.308	0.016	0.03	11/2/2013	1.41
Springer	S1120-93651	1120	2013	1.166	4.034	0.048	0.037	11/2/2013	3.46
Springer	S1120-93677	1120	2013	1.269	1.808	0.022	0.041	11/2/2013	1.42
Springer	S1120-93695	1120	2013	1.628	9.834	0.118	0.052	11/2/2013	6.04
Springer	S1120-94610	1120	2013	22.469	25.835	0.31	0.719	11/13/2013	1.15
Springer	S1120-94613	1120	2013	40.938	30.419	0.365	1.31	11/13/2013	0.74
Springer	S1120-94621	1120	2013	40.312	20.335	0.244	1.29	11/13/2013	0.50
Springer	S1120-94639	1120	2013	57.188	43.836	0.526	1.83	11/13/2013	0.77
Springer	S1120-94644	1120	2013	28.031	38.169	0.458	0.897	11/13/2013	1.36
Springer	S1120-94660	1120	2013	55.312	32.836	0.394	1.77	11/13/2013	0.59
Springer	s1108-95626	1108	2013	1.166	4.534	0.054	0.037	11/19/2013	3.89
Springer	s1108-95632	1108	2013	1.116	6.55	0.079	0.036	11/19/2013	5.87
Springer	s1108-95650	1108	2013	0.237	16.168	0.194	0.008	11/19/2013	68.22
Springer	S1120-95639	1120	2013	21.312	10.917	0.131	0.682	11/25/2013	0.51
Springer	S1120-95668	1120	2013	7.031	8.667	0.104	0.225	11/25/2013	1.23
Springer	S1120-95693	1120	2013	40.312	24.335	0.292	1.29	11/25/2013	0.60
Springer	S1120-95718	1120	2013	4.668	9.001	0.108	0.15	11/25/2013	1.93
Springer	S1108-97304	1108	2013	0.544	5.875	0.07	0.017	11/27/2013	10.80
Springer	S1108-97600	1108	2013	9.75	14.584	0.175	0.312	11/27/2013	1.50
Springer	S1108-97636	1108	2013	4	7.901	0.095	0.128	11/27/2013	1.98
Springer	S1108-97641	1108	2013	1.503	2.1	0.025	0.048	11/27/2013	1.40
Springer	S1108-97659	1108	2013	1.441	4.2	0.05	0.046	11/27/2013	2.91
Springer	S1108-97663	1108	2013	4.406	13.084	0.157	0.141	11/27/2013	2.97
Springer	S1108-99003	1108	2013	21.344	11.334	0.136	0.683	12/17/2013	0.53
Springer	S1108-98643	1108	2013	1.728	0.449	0.005	0.055	12/18/2013	0.26
Springer	S1108-98796	1108	2013	35	27.752	0.333	1.12	12/18/2013	0.79
Springer	S1108-98822	1108	2013	14	9.167	0.11	0.448	12/18/2013	0.65
Springer	S1108-98826	1108	2013	18.406	14.168	0.17	0.589	12/18/2013	0.77
Springer	S1108-98859	1108	2013	31.875	11.584	0.139	1.02	12/18/2013	0.36
Springer	S1108-98865	1108	2013	70.625	14.834	0.178	2.26	12/18/2013	0.21
Springer	S1108-98877	1108	2013	84.375	26.585	0.319	2.7	12/18/2013	0.32
Springer	S1108-101606	1108	2013	2.625	0.908	0.011	0.084	12/30/2013	0.35
Springer	S1108-101619	1108	2013	6.469	14.168	0.17	0.207	12/30/2013	2.19
Springer	S1108-101659	1108	2013	3.25	2.534	0.03	0.104	12/30/2013	0.78
Springer	S1108-101667	1108	2013	8.875	37.169	0.446	0.284	12/30/2013	4.19
Springer	S1096-80603	1096	2014	0.722	11.584	0.139	0.023	1/9/2014	16.04
Springer	S1096-80615	1096	2014	0.916	18.001	0.216	0.029	1/9/2014	19.65
Springer	S1096-80621	1096	2014	1.409	31.169	0.374	0.045	1/9/2014	22.12
Springer	S1096-80648	1096	2014	1.606	17.418	0.209	0.051	1/9/2014	10.85
Springer	S1096-80680	1096	2014	1.456	24.835	0.298	0.047	1/9/2014	17.06
Springer	S1108-103605	1108	2014	4.469	12.084	0.145	0.143	1/20/2014	2.70
Springer	S1108-103623	1108	2014	0.494	0.634	0.008	0.016	1/20/2014	1.28
Springer	S1108-103632	1108	2014	2.194	16.084	0.193	0.07	1/20/2014	7.33
Springer	S1108-103664	1108	2014	1.031	10.751	0.129	0.033	1/20/2014	10.43
Springer	S1108-103679	1108	2014	0.628	2.35	0.028	0.02	1/20/2014	3.74
Springer	S1108-103682	1108	2014	0.819	8.151	0.098	0.026	1/20/2014	9.95
Springer	S1108-103701	1108	2014	0.559	23.752	0.285	0.018	1/20/2014	42.49
Springer	S1108-106608	1108	2014	3.156	33.919	0.407	0.101	1/24/2014	10.75
Springer	S1108-106612	1108	2014	14.875	14.918	0.179	0.476	1/24/2014	1.00
Springer	S1108-106625	1108	2014	47.188	48.003	0.576	1.51	1/24/2014	1.02
Springer	S1108-106629	1108	2014	16.938	16.168	0.194	0.542	1/24/2014	0.95
Springer	S1108-106635	1108	2014	40.625	21.085	0.253	1.3	1/24/2014	0.52
Springer	S1108-106646	1108	2014	24.062	21.751	0.261	0.77	1/24/2014	0.90
Springer	S1108-106653	1108	2014	49.062	17.585	0.211	1.57	1/24/2014	0.36
Springer	S1108-106661	1108	2014	35.938	19.085	0.229	1.15	1/24/2014	0.53
Springer	S1108-106676	1108	2014	30.594	17.334	0.208	0.979	1/24/2014	0.57
Springer	S1108-107602	1108	2014	34.062	24.585	0.295	1.09	1/28/2014	0.72
Springer	S1108-107620	1108	2014	65.625	43.92	0.527	2.1	1/28/2014	0.67
Springer	S1108-107657	1108	2014	12.281	40.253	0.483	0.393	1/28/2014	3.28
Springer	S1108-108607	1108	2014	0.55	1.817	0.022	0.018	2/5/2014	3.30
Springer	S1108-108625	1108	2014	0.947	10.751	0.129	0.03	2/5/2014	11.35
Springer	S1108-108632	1108	2014	0.631	8.501	0.102	0.02	2/5/2014	13.47
Springer	S1108-108723	1108	2014	0.838	36.336	0.436	0.027	2/5/2014	43.36
Springer	S1108-108741	1108	2014	1.066	13.168	0.158	0.034	2/5/2014	12.35
Springer	S1108-108747	1108	2014	1.112	1.583	0.019	0.036	2/5/2014	1.42
Springer	S1108-108755	1108	2014	1.359	3.9	0.047	0.044	2/5/2014	2.87
Springer	S1108-108758	1108	2014	0.997	10.917	0.131	0.032	2/5/2014	10.95
Springer	S1108-108796	1108	2014	0.634	7.926	0.095	0.02	2/5/2014	12.50
Springer	S1108-109607	1108	2014	6.75	1.317	0.016	0.216	2/10/2014	0.20
Springer	S1108-109612	1108	2014	1.709	1.567	0.019	0.055	2/10/2014	0.92
Springer	S1108-109622	1108	2014	1.606	1.075	0.013	0.051	2/10/2014	0.67
Springer	S1108-109690	1108	2014	21.5	12.167	0.146	0.688	2/10/2014	0.57
Springer	S1108-109720	1108	2014	1.931	0.685	0.008	0.062	2/10/2014	0.35
Springer	S1108-110602	1108	2014	6.125	13.251	0.159	0.196	2/20/2014	2.16
Springer	S1108-110612	1108	2014	0.744	0.883	0.011	0.024	2/20/2014	1.19
Springer	S1108-110624	1108	2014	0.991	0.819	0.01	0.032	2/20/2014	0.83
Springer	S1108-110635	1108	2014	2.153	52.337	0.628	0.069	2/20/2014	24.31
Springer	S1108-110680	1108	2014	0.778	12.001	0.144	0.025	2/20/2014	15.43
Springer	S1108-110695	1108	2014	0.384	8.501	0.102	0.012	2/20/2014	22.14
Springer	S1108-110700	1108	2014	0.466	1.817	0.022	0.015	2/20/2014	3.90
Springer	S1108-104225	1108	2014	4.281	52.92	0.635	0.137	2/24/2014	12.36
Springer	S1108-104242	1108	2014	5.688	40.753	0.489	0.182	2/24/2014	7.16
Springer	S1108-104308	1108	2014	2.988	186.679	2.24	0.096	2/24/2014	62.48
Springer	S1108-104608	1108	2014	1.962	51.337	0.616	0.063	2/24/2014	26.17
Springer	S1108-104612	1108	2014	4.688	5.609	0.067	0.15	2/24/2014	1.20
Springer	S1108-104671	1108	2014	4.094	108.341	1.3	0.131	2/24/2014	26.46
Springer	S1108-104678	1108	2014	3.844	11.834	0.142	0.123	2/24/2014	3.08
Springer	S1108-104684	1108	2014	4.094	153.344	1.84	0.131	2/24/2014	37.46
Springer	S1108-113608	1108	2014	63.125	24.835	0.298	2.02	3/11/2014	0.39
Springer	S1108-113615	1108	2014	42.5	8.917	0.107	1.36	3/11/2014	0.21
Springer	S1108-113631	1108	2014	26.188	9.917	0.119	0.838	3/11/2014	0.38
Springer	S1108-113643	1108	2014	45	7.259	0.087	1.44	3/11/2014	0.16
Springer	S1108-111605	1108	2014	17.125	15.584	0.187	0.548	3/12/2014	0.91
Springer	S1108-111610	1108	2014	5.875	13.834	0.166	0.188	3/12/2014	2.35
Springer	S1108-111619	1108	2014	1.153	17.835	0.214	0.037	3/12/2014	15.47
Springer	S1108-111630	1108	2014	31.875	18.168	0.218	1.02	3/12/2014	0.57
Springer	S1108-111633	1108	2014	9.812	9.001	0.108	0.314	3/12/2014	0.92
Springer	S1108-111643	1108	2014	5.906	1.25	0.015	0.189	3/12/2014	0.21
Springer	S1108-111651	1108	2014	13	14.001	0.168	0.416	3/12/2014	1.08

Springer	S1108-111655	1108	2014	13.938	11.251	0.135	0.446	3/12/2014	0.81
Springer	S1108-111666	1108	2014	0.294	1.1	0.013	0.009	3/12/2014	3.74
Springer	S1108-111671	1108	2014	3.875	19.835	0.238	0.124	3/12/2014	5.12
Springer	S1108-111687	1108	2014	12.344	8.117	0.097	0.395	3/12/2014	0.66
Springer	S1108-105309	1108	2014	0.322	9.251	0.111	0.01	3/13/2014	28.73
Springer	S1108-105613	1108	2014	5.125	5.142	0.062	0.164	3/13/2014	1.00
Springer	S1108-105623	1108	2014	0.641	22.085	0.265	0.02	3/13/2014	34.45
Springer	S1108-105633	1108	2014	3.438	2.408	0.029	0.11	3/13/2014	0.70
Springer	S1108-105638	1108	2014	1.153	1.408	0.017	0.037	3/13/2014	1.22
Springer	S1108-105704	1108	2014	3.25	6.734	0.081	0.104	3/13/2014	2.07
Springer	S1108-105834	1108	2014	5.344	6.117	0.073	0.171	3/13/2014	1.14
Springer	S1108-105838	1108	2014	3.781	15.334	0.184	0.121	3/13/2014	4.06
Springer	S1108-112608	1108	2014	46.875	42.92	0.515	1.5	3/17/2014	0.92
Springer	S1108-112622	1108	2014	7.719	10.251	0.123	0.247	3/17/2014	1.33
Springer	S1108-112630	1108	2014	28.438	14.584	0.175	0.91	3/17/2014	0.51
Springer	S1108-112646	1108	2014	20.875	36.086	0.433	0.668	3/17/2014	1.73
Springer	S1108-112658	1108	2014	24.688	7.467	0.09	0.79	3/17/2014	0.30
Springer	S1108-112667	1108	2014	50	24.585	0.295	1.6	3/17/2014	0.49
Springer	s1096-82603	1096	2014	0.975	14.751	0.177	0.031	3/18/2014	15.13
Springer	s1096-82610	1096	2014	1.544	37.586	0.451	0.049	3/18/2014	24.34
Springer	s1096-82630	1096	2014	1.112	2.725	0.033	0.036	3/18/2014	2.45
Springer	s1096-82638	1096	2014	0.944	77.922	0.935	0.03	3/18/2014	82.54
Springer	s1096-82650	1096	2014	0.734	7.192	0.086	0.024	3/18/2014	9.80
Springer	s1096-82661	1096	2014	1.081	16.501	0.198	0.035	3/18/2014	15.26
Springer	s1096-82678	1096	2014	1.569	14.751	0.177	0.05	3/18/2014	9.40
Springer	s1096-82704	1096	2014	0.631	17.918	0.215	0.02	3/18/2014	28.40
Springer	s1096-82708	1096	2014	1.459	0.527	0.006	0.047	3/18/2014	0.36
Springer	s1096-82757	1096	2014	1.781	3.017	0.036	0.057	3/18/2014	1.69
Springer	S1096-83621	1096	2014	0.434	19.251	0.231	0.014	3/24/2014	44.36
Springer	S1096-83645	1096	2014	1.638	19.751	0.237	0.052	3/24/2014	12.06
Springer	S1096-83666	1096	2014	1.328	41.503	0.498	0.042	3/24/2014	31.25
Springer	S1096-83684	1096	2014	0.941	34.002	0.408	0.03	3/24/2014	36.13
Springer	S1096-83694	1096	2014	2.072	2.025	0.024	0.066	3/24/2014	0.98
Springer	S1096-83803	1096	2014	6	28.502	0.342	0.192	3/24/2014	4.75
Springer	S1096-84602	1096	2014	0.659	8.667	0.104	0.021	3/24/2014	13.15
Springer	S1096-84604	1096	2014	0.478	6.909	0.083	0.015	3/24/2014	14.45
Springer	S1096-84639	1096	2014	0.781	4.625	0.056	0.025	3/24/2014	5.92
Springer	S1096-84642	1096	2014	0.512	7.384	0.089	0.016	3/24/2014	14.42
Springer	S1096-84645	1096	2014	1.109	51.337	0.616	0.036	3/24/2014	46.29
Springer	S1096-84687	1096	2014	0.8	17.001	0.204	0.026	3/24/2014	21.25
Springer	S1096-84690	1096	2014	0.922	10.417	0.125	0.03	3/24/2014	11.30
Springer	s1096-85651	1096	2014	1.556	11.751	0.141	0.05	3/31/2014	7.55
Springer	s1096-85654	1096	2014	0.344	0.733	0.009	0.011	3/31/2014	2.13
Springer	s1096-85691	1096	2014	0.45	1.625	0.02	0.014	3/31/2014	3.61
Springer	s1096-85736	1096	2014	1.294	1.358	0.016	0.041	3/31/2014	1.05
Springer	s1096-85741	1096	2014	0.481	1.2	0.014	0.015	3/31/2014	2.49
Springer	S1096-87601	1096	2014	0.75	1.533	0.018	0.024	4/8/2014	2.04
Springer	S1096-87620	1096	2014	1.712	2.158	0.026	0.055	4/8/2014	1.26
Springer	S1096-87634	1096	2014	1.275	0.691	0.008	0.041	4/8/2014	0.54
Springer	S1096-87648	1096	2014	0.609	3.842	0.046	0.02	4/8/2014	6.31
Springer	S1096-87664	1096	2014	1.341	4.075	0.049	0.043	4/8/2014	3.04
Springer	S1096-87671	1096	2014	0.544	21.335	0.256	0.017	4/8/2014	39.22
Springer	S1096-86610	1096	2014	2.75	15.751	0.189	0.088	4/15/2014	5.73
Springer	S1096-86629	1096	2014	0.703	6.6	0.079	0.022	4/15/2014	9.39
Springer	S1096-86661	1096	2014	0.525	30.002	0.36	0.017	4/15/2014	57.15
Springer	S1096-86735	1096	2014	1.175	0.79	0.009	0.038	4/15/2014	0.67
Springer	S1096-86756	1096	2014	0.559	0.95	0.011	0.018	4/15/2014	1.70
Springer	S1096-88604	1096	2014	1.216	5.725	0.069	0.039	4/21/2014	4.71
Springer	S1096-88632	1096	2014	2.375	34.002	0.408	0.076	4/21/2014	14.32
Springer	S1096-88646	1096	2014	0.431	-0.298	-0.004	0.014	4/21/2014	-0.69
Springer	S1096-88677	1096	2014	9.5	30.335	0.364	0.304	4/21/2014	3.19
Springer	S1096-88686	1096	2014	0.422	1.508	0.018	0.014	4/21/2014	3.57
Springer	S1096-88695	1096	2014	0.838	0.25	0.003	0.027	4/21/2014	0.30
Springer	S1096-88723	1096	2014	0.547	6.675	0.08	0.018	4/21/2014	12.20
Springer	S1096-88730	1096	2014	1.05	-0.031	0	0.034	4/21/2014	-0.03
Springer	S1096-89623	1096	2014	0.788	6.742	0.081	0.025	5/5/2014	8.56
Springer	S1096-89632	1096	2014	15.656	4.267	0.051	0.501	5/5/2014	0.27
Springer	S1096-89641	1096	2014	50.938	9.834	0.118	1.63	5/5/2014	0.19
Springer	S1096-89701	1096	2014	0.706	0.613	0.007	0.023	5/5/2014	0.87
Springer	S1096-89709	1096	2014	2.416	6.175	0.074	0.077	5/5/2014	2.56
Springer	S1096-89713	1096	2014	22.625	12.501	0.15	0.724	5/5/2014	0.55
Springer	S1096-89769	1096	2014	18.219	15.168	0.182	0.583	5/5/2014	0.83
Springer	S1096-89773	1096	2014	1.294	0.737	0.009	0.041	5/5/2014	0.57
Springer	S1096-89811	1096	2014	15.812	59.087	0.709	0.506	5/5/2014	3.74
Springer	S1096-89837	1096	2014	2.197	12.334	0.148	0.07	5/5/2014	5.61
Springer	S1096-90682	1096	2014	3.312	7.084	0.085	0.106	5/6/2014	2.14
Springer	S1096-90630	1096	2014	5.125	21.168	0.254	0.164	5/12/2014	4.13
Springer	S1096-90646	1096	2014	2.444	11.667	0.14	0.078	5/12/2014	4.77
Springer	S1096-90651	1096	2014	3.125	4	0.048	0.1	5/12/2014	1.28
Springer	S1096-90664	1096	2014	3.438	9.751	0.117	0.11	5/12/2014	2.84
Springer	S1096-91314	1096	2014	1.569	16.084	0.193	0.05	5/14/2014	10.25
Springer	S1096-91619	1096	2014	4.062	11.917	0.143	0.13	5/14/2014	2.93
Springer	S1096-91623	1096	2014	9.344	13.084	0.157	0.299	5/14/2014	1.40
Springer	S1096-91627	1096	2014	6.406	25.502	0.306	0.205	5/14/2014	3.98
Springer	S1096-91631	1096	2014	0.891	12.584	0.151	0.028	5/14/2014	14.12
Springer	S1096-92602	1096	2014	0.438	3.892	0.047	0.014	5/15/2014	8.89
Springer	S1096-92611	1096	2014	0.322	26.168	0.314	0.01	5/15/2014	81.27
Springer	S1096-92621	1096	2014	0.25	7.167	0.086	0.008	5/15/2014	28.67
Springer	S1096-92645	1096	2014	1.738	16.334	0.196	0.056	5/15/2014	9.40
Springer	S1096-92670	1096	2014	0.419	20.918	0.251	0.013	5/15/2014	49.92
Springer	S1096-92679	1096	2014	1.206	27.919	0.335	0.039	5/15/2014	23.15
Springer	S1096-93309	1096	2014	0.753	6.917	0.083	0.024	5/20/2014	9.19
Springer	S1096-93633	1096	2014	0.916	8.292	0.1	0.029	5/20/2014	9.05
Springer	S1096-93643	1096	2014	2.425	11.251	0.135	0.078	5/20/2014	4.64
Springer	S1096-94620	1096	2014	35.938	17.251	0.207	1.15	5/28/2014	0.48
Springer	S1096-94647	1096	2014	59.375	35.419	0.425	1.9	5/28/2014	0.60
Springer	S1096-94673	1096	2014	35.625	6.259	0.075	1.14	5/28/2014	0.18
Springer	S1096-94686	1096	2014	0.597	1.225	0.015	0.019	5/28/2014	2.05
Springer	S1096-94702	1096	2014	19.781	28.335	0.34	0.633	5/28/2014	1.43
Springer	S1096-94741	1096	2014	9.562	27.669	0.332	0.306	5/28/2014	2.89
Springer	S1096-94753	1096	2014	0.872	3.334	0.04	0.028	5/28/2014	3.82
Springer	S1096-94776	1096	2014	3.312	37.336	0.448	0.106	5/28/2014	11.27
Springer	S1096-96605	1096	2014	6.094	59.921	0.719	0.195	6/3/2014	9.83
Springer	S1096-96629	1096	2014	14	55.17	0.662	0.448	6/3/2014	3.94
Springer	S1096-96646	1096	2014	7.781	64.254	0.771	0.249	6/3/2014	8.26
Springer	S1096-96686	1096	2014	7.281	65.754	0.789	0.233	6/3/2014	9.03
Springer	S1096-97611	1096	2014	0.938	1.667	0.02	0.03	6/9/2014	1.78
Springer	S1096-97626	1096	2014	17.5	20.835	0.25	0.56	6/9/2014	1.19
Springer	S1096-97678	1096	2014	16.875	1.667	0.02	0.54	6/9/2014	0.10
Springer	S1096-97692	1096	2014	1.25	1.667	0.02	0.04	6/9/2014	1.33
Springer	S1096-95613	1096	2014	40.938	47.503	0.57	1.31	6/16/2014	1.16
Springer	S1096-95629	1096	2014	39.375	15.001	0.18	1.26	6/16/2014	0.38
Springer	S1096-95666	1096	2014	50.625	32.502	0.39	1.62	6/16/2014	0.64
Springer	S1096-95689	1096	2014	37.188	20.001	0.24	1.19	6/16/2014	0.54
Springer	S1096-98613	1096	2014	20.938	11.667	0.14	0.67	6/19/2014	0.56
Springer	S1096-98621	1096	2014	30.938	23.335	0.28	0.99	6/19/2014	0.75
Springer	S1096-98629	1096	2014	53.438	20.835	0.25	1.71	6/19/2014	0.39
Springer	S1084-77623	1084	2014	2.812	7.5	0.09	0.09	7/7/2014	2.67
Springer	S1084-77669	1084	2014	2.188	15.834	0.19	0.07	7/7/2014	7.24
Springer	S1084-77678	1084	2014	1.875	14.168	0.17	0.06	7/7/2014	7.56
Springer	S1084-77745	1084	2014	2.5	8.334	0.1	0.08	7/7/2014	3.33
Springer	S1084-77761	1084	2014	1.562	7.5	0.09	0.05	7/7/2014	4.80
Springer	S1084-77772	1084	2014	1.875	26.668	0.32	0.06	7/7/2014	14.22
Springer	S1084-77814	1084	2014	4.375	31.669	0.38	0.14	7/7/2014	7.24
Springer	S1084-77828	1084	2014	2.188	10.001	0.12	0.07	7/7/2014	4.57
Springer	S1096-99613	1096	2014	0.938	7.5	0.09	0.03	7/10/2014	8.00
Springer	S1096-99629	1096	2014	0.625	2.5	0.03	0.02	7/10/2014	4.00
Springer	S1096-99695	1096	2014	0.938	16.668	0.2	0.03	7/10/2014	17.77
Springer	S1096-99746	1096	2014	1.25	22.501	0.27	0.04	7/10/2014	18.00
Springer	S1084-79617	1084	2014	1.875	30.002	0.36	0.06	7/22/2014	16.00
Springer	S1084-79628	1084	2014	0.312	1.667	0.02	0.01	7/22/2014	5.34
Springer	S1084-79682	1084	2014	0.312	4.167	0.05	0.01	7/22/2014	13.36
Springer	S1084-79684	1084	2014	0.938	1.667	0.02	0.03	7/22/2014	1.78
Springer	S1096-101608	1096	2014	1.25	2.5	0.03	0.04	7/22/2014	2.00
Springer	S1096-101627	1096	2014	0.312	1.667	0.02	0.01	7/22/2014	5.34
Springer	S1096-101645	1096	2014	1.562	6.667	0.08	0.05	7/22/2014	4.27
Springer	S1084-81636	1084	2014	2.188	19.168	0.23	0.07	8/20/2014	8.76
Springer	S1084-81654	1084	2014	7.812	66.671	0.8	0.25	8/20/2014	8.53
Springer	S1084-81662	1084	2014	19.688	14.168	0.17	0.63	8/20/2014	0.72
Springer	S1084-81690	1084	2014	19.062	5	0.06	0.61	8/20/2014	0.26
Springer	S1108-114609	1108	2014	0.625	1.667	0.02	0.02	8/25/2014	2.67
Springer	S1108-114633	1108	2014	0.938	20.001	0.24	0.03	8/25/2014	21.32
Springer	S1108-114677	1108	2014	1.25	34.169	0.41	0.04	8/25/2014	27.34
Springer	S1108-114682	1108	2014	0.938	0.833	0.01	0.03	8/25/2014	0.89
Springer	S1084-82630	1084	2014	4.375	5.834	0.07	0.14	8/28/2014	1.33
Springer	S1084-82655	1084	2014	3.75	5.834	0.07	0.12	8/28/2014	1.56
Springer	S1084-82670	1084	2014	6.875	11.667	0.14	0.22	8/28/2014	1.70
Springer	S1084-82700	1084	2014	3.125	4.167	0.05	0.1	8/28/2014	1.33
Springer	S1084-82721	1084	2014	1.562	33.336	0.4	0.05	8/28/2014	21.34
Springer	S1108-115631	1108	2014	2.188	17.501	0.21	0.07	8/28/2014	8.00
Springer	S1108-115652	1108	2014	0.938	25.002	0.3	0.03	8/28/2014	26.65
Springer	S1084-81618	1084	2014	0.938	2.5	0.03	0.03	9/2/2014	2.67
Springer	S1084-81622	1084	2014	1.562	5	0.06	0.05	9/2/2014	3.20

Springer	S1084-998001	1084	2014	9.375	35.836	0.43	0.3	9/2/2014	3.82
Springer	S1084-998002	1084	2014	8.438	28.335	0.34	0.27	9/2/2014	3.36
Springer	S1084-998003	1084	2014	15.938	39.169	0.47	0.51	9/2/2014	2.46
Springer	S1084-998004	1084	2014	10.625	43.336	0.52	0.34	9/2/2014	4.08
Springer	S1084-998010	1084	2014	3.75	28.335	0.34	0.12	9/2/2014	7.56
Springer	S1084-998017	1084	2014	53.125	52.503	0.63	1.7	9/2/2014	0.99
Springer	S1084-998018	1084	2014	41.875	34.169	0.41	1.34	9/2/2014	0.82
Springer	S1084-998022	1084	2014	34.062	45.836	0.55	1.09	9/2/2014	1.35
Springer	S1084-998023	1084	2014	47.812	55.837	0.67	1.53	9/2/2014	1.17
Springer	S1084-998024	1084	2014	61.875	71.671	0.86	1.98	9/2/2014	1.16
Springer	S1084-998025	1084	2014	5.938	40.836	0.49	0.19	9/2/2014	6.88
Springer	S1084-998026	1084	2014	10.312	45.836	0.55	0.33	9/2/2014	4.44
Springer	S1084-998027	1084	2014	2.5	32.502	0.39	0.08	9/2/2014	13.00
Springer	S1084-998028	1084	2014	1.562	25.835	0.31	0.05	9/2/2014	16.54
Springer	S1084-998029	1084	2014	3.125	38.336	0.46	0.1	9/2/2014	12.27
Springer	S1084-998030	1084	2014	4.062	39.169	0.47	0.13	9/2/2014	9.64
Springer	S1084-998035	1084	2014	54.688	50.003	0.6	1.75	9/2/2014	0.91
Springer	S1084-998036	1084	2014	33.438	30.835	0.37	1.07	9/2/2014	0.92
Springer	S1084-998037	1084	2014	15.938	32.502	0.39	0.51	9/2/2014	2.04
Springer	S1084-998038	1084	2014	9.688	33.336	0.4	0.31	9/2/2014	3.44
Springer	S1084-998039	1084	2014	8.75	24.168	0.29	0.28	9/2/2014	2.76
Springer	S1084-998042	1084	2014	12.812	47.503	0.57	0.41	9/2/2014	3.71
Springer	S1084-998043	1084	2014	38.125	51.67	0.62	1.22	9/2/2014	1.36
Springer	S1084-998045	1084	2014	25.312	21.668	0.26	0.81	9/2/2014	0.86
Springer	S1084-998046	1084	2014	24.062	50.837	0.61	0.77	9/2/2014	2.11
Springer	S1084-998047	1084	2014	4.375	22.501	0.27	0.14	9/2/2014	5.14
Springer	S1084-998048	1084	2014	23.75	39.169	0.47	0.76	9/2/2014	1.65
Springer	S1084-998050	1084	2014	57.188	40.836	0.49	1.83	9/2/2014	0.71
Springer	S1084-998051	1084	2014	57.5	49.17	0.59	1.84	9/2/2014	0.86
Springer	S1084-998052	1084	2014	14.062	30.002	0.36	0.45	9/2/2014	2.13
Springer	S1084-998056	1084	2014	19.375	35.002	0.42	0.62	9/2/2014	1.81
Springer	S1096-104607	1096	2014	1.25	15.001	0.18	0.04	9/8/2014	12.00
Springer	S1096-104617	1096	2014	3.75	43.336	0.52	0.12	9/8/2014	11.56
Springer	S1096-104646	1096	2014	2.5	29.169	0.35	0.08	9/8/2014	11.67
Springer	S1084-998041	1084	2014	6.562	42.503	0.51	0.21	9/10/2014	6.48
Springer	S1084-83627	1084	2014	1.25	25.835	0.31	0.04	9/15/2014	20.67
Springer	S1084-83659	1084	2014	1.25	15.834	0.19	0.04	9/15/2014	12.67
Springer	S1084-83671	1084	2014	1.25	56.67	0.68	0.04	9/15/2014	45.34
Springer	S1084-83693	1084	2014	0.938	22.501	0.27	0.03	9/15/2014	23.99
Springer	S1084-83776	1084	2014	0.625	2.5	0.03	0.02	9/15/2014	4.00
Springer	S1084-84654	1084	2014	1.25	2.5	0.03	0.04	9/15/2014	2.00
Springer	S1084-83822	1084	2014	0.312	15.834	0.19	0.01	9/18/2014	50.75
Springer	S1084-85753	1084	2014	0.312	5.834	0.07	0.01	9/18/2014	18.70
Springer	S1084-87605	1084	2014	0.828	23.752	0.285	0.026	9/22/2014	28.69
Springer	S1084-87634	1084	2014	0.217	7.409	0.089	0.007	9/22/2014	34.14
Springer	S1084-87641	1084	2014	0.21	12.084	0.145	0.007	9/22/2014	57.54
Springer	S1084-88605	1084	2014	1.275	12.167	0.146	0.041	9/25/2014	9.54
Springer	S1084-88612	1084	2014	1.041	6.5	0.078	0.033	9/25/2014	6.24
Springer	S1084-88648	1084	2014	1.938	14.418	0.173	0.062	9/25/2014	7.44
Springer	S1084-88205	1084	2014	2.944	5.759	0.069	0.094	9/29/2014	1.96
Springer	S1084-999062	1084	2014	15	55.004	0.66	0.48	9/29/2014	3.67
Springer	S1084-999063	1084	2014	7.188	50.003	0.6	0.23	9/29/2014	6.96
Springer	S1084-999064	1084	2014	49.062	25.835	0.31	1.57	9/29/2014	0.53
Springer	S1084-999065	1084	2014	11.875	42.503	0.51	0.38	9/29/2014	3.58
Springer	S1084-999066	1084	2014	5	28.335	0.34	0.16	9/29/2014	5.67
Springer	S1084-999068	1084	2014	16.25	62.504	0.75	0.52	9/29/2014	3.85
Springer	S1084-999069	1084	2014	6.25	75.838	0.91	0.2	9/29/2014	12.13
Springer	S1084-999070	1084	2014	35.625	41.669	0.5	1.14	9/29/2014	1.17
Springer	S1084-999071	1084	2014	42.812	33.336	0.4	1.37	9/29/2014	0.78
Springer	S1084-999072	1084	2014	16.25	29.169	0.35	0.52	9/29/2014	1.80
Springer	S1084-999073	1084	2014	4.375	25.002	0.3	0.14	9/29/2014	5.71
Springer	S1084-997005	1084	2014	11.875	45.003	0.54	0.38	9/30/2014	3.79
Springer	S1084-997006	1084	2014	3.438	27.502	0.33	0.11	9/30/2014	8.00
Springer	S1084-997007	1084	2014	3.75	21.668	0.26	0.12	9/30/2014	5.78
Springer	S1084-997008	1084	2014	2.812	53.337	0.64	0.09	9/30/2014	18.97
Springer	S1084-997009	1084	2014	4.688	41.669	0.5	0.15	9/30/2014	8.89
Springer	S1084-997011	1084	2014	2.5	19.168	0.23	0.08	9/30/2014	7.67
Springer	S1084-997012	1084	2014	3.438	45.003	0.54	0.11	9/30/2014	13.09
Springer	S1084-997013	1084	2014	12.188	35.002	0.42	0.39	9/30/2014	2.87
Springer	S1084-997014	1084	2014	32.188	52.503	0.63	1.03	9/30/2014	1.63
Springer	S1084-997015	1084	2014	31.875	74.172	0.89	1.02	9/30/2014	2.33
Springer	S1084-997016	1084	2014	33.438	37.502	0.45	1.07	9/30/2014	1.12
Springer	S1084-997019	1084	2014	18.125	32.502	0.39	0.58	9/30/2014	1.79
Springer	S1084-997020	1084	2014	24.688	29.169	0.35	0.79	9/30/2014	1.18
Springer	S1084-997021	1084	2014	20.938	19.168	0.23	0.67	9/30/2014	0.92
Springer	S1084-997032	1084	2014	1.25	21.668	0.26	0.04	9/30/2014	17.33
Springer	S1084-997033	1084	2014	2.812	27.502	0.33	0.09	9/30/2014	9.78
Springer	S1084-997034	1084	2014	3.438	20.835	0.25	0.11	9/30/2014	6.06
Springer	S1084-997040	1084	2014	6.562	35.836	0.43	0.21	9/30/2014	5.46
Springer	S1084-997044	1084	2014	42.812	57.504	0.69	1.37	9/30/2014	1.34
Springer	S1084-997057	1084	2014	28.125	38.336	0.46	0.9	9/30/2014	1.36
Springer	S1084-997058	1084	2014	25.625	36.669	0.44	0.82	9/30/2014	1.43
Springer	S1084-997061	1084	2014	6.562	39.169	0.47	0.21	9/30/2014	5.97
Springer	S1084-89302	1084	2014	0.988	12.584	0.151	0.032	10/2/2014	12.74
Springer	S1084-89504	1084	2014	0.872	16.584	0.199	0.028	10/2/2014	19.02
Springer	S1084-89607	1084	2014	2.419	8.301	0.1	0.077	10/2/2014	3.43
Springer	S1084-89822	1084	2014	5.812	6.759	0.081	0.186	10/2/2014	1.16
Springer	S1084-85641	1084	2014	0.625	5	0.06	0.02	10/6/2014	8.00
Springer	S1084-85672	1084	2014	0.312	7.5	0.09	0.01	10/6/2014	24.04
Springer	S1084-85715	1084	2014	0.319	16.834	0.202	0.01	10/6/2014	52.77
Springer	S1084-85724	1084	2014	0.108	5.767	0.069	0.003	10/6/2014	53.40
Springer	S1096-102801	1096	2014	0.092	10.251	0.123	0.003	10/6/2014	111.42
Springer	S1084-90612	1084	2014	0.277	9.501	0.114	0.009	10/21/2014	34.30
Springer	S1084-90659	1084	2014	0.252	16.084	0.193	0.008	10/21/2014	63.83
Springer	S1084-90682	1084	2014	0.199	1.85	0.022	0.006	10/21/2014	9.30
Springer	S1084-90716	1084	2014	0.116	15.418	0.185	0.004	10/21/2014	132.91
Springer	S1084-90806	1084	2014	0.087	4.084	0.049	0.003	10/22/2014	46.94
Springer	S1108-117330	1108	2015	1.725	11.501	0.138	0.055	9/7/2015	6.67
Springer	S1108-117625	1108	2015	3.091	90.841	1.09	0.099	9/8/2015	29.39
Springer	S1108-117635	1108	2015	2.366	18.251	0.219	0.076	9/8/2015	7.71
Springer	S1108-117636	1108	2015	4.594	39.753	0.477	0.147	9/8/2015	8.65
Springer	S1108-117657	1108	2015	3.219	14.251	0.171	0.103	9/8/2015	4.43
Springer	S1084-94100	1084	2015	1.519	11.418	0.137	0.049	9/10/2015	7.52
Springer	S1084-94101	1084	2015	2.178	94.174	1.13	0.07	9/10/2015	43.24
Springer	S1084-94102	1084	2015	3.406	80.673	0.968	0.109	9/10/2015	23.69
Springer	S1084-94103	1084	2015	1.719	15.751	0.189	0.055	9/10/2015	9.16

Springer	S1084-94104	1084	2015	1.553	27.919	0.335	0.05	9/10/2015	17.98
Springer	S1084-94105	1084	2015	1.828	26.835	0.322	0.059	9/10/2015	14.68
Springer	S1084-94106	1084	2015	1.319	27.669	0.332	0.042	9/10/2015	20.98
Springer	S1084-94107	1084	2015	1.591	22.919	0.275	0.051	9/10/2015	14.41
Springer	S1084-94108	1084	2015	0.825	5.6	0.067	0.026	9/10/2015	6.79
Springer	S1084-94109	1084	2015	0.828	16.501	0.198	0.027	9/10/2015	19.93
Springer	S1084-94110	1084	2015	1.169	19.002	0.228	0.037	9/10/2015	16.25
Springer	S1084-94111	1084	2015	1.428	1.775	0.021	0.046	9/10/2015	1.24
Springer	S1084-94112	1084	2015	1.694	0.703	0.008	0.054	9/10/2015	0.41
Springer	S1084-94113	1084	2015	1.713	0.039	0	0.055	9/10/2015	0.02
Springer	S1084-94114	1084	2015	1.803	0.328	0.004	0.058	9/10/2015	0.18
Springer	S1084-94115	1084	2015	1.228	1.508	0.018	0.039	9/10/2015	1.23
Springer	S1084-94116	1084	2015	1.759	23.919	0.287	0.056	9/10/2015	13.60
Springer	S1084-94117	1084	2015	1.038	0.823	0.01	0.033	9/10/2015	0.79
Springer	S1084-94119	1084	2015	2.172	8.917	0.107	0.07	9/10/2015	4.11
Springer	S1084-94120	1084	2015	1.394	8.751	0.105	0.045	9/10/2015	6.28
Springer	S1084-94121	1084	2015	1.859	15.001	0.18	0.06	9/10/2015	8.07
Springer	S1084-94122	1084	2015	1.547	5.117	0.061	0.05	9/10/2015	3.31
Springer	S1084-94123	1084	2015	1.913	8.501	0.102	0.061	9/10/2015	4.44
Springer	S1084-94124	1084	2015	1.575	9.251	0.111	0.05	9/10/2015	5.87
Springer	S1084-94125	1084	2015	1.628	8.501	0.102	0.052	9/10/2015	5.22
Springer	S1084-94126	1084	2015	1.563	7.951	0.095	0.05	9/10/2015	5.09
Springer	S1084-96600	1084	2015	34.375	1.1	16.501	0.48	9/16/2015	0.03
Springer	S1084-96610	1084	2015	38.125	23.085	0.277	1.22	9/16/2015	0.61
Springer	S1084-96619	1084	2015	32.188	1.03	15.668	0.487	9/16/2015	0.03
Springer	S1084-96622	1084	2015	26.688	18.168	0.218	0.854	9/16/2015	0.68
Springer	S1084-96631	1084	2015	44.688	1.43	41.087	0.919	9/16/2015	0.03
Springer	S1084-96659	1084	2015	26.438	7.909	0.095	0.846	9/16/2015	0.30
Springer	S1084-96661	1084	2015	17.125	19.668	0.236	0.548	9/16/2015	1.15
Springer	S1084-96676	1084	2015	36.25	1.16	19.668	0.543	9/16/2015	0.03
Springer	S1096-107606	1096	2015	2.134	6.834	0.082	0.068	9/23/2015	3.20
Springer	S1096-107612	1096	2015	1.019	50.254	0.603	0.033	9/23/2015	49.32
Springer	S1096-107635	1096	2015	4.594	23.335	0.28	0.147	9/23/2015	5.08
Springer	S1096-107657	1096	2015	2.028	8.751	0.105	0.065	9/23/2015	4.32
Springer	S1096-107664	1096	2015	2.691	10.584	0.127	0.086	9/23/2015	3.93
Springer	S1096-107681	1096	2015	1.475	25.002	0.3	0.047	9/23/2015	16.95
Springer	S1096-107684	1096	2015	0.778	7.709	0.093	0.025	9/23/2015	9.91
Springer	S1096-107690	1096	2015	4.656	15.168	0.182	0.149	9/23/2015	3.26
Springer	S1096-107693	1096	2015	1.016	5.1	0.061	0.033	9/23/2015	5.02
Springer	S1096-107701	1096	2015	3.625	7.317	0.088	0.116	9/23/2015	2.02
Springer	S1096-107709	1096	2015	6.156	18.585	0.223	0.197	9/23/2015	3.02
Springer	S1096-107721	1096	2015	4.688	10.501	0.126	0.15	9/23/2015	2.24
Springer	S1096-107723	1096	2015	5.344	34.086	0.409	0.171	9/23/2015	6.38
Springer	S1096-107725	1096	2015	5.094	22.085	0.265	0.163	9/23/2015	4.34
Springer	S1096-108603	1096	2015	1.691	20.752	0.249	0.054	10/2/2015	12.27
Springer	S1096-108617	1096	2015	1.163	14.251	0.171	0.037	10/2/2015	12.25
Springer	S1096-108629	1096	2015	1.247	23.752	0.285	0.04	10/2/2015	19.05
Springer	S1096-108633	1096	2015	1.647	2.217	0.027	0.053	10/2/2015	1.35
Springer	S1096-108645	1096	2015	0.403	1.383	0.017	0.013	10/2/2015	3.43
Springer	S1096-108657	1096	2015	0.556	4.567	0.055	0.018	10/2/2015	8.21
Springer	S1096-108663	1096	2015	0.756	1.717	0.021	0.024	10/2/2015	2.27
Springer	S1096-108692	1096	2015	1.372	7.392	0.089	0.044	10/2/2015	5.39
Springer	S1096-109605	1096	2015	5.375	37.336	0.448	0.172	10/2/2015	6.95
Springer	S1096-109632	1096	2015	1.791	26.168	0.314	0.057	10/7/2015	14.61
Springer	S1096-109640	1096	2015	2.903	17.251	0.207	0.093	10/7/2015	5.94
Springer	S1096-109657	1096	2015	6.938	42.253	0.507	0.222	10/7/2015	6.09
Springer	S1096-109666	1096	2015	3.719	21.918	0.263	0.119	10/7/2015	5.89
Springer	S1096-109679	1096	2015	2.322	33.669	0.404	0.074	10/7/2015	14.50
Springer	S1096-109719	1096	2015	3.812	20.501	0.246	0.122	10/7/2015	5.38
Springer	S1096-109734	1096	2015	1.347	7.784	0.093	0.043	10/7/2015	5.78
Springer	S1096-109735	1096	2015	8.562	13.418	0.161	0.092	10/7/2015	1.57
Springer	S1096-109738	1096	2015	4.156	46.753	0.561	0.133	10/7/2015	11.25
Springer	S1096-109742	1096	2015	4.188	17.751	0.213	0.134	10/7/2015	4.24
Springer	S1096-109746	1096	2015	4.031	42.003	0.504	0.129	10/7/2015	10.42
Springer	S1096-109800	1096	2015	1.853	8.584	0.103	0.059	10/7/2015	4.63
Springer	S1084-97614	1084	2015	2.884	2.667	0.032	0.092	10/11/2015	0.92
Springer	S1084-97619	1084	2015	2.169	1.667	0.02	0.069	10/11/2015	0.77
Springer	S1084-97623	1084	2015	1.616	9.251	0.111	0.052	10/11/2015	5.72
Springer	S1084-97663	1084	2015	0.878	9.167	0.11	0.028	10/11/2015	10.44
Springer	S1084-97666	1084	2015	1.384	10.417	0.125	0.044	10/11/2015	7.53
Springer	S1084-97669	1084	2015	3.469	66.088	0.793	0.111	10/11/2015	19.05
Springer	S1084-97673	1084	2015	2.406	17.418	0.209	0.077	10/11/2015	7.24
Springer	S1084-97693	1084	2015	0.725	1.075	0.013	0.023	10/11/2015	1.48
Springer	S1084-97696	1084	2015	0.922	9.917	0.119	0.03	10/11/2015	10.76
Springer	s1084-98615	1084	2015	0.856	14.418	0.173	0.027	10/22/2015	16.84
Springer	s1084-98618	1084	2015	0.872	17.334	0.208	0.028	10/22/2015	19.88
Springer	s1084-98634	1084	2015	0.569	12.751	0.153	0.018	10/22/2015	22.41
Springer	s1084-98648	1084	2015	0.195	6.942	0.083	0.006	10/22/2015	35.60
Springer	s1084-98692	1084	2015	0.174	1.108	0.013	0.006	10/22/2015	6.37
Springer	s1084-98696	1084	2015	0.975	4.559	0.055	0.031	10/22/2015	4.68
Springer	s1084-98721	1084	2015	0.16	1.492	0.018	0.005	10/22/2015	9.33
Springer	s1084-98724	1084	2015	0.264	1.633	0.02	0.008	10/22/2015	6.19
Springer	s1084-98729	1084	2015	0.212	2.617	0.031	0.007	10/22/2015	12.34
Springer	s1084-98736	1084	2015	0.691	13.418	0.161	0.022	10/22/2015	19.42
Springer	s1084-98754	1084	2015	0.298	2.292	0.028	0.01	10/22/2015	7.69
Springer	s1084-98769	1084	2015	0.375	28.419	0.341	0.012	10/22/2015	75.78
Springer	s1084-98772	1084	2015	0.534	5.084	0.061	0.017	10/22/2015	9.52
Springer	s1084-98779	1084	2015	0.309	2.367	0.028	0.01	10/22/2015	7.66
Springer	s1084-98783	1084	2015	0.156	2.125	0.026	0.005	10/22/2015	13.62
Springer	s1084-98794	1084	2015	0.178	0.85	0.01	0.006	10/22/2015	4.78
Springer	S1084-99830	1084	2015	71.25	30.169	0.362	2.28	10/22/2015	0.42
Springer	S1084-99834	1084	2015	30.094	28.085	0.337	0.963	10/22/2015	0.93
Springer	S1084-99864	1084	2015	35	26.252	0.315	1.12	10/22/2015	0.75
Springer	S1084-99889	1084	2015	63.125	45.253	0.543	2.02	10/22/2015	0.72
Springer	S1084-99893	1084	2015	9.344	39.253	0.471	0.299	10/22/2015	4.20
Springer	S1084-100009	1084	2015	2.778	90.006	1.08	0.089	10/29/2015	32.40
Springer	S1084-100011	1084	2015	2.978	16.834	0.202	0.095	10/29/2015	5.65
Springer	S1084-100050	1084	2015	0.581	14.584	0.175	0.019	10/29/2015	25.10
Springer	S1084-100075	1084	2015	0.428	13.668	0.164	0.014	10/31/2015	31.93
Springer	S1084-100083	1084	2015	0.375	1.05	0.013	0.012	10/31/2015	2.80
Springer	S1084-100100	1084	2015	1.262	0.942	0.011	0.04	10/31/2015	0.75
Springer	S1084-100121	1084	2015	0.522	3.325	0.04	0.017	10/31/2015	6.37
Springer	S1084-100137	1084	2015	1.103	11.584	0.139	0.035	10/31/2015	10.50
Springer	S1084-100309	1084	2015	0.309	3.859	0.046	0.01	10/31/2015	12.49
Springer	S1084-101014	1084	2015	0.158	1.325	0.016	0.005	11/8/2015	8.39
Springer	S1084-101019	1084	2015	0.221	17.001	0.204	0.007	11/8/2015	76.93
Springer	S1084-101031	1084	2015	8.5	27.835	0.334	0.272	11/8/2015	3.27
Springer	S1084-101040	1084	2015	0.7	40.753	0.489	0.022	11/8/2015	58.22
Springer	S1084-101048	1084	2015	0.816	17.751	0.213	0.026	11/8/2015	21.75
Springer	S1084-101060	1084	2015	1.066	75.172	0.902	0.034	11/8/2015	70.52
Springer	S1084-101063	1084	2015	5.312	48.92	0.587	0.17	11/8/2015	9.21
Springer	S1084-101078	1084	2015	0.581	3.609	0.043	0.019	11/8/2015	6.21
Springer	S1084-101085	1084	2015	2.831	12.584	0.151	0.091	11/8/2015	4.45
Springer	S1084-101107	1084	2015	1.159	5.817	0.07	0.037	11/8/2015	5.02
Springer	S1084-101115	1084	2015	0.662	35.669	0.428	0.021	11/8/2015	53.88
Springer	S1084-101120	1084	2015	0.641	5.425	0.065	0.02	11/8/2015	8.46
Springer	S1084-101123	1084	2015	0.307	4.884	0.059	0.01	11/8/2015	15.91
Springer	S1084-101157	1084	2015	3.719	13.168	0.158	0.119	11/8/2015	3.54
Springer	S1084-102009	1084	2015	1.006	15.751	0.189	0.032	11/15/2015	15.66
Springer	S1084-102015	1084	2015	0.419	42.92	0.515	0.013	11/15/2015	102.43

Springer	S1084-102021	1084	2015	0.575	22.585	0.271	0.018	11/15/2015	39.28
Springer	S1084-102028	1084	2015	4.031	8.584	0.103	0.129	11/15/2015	2.13
Springer	S1084-102036	1084	2015	0.831	17.168	0.206	0.027	11/15/2015	20.66
Springer	S1084-102074	1084	2015	1.175	43.503	0.522	0.038	11/15/2015	37.02
Springer	S1084-102078	1084	2015	4.031	59.587	0.715	0.129	11/15/2015	14.78
Springer	S1084-102095	1084	2015	1.738	24.502	0.294	0.056	11/15/2015	14.10
Springer	S1084-102098	1084	2015	1.388	16.418	0.197	0.044	11/15/2015	11.83
Springer	S1084-102142	1084	2015	3.406	31.169	0.374	0.109	11/15/2015	9.15
Springer	S1084-102606	1084	2015	1.947	32.252	0.387	0.062	11/15/2015	16.56
Springer	S1084-103602	1084	2015	5.344	21.335	0.256	0.171	11/20/2015	3.99
Springer	S1084-103609	1084	2015	6.188	19.085	0.229	0.198	11/20/2015	3.08
Springer	S1084-103614	1084	2015	6.969	7.309	0.088	0.223	11/20/2015	1.05
Springer	S1084-103631	1084	2015	1.506	7.534	0.09	0.048	11/20/2015	5.00
Springer	S1084-104637	1084	2015	3.594	10.667	0.128	0.115	11/24/2015	2.97
Springer	S1084-104672	1084	2015	2.406	6.609	0.079	0.077	11/24/2015	2.75
Springer	S1084-104714	1084	2015	2.016	7.459	0.09	0.064	11/24/2015	3.70
Springer	S1072-69193	1072	2015	1.725	0.917	0.011	0.055	11/27/2015	0.53
Springer	S1072-69211	1072	2015	2.319	1.5	0.018	0.074	11/27/2015	0.65
Springer	S1072-69242	1072	2015	0.85	7.534	0.09	0.027	11/27/2015	8.86
Springer	S1072-70622	1072	2015	1.269	4.084	0.049	0.041	11/29/2015	3.22
Springer	S1072-70632	1072	2015	11.188	4.025	0.048	0.358	11/29/2015	0.36
Springer	S1072-70648	1072	2015	39.375	11.751	0.141	1.26	11/29/2015	0.30
Springer	S1072-70666	1072	2015	28.125	30.252	0.363	0.9	11/29/2015	1.08
Springer	S1072-70668	1072	2015	1.162	0.412	0.005	0.037	11/29/2015	0.35
Springer	S1072-70672	1072	2015	1.419	11.667	0.14	0.045	11/29/2015	8.22
Springer	S1072-70686	1072	2015	0.678	0.395	0.005	0.022	11/29/2015	0.58
Springer	S1072-71621	1072	2015	0.428	0.433	0.005	0.014	11/29/2015	1.01
Springer	S1072-71649	1072	2015	10.312	10.917	0.131	0.33	11/29/2015	1.06
Springer	S1072-71707	1072	2015	0.559	1.608	0.019	0.018	11/29/2015	2.88
Springer	S1072-72118	1072	2015	25.438	18.835	0.226	0.814	12/3/2015	0.74
Springer	S1072-72133	1072	2015	14.469	21.085	0.253	0.463	12/3/2015	1.46
Springer	S1072-72626	1072	2015	25.469	25.752	0.309	0.815	12/3/2015	1.01
Springer	S1072-72652	1072	2015	12.688	25.918	0.311	0.406	12/3/2015	2.04
Springer	S1072-72664	1072	2015	22	11.334	0.136	0.704	12/3/2015	0.52
Springer	S1072-72675	1072	2015	41.25	31.335	0.376	1.32	12/3/2015	0.76
Springer	S1072-72686	1072	2015	61.875	20.751	0.249	1.98	12/3/2015	0.34
Springer	S1096-101800	1096	2015	2.631	5.859	0.07	0.084	12/9/2015	2.23
Springer	S1096-106310	1096	2015	7.656	10.917	0.131	0.245	12/9/2015	1.43
Springer	S1096-111243	1096	2015	12.312	174.178	2.09	0.394	12/9/2015	14.15
Springer	S1096-111833	1096	2015	4.688	7.942	0.095	0.15	12/9/2015	1.69
Springer	S1072-74636	1072	2015	2.831	28.335	0.34	0.091	12/12/2015	10.01
Springer	S1072-74645	1072	2015	1.416	100.007	1.2	0.045	12/12/2015	70.63
Springer	S1072-74677	1072	2015	2.134	21.751	0.261	0.068	12/12/2015	10.19
Springer	S1072-73600	1072	2015	43.75	52.92	0.635	1.4	12/14/2015	1.21
Springer	S1072-73605	1072	2015	22.75	21.085	0.253	0.728	12/14/2015	0.93
Springer	S1072-73624	1072	2015	6.75	42.253	0.507	0.216	12/14/2015	6.26
Springer	S1072-73629	1072	2015	0.212	23.668	0.284	0.007	12/14/2015	111.64
Springer	S1072-73648	1072	2015	45.312	16.334	0.196	1.45	12/14/2015	0.36
Springer	S1072-73653	1072	2015	0.656	40.086	0.481	0.021	12/14/2015	61.11
Springer	S1072-73657	1072	2015	0.193	7.842	0.094	0.006	12/14/2015	40.63
Springer	S1072-73675	1072	2015	47.5	34.336	0.412	1.52	12/14/2015	0.72
Springer	S1072-73680	1072	2015	9	5.434	0.065	0.288	12/14/2015	0.60
Springer	S1072-73685	1072	2015	0.366	0.816	0.01	0.012	12/14/2015	2.23
Springer	S1072-73707	1072	2015	48.125	25.752	0.309	1.54	12/14/2015	0.54
Springer	S1072-73718	1072	2015	0.204	1.433	0.017	0.007	12/14/2015	7.02
Springer	S1072-73731	1072	2015	31.562	25.168	0.302	1.01	12/14/2015	0.80
Springer	S1072-73737	1072	2015	29.562	17.751	0.213	0.946	12/14/2015	0.60
Cariboo	C1072-76100	1072	2015	14.344	28.169	0.338	0.459	12/18/2015	1.96
Cariboo	C1072-76122	1072	2015	2.497	16.584	0.199	0.08	12/18/2015	6.64
Cariboo	C1072-76130	1072	2015	2.688	28.752	0.345	0.086	12/18/2015	10.70
Cariboo	C1072-76601	1072	2015	3.344	31.835	0.382	0.107	12/18/2015	9.52
Cariboo	C1072-76606	1072	2015	2.622	19.668	0.236	0.084	12/18/2015	7.50
Cariboo	C1072-76633	1072	2015	5.5	43.753	0.525	0.176	12/18/2015	7.96
Cariboo	C1072-75612	1072	2015	0.322	0.324	0.004	0.01	12/19/2015	1.01
Cariboo	C1072-75625	1072	2015	3.25	0.293	0.004	0.104	12/19/2015	0.09
Cariboo	C1072-75656	1072	2015	0.35	0.146	0.002	0.011	12/19/2015	0.42
Cariboo	C1072-75661	1072	2015	0.227	0.642	0.008	0.007	12/19/2015	2.83
Cariboo	C1072-75667	1072	2015	1.466	5.075	0.061	0.047	12/19/2015	3.46
Cariboo	C1072-77610	1072	2015	0.841	22.335	0.268	0.027	12/23/2015	26.56
Cariboo	C1072-77629	1072	2015	1.106	18.251	0.219	0.035	12/23/2015	16.50
Cariboo	C1072-77662	1072	2015	0.156	0.459	0.006	0.005	12/23/2015	2.94
Cariboo	C1072-77668	1072	2015	0.161	0.677	0.008	0.005	12/23/2015	4.20
Cariboo	C1072-77672	1072	2015	0.497	2.7	0.032	0.016	12/23/2015	5.43
Cariboo	C1072-78608	1072	2015	0.148	6.367	0.076	0.005	12/29/2015	43.02
Cariboo	C1072-78615	1072	2015	0.012	2.692	0.032	0	12/29/2015	224.33
Cariboo	C1072-78618	1072	2015	0.015	0.238	0.003	0	12/29/2015	15.87
Cariboo	C1072-78662	1072	2015	0.172	1.458	0.018	0.006	12/29/2015	8.48
Cariboo	C1072-78665	1072	2015	0.108	2.05	0.025	0.003	12/29/2015	18.98
Cariboo	C1072-78668	1072	2015	0.087	35.086	0.421	0.003	12/29/2015	403.29
Cariboo	C1072-78671	1072	2015	0.219	0.397	0.005	0.007	12/29/2015	1.81
Cariboo	C1072-78687	1072	2015	0.007	0.892	0.011	0	12/29/2015	127.43
Cariboo	C1072-79100	1072	2016	0.243	9.667	0.116	0.008	1/3/2016	39.78
Cariboo	C1072-79150	1072	2016	0.316	3.067	0.037	0.01	1/3/2016	9.71
Cariboo	C1072-79622	1072	2016	0.341	2.975	0.036	0.011	1/3/2016	8.72
Cariboo	C1072-79627	1072	2016	0.394	0.752	0.009	0.013	1/3/2016	1.91
Cariboo	C1072-79632	1072	2016	1.244	7.617	0.091	0.04	1/3/2016	6.12
Cariboo	C1072-79637	1072	2016	2.459	10.417	0.125	0.079	1/3/2016	4.24
Cariboo	C1072-79664	1072	2016	0.4	12.251	0.147	0.013	1/3/2016	30.63
Cariboo	C1072-79679	1072	2016	0.819	6.675	0.08	0.026	1/3/2016	8.15
Cariboo	C1072-79697	1072	2016	1.934	6.242	0.075	0.062	1/3/2016	3.23
Cariboo	C1072-79739	1072	2016	1.003	50.837	0.61	0.032	1/3/2016	50.68
Cariboo	C1072-79752	1072	2016	2.003	5.6	0.067	0.064	1/3/2016	2.80
Cariboo	C1084-106648	1084	2016	3.344	28.169	0.338	0.107	1/8/2016	8.42
Cariboo	C1084-106663	1084	2016	5.469	4.95	0.059	0.175	1/8/2016	0.91
Cariboo	C1072-80606	1072	2016	0.712	5.592	0.067	0.023	1/12/2016	7.85
Cariboo	C1072-80611	1072	2016	3.081	4.5	0.054	0.099	1/12/2016	1.46
Cariboo	C1072-80614	1072	2016	2.056	10.834	0.13	0.066	1/12/2016	5.27
Cariboo	C1072-80625	1072	2016	0.838	15.751	0.189	0.027	1/12/2016	18.80
Cariboo	C1072-80632	1072	2016	1.2	5.834	0.07	0.038	1/12/2016	4.86
Cariboo	C1072-80641	1072	2016	1.872	11.001	0.132	0.06	1/12/2016	5.88
Cariboo	C1072-80644	1072	2016	1.078	10.417	0.125	0.034	1/12/2016	9.66
Cariboo	C1072-80647	1072	2016	1.9	7.059	0.085	0.061	1/12/2016	3.72
Cariboo	C1072-80656	1072	2016	1.619	9.334	0.112	0.052	1/12/2016	5.77
Cariboo	C1072-80660	1072	2016	1.084	23.835	0.286	0.035	1/12/2016	21.99
Cariboo	C1072-80672	1072	2016	1.391	13.501	0.162	0.044	1/12/2016	9.71
Cariboo	C1072-80676	1072	2016	1.041	11.584	0.139	0.033	1/12/2016	11.13
Cariboo	C1072-80681	1072	2016	1.503	17.668	0.212	0.048	1/12/2016	11.76
Cariboo	C1072-80686	1072	2016	1.297	9.834	0.118	0.042	1/12/2016	7.58
Cariboo	C1072-80698	1072	2016	1.562	8.001	0.096	0.05	1/12/2016	5.12
Cariboo	C1072-80701	1072	2016	1.716	15.168	0.182	0.055	1/12/2016	8.84
Cariboo	C1060-62100	1060	2016	55.312	32.752	0.393	1.77	1/16/2016	0.59
Cariboo	C1060-62111	1060	2016	39.062	51.92	0.623	1.25	1/16/2016	1.33
Cariboo	C1060-62506	1060	2016	51.562	43.253	0.519	1.65	1/16/2016	0.84
Cariboo	C1060-62511	1060	2016	78.75	45.003	0.54	2.52	1/16/2016	0.57
Cariboo	C1060-62517	1060	2016	69.062	18.835	0.226	2.21	1/16/2016	0.27
Cariboo	C1060-62519	1060	2016	71.562	44.17	0.53	2.29	1/16/2016	0.62
Cariboo	C1060-62610	1060	2016	66.875	40.503	0.486	2.14	1/16/2016	0.61
Cariboo	C1060-62619	1060	2016	55.938	24.918	0.299	1.79	1/16/2016	0.45
Cariboo	C1060-62622	1060	2016	67.188	36.836	0.442	2.15	1/16/2016	0.55
Cariboo	C1060-62626	1060	2016	29.094	24.502	0.294	0.931	1/16/2016	0.84
Cariboo	C1060-62629	1060	2016	49.062	52.17	0.626	1.57	1/16/2016	1.06
Cariboo	C1084-108624	1084	2016	2.775	7.984	0.096	0.089	1/20/2016	2.88
Cariboo	C1084-108640	1084	2016	4	10.917	0.131	0.128	1/20/2016	2.73
Cariboo	C1084-108646	1084	2016	3.406	52.92	0.635	0.109	1/20/2016	15.54
Cariboo	C1084-108651	1084	2016	2.95	19.835	0.238	0.094	1/20/2016	6.72
Cariboo	C1084-108678	1084	2016	7	12.001	0.144	0.224	1/20/2016	1.71
Cariboo	C1084-108704	1084	2016	5.938	10.334	0.124	0.19	1/20/2016	1.74
Cariboo	C1084-108723	1084	2016	1.775	10.917	0.131	0.057	1/20/2016	6.15
Cariboo	C1060-63142	1060	2016	47.188	44.503	0.534	1.51	1/23/2016	0.94
Cariboo	C1060-63624	1060	2016	61.25	22.335	0.268	1.96	1/23/2016	0.36
Cariboo	C1084-109603	1084	2016	2.241	12.668	0.152	0.072	1/28/2016	5.65
Cariboo	C1084-109614	1084	2016	3.969	11.334	0.136	0.127	1/28/2016	2.86
Cariboo	C1084-109623	1084	2016	0.834	2.667	0.032	0.027	1/28/2016	3.20
Cariboo	C1084-109642	1084	2016	0.65	2.575	0.031	0.021	1/28/2016	3.96
Cariboo	C1084-109653	1084	2016	4.656	8.584	0.103	0.149	1/28/2016	1.84
Cariboo	C1084-109656	1084	2016	1.269	7.3	0.088	0.041	1/28/2016	5.75
Cariboo	C1084-109667	1084	2016	2.775	105.007	1.26	0.089	1/28/2016	37.84
Cariboo	C1084-109678	1084	2016	4.312	3.642	0.044	0.138	1/28/2016	0.84
Cariboo	C1084-109686	1084	2016	2.684	2.575	0.031	0.086	1/28/2016	0.96
Cariboo	C1084-109717	1084	2016	2.872	3.217	0.039	0.092	1/28/2016	1.12
Cariboo	C1084-109721	1084	2016	1.769	12.334	0.148	0.057	1/28/2016	6.97
Cariboo	C1072-999101	1072	2016	7.906	18.585	0.223	0.253	2/5/2016	2.35
Cariboo	C1072-999102	1072	2016	39.062	42.836	0.514	1.25	2/5/2016	1.10
Cariboo	C1072-999103	1072	2016	64.375	55.17	0.662	2.06	2/5/2016	0.86
Cariboo	C1072-999104	1072	2016	11.719	29.669	0.356	0.375	2/5/2016	2.53
Cariboo	C1072-999105	1072	2016	22.938	45.42	0.545	0.734	2/5/2016	1.98
Cariboo	C1072-999106	1072	2016	33.125	38.253	0.459	1.06	2/5/2016	1.15
Cariboo	C1072-999107	1072	2016	4.938	34.919	0.419	0.158	2/5/2016	7.07
Cariboo	C1072-999108	1072	2016	5.188	23.918	0.287	0.166	2/5/2016	4.61
Cariboo	C1072-999109	1072	2016	34.688	48.92	0.587	1.11	2/5/2016	1.41

Cariboo	C1072-999110	1072	2016	20.906	63.504	0.762	0.669	2/5/2016	3.04
Cariboo	C1072-999116	1072	2016	12.188	30.002	0.36	0.39	2/5/2016	2.46
Cariboo	C1072-999117	1072	2016	6.375	26.168	0.314	0.204	2/5/2016	4.10
Cariboo	C1072-999119	1072	2016	37.812	64.421	0.773	1.21	2/5/2016	1.70
Cariboo	C1072-999120	1072	2016	33.438	56.254	0.675	1.07	2/5/2016	1.68
Cariboo	C1072-999121	1072	2016	15.969	35.836	0.43	0.511	2/5/2016	2.24
Cariboo	C1072-999122	1072	2016	7.969	35.919	0.431	0.255	2/5/2016	4.51
Cariboo	C1072-999123	1072	2016	1.447	19.835	0.238	0.046	2/5/2016	13.71
Cariboo	C1072-999124	1072	2016	9.094	16.751	0.201	0.291	2/5/2016	1.84
Cariboo	C1072-999127	1072	2016	5	26.918	0.323	0.16	2/5/2016	5.38
Cariboo	C1072-999128	1072	2016	17.656	27.669	0.332	0.565	2/5/2016	1.57
Cariboo	C1072-999129	1072	2016	7.156	32.169	0.386	0.229	2/5/2016	4.50
Cariboo	C1072-999130	1072	2016	31.875	38.086	0.457	1.02	2/5/2016	1.19
Cariboo	C1072-999131	1072	2016	18.25	27.835	0.334	0.584	2/5/2016	1.53
Cariboo	C1072-999136	1072	2016	23.594	54.504	0.654	0.755	2/5/2016	2.31
Cariboo	C1072-999137	1072	2016	5.469	23.752	0.285	0.175	2/5/2016	4.34
Cariboo	C1072-999138	1072	2016	8.281	31.169	0.374	0.265	2/5/2016	3.76
Cariboo	C1072-999139	1072	2016	16.656	34.169	0.41	0.533	2/5/2016	2.05
Cariboo	C1072-999141	1072	2016	18.625	41.169	0.494	0.596	2/5/2016	2.21
Cariboo	C1072-999142	1072	2016	5.156	22.335	0.268	0.165	2/5/2016	4.33
Cariboo	C1072-999143	1072	2016	7.125	29.085	0.349	0.228	2/5/2016	4.08
Cariboo	C1072-999144	1072	2016	41.25	23.835	0.286	1.32	2/5/2016	0.58
Cariboo	C1072-999145	1072	2016	31.25	46.67	0.56	1	2/5/2016	1.49
Cariboo	C1072-999146	1072	2016	43.125	31.252	0.375	1.38	2/5/2016	0.72
Cariboo	C1072-999147	1072	2016	10.312	26.252	0.315	0.33	2/5/2016	2.55
Cariboo	C1072-999148	1072	2016	2.712	23.168	0.278	0.087	2/5/2016	8.54
Cariboo	C1072-999149	1072	2016	21.531	33.252	0.399	0.689	2/5/2016	1.54
Cariboo	C1072-999150	1072	2016	13.531	26.252	0.315	0.433	2/5/2016	1.94
Cariboo	C1072-999151	1072	2016	3.625	17.251	0.207	0.116	2/5/2016	4.76
Cariboo	C1072-999152	1072	2016	10.75	29.585	0.355	0.344	2/5/2016	2.75
Cariboo	C1072-999165	1072	2016	23.656	36.669	0.44	0.757	2/5/2016	1.55
Cariboo	C1072-999166	1072	2016	1.291	10.917	0.131	0.041	2/5/2016	8.46
Cariboo	C1084-105100	1084	2016	0.806	10.167	0.122	0.026	2/5/2016	12.61
Cariboo	C1084-105145	1084	2016	5.312	7.876	0.094	0.17	2/5/2016	1.48
Cariboo	C1084-105306	1084	2016	4.219	5.459	0.066	0.135	2/5/2016	1.29
Cariboo	C1084-105606	1084	2016	2.138	2.375	0.028	0.068	2/5/2016	1.11
Cariboo	C1084-105620	1084	2016	2.509	4.984	0.06	0.08	2/5/2016	1.99
Cariboo	C1084-105628	1084	2016	4.906	0.739	0.009	0.157	2/5/2016	0.15
Cariboo	C1084-105640	1084	2016	1.878	7.717	0.093	0.06	2/5/2016	4.11
Cariboo	C1084-107509	1084	2016	0.434	7.017	0.084	0.014	2/8/2016	16.17
Cariboo	C1084-107605	1084	2016	0.681	11.167	0.134	0.022	2/8/2016	16.40
Cariboo	C1084-107642	1084	2016	0.512	40.253	0.483	0.016	2/8/2016	78.62
Cariboo	C1084-110301	1084	2016	9.906	16.251	0.195	0.317	2/13/2016	1.64
Cariboo	C1084-110310	1084	2016	2.419	12.251	0.147	0.077	2/13/2016	5.06
Cariboo	C1084-110316	1084	2016	7.031	10.667	0.128	0.225	2/13/2016	1.52
Cariboo	C1084-110323	1084	2016	9.844	24.002	0.288	0.315	2/13/2016	2.44
Cariboo	C1084-110603	1084	2016	5.75	40.753	0.489	0.184	2/13/2016	7.09
Cariboo	C1084-110623	1084	2016	1.344	18.085	0.217	0.043	2/13/2016	13.46
Cariboo	C1084-110639	1084	2016	9.156	15.418	0.185	0.293	2/13/2016	1.68
Cariboo	C1084-110644	1084	2016	6.156	6.625	0.08	0.197	2/13/2016	1.08
Cariboo	C1072-81616	1072	2016	2.691	9.417	0.113	0.086	2/16/2016	3.50
Cariboo	C1072-81638	1072	2016	2.628	12.918	0.155	0.084	2/16/2016	4.92
Cariboo	C1072-81647	1072	2016	3.844	13.251	0.159	0.123	2/16/2016	3.45
Cariboo	C1072-81654	1072	2016	0.984	9.334	0.112	0.032	2/16/2016	9.49
Cariboo	C1072-81673	1072	2016	2.75	3.8	0.046	0.088	2/16/2016	1.38

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP
							%	%			%C	%C	kgCaCO3/t
82	49 1130 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite Volcanic	0.09	-0.01	9.2	9.5	#N/A	0.33	41
83	50 1130 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.22	0.01	8.9	9.2	#N/A	0.68	53
84	51 55145	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.43	0.01	8.7	9.1	#N/A	0.63	47
85	52 55137	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.28	-0.01	8.5	8.8	#N/A	0.44	47
86	71 55135	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.57	-0.01	8.8	9.1	#N/A	0.33	37
87	72 55141	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.12	-0.01	8.8	9	#N/A	0.52	48
88	39 1140 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite Volcanic	0.03	-0.01	9.2	9.5	#N/A	0.27	36
89	40 1140 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.21	-0.01	8.9	9.2	#N/A	0.49	48
90	42 54642	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.99	0.01	9	9.3	#N/A	0.35	43
91	43 55148	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.81	-0.01	8.8	9.2	#N/A	0.35	42
92	44 55136	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.05	0.01	8.5	8.8	#N/A	0.46	43
93	45 55685	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.46	0.01	8.8	9.2	#N/A	0.25	29
94	46 55666	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.16	0.01	8.8	9.2	#N/A	0.33	38
95	47 55670	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.13	0.01	8.9	9.4	#N/A	0.22	28
96	48 55681	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1	-0.01	8.8	9	#N/A	0.68	70
97	26 1150 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.03	0.01	9	9.4	#N/A	0.52	52
98	27 1150 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.36	0.01	9	9.4	#N/A	0.30	46
99	28 1150 C	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.18	0.03	9	9.4	#N/A	0.27	33
100	29 62673	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.06	0.04	9.2	9.5	#N/A	0.27	36
101	30 62690	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.14	0.03	9	9.4	#N/A	0.30	39
102	31 77864	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.88	0.03	8.9	9.2	#N/A	0.27	31
103	32 77880	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.65	0.02	8.7	9	#N/A	0.68	68
104	33 77889	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.5	0.03	8.7	9.1	#N/A	0.25	35
105	34 63774	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.53	0.01	9.3	9.6	#N/A	0.22	25
106	35 63781	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.29	0.02	8.7	9	#N/A	0.44	49
107	36 63755	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.87	0.02	9.1	9.4	#N/A	0.14	20
108	37 63995	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.04	0.02	9.2	9.6	#N/A	0.33	40
109	38 54609	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.49	-0.01	9.1	9.4	#N/A	0.27	39
110	COMP#1	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.5	8.1	#N/A	0.44	47
111	COMP#3	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.13	-0.01	8.5	8.1	#N/A	0.22	39
112	COMP#2	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.15	-0.01	8.9	8.6	#N/A	0.22	33
113	COMP#4	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.74	-0.01	8.4	7.8	#N/A	0.33	39
114	COMP#5	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.97	-0.01	8.5	7.8	#N/A	0.22	34
115	COMP#8	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.92	-0.01	8.7	8.1	#N/A	0.33	45
116	COMP#10	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.11	-0.01	8.7	8	#N/A	0.22	33
117	COMP#11	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.93	-0.01	8.6	8	#N/A	0.27	38
118	COMP#19	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.7	-0.01	9	8.1	#N/A	0.22	31
119	77766	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.7	-0.01	8.7	8	#N/A	0.27	33
120	77807	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.6	0.03	9	7.9	#N/A	0.11	26
121	77718	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.5	0.03	8.7	7.7	#N/A	0.11	27
122	77761	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.61	0.01	9.1	7.8	#N/A	0.11	23
123	77762	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.75	0.01	8.7	8	#N/A	0.27	37
124	77765	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.44	-0.01	9.2	8.2	#N/A	0.05	24
125	77767	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.23	0.03	8.7	7.9	#N/A	0.16	25
126	77769	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1	0.03	8.9	8	#N/A	0.22	32
127	77770	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.99	0.02	8.3	7.7	#N/A	0.55	55
128	77774	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.07	0.02	8.8	8.1	#N/A	0.05	23
129	77806	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.89	0.03	8.9	8	#N/A	0.16	29
130	COMP#1	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.5	8.1	#N/A	0.44	47
131	COMP#2	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.15	-0.01	8.9	8.6	#N/A	0.22	33
132	COMP#3	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.13	-0.01	8.5	8.1	#N/A	0.22	39
133	COMP#4	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.74	-0.01	8.4	7.8	#N/A	0.33	39
134	COMP#5	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.97	-0.01	8.5	7.8	#N/A	0.22	34
135	20-57438	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.42	0.02	8.1	7.7	#N/A	0.05	8
136	22-57431	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.46	0.02	8.7	8.1	#N/A	0.49	36
137	23-57440	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.37	0.01	8.4	7.6	#N/A	-0.05	11
138	24-57003	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.88	0.01	8.8	8.4	#N/A	0.11	23
139	25-57010	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.18	0.01	8.5	7.8	#N/A	0.11	10
140	26-57441	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.24	0.01	8.5	7.7	#N/A	0.11	12
141	27-57446	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.38	-0.01	8	7.3	#N/A	-0.05	15
142	28-57448	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.2	-0.01	8.4	8.1	#N/A	0.11	20
143	30-57053	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.42	0.02	8.2	8.1	#N/A	0.49	62
144	31-57033	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.89	-0.01	8.9	8.5	#N/A	0.33	38
145	32-57035	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.48	0.01	8.1	7.8	#N/A	-0.05	18
146	33-57067	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.28	0.01	8.9	8.1	#N/A	0.11	16
147	34-57096	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.64	0.01	8.7	8	#N/A	0.16	19
148	35-57101	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.33	0.01	9	8.2	#N/A	0.76	36
149	36-57103	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.71	0.02	8.6	8	#N/A	0.27	35
150	37-57107	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.15	0.02	8.4	7.8	#N/A	-0.05	11
151	39-57688	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.1	-0.01	8.2	7.7	#N/A	0.11	27
152	40-57694	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.41	-0.01	8.8	8.5	#N/A	0.27	37
153	COMP#41	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.9	8.7	#N/A	0.44	50
154	COMP#65	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.07	-0.01	8.9	8.9	#N/A	0.27	38
155	COMP#44	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.27	-0.01	9.3	8.9	#N/A	0.22	34
156	COMP#45	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.21	-0.01	8.9	8.5	#N/A	0.11	26
157	COMP#53	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.2	-0.01	8.9	8.8	#N/A	0.38	44
158	COMP#66	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.07	-0.01	8.9	8.7	#N/A	0.33	41
159	COMP#68	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.17	-0.01	9.3	8.9	#N/A	0.22	41
452	56439	Boundary Pit	#N/A	Blast Hole Cuttings	56439	#N/A	0.216	#N/A	#N/A	#N/A	#N/A	0.58	48.41666667
453	56439 dup	Boundary Pit	#N/A	Blast Hole Cuttings	56439 dup	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.57	47.33333333
454	56440	Boundary Pit	#N/A	Blast Hole Cuttings	56440	#N/A	0.164	#N/A	#N/A	#N/A	#N/A	0.76	63.08333333
455	56440 dup	Boundary Pit	#N/A	Blast Hole Cuttings	56440 dup	#N/A	0.167	#N/A	#N/A	#N/A	#N/A	0.76	63.08333333
456	56442	Boundary Pit	#N/A	Blast Hole Cuttings	56442	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.26	21.75
457	79152	Boundary Pit	#N/A	Blast Hole Cuttings	79152	#N/A	0.126	#N/A	#N/A	#N/A	#N/A	0.24	20.25
458	56446	Boundary Pit	#N/A	Blast Hole Cuttings	56446	#N/A	0.917	#N/A	#N/A	#N/A	#N/A	0.81	67.08333333
459	56448	Boundary Pit	#N/A	Blast Hole Cuttings	56448	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.28	22.91666667
460	79157	Boundary Pit	#N/A	Blast Hole Cuttings	79157	#N/A	0.25	#N/A	#N/A	#N/A	#N/A	0.25	20.83333333
461	79165	Boundary Pit	#N/A	Blast Hole Cuttings	79165	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.94	78.58333333
462	79162	Boundary Pit	#N/A	Blast Hole Cuttings	79162	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.33	27.66666667
463	79163	Boundary Pit	#N/A	Blast Hole Cuttings	79163	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.80	66.66666667
464	79409	Boundary Pit	#N/A	Blast Hole Cuttings	79409	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.42	35
465	79413	Boundary Pit	#N/A	Blast Hole Cuttings	79413	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	1.15	95.83333333
466	79454	Boundary Pit	#N/A	Blast Hole Cuttings	79454	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.24	20.25
467	79455	Boundary Pit	#N/A	Blast Hole Cuttings	79455	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.26	21.66666667
468	79456	Boundary Pit	#N/A	Blast Hole Cuttings	79456	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.46	38.58333333
469	79457	Boundary Pit	#N/A	Blast Hole Cuttings	79457	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.15	12.66666667
470	79464	Boundary Pit	#N/A	Blast Hole Cuttings	79464	#N/A	0.453	#N/A	#N/A	#N/A	#N/A	0.78	65.25
471	79401	Boundary Pit	B1180-12	Blast Hole Cuttings	79401	#N/A	2.48	#N/A	#N/A	#N/A	#N/A	0.34	28.5
472	79401	Boundary Pit	B1180-12	Blast Hole Cuttings	79401	#N/A	2.05	#N/A	#N/A	#N/A	#N/A	0.17	14.41666667
473	79402	Boundary Pit	B1180-12	Blast Hole Cuttings	79402	#N/A	0.911	#N/A	#N/A	#N/A	#N/A	0.16	12.91666667
474	79402	Boundary Pit	B1180-12	Blast Hole Cuttings	79402	#N/A	1.46	#N/A	#N/A	#N/A	#N/A	0.32	26.66666667
475	79403	Boundary Pit	B1180-12	Blast Hole Cuttings	79403	#N/A	0.886	#N/A	#N/A	#N/A	#N/A	0.13	10.75
476	79403	Boundary Pit	B1180-12	Blast Hole Cuttings	79403	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	0.13	10.91666667
477	79404	Boundary Pit	B1180-12	Blast Hole Cuttings	79404	#N/A	0.74	#N/A	#N/A	#N/A	#N/A	0.22	18.25
478	79404	Boundary Pit	B1180-12	Blast Hole Cuttings	79404	#N/A	0.872	#N/A	#N/A	#N/A	#N/A	0.30	24.66666667
479	M82319	Boundary Pit	B1168-13	Blast Hole Cuttings	M82319	#N/A	0.019	#N/A	#N/A	#N/A	#N/A	0.36	29.75
480	79153	Boundary Pit	B1168-12	Blast Hole Cuttings	79153	#N/A	1.35	#N/A	#N/A	#N/A	#N/A	0.37	30.91666667
481	79154	Boundary Pit	B1168-12	Blast Hole Cuttings	79154	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.36	30.33333333
482	79155	Boundary Pit	B1168-12	Blast Hole Cuttings	79155	#N/A	1.23	#N/A	#N/A	#N/A	#N/A	0.48	39.91666667
483	56447	Boundary Pit	B1168-11	Blast Hole Cuttings	56447	#N/A	0.904	#N/A	#N/A	#N/A	#N/A	0.31	25.5
484	56446	Boundary Pit	B1168-11	Blast Hole Cuttings	56446	#N/A	0.917	#N/A	#N/A	#N/A	#N/A	0.81	67.08333333
485	79451	Boundary Pit	B1156-23	Blast Hole Cuttings	79451	#N/A	1.44	#N/A	#N/A	#N/A	#N/A	0.47	39.5
486	79452	Boundary Pit	B1156-23	Blast Hole Cuttings	79452	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.69	57.16666667
487	79411	Boundary Pit	B1156-22	Blast Hole Cuttings	79411	#N/A	1.22	#N/A	#N/A	#N/A	#N/A	0.47	39.41666667
488	79412	Boundary Pit	B1156-22	Blast Hole Cuttings	79412	#N/A	1.05	#N/A	#N/A	#N/A	#N/A	0.41	34.08333333
489	79413	Boundary Pit	B1156-22	Blast Hole Cuttings	79413	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	1.15	95.83333333
490	79165	Boundary Pit	B1156-20	Blast Hole Cuttings	79165	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.94	78.58333333
491	79159	Boundary Pit	B1156-19	Blast Hole Cuttings	79159	#N/A	0.854	#N/A	#N/A	#N/A	#N/A	0.11	9.25
492	79160	Boundary Pit	B1156-19	Blast Hole Cuttings	79160	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	0.17	14.5
493	79156	Boundary Pit	B1156-18	Blast Hole Cuttings	79156	#N/A	1.65	#N/A	#N/A	#N/A	#N/A	0.42	34.91666667
494	79151	Boundary Pit	B1156-15	Blast Hole Cuttings	79151	#N/A	0.818	#N/A	#N/A	#N/A	#N/A	0.08	6.833333333
495	79152	Boundary Pit	B1156-15	Blast Hole Cuttings	79152	#N/A	0.126	#N/A	#N/A	#N/A	#N/A	0.24	20.25
496	56448	Boundary Pit	B1156-11	Blast Hole Cuttings	56448	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.28	22.91666667
497	56441	Boundary Pit	B1156-07	Blast Hole Cuttings	56441	#N/A	0.985	#N/A	#N/A	#N/A	#N/A	0.49	40.75
498	56442	Boundary Pit	B1156-07	Blast Hole Cuttings	56442	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.26	21.75
499	56443	Boundary Pit	B1156-07	Blast Hole Cuttings	56443	#N/A	0.376	#N/A	#N/A	#N/A	#N/A	0.42	34.83333333
500	56439	Boundary Pit	B1156-05	Blast Hole Cuttings	56439	#N/A	0.216	#N/A	#N/A	#N/A	#N/A	0.58	48.41666667
501	56439 dup	Boundary Pit	B1156-05	Blast Hole Cuttings	56439 dup	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.57	47.33333333
502	56440	Boundary Pit	B1156-05	Blast Hole Cuttings	56440	#N/A	0.164	#N/A	#N/A	#N/A	#N/A	0.76	63.08333333
503	56440 dup	Boundary Pit	B1156-05	Blast Hole Cuttings	56440 dup	#N/A	0.167	#N/A	#N/A	#N/A	#N/A	0.76	63.08333333
504	M82320	Boundary Pit	B1144-23	Blast Hole Cuttings	M82320	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.24	19.58333333
505	M 79203	Boundary Pit	B1144-20	Blast Hole Cuttings	M 79203	#N/A	1.24	#N/A	#N/A	#N/A	#N/A	0.51	42.58333333
506	M 79204	Boundary Pit	B1144-20	Blast Hole Cuttings	M 79204	#N/A	2.41	#N/A	#N/A	#N/A	#N/A	0.43	35.58333333
507	M 79467	Boundary Pit	B1144-16	Blast Hole Cuttings	M 79467	#N/A	0.915	#N/A	#N/A	#N/A	#N/A	1.07	89.16666667
508	M 79468	Boundary Pit	B1144-16	Blast Hole Cuttings	M 79468	#N/A	1.11	#N/A	#N/A	#N/A	#N/A	0.22	18.5
509	79454	Boundary Pit	B1144-13	Blast Hole Cuttings	79454	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.24	20.25
510	79461	Boundary Pit	B1144-13	Blast Hole Cuttings	79461	#N/A	1.61	#N/A	#N/A	#N/A	#N/A	0.45	37.75
511	79463	Boundary Pit	B1144-13	Blast Hole Cuttings	79463	#N/A	0.872	#N/A	#N/A	#N/A	#N/A	0.22	18.08333333
512	79464	Boundary Pit	B1144-13	Blast Hole Cuttings	79464	#N/A	0.453	#N/A	#N/A	#N/A	#N/A	0.78	65.25
513	79408	Boundary Pit	B1144-11	Blast Hole Cuttings	79408	#N/A	0.386	#N/A	#N/A	#N/A	#N/A	0.25	21
514	79455	Boundary Pit	B1144-10	Blast Hole Cuttings	79455	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.26	21.66666667
515	79161	Boundary Pit	B1144-08	Blast Hole Cuttings	79161	#N/A	1.17	#N/A	#N/A	#N/A	#N/A	0.47	39.08333333
516	79162	Boundary Pit	B1144-08	Blast Hole Cuttings	79162	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.33	27.66666667
517	79163	Boundary Pit	B1144-08	Blast Hole Cuttings	79163	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.80	66.66666667
518	79409	Boundary Pit	B1144-08	Blast Hole Cuttings	79409	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.42	35
519	79410	Boundary Pit	B1144-08	Blast Hole Cuttings	79410	#N/A	1.68	#N/A	#N/A	#N/A	#N/A	0.33	27.08333333
520	79157	Boundary Pit	B1144-05	Blast Hole Cuttings	79157	#N/A	0.25	#N/A	#N/A	#N/A	#N/A	0.25	20.83333333
521	M79201	Boundary Pit	B1132-5	Blast Hole Cuttings	M79201	#N/A	0.028	#N/A	#N/A	#N/A	#N/A	0.05	4.5
522	M 79469	Boundary Pit	B1132-4	Blast Hole Cuttings	M 79469	#N/A	0.067	#N/A	#N/A	#N/A	#N/A	0.11	9.083333333
523	M79212	Boundary Pit	B1132-19	Blast Hole Cuttings	M79212	#N/A	0.489	#N/A	#N/A	#N/A	#N/A	0.71	59
524	M79213	Boundary Pit	B1132-19	Blast Hole Cuttings	M79213	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.32	26.75
525	M79420	Boundary Pit	B1132-17	Blast Hole Cuttings	M79420	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.24	19.66666667
526	M79421	Boundary Pit	B1132-17	Blast Hole Cuttings	M79421	#N/A	0.467	#N/A	#N/A	#N/A	#N/A	0.84	70.25
527	M79419	Boundary Pit	B1132-16	Blast Hole Cuttings	M79419	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.14	11.33333333
528	M79418	Boundary Pit	B1132-13	Blast Hole Cuttings	M79418	#N/A	0.041	#N/A	#N/A	#N/A	#N/A	0.09	7.416666667
529	M79210	Boundary Pit	B1132-11	Blast Hole Cuttings	M79210	#N/A	0.051	#N/A	#N/A	#N/A	#N/A	0.11	8.916666667
530	M79209	Boundary Pit	B1132-10	Blast Hole Cuttings	M79209	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.22	17.91666667
531	79457	Boundary Pit	B1132-02	Blast Hole Cuttings	79457	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.15	12.66666667
532	79456	Boundary Pit	B1132-01	Blast Hole Cuttings	79456	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.46	38.58333333
533	M 82338	Boundary Pit	B1120-21	Blast Hole Cuttings	M 82338	#N/A	2	#N/A	#N/A	#N/A	#N/A	0.27	22.66666667
534	M 82339	Boundary Pit	B1120-21	Blast Hole Cuttings	M 82339	#N/A	0.767	#N/A	#N/A	#N/A	#N/A	1.66	138.3333333
535	M82481	Boundary Pit	B1120-19	Blast Hole Cuttings	M82481	#N/A	0.075	#N/A	#N/A	#N/A	#N/A	0.19	15.41666667
536	M82480	Boundary Pit	B1120-18	Blast Hole Cuttings	M82480	#N/A	0.031	#N/A	#N/A	#N/A	#N/A	0.22	18.25
537	M79168	Boundary Pit	B1120-12	Blast Hole Cuttings	M79168	#N/A	0.155	#N/A	#N/A	#N/A	#N/A	0.41	34.08333333
538	M79167	Boundary Pit	B1120-11	Blast Hole Cuttings	M79167	#N/A	0.056	#N/A	#N/A	#N/A	#N/A	0.05	4.416666667
539	M79166	Boundary Pit	B1120-10	Blast Hole Cuttings	M79166	#N/A	0.787	#N/A	#N/A	#N/A	#N/A	0.33	27.75
540	M79220	Boundary Pit	B1120-09	Blast Hole Cuttings	M79220	#N/A	0.116	#N/A	#N/A	#N/A	#N/A	0.43	35.58333333
541	M79219	Boundary Pit	B1120-08	Blast Hole Cuttings	M79219	#N/A	0.896	#N/A	#N/A	#N/A	#N/A	0.73	60.5
542	M79215	Boundary Pit	B1120-07	Blast Hole Cuttings	M79215	#N/A	0.061	#N/A	#N/A	#N/A	#N/A	0.07	6.083333333
543	M79214	Boundary Pit	B1120-06	Blast Hole Cuttings	M79214	#N/A	0.081	#N/A	#N/A	#N/A	#N/A	0.10	8.416666667
544	M 82677	Boundary Pit	B1108-13	Blast Hole Cuttings	M 82677	#N/A	1.28	#N/A	#N/A	#N/A	#N/A	0.54	45
545	82316	Boundary Pit	B1108-12	Blast Hole Cuttings	82316	#N/A	0.072	#N/A	#N/A	#N/A	#N/A	0.06	4.833333333
546	82317	Boundary Pit	B1108-12	Blast Hole Cuttings	82317	#N/A	0.064	#N/A	#N/A	#N/A	#N/A	0.05	4.25
547	M82303	Boundary Pit	B1108-11	Blast Hole Cuttings	M82303	#N/A	0.086	#N/A	#N/A	#N/A	#N/A	0.06	5.166666667
548	M82304	Boundary Pit	B1108-10	Blast Hole Cuttings	M82304	#N/A	0.038	#N/A	#N/A	#N/A	#N/A	0.09	7.166666667
549	M82301	Boundary Pit	B1108-09	Blast Hole Cuttings	M82301	#N/A	0.852	#N/A	#N/A	#N/A	#N/A	0.35	29.25
550	M82302	Boundary Pit	B1108-09	Blast Hole Cuttings	M82302	#N/A	0.111	#N/A	#N/A	#N/A	#N/A	0.06	4.916666667
551	M82496	Boundary Pit	B1108-06	Blast Hole Cuttings	M82496	#N/A	0.613	#N/A	#N/A	#N/A	#N/A	0.37	30.83333333

P:\01_SITES\Mt_Polley\1CI008.007_Se_Source_Evalu

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP
							%	%			%C	%C	kgCaCO3/t
552	M82497	Boundary Pit	B1108-05	Blast Hole Cuttings	M82497	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.14	11.83333333
553	M82478	Boundary Pit	B1108-01	Blast Hole Cuttings	M82478	#N/A	0.03	#N/A	#N/A	#N/A	#N/A	0.15	12.41666667
554	82501	Boundary Pit	B1096-8	Blast Hole Cuttings	82501	#N/A	0.056	#N/A	#N/A	#N/A	#N/A	0.03	2.833333333
555	82502	Boundary Pit	B1096-5	Blast Hole Cuttings	82502	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.22	18.41666667
556	82503	Boundary Pit	B1096-2	Blast Hole Cuttings	82503	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.21	17.75
557	M82323	Boundary Pit	B1096-18	Blast Hole Cuttings	M82323	#N/A	0.059	#N/A	#N/A	#N/A	#N/A	0.08	6.583333333
558	M82322	Boundary Pit	B1096-17	Blast Hole Cuttings	M82322	#N/A	0.032	#N/A	#N/A	#N/A	#N/A	0.17	14
559	M82321	Boundary Pit	B1096-16	Blast Hole Cuttings	M82321	#N/A	0.115	#N/A	#N/A	#N/A	#N/A	0.12	9.583333333
560	M 82516	Boundary Pit	B1096-15	Blast Hole Cuttings	M 82516	#N/A	0.086	#N/A	#N/A	#N/A	#N/A	0.16	12.91666667
561	M 82517	Boundary Pit	B1096-15	Blast Hole Cuttings	M 82517	#N/A	0.414	#N/A	#N/A	#N/A	#N/A	0.21	17.16666667
562	M 82514	Boundary Pit	B1096-13	Blast Hole Cuttings	M 82514	#N/A	0.107	#N/A	#N/A	#N/A	#N/A	0.44	36.41666667
563	M 82515	Boundary Pit	B1096-13	Blast Hole Cuttings	M 82515	#N/A	0.078	#N/A	#N/A	#N/A	#N/A	0.11	9.416666667
564	M 82513	Boundary Pit	B1096-11	Blast Hole Cuttings	M 82513	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.26	21.66666667
565	M 82512	Boundary Pit	B1096-09	Blast Hole Cuttings	M 82512	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.06	5.333333333
566	M82318	Boundary Pit	B1084-2	Blast Hole Cuttings	M82318	#N/A	0.042	#N/A	#N/A	#N/A	#N/A	0.15	12.83333333
567	M 82530	Boundary Pit	B1084-09	Blast Hole Cuttings	M 82530	#N/A	0.073	#N/A	#N/A	#N/A	#N/A	0.14	11.33333333
568	M 82676	Boundary Pit	B1072-04	Blast Hole Cuttings	M 82676	#N/A	0.088	#N/A	#N/A	#N/A	#N/A	0.12	10.08333333
569	M 82529	Boundary Pit	B1072-01	Blast Hole Cuttings	M 82529	#N/A	0.048	#N/A	#N/A	#N/A	#N/A	0.10	8.666666667
570	1065-1	Boundary Pit	#N/A	Blast Hole Cuttings	1065-1	#N/A	0.479	#N/A	#N/A	#N/A	#N/A	0.72	59.75
571	1084-2	Boundary Pit	#N/A	Blast Hole Cuttings	1084-2	#N/A	1.28	#N/A	#N/A	#N/A	#N/A	0.63	52.58333333
572	1111-1	Boundary Pit	#N/A	Blast Hole Cuttings	1111-1	#N/A	0.044	#N/A	#N/A	#N/A	#N/A	1.06	88.33333333
573	1526-2	Boundary Pit	#N/A	Blast Hole Cuttings	1526-2	#N/A	0.252	#N/A	#N/A	#N/A	#N/A	0.96	79.58333333
574	1639-1	Boundary Pit	#N/A	Blast Hole Cuttings	1639-1	#N/A	0.096	#N/A	#N/A	#N/A	#N/A	0.82	68.66666667
591	Z1030-04	SE Zone	#N/A	Blast Hole Cuttings	Z1030-04	#N/A	0.661	#N/A	#N/A	#N/A	#N/A	0.20	16.83333333
592	Z1030-05	SE Zone	#N/A	Blast Hole Cuttings	Z1030-05	#N/A	0.959	#N/A	#N/A	#N/A	#N/A	0.19	15.66666667
593	Z1030-06	SE Zone	#N/A	Blast Hole Cuttings	Z1030-06	#N/A	0.663	#N/A	#N/A	#N/A	#N/A	0.15	12.08333333
594	Z1030-07	SE Zone	#N/A	Blast Hole Cuttings	Z1030-07	#N/A	0.756	#N/A	#N/A	#N/A	#N/A	0.08	6.583333333
595	Z1030-07	SE Zone	#N/A	Blast Hole Cuttings	Z1030-07	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	0.11	9.5
596	Z1030-08	SE Zone	#N/A	Blast Hole Cuttings	Z1030-08	#N/A	0.685	#N/A	#N/A	#N/A	#N/A	0.19	15.75
597	Z1030-08	SE Zone	#N/A	Blast Hole Cuttings	Z1030-08	#N/A	0.767	#N/A	#N/A	#N/A	#N/A	0.09	7.166666667
598	Z1030-09	SE Zone	#N/A	Blast Hole Cuttings	Z1030-09	#N/A	0.471	#N/A	#N/A	#N/A	#N/A	0.25	20.66666667
599	Z1030-09	SE Zone	#N/A	Blast Hole Cuttings	Z1030-09	#N/A	0.689	#N/A	#N/A	#N/A	#N/A	0.13	10.5
600	Z1030-10	SE Zone	#N/A	Blast Hole Cuttings	Z1030-10	#N/A	0.928	#N/A	#N/A	#N/A	#N/A	0.21	17.5
601	Z1040-01	SE Zone	#N/A	Blast Hole Cuttings	Z1040-01	#N/A	0.185	#N/A	#N/A	#N/A	#N/A	0.03	2.666666667
602	Z1040-04	SE Zone	#N/A	Blast Hole Cuttings	Z1040-04	#N/A	0.754	#N/A	#N/A	#N/A	#N/A	0.05	3.916666667
603	Z1040-05	SE Zone	#N/A	Blast Hole Cuttings	Z1040-05	#N/A	0.819	#N/A	#N/A	#N/A	#N/A	0.07	5.833333333
604	Z1040-06	SE Zone	#N/A	Blast Hole Cuttings	Z1040-06	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.10	8.083333333
605	Z1040-07	SE Zone	#N/A	Blast Hole Cuttings	Z1040-07	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.07	5.583333333
606	Z1040-08	SE Zone	#N/A	Blast Hole Cuttings	Z1040-08	#N/A	0.55	#N/A	#N/A	#N/A	#N/A	0.03	2.166666667
607	Z1040-09	SE Zone	#N/A	Blast Hole Cuttings	Z1040-09	#N/A	0.94	#N/A	#N/A	#N/A	#N/A	0.11	9.25
608	Z1040-10	SE Zone	#N/A	Blast Hole Cuttings	Z1040-10	#N/A	0.482	#N/A	#N/A	#N/A	#N/A	0.11	8.75
609	Z1040-11	SE Zone	#N/A	Blast Hole Cuttings	Z1040-11	#N/A	0.729	#N/A	#N/A	#N/A	#N/A	0.06	5.166666667
610	Z1040-12	SE Zone	#N/A	Blast Hole Cuttings	Z1040-12	#N/A	0.315	#N/A	#N/A	#N/A	#N/A	0.08	6.5
611	Z1040-13	SE Zone	#N/A	Blast Hole Cuttings	Z1040-13	#N/A	0.583	#N/A	#N/A	#N/A	#N/A	0.23	19.25
612	Z1040-14	SE Zone	#N/A	Blast Hole Cuttings	Z1040-14	#N/A	0.898	#N/A	#N/A	#N/A	#N/A	0.14	11.83333333
613	Z1040-15	SE Zone	#N/A	Blast Hole Cuttings	Z1040-15	#N/A	0.798	#N/A	#N/A	#N/A	#N/A	0.16	13
614	Z1050-02	SE Zone	#N/A	Blast Hole Cuttings	Z1050-02	#N/A	0.323	#N/A	#N/A	#N/A	#N/A	0.04	3
615	Z1050-03	SE Zone	#N/A	Blast Hole Cuttings	Z1050-03	#N/A	0.478	#N/A	#N/A	#N/A	#N/A	0.02	1.916666667
616	Z1050-04	SE Zone	#N/A	Blast Hole Cuttings	Z1050-04	#N/A	0.679	#N/A	#N/A	#N/A	#N/A	0.11	9.333333333
617	Z1050-05	SE Zone	#N/A	Blast Hole Cuttings	Z1050-05	#N/A	0.91	#N/A	#N/A	#N/A	#N/A	0.09	7.5
618	Z1050-06	SE Zone	#N/A	Blast Hole Cuttings	Z1050-06	#N/A	0.886	#N/A	#N/A	#N/A	#N/A	0.09	7.75
619	Z1050-07	SE Zone	#N/A	Blast Hole Cuttings	Z1050-07	#N/A	0.708	#N/A	#N/A	#N/A	#N/A	0.18	14.58333333
620	Z1050-09	SE Zone	#N/A	Blast Hole Cuttings	Z1050-09	#N/A	0.427	#N/A	#N/A	#N/A	#N/A	0.08	6.25
621	Z1050-10	SE Zone	#N/A	Blast Hole Cuttings	Z1050-10	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.21	17.83333333
622	Z1060-05	SE Zone	#N/A	Blast Hole Cuttings	Z1060-05	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	0.13	11.08333333
623	Z1060-09	SE Zone	#N/A	Blast Hole Cuttings	Z1060-09	#N/A	0.472	#N/A	#N/A	#N/A	#N/A	0.09	7.75
624	106257	SE Zone	#N/A	Blast Hole Cuttings	106257	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.97	80.58
625	106276	SE Zone	#N/A	Blast Hole Cuttings	106276	#N/A	0.091	#N/A	#N/A	#N/A	#N/A	0.43	35.42
626	106585	SE Zone	#N/A	Blast Hole Cuttings	106585	#N/A	0.105	#N/A	#N/A	#N/A	#N/A	0.23	19.5
627	106740	SE Zone	#N/A	Blast Hole Cuttings	106740	#N/A	0.218	#N/A	#N/A	#N/A	#N/A	0.31	25.42
628	106838	SE Zone	#N/A	Blast Hole Cuttings	106838	#N/A	0.148	#N/A	#N/A	#N/A	#N/A	0.40	33.42
629	106933	SE Zone	#N/A	Blast Hole Cuttings	106933	#N/A	2.49	#N/A	#N/A	#N/A	#N/A	0.54	44.67
630	107035	SE Zone	#N/A	Blast Hole Cuttings	107035	#N/A	0.168	#N/A	#N/A	#N/A	#N/A	0.31	25.83
631	107291	SE Zone	#N/A	Blast Hole Cuttings	107291	#N/A	0.226	#N/A	#N/A	#N/A	#N/A	0.10	8.29
632	109016	SE Zone	#N/A	Blast Hole Cuttings	109016	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.67	55.83
633	109054	SE Zone	#N/A	Blast Hole Cuttings	109054	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.30	25.08
634	109323	SE Zone	#N/A	Blast Hole Cuttings	109323	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	0.23	19.25
635	109434	SE Zone	#N/A	Blast Hole Cuttings	109434	#N/A	0.074	#N/A	#N/A	#N/A	#N/A	0.15	12.83
636	109445	SE Zone	#N/A	Blast Hole Cuttings	109445	#N/A	1.47	#N/A	#N/A	#N/A	#N/A	0.10	7.99
637	111916	SE Zone	#N/A	Blast Hole Cuttings	111916	#N/A	0.16	#N/A	#N/A	#N/A	#N/A	0.23	18.83
638	23048	SE Zone	#N/A	Blast Hole Cuttings	23048	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.22	18.25
639	23617	SE Zone	#N/A	Blast Hole Cuttings	23617	#N/A	0.713	#N/A	#N/A	#N/A	#N/A	0.19	15.92
640	23892	SE Zone	#N/A	Blast Hole Cuttings	23892	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.11	9.08
641	30964	SE Zone	#N/A	Blast Hole Cuttings	30964	#N/A	0.624	#N/A	#N/A	#N/A	#N/A	0.57	47.25
642	90607	SE Zone	#N/A	Blast Hole Cuttings	90607	#N/A	1.89	#N/A	#N/A	#N/A	#N/A	0.45	37.58
643	106606	SE Zone	#N/A	Blast Hole Cuttings	106606	#N/A	0.026	#N/A	#N/A	#N/A	#N/A	0.22	18.67
644	106622	SE Zone	#N/A	Blast Hole Cuttings	106622	#N/A	0.061	#N/A	#N/A	#N/A	#N/A	0.12	9.75
645	106718	SE Zone	#N/A	Blast Hole Cuttings	106718	#N/A	0.189	#N/A	#N/A	#N/A	#N/A	0.46	38.33
646	106854	SE Zone	#N/A	Blast Hole Cuttings	106854	#N/A	0.172	#N/A	#N/A	#N/A	#N/A	0.14	12
647	106867	SE Zone	#N/A	Blast Hole Cuttings	106867	#N/A	0.315	#N/A	#N/A	#N/A	#N/A	0.31	25.67
648	107253	SE Zone	#N/A	Blast Hole Cuttings	107253	#N/A	0.085	#N/A	#N/A	#N/A	#N/A	0.35	29.42
649	109028	SE Zone	#N/A	Blast Hole Cuttings	109028	#N/A	0.397	#N/A	#N/A	#N/A	#N/A	0.81	67.42
650	109463	SE Zone	#N/A	Blast Hole Cuttings	109463	#N/A	0.543	#N/A	#N/A	#N/A	#N/A	0.48	40.17
651	111998	SE Zone	#N/A	Blast Hole Cuttings	111998	#N/A	0.101	#N/A	#N/A	#N/A	#N/A	0.30	25
652	121049	SE Zone	#N/A	Blast Hole Cuttings	121049	#N/A	0.487	#N/A	#N/A	#N/A	#N/A	0.84	69.75
653	121071	SE Zone	#N/A	Blast Hole Cuttings	121071	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.26	21.83
654	121157	SE Zone	#N/A	Blast Hole Cuttings	121157	#N/A	0.84	#N/A	#N/A	#N/A	#N/A	0.27	22.75
655	30768	SE Zone	#N/A	Blast Hole Cuttings	30768	#N/A	0.662	#N/A	#N/A	#N/A	#N/A	0.28	23.17
656	30977	SE Zone	#N/A	Blast Hole Cuttings	30977	#N/A	0.399	#N/A	#N/A	#N/A	#N/A	0.68	56.33
657	30988	SE Zone	#N/A	Blast Hole Cuttings	30988	#N/A	0.235	#N/A	#N/A	#N/A	#N/A	0.59	49.17
658	1520	SE Zone	#N/A	Blast Hole Cuttings	1520	#N/A	0.428	#N/A	#N/A	#N/A	#N/A	0.03	2.666666667
659	1922	SE Zone	#N/A	Blast Hole Cuttings	1922	#N/A	0.296	#N/A	#N/A	#N/A	#N/A	0.05	3.75
660	1926	SE Zone	#N/A	Blast Hole Cuttings	1926	#N/A	0.013	#N/A	#N/A	#N/A	#N/A	0.02	1.833333333
661	2324	SE Zone	#N/A	Blast Hole Cuttings	2324	#N/A	0.161	#N/A	#N/A	#N/A	#N/A	0.05	3.75
662	2328	SE Zone	#N/A	Blast Hole Cuttings	2328	#N/A	0.107	#N/A	#N/A	#N/A	#N/A	0.05	4.25
663	2726	SE Zone	#N/A	Blast Hole Cuttings	2726	#N/A	0.218	#N/A	#N/A	#N/A	#N/A	0.05	4.416666667
664	2730	SE Zone	#N/A	Blast Hole Cuttings	2730	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.27	22.08333333
665	3124	SE Zone	#N/A	Blast Hole Cuttings	3124	#N/A	0.533	#N/A	#N/A	#N/A	#N/A	0.19	15.66666667
666	3128	SE Zone	#N/A	Blast Hole Cuttings	3128	#N/A	0.038	#N/A	#N/A	#N/A	#N/A	0.04	3.5
667	3132	SE Zone	#N/A	Blast Hole Cuttings	3132	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.03	2.083333333
668	2013	SE Zone	#N/A	Blast Hole Cuttings	2013	#N/A	0.173	#N/A	#N/A	#N/A	#N/A	0.12	9.583333333
669	2106	SE Zone	#N/A	Blast Hole Cuttings	2106	#N/A	0.608	#N/A	#N/A	#N/A	#N/A	0.08	6.916666667
670	2114	SE Zone	#N/A	Blast Hole Cuttings	2114	#N/A	0.466	#N/A	#N/A	#N/A	#N/A	0.16	13.66666667
671	2007	SE Zone	#N/A	Blast Hole Cuttings	2007	#N/A	0.502	#N/A	#N/A	#N/A	#N/A	0.07	5.916666667
672	2218	SE Zone	#N/A	Blast Hole Cuttings	2218	#N/A	0.546	#N/A	#N/A	#N/A	#N/A	0.13	10.75
673	2244	SE Zone	#N/A	Blast Hole Cuttings	2244	#N/A	0.265	#N/A	#N/A	#N/A	#N/A	0.21	17.5
674	2248	SE Zone	#N/A	Blast Hole Cuttings	2248	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	0.09	7.416666667
675	2203	SE Zone	#N/A	Blast Hole Cuttings	2203	#N/A	0.396	#N/A	#N/A	#N/A	#N/A	0.10	8.333333333
676	5005	SE Zone	#N/A	Blast Hole Cuttings	5005	#N/A	0.944	#N/A	#N/A	#N/A	#N/A	0.24	19.66666667
677	5064	SE Zone	#N/A	Blast Hole Cuttings	5064	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.34	28.16666667
678	5500	SE Zone	#N/A	Blast Hole Cuttings	5500	#N/A	1.36	#N/A	#N/A	#N/A	#N/A	0.26	21.33333333
679	5508	SE Zone	#N/A	Blast Hole Cuttings	5508	#N/A	1.77	#N/A	#N/A	#N/A	#N/A	0.19	15.66666667
680	5512	SE Zone	#N/A	Blast Hole Cuttings	5512	#N/A	0.492	#N/A	#N/A	#N/A	#N/A	0.23	18.83333333
681	5527	SE Zone	#N/A	Blast Hole Cuttings	5527	#N/A	0.646	#N/A	#N/A	#N/A	#N/A	0.18	15.25
682	5529	SE Zone	#N/A	Blast Hole Cuttings	5529	#N/A	0.961	#N/A	#N/A	#N/A	#N/A	0.19	15.41666667
683	5544	SE Zone	#N/A	Blast Hole Cuttings	5544	#N/A	1.88	#N/A	#N/A	#N/A	#N/A	0.23	19.08333333
684	6511	SE Zone	#N/A	Blast Hole Cuttings	6511	#N/A	0.538	#N/A	#N/A	#N/A	#N/A	0.19	15.58333333
685	6516	SE Zone	#N/A	Blast Hole Cuttings	6516	#N/A	0.389	#N/A	#N/A	#N/A	#N/A	0.21	17.83333333
686	6570	SE Zone	#N/A	Blast Hole Cuttings	6570	#N/A	2.63	#N/A	#N/A	#N/A	#N/A	0.30	25.16666667
687	6580	SE Zone	#N/A	Blast Hole Cuttings	6580	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.24	20.25
688	Z10006	SE Zone	#N/A	Blast Hole Cuttings	Z10006	#N/A	1.16	#N/A	#N/A	#N/A	#N/A	0.10	8.166666667
689	Z10009	SE Zone	#N/A	Blast Hole Cuttings	Z10009	#N/A	1.51	#N/A	#N/A	#N/A	#N/A	0.07	6
690	Z10019	SE Zone	#N/A	Blast Hole Cuttings	Z10019	#N/A	0.823	#N/A	#N/A	#N/A	#N/A	0.06	5.333333333
691	Z10042	SE Zone	#N/A	Blast Hole Cuttings	Z10042	#N/A	0.662	#N/A	#N/A	#N/A	#N/A	0.19	15.41666667
692	Z10045	SE Zone	#N/A	Blast Hole Cuttings	Z10045	#N/A	1.55	#N/A	#N/A	#N/A	#N/A	0.04	3
693	5212	SE Zone	Z1080-05	Blast Hole Cuttings	5212	#N/A	1.56	#N/A	#N/A	#N/A	#N/A	0.04	3.333333333
694	7283	SE Zone	Z1080-05	Blast Hole Cuttings	7283	#N/A	2.17	#N/A	#N/A	#N/A	#N/A	0.06	4.583333333
695	5092	SE Zone	Z1080-05	Blast Hole Cuttings	5092	#N/A	1.16	#N/A	#N/A	#N/A	#N/A	0.06	4.833333333
696	5203	SE Zone	Z1080-05	Blast Hole Cuttings	5203	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	0.05	4.5
697	5267	SE Zone	Z1080-05	Blast Hole Cuttings	5267	#N/A	0.411	#N/A	#N/A	#N/A	#N/A	0.03	2.083333333
698	5246	SE Zone	Z1080-05	Blast Hole Cuttings	5246	#N/A	0.866	#N/A	#N/A	#N/A	#N/A	0.05	4.5
699	7273	SE Zone	Z1080-05	Blast Hole Cuttings	7273	#N/A	1.96	#N/A	#N/A	#N/A	#N/A	0.13	10.91666667
700	7315	SE Zone	Z1080-05	Blast Hole Cuttings	7315	#N/A	0.362	#N/A	#N/A	#N/A	#N/A	0.03	2.166666667
701	7263	SE Zone	Z1080-05	Blast Hole Cuttings	7263	#N/A	0.445	#N/A	#N/A	#N/A	#N/A	0.07	6.083333333
702	7202	SE Zone	Z1080-05	Blast Hole Cuttings	7202	#N/A	0.168	#N/A	#N/A	#N/A	#N/A	0.03	2.416666667
703	7297	SE Zone	Z1080-05	Blast Hole Cuttings	7297	#N/A	0.77	#N/A	#N/A	#N/A	#N/A	0.14	11.66666667
704	7319	SE Zone	Z1080-05	Blast Hole Cuttings	7319	#N/A	0.422	#N/A	#N/A	#N/A	#N/A	0.38	31.33333333
705	7182	SE Zone	Z1080-05	Blast Hole Cuttings	7182	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.69	57.66666667
706	7001	SE Zone	Z1070-07	Blast Hole Cuttings	7001	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	0.32	26.58333333
707	11019	SE Zone	Z1060-11	Blast Hole Cuttings	11019	#N/A	1.03	#N/A	#N/A	#N/A	#N/A	0.22	17.91666667
708	11024	SE Zone	Z1060-11	Blast Hole Cuttings	11024	#N/A	1.8	#N/A	#N/A	#N/A	#N/A	0.23	19
709	11035	SE Zone	Z1060-11	Blast Hole Cuttings	11035	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	0.14	11.91666667
710	11043	SE Zone	Z1060-11	Blast Hole Cuttings	11043	#N/A	0.624	#N/A	#N/A	#N/A	#N/A	0.11	9
711	11057	SE Zone	Z1060-11	Blast Hole Cuttings	11057	#N/A	2.6	#N/A	#N/A	#N/A	#N/A	0.11	8.833333333
712	11255	SE Zone	Z1060-11	Blast Hole Cuttings	11255	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.22	18.66666667
713	11314	SE Zone	Z1060-11	Blast Hole Cuttings	11314	#N/A	1.98	#N/A	#N/A	#N/A	#N/A	0.12	9.583333333
714	11443	SE Zone	Z1060-11	Blast Hole Cuttings	11443	#N/A	0.226	#N/A	#N/A	#N/A	#N/A	0.27	22.08333333
715	11512	SE Zone	Z1060-11	Blast Hole Cuttings	11512	#N/A	1.9	#N/A	#N/A	#N/A	#N/A	0.09	7.083333333
716	11608	SE Zone	Z1060-11	Blast Hole Cuttings	11608	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.07	5.75
717	11216	SE Zone	Z1060-11	Blast Hole Cuttings	11216	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.02	1.5
718	11222	SE Zone	Z1060-11	Blast Hole Cuttings	11222	#N/A	0.848	#N/A	#N/A	#N/A	#N/A	0.09	7.166666667
719	11211	SE Zone	Z1060-11	Blast Hole Cuttings	11211	#N/A	0.007	#N/A	#N/A	#N/A	#N/A	0.28	23.08333333
720	11325	SE Zone	Z1060-11	Blast Hole Cuttings	11325	#N/A	0.265	#N/A	#N/A	#N/A	#N/A	0.21	17.25
721	11405	SE Zone	Z1060-11	Blast Hole Cuttings	11405	#N/A	0.004	#N/A	#N/A	#N/A	#N/A	0.04	3.25
722	11809	SE Zone	Z1060-11	Blast Hole Cuttings	11809	#N/A	0.103	#N/A	#N/A	#N/A	#N/A	0.64	53
723	P1060-01	Pond Zone	Pond Pit. Holes: 1154, 1017, 1020, 1104, 1043, 1049	Blast Hole Cuttings	P1060-01	#N/A	0.548	#N/A	#N/A	#N/A	#N/A	1.74	145
724	P1070-01	Pond Zone	Pond Pit. Holes: 1149, 1090, 1027, 1032, 1092, 1069	Blast Hole Cuttings	P1070-01	#N/A	0.291	#N/A	#N/A	#N/A	#N/A	0.07	5.666666667
725	P1070-01	Pond Zone	Pond Pit. Holes: 1053, 1056, 1017, 1021, 1024, 1086	Blast Hole Cuttings	P1070-01	#N/A	0.688	#N/A	#N/A	#N/A	#N/A	0.15	12.83333333
726	P1070-01	Pond Zone	Pond Pit. Holes: 1051, 1108, 1111, 1136, 1154, 1147	Blast Hole Cuttings	P1070-01	#N/A	0.224	#N/A	#N/A	#N/A	#N/A	0.17	14.08333333
727	P1070-02	Pond Zone	Pond Pit. Holes: 2006, 2057, 2112, 2052	Blast Hole Cuttings	P1070-02	#N/A	0.024	#N/A	#N/A	#N/A	#N/A	0.01	1.166666667
728	P1080-01	Pond Zone	Pond Pit. Holes: 1270, 1075, 1078, 1241	Blast Hole Cuttings	P1080-01	#N/A	0.127	#N/A	#N/A	#N/A	#N/A	0.11	9.25
729	P1080-01	Pond Zone	Pond Pit. Holes: 1069, 1219, 1061, 1237	Blast Hole Cuttings	P1080-01	#N/A	0.124	#N/A	#N/A	#N/A	#N/A	0.04	3.25
730	1104	Pond Zone	Pond. 1040	Blast Hole Cuttings	1104	#N/A	0.349	#N/A	#N/A	#N/A	#N/A	0.21	17.16666667
731	1062	Pond Zone	Pond. 1040	Blast Hole Cuttings	1062	#N/A	0.043	#N/A	#N/A	#N/A	#N/A	0.02	1.833333333
732	1086	Pond Zone	Pond. 1040	Blast Hole Cuttings	1086	#N/A	0.058	#N/A	#N/A	#N/A	#N/A	0.02	1.583333333
733	1018	Pond Zone	Pond. 1040	Blast Hole Cuttings	1018	#N/A	0.037	#N/A	#N/A	#N/A	#N/A	0.04	3.583333333
734	1032	Pond Zone	Pond. 1040	Blast Hole Cuttings	1032	#N/A	0.066	#N/A	#N/A	#N/A	#N/A	1.45	120.8333333
735	1035	Pond Zone	Pond. 1040	Blast Hole Cuttings	1035	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.41	33.83333333
736	1038	Pond Zone	Pond. 1040	Blast Hole Cuttings	1038	#N/A	0.044	#N/A	#N/A	#N/A	#N/A	0.53	44.08333333
737	1053	Pond Zone	Pond. 1040	Blast Hole Cuttings	1053	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.26	21.75
738	1056	Pond Zone	Pond. 1040	Blast Hole Cuttings	1056	#N/A	0.037	#N/A	#N/A	#N/A	#N/A	0.18	15.25
739	1059	Pond Zone	Pond. 1040	Blast Hole Cuttings	1059	#N/A	0.06	#N/A	#N/A	#N/A	#N/A	0.32	27
740	1077	Pond Zone	Pond. 1040	Blast Hole Cuttings	1077	#N/A	0.345	#N/A	#N/A	#N/A	#N/A	0.26	21.91666667
741	1080	Pond Zone	Pond. 1040	Blast Hole Cuttings	1080	#N/A	0.066	#N/A	#N/A	#N/A	#N/A	0.35	28.83333333
742	1083	Pond Zone	Pond. 1040	Blast Hole Cuttings	1083	#N/A	0.153	#N/A	#N/A	#N/A	#N/A	0.49	40.41666667
743	1101	Pond Zone	Pond. 1040	Blast Hole Cuttings	1101	#N/A	0.03	#N/A	#N/A	#N/A	#N/A	0.24	20.16666667
744	1108	Pond Zone	Pond. 1040	Blast Hole Cuttings	1108	#N/A	0.198	#N/A	#N/A	#N/A	#N/A	0.19	15.66666667
745	1111	Pond Zone	Pond. 1040	Blast Hole Cuttings	1111	#N/A	0.379	#N/A	#N/A	#N/A	#N/A	0.30	25

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C	NP
							%	%			%C	%C	kgCaCO3/t
746	1123	Pond Zone	Pond. 1040	Blast Hole Cuttings	1123	#N/A	0.294	#N/A	#N/A	#N/A	#N/A	0.22	18.5
747	1126	Pond Zone	Pond. 1040	Blast Hole Cuttings	1126	#N/A	0.343	#N/A	#N/A	#N/A	#N/A	0.30	25.25
748	1129	Pond Zone	Pond. 1040	Blast Hole Cuttings	1129	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.36	30.08333333
749	1141	Pond Zone	Pond. 1040	Blast Hole Cuttings	1141	#N/A	0.065	#N/A	#N/A	#N/A	#N/A	0.15	12.66666667
750	1144	Pond Zone	Pond. 1040	Blast Hole Cuttings	1144	#N/A	0.294	#N/A	#N/A	#N/A	#N/A	0.22	18.58333333
751	1158	Pond Zone	Pond. 1040	Blast Hole Cuttings	1158	#N/A	0.467	#N/A	#N/A	#N/A	#N/A	0.26	21.75
752	2002	Pond Zone	Pond. 1040	Blast Hole Cuttings	2002	#N/A	0.682	#N/A	#N/A	#N/A	#N/A	0.19	15.83333333
753	2006	Pond Zone	Pond. 1040	Blast Hole Cuttings	2006	#N/A	1.39	#N/A	#N/A	#N/A	#N/A	0.21	17.08333333
754	2016	Pond Zone	Pond. 1040	Blast Hole Cuttings	2016	#N/A	0.46	#N/A	#N/A	#N/A	#N/A	0.28	23.5
755	2031	Pond Zone	Pond. 1040	Blast Hole Cuttings	2031	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.60	49.91666667
756	2040	Pond Zone	Pond. 1040	Blast Hole Cuttings	2040	#N/A	0.511	#N/A	#N/A	#N/A	#N/A	0.08	6.666666667
757	2042	Pond Zone	Pond. 1040	Blast Hole Cuttings	2042	#N/A	0.87	#N/A	#N/A	#N/A	#N/A	0.26	21.83333333
758	2061	Pond Zone	Pond. 1040	Blast Hole Cuttings	2061	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.89	74.5
759	2104	Pond Zone	Pond. 1040	Blast Hole Cuttings	2104	#N/A	2.39	#N/A	#N/A	#N/A	#N/A	0.36	30
760	2111	Pond Zone	Pond. 1040	Blast Hole Cuttings	2111	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	0.22	18.25
761	2113	Pond Zone	Pond. 1040	Blast Hole Cuttings	2113	#N/A	0.301	#N/A	#N/A	#N/A	#N/A	0.17	13.75
762	2123	Pond Zone	Pond. 1040	Blast Hole Cuttings	2123	#N/A	0.282	#N/A	#N/A	#N/A	#N/A	0.09	7.75
763	2019	Pond Zone	Pond. 1040	Blast Hole Cuttings	2019	#N/A	0.176	#N/A	#N/A	#N/A	#N/A	0.03	2.333333333
764	2045	Pond Zone	Pond. 1040	Blast Hole Cuttings	2045	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.03	2.416666667
765	2073	Pond Zone	Pond. 1040	Blast Hole Cuttings	2073	#N/A	0.084	#N/A	#N/A	#N/A	#N/A	0.01	0.416666667
766	2076	Pond Zone	Pond. 1040	Blast Hole Cuttings	2076	#N/A	0.309	#N/A	#N/A	#N/A	#N/A	0.37	31.16666667
767	5102	Pond Zone	Pond. 1040	Blast Hole Cuttings	5102	#N/A	0.731	#N/A	#N/A	#N/A	#N/A	1.27	105.8333333
768	5105	Pond Zone	Pond. 1040	Blast Hole Cuttings	5105	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	1.03	85.83333333
769	5108	Pond Zone	Pond. 1040	Blast Hole Cuttings	5108	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.54	45
770	5111	Pond Zone	Pond. 1040	Blast Hole Cuttings	5111	#N/A	2.41	#N/A	#N/A	#N/A	#N/A	0.98	81.41666667
771	5114	Pond Zone	Pond. 1040	Blast Hole Cuttings	5114	#N/A	1.88	#N/A	#N/A	#N/A	#N/A	0.11	9.416666667
772	5117	Pond Zone	Pond. 1040	Blast Hole Cuttings	5117	#N/A	0.221	#N/A	#N/A	#N/A	#N/A	0.05	4.166666667
773	5305	Pond Zone	Pond. 1040	Blast Hole Cuttings	5305	#N/A	2.34	#N/A	#N/A	#N/A	#N/A	0.26	21.5
774	5308	Pond Zone	Pond. 1040	Blast Hole Cuttings	5308	#N/A	2.58	#N/A	#N/A	#N/A	#N/A	0.29	24.33333333
775	5311	Pond Zone	Pond. 1040	Blast Hole Cuttings	5311	#N/A	2.48	#N/A	#N/A	#N/A	#N/A	0.08	6.25
776	5314	Pond Zone	Pond. 1040	Blast Hole Cuttings	5314	#N/A	0.797	#N/A	#N/A	#N/A	#N/A	0.11	9.083333333
777	5317	Pond Zone	Pond. 1040	Blast Hole Cuttings	5317	#N/A	0.647	#N/A	#N/A	#N/A	#N/A	0.22	18.16666667
778	1005	Pond Zone	Pond. 1050	Blast Hole Cuttings	1005	#N/A	0.115	#N/A	#N/A	#N/A	#N/A	0.17	14
779	1016	Pond Zone	Pond. 1050	Blast Hole Cuttings	1016	#N/A	0.023	#N/A	#N/A	#N/A	#N/A	0.17	14.08333333
780	1029	Pond Zone	Pond. 1050	Blast Hole Cuttings	1029	#N/A	0.14	#N/A	#N/A	#N/A	#N/A	0.16	13.08333333
781	1032	Pond Zone	Pond. 1050	Blast Hole Cuttings	1032	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.16	13.08333333
782	1035	Pond Zone	Pond. 1050	Blast Hole Cuttings	1035	#N/A	0.316	#N/A	#N/A	#N/A	#N/A	0.58	48
783	1038	Pond Zone	Pond. 1050	Blast Hole Cuttings	1038	#N/A	0.093	#N/A	#N/A	#N/A	#N/A	0.66	54.58333333
784	1057	Pond Zone	Pond. 1050	Blast Hole Cuttings	1057	#N/A	0.039	#N/A	#N/A	#N/A	#N/A	0.16	13
785	1060	Pond Zone	Pond. 1050	Blast Hole Cuttings	1060	#N/A	0.182	#N/A	#N/A	#N/A	#N/A	0.16	13.33333333
786	1063	Pond Zone	Pond. 1050	Blast Hole Cuttings	1063	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.52	43.66666667
787	1066	Pond Zone	Pond. 1050	Blast Hole Cuttings	1066	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.19	16.16666667
788	1069	Pond Zone	Pond. 1050	Blast Hole Cuttings	1069	#N/A	0.264	#N/A	#N/A	#N/A	#N/A	0.17	14.25
789	1073	Pond Zone	Pond. 1050	Blast Hole Cuttings	1073	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.18	14.75
790	1096	Pond Zone	Pond. 1050	Blast Hole Cuttings	1096	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.18	14.75
791	1099	Pond Zone	Pond. 1050	Blast Hole Cuttings	1099	#N/A	0.197	#N/A	#N/A	#N/A	#N/A	0.35	29.33333333
792	1103	Pond Zone	Pond. 1050	Blast Hole Cuttings	1103	#N/A	0.069	#N/A	#N/A	#N/A	#N/A	0.17	14.16666667
793	1106	Pond Zone	Pond. 1050	Blast Hole Cuttings	1106	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	0.16	13.41666667
794	1110	Pond Zone	Pond. 1050	Blast Hole Cuttings	1110	#N/A	2.95	#N/A	#N/A	#N/A	#N/A	0.30	24.83333333
795	1113	Pond Zone	Pond. 1050	Blast Hole Cuttings	1113	#N/A	0.184	#N/A	#N/A	#N/A	#N/A	0.16	13.08333333
796	1134	Pond Zone	Pond. 1050	Blast Hole Cuttings	1134	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.14	11.75
797	1139	Pond Zone	Pond. 1050	Blast Hole Cuttings	1139	#N/A	0.193	#N/A	#N/A	#N/A	#N/A	0.21	17.83333333
798	1142	Pond Zone	Pond. 1050	Blast Hole Cuttings	1142	#N/A	2.96	#N/A	#N/A	#N/A	#N/A	0.35	29.16666667
799	1145	Pond Zone	Pond. 1050	Blast Hole Cuttings	1145	#N/A	0.608	#N/A	#N/A	#N/A	#N/A	0.21	17.83333333
800	1149	Pond Zone	Pond. 1050	Blast Hole Cuttings	1149	#N/A	0.207	#N/A	#N/A	#N/A	#N/A	0.65	54.33333333
801	1152	Pond Zone	Pond. 1050	Blast Hole Cuttings	1152	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.16	13.33333333
802	1502	Pond Zone	Pond. 1050	Blast Hole Cuttings	1502	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.21	17.25
803	2037	Pond Zone	Pond. 1050	Blast Hole Cuttings	2037	#N/A	1.13	#N/A	#N/A	#N/A	#N/A	0.31	25.41666667
804	2040	Pond Zone	Pond. 1050	Blast Hole Cuttings	2040	#N/A	1.27	#N/A	#N/A	#N/A	#N/A	0.12	9.833333333
805	2112	Pond Zone	Pond. 1050	Blast Hole Cuttings	2112	#N/A	3.81	#N/A	#N/A	#N/A	#N/A	1.47	122.5
806	2118	Pond Zone	Pond. 1050	Blast Hole Cuttings	2118	#N/A	2.38	#N/A	#N/A	#N/A	#N/A	1.33	110.8333333
807	2122	Pond Zone	Pond. 1050	Blast Hole Cuttings	2122	#N/A	2.34	#N/A	#N/A	#N/A	#N/A	2.12	176.6666667
808	2115	Pond Zone	Pond. 1050	Blast Hole Cuttings	2115	#N/A	1.9	#N/A	#N/A	#N/A	#N/A	6.33	527.5
809	2125	Pond Zone	Pond. 1050	Blast Hole Cuttings	2125	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.44	37
810	2104	Pond Zone	Pond. 1050	Blast Hole Cuttings	2104	#N/A	0.425	#N/A	#N/A	#N/A	#N/A	6.88	573.3333333
811	2025	Pond Zone	Pond. 1050	Blast Hole Cuttings	2025	#N/A	0.523	#N/A	#N/A	#N/A	#N/A	0.04	3
812	2028	Pond Zone	Pond. 1050	Blast Hole Cuttings	2028	#N/A	0.087	#N/A	#N/A	#N/A	#N/A	0.02	1.916666667
813	2030	Pond Zone	Pond. 1050	Blast Hole Cuttings	2030	#N/A	0.177	#N/A	#N/A	#N/A	#N/A	0.15	12.75
814	2052	Pond Zone	Pond. 1050	Blast Hole Cuttings	2052	#N/A	0.292	#N/A	#N/A	#N/A	#N/A	0.02	1.75
815	2054	Pond Zone	Pond. 1050	Blast Hole Cuttings	2054	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.02	1.75
816	2056	Pond Zone	Pond. 1050	Blast Hole Cuttings	2056	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	1.04	86.66666667
817	2078	Pond Zone	Pond. 1050	Blast Hole Cuttings	2078	#N/A	0.18	#N/A	#N/A	#N/A	#N/A	0.04	3.583333333
818	2081	Pond Zone	Pond. 1050	Blast Hole Cuttings	2081	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.35	29.41666667
819	2094	Pond Zone	Pond. 1050	Blast Hole Cuttings	2094	#N/A	0.072	#N/A	#N/A	#N/A	#N/A	0.51	42.08333333
820	2099	Pond Zone	Pond. 1050	Blast Hole Cuttings	2099	#N/A	0.563	#N/A	#N/A	#N/A	#N/A	0.61	51.16666667
821	2043	Pond Zone	Pond. 1050	Blast Hole Cuttings	2043	#N/A	2.81	#N/A	#N/A	#N/A	#N/A	0.12	10
822	2046	Pond Zone	Pond. 1050	Blast Hole Cuttings	2046	#N/A	1.41	#N/A	#N/A	#N/A	#N/A	0.15	12.83333333
823	2129	Pond Zone	Pond. 1050	Blast Hole Cuttings	2129	#N/A	1.62	#N/A	#N/A	#N/A	#N/A	0.13	11.16666667
824	2134	Pond Zone	Pond. 1050	Blast Hole Cuttings	2134	#N/A	1.57	#N/A	#N/A	#N/A	#N/A	0.68	56.83333333
825	2139	Pond Zone	Pond. 1050	Blast Hole Cuttings	2139	#N/A	2.2	#N/A	#N/A	#N/A	#N/A	0.08	6.833333333
826	2144	Pond Zone	Pond. 1050	Blast Hole Cuttings	2144	#N/A	0.181	#N/A	#N/A	#N/A	#N/A	0.23	19.16666667
827	P3025	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3025	#N/A	0.027	#N/A	#N/A	#N/A	#N/A	0.07	6.083333333
828	P3034	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3034	#N/A	0.016	#N/A	#N/A	#N/A	#N/A	0.04	3.666666667
829	P3043	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3043	#N/A	0.022	#N/A	#N/A	#N/A	#N/A	0.01	1
830	P3052	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3052	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.02	1.583333333
831	P3061	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3061	#N/A	0.255	#N/A	#N/A	#N/A	#N/A	0.01	1.083333333
832	P3070	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3070	#N/A	0.017	#N/A	#N/A	#N/A	#N/A	0.11	8.916666667
833	P3076	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3076	#N/A	0.02	#N/A	#N/A	#N/A	#N/A	0.01	0.416666667
834	P3082	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3082	#N/A	0.073	#N/A	#N/A	#N/A	#N/A	0.01	0.666666667
835	P3088	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3088	#N/A	0.18	#N/A	#N/A	#N/A	#N/A	0.03	2.166666667
836	P3095	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3095	#N/A	0.017	#N/A	#N/A	#N/A	#N/A	0.02	1.583333333
837	P3099	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3099	#N/A	0.308	#N/A	#N/A	#N/A	#N/A	0.01	1
838	P3105	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3105	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.01	1.083333333
839	5134	Pond Zone	Pond. 1050	Blast Hole Cuttings	5134	#N/A	1.56	#N/A	#N/A	#N/A	#N/A	0.87	72.5
840	5146	Pond Zone	Pond. 1050	Blast Hole Cuttings	5146	#N/A	1.48	#N/A	#N/A	#N/A	#N/A	0.26	21.91666667
841	5158	Pond Zone	Pond. 1050	Blast Hole Cuttings	5158	#N/A	1.23	#N/A	#N/A	#N/A	#N/A	0.28	23.25
842	5167	Pond Zone	Pond. 1050	Blast Hole Cuttings	5167	#N/A	1.85	#N/A	#N/A	#N/A	#N/A	0.19	15.58333333
843	5219	Pond Zone	Pond. 1050	Blast Hole Cuttings	5219	#N/A	1.99	#N/A	#N/A	#N/A	#N/A	2.22	185
844	5223	Pond Zone	Pond. 1050	Blast Hole Cuttings	5223	#N/A	2.98	#N/A	#N/A	#N/A	#N/A	0.38	31.5
845	5227	Pond Zone	Pond. 1050	Blast Hole Cuttings	5227	#N/A	2.08	#N/A	#N/A	#N/A	#N/A	0.26	22
846	5233	Pond Zone	Pond. 1050	Blast Hole Cuttings	5233	#N/A	0.401	#N/A	#N/A	#N/A	#N/A	0.18	14.91666667
847	5223	Pond Zone	Pond. 1050	Blast Hole Cuttings	5223	#N/A	2.98	#N/A	#N/A	#N/A	#N/A	0.38	31.5
848	5227	Pond Zone	Pond. 1050	Blast Hole Cuttings	5227	#N/A	2.08	#N/A	#N/A	#N/A	#N/A	0.26	22
849	5233	Pond Zone	Pond. 1050	Blast Hole Cuttings	5233	#N/A	0.401	#N/A	#N/A	#N/A	#N/A	0.18	14.91666667
850	5103	Pond Zone	Pond. 1050	Blast Hole Cuttings	5103	#N/A	0.505	#N/A	#N/A	#N/A	#N/A	0.06	5.083333333
851	5112	Pond Zone	Pond. 1050	Blast Hole Cuttings	5112	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.06	4.833333333
852	5120	Pond Zone	Pond. 1050	Blast Hole Cuttings	5120	#N/A	0.281	#N/A	#N/A	#N/A	#N/A	0.07	5.416666667
853	5208	Pond Zone	Pond. 1050	Blast Hole Cuttings	5208	#N/A	0.304	#N/A	#N/A	#N/A	#N/A	0.06	4.583333333
854	5212	Pond Zone	Pond. 1050	Blast Hole Cuttings	5212	#N/A	0.111	#N/A	#N/A	#N/A	#N/A	0.06	4.75
855	5216	Pond Zone	Pond. 1050	Blast Hole Cuttings	5216	#N/A	0.324	#N/A	#N/A	#N/A	#N/A	1.56	130
856	P1060-1009	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1009	#N/A	0.043	#N/A	#N/A	#N/A	#N/A	0.05	3.916666667
857	P1060-1020	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1020	#N/A	0.34	#N/A	#N/A	#N/A	#N/A	0.03	2.666666667
858	P1060-1034	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1034	#N/A	0.114	#N/A	#N/A	#N/A	#N/A	0.01	1.166666667
859	P1060-1131	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1131	#N/A	0.039	#N/A	#N/A	#N/A	#N/A	0.00	0.083333333
860	P1060-1176	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1176	#N/A	0.058	#N/A	#N/A	#N/A	#N/A	0.16	13.41666667
861	P2010	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2010	#N/A	0.163	#N/A	#N/A	#N/A	#N/A	0.12	10.33333333
862	P2013	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2013	#N/A	0.011	#N/A	#N/A	#N/A	#N/A	0.02	1.416666667
863	P2016	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2016	#N/A	0.011	#N/A	#N/A	#N/A	#N/A	0.03	2.166666667
864	P2019	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2019	#N/A	0.117	#N/A	#N/A	#N/A	#N/A	0.03	2.333333333
865	P2022	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2022	#N/A	0.161	#N/A	#N/A	#N/A	#N/A	0.05	3.833333333
866	P2025	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2025	#N/A	0.58	#N/A	#N/A	#N/A	#N/A	0.28	23.5
867	P2028	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2028	#N/A	0.255	#N/A	#N/A	#N/A	#N/A	0.06	4.833333333
868	P2031	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2031	#N/A	0.136	#N/A	#N/A	#N/A	#N/A	0.05	3.833333333
869	P2034	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2034	#N/A	0.148	#N/A	#N/A	#N/A	#N/A	0.02	1.916666667
870	P2037	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2037	#N/A	0.199	#N/A	#N/A	#N/A	#N/A	0.04	3.166666667
871	P2074	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2074	#N/A	0.012	#N/A	#N/A	#N/A	#N/A	0.05	4.25
872	P2076	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2076	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.06	5.25
873	P2078	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2078	#N/A	0.065	#N/A	#N/A	#N/A	#N/A	0.06	4.75
874	P2080	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2080	#N/A	0.552	#N/A	#N/A	#N/A	#N/A	0.04	3
875	P2082	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2082	#N/A	0.179	#N/A	#N/A	#N/A	#N/A	0.04	3.583333333
876	P2086	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2086	#N/A	0.425	#N/A	#N/A	#N/A	#N/A	0.03	2.666666667
877	3008	Pond Zone	Pond. 1060	Blast Hole Cuttings	3008	#N/A	0.291	#N/A	#N/A	#N/A	#N/A	0.12	10.33333333
878	3017	Pond Zone	Pond. 1060	Blast Hole Cuttings	3017	#N/A	0.659	#N/A	#N/A	#N/A	#N/A	0.64	53.5
879	3026	Pond Zone	Pond. 1060	Blast Hole Cuttings	3026	#N/A	1.44	#N/A	#N/A	#N/A	#N/A	0.50	41.66666667
880	3035	Pond Zone	Pond. 1060	Blast Hole Cuttings	3035	#N/A	1.6	#N/A	#N/A	#N/A	#N/A	0.18	15.25
881	3044	Pond Zone	Pond. 1060	Blast Hole Cuttings	3044	#N/A	0.408	#N/A	#N/A	#N/A	#N/A	0.16	12.91666667
882	3071	Pond Zone	Pond. 1060	Blast Hole Cuttings	3071	#N/A	0.273	#N/A	#N/A	#N/A	#N/A	0.12	9.666666667
883	3075	Pond Zone	Pond. 1060	Blast Hole Cuttings	3075	#N/A	0.14	#N/A	#N/A	#N/A	#N/A	0.57	47.5
884	3078	Pond Zone	Pond. 1060	Blast Hole Cuttings	3078	#N/A	1.19	#N/A	#N/A	#N/A	#N/A	1.86	155
885	3082	Pond Zone	Pond. 1060	Blast Hole Cuttings	3082	#N/A	0.539	#N/A	#N/A	#N/A	#N/A	0.15	12.33333333
886	3087	Pond Zone	Pond. 1060	Blast Hole Cuttings	3087	#N/A	0.834	#N/A	#N/A	#N/A	#N/A	0.19	15.83333333
887	3092	Pond Zone	Pond. 1060	Blast Hole Cuttings	3092	#N/A	0.202	#N/A	#N/A	#N/A	#N/A	0.12	9.75
888	5005	Pond Zone	Pond. 1060	Blast Hole Cuttings	5005	#N/A	0.734	#N/A	#N/A	#N/A	#N/A	0.23	19.33333333
889	5011	Pond Zone	Pond. 1060	Blast Hole Cuttings	5011	#N/A	1.74	#N/A	#N/A	#N/A	#N/A	0.20	16.41666667
890	5020	Pond Zone	Pond. 1060	Blast Hole Cuttings	5020	#N/A	3.45	#N/A	#N/A	#N/A	#N/A	0.34	28.16666667
891	5052	Pond Zone	Pond. 1060	Blast Hole Cuttings	5052	#N/A	0.471	#N/A	#N/A	#N/A	#N/A	0.17	14.33333333
892	5058	Pond Zone	Pond. 1060	Blast Hole Cuttings	5058	#N/A	2.86	#N/A	#N/A	#N/A	#N/A	0.20	17
893	5060	Pond Zone	Pond. 1060	Blast Hole Cuttings	5060	#N/A	1	#N/A	#N/A	#N/A	#N/A	0.19	15.91666667
894	5068	Pond Zone	Pond. 1060	Blast Hole Cuttings	5068	#N/A	0.192	#N/A	#N/A	#N/A	#N/A	0.29	24.41666667
895	5070	Pond Zone	Pond. 1060	Blast Hole Cuttings	5070	#N/A	0.246	#N/A	#N/A	#N/A	#N/A	0.22	18.33333333
896	5078	Pond Zone	Pond. 1060	Blast Hole Cuttings	5078	#N/A	0.96	#N/A	#N/A	#N/A	#N/A	0.25	20.91666667

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
1	SD 1 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	7.4	7.6	#N/A	-0.05
2	SD 1 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	7.4	7.7	#N/A	-0.05
3	SD 2 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	6.8	7.2	#N/A	-0.05
4	SD 2 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	-0.01	-0.01	6.9	7.3	#N/A	-0.05
5	SD 3 - 1	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.25	0.02	7.9	8.1	#N/A	0.86
6	SD 3 - 2	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.13	0.01	7.9	7.9	#N/A	0.52
7	SD 3 - 3	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.23	0.01	8.3	8.1	#N/A	0.50
8	SD 3 - 4	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.53	0.02	8	8	#N/A	1.01
9	SD 3 - 5	Springer Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.58	0.01	7.9	8	#N/A	1.12
10	CPD 1	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.32	-0.01	8.1	8.2	#N/A	0.48
11	CPD 2	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.44	0.02	8	8	#N/A	0.71
12	CPD 3	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.17	0.02	8	8	#N/A	0.85
13	CPD 4	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.41	0.01	8.2	8.2	#N/A	0.54
14	CPD 5	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.78	0.02	8	8.2	#N/A	0.72
15	CPD 6	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.84	0.01	8.1	8	#N/A	0.75
16	CPD 7	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.36	0.01	8.2	8.2	#N/A	0.52
17	CPD 8	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.47	0.01	8.1	8.2	#N/A	0.55
18	CPD 9	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.49	0.01	8.2	8.2	#N/A	0.52
19	CPD 10	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.32	0.01	8.1	8.1	#N/A	0.50
20	CPD 11	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.07	0.02	8	8	#N/A	0.67
21	CPD 12	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	1.15	0.02	7.8	7.9	#N/A	0.85
22	CPD 13	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.6	0.02	8	8.1	#N/A	0.64
23	CPD 14	Cariboo Pit	Cariboo Pit Backfill	Waste Rock	#N/A	#N/A	0.96	0.03	7.9	8	#N/A	1.02
24	HWD 1	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.44	0.02	7.7	7.8	#N/A	0.46
25	HWD 2	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.08	0.02	8.1	8.2	#N/A	0.82
26	HWD 3	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.28	0.03	7.9	7.8	#N/A	0.41
27	HWD 4	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.19	0.02	7.8	8	#N/A	0.38
28	HWD 5	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.13	-0.01	8	8.1	#N/A	0.55
29	HWD 6	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.25	0.01	8	8	#N/A	0.78
30	HWD 7	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.17	0.02	7.9	8	#N/A	1.21
31	63 DP6 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.2	0.01	8.3	0	#N/A	1.31
32	64 DP7 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.01	-0.01	8.5	0	#N/A	0.22
33	65 DP8 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.05	0.01	8.6	0	#N/A	0.71
34	66 DP9 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.23	0.02	8.1	0	#N/A	1.75
35	67 DP10 (-2MM)	Unknown	Cariboo Pit Backfill HW	Waste Rock	#N/A	#N/A	0.12	0.01	8.2	0	#N/A	1.09
36	Jan 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 1-2 mm	LG Breccia	0.26	-0.01	8	#N/A	0.94	#N/A
37	Jan 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jan 2001 Sample - 2-2 mm	0	0.39	-0.01	not/ss	#N/A	0.34	#N/A
38	Feb 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 1-2 mm	LG Breccia	0.35	-0.01	not/ss not/ss	#N/A	0.34	#N/A
39	Feb 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Feb 2001 Sample - 2-2 mm	0	0.29	-0.01	0	#N/A	0.86	#N/A
40	Mar 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 2-2 mm	LG Breccia	0.14	-0.01	7.8	#N/A	-0.09	#N/A
41	May 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 1-2 mm	0	0.33	-0.01	7.9	#N/A	0.77	#N/A
42	Mar 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Mar 2001 Sample - 1-2 mm	0	0.1	-0.01	7.9	#N/A	0.69	#N/A
43	Apr 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 1-2 mm	0	0.28	-0.01	8	#N/A	0.43	#N/A
44	Apr 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Apr 2001 Sample - 2-2 mm	Monzonite	0.08	-0.01	7.9	#N/A	0.17	#N/A
45	May 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	May 2001 Sample - 2-2 mm	0	0.24	-0.01	not/ss	#N/A	0.51	#N/A
46	Jun 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 1-2 mm	Monzonite	0.45	-0.01	not/ss not/ss	#N/A	0.60	#N/A
47	Jun 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Jun 2001 Sample - 2-2 mm	0	0.48	-0.01	0	#N/A	0.51	#N/A
48	July 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 1-2 mm	0	0.28	-0.01	7.9	#N/A	0.94	#N/A
49	July 2001 Sample - 2-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	July 2001 Sample - 2-2 mm	0	0.3	-0.01	not/ss 8.8	#N/A	1.03	#N/A
50	Aug 2001 Sample - 1-2 mm	Cariboo Pit	Cariboo Pit	-2 mm Muck	Aug 2001 Sample - 1-2 mm	Monzonite	0.22	-0.01	8.6	#N/A	0.09	#N/A
51	Aug 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Aug 2001 Sample - 2+2 mm	0	0.28	0.03	0	#N/A	0.69	#N/A
52	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	0	0.2	0.01	8.6	#N/A	0.09	#N/A
53	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	0	0.31	0.01	8.7	#N/A	0.69	#N/A
54	Oct 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 1+2 mm	Monzonite	0.22	-0.01	8.5	#N/A	0.09	#N/A
55	Oct 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Oct 2001 Sample - 2+2 mm	0	0.46	0.01	8.4	#N/A	0.94	#N/A
56	Jan 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jan 2001 Sample - 2+2 mm	LG Breccia	0.13	0.01	9.1	#N/A	0.09	#N/A
57	Feb 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Feb 2001 Sample - 2+2 mm	0	0.16	0.01	9	#N/A	0.17	#N/A
58	Mar 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Mar 2001 Sample - 2+2 mm	LG Breccia	0.07	-0.01	8.8	#N/A	-0.09	#N/A
59	Apr 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Apr 2001 Sample - 2+2 mm	Monzonite	0.04	-0.01	8.9	#N/A	-0.09	#N/A
60	May 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	May 2001 Sample - 2+2 mm	0	0.15	-0.01	8.9	#N/A	-0.09	#N/A
61	Jun 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Jun 2001 Sample - 2+2 mm	Monzonite	0.27	0.01	9	#N/A	0.09	#N/A
62	July 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	July 2001 Sample - 2+2 mm	Monzonite	0.13	-0.01	8.9	#N/A	0.17	#N/A
63	Sep 2001 Sample - 1+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 1+2 mm	0	0.2	0.01	8.6	#N/A	0.09	#N/A
64	Sep 2001 Sample - 2+2 mm	Cariboo Pit	Cariboo Pit	+2 mm Muck	Sep 2001 Sample - 2+2 mm	0	0.31	0.01	8.7	#N/A	0.69	#N/A
65	BD 1 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 1	0	0.23	#N/A	7.4	7.7	#N/A	#N/A
66	BD 1 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 2	0	0.18	#N/A	7.6	7.7	#N/A	#N/A
67	BD 1 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 3	0	0.14	#N/A	7.5	7.6	#N/A	#N/A
68	BD 1 - 4	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 4	0	0.39	#N/A	7.7	7.6	#N/A	#N/A
69	BD 1 - 5	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 5	0	0.46	#N/A	8.1	8.1	#N/A	#N/A
70	BD 1 - 6	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 6	0	0.4	#N/A	8.1	8.2	#N/A	#N/A
71	BD 1 - 7	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 7	0	0.32	#N/A	8.2	8.3	#N/A	#N/A
72	BD 1 - 8	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 8	0	0.45	#N/A	8.1	8.2	#N/A	#N/A
73	BD 1 - 9	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 9	0	0.47	#N/A	8	8.1	#N/A	#N/A
74	BD 1 - 10	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 1 - 10	0	0.44	#N/A	7.9	7.9	#N/A	#N/A
75	BD 2 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 1	0	0.51	#N/A	8.1	8.1	#N/A	#N/A
76	BD 2 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 2 - 2	0	0.41	#N/A	7.8	7.9	#N/A	#N/A
77	BD 3 - 1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 1	0	0.06	#N/A	7.9	8	#N/A	#N/A
78	BD 3 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 3 - 2	0	0.05	#N/A	7.8	8.1	#N/A	#N/A
79	BD 4 -1	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 -1	0	0.07	#N/A	7.8	8	#N/A	#N/A
80	BD 4 - 2	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 2	0	0.08	#N/A	7.6	7.8	#N/A	#N/A
81	BD 4 - 3	Bell Dump	Bell Dump	Waste Rock -2 mm	BD 4 - 3	0	0.03	#N/A	7.8	8	#N/A	#N/A
82	49 1130 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite Volcanic	0.09	-0.01	9.2	9.5	#N/A	0.33
83	50 1130 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.22	0.01	8.9	9.2	#N/A	0.68
84	51 55145	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.43	0.01	8.7	9.1	#N/A	0.63
85	52 55137	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.28	-0.01	8.5	8.8	#N/A	0.44
86	71 55135	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.57	-0.01	8.8	9.1	#N/A	0.33
87	72 55141	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.12	-0.01	8.8	9	#N/A	0.52
88	39 1140 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite Volcanic	0.03	-0.01	9.2	9.5	#N/A	0.27
89	40 1140 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.21	-0.01	8.9	9.2	#N/A	0.49
90	42 54642	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.99	0.01	9	9.3	#N/A	0.35
91	43 55148	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.81	-0.01	8.8	9.2	#N/A	0.35
92	44 55136	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.05	0.01	8.5	8.8	#N/A	0.46
93	45 55685	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.46	0.01	8.8	9.2	#N/A	0.25
94	46 55666	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.16	0.01	8.8	9.2	#N/A	0.33

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
1	SD 1 - 1	15	0.7	8.41	10	2130	1	-2	3.76	-0.5	28	77	1745	0.061	5.74	6	3.34	2.19	1420	-1	2.14	33	1820	4	-5	-1	374	0.31	174	10	84
2	SD 1 - 2	16	0.7	7.89	7	2130	1.1	-2	4.46	-0.5	33	126	1560	0.063	6.42	6	3.4	2.92	1530	1	1.75	51	1850	8	-5	-1	398	0.27	190	10	99
3	SD 2 - 1	12	0.8	8.34	16	2340	1.1	-2	3.54	-0.5	35	102	2570	0.093	7.13	9	3.9	2.62	1225	-1	1.49	39	1710	5	-5	-1	402	0.31	239	10	88
4	SD 2 - 2	14	0.7	7.73	15	1850	1	-2	4.46	-0.5	36	146	1415	0.052	6.77	9	3.06	3.22	1410	1	1.83	59	1450	7	-5	-1	427	0.32	214	10	89
5	SD 3 - 1	100	1	8.33	32	1420	1.1	-2	5.59	-0.5	25	46	1965	0.06	5.53	20	2.71	1.86	916	16	2.26	23	1330	4	-5	3	452	0.34	198	10	67
6	SD 3 - 2	65	1	9.02	34	1710	1.1	-2	4.89	-0.5	26	28	1885	0.07	6.23	13	2.6	1.52	1070	8	2.55	9	1460	6	-5	2	539	0.38	208	10	73
7	SD 3 - 3	67	0.9	8.8	38	1570	1.1	-2	4.61	-0.5	30	43	2090	0.079	6.18	13	2.97	1.81	958	16	2.51	22	1520	-2	-5	3	506	0.35	219	10	66
8	SD 3 - 4	114	1	8.42	29	1410	1.2	-2	6.24	-0.5	29	61	1675	0.035	6.29	13	2.67	1.98	1270	19	2.04	32	1530	3	-5	3	468	0.34	207	10	84
9	SD 3 - 5	114	1.6	8.82	48	1160	1.2	-2	5.7	-0.5	27	19	4760	0.063	6.81	22	3.53	1.36	1000	14	2.07	6	1350	5	-5	5	424	0.3	224	10	75
10	CPD 1	50	1	8.93	21	1520	1.1	2	3.82	-0.5	24	31	2470	0.08	5.9	13	3.56	1.53	705	15	2.65	14	1350	3	-5	5	501	0.36	202	10	64
11	CPD 2	79	1.2	9.06	46	260	1.2	2	4.59	-0.5	36	30	2820	0.057	7	20	3.77	1.42	645	55	2.52	9	1380	-2	-5	6	468	0.33	205	10	61
12	CPD 3	84	1.3	9.37	38	330	1.3	2	4.55	-0.5	33	22	3200	0.046	7.28	22	4.39	1.23	584	41	2.46	6	1370	5	-5	7	499	0.32	196	10	59
13	CPD 4	62	0.9	9.47	21	1630	1.1	2	4.92	-0.5	27	36	1885	0.042	6.41	10	3.64	1.69	897	23	2.77	14	1540	3	-5	3	546	0.36	225	10	78
14	CPD 5	84	1.1	9.23	36	1130	1.2	2	6.07	-0.5	31	23	1975	0.037	7.02	14	3.23	1.67	1045	27	2.39	7	1550	2	-5	4	544	0.39	217	10	85
15	CPD 6	80	1.2	9.23	32	730	1.1	2	5.21	-0.5	31	30	1985	0.043	6.89	15	3.31	1.58	972	30	2.63	11	1480	5	-5	4	528	0.37	217	10	91
16	CPD 7	58	0.9	9.05	31	1640	1	2	4.28	-0.5	24	37	1875	0.046	6.07	11	3.7	1.53	826	16	2.64	16	1460	2	-5	2	525	0.37	214	10	73
17	CPD 8	62	1.1	9.32	43	1690	1.1	2	4.24	-0.5	25	54	2470	0.055	6.26	15	4.24	1.7	803	32	2.71	23	1390	5	6	4	523	0.37	231	10	75
18	CPD 9	64	0.6	8.26	30	1400	1.4	2	3.85	-0.5	21	38	1945	0.057	5.64	14	3.85	1.54	825	38	2.64	21	1280	11	-5	3	465	0.33	207	-10	83
19	CPD 10	59	0.9	8.15	23	1470	1.4	2	3.9	-0.5	22	30	1800	0.067	5.92	15	3.55	1.46	964	16	2.48	14	1260	11	-5	3	514	0.33	196	-10	79
20	CPD 11	77	0.8	8.23	32	1100	1.5	2	4.26	-0.5	26	19	2200	0.049	6.27	19	3.64	1.3	741	35	2.53	6	1190	9	-5	5	470	0.32	185	-10	69
21	CPD 12	90	0.8	8.29	45	830	1.6	2	4.55	-0.5	28	18	2250	0.046	6.43	24	3.59	1.35	757	43	2.51	6	1240	13	-5	7	440	0.32	192	-10	64
22	CPD 13	74	0.9	8.54	23	1380	1.6	2	4.35	1.1	26	19	2160	0.071	6.33	15	3.57	1.5	998	31	2.47	7	1390	11	-5	3	508	0.35	202	-10	105
23	CPD 14	113	0.7	8.35	36	800	1.6	2	5.18	-0.5	23	14	1880	0.033	5.89	19	2.88	1.29	770	32	2.73	6	1190	11	-5	5	398	0.31	194	-10	62
24	HWD 1	61	0.5	7.84	28	1700	1.5	-2	4.03	-0.5	28	31	2390	0.086	6.28	12	3.86	1.56	1095	25	1.84	13	1540	7	-5	4	439	0.31	212	-10	72
25	HWD 2	104	-0.5	8.43	13	1920	1.5	-2	7.86	-0.5	20	12	617	0.014	5.75	10	2.01	2.05	1415	3	1.83	4	1560	13	5	-1	567	0.39	216	-10	96
26	HWD 3	57	0.5	7.88	23	1730	1.5	-2	4.24	-0.5	25	28	1980	0.084	5.84	14	3.12	1.58	1170	13	2.08	13	1610	11	-5	2	434	0.31	190	-10	76
27	HWD 4	52	0.6	8.48	34	1460	1.8	-2	3.2	0.6	28	40	2490	0.138	5.73	13	3.98	1.65	821	27	2.42	22	1360	12	-5	3	400	0.32	218	-10	60
28	HWD 5	67	0.6	8.65	14	1470	1.5	-2	4.7	-0.5	16	44	2040	0.064	4.61	7	3.06	1.57	825	4	2.87	25	1190	11	-5	4	580	0.37	177	-10	65
29	HWD 6	92	-0.5	8.36	11	1440	1.6	-2	5.25	0.7	21	61	1975	0.057	5.27	18	3.41	1.99	937	11	2.49	42	1290	10	-5	3	470	0.33	213	-10	73
30	HWD 7	122	0.7	7.64	28	1300	1.4	-2	5.45	-0.5	13	31	2610	0.039	3.75	10	3.84	1.58	728	3	2.24	18	1040	8	-5	3	373	0.31	246	-10	48
31	63 DP6 (-2MM)	139	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32	64 DP7 (-2MM)	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33	65 DP8 (-2MM)	101	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34	66 DP9 (-2MM)	171	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35	67 DP10 (-2MM)	102	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36	Jan 2001 Sample - 1-2 mm	67	0.2	7.82	16	1360	0.5	-2	6.16	0.5	26	134	3580	0.07	6.07	70	2.73	3.02	845	67	2.17	53	1220	8	1	2.8	492	0.37	355	-10	74
37	Jan 2001 Sample - 2-2 mm	not/ss	0.2	7.65	9	1900	1	-2	4.1	1	21	220	3630	#N/A	6.79	160	2.96	2.08	890	6	2.31	128	1240	24	#N/A	#N/A	831	0.42	314	20	120
38	Feb 2001 Sample - 1-2 mm	not/ss 64	0.6	7.3	11	1360	0.5	-2	3.83	-0.5	19	123	3510	0.023	6.36	90	2.58	1.81	780	5	2.29	63	1290	22	0	0	698	0.38	276	10	96
39	Feb 2001 Sample - 2-2 mm	0	-0.2	7.39	16	1210	0.5	-2	4.68	-0.5	16	102	2870	0	4.79	50	1.44	1.77	605	48	2.58	43	990	8	0	0	574	0.37	247	10	42
40	Mar 2001 Sample - 2-2 mm	16	0.2	7.96	12	1290	1	-2	2.81	-0.5	19	20	5300	0.212	7.57	160	1.9	1.75	665	5	2.96	7	1810	6	0.2	1.6	463	0.35	378	20	40
41	May 2001 Sample - 1-2 mm	60	0.2	8.05	16	1350	1	2	5.13	-0.5	22	86	3480	0.03	5.2	60	2.77	2.53	735	150	2.37	33	1150	10	0.6	3	475	0.36	276	-10	58
42	Mar 2001 Sample - 1-2 mm	53	0.2	7.44	11	1480	0.5	-2	4.51	-0.5	16	20	1475	0.018	4.83	30	2.37	1.67	715	-1	2.04	10	1200	14	0.2	0.8	494	0.33	246	10	58
43	Apr 2001 Sample - 1-2 mm	42	0.4	6.75	10	1060	1	-2	2.84	-0.5	12	30	2240	0.014	4	150	4.01	1.14	550	5	1.87	11	640	14	1.8	2.2	366	0.23	227	10	100
44	Apr 2001 Sample - 2-2 mm	31	0.2	6.54	9	1090	0.5	-2	2.72	-0.5	22	53	4780	0.251	6.67	130	1.52	2.09	1685	-1	1.5	22	1720	8	0.8	1.6	400	0.39	261	10	64
45	May 2001 Sample - 2-2 mm	not/ss	0.2	8.17	11	980	0.5	-2	4.76	-0.5	20	190	2990	not/ss	6.88	140	2.66	1.94	635	54	2.4	99	1260	10	#N/A	#N/A	556	0.36	319	-10	62
46	Jun 2001 Sample - 1-2 mm	not/ss 47	0.4	7.93	13	1200	0.5	-2	4.44	-0.5	23	219	4690	not/ss 0.041	6.72	150	3.69	2.17	715	12	2.24	76	1370	10	#N/A	#N/A	553	0.39	299	-10	66
47	Jun 2001 Sample - 2-2 mm	0	0.6	7.49	27	960	0.5	12	3.82	-0.5	20	121	4610	0	6.76	130	3.4	1.65	625	6	2.12	61	1340	8	0	0	470	0.36	322	-10	60
48	July 2001 Sample - 1-2 mm	73	0.4	7.88	24	1170	1	-2	5.78	-0.5	20	103	2890	0.018	5.29	150	2.36	2.49	740	3	1.69	58	1600	8	0.8	3	557	0.38	245	-10	60
49	July 2001 Sample - 2-2 mm	75	0.6	7.42	27	1260	0.5	-2	5.52	-0.5	21	88	2510	0.018	5.43	140	2.36	2.46	745	4	1.61	47	1640	8	0.2	2.2	499	0.38	247	-10	58
50	Aug 2001 Sample - 1-2 mm	16	-0.5	6.34	5	1140	2	-2	2.9	-0.5	17	54	6830	0.298	7.96	100	4.21	1.48	700	3	2.41	6	980	10	5	7	419	0.33	340	-10	80
51	Aug 2001 Sample - 2+2 mm	96	0.5	6.52	5	2730	2	-2	4.6	-0.5	19	65	3010	0.026	5.75	100	2.84	1.95	785	7	3.04	34	1490	16	15	3	746	0.39	208	-10	76
52	Sep 2001 Sample - 1+2 mm	16	-0.5	6.5	5	1110	2	-2	2.8	-0.5	17	47	6470	0.299	7.78	70	4.29	1.48	690	8	2.43	6	990	8	5	7	401	0.34	336	-10	72
53	Sep 2001 Sample - 2+2 mm	90	0.5	6.83	5	2730	2	-2	4.8	-0.5	19	59	3350	0.028	5.94	100	3	1.97	800	9	3.18	33	1510	12	5	3	746	0.4	214	-10	78
54	Oct 2001 Sample - 1+2 mm	19	0.5	6.38	5	1150	2	-2	3	-0.5	16	26	6580	0.285	7	90	4.26	1.42	680	6	2.53	2	990	10	10	7	422	0.32	307	-10	68
55	Oct 2001 Sample - 2+2 mm	94	-0.5	6.53	15	2120	2	-2	5	-0.5	18	41	5300	0.045	6.26	200	3.11	1.59	755	11	3.14	11	1090	14	5	4	547	0.35	232	-10	82
56	Jan 2001 Sample - 2+2 mm	21	-0.2	8.67	6	1640	0.5	-2	2.86	-0.5	14	47	1160	0.005	4.29	40	3.62	1.44	775	3	3.3	15	1490	4	-0.2	1	632	0.36	175	-10	58
57	Feb 2001 Sample - 2+2 mm	22	0.2	8.49	9	1220	0.5	-2	2.62	-0.5	14	34	1440	0.009	4.35	30	3.1	1.31	440	9	3.54	4	1130	4	-0.2	2	574	0.32	233	-10	30
58	Mar 2001 Sample - 2+2 mm	14	-0.2	8.21	9	1250	1	-2	2.16	-0.5	15	20	2040	0.076	5.17	70	2.98	1.25	415	5	3.42	3	1490	2	-0.2	2	486	0.29	261	-10	26
59	Apr 2001 Sample - 2+2 mm	13	0.4	7.97	6	1080	0.5	-2	2.02	-0.5	15	32	2340	0.162	6.04	50	4.41	1.23	395	2	2.63	7	1080	4	0.2	1	391	0.3	239	-10	40
60	May 2001 Sample - 2+2 mm	20	0.4	8.34	7	860	0.5	-2	2.83	-0.5	19	18	1745	0.026	7.28	70	2.67	1.88	495	2	3.03	5	1250	2	-0.2	1	561	0.38	272	-10	48
61	Jun 2001 Sample - 2+2 mm	28	-0.2	7.99	13	890	0.5	-2	3.08	-0.5	18	21	2300	0.01	6.12	90	3.02	1.63	535	2	3.08	7	1300	2	-0.2	2	582	0.35	253	-10	44
62	July 2001 Sample - 2+2 mm	24	0.2	8.91	13	1190	0.5	-2	3.86	-0.5	16	20	1255	0.006	5.66	50	2.76	1.8	570	1	2.98	7	1280	2	-0.2	1	665	0.38	243	-10	44
63	Sep 2001 Sample - 1+2 mm	16	-0.5	6.5	5	1110	2	-2	2.8	-0.5	17	47	6470	0.299	7.78	70	4.29	1.48	690	8	2.43	6	990	8	5	7	401	0.34	336	-10	72
64	Sep 2001 Sample - 2+2 mm	90	0.5	6.83	5	2730	2	-2	4.8	-0.5	19	59	3350	0.028	5.94	100	3	1.97	800	9	3.18	33	1510	12	5	3	746	0.4	214	-10	78
65	BD 1 - 1	106	1.2	9.38	25	1940	1	-2	6.98	-0.5	24	23	1995	0.047	6.1	10	2.59	1.55	1375	2	2.43	4	1540	6	-5	2	642	0.36	197	10	93
66	BD 1 - 2	95	1	9.36	28	2000	1	-2	7.24	-0.5	23	23	876	0.019	6.18	8	2.24	1.82	1405	6	2.53	6	1700	4	-5	1	647	0.41	216	10	89
67	BD 1 - 3	103	0.9	8.91	18	1770	0.9	-2	7.62	-0.5	26	18	602	0.009	6.48	7	2.12	1.96	1510	3	2.23	5	1650	8	-5	1	594	0.38	230	10	96
68	BD 1 - 4	100	0.8	9.06	22	1580	1.1	-2	5.21	-0.5	23	28	2480	0.033	6.12	12	3.66	1.37	738	26	2.69	9	1350	4	-5	4	524	0.34	206	10	58
69	BD 1 - 5	119	1.1	8.58	28	1570	1.1	-2	6.07	-0.5	24	27	2190	0.034	6.12	17	3.41	1.73	773	32	2.31	11	1460	-2	-5	2	544	0.35	233	10	52
70	BD 1 - 6	110	1	8.68	26	1560	1.1	-2	6.26	-0.5	26	31	2300	0.046	6.05	14	3.56	1.78	823	23	2.27	10	1440	9	-5	4	532	0.32	234	10	58
71	BD 1 - 7	72	1	9.59	26	1580	1.1	-2	4.76	-0.5	24	26	2500	0.068	6.05	10	3.59	1.44	753	17	2.94	8	1380	4	6	2	560	0.37	206	10	63
72	BD 1 - 8	72	1.1	9.33	21	1570	1.1	-2	4.39	-0.5	26	35	2770	0.054	6.26	11	3.8	1.44	679	30	2.78	9	1470	6	-5	3	527	0.37	215	10	59
73	BD 1 - 9	60	1.2	9.51	23	1570	1.2	-2	3.7	-0.5	30	26	3140	0.087	6.57	14	3.97	1.32	684	28	2.81	9	1380	3	-5	5	529	0.33	215	10	56
74	BD 1 - 10	66	1.1	9.39	21	1390	1.3	-2	3.73	-0.5	33	24	2740	0.099	6.68	14	3.73	1.37	776	39	2.74	7	1380	6	-5	5	458	0.32	217	10	54
75	BD 2 - 1	107	1.2	8.93	24	1330	1.2	-2	5.37	-0.5	27	19	2900	0.075	5.89	12	3.16	1.37	631	25	2.47	7	1330	7	-5	5	477	0.32	198	10	50
76	BD 2 - 2	135	0.8	8.72	12	1540	1.1	-2	6.1	-0.5	24	19	2580	0.036	5.74	9	3	1.19	596	19	2.17	4	1290	-2	-5	3	406	0.31	191	10	45
77	BD 3 - 1	31	0.8	9.93	33	2190	1	-2	6.84	-0.5	27	18	428	0.014	6.47	10	1.95	1.79	1605	1	2.47	7	1870	5	-5	-1	579	0.37	222	10	118
78	BD 3 - 2	28	1	9.62	31	2490	1	-2	6.59	-0.5	26	23	488	0.019	6.37	13	2.01	1.74	1595	-1	2.34	5	1850	7	-5	-1	599	0.38	211	10	115
79	BD 4 -1	46	0.9	8.58	19	2040	1	-2	5.9	-0.5	26	58	776	0.025	5.9	13	2.14	2.25	1210	1	2.14	46	1610	7	-5	1	667	0.39	211	10	78
80	BD 4 - 2	35	0.8	9.29	15	2130	0.9	-2	5.73	-0.5	28	43	827	0.018	6.33	11	2.39	1.99	1305	1	2.39	24	1710	4	-5	-1	632	0.4	224	10	87
81	BD 4 - 3	73	0.7	9.58	14	2620	1	-2	6.9	-0.5	27	21	458	0.013	6.28	7	2.2	1.79	1445	1	2.55	10	1750	4	-5	-1	616	0.41	229	10	82
82	49 1130 A	41	-0.5	5.65	25	1810	1.5	-2	5	-0.5	23	16	902	#N/A	6.03	40	2.62	1.67	1380	5	2.73	-1	1600	12	5	-1	679	0.45	249	-10	90
83	50 1130 B	53	-0.5	6.17	50	1490	2.5	-2	2.6	-0.5	19	44	1770	#N/A	5.69	160	4.01	1.17	490	11	2.91	8	1160	12	10	1	501	0.32	192	-10	50
84	51 55145	47	-0.5	6.88	15	1280	1.5	-2	2.3	-0.5	10	32	228	#N/A	3.6	50	2.64	0.83	515	8	4.09	1	850	14	5	-1	506	0.29	125	-10	38
85	52 55137	47	-0.5	6.99	25	330	1	-2	1.7	-0.5	8	17	934	#N/A	3.57	110	4.34	0.62	265	8	3.52	1	740	8	-5	2	539	0.29	124	-10	24
86	71 55135	37	-0.5	6.86	10	1400	1	4	1.85	-0.5	6	31	746	#N/A	3.12	70	4.84	0.68	390	6	3.23	-1	720	6	5	1	508	0.27	120	-10	30
87	72 55141	48	-0.5	5.91	45	500	1.5	-2	2.3	-0.5	16	21	2160	#N/A	5.8	110	3.51	0.95	440	8	3.54	2	1180	10	-5	3	529	0.31	198	-10	36
88	39 1140 A	36	-0.5	5.66	20	1930	2	-2	5.4	-0.5	24	16	240	#N/A	5.87	20	2.42	1.71	1420	6	2.55	-1	1630	8	5	-1	728	0.45	249	-10	94
89	40 1140 B	48	-0.5	5.79	20	1440	2	-2	3	-0.5	20	46	1185	#N/A	5.17	90	3.64	1.26	680	16	2.47	8	1210	16	5	1	500	0.33	204	-10	58
90	42 54642	43	-0.5	6.39	20	1010	2	-2	2	-0.5	18	26	1860	#N/A	7.34	40	2.41	1.04	500	9	3.8	2	1090	16	-5	2	432	0.28	234	-10	34
91	43 55148	42	-0.5	6.78	15	960	2	8	1.85	-0.5	12	36	1835	#N/A	4	50	4.94	0.74	345	17	3.01	-1	1040	12	5	3	520	0.28	205	-10	34
92	44 55136	43	-0.5	6.59	20	440	1.5	-2	1.7	-0.5	11	25	1210	#N/A	3.34	110	5.13	0.6	270	16	2.59	-1	920	14	-5	2	459	0.28	173	-10	32
93	45 55685	29	-0.5	7.89	5	290	1	-2	1.7	-0.5	11	42	151	#N/A	3.34	130	2.05	0.83	305	6	4.54	-1	750	14	-5	3	576	0.27	105	-10	30
94	46 55666	38	0.5	6.35	10	600	1.5	4	1.85	-0.5	12	23	1240	#N/A	3.64	190	5.68	0.65	440	6	2.71	1	750	12	5	2	414	0.28	150	-10	34

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
95	47 55670	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.13	0.01	8.9	9.4	#N/A	0.22
96	48 55681	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1	-0.01	8.8	9	#N/A	0.68
97	26 1150 A	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.03	0.01	9	9.4	#N/A	0.52
98	27 1150 B	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.36	0.01	9	9.4	#N/A	0.30
99	28 1150 C	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.18	0.03	9	9.4	#N/A	0.27
100	29 62673	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.06	0.04	9.2	9.5	#N/A	0.27
101	30 62690	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.14	0.03	9	9.4	#N/A	0.30
102	31 77864	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.88	0.03	8.9	9.2	#N/A	0.27
103	32 77880	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.65	0.02	8.7	9	#N/A	0.68
104	33 77889	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.5	0.03	8.7	9.1	#N/A	0.25
105	34 63774	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.53	0.01	9.3	9.6	#N/A	0.22
106	35 63781	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.29	0.02	8.7	9	#N/A	0.44
107	36 63755	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.87	0.02	9.1	9.4	#N/A	0.14
108	37 63995	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.04	0.02	9.2	9.6	#N/A	0.33
109	38 54609	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.49	-0.01	9.1	9.4	#N/A	0.27
110	COMP#1	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.5	8.1	#N/A	0.44
111	COMP#3	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.13	-0.01	8.5	8.1	#N/A	0.22
112	COMP#2	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.15	-0.01	8.9	8.6	#N/A	0.22
113	COMP#4	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.74	-0.01	8.4	7.8	#N/A	0.33
114	COMP#5	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.97	-0.01	8.5	7.8	#N/A	0.22
115	COMP#8	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.92	-0.01	8.7	8.1	#N/A	0.33
116	COMP#10	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.11	-0.01	8.7	8	#N/A	0.22
117	COMP#11	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.93	-0.01	8.6	8	#N/A	0.27
118	COMP#19	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.7	-0.01	9	8.1	#N/A	0.22
119	77766	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.7	-0.01	8.7	8	#N/A	0.27
120	77807	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.6	0.03	9	7.9	#N/A	0.11
121	77718	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.5	0.03	8.7	7.7	#N/A	0.11
122	77761	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.61	0.01	9.1	7.8	#N/A	0.11
123	77762	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.75	0.01	8.7	8	#N/A	0.27
124	77765	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.44	-0.01	9.2	8.2	#N/A	0.05
125	77767	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.23	0.03	8.7	7.9	#N/A	0.16
126	77769	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1	0.03	8.9	8	#N/A	0.22
127	77770	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.99	0.02	8.3	7.7	#N/A	0.55
128	77774	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.07	0.02	8.8	8.1	#N/A	0.05
129	77806	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.89	0.03	8.9	8	#N/A	0.16
130	COMP#1	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.5	8.1	#N/A	0.44
131	COMP#2	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.15	-0.01	8.9	8.6	#N/A	0.22
132	COMP#3	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.13	-0.01	8.5	8.1	#N/A	0.22
133	COMP#4	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.74	-0.01	8.4	7.8	#N/A	0.33
134	COMP#5	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.97	-0.01	8.5	7.8	#N/A	0.22
135	20-57438	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.42	0.02	8.1	7.7	#N/A	0.05
136	22-57431	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.46	0.02	8.7	8.1	#N/A	0.49
137	23-57440	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.37	0.01	8.4	7.6	#N/A	-0.05
138	24-57003	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.88	0.01	8.8	8.4	#N/A	0.11
139	25-57010	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.18	0.01	8.5	7.8	#N/A	0.11
140	26-57441	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.24	0.01	8.5	7.7	#N/A	0.11
141	27-57446	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.38	-0.01	8	7.3	#N/A	-0.05
142	28-57448	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.2	-0.01	8.4	8.1	#N/A	0.11
143	30-57053	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.42	0.02	8.2	8.1	#N/A	0.49
144	31-57033	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.89	-0.01	8.9	8.5	#N/A	0.33
145	32-57035	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.48	0.01	8.1	7.8	#N/A	-0.05
146	33-57067	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.28	0.01	8.9	8.1	#N/A	0.11
147	34-57096	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.64	0.01	8.7	8	#N/A	0.16
148	35-57101	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.33	0.01	9	8.2	#N/A	0.76
149	36-57103	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.71	0.02	8.6	8	#N/A	0.27
150	37-57107	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	1.15	0.02	8.4	7.8	#N/A	-0.05
151	39-57688	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.1	-0.01	8.2	7.7	#N/A	0.11
152	40-57694	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.41	-0.01	8.8	8.5	#N/A	0.27
153	COMP#41	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.21	-0.01	8.9	8.7	#N/A	0.44
154	COMP#65	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.07	-0.01	8.9	8.9	#N/A	0.27
155	COMP#44	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.27	-0.01	9.3	8.9	#N/A	0.22
156	COMP#45	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	East Breccia waste	0.21	-0.01	8.9	8.5	#N/A	0.11
157	COMP#53	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	Volcanic	0.2	-0.01	8.9	8.8	#N/A	0.38
158	COMP#66	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.07	-0.01	8.9	8.7	#N/A	0.33
159	COMP#68	Bell Pit	Bell Pit	Blast Hole Cuttings	#N/A	West Wall Diorite	0.17	-0.01	9.3	8.9	#N/A	0.22
160	Feb 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.11	-0.01	8.1	8	#N/A	0.60
161	Mar 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.1	0.01	8.2	8	#N/A	0.87
162	Apr 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.05	-0.01	7.7	7.1	#N/A	-0.05
163	May 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite	0.04	-0.01	8.1	8.1	#N/A	0.55
164	Jun 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	East Breccia waste	1.32	0.02	7.6	not/ss	#N/A	0.44
165	Jun 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	East Breccia waste	1.41	0.05	6.7	not/ss	#N/A	-0.05
166	Jul 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic West Wall Diorite	0.93	-0.01	7.8	7.9	#N/A	0.71
167	Jul 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	0.07	-0.01	8	8	#N/A	1.04
168	Aug 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic West Wall Diorite East Breccia waste	0.86	0.02	8	0	#N/A	1.15
169	Aug 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	0.44	0.01	8.2	0	#N/A	0.55
170	Aug 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.45	0.02	8	0	#N/A	0.55
171	Sep 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.82	0.02	8	0	#N/A	1.15
172	Sep 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.57	0.02	8.1	0	#N/A	0.60
173	Sep 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.99	0.03	8.6	0	#N/A	0.55
174	Oct 2001 Sample 1-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	Volcanic	0.88	0.03	8.1	0	#N/A	1.20
175	Oct 2001 Sample 2-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.45	0.01	8.1	0	#N/A	0.60
176	Oct 2001 Sample 3-2 mm	Bell Pit	Bell Pit	-2 mm Muck	#N/A	0	1.64	0.02	8.1	0	#N/A	1.15
177	Mar 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.08	-0.01	8.7	8	#N/A	0.22
178	May 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	West Wall Diorite	0.03	-0.01	8.6	8.1	#N/A	0.16
179	Jun 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	East Breccia waste	0.92	0.02	8.7	not/ss	#N/A	0.11
180	Jun 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	East Breccia waste	1.5	0.03	8.2	8.1	#N/A	0.05
181	Sep 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.65	-0.01	8.3	0	#N/A	0.79
182	Sep 2001 Sample 2+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	West Wall Diorite East Breccia waste	0.74	0.01	8.7	0	#N/A	0.46
183	Sep 2001 Sample 3+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	0	1.28	0.03	8.7	0	#N/A	0.27
184	Oct 2001 Sample 1+2 mm	Bell Pit	Bell Pit	+2 mm Muck	#N/A	Volcanic	0.69	-0.01	8.4	0	#N/A	0.71
185	102 - 10 - 100	Springer Pit	Springer Pit	DD Core	102 - 10 - 100	#N/A	0.04	0.04	8.8	#N/A	#N/A	#N/A
186	102 - 100 - 200	Springer Pit	Springer Pit	DD Core	102 - 100 - 200	#N/A	0.05	0.03	8.8	#N/A	#N/A	#N/A
187	102 - 200 - 300	Springer Pit	Springer Pit	DD Core	102 - 200 - 300	#N/A	0.05	0.04	8.8	#N/A	#N/A	#N/A
188	102 - 300 - 400	Springer Pit	Springer Pit	DD Core	102 - 300 - 400	#N/A	0.13	0.03	8.8	#N/A	#N/A	#N/A
189	102 - 400 - 500	Springer Pit	Springer Pit	DD Core	102 - 400 - 500	#N/A	0.21	0.05	9	#N/A	#N/A	#N/A
190	102 - 500 - 600	Springer Pit	Springer Pit	DD Core	102 - 500 - 600	#N/A	0.16	0.04	8.9	#N/A	#N/A	#N/A
191	103 - 10 - 100	Springer Pit	Springer Pit	DD Core	103 - 10 - 100	#N/A	0.01	0.01	8.9	#N/A	#N/A	#N/A
192	103 - 100 - 200	Springer Pit	Springer Pit	DD Core	103 - 100 - 200	#N/A	0	0	8.9	#N/A	#N/A	#N/A
193	103 - 200 - 300	Springer Pit	Springer Pit	DD Core	103 - 200 - 300	#N/A	0	0	8.9	#N/A	#N/A	#N/A
194	103 - 300 - 400	Springer Pit	Springer Pit	DD Core	103 - 300 - 400	#N/A	0.05	0.03	8.8	#N/A	#N/A	#N/A
195	103 - 400 - 500	Springer Pit	Springer Pit	DD Core	103 - 400 - 500	#N/A	0.04	0.04	9	#N/A	#N/A	#N/A

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
95	47 55670	28	-0.5	7.72	5	510	1.5	-2	1.65	-0.5	12	57	284	#N/A	3.5	80	2.39	0.84	470	13	4.71	-1	810	12	-5	1	509	0.29	125	-10	54
96	48 55681	70	0.5	5.31	145	710	1	-2	2.5	-0.5	15	17	1860	#N/A	2.88	390	6.13	0.53	410	50	1.5	1	980	10	5	2	251	0.25	243	-10	54
97	26 1150 A	52	-0.5	5.69	15	1940	1.5	-2	5.4	-0.5	24	15	211	#N/A	5.93	20	2.28	1.79	1465	4	2.57	-1	1680	8	-5	-1	710	0.45	254	-10	96
98	27 1150 B	46	0.5	5.32	25	1260	1.5	-2	2.4	-0.5	19	50	1890	#N/A	5.11	60	3.55	1.16	505	20	2.43	11	1100	14	-5	2	444	0.29	188	-10	50
99	28 1150 C	33	-0.5	6.73	15	530	1.5	-2	2	-0.5	16	30	1350	#N/A	4.84	80	3.96	0.71	430	45	3.26	-1	870	10	5	2	577	0.31	135	-10	46
100	29 62673	36	-0.5	6.61	30	650	1.5	-2	1.65	-0.5	16	52	1870	#N/A	5.63	80	2.71	0.98	415	30	3.99	4	1070	8	-5	2	429	0.3	172	-10	40
101	30 62690	39	-0.5	7.09	10	590	1.5	-2	1.9	-0.5	13	38	606	#N/A	4.88	50	2.67	1.11	530	9	4.36	3	920	10	-5	2	510	0.31	147	-10	42
102	31 77864	31	-0.5	7.75	15	1090	1.5	-2	2.1	-0.5	14	41	323	#N/A	4.17	120	2.58	1.11	585	13	4.36	4	930	8	-5	1	504	0.32	139	-10	44
103	32 77880	68	-0.5	6.41	20	990	1.5	-2	3.1	-0.5	17	24	1640	#N/A	4.93	110	3.28	0.77	540	90	3.95	3	1010	14	5	2	378	0.3	191	-10	56
104	33 77889	35	-0.5	7.21	5	280	1	-2	1.65	-0.5	10	45	241	#N/A	3.15	110	2.36	0.86	490	48	4.29	3	780	16	5	2	464	0.27	111	-10	64
105	34 63774	25	-0.5	7.28	5	890	1.5	-2	1.65	-0.5	11	32	896	#N/A	3.66	130	3.48	0.9	535	24	4.1	4	750	16	5	1	430	0.28	160	-10	46
106	35 63781	49	-0.5	6.31	20	400	1.5	6	2.4	-0.5	17	46	1955	#N/A	4.15	140	5.85	0.69	410	17	2.57	1	850	10	-5	2	528	0.32	145	-10	36
107	36 63755	20	0.5	7.81	15	1230	2	-2	2	-0.5	18	40	1535	#N/A	3.36	70	7.08	0.95	575	22	2.17	4	980	10	-5	1	546	0.3	162	-10	48
108	37 63995	40	-0.5	5.94	40	830	1.5	-2	3	-0.5	19	85	614	#N/A	3.86	60	5.97	1.04	860	11	2.19	14	940	8	-5	1	239	0.24	238	-10	36
109	38 54609	39	0.5	5.71	5	1440	1.5	-2	2.5	-0.5	12	16	1050	#N/A	4.04	80	5.73	0.95	745	21	2.07	-1	940	12	5	1	420	0.31	204	-10	54
110	COMP#1	47	0.4	8.26	15	1460	0.5	-2	2.96	-0.5	19	59	1185	#N/A	5.1	80	3.71	1.36	490	10	2.7	5	1310	-2	1	0.2	597	0.34	210	-10	42
111	COMP#3	39	0.2	8.39	12	1810	0.5	-2	4.68	-0.5	22	13	340	#N/A	5.29	30	2.67	1.76	1160	5	2.42	1	1580	-2	0.2	-0.2	671	0.38	218	-10	76
112	COMP#2	33	0.2	7.9	14	1550	0.5	-2	4.48	-0.5	24	46	1130	#N/A	5.7	30	3.11	1.99	1040	1	2.26	10	1470	-2	0.4	1	699	0.32	234	-10	64
113	COMP#4	39	-0.2	8.18	23	660	0.5	-2	2.09	-0.5	16	35	602	#N/A	3.99	60	3.11	0.94	415	9	3.11	3	910	-2	-0.2	1.4	448	0.26	143	-10	30
114	COMP#5	34	0.4	7.99	13	830	0.5	-2	2.13	-0.5	17	30	1085	#N/A	4.16	90	4.09	1.04	505	12	2.82	5	1100	-2	0.2	2.4	430	0.26	182	-10	36
115	COMP#8	45	0.2	8.21	9	540	0.5	-2	2.2	-0.5	16	35	1455	#N/A	4.92	180	3.34	1.18	540	27	3.28	3	1260	2	-0.2	2	401	0.28	196	-10	52
116	COMP#10	33	-0.2	7.65	17	360	0.5	-2	1.52	-0.5	13	40	654	#N/A	2.57	80	4.67	0.63	395	27	1.44	1	930	-2	0.2	2.6	231	0.22	234	-10	30
117	COMP#11	38	0.4	7.66	27	1480	0.5	-2	2.09	-0.5	17	46	2000	#N/A	3.11	120	2.96	1.21	475	481	1.41	7	880	2	0.2	3.2	201	0.22	214	-10	50
118	COMP#19	31	0.2	8.12	13	1000	0.5	-2	2.36	-0.5	16	69	1565	#N/A	4.25	70	3.28	1.35	565	14	3.24	13	1050	-2	0.2	2.2	442	0.28	184	-10	36
119	77766	33	-0.2	8.65	9	620	0.5	-2	2.98	-0.5	12	28	948	#N/A	2.7	90	4.32	1.29	670	27	2.23	1	1200	6	0.2	1.8	409	0.33	256	-10	38
120	77807	26	-0.2	10.15	6	1440	0.5	-2	1.89	-0.5	12	38	256	#N/A	3.63	40	2.43	1.17	410	18	4.75	3	940	2	-0.2	1.8	450	0.32	131	-10	30
121	77718	27	-0.2	9.18	6	150	0.5	-2	1.68	-0.5	10	62	129	#N/A	3.31	130	1.81	0.95	390	3	4.29	1	760	6	0.6	0.6	519	0.25	110	-10	40
122	77761	23	-0.2	9.22	7	880	0.5	-2	1.98	-0.5	13	41	207	#N/A	3.5	80	2.37	1.21	585	4	4.75	8	920	6	0.8	1	481	0.3	136	-10	38
123	77762	37	0.2	8.78	16	760	0.5	-2	2.64	-0.5	19	54	970	#N/A	3.76	90	3.06	1.39	595	7	3.84	12	1070	2	0.8	1.6	488	0.29	167	-10	32
124	77765	24	-0.2	8.94	22	1350	0.5	-2	3.22	-0.5	19	95	215	#N/A	4.21	20	2.61	2.08	750	4	3.82	23	1070	-2	0.6	1.2	554	0.3	167	-10	40
125	77767	25	0.8	9.09	15	190	0.5	-2	1.72	-0.5	25	34	3830	#N/A	5.06	280	4.5	1.05	510	19	3.12	4	1260	4	1.4	4.4	468	0.3	236	-10	52
126	77769	32	0.2	8.65	4	1630	0.5	-2	1.96	-0.5	15	33	988	#N/A	3.14	120	7.53	0.81	495	122	1.67	1	990	6	2	2.2	213	0.26	268	-10	46
127	77770	55	-0.2	9.44	27	190	0.5	-2	2.57	-0.5	19	19	891	#N/A	5.58	170	3.94	1.05	455	11	2.94	1	1490	2	0.8	1	610	0.37	252	-10	34
128	77774	23	0.2	9.03	18	270	0.5	-2	2.38	-0.5	16	29	1230	#N/A	3.66	70	4.49	0.99	460	23	2.68	1	1060	2	1.2	3.8	568	0.31	157	-10	30
129	77806	29	0.2	8.6	18	280	0.5	-2	2.69	-0.5	16	64	219	#N/A	3.58	80	2.55	1.46	625	21	3.84	12	930	4	0.6	0.6	596	0.28	139	-10	34
130	COMP#1	47	0.4	8.26	15	1460	0.5	-2	2.96	-0.5	19	59	1185	#N/A	5.1	80	3.71	1.36	490	10	2.7	5	1310	-2	1	0.2	597	0.34	210	-10	42
131	COMP#2	33	0.2	7.9	14	1550	0.5	-2	4.48	-0.5	24	46	1130	#N/A	5.7	30	3.11	1.99	1040	1	2.26	10	1470	-2	0.4	1	699	0.32	234	-10	64
132	COMP#3	39	0.2	8.39	12	1810	0.5	-2	4.68	-0.5	22	13	340	#N/A	5.29	30	2.67	1.76	1160	5	2.42	1	1580	-2	0.2	-0.2	671	0.38	218	-10	76
133	COMP#4	39	-0.2	8.18	23	660	0.5	-2	2.09	-0.5	16	35	602	#N/A	3.99	60	3.11	0.94	415	9	3.11	3	910	-2	-0.2	1.4	448	0.26	143	-10	30
134	COMP#5	34	0.4	7.99	13	830	0.5	-2	2.13	-0.5	17	30	1085	#N/A	4.16	90	4.09	1.04	505	12	2.82	5	1100	-2	0.2	2.4	430	0.26	182	-10	36
135	20-57438	8	-0.2	7.24	12	850	0.5	2	2.7	-0.5	21	31	1505	#N/A	6.84	130	6.09	0.75	1175	28	1.48	-1	1230	10	1.2	2.6	151	0.22	364	10	42
136	22-57431	36	-0.2	7.52	9	1020	0.5	2	2.71	-0.5	15	64	1425	#N/A	5.13	120	6.73	0.75	695	22	1.29	1	940	10	0.8	1.8	169	0.22	272	10	46
137	23-57440	11	-0.2	8.24	7	1090	1	2	0.88	-0.5	9	53	1085	#N/A	4.34	80	5.14	0.97	370	18	2.41	-1	1110	14	0.6	0.8	395	0.26	262	10	40
138	24-57003	23	-0.2	8.12	20	270	0.5	2	3.93	-0.5	31	54	1255	#N/A	5.96	90	3.61	2.23	1075	10	1.98	14	1680	12	0.8	2	521	0.33	273	20	82
139	25-57010	10	-0.2	9.35	17	1270	0.5	2	2.15	0.5	8	34	2410	#N/A	4.12	40	3.73	0.93	485	9	3.08	1	1120	8	0.6	1.8	602	0.33	148	-10	44
140	26-57441	12	0.2	8.67	10	1950	0.5	2	1.3	-0.5	25	28	1475	#N/A	4.19	80	6.02	0.89	720	12	1.86	2	1480	10	0.6	1.2	403	0.23	282	-10	52
141	27-57446	15	0.2	9	26	1680	1	2	1.99	-0.5	20	28	1500	#N/A	5.84	90	3.98	1.13	695	13	2.88	3	1390	10	0.6	1.8	595	0.29	264	-10	52
142	28-57448	20	-0.2	7.87	20	1980	0.5	2	4.77	-0.5	35	49	1045	#N/A	6.06	60	3.87	2.2	1120	11	1.32	17	1580	10	0.8	0.6	541	0.3	261	-10	80
143	30-57053	62	-0.2	8.64	6	1480	1	2	2.68	-0.5	23	17	1335	#N/A	6.12	170	3.85	1.48	475	13	2.05	4	1550	10	0.6	1.2	411	0.3	251	-10	40
144	31-57033	38	-0.2	8.77	21	480	0.5	2	2.31	-0.5	17	43	1330	#N/A	4.36	80	4.07	1.25	390	21	2.87	6	1130	8	0.6	2	572	0.3	156	-10	40
145	32-57035	18	0.2	8.52	16	1110	1	2	2.23	-0.5	23	17	2340	#N/A	7.21	230	3.19	1.33	650	17	2.76	6	2270	10	0.4	1.8	433	0.29	271	-10	44
146	33-57067	16	0.2	8.92	7	1520	0.5	2	1.16	-0.5	13	36	1135	#N/A	3.44	70	6.31	0.96	350	10	2.19	3	1010	10	0.6	1.6	456	0.28	211	-10	40
147	34-57096	19	0.2	9.44	13	520	1	2	1.44	-0.5	14	30	2580	#N/A	5.75	40	2.63	1.15	310	6	3.82	2	1230	8	0.6	2	455	0.29	182	-10	38
148	35-57101	36	-0.2	9.04	19	1650	0.5	2	2.52	-0.5	16	46	1605	#N/A	3.97	60	4.29	1.03	560	9	2.79	5	1170	8	0.6	1.2	584	0.29	176	-10	46
149	36-57103	35	0.6	8.48	15	960	0.5	2	2.77	-0.5	22	37	2250	#N/A	5.81	70	2.98	1.34	580	17	2.81	3	1310	6	0.6	2.6	602	0.34	194	-10	52
150	37-57107	11	-0.2	8.84	10	240	0.5	2	1.19	-0.5	20	34	973	#N/A	3.36	40	2.15	0.92	265	6	4.03	1	740	8	0.6	1.6	580	0.23	110	-10	38
151	39-57688	27	0.2	8.96	20	1730	0.5	2	3.78	-0.5	24	46	1495	#N/A	5.89	100	4.34	2.05	790	31	2.04	13	1420	12	0.8	2	600	0.34	241	-10	64
152	40-57694	37	-0.2	8.44	15	1520	0.5	2	3.62	-0.5	21	37	2170	#N/A	5.32	50	3.62	1.84	685	7	2.35	10	1340	8	0.4	2.2	709	0.32	241	-10	60
153	COMP#41	50	-0.2	8.65	16	1450	0.5	2	3.85	-0.5	18	33	1310	#N/A	4.61	70	3.42	1.64	615	10	2.62	9	1320	10	0.8	1.4	656	0.34	211	-10	62
154	COMP#65	38	-0.2	8.35	10	1920	0.5	2	5.07	-0.5	22	11	178	#N/A	5.02	30	2.21	1.87	1225	3	2.32	3	1710	8	0.8	0.2	695	0.37	227	-10	96
155	COMP#44	34	-0.2	9.16	10	1790	0.5	-2	2.22	-0.5	14	29	1900	#N/A	4.94	70	4.51	1.21	400	26	2.65	4	1280	6	0.6	1.2	570	0.31	210	-10	42
156	COMP#45	26	0.2	9.28	11	1770	0.5	-2	2.81	-0.5	19	16	2180	#N/A	5.04	50	3.73	1.39	675	5	2.96	4	1250	10	0.6	1	662	0.33	196	-10	76
157	COMP#53	44	-0.2	8.84	14	1540	0.5	-2	3.24	-0.5	18	29	1385	#N/A	4.85	60	4	1.46	585	9	2.58	7	1210	8	0.8	1	673	0.32	211	-10	60
158	COMP#66	41	-0.2	8.28	11	1800	0.5	-2	4.83	-0.5	21	17	309	#N/A	5.01	50	2.45	1.9	1140	1	2.22	5	1540	10	0.6	-0.2	654	0.36	222	-10	92
159	COMP#68	41	-0.2	8.64	12	1610	0.5	-2	4.18	-0.5	24	38	1305	#N/A	5.06	50	3.2	1.93	630	4	2.4	10	1460	8	0.6	1.2	773	0.37	267	40	48
160	Feb 2001 Sample 1-2 mm	70	0.2	5.53	10	690	1	-2	4.88	-0.5	39	388	453	#N/A	4.85	160	1.4	7.19	965	1	1.55	335	1320	8	0.2	-0.2	374	0.34	168	-10	58
161	Mar 2001 Sample 1-2 mm	87	-0.2	5.24	13	1070	1	-2	5.14	-0.5	40	354	878	#N/A	5.24	160	1.2	7.03	960	3	1.26	381	1190	8	-0.2	0.2	381	0.32	159	-10	58
162	Apr 2001 Sample 1-2 mm	15	-0.2	9.08	78	1820	0.5	-2	5.44	-0.5	31	58	1095	#N/A	5.78	90	1.43	1.75	1355	8	2.72	12	1490	14	1.4	0.2	626	0.38	220	-10	80
163	May 2001 Sample 1-2 mm	70	-0.2	5.11	4	440	1	-2	5.05	-0.5	39	422	103	#N/A	4.48	60	1.25	7.39	940	-1	1.43	363	1360	4	0.6	-0.2	262	0.35	144	-10	56
164	Jun 2001 Sample 1-2 mm	49	1	7.23	47	200	1	-2	2.6	-0.5	51	42	3720	#N/A	6.36	240	4.19	1.28	895	102	1.63	11	1330	10	1	7.6	275	0.28	288	-10	48
165	Jun 2001 Sample 2-2 mm	10	1	8.71	62	1400	0.5	-2	1.82	-0.5	51	48	2770	#N/A	8.65	350	3.73	1.27	700	133	2.25	8	1190	14	2.8	4.8	457	0.36	208	-10	58
166	Jul 2001 Sample 1-2 mm	71	0.6	8.1	29	1460	0.5	-2	6.07	-0.5	29	118	1180	#N/A	5.27	90	4.09	2.33	980	90	2.09	45	990	10	0.6	2.2	499	0.29	222	-10	64
167	Jul 2001 Sample 2-2 mm	112	-0.2	7.96	12	2300	0.5	-2	7.05	-0.5	23	57	398	#N/A	5.34	60	1.86	2.13	1720	5	1.96	21	1410	6	0.8	0.2	649	0.38	221	-10	86
168	Aug 2001 Sample 1-2 mm	113	0.5	6.54	140	1530	2	-2	4	-0.5	26	91	4440	#N/A	7.24	470	4.78	1.08	585	46	2.18	7	1100	10	20	4	475	0.31	229	-10	62
169	Aug 2001 Sample 2-2 mm	122	-0.5	6.25	25	1580	1.5	-2	5.2	-0.5	20	36	4940	#N/A	6.15	160	4.31	1.32	990	17	2.29	12	1140	12	15	3	553	0.34	218	-10	74
170	Aug 2001 Sample 3-2 mm	73	2	6.71	35	550	2	2	3	0.5	31	24	3580	#N/A	7.04	220	4.82	0.99	650	59	2.27	3	920	8	15	4	455	0.3	180	-10	60
171	Sep 2001 Sample 1-2 mm	130	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
172	Sep 2001 Sample 2-2 mm	103	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
173	Sep 2001 Sample 3-2 mm	108	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
174	Oct 2001 Sample 1-2 mm	134	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
175	Oct 2001 Sample 2-2 mm	77	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
176	Oct 2001 Sample 3-2 mm	117	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
177	Mar 2001 Sample 1+2 mm	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
178	May 2001 Sample 1+2 mm	45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
179	Jun 2001 Sample 1+2 mm	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
180	Jun 2001 Sample 2+2 mm	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
181	Sep 2001 Sample 1+2 mm	52	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
182	Sep 2001 Sample 2+2 mm	47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
183	Sep 2001 Sample 3+2 mm	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
184	Oct 2001 Sample 1+2 mm	51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
185	102 - 10 - 100	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
186	102 - 100 - 200	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
187	102 - 200 - 300	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
188	102 - 300 - 400	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
189	102 - 400 - 500	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
190	102 - 500 - 600	46	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
191	103 - 10 - 100	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
196	103 - 500 - 600	Springer Pit	Springer Pit	DD Core	103 - 500 - 600	#N/A	0.34	0.04	8.7	#N/A	#N/A	#N/A
197	105 - 10 - 100	Springer Pit	Springer Pit	DD Core	105 - 10 - 100	#N/A	0.08	0.03	9.2	#N/A	#N/A	#N/A
198	105 - 100 - 200	Springer Pit	Springer Pit	DD Core	105 - 100 - 200	#N/A	0.03	0.03	9	#N/A	#N/A	#N/A
199	105 - 200 - 300	Springer Pit	Springer Pit	DD Core	105 - 200 - 300	#N/A	0.06	0.06	9.1	#N/A	#N/A	#N/A
200	105 - 300 - 400	Springer Pit	Springer Pit	DD Core	105 - 300 - 400	#N/A	0.03	0.03	9.1	#N/A	#N/A	#N/A
201	105 - 400 - 500	Springer Pit	Springer Pit	DD Core	105 - 400 - 500	#N/A	0.08	0.03	9.2	#N/A	#N/A	#N/A
202	105 - 500 - 600	Springer Pit	Springer Pit	DD Core	105 - 500 - 600	#N/A	0.09	0.05	9.3	#N/A	#N/A	#N/A
203	106 - 10 - 100	Springer Pit	Springer Pit	DD Core	106 - 10 - 100	#N/A	0.06	0.02	8.9	#N/A	#N/A	#N/A
204	106 - 100 - 200	Springer Pit	Springer Pit	DD Core	106 - 100 - 200	#N/A	0.02	0.02	8.8	#N/A	#N/A	#N/A
205	106 - 200 - 300	Springer Pit	Springer Pit	DD Core	106 - 200 - 300	#N/A	0.04	0.02	8.9	#N/A	#N/A	#N/A
206	106 - 300 - 400	Springer Pit	Springer Pit	DD Core	106 - 300 - 400	#N/A	0.07	0.01	8.9	#N/A	#N/A	#N/A
207	106 - 400 - 500	Springer Pit	Springer Pit	DD Core	106 - 400 - 500	#N/A	0.03	0.01	9.3	#N/A	#N/A	#N/A
208	106 - 500 - 600	Springer Pit	Springer Pit	DD Core	106 - 500 - 600	#N/A	0.05	0.03	9.3	#N/A	#N/A	#N/A
209	108 - 10 - 100	Springer Pit	Springer Pit	DD Core	108 - 10 - 100	#N/A	0.01	0.01	8.2	#N/A	#N/A	#N/A
210	108 - 100 - 200	Springer Pit	Springer Pit	DD Core	108 - 100 - 200	#N/A	0.04	0.03	8.7	#N/A	#N/A	#N/A
211	108 - 200 - 300	Springer Pit	Springer Pit	DD Core	108 - 200 - 300	#N/A	0.02	0.01	8.7	#N/A	#N/A	#N/A
212	108 - 300 - 400	Springer Pit	Springer Pit	DD Core	108 - 300 - 400	#N/A	0.04	0.02	8.7	#N/A	#N/A	#N/A
213	108 - 400 - 500	Springer Pit	Springer Pit	DD Core	108 - 400 - 500	#N/A	0.04	0.04	9	#N/A	#N/A	#N/A
214	108 - 500 - 600	Springer Pit	Springer Pit	DD Core	108 - 500 - 600	#N/A	0.13	0.08	9.1	#N/A	#N/A	#N/A
215	150 - 10 - 100	Springer Pit	Springer Pit	DD Core	150 - 10 - 100	#N/A	0.06	0.04	8.8	#N/A	#N/A	#N/A
216	150 - 100 - 200	Springer Pit	Springer Pit	DD Core	150 - 100 - 200	#N/A	0.06	0.02	8.7	#N/A	#N/A	#N/A
217	150 - 200 - 300	Springer Pit	Springer Pit	DD Core	150 - 200 - 300	#N/A	0.84	0.02	8.8	#N/A	#N/A	#N/A
218	150 - 300 - 400	Springer Pit	Springer Pit	DD Core	150 - 300 - 400	#N/A	0.67	0.03	8.8	#N/A	#N/A	#N/A
219	150 - 400 - 500	Springer Pit	Springer Pit	DD Core	150 - 400 - 500	#N/A	0.34	0.01	8.9	#N/A	#N/A	#N/A
220	150 - 500 - 600	Springer Pit	Springer Pit	DD Core	150 - 500 - 600	#N/A	0.47	0.01	8.8	#N/A	#N/A	#N/A
221	73093	Springer Pit	Springer Pit	DD Core	73093	#N/A	-0.01	-0.01	9	0	0.218181818	#N/A
222	73113	Springer Pit	Springer Pit	DD Core	73113	#N/A	-0.01	-0.01	8.4	0	0.218181818	#N/A
223	73233	Springer Pit	Springer Pit	DD Core	73233	#N/A	0.01	-0.01	8.4	0	0.272727273	#N/A
224	73253	Springer Pit	Springer Pit	DD Core	73253	#N/A	0.49	-0.01	8	0	0.163636364	#N/A
225	73273	Springer Pit	Springer Pit	DD Core	73273	#N/A	0.8	-0.01	8.1	0	0.545454545	#N/A
226	73293	Springer Pit	Springer Pit	DD Core	73293	#N/A	0.29	-0.01	8	0	0.109090909	#N/A
227	73488	Springer Pit	Springer Pit	DD Core	73488	#N/A	0.31	-0.01	8.3	0	0.054545455	#N/A
228	74333	Springer Pit	Springer Pit	DD Core	74333	#N/A	0.56	-0.01	8.3	0	0.054545455	#N/A
229	74478	Springer Pit	Springer Pit	DD Core	74478	#N/A	0.57	-0.01	8.5	0	0.054545455	#N/A
230	74498	Springer Pit	Springer Pit	DD Core	74498	#N/A	0.18	-0.01	8.7	0	0.272727273	#N/A
231	MP-66	Springer Pit	Springer Pit	DD Core	MP-66	#N/A	0.25	-0.05	9.3	0	0.111818182	#N/A
232	MP-67	Springer Pit	Springer Pit	DD Core	MP-67	#N/A	0.51	0.02	8.2	8.6	0.163636364	#N/A
233	476111	Springer Pit	Springer Pit	DD Core	476111	#N/A	0.04	0.01	7.92	#N/A	0.010909091	0.03
234	146670	Springer Pit	Springer Pit	DD Core	146670	#N/A	1.74	0.04	8.07	#N/A	0.93	0.93
235	146671	Springer Pit	Springer Pit	DD Core	146671	#N/A	2.15	0.01	7.93	#N/A	1.009090909	0.98
236	146672	Springer Pit	Springer Pit	DD Core	146672	#N/A	0.84	0.01	8.21	#N/A	1.120909091	1.13
237	146673	Springer Pit	Springer Pit	DD Core	146673	#N/A	0.96	0.01	8.22	#N/A	0.785454545	0.81
238	146674	Springer Pit	Springer Pit	DD Core	146674	#N/A	2.13	0.02	8.01	#N/A	1.300909091	1.33
239	146675	Springer Pit	Springer Pit	DD Core	146675	#N/A	0.66	0.01	8.34	#N/A	1.180909091	1.20
240	146676	Springer Pit	Springer Pit	DD Core	146676	#N/A	0.09	0.01	8.43	#N/A	2.149090909	2.09
241	146677	Springer Pit	Springer Pit	DD Core	146677	#N/A	0.1	0.01	8.39	#N/A	1.999090909	1.93
242	146678	Springer Pit	Springer Pit	DD Core	146678	#N/A	0.62	0.01	8.27	#N/A	1.669090909	1.64
243	146679	Springer Pit	Springer Pit	DD Core	146679	#N/A	1.58	0.02	8.14	#N/A	1.14	1.14
244	146680	Springer Pit	Springer Pit	DD Core	146680	#N/A	0.86	0.01	8.45	#N/A	1.069090909	1.10
245	146790	Springer Pit	Springer Pit	DD Core	146790	#N/A	2.49	0.08	7.91	#N/A	1.069090909	1.19
246	146791	Springer Pit	Springer Pit	DD Core	146791	#N/A	2.29	0.05	7.98	#N/A	1.030909091	0.97
247	146794	Springer Pit	Springer Pit	DD Core	146794	#N/A	0.15	0.01	8.42	#N/A	1.44	1.43
248	146795	Springer Pit	Springer Pit	DD Core	146795	#N/A	1.66	0.02	8.05	#N/A	0.81	0.83
249	146796	Springer Pit	Springer Pit	DD Core	146796	#N/A	0.69	0.01	8.39	#N/A	1.249090909	1.24
250	146797	Springer Pit	Springer Pit	DD Core	146797	#N/A	0.88	0.02	8	#N/A	1.5	1.51
251	146798	Springer Pit	Springer Pit	DD Core	146798	#N/A	1.1	0.02	8.39	#N/A	1.159090909	1.14
252	146799	Springer Pit	Springer Pit	DD Core	146799	#N/A	0.55	0.01	8.36	#N/A	1.44	1.42
253	146922	Springer Pit	Springer Pit	DD Core	146922	#N/A	1.13	0.01	8.18	#N/A	1.819090909	1.79
254	146923	Springer Pit	Springer Pit	DD Core	146923	#N/A	0.64	0.01	8.45	#N/A	1.300909091	1.27
255	146926	Springer Pit	Springer Pit	DD Core	146926	#N/A	0.52	0.01	8.51	#N/A	0.829090909	0.84
256	465229	Springer Pit	Springer Pit	DD Core	465229	#N/A	0.01	#N/A	8.62	#N/A	0.226363636	0.22
257	470445	Springer Pit	Springer Pit	DD Core	470445	#N/A	0.05	#N/A	8.84	#N/A	0.182727273	0.18
258	465244	Springer Pit	Springer Pit	DD Core	465244	#N/A	0.47	#N/A	8.37	#N/A	0.619090909	0.59
259	465240	Springer Pit	Springer Pit	DD Core	465240	#N/A	0.39	#N/A	8.1	#N/A	0.48	0.45
260	470436	Springer Pit	Springer Pit	DD Core	470436	#N/A	1.1	#N/A	8.06	#N/A	0.57	0.56
261	470423	Springer Pit	Springer Pit	DD Core	470423	#N/A	1.31	#N/A	8.38	#N/A	0.327272727	0.31
262	480754	Springer Pit	Springer Pit	DD Core	480754	#N/A	0.9	#N/A	8.62	#N/A	0.068181818	0.07
263	480757	Springer Pit	Springer Pit	DD Core	480757	#N/A	0.4	#N/A	8.75	#N/A	0.365454545	0.37
264	475695	Springer Pit	Springer Pit	DD Core	475695	#N/A	2.52	#N/A	8.1	#N/A	0.27	0.27
265	475682	Springer Pit	Springer Pit	DD Core	475682	#N/A	1.7	#N/A	8.43	#N/A	0.147272727	0.16
266	475668	Springer Pit	Springer Pit	DD Core	475668	#N/A	2.2	#N/A	8.12	#N/A	0.319090909	0.33
267	480746	Springer Pit	Springer Pit	DD Core	480746	#N/A	1.49	#N/A	8.26	#N/A	0.842727273	0.83
268	475493	Springer Pit	Springer Pit	DD Core	475493	#N/A	0.14	#N/A	9.13	#N/A	0.261818182	0.27
269	475466	Springer Pit	Springer Pit	DD Core	475466	#N/A	0.06	#N/A	8.94	#N/A	0.117272727	0.12
270	475479	Springer Pit	Springer Pit	DD Core	475479	#N/A	0.04	#N/A	9.34	#N/A	0.062727273	0.10
271	481100	Springer Pit	Springer Pit	DD Core	481100	#N/A	0.01	#N/A	8.78	#N/A	0.160909091	0.17
272	474152	Springer Pit	Springer Pit	DD Core	474152	#N/A	0.07	#N/A	9.15	#N/A	0.06	0.09
273	470040	Springer Pit	Springer Pit	DD Core	470040	#N/A	0.02	#N/A	8.71	#N/A	0.188181818	0.19
274	470063	Springer Pit	Springer Pit	DD Core	470063	#N/A	0.01	#N/A	8.57	#N/A	0.515454545	0.51
275	480677	Springer Pit	Springer Pit	DD Core	480677	#N/A	0.04	#N/A	8.89	#N/A	0.163636364	0.14
276	470050	Springer Pit	Springer Pit	DD Core	470050	#N/A	0.03	#N/A	8.6	#N/A	0.392727273	0.40
277	480664	Springer Pit	Springer Pit	DD Core	480664	#N/A	0.16	#N/A	8.48	#N/A	0.158181818	0.15
278	471271	Springer Pit	Springer Pit	DD Core	471271	#N/A	0.02	#N/A	9.23	#N/A	0.079090909	0.09
279	480684	Springer Pit	Springer Pit	DD Core	480684	#N/A	0.06	#N/A	8.9	#N/A	0.144545455	0.15
280	474261	Springer Pit	Springer Pit	DD Core	474261	#N/A	0.01	#N/A	8.71	#N/A	-0.005454545	-0.02
281	480178	Springer Pit	Springer Pit	DD Core	480178	#N/A	0.02	#N/A	8.39	#N/A	0.076363636	0.08
282	471262	Springer Pit	Springer Pit	DD Core	471262	#N/A	0.01	#N/A	9.07	#N/A	0.068181818	0.07
283	471269	Springer Pit	Springer Pit	DD Core	471269	#N/A	0.02	#N/A	9.29	#N/A	0.051818182	0.05
284	470298	Springer Pit	Springer Pit	DD Core	470298	#N/A	1.5	#N/A	8.32	#N/A	0.379090909	0.37
285	470279	Springer Pit	Springer Pit	DD Core	470279	#N/A	0.61	#N/A	8.61	#N/A	0.349090909	0.34
286	262761	Pond Zone	East Wall	DD Core	262761	Volcanic	6.33	0.05	7.66	#N/A	0.14	0.17
287	262775	Pond Zone	East Wall	DD Core	262775	Volcanic	1.06	0.03	8.2	#N/A	0.29	0.29
288	275422	Pond Zone	East Wall	DD Core	275422	Volcanic	0.98	0.01	8.29	#N/A	0.1	0.12
289	482023	Pond Zone	East wall South Ramp	DD Core	482023	Skarn/Vol	0.63	0.01	7.88	#N/A	0.16	0.17
290	482021	Pond Zone	East wall South Ramp	DD Core	482021	Skarn/Vol	0.38	0.01	8.47	#N/A	0.06	0.07
291	482034	Pond Zone	South Ramp	DD Core	482034	Skarn/Vol	0.63	0.01	8.7	#N/A	0.05	0.09
292	482042	Pond Zone	South Ramp	DD Core	482042	Skarn/Vol	0.47	0.01	8.51	#N/A	0.19	0.20
293	482032	Pond Zone	South Ramp	DD Core	482032	Skarn/Vol	0.85	0.01	8.42	#N/A	0.13	0.13
294	482041	Pond Zone	South Ramp	DD Core	482041	Skarn/Vol	0.78	0.01	8.58	#N/A	0.08	0.08
295	499413	Pond Zone	North Wall (Skarn)	DD Core	499413	Skarn	0.58	0.01	8.37	#N/A	0.37	0.39
296	499431	Pond Zone	North Wall (Skarn)	DD Core	499431	Skarn	0.08	0.01	8.42	#N/A	8.54	8.59
297	499502	Pond Zone	Lower North Wall (Skarn)	DD Core	499502	Skarn	0.15	0.01	8.29	#N/A	0.76	0.76
298	499521	Pond Zone	Lower North Wall (Skarn)	DD Core	499521	Skarn	1.59	0.01	8.34	#N/A	0.45	0.46
299	483866	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	483866	Diorite	1.42	0.01	8.48	#N/A	0.06	0.07
300	273110	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	273110	Diorite	0.99	0.02	8.32	#N/A	0.15	0.16
301	273120	Pond Zone	West wall(North 1/2),same rock as above	DD Core	273120	Diorite	0.84	0.01	8.1	#N/A	0.08	0.08
302	483849	Pond Zone	West wall(North 1/2),same rock as below	DD Core	483849	Diorite	0.37	0.01	8.5	#N/A	0.05	0.06
303	464304	Pond Zone	West Wall of South Ramp	DD Core	464304	Diorite	0.11	-0.01	7.99	#N/A	0	0.03
304	499406	Pond Zone	West wall(North 1/2),same Diorite as above with some P alteration	DD Core	499406	Diorite	0.02	0.01	8.27	#N/A	-0.01	0.01
305	464317	Pond Zone	Upper North Wall (monz above Skarn)	DD Core	464317	Monzonite	0.31	-0.01	8.87	#N/A	0.01	0.04

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
196	103 - 500 - 600	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
197	105 - 10 - 100	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
198	105 - 100 - 200	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
199	105 - 200 - 300	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
200	105 - 300 - 400	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
201	105 - 400 - 500	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
202	105 - 500 - 600	43	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
203	106 - 10 - 100	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
204	106 - 100 - 200	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
205	106 - 200 - 300	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
206	106 - 300 - 400	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
207	106 - 400 - 500	44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
208	106 - 500 - 600	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
209	108 - 10 - 100	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
210	108 - 100 - 200	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
211	108 - 200 - 300	33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
212	108 - 300 - 400	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
213	108 - 400 - 500	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
214	108 - 500 - 600	38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
215	150 - 10 - 100	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
216	150 - 100 - 200	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
217	150 - 200 - 300	84	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
218	150 - 300 - 400	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
219	150 - 400 - 500	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
220	150 - 500 - 600	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
221	73093	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
222	73113	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
223	73233	39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
224	73253	37	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
225	73273	66	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
226	73293	34	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
227	73488	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
228	74333	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
229	74478	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
230	74498	36	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
231	MP-66	44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
232	MP-67	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
233	476111	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
234	146670	102	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
235	146671	117	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
236	146672	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
237	146673	51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
238	146674	146	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
239	146675	115	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
240	146676	218	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
241	146677	150	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
242	146678	156	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
243	146679	140	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
244	146680	128	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
245	146790	127	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
246	146791	113	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
247	146794	155	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
248	146795	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
249	146796	132	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
250	146797	130	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
251	146798	128	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
252	146799	118	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
253	146922	153	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
254	146923	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
255	146926	69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
256	465229	60	0.393	1.84	20	64.3	#N/A	0.05	2.12	0.57	14.7	11.4	960.62	#N/A	3.64	147	0.11	0.89	1479	2.5	0.071	3.7	0.18	7.83	0.17	0.4	439.1	0.06	117	0.7	146.1
257	470445	79	0.186	2.85	11	143.8	#N/A	0.03	2.41	0.6	17.7	9.4	522.51	#N/A	4.36	379	0.25	1.03	791	3.18	0.439	5.6	0.226	17.35	0.1	0.6	990.9	0.097	194	0.2	177.4
258	465244	105	0.345	1.41	33.3	62	#N/A	0.08	3.1	0.22	11.5	12.2	517.73	#N/A	4.44	120	0.06	0.91	1663	11.29	0.012	2.3	0.115	4.8	0.38	1.2	153.8	0.058	113	0.8	70.8
259	465240	96	0.619	1.83	33.5	82.1	#N/A	0.14	2.58	0.98	13.6	11.5	715.44	#N/A	3.57	401	0.07	0.95	1546	5.97	0.016	2.8	0.147	10.04	0.28	4.3	89.6	0.021	125	0.3	85.8
260	470436	113	0.367	2.33	14.9	31.5	#N/A	0.12	3.18	0.19	18.9	13.5	1108.5	#N/A	4.84	105	0.19	1.35	662	18.19	0.119	5.1	0.176	9.13	0.24	3.5	646.3	0.131	169	0.4	61.4
261	470423	89	0.284	2.27	16.8	34.6	#N/A	0.07	2.48	0.09	13.7	9.1	979.52	#N/A	3.87	139	0.15	1.16	611	8.07	0.534	4.5	0.182	7.71	0.22	3.7	962.6	0.089	133	0.4	43.3
262	480754	55	0.25	2.7	10.2	56.1	#N/A	0.03	1.63	0.28	19.7	6.9	509.8	#N/A	4.6	91	0.25	0.82	576	18.17	0.856	4.2	0.155	10.48	0.12	3.5	274.6	0.124	139	0.5	95.8
263	480757	98	0.189	2.38	12.1	60.1	#N/A	0.02	2.38	0.24	13.8	6.9	287.3	#N/A	5.39	79	0.2	0.86	868	16.65	0.68	3.8	0.146	9.57	0.15	2.5	254	0.107	178	0.7	111.9
264	475695	94	0.88	3.09	18	66.6	#N/A	0.2	2.31	0.09	20.2	11.7	778.79	#N/A	5.14	15	0.22	1	495	18.35	1.008	5	0.166	10.7	0.07	8.2	338.9	0.13	150	0.6	40.5
265	475682	96	0.452	3.4	19.4	64.8	#N/A	0.08	1.78	0.62	17.6	11.3	384.19	#N/A	5.03	5	0.32	1.02	513	10.28	1.445	4.2	0.159	7.17	0.09	3.6	212.8	0.163	155	0.3	95.9
266	475668	101	0.796	3.34	19.6	50.1	#N/A	0.13	2.52	0.48	17.7	8.7	253.97	#N/A	4.8	16	0.17	1.13	760	18.42	1.056	3.9	0.171	10.58	0.07	4.5	395.6	0.147	125	0.9	98.2
267	480746	129	0.348	2.23	14.6	56.9	#N/A	0.05	3.75	0.32	18.6	7	436.47	#N/A	5.16	139	0.19	1.47	1065	22.13	0.254	4.8	0.171	10.81	0.21	6.3	76.8	0.127	169	0.5	112.5
268	475493	41	0.151	0.33	3	850.3	#N/A	0.05	1.07	0.04	6.6	13.9	649.9	#N/A	2.68	10	0.03	0.29	219	2.74	0.042	2.8	0.071	5.19	0.07	0.8	55.5	0.083	88	0.5	19.5
269	475466	40	0.211	0.43	4.2	806.1	#N/A	0.03	0.77	0.22	8.9	55.3	506.83	#N/A	2.75	24	0.1	0.54	229	2.78	0.069	16	0.087	7.19	0.16	0.7	102.1	0.08	102	0.3	51.2
270	475479	16	0.135	0.52	5.4	333.2	#N/A	0.05	0.65	0.06	6.7	54.6	503.11	#N/A	1.9	5	0.04	0.57	247	2.06	0.037	10.8	0.073	4.51	0.09	0.4	30.2	0.069	71	0.3	29.1
271	481100	66	0.563	2.37	17.4	240.6	#N/A	0.03	2.37	0.74	20.4	6	148.46	#N/A	3.55	173	0.1	0.8	1185	1.53	0.261	2.3	0.174	24.35	0.17	0.4	369.5	0.055	116	0.5	179.5
272	474152	16	0.117	0.39	6.8	243.5	#N/A	0.13	0.7	0.09	4.9	20.5	244.69	#N/A	1.83	12	0.14	0.31	153	4.85	0.03	4.7	0.065	5.23	0.16	1.1	16.2	0.068	64	1.2	21.1
273	470040	59	0.27	2.17	9.5	127.4	#N/A	0.03	2.05	0.65	9.1	11	218.05	#N/A	2.75	183	0.16	0.49	1025	4.71	0.639	2	0.149	13.25	0.09	0.3	246.1	0.045	110	0.5	148.8
274	470063	76	0.122	1.13	12.4	44.4	#N/A	0.06	2.21	0.34	11.5	12.5	492.87	#N/A	2.64	124	0.09	0.6	1176	1.79	0.009	2.6	0.107	5.11	0.37	0.2	242.5	0.026	95	0.2	138.8
275	480677	65	0.312	2.31	6.8	114.1	#N/A	0.03	1.68	0.43	12.1	8.7	156.76	#N/A	3.87	73	0.15	0.57	509	2.08	1.129	2.6	0.188	10.8	0.11	0.3	210.7	0.08	148	0.2	101.4
276	470050	75	0.291	1.62	9	38.3	#N/A	0.05	2.76	0.6	10	10.6	408.78	#N/A	2.77	117	0.11	0.63	1860	5.95	0.101	2.1	0.12	15.13	0.16	0.5	394.3	0.058	85	0.7	187.7
277	480664	78	0.834	1.74	14.1	147.9	#N/A	0.05	1.98	1.14	19.8	6.5	740.33	#N/A	4.2	504	0.08	1.31	1295	6.77	0.016	3.4	0.188	14.1	0.49	1.8	226.8	0.091	128	0.8	409.4
278	471271	23	0.095	2.14	9.6	617.3	#N/A	-0.02	2.27	0.11	20.2	11.2	218.24	#N/A	4.88	7	0.13	1.21	622	4.87	0.026	4.8	0.114	2.93	0.06	0.3	66.1	0.155	187	0.2	38.7
279	480684	69	0.521	2.8	12.5	283.8	#N/A	0.04	2.18	0.43	13.7	8.3	361.74	#N/A	3.85	144	0.14	0.67	731	3.45	0.921	2.4	0.182	9.95	0.16	0.5	338.3	0.078	125	0.4	92.3
280	474261	12	0.236	1.43	18.7	106.4	#N/A	0.09	1.14	0.21	11.5	11.5	717.72	#N/A	3.57	73	0.14	0.84	414	4.32	0.148	2.4	0.16	4.93	0.18	0.6	35	0.102	115	0.6	39.8
281	480178	34	0.335	3.22	6	101.8	#N/A	0.04	1.89	0.32	13.8	14.8	747.83	#N/A	4.64	97	0.31	0.82	951	2.39	0.866	3.4	0.149	7.27	0.05	0.2	879.3	0.074	162	0.3	98.6
282	471262	26	0.118	2.42	8.6	286.5	#N/A	-0.02	2.63	0.08	21.4	10.6	102.4	#N/A	4.99	6	0.12	1.26	587	2.57	0.028	4.3	0.119	4.11	0.07	0.1	52	0.181	201	0.2	44.5
283	471269	22	0.064	2.37	16.6	752	#N/A	-0.02	2.47	0.11	22.1	9.2	146.86	#N/A	4.92	6	0.14	1.22	638	2.63	0.041	4.3	0.121	3.27	0.09	0.1	80.8	0.18	194	0.2	36.8
284	470298	90	0.448	2.56	19	78	#N/A	0.05	2.63	0.36	18	12.8	564.26	#N/A	4.46	85	0.28	0.9	608	33.74	0.428	4	0.163	16.35	0.2	5	659.9	0.101	147	0.5	86.7
285	470279	78	0.403	2.46	16.8	71.2	#N/A	0.03	2.67	0.81	17.7	6.4	229.47	#N/A	4.74	126	0.2	1.04	755	19.41	0.537	3.6	0.209	24.49	0.15	3.1	181.7	0.125	175	0.6	176.7
286	262761	124	0.763	2.02	30.1	18.5	#N/A	0.88	1.5	0.12	44.2	23.6	752.17	#N/A	8.46	271	0.05	2.53	1184	12.73	0.013	16.6	0.2	5.14	0.3	6.7	104.3	0.228	170	1.3	79.9
287	262775	150	0.158	2.77	15.9	17.1	#N/A	0.14	1.74	0.02	23.1	38.7	95.99	#N/A	5.25	47	0.06	3.17	1287	2.36	0.024	19.4	0.191	2.59	0.14	1.3	92.2	0.213	131	0.7	92.2
288	275422	133	0.221	2.38	11.3	19.4	#N/A	0.31	1.64	0.03	21.9	101.9	236.61	#N/A	4.86	26	0.07	2.49	1204	4.15	0.026

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
306	464308	Pond Zone	West wall(south 1/2), same rock as above	DD Core	464308	Monzonite	0.25	0.01	8	#N/A	0.03	0.03
307	464315	Pond Zone	West wall(south 1/2),same rock as below	DD Core	464315	Monzonite	0.17	-0.01	8.83	#N/A	0.1	0.11
308	464314	Pond Zone	West Wall of South Ramp	DD Core	464314	Monzonite	0.06	-0.01	8.45	#N/A	0.02	0.05
309	464306	Pond Zone	Ore Zone	DD Core	464306	Fault zone	0.13	0.02	8.62	#N/A	0.29	0.30
310	468311	Pond Zone	Ore Zone	DD Core	468311	Fault zone	0.53	0.01	8.46	#N/A	0.07	0.10
311	468316	Pond Zone	Ore Zone	DD Core	468316	Fault zone	0.18	0.01	8.37	#N/A	0.49	0.49
312	468323	Pond Zone	Ore Zone	DD Core	468323	Monz Dyke	0.96	0.01	8.24	#N/A	0.08	0.09
313	241931	SE Zone	SE Zone	DD Core	241931	KP	1.67	-0.01	8.4	#N/A	0.174545455	#N/A
314	241932	SE Zone	SE Zone	DD Core	241932	KP	0.17	-0.01	9	#N/A	0.092727273	#N/A
315	241933	SE Zone	SE Zone	DD Core	241933	KP	0.45	-0.01	9	#N/A	0.100909091	#N/A
316	241941	SE Zone	SE Zone	DD Core	241941	KP	0.61	-0.01	9.4	#N/A	0.032727273	#N/A
317	241943	SE Zone	SE Zone	DD Core	241943	KP	0.83	-0.01	9.2	#N/A	0.021818182	#N/A
318	255935	SE Zone	SE Zone	DD Core	255935	KP	0.04	-0.01	8.7	#N/A	0.002727273	#N/A
319	255936	SE Zone	SE Zone	DD Core	255936	KP	0.17	-0.01	9	#N/A	0.019090909	#N/A
320	256192	SE Zone	SE Zone	DD Core	256192	KP	1.99	0.01	7.9	#N/A	0.013636364	#N/A
321	256194	SE Zone	SE Zone	DD Core	256194	KP	1.58	0.01	8	#N/A	0.049090909	#N/A
322	241232	SE Zone	SE Zone	DD Core	241232	Mz	0.98	-0.01	9.2	#N/A	0.070909091	#N/A
323	241234	SE Zone	SE Zone	DD Core	241234	Mz	1.09	-0.01	8.6	#N/A	0.171818182	#N/A
324	241392	SE Zone	SE Zone	DD Core	241392	Mz	0.54	-0.01	8.8	#N/A	0.024545455	#N/A
325	241394	SE Zone	SE Zone	DD Core	241394	Mz	1.31	0.01	8.6	#N/A	0.070909091	#N/A
326	241416	SE Zone	SE Zone	DD Core	241416	Mz	0.96	-0.01	8.7	#N/A	0.100909091	#N/A
327	241419	SE Zone	SE Zone	DD Core	241419	Mz	1.32	-0.01	8.8	#N/A	0.057272727	#N/A
328	256208	SE Zone	SE Zone	DD Core	256208	Mz	1.67	-0.01	8.5	#N/A	0.038181818	#N/A
329	256210	SE Zone	SE Zone	DD Core	256210	Mz	0.96	-0.01	8.9	#N/A	0.081818182	#N/A
330	256319	SE Zone	SE Zone	DD Core	256319	Mz	0.49	0.05	6.7	#N/A	0.010909091	#N/A
331	256321	SE Zone	SE Zone	DD Core	256321	Mz	1.91	0.02	7.05	#N/A	0.002727273	#N/A
332	256331	SE Zone	SE Zone	DD Core	256331	Mz	1.65	-0.01	8.7	#N/A	0.027272727	#N/A
333	256332	SE Zone	SE Zone	DD Core	256332	Mz	1.57	-0.01	8.6	#N/A	0.098181818	#N/A
334	258583	SE Zone	SE Zone	DD Core	258583	Mz	2.36	-0.01	8.6	#N/A	0.081818182	#N/A
335	258585	SE Zone	SE Zone	DD Core	258585	Mz	1.1	-0.01	9	#N/A	0.100909091	#N/A
336	259062	SE Zone	SE Zone	DD Core	259062	Mz	1.27	-0.01	8.8	#N/A	0.070909091	#N/A
337	259065	SE Zone	SE Zone	DD Core	259065	Mz	1.82	-0.01	8.5	#N/A	0.040909091	#N/A
338	259250	SE Zone	SE Zone	DD Core	259250	Mz	1.15	0.01	8.2	#N/A	0.133636364	#N/A
339	259253	SE Zone	SE Zone	DD Core	259253	Mz	1.15	0.01	8.3	#N/A	0.152727273	#N/A
340	259502	SE Zone	SE Zone	DD Core	259502	Mz	1.62	0.02	7.5	#N/A	0.010909091	#N/A
341	259505	SE Zone	SE Zone	DD Core	259505	Mz	1.88	-0.01	8.5	#N/A	0.03	#N/A
342	259795	SE Zone	SE Zone	DD Core	259795	Mz	0.17	-0.01	9.5	#N/A	0.114545455	#N/A
343	259796	SE Zone	SE Zone	DD Core	259796	Mz	0.12	-0.01	9.5	#N/A	0.155454545	#N/A
344	260569	SE Zone	SE Zone	DD Core	260569	Mz	0.12	-0.01	9.4	#N/A	0.057272727	#N/A
345	260573	SE Zone	SE Zone	DD Core	260573	Mz	1.52	-0.01	9	#N/A	0.019090909	#N/A
346	261763	SE Zone	SE Zone	DD Core	261763	Mz	0.39	-0.01	9	#N/A	0.24	#N/A
347	261765	SE Zone	SE Zone	DD Core	261765	Mz	0.81	-0.01	9.2	#N/A	0.139090909	#N/A
348	261775	SE Zone	SE Zone	DD Core	261775	Mz	1.33	-0.01	8.8	#N/A	0.125454545	#N/A
349	261776	SE Zone	SE Zone	DD Core	261776	Mz	0.79	-0.01	9	#N/A	0.171818182	#N/A
350	31929	Wight Pit	WB-03-06	DD Core	31929	AP	0.04	-0.01	8.15	#N/A	1.131818182	#N/A
351	32550	Wight Pit	WB-03-11	DD Core	32550	AP	0.05	-0.01	8.57	#N/A	0.632727273	#N/A
352	31636	Wight Pit	WB-03-03	DD Core	31636	BX	0.67	-0.01	8.53	#N/A	1.56	#N/A
353	31598	Wight Pit	WB-03-03	DD Core	31598	BX	3.79	-0.01	8	#N/A	1.2	#N/A
354	31943	Wight Pit	WB-03-06	DD Core	31943	BX	0.88	-0.01	8.3	#N/A	1.082727273	#N/A
355	31998	Wight Pit	WB-03-06	DD Core	31998	BX	0.3	0.02	8.27	#N/A	1.180909091	#N/A
356	32491	Wight Pit	WB-03-11	DD Core	32491	BX	0.47	-0.01	8.4	#N/A	1.189090909	#N/A
357	32539	Wight Pit	WB-03-11	DD Core	32539	BX	0.49	0.02	8.39	#N/A	1.055454545	#N/A
358	32727	Wight Pit	WB-03-14	DD Core	32727	BX	0.86	0.17	7.86	#N/A	1.461818182	#N/A
359	32635	Wight Pit	WB-03-14	DD Core	32635	BXm	0.76	-0.01	8.16	#N/A	1.404545455	#N/A
360	31557	Wight Pit	WB-03-03	DD Core	31557	PP	1.51	-0.01	7.63	#N/A	1.142727273	#N/A
361	31945	Wight Pit	WB-03-06	DD Core	31945	PPg	0.05	-0.01	8.21	#N/A	0.084545455	#N/A
362	32561	Wight Pit	WB-03-11	DD Core	32561	PPg	0.07	-0.01	8.51	#N/A	0.496363636	#N/A
363	32640	Wight Pit	WB-03-14	DD Core	32640	PPg	2.18	-0.01	8.09	#N/A	1.063636364	#N/A
364	32729	Wight Pit	WB-03-14	DD Core	32729	PPg	0.81	0.28	7.97	#N/A	1.060909091	#N/A
365	31603	Wight Pit	WB-03-03	DD Core	31603	PPp	0.83	0.01	8.24	#N/A	0.946363636	#N/A
366	31576	Wight Pit	WB-03-03	DD Core	31576	PPp	1.57	-0.01	8.07	#N/A	0.938181818	#N/A
367	31973	Wight Pit	WB-03-06	DD Core	31973	PPp	0.66	-0.01	8.54	#N/A	0.777272727	#N/A
368	32519	Wight Pit	WB-03-11	DD Core	32519	PPp	0.51	-0.01	8.42	#N/A	0.616363636	#N/A
369	32702	Wight Pit	WB-03-14	DD Core	32702	PPp	1.57	0.02	8.32	#N/A	1.17	#N/A
370	1	Wight Pit	WB-03-01	DD Core	1	#N/A	1.85	0.01	8.4	#N/A	1.096363636	#N/A
371	2	Wight Pit	WB-03-01	DD Core	2	#N/A	0.47	0.01	8.3	#N/A	1.595454545	#N/A
372	3	Wight Pit	WB-03-02	DD Core	3	#N/A	-0.02	<0.01	8.1	#N/A	0.141818182	#N/A
373	4	Wight Pit	WB-03-02	DD Core	4	#N/A	1.79	0.01	8.3	#N/A	1.036363636	#N/A
374	5	Wight Pit	WB-03-03	DD Core	5	#N/A	1.55	0.01	8.4	#N/A	1.025454545	#N/A
375	6	Wight Pit	WB-03-03	DD Core	6	#N/A	1.33	0.01	8.1	#N/A	0.976363636	#N/A
376	7	Wight Pit	WB-03-04	DD Core	7	#N/A	0.51	<0.01	8.6	#N/A	0.965454545	#N/A
377	8	Wight Pit	WB-03-04	DD Core	8	#N/A	-0.02	<0.01	8.1	#N/A	0.319090909	#N/A
378	9	Wight Pit	WB-03-05	DD Core	9	#N/A	1.62	0.01	8.5	#N/A	1.227272727	#N/A
379	10	Wight Pit	WB-03-05	DD Core	10	#N/A	0.65	0.02	8.7	#N/A	1.257272727	#N/A
380	11	Wight Pit	WB-03-06	DD Core	11	#N/A	0.2	<0.01	8.2	#N/A	1.505454545	#N/A
381	12	Wight Pit	WB-03-06	DD Core	12	#N/A	2.37	0.1	6.2	#N/A	0.477272727	#N/A
382	13	Wight Pit	WB-03-07	DD Core	13	#N/A	0.98	0.01	8.6	#N/A	0.951818182	#N/A
383	14	Wight Pit	WB-03-08	DD Core	14	#N/A	0.69	<0.01	8.8	#N/A	0.850909091	#N/A
384	15	Wight Pit	WB-03-08	DD Core	15	#N/A	1.59	0.01	9	#N/A	0.548181818	#N/A
385	16	Wight Pit	WB-03-09	DD Core	16	#N/A	0.7	<0.01	8.9	#N/A	1.175454545	#N/A
386	17	Wight Pit	WB-03-09	DD Core	17	#N/A	0.9	0.01	8.4	#N/A	1.295454545	#N/A
387	18	Wight Pit	WB-03-10	DD Core	18	#N/A	1.04	0.01	9	#N/A	1.107272727	#N/A
388	19	Wight Pit	WB-03-11	DD Core	19	#N/A	0.99	0.01	8.7	#N/A	1.025454545	#N/A
389	20	Wight Pit	WB-03-12	DD Core	20	#N/A	1.13	0.01	9.2	#N/A	0.812727273	#N/A
390	21	Wight Pit	WB-03-12	DD Core	21	#N/A	1.47	0.01	8.4	#N/A	0.69	#N/A
391	22	Wight Pit	WB-03-13	DD Core	22	#N/A	0.08	<0.01	8.7	#N/A	1.006363636	#N/A
392	23	Wight Pit	WB-03-13	DD Core	23	#N/A	1.46	0.01	8.4	#N/A	1.047272727	#N/A
393	24	Wight Pit	WB-03-14	DD Core	24	#N/A	0.49	<0.01	8.3	#N/A	1.415454545	#N/A
394	25	Wight Pit	WB-03-15	DD Core	25	#N/A	0.94	0.01	8.5	#N/A	0.801818182	#N/A
395	26	Wight Pit	WB-03-16	DD Core	26	#N/A	0.16	<0.01	8.7	#N/A	1.055454545	#N/A
396	27	Wight Pit	WB-03-16	DD Core	27	#N/A	0.65	0.01	8.7	#N/A	1.096363636	#N/A
397	28	Wight Pit	WB-03-17	DD Core	28	#N/A	0.86	0.01	8.6	#N/A	1.257272727	#N/A
398	29	Wight Pit	WB-03-17	DD Core	29	#N/A	0.73	<0.01	8.6	#N/A	0.886363636	#N/A
399	30	Wight Pit	WB-03-18	DD Core	30	#N/A	1.03	0.01	8.6	#N/A	1.197272727	#N/A
400	31	Wight Pit	WB-03-18	DD Core	31	#N/A	0.47	<0.01	9.2	#N/A	0.199090909	#N/A
401	32	Wight Pit	WB-03-18	DD Core	32	#N/A	0.67	0.01	8.8	#N/A	0.700909091	#N/A
402	33	Wight Pit	WB-03-19	DD Core	33	#N/A	0.26	0.01	8.6	#N/A	0.54	#N/A
403	34	Wight Pit	WB-03-19	DD Core	34	#N/A	0.1	<0.01	8.7	#N/A	0.534545455	#N/A

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
306	464308	14	0.201	1.03	18.8	67.8	#N/A	0.19	0.97	0.12	11	30.9	160.65	#N/A	2.5	19	0.07	0.47	552	2.5	0.075	3.6	0.126	9.32	0.68	2.2	176.6	0.15	76	0.5	33.8
307	464315	26	0.411	0.98	11.8	70.1	#N/A	0.1	1.48	0.14	10.9	43.3	330.67	#N/A	2.03	18	0.08	0.69	692	2.27	0.063	5.4	0.129	4.29	0.69	0.9	211.7	0.139	65	0.5	46.4
308	464314	15	0.503	1.08	13.2	53	#N/A	0.17	1.44	0.09	14.3	34.9	397.99	#N/A	2.5	12	0.08	0.74	831	2.54	0.055	5.4	0.129	5.53	0.59	1.8	161.7	0.131	73	0.5	60.3
309	464306	115	1.186	1.33	43.3	15.3	#N/A	0.61	4.67	1	8	43.4	955.42	#N/A	1.23	52	0.15	0.59	1178	5.56	0.009	3.4	0.198	3.45	0.38	0.9	17.9	0.102	47	0.5	168.8
310	468311	91	3.229	1.81	30.1	8.2	#N/A	0.14	4.32	0.95	19	26.4	2646.24	#N/A	2.72	147	0.22	1.39	2218	12.43	0.005	5	0.223	9.88	0.4	1.2	24.5	0.122	91	1.2	160.6
311	468316	147	2.166	1.28	37.8	5.5	#N/A	0.27	5.9	0.65	6.7	32.3	1479.66	#N/A	1.75	82	0.03	0.48	1394	4.81	0.005	3.2	0.159	6.2	0.32	1.2	36.9	0.088	51	0.9	103.6
312	468323	64	0.71	1.23	10.9	17.7	#N/A	0.14	1.67	0.29	19.8	17.7	695.19	#N/A	2.48	58	0.08	0.7	617	4.84	0.114	3.9	0.123	7.32	0.13	3.1	45.5	0.032	43	0.4	75.1
313	241931	51	0.2	1.22	15.8	21	#N/A	0.8	1.5	0.1	34.3	17.8	307.6	#N/A	2.95	310	0.08	0.95	645	6.6	0.015	2.7	0.104	4.9	0.6	1.4	159	0.119	72	0.6	46
314	241932	19	0.1	1.3	12.2	24	#N/A	0.2	1.51	0.1	5.6	28.8	37.8	#N/A	1.89	80	0.07	0.76	534	2.4	0.032	2.7	0.081	4	0.6	-0.5	232	0.123	78	0.5	38
315	241933	21	0.1	1.31	18.1	12	#N/A	0.2	1.56	0.1	8.7	18.8	57.9	#N/A	2.2	50	0.06	1.06	768	2.2	0.015	3.3	0.107	5.2	0.5	0.5	144	0.117	70	0.7	47
316	241941	11	0.2	1.14	11.7	21	#N/A	0.3	1.31	0.1	9.2	29.1	130.5	#N/A	1.85	220	0.06	0.55	507	2.6	0.036	1.8	0.061	7.1	0.7	0.7	221	0.119	69	0.4	39
317	241943	10	0.2	0.94	11.8	15	#N/A	0.7	1.04	0.1	13.9	21.2	79.9	#N/A	1.66	340	0.05	0.58	513	4.2	0.023	2	0.057	9.9	0.6	0.7	163	0.094	57	0.4	41
318	255935	6	-0.1	1	7.3	16	#N/A	0.1	0.84	0.1	4.3	25.6	336.4	#N/A	1.57	50	0.05	0.58	531	1.8	0.029	2.6	0.053	5.4	0.6	-0.5	234	0.103	61	0.4	38
319	255936	8	0.1	1.11	9.1	18	#N/A	0.2	0.99	0.1	7.2	26.3	258.5	#N/A	1.78	70	0.05	0.63	516	2	0.03	2.5	0.068	5	0.6	-0.5	235	0.122	68	0.4	41
320	256192	12	0.1	1.81	13.7	88	#N/A	0.4	1.34	0.1	9.8	18	121.9	#N/A	2.53	130	0.08	0.66	347	5.2	0.287	2.2	0.074	11.3	0.4	3	96	0.098	80	0.6	34
321	256194	7	0.1	1.3	13.5	33	#N/A	0.4	1.2	-0.1	11.6	20.9	148.9	#N/A	2.5	220	0.08	0.65	362	11	0.03	2.3	0.078	8.6	0.7	2.4	142	0.119	87	0.8	33
322	241232	21	0.1	1.58	13.6	27	#N/A	0.3	1.86	0.1	11.2	31.8	345.3	#N/A	3.07	120	0.1	0.82	511	9.5	0.045	2.4	0.106	7.1	0.4	1.7	210	0.162	121	1	31
323	241234	45	0.2	1.47	10.2	36	#N/A	0.3	1.96	0.1	11.9	17	392.1	#N/A	3.18	70	0.09	0.77	518	2.7	0.076	2.7	0.104	7	0.3	1.4	112	0.146	119	0.7	31
324	241392	12	0.2	1.77	11.4	110	#N/A	0.3	1.78	0.1	10.3	30	56.4	#N/A	3.03	30	0.09	0.9	743	3.5	0.031	2.8	0.107	5.1	0.5	0.6	201	0.142	118	1	41
325	241394	19	0.1	1.86	14	47	#N/A	0.5	2.07	0.1	9.8	29.2	122.3	#N/A	3.47	40	0.1	1.04	676	3.3	0.044	2.8	0.127	4.2	0.5	1.3	183	0.174	121	1.4	41
326	241416	23	0.1	1.55	10.7	142	#N/A	0.2	1.7	0.1	13.2	14.8	229.8	#N/A	3.54	60	0.13	0.97	580	2.3	0.038	3.2	0.13	3.4	0.3	1.3	120	0.169	140	0.7	36
327	241419	16	0.1	1.46	12.8	100	#N/A	0.2	1.57	0.1	15	17	145.7	#N/A	3.5	90	0.11	0.95	490	1.9	0.035	3.3	0.126	3.1	0.4	1.7	152	0.164	120	0.6	34
328	256208	15	0.1	1.24	14.7	17	#N/A	0.2	1.28	0.1	19.6	21.3	310.1	#N/A	2.69	160	0.06	0.89	451	6.1	0.024	1.9	0.102	2.9	0.9	2.4	236	0.136	94	0.7	35
329	256210	18	0.1	1.52	18.6	23	#N/A	0.2	1.77	0.1	10.5	22.7	229.5	#N/A	2.96	40	0.07	0.95	543	27.1	0.025	2.5	0.109	3.3	0.8	1.6	188	0.134	108	0.9	37
330	256319	6	0.1	1.2	10.5	26	#N/A	0.3	0.85	0.1	5.6	28.2	89.5	#N/A	3.21	220	0.06	0.68	240	7.8	0.032	2.6	0.098	3.1	0.5	2.7	190	0.195	95	0.7	31
331	256321	11	0.2	1.23	17.7	12	#N/A	0.3	0.98	0.1	13	22.2	228.6	#N/A	3.57	250	0.03	0.95	310	11.6	0.025	4.4	0.123	4.2	0.7	3.9	302	0.18	80	0.9	37
332	256331	12	0.4	1.75	12.2	11	#N/A	0.2	2.03	0.1	13.8	26	276.1	#N/A	3	100	0.03	0.85	427	135.8	0.036	2.7	0.103	9.7	0.5	4	218	0.153	93	0.9	35
333	256332	23	0.2	1.31	13.2	13	#N/A	0.2	1.72	-0.1	13.9	18.7	232.1	#N/A	3.13	100	0.03	0.76	361	65.6	0.026	3	0.115	5.7	0.3	3.3	108	0.118	90	0.6	31
334	258583	21	0.1	1.12	13.3	20	#N/A	0.5	1.05	0.1	11.3	23.7	124.4	#N/A	3.14	100	0.06	1.04	409	2.7	0.027	3.5	0.114	2.5	0.7	1.5	191	0.134	68	0.9	39
335	258585	21	0.1	1.24	9.4	23	#N/A	0.2	1.18	-0.1	9.6	24.8	121.6	#N/A	3.01	60	0.06	1.08	518	1.9	0.026	3	0.112	2	0.8	0.9	234	0.141	85	0.6	43
336	259062	16	0.1	1.52	11.9	24	#N/A	0.2	1.86	-0.1	15.3	21.2	219.7	#N/A	3	40	0.06	0.8	401	4.5	0.02	2.3	0.124	3.3	0.2	1.9	124	0.128	85	0.6	29
337	259065	20	0.1	1.4	10.7	21	#N/A	0.2	1.28	-0.1	12.4	19.1	248.1	#N/A	3.73	40	0.06	1.26	428	2.1	0.022	5.7	0.124	2	0.2	2.1	176	0.141	108	0.7	38
338	259250	38	0.1	2.77	13.2	55	#N/A	0.3	1.94	0.2	18.4	18.1	142.3	#N/A	3.39	140	0.3	1.88	915	2.3	0.39	4	0.156	9.7	0.4	1.4	304	0.147	141	0.5	70
339	259253	30	0.1	2.28	11.1	73	#N/A	0.4	1.95	0.2	12.2	16.6	87.2	#N/A	3.42	90	0.16	1.29	834	1.9	0.396	3.7	0.144	7.1	0.3	1	317	0.145	126	1.2	65
340	259502	10	0.2	1.33	13.2	30	#N/A	0.7	1.11	0.1	14	18.2	299.7	#N/A	2.82	330	0.08	0.96	502	4.2	0.027	3.2	0.111	6.4	0.4	2.2	216	0.162	89	1.1	41
341	259505	14	0.1	1.46	14.7	18	#N/A	0.7	1.64	0.2	13.5	20.9	191.5	#N/A	2.71	330	0.07	0.94	699	2.9	0.025	2.6	0.105	6.4	0.5	1.3	171	0.139	89	1	57
342	259795	15	0.2	0.57	6.2	21	#N/A	0.1	1.09	0.2	3.3	27.2	317.6	#N/A	1.7	70	0.08	0.21	257	4.1	0.029	1.5	0.068	6.9	0.3	0.6	27	0.11	100	0.4	29
343	259796	21	0.2	0.49	7.6	38	#N/A	0.1	1.2	0.2	4.4	45.4	625.4	#N/A	4.84	130	0.1	0.26	291	6.3	0.046	4	0.141	5.6	0.3	-0.5	65	0.119	228	0.4	34
344	260569	12	-0.1	1.31	9	22	#N/A	0.5	1.4	0.1	7.7	22.9	30	#N/A	2.62	190	0.06	0.95	701	3.2	0.029	2.6	0.099	6.1	0.6	-0.5	256	0.157	100	0.6	47
345	260573	16	0.1	1.37	12.5	19	#N/A	0.9	1.52	0.1	14.6	48.2	70.5	#N/A	2.56	300	0.07	0.97	692	6.9	0.033	3.6	0.103	3.6	0.4	0.7	199	0.158	84	1	46
346	261763	31	0.1	1.57	20.7	22	#N/A	0.1	2.41	0.1	11.2	34	203.9	#N/A	3.29	60	0.06	0.78	485	6.7	0.026	4.1	0.114	4.7	0.7	-0.5	186	0.17	121	1.4	34
347	261765	21	-0.1	0.87	11.5	10	#N/A	0.1	1.2	-0.1	11.4	27	124.2	#N/A	2.79	20	0.04	0.58	311	2.9	0.026	2.3	0.101	3	0.4	0.7	103	0.134	88	1	27
348	261775	27	0.2	1.43	15	25	#N/A	0.3	1.77	0.1	15.5	26.4	304.5	#N/A	3.68	160	0.08	0.86	550	5.5	0.026	2.4	0.117	3	0.5	1.6	166	0.148	123	1	38
349	261776	19	0.1	1.35	14.6	35	#N/A	0.2	1.88	0.1	13.1	27.4	252	#N/A	3.58	40	0.07	0.63	578	8.9	0.042	2.9	0.097	3.9	0.5	1.2	122	0.147	110	0.8	37
350	31929	136	1.2	1.2	5	64	#N/A	-3	3.77	1	13	3	0.05	#N/A	4.22	#N/A	0.22	0.82	1965	2	0.03	3	0.145	7	-3	#N/A	96	0.09	156	-2	152
351	32550	97	-0.3	2.43	24	102	#N/A	-3	2.97	-0.5	29	125	0.03	#N/A	7.11	#N/A	0.18	2.39	2821	-1	0.03	52	0.155	-3	4	#N/A	205	0.27	250	-2	123
352	31636	151	1.1	1.58	9	61	#N/A	-3	5.58	0.5	21	10	0.108	#N/A	6.04	#N/A	0.18	1.41	3027	4	0.04	4	0.155	7	-3	#N/A	172	0.13	270	-2	199
353	31598	120	0.9	1.1	20	62	#N/A	-3	4.25	0.9	13	4	0.068	#N/A	4.16	#N/A	0.21	0.85	1545	10	0.04	3	0.126	15	-3	#N/A	125	0.14	128	-2	115
354	31943	113	1.1	0.82	7	51	#N/A	-3	4.33	0.7	19	11	0.118	#N/A	4.93	#N/A	0.13	0.71	2070	5	0.03	5	0.122	5	-3	#N/A	106	0.14	229	-2	164
355	31998	149	1.4	2.01	17	45	#N/A	-3	5.9	0.7	16	4	0.154	#N/A	4.76	#N/A	0.13	1.05	2371	5	0.46	1	0.543	7	-3	#N/A	368	0.11	184	-2	157
356	32491	127	1.2	1.88	9	70	#N/A	-3	4.65	0.5	18	5	0.15	#N/A	5.37	#N/A	0.17	1.41	1799	5	0.03	4	0.181	10	3	#N/A	140	0.13	270	-2	145
357	32539	113	0.7	1.49	7	184	#N/A	-3	4.32	-0.5	13	9	0.069	#N/A	4.14	#N/A	0.21	0.97	1435	4	0.04	5	0.139	7	-3	#N/A	874	0.1	216	-2	113
358	32727	146	0.5	1.86	7	61	#N/A	-3	6.29	-0.5	15	8	0.062	#N/A	4.31	#N/A	0.11	0.96	1477	77	0.06	3	0.145	9	-3	#N/A	144	0.15	209	-2	123
359	32635	116	0.8	1.52	10	56	#N/A	-3	4.7	-0.5	17	6	0.016	#N/A	4.34	#N/A	0.15	1.14	1959	3	0.03	3	0.178	18	3	#N/A	137	0.07	165	-2	121
360	31557	108	0.6	1.14	12	79	#N/A	-3	4.12	0.6	12	5	0.097	#N/A	3.47	#N/A	0.16	0.87	1393	5	0.03	3	0.128	10	-3	#N/A	130	0.02	115	-2	111
361	31945	20	-0.3	1.44	13	124	#N/A	-3	3.62	-0.5	15	8	0.023	#N/A	4.52	#N/A	0.23	1.22	1642	4	0.06	4	0.159	-3	-3	#N/A	108	0.11	167	-2	80
362	32561	61	0.3	2.53	30	140	#N/A	-3	4.06	-0.5	12	7	0.033	#N/A	3.96	#N/A	0.27	0.86	1442	1	0.04	4	0.113	4	-3	#N/A	294	0.16	199	-2	98
363	32640	122	1.5	1.47	21	37	#N/A	-3	3.99	-0.5	16	5	0.133	#N/A	3.97	#N/A	0.22	1.16	2274	11	0.03	4	0.124	19	-3	#N/A	114	0.1	129	2	123
364	32729	121	0.8	1.61	7	103	#N/A	-3	4.46	-0.5	13	2	0.012	#N/A	4.41	#N/A	0.19	1.14	1421	2	0.06	1	0.164	8	-3	#N/A	178	0.17	167	-2	71
365	31603	93	1	1.21	12	67	#N/A	4	3.56	0.6	11	5	0.14	#N/A	3.8	#N/A	0.24	0.92	1707	5	0.04	2	0.125	11	-3	#N/A	155	0.11	183	-2	139
366	31576	91	-0.3	0.88	15	111	#N/A	3	3.28	0.8	7	3	0.01	#N/A	2.5	#N/A	0.2	0.46	1412	13	0.05	1	0.078	29	-3	#N/A	115	-0.01	71	-2	133
367	31973	93	0.4	1.49	10	104	#N/A	-3	3.62	-0.5	14	6	0.02	#N/A	4.26	#N/A	0.14	1.12	1730	6	0.11	1	0.141	6	-3	#N/A	149	0.17	172	-2	75
368	32519	72	0.7	1.86	20	60	#N/A	-3	3.25	-0.5	13	8	0.152	#N/A	4.2	#N/A	0.15	1.09	1264	1	0.04	4	0.126	8	3	#N/A	125	0.17	193	2	93
369	32702	117	0.9	1.26	21	71	#N/A	-3	4.68	-0.5	14	6	0.021	#N/A	4.6	#N/A	0.11	1.08	1356	13	0.03	3	0.166	11	-3	#N/A	420	0.17	174	-2	80
370	1	121	#N/A	#N/A	#N/A	901	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	419	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
371	2	160	#N/A	#N/A	#N/A	1817	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	170	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
372	3	40	#N/A	#N/A	#N/A	1517	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
373	4	119	#N/A	#N/A	#N/A	1758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	421	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
374	5	107	#N/A	#N/A	#N/A	1545	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	544	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
375	6	109	#N/A	#N/A	#N/A	1548	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	334	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
376	7	88	#N/A	#N/A	#N/A	1847	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	156	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
377	8	47	#N/A	#N/A	#N/A	1480	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
378	9	130	#N/A	#N/A	#N/A	1467	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	593	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
379	10	138	#N/A	#N/A	#N/A	1754	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	285	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	#N/A
380	11	149	#N/A	#N/A	#N/A	1457	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	146	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
381	12	69	#N/A	#N/A	#N/A	1465	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2394	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	18.6	#N/A	#N/A	#N/A	#N/A	#N/A
382	13	90	#N/A	#N/A	#N/A	1391	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	523	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	#N/A
383	14	98	#N/A	#N/A	#N/A	1437	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	247	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
384	15	57	#N/A	#N/A	#N/A	1301	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	146	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
385	16	130	#N/A	#N/A	#N/A	1322	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	457	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
386	17	143	#N/A	#N/A	#N/A	1279	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	430	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
387	18	121	#N/A	#N/A	#N/A	1321	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
388	19	110	#N/A	#N/A	#N/A	1556	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	605	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
389	20	93	#N/A	#N/A	#N/A	1592	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	272	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
390	21	81	#N/A	#N/A	#N/A	1001	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	259	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
391	22	128	#N/A	#N/A	#N/A	1402	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
392	23	121	#N/A	#N/A	#N/A	1289	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	382	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
393	24	130	#N/A	#N/A	#N/A	1721	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	244	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
394	25	102	#N/A	#N/A	#N/A	1417	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	678	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
395	26	123	#N/A	#N/A	#N/A	1033	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	157	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
396	27	132	#N/A	#N/A	#N/A	1643	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	424	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	#N/A
397	28	145	#N/A	#N/A	#N/A	2080	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	555	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
398	29	109	#N/A	#N/A	#N/A	1689	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	373	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
399	30	274	#N/A	#N/A	#N/A	1341	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1110	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	#N/A
400	31	46	#N/A	#N/A	#N/A	820	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
404	37	Wight Pit	WB-03-20	DD Core	37	#N/A	0.26	0.02	7.8	#N/A	0.812727273	#N/A
405	38	Wight Pit	WB-03-20	DD Core	38	#N/A	0.3	<0.01	9.1	#N/A	0.499090909	#N/A
406	39	Wight Pit	WB-03-21	DD Core	39	#N/A	0.13	<0.01	8.7	#N/A	0.706363636	#N/A
407	40	Wight Pit	WB-03-22	DD Core	40	#N/A	0.51	<0.01	8.8	#N/A	0.769090909	#N/A
408	41	Wight Pit	WB-03-22	DD Core	41	#N/A	0.05	0.01	8	#N/A	0.962727273	#N/A
409	42	Wight Pit	WB-03-22	DD Core	42	#N/A	1	-0.01	8.5	#N/A	1.115454545	#N/A
410	44	Wight Pit	WB-03-23	DD Core	44	#N/A	0.59	-0.01	8.3	#N/A	1.660909091	#N/A
411	46	Wight Pit	WB-03-24	DD Core	46	#N/A	1.24	0.01	8.8	#N/A	1.303636364	#N/A
412	47	Wight Pit	WB-03-25	DD Core	47	#N/A	0.35	-0.01	8.8	#N/A	0.818181818	#N/A
413	48	Wight Pit	WB-03-25	DD Core	48	#N/A	0.05	-0.01	8	#N/A	1.2	#N/A
414	49	Wight Pit	WB-03-25	DD Core	49	#N/A	0.04	0.01	9.2	#N/A	0.799090909	#N/A
415	50	Wight Pit	WB-03-26	DD Core	50	#N/A	0.25	-0.01	8.9	#N/A	1.071818182	#N/A
416	51	Wight Pit	WB-03-26	DD Core	51	#N/A	0.11	-0.01	9.3	#N/A	0.856363636	#N/A
417	53	Wight Pit	WB-03-27	DD Core	53	#N/A	0.65	-0.01	9.4	#N/A	0.589090909	#N/A
418	54	Wight Pit	WB-03-27	DD Core	54	#N/A	0.38	0.01	8.7	#N/A	0.63	#N/A
419	55	Wight Pit	WB-03-27	DD Core	55	#N/A	0.78	0.01	8.6	#N/A	0.662727273	#N/A
420	56	Wight Pit	WB-03-28	DD Core	56	#N/A	0.75	-0.01	8.3	#N/A	0.616363636	#N/A
421	57	Wight Pit	WB-03-28	DD Core	57	#N/A	0.98	0.01	8.4	#N/A	0.889090909	#N/A
422	58	Wight Pit	WB-03-28	DD Core	58	#N/A	0.71	-0.01	8.8	#N/A	0.621818182	#N/A
423	59	Wight Pit	WB-03-29	DD Core	59	#N/A	0.94	0.01	7.9	#N/A	1.388181818	#N/A
424	62	Wight Pit	WB-03-31	DD Core	62	#N/A	0.62	0.01	8.2	#N/A	0.962727273	#N/A
425	63	Wight Pit	WB-03-31	DD Core	63	#N/A	1.13	0.01	8.1	#N/A	1.145454545	#N/A
426	64	Wight Pit	WB-03-32	DD Core	64	#N/A	2.49	0.01	8	#N/A	1.104545455	#N/A
427	65	Wight Pit	WB-03-32	DD Core	65	#N/A	1.14	0.01	8.3	#N/A	0.758181818	#N/A
428	67	Wight Pit	WB-03-33	DD Core	67	#N/A	0.28	0.01	7.9	#N/A	1.565454545	#N/A
429	69	Wight Pit	WB-03-35	DD Core	69	#N/A	0.78	-0.01	8.7	#N/A	1.273636364	#N/A
430	70	Wight Pit	WB-03-35	DD Core	70	#N/A	0.66	-0.01	8.5	#N/A	1.251818182	#N/A
431	71	Wight Pit	WB-03-35	DD Core	71	#N/A	0.97	-0.01	8.6	#N/A	1.071818182	#N/A
432	74	Wight Pit	WB-03-37	DD Core	74	#N/A	0.56	0.01	8.1	#N/A	0.463636364	#N/A
433	75	Wight Pit	WB-03-37	DD Core	75	#N/A	1.64	0.02	8.4	#N/A	1.388181818	#N/A
434	76	Wight Pit	WB-03-38	DD Core	76	#N/A	0.63	-0.01	8.7	#N/A	0.867272727	#N/A
435	77	Wight Pit	WB-03-38	DD Core	77	#N/A	0.07	-0.01	8.4	#N/A	0.297272727	#N/A
436	79	Wight Pit	WB-03-39	DD Core	79	#N/A	0.52	-0.01	8.3	#N/A	1.205454545	#N/A
437	81	Wight Pit	WB-03-40	DD Core	81	#N/A	0.79	0.01	8.7	#N/A	1.194545455	#N/A
438	82	Wight Pit	WB-03-41	DD Core	82	#N/A	0.7	-0.01	8.5	#N/A	2.086363636	#N/A
439	83	Wight Pit	WB-03-41	DD Core	83	#N/A	0.65	-0.01	8.8	#N/A	1.02	#N/A
440	84	Wight Pit	WB-03-42	DD Core	84	#N/A	0.02	-0.01	8.7	#N/A	0.264545455	#N/A
441	85	Wight Pit	WB-03-42	DD Core	85	#N/A	1.15	0.01	8.5	#N/A	1.407272727	#N/A
442	87	Wight Pit	WB-03-43	DD Core	87	#N/A	0.68	-0.01	8.4	#N/A	1.205454545	#N/A
443	88	Wight Pit	WB-03-44	DD Core	88	#N/A	0.78	0.01	8.2	#N/A	1.418181818	#N/A
444	89	Wight Pit	WB-03-44	DD Core	89	#N/A	0.56	-0.01	8.1	#N/A	0.897272727	#N/A
445	91	Wight Pit	WB-03-46	DD Core	91	#N/A	0.51	-0.01	8.7	#N/A	0.580909091	#N/A
446	92	Wight Pit	WB-03-47	DD Core	92	#N/A	0.13	-0.01	7.8	#N/A	0.316363636	#N/A
447	93	Wight Pit	WB-03-47	DD Core	93	#N/A	0.83	0.01	8.2	#N/A	0.340909091	#N/A
448	94	Wight Pit	WB-03-48	DD Core	94	#N/A	0.37	-0.01	8.4	#N/A	1.036363636	#N/A
449	95	Wight Pit	WB-03-48	DD Core	95	#N/A	0.48	-0.01	8.8	#N/A	1.26	#N/A
450	96	Wight Pit	WB-03-49	DD Core	96	#N/A	0.46	0.01	8.6	#N/A	1.671818182	#N/A
451	97	Wight Pit	WB-03-49	DD Core	97	#N/A	0.97	-0.01	8.5	#N/A	1.131818182	#N/A
452	56439	Boundary Pit	#N/A	Blast Hole Cuttings	56439	#N/A	0.216	#N/A	#N/A	#N/A	#N/A	0.58
453	56439 dup	Boundary Pit	#N/A	Blast Hole Cuttings	56439 dup	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.57
454	56440	Boundary Pit	#N/A	Blast Hole Cuttings	56440	#N/A	0.164	#N/A	#N/A	#N/A	#N/A	0.76
455	56440 dup	Boundary Pit	#N/A	Blast Hole Cuttings	56440 dup	#N/A	0.167	#N/A	#N/A	#N/A	#N/A	0.76
456	56442	Boundary Pit	#N/A	Blast Hole Cuttings	56442	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.26
457	79152	Boundary Pit	#N/A	Blast Hole Cuttings	79152	#N/A	0.126	#N/A	#N/A	#N/A	#N/A	0.24
458	56446	Boundary Pit	#N/A	Blast Hole Cuttings	56446	#N/A	0.917	#N/A	#N/A	#N/A	#N/A	0.81
459	56448	Boundary Pit	#N/A	Blast Hole Cuttings	56448	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.28
460	79157	Boundary Pit	#N/A	Blast Hole Cuttings	79157	#N/A	0.25	#N/A	#N/A	#N/A	#N/A	0.25
461	79165	Boundary Pit	#N/A	Blast Hole Cuttings	79165	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.94
462	79162	Boundary Pit	#N/A	Blast Hole Cuttings	79162	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.33
463	79163	Boundary Pit	#N/A	Blast Hole Cuttings	79163	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.80
464	79409	Boundary Pit	#N/A	Blast Hole Cuttings	79409	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.42
465	79413	Boundary Pit	#N/A	Blast Hole Cuttings	79413	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	1.15
466	79454	Boundary Pit	#N/A	Blast Hole Cuttings	79454	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.24
467	79455	Boundary Pit	#N/A	Blast Hole Cuttings	79455	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.26
468	79456	Boundary Pit	#N/A	Blast Hole Cuttings	79456	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.46
469	79457	Boundary Pit	#N/A	Blast Hole Cuttings	79457	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.15
470	79464	Boundary Pit	#N/A	Blast Hole Cuttings	79464	#N/A	0.453	#N/A	#N/A	#N/A	#N/A	0.78
471	79401	Boundary Pit	B1180-12	Blast Hole Cuttings	79401	#N/A	2.48	#N/A	#N/A	#N/A	#N/A	0.34
472	79401	Boundary Pit	B1180-12	Blast Hole Cuttings	79401	#N/A	2.05	#N/A	#N/A	#N/A	#N/A	0.17
473	79402	Boundary Pit	B1180-12	Blast Hole Cuttings	79402	#N/A	0.911	#N/A	#N/A	#N/A	#N/A	0.16
474	79402	Boundary Pit	B1180-12	Blast Hole Cuttings	79402	#N/A	1.46	#N/A	#N/A	#N/A	#N/A	0.32
475	79403	Boundary Pit	B1180-12	Blast Hole Cuttings	79403	#N/A	0.886	#N/A	#N/A	#N/A	#N/A	0.13
476	79403	Boundary Pit	B1180-12	Blast Hole Cuttings	79403	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	0.13
477	79404	Boundary Pit	B1180-12	Blast Hole Cuttings	79404	#N/A	0.74	#N/A	#N/A	#N/A	#N/A	0.22
478	79404	Boundary Pit	B1180-12	Blast Hole Cuttings	79404	#N/A	0.872	#N/A	#N/A	#N/A	#N/A	0.30
479	M82319	Boundary Pit	B1168-13	Blast Hole Cuttings	M82319	#N/A	0.019	#N/A	#N/A	#N/A	#N/A	0.36
480	79153	Boundary Pit	B1168-12	Blast Hole Cuttings	79153	#N/A	1.35	#N/A	#N/A	#N/A	#N/A	0.37
481	79154	Boundary Pit	B1168-12	Blast Hole Cuttings	79154	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.36
482	79155	Boundary Pit	B1168-12	Blast Hole Cuttings	79155	#N/A	1.23	#N/A	#N/A	#N/A	#N/A	0.48
483	56447	Boundary Pit	B1168-11	Blast Hole Cuttings	56447	#N/A	0.904	#N/A	#N/A	#N/A	#N/A	0.31
484	56446	Boundary Pit	B1168-11	Blast Hole Cuttings	56446	#N/A	0.917	#N/A	#N/A	#N/A	#N/A	0.81
485	79451	Boundary Pit	B1156-23	Blast Hole Cuttings	79451	#N/A	1.44	#N/A	#N/A	#N/A	#N/A	0.47
486	79452	Boundary Pit	B1156-23	Blast Hole Cuttings	79452	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.69
487	79411	Boundary Pit	B1156-22	Blast Hole Cuttings	79411	#N/A	1.22	#N/A	#N/A	#N/A	#N/A	0.47
488	79412	Boundary Pit	B1156-22	Blast Hole Cuttings	79412	#N/A	1.05	#N/A	#N/A	#N/A	#N/A	0.41
489	79413	Boundary Pit	B1156-22	Blast Hole Cuttings	79413	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	1.15
490	79165	Boundary Pit	B1156-20	Blast Hole Cuttings	79165	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.94
491	79159	Boundary Pit	B1156-19	Blast Hole Cuttings	79159	#N/A	0.854	#N/A	#N/A	#N/A	#N/A	0.11
492	79160	Boundary Pit	B1156-19	Blast Hole Cuttings	79160	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	0.17
493	79156	Boundary Pit	B1156-18	Blast Hole Cuttings	79156	#N/A	1.65	#N/A	#N/A	#N/A	#N/A	0.42
494	79151	Boundary Pit	B1156-15	Blast Hole Cuttings	79151	#N/A	0.818	#N/A	#N/A	#N/A	#N/A	0.08
495	79152	Boundary Pit	B1156-15	Blast Hole Cuttings	79152	#N/A	0.126	#N/A	#N/A	#N/A	#N/A	0.24
496	56448	Boundary Pit	B1156-11	Blast Hole Cuttings	56448	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.28
497	56441	Boundary Pit	B1156-07	Blast Hole Cuttings	56441	#N/A	0.985	#N/A	#N/A	#N/A	#N/A	0.49
498	56442	Boundary Pit	B1156-07	Blast Hole Cuttings	56442	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.26
499	56443	Boundary Pit	B1156-07	Blast Hole Cuttings	56443	#N/A	0.376	#N/A	#N/A	#N/A	#N/A	0.42
500	56439	Boundary Pit	B1156-05	Blast Hole Cuttings	56439	#N/A	0.216	#N/A	#N/A	#N/A	#N/A	0.58
501	56439 dup	Boundary Pit	B1156-05	Blast Hole Cuttings	56439 dup	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.57
502	56440	Boundary Pit	B1156-05	Blast Hole Cuttings	56440	#N/A	0.164	#N/A	#N/A	#N/A	#N/A	0.76
503	56440 dup	Boundary Pit	B1156-05	Blast Hole Cuttings	56440 dup	#N/A	0.167	#N/A	#N/A	#N/A	#N/A	0.76
504	M82320	Boundary Pit	B1144-23	Blast Hole Cuttings	M82320	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.24
505	M 79203	Boundary Pit	B1144-20	Blast Hole Cuttings	M 79203	#N/A	1.24	#N/A	#N/A	#N/A	#N/A	0.51
506	M 79204	Boundary Pit	B1144-20	Blast Hole Cuttings	M 79204	#N/A	2.41	#N/A	#N/A	#N/A	#N/A	0.43
507	M 79467	Boundary Pit	B1144-16	Blast Hole Cuttings	M 79467	#N/A	0.915	#N/A	#N/A	#N/A	#N/A	1.07
508	M 79468	Boundary Pit	B1144-16	Blast Hole Cuttings	M 79468	#N/A	1.11	#N/A	#N/A	#N/A	#N/A	0.22
509	79454	Boundary Pit	B1144-13	Blast Hole Cuttings	79454	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.24

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
404	37	128	#N/A	#N/A	#N/A	1397	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	388	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
405	38	75	#N/A	#N/A	#N/A	758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
406	39	84	#N/A	#N/A	#N/A	1665	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	217	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
407	40	96	#N/A	#N/A	#N/A	1487	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	199	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
408	41	170	#N/A	#N/A	#N/A	665	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	95	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
409	42	126	#N/A	#N/A	#N/A	1286	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	566	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
410	44	192	#N/A	#N/A	#N/A	1384	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	437	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	#N/A
411	46	142	#N/A	#N/A	#N/A	1613	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	448	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
412	47	102	#N/A	#N/A	#N/A	1798	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	564	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
413	48	188	#N/A	#N/A	#N/A	56	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
414	49	117	#N/A	#N/A	#N/A	841	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
415	50	125	#N/A	#N/A	#N/A	1537	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	284	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
416	51	111	#N/A	#N/A	#N/A	1726	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	221	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
417	53	64	#N/A	#N/A	#N/A	1241	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	424	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	#N/A	#N/A	#N/A	#N/A
418	54	110	#N/A	#N/A	#N/A	1907	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	305	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.3	#N/A	#N/A	#N/A	#N/A	#N/A
419	55	81	#N/A	#N/A	#N/A	2121	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	425	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
420	56	99	#N/A	#N/A	#N/A	865	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	382	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
421	57	117	#N/A	#N/A	#N/A	1356	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	792	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	#N/A
422	58	64	#N/A	#N/A	#N/A	1124	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	251	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6	#N/A	#N/A	#N/A	#N/A	#N/A
423	59	150	#N/A	#N/A	#N/A	1811	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
424	62	86	#N/A	#N/A	#N/A	1935	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	113	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
425	63	125	#N/A	#N/A	#N/A	1758	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	250	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
426	64	126	#N/A	#N/A	#N/A	1213	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	948	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
427	65	95	#N/A	#N/A	#N/A	1996	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	523	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	#N/A
428	67	151	#N/A	#N/A	#N/A	1623	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.7	#N/A	#N/A	#N/A	#N/A	#N/A
429	69	104	#N/A	#N/A	#N/A	1056	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	163	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
430	70	137	#N/A	#N/A	#N/A	1592	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	207	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
431	71	96	#N/A	#N/A	#N/A	1559	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	193	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
432	74	65	#N/A	#N/A	#N/A	2159	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.9	#N/A	#N/A	#N/A	#N/A	#N/A
433	75	123	#N/A	#N/A	#N/A	1644	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	325	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
434	76	92	#N/A	#N/A	#N/A	1716	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	128	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
435	77	84	#N/A	#N/A	#N/A	1745	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
436	79	136	#N/A	#N/A	#N/A	1524	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	143	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
437	81	148	#N/A	#N/A	#N/A	1307	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	329	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
438	82	161	#N/A	#N/A	#N/A	1069	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	163	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.3	#N/A	#N/A	#N/A	#N/A	#N/A
439	83	99	#N/A	#N/A	#N/A	1633	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	82	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
440	84	90	#N/A	#N/A	#N/A	1515	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.1	#N/A	#N/A	#N/A	#N/A	#N/A
441	85	111	#N/A	#N/A	#N/A	1738	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	92	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.5	#N/A	#N/A	#N/A	#N/A	#N/A
442	87	128	#N/A	#N/A	#N/A	1324	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	230	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
443	88	137	#N/A	#N/A	#N/A	1514	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	419	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
444	89	106	#N/A	#N/A	#N/A	1304	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	162	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
445	91	59	#N/A	#N/A	#N/A	1459	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
446	92	195	#N/A	#N/A	#N/A	260	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	304	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
447	93	67	#N/A	#N/A	#N/A	1190	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	302	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.3	#N/A	#N/A	#N/A	#N/A	#N/A
448	94	136	#N/A	#N/A	#N/A	1423	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	#N/A	#N/A	#N/A	#N/A
449	95	146	#N/A	#N/A	#N/A	1421	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	422	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A
450	96	161	#N/A	#N/A	#N/A	1469	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	144	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.4	#N/A	#N/A	#N/A	#N/A	#N/A
451	97	125	#N/A	#N/A	#N/A	1371	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	293	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A	#N/A
452	56439	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
453	56439 dup	47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
454	56440	63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
455	56440 dup	63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
456	56442	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
457	79152	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
458	56446	67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
459	56448	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
460	79157	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
461	79165	79	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
462	79162	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
463	79163	67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
464	79409	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
465	79413	96	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
466	79454	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
467	79455	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
468	79456	39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
469	79457	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
470	79464	65	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
471	79401	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
472	79401	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
473	79402	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
474	79402	27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
475	79403	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
476	79403	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
477	79404	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
478	79404	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
479	M82319	30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
480	79153	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
481	79154	30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
482	79155	40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
483	56447	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
484	56446	67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
485	79451	40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
486	79452	57	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
487	79411	39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
488	79412	34	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
489	79413	96	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
490	79165	79	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
491	79159	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
492	79160	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
493	79156	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
494	79151	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
495	79152	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
496	56448	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
497	56441	41	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
498	56442	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
499	56443	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
500	56439	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
501	56439 dup	47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
502	56440	63	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
510	79461	Boundary Pit	B1144-13	Blast Hole Cuttings	79461	#N/A	1.61	#N/A	#N/A	#N/A	#N/A	0.45
511	79463	Boundary Pit	B1144-13	Blast Hole Cuttings	79463	#N/A	0.872	#N/A	#N/A	#N/A	#N/A	0.22
512	79464	Boundary Pit	B1144-13	Blast Hole Cuttings	79464	#N/A	0.453	#N/A	#N/A	#N/A	#N/A	0.78
513	79408	Boundary Pit	B1144-11	Blast Hole Cuttings	79408	#N/A	0.386	#N/A	#N/A	#N/A	#N/A	0.25
514	79455	Boundary Pit	B1144-10	Blast Hole Cuttings	79455	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.26
515	79161	Boundary Pit	B1144-08	Blast Hole Cuttings	79161	#N/A	1.17	#N/A	#N/A	#N/A	#N/A	0.47
516	79162	Boundary Pit	B1144-08	Blast Hole Cuttings	79162	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.33
517	79163	Boundary Pit	B1144-08	Blast Hole Cuttings	79163	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.80
518	79409	Boundary Pit	B1144-08	Blast Hole Cuttings	79409	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.42
519	79410	Boundary Pit	B1144-08	Blast Hole Cuttings	79410	#N/A	1.68	#N/A	#N/A	#N/A	#N/A	0.33
520	79157	Boundary Pit	B1144-05	Blast Hole Cuttings	79157	#N/A	0.25	#N/A	#N/A	#N/A	#N/A	0.25
521	M79201	Boundary Pit	B1132-5	Blast Hole Cuttings	M79201	#N/A	0.028	#N/A	#N/A	#N/A	#N/A	0.05
522	M 79469	Boundary Pit	B1132-4	Blast Hole Cuttings	M 79469	#N/A	0.067	#N/A	#N/A	#N/A	#N/A	0.11
523	M79212	Boundary Pit	B1132-19	Blast Hole Cuttings	M79212	#N/A	0.489	#N/A	#N/A	#N/A	#N/A	0.71
524	M79213	Boundary Pit	B1132-19	Blast Hole Cuttings	M79213	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.32
525	M79420	Boundary Pit	B1132-17	Blast Hole Cuttings	M79420	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.24
526	M79421	Boundary Pit	B1132-17	Blast Hole Cuttings	M79421	#N/A	0.467	#N/A	#N/A	#N/A	#N/A	0.84
527	M79419	Boundary Pit	B1132-16	Blast Hole Cuttings	M79419	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.14
528	M79418	Boundary Pit	B1132-13	Blast Hole Cuttings	M79418	#N/A	0.041	#N/A	#N/A	#N/A	#N/A	0.09
529	M79210	Boundary Pit	B1132-11	Blast Hole Cuttings	M79210	#N/A	0.051	#N/A	#N/A	#N/A	#N/A	0.11
530	M79209	Boundary Pit	B1132-10	Blast Hole Cuttings	M79209	#N/A	1.07	#N/A	#N/A	#N/A	#N/A	0.22
531	79457	Boundary Pit	B1132-02	Blast Hole Cuttings	79457	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.15
532	79456	Boundary Pit	B1132-01	Blast Hole Cuttings	79456	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.46
533	M 82338	Boundary Pit	B1120-21	Blast Hole Cuttings	M 82338	#N/A	2	#N/A	#N/A	#N/A	#N/A	0.27
534	M 82339	Boundary Pit	B1120-21	Blast Hole Cuttings	M 82339	#N/A	0.767	#N/A	#N/A	#N/A	#N/A	1.66
535	M82481	Boundary Pit	B1120-19	Blast Hole Cuttings	M82481	#N/A	0.075	#N/A	#N/A	#N/A	#N/A	0.19
536	M82480	Boundary Pit	B1120-18	Blast Hole Cuttings	M82480	#N/A	0.031	#N/A	#N/A	#N/A	#N/A	0.22
537	M79168	Boundary Pit	B1120-12	Blast Hole Cuttings	M79168	#N/A	0.155	#N/A	#N/A	#N/A	#N/A	0.41
538	M79167	Boundary Pit	B1120-11	Blast Hole Cuttings	M79167	#N/A	0.056	#N/A	#N/A	#N/A	#N/A	0.05
539	M79166	Boundary Pit	B1120-10	Blast Hole Cuttings	M79166	#N/A	0.787	#N/A	#N/A	#N/A	#N/A	0.33
540	M79220	Boundary Pit	B1120-09	Blast Hole Cuttings	M79220	#N/A	0.116	#N/A	#N/A	#N/A	#N/A	0.43
541	M79219	Boundary Pit	B1120-08	Blast Hole Cuttings	M79219	#N/A	0.896	#N/A	#N/A	#N/A	#N/A	0.73
542	M79215	Boundary Pit	B1120-07	Blast Hole Cuttings	M79215	#N/A	0.061	#N/A	#N/A	#N/A	#N/A	0.07
543	M79214	Boundary Pit	B1120-06	Blast Hole Cuttings	M79214	#N/A	0.081	#N/A	#N/A	#N/A	#N/A	0.10
544	M 82677	Boundary Pit	B1108-13	Blast Hole Cuttings	M 82677	#N/A	1.28	#N/A	#N/A	#N/A	#N/A	0.54
545	82316	Boundary Pit	B1108-12	Blast Hole Cuttings	82316	#N/A	0.072	#N/A	#N/A	#N/A	#N/A	0.06
546	82317	Boundary Pit	B1108-12	Blast Hole Cuttings	82317	#N/A	0.064	#N/A	#N/A	#N/A	#N/A	0.05
547	M82303	Boundary Pit	B1108-11	Blast Hole Cuttings	M82303	#N/A	0.086	#N/A	#N/A	#N/A	#N/A	0.06
548	M82304	Boundary Pit	B1108-10	Blast Hole Cuttings	M82304	#N/A	0.038	#N/A	#N/A	#N/A	#N/A	0.09
549	M82301	Boundary Pit	B1108-09	Blast Hole Cuttings	M82301	#N/A	0.852	#N/A	#N/A	#N/A	#N/A	0.35
550	M82302	Boundary Pit	B1108-09	Blast Hole Cuttings	M82302	#N/A	0.111	#N/A	#N/A	#N/A	#N/A	0.06
551	M82496	Boundary Pit	B1108-06	Blast Hole Cuttings	M82496	#N/A	0.613	#N/A	#N/A	#N/A	#N/A	0.37
552	M82497	Boundary Pit	B1108-05	Blast Hole Cuttings	M82497	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.14
553	M82478	Boundary Pit	B1108-01	Blast Hole Cuttings	M82478	#N/A	0.03	#N/A	#N/A	#N/A	#N/A	0.15
554	82501	Boundary Pit	B1096-8	Blast Hole Cuttings	82501	#N/A	0.056	#N/A	#N/A	#N/A	#N/A	0.03
555	82502	Boundary Pit	B1096-5	Blast Hole Cuttings	82502	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.22
556	82503	Boundary Pit	B1096-2	Blast Hole Cuttings	82503	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.21
557	M82323	Boundary Pit	B1096-18	Blast Hole Cuttings	M82323	#N/A	0.059	#N/A	#N/A	#N/A	#N/A	0.08
558	M82322	Boundary Pit	B1096-17	Blast Hole Cuttings	M82322	#N/A	0.032	#N/A	#N/A	#N/A	#N/A	0.17
559	M82321	Boundary Pit	B1096-16	Blast Hole Cuttings	M82321	#N/A	0.115	#N/A	#N/A	#N/A	#N/A	0.12
560	M 82516	Boundary Pit	B1096-15	Blast Hole Cuttings	M 82516	#N/A	0.086	#N/A	#N/A	#N/A	#N/A	0.16
561	M 82517	Boundary Pit	B1096-15	Blast Hole Cuttings	M 82517	#N/A	0.414	#N/A	#N/A	#N/A	#N/A	0.21
562	M 82514	Boundary Pit	B1096-13	Blast Hole Cuttings	M 82514	#N/A	0.107	#N/A	#N/A	#N/A	#N/A	0.44
563	M 82515	Boundary Pit	B1096-13	Blast Hole Cuttings	M 82515	#N/A	0.078	#N/A	#N/A	#N/A	#N/A	0.11
564	M 82513	Boundary Pit	B1096-11	Blast Hole Cuttings	M 82513	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.26
565	M 82512	Boundary Pit	B1096-09	Blast Hole Cuttings	M 82512	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.06
566	M82318	Boundary Pit	B1084-2	Blast Hole Cuttings	M82318	#N/A	0.042	#N/A	#N/A	#N/A	#N/A	0.15
567	M 82530	Boundary Pit	B1084-09	Blast Hole Cuttings	M 82530	#N/A	0.073	#N/A	#N/A	#N/A	#N/A	0.14
568	M 82676	Boundary Pit	B1072-04	Blast Hole Cuttings	M 82676	#N/A	0.088	#N/A	#N/A	#N/A	#N/A	0.12
569	M 82529	Boundary Pit	B1072-01	Blast Hole Cuttings	M 82529	#N/A	0.048	#N/A	#N/A	#N/A	#N/A	0.10
570	1065-1	Boundary Pit	#N/A	Blast Hole Cuttings	1065-1	#N/A	0.479	#N/A	#N/A	#N/A	#N/A	0.72
571	1084-2	Boundary Pit	#N/A	Blast Hole Cuttings	1084-2	#N/A	1.28	#N/A	#N/A	#N/A	#N/A	0.63
572	1111-1	Boundary Pit	#N/A	Blast Hole Cuttings	1111-1	#N/A	0.044	#N/A	#N/A	#N/A	#N/A	1.06
573	1526-2	Boundary Pit	#N/A	Blast Hole Cuttings	1526-2	#N/A	0.252	#N/A	#N/A	#N/A	#N/A	0.96
574	1639-1	Boundary Pit	#N/A	Blast Hole Cuttings	1639-1	#N/A	0.096	#N/A	#N/A	#N/A	#N/A	0.82
575	320198	Boundary Pit	ND-06-05 6.1-7.5	DD Core	320198	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	0.74
576	320302	Boundary Pit	ND-06-06 17.5-20	DD Core	320302	#N/A	0.197	#N/A	#N/A	#N/A	#N/A	1.25
577	320380	Boundary Pit	ND-06-07 30-32.5	DD Core	320380	#N/A	0.685	#N/A	#N/A	#N/A	#N/A	1.26
578	320447	Boundary Pit	ND-06-08 22.5-25	DD Core	320447	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.86
579	320534	Boundary Pit	ND-06-09 4.57-5	DD Core	320534	#N/A	0.41	#N/A	#N/A	#N/A	#N/A	0.77
580	320735	Boundary Pit	ND-06-10 5-7.5	DD Core	320735	#N/A	0.511	#N/A	#N/A	#N/A	#N/A	0.97
581	320855	Boundary Pit	ND-06-11 18.75-20	DD Core	320855	#N/A	0.025	#N/A	#N/A	#N/A	#N/A	0.60
582	320880	Boundary Pit	ND-06-11 67.5-70	DD Core	320880	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	1.14
583	215305	Boundary Pit	ND-06-14 45-47.5	DD Core	215305	#N/A	0.298	#N/A	#N/A	#N/A	#N/A	0.82
584	215401	Boundary Pit	ND-06-15 15-15.24	DD Core	215401	#N/A	0.659	#N/A	#N/A	#N/A	#N/A	0.71
585	265862	Boundary Pit	ND-06-16 45-47.5	DD Core	265862	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.75
586	265988	Boundary Pit	ND-06-17 12.5-15	DD Core	265988	#N/A	0.729	#N/A	#N/A	#N/A	#N/A	1.04
587	400129	Boundary Pit	ND-06-18 15-17.5	DD Core	400129	#N/A	0.188	#N/A	#N/A	#N/A	#N/A	0.97
588	400251	Boundary Pit	ND-06-19 7.5-10	DD Core	400251	#N/A	0.186	#N/A	#N/A	#N/A	#N/A	0.66
589	320856	Boundary Pit	ND-06-11 20-22.5	DD Core	320856	#N/A	1.08	#N/A	#N/A	#N/A	#N/A	1.14
590	320881	Boundary Pit	ND-06-11 70-72.5	DD Core	320881	#N/A	0.025	#N/A	#N/A	#N/A	#N/A	0.60
591	Z1030-04	SE Zone	#N/A	Blast Hole Cuttings	Z1030-04	#N/A	0.661	#N/A	#N/A	#N/A	#N/A	0.20
592	Z1030-05	SE Zone	#N/A	Blast Hole Cuttings	Z1030-05	#N/A	0.959	#N/A	#N/A	#N/A	#N/A	0.19
593	Z1030-06	SE Zone	#N/A	Blast Hole Cuttings	Z1030-06	#N/A	0.663	#N/A	#N/A	#N/A	#N/A	0.15
594	Z1030-07	SE Zone	#N/A	Blast Hole Cuttings	Z1030-07	#N/A	0.756	#N/A	#N/A	#N/A	#N/A	0.08
595	Z1030-07	SE Zone	#N/A	Blast Hole Cuttings	Z1030-07	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	0.11

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
510	79461	38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
511	79463	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
512	79464	65	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
513	79408	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
514	79455	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
515	79161	39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
516	79162	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
517	79163	67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
518	79409	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
519	79410	27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
520	79157	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
521	M79201	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
522	M 79469	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
523	M79212	59	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
524	M79213	27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
525	M79420	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
526	M79421	70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
527	M79419	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
528	M79418	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
529	M79210	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
530	M79209	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
531	79457	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
532	79456	39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
533	M 82338	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
534	M 82339	138	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
535	M82481	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
536	M82480	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
537	M79168	34	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
538	M79167	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
539	M79166	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
540	M79220	36	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
541	M79219	61	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
542	M79215	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
543	M79214	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
544	M 82677	45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
545	82316	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
546	82317	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
547	M82303	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
548	M82304	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
549	M82301	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
550	M82302	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
551	M82496	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
552	M82497	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
553	M82478	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
554	82501	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
555	82502	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
556	82503	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
557	M82323	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
558	M82322	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
559	M82321	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
560	M 82516	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
561	M 82517	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
562	M 82514	36	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
563	M 82515	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
564	M 82513	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
565	M 82512	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
566	M82318	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
567	M 82530	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
568	M 82676	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
569	M 82529	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
570	1065-1	60	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
571	1084-2	53	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
572	1111-1	88	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
573	1526-2	80	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
574	1639-1	69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
575	320198	62	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
576	320302	104	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
577	320380	105	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
578	320447	72	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
579	320534	64	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
580	320735	80	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
581	320855	50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
582	320880	95	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
583	215305	68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
584	215401	60	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
585	265862	63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
586	265988	87	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
587	400129	81	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
588	400251	55	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
589	320856	95	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
590	320881	50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
591	Z1030-04	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
592	Z1030-05	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
593	Z1030-06	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
594	Z1030-07	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
595	Z1030-07	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
596	Z1030-08	SE Zone	#N/A	Blast Hole Cuttings	Z1030-08	#N/A	0.685	#N/A	#N/A	#N/A	#N/A	0.19
597	Z1030-08	SE Zone	#N/A	Blast Hole Cuttings	Z1030-08	#N/A	0.767	#N/A	#N/A	#N/A	#N/A	0.09
598	Z1030-09	SE Zone	#N/A	Blast Hole Cuttings	Z1030-09	#N/A	0.471	#N/A	#N/A	#N/A	#N/A	0.25
599	Z1030-09	SE Zone	#N/A	Blast Hole Cuttings	Z1030-09	#N/A	0.689	#N/A	#N/A	#N/A	#N/A	0.13
600	Z1030-10	SE Zone	#N/A	Blast Hole Cuttings	Z1030-10	#N/A	0.928	#N/A	#N/A	#N/A	#N/A	0.21
601	Z1040-01	SE Zone	#N/A	Blast Hole Cuttings	Z1040-01	#N/A	0.185	#N/A	#N/A	#N/A	#N/A	0.03
602	Z1040-04	SE Zone	#N/A	Blast Hole Cuttings	Z1040-04	#N/A	0.754	#N/A	#N/A	#N/A	#N/A	0.05
603	Z1040-05	SE Zone	#N/A	Blast Hole Cuttings	Z1040-05	#N/A	0.819	#N/A	#N/A	#N/A	#N/A	0.07
604	Z1040-06	SE Zone	#N/A	Blast Hole Cuttings	Z1040-06	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.10
605	Z1040-07	SE Zone	#N/A	Blast Hole Cuttings	Z1040-07	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.07
606	Z1040-08	SE Zone	#N/A	Blast Hole Cuttings	Z1040-08	#N/A	0.55	#N/A	#N/A	#N/A	#N/A	0.03
607	Z1040-09	SE Zone	#N/A	Blast Hole Cuttings	Z1040-09	#N/A	0.94	#N/A	#N/A	#N/A	#N/A	0.11
608	Z1040-10	SE Zone	#N/A	Blast Hole Cuttings	Z1040-10	#N/A	0.482	#N/A	#N/A	#N/A	#N/A	0.11
609	Z1040-11	SE Zone	#N/A	Blast Hole Cuttings	Z1040-11	#N/A	0.729	#N/A	#N/A	#N/A	#N/A	0.06
610	Z1040-12	SE Zone	#N/A	Blast Hole Cuttings	Z1040-12	#N/A	0.315	#N/A	#N/A	#N/A	#N/A	0.08
611	Z1040-13	SE Zone	#N/A	Blast Hole Cuttings	Z1040-13	#N/A	0.583	#N/A	#N/A	#N/A	#N/A	0.23
612	Z1040-14	SE Zone	#N/A	Blast Hole Cuttings	Z1040-14	#N/A	0.898	#N/A	#N/A	#N/A	#N/A	0.14
613	Z1040-15	SE Zone	#N/A	Blast Hole Cuttings	Z1040-15	#N/A	0.798	#N/A	#N/A	#N/A	#N/A	0.16
614	Z1050-02	SE Zone	#N/A	Blast Hole Cuttings	Z1050-02	#N/A	0.323	#N/A	#N/A	#N/A	#N/A	0.04
615	Z1050-03	SE Zone	#N/A	Blast Hole Cuttings	Z1050-03	#N/A	0.478	#N/A	#N/A	#N/A	#N/A	0.02
616	Z1050-04	SE Zone	#N/A	Blast Hole Cuttings	Z1050-04	#N/A	0.679	#N/A	#N/A	#N/A	#N/A	0.11
617	Z1050-05	SE Zone	#N/A	Blast Hole Cuttings	Z1050-05	#N/A	0.91	#N/A	#N/A	#N/A	#N/A	0.09
618	Z1050-06	SE Zone	#N/A	Blast Hole Cuttings	Z1050-06	#N/A	0.886	#N/A	#N/A	#N/A	#N/A	0.09
619	Z1050-07	SE Zone	#N/A	Blast Hole Cuttings	Z1050-07	#N/A	0.708	#N/A	#N/A	#N/A	#N/A	0.18
620	Z1050-09	SE Zone	#N/A	Blast Hole Cuttings	Z1050-09	#N/A	0.427	#N/A	#N/A	#N/A	#N/A	0.08
621	Z1050-10	SE Zone	#N/A	Blast Hole Cuttings	Z1050-10	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.21
622	Z1060-05	SE Zone	#N/A	Blast Hole Cuttings	Z1060-05	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	0.13
623	Z1060-09	SE Zone	#N/A	Blast Hole Cuttings	Z1060-09	#N/A	0.472	#N/A	#N/A	#N/A	#N/A	0.09
624	106257	SE Zone	#N/A	Blast Hole Cuttings	106257	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.97
625	106276	SE Zone	#N/A	Blast Hole Cuttings	106276	#N/A	0.091	#N/A	#N/A	#N/A	#N/A	0.43
626	106585	SE Zone	#N/A	Blast Hole Cuttings	106585	#N/A	0.105	#N/A	#N/A	#N/A	#N/A	0.23
627	106740	SE Zone	#N/A	Blast Hole Cuttings	106740	#N/A	0.218	#N/A	#N/A	#N/A	#N/A	0.31
628	106838	SE Zone	#N/A	Blast Hole Cuttings	106838	#N/A	0.148	#N/A	#N/A	#N/A	#N/A	0.40
629	106933	SE Zone	#N/A	Blast Hole Cuttings	106933	#N/A	2.49	#N/A	#N/A	#N/A	#N/A	0.54
630	107035	SE Zone	#N/A	Blast Hole Cuttings	107035	#N/A	0.168	#N/A	#N/A	#N/A	#N/A	0.31
631	107291	SE Zone	#N/A	Blast Hole Cuttings	107291	#N/A	0.226	#N/A	#N/A	#N/A	#N/A	0.10
632	109016	SE Zone	#N/A	Blast Hole Cuttings	109016	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.67
633	109054	SE Zone	#N/A	Blast Hole Cuttings	109054	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.30
634	109323	SE Zone	#N/A	Blast Hole Cuttings	109323	#N/A	1.7	#N/A	#N/A	#N/A	#N/A	0.23
635	109434	SE Zone	#N/A	Blast Hole Cuttings	109434	#N/A	0.074	#N/A	#N/A	#N/A	#N/A	0.15
636	109445	SE Zone	#N/A	Blast Hole Cuttings	109445	#N/A	1.47	#N/A	#N/A	#N/A	#N/A	0.10
637	111916	SE Zone	#N/A	Blast Hole Cuttings	111916	#N/A	0.16	#N/A	#N/A	#N/A	#N/A	0.23
638	23048	SE Zone	#N/A	Blast Hole Cuttings	23048	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.22
639	23617	SE Zone	#N/A	Blast Hole Cuttings	23617	#N/A	0.713	#N/A	#N/A	#N/A	#N/A	0.19
640	23892	SE Zone	#N/A	Blast Hole Cuttings	23892	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.11
641	30964	SE Zone	#N/A	Blast Hole Cuttings	30964	#N/A	0.624	#N/A	#N/A	#N/A	#N/A	0.57
642	90607	SE Zone	#N/A	Blast Hole Cuttings	90607	#N/A	1.89	#N/A	#N/A	#N/A	#N/A	0.45
643	106606	SE Zone	#N/A	Blast Hole Cuttings	106606	#N/A	0.026	#N/A	#N/A	#N/A	#N/A	0.22
644	106622	SE Zone	#N/A	Blast Hole Cuttings	106622	#N/A	0.061	#N/A	#N/A	#N/A	#N/A	0.12
645	106718	SE Zone	#N/A	Blast Hole Cuttings	106718	#N/A	0.189	#N/A	#N/A	#N/A	#N/A	0.46
646	106854	SE Zone	#N/A	Blast Hole Cuttings	106854	#N/A	0.172	#N/A	#N/A	#N/A	#N/A	0.14
647	106867	SE Zone	#N/A	Blast Hole Cuttings	106867	#N/A	0.315	#N/A	#N/A	#N/A	#N/A	0.31
648	107253	SE Zone	#N/A	Blast Hole Cuttings	107253	#N/A	0.085	#N/A	#N/A	#N/A	#N/A	0.35
649	109028	SE Zone	#N/A	Blast Hole Cuttings	109028	#N/A	0.397	#N/A	#N/A	#N/A	#N/A	0.81
650	109463	SE Zone	#N/A	Blast Hole Cuttings	109463	#N/A	0.543	#N/A	#N/A	#N/A	#N/A	0.48
651	111998	SE Zone	#N/A	Blast Hole Cuttings	111998	#N/A	0.101	#N/A	#N/A	#N/A	#N/A	0.30
652	121049	SE Zone	#N/A	Blast Hole Cuttings	121049	#N/A	0.487	#N/A	#N/A	#N/A	#N/A	0.84
653	121071	SE Zone	#N/A	Blast Hole Cuttings	121071	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.26
654	121157	SE Zone	#N/A	Blast Hole Cuttings	121157	#N/A	0.84	#N/A	#N/A	#N/A	#N/A	0.27
655	30768	SE Zone	#N/A	Blast Hole Cuttings	30768	#N/A	0.662	#N/A	#N/A	#N/A	#N/A	0.28
656	30977	SE Zone	#N/A	Blast Hole Cuttings	30977	#N/A	0.399	#N/A	#N/A	#N/A	#N/A	0.68
657	30988	SE Zone	#N/A	Blast Hole Cuttings	30988	#N/A	0.235	#N/A	#N/A	#N/A	#N/A	0.59
658	1520	SE Zone	#N/A	Blast Hole Cuttings	1520	#N/A	0.428	#N/A	#N/A	#N/A	#N/A	0.03
659	1922	SE Zone	#N/A	Blast Hole Cuttings	1922	#N/A	0.296	#N/A	#N/A	#N/A	#N/A	0.05
660	1926	SE Zone	#N/A	Blast Hole Cuttings	1926	#N/A	0.013	#N/A	#N/A	#N/A	#N/A	0.02
661	2324	SE Zone	#N/A	Blast Hole Cuttings	2324	#N/A	0.161	#N/A	#N/A	#N/A	#N/A	0.05
662	2328	SE Zone	#N/A	Blast Hole Cuttings	2328	#N/A	0.107	#N/A	#N/A	#N/A	#N/A	0.05
663	2726	SE Zone	#N/A	Blast Hole Cuttings	2726	#N/A	0.218	#N/A	#N/A	#N/A	#N/A	0.05
664	2730	SE Zone	#N/A	Blast Hole Cuttings	2730	#N/A	0.054	#N/A	#N/A	#N/A	#N/A	0.27
665	3124	SE Zone	#N/A	Blast Hole Cuttings	3124	#N/A	0.533	#N/A	#N/A	#N/A	#N/A	0.19
666	3128	SE Zone	#N/A	Blast Hole Cuttings	3128	#N/A	0.038	#N/A	#N/A	#N/A	#N/A	0.04
667	3132	SE Zone	#N/A	Blast Hole Cuttings	3132	#N/A	0.07	#N/A	#N/A	#N/A	#N/A	0.03
668	2013	SE Zone	#N/A	Blast Hole Cuttings	2013	#N/A	0.173	#N/A	#N/A	#N/A	#N/A	0.12
669	2106	SE Zone	#N/A	Blast Hole Cuttings	2106	#N/A	0.608	#N/A	#N/A	#N/A	#N/A	0.08
670	2114	SE Zone	#N/A	Blast Hole Cuttings	2114	#N/A	0.466	#N/A	#N/A	#N/A	#N/A	0.16
671	2007	SE Zone	#N/A	Blast Hole Cuttings	2007	#N/A	0.502	#N/A	#N/A	#N/A	#N/A	0.07
672	2218	SE Zone	#N/A	Blast Hole Cuttings	2218	#N/A	0.546	#N/A	#N/A	#N/A	#N/A	0.13
673	2244	SE Zone	#N/A	Blast Hole Cuttings	2244	#N/A	0.265	#N/A	#N/A	#N/A	#N/A	0.21
674	2248	SE Zone	#N/A	Blast Hole Cuttings	2248	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	0.09
675	2203	SE Zone	#N/A	Blast Hole Cuttings	2203	#N/A	0.396	#N/A	#N/A	#N/A	#N/A	0.10
676	5005	SE Zone	#N/A	Blast Hole Cuttings	5005	#N/A	0.944	#N/A	#N/A	#N/A	#N/A	0.24
677	5064	SE Zone	#N/A	Blast Hole Cuttings	5064	#N/A	0.506	#N/A	#N/A	#N/A	#N/A	0.34
678	5500	SE Zone	#N/A	Blast Hole Cuttings	5500	#N/A	1.36	#N/A	#N/A	#N/A	#N/A	0.26
679	5508	SE Zone	#N/A	Blast Hole Cuttings	5508	#N/A	1.77	#N/A	#N/A	#N/A	#N/A	0.19
680	5512	SE Zone	#N/A	Blast Hole Cuttings	5512	#N/A	0.492	#N/A	#N/A	#N/A	#N/A	0.23
681	5527	SE Zone	#N/A	Blast Hole Cuttings	5527	#N/A	0.646	#N/A	#N/A	#N/A	#N/A	0.18
682	5529	SE Zone	#N/A	Blast Hole Cuttings	5529	#N/A	0.961	#N/A	#N/A	#N/A	#N/A	0.19
683	5544	SE Zone	#N/A	Blast Hole Cuttings	5544	#N/A	1.88	#N/A	#N/A	#N/A	#N/A	0.23

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
596	Z1030-08	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
597	Z1030-08	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
598	Z1030-09	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
599	Z1030-09	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
600	Z1030-10	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
601	Z1040-01	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
602	Z1040-04	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
603	Z1040-05	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
604	Z1040-06	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
605	Z1040-07	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
606	Z1040-08	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
607	Z1040-09	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
608	Z1040-10	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
609	Z1040-11	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
610	Z1040-12	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
611	Z1040-13	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
612	Z1040-14	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
613	Z1040-15	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
614	Z1050-02	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
615	Z1050-03	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
616	Z1050-04	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
617	Z1050-05	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
618	Z1050-06	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
619	Z1050-07	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
620	Z1050-09	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
621	Z1050-10	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
622	Z1060-05	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
623	Z1060-09	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
624	106257	81	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
625	106276	35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
626	106585	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
627	106740	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
628	106838	33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
629	106933	45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
630	107035	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
631	107291	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
632	109016	56	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
633	109054	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
634	109323	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
635	109434	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
636	109445	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
637	111916	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
638	23048	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
639	23617	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
640	23892	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
641	30964	47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
642	90607	38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
643	106606	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
644	106622	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
645	106718	38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
646	106854	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
647	106867	26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
648	107253	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
649	109028	67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
650	109463	40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
651	111998	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
652	121049	70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
653	121071	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
654	121157	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
655	30768	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
656	30977	56	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
657	30988	49	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
658	1520	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
659	1922	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
660	1926	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
661	2324	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
662	2328	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
663	2726	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
664	2730	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
665	3124	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
666	3128	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
667	3132	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
668	2013	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
669	2106	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
670	2114	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
671	2007	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
672	2218	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
673	2244	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
674	2248	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
675	2203	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
676	5005	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
677	5064	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
678	5500	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
679	5508	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
680	5512	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
681	5527	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
682	5529	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
683	5544	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
684	6511	SE Zone	#N/A	Blast Hole Cuttings	6511	#N/A	0.538	#N/A	#N/A	#N/A	#N/A	0.19
685	6516	SE Zone	#N/A	Blast Hole Cuttings	6516	#N/A	0.389	#N/A	#N/A	#N/A	#N/A	0.21
686	6570	SE Zone	#N/A	Blast Hole Cuttings	6570	#N/A	2.63	#N/A	#N/A	#N/A	#N/A	0.30
687	6580	SE Zone	#N/A	Blast Hole Cuttings	6580	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.24
688	Z10006	SE Zone	#N/A	Blast Hole Cuttings	Z10006	#N/A	1.16	#N/A	#N/A	#N/A	#N/A	0.10
689	Z10009	SE Zone	#N/A	Blast Hole Cuttings	Z10009	#N/A	1.51	#N/A	#N/A	#N/A	#N/A	0.07
690	Z10019	SE Zone	#N/A	Blast Hole Cuttings	Z10019	#N/A	0.823	#N/A	#N/A	#N/A	#N/A	0.06
691	Z10042	SE Zone	#N/A	Blast Hole Cuttings	Z10042	#N/A	0.662	#N/A	#N/A	#N/A	#N/A	0.19
692	Z10045	SE Zone	#N/A	Blast Hole Cuttings	Z10045	#N/A	1.55	#N/A	#N/A	#N/A	#N/A	0.04
693	5212	SE Zone	Z1080-05	Blast Hole Cuttings	5212	#N/A	1.56	#N/A	#N/A	#N/A	#N/A	0.04
694	7283	SE Zone	Z1080-05	Blast Hole Cuttings	7283	#N/A	2.17	#N/A	#N/A	#N/A	#N/A	0.06
695	5092	SE Zone	Z1080-05	Blast Hole Cuttings	5092	#N/A	1.16	#N/A	#N/A	#N/A	#N/A	0.06
696	5203	SE Zone	Z1080-05	Blast Hole Cuttings	5203	#N/A	1.01	#N/A	#N/A	#N/A	#N/A	0.05
697	5267	SE Zone	Z1080-05	Blast Hole Cuttings	5267	#N/A	0.411	#N/A	#N/A	#N/A	#N/A	0.03
698	5246	SE Zone	Z1080-05	Blast Hole Cuttings	5246	#N/A	0.866	#N/A	#N/A	#N/A	#N/A	0.05
699	7273	SE Zone	Z1080-05	Blast Hole Cuttings	7273	#N/A	1.96	#N/A	#N/A	#N/A	#N/A	0.13
700	7315	SE Zone	Z1080-05	Blast Hole Cuttings	7315	#N/A	0.362	#N/A	#N/A	#N/A	#N/A	0.03
701	7263	SE Zone	Z1080-05	Blast Hole Cuttings	7263	#N/A	0.445	#N/A	#N/A	#N/A	#N/A	0.07
702	7202	SE Zone	Z1080-05	Blast Hole Cuttings	7202	#N/A	0.168	#N/A	#N/A	#N/A	#N/A	0.03
703	7297	SE Zone	Z1080-05	Blast Hole Cuttings	7297	#N/A	0.77	#N/A	#N/A	#N/A	#N/A	0.14
704	7319	SE Zone	Z1080-05	Blast Hole Cuttings	7319	#N/A	0.422	#N/A	#N/A	#N/A	#N/A	0.38
705	7182	SE Zone	Z1080-05	Blast Hole Cuttings	7182	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.69
706	7001	SE Zone	Z1070-07	Blast Hole Cuttings	7001	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	0.32
707	11019	SE Zone	Z1060-11	Blast Hole Cuttings	11019	#N/A	1.03	#N/A	#N/A	#N/A	#N/A	0.22
708	11024	SE Zone	Z1060-11	Blast Hole Cuttings	11024	#N/A	1.8	#N/A	#N/A	#N/A	#N/A	0.23
709	11035	SE Zone	Z1060-11	Blast Hole Cuttings	11035	#N/A	1.1	#N/A	#N/A	#N/A	#N/A	0.14
710	11043	SE Zone	Z1060-11	Blast Hole Cuttings	11043	#N/A	0.624	#N/A	#N/A	#N/A	#N/A	0.11
711	11057	SE Zone	Z1060-11	Blast Hole Cuttings	11057	#N/A	2.6	#N/A	#N/A	#N/A	#N/A	0.11
712	11255	SE Zone	Z1060-11	Blast Hole Cuttings	11255	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.22
713	11314	SE Zone	Z1060-11	Blast Hole Cuttings	11314	#N/A	1.98	#N/A	#N/A	#N/A	#N/A	0.12
714	11443	SE Zone	Z1060-11	Blast Hole Cuttings	11443	#N/A	0.226	#N/A	#N/A	#N/A	#N/A	0.27
715	11512	SE Zone	Z1060-11	Blast Hole Cuttings	11512	#N/A	1.9	#N/A	#N/A	#N/A	#N/A	0.09
716	11608	SE Zone	Z1060-11	Blast Hole Cuttings	11608	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.07
717	11216	SE Zone	Z1060-11	Blast Hole Cuttings	11216	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.02
718	11222	SE Zone	Z1060-11	Blast Hole Cuttings	11222	#N/A	0.848	#N/A	#N/A	#N/A	#N/A	0.09
719	11211	SE Zone	Z1060-11	Blast Hole Cuttings	11211	#N/A	0.007	#N/A	#N/A	#N/A	#N/A	0.28
720	11325	SE Zone	Z1060-11	Blast Hole Cuttings	11325	#N/A	0.265	#N/A	#N/A	#N/A	#N/A	0.21
721	11405	SE Zone	Z1060-11	Blast Hole Cuttings	11405	#N/A	0.004	#N/A	#N/A	#N/A	#N/A	0.04
722	11809	SE Zone	Z1060-11	Blast Hole Cuttings	11809	#N/A	0.103	#N/A	#N/A	#N/A	#N/A	0.64
723	P1060-01	Pond Zone	Pond Pit. Holes: 1154, 1017, 1020, 1104, 1043, 1049	Blast Hole Cuttings	P1060-01	#N/A	0.548	#N/A	#N/A	#N/A	#N/A	1.74
724	P1070-01	Pond Zone	Pond Pit. Holes: 1149, 1090, 1027, 1032, 1092, 1069	Blast Hole Cuttings	P1070-01	#N/A	0.291	#N/A	#N/A	#N/A	#N/A	0.07
725	P1070-01	Pond Zone	Pond Pit. Holes: 1053, 1056, 1017, 1021, 1024, 1086	Blast Hole Cuttings	P1070-01	#N/A	0.688	#N/A	#N/A	#N/A	#N/A	0.15
726	P1070-01	Pond Zone	Pond Pit. Holes: 1051, 1108, 1111, 1136, 1154, 1147	Blast Hole Cuttings	P1070-01	#N/A	0.224	#N/A	#N/A	#N/A	#N/A	0.17
727	P1070-02	Pond Zone	Pond Pit. Holes: 2006, 2057, 2112, 2052	Blast Hole Cuttings	P1070-02	#N/A	0.024	#N/A	#N/A	#N/A	#N/A	0.01
728	P1080-01	Pond Zone	Pond Pit. Holes: 1270, 1075, 1078, 1241	Blast Hole Cuttings	P1080-01	#N/A	0.127	#N/A	#N/A	#N/A	#N/A	0.11
729	P1080-01	Pond Zone	Pond Pit. Holes: 1069, 1219, 1061, 1237	Blast Hole Cuttings	P1080-01	#N/A	0.124	#N/A	#N/A	#N/A	#N/A	0.04
730	1104	Pond Zone	Pond. 1040	Blast Hole Cuttings	1104	#N/A	0.349	#N/A	#N/A	#N/A	#N/A	0.21
731	1062	Pond Zone	Pond. 1040	Blast Hole Cuttings	1062	#N/A	0.043	#N/A	#N/A	#N/A	#N/A	0.02
732	1086	Pond Zone	Pond. 1040	Blast Hole Cuttings	1086	#N/A	0.058	#N/A	#N/A	#N/A	#N/A	0.02
733	1018	Pond Zone	Pond. 1040	Blast Hole Cuttings	1018	#N/A	0.037	#N/A	#N/A	#N/A	#N/A	0.04
734	1032	Pond Zone	Pond. 1040	Blast Hole Cuttings	1032	#N/A	0.066	#N/A	#N/A	#N/A	#N/A	1.45
735	1035	Pond Zone	Pond. 1040	Blast Hole Cuttings	1035	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.41
736	1038	Pond Zone	Pond. 1040	Blast Hole Cuttings	1038	#N/A	0.044	#N/A	#N/A	#N/A	#N/A	0.53
737	1053	Pond Zone	Pond. 1040	Blast Hole Cuttings	1053	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.26
738	1056	Pond Zone	Pond. 1040	Blast Hole Cuttings	1056	#N/A	0.037	#N/A	#N/A	#N/A	#N/A	0.18
739	1059	Pond Zone	Pond. 1040	Blast Hole Cuttings	1059	#N/A	0.06	#N/A	#N/A	#N/A	#N/A	0.32
740	1077	Pond Zone	Pond. 1040	Blast Hole Cuttings	1077	#N/A	0.345	#N/A	#N/A	#N/A	#N/A	0.26
741	1080	Pond Zone	Pond. 1040	Blast Hole Cuttings	1080	#N/A	0.066	#N/A	#N/A	#N/A	#N/A	0.35
742	1083	Pond Zone	Pond. 1040	Blast Hole Cuttings	1083	#N/A	0.153	#N/A	#N/A	#N/A	#N/A	0.49
743	1101	Pond Zone	Pond. 1040	Blast Hole Cuttings	1101	#N/A	0.03	#N/A	#N/A	#N/A	#N/A	0.24
744	1108	Pond Zone	Pond. 1040	Blast Hole Cuttings	1108	#N/A	0.198	#N/A	#N/A	#N/A	#N/A	0.19
745	1111	Pond Zone	Pond. 1040	Blast Hole Cuttings	1111	#N/A	0.379	#N/A	#N/A	#N/A	#N/A	0.30
746	1123	Pond Zone	Pond. 1040	Blast Hole Cuttings	1123	#N/A	0.294	#N/A	#N/A	#N/A	#N/A	0.22
747	1126	Pond Zone	Pond. 1040	Blast Hole Cuttings	1126	#N/A	0.343	#N/A	#N/A	#N/A	#N/A	0.30
748	1129	Pond Zone	Pond. 1040	Blast Hole Cuttings	1129	#N/A	0.08	#N/A	#N/A	#N/A	#N/A	0.36
749	1141	Pond Zone	Pond. 1040	Blast Hole Cuttings	1141	#N/A	0.065	#N/A	#N/A	#N/A	#N/A	0.15
750	1144	Pond Zone	Pond. 1040	Blast Hole Cuttings	1144	#N/A	0.294	#N/A	#N/A	#N/A	#N/A	0.22
751	1158	Pond Zone	Pond. 1040	Blast Hole Cuttings	1158	#N/A	0.467	#N/A	#N/A	#N/A	#N/A	0.26
752	2002	Pond Zone	Pond. 1040	Blast Hole Cuttings	2002	#N/A	0.682	#N/A	#N/A	#N/A	#N/A	0.19
753	2006	Pond Zone	Pond. 1040	Blast Hole Cuttings	2006	#N/A	1.39	#N/A	#N/A	#N/A	#N/A	0.21
754	2016	Pond Zone	Pond. 1040	Blast Hole Cuttings	2016	#N/A	0.46	#N/A	#N/A	#N/A	#N/A	0.28
755	2031	Pond Zone	Pond. 1040	Blast Hole Cuttings	2031	#N/A	0.094	#N/A	#N/A	#N/A	#N/A	0.60
756	2040	Pond Zone	Pond. 1040	Blast Hole Cuttings	2040	#N/A	0.511	#N/A	#N/A	#N/A	#N/A	0.08
757	2042	Pond Zone	Pond. 1040	Blast Hole Cuttings	2042	#N/A	0.87	#N/A	#N/A	#N/A	#N/A	0.26
758	2061	Pond Zone	Pond. 1040	Blast Hole Cuttings	2061	#N/A	1.43	#N/A	#N/A	#N/A	#N/A	0.89
759	2104	Pond Zone	Pond. 1040	Blast Hole Cuttings	2104	#N/A	2.39	#N/A	#N/A	#N/A	#N/A	0.36
760	2111	Pond Zone	Pond. 1040	Blast Hole Cuttings	2111	#N/A	0.8	#N/A	#N/A	#N/A	#N/A	0.22
761	2113	Pond Zone	Pond. 1040	Blast Hole Cuttings	2113	#N/A	0.301	#N/A	#N/A	#N/A	#N/A	0.17
762	2123	Pond Zone	Pond. 1040	Blast Hole Cuttings	2123	#N/A	0.282	#N/A	#N/A	#N/A	#N/A	0.09
763	2019	Pond Zone	Pond. 1040	Blast Hole Cuttings	2019	#N/A	0.176	#N/A	#N/A	#N/A	#N/A	0.03
764	2045	Pond Zone	Pond. 1040	Blast Hole Cuttings	2045	#N/A	0.09	#N/A	#N/A	#N/A	#N/A	0.03
765	2073	Pond Zone	Pond. 1040	Blast Hole Cuttings	2073	#N/A	0.084	#N/A	#N/A	#N/A	#N/A	0.01
766	2076	Pond Zone	Pond. 1040	Blast Hole Cuttings	2076	#N/A	0.309	#N/A	#N/A	#N/A	#N/A	0.37

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
684	6511	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
685	6516	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
686	6570	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
687	6580	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
688	Z10006	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
689	Z10009	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
690	Z10019	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
691	Z10042	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
692	Z10045	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
693	5212	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
694	7283	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
695	5092	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
696	5203	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
697	5267	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
698	5246	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
699	7273	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
700	7315	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
701	7263	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
702	7202	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
703	7297	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
704	7319	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
705	7182	58	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
706	7001	27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
707	11019	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
708	11024	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
709	11035	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
710	11043	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
711	11057	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
712	11255	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
713	11314	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
714	11443	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
715	11512	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
716	11608	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
717	11216	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
718	11222	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
719	11211	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
720	11325	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
721	11405	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
722	11809	53	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
723	P1060-01	145	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
724	P1070-01	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
725	P1070-01	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
726	P1070-01	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
727	P1070-02	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
728	P1080-01	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
729	P1080-01	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
730	1104	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
731	1062	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
732	1086	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
733	1018	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
734	1032	121	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
735	1035	34	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
736	1038	44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
737	1053	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
738	1056	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
739	1059	27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
740	1077	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
741	1080	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
742	1083	40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
743	1101	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
744	1108	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
745	1111	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
746	1123	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
747	1126	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
748	1129	30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
749	1141	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
750	1144	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
751	1158	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
752	2002	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
753	2006	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
754	2016	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
755	2031	50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
756	2040	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
757	2042	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
758	2061	75	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
759	2104	30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
760	2111	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
761	2113	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
762	2123	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
763	2019	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
764	2045	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
765	2073	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
766	2076	31	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
767	5102	Pond Zone	Pond. 1040	Blast Hole Cuttings	5102	#N/A	0.731	#N/A	#N/A	#N/A	#N/A	1.27
768	5105	Pond Zone	Pond. 1040	Blast Hole Cuttings	5105	#N/A	1.14	#N/A	#N/A	#N/A	#N/A	1.03
769	5108	Pond Zone	Pond. 1040	Blast Hole Cuttings	5108	#N/A	1.52	#N/A	#N/A	#N/A	#N/A	0.54
770	5111	Pond Zone	Pond. 1040	Blast Hole Cuttings	5111	#N/A	2.41	#N/A	#N/A	#N/A	#N/A	0.98
771	5114	Pond Zone	Pond. 1040	Blast Hole Cuttings	5114	#N/A	1.88	#N/A	#N/A	#N/A	#N/A	0.11
772	5117	Pond Zone	Pond. 1040	Blast Hole Cuttings	5117	#N/A	0.221	#N/A	#N/A	#N/A	#N/A	0.05
773	5305	Pond Zone	Pond. 1040	Blast Hole Cuttings	5305	#N/A	2.34	#N/A	#N/A	#N/A	#N/A	0.26
774	5308	Pond Zone	Pond. 1040	Blast Hole Cuttings	5308	#N/A	2.58	#N/A	#N/A	#N/A	#N/A	0.29
775	5311	Pond Zone	Pond. 1040	Blast Hole Cuttings	5311	#N/A	2.48	#N/A	#N/A	#N/A	#N/A	0.08
776	5314	Pond Zone	Pond. 1040	Blast Hole Cuttings	5314	#N/A	0.797	#N/A	#N/A	#N/A	#N/A	0.11
777	5317	Pond Zone	Pond. 1040	Blast Hole Cuttings	5317	#N/A	0.647	#N/A	#N/A	#N/A	#N/A	0.22
778	1005	Pond Zone	Pond. 1050	Blast Hole Cuttings	1005	#N/A	0.115	#N/A	#N/A	#N/A	#N/A	0.17
779	1016	Pond Zone	Pond. 1050	Blast Hole Cuttings	1016	#N/A	0.023	#N/A	#N/A	#N/A	#N/A	0.17
780	1029	Pond Zone	Pond. 1050	Blast Hole Cuttings	1029	#N/A	0.14	#N/A	#N/A	#N/A	#N/A	0.16
781	1032	Pond Zone	Pond. 1050	Blast Hole Cuttings	1032	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.16
782	1035	Pond Zone	Pond. 1050	Blast Hole Cuttings	1035	#N/A	0.316	#N/A	#N/A	#N/A	#N/A	0.58
783	1038	Pond Zone	Pond. 1050	Blast Hole Cuttings	1038	#N/A	0.093	#N/A	#N/A	#N/A	#N/A	0.66
784	1057	Pond Zone	Pond. 1050	Blast Hole Cuttings	1057	#N/A	0.039	#N/A	#N/A	#N/A	#N/A	0.16
785	1060	Pond Zone	Pond. 1050	Blast Hole Cuttings	1060	#N/A	0.182	#N/A	#N/A	#N/A	#N/A	0.16
786	1063	Pond Zone	Pond. 1050	Blast Hole Cuttings	1063	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.52
787	1066	Pond Zone	Pond. 1050	Blast Hole Cuttings	1066	#N/A	0.053	#N/A	#N/A	#N/A	#N/A	0.19
788	1069	Pond Zone	Pond. 1050	Blast Hole Cuttings	1069	#N/A	0.264	#N/A	#N/A	#N/A	#N/A	0.17
789	1073	Pond Zone	Pond. 1050	Blast Hole Cuttings	1073	#N/A	0.062	#N/A	#N/A	#N/A	#N/A	0.18
790	1096	Pond Zone	Pond. 1050	Blast Hole Cuttings	1096	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.18
791	1099	Pond Zone	Pond. 1050	Blast Hole Cuttings	1099	#N/A	0.197	#N/A	#N/A	#N/A	#N/A	0.35
792	1103	Pond Zone	Pond. 1050	Blast Hole Cuttings	1103	#N/A	0.069	#N/A	#N/A	#N/A	#N/A	0.17
793	1106	Pond Zone	Pond. 1050	Blast Hole Cuttings	1106	#N/A	1.2	#N/A	#N/A	#N/A	#N/A	0.16
794	1110	Pond Zone	Pond. 1050	Blast Hole Cuttings	1110	#N/A	2.95	#N/A	#N/A	#N/A	#N/A	0.30
795	1113	Pond Zone	Pond. 1050	Blast Hole Cuttings	1113	#N/A	0.184	#N/A	#N/A	#N/A	#N/A	0.16
796	1134	Pond Zone	Pond. 1050	Blast Hole Cuttings	1134	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.14
797	1139	Pond Zone	Pond. 1050	Blast Hole Cuttings	1139	#N/A	0.193	#N/A	#N/A	#N/A	#N/A	0.21
798	1142	Pond Zone	Pond. 1050	Blast Hole Cuttings	1142	#N/A	2.96	#N/A	#N/A	#N/A	#N/A	0.35
799	1145	Pond Zone	Pond. 1050	Blast Hole Cuttings	1145	#N/A	0.608	#N/A	#N/A	#N/A	#N/A	0.21
800	1149	Pond Zone	Pond. 1050	Blast Hole Cuttings	1149	#N/A	0.207	#N/A	#N/A	#N/A	#N/A	0.65
801	1152	Pond Zone	Pond. 1050	Blast Hole Cuttings	1152	#N/A	0.082	#N/A	#N/A	#N/A	#N/A	0.16
802	1502	Pond Zone	Pond. 1050	Blast Hole Cuttings	1502	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	0.21
803	2037	Pond Zone	Pond. 1050	Blast Hole Cuttings	2037	#N/A	1.13	#N/A	#N/A	#N/A	#N/A	0.31
804	2040	Pond Zone	Pond. 1050	Blast Hole Cuttings	2040	#N/A	1.27	#N/A	#N/A	#N/A	#N/A	0.12
805	2112	Pond Zone	Pond. 1050	Blast Hole Cuttings	2112	#N/A	3.81	#N/A	#N/A	#N/A	#N/A	1.47
806	2118	Pond Zone	Pond. 1050	Blast Hole Cuttings	2118	#N/A	2.38	#N/A	#N/A	#N/A	#N/A	1.33
807	2122	Pond Zone	Pond. 1050	Blast Hole Cuttings	2122	#N/A	2.34	#N/A	#N/A	#N/A	#N/A	2.12
808	2115	Pond Zone	Pond. 1050	Blast Hole Cuttings	2115	#N/A	1.9	#N/A	#N/A	#N/A	#N/A	6.33
809	2125	Pond Zone	Pond. 1050	Blast Hole Cuttings	2125	#N/A	1.21	#N/A	#N/A	#N/A	#N/A	0.44
810	2104	Pond Zone	Pond. 1050	Blast Hole Cuttings	2104	#N/A	0.425	#N/A	#N/A	#N/A	#N/A	6.88
811	2025	Pond Zone	Pond. 1050	Blast Hole Cuttings	2025	#N/A	0.523	#N/A	#N/A	#N/A	#N/A	0.04
812	2028	Pond Zone	Pond. 1050	Blast Hole Cuttings	2028	#N/A	0.087	#N/A	#N/A	#N/A	#N/A	0.02
813	2030	Pond Zone	Pond. 1050	Blast Hole Cuttings	2030	#N/A	0.177	#N/A	#N/A	#N/A	#N/A	0.15
814	2052	Pond Zone	Pond. 1050	Blast Hole Cuttings	2052	#N/A	0.292	#N/A	#N/A	#N/A	#N/A	0.02
815	2054	Pond Zone	Pond. 1050	Blast Hole Cuttings	2054	#N/A	0.049	#N/A	#N/A	#N/A	#N/A	0.02
816	2056	Pond Zone	Pond. 1050	Blast Hole Cuttings	2056	#N/A	0.035	#N/A	#N/A	#N/A	#N/A	1.04
817	2078	Pond Zone	Pond. 1050	Blast Hole Cuttings	2078	#N/A	0.18	#N/A	#N/A	#N/A	#N/A	0.04
818	2081	Pond Zone	Pond. 1050	Blast Hole Cuttings	2081	#N/A	0.046	#N/A	#N/A	#N/A	#N/A	0.35
819	2094	Pond Zone	Pond. 1050	Blast Hole Cuttings	2094	#N/A	0.072	#N/A	#N/A	#N/A	#N/A	0.51
820	2099	Pond Zone	Pond. 1050	Blast Hole Cuttings	2099	#N/A	0.563	#N/A	#N/A	#N/A	#N/A	0.61
821	2043	Pond Zone	Pond. 1050	Blast Hole Cuttings	2043	#N/A	2.81	#N/A	#N/A	#N/A	#N/A	0.12
822	2046	Pond Zone	Pond. 1050	Blast Hole Cuttings	2046	#N/A	1.41	#N/A	#N/A	#N/A	#N/A	0.15
823	2129	Pond Zone	Pond. 1050	Blast Hole Cuttings	2129	#N/A	1.62	#N/A	#N/A	#N/A	#N/A	0.13
824	2134	Pond Zone	Pond. 1050	Blast Hole Cuttings	2134	#N/A	1.57	#N/A	#N/A	#N/A	#N/A	0.68
825	2139	Pond Zone	Pond. 1050	Blast Hole Cuttings	2139	#N/A	2.2	#N/A	#N/A	#N/A	#N/A	0.08
826	2144	Pond Zone	Pond. 1050	Blast Hole Cuttings	2144	#N/A	0.181	#N/A	#N/A	#N/A	#N/A	0.23
827	P3025	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3025	#N/A	0.027	#N/A	#N/A	#N/A	#N/A	0.07
828	P3034	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3034	#N/A	0.016	#N/A	#N/A	#N/A	#N/A	0.04
829	P3043	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3043	#N/A	0.022	#N/A	#N/A	#N/A	#N/A	0.01
830	P3052	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3052	#N/A	0.547	#N/A	#N/A	#N/A	#N/A	0.02
831	P3061	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3061	#N/A	0.255	#N/A	#N/A	#N/A	#N/A	0.01
832	P3070	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3070	#N/A	0.017	#N/A	#N/A	#N/A	#N/A	0.11
833	P3076	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3076	#N/A	0.02	#N/A	#N/A	#N/A	#N/A	0.01
834	P3082	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3082	#N/A	0.073	#N/A	#N/A	#N/A	#N/A	0.01
835	P3088	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3088	#N/A	0.18	#N/A	#N/A	#N/A	#N/A	0.03
836	P3095	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3095	#N/A	0.017	#N/A	#N/A	#N/A	#N/A	0.02
837	P3099	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3099	#N/A	0.308	#N/A	#N/A	#N/A	#N/A	0.01
838	P3105	Pond Zone	Pond. 1050	Blast Hole Cuttings	P3105	#N/A	0.079	#N/A	#N/A	#N/A	#N/A	0.01
839	5134	Pond Zone	Pond. 1050	Blast Hole Cuttings	5134	#N/A	1.56	#N/A	#N/A	#N/A	#N/A	0.87
840	5146	Pond Zone	Pond. 1050	Blast Hole Cuttings	5146	#N/A	1.48	#N/A	#N/A	#N/A	#N/A	0.26
841	5158	Pond Zone	Pond. 1050	Blast Hole Cuttings	5158	#N/A	1.23	#N/A	#N/A	#N/A	#N/A	0.28
842	5167	Pond Zone	Pond. 1050	Blast Hole Cuttings	5167	#N/A	1.85	#N/A	#N/A	#N/A	#N/A	0.19

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
767	5102	106	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
768	5105	86	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
769	5108	45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
770	5111	81	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
771	5114	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
772	5117	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
773	5305	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
774	5308	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
775	5311	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
776	5314	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
777	5317	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
778	1005	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
779	1016	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
780	1029	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
781	1032	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
782	1035	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
783	1038	55	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
784	1057	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
785	1060	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
786	1063	44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
787	1066	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
788	1069	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
789	1073	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
790	1096	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
791	1099	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
792	1103	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
793	1106	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
794	1110	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
795	1113	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
796	1134	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
797	1139	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
798	1142	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
799	1145	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
800	1149	54	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
801	1152	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
802	1502	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
803	2037	25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
804	2040	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
805	2112	123	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
806	2118	111	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
807	2122	177	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
808	2115	528	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
809	2125	37	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
810	2104	573	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
811	2025	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
812	2028	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
813	2030	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
814	2052	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
815	2054	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
816	2056	87	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
817	2078	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
818	2081	29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
819	2094	42	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
820	2099	51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
821	2043	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
822	2046	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
823	2129	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
824	2134	57	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
825	2139	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
826	2144	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
827	P3025	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
828	P3034	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
829	P3043	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
830	P3052	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
831	P3061	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
832	P3070	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
833	P3076	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
834	P3082	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
835	P3088	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
836	P3095	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
837	P3099	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
838	P3105	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
839	5134	73	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
840	5146	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
841	5158	23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
842	5167	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Index	Sample ID	Source	Location	Sample Type	Sample ID	Rock Type	Total S	Sulphate S	Paste pH	Rinse pH	Total Carbonate	Total C
											%C	%C
843	5219	Pond Zone	Pond. 1050	Blast Hole Cuttings	5219	#N/A	1.99	#N/A	#N/A	#N/A	#N/A	2.22
844	5223	Pond Zone	Pond. 1050	Blast Hole Cuttings	5223	#N/A	2.98	#N/A	#N/A	#N/A	#N/A	0.38
845	5227	Pond Zone	Pond. 1050	Blast Hole Cuttings	5227	#N/A	2.08	#N/A	#N/A	#N/A	#N/A	0.26
846	5233	Pond Zone	Pond. 1050	Blast Hole Cuttings	5233	#N/A	0.401	#N/A	#N/A	#N/A	#N/A	0.18
847	5223	Pond Zone	Pond. 1050	Blast Hole Cuttings	5223	#N/A	2.98	#N/A	#N/A	#N/A	#N/A	0.38
848	5227	Pond Zone	Pond. 1050	Blast Hole Cuttings	5227	#N/A	2.08	#N/A	#N/A	#N/A	#N/A	0.26
849	5233	Pond Zone	Pond. 1050	Blast Hole Cuttings	5233	#N/A	0.401	#N/A	#N/A	#N/A	#N/A	0.18
850	5103	Pond Zone	Pond. 1050	Blast Hole Cuttings	5103	#N/A	0.505	#N/A	#N/A	#N/A	#N/A	0.06
851	5112	Pond Zone	Pond. 1050	Blast Hole Cuttings	5112	#N/A	0.214	#N/A	#N/A	#N/A	#N/A	0.06
852	5120	Pond Zone	Pond. 1050	Blast Hole Cuttings	5120	#N/A	0.281	#N/A	#N/A	#N/A	#N/A	0.07
853	5208	Pond Zone	Pond. 1050	Blast Hole Cuttings	5208	#N/A	0.304	#N/A	#N/A	#N/A	#N/A	0.06
854	5212	Pond Zone	Pond. 1050	Blast Hole Cuttings	5212	#N/A	0.111	#N/A	#N/A	#N/A	#N/A	0.06
855	5216	Pond Zone	Pond. 1050	Blast Hole Cuttings	5216	#N/A	0.324	#N/A	#N/A	#N/A	#N/A	1.56
856	P1060-1009	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1009	#N/A	0.043	#N/A	#N/A	#N/A	#N/A	0.05
857	P1060-1020	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1020	#N/A	0.34	#N/A	#N/A	#N/A	#N/A	0.03
858	P1060-1034	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1034	#N/A	0.114	#N/A	#N/A	#N/A	#N/A	0.01
859	P1060-1131	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1131	#N/A	0.039	#N/A	#N/A	#N/A	#N/A	0.00
860	P1060-1176	Pond Zone	Pond. 1060	Blast Hole Cuttings	P1060-1176	#N/A	0.058	#N/A	#N/A	#N/A	#N/A	0.16
861	P2010	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2010	#N/A	0.163	#N/A	#N/A	#N/A	#N/A	0.12
862	P2013	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2013	#N/A	0.011	#N/A	#N/A	#N/A	#N/A	0.02
863	P2016	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2016	#N/A	0.011	#N/A	#N/A	#N/A	#N/A	0.03
864	P2019	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2019	#N/A	0.117	#N/A	#N/A	#N/A	#N/A	0.03
865	P2022	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2022	#N/A	0.161	#N/A	#N/A	#N/A	#N/A	0.05
866	P2025	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2025	#N/A	0.58	#N/A	#N/A	#N/A	#N/A	0.28
867	P2028	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2028	#N/A	0.255	#N/A	#N/A	#N/A	#N/A	0.06
868	P2031	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2031	#N/A	0.136	#N/A	#N/A	#N/A	#N/A	0.05
869	P2034	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2034	#N/A	0.148	#N/A	#N/A	#N/A	#N/A	0.02
870	P2037	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2037	#N/A	0.199	#N/A	#N/A	#N/A	#N/A	0.04
871	P2074	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2074	#N/A	0.012	#N/A	#N/A	#N/A	#N/A	0.05
872	P2076	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2076	#N/A	0.055	#N/A	#N/A	#N/A	#N/A	0.06
873	P2078	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2078	#N/A	0.065	#N/A	#N/A	#N/A	#N/A	0.06
874	P2080	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2080	#N/A	0.552	#N/A	#N/A	#N/A	#N/A	0.04
875	P2082	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2082	#N/A	0.179	#N/A	#N/A	#N/A	#N/A	0.04
876	P2086	Pond Zone	Pond. 1060	Blast Hole Cuttings	P2086	#N/A	0.425	#N/A	#N/A	#N/A	#N/A	0.03
877	3008	Pond Zone	Pond. 1060	Blast Hole Cuttings	3008	#N/A	0.291	#N/A	#N/A	#N/A	#N/A	0.12
878	3017	Pond Zone	Pond. 1060	Blast Hole Cuttings	3017	#N/A	0.659	#N/A	#N/A	#N/A	#N/A	0.64
879	3026	Pond Zone	Pond. 1060	Blast Hole Cuttings	3026	#N/A	1.44	#N/A	#N/A	#N/A	#N/A	0.50
880	3035	Pond Zone	Pond. 1060	Blast Hole Cuttings	3035	#N/A	1.6	#N/A	#N/A	#N/A	#N/A	0.18
881	3044	Pond Zone	Pond. 1060	Blast Hole Cuttings	3044	#N/A	0.408	#N/A	#N/A	#N/A	#N/A	0.16
882	3071	Pond Zone	Pond. 1060	Blast Hole Cuttings	3071	#N/A	0.273	#N/A	#N/A	#N/A	#N/A	0.12
883	3075	Pond Zone	Pond. 1060	Blast Hole Cuttings	3075	#N/A	0.14	#N/A	#N/A	#N/A	#N/A	0.57
884	3078	Pond Zone	Pond. 1060	Blast Hole Cuttings	3078	#N/A	1.19	#N/A	#N/A	#N/A	#N/A	1.86
885	3082	Pond Zone	Pond. 1060	Blast Hole Cuttings	3082	#N/A	0.539	#N/A	#N/A	#N/A	#N/A	0.15
886	3087	Pond Zone	Pond. 1060	Blast Hole Cuttings	3087	#N/A	0.834	#N/A	#N/A	#N/A	#N/A	0.19
887	3092	Pond Zone	Pond. 1060	Blast Hole Cuttings	3092	#N/A	0.202	#N/A	#N/A	#N/A	#N/A	0.12
888	5005	Pond Zone	Pond. 1060	Blast Hole Cuttings	5005	#N/A	0.734	#N/A	#N/A	#N/A	#N/A	0.23
889	5011	Pond Zone	Pond. 1060	Blast Hole Cuttings	5011	#N/A	1.74	#N/A	#N/A	#N/A	#N/A	0.20
890	5020	Pond Zone	Pond. 1060	Blast Hole Cuttings	5020	#N/A	3.45	#N/A	#N/A	#N/A	#N/A	0.34
891	5052	Pond Zone	Pond. 1060	Blast Hole Cuttings	5052	#N/A	0.471	#N/A	#N/A	#N/A	#N/A	0.17
892	5058	Pond Zone	Pond. 1060	Blast Hole Cuttings	5058	#N/A	2.86	#N/A	#N/A	#N/A	#N/A	0.20
893	5060	Pond Zone	Pond. 1060	Blast Hole Cuttings	5060	#N/A	1	#N/A	#N/A	#N/A	#N/A	0.19
894	5068	Pond Zone	Pond. 1060	Blast Hole Cuttings	5068	#N/A	0.192	#N/A	#N/A	#N/A	#N/A	0.29
895	5070	Pond Zone	Pond. 1060	Blast Hole Cuttings	5070	#N/A	0.246	#N/A	#N/A	#N/A	#N/A	0.22
896	5078	Pond Zone	Pond. 1060	Blast Hole Cuttings	5078	#N/A	0.96	#N/A	#N/A	#N/A	#N/A	0.25

Index	Sample ID	NP	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Non- Sulphide Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Sr	Ti	V	W	Zn
			ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppb	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
843	5219	185	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
844	5223	32	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
845	5227	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
846	5233	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
847	5223	32	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
848	5227	22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
849	5233	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
850	5103	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
851	5112	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
852	5120	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
853	5208	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
854	5212	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
855	5216	130	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
856	P1060-1009	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
857	P1060-1020	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
858	P1060-1034	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
859	P1060-1131	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
860	P1060-1176	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
861	P2010	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
862	P2013	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
863	P2016	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
864	P2019	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
865	P2022	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
866	P2025	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
867	P2028	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
868	P2031	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
869	P2034	2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
870	P2037	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
871	P2074	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
872	P2076	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
873	P2078	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
874	P2080	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
875	P2082	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
876	P2086	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
877	3008	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
878	3017	54	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
879	3026	42	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
880	3035	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
881	3044	13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
882	3071	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
883	3075	48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
884	3078	155	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
885	3082	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
886	3087	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
887	3092	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
888	5005	19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
889	5011	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
890	5020	28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
891	5052	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
892	5058	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
893	5060	16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
894	5068	24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
895	5070	18	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
896	5078	21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Appendix D – Evaluation of Delay to Onset of Acidification

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Memo

To:	Ron Martel, Mount Polley	**Date:**	August 27, 2010
cc:		**From:**	Stephen Day
Subject:	Delay to Onset of Acidic Conditions for Springer Zone PAG Waste Rock DRAFT	**Project #:**	1CI008.000

1 Background

The proposed expansion of mining in Mount Polley Mine's Springer Pit will result in generation of PAG rock. A number of options are under consideration for management of this rock one of which would involve placement in a temporary stockpile prior to re-handling and permanent subaqueous disposal in the Springer Pit following completion of mining. It is important that the PAG waste rock is placed underwater before it becomes acidic so that ARD from the stockpile does not need to be managed, and the Springer Pit lake is not affected by acidic salts in the PAG waste rock as it becomes inundated.

This memorandum describes calculation of the delay to onset of acidic conditions for Springer Zone PAG waste rock.

2 Method

The delay to onset depends on two factors:

- The amount of acid neutralizing minerals; and
- The rate at which the acid neutralizing minerals are consumed.

The latter is dependent on the rate of acid generation from sulphide oxidation is proportional to the sulphide content. The ratio of consumption of acid neutralizing minerals compared to sulphate generation is also the critical NPR (NPR_{crit}).

These concepts can be brought together in the following equation:

$$t_{onset} = \frac{NPR_{rock}}{k.NPR_{crit}}$$

where k is the slope of the line (in $week^{-1}$) relating sulphide content (in mgS/kg) to oxidation rate (in mgS/kg/week).

3 Results

3.1 Calculation of NPR_{crit}

Site-specific values of NPR_{crit} have previously developed using humidity cell data. Earlier estimates were hampered by a lack of testing on samples oxidizing fast enough to indicate the effect of acid

generation. Figure 1 shows the average ratio of release of calcium and magnesium (reflecting carbonate dissolution) to sulphate release (reflecting sulphide oxidation) compared to sulphate release for each test. The pattern of decreasing ratio as oxidation rate increases reflects the increasing influence of acid generation on carbonate dissolution. At lower oxidation rates, carbonate dissolution occurs by simple dissolution due to the high water volumes applied to humidity cells. The theoretical range of ratios is 1 to 2 which the trend approaches and is crossed for the Springer Zone sample with the highest oxidation rate.

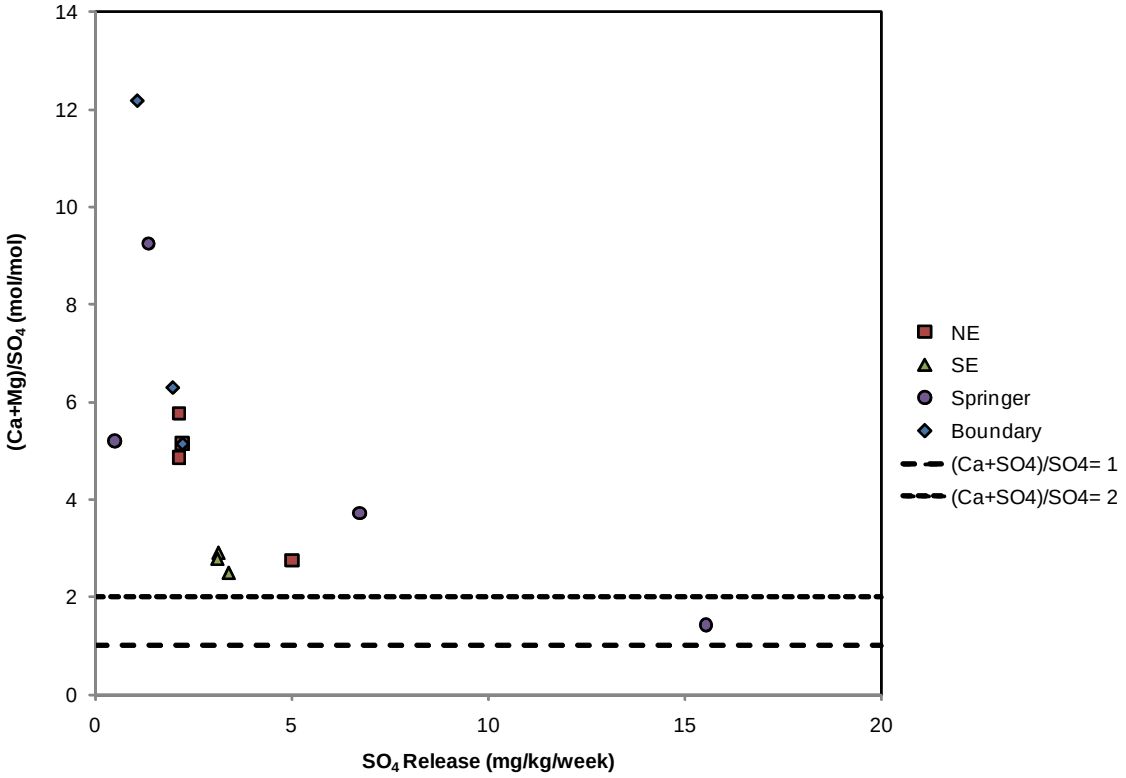

Figure 1. Estimation of NP_{crit} Values from Mount Polley Humidity Cells

This evaluation supports the permit-specified value of NPR_{crit} of 2 which is the upper end of the theoretical range. This value was adopted for subsequent calculations. Note that in the t_{onset} calculation, higher values of NPR_{crit} result in more rapid onset due to higher relative rates of NP consumption.

3.2 Calculation of k

The value of k is estimated from the average rates of sulphide oxidation indicated by the humidity cells compared to sulphide content (Figure 2). Overall data from Mount Polley show a strong positive correlation (r=0.85). The regression equation for the best fit is:

$$R_{SO_4} = 0.00016 \cdot S + 0.16$$

The intercept is non-negative but the 95% confidence limit for the intercept includes 0 mg/kg/week indicating the expected condition that when sulphur content is zero, the rate is also zero. The additional dashed lines indicate the 95% confidence limits on the regression slope of 0.00016 $week^{-1}$ which is 0.000096 to 0.00023 $week^{-1}$.

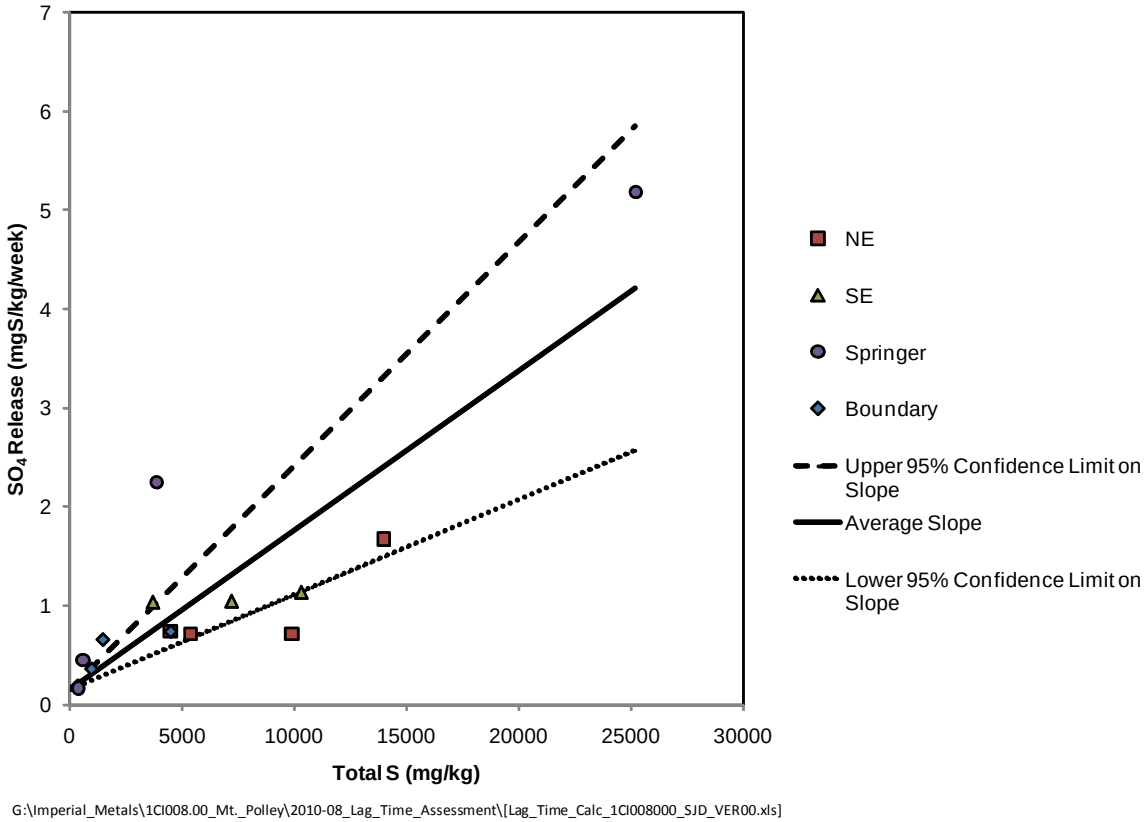

Figure 2. Sulphur Content Compared to Oxidation Rate.

4 Calculation of t_{onset}

The range of NPR indicated by blast hole and drill hole samples in the Springer Pit was used to estimate the distribution of t_{onset} for PAG waste (Figure 3). The calculation is based on an NPR_{crit} value of 3, the range of k values indicated above and a temperature correction of 0.3 to reflect slow reaction rates under cooler site conditions. For reference, the distribution at room temperature with the highest value is also shown. This line indicates the delay to onset for humidity cell tests.

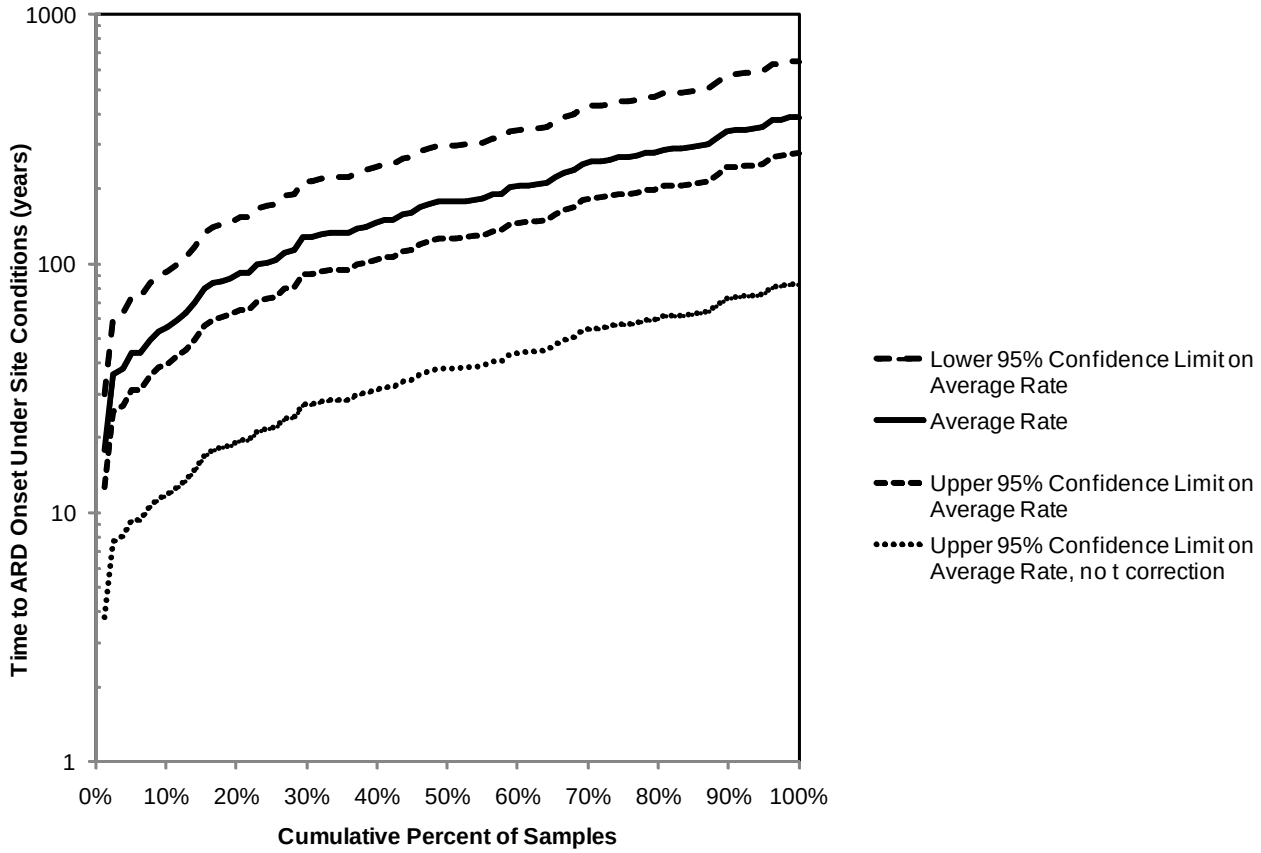

G:\Imperial_Metals\1CI008.00_Mt._Polley\2010-08_Lag_Time_Assessment\[Lag_Time_Calc_1CI008000_SJD_VER00.xls]

Figure 3. Distribution of t_{onset} for PAG Waste Rock in Springer Pit

The distribution for faster-reacting components represented by the lower dashed line indicates that about 2% of the rock might become acidic in 20 years, and 10% after 40 years. The majority of the rock with higher NPR might take over 100 years to become acidic. A number of factors complicate the actual estimate for higher NPR materials. Increasing acidification along with heating would result in accelerated oxidation and NP depletion though decreasing oxidation rates due to sulphide depletion and formation of secondary mineral coatings would result in lower oxidation rates and greater time to onset of acidic conditions.

5 Conclusion

This calculation indicates that PAG rock placed in stockpiles for a few years is not likely to become significantly acidic due to buffering provided by carbonate minerals.

Appendix E – Waste Rock Seepage Chemistry Database

Location Type	Sample Point	Original Date As Is	Recoded Date	Location	Source Term Group	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Q (m3/s)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Alkalinity (CaCO3) (mg/L)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)
							µs/cm	su	m3/s	C	ntu	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Boundary Dump Seep 1	4/6/2013	4/6/2013	Boundary	Boundary	Wet spot at dump toe. Full suite sample taken at puddle ~3m d/s. Shallow, leaf littler, may be TSS in sample.	352	7.1	0	7.9	#N/A	320	161	7.46	211	16.3	2.28	57.7	0.0195	-0.5	0.045	0.286	0.286	-0.001	0.0211	0.038	0.15	99	1.1
Bi-annual Seep Sampling	Boundary Dump Seep 2	4/6/2013	4/6/2013	Boundary	Boundary	Full suite sample taken at puddle where flowing out of sump. Maybe some alage in samples. Addditional pooling at dump toe near seep.	1020	7.9	0.003	2	#N/A	998	526	7.9	728	-3	0.54	142	0.0168	-5	0.3	0.877	0.877	-0.01	0.0201	0.0283	0.0554	438	1.04
Bi-annual Seep Sampling	Boundary Dump Seep 2	10/12/2013	10/12/2013	Boundary	Boundary	Sample Taken	1358	7.498	#N/A	0.2	#N/A	1320	793	7.71	1090	-3	29.5	213	0.273	-5	0.26	0.112	0.112	-0.01	0.161	0.195	0.225	600	0.639
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2013 15:26	10/23/2013	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1330	812	7.8	999	-3	1.01	186	0.15	-5	-0.2	0.173	0.173	-0.01	0.0803	0.0908	0.202	642	0.591
Bi-annual Seep Sampling	Boundary Dump Seep 2	14-11-2013 10:35	11/14/2013	Boundary	Boundary	sample taken	1092	7.757	#N/A	1	1.2	1300	793	8.06	1050	-3	3.77	181	0.0959	-5	-0.2	0.118	0.131	0.013	0.0766	0.0889	0.15	609	0.468
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-01-2014 11:10	1/16/2014	Boundary	Boundary	Ash like substance flowting around, Sulfer smell, Sample taken	378	8.601	#N/A	0	108.9	1160	654	7.61	912	26.9	95.6	175	0.213	-5	-0.2	-0.05	-0.051	-0.01	0.162	0.256	2.03	513	2.55
Bi-annual Seep Sampling	Boundary Dump Seep 2	18-02-2014 10:11	2/18/2014	Boundary	Boundary	Broke threw ice and stirred it up a bit had to wait sample taken	1184	7.667	#N/A	0	3.84	1200	748	7.79	983	4.4	10.5	223	0.412	-5	-0.2	-0.05	-0.051	-0.01	0.183	0.172	0.247	521	0.681
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/7/2014	3/7/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1310	809	8.06	1120	5.4	1.1	146	0.0288	-5	0.2	0.395	0.395	-0.01	0.0341	0.0401	0.048	659	0.618
Bi-annual Seep Sampling	Boundary Dump Seep 2	15-05-2014 9:15	5/15/2014	Boundary	Boundary	pH taken with pen	667	7.8	#N/A	3.6	#N/A	675	372	8.02	494	-3	0.27	107	0.0065	-0.5	0.145	0.985	0.987	0.0022	0.016	0.0198	0.021	244	1.13
Bi-annual Seep Sampling	Boundary Dump Seep 2	6/8/2014	6/8/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1170	711	7.97	982	-3	0.27	148	0.0094	-5	0.28	0.539	0.539	-0.01	0.0252	0.0299	0.024	555	0.726
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-06-2014 11:53	6/16/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1250	795	8.02	1010	-3	0.26	131	0.0177	-5	-0.2	0.677	0.677	-0.01	0.0249	0.0315	0.0366	612	0.848
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/9/2014	8/9/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1260	715	7.91	968	5.4	0.81	176	0.0217	-5	0.29	0.323	0.323	-0.01	0.0314	0.0434	0.0514	589	0.515
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/12/2014	8/12/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1300	746	8.11	1040	-3	0.4	142	0.096	-5	-0.2	0.35	0.35	-0.01	0.0616	0.0722	0.0831	630	0.563
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2014 9:42	10/23/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1260	737	7.97	981	-3	0.28	178	0.0172	-5	-0.2	0.172	0.172	-0.01	0.0607	0.0679	0.0648	591	0.39
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/11/2014	11/11/2014	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1130	620	8.14	875	-3	0.29	168	0.0294	-5	-0.2	0.906	0.93	0.023	0.0422	0.0465	0.0476	502	1.04
Bi-annual Seep Sampling	Boundary Dump Seep 2	1/7/2015	1/7/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	974	556	7.83	703	61.7	8.53	183	0.0129	-1	0.155	-0.01	-0.01	-0.002	0.0247	0.0368	0.282	368	0.858
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/6/2015	2/6/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	936	483	8.36	682	5.9	1.47	181	0.0189	-1	0.123	0.181	0.184	0.0025	0.0181	0.0236	0.0522	325	0.411
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/9/2015	2/9/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	976	582	7.55	766	-3	0.92	207	0.0799	-2.5	0.14	0.094	0.094	-0.005	0.0908	0.084	0.119	351	0.443
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/2/2015	3/2/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	853	510	8.12	656	-3	0.2	167	0.0156	-1	0.148	0.473	0.473	-0.002	0.0386	0.0421	0.046	318	0.573
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/3/2015	3/3/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	916	514	7.95	725	-3	0.17	147	0.0055	-1	0.167	0.564	0.564	-0.002	0.0317	0.0374	0.0349	383	0.712
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/4/2015	7/4/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	908	511	7.97	663	-3	0.18	136	0.0078	-1	0.145	0.989	0.992	0.0028	0.0216	0.0257	0.0233	371	1.09
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/5/2015	7/5/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	784	435	8.32	582	-3	0.24	156	0.0057	-1	0.112	0.63	0.63	-0.002	0.0285	0.0323	0.0335	276	0.727
Bi-annual Seep Sampling	Boundary Dump Seep 2	29-10-2015 11:29	10/29/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1110	620	7.88	884	-3	4.24	200	0.229	-2.5	0.18	-0.025	-0.025	-0.005	0.167	0.181	0.261	456	0.554
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/8/2015	11/8/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1060	589	8.19	814	3.5	0.77	199	0.0926	-2.5	0.19	0.074	0.074	-0.005	0.0839	0.0923	0.129	412	0.417
Bi-annual Seep Sampling	Boundary Dump Seep 2	30-11-2015 11:50	11/30/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1170	707	7.57	903	26.6	6.87	200	0.125	-2.5	0.13	0.1	0.114	0.0139	0.081	0.0923	0.324	475	0.883
Bi-annual Seep Sampling	Boundary Dump Seep 2	12/1/2015	12/1/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	1060	632	7.93	815	-3	0.23	177	0.0498	2.5	0.15	0.349	0.357	0.0076	0.0456	0.0559	0.0626	441	0.53
Bi-annual Seep Sampling	Boundary Dump Seep 3	19-05-2015 13:49	5/19/2015	Boundary	Boundary		#N/A	#N/A	#N/A	#N/A	#N/A	748	413	8.28	570	5.7	0.57	179	0.0137	-0.5	0.1	0.359	0.361	0.0018	0.0198	0.0231	0.0423	223	0.578
Bi-annual Seep Sampling	East Dump Seep 1	9/5/2013	9/5/2013	Wight	Wight	Sample taken from pond collecting water from 2 seeps (combined outflow).	526	6.85	0.003	1.7	#N/A	971	514	7.2	784	-3	0.32	29.5	-0.005	-5	0.22	2.49	2.49	-0.01	-0.001	0.0058	0.0089	505	2.56
Bi-annual Seep Sampling	East Dump Seep 1	23-10-2014 14:15	10/23/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	995	549	7.86	814	-3	0.72	60.8	-0.005	-5	-0.2	0.169	0.169	-0.01	-0.001	0.0025	0.004	499	0.31
Bi-annual Seep Sampling	East Dump Seep 1	28-05-2015 10:46	5/28/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1070	572	8.04	863	4.1	0.46	56	-0.005	-2.5	-0.1	0.227	0.235	0.008	0.0016	0.0025	0.0095	519	0.388
Bi-annual Seep Sampling	East Dump Seep 1	26-11-2015 12:46	11/26/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1020	554	7.41	731	35.6	18.1	57	0.0051	-2.5	-0.1	0.32	0.32	-0.005	-0.001	0.0035	0.195	501	0.587
Bi-annual Seep Sampling	East Dump Seep 2	9/5/2013	9/5/2013	Wight	Wight	Still some snow - come back and sample. Full suite sample taken June 20th.	394	#N/A	0.002	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 2	20-06-2013 13:24	6/20/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	842	430	7.41	646	-3	0.53	24.9	-0.005	-5	-0.2	1.76	1.76	-0.01	0.0045	0.0093	0.0117	431	1.79
Bi-annual Seep Sampling	East Dump Seep 3	9/5/2013	9/5/2013	Wight	Wight	Still some snow - come back and sample. Full suite sample taken June 20th.	519	#N/A	0.002	0.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 3	20-06-2013 13:36	6/20/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	936	495	7.48	737	5.7	0.91	22.7	0.0072	-5	0.37	1.72	1.73	0.011	0.001	0.0058	0.0123	496	1.7
Bi-annual Seep Sampling	East Dump Seep 4	9/5/2013	9/5/2013	Wight	Wight	Still some snow - come back and sample. Full suite sample taken June 20th.	633	#N/A	0.005	3.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 4	20-06-2013 13:55	6/20/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1280	732	7.59	1060	-3	0.22	33.6	-0.005	-5	-0.2	3.66	3.66	-0.01	0.0089	0.0128	0.0137	708	3.67
Bi-annual Seep Sampling	East Dump Seep 4	26-11-2015 13:16	11/26/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	884	465	7.83	658	6.4	1.27	60.8	-0.005	-2.5	-0.1	3.31	3.31	-0.005	-0.001	-0.002	0.0754	406	3.3
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/7/2013	2/7/2013	Wight	Wight	Full suite sample taken. Photo taken.	2010	8.1	0.2	2.6	#N/A	1860	1160	7.83	1700	-3	1.01	56.5	-0.005	-10	-0.4	15.3	15.3	-0.02	0.0033	0.0053	0.0064	1090	14.5
Bi-annual Seep Sampling	NEZ Dump Seep 1	10/12/2013	10/12/2013	Wight	Wight	Sample Taken	1799	8.03	#N/A	0.1	#N/A	1700	1040	7.86	1520	-3	0.29	78.3	-0.005	-10	0.5	7.16	7.16	-0.02	0.0067	0.0107	0.0115	1000	6.77
Bi-annual Seep Sampling	NEZ Dump Seep 1	23-10-2013 13:55	10/23/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1670	981	7.9	1450	-3	0.14	78.9	-0.005	12	-0.4	8.12	8.12	-0.02	0.0063	0.0091	0.0097	948	7.47
Bi-annual Seep Sampling	NEZ Dump Seep 1	26-11-2013 9:14	11/26/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1700	1040	7.95	1480	-3	0.18	73.7	0.0085	-10	-0.4	7.19	7.19	-0.02	0.0061	0.0101	0.0097	964	7.24
Bi-annual Seep Sampling	NEZ Dump Seep 1	16-01-2014 10:15	1/16/2014	Wight	Wight	Seep was totally exposed Sample taken	1850	8.761	#N/A	1.4	0.22	1800	1050	7.84	1650	-3	0.34	76.2	0.0166	-10	-0.4	6.59	6.59	-0.02	0.0081	0.0102	0.0121	1070	6.36
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-02-2014 13:08	2/18/2014	Wight	Wight	Sample Taken	1902	7.924	#N/A	0.2	0.13	1800	1140	7.85	1660	-3	0.26	76.3	-0.005	-10	-0.4	6.46	6.46	-0.02	0.0085	0.0109	0.0127	1110	6.19
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/6/2014	3/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1750	1050	7.88	1560	4.9	2.18	54.8	-0.005	8	0.47	5.12	5.12	-0.01	0.0014	0.0022	0.0058	1000	5.04
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/7/2014	3/7/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1830	1160	7.86	1670	-3	0.43	62.4	-0.005	-10	0.45	5.29	5.29	-0.02	0.0029	0.0048	0.0064	1130	4.98
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-05-2014 11:45	5/13/2014	Wight	Wight	Sample taken, grey/blue precipitate observed (pH taken with pen-1)	1763	7.39	#N/A	2.7	#N/A	1720	1050	7.59	1560	10	7.93	34.3	0.0071	5.2	0.7	5.16	5.16	-0.01	-0.001	-0.002	-0.002	1030	5.16
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/8/2014	6/8/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1730	1090	7.85	1540	-3	0.32	60	-0.005	-10	0.78	5.92	5.92	-0.02	0.0025	0.004	0.0041	1030	5.44
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/4/2014	8/4/2014	Wight	Wight		1390	8.059	#N/A	1.8	0.19	1350	768	8.05	1140	4.3	0.39	99.3	-0.005	21.3	0.33	3.34	3.34	-0.01	0.008	0.0123	0.0148	659	3.03
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/9/2014	8/9/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1790	1120	7.87	1580	-3	0.22	68.5	-0.005	-10	-0.4	5.34	#N/A	-0.02	0.0035	0.0052	0.006	1070	4.69
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/12/2014	8/12/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1860	1110	7.85	1520	-3	0.46	64.7	-0.005	-10	0.56	5.49	5.49	-0.02	-0.001	0.0037	0.0045	1130	4.94
Bi-annual Seep Sampling	NEZ Dump Seep 1	27-10-2014 11:23	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1540	905	8.03	1340	-3	0.85	64.9	-0.005	10	0.39	5.86	5.86	-0.01	0.0041	0.0055	0.0049	801	5.86
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/3/2014	11/3/2014	Wight	Wight	Broke through ice, but no disturbance	1957	7.64	#N/A	0.1	0.1	1860	1170	7.89	1670	-3	0.17	83.2	-0.005	-10	0.43	6.37	6.37	-0.02	0.0075	0.0112	0.0109	1130	6.2
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2014	11/11/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1550	900	7.87	1250	-3	1.26	65.8	-0.005	11.6	0.51	6.66	6.66	-0.01	0.0026	0.0047	0.005	834	6.18
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-01-2015 10:28	1/13/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1890	1190	7.79	1690	-3	0.28	61	-0.005	9.9	0.58	5.38	5.38	-0.01	0.0019	0.005	0.0048	1140	5.06
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/9/2015	2/9/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1780	1150	7.66	1610	-3	0.5	67.9	-0.005	-5	0.47	3.94	3.94	-0.01	0.0023	0.0053	0.0048	1060	3.91
Bi-annual Seep Sampling	NEZ Dump Seep 1	4/6/2015	4/6/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1720	1110	7.84	1590	-3	0.26	63.8	-0.005	4.7	0.56	4.67	4.67	-0.005	0.0012	0.0035	0.0032	1040	4.63
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/2/2015	5/2/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1790	1070	7.87	1600	3.4	1.27	57.9	-0.005	6.4	0.72	5.08	5.08	-0.01	0.0014	0.0026	0.0046	1050	4.84
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/3/2015	5/3/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1760	1150	7.54	1590	-3	2.81	55.5	-0.005	7.6	0.79	4.77	4.77	-0.01	0.0015	0.0037	0.0056	1060	4.82
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/5/2015	6/5/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1830	1080	7.98	1570	-3	2.4	58.9	-0.005	5.3	0.6	5	5	-0.01	-0.001	0.0021	0.0059	1080	4.75
Bi-annual Seep Sampling	NEZ Dump Seep 1	7/7/2015	7/7/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1900	1170	7.86	1640	-3	0.7	63.2	-0.005	-5	0.54	4.23	4.23	-0.01	0.0019	0.0042	0.0044	1100	4.31
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-08-2015 13:28	8/18/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1840	1070	7.73	1710	-3	0.36	66.9	-0.005	5	0.56	4.26	4.26	-0.01	0.0032	0.0047	0.0041	1110	3.88
Bi-annual Seep Sampling	NEZ Dump Seep 1	9/4/2015	9/4/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1610	1010	7.83	1360	6.2	6.35	50.7	-0.005	7	0.73	5.67	5.67	-0.01	-0.001	0.0021	0.0043	991	5.26
Bi-annual Seep Sampling	NEZ Dump Seep 1	29-10-2015 10:44	10/29/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1790	1080	7.89	1570	-3	0.32	76.7	-0.005	5.7	0.47	3.7	3.7	-0.01	0.0037	0.0056	0.0045	1020	3.64
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2015	11/11/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1660	956	7.95	1420	-3	0.54	75.3	-0.005	6.8	0.51	3.93	3.93	-0.01	0.0031	0.0052	0.0048	895	3.97
Bi-annual Seep Sampling	NEZ Dump Seep 1	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1433	8.3	0.0085	5.1	5.2	1380	835	8.08	1170	-3	0.52	165	-0.005	-5	-0.2	1.21	1.21	0.01	0.0102	0.0118	0.0134	681	1.25
Bi-annual Seep Sampling	NEZ Dump Seep 10	27-10-2014 13:57	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1390	809	8.26	1190	-3	0.56	148	-0.005	-5	-0.2	0.793	0.793	-0.01	0.0099	0.0132	0.0137	681	0.88
Bi-annual Seep Sampling	NEZ Dump Seep 10	8/6/2015	8/6/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1310	813	8.27	1070	-3	0.72	182	0.0055	-2.5	0.14	0.732	0.732	-0.005	0.0087	0.0126	0.0112	645	0.857
Bi-annual Seep Sampling	NEZ Dump Seep 11	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1479	8.2	0.002	7.2	#N/A	1440	878	8.11	1240	42.7	11.6	245	-0.005	-5	-0.2	1.11	1.11	-0.01	0.0021	0.0044	0.0674	656	1.3
Bi-annual Seep Sampling	NEZ Dump Seep 11	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1340	807	8.23	1150	6.1	0.33	238	-0.005	-5	-0.2	0.826	0.826	-0.01	0.0022	0.0026	0.0183	592	1.02
Bi-annual Seep Sampling	NEZ Dump Seep 11	27-10-2014 14:28	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1450	845	8.28	1240	3	0.44	202	-0.005	-5	-0.2	1.44	1.44	-0.01	0.0051	0.0049	0.0045	670	1.5
Bi-annual Seep Sampling	NEZ Dump Seep 11	28-05-2015 13:17	5/28/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1390	820	8.37	1150	14	3.7	216	-0.005	-5	-0.2	0.529	0.529	-0.01	0.0022	0.0042	0.0396	615	0.724
Bi-annual Seep Sampling	NEZ Dump Seep 12	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1338	8.3	0.0035	6.4	#N/A	1260	757	8.09	1080	6.7	2.16	159	0.0051	-5	0.26	1.01	1.01	-0.01	0.0075	0.0102	0.0184	602	1.07
Bi-annual Seep Sampling	NEZ Dump Seep 12	27-10-2014 15:29	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1370	808	8.23	1120	-3	0.5	136	-0.005	-5	0.26	0.72	0.72	-0.01	0.0025	0.0038	0.0045	689	0.8
Bi-annual Seep Sampling	NEZ Dump Seep 12	28-05-2015 12:53	5/28/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1230	709	8.28	1000	3.8	0.56	131	-0.005	-2.5	0.22	0.721	0.721	-0.005	0.0024	0.0044	0.0052	583	0.805
Bi-annual Seep Sampling	NEZ Dump Seep 13	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1453	8.1	0.0025	6.5	#N/A	1370	831	8.02	1180	-3	1.73	203	-0.005	-5	0.26	1.44	1.44	-0.01	0.0031	0.0045	0.0084	633	1.47
Bi-annual Seep Sampling	NEZ Dump Seep 13	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1290	759	8.16	1090	4.1	0.39	156	-0.005	-5	0.34	1.96	1.96	-0.01	0.0024	0.0024	0.0125	617	2.13
Bi-annual Seep Sampling	NEZ Dump Seep 13	27-10-2014 15:47	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1390	821	8.23	1160	5.7	1.26	140	-0.005	-5	0.27	1.21	1.21	-0.01	0.0022	0.0032	0.0035	696	1.22
Bi-annual Seep Sampling	NEZ Dump Seep 13	28-05-2015 12:37	5/28/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1420	838	8.33	1200	8.2	3.21	225	0.0055	-5	0.23	1.15	1.15	-0.01	0.0022	0.0037	0.0107	633	1.22
Bi-annual Seep Sampling	NEZ Dump Seep 14	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken. High flow.	661	7.9	0.004	4.8	#N/A	616	318	7.8	469	-3	0.22	67.3	-0.005	-0.5	0.048	0.551	0.551	-0.001	0.0012	0.0027	0.0036	247	0.606
Bi-annual Seep Sampling	NEZ Dump Seep 14	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	464	232	8.05	336	3.4	0.15	72.8	-0.005	-0.5	0.052	0.308	0.308	-0.001	-0.001	-0

Location Type	Sample Point	Original Date As Is	Recoded Date	Dissolved Organic Carbon (mg/L)	Aluminum (Al)-Total (mg/L)	Antimony (Sb)-Total (mg/L)	Arsenic (As)-Total (mg/L)	Barium (Ba)-Total (mg/L)	Beryllium (Be)-Total (mg/L)	Bismuth (Bi)-Total (mg/L)	Boron (B)-Total (mg/L)	Cadmium (Cd)-Total (mg/L)	Calcium (Ca)-Total (mg/L)	Chromium (Cr)-Total (mg/L)	Cobalt (Co)-Total (mg/L)	Copper (Cu)-Total (mg/L)	Iron (Fe)-Total (mg/L)	Lead (Pb)-Total (mg/L)	Lithium (Li)-Total (mg/L)	Magnesium (Mg)-Total (mg/L)	Manganese (Mn)-Total (mg/L)	Molybdenum (Mo)-Total (mg/L)	Nickel (Ni)-Total (mg/L)	Potassium (K)-Total (mg/L)	Selenium (Se)-Total (mg/L)	Silicon (Si)-Total (mg/L)	Silver (Ag)-Total (mg/L)	Sodium (Na)-Total (mg/L)	Strontium (Sr)-Total (mg/L)	Thallium (Tl)-Total (mg/L)	Tin (Sn)-Total (mg/L)	Titanium (Ti)-Total (mg/L)	Uranium (U)-Total (mg/L)	Vanadium (V)-Total (mg/L)	Zinc (Zn) Total (mg/L)	Aluminum (Al)-Dissolved (mg/L)	Antimony (Sb)-Dissolved (mg/L)	Arsenic (As) Dissolved (mg/L)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Boundary Dump Seep 1	4/6/2013	4/6/2013	6.84	0.0298	-0.0001	0.00024	0.0197	-0.0001	-0.0005	0.053	-0.00001	55.1	-0.0005	-0.0001	0.00309	0.052	-0.00005	-0.0005	4.93	0.0255	0.00371	-0.0005	0.314	0.001	5.26	-0.00001	2.28	0.165	-0.00001	-0.0001	-0.01	0.000024	-0.001	-0.003	0.0055	-0.0001	0.0002
Bi-annual Seep Sampling	Boundary Dump Seep 2	4/6/2013	4/6/2013	5.75	0.0081	0.00018	0.00087	0.0369	-0.0001	-0.0005	0.054	0.000057	190	-0.0005	0.00019	0.0113	0.046	7.8E-05	0.00179	23.6	0.0341	0.0319	-0.0005	1.51	0.00479	6.02	-0.00001	6.03	1.85	-0.00001	-0.0001	0.011	0.00111	-0.001	-0.003	0.0032	0.0002	0.00067
Bi-annual Seep Sampling	Boundary Dump Seep 2	10/12/2013	10/12/2013	8.53	0.0104	0.00017	0.00237	0.0559	-0.0001	-0.0005	0.057	0.000018	273	-0.0005	0.00035	0.00404	0.192	0.00027	0.002	36.6	0.292	0.0237	-0.0005	1.95	0.00201	7.61	-0.00001	7.81	2.9	-0.00001	-0.0001	0.02	0.000801	-0.001	-0.003	-0.003	0.00015	0.00202
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2013 15:26	10/23/2013	7.06	0.0065	0.00017	0.00218	0.054	-0.0001	-0.0005	0.057	0.000035	254	-0.0005	0.00045	0.00435	0.281	0.00021	0.0027	36.9	0.312	0.0256	-0.0005	1.95	0.00195	6.65	-0.00001	8.18	2.99	-0.00001	-0.0001	-0.01	0.000983	0.0011	-0.003	0.0045	0.00012	0.00184
Bi-annual Seep Sampling	Boundary Dump Seep 2	14-11-2013 10:35	11/14/2013	6.59	0.0063	0.00026	0.00255	0.0524	-0.0001	-0.0005	0.061	0.000039	260	-0.0005	0.00069	0.00517	0.03	0.00017	0.00266	37.1	0.34	0.0245	0.00073	1.94	0.0023	6.39	-0.00001	7.97	2.99	-0.00001	-0.0001	0.025	0.000883	0.0019	-0.003	0.0033	0.00018	0.00171
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-01-2014 11:10	1/16/2014	8.04	0.0352	0.00016	0.00316	0.0527	-0.0001	-0.0005	0.059	-0.0001	215	-0.0005	0.00105	0.0194	1.74	0.00071	0.00194	27.5	0.411	0.0209	-0.0005	1.76	0.00339	6.27	-0.00001	5.92	2.21	-0.00001	-0.0001	0.015	0.000635	0.0014	0.0043	0.0031	0.00012	0.0029
Bi-annual Seep Sampling	Boundary Dump Seep 2	18-02-2014 10:11	2/18/2014	8.25	0.0088	0.00012	0.00154	0.0484	-0.0001	-0.0005	0.055	0.000022	248	-0.0005	0.00027	0.0048	0.214	0.00019	0.0016	32.4	0.408	0.0145	-0.0005	1.77	0.00155	7.59	-0.00001	6.88	2.18	-0.00001	-0.0001	0.012	0.000654	-0.001	-0.003	0.0038	0.00011	0.00149
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/7/2014	3/7/2014	5.8	0.0136	0.00022	0.00083	0.0443	-0.0001	-0.0005	0.054	-0.0001	261	-0.0005	0.00031	0.0113	0.103	0.00016	0.00235	42.1	0.0778	0.0508	-0.0005	1.68	0.00517	5.69	-0.00001	8.67	3.25	-0.00001	-0.0001	0.017	0.00152	-0.001	0.0033	-0.003	0.00021	0.00073
Bi-annual Seep Sampling	Boundary Dump Seep 2	15-05-2014 9:15	5/15/2014	5.86	0.0166	0.00016	0.00061	0.0261	-0.0001	-0.0005	0.059	0.000053	127	-0.0005	0.00023	0.012	0.042	0.00018	0.00129	15.3	0.0281	0.0215	-0.0005	1.23	0.0034	5.35	-0.00001	4.38	1.02	-0.00001	-0.0001	0.015	0.000582	-0.001	0.0048	0.0069	0.00014	0.00055
Bi-annual Seep Sampling	Boundary Dump Seep 2	6/8/2014	6/8/2014	4.83	0.0061	0.00018	0.00075	0.0399	-0.0001	-0.0005	0.058	0.000044	238	-0.0005	0.0002	0.0107	0.042	9.5E-05	0.00245	32.6	0.0307	0.0349	-0.0005	1.46	0.00405	6.11	-0.00001	7.59	2.29	-0.00001	-0.0001	0.013	0.00117	-0.001	-0.003	0.0031	0.00018	0.00069
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-06-2014 11:53	6/16/2014	5.54	0.0053	0.00021	0.00066	0.0418	-0.0001	-0.0005	0.05	-0.00007	238	-0.0005	0.00018	0.00861	0.034	9.3E-05	0.00281	38.1	0.0319	0.0547	-0.0005	1.62	0.00679	5.49	-0.00001	7.97	3.07	-0.00001	-0.0001	0.013	0.00135	-0.001	-0.003	0.0033	0.00021	0.00063
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/9/2014	8/9/2014	6.29	0.0087	0.00027	0.00097	0.0429	-0.0001	-0.0005	0.056	0.000092	244	-0.0005	0.00043	0.0131	0.077	0.00029	0.00293	37.3	0.0726	0.0351	-0.0005	1.55	0.00297	5.89	-0.00001	7.76	3	-0.00001	-0.0001	0.02	0.00147	-0.001	0.0032	0.0099	0.00019	0.00079
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/12/2014	8/12/2014	7.06	0.0053	0.00012	0.0012	0.0458	-0.0001	-0.0005	0.051	0.000027	245	-0.0005	0.00032	0.00695	0.124	0.00022	0.00207	33.9	0.0959	0.0258	-0.0005	1.78	0.00206	6.13	-0.00001	7.95	2.66	-0.00001	-0.0001	0.014	0.000755	-0.001	-0.003	0.0036	0.00012	0.0012
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2014 9:42	10/23/2014	6.88	0.0047	0.00019	0.00107	0.0409	-0.0001	-0.0005	0.046	0.000064	247	-0.0005	0.00043	0.0122	0.075	0.00018	0.00227	37.8	0.0866	0.0306	-0.0005	1.61	0.00219	6.09	-0.00001	7.81	3.12	-0.00001	-0.0001	0.02	0.00105	-0.001	0.0031	-0.003	0.00017	0.00105
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/11/2014	11/11/2014	6.85	0.0052	0.00017	0.00097	0.0411	-0.0001	-0.0005	0.064	0.000039	208	-0.0005	0.00026	0.00726	0.07	0.00015	0.00213	25.9	0.0482	0.0328	-0.0005	1.51	0.00354	5.94	-0.00001	6.62	1.83	-0.00001	-0.0001	0.016	0.000947	-0.001	-0.003	0.0294	0.00024	0.001
Bi-annual Seep Sampling	Boundary Dump Seep 2	1/7/2015	1/7/2015	6.07	0.0446	0.00018	0.00173	0.0371	-0.0001	-0.00005	0.053	0.000221	180	-0.0005	0.001	0.0373	0.323	0.0007	0.0017	22.4	0.174	0.0213	0.00065	1.69	0.00247	6.02	1.1E-05	6.32	1.59	-0.00001	-0.0001	-0.01	0.00091	0.00089	0.0064	-0.003	0.00017	0.00087
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/6/2015	2/6/2015	5.37	0.0147	0.00017	0.00088	0.0351	-0.0001	-0.00005	0.059	0.0000782	170	-0.0005	0.00049	0.0155	0.081	0.00028	0.0015	19.4	0.0854	0.0188	-0.0005	1.2	0.00161	5.91	1.8E-05	5.44	1.42	-0.00001	-0.0001	-0.01	0.000768	0.00062	-0.003	-0.003	0.00012	0.00073
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/9/2015	2/9/2015	6.94	0.0128	0.00019	0.00209	0.0466	-0.0001	-0.00005	0.062	0.0000433	205	-0.0005	0.0019	0.0096	0.402	0.00024	0.0026	25	0.53	0.0168	-0.0005	1.34	0.00143	6.95	-0.00001	6.22	2.02	-0.00001	-0.0001	-0.01	0.00098	0.00132	-0.003	0.008	0.00016	0.00154
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/2/2015	3/2/2015	5.58	0.0045	0.00013	0.00081	0.0316	-0.0001	-0.0005	0.063	0.00002	174	-0.0005	0.0002	0.00745	0.041	0.00013	0.00165	22.4	0.0316	0.0294	-0.0005	1.24	0.00237	6.08	-0.00001	5.74	1.61	-0.00001	-0.0001	0.013	0.000657	-0.001	-0.003	-0.003	0.00013	0.00079
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/3/2015	3/3/2015	5.73	0.0035	0.00016	0.00076	0.0325	-0.0001	-0.0005	0.061	0.000039	178	-0.0005	0.00015	0.00803	-0.03	8.8E-05	0.00167	23.5	0.0173	0.0343	-0.0005	1.21	0.0032	6.08	-0.00001	5.79	1.76	-0.00001	-0.0001	0.015	0.000725	-0.001	-0.003	-0.003	0.00014	0.00065
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/4/2015	7/4/2015	6.07	0.0039	0.00017	0.00057	0.0316	-0.0001	-0.00005	0.06	0.0000387	173	-0.0005	0.00011	0.00864	-0.03	6.5E-05	0.0017	22.1	0.0139	0.0332	-0.0005	1.28	0.00417	5.91	-0.00001	5.96	1.67	-0.00001	-0.0001	0.013	0.000639	0.00051	-0.003	0.0031	0.00015	0.00055
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/5/2015	7/5/2015	5.25	0.0041	0.00015	0.00059	0.0294	-0.0001	-0.00005	0.069	0.000018	150	-0.0005	-0.0001	0.00936	-0.03	-0.00005	0.002	17.2	0.00989	0.0223	-0.0005	1.06	0.00216	6.27	-0.00001	4.99	1.3	-0.00001	-0.0001	-0.01	0.000625	0.00052	-0.003	-0.003	0.00013	0.00054
Bi-annual Seep Sampling	Boundary Dump Seep 2	29-10-2015 11:29	10/29/2015	6.82	0.0139	0.00017	0.00162	0.043	-0.0001	-0.00005	0.06	0.0000404	192	-0.0005	0.00094	0.00964	0.378	0.00012	0.0025	26.2	0.747	0.021	-0.0005	1.4	0.00162	7.22	-0.00001	6.64	2.31	-0.00001	-0.0001	-0.01	0.000912	0.00079	-0.003	0.0054	0.00013	0.00147
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/8/2015	11/8/2015	6.81	0.0104	0.00019	0.00137	0.0394	-0.0001	-0.00005	0.058	0.0000484	193	-0.0005	0.00156	0.00848	0.287	0.0002	0.0027	25.8	0.53	0.0249	-0.0005	1.31	0.00174	6.39	-0.00001	6.23	2.24	-0.00001	-0.0001	-0.01	0.000944	0.00069	-0.003	0.0037	0.00017	0.00115
Bi-annual Seep Sampling	Boundary Dump Seep 2	30-11-2015 11:50	11/30/2015	6.6	0.0957	0.00014	0.00346	0.0544	-0.0001	-0.00005	0.055	0.0000743	229	-0.0005	0.00183	0.0351	1.73	0.00112	0.0018	27.6	0.575	0.0196	-0.0005	1.57	0.00215	6.74	2.2E-05	6.73	2.1	-0.00001	-0.0001	0.01	0.00066	0.00154	0.0035	-0.003	0.0001	0.00138
Bi-annual Seep Sampling	Boundary Dump Seep 2	12/1/2015	12/1/2015	6.27	0.0042	0.00014	0.00115	0.0372	-0.0001	-0.00005	0.06	0.000018	210	-0.0005	0.00027	0.00846	0.097	0.00021	0.0015	28.3	0.0547	0.0251	-0.0005	1.46	0.00174	6.47	-0.00001	6.68	2.05	-0.00001	-0.0001	0.018	0.000732	-0.001	-0.003	-0.003	0.00012	0.00103
Bi-annual Seep Sampling	Boundary Dump Seep 3	19-05-2015 13:49	5/19/2015	5.14	0.0465	0.00013	0.00072	0.0335	-0.0001	-0.00005	0.072	0.0000332	139	-0.0005	0.00017	0.0112	0.106	0.00013	0.0014	13	0.0623	0.00878	-0.0005	1	0.000993	6.27	-0.00001	4.27	0.817	-0.00001	-0.0001	-0.01	0.000542	0.00078	-0.003	0.0035	0.0001	0.00068
Bi-annual Seep Sampling	East Dump Seep 1	9/5/2013	9/5/2013	4.07	0.0288	0.00018	0.0003	0.0306	-0.0001	-0.0005	0.064	-0.00015	157	-0.0005	-0.0001	0.00324	-0.03	-0.00005	-0.0005	31.1	0.0239	0.202	-0.0005	2.41	0.0625	3.88	-0.00001	15.1	3.12	-0.00001	-0.0001	-0.01	0.00003	-0.001	0.0169	0.009	0.00015	0.00019
Bi-annual Seep Sampling	East Dump Seep 1	23-10-2014 14:15	10/23/2014	7.74	0.0628	-0.0001	0.00033	0.0494	-0.0001	-0.0005	0.043	0.000247	162	-0.0005	0.00155	0.00739	0.07	5.6E-05	-0.0005	32.8	0.515	0.0945	0.0016	2.32	0.017	3.7	1.1E-05	13.3	3.01	-0.00001	-0.0001	0.018	0.000035	-0.001	0.0214	0.0173	-0.0001	0.00025
Bi-annual Seep Sampling	East Dump Seep 1	28-05-2015 10:46	5/28/2015	7.23	0.0676	0.0001	0.00035	0.0576	-0.0001	-0.00005	0.053	0.000213	172	-0.0005	0.00117	0.00696	0.08	-0.00005	-0.001	34.6	0.646	0.115	0.00112	2.1	0.0268	3.93	-0.00001	14.4	3.19	-0.00001	-0.0001	0.016	0.000445	0.00065	0.0171	0.0152	-0.0001	0.00028
Bi-annual Seep Sampling	East Dump Seep 1	26-11-2015 12:46	11/26/2015	5.42	1.46	-0.0001	0.00112	0.0548	-0.0001	-0.0005	0.046	0.000269	161	0.00157	0.00502	0.0296	1.96	0.00067	0.0014	33.8	1.14	0.0494	0.00276	2.14	0.00835	6.7	3.1E-05	13.6	2.7	-0.00001	-0.0001	0.104	0.000468	0.00558	0.0327	0.011	-0.0001	0.00017
Bi-annual Seep Sampling	East Dump Seep 2	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 2	20-06-2013 13:24	6/20/2013	3.35	0.0147	0.00015	0.00024	0.0237	-0.0001	-0.0005	0.057	-0.0005	128	-0.0005	0.0016	0.00442	-0.03	-0.00005	-0.0005	27.6	0.251	0.32	0.00078	2.36	0.0736	3.31	-0.00001	14.2	3.36	-0.00001	-0.0001	0.011	0.000019	-0.001	0.0167	0.0118	0.00015	0.00023
Bi-annual Seep Sampling	East Dump Seep 3	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 3	20-06-2013 13:36	6/20/2013	2.88	0.186	0.00019	0.00023	0.0336	-0.0001	-0.0005	0.064	-0.001	142	-0.0005	0.00719	0.00686	0.184	9.4E-05	0.00126	34.8	1.2	0.403	0.00357	2.33	0.0397	4.4	-0.00001	18.3	4.28	-0.00001	-0.0001	0.017	0.000082	-0.001	0.0747	0.027	0.00017	0.00011
Bi-annual Seep Sampling	East Dump Seep 4	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 4	20-06-2013 13:55	6/20/2013	4.25	0.0102	0.0001	0.00035	0.0446	-0.0001	-0.0005	0.041	0.000296	231	-0.0005	-0.0001	0.00516	-0.03	-0.00005	-0.0005	36.4	0.00526	0.108	0.00096	2.62	0.0479	5.06	-0.00001	17.3	2.75	-0.00001	-0.0001	0.014	0.000087	-0.001	0.0544	0.0077	-0.0001	0.00034
Bi-annual Seep Sampling	East Dump Seep 4	26-11-2015 13:16	11/26/2015	3.11	0.146	-0.0001	0.00024	0.0623	-0.0001	-0.00005	0.035	0.00123	146	-0.0005	0.00013	0.0111	0.149	0.00011	0.0013	22.6	0.00635	0.115	0.00087	1.33	0.028	5.66	-0.00001	9.74	1.84	-0.00001	-0.0001	0.018	0.000296	0.00068	0.151	-0.003	-0.0001	0.00013
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/7/2013	2/7/2013	2.91	0.0575	0.00074	0.00029	0.0509	-0.0002	-0.001	0.109	-0.0003	358	-0.0005	0.00077	0.0758	-0.03	-0.0001	0.0013	63.4	0.0939	0.321	0.0016	2.2	0.247	5.15	-0.00002	22.1	3.35	-0.00002	-0.0002	0.014	0.00158	-0.002	0.012	0.025	0.00068	0.00032
Bi-annual Seep Sampling	NEZ Dump Seep 1	10/12/2013	10/12/2013	4.46	0.0223	0.00037	0.00033	0.0607	-0.0002	-0.001	0.086	-0.0001	324	-0.0005	-0.0002	0.0217	-0.03	-0.0001	0.0012	57.5	0.0224	0.2	-0.001	2.21	0.127	5.46	-0.00002	19.7	4.14	-0.00002	-0.0002	0.021	0.00135	-0.002	-0.006	0.008	0.00037	0.00025
Bi-annual Seep Sampling	NEZ Dump Seep 1	23-10-2013 13:55	10/23/2013	3.91	0.0148	0.00054	0.00038	0.0515	-0.0002	-0.001	0.092	-0.00013	291	-0.0005	-0.0002	0.0238	0.082	0.00013	0.0022	54.3	0.0177	0.189	-0.001	2.18	0.13	5.56	-0.00002	19.5	3.37	-0.00002	-0.0002	-0.01	0.00135	-0.002	0.0073	0.007	0.00052	0.00033
Bi-annual Seep Sampling	NEZ Dump Seep 1	26-11-2013 9:14	11/26/2013	4.57	0.0121	0.00043	0.00038	0.0575	-0.0002	-0.001	0.094	-0.00012	310	-0.0005	-0.0002	0.0189	-0.03	-0.0001	0.0021	56.2	0.0138	0.194	-0.001	2.15	0.136	5.35	-0.00002	20	3.99	-0.00002	-0.0002	0.019	0.00133	-0.002	-0.006	0.008	0.0004	0.00031
Bi-annual Seep Sampling	NEZ Dump Seep 1	16-01-2014 10:15	1/16/2014	4.57	0.0389	0.0004	0.00064	0.0602	-0.0002	-0.001	0.065	0.00002	330	-0.0005	0.00028	0.0226	0.131	0.00013	0.0027	58.5	0.0277	0.226	-0.001	2.35	0.133	5.05	-0.00002	20.8	4.62	-0.00002	-0.0002	0.016	0.00148	-0.002	0.0077	0.0084	0.00037	0.00028
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-02-2014 13:08	2/18/2014	4.39	0.0256	0.00036	0.00032	0.0682	-0.0002	-0.001	0.1	-0.00012	349	-0.0005	-0.0002	0.0173	-0.03	-0.0001	0.0021	64	0.017	0.266	-0.001	2.26	0.134	5.31	-0.00002	21.2	5.3	-0.00002	-0.0002	0.012	0.00158	-0.002	-0.006	0.006	0.00033	0.00028
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/6/2014	3/6/2014	3.26	0.453	0.00045	0.00022	0.0447	-0.0002	-0.001	0.074	-0.0004	318	-0.0005	0.00328	0.29	-0.03	-0.0001	0.0029	60.8	0.313	0.243	0.005	2.19	0.176	5.26	-0.00002	20.2	3.28	-0.00002	-0.0002	-0.01	0.00114	-0.002	0.027	0.0556	0.00045	-0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/7/2014	3/7/2014	3.65	0.0854	0.00047	0.00026	0.0486	-0.0002	-0.001	0.094	-0.0004	362	-0.0005	0.00185	0.138	-0.03	-0.0001	0.0028	67.8	0.21	0.294	0.0034	2.32	0.191	5.25	-0.00002	22.3	4.17	-0.00002	-0.0002	0.017	0.00131	-0.002	0.0194	0.0364	0.00047	0.00027
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-05-2014 11:45	5/13/2014	2.74	1.93	0.00043	0.00029	0.0503	0.00024	-0.001	0.076	-0.0009	315	-0.0005	0.0169	1.28	0.045	-0.0001	0.0054	65	1.08	0.254	0.0147	2.18	0.158	5.9	-0.00002	18.8	3.58	-0.00002	-0.0002	0.017	0.00099	-0.002	0.0848	0.0405	0.00041	-0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/8/2014	6/8/2014	3.04	0.0478	0.00048	0.00026	0.0423	-0.0002	-0.001	0.082	0.000182	334	-0.0005	0.00141	0.0927	-0.03	-0.0001	0.0026	58.8	0.162	0.192	0.0024	2.1	0.153	5.03	-0.00002	19.9	3.12	-0.00002	-0.0002	0.016	0.00106	-0.002	0.0141	0.0153	0.0005	0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/4/2014	8/4/2014	3.88	0.0385	0.00056	0.00037	0.0362	-0.0001	-0.0005	0.06	-0.00012	231	-0.0005	0.0003	0.034	0.035	-0.00005	0.00173	39	0.055	0.165	0.00066	1.78	0.0987	5.04	-0.00001	16.7	2.24	-0.00001	-0.0001	0.019	0.00137	-0.001	0.0041	0.0082	0.00056	0.00035
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/9/2014	8/9/2014	3.47	0.0308	0.00049	0.00028	0.0463	-0.0002	-0.001	0.087	-0.0002	342	-0.0005	0.0012	0.0821	-0.03	-0.0001	0.0029	64.5	0.143	0.224	0.0023	2.33	0.18	5.4	-0.00002	20.1	3.37	-0.00002	-0.0002	0.024	0.00131	-0.002	0.0144	0.0154	0.00046	0.00021
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/12/2014	8/12/2014	11.3	0.0906	0.00044	0.00022	0.045	-0.0002	-0.001	0.08	0.000169	343	-0.0005	0.00186	0.174	-0.03	-0.0001	0.0027	65.3	0.188	0.222	0.0037	2.28	0.175	5.57	-0.00002	20.8	3.39	-0.00002	-0.0002	0.016	0.00119	-0.002	0.0222	0.036	0.00044	-0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 1	27-10-2014 11:23	10/27/2014	3.88	0.0882	0.00054	0.00031	0.0355	-0.0001	-0.0005	0.074	0.000111	277	-0.0005	0.00092	0.0797	-0.03	-0.0001	0.00301	47.1	0.124	0.207	0.00135	2.02	0.126	4.68	-0.00001	17.4	3.18	-0.00001	-0.0001	0.022	0.00135	-0.001	0.009	0.0124	0.00054	0.00024
Bi-annual Seep Sampling	NEZ Dump Seep 1	1/3/2014	1/3/2014	4.38	0.0098	0.00029	0.00027	0.0709	-0.0002	-0.001	0.105	-0.00014	360	-0.0005	-0.0002	0.0153	-0.03	-0.0001	0.0019	64.6	0.00883	0.216	-0.001	2.34	0.132	5.17	-0.00002	22.3	4.63	-0.00002	-0.0002	0.017	0.0014	-0.002	-0.006	0.005	0.0003	0.00029
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2014	11/11/2014	4.4	0.22	0.00039	0.0003	0.0384	-0.0001	-0.0005	0.061	0.000166	282	-0.0005	0.00279	0.175	-0.03	-0.00005	0.00244	49.6	0.252	0.155	0.00327	2.2	0.124	5.18	-0.00001	18.5	2.56	-0.00001	-0.0001	0.021	0.000913	-0.001	0.0172	0.0611	0.00053	0.00022
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-01-2015 10:28	1/13/2015	3.87	0.118	0.00048	0.00025	0.0478	-0.0002	-0.001	0.088	0.000247	369	-0.0005

Location Type	Sample Point	Original Date As Is	Recoded Date	Barium (Ba) Dissolved (mg/L)	Beryllium (Be)-Dissolved (mg/L)	Bismuth (Bi)-Dissolved (mg/L)	Boron (B)-Dissolved (mg/L)	Cadmium (Cd)-Dissolved (mg/L)	Calcium (Ca)-Dissolved (mg/L)	Chromium (Cr)-Dissolved (mg/L)	Cobalt (Co)-Dissolved (mg/L)	Copper (Cu)-Dissolved (mg/L)	Iron (Fe)-Dissolved (mg/L)	Lead (Pb)-Dissolved (mg/L)	Lithium (Li)-Dissolved (mg/L)	Magnesium (Mg)-Dissolved (mg/L)	Manganese (Mn)-Dissolved (mg/L)	Molybdenum (Mo)-Dissolved (mg/L)	Nickel (Ni)-Dissolved (mg/L)	Potassium (K)-Dissolved (mg/L)	Selenium (Se)-Dissolved (mg/L)	Silicon (Si)-Dissolved (mg/L)	Silver (Ag)-Dissolved (mg/L)	Sodium (Na)-Dissolved (mg/L)	Strontium (Sr)-Dissolved (mg/L)	Thallium (Tl)-Dissolved (mg/L)	Tin (Sn)-Dissolved (mg/L)	Titanium (Ti)-Dissolved (mg/L)	Uranium (U)-Dissolved (mg/L)	Vanadium (V)-Dissolved (mg/L)	Zinc (Zn)-Dissolved (mg/L)		Julian Date	EC-Field
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			µs/cm
Bi-annual Seep Sampling	Boundary Dump Seep 1	4/6/2013	4/6/2013	0.0205	-0.0001	-0.0005	0.051	-0.00001	56.2	-0.0005	-0.0001	0.00213	0.038	-0.00005	-0.0005	5.04	0.000591	0.00513	-0.0005	0.494	0.00079	4.58	-0.00001	2.34	0.194	-0.00001	-0.0001	-0.01	0.000037	-0.001	-0.003		2013.26	352
Bi-annual Seep Sampling	Boundary Dump Seep 2	4/6/2013	4/6/2013	0.0336	-0.0001	-0.0005	0.061	0.000052	176	-0.0005	0.00015	0.00868	-0.03	-0.00005	0.00186	21	0.0222	0.0328	-0.0005	1.35	0.00456	5.88	-0.00001	5.44	1.8	-0.00001	-0.0001	0.011	0.0012	-0.001	-0.003		2013.26	1020
Bi-annual Seep Sampling	Boundary Dump Seep 2	10/12/2013	10/12/2013	0.0503	-0.0001	-0.0005	0.049	0.00001	261	-0.0005	-0.0001	0.00196	0.038	-0.00005	0.00165	34.5	0.0354	0.0225	-0.0005	1.78	0.00249	7.16	-0.00001	7.1	2.76	-0.00001	-0.0001	0.02	0.000757	-0.001	-0.003		2013.78	1358
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2013 15:26	10/23/2013	0.0556	-0.0001	-0.0005	0.048	0.000013	260	-0.0005	0.00041	0.00099	0.249	0.000063	0.00226	39.6	0.316	0.0215	-0.0005	1.99	0.00205	6.62	-0.00001	8.08	2.98	-0.00001	-0.0001	-0.01	0.000874	-0.001	-0.003		2013.81	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	14-11-2013 10:35	11/14/2013	0.0511	-0.0001	-0.0005	0.057	0.00003	258	-0.0005	0.00028	0.00287	0.055	-0.00005	0.00231	36.1	0.166	0.0231	0.00068	1.89	0.00242	6.32	-0.00001	7.79	2.91	-0.00001	-0.0001	0.024	0.000867	-0.001	-0.003		2013.87	1092
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-01-2014 11:10	1/16/2014	0.0523	-0.0001	-0.0005	0.058	-0.00002	217	-0.0005	0.00048	-0.0005	0.326	-0.00005	0.00198	27.2	0.397	0.0151	-0.0005	1.82	0.00296	6.33	-0.00001	6.23	2.24	-0.00001	-0.0001	0.015	0.000558	-0.001	-0.003		2014.04	378
Bi-annual Seep Sampling	Boundary Dump Seep 2	18-02-2014 10:11	2/18/2014	0.0502	-0.0001	-0.0005	0.052	-0.00001	248	-0.0005	0.00019	0.00112	0.124	0.000055	0.00136	31.3	0.405	0.0128	-0.0005	1.76	0.00169	7.59	-0.00001	6.59	2.07	-0.00001	-0.0001	0.011	0.00062	-0.001	-0.003		2014.13	1184
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/7/2014	3/7/2014	0.044	-0.0001	-0.0005	0.052	-0.0001	257	-0.0005	-0.0001	0.00736	-0.03	-0.00005	0.00252	40.5	0.00383	0.0543	-0.0005	1.69	0.00495	5.59	-0.00001	8.79	3.55	-0.00001	-0.0001	0.017	0.00154	-0.001	-0.003		2014.18	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	15-05-2014 9:15	5/15/2014	0.025	-0.0001	-0.0005	0.052	0.000047	124	-0.0005	0.00015	0.00951	-0.03	-0.00005	0.00133	14.9	0.0211	0.0218	-0.0005	1.21	0.0033	5.14	-0.00001	4.14	0.969	-0.00001	-0.0001	0.014	0.000567	-0.001	-0.003		2014.37	667
Bi-annual Seep Sampling	Boundary Dump Seep 2	6/8/2014	6/8/2014	0.0412	-0.0001	-0.0005	0.057	0.000045	232	-0.0005	0.00022	0.00604	0.04	0.000073	0.00203	32.3	0.0344	0.0371	-0.0005	1.49	0.00412	5.8	-0.00001	7.42	2.39	-0.00001	-0.0001	0.013	0.001125	-0.001	-0.003		2014.43	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-06-2014 11:53	6/16/2014	0.0431	-0.0001	-0.0005	0.047	-0.00007	252	-0.0005	0.00017	0.00393	-0.03	0.000065	0.00284	39.9	0.0332	0.0517	-0.0005	1.67	0.00687	5.52	-0.00001	8.28	3.06	-0.00001	-0.0001	0.014	0.00137	-0.001	-0.003		2014.45	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/9/2014	8/9/2014	0.0441	-0.0001	-0.0005	0.057	0.000015	233	-0.0005	0.00034	0.0035	0.057	-0.00005	0.0024	32.4	0.0594	0.0253	-0.0005	1.45	0.00241	6.24	-0.00001	6.84	2.35	-0.00001	-0.0001	0.019	0.0013	-0.001	0.004		2014.6	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/12/2014	8/12/2014	0.0452	-0.0001	-0.0005	0.048	0.000031	243	-0.0005	0.00031	0.00433	0.097	0.000168	0.00188	34.1	0.0976	0.0245	-0.0005	1.75	0.00257	6.07	-0.00001	7.99	2.6	-0.00001	-0.0001	0.015	0.000722	-0.001	-0.003		2014.61	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2014 9:42	10/23/2014	0.0396	-0.0001	-0.0005	0.044	0.000028	238	-0.0005	0.00052	0.00356	0.075	0.000052	0.00205	34.4	0.105	0.0292	-0.0005	1.55	0.00299	6.18	-0.00001	7.35	2.83	-0.00001	-0.0001	0.018	0.00104	-0.001	-0.003		2014.81	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/11/2014	11/11/2014	0.0408	0.00019	-0.0005	0.066	0.000055	206	-0.0005	0.00023	0.00594	-0.03	0.000164	0.0025	25.8	0.0259	0.0348	-0.0005	1.48	0.00435	5.89	-0.00001	6.75	1.98	0.00002	-0.0001	0.015	0.000999	0.0015	0.004		2014.86	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	1/7/2015	1/7/2015	0.0342	-0.0001	-0.00005	0.059	0.0000715	184	-0.0005	-0.0001	0.00675	-0.03	-0.00005	0.0019	23.4	0.0207	0.0246	-0.0005	1.29	0.00225	5.48	-0.00001	6.35	1.91	-0.00001	-0.0001	-0.01	0.00107	-0.0005	0.003		2015.02	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/6/2015	2/6/2015	0.0342	-0.0001	-0.00005	0.062	0.000074	164	-0.0005	0.00016	0.00905	-0.03	-0.00005	0.0013	17.9	0.0393	0.0173	-0.0005	1.18	0.00154	6.13	-0.00001	5.23	1.27	-0.00001	-0.0001	-0.01	0.000783	-0.0005	-0.003		2015.1	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/9/2015	2/9/2015	0.0453	-0.0001	-0.00005	0.066	0.0000211	195	-0.0005	0.00155	0.00317	0.185	0.000096	0.002	23	0.498	0.0173	-0.0005	1.32	0.00156	6.67	-0.00001	6.02	1.87	-0.00001	-0.0001	-0.01	0.00103	0.00069	-0.003		2015.11	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/2/2015	3/2/2015	0.0315	-0.0001	-0.0005	0.062	0.000021	169	-0.0005	-0.0001	0.00616	-0.03	-0.00005	0.00193	21.2	0.0205	0.028	-0.0005	1.18	0.00258	5.91	-0.00001	5.65	1.57	-0.00001	-0.0001	0.012	0.000645	-0.001	-0.003		2015.16	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/3/2015	3/3/2015	0.0312	-0.0001	-0.0005	0.056	0.000036	169	-0.0005	0.00012	0.00654	-0.03	-0.00005	0.00157	22.5	0.0134	0.0342	-0.0005	1.13	0.00352	5.73	-0.00001	5.54	1.73	-0.00001	-0.0001	0.015	0.000738	-0.001	-0.003		2015.17	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/4/2015	7/4/2015	0.0315	-0.0001	-0.00005	0.059	0.0000306	169	-0.0005	0.00011	0.00571	-0.03	-0.00005	0.0017	21.7	0.0138	0.0324	-0.0005	1.31	0.00389	5.68	-0.00001	5.94	1.66	-0.00001	-0.0001	0.013	0.000604	-0.0005	-0.003		2015.5	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/5/2015	7/5/2015	0.0294	-0.0001	-0.00005	0.067	0.000027	147	-0.0005	-0.0001	0.00716	-0.03	-0.00005	0.002	16.5	0.00726	0.0208	-0.0005	1.03	0.00204	6.14	-0.00001	4.68	1.22	-0.00001	-0.0001	-0.01	0.0006	-0.0005	-0.003		2015.51	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	29-10-2015 11:29	10/29/2015	0.047	-0.0001	-0.00005	0.038	0.0000114	200	-0.0005	0.0011	0.00168	0.157	-0.00005	-0.001	29.1	0.00398	0.0158	-0.0005	1.68	0.00161	6.76	0.00001	7.06	2.75	-0.00001	-0.0001	-0.01	0.00076	0.00075	-0.003		2015.82	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/8/2015	11/8/2015	0.04	-0.0001	-0.00005	0.06	0.00004	195	-0.0005	0.00115	0.00537	0.103	0.000061	0.0029	24.6	0.419	0.0243	-0.0005	1.29	0.00208	6.45	-0.00001	6.18	2.13	-0.00001	-0.0001	-0.01	0.00107	0.00056	-0.003		2015.85	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	30-11-2015 11:50	11/30/2015	0.0453	-0.0001	-0.00005	0.056	0.0000353	237	-0.0005	0.00019	0.00332	0.034	-0.00005	0.0017	28.1	0.116	0.0183	-0.0005	1.58	0.00177	6.5	-0.00001	6.97	2.16	-0.00001	-0.0001	-0.01	0.000665	0.0005	-0.003		2015.91	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 2	12/1/2015	12/1/2015	0.0363	-0.0001	-0.0005	0.057	0.000013	209	-0.0005	0.00026	0.00115	0.063	-0.00005	0.0013	26.7	0.0491	0.0226	-0.0005	1.41	0.00187	6.48	-0.00001	6.38	1.92	-0.00001	-0.0001	0.018	0.00069	-0.001	-0.003		2015.91	#N/A
Bi-annual Seep Sampling	Boundary Dump Seep 3	19-05-2015 13:49	5/19/2015	0.0331	-0.0001	-0.00005	0.069	0.0000227	144	-0.0005	0.00013	0.00634	0.04	-0.00005	0.0013	13.2	0.0509	0.0089	-0.0005	0.972	0.00106	6.3	-0.00001	4.24	0.815	-0.00001	-0.0001	-0.01	0.000551	0.00055	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	East Dump Seep 1	9/5/2013	9/5/2013	0.0301	-0.0001	-0.0005	0.057	-0.00015	156	-0.0005	-0.0001	0.00226	-0.03	-0.00005	-0.0005	30.5	0.0195	0.195	-0.0005	2.29	0.0612	3.77	-0.00001	14.4	3.05	-0.00001	-0.0001	-0.01	0.000022	-0.001	0.0147		2013.68	526
Bi-annual Seep Sampling	East Dump Seep 1	23-10-2014 14:15	10/23/2014	0.0492	-0.0001	-0.0005	0.039	0.000237	166	-0.0005	0.00179	0.00561	-0.03	-0.00005	-0.0005	32.9	0.594	0.0926	0.0017	2.3	0.017	3.71	-0.00001	12.9	2.92	-0.00001	-0.0001	0.016	0.000031	-0.001	0.0212		2014.81	#N/A
Bi-annual Seep Sampling	East Dump Seep 1	28-05-2015 10:46	5/28/2015	0.0586	-0.0001	-0.00005	0.045	0.000226	171	-0.0005	0.0011	0.00571	-0.03	-0.00005	-0.001	35	0.646	0.102	0.00107	2.16	0.0257	3.76	-0.00001	14.5	2.81	-0.00001	-0.0001	0.011	0.000037	-0.0005	0.0176		2015.4	#N/A
Bi-annual Seep Sampling	East Dump Seep 1	26-11-2015 12:46	11/26/2015	0.0383	-0.0001	-0.00005	0.045	0.000159	167	-0.0005	0.00015	0.00342	-0.03	-0.00005	-0.001	33.4	0.217	0.0392	0.00138	1.94	0.00789	3.9	-0.00001	13.6	2.74	-0.00001	-0.0001	0.013	0.000017	-0.0005	0.0175		2015.9	#N/A
Bi-annual Seep Sampling	East Dump Seep 2	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.68	394
Bi-annual Seep Sampling	East Dump Seep 2	20-06-2013 13:24	6/20/2013	0.0233	-0.0001	-0.0005	0.051	-0.0005	128	-0.0005	0.00154	0.00321	-0.03	-0.00005	-0.0005	26.8	0.244	0.312	0.00078	2.3	0.0726	3.25	-0.00001	13.8	3.26	-0.00001	-0.0001	0.011	0.000016	-0.001	0.0135		2013.47	#N/A
Bi-annual Seep Sampling	East Dump Seep 3	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.68	519
Bi-annual Seep Sampling	East Dump Seep 3	20-06-2013 13:36	6/20/2013	0.0312	-0.0001	-0.0005	0.062	-0.001	141	-0.0005	0.00659	0.00477	-0.03	-0.00005	0.00109	34.5	1.11	0.393	0.00333	2.19	0.0399	4.1	-0.00001	17.3	4.2	-0.00001	-0.0001	0.011	0.000068	-0.001	0.0695		2013.47	#N/A
Bi-annual Seep Sampling	East Dump Seep 4	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.68	633
Bi-annual Seep Sampling	East Dump Seep 4	20-06-2013 13:55	6/20/2013	0.0441	-0.0001	-0.0005	0.039	0.000309	232	-0.0005	-0.0001	0.00479	-0.03	-0.00005	-0.0005	37.2	0.00473	0.107	0.00093	2.6	0.0491	5.04	-0.00001	17.1	2.73	-0.00001	-0.0001	0.013	0.000086	-0.001	0.0546		2013.47	#N/A
Bi-annual Seep Sampling	East Dump Seep 4	26-11-2015 13:16	11/26/2015	0.0622	-0.0001	-0.00005	0.035	0.00123	148	-0.0005	-0.0001	0.00397	-0.03	-0.00005	0.0012	22.8	0.00051	0.117	0.00078	1.32	0.0282	5.5	-0.00001	9.86	1.84	-0.00001	-0.0001	0.013	0.000287	-0.0005	0.14		2015.9	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/7/2013	2/7/2013	0.0504	-0.0002	-0.001	0.105	-0.0003	359	-0.0005	0.00076	0.0652	-0.03	-0.0001	-0.001	63	0.0938	0.313	0.0016	2.23	0.242	5.14	-0.00002	22.5	3.22	-0.00002	-0.0002	0.013	0.00147	-0.002	0.0117		2013.1	2010
Bi-annual Seep Sampling	NEZ Dump Seep 1	10/12/2013	10/12/2013	0.0607	-0.0002	-0.001	0.082	-0.0001	322	-0.0005	-0.0002	0.0168	-0.03	-0.0001	-0.001	56.2	0.0117	0.195	-0.001	2.14	0.125	5.35	-0.00002	19.1	4.1	-0.00002	-0.0002	0.02	0.00133	-0.002	0.005		2013.78	1799
Bi-annual Seep Sampling	NEZ Dump Seep 1	23-10-2013 13:55	10/23/2013	0.0527	-0.0002	-0.001	0.09	-0.00012	301	-0.0005	-0.0002	0.0198	-0.03	-0.0001	0.0023	55.6	0.0181	0.188	-0.001	2.27	0.133	5.68	-0.00002	19.6	3.44	-0.00002	-0.0002	-0.01	0.00136	-0.002	0.0053		2013.81	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	26-11-2013 9:14	11/26/2013	0.056	-0.0002	-0.001	0.089	-0.00012	327	-0.0005	-0.0002	0.0173	-0.03	-0.0001	0.0019	54.4	0.0134	0.184	-0.001	2.21	0.132	5.31	-0.00002	19.9	3.78	-0.00002	-0.0002	0.019	0.00133	-0.002	0.005		2013.9	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	16-01-2014 10:15	1/16/2014	0.0613	-0.0002	-0.001	0.095	-0.0002	325	-0.0005	-0.0002	0.0164	-0.03	-0.0001	0.0025	57.9	0.0114	0.227	-0.001	2.21	0.132	4.9	-0.00002	19.7	4.57	-0.00002	-0.0002	0.015	0.00148	-0.002	0.0061		2014.04	1850
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-02-2014 13:08	2/18/2014	0.0677	-0.0002	-0.001	0.095	-0.00012	353	-0.0005	-0.0002	0.0145	-0.03	-0.0001	0.0019	63.4	0.011	0.256	-0.001	2.31	0.136	5.15	-0.00002	21.6	5.26	-0.00002	-0.0002	0.012	0.00153	-0.002	0.0052		2014.13	1902
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/6/2014	3/6/2014	0.0462	-0.0002	-0.001	0.071	-0.0004	320	-0.0005	0.00327	0.17	-0.03	-0.0001	0.0028	60.5	0.315	0.245	0.0051	2.21	0.174	5.16	-0.00002	19.8	3.2	-0.00002	-0.0002	-0.01	0.00106	-0.002	0.0241		2014.17	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/7/2014	3/7/2014	0.0472	-0.0002	-0.001	0.089	-0.0004	355	-0.0005	0.00177	0.112	-0.03	-0.0001	0.0024	67.1	0.202	0.272	0.0032	2.22	0.182	5.15	0	21	3.92	-0.00002	-0.0002	0.017	0.00129	-0.002	0.018		2014.18	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-05-2014 11:45	5/13/2014	0.0495	-0.0002	-0.001	0.076	-0.0009	314	-0.0005	0.0167	0.516	-0.03	-0.0001	0.0051	64.9	1.05	0.252	0.0145	2.16	0.156	5.45	-0.00002	18.5	3.53	-0.00002	-0.0002	0.016	0.000707	-0.002	0.0733		2014.36	1763
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/8/2014	6/8/2014	0.0432	-0.0002	-0.001	0.089	0.000168	339	-0.0005	0.00142	0.0817	-0.03	-0.0001	0.003	60	0.169	0.203	0.0025	2.15	0.156	5.17	-0.00002	20.2	3.22	-0.00002	-0.0002	0.016	0.00108	-0.002	0.0141		2014.43	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/4/2014	8/4/2014	0.0359	-0.0001	-0.0005	0.06	-0.00013	241	-0.0005	0.00019	0.0217	-0.03	-0.00005	0.00146	40.5	0.0296	0.178	0.00061	1.77	0.101	5.22	-0.00001	17.4	2.28	-0.00001	-0.0001	0.017	0.00137	-0.001	0.0037		2014.59	1390
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/9/2014	8/9/2014	0.0449	-0.0002	-0.001	0.084	-0.0002	344	-0.0005	0.00118	0.0732	-0.03	-0.0001	0.0026	63.6	0.141	0.22	0.0023	2.28	0.178	5.44	-0.00002	20	3.31	-0.00002	-0.0002	0.024	0.00129	-0.002	0.0136		2014.6	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/12/2014	8/12/2014	0.0459	-0.0002	-0.001	0.075	0.000192	342	-0.0005	0.00193	0.143	-0.03	-0.0001	0.0028	62.2	0.194	0.216	0.0034	2.39	0.177	5.53	-0.00002	20.8	3.29	-0.00002	-0.0002	0.015	0.00116	-0.002	0.0212		2014.61	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	27-10-2014 11:23	10/27/2014	0.0379	-0.0001	-0.0005	0.075	0.000105	283	-0.0005	0.00089	0.0616	-0.03	-0.00005	0.00276	48.2	0.126	0.195	0.00134	2.06	0.125	4.79	-0.00001	17.6	3.13	-0.00001	-0.0001	0.023	0.00128	-0.001	0.0081		2014.82	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/3/2014	11/3/2014	0.0708	-0.0002	-0.001	0.096	-0.00014	361	-0.0005	-0.0002	0.0139	-0.03	-0.0001	0.0016	64.5	0.00791	0.232	-0.001	2.3	0.136	5.23	-0.00002	21.3	5.03	-0.00002	-0.0002	0.019	0.00145	-0.002	0.0051		2014.84	1957
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2014	11/11/2014	0.0384	-0.0001	-0.0005	0.072	0.000196	283	-0.0005	0.00268	0.116	-0.03	-0.00005	0.00292	49.1	0.238	0.186	0.0032	2.11	0.115	5.16	-0.00001	17.2	3.01	-0.00001	-0.0001	0.021	0.00109	-0.001	0.0165		2014.86	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-01-2015 10:28	1/13/2015	0.0448	-0.0002	-0.001	0.079	0.00023	364	-0.0005	0.00202	0.153	-0.03	-0.0001	0.0029	67.4	0.203	0.245	0.0036	2.26	0.197	5.47	-0.00002	19.8	3.16	0.000035	-0.0002	0.02	0.00123	-0.002	0.0242		2015.03	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/9/2015	2/9/2015	0.0457	-0.0002	-0.0001	0.085	0.000198	357	-0.0005	0.00169	0.132	-0.03	-0.0001	0.003	63.5	0.204	0.182	0.003	2.32	0.176	5.38	-0.00002	20.5	3.19	-0.00002	-0.0002	-0.01	0.00134	-0.001	0.0209		2015.11	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	4/6/2015	4/6/2015	0.0434	-0.0002	-0.0001	0.081	0.000247	342	-0.0005	0.0022	0.179	-0.03	-0.0001	0.0032	61.8	0.267	0.219	0.0039	2.32	0.205	5.32	-0.00002	20.3	3.33	-0.00002	-0.0002	-0.01	0.00116	-0.001	0.0249		2015.26	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/2/2015	5/2/2015	0.0506	-0.0002	-0.001	0.079	0.000249	326	-0.0005	0.00352	0.234	-0.03	-0.0001	0.0034	62.8	0.318	0.249	0.0051	2.59	0.174	5.28	-0.00002	24.1	3.55	-0.00002	-0.0002	0.016	0.0011	-0.002	0.0316		2015.33	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/3/2015	5/3/2015	0.0424	-0.0002	-0.001	0.083	0.000255	355	-0.0005	0.00324	0.198	-0.03	-0.0001	0.0048	64.9	0.299	0.284	0.0045	2.24	0.184	5.42	-0.00002	19.8	3.6	-0.00002	-0.0002	0.026	0.00122	-0.002	0.0248		2015.33	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/5/2015	6/5/2015	0.0433	-0.0002	-0.0001	0.074	0.000287	327	-0.0005	0.00324	0.213	-0.03	-0.0001	0.0035	63.4	0.345	0.218	0.0049	2.27	0.207	5.43	-0.00002	19.8	3.17	-0.00002	-0.0002	-0.01	0.00091	-0.001	0.0278		2015.42	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	7/7/2015	7/7/2015	0.0467	-0.0002	-0.0001	0.1	-0.0002	367	-0.0005	0.00175	0.153	-0.03	-0.0001	0.0034	60.5	0.211	0.196	0.0035	2.33	0.18	5	-0.00002	20.1	3.03	-0.00002	-0.0002	-0.01	0.00117	-0.001	0.0246		2015.51	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-08-2015 13:28	8/18/2015	0.043	-0.0002	-0.0001	0.089	0.000189	330	-0.0005	0.00166	0.135	-0.03	-0.0001	0.0022	60.5	0.206	0.172	0.003	2.22	0.156	5.32	-0.00002	19.7	2.94	-0.00002	-0.0002	-0.01	0.00121	-0.001	0.022		2015.63	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 1	9/4/2015	9/4/2015	0.0424	-0.0001	-0.00005	0.082	0.000347	308	-0.0005	0.00494	0.266	-0.03	-0.00005	0.0049	58

Location Type	Sample Point	Original Date As Is	Recoded Date	pH-field	Q	T	Turbidity-Field	EC	Hardness	pH	TDS	TSS	Turbidity	Alkalinity	NH3	Cl	F	NO3	NO3+NO2	NO2	PO4	P-D	P-T	SO4	N-T
					m3/s	C	NTU	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Boundary Dump Seep 1	4/6/2013	4/6/2013	7.1	0	7.9	#N/A	320	161	7.46	211	16.3	2.28	57.7	0.0195	0.25	0.045	0.286	0.286	0.0005	0.0211	0.038	0.15	99	1.1
Bi-annual Seep Sampling	Boundary Dump Seep 2	4/6/2013	4/6/2013	7.9	0.003	2	#N/A	998	526	7.9	728	1.5	0.54	142	0.0168	2.5	0.3	0.877	0.877	0.005	0.0201	0.0283	0.0554	438	1.04
Bi-annual Seep Sampling	Boundary Dump Seep 2	10/12/2013	10/12/2013	7.498	#N/A	0.2	#N/A	1320	793	7.71	1090	1.5	29.5	213	0.273	2.5	0.26	0.112	0.112	0.005	0.161	0.195	0.225	600	0.639
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2013 15:26	10/23/2013	#N/A	#N/A	#N/A	#N/A	1330	812	7.8	999	1.5	1.01	186	0.15	2.5	0.1	0.173	0.173	0.005	0.0803	0.0908	0.202	642	0.591
Bi-annual Seep Sampling	Boundary Dump Seep 2	14-11-2013 10:35	11/14/2013	7.757	#N/A	1	1.2	1300	793	8.06	1050	1.5	3.77	181	0.0959	2.5	0.1	0.118	0.131	0.013	0.0766	0.0889	0.15	609	0.468
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-01-2014 11:10	1/16/2014	8.601	#N/A	0	108.9	1160	654	7.61	912	26.9	95.6	175	0.213	2.5	0.1	0.025	0.0255	0.005	0.162	0.256	2.03	513	2.55
Bi-annual Seep Sampling	Boundary Dump Seep 2	18-02-2014 10:11	2/18/2014	7.667	#N/A	0	3.84	1200	748	7.79	983	4.4	10.5	223	0.412	2.5	0.1	0.025	0.0255	0.005	0.183	0.172	0.247	521	0.681
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/7/2014	3/7/2014	#N/A	#N/A	#N/A	#N/A	1310	809	8.06	1120	5.4	1.1	146	0.0288	2.5	0.2	0.395	0.395	0.005	0.0341	0.0401	0.048	659	0.618
Bi-annual Seep Sampling	Boundary Dump Seep 2	15-05-2014 9:15	5/15/2014	7.8	#N/A	3.6	#N/A	675	372	8.02	494	1.5	0.27	107	0.0065	0.25	0.145	0.985	0.987	0.0022	0.016	0.0198	0.021	244	1.13
Bi-annual Seep Sampling	Boundary Dump Seep 2	6/8/2014	6/8/2014	#N/A	#N/A	#N/A	#N/A	1170	711	7.97	982	1.5	0.27	148	0.0094	2.5	0.28	0.539	0.539	0.005	0.0252	0.0299	0.024	555	0.726
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-06-2014 11:53	6/16/2014	#N/A	#N/A	#N/A	#N/A	1250	795	8.02	1010	1.5	0.26	131	0.0177	2.5	0.1	0.677	0.677	0.005	0.0249	0.0315	0.0366	612	0.848
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/9/2014	8/9/2014	#N/A	#N/A	#N/A	#N/A	1260	715	7.91	968	5.4	0.81	176	0.0217	2.5	0.29	0.323	0.323	0.005	0.0314	0.0434	0.0514	589	0.515
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/12/2014	8/12/2014	#N/A	#N/A	#N/A	#N/A	1300	746	8.11	1040	1.5	0.4	142	0.096	2.5	0.1	0.35	0.35	0.005	0.0616	0.0722	0.0831	630	0.563
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2014 9:42	10/23/2014	#N/A	#N/A	#N/A	#N/A	1260	737	7.97	981	1.5	0.28	178	0.0172	2.5	0.1	0.172	0.172	0.005	0.0607	0.0679	0.0648	591	0.39
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/11/2014	11/11/2014	#N/A	#N/A	#N/A	#N/A	1130	620	8.14	875	1.5	0.29	168	0.0294	2.5	0.1	0.906	0.93	0.023	0.0422	0.0465	0.0476	502	1.04
Bi-annual Seep Sampling	Boundary Dump Seep 2	1/7/2015	1/7/2015	#N/A	#N/A	#N/A	#N/A	974	556	7.83	703	61.7	8.53	183	0.0129	0.5	0.155	0.005	0.005	0.001	0.0247	0.0368	0.282	368	0.858
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/6/2015	2/6/2015	#N/A	#N/A	#N/A	#N/A	936	483	8.36	682	5.9	1.47	181	0.0189	0.5	0.123	0.181	0.184	0.0025	0.0181	0.0236	0.0522	325	0.411
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/9/2015	2/9/2015	#N/A	#N/A	#N/A	#N/A	976	582	7.55	766	1.5	0.92	207	0.0799	1.25	0.14	0.094	0.094	0.0025	0.0908	0.084	0.119	351	0.443
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/2/2015	3/2/2015	#N/A	#N/A	#N/A	#N/A	853	510	8.12	656	1.5	0.2	167	0.0156	0.5	0.148	0.473	0.473	0.001	0.0386	0.0421	0.046	318	0.573
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/3/2015	3/3/2015	#N/A	#N/A	#N/A	#N/A	916	514	7.95	725	1.5	0.17	147	0.0055	0.5	0.167	0.564	0.564	0.001	0.0317	0.0374	0.0349	383	0.712
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/4/2015	7/4/2015	#N/A	#N/A	#N/A	#N/A	908	511	7.97	663	1.5	0.18	136	0.0078	0.5	0.145	0.989	0.992	0.0028	0.0216	0.0257	0.0233	371	1.09
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/5/2015	7/5/2015	#N/A	#N/A	#N/A	#N/A	784	435	8.32	582	1.5	0.24	156	0.0057	0.5	0.112	0.63	0.63	0.001	0.0285	0.0323	0.0335	276	0.727
Bi-annual Seep Sampling	Boundary Dump Seep 2	29-10-2015 11:29	10/29/2015	#N/A	#N/A	#N/A	#N/A	1110	620	7.88	884	1.5	4.24	200	0.229	1.25	0.18	0.0125	0.0125	0.0025	0.167	0.181	0.261	456	0.554
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/8/2015	11/8/2015	#N/A	#N/A	#N/A	#N/A	1060	589	8.19	814	3.5	0.77	199	0.0926	1.25	0.19	0.074	0.074	0.0025	0.0839	0.0923	0.129	412	0.417
Bi-annual Seep Sampling	Boundary Dump Seep 2	30-11-2015 11:50	11/30/2015	#N/A	#N/A	#N/A	#N/A	1170	707	7.57	903	26.6	6.87	200	0.125	1.25	0.13	0.1	0.114	0.0139	0.081	0.0923	0.324	475	0.883
Bi-annual Seep Sampling	Boundary Dump Seep 2	12/1/2015	12/1/2015	#N/A	#N/A	#N/A	#N/A	1060	632	7.93	815	1.5	0.23	177	0.0498	2.5	0.15	0.349	0.357	0.0076	0.0456	0.0559	0.0626	441	0.53
Bi-annual Seep Sampling	Boundary Dump Seep 3	19-05-2015 13:49	5/19/2015	#N/A	#N/A	#N/A	#N/A	748	413	8.28	570	5.7	0.57	179	0.0137	0.25	0.1	0.359	0.361	0.0018	0.0198	0.0231	0.0423	223	0.578
Bi-annual Seep Sampling	East Dump Seep 1	9/5/2013	9/5/2013	6.85	0.003	1.7	#N/A	971	514	7.2	784	1.5	0.32	29.5	0.0025	2.5	0.22	2.49	2.49	0.005	0.0005	0.0058	0.0089	505	2.56
Bi-annual Seep Sampling	East Dump Seep 1	23-10-2014 14:15	10/23/2014	#N/A	#N/A	#N/A	#N/A	995	549	7.86	814	1.5	0.72	60.8	0.0025	2.5	0.1	0.169	0.169	0.005	0.0005	0.0025	0.004	499	0.31
Bi-annual Seep Sampling	East Dump Seep 1	28-05-2015 10:46	5/28/2015	#N/A	#N/A	#N/A	#N/A	1070	572	8.04	863	4.1	0.46	56	0.0025	1.25	0.05	0.227	0.235	0.008	0.0016	0.0025	0.0095	519	0.388
Bi-annual Seep Sampling	East Dump Seep 1	26-11-2015 12:46	11/26/2015	#N/A	#N/A	#N/A	#N/A	1020	554	7.41	731	35.6	18.1	57	0.0051	1.25	0.05	0.32	0.32	0.0025	0.0005	0.0035	0.195	501	0.587
Bi-annual Seep Sampling	East Dump Seep 2	9/5/2013	9/5/2013	#N/A	0.002	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 2	20-06-2013 13:24	6/20/2013	#N/A	#N/A	#N/A	#N/A	842	430	7.41	646	1.5	0.53	24.9	0.0025	2.5	0.1	1.76	1.76	0.005	0.0045	0.0093	0.0117	431	1.79
Bi-annual Seep Sampling	East Dump Seep 3	9/5/2013	9/5/2013	#N/A	0.002	0.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 3	20-06-2013 13:36	6/20/2013	#N/A	#N/A	#N/A	#N/A	936	495	7.48	737	5.7	0.91	22.7	0.0072	2.5	0.37	1.72	1.73	0.011	0.001	0.0058	0.0123	496	1.7
Bi-annual Seep Sampling	East Dump Seep 4	9/5/2013	9/5/2013	#N/A	0.005	3.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	East Dump Seep 4	20-06-2013 13:55	6/20/2013	#N/A	#N/A	#N/A	#N/A	1280	732	7.59	1060	1.5	0.22	33.6	0.0025	2.5	0.1	3.66	3.66	0.005	0.0089	0.0128	0.0137	708	3.67
Bi-annual Seep Sampling	East Dump Seep 4	26-11-2015 13:16	11/26/2015	#N/A	#N/A	#N/A	#N/A	884	465	7.83	658	6.4	1.27	60.8	0.0025	1.25	0.05	3.31	3.31	0.0025	0.0005	0.001	0.0754	406	3.3
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/7/2013	2/7/2013	8.1	0.2	2.6	#N/A	1860	1160	7.83	1700	1.5	1.01	56.5	0.0025	5	0.2	15.3	15.3	0.01	0.0033	0.0053	0.0064	1090	14.5
Bi-annual Seep Sampling	NEZ Dump Seep 1	10/12/2013	10/12/2013	8.03	#N/A	0.1	#N/A	1700	1040	7.86	1520	1.5	0.29	78.3	0.0025	5	0.5	7.16	7.16	0.01	0.0067	0.0107	0.0115	1000	6.77
Bi-annual Seep Sampling	NEZ Dump Seep 1	23-10-2013 13:55	10/23/2013	#N/A	#N/A	#N/A	#N/A	1670	981	7.9	1450	1.5	0.14	78.9	0.0025	12	0.2	8.12	8.12	0.01	0.0063	0.0091	0.0097	948	7.47
Bi-annual Seep Sampling	NEZ Dump Seep 1	26-11-2013 9:14	11/26/2013	#N/A	#N/A	#N/A	#N/A	1700	1040	7.95	1480	1.5	0.18	73.7	0.0085	5	0.2	7.19	7.19	0.01	0.0061	0.0101	0.0097	964	7.24
Bi-annual Seep Sampling	NEZ Dump Seep 1	16-01-2014 10:15	1/16/2014	8.761	#N/A	1.4	0.22	1800	1050	7.84	1650	1.5	0.34	76.2	0.0166	5	0.2	6.59	6.59	0.01	0.0081	0.0102	0.0121	1070	6.36
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-02-2014 13:08	2/18/2014	7.924	#N/A	0.2	0.13	1800	1140	7.85	1660	1.5	0.26	76.3	0.0025	5	0.2	6.46	6.46	0.01	0.0085	0.0109	0.0127	1110	6.19
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1750	1050	7.88	1560	4.9	2.18	54.8	0.0025	8	0.47	5.12	5.12	0.005	0.0014	0.0022	0.0058	1000	5.04
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/7/2014	3/7/2014	#N/A	#N/A	#N/A	#N/A	1830	1160	7.86	1670	1.5	0.43	62.4	0.0025	5	0.45	5.29	5.29	0.01	0.0029	0.0048	0.0064	1130	4.98
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-05-2014 11:45	5/13/2014	7.39	#N/A	2.7	#N/A	1720	1050	7.59	1560	10	7.93	34.3	0.0071	5.2	0.7	5.16	5.16	0.005	0.0005	0.001	0.001	1030	5.16
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/8/2014	6/8/2014	#N/A	#N/A	#N/A	#N/A	1730	1090	7.85	1540	1.5	0.32	60	0.0025	5	0.78	5.92	5.92	0.01	0.0025	0.004	0.0041	1030	5.44
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/4/2014	8/4/2014	8.059	#N/A	1.8	0.19	1350	768	8.05	1140	4.3	0.39	99.3	0.0025	21.3	0.33	3.34	3.34	0.005	0.008	0.0123	0.0148	659	3.03
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/9/2014	8/9/2014	#N/A	#N/A	#N/A	#N/A	1790	1120	7.87	1580	1.5	0.22	68.5	0.0025	5	0.2	5.34	#N/A	0.01	0.0035	0.0052	0.006	1070	4.69
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/12/2014	8/12/2014	#N/A	#N/A	#N/A	#N/A	1860	1110	7.85	1520	1.5	0.46	64.7	0.0025	5	0.56	5.49	5.49	0.01	0.0005	0.0037	0.0045	1130	4.94
Bi-annual Seep Sampling	NEZ Dump Seep 1	27-10-2014 11:23	10/27/2014	#N/A	#N/A	#N/A	#N/A	1540	905	8.03	1340	1.5	0.85	64.9	0.0025	10	0.39	5.86	5.86	0.005	0.0041	0.0055	0.0049	801	5.86
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/3/2014	11/3/2014	7.64	#N/A	0.1	0.1	1860	1170	7.89	1670	1.5	0.17	83.2	0.0025	5	0.43	6.37	6.37	0.01	0.0075	0.0112	0.0109	1130	6.2
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2014	11/11/2014	#N/A	#N/A	#N/A	#N/A	1550	909	7.87	1250	1.5	1.26	65.8	0.0025	11.6	0.51	6.66	6.66	0.005	0.0026	0.0047	0.005	834	6.18
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-01-2015 10:28	1/13/2015	#N/A	#N/A	#N/A	#N/A	1890	1190	7.79	1690	1.5	0.28	61	0.0025	9.9	0.58	5.38	5.38	0.005	0.0019	0.005	0.0048	1140	5.06
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/9/2015	2/9/2015	#N/A	#N/A	#N/A	#N/A	1780	1150	7.66	1610	1.5	0.5	67.9	0.0025	2.5	0.47	3.94	3.94	0.005	0.0023	0.0053	0.0048	1060	3.91
Bi-annual Seep Sampling	NEZ Dump Seep 1	4/6/2015	4/6/2015	#N/A	#N/A	#N/A	#N/A	1720	1110	7.84	1590	1.5	0.26	63.8	0.0025	4.7	0.56	4.67	4.67	0.0025	0.0012	0.0035	0.0032	1040	4.63
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/2/2015	5/2/2015	#N/A	#N/A	#N/A	#N/A	1790	1070	7.87	1600	3.4	1.27	57.9	0.0025	6.4	0.72	5.08	5.08	0.005	0.0014	0.0026	0.0046	1050	4.84
Bi-annual Seep Sampling	NEZ Dump Seep 1	5/3/2015	5/3/2015	#N/A	#N/A	#N/A	#N/A	1760	1150	7.54	1590	1.5	2.81	55.5	0.0025	7.6	0.79	4.77	4.77	0.005	0.0015	0.0037	0.0056	1060	4.82
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/5/2015	6/5/2015	#N/A	#N/A	#N/A	#N/A	1830	1080	7.98	1570	1.5	2.4	58.9	0.0025	5.3	0.6	5	5	0.005	0.0005	0.0021	0.0059	1080	4.75
Bi-annual Seep Sampling	NEZ Dump Seep 1	7/7/2015	7/7/2015	#N/A	#N/A	#N/A	#N/A	1900	1170	7.86	1640	1.5	0.7	63.2	0.0025	2.5	0.54	4.23	4.23	0.005	0.0019	0.0042	0.0044	1100	4.31
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-08-2015 13:28	8/18/2015	#N/A	#N/A	#N/A	#N/A	1840	1070	7.73	1710	1.5	0.36	66.9	0.0025	5	0.56	4.26	4.26	0.005	0.0032	0.0047	0.0041	1110	3.88
Bi-annual Seep Sampling	NEZ Dump Seep 1	9/4/2015	9/4/2015	#N/A	#N/A	#N/A	#N/A	1610	1010	7.83	1360	6.2	6.35	50.7	0.0025	7	0.73	5.67	5.67	0.005	0.0005	0.0021	0.0043	991	5.26
Bi-annual Seep Sampling	NEZ Dump Seep 1	29-10-2015 10:44	10/29/2015	#N/A	#N/A	#N/A	#N/A	1790	1080	7.89	1570	1.5	0.32	76.7	0.0025	5.7	0.47	3.7	3.7	0.005	0.0037	0.0056	0.0045	1020	3.64
Bi-annual Seep Sampling	NEZ Dump Seep 1	11/11/2015	11/11/2015	#N/A	#N/A	#N/A	#N/A	1660	956	7.95	1420	1.5	0.54	75.3	0.0025	6.8	0.51	3.93	3.93	0.005	0.0031	0.0052	0.0048	895	3.97
Bi-annual Seep Sampling	NEZ Dump Seep 10	4/7/2013	4/7/2013	8.3	0.0085	5.1	#N/A	1360	835	8.08	1170	1.5	0.52	165	0.0025	2.5	0.1	1.21	1.21	0.005	0.0102	0.0118	0.0133	681	1.25
Bi-annual Seep Sampling	NEZ Dump Seep 10	27-10-2014 13:57	10/27/2014	#N/A	#N/A	#N/A	#N/A	1390	809	8.26	1190	1.5	0.56	148	0.0025	2.5	0.1	0.793	0.793	0.005	0.0099	0.0132	0.0137	681	0.88
Bi-annual Seep Sampling	NEZ Dump Seep 10	8/6/2015	8/6/2015	#N/A	#N/A	#N/A	#N/A	1310	813	8.27	1070	1.5	0.72	182	0.0055	1.25	0.14	0.732	0.732	0.0025	0.0087	0.0126	0.0112	645	0.857
Bi-annual Seep Sampling	NEZ Dump Seep 11	4/7/2013	4/7/2013	8.2	0.002	7.2	#N/A	1440	878	8.11	1240	42.7	11.6	245	0.0025	2.5	0.1	1.11	1.11	0.005	0.0021	0.0044	0.0674	656	1.3
Bi-annual Seep Sampling	NEZ Dump Seep 11	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1340	807	8.23	1150	6.1	0.33	238	0.0025	2.5	0.1	0.826	0.826	0.005	0.0022	0.0026	0.0183	592	1.02
Bi-annual Seep Sampling	NEZ Dump Seep 11	27-10-2014 14:28	10/27/2014	#N/A	#N/A	#N/A	#N/A	1450	845	8.28	1240	3	0.44	202	0.0025	2.5	0.1	1.44	1.44	0.005	0.0051	0.0049	0.0045	670	1.5
Bi-annual Seep Sampling	NEZ Dump Seep 11	28-05-2015 13:17	5/28/2015	#N/A	#N/A	#N/A	#N/A	1390	820	8.37	1150	14	3.7	216	0.0025	2.5	0.1	0.529	0.529	0.005	0.0022	0.0042	0.0396	615	0.724
Bi-annual Seep Sampling	NEZ Dump Seep 12	4/7/2013	4/7/2013	8.3	0.0035	6.4	#N/A	1260	757	8.09	1080	6.7	2.16	159	0.0051	2.5	0.26	1.01	1.01	0.005	0.0075	0.0102	0.0184	602	1.07
Bi-annual Seep Sampling	NEZ Dump Seep 12	27-10-2014 15:29	10/27/2014	#N/A	#N/A	#N/A	#N/A	1370	808	8.23	1120	1.5	0.5	136	0.0025	2.5	0.26	0.72	0.72	0.005	0.0025	0.0038	0.0045	689	0.8
Bi-annual Seep Sampling	NEZ Dump Seep 12	28-05-2015 12:53	5/28/2015	#N/A	#N/A	#N/A	#N/A	1230	709	8.28	1000	3.8	0.56	131	0.0025	1.25	0.22	0.721	0.721	0.0025	0.0024	0.0044	0.0052	583	0.805
Bi-annual Seep Sampling	NEZ Dump Seep 13	4/7/2013	4/7/2013	8.1	0.0025	6.5	#N/A	1370	831	8.02	1180	1.5	1.73	203	0.0025	2.5	0.26	1.44	1.44	0.005	0.0031	0.0045	0.0084	633	1.47
Bi-annual Seep Sampling	NEZ Dump Seep 13	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1290	759	8.16	1090	4.1	0.39	156	0.0025	2.5	0.34	1.96	1.96	0.005	0.0024	0.0024	0.0125	617	2.13
Bi-annual Seep Sampling	NEZ Dump Seep 13	27-10-2014 15:47	10/27/2014	#N/A	#N/A	#N/A	#N/A	1390	821	8.23	1160	5.7	1.26	140	0.0025	2.5	0.27	1.21	1.21	0.005	0.0022	0.0032	0.0035	696	1.22
Bi-annual Seep Sampling	NEZ Dump Seep 13	28-05-2015 12:37	5/28/2015	#N/A	#N/A	#N/A	#N/A	1420	838	8.33	1200	8.2	3.21	225	0.0055	2.5	0.23	1.15	1.15	0.005	0.0022	0.0037	0.0107	633	1.22
Bi-annual Seep Sampling	NEZ Dump Seep 14	4/7/2013	4/7/2013	7.9	0.004	4.8	#N/A	616	318	7.8	469	1.5	0.22	67.3	0.0025	0.25	0.048	0.551	0.551	0.0005	0.0012	0.0027	0.0036	247	0.606
Bi-annual Seep Sampling	NEZ Dump Seep 14	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	464	232	8.05	336	3.4	0.15	72.8	0.0025	0.25	0.052	0.308	0.308	0.0005	0.0005	0.001	0.0039	166	0.41
Bi-annual Seep Sampling	NEZ Dump Seep 14	27-10-2014 15:26	10/27/2014	#N/A	#N/A	#N/A	#N/A	889	511	7.92	710	1.5	0.19	146	0.0025	2.5	0.1	0.203	0.203	0.005	0.0005	0.001	0.0022	357	0.26
Bi-annual Seep Sampling	NEZ Dump Seep 14	28-05-2015 12:16	5/28/2015	#N/A	#N/A	#N/A	#N/A	629	316	8.02	458	1.5	0.68	71.1	0.0025	0.5	0.051	0.329	0.329	0.001	0.0011	0.0025	0.0022	254	0.391
Bi-annual Seep Sampling	NEZ Dump Seep 15	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1170	687	8.28	894	3.2	0.13	151	0.0025	2.5	0.22	0.518	0.518	0.005	0.0045	0.0051	0.0096	560	0.591
Bi-annual Seep Sampling	NEZ Dump Seep 15	28-05-2015 11:55	5/28/2015	#N/A	#N/A	#N/A	#N/A	1310	759	8.26	1090	6.6	0.5	134	0.0025	1.25	0.18	0.917	0.917	0.0025	0.0048	0.0072	0.0106	636	0.933
Bi-annual Seep Sampling	NEZ Dump Seep 16	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1070	614	8.32	862	1.5	0.19	161	0.0025	2.5	0.1	1.23	1.23	0.005	0.0024	0.0032	0.0083	481	1.25
Bi-annual Seep Sampling	NEZ Dump Seep 2	2/7/2013	2/7/2013	8	0.2	3.4	#N/A	2080	1350	7.84	2010	1.5	0.46	57.8	0.0025	5	0.44	13.8	13.8	0.01	0.0059	0.0074	0.0092	1280	13.4
Bi-annual Seep Sampling	NEZ Dump Seep 2	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1930	1190	7.88	1820	5	1.03	66	0.0025	5	0.52	5.47	5.47	0.01	0.0045	0.0055	0.0088	1230	5.19
Bi-annual Seep Sampling	NEZ Dump Seep 2	27-10-2014 11:45	10/27/2014	#N/A	#N/A	#N/A	#N/A	1640	980	8.02	1440	1.5	0.35	65.7	0.0025	6.2	0.44	4.61	4.61	0.005	0.0057	0.0072	0.0059	892	4.6
Bi-annual Seep Sampling	NEZ Dump Seep 2	25-05-2015 14:26	5/25/2015	#N/A	#N/A	#N/A	#N/A	1860	1150	7.94	1690	1.5	0.84	78.1	0.0025	2.5	0.38	3.5	3.5	0.005	0.0059	0.0092	0.0088	1070	3.62
Bi-annual Seep Sampling	NEZ Dump Seep 2	11/11/2015	11/11/

Location Type	Sample Point	Original Date As Is	Recoded Date	DOC	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D	Se/SO4	Ca	Mg+K+Na	(Mg+K+Na)/Ca	Zn/Cd	Year
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/mg$	meq/L	meq/L	meq/meq		Year
Bi-annual Seep Sampling	Boundary Dump Seep 1	4/6/2013	4/6/2013	6.84	0.0055	0.00005	0.0002	0.0205	0.00005	0.00025	0.051	5E-06	56.2	0.00025	0.00005	0.00213	0.038	2.5E-05	0.00025	5.04	0.00059	0.00513	0.00025	0.494	0.00079	4.58	5E-06	2.34	0.194	5E-06	0.00005	0.005	3.7E-05	0.0005	0.0015	2.39394E-05	2.81	0.40828	0.145296565	300	2013
Bi-annual Seep Sampling	Boundary Dump Seep 2	4/6/2013	4/6/2013	5.75	0.0032	0.0002	0.00067	0.0336	0.00005	0.00025	0.061	5.2E-05	176	0.00025	0.00015	0.00868	0.015	2.5E-05	0.00186	21	0.0222	0.0328	0.00025	1.35	0.00456	5.88	5E-06	5.44	1.8	5E-06	0.00005	0.011	0.0012	0.0005	0.0015	3.12329E-05	8.8	1.49563	0.169957605	28.8462	2013
Bi-annual Seep Sampling	Boundary Dump Seep 2	10/12/2013	10/12/2013	8.53	0.0015	0.00015	0.00202	0.0503	0.00005	0.00025	0.049	0.00001	261	0.00025	0.00005	0.00196	0.038	2.5E-05	0.00165	34.5	0.0354	0.0225	0.00025	1.78	0.00249	7.16	5E-06	7.1	2.76	5E-06	0.00005	0.02	0.00076	0.0005	0.0015	0.00001245	13.05	2.366	0.181302566	150	2013
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2013 15:26	10/23/2013	7.06	0.0045	0.00012	0.00184	0.0556	0.00005	0.00025	0.048	1.3E-05	260	0.00025	0.00041	0.00099	0.249	6.3E-05	0.00226	39.6	0.316	0.0215	0.00025	1.99	0.00205	6.62	5E-06	8.08	2.98	5E-06	0.00005	0.005	0.00087	0.0005	0.0015	9.57944E-06	13	2.71137	0.208568761	115.385	2013
Bi-annual Seep Sampling	Boundary Dump Seep 2	14-11-2013 10:35	11/14/2013	6.59	0.0033	0.00018	0.00171	0.0511	0.00005	0.00025	0.057	0.00003	238	0.00025	0.00028	0.00287	0.055	2.5E-05	0.00231	36.1	0.166	0.0231	0.00068	1.89	0.00242	6.32	5E-06	7.79	2.91	5E-06	0.00005	0.024	0.00087	0.0005	0.0015	1.19212E-05	12.9	2.49211	0.193187099	50	2013
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-01-2014 11:10	1/16/2014	8.04	0.0031	0.00012	0.0029	0.0523	0.00005	0.00025	0.058	0.00001	217	0.00025	0.00048	0.00025	0.326	2.5E-05	0.00198	27.2	0.397	0.0151	0.00025	1.82	0.00296	6.33	5E-06	6.23	2.24	5E-06	0.00005	0.015	0.00056	0.0005	0.0015	1.73099E-05	10.85	1.90354	0.175441665	150	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	18-02-2014 10:11	2/18/2014	8.25	0.0038	0.00011	0.00149	0.0502	0.00005	0.00025	0.052	5E-06	248	0.00025	0.00019	0.00112	0.124	5.5E-05	0.00136	31.3	0.405	0.0128	0.00025	1.76	0.00169	7.59	5E-06	6.59	2.07	5E-06	0.00005	0.011	0.00062	0.0005	0.0015	9.73129E-06	12.4	2.15672	0.173929261	300	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/7/2014	3/7/2014	5.8	0.0015	0.00021	0.00073	0.044	0.00005	0.00025	0.052	0.00005	257	0.00025	0.00005	0.00736	0.015	2.5E-05	0.00252	40.5	0.00383	0.0543	0.00025	1.69	0.00495	5.59	5E-06	8.79	3.55	5E-06	0.00005	0.017	0.00154	0.0005	0.0015	2.25341E-05	12.85	2.78702	0.216888971	30	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	15-05-2014 9:15	5/15/2014	5.86	0.0069	0.00014	0.00055	0.025	0.00005	0.00025	0.052	4.7E-05	124	0.00025	0.00015	0.00951	0.015	2.5E-05	0.00133	14.9	0.0211	0.0218	0.00025	1.21	0.0033	5.14	5E-06	4.14	0.969	5E-06	0.00005	0.014	0.00057	0.0005	0.0015	4.05738E-05	6.2	1.07983	0.174166178	31.9149	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	6/8/2014	6/8/2014	4.83	0.0031	0.00018	0.00069	0.0412	0.00005	0.00025	0.057	4.5E-05	232	0.00025	0.00022	0.00604	0.04	7.3E-05	0.00203	32.3	0.0344	0.0371	0.00025	1.49	0.00412	5.8	5E-06	7.42	2.39	5E-06	0.00005	0.013	0.00125	0.0005	0.0015	2.22703E-05	11.6	2.2442	0.193465151	33.3333	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	16-06-2014 11:53	6/16/2014	5.54	0.0033	0.00021	0.00063	0.0431	0.00005	0.00025	0.047	3.5E-05	252	0.00025	0.00017	0.00393	0.015	6.5E-05	0.00284	39.9	0.0332	0.0517	0.00025	1.67	0.00687	5.52	5E-06	8.28	3.06	5E-06	0.00005	0.014	0.00137	0.0005	0.0015	3.36765E-05	12.6	2.72935	0.216615169	42.8571	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/9/2014	8/9/2014	6.29	0.0099	0.00019	0.00079	0.0441	0.00005	0.00025	0.057	1.5E-05	233	0.00025	0.00034	0.0035	0.057	2.5E-05	0.0024	32.4	0.0594	0.0253	0.00025	1.45	0.00241	6.24	5E-06	6.84	2.35	5E-06	0.00005	0.019	0.0013	0.0005	0.004	1.2275E-05	11.65	2.22378	0.190882714	266.667	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	8/12/2014	8/12/2014	7.06	0.0036	0.00012	0.0012	0.0452	0.00005	0.00025	0.048	3.1E-05	243	0.00025	0.00031	0.00433	0.097	0.00017	0.00188	34.1	0.0976	0.0245	0.00025	1.75	0.00257	6.07	5E-06	7.99	2.6	5E-06	0.00005	0.015	0.00072	0.0005	0.0015	1.22381E-05	12.15	2.3806	0.195934263	48.3871	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	23-10-2014 9:42	10/23/2014	6.88	0.0015	0.00017	0.00105	0.0396	0.00005	0.00025	0.044	2.8E-05	238	0.00025	0.00052	0.00356	0.075	5.2E-05	0.00205	34.4	0.105	0.0292	0.00025	1.55	0.00299	6.18	5E-06	7.35	2.83	5E-06	0.00005	0.018	0.00104	0.0005	0.0015	1.51777E-05	11.9	2.36514	0.198751236	53.5714	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/11/2014	11/11/2014	6.85	0.0294	0.00024	0.001	0.0408	0.00019	0.00025	0.066	5.5E-05	206	0.00025	0.00023	0.00594	0.015	0.00016	0.0025	25.8	0.0259	0.0348	0.00025	1.48	0.00435	5.89	5E-06	6.75	1.98	0.00002	0.00005	0.015	0.001	0.0015	0.004	2.5996E-05	10.3	1.8358	0.178233025	72.7273	2014
Bi-annual Seep Sampling	Boundary Dump Seep 2	1/7/2015	1/7/2015	6.07	0.0015	0.00017	0.00087	0.0342	0.00005	2.5E-05	0.059	7.2E-05	184	0.00025	0.00005	0.00675	0.015	2.5E-05	0.0019	23.4	0.0207	0.0246	0.00025	1.29	0.00225	5.48	5E-06	6.35	1.91	5E-06	0.00005	0.005	0.00107	0.00025	0.003	1.83424E-05	9.2	1.6736	0.18191254	41.958	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/6/2015	2/6/2015	5.37	0.0015	0.00012	0.00073	0.0342	0.00005	2.5E-05	0.062	7.4E-05	164	0.00025	0.00016	0.00905	0.015	2.5E-05	0.0013	17.9	0.0393	0.0173	0.00025	1.18	0.00154	6.13	5E-06	5.23	1.27	5E-06	0.00005	0.005	0.00078	0.00025	0.0015	1.42154E-05	8.2	1.30138	0.158704816	20.2703	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	2/9/2015	2/9/2015	6.94	0.008	0.00016	0.00154	0.0453	0.00005	2.5E-05	0.066	2.1E-05	195	0.00025	0.00015	0.00317	0.185	9.6E-05	0.002	23	0.498	0.0173	0.00025	1.32	0.00156	6.67	5E-06	6.02	1.87	5E-06	0.00005	0.005	0.00103	0.00069	0.0015	1.33333E-05	9.75	1.63669	0.167865965	71.09	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/2/2015	3/2/2015	5.58	0.0015	0.00013	0.00079	0.0315	0.00005	0.00025	0.062	2.1E-05	169	0.00025	0.00005	0.00616	0.015	2.5E-05	0.00193	21.2	0.0205	0.028	0.00025	1.18	0.00258	5.91	5E-06	5.65	1.57	5E-06	0.00005	0.012	0.00065	0.0005	0.0015	2.43396E-05	8.45	1.51206	0.178942034	71.4286	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	3/3/2015	3/3/2015	5.73	0.0015	0.00014	0.00065	0.0312	0.00005	0.00025	0.056	3.6E-05	169	0.00025	0.00012	0.00654	0.015	2.5E-05	0.00157	22.5	0.0134	0.0342	0.00025	1.13	0.00352	5.73	5E-06	5.54	1.73	5E-06	0.00005	0.015	0.00074	0.0005	0.0015	2.75718E-05	8.45	1.5818	0.187194944	41.6667	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/4/2015	7/4/2015	6.07	0.0031	0.00015	0.00055	0.0315	0.00005	2.5E-05	0.059	3.1E-05	169	0.00025	0.00011	0.00571	0.015	2.5E-05	0.0017	21.7	0.0138	0.0324	0.00025	1.31	0.00389	5.68	5E-06	5.94	1.66	5E-06	0.00005	0.013	0.0006	0.00025	0.0015	3.14555E-05	8.45	1.55716	0.184278904	49.0196	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	7/5/2015	7/5/2015	5.25	0.0015	0.00013	0.00054	0.0294	0.00005	2.5E-05	0.067	2.7E-05	147	0.00025	0.00005	0.00716	0.015	2.5E-05	0.002	16.5	0.00726	0.0208	0.00025	1.03	0.00204	6.14	5E-06	4.68	1.22	5E-06	0.00005	0.005	0.0006	0.00025	0.0015	2.21739E-05	7.35	1.19199	0.162175189	55.5556	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	29-10-2015 11:29	10/29/2015	6.82	0.0054	0.00013	0.00147	0.047	0.00005	2.5E-05	0.038	1.1E-05	200	0.00025	0.0011	0.00168	0.157	2.5E-05	0.0005	29.1	0.00398	0.0158	0.00025	1.68	0.00161	6.76	0.00001	7.06	2.75	5E-06	0.00005	0.005	0.00076	0.00075	0.0015	1.05921E-05	10	2.04683	0.204682645	131.579	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	11/8/2015	11/8/2015	6.81	0.0039	0.00017	0.00115	0.04	0.00005	2.5E-05	0.06	0.00004	195	0.00025	0.00115	0.00537	0.103	6.1E-05	0.0029	24.6	0.419	0.0243	0.00025	1.29	0.00208	6.45	5E-06	6.18	2.13	5E-06	0.00005	0.005	0.00107	0.00056	0.0015	1.51456E-05	9.75	1.73617	0.178069221	37.5	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	30-11-2015 11:50	11/30/2015	6.6	0.0015	0.0001	0.00138	0.0453	0.00005	2.5E-05	0.056	3.5E-05	237	0.00025	0.00019	0.00332	0.034	2.5E-05	0.0017	28.1	0.116	0.0183	0.00025	1.58	0.00177	6.5	5E-06	6.97	2.16	5E-06	0.00005	0.005	0.00067	0.0005	0.0015	1.11789E-05	11.85	1.98204	0.167260782	42.4929	2015
Bi-annual Seep Sampling	Boundary Dump Seep 2	12/1/2015	12/1/2015	6.27	0.0015	0.00012	0.00103	0.0363	0.00005	2.5E-05	0.057	1.3E-05	209	0.00025	0.00025	0.00111	0.063	2.5E-05	0.00124	26.7	0.0491	0.0226	0.00025	1.41	0.00187	6.48	5E-06	6.38	1.92	5E-06	0.00005	0.018	0.00069	0.0005	0.0015	1.27211E-05	10.45	1.8704	0.178985307	115.385	2015
Bi-annual Seep Sampling	Boundary Dump Seep 3	19-05-2015 13:49	5/19/2015	5.14	0.0035	0.0001	0.00068	0.0331	0.00005	2.5E-05	0.069	2.3E-05	144	0.00025	0.00013	0.00634	0.04	2.5E-05	0.0013	13.2	0.0509	0.0089	0.00025	0.972	0.00106	6.3	5E-06	4.24	0.815	5E-06	0.00005	0.005	0.00055	0.00055	0.0015	1.42601E-05	7.2	0.97895	0.135965306	66.0793	2015
Bi-annual Seep Sampling	East Dump Seep 1	9/5/2013	9/5/2013	4.07	0.009	0.00015	0.00019	0.0301	0.00005	0.00025	0.057	7.5E-05	156	0.00025	0.00005	0.00226	0.015	2.5E-05	0.00025	30.5	0.0195	0.195	0.00025	2.29	0.0612	3.77	5E-06	14.4	3.05	5E-06	0.00005	0.005	2.2E-05	0.0005	0.0147	0.000363564	7.8	2.46323	0.31579879	196	2013
Bi-annual Seep Sampling	East Dump Seep 1	23-10-2014 14:15	10/23/2014	7.74	0.0173	0.00005	0.00025	0.0492	0.00005	0.00025	0.039	0.00024	166	0.00025	0.00179	0.00561	0.015	2.5E-05	0.00025	32.9	0.594	0.0926	0.0017	2.3	0.017	3.71	5E-06	12.9	2.92	5E-06	0.00005	0.016	3.1E-05	0.0005	0.0212	0.000102204	8.3	2.53821	0.305808587	89.4515	2014
Bi-annual Seep Sampling	East Dump Seep 1	28-05-2015 10:46	5/28/2015	7.23	0.0152	0.00005	0.00028	0.0586	0.00005	2.5E-05	0.045	0.00023	171	0.00025	0.0011	0.00571	0.015	2.5E-05	0.0005	35	0.646	0.102	0.00107	2.16	0.0257	3.76	5E-06	14.5	2.81	5E-06	0.00005	0.011	3.7E-05	0.00025	0.0176	0.000148555	8.55	2.72664	0.318904763	77.8761	2015
Bi-annual Seep Sampling	East Dump Seep 1	26-11-2015 12:46	11/26/2015	5.42	0.011	0.00005	0.00017	0.0383	0.00005	2.5E-05	0.045	0.00016	167	0.00025	0.00015	0.00342	0.015	2.5E-05	0.0005	33.4	0.217	0.0392	0.00138	1.94	0.00789	3.9	5E-06	13.6	2.74	5E-06	0.00005	0.013	1.7E-05	0.00025	0.0175	1.72455E-05	8.35	2.58857	0.31000836	110.063	2015
Bi-annual Seep Sampling	East Dump Seep 2	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	East Dump Seep 2	20-06-2013 13:24	6/20/2013	3.35	0.0118	0.00015	0.00023	0.0233	0.00005	0.00025	0.051	0.00025	128	0.00025	0.00154	0.00321	0.015	2.5E-05	0.00025	26.8	0.244	0.312	0.00078	2.3	0.0726	3.25	5E-06	13.8	3.26	5E-06	0.00005	0.011	1.6E-05	0.0005	0.0135	0.000505536	6.4	2.22166	0.34713384	54	2013
Bi-annual Seep Sampling	East Dump Seep 3	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	East Dump Seep 3	20-06-2013 13:36	6/20/2013	2.88	0.027	0.00017	0.00011	0.0312	0.00005	0.00025	0.062	0.0005	141	0.00025	0.00659	0.00477	0.015	2.5E-05	0.00109	34.5	1.11	0.393	0.00333	2.19	0.0399	4.1	5E-06	17.3	4.2	5E-06	0.00005	0.011	6.8E-05	0.0005	0.0695	0.000241331	7.05	2.81999	0.39999852	139	2013
Bi-annual Seep Sampling	East Dump Seep 4	9/5/2013	9/5/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	East Dump Seep 4	20-06-2013 13:55	6/20/2013	4.25	0.0077	0.00005	0.00034	0.0441	0.00005	0.00025	0.039	0.00031	232	0.00025	0.00005	0.00479	0.015	2.5E-05	0.00025	37.2	0.00473	0.107	0.00093	2.6	0.0491	5.04	5E-06	17.1	2.73	5E-06	0.00005	0.013	8.6E-05	0.0005	0.0546	0.000208051	11.6	2.97924	0.256831133	176.699	2013
Bi-annual Seep Sampling	East Dump Seep 4	26-11-2015 13:16	11/26/2015	3.11	0.0015	0.00005	0.00013	0.0622	0.00005	2.5E-05	0.035	0.00123	148	0.00025	0.00005	0.00397	0.015	2.5E-05	0.0012	22.8	0.00051	0.117	0.00078	1.32	0.0282	5.5	5E-06	9.86	1.84	5E-06	0.00005	0.013	0.00029	0.00025	0.14	0.000208374	7.4	1.79199	0.242160523	113.821	2015
Bi-annual Seep Sampling	NEZ Dump Seep 1	2/7/2013	2/7/2013	2.91	0.025	0.00068	0.00032	0.0504	0.0001	0.0005	0.105	0.00015	359	0.00025	0.00076	0.0652	0.015	0.00005	0.0005	63	0.0938	0.313	0.0016	2.23	0.242	5.14	0.00001	22.5	3.22	0.00001	0.0001	0.013	0.00147	0.001	0.0117	0.000666055	17.95	4.70891	0.262334805	78	2013
Bi-annual Seep Sampling	NEZ Dump Seep 1	10/12/2013	10/12/2013	4.46	0.008	0.00037	0.00025	0.0607	0.0001	0.0005	0.082	0.00005	322	0.00025	0.0001	0.0168	0.015	0.00005	0.0005	56.2	0.0117	0.195	0.0005	2.14	0.125	5.35	0.00001	19.1	4.1	0.00001	0.0001	0.02	0.00133	0.001	0.005	0.000375	16.1	4.16227	0.258526367	100	2013
Bi-annual Seep Sampling	NEZ Dump Seep 1	23-10-2013 13:55	10/23/2013	3.91	0.007	0.00052	0.00033	0.0527	0.0001	0.0005	0.09	0.00006	301	0.00025	0.0001	0.0198	0.015	0.00005	0.0023	55.6	0.0181	0.188	0.0005	2.27	0.133	5.68	0.00001	19.6	3.44	0.00001	0.0001	0.005	0.00136	0.001	0.0053	0.000420886	15.05	4.15236	0.275904422	88.3333	2013
Bi-annual Seep Sampling	NEZ Dump Seep 1	26-11-2013 9:14	11/26/2013	4.57	0.008	0.0004	0.00031	0.056	0.0001	0.0005	0.089	0.00006	327	0.00025	0.0001	0.0173	0.015	0.00005	0.0019	54.4	0.0134	0.184	0.0005	2.21	0.132	5.31	0.00001	19.9	3.78	0.00001	0.0001	0.019	0.00133	0.001	0.005	0.000410788	16.35	4.0939	0.250391176	83.3333	2013
Bi-annual Seep Sampling	NEZ Dump Seep 1	16-01-2014 10:15	1/16/2014	4.57	0.0084	0.00037	0.00028	0.0613	0.0001	0.0005	0.095	0.0001	325	0.00025	0.0001	0.0164	0.015	0.00005	0.0025	57.9	0.0114	0.227	0.0005	2.21	0.132	4.9	0.00001	19.7	4.57	0.00001	0.0001	0.015	0.00148	0.001	0.0061	0.000370093	16.25	4.28928	0.263955797	61	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	18-02-2014 13:08	2/18/2014	4.39	0.006	0.00033	0.00028	0.0677	0.0001	0.0005	0.095	0.00006	353	0.00025	0.0001	0.0145	0.015	0.00005	0.0019	63.4	0.011	0.256	0.0005	2.31	0.136	5.15	0.00001	21.6	5.26	0.00001	0.0001	0.012	0.00153	0.001	0.0052	0.000367568	17.65	4.69515	0.266014403	86.6667	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/6/2014	3/6/2014	3.26	0.0556	0.00045	0.0001	0.0462	0.0001	0.0005	0.071	0.0002	320	0.00025	0.00327	0.17	0.015	0.00005	0.0028	60.5	0.315	0.245	0.0051	2.21	0.174	5.16	0.00001	19.8	3.2	0.00001	0.0001	0.005	0.00106	0.001	0.0241	0.000522	16	4.44523	0.277827064	120.5	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	3/7/2014	3/7/2014	3.65	0.0364	0.00047	0.00027	0.0472	0.0001	0.0005	0.089	0.0002	355	0.00025	0.00175	0.112	0.015	0.00005	0.0024	67.1	0.202	0.272	0.0032	2.22	0.182	5.15	0.00001	21	3.92	0.00001	0.0001	0.017	0.00129	0.001	0.018	0.000483186	17.75	4.8825	0.275070591	90	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	13-05-2014 11:45	5/13/2014	2.74	0.0405	0.00041	0.0001	0.0495	0.0001	0.0005	0.076	0.00045	314	0.00025	0.0167	0.516	0.015	0.00005	0.0051	64.9	1.05	0.252	0.0145	2.16	0.156	5.45	0.00001	18.5	3.53	0.00001	0.0001	0.016	0.00071	0.001	0.0733	0.000454369	15.7	4.64399	0.295795478	162.889	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	6/8/2014	6/8/2014	3.04	0.0153	0.0005	0.0002	0.0432	0.0001	0.0005	0.089	0.00017	339	0.00025	0.00142	0.0817	0.015	0.00005	0.003	60	0.169	0.203	0.0025	2.15	0.156	5.17	0.00001	20.2	3.22	0.00001	0.0001	0.016	0.00108	0.001	0.0141	0.000454369	16.95	4.43193	0.261470876	83.9286	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/4/2014	8/4/2014	3.88	0.0082	0.00056	0.00035	0.0359	0.00005	0.00025	0.06	6.5E-05	241	0.00025	0.00019	0.0217	0.015	2.5E-05	0.00146	40.5	0.0296	0.178	0.00061	1.77	0.101	5.22	5E-06	17.4	2.28	5E-06	0.00005	0.017	0.00137	0.0005	0.0037	0.000459788	12.05	3.16342	0.26252468	56.9231	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/9/2014	8/9/2014	3.47	0.0154	0.00046	0.00021	0.0449	0.0001	0.0005	0.084	0.0001	344	0.00025	0.00118	0.0732	0.015	0.00005	0.0026	63.6	0.141	0.22	0.0023	2.28	0.178	5.44	0.00001	20	3.31	0.00001	0.0001	0.024	0.00129	0.001	0.0136	0.000499065	17.2	4.63648	0.269562882	136	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	8/12/2014	8/12/2014	11.3	0.036	0.00044	0.0001	0.0459	0.0001	0.0005	0.075	0.00019	342	0.00025	0.00193	0.143	0.015	0.00005	0.0028	62.2	0.194	0.216	0.0034	2.39	0.177	5.53	0.00001	20.8	3.29	0.00001	0.0001	0.015	0.00116	0.001	0.0212	0.000469912	17.1	4.59245	0.268564446	110.417	2014
Bi-annual Seep Sampling	NEZ Dump Seep 1	27-10-2014 11:23	10/27/2014	3.88	0.0124	0.00054	0.00024	0.0379	0.00005	0.00025	0.075	0.00011	283	0.00025	0.00089	0.0616	0.015	2.5E-05	0.00276	48.2	0.126

Location Type	Sample Point	Original Date As Is	Recoded Date	Location	Source Term Group	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Q (m3/s)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Alkalinity (CaCO3) (mg/L)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)
							µs/cm	su	m3/s	C	ntu	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	NEZ Dump Seep 6	2/7/2013	2/7/2013	Wight	Wight	Water trickles through rock (and goes to ground?) - difficult to tell in slash. Unable to sample.	531	8.1	0.002	6.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 6	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1390	790	8.28	1190	6.8	1.27	148	-0.005	-5	0.77	6.49	6.49	-0.01	0.0079	0.0097	0.0115	685	6.55
Bi-annual Seep Sampling	NEZ Dump Seep 6	27-10-2014 14:22	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1200	663	8.02	943	3.3	1.22	127	-0.005	-5	0.36	2.11	2.11	-0.01	0.0019	0.0033	0.0046	571	2.04
Bi-annual Seep Sampling	NEZ Dump Seep 7	2/7/2013	2/7/2013	Wight	Wight	Full suite sample taken. Photo Taken.	5.4	8.3	0.002	7.1	#N/A	468	242	8.17	333	20	1.54	99.6	-0.005	-0.5	0.178	0.638	0.638	-0.001	0.0059	0.0072	0.0329	137	0.687
Bi-annual Seep Sampling	NEZ Dump Seep 7	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	859	464	8.2	665	3.2	0.39	112	-0.005	-2.5	0.31	2.52	2.52	-0.005	0.0047	0.0048	0.0071	361	2.66
Bi-annual Seep Sampling	NEZ Dump Seep 7	27-10-2014 13:52	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1020	571	8.02	819	-3	1.92	86.3	-0.005	-5	0.31	1.52	1.52	-0.01	0.0061	0.0066	0.0093	501	1.48
Bi-annual Seep Sampling	NEZ Dump Seep 7	28-05-2015 14:25	5/28/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	812	423	8.24	609	25.9	5.31	111	-0.005	-1	0.245	1.09	1.09	-0.002	0.0038	0.0055	0.135	322	1.1
Bi-annual Seep Sampling	NEZ Dump Seep 8	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1452	7.9	0.0025	5.8	#N/A	1430	850	7.65	1240	88.7	20	87.3	-0.005	-5	-0.2	1.58	1.58	-0.01	0.006	0.0078	0.129	647	2.31
Bi-annual Seep Sampling	NEZ Dump Seep 8	8/6/2015	8/6/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1100	639	7.93	876	14.3	2.82	106	0.0057	-2.5	-0.1	0.959	0.959	-0.005	0.0062	0.0093	0.0224	543	1.09
Bi-annual Seep Sampling	NEZ Dump Seep 9	4/7/2013	4/7/2013	Wight	Wight	Full suite sample taken.	1984	7.9	0.01	5.3	#N/A	1970	1240	7.79	1850	-3	0.37	58.3	-0.005	-10	-0.4	4.7	4.7	-0.02	0.0068	0.0085	0.0102	1180	4.56
Bi-annual Seep Sampling	NEZ Dump Seep 9	23-10-2013 13:21	10/23/2013	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1690	1020	7.92	1500	-3	0.46	71.8	-0.005	-10	-0.4	2.71	2.71	-0.02	0.0042	0.0079	0.0082	1020	2.61
Bi-annual Seep Sampling	NEZ Dump Seep 9	5/6/2014	5/6/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1480	879	7.84	1230	3.5	0.43	56.2	-0.005	-5	0.23	2.09	2.09	-0.01	0.0052	0.0064	0.0211	852	2.2
Bi-annual Seep Sampling	NEZ Dump Seep 9	27-10-2014 13:31	10/27/2014	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1420	814	7.99	1220	7.8	10.9	62.3	-0.005	-5	0.21	1.55	1.55	-0.01	0.0038	0.0069	0.0189	779	1.6
Bi-annual Seep Sampling	NEZ Dump Seep 9	8/6/2015	8/6/2015	Wight	Wight		#N/A	#N/A	#N/A	#N/A	#N/A	1540	963	7.91	1360	-3	0.28	67	-0.005	-5	-0.2	1.45	1.45	-0.01	0.0047	0.0062	0.0048	918	1.53
Bi-annual Seep Sampling	North Bell Dump Seep 1	30-05-2013 9:43	5/30/2013	Bell	All Non-PAG	No sample taken. Photo taken. In a wet depressional area. A tiny bit of snow in area.	478	8.6	0	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	North Bell Dump Seep 1	14-10-2015 13:57	10/14/2015	Bell	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	562	295	7.11	411	11.6	4.41	127	0.233	0.92	0.064	1.64	4.14	2.5	0.0162	0.0312	0.445	162	6.04
Bi-annual Seep Sampling	North Bell Dump Seep 2	4/6/2013	4/6/2013	Bell	All Non-PAG	Full suite sample. Will have some TSS (shallow pond). Puddle from dump toe goes to ground.	801	8.2	0	0.4	#N/A	712	369	7.91	498	106	108	95	0.0409	-2.5	0.27	9.53	9.57	0.0364	0.0951	0.124	0.333	246	9.57
Bi-annual Seep Sampling	North Bell Dump Seep 3	4/6/2013	4/6/2013	Bell	All Non-PAG	Full suite sample. Will have some TSS/algae (shallow pond). Puddle from dump toe goes to ground.	1083	7.8	0	4.4	#N/A	883	498	7.36	658	26.3	1.71	44.2	0.0077	-5	0.23	0.86	0.86	-0.01	-0.001	0.0061	0.0694	444	1.56
Bi-annual Seep Sampling	North Bell Dump Seep 4	2/7/2013	2/7/2013	Bell	All Non-PAG	Stagnant pond starting ~10-15m d/s of dump toe. No sample taken. Photo taken.	588	6.8	0	15.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 1	30-05-2013 9:42	5/30/2013	PAG Ex-Pit	All PAG - Pre-Acid	Full suite. Sampled water flowing into pool ~3m d/s of dump toe. Filled bottles w/ DOC 120mL amber.	736	7.23	0.005	4.36	#N/A	1220	650	8.01	996	6.8	0.99	139	0.0336	7.8	0.28	31.8	31.9	0.066	0.0536	0.0666	0.0739	428	30.7
Bi-annual Seep Sampling	PAG Dump Seep 10	29-05-2014 9:48	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	842	455	8.08	606	9	3.54	172	0.0087	-5	-0.2	6.12	6.69	0.562	-0.001	0.0105	0.0331	273	6.76
Bi-annual Seep Sampling	PAG Dump Seep 10	23-10-2014 12:28	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1360	793	7.99	1100	-3	0.37	251	0.0393	5.6	-0.2	8.01	8.01	-0.01	0.0073	0.0146	0.0175	540	7.8
Bi-annual Seep Sampling	PAG Dump Seep 10	20-05-2015 13:03	5/20/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1310	741	7.82	1070	-3	0.25	173	0.0087	3.3	-0.1	13.4	13.5	0.0103	0.0124	0.0169	0.0176	533	13.8
Bi-annual Seep Sampling	PAG Dump Seep 10	24-11-2015 13:22	11/24/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1570	914	7.78	1250	-3	0.32	181	-0.005	3.6	-0.1	13.8	13.8	0.0057	0.0154	0.0208	0.0181	670	13.6
Bi-annual Seep Sampling	PAG Dump Seep 12	29-05-2014 10:04	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	645	333	8	501	6.5	3.49	116	0.0075	3.4	0.14	3.67	3.95	0.278	-0.001	0.018	0.0561	210	4.39
Bi-annual Seep Sampling	PAG Dump Seep 13	23-10-2014 10:49	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	295	149	8.15	144	30.7	8.32	151	0.0232	0.79	0.115	0.0916	0.109	0.0173	0.0059	0.0061	0.0354	9.91	0.38
Bi-annual Seep Sampling	PAG Dump Seep 13	20-05-2015 13:36	5/20/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	307	151	8.25	214	-3	0.66	112	0.0176	0.57	0.119	0.808	0.809	0.002	0.0288	0.0283	0.037	26.8	0.964
Bi-annual Seep Sampling	PAG Dump Seep 14	23-10-2014 11:13	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1050	591	8.17	838	3.5	3.71	261	0.0577	-5	-0.2	5.95	6.12	0.166	-0.001	0.007	0.0177	328	5.94
Bi-annual Seep Sampling	PAG Dump Seep 14	20-05-2015 13:16	5/20/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1470	854	8.09	1210	-3	0.35	196	0.0077	-5	-0.2	16.4	16.4	0.026	0.0092	0.0111	0.0155	647	15.2
Bi-annual Seep Sampling	PAG Dump Seep 14	24-11-2015 14:48	11/24/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1670	975	8.14	1340	-3	0.46	210	0.0098	4.1	-0.1	13.7	13.7	0.005	0.0178	0.0213	0.0247	736	13.2
Bi-annual Seep Sampling	PAG Dump Seep 15	9/12/2014	9/12/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1260	679	7.96	959	103	23.9	120	0.236	5.6	-0.2	21.2	22.3	1.03	-0.001	0.0043	0.196	533	21.2
Bi-annual Seep Sampling	PAG Dump Seep 15	23-10-2014 11:56	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1230	712	7.89	972	87.8	18.9	325	0.144	6.4	-0.2	1.04	1.55	0.516	0.0022	0.0323	0.391	390	3
Bi-annual Seep Sampling	PAG Dump Seep 15	1/9/2015	1/9/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1730	1030	7.57	1480	9.1	7.38	187	0.0641	-5	-0.2	18.1	18.5	0.338	0.0029	0.0051	0.0517	805	18.3
Bi-annual Seep Sampling	PAG Dump Seep 15	2/2/2015	2/2/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1770	977	7.81	1520	45.2	28.9	161	0.2	8	-0.2	34.7	36.7	2.07	0.002	0.0134	0.0997	771	35.9
Bi-annual Seep Sampling	PAG Dump Seep 15	2/6/2015	2/6/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1720	968	8.25	1450	6.8	7.16	186	0.0805	5.4	-0.2	21	21.5	0.453	-0.001	-0.002	0.0376	761	20.5
Bi-annual Seep Sampling	PAG Dump Seep 15	3/3/2015	3/3/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1820	1050	7.92	1560	17.1	9.49	148	0.156	10	0.29	37.1	38.4	1.33	0.0015	0.0073	0.0515	834	38.7
Bi-annual Seep Sampling	PAG Dump Seep 15	5/5/2015	5/5/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1630	906	8.06	1330	9.8	6.6	201	0.0806	5.8	-0.2	23.8	24.5	0.722	-0.001	0.0081	0.0365	703	22.7
Bi-annual Seep Sampling	PAG Dump Seep 15	6/1/2015	6/1/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1640	926	7.76	1330	157	97.1	190	0.348	10	-0.2	27	28.9	1.92	0.0015	0.0092	0.27	682	29.1
Bi-annual Seep Sampling	PAG Dump Seep 15	6/8/2015	6/8/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1780	1040	7.86	1660	15.2	9.18	180	0.0935	-5	-0.2	20	20.4	0.374	0.0029	-0.002	0.0502	822	22.1
Bi-annual Seep Sampling	PAG Dump Seep 15	7/7/2015	7/7/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1690	986	8.07	1480	9.9	5.8	196	0.0573	-5	-0.2	17.7	18.1	0.413	0.0019	0.0059	0.0417	754	17.6
Bi-annual Seep Sampling	PAG Dump Seep 15	8/4/2015	8/4/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1840	1090	8.03	1600	7.5	6.25	150	0.0905	6.3	-0.1	33.8	34.7	0.914	-0.001	0.0041	0.0244	863	33.5
Bi-annual Seep Sampling	PAG Dump Seep 15	29-10-2015 12:55	10/29/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1650	952	8	1370	5.2	6.19	238	0.0507	5.1	-0.2	14.9	15.4	0.554	0.0018	-0.002	0.0555	707	15.7
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 13:05	11/24/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1840	1090	8.05	1550	-3	1.24	183	0.0146	5.3	-0.2	20.9	21	0.09	0.0148	0.0196	0.031	830	20.5
Bi-annual Seep Sampling	PAG Dump Seep 2	30-05-2013 9:56	5/30/2013	PAG Ex-Pit	All PAG - Pre-Acid	Full suite. Sampled flow just below dump toe. Filled bottles w/ DOC 120mL amber.	996	6.41	0.005	1.3	#N/A	2040	1190	7.57	1670	51.3	37.5	289	0.694	17	0.54	26.7	49.6	22.9	0.0052	0.0342	0.236	819	45.4
Bi-annual Seep Sampling	PAG Dump Seep 3	30-05-2013 10:08	5/30/2013	PAG Ex-Pit	All PAG - Pre-Acid	Full suite. Sampled shallow trickle out of till berm" ~20m below dump toe. Filled bottles w/ DOC 120mL amber (may have picked up some TSS)."	690	6.79	0.003	9.4	#N/A	1060	599	7.87	841	24.7	7.21	127	0.538	7.6	0.2	2.67	2.68	0.016	0.0021	0.0067	0.048	469	3.17
Bi-annual Seep Sampling	PAG Dump Seep 3	29-05-2014 10:52	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1200	678	7.81	995	24.1	5.02	48.8	-0.005	-5	-0.2	18.8	18.9	0.018	-0.001	0.0041	0.0475	570	17.7
Bi-annual Seep Sampling	PAG Dump Seep 4	30-05-2013 11:03	5/30/2013	PAG Ex-Pit	All PAG - Pre-Acid	Full suite. Sample taken from flow into roadside ditch. Appears till was packed against toe to prevent seep flow. Filled bottles w/ DOC 120mL ambers.	899	7.88	0.003	4.4	#N/A	1470	829	8.09	1100	47.3	27.1	210	0.0651	19.2	0.23	34.5	34.9	0.336	0.007	0.0088	0.0907	509	32.8
Bi-annual Seep Sampling	PAG Dump Seep 4	29-05-2014 11:11	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	2230	1360	8.13	1940	5.2	1.16	151	0.0542	14	-0.4	49.9	50	0.136	0.0079	0.0158	0.0219	1140	45.1
Bi-annual Seep Sampling	PAG Dump Seep 4	14-05-2015 13:57	5/14/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	2180	1260	7.97	1850	3.2	0.24	146	-0.005	10.6	-0.2	48.6	48.6	-0.01	0.0116	0.0161	0.0193	959	51.3
Bi-annual Seep Sampling	PAG Dump Seep 5	29-05-2014 10:40	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1950	1110	8.02	1710	5.1	3.27	137	0.337	11	-0.4	52.4	56	3.55	0.0022	0.008	0.0468	907	51.2
Bi-annual Seep Sampling	PAG Dump Seep 5	23-10-2014 10:50	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1810	1070	8.07	1530	12.3	4.73	171	0.288	11	-0.4	35.9	36.8	0.95	-0.001	0.0041	0.054	797	34
Bi-annual Seep Sampling	PAG Dump Seep 5	14-05-2015 14:22	5/14/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	2400	1360	8.08	2140	3.3	1.18	169	0.0475	11.5	-0.2	54.4	54.4	0.049	0.0018	0.0083	0.0067	1100	53.3
Bi-annual Seep Sampling	PAG Dump Seep 5	24-11-2015 12:38	11/24/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	2290	1390	7.86	1980	-3	2.41	256	0.0299	9	-0.2	34.1	34.2	0.017	-0.001	-0.002	-0.002	1060	34.3
Bi-annual Seep Sampling	PAG Dump Seep 7	29-05-2014 9:01	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	376	213	7.47	340	180	235	193	0.18	2.15	0.086	-0.005	-0.0051	-0.001	0.0267	0.0492	0.584	20.8	1.33
Bi-annual Seep Sampling	PAG Dump Seep 7	23-10-2014 11:16	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1050	587	7.42	849	33.7	33.2	355	1.2	6.1	-0.2	-0.05	-0.051	0.01	0.0257	0.0601	1.05	199	8.2
Bi-annual Seep Sampling	PAG Dump Seep 7	20-05-2015 12:27	5/20/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1110	619	7.63	913	69.9	80.7	300	0.869	3.2	-0.1	-0.025	-0.025	-0.005	0.0105	0.0234	0.454	353	2.16
Bi-annual Seep Sampling	PAG Dump Seep 7	24-11-2015 12:48	11/24/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1260	727	7.34	927	57.6	142	379	1.63	3	-0.1	-0.025	-0.025	-0.005	0.0018	0.0092	0.859	374	2.3
Bi-annual Seep Sampling	PAG Dump Seep 8	29-05-2014 9:20	5/29/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	873	397	7.88	659	6.9	3.32	109	0.141	-5	0.31	38.6	42.5	3.85	-0.001	0.0113	0.0456	186	40.8
Bi-annual Seep Sampling	PAG Dump Seep 8	23-10-2014 12:15	10/23/2014	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	776	381	7.87	548	11.7	11.4	227	0.0461	4.2	0.17	0.646	2.17	1.53	0.0025	0.0199	0.182	196	3.27
Bi-annual Seep Sampling	PAG Dump Seep 8	20-05-2015 12:44	5/20/2015	PAG Ex-Pit	All PAG - Pre-Acid		#N/A	#N/A	#N/A	#N/A	#N/A	1030	538	7.69	803	6	5.9	279	0.858	2.8	-0.1	2.23	2.43	0.201	0.0053	0.0131	0.036	301	3.58
Bi-annual Seep Sampling	SERDS Seep 1	6/6/2013	6/6/2013	South East	All Non-PAG	No sample taken (no flow).	702	7.6	0	15.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 10	6/6/2013	6/6/2013	South East	All Non-PAG	No sample taken. Bullrushes observed. No flow, but ground saturated.	690	8.6	0	9.7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 11	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken. Lots of algae (some rust coloured). Seep flows out in a few braids - area saturated.	880	6.7	0.005	12	#N/A	1060	541	7.59	843	148	159	91.4	0.39	-5	-0.2	-0.05	-0.051	-0.01	0.0167	0.0331	0.272	522	1.32
Bi-annual Seep Sampling	SERDS Seep 11	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2530	1500	8.05	2370	-3	0.42	98.4	0.0469	-10	0.55	61.9	62.2	0.223	0.0078	0.0148	0.0226	1360	58.9
Bi-annual Seep Sampling	SERDS Seep 11	25-05-2015 12:41	5/25/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2780	1630	7.81	2770	73.1	22.7	87	0.0184	-10	-0.4	76.3	76.3	0.056	0.0131	0.0177	0.1	1500	70.7
Bi-annual Seep Sampling	SERDS Seep 12	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken at lower stream (collects multiple flow points out of dump toe from same source).	2040	8.3	0.01	15.9	#N/A	2130	1210	7.98	1840	44.2	16.4	102	0.0185	-10	0.42	38.4	38.6	0.216	0.0016	0.0104	0.0493	1170	37
Bi-annual Seep Sampling	SERDS Seep 12	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1590	912	8.17	1380	-3	0.39	139	-0.005	5.2	0.4	25.7	25.7	0.02	0.0104	0.0133	0.0145	738	24.6
Bi-annual Seep Sampling	SERDS Seep 13	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken. Video taken.	1572	8.1	0.6	2.9	#N/A	1460	824	8.06	1170	3.4	0.78	111	-0.005	-5	0.29	18.9	18.9	-0.01	0.0067	0.0123	0.0184	718	18
Bi-annual Seep Sampling	SERDS Seep 13	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1600	912	8.12	1390	-3	0.49	126	-0.005	5.1	0.34	27.2	27.2	0.013	0.01	0.012	0.0199	758	26.5
Bi-annual Seep Sampling	SERDS Seep 13	27-10-2014 10:42	10/27/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1560	905	8.16	1370	-3	0.75	133	-0.005	5.3	0.36	25.9	25.9	-0.01	0.0119	0.0136	0.0172	716	25.3
Bi-annual Seep Sampling	SERDS Seep 13	13-01-2015 10:51	1/13/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1670	1010	8.06	1450	-3	0.16	141	-0.005	-5	0.38	26.3	26.3	-0.01	0.011	0.0163	0.0147	824	24.5
Bi-annual Seep Sampling	SERDS Seep 13	2/9/2015	2/9/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1580	974	7.9	1350	3.4	0.38	142	-0.005	-5	0.33	22.2	22.2	-0.01	0.0111	0.0144	0.0119	745	21.9
Bi-annual Seep Sampling	SERDS Seep 13	4/6/2015	4/6/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1590	987	8.12	1450	6.4	0.37	145	-0.005	3.8	0.37	22.8	22.8	-0.005	0.0088	0.0139	0.0125	774	23
Bi-annual Seep Sampling	SERDS Seep 13	5/2/2015	5/2/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1710	1010	8.12	1490	-3	0.23	143	-0.005	-5	0.44	25.2	25.2	-0.01	0.0129	0.0152	0.0155	819	23.9
Bi-annual Seep Sampling	SERDS Seep 13	5/3/2015	5/3/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1700	1020	8	1490	-3	0.25	152	-0.005	-5	0.45	24.7	24.7	-0.01	0.0126	0.0165	0.0152	826	24.5
Bi-annual Seep Sampling	SERDS Seep 13	6/5/2015	6/5/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1720	1040	8.29	1440	-3	0.37	146	-0.005	-5	0.33	24.4	24.4	-0.01	0.0095	0.0136	0.0143	815	23.3
Bi-annual Seep Sampling	SERDS Seep 13	7/7/2015	7/7/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1650	969	8.15	1420	-3	0.17	151	-0.005	-5	0.35	21.8	21.8	-0.01	0.0086	0.0118

Location Type	Sample Point	Original Date As Is	Recoded Date	Dissolved Organic Carbon (mg/L)	Aluminum (Al)-Total (mg/L)	Antimony (Sb)-Total (mg/L)	Arsenic (As)-Total (mg/L)	Barium (Ba)-Total (mg/L)	Beryllium (Be)-Total (mg/L)	Bismuth (Bi)-Total (mg/L)	Boron (B)-Total (mg/L)	Cadmium (Cd)-Total (mg/L)	Calcium (Ca)-Total (mg/L)	Chromium (Cr)-Total (mg/L)	Cobalt (Co)-Total (mg/L)	Copper (Cu)-Total (mg/L)	Iron (Fe)-Total (mg/L)	Lead (Pb)-Total (mg/L)	Lithium (Li)-Total (mg/L)	Magnesium (Mg)-Total (mg/L)	Manganese (Mn)-Total (mg/L)	Molybdenum (Mo)-Total (mg/L)	Nickel (Ni)-Total (mg/L)	Potassium (K)-Total (mg/L)	Selenium (Se)-Total (mg/L)	Silicon (Si)-Total (mg/L)	Silver (Ag)-Total (mg/L)	Sodium (Na)-Total (mg/L)	Strontium (Sr)-Total (mg/L)	Thallium (Tl)-Total (mg/L)	Tin (Sn)-Total (mg/L)	Titanium (Ti)-Total (mg/L)	Uranium (U)-Total (mg/L)	Vanadium (V)-Total (mg/L)	Zinc (Zn) Total (mg/L)	Aluminum (Al)-Dissolved (mg/L)	Antimony (Sb)-Dissolved (mg/L)	Arsenic (As) Dissolved (mg/L)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	NEZ Dump Seep 6	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 6	5/6/2014	5/6/2014	1.67	0.083	0.00097	0.00114	0.0739	-0.0001	-0.0005	0.422	-0.0002	262	-0.0005	-0.0001	0.00872	0.073	-0.00005	0.00695	35.4	0.0231	0.192	-0.0005	1.98	0.0149	7.85	-0.00001	30.2	7	-0.00001	-0.0001	0.011	0.00491	0.0017	-0.003	-0.003	0.00091	0.00105
Bi-annual Seep Sampling	NEZ Dump Seep 6	27-10-2014 14:22	10/27/2014	4.15	0.356	0.00032	0.00039	0.0645	-0.0001	-0.0005	0.309	0.000038	213	0.00071	0.00021	0.00841	0.36	0.00011	0.00359	28.3	0.0156	0.0685	0.00095	1.23	0.0123	7.64	1.3E-05	22.9	5.42	-0.00001	-0.0001	0.031	0.00106	0.0015	-0.003	0.0049	0.00032	0.00027
Bi-annual Seep Sampling	NEZ Dump Seep 7	2/7/2013	2/7/2013	3.13	0.853	0.00018	0.00095	0.0369	-0.0001	-0.0005	0.07	0.000031	80.3	0.00128	0.0006	0.0246	0.847	0.00036	0.00135	11	0.0403	0.0258	0.00109	0.773	0.00428	8.49	1.2E-05	5.52	0.742	-0.00001	-0.0001	0.05	0.00053	0.0039	0.0038	0.0075	0.00013	0.00047
Bi-annual Seep Sampling	NEZ Dump Seep 7	5/6/2014	5/6/2014	2.16	0.098	0.00031	0.00066	0.0467	-0.0001	-0.0005	0.154	-0.00005	154	-0.0005	-0.0001	0.00925	0.098	6.9E-05	0.00235	21.7	0.00518	0.0767	-0.0005	0.986	0.00938	6.8	-0.00001	13.1	2.27	-0.00001	-0.0001	0.011	0.00176	0.0017	-0.003	0.0036	0.0003	0.00054
Bi-annual Seep Sampling	NEZ Dump Seep 7	27-10-2014 13:52	10/27/2014	2.91	0.108	0.00034	0.00066	0.0516	-0.0001	-0.0005	0.102	0.000032	184	-0.0005	0.0001	0.0108	0.123	5.1E-05	0.00229	24.7	0.00755	0.0825	-0.0005	1.26	0.0192	6.27	-0.00001	12.4	2.07	-0.00001	-0.0001	0.022	0.00138	0.0017	-0.003	0.0035	0.00031	0.00057
Bi-annual Seep Sampling	NEZ Dump Seep 7	28-05-2015 14:25	5/28/2015	2.38	1.54	0.00023	0.00225	0.061	0.00015	-0.00005	0.139	0.0000535	146	0.00172	0.00145	0.0523	2.24	0.00126	0.0037	18.2	0.122	0.0393	0.00179	0.948	0.017	9.45	2.1E-05	9.66	1.52	-0.00001	-0.0001	0.061	0.00107	0.00978	0.0079	-0.003	0.00023	0.00045
Bi-annual Seep Sampling	NEZ Dump Seep 8	4/7/2013	4/7/2013	4.27	0.827	-0.0001	0.00089	0.1	-0.0001	-0.0005	0.045	0.000065	244	0.00134	0.00227	0.0398	1.19	0.00057	-0.0005	52.7	1.28	0.103	0.00606	3.18	0.0107	5.82	0.00005	13.4	2.93	0.000015	-0.0001	0.036	0.000269	0.004	0.0071	0.0037	-0.0001	0.00018
Bi-annual Seep Sampling	NEZ Dump Seep 8	8/6/2015	8/6/2015	3.9	0.183	-0.0001	0.00039	0.0517	-0.0001	-0.00005	0.045	0.0000659	187	0.0005	0.00048	0.0114	0.325	0.00017	-0.001	38.6	0.234	0.076	0.00129	2.38	0.00492	5.07	1.6E-05	10.1	1.93	-0.00001	-0.0001	0.011	0.000343	0.00119	-0.003	0.0036	-0.0001	0.00021
Bi-annual Seep Sampling	NEZ Dump Seep 9	4/7/2013	4/7/2013	3.85	0.0354	0.00027	0.00034	0.038	-0.0002	-0.001	0.093	-0.0004	380	-0.0005	0.00063	0.059	-0.03	-0.0001	0.0041	67.9	0.134	0.432	0.0021	2.41	0.043	4.18	-0.00002	22.6	5.5	-0.00002	-0.0002	0.014	0.00268	-0.002	0.0239	0.0158	0.00025	0.00026
Bi-annual Seep Sampling	NEZ Dump Seep 9	23-10-2013 13:21	10/23/2013	4.4	0.0369	0.00021	0.00027	0.0331	-0.0002	-0.001	0.079	0.00032	303	-0.0005	0.00069	0.0747	-0.03	-0.0001	0.0036	60.8	0.185	0.152	0.0024	2.55	0.0509	5.11	-0.00002	18.1	3.57	-0.00002	-0.0002	-0.01	0.00141	-0.002	0.0319	0.0096	-0.0002	-0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 9	5/6/2014	5/6/2014	4.07	0.0532	0.00015	0.00023	0.0288	-0.0001	-0.0005	0.058	-0.00025	269	-0.0005	0.00051	0.0535	0.032	-0.00005	0.00227	54.7	0.119	0.154	0.00211	2.39	0.0739	4.75	-0.00001	16.2	3.35	-0.00001	-0.0001	-0.01	0.00107	-0.001	0.0189	0.013	0.00014	0.0002
Bi-annual Seep Sampling	NEZ Dump Seep 9	27-10-2014 13:31	10/27/2014	4.78	0.575	0.00015	0.0005	0.0334	-0.0001	-0.0005	0.068	0.0001193	243	0.00056	0.00084	0.0808	0.554	0.00021	0.00304	47	0.134	0.158	0.00202	2.31	0.0435	5.58	1.7E-05	14.8	2.58	-0.00001	-0.0001	0.05	0.00107	0.0019	0.0178	0.0086	0.00025	0.00025
Bi-annual Seep Sampling	NEZ Dump Seep 9	8/6/2015	8/6/2015	5.34	0.0175	0.00016	0.00026	0.0309	-0.0001	-0.00005	0.066	0.000118	300	-0.0005	0.00027	0.0432	-0.03	-0.00005	0.0024	52.9	0.0952	0.145	0.0014	2.61	0.0581	4.76	1.5E-05	17.6	3.35	-0.00001	-0.0001	-0.01	0.00113	-0.0005	0.0157	0.0184	0.00012	0.0002
Bi-annual Seep Sampling	North Bell Dump Seep 1	30-05-2013 9:43	5/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	North Bell Dump Seep 1	14-10-2015 13:57	10/14/2015	6.6	0.0245	0.00031	0.00063	0.0577	-0.0001	-0.00005	0.026	0.0000578	99.3	-0.0005	0.00042	0.0178	0.303	-0.00005	0.0047	11.8	0.633	0.0316	-0.0005	1.07	0.0307	7.63	-0.00001	4.6	0.359	-0.00001	-0.0001	-0.01	0.000452	0.00079	0.0045	-0.003	0.00029	0.00047
Bi-annual Seep Sampling	North Bell Dump Seep 2	4/6/2013	4/6/2013	4.86	2.7	0.00027	0.00258	0.0696	-0.0001	-0.0005	0.043	0.000143	114	0.00245	0.00234	0.134	3.19	0.00143	0.00591	22.6	0.197	0.0385	0.00235	1.72	0.0683	11.7	4.4E-05	8.84	0.375	0.000011	-0.0001	0.165	0.0016	0.0106	0.018	0.0087	0.00024	0.00114
Bi-annual Seep Sampling	North Bell Dump Seep 3	4/6/2013	4/6/2013	5.85	0.0734	0.00021	0.00045	0.0674	-0.0001	-0.0005	0.024	0.000015	151	-0.0005	-0.0001	0.00912	0.051	-0.00005	0.00051	21.4	0.00655	0.0139	-0.0005	1.77	0.0064	4.23	-0.00001	6.74	1.03	-0.00001	-0.0001	0.014	0.000097	-0.001	-0.003	0.0229	0.00022	0.00033
Bi-annual Seep Sampling	North Bell Dump Seep 4	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 1	30-05-2013 9:42	5/30/2013	9.05	0.174	0.00042	0.00093	0.107	-0.0001	-0.0005	0.046	0.000039	183	-0.0005	0.00026	0.0163	0.464	0.00011	0.00249	34.3	0.151	0.051	-0.0005	4.39	0.143	7.97	1.5E-05	15.9	0.733	-0.00001	-0.0001	0.012	0.000801	0.0015	0.0038	0.0053	0.00046	0.00068
Bi-annual Seep Sampling	PAG Dump Seep 10	29-05-2014 9:48	5/29/2014	12.4	0.239	0.00021	0.00083	0.0937	-0.0001	-0.0005	0.04	-0.0002	146	-0.0005	0.00162	0.0343	0.298	0.00012	0.00109	23.6	0.885	0.0258	0.00078	3.21	0.018	8.55	3.9E-05	10.1	0.667	-0.00001	0.00016	0.019	0.000873	0.0014	0.005	0.0117	0.00018	0.00063
Bi-annual Seep Sampling	PAG Dump Seep 10	23-10-2014 12:28	10/23/2014	12.6	0.0398	0.00014	0.00049	0.131	-0.0001	-0.0005	0.034	0.000032	243	-0.0005	0.00028	0.0149	0.043	-0.00005	-0.0005	43.8	0.238	0.02	0.00062	4.21	0.0172	7.3	1.5E-05	16	1.07	-0.00001	-0.0001	0.021	0.0018	-0.001	-0.003	0.0135	0.00012	0.00045
Bi-annual Seep Sampling	PAG Dump Seep 10	20-05-2015 13:03	5/20/2015	8.12	0.0813	0.00023	0.0004	0.111	-0.0001	-0.00005	0.036	0.0000349	235	-0.0005	0.00024	0.0103	0.08	-0.00005	0.001	39.2	0.0675	0.0438	-0.0005	2.92	0.0321	7.72	-0.00001	15.4	0.96	-0.00001	-0.0001	0.012	0.00118	0.00084	-0.003	0.0093	0.00021	0.00034
Bi-annual Seep Sampling	PAG Dump Seep 10	24-11-2015 13:22	11/24/2015	7.3	0.0193	0.00022	0.0004	0.111	-0.0001	-0.00005	0.038	0.0000108	284	-0.0005	0.00011	0.00719	-0.03	-0.00005	-0.001	49.2	0.017	0.0586	-0.0005	3.01	0.0332	7.35	-0.00001	17.7	0.982	-0.00001	-0.0001	0.021	0.000172	0.0006	-0.003	0.0062	0.00021	0.00038
Bi-annual Seep Sampling	PAG Dump Seep 12	29-05-2014 10:04	5/29/2014	20.5	0.177	0.00018	0.00113	0.0875	-0.0001	-0.0005	0.051	0.000125	103	0.00056	0.00271	0.0358	0.23	8.1E-05	0.00101	19.7	1.14	0.011	0.00087	2.68	0.016	7.04	0.00008	8.16	0.572	-0.00001	-0.0001	0.012	0.000818	0.0014	0.0055	0.022	0.00016	0.00093
Bi-annual Seep Sampling	PAG Dump Seep 13	23-10-2014 10:49	10/23/2014	4.87	0.0513	0.0004	0.00208	0.0156	-0.0001	-0.0005	0.157	-0.00001	46	-0.0005	0.00101	0.00403	0.363	-0.00005	0.00188	8.83	0.934	0.018	-0.0005	0.693	0.00112	9.84	-0.00001	6.47	0.211	-0.00001	-0.0001	-0.01	0.000472	0.0034	-0.003	0.0092	0.00043	0.00176
Bi-annual Seep Sampling	PAG Dump Seep 13	20-05-2015 13:36	5/20/2015	3.87	0.0348	0.00046	0.0026	0.0129	-0.0001	-0.00005	0.169	0.0000149	47.9	-0.0005	0.00034	0.00498	0.075	-0.00005	0.002	9.2	0.509	0.0359	-0.0005	0.72	0.00371	9.56	-0.00001	7.09	0.218	-0.00001	-0.0001	-0.01	0.000582	0.00405	-0.003	0.005	0.00043	0.00243
Bi-annual Seep Sampling	PAG Dump Seep 14	23-10-2014 11:13	10/23/2014	14.7	0.114	0.00012	0.00069	0.0975	-0.0001	-0.0005	0.065	0.00005	174	-0.0005	0.00141	0.0202	0.495	-0.00005	-0.0005	34.7	3.23	0.0201	0.00093	2.74	0.0138	7.94	1.3E-05	11.5	0.844	-0.00001	-0.0001	0.02	0.00163	0.0014	-0.003	0.014	0.00011	0.00055
Bi-annual Seep Sampling	PAG Dump Seep 14	20-05-2015 13:16	5/20/2015	9.04	0.0101	0.00017	0.00048	0.103	-0.0001	-0.00005	0.072	0.0000079	267	-0.0005	0.00031	0.00785	0.047	-0.00005	0.0011	49.3	0.54	0.03	-0.0005	3.03	0.0425	7.2	-0.00001	17.3	1.26	-0.00001	-0.0001	-0.01	0.00271	0.00061	-0.003	0.0043	0.00015	0.00041
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 14:48	11/24/2015	7.57	0.0113	0.00014	0.00056	0.115	-0.0001	-0.00005	0.066	-0.000005	312	-0.0005	0.00011	0.00587	0.072	-0.00005	-0.001	60.7	0.264	0.05	-0.0005	3.09	0.0404	7.85	6.2E-05	18.6	1.24	-0.00001	-0.0001	0.021	0.00285	0.00065	-0.003	0.0034	0.00012	0.00049
Bi-annual Seep Sampling	PAG Dump Seep 15	9/12/2014	9/12/2014	14.6	2.68	0.0004	0.00211	0.127	-0.0001	-0.0005	0.04	0.000147	202	0.00273	0.00725	0.0812	3.84	0.00105	0.00377	39.2	2.16	0.077	0.00254	4.27	0.0678	10.5	3.7E-05	15.6	1.01	0.000012	-0.0001	0.17	0.000958	0.0093	0.0139	0.016	0.00034	0.00057
Bi-annual Seep Sampling	PAG Dump Seep 15	23-10-2014 11:56	10/23/2014	67.9	2.64	0.00037	0.00277	0.168	-0.0001	-0.0005	0.047	0.000118	207	0.00291	0.0186	0.0783	6.27	0.00107	0.00284	44	7.98	0.029	0.00344	7.29	0.0234	12.4	6.9E-05	14.2	1.2	0.000015	-0.0001	0.156	0.00163	0.0105	0.0159	0.0307	0.00028	0.00106
Bi-annual Seep Sampling	PAG Dump Seep 15	1/9/2015	1/9/2015	15.3	0.192	0.00035	0.00077	0.102	-0.0001	-0.00005	0.054	0.0000675	314	-0.0005	0.00553	0.0146	1.06	8.2E-05	0.0028	55.5	1.76	0.122	0.00082	4.76	0.0822	7.26	1.7E-05	24.8	1.43	-0.00001	-0.0001	0.014	0.00166	0.00139	0.0036	0.0147	0.00033	0.00054
Bi-annual Seep Sampling	PAG Dump Seep 15	2/2/2015	2/2/2015	18.9	1.05	0.00034	0.00123	0.14	-0.0002	-0.001	0.047	0.0001165	304	0.00122	0.00772	0.0337	2.47	0.00047	0.0025	55.6	2.64	0.0856	0.0019	5.05	0.12	9.08	-0.00002	22.6	1.38	-0.00002	-0.0002	0.078	0.000991	0.0044	0.0107	0.0093	0.0003	0.00053
Bi-annual Seep Sampling	PAG Dump Seep 15	2/6/2015	2/6/2015	14.8	0.167	0.00037	0.00073	0.108	-0.0001	-0.00005	0.056	0.000073	302	-0.0005	0.00564	0.0154	1.19	7.4E-05	0.0022	53.3	2.22	0.107	0.00104	4.89	0.0914	7.85	1.5E-05	23.4	1.32	-0.00001	-0.0001	0.014	0.00162	0.0014	0.0032	0.0062	0.00033	0.0005
Bi-annual Seep Sampling	PAG Dump Seep 15	3/3/2015	3/3/2015	15	0.32	0.00031	0.0008	0.131	-0.0002	-0.001	0.046	0.0000139	323	-0.0005	0.00627	0.0206	1.16	0.00015	0.0026	57.7	2.18	0.104	0.0012	5.03	0.128	7.48	-0.00002	26.4	1.43	-0.00002	-0.0002	0.036	0.000894	-0.002	0.0067	0.0061	0.0003	0.00044
Bi-annual Seep Sampling	PAG Dump Seep 15	5/5/2015	5/5/2015	19.3	0.131	0.00037	0.00081	0.112	-0.0001	-0.00005	0.06	0.0000827	287	-0.0005	0.00719	0.0156	1.6	0.00006	0.0026	52.8	2.78	0.0961	0.00112	5.1	0.0953	8.39	1.5E-05	24.8	1.22	-0.00001	-0.0001	0.014	0.00128	0.00134	0.0038	0.0103	0.00035	0.00056
Bi-annual Seep Sampling	PAG Dump Seep 15	6/1/2015	6/1/2015	24.6	5.27	0.0004	0.00348	0.188	0.00015	-0.0005	0.052	0.000188	284	0.00541	0.0135	0.11	7.33	0.00212	0.00604	54.1	3.92	0.0705	0.00508	6.05	0.0972	17.4	6.3E-05	23.6	1.29	0.000025	0.00013	0.338	0.00104	0.0181	0.0236	0.0104	0.00031	0.00065
Bi-annual Seep Sampling	PAG Dump Seep 15	6/8/2015	6/8/2015	14.6	0.374	0.00043	0.00092	0.108	-0.0002	-0.0001	0.051	0.0000074	326	-0.0005	0.00711	0.0191	1.17	0.00017	0.003	56.5	1.96	0.111	0.0012	4.89	0.0987	7.86	-0.00002	25.4	1.46	-0.00002	-0.0002	0.026	0.00168	0.0021	-0.006	0.0095	0.00036	0.0005
Bi-annual Seep Sampling	PAG Dump Seep 15	7/7/2015	7/7/2015	14	0.264	0.00036	0.0018	0.117	-0.0002	-0.0001	0.054	0.0000072	311	0.00057	0.00571	0.0175	0.944	0.00021	-0.002	53.3	2.17	0.104	0.0028	5.27	0.0781	7.67	-0.00002	25	1.34	0.000042	-0.0002	0.019	0.00156	0.0016	-0.006	0.0166	0.00035	0.00061
Bi-annual Seep Sampling	PAG Dump Seep 15	8/4/2015	8/4/2015	14.1	0.152	0.00034	0.00069	0.118	-0.0002	-0.0001	0.054	0.000076	332	-0.0005	0.00511	0.0153	1.06	-0.00001	0.003	58.5	1.87	0.116	-0.001	4.7	0.122	7.48	2.6E-05	26.5	1.36	-0.00002	-0.0002	0.03	0.00101	0.0012	-0.006	0.0071	0.00033	0.00048
Bi-annual Seep Sampling	PAG Dump Seep 15	29-10-2015 12:55	10/29/2015	18.9	0.11	0.00034	0.00074	0.0891	-0.0001	-0.00005	0.059	0.0000375	298	-0.0005	0.00496	0.0146	1.08	6.5E-05	0.0023	52	1.97	0.108	0.00064	4.93	0.0576	7.96	1.6E-05	25.5	1.31	-0.00001	-0.0001	0.017	0.00164	0.00124	0.0031	0.0097	0.00033	0.00053
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 13:05	11/24/2015	8.93	0.0209	0.00038	0.00058	0.0819	-0.0001	-0.00005	0.054	0.0000067	346	-0.0005	0.00079	0.0105	0.147	-0.00005	0.0028	61.7	0.294	0.117	-0.0005	4.27	0.0883	7.89	1.3E-05	25.8	1.26	-0.00001	-0.0001	0.021	0.00177	0.00076	-0.003	0.0054	0.00036	0.00048
Bi-annual Seep Sampling	PAG Dump Seep 2	30-05-2013 9:56	5/30/2013	62.4	0.17	0.00031	0.00145	0.204	-0.0002	-0.001	0.058	-0.0004	361	-0.0005	0.0219	0.0186	7.36	0.00015	0.0044	67.3	9.12	0.31	0.0017	9.93	0.273	6.92	2.9E-05	23.4	1.44	-0.00002	-0.0002	0.012	0.00233	0.0023	0.0322	0.0117	0.00029	0.00077
Bi-annual Seep Sampling	PAG Dump Seep 3	30-05-2013 10:08	5/30/2013	9.26	0.384	-0.0001	0.00074	0.102	-0.0001	-0.0005	0.014	0.000245	184	-0.0005	0.00587	0.0199	2.03	0.00018	-0.0005	37.8	6.35	0.00254	0.0008	2.97	0.0363	8.36	2.4E-05	9.24	0.751	-0.00001	-0.0001	0.023	0.000074	0.002	0.0089	0.007	-0.0001	0.00033
Bi-annual Seep Sampling	PAG Dump Seep 3	29-05-2014 10:52	5/29/2014	5.04	0.0268	-0.0001	0.00026	0.0655	-0.0001	-0.0005	0.023	0.000035	202	-0.0005	0.0002	0.00578	0.099	-0.00005	-0.0005	39.4	0.0834	0.000201	-0.0005	2.09	0.0717	5.87	1.3E-05	13.3	0.985	-0.00001	-0.0001	-0.01	0.00001	-0.001	-0.003	0.003	-0.0001	0.00016
Bi-annual Seep Sampling	PAG Dump Seep 4	30-05-2013 11:03	5/30/2013	13.3	2.87	0.00025	0.00213	0.0768	-0.0001	-0.0005	0.038	0.000548	260	0.00311	0.00242	0.0635	3.44	0.00108	0.00303	45.6	1.26	0.0452	0.00275	3.51	0.152	12.4	0.0001	16.7	0.982	0.000022	-0.0001	0.175	0.0016	0.0109	0.0185	0.427	0.0004	0.00074
Bi-annual Seep Sampling	PAG Dump Seep 4	29-05-2014 11:11	5/29/2014	10.9	0.0418	0.00031	0.00081	0.0858	-0.0002	-0.001	0.058	-0.0004	416	-0.0005	0.00151	0.0211	0.114	-0.0001	0.0027	76.6	1.56	0.26	-0.001	4.64	0.243	5.98	-0.00002	30.1	1.55	-0.00002	-0.0002	0.012	0.00199	-0.002	-0.006	0.007	0.00031	0.00067
Bi-annual Seep Sampling	PAG Dump Seep 4	14-05-2015 13:57	5/14/2015	7.81	0.0324	-0.0002	0.0005	0.0485	-0.0002	-0.0001	0.055	0.000352	419	-0.0005	-0.0002	0.0118	0.034	-0.00005	-0.0002	71.8	0.0531	0.208	0.001	3.32	0.247	6.64	-0.00002	29.4	1.32	-0.00002	-0.0002	-0.01	0.00154	-0.001	-0.005	-0.003	-0.0002	0.00044
Bi-annual Seep Sampling	PAG Dump Seep 5	29-05-2014 10:40	5/29/2014	10.7	0.0906	0.00042	0.00071	0.149	-0.0002	-0.001	0.068	-0.0003	364	-0.0005	0.00592	0.0161	0.622	-0.0001	0.0029	63	2.77	0.233	0.0011	6.52	0.188	7.1	-0.00002	31.6	1.45	-0.00002	-0.0002	0.015	0.00153	-0.002	0.0097	0.0046	0.00034	0.00047
Bi-annual Seep Sampling	PAG Dump Seep 5	23-10-2014 10:50	10/23/2014	11.1	0.394	0.00037	0.00088	0.0932	-0.0002	-0.001	0.065	0.000144	325	0.00056	0.00348	0.0357	0.847	0.00026	0.004	56	2.31	0.177	0.0011	4.96	0.124	7.67	-0.00002	29.9	1.27	-0.00002	-0.0002	0.042	0.0015	-0.002	0.0079	0.0075	0.00037	0.00057
Bi-annual Seep Sampling	PAG Dump Seep 5	14-05-2015 14:22	5/14/2015	10.9	0.0307	0.00034	0.00059	0.0988	-0.0002	-0.0001	0.083	0.000336	437	-0.0005	0.00516	0.0207	0.292	-0.0001	0.0029	72.7	4.62	0.583	0.0011	5.77	0.224	6.54	-0.00002	44.1	1.49	-0.00002	-0.0002	-0.01	0.00172	-0.001	0.0095	0.0062	0.00033	0.00051
Bi-annual Seep Sampling	PAG Dump Seep 5	24-11-2015 12:38	11/24/2015	10	0.0165	-0.0002	0.00047	0.051	-0.0002	0.00012	0.08	-0.00012	433	-0.0005	0.0016	0.0125	0.355	-0.0001	0.0035	74.9	2.04	0.328	-0.001	5.24	0.104	7.25	7.6E-05	35.5	1.3	-0.00002	-0.0002	0.02	0.00272	-0.001	-0.006	0.005	-0.0002	0.0004
Bi-annual Seep Sampling	PAG Dump Seep 7	29-05-2014 9:01	5/29/2014	30.2	10.2	0.00027	0.00601	0.145	0.00034	-0.0005	0.017	0.000246	61.1	0.0113	0.0132	0.241	13.9	0.00422	0.0093	18.1	2.46	0.00383	0.0102	4.95	0.00124	27.1	0.00023	5.18	0.337	0.000055	0.00015	0.505	0.000381	0.0315	0.0422	0.0668	-0.0001	0.0028
Bi-annual Seep Sampling	PAG Dump Seep 7	23-10-2014 11:16	10/23/2014	7.07	0.528	0.0002

Location Type	Sample Point	Original Date As Is	Recoded Date	Barium (Ba) Dissolved (mg/L)	Beryllium (Be)-Dissolved (mg/L)	Bismuth (Bi)-Dissolved (mg/L)	Boron (B)-Dissolved (mg/L)	Cadmium (Cd)-Dissolved (mg/L)	Calcium (Ca)-Dissolved (mg/L)	Chromium (Cr)-Dissolved (mg/L)	Cobalt (Co)-Dissolved (mg/L)	Copper (Cu)-Dissolved (mg/L)	Iron (Fe)-Dissolved (mg/L)	Lead (Pb)-Dissolved (mg/L)	Lithium (Li)-Dissolved (mg/L)	Magnesium (Mg)-Dissolved (mg/L)	Manganese (Mn)-Dissolved (mg/L)	Molybdenum (Mo)-Dissolved (mg/L)	Nickel (Ni)-Dissolved (mg/L)	Potassium (K)-Dissolved (mg/L)	Selenium (Se)-Dissolved (mg/L)	Silicon (Si)-Dissolved (mg/L)	Silver (Ag)-Dissolved (mg/L)	Sodium (Na)-Dissolved (mg/L)	Strontium (Sr)-Dissolved (mg/L)	Thallium (Tl)-Dissolved (mg/L)	Tin (Sn)-Dissolved (mg/L)	Titanium (Ti)-Dissolved (mg/L)	Uranium (U)-Dissolved (mg/L)	Vanadium (V)-Dissolved (mg/L)	Zinc (Zn)-Dissolved (mg/L)		Julian Date	EC-Field
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			µs/cm
Bi-annual Seep Sampling	NEZ Dump Seep 6	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.1	531
Bi-annual Seep Sampling	NEZ Dump Seep 6	5/6/2014	5/6/2014	0.0694	-0.0001	-0.0005	0.413	-0.0002	259	-0.0005	-0.0001	0.00621	-0.03	-0.00005	0.00698	34.5	0.0189	0.183	-0.0005	1.89	0.0143	7.56	-0.00001	28.6	6.51	-0.00001	-0.0001	-0.01	0.00487	0.0013	-0.003		2014.34	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 6	27-10-2014 14:22	10/27/2014	0.062	-0.0001	-0.0005	0.292	0.000019	219	-0.0005	-0.0001	0.00366	-0.03	-0.00005	0.0032	28.4	0.00342	0.0652	-0.0005	1.18	0.0135	7.06	-0.00001	22.1	5.34	-0.00001	-0.0001	0.019	0.00103	-0.001	-0.003		2014.82	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 7	2/7/2013	2/7/2013	0.0235	-0.0001	0.00082	0.068	0.000018	79.5	-0.0005	-0.0001	0.00651	-0.03	-0.00005	-0.0005	10.5	0.00129	0.0253	-0.0005	0.626	0.0041	6.81	-0.00001	5.23	0.721	-0.00001	-0.0001	-0.01	0.000501	0.0013	-0.003		2013.1	5.4
Bi-annual Seep Sampling	NEZ Dump Seep 7	5/6/2014	5/6/2014	0.0453	-0.0001	-0.0005	0.164	-0.00004	151	-0.0005	-0.0001	0.00537	-0.03	-0.00005	0.00273	21.4	0.0008	0.0754	-0.0005	0.986	0.00927	6.54	-0.00001	12.1	2.12	-0.00001	-0.0001	-0.01	0.00176	0.0013	-0.003		2014.34	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 7	27-10-2014 13:52	10/27/2014	0.048	-0.0001	-0.0005	0.098	0.000032	188	-0.0005	-0.0001	0.00617	-0.03	-0.00005	0.00227	24.3	0.00327	0.0803	-0.0005	1.18	0.0208	6.07	-0.00001	11.6	2.05	-0.00001	-0.0001	0.017	0.00134	0.0012	-0.003		2014.82	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 7	28-05-2015 14:25	5/28/2015	0.034	-0.0001	-0.00005	0.118	0.0000126	141	-0.0005	-0.0001	0.00402	-0.03	-0.00005	0.0024	17.4	0.00091	0.0419	-0.0005	0.769	0.0103	6.83	-0.00001	10	1.48	-0.00001	-0.0001	-0.01	0.00104	0.00122	-0.003		2015.4	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 8	4/7/2013	4/7/2013	0.0762	-0.0001	-0.0005	0.066	-0.00006	250	-0.0005	-0.0001	0.00289	-0.03	-0.00005	-0.0005	54.9	0.00333	0.0869	-0.0005	3.19	0.00991	4.63	-0.00001	13.7	3.01	-0.00001	-0.0001	0.013	0.000174	-0.001	-0.003		2013.26	1452
Bi-annual Seep Sampling	NEZ Dump Seep 8	8/6/2015	8/6/2015	0.0479	-0.0001	-0.00005	0.045	0.0000323	191	-0.0005	-0.0001	0.00297	-0.03	-0.00005	-0.001	39.5	0.00806	0.0734	0.00051	2.43	0.00467	4.89	-0.00001	10.5	1.96	-0.00001	-0.0001	-0.01	0.000323	-0.0005	-0.003		2015.59	1984
Bi-annual Seep Sampling	NEZ Dump Seep 9	4/7/2013	4/7/2013	0.0379	-0.0002	-0.001	0.092	-0.0004	382	-0.0005	0.00062	0.0496	-0.03	-0.0001	0.0042	68.7	0.135	0.404	0.0021	2.46	0.0413	4.17	-0.00002	22.6	5.36	-0.00002	-0.0002	0.014	0.00264	-0.002	0.0242		2013.26	1984
Bi-annual Seep Sampling	NEZ Dump Seep 9	23-10-2013 13:21	10/23/2013	0.0324	-0.0002	-0.001	0.075	0.000316	308	-0.0005	0.00064	0.0495	-0.03	-0.0001	0.0035	62.2	0.183	0.149	0.0023	2.51	0.0503	5.04	-0.00002	17.9	3.59	-0.00002	-0.0002	-0.01	0.00141	-0.002	0.0299		2013.81	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 9	5/6/2014	5/6/2014	0.0285	-0.0001	-0.0005	0.057	-0.00025	264	-0.0005	0.00046	0.0371	-0.03	-0.00005	0.00211	53.3	0.114	0.15	0.00204	2.34	0.0708	4.59	-0.00001	15.9	3.24	-0.00001	-0.0001	-0.01	0.00101	-0.001	0.0184		2014.34	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 9	27-10-2014 13:31	10/27/2014	0.0292	-0.0001	-0.0005	0.067	0.000225	247	-0.0005	0.00045	0.0323	-0.03	-0.00005	0.00237	47.8	0.118	0.155	0.00153	2.2	0.0452	4.43	-0.00001	15	2.68	-0.00001	-0.0001	0.021	0.00104	-0.001	0.0147		2014.82	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 9	8/6/2015	8/6/2015	0.0301	-0.0001	-0.00005	0.063	0.000136	296	-0.0005	0.00027	0.0336	-0.03	-0.00005	0.0022	54.5	0.0938	0.142	0.00141	2.52	0.0566	4.72	-0.00001	17.2	3.27	-0.00001	-0.0001	-0.01	0.0011	-0.0005	0.0153		2015.59	#N/A
Bi-annual Seep Sampling	North Bell Dump Seep 1	30-05-2013 9:43	5/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.41	478
Bi-annual Seep Sampling	North Bell Dump Seep 1	14-10-2015 13:57	10/14/2015	0.055	-0.0001	-0.00005	0.026	0.0000553	99	-0.0005	0.00037	0.00823	0.042	-0.00005	0.0044	11.6	0.6	0.0313	-0.0005	0.993	0.0295	7.47	-0.00001	4.44	0.34	-0.00001	-0.0001	-0.01	0.000449	0.00054	0.0034		2015.78	#N/A
Bi-annual Seep Sampling	North Bell Dump Seep 2	4/6/2013	4/6/2013	0.0325	-0.0001	-0.0005	0.043	0.000101	113	-0.0005	0.00015	0.0255	-0.03	-0.00005	0.00379	21.3	0.089	0.0426	-0.0005	1.44	0.0742	6.28	-0.00001	8.55	0.376	-0.00001	-0.0001	-0.01	0.00168	0.002	0.003		2013.26	801
Bi-annual Seep Sampling	North Bell Dump Seep 3	4/6/2013	4/6/2013	0.0683	-0.0001	-0.0005	0.024	0.000019	162	-0.0005	-0.0001	0.00542	-0.03	-0.00005	-0.0005	22.8	0.00713	0.0146	-0.0005	1.75	0.00697	3.82	-0.00001	7.04	1.11	-0.00001	-0.0001	0.011	0.000086	-0.001	-0.003		2013.26	1083
Bi-annual Seep Sampling	North Bell Dump Seep 4	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.1	588
Bi-annual Seep Sampling	PAG Dump Seep 1	30-05-2013 9:42	5/30/2013	0.108	-0.0001	-0.0005	0.048	0.000035	200	-0.0005	0.0001	0.0066	-0.03	-0.00005	0.00281	36.8	0.103	0.0556	-0.0005	4.64	0.155	8.21	-0.00001	16.7	0.783	-0.00001	-0.0001	-0.01	0.000812	-0.001	-0.003		2013.41	736
Bi-annual Seep Sampling	PAG Dump Seep 10	29-05-2014 9:48	5/29/2014	0.0881	-0.0001	-0.0005	0.036	-0.0001	144	-0.0005	0.00029	0.0213	-0.03	-0.00005	0.00076	23.2	0.588	0.0245	0.00067	3.15	0.0183	7.9	-0.00001	10.1	0.654	-0.00001	-0.0001	-0.01	0.000836	-0.001	0.0037		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 10	23-10-2014 12:28	10/23/2014	0.126	-0.0001	-0.0005	0.036	0.000029	245	-0.0005	0.00023	0.0129	-0.03	-0.00005	0.00117	44.2	0.208	0.0184	-0.0005	4.24	0.0175	7.32	-0.00001	16.6	1.05	-0.00001	-0.0001	0.02	0.00185	-0.001	-0.003		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 10	20-05-2015 13:03	5/20/2015	0.108	-0.0001	-0.00005	0.036	0.0000296	233	-0.0005	0.00011	0.00735	-0.03	-0.00005	0.001	38.6	0.0236	0.0456	-0.0005	2.9	0.0315	7.56	-0.00001	15.1	0.938	-0.00001	-0.0001	-0.01	0.00115	0.00053	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 10	24-11-2015 13:22	11/24/2015	0.103	-0.0001	-0.00005	0.033	0.0000111	284	-0.0005	-0.0001	0.00632	-0.03	-0.00005	-0.001	49.7	0.00883	0.0581	-0.0005	2.89	0.0321	7.32	-0.00001	16.7	0.995	-0.00001	-0.0001	0.02	0.00163	-0.0005	-0.003		2015.88	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 12	29-05-2014 10:04	5/29/2014	0.077	-0.0001	-0.0005	0.049	0.000088	102	-0.0005	0.0004	0.0234	0.052	-0.00005	0.00078	19.2	0.465	0.0101	0.00077	2.62	0.0154	6.42	0.00002	7.85	0.562	-0.00001	-0.0001	-0.01	0.000772	-0.001	0.0038		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 13	23-10-2014 10:49	10/23/2014	0.0103	-0.0001	-0.0005	0.148	-0.00001	45.6	-0.0005	0.00087	0.00225	0.158	-0.00005	0.00173	8.6	0.864	0.0172	-0.0005	0.634	0.00118	9.5	-0.00001	6.12	0.205	-0.00001	-0.0001	-0.01	0.000437	0.0027	-0.003		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 13	20-05-2015 13:36	5/20/2015	0.0111	-0.0001	-0.00005	0.16	0.0000074	46.1	-0.0005	0.0002	0.00314	-0.03	-0.00005	0.0022	8.61	0.428	0.0355	-0.0005	0.698	0.00357	8.82	-0.00001	7.03	0.21	-0.00001	-0.0001	-0.01	0.000573	0.00373	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 14	23-10-2014 11:13	10/23/2014	0.0955	-0.0001	-0.0005	0.06	0.000037	179	-0.0005	0.00131	0.0116	0.114	-0.00005	-0.0005	34.8	3.15	0.0201	0.00077	2.66	0.0148	7.76	-0.00001	11.3	0.831	-0.00001	-0.0001	0.017	0.00163	-0.001	-0.003		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 14	20-05-2015 13:16	5/20/2015	0.1	-0.0001	-0.00005	0.068	0.0000101	263	-0.0005	0.00017	0.00683	-0.03	-0.00005	-0.001	48.1	0.463	0.0297	-0.0005	2.92	0.0414	6.99	-0.00001	16.4	1.23	-0.00001	-0.0001	-0.01	0.00267	-0.0005	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 14	24-11-2015 14:48	11/24/2015	0.109	-0.0001	-0.00005	0.064	-0.000005	298	-0.0005	-0.0001	0.00482	-0.03	-0.00005	-0.001	55.9	0.243	0.0475	-0.0005	2.98	0.0385	7.31	-0.00001	17.8	1.18	-0.00001	-0.0001	0.02	0.00274	0.00054	-0.003		2015.89	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	9/12/2014	9/12/2014	0.101	-0.0001	-0.0005	0.039	0.000109	208	-0.0005	0.00564	0.0104	0.05	-0.00005	0.00185	39	2.16	0.0803	0.00105	4	0.0684	5.86	-0.00001	15.7	1.01	-0.00001	-0.0001	0.024	0.000933	-0.001	0.0044		2014.7	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	23-10-2014 11:56	10/23/2014	0.139	-0.0001	-0.0005	0.04	0.000059	213	-0.0005	0.0165	0.00994	0.738	-0.00005	0.00116	43.8	7.83	0.0288	0.00155	6.91	0.0202	8.09	0.000021	13.9	1.19	-0.00001	-0.0001	0.02	0.00158	0.0012	0.0049		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	1/9/2015	1/9/2015	0.0985	-0.0001	-0.00005	0.051	0.0000546	322	-0.0005	0.00524	0.00783	0.085	-0.00005	0.0026	55.6	1.71	0.119	0.00077	4.69	0.0818	7.09	-0.00001	24.5	1.41	-0.00001	-0.0001	-0.01	0.00161	-0.0005	-0.003		2015.02	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	2/2/2015	2/2/2015	0.133	-0.0002	-0.001	0.048	0.000115	299	-0.0005	0.00711	0.0102	0.033	-0.0001	0.0015	56.1	2.63	0.0866	0.0012	4.98	0.123	7.06	-0.00002	23.2	1.38	-0.00002	-0.0002	0.01	0.000967	-0.002	0.0052		2015.09	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	2/6/2015	2/6/2015	0.103	-0.0001	-0.00005	0.051	0.0000743	300	-0.0005	0.00504	0.00821	-0.03	-0.00005	0.0018	53.2	2.13	0.101	0.00089	4.78	0.0856	7.46	-0.00001	23.2	1.25	-0.00001	-0.0001	-0.01	0.00152	-0.0005	-0.003		2015.1	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	3/3/2015	3/3/2015	0.127	-0.0002	-0.001	0.044	0.000142	325	-0.0005	0.00361	0.00925	-0.03	-0.0001	0.0022	57.2	1.98	0.103	0.0011	4.99	0.127	6.82	-0.00002	26	1.42	-0.00002	-0.0002	0.02	0.00161	-0.002	0.0042		2015.17	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	5/5/2015	5/5/2015	0.108	-0.0001	-0.00005	0.056	0.0000958	278	-0.0005	0.00674	0.00857	0.089	-0.00005	0.0023	51.5	2.66	0.0909	0.00109	4.88	0.0926	7.79	-0.00001	23.5	1.17	-0.00001	-0.0001	-0.01	0.00124	-0.0005	0.0034		2015.34	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	6/1/2015	6/1/2015	0.144	-0.0001	-0.0005	0.045	0.000119	283	-0.0005	0.00962	0.0113	0.035	-0.00005	0.00206	53.4	3.92	0.0711	0.00141	5.54	0.093	7.03	-0.00001	23.8	1.29	-0.00001	-0.0001	-0.01	0.000952	-0.001	0.0031		2015.41	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	6/8/2015	6/8/2015	0.105	-0.0002	-0.0001	0.052	0.000074	325	-0.0005	0.00667	0.00848	0.038	-0.0001	0.0029	55.3	1.89	0.109	-0.001	4.74	0.0965	7.07	-0.00002	24.6	1.44	-0.00002	-0.0002	-0.01	0.00159	-0.001	-0.003		2015.43	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	7/7/2015	7/7/2015	0.108	-0.0002	-0.0001	0.049	0.000072	309	-0.0005	0.00521	0.00854	0.095	-0.0001	-0.002	51.9	2.06	0.103	-0.001	5.09	0.0758	7.18	-0.00002	24.1	1.3	-0.00002	-0.0002	-0.01	0.00155	-0.001	-0.003		2015.51	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	8/4/2015	8/4/2015	0.12	-0.0002	-0.0001	0.053	0.000095	338	-0.0005	0.00496	0.00901	0.049	-0.0001	0.0027	60.1	1.9	0.119	0.001	4.77	0.122	7.35	-0.00002	27.3	1.41	-0.00002	-0.0002	0.022	0.00105	-0.001	0.0043		2015.59	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	29-10-2015 12:55	10/29/2015	0.0861	-0.0001	-0.00005	0.057	0.0000298	295	-0.0005	0.00457	0.00796	0.034	-0.00005	0.0021	52.4	1.9	0.107	0.0007	4.8	0.0558	7.71	-0.00001	24.5	1.29	-0.00001	-0.0001	0.012	0.00159	-0.0005	-0.003		2015.82	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 13:05	11/24/2015	0.0811	-0.0001	-0.00005	0.049	0.0000162	338	-0.0005	0.00076	0.00857	-0.03	-0.00005	0.0023	60.3	0.277	0.118	-0.0005	4.03	0.0864	7.65	-0.00001	25.2	1.26	-0.00001	-0.0001	0.019	0.00168	0.00055	-0.003		2015.89	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 2	30-05-2013 9:56	5/30/2013	0.192	-0.0002	-0.001	0.058	-0.0003	363	-0.0005	0.021	0.00555	0.171	-0.0001	0.0042	67.5	8.91	0.294	0.0017	9.79	0.265	6.57	-0.00002	23.4	1.38	-0.00002	-0.0002	-0.01	0.00227	-0.002	0.0283		2013.41	996
Bi-annual Seep Sampling	PAG Dump Seep 3	30-05-2013 10:08	5/30/2013	0.0963	-0.0001	-0.0005	0.015	0.000218	180	-0.0005	0.00481	0.00707	0.041	-0.00005	-0.0005	36.5	6.11	0.0021	0.00062	2.75	0.0351	7.32	-0.00001	9.02	0.713	-0.00001	-0.0001	-0.01	0.000064	-0.001	0.0062		2013.41	690
Bi-annual Seep Sampling	PAG Dump Seep 3	29-05-2014 10:52	5/29/2014	0.063	-0.0001	-0.0005	0.023	0.000012	207	-0.0005	-0.0001	0.00371	-0.03	-0.00005	-0.0005	39.1	0.000188	0.000183	-0.0005	1.87	0.0676	5.8	-0.00001	12.7	0.896	-0.00001	-0.0001	-0.01	0.00001	-0.001	-0.003		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 4	30-05-2013 11:03	5/30/2013	0.0521	-0.0001	-0.0005	0.041	0.000498	258	0.00059	0.00108	0.0252	0.6	0.000201	0.00144	44.8	1.17	0.044	0.00121	3.04	0.149	8.17	0.000039	16.4	0.98	-0.00001	-0.0001	0.031	0.00152	0.0024	0.0063		2013.41	899
Bi-annual Seep Sampling	PAG Dump Seep 4	29-05-2014 11:11	5/29/2014	0.0849	-0.0002	-0.001	0.057	-0.0003	418	-0.0005	0.00147	0.017	-0.03	-0.0001	0.0025	76.5	1.56	0.256	-0.001	4.69	0.242	5.99	-0.00002	29.3	1.53	-0.00002	-0.0002	0.01	0.00195	-0.002	0.0034		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 4	14-05-2015 13:57	5/14/2015	0.0465	-0.0002	-0.0001	0.052	0.0000346	392	-0.0005	-0.0002	0.0101	-0.03	-0.0001	-0.002	68.1	0.0458	0.204	-0.001	3.15	0.244	6.36	-0.00002	28.2	1.29	-0.00002	-0.0002	-0.01	0.00154	-0.001	0.004		2015.36	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 5	29-05-2014 10:40	5/29/2014	0.135	-0.0002	-0.001	0.067	-0.0003	346	-0.0005	0.00478	0.00937	-0.03	-0.0001	0.003	59.8	2.87	0.226	-0.001	6.24	0.172	6.85	-0.00002	30.4	1.41	-0.00002	-0.0002	-0.01	0.00143	-0.002	0.008		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 5	23-10-2014 10:50	10/23/2014	0.089	-0.0002	-0.001	0.062	0.00017	336	-0.0005	0.00297	0.0212	0.29	-0.0001	0.0037	55.8	2.13	0.185	-0.001	4.87	0.126	7	-0.00002	29.3	1.32	-0.00002	-0.0002	0.023	0.00161	-0.002	0.0041		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 5	14-05-2015 14:22	5/14/2015	0.0952	-0.0002	-0.0001	0.083	0.000351	427	-0.0005	0.00499	0.0157	-0.03	0.00013	0.0031	70.5	4.57	0.585	0.0011	5.64	0.216	6.24	-0.00002	43.7	1.51	-0.00002	-0.0002	-0.01	0.00179	-0.001	0.0086		2015.36	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 5	24-11-2015 12:38	11/24/2015	0.0484	-0.0002	-0.0001	0.073	-0.0001	432	-0.0005	0.0015	0.0101	-0.03	-0.0001	0.0031	75	1.93	0.316	-0.001	5.12	0.101	7.18	-0.00002	34.8	1.28	-0.00002	-0.0002	0.019	0.00261	-0.001	0.0042		2015.89	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 7	29-05-2014 9:01	5/29/2014	0.0429	-0.0001	-0.0005	0.014	0.000027	60.7	-0.0005	0.00625	0.007	1.85	0.00007	0.00114	14.9	2.42	0.0029	0.00211	3.55	0.00052	7.52	0.00002	4.72	0.267	-0.00001	-0.0001	-0.01	0.000162	0.0033	-0.003		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 7	23-10-2014 11:16	10/23/2014	0.169	-0.0001	-0.0005	0.019	0.00003	171	-0.0005	0.0265	0.0847	9.57	0.00015	0.00201	38.7	8.76	0.00934	0.00322	4.59	0.0203	9.36	0.00044	8.88	0.824	-0.00001	-0.0001	0.019	0.000871	0.004	-0.003		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 7	20-05-2015 12:27	5/20/2015	0.0633	-0.0001	-0.00005	0.019	0.000006	176	-0.0005	0.00011	0.00783	-0.03	-0.00005	-0.001	43.8	0.00669	0.00192	0.0008	4.97	0.00279	6.69	-0.00001	11.3	0.798	-0.00001	-0.0001	-0.01	0.000335	-0.0005	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 7	24-11-2015 12:48	11/24/2015	0.0891	-0.0001	-0.00005	-0.01	-0.000005	200	-0.0005	0.0021	0.00111	0.062	-0.00005	-0.001	55	5.51	0.000605	-0.0005	4.75	0.000597	8.34	-0.00001	10.6	0.726	-0.00001	-0.0001	0.019	0.000147	-0.0005	-0.003		2015.89	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 8	29-05-2014 9:20	5/29/2014	0.0801	-0.0001	-0.0005	0.218	-0.00001	123	-0.0005	-0.0001	0.0047	-0.03	-0.00005	0.00194	22	0.000841	0.0346	-0.0005	2.81	0.113	6.02	-0.00001	21.3	0.703	-0.00001	-0.0001	-0.01	0.00106	-0.001	-0.003		2014.4	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 8	23-10-2014 12:15	10/23/2014	0.0796	-0.0001	-0.0005	0.383	0.000053	116	-0.0005	0.0102	0.00551	1.8	-0.00005	0.00149	22.4	3.82	0.0518	0.00063	3.62	0.0414	7.79	0.000015	23.2	0.719	-0.00001	-0.0001	0.013	0.00131	0.0012	0.0062		2014.81	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 8	20-05-2015 12:44	5/20/2015	0.0663	-0.0001	-0.00005	0.261	0.0000477	164	-0.0005	0.00133	0.00571	0.055	0.000065	-0.001	31.1	3.47	0.0507	0.00103	3.84	0.00884	7.48	-0.00001	24	0.88	-0.00001	-0.0001	-0.01	0.000946	-0.0005	-0.003		2015.38	#N/A
Bi-annual Seep Sampling	SERDS Seep 1	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	702
Bi-annual Seep Sampling	SERDS Seep 10	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	690
Bi-annual Seep Sampling	SERDS Seep 11	6/6/2013	6/6/2013	0.106	-0.0001	-0.0005	0.069	-0.0002	169	-0.0005	0.00605	0.00087	0.944	-0.00005	-0.0005	29.1	4.08	0.375	0.0018	3

Location Type	Sample Point	Original Date As Is	Recoded Date	pH-field	Q	T	Turbidity-Field	EC	Hardness	pH	TDS	TSS	Turbidity	Alkalinity	NH3	Cl	F	NO3	NO3+NO2	NO2	PO4	P-D	P-T	SO4	N-T
					m3/s	C	NTU	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	NEZ Dump Seep 6	2/7/2013	2/7/2013	8.1	0.002	6.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	NEZ Dump Seep 6	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1390	790	8.28	1190	6.8	1.27	148	0.0025	2.5	0.77	6.49	6.49	0.005	0.0079	0.0097	0.0115	685	6.55
Bi-annual Seep Sampling	NEZ Dump Seep 6	27-10-2014 14:22	10/27/2014	#N/A	#N/A	#N/A	#N/A	1200	663	8.02	943	3.3	1.22	127	0.0025	2.5	0.36	2.11	2.11	0.005	0.0019	0.0033	0.0046	571	2.04
Bi-annual Seep Sampling	NEZ Dump Seep 7	2/7/2013	2/7/2013	8.3	0.002	7.1	#N/A	468	242	8.17	333	20	1.54	99.6	0.0025	0.25	0.178	0.638	0.638	0.0005	0.0059	0.0072	0.0329	137	0.687
Bi-annual Seep Sampling	NEZ Dump Seep 7	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	859	464	8.2	665	3.2	0.39	112	0.0025	1.25	0.31	2.52	2.52	0.0025	0.0047	0.0048	0.0071	361	2.66
Bi-annual Seep Sampling	NEZ Dump Seep 7	27-10-2014 13:52	10/27/2014	#N/A	#N/A	#N/A	#N/A	1020	571	8.02	819	1.5	1.92	86.3	0.0025	2.5	0.31	1.52	1.52	0.005	0.0061	0.0066	0.0093	501	1.48
Bi-annual Seep Sampling	NEZ Dump Seep 7	28-05-2015 14:25	5/28/2015	#N/A	#N/A	#N/A	#N/A	812	423	8.24	609	25.9	5.31	111	0.0025	0.5	0.245	1.09	1.09	0.001	0.0038	0.0055	0.135	322	1.1
Bi-annual Seep Sampling	NEZ Dump Seep 8	4/7/2013	4/7/2013	7.9	0.0025	5.8	#N/A	1430	850	7.85	1240	68.7	20	87.3	0.0025	2.5	0.1	1.58	1.58	0.005	0.006	0.0078	0.129	647	2.31
Bi-annual Seep Sampling	NEZ Dump Seep 8	8/6/2015	8/6/2015	#N/A	#N/A	#N/A	#N/A	1100	639	7.93	876	14.3	2.82	106	0.0057	1.25	0.05	0.959	0.959	0.0025	0.0062	0.0093	0.0224	543	1.09
Bi-annual Seep Sampling	NEZ Dump Seep 9	4/7/2013	4/7/2013	7.9	0.01	5.3	#N/A	1970	1240	7.79	1850	1.5	0.37	58.3	0.0025	5	0.2	4.7	4.7	0.01	0.0068	0.0085	0.0102	1180	4.56
Bi-annual Seep Sampling	NEZ Dump Seep 9	23-10-2013 13:21	10/23/2013	#N/A	#N/A	#N/A	#N/A	1690	1020	7.92	1500	1.5	0.46	71.8	0.0025	5	0.2	2.71	2.71	0.01	0.0042	0.0079	0.0082	1020	2.61
Bi-annual Seep Sampling	NEZ Dump Seep 9	5/6/2014	5/6/2014	#N/A	#N/A	#N/A	#N/A	1480	879	7.84	1230	3.5	0.43	56.2	0.0025	2.5	0.23	2.09	2.09	0.005	0.0052	0.0064	0.0211	852	2.2
Bi-annual Seep Sampling	NEZ Dump Seep 9	27-10-2014 13:31	10/27/2014	#N/A	#N/A	#N/A	#N/A	1420	814	7.99	1220	7.8	10.9	62.3	0.0025	2.5	0.21	1.55	1.55	0.005	0.0038	0.0069	0.0189	779	1.6
Bi-annual Seep Sampling	NEZ Dump Seep 9	8/6/2015	8/6/2015	#N/A	#N/A	#N/A	#N/A	1540	963	7.91	1360	1.5	0.28	67	0.0025	2.5	0.1	1.45	1.45	0.005	0.0047	0.0062	0.0048	918	1.53
Bi-annual Seep Sampling	North Bell Dump Seep 1	30-05-2013 9:43	5/30/2013	8.6	0	0.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	North Bell Dump Seep 1	14-10-2015 13:57	10/14/2015	#N/A	#N/A	#N/A	#N/A	562	295	7.11	411	11.6	4.41	127	0.233	0.92	0.064	1.64	4.14	2.5	0.0162	0.0312	0.445	162	6.04
Bi-annual Seep Sampling	North Bell Dump Seep 2	4/6/2013	4/6/2013	8.2	0	0.4	#N/A	712	369	7.91	498	106	108	95	0.0409	1.25	0.27	9.53	9.57	0.0364	0.0951	0.124	0.333	246	9.57
Bi-annual Seep Sampling	North Bell Dump Seep 3	4/6/2013	4/6/2013	7.8	0	4.4	#N/A	883	498	7.36	658	26.3	1.71	44.2	0.0077	2.5	0.23	0.86	0.86	0.005	0.0005	0.0061	0.0694	444	1.56
Bi-annual Seep Sampling	North Bell Dump Seep 4	2/7/2013	2/7/2013	6.8	0	15.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	PAG Dump Seep 1	30-05-2013 9:42	5/30/2013	7.23	0.005	4.36	#N/A	1220	650	8.01	996	6.8	0.99	139	0.0336	7.8	0.28	31.8	31.9	0.066	0.0536	0.0666	0.0739	428	30.7
Bi-annual Seep Sampling	PAG Dump Seep 10	29-05-2014 9:48	5/29/2014	#N/A	#N/A	#N/A	#N/A	842	455	8.08	606	9	3.54	172	0.0087	2.5	0.1	6.12	6.69	0.562	0.0005	0.0105	0.0331	273	6.76
Bi-annual Seep Sampling	PAG Dump Seep 10	23-10-2014 12:28	10/23/2014	#N/A	#N/A	#N/A	#N/A	1360	793	7.99	1100	1.5	0.37	251	0.0393	5.6	0.1	8.01	8.01	0.005	0.0073	0.0146	0.0175	540	7.8
Bi-annual Seep Sampling	PAG Dump Seep 10	20-05-2015 13:03	5/20/2015	#N/A	#N/A	#N/A	#N/A	1310	741	7.82	1070	1.5	0.25	173	0.0087	3.3	0.05	13.4	13.5	0.0103	0.0124	0.0169	0.0176	533	13.8
Bi-annual Seep Sampling	PAG Dump Seep 10	24-11-2015 13:22	11/24/2015	#N/A	#N/A	#N/A	#N/A	1570	914	7.78	1250	1.5	0.32	181	0.0025	3.6	0.05	13.8	13.8	0.0057	0.0154	0.0208	0.0181	670	13.6
Bi-annual Seep Sampling	PAG Dump Seep 12	29-05-2014 10:04	5/29/2014	#N/A	#N/A	#N/A	#N/A	645	333	8	501	6.5	3.49	116	0.0075	3.4	0.14	3.67	3.95	0.278	0.0005	0.018	0.0561	210	4.39
Bi-annual Seep Sampling	PAG Dump Seep 13	23-10-2014 10:49	10/23/2014	#N/A	#N/A	#N/A	#N/A	295	149	8.15	144	30.7	8.32	151	0.0232	0.79	0.115	0.0916	0.109	0.0173	0.0059	0.0061	0.0354	9.91	0.38
Bi-annual Seep Sampling	PAG Dump Seep 13	20-05-2015 13:36	5/20/2015	#N/A	#N/A	#N/A	#N/A	307	151	8.25	214	1.5	0.66	112	0.0176	0.57	0.119	0.808	0.809	0.002	0.0288	0.0283	0.037	26.8	0.964
Bi-annual Seep Sampling	PAG Dump Seep 14	23-10-2014 11:13	10/23/2014	#N/A	#N/A	#N/A	#N/A	1050	591	8.17	838	3.5	3.71	261	0.0577	2.5	0.1	5.95	6.12	0.166	0.0005	0.007	0.0177	328	5.94
Bi-annual Seep Sampling	PAG Dump Seep 14	20-05-2015 13:16	5/20/2015	#N/A	#N/A	#N/A	#N/A	1470	854	8.09	1210	1.5	0.35	196	0.0077	2.5	0.1	16.4	16.4	0.026	0.0092	0.0111	0.0155	647	15.2
Bi-annual Seep Sampling	PAG Dump Seep 14	24-11-2015 14:48	11/24/2015	#N/A	#N/A	#N/A	#N/A	1670	975	8.14	1340	1.5	0.46	210	0.0098	4.1	0.05	13.7	13.7	0.0025	0.0178	0.0213	0.0247	736	13.2
Bi-annual Seep Sampling	PAG Dump Seep 15	9/12/2014	9/12/2014	#N/A	#N/A	#N/A	#N/A	1260	679	7.96	959	103	23.9	120	0.236	5.6	0.1	21.2	22.3	1.03	0.0005	0.0043	0.196	533	21.2
Bi-annual Seep Sampling	PAG Dump Seep 15	23-10-2014 11:56	10/23/2014	#N/A	#N/A	#N/A	#N/A	1230	712	7.89	972	87.8	18.9	325	0.144	6.4	0.1	1.04	1.55	0.516	0.0022	0.0323	0.391	390	3
Bi-annual Seep Sampling	PAG Dump Seep 15	1/9/2015	1/9/2015	#N/A	#N/A	#N/A	#N/A	1730	1030	7.57	1480	9.1	7.38	187	0.0641	2.5	0.1	18.1	18.5	0.338	0.0029	0.0051	0.0517	805	18.3
Bi-annual Seep Sampling	PAG Dump Seep 15	2/2/2015	2/2/2015	#N/A	#N/A	#N/A	#N/A	1770	977	7.81	1520	45.2	28.9	161	0.2	8	0.1	34.7	36.7	2.07	0.002	0.0134	0.0997	771	35.9
Bi-annual Seep Sampling	PAG Dump Seep 15	2/6/2015	2/6/2015	#N/A	#N/A	#N/A	#N/A	1720	968	8.25	1450	6.8	7.16	186	0.0805	5.4	0.1	21	21.5	0.453	0.0005	0.001	0.0376	761	20.5
Bi-annual Seep Sampling	PAG Dump Seep 15	3/3/2015	3/3/2015	#N/A	#N/A	#N/A	#N/A	1820	1050	7.92	1560	17.1	9.49	148	0.156	10	0.29	37.1	38.4	1.33	0.0015	0.0073	0.0515	834	38.7
Bi-annual Seep Sampling	PAG Dump Seep 15	5/5/2015	5/5/2015	#N/A	#N/A	#N/A	#N/A	1630	906	8.06	1330	9.8	6.6	201	0.0806	5.8	0.1	23.8	24.5	0.722	0.0005	0.0081	0.0365	703	22.7
Bi-annual Seep Sampling	PAG Dump Seep 15	6/1/2015	6/1/2015	#N/A	#N/A	#N/A	#N/A	1640	926	7.76	1330	157	97.1	190	0.348	10	0.1	27	28.9	1.92	0.0015	0.0092	0.27	682	29.1
Bi-annual Seep Sampling	PAG Dump Seep 15	6/8/2015	6/8/2015	#N/A	#N/A	#N/A	#N/A	1780	1040	7.86	1660	15.2	9.18	180	0.0935	2.5	0.1	20	20.4	0.374	0.0029	0.001	0.0502	822	22.1
Bi-annual Seep Sampling	PAG Dump Seep 15	7/7/2015	7/7/2015	#N/A	#N/A	#N/A	#N/A	1690	986	8.07	1480	9.9	5.8	196	0.0573	2.5	0.1	17.7	18.1	0.413	0.0019	0.0059	0.0417	754	17.6
Bi-annual Seep Sampling	PAG Dump Seep 15	8/4/2015	8/4/2015	#N/A	#N/A	#N/A	#N/A	1840	1090	8.03	1600	7.5	6.25	150	0.0905	6.3	0.05	33.8	34.7	0.914	0.0005	0.0041	0.0244	863	33.5
Bi-annual Seep Sampling	PAG Dump Seep 15	29-10-2015 12:55	10/29/2015	#N/A	#N/A	#N/A	#N/A	1650	952	8	1370	5.2	6.19	238	0.0507	5.1	0.1	14.9	15.4	0.554	0.0018	0.001	0.0555	707	15.7
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 13:05	11/24/2015	#N/A	#N/A	#N/A	#N/A	1840	1090	8.05	1550	1.5	1.24	183	0.0146	5.3	0.1	20.9	21	0.09	0.0148	0.0196	0.031	830	20.5
Bi-annual Seep Sampling	PAG Dump Seep 2	30-05-2013 9:56	5/30/2013	6.41	0.005	1.3	#N/A	2040	1190	7.57	1670	51.3	37.5	289	0.694	17	0.54	26.7	49.6	#N/A	0.0052	0.0342	0.236	819	45.4
Bi-annual Seep Sampling	PAG Dump Seep 3	30-05-2013 10:08	5/30/2013	6.79	0.003	9.4	#N/A	1060	599	7.87	841	24.7	7.21	127	0.538	7.6	0.2	2.67	2.68	0.016	0.0021	0.0067	0.048	469	3.17
Bi-annual Seep Sampling	PAG Dump Seep 3	29-05-2014 10:52	5/29/2014	#N/A	#N/A	#N/A	#N/A	1200	678	7.81	995	24.1	5.02	48.8	0.0025	2.5	0.1	18.8	18.9	0.018	0.0005	0.0041	0.0475	570	17.7
Bi-annual Seep Sampling	PAG Dump Seep 4	30-05-2013 11:03	5/30/2013	7.88	0.003	4.4	#N/A	1470	829	8.09	1100	47.3	27.1	210	0.0651	19.2	0.23	34.5	34.9	0.336	0.007	0.0088	0.0907	509	32.8
Bi-annual Seep Sampling	PAG Dump Seep 4	29-05-2014 11:11	5/29/2014	#N/A	#N/A	#N/A	#N/A	2230	1360	8.13	1940	5.2	1.16	151	0.0542	14	0.2	49.9	50	0.136	0.0079	0.0158	0.0219	1140	45.1
Bi-annual Seep Sampling	PAG Dump Seep 4	14-05-2015 13:57	5/14/2015	#N/A	#N/A	#N/A	#N/A	2180	1260	7.97	1850	3.2	0.24	146	0.0025	10.6	0.1	48.6	48.6	0.005	0.0116	0.0161	0.0193	959	51.3
Bi-annual Seep Sampling	PAG Dump Seep 5	29-05-2014 10:40	5/29/2014	#N/A	#N/A	#N/A	#N/A	1950	1110	8.02	1710	5.1	3.27	137	0.337	11	0.2	52.4	56	3.55	0.0022	0.008	0.0468	907	51.2
Bi-annual Seep Sampling	PAG Dump Seep 5	23-10-2014 10:50	10/23/2014	#N/A	#N/A	#N/A	#N/A	1810	1070	8.07	1530	12.3	4.73	171	0.288	11	0.2	35.9	36.8	0.95	0.0005	0.0041	0.054	797	34
Bi-annual Seep Sampling	PAG Dump Seep 5	14-05-2015 14:22	5/14/2015	#N/A	#N/A	#N/A	#N/A	2400	1360	8.08	2140	3.3	1.18	169	0.0475	11.5	0.1	54.4	54.4	0.049	0.0018	0.0083	0.0067	1100	53.3
Bi-annual Seep Sampling	PAG Dump Seep 5	24-11-2015 12:38	11/24/2015	#N/A	#N/A	#N/A	#N/A	2290	1390	7.86	1980	1.5	2.41	256	0.0299	9	0.1	34.1	34.2	0.017	0.0005	0.001	0.001	1060	34.3
Bi-annual Seep Sampling	PAG Dump Seep 7	29-05-2014 9:01	5/29/2014	#N/A	#N/A	#N/A	#N/A	376	213	7.47	340	180	235	193	0.18	2.15	0.086	0.0025	0.00255	0.0005	0.0267	0.0492	0.584	20.8	1.33
Bi-annual Seep Sampling	PAG Dump Seep 7	23-10-2014 11:16	10/23/2014	#N/A	#N/A	#N/A	#N/A	1050	587	7.42	849	33.7	33.2	355	1.2	6.1	0.1	0.025	0.0255	0.005	0.0257	0.0601	1.05	199	8.2
Bi-annual Seep Sampling	PAG Dump Seep 7	20-05-2015 12:27	5/20/2015	#N/A	#N/A	#N/A	#N/A	1110	619	7.63	913	69.9	80.7	300	0.869	3.2	0.05	0.0125	0.0125	0.0025	0.0105	0.0234	0.454	353	2.16
Bi-annual Seep Sampling	PAG Dump Seep 7	24-11-2015 12:48	11/24/2015	#N/A	#N/A	#N/A	#N/A	1260	727	7.34	927	57.6	142	379	1.63	3	0.05	0.0125	0.0125	0.0025	0.0018	0.0092	0.859	374	2.3
Bi-annual Seep Sampling	PAG Dump Seep 8	29-05-2014 9:20	5/29/2014	#N/A	#N/A	#N/A	#N/A	873	397	7.88	659	6.9	3.32	109	0.141	2.5	0.31	38.6	42.5	3.85	0.0005	0.0113	0.0456	186	40.8
Bi-annual Seep Sampling	PAG Dump Seep 8	23-10-2014 12:15	10/23/2014	#N/A	#N/A	#N/A	#N/A	776	381	7.87	548	11.7	11.4	227	0.0461	4.2	0.17	0.646	2.17	1.53	0.0025	0.0199	0.182	196	3.27
Bi-annual Seep Sampling	PAG Dump Seep 8	20-05-2015 12:44	5/20/2015	#N/A	#N/A	#N/A	#N/A	1030	538	7.69	803	6	5.9	279	0.858	2.8	0.05	2.23	2.43	0.201	0.0053	0.0131	0.036	301	3.58
Bi-annual Seep Sampling	SERDS Seep 1	6/6/2013	6/6/2013	7.6	0	15.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 10	6/6/2013	6/6/2013	8.6	0	9.7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 11	6/6/2013	6/6/2013	6.7	0.005	12	#N/A	1060	541	7.59	843	148	159	91.4	0.39	2.5	0.1	0.025	0.0255	0.005	0.0167	0.0331	0.272	522	1.32
Bi-annual Seep Sampling	SERDS Seep 11	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	2530	1500	8.05	2370	1.5	0.42	98.4	0.0469	5	0.55	61.9	62.2	0.223	0.0078	0.0148	0.0226	1360	58.9
Bi-annual Seep Sampling	SERDS Seep 11	25-05-2015 12:41	5/25/2015	#N/A	#N/A	#N/A	#N/A	2780	1630	7.81	2770	73.1	22.7	87	0.0184	5	0.2	76.3	76.3	0.056	0.0131	0.0177	0.1	1500	70.7
Bi-annual Seep Sampling	SERDS Seep 12	6/6/2013	6/6/2013	8.3	0.01	15.9	#N/A	2130	1210	7.98	1840	44.2	16.4	102	0.0185	5	0.42	38.4	38.6	0.216	0.0016	0.0104	0.0493	1170	37
Bi-annual Seep Sampling	SERDS Seep 12	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1590	912	8.17	1380	1.5	0.39	139	0.0025	5.2	0.4	25.7	25.7	0.02	0.0104	0.0133	0.0145	738	24.6
Bi-annual Seep Sampling	SERDS Seep 13	6/6/2013	6/6/2013	8.1	0.6	2.9	#N/A	1460	824	8.06	1170	3.4	0.78	111	0.0025	2.5	0.29	18.9	18.9	0.005	0.0067	0.0123	0.0184	718	18
Bi-annual Seep Sampling	SERDS Seep 13	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1600	912	8.12	1390	1.5	0.49	126	0.0025	5.1	0.34	27.2	27.2	0.013	0.01	0.012	0.0139	758	26.5
Bi-annual Seep Sampling	SERDS Seep 13	27-10-2014 10:42	10/27/2014	#N/A	#N/A	#N/A	#N/A	1560	905	8.16	1370	1.5	0.75	133	0.0025	5.3	0.36	25.9	25.9	0.005	0.0119	0.0136	0.0172	716	25.3
Bi-annual Seep Sampling	SERDS Seep 13	13-01-2015 10:51	1/13/2015	#N/A	#N/A	#N/A	#N/A	1670	1010	8.06	1450	1.5	0.16	141	0.0025	2.5	0.38	26.3	26.3	0.005	0.011	0.0163	0.0147	824	24.5
Bi-annual Seep Sampling	SERDS Seep 13	2/9/2015	2/9/2015	#N/A	#N/A	#N/A	#N/A	1580	974	7.9	1350	3.4	0.38	142	0.0025	2.5	0.33	22.2	22.2	0.005	0.0111	0.0144	0.0119	745	21.9
Bi-annual Seep Sampling	SERDS Seep 13	4/6/2015	4/6/2015	#N/A	#N/A	#N/A	#N/A	1590	987	8.12	1450	6.4	0.37	145	0.0025	3.8	0.37	22.8	22.8	0.0025	0.0088	0.0139	0.0125	774	23
Bi-annual Seep Sampling	SERDS Seep 13	5/2/2015	5/2/2015	#N/A	#N/A	#N/A	#N/A	1710	1010	8.12	1490	1.5	0.23	143	0.0025	2.5	0.44	25.2	25.2	0.005	0.0129	0.0152	0.0155	819	23.9
Bi-annual Seep Sampling	SERDS Seep 13	5/3/2015	5/3/2015	#N/A	#N/A	#N/A	#N/A	1700	1020	8	1490	1.5	0.25	152	0.0025	2.5	0.45	24.7	24.7	0.005	0.0126	0.0165	0.0152	826	24.5
Bi-annual Seep Sampling	SERDS Seep 13	6/5/2015	6/5/2015	#N/A	#N/A	#N/A	#N/A	1720	1040	8.29	1440	1.5	0.37	146	0.0025	2.5	0.33	24.4	24.4	0.005	0.0095	0.0136	0.0143	815	23.3
Bi-annual Seep Sampling	SERDS Seep 13	7/7/2015	7/7/2015	#N/A	#N/A	#N/A	#N/A	1650	969	8.15	1420	1.5	0.17	151	0.0025	2.5	0.35	21.8	21.8	0.005	0.0086	0.0118	0.0126	763	21.9
Bi-annual Seep Sampling	SERDS Seep 13	18-08-2015 13:01	8/18/2015	#N/A	#N/A	#N/A	#N/A	1640	927	7.89	1380	1.5	0.48	143	0.0025	2.5	0.36	22.3	22.3	0.005	0.0099	0.0141	0.0117	761	20.5
Bi-annual Seep Sampling	SERDS Seep 13	9/4/2015	9/4/2015	#N/A	#N/A	#N/A	#N/A	1640	1020	8.15	1430	1.5	0.6	151	0.0025	2.5	0.35	25.5	25.5	0.005	0.0094	0.0144	0.013	849	23.5
Bi-annual Seep Sampling	SERDS Seep 13	29-10-2015 10:30	10/29/2015	#N/A	#N/A	#N/A	#N/A	1600	934	8.09	1370	1.5	0.19	136	0.0025	2.5	0.32	23.9	23.9	0.005	0.0105	0.0136	0.0114	724	24.2
Bi-annual Seep Sampling	SERDS Seep 13	11/11/2015	11/11/2015	#N/A	#N/A	#N/A	#N/A	1630	894	8.16	1340	3.2	0.24	135	0.0025	2.5	0.35	23.3	23.3	0.005	0.0113	0.0118	0.0106	716	24
Bi-annual Seep Sampling	SERDS Seep 14	6/6/2013	6/6/2013	8.1	0.005	6.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 14	25-05-2015 14:01	5/25/2015	#N/A	#N/A	#N/A	#N/A	1910	1170	7.72	1720	5.4	0.3	70.2	0.0513	5	0.2	0.62	0.62	0.01	0.004	0.0092	0.025	1170	0.863
Bi-annual Seep Sampling	SERDS Seep 15	6/6/2013	6/6/2013	7.9	0	1.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 16	6/6/2013	6/6/2013	7.3	0	14.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 17	6/6/2013	6/6/2013	7.8	0.01	5.6	#N/A	1310	729	7.97	1030	5	1.39	68.9	0.0025	6.4	0.1	6.93	6.93	0.005	0.0092	0.0168	0.0229	691	6.68
Bi-annual Seep Sampling	SERDS Seep 17	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1320	729	8	1100	15.2	4.39	68.8	0.0025	6.5	0.1	3.98	3.98	0.005	0.009	0.0129	0.0445	690	4.05
Bi-annual Seep Sampling	SERDS Seep 18	27-10-2014 10:12	10/27/2014	#N/A	#N/A	#N/A	#N/A	1260	687	8.13	1050	1.5	0.79	90.7	0.0025	2.5	0.32	23.3	23.3	0.005	0.0257	0.0276	0.0238	548	22.4
Bi-annual Seep Sampling	SERDS Seep 18	25-05-2015 12:23	5/25/2015	#N/A	#N/A	#N/A	#N/A	2170	1280	8.07	2030	6.6	0.7	64.5	0.0074	5	0.2	71.5	71.5	0.01	0.0176	0.0239	0.0347	1050	67
Bi-annual Seep Sampling	SERDS Seep 19	27-10-2014 10:35	10/27/2014	#N/A	#N/A	#N/A	#N/A	1540	848	7.92	1330	3.6	1.64	87.4	0.117	5.8	0.1	42.5	42.6	0.07	0.0036	0.0068	0.0163	646	42.6
Bi-annual Seep Sampling	SERDS Seep 19	25-05-2015 12:38	5/25/2015	#N/A	#N/A	#N/A	#N/A	2860	1720	7.79	2800	11	1.31	62.9	0.024	5	0.2	129	129	0.062	0.0141	0.0156	0.0356	1340	119
Bi-annual Seep Sampling	SERDS Seep 19	11/11/2015	11/11/2015	#N/A	#N/A	#N/A	#N/A	2850	1630	7.84	2520	15.8	4.89	89.3	0.0105	5

Location Type	Sample Point	Original Date As Is	Recoded Date	DOC	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D	Se/SO4	Ca	Mg+K+Na	(Mg+K+Na)/Ca	Zn/Cd	Year
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/mgS	meq/L	meq/L	meq/meq		Year
Bi-annual Seep Sampling	NEZ Dump Seep 6	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	NEZ Dump Seep 6	5/6/2014	5/6/2014	1.67	0.0015	0.00091	0.00105	0.0694	0.00005	0.00025	0.413	0.0001	259	0.00025	0.00005	0.00621	0.015	2.5E-05	0.00698	34.5	0.0189	0.183	0.00025	1.89	0.0143	7.56	5E-06	28.6	6.51	5E-06	0.00005	0.005	0.00487	0.0013	0.0015	6.26277E-05	12.95	3.3036	0.255104371	15	2014
Bi-annual Seep Sampling	NEZ Dump Seep 6	27-10-2014 14:22	10/27/2014	4.15	0.0049	0.00032	0.00027	0.062	0.00005	0.00025	0.292	1.9E-05	219	0.00025	0.00005	0.00366	0.015	2.5E-05	0.0032	28.4	0.00342	0.0652	0.00025	1.18	0.0135	7.06	5E-06	22.1	5.34	5E-06	0.00005	0.019	0.00103	0.0005	0.0015	7.09282E-05	10.95	2.6471	0.241744534	78.9474	2014
Bi-annual Seep Sampling	NEZ Dump Seep 7	2/7/2013	2/7/2013	3.13	0.0075	0.00013	0.00047	0.0235	0.00005	0.00082	0.068	1.8E-05	79.5	0.00025	0.00005	0.00651	0.015	2.5E-05	0.00025	10.5	0.00129	0.0253	0.00025	0.626	0.0041	6.81	5E-06	5.23	0.721	5E-06	0.00005	0.005	0.0005	0.0013	0.0015	8.9781E-05	3.975	0.85569	0.215267292	83.3333	2013
Bi-annual Seep Sampling	NEZ Dump Seep 7	5/6/2014	5/6/2014	2.16	0.0036	0.0003	0.00054	0.0453	0.00005	0.00025	0.164	0.00002	151	0.00025	0.00005	0.00537	0.015	2.5E-05	0.00273	21.4	0.0008	0.0754	0.00025	0.986	0.00927	6.54	5E-06	12.1	2.12	5E-06	0.00005	0.005	0.00176	0.0013	0.0015	7.7036E-05	7.55	1.79918	0.238302307	75	2014
Bi-annual Seep Sampling	NEZ Dump Seep 7	27-10-2014 13:52	10/27/2014	2.91	0.0035	0.00031	0.00057	0.048	0.00005	0.00025	0.098	3.2E-05	188	0.00025	0.00005	0.00617	0.015	2.5E-05	0.00227	24.3	0.00327	0.0803	0.00025	1.18	0.0208	6.07	5E-06	11.6	2.05	5E-06	0.00005	0.017	0.00134	0.0012	0.0015	0.000124551	9.4	1.95151	0.207607857	46.875	2014
Bi-annual Seep Sampling	NEZ Dump Seep 7	28-05-2015 14:25	5/28/2015	2.38	0.0015	0.00023	0.00045	0.034	0.00005	2.5E-05	0.118	1.3E-05	141	0.00025	0.00005	0.00402	0.015	2.5E-05	0.0024	17.4	0.00091	0.0419	0.00025	0.769	0.0103	6.83	5E-06	10	1.48	5E-06	0.00005	0.005	0.00104	0.00122	0.0015	9.59627E-05	7.05	1.46908	0.208379832	119.048	2015
Bi-annual Seep Sampling	NEZ Dump Seep 8	4/7/2013	4/7/2013	4.27	0.0037	0.00005	0.00018	0.0762	0.00005	0.00025	0.066	0.00003	250	0.00025	0.00005	0.00289	0.015	2.5E-05	0.00025	54.9	0.00533	0.0869	0.00086	3.19	0.00991	4.63	5E-06	13.7	3.01	5E-06	0.00005	0.013	0.00017	0.0005	0.0015	4.59505E-05	12.5	3.87861	0.310289058	50	2013
Bi-annual Seep Sampling	NEZ Dump Seep 8	8/6/2015	8/6/2015	3.9	0.0036	0.00005	0.00021	0.0479	0.00005	2.5E-05	0.045	3.2E-05	191	0.00025	0.00005	0.00297	0.015	2.5E-05	0.0005	39.5	0.00806	0.0734	0.00051	2.43	0.00467	4.89	5E-06	10.5	1.96	5E-06	0.00005	0.005	0.00032	0.00025	0.0015	2.58011E-05	9.55	2.82204	0.295501197	46.4396	2015
Bi-annual Seep Sampling	NEZ Dump Seep 9	4/7/2013	4/7/2013	3.85	0.0158	0.00025	0.00026	0.0379	0.0001	0.0005	0.092	0.0002	382	0.00025	0.00062	0.0496	0.015	0.00005	0.0042	68.7	0.135	0.404	0.0021	2.46	0.0413	4.17	0.00001	22.6	5.36	0.00001	0.0001	0.014	0.00264	0.001	0.0242	0.000105	19.1	5.05152	0.264477305	121	2013
Bi-annual Seep Sampling	NEZ Dump Seep 9	23-10-2013 13:21	10/23/2013	4.4	0.0096	0.0001	0.0001	0.0324	0.0001	0.0005	0.075	0.00032	308	0.00025	0.00064	0.0495	0.015	0.00005	0.0035	62.2	0.183	0.149	0.0023	2.51	0.0503	5.04	0.00001	17.9	3.59	0.00001	0.0001	0.005	0.00141	0.001	0.0299	0.000147941	15.4	4.46944	0.290223507	94.6203	2013
Bi-annual Seep Sampling	NEZ Dump Seep 9	5/6/2014	5/6/2014	4.07	0.013	0.00014	0.0002	0.0285	0.00005	0.00025	0.057	0.00013	264	0.00025	0.00046	0.0371	0.015	2.5E-05	0.00211	53.3	0.114	0.15	0.00204	2.34	0.0708	4.59	5E-06	15.9	3.24	5E-06	0.00005	0.005	0.00101	0.0005	0.0184	0.000249296	13.2	3.85918	0.292361823	147.2	2014
Bi-annual Seep Sampling	NEZ Dump Seep 9	27-10-2014 13:31	10/27/2014	4.78	0.0086	0.00015	0.00025	0.0292	0.00005	0.00025	0.067	0.00023	247	0.00025	0.00045	0.0323	0.015	2.5E-05	0.00237	47.8	0.118	0.155	0.00153	2.2	0.0452	4.43	5E-06	15	2.68	5E-06	0.00005	0.021	0.00104	0.0005	0.0147	0.000174089	12.35	3.49576	0.283057181	65.3333	2014
Bi-annual Seep Sampling	NEZ Dump Seep 9	8/6/2015	8/6/2015	5.34	0.0184	0.00012	0.0002	0.0301	0.00005	2.5E-05	0.063	0.00014	296	0.00025	0.00027	0.0336	0.015	2.5E-05	0.0022	54.5	0.0938	0.142	0.00141	2.52	0.0566	4.72	5E-06	17.2	3.27	5E-06	0.00005	0.005	0.0011	0.00025	0.0153	0.000184967	14.8	3.99028	0.269613786	112.5	2015
Bi-annual Seep Sampling	North Bell Dump Seep 1	30-05-2013 9:43	5/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	North Bell Dump Seep 1	14-10-2015 13:57	10/14/2015	6.6	0.0015	0.00029	0.00047	0.055	0.00005	2.5E-05	0.026	5.5E-05	99	0.00025	0.00037	0.00823	0.042	2.5E-05	0.0044	11.6	0.6	0.0313	0.00025	0.993	0.0295	7.47	5E-06	4.44	0.34	5E-06	0.00005	0.005	0.00045	0.00054	0.0034	0.000546296	4.95	0.89489	0.18078583	61.4828	2015
Bi-annual Seep Sampling	North Bell Dump Seep 2	4/6/2013	4/6/2013	4.86	0.0087	0.00024	0.00114	0.0325	0.00005	0.00025	0.043	0.0001	113	0.00025	0.00015	0.0255	0.015	2.5E-05	0.00379	21.3	0.089	0.0426	0.00025	1.44	0.0742	6.28	5E-06	8.55	0.376	5E-06	0.00005	0.005	0.00168	0.002	0.003	0.00090487	5.65	1.65064	0.292149507	29.703	2013
Bi-annual Seep Sampling	North Bell Dump Seep 3	4/6/2013	4/6/2013	5.85	0.0229	0.00022	0.00033	0.0683	0.00005	0.00025	0.024	1.9E-05	162	0.00025	0.00005	0.00542	0.015	2.5E-05	0.00025	22.8	0.00713	0.0146	0.00025	1.75	0.00697	3.82	5E-06	7.04	1.11	5E-06	0.00005	0.011	8.6E-05	0.0005	0.0015	4.70946E-05	8.1	1.6804	0.207457385	78.9474	2013
Bi-annual Seep Sampling	North Bell Dump Seep 4	2/7/2013	2/7/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	PAG Dump Seep 1	30-05-2013 9:42	5/30/2013	9.05	0.0053	0.00046	0.00068	0.108	0.00005	0.00025	0.048	3.5E-05	200	0.00025	0.0001	0.0066	0.015	2.5E-05	0.00281	36.8	0.103	0.0556	0.00025	4.64	0.155	8.21	5E-06	16.7	0.783	5E-06	0.00005	0.005	0.00081	0.0005	0.0015	0.001086449	10	2.99083	0.299083391	42.8571	2013
Bi-annual Seep Sampling	PAG Dump Seep 10	29-05-2014 9:48	5/29/2014	12.4	0.0117	0.00018	0.00063	0.0881	0.00005	0.00025	0.036	0.00005	144	0.00025	0.00029	0.0213	0.015	2.5E-05	0.00076	23.2	0.588	0.0245	0.00067	3.15	0.0183	7.9	5E-06	10.1	0.654	5E-06	0.00005	0.005	0.00084	0.0005	0.0037	0.000201099	7.2	1.87267	0.260092965	74	2014
Bi-annual Seep Sampling	PAG Dump Seep 10	23-10-2014 12:28	10/23/2014	12.6	0.0135	0.00012	0.00045	0.126	0.00005	0.00025	0.036	2.9E-05	245	0.00025	0.00023	0.0129	0.015	2.5E-05	0.00117	44.2	0.208	0.0184	0.00025	4.24	0.0175	7.32	5E-06	16.6	1.05	5E-06	0.00005	0.02	0.00185	0.0005	0.0015	9.72222E-05	12.25	3.40772	0.278180943	51.7241	2014
Bi-annual Seep Sampling	PAG Dump Seep 10	20-05-2015 13:03	5/20/2015	8.12	0.0093	0.00021	0.00034	0.108	0.00005	2.5E-05	0.036	3E-05	233	0.00025	0.00011	0.00735	0.015	2.5E-05	0.001	38.6	0.0236	0.0456	0.00025	2.9	0.0315	7.56	5E-06	15.1	0.938	5E-06	0.00005	0.005	0.00115	0.00053	0.0015	0.000177298	11.65	2.98161	0.255932152	50.6757	2015
Bi-annual Seep Sampling	PAG Dump Seep 11	24-11-2015 13:22	11/24/2015	7.3	0.0062	0.00021	0.00038	0.103	0.00005	2.5E-05	0.033	1.1E-05	284	0.00025	0.00005	0.00632	0.015	2.5E-05	0.0005	49.7	0.00863	0.0581	0.00025	2.89	0.0321	7.32	5E-06	16.7	0.995	5E-06	0.00005	0.02	0.00163	0.00025	0.0015	0.000143731	14.2	3.69815	0.260433007	135.135	2015
Bi-annual Seep Sampling	PAG Dump Seep 12	29-05-2014 10:04	5/29/2014	20.5	0.022	0.00016	0.00093	0.077	0.00005	0.00025	0.049	8.8E-05	102	0.00025	0.0004	0.0234	0.052	2.5E-05	0.00078	19.2	0.465	0.0101	0.00077	2.62	0.0154	6.42	0.00002	7.85	0.562	5E-06	0.00005	0.005	0.00077	0.0005	0.0038	0.00022	5.1	1.52802	0.299611248	43.1818	2014
Bi-annual Seep Sampling	PAG Dump Seep 13	23-10-2014 10:49	10/23/2014	4.87	0.0092	0.00043	0.00176	0.0103	0.00005	0.00025	0.148	5E-06	45.6	0.00025	0.00087	0.00225	0.158	2.5E-05	0.00173	8.6	0.864	0.0172	0.00025	0.634	0.00118	9.5	5E-06	6.12	0.205	5E-06	0.00005	0.005	0.00044	0.0027	0.0015	0.000357215	2.28	0.7838	0.343772409	300	2014
Bi-annual Seep Sampling	PAG Dump Seep 13	20-05-2015 13:36	5/20/2015	3.87	0.005	0.00043	0.00243	0.0111	0.00005	2.5E-05	0.16	7.4E-06	46.1	0.00025	0.0002	0.00314	0.015	2.5E-05	0.0022	8.61	0.428	0.0355	0.00025	0.698	0.00357	8.82	5E-06	7.03	0.21	5E-06	0.00005	0.005	0.00057	0.00373	0.0015	0.000399627	2.305	0.82559	0.358173721	202.703	2015
Bi-annual Seep Sampling	PAG Dump Seep 14	23-10-2014 11:13	10/23/2014	14.7	0.014	0.00011	0.00055	0.0955	0.00005	0.00025	0.06	3.7E-05	179	0.00025	0.00131	0.0116	0.114	2.5E-05	0.00025	34.8	3.15	0.0201	0.00077	2.66	0.0148	7.76	5E-06	11.3	0.831	5E-06	0.00005	0.017	0.00163	0.0005	0.0015	0.000135366	8.95	2.58866	0.289236201	40.5405	2014
Bi-annual Seep Sampling	PAG Dump Seep 14	20-05-2015 13:16	5/20/2015	9.04	0.0043	0.00015	0.00041	0.1	0.00005	2.5E-05	0.068	1E-05	263	0.00025	0.00017	0.00683	0.015	2.5E-05	0.0005	48.1	0.463	0.0297	0.00025	2.92	0.0414	6.99	5E-06	16.4	1.23	5E-06	0.00005	0.005	0.00267	0.00025	0.0015	0.000191963	13.15	3.59258	0.2732	148.515	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 14:48	11/24/2015	7.57	0.0034	0.00012	0.00049	0.109	0.00005	2.5E-05	0.064	2.5E-06	298	0.00025	0.00005	0.00482	0.015	2.5E-05	0.0005	55.9	0.243	0.0475	0.00025	2.98	0.0385	7.31	5E-06	17.8	1.18	5E-06	0.00005	0.02	0.00274	0.00054	0.0015	0.000156929	14.9	4.1098	0.275825404	600	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	9/12/2014	9/12/2014	14.6	0.016	0.00034	0.00057	0.101	0.00005	0.00025	0.039	0.00011	208	0.00025	0.00564	0.0104	0.05	2.5E-05	0.00185	39	2.16	0.0803	0.00105	4	0.0684	5.86	5E-06	15.7	1.01	5E-06	0.00005	0.024	0.00093	0.0005	0.0044	0.000384991	10.4	3.05923	0.294156277	40.367	2014
Bi-annual Seep Sampling	PAG Dump Seep 15	23-10-2014 11:56	10/23/2014	67.9	0.0307	0.00028	0.00106	0.139	0.00005	0.00025	0.04	5.9E-05	213	0.00025	0.0165	0.00994	0.738	2.5E-05	0.00116	43.8	7.83	0.0288	0.00155	6.91	0.0202	8.09	2.1E-05	13.9	1.19	5E-06	0.00005	0.02	0.00158	0.0012	0.0049	0.000155385	10.65	3.33546	0.31318903	83.0508	2014
Bi-annual Seep Sampling	PAG Dump Seep 15	1/9/2015	1/9/2015	15.3	0.0147	0.00033	0.00054	0.0985	0.00005	2.5E-05	0.051	5.5E-05	322	0.00025	0.00524	0.00783	0.085	2.5E-05	0.0026	55.6	1.71	0.119	0.00077	4.69	0.0818	7.09	5E-06	24.5	1.41	5E-06	0.00005	0.005	0.00161	0.00025	0.0015	0.000304845	16.1	4.42746	0.274997286	27.4725	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	2/2/2015	2/2/2015	18.9	0.0093	0.0003	0.00053	0.133	0.0001	0.0005	0.048	0.00012	299	0.00025	0.00711	0.0102	0.033	0.00005	0.0015	56.1	2.63	0.0866	0.0012	4.98	0.123	7.06	0.00001	23.2	1.38	0.00001	0.001	0.01	0.00097	0.001	0.0052	0.000478599	14.95	4.40752	0.294817725	45.2174	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	2/6/2015	2/6/2015	14.8	0.0062	0.00033	0.0005	0.103	0.00005	2.5E-05	0.051	7.4E-05	300	0.00025	0.00504	0.00821	0.015	2.5E-05	0.0018	53.2	2.13	0.101	0.00089	4.78	0.0856	7.46	5E-06	23.2	1.25	5E-06	0.00005	0.005	0.00152	0.00025	0.0015	0.000337451	15	4.2333	0.282220038	20.1884	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	3/3/2015	3/3/2015	15	0.0061	0.0003	0.00044	0.127	0.0001	0.0005	0.044	0.00014	325	0.00025	0.00361	0.00925	0.015	0.00005	0.0022	57.2	1.98	0.103	0.0011	4.99	0.127	6.82	0.00001	26	1.42	0.00001	0.0001	0.02	0.00101	0.001	0.0042	0.000456835	16.25	4.59366	0.282686798	29.5775	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	5/5/2015	5/5/2015	19.3	0.0103	0.00035	0.00056	0.108	0.00005	2.5E-05	0.056	9.6E-05	278	0.00025	0.00674	0.00857	0.089	2.5E-05	0.0023	51.5	2.66	0.0909	0.00109	4.88	0.0926	7.79	5E-06	23.5	1.17	5E-06	0.00005	0.005	0.00124	0.00025	0.0034	0.000395164	13.9	4.14978	0.298545524	35.4906	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	6/1/2015	6/1/2015	24.6	0.0104	0.00031	0.00065	0.144	0.00005	0.00025	0.045	0.00012	283	0.00025	0.00962	0.0113	0.035	2.5E-05	0.00206	53.4	3.92	0.0711	0.00141	5.54	0.093	7.03	5E-06	23.8	1.29	5E-06	0.00005	0.005	0.00095	0.0005	0.0031	0.000409091	14.15	4.29054	0.303218128	26.0504	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	6/8/2015	6/8/2015	14.6	0.0095	0.00036	0.0005	0.105	0.0001	0.00005	0.052	7.4E-05	325	0.00025	0.00667	0.00848	0.038	0.00005	0.0029	55.3	1.89	0.109	0.0005	4.74	0.0965	7.07	0.00001	24.6	1.44	0.00001	0.0001	0.005	0.00159	0.0005	0.0015	0.00035219	16.25	4.41559	0.271728829	20.2703	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	7/7/2015	7/7/2015	14	0.0166	0.00035	0.00061	0.108	0.0001	0.00005	0.049	7.2E-05	309	0.00025	0.00521	0.00854	0.095	0.00005	0.001	51.9	2.06	0.103	0.0005	5.09	0.0758	7.18	0.00001	24.1	1.3	0.00001	0.0001	0.005	0.00155	0.0005	0.0015	0.000301592	15.45	4.20458	0.272140969	20.8333	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	8/4/2015	8/4/2015	14.1	0.0071	0.00033	0.00048	0.12	0.0001	0.00005	0.053	9.5E-05	338	0.00025	0.00496	0.00901	0.049	0.00005	0.0027	60.1	1.9	0.119	0.001	4.77	0.122	7.35	0.00001	27.3	1.41	0.00001	0.0001	0.022	0.00105	0.0005	0.0043	0.000424102	16.9	4.81364	0.284830615	45.2632	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	29-10-2015 12:55	10/29/2015	18.9	0.0097	0.00033	0.00053	0.0861	0.00005	2.5E-05	0.057	3E-05	295	0.00025	0.00457	0.00796	0.034	2.5E-05	0.0021	52.4	1.9	0.107	0.0007	4.8	0.0558	7.71	5E-06	24.5	1.29	5E-06	0.00005	0.012	0.00159	0.00025	0.0015	0.000236774	14.75	4.24369	0.287707654	50.3356	2015
Bi-annual Seep Sampling	PAG Dump Seep 15	24-11-2015 13:05	11/24/2015	8.93	0.0054	0.00036	0.00048	0.0811	0.00005	2.5E-05	0.049	1.6E-05	338	0.00025	0.00076	0.00857	0.015	2.5E-05	0.0023	60.3	0.277	0.118	0.00025	4.03	0.0864	7.65	5E-06	25.2	1.26	5E-06	0.00005	0.019	0.00168	0.00055	0.0015	0.000312289	16.9	4.71502	0.278995295	92.5926	2015
Bi-annual Seep Sampling	PAG Dump Seep 2	30-05-2013 9:56	5/30/2013	62.4	0.0117	0.00029	0.00077	0.192	0.0001	0.0005	0.058	0.00015	363	0.00025	0.021	0.00555	0.171	0.00005	0.0042	67.5	8.91	0.294	0.0017	9.79	0.265	6.57	0.00001	23.4	1.38	0.00001	0.001	0.005	0.00227	0.001	0.0283	0.000970696	18.15	5.20428	0.286737025	188.667	2013
Bi-annual Seep Sampling	PAG Dump Seep 3	30-05-2013 10:08	5/30/2013	9.26	0.007	0.00005	0.00033	0.0963	0.00005	0.00025	0.015	0.00022	180	0.00025	0.00481	0.00707	0.041	2.5E-05	0.00025	36.5	6.11	0.0021	0.00062	2.75	0.0351	7.32	5E-06	9.02	0.713	5E-06	0.00005	0.005	6.4E-05	0.0005	0.0062	0.00022452	9	2.59097	0.28788518	28.4404	2013
Bi-annual Seep Sampling	PAG Dump Seep 3	29-05-2014 10:52	5/29/2014	5.04	0.003	0.00005	0.00016	0.063	0.00005	0.00025	0.023	1.2E-05	207	0.00025	0.00005	0.00371	0.015	2.5E-05	0.00025	39.1	0.00019	0.00018	0.00025	1.87	0.0676	5.8	5E-06	12.7	0.896	5E-06	0.00005	0.005	0.00041	0.0005	0.0015	0.000355789	10.35	2.88001	0.278261451	125	2014
Bi-annual Seep Sampling	PAG Dump Seep 4	30-05-2013 11:03	5/30/2013	13.3	0.427	0.0004	0.00074	0.0521	0.00005	0.00025	0.041	0.0005	258	0.00059	0.00108	0.0252	0.6	0.0002	0.00144	44.8	1.17	0.044	0.00121	3.04	0.149	8.17	3.9E-05	16.4	0.98	5E-06	0.00005	0.031	0.00152	0.0024	0.0063	0.000878193	12.9	3.40324	0.263816829	12.6506	2013
Bi-annual Seep Sampling	PAG Dump Seep 4	29-05-2014 11:11	5/29/2014	10.9	0.007	0.00031	0.00067	0.0849	0.0001	0.0005	0.057	0.00015	418	0.00025	0.00147	0.017	0.015	0.00005	0.0025	76.5	1.56	0.256	0.0005	4.69	0.242	5.99	0.00001	29.3	1.53	0.00001	0.0001	0.01	0.00195	0.001	0.0034	0.000636842	20.9	5.85481	0.280134491	22.6667	2014
Bi-annual Seep Sampling	PAG Dump Seep 4	14-05-2015 13:57	5/14/2015	7.81	0.0015	0.00021	0.00044	0.0465	0.00005	0.00025	0.052	0.00035	392	0.00025	0.0001	0.00647	0.015	0.00005	0.001	68.1	0.0458	0.204	0.0005	3.15	0.244	6.36	0.00001	28.2	1.29	0.00001	0.0001	0.005	0.00154	0.0005	0.004	0.000763295	19.6	5.27777	0.269270493	11.5607	2015
Bi-annual Seep Sampling	PAG Dump Seep 5	29-05-2014 10:40	5/29/2014	10.7	0.0046	0.00034	0.00047	0.135	0.0001	0.0005	0.067	0.00015	346	0.00025	0.00478	0.00937	0.015	0.00005	0.003	59.8	2.87	0.226	0.0005	6.24	0.172	6.85	0.00001	30.4	1.41	0.00001	0.0001	0.005	0.00143	0.001	0.008	0.000568908	17.3	4.96862	0.287203445	53.3333	2014
Bi-annual Seep Sampling	PAG Dump Seep 5	23-10-2014 10:50	10/23/2014	11.1	0.0075	0.00037	0.00057	0.089	0.0001	0.0005	0.062	0.00017	336	0.00025	0.00297	0.0212	0.29	0.00005	0.0037	55.8	2.13	0.185	0.0005	4.87	0.126	7	0.00001	29.3	1.32	0.00001	0.0001	0.023	0.00161	0.001	0.0041	0.000474279	16.8	4.65243	0.276930307	24.1176	2014
Bi-annual Seep Sampling	PAG Dump Seep 5	14-05-2015 14:22	5/14/2015	10.9	0.0062	0.00033	0.00051	0.0952	0.0001	0.0005	0.083	0.00035	427	0.00025	0.00499	0.0157	0.015	0.00013	0.0031	70.5	4.57	0.585	0.0011	5.64	0.216	6.24

Location Type	Sample Point	Original Date As Is	Recoded Date	Location	Source Term Group	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Q (m3/s)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Alkalinity (CaCO3) (mg/L)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)
							µs/cm	su	m3/s	C	ntu	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	SERDS Seep 21	11/11/2015	11/11/2015	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2420	1330	7.95	2100	5	1.48	105	0.0112	-10	-0.4	96.9	97	0.098	0.0325	0.0357	0.0557	985	98.3
Bi-annual Seep Sampling	SERDS Seep 3	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken (will have TSS due to shallow sampling enviro). Multiple seeps adjacent that are not samplable (likely all the same source).	1663	7.4	0.001	15.6	#N/A	1670	939	7.81	1540	272	134	57.8	0.0196	-5	-0.2	5.88	5.88	-0.01	-0.001	0.014	0.521	974	7.71
Bi-annual Seep Sampling	SERDS Seep 3	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2400	1430	7.79	2170	17.7	5.34	70.7	0.185	11	-0.4	88.5	89.7	1.24	0.0098	0.0197	0.0501	1130	83
Bi-annual Seep Sampling	SERDS Seep 4	6/6/2013	6/6/2013	South East	All Non-PAG	Not sampled - water chemistry expected to be the sample as seeps 2 and 3.	1633	7.5	0.003	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 4	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1760	988	7.92	1510	15.7	4.89	67.8	0.181	5.8	-0.2	53.4	54	0.584	0.0195	0.0281	0.036	786	51.8
Bi-annual Seep Sampling	SERDS Seep 5	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken. Comes out of dump toe in a few places, feeds into major pooling. Stinky (organic matter in pools).	2025	7.5	0.003	9.1	#N/A	2010	1170	8	1820	9	7.95	112	0.0769	-10	-0.4	5.98	6.01	0.028	0.0186	0.0357	0.0597	1210	6.14
Bi-annual Seep Sampling	SERDS Seep 5	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2190	1330	8.07	2030	14.8	6.41	106	0.0644	13	-0.4	55.1	55.5	0.337	0.0137	0.0243	0.044	1110	52.1
Bi-annual Seep Sampling	SERDS Seep 6	6/6/2013	6/6/2013	South East	All Non-PAG	No sample taken (virtually stagnant). Second similar seep ~5 m north - similar conditions.	1317	8.2	0.001	10.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 7	6/6/2013	6/6/2013	South East	All Non-PAG	Sample taken. Comes out of dump toe in a few places (likely same source).	1613	7.9	0.01	7	#N/A	1570	902	8.01	1240	31.8	15.9	104	0.0709	-5	0.25	12.5	12.6	0.063	0.0674	0.0879	0.133	828	12.2
Bi-annual Seep Sampling	SERDS Seep 8	6/6/2013	6/6/2013	South East	All Non-PAG	No sample (water chemistry expected to be similary to seep 7).	1324	7.9	0.005	5.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 8	3/6/2014	3/6/2014	South East	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1630	901	7.92	1390	6.7	2.35	70.9	0.0713	-5	-0.2	45.8	46	0.168	0.0354	0.0461	0.058	737	43.5
Bi-annual Seep Sampling	SERDS Seep 9	6/6/2013	6/6/2013	South East	All Non-PAG	No sample taken. No flow but ground saturated.	1417	7.6	0	11.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-06-2014 8:47	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	440	237	8.3	315	16.3	8.09	198	-0.005	-0.5	0.132	-0.005	-0.0051	-0.001	0.0012	0.0066	0.0766	51.9	0.351
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-05-2015 11:10	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	896	462	8.1	684	221	7.54	94.9	0.0109	1.1	0.114	6.21	6.22	0.01	0.0076	0.0097	0.465	371	6.24
Bi-annual Seep Sampling	TSF Haul Road Seep 11	30-07-2013 13:52	7/30/2013	TSF Haul Road	All Non-PAG	Full suite sample taken.	734	7.4	0.002	8.7	#N/A	658	315	7.41	542	98.5	39.2	59.2	-0.005	3.71	0.087	35	35	0.0081	0.0127	0.0159	0.233	148	35
Bi-annual Seep Sampling	TSF Haul Road Seep 11	26-11-2013 11:06	11/26/2013	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	555	264	7.35	413	14.9	11	58.9	-0.005	3.1	0.095	19.9	19.9	0.0021	0.0105	0.0131	0.0452	132	19
Bi-annual Seep Sampling	TSF Haul Road Seep 12	30-07-2013 14:05	7/30/2013	TSF Haul Road	All Non-PAG	Not sampled.	650	8	0.002	7.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 12	26-06-2014 10:45	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1480	757	7.98	1160	4.9	1.18	96.6	0.0352	6.1	-0.2	60.7	60.8	0.106	0.0011	0.0066	0.0538	533	54.8
Bi-annual Seep Sampling	TSF Haul Road Seep 12	11/5/2015	11/5/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1030	557	8.14	754	13.4	3.53	90	0.021	-2.5	0.12	21.4	21.4	0.0414	0.0098	0.0148	0.0495	397	20.5
Bi-annual Seep Sampling	TSF Haul Road Seep 14	26-05-2015 11:28	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	629	311	8.02	425	3.4	0.73	80.8	0.0115	-0.5	0.28	4.59	4.59	0.0068	-0.001	0.0035	0.0375	226	4.79
Bi-annual Seep Sampling	TSF Haul Road Seep 15	26-06-2014 9:30	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2160	1250	8.11	1590	4.7	0.75	122	0.0159	-10	-0.4	55.2	55.2	0.059	-0.001	0.0059	0.0146	1080	50.6
Bi-annual Seep Sampling	TSF Haul Road Seep 16	30-09-2014 12:56	9/30/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1930	1110	7.68	1630	17.9	10.8	84	0.052	-10	-0.4	49.2	49.3	0.077	0.0278	0.0398	0.0939	933	45
Bi-annual Seep Sampling	TSF Haul Road Seep 16	11/5/2015	11/5/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1640	936	8.04	1370	24.8	5.66	93.2	-0.005	-5	-0.2	46.1	46.1	-0.01	0.0259	0.0306	0.116	714	44.5
Bi-annual Seep Sampling	TSF Haul Road Seep 16	26-05-2015 12:10	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1900	1070	7.81	1710	14.6	4.15	65.7	0.0205	-5	-0.2	34.5	34.5	0.029	0.0365	0.0488	0.0665	945	34.3
Bi-annual Seep Sampling	TSF Haul Road Seep 3	30-07-2013 12:23	7/30/2013	TSF Haul Road	All Non-PAG	Not sampled. Ground saturated downstream.	1123	7.9	0	21.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 4	30-07-2013 12:27	7/30/2013	TSF Haul Road	All Non-PAG	Not sampled. Ground saturated downstream.	1419	7.5	0	18.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-07-2013 12:37	7/30/2013	TSF Haul Road	All Non-PAG	Full suite sample taken of one branch of the seep. May have been slightly contaminated by algae.	846	7.8	0.008	8.4	#N/A	829	407	8.02	665	5	0.58	109	0.0057	-5	0.75	15.4	15.4	-0.01	0.0041	0.0079	0.011	284	15.5
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-06-2014 9:39	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1020	545	8.09	670	-3	0.79	137	0.0118	-5	0.41	13.6	13.6	0.022	0.0015	0.0033	0.0123	394	12.8
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-09-2014 12:29	9/30/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	872	480	7.87	630	-3	0.17	114	-0.005	-5	0.62	13.1	13.1	0.013	0.0139	0.0187	0.0132	319	12.4
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-05-2015 11:40	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	965	512	8.16	727	-3	0.3	108	-0.005	2.2	0.593	13.7	13.7	-0.002	0.01	0.0123	0.0147	371	13.5
Bi-annual Seep Sampling	TSF Haul Road Seep 6	30-07-2013 12:50	7/30/2013	TSF Haul Road	All Non-PAG	Full suite sample taken.	734	8	0.001	7.4	#N/A	698	345	7.99	544	4.9	0.98	99.9	-0.005	-2.5	0.71	12.9	12.9	-0.005	0.0044	0.0084	0.0106	225	13.1
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-06-2014 9:50	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	933	488	8.05	696	-3	0.17	103	-0.005	-5	0.55	16.9	16.9	-0.01	0.0115	0.0151	0.0162	352	14.9
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-05-2015 11:51	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	865	447	8.14	665	5.6	0.4	106	-0.005	2	0.613	10.7	10.7	-0.002	0.0099	0.0128	0.0142	322	10.6
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-07-2013 13:00	7/30/2013	TSF Haul Road	All Non-PAG	Not sampled.	1088	7.5	0	20.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-09-2014 12:42	9/30/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2010	1210	7.9	1760	12	3.56	140	0.0765	-10	-0.4	59.3	59.4	0.085	0.0894	0.109	0.144	937	53.7
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 12:00	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2160	1280	7.98	1960	-3	0.71	115	0.0193	-10	-0.4	46.3	46.4	0.022	0.0727	0.0938	0.185	1080	44.9
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-07-2013 13:10	7/30/2013	TSF Haul Road	All Non-PAG	Full suite sample taken.	666	8	0.003	6.6	#N/A	637	320	7.81	475	6.2	0.88	93	-0.005	2.09	0.175	15.6	15.6	0.0036	0.0027	0.004	0.0098	179	15.4
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-06-2014 10:02	6/26/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	802	419	7.88	596	3.3	0.8	91.6	-0.005	-5	-0.2	18.4	18.4	-0.01	0.004	0.0057	0.0207	276	17.9
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-09-2014 13:20	9/30/2014	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1700	952	7.86	1410	46.1	19.1	106	0.0203	-10	-0.4	52.3	52.4	0.167	0.0297	0.038	0.0565	718	49.4
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-05-2015 12:25	5/26/2015	TSF Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1280	690	8.03	1050	-3	0.84	71.6	0.0062	2.7	-0.1	21.1	21.1	0.0114	0.0351	0.0353	0.0434	570	20.3
Bi-annual Seep Sampling	TSF Haul Road Seep 9	30-07-2013 13:21	7/30/2013	TSF Haul Road	All Non-PAG	Not sampled. Small pool at toe of road.	985	7.6	0	16.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 1	30-05-2013 9:15	5/30/2013	Waste Haul Road	All Non-PAG	D-Metals and T-Metals only	594	7	0.001	2.4	#N/A	525	246	7.25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Location Type	Sample Point	Original Date As Is	Recoded Date	Dissolved Organic Carbon (mg/L)	Aluminum (Al)-Total (mg/L)	Antimony (Sb)-Total (mg/L)	Arsenic (As)-Total (mg/L)	Barium (Ba)-Total (mg/L)	Beryllium (Be)-Total (mg/L)	Bismuth (Bi)-Total (mg/L)	Boron (B)-Total (mg/L)	Cadmium (Cd)-Total (mg/L)	Calcium (Ca)-Total (mg/L)	Chromium (Cr)-Total (mg/L)	Cobalt (Co)-Total (mg/L)	Copper (Cu)-Total (mg/L)	Iron (Fe)-Total (mg/L)	Lead (Pb)-Total (mg/L)	Lithium (Li)-Total (mg/L)	Magnesium (Mg)-Total (mg/L)	Manganese (Mn)-Total (mg/L)	Molybdenum (Mo)-Total (mg/L)	Nickel (Ni)-Total (mg/L)	Potassium (K)-Total (mg/L)	Selenium (Se)-Total (mg/L)	Silicon (Si)-Total (mg/L)	Silver (Ag)-Total (mg/L)	Sodium (Na)-Total (mg/L)	Strontium (Sr)-Total (mg/L)	Thallium (Tl)-Total (mg/L)	Tin (Sn)-Total (mg/L)	Titanium (Ti)-Total (mg/L)	Uranium (U)-Total (mg/L)	Vanadium (V)-Total (mg/L)	Zinc (Zn) Total (mg/L)	Aluminum (Al)-Dissolved (mg/L)	Antimony (Sb)-Dissolved (mg/L)	Arsenic (As) Dissolved (mg/L)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	SERDS Seep 21	11/11/2015	11/11/2015	13.1	0.645	0.00051	0.00098	0.0882	-0.0002	-0.0001	0.046	0.000322	405	0.00118	0.0046	0.065	0.737	0.00033	0.0039	73.5	2.14	0.121	0.0017	4.12	0.198	6.3	-0.00002	24.5	2.65	-0.00002	-0.0002	0.04	0.00312	0.0025	0.0097	0.0106	0.00045	0.0007
Bi-annual Seep Sampling	SERDS Seep 3	6/6/2013	6/6/2013	14.8	7.69	0.00052	0.00321	0.249	0.00016	-0.0005	0.062	-0.0002	257	0.0124	0.00385	0.0424	8.43	0.0021	0.0079	66.1	0.234	0.0237	0.0103	6.02	0.012	15	8.7E-05	24.7	5.58	0.000037	0.00014	0.306	0.000292	0.0212	0.0286	0.0308	0.00048	0.00048
Bi-annual Seep Sampling	SERDS Seep 3	3/6/2014	3/6/2014	14.2	0.283	0.00039	0.00076	0.0976	-0.0002	-0.001	0.055	-0.0003	416	0.0005	0.00252	0.0358	0.272	0.00013	0.0027	89.9	1.54	0.0497	0.0019	4.7	0.146	6.65	-0.00002	26.9	4.94	-0.00002	-0.0002	0.022	0.00183	-0.002	-0.006	0.0342	0.0004	0.00067
Bi-annual Seep Sampling	SERDS Seep 4	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 4	3/6/2014	3/6/2014	9.02	0.132	0.00032	0.00077	0.0569	-0.0001	-0.0005	0.057	-0.0002	288	-0.0005	0.00186	0.0263	0.134	5.5E-05	0.0023	67.5	0.645	0.0734	0.00108	3.9	0.0987	8.28	1.3E-05	20.8	2.97	-0.00001	-0.0001	0.014	0.00132	-0.001	0.0046	0.0148	0.00029	0.00064
Bi-annual Seep Sampling	SERDS Seep 5	6/6/2013	6/6/2013	14.9	0.414	0.00057	0.00126	0.105	-0.0002	-0.001	0.105	-0.0002	339	0.00082	0.00169	0.0247	0.432	0.00014	0.005	77	0.797	0.232	0.0013	4.3	0.0266	6	2.8E-05	34.3	9.51	-0.00002	-0.0002	0.026	0.00215	-0.002	-0.006	0.0163	0.00061	0.00107
Bi-annual Seep Sampling	SERDS Seep 5	3/6/2014	3/6/2014	0.61	0.618	0.00038	0.00115	0.116	-0.0002	-0.001	0.104	-0.0003	374	0.00101	0.00242	0.0842	0.6	0.0004	0.0034	86.2	1.52	0.103	0.0015	4.47	0.0713	8.28	2.3E-05	26.6	5.43	-0.00002	0.00028	0.038	0.00193	0.0029	-0.006	0.0183	0.00038	0.00092
Bi-annual Seep Sampling	SERDS Seep 6	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 7	6/6/2013	6/6/2013	12.7	1.18	0.00041	0.00133	0.076	-0.0001	-0.0005	0.112	-0.0001	254	0.00213	0.00094	0.015	1.12	0.00034	0.00928	59	0.401	0.168	0.00176	5.01	0.0266	9.15	1.7E-05	26.6	6.08	-0.00001	-0.0001	0.061	0.00098	0.0037	0.0066	0.008	0.00038	0.00091
Bi-annual Seep Sampling	SERDS Seep 8	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 8	3/6/2014	3/6/2014	6.71	0.145	0.00026	0.00067	0.0664	-0.0001	-0.0005	0.077	-0.0002	261	-0.0005	0.00125	0.0155	0.156	6.9E-05	0.0057	60.3	0.433	0.148	0.00078	3	0.0788	8.2	-0.00001	18.4	3.93	-0.00001	-0.0001	0.014	0.000841	0.001	0.0045	0.0073	0.00026	0.00056
Bi-annual Seep Sampling	SERDS Seep 9	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-06-2014 8:47	6/26/2014	9.79	0.377	-0.0001	0.00065	0.0271	-0.0001	-0.0005	0.012	0.000013	63.2	0.00058	0.00047	0.0159	0.477	0.00013	0.00274	18.3	0.13	0.00451	0.00147	0.627	0.00113	8.92	1.1E-05	5.78	0.237	-0.00001	-0.0001	0.028	0.000191	0.0019	-0.003	0.0052	-0.0001	0.00048
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-05-2015 11:10	5/26/2015	2.33	3.1	0.00038	0.00232	0.11	-0.0001	-0.00005	0.058	0.0000871	136	0.00131	0.00258	0.124	2.64	0.00099	0.0053	30.5	0.434	0.0841	0.00232	2.09	0.0636	10.5	3.6E-05	13.2	0.576	-0.00001	0.00011	0.222	0.00134	0.00969	0.0111	0.0069	0.00032	0.00072
Bi-annual Seep Sampling	TSF Haul Road Seep 11	30-07-2013 13:52	7/30/2013	4.55	1.33	-0.0001	0.00069	0.0519	-0.0001	-0.0005	0.017	0.000116	83.7	0.0012	0.00132	0.0499	1.27	0.00052	0.00443	25.9	0.0944	0.00143	0.00276	1.59	0.0347	11.6	2.8E-05	6.12	0.318	-0.00001	-0.0001	0.069	0.000055	0.0036	0.0117	0.0096	-0.0001	0.00011
Bi-annual Seep Sampling	TSF Haul Road Seep 11	26-11-2013 11:06	11/26/2013	3.87	0.873	-0.0001	0.00044	0.0384	-0.0001	-0.0005	0.015	0.000052	65.3	0.00053	0.00075	0.0311	0.848	0.00032	0.00294	20	0.0356	0.0014	0.00189	1.26	0.0173	10.7	1.5E-05	5.5	0.241	-0.00001	-0.0001	0.06	0.000039	0.0025	0.0075	0.0075	-0.0001	-0.0001
Bi-annual Seep Sampling	TSF Haul Road Seep 12	30-07-2013 14:05	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 12	26-06-2014 10:45	6/26/2014	7.01	0.755	0.00013	0.00073	0.109	-0.0001	-0.0005	0.022	0.000048	225	0.00051	0.00081	0.0367	0.684	0.0002	0.0032	53.8	0.236	0.0124	0.00121	2.88	0.119	7.45	1.2E-05	10.6	0.84	-0.00001	-0.0001	0.062	0.000433	0.0023	0.0058	-0.003	-0.0001	0.00039
Bi-annual Seep Sampling	TSF Haul Road Seep 12	11/5/2015	11/5/2015	6.62	0.345	0.00015	0.00058	0.0715	-0.0001	-0.00005	0.02	0.0000306	157	-0.0005	0.00044	0.0225	0.368	0.00011	0.0022	39.4	0.249	0.0194	0.00064	2.55	0.0544	7.86	-0.00001	9.03	0.564	-0.00001	-0.0001	0.025	0.000227	0.0014	-0.003	0.0051	0.00014	0.00043
Bi-annual Seep Sampling	TSF Haul Road Seep 14	26-05-2015 11:28	5/26/2015	2.9	0.0275	0.00039	0.0008	0.0192	-0.0001	-0.00005	0.042	0.0000203	86.4	-0.0005	0.00012	0.00862	0.03	-0.00005	0.0031	21.2	0.0747	0.111	-0.0005	0.271	0.034	6.47	-0.00001	12.3	0.351	-0.00001	-0.0001	-0.01	0.000443	0.001	-0.003	0.0034	0.00036	0.00076
Bi-annual Seep Sampling	TSF Haul Road Seep 15	26-06-2014 9:30	6/26/2014	9.01	0.219	0.00024	0.00054	0.146	-0.0002	-0.001	0.072	-0.00025	354	0.00057	0.00042	0.0131	0.281	0.0001	0.0034	81	0.257	0.205	0.0015	4.17	0.282	2.41	-0.00002	40	1.27	-0.00002	-0.0002	0.029	0.000769	-0.002	-0.006	0.0041	0.00022	0.00041
Bi-annual Seep Sampling	TSF Haul Road Seep 16	30-09-2014 12:56	9/30/2014	20.4	1.13	-0.0002	0.00105	0.117	-0.0002	-0.001	0.032	0.000112	322	0.00072	0.0014	0.0629	1.05	0.00038	0.002	64.7	0.52	0.0329	0.002	8.15	0.139	7.92	3.2E-05	28.8	1.48	-0.00002	-0.0002	0.094	0.000272	0.0035	0.009	0.0179	-0.0002	0.00057
Bi-annual Seep Sampling	TSF Haul Road Seep 16	11/5/2015	11/5/2015	8.03	0.622	0.00032	0.00084	0.0652	-0.0001	-0.00005	0.028	0.0000292	274	0.00072	0.00068	0.0255	0.61	0.00022	0.0037	57.5	0.0905	0.0881	0.00118	2.76	0.0935	8.85	-0.00001	14.2	2.07	-0.00001	-0.0001	0.037	0.00103	0.00212	0.0042	0.004	0.0003	0.00053
Bi-annual Seep Sampling	TSF Haul Road Seep 16	26-05-2015 12:10	5/26/2015	19.5	0.327	0.00022	0.00082	0.101	-0.0002	-0.0001	0.026	0.000081	313	-0.0005	0.00054	0.0275	0.284	0.00013	-0.002	66.5	0.159	0.0581	0.0012	7.93	0.151	6.28	-0.00002	26	1.38	-0.00002	-0.0002	0.03	0.000172	0.0013	-0.006	0.0208	0.0002	0.0006
Bi-annual Seep Sampling	TSF Haul Road Seep 3	30-07-2013 12:23	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 4	30-07-2013 12:27	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-07-2013 12:37	7/30/2013	3.36	0.436	0.00286	0.00243	0.0474	-0.0001	-0.0005	0.043	-0.00015	123	0.00092	0.00053	0.0112	0.469	0.00024	0.00915	24.4	0.174	0.0969	0.00102	1.32	0.048	10.1	1.9E-05	11.5	0.451	-0.00001	-0.0001	0.021	0.00594	0.0023	0.01	-0.003	0.00287	0.00208
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-06-2014 9:39	6/26/2014	6.98	0.068	0.00162	0.00064	0.0545	-0.0001	-0.0005	0.044	-0.00008	166	-0.0005	0.00098	0.00462	0.109	-0.00005	0.00455	34.3	0.585	0.0096	0.00057	2.04	0.0647	7.76	-0.00001	14.1	0.545	-0.00001	-0.0001	0.019	0.00295	-0.001	-0.003	0.0054	0.00151	0.00052
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-09-2014 12:29	9/30/2014	2.13	0.011	0.00384	0.003	0.0271	-0.0001	-0.0005	0.051	0.000063	146	-0.0005	-0.0001	0.00525	-0.03	-0.00005	0.0143	28.5	0.0286	0.128	-0.0005	0.814	0.0559	11.5	-0.00001	11.6	0.472	-0.00001	-0.0001	0.02	0.0123	0.0019	0.0041	-0.003	0.00388	0.00281
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-05-2015 11:40	5/26/2015	2.18	0.1	0.00344	0.00333	0.0284	-0.0001	-0.00005	0.046	0.000117	151	-0.0005	0.00017	0.00864	0.139	9.8E-05	0.0116	29.9	0.0357	0.17	-0.0005	0.752	0.0727	11.1	-0.00001	12.5	0.445	-0.00001	-0.0001	0.015	0.00876	0.0022	0.0045	-0.003	0.00342	0.00309
Bi-annual Seep Sampling	TSF Haul Road Seep 6	30-07-2013 12:50	7/30/2013	2.37	0.0297	0.00326	0.00211	0.0308	-0.0001	-0.0005	0.04	-0.00005	106	-0.0005	-0.0001	0.00211	-0.03	-0.00005	0.00866	20.6	0.000894	0.103	-0.0005	0.459	0.0325	10.5	-0.00001	9.35	0.362	-0.00001	-0.0001	-0.01	0.00574	-0.001	-0.003	0.0039	0.0033	0.00216
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-06-2014 9:50	6/26/2014	3.03	0.012	0.00297	0.00147	0.042	-0.0001	-0.0005	0.043	-0.00005	154	-0.0005	-0.0001	0.00103	-0.03	-0.00005	0.00665	29	0.00126	0.129	-0.0005	0.87	0.0785	10.1	-0.00001	11.6	0.453	-0.00001	-0.0001	0.016	0.00493	-0.001	-0.003	0.0035	0.00284	0.00134
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-05-2015 11:51	5/26/2015	2.33	0.0064	0.00368	0.0032	0.0269	-0.0001	-0.00005	0.043	0.00003	141	-0.0005	-0.0001	0.00112	-0.03	-0.00005	0.0113	28.3	0.00016	0.121	-0.0005	0.609	0.0508	11.7	-0.00001	10.7	0.386	-0.00001	-0.0001	0.01	0.00843	0.0016	-0.003	-0.0032	0.0036	0.00312
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-07-2013 13:00	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-09-2014 12:42	9/30/2014	20.1	0.342	0.00063	0.00134	0.1	-0.0002	-0.001	0.037	0.000075	376	-0.0005	0.00054	0.0254	0.297	0.00012	0.0053	74.6	0.25	0.0728	-0.001	8.28	0.25	8.21	-0.00002	22.5	1.37	-0.00002	0.00058	0.044	0.00258	-0.002	-0.006	0.0094	0.00056	0.00109
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 12:00	5/26/2015	22.8	0.0677	0.00034	0.00112	0.0823	-0.0002	-0.0001	0.025	0.000068	370	-0.0005	0.00028	0.0185	0.058	-0.0001	0.0038	80.6	0.118	0.0804	-0.001	8.95	0.283	6.36	-0.00002	21.2	1.28	-0.00002	-0.0002	0.015	0.00184	-0.001	-0.006	0.0282	0.00029	0.00107
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-07-2013 13:10	7/30/2013	1.48	0.101	-0.0001	0.00017	0.00921	-0.0001	-0.0005	0.016	0.000126	83.8	-0.0005	-0.0001	0.00343	0.098	-0.00005	0.00501	29.1	0.00784	0.00441	-0.0005	1.87	0.0445	9.25	0.00001	5.24	0.298	-0.00001	-0.0001	0.011	0.000148	-0.001	0.0074	-0.003	-0.0001	0.00011
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-06-2014 10:02	6/26/2014	1.51	0.095	-0.0001	0.00019	0.0112	-0.0001	-0.0005	0.018	0.00014	110	-0.0005	-0.0001	0.00449	0.093	-0.00005	0.00393	35.8	0.00986	0.00396	-0.0005	1.94	0.0767	9.1	0.00001	6.18	0.354	-0.00001	-0.0001	0.019	0.000159	-0.001	0.009	-0.003	-0.0001	0.0001
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-09-2014 13:20	9/30/2014	13.3	0.877	0.00018	0.0011	0.134	-0.0001	-0.0005	0.031	0.000119	268	0.00085	0.00113	0.0538	0.886	0.00028	0.00268	61	0.502	0.0288	0.00212	6.05	0.148	8.28	0.00002	22.2	1.19	-0.00001	-0.0001	0.075	0.00137	0.0035	0.0076	0.0118	0.00016	0.00076
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-05-2015 12:25	5/26/2015	13.7	0.179	0.00023	0.00109	0.0454	-0.0001	-0.00005	0.022	0.0000839	195	-0.0005	0.00072	0.0503	0.219	0.00013	0.0016	46.4	0.349	0.0313	0.00128	5.47	0.0523	6.71	-0.00001	18	0.809	-0.00001	-0.0001	0.017	0.00107	0.00182	-0.003	0.0078	0.00022	0.00094
Bi-annual Seep Sampling	TSF Haul Road Seep 9	30-07-2013 13:21	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 1	30-05-2013 9:15	5/30/2013	#N/A	0.442	-0.0001	0.00031	0.041	0.00014	-0.0005	0.027	0.000049	63.5	-0.0005	0.0003	0.0216	0.341	0.00014	0.00106	20.2	0.0378	0.0113	0.00053	2.1	0.0705	6.63	2.9E-05	6.34	0.312	-0.00001	-0.0001	0.017	0.000023	0.0012	0.0072	0.033	-0.0001	0.00015

Location Type	Sample Point	Original Date As Is	Recoded Date	Barium (Ba) Dissolved (mg/L)	Beryllium (Be)-Dissolved (mg/L)	Bismuth (Bi)-Dissolved (mg/L)	Boron (B)-Dissolved (mg/L)	Cadmium (Cd)-Dissolved (mg/L)	Calcium (Ca)-Dissolved (mg/L)	Chromium (Cr)-Dissolved (mg/L)	Cobalt (Co)-Dissolved (mg/L)	Copper (Cu)-Dissolved (mg/L)	Iron (Fe)-Dissolved (mg/L)	Lead (Pb)-Dissolved (mg/L)	Lithium (Li)-Dissolved (mg/L)	Magnesium (Mg)-Dissolved (mg/L)	Manganese (Mn)-Dissolved (mg/L)	Molybdenum (Mo)-Dissolved (mg/L)	Nickel (Ni)-Dissolved (mg/L)	Potassium (K)-Dissolved (mg/L)	Selenium (Se)-Dissolved (mg/L)	Silicon (Si)-Dissolved (mg/L)	Silver (Ag)-Dissolved (mg/L)	Sodium (Na)-Dissolved (mg/L)	Strontium (Sr)-Dissolved (mg/L)	Thallium (Tl)-Dissolved (mg/L)	Tin (Sn)-Dissolved (mg/L)	Titanium (Ti)-Dissolved (mg/L)	Uranium (U)-Dissolved (mg/L)	Vanadium (V)-Dissolved (mg/L)	Zinc (Zn)-Dissolved (mg/L)		Julian Date	EC-Field
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			µs/cm
Bi-annual Seep Sampling	SERDS Seep 21	11/11/2015	11/11/2015	0.0807	-0.0002	-0.0001	0.045	0.000279	411	-0.0005	0.00401	0.0476	0.051	-0.0001	0.0033	74.3	2.06	0.117	0.0011	4.17	0.196	5.39	-0.00002	24.9	2.57	-0.00002	-0.0002	0.014	0.00315	-0.001	0.0075		2015.86	#N/A
Bi-annual Seep Sampling	SERDS Seep 3	6/6/2013	6/6/2013	0.172	-0.0001	-0.0005	0.058	0.000086	267	-0.0005	0.00016	0.00439	-0.03	-0.00005	-0.0005	66	0.0503	0.0242	0.00113	5.33	0.0122	5.86	-0.00001	25.3	5.63	-0.00001	-0.0001	-0.01	0.000132	-0.001	-0.003		2013.43	1663
Bi-annual Seep Sampling	SERDS Seep 3	3/6/2014	3/6/2014	0.0925	-0.0002	-0.001	0.055	-0.0003	423	-0.0005	0.0024	0.0227	0.03	-0.0001	0.0024	89.7	1.48	0.0499	0.0017	4.58	0.145	6.24	-0.00002	26.8	4.94	-0.00002	-0.0002	-0.01	0.00181	-0.002	0.005		2014.18	#N/A
Bi-annual Seep Sampling	SERDS Seep 4	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	1633
Bi-annual Seep Sampling	SERDS Seep 4	3/6/2014	3/6/2014	0.0547	-0.0001	-0.0005	0.057	-0.0002	286	-0.0005	0.00174	0.0209	-0.03	-0.00005	0.00237	66.8	0.635	0.074	0.00099	3.86	0.0939	8.03	-0.00001	20.3	2.9	-0.00001	-0.0001	-0.01	0.00129	-0.001	0.0035		2014.18	#N/A
Bi-annual Seep Sampling	SERDS Seep 5	6/6/2013	6/6/2013	0.098	-0.0002	-0.001	0.107	-0.0002	343	-0.0005	0.00053	0.0157	-0.03	-0.0001	0.0047	77	0.366	0.241	-0.001	4.22	0.0254	5.18	-0.00002	34.2	9.73	-0.00002	-0.0002	-0.01	0.00234	-0.002	-0.003		2013.43	2025
Bi-annual Seep Sampling	SERDS Seep 5	3/6/2014	3/6/2014	0.113	-0.0002	-0.001	0.106	-0.0002	387	-0.0005	0.00206	0.0639	-0.03	-0.0001	0.0032	87.4	1.47	0.106	0.0011	4.41	0.0709	7.45	-0.00002	27.2	5.65	-0.00002	-0.0002	-0.01	0.00194	-0.002	-0.003		2014.18	#N/A
Bi-annual Seep Sampling	SERDS Seep 6	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	1317
Bi-annual Seep Sampling	SERDS Seep 7	6/6/2013	6/6/2013	0.063	-0.0001	-0.0005	0.101	-0.00007	263	-0.0005	0.00034	0.00882	0.037	-0.00005	0.00717	59.4	0.112	0.158	-0.0005	4.74	0.0261	7.22	-0.00001	24.3	5.73	-0.00001	-0.0001	0.013	0.000893	-0.001	-0.003		2013.43	1613
Bi-annual Seep Sampling	SERDS Seep 8	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	1324
Bi-annual Seep Sampling	SERDS Seep 8	3/6/2014	3/6/2014	0.0657	-0.0001	-0.0005	0.078	-0.0002	264	-0.0005	0.00118	0.0115	-0.03	-0.00005	0.00562	58.7	0.435	0.152	0.00072	2.96	0.0874	8	-0.00001	18.1	3.96	-0.00001	-0.0001	-0.01	0.000839	-0.001	0.0034		2014.18	#N/A
Bi-annual Seep Sampling	SERDS Seep 9	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.43	1417
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-06-2014 8:47	6/26/2014	0.0208	-0.0001	-0.0005	0.012	-0.00001	64.3	-0.0005	-0.0001	0.00689	-0.03	-0.00005	0.00242	18.6	0.0124	0.00447	0.00115	0.575	0.00114	8.24	-0.00001	5.67	0.242	-0.00001	-0.0001	0.01	0.000184	-0.001	-0.003		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-05-2015 11:10	5/26/2015	0.0308	-0.0001	-0.00005	0.056	0.000042	137	-0.0005	0.00038	0.0121	-0.03	-0.00005	0.003	29	0.314	0.0869	-0.0005	1.55	0.0648	4.34	-0.00001	13	0.569	-0.00001	-0.0001	-0.01	0.00127	0.00083	-0.003		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 11	30-07-2013 13:52	7/30/2013	0.0332	-0.0001	-0.0005	0.018	0.000079	85.3	-0.0005	0.00012	0.00519	-0.03	-0.00005	0.00351	24.9	0.00763	0.00124	0.00106	1.38	0.0347	8.78	-0.00001	6.33	0.305	-0.00001	-0.0001	-0.01	0.000016	-0.001	0.0051		2013.57	734
Bi-annual Seep Sampling	TSF Haul Road Seep 11	26-11-2013 11:06	11/26/2013	0.0255	-0.0001	-0.0005	0.015	0.000054	72	-0.0005	-0.0001	0.00525	-0.03	-0.00005	0.00232	20.4	0.00491	0.00139	0.00091	1.23	0.0187	9.42	-0.00001	5.81	0.25	-0.00001	-0.0001	0.011	0.000021	-0.001	0.0034		2013.9	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 12	30-07-2013 14:05	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.57	650
Bi-annual Seep Sampling	TSF Haul Road Seep 12	26-06-2014 10:45	6/26/2014	0.092	-0.0001	-0.0005	0.022	0.00004	219	-0.0005	0.00015	0.00805	-0.03	-0.00005	0.00267	50.9	0.125	0.0136	0.00053	2.79	0.112	5.49	-0.00001	10.8	0.796	-0.00001	-0.0001	0.018	0.000439	-0.001	-0.003		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 12	11/5/2015	11/5/2015	0.0657	-0.0001	-0.00005	0.019	0.0000237	158	-0.0005	0.00015	0.00861	-0.03	-0.00005	0.0019	39.3	0.119	0.0197	-0.0005	2.58	0.0539	7.21	-0.00001	9.29	0.575	-0.00001	-0.0001	-0.01	0.000224	-0.0005	-0.003		2015.84	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 14	26-05-2015 11:28	5/26/2015	0.0172	-0.0001	-0.00005	0.039	0.0000142	89.8	-0.0005	-0.0001	0.00697	-0.03	-0.00005	0.003	21	0.0675	0.108	-0.0005	0.272	0.0332	6.47	-0.00001	12.1	0.328	-0.00001	-0.0001	-0.01	0.000469	0.00081	-0.003		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 15	26-06-2014 9:30	6/26/2014	0.145	-0.0002	-0.001	0.074	-0.0002	364	-0.0005	-0.0002	0.007	-0.03	-0.0001	0.0031	83.1	0.106	0.213	0.0011	4.22	0.285	1.87	-0.00002	40.8	1.29	-0.00002	-0.0002	0.019	0.000777	-0.002	-0.003		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 16	30-09-2014 12:56	9/30/2014	0.108	-0.0002	-0.001	0.031	0.00011	337	-0.0005	0.00072	0.0246	0.031	-0.0001	-0.001	65.7	0.501	0.0344	-0.001	8.35	0.143	5.72	-0.00002	29.3	1.55	-0.00002	-0.0002	0.027	0.000261	-0.002	0.0038		2014.74	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 16	11/5/2015	11/5/2015	0.0556	-0.0001	-0.00005	0.029	0.0000198	282	-0.0005	0.00016	0.00475	-0.03	-0.00005	0.0034	56.5	0.00519	0.091	-0.0005	2.71	0.0942	7.74	-0.00001	14.2	2.13	-0.00001	-0.0001	-0.01	0.00103	-0.0005	-0.003		2015.84	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 16	26-05-2015 12:10	5/26/2015	0.0988	-0.0002	-0.0001	0.025	0.000079	316	-0.0005	0.0003	0.0173	-0.03	-0.0001	-0.002	67.1	0.142	0.0586	-0.001	7.77	0.15	5.72	-0.00002	25.5	1.42	-0.00002	-0.0002	0.012	0.000161	-0.001	0.0037		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 3	30-07-2013 12:23	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.57	1123
Bi-annual Seep Sampling	TSF Haul Road Seep 4	30-07-2013 12:27	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.57	1419
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-07-2013 12:37	7/30/2013	0.0405	-0.0001	-0.0005	0.043	-0.00006	124	-0.0005	-0.0001	0.00129	-0.03	-0.00005	0.00899	23.9	0.012	0.0975	-0.0005	1.22	0.0471	9.37	-0.00001	11.4	0.434	-0.00001	-0.0001	-0.01	0.00558	-0.001	0.0033		2013.57	846
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-06-2014 9:39	6/26/2014	0.0487	-0.0001	-0.0005	0.041	-0.00006	163	-0.0005	-0.0001	0.00346	-0.03	-0.00005	0.00434	33.5	0.174	0.0957	-0.0005	1.95	0.0603	7.41	-0.00001	13.3	0.537	-0.00001	-0.0001	0.016	0.00282	-0.001	-0.003		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-09-2014 12:29	9/30/2014	0.0268	-0.0001	-0.0005	0.05	0.000079	146	-0.0005	-0.0001	0.00422	-0.03	-0.00005	0.0139	28	0.0267	0.129	-0.0005	0.758	0.057	11.7	-0.00001	10.8	0.486	-0.00001	-0.0001	0.019	0.0119	0.0018	0.0038		2014.74	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-05-2015 11:40	5/26/2015	0.0273	-0.0001	-0.00005	0.044	0.0000809	155	-0.0005	-0.0001	0.00431	-0.03	-0.00005	0.011	30.5	0.0109	0.169	-0.0005	0.727	0.0708	11.2	-0.00001	12.5	0.43	-0.00001	-0.0001	0.01	0.00898	0.00169	0.0035		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 6	30-07-2013 12:50	7/30/2013	0.0294	-0.0001	-0.0005	0.041	-0.00005	105	-0.0005	-0.0001	0.00075	-0.03	-0.00005	0.00905	20	0.000298	0.0966	-0.0005	0.487	0.0315	10.3	-0.00001	9.27	0.342	-0.00001	-0.0001	-0.01	0.00583	-0.001	-0.003		2013.57	734
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-06-2014 9:50	6/26/2014	0.041	-0.0001	-0.0005	0.039	-0.00005	149	-0.0005	-0.0001	0.00087	-0.03	-0.00005	0.00625	28.1	0.000522	0.122	-0.0005	0.839	0.0762	9.76	-0.00001	11	0.428	-0.00001	-0.0001	0.015	0.0048	-0.001	-0.003		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-05-2015 11:51	5/26/2015	0.0263	-0.0001	-0.00005	0.04	0.0000203	136	-0.0005	-0.0001	0.00091	-0.03	-0.00005	0.0108	26.3	-0.0001	0.117	-0.0005	0.596	0.0493	11.3	-0.00001	10.3	0.37	-0.00001	-0.0001	-0.01	0.00847	0.0014	-0.003		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-07-2013 13:00	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.57	1088
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-09-2014 12:42	9/30/2014	0.0929	-0.0002	-0.001	0.032	0.000075	370	-0.0005	0.00027	0.0136	-0.03	-0.0001	0.0042	70.6	0.225	0.0649	-0.001	8.06	0.248	7.45	-0.00002	21.5	1.22	-0.00002	-0.0002	0.027	0.00229	-0.002	0.004		2014.74	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 12:00	5/26/2015	0.0845	-0.0002	-0.0001	0.024	0.000061	376	-0.0005	0.00026	0.0172	0.033	-0.0001	0.0035	82.9	0.12	0.0804	-0.001	9	0.28	6.35	-0.00002	21.8	1.29	-0.00002	-0.0002	0.014	0.00184	-0.001	0.0032		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-07-2013 13:10	7/30/2013	0.00746	-0.0001	-0.0005	0.015	0.00011	81.7	-0.0005	-0.0001	0.00092	-0.03	-0.00005	0.00481	28.1	0.00462	0.00415	-0.0005	1.82	0.0423	8.78	-0.00001	5.26	0.282	-0.00001	-0.0001	-0.01	0.000134	-0.001	0.0063		2013.57	666
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-06-2014 10:02	6/26/2014	0.01	-0.0001	-0.0005	0.017	0.000147	109	-0.0005	-0.0001	0.00177	-0.03	-0.00005	0.00374	35.5	0.00662	0.0038	-0.0005	1.92	0.0744	8.79	-0.00001	6.37	0.357	-0.00001	-0.0001	0.013	0.000153	-0.001	0.0074		2014.48	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-09-2014 13:20	9/30/2014	0.124	-0.0001	-0.0005	0.031	0.000105	278	-0.0005	0.00053	0.0284	-0.03	-0.00005	0.00204	62.7	0.48	0.0311	0.00148	6.11	0.152	6.66	-0.00001	22.7	1.29	-0.00001	-0.0001	0.026	0.00142	-0.001	-0.003		2014.74	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-05-2015 12:25	5/26/2015	0.0422	-0.0001	-0.00005	0.022	0.0000768	198	-0.0005	0.00054	0.0434	-0.03	-0.00005	0.0017	47.2	0.329	0.0332	0.00094	5.21	0.0545	6.54	-0.00001	17.7	0.809	-0.00001	-0.0001	0.011	0.00111	0.00098	-0.003		2015.4	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 9	30-07-2013 13:21	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		2013.57	985
Bi-annual Seep Sampling	Waste Haul Road Seep 1	30-05-2013 9:15	5/30/2013	0.0387	-0.0001	-0.0005	0.027	0.000047	64.8	-0.0005	-0.0001	0.00556	-0.03	-0.00005	0.00089	20.4	0.0208	0.0113	-0.0005	2.1	0.0709	6.14	-0.00001	6.35	0.324	-0.00001	-0.0001	-0.01	-0.00001	-0.001	0.005		2013.41	594

Location Type	Sample Point	Original Date As Is	Recoded Date	pH-field	Q	T	Turbidity-Field	EC	Hardness	pH	TDS	TSS	Turbidity	Alkalinity	NH3	Cl	F	NO3	NO3+NO2	NO2	PO4	P-D	P-T	SO4	N-T
					m3/s	C	NTU	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	SERDS Seep 21	11/11/2015	11/11/2015	#N/A	#N/A	#N/A	#N/A	2420	1330	7.95	2100	5	1.48	105	0.0112	5	0.2	96.9	97	0.098	0.0325	0.0357	0.0557	985	98.3
Bi-annual Seep Sampling	SERDS Seep 3	6/6/2013	6/6/2013	7.4	0.001	15.6	#N/A	1670	939	7.81	1540	272	134	57.8	0.0196	2.5	0.1	5.88	5.88	0.005	0.0005	0.014	0.521	974	7.71
Bi-annual Seep Sampling	SERDS Seep 3	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	2400	1430	7.79	2170	17.7	5.34	70.7	0.185	11	0.2	88.5	89.7	1.24	0.0098	0.0197	0.0501	1130	83
Bi-annual Seep Sampling	SERDS Seep 4	6/6/2013	6/6/2013	7.5	0.003	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 4	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1760	988	7.92	1510	15.7	4.89	67.8	0.181	5.8	0.1	53.4	54	0.584	0.0195	0.0281	0.036	786	51.8
Bi-annual Seep Sampling	SERDS Seep 5	6/6/2013	6/6/2013	7.5	0.003	9.1	#N/A	2010	1170	8	1820	9	7.95	112	0.0769	5	0.2	5.98	6.01	0.028	0.0186	0.0357	0.0597	1210	6.14
Bi-annual Seep Sampling	SERDS Seep 5	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	2190	1330	8.07	2030	14.8	6.41	106	0.0644	13	0.2	55.1	55.5	0.337	0.0137	0.0243	0.044	1110	52.1
Bi-annual Seep Sampling	SERDS Seep 6	6/6/2013	6/6/2013	8.2	0.001	10.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 7	6/6/2013	6/6/2013	7.9	0.01	7	#N/A	1570	902	8.01	1240	31.8	15.9	104	0.0709	2.5	0.25	12.5	12.6	0.063	0.0674	0.0879	0.133	828	12.2
Bi-annual Seep Sampling	SERDS Seep 8	6/6/2013	6/6/2013	7.9	0.005	5.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	SERDS Seep 8	3/6/2014	3/6/2014	#N/A	#N/A	#N/A	#N/A	1630	901	7.92	1390	6.7	2.35	70.9	0.0713	2.5	0.1	45.8	46	0.168	0.0354	0.0461	0.058	737	43.5
Bi-annual Seep Sampling	SERDS Seep 9	6/6/2013	6/6/2013	7.6	0	11.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-06-2014 8:47	6/26/2014	#N/A	#N/A	#N/A	#N/A	440	237	8.3	315	16.3	8.09	198	0.0025	0.25	0.132	0.0025	0.00255	0.0005	0.0012	0.0066	0.0766	51.9	0.351
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-05-2015 11:10	5/26/2015	#N/A	#N/A	#N/A	#N/A	896	462	8.1	684	221	7.54	94.9	0.0109	1.1	0.114	6.21	6.22	0.01	0.0076	0.0097	0.465	371	6.24
Bi-annual Seep Sampling	TSF Haul Road Seep 11	30-07-2013 13:52	7/30/2013	7.4	0.002	8.7	#N/A	658	315	7.41	542	98.5	39.2	59.2	0.0025	3.71	0.087	35	35	0.0081	0.0127	0.0159	0.233	148	35
Bi-annual Seep Sampling	TSF Haul Road Seep 11	26-11-2013 11:06	11/26/2013	#N/A	#N/A	#N/A	#N/A	555	264	7.35	413	14.9	11	58.9	0.0025	3.1	0.095	19.9	19.9	0.0021	0.0105	0.0131	0.0452	132	19
Bi-annual Seep Sampling	TSF Haul Road Seep 12	30-07-2013 14:05	7/30/2013	8	0.002	7.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 12	26-06-2014 10:45	6/26/2014	#N/A	#N/A	#N/A	#N/A	1480	757	7.98	1160	4.9	1.18	96.6	0.0352	6.1	0.1	60.7	60.8	0.106	0.0011	0.0066	0.0538	533	54.8
Bi-annual Seep Sampling	TSF Haul Road Seep 12	11/5/2015	11/5/2015	#N/A	#N/A	#N/A	#N/A	1030	557	8.14	754	13.4	3.53	90	0.021	1.25	0.12	21.4	21.4	0.0414	0.0098	0.0148	0.0495	397	20.5
Bi-annual Seep Sampling	TSF Haul Road Seep 14	26-05-2015 11:28	5/26/2015	#N/A	#N/A	#N/A	#N/A	629	311	8.02	425	3.4	0.73	80.8	0.0115	0.25	0.28	4.59	4.59	0.0068	0.0005	0.0035	0.0375	226	4.79
Bi-annual Seep Sampling	TSF Haul Road Seep 15	26-06-2014 9:30	6/26/2014	#N/A	#N/A	#N/A	#N/A	2160	1250	8.11	1590	4.7	0.75	122	0.0159	5	0.2	55.2	55.2	0.059	0.0005	0.0059	0.0146	1080	50.6
Bi-annual Seep Sampling	TSF Haul Road Seep 16	30-09-2014 12:56	9/30/2014	#N/A	#N/A	#N/A	#N/A	1930	1110	7.68	1630	17.9	10.8	84	0.052	5	0.2	49.2	49.3	0.077	0.0278	0.0398	0.0939	933	45
Bi-annual Seep Sampling	TSF Haul Road Seep 16	11/5/2015	11/5/2015	#N/A	#N/A	#N/A	#N/A	1640	936	8.04	1370	24.8	5.66	93.2	0.0025	2.5	0.1	46.1	46.1	0.005	0.0259	0.0306	0.116	714	44.5
Bi-annual Seep Sampling	TSF Haul Road Seep 16	26-05-2015 12:10	5/26/2015	#N/A	#N/A	#N/A	#N/A	1900	1070	7.81	1710	14.6	4.15	65.7	0.0205	2.5	0.1	34.5	34.5	0.029	0.0365	0.0488	0.0665	945	34.3
Bi-annual Seep Sampling	TSF Haul Road Seep 3	30-07-2013 12:23	7/30/2013	7.9	0	21.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 4	30-07-2013 12:27	7/30/2013	7.5	0	18.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-07-2013 12:37	7/30/2013	7.8	0.008	8.4	#N/A	829	407	8.02	665	5	0.58	109	0.0057	2.5	0.75	15.4	15.4	0.005	0.0041	0.0079	0.011	284	15.5
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-06-2014 9:39	6/26/2014	#N/A	#N/A	#N/A	#N/A	1020	545	8.09	670	1.5	0.79	137	0.0118	2.5	0.41	13.6	13.6	0.022	0.0015	0.0033	0.0123	394	12.8
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-09-2014 12:29	9/30/2014	#N/A	#N/A	#N/A	#N/A	872	480	7.87	630	1.5	0.17	114	0.0025	2.5	0.62	13.1	13.1	0.013	0.0139	0.0187	0.0132	319	12.4
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-05-2015 11:40	5/26/2015	#N/A	#N/A	#N/A	#N/A	965	512	8.16	727	1.5	0.3	108	0.0025	2.2	0.593	13.7	13.7	0.001	0.01	0.0123	0.0147	371	13.5
Bi-annual Seep Sampling	TSF Haul Road Seep 6	30-07-2013 12:50	7/30/2013	8	0.001	7.4	#N/A	698	345	7.99	544	4.9	0.98	99.9	0.0025	1.25	0.71	12.9	12.9	0.0025	0.0044	0.0084	0.0106	225	13.1
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-06-2014 9:50	6/26/2014	#N/A	#N/A	#N/A	#N/A	933	488	8.05	696	1.5	0.17	103	0.0025	2.5	0.55	16.9	16.9	0.005	0.0115	0.0151	0.0162	352	14.9
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-05-2015 11:51	5/26/2015	#N/A	#N/A	#N/A	#N/A	865	447	8.14	665	5.6	0.4	106	0.0025	2	0.613	10.7	10.7	0.001	0.0099	0.0128	0.0142	322	10.6
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-07-2013 13:00	7/30/2013	7.5	0	20.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-09-2014 12:42	9/30/2014	#N/A	#N/A	#N/A	#N/A	2010	1210	7.9	1760	12	3.56	140	0.0765	5	0.2	59.3	59.4	0.085	0.0894	0.109	0.144	937	53.7
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 12:00	5/26/2015	#N/A	#N/A	#N/A	#N/A	2160	1280	7.98	1960	1.5	0.71	115	0.0193	5	0.2	46.3	46.4	0.022	0.0727	0.0938	0.185	1080	44.9
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-07-2013 13:10	7/30/2013	8	0.003	6.6	#N/A	637	320	7.81	475	6.2	0.88	93	0.0025	2.09	0.175	15.6	15.6	0.0036	0.0027	0.004	0.0098	179	15.4
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-06-2014 10:02	6/26/2014	#N/A	#N/A	#N/A	#N/A	802	419	7.88	596	3.3	0.8	91.6	0.0025	2.5	0.1	18.4	18.4	0.005	0.004	0.0057	0.0207	276	17.9
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-09-2014 13:20	9/30/2014	#N/A	#N/A	#N/A	#N/A	1700	952	7.86	1410	46.1	19.1	106	0.0203	5	0.2	52.3	52.4	0.167	0.0297	0.038	0.0565	718	49.4
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-05-2015 12:25	5/26/2015	#N/A	#N/A	#N/A	#N/A	1280	690	8.03	1050	1.5	0.84	71.6	0.0062	2.7	0.05	21.1	21.1	0.0114	0.0351	0.0353	0.0434	570	20.3
Bi-annual Seep Sampling	TSF Haul Road Seep 9	30-07-2013 13:21	7/30/2013	7.6	0	16.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 1	30-05-2013 9:15	5/30/2013	7	0.001	2.4	#N/A	525	246	7.25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Location Type	Sample Point	Original Date As Is	Recoded Date	DOC	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D	Se/SO4	Ca	Mg+K+Na	(Mg+K+Na)/Ca	Zn/Cd	Year
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/mgS	meq/L	meq/L	meq/meq		Year
Bi-annual Seep Sampling	SERDS Seep 21	11/11/2015	11/11/2015	13.1	0.0106	0.00045	0.0007	0.0807	0.0001	0.00005	0.045	0.00028	411	0.00025	0.00401	0.0476	0.051	0.00005	0.0033	74.3	2.06	0.117	0.0011	4.17	0.196	5.39	0.00001	24.9	2.57	0.00001	0.0001	0.014	0.00315	0.0005	0.0075	0.000596954	20.55	5.52189	0.26870527	26.8817	2015
Bi-annual Seep Sampling	SERDS Seep 3	6/6/2013	6/6/2013	14.8	0.0308	0.00048	0.00048	0.172	0.00005	0.00025	0.058	8.6E-05	267	0.00025	0.00016	0.00439	0.015	2.5E-05	0.00025	66	0.0503	0.0242	0.00113	5.33	0.0122	5.86	5E-06	25.3	5.63	5E-06	0.00005	0.005	0.00013	0.0005	0.0015	3.7577E-05	13.35	5.08506	0.380903608	17.4419	2013
Bi-annual Seep Sampling	SERDS Seep 3	3/6/2014	3/6/2014	14.2	0.0342	0.0004	0.00067	0.0925	0.0001	0.0005	0.055	0.00015	423	0.00025	0.0024	0.0227	0.03	0.00005	0.0024	89.7	1.48	0.0499	0.0017	4.58	0.145	6.24	0.00001	26.8	4.94	0.00001	0.0001	0.005	0.00181	0.001	0.005	0.000384956	21.15	6.51297	0.307942033	33.3333	2014
Bi-annual Seep Sampling	SERDS Seep 4	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	SERDS Seep 4	3/6/2014	3/6/2014	9.02	0.0148	0.00029	0.00064	0.0547	0.00005	0.00025	0.057	0.0001	286	0.00025	0.00174	0.0209	0.015	2.5E-05	0.00237	66.8	0.635	0.074	0.00099	3.86	0.0939	8.03	5E-06	20.3	2.9	5E-06	0.00005	0.005	0.00129	0.0005	0.0035	0.000358397	14.3	4.87663	0.341022852	35	2014
Bi-annual Seep Sampling	SERDS Seep 5	6/6/2013	6/6/2013	14.9	0.0163	0.00061	0.00107	0.098	0.0001	0.0005	0.107	0.0001	343	0.00025	0.00053	0.0157	0.015	0.00005	0.0047	77	0.366	0.241	0.0005	4.22	0.0254	5.18	0.00001	34.2	9.73	0.00001	0.0001	0.005	0.00234	0.001	0.0015	6.29752E-05	17.15	6.08496	0.354808021	15	2013
Bi-annual Seep Sampling	SERDS Seep 5	3/6/2014	3/6/2014	0.61	0.0183	0.00038	0.00092	0.113	0.0001	0.0005	0.106	0.0001	387	0.00025	0.00206	0.0639	0.015	0.00005	0.0032	87.4	1.47	0.106	0.0011	4.41	0.0709	7.45	0.00001	27.2	5.65	0.00001	0.0001	0.005	0.00194	0.001	0.0015	0.000191622	19.35	6.3919	0.330330518	15	2014
Bi-annual Seep Sampling	SERDS Seep 6	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	SERDS Seep 7	6/6/2013	6/6/2013	12.7	0.008	0.00038	0.00091	0.063	0.00005	0.00025	0.101	3.5E-05	263	0.00025	0.00034	0.00882	0.037	2.5E-05	0.00717	59.4	0.112	0.158	0.00025	4.74	0.0261	7.22	5E-06	24.3	5.73	5E-06	0.00005	0.013	0.00089	0.0005	0.0015	9.45652E-05	13.15	4.64162	0.352974681	42.8571	2013
Bi-annual Seep Sampling	SERDS Seep 8	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	SERDS Seep 8	3/6/2014	3/6/2014	6.71	0.0073	0.00026	0.00056	0.0657	0.00005	0.00025	0.078	0.0001	264	0.00025	0.00118	0.0115	0.015	2.5E-05	0.00562	58.7	0.435	0.152	0.00072	2.96	0.0874	8	5E-06	18.1	3.96	5E-06	0.00005	0.005	0.00084	0.0005	0.0034	0.000355767	13.2	4.28559	0.324666249	34	2014
Bi-annual Seep Sampling	SERDS Seep 9	6/6/2013	6/6/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-06-2014 8:47	6/26/2014	9.79	0.0052	0.00005	0.00048	0.0208	0.00005	0.00025	0.012	5E-06	64.3	0.00025	0.00005	0.00689	0.015	2.5E-05	0.00242	18.6	0.0124	0.00447	0.00115	0.575	0.00114	8.24	5E-06	5.67	0.242	5E-06	0.00005	0.01	0.00018	0.0005	0.0015	6.5896E-05	3.215	1.34581	0.41860449	300	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 1	26-05-2015 11:10	5/26/2015	2.33	0.0069	0.00032	0.00072	0.0308	0.00005	2.5E-05	0.056	4.2E-05	137	0.00025	0.00038	0.0121	0.015	2.5E-05	0.003	29	0.314	0.0869	0.00025	1.55	0.0648	4.34	5E-06	13	0.569	5E-06	0.00005	0.005	0.00127	0.00083	0.0015	0.000523989	6.85	2.29592	0.335171253	35.7143	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 11	30-07-2013 13:52	7/30/2013	4.55	0.0096	0.00005	0.00011	0.0332	0.00005	0.00025	0.018	7.9E-05	85.3	0.00025	0.00012	0.00519	0.015	2.5E-05	0.00351	24.9	0.00763	0.00124	0.00106	1.38	0.0347	8.78	5E-06	6.33	0.305	5E-06	0.00005	0.005	1.6E-05	0.0005	0.0051	0.000703378	4.265	1.7625	0.413246671	64.557	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 11	26-11-2013 11:06	11/26/2013	3.87	0.0075	0.00005	0.00005	0.0255	0.00005	0.00025	0.015	5.4E-05	72	0.00025	0.00005	0.00525	0.015	2.5E-05	0.00232	20.4	0.00491	0.00139	0.00091	1.23	0.0187	9.42	5E-06	5.81	0.25	5E-06	0.00005	0.011	2.1E-05	0.0005	0.0034	0.000425	3.6	1.47365	0.409347647	62.963	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 12	30-07-2013 14:05	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 12	26-06-2014 10:45	6/26/2014	7.01	0.0015	0.00005	0.00039	0.092	0.00005	0.00025	0.022	0.00004	219	0.00025	0.00015	0.00805	0.015	2.5E-05	0.00267	50.9	0.125	0.0136	0.00053	2.79	0.112	5.49	5E-06	10.8	0.796	5E-06	0.00005	0.018	0.00044	0.0005	0.0015	0.000630394	10.95	3.50903	0.320459699	37.5	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 12	11/5/2015	11/5/2015	6.62	0.0051	0.00014	0.00043	0.0657	0.00005	2.5E-05	0.019	2.4E-05	158	0.00025	0.00015	0.00861	0.015	2.5E-05	0.0019	39.3	0.119	0.0197	0.00025	2.58	0.0539	7.21	5E-06	9.29	0.575	5E-06	0.00005	0.005	0.00022	0.00025	0.0015	0.000407305	7.9	2.76161	0.349571149	63.2911	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 14	26-05-2015 11:28	5/26/2015	2.9	0.0034	0.00036	0.00076	0.0172	0.00005	2.5E-05	0.039	1.4E-05	89.8	0.00025	0.00005	0.00697	0.015	2.5E-05	0.003	21	0.0675	0.108	0.00025	0.272	0.0332	6.47	5E-06	12.1	0.328	5E-06	0.00005	0.005	0.00047	0.00081	0.0015	0.000440708	4.49	1.75755	0.391436773	105.634	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 15	26-06-2014 9:30	6/26/2014	9.01	0.0041	0.00022	0.00041	0.145	0.0001	0.0005	0.074	0.0001	364	0.00025	0.0001	0.007	0.015	0.00005	0.0031	83.1	0.106	0.213	0.0011	4.22	0.285	1.87	0.00001	40.8	1.29	0.00001	0.0001	0.019	0.00078	0.001	0.0015	0.000791667	18.2	6.7276	0.369648309	15	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 16	30-09-2014 12:56	9/30/2014	20.4	0.0179	0.0001	0.00057	0.108	0.0001	0.0005	0.031	0.00011	337	0.00025	0.00072	0.0246	0.031	0.00005	0.0005	65.7	0.501	0.0344	0.0005	8.35	0.143	5.72	0.00001	29.3	1.55	0.00001	0.0001	0.027	0.00026	0.001	0.0038	0.000459807	16.85	5.31892	0.315662872	34.5455	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 16	11/5/2015	11/5/2015	8.03	0.004	0.0003	0.00053	0.0556	0.00005	2.5E-05	0.029	2E-05	282	0.00025	0.00016	0.00475	0.015	2.5E-05	0.0034	56.5	0.00519	0.091	0.00025	2.71	0.0942	7.74	5E-06	14.2	2.13	5E-06	0.00005	0.005	0.00103	0.00025	0.0015	0.000395798	14.1	3.98134	0.282364477	75.7576	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 16	26-05-2015 12:10	5/26/2015	19.5	0.0208	0.0002	0.0006	0.0988	0.0001	0.00005	0.025	7.9E-05	316	0.00025	0.0003	0.0173	0.015	0.00005	0.001	67.1	0.142	0.0586	0.0005	7.77	0.15	5.72	0.00001	25.5	1.42	0.00001	0.0001	0.012	0.00016	0.0005	0.0037	0.00047619	15.8	5.22046	0.330409042	46.8354	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 3	30-07-2013 12:23	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 4	30-07-2013 12:27	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-07-2013 12:37	7/30/2013	3.36	0.0015	0.00287	0.00208	0.0405	0.00005	0.00025	0.043	0.00003	124	0.00025	0.00005	0.00129	0.015	2.5E-05	0.00899	23.9	0.012	0.0975	0.00025	1.22	0.0471	9.37	5E-06	11.4	0.434	5E-06	0.00005	0.005	0.00558	0.0005	0.0033	0.000497535	6.2	1.92052	0.309731328	110	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-06-2014 9:39	6/26/2014	6.98	0.0054	0.00151	0.00052	0.0487	0.00005	0.00025	0.041	0.00003	163	0.00025	0.00005	0.00346	0.015	2.5E-05	0.00434	33.5	0.174	0.0957	0.00025	1.95	0.0603	7.41	5E-06	13.3	0.537	5E-06	0.00005	0.016	0.00282	0.0005	0.0015	0.000459137	8.15	2.58161	0.31676241	50	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 5	30-09-2014 12:29	9/30/2014	2.13	0.0015	0.00388	0.00281	0.0266	0.00005	0.00025	0.05	7.9E-05	146	0.00025	0.00005	0.00422	0.015	2.5E-05	0.0139	28	0.0267	0.129	0.00025	0.758	0.057	11.7	5E-06	10.8	0.466	5E-06	0.00005	0.019	0.00119	0.0018	0.0038	0.00053605	7.3	2.12165	0.290637558	48.1013	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 5	26-05-2015 11:40	5/26/2015	2.18	0.0015	0.00342	0.00309	0.0273	0.00005	2.5E-05	0.044	8.1E-05	155	0.00025	0.00005	0.00431	0.015	2.5E-05	0.011	30.5	0.0109	0.169	0.00025	0.727	0.0708	11.2	5E-06	12.5	0.43	5E-06	0.00005	0.01	0.00898	0.00169	0.0035	0.000572507	7.75	2.34054	0.302005799	43.2633	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 6	30-07-2013 12:50	7/30/2013	2.37	0.0039	0.0033	0.00216	0.0294	0.00005	0.00025	0.041	2.5E-05	105	0.00025	0.00005	0.00075	0.015	2.5E-05	0.00905	20	0.0003	0.0966	0.00025	0.487	0.0315	10.3	5E-06	9.27	0.342	5E-06	0.00005	0.005	0.00583	0.0005	0.0015	0.00042	5.25	1.58171	0.301278365	60	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 6	26-06-2014 9:50	6/26/2014	3.03	0.0035	0.00284	0.00134	0.041	0.00005	0.00025	0.039	2.5E-05	149	0.00025	0.00005	0.00087	0.015	2.5E-05	0.00625	28.1	0.00052	0.122	0.00025	0.839	0.0762	9.76	5E-06	11	0.428	5E-06	0.00005	0.015	0.0048	0.0005	0.0015	0.000649432	7.45	2.13826	0.28701445	60	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 11:51	5/26/2015	2.33	0.0032	0.0036	0.00312	0.0263	0.00005	2.5E-05	0.04	2E-05	136	0.00025	0.00005	0.00091	0.015	2.5E-05	0.0108	26.3	0.00005	0.117	0.00025	0.596	0.0493	11.3	5E-06	10.3	0.37	5E-06	0.00005	0.005	0.00847	0.0014	0.0015	0.000459317	6.8	1.99664	0.293622917	73.8916	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-07-2013 13:00	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 7	30-09-2014 12:42	9/30/2014	20.1	0.0094	0.00056	0.00109	0.0929	0.0001	0.0005	0.032	7.5E-05	370	0.00025	0.00027	0.0136	0.015	0.00005	0.0042	70.6	0.225	0.0649	0.0005	8.06	0.248	7.45	0.00001	21.5	1.22	0.00001	0.0001	0.027	0.00229	0.001	0.004	0.000794023	18.5	5.25807	0.284219857	53.3333	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 7	26-05-2015 12:00	5/26/2015	22.8	0.0282	0.00029	0.00107	0.0845	0.0001	0.00005	0.024	6.1E-05	376	0.00025	0.00026	0.0172	0.033	0.00005	0.0035	82.9	0.12	0.0804	0.0005	9	0.28	6.35	0.00001	21.8	1.29	0.00001	0.0001	0.014	0.00184	0.0005	0.0032	0.000777778	18.8	6.01241	0.319809285	52.459	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-07-2013 13:10	7/30/2013	1.48	0.0015	0.00005	0.00011	0.00746	0.00005	0.00025	0.015	0.00011	81.7	0.00025	0.00005	0.00092	0.015	2.5E-05	0.00481	28.1	0.00462	0.00415	0.00025	1.82	0.0423	8.78	5E-06	5.26	0.282	5E-06	0.00005	0.005	0.00013	0.0005	0.0063	0.000708939	4.085	1.91385	0.468505822	57.2727	2013
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-06-2014 10:02	6/26/2014	1.51	0.0015	0.00005	0.0001	0.01	0.00005	0.00025	0.017	0.00015	109	0.00025	0.00005	0.00177	0.015	2.5E-05	0.00374	35.5	0.00662	0.0038	0.00025	1.92	0.0744	8.79	5E-06	6.37	0.357	5E-06	0.00005	0.013	0.00015	0.0005	0.0074	0.000808696	5.45	2.39616	0.439662043	50.3401	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 8	30-09-2014 13:20	9/30/2014	13.3	0.0118	0.00016	0.00076	0.124	0.00005	0.00025	0.031	0.00011	278	0.00025	0.00053	0.0284	0.015	2.5E-05	0.00204	62.7	0.48	0.0311	0.00148	6.11	0.152	6.66	5E-06	22.7	1.29	5E-06	0.00005	0.026	0.00142	0.0005	0.0015	0.000635097	13.9	4.7996	0.345294954	14.2857	2014
Bi-annual Seep Sampling	TSF Haul Road Seep 8	26-05-2015 12:25	5/26/2015	13.7	0.0078	0.00022	0.00094	0.0422	0.00005	2.5E-05	0.022	7.7E-05	198	0.00025	0.00054	0.0434	0.015	2.5E-05	0.0017	47.2	0.329	0.0332	0.00094	5.21	0.0545	6.54	5E-06	17.7	0.809	5E-06	0.00005	0.011	0.00111	0.00098	0.0015	0.000286842	9.9	3.65534	0.369226419	19.5313	2015
Bi-annual Seep Sampling	TSF Haul Road Seep 9	30-07-2013 13:21	7/30/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 1	30-05-2013 9:15	5/30/2013	#N/A	0.033	0.00005	0.00015	0.0387	0.00005	0.00025	0.027	4.7E-05	64.8	0.00025	0.00005	0.00556	0.015	2.5E-05	0.00089	20.4	0.0208	0.0113	0.00025	2.1	0.0709	6.14	5E-06	6.35	0.324	5E-06	0.00005	0.005	5E-06	0.0005	0.005	#N/A	3.24	1.51944	0.468962186	106.383	2013

Location Type	Sample Point	Original Date As Is	Recoded Date	Location	Source Term Group	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Q (m3/s)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Alkalinity (CaCO3) (mg/L)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Total Nitrogen (mg/L)
							µs/cm	su	m3/s	C	ntu	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Waste Haul Road Seep 1	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	568	282	7.98	438	9.2	1.99	73.8	0.0068	9.08	0.072	8.22	8.22	0.002	0.0196	0.0236	0.0394	174	8.01
Bi-annual Seep Sampling	Waste Haul Road Seep 1	20-10-2014 15:12	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	765	389	8.07	607	14.9	8.12	89.6	0.0826	-5	-0.2	4.62	4.66	0.041	0.0166	0.0192	0.0675	302	4.59
Bi-annual Seep Sampling	Waste Haul Road Seep 10	30-05-2013 11:27	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. The sample was taken from a pond at the toe of the road, with no apparent flow. Heavy algae.	337	7.8	#N/A	9	#N/A	301	149	7.8	226	8	2.84	108	0.0564	17.7	0.039	1.55	1.57	0.0186	-0.001	0.0057	0.0247	30	1.83
Bi-annual Seep Sampling	Waste Haul Road Seep 11	30-05-2013 11:37	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. The sample was taken from a corner of a natural gulley, where the water is directed towards BJ Lake, not parallel to the toe of the road. Heavy algae.	369	7.9	0.0075	7.9	#N/A	331	161	7.86	243	-3	0.96	93.3	0.0152	16.5	0.048	3.28	3.28	0.002	0.0034	0.0056	0.0064	49.2	3.17
Bi-annual Seep Sampling	Waste Haul Road Seep 12	30-05-2013 11:56	5/30/2013	Waste Haul Road	All Non-PAG	Full suite.	744	7.5	0.004	7	#N/A	675	335	7.71	492	-3	1.78	143	0.0113	13.7	-0.1	17.3	17.3	0.0149	0.0063	0.0106	0.0183	151	16.5
Bi-annual Seep Sampling	Waste Haul Road Seep 13	24-06-2013 13:10	6/24/2013	Waste Haul Road	All Non-PAG	No sample taken.	509	6.4	0	6.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 14	24-06-2013 13:18	6/24/2013	Waste Haul Road	All Non-PAG	No sample taken.	414	7.4	0	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 15	24-06-2013 13:23	6/24/2013	Waste Haul Road	All Non-PAG	No sample taken.	413	7.1	0	9.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 16	24-06-2013 13:28	6/24/2013	Waste Haul Road	All Non-PAG	No sample taken.	862	7.1	0	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 17	24-06-2013 13:40	6/24/2013	Waste Haul Road	All Non-PAG	Full suite sample taken. Some algae in sample pool. Seep comes out of toe in 2 channels	1609	8.4	0.003	15.6	#N/A	1620	925	8.04	1360	15.2	6.16	189	0.239	-10	0.43	44.1	50.8	6.69	0.0013	0.0132	0.0586	602	50.5
Bi-annual Seep Sampling	Waste Haul Road Seep 17	20-10-2014 14:15	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2080	1250	8.2	1810	6.5	4.77	233	0.322	-10	-0.4	26.5	32.6	6.06	-0.001	0.0053	0.0434	1010	29.8
Bi-annual Seep Sampling	Waste Haul Road Seep 18	24-06-2013 13:46	6/24/2013	Waste Haul Road	All Non-PAG	Full suite sample taken. Adjacent small seep (assumed to be the same source) flows out at 1L/min.	2025	8	0.003	8.8	#N/A	1980	1210	7.96	1770	25.8	4.25	148	0.114	-10	0.41	52.2	56.3	4.12	0.0012	0.0075	0.0481	899	54.4
Bi-annual Seep Sampling	Waste Haul Road Seep 19	24-06-2013 13:53	6/24/2013	Waste Haul Road	All Non-PAG	Full suite sample taken.	782	8	0.0015	4.7	#N/A	718	375	8.06	510	21.2	4.25	122	0.0052	-2.5	0.28	6.01	6.23	0.218	-0.001	-0.002	0.048	244	6.26
Bi-annual Seep Sampling	Waste Haul Road Seep 19	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1060	572	8.09	793	6.1	3.8	87.2	0.0147	-2.5	-0.1	11.5	11.6	0.026	-0.001	-0.002	0.0101	460	11.2
Bi-annual Seep Sampling	Waste Haul Road Seep 2	30-05-2013 9:22	5/30/2013	Waste Haul Road	All Non-PAG	D-Metals and T-Metals only	724	8	0.004	10	#N/A	689	352	8.11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 20	24-06-2013 13:58	6/24/2013	Waste Haul Road	All Non-PAG	Full suite sample taken.	1313	8.3	0.005	1.5	#N/A	1180	654	8.01	1000	41.8	11.6	75.5	0.052	-5	0.29	24.9	25	0.112	-0.001	-0.002	0.075	510	24.5
Bi-annual Seep Sampling	Waste Haul Road Seep 20	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1360	786	7.93	1180	4.9	3.7	66.2	0.027	-5	0.21	39.6	39.6	0.042	0.0069	0.0087	0.0131	583	39.8
Bi-annual Seep Sampling	Waste Haul Road Seep 20	20-10-2014 13:57	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1390	768	7.99	1170	10	3.26	113	0.0583	7.3	-0.2	25	25.1	0.106	-0.001	-0.002	0.0104	616	23.4
Bi-annual Seep Sampling	Waste Haul Road Seep 20	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1920	1120	8.14	1700	39	10.7	89.8	-0.005	-5	-0.2	36.2	36.3	0.031	0.0011	0.0038	0.0904	982	34.5
Bi-annual Seep Sampling	Waste Haul Road Seep 21	24-06-2013 14:14	6/24/2013	Waste Haul Road	All Non-PAG	No sample taken.	1422	7.8	0	3.6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	24-06-2013 14:14	6/24/2013	Waste Haul Road	All Non-PAG	Full suite sample taken. Flows out of toe in a few streams. Flows directly into creek approximately 20m d/s.	794	7.8	0.006	2.6	#N/A	765	385	7.78	611	4.5	1.18	50.4	0.0156	-5	0.25	27.6	27.7	0.073	0.0092	0.0151	0.0254	249	26.9
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/12/2013	10/12/2013	Waste Haul Road	All Non-PAG	Sample Taken	797	7.877	#N/A	0.9	#N/A	768	391	7.38	566	16	12.1	82.1	0.0258	6.8	0.11	10.3	10.3	0.01	0.0037	0.0085	0.0539	287	10.1
Bi-annual Seep Sampling	Waste Haul Road Seep 22	26-11-2013 10:20	11/26/2013	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	636	314	7.67	459	35.1	31.2	79.3	0.0332	10.5	0.049	5.35	5.36	0.0147	0.0023	0.0078	0.0769	208	5.49
Bi-annual Seep Sampling	Waste Haul Road Seep 22	14-01-2014 12:15	1/14/2014	Waste Haul Road	All Non-PAG	Stirred up some silt	773	7.859	#N/A	1.4	38.7	753	384	7.35	567	78.7	60.1	103	0.0146	6.8	-0.2	8.56	8.56	-0.01	0.0046	0.0094	0.206	262	8.5
Bi-annual Seep Sampling	Waste Haul Road Seep 22	18-02-2014 13:24	2/18/2014	Waste Haul Road	All Non-PAG	Sample taken	805	7.602	#N/A	0.7	2.64	782	392	7.59	581	5.6	2.86	76.1	0.0709	7.5	-0.2	6.59	6.61	0.018	0.0035	0.008	0.0239	319	6.41
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/7/2014	3/7/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1350	767	7.8	1130	9	12.6	91.7	0.0261	5	-0.2	28.3	28.3	0.033	0.0029	0.0067	0.0239	585	26.6
Bi-annual Seep Sampling	Waste Haul Road Seep 22	15-05-2014 10:50	5/15/2014	Waste Haul Road	All Non-PAG	Filled ambers and 1L with D-metals (pH taken with pen)	637	8	#N/A	4.2	#N/A	640	308	7.65	484	8.5	4.41	40.1	0.0595	1.36	0.03	9.83	9.85	0.0142	0.0293	0.0377	0.0525	242	9.66
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/8/2014	6/8/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1110	627	7.87	958	8.8	1.48	119	0.0292	-5	-0.2	9.26	9.28	0.018	0.0041	0.0075	0.009	481	8.87
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/4/2014	8/4/2014	Waste Haul Road	All Non-PAG	disturbed a bit in the morning. When we came back 3 hours later for sampling, still turbid	662	7.827	#N/A	0.8	84.8	643	311	7.64	462	146	65	89.3	0.0813	4.56	0.067	7.2	7.21	0.0132	0.0057	0.0129	0.268	208	7.52
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/9/2014	8/9/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1170	668	7.78	970	218	69.1	177	0.0575	-5	-0.2	4.22	#N/A	0.022	0.0064	0.0134	0.391	507	4.52
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/12/2014	9/12/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	735	382	8.11	511	78	29.9	180	0.0274	5.2	-0.2	2.14	2.14	-0.01	0.0054	0.0087	0.135	224	2.35
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1120	614	7.6	907	14.2	38.6	103	0.0229	-5	-0.2	28.9	29	0.019	0.0014	0.0029	0.0465	424	29.3
Bi-annual Seep Sampling	Waste Haul Road Seep 22	20-10-2014 13:40	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1130	661	8.07	858	65.8	19.8	222	0.0613	8.3	-0.2	0.757	0.769	0.012	0.0055	0.0071	0.224	437	1.14
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/3/2014	11/3/2014	Waste Haul Road	All Non-PAG	Open, snow and dirt pushed into seep area from road above	877	6.87	#N/A	0.9	1.65	843	440	7.45	637	7.7	2.84	99.8	0.0201	5.5	-0.2	8.03	8.05	0.015	0.004	0.0085	0.0335	329	7.64
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/11/2014	11/11/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	947	519	8.02	673	-3	1.93	217	0.0608	-5	-0.2	0.823	0.835	0.012	0.0036	0.0039	0.01	331	0.88
Bi-annual Seep Sampling	Waste Haul Road Seep 22	13-01-2015 11:30	1/13/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	921	493	7.44	692	5.2	3.26	175	0.0356	5.2	0.049	4.19	4.2	0.0069	0.004	0.005	0.0246	321	4.26
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/3/2015	3/3/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	803	429	7.62	603	39.2	14	124	0.0227	4.6	0.087	5.45	5.45	0.0042	0.0036	0.0046	0.0431	306	5.68
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/2/2015	4/2/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	766	421	7.44	571	94.3	31.7	159	0.0473	5.3	0.072	1.45	1.45	0.0035	0.0033	0.0073	0.281	257	1.74
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/6/2015	4/6/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	988	574	7.78	797	457	149	121	0.0236	3.5	0.051	4.82	4.82	0.0049	0.0015	0.006	1.93	428	5.21
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/5/2015	6/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1030	532	8.08	781	25.8	6.34	113	0.011	4.1	-0.1	10.7	10.7	-0.005	-0.001	0.004	0.113	410	10.6
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/4/2015	9/4/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	833	451	7.7	608	29.7	3.37	118	0.0125	2.5	0.045	7.01	7.02	0.0063	-0.001	0.0037	0.0677	311	6.99
Bi-annual Seep Sampling	Waste Haul Road Seep 22	29-10-2015 13:39	10/29/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1080	573	7.28	831	15.3	19.7	183	0.0988	6.2	-0.1	0.067	0.067	-0.005	0.0082	0.0089	0.0481	434	0.423
Bi-annual Seep Sampling	Waste Haul Road Seep 22	30-11-2015 12:40	11/30/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1050	573	6.85	777	6.7	5.63	173	0.113	6.1	0.1	-0.025	0.025	0.0054	0.0208	0.0182	0.125	412	0.366
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/6/2014	12/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	952	514	8.27	763	13	5.79	164	0.0073	10.2	-0.2	11	11	0.019	0.0057	0.0117	0.0229	333	10.8
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	874	436	8.37	620	164	55.9	172	0.0107	15.3	0.111	22.7	22.7	0.0109	0.0116	0.0151	0.45	209	21.7
Bi-annual Seep Sampling	Waste Haul Road Seep 24	12/6/2014	12/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1100	560	7.8	791	-3	0.85	125	0.0454	12.9	-0.2	14	14.1	0.077	0.0161	0.0188	0.0294	426	13.5
Bi-annual Seep Sampling	Waste Haul Road Seep 25	11/5/2015	11/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1330	739	7.92	1090	8	3.58	65	0.0229	3.1	-0.1	31.4	31.4	0.0882	0.0028	0.0022	0.0407	566	28.9
Bi-annual Seep Sampling	Waste Haul Road Seep 26	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	2140	1290	8.09	1980	5.1	0.33	76.4	0.0096	-10	-0.4	62.7	62.8	0.03	0.004	0.0059	0.0096	1040	58.3
Bi-annual Seep Sampling	Waste Haul Road Seep 27	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1400	769	8.19	1110	13	14.2	130	0.0705	10.6	-0.1	16.6	16.7	0.0258	0.0032	0.0042	0.13	614	15.7
Bi-annual Seep Sampling	Waste Haul Road Seep 28	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1330	746	8.16	1030	-3	0.42	167	0.0323	5.5	-0.1	12.5	12.6	0.0556	0.006	0.0065	0.0267	551	12.1
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 9:30	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Sample site previously named WHR Runoff""	527	7.9	0.02	4.5	#N/A	480	230	8.09	321	-3	0.72	104	-0.005	10	0.18	12.3	12.3	0.0093	0.019	0.0209	0.0238	81.8	12
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 12:17	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Dug a small sump and sampled later.	615	7.9	0.005	7.5	#N/A	578	293	8.17	250	18	12.2	178	0.0129	13.1	0.114	5.71	5.72	0.0087	0.0104	0.016	0.0667	92.5	5.9
Bi-annual Seep Sampling	Waste Haul Road Seep 3	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	413	189	8.21	286	-3	2.24	90.4	-0.005	5.25	0.184	4.21	4.21	0.0012	0.023	0.0231	0.0272	90.4	3.99
Bi-annual Seep Sampling	Waste Haul Road Seep 4	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	417	207	8.03	287	-3	1.85	97.6	-0.005	4.83	0.172	4.59	4.6	0.0011	0.0204	0.0208	0.0242	93	4.51
Bi-annual Seep Sampling	Waste Haul Road Seep 4	20-10-2014 15:42	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	467	224	8.23	338	4	5.56	85.6	-0.005	5.64	0.198	5.2	5.2	0.002	0.0218	0.0231	0.0298	118	4.53
Bi-annual Seep Sampling	Waste Haul Road Seep 5	30-05-2013 12:24	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Dug a small sump and sampled later.	696	8.2	0.003	3.7	#N/A	639	325	8.19	304	19.3	15.3	217	0.284	17.3	0.098	6.4	6.6	0.198	0.014	0.026	0.0807	78.7	6.95
Bi-annual Seep Sampling	Waste Haul Road Seep 5	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	590	308	8.01	418	14	9.29	154	0.0838	10.8	0.16	2.08	2.09	0.0118	0.0184	0.0191	0.0851	139	2.39
Bi-annual Seep Sampling	Waste Haul Road Seep 5	20-10-2014 15:55	10/20/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	512	259	8.36	354	14	14.6	165	0.0922	5.93	0.142	0.59	0.598	0.0075	0.0243	0.0307	0.0636	105	0.883
Bi-annual Seep Sampling	Waste Haul Road Seep 5	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	586	293	8.25	407	15.4	12.2	111	0.0458	9.91	0.12	1.77	1.78	0.0089	0.0165	0.0218	0.0675	150	1.85
Bi-annual Seep Sampling	Waste Haul Road Seep 6	30-05-2013 9:45	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Filled sample bottles with 120ml amber. Multiple seeps, sample taken from largest one.	932	6.9	0.005	5.8	#N/A	871	453	7.81	537	4.7	17.1	220	0.279	10.4	-0.2	2.84	3.77	0.926	0.0147	0.0351	0.0964	239	5.21
Bi-annual Seep Sampling	Waste Haul Road Seep 6	10/6/2014	10/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	867	477	7.98	637	150	48	244	0.277	5.3	-0.2	4.36	4.41	0.05	0.0048	0.0081	0.146	224	5.26
Bi-annual Seep Sampling	Waste Haul Road Seep 7	30-05-2013 10:16	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Multiple seeps, sample taken from lagest one. This seep may reach BJ Lake on surface.	655	7.7	0.04	5.4	#N/A	586	308	7.98	443	14.4	17.3	182	0.0125	4.6	0.083	4.59	4.59	0.0056	0.0132	0.0207	0.051	133	4.6
Bi-annual Seep Sampling	Waste Haul Road Seep 7	26-11-2013 12:10	11/26/2013	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	929	491	8.19	664	26.9	17.7	189	0.037	6.5	-0.2	14.6	14.6	0.037	0.0093	0.0145	0.0875	246	14.5
Bi-annual Seep Sampling	Waste Haul Road Seep 7	3/7/2014	3/7/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1070	605	8.36	851	124	106	208	0.0164	5.1	-0.2	15.4	15.4	0.052	0.0164	0.0241	0.161	355	14.9
Bi-annual Seep Sampling	Waste Haul Road Seep 7	15-05-2014 10:09	5/15/2014	Waste Haul Road	All Non-PAG	Sample taken ~20m d/s of WHR toe, multiple streams, filled bottles with 250mL amber, bear scat, squirrel, butterfly. (pH taken with pen)	714	8.1	#N/A	4	#N/A	705	367	8.17	530	25.5	16.9	150	0.0144	2.5	0.08	9.33	9.34	0.0097	0.0159	0.0203	0.0751	189	9.22
Bi-annual Seep Sampling	Waste Haul Road Seep 7	11/11/2014	11/11/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	1230	706	8.35	911	88.1	55.3	255	0.016	9	-0.2	4.9	4.91	0.013	0.0075	0.0131	0.226	462	4.74
Bi-annual Seep Sampling	Waste Haul Road Seep 7	12/6/2014	12/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	861	468	8.09	664	8.7	4.58	183	0.0172	-5	-0.2	9.69	9.71	0.017	0.0156	0.0163	0.0531	262	9.53
Bi-annual Seep Sampling	Waste Haul Road Seep 8	30-05-2013 10:50	5/30/2013	Waste Haul Road	All Non-PAG	Full suite.	929	7.7	0.001	1.5	#N/A	813	411	7.73	624	7	1.87	105	0.0052	22.4	-0.2	13.8	13.9	0.024	0.0521	0.0618	0.0702	272	13.2
Bi-annual Seep Sampling	Waste Haul Road Seep 8	12/6/2014	12/6/2014	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	889	461	7.97	689	-3	0.69	90.3	0.0075	13.9	-0.2	9.55	9.57	0.022	0.0265	0.0334	0.0386	344	9.6
Bi-annual Seep Sampling	Waste Haul Road Seep 8	12/5/2015	12/5/2015	Waste Haul Road	All Non-PAG		#N/A	#N/A	#N/A	#N/A	#N/A	869	424	8.13	636	11	0.15	79.4	-0.005	7.1	0.045	5.19	5.19	-0.002	0.0212	0.0243	0.0256	353	5.03
Bi-annual Seep Sampling	Waste Haul Road Seep 9	30-05-2013 11:06	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. The sample was taken from a pond in a small gulley with no apparent flow. Heavy algae.	497	7.4	#N/A	5.3	#N/A	444	220	7.41	318	-3	0.55	119	0.0168	22.6	0.038	2.56	2.57	0.0075	0.0058	0.0078	0.0155	79.9	3.35
Bi-annual Seep Sampling	Waste Haul Road Under Culvert	30-05-2013 12:47	5/30/2013	Waste Haul Road	All Non-PAG	Full suite. Sample taken from below WHR culvert where it appears as though water is flowing from under the culvert. Flow unkown because it comes out of the rocks and enters the stream and its hard to see where one starts and the other begins.	526	8.3	#N/A	8.8	#N/A	495	231	7.91	294	9.3	2.87	68.3	-0.005	18.3	0.085	1.89	1.9	0.0061	0.006	0.0104	0.0325	146	2.03

Location Type	Sample Point	Original Date As Is	Recoded Date	Dissolved Organic Carbon (mg/L)	Aluminum (Al)-Total (mg/L)	Antimony (Sb)-Total (mg/L)	Arsenic (As)-Total (mg/L)	Barium (Ba)-Total (mg/L)	Beryllium (Be)-Total (mg/L)	Bismuth (Bi)-Total (mg/L)	Boron (B)-Total (mg/L)	Cadmium (Cd)-Total (mg/L)	Calcium (Ca)-Total (mg/L)	Chromium (Cr)-Total (mg/L)	Cobalt (Co)-Total (mg/L)	Copper (Cu)-Total (mg/L)	Iron (Fe)-Total (mg/L)	Lead (Pb)-Total (mg/L)	Lithium (Li)-Total (mg/L)	Magnesium (Mg)-Total (mg/L)	Manganese (Mn)-Total (mg/L)	Molybdenum (Mo)-Total (mg/L)	Nickel (Ni)-Total (mg/L)	Potassium (K)-Total (mg/L)	Selenium (Se)-Total (mg/L)	Silicon (Si)-Total (mg/L)	Silver (Ag)-Total (mg/L)	Sodium (Na)-Total (mg/L)	Strontium (Sr)-Total (mg/L)	Thallium (Tl)-Total (mg/L)	Tin (Sn)-Total (mg/L)	Titanium (Ti)-Total (mg/L)	Uranium (U)-Total (mg/L)	Vanadium (V)-Total (mg/L)	Zinc (Zn) Total (mg/L)	Aluminum (Al)-Dissolved (mg/L)	Antimony (Sb)-Dissolved (mg/L)	Arsenic (As) Dissolved (mg/L)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Waste Haul Road Seep 1	10/6/2014	10/6/2014	7.39	0.184	0.00011	0.0009	0.0336	-0.0001	-0.0005	0.043	0.000051	80.2	-0.0005	0.00029	0.0195	0.171	9.2E-05	0.00087	21	0.0664	0.0525	0.0005	2.09	0.024	8.29	1.4E-05	8.73	0.364	-0.00001	-0.0001	0.019	0.000293	0.0019	0.0079	0.0391	-0.0001	0.00074
Bi-annual Seep Sampling	Waste Haul Road Seep 1	20-10-2014 15:12	10/20/2014	7.5	0.601	0.00011	0.00045	0.0674	-0.0001	-0.0005	0.034	0.000107	104	-0.0005	0.00097	0.0304	0.451	0.00015	0.00125	27.5	0.512	0.0162	0.00087	2.62	0.0279	8.27	1.8E-05	9.18	0.459	-0.00001	-0.0001	0.04	0.000043	0.0016	0.0068	0.0322	-0.0001	0.00025
Bi-annual Seep Sampling	Waste Haul Road Seep 10	30-05-2013 11:27	5/30/2013	5.63	0.058	-0.0001	0.00028	0.0232	-0.0001	-0.0005	0.019	0.000022	49.2	-0.0005	-0.0001	0.0112	0.075	-0.00005	0.00111	6.97	0.00731	0.00284	-0.0005	0.679	0.00819	7.34	-0.00001	4.96	0.12	-0.00001	-0.0001	-0.01	0.000025	-0.001	-0.003	-0.003	-0.0001	0.00023
Bi-annual Seep Sampling	Waste Haul Road Seep 11	30-05-2013 11:37	5/30/2013	4.21	0.0764	-0.0001	0.00027	0.026	-0.0001	-0.0005	0.016	0.000017	49.3	-0.0005	-0.0001	0.00704	0.063	5.1E-05	0.00116	9.62	0.00348	0.00199	-0.0005	1.01	0.0141	8.08	-0.00001	4.98	0.134	-0.00001	-0.0001	0.011	-0.00001	-0.001	0.0031	0.0031	-0.0001	0.00022
Bi-annual Seep Sampling	Waste Haul Road Seep 12	30-05-2013 11:56	5/30/2013	3.92	0.0911	0.00013	0.00048	0.0584	-0.0001	-0.0005	0.048	0.000112	97.9	0.0011	0.00044	0.0171	0.159	-0.00005	0.00329	23.9	0.137	0.0118	0.00063	1.8	0.0254	8.85	-0.00001	10.6	0.352	-0.00001	-0.0001	0.012	0.000535	0.0016	0.0066	0.0115	0.00012	0.00036
Bi-annual Seep Sampling	Waste Haul Road Seep 13	24-06-2013 13:10	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 14	24-06-2013 13:18	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 15	24-06-2013 13:23	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 16	24-06-2013 13:28	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 17	24-06-2013 13:40	6/24/2013	23.2	0.103	0.0005	0.0015	0.0883	-0.0001	-0.0005	0.035	0.000239	268	-0.0005	0.00963	0.0161	0.91	7.4E-05	0.00516	48.7	4.4	0.0824	0.00226	5.13	0.276	6.33	8.1E-05	16.9	0.859	-0.00001	-0.0001	0.018	0.0016	0.0012	0.0092	0.0104	0.00049	0.00135
Bi-annual Seep Sampling	Waste Haul Road Seep 17	20-10-2014 14:15	10/20/2014	26.4	0.0247	0.00035	0.00099	0.0845	-0.0002	-0.001	0.033	0.000289	386	-0.0005	0.0186	0.0258	0.832	-0.0001	0.0031	62.7	7.35	0.125	0.0028	3.02	0.279	5.89	2.1E-05	17.8	1.04	-0.00002	-0.0002	0.028	0.00178	-0.002	0.0068	0.01	0.00031	0.0009
Bi-annual Seep Sampling	Waste Haul Road Seep 18	24-06-2013 13:46	6/24/2013	11.4	0.317	0.00036	0.00137	0.0705	-0.0002	-0.001	0.024	-0.0005	351	0.00074	0.0107	0.0176	0.965	0.00016	0.0039	60.9	5.28	0.16	0.0034	1.93	0.631	6.03	-0.00002	17	0.899	-0.00002	-0.0002	0.029	0.00256	-0.002	-0.006	0.007	0.00036	0.00117
Bi-annual Seep Sampling	Waste Haul Road Seep 19	24-06-2013 13:53	6/24/2013	5.55	0.284	0.00041	0.00163	0.0307	-0.0001	-0.0005	0.027	-0.0003	107	-0.0005	0.0015	0.0311	0.45	0.00025	0.00301	20.2	0.859	0.113	0.00092	0.754	0.117	5.13	1.2E-05	11.7	0.371	-0.00001	-0.0001	0.021	0.00283	0.0022	0.006	-0.003	0.00043	0.00156
Bi-annual Seep Sampling	Waste Haul Road Seep 19	12/5/2015	12/5/2015	3.25	0.095	0.00031	0.00079	0.0332	-0.0001	-0.00005	0.029	0.000112	177	-0.0005	0.00086	0.00992	0.421	5.6E-05	0.0054	35.2	0.447	0.192	-0.0005	0.911	0.21	8.06	-0.00001	8.89	0.455	-0.00001	-0.0001	0.011	0.00221	0.00106	-0.003	-0.003	0.00027	0.00055
Bi-annual Seep Sampling	Waste Haul Road Seep 2	30-05-2013 9:22	5/30/2013	#N/A	0.367	-0.0001	0.00128	0.0366	-0.0001	-0.0005	0.14	0.000021	96.4	-0.0005	0.0006	0.0176	0.479	0.00013	0.00108	26.6	0.23	0.0113	0.00074	2.26	0.00259	7.68	-0.00001	11.2	0.453	-0.00001	-0.0001	0.025	0.000408	0.0021	0.0031	0.0148	-0.0001	0.00103
Bi-annual Seep Sampling	Waste Haul Road Seep 20	24-06-2013 13:58	6/24/2013	4.32	1.39	0.00038	0.00145	0.0547	-0.0001	-0.0005	0.028	-0.0002	185	0.00068	0.00206	0.0588	1.28	0.00035	0.00656	37.7	0.646	0.127	0.00146	1.58	0.213	9.43	2.4E-05	12.5	0.572	-0.00001	-0.0001	0.09	0.00217	0.0052	0.0061	0.0041	0.00038	0.00071
Bi-annual Seep Sampling	Waste Haul Road Seep 20	10/6/2014	10/6/2014	2.6	0.105	0.00032	0.00071	0.0345	-0.0001	-0.0005	0.033	-0.0003	229	-0.0005	0.00065	0.0168	0.118	9.1E-05	0.0045	46.2	0.296	0.279	0.00062	1.25	0.298	7.53	-0.00001	12.1	0.624	-0.00001	-0.0001	0.021	0.00223	0.0011	0.0067	0.003	0.0003	0.00057
Bi-annual Seep Sampling	Waste Haul Road Seep 20	20-10-2014 13:57	10/20/2014	3.89	0.17	0.00031	0.00071	0.0359	-0.0001	-0.0005	0.041	0.000139	226	-0.0005	0.00145	0.0201	0.359	9.1E-05	0.00457	45	0.986	0.129	0.00078	1.42	0.186	6.84	1.1E-05	13.4	0.655	-0.00001	-0.0001	0.03	0.00198	0.0012	0.005	-0.003	0.0003	0.00055
Bi-annual Seep Sampling	Waste Haul Road Seep 20	12/5/2015	12/5/2015	4.37	0.804	0.00064	0.0019	0.0669	-0.0002	-0.0001	0.069	0.000113	342	0.00117	0.001	0.0162	1.08	0.00044	0.0091	64.7	0.105	0.452	0.0012	2.16	0.343	7.16	-0.00002	21.7	0.946	-0.00002	-0.0002	0.043	0.00284	0.0045	-0.006	0.0068	0.00066	0.00116
Bi-annual Seep Sampling	Waste Haul Road Seep 21	24-06-2013 14:14	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	24-06-2013 14:14	6/24/2013	3.43	0.174	0.00018	0.00055	0.0411	-0.0001	-0.0005	0.018	0.000073	105	-0.0005	0.00039	0.00396	0.232	0.00011	0.00144	26.7	0.128	0.0512	0.00067	2.03	0.134	8.09	-0.00001	11	0.452	-0.00001	-0.0001	0.019	0.000325	0.0013	-0.003	0.0061	0.00017	0.00038
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/12/2013	10/12/2013	5.99	0.49	0.00016	0.00078	0.0557	-0.0001	-0.0005	0.069	0.000038	109	0.00105	0.00094	0.00559	1.5	0.00036	0.00055	33	0.284	0.00212	0.00145	1.67	0.0364	7.38	-0.00001	13.5	0.464	-0.00001	-0.0001	0.038	0.00004	0.0031	-0.003	0.006	0.00013	0.00019
Bi-annual Seep Sampling	Waste Haul Road Seep 22	26-11-2013 10:20	11/26/2013	7.97	0.14	0.00012	0.00033	0.0437	-0.0001	-0.0005	0.042	0.000029	81.4	-0.0005	0.00047	0.00385	0.226	-0.00005	-0.0005	26.1	0.312	0.00196	0.00126	1.53	0.0245	6.12	-0.00001	10.6	0.351	-0.00001	-0.0001	0.021	0.000032	-0.001	-0.003	0.0136	0.0001	0.00021
Bi-annual Seep Sampling	Waste Haul Road Seep 22	14-01-2014 12:15	1/14/2014	6.07	2	0.00021	0.00248	0.0702	-0.0001	-0.0005	0.078	0.000079	108	0.00367	0.00292	0.0142	6.26	0.00079	0.00173	33	0.54	0.00356	0.00349	1.9	0.0205	10.7	2.9E-05	13.8	0.443	0.000017	-0.0001	0.106	0.000093	0.0121	0.0083	0.0143	0.00015	0.00021
Bi-annual Seep Sampling	Waste Haul Road Seep 22	18-02-2014 13:24	2/18/2014	4.09	0.0817	0.00036	0.00027	0.0486	-0.0001	-0.0005	0.133	0.000032	106	-0.0005	0.00037	0.00234	0.14	-0.00005	-0.0005	30.7	0.209	0.0046	0.00083	1.61	0.0231	5.72	1.5E-05	16.9	0.421	-0.00001	-0.0001	0.011	0.000043	-0.001	-0.003	0.0072	0.00033	0.0002
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/7/2014	3/7/2014	5.71	0.762	0.00025	0.00057	0.11	-0.0001	-0.0005	0.076	0.000067	214	0.00133	0.00055	0.0068	0.748	0.00021	0.0009	56.7	0.305	0.00565	0.00198	2.24	0.182	7.59	-0.00001	18.5	1.02	-0.00001	-0.0001	0.047	0.000071	0.0023	0.0049	0.0044	0.00023	0.00029
Bi-annual Seep Sampling	Waste Haul Road Seep 22	15-05-2014 10:50	5/15/2014	5.67	0.145	-0.0001	0.00027	0.0402	-0.0001	-0.0005	0.013	0.000025	87.1	-0.0005	0.00013	0.00233	0.162	-0.00005	-0.0005	22.4	0.00515	0.00527	-0.0005	2.75	0.0594	6.98	-0.00001	8.42	0.361	-0.00001	-0.0001	0.018	-0.00001	-0.001	-0.003	0.0146	-0.0001	0.00021
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/8/2014	6/8/2014	6.45	0.0798	0.0002	0.00038	0.0793	-0.0001	-0.0005	0.077	0.000064	172	-0.0005	0.00037	0.00444	0.116	-0.00005	-0.0005	43.9	0.456	0.0063	0.00166	2.01	0.0878	6.56	-0.00001	17.2	0.69	-0.00001	-0.0001	0.014	0.000109	-0.001	-0.003	0.007	0.00019	0.00032
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/4/2014	8/4/2014	6.09	4.32	0.00045	0.00251	0.0866	-0.0001	-0.0005	0.079	0.000068	82.6	0.0068	0.00374	0.0327	6.42	0.00148	0.00283	24	0.578	0.00976	0.00582	2	0.0267	13.7	0.00003	12.3	0.345	0.00003	-0.0001	0.226	0.000196	0.0142	0.0152	0.0135	0.00032	0.00034
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/9/2014	8/9/2014	8.56	7.28	0.00036	0.00518	0.165	0.0002	-0.0005	0.06	0.000234	181	0.0109	0.0071	0.0589	9.83	0.00327	0.00559	49.8	1.76	0.00928	0.0114	3.49	0.0709	20.4	4.6E-05	16.7	0.775	0.000045	-0.0001	0.371	0.000441	0.0255	0.0284	0.0069	0.00016	0.00042
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/12/2014	9/12/2014	9.77	2.81	0.00028	0.00212	0.0731	-0.0001	-0.0005	0.029	0.000104	103	0.00392	0.00439	0.032	4.45	0.00105	0.00278	28	1.44	0.0153	0.00453	2.1	0.0154	10.5	2.5E-05	9.97	0.427	0.000017	-0.0001	0.151	0.000389	0.0093	0.0113	0.0105	0.00017	0.00035
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/6/2014	10/6/2014	5.36	1.04	0.00026	0.00084	0.0991	-0.0001	-0.0005	0.065	0.000067	172	0.00198	0.00128	0.0113	1.35	0.00044	0.00094	46	0.555	0.00531	0.00239	2.29	0.173	7.58	-0.00001	14.6	0.706	-0.00001	-0.0001	0.052	0.000114	0.0038	0.005	0.0104	0.00025	0.0003
Bi-annual Seep Sampling	Waste Haul Road Seep 22	20-10-2014 13:40	10/20/2014	10.1	2.24	0.00026	0.00157	0.0866	-0.0001	-0.0005	0.056	0.000098	170	0.00365	0.00316	0.0179	2.89	0.00077	0.00197	44.6	1.4	0.00587	0.00547	2.52	0.0177	11	2.8E-05	14.9	0.675	0.000017	-0.0001	0.133	0.000322	0.0072	0.0101	0.0114	0.00017	0.00038
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/3/2014	11/3/2014	4.35	0.158	0.00031	0.00044	0.0533	-0.0001	-0.0005	0.167	0.000036	118	-0.0005	0.00075	0.00337	0.615	6.2E-05	0.00089	32.8	0.226	0.00376	0.00092	1.81	0.0231	5.68	-0.00001	18.6	0.477	-0.00001	-0.0001	0.02	0.000051	0.002	-0.003	0.0079	0.00027	0.00021
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/11/2014	11/11/2014	9.88	0.15	0.00025	0.00068	0.0562	-0.0001	-0.0005	0.041	0.000059	146	0.00055	0.00318	0.00515	0.77	8.7E-05	-0.0005	38.1	1.44	0.00665	0.00253	1.98	0.0135	7.19	-0.00001	13.9	0.571	-0.00001	-0.0001	0.024	0.000221	0.0013	-0.003	0.004	0.00017	0.00033
Bi-annual Seep Sampling	Waste Haul Road Seep 22	13-01-2015 11:30	1/13/2015	8.02	0.219	0.00018	0.00051	0.0579	-0.0001	-0.0005	0.032	0.000052	138	0.00059	0.00184	0.0047	0.65	9.1E-05	-0.0005	37.2	0.94	0.00274	0.00195	1.7	0.0315	6.54	-0.00001	11.7	0.56	-0.00001	-0.0001	0.023	0.000126	0.0016	0.003	0.0085	0.00016	0.00023
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/3/2015	3/3/2015	7.3	0.488	0.00019	0.00061	0.0498	-0.0001	-0.0005	0.029	0.000039	113	0.00097	0.00126	0.00543	0.993	0.00019	0.00064	31.5	0.507	0.00224	0.00162	1.47	0.0415	6.09	-0.00001	10.2	0.481	-0.00001	-0.0001	0.035	0.000057	0.0024	0.0034	0.0077	0.00014	0.0002
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/2/2015	4/2/2015	7.89	0.187	0.00018	0.00047	0.0454	-0.0001	-0.0005	0.033	0.000042	112	0.00072	0.00172	0.00448	0.561	9.5E-05	0.0005	30.1	0.783	0.00293	0.00183	1.59	0.0161	5.93	-0.00001	11.5	0.457	-0.00001	-0.0001	0.017	0.000106	0.0015	-0.003	0.0079	0.00014	0.00026
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/6/2015	4/6/2015	7.36	11.6	0.00049	0.00839	0.221	0.00035	0.000069	0.04	0.000211	165	0.018	0.0158	0.0751	21.1	0.0042	0.0101	46.1	3.14	0.0091	0.0169	2.97	0.0867	27.3	6.4E-05	14.6	0.689	0.000058	0.00014	0.512	0.000379	0.0419	0.0381	0.016	0.00014	0.00026
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/5/2015	6/5/2015	6.8	1.52	0.0002	0.00144	0.0803	-0.0001	-0.00005	0.028	0.0000514	146	0.0023	0.00275	0.0128	3.16	0.00055	0.001	41.1	0.741	0.00354	0.00279	1.96	0.13	8.61	1.4E-05	12.2	0.614	-0.00001	-0.0001	0.078	0.000086	0.00636	0.0061	0.0041	0.00014	0.00022
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/4/2015	9/4/2015	6.64	0.83	0.00022	0.00107	0.0614	-0.0001	0.000056	0.031	0.0000482	125	0.00158	0.00181	0.0099	1.76	0.00038	0.0011	32.8	0.509	0.00314	0.00188	1.78	0.0745	7.11	1.2E-05	9.87	0.503	-0.00001	-0.0001	0.051	0.000094	0.00427	0.0045	0.006	0.00017	0.00023
Bi-annual Seep Sampling	Waste Haul Road Seep 22	29-10-2015 13:39	10/29/2015	10.1	0.0949	-0.0001	0.00232	0.0903	-0.0001	-0.00005	0.039	0.0000199	167	0.00071	0.00976	0.00191	5.37	-0.00005	-0.001	42.7	3.66	0.00702	0.00448	2.51	0.00145	7.69	-0.00001	20	0.677	-0.00001	-0.0001	0.013	0.000117	0.0029	-0.003	0.0068	-0.0001	0.00108
Bi-annual Seep Sampling	Waste Haul Road Seep 22	30-11-2015 12:40	11/30/2015	9.32	0.0822	-0.0001	0.00189	0.0731	-0.0001	-0.00005	0.041	0.0000324	164	0.00072	0.00754	0.00242	5.69	-0.00005	-0.001	40.6	3.03	0.0043	0.0043	1.74	0.000694	6.86	-0.00001	18.5	0.638	-0.00001	-0.0001	-0.01	0.000075	0.00232	-0.003	0.0085	-0.0001	0.00093
Bi-annual Seep Sampling	Waste Haul Road Seep 22	12/5/2015	12/5/2015	8.08	0.527	0.00021	0.00092	0.0382	-0.0001	-0.00005	0.036	0.0000427	128	0.00055	0.00165	0.03	0.651	0.00022	0.002	31.7	0.19	0.0743	0.00068	2.88	0.0206	7.53	0.00001	15.1	0.578	-0.00001	-0.0001	0.037	0.000981	0.00236	0.0036	0.0078	0.00023	0.00054
Bi-annual Seep Sampling	Waste Haul Road Seep 22	12/6/2014	12/6/2014	4.87	0.0474	0.00128	0.00049	0.0704	-0.0001	-0.0005	0.122	-0.0002	177	-0.0005	0.00052	0.015	0.081	-0.00005	0.00374	31.3	0.299	0.0754	-0.0005	2.66	0.0425	7.04	-0.00001	22.4	0.803	-0.00001	-0.0001	0.016	0.00338	-0.001	0.0045	0.0078	0.00126	0.00042
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/5/2015	11/5/2015	5.41	0.0914	0.00033	0.00104	0.0505	-0.0001	-0.00005	0.046	0.0000545	218	-0.0005	0.00153	0.00375	1.91	-0.00005	0.0025	49.6	0.8	0.501	0.00108	2.06	0.322	8.19	-0.00001	16.4	0.751	-0.00001	-0.0001	0.012	0.000251	0.00281	-0.003	0.0041	0.00032	0.00052
Bi-annual Seep Sampling	Waste Haul Road Seep 26	12/5/2015	12/5/2015	3.46	0.0378	0.00032	0.00087	0.0393	-0.0002	-0.0001	0.038	0.000094	388	-0.0005	0.00032	0.013	0.087	-0.0001	0.0053	75.8	0.157	0.18	-0.001	1.93	0.482	6.12	-0.00002	21	1.12	-0.00002	-0.0002	-0.01	0.0035	-0.001	-0.006	-0.003	0.00034	0.00064
Bi-annual Seep Sampling	Waste Haul Road Seep 27	12/5/2015	12/5/2015	7.24	0.272	0.00027	0.00068	0.0545	-0.0001	-0.00005	0.059	0.0000881	215	-0.0005	0.00106	0.0247	0.454	9.7E-05	0.0025	49.6	0.711	0.0783	0.00084	2.1	0.0561	6.3	-0.00001	19.6	0.83	-0.00001	-0.0001	0.024	0.000982	0.00148	0.0032	0.0074	0.00026	0.00041
Bi-annual Seep Sampling	Waste Haul Road Seep 28	12/5/2015	12/5/2015	11.2	0.0544	0.00023	0.00062	0.0614	-0.0001	-0.00005	0.035	0.0000532	227	-0.0005	0.00088	0.0158	0.443	-0.00005	0.0017	45.8	0.737	0.202	0.00056	2.93	0.0453	6.69	-0.00001	16	0.976	-0.00001	-0.0001	0.01	0.00196	0.00103	-0.003	0.0104	0.00021	0.00044
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 9:30	5/30/2013	2.86	0.0441	0.00013	0.00291	0.0157	-0.0001	-0.0005	0.242	0.000014	67.9	0.00072	-0.0001	0.00669	0.053	-0.00005	0.00215	15.6	0.0203	0.0349	-0.0005	1.01	0.0143	12.1	-0.00001	7.15	0.293	-0.00001	-0.0001	-0.01	0.000493	0.003	-0.003	-0.003	0.00012	0.00278
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 12:17	5/30/2013	8.6	0.711	0.0001	0.00182	0.0386	-0.0001	-0.0005	0.076	0.000022	85.6	0.00063	0.00056	0.0314	0.689	0.00028	0.00225	19.4	0.0473	0.0216	0.00118	3.6	0.00808	11.9	1.5E-05	7.43	0.394	-0.00001	-0.0001	0.05	0.00135	0.0035	0.0049	0.0222	-0.0001	0.00142
Bi-annual Seep Sampling	Waste Haul Road Seep 3	12/5/2015	12/5/2015	1.47	0.12	0.00014	0.00359	0.0132	-0.0001	-0.00005	0.24	0.0000102	59.2	0.00151	0.00012	0.00808	0.13	-0.00005	0.0018	12.6	0.0169	0.0312	-0.0005	0.8	0.00711	13.2	-0.00001	7.1	0.246	-0.00001	-0.0001	-0.01	0.000326	0.00374	-0.003	0.0035	0.00014	0.00329
Bi-annual Seep Sampling	Waste Haul Road Seep 4	10/6/2014	10/6/2014	1.83	0.0587	0.00013	0.0029	0.0167	-0.0001	-0.0005	0.227	0.000025	60.2	-0.0005	-0.0001	0.00799	0.071	-0.00005	0.00188	13.2	0.0218	0.0334	-0.0005	0.999	0.00947	11.7	-0.00001	6.44	0.26	-0.00001	-0.0001	0.011	0.00037	0.0029	-0.003	0.0036	0.00012	0.00285
Bi-annual Seep Sampling	Waste Haul Road Seep 4	20-10-2014 15:42	10/20/2014	1.66	0.319	0.00016	0.00382	0.0242	-0.0001	-0.0005	0.268	0.000018	66.3	-0.0005	0.00027	0.0161	0.272	0.00011	0.00283	13.6	0.0256	0.0354	-0.0005	0.871	0.00788	12.7	-0.00001	7.78	0.294	-0.00001	-0.0001	0.028	0.00041	0.0041	-0.003	0.003	0.00015	0.00383
Bi-annual Seep Sampling	Waste Haul Road Seep 5	30-05-2013 12:24	5/30/2013	14.4	0.417	-0

Location Type	Sample Point	Original Date As Is	Recoded Date	Barium (Ba) Dissolved (mg/L)	Beryllium (Be)-Dissolved (mg/L)	Bismuth (Bi)-Dissolved (mg/L)	Boron (B)-Dissolved (mg/L)	Cadmium (Cd)-Dissolved (mg/L)	Calcium (Ca)-Dissolved (mg/L)	Chromium (Cr)-Dissolved (mg/L)	Cobalt (Co)-Dissolved (mg/L)	Copper (Cu)-Dissolved (mg/L)	Iron (Fe)-Dissolved (mg/L)	Lead (Pb)-Dissolved (mg/L)	Lithium (Li)-Dissolved (mg/L)	Magnesium (Mg)-Dissolved (mg/L)	Manganese (Mn)-Dissolved (mg/L)	Molybdenum (Mo)-Dissolved (mg/L)	Nickel (Ni)-Dissolved (mg/L)	Potassium (K)-Dissolved (mg/L)	Selenium (Se)-Dissolved (mg/L)	Silicon (Si)-Dissolved (mg/L)	Silver (Ag)-Dissolved (mg/L)	Sodium (Na)-Dissolved (mg/L)	Strontium (Sr)-Dissolved (mg/L)	Thallium (Tl)-Dissolved (mg/L)	Tin (Sn)-Dissolved (mg/L)	Titanium (Ti)-Dissolved (mg/L)	Uranium (U)-Dissolved (mg/L)	Vanadium (V)-Dissolved (mg/L)	Zinc (Zn)-Dissolved (mg/L)	Julian Date	EC-Field
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		µs/cm
Bi-annual Seep Sampling	Waste Haul Road Seep 1	10/6/2014	10/6/2014	0.0297	-0.0001	-0.0005	0.041	0.000043	79	-0.0005	0.00014	0.0137	-0.03	-0.00005	0.00079	20.5	0.0435	0.0514	-0.0005	2.01	0.0231	7.86	-0.00001	8.64	0.35	-0.00001	-0.0001	0.01	0.00029	0.0013	0.0068	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 1	20-10-2014 15:12	10/20/2014	0.0576	-0.0001	-0.0005	0.031	0.000093	109	-0.0005	0.00062	0.00555	0.057	-0.00005	0.00113	28.3	0.48	0.0163	0.00056	2.63	0.0278	7.56	-0.00001	9.54	0.489	-0.00001	-0.0001	0.014	0.000021	-0.001	0.0049	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 10	30-05-2013 11:27	5/30/2013	0.0216	-0.0001	-0.0005	0.018	0.000019	48.5	-0.0005	-0.0001	0.00783	-0.03	-0.00005	0.00096	6.86	0.0037	0.00274	-0.0005	0.568	0.00796	7.07	-0.00001	4.77	0.113	-0.00001	-0.0001	-0.01	0.000022	-0.001	-0.003	2013.41	337
Bi-annual Seep Sampling	Waste Haul Road Seep 11	30-05-2013 11:37	5/30/2013	0.0256	-0.0001	-0.0005	0.015	0.000016	49	-0.0005	-0.0001	0.00423	-0.03	-0.00005	0.00105	9.42	0.00083	0.0019	-0.0005	0.974	0.0137	7.81	-0.00001	4.86	0.129	-0.00001	-0.0001	-0.01	-0.00001	-0.001	-0.003	2013.41	369
Bi-annual Seep Sampling	Waste Haul Road Seep 12	30-05-2013 11:56	5/30/2013	0.0546	-0.0001	-0.0005	0.047	0.000097	95.8	-0.0005	0.00039	0.0125	0.031	-0.00005	0.00316	23.2	0.128	0.0116	0.00061	1.73	0.025	8.46	-0.00001	10.1	0.35	-0.00001	-0.0001	-0.01	0.000528	-0.001	0.0051	2013.41	744
Bi-annual Seep Sampling	Waste Haul Road Seep 13	24-06-2013 13:10	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013.48	509
Bi-annual Seep Sampling	Waste Haul Road Seep 14	24-06-2013 13:18	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013.48	414
Bi-annual Seep Sampling	Waste Haul Road Seep 15	24-06-2013 13:23	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013.48	413
Bi-annual Seep Sampling	Waste Haul Road Seep 16	24-06-2013 13:28	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013.48	862
Bi-annual Seep Sampling	Waste Haul Road Seep 17	24-06-2013 13:40	6/24/2013	0.0899	-0.0001	-0.0005	0.033	0.000225	284	-0.0005	0.00957	0.0116	0.301	-0.00005	0.00535	52.8	4.45	0.0802	0.00221	5.31	0.304	6.32	0.000014	17.5	0.854	-0.00001	-0.0001	0.013	0.00158	-0.001	0.0094	2013.48	1609
Bi-annual Seep Sampling	Waste Haul Road Seep 17	20-10-2014 14:15	10/20/2014	0.0854	-0.0002	-0.001	0.026	0.000261	393	-0.0005	0.018	0.0186	0.613	-0.0001	0.003	63.9	7.12	0.114	0.0028	2.94	0.291	5.92	-0.00002	17	1	-0.00002	-0.0002	0.027	0.00166	-0.002	0.0063	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 18	24-06-2013 13:46	6/24/2013	0.0699	-0.0002	-0.001	0.023	-0.0005	376	-0.0005	0.0105	0.0111	0.131	-0.0001	0.0034	66.4	5.48	0.154	0.003	1.98	0.684	5.76	-0.00002	17.3	0.864	-0.00002	-0.0002	0.014	0.00263	-0.002	0.0086	2013.48	2025
Bi-annual Seep Sampling	Waste Haul Road Seep 19	24-06-2013 13:53	6/24/2013	0.0287	-0.0001	-0.0005	0.027	-0.0003	115	-0.0005	0.00133	0.0177	-0.03	-0.00005	0.00284	21.4	0.848	0.113	0.00064	0.729	0.136	4.91	-0.00001	12	0.373	-0.00001	-0.0001	-0.01	0.00285	-0.001	0.0055	2013.48	782
Bi-annual Seep Sampling	Waste Haul Road Seep 19	12/5/2015	12/5/2015	0.0334	-0.0001	-0.00005	0.028	0.0000839	173	-0.0005	0.00082	0.00439	-0.03	-0.00005	0.0051	33.9	0.479	0.188	-0.0005	1	0.203	7.61	-0.00001	9.58	0.449	-0.00001	-0.0001	-0.01	0.00215	-0.0005	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 2	30-05-2013 9:22	5/30/2013	0.0329	-0.0001	-0.0005	0.14	0.000016	97.2	-0.0005	0.00039	0.00662	0.074	-0.00005	0.00067	26.5	0.216	0.0114	0.00053	2.19	0.00257	6.99	-0.00001	11.4	0.456	-0.00001	-0.0001	-0.01	0.000405	-0.001	-0.003	2013.41	724
Bi-annual Seep Sampling	Waste Haul Road Seep 20	24-06-2013 13:58	6/24/2013	0.0333	-0.0001	-0.0005	0.026	-0.0002	197	-0.0005	0.00108	0.00942	-0.03	-0.00005	0.00535	39.3	0.584	0.124	0.00065	1.38	0.245	7.38	-0.00001	12.4	0.56	-0.00001	-0.0001	0.012	0.00213	-0.001	-0.003	2013.48	1313
Bi-annual Seep Sampling	Waste Haul Road Seep 20	10/6/2014	10/6/2014	0.033	-0.0001	-0.0005	0.034	-0.0003	237	-0.0005	0.00054	0.00955	-0.03	-0.00005	0.00508	47	0.284	0.278	0.00056	1.27	0.299	7.54	-0.00001	12.1	0.654	-0.00001	-0.0001	0.016	0.00226	-0.001	0.0059	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 20	20-10-2014 13:57	10/20/2014	0.0337	-0.0001	-0.0005	0.032	0.000132	233	-0.0005	0.00132	0.0107	0.038	-0.00005	0.00447	45.2	0.958	0.125	0.00067	1.39	0.197	6.62	-0.00001	13.2	0.656	-0.00001	-0.0001	0.021	0.00193	-0.001	0.0031	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 20	12/5/2015	12/5/2015	0.0604	-0.0002	-0.0001	0.068	0.000104	343	-0.0005	0.0002	0.00731	-0.03	-0.0001	0.0079	64.6	0.0643	0.461	-0.001	2.09	0.343	5.97	-0.00002	22	0.96	-0.00002	-0.0002	-0.01	0.00269	-0.001	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 21	24-06-2013 14:14	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013.48	1422
Bi-annual Seep Sampling	Waste Haul Road Seep 22	24-06-2013 14:14	6/24/2013	0.0414	-0.0001	-0.0005	0.017	0.000063	109	-0.0005	0.00019	0.00229	-0.03	-0.00005	0.00136	27.4	0.109	0.0454	-0.0005	1.95	0.152	7.87	-0.00001	10.6	0.423	-0.00001	-0.0001	-0.01	0.000291	-0.001	-0.003	2013.48	794
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/12/2013	10/12/2013	0.0475	-0.0001	-0.0005	0.06	0.000019	105	-0.0005	-0.0001	0.00223	-0.03	-0.00005	-0.0005	31.3	0.0751	0.00175	0.00073	1.47	0.0341	5.98	-0.00001	12.5	0.431	-0.00001	-0.0001	0.013	0.000033	-0.001	-0.003	2013.78	797
Bi-annual Seep Sampling	Waste Haul Road Seep 22	26-11-2013 10:20	11/26/2013	0.0402	-0.0001	-0.0005	0.04	0.000026	83.9	-0.0005	0.00027	0.00304	-0.03	-0.00005	-0.0005	25.3	0.24	0.00193	0.00094	1.46	0.0246	5.75	-0.00001	10.2	0.341	-0.00001	-0.0001	0.013	0.000027	-0.001	-0.003	2013.9	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	14-01-2014 12:15	1/14/2014	0.048	-0.0001	-0.0005	0.082	0.000035	104	-0.0005	0.00031	0.00237	-0.03	-0.00005	-0.0005	30.4	0.113	0.00171	0.00079	1.68	0.0207	6.19	-0.00001	14.6	0.444	-0.00001	-0.0001	0.01	0.000038	-0.001	-0.003	2014.03	773
Bi-annual Seep Sampling	Waste Haul Road Seep 22	18-02-2014 13:24	2/18/2014	0.0482	-0.0001	-0.0005	0.131	0.000035	107	-0.0005	0.00031	0.00186	-0.03	-0.00005	-0.0005	30.6	0.228	0.00496	0.00078	1.57	0.0227	5.59	-0.00001	16.9	0.431	-0.00001	-0.0001	-0.01	0.000037	-0.001	-0.003	2014.13	805
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/7/2014	3/7/2014	0.101	-0.0001	-0.0005	0.075	0.000065	215	-0.0005	-0.0001	0.00302	-0.03	-0.00005	-0.0005	55.8	0.165	0.00543	0.00129	2.1	0.18	6.13	-0.00001	18.8	0.99	-0.00001	-0.0001	0.017	0.000052	-0.001	-0.003	2014.18	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	15-05-2014 10:50	5/15/2014	0.0395	-0.0001	-0.0005	0.012	0.000022	87.1	-0.0005	-0.0001	0.00185	-0.03	-0.00005	-0.0005	22.1	0.00271	0.00488	-0.0005	2.64	0.0587	6.62	-0.00001	8.5	0.318	-0.00001	-0.0001	0.011	-0.00001	-0.001	-0.003	2014.37	637
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/8/2014	6/8/2014	0.0805	-0.0001	-0.0005	0.075	0.000067	178	-0.0005	0.00029	0.00385	-0.03	-0.00005	-0.0005	44.5	0.45	0.00632	0.00164	2.1	0.0896	6.56	-0.00001	17.7	0.702	-0.00001	-0.0001	0.01	0.000107	-0.001	-0.003	2014.43	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/4/2014	8/4/2014	0.053	-0.0001	-0.0005	0.096	0.000035	85.9	-0.0005	0.00023	0.00407	-0.03	-0.00005	-0.0005	23.5	0.211	0.00924	0.00102	2.12	0.0266	4.94	-0.00001	13	0.356	-0.00001	-0.0001	0.011	0.000104	-0.001	-0.003	2014.59	662
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/9/2014	8/9/2014	0.0783	-0.0001	-0.0005	0.058	0.000034	187	-0.0005	-0.0001	0.00468	-0.03	-0.00005	-0.0005	48.6	0.047	0.00612	0.00163	2.78	0.0715	7.16	-0.00001	16.7	0.78	-0.00001	-0.0001	0.017	0.000269	-0.001	-0.003	2014.6	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/12/2014	9/12/2014	0.0359	-0.0001	-0.0005	0.028	0.000033	107	-0.0005	0.00056	0.0074	-0.03	-0.00005	-0.0005	27.7	0.367	0.0145	0.00101	1.87	0.0159	5.46	-0.00001	10.8	0.431	-0.00001	-0.0001	0.016	0.000358	-0.001	-0.003	2014.7	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/6/2014	10/6/2014	0.0842	-0.0001	-0.0005	0.063	0.000052	171	-0.0005	0.0003	0.00309	-0.03	-0.00005	-0.0005	45.3	0.403	0.00572	0.00118	2.08	0.171	5.46	-0.00001	14.2	0.693	-0.00001	-0.0001	0.015	0.000121	-0.001	-0.003	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	20-10-2014 13:40	10/20/2014	0.0668	-0.0001	-0.0005	0.048	0.000077	185	-0.0005	0.00144	0.00431	0.031	-0.00005	0.00053	48.4	1.15	0.00522	0.00286	2.38	0.0204	7.36	-0.00001	15.8	0.71	-0.00001	-0.0001	0.021	0.000288	-0.001	-0.003	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/3/2014	11/3/2014	0.0501	-0.0001	-0.0005	0.136	0.000026	121	-0.0005	0.00031	0.00202	-0.03	-0.00005	-0.0005	33.4	0.106	0.00333	0.0007	1.68	0.0232	5.5	-0.00001	18.8	0.477	-0.00001	-0.0001	0.014	0.000043	-0.001	-0.003	2014.84	877
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/11/2014	11/11/2014	0.0493	-0.0001	-0.0005	0.042	0.000032	145	-0.0005	0.00015	0.00312	-0.03	-0.00005	0.00061	37.8	0.367	0.00502	0.00202	1.98	0.0132	6.85	-0.00001	14	0.558	-0.00001	-0.0001	0.017	0.000214	-0.001	-0.003	2014.86	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	13-01-2015 11:30	1/13/2015	0.0526	-0.0001	-0.0005	0.031	0.000047	137	-0.0005	0.00151	0.00297	0.052	-0.00005	-0.0005	37	0.951	0.0025	0.00185	1.72	0.032	6.14	-0.00001	11.9	0.555	-0.00001	-0.0001	0.014	0.000126	-0.001	-0.003	2015.03	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/3/2015	3/3/2015	0.0452	-0.0001	-0.0005	0.026	0.000033	119	-0.0005	0.00048	0.00242	-0.03	-0.00005	-0.0005	31.7	0.349	0.00198	0.0011	1.48	0.0451	5.37	-0.00001	10.7	0.497	-0.00001	-0.0001	0.012	0.000049	-0.001	-0.003	2015.17	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/2/2015	4/2/2015	0.0419	-0.0001	-0.0005	0.027	0.000032	118	-0.0005	0.0003	0.00286	-0.03	-0.00005	-0.0005	30.9	0.359	0.00244	0.00143	1.62	0.0168	5.93	-0.00001	11.5	0.414	-0.00001	-0.0001	-0.01	0.000091	-0.001	-0.003	2015.25	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/6/2015	4/6/2015	0.0602	-0.0001	-0.00005	0.036	0.0000263	161	-0.0005	0.00023	0.00297	-0.03	-0.00005	-0.001	41.5	0.168	0.00325	0.00116	1.57	0.0855	6.36	-0.00001	14.1	0.632	-0.00001	-0.0001	0.011	0.000093	-0.0005	-0.003	2015.26	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/5/2015	6/5/2015	0.0566	-0.0001	-0.00005	0.028	0.0000164	147	-0.0005	-0.0001	0.00222	-0.03	-0.00005	-0.001	40.2	0.0609	0.00254	0.00079	1.77	0.13	5.47	-0.00001	12.3	0.611	-0.00001	-0.0001	-0.01	0.000051	-0.0005	-0.003	2015.42	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/4/2015	9/4/2015	0.0491	-0.0001	-0.00005	0.028	0.0000259	127	-0.0005	0.00034	0.00234	-0.03	-0.00005	-0.001	32.6	0.239	0.00276	0.00089	1.6	0.0737	5.02	-0.00001	10.3	0.521	-0.00001	-0.0001	0.013	0.000069	-0.0005	-0.003	2015.67	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 23	29-10-2015 13:39	10/29/2015	0.0811	-0.0001	-0.00005	0.037	0.0000208	163	-0.0005	0.00845	0.0009	0.29	-0.00005	-0.001	40.4	3.25	0.00593	0.004	2.38	0.00113	7.17	-0.00001	18.8	0.652	-0.00001	-0.0001	-0.01	0.000106	-0.0005	-0.003	2015.82	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	30-11-2015 12:40	11/30/2015	0.0685	-0.0001	-0.00005	0.041	0.0000239	163	-0.0005	0.00756	0.001	0.581	-0.00005	-0.001	40.3	3.14	0.00375	0.00336	1.73	0.000463	6.56	-0.00001	18.2	0.629	-0.00001	-0.0001	-0.01	0.000165	-0.0005	-0.003	2015.91	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/6/2014	12/6/2014	0.0365	-0.0001	-0.0005	0.045	-0.0001	148	-0.0005	0.0006	0.0184	-0.03	-0.00005	0.00316	35.3	0.283	0.158	0.00056	3.1	0.0253	6.7	-0.00001	17	0.599	-0.00001	-0.0001	0.014	0.00175	-0.001	-0.003	2014.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/5/2015	12/5/2015	0.0285	-0.0001	-0.00005	0.036	0.0000191	123	-0.0005	0.00118	0.0117	-0.03	-0.00005	0.0024	31	0.0975	0.076	-0.0005	2.79	0.0185	6.32	-0.00001	15.1	0.547	-0.00001	-0.0001	-0.01	0.000952	0.00065	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 25	11/5/2015	11/5/2015	0.0483	-0.0001	-0.00005	0.045	0.000041	215	-0.0005	0.00138	0.00251	-0.03	-0.00005	0.0025	49.1	0.76	0.475	0.00095	2.02	0.325	7.66	-0.00001	16.2	0.716	-0.00001	-0.0001	-0.01	0.000235	-0.0005	-0.003	2015.84	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 26	12/5/2015	12/5/2015	0.037	-0.0002	-0.0001	0.035	0.000084	391	-0.0005	0.00028	0.00898	-0.03	-0.0001	0.0052	75.8	0.164	0.189	-0.001	1.94	0.448	6.08	-0.00002	20.1	1.08	-0.00002	-0.0002	-0.01	0.00362	-0.001	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 27	12/5/2015	12/5/2015	0.0507	-0.0001	-0.00005	0.054	0.000073	224	-0.0005	0.00089	0.0128	0.036	-0.00005	0.0022	51	0.714	0.0802	0.00063	2.12	0.0581	5.9	-0.00001	19.2	0.843	-0.00001	-0.0001	-0.01	0.00101	-0.0005	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 28	12/5/2015	12/5/2015	0.0599	-0.0001	-0.00005	0.031	0.0000559	225	-0.0005	0.0008	0.00942	0.226	-0.00005	0.0014	44.8	0.714	0.191	0.00059	2.85	0.0442	6.48	-0.00001	15.4	0.916	-0.00001	-0.0001	-0.01	0.00173	0.00064	0.0034	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 9:30	5/30/2013	0.0152	-0.0001	-0.0005	0.232	0.000014	67.2	-0.0005	-0.0001	0.00391	-0.03	-0.00005	0.00196	15.1	0.018	0.034	-0.0005	0.973	0.014	11.7	-0.00001	6.76	0.288	-0.00001	-0.0001	-0.01	0.000481	0.0025	-0.003	2013.41	527
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 12:17	5/30/2013	0.0279	-0.0001	-0.0005	0.072	0.000016	86.1	-0.0005	-0.0001	0.0103	-0.03	-0.00005	0.00149	19	0.0201	0.0214	-0.0005	3.48	0.00828	10.5	-0.00001	7.41	0.383	-0.00001	-0.0001	-0.01	0.00131	0.0015	-0.003	2013.41	615
Bi-annual Seep Sampling	Waste Haul Road Seep 3	12/5/2015	12/5/2015	0.011	-0.0001	-0.00005	0.224	0.0000122	56.4	-0.0005	-0.0001	0.00283	-0.03	-0.00005	0.0023	11.8	0.00953	0.0292	-0.0005	0.765	0.00702	12.3	-0.00001	7.33	0.234	0.000028	-0.0001	-0.01	0.000334	0.00311	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 4	10/6/2014	10/6/2014	0.0153	-0.0001	-0.0005	0.231	0.000021	60.8	-0.0005	-0.0001	0.00452	-0.03	-0.00005	0.00178	13.3	0.0148	0.0325	-0.0005	0.981	0.00937	11.8	-0.00001	6.32	0.248	-0.00001	-0.0001	-0.01	0.000366	0.0025	-0.003	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 4	20-10-2014 15:42	10/20/2014	0.0191	-0.0001	-0.0005	0.255	0.00001	67.4	-0.0005	-0.0001	0.00222	-0.03	-0.00005	0.00275	13.7	0.0138	0.0338	-0.0005	0.842	0.00848	12.2	-0.00001	7.99	0.29	-0.00001	-0.0001	-0.01	0.000393	0.0034	-0.003	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 5	30-05-2013 12:24	5/30/2013	0.034	-0.0001	-0.0005	0.034	0.000051	96	-0.0005	0.00131	0.00985	0.252	-0.00005	0.00076	20.8	1.69	0.018	0.00066	4.39	0.0108	10.5	-0.00001	7.26	0.39	-0.00001	-0.0001	-0.01	0.00051	0.001	-0.003	2013.41	696
Bi-annual Seep Sampling	Waste Haul Road Seep 5	10/6/2014	10/6/2014	0.0292	-0.0001	-0.0005	0.044	0.000036	93.2	-0.0005	0.00025	0.00738	0.081	-0.00005	0.00099	18.4	0.447	0.0266	0.0005	3.11	0.00737	9.72	-0.00001	7.44	0.36	-0.00001	-0.0001	0.011	0.000382	-0.001	-0.003	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 5	20-10-2014 15:55	10/20/2014	0.0288	-0.0001	-0.0005	0.072	0.000025	80.2	-0.0005	0.00051	0.00276	0.223	-0.00005	0.00144	14.3	0.855	0.0211	-0.0005	2.31	0.00316	11.8	-0.00001	8.79	0.301	-0.00001	-0.0001	0.011	0.000301	-0.001	-0.003	2014.8	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 5	12/5/2015	12/5/2015	0.0255	-0.0001	-0.00005	0.056	0.0000296	89.6	-0.0005	0.00038	0.00523	0.037	0.000155	0.0013	16.8	0.337	0.027	-0.0005	1.98	0.00746	10.7	-0.00001	8.06	0.329	-0.00001	-0.0001	-0.01	0.000353	0.00097	-0.003	2015.93	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 6	30-05-2013 9:45	5/30/2013	0.0943	-0.0001	-0.0005	0.019	0.000063	135	-0.0005	0.00881	0.0211	3.15	-0.00005	-0.0005	28.4	3.97	0.00961	0.00253	6.73	0.00928	7.85	0.000014	11.5	0.589	-0.00001	-0.0001	0.012	0.000525	0.002	0.0042	2013.41	932
Bi-annual Seep Sampling	Waste Haul Road Seep 6	10/6/2014	10/6/2014	0.0663	-0.0001	-0.0005	0.024	-0.0001	144	-0.0005	0.00026	0.021	-0.03	-0.00005	-0.0005	28.9	0.398	0.023	0.00076	4.66	0.00559	6.98	-0.00001	10.3	0.592	-0.00001	-0.0001	0.014	0.000645	-0.001	-0.003	2014.76	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 7	30-05-2013 10:16	5/30/2013	0.0433	-0.0001	-0.0005	0.022	0.000032	88.8	-0.0005	0.00017	0.0261	0.035	-0.00005	0.00065	20.8	0.101	0.0207	0.00056	2.63	0.00592	6.78	-0.00001	8.48	0.426	-0.00001	-0.0001	-0.01	0.000741	-0.001	0.0051	2013.41	655
Bi-annual Seep Sampling	Waste Haul Road Seep 7	26-11-2013 12:10	11/26/2013	0.0576	-0.0001	-0.0005	0.018	0.000045	142	-0.0005	0.00037	0.0224	-0.03	-0.00005	0.00134	33.4	0.444	0.0137	0.00063	2.69	0.00775	6.55	-0.00001	12.2	0.678	-0.00001	-0.0001	0.016	0.000868	-0.001	-0.003	2013.9	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 7	3/7/2014	3/7/2014	0.0764	-0.0001	-0.0005	0.034	-0.0001	177	-0.0005	0.00019	0.0192	0.944	-0.00

Location Type	Sample Point	Original Date As Is	Recoded Date	pH-field	Q	T	Turbidity-Field	EC	Hardness	pH	TDS	TSS	Turbidity	Alkalinity	NH3	Cl	F	NO3	NO3+NO2	NO2	PO4	P-D	P-T	SO4	N-T
					m3/s	C	NTU	µs/cm	mg/L	-	mg/L	mg/L	ntu	mg/L	mgN/L	mg/L	mg/L	mgN/L	mgN/L	mg/L	mgP/L	mg/L	mg/L	mg/L	mg/L
Bi-annual Seep Sampling	Waste Haul Road Seep 1	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	568	282	7.98	438	9.2	1.99	73.8	0.0068	9.08	0.072	8.22	8.22	0.002	0.0196	0.0236	0.0394	174	8.01
Bi-annual Seep Sampling	Waste Haul Road Seep 1	20-10-2014 15:12	10/20/2014	#N/A	#N/A	#N/A	#N/A	765	389	8.07	607	14.9	8.12	89.6	0.0826	2.5	0.1	4.62	4.66	0.041	0.0166	0.0192	0.0675	302	4.59
Bi-annual Seep Sampling	Waste Haul Road Seep 10	30-05-2013 11:27	5/30/2013	7.8	#N/A	9	#N/A	301	149	7.8	226	8	2.84	108	0.0564	17.7	0.039	1.55	1.57	0.0186	0.0005	0.0057	0.0247	30	1.83
Bi-annual Seep Sampling	Waste Haul Road Seep 11	30-05-2013 11:37	5/30/2013	7.9	0.0075	7.9	#N/A	331	161	7.86	243	1.5	0.96	93.3	0.0152	16.5	0.048	3.28	3.28	0.002	0.0034	0.0056	0.0064	49.2	3.17
Bi-annual Seep Sampling	Waste Haul Road Seep 12	30-05-2013 11:56	5/30/2013	7.5	0.004	7	#N/A	675	335	7.71	492	1.5	1.78	143	0.0113	13.7	0.05	17.3	17.3	0.0149	0.0063	0.0106	0.0183	151	16.5
Bi-annual Seep Sampling	Waste Haul Road Seep 13	24-06-2013 13:10	6/24/2013	6.4	0	6.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 14	24-06-2013 13:18	6/24/2013	7.4	0	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 15	24-06-2013 13:23	6/24/2013	7.1	0	9.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 16	24-06-2013 13:28	6/24/2013	7.1	0	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 17	24-06-2013 13:40	6/24/2013	8.4	0.003	15.6	#N/A	1620	925	8.04	1360	15.2	6.16	189	0.239	5	0.43	44.1	50.8	6.69	0.0013	0.0132	0.0586	602	50.5
Bi-annual Seep Sampling	Waste Haul Road Seep 17	20-10-2014 14:15	10/20/2014	#N/A	#N/A	#N/A	#N/A	2080	1250	8.2	1810	6.5	4.77	233	0.322	5	0.2	26.5	32.6	6.06	0.0005	0.0053	0.0434	1010	29.8
Bi-annual Seep Sampling	Waste Haul Road Seep 18	24-06-2013 13:46	6/24/2013	8	0.003	8.8	#N/A	1980	1210	7.96	1770	25.8	4.25	148	0.114	5	0.41	52.2	56.3	4.12	0.0012	0.0075	0.0481	899	54.4
Bi-annual Seep Sampling	Waste Haul Road Seep 19	24-06-2013 13:53	6/24/2013	8	0.0015	4.7	#N/A	718	375	8.06	510	21.2	4.25	122	0.0052	1.25	0.28	6.01	6.23	0.218	0.0005	0.001	0.048	244	6.26
Bi-annual Seep Sampling	Waste Haul Road Seep 19	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	1060	572	8.09	793	6.1	3.8	87.2	0.0147	1.25	0.05	11.5	11.6	0.026	0.0005	0.001	0.0101	460	11.2
Bi-annual Seep Sampling	Waste Haul Road Seep 2	30-05-2013 9:22	5/30/2013	8	0.004	10	#N/A	689	352	8.11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 20	24-06-2013 13:58	6/24/2013	8.3	0.005	1.5	#N/A	1180	654	8.01	1000	41.8	11.6	75.5	0.052	2.5	0.29	24.9	25	0.112	0.0005	0.001	0.075	510	24.5
Bi-annual Seep Sampling	Waste Haul Road Seep 20	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	1360	786	7.93	1180	4.9	3.7	66.2	0.027	2.5	0.21	39.6	39.6	0.042	0.0069	0.0087	0.0131	583	39.8
Bi-annual Seep Sampling	Waste Haul Road Seep 20	20-10-2014 13:57	10/20/2014	#N/A	#N/A	#N/A	#N/A	1390	768	7.99	1170	10	3.26	113	0.0583	7.3	0.1	25	25.1	0.106	0.0005	0.001	0.0104	616	23.4
Bi-annual Seep Sampling	Waste Haul Road Seep 20	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	1920	1120	8.14	1700	39	10.7	89.8	0.0025	2.5	0.1	36.2	36.3	0.031	0.0011	0.0038	0.0904	982	34.5
Bi-annual Seep Sampling	Waste Haul Road Seep 21	24-06-2013 14:14	6/24/2013	7.8	0	3.6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Bi-annual Seep Sampling	Waste Haul Road Seep 22	24-06-2013 14:14	6/24/2013	7.8	0.006	2.6	#N/A	765	385	7.78	611	4.5	1.18	50.4	0.0156	2.5	0.25	27.6	27.7	0.073	0.0092	0.0151	0.0254	249	26.9
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/12/2013	10/12/2013	7.877	#N/A	0.9	#N/A	768	391	7.38	566	16	12.1	82.1	0.0258	6.8	0.11	10.3	10.3	0.01	0.0037	0.0085	0.0539	287	10.1
Bi-annual Seep Sampling	Waste Haul Road Seep 22	26-11-2013 10:20	11/26/2013	#N/A	#N/A	#N/A	#N/A	636	314	7.67	459	35.1	31.2	79.3	0.0332	10.5	0.049	5.35	5.36	0.0147	0.0023	0.0078	0.0769	208	5.49
Bi-annual Seep Sampling	Waste Haul Road Seep 22	14-01-2014 12:15	1/14/2014	7.859	#N/A	1.4	38.7	753	384	7.35	567	78.7	60.1	103	0.0146	6.8	0.1	8.56	8.56	0.005	0.0046	0.0094	0.206	262	8.5
Bi-annual Seep Sampling	Waste Haul Road Seep 22	18-02-2014 13:24	2/18/2014	7.602	#N/A	0.7	2.64	782	392	7.59	581	5.6	2.86	76.1	0.0709	7.5	0.1	6.59	6.61	0.018	0.0035	0.008	0.0239	319	6.41
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/7/2014	3/7/2014	#N/A	#N/A	#N/A	#N/A	1350	767	7.8	1130	9	12.6	91.7	0.0261	5	0.1	28.3	28.3	0.033	0.0029	0.0067	0.0239	585	26.6
Bi-annual Seep Sampling	Waste Haul Road Seep 22	15-05-2014 10:50	5/15/2014	8	#N/A	4.2	#N/A	640	308	7.65	484	8.5	4.41	40.1	0.0595	1.36	0.03	9.83	9.85	0.0142	0.0293	0.0377	0.0525	242	9.66
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/8/2014	6/8/2014	#N/A	#N/A	#N/A	#N/A	1110	627	7.87	958	8.8	1.48	119	0.0292	2.5	0.1	9.26	9.28	0.018	0.0041	0.0075	0.009	481	8.87
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/4/2014	8/4/2014	7.827	#N/A	0.8	84.8	643	311	7.64	462	146	65	89.3	0.0813	4.56	0.067	7.2	7.21	0.0132	0.0057	0.0129	0.268	208	7.52
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/9/2014	8/9/2014	#N/A	#N/A	#N/A	#N/A	1170	668	7.78	970	218	69.1	177	0.0575	2.5	0.1	4.22	#N/A	0.022	0.0064	0.0134	0.391	507	4.52
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/12/2014	9/12/2014	#N/A	#N/A	#N/A	#N/A	735	382	8.11	511	78	29.9	180	0.0274	5.2	0.1	2.14	2.14	0.005	0.0054	0.0087	0.135	224	2.35
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	1120	614	7.6	907	14.2	38.6	103	0.0229	2.5	0.1	28.9	29	0.019	0.0014	0.0029	0.0465	424	29.3
Bi-annual Seep Sampling	Waste Haul Road Seep 22	20-10-2014 13:40	10/20/2014	#N/A	#N/A	#N/A	#N/A	1130	661	8.07	858	65.8	19.8	222	0.0613	8.3	0.1	0.757	0.769	0.012	0.0055	0.0071	0.224	437	1.14
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/3/2014	11/3/2014	6.87	#N/A	0.9	1.65	843	440	7.45	637	7.7	2.84	99.8	0.0201	5.5	0.1	8.03	8.05	0.015	0.004	0.0085	0.0335	329	7.64
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/11/2014	11/11/2014	#N/A	#N/A	#N/A	#N/A	947	519	8.02	673	1.5	1.93	217	0.0608	2.5	0.1	0.823	0.835	0.012	0.0036	0.0039	0.01	331	0.88
Bi-annual Seep Sampling	Waste Haul Road Seep 22	13-01-2015 11:30	1/13/2015	#N/A	#N/A	#N/A	#N/A	921	493	7.44	692	5.2	3.26	175	0.0356	5.2	0.049	4.19	4.2	0.0069	0.004	0.005	0.0246	321	4.26
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/3/2015	3/3/2015	#N/A	#N/A	#N/A	#N/A	803	429	7.62	603	39.2	14	124	0.0227	4.6	0.087	5.45	5.45	0.0042	0.0036	0.0046	0.0431	306	5.68
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/2/2015	4/2/2015	#N/A	#N/A	#N/A	#N/A	766	421	7.44	571	94.3	31.7	159	0.0473	5.3	0.072	1.45	1.45	0.0035	0.0033	0.0073	0.281	257	1.74
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/6/2015	4/6/2015	#N/A	#N/A	#N/A	#N/A	988	574	7.78	797	457	149	121	0.0236	3.5	0.051	4.82	4.82	0.0049	0.0015	0.006	1.93	428	5.21
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/5/2015	6/5/2015	#N/A	#N/A	#N/A	#N/A	1030	532	8.08	781	25.8	6.34	113	0.011	4.1	0.05	10.7	10.7	0.0025	0.0005	0.004	0.113	410	10.6
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/4/2015	9/4/2015	#N/A	#N/A	#N/A	#N/A	833	451	7.7	608	29.7	3.37	118	0.0125	2.5	0.045	7.01	7.02	0.0063	0.0005	0.0037	0.0677	311	6.99
Bi-annual Seep Sampling	Waste Haul Road Seep 22	29-10-2015 13:39	10/29/2015	#N/A	#N/A	#N/A	#N/A	1080	573	7.28	831	15.3	19.7	183	0.0988	6.2	0.05	0.067	0.067	0.0025	0.0082	0.0089	0.0481	434	0.423
Bi-annual Seep Sampling	Waste Haul Road Seep 22	30-11-2015 12:40	11/30/2015	#N/A	#N/A	#N/A	#N/A	1050	573	6.85	777	6.7	5.63	173	0.113	6.1	0.05	0.0125	0.0125	0.0054	0.0208	0.0182	0.125	412	0.366
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/6/2014	12/6/2014	#N/A	#N/A	#N/A	#N/A	952	514	8.27	763	13	5.79	164	0.0073	10.2	0.1	11	11	0.019	0.0057	0.0117	0.0229	333	10.8
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	874	436	8.37	620	164	55.9	172	0.0107	15.3	0.111	22.7	22.7	0.0109	0.0116	0.0151	0.45	209	21.7
Bi-annual Seep Sampling	Waste Haul Road Seep 24	12/6/2014	12/6/2014	#N/A	#N/A	#N/A	#N/A	1100	560	7.8	791	1.5	0.85	125	0.0454	12.9	0.1	14	14.1	0.077	0.0161	0.0188	0.0294	426	13.5
Bi-annual Seep Sampling	Waste Haul Road Seep 25	11/5/2015	11/5/2015	#N/A	#N/A	#N/A	#N/A	1330	739	7.92	1090	8	3.58	65	0.0229	3.1	0.05	31.4	31.4	0.0882	0.0028	0.0022	0.0407	566	28.9
Bi-annual Seep Sampling	Waste Haul Road Seep 26	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	2140	1290	8.09	1980	5.1	0.33	76.4	0.0096	5	0.2	62.7	62.8	0.03	0.004	0.0059	0.0096	1040	58.3
Bi-annual Seep Sampling	Waste Haul Road Seep 27	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	1400	769	8.19	1110	13	14.2	130	0.0705	10.6	0.05	16.6	16.7	0.0258	0.0032	0.0042	0.13	614	15.7
Bi-annual Seep Sampling	Waste Haul Road Seep 28	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	1330	746	8.16	1030	1.5	0.42	167	0.0323	5.5	0.05	12.5	12.6	0.0556	0.006	0.0065	0.0267	551	12.1
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 9:30	5/30/2013	7.9	0.02	4.5	#N/A	480	230	8.09	321	1.5	0.72	104	0.0025	10	0.18	12.3	12.3	0.0093	0.019	0.0209	0.0238	81.8	12
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 12:17	5/30/2013	7.9	0.005	7.5	#N/A	578	293	8.17	250	18	12.2	178	0.0129	13.1	0.114	5.71	5.72	0.0087	0.0104	0.016	0.0667	92.5	5.9
Bi-annual Seep Sampling	Waste Haul Road Seep 3	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	413	189	8.21	286	1.5	2.24	90.4	0.0025	5.25	0.184	4.21	4.21	0.0012	0.023	0.0231	0.0272	90.4	3.99
Bi-annual Seep Sampling	Waste Haul Road Seep 4	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	417	207	8.03	287	1.5	1.85	97.6	0.0025	4.83	0.172	4.59	4.6	0.0011	0.0204	0.0208	0.0242	93	4.51
Bi-annual Seep Sampling	Waste Haul Road Seep 4	20-10-2014 15:42	10/20/2014	#N/A	#N/A	#N/A	#N/A	467	224	8.23	338	4	5.56	85.6	0.0025	5.64	0.198	5.2	5.2	0.002	0.0218	0.0231	0.0298	118	4.53
Bi-annual Seep Sampling	Waste Haul Road Seep 5	30-05-2013 12:24	5/30/2013	8.2	0.003	3.7	#N/A	639	325	8.19	304	19.3	15.3	217	0.284	17.3	0.098	6.4	6.6	0.198	0.014	0.026	0.0807	78.7	6.95
Bi-annual Seep Sampling	Waste Haul Road Seep 5	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	590	308	8.01	418	14	9.29	154	0.0838	10.8	0.16	2.08	2.09	0.0118	0.0184	0.0191	0.0851	139	2.39
Bi-annual Seep Sampling	Waste Haul Road Seep 5	20-10-2014 15:55	10/20/2014	#N/A	#N/A	#N/A	#N/A	512	259	8.36	354	14	14.6	165	0.0922	5.93	0.142	0.59	0.598	0.0075	0.0243	0.0307	0.0636	105	0.883
Bi-annual Seep Sampling	Waste Haul Road Seep 5	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	586	293	8.25	407	15.4	12.2	111	0.0458	9.91	0.12	1.77	1.78	0.0089	0.0165	0.0218	0.0675	150	1.85
Bi-annual Seep Sampling	Waste Haul Road Seep 6	30-05-2013 9:45	5/30/2013	6.9	0.005	5.8	#N/A	871	453	7.81	537	4.7	17.1	220	0.279	10.4	0.1	2.84	3.77	0.926	0.0147	0.0351	0.0964	239	5.21
Bi-annual Seep Sampling	Waste Haul Road Seep 6	10/6/2014	10/6/2014	#N/A	#N/A	#N/A	#N/A	867	477	7.98	637	150	48	244	0.277	5.3	0.1	4.36	4.41	0.05	0.0048	0.0081	0.146	224	5.26
Bi-annual Seep Sampling	Waste Haul Road Seep 7	30-05-2013 10:16	5/30/2013	7.7	0.04	5.4	#N/A	586	308	7.98	443	14.4	17.3	182	0.0125	4.6	0.083	4.59	4.59	0.0056	0.0132	0.0207	0.051	133	4.6
Bi-annual Seep Sampling	Waste Haul Road Seep 7	26-11-2013 12:10	11/26/2013	#N/A	#N/A	#N/A	#N/A	929	491	8.19	664	26.9	17.7	189	0.037	6.5	0.1	14.6	14.6	0.037	0.0093	0.0145	0.0875	246	14.5
Bi-annual Seep Sampling	Waste Haul Road Seep 7	3/7/2014	3/7/2014	#N/A	#N/A	#N/A	#N/A	1070	605	8.36	851	124	106	208	0.0164	5.1	0.1	15.4	15.4	0.052	0.0164	0.0241	0.161	355	14.9
Bi-annual Seep Sampling	Waste Haul Road Seep 7	15-05-2014 10:09	5/15/2014	8.1	#N/A	4	#N/A	705	367	8.17	530	25.5	16.9	150	0.0144	2.5	0.08	9.33	9.34	0.0097	0.0159	0.0203	0.0751	189	9.22
Bi-annual Seep Sampling	Waste Haul Road Seep 7	11/11/2014	11/11/2014	#N/A	#N/A	#N/A	#N/A	1230	706	8.35	911	88.1	55.3	255	0.016	9	0.1	4.9	4.91	0.013	0.0075	0.0131	0.226	462	4.74
Bi-annual Seep Sampling	Waste Haul Road Seep 7	12/6/2014	12/6/2014	#N/A	#N/A	#N/A	#N/A	861	468	8.09	664	8.7	4.58	183	0.0172	2.5	0.1	9.69	9.71	0.017	0.0156	0.0163	0.0531	262	9.53
Bi-annual Seep Sampling	Waste Haul Road Seep 8	30-05-2013 10:50	5/30/2013	7.7	0.001	1.5	#N/A	813	411	7.73	624	7	1.87	105	0.0052	22.4	0.1	13.8	13.9	0.024	0.0521	0.0618	0.0702	272	13.2
Bi-annual Seep Sampling	Waste Haul Road Seep 8	12/6/2014	12/6/2014	#N/A	#N/A	#N/A	#N/A	889	461	7.97	689	1.5	0.69	90.3	0.0075	13.9	0.1	9.55	9.57	0.022	0.0265	0.0334	0.0388	344	9.6
Bi-annual Seep Sampling	Waste Haul Road Seep 8	12/5/2015	12/5/2015	#N/A	#N/A	#N/A	#N/A	869	424	8.13	636	11	0.15	79.4	0.0025	7.1	0.045	5.19	5.19	0.001	0.0212	0.0243	0.0256	353	5.03
Bi-annual Seep Sampling	Waste Haul Road Seep 9	30-05-2013 11:06	5/30/2013	7.4	#N/A	5.3	#N/A	444	220	7.41	318	1.5	0.55	119	0.0168	22.6	0.038	2.56	2.57	0.0075	0.0058	0.0078	0.0155	79.9	3.35
Bi-annual Seep Sampling	Waste Haul Road Under Culvert	30-05-2013 12:47	5/30/2013	8.3	#N/A	8.8	#N/A	495	231	7.91	294	9.3	2.87	68.3	0.0025	18.3	0.085	1.89	1.9	0.0061	0.006	0.0104	0.0325	146	2.03

Location Type	Sample Point	Original Date As Is	Recoded Date	DOC	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D	Se/SO4	Ca	Mg+K+Na	(Mg+K+Na)/Ca	Zn/Cd	Year
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/mgS	meq/L	meq/L	meq/meq		Year
Bi-annual Seep Sampling	Waste Haul Road Seep 1	10/6/2014	10/6/2014	7.39	0.0391	0.00005	0.00074	0.0297	0.00005	0.00025	0.041	4.3E-05	79	0.00025	0.00014	0.0137	0.015	2.5E-05	0.00079	20.5	0.0435	0.0514	0.00025	2.01	0.0231	7.86	5E-06	8.64	0.35	5E-06	0.00005	0.01	0.00029	0.0013	0.0068	0.000398276	3.95	1.62253	0.410766054	158.14	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 1	20-10-2014 15:12	10/20/2014	7.5	0.0322	0.00005	0.00025	0.0576	0.00005	0.00025	0.031	9.3E-05	109	0.00025	0.00062	0.00555	0.057	2.5E-05	0.00113	28.3	0.48	0.0163	0.00056	2.63	0.0278	7.56	5E-06	9.54	0.489	5E-06	0.00005	0.014	2.1E-05	0.0005	0.0049	0.000276159	5.45	2.13236	0.391259501	52.6882	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 10	30-05-2013 11:27	5/30/2013	5.63	0.0015	0.00005	0.00023	0.0216	0.00005	0.00025	0.018	1.9E-05	48.5	0.00025	0.00005	0.00783	0.015	2.5E-05	0.00096	6.86	0.0037	0.00274	0.00025	0.568	0.00796	7.07	5E-06	4.77	0.113	5E-06	0.00005	0.005	2.2E-05	0.0005	0.0015	0.000796	2.425	0.62196	0.256476456	78.9474	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 11	30-05-2013 11:37	5/30/2013	4.21	0.0031	0.00005	0.00022	0.0256	0.00005	0.00025	0.015	1.6E-05	49	0.00025	0.00005	0.00423	0.015	2.5E-05	0.00105	9.42	0.00083	0.0019	0.00025	0.974	0.0137	7.81	5E-06	4.86	0.129	5E-06	0.00005	0.005	5E-06	0.0005	0.0015	0.000835366	2.45	0.78555	0.320632589	93.75	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 12	30-05-2013 11:56	5/30/2013	3.92	0.0115	0.00012	0.00036	0.0546	0.00005	0.00025	0.047	9.7E-05	95.8	0.00025	0.00039	0.0125	0.031	2.5E-05	0.00316	23.2	0.128	0.0116	0.00061	1.73	0.025	8.46	5E-06	10.1	0.35	5E-06	0.00005	0.005	0.00053	0.0005	0.0051	0.000496689	4.79	1.83626	0.383352628	52.5773	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 13	24-06-2013 13:10	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 14	24-06-2013 13:18	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 15	24-06-2013 13:23	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 16	24-06-2013 13:28	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 17	24-06-2013 13:40	6/24/2013	23.2	0.0104	0.00049	0.00135	0.0899	0.00005	0.00025	0.033	0.00023	284	0.00025	0.00957	0.0116	0.301	2.5E-05	0.00535	52.8	4.45	0.0802	0.00221	5.31	0.304	6.32	1.4E-05	17.5	0.854	5E-06	0.00005	0.013	0.00158	0.0005	0.0094	0.00151495	14.2	3.97574	0.279981733	41.7778	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 17	20-10-2014 14:15	10/20/2014	26.4	0.01	0.00031	0.0009	0.0854	0.0001	0.0005	0.026	0.00026	393	0.00025	0.018	0.0186	0.613	0.00005	0.003	63.9	7.12	0.114	0.0028	2.94	0.291	5.92	0.00001	17	1	0.00001	0.0001	0.027	0.00166	0.001	0.0063	0.000864356	19.65	4.54046	0.231066798	24.1379	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 18	24-06-2013 13:46	6/24/2013	11.4	0.007	0.00036	0.00117	0.0699	0.0001	0.0005	0.023	0.00025	376	0.00025	0.0105	0.0111	0.131	0.00005	0.0034	66.4	5.48	0.154	0.003	1.98	0.684	5.76	0.00001	17.3	0.864	0.00001	0.0001	0.014	0.00263	0.001	0.0086	0.002282536	18.8	4.67466	0.248652301	34.4	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 19	24-06-2013 13:53	6/24/2013	5.55	0.0015	0.00043	0.00156	0.0287	0.00005	0.00025	0.027	0.00015	115	0.00025	0.00133	0.0177	0.015	2.5E-05	0.00284	21.4	0.848	0.113	0.00064	0.729	0.136	4.91	5E-06	12	0.373	5E-06	0.00005	0.005	0.00285	0.0005	0.0055	0.001672131	5.75	1.78824	0.310999104	36.6667	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 19	12/5/2015	12/5/2015	3.25	0.0015	0.00027	0.00055	0.0334	0.00005	2.5E-05	0.028	8.4E-05	173	0.00025	0.00082	0.00439	0.015	2.5E-05	0.0051	33.9	0.479	0.188	0.00025	1	0.203	7.61	5E-06	9.58	0.449	5E-06	0.00005	0.005	0.00215	0.00025	0.0015	0.001323913	8.65	2.41884	0.279634584	17.8784	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 2	30-05-2013 9:22	5/30/2013	#N/A	0.0148	0.00005	0.00103	0.0329	0.00005	0.00025	0.14	1.6E-05	97.2	0.00025	0.00039	0.00662	0.074	2.5E-05	0.00067	26.5	0.216	0.0114	0.00053	2.19	0.00257	6.99	5E-06	11.4	0.456	5E-06	0.00005	0.005	0.00041	0.0005	0.0015	#N/A	4.86	2.097	0.431480561	93.75	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 20	24-06-2013 13:58	6/24/2013	4.32	0.0041	0.00038	0.00071	0.0333	0.00005	0.00025	0.026	0.0001	197	0.00025	0.00108	0.00942	0.015	2.5E-05	0.00535	39.3	0.584	0.124	0.00065	1.38	0.245	7.38	5E-06	12.4	0.56	5E-06	0.00005	0.012	0.00213	0.0005	0.0015	0.001441176	9.85	2.86606	0.290970583	15	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 20	10/6/2014	10/6/2014	2.6	0.003	0.0003	0.00057	0.033	0.00005	0.00025	0.034	0.00015	237	0.00025	0.00054	0.00955	0.015	2.5E-05	0.00508	47	0.284	0.278	0.00056	1.27	0.299	7.54	5E-06	12.1	0.654	5E-06	0.00005	0.016	0.00226	0.0005	0.0059	0.001538593	11.85	3.29918	0.278411463	39.3333	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 20	20-10-2014 13:57	10/20/2014	3.89	0.0015	0.0003	0.00055	0.0337	0.00005	0.00025	0.032	0.00013	233	0.00025	0.00132	0.0107	0.038	2.5E-05	0.00447	45.2	0.958	0.125	0.00067	1.39	0.197	6.62	5E-06	13.2	0.656	5E-06	0.00005	0.021	0.00193	0.0005	0.0031	0.000959416	11.65	3.24512	0.278551295	23.4848	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 20	12/5/2015	12/5/2015	4.37	0.0068	0.00066	0.00116	0.0604	0.0001	0.00005	0.068	0.0001	343	0.00025	0.0002	0.00731	0.015	0.00005	0.0079	64.6	0.0643	0.461	0.0005	2.09	0.343	5.97	0.00001	22	0.96	0.00001	0.0001	0.005	0.00269	0.0005	0.0015	0.001047862	17.15	4.77688	0.278535005	14.4231	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 21	24-06-2013 14:14	6/24/2013	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 22	24-06-2013 14:14	6/24/2013	3.43	0.0061	0.00017	0.00038	0.0414	0.00005	0.00025	0.017	6.3E-05	109	0.00025	0.00019	0.00229	0.015	2.5E-05	0.00136	27.4	0.109	0.0454	0.00025	1.95	0.152	7.87	5E-06	10.6	0.423	5E-06	0.00005	0.005	0.00029	0.0005	0.0015	0.001831325	5.45	2.10854	0.38688756	23.8095	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/12/2013	10/12/2013	5.99	0.006	0.00013	0.00019	0.0475	0.00005	0.00025	0.06	1.9E-05	105	0.00025	0.00005	0.00223	0.015	2.5E-05	0.00025	31.3	0.0751	0.00175	0.00073	1.47	0.0341	5.98	5E-06	12.5	0.431	5E-06	0.00005	0.013	3.3E-05	0.0005	0.0015	0.000356446	5.25	2.40624	0.458332087	78.9474	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 22	26-11-2013 10:20	11/26/2013	7.97	0.0136	0.0001	0.00021	0.0402	0.00005	0.00025	0.04	2.6E-05	83.9	0.00025	0.00027	0.00304	0.015	2.5E-05	0.00025	25.3	0.24	0.00193	0.00094	1.46	0.0246	5.75	5E-06	10.2	0.341	5E-06	0.00005	0.013	2.7E-05	0.0005	0.0015	0.000354808	4.195	1.95613	0.466301029	57.6923	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 22	14-01-2014 12:15	1/14/2014	6.07	0.0143	0.00015	0.00021	0.048	0.00005	0.00025	0.082	3.5E-05	104	0.00025	0.00031	0.00237	0.015	2.5E-05	0.00025	30.4	0.113	0.00171	0.00079	1.68	0.0207	6.19	5E-06	14.6	0.444	5E-06	0.00005	0.01	3.8E-05	0.0005	0.0015	0.000237023	5.2	2.45045	0.471241208	42.8571	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	18-02-2014 13:24	2/18/2014	4.09	0.0072	0.00033	0.0002	0.0482	0.00005	0.00025	0.131	3.5E-05	107	0.00025	0.00031	0.00186	0.015	2.5E-05	0.00025	30.6	0.228	0.00496	0.00078	1.57	0.0227	5.59	5E-06	16.9	0.431	5E-06	0.00005	0.005	3.7E-05	0.0005	0.0015	0.00021348	5.35	2.5593	0.478373005	42.8571	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/7/2014	3/7/2014	5.71	0.0044	0.00023	0.00029	0.101	0.00005	0.00025	0.075	6.5E-05	215	0.00025	0.00005	0.00302	0.015	2.5E-05	0.00025	55.8	0.165	0.00543	0.00129	2.1	0.18	6.13	5E-06	18.8	0.99	5E-06	0.00005	0.017	5.2E-05	0.0005	0.0015	0.000923077	10.75	4.12488	0.383709932	23.0769	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	15-05-2014 10:50	5/15/2014	5.67	0.0146	0.00005	0.00021	0.0395	0.00005	0.00025	0.012	2.2E-05	87.1	0.00025	0.00005	0.00185	0.015	2.5E-05	0.00025	22.1	0.00271	0.00488	0.00025	2.64	0.0587	6.62	5E-06	8.5	0.318	5E-06	0.00005	0.011	5E-06	0.0005	0.0015	0.000727686	4.355	1.72589	0.396300175	68.1818	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/8/2014	6/8/2014	6.45	0.007	0.00019	0.00032	0.0805	0.00005	0.00025	0.075	6.7E-05	178	0.00025	0.00029	0.00385	0.015	2.5E-05	0.00025	44.5	0.45	0.00632	0.00164	2.1	0.0896	6.56	5E-06	17.7	0.702	5E-06	0.00005	0.01	0.00011	0.0005	0.0015	0.000558836	8.9	3.41816	0.384063321	22.3881	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/4/2014	8/4/2014	6.09	0.0135	0.00032	0.00034	0.053	0.00005	0.00025	0.096	3.5E-05	85.9	0.00025	0.00023	0.00407	0.015	2.5E-05	0.00025	23.5	0.211	0.00924	0.00102	2.12	0.0266	4.94	5E-06	13	0.356	5E-06	0.00005	0.011	0.0001	0.0005	0.0015	0.000383654	4.295	1.98984	0.463291911	42.8571	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	8/9/2014	8/9/2014	8.56	0.0069	0.00016	0.00042	0.0783	0.00005	0.00025	0.058	3.4E-05	187	0.00025	0.00005	0.00468	0.015	2.5E-05	0.00025	48.6	0.047	0.00612	0.00163	2.78	0.0715	7.16	5E-06	16.7	0.78	5E-06	0.00005	0.017	0.00027	0.0005	0.0015	0.000423077	9.35	3.63119	0.38836238	44.1176	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/12/2014	9/12/2014	9.77	0.0105	0.00017	0.00035	0.0359	0.00005	0.00025	0.028	3.3E-05	107	0.00025	0.00058	0.0074	0.015	2.5E-05	0.00025	27.7	0.367	0.0145	0.00101	1.87	0.0159	5.46	5E-06	10.8	0.431	5E-06	0.00005	0.016	0.00036	0.0005	0.0015	0.000212946	5.35	2.13267	0.398630708	45.4545	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	10/6/2014	10/6/2014	5.36	0.0104	0.00025	0.0003	0.0842	0.00005	0.00025	0.063	5.2E-05	171	0.00025	0.0003	0.00309	0.015	2.5E-05	0.00025	45.3	0.403	0.00572	0.00118	2.08	0.171	5.46	5E-06	14.2	0.693	5E-06	0.00005	0.015	0.00012	0.0005	0.0015	0.001209906	8.55	3.31212	0.38738293	28.8462	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	20-10-2014 13:40	10/20/2014	10.1	0.0114	0.00017	0.00038	0.0668	0.00005	0.00025	0.048	7.7E-05	185	0.00025	0.00144	0.00431	0.031	2.5E-05	0.00053	48.4	1.15	0.00522	0.00286	2.38	0.0204	7.36	5E-06	15.8	0.71	5E-06	0.00005	0.021	0.00029	0.0005	0.0015	0.000140046	9.25	3.57014	0.385961038	19.4805	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/3/2014	11/3/2014	4.35	0.0079	0.00027	0.00021	0.0501	0.00005	0.00025	0.136	2.6E-05	121	0.00025	0.00031	0.00202	0.015	2.5E-05	0.00025	33.4	0.106	0.00333	0.0007	1.68	0.0232	5.5	5E-06	18.8	0.477	5E-06	0.00005	0.014	4.3E-05	0.0005	0.0015	0.00021155	6.05	2.80799	0.464130594	57.6923	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	11/11/2014	11/11/2014	9.88	0.004	0.00017	0.00033	0.0493	0.00005	0.00025	0.042	3.2E-05	145	0.00025	0.00015	0.00312	0.015	2.5E-05	0.00061	37.8	0.367	0.00502	0.00202	1.98	0.0132	6.85	5E-06	14	0.558	5E-06	0.00005	0.017	0.00021	0.0005	0.0015	0.000119637	7.25	2.86355	0.394971933	46.875	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 22	13-01-2015 11:30	1/13/2015	8.02	0.0085	0.00016	0.00023	0.0526	0.00005	0.00025	0.031	4.7E-05	137	0.00025	0.00151	0.00297	0.052	2.5E-05	0.00025	37	0.951	0.0025	0.00185	1.72	0.032	6.14	5E-06	11.9	0.555	5E-06	0.00005	0.014	0.00013	0.0005	0.0015	0.000299065	6.85	2.71893	0.396923835	31.9149	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	3/3/2015	3/3/2015	7.3	0.0077	0.00014	0.0002	0.0452	0.00005	0.00025	0.026	3.3E-05	119	0.00025	0.00048	0.00242	0.015	2.5E-05	0.00025	31.7	0.349	0.00198	0.00111	1.48	0.0451	5.37	5E-06	10.7	0.497	5E-06	0.00005	0.012	4.9E-05	0.0005	0.0015	0.000442157	5.95	2.35196	0.395220607	45.4545	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/2/2015	4/2/2015	7.89	0.0079	0.00014	0.00026	0.0419	0.00005	0.00025	0.027	3.2E-05	118	0.00025	0.0003	0.00286	0.015	2.5E-05	0.00025	30.9	0.359	0.00244	0.00143	1.62	0.0168	5.93	5E-06	11.5	0.414	5E-06	0.00005	0.005	9.1E-05	0.0005	0.0015	0.000196109	5.9	2.34329	0.397167412	46.875	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	4/6/2015	4/6/2015	7.36	0.016	0.00014	0.00026	0.0602	0.00005	2.5E-05	0.036	2.6E-05	161	0.00025	0.00023	0.00297	0.015	2.5E-05	0.0005	41.5	0.168	0.00325	0.00116	1.57	0.0855	6.36	5E-06	14.1	0.632	5E-06	0.00005	0.011	9.3E-05	0.00025	0.0015	0.000599299	8.05	3.07312	0.381754654	57.0342	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	6/5/2015	6/5/2015	6.8	0.0041	0.00014	0.00022	0.0566	0.00005	2.5E-05	0.028	1.6E-05	147	0.00025	0.00005	0.00222	0.015	2.5E-05	0.0005	40.2	0.0609	0.00254	0.00079	1.77	0.13	5.47	5E-06	12.3	0.611	5E-06	0.00005	0.005	5.1E-05	0.00025	0.0015	0.00095122	7.35	2.92419	0.397849054	91.4634	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	9/4/2015	9/4/2015	6.64	0.006	0.00017	0.00023	0.0491	0.00005	2.5E-05	0.028	2.6E-05	127	0.00025	0.00034	0.00234	0.015	2.5E-05	0.0005	32.6	0.239	0.00276	0.00089	1.6	0.0737	5.02	5E-06	10.3	0.521	5E-06	0.00005	0.013	6.9E-05	0.00025	0.0015	0.000710932	6.35	2.38973	0.37633486	57.9151	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	29-10-2015 13:39	10/29/2015	10.1	0.0068	0.00005	0.00108	0.0811	0.00005	2.5E-05	0.037	2.1E-05	163	0.00025	0.00845	0.0009	0.29	2.5E-05	0.0005	40.4	3.25	0.00593	0.004	2.38	0.00113	7.17	5E-06	18.8	0.652	5E-06	0.00005	0.005	0.00011	0.00025	0.0015	7.8106E-06	8.15	3.2341	0.396822341	72.1154	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 22	30-11-2015 12:40	11/30/2015	9.32	0.0085	0.00005	0.00093	0.0685	0.00005	2.5E-05	0.041	2.4E-05	163	0.00025	0.00756	0.001	0.581	2.5E-05	0.0005	40.3	3.14	0.00375	0.00336	1.73	0.00046	6.56	5E-06	18.2	0.629	5E-06	0.00005	0.005	7.5E-05	0.00025	0.0015	3.3713E-06	8.15	3.18552	0.390861049	62.7615	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/6/2014	12/6/2014	9.54	0.0068	0.00033	0.00065	0.0365	0.00005	0.00025	0.045	0.00005	148	0.00025	0.0006	0.0184	0.015	2.5E-05	0.00316	35.3	0.283	0.158	0.00056	3.1	0.0253	6.7	5E-06	17	0.599	5E-06	0.00005	0.014	0.00175	0.0005	0.0015	0.000227928	7.4	2.87693	0.388773872	30	2014
Bi-annual Seep Sampling	Waste Haul Road Seep 23	12/5/2015	12/5/2015	8.08	0.0078	0.00023	0.00054	0.0285	0.00005	2.5E-05	0.036	1.9E-05	123	0.00025	0.00118	0.0117	0.015	2.5E-05	0.0024	31	0.0975	0.076	0.00025	2.79	0.0185	6.32	5E-06	15.1	0.547	5E-06	0.00005	0.005	0.00095	0.00065	0.0015	0.00026555	6.15	2.53564	0.412299248	78.534	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 25	11/5/2015	11/5/2015	5.41	0.0041	0.00032	0.00052	0.0483	0.00005	2.5E-05	0.045	4.1E-05	215	0.00025	0.00138	0.00251	0.015	2.5E-05	0.0025	49.1	0.76	0.475	0.00095	2.02	0.325	7.66	5E-06	16.2	0.716	5E-06	0.00005	0.005	0.00024	0.00025	0.0015	0.001722615	10.75	3.61912	0.336661996	36.5854	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 26	12/5/2015	12/5/2015	3.46	0.0015	0.00034	0.00064	0.037	0.0001	0.00005	0.035	8.4E-05	391	0.00025	0.00028	0.00898	0.015	0.00005	0.0052	75.8	0.164	0.189	0.0005	1.94	0.448	6.08	0.00001	20.1	1.08	0.00001	0.0001	0.005	0.00362	0.0005	0.0015	0.001292308	19.55	5.34348	0.273323872	17.8571	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 27	12/5/2015	12/5/2015	7.24	0.0074	0.00026	0.00041	0.0507	0.00005	2.5E-05	0.054	7.3E-05	224	0.00025	0.00089	0.0128	0.036	2.5E-05	0.0022	51	0.714	0.0802	0.00063	2.12	0.0581	5.9	5E-06	19.2	0.843	5E-06	0.00005	0.005	0.00101	0.00025	0.0015	0.000283876	11.2	3.8629	0.34490201	20.5479	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 28	12/5/2015	12/5/2015	11.2	0.0104	0.00021	0.00044	0.0599	0.00005	2.5E-05	0.031	5.6E-05	225	0.00025	0.0008	0.00942	0.226	2.5E-05	0.0014	44.8	0.714	0.191	0.00059	2.85	0.0442	6.48	5E-06	15.4	0.916	5E-06	0.00005	0.005	0.00173	0.00064	0.0034	0.000240653	11.25	3.35489	0.298212181	60.8229	2015
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 9:30	5/30/2013	2.86	0.0015	0.00012	0.00278	0.0152	0.00005	0.00025	0.232	1.4E-05	67.2	0.00025	0.00005	0.00391	0.015	2.5E-05	0.00196	15.1	0.018	0.034	0.00025	0.973	0.014	11.7	5E-06	6.76	0.288	5E-06	0.00005	0.005	0.00048	0.0025	0.0015	0.000513447	3.36	1.19933	0.356942927	107.143	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 3	30-05-2013 12:17	5/30/2013	8.6	0.0222	0.00005	0.00142	0.0279	0.00005	0.00025	0.072	1.6E-05	86.1	0.00025	0.00005	0.0103	0.015	2.5E-05	0.00149	19	0.0201	0.0214	0.00025	3.48	0.00828	10.5	5E-06	7.41	0.383	5E-06	0.00005	0.005	0.00131	0.0015	0.0015	0.000268541	4.305	1.51928	0.352909733	93.75	2013
Bi-annual Seep Sampling	Waste Haul Road Seep 3	12/5/2015	12/5/2015	1.47	0.0035	0.00014	0.00329	0.011	0.00005	2.5E-05	0.224	1.2E-05	56.4	0.00025	0.00005	0.00283	0.015	2.5E-05	0.0023

Appendix F – NAG Waste Rock Source Terms

		pH	Alkalinity	Cl	F	P-D	SO4	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Mo-D	Ni-D	K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	Tl-D	Sn-D	Ti-D	U-D	V-D	Zn-D
Boundary	Median Cation Ratio	8.3496	220.4	5.769812	0.686377	0.554225	1510.721	0.056152	0.000536	0.006165	0.12634	0.000354	0.000577	0.158047	0.000169	601.7683	0.000577	0.003337	0.021672	0.087701	0.000385331	0.006657	93.11092	1.101942	0.12376	0.001311	4.532764	0.014703	17.25912	2.00789E-05	19.98063	7.899103	3.71576E-05	0.000115	0.05299	0.003452	0.003012	0.009232
Wight	Median Cation Ratio	8.3356	238.98	15.69779	0.922136	0.021402	1591.257	0.072452	0.00084	0.000874	0.090618	0.000118	0.000643	0.366612	0.000711	475.8903	0.000295	0.009447	0.355212	0.017702	5.90054E-05	0.006329	106.441	1.249026	0.498737	0.0095	4.284972	0.250065	8.475062	1.18011E-05	34.03195	8.321412	1.59315E-05	0.000153	0.029668	0.00577	0.001534	0.097522
All Other Non-PAG	Median Cation Ratio	8.36	240.59	26.14414	0.844002	0.147679	1675.136	0.048464	0.004381	0.004001	0.170842	0.000124	0.000619	0.293699	0.000338	625.7321	0.000309	0.012613	0.067437	0.01856	6.18679E-05	0.017036	117.7557	6.360145	0.694579	0.004011	10.21353	0.511462	14.93244	1.56897E-05	48.79522	16.96666	1.23736E-05	0.000124	0.033409	0.010903	0.003599	0.011305
All PAG - Pre-Acid	Median Cation Ratio	8.25	369.4	26.24464	0.84179	0.091684	1610.206	0.408167	0.000693	0.003799	0.261873	0.000143	0.000716	0.478764	0.000629	616.0041	0.00065	0.034811	0.035069	0.048707	0.000247261	0.00573	108.7319	12.67822	0.683908	0.003977	13.56642	0.367597	13.52917	6.01678E-05	57.50327	2.180368	1.43257E-05	0.000143	0.040398	0.003885	0.005576	0.029253
Boundary	High Cation Ratio	8.3496	220.4	5.893454	0.701085	0.566102	1543.095	0.057355	0.000547	0.006297	0.129048	0.000362	0.000589	0.161433	0.000173	614.6637	0.000589	0.003409	0.022137	0.08958	0.000393588	0.0068	95.1062	1.125555	0.126412	0.001339	4.629897	0.015018	17.62897	2.05092E-05	20.4088	8.068374	3.79538E-05	0.000118	0.054125	0.003526	0.003076	0.00943
Wight	High Cation Ratio	8.3356	238.98	16.43347	0.965352	0.022405	1665.831	0.075847	0.00088	0.000915	0.094865	0.000124	0.000673	0.383793	0.000744	498.1927	0.000309	0.00989	0.371859	0.018531	6.17707E-05	0.006626	111.4293	1.307561	0.52211	0.009945	4.485785	0.261784	8.872243	1.23541E-05	35.62684	8.711392	1.66781E-05	0.00016	0.031058	0.006041	0.001606	0.102092
All Non-PAG	High Cation Ratio	8.36	240.59	27.68951	0.893891	0.156408	1774.152	0.051328	0.00464	0.004238	0.18094	0.000131	0.000655	0.31106	0.000358	662.7187	0.000328	0.013358	0.071423	0.019657	6.55249E-05	0.018043	124.7161	6.736089	0.735635	0.004248	10.81724	0.541694	15.81509	1.66171E-05	51.67948	17.96955	1.3105E-05	0.000131	0.035383	0.011548	0.003812	0.011973
All PAG - Pre-Acid	High Cation Ratio	8.25	369.4	27.61957	0.675413	0.096488	1694.563	0.429551	0.00073	0.003998	0.275593	0.000151	0.000754	0.503846	0.000662	648.276	0.000684	0.036635	0.036907	0.051259	0.000260215	0.00603	114.4283	13.34243	0.719737	0.004185	14.27715	0.386855	14.23795	6.332E-05	60.51581	2.294596	1.50762E-05	0.000151	0.042515	0.004089	0.005868	0.030786

Nitrogen				
		NH3	NO3	NO2
		mgN/L	mgN/L	mgN/L
Inactive	LCL	0	1.699526	0
	Average	0.053287	3.446876	0.50763
	UCL	0.17855	5.194225	1.89058
Active	LCL	0.03428	11.0534	0
	Average	0.152813	27.91705	0.294244
	UCL	0.271345	44.7807	0.613134

Appendix G – Pit Wall Source Terms

Source Terms

Case	Alkalinity	Cl	F	P	SO4	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Mo	Ni	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	U	V	Zn		Acidity
	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
PAG Low	0	0	0	0	1341.014	4.288598	0.006371	0.058803	2.572783	0.011654	0.003587	2.879341	0.005819	195.4517	0.008946	0.630366	11.15438	1.644187	0.004691	0.19557	35.78528	17.74187	0.018239	0.154679	21.40939	0.104655	367.835	0.001443	86.74184	0.730488	0.000688	0.011555	0.037682	0.001893	0.018246	2.895168		45.65833
PAG High	0	0	0	0	1828.241	4.431467	0.011108	0.109706	3.144059	0.016543	0.006766	3.278481	0.006704	224.6746	0.010225	1.029472	17.96628	2.44708	0.006766	0.288323	39.48672	23.70838	0.031152	0.224855	30.42945	0.191079	516.1487	0.001691	141.7211	0.89643	0.000921	0.016344	0.04136	0.003383	0.021176	3.575614		54.94504
NAG Average	187.0697854	#N/A	#N/A	#N/A	111.393	0.073312	0.00081	0.00231	0.03145	-0.0001	#N/A	0.37968	0.000237	125.5831	0.000587	0.001157	0.064399	0.144091	0.000755	#N/A	10.57866	0.034505	0.089177	0.001039	2.335905	0.0462	8.5954	2.8E-06	10.38601	0.27285	#N/A	-0.0001	#N/A	#N/A	#N/A	0.025448		

Nitrogen Forms:

Assume 0 mg/L

Explanatory Notes

1 MPMC estimates PAG rock about 1050 masl is 18%. Acidification will be progressive.

2 Concentrations are "annual". Seasonal variation can be expected but these concentrations are intended to reflect seasonal worst for each case.

3 Concentations are dissolved.

4 Probabilities cannot be attached to the terms. Use the terms to assess proximity to trigger levels but not to assess probability of exceedance.

Appendix H – Tailings Seepage Water Chemistry Database

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
1	E4 - Main Embankment Seepage Pond	7/12/2001 13:30		545	8.84	22.4		82		148			11	1.75	0.011				16.3		
3	E4 - Main Embankment Seepage Pond	7/26/2001 8:00		593	8.43	15.3		94		207			-4	3.2	-0.005				27.2		
4	E4 - Main Embankment Seepage Pond	8/3/2001		567	8.78	16.2		87		192			-4	1.27	-0.005				24.4		
5	E4 - Main Embankment Seepage Pond	8/10/2001 10:15		577	8.97	16.8		73		179			-4	0.68	0.013				28.9		
7	E4 - Main Embankment Seepage Pond	8/30/2001 14:25		545	9.18	18.3		71		141			-4	1.01	0.019				15.8		
8	E4 - Main Embankment Seepage Pond	10/23/2001 14:30		768	7.82	5.1		112		143			5	7.99	0.017				8.1		
9	E4 - Main Embankment Seepage Pond	11/13/2001 8:45		657	7.46	6.1		140		217			-4	0.78	-0.005				17.9		
15	E4 - Main Embankment Seepage Pond	5/22/2002 12:30		362	7.98	8.05		96		131		230	17	27.8	0.12				6.52		7.43
17	E4 - Main Embankment Seepage Pond	7/31/2002 9:10		423	7.57	16		102		114		256	-4	0.48	0.03				2.51		3.06
26	E4 - Main Embankment Seepage Pond	5/5/2003 14:50		364	9.15	13		124		154		234	6	5.1	0.079				1.61	0.033	
27	E4 - Main Embankment Seepage Pond	5/29/2003 10:30		355	9.51	17.4		121		132		244	-4	1.33	0.038					0.031	
28	E4 - Main Embankment Seepage Pond	6/24/2003 7:00		366	9.06	20.3		125		135		250	-4	1.66	0.166					0.031	
29	E4 - Main Embankment Seepage Pond	8/5/2003 14:30		345	9.82	22.9		106		99.3		226	-4	0.76	-0.005					-0.005	
30	E4 - Main Embankment Seepage Pond	8/20/2003 10:00		330	9.32	19.6		102		86.4		206	-4	2.54	-0.005					-0.005	
31	E4 - Main Embankment Seepage Pond	10/16/2003 16:00		473	8.16	10		139		134		222	-4	2.81	0.016					0.011	
32	E4 - Main Embankment Seepage Pond	11/11/2003 9:55		425	8.16	6		160		172		278	-4	4.12	-0.005					0.019	
33	E4 - Main Embankment Seepage Pond	3/4/2004 10:00		178.1	6.98	1.7		108		146		204	9	10.9	0.031					0.009	
34	E4 - Main Embankment Seepage Pond	3/22/2004		515	7.2	1		161		185		280	-4	2.15	0.086					0.007	
35	E4 - Main Embankment Seepage Pond	3/22/2004 10:40		515	7.2	1		161		185		280	-4	2.15	0.086					0.007	
36	E4 - Main Embankment Seepage Pond	4/3/2004 10:00		178.1	6.98	1.7		108		146		204	9	10.9	0.031					0.009	
37	E4 - Main Embankment Seepage Pond	5/1/2004 13:32		293	8.61	12		112		130		182	7	5.7	0.07				0.46	0.013	
38	E4 - Main Embankment Seepage Pond	5/7/2004		355	8.13	20.7		126		143		244	-4	2.21	0.055				0.17	0.009	
39	E4 - Main Embankment Seepage Pond	6/9/2004		278	8.56	6.3		106		117		174	-4	2.07	0.008					-0.005	
40	E4 - Main Embankment Seepage Pond	7/5/2004		355	8.13	20.7		126		143		244	-4	2.21	0.055				0.17	0.009	
41	E4 - Main Embankment Seepage Pond	8/2/2004		342	8.65	22.3		114		151		276	-4	2.98	-0.005				-0.02	-0.005	
42	E4 - Main Embankment Seepage Pond	8/25/2004		438	7.91	16.3		123		154		300	-4	2.05	0.031				-0.02	-0.005	
43	E4 - Main Embankment Seepage Pond	12/8/2004		403	7.85	2.4		141		174		290	-4	2.39	0.042				0.52	0.014	
44	E4 - Main Embankment Seepage Pond	1/31/2005		275	7.75	1.9		107		147		192	6	11	0.042				0.71	0.009	
45	E4 - Main Embankment Seepage Pond	2/16/2005		596	7.65	3.2		137		200		358	-4	5.8	0.01				0.51	0.044	
46	E4 - Main Embankment Seepage Pond	3/16/2005		723	7.6	4.5		157		260		210	3	3.1	0.088				0.181		
48	E4 - Main Embankment Seepage Pond	4/11/2005		494	7.14	6.6		134		170		312	6	5.4	0.024				-0.002		
49	E4 - Main Embankment Seepage Pond	5/4/2005		557	7.93	12.7		144		170		336	27.5	17.2	0.04				0.005		
50	E4 - Main Embankment Seepage Pond	6/6/2005		613	7.87	7.5		138		160		344	1	1.2	-0.005				0.052		
52	E4 - Main Embankment Seepage Pond	8/11/2005		543	7.99	17.6		133		170		336	3	4.6	0.017						
53	E4 - Main Embankment Seepage Pond	9/13/2005		585	7.59	13.1		151		180		378	8	7.4	0.035						
55	E4 - Main Embankment Seepage Pond	11/8/2005			7.97	3.1		147		190		314	13	9.9	0.117						
56	E4 - Main Embankment Seepage Pond	12/14/2005			7.49	3		196		200		288	4	4.6	-0.005						
57	E4 - Main Embankment Seepage Pond	1/17/2006		593	7.34	3.4		151		180		354	7	4.1	-0.01						
58	E4 - Main Embankment Seepage Pond	2/8/2006		604	7.37	4		149		180		356	4	5.1	-0.005						
59	E4 - Main Embankment Seepage Pond	3/6/2006 12:30		645	7.59	4.15		153		180		388	3	5.2	0.017			0.1		0.063	
60	E4 - Main Embankment Seepage Pond	4/11/2006 9:20		380	7.87	8.7		115		140		236	30	41.8	0.016					0.015	
61	E4 - Main Embankment Seepage Pond	5/9/2006		524	9.3	12.5		142		175		345	13.9	12	0.0493						
62	E4 - Main Embankment Seepage Pond	6/14/2006		565	8.41	18.4		142		175		351	-3	2.66	0.009			0.0575		0.0017	
63	E4 - Main Embankment Seepage Pond	7/4/2006		558	8.53	22.9		138		174		373	3	2.82	-0.02			-0.005		-0.001	
64	E4 - Main Embankment Seepage Pond	8/3/2006		580	7.66	15		125		152		363	4.5	3.42	0.025			-0.005		-0.001	
66	E4 - Main Embankment Seepage Pond	10/12/2006		651	7.74	8		149		211		422	8.1	5.76	0.0187			0.21		-0.001	
67	E4 - Main Embankment Seepage Pond	11/15/2006		706	7.41	2.4		146		237		443	6.3	7.45	0.0613			1.72		0.0207	
68	E4 - Main Embankment Seepage Pond	12/4/2006		713	7.7	1		152		234		465	6.2	4.53	0.0107			1.21		0.0676	
72	E4 - Main Embankment Seepage Pond	2/5/2007 10:59		669	7.3	2.4		156		218		446	7.7	6.93	-0.005			0.283		0.0426	
73	E4 - Main Embankment Seepage Pond	3/5/2007		658	7.41	0		149		213		426	7	6.64	-0.005			0.249		0.0433	
74	E4 - Main Embankment Seepage Pond	4/11/2007 11:15		445	7.68	5.5		100		202		303	24	45.2	0.0089			2.49		0.0066	
75	E4 - Main Embankment Seepage Pond	5/7/2007 10:00		720	8.16	10.1		132		273		482	20.5	20.7	0.0285			2.56		0.0134	
77	E4 - Main Embankment Seepage Pond	6/4/2007 10:34		786	8.47	19.6		121		288		514	8.3	3.13	0.164			2.51		0.0206	
79	E4 - Main Embankment Seepage Pond	6/11/2007 10:59		761	8.19	14		113		277		501	8.5	6.19	0.0188			2.64		0.0134	
80	E4 - Main Embankment Seepage Pond	6/18/2007 9:45		727	8.43	14.5		105		275		476	20.2	17.2	0.025			2.31		0.016	
81	E4 - Main Embankment Seepage Pond	6/25/2007 10:00		731	8.52	14.9		102		272		499	-3	4.1	0.0542			2.57		0.0216	
83	E4 - Main Embankment Seepage Pond	7/9/2007 13:30		730	8.39	18		91		246		515	10.4	7.61	0.0363			2.52		0.0203	
84	E4 - Main Embankment Seepage Pond	7/17/2007 10:59		757	8.21	18.2		91.4		249		511	-3	5.53	0.017			1.75		0.0187	
85	E4 - Main Embankment Seepage Pond	7/24/2007 14:19		733	8.7	16.3		87.9		262		487	-3	4.52	0.0174			1.66		0.0136	
86	E4 - Main Embankment Seepage Pond	7/31/2007 14:44		730	8.27	18.3		71		220		460	-3	5.06	0.0186			1.44		0.0114	
87	E4 - Main Embankment Seepage Pond	8/2/2007 10:14		689	8.8	18		66.2		204		453	3	2.83	0.0163			1.35		0.0128	
88	E4 - Main Embankment Seepage Pond	8/14/2007 9:15		689	8.8	14.7		73		205		471	6	3.55	0.0132			1.28		0.0127	
89	E4 - Main Embankment Seepage Pond	8/29/2007 15:15		679	8.9	14.6		94.8		203		449	5.5	3.17	0.0223			0.709		0.0128	
90	E4 - Main Embankment Seepage Pond	9/5/2007 11:30		695	8.43	13.9		103		227		449	-3	2.2	0.0362			0.753		0.0095	
91	E4 - Main Embankment Seepage Pond	10/2/2007 15:00		716	8.1	8.3		123		245		458	9	9.78	0.0511			1.46		0.0139	
92	E4 - Main Embankment Seepage Pond	11/5/2007 10:45		750	8.1	0.8		131		312		519	3.8	5.7	0.0265			3.08		0.0114	
94	E4 - Main Embankment Seepage Pond	12/27/2007		856	7.817	1.6		148		307		590	-3	2.48	0.0344			2.3		0.0584	
96	E4 - Main Embankment Seepage Pond	1/8/2008 14:15		789	7.97	0.2		122		249		474	-3	1.35	0.0343			1.6		0.0399	
97	E4 - Main Embankment Seepage Pond	1/15/2008 14:19		814	8.06	2		158		282		520	-3	1.87	0.0276			1.41		0.0269	
98	E4 - Main Embankment Seepage Pond	1/22/2008 10:50		828	8.07	1.2		143		312		528	-3	1.75	0.0319			1.32		0.0412	
100	E4 - Main Embankment Seepage Pond	2/6/2008 10:09		812	8.03	1.2		146		266		538	4.8	2.68	-0.005			0.963		0.0437	
102	E4 - Main Embankment Seepage Pond	3/4/2008 10:09		781	7.867	3.3		137		261		523	-3	1.15	0.0968			0.76		0.0544	
104	E4 - Main Embankment Seepage Pond	4/16/2008 10:14		638	7.931	2.65		106		228		368	10.3	15.8	-0.005			2.24		0.008	
105	E4 - Main Embankment Seepage Pond	5/13/2008 10:45		847	8.61	10.7		108		337		609	6.3	5.21	0.0388			3.48		0.0124	
106	E4 - Main Embankment Seepage Pond	5/20/2008 13:50		836	8.679	13.7		106		348		584	-3	1.75	0.0126			2.91		0.0161	
107	E4 - Main Embankment Seepage Pond	6/16/2008 10:00		814	8.883	14.7		61.6		294		592	-3	1.48	0.0281			2.34		0.0189	
108	E4 - Main Embankment Seepage Pond	7/15/2008 9:00		782	8.202	18.3		53		267		540	5	5	0.0105			1.14		0.0169	
109	E4 - Main Embankment Seepage Pond	8/6/2008 9:24		785	8.7	16.7		57.1		230		538	13.4	15	0.0172	20.3		0.699		0.0127	
110	E4 - Main Embankment Seepage Pond	9/9/2008 8:15		829	8.1	11.9		108		254		541	-3	3.49	0.0158	19.9		0.761		0.0235	
111	E4 - Main Embankment Seepage Pond	9/30/2008 11:39		823	8.32	10.6		113		263		544	-3	2.34	0.0104	20.4		0.65		0.0213	
112	E4 - Main Embankment Seepage Pond	10/22/2008 11:39			8.449	5.2		125		267		548	5.9	6.28	0.0062	19.1		0.879		0.0152	
113	E4 - Main Embankment Seepage Pond	11/4/2008 13:39		832	8.38	5.6		128		286		590	-3	3.48	0.137	19.7		0.902		0.0161	
114	E4 - Main Embankment Seepage Pond	12/2/2008 11:28			8.46	3.1		134		326		609	3.6	4.3	0.0587	18.9		1.76		0.0204	
115	E4 - Main Embankment Seepage Pond	1/14/2009 14:05		885	7.98	0.9		146		307		610	133	62.1	0.168	19.5		0.854		0.0816	
116	E4 - Main Embankment Seepage Pond	2/10/2009 12:00		880	7.82	2.4		135		278		581	5.8	5.54	0.0967	19.2		0.284		0.117	
117	E4 - Main Embankment Seepage Pond	3/4/2009		852	7.81	1.7		133		283		552	8.8	7.58	0.0883			0.449		0.101	
118	E4 - Main Embankment Seepage Pond	4/7/2009 13:39		798	7.8	1.7		120		279		529	-3	6.92	0.0569	15.1		1.27		0.0452	
119	E4 - Main Embankment Seepage Pond	5/12/2009 10:14		808	8.52	10.7		115		368		638	11.2	5.52	-0.005	12.9		3.66		0.0235	
120	E4 - Main Embankment Seepage Pond	6/9/2009 9:45		912	8.53	14.2		66.6		315		856	-3	3.19	0.0139	18.2		1.82		0.0154	
121	E4 - Main Embankment Seepage Pond	7/7/2009 10:00		862	8.1	15.5		66.2		293		596	18.5	24.5	-0.005	16.8		1.12		0.0183	
122	E4 - Main Embankment Seepage Pond	8/5/2009 10:39		875	8.91	17.4		71.9		282		612	-3	1.98	0.022	19.3		0.692		0.0131	
123	E4 - Main Embankment Seepage Pond	8/19/2009		867	9.05	20.5		81.9		289		614	4	2.98	0.0292	22		0.545		-0.01	
124	E4 - Main Embankment Seepage Pond	9/2/2009 9:00		891	8.48	16.9		99		300		594	4	3.91	0.0487	20.3		0.567		0.016	
125	E4 - Main Embankment Seepage Pond	10/6/2009 9:49		898	8.51	7.6		120		312		612	3.8	3.16	0.0381	19.1		0.683		0.0193	
126	E4 - Main Embankment Seepage Pond	10/29/2009 12:15		877	8.35	2.7		126		298		602	4.7	4.08	0.05	18.6		0.848		0.0109	
127	E4 - Main Embankment Seepage Pond	11/19/2009 9:18		957	8.27	3		146		384		520	5	3.67	0.012	15.5		2.21		0.0278	
129	E4 - Main Embankment Seepage Pond	1/13/2010 14:05		983	7.91	2.4		159		332		570	4	3.84	0.027	13		1.41		0.0273	
130	E4 - Main Embankment Seepage Pond	2/10/2010 13:32		987	7.72	1		143		361		688	5.8	2.52	0.0412	18.8		0.749		0.227	
131	E4 - Main Embankment Seepage Pond	3/3/2010 12:00		613	7.99	1.6		125		217		347	6.3	4.11	-0.005	7.17		0.765		0.0155	
132	E4 - Main Embankment Seepage Pond	4/7/2010 13:20		872	8.61	6.7		129		356		605	5	11.3	0.0098	15.7		1.04		0.0154	
133	E4 - Main Embankment Seepage Pond	5/11/2010		1061	8.05	8.2		173		546		780	7	4.12	0.006	17.4		1.82	1.82	-0.01	
134	E4 - Main Embankment Seepage Pond	6/3/2010 8:40			6.57	7.8		68.1	844	296	8.06	574	4	0.73	0.012	16.9		0.563	0.568	0.0054	
135	E4 - Main Embankment Seepage Pond	7/8/2010		872	8.87	19.6		41.7	848	312	8.77	648	-3	0.86	0.0141	20.1		0.418	0.426	0.0087	
136	E4 - Main Embankment Seepage Pond	8/5/2010		1000	8.02	19.4		84.9		372		743	-3	0.78	0.0398	24.8		0.376	0.395	0.019	
138	E4 - Main Embankment Seepage Pond	10/7/2010		1334	7.56	9.3		104	1310	537	8.21	992	-3	0.92	0.0445	26.8		2.05	2.11	0.055	
139	E4 - Main Embankment Seepage Pond	11/4/2010		1502	7.63	5.6		92.9	1490	656	8.04	1190	-3	1.35	0.1	28.7		3.83	3.91	0.08	
140	E4 - Main Embankment Seepage Pond	12/1/2010 9:50		1604	7.99	2.2		94.2	1380	570	7.96	1060	7.3	7.09	0.0371	30.3		3.11	3.14	0.027	
141	E4 - Main Embankment Seepage Pond	1/10/2011 10:30		1583	7.49	1.3		76.5	1550	711	7.8	1280	-3	2.26	0.0612	31.9		5.97	6.02	0.049	
144	E4 - Main Embankment Seepage Pond	4/5/2011 11:16		1138	7.57	12.2		105	1090	508	7.94	859	64.2	45.8	0.0119	16		3.77	3.77	-0.01	
145	E4 - Main Embankment Seepage Pond	5/12/2011 13:29		1017	7.78	11.7		90.3	999	423	8	752	37.2	27.8	0.0075	18.7		3.82	3.84	0.016	
146	E4 - Main Embankment Seepage Pond	6/9/2011 13:02		1117	8.42	16.7		51.8	1080	473	8.09	786	4	1.19	0.0137	18	0.53	4.23	4.26	0.028	
147	E4 - Main Embankment Seepage Pond	7/13/2011 9:25		1111	8.32	15.6		50.8	1100	466	7.86	847	3.5	3.17	0.0128	18.3		3.99	4.06	0.07	

Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
1	E4 - Main Embankment Seepage Pond	7/12/2001 13:30	-0.005	0.022	0.025	86.8		0.81	17.1	5.1		0.0185	0.00026	0.0021	0.0497	-0.00005	-0.00005		0.00013	41.8	-0.0002	0.00025
3	E4 - Main Embankment Seepage Pond	7/26/2001 8:00	0.03	0.06	0.055	71.1		0.2	27.4	6.9		0.0111	0.00027	0.0015	0.075	-0.00005	-0.00005		0.0001	63.5	0.0006	0.00026
4	E4 - Main Embankment Seepage Pond	8/3/2001	0.015	0.016	0.026	77.7		0.2	24.6	5.3		0.0175	0.00027	0.0016	0.07	-0.00005	-0.00005		0.0001	58.6	0.0006	0.00039
5	E4 - Main Embankment Seepage Pond	8/10/2001 10:15	0.006	0.015	0.038	96.2		0.34	29.2	4.2		0.0055	0.00033	0.0017	0.0661	-0.00005	0.0001		0.00011	52	0.0005	0.00021
7	E4 - Main Embankment Seepage Pond	8/30/2001 14:25	-0.005	0.017	0.027	103		0.21	16	4.2		0.0032	0.00035	0.0021	0.0546	-0.00005	0.0001		0.00019	37.7	-0.0002	0.00023
8	E4 - Main Embankment Seepage Pond	10/23/2001 14:30	0.022	0.031	0.051	44.9		0.85	8.95	6.2		0.0165	0.00017	0.0014	0.0388	-0.00005	-0.00005		0.0001	40.4	0.0003	0.00013
9	E4 - Main Embankment Seepage Pond	11/13/2001 8:45	0.025	0.065	0.078	92.1		0.73	18.6	5.6		0.0093	0.00021	0.0024	0.0693	-0.00005	0.00017		0.00014	70.1	-0.0002	0.00028
15	E4 - Main Embankment Seepage Pond	5/22/2002 12:30	0.005	0.013	0.046	34.2		0.91		8.2		0.0141	0.00015	0.001	0.0348	-0.00005	-0.00005		0.00002	42.9	-0.0002	-0.00002
17	E4 - Main Embankment Seepage Pond	7/31/2002 9:10	-0.005	0.015	0.032	72.5		0.55		4		0.002	0.00014	0.002	0.0249	-0.00005	-0.00005		0.00012	30.3	-0.0002	-0.00002
26	E4 - Main Embankment Seepage Pond	5/5/2003 14:50	0.008	0.02	0.036	56.8				5.7		0.0052	0.00014	0.0014	0.0365	-0.00005	-0.00005		0.00004	45.2	-0.0002	0.00016
27	E4 - Main Embankment Seepage Pond	5/29/2003 10:30	0.007	-0.005	0.019	57.6				6.7		0.0013	0.00015	0.0017	0.034	-0.00005	-0.00005		0.00007	36	-0.0002	0.00011
28	E4 - Main Embankment Seepage Pond	6/24/2003 7:00	-0.005	0.007	0.022	62.2				7.2		0.0044	0.00015	0.0023	0.0303	-0.00005	-0.00005		0.00009	35.8	0.0003	0.00007
29	E4 - Main Embankment Seepage Pond	8/5/2003 14:30	-0.005	0.016	0.024	51.9				8.4		0.0059	0.00012	0.0033	0.0249	-0.00005	-0.00005		0.00012	22.3	-0.0002	0.00008
30	E4 - Main Embankment Seepage Pond	8/20/2003 10:00	-0.005	0.013	0.022	48				7.1		0.0094	0.00012	0.0032	0.0193	-0.00005	-0.00005		0.00012	17.6	0.0007	0.00008
31	E4 - Main Embankment Seepage Pond	10/16/2003 16:00	-0.005	0.028	0.023	46.3				6.1		0.0206	0.00014	0.0016	0.0335	-0.00005	-0.00005		0.00006	37.1	0.0017	0.00004
32	E4 - Main Embankment Seepage Pond	11/11/2003 9:55	-0.005	0.013	0.027	55.3				5.5		0.0127	0.00016	0.0015	0.0443	-0.00005	-0.00005		0.00007	50.1	0.0048	0.00005
33	E4 - Main Embankment Seepage Pond	3/4/2004 10:00	0.017	0.022	0.045	40.4				7.8		0.0688	0.00012	0.0007	0.0324	-0.00005	-0.00005		0.00002	44.9	0.0034	0.00011
34	E4 - Main Embankment Seepage Pond	3/22/2004	0.007	0.016	0.042	50.7				5		0.0175	0.00011	0.0013	0.0426	-0.00005	-0.00005		0.00005	55.7	0.004	0.00024
35	E4 - Main Embankment Seepage Pond	3/22/2004 10:40	0.007	0.016	0.042	50.7				5		0.0175	0.00011	0.0013	0.0426	-0.00005	-0.00005		0.00005	55.7	0.004	0.00024
36	E4 - Main Embankment Seepage Pond	4/3/2004 10:00	0.017	0.022	0.045	40.4				7.8		0.0688	0.00012	0.0007	0.0324	-0.00005	-0.00005		0.00002	44.9	0.0034	0.00011
37	E4 - Main Embankment Seepage Pond	5/1/2004 13:32	-0.005	0.01	0.039	36.2				8		0.0094	0.00015	0.0011	0.0312	-0.00005	-0.00005		0.00004	40.2	-0.0002	0.00009
38	E4 - Main Embankment Seepage Pond	5/7/2004	-0.005	0.014	0.023	59.5				6.7		0.0084	0.00014	0.0016	0.0378	-0.00005	-0.00005		0.00006	42.5	-0.0002	0.00008
39	E4 - Main Embankment Seepage Pond	6/9/2004	-0.005	0.012	0.022	27.8				7.9		0.0342	0.00017	0.0011	0.0255	-0.00005	-0.00005		0.00005	34.3	-0.0002	0.00011
40	E4 - Main Embankment Seepage Pond	7/5/2004	-0.005	0.014	0.023	59.5				6.7		0.0084	0.00014	0.0016	0.0378	-0.00005	-0.00005		0.00006	42.5	-0.0002	0.00008
41	E4 - Main Embankment Seepage Pond	8/2/2004	-0.005	0.006	0.024	84.2				6.5		0.0069	0.00016	0.0022	0.0414	-0.00005	-0.00005		0.00009	44	-0.0002	0.00006
42	E4 - Main Embankment Seepage Pond	8/25/2004	0.005	0.013	0.029	96.4				7.1		0.0044	0.00012	0.003	0.0424	-0.00005	-0.00005		0.0001	44.4	-0.0002	0.00007
43	E4 - Main Embankment Seepage Pond	12/8/2004	0.007	0.019	0.028	77.5				6.7		0.0072	0.00012	0.0012	0.052	-0.00005	-0.00005		0.0001	52.7	-0.0002	0.00012
44	E4 - Main Embankment Seepage Pond	1/31/2005	0.02	0.021	0.027	48.2				7.1		0.0161	0.00013	0.0007	0.0367	-0.00005	-0.00005		0.00005	45.8	0.0003	0.0001
45	E4 - Main Embankment Seepage Pond	2/16/2005	0.008	0.03	0.055	120				5.8		0.0072	0.00017	0.0016	0.0688	-0.00005	-0.00005	0.09	0.00019	62.8	-0.0002	0.00035
46	E4 - Main Embankment Seepage Pond	3/16/2005	0.006	0.015	0.034	34.2				9		0.003	0.00016	0.0006	0.0461	-0.00005	-0.00005	0.019	0.00002	78.2	0.0003	0.00013
48	E4 - Main Embankment Seepage Pond	4/11/2005	0.003	0.017	0.037	90.8				5		0.0016	0.00018	0.0015	0.0551	-0.00005	-0.00005	0.073	0.00018	51.3	-0.0002	0.00015
49	E4 - Main Embankment Seepage Pond	5/4/2005	0.007	0.019	0.091	108				5		0.0017	0.00021	0.0022	0.0486	-0.00005	-0.00005	0.095	0.00024	52.2	-0.0002	0.00007
50	E4 - Main Embankment Seepage Pond	6/6/2005	0.003	0.021	0.028	117				3.6		0.0026	0.00021	0.0026	0.0579	-0.00005	-0.00005	0.102	0.00025	50	-0.0002	0.00015
52	E4 - Main Embankment Seepage Pond	8/11/2005	0.007	0.01	0.015	117				5.7		0.0036	0.00014	0.0021	0.0455	-0.00005	-0.00005	0.093	0.00011	49.7	-0.0002	0.00011
53	E4 - Main Embankment Seepage Pond	9/13/2005	0.013	0.023	0.037	121				5.3		0.0052	0.00016	0.0021	0.0566	-0.00005	-0.00005	0.099	0.00017	53.1	-0.0002	0.00008
55	E4 - Main Embankment Seepage Pond	11/8/2005	0.01	0.038	0.025	94.2				4.2		0.013	0.00021	0.0024	0.0664	-0.00005	-0.00005	0.109	0.00034	58.6	-0.0002	0.00007
56	E4 - Main Embankment Seepage Pond	12/14/2005	0.018	0.019	0.027	47.6				6.8		0.0032	0.00016	0.0013	0.0481	-0.00005	-0.00005	0.084	0.00011	56.8	-0.0002	0.00012
57	E4 - Main Embankment Seepage Pond	1/17/2006	0.019	0.065	0.077	113				4.4		0.0018	0.00023	0.002	0.068	-0.00005	-0.00005	0.091	0.00021	56.8	-0.0002	0.00028
58	E4 - Main Embankment Seepage Pond	2/8/2006	0.011	0.048	0.059	127		0.44		3.9		0.004	0.00028	0.0028	0.0702	-0.00005	-0.00005	0.103	0.00029	54.3	0.0004	0.00032
59	E4 - Main Embankment Seepage Pond	3/6/2006 12:30	0.015	0.053	0.052	132		0.43		3.5		0.0036	0.00029	0.003	0.0755	-0.00005	-0.00005	0.106	0.00025	53.7	-0.0002	0.00032
60	E4 - Main Embankment Seepage Pond	4/11/2006 9:20	0.034	0.036	0.063	77.4		1		5.9		0.0103	0.00018	0.0017	0.0444	-0.00005	-0.00005	0.068	0.00013	42.1	0.0004	0.00021
61	E4 - Main Embankment Seepage Pond	5/9/2006	0.0014	-0.002		112			-0.5	4.86		0.0027	0.00034	0.00292	0.0617	-0.0005	-0.0005	0.09	-0.00005	51.8	0.00067	0.00012
62	E4 - Main Embankment Seepage Pond	6/14/2006	0.001	0.0122	0.0224	123			0.32	4.77		0.0026	0.00032	0.00279	0.0573	-0.0005	-0.0005	0.101	-0.00005	49.8	-0.0008	0.00012
63	E4 - Main Embankment Seepage Pond	7/4/2006	0.006	0.0229	0.0232	136			0.32	5.09		0.135	0.0003	0.00271	0.0568	-0.0005	-0.0005	0.11	-0.00005	48.1	0.00057	0.00017
64	E4 - Main Embankment Seepage Pond	8/3/2006	-0.001	0.0108	0.0317	136		0.214	0.214	4.4		0.0067	0.00027	0.00294	0.0477	-0.0005	-0.0005	0.114	-0.00005	42.4	-0.0025	-0.0001
66	E4 - Main Embankment Seepage Pond	10/12/2006	-0.001	0.0114	0.0323	156			0.31	3.69		0.0012	0.00024	0.00232	0.0749	-0.0005	-0.0005	0.108	-0.00005	62.5	-0.0005	-0.0001
67	E4 - Main Embankment Seepage Pond	11/15/2006	0.003	0.0136	0.0434	171			2.07	3.6		0.002	0.00028	0.00218	0.0919	-0.0005	-0.0005	0.103	-0.00005	71.6	-0.0005	0.00012
68	E4 - Main Embankment Seepage Pond	12/4/2006	-0.001	0.0149	0.0409	178			1.72	3.26		0.0024	0.0004	0.00236	0.0832	-0.0005	-0.0005	0.111	-0.00005	70.3	-0.0005	0.00026
72	E4 - Main Embankment Seepage Pond	2/5/2007 10:59	0.0011	0.0148	0.0561	163			0.64	3.35		0.0011	0.0004	0.00259	0.0796	-0.0005	-0.0005	0.12	-0.00004	66.5	-0.0005	0.0003
73	E4 - Main Embankment Seepage Pond	3/5/2007	-0.001	0.0151	0.0458	157			0.51	3.41		0.0017	0.00036	0.00266	0.0703	-0.0005	-0.0005	0.122	-0.00005	64.9	-0.0005	0.0003
74	E4 - Main Embankment Seepage Pond	4/11/2007 11:15	0.0023	0.0111	0.0584	107			2.85	6.58		0.0143	0.00018	0.00081	0.0387	-0.0005	-0.0005	0.048	0.000032	62.2	-0.0005	0.00016
75	E4 - Main Embankment Seepage Pond	5/7/2007 10:00	-0.001	0.0112	0.0478	192			3.02	4.45		0.0022	0.0003	0.00173	0.0809	-0.0005	-0.0005	0.103	-0.00005	84.6	-0.0005	0.00012
77	E4 - Main Embankment Seepage Pond	6/4/2007 10:34	0.0028	0.0131	0.0449	235			3.35	4.01		0.0039	0.00036	0.00202	0.076	-0.0005	-0.0005	0.119	-0.000017	86.6	-0.0005	-0.0001
79	E4 - Main Embankment Seepage Pond	6/11/2007 10:59	-0.001	0.0113	0.0246	233			3.23	3.86		0.0052	0.00032	0.00205	0.0756	-0.001	-0.001	0.126	0.000035	84.3	-0.001	-0.0002
80	E4 - Main Embankment Seepage Pond	6/18/2007 9:45	-0.001	0.0114	0.0321	215			3.01	4.06		0.0075	0.00033	0.00211	0.0671	-0.0005	-0.0005	0.119	-0.000017	83.5	-0.0005	-0.0001
81	E4 - Main Embankment Seepage Pond	6/25/2007 10:00	-0.001	0.01	0.0177	231			3.25	3.93		0.0046	0.00038	0.00216	0.0658	-0.0005	-0.0005	0.116	0.000046	81.7	-0.0005	0.00011
83	E4 - Main Embankment Seepage Pond	7/9/2007 13:30	-0.001	0.0111	0.0302	237			3.65	3.89		0.007	0.00032	0.0021	0.0657	-0.0005	-0.0005	0.113	0.000057	71.8	-0.0005	-0.0001
84	E4 - Main Embankment Seepage Pond	7/17/2007 10:59	-0.001	0.0117	0.0239	243			2.6	4.83		0.002	0.00029	0.00202	0.0615	-0.0005	-0.0005	0.117	0.000063	72.1	-0.0005	-0.0001
85	E4 - Main Embankment Seepage Pond	7/24/2007 14:19	0.0012	0.0108	0.0234	237			2.2	4.41		0.0045	0.00026	0.00204	0.0543	-0.0005	-0.0005	0.123	-0.00005	76.4	-0.0005	-0.0001
86	E4 - Main Embankment Seepage Pond	7/31/2007 14:44	-0.001	0.0094	0.019	227			2	4.06		0.0039	0.00029	0.0023	0.0546	-0.0005	-0.0005	0.124	-0.0004	61.6	-0.0005	-0.0001
87	E4 - Main Embankment Seepage Pond	8/2/2007 10:14	-0.001	0.0091	0.0198	228			1.8	4.11		-0.004	0.00026	0.00214	0.0538	-0.001	-0.001	0.129	0.000049	55.9	-0.001	-0.0002
88	E4 - Main Embankment Seepage Pond	8/14/2007 9:15	0.0011	0.0092	0.0172	226			1.6	3.92		-0.002	0.00024	0.00233	0.0522	-0.0005	-0.0005	0.121	0.000027	56.9	-0.0005	-0.0001
89	E4 - Main Embankment Seepage Pond	8/29/2007 15:15	-0.001	0.0096	0.0195	207			1.5	4.4		0.0017	0.00026	0.00251	0.0522	-0.0005	-0.0005	0.126	-0.000017	57	-0.0005	-0.0001
90	E4 - Main Embankment Seepage Pond	9/5/2007 11:30	-0.001	0.012	0.017	212			0.85	4.34		0.0012	0.00018	0.00258	0.0503	-0.0005	-0.0005	0.113	-0.0003	67.4	-0.0005	-0.0001
91	E4 - Main Embankment Seepage Pond	10/2/2007 15:00	0.0012	0.0091	0.0302	198			1.77	3.74		0.0022	0.00018	0.00207	0.0593	-0.0005	-0.0005	0.093	0.000041	73.2	-0.0005	-0.0001
92	E4 - Main Embankment Seepage Pond	11/5/2007 10:45	-0.001	0.0109	0.0324	225			4.18	5.26		0.0028	0.00019	0.00183	0.0655	-0.0005	-0.0005	0.092	0.000067	97.2	0.00144	-0.0001
94	E4 - Main Embankment Seepage Pond	12/27/2007	-0.001	0.0143	0.0364	241			4.23	3.38		-0.002	0.0004	0.00212	0.0755	-0.001	-0.001	0.128	-0.00008	95.8	-0.001	-0.0002
96	E4 - Main Embankment Seepage Pond	1/8/2008 14:15	-0.001	0.0113	0.0295	210			2.49	2.8		0.0011	0.00036	0.00188	0.0634	-0.0005	-0.0005	0.101	-0.0003	76.6	-0.0005	0.00016
97	E4 - Main Embankment Seepage Pond	1/15/2008 14:19	-0.001	0.0114	0.031	222			2.75	3.9		-0.002	0.00042	0.0022	0.073	-0.0005	-0.0005	0.107	-0.0004	87.5	-0.0005	0.00019
98	E4 - Main Embankment Seepage Pond	1/22/2008 10:50	0.0013	0.0143	0.0401	237			1.62	3.19		0.0014	0.00043	0.00235	0.0718	-0.0005	-0.0005	0.117	-0.00004	99.3	-0.0005	0.00021
100	E4 - Main Embankment Seepage Pond	2/6/2008 10:09	0.0011	0.0142	0.0416	234			1.6	3.15		-0.001	0.00041	0.00218	0.0659	-0.0005	-0.0005	0.104	-0.0003	80.5	-0.0005	0.00013
102	E4 - Main Embankment Seepage Pond	3/4/2008 10:09	0.03	0.0215	0.0737	230			1.43	3.23		0.0024	0.00038	0.00217	0.0596	-0.0005	-0.0005	0.102	-0.00009	80	-0.0005	0.00028
104	E4 - Main Embankment Seepage Pond	4/16/2008 10:14	-0.001	0.0071	0.0349	167			3.72	5.05		0.0102	0.00019	0.00088	0.0421	-0.0005	-0.0005	0.052	0.000036	70.5	-0.0005	-0.0001
105	E4 - Main Embankment Seepage Pond	5/13/2008 10:45	-0.001	0.0084	0.0293	294			6.5	5.1		-0.002	0.00026	0.00139	0.0656	-0.001	-0.001	0.093	-0.000034	106	-0.001	-0.0002
106	E4 - Main Embankment Seepage Pond	5/20/2008 13:50	-0.001	0.0083	0.0172	292			4.59	4.67		-0.002	0.00024	0.00161	0.0589	-0.0005	-0.0005	0.086	-0.00003	110	-0.0005	-0.0001
107	E4 - Main Embankment Seepage Pond	6/16/2008 10:00	-0.001	0.0077	0.0129	308			3.18	3.67		0.0022	0.0003	0.00172	0.0488	-0.0005	-0.0005	0.115	-0.00051	89.1	-0.0005	-0.0001
108	E4 - Main Embankment Seepage Pond	7/15/2008 9:00	0.001	0.0085	0.0191	307			1.29	4.18		0.117	0.00031	0.00192	0.0428	-0.0005	-0.0005	0.112	-0.00045	78.8	-0.0005	-0.0001
109	E4 - Main Embankment Seepage Pond	8/6/2008 9:24	0.0016	0.0072	0.0254	281			1.13	3.65		-0.02	-0.002	-0.002	0.0389	-0.01	-0.01	-0.2	-0.00034	66.3	-0.01	-0.002
110	E4 - Main Embankment Seepage Pond	9/9/2008 8:15	-0.001	0.007	0.0208	270			1.16	3.24		0.0069	0.00042	0.00239	0.0527	-0.0005	-0.0005	0.144	-0.0004	77.3	-0.0005	-0.0001
111	E4 - Main Embankment Seepage Pond	9/30/2008 11:39	-0.001	0.0081	0.0139	266			0.79	3.12		0.0011	0.00037	0.00249	0.0539	-0.0005	-0.0005	0.134	-0.0005	81.3	-0.0005	-0.0001
112	E4 - Main Embankment Seepage Pond	10/22/2008 11:39	0.0015	0.0154	0.0311	260			1.17	3.39		-0.001	0.00034	0.00243	0.0507	-0.0005	-0.0005	0.134	-0.000017	81.9	-0.0005	-0.0001
113	E4 - Main Embankment Seepage Pond	11/4/2008 13:39	-0.001	0.0101	0.0307	268			1.24	2.99		-0.002	0.00031	0.00226	0.0565	-0.001	-0.001	0.149	-0.0006	89.3	-0.001	-0.0002
114	E4 - Main Embankment Seepage Pond	12/2/2008 11:28	-0.001	0.0102	0.033	290			2.34	2.7		-0.003	0.00031	0.00229	0.0594	-0.0005	-0.0005	0.122	-0.0004	103	-0.0005	-0.0001
115	E4 - Main Embankment Seepage Pond	1/14/2009 14:05	-0.001	0.0124	0.223	282			1.35	3.13		0.0079	0.00032	0.00185	0.0581	-0.0005	-0.0005	0.144	-0.00041	96.2	-0.0005	0.0004
116	E4 - Main Embankment Seepage Pond	2/10/2009 12:00	0.0095	0.0248	0.0531	253			0.52	2.82		0.0055	0.00027	0.00247	0.0688	-0.001	-0.001	0.143	-0.0004	87.2	-0.001	0.00029
117	E4 - Main Embankment Seepage Pond	3/4/2009	-0.001	0.013	0.0419	257			0.78	3.19		0.0041	0.00031	0.00222	0.0583	-0.0005	-0.0005	0.135	-0.000017	90.4	-0.0005	0.00021
118	E4 - Main Embankment Seepage Pond	4/7/2009 13:39	-0.001	0.0116	0.0358	245			1.73	2.96		0.0026	0.00023	0.00172	0.0544	-0.0005	-0.0005	0.116	-0.00031	87.9	0.00116	0.00018
119	E4 - Main Embankment Seepage Pond	5/12/2009 10:14	-0.001	0.0062	0.0226	325			5.03	3.52		0.0035	0.00029	0.00155	0.0645	-0.001	-0.001	0.116	-0.0008	117	-0.001	-0.0002
120	E4 - Main Embankment Seepage Pond	6/9/2009 9:45	0.0015	0.0067	0.0153	354			2.73	3.57		0.002	0.00026	0.00185	0.0487	-0.0005	-0.0005	0.14	-0.0006	93	-0.0005	-0.0001
121	E4 - Main Embankment Seepage Pond	7/7/2009 10:00	-0.001	0.0068	0.0265	304			1.24	4.55		0.0034	0.00021	0.0019	0.0475	-0.0005	-0.0005	0.13	-0.0004	87.6	-0.0005	-0.0001
122	E4 - Main Embankment Seepage Pond	8/5/2009 10:39	-0.001	0.0068	0.0119	337			0.72	3.84		0.0014	0.00025	0.00213	0.0491	-0.0005	-0.0005	0.149	-0.00041	83.3	-0.0005	-0.0001
123	E4 - Main Embankment Seepage Pond	8/19/2009	-0.001	0.0065	0.0264	327			0.88	4.6		0.0027	0.00025	0.00229	0.052	-0.0005	-0.0005	0.145	-0.00043	86.2	-0.0005	-0.0001
124	E4 - Main Embankment Seepage Pond	9/2/2009 9:00	-0.001	0.0063	0.0151	327			0.55	3.92		0.0012	0.00022	0.00218	0.0532	-0.0005	-0.0005	0.144	-0.0004	92.3	0.00064	-0.0001
125	E4 - Main Embankment Seepage Pond	10/6/2009 9:49	-0.001	0.0082	0.0205	299			0.8	3.14		-0.002	0.0002	0.00198	0.065	-0.001	-0.001	0.149	-0.001	97.1	-0.001	-0.0002
126	E4 - Main Embankment Seepage Pond	10/29/2009 12:15	-0.001	0.0102	0.0282	286			0.92	2.83		0.0017	0.00017	0.00207	0.0612	-0.0005	-0.0005	0.142	-0.0005	93.2	0.00142	-0.0001
127	E4 - Main Embankment Seepage Pond	11/19/2009 9:18	-0.001	0.0095	0.0291	337			2.99	4.28		-0.002	-0.0002	0.00152	0.0677	-0.001	-0.001	0.125	-0.000034	122	-0.001	-0.0002
129	E4 - Main Embankment Seepage Pond	1/13/2010 14:05	-0.001	0.0063	0.0251	258			2.24	4.09		0.0022	-0.0002	0.00124	0.0475	-0.001	-0.001	0.115	0.000051	104	-0.001	-0.0002
130	E4 - Main Embankment Seepage Pond	2/10/2010 13:32	0.0035	0.0142	0.0555	339			1.18	4.64		-0.002	0.00028	0.00201	0.0718	-0.001	-0.001	0.121		114	-0.001	0.00034
131	E4 - Main Embankment Seepage Pond	3/3/2010 12:00	0.0013	0.0089	0.0426	173			1.47	3.85		-0.005	0.00013	0.00077	0.036	-0.0005	-0.0005	0.063	-0.000017	68.6	-0.0005	-0.0001
132	E4 - Main Embankment Seepage Pond	4/7/2010 13:20	0.0018	0.0112	0.0476	297			1.63	4.98		-0.002	0.00029	0.0018	0.0611	-0.001	-0.001	0.128	-0.00031	112	-0.001	-0.0002
133	E4 - Main Embankment Seepage Pond	5/11/2010	-0.001	0.0047	0.0119	409			2.21	3.43		0.0035	-0.0002	0.00076	0.0466	-0.001	-0.001	0.113	0.000048	178	-0.001	-0.0002
134	E4 - Main Embankment Seepage Pond	6/3/2010 8:40	-0.001	0.0089	0.0426	333			0.97	5		0.0023	0.00026	0.00188	0.0184	-0.0005	-0.0005	0.104	-0.0004	86	-0.0005	-0.0001
135	E4 - Main Embankment Seepage Pond	7/8/2010	-0.001	0.0078	0.0134	382			0.68	4.74		0.0014	0.00033	0.00204	0.0326	-0.0005	-0.0005	0.116	-0.00041	89.8	-0.0005	-0.0001
136	E4 - Main Embankment Seepage Pond	8/5/2010	0.0017	0.0087	0.0159	425			0.55	4.35		-0.002	0.00032	0.00213	0.0488	-0.001	-0.001	0.137	-0.0004	113	-0.001	-0.0002
138	E4 - Main Embankment Seepage Pond	10/7/2010	-0.001	0.007	0.0153	558			2.8	3.99		-0.003	0.00068	0.00183	0.0455	-0.0005	-0.0005	0.14	-0.00005	174	-0.0005	0.00011
139	E4 - Main Embankment Seepage Pond	11/4/2010	0.0021	0.0072	0.0124	680			4.34	5		-0.003	0.00118	0.00179	0.0561	-0.0005	-0.0005	0.131	-0.00015	219	-0.0005	0.00014
140	E4 - Main Embankment Seepage Pond	12/1/2010 9:50	0.0014	0.0107	0.0364	642			3.77	5.66		-0.003	0.00086	0.00154	0.0572	-0.0005	-0.0005	0.132	-0.00015	184	-0.0005	0.00015

Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
1	E4 - Main Embankment Seepage Pond	7/12/2001 13:30	0.0079	0.076	0.00012	0.0039	12.4	0.00612	-0.00005	0.056	-0.0005	6.92	0.0026	0.47	0.00001	48.5	0.563	-0.00005	0.00054
3	E4 - Main Embankment Seepage Pond	7/26/2001 8:00	0.0062	0.061	0.00005	0.003	12.9	0.0208	-0.00005	0.0368	-0.0005	5.44	0.0031	3.25	-0.00001	34.9	0.751	-0.00005	0.00023
4	E4 - Main Embankment Seepage Pond	8/3/2001	0.0077	0.068	0.00008	0.0031	12.7	0.00673	-0.00005	0.0399	-0.0005	5.42	0.0028	2.51	-0.00001	35.2	0.791	-0.00005	0.00025
5	E4 - Main Embankment Seepage Pond	8/10/2001 10:15	0.0054	0.058	0.00003	0.0037	13	0.00773	-0.00005	0.0514	-0.0005	6.36	0.0031	0.77	0.00001	43	0.842	-0.00005	0.00059
7	E4 - Main Embankment Seepage Pond	8/30/2001 14:25	0.0052	-0.005	-0.00002	0.0042	11.4	0.00365	-0.00005	0.0671	-0.0005	7.27	0.0024	1.13	-0.00001	49.5	0.512	-0.00005	0.00025
8	E4 - Main Embankment Seepage Pond	10/23/2001 14:30	0.0046	0.024	0.00005	0.0022	9.2	0.0233	-0.00005	0.0343	-0.0005	5.26	0.0011	3.6	-0.00001	29.5	0.447	-0.00005	0.00014
9	E4 - Main Embankment Seepage Pond	11/13/2001 8:45	0.0046	-0.005	0.00009	0.0032	12.3	0.135	-0.00005	0.0625	-0.0005	8.17	0.0022	5.7	-0.00001	50.9	0.728	-0.00005	0.00028
15	E4 - Main Embankment Seepage Pond	5/22/2002 12:30	0.0034	-0.005	-0.00002	0.0009	7.59	0.00046	-0.00005	0.0172	-0.0005	2.87	0.0013	3.18	-0.00001	13.7	0.308	-0.00005	0.00008
17	E4 - Main Embankment Seepage Pond	7/31/2002 9:10	0.0036	-0.005	0.00004	-0.0002	9.48	0.00015	-0.00005	0.0581	-0.0005	4.69	-0.0005	1.54	-0.00001	42.5	0.376	-0.00005	-0.00005
26	E4 - Main Embankment Seepage Pond	5/5/2003 14:50	0.0023	0.007	0.00003	0.0016	9.91	0.00225	-0.00005	0.0295	-0.0005	3.33	0.0005	4.56	-0.00001	24.4	0.38	-0.00005	0.00016
27	E4 - Main Embankment Seepage Pond	5/29/2003 10:30	0.0031	-0.005	-0.00002	0.0018	10.3	0.00926	-0.00005	0.0371	-0.0005	4.08	0.0007	3.96	-0.00001	28.5	0.398	-0.00005	0.00009
28	E4 - Main Embankment Seepage Pond	6/24/2003 7:00	0.0036	-0.005	0.00003	0.0017	11.1	0.00055	-0.00005	0.0468	-0.0005	4.03	-0.0005	3.34	-0.00001	36	0.363	-0.00005	0.00008
29	E4 - Main Embankment Seepage Pond	8/5/2003 14:30	0.0057	0.005	0.00002	0.0022	10.6	0.0025	-0.00005	0.0527	-0.0005	4.3	-0.0005	0.17	-0.00001	41.4	0.308	-0.00005	-0.00005
30	E4 - Main Embankment Seepage Pond	8/20/2003 10:00	0.0048	-0.005	0.00004	0.0021	10.3	0.0142	-0.00005	0.0511	-0.0005	3.26	-0.0005	0.14	-0.00001	42.8	0.283	-0.00005	0.00007
31	E4 - Main Embankment Seepage Pond	10/16/2003 16:00	0.0033	0.027	0.00004	0.0016	9.95	0.0172	-0.00005	0.0391	-0.0005	4	-0.0005	1.66	-0.00001	33.5	0.287	-0.00005	-0.00005
32	E4 - Main Embankment Seepage Pond	11/11/2003 9:55	0.0035	0.015	0.00004	0.0016	11.4	0.0129	-0.00005	0.031	-0.0005	4.43	0.0012	3.16	-0.00001	29.8	0.394	-0.00005	-0.00005
33	E4 - Main Embankment Seepage Pond	3/4/2004 10:00	0.0037	0.077	-0.00002	0.0007	8.22	0.138	-0.00005	0.0107	-0.0005	2.45	0.0017	4.82	-0.00001	10.3	0.279	-0.00005	0.00008
34	E4 - Main Embankment Seepage Pond	3/22/2004	0.0024	0.035	0.00002	0.0016	11.1	0.463	-0.00005	0.0226	-0.0005	3.25	0.0017	5.51	-0.00001	20	0.394	-0.00005	-0.00005
35	E4 - Main Embankment Seepage Pond	3/22/2004 10:40	0.0024	0.035	0.00002	0.0016	11.1	0.463	-0.00005	0.0226	-0.0005	3.25	0.0017	5.51	-0.00001	20	0.394	-0.00005	-0.00005
36	E4 - Main Embankment Seepage Pond	4/3/2004 10:00	0.0037	0.077	-0.00002	0.0007	8.22	0.138	-0.00005	0.0107	-0.0005	2.45	0.0017	4.82	-0.00001	10.3	0.279	-0.00005	0.00008
37	E4 - Main Embankment Seepage Pond	5/1/2004 13:32	0.0037	0.012	0.00002	0.0009	7.3	0.0287	-0.00005	0.019	-0.0005	2.29	0.0012	3.51	-0.00001	15.1	0.301	-0.00005	0.0001
38	E4 - Main Embankment Seepage Pond	5/7/2004	0.0039	0.012	0.00006	0.0013	9.06	0.0319	-0.00005	0.0342	-0.0005	4.53	-0.0005	2.58	-0.00001	26.3	0.369	-0.00005	-0.00005
39	E4 - Main Embankment Seepage Pond	6/9/2004	0.0063	0.029	0.00014	0.0009	7.51	0.0104	-0.00005	0.019	0.0007	2.41	0.0009	2.2	-0.00001	14.7	0.282	-0.00005	0.00008
40	E4 - Main Embankment Seepage Pond	7/5/2004	0.0039	0.012	0.00006	0.0013	9.06	0.0319	-0.00005	0.0342	-0.0005	4.53	-0.0005	2.58	-0.00001	26.3	0.369	-0.00005	-0.00005
41	E4 - Main Embankment Seepage Pond	8/2/2004	0.003	0.014	0.00006	0.0016	10.1	0.00219	-0.00005	0.0517	-0.0005	4.09	0.0007	3.87	-0.00001	32.3	0.441	-0.00005	-0.00005
42	E4 - Main Embankment Seepage Pond	8/25/2004	0.0032	0.011	-0.00002	0.0019	10.4	0.0602	-0.00005	0.0646	-0.0005	4.87	0.0008	5.27	-0.00001	40.7	0.495	-0.00005	-0.00005
43	E4 - Main Embankment Seepage Pond	12/8/2004	0.002	0.01	-0.00002	0.0018	10.3	0.309	-0.00005	0.0586	-0.0005	3.36	0.0011	5.18	-0.00001	30.1	0.447	-0.00005	-0.00005
44	E4 - Main Embankment Seepage Pond	1/31/2005	0.0031	0.019	0.00015	0.0013	8.02	0.134	-0.00005	0.0233	-0.0005	2.53	0.0012	4.36	-0.00001	14.1	0.291	-0.00005	-0.00005
45	E4 - Main Embankment Seepage Pond	2/16/2005	0.0011	0.015	-0.00002	0.0032	9.89	0.471		0.1	-0.0005	5.29	0.0012	6.06	-0.00001	42.8	0.526	-0.00005	0.00007
46	E4 - Main Embankment Seepage Pond	3/16/2005	0.002	-0.005	-0.00002	0.0009	16.3	0.316		0.00737	-0.0005	2.01	-0.0005	3.57	-0.00001	5.93	0.441	-0.00005	-0.00005
48	E4 - Main Embankment Seepage Pond	4/11/2005	0.0013	-0.005	-0.00002	0.003	9.26	0.0277		0.106	-0.0005	5.25	0.0006	4.57	-0.00001	42.3	0.465	-0.00005	-0.00005
49	E4 - Main Embankment Seepage Pond	5/4/2005	-0.0001	-0.01	-0.00002	0.003	9.45	0.00142		0.118	-0.0005	4.19	0.0011	4.99	-0.00001	50.3	0.485	-0.00005	-0.00005
50	E4 - Main Embankment Seepage Pond	6/6/2005	0.0015	0.015	-0.00002	0.0032	9.57	0.225		0.124	0.0008	7.13	0.0012	4.71	-0.00001	55.4	0.528	-0.00005	-0.00005
52	E4 - Main Embankment Seepage Pond	8/11/2005	0.0002	0.024	0.00004	0.002	10.5	0.0159		0.0901	-0.0005	6	0.0006	4.19	-0.00001	54.6	0.452	-0.00005	-0.00005
53	E4 - Main Embankment Seepage Pond	9/13/2005	0.002	0.198	0.00002	0.0025	10.4	0.0491		0.101	-0.0005	6.54	0.0009	4.8	-0.00001	55.2	0.465	-0.00005	-0.00005
55	E4 - Main Embankment Seepage Pond	11/8/2005	0.003	0.013	0.00007	0.0032	10.8	0.0362		0.109	-0.0005	6.66	0.0013	5.17	-0.00001	54	0.45	-0.00005	0.00006
56	E4 - Main Embankment Seepage Pond	12/14/2005	0.0018	0.008	-0.00002	0.0019	13.2	0.178		0.0574	-0.0005	4.85	0.0009	6.44	-0.00001	35.3	0.459	-0.00005	-0.00005
57	E4 - Main Embankment Seepage Pond	1/17/2006	0.0009	0.008	0.00002	0.0034	10.3	0.521		0.106	-0.0005	6.66	0.0018	6.81	-0.00001	44.3	0.491	-0.00005	-0.00005
58	E4 - Main Embankment Seepage Pond	2/8/2006	0.0004	0.006	-0.00002	0.0038	10.7	0.439		0.11	-0.0005	7.02	0.0014	7.09	0.00001	49.8	0.548	-0.00005	-0.00005
59	E4 - Main Embankment Seepage Pond	3/6/2006 12:30	0.001	0.06	-0.00002	0.0037	10.3	0.433		0.118	-0.0005	6.98	0.0014	6.67	-0.00001	49.8	0.588	-0.00005	-0.00005
60	E4 - Main Embankment Seepage Pond	4/11/2006 9:20	0.0013	0.028	0.00007	0.0021	8.69	0.182		0.0504	0.0006	3.9	0.0012	4.84	-0.00001	27.9	0.358	-0.00005	-0.00005
61	E4 - Main Embankment Seepage Pond	5/9/2006	0.00138	-0.03	-0.00005	-0.005	11	0.0767		0.0918	-0.0005	6.34	0.0013	5.34	-0.00001	43	0.533	-0.0001	-0.0001
62	E4 - Main Embankment Seepage Pond	6/14/2006	0.00231	-0.03	-0.00005	-0.005	12.3	0.168		0.0953	-0.0005	6.5	0.0018	3.66	-0.00001	47.6	0.602	-0.0001	-0.0001
63	E4 - Main Embankment Seepage Pond	7/4/2006	0.00271	0.153	0.000061	-0.005	13	0.115		0.102	0.0006	7.14	-0.001	4.31	-0.00001	55.6	0.569	-0.0001	-0.0001
64	E4 - Main Embankment Seepage Pond	8/3/2006	0.00179	-0.03	-0.00005	-0.005	11.3	0.0785		0.103	-0.0005	6.86	0.0011	4.69	-0.00001	52.4	0.552	-0.0001	-0.0001
66	E4 - Main Embankment Seepage Pond	10/12/2006	0.0011	-0.03	-0.00005	-0.005	13.3	0.0503		0.112	-0.0005	7.82	0.0019	4.89	-0.00001	52	0.685	-0.0001	-0.0001
67	E4 - Main Embankment Seepage Pond	11/15/2006	0.00128	-0.03	-0.00005	-0.005	14.1	0.235		0.125	-0.0005	7.45	0.0049	6.78	-0.00001	48.1	1.13	-0.0001	-0.0001
68	E4 - Main Embankment Seepage Pond	12/4/2006	0.00098	-0.03	-0.00005	-0.005	14.3	0.476		0.12	0.00051	8.3	0.0052	6.92	0.000015	51.4	0.897	-0.0001	-0.0001
72	E4 - Main Embankment Seepage Pond	2/5/2007 10:59	0.00044	-0.03	-0.00005	-0.005	12.6	0.472		0.0984	-0.0005	9.18	0.0028	6.41	-0.00001	52.8	0.768	-0.0001	-0.0001
73	E4 - Main Embankment Seepage Pond	3/5/2007	0.00094	-0.03	-0.00005	-0.005	12.4	0.408		0.108	0.00076	9.39	0.0028	6.61	-0.00001	58.4	0.8	-0.0001	-0.0001
74	E4 - Main Embankment Seepage Pond	4/11/2007 11:15	0.00391	-0.03	-0.00005	-0.005	11.2	0.0731		0.0742	-0.0005	3.17	0.0053	4.05	-0.00001	17.3	0.769	-0.0001	-0.0001
75	E4 - Main Embankment Seepage Pond	5/7/2007 10:00	0.00141	-0.03	-0.00005	-0.005	14.9	0.069		0.122	-0.0005	6.76	0.0084	4.34	-0.00001	43.1	1.17	-0.0001	-0.0001
77	E4 - Main Embankment Seepage Pond	6/4/2007 10:34	0.00267	-0.03	-0.00005	-0.005	17.5	0.0176		0.126	-0.0005	8.45	0.011	3.35	-0.00001	59.1	1.1	-0.0001	-0.0001
79	E4 - Main Embankment Seepage Pond	6/11/2007 10:59	0.00277	-0.03	-0.0001	-0.01	16.2	0.0887		0.124	0.001	7.89	0.0105	3.45	-0.00002	57.2	1.06	-0.0002	-0.0002
80	E4 - Main Embankment Seepage Pond	6/18/2007 9:45	0.00368	-0.03	-0.00005	-0.005	16.2	0.0748		0.123	-0.0005	8.02	0.0111	3.46	-0.00001	53.6	1.06	-0.0001	-0.0001
81	E4 - Main Embankment Seepage Pond	6/25/2007 10:00	0.00378	-0.03	-0.00005	-0.005	16.5	0.0643		0.132	-0.0005	7.67	0.0119	3.87	-0.00001	52.7	1.12	-0.0001	-0.0001
83	E4 - Main Embankment Seepage Pond	7/9/2007 13:30	0.00335	-0.03	-0.00005	-0.005	16.1	0.0421		0.127	-0.0005	7.63	0.0106	4.07	-0.00001	51.5	1.12	-0.0001	-0.0001
84	E4 - Main Embankment Seepage Pond	7/17/2007 10:59	0.00301	-0.03	-0.00005	-0.005	16.9	0.000558		0.123	-0.0005	7.72	0.0096	4.04	-0.00001	56.6			
85	E4 - Main Embankment Seepage Pond	7/24/2007 14:19	0.00349	-0.03	0.000063	-0.005	17.4	0.0149		0.117	-0.0005	7.79	0.0097	3.76	-0.00001	60.5	0.947	-0.0001	-0.0001
86	E4 - Main Embankment Seepage Pond	7/31/2007 14:44	0.00263	-0.03	-0.00005	-0.005	16.1	0.00092	-0.00001	0.118	-0.0005	8.1	0.0078	3.43	-0.00001	59.4	0.871	-0.0001	-0.0001
87	E4 - Main Embankment Seepage Pond	8/2/2007 10:14	0.00286	-0.03	-0.0001	-0.01	15.7	0.00056	-0.00001	0.119	-0.001	8.14	0.0074	2.75	-0.00002	61.2	0.898	-0.0002	-0.0002
88	E4 - Main Embankment Seepage Pond	8/14/2007 9:15	0.00224	-0.03	-0.00005	-0.005	15.3	0.000849	-0.00001	0.117	-0.0005	8.72	0.007	2.35	-0.00001	62.5	0.891	-0.0001	-0.0001
89	E4 - Main Embankment Seepage Pond	8/29/2007 15:15	0.00232	-0.03	0.000158	-0.005	14.8	0.000279		0.109	-0.0005	8.63	0.0054	2.64	-0.00001	59.6	0.858	-0.0001	-0.0001
90	E4 - Main Embankment Seepage Pond	9/5/2007 11:30	0.00236	-0.03	-0.00005	-0.005	14.3	0.0146	-0.00001	0.103	-0.0005	8.68	0.0045	3.07	-0.00001	59.4	0.878	-0.0001	-0.0001
91	E4 - Main Embankment Seepage Pond	10/2/2007 15:00	0.00199	-0.03	-0.00005	-0.005	15.2	0.0468		0.13	-0.0005	7.27	0.0047	3.97	-0.00001	48.4	1.05	-0.0001	-0.0001
92	E4 - Main Embankment Seepage Pond	11/5/2007 10:45	0.00273	-0.03	-0.00005	-0.005	16.8	0.0732		0.128	-0.0005	6.84	0.0105	5.39	-0.00001	41.2	1.2	-0.0001	-0.0001
94	E4 - Main Embankment Seepage Pond	12/27/2007	-0.002	-0.03	-0.0005	-0.01	16.4	0.144		0.11	-0.001	9.78	0.0075	6.83	-0.00002	59.1	1.05	-0.0002	-0.0002
96	E4 - Main Embankment Seepage Pond	1/8/2008 14:15	-0.0001	-0.03	-0.00005	-0.005	14.1	0.433		0.0881	-0.0005	8.63	0.0048	5.69	-0.00001	57.4	0.891	-0.0001	-0.0001
97	E4 - Main Embankment Seepage Pond	1/15/2008 14:19	-0.001	-0.03	-0.00005	-0.005	15.5	0.532		0.101	-0.0005	9.42	0.0052	6.69	-0.00001	60.5	1.06	-0.0001	-0.0001
98	E4 - Main Embankment Seepage Pond	1/22/2008 10:50	-0.0007	-0.03	-0.00005	0.0051	15.6	0.51		0.0999	-0.0005	10.5	0.0052	7.09	-0.00001	63.6	0.986	-0.0001	-0.0001
100	E4 - Main Embankment Seepage Pond	2/6/2008 10:09	0.00089	-0.03	-0.00005	-0.005	15.7	0.405		0.0935	-0.0005	10.2	0.0038	6.55	-0.00001	64	0.855	-0.0001	-0.0001
102	E4 - Main Embankment Seepage Pond	3/4/2008 10:09	0.00181	-0.03	-0.00005	-0.005	15	0.401		0.0952	-0.0005	9.93	0.0031	6.44	-0.00001	52.6	0.803	-0.0001	-0.0001
104	E4 - Main Embankment Seepage Pond	4/16/2008 10:14	0.00344	-0.03	-0.00005	-0.005	12.5	0.0843		0.105	-0.0005	3.9	0.006	3.83	-0.00001	22.1	0.895	-0.0001	-0.0001
105	E4 - Main Embankment Seepage Pond	5/13/2008 10:45	0.00185	-0.03	-0.0001	-0.01	17.3	0.00094		0.171	-0.001	7.05	0.0097	3.97	-0.00002	44	1.45	-0.0002	-0.0002
106	E4 - Main Embankment Seepage Pond	5/20/2008 13:50	-0.002	-0.03	-0.00005	-0.005	17.7	0.0137		0.158	-0.0005	7.21	0.0102	3.81	-0.00001	43.8	1.19	-0.0001	-0.0001
107	E4 - Main Embankment Seepage Pond	6/16/2008 10:00	0.00264	-0.03	-0.00005	-0.005	17.4	0.0344		0.145	8.29	0.0087	1.55	-0.00001	52	0.986	-0.0001	-0.0001	
108	E4 - Main Embankment Seepage Pond	7/15/2008 9:00	0.00173	0.191	0.00006	-0.005	17	0.0316		0.129	-0.0005	7.89	0.0078	4.94	-0.00001	63.3	0.96	-0.0001	-0.0001
109	E4 - Main Embankment Seepage Pond	8/6/2008 9:24	-0.002	-0.03	-0.001	-0.1	15.7	-0.001		0.116	-0.01	9.7	-0.02	3.67	-0.0002	58.9	0.817	-0.002	-0.002
110	E4 - Main Embankment Seepage Pond	9/9/2008 8:15	0.00061	-0.03	-0.00005	0.005	14.7	0.0743		0.129	-0.0005	11	0.0051	3.45	-0.00001	63.8	0.932	-0.0001	-0.0001
111	E4 - Main Embankment Seepage Pond	9/30/2008 11:39	0.00086	-0.03	-0.00005	0.0052	14.6	0.000557		0.132	-0.0005	11.9	0.0045	3.77	-0.00001	69.6	0.834	-0.0001	-0.0001
112	E4 - Main Embankment Seepage Pond	10/22/2008 11:39	-0.0007	-0.03	-0.00005	0.0054	15.2	0.063		0.132	-0.0005	10.7	0.0044	4.97	-0.00001	67.9	0.935	-0.0001	-0.0001
113	E4 - Main Embankment Seepage Pond	11/4/2008 13:39	0.00076	-0.03	-0.0001	-0.01	15.2	0.132	-0.00001	0.134	-0.001	10.9	0.0041	5.27	-0.00002	68.8	1.02	-0.0002	-0.0002
114	E4 - Main Embankment Seepage Pond	12/2/2008 11:28	0.00086	-0.03	-0.00005	-0.005	17	0.253	-0.00001	0.142	-0.0005	10.2	0.005	6.48	-0.00001	60.1	1.14	-0.0001	-0.0001
115	E4 - Main Embankment Seepage Pond	1/14/2009 14:05	-0.0001	-0.03	0.000052	0.005	16.1	0.835		0.115	-0.0005	11.3	0.0035	7.18	-0.00001	68	0.923	-0.0001	-0.0001
116	E4 - Main Embankment Seepage Pond	2/10/2009 12:00	0.00038	-0.03	-0.0001	-0.01	14.6	0.858		0.106	-0.001	10.4	0.0024	6.79	-0.00002	68.1	1.12	-0.0002	-0.0002
117	E4 - Main Embankment Seepage Pond	3/4/2009	-0.0009	-0.03	-0.00005	-0.005	13.8	0.36		0.109	-0.0005	10.4	0.0027	6.97	-0.00001	62.5	1.01	-0.0001	-0.0001
118	E4 - Main Embankment Seepage Pond	4/7/2009 13:39	0.00108	-0.03	-0.00005	-0.005	14.4	0.274	-0.00001	0.106	0.0006	9.8	0.0055	5.74	-0.00001	55.4	1.03	-0.0001	-0.0001
119	E4 - Main Embankment Seepage Pond	5/12/2009 10:14	0.00368	-0.03	-0.0001	-0.01	18.6	0.0297		0.191	0.0012	8.2	0.0112	3.36	-0.00002	45.4	1.62	-0.0002	-0.0002
120	E4 - Main Embankment Seepage Pond	6/9/2009 9:45	0.00217	-0.03	-0.00005	0.0056	20.1	0.0585		0.15	-0.0005	10.4	0.0088	2.8	-0.00001	65	1.28	-0.0001	-0.0001
121	E4 - Main Embankment Seepage Pond	7/7/2009 10:00	0.00254	-0.03	-0.00005	-0.005	17.9	0.0141		0.132	-0.0005	9.89	0.0068	3.85	-0.00001	62.9	1.32	-0.0001	-0.0001
122	E4 - Main Embankment Seepage Pond	8/5/2009 10:39	0.00201	-0.03	-0.00005	0.0054	17.9	0.00127	-0.00001	0.133	0.00089	11.7	0.0055	1.52	-0.00001	72.3	1.22	-0.0001	-0.0001
123	E4 - Main Embankment Seepage Pond	8/19/2009	-0.004	-0.03	-0.00005	0.0061	17.8	0.0271		0.128	0.0006	13.5	0.0052	1.33	-0.00001	72.4	1.25	-0.0001	-0.0001
124	E4 - Main Embankment Seepage Pond	9/2/2009 9:00	-0.003	-0.03	-0.00005	-0.005	16.9	0.000728		0.116	-0.0005	11.4	0.0045	1.75	-0.00001	68	1.14	-0.0001	-0.0001
125	E4 - Main Embankment Seepage Pond	10/6/2009 9:49	0.00197	-0.03	0.00013	-0.01	16.8	0.0591		0.116	-0.001	11.7	0.0035	3.5	-0.00002	69.5	1.26	-0.0002	-0.0002
126	E4 - Main Embankment Seepage Pond	10/29/2009 12:15	0.00124	-0.03	-0.00005	-0.005	15.8	0.0806		0.119	-0.0005	10.7	0.0037	4.62	-0.00001	64.2	1.18	-0.0001	-0.0001
127	E4 - Main Embankment Seepage Pond	11/19/2009 9:18	0.00181	-0.03	-0.0001	-0.01	19.6	0.149		0.16	-0.001	9.59	0.008	5.41	-0.00002	56	1.49	-0.0002	-0.0002
129	E4 - Main Embankment Seepage Pond	1/13/2010 14:05	0.006	-0.03	-0.0001	-0.01	17.5	0.428		0.0866	-0.001	5.34	0.0046	6.23	-0.00002	46.4	1.14	-0.0002	-0.0002
130	E4 - Main Embankment Seepage Pond	2/10/2010 13:32	0.00167	-0.03	-0.0001	-0.01	18.6	0.575		0.112	-0.001	10.5	0.0051	6.58	-0.00002	59.5	1.3	-0.0002	-0.0002
131	E4 - Main Embankment Seepage Pond	3/3/2010 12:00	0.00472	-0.03	-0.00005	-0.005	11.1	0.0901		0.0522	-0.0005	4.34	0.0021	4.26	-0.00001	26	0.746	-0.0001	-0.0001
132	E4 - Main Embankment Seepage Pond	4/7/2010 13:20	0.00172	-0.03	-0.0001	-0.01	18.7	0.0954		0.118	-0.001	9.14	0.0058	4.56	-0.00002	57.1	1.37	-0.0002	-0.0002
133	E4 - Main Embankment Seepage Pond	5/11/2010	0.00403	-0.03	-0.0001	-0.01	24.7	0.0514		0.135	-0.001	2.5	0.0054	5.83	-0.00002	47.5	1.79	-0.0002	-0.0002
134	E4 - Main Embankment Seepage Pond	6/3/2010 8:40	0.00233	-0.03	-0.00005	-0.005	19.8	0.0431		0.101	-0.0005	8.86	0.0052	2.92	-0.00001	55.6	1.15	-0.0001	-0.0001
135	E4 - Main Embankment Seepage Pond	7/8/2010	0.00197	-0.03	-0.00005	-0.005	21.2	0.00218		0.109	-0.0005	10.7	0.0052	1.27	-0.00001	71.5	1.53	-0.0001	-0.0001
136	E4 - Main Embankment Seepage Pond	8/5/2010	-0.002	-0.03	-0.0001	-0.01	21.9	0.00087		0.11	-0.001	13	0.0045	0.402	-0.00002	76.9	1.67	-0.0002	-0.0002
138	E4 - Main Embankment Seepage Pond	10/7/2010	0.00158	-0.03	-0.00005	0.0073	24.8	0.155	-0.00005	0.156	-0.0005	13.6	0.0095	5.05	-0.00001	83.6	2.09	-0.0001	-0.0001
139	E4 - Main Embankment Seepage Pond	11/4/2010	0.00168	-0.03	-0.00005	0.0069	26.3	0.129		0.171	-0.0005	15	0.0149	5.52	-0.00001	88.8	2.4	-0.0001	-0.0001
140	E4 - Main Embankment Seepage Pond	12/1/2010 9:50	0.00388	-0.03	-0.00005	0.0065	27.2	0.119	-0.00005	0.139	0.00052	14.9	0.0094	4.34	-0.00001	83.6	1.97	-0.0001	-0.0001
141	E4 - Main Embankment Seepage Pond	1/10/2011 10:30	0.00457	-0.03	-0.00005	0.0104	29.6	0.243		0.221	-0.0005	15.2	0.0174	5.88	-0.00001	88.8	2.62	-0.0001	-0.0001
144	E4 - Main Embankment Seepage Pond	4/5/2011 11:16	0.00639	-0.03	-0.00005	-0.005	24.5	0.21	-0.00005	0.145	0.00059	8.19	0.0123	5.26	-0.00001	47.1	1.86	-0.0001	-0.0001
145	E4 - Main Embankment Seepage Pond	5/12/2011 13:29	0.00359	-0.03	-0.00005	0.0053	19.8	0.182	-0.00005	0.136	-0.0005	8.25	0.0111	4.66	-0.00001	51.9	1.52	-0.0001	-0.0001
146	E4 - Main Embankment Seepage Pond	6/9/2011 13:02

Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
1	E4 - Main Embankment Seepage Pond	7/12/2001 13:30	0.00183	0.00121	0.00116	0.0051	0.0176	0.00023	0.0011	0.104	-0.00005	0.00067		0.00005	39.7	0.0003	0.00119	0.0077	0.095	0.00025	0.0029	11.9
3	E4 - Main Embankment Seepage Pond	7/26/2001 8:00	0.00222	0.00102	0.00087	0.0027	0.147	0.00074	0.0017	0.0829	-0.00005	-0.00005		0.00009	61.9	0.0036	0.00035	0.0073	0.208	0.0141	0.0031	12.8
4	E4 - Main Embankment Seepage Pond	8/3/2001	0.00227	0.00108	0.00067	0.0056	0.0812	0.00027	0.0018	0.0697	-0.00005	-0.00005		0.00008	57.3	0.0008	0.00049	0.007	0.141	0.00005	0.0031	12
5	E4 - Main Embankment Seepage Pond	8/10/2001 10:15	0.00263	0.00116	0.00074	0.0031	0.0284	0.00043	0.0019	0.0704	-0.00005	0.00131		0.00012	51	0.0005	0.00024	0.0066	0.078	0.00011	0.004	12.6
7	E4 - Main Embankment Seepage Pond	8/30/2001 14:25	0.00355	0.00126	0.00057	0.0011	0.0154	0.00036	0.0022	0.0564	-0.00005	0.00018		0.00017	35.8	-0.0002	0.00027	0.0057	0.008	-0.00002	0.0041	10.6
8	E4 - Main Embankment Seepage Pond	10/23/2001 14:30	0.00213	0.00091	0.00057	0.0039	0.321	0.00019	0.0014	0.0429	-0.00005	0.00033		0.00009	41.7	0.0008	0.00035	0.0116	0.472	0.00023	0.0024	9.54
9	E4 - Main Embankment Seepage Pond	11/13/2001 8:45	0.00215	0.00142	0.001	0.002	0.068	0.00022	0.0024	0.0719	-0.00005	0.00025		0.00014	67.4	-0.0002	0.00032	0.0045	0.067	0.00007	0.0033	11.9
15	E4 - Main Embankment Seepage Pond	5/22/2002 12:30	0.0011	0.00071	0.00086	-0.0005	0.78	0.00016	0.0012	0.0414	-0.00005	-0.00005		0.00002	40.1	0.0014	0.00078	0.0077	1.03	0.00037	0.0014	7.41
17	E4 - Main Embankment Seepage Pond	7/31/2002 8:10	0.00158	0.001	0.0007	0.0058	0.0199	0.00016	0.0021	0.0265	-0.00005	-0.00005		0.00012	29.9	-0.0002	-0.00002	0.005	0.028	0.00006	-0.0002	9.46
26	E4 - Main Embankment Seepage Pond	5/5/2003 14:50	0.00219	0.00084	0.00125	0.0011	0.108	0.00015	0.0016	0.0418	-0.00005	-0.00005		0.00004	44.1	-0.0002	0.00027	0.0035	0.097	0.00013	0.0017	9.89
27	E4 - Main Embankment Seepage Pond	5/29/2003 10:30	0.00207	0.00093	0.001	0.0006	0.0211	0.00015	0.0017	0.0355	-0.00005	0.00005		0.00007	36.4	-0.0002	0.00011	0.0034	0.036	-0.00002	0.0018	10.3
28	E4 - Main Embankment Seepage Pond	6/24/2003 7:00	0.00223	0.00085	0.00076	0.0006	0.0224	0.00016	0.0024	0.0331	-0.00005	-0.00005		0.00009	33.3	0.0003	0.00012	0.0046	0.083	0.00006	0.0018	10.8
29	E4 - Main Embankment Seepage Pond	8/5/2003 14:30	0.00149	0.0007	0.00079	-0.0005	0.0205	0.00012	0.0034	0.0252	-0.00005	-0.00005		0.0001	21.8	0.0009	0.00009	0.0062	0.024	0.00004	0.0021	10.3
30	E4 - Main Embankment Seepage Pond	8/20/2003 10:00	0.00169	0.00064	0.00115	0.0026	0.108	0.00013	0.0033	0.0215	-0.00005	-0.00005		0.00012	18.2	0.0009	0.00016	0.0056	0.175	0.0001	0.0022	10.6
31	E4 - Main Embankment Seepage Pond	10/16/2003 16:00	0.00172	0.00077	0.00108	-0.0005	0.141	0.00014	0.0018	0.0364	-0.00005	-0.00005		0.00006	36.6	0.0018	0.00009	0.0042	0.187	0.0001	0.0018	10.1
32	E4 - Main Embankment Seepage Pond	11/11/2003 9:55	0.00178	0.00096	0.00192	0.0011	0.164	0.00017	0.0016	0.0475	-0.00005	-0.00005		0.00007	48.5	0.0039	0.00011	0.004	0.235	0.0001	0.0018	11.3
33	E4 - Main Embankment Seepage Pond	3/4/2004 10:00	0.00324	0.00071	0.00139	0.0044	0.244	0.00013	0.0006	0.0354	-0.00005	-0.00005		0.00003	42.7	0.0027	0.00019	0.0043	0.272	0.00011	0.0009	8.01
34	E4 - Main Embankment Seepage Pond	3/22/2004	0.00188	0.00104	0.0015	0.0068	0.0827	0.0001	0.0013	0.0426	-0.00005	-0.00005		0.00005	51.5	0.004	0.00027	0.0025	0.132	0.00004	0.0015	10.3
35	E4 - Main Embankment Seepage Pond	3/22/2004 10:40	0.00188	0.00104	0.0015	0.0068	0.0827	0.0001	0.0013	0.0426	-0.00005	-0.00005		0.00005	51.5	0.004	0.00027	0.0025	0.132	0.00004	0.0015	10.3
36	E4 - Main Embankment Seepage Pond	4/3/2004 10:00	0.00324	0.00071	0.00139	0.0044	0.244	0.00013	0.0006	0.0354	-0.00005	-0.00005		0.00003	42.7	0.0027	0.00019	0.0043	0.272	0.00011	0.0009	8.01
37	E4 - Main Embankment Seepage Pond	5/1/2004 13:32	0.00107	0.00072	0.00076	0.0012	0.149	0.00015	0.001	0.0351	-0.00005	-0.00005		0.00005	39.6	0.0005	0.00018	0.0045	0.263	0.00013	0.0011	7.25
38	E4 - Main Embankment Seepage Pond	5/7/2004	-0.0005	0.00086	0.00084	0.0007	0.0972	0.00014	0.0017	0.0409	-0.00005	-0.00005		0.00007	46	-0.0002	0.00013	0.0041	0.121	0.00008	0.0013	8.91
39	E4 - Main Embankment Seepage Pond	6/9/2004	0.00097	0.00077	0.00087	0.0038	0.119	0.00017	0.0011	0.028	-0.00005	-0.00005		0.00004	35.1	0.0003	0.00018	0.0063	0.171	0.00008	0.0009	7.57
40	E4 - Main Embankment Seepage Pond	7/5/2004	-0.0005	0.00086	0.00084	0.0007	0.0972	0.00014	0.0017	0.0409	-0.00005	-0.00005		0.00007	46	-0.0002	0.00013	0.0041	0.121	0.00008	0.0013	8.91
41	E4 - Main Embankment Seepage Pond	8/2/2004	-0.0005	0.001	0.00081	0.0007	0.028	0.00015	0.0023	0.044	-0.00005	-0.00005		0.00008	43.6	-0.0002	0.00009	0.0029	0.06	0.00002	0.0016	9.92
42	E4 - Main Embankment Seepage Pond	8/25/2004	-0.0005	0.0011	0.00078	-0.0005	0.069	0.00012	0.0032	0.0426	-0.00005	-0.00005		0.00009	43.1	-0.0002	0.00009	0.0024	0.074	-0.00002	0.0019	10.5
43	E4 - Main Embankment Seepage Pond	12/8/2004	-0.0005	0.00152	0.00047	0.0029	0.0929	0.00012	0.0013	0.0531	-0.00005	-0.00005		0.00011	56.6	0.0002	0.00016	0.0026	0.123	-0.00002	0.0021	10.2
44	E4 - Main Embankment Seepage Pond	1/31/2005	-0.0005	0.001	0.00046	0.0022	0.325	0.00013	0.0008	0.0416	-0.00005	-0.00005		0.00005	44.2	0.0007	0.00027	0.005	0.488	0.00017	0.0014	7.7
45	E4 - Main Embankment Seepage Pond	2/16/2005	-0.0005	0.00203	0.00051	0.0009	0.146	0.00018	0.0018	0.0677	-0.00005	-0.00005	0.088	0.0002	62	0.0004	0.00043	0.0029	0.225	0.0001	0.003	9.97
46	E4 - Main Embankment Seepage Pond	3/16/2005	-0.0005	0.00194	0.00026	0.0099	0.0799	0.00018	0.0006	0.0465	-0.00005	-0.00005	-0.008	0.00002	76.5	-0.0002	0.00019	0.003	0.136	0.00005	0.0007	15.6
48	E4 - Main Embankment Seepage Pond	4/11/2005	-0.0005	0.00152	0.00066	-0.0005	0.165	0.00018	0.0019	0.0608	-0.00005	-0.00005	0.078	0.00023	49.5	0.0012	0.00032	0.0027	0.243	0.00011	0.0033	9.14
49	E4 - Main Embankment Seepage Pond	5/4/2005	-0.0005	0.00143	0.001	0.0005	0.632	0.00021	0.0024	0.0664	-0.00005	-0.00005	0.1	0.00028	54.7	0.0018	0.00051	0.946	0.00068	0.00035	0.0039	10.2
50	E4 - Main Embankment Seepage Pond	6/6/2005	0.0006	0.00139	0.00124	-0.0005	0.0376	0.00021	0.0024	0.0617	-0.00005	-0.00005	0.09	0.00024	46.2	-0.0002	0.00021	0.0025	0.088	0.00004	0.0033	8.91
52	E4 - Main Embankment Seepage Pond	8/11/2005	-0.0005	0.00092	0.00103	-0.0005	0.194	0.00016	0.0021	0.05	-0.00005	-0.00005	0.091	0.00013	50	0.0005	0.0002	0.0007	0.239	0.00009	0.0032	10.4
53	E4 - Main Embankment Seepage Pond	9/13/2005	-0.0005	0.00106	0.00108	0.002	0.111	0.00017	0.0023	0.0588	-0.00005	-0.00005	0.102	0.00015	54.7	-0.0002	0.00015	0.0026	0.429	0.0001	0.0028	10.9
55	E4 - Main Embankment Seepage Pond	11/8/2005	0.0007	0.00153	0.00091	0.0054	0.142	0.00022	0.0022	0.0655	-0.00005	-0.00005	0.098	0.00023	51.7	-0.0002	0.00029	0.0037	0.47	0.00022	0.0027	9.54
56	E4 - Main Embankment Seepage Pond	12/14/2005	-0.0005	0.00152	0.00055	0.0089	0.0692	0.00019	0.0017	0.0597	-0.00005	-0.00005	0.092	0.00014	56	0.0004	0.00029	0.0034	0.203	0.00013	0.0025	12.6
57	E4 - Main Embankment Seepage Pond	1/17/2006	-0.0005	0.00186	0.0005	0.0863	0.118	0.00028	0.003	0.0756	-0.00005	-0.00005	0.098	0.00022	57	-0.0002	0.0004	0.0122	0.423	0.00032	0.0033	10.7
58	E4 - Main Embankment Seepage Pond	2/8/2006	0.0011	0.00177	0.00008	0.0017	0.148	0.00028	0.0033	0.0745	-0.00005	-0.00005	0.102	0.00035	56	0.0008	0.00016	0.0028	0.31	0.00008	0.004	10.9
59	E4 - Main Embankment Seepage Pond	3/6/2006 12:30	0.0006	0.00179	0.00071	0.004	0.088	0.00031	0.0037	0.0791	-0.00005	-0.00005	0.109	0.00026	55.4	-0.0002	0.00041	0.0029	0.245	0.00012	0.0046	10.9
60	E4 - Main Embankment Seepage Pond	4/11/2006 9:20	0.0011	0.00106	0.00096	0.0006	1.77	0.00023	0.0027	0.0777	-0.00005	-0.00005	0.067	0.00015	45.1	0.004	0.00123	0.0088	2.34	0.00088	0.0036	9.28
61	E4 - Main Embankment Seepage Pond	5/9/2006	-0.01	0.00158	0.0019	-0.001	0.443	0.00038	0.00302	0.0685	-0.0005	-0.0005	0.09	-0.00005	51.3	0.00117	0.00047	0.00444	0.433	0.000261	-0.005	11.1
62	E4 - Main Embankment Seepage Pond	6/14/2006	-0.01	0.00135	0.0013	-0.001	0.112	0.00033	0.00291	0.0593	-0.0005	-0.0005	0.101	-0.00005	47.5	-0.0008	0.00021	0.00303	0.146	0.000052	-0.005	12.1
63	E4 - Main Embankment Seepage Pond	7/4/2006	-0.01	0.00125	0.0015	0.0014	0.0029	0.00029	0.00257	0.0533	-0.0005	-0.0005	0.108	-0.00005	47.7	-0.0005	-0.0001	0.00246	-0.03	-0.00005	-0.005	12.9
64	E4 - Main Embankment Seepage Pond	8/3/2006	-0.01	0.0011	-0.001	-0.001	0.102	0.0004	0.00286	0.0516	-0.0005	-0.0005	0.117	-0.00005	42.3	-0.0005	0.00013	0.00254	0.137	-0.00008	-0.005	11.3
66	E4 - Main Embankment Seepage Pond	10/12/2006	-0.01	0.00159	-0.001	-0.001	0.159	0.00024	0.00236	0.0772	-0.0005	-0.0005	0.108	-0.00005	62.9	-0.0005	0.00016	0.0023	0.231	0.000092	-0.005	13.6
67	E4 - Main Embankment Seepage Pond	11/15/2006	-0.01	0.00159	-0.001	0.0012	0.257	0.0003	0.00236	0.0972	-0.0005	-0.0005	0.105	0.000059	74	0.0006	0.0003	0.00261	0.25	0.000138	-0.005	14.6
68	E4 - Main Embankment Seepage Pond	12/4/2006	-0.01	0.00183	-0.001	0.0037	0.115	0.0004	0.00275	0.0901	-0.0005	-0.0005	0.112	-0.00005	69.9	0.00055	0.00036	0.00197	0.163	0.000081	-0.005	14.3
72	E4 - Main Embankment Seepage Pond	2/5/2007 10:59	-0.01	0.0017	-0.001	0.0013	0.188	0.00042	0.00344	0.0857	-0.0005	-0.0005	0.126	-0.00004	67.7	-0.0005	0.00046	0.00227	0.262	0.000096	0.0051	12.9
73	E4 - Main Embankment Seepage Pond	3/5/2007	-0.01	0.0016	-0.001	0.0022	0.157	0.00037	0.00341	0.0744	-0.0005	-0.0005	0.126	0.00005	66.6	0.00058	0.00046	0.00297	0.291	0.000115	0.0051	12.7
74	E4 - Main Embankment Seepage Pond	4/11/2007 11:15	-0.01	0.00112	-0.001	0.0018	0.924	0.0002	0.00128	0.0478	-0.0005	-0.0005	0.046	0.000083	59.7	0.00213	0.00088	0.011	1.43	0.00126	-0.005	11.4
75	E4 - Main Embankment Seepage Pond	5/7/2007 10:00	-0.01	0.00168	0.0012	0.0015	0.653	0.00032	0.0021	0.0877	-0.0005	-0.0005	0.108	-0.00005	82.3	0.00126	0.00059	0.00604	0.787	0.000473	-0.005	14.8
77	E4 - Main Embankment Seepage Pond	6/4/2007 10:34	-0.01	0.0019	0.0015	-0.001	0.067	0.00035	0.00199	0.0777	-0.0005	-0.0005	0.122	0.000026	83.1	-0.0005	0.00015	0.00358	0.088	-0.00008	-0.005	16.9
79	E4 - Main Embankment Seepage Pond	6/11/2007 10:59	-0.01	0.00161	-0.002	0.0012	0.0762	0.00213	0.00762	-0.001	-0.0005	-0.001	0.123	-0.000034	85.6	-0.001	0.00024	0.00367	0.189	0.00012	-0.01	16.2
80	E4 - Main Embankment Seepage Pond	6/18/2007 9:45	-0.01	0.00164	0.0011	-0.002	0.675	0.00033	0.00213	0.0701	-0.0005	-0.0005	0.114	0.000076	78.5	0.00144	0.00049	0.00657	0.783	0.000307	-0.005	15.5
81	E4 - Main Embankment Seepage Pond	6/25/2007 10:00	-0.01	0.00157	0.0013	-0.001	0.196	0.00056	0.00225	0.0687	-0.0005	-0.0005	0.12	0.000034	81.3	-0.0005	0.00019	0.00503	0.188	0.000134	-0.005	16.7
83	E4 - Main Embankment Seepage Pond	7/9/2007 13:30	-0.01	0.00147	0.0012	-0.001	0.32	0.00032	0.00226	0.0707	-0.0005	-0.0005	0.124	0.000037	70.8	0.00066	0.00025	0.00522	0.396	0.000194	0.0051	16.2
84	E4 - Main Embankment Seepage Pond	7/17/2007 10:59					0.202	0.00029	0.00219	0.0626	-0.0005	-0.0005	0.135	0.000028	83.9	-0.0005	0.00018	0.00499	0.247	0.0001	-0.005	17.9
85	E4 - Main Embankment Seepage Pond	7/24/2007 14:19	-0.01	0.00123	0.001	0.0011	0.175	0.00027	0.00212	0.0604	-0.0005	-0.0005	0.126	-0.00005	75.2	-0.0005	0.00013	0.00416	0.18	0.000097	-0.005	16.7
86	E4 - Main Embankment Seepage Pond	7/31/2007 14:44	-0.01	0.00127	0.0013	-0.001	0.193	0.00027	0.00223	0.0565	-0.0005	-0.0005	0.122	-0.0004	60.6	-0.0005	0.00017	0.00374	0.217	0.000085	-0.005	15.7
87	E4 - Main Embankment Seepage Pond	8/2/2007 10:14	-0.01	0.00134	-0.002	-0.002	0.113	0.00028	0.00224	0.0557	-0.0005	0.001	0.128	-0.000034	57	-0.001	-0.0002	0.00389	0.111	-0.0001	-0.01	15.2
88	E4 - Main Embankment Seepage Pond	8/14/2007 9:15	-0.01	0.00141	0.0012	-0.001	0.12	0.00025	0.00234	0.0532	-0.0005	-0.0005	0.119	0.000035	56.4	-0.0005	0.00013	0.00297	0.112	0.000068	-0.005	15.4
89	E4 - Main Embankment Seepage Pond	8/29/2007 15:15	-0.01	0.00136	0.001	0.0017	0.0619	0.00031	0.00262	0.0531	-0.0005	-0.0005	0.126	-0.000017	56.3	-0.0005	0.00011	0.00312	0.104	0.00048	-0.005	14.7
90	E4 - Main Embankment Seepage Pond	9/5/2007 11:30	-0.01	0.00133	0.0011	0.0011	0.0779	0.0002	0.0026	0.0515	-0.0005	-0.0005	0.114	-0.0003	66.7	-0.0005	0.00012	0.00328	0.114	0.000058	-0.005	14.3
91	E4 - Main Embankment Seepage Pond	10/2/2007 15:00	-0.01	0.0014	-0.001	-0.001	0.263	0.0002	0.0022	0.0624	-0.0005	-0.0005	0.095	0.000045	72.8	0.0006	0.00025	0.00454	0.308	0.000143	-0.005	14.9
92	E4 - Main Embankment Seepage Pond	11/5/2007 10:45	-0.01	0.00159	-0.001	0.0023	0.146	0.0002	0.00199	0.0686	-0.0005	-0.0005	0.09	0.000046	98.6	0.00171	0.00019	0.00396	0.158	0.000083	-0.005	17.2
94	E4 - Main Embankment Seepage Pond	12/27/2007	-0.01	0.00191	-0.002	0.003	0.0351	0.00043	0.00223	0.0791	-0.001	-0.001	0.127	-0.00009	93.6	-0.001	0.00024	0.0049	0.078	-0.0001	-0.01	16.3
96	E4 - Main Embankment Seepage Pond	1/8/2008 14:15	-0.01	0.0016	-0.001	-0.001	0.0223	0.00039	0.00203	0.0681	-0.0005	-0.0005	0.095	-0.0003	77.7	-0.0005	0.00028	-0.0007	0.048	0.000051	-0.005	14.3
97	E4 - Main Embankment Seepage Pond	1/15/2008 14:19	-0.01	0.00197	-0.001	0.002	0.029	0.00038	0.00267	0.0701	-0.0005	-0.0005	0.102	-0.0004	88	-0.0005	0.00025	0.00031	0.00165	0.072	-0.0005	15.5
98	E4 - Main Embankment Seepage Pond	1/22/2008 10:50	-0.01	0.00205	-0.001	-0.002	0.0201	0.00044	0.00284	0.0758	-0.0005	-0.0005	0.118	-0.00007	101	-0.0005	0.00034	0.00239	0.069	-0.00005	-0.005	15.6
100	E4 - Main Embankment Seepage Pond	2/6/2008 10:09	-0.01	0.00182	-0.001	0.0043	0.0346	0.00043	0.00264	0.0685	-0.0005	-0.0005	0.105	-0.0003	81.9	-0.0005	0.00033	0.00187	0.12	-0.00005	-0.005	15.5
102	E4 - Main Embankment Seepage Pond	3/4/2008 10:09	-0.01	0.00171	-0.001	0.0022	0.0121	0.00039	0.00242	0.0601	-0.0005	-0.0005	0.101	-0.00007	82.3	-0.0005	0.0003	0.00244	0.043	-0.00005	-0.005	15.2
104	E4 - Main Embankment Seepage Pond	4/16/2008 10:14	-0.01	0.00107	-0.001	0.0022	0.424	0.00023	0.00097	0.0453	-0.0005	-0.0005	0.053	0.000048	67.6	0.00102	0.00033	0.00675	0.515	0.000276	-0.005	12.2
105	E4 - Main Embankment Seepage Pond	5/13/2008 10:45	-0.01	0.00143	-0.002	-0.002	0.127	0.00026	0.00155	0.0679	-0.001	-0.001	0.09	-0.000034	108	-0.001	-0.0002	0.00289	0.123	-0.0001	-0.01	17.7
106	E4 - Main Embankment Seepage Pond	5/20/2008 13:50	-0.01	0.00139	-0.001	-0.001	0.0475	0.00026	0.00163	0.0609	-0.0005	-0.0005	0.089	-0.00004	110	-0.0005	0.0001	-0.003	0.06	0.000057	-0.005	17.6
107	E4 - Main Embankment Seepage Pond	6/16/2008 10:00	-0.01	0.00127	-0.001	-0.001	0.0758	0.0003	0.00179	0.0494	-0.0005	-0.0005	0.113	-0.00005	89.7	-0.0005	-0.0001	0.00274	0.103	0.000085	-0.005	17.5
108	E4 - Main Embankment Seepage Pond	7/15/2008 9:00	0.012	0.00102	0.0011	-0.001	0.103	0.00032	0.00195	0.0428	-0.0005	-0.0005	0.116	-0.0005	77.4	0.0006	-0.0001	0.00183	0.192	0.000061	-0.005	16.6
109	E4 - Main Embankment Seepage Pond	8/6/2008 9:24	-0.01	0.00111	-0.02	-0.02	0.405	-0.002	-0.002	0.0419	-0.01	-0.01	-0.2	-0.00034	61.5	-0.01	-0.002	0.0024	0.558	-0.001	-0.1	15.3
110	E4 - Main Embankment Seepage Pond	9/9/2008 8:15	-0.01	0.00125	-0.001	-0.001	0.0316	0.00039	0.00253	0.0534	-0.0005	-0.0005	0.14	-0.0004	78.5	-0.002	-0.0001	0.00094	0.057	-0.00005	-0.005	14.8
111	E4 - Main Embankment Seepage Pond	9/30/2008 11:39	-0.01	0.00131	-0.001	-0.001	0.0543	0.00037	0.00249	0.0558	-0.0005	-0.0005	0.138	-0.0005	78.7	-0.0005	0.00011	0.00139	0.086	0.000073	0.0055	14.6
112	E4 - Main Embankment Seepage Pond	10/22/2008 11:39	-0.01	0.00133	-0.001	-0.001	0.099	0.00033	0.00222	0.0532	-0.0005	-0.0005	0.135	-0.000017	79.7	-0.0005	0.00013	0.00333	0.124	0.000082	0.0059	14.9
113	E4 - Main Embankment Seepage Pond	11/4/2008 13:39	-0.01	0.00127	-0.002	-0.002	0.0791	0.00031	0.0023	0.0587	-0.001	-0.001	0.156	-0.0006	88.3	-0.001	-0.0002	0.0015	0.116	-0.0001	-0.01	15.1
114	E4 - Main Embankment Seepage Pond	12/2/2008 11:28	-0.01	0.0015	-0.001	-0.001	0.101	0.0003	0.00231	0.0601	-0.0005	-0.0005	0.122	-0.0006	101	-0.0005	0.00017	0.00198	0.163	0.000075	-0.005	16.5
115	E4 - Main Embankment Seepage Pond	1/14/2009 14:05	-0.01	0.00128	-0.001	0.02	1.58	0.00039	0.00327	0.0702	-0.0005	-0.0005	0.143	0.000118	95.3	0.00848	0.0017	0.0292	2.36	0.00146	0.0066	16.1
116	E4 - Main Embankment Seepage Pond	2/10/2009 12:00	-0.01	0.00114	-0.002	0.0035	0.139	0.00026	0.00289	0.0728	-0.001	-0.001	0.15	0.000117	88	-0.001	0.00036	0.00262	0.223	-0.0001	-0.01	14.6
117	E4 - Main Embankment Seepage Pond	3/4/2009	-0.01	0.000989	0.0013	-0.001	0.197	0.00031	0.00253	0.0599	-0.0005	-0.0005	0.137		88.8	-0.0005	0.00034	0.011	0.273	0.000134	-0.005	13.6
118	E4 - Main Embankment Seepage Pond	4/7/2009 13:39	-0.01	0.0011	-0.001	0.004	0.243	0.00022	0.00192	0.0543	-0.0005	-0.0005	0.11	0.000027	82.6	0.00076	0.00036	0.00503	0.291	0.000112	-0.005	13.9
119	E4 - Main Embankment Seepage Pond	5/12/2009 10:14	-0.01	0.00138	-0.002	-0.002	0.343	0.00028	0.00174	0.0687	-0.001	-0.001	0.118	0.000087	114	0.0015	0.00032	0.0139	0.422	0.00051	-0.01	18.4
120	E4 - Main Embankment Seepage Pond	6/9/2009 9:45	-0.01	0.00125	-0.001	-0.001	0.111	0.00026	0.00202	0.0521	-0.0005	-0.0005	0.146	0.000121	93.8	0.0007	0.00011	0.00406	0.152	0.000082	0.0055	20.4
121	E4 - Main Embankment Seepage Pond	7/7/2009 10:00	-0.01	0.00104	-0.001	-0.001	0.526	0.00021	0.0022	0.0544	-0.0005	-0.0005	0.129	0.000147	88.9	0.00126	0.00035	0.00524	0.536	0.000242	0.0055	18.3
122	E4 - Main Embankment Seepage Pond	8/5/2009 10:39	-0.01	0.00109	-0.001	0.0013	0.0173	0.00024	0.00217	0.0499	-0.0005	-0.0005	0.139	0.000096	84.4	-0.0005	-0.0001	0.0029	0.035	-0.00005	-0.005	18
123	E4 - Main Embankment Seepage Pond	8/19/2009	-0.01	0.00118	-0.001	0.0012	0.0513	0.00026	0.00232	0.0522	-0.0005	-0.0005	0.144	-0.00051	85.6	-0.0005	0.00011	-0.005	0.082	0.000074	0.0055	17.6
124	E4 - Main Embankment Seepage Pond	9/2/2009 9:00	-0.01	0.00107	-0.001	-0.001	0.086	0.00024	0.00235	0.0558	-0.0005	-0.0005	0.157	0.000046	91.1	-0.0005	0.00015	0.00737	0.133	0.000106	0.0054	16.8
125	E4 - Main Embankment Seepage Pond	10/6/2009 9:49	-0.01	0.00114	-0.002	-0.002	0.0902	0.00022	0.00219	0.0707	-0.001	-0.001	0.158	-0.

Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
1	E4 - Main Embankment Seepage Pond	7/12/2001 13:30	0.11	-0.00005	0.0181	-0.0005		0.0052	0.5	0.00003	45.4	1.09	-0.00005	0.00184	0.00227	0.00122	0.00109	0.0033
3	E4 - Main Embankment Seepage Pond	7/26/2001 8:00	0.0376	-0.00005	0.0378	-0.0005		0.0031	3.4	-0.00001	34.3	0.767	-0.00005	0.0002	0.00697	0.00101	0.00125	0.0031
4	E4 - Main Embankment Seepage Pond	8/3/2001	0.0153	-0.00005	0.038	-0.0005		0.0031	1.9	0.00001	30	0.766	-0.00005	0.0002	0.00523	0.00103	0.00106	0.0032
5	E4 - Main Embankment Seepage Pond	8/10/2001 10:15	0.0168	-0.00005	0.0548	-0.0005		0.0033	0.8	0.00005	40.5	0.879	0.00005	0.00187	0.00333	0.00123	0.0007	0.0031
7	E4 - Main Embankment Seepage Pond	8/30/2001 14:25	0.0255	-0.00005	0.0661	-0.0005		0.0023	1.1	-0.00001	45.3	0.51	-0.00005	0.00035	0.00377	0.00126	0.00076	0.001
8	E4 - Main Embankment Seepage Pond	10/23/2001 14:30	0.0423	-0.00005	0.0356	-0.0005		0.0009	3.8	0.00001	30.1	0.45	-0.00005	0.00032	0.0114	0.00094	0.00139	0.0059
9	E4 - Main Embankment Seepage Pond	11/13/2001 8:45	0.147	-0.00005	0.0614	-0.0005		0.0021	5.6	-0.00001	49.2	0.741	-0.00005	0.00035	0.00387	0.00139	0.00111	0.0015
15	E4 - Main Embankment Seepage Pond	5/22/2002 12:30	0.0516	-0.00005	0.0175	0.0008		0.0012	4.62	-0.00001	13	0.292	-0.00005	0.00011	0.0323	0.00072	0.00272	0.0043
17	E4 - Main Embankment Seepage Pond	7/31/2002 9:10	0.0292	-0.00005	0.0583	-0.0005		0.0007	1.52	-0.00001	43.2	0.386	-0.00005	-0.00005	0.0026	0.00091	0.00085	0.0114
26	E4 - Main Embankment Seepage Pond	5/5/2003 14:50	0.143	-0.00005	0.0299	-0.0005		0.0007	4.85	-0.00001	24.8	0.399	-0.00005	0.00008	0.0071	0.00084	0.0015	0.0017
27	E4 - Main Embankment Seepage Pond	5/29/2003 10:30	0.0237	-0.00005	0.0363	-0.0005		0.0006	3.84	-0.00001	28.5	0.398	-0.00005	0.00007	0.0026	0.00088	0.00101	0.0006
28	E4 - Main Embankment Seepage Pond	6/24/2003 7:00	0.0651	-0.00005	0.0475	-0.0005		0.0005	3.31	-0.00001	33.8	0.37	-0.00005	0.00005	0.0026	0.00079	0.0009	0.0007
29	E4 - Main Embankment Seepage Pond	8/5/2003 14:30	0.0138	-0.00005	0.0529	-0.0005		-0.0005	0.22	-0.00001	40.2	0.306	-0.00005	0.00006	0.0023	0.00063	0.00103	-0.0005
30	E4 - Main Embankment Seepage Pond	8/20/2003 10:00	0.037	-0.00005	0.0528	-0.0005		-0.0005	0.46	-0.00001	43.3	0.302	-0.00005	-0.00005	0.0055	0.00065	0.0014	0.0014
31	E4 - Main Embankment Seepage Pond	10/16/2003 16:00	0.0236	-0.00005	0.0406	-0.0005		-0.0005	1.84	-0.00001	34.8	0.295	-0.00005	-0.00005	0.0067	0.00079	0.0014	-0.0005
32	E4 - Main Embankment Seepage Pond	11/11/2003 9:55	0.0187	-0.00005	0.0312	-0.0005		0.0013	3.41	-0.00001	29.4	0.401	-0.00005	-0.00005	0.0073	0.00093	0.00199	0.0012
33	E4 - Main Embankment Seepage Pond	3/4/2004 10:00	0.147	-0.00005	0.0101	-0.0005		0.0012	5.01	-0.00001	9.61	0.267	-0.00005	-0.00005	0.0083	0.00071	0.00153	0.0049
34	E4 - Main Embankment Seepage Pond	3/22/2004	0.48	-0.00005	0.0232	-0.0005		0.0016	5.37	-0.00001	18.8	0.39	-0.00005	-0.00005	0.004	0.00103	0.00163	0.0065
35	E4 - Main Embankment Seepage Pond	3/22/2004 10:40	0.48	-0.00005	0.0232	-0.0005		0.0016	5.37	-0.00001	18.8	0.39	-0.00005	-0.00005	0.004	0.00103	0.00163	0.0065
36	E4 - Main Embankment Seepage Pond	4/3/2004 10:00	0.147	-0.00005	0.0101	-0.0005		0.0012	5.01	-0.00001	9.61	0.267	-0.00005	-0.00005	0.0083	0.00071	0.00153	0.0049
37	E4 - Main Embankment Seepage Pond	5/1/2004 13:32	0.0696	-0.00005	0.0194	-0.0005		0.0008	4.08	-0.00001	15	0.299	-0.00005	0.00009	0.006	0.0007	0.00107	0.0025
38	E4 - Main Embankment Seepage Pond	5/7/2004	0.05	-0.00005	0.0352	-0.0005		0.0005	2.66	-0.00001	24.4	0.387	-0.00005	-0.00005	0.0038	0.00084	0.00105	0.0007
39	E4 - Main Embankment Seepage Pond	6/9/2004	0.0358	-0.00005	0.0193	-0.0005		-0.0005	2.37	-0.00001	14.5	0.274	-0.00005	-0.00005	0.0045	0.00077	0.00114	0.0074
40	E4 - Main Embankment Seepage Pond	7/5/2004	0.05	-0.00005	0.0352	-0.0005		0.0005	2.66	-0.00001	24.4	0.387	-0.00005	-0.00005	0.0038	0.00084	0.00105	0.0007
41	E4 - Main Embankment Seepage Pond	8/2/2004	0.0521	-0.00005	0.0546	-0.0005		0.0009	3.87	-0.00001	33.3	0.459	-0.00005	-0.00005	0.0012	0.00099	0.00091	-0.0005
42	E4 - Main Embankment Seepage Pond	8/25/2004	0.0962	-0.00005	0.0634	-0.0005		0.0006	5.57	-0.00001	41.8	0.496	-0.00005	-0.00005	0.0027	0.00104	0.00093	-0.0005
43	E4 - Main Embankment Seepage Pond	12/8/2004	0.332	-0.00005	0.063	-0.0005		0.0013	5.12	-0.00001	29.2	0.458	-0.00005	-0.00005	0.0035	0.00153	0.00069	0.0036
44	E4 - Main Embankment Seepage Pond	1/31/2005	0.155	-0.00005	0.0234	0.0005		0.0011	4.95	-0.00001	13.6	0.298	-0.00005	-0.00005	0.0104	0.001	0.00113	0.004
45	E4 - Main Embankment Seepage Pond	2/16/2005	0.502		0.103	0.0006		0.0011	6.48	-0.00001	43.9	0.527	-0.00005	0.00016	0.0049	0.00188	0.00088	0.0015
46	E4 - Main Embankment Seepage Pond	3/16/2005	0.371		0.00696	-0.0005		-0.0005	3.55	-0.00001	5.56	0.444	-0.00005	-0.00005	0.0022	0.00192	0.00053	0.0099
48	E4 - Main Embankment Seepage Pond	4/11/2005	0.128		0.112	0.0012		0.0009	4.99	-0.00001	41.8	0.471	-0.00005	-0.00005	0.0079	0.00159	0.0013	0.0008
49	E4 - Main Embankment Seepage Pond	5/4/2005	0.278		0.131	0.0013		0.0008	6.16	-0.00001	55	0.568	-0.00005	0.00006	0.0277	0.00165	0.00285	0.0041
50	E4 - Main Embankment Seepage Pond	6/6/2005	0.302		0.136	0.001		0.001	4.54	-0.00001	51	0.579	-0.00005	-0.00005	0.002	0.0014	0.00143	-0.0005
52	E4 - Main Embankment Seepage Pond	8/11/2005	0.0373		0.0994	0.0008		0.0007	4.49	-0.00001	53	0.506	-0.00005	-0.00005	0.0065	0.00094	0.00146	0.001
53	E4 - Main Embankment Seepage Pond	9/13/2005	0.0704		0.102	-0.0005		0.0007	5.41	-0.00001	58.2	0.462	-0.00005	-0.00005	0.004	0.00107	0.00141	0.0011
55	E4 - Main Embankment Seepage Pond	11/8/2005	0.162		0.093	0.0006		0.0009	5.03	-0.00001	47.2	0.424	-0.00005	-0.00005	0.0058	0.00139	0.00152	0.0017
56	E4 - Main Embankment Seepage Pond	12/14/2005	0.31		0.0747	-0.0005		0.0008	6.03	-0.00001	38.8	0.504	-0.00005	-0.00005	0.0031	0.00158	0.00096	0.0109
57	E4 - Main Embankment Seepage Pond	1/17/2006	0.564		0.105	-0.0005		0.0017	7.19	-0.00001	45.2	0.541	-0.00005	-0.00005	0.0046	0.00167	0.00113	0.105
58	E4 - Main Embankment Seepage Pond	2/8/2006	0.461		0.121	0.0012		0.0012	7.42	-0.00001	49.9	0.558	-0.00005	-0.00005	0.0091	0.00178	0.00136	0.0025
59	E4 - Main Embankment Seepage Pond	3/6/2006 12:30	0.487		0.128	0.0006		0.0013	7.06	-0.00001	53	0.621	-0.00005	-0.00005	0.0036	0.00192	0.00107	0.005
60	E4 - Main Embankment Seepage Pond	4/11/2006 9:20	0.261		0.0568	0.0033		0.0011	8.37	0.00002	27.5	0.404	-0.00005	0.00007	0.0881	0.00115	0.00589	0.0073
61	E4 - Main Embankment Seepage Pond	5/9/2006	0.138		0.0927	0.00106		0.0011	5.91	-0.00001	43.2	0.551	-0.0001	-0.0001	0.012	0.00159	0.0031	0.0022
62	E4 - Main Embankment Seepage Pond	6/14/2006	0.18		0.0956	-0.0005		0.0019	3.8	-0.00001	47.5	0.602	-0.0001	-0.0001	-0.01	0.00134	0.0016	0.001
63	E4 - Main Embankment Seepage Pond	7/4/2006	0.0972		0.0986	-0.0005		-0.001	3.98	-0.00001	55.7	0.548	-0.0001	-0.0001	-0.01	0.00121	0.0011	0.0019
64	E4 - Main Embankment Seepage Pond	8/3/2006	0.0935		0.106	0.00057		-0.001	4.79	-0.00001	53.9	0.572	-0.0001	-0.0001	-0.01	0.00113	0.0012	-0.005
66	E4 - Main Embankment Seepage Pond	10/12/2006	0.0632		0.112	-0.0005		0.002	5.3	-0.00001	52.5	0.69	-0.0001	-0.0001	-0.01	0.00157	0.0012	0.0014
67	E4 - Main Embankment Seepage Pond	11/15/2006	0.281		0.124	-0.0005		0.0048	7.43	-0.00001	50.1	1.13	-0.0001	-0.0001	-0.01	0.00161	0.0012	0.0021
68	E4 - Main Embankment Seepage Pond	12/4/2006	0.507		0.122	0.00063		0.0051	7.01	-0.00001	50.9	0.906	-0.0001	-0.0001	-0.01	0.00187	-0.001	0.0028
72	E4 - Main Embankment Seepage Pond	2/5/2007 10:59	0.52		0.101	0.00063		0.0028	6.87	-0.00001	58	0.797	-0.0001	-0.0001	-0.01	0.00171	0.0012	0.0022
73	E4 - Main Embankment Seepage Pond	3/5/2007	0.436		0.109	0.00099		0.0028	7.05	-0.00001	59.5	0.819	-0.0001	-0.0001	-0.01	0.00162	0.0013	0.0029
74	E4 - Main Embankment Seepage Pond	4/11/2007 11:15	0.113		0.0575	-0.005		0.005	5.39	-0.00002	16.3	0.745	-0.0001	-0.0001	0.036	0.0011	0.003	0.0182
75	E4 - Main Embankment Seepage Pond	5/7/2007 10:00	0.173		0.127	0.00193		0.0083	5.4	-0.00001	44.7	1.22	-0.0001	-0.0001	0.03	0.0016	0.003	-0.007
77	E4 - Main Embankment Seepage Pond	6/4/2007 10:34	0.0452		0.126	0.00059		0.0096	3.25	-0.00001	56.3	1.1	-0.0001	-0.0001	-0.01	0.00183	0.0018	-0.006
79	E4 - Main Embankment Seepage Pond	6/11/2007 10:59	0.0988		0.121	-0.001		0.009	3.77	-0.00002	56.2	1.05	-0.0002	-0.0002	-0.01	0.00155	-0.002	-0.002
80	E4 - Main Embankment Seepage Pond	6/18/2007 9:45	0.105		0.112	0.00127		0.009	4.48	-0.00001	51.2	0.997	-0.0001	-0.0001	0.027	0.00151	0.003	-0.004
81	E4 - Main Embankment Seepage Pond	6/25/2007 10:00	0.0812		0.131	-0.0005		0.0125	4.32	-0.00001	53	1.11	-0.0001	-0.0001	-0.01	0.00157	0.0016	0.0018
83	E4 - Main Embankment Seepage Pond	7/9/2007 13:30	0.0585		0.137	0.00072		0.0094	4.68	-0.00001	55.8	1.12	-0.0001	-0.0001	0.015	0.0016	0.0021	0.0023
84	E4 - Main Embankment Seepage Pond	7/17/2007 10:59	0.0623		0.128	-0.0005		0.0092	4.45	-0.00001	60.8	1.06	-0.0001	-0.0001	0.011	0.00133	0.0018	0.0018
85	E4 - Main Embankment Seepage Pond	7/24/2007 14:19	0.0283		0.121	-0.0005		0.0088	3.98	-0.00001	61.7	1	-0.0001	-0.0001	0.01	0.00131	0.0014	0.0024
86	E4 - Main Embankment Seepage Pond	7/31/2007 14:44	0.0201	-0.00001	0.12	0.00074		0.0075	3.85	-0.00001	58	0.889	-0.0001	-0.0001	-0.01	0.0013	0.0017	-0.001
87	E4 - Main Embankment Seepage Pond	8/2/2007 10:14	0.0144	-0.00001	0.119	-0.001		0.0074	3.1	-0.00002	60.8	0.905	-0.0002	-0.0002	-0.01	0.00134	-0.002	-0.002
88	E4 - Main Embankment Seepage Pond	8/14/2007 9:15	0.0199	-0.00001	0.115	-0.0005		0.0072	2.52	-0.00001	61.6	0.88	-0.0001	-0.0001	-0.01	0.00138	0.0015	-0.001
89	E4 - Main Embankment Seepage Pond	8/29/2007 15:15	0.0301		0.111	-0.0005		0.0054	2.7	-0.00002	57.4	0.86	-0.0001	-0.0001	-0.01	0.00143	0.0013	0.0031
90	E4 - Main Embankment Seepage Pond	9/5/2007 11:30	0.0334	-0.00001	0.107	-0.0005		0.0046	3.23	-0.00001	59.8	0.888	-0.0001	-0.0001	-0.01	0.00133	0.0014	0.0029
91	E4 - Main Embankment Seepage Pond	10/2/2007 15:00	0.0807		0.13	0.00064		0.0048	4.44	-0.00001	47	1.05	-0.0001	-0.0001	0.011	0.0014	0.0014	0.002
92	E4 - Main Embankment Seepage Pond	11/5/2007 10:45	0.118		0.128	-0.0005		0.0108	5.78	-0.00001	41.7	1.22	-0.0001	-0.0001	-0.01	0.00156	0.001	0.0028
94	E4 - Main Embankment Seepage Pond	12/27/2007	0.481		0.11	0.0095		0.0071	6.74	-0.00002	60.6	1.06	-0.0002	-0.0002	-0.01	0.00198	-0.002	0.0082
96	E4 - Main Embankment Seepage Pond	1/8/2008 14:15	0.495		0.0844	-0.0005		0.0054	5.79	0.000022	54.3	0.888	-0.0001	-0.0001	-0.01	0.00158	-0.001	0.0012
97	E4 - Main Embankment Seepage Pond	1/15/2008 14:19	0.559		0.0898	-0.0005		0.0057	6.82	-0.00001	61.3	0.977	-0.0001	-0.0001	-0.01	0.00176	-0.001	0.0031
98	E4 - Main Embankment Seepage Pond	1/22/2008 10:50	0.585		0.101	-0.0005		0.0062	7.2	-0.00001	63.7	0.986	-0.0001	-0.0001	-0.01	0.00205	-0.001	0.0033
100	E4 - Main Embankment Seepage Pond	2/6/2008 10:09	0.49		0.0935	-0.0005			6.62	-0.00001	61.3		-0.0001	-0.0001	-0.01	0.00182	-0.001	0.0053
102	E4 - Main Embankment Seepage Pond	3/4/2008 10:09	0.404		0.0885	-0.0005			6.59	-0.00001	52.2		-0.0001	-0.0001	-0.01	0.00148	-0.001	0.0048
104	E4 - Main Embankment Seepage Pond	4/16/2008 10:14	0.13		0.102	0.00103			4.66	0.000014	23.2		-0.0001	-0.0001	0.022	0.00107	0.0015	0.0045
105	E4 - Main Embankment Seepage Pond	5/13/2008 10:45	0.0824		0.169	-0.001		0.0109	4.3	-0.00002	44	1.45	-0.0002	-0.0002	-0.01	0.00141	-0.002	0.0023
106	E4 - Main Embankment Seepage Pond	5/20/2008 13:50	0.0622		0.161	-0.0005		0.0105	3.84	-0.00001	44.3	1.19	-0.0001	-0.0001	-0.01	0.00142	0.001	-0.001
107	E4 - Main Embankment Seepage Pond	6/16/2008 10:00	0.0461		0.137	-0.0005		0.0094	1.66	-0.00001	51.8	0.968	-0.0001	-0.0001	-0.01	0.00129	-0.001	-0.001
108	E4 - Main Embankment Seepage Pond	7/15/2008 9:00	0.0306		0.132	-0.0005		0.0074	4.79	-0.00001	62.3	0.956	-0.0001	-0.0001	-0.01	0.00103	0.0011	-0.001
109	E4 - Main Embankment Seepage Pond	8/6/2008 9:24	0.0377		0.114	-0.01		-0.02	4.35	-0.0002	59.5	0.815	-0.002	-0.002	0.025	0.00113	-0.02	-0.02
110	E4 - Main Embankment Seepage Pond	9/9/2008 8:15	0.143		0.124	-0.0005		0.0054	3.52	-0.00001	62.5	0.903	-0.0001	-0.0001	-0.01	0.00119	0.001	0.0013
111	E4 - Main Embankment Seepage Pond	9/30/2008 11:39	0.0741		0.133	0.0005		0.0043	3.78	-0.00001	69	0.845	-0.0001	-0.0001	-0.01	0.00134	0.001	0.0017
112	E4 - Main Embankment Seepage Pond	10/22/2008 11:39	0.125		0.137	-0.0005		0.0035	5.05	-0.00001	68.2	0.985	-0.0001	-0.0001	0.011	0.00135	0.001	0.0013
113	E4 - Main Embankment Seepage Pond	11/4/2008 13:39	0.149	-0.00001	0.135	-0.001		0.0039	5.42	-0.00002	70.8	1.04	-0.0002	-0.0002	0.011	0.00129	-0.002	-0.002
114	E4 - Main Embankment Seepage Pond	12/2/2008 11:28	0.31	-0.00001	0.14	-0.0005		0.0045	6.5	-0.00001	61.2	1.13	-0.0001	-0.0001	0.014	0.00151	-0.001	-0.002
115	E4 - Main Embankment Seepage Pond	1/14/2009 14:05	0.919		0.111	0.00371		0.0032	10	0.00003	66.7	0.908	-0.0001	0.00013	0.08	0.00129	0.0057	0.0517
116	E4 - Main Embankment Seepage Pond	2/10/2009 12:00	0.89		0.109	-0.001		0.0023	7.05	-0.00002	68.3	1.13	-0.0002	-0.0002	-0.01	0.00118	-0.002	-0.006
117	E4 - Main Embankment Seepage Pond	3/4/2009	0.381	-0.00001	0.11	-0.0005		0.0028	7.21	-0.00001	63.2	1.01	-0.0001	-0.0001	0.013	0.000988	0.002	0.0058
118	E4 - Main Embankment Seepage Pond	4/7/2009 13:39	0.285	-0.00001	0.101	-0.001		0.0049	5.99	-0.00001	52.4	0.975	-0.0001	-0.0001	0.012	0.00105	0.0014	-0.007
119	E4 - Main Embankment Seepage Pond	5/12/2009 10:14	0.132		0.189	0.0026		0.0101	4.06	-0.00002	45.4	1.62	-0.0002	-0.0002	0.019	0.00138	-0.002	0.0137
120	E4 - Main Embankment Seepage Pond	6/9/2009 9:45	0.0786		0.16	0.00062		0.0091	3.05	-0.00001	67.3	1.36	-0.0001	-0.0001	-0.01	0.00131	0.0013	-0.003
121	E4 - Main Embankment Seepage Pond	7/7/2009 10:00	0.0913		0.128	0.00084		0.008	4.77	-0.00001	63	1.3	-0.0001	-0.0001	0.025	0.00103	0.0019	0.0023
122	E4 - Main Embankment Seepage Pond	8/5/2009 10:39	0.0387		0.129	0.001		0.0056	1.58	-0.00001	68	1.18	-0.0001	-0.0001	-0.01	0.00104	-0.001	-0.001
123	E4 - Main Embankment Seepage Pond	8/19/2009	0.0578		0.119	-0.0005		0.0052	1.47	-0.00001	74	1.17	-0.0001	-0.0001	0.011	0.00109	-0.001	0.0037
124	E4 - Main Embankment Seepage Pond	9/2/2009 9:00	0.12		0.119	0.00137		0.0047	1.87	-0.00001	70.3	1.18	-0.0001	-0.0001	0.011	0.00114	-0.001	-0.002
125	E4 - Main Embankment Seepage Pond	10/6/2009 9:49	0.095		0.127	-0.001		0.0038	3.69	-0.00002	72.9	1.35	-0.0002	-0.0002	-0.01	0.00123	-0.002	-0.002
126	E4 - Main Embankment Seepage Pond	10/29/2009 12:15	0.217		0.123	0.00068		0.0036	4.77	-0.00001	65.9	1.22	-0.0001	-0.0001	0.013	0.00116	-0.001	-0.001
127	E4 - Main Embankment Seepage Pond	11/19/2009 9:18	0.189		0.163	-0.001		0.0078	5.7	-0.00002	57.1	1.52	-0.0002	-0.0002	-0.01	0.00141	-0.002	0.0023
129	E4 - Main Embankment Seepage Pond	1/13/2010 14:05	0.473		0.0875	-0.001		0.0045	6.33	-0.00002	47.4	1.17	-0.0002	-0.0002	-0.01	0.00153	-0.002	0.0049
130	E4 - Main Embankment Seepage Pond	2/10/2010 13:32	0.648		0.119	-0.001		0.0049	6.51	-0.00002	64.1	1.4	-0.0002	-0.0002	-0.01	0.00132	-0.002	0.0059
131	E4 - Main Embankment Seepage Pond	3/3/2010 12:00	0.194		0.0453	0.00058		0.0023	4.52	-0.00001	23.8	0.693	-0.0001	-0.0001	0.01	0.000753	-0.001	0.0022
132	E4 - Main Embankment Seepage Pond	4/7/2010 13:20	0.192		0.118	0.0011		0.0052	5.54	-0.00002	57.6	1.36	-0.0002	-0.0002	0.016	0.00148	-0.002	0.0021
133	E4 - Main Embankment Seepage Pond	5/11/2010	0.086		0.137	-0.001		0.0056	6.1	-0.00002	49	1.83	-0.0002	-0.0002	0.015	0.00191	-0.002	0.0021
134	E4 - Main Embankment Seepage Pond	6/3/2010 8:40	0.0647		0.107	0.00067		0.0047	2.99	-0.00001	63.8	1.21	-0.0001	-0.0001	-0.01	0.00127	-0.001	-0.001
135	E4 - Main Embankment Seepage Pond	7/8/2010	0.0408		0.113	-0.0005		0.0047	1.27	-0.00001	72.7	1.61	-0.0001	-0.0001	-0.01	0.000998	-0.001	0.0013
136	E4 - Main Embankment Seepage Pond	8/5/2010	0.103		0.114	-0.001		0.0047	0.492	-0.00002	81.8	1.75	-0.0002	-0.0002	-0.01	0.00114	-0.002	-0.002
138	E4 - Main Embankment Seepage Pond	10/7/2010	0.165	-0.00005	0.164	-0.0005		0.01	5.31	-0.00001	84.4	2.19	-0.0001	-0.0001	-0.01	0.00135	-0.001	0.004
139	E4 - Main Embankment Seepage Pond	11/4/2010	0.141		0.18	-0.0006		0.0151	5.67	0.00002	92.6	2.49	-0.0001	-0.0001	0.015	0.00145	-0.001	0.0037
140	E4 - Main Embankment Seepage Pond	12/1/2010 9:50	0.137	-0.00005	0.134	0.00077		0.0091	4.51	-0.00001	81	1.9	-0.0001	-0.0001	0.021	0.00104	0.0011	0.01
141	E4 - Main Embankment Seepage Pond	1/10/2011 10:30	0.249		0.197	0.00059		0.0171	6.18	-0.00001	88.9	2.31	-0.0001	-0.0001	0.013	0.00106	-0.001	0.0049
144	E4 - Main Embankment Seepage Pond	4/5/2011 11:16	0.508	-0.00005	0.15	0.00464		0.0119	9.83	0.000015	48.6	1.92	-0.0001	0.00049	0.129	0.00139	0.0064	0.0435
145	E4 - Main Embankment Seepage Pond	5/12/2011 13:29	0.232	-0.00005	0.14	0.00283		0.0106	7.31	-0.00001	52.6	1.58	-0.0001	-0.0001	0.071	0.0011	0.0046	0.0065
146	E4 - Main Embankment Seepage Pond	6/9/2011 13:02	0.0883	-0.00005	0.166	0.00052		0.0214	4.23	-0.00001	71.1	1.75	-0.00001	-0.0001	0.018	0.00116	0.0017	0.0041
147	E4 - Main Embankment Seepage Pond	7/13/2011 9:25	0.0741	-0.00005	0.153	0.00057		0.0147	5.2	-0.00001	65.1	1.59	-0.00001	-0.0001	0.014	0.00104	0.0015	0.0073

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
148	E4 - Main Embankment Seepage Pond	8/4/2011 11:42		1188	9.2	16.7		63.5	1170	506	8	912	-3	1.61	0.0172	21.4		4.43	4.5	0.069	
149	E4 - Main Embankment Seepage Pond	9/8/2011 8:26		1201	8.17	13.9		81.9	1190	496	8.05	916	-3	1.11	0.031	21.7		2.9	2.99	0.095	
150	E4 - Main Embankment Seepage Pond	10/5/2011 11:20		1240	8.07	9.1		90.2	1200	493	8.05	914	-3	1.81	0.0417	22.6		2.64	2.71	0.066	
152	E4 - Main Embankment Seepage Pond	11/1/2011 10:43		1254	8.18	4.3		86.6	1230	491	8.05	911	-3	1.43	0.0228	22.8		3.29	3.36	0.075	
153	E4 - Main Embankment Seepage Pond	12/5/2011 10:49		1283	8.06	3.5		79.1	1210	497	7.97	903	4.7	3.31	0.032	22.7	0.67	3.3	3.35	0.053	
154	E4 - Main Embankment Seepage Pond	1/4/2012 13:23		1268	8.17	3.7		78.4	1220	488	8.03	907	37.3	23.3	0.0469	24.9	0.76	3.72	3.78	0.057	
155	E4 - Main Embankment Seepage Pond	2/8/2012 10:20		1298	8.11	2.3		75.9	1220	485	7.95	939	-3	2.66	0.0333	25.9	0.73	3.99	4.06	0.062	
156	E4 - Main Embankment Seepage Pond	3/14/2012 13:45		1288	7.61	2		80.8	1190	464	7.95	918	-3	4.04	0.041	24.6	0.69	3.71	3.77	0.057	
158	E4 - Main Embankment Seepage Pond	5/2/2012 11:29		1050	8.7	8		90.3	1010	420	8.35	737	8.5	6.14	0.0163	19.6	0.64	2.48	2.53	0.053	
159	E4 - Main Embankment Seepage Pond	6/7/2012 9:10	Actual Field Reading	1083	8.48	10.5		72.2	1010	422	7.84	796	5.2	4.01	0.0184	21.8	0.59	2.11	2.18	0.078	
160	E4 - Main Embankment Seepage Pond	7/5/2012 9:09	Actual field reading	1115	8.35	13.3		77.3	1070	443	8.02	908	-3	1.53	0.0204	19	0.57	2.56	2.64	0.083	
161	E4 - Main Embankment Seepage Pond	8/1/2012 11:03		1213	7.813	16.6		81.3	1140	470	7.99	956	-3	1.97	0.117	21.8	0.66	2.02	2.09	0.078	
162	E4 - Main Embankment Seepage Pond	9/6/2012 11:20		1214	8.389	13.4		72.1	1150	459	8.13	938	-3	1.67	0.0127	23.3	0.71	2.84	2.94	0.1	
163	E4 - Main Embankment Seepage Pond	10/3/2012 9:35		1220	8.07	7.8		92.3	922	456	8	930	-3	2.56	0.0112	27	0.75	2.26	2.36	0.104	
164	E4 - Main Embankment Seepage Pond	11/15/2012 12:54		1264	8.141	5.3		79.4	1170	492	7.99	936	-3	2.11	0.0184	24.2	0.67	3.04	3.11	0.076	
165	E4 - Main Embankment Seepage Pond	12/6/2012 10:20		1223	7.955	3.8		87.1	1130	453	8	893	-3	1.39	0.0196	23.2	0.71	2.75	2.83	0.073	
166	E4 - Main Embankment Seepage Pond	1/2/2013 14:27		1245	8	0.6		82.3	1170	468	7.98	920	-3	1.42	0.0169	23.2	0.79	3.69	3.78	0.088	
167	E4 - Main Embankment Seepage Pond	2/6/2013 9:20		1251	8.012	2.6		64.9	1170	484	7.83	908	-3	2.26	0.144	23.8	0.61	5.09	5.19	0.093	
169	E4 - Main Embankment Seepage Pond	3/13/2013 13:20	GH - sample	1201	8.07	5.1		76.8	1170	461	7.94	902	3.2	2.88	0.128	23.4	0.81	4.35	4.45	0.095	
170	E4 - Main Embankment Seepage Pond	4/4/2013 14:24	ok	1221	7.425	7.6		90	1210	515	7.74	916	-3	0.21	0.0446	22	0.77	3.09	3.27	0.174	
171	E4 - Main Embankment Seepage Pond	5/1/2013 9:12		1183	7.762	6.6	3.85	83.9	1170	476	7.94	822	6.2	3.85	0.0162	19	0.8	3.43	3.51	0.081	
172	E4 - Main Embankment Seepage Pond	6/6/2013 9:21		878	8.26	13	1.13	74.3	1160	447	8.02	787	-3	1.57	0.0448	21.3	0.63	3.59	3.79	0.2	
173	E4 - Main Embankment Seepage Pond	7/10/2013 10:11	Sample taken	944	8.49	15.5	1.02	94.1	1170	429	8.01	862	-3	0.39	0.0409	23.5	0.81	2.32	2.54	0.217	
174	E4 - Main Embankment Seepage Pond	8/8/2013 9:55		1176	8.059	16.4		69.2	1160	425	8.02	910	-3	0.89	0.0488	22.9	0.91	3.24	3.45	0.212	
175	E4 - Main Embankment Seepage Pond	9/5/2013 9:06	sample taken	1197	8.095	15		73.3	1170	440	7.89	920	4.6	2.41	0.0308	25.6	0.71	3.08	3.26	0.173	
176	E4 - Main Embankment Seepage Pond	10/3/2013 8:48	sample taken	1255	7.92	10.9		70.3	1230	500	8.05	921	-3	2.02	0.0463	23.3	0.59	4.78	4.99	0.209	
177	E4 - Main Embankment Seepage Pond	11/5/2013 10:26	crush washed in from the pump house, sample taken	1227	8.115	5.4		81.2	1220	486	8.01	905	-3	0.93	0.0132	23	0.62	4.68	4.81	0.137	
178	E4 - Main Embankment Seepage Pond	12/5/2013 11:55	sample taken	1142	8.21	3.4	1.61	87	1210	485	8	918	-3	1.26	0.0156	25.8	0.66	4.06	4.18	0.123	
179	E4 - Main Embankment Seepage Pond	1/7/2014 10:27	Sample taken	1240	7.838	3.6		81.9	1200	488	7.92	918	-3	1.02	0.0756	24.3	0.81	4.18	4.3	0.123	
180	E4 - Main Embankment Seepage Pond	2/11/2014 11:00	Sample taken	1252	7.306	3	0.82	70.3	1260	500	8	941	-3	0.94	0.0762	24.7	0.66	4.89	5.03	0.137	
181	E4 - Main Embankment Seepage Pond	3/4/2014 9:36	Had to break ice	1297	7.96	2.7	1.23	72.9	1240	484	8.02	944	-3	0.81	0.0851	24.4	0.79	4.98	5.12	0.136	
182	E4 - Main Embankment Seepage Pond	4/1/2014 11:35	duplicate taken	1238	7.942	4.1	3.77	83.9	1200	499	7.96	919	-3	2.44	0.0498	23.4	0.65	4.27	4.38	0.117	
183	E4 - Main Embankment Seepage Pond	5/1/2014 9:54	sample taken	989	8.34	9.2	5.25	80.5	890	382	8.07	682	8.4	5.6	0.0081	15.2	0.44	4.75	4.83	0.075	
184	E4 - Main Embankment Seepage Pond	6/3/2014 12:59	Sample taken	1166	8.657	12.9	1.37	67.3	1150	459	8.15	861	-3	1.14	0.015	21.4	0.59	5.44	5.58	0.138	
185	E4 - Main Embankment Seepage Pond	7/3/2014 12:52	Sample taken	1168	8.32	16.3		75.8	1170	489	8.03	883	-3	1.13	0.0343	19.2	0.58	5.21	5.35	0.149	
186	E4 - Main Embankment Seepage Pond	8/5/2014 8:25	Sample taken, water level seems to have risen ~50-60cm in depth and 1.5m to shore edge	1180	8.006	17.2		67.1	1170	480	7.98	901	3.9	0.89	0.0534	18.4	0.67	5.44	5.53	0.099	
187	E4 - Main Embankment Seepage Pond	9/2/2014 11:43	Sample taken	1148	7.934	14.4	0.82	66.4	1150	441	8.01	855	-3	0.72	0.0322	20.9	0.75	2.6	2.72	0.117	
188	E4 - Main Embankment Seepage Pond	10/1/2014 13:53	Sample taken.	1203	8.093	11.4	1.52	77.3	1170	477	7.91	878	-3	1.36	0.0135	24.3	0.84	1.97	2.03	0.063	
189	E4 - Main Embankment Seepage Pond	11/3/2014 11:15	Sample taken	1124	8.136	5.5	2.77	84.1	1120	446	8.14	811	-3	2.78	0.0126	21.1	0.61	2.25	2.31	0.061	
190	E4 - Main Embankment Seepage Pond	12/3/2014 11:58	Sample taken	1239	7.823	2.5	1.14	93	1180	451	8.14	900	-3	1.11	0.1	22.7	0.69	2.56	2.69	0.126	
191	E4 - Main Embankment Seepage Pond	1/8/2015 14:02	Sample taken.	1207	7.993	2.9	1.8	108	1170	431	8.12	842	-3	1.77	0.111	24.4	0.73	1.89	1.96	0.073	
192	E4 - Main Embankment Seepage Pond	2/2/2015 11:41	Sample taken.	1190	7.867	2	1.86	113	1120	429	8.07	821	-3	2.02	0.0948	21	0.65	1.81	1.88	0.0681	
197	East Main Toe Drain	4/15/2010 13:30		1098	7.89	8.4		114		655		946	-3	0.2	-0.005	22.1		3.96		0.0203	
198	East Main Toe Drain	7/8/2010		1010	7.48	8.4		120	892	318	8.07	693	32.5	4.73	0.11	25.1		0.259	0.278	0.019	
199	East Main Toe Drain	8/5/2010		1092	8.13	10		96.5		389		823	4.3	0.56	0.0326	29		0.683	0.75	0.067	
200	East Main Toe Drain	10/14/2010		1200	7.81	7.9		94.9		429		850	-3	-0.1	0.0988	28.6		1.06	1.14	0.082	
201	East Main Toe Drain	4/5/2011 14:06		1274	7.78	7.7		91.2	1230	472	8	972	24.2	10.7	0.0899	28.1		1.41	1.49	0.084	
202	East Main Toe Drain	5/11/2011 8:20		1295	7.79	7.5		88.1	1260	468	8.02	941	-3	0.12	0.0793	32.2		1.56	1.65	0.096	
203	East Main Toe Drain	5/18/2011 9:08		1303	7.68	7.3		88.5		459		961	-3	1.24	0.0743	29.3		1.51	1.6	0.093	
204	East Main Toe Drain	6/9/2011 10:53		1218	7.95	8.7		86.6	1200	461	7.68	933	-3	0.41	0.0798	28.9		1.44	1.48	0.042	
205	East Main Toe Drain	7/13/2011 9:50		1214	8.32	7.4		86.8	1190	432	7.99	890	-3	0.38	0.0802	27		1.6	1.68	0.085	
206	East Main Toe Drain	8/3/2011 9:21		791	8.25	7.1		155	770	206	8.27	509	-3	0.25	0.178	29.2		0.037	0.037	-0.005	
208	East Main Toe Drain	8/31/2011 10:58		1130	8.1	7.9		86.6	1130	408	8.01	836	-3	0.41	0.0684	27.3		1.64	1.78	0.14	
209	East Main Toe Drain	10/5/2011 11:51		940	8.09	7.3		133	912	259	8.23	644	-3	0.39	0.132	28.6		0.063	0.063	-0.01	
210	East Main Toe Drain	10/31/2011 14:42		907	8.16	6.8		140	875	250	8.25	598	-3	0.33	0.136	28.9		-0.05	-0.051	-0.01	
213	East Main Toe Drain	4/26/2012 10:28		1156	8.01	3.4		121	1080	389	7.52	760	-3	0.15	0.0938	28.3	0.95	0.864	1.03	0.164	
214	East Main Toe Drain	5/2/2012 10:30		1310	7.045	2.5		79.2	1220	423	7.98	910	-3	2.1	0.186	28.6	1.09	-0.05	-0.051	-0.01	
215	East Main Toe Drain	6/7/2012 10:39		1158	7.84	8.3		83.9	1100	391	7.99	830	-3	0.47	0.0697	27.4	0.96	1.22	1.37	0.152	
216	East Main Toe Drain	6/28/2012 14:15		1143	8.07	9.4		88.2	1110	384	7.87	804	3.8	3.41	0.0699	26.5	0.93	1.18	1.33	0.147	
217	East Main Toe Drain	7/5/2012 11:52		1158	8.2	7.7		84.6	1090	389	8.06	832	-3	2.05	0.0558	26.6	0.92	1.36	1.54	0.176	
218	East Main Toe Drain	11/15/2012 13:26		1160	8.142	6.5		83.2	1100	402	8.03	828	-3	0.54	0.059	26.7	0.91	1.33	1.56	0.233	
219	East Main Toe Drain	2/7/2013 9:16		1179	7.967	6.9		84.3	1110	380	7.94	843	-3	0.63	0.0619	25.7	0.97	1.2	1.41	0.216	
221	East Main Toe Drain	5/1/2013 12:32		1187	7.592	8.3	8.3	81.3	1190	408	7.85	848	-3	0.21	0.0565	26.1	1.19	1.5	1.72	0.219	
222	East Main Toe Drain	6/6/2013 11:40		797	8.07	8.5	0.13	82	1170	401	8.07	818	-3	0.27	0.0607	27.3	0.93	1.53	1.76	0.232	
223	East Main Toe Drain	7/10/2013 10:57	Sample taken	812	7.99	8.5	0.18	80.6	1180	396	8.03	837	-3	0.28	0.0546	26.5	0.82	1.34	1.6	0.263	
224	East Main Toe Drain	8/8/2013 9:32	Most of the flow diverted to ABR	1183	7.993	8.5		78.3	1160	394	8.08	902	-3	0.13	0.0567	26.7	1.1	1.34	1.63	0.283	
225	East Main Toe Drain	9/5/2013 8:57	sample taken	1181	8.03	8.3		78	1160	396	7.91	883	-3	0.12	0.0571	29.4	0.92	1.32	1.6	0.283	
226	East Main Toe Drain	10/3/2013 9:00	sample taken	1187	7.996	8		78.4	1170	413	8.05	863	-3	0.35	0.0579	25.5	0.87	1.35	1.63	0.283	
227	East Main Toe Drain	11/5/2013 10:31	sample taken, toxicity mixed 50/50	1201	8.112	7.2		84.8	1170	413	8.03	863	-3	0.14	0.0576	26.5	0.9	1.36	1.64	0.281	
228	East Main Toe Drain	11/12/2013 11:58	sample taken, toxicity Q changed due to data entry error 14.08 seconds per 10 litre bucket flow	1200	8.206	7.7		85.7	1160	410	7.99	891	-3	0.16	0.0502	25.7	0.9	1.34	1.61	0.269	
229	East Main Toe Drain	12/5/2013 11:20	sample taken	1210	7.931	7.4	0	79.8	1170	424	7.95	893	-3	0.12	0.0534	27.7	0.87	1.48	1.76	0.28	
231	East Main Toe Drain	2/11/2014 11:16	Sample taken	1239	7.742	7.2	0	69.2	1220	405	8.06	893	-3	0.16	0.0561	27.1	0.94	1.84	2.12	0.281	
233	East Main Toe Drain	3/4/2014 9:59		1252	7.91	7.2	0	78.3	1220	422	8.07	901	-3	0.13	0.0547	26.7	1.03	1.86	2.14	0.277	
234	East Main Toe Drain	4/3/2014 9:38		1245	8.114	7.2	0	78.2	1220	451	8.11	897	-3	0.12	0.055	26.8	0.89	1.92	2.2	0.286	
235	East Main Toe Drain	5/1/2014 10:15	sample taken	1259	7.97	7.2	0	71.7	1200	429	7.99	912	-3	0.11	0.0475	26.6	0.85	1.89	2.18	0.284	
236	East Main Toe Drain	6/3/2014 12:35	Sample taken	1215	7.981	8.1	0	73.7	1200	425	8.04	870	-3	0.2	0.0429	29.6	0.89	2.26	2.55	0.294	
238	East Main Toe Drain	12/8/2014 12:21	Sample taken. Strong odour in shack.	1179	8.065	7.4	0.05	74.8	1150	375	8.09	790	-3	0.21	0.0886	27.5	0.91	0.871	1.1	0.225	
239	East Main Toe Drain	2/5/2015 11:45	Sample taken from discharge shack. ABR-IN feed rerouted to main seepage pond for approximately 20 hrs before taking sample	1225	8.149	7.7	0.95	79.4	1190	417	8.1	903	-3	0.62	0.0495	26	0.86	0.33	0.597	0.267	
240	East Main Toe Drain	3/5/2015 9:40	Sample taken. Shut off feed to ABR-IN and opened up feed to East MTD. Let run for approx 20 hrs. Should be same results for ABR-IN	1208	8.072	7.6	0.13	80.3	1150	408	7.91	885	-3	0.11	0.0423	27.2	0.94	0.194	0.407	0.214	
241	East Main Toe Drain	4/9/2015 10:30	Sample Taken	1246	8.286	7.5	0.2	89.2	1190	421	8.14	834	-3	0.18	0.083	27.7	0.89	0.036	0.111	0.0752	
246	West Main Toe Drain	8/8/2013 9:22	Does not include water diverted to ABR	1108	8.032	8.1		80.3	1100	349	8.04	794	-3	0.1	0.05	25.7	1.14	1.3	1.57	0.269	
247	West Main Toe Drain	9/5/2013 8:58	sample taken	1108	8.066	7.9		82.7	1080	344	7.92	825	-3	0.13	0.0513	28.6	0.95	1.29	1.56	0.273	
248	West Main Toe Drain	10/3/2013 8:58	sample taken	1114	8.051	7.9		80.8	1100	368	8.07	809	-3	0.13	0.0529	25.7	0.9	1.38	1.66	0.277	
249	West Main Toe Drain	11/5/2013 10:37	sample taken, toxicity mixed 50/50	1130	8.069	8		90.6	1110	363	8.06	810	-3	0.31	0.054	26.2	0.91	1.42	1.68	0.263	
250	West Main Toe Drain	11/12/2013 12:05	sample taken, W MTD has much higher flow than E MTD. Toxicity	1134	7.985	8		84.9	1060	366	8.04	821	-3	0.2	0.0473	24.8	0.93	1.41	1.67	0.263	
251	West Main Toe Drain	12/5/2013 11:31	sample taken	1146	8.029	8.3	0	83.3	1110	373	7.98	841	-3	0.21	0.0486	27.2	0.92	1.55	1.82	0.27	
252	West Main Toe Drain	1/7/2014 10:36	Sample taken	1156	7.99	8.4		79.8	1120	386	8.02	829	-3	0.1	0.0452	31.8	0.93	1.74	2	0.263	
253	West Main Toe Drain	2/11/2014 11:24	Ecoli and Coliform taken at 11:27 Sample taken	1174	7.854	9	0	74.8	1170	380	8.08	834	-3	0.46	0.0513	26.1	0.98	1.84	2.12	0.282	
254	West Main Toe Drain	3/4/2014 9:51		1195	8.01	8.8	0.07	80.7	1140	382	8.1	855	-3	0.11	0.0515	26	1.16	1.86	2.14	0.284	
255	West Main Toe Drain	4/3/2014 9:35		1184	8.253	9	0	81.6	1160	414	8.13	839	-3	0.11	0.0518	28.1	0.93	1.83	2.11	0.278	
256	West Main Toe Drain	5/1/2014 10:24	sample taken	1193	7.99	9	0	77.1	1150	386	7.97	857	-3	0.1	0.0436	27.7	0.9	1.82	2.1	0.275	
257	West Main Toe Drain	6/3/2014 12:43	Sample taken	1187	8.044	8.7	0	88.4	1170	389	8.09	850	-3	0.16	0.0555	28.7	0.95	1.42	1.66	0.24	

Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
148	E4 - Main Embankment Seepage Pond	8/4/2011 11:42	-0.001	0.0048	0.0101	544			5.44	3.5		-0.003	0.00082	0.00157	0.0411	-0.0001	-0.0005	0.107	-0.00007	164	-0.0005	-0.0001
149	E4 - Main Embankment Seepage Pond	9/8/2011 8:26	-0.001		0.0123	535			4.27	3.98		0.0032	0.00071	0.00185	0.0424	-0.0001	-0.0005	0.119	-0.00015	160	-0.0005	-0.0001
150	E4 - Main Embankment Seepage Pond	10/5/2011 11:20	-0.001	0.0054	0.0145	537			3.12	3.82		-0.003	0.00051	0.00141	0.0533	-0.0001	-0.0005	0.11	-0.00006	159	-0.0005	-0.0001
152	E4 - Main Embankment Seepage Pond	11/1/2011 10:43	0.0025	0.0073	0.0114	536			4.68	2.99		-0.003	0.00058	0.00164	0.0458	-0.0001	-0.0005	0.131	-0.00008	160	-0.0005	0.00012
153	E4 - Main Embankment Seepage Pond	12/5/2011 10:49	0.003	0.0074	0.0157	545			4.92	3.29		0.0146	0.00063	0.00145	0.0403	-0.0001	-0.0005	0.11	-0.0002	163	-0.0005	0.00016
154	E4 - Main Embankment Seepage Pond	1/4/2012 13:23	0.002	0.0064	0.0418	549			5.05	3.39		0.0038	0.00073	0.00153	0.0424	-0.0001	-0.0005	0.123		162	-0.0005	0.00016
155	E4 - Main Embankment Seepage Pond	2/8/2012 10:20	0.0043	0.0098	0.017	553			7.14	4.6		0.0041	0.0007	0.0017	0.0401	-0.0001	-0.0005	0.121	-0.00013	159	-0.0005	0.00015
156	E4 - Main Embankment Seepage Pond	3/14/2012 13:45	0.003	0.0096	0.0196	536			5.03	4.92		0.0069	0.00069	0.00157	0.0417	-0.0001	-0.0005	0.116	-0.00015	154	-0.0005	0.00013
158	E4 - Main Embankment Seepage Pond	5/2/2012 11:29	-0.001	0.0074	0.0259	434			3.43	4.32		-0.003	0.00057	0.00148	0.0365	-0.0001	-0.0005	0.103	-0.0002	137	-0.0005	0.00015
159	E4 - Main Embankment Seepage Pond	6/7/2012 9:10	-0.001	0.0061	0.0149	446			2.66	4.06		0.0037	0.0007	0.00161	0.0322	-0.0001	-0.0005	0.115	-0.00015	138	-0.0005	0.00011
160	E4 - Main Embankment Seepage Pond	7/5/2012 9:09	-0.001	0.0062	0.0118	490			3.02	5.31		-0.003	0.00067	0.00147	0.0345	-0.0001	-0.0005	0.097	-0.0001	141	-0.0005	0.00011
161	E4 - Main Embankment Seepage Pond	8/1/2012 11:03	0.0014	0.0085	0.0157	513			2.28	4.22		-0.003	0.00077	0.00174	0.0491	-0.0001	-0.0005	0.117	-0.0001	152	-0.0005	0.00015
162	E4 - Main Embankment Seepage Pond	9/6/2012 11:20	0.0014	0.0083	0.0135	528			3.58	3.19		-0.003	0.00094	0.00179	0.0487	-0.0001	-0.0005	0.134	-0.0001	149	-0.0005	-0.0001
163	E4 - Main Embankment Seepage Pond	10/3/2012 9:35	0.0013	0.0137	0.0228	515			2.71	3.71		-0.003	0.00063	0.00172	0.0476	-0.0001	-0.0005	0.135	-0.00006	149	-0.0005	-0.0001
164	E4 - Main Embankment Seepage Pond	11/15/2012 12:54	0.0026	0.0059	0.0126	544			2.79	3.28		-0.003	0.00066	0.00175	0.0462	-0.0001	-0.0005	0.117	-0.0001	162	-0.0005	0.00012
165	E4 - Main Embankment Seepage Pond	12/6/2012 10:20	0.0029	0.009	0.0152	517			2.81	5.57		-0.003	0.00059	0.00169	0.0459	-0.0001	-0.0005	0.12	-0.00012	146	-0.0005	0.00012
166	E4 - Main Embankment Seepage Pond	1/2/2013 14:27	0.0028	0.0086	0.0173	512			3.3	2.97		-0.003	0.00073	0.0017	0.0416	-0.0001	-0.0005	0.106	-0.0001	153	-0.0005	0.00021
167	E4 - Main Embankment Seepage Pond	2/6/2013 9:20	0.0039	0.0073	0.0107	544			937	4.24												
169	E4 - Main Embankment Seepage Pond	3/13/2013 13:20	0.005	0.0114	0.017	522			4.39	5.01												
170	E4 - Main Embankment Seepage Pond	4/4/2013 14:24	0.0189	0.0311	0.0335	547			3.14	4.3												
171	E4 - Main Embankment Seepage Pond	5/1/2013 9:12	0.0019	0.007	0.0169	509			3.36	4.45												
172	E4 - Main Embankment Seepage Pond	6/6/2013 9:21	-0.001	0.006	0.0118	530				4.81												
173	E4 - Main Embankment Seepage Pond	7/10/2013 10:11	0.0186	0.0268	0.033	492			2.55	3.81												
174	E4 - Main Embankment Seepage Pond	8/8/2013 9:55	-0.001	0.0061	0.0116	542			4.74	3.37												
175	E4 - Main Embankment Seepage Pond	9/5/2013 9:06	0.0018	0.0058	0.0134	521			13.6	2.85												
176	E4 - Main Embankment Seepage Pond	10/3/2013 8:48	0.0057	0.0083	0.0132	543			4.82	2.42												
177	E4 - Main Embankment Seepage Pond	11/5/2013 10:26	0.0026	0.005	0.0111	544			4.47	2												
178	E4 - Main Embankment Seepage Pond	12/5/2013 11:55	-0.001	0.0063	0.0112	543			4.04	2.8		-0.003	0.0006	0.0016	0.0466	-0.0001	-0.0005	0.108	-0.00011	159	-0.0005	0.00014
179	E4 - Main Embankment Seepage Pond	1/7/2014 10:27	0.0103	0.018	0.0203	536				2.36												
180	E4 - Main Embankment Seepage Pond	2/11/2014 11:00	0.0117	0.0173	0.0221	555			4.77	3.11												
181	E4 - Main Embankment Seepage Pond	3/4/2014 9:36	0.0082	0.0145	0.0171	542			5.12	2.93												
182	E4 - Main Embankment Seepage Pond	4/1/2014 11:35	0.0081	0.0131	0.0191	534			4.48	3.61												
183	E4 - Main Embankment Seepage Pond	5/1/2014 9:54	-0.001	0.0058	0.0217	378			3.94	3.78												
184	E4 - Main Embankment Seepage Pond	6/3/2014 12:59	-0.001	0.0038	0.0135	507			5.43	3.05		-0.003	0.00079	0.00141	0.032	-0.0001	-0.0005	0.094	-0.0001	147	-0.0005	0.0001
185	E4 - Main Embankment Seepage Pond	7/3/2014 12:52	-0.001	0.0049	0.0168	532			5.27	3.99		-0.003	0.00086	0.00218	0.0325	-0.0001	-0.0005	0.115	-0.0001	157	-0.0005	-0.0001
186	E4 - Main Embankment Seepage Pond	8/5/2014 8:25	-0.001	0.0053	0.0167	531			5.44	2.79		-0.003	0.0009	0.00188	0.034	-0.0001	-0.0005	0.113	0.000028	152	-0.0005	-0.0001
187	E4 - Main Embankment Seepage Pond	9/2/2014 11:43	-0.001	0.0076	0.0132	508			2.84	3.01		-0.003	0.00074	0.00177	0.0368	-0.0001	-0.0005	0.118	0.00002	141	-0.0005	-0.0001
188	E4 - Main Embankment Seepage Pond	10/1/2014 13:53	-0.001	0.0062	0.0142	517			2.18	3.05		-0.003	0.0005	0.00179	0.042	-0.0001	-0.0005	0.112	-0.00001	150	-0.0005	-0.0001
189	E4 - Main Embankment Seepage Pond	11/3/2014 11:15	-0.001	0.0079	0.0166	474			2.46	3.54		-0.003	0.00033	0.00149	0.0457	-0.0001	-0.0005	0.099	-0.00001	140	-0.0005	-0.0001
190	E4 - Main Embankment Seepage Pond	12/3/2014 11:58	0.0081	0.0163	0.022	511			2.72	3.64		-0.003	0.00036	0.00192	0.0498	-0.0001	-0.0005	0.111	0.00003	142	-0.0005	0.00016
191	E4 - Main Embankment Seepage Pond	1/8/2015 14:02	0.01	0.0164	0.0176	485			2.12	4.21		-0.003	0.00026	0.00146	0.0594	-0.0001	-0.0005	0.118	-0.00005	134	-0.0005	0.00011
192	E4 - Main Embankment Seepage Pond	2/2/2015 11:41	0.0097	0.0184	0.0271	460			1.91	4.15		-0.003	0.00025	0.00142	0.056	-0.0001	-0.0005	0.109	0.00002	134	-0.0005	0.00018
197	East Main Toe Drain	4/15/2010 13:30	0.0332	0.0446	0.0473	499			6.73	3.03		-0.002	0.00029	0.00061	0.0632	-0.001	-0.001	0.104	-0.000034	215	-0.001	-0.0002
198	East Main Toe Drain	7/8/2010	0.0472	0.067	0.099	336			0.47	3.15		0.0032	0.00086	0.00204	0.102	-0.0005	-0.0005	0.141	-0.0005	100	-0.0005	0.00048
199	East Main Toe Drain	8/5/2010	0.0293	0.0401	0.0438	456			0.88	3.25		-0.002	0.00066	0.00157	0.0662	-0.001	-0.001	0.144	-0.0008	122	-0.001	0.00036
200	East Main Toe Drain	10/14/2010	0.0271	0.0378	0.0391	479			4.14	3.92		0.0041	0.00056	0.00166	0.0762	-0.0005	-0.0005	0.171	-0.00015	135	-0.0005	0.00038
201	East Main Toe Drain	4/5/2011 14:06	0.0254	0.0369	0.0989	545			1.89	4.04		-0.003	0.00056	0.0018	0.081	-0.0005	-0.0005	0.156	-0.0002	148	-0.0005	0.00056
202	East Main Toe Drain	5/11/2011 8:20	0.0249	0.0338	0.0345	562			2.63	4.24		-0.003	0.00045	0.00166	0.0638	-0.0005	-0.0005	0.147	-0.00012	147	-0.0005	0.00043
203	East Main Toe Drain	5/18/2011 9:08	0.0215	0.0376	0.0391	549			1.58	4.14		-0.003	0.00047	0.00167	0.0638	-0.0005	-0.0005	0.144	0.000105	145	-0.0005	0.00045
204	East Main Toe Drain	6/9/2011 10:53	0.0226	0.0382	0.039	545			2.43	4.7		0.0038	0.00044	0.00148	0.0621	-0.0005	-0.0005	0.139	-0.00015	145	-0.0005	0.00043
205	East Main Toe Drain	7/13/2011 9:50	0.0229	0.0328	0.0358	513			2.08	4.39		0.0031	0.00043	0.0016	0.0634	-0.0001	-0.0005	0.153	-0.0001	136	-0.0005	0.00042
206	East Main Toe Drain	8/3/2011 9:21	0.101	0.118	0.13	201			0.35	4.99		-0.003	-0.0001	0.00277	0.212	-0.0001	-0.0005	0.121	-0.00004	64.5	-0.0005	0.00054
208	East Main Toe Drain	8/31/2011 10:58	0.0241		0.0328	471			2.59	4.14		0.0075	0.00047	0.0016	0.0618	-0.0001	-0.0005	0.146	-0.00015	129	-0.0005	0.00037
209	East Main Toe Drain	10/5/2011 11:51	0.0692	0.0931	0.853	307			0.27	4.62		-0.003	-0.0001	0.00238	0.161	-0.0001	-0.0005	0.137	-0.00004	81.1	-0.0005	0.00049
210	East Main Toe Drain	10/31/2011 14:42	0.0776	0.092	0.104	279			0.11	4.83		-0.003	-0.0001	0.00256	0.179	-0.0001	-0.0005	0.131	-0.00005	78	-0.0005	0.00052
213	East Main Toe Drain	4/26/2012 10:28	0.0479	0.0596	0.064	448			0.92	4.05		-0.003	0.00037	0.00178	0.096	-0.0001	-0.0005	0.133	-0.00011	121	-0.0005	0.00049
214	East Main Toe Drain	5/2/2012 10:30	0.0202	0.0252	0.0616	554			0.23	3.61		-0.003	-0.0001	0.00418	0.091	-0.0001	-0.0005	0.169	-0.0002	132	-0.0005	0.00064
215	East Main Toe Drain	6/7/2012 10:39	0.0239	0.033	0.0346	475			1.53	3.95		0.0032	0.0004	0.00158	0.0571	-0.0001	-0.0005	0.124	-0.0002	123	-0.0005	0.00035
216	East Main Toe Drain	6/28/2012 14:15	0.0244	0.0325	0.038	471			1.44	4.04		0.0033	0.0004	0.00154	0.0622	-0.0001	-0.0005	0.145	-0.0001	121	-0.0005	0.00036
217	East Main Toe Drain	7/5/2012 11:52	0.0242	0.0361	0.0358	472			1.66	4.17		-0.003	0.00037	0.00159	0.0618	-0.0001	-0.0005	0.116	-0.00015	120	-0.0005	0.00034
218	East Main Toe Drain	11/15/2012 13:26	0.0222	0.0304	0.0342	481			2.03	3.37		-0.003	0.00048	0.00159	0.0562	-0.0001	-0.0005	0.129	-0.00012	127	-0.0005	0.00035
219	East Main Toe Drain	2/7/2013 9:16	0.0234	0.0362	0.0412	488			1.4	4.51												
221	East Main Toe Drain	5/1/2013 12:32	0.0239	0.033	0.0341	506			1.7	4.87		-0.003	0.00046	0.00155	0.0564	-0.0001	-0.0005	0.128	0.000095	128	-0.0005	0.00033
222	East Main Toe Drain	6/6/2013 10:40	0.0297	0.0337	0.0357	512			1.78	4.38		0.0036	0.00045	0.00157	0.0567	-0.0001	-0.0005	0.139	-0.0002	125	-0.0005	0.00034
223	East Main Toe Drain	7/10/2013 10:57	0.0191	0.0298	0.0335	499			1.66	4.65		-0.003	0.00043	0.00148	0.0605	-0.0001	-0.0005	0.126	-0.0001	125	-0.0005	0.00032
224	East Main Toe Drain	8/8/2013 9:32	0.0218	0.0315	0.0328	503			1.63	4		-0.003	0.00043	0.00153	0.0543	-0.0001	-0.0005	0.118	-0.00011	124	-0.0005	0.0003
225	East Main Toe Drain	9/5/2013 8:57	0.0219	0.0318	0.0358	501			3.45	3.93		-0.003	0.00043	0.0015	0.057	-0.0001	-0.0005	0.125	-0.00012	124	-0.0005	0.00031
226	East Main Toe Drain	10/3/2013 9:00	0.0219	0.0333	0.0339	500			1.6	3.86		0.0035	0.00044	0.00154	0.0547	-0.0001	-0.0005	0.122	-0.00013	130	-0.0005	0.0003
227	East Main Toe Drain	11/5/2013 10:31	0.0217	0.0303	0.0314	507			1.61	3.34		-0.003	0.00048	0.00158	0.0554	-0.0001	-0.0005	0.117	-0.00015	129	-0.0005	0.00033
228	East Main Toe Drain	11/12/2013 11:58	0.0206	0.0301	0.0308	504			1.67	3.44		-0.003	0.00046	0.00167	0.0574	-0.0001	-0.0005	0.145	-0.00015	129	-0.0005	0.00032
229	East Main Toe Drain	12/5/2013 11:20	0.0222	0.0327	0.0335	518			1.73	3.48		-0.003	0.00049	0.0016	0.0553	-0.0001	-0.0005	0.122	-0.00012	135	-0.0005	0.00031
231	East Main Toe Drain	2/11/2014 11:16	0.0215	0.0341	0.0353	532			2.05	3.47		0.0031	0.00049	0.00168	0.0564	-0.0001	-0.0005	0.147	-0.00011	126	-0.0005	0.00031
233	East Main Toe Drain	3/4/2014 9:59	0.0244	0.0316	0.0322	528			2.15	2.94		-0.003	0.00048	0.00154	0.0524	-0.0001	-0.0005	0.132	-0.00012	133	-0.0005	0.00032
234	East Main Toe Drain	4/3/2014 9:38	0.0213	0.03	0.0308	532			2.22	3.44		-0.003	0.00049	0.00153	0.0531	-0.0001	-0.0005	0.129	-0.0001	143	-0.0005	0.00031
235	East Main Toe Drain	5/1/2014 10:15	0.0213	0.0306	0.0326	523			2.11	2.98		-0.003	0.00047	0.00163	0.0541	-0.0001	-0.0005	0.13	-0.00022	135	-0.0005	0.00033
236	East Main Toe Drain	6/3/2014 12:35	0.0169	0.0259	0.0259	513			2.54	3.36		0.0032	0.0005	0.00172	0.0499	-0.0001	-0.0005	0.12	-0.0002	133	-0.0005	0.00031
238	East Main Toe Drain	12/8/2014 12:21	0.0289	0.0392	0.0415	488			1.1	3.67		-0.003	0.00044	0.00213	0.053	-0.0001	-0.0005	0.127	0.000049	118	-0.0005	0.00028
239	East Main Toe Drain	2/5/2015 11:45	0.0202	0.0344	0.0344	498			0.63	4.15		-0.003	0.00044	0.00185	0.056	-0.0001	-0.0005	0.132	0.000036	132	-0.0005	0.00029
240	East Main Toe Drain	3/5/2015 9:40	0.02	0.0306	0.0324	500			0.464	4.21		0.0097	0.00048	0.00208	0.056	-0.0001	-0.0005	0.136	0.000046	129	-0.0005	0.0003
241	East Main Toe Drain	4/9/2015 10:30	0.0382	0.052	0.0469	522			0.202	4.16		0.0054	0.0005	0.0024	0.056	-0.0001	-0.00005	0.121	0.0000423	135	-0.0005	0.00028
246	West Main Toe Drain	8/8/2013 9:22	0.0149	0.0253	0.0252	459			1.6	3.59		-0.003	0.00039	0.00178	0.0614	-0.0001	-0.0005	0.126	-0.0001	111	-0.0005	0.00035
247	West Main Toe Drain	9/5/2013 8:58	0.0139	0.0256	0.0253	452			3.26	3.32		0.0031	0.00039	0.00175	0.0628	-0.0001	-0.0005	0.136	-0.0001	109	-0.0005	0.00035
248	West Main Toe Drain	10/3/2013 8:58	0.0141	0.0248	0.025	456			1.61	3.49		-0.003	0.0004	0.00184	0.0595	-0.0001	-0.0005	0.133	-0.00013	117	-0.0005	0.00035
249	West Main Toe Drain	11/5/2013 10:37	0.0145	0.0225	0.0234	460			1.65	2.94		0.0033	0.00046	0.00188	0.0612	-0.0001	-0.0005	0.125	-0.00015	115	-0.0005	0.0004
250	West Main Toe Drain	11/12/2013 12:05	0.0127	0.0233	0.0242	463			1.63	3		0.0031	0.00041	0.00192	0.0624	-0.0001	-0.0005	0.152	-0.00012	116	-0.0005	0.00038
251	West Main Toe Drain	12/5/2013 11:31	0.0146	0.0245	0.0251	480			1.75	2.97		-0.003	0.00044	0.00179	0.0591	-0.0001	-0.0005	0.131	-0.0001	119	-0.0005	0.00036
252	West Main Toe Drain	1/7/2014 10:36	0.0137	0.0242	0.0241	481				3.03												
253	West Main Toe Drain	2/11/2014 11:24	0.0126	0.0253	0.0258	491			2.07	2.81		0.0031	0.00047	0.00197	0.0612	-0.0001	-0.0005	0.173	-0.00009	120	-0.0005	0.00036
254	West Main Toe Drain	3/4/2014 9:51	0.0154	0.0237	0.0247	486			2.17	2.51		-0.003	0.00043	0.00184	0.0561	-0.0001	-0.0005	0.133	-0.0001	121	-0.0005	0.00038
255	West Main Toe Drain	4/3/2014 9:35	0.0127	0.0256	0.0253	494			2.14	3.01		-0.003	0.00042	0.00192	0.0577	-0.0001	-0.0005	0.146	-0.00015	132	-0.0005	0.00038
256	West Main Toe Drain	5/1/2014 10:24	0.0136	0.0241	0.0245	482			2.03	2.58		0.0035	0.00042	0.00183	0.0579	-0.0001	-0.0005	0.14	-0.00008	122	-0.0005	0.00039
257	West Main Toe Drain	6/3/2014 12:43	0.0143	0.025	0.0262	488			1.69	3.11		0.0074	0.00035	0.00185	0.073	-0.0001	-0.0005	0.133	-0.0001	122	-0.0005	0.00045

Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
148	E4 - Main Embankment Seepage Pond	8/4/2011 11:42	0.00334	-0.03	-0.00005	0.0064	23.3	0.0609	-0.00005	0.167	-0.0005	11.1	0.0147	5.09	-0.00001	63.8	1.75	-0.00001	-0.0001
149	E4 - Main Embankment Seepage Pond	9/8/2011 8:26	0.00244	-0.03	-0.00005	0.00695	23.5	0.000392		0.159	-0.0005	12.3	0.0126	3.81	-0.00001	74.8	1.67	-0.00001	-0.0001
150	E4 - Main Embankment Seepage Pond	10/5/2011 11:20	0.00213	-0.03	-0.00005	0.00504	23	0.0753		0.139	-0.0005	11.3	0.0106	5.06	-0.00001	74.5	1.59	-0.00001	-0.0001
152	E4 - Main Embankment Seepage Pond	11/1/2011 10:43	0.00242	-0.03	-0.00005	0.00641	22	0.121	-0.00005	0.165	-0.0005	12.2	0.0115	5.29	-0.00001	78.6	1.66	-0.00001	-0.0001
153	E4 - Main Embankment Seepage Pond	12/5/2011 10:49	0.00373	-0.03	-0.00005	0.00714	21.8	0.148		0.161	-0.0005	12.3	0.0122	5.78	-0.00001	81.8	1.74	-0.00001	-0.0001
154	E4 - Main Embankment Seepage Pond	1/4/2012 13:23	0.00267	-0.03	-0.00005	0.00628	20.4	0.197		0.16	-0.0005	12.3	0.0124	5.82	-0.00001	84.2	1.7	-0.00001	-0.0001
155	E4 - Main Embankment Seepage Pond	2/8/2012 10:20	0.00319	-0.03	-0.00005	0.00687	21.5	0.188	-0.00005	0.169	-0.0005	13	0.0133	5.9	-0.00001	85.9	1.62	0.000031	-0.0001
156	E4 - Main Embankment Seepage Pond	3/14/2012 13:45	0.00318	-0.03	-0.00005	0.00564	19.4	0.183		0.155	-0.0005	11.2	0.0116	5.64	-0.00001	80	1.55	0.000021	-0.0001
158	E4 - Main Embankment Seepage Pond	5/2/2012 11:29	0.00431	-0.03	-0.00005	0.00523	18.9	0.149	-0.00005	0.165	-0.0005	9.94	0.00999	3.58	-0.00001	62.3	1.67	-0.00001	-0.0001
159	E4 - Main Embankment Seepage Pond	6/7/2012 9:10	0.00374	-0.03	0.000152	0.0062	18.8	0.143		0.164	-0.0005	10.2	0.00942	3.09	-0.00001	66.7	1.7	-0.00001	-0.0001
160	E4 - Main Embankment Seepage Pond	7/5/2012 9:09	0.00362	-0.03	-0.00005	0.00568	22	0.158		0.164	-0.0005	9.63	0.011	3.71	-0.00001	67	1.92	-0.00001	-0.0001
161	E4 - Main Embankment Seepage Pond	8/1/2012 11:03	0.00213	-0.03	-0.00005	0.00711	21.9	0.269	-0.00001	0.17	-0.0005	11.6	0.00971	4.82	-0.00001	77.3	2.27	-0.00001	-0.0001
162	E4 - Main Embankment Seepage Pond	9/6/2012 11:20	0.00194	-0.03	-0.00005	0.00997	20.9	0.0706		0.192	-0.0005	15	0.0132	5.95	-0.00001	92.2	1.75	-0.00001	-0.0001
163	E4 - Main Embankment Seepage Pond	10/3/2012 9:35	0.00155	-0.03	-0.00005	0.00809	20.2	0.0929		0.188	-0.0005	13.6	0.0098	6.48	-0.00001	87.6	1.7	-0.00001	-0.0001
164	E4 - Main Embankment Seepage Pond	11/15/2012 12:54	0.002	-0.03	-0.00005	0.00872	21.2	0.109	-0.00001	0.187	-0.0005	12.1	0.0133	6.02	-0.00001	81	1.82	-0.00001	-0.0001
165	E4 - Main Embankment Seepage Pond	12/6/2012 10:20	0.00208	-0.03	-0.00005	0.0071	21.5	0.139		0.164	-0.0005	12.7	0.0118	6.02	-0.00001	79.5	1.77	-0.00001	-0.0001
166	E4 - Main Embankment Seepage Pond	1/2/2013 14:27	0.00284	-0.03	-0.00005	0.00785	20.9	0.239		0.183	-0.0005	12	0.0138	6.2	-0.00001	84.8	1.84	-0.00001	-0.0001
167	E4 - Main Embankment Seepage Pond	2/6/2013 9:20																	
169	E4 - Main Embankment Seepage Pond	3/13/2013 13:20																	
170	E4 - Main Embankment Seepage Pond	4/4/2013 14:24																	
171	E4 - Main Embankment Seepage Pond	5/1/2013 9:12																	
172	E4 - Main Embankment Seepage Pond	6/6/2013 9:21																	
173	E4 - Main Embankment Seepage Pond	7/10/2013 10:11																	
174	E4 - Main Embankment Seepage Pond	8/8/2013 9:55																	
175	E4 - Main Embankment Seepage Pond	9/5/2013 9:06																	
176	E4 - Main Embankment Seepage Pond	10/3/2013 8:48																	
177	E4 - Main Embankment Seepage Pond	11/5/2013 10:26																	
178	E4 - Main Embankment Seepage Pond	12/5/2013 11:55	0.00239	-0.03	-0.00005	0.00732	21.6	0.192		0.172	-0.0005	11.9	0.0152	6.49	-0.00001	79.1	1.72	-0.00001	-0.0001
179	E4 - Main Embankment Seepage Pond	1/7/2014 10:27																	
180	E4 - Main Embankment Seepage Pond	2/11/2014 11:00																	
181	E4 - Main Embankment Seepage Pond	3/4/2014 9:36																	
182	E4 - Main Embankment Seepage Pond	4/1/2014 11:35																	
183	E4 - Main Embankment Seepage Pond	5/1/2014 9:54																	
184	E4 - Main Embankment Seepage Pond	6/3/2014 12:59	0.00281	-0.03	-0.00005	0.00664	22.2	0.142		0.179	-0.0005	8.92	0.0224	4.27	-0.00001	68.1	1.77	-0.00001	-0.0001
185	E4 - Main Embankment Seepage Pond	7/3/2014 12:52	0.00279	-0.03	-0.00005	0.0083	23.5	0.000429		0.218	-0.0005	9.86	0.0235	4.72	-0.00001	70.7	2.03	-0.00001	-0.0001
186	E4 - Main Embankment Seepage Pond	8/5/2014 8:25	0.00369	-0.03	-0.00005	0.0089	24.4	0.0784		0.18	-0.0005	8.34	0.0243	5.14	-0.00001	59.2	2.11	-0.00001	-0.0001
187	E4 - Main Embankment Seepage Pond	9/2/2014 11:43	0.0018	-0.03	-0.00005	0.00795	21.6	0.201		0.175	-0.0005	10.4	0.011	5.89	-0.00001	71.7	1.81	-0.00001	-0.0001
188	E4 - Main Embankment Seepage Pond	10/1/2014 13:53	0.0023	-0.03	-0.00005	0.00747	24.6	0.125		0.162	-0.0005	11.2	0.00893	5.28	-0.00001	81.5	2.06	-0.00001	-0.0001
189	E4 - Main Embankment Seepage Pond	11/3/2014 11:15	0.00203	-0.03	-0.00005	0.00685	23.3	0.0643		0.145	-0.0005	10.6	0.0101	5.21	-0.00001	68.1	2.1	-0.00001	-0.0001
190	E4 - Main Embankment Seepage Pond	12/3/2014 11:58	0.0015	-0.03	-0.00005	0.00664	23.3	0.263		0.165	-0.0005	11.6	0.0108	5.85	-0.00001	77.8	2.32	-0.00001	-0.0001
191	E4 - Main Embankment Seepage Pond	1/8/2015 14:02	0.00122	-0.03	-0.00005	0.00637	23.1	0.44		0.141	-0.0005	11.8	0.00895	5.93	-0.00001	76	2.31	-0.00001	-0.0001
192	E4 - Main Embankment Seepage Pond	2/2/2015 11:41	0.00119	-0.03	-0.00005	0.00582	23	0.508		0.128	-0.0005	11.4	0.00809	6.09	-0.00001	70.9	2.11	-0.00001	-0.0001
197	East Main Toe Drain	4/15/2010 13:30	0.00317	-0.03	-0.0001	-0.01	29	0.0246		0.185	-0.001	6.44	0.0239	5.98	-0.00002	53	3.07	-0.0002	-0.0002
198	East Main Toe Drain	7/8/2010	0.019	-0.03	-0.00005	0.0055	16.6	1.05		0.14	-0.0005	13	0.0041	6.4	0.00003	86.1	1.24	-0.0001	-0.0001
199	East Main Toe Drain	8/5/2010	-0.008	-0.03	-0.0001	-0.01	20.2	0.623		0.15	-0.001	15.4	0.0025	5.9	-0.00002	86.3	1.76	-0.0002	-0.0002
200	East Main Toe Drain	10/14/2010	0.0022	-0.03	-0.00005	0.006	21.9	0.772		0.187	0.00068	16.8	0.0023	6.34	-0.00001	89.7	2.02	-0.0001	-0.0001
201	East Main Toe Drain	4/5/2011 14:06	0.0109	-0.03	-0.00005	0.0075	24.6	0.942		0.184	0.00069	16.5	0.00229	6.25	-0.00001	95.7	2.21	-0.0001	-0.0001
202	East Main Toe Drain	5/11/2011 8:20	0.00317	-0.03	-0.00005	0.0064	24.4	0.849		0.168	0.00071	16.6	0.00231	6.15	-0.00001	93.9	2.29	-0.0001	-0.0001
203	East Main Toe Drain	5/18/2011 9:08	0.00321	-0.03	-0.00005	0.0065	23.6	0.829		0.172	0.00099	16.5	0.00238	5.92	-0.00001	95.1	2.33	-0.0001	-0.0001
204	East Main Toe Drain	6/9/2011 10:53	0.00333	-0.03	-0.00005	0.0067	23.9	0.854		0.186	0.00163	16.5	0.00203	6.13	-0.00001	103	2.31	-0.0001	-0.0001
205	East Main Toe Drain	7/13/2011 9:50	0.00291	-0.03	-0.00005	0.00648	22.5	0.8		0.183	0.00072	15.5	0.00252	5.92	-0.00001	89.7	2.13	-0.00001	-0.0001
206	East Main Toe Drain	8/3/2011 9:21	-0.0005	-0.03	-0.00005	0.00344	11	1.88		0.18	-0.0005	11	-0.0005	6.39	-0.00001	76.8	0.817	-0.00001	-0.0001
208	East Main Toe Drain	8/31/2011 10:58	0.00268	-0.03	-0.00005	0.00688	21.1	0.72		0.176	0.00061	16.1	0.00257	6.09	-0.00001	90.7	2.04	-0.00001	-0.0001
209	East Main Toe Drain	10/5/2011 11:51	-0.0005	-0.03	-0.00005	0.00384	13.8	1.46		0.174	-0.0005	12.3	-0.0005	6.18	-0.00001	88.5	1.06	-0.00001	-0.0001
210	East Main Toe Drain	10/31/2011 14:42	-0.0005	-0.03	-0.00005	0.0034	13.3	1.75		0.172	-0.0005	12.9	-0.0005	6.4	-0.00001	93.2	0.991	-0.00001	-0.0001
213	East Main Toe Drain	4/26/2012 10:28	0.00264	-0.03	-0.00005	0.00661	21	1.13		0.195	0.00125	14.1	0.00159	6.13	-0.00001	89.6	1.67	-0.00001	-0.0001
214	East Main Toe Drain	5/2/2012 10:30	-0.0005	-0.03	-0.00005	0.0065	22.5	0.925		0.159	0.00061	15.7	-0.0005	5.9	-0.00001	108	1.62	-0.00001	-0.0001
215	East Main Toe Drain	6/7/2012 10:39	0.00306	-0.03	-0.00005	0.00657	20.4	0.685		0.176	0.00064	15	0.00317	5.99	-0.00001	87.9	1.72	-0.00001	-0.0001
216	East Main Toe Drain	6/28/2012 14:15	0.00308	-0.03	-0.00005	0.00745	20	0.686		0.193	0.00181	14.7	0.00368	5.96	-0.00001	89.1	1.88	-0.00001	-0.0001
217	East Main Toe Drain	7/5/2012 11:52	0.00264	-0.03	-0.00005	0.00566	21.6	0.673		0.16	0.00081	14.3	0.00409	6.21	-0.00001	89.1	1.53	-0.00001	-0.0001
218	East Main Toe Drain	11/15/2012 13:26	0.00324	-0.03	-0.00005	0.00743	20.2	0.617		0.203	0.00074	14.4	0.00416	6.09	-0.00001	86.9	1.95	-0.00001	-0.0001
219	East Main Toe Drain	2/7/2013 9:16																	
221	East Main Toe Drain	5/1/2013 12:32	0.00288	-0.03	-0.00005	0.00673	21.5	0.619		0.199	0.00052	15.2	0.00565	6.08	-0.00001	89.4	1.93	-0.00001	-0.0001
222	East Main Toe Drain	6/6/2013 11:40	0.00344	-0.03	-0.00005	0.00792	21.9	0.623		0.206	-0.0005	14.9	0.00579	6.18	-0.00001	90.1	2	-0.00001	-0.0001
223	East Main Toe Drain	7/10/2013 10:57	0.00301	-0.03	-0.00005	0.00703	20.5	0.637		0.203	-0.0005	15.5	0.00564	5.87	-0.00001	89.6	1.97	-0.00001	-0.0001
224	East Main Toe Drain	8/8/2013 9:32	0.00228	-0.03	-0.00005	0.00693	20.6	0.632		0.204	-0.0005	15.2	0.00544	5.74	-0.00001	91.3	1.9	-0.00001	-0.0001
225	East Main Toe Drain	9/5/2013 8:57	0.00281	-0.03	-0.00005	0.00668	20.7	0.611		0.208	-0.0005	14.7	0.00565	5.64	-0.00001	89.7	1.84	-0.00001	-0.0001
226	East Main Toe Drain	10/3/2013 9:00	0.00241	-0.03	-0.00005	0.00702	21.6	0.573		0.205	-0.0005	14.2	0.0057	6.19	-0.00001	86.4	1.94	-0.00001	-0.0001
227	East Main Toe Drain	11/5/2013 10:31	0.00251	-0.03	-0.00005	0.00737	21.8	0.614	-0.00001	0.225	-0.0005	14.7	0.00558	6.28	-0.00001	89.6	1.99	-0.00001	-0.0001
228	East Main Toe Drain	11/12/2013 11:58	0.00188	-0.03	-0.00005	0.00787	21.4	0.615		0.208	-0.0005	15.5	0.00573	5.99	-0.00001	87.3	1.95	-0.00001	-0.0001
229	East Main Toe Drain	12/5/2013 11:20	0.0027	-0.03	-0.00005	0.00735	21.3	0.594		0.207	-0.0005	15.6	0.00587	6.24	-0.00001	87.8	1.99	-0.00001	-0.0001
231	East Main Toe Drain	2/11/2014 11:16	0.00321	-0.03	-0.00005	0.00764	21.7	0.605		0.198	0.00052	16	0.00651	5.86	-0.00001	89.8	1.99	-0.00001	-0.0001
233	East Main Toe Drain	3/4/2014 9:59	0.00237	-0.03	-0.00005	0.00739	22	0.585		0.208	0.00058	14.6	0.00712	5.93	-0.00001	97	2.07	-0.00001	-0.0001
234	East Main Toe Drain	4/3/2014 9:38	0.00342	-0.03	-0.00005	0.00758	23.1	0.589		0.21	-0.0005	15.3	0.00763	6.14	-0.00001	92.2	2.19	-0.00001	-0.0001
235	East Main Toe Drain	5/1/2014 10:15	0.00292	-0.03	-0.00005	0.0075	22.6	0.611		0.208	-0.0005	16.9	0.00778	6.06	-0.00001	98.5	2.46	-0.00001	-0.0001
236	East Main Toe Drain	6/3/2014 12:35	0.0039	-0.03	-0.00005	0.00729	22.1	0.517		0.206	-0.0005	14.7	0.00817	6.08	-0.00001	87.6	2.1	-0.00001	-0.0001
238	East Main Toe Drain	12/8/2014 12:21	0.0013	-0.03	-0.00005	0.00687	19.6	0.555		0.193	-0.0005	15	0.00337	6.17	-0.00001	88.9	1.92	-0.00001	-0.0001
239	East Main Toe Drain	2/5/2015 11:45	0.00298	-0.03	-0.00005	0.00722	21.4	0.557		0.224	-0.0005	15.4	0.00259	6	-0.00001	92.6	2.13	-0.00001	-0.0001
240	East Main Toe Drain	3/5/2015 9:40	0.00549	0.036	-0.00005	0.00791	20.7	0.565		0.224	-0.0005	0.00255	5.98		-0.00001	92.5	2.15	-0.00001	-0.0001
241	East Main Toe Drain	4/9/2015 10:30	0.00349	0.046	-0.00005	0.0062	21.4	0.552		0.227	-0.0005	0.00165	6.44		-0.00001	82.2	2.17	-0.00001	-0.0001
246	West Main Toe Drain	8/8/2013 9:22	-0.0019	-0.03	-0.00005	0.00586	17.5	0.351		0.187	-0.0005	14.4	0.00451	6.02	-0.00001	87.6	1.82	-0.00001	-0.0001
247	West Main Toe Drain	9/5/2013 8:58	0.00204	-0.03	-0.00005	0.006	17.3	0.341		0.19	-0.0005	14.7	0.00479	5.83	-0.00001	90.2	1.78	-0.00001	-0.0001
248	West Main Toe Drain	10/3/2013 8:58	0.00182	-0.03	-0.00005	0.00655	18.6	0.325		0.191	0.00054	14	0.00479	6.51	-0.00001	86.4	1.92	-0.00001	-0.0001
249	West Main Toe Drain	11/5/2013 10:37	0.00226	-0.03	-0.00005	0.00702	18.4	0.362	-0.00001	0.204	-0.0005	14.7	0.00481	6.41	-0.00001	91.8	1.95	-0.00001	-0.0001
250	West Main Toe Drain	11/12/2013 12:05	0.00173	-0.03	-0.00005	0.00663	18.5	0.357		0.192	-0.0005	15.7	0.00507	6.28	-0.00001	89.3	1.88	-0.00001	-0.0001
251	West Main Toe Drain	12/5/2013 11:31	0.00235	-0.06	-0.00005	0.00658	18.1	0.35		0.193	-0.0005	15.5	0.0051	6.25	-0.00001	91.9	2.07	-0.00001	-0.0001
252	West Main Toe Drain	1/7/2014 10:36																	
253	West Main Toe Drain	2/11/2014 11:24	0.00233	-0.03	-0.00005	0.00803	19.8	0.369		0.179	-0.0005	16.8	0.00571	6.51	-0.00001	92.1	1.94	-0.00001	-0.0001
254	West Main Toe Drain	3/4/2014 9:51	0.00213	-0.03	-0.00005	0.00733	19.5	0.359		0.198	-0.0005	15.5	0.00631	6.39	-0.00001	98.1	2.1	-0.00001	-0.0001
255	West Main Toe Drain	4/3/2014 9:35	0.00256	-0.03	-0.00005	0.00759	20.5	0.365		0.186	-0.0005	16.1	0.00656	6.63	-0.00001	94.4	2.17	-0.00001	-0.0001
256	West Main Toe Drain	5/1/2014 10:24	0.00245	-0.03	-0.00005	0.00695	19.8	0.353		0.183	-0.0005	15.9	0.00661	6.47	-0.00001	90	2.15	-0.00001	-0.0001
257	West Main Toe Drain	6/3/2014 12:43	0.00166	-0.03	-0.00005	0.00711	20.2	0.365		0.172	-0.0005	15.9	0.00452	6.57	-0.00001	90.8	2.11	-0.00001	-0.0001

Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
148	E4 - Main Embankment Seepage Pond	8/4/2011 11:42	-0.01	0.00126	0.0012	-0.003	0.0705	0.0008	0.00172	0.0419	-0.0001	-0.0005	0.113	0.000047	169	-0.0005	0.00012	0.00485	0.089	-0.00005	0.00646	24.1
149	E4 - Main Embankment Seepage Pond	9/8/2011 8:26	-0.01	0.00117	0.001	-0.003	0.0417	0.00069	0.0019	0.0438	-0.0001	-0.0005	0.123	0.000062	160	-0.0005	0.00014	0.00457	0.062	0.000086	0.00705	23.7
150	E4 - Main Embankment Seepage Pond	10/5/2011 11:20	-0.01	0.000973	-0.001	-0.003	0.0693	0.00054	0.0014	0.0542	-0.0001	-0.0005	0.112	0.000027	161	-0.0005	0.00014	0.00404	0.083	0.000059	0.00523	23.3
152	E4 - Main Embankment Seepage Pond	11/1/2011 10:43	-0.01	0.00111	-0.001	-0.003	0.0634	0.00057	0.00171	0.0461	-0.0001	-0.0005	0.131	0.00005	157	-0.0005	0.00016	-0.004	0.078	-0.00005	0.00627	21.7
153	E4 - Main Embankment Seepage Pond	12/5/2011 10:49	-0.01	0.00109	-0.001	0.0037	0.136	0.00058	0.0016	0.0415	-0.0001	-0.0005	0.107	0.000085	162	-0.0005	0.00023	0.00629	0.171	0.000068	0.00655	21.6
154	E4 - Main Embankment Seepage Pond	1/4/2012 13:23	-0.01	0.00107	-0.001	0.0271	1.3	0.00072	0.00201	0.0515	-0.0001	-0.0005	0.126	0.000107	166	0.0027	0.00085	0.0106	1.62	0.000443	0.00781	21.3
155	E4 - Main Embankment Seepage Pond	2/8/2012 10:20	-0.01	0.000918	-0.001	-0.003	0.121	0.00073	0.0019	0.0418	-0.0001	-0.0005	0.128	0.000075	162	-0.0005	0.00022	0.00578	0.203	0.000076	0.00723	21.5
156	E4 - Main Embankment Seepage Pond	3/14/2012 13:45	0.011	0.000926	-0.001	-0.003	0.182	0.00065	0.00168	0.0427	-0.0001	-0.0005	0.118	0.000066	152	-0.0005	0.00024	0.00738	0.205	0.000196	0.00573	19.1
158	E4 - Main Embankment Seepage Pond	5/2/2012 11:29	-0.01	0.00104	-0.001	-0.003	0.209	0.00056	0.00164	0.0382	-0.0001	-0.0005	0.106	0.000052	136	0.00058	0.00028	0.00796	0.289	0.00011	0.00551	18.8
159	E4 - Main Embankment Seepage Pond	6/7/2012 9:10	0.015	0.00104	-0.001	-0.003	0.224	0.00072	0.00154	0.0304	-0.0001	-0.0005	0.115	-0.00004	141	0.00055	0.00021	0.00791	0.31	0.000125	0.00661	19.7
160	E4 - Main Embankment Seepage Pond	7/5/2012 9:09	-0.01	0.00115	0.0011	-0.003	0.0437	0.00059	0.00158	0.0327	-0.0001	-0.0005	0.099	-0.00005	142	-0.0005	0.00014	0.00519	0.067	-0.00005	0.00635	22.6
161	E4 - Main Embankment Seepage Pond	8/1/2012 11:03	-0.01	0.00107	0.0012	-0.003	0.0805	0.0008	0.00186	0.0515	-0.0001	-0.0005	0.123	-0.00004	156	-0.0005	0.0002	0.00394	0.132	-0.00005	0.00737	22.6
162	E4 - Main Embankment Seepage Pond	9/6/2012 11:20	-0.01	0.00101	0.0018	-0.003	0.0703	0.00091	0.00193	0.0497	-0.0001	-0.0005	0.141	0.000034	148	-0.0005	0.00012	0.00376	0.08	-0.00005	0.0103	20.8
163	E4 - Main Embankment Seepage Pond	10/3/2012 9:35	-0.01	0.00101	0.0013	-0.003	0.116	0.00063	0.00187	0.0492	-0.0001	-0.0005	0.141	0.000034	155	-0.0005	0.00016	0.0045	0.161	0.000058	0.00868	20.9
164	E4 - Main Embankment Seepage Pond	11/15/2012 12:54	0.013	0.00105	0.0014	-0.003	0.0722	0.00064	0.00179	0.0447	-0.0001	-0.0005	0.117	-0.0001	156	-0.0005	0.00018	0.005	0.105	0.000096	0.00876	20.6
165	E4 - Main Embankment Seepage Pond	12/6/2012 10:20	-0.01	0.00111	0.0011	-0.003	0.0541	0.00062	0.0018	0.0458	-0.0001	-0.0005	0.127	-0.00012	143	-0.0005	0.00019	0.00392	0.091	0.000052	0.00835	21.6
166	E4 - Main Embankment Seepage Pond	1/2/2013 14:27	0.012	0.00112	0.0011	0.0039	0.0389	0.00077	0.00178	0.0405	-0.0001	-0.0005	0.104	-0.0001	146	-0.0005	0.00022	0.00617	0.082	0.000151	0.00832	20.1
167	E4 - Main Embankment Seepage Pond	2/6/2013 9:20					0.0692	0.00104	0.00184	0.048	-0.0001	-0.0005	0.127	-0.00005	159	-0.0005	0.00021	0.00418	0.084	-0.00005	0.00974	20.8
169	E4 - Main Embankment Seepage Pond	3/13/2013 13:20					0.146	0.0011	0.00196	0.0537	-0.0001	-0.0005	0.119	-0.0001	152	-0.0005	0.00026	0.00614	0.163	-0.00005	0.00925	19.5
170	E4 - Main Embankment Seepage Pond	4/4/2013 14:24					0.0107	0.00043	0.00196	0.0648	-0.0001	-0.0005	0.125	-0.0007	165	-0.0005	0.00029	0.00282	0.031	-0.00005	0.00639	25.2
171	E4 - Main Embankment Seepage Pond	5/1/2013 9:12					0.25	0.00074	0.00167	0.045	-0.0001	-0.0005	0.101	-0.0001	155	0.00056	0.0003	0.0047	0.282	0.000081	0.00633	21.8
172	E4 - Main Embankment Seepage Pond	6/6/2013 9:21					0.0696	0.00087	0.00185	0.0379	-0.0001	-0.0005	0.119	-0.00012	143	-0.0005	0.00022	0.00569	0.088	-0.00005	0.00805	21.6
173	E4 - Main Embankment Seepage Pond	7/10/2013 10:11					0.0055	0.0004	0.0017	0.0638	-0.0001	-0.0005	0.124	0.000054	137	-0.0005	0.00035	0.00273	0.056	-0.00005	0.00627	20.9
174	E4 - Main Embankment Seepage Pond	8/8/2013 9:55					0.0353	0.00092	0.00165	0.0408	-0.0001	-0.0005	0.113	-0.00008	138	-0.0005	0.00016	0.00346	0.053	-0.00005	0.00804	19.6
175	E4 - Main Embankment Seepage Pond	9/5/2013 9:06					0.0923	0.00088	0.00185	0.0487	-0.0001	-0.0005	0.129	-0.0001	142	-0.0005	0.00016	0.00386	0.12	-0.00005	0.00818	20.8
176	E4 - Main Embankment Seepage Pond	10/3/2013 8:48					0.124	0.0011	0.00204	0.0379	-0.0001	-0.0005	0.122	-0.00015	165	-0.0005	0.00018	0.00584	0.154	0.000056	0.00988	21.5
177	E4 - Main Embankment Seepage Pond	11/5/2013 10:26					0.0373	0.00099	0.00204	0.038	-0.0001	-0.0005	0.102	-0.00015	159	-0.0005	0.00013	0.00499	0.052	-0.00005	0.00894	21.5
178	E4 - Main Embankment Seepage Pond	12/5/2013 11:55	0.018	0.00105	0.0011	-0.003	0.0794	0.00067	0.00179	0.0483	-0.0001	-0.0005	0.113	-0.00011	157	-0.0005	0.0002	0.00405	0.209	-0.00005	0.0078	22
179	E4 - Main Embankment Seepage Pond	1/7/2014 10:27					0.0465	0.00067	0.00185	0.0461	-0.0001	-0.0005	0.114	-0.00012	160	-0.0005	0.00023	0.0044	0.069	-0.00005	0.00699	21.8
180	E4 - Main Embankment Seepage Pond	2/11/2014 11:00					0.0206	0.00074	0.0018	0.0409	-0.0001	-0.0005	0.129	-0.00013	162	-0.0005	0.00019	0.00437	-0.03	-0.00005	0.00812	23.1
181	E4 - Main Embankment Seepage Pond	3/4/2014 9:36					0.038	0.00074	0.00154	0.0357	-0.0001	-0.0005	0.104	-0.00014	158	-0.0005	0.00023	0.00561	0.055	-0.00005	0.00756	22
182	E4 - Main Embankment Seepage Pond	4/1/2014 11:35					0.12	0.00061	0.00167	0.0435	-0.0001	-0.0005	0.109	-0.00012	162	-0.0005	0.00027	0.00445	0.177	-0.00005	0.00764	23.2
183	E4 - Main Embankment Seepage Pond	5/1/2014 9:54					0.32	0.00055	0.0013	0.0372	-0.0001	-0.0005	0.082	-0.00022	123	0.00071	0.00036	0.00694	0.363	0.000118	0.00534	18.4
184	E4 - Main Embankment Seepage Pond	6/3/2014 12:59	-0.01	0.00133	0.0012	-0.003	0.0404	0.00085	0.00154	0.0327	-0.0001	-0.0005	0.097	-0.0001	150	-0.0005	0.00014	0.0054	0.048	-0.00005	0.00701	22.4
185	E4 - Main Embankment Seepage Pond	7/3/2014 12:52	0.014	0.0016	0.0013	-0.003	0.258	0.00089	0.0023	0.0349	-0.0001	-0.0005	0.11	-0.0002	156	0.00057	0.00028	0.00746	0.308	0.000099	0.00784	23.6
186	E4 - Main Embankment Seepage Pond	8/5/2014 8:25	0.015	0.00167	0.0014	-0.003	0.0698	0.00096	0.00202	0.0355	-0.0001	-0.0005	0.117	0.000026	154	-0.0005	0.00014	0.00543	0.094	-0.00005	0.00888	25.3
187	E4 - Main Embankment Seepage Pond	9/2/2014 11:43	0.014	0.00126	0.0013	-0.003	0.0196	0.00074	0.00179	0.0375	-0.0001	-0.0005	0.124	-0.00001	142	-0.0005	-0.0001	0.00347	0.033	-0.00005	0.0084	21.8
188	E4 - Main Embankment Seepage Pond	10/1/2014 13:53	0.02	0.00124	0.0012	-0.003	0.0579	0.00055	0.0018	0.0435	-0.0001	-0.0005	0.123	-0.00005	147	-0.0005	0.00011	0.00335	0.087	-0.00005	0.00796	24.2
189	E4 - Main Embankment Seepage Pond	11/3/2014 11:15	-0.01	0.00117	-0.001	-0.003	0.11	0.00045	0.00169	0.049	-0.0001	-0.0005	0.107	0.000014	145	-0.0005	0.00018	0.00463	0.134	0.000081	0.0074	24.3
190	E4 - Main Embankment Seepage Pond	12/3/2014 11:58	0.019	0.0012	-0.001	-0.003	0.0485	0.00042	0.0021	0.0519	-0.0001	-0.0005	0.117	0.000043	142	-0.0005	0.0002	0.00294	0.077	-0.00005	0.00694	23.5
191	E4 - Main Embankment Seepage Pond	1/8/2015 14:02	0.014	0.00105	-0.001	-0.003	0.0625	0.00033	0.00162	0.0628	-0.0001	-0.0005	0.127	-0.00005	140	-0.0005	0.00026	0.00256	0.101	0.000062	0.007	24.2
192	E4 - Main Embankment Seepage Pond	2/2/2015 11:41	-0.01	0.00097	-0.001	-0.003	0.0697	0.00025	0.00162	0.0575	-0.0001	-0.0005	0.113	0.00002	138	-0.0005	0.00024	0.00239	0.119	-0.00005	0.00617	23.8
197	East Main Toe Drain	4/15/2010 13:30	-0.01	0.00259	-0.002	-0.002	0.0064	0.00062	0.00145	0.0645	-0.001	-0.001	0.152	0.000073	119	-0.001	0.00032	0.00342	-0.03	-0.0001	-0.01	19.1
198	East Main Toe Drain	7/8/2010	-0.01	0.0012	-0.001	-0.001	1.47	0.00202	0.00403	0.147	-0.0005	-0.0005	0.131	-0.0009	97.8	0.00096	0.00159	0.331	2.09	0.000667	0.0061	17
199	East Main Toe Drain	8/5/2010	-0.01	0.00119	-0.002	0.0036	0.012	0.00068	0.00162	0.0673	-0.001	-0.001	0.149	-0.0008	123	-0.001	0.00041	-0.006	-0.03	-0.0001	-0.01	20.3
200	East Main Toe Drain	10/14/2010	-0.01	0.000995	-0.001	-0.003	0.0099	0.00059	0.00172	0.0779	-0.0005	-0.0005	0.174	-0.00015	136	-0.0005	0.0004	0.00301	-0.03	0.000075	0.006	22.2
201	East Main Toe Drain	4/5/2011 14:06	-0.01	0.0013	-0.001	0.0047	0.636	0.00084	0.00422	0.105	-0.0005	-0.0005	0.158	-0.00038	146	0.00054	0.00107	0.503	1.64	0.00112	0.0077	24.3
202	East Main Toe Drain	5/11/2011 8:20	-0.01	0.00128	-0.001	0.0036	0.0066	0.00045	0.0017	0.0648	-0.0005	-0.0005	0.155	-0.00012	151	-0.0005	0.00046	0.00387	-0.03	0.000078	0.0063	24.6
203	East Main Toe Drain	5/18/2011 9:08	-0.01	0.0012	-0.001	0.0056	0.0077	0.00048	0.00177	0.0664	-0.0005	-0.0005	0.148	0.00012	149	-0.0005	0.00048	0.00419	-0.03	0.000197	0.0065	24.5
204	East Main Toe Drain	6/9/2011 10:53	-0.01	0.00117	-0.001	0.0057	0.0041	0.00048	0.00164	0.0616	-0.0005	-0.0005	0.148	-0.00015	151	-0.0005	0.00045	0.00413	0.031	0.000297	0.007	24.9
205	East Main Toe Drain	7/13/2011 9:50	-0.01	0.0012	-0.001	0.0038	0.0053	0.00046	0.00173	0.0656	-0.0001	-0.0005	0.168	-0.00012	137	-0.0005	0.00043	0.00637	0.034	0.000267	0.00679	22.9
206	East Main Toe Drain	8/3/2011 9:21	-0.01	0.000826	-0.001	-0.003	0.0047	-0.0001	0.00282	0.219	-0.0001	-0.0005	0.127	-0.00004	66.5	-0.0005	0.00055	0.00061	0.131	0.000296	0.00359	11.4
208	East Main Toe Drain	8/31/2011 10:58	-0.01	0.00104	-0.001	0.0188	0.0053	0.00048	0.00172	0.0616	-0.0001	-0.0005	0.148	-0.00015	129	-0.0005	0.00038	0.00363	-0.03	0.00006	0.00686	21.2
209	East Main Toe Drain	10/5/2011 11:51	-0.01	0.000794	-0.001	-0.003	0.0078	-0.0001	0.00245	0.167	-0.0001	-0.0005	0.125	-0.00004	80	-0.0005	0.00053	0.0017	0.102	0.000091	0.00337	13.7
210	East Main Toe Drain	10/31/2011 14:42	-0.01	0.000738	-0.001	-0.003	0.0059	-0.0001	0.00257	0.182	-0.0001	-0.0005	0.132	-0.00005	79.2	-0.0005	0.00053	0.00056	0.113	-0.00005	0.00331	13.5
213	East Main Toe Drain	4/26/2012 10:28	-0.01	0.0013	-0.001	0.0061	0.0044	0.00038	0.00183	0.0959	-0.0001	-0.0005	0.133	-0.00012	120	-0.0005	0.00049	0.00395	-0.03	0.000166	0.00665	20.8
214	East Main Toe Drain	5/2/2012 10:30	-0.01	0.00062	-0.001	0.0036	0.0051	-0.0001	0.00494	0.0924	-0.0001	-0.0005	0.178	-0.0002	131	-0.0005	0.00067	0.00087	0.307	0.00007	0.00673	27.7
215	East Main Toe Drain	6/7/2012 10:39	0.015	0.00101	-0.001	0.0299	0.0218	0.00047	0.00171	0.0585	-0.0001	-0.0005	0.145	-0.0002	126	-0.0005	0.00037	0.00454	0.054	0.000078	0.00759	21
216	East Main Toe Drain	6/28/2012 14:15	-0.01	0.00111	-0.001	0.0053	0.185	0.00042	0.0017	0.066	-0.0001	-0.0005	0.15	-0.0001	124	-0.0005	0.00046	0.00678	0.235	0.000293	0.00768	20.8
217	East Main Toe Drain	7/5/2012 11:52	-0.01	0.000912	-0.001	0.0033	0.0647	0.00037	0.00168	0.0642	-0.0001	-0.0005	0.124	-0.00015	120	-0.0005	0.00041	0.00491	0.09	0.000192	0.00618	21.8
218	East Main Toe Drain	11/15/2012 13:26	0.012	0.00115	-0.001	0.0048	0.0442	0.0005	0.00173	0.0576	-0.0001	-0.0005	0.131	-0.00012	131	-0.0005	0.00035	0.00522	0.068	0.000073	0.0077	20.9
219	East Main Toe Drain	2/7/2013 9:16					0.0373	0.0004	0.00176	0.0664	-0.0001	-0.0005	0.101	-0.0001	120	-0.0005	0.00037	0.0104	0.078	0.00011	0.00612	19.6
221	East Main Toe Drain	5/1/2013 12:32	-0.01	0.00114	-0.001	0.006	0.0184	0.00051	0.00172	0.0571	-0.0001	-0.0005	0.133	0.000091	131	-0.0005	0.00035	0.00473	0.056	0.000071	0.00701	21.9
222	East Main Toe Drain	6/6/2013 11:40	0.01	0.00106	-0.001	0.0087	0.006	0.00043	0.00158	0.056	-0.0001	-0.0005	0.132	-0.0002	125	-0.0005	0.00036	0.00487	0.322	-0.00005	0.00792	22.4
223	East Main Toe Drain	7/10/2013 10:57	-0.01	0.001	-0.001	0.008	0.0063	0.00045	0.00163	0.0582	-0.0001	-0.0005	0.132	-0.0001	123	-0.0005	0.00033	0.00558	0.153	-0.00005	0.00742	20.3
224	East Main Toe Drain	8/8/2013 9:32	-0.01	0.000987	-0.001	-0.003	0.0042	0.00045	0.00168	0.0552	-0.0001	-0.0005	0.126	-0.00011	129	-0.0005	0.00033	0.00371	-0.03	-0.00005	0.00733	21.2
225	East Main Toe Drain	9/5/2013 8:57	-0.01	0.000964	-0.001	-0.003	0.0041	0.00045	0.00165	0.0568	-0.0001	-0.0005	0.135	-0.00012	126	-0.0005	0.00032	0.00389	-0.03	-0.00005	0.00706	21.1
226	East Main Toe Drain	10/3/2013 9:00	-0.01	0.00104	-0.001	-0.003	0.0042	0.00048	0.00169	0.0561	-0.0001	-0.0005	0.131	-0.00013	131	-0.0005	0.00031	0.00676	-0.03	0.000156	0.0076	21.8
227	East Main Toe Drain	11/5/2013 10:31	-0.01	0.0011	-0.001	-0.003	0.0041	0.00058	0.00192	0.0572	-0.0001	-0.0005	0.12	-0.00015	131	-0.0005	0.00034	0.00394	-0.03	-0.00005	0.0076	22
228	East Main Toe Drain	11/12/2013 11:58	-0.01	0.00107	-0.001	-0.003	0.0039	0.00051	0.0018	0.0599	-0.0001	-0.0005	0.154	-0.00015	131	-0.0005	0.00032	0.00332	-0.03	-0.00005	0.00835	22.1
229	East Main Toe Drain	12/5/2013 11:20	0.016	0.00108	-0.001	-0.003	0.0051	0.0005	0.00164	0.0563	-0.0001	-0.0005	0.122	-0.00012	136	-0.0005	0.00032	0.00353	-0.03	-0.00005	0.00722	21.7
231	East Main Toe Drain	2/11/2014 11:16	0.011	0.00108	-0.001	-0.003	0.0037	0.00051	0.00164	0.0554	-0.0001	-0.0005	0.149	-0.00011	137	-0.0005	0.00034	0.00374	-0.03	-0.00005	0.00804	23.7
233	East Main Toe Drain	3/4/2014 9:59	0.012	0.00111	-0.001	-0.003	-0.003	0.0005	0.0016	0.0514	-0.0001	-0.0005	0.137	-0.00012	134	-0.0005	0.0003	0.0035	-0.03	-0.00005	0.00759	22.6
234	East Main Toe Drain	4/3/2014 9:38	-0.01	0.00111	-0.001	-0.003	0.0071	0.00049	0.0017	0.053	-0.0001	-0.0005	0.134	-0.0001	147	-0.0005	0.00032	0.0151	0.051	-0.00005	0.00791	23.9
235	East Main Toe Drain	5/1/2014 10:15	0.014	0.00111	-0.001	-0.003	0.0046	0.00049	0.00168	0.0554	-0.0001	-0.0005	0.137	-0.00035	135	-0.0005	0.00034	0.00362	-0.03	-0.00005	0.00762	22.5
236	East Main Toe Drain	6/3/2014 12:35	-0.01	0.00104	-0.001	-0.003	0.054	0.00052	0.00197	0.0491	-0.0001	-0.0005	0.131	-0.00013	133	-0.0005	0.00035	0.011	0.112	-0.00005	0.00809	22.2
238	East Main Toe Drain	12/8/2014 12:21	-0.01	0.00098	-0.001	-0.003	0.0078	0.00044	0.00233	0.0524	-0.0001	-0.0005	0.13	0.000058	119	-0.0005	0.00029	0.00414	0.126	-0.00005	0.00697	19.7
239	East Main Toe Drain	2/5/2015 11:45	0.011	0.00103	-0.001	-0.003	0.0243	0.00044	0.00193	0.0571	-0.0001	-0.0005	0.137	0.000036	131	-0.0005	0.0003	0.00419	0.052	-0.00005	0.00745	21.5
240	East Main Toe Drain	3/5/2015 9:40	0.01	0.00105	-0.001	-0.003	-0.003	0.00044	0.0019	0.0554	-0.0001	-0.0005	0.126	0.000037	129	-0.0005	0.00028	0.00297	-0.03	-0.00005	0.00741	20.6
241	East Main Toe Drain	4/9/2015 10:30	0.013	0.00107	0.00105	-0.003	-0.003	0.0005	0.00229	0.0554	-0.0001	-0.00005	0.123	0.0000415	133	-0.0005	0.00028	0.00167	-0.03	-0.00005	0.0066	21.3
246	West Main Toe Drain	8/8/2013 9:22	-0.01	0.000822	-0.001	-0.003	0.0038	0.00041	0.00195	0.0634	-0.0001	-0.0005	0.134	-0.0001	111	-0.0005	0.00036	0.00271	-0.03	-0.00005	0.00641	17.9
247	West Main Toe Drain	9/5/2013 8:58	-0.01	0.000812	-0.001	-0.003	0.0039	0.00038	0.00192	0.0642	-0.0001	-0.0005	0.147	-0.00012	112	-0.0005	0.00039	0.00287	-0.03	-0.00005	0.00667	17.5
248	West Main Toe Drain	10/3/2013 8:58	-0.01	0.000826	-0.001	-0.003	0.0054	0.00041	0.00185	0.0594	-0.0001	-0.0005	0.138	-0.00013	114	-0.0005	0.00036	0.00255	-0.03	-0.00005	0.00663	18
249	West Main Toe Drain	11/5/2013 10:37	-0.01	0.000902	-0.001	-0.003	0.0042	0.00048	0.00212	0.0599	-0.0001	-0.0005	0.131	-0.00015	118	-0.0005	0.00037	0.00311	-0.03	-0.00005	0.00701	19.1
250	West Main Toe Drain	11/12/2013 12:05	-0.01	0.000898	-0.001	-0.003	0.0046	0.00047	0.00204	0.0626	-0.0001	-0.0005	0.161	-0.00012	119	-0.0005	0.00039	0.00302	-0.03	-0.00005	0.007	19.3
251	West Main Toe Drain	12/5/2013 11:31	-0.02	0.000955	-0.001	-0.003	0.0042	0.00045	0.00205	0.0598	-0.0001	-0.0005	0.133	-0.00011	127	-0.0005	0.00037	0.00318	-0.06	-0.00005	0.00672	19.5
252	West Main Toe Drain	1/7/2014 10:36					0.004	0.00046	0.00206	0.0603	-0.0001	-0.0005	0.143	-0.0001	123	-0.0005	0.00041	0.00309	-0.03	-0.00005	0.00649	19.1
253	West Main Toe Drain	2/11/2014 11:24	0.01	0.000938	-0.001	-0.003	0.0035	0.00049	0.00215	0.0624	-0.0001	-0.0005	0.175	-0.0001	123	-0.0005	0.00038	0.00313	-0.03	-0.00005	0.00814	20.1
254	West Main Toe Drain	3/4/2014 9:51	0.012	0.000933	-0.001	-0.003	0.0031	0.00048	0.00194	0.0575	-0.0001	-0.0005	0.146	-0.0001	126	-0.0005	0.00038	0.00312	-0.03	-0.00005	0.00741	20.1
255	West Main Toe Drain	4/3/2014 9:35	-0.01	0.000942	-0.001	-0.003	0.0042	0.00045	0.00201	0.0588	-0.0001	-0.0005	0.154	-0.00015	130	-0.0005	0.00038	0.00377	-0.03	-0.00005	0.00814	20.3
256	West Main Toe Drain	5/1/2014 10:24	0.013	0.000904	-0.001	-0.003	0.0045	0.00044	0.00199	0.0583	-0.0001	-0.0005	0.148	-0.00024	121	-0.0005	0.0004	0.00345	-0.03	-0.00005	0.00731	19.6
257	West Main Toe Drain	6/3/2014 12:43	-0.01	0.00088	-0.001	-0.003	0.0034	0.00036	0.00193	0.0706	-0.0001	-0.0005	0.141	-0.0001	121	-0.0005	0.00047	0.00248	-0.03	-0.00005	0.00728	20.1

Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
148	E4 - Main Embankment Seepage Pond	8/4/2011 11:42	0.076	-0.00005	0.165	-0.0005		0.0149	5.41	-0.00001	72.7	1.77	-0.00001	-0.0001	-0.01	0.00121	0.0014	0.0055
149	E4 - Main Embankment Seepage Pond	9/8/2011 8:26	0.156		0.16	-0.0005		0.0115	3.92	-0.00001	75.1	1.69	-0.00001	-0.0001	-0.01	0.00117	0.0013	0.004
150	E4 - Main Embankment Seepage Pond	10/5/2011 11:20	0.108		0.144	0.00052		0.0104	5.29	-0.00001	74.9	1.65	-0.00001	-0.0001	-0.01	0.00102	0.0011	-0.003
152	E4 - Main Embankment Seepage Pond	11/1/2011 10:43	0.125	-0.00005	0.161	-0.0005		0.011	5.29	-0.00001	78.5	1.63	-0.00001	-0.0001	-0.01	0.00108	0.0012	-0.003
153	E4 - Main Embankment Seepage Pond	12/5/2011 10:49	0.164		0.157	-0.0005		0.0111	5.92	-0.00001	84	1.7	-0.00001	-0.0001	0.01	0.00106	0.0014	0.0048
154	E4 - Main Embankment Seepage Pond	1/4/2012 13:23	0.24		0.168	0.00238		0.0122	8.18	-0.00001	89.3	1.8	0.000016	-0.0001	0.059	0.00114	0.0039	1.58
155	E4 - Main Embankment Seepage Pond	2/8/2012 10:20	0.203	-0.00005	0.176	-0.0005		0.0127	6.12	-0.00001	88.2	1.67	0.000031	-0.0001	0.014	0.000948	0.0013	0.0036
156	E4 - Main Embankment Seepage Pond	3/14/2012 13:45	0.2		0.155	0.00059		0.0114	5.85	-0.00001	79.4	1.54	0.000023	0.00017	0.018	0.000918	0.0012	0.0044
158	E4 - Main Embankment Seepage Pond	5/2/2012 11:29	0.175	-0.00005	0.164	0.00074		0.0102	4.24	-0.00001	62.1	1.66	-0.00001	-0.0001	0.013	0.00103	0.0018	-0.003
159	E4 - Main Embankment Seepage Pond	6/7/2012 9:10	0.165		0.169	0.00057		0.00999	3.83	-0.00001	59.4	1.73	-0.00001	-0.0001	0.032	0.00108	0.0016	0.0031
160	E4 - Main Embankment Seepage Pond	7/5/2012 9:09	0.168		0.146	-0.0005		0.0111	3.87	-0.00001	69.3	1.75	-0.00001	-0.0001	-0.01	0.00107	0.0013	-0.003
161	E4 - Main Embankment Seepage Pond	8/1/2012 11:03	0.286	-0.00001	0.176	-0.0005		0.0103	5.12	-0.00001	77.8	2.33	-0.00001	-0.0001	0.011	0.00109	0.0016	-0.003
162	E4 - Main Embankment Seepage Pond	9/6/2012 11:20	0.096		0.195	-0.0005		0.0135	6.06	-0.00001	93.9	1.79	-0.00001	-0.0001	0.011	0.000987	0.0021	-0.003
163	E4 - Main Embankment Seepage Pond	10/3/2012 9:35	0.11		0.192	-0.0005		0.0103	6.97	-0.00001	90	1.79	-0.00001	-0.0001	0.014	0.00103	0.0018	-0.003
164	E4 - Main Embankment Seepage Pond	11/15/2012 12:54	0.119	-0.00001	0.183	-0.0005		0.0137	5.99	-0.00001	80.4	1.83	-0.00001	-0.0001	0.017	0.00104	0.0018	-0.003
165	E4 - Main Embankment Seepage Pond	12/6/2012 10:20	0.181		0.17	-0.0005		0.0139	6.12	-0.00001	79.1	1.85	-0.00001	-0.0001	-0.01	0.0011	0.0014	-0.003
166	E4 - Main Embankment Seepage Pond	1/2/2013 14:27	0.25		0.181	-0.0005		0.0135	5.99	-0.00001	84.2	1.85	-0.00001	-0.0001	0.014	0.00112	0.0014	0.0046
167	E4 - Main Embankment Seepage Pond	2/6/2013 9:20	0.155	-0.00001	0.197	-0.0005		0.0183	6.15	-0.00001	87	1.78	-0.00001	-0.0001	-0.01	0.00101	0.002	-0.003
169	E4 - Main Embankment Seepage Pond	3/13/2013 13:20	0.233		0.178	-0.0005		0.0169	5.84	-0.00001	87.7	1.78	-0.00001	-0.0001	0.013	0.000884	0.0026	-0.003
170	E4 - Main Embankment Seepage Pond	4/4/2013 14:24	0.296		0.216	-0.0005		0.0149	6.2	0.000013	74	2.53	-0.00001	-0.0001	-0.01	0.00121	-0.001	-0.003
171	E4 - Main Embankment Seepage Pond	5/1/2013 9:12	0.177	-0.00001	0.183	0.00065		0.0157	5.43	-0.00001	73.3	1.81	-0.00001	-0.0001	0.018	0.00111	0.0019	-0.003
172	E4 - Main Embankment Seepage Pond	6/6/2013 9:21	0.257		0.193	-0.0005		0.0152	4.12	-0.00001	75.4	1.67	-0.00001	-0.0001	0.014	0.00105	0.0015	-0.003
173	E4 - Main Embankment Seepage Pond	7/10/2013 10:11	0.398		0.177	-0.0005		0.00919	6.2	-0.00001	84.2	2.05	-0.00001	-0.0001	-0.01	0.00102	-0.001	-0.003
174	E4 - Main Embankment Seepage Pond	8/8/2013 9:55	0.147	-0.00001	0.192	-0.0005		0.0135	6.09	-0.00001	79.5	1.57	-0.00001	-0.0001	-0.01	0.00103	0.0017	-0.003
175	E4 - Main Embankment Seepage Pond	9/5/2013 9:06	0.116		0.193	-0.0005		0.0143	6.37	-0.00001	82.9	1.59	-0.00001	-0.0001	0.011	0.00106	0.0023	-0.003
176	E4 - Main Embankment Seepage Pond	10/3/2013 8:48	0.0951		0.199	-0.0005		0.0198	7.56	0.000012	83	1.54	-0.00001	-0.0001	0.015	0.00114	0.0027	-0.003
177	E4 - Main Embankment Seepage Pond	11/5/2013 10:26	0.087		0.207	-0.0005		0.0183	6.61	-0.00001	81	1.61	-0.00001	-0.0001	0.01	0.00115	0.0022	-0.003
178	E4 - Main Embankment Seepage Pond	12/5/2013 11:55	0.22		0.181	-0.0005		0.0156	6.68	-0.00001	81.8	1.81	-0.00001	-0.0001	0.021	0.00112	0.0015	0.0053
179	E4 - Main Embankment Seepage Pond	1/7/2014 10:27	0.352		0.178	-0.0005		0.0163	6.2	-0.00001	84.2	1.79	-0.00001	-0.0001	-0.01	0.00116	0.0016	0.0063
180	E4 - Main Embankment Seepage Pond	2/11/2014 11:00	0.25		0.193	0.00059		0.0206	6.21	-0.00001	85.8	1.82	-0.00001	-0.0001	0.013	0.00123	0.0016	-0.003
181	E4 - Main Embankment Seepage Pond	3/4/2014 9:36	0.23		0.193	-0.0005		0.0193	5.76	-0.00001	87.6	1.68	-0.00001	-0.0001	0.015	0.0011	0.0014	-0.003
182	E4 - Main Embankment Seepage Pond	4/1/2014 11:35	0.275		0.168	-0.0005		0.0173	5.87	-0.00001	80.9	1.81	-0.00001	-0.0001	0.033	0.00104	0.0016	-0.003
183	E4 - Main Embankment Seepage Pond	5/1/2014 9:54	0.199		0.142	0.00122		0.0189	4.91	-0.00001	54.2	1.88	-0.00001	-0.0001	0.025	0.00101	0.0018	-0.003
184	E4 - Main Embankment Seepage Pond	6/3/2014 12:59	0.217		0.183	-0.0005		0.0231	4.35	-0.00001	69.6	1.86	-0.00001	-0.0001	-0.01	0.0013	0.0014	-0.003
185	E4 - Main Embankment Seepage Pond	7/3/2014 12:52	0.226		0.204	0.00063		0.0238	5.41	-0.00001	70.3	1.91	-0.00001	-0.0001	0.03	0.00167	0.0022	-0.003
186	E4 - Main Embankment Seepage Pond	8/5/2014 8:25	0.102		0.187	-0.0005		0.0255	5.41	-0.00001	60.6	2.16	-0.00001	-0.0001	0.018	0.0017	0.0017	-0.003
187	E4 - Main Embankment Seepage Pond	9/2/2014 11:43	0.211		0.178	-0.0005		0.0111	5.98	-0.00001	72.4	1.86	-0.00001	-0.0001	0.014	0.00132	0.0015	-0.003
188	E4 - Main Embankment Seepage Pond	10/1/2014 13:53	0.14		0.174	-0.0005		0.00911	5.36	0.000014	82.5	2.12	-0.00001	-0.0001	0.022	0.00136	0.0014	-0.003
189	E4 - Main Embankment Seepage Pond	11/3/2014 11:15	0.0939		0.155	-0.0005		0.0108	5.63	-0.00001	72.1	2.18	-0.00001	-0.0001	-0.01	0.00123	0.0013	-0.003
190	E4 - Main Embankment Seepage Pond	12/3/2014 11:58	0.284		0.17	-0.0005		0.0111	6.02	0.000028	79.9	2.4	-0.00001	-0.0001	0.021	0.00124	-0.001	-0.003
191	E4 - Main Embankment Seepage Pond	1/8/2015 14:02	0.564		0.15	-0.0005		0.00969	6.23	-0.00001	78	2.5	-0.00001	-0.0001	0.017	0.00115	0.0012	-0.003
192	E4 - Main Embankment Seepage Pond	2/2/2015 11:41	0.545		0.134	-0.0005		0.00821	6.43	-0.00001	72.6	2.22	-0.00001	-0.0001	0.011	0.00101	0.0011	-0.003
197	East Main Toe Drain	4/15/2010 13:30	0.585		0.147	-0.001		0.0045	6.14	-0.00002	81.8	1.82	-0.0002	-0.0002	-0.01	0.0013	-0.002	-0.002
198	East Main Toe Drain	7/8/2010	1.12		0.136	0.00154		0.0069	10.3	0.000012	87.9	1.26	-0.0001	-0.0001	0.084	0.00118	0.0057	0.0058
199	East Main Toe Drain	8/5/2010	0.674		0.153	-0.001		0.0024	5.94	-0.00002	88.9	1.78	-0.0002	-0.0002	-0.01	0.00123	-0.002	-0.002
200	East Main Toe Drain	10/14/2010	0.794		0.195	0.00068		0.0023	6.49	-0.00001	90.9	2.08	-0.0001	-0.0001	-0.01	0.00103	-0.001	0.005
201	East Main Toe Drain	4/5/2011 14:06	0.941		0.18	0.00126		0.00301	7.72	-0.00001	92.8	2.19	-0.0001	-0.0001	0.042	0.0013	0.0038	0.012
202	East Main Toe Drain	5/11/2011 8:20	0.867		0.171	0.00072		0.00246	6.23	-0.00001	96.8	2.31	-0.0001	-0.0001	-0.01	0.00132	-0.001	0.004
203	East Main Toe Drain	5/18/2011 9:08	0.872		0.181	0.00109		0.00242	6.16	-0.00001	99.8	2.43	-0.0001	-0.0001	-0.01	0.00128	-0.001	0.0065
204	East Main Toe Drain	6/9/2011 10:53	0.834		0.199	0.00143		0.00186	6.36	-0.00001	109	2.47	-0.0001	-0.0001	0.011	0.00123	-0.001	0.0085
205	East Main Toe Drain	7/13/2011 9:50	0.821		0.187	0.0008		0.00252	6.01	-0.00001	93.4	2.18	-0.00001	-0.0001	-0.01	0.00123	-0.001	0.0066
206	East Main Toe Drain	8/3/2011 9:21	1.96		0.188	-0.0005		-0.0005	6.58	-0.00001	80.3	0.852	-0.00001	-0.0001	-0.01	0.000851	-0.001	-0.003
208	East Main Toe Drain	8/31/2011 10:58	0.751		0.181	0.0006		0.00246	6.13	-0.00001	94.2	2.1	-0.00001	-0.0001	-0.01	0.00108	-0.001	0.0176
209	East Main Toe Drain	10/5/2011 10:50	1.53		0.163	-0.0005		-0.0005	6.14	-0.00001	91.2	0.992	-0.00001	-0.0001	-0.01	0.000745	-0.001	-0.003
210	East Main Toe Drain	10/31/2011 14:42	1.8		0.179	-0.0005		-0.0005	6.56	-0.00001	96.4	1.02	-0.00001	-0.0001	-0.01	0.000743	-0.001	-0.003
213	East Main Toe Drain	4/26/2012 10:28	1.13		0.196	0.00118		0.00157	6.09	-0.00001	88.8	1.69	-0.00001	-0.0001	-0.01	0.0013	-0.001	0.0068
214	East Main Toe Drain	5/2/2012 10:30	0.966		0.158	0.00064		-0.0005	5.93	-0.00001	107	1.61	-0.00001	-0.0001	-0.01	0.000627	-0.001	0.0061
215	East Main Toe Drain	6/7/2012 10:39	0.695		0.202	0.00067		0.00331	6.21	-0.00001	88.1	1.93	-0.00001	-0.0001	0.016	0.00113	-0.001	0.0171
216	East Main Toe Drain	6/28/2012 14:15	0.697		0.197	0.00202		0.00385	6.61	-0.00001	89.6	1.91	-0.00001	-0.0001	0.013	0.00116	0.0011	0.0077
217	East Main Toe Drain	7/5/2012 11:52	0.691		0.162	0.00094		0.00415	6.36	-0.00001	89.4	1.55	-0.00001	-0.0001	-0.01	0.000923	-0.001	0.0064
218	East Main Toe Drain	11/15/2012 13:26	0.628		0.214	0.00102		0.00424	6.35	-0.00001	89.6	1.98	-0.00001	-0.0001	0.013	0.00118	0.001	0.0056
219	East Main Toe Drain	2/7/2013 9:16	0.698	-0.00001	0.164	0.00066		0.00477	5.96	-0.00001	93.5	1.6	-0.00001	-0.0001	-0.01	0.000927	-0.001	0.009
221	East Main Toe Drain	5/1/2013 12:32	0.645		0.204	-0.0005		0.006	6.21	-0.00001	92	2.04	-0.00001	-0.0001	-0.01	0.00114	-0.001	0.0068
222	East Main Toe Drain	6/6/2013 11:40	0.63		0.203	0.00056		0.0057	6.27	-0.00001	90.3	2.05	-0.00001	-0.0001	0.011	0.00106	-0.001	0.0081
223	East Main Toe Drain	7/10/2013 10:57	0.617		0.2	-0.0005		0.00563	5.8	-0.00001	89.8	1.98	-0.00001	-0.0001	-0.01	0.000979	-0.001	0.0097
224	East Main Toe Drain	8/8/2013 9:32	0.632		0.206	-0.0005		0.00579	5.94	-0.00001	93.6	1.96	-0.00001	-0.0001	-0.01	0.000981	-0.001	-0.003
225	East Main Toe Drain	9/5/2013 8:57	0.629		0.216	-0.0005		0.00591	5.8	-0.00001	92.1	1.92	-0.00001	-0.0001	-0.01	0.001	-0.001	-0.003
226	East Main Toe Drain	10/3/2013 9:00	0.592		0.214	-0.0005		0.00586	6.24	-0.00001	89.6	2.02	-0.00001	-0.0001	-0.01	0.00107	-0.001	0.004
227	East Main Toe Drain	11/5/2013 10:31	0.634	-0.00001	0.224	0.00076		0.00567	6.34	-0.00001	93.8	2.05	-0.00001	-0.0001	-0.01	0.00113	0.0011	-0.003
228	East Main Toe Drain	11/12/2013 11:58	0.641		0.217	-0.0005		0.00576	6.17	-0.00001	89.9	2.04	-0.00001	-0.0001	-0.01	0.00109	-0.001	-0.003
229	East Main Toe Drain	12/5/2013 11:20	0.61		0.213	-0.0005		0.00607	6.43	-0.00001	90	2.03	-0.00001	-0.0001	0.017	0.00114	-0.001	-0.003
231	East Main Toe Drain	2/11/2014 11:16	0.632		0.215	0.00054		0.00736	6.44	-0.00001	92.1	2.15	-0.00001	-0.0001	0.011	0.00114	-0.001	-0.003
233	East Main Toe Drain	3/4/2014 9:59	0.599		0.223	0.00062		0.00729	6.09	-0.00001	96.6	2.19	-0.00001	-0.0001	0.013	0.00113	-0.001	-0.003
234	East Main Toe Drain	4/3/2014 9:38	0.592		0.21	-0.0005		0.00762	6.4	-0.00001	90.2	2.2	-0.00001	-0.0001	-0.01	0.00111	-0.001	-0.003
235	East Main Toe Drain	5/1/2014 10:15	0.62		0.215	-0.0005		0.00792	6.07	-0.00001	98.8	2.55	-0.00001	-0.0001	0.014	0.00116	-0.001	-0.003
236	East Main Toe Drain	6/3/2014 12:35	0.505		0.214	-0.0005		0.00881	6.16	-0.00001	87.7	2.2	-0.00001	-0.0001	-0.01	0.000996	0.0012	-0.003
238	East Main Toe Drain	12/8/2014 12:21	0.565		0.197	-0.0005		0.00355	6.2	-0.00001	92.6	2	-0.00001	-0.0001	-0.01	0.001	-0.001	-0.003
239	East Main Toe Drain	2/5/2015 11:45	0.567		0.228	-0.0005		0.00277	6.1	-0.00001	93.2	2.21	-0.00001	-0.0001	0.011	0.00104	-0.001	-0.003
240	East Main Toe Drain	3/5/2015 9:40	0.545		0.214	-0.0005		0.00249	5.92	-0.00001	89	2.06	-0.00001	-0.0001	-0.01	0.00103	-0.001	-0.003
241	East Main Toe Drain	4/9/2015 10:30	0.547		0.228	-0.0005		0.00222	6.33	-0.00001	83.6	2.17	-0.00001	-0.0001	0.013	0.00109	0.00087	-0.003
246	West Main Toe Drain	8/8/2013 9:22	0.37		0.194	-0.0005		0.00465	6.15	-0.00001	91.6	1.88	-0.00001	-0.0001	-0.01	0.000829	-0.001	-0.003
247	West Main Toe Drain	9/5/2013 8:58	0.363		0.196	-0.0005		0.00485	5.99	-0.00001	93.5	1.87	-0.00001	-0.0001	-0.01	0.000808	0.001	-0.003
248	West Main Toe Drain	10/3/2013 8:58	0.332		0.19	-0.0005		0.00479	6.32	-0.00001	88	1.9	-0.00001	-0.0001	-0.01	0.000828	-0.001	-0.003
249	West Main Toe Drain	11/5/2013 10:37	0.358	-0.00001	0.21	-0.0005		0.00502	6.63	-0.00001	92.8	2.01	-0.00001	-0.0001	-0.01	0.000915	0.0011	-0.003
250	West Main Toe Drain	11/12/2013 12:05	0.389		0.197	-0.0005		0.00522	6.52	-0.00001	91.7	1.98	-0.00001	-0.0001	-0.01	0.000892	-0.001	-0.003
251	West Main Toe Drain	12/5/2013 11:31	0.356		0.203	-0.0005		0.00649	6.77	0.000012	92.4	2.05	-0.00001	-0.0001	-0.02	0.000982	-0.001	-0.003
252	West Main Toe Drain	1/7/2014 10:36	0.372		0.195	-0.0005		0.00553	6.35	-0.00001	97	2.1	-0.00001	-0.0001	-0.01	0.001	-0.001	-0.003
253	West Main Toe Drain	2/11/2014 11:24	0.383	-0.00001	0.191	-0.0005		0.00612	6.68	-0.00001	95.6	2.04	-0.00001	-0.0001	0.011	0.000968	-0.001	-0.003
254	West Main Toe Drain	3/4/2014 9:51	0.367		0.197	-0.0005		0.00667	6.54	-0.00001	98.9	2.18	-0.00001	-0.0001	0.015	0.000969	-0.001	-0.003
255	West Main Toe Drain	4/3/2014 9:35	0.376		0.19	-0.0005		0.00648	6.54	-0.00001	95.3	2.18	-0.00001	-0.0001	-0.01	0.000951	-0.001	-0.003
256	West Main Toe Drain	5/1/2014 10:24	0.374		0.193	-0.0005		0.00689	6.44	-0.00001	99.8	2.51	-0.00001	-0.0001	0.013	0.000959	-0.001	-0.003
257	West Main Toe Drain	6/3/2014 12:43	0.378		0.178	-0.0005		0.00461	6.5	-0.00001	94.8	2.1	-0.00001	-0.0001	-0.01	0.000865	-0.001	-0.003

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
259	West Main Toe Drain	7/3/2014 12:03	Sample taken, no tss observed	1165	8.07	8.7		85	1140	376	8.03	827	-3	0.1	0.0542	26.8	0.97	1.39	1.62	0.228	
261	West Main Toe Drain	9/2/2014 12:03	Sample taken. No power in building.	1164	8.029	8.1	0	81.1	1130	374	8.11	795	-3	0.13	0.054	25.1	1.1	1.58	1.85	0.279	
263	West Main Toe Drain	10/1/2014 14:11	Sample taken.	1167	8.035	7.9	0	86.2	1130	385	8.02	849	-3	0.17	0.049	28.5	1.1	1.41	1.69	0.278	
264	West Main Toe Drain	11/3/2014 11:29	Sample taken + MOG + Ecoli/Coliform. No water from Fast MTD or FD's 1-5	1135	8.118	7.8	0.04	73.9	1130	371	8.12	791	-3	0.13	0.0521	29.9	0.86	1.07	1.36	0.293	
265	West Main Toe Drain	12/8/2014 12:25	Sample taken.	1207	8.072	7.8	0	91.2	1180	363	8.11	831	-3	0.12	0.0682	27.5	0.98	0.37	0.59	0.22	
266	West Main Toe Drain	1/13/2015 14:11	Sample taken.	1153	8.179	7.9	0	86.8	1150	369	8.06	840	-3	0.13	0.0491	27	0.99	0.385	0.619	0.234	
267	West Main Toe Drain	2/2/2015 12:06	Sample taken.	1184	8.11	8	0	86.9	1150	361	8.11	844	-3	0.13	0.0508	26.1	0.98	0.262	0.461	0.199	
268	West Main Toe Drain	3/5/2015 9:30	Sample taken.	1189	8.043	8.4	0.01	89.5	1140	370	7.96	872	-3	0.15	0.0555	27.7	1.01	0.107	0.251	0.144	
269	West Main Toe Drain	4/9/2015 10:47	Sample Taken	1227	8.177	8.3	0.11	90.9	1190	388	8.18	835	-3	0.13	0.0596	27.1	0.93	-0.025	0.076	0.0764	
273	Perimeter Toe Drain	7/7/2009 10:45		1094	7.9	8.5		104		372		777	16	4.55	0.0612	20.5		0.401		-0.005	
274	Perimeter Toe Drain	8/5/2009 11:42		1104	8.26	8.2		105		379		791	87.3	10.5	0.068	18.5		0.301		0.012	
275	Perimeter Toe Drain	9/1/2009 13:30		1118	8.24	9.4		101		394		787	12	2.05	0.0447	23.2		0.317		-0.01	
277	Perimeter Toe Drain	5/18/2011 9:29		1533	7.5	6.3		84		612		1180	-3	0.59	0.155	27.7		1.51	1.54	0.025	
278	Perimeter Toe Drain	7/13/2011 10:07		1407	8.06	6.6		79.9	1380	595	7.92	1120	-3	0.28	0.0584	23.6		1.85	1.88	0.033	
279	Perimeter Toe Drain	8/3/2011 9:57		1388	7.92	6.3		77.9	1360	572	7.98	1090	-3	0.15	0.163	24.6		2.12	2.21	0.095	
283	Perimeter Toe Drain	10/5/2011 13:55		1392	7.83	7.7		79	1350	561	8.03	1060	-3	0.33	0.125	22.6		1.65	1.74	0.09	
285	Perimeter Toe Drain	10/31/2011 13:24		1363	7.74	8		79.1	1350	571	8.02	1070	-3	0.16	0.148	22.3		1.52	1.61	0.086	
286	Perimeter Toe Drain	12/5/2011 12:18		1394	7.99	7.9		78.5	1350	562	8.03	1030	-3	0.42	0.129	22.6	0.91	1.17	1.25	0.078	
287	Perimeter Toe Drain	2/8/2012 11:15		1396	8.07	6.6		76	1330	548	7.95	1040	14.7	4.94	0.146	24.6	0.94	1.11	1.18	0.074	
288	Perimeter Toe Drain	4/3/2012 13:42		1343	8.03	7.4		86.9	1280	527	7.41	1000	5.7	2.08	0.111	22.8	0.85	1.64	1.7	0.066	
289	Perimeter Toe Drain	5/2/2012 9:52		1354	7.067	7.8		74.4	980	394	7.8	739	-3	2.07	0.103	16.9	0.7	0.839	0.888	0.05	
293	Perimeter Toe Drain	8/1/2012 11:36		1315	7.926	7.1		66.9	1230	508	7.94	1040	-3	0.16	0.145	24.1	0.9	1.36	1.49	0.134	
297	Perimeter Toe Drain	11/5/2012 10:11	Okay	1332	7.896	8.5		69.6	1250	509	7.89	1000	-3	0.28	0.137	24	1.03	1.65	1.79	0.148	
299	Perimeter Toe Drain	2/6/2013 9:55	Okay	1364	7.626	7.6		68.9	1280	528	7.79	1000	-3	0.53	0.0219	25.3	0.82	1.77	1.8	0.027	
301	Perimeter Toe Drain	5/1/2013 13:21		1322	7.534	7.3	2.42	61.4	1300	495	7.75	977	-3	0.17	0.121	24.3	1.12	2.17	2.42	0.256	
305	Perimeter Toe Drain	8/8/2013 11:16		1266	7.719	6.8		61.4	1240	455	7.92	977	-3	0.18	0.113	23.7	1.02	2.03	2.37	0.337	
307	Perimeter Toe Drain	11/5/2013 9:12		1299	7.961	8.5		69	1280	477	8.17	968	-3	0.16	0.121	25.8	0.83	2.02	2.33	0.311	
309	Perimeter Toe Drain	5/28/2014 11:15	Full suite sample	1286	7.88	8.3		59.3	1220	489	7.65	924	-3	0.22	0.106	24.1	0.78	3.2	3.51	0.307	
312	South Toe Drain	5/18/2011 8:19		1232	7.54	6.3		62.6		514		908	-3	0.26	0.0275	20.7		6.27	6.32	0.045	
313	South Toe Drain	7/14/2011 8:42		1166	8.1	12.8		59	1160	512	7.9	891	-3	0.62	0.0259	18		5.25	5.39	0.136	
314	South Toe Drain	8/3/2011 8:06		1232	7.85	13.5		58.7	1230	550	7.94	980	-3	0.22	0.079	21.7		5.66	5.79	0.133	
315	South Toe Drain	8/31/2011 11:13		1253	7.77	14.5		58.8	1240	546	7.84	997	-3	0.38	0.132	21.9		4.19	4.27	0.079	
318	South Toe Drain	10/12/2011 10:31		1345	7.63	12.2		64.1	1310	569	7.84	1050	-3	0.18	0.0682	21.5		4.04	4.09	0.05	
320	South Toe Drain	10/31/2011 13:05		1336	7.69	9.9		58.7	1300	556	7.91	1030	6.8	0.15	0.0478	23.4		4.87	4.9	0.029	
321	South Toe Drain	12/5/2011 10:35		1381	7.82	6.1		57.7	1320	559	7.86	1050	-3	0.32	0.0339	24.3	0.63	4.63	4.65	0.023	
322	South Toe Drain	2/7/2012 12:05		1382	8.12	3.1		51.8	1310	528	7.88	1030	-3	0.25	0.0424	26.4	0.66	5.54	5.57	0.03	
323	South Toe Drain	4/3/2012 13:24		1367	8.31	3.4		59.7	1270	510	7.09	982	-3	1.31	0.0481	27.7	0.65	4.58	4.66	0.086	
324	South Toe Drain	5/2/2012 10:47		1265	7.054	4.7		65.7	1190	478	7.91	911	-3	0.43	0.0351	24.6	0.69	3.63	3.7	0.069	
328	South Toe Drain	8/1/2012 10:05		1291	7.835	11.5		63.8	1190	485	7.88	1010	-3	0.13	0.0757	23.4	0.67	3.55	3.72	0.164	
334	South Toe Drain	11/5/2012 11:17	okay	1315	7.583	10.5		62.2	1240	508	7.81	982	-3	0.3	0.0709	24.3	0.75	3.96	4.07	0.105	
336	South Toe Drain	2/6/2013 9:00	Okay	1334	7.783	6		61.7	1240	530	7.81	997	-3	0.13	0.0795	25	0.57	5.26	5.34	0.08	
338	South Toe Drain	5/1/2013 9:02		1297	7.57	5.9	0.35	62.6	1280	511	7.55	967	-3	0.15	0.094	22.4	0.86	4.61	4.81	0.199	
342	South Toe Drain	8/8/2013 9:47		1213	7.758	13.2		61.8	1200	448	7.94	913	-3	-0.1	0.0958	20.9	0.77	4.99	5.37	0.388	
345	South Toe Drain	11/5/2013 10:00	full pipe, sample taken	1273	7.775	12.4		69	1250	491	7.75	946	-3	0.27	0.103	25	0.58	5.73	5.99	0.257	
348	South Toe Drain	5/28/2014 11:28	Full suite sample	1170	7.92	5.6		58	1120	435	7.75	854	-3	0.27	0.0873	21.7	0.54	5.82	6.01	0.189	
351	South Toe Drain	8/5/2014 8:35	Sample taken, fairly large flow	1188	7.747	11.5		69.7	1160	447	7.98	882	-3	0.29	0.089	20.7	0.69	5.09	5.34	0.252	
354	South Toe Drain	11/3/2014 11:03	Sample taken	1217	7.737	9.1	0.32	54.1	1210	461	7.91	876	-3	0.15	0.15	25.4	0.62	0.68	0.994	0.315	
365	E5 - Tailings Impoundment Main Embank Drain Comp	7/12/2001 13:15		1044	7.04	7.7		191		560			-4	0.76	0.009				68.4		
367	E5 - Tailings Impoundment Main Embank Drain Comp	7/26/2001 8:50		1465	6.9	8.7		120		638			-4	0.36	-0.005				127		
368	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2001		1226	7.01	8.2		128		571			-4	0.75	-0.005				111		
369	E5 - Tailings Impoundment Main Embank Drain Comp	8/10/2001 10:05		1290	6.98	8.8		151		645			-4	0.45	0.012				105		
371	E5 - Tailings Impoundment Main Embank Drain Comp	8/30/2001 14:40		982	7.13	9		179		477			4	0.73	0.019				65.2		
372	E5 - Tailings Impoundment Main Embank Drain Comp	10/24/2001 10:30		982	6.85	7.4		123		498			-4	0.53	-0.005				79.8		
374	E5 - Tailings Impoundment Main Embank Drain Comp	10/16/2003 18:10		566	8.49	11.5		81.5		162		298	-4	0.74	0.023					0.007	
375	E5 - Tailings Impoundment Main Embank Drain Comp	5/31/2005		617	7.63	7.1		145		180		392	1	0.4	0.005				0.617		
376	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2005		569	7.95	7.5		151		190		380	-1	0.4	-0.005				0.689		
377	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2005		577	7.49	7.4		139		170		354	1	0.4	-0.005						
378	E5 - Tailings Impoundment Main Embank Drain Comp	8/11/2005		585	7.74	9.8		149		160		384	-1	0.7	0.026						
379	E5 - Tailings Impoundment Main Embank Drain Comp	9/14/2005		601	8.53	9.4		143		150		372	-1	0.4	-0.005						
380	E5 - Tailings Impoundment Main Embank Drain Comp	10/11/2005		580	8.49	7.6		142		150		350	1	0.4	0.053						
381	E5 - Tailings Impoundment Main Embank Drain Comp	11/8/2005		607	8.37	8		142		170		358	-1	0.3	-0.005						
382	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/2005		644	8.2	6		144		180		386	-1	0.4	0.045						
383	E5 - Tailings Impoundment Main Embank Drain Comp	1/17/2006		668	7.3	1.6		139		190		408	-1	0.3	0.009						
384	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2006		650	7.33	8.3		136		180		396	-1	0.2	0.047						
385	E5 - Tailings Impoundment Main Embank Drain Comp	3/6/2006 13:00		642	7.88	8.1		139		170		392	1	0.2	0.044			0.41		0.021	
386	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2006 9:35		597	8	9.2		132		190		396	-4	0.6	0.005					0.026	
387	E5 - Tailings Impoundment Main Embank Drain Comp	5/9/2006		624	8.49	8.8		136		178		401	-3	0.25	-0.005						
388	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2006		635	7.03	8		137		182		394	-3		0.026			0.353		0.0183	
389	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2006		605	7.5	9.5		137		161		394	-3	0.73	0.032			0.304		0.0268	
390	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2006		631	6.43	9.2		136		156		400	-3	1.21	0.0233			0.119		0.0062	
391	E5 - Tailings Impoundment Main Embank Drain Comp	10/12/2006		655	7.56	8.6		151		174		411	-3	0.27	-0.005			0.48		-0.001	
392	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2006		709	7.33	7.6		138		212		448	-2.3	0.44	-0.005			1.3		0.0081	
393	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2006		753	7.75	6		144		201		471	-2.3	0.21	0.033			0.764		0.0088	
395	E5 - Tailings Impoundment Main Embank Drain Comp	2/5/2007 10:30		733	7.3	7.6		144		210		458	-3	0.22	0.0809			0.557		0.0066	
396	E5 - Tailings Impoundment Main Embank Drain Comp	3/5/2007		724	7.49	6.9		137		222		467	-3	0.65	0.0987			0.42		0.001	
397	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2007 10:59		849	7.58	6.9		124		312		574	-3	0.41	0.0316			6.38		0.0012	
398	E5 - Tailings Impoundment Main Embank Drain Comp	5/7/2007 9:29		789	7.38	7.2		131		248		520	-3	0.22	0.0558			3.04		0.0012	
399	E5 - Tailings Impoundment Main Embank Drain Comp	6/4/2007 10:50		782	7.77	7.7		129		267		519	-3	0.45	0.0338			3.76		0.0022	
400	E5 - Tailings Impoundment Main Embank Drain Comp	7/3/2007 11:08		765	7.7	8.1		126		223		489	-3	1.01	0.0613			1.88		0.0015	
401	E5 - Tailings Impoundment Main Embank Drain Comp	8/2/2007 10:30		769	7.92	8.4		130		248		520	-3	0.46	0.0416			2.77		0.0019	
402	E5 - Tailings Impoundment Main Embank Drain Comp	9/5/2007 10:05		756	7.32	7		132		234		510	3.1	0.38	-0.005			1.32		0.0024	
403	E5 - Tailings Impoundment Main Embank Drain Comp	10/2/2007 15:15		876	7.84	7.4		121		310		589	-3	0.34	0.0324			5.4		0.0025	
404	E5 - Tailings Impoundment Main Embank Drain Comp	11/5/2007 10:45		883	8.04	5.6		130		326		625	-3	0.92	0.0227			4.07		0.0022	
405	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2007 14:12		1010	7.65	6.8		137		404		704	-3	0.39	0.0731			9.07		-0.001	
406	E5 - Tailings Impoundment Main Embank Drain Comp	1/15/2008 14:33		855	8.35	6.3		127		267		570	-3	0.41	0.118			1.03		0.0159	
407	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2008 10:09		853	8.06	4.2		125		254		560	-3	0.35	0.128			0.781		0.0196	
408	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2008 10:09		830	7.914	6.9		121		261		578	-3	0.28	0.113			0.612		0.031	
409	E5 - Tailings Impoundment Main Embank Drain Comp	4/16/2008 9:45		1097	7.655	5.9		105		432		814	-3	1.2	0.0814			6.44		0.0015	
410	E5 - Tailings Impoundment Main Embank Drain Comp	5/13/2008 10:34		898	7.76	6.8		110		282		606	-3	0.29	0.116			1.67		-0.001	
411	E5 - Tailings Impoundment Main Embank Drain Comp	7/15/2008 9:15		787	7.989	18.2		47.3		254		396	46.5	19.1	0.0973			1.39		0.0172	
412	E5 - Tailings Impoundment Main Embank Drain Comp	8/6/2008 9:40		787	8.7	16.8		51		233		533	28.4	12	0.192			1.13		0.0158	
413	E5 - Tailings Impoundment Main Embank Drain Comp	8/12/2008 12:36		841	7.986	8.3		111		261		586	-3	0.29	0.0679			1.38		0.0278	
414	E5 - Tailings Impoundment Main Embank Drain Comp	9/9/2008 8:30		843	7.99	7.9		111		244		558	-3	0.34	0.0869			0.99		0.0274	
415	E5 - Tailings Impoundment Main Embank Drain Comp	9/30/2008 11:30		855	7.97	8.9		113		254		584	-3	0.25	0.125			0.961		0.0249	
416	E5 - Tailings Impoundment Main Embank Drain Comp	10/22/2008 11:50			8.038	7.6		122		269		613	5.9	2.21	0.0717			2.7		0.0085	
417	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2008 13:57		852	8.27	5.5		127		284		580	3.9	3.84	0.114			0.931		0.015	
418	E5 - Tailings Impoundment Main Embank Drain Comp	12/2/2008 11:55			8.37	3		156		321		604	4.1	4.22	0.0725			1.76		0.0215	
419	E5 - Tailings Impoundment Main Embank Drain Comp	1/14/2009 13:59		887	8.01	7.2		117		260		578	-3	0.34	0.103			0.748		-0.001	
420	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2009 11:39		884	7.94	7.3		115		261		597	-3	0.42	0.117			0.562		-0.001	
421	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2009		871	7.66	6.5		118		270		571	-3	0.29	0.108			0.54		-0.001	
422	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2009 13:14		941	7.53	8.3		110		335		677	-3	0.38	0.0525	19.4		2.57		-0.001	
423	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2009 12:45		931	8.07	8.1		126		301		650	-3	1.11	0.109	21.7		1.56		-0.001	
424	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2009 9:29		1010	7.8	8.4		119		351		704	-3	0.54	0.0865	21		2.68		0.0013	
425	E5 - Tailings Impoundment Main Embank Drain Comp	7/7/2009 10:14		928	7.78	10.7		116		301		627	-3	0.32	0.102	21.4		1.04		-0.001	
426	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2009 10:50		923	8.34	8.3		120		290		646	-3	0.35	0.086	21.8		0.93		0.0017	
427	E5 - Tailings Impoundment Main Embank Drain Comp	9/2/2009 9:15		903	8.39	8.5		112		290		613	-3	0.18	0.0952	24.4		0.931		-0.01	
428	E5 - Tailings Impoundment Main Embank Drain Comp	10/6/2009 9:49		909	8.44	7.6		115		296		623	-3	0.49	0.0941	22		0.828		0.0078	
429	E5 - Tailings Impoundment Main Embank Drain Comp	10/29/2009 12:29		920	8.46	6.1		115		286		627	-3	0.26	0.0999	22.3		0.891		-0.005	
430	E5 - Tailings Impoundment Main Embank Drain Comp	11/19/2009 9:26		987	8.28	6.1		125		318		658	-3	0.3	0.0946	23.1		1.09		-0.005	

Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
259	West Main Toe Drain	7/3/2014 12:03	0.0171	0.0275	0.029	483			1.64	3.76		-0.003	0.00033	0.00184	0.0665	-0.0001	-0.0005	0.154	-0.0002	118	-0.0005	0.00035
261	West Main Toe Drain	9/2/2014 12:03	0.0125	0.0267	0.0261	464			1.89	3.16		-0.003	0.00037	0.00196	0.0606	-0.0001	-0.0005	0.139	0.00005	118	-0.0005	0.00036
263	West Main Toe Drain	10/1/2014 14:11	0.0148	0.0282	0.0235	472			1.66	3.15		-0.003	0.00034	0.00199	0.0596	-0.0001	-0.0005	0.133	-0.00005	121	-0.0005	0.00038
264	West Main Toe Drain	11/3/2014 11:29	0.0163	0.0278	0.0253	467			1.41	3.44		-0.003	0.00035	0.0019	0.0593	-0.0001	-0.0005	0.131	0.000056	117	-0.0005	0.00039
265	West Main Toe Drain	12/8/2014 12:25	0.012	0.0257	0.0263	491			0.629	3.66		-0.003	0.00024	0.00171	0.0711	-0.0001	-0.0005	0.146	0.000058	113	-0.0005	0.00052
266	West Main Toe Drain	1/13/2015 14:11	0.0159	0.0281	0.0248	474			0.667	3.63		-0.003	0.00034	0.00195	0.0589	-0.0001	-0.0005	0.149	0.000046	116	-0.0005	0.00041
267	West Main Toe Drain	2/2/2015 12:06	0.0145	0.0294	0.029	475			0.501	3.57		-0.003	0.00031	0.00199	0.0587	-0.0001	-0.0005	0.154	0.000043	112	-0.0005	0.00039
268	West Main Toe Drain	3/5/2015 9:30	0.0157	0.0282	0.0285	477			0.354	4.01		0.0034	0.00035	0.00217	0.0606	-0.0001	-0.0005	0.154	0.000059	119	-0.0005	0.00042
269	West Main Toe Drain	4/9/2015 10:47	0.0161	0.0283	0.0268	487			0.212	3.8		0.0031	0.0003	0.00217	0.0606	-0.0001	-0.00005	0.14	0.0000475	123	-0.0005	0.00042
273	Perimeter Toe Drain	7/7/2009 10:45	0.0026	0.0051	0.0122	419			0.49	2.14		-0.003	0.00066	0.00134	0.041	-0.001	-0.001	0.169	0.000072	117	-0.001	-0.0002
274	Perimeter Toe Drain	8/5/2009 11:42	0.0015	0.0048	0.0962	420			0.43	2.04		-0.002	0.00066	0.00135	0.0397	-0.001	-0.001	0.174	-0.00051	120	-0.001	-0.0002
275	Perimeter Toe Drain	9/1/2009 13:30	0.0021	0.0044	0.0153	462			0.24	2.05		-0.002	0.00068	0.00133	0.0374	-0.001	-0.001	0.184	-0.0006	125	-0.001	-0.0002
277	Perimeter Toe Drain	5/18/2011 9:29	0.0091	0.0175		724			1.51	3.58		-0.006	0.00058	0.00144	0.0432	-0.001	-0.001	0.14	0.000143	197	-0.001	0.00108
278	Perimeter Toe Drain	7/13/2011 10:07	0.0107	0.0148		668			2.24	3.87		-0.003	0.00062	0.00141	0.043	-0.0001	-0.0005	0.119	-0.0001	194	-0.0005	0.00091
279	Perimeter Toe Drain	8/3/2011 9:57	0.0071	0.0092		652			2.68	4.05		-0.003	0.00059	0.00132	0.0412	-0.0001	-0.0005	0.131	-0.00012	185	-0.0005	0.00089
283	Perimeter Toe Drain	10/5/2011 13:55	0.006	0.009	0.0134	646			2.08	3.44		-0.006	0.00063	0.00134	0.0393	-0.0002	-0.001	0.134	-0.0001	182	-0.001	0.0007
285	Perimeter Toe Drain	10/31/2011 13:24	0.0111	0.0163	0.0161	654			1.57	3.55		-0.003	0.0007	0.00141	0.0412	-0.0001	-0.0005	0.143	-0.00015	186	-0.0005	0.00085
286	Perimeter Toe Drain	12/5/2011 12:18	0.006	0.0088	0.0126	636			1.46	3.56		-0.003	0.00068	0.00139	0.0411	-0.0001	-0.0005	0.134	-0.0002	182	-0.0005	0.0007
287	Perimeter Toe Drain	2/8/2012 11:15	-0.001	0.0073	0.0529	641			1.94	3.63		-0.003	0.00066	0.00141	0.0401	-0.0001	-0.0005	0.143	-0.00011	176	-0.0005	0.00062
288	Perimeter Toe Drain	4/3/2012 13:42	0.0058	0.0102	0.0194	593			1.94	4		-0.003	0.00062	0.00139	0.0395	-0.0001	-0.0005	0.135	-0.0002	171	-0.0005	0.00065
289	Perimeter Toe Drain	5/2/2012 9:52	0.0051	0.0126	0.0191	437			1.18	10.1		0.0679	0.00048	0.00114	0.0306	-0.0001	-0.0005	0.101	-0.0002	128	-0.0005	0.00053
293	Perimeter Toe Drain	8/1/2012 11:36	0.0087	0.0122	0.0129	585			1.67	4.15		-0.003	0.00068	0.0015	0.0384	-0.0001	-0.0005	0.13	-0.00015	165	-0.0005	0.00069
297	Perimeter Toe Drain	11/5/2012 10:11	0.005	0.0091	0.0132	600			2.24	3.79		-0.003	0.00077	0.00152	0.0355	-0.0001	-0.0005	0.148	-0.00011	165	-0.0005	0.00064
299	Perimeter Toe Drain	2/6/2013 9:55	0.0057	0.0105	0.0133	616			1.5	3.09												
301	Perimeter Toe Drain	5/1/2013 13:21	0.0053	0.0084	0.0116	592			2.51	5.33												
305	Perimeter Toe Drain	8/8/2013 11:16	0.0053	0.0104	0.0127	570			2.46	3.97		-0.003	0.00058	0.00166	0.0342	-0.0001	-0.0005	0.116	-0.00012	148	-0.0005	0.00054
307	Perimeter Toe Drain	11/5/2013 9:12	0.0072	0.0117	0.0143	586			2.38	3.08												
309	Perimeter Toe Drain	5/28/2014 11:15	0.0073	0.0089	0.0175	572			3.44	3.49		-0.003	0.00066	0.00194	0.0358	-0.0001	-0.0005	0.126	-0.00015	161	-0.0005	0.00045
312	South Toe Drain	5/18/2011 8:19	0.0021	0.0073	0.009	547			6.29	3.73		-0.003	0.00145	0.00152	0.0258	-0.0005	-0.0005	0.069	0.000187	170	-0.0005	0.00015
313	South Toe Drain	7/14/2011 8:42	0.0084	0.0104	0.0113	530			7.69	3.13		-0.003	0.00142	0.00202	0.0292	-0.0001	-0.0005	0.087	-0.00018	171	-0.0005	0.00014
314	South Toe Drain	8/3/2011 8:06	0.0061	0.0089	0.0121	583			6.76	3.27		0.0031	0.00119	0.00169	0.032	-0.0001	-0.0005	0.105	-0.0002	183	-0.0005	0.00012
315	South Toe Drain	8/31/2011 11:13	0.0068		0.0113	586			5.22	3.72		0.0044	0.00114	0.00168	0.0328	-0.0001	-0.0005	0.118	-0.0002	182	-0.0005	0.00013
318	South Toe Drain	10/12/2011 10:31	0.0073	0.0097	0.0108	579			5.96	2.65		0.0034	0.00109	0.00179	0.036	-0.0001	-0.0005	0.116	-0.00025	190	-0.0005	0.00019
320	South Toe Drain	10/31/2011 13:05	0.0067	0.0091	0.0101	618			5.98	2.45		-0.006	0.00092	0.00163	0.0325	-0.0001	-0.0005	0.112	-0.0002	186	-0.0005	0.00015
321	South Toe Drain	12/5/2011 10:35	0.0046	0.0069	0.0093	629			7.13	3.52		-0.003	0.00084	0.00143	0.0311	-0.0001	-0.0005	0.108	0.000178	188	-0.0005	0.00018
322	South Toe Drain	2/7/2012 12:05	0.0073	0.0096	0.0104	610			9.17	5.54		-0.003	0.00101	0.00177	0.0296	-0.0001	-0.0005	0.121	-0.0002	178	-0.0005	0.00016
323	South Toe Drain	4/3/2012 13:24	0.0084	0.0121	0.015	605			5.64	6.64		-0.003	0.00095	0.00156	0.028	-0.0001	-0.0005	0.107	-0.0003	173	-0.0005	0.00016
324	South Toe Drain	5/2/2012 10:47	0.005	0.01	0.0109	544			5.09	2.3		-0.003	0.00093	0.00165	0.0263	-0.0001	-0.0005	0.103	-0.0002	162	-0.0005	0.00017
328	South Toe Drain	8/1/2012 10:05	0.0097	0.0143	0.0147	566			4.32	3.32		-0.003	0.00126	0.00191	0.0306	-0.0001	-0.0005	0.124	-0.0002	163	-0.0005	0.00014
334	South Toe Drain	11/5/2012 11:17	0.0081	0.0114	0.0126	591			4.61	5.06		-0.003	0.00104	0.00166	0.0293	-0.0001	-0.0005	0.125	-0.00017	170	-0.0005	0.00024
336	South Toe Drain	2/6/2013 9:00	0.0078	0.0097	0.0106	596				4.07												
338	South Toe Drain	5/1/2013 9:02	0.0098	0.0123	0.0143	592			4.62	5.49												
342	South Toe Drain	8/8/2013 9:47	0.011	0.0155	0.0152	522			5.43	2.53		0.0035	0.00127	0.00194	0.0303	-0.0001	-0.0005	0.097	-0.00021	149	-0.0005	0.00027
345	South Toe Drain	11/5/2013 10:00	0.0124	0.0156	0.0152	564			5.74	1.91												
348	South Toe Drain	5/28/2014 11:28	0.0125	0.0124	0.0146	493			5.8	3.13		-0.003	0.00107	0.00151	0.0231	-0.0001	-0.0005	0.102	-0.0002	143	-0.0005	0.00021
351	South Toe Drain	8/5/2014 8:35	0.0142	0.0168	0.0168	510			5.17	2.53		0.003	0.00132	0.00162	0.0277	-0.0001	-0.0005	0.121	0.000147	147	-0.0005	0.00021
354	South Toe Drain	11/3/2014 11:03	0.0087	0.013	0.0128	559			1.16	4.44		-0.003	0.00098	0.00193	0.0269	-0.0001	-0.0005	0.107	0.000145	155	-0.0005	0.00025
365	E5 - Tailings Impoundment Main Embank Drain Comp	7/12/2001 13:15	0.127	0.141	0.083	84.4		0.32	68.7	2.1		0.0059	-0.00005	0.0007	0.124	-0.00005	-0.00005		0.00004	166	0.0057	0.00183
367	E5 - Tailings Impoundment Main Embank Drain Comp	7/26/2001 8:50	0.071	0.072	0.088	159		-0.1	127	6.7		0.0044	0.00016	0.0008	0.216	-0.00005	0.00008		0.00008	203	0.0008	0.00123
368	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2001	0.033	0.029	0.06	145		0.34	111	3.6		0.0108	0.00013	0.0007	0.153	-0.00005	-0.00005		0.00003	183	0.0007	0.00125
369	E5 - Tailings Impoundment Main Embank Drain Comp	8/10/2001 10:05	0.04	0.026	0.036	143		-0.1	105	2.6		0.0045	0.00015	0.0007	0.181	-0.00005	-0.00005	2.6	0.00004	221	0.0009	0.00008
371	E5 - Tailings Impoundment Main Embank Drain Comp	8/30/2001 14:40	0.03	0.025	0.042	92.3		0.12	65.3	2.8		0.0026	0.00016	0.001	0.117	-0.00005	-0.00005		0.00006	150	-0.0002	0.00079
372	E5 - Tailings Impoundment Main Embank Drain Comp	10/24/2001 10:30	0.036	0.07	0.08	107		0.44	80.2	2.7		0.0028	0.00017	0.0007	0.141	-0.00005	-0.00005		0.00003	153	0.0008	0.00086
374	E5 - Tailings Impoundment Main Embank Drain Comp	10/16/2003 18:10	0.019	0.02	0.026	124				2.5		0.0032	0.00206	0.0032	0.0462	-0.00005	-0.00005		0.00015	50.3	0.001	-0.00002
375	E5 - Tailings Impoundment Main Embank Drain Comp	5/31/2005	0.02	0.047	0.068	128				3.4		0.0027	0.00014	0.0022	0.074	-0.00005	-0.00005	0.104	0.0003	57.1	-0.0002	0.00033
376	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2005	0.006	0.033	0.048	131				2.6		0.0035	0.00017	0.0021	0.0775	-0.00005	-0.00005	0.099	0.00026	60.7	-0.0002	0.00031
377	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2005	0.022	0.05	0.063	120				4.5		0.0029	0.00013	0.002	0.0828	-0.00005	-0.00005	0.097	0.00022	52.6	-0.0002	0.00041
378	E5 - Tailings Impoundment Main Embank Drain Comp	8/11/2005	0.031	0.058	0.066	126				2.5		0.0053	0.00015	0.0019	0.0783	-0.00005	-0.00005	0.109	0.00016	51.6	-0.0002	0.00038
379	E5 - Tailings Impoundment Main Embank Drain Comp	9/14/2005	0.012	0.041	0.043	126				3.3		0.0045	0.00015	0.0022	0.075	-0.00005	-0.00005	0.111	0.00024	46	-0.0002	0.00031
380	E5 - Tailings Impoundment Main Embank Drain Comp	10/11/2005	0.045	0.053	0.063	109				4.3		0.0055	0.00016	0.0022	0.0765	-0.00005	-0.00005	0.107	0.00023	48.7	-0.0002	0.00031
381	E5 - Tailings Impoundment Main Embank Drain Comp	11/8/2005	0.01	0.03	0.031	116				3.4		0.0054	0.00026	0.0024	0.0776	-0.00005	-0.00005	0.104	0.00031	53.5	-0.0002	0.00034
382	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/2005	0.043	0.059	0.059	135				4.5		0.0057	0.00032	0.0022	0.0797	-0.00005	-0.00005	0.108	0.00025	56	-0.0002	0.00035
383	E5 - Tailings Impoundment Main Embank Drain Comp	1/17/2006	0.039	0.053	0.048	152				3.3		0.0031	0.00033	0.002	0.0824	-0.00005	-0.00005	0.107	0.00028	60.6	-0.0002	0.00034
384	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2006	0.033	0.05	0.054	160			0.57	4		0.0042	0.00036	0.0024	0.0832	-0.00005	-0.00005	0.11	0.00039	55.7	0.002	0.00036
385	E5 - Tailings Impoundment Main Embank Drain Comp	3/6/2006 13:00	0.033	0.054	0.053	151			0.55	2.7		0.0033	0.00035	0.0024	0.0882	-0.00005	-0.00005	0.105	0.00032	54	0.0003	0.00037
386	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2006 9:35	0.025	0.043	0.042	165			0.73	3.8		0.0036	0.00031	0.0022	0.0795	-0.00005	-0.00005	0.121	0.00031	57.7	0.0002	0.00035
387	E5 - Tailings Impoundment Main Embank Drain Comp	5/9/2006	0.0076	0.0311		143			0.44	3.43		0.0034	0.00042	0.00235	0.0835	-0.0005	-0.0005	0.104	-0.00005	54.9	0.00076	0.00034
388	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2006	0.002	0.0229	0.0367	139			0.33	-0.5		0.0051	0.00041	0.00235	0.085	-0.0005	-0.0005	0.117	-0.00005	56.1	-0.0005	0.00036
389	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2006	0.0158	0.031	0.0376	139		0.159	0.49	3.4		0.0032	0.00052	0.00226	0.0818	-0.0005	-0.0005	0.112	-0.00005	49	-0.0025	0.00033
390	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2006	0.0035	0.0345	0.043	140			0.35	3.4		0.0029	0.00046	0.0022	0.0828	-0.0005	-0.0005	0.146	-0.00005	47.1	-0.0005	0.00034
391	E5 - Tailings Impoundment Main Embank Drain Comp	10/12/2006	0.0146	0.0288	0.0372	150			0.52	3.4		0.0035	0.00032	0.00215	0.0825	-0.0005	-0.0005	0.11	-0.00005	52.7	-0.0005	0.00033
392	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2006	0.0111	0.0337	0.044	171			1.68	3.25		0.003	0.00054	0.00224	0.107	-0.0005	-0.0005	0.131	-0.00005	65.4	-0.0005	0.00034
393	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2006	0.0253	0.0434	0.0474	179			1.08	3.1		0.003	0.0006	0.00226	0.0916	-0.0005	-0.0005	0.127	-0.00005	61.5	-0.0005	0.00037
395	E5 - Tailings Impoundment Main Embank Drain Comp	2/5/2007 10:30	0.0244	0.041	0.0492	182			0.87	3.21		0.0026	0.00054	0.00219	0.0936	-0.0005	-0.0005	0.135	-0.00005	65.5	-0.0005	0.00037
396	E5 - Tailings Impoundment Main Embank Drain Comp	3/5/2007	0.0245	0.0417	0.0484	184			0.64	3.23		0.0033	0.00038	0.00243	0.0845	-0.0005	-0.0005	0.137	-0.00005	68.6	-0.0005	0.00036
397	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2007 10:59	0.0164	0.038	0.0449	247			7.48	2.93		0.0028	0.00026	0.00168	0.0885	-0.0005	-0.0005	0.115	-0.000017	98.3	-0.0005	0.00025
398	E5 - Tailings Impoundment Main Embank Drain Comp	5/7/2007 9:29	0.0195	0.036	0.0439	210			3.48	3.24		0.003	0.00029	0.00187	0.0906	-0.0005	-0.0005	0.133	-0.00005	77.8	-0.0005	0.00033
399	E5 - Tailings Impoundment Main Embank Drain Comp	6/4/2007 10:50	0.0164	0.0358	0.049	217			4.75	3.41		0.004	0.00031	0.00189	0.0859	-0.0005	-0.0005	0.122	0.000046	83.7	-0.0005	0.00033
400	E5 - Tailings Impoundment Main Embank Drain Comp	7/3/2007 11:08	0.0207	0.0418	0.0486	201			2.72	3		0.0026	0.00026	0.00192	0.0798	-0.0005	-0.0005	0.105	-0.000032	69.5	-0.0005	0.00025
401	E5 - Tailings Impoundment Main Embank Drain Comp	8/2/2007 10:30	0.0173	0.0322	0.0399	215			3.3	3.19		-0.004	0.00026	0.00185	0.087	-0.001	-0.001	0.136	0.000134	77.5	-0.001	0.00029
402	E5 - Tailings Impoundment Main Embank Drain Comp	9/5/2007 10:26	0.0025	0.0291	0.0332	209			1.31	3.28		0.0035	0.00027	0.00194	0.0823	-0.0005	-0.0005	0.114	-0.0004	74.1	-0.0005	0.00034
403	E5 - Tailings Impoundment Main Embank Drain Comp	10/2/2007 15:15	0.0235	0.0381	0.044	268			6.8	2.81		0.0023	0.00025	0.00159	0.0902	-0.0005	-0.0005	0.101	0.000046	96.4	-0.0005	0.00024
404	E5 - Tailings Impoundment Main Embank Drain Comp	11/5/2007 10:45	0.0057	0.0208	0.0478	278			5.16	3.37		0.0027	0.00026	0.0019	0.0925	-0.001	-0.001	0.127	0.000066	104	-0.001	0.00032
405	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2007 14:12	0.0275	0.0396	0.045	314			14.3	2.78		-0.002	0.00079	0.00136	0.0792	-0.001	-0.001	0.103	-0.00015	129	-0.001	-0.0002
406	E5 - Tailings Impoundment Main Embank Drain Comp	1/15/2008 14:33	0.0225			261			2.03	3.08		-0.008	0.00056	0.00185	0.0869	-0.001	-0.001	0.139	-0.0006	83.6	-0.001	0.0004
407	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2008 10:09	0.0231	0.0409	0.043	262			1.19	2.99		0.0015	0.00046	0.00177	0.0745	-0.0005	-0.0005	0.113	-0.0004	78.3	-0.0005	0.00033
408	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2008 10:09	0.0258	0.0374	0.0403	266			1.09	2.91		0.0031	0.00045	0.00179	0.0712	-0.0005	-0.0005	0.121	-0.00007	81	-0.0005	0.00037
409	E5 - Tailings Impoundment Main Embank Drain Comp	4/16/2008 9:45	0.0257	0.0319	0.0432	417			11.5	2.76		-0.003	0.00044	0.00141	0.101	-0.0001	-0.0001	0.114	-0.0001	138	-0.0001	0.00023
410	E5 - Tailings Impoundment Main Embank Drain Comp	5/13/2008 10:34	0.0194	0.0362	0.0402	297			2.9	3.2		0.0034	0.00025	0.00171	0.091	-0.0005	-0.0005	0.127	-0.000017	88.8	-0.0005	0.00027
411	E5 - Tailings Impoundment Main Embank Drain Comp	7/15/2008 9:15	0.0011	0.0089	0.079	306			1.49	4.01		0.348	0.00036	0.00233	0.0487	-0.001	-0.001	0.126	-0.0003	72.9	-0.001	0.00025
412	E5 - Tailings Impoundment Main Embank Drain Comp	8/6/2008 9:40	0.01	0.0167	0.0768	291			1.68	4.15		-0.02	-0.002	0.0021	0.0409	-0.01	-0.01	-0.2	-0.00034	67.1	-0.01	-0.002
413	E5 - Tailings Impoundment Main Embank Drain Comp	8/12/2008 12:36	0.0168	0.0332	0.0401	274			2.83	2.78		0.0046	0.00063	0.00164	0.0684	-0.0005	-0.0005	0.128	-0.0005	82.2	-0.0005	0.00026
414	E5 - Tailings Impoundment Main Embank Drain Comp	9/9/2008 8:30	0.0203	0.0338	0.0366	272			1.42	2.71		0.0033	0.00058	0.002	0.0707	-0.0005	-0.0005	0.157	-0.0005	77	-0.0005	0.00029
415	E5 - Tailings Impoundment Main Embank Drain Comp	9/30/2008 11:30	0.0194	0.0345	0.0386	273			1.13	3.06		0.0039	0.00054	0.00187	0.0615	-0.0005	-0.0005	0.14	-0.0005	80.7	-0.0005	0.00028
416	E5 - Tailings Impoundment Main Embank Drain Comp	10/22/2008 11:50	0.0193	0.0303	0.0647	299			3.65	2.75		0.0034	0.00054	0.00198	0.0615	-0.0005	-0.0005	0.148	-0.00007	84.7	-0.0005	0.00023
417	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2008 13:57	0.0019	0.0102	0.0315	267			1.28	3.2		-0.002	0.00033	0.00227	0.0564	-0.001	-0.001	0.147	-0.0006	88.4	-0.001	-0.0002
418	E5 - Tailings Impoundment Main Embank Drain Comp	12/2/2008 11:55	-0.001	0.0105	0.0315	290			2.32	2.79		-0.001	0.0003	0.00219	0.0573	-0.0005	-0.0005	0.117	-0.0003	101	-0.0005	-0.0001
419	E5 - Tailings Impoundment Main Embank Drain Comp	1/14/2009 13:59	0.0213	0.0402	0.0439	283			1.14	2.72		0.0035	0.00029	0.00186	0.0597	-0.0005	-0.0005	0.161	-0.00041	82.3	-0.0005	0.00031
420	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2009 11:39	0.0224	0.0393	0.0404	275			0.66	2.74		0.0077	0.00027	0.00196	0.0738	-0.001	-0.001	0.162	-0.0004	83.1	-0.001	0.00026
421	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2009	0.0226	0.039	0.0424	287			0.68	3.03		0.0046	0.00026	0.00193	0.0689	-0.0005	-0.0005	0.152	-0.00003	85.9	-0.0005	0.00027
422	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2009 13:14	0.0248	0.031	0.0395	335			3.37	2.76		0.0033	0.00023	0.00169	0.0764	-0.001	-0.001	0.152	-0.00051	108	-0.001	0.00025
423	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2009 12:45	0.0231	0.0391	0.0412	313			2.15	2.63		0.0033	0.00021	0.00187	0.0819	-0.0005	-0.0005	0.154	0.000024	96.2	-0.0005	0.00022
424	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2009 9:29	0.0112	0.0354	0.0399	350			4.14	2.55		0.0028	0.00024	0.00159	0.0681	-0.001	-0.001	0.139	0.000065	112	-0.001	0.00026
425	E5 - Tailings Impoundment Main Embank Drain Comp	7/7/2009 10:14	0.0223	0.0336	0.0373	301			1.25	2.63		-0.004	0.00024	0.00182	0.077	-0.001	-0.001	0.144	0.000036	96.3	-0.001	0.00025
426	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2009 10:50	0.0213	0.0347	0.0371	312			0.82	2.89		0.0028	0.00033	0.0019	0.0756	-0.001	-0.001	0.154	0.000083	92.7	-0.001	0.00028
427	E5 - Tailings Impoundment Main Embank Drain Comp	9/2/2009 9:15	0.022	0.0349	0.0381	320			0.78	2.61		0.0027	0.00028	0.00187	0.0708	-0.0005	-0.0005	0.156	-0.0004	93	-0.0005	0.00027
428	E5 - Tailings Impoundment Main Embank Drain Comp	10/6/2009 9:49	0.0231	0.0399	0.0442	308			0.9	2.74		0.0032	0.00028	0.0019	0.0767	-0.001	-0.001	0.151	-0.000034	94.7	-0.001	0.00027
429	E5 - Tailings Impoundment Main Embank Drain Comp	10/29/2009 12:29	0.0213	0.0351	0.0385	306			0.98	2.51		0.004	0.00023	0.00187	0.0724	-0.0005	-0.0005	0.156	-0.0004	90.9	0.00062	0.00026
430	E5 - Tailings

Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
259	West Main Toe Drain	7/3/2014 12:03	0.00163	-0.03	-0.00005	0.00766	19.5	0.343		0.214	-0.0005	16.8	0.00488	6.35	-0.00001	95.2	2.27	-0.00001	-0.0001
261	West Main Toe Drain	9/2/2014 12:03	0.00199	-0.03	-0.00005	0.00693	19.4	0.343		0.19	-0.0005	15.8	0.00544	6.3	-0.00001	89.8	2.11	-0.00001	-0.0001
263	West Main Toe Drain	10/1/2014 14:11	0.00065	-0.03	-0.00005	0.00705	20	0.352		0.184	-0.0005	15.7	0.00444	6.5	-0.00001	95.6	2.04	-0.00001	-0.0001
264	West Main Toe Drain	11/3/2014 11:29	0.00195	-0.03	-0.00005	0.00799	19.4	0.349		0.187	-0.0005	16.5	0.00348	6.17	-0.00001	92.9	1.96	0.000021	-0.0001
265	West Main Toe Drain	12/8/2014 12:25	0.0009	-0.03	-0.00005	0.00813	19.5	0.394		0.169	-0.0005	18	0.0013	6.58	-0.00001	100	2.11	-0.00001	-0.0001
266	West Main Toe Drain	1/13/2015 14:11	0.00188	-0.03	-0.00005	0.00723	19.1	0.342		0.18	-0.0005	16.5	0.00198	6.33	-0.00001	90.5	2.07	-0.00001	-0.0001
267	West Main Toe Drain	2/2/2015 12:06	0.00179	-0.03	-0.00005	0.00777	19.4	0.366		0.188	-0.0005	16.2	0.00179	6.36	-0.00001	95.7	2.07	-0.00001	-0.0001
268	West Main Toe Drain	3/5/2015 9:30	0.00218	-0.03	-0.00005	0.00749	19	0.381		0.189	-0.0005		0.00152	6.42	-0.00001	96.6	2.21	-0.00001	-0.0001
269	West Main Toe Drain	4/9/2015 10:47	0.00279	0.036	-0.00005	0.0063	19.9	0.381		0.196	-0.0005		0.00134	6.8	-0.00001	87.9	2.23	-0.00001	-0.0001
273	Perimeter Toe Drain	7/7/2009 10:45	0.00197	-0.03	-0.0001	0.011	19	0.157		0.158	-0.001	17.6	0.0025	5.1	-0.00002	83.5	3.68	-0.0002	-0.0002
274	Perimeter Toe Drain	8/5/2009 11:42	0.00199	-0.03	-0.0001	0.011	19	0.177		0.15	0.0015	17.8	0.0022	5.1	-0.00002	84.2	3.4	-0.0002	-0.0002
275	Perimeter Toe Drain	9/1/2009 13:30	-0.004	-0.03	-0.0001	0.012	20.1	0.0484		0.157	-0.001	19.2	-0.002	5.38	-0.00002	81.3	3.68	-0.0002	-0.0002
277	Perimeter Toe Drain	5/18/2011 9:29	0.0037	-0.03	-0.0001	0.012	29.3	0.957		0.178	0.001	21.6	0.0029	4.97	-0.00002	92.2	5.98	-0.0002	-0.0002
278	Perimeter Toe Drain	7/13/2011 10:07	0.00408	-0.03	-0.00005	0.0106	26.9	0.88		0.18	0.00069	20	0.00409	5.13	-0.00001	84.5	5.31	-0.00001	-0.0001
279	Perimeter Toe Drain	8/3/2011 9:57	0.00402	-0.03	-0.00005	0.0112	26.9	0.861		0.173	0.00069	20.8	0.00432	5.21	-0.00001	88.7	4.97	-0.00001	-0.0001
283	Perimeter Toe Drain	10/5/2011 13:55	0.0031	-0.03	-0.0001	0.0102	25.7	0.738		0.177	-0.001	19.2	0.0026	5.23	-0.00002	83.1	4.73	-0.00002	-0.0002
285	Perimeter Toe Drain	10/31/2011 13:24	0.00777	-0.03	-0.00005	0.0111	26.1	0.82		0.183	0.00069	21.5	0.0028	5.44	-0.00001	87.2	5.03	-0.00001	-0.0001
286	Perimeter Toe Drain	12/5/2011 12:18	0.00276	-0.03	-0.00005	0.0115	26.4	0.755		0.186	0.00061	21.3	0.00261	5.41	-0.00001	89.2	4.96	-0.00001	-0.0001
287	Perimeter Toe Drain	2/8/2012 11:15	0.00246	-0.03	-0.00005	0.0124	26.4	0.724	-0.00005	0.182	0.00058	20.6	0.0026	5.21	-0.00001	87	4.64	0.000022	-0.0001
288	Perimeter Toe Drain	4/3/2012 13:42	0.00307	-0.03	-0.00005	0.0103	24.4	0.706		0.176	0.00057	18.2	0.00398	5.19	-0.00001	79.3	4.56	-0.00001	-0.0001
289	Perimeter Toe Drain	5/2/2012 9:52	0.00627	0.031	-0.00005	0.00746	18.1	0.545		0.129	0.00091	13	0.00224	4.72	-0.00001	56.6	3.54	-0.00001	-0.0001
293	Perimeter Toe Drain	8/1/2012 11:36	0.00284	-0.03	-0.00005	0.00974	23.1	0.773		0.197	0.00058	17.4	0.00436	5.06	-0.00001	85.3	4.28	-0.00001	-0.0001
297	Perimeter Toe Drain	11/5/2012 10:11	0.00123	-0.03	-0.00005	0.0106	23.4	0.78		0.213	0.00052	17.1	0.00579	5.23	-0.00001	87.6	4.1	-0.00001	-0.0001
299	Perimeter Toe Drain	2/6/2013 9:55																	
301	Perimeter Toe Drain	5/1/2013 13:21																	
305	Perimeter Toe Drain	8/8/2013 11:16	-0.0018	-0.03	-0.00005	0.00923	20.8	0.685		0.229	-0.0005	15.1	0.00695	4.74	-0.00001	83.4	3.64	-0.00001	-0.0001
307	Perimeter Toe Drain	11/5/2013 9:12																	
309	Perimeter Toe Drain	5/28/2014 11:15	0.00261	-0.03	-0.00005	0.00987	21.3	0.616		0.222	0.00052	14.6	0.0113	5.28	-0.00001	83.5	3.27	-0.00001	-0.0001
312	South Toe Drain	5/18/2011 8:19	0.0179	-0.03	-0.00005	0.0063	21.7	0.0781		0.132	0.00057	9.84	0.0185	5.5	-0.00001	62.8	1.36	-0.0001	-0.0001
313	South Toe Drain	7/14/2011 8:42	0.0148	-0.03	-0.00005	0.00595	20.7	0.0969		0.155	-0.0005	10.4	0.0196	6.9	-0.00001	62.8	1.39	0.000014	-0.0001
314	South Toe Drain	8/3/2011 8:06	0.0146	-0.03	-0.00005	0.0083	22.7	0.103		0.175	-0.0005	11	0.0191	7.21	-0.00001	63.1	1.61	0.000015	-0.0001
315	South Toe Drain	8/31/2011 11:13	0.0119	-0.03	-0.00005	0.00858	22.3	0.11		0.168	-0.0005	13.4	0.0171	7.24	-0.00001	73.5	1.71	0.000014	-0.0001
318	South Toe Drain	10/12/2011 10:31	0.0127	-0.03	-0.00005	0.00792	22.7	0.123		0.173	-0.0005	13.4	0.0184	6.62	-0.00001	80.4	1.67	0.000014	-0.0001
320	South Toe Drain	10/31/2011 13:05	0.0101	-0.03	-0.00005	0.00713	21.9	0.0969		0.18	-0.0005	12.4	0.0191	6.53	-0.00001	82.7	1.66	0.000011	-0.0001
321	South Toe Drain	12/5/2011 10:35	0.0109	-0.03	-0.00005	0.00767	21.7	0.124		0.179	-0.0005	13.1	0.0176	5.84	-0.00001	89.4	1.68	0.00001	-0.0001
322	South Toe Drain	2/7/2012 12:05	0.00912	-0.03	-0.00005	0.00726	20.2	0.0836		0.197	-0.0005	13.1	0.02	5.81	-0.00001	91.7	1.52	0.000035	-0.0001
323	South Toe Drain	4/3/2012 13:24	0.00931	-0.03	-0.00005	0.00664	19.2	0.102		0.196	-0.0005	13.1	0.0104	5.58	-0.00001	88.3	1.53	-0.00001	-0.0001
324	South Toe Drain	5/2/2012 10:47	0.0113	-0.03	-0.00005	0.00682	18.2	0.0952		0.183	-0.0005	12	0.0139	5.68	-0.00001	80.5	1.46	-0.00001	-0.0001
328	South Toe Drain	8/1/2012 10:05	0.0119	-0.03	-0.00005	0.00928	19.1	0.127		0.215	-0.0005	14.1	0.0161	7.04	-0.00001	84.2	1.57	0.000011	-0.0001
334	South Toe Drain	11/5/2012 11:17	0.00933	-0.03	-0.00005	0.0101	20.4	0.146		0.19	-0.0005	12.2	0.0181	6.24	-0.00001	80	1.63	-0.00001	-0.0001
336	South Toe Drain	2/6/2013 9:00																	
338	South Toe Drain	5/1/2013 9:02																	
342	South Toe Drain	8/8/2013 9:47	0.0108	-0.03	-0.00005	0.00783	18.5	0.153		0.208	-0.0005	11	0.0208	6.89	-0.00001	75.2	1.32	0.000013	-0.0001
345	South Toe Drain	11/5/2013 10:00																	
348	South Toe Drain	5/28/2014 11:28	0.00877	-0.03	-0.00005	0.00807	18.6	0.144		0.186	-0.0005	8.44	0.0209	5.49	-0.00001	74.8	1.29	-0.00001	-0.0001
351	South Toe Drain	8/5/2014 8:35	0.0107	-0.03	-0.00005	0.0104	19.5	0.159		0.2	-0.0005	9.34	0.0193	6.7	-0.00001	66	1.42	-0.00001	-0.0001
354	South Toe Drain	11/3/2014 11:03	0.00698	-0.03	-0.00005	0.00942	18.1	0.196		0.209	-0.0005	10.3	0.0052	5.81	-0.00001	81.9	1.58	0.000014	-0.0001
365	E5 - Tailings Impoundment Main Embank Drain Comp	7/12/2001 13:15	0.0064	0.094	0.0007	0.0027	27.7	0.174	-0.00005	0.00202	-0.0005	2.99	0.0057	9.05	-0.00001	16.8	1.4	-0.00005	0.00008
367	E5 - Tailings Impoundment Main Embank Drain Comp	7/26/2001 8:50	0.006	0.066	0.00006	0.0027	31.3	0.168	-0.00005	0.00222	-0.0005	4.26	0.0075	8.08	0.00001	21	1.94	-0.00005	0.00039
368	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2001	0.0061	0.063	0.0001	0.0026	28.1	0.114	-0.00005	0.00161	-0.0005	3.52	0.0055	10.6	-0.00001	17.8	1.71	-0.00005	0.00024
369	E5 - Tailings Impoundment Main Embank Drain Comp	8/10/2001 10:05	0.0053	0.06	0.00002	0.0027	35.8	0.0497	-0.00005	0.00191	-0.0005	4.55	0.0087	7.73	-0.00001	20.6	2.21	-0.00005	0.0002
371	E5 - Tailings Impoundment Main Embank Drain Comp	8/30/2001 14:40	0.0045	-0.005	-0.00002	0.0023	24.8	0.0671	-0.00005	0.00266	-0.0005	2.86	0.005	8.24	-0.00001	17	1.05	-0.00005	0.00015
372	E5 - Tailings Impoundment Main Embank Drain Comp	10/24/2001 10:30	0.0041	-0.005	0.00002	0.0021	23.6	0.0923	-0.00005	0.002	-0.0005	4.04	0.0044	8.17	-0.00001	16.4	1.33	-0.00005	0.00009
374	E5 - Tailings Impoundment Main Embank Drain Comp	10/16/2003 18:10	0.0282	-0.005	0.00004	0.0053	8.73	0.0042	-0.00005	0.0746	-0.0005	4	0.0291	5.28	-0.00001	32.8	0.278	-0.00005	0.00016
375	E5 - Tailings Impoundment Main Embank Drain Comp	5/31/2005	0.0003	0.025	-0.00002	0.0032	9.18	0.371		0.147	-0.0005	7.7	0.0012	6.69	-0.00001	60.5	0.594	-0.00005	-0.00005
376	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2005	0.0007	0.042	-0.00002	0.0035	9.32	0.368		0.139	0.0006	7.54	0.0017	6.63	-0.00001	56.6	0.587	-0.00005	-0.00005
377	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2005	0.0003	0.036	-0.00002	0.003	8.33	0.359		0.131	-0.0005	7.01	0.0012	6.74	-0.00001	58.7	0.544	-0.00005	-0.00005
378	E5 - Tailings Impoundment Main Embank Drain Comp	8/11/2005	0.0008	0.063	-0.00002	0.0032	8.28	0.368		0.133	-0.0005	7.85	0.0007	6.67	-0.00001	65.8	0.504	-0.00005	-0.00005
379	E5 - Tailings Impoundment Main Embank Drain Comp	9/14/2005	0.0011	0.033	-0.00002	0.0034	7.48	0.344		0.149	-0.0005	7.38	0.0006	6.83	-0.00001	63.2	0.434	-0.00005	-0.00005
380	E5 - Tailings Impoundment Main Embank Drain Comp	10/11/2005	0.0012	0.052	-0.00002	0.0032	7.93	0.332		0.131	-0.0005	7.16	0.0008	7.14	-0.00001	60.5	0.437	-0.00005	-0.00005
381	E5 - Tailings Impoundment Main Embank Drain Comp	11/8/2005	0.0017	0.01	-0.00002	0.0039	8.67	0.286		0.123	-0.0005	7.67	0.0016	7.24	-0.00001	57	0.451	-0.00005	-0.00005
382	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/2005	0.0011	0.049	0.00002	0.0033	9.24	0.296		0.122	-0.0005	8.59	0.0013	7.71	-0.00001	57.2	0.521	-0.00005	-0.00005
383	E5 - Tailings Impoundment Main Embank Drain Comp	1/17/2006	0.0011	0.006	-0.00002	0.0042	9.62	0.335		0.145	-0.0005	8.59	0.0017	7.28	-0.00001	56.6	0.56	-0.00005	-0.00005
384	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2006	0.0006	0.039	-0.00002	0.0045	9.46	0.327		0.139	0.0006	8.49	0.0017	7.03	-0.00001	59.9	0.569	-0.00005	-0.00005
385	E5 - Tailings Impoundment Main Embank Drain Comp	3/6/2006 13:00	0.0014	-0.005	0.00003	0.0042	9.01	0.34		0.14	-0.0005	8.32	0.0013	6.49	-0.00001	54.5	0.625	-0.00005	-0.00005
386	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2006 9:35	0.0007	0.024	0.00002	0.0042	10.1	0.3		0.128	-0.0005	7.76	0.0019	6.56	-0.00001	59.2	0.588	-0.00005	-0.00005
387	E5 - Tailings Impoundment Main Embank Drain Comp	5/9/2006	0.00097	-0.03	-0.00005	0.005	9.94	0.358		0.133	-0.0005	8.87	0.0019	6.52	-0.00001	58.2	0.615	-0.0001	-0.0001
388	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2006	0.00094	0.042	-0.00005	-0.005	10.3	0.352		0.127	-0.0005	8.58	0.0027	6.25	-0.00001	60.1	0.608	-0.0001	-0.0001
389	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2006	0.00082	-0.03	-0.00005	-0.005	9.34	0.349		0.121	-0.0005	8.59	0.0021	6.17	-0.00001	54.9	0.563	-0.0001	-0.0001
390	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2006	0.00081	-0.03	-0.00005	-0.005	9.41	0.37		0.129	-0.0005	9.5	0.0014	5.89	-0.00001	62.4	0.601	-0.0001	-0.0001
391	E5 - Tailings Impoundment Main Embank Drain Comp	10/12/2006	0.00056	-0.03	-0.00005	-0.005	10.2	0.317		0.121	-0.0005	9.28	0.0017	5.76	-0.00001	56.7	0.572	-0.0001	-0.0001
392	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2006	0.0011	-0.03	-0.00005	0.0053	11.8	0.396		0.124	-0.0005	10.2	0.0039	7.77	-0.00001	68.8	0.904	-0.0001	-0.0001
393	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2006	0.00086	-0.03	-0.00005	0.0055	11.6	0.34		0.122	-0.0005	11.2	0.0039	6.85	-0.00001	63.9	0.77	-0.0001	-0.0001
395	E5 - Tailings Impoundment Main Embank Drain Comp	2/5/2007 10:30	0.0008	-0.03	-0.00005	0.0057	11.4	0.377		0.125	-0.0005	11.7	0.0031	6.16	-0.00001	63.8	0.823	-0.0001	-0.0001
396	E5 - Tailings Impoundment Main Embank Drain Comp	3/5/2007	0.00091	-0.03	0.0001	0.0054	12.2	0.342		0.137	0.00067	12	0.0032	6.95	-0.00001	72.6	0.841	-0.0001	-0.0001
397	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2007 10:59	0.00098	-0.03	-0.00005	-0.005	16.1	0.278		0.145	-0.0005	9.16	0.0116	6.37	-0.00001	53.9	1.04	-0.0001	-0.0001
398	E5 - Tailings Impoundment Main Embank Drain Comp	5/7/2007 9:29	0.0008	-0.03	-0.00005	-0.005	13.1	0.361		0.131	-0.0005	10.5	0.0072	5.61	-0.00001	63.2	1	-0.0001	-0.0001
399	E5 - Tailings Impoundment Main Embank Drain Comp	6/4/2007 10:50	0.00145	-0.03	-0.00005	-0.005	14.2	0.343		0.127	-0.0005	11	0.0088	5.37	-0.00001	66.7	0.904	-0.0001	-0.0001
400	E5 - Tailings Impoundment Main Embank Drain Comp	7/3/2007 11:08	0.00088	-0.03	-0.00005	-0.005	11.9	0.292		0.123	-0.0005	10.1	0.0057	6.24	-0.00001	65.1	0.818	-0.0001	-0.0001
401	E5 - Tailings Impoundment Main Embank Drain Comp	8/2/2007 10:30	0.00124	-0.03	-0.0001	-0.01	13.3	0.355		0.129	-0.001	11.2	0.007	5.95	-0.00002	69.6	0.974	-0.0002	-0.0002
402	E5 - Tailings Impoundment Main Embank Drain Comp	9/5/2007 10:05	0.00103	-0.03	-0.00005	-0.005	11.9	0.423		0.121	-0.0005	11.3	0.0038	6.07	-0.00001	66.1	0.909	-0.0001	-0.0001
403	E5 - Tailings Impoundment Main Embank Drain Comp	10/2/2007 15:15	0.00079	-0.03	-0.00005	-0.005	16.9	0.298		0.136	-0.0005	9.09	0.0114	6.54	-0.00001	54	1.19	-0.0001	-0.0001
404	E5 - Tailings Impoundment Main Embank Drain Comp	11/5/2007 10:45	0.00116	-0.03	-0.0001	-0.01	16.3	0.377		0.13	-0.001	11	0.0098	6.53	-0.00002	64	1.19	-0.0002	-0.0002
405	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2007 14:12	0.00456	-0.03	-0.0001	-0.01	19.9	0.239		0.103	-0.001	8.92	0.0162	6.88	-0.00002	49.6	1.22	-0.0002	-0.0002
406	E5 - Tailings Impoundment Main Embank Drain Comp	1/15/2008 14:33	0.00147	-0.03	-0.0001	-0.01	14.3	0.384		0.121	-0.001	13.2	0.0041	6.74	-0.00002	71.6	1.1	-0.0002	-0.0002
407	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2008 10:09	0.00117	-0.03	-0.00005	0.0051	14.2	0.327		0.111	-0.0005	12.4	0.003	6.24	-0.00001	77.5	0.863	-0.0001	-0.0001
408	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2008 10:09	0.0023	-0.03	-0.00005	0.0051	14.3	0.328		0.121	-0.0005	13.2	0.0026	6.58	-0.00001	66.8	0.886	-0.0001	-0.0001
409	E5 - Tailings Impoundment Main Embank Drain Comp	4/16/2008 9:45	0.00365	-0.03	-0.0001	-0.01	21.2	0.326		0.156	-0.001	10.4	0.0163	6.34	-0.00002	63	1.46	-0.0002	-0.0002
410	E5 - Tailings Impoundment Main Embank Drain Comp	5/13/2008 10:34	-0.0008	-0.03	-0.00005	0.0053	14.6	0.385		0.14	-0.0005	12	0.0041	6.1	-0.00001	75	1.2	-0.0001	-0.0001
411	E5 - Tailings Impoundment Main Embank Drain Comp	7/15/2008 9:15	0.00356	0.405	0.00027	-0.01	17.5	0.0682		0.137	-0.001	9.26	0.0084	4.81	-0.00002	63.4	0.982	-0.0002	-0.0002
412	E5 - Tailings Impoundment Main Embank Drain Comp	8/6/2008 9:40	-0.002	-0.03	-0.001	-0.1	16	0.0024		0.122	-0.01	10.2	-0.02	2.9	-0.0002	60.4	0.841	-0.002	-0.002
413	E5 - Tailings Impoundment Main Embank Drain Comp	8/12/2008 12:36	0.00952	-0.03	-0.00005	0.0053	13.6	0.357		0.145	-0.0005	12	0.0045	6.3	-0.00001	76.3	0.97	-0.0001	-0.0001
414	E5 - Tailings Impoundment Main Embank Drain Comp	9/9/2008 8:30	0.00104	-0.03	-0.00005	0.0056	12.6	0.31		0.144	-0.0005	12.8	0.0047	6.35	-0.00001	71.7	0.921	-0.0001	-0.0001
415	E5 - Tailings Impoundment Main Embank Drain Comp	9/30/2008 11:30	0.00135	-0.03	-0.00005	0.0057	12.8	0.276		0.146	-0.0005	13.6	0.004	6.44	-0.00001	77.1	0.818	-0.0001	-0.0001
416	E5 - Tailings Impoundment Main Embank Drain Comp	10/22/2008 11:50	0.00224	-0.03	-0.00005	0.0063	14	0.348		0.152	-0.0005	13.2	0.0041	6.55	-0.00001	74.9	0.984	-0.0001	-0.0001
417	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2008 13:57	0.00086	-0.03	-0.0001	-0.01	15.3	0.144		0.133	0.00011	10.9	0.0039	5.32	-0.00002	68.7	1.01	-0.0002	-0.0002
418	E5 - Tailings Impoundment Main Embank Drain Comp	12/2/2008 11:55	0.00094	-0.03	-0.00005	-0.005	16.7	0.244		0.138	-0.0005	9.64	0.0047	6.38	-0.00001	58.5	1.09	-0.0001	-0.0001
419	E5 - Tailings Impoundment Main Embank Drain Comp	1/14/2009 13:59	0.00015	-0.03	-0.00005	0.0055	13.2	0.34		0.133	-0.0005	14.8	0.0022	6.51	-0.00001	80	0.885	-0.0001	-0.0001
420	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2009 11:39	0.00073	-0.03	-0.0001	-0.01	13	0.377		0.131	-0.001	13.2	-0.002	6.53	-0.00002	77.2	1.12	-0.0002	-0.0002
421	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2009	-0.0005	-0.03	-0.00005	0.0056	13.3	0.332		0.139	-0.0005	13.1	0.0018	6.74	-0.00001	74.3	0.936	-0.0001	-0.0001
422	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2009 13:14	0.00065	-0.03	-0.0001	-0.01	15.9	0.298		0.166	-0.001	13.1	0.0079	6.3	-0.00002	71.5	1.19	-0.0002	-0.0002
423	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2009 12:45	-0.003	-0.03	-0.00005	0.0053	14.8	0.349		0.139	-0.0005	12.2	0.0046	6.36	-0.00001	67.5	1.25	-0.0001	-0.0001
424	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2009 9:29	0.00095	-0.03	-0.0001	-0.01	17.6	0.331		0.136	0.0011	12.4	0.0079	6.54	-0.00002	69.6	1.2	-0.0002	-0.0002
425	E5 - Tailings Impoundment Main Embank Drain Comp	7/7/2009 10:14	0.00109	-0.03	-0.0001	-0.01	14.7	0.397		0.14	-0.001	13.5	0.0044	6.51	-0.00002	75.9	1.31	-0.0002	-0.0002
426	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2009 10:50	0.00096	-0.03	-0.0001	-0.01	14.3	0.363		0.136	-0.001	13.3	0.0038	6.37	-0.00002	78.1	1.18	-0.0002	-0.0002
427	E5 - Tailings Impoundment Main Embank Drain Comp	9/2/2009 9:15	-0.003	-0.03	-0.00005	-0.005	14	0.362		0.131	-0.0005	13.3	0.0032	6.3	-0.00001	76.7	1.13	-0.0001	-0.0001
428	E5 - Tailings Impoundment Main Embank Drain Comp	10/6/2009 9:49	0.0011	-0.03	-0.0001	-0.01	14.5	0.372		0.136	-0.001	13.5	0.003	6.46	-0.00002	76.8	1.16	-0.0002	-0.0002
429	E5 - Tailings Impoundment Main Embank Drain Comp	10/29/2009 12:29	0.00101	-0.03	-0.00005	0.0051	14.3	0.357		0.14	-0.0005	13	0.0029	6.16	-0.00001	74.7	1.18	-0.0001	-0.0001
430	E5 - Tailings Impoundment Main Embank Drain Comp	11/19/2009 9:26	0.00125	-0.03	-0.0001	-0.01	15.7	0.349		0.15	-0.001	13.5	0.004	6.53	-0.00002	74.6	1.22	-0.0002	-0.0002

Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
259	West Main Toe Drain	7/3/2014 12:03	0.013	0.000806	-0.001	-0.003	0.0044	0.00034	0.00192	0.0682	-0.0001	-0.0005	0.156	-0.0002	118	-0.0005	0.00041	0.00257	-0.03	-0.00005	0.00765	19.4
261	West Main Toe Drain	9/2/2014 12:03	0.013	0.000828	-0.001	-0.003	0.0036	0.00038	0.0021	0.0601	-0.0001	-0.0005	0.145	0.000049	120	-0.0005	0.00037	0.00288	-0.03	-0.00005	0.00714	19.8
263	West Main Toe Drain	10/1/2014 14:11	0.017	0.0008	-0.001	-0.003	0.0032	0.00037	0.00195	0.0586	-0.0001	-0.0005	0.146	-0.00005	118	-0.0005	0.00037	0.00282	-0.03	-0.00005	0.00711	19.4
264	West Main Toe Drain	11/3/2014 11:29	-0.01	0.000823	-0.001	-0.003	0.0036	0.00038	0.00204	0.0606	-0.0001	-0.0005	0.14	0.000042	118	-0.0005	0.00038	0.00274	-0.03	-0.00005	0.00812	20.1
265	West Main Toe Drain	12/8/2014 12:25	-0.01	0.000793	-0.001	-0.003	0.0039	0.00023	0.0019	0.0728	-0.0001	-0.0005	0.154	0.000052	111	-0.0005	0.00053	0.00154	0.032	-0.00005	0.00835	19
266	West Main Toe Drain	1/13/2015 14:11	0.012	0.000833	-0.001	-0.003	0.0035	0.00033	0.0022	0.0596	-0.0001	-0.0005	0.154	0.000061	118	-0.0005	0.0004	0.00253	-0.03	-0.00005	0.00741	19.5
267	West Main Toe Drain	2/2/2015 12:06	-0.01	0.000812	-0.001	-0.003	0.0032	0.00041	0.00207	0.0593	-0.0001	-0.0005	0.158	0.000056	115	-0.0005	0.00039	0.00239	-0.03	-0.00005	0.00763	19.8
268	West Main Toe Drain	3/5/2015 9:30	-0.01	0.000854	-0.001	-0.003	-0.003	0.0003	0.002	0.0601	-0.0001	-0.0005	0.15	0.000062	117	-0.0005	0.00041	0.00181	-0.03	-0.00005	0.00742	18.6
269	West Main Toe Drain	4/9/2015 10:47	0.013	0.000866	0.00077	-0.003	-0.003	0.0003	0.00197	0.0626	-0.0001	-0.00005	0.141	0.000124	123	-0.0005	0.00042	0.00191	-0.03	-0.00005	0.0066	19.8
273	Perimeter Toe Drain	7/7/2009 10:45	0.011	0.00263	-0.002	-0.002	0.0938	0.00062	0.00135	0.042	-0.001	-0.001	0.158	0.000076	115	-0.001	0.00037	0.00384	0.12	0.00014	0.011	18.8
274	Perimeter Toe Drain	8/5/2009 11:42	0.01	0.00243	-0.002	-0.002	0.143	0.00071	0.00146	0.0423	-0.001	-0.001	0.181	-0.00051	117	-0.001	0.00036	0.00407	0.185	-0.0002	0.011	18.5
275	Perimeter Toe Drain	9/1/2009 13:30	-0.01	0.00244	-0.002	-0.002	0.555	0.00071	0.00157	0.0437	-0.001	-0.001	0.192	-0.0006	122	-0.001	0.00045	0.00835	0.337	0.00033	0.012	19.7
277	Perimeter Toe Drain	5/18/2011 9:29	-0.01	0.00222	-0.002	-0.006	0.0156	0.0006	0.00154	0.0436	-0.001	-0.001	0.142	0.00014	199	-0.001	0.00108	0.0047	-0.03	-0.0001	0.011	30.1
278	Perimeter Toe Drain	7/13/2011 10:07	-0.01	0.00198	-0.002	-0.003	0.0053	0.00063	0.00138	0.044	-0.0001	-0.0005	0.131	-0.00011	198	-0.0005	0.00095	0.00478	-0.03	-0.0005	0.0118	27.4
279	Perimeter Toe Drain	8/3/2011 9:57	-0.01	0.00184	-0.001	-0.003	0.0059	0.00061	0.00138	0.0417	-0.0001	-0.0005	0.138	-0.00012	186	-0.0005	0.00092	0.00468	-0.03	-0.00005	0.0117	27.4
283	Perimeter Toe Drain	10/5/2011 13:55	-0.01	0.00195	-0.002	-0.006	0.0278	0.00059	0.0014	0.0392	-0.0002	-0.001	0.14	-0.00012	181	-0.001	0.00076	0.0053	0.03	-0.0001	0.0101	25.6
285	Perimeter Toe Drain	10/31/2011 13:24	-0.01	0.00195	-0.001	0.0032	0.0091	0.00073	0.00149	0.0423	-0.0001	-0.0005	0.151	-0.00015	190	-0.0005	0.00088	0.00671	-0.03	-0.00005	0.0116	26.9
286	Perimeter Toe Drain	12/5/2011 12:18	-0.01	0.00192	-0.001	-0.003	0.0101	0.00065	0.00131	0.0399	-0.0001	-0.0005	0.139	-0.0002	177	-0.0005	0.00072	0.00361	-0.03	-0.00005	0.011	25.9
287	Perimeter Toe Drain	2/8/2012 11:15	-0.01	0.00171	-0.001	-0.003	0.0192	0.00064	0.00148	0.0411	-0.0001	-0.0005	0.145	-0.00012	176	-0.0005	0.00068	0.00395	-0.03	-0.00005	0.012	26.7
288	Perimeter Toe Drain	4/3/2012 13:42	0.013	0.0017	-0.001	-0.003	0.106	0.00062	0.00145	0.0406	-0.0001	-0.0005	0.137	-0.0002	168	-0.0005	0.0007	0.00601	0.105	0.000061	0.0104	24.3
289	Perimeter Toe Drain	5/2/2012 9:52	-0.01	0.00123	-0.001	-0.003	0.183	0.00051	0.00127	0.0334	-0.0001	-0.0005	0.114	-0.00002	152	-0.0005	0.00063	0.0107	0.143	0.00052	0.00824	19.1
293	Perimeter Toe Drain	8/1/2012 11:36	-0.01	0.00146	-0.001	-0.003	0.0502	0.0008	0.00182	0.0457	-0.0001	-0.0005	0.154	-0.00015	187	-0.0005	0.00087	0.00586	0.053	-0.0001	0.0115	26.3
297	Perimeter Toe Drain	11/5/2012 10:11	0.01	0.00167	-0.001	-0.003	0.0136	0.00074	0.00151	0.0355	-0.0001	-0.0005	0.15	-0.00011	163	-0.0005	0.00064	0.00337	-0.03	-0.00005	0.0105	23.5
299	Perimeter Toe Drain	2/6/2013 9:55					0.012	0.00058	0.00139	0.0318	-0.0001	-0.0005	0.125	-0.0001	173	-0.0005	0.00013	0.00197	-0.03	-0.00005	0.00935	23.7
301	Perimeter Toe Drain	5/1/2013 13:21					0.0064	0.00065	0.00175	0.0371	-0.0001	-0.0005	0.122	-0.0002	161	-0.0005	0.0006	0.00276	-0.03	-0.00005	0.00936	22.6
305	Perimeter Toe Drain	8/8/2013 11:16	-0.01	0.00134	-0.001	-0.003	0.0075	0.00063	0.00175	0.0342	-0.0001	-0.0005	0.109	-0.00011	149	-0.0005	0.00054	0.00263	-0.03	-0.00005	0.00834	21
307	Perimeter Toe Drain	11/5/2013 9:12					0.008	0.00068	0.00194	0.0363	-0.0001	-0.0005	0.122	-0.00015	155	-0.0005	0.00053	0.00294	-0.03	-0.00005	0.00979	21.6
309	Perimeter Toe Drain	5/28/2014 11:15	-0.01	0.00148	0.0011	-0.003	0.0241	0.00065	0.00225	0.0361	-0.0001	-0.0005	0.125	-0.00015	158	-0.0005	0.00432	-0.03	-0.0005	0.00068	0.00982	21
312	South Toe Drain	5/18/2011 8:19	-0.01	0.000925	0.0011	-0.003	0.0123	0.00105	0.00167	0.0269	-0.0005	-0.0005	0.058	0.000202	174	-0.0005	0.00018	0.0207	-0.03	-0.00005	0.0055	22.4
313	South Toe Drain	7/14/2011 8:42	-0.01	0.00106	0.0017	-0.003	0.0085	0.00139	0.00191	0.0299	-0.0001	-0.0005	0.092	-0.00018	171	-0.0005	0.00016	0.0156	-0.03	-0.00005	0.00629	20.7
314	South Toe Drain	8/3/2011 8:06	-0.01	0.00123	0.0017	-0.003	0.0177	0.00119	0.00164	0.0325	-0.0001	-0.0005	0.112	-0.0002	182	-0.0005	0.00013	0.0158	-0.03	-0.00005	0.00931	22.8
315	South Toe Drain	8/31/2011 11:13	-0.01	0.00111	0.002	-0.003	0.008	0.00114	0.0017	0.033	-0.0001	-0.0005	0.125	-0.0002	182	-0.0005	0.00013	0.0131	-0.03	-0.00005	0.00888	22.4
318	South Toe Drain	10/12/2011 10:31	-0.01	0.00119	0.002	-0.003	0.0059	0.00092	0.00178	0.0354	-0.0001	-0.0005	0.105	-0.00025	189	-0.0005	0.0002	0.0132	-0.03	-0.00005	0.00702	22.7
320	South Toe Drain	10/31/2011 13:05	-0.01	0.00103	0.0017	-0.003	0.0043	0.00093	0.00163	0.0336	-0.0001	-0.0005	0.119	-0.0002	192	-0.0005	0.00015	0.0112	-0.03	-0.00005	0.00751	22.7
321	South Toe Drain	12/5/2011 10:35	-0.01	0.00111	0.0014	-0.003	0.0247	0.00084	0.0014	0.0299	-0.0001	-0.0005	0.115	0.000182	184	-0.0005	0.00019	0.0125	-0.03	-0.00005	0.00816	21.1
322	South Toe Drain	2/7/2012 12:05	0.01	0.000825	0.0013	-0.003	0.0062	0.001	0.00179	0.0294	-0.0003	-0.0005	0.123	-0.00022	181	-0.0005	0.00016	0.0101	-0.03	-0.00005	0.00737	21.5
323	South Toe Drain	4/3/2012 13:24	0.013	0.000745	0.0014	-0.003	0.0094	0.00097	0.00162	0.0282	-0.0001	-0.0005	0.111	-0.0003	171	-0.0005	0.00018	0.0103	-0.03	-0.00005	0.00663	19.5
324	South Toe Drain	5/2/2012 10:47	-0.01	0.000873	0.0016	-0.003	0.0127	0.00095	0.00184	0.0256	-0.0001	-0.0005	0.112	-0.00035	167	-0.0005	0.00018	0.0131	-0.03	-0.00005	0.00724	18.6
328	South Toe Drain	8/1/2012 10:05	-0.01	0.00107	0.0023	-0.003	0.01	0.00133	0.00197	0.0316	-0.0001	-0.0005	0.129	-0.0003	167	-0.0005	0.00015	0.0133	-0.03	-0.00005	0.00965	19.4
334	South Toe Drain	11/5/2012 11:17	-0.01	0.000983	0.0019	-0.003	0.0053	0.0011	0.00169	0.032	-0.0001	-0.0005	0.118	-0.00017	170	-0.0005	0.00024	0.0103	-0.03	-0.00005	0.00999	20.6
336	South Toe Drain	2/6/2013 9:00					0.0045	0.00109	0.00163	0.0333	-0.0001	-0.0005	0.129	-0.0002	177	-0.0005	0.0004	0.0116	-0.03	-0.00005	0.0105	21.2
338	South Toe Drain	5/1/2013 9:02					0.0083	0.00108	0.00176	0.0286	-0.0001	-0.0005	0.11	-0.00025	170	-0.0005	0.00037	0.011	-0.03	-0.00005	0.0085	21.1
342	South Toe Drain	8/8/2013 9:47	-0.01	0.00102	0.0027	-0.003	0.0048	0.00142	0.00195	0.0293	-0.0001	-0.0005	0.112	-0.00021	150	-0.0005	0.00024	0.012	-0.03	-0.00005	0.00964	18.6
345	South Toe Drain	11/5/2013 10:00					0.0042	0.00125	0.00205	0.0312	-0.0001	-0.0005	0.097	-0.00025	163	-0.0005	0.00023	0.0101	-0.03	-0.00005	0.00974	20.2
348	South Toe Drain	5/28/2014 11:28	0.015	0.0012	0.0015	-0.003	0.0038	0.00102	0.0017	0.0233	-0.0001	-0.0005	0.106	-0.0002	147	-0.0005	0.00022	0.01	-0.03	-0.00005	0.00788	18.1
351	South Toe Drain	8/5/2014 8:35	0.015	0.00153	0.0021	-0.003	0.0042	0.00135	0.00182	0.0278	-0.0001	-0.0005	0.126	0.000137	147	-0.0005	0.00022	0.0116	-0.03	-0.00005	0.0105	19.6
354	South Toe Drain	11/3/2014 11:03	-0.01	0.00111	0.0019	-0.003	0.0041	0.00095	0.00205	0.0276	-0.0001	-0.0005	0.115	0.000127	158	-0.0005	0.00023	0.00812	-0.03	-0.00005	0.00987	18.3
365	E5 - Tailings Impoundment Main Embank Drain Comp	7/12/2001 13:15	0.00185	0.00124	0.00089	0.0053	0.0061	-0.00005	0.0007	0.124	-0.00005	-0.00005		0.00004	176	0.0057	0.00186	0.0064	0.094	0.00008	0.0027	29.2
367	E5 - Tailings Impoundment Main Embank Drain Comp	7/26/2001 8:50	0.00371	0.00097	0.00055	0.0041	0.018	0.00021	0.0009	0.218	-0.00005	0.00092		0.00005	203	0.0009	0.0011	0.0063	0.081	0.00016	0.0026	31.8
368	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2001	0.00307	0.00097	0.00054	0.0029	0.0104	0.00017	0.0007	0.169	-0.00005	0.00014		0.00002	183	0.0008	0.00109	0.0056	0.073	0.00003	0.0025	27.6
369	E5 - Tailings Impoundment Main Embank Drain Comp	8/10/2001 10:05	0.00456	0.00157	0.00063	0.003	0.0095	0.00012	0.0009	0.144	-0.00005	-0.00005		0.00002	210	0.0006	0.00142	0.0075	0.075	0.00002	0.0027	29.3
371	E5 - Tailings Impoundment Main Embank Drain Comp	8/30/2001 14:40	0.00281	0.00137	0.00085	0.0021	0.0148	0.00017	0.001	0.115	-0.00005	-0.00005		0.00002	140	-0.0002	0.00084	0.0046	0.011	-0.00002	0.0022	22.5
372	E5 - Tailings Impoundment Main Embank Drain Comp	10/24/2001 10:30	0.00301	0.00084	0.00059	0.0016	0.0218	0.00019	0.0006	0.151	-0.00005	0.00033		0.00002	159	0.0009	0.00065	0.0051	0.098	0.00004	0.0022	24.4
374	E5 - Tailings Impoundment Main Embank Drain Comp	10/16/2003 18:10	0.00229	0.00121	0.00339	-0.0005	0.0194	0.00214	0.0032	0.0496	-0.00005	-0.00005		0.00017	50.2	0.0008	-0.00002	0.0338	0.029	0.00009	0.0057	9
375	E5 - Tailings Impoundment Main Embank Drain Comp	5/31/2005	-0.0005	0.00137	0.00062	-0.0005	0.0092	0.00016	0.0018	0.0754	-0.00005	-0.00005	0.107	0.00034	60.3	0.0007	0.00035	0.0017	0.073	0.0002	0.0041	9.28
376	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2005	0.001	0.00139	0.00059	-0.0005	0.0131	0.00016	0.0019	0.0822	-0.00005	-0.00005	0.092	0.00028	59	0.0002	0.00034	0.0022	0.081	-0.00002	0.0035	9.12
377	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2005	-0.0005	0.00137	0.00058	-0.0005	0.0145	0.00018	0.002	0.0861	-0.00005	-0.00005	0.1	0.00023	52.5	-0.0002	0.00044	0.0031	0.101	0.00002	0.0031	8.19
378	E5 - Tailings Impoundment Main Embank Drain Comp	8/11/2005	-0.0005	0.00136	0.00049	-0.0005	0.0406	0.00016	0.0021	0.0797	-0.00005	-0.00005	0.106	0.00019	53.3	0.0002	0.00044	0.0098	0.115	0.00014	0.0042	8.43
379	E5 - Tailings Impoundment Main Embank Drain Comp	9/14/2005	-0.0005	0.00127	0.00071	0.0007	0.0241	0.00017	0.0023	0.0858	-0.00005	-0.00005	0.113	0.00026	48.8	-0.0002	0.00034	0.0061	0.169	0.00008	0.0036	7.99
380	E5 - Tailings Impoundment Main Embank Drain Comp	10/11/2005	-0.0005	0.00138	0.00056	-0.0005	0.0207	0.00017	0.002	0.0774	-0.00005	-0.00005	0.109	0.00024	47.9	-0.0002	0.00031	0.0025	0.117	0.00003	0.0033	7.69
381	E5 - Tailings Impoundment Main Embank Drain Comp	11/8/2005	-0.0005	0.00184	0.0009	0.0011	0.0117	0.00028	0.0024	0.0803	-0.00005	-0.00005	0.11	0.00034	53.1	-0.0002	0.00037	0.0031	0.058	-0.00002	0.0038	8.52
382	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/2005	0.0006	0.00208	0.0012	0.0005	0.0132	0.00035	0.0025	0.0864	-0.00005	-0.00005	0.111	0.00028	56.7	-0.0002	0.00042	0.0055	0.077	0.0001	0.0036	9.45
383	E5 - Tailings Impoundment Main Embank Drain Comp	1/17/2006	-0.0005	0.00242	0.00086	0.0012	0.0102	0.00038	0.0023	0.0865	-0.00005	-0.00005	0.112	0.0003	60.1	-0.0002	0.00036	0.0035	0.054	0.00005	0.0043	9.76
384	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2006	0.0012	0.00219	0.00104	0.0006	0.0084	0.00037	0.0023	0.0867	-0.00005	-0.00005	0.108	0.00042	55.4	0.0005	0.00046	0.0027	0.043	-0.00002	0.0045	9.26
385	E5 - Tailings Impoundment Main Embank Drain Comp	3/6/2006 13:00	0.0007	0.00195	0.00094	-0.0005	0.0081	0.00035	0.0024	0.086	-0.00005	-0.00005	0.115	0.00034	56.1	-0.0002	0.00036	0.0027	0.061	0.00004	0.0048	9.5
386	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2006 9:35	0.0013	0.00195	0.00095	0.0005	0.0363	0.0004	0.0021	0.0947	-0.00005	-0.00005	0.112	0.00032	59.5	0.0006	0.0004	0.0085	0.085	0.00006	0.0043	9.86
387	E5 - Tailings Impoundment Main Embank Drain Comp	5/9/2006	-0.01	0.00189	-0.001	-0.001	0.0063	0.00042	0.00239	0.0819	-0.0005	-0.0005	0.104	-0.00005	55.1	0.00064	0.00034	0.00276	0.038	-0.00005	-0.005	10.1
388	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2006	-0.01	0.00146	-0.001	0.001	0.0069	0.00044	0.00235	0.0858	-0.0005	-0.0005	0.118	0.000067	58.4	-0.0005	0.00036	0.00176	0.05	-0.00005	-0.005	10.6
389	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2006	-0.01	0.00149	-0.001	-0.001	0.0064	0.00053	0.00242	0.0844	-0.0005	-0.0005	0.114	-0.00005	49.1	-0.002	0.00033	0.00234	0.059	-0.00005	-0.005	9.38
390	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2006	-0.01	0.00151	-0.001	-0.001	0.0061	0.00049	0.00235	0.0843	-0.0005	-0.0005	0.142	-0.00005	46.8	-0.0005	0.00035	0.00183	0.074	-0.00005	0.0052	9.38
391	E5 - Tailings Impoundment Main Embank Drain Comp	10/12/2006	-0.01	0.00158	-0.001	-0.001	0.0583	0.00034	0.00233	0.0852	-0.0005	-0.0005	0.114	0.000462	56.6	-0.0005	0.00033	0.00154	0.064	-0.00005	-0.005	10.2
392	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2006	-0.01	0.0019	-0.001	-0.001	0.0114	0.00055	0.00229	0.107	-0.0005	-0.0005	0.128	-0.00005	64.8	-0.0005	0.00033	0.00222	0.075	-0.00005	0.0054	11.6
393	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2006	-0.01	0.00207	-0.001	0.0021	0.0052	0.00061	0.00239	0.0919	-0.0005	-0.0005	0.126	-0.00005	61.8	-0.0005	0.00039	0.00218	0.061	-0.00005	0.0057	11.7
395	E5 - Tailings Impoundment Main Embank Drain Comp	2/5/2007 10:30	-0.01	0.00201	-0.001	-0.001	0.0046	0.00054	0.00226	0.0933	-0.0005	-0.0005	0.136	-0.00004	68.5	-0.0005	0.00038	0.00217	0.047	-0.00005	0.0057	12
396	E5 - Tailings Impoundment Main Embank Drain Comp	3/5/2007	-0.01	0.00186	-0.001	0.0015	0.0058	0.00039	0.00248	0.0858	-0.0005	-0.0005	0.138	0.000055	66.9	-0.0005	0.00039	0.00256	0.073	-0.00005	0.0053	12.2
397	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2007 10:59	-0.01	0.00173	-0.001	0.0011	0.0061	0.0003	0.00174	0.0906	-0.0005	-0.0005	0.115	0.000069	97.5	-0.0005	0.00028	0.00356	0.052	-0.00005	-0.005	16
398	E5 - Tailings Impoundment Main Embank Drain Comp	5/7/2007 9:29	-0.01	0.00162	-0.001	-0.001	0.005	0.00032	0.00196	0.092	-0.0005	-0.0005	0.135	-0.00005	78.5	-0.0005	0.00034	0.00175	0.052	-0.00005	-0.005	13.3
399	E5 - Tailings Impoundment Main Embank Drain Comp	6/4/2007 10:50	-0.01	0.00175	-0.001	-0.001	0.0085	0.00032	0.00199	0.0864	-0.0005	-0.0005	0.125	0.00004	84.7	-0.0005	0.00034	0.00279	0.064	-0.00005	0.0052	14.7
400	E5 - Tailings Impoundment Main Embank Drain Comp	7/3/2007 11:08	-0.01	0.00145	-0.001	-0.001	0.0194	0.00027	0.00204	0.0819	-0.0005	-0.0005	0.109	-0.000019	69.8	-0.0005	0.00028	0.00185	0.062	-0.00005	-0.005	11.9
401	E5 - Tailings Impoundment Main Embank Drain Comp	8/2/2007 10:30	-0.01	0.00162	-0.002	-0.002	0.0105	0.00027	0.00188	0.088	-0.001	-0.001	0.135	0.000122	77.9	-0.001	0.00035	0.00177	0.053	-0.0001	-0.01	13.4
402	E5 - Tailings Impoundment Main Embank Drain Comp	9/5/2007 10:05	-0.01	0.00172	-0.001	0.0011	0.0068	0.00028	0.00195	0.0832	-0.0005	-0.0005	0.119	-0.0004	74.5	-0.0005	0.00034	0.00171	0.053	-0.00005	0.0051	12
403	E5 - Tailings Impoundment Main Embank Drain Comp	10/2/2007 15:15	-0.01	0.00153	-0.001	-0.001	0.0111	0.00024	0.0016	0.0916	-0.0005	-0.0005	0.102	0.000102	97.1	-0.0005	0.00026	0.00319	0.053	0.000166	-0.005	16.9
404	E5 - Tailings Impoundment Main Embank Drain Comp	11/5/2007 10:45	-0.01	0.00196	-0.002	-0.002	0.0057	0.00024	0.00196	0.0943	-0.001	-0.001	0.13	0.000058	106	-0.001	0.00032	0.00269	0.058	-0.0001	-0.01	16.7
405	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2007 14:12	-0.01	0.00202	-0.002	-0.002	0.004	0.00047	0.00155	0.0836	-0.001	-0.001	0.107	-0.000034	135	-0.001	0.00023	0.0102	0.05	-0.0001	-0.01	20.1
406	E5 - Tailings Impoundment Main Embank Drain Comp	1/15/2008 14:33	-0.01	0.00226	-0.002	-0.002	0.016	0.00053	0.00197	0.0841	-0.001	-0.001	0.137	-0.0006	82.2	-0.001	0.00038	0.00269	0.05	-0.0001	-0.01	14
407	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2008 10:09	-0.01	0.00203	-0.001	-0.001	0.0029	0.00049	0.00186	0.0738	-0.0005	-0.0005	0.113	-0.0004	78.4	-0.0005	0.00033	0.00185	0.036	-0.00005	0.0051	14.2
408	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2008 10:09	-0.01	0.00191	-0.001	-0.001	0.0141	0.00048	0.00195	0.0723	-0.0005	-0.0005	0.12	-0.00005	83.1	-0.0005	0.00037	0.00425	0.046	0.000051	0.0051	14.7
409	E5 - Tailings Impoundment Main Embank Drain Comp	4/16/2008 9:45	-0.01	0.00174	-0.001	-0.002	0.0379	0.0006	0.00148	0.103	-0.001	-0.001	0.119	-0.00015	135	-0.001	0.00025	0.0494	0.111	0.00015	-0.01	20.8
410	E5 - Tailings Impoundment Main Embank Drain Comp	5/13/2008 10:34	-0.01	0.0014	-0.001	-0.001	0.0047	0.00025	0.00194	0.0908	-0.0005	-0.0005	0.122	-0.000017	88.1	-0.0005	0.00027	-0.002	0.043	-0.00005	-0.005	14.5
411	E5 - Tailings Impoundment Main Embank Drain Comp	7/15/2008 9:15	-0.01	0.00102	-0.002	-0.002	0.613	0.00038	0.00247	0.0534	-0.001	-0.001	0.136	-0.0003	66.5	0.0014	0.00034	0.00617	0.791	0.00027	-0.01	16.3
412	E5 - Tailings Impoundment Main Embank Drain Comp	8/6/2008 9:40	-0.01	0.00121	-0.02	-0.02	0.208	-0.002	0.0022	0.044	-0.01	-0.01	-0.2	-0.00034	65.2	-0.01	-0.002	0.0029	0.297	-0.001	-0.1	15.7
413	E5 - Tailings Impoundment Main Embank Drain Comp	8/12/2008 12:36	-0.01	0.00135	-0.001	-0.001	0.0072	0.00068	0.0018	0.0703	-0.0005	-0.0005	0.125	-0.0005	83.2	-0.0005	0.00027	0.0122	0.078	-0.00005	0.0052	13.5
414	E5 - Tailings Impoundment Main Embank Drain Comp	9/9/2008 8:30	-0.01	0.00136	0.0011	-0.001	0.0047	0.00056	0.00215	0.07	-0.0005	-0.0005	0.154	-0.0005	78.1	-0.002	0.00028	0.00195	0.033	-0.00005	0.0058	12.8
415	E5 - Tailings Impoundment Main Embank Drain Comp	9/30/2008 11:30	-0.01	0.00134	-0.001	-0.001	0.0043	0.00054	0.00212	0.0602	-0.0005	-0.0005	0.138	-0.0005	84.3	-0.0005	0.00028	0.00212	0.042	-0.00005	0.0055	13
416	E5 - Tailings Impoundment Main Embank Drain Comp	10/22/2008 11:50	-0.01

Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
259	West Main Toe Drain	7/3/2014 12:03	0.347		0.212	-0.0005		0.00487	6.35	-0.00001	96.3	2.29	-0.00001	-0.0001	0.013	0.000802	-0.001	-0.003
261	West Main Toe Drain	9/2/2014 12:03	0.36		0.194	-0.0005		0.00557	6.41	-0.00001	92.6	2.15	-0.00001	-0.0001	0.013	0.000847	-0.001	-0.003
263	West Main Toe Drain	10/1/2014 14:11	0.35		0.19	-0.0005		0.00444	6.38	-0.00001	94.3	2.04	-0.00001	-0.0001	0.017	0.000822	-0.001	-0.003
264	West Main Toe Drain	11/3/2014 11:29	0.358		0.195	-0.0005		0.00345	6.38	-0.00001	94.3	2.03	-0.00001	-0.0001	-0.01	0.000836	-0.001	-0.003
265	West Main Toe Drain	12/8/2014 12:25	0.401		0.174	-0.0005		0.00137	6.42	-0.00001	105	2.19	-0.00001	-0.0001	-0.01	0.000791	-0.001	-0.003
266	West Main Toe Drain	1/13/2015 14:11	0.357		0.187	-0.0005		0.00199	6.49	-0.00001	93	2.14	-0.00001	-0.0001	0.012	0.000874	-0.001	-0.003
267	West Main Toe Drain	2/2/2015 12:06	0.369		0.195	-0.0005		0.00186	6.51	-0.00001	97.7	2.12	-0.00001	-0.0001	-0.01	0.00084	-0.001	-0.003
268	West Main Toe Drain	3/5/2015 9:30	0.368		0.185	-0.0005		0.00153	6.33	-0.00001	94.6	2.14	-0.00001	-0.0001	-0.01	0.000847	-0.001	-0.003
269	West Main Toe Drain	4/9/2015 10:47	0.37		0.196	-0.0005		0.00127	6.77	-0.00001	89.8	2.25	-0.00001	-0.0001	0.013	0.000885	0.0006	-0.003
273	Perimeter Toe Drain	7/7/2009 10:45	0.357		0.155	-0.001		0.002	5.14	-0.00002	80.5	3.68	-0.0002	-0.0002	0.013	0.00258	-0.002	-0.005
274	Perimeter Toe Drain	8/5/2009 11:42	0.288		0.151	0.0016		0.0022	5.2	-0.00002	83.8	3.43	-0.0002	-0.0002	0.017	0.00244	-0.002	-0.002
275	Perimeter Toe Drain	9/1/2009 13:30	0.252		0.159	-0.001		0.002	5.71	-0.00002	85.9	3.8	-0.0002	-0.0002	0.019	0.00257	-0.002	-0.003
277	Perimeter Toe Drain	5/18/2011 9:29	1.01		0.186	0.0028		0.0029	5.07	-0.00002	94.5	6.1	-0.0002	-0.0002	-0.01	0.00233	-0.002	-0.006
278	Perimeter Toe Drain	7/13/2011 10:07	0.923		0.192	0.00075		0.00397	5.24	-0.00001	88	5.59	-0.00001	-0.0001	-0.01	0.00203	-0.001	-0.003
279	Perimeter Toe Drain	8/3/2011 9:57	0.892		0.181	0.00076		0.00419	5.29	-0.00001	91.2	5.15	-0.00001	-0.0001	-0.01	0.00191	-0.001	-0.003
283	Perimeter Toe Drain	10/5/2011 13:55	0.743		0.177	-0.001		0.0027	5.23	-0.00002	82.1	4.73	-0.00002	-0.0002	-0.01	0.00193	-0.002	-0.006
285	Perimeter Toe Drain	10/31/2011 13:24	0.851		0.194	0.00066		0.00276	5.58	-0.00001	89.4	5.26	-0.00001	-0.0001	-0.01	0.00203	-0.001	-0.003
286	Perimeter Toe Drain	12/5/2011 12:18	0.749		0.188	0.00058		0.00239	5.35	-0.00001	87.9	4.99	-0.00001	-0.0001	-0.01	0.0019	-0.001	-0.003
287	Perimeter Toe Drain	2/8/2012 11:15	0.754	-0.00005	0.192	0.00056		0.00244	5.34	-0.00001	88.3	4.87	0.000025	-0.0001	-0.01	0.00177	-0.001	0.0033
288	Perimeter Toe Drain	4/3/2012 13:42	0.716		0.181	0.00066		0.00395	5.33	-0.00001	78.4	4.61	-0.00001	-0.0001	0.018	0.0017	0.0011	0.0037
289	Perimeter Toe Drain	5/2/2012 9:52	0.587		0.137	0.00102		0.00237	5.01	0.000011	59.9	3.79	-0.00001	-0.0001	-0.01	0.00132	0.0011	-0.003
293	Perimeter Toe Drain	8/1/2012 11:36	0.907		0.232	0.00067		0.00515	5.84	-0.00001	98.8	4.96	-0.00001	-0.0001	0.012	0.00174	0.0012	-0.003
297	Perimeter Toe Drain	11/5/2012 10:11	0.772		0.224	0.00053		0.00589	5.24	-0.00001	86.9	4.29	-0.00001	-0.0001	0.011	0.00168	-0.001	-0.003
299	Perimeter Toe Drain	2/6/2013 9:55	0.267		0.233	-0.0005		0.00551	5.36	-0.00001	91.4	4.07	-0.00001	-0.0001	-0.01	0.00141	-0.001	0.0121
301	Perimeter Toe Drain	5/1/2013 13:21	0.78		0.237	-0.0005		0.00763	5.01	0.000013	89.6	3.99	-0.00001	-0.0001	-0.01	0.0014	0.001	-0.003
305	Perimeter Toe Drain	8/8/2013 11:16	0.701		0.226	-0.0005		0.00752	4.73	-0.00001	81.6	3.57	-0.00001	-0.0001	-0.01	0.00126	0.0011	-0.003
307	Perimeter Toe Drain	11/5/2013 9:12	0.695		0.249	-0.0005		0.00658	5.42	-0.00001	84.8	3.44	-0.00001	-0.0001	-0.01	0.00144	0.0014	-0.003
309	Perimeter Toe Drain	5/28/2014 11:15	0.687		0.214	0.00053		0.0112	5.23	-0.00001	82.9	3.32	-0.00001	-0.0001	-0.01	0.00148	0.0014	-0.003
312	South Toe Drain	5/18/2011 8:19	0.0851		0.11	0.0007		0.0184	5.69	-0.00001	65.1	1.12	-0.0001	-0.0001	-0.01	0.000715	0.00112	-0.003
313	South Toe Drain	7/14/2011 8:42	0.0984		0.155	-0.0005		0.0196	6.89	-0.00001	63	1.38	0.000013	-0.0001	-0.01	0.00105	0.0017	0.003
314	South Toe Drain	8/3/2011 8:06	0.106		0.176	-0.0005		0.0186	7.24	0.000042	63.9	1.64	0.000013	-0.0001	-0.01	0.00122	0.0019	-0.003
315	South Toe Drain	8/31/2011 11:13	0.113		0.174	-0.0005		0.0171	7.29	-0.00001	75	1.73	0.000015	-0.0001	-0.01	0.00111	0.002	-0.003
318	South Toe Drain	10/12/2011 10:31	0.126		0.153	-0.0005		0.0174	6.67	-0.00001	82.4	1.47	0.000013	-0.0001	-0.01	0.00104	0.002	-0.003
320	South Toe Drain	10/31/2011 13:05	0.103		0.189	-0.0005		0.0189	6.73	-0.00001	87.5	1.74	0.000012	-0.0001	-0.01	0.00109	0.0019	-0.003
321	South Toe Drain	12/5/2011 10:35	0.126		0.181	-0.0005		0.0161	5.74	-0.00001	89.5	1.7	-0.00001	-0.0001	-0.01	0.0011	0.0015	0.0034
322	South Toe Drain	2/7/2012 12:05	0.0874		0.206	-0.0005		0.0198	5.89	-0.00001	94.4	1.59	0.000036	-0.0001	0.011	0.000866	0.0014	0.003
323	South Toe Drain	4/3/2012 13:24	0.105		0.201	-0.0005		0.0149	5.65	-0.00001	90.2	1.56	-0.00001	-0.0001	0.013	0.00077	0.0015	0.0033
324	South Toe Drain	5/2/2012 10:47	0.103		0.185	-0.0005		0.0143	5.85	-0.00001	83.3	1.51	-0.00001	-0.0001	-0.01	0.000892	0.002	-0.003
328	South Toe Drain	8/1/2012 10:05	0.131		0.222	-0.0005		0.0166	7.15	0.000015	86	1.61	0.000011	-0.0001	-0.01	0.00109	0.0025	-0.003
334	South Toe Drain	11/5/2012 11:17	0.147		0.191	-0.0005		0.0186	6.29	-0.00001	81.5	1.65	0.000011	-0.0001	0.011	0.00101	0.002	-0.003
336	South Toe Drain	2/6/2013 9:00	0.198		0.215	-0.0005		0.0189	5.87	-0.00001	90.4	1.73	-0.00001	-0.0001	-0.01	0.00111	0.0018	-0.003
338	South Toe Drain	5/1/2013 9:02	0.216		0.221	-0.0005		0.0207	5.7	-0.00001	84.5	1.64	-0.00001	-0.0001	-0.01	0.00108	0.0019	-0.003
342	South Toe Drain	8/8/2013 9:47	0.154		0.211	-0.0005		0.0201	6.87	-0.00001	79.6	1.28	-0.00001	-0.0001	-0.01	0.00109	0.0027	-0.003
345	South Toe Drain	11/5/2013 10:00	0.164		0.221	-0.0005		0.0229	6.98	-0.00001	82.1	1.45	-0.00001	-0.0001	-0.01	0.00117	0.0026	-0.003
348	South Toe Drain	5/28/2014 11:28	0.146		0.186	-0.0005		0.0211	5.44	-0.00001	78.1	1.27	-0.00001	-0.0001	-0.01	0.00119	0.0018	-0.003
351	South Toe Drain	8/5/2014 8:35	0.163		0.202	-0.0005		0.0199	6.73	-0.00001	67.3	1.44	-0.00001	-0.0001	0.014	0.00153	0.0022	-0.003
354	South Toe Drain	11/3/2014 11:03	0.206		0.217	-0.0005		0.00527	5.91	-0.00001	87.3	1.66	-0.00001	-0.0001	-0.01	0.00119	0.002	-0.003
365	E5 - Tailings Impoundment Main Embank Drain Comp	7/12/2001 13:15	0.172	-0.00005	0.00218	-0.0005		0.0055	8.9	-0.00001	17.1	1.38	-0.00005	0.00009	0.00191	0.00126	0.00096	0.0053
367	E5 - Tailings Impoundment Main Embank Drain Comp	7/26/2001 8:50	0.113	-0.00005	0.00279	-0.0005		0.0078	7.9	0.00002	21.8	1.95	-0.00005	0.00082	0.00437	0.00112	0.00058	0.0035
368	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2001	0.0945	-0.00005	0.00203	-0.0005		0.006	7.4	0.00001	15.3	1.69	-0.00005	0.00047	0.00339	0.00114	0.00068	0.0022
369	E5 - Tailings Impoundment Main Embank Drain Comp	8/10/2001 10:05	0.127	-0.00005	0.00211	-0.0005		0.0055	7.9	-0.00001	16.7	1.82	-0.00005	0.00009	0.00318	0.00111	0.00062	0.0035
371	E5 - Tailings Impoundment Main Embank Drain Comp	8/30/2001 14:40	0.0723	-0.00005	0.00354	-0.0005		0.0048	7.9	-0.00001	15.3	1.04	-0.00005	0.00015	0.00287	0.00129	0.00093	0.0025
372	E5 - Tailings Impoundment Main Embank Drain Comp	10/24/2001 10:30	0.0662	-0.00005	0.00349	-0.0005		0.0047	7	-0.00001	15.5	1.43	-0.00005	0.00044	0.00359	0.00094	0.00048	0.0021
374	E5 - Tailings Impoundment Main Embank Drain Comp	10/16/2003 18:10	0.00509	-0.00005	0.0803	-0.0005		0.0299	5.26	-0.00001	34.6	0.293	-0.00005	-0.00005	0.0031	0.00126	0.0036	0.0007
375	E5 - Tailings Impoundment Main Embank Drain Comp	5/31/2005	0.402		0.159	-0.0005		0.0009	6.86	-0.00001	62.1	0.654	-0.00005	-0.00005	0.0005	0.00146	0.0007	-0.0005
376	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2005	0.382		0.154	0.0008		0.0012	6.62	-0.00001	56	0.637	-0.00005	-0.00005	0.0007	0.00148	0.00063	-0.0005
377	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2005	0.362		0.142	-0.0005		0.0008	6.65	0.00002	57.9	0.565	-0.00005	-0.00005	-0.0005	0.00136	0.00061	-0.0005
378	E5 - Tailings Impoundment Main Embank Drain Comp	8/11/2005	0.402		0.137	-0.0005		0.001	6.63	0.00002	61.9	0.547	-0.00005	0.00011	0.0016	0.00131	0.00072	0.0014
379	E5 - Tailings Impoundment Main Embank Drain Comp	9/14/2005	0.377		0.158	-0.0005		0.0008	6.79	-0.00001	65.7	0.499	-0.00005	-0.00005	0.0006	0.00137	0.00078	0.001
380	E5 - Tailings Impoundment Main Embank Drain Comp	10/11/2005	0.341		0.136	-0.0005		0.0008	6.87	-0.00001	57.6	0.454	-0.00005	-0.00005	0.0005	0.00142	0.00064	0.0019
381	E5 - Tailings Impoundment Main Embank Drain Comp	11/8/2005	0.289		0.128	-0.0005		0.0014	6.99	-0.00001	56.5	0.453	-0.00005	-0.00005	0.0006	0.00185	0.0009	-0.0005
382	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/2005	0.344		0.138	-0.0005		0.0016	6.78	-0.00001	58.4	0.587	-0.00005	-0.00005	0.0011	0.00229	0.00124	-0.0005
383	E5 - Tailings Impoundment Main Embank Drain Comp	1/17/2006	0.361		0.149	-0.0005		0.0021	7.15	-0.00001	57.3	0.621	-0.00005	-0.00005	-0.0005	0.00232	0.00098	0.0024
384	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2006	0.357		0.156	0.0009		0.0015	6.78	-0.00001	57.7	0.614	-0.00005	-0.00005	0.0017	0.0022	0.00117	-0.0005
385	E5 - Tailings Impoundment Main Embank Drain Comp	3/6/2006 13:00	0.368		0.148	-0.0005		0.0013	6.74	-0.00001	58.4	0.639	-0.00005	-0.00005	0.0008	0.00222	0.00098	0.001
386	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2006 9:35	0.306		0.134	0.0005		0.0013	6.89	-0.00001	56.9	0.629	-0.00005	-0.00005	0.0023	0.00205	0.00103	-0.0005
387	E5 - Tailings Impoundment Main Embank Drain Comp	5/9/2006	0.351		0.132	-0.0005		0.0017	6.61	-0.00001	58.5	0.61	-0.0001	-0.0001	-0.01	0.00192	-0.001	-0.001
388	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2006	0.356		0.128	-0.0005		0.0027	6.55	-0.00001	60.4	0.611	-0.0001	-0.0001	-0.01	0.00148	-0.001	-0.001
389	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2006	0.351		0.121	-0.0005		0.0024	6.25	-0.00001	55.8	0.569	-0.0001	-0.0001	-0.01	0.00149	-0.001	-0.001
390	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2006	0.372		0.13	-0.0005		0.0013	5.85	-0.00001	62.5	0.601	-0.0001	-0.0001	-0.01	0.00154	-0.001	-0.001
391	E5 - Tailings Impoundment Main Embank Drain Comp	10/12/2006	0.325		0.123	-0.0005		0.0017	5.83	0.000068	58.7	0.585	-0.0001	-0.0001	-0.01	0.00162	-0.001	-0.001
392	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2006	0.39		0.121	-0.0005		0.0041	7.56	-0.00001	66.9	0.888	-0.0001	-0.0001	-0.01	0.00187	-0.001	-0.001
393	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2006	0.333		0.121	-0.0005		0.0038	7.01	-0.00001	62	0.763	-0.0001	-0.0001	-0.01	0.00211	-0.001	-0.001
395	E5 - Tailings Impoundment Main Embank Drain Comp	2/5/2007 10:30	0.382		0.124	-0.0005		0.0031	6.47	-0.00001	67	0.815	-0.0001	-0.0001	-0.01	0.002	-0.001	-0.001
396	E5 - Tailings Impoundment Main Embank Drain Comp	3/5/2007	0.35		0.138	0.00062		0.003	6.86	-0.00001	74.1	0.851	-0.0001	-0.0001	-0.01	0.00188	-0.001	0.0017
397	E5 - Tailings Impoundment Main Embank Drain Comp	4/11/2007 10:59	0.279		0.147	-0.0005		0.0118	6.35	-0.00001	55.1	1.05	-0.0001	-0.0001	-0.01	0.00179	-0.001	0.0012
398	E5 - Tailings Impoundment Main Embank Drain Comp	5/7/2007 9:29	0.367		0.133	-0.0005		0.0074	5.61	-0.00001	64.4	1.01	-0.0001	-0.0001	-0.01	0.00166	-0.001	-0.001
399	E5 - Tailings Impoundment Main Embank Drain Comp	6/4/2007 10:50	0.349		0.127	-0.0005		0.0092	5.49	-0.00001	68.3	0.908	-0.0001	-0.0001	-0.01	0.00181	-0.001	-0.001
400	E5 - Tailings Impoundment Main Embank Drain Comp	7/3/2007 11:08	0.297		0.124	-0.0005		0.0059	6.22	-0.00001	65.7	0.833	-0.0001	-0.0001	-0.01	0.00148	-0.001	-0.001
401	E5 - Tailings Impoundment Main Embank Drain Comp	8/2/2007 10:30	0.376		0.127	-0.001		0.0071	6.01	-0.00002	68	0.958	-0.0002	-0.0002	-0.01	0.00158	-0.002	-0.002
402	E5 - Tailings Impoundment Main Embank Drain Comp	9/5/2007 10:05	0.405		0.12	-0.0005		0.0038	6.18	-0.00001	66.7	0.897	-0.0001	-0.0001	-0.01	0.0017	-0.001	-0.001
403	E5 - Tailings Impoundment Main Embank Drain Comp	10/2/2007 15:15	0.298		0.14	-0.0005		0.0109	6.54	-0.00001	54.9	1.2	-0.0001	-0.0001	-0.01	0.00152	-0.001	-0.001
404	E5 - Tailings Impoundment Main Embank Drain Comp	11/5/2007 10:45	0.387		0.133	-0.001		0.0103	6.69	-0.00002	64.7	1.22	-0.0002	-0.0002	-0.01	0.002	-0.002	-0.002
405	E5 - Tailings Impoundment Main Embank Drain Comp	12/4/2007 14:12	0.266		0.107	-0.001		0.018	7.06	-0.00002	51.6	1.26	-0.0002	-0.0002	-0.01	0.00209	-0.002	-0.002
406	E5 - Tailings Impoundment Main Embank Drain Comp	1/15/2008 14:33	0.378		0.117	-0.001		0.0041	6.8	-0.00002	70.1	1.07	-0.0002	-0.0002	-0.01	0.00216	-0.002	-0.002
407	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2008 10:09	0.338		0.111	-0.0005		0.0031	6.24	-0.00001	76.4	0.865	-0.0001	-0.0001	-0.01	0.00197	-0.001	-0.001
408	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2008 10:09	0.334		0.114	0.00056		0.003	6.77	-0.00001	66	0.9	-0.0001	-0.0001	-0.01	0.00187	-0.001	0.0014
409	E5 - Tailings Impoundment Main Embank Drain Comp	4/16/2008 9:45	0.335		0.16	-0.001		0.0154	6.24	-0.00002	64	1.48	-0.0002	-0.0002	-0.01	0.00179	-0.002	-0.002
410	E5 - Tailings Impoundment Main Embank Drain Comp	5/13/2008 10:34	0.382		0.136	-0.0005		0.0046	6.14	-0.00001	80.5	1.2	-0.0001	-0.0001	-0.01	0.00142	-0.001	-0.001
411	E5 - Tailings Impoundment Main Embank Drain Comp	7/15/2008 9:15	0.0821		0.151	0.0012		0.0079	5.37	-0.00002	69.2	1.03	-0.0002	-0.0002	0.027	0.00111	0.0025	-0.004
412	E5 - Tailings Impoundment Main Embank Drain Comp	8/6/2008 9:40	0.0491		0.125	-0.01		-0.02	3.32	-0.0002	62.9	0.868	-0.002	-0.002	0.015	0.00125	-0.02	-0.02
413	E5 - Tailings Impoundment Main Embank Drain Comp	8/12/2008 12:36	0.349		0.143	-0.0005		0.0052	6.35	-0.00001	75.8	0.973	-0.0001	-0.0001	-0.01	0.00132	-0.001	-0.001
414	E5 - Tailings Impoundment Main Embank Drain Comp	9/9/2008 8:30	0.309		0.141	-0.0005		0.0047	6.41	-0.00001	70.7	0.914	-0.0001	-0.0001	-0.01	0.00134	0.0012	-0.001
415	E5 - Tailings Impoundment Main Embank Drain Comp	9/30/2008 11:30	0.271		0.142	-0.0005		0.0049	6.6	-0.00001	77.8	0.786	-0.0001	-0.0001	-0.01	0.00127	0.0012	-0.001
416	E5 - Tailings Impoundment Main Embank Drain Comp	10/22/2008 11:50	0.351		0.151	-0.0005		0.0044	6.61	-0.00001	73.3	0.972	-0.0001	-0.0001	-0.01	0.00142	-0.001	-0.001
417	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2008 13:57	0.166		0.138	0.0013			5.55	-0.00001	71.9	1.06	-0.0002	-0.0002	-0.01	0.00132	-0.002	-0.003
418	E5 - Tailings Impoundment Main Embank Drain Comp	12/2/2008 11:55	0.317		0.141	-0.0005		0.0046	6.61	-0.00001	61.6	1.14	-0.0001	-0.0001	0.014	0.0015	-0.001	-0.002
419	E5 - Tailings Impoundment Main Embank Drain Comp	1/14/2009 13:59	0.329		0.127	-0.0005		0.0019	6.16	-0.00001	74.9	0.846	-0.0001	-0.0001	-0.01	0.00127	-0.001	-0.002
420	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2009 11:39	0.384		0.134	-0.001		0.002	6.72	-0.00002	77.4	1.13	-0.0002	-0.0002	-0.01	0.00128	-0.002	-0.002
421	E5 - Tailings Impoundment Main Embank Drain Comp	3/4/2009	0.322		0.133	-0.0005		0.0019	6.82	-0.00001	72.1	0.905	-0.0001	-0.0001	-0.01	0.00122	-0.001	-0.001
422	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2009 13:14	0.298		0.166	-0.001		0.0081	6.46	-0.00002	71.3	1.18	-0.0002	-0.0002	-0.01	0.00131	-0.002	-0.002
423	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2009 12:45	0.38		0.141	0.00095		0.0043	6.32	-0.00001	68.9	1.28	-0.0001	-0.0001	-0.01	0.00122	-0.001	-0.001
424	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2009 9:29	0.359		0.146	0.0013		0.0085	6.77	-0.00002	74.3	1.26	-0.0002	-0.0002	-0.01	0.00133	-0.002	-0.002
425	E5 - Tailings Impoundment Main Embank Drain Comp	7/7/2009 10:14	0.375		0.135	-0.001		0.0041	6.56	-0.00002	71.9	1.24	-0.0002	-0.0002	-0.01	0.00117	-0.002	-0.002
426	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2009 10:50	0.368		0.134	0.0013		0.0041	6.4	-0.00002	78	1.18	-0.0002	-0.0002	-0.01	0.00112	-0.002	-0.002
427	E5 - Tailings Impoundment Main Embank Drain Comp	9/2/2009 9:15	0.373		0.132	-0.0005		0.0034	6.15	-0.00001	78.4	1.15	-0.0001	-0.0001	-0.01	0.00113	-0.001	-0.001
428	E5 - Tailings Impoundment Main Embank Drain Comp	10/6/2009 9:49	0.388		0.143	-0.001		0.003	6.47	-0.00002	79.7	1.2	-0.0002	-0.0002	-0.01	0.00127	-0.002	-0.002
429	E5 - Tailings Impoundment Main Embank Drain Comp	10/29/2009 12:29	0.366		0.139	-0.0005		0.0027	6.13	-0.00001	75.8	1.2	-0.0001	-0.0001	-0.01	0.00115	-0.001	-0.001
430	E5 - Tailings Impoundment Main Embank Drain Comp	11/19/2009 9:26	0.367		0.15	-0.001		0.0039	6.41	-0.00002	77.4	1.29	-0.0002	-0.0002	-0.01	0.00122	-0.002	-0.002

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
432	E5 - Tailings Impoundment Main Embank Drain Comp	1/13/2010 13:50		999	7.87	7.5		126		323		674	-3	0.3	0.082	21.1		1.67		0.0016	
433	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2010 13:20		1054	7.69	8		123		373		778	-3	0.24	0.0848	21.6		2		-0.001	
434	E5 - Tailings Impoundment Main Embank Drain Comp	3/3/2010 12:24		1060	7.85	8.4		128		399		745	-3	0.24	0.0902	22.1		2.69		0.019	
435	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2010 14:05		1059	7.79	7.8		118		381		734	-3	0.22	0.0929	23.6		1.45		0.0218	
436	E5 - Tailings Impoundment Main Embank Drain Comp	5/11/2010		856	8.23	11.4		120		406		749	-3	0.3	0.0896	24.3		2.01	2.04	0.028	
438	E5 - Tailings Impoundment Main Embank Drain Comp	7/8/2010		1030	7.49	7.8		118	950	364	8	751	56.7	6.56	0.0706	24.4		1.04	1.06	0.026	
439	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2010		1035	8.06	8.8		115		384		760	-3	0.25	0.0378	25.5		1.65	1.68	0.037	
441	E5 - Tailings Impoundment Main Embank Drain Comp	10/7/2010		1128	7.28	7.9		104	1120	391	8.11	816	-3	0.31	0.0931	27		1.16	1.22	0.067	
442	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2010		1107	7.26	7.8		118	1090	414	8	805	-3	0.3	0.0795	24.8		1.74	1.79	0.059	
443	E5 - Tailings Impoundment Main Embank Drain Comp	12/1/2010 10:20		1089	7.83	7.5		115	1110	422	8.06	787	-3	0.4	0.074	26.7		1.83	1.89	0.059	
444	E5 - Tailings Impoundment Main Embank Drain Comp	1/10/2011 10:13		1133	7.6	7.3		111	1120	425	7.94	839	-3	0.4	0.072	26.5		1.63	1.7	0.076	
446	E5 - Tailings Impoundment Main Embank Drain Comp	3/7/2011 10:15		1155	7.58	7.4		112	1140	413	8.06	851	-3	0.26	0.0778	25.9		1.59	1.65	0.06	
447	E5 - Tailings Impoundment Main Embank Drain Comp	4/5/2011 10:44		1314	7.65	6.2		89.5	1260	547	7.92	1010	-3	0.55	0.0694	20.8		3.71	3.78	0.07	
448	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2011 13:08		1160	7.51	7.5		97.5	1120	452	7.93	846	-3	0.4	0.0495	22.9		3.54	3.6	0.054	
449	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2011 13:25		1288	7.85	8.4		100	1210	504	7.73	945	-3	0.19	0.0611	24	0.84	3.03	3.07	0.048	
450	E5 - Tailings Impoundment Main Embank Drain Comp	7/13/2011 9:02		1212	7.96	7.5		102	1210	514	8.07	917	-3	0.41	0.0194	22		3.34	3.43	0.098	
451	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2011 8:46		1219	7.88	7.7		93	1200	479	7.94	930	-3	0.26	0.0651	24.8		3.44	3.55	0.111	
453	E5 - Tailings Impoundment Main Embank Drain Comp	10/5/2011 11:10		1139	7.8	7.9		97.4	1120	411	7.99	842	-3	0.28	0.0561	23.1		2.29	2.44	0.147	
454	E5 - Tailings Impoundment Main Embank Drain Comp	11/1/2011 10:32		1155	7.81	7		100	1120	422	8.02	840	-3	0.61	0.0608	23.4		2.46	2.62	0.153	
455	E5 - Tailings Impoundment Main Embank Drain Comp	12/5/2011 11:00		1149	7.92	7		98	1090	399	8.06	787	-3	0.31	0.0571	23.4	0.95	1.89	2.06	0.173	
456	E5 - Tailings Impoundment Main Embank Drain Comp	1/4/2012 13:40		1136	7.98	7.7		96.4	1110	405	8.12	808	-3	0.94	0.0591	24.9	1.03	1.73	1.9	0.171	
457	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2012 9:50		1140	7.95	7.8		98.1	1100	404	8.05	805	-3	0.4	0.0598	23.7	0.96	1.67	1.84	0.174	
458	E5 - Tailings Impoundment Main Embank Drain Comp	3/14/2012 14:10		1163	7.8	6.7		98.7	1110	408	8.04	829	-3	0.19	0.0654	23.9	0.92	1.83	2	0.17	
460	E5 - Tailings Impoundment Main Embank Drain Comp	5/2/2012 11:05		1183	7.84	7.3		95.7	1120	453	8.04	835	-3	0.45	0.051	23.1	0.94	2.62	2.76	0.145	
461	E5 - Tailings Impoundment Main Embank Drain Comp	6/7/2012 9:15	Actual Field Reading	1137	7.88	9.2		94.3	1070	458	7.93	834	-3	1.46	0.0555	22.5	0.83	2.84	2.95	0.103	
462	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2012 8:47		1211	7.71	9		93.8	1150	478	7.96	974	-3	0.18	0.0355	20.1	0.83	3.68	3.8	0.118	
463	E5 - Tailings Impoundment Main Embank Drain Comp	8/1/2012 10:24		1177	7.895	7.7		87.9	1070	412	8.02	903	3	3.95	0.0505	23.8	0.93	2.18	2.32	0.141	
464	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2012 11:05		1100	8.239	8.4		93.3	1060	388	8.05	819	-3	0.29	0.0573	24	0.93	1.81	1.98	0.169	
465	E5 - Tailings Impoundment Main Embank Drain Comp	10/3/2012 9:30		1106	8.02	7		97.9	989	392	8	831	5.9	3.03	0.0572	31.2	0.95	1.71	1.9	0.193	
466	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2012 13:07		1101	8.12	7.6		97.4	1060	408	8.01	800	-3	0.54	0.047	23	0.88	1.91	2.09	0.171	
467	E5 - Tailings Impoundment Main Embank Drain Comp	12/6/2012 10:11		1149	7.646	7.9		93.1	1070	399	7.94	828	3.1	0.22	0.0506	24.3	0.92	1.87	2.06	0.19	
468	E5 - Tailings Impoundment Main Embank Drain Comp	1/2/2013 14:04		1159	7.797	8		95.2	1090	395	8.05	830	-3	0.25	0.0244	23.8	1.01	1.85	2.05	0.202	
469	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2013 9:30		1162	7.792	8.3		92.7	1080	410	7.88	810	-3	0.26	0.0542	23.6	0.89	2.19	2.39	0.199	
470	E5 - Tailings Impoundment Main Embank Drain Comp	3/13/2013 13:05	GH - sample	1170	7.846	8		101	1130	404	7.89	857	3.7	0.35	0.0528	24.3	1.06	2	2.2	0.205	
471	E5 - Tailings Impoundment Main Embank Drain Comp	4/4/2013 14:45	ok	1021	7.858	7		97.8	1020	440	7.87	748	15	11.6	0.0469	18.8	0.48	3.03	3.1	0.07	
472	E5 - Tailings Impoundment Main Embank Drain Comp	5/1/2013 9:18	PH did not stabilize	1238	9.028	7.5	0.07	90.1	1240	486	7.92	936	-3	0.28	0.0409	21.8	1.1	3.16	3.33	0.175	
473	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2013 9:05	Lid was of sampling well.	783	7.75	8.4	1.95	90.2	1150	421	8.1	781	-3	0.4	0.048	24.7	0.91	2.36	2.55	0.198	
474	E5 - Tailings Impoundment Main Embank Drain Comp	7/10/2013 10:02	Sample taken	795	7.79	8	0.05	62.7	1130	422	8.13	845	-3	1.59	0.0282	21.7	0.58	3.51	3.73	0.223	
475	E7 - Perimeter Pond	8/3/2001		563	8.13	17		249		108			-4	4.78	0.09				20.3		
476	E7 - Perimeter Pond	8/10/2001 10:30		592	8.21	18.1		111		240			-4	1.65	0.055				22.7		
478	E7 - Perimeter Pond	8/30/2001 14:15		577	8.28	19.9		107		252			4	3.08	0.036				17.8		
479	E7 - Perimeter Pond	10/23/2001 15:00		560	7.85	4.1		104		257			36	32.2	0.008				17.4		
480	E7 - Perimeter Pond	11/13/2001 8:30		731	7.98	2.6		142		355			8	4.66	0.013				20.2		
485	E7 - Perimeter Pond	5/22/2002 9:15		500	7.4	11		72		160		260	11	20.4	0.025				4.76		5.41
487	E7 - Perimeter Pond	7/31/2002 16:15		620	7.35	16.4		170		319		446	-4	2.84	0.015				0.1		0.53
496	E7 - Perimeter Pond	5/5/2003 16:20		258	9.08	13.6		136		255		316	4	2.81	0.022				0.52	0.012	
497	E7 - Perimeter Pond	5/29/2003 9:10		450	9.17	17.2		150		261		360	-4	1.99	0.011					0.005	
498	E7 - Perimeter Pond	6/24/2003 6:30		46	8.35	20.9		182		324		412	5	3.55	0.044					-0.005	
499	E7 - Perimeter Pond	8/5/2003 14:05		601	8.69	23.5		183		330		438	20	5.27	-0.005					-0.005	
500	E7 - Perimeter Pond	8/20/2003 10:30		588	8.14	20.2		179		314		428	-4	0.99	-0.005					-0.005	
501	E7 - Perimeter Pond	10/16/2003 15:10		704	8.06	9.5		163		306		388	5	1.74	0.012					0.005	
502	E7 - Perimeter Pond	5/1/2004 14:53		542	7.88	13.8		165		312		408	-4	1.85	0.065				0.08	0.008	
503	E7 - Perimeter Pond	7/5/2004		546	7.51	22.6		179		311		430	-4	7.09	-0.005				-0.02	-0.005	
505	E7 - Perimeter Pond	8/25/2004			7.58	16.6		173		308		422	-4	1.69	-0.005				-0.02	-0.005	
506	E7 - Perimeter Pond	10/17/2004		568	7.99	8.2		208		357		448	9	11.1	-0.005				-0.02	-0.005	
507	E7 - Perimeter Pond	12/8/2004		344	8.85	0.3		128		233		324	9	5.96	0.008				1.53	0.036	
508	E7 - Perimeter Pond	1/27/2005		268	7.7	0.6		84.3		146		192	9	32.8	0.066				2.54	0.017	
509	E7 - Perimeter Pond	3/16/2005		376	7.97	3		113		180		210	35.4	43.4	0.016				1.78		
511	E7 - Perimeter Pond	4/11/2005		465	7.18	5.9		152		230		288	12.8	15.3	0.027				1.44		
512	E7 - Perimeter Pond	5/4/2005		500	8.04	12.5		140		240		308	5	2.3	0.029				1.41		
513	E7 - Perimeter Pond	9/6/2006		776	7.2	18.6		577		745		906	-3	0.54	0.008			3.61		0.0174	
515	E7 - Perimeter Pond	11/15/2006		897	7.6	1.4		138				550	2.3	1.6	0.0513			7.71		0.0198	
516	E7 - Perimeter Pond	2/13/2007		1060	7.24	4.1		240		597		756	17.4	14.5	0.185			10.3		0.0247	
517	E7 - Perimeter Pond	3/27/2007		971	7.45	4.7		129		515		711	29.5	22.2	0.0205			58		0.0331	
518	E7 - Perimeter Pond	4/17/2007 10:07		609	7.6	0.6		86.8		335		475	10.1	13.5	0.0083			5.8		0.0041	
519	E7 - Perimeter Pond	5/8/2007 8:48		485	8.02	10.8		129		645		941	3.5	3.42	0.0135			9.3		0.0112	
520	E7 - Perimeter Pond	6/11/2007 12:09		1117	7.88	15		138		602		862	-3	2	0.0155			6.32		0.041	
521	E7 - Perimeter Pond	7/3/2007 10:14		996	8.14	19.5		121		526		752	-3	3.13	0.035			5.15		0.0319	
522	E7 - Perimeter Pond	8/8/2007 9:18		963	8.19	18.5		64.5		483		731	-3	1.13	0.0168			3.78		0.0257	
523	E7 - Perimeter Pond	9/6/2007 11:48		994	7.96	15		90.4		498		719	-3	1	0.0223			1.67		0.0194	
524	E7 - Perimeter Pond	10/2/2007 14:46		1047	7.96	7.9		131		463		742	4	3.2	0.141			2.05		0.0088	
525	E7 - Perimeter Pond	11/5/2007 12:49		1180	8.13	0.8		129		547		869	3.8	3.18	-0.005			4.83		0.0046	
526	E7 - Perimeter Pond	1/14/2008 11:39		927	8.37	0		108		383		752	-3	1.19	-0.005			1.44		0.0036	
527	E7 - Perimeter Pond	6/16/2008 10:50		936	8.529	15.7		91		370		687	3.2	1.62	0.0183			1.71		0.0106	
528	E7 - Perimeter Pond	4/22/2009 14:44		339	6.83	9.3		47.6		157		252	16.5	28.7	-0.005	0.6		2.99		0.0046	
529	E7 - Perimeter Pond	6/8/2011 10:17		1393	7.99	13.1		95.4	1380	772	8.06	1170	12	4.34	0.0061	6		10	10	0.014	
530	E7 - Perimeter Pond	8/3/2011 9:34		1339	8.16	15.6		100	1310	722	8.08	1160	14	7.35	-0.005	7.7		7.69	7.69	-0.01	
531	E7 - Perimeter Pond	9/8/2011 10:25		1348	8.2	14.4		130	1350	725	8.16	1130	8.3	4.95	0.0173	6.1		7.76	7.8	0.043	
532	E7 - Perimeter Pond	10/5/2011 13:40		1388	7.86	8.2		91.9	1360	618	8.07	1100	4.2	2.64	0.005	17.7		3.77	3.78	0.01	
533	E7 - Perimeter Pond	11/1/2011 11:48		1245	8.17	2.9		109	1180	618	8.12	955	-3	4.24	0.005	8.6		6.68	6.69	0.015	
534	E7 - Perimeter Pond	2/8/2012 10:45		1203	8.14	2.6		121	1140	557	8.09	901	4.7	5.12	0.0544	11.1	0.72	4.42	4.45	0.026	
535	E7 - Perimeter Pond	5/2/2012 10:19		985	7.043	5		83.6	922	500	8	730	49.2	36.4	0.0215	-5	0.3	4.97	4.97	-0.01	
538	E7 - Perimeter Pond	8/1/2012 11:26		1304	7.969	16.4		102	1220	684	8.05	1140	5.4	4.41	0.022	6.7	0.46	8.3	8.32	0.026	
541	E7 - Perimeter Pond	11/15/2012 13:39	okay	1131	8.281	0.1		92.2	1080	632	8.01	886	4	4.43	0.0095	7.4	0.26	7.23	7.24	0.011	
542	E7 - Perimeter Pond	12/6/2012 11:02		1307	7.795	3.6		120	1220	620	8.06	1030	3.1	1.73	0.0113	9.2	0.69	5.58	5.59	0.014	
543	E7 - Perimeter Pond	1/2/2013 14:40		1239	8.199	0		139	1170	675	8.13	976	3.9	3.75	-0.005	-5	0.66	7.68	7.69	0.011	
544	E7 - Perimeter Pond	2/6/2013 10:13		1112	8.034	0.1		109	1040	622	7.99	851	-3	3.04	0.0071	-5	0.31	8.88	8.88	-0.01	
545	E7 - Perimeter Pond	5/1/2013 13:28		1250	7.793	5.9	5.9	74	1240	679	7.89	979	11.1	3.85	-0.005	5.5	0.44	10.2	10.2	-0.01	
546	E7 - Perimeter Pond	8/8/2013 11:24		1493	8.21	18.5		71.9	1490	757	8.02	1230	9.7	2.7	0.0065	13.5	0.74	6.91	6.94	0.028	
547	E7 - Perimeter Pond	11/5/2013 9:20	Had to scrape slush from pond, sample taken	1316	8.231	2.2		121	1250	659	7.85	1050	-3	5.31	0.079	10.9	0.61	6.91	6.97	0.06	
548	E7 - Perimeter Pond	12/5/2013 12:20	sample taken	1251	8.443	1.6	14.8	153	1540	852	8.07	1230	12.3	15.9	0.279	13.3	0.71	10.8	10.9	0.178	
549	E7 - Perimeter Pond	12/10/2013 13:52	Sample Taken	1162	7.678			106	1130	579	7.83	892	19.8	38.7	0.309	7.6	0.63	9.37	9.54	0.177	
550	E7 - Perimeter Pond	12/12/2013 11:44	Sample taken	1147	7.306	3.3		109	1140	597	8.02	900	26.5	27.6	0.211	8.1	0.51	8.72	8.89	0.171	
551	E7 - Perimeter Pond	12/16/2013 13:36	Sample taken	1050	7.585	2		107	1040	512	8.02	806	20.9	30.1	0.329	10.8	0.44	8.67	8.93	0.262	
552	E7 - Perimeter Pond	12/19/2013 8:23	Sample taken	1347	8.141	3.7		113	1270	663	8.06	1000	5.7	6.07	0.0845	11.6	0.68	6.49	6.63	0.142	
553	E7 - Perimeter Pond	1/7/2014 11:37	Sample taken beside pump, very hazardous conditions	1010	7.845	1.6		91	985	494	8.04	743	81.3	91.8	0.555	11.4	0.52	8.1	8.33	0.232	
555	E7 - Perimeter Pond	1/27/2014 13:44	Sample taken Filtered D-Metals	1211	7.127	5.3		105	1160	589	8.15	678	22.1	31.4	0.175	10.8	0.56	5.21	5.34	0.135	
556	E7 - Perimeter Pond	1/28/2014 14:01	Sample taken Filtered D-Metals	1270	7.91	5.3		109	1200	622	8.06	977	20.5	20.2	0.0968	12.1	0.72	5.25	5.38	0.128	
557	E7 - Perimeter Pond	1/29/2014 14:37	Sample taken Filtered D-Metals	1258	8.123	5.5		108	1190	626	8.06	945	19.7	20.3	0.123	10.1	0.72	5.42	5.55	0.131	
558	E7 - Perimeter Pond	1/30/2014 13:48		1205	8.067	3.2		105	1160	606	8.11	703	27.6	28.8	0.206	12.1	0.62	6.37	6.54	0.17	
559	E7 - Perimeter Pond	2/11/2014 14:01	sample taken	1185	7.573	0.1	6.7	87.9	1170	557	8.1	891	-3	7.75	0.226	11.1	0.57	6.45	6.64	0.193	
560	E7 - Perimeter Pond	3/4/2014 8:54	Had to break ice. Took 3L sample for metallurgy	1390	8.38	0.5	15.7	102	1300	602	8.11	850	6.9	7.77	0.81	16.5	0.68	9.4	9.87	0.475	
561	E7 - Perimeter Pond	4/1/2014 11:20		797	8.009	1.9	38.3	89.3	773	395	8.01	576	27.8	31.3	0.732	7.1	0.2	9.09	9.37	0.278	
562	E7 - Perimeter Pond	5/1/2014 11:12	sample taken	960	7.91	7.8	20.5	75.5	890	485	7.93	739	32.5	29.4	0.0655	5.3	0.28	6.92	6.96	0.049	
563	E7 - Perimeter Pond	6/3/2014 11:11	Sample taken, water level in the yellow, duplicate taken	1186	8.091	14	4.15	85.9	1180	582	8.07	928	4.3	4.1	-0.005	12.9	0.41	9.34	9.37	0.033	
564	E7 - Perimeter Pond	7/3/2014 8:38	Sample taken, waterstriders on pond	1410	8.21	15.6		83.3	1400	754	8.06	1150	6.8	6.15	0.0243	11.9	0.51	9.35	9.38	0.034	
565	E7 - Perimeter Pond	9/2/2014 11:22	Sample taken	1178	7.959	15.3	3.47	69.4	1150	466	7.97	885	6.9	3.81	0.0363	19.1	0.73	3.61	3.72	0.11	

Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
432	E5 - Tailings Impoundment Main Embank Drain Comp	1/13/2010 13:50	0.0196	0.0316	0.0405	349			2.42	2.81		0.0023	0.00038	0.00177	0.0737	-0.001	-0.001	0.164	-0.000034	102	-0.001	0.00031
433	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2010 13:20	0.0177	0.0318	0.0394	388			2.33	3.25		0.0021	0.00038	0.00155	0.0718	-0.001	-0.001	0.136	-0.0004	119	-0.001	0.0003
434	E5 - Tailings Impoundment Main Embank Drain Comp	3/3/2010 12:24	0.0214	0.0321	0.0385	451			3.92	2.32		-0.003	0.00042	0.0015	0.0716	-0.001	-0.001	0.139	-0.000034	129	-0.001	0.00027
435	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2010 14:05	0.0234	0.0352	0.0403	379			1.67	-5		0.0025	0.00036	0.0016	0.0768	-0.001	-0.001	0.161	-0.00041	122	-0.001	0.00034
436	E5 - Tailings Impoundment Main Embank Drain Comp	5/11/2010	0.0191	0.0334	0.0383	395			2.45	3.01		0.0023	0.00034	0.00156	0.0741	-0.001	-0.001	0.144	-0.000034	132	-0.001	0.00024
438	E5 - Tailings Impoundment Main Embank Drain Comp	7/8/2010	0.0242	0.0379	0.116	377			1.25	3.14		0.0027	0.00083	0.0016	0.0902	-0.001	-0.001	0.139	-0.00071	115	-0.001	0.00044
439	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2010	0.0198	0.0308	0.0371	404			1.9	2.8		-0.002	0.00041	0.00152	0.0753	-0.001	-0.001	0.138	-0.0006	123	-0.001	0.00033
441	E5 - Tailings Impoundment Main Embank Drain Comp	10/7/2010	0.0238	0.036	0.0387	432			1.58	3.55		-0.003	0.00047	0.00177	0.0732	-0.0005	-0.0005	0.168	-0.00008	123	-0.0005	0.00039
442	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2010	0.0203	0.0285	0.0383	418			1.89	6.66		-0.003	0.00038	0.00162	0.081	-0.0005	-0.0005	0.143	-0.00006	133	-0.0005	0.00039
443	E5 - Tailings Impoundment Main Embank Drain Comp	12/1/2010 10:20	0.0193	0.0294	0.0357	451			2.11	3.45		-0.003	0.00039	0.00165	0.0767	-0.0005	-0.0005	0.146	-0.0001	136	-0.0005	0.0004
444	E5 - Tailings Impoundment Main Embank Drain Comp	1/10/2011 10:13	0.0147	0.0278	0.0337	453			1.66	4.38		-0.003	0.00038	0.00161	0.0727	-0.0005	-0.0005	0.15	-0.00006	136	-0.0005	0.00041
446	E5 - Tailings Impoundment Main Embank Drain Comp	3/7/2011 10:15	0.0158	0.0255	0.0315	458			1.63	3.63		-0.003	0.00038	0.00175	0.0766	-0.0005	-0.0005	0.139	-0.00008	132	-0.0005	0.00046
447	E5 - Tailings Impoundment Main Embank Drain Comp	4/5/2011 10:44	0.023	0.0305	0.0404	577			7.24	2.69		-0.003	0.00053	0.00146	0.0724	-0.0005	-0.0005	0.125	-0.0003	176	-0.0005	0.00037
448	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2011 13:08	0.0223	0.0318	0.0351	484			4.73	3.55		-0.003	0.00033	0.00145	0.07	-0.0005	-0.0005	0.125	-0.00009	144	-0.0005	0.00031
449	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2011 13:25	0.0179	0.0278	0.0328	547			5.32	3.76		-0.003	0.00035	0.0016	0.0774	-0.0001	-0.0005	0.135	-0.00009	163	-0.0005	0.00039
450	E5 - Tailings Impoundment Main Embank Drain Comp	7/13/2011 9:02	0.0187	0.0284	0.0336	520			4.92	3.55		-0.003	0.00035	0.00148	0.0735	-0.0001	-0.0005	0.12	-0.00006	167	-0.0005	0.00038
451	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2011 8:46	0.0143	0.0231	0.0259	526			4.03	3.92		-0.003	0.00044	0.00153	0.0646	-0.0001	-0.0005	0.137	-0.00008	152	-0.0005	0.00038
453	E5 - Tailings Impoundment Main Embank Drain Comp	10/5/2011 11:10	0.0177	0.0276	0.0315	440			2.91	4.18		-0.003	0.00042	0.00161	0.0607	-0.0001	-0.0005	0.127	-0.00007	131	-0.0005	0.00036
454	E5 - Tailings Impoundment Main Embank Drain Comp	11/1/2011 10:32	0.0158	0.0253	0.0302	469			3.32	3.42		0.003	0.00043	0.00161	0.0614	-0.0001	-0.0005	0.146	-0.00007	134	-0.0005	0.00038
455	E5 - Tailings Impoundment Main Embank Drain Comp	12/5/2011 11:00	0.0152	0.0258	0.0285	456			2.68	3.2		0.0035	0.00044	0.00162	0.06	-0.0001	-0.0005	0.131	-0.00009	126	-0.0005	0.00035
456	E5 - Tailings Impoundment Main Embank Drain Comp	1/4/2012 13:40	0.0137	0.0236	0.0265	459			2.37	2.77		0.003	0.00044	0.00163	0.0603	-0.0001	-0.0005	0.144	-0.00008	130	-0.0005	0.00036
457	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2012 9:50	0.0132	0.0244	0.027	458			2.83	3.11		0.0036	0.00043	0.00158	0.0604	-0.0001	-0.0005	0.141	-0.00008	128	-0.0005	0.00034
458	E5 - Tailings Impoundment Main Embank Drain Comp	3/14/2012 14:10	0.0137	0.0256	0.0288	462			2.57	3.23		0.0032	0.00042	0.00153	0.0615	-0.0001	-0.0005	0.139	-0.0001	131	-0.0005	0.00035
460	E5 - Tailings Impoundment Main Embank Drain Comp	5/2/2012 11:05	0.02	0.0301	0.0343	482			3.83	3.19		0.0035	0.00039	0.00156	0.0652	-0.0001	-0.0005	0.124	-0.00025	145	-0.0005	0.00034
461	E5 - Tailings Impoundment Main Embank Drain Comp	6/7/2012 9:15	0.0213	0.0309	0.0364	471			3.64	2.94		0.0035	0.00037	0.00137	0.0617	-0.0001	-0.0005	0.129	-0.0002	149	-0.0005	0.00028
462	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2012 8:47	0.0201	0.029	0.0348	518			4.32	5.65		-0.003	0.00031	0.00139	0.0647	-0.0001	-0.0005	0.115	-0.00011	151	-0.0005	0.00028
463	E5 - Tailings Impoundment Main Embank Drain Comp	8/1/2012 10:24	0.021	0.0324	0.036	464			2.53	3.56		0.0036	0.00041	0.00161	0.0654	-0.0001	-0.0005	0.132	-0.0001	131	-0.0005	0.00032
464	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2012 11:05	0.0189	0.0286	0.0324	440			2.37	3.35		0.003	0.00039	0.00166	0.0671	-0.0001	-0.0005	0.143	-0.00012	124	-0.0005	0.00035
465	E5 - Tailings Impoundment Main Embank Drain Comp	10/3/2012 9:30	0.0165	0.0297	0.0306	450			2.02	4.36		-0.003	0.0004	0.00164	0.067	-0.0001	-0.0005	0.137	-0.00009	125	-0.0005	0.00035
466	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2012 13:07	0.0162	0.0227	0.028	445			1.8	3.03		-0.003	0.00037	0.00157	0.0684	-0.0001	-0.0005	0.128	-0.0001	131	-0.0005	0.00034
467	E5 - Tailings Impoundment Main Embank Drain Comp	12/6/2012 10:11	0.0174	0.0281	0.0315	472			1.92	2.65		-0.003	0.00048	0.00157	0.0623	-0.0001	-0.0005	0.131	-0.0001	126	-0.0005	0.00029
468	E5 - Tailings Impoundment Main Embank Drain Comp	1/2/2013 14:04	0.0128	0.0205	0.0287	457			1.89	3.15		-0.003	0.00046	0.00171	0.059	-0.0001	-0.0005	0.105	-0.0001	126	-0.0005	0.00035
469	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2013 9:30	0.0153	0.0234	0.0275	460			947	3.06												
470	E5 - Tailings Impoundment Main Embank Drain Comp	3/13/2013 13:05	0.0152	0.0237	0.0285	476			2.1	3.14												
471	E5 - Tailings Impoundment Main Embank Drain Comp	4/4/2013 14:45	0.0051	0.0134	0.0411	428			3.07	5.51												
472	E5 - Tailings Impoundment Main Embank Drain Comp	5/1/2013 9:18	0.0207	0.0289	0.0344	542			3.32	3.68												
473	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2013 9:05	0.0173	0.029	0.0319	502			2.45	3.58												
474	E5 - Tailings Impoundment Main Embank Drain Comp	7/10/2013 10:02	-0.001	0.0055	0.0118	496			3.86	4.21												
475	E7 - Perimeter Pond	8/3/2001	0.017	0.031		75.1		0.63	20.9	6.1		0.0122	0.00043	0.0009	0.0524	-0.00005	-0.00005	6.1	0.00006	81.1	0.0008	0.00038
476	E7 - Perimeter Pond	8/10/2001 10:30	0.019	0.017	0.017	85		0.71	23.4	5.2		0.0117	0.00047	0.0012	0.0521	-0.00005	-0.00005		0.00004	80	0.0006	0.00038
478	E7 - Perimeter Pond	8/30/2001 14:15	0.009	0.023	0.021	94.4		0.29	18.1	5.8		0.0083	0.00047	0.0008	0.0554	-0.00005	0.00044		0.00005	76.8	-0.0002	0.0003
479	E7 - Perimeter Pond	10/23/2001 15:00	0.029	0.02	0.077	93		0.82	18.2	6		0.0219	0.00028	0.0004	0.0575	-0.00005	-0.00005		0.00004	80.5	0.0006	0.00014
480	E7 - Perimeter Pond	11/13/2001 8:30	0.022	0.03	0.048	138		1.25	21.5	7.2		0.0102	0.00033	0.0006	0.0743	-0.00005	0.00064		0.00003	115	-0.0002	0.00018
485	E7 - Perimeter Pond	5/22/2002 9:15	0.006	0.015	0.035	83.6		0.65		0.6		0.0233	0.00031	0.001	0.03	-0.00005	-0.00005		0.00003	53.7	-0.0002	0.00009
487	E7 - Perimeter Pond	7/31/2002 16:15	-0.005	0.009	0.014	182		0.43		5.4		0.018	0.00018	0.0008	0.0473	-0.00005	-0.00005		0.00002	98.2	-0.0002	-0.00002
496	E7 - Perimeter Pond	5/5/2003 16:20	-0.005	0.007	0.012	114				7.9		0.0042	0.00024	0.0007	0.032	-0.00005	-0.00005		-0.00001	79.6	-0.0002	0.00015
497	E7 - Perimeter Pond	5/29/2003 9:10	-0.005	0.032	0.031	127				8.5		0.0013	0.00026	0.0009	0.0229	-0.00005	-0.00005		0.00002	78.8	-0.0002	0.0001
498	E7 - Perimeter Pond	6/24/2003 6:30	-0.005	-0.005	0.01	151				10.3		0.0019	0.00025	0.0012	0.0287	-0.00005	-0.00005		0.00002	97.5	0.0005	0.00024
499	E7 - Perimeter Pond	8/5/2003 14:05	-0.005	0.012	0.019	151				11.4		0.0021	0.00023	0.0013	0.0344	-0.00005	-0.00005		0.00003	96.8	-0.0002	0.00011
500	E7 - Perimeter Pond	8/20/2003 10:30	-0.005	0.006	0.011	147				9.4		0.002	0.00021	0.0012	0.0329	-0.00005	-0.00005		0.00002	91.1	0.0032	0.00009
501	E7 - Perimeter Pond	10/16/2003 15:10	-0.005	-0.005	0.009	152				6		0.0022	0.00019	0.0007	0.0396	-0.00005	-0.00005		0.00002	92.4	0.0019	-0.00002
502	E7 - Perimeter Pond	5/1/2004 14:53	-0.005	-0.005	0.019	156				5		0.0082	0.00033	0.0007	0.0586	-0.00005	-0.00005		0.00004	99.3	-0.0002	0.00021
503	E7 - Perimeter Pond	7/5/2004	-0.005	-0.005	0.013	148				6.2		0.0097	0.00025	0.0008	0.0434	-0.00005	-0.00005		0.00002	96.4	-0.0002	0.00005
505	E7 - Perimeter Pond	8/25/2004	-0.005	-0.005	0.009	148				6.1		0.0021	0.00019	0.001	0.035	-0.00005	-0.00005		0.00003	95	-0.0002	0.00003
506	E7 - Perimeter Pond	10/17/2004	-0.005	0.005	0.033	148				6.3		0.005	0.00027	0.001	0.0528	-0.00005	-0.00005		0.00004	112	-0.0002	0.00033
507	E7 - Perimeter Pond	12/8/2004	0.007	0.015	0.036	109				5.5		0.0036	0.00028	0.0005	0.0444	-0.00005	-0.00005		0.00003	73.9	0.0003	0.0001
508	E7 - Perimeter Pond	1/27/2005	-0.005	0.015	0.04	55				4		0.0177	0.00027	0.0004	0.0391	-0.00005	-0.00005		0.00004	47.7	-0.0002	0.00022
509	E7 - Perimeter Pond	3/16/2005	0.004	0.009	0.043	54.4				2.5		0.0165	0.00024	0.0004	0.0425	-0.00005	-0.00005	0.03	0.00004	58.7	-0.0002	0.00013
511	E7 - Perimeter Pond	4/11/2005	0.002	-0.005	0.025	66.4				3.3		0.0037	0.00023	0.0006	0.0502	-0.00005	-0.00005	0.02	0.00004	73.7	-0.0002	0.00018
512	E7 - Perimeter Pond	5/4/2005	0.003	-0.01	0.014	94.6				4.5		0.0064	0.00033	0.0008	0.0473	-0.00005	-0.00005	0.028	0.00005	74.8	-0.0002	0.00008
513	E7 - Perimeter Pond	9/6/2006	0.0151	0.0206	0.0224	192			4.09	6.95		-0.005	-0.0005	0.00055	0.0795	-0.0025	-0.0025	-0.05	-0.00025	236	0.0042	0.00104
515	E7 - Perimeter Pond	11/15/2006	-0.001	0.0044	0.0253	247			8.79	4.19			0.00028	0.00059	0.0576	-0.001	-0.001	0.039	-0.0001	133	-0.001	-0.0002
516	E7 - Perimeter Pond	2/13/2007	0.0065	0.0097	0.0319	282			15	4.14		0.0027	0.00032	0.00065	0.0791	-0.0005	-0.001	0.076	-0.000034	191	-0.0005	0.00028
517	E7 - Perimeter Pond	3/27/2007	0.0075	0.0116	0.0405	1660			16.2	3.68		0.0362	0.00031	0.00049	0.063	-0.001	-0.001	0.076	0.000098	167	-0.001	-0.0002
518	E7 - Perimeter Pond	4/17/2007 10:07	0.0041	0.0075	0.0284	241			6.7	5.54		0.0175	0.00026	0.00038	0.0435	-0.001	-0.001	0.034	0.000058	109	-0.001	-0.0002
519	E7 - Perimeter Pond	5/8/2007 8:48	-0.001	0.0045	0.0149	464			12.4	4.03		-0.005	-0.0005	-0.0005	0.0834	-0.0025	-0.0025	0.101	-0.000085	208	-0.0025	-0.0005
520	E7 - Perimeter Pond	6/11/2007 12:09	-0.001	0.0053	0.0159	435			7.94	4.27		-0.002	0.00048	0.00057	0.0741	-0.001	-0.001	0.104	0.000086	187	-0.001	-0.0002
521	E7 - Perimeter Pond	7/3/2007 10:14	-0.001	0.0039	0.0137	379			7.55	4.58		0.0035	0.00042	0.00066	0.0626	-0.001	-0.001	0.078	-0.000034	160	-0.001	-0.0002
522	E7 - Perimeter Pond	8/8/2007 9:18	-0.001	0.0037	0.0111	410			4.5	4.56		-0.002	0.00044	0.00068	0.0536	-0.001	-0.001	0.087	0.000004	139	-0.001	-0.0002
523	E7 - Perimeter Pond	9/6/2007 11:48	-0.001	0.0047	0.0108	309			2.39	4.35		0.0024	0.00084	0.00084	0.0631	-0.001	-0.001	0.096	0.000052	149	-0.001	-0.0002
524	E7 - Perimeter Pond	10/2/2007 14:46	0.0018	0.005	0.0138	371			2.38	3.32		-0.002	0.00113	0.00074	0.0684	-0.001	-0.001	0.109	0.000171	143	-0.001	-0.0002
525	E7 - Perimeter Pond	11/5/2007 12:49	-0.001	0.0025	0.0111	465			6.3	3.5		-0.002	0.00103	0.00077	0.0679	-0.001	-0.001	0.123	0.000079	176	-0.001	-0.0002
526	E7 - Perimeter Pond	1/14/2008 11:39	0.0011	0.005	0.0108	401			2.75	2.43		0.0388	0.00119	0.00085	0.0518	-0.001	-0.001	0.135	-0.0004	123	-0.001	-0.0002
527	E7 - Perimeter Pond	6/16/2008 10:50	-0.001	0.0031	0.0113	351			2.35	2.41		0.0028	0.00084	0.00082	0.0432	-0.001	-0.001	0.152	-0.0004	118	-0.001	-0.0002
528	E7 - Perimeter Pond	4/22/2009 14:44	0.0053	0.0109	0.0426	99.1			5.06	13		0.0946	-0.0001	0.00035	0.0219	-0.0005	-0.0005	0.013	0.000056	47.5	-0.0005	0.00014
529	E7 - Perimeter Pond	6/8/2011 10:17	0.0012	0.0031	0.0145	701			14.8	4.44		0.0063	0.00057	0.00063	0.0549	-0.0005	-0.0005	0.142	-0.0001	242	-0.0005	0.00015
530	E7 - Perimeter Pond	8/3/2011 9:34	0.0018	0.0049	0.0404	652			8.07	5.14		0.024	0.00051	0.00053	0.0593	-0.0002	-0.001	0.166	-0.00007	224	-0.001	-0.0002
531	E7 - Perimeter Pond	9/8/2011 10:25	-0.001		0.0129	644			11.9	3.21		-0.006	0.00103	0.00083	0.0455	-0.0002	-0.001	0.381	-0.0002	230	-0.001	0.00054
532	E7 - Perimeter Pond	10/5/2011 13:40	0.0025	0.006	0.0128	629			5.41	3.25		-0.006	0.00057	0.00092	0.0428	-0.0002	-0.001	0.154	-0.00008	198	-0.001	-0.0002
533	E7 - Perimeter Pond	11/1/2011 11:48	0.0024	0.005	0.0107	552			9.52	4.34		0.0052	0.00055	0.00073	0.0423	-0.0001	-0.0005	0.191	-0.0001	192	-0.0005	0.00031
534	E7 - Perimeter Pond	2/8/2012 10:45	0.0045	0.0083	0.0148	504			8.21	2.51		-0.003	0.00086	0.0009	0.0392	-0.0001	-0.0005	0.242	-0.00013	178	-0.0005	0.00029
535	E7 - Perimeter Pond	5/2/2012 10:19	0.0035	0.0084	0.075	425			6.79	7.18		0.0248	0.00037	0.0005	0.0351	-0.0001	-0.0005	0.106	-0.0002	156	-0.0005	0.00016
538	E7 - Perimeter Pond	8/1/2012 11:26	-0.001	0.0045	0.0126	589			10.7	5.17		0.0065	0.00072	0.00067	0.0558	-0.0001	-0.0005	0.17	-0.0001	214	-0.0005	0.00025
541	E7 - Perimeter Pond	11/15/2012 13:39	0.0026	0.0026	0.0129	515			8.06	4.68		-0.003	0.00031	0.00046	0.0445	-0.0001	-0.0005	0.071	-0.00006	193	-0.0005	0.00011
542	E7 - Perimeter Pond	12/6/2012 11:02	0.0044	0.0085	0.0113	591			5.55	4.3		-0.003	0.0008	0.00078	0.0405	-0.0001	-0.0005	0.251	-0.00025	199	-0.0005	0.0006
543	E7 - Perimeter Pond	1/2/2013 14:40	0.0026	0.0049	0.0099	531			7.15	3.07		-0.003	0.00077	0.0007	0.038	-0.0001	-0.0005	0.249	-0.00025	216	-0.0005	0.00084
544	E7 - Perimeter Pond	2/6/2013 10:13	0.0028	0.0047	0.0084	479			8.15	4.33												
545	E7 - Perimeter Pond	5/1/2013 13:28	0.003	0.0058	0.015	595			9.94	5.28												
546	E7 - Perimeter Pond	8/8/2013 11:24	-0.001	0.0041	0.0134	761			6.66	3.33												
547	E7 - Perimeter Pond	11/5/2013 9:20	0.0022	0.0041	0.0112	595			6.58	2.87		0.003	0.00076	0.00075	0.0492	-0.0001	-0.0005	0.222	-0.0003	211	-0.0005	0.00056
548	E7 - Perimeter Pond	12/5/2013 12:20	0.0036	0.0072	0.031	731			10.1	4.8		0.0047	0.0014	0.00113	0.0576	-0.0001	-0.0005	0.305	-0.00027	272	-0.0005	0.00088
549	E7 - Perimeter Pond	12/10/2013 13:52	0.0025	0.0065	0.0513	493			9.65	3.07		0.0035	0.00173	0.00093	0.0437	-0.0001	-0.0005	0.253	-0.00016	181	-0.0005	0.0006
550	E7 - Perimeter Pond	12/12/2013 11:44	0.0029	0.007	0.044	514			8.92	3.1		-0.003	0.00131	0.0009	0.0437	-0.0001	-0.0005	0.235	-0.00017	188	-0.0005	0.00054
551	E7 - Perimeter Pond	12/16/2013 13:36	-0.001	0.0057	0.0558	448			8.81	4.06		-0.003	0.00136	0.00103	0.0437	-0.0001	-0.0005	0.174	-0.0001	159	-0.0005	0.00041
552	E7 - Perimeter Pond	12/19/2013 8:23	0.0038	0.0065	0.0167	585			6.5	2.94		-0.003	0.00084	0.00112	0.0404	-0.0001	-0.0005	0.248	-0.00023	216	-0.0005	0.0008
553	E7 - Perimeter Pond	1/7/2014 11:37	-0.001	0.0073	0.113	407				3.43		0.0224	0.00219	0.0012	0.0436	-0.0001	-0.0005	0.138	-0.00007	153	-0.0005	0.00031
555	E7 - Perimeter Pond	1/27/2014 13:44	0.0041	0.0078	0.0494	526			5.52	3.45		-0.003	0.00108	0.00108	0.0392	-0.0001	-0.0005	0.264	-0.0002	193	-0.0005	0.00064
556	E7 - Perimeter Pond	1/28/2014 14:01	0.005	0.0083	0.0389	572			5.31	3.11		-0.003	0.00087	0.00108	0.0396	-0.0001	-0.0005	0.285	-0.00025	202	-0.0005	0.00072
557	E7 - Perimeter Pond	1/29/2014 14:37	0.0061	0.0096	0.0428	571			5.59	3.35		-0.003	0.00092	0.00102	0.0393	-0.0001	-0.0005	0.262	-0.00021	204	-0.0005	0.0007
558	E7 - Perimeter Pond	1/30/2014 13:48	0.0046	0.0081	0.0462	522			6.47	2.57		-0.003	0.00145	0.00101	0.0373	-0.0001	-0.0005	0.243	-0.00017	194	-0.0005	0.00059
559	E7 - Perimeter Pond	2/11/2014 14:01	0.0063	0.0102	0.0239	518			6.7	4.04		-0.003	0.00153	0.00129	0.0402	-0.0001	-0.0005	0.211	-0.00012	175	-0.0005	0.00014
560	E7 - Perimeter Pond	3/4/2014 8:54	0.0036	0.0078	0.0196	581			10.7	4.07		-0.003	0.00211	0.0018	0.0495	-0.0001	-0.0005	0.167	-0.0001	185	-0.0005	0.00056
561	E7 - Perimeter Pond	4/1/2014 11:20	0.0014	0.0048	0.0437	291			9.44	4.97		0.036	0.00296	0.00113	0.0433	-0.0001	-0.0005	0.109	-0.00006	118	-0.0005	0.00025
562	E7 - Perimeter Pond	5/1/2014 11:12	0.0037	0.0091	0.0495	429			6.6	5.25		0.0499	0.00061	0.00052	0.0373	-0.0001	-0.0005	0.081	-0.00014	149	-0.0005	0.00064
563	E7 - Perimeter Pond	6/3/2014 11:11	-0.001	0.003	0.0149	522			9	4.91		0.0154	0.00051	0.00076	0.0478	-0.0001	-0.0005	0.078	-0.0001	178	-0.0005	0.00021
564	E7 - Perimeter Pond	7/3/2014 8:38	-0.001	0.0036	0.0167	709			8.52	3.81		0.0069	0.00063	0.00085	0.0501	-0.0001	-0.0005	0.117	-0.0001	233	-0.0005	-0.0001
565	E7 - Perimeter Pond	9/2/2014 11:22	-0.001	0.0059	0.0146	506			3.72	3.34		-0.003	0.00077	0.00166	0.0391	-0.0001	-0.0005	0.117	0.000019	148	-0.0005	-0.0001

Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
432	E5 - Tailings Impoundment Main Embank Drain Comp	1/13/2010 13:50	0.00153	-0.03	-0.0001	-0.01	16.3	0.332		0.133	-0.001	12.8	0.0066	6.65	-0.00002	76.4	1.35	-0.0002	-0.0002
433	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2010 13:20	-0.004	-0.03	-0.0001	-0.01	18.2	0.336		0.13	-0.001	12.6	0.0069	6.58	-0.00002	70	1.37	-0.0002	-0.0002
434	E5 - Tailings Impoundment Main Embank Drain Comp	3/3/2010 12:24	0.00186	-0.03	-0.0001	-0.01	18.7	0.325		0.146	-0.001	12.6	0.0077	6.32	-0.00002	68.8	1.47	-0.0002	-0.0002
435	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2010 14:05	0.0019	-0.03	-0.0001	-0.01	18.6	0.345		0.138	-0.001	13.2	0.005	6.55	-0.00002	78.9	1.46	-0.0002	-0.0002
436	E5 - Tailings Impoundment Main Embank Drain Comp	5/11/2010	0.00202	-0.03	-0.0001	-0.01	18.6	0.25		0.137	-0.001	12.3	0.0064	6.96	-0.00002	73.1	1.45	-0.0002	-0.0002
438	E5 - Tailings Impoundment Main Embank Drain Comp	7/8/2010	0.00875	-0.03	-0.0001	-0.01	18.7	0.76		0.144	-0.001	13.1	0.0096	6.62	-0.00002	76.6	1.54	-0.0002	-0.0002
439	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2010	-0.0018	-0.03	-0.0001	-0.01	18.8	0.299		0.13	-0.001	13.3	0.0057	6.29	-0.00002	72.6	1.52	-0.0002	-0.0002
441	E5 - Tailings Impoundment Main Embank Drain Comp	10/7/2010	0.00245	-0.03	-0.00005	0.0062	20.4	0.494		0.155	0.00057	15.1	0.0033	6.54	-0.00001	83.5	1.72	-0.0001	-0.0001
442	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2010	0.00117	-0.03	-0.00005	0.0051	19.9	0.35		0.148	-0.0005	13.8	0.0057	6.91	-0.00001	80.8	1.78	-0.0001	-0.0001
443	E5 - Tailings Impoundment Main Embank Drain Comp	12/1/2010 10:20	0.00161	-0.03	-0.00005	0.0051	19.9	0.352		0.153	-0.0005	14.1	0.0056	6.62	-0.00001	77.9	1.74	-0.0001	-0.0001
444	E5 - Tailings Impoundment Main Embank Drain Comp	1/10/2011 10:13	0.00102	-0.03	-0.00005	0.0057	20.5	0.357		0.152	-0.0005	14.6	0.0054	6.9	-0.00001	78.7	1.88	-0.0001	-0.0001
446	E5 - Tailings Impoundment Main Embank Drain Comp	3/7/2011 10:15	0.00155	-0.03	-0.00005	0.0057	20.2	0.396		0.154	0.00097	15.5	0.00476	6.74	-0.00001	85.3	1.81	-0.0001	-0.0001
447	E5 - Tailings Impoundment Main Embank Drain Comp	4/5/2011 10:44	0.00615	-0.03	-0.00005	0.0051	26.1	0.388		0.201	-0.0005	12.9	0.0136	6.27	-0.00001	63.9	2.3	-0.0001	-0.0001
448	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2011 13:08	0.00157	-0.03	-0.00005	0.0051	22.2	0.293		0.185	-0.0005	11.7	0.0114	6.22	-0.00001	66.6	2	-0.0001	-0.0001
449	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2011 13:25	0.0017	-0.03	-0.00005	0.005	23.9	0.363		0.179	-0.0005	13.5	0.0109	6.59	-0.00001	79.8	2.1	-0.00001	-0.0001
450	E5 - Tailings Impoundment Main Embank Drain Comp	7/13/2011 9:02	0.00154	-0.03	-0.00005	0.00462	23.5	0.327		0.176	-0.0005	13.1	0.0106	6.6	-0.00001	77	2.05	-0.00001	-0.0001
451	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2011 8:46	0.00184	-0.03	-0.00005	0.00577	23.8	0.435		0.191	-0.0005	13.2	0.00912	6.36	-0.00001	73.2	2.08	-0.00001	-0.0001
453	E5 - Tailings Impoundment Main Embank Drain Comp	10/5/2011 11:10	0.00185	-0.03	-0.00005	0.00539	20.6	0.46		0.17	-0.0005	13.5	0.00574	6.36	-0.00001	82.1	1.79	-0.00001	-0.0001
454	E5 - Tailings Impoundment Main Embank Drain Comp	11/1/2011 10:32	0.00089	-0.03	-0.00005	0.00595	21	0.452		0.174	0.00059	14	0.00564	6.34	-0.00001	82.1	1.82	-0.00001	-0.0001
455	E5 - Tailings Impoundment Main Embank Drain Comp	12/5/2011 11:00	0.00128	-0.03	-0.00005	0.00674	20.2	0.377		0.172	-0.0005	15.9	0.005	6.48	-0.00001	89.9	1.92	-0.00001	-0.0001
456	E5 - Tailings Impoundment Main Embank Drain Comp	1/4/2012 13:40	0.00198	-0.03	-0.00005	0.00637	19.7	0.381		0.173	-0.0005	15.3	0.00494	6.46	-0.00001	88.3	1.97	-0.00001	-0.0001
457	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2012 9:50	0.00175	-0.03	-0.00005	0.00709	20.7	0.374		0.172	-0.0005	15.1	0.00493	6.42	-0.00001	84.7	1.9	0.000023	-0.0001
458	E5 - Tailings Impoundment Main Embank Drain Comp	3/14/2012 14:10	0.00186	-0.03	-0.00005	0.006	19.8	0.355		0.17	0.00051	13.3	0.00562	6.41	-0.00001	81.5	1.86	0.000016	-0.0001
460	E5 - Tailings Impoundment Main Embank Drain Comp	5/2/2012 11:05	0.00137	-0.03	-0.00005	0.0057	22.1	0.442		0.193	-0.0005	13.3	0.00895	6.15	-0.00001	74.5	2.01	-0.00001	-0.0001
461	E5 - Tailings Impoundment Main Embank Drain Comp	6/7/2012 9:15	0.00156	-0.03	-0.00005	0.00537	21	0.274		0.188	-0.0005	11.5	0.00935	6.08	-0.00001	66.3	1.99	-0.00001	-0.0001
462	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2012 8:47	0.00132	-0.03	-0.00005	0.00534	24.7	0.284		0.186	-0.0005	12.2	0.0121	6.32	-0.00001	70.9	2.04	-0.00001	-0.0001
463	E5 - Tailings Impoundment Main Embank Drain Comp	8/1/2012 10:24	0.00184	-0.03	-0.00005	0.006	20.8	0.4		0.195	-0.0005	13	0.00646	6.24	-0.00001	81.5	2.04	-0.00001	-0.0001
464	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2012 11:05	0.0019	-0.03	-0.00005	0.00659	19.3	0.435		0.18	-0.0005	14.4	0.00631	6.21	-0.00001	90.4	1.86	-0.00001	-0.0001
465	E5 - Tailings Impoundment Main Embank Drain Comp	10/3/2012 9:30	0.00194	-0.03	-0.00005	0.00576	19.2	0.432		0.181	-0.0005	14.1	0.00517	6.58	-0.00001	87.1	1.73	-0.00001	-0.0001
466	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2012 13:07	0.00091	-0.03	-0.00005	0.00629	19.6	0.361		0.188	-0.0005	13.2	0.00624	6.41	-0.00001	79.1	1.99	-0.00001	-0.0001
467	E5 - Tailings Impoundment Main Embank Drain Comp	12/6/2012 10:11	0.00201	-0.03	-0.00005	0.00608	20.8	0.436		0.184	-0.0005	13.9	0.00619	6.39	-0.00001	83.8	1.98	-0.00001	-0.0001
468	E5 - Tailings Impoundment Main Embank Drain Comp	1/2/2013 14:04	0.00088	-0.03	-0.00005	0.00514	19.6	0.482		0.181	-0.0005	14.5	0.00619	6.34	-0.00001	88.2	1.86	-0.00001	-0.0001
469	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2013 9:30																	
470	E5 - Tailings Impoundment Main Embank Drain Comp	3/13/2013 13:05																	
471	E5 - Tailings Impoundment Main Embank Drain Comp	4/4/2013 14:45																	
472	E5 - Tailings Impoundment Main Embank Drain Comp	5/1/2013 9:18																	
473	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2013 9:05																	
474	E5 - Tailings Impoundment Main Embank Drain Comp	7/10/2013 10:02																	
475	E7 - Perimeter Pond	8/3/2001	0.0087	0.059	0.00004	0.0018	13.2	0.0143	-0.00005	0.00915	-0.0005	3.77	0.0055	4.61	-0.00001	12.8	0.745	-0.00005	0.00014
476	E7 - Perimeter Pond	8/10/2001 10:30	0.0082	0.058	-0.00002	0.0019	13.8	0.0189	-0.00005	0.00892	-0.0005	3.75	0.0065	3.3	-0.00001	13.4	0.826	-0.00005	0.00018
478	E7 - Perimeter Pond	8/30/2001 14:15	0.0094	-0.005	0.00002	0.0021	14.7	0.0233	-0.00005	0.00844	-0.0005	3.79	0.0057	2.57	-0.00001	15.2	0.569	-0.00005	0.00078
479	E7 - Perimeter Pond	10/23/2001 15:00	0.0081	0.012	0.00006	0.0014	12.7	0.0491	-0.00005	0.00629	-0.0005	3.53	0.0055	4.39	-0.00001	10.5	0.642	-0.00005	0.00012
480	E7 - Perimeter Pond	11/13/2001 8:30	0.0076	-0.005	0.00004	0.0018	17.9	0.0649	-0.00005	0.0085	-0.0005	3.81	0.0074	4.76	-0.00001	15.6	0.876	-0.00005	0.00052
485	E7 - Perimeter Pond	5/22/2002 9:15	0.0107	0.022	0.00003	0.0008	8.3	0.0006	-0.00005	0.00947	-0.0005	2.24	0.0116	3.02	-0.00001	7.16	0.301	-0.00005	0.00024
487	E7 - Perimeter Pond	7/31/2002 16:15	0.0042	-0.005	0.00008	-0.0002	18	0.146	-0.00005	0.00663	-0.0005	3.3	0.0017	1.24	-0.00001	20	0.643	-0.00005	0.00007
496	E7 - Perimeter Pond	5/5/2003 16:20	0.0038	0.008	0.00003	0.0015	13.7	0.0362	-0.00005	0.00624	-0.0005	2.38	0.0026	1.59	-0.00001	10.8	0.443	-0.00005	0.00009
497	E7 - Perimeter Pond	5/29/2003 9:10	0.004	-0.005	-0.00002	0.0016	15.6	0.0509	-0.00005	0.00676	-0.0005	2.81	0.0026	0.8	-0.00001	11.8	0.523	-0.00005	0.00007
498	E7 - Perimeter Pond	6/24/2003 6:30	0.0028	-0.005	0.00003	0.0016	19.5	0.438	-0.00005	0.00686	-0.0005	2.8	0.0018	1.54	-0.00001	14	0.58	-0.00005	0.00013
499	E7 - Perimeter Pond	8/5/2003 14:05	0.0022	-0.005	0.00003	0.0021	21.5	0.102	-0.00005	0.00612	-0.0005	2.77	0.0013	1.74	-0.00001	15.5	0.636	-0.00005	0.00009
500	E7 - Perimeter Pond	8/20/2003 10:30	0.0024	-0.005	-0.00002	0.0019	21.1	0.0286	-0.00005	0.00579	-0.0005	2.29	0.0012	2.01	-0.00001	15.7	0.641	-0.00005	0.00006
501	E7 - Perimeter Pond	10/16/2003 15:10	0.0036	0.006	0.00003	0.0017	18.4	0.0352	-0.00005	0.00483	-0.0005	3	0.0021	2.9	-0.00001	12.6	0.446	-0.00005	-0.00005
502	E7 - Perimeter Pond	5/1/2004 14:53	0.0046	0.01	0.00004	0.0018	15.6	0.415	-0.00005	0.0119	-0.0005	2.78	0.0078	3.15	-0.00001	10.8	0.555	-0.00005	0.0001
503	E7 - Perimeter Pond	7/5/2004	0.0044	0.024	0.00007	0.0016	17.1	0.0535	-0.00005	0.00779	-0.0005	3.65	0.0034	2.66	-0.00001	13.2	0.563	-0.00005	-0.00005
505	E7 - Perimeter Pond	8/25/2004	0.0026	0.027	-0.00002	0.0019	17.2	0.178	-0.00005	0.00785	-0.0005	3.06	0.0032	3.69	-0.00001	12.8	0.602	-0.00005	-0.00005
506	E7 - Perimeter Pond	10/17/2004	0.0025	0.028	-0.00002	0.0018	18.9	0.612	-0.00005	0.00974	-0.0005	2.83	0.0114	5.67	-0.00001	13.6	0.553	-0.00005	-0.00005
507	E7 - Perimeter Pond	12/8/2004	0.003	-0.005	-0.00002	0.0013	11.7	0.111	-0.00005	0.0104	-0.0005	2.15	0.0115	4.72	-0.00001	9.72	0.439	-0.00005	-0.00005
508	E7 - Perimeter Pond	1/27/2005	0.0067	0.026	0.00002	0.0007	6.58	0.112	-0.00005	0.00551	-0.0005	2.35	0.0069	3.45	-0.00001	5.95	0.273	-0.00005	-0.00005
509	E7 - Perimeter Pond	3/16/2005	0.0023	0.01	-0.00002	0.0011	7.9	0.189		0.0148	-0.0005	2.59	0.0051	3.89	-0.00001	12.7	0.32	-0.00005	-0.00005
511	E7 - Perimeter Pond	4/11/2005	0.0033	-0.005	-0.00002	0.0013	11.7	0.197		0.0104	-0.0005	2	0.0066	3.66	-0.00001	10.1	0.388	-0.00005	-0.00005
512	E7 - Perimeter Pond	5/4/2005	0.0044	-0.01	0.00006	0.0016	13.8	0.0138		0.0161	-0.0005	1.93	0.0104	2.91	-0.00001	12.6	0.486	-0.00005	0.00006
513	E7 - Perimeter Pond	9/6/2006	0.00422	-0.03	-0.00025	-0.025	37.9	1.54		0.00763	0.0031	3.69	-0.005	8.98	-0.00005	17.3	1.18	-0.0005	-0.0005
515	E7 - Perimeter Pond	11/15/2006	0.00599	0.035	-0.0001	-0.01	21.4	0.026		0.1	-0.001	2.42	0.0239	4.23	-0.00002	11.8	1.62	-0.0002	-0.0002
516	E7 - Perimeter Pond	2/13/2007	0.00232	-0.03	-0.0001	-0.01	29.3	0.636		0.074	-0.001	3.09	0.0285	6.68	-0.00002	18.1	1.52	-0.0002	-0.0002
517	E7 - Perimeter Pond	3/27/2007	0.00477	0.044	-0.0001	-0.01	23.6	0.0771		0.136	-0.001	2.86	0.0306	4.71	-0.00002	12.2	1.78	-0.0002	-0.0002
518	E7 - Perimeter Pond	4/17/2007 10:07	0.00703	-0.03	-0.0001	-0.01	15.1	0.0348		0.0943	-0.001	1.74	0.0185	3.19	-0.00002	7.19	1.09	-0.0002	-0.0002
519	E7 - Perimeter Pond	5/8/2007 8:48	0.0065	-0.03	-0.00025	-0.025	30.2	0.0515		0.284	-0.0025	3.82	0.0294	3.44	-0.00005	18.2	2.66	-0.0005	-0.0005
520	E7 - Perimeter Pond	6/11/2007 12:09	0.00546	-0.03	-0.0001	-0.01	32.7	0.00193		0.228	-0.001	3.66	0.0263	1.63	-0.00002	20.3	2.24	-0.0002	-0.0002
521	E7 - Perimeter Pond	7/3/2007 10:14	0.0046	-0.03	-0.0001	-0.01	30.8	0.00262		0.193	-0.001	2.68	0.0217	1.92	-0.00002	17.9	2.06	-0.0002	-0.0002
522	E7 - Perimeter Pond	8/8/2007 8:18	0.00347	-0.03	-0.0001	-0.01	32.9	0.00142		0.153	-0.001	2.52	0.0205	1.47	-0.00002	25.4	2.11	-0.0002	-0.0002
523	E7 - Perimeter Pond	9/6/2007 11:48	0.00391	-0.03	-0.0001	-0.01	30.7	0.0183		0.174	-0.001	4.97	0.0145	2.24	-0.00002	38.7	2.54	-0.0002	-0.0002
524	E7 - Perimeter Pond	10/2/2007 14:46	0.0032	-0.03	-0.0001	-0.01	25.8	0.00889		0.209	-0.001	6.86	0.0123	4.14	-0.00002	42.9	2.57	-0.0002	-0.0002
525	E7 - Perimeter Pond	11/5/2007 12:49	0.00407	-0.03	-0.0001	-0.01	25.9	0.0167		0.241	-0.001	8.13	0.0182	4.91	-0.00002	50.3	3.22	-0.0002	-0.0002
526	E7 - Perimeter Pond	1/14/2008 11:39	0.00308	-0.03	-0.0001	-0.01	18.8	0.0232		0.188	-0.001	12	0.0092	4.77	-0.00002	71.5	2.92	-0.0002	-0.0002
527	E7 - Perimeter Pond	6/16/2008 10:50	0.00263	-0.03	-0.0001	-0.01	18.6	0.00023		0.198	-0.001	11.4	0.0068	3.15	-0.00002	54.5	1.79	-0.0002	-0.0002
528	E7 - Perimeter Pond	4/22/2009 14:44	0.0151	0.085	-0.00005	-0.005	9.4	0.0289		0.0209	0.00089	1.24	0.0058	3.98	0.000011	4.02	0.355	-0.0001	-0.0001
529	E7 - Perimeter Pond	6/8/2011 10:17	0.0077	-0.03	-0.00005	0.0053	40.9	0.0479		0.213	0.0007	5.54	0.0532	5.05	-0.00001	30.3	4.48	-0.00001	-0.0001
530	E7 - Perimeter Pond	8/3/2011 9:34	0.007	-0.03	-0.0001	0.0053	39.3	0.032		0.162	-0.001	6	0.029	5	-0.00002	31.3	4.35	-0.00002	-0.0002
531	E7 - Perimeter Pond	9/8/2011 10:25	0.0044	-0.03	-0.0001	0.0078	36.6	0.139		0.176	-0.001	5.28	0.0122	6.54	-0.00002	37.8	5.16	-0.00002	-0.0002
532	E7 - Perimeter Pond	10/5/2011 13:40	0.0037	-0.03	-0.0001	0.0085	30.1	0.0199		0.166	-0.001	15.1	0.012	4.95	-0.00002	68.1	4.68	-0.00002	-0.0002
533	E7 - Perimeter Pond	11/1/2011 11:48	0.00654	-0.03	-0.00005	0.0059	33.6	0.0966		0.122	0.00065	7.71	0.0139	5.57	-0.00001	38.6	3.58	-0.00001	-0.0001
534	E7 - Perimeter Pond	2/8/2012 10:45	0.00379	-0.03	-0.00005	0.00793	27.2	0.101		0.135	-0.0005	8.35	0.0089	6.41	-0.00001	45.2	4.16	0.000028	-0.0001
535	E7 - Perimeter Pond	5/2/2012 10:19	0.00951	-0.03	-0.00005	0.00298	27.2	0.0431		0.112	0.00073	3.62	0.0246	5.12	-0.00001	19.4	2.65	-0.00001	-0.0001
538	E7 - Perimeter Pond	8/1/2012 11:26	0.00707	-0.03	-0.00005	0.00468	36.4	0.0794		0.143	0.00067	4.91	0.0308	5.39	-0.00001	32.1	4.03	-0.00001	-0.0001
541	E7 - Perimeter Pond	11/15/2012 13:39	0.00545	-0.03	-0.00005	0.00289	36.4	0.0332		0.0836	0.00051	3.89	0.0281	5.21	-0.00001	22.2	2.56	-0.00001	-0.0001
542	E7 - Perimeter Pond	12/6/2012 11:02	0.00473	-0.03	-0.00005	0.0063	29.8	0.177		0.149	0.00056	6.35	0.0124	6.64	-0.00001	44.4	5	-0.00001	-0.0001
543	E7 - Perimeter Pond	1/2/2013 14:40	0.0072	-0.03	-0.00005	0.00424	33	0.22		0.125	0.00066	2.09	0.0182	7.46	-0.00001	23.8	4.59	-0.00001	-0.0001
544	E7 - Perimeter Pond	2/6/2013 10:13																	
545	E7 - Perimeter Pond	5/1/2013 13:28																	
546	E7 - Perimeter Pond	8/8/2013 11:24																	
547	E7 - Perimeter Pond	11/5/2013 9:20	0.00441	-0.03	-0.00005	0.00701	32.3	0.188		0.16	0.00069	5.67	0.0162	6.82	-0.00001	43	4.83	-0.00001	-0.0001
548	E7 - Perimeter Pond	12/5/2013 12:20	0.00714	-0.03	-0.00005	0.0086	42.1	0.385		0.189	0.00086	7.09	0.0291	9.99	-0.00001	51.1	5.04	-0.00001	-0.0001
549	E7 - Perimeter Pond	12/10/2013 13:52	0.00561	-0.03	0.000107	0.00657	31.1	0.269	-0.00001	0.124	0.00057	4.33	0.0313	7.05	-0.00001	34.8	3.12	-0.00001	-0.0001
550	E7 - Perimeter Pond	12/12/2013 11:44	0.00733	-0.03	0.000098	0.00617	31	0.243		0.122	0.00051	4.7	0.0286	7.22	-0.00001	36	3.21	-0.00001	-0.0001
551	E7 - Perimeter Pond	12/16/2013 13:36	0.00601	-0.03	-0.00005	0.00636	27.7	0.274		0.122	0.00051	5.48	0.0248	6.86	-0.00001	38.2	2.33	-0.00001	-0.0001
552	E7 - Perimeter Pond	12/19/2013 8:23	0.00579	-0.03	0.000058	0.00695	30.3	0.362		0.143	0.0007	5.94	0.0165	7.18	-0.00001	40.6	4.15	0.00001	-0.0001
553	E7 - Perimeter Pond	1/7/2014 11:37	0.00357	-0.03	-0.00005	0.00507	27.3	0.282		0.108	-0.0005	5.95	0.0244	7	-0.00001	37.6	1.72	-0.00001	-0.0001
555	E7 - Perimeter Pond	1/27/2014 13:44	0.00522	-0.03	0.000284	0.0066	25.7	0.355		0.133	0.00189	5.5	0.0173	6.76	-0.00001	39.9	3.72	-0.00001	-0.0001
556	E7 - Perimeter Pond	1/28/2014 14:01	0.00776	-0.03	0.000162	0.00715	28.6	0.365		0.152	0.00515	6.31	0.0149	6.89	-0.00001	44.8	4.18	-0.00001	-0.0001
557	E7 - Perimeter Pond	1/29/2014 14:37	0.00515	-0.03	0.000051	0.00703	28.4	0.342		0.148	0.00062	5.77	0.0156	6.97	-0.00001	39.2	4.09	-0.00001	-0.0001
558	E7 - Perimeter Pond	1/30/2014 13:48	0.00459	-0.03	-0.00005	0.00727	29.5	0.305		0.137	0.00095	4.49	0.0181	7.46	-0.00001	39.3	3.57	-0.00001	-0.0001
559	E7 - Perimeter Pond	2/11/2014 14:01	0.00427	-0.03	-0.00005	0.00705	28.8	0.211		0.13	-0.0005	6.63	0.0217	6.8	-0.00001	45.2	2.75	-0.00001	-0.0001
560	E7 - Perimeter Pond	3/4/2014 8:54	0.00604	-0.03	-0.00005	0.00883	33.8	0.393		0.178	0.00058	9.2	0.0276	7.31	-0.00001	64	2.69	-0.00001	-0.0001
561	E7 - Perimeter Pond	4/1/2014 11:20	0.0073	0.032	-0.00005	0.00463	24.2	0.158		0.0622	-0.0005	1.91	0.0372	6.57	-0.00001	18.4	0.711	0.000012	-0.0001
562	E7 - Perimeter Pond	5/1/2014 11:12	0.036	-0.03	-0.00005	0.00304	27.4	0.113		0.119	0.00105	2.01	0.0383	4.96	-0.00001	15	2.44	-0.00001	-0.0001
563	E7 - Perimeter Pond	6/3/2014 11:11	0.014	-0.03	-0.00005	0.00494	33.3	0.0561		0.135	0.00074	6.44	0.0393	5.08	-0.00001	37.1	2.44	-0.00001	-0.0001
564	E7 - Perimeter Pond	7/3/2014 8:38	0.00737	-0.03	-0.00005	0.00823	41.7	0.000902		0.194	0.00056	7.22	0.0398	4.85	-0.00001	44.3	3.56	-0.00001	-0.0001
565	E7 - Perimeter Pond	9/2/2014 11:22	0.00481	-0.03	-0.00005	0.00798	23	0.0754		0.171	-0.0005	9.77	0.0148	5.65	-0.00001	66.4	1.95	-0.00001	-0.0001

Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
432	E5 - Tailings Impoundment Main Embank Drain Comp	1/13/2010 13:50	-0.01	0.00139	-0.002	-0.002	-0.007	0.00038	0.00185	0.0744	-0.001	-0.001	0.167	-0.000034	100	-0.001	0.00033	0.00282	0.063	-0.0001	-0.01	16.2
433	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2010 13:20	-0.01	0.00131	-0.002	-0.002	-0.008	0.0004	0.0018	0.0777	-0.001	-0.001	0.143	-0.0004	114	-0.001	0.00034	-0.004	0.064	-0.0001	-0.01	17.9
434	E5 - Tailings Impoundment Main Embank Drain Comp	3/3/2010 12:24	-0.01	0.00145	-0.002	-0.002	0.0047	0.00043	0.00161	0.075	-0.001	-0.001	0.15	-0.000034	126	-0.001	0.00031	0.00279	0.059	-0.0001	-0.01	18.6
435	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2010 14:05	-0.01	0.00141	-0.002	-0.002	0.0057	0.00036	0.0018	0.08	-0.001	-0.001	0.174	-0.00041	124	-0.001	0.00035	0.00276	0.056	-0.0001	-0.01	18.8
436	E5 - Tailings Impoundment Main Embank Drain Comp	5/11/2010	-0.01	0.00134	-0.002	-0.002	0.0125	0.00034	0.00163	0.0746	-0.001	-0.001	0.145	0.000063	118	-0.001	0.00029	0.00318	0.065	-0.0001	-0.01	17.7
438	E5 - Tailings Impoundment Main Embank Drain Comp	7/8/2010	-0.01	0.00123	-0.002	-0.002	1.53	0.00136	0.00348	0.138	-0.001	-0.001	0.139	-0.00087	112	0.0016	0.00175	0.27	1.92	0.00062	-0.01	18.7
439	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2010	-0.01	0.00135	-0.002	-0.002	0.0053	0.0004	0.00166	0.0795	-0.001	-0.001	0.141	-0.0006	124	-0.001	0.00038	-0.004	0.062	-0.0001	-0.01	19.1
441	E5 - Tailings Impoundment Main Embank Drain Comp	10/7/2010	-0.01	0.00122	-0.001	-0.003	0.02	0.00047	0.00181	0.0755	-0.0005	-0.0005	0.166	-0.00015	125	-0.0005	0.00041	0.00508	0.05	-0.00005	0.0062	20.7
442	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2010	-0.01	0.00141	-0.001	-0.003	0.0053	0.0004	0.00182	0.086	-0.0005	-0.0005	0.151	-0.00008	135	-0.0005	0.00042	0.00288	0.07	-0.00005	0.0052	20.4
443	E5 - Tailings Impoundment Main Embank Drain Comp	12/1/2010 10:20	-0.01	0.0015	-0.001	-0.003	0.0066	0.0004	0.0019	0.0793	-0.0005	-0.0005	0.151	-0.0001	137	-0.0005	0.00041	0.00387	0.063	-0.00005	-0.005	20.2
444	E5 - Tailings Impoundment Main Embank Drain Comp	1/10/2011 10:13	-0.01	0.00132	-0.001	-0.003	0.0044	0.00042	0.00169	0.0718	-0.0005	-0.0005	0.168	-0.00006	137	-0.0005	0.00039	0.00263	0.063	-0.00005	0.006	21.1
446	E5 - Tailings Impoundment Main Embank Drain Comp	3/7/2011 10:15	0.012	0.00132	-0.001	-0.003	0.0061	0.00037	0.00198	0.0788	-0.0005	-0.0005	0.143	-0.00009	137	-0.0005	0.0005	0.0029	0.06	-0.00005	0.0057	21.1
447	E5 - Tailings Impoundment Main Embank Drain Comp	4/5/2011 10:44	-0.01	0.0013	-0.001	-0.003	0.0243	0.00056	0.00161	0.0675	-0.0005	-0.0005	0.126	-0.00035	168	-0.0005	0.00036	0.052	0.193	0.000229	-0.005	25.4
448	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2011 13:08	-0.01	0.00129	-0.001	-0.003	0.0104	0.00033	0.00145	0.0692	-0.0005	-0.0005	0.124	-0.00009	143	-0.0005	0.00033	0.00293	0.045	-0.00005	-0.005	22
449	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2011 13:25	0.011	0.00136	-0.001	-0.003	0.0046	0.00036	0.00168	0.0789	-0.0001	-0.0005	0.142	-0.0001	163	-0.0005	0.00041	0.00275	0.046	-0.00005	0.00545	24.1
450	E5 - Tailings Impoundment Main Embank Drain Comp	7/13/2011 9:02	-0.01	0.00129	-0.001	-0.003	0.0052	0.00035	0.0016	0.0749	-0.0001	-0.0005	0.129	-0.00007	168	-0.0005	0.00036	0.00236	0.053	-0.00005	0.0049	23.6
451	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2011 8:46	-0.01	0.00142	-0.001	-0.003	0.007	0.00045	0.00161	0.066	-0.0001	-0.0005	0.141	-0.00009	155	-0.0005	0.00038	0.00302	0.05	-0.00005	0.00606	24.5
453	E5 - Tailings Impoundment Main Embank Drain Comp	10/5/2011 11:10	-0.01	0.0013	-0.001	-0.003	0.006	0.00041	0.00164	0.0607	-0.0001	-0.0005	0.13	-0.00007	131	-0.0005	0.00038	0.00327	0.039	0.000055	0.00578	20.7
454	E5 - Tailings Impoundment Main Embank Drain Comp	11/1/2011 10:32	-0.01	0.00127	-0.001	-0.003	0.0085	0.00043	0.00167	0.0624	-0.0001	-0.0005	0.148	-0.00008	136	-0.0005	0.0004	-0.0035	0.05	-0.00005	0.006	21.2
455	E5 - Tailings Impoundment Main Embank Drain Comp	12/5/2011 11:00	-0.01	0.00126	-0.001	-0.003	0.0051	0.00042	0.0016	0.0567	-0.0001	-0.0005	0.118	-0.00008	123	-0.0005	0.00035	0.0029	0.043	-0.00005	0.00583	19.5
456	E5 - Tailings Impoundment Main Embank Drain Comp	1/4/2012 13:40	-0.01	0.00119	-0.001	-0.003	0.0058	0.00044	0.0017	0.0615	-0.0001	-0.0005	0.146	-0.00008	129	-0.0005	0.00037	0.00295	0.047	-0.00005	0.0064	20.3
457	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2012 9:50	-0.01	0.00117	-0.001	-0.003	0.0055	0.00044	0.00179	0.0613	-0.0001	-0.0005	0.144	-0.00009	129	-0.0005	0.00036	0.00282	0.047	-0.00005	0.00721	21.2
458	E5 - Tailings Impoundment Main Embank Drain Comp	3/14/2012 14:10	-0.01	0.00116	-0.001	-0.003	-0.012	0.0004	0.00159	0.0586	-0.0001	-0.0005	0.138	-0.0001	126	-0.0005	0.00033	0.00257	0.042	-0.00005	0.0059	19
460	E5 - Tailings Impoundment Main Embank Drain Comp	5/2/2012 11:05	-0.01	0.00123	-0.001	-0.003	0.0176	0.00041	0.00171	0.067	-0.0001	-0.0005	0.141	-0.00025	147	-0.0005	0.00035	0.00274	0.04	-0.00005	0.00624	22.5
461	E5 - Tailings Impoundment Main Embank Drain Comp	6/7/2012 9:15	0.015	0.00121	-0.001	-0.003	0.101	0.00037	0.00158	0.0626	-0.0001	-0.0005	0.131	-0.0002	152	-0.0005	0.00036	0.00689	0.132	0.000058	0.00565	21.6
462	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2012 8:47	-0.01	0.00123	-0.001	-0.003	0.0049	0.00034	0.00157	0.0727	-0.0001	-0.0005	0.126	-0.0001	154	-0.0005	0.00031	0.00235	0.05	-0.00005	0.00567	25.3
463	E5 - Tailings Impoundment Main Embank Drain Comp	8/1/2012 10:24	-0.01	0.00113	-0.001	-0.003	0.216	0.00042	0.00177	0.0688	-0.0001	-0.0005	0.137	-0.0001	131	-0.0005	0.00042	0.00698	0.207	-0.0001	0.00619	20.8
464	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2012 11:05	-0.01	0.00101	-0.001	-0.003	0.0316	0.0004	0.0018	0.067	-0.0001	-0.0005	0.15	-0.00012	120	-0.0005	0.00038	0.00349	0.063	-0.00005	0.00689	19.6
465	E5 - Tailings Impoundment Main Embank Drain Comp	10/3/2012 9:30	-0.01	0.00109	-0.001	-0.003	0.192	0.00042	0.00189	0.0679	-0.0001	-0.0005	0.145	-0.0001	127	-0.0005	0.00049	0.0205	0.299	0.000119	0.00639	19.7
466	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2012 13:07	0.012	0.00118	-0.001	-0.003	0.0077	0.00041	0.00184	0.0699	-0.0001	-0.0005	0.132	-0.0001	131	-0.0005	0.00036	0.00417	0.06	-0.00005	0.00634	19.7
467	E5 - Tailings Impoundment Main Embank Drain Comp	12/6/2012 10:11	-0.01	0.00121	-0.001	-0.003	0.0043	0.00049	0.00161	0.0551	-0.0001	-0.0005	0.141	-0.0001	124	-0.0005	0.00032	0.0033	0.051	-0.00005	0.00665	20.4
468	E5 - Tailings Impoundment Main Embank Drain Comp	1/2/2013 14:04	0.011	0.00124	-0.001	-0.003	0.0256	0.0005	0.00202	0.0562	-0.0001	-0.0005	0.102	-0.0005	123	-0.0005	0.00037	0.0391	0.121	-0.00005	0.00539	19.4
469	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2013 9:30					0.0084	0.0005	0.00181	0.0612	-0.0001	-0.0005	0.137	-0.00015	131	-0.0005	0.00036	0.0029	0.054	-0.00005	0.00636	20
470	E5 - Tailings Impoundment Main Embank Drain Comp	3/13/2013 13:05					0.0053	0.00044	0.00184	0.0594	-0.0001	-0.0005	0.138	-0.0001	130	-0.0005	0.00035	0.00426	0.05	-0.00005	0.00717	19.3
471	E5 - Tailings Impoundment Main Embank Drain Comp	4/4/2013 14:45					0.599	0.00072	0.0021	0.0517	-0.0001	-0.0005	0.09	-0.0001	141	0.00125	0.00049	0.00694	0.718	0.000176	0.0066	21.1
472	E5 - Tailings Impoundment Main Embank Drain Comp	5/1/2013 9:18					0.0078	0.00042	0.00164	0.0645	-0.0001	-0.0005	0.126	-0.0001	155	-0.0005	0.00032	0.00276	0.051	-0.00005	0.00557	24.1
473	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2013 9:05					0.0075	0.00038	0.00178	0.0619	-0.0001	-0.0005	0.133	-0.0002	133	-0.0005	0.00035	0.00277	0.046	-0.00005	0.00675	21.8
474	E5 - Tailings Impoundment Main Embank Drain Comp	7/10/2013 10:02					0.0407	0.00086	0.00181	0.0314	-0.0001	-0.0005	0.114	-0.0001	137	-0.0005	0.00016	0.00437	0.061	-0.00005	0.00823	19.7
475	E7 - Perimeter Pond	8/3/2001	0.00202	0.00118	0.00085	0.0037	0.175	0.00044	0.0009	0.0551	-0.00005	-0.00005	0.0003	0.00003	79	0.0009	0.00043	0.01	0.242	0.00013	0.002	12.5
476	E7 - Perimeter Pond	8/10/2001 10:30	0.00211	0.0012	0.00103	0.0033	0.0916	0.00041	0.0012	0.0552	-0.00005	-0.00005		0.00003	75	0.0008	0.00048	0.0096	0.138	0.00009	0.0021	12.8
478	E7 - Perimeter Pond	8/30/2001 14:15	0.00299	0.00149	0.00111	0.0024	0.105	0.00049	0.001	0.0577	-0.00005	0.00078		0.00003	73.8	-0.0002	0.00039	0.0106	0.118	0.00007	0.0022	13.8
479	E7 - Perimeter Pond	10/23/2001 15:00	0.00304	0.00112	0.00063	0.002	0.619	0.00028	0.0008	0.0706	-0.00005	0.00018		0.00003	81.8	0.0013	0.00072	0.0284	0.759	0.00072	0.0017	12.9
480	E7 - Perimeter Pond	11/13/2001 8:30	0.00318	0.00167	0.00079	0.0037	0.205	0.00041	0.0006	0.0801	-0.00005	0.00124		0.00004	113	-0.0002	0.00035	0.011	0.207	0.00018	0.0019	17.7
485	E7 - Perimeter Pond	5/22/2002 9:15	0.00206	0.00065	0.00065	0.0093	0.512	0.00032	0.0011	0.0344	-0.00005	0.00024		0.00003	50.8	0.0009	0.00064	0.0179	0.675	0.00041	0.001	8.04
487	E7 - Perimeter Pond	7/31/2002 16:15	0.00325	0.00156	0.00034	0.0124	0.0539	0.00018	0.0009	0.0493	-0.00005	-0.00005		0.00002	97.4	-0.0002	-0.00002	0.0048	0.072	0.00008	-0.0002	18.3
496	E7 - Perimeter Pond	5/5/2003 16:20	0.00421	0.00138	0.00105	0.0008	0.0848	0.00024	0.0008	0.0362	-0.00005	-0.00005		0.00004	74.8	-0.0002	0.00022	0.0049	0.08	0.00011	0.0016	13.1
497	E7 - Perimeter Pond	5/29/2003 9:10	0.00445	0.00157	0.0007	0.0012	0.0454	0.00025	0.0009	0.0238	-0.00005	-0.00005		0.00002	77.9	-0.0002	0.00013	0.0046	0.085	0.00006	0.0017	15.2
498	E7 - Perimeter Pond	6/24/2003 6:30	0.00484	0.0018	0.00072	0.0067	0.0579	0.00026	0.0012	0.0306	-0.00005	-0.00005		0.00004	92.7	0.0008	0.00031	0.0035	0.178	0.00012	0.0017	19.7
499	E7 - Perimeter Pond	8/5/2003 14:05	0.00427	0.00193	0.00054	0.002	0.0347	0.00025	0.0014	0.0372	-0.00005	-0.00005		0.00002	96.3	0.0017	0.00013	0.0026	0.069	0.00008	0.0022	21.2
500	E7 - Perimeter Pond	8/20/2003 10:30	0.00424	0.00175	0.00153	0.0017	0.0367	0.00022	0.0011	0.0356	-0.00005	-0.00005		0.00002	91.8	0.0003	0.00013	0.0037	0.069	0.00009	0.0021	21.4
501	E7 - Perimeter Pond	10/16/2003 15:10	0.00301	0.00153	0.00087	0.0016	0.0557	0.00022	0.0009	0.042	-0.00005	-0.00005		0.00001	90.8	0.0017	-0.00002	0.0043	0.126	0.0001	0.0017	18.8
502	E7 - Perimeter Pond	5/1/2004 14:53	0.00337	0.00173	0.00031	0.007	0.0681	0.0003	0.0007	0.0607	-0.00005	-0.00005		0.00003	100	0.0003	0.00027	0.0031	0.164	0.00009	0.0016	16
503	E7 - Perimeter Pond	7/5/2004	0.00101	0.00204	0.00059	0.0015	0.149	0.00028	0.0009	0.0469	-0.00005	-0.00005		0.00002	106	-0.0002	0.00014	0.006	0.238	0.00016	0.0018	17.1
505	E7 - Perimeter Pond	8/25/2004	-0.0005	0.00197	0.0004	0.0016	0.0258	0.00019	0.001	0.0367	-0.00005	-0.00005		0.00003	94	-0.0002	0.00005	0.0031	0.038	0.00003	0.0022	17.8
506	E7 - Perimeter Pond	10/17/2004	-0.0005	0.00265	0.0005	0.0013	0.291	0.00028	0.0011	0.0585	-0.00005	-0.00005		0.00004	109	0.0003	0.00051	0.0038	0.486	0.0001	0.002	18.6
507	E7 - Perimeter Pond	12/8/2004	-0.0005	0.00148	0.00034	0.0006	0.109	0.00033	0.0007	0.0486	-0.00005	-0.00005		0.00004	78.8	0.0007	0.0002	0.0048	0.166	0.00032	0.0014	11.5
508	E7 - Perimeter Pond	1/27/2005	0.00075	0.00069	0.00036	0.0026	0.419	0.00028	0.0007	0.0552	-0.00005	-0.00005		0.00003	48.2	0.0006	0.00067	0.0272	1.33	0.00068	0.0011	6.98
509	E7 - Perimeter Pond	3/16/2005	-0.0005	0.00092	0.00039	-0.0005	1.04	0.00024	0.0007	0.0587	-0.00005	-0.00005	0.026	0.00004	56.5	0.0017	0.00104	0.0146	2.91	0.00072	0.0019	8.32
511	E7 - Perimeter Pond	4/11/2005	-0.0005	0.00162	0.00023	-0.0005	0.596	0.00025	0.0011	0.0614	-0.00005	-0.00005	0.023	0.00004	70.7	0.0018	0.00065	0.021	0.733	0.00046	0.0018	11.7
512	E7 - Perimeter Pond	5/4/2005	-0.0005	0.00194	0.00044	0.0032	0.12	0.00035	0.0008	0.0508	-0.00005	-0.00005	0.034	0.00004	75.9	0.001	0.00017	0.0073	0.15	0.00008	0.0017	14.3
513	E7 - Perimeter Pond	9/6/2006	-0.01	0.0132	-0.005	-0.005	-0.005	-0.0005	0.00062	0.0794	-0.0025	-0.0025	-0.05	-0.00025	239	0.0054	0.00099	-0.03	0.0449	-0.03	-0.00025	37.2
515	E7 - Perimeter Pond	11/15/2006	-0.01	0.00268	-0.002	0.0047	0.0177	0.00028	0.00052	0.0558	-0.001	-0.001	0.039	0.00011	131	-0.001	-0.0002	0.00525	-0.03	-0.0001	-0.01	21.3
516	E7 - Perimeter Pond	2/13/2007	-0.01	0.00393	-0.002	0.009	0.347	0.00034	0.00096	0.0853	-0.0005	-0.001	0.078	0.000094	191	0.00087	0.00057	0.0103	0.581	0.00029	-0.01	29.7
517	E7 - Perimeter Pond	3/27/2007	-0.01	0.0023	-0.002	0.0078	0.973	0.00035	0.0009	0.076	-0.001	-0.001	0.08	0.000093	147	-0.003	-0.0008	0.0128	1.17	-0.0005	-0.01	24.2
518	E7 - Perimeter Pond	4/17/2007 10:07	-0.01	0.00134	-0.002	0.0035	0.689	0.00031	0.00071	0.0524	-0.001	-0.001	0.038	0.000092	110	0.0013	0.00049	0.0194	0.743	0.00035	-0.01	15.2
519	E7 - Perimeter Pond	5/8/2007 8:48	-0.01	0.00305	-0.005	-0.005	0.112	-0.0005	0.00054	0.0848	-0.0025	-0.0025	0.106	0.000088	201	-0.0025	-0.0005	0.00895	0.136	-0.00025	-0.025	29.4
520	E7 - Perimeter Pond	6/11/2007 12:09	-0.01	0.00496	-0.002	0.0032	0.0343	0.00051	0.0006	0.0698	-0.001	-0.001	0.096	0.000117	182	-0.001	-0.0002	0.00597	0.037	-0.0001	-0.01	32.5
521	E7 - Perimeter Pond	7/3/2007 10:14	-0.01	0.00411	-0.002	-0.002	0.0538	0.00041	0.00071	0.0633	-0.001	-0.001	0.08	0.000077	161	-0.001	-0.0002	0.0056	0.057	-0.0001	-0.01	31.2
522	E7 - Perimeter Pond	8/8/2007 10:18	-0.01	0.0048	-0.002	0.0052	0.0201	0.00048	0.00075	0.0554	-0.001	-0.001	0.089	-0.000034	138	-0.001	-0.0002	0.00396	-0.03	-0.0001	-0.01	33.1
523	E7 - Perimeter Pond	9/6/2007 11:48	-0.01	0.00625	-0.002	0.0026	0.0167	0.00091	0.0008	0.0637	-0.001	-0.001	0.099	-0.000034	146	-0.001	-0.0002	0.00441	-0.03	-0.0001	-0.01	29.9
524	E7 - Perimeter Pond	10/2/2007 14:46	-0.01	0.00554	-0.002	0.0045	0.0832	0.00113	0.00074	0.0696	-0.001	-0.001	0.109	0.000111	141	-0.001	-0.0002	0.00421	0.092	-0.0001	-0.01	24.9
525	E7 - Perimeter Pond	11/5/2007 12:49	-0.01	0.00508	-0.002	0.023	0.116	0.0011	0.00082	0.0716	-0.001	-0.001	0.129	0.000175	175	-0.001	-0.0002	0.0074	0.14	0.00014	-0.01	26.1
526	E7 - Perimeter Pond	1/14/2008 11:39	-0.01	0.00394	-0.002	0.0451	0.0403	0.0012	0.0009	0.0521	-0.001	-0.001	0.133	-0.0004	125	-0.001	-0.0002	0.00413	0.046	-0.0001	0.01	19
527	E7 - Perimeter Pond	6/16/2008 10:50	-0.01	0.0027	-0.002	0.0043	0.143	0.00088	0.00094	0.0449	-0.001	-0.001	0.152	-0.0004	116	-0.001	-0.0002	0.00778	0.176	0.00028	-0.01	18.5
528	E7 - Perimeter Pond	4/22/2009 14:44	-0.01	0.000205	-0.001	0.0012	1.66	0.00011	0.00082	0.0364	-0.0005	-0.0005	0.014	0.0001	47	0.00313	0.00095	0.0286	1.63	0.000482	-0.005	9.99
529	E7 - Perimeter Pond	6/8/2011 10:17	0.014	0.00243	-0.001	-0.003	0.234	0.00054	0.00064	0.0589	-0.0005	-0.0005	0.143	-0.00011	245	0.00051	0.00029	0.0123	0.215	0.000078	0.0052	42
530	E7 - Perimeter Pond	8/3/2011 9:34	-0.01	0.0023	-0.002	-0.006	0.319	0.00049	0.00064	0.0625	-0.0002	-0.001	0.151	-0.00008	228	-0.001	0.00027	0.011	0.299	-0.0001	0.0048	40.2
531	E7 - Perimeter Pond	9/8/2011 10:25	-0.01	0.00473	-0.002	-0.006	0.191	0.00104	0.0009	0.0498	-0.0002	-0.001	0.405	-0.00025	232	-0.001	0.00087	0.0095	0.193	-0.0001	0.0083	37.4
532	E7 - Perimeter Pond	10/5/2011 13:40	-0.01	0.00211	-0.002	-0.006	0.0964	0.00053	0.00089	0.0421	-0.0002	-0.001	0.152	-0.00008	193	-0.001	-0.0002	0.0066	0.107	-0.0001	0.0083	29.8
533	E7 - Perimeter Pond	11/1/2011 11:48	-0.01	0.00212	-0.001	0.0053	0.263	0.00052	0.00076	0.0446	-0.0001	-0.0005	0.187	-0.0001	188	0.00057	0.00043	0.0121	0.229	-0.00005	0.00589	32.9
534	E7 - Perimeter Pond	2/8/2012 10:45	-0.01	0.00282	-0.001	0.009	0.279	0.00088	0.00104	0.0426	-0.0001	-0.0005	0.257	-0.00013	182	0.00064	0.00044	0.0065	0.294	0.000128	0.00862	27.9
535	E7 - Perimeter Pond	5/2/2012 10:19	-0.01	0.0013	-0.001	0.003	1.68	0.00043	0.00122	0.0564	-0.0001	-0.0005	0.11	-0.0002	155	0.00269	0.00123	0.0463	1.9	0.000565	0.0045	27.9
538	E7 - Perimeter Pond	8/1/2012 11:26	-0.01	0.00203	-0.001	-0.003	0.245	0.0008	0.00081	0.0587	-0.0001	-0.0005	0.179	-0.0001	221	0.00053	0.0004	0.0124	0.258	-0.0002	0.00521	37.3
541	E7 - Perimeter Pond	11/15/2012 13:39	0.014	0.000956	-0.001	0.0039	0.207	0.0003	0.00059	0.0456	-0.0001	-0.0005	0.07	-0.00006	188	-0.0005	0.00021	0.00896	0.236	0.000091	0.00313	35.8
542	E7 - Perimeter Pond	12/6/2012 11:02	-0.01	0.00295	-0.001	0.0075	0.0837	0.00086	0.00075	0.0368	-0.0001	-0.0005	0.251	-0.00025	204	-0.0005	0.00058	0.00614	0.107	-0.00005	0.00697	31.7
543	E7 - Perimeter Pond	1/2/2013 14:40	0.015	0.00347	-0.001	0.007	0.116	0.00081	0.00077	0.0374	-0.0001	-0.0005	0.256	-0.00025	220	-0.0005	0.00095	0.0105	0.309	0.000054	0.00489	33.9
544	E7 - Perimeter Pond	2/6/2013 10:13					0.132	0.00047	0.00059	0.0422	-0.0001	-0.0005	0.119	-0.0001	188	-0.0005	0.00019	0.00757	0.13	0.00008	0.00312	37
545	E7 - Perimeter Pond	5/1/2013 13:28					0.47	0.00042	0.00067	0.0475	-0.0001	-0.0005	0.078	-0.0002	207	0.00062	0.00047	0.0357	0.388	0.000105	0.0033	39.5
546	E7 - Perimeter Pond	8/8/2013 11:24					0.182	0.00062	0.00088	0.0466	-0.0001	-0.0005	0.119	-0.00011	236	-0.0005	0.00016	0.00948	0.167	0.000058	0.00707	40.6
547	E7 - Perimeter Pond	11/5/2013 9:20	-0.01	0.00284	-0.001	0.0048	0.326	0.00088	0.00127	0.0645	-0.0001	-0.0005	0.231	-0.0003	217	0.00064	0.00094	0.00969	0.278	0.000107	0.00779	32.9
548	E7 - Perimeter Pond	12/5/2013 12:20	0.022	0.00502	0.0012	0.0056	1.01	0.00138	0.00148	0.0633	-0.0001	-0.0005	0.295	-0.00027	256	0.00139	0.00135	0.0184	1.01	0.000271	0.00893	39.9
549	E7 - Perimeter Pond	12/10/2013 13:52	0.017	0.0048	-0.001	0.007	3.03	0.00177	0.00173	0.0601	-0.0001	-0.0005	0.28	-0.00021	178	0.0037	0.00175	0.0284	2.76	0.002	0.0089	30.8
550	E7 - Perimeter Pond	12/12/2013 11:44	-0.01	0.00367	-0.001	0.0054	1.53	0.00131	0.00148	0.0554	-0.0001	-0.0005	0.254	-0.00018	178	0.00231	0.00128	0.0242	1.73	0.00103	0.00787	30.2
551	E7 - Perimeter Pond	12/16/2013 13:36	0.016	0.004	0.0011	0.0062	2.02	0.00142	0.00163	0.0606	-0.0001	-0.0005	0.194	-0.00012	161	0.00269	0.00197	0.0213	1.9	0.000896	0.00811	28.3
552	E7 - Perimeter Pond	12/19/2013 8:23	0.012	0.00312	-0.001	0.0072	0.457	0.00084	0.00126	0.0422	-0.0001	-0.0005	0.26	-0.00024	211	0.00074	0.00105	0.00988	0.443	0.00023	0.00736	29.8
553	E7 - Perimeter Pond	1/7/2014 11:37	-0.01	0.00368	0.0013	0.0041

Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
432	E5 - Tailings Impoundment Main Embank Drain Comp	1/13/2010 13:50	0.359		0.134	-0.001		0.0061	6.53	-0.00002	77.5	1.36	-0.0002	-0.0002	-0.01	0.00141	-0.002	-0.002
433	E5 - Tailings Impoundment Main Embank Drain Comp	2/10/2010 13:20	0.37		0.138	-0.001		0.0076	6.39	-0.00002	83.6	1.49	-0.0002	-0.0002	-0.01	0.00142	-0.002	-0.002
434	E5 - Tailings Impoundment Main Embank Drain Comp	3/3/2010 12:24	0.352		0.151	-0.001			6.26	-0.00002	73.6		-0.0002	-0.0002	-0.01	0.00153	-0.002	-0.002
435	E5 - Tailings Impoundment Main Embank Drain Comp	4/7/2010 14:05	0.356		0.144	-0.001		0.0045	6.61	-0.00002	82.7	1.52	-0.0002	-0.0002	-0.01	0.00146	-0.002	-0.002
436	E5 - Tailings Impoundment Main Embank Drain Comp	5/11/2010	0.294		0.136	-0.001		0.0063	6.61	-0.00002	71.9	1.48	-0.0002	-0.0002	-0.01	0.00133	-0.002	-0.002
438	E5 - Tailings Impoundment Main Embank Drain Comp	7/8/2010	0.843		0.144	0.0016		0.01	10.3	-0.00002	76.5	1.59	-0.0002	-0.0002	0.092	0.0013	0.0065	0.0044
439	E5 - Tailings Impoundment Main Embank Drain Comp	8/5/2010	0.323		0.137	-0.001		0.0057	6.39	-0.00002	76.9	1.62	-0.0002	-0.0002	-0.01	0.0014	-0.002	-0.002
441	E5 - Tailings Impoundment Main Embank Drain Comp	10/7/2010	0.509		0.16	0.00055		0.0034	6.62	-0.00001	84.3	1.75	-0.0001	-0.0001	-0.01	0.00122	-0.001	-0.003
442	E5 - Tailings Impoundment Main Embank Drain Comp	11/4/2010	0.379		0.157	-0.0005		0.0059	7.07	-0.00001	86.4	1.88	-0.0001	-0.0001	-0.01	0.00146	-0.001	-0.003
443	E5 - Tailings Impoundment Main Embank Drain Comp	12/1/2010 10:20	0.371		0.158	-0.0005		0.0056	6.71	-0.00001	80.9	1.78	-0.0001	-0.0001	-0.01	0.0014	-0.001	-0.003
444	E5 - Tailings Impoundment Main Embank Drain Comp	1/10/2011 10:13	0.355		0.176	-0.0005		0.00549	7.01	-0.00001	77	2.12	-0.0001	-0.0001	-0.01	0.00149	-0.001	-0.003
446	E5 - Tailings Impoundment Main Embank Drain Comp	3/7/2011 10:15	0.415		0.16	-0.0005		0.00488	7	-0.00001	89.6	1.88	-0.0001	-0.0001	0.012	0.00135	-0.001	-0.003
447	E5 - Tailings Impoundment Main Embank Drain Comp	4/5/2011 10:44	0.368		0.187	-0.0005		0.0131	6.13	-0.00001	60.5	2.27	-0.0001	-0.0001	-0.01	0.0013	-0.001	-0.003
448	E5 - Tailings Impoundment Main Embank Drain Comp	5/12/2011 13:08	0.298		0.187	-0.0005		0.0108	6.2	-0.00001	67.1	1.98	-0.0001	-0.0001	-0.01	0.00129	-0.001	-0.003
449	E5 - Tailings Impoundment Main Embank Drain Comp	6/9/2011 13:25	0.384		0.187	-0.0005		0.0103	6.62	-0.00001	84.6	2.17	-0.0001	-0.0001	0.011	0.0014	-0.001	-0.003
450	E5 - Tailings Impoundment Main Embank Drain Comp	7/13/2011 9:02	0.331		0.181	-0.0005		0.0102	6.62	-0.00001	77.9	2.11	-0.00001	-0.0001	-0.01	0.00133	-0.001	-0.003
451	E5 - Tailings Impoundment Main Embank Drain Comp	8/3/2011 8:46	0.452		0.192	-0.0005		0.00888	6.55	-0.00001	75	2.12	-0.00001	-0.0001	-0.01	0.00145	-0.001	0.0035
453	E5 - Tailings Impoundment Main Embank Drain Comp	10/5/2011 11:10	0.465		0.176	-0.0005		0.00558	6.4	0.000024	82.3	1.86	-0.00001	-0.0001	-0.01	0.00133	-0.001	-0.003
454	E5 - Tailings Impoundment Main Embank Drain Comp	11/1/2011 10:32	0.467		0.178	-0.0005		0.00536	6.37	-0.00001	84.2	1.84	-0.00001	-0.0001	-0.01	0.00128	-0.001	-0.003
455	E5 - Tailings Impoundment Main Embank Drain Comp	12/5/2011 11:00	0.363		0.161	-0.0005		0.00459	6.22	-0.00001	85.5	1.8	-0.00001	-0.0001	-0.01	0.00115	-0.001	-0.003
456	E5 - Tailings Impoundment Main Embank Drain Comp	1/4/2012 13:40	0.397		0.182	-0.0005		0.00474	6.5	-0.00001	90.7	2.07	-0.00001	-0.0001	-0.01	0.00123	-0.001	0.004
457	E5 - Tailings Impoundment Main Embank Drain Comp	2/8/2012 9:50	0.395		0.181	-0.0005		0.00481	6.55	-0.00001	89.1	1.95	0.000022	-0.0001	-0.01	0.00124	-0.001	-0.003
458	E5 - Tailings Impoundment Main Embank Drain Comp	3/14/2012 14:10	0.356		0.17	-0.0005		0.00518	6.15	-0.00001	80.1	1.83	0.000015	-0.0001	-0.01	0.00115	-0.001	-0.003
460	E5 - Tailings Impoundment Main Embank Drain Comp	5/2/2012 11:05	0.452		0.209	-0.0005		0.00921	6.24	-0.00001	75.8	2.19	-0.00001	-0.0001	-0.01	0.00129	0.001	-0.003
461	E5 - Tailings Impoundment Main Embank Drain Comp	6/7/2012 9:15	0.289		0.188	-0.0005		0.00974	6.45	-0.00001	69.1	1.99	-0.00001	-0.0001	0.02	0.00119	0.001	-0.003
462	E5 - Tailings Impoundment Main Embank Drain Comp	7/5/2012 8:47	0.318		0.191	-0.0005		0.013	6.48	-0.00001	73.1	2.05	-0.00001	-0.0001	-0.01	0.00123	-0.001	-0.003
463	E5 - Tailings Impoundment Main Embank Drain Comp	8/1/2012 10:24	0.414		0.198	0.00053		0.00661	6.78	0.000012	84.8	2.08	-0.00001	-0.0001	0.018	0.00113	0.0012	-0.003
464	E5 - Tailings Impoundment Main Embank Drain Comp	9/6/2012 11:05	0.437		0.182	-0.0005		0.00614	6.26	-0.00001	93.1	1.86	-0.00001	-0.0001	-0.01	0.00104	-0.001	-0.003
465	E5 - Tailings Impoundment Main Embank Drain Comp	10/3/2012 9:30	0.441		0.184	0.00065		0.00542	7.04	-0.00001	90.3	1.79	-0.00001	-0.0001	0.017	0.00111	0.0013	-0.003
466	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2012 13:07	0.371		0.191	-0.0005		0.00651	6.48	-0.00001	81.8	1.98	-0.00001	-0.0001	0.012	0.00116	0.001	-0.003
467	E5 - Tailings Impoundment Main Embank Drain Comp	12/6/2012 10:11	0.425		0.183	-0.0005		0.00674	6.28	-0.00001	77.4	1.97	-0.00001	-0.0001	-0.01	0.00124	-0.001	-0.003
468	E5 - Tailings Impoundment Main Embank Drain Comp	1/2/2013 14:04	0.459		0.185	-0.0005		0.00594	6.26	-0.00001	87.5	1.92	-0.00001	-0.0001	0.012	0.00124	0.001	-0.003
469	E5 - Tailings Impoundment Main Embank Drain Comp	2/6/2013 9:30	0.367	-0.00001	0.187	-0.0005		0.00732	6.65	-0.00001	87.5	2.09	-0.00001	-0.0001	-0.01	0.00116	-0.001	-0.003
470	E5 - Tailings Impoundment Main Embank Drain Comp	3/13/2013 13:05	0.367		0.176	-0.0005		0.00734	6.33	-0.00001	88.1	2.02	-0.00001	-0.0001	-0.01	0.00107	-0.001	-0.003
471	E5 - Tailings Impoundment Main Embank Drain Comp	4/4/2013 14:45	0.285		0.159	0.00123		0.0128	6.71	-0.00001	59.1	1.71	-0.00001	-0.0001	0.043	0.00106	0.0029	0.0038
472	E5 - Tailings Impoundment Main Embank Drain Comp	5/1/2013 9:18	0.373		0.194	-0.0005		0.0133	6.34	-0.00001	78.4	2.31	-0.00001	-0.0001	-0.01	0.00119	-0.001	-0.003
473	E5 - Tailings Impoundment Main Embank Drain Comp	6/6/2013 9:05	0.378		0.185	-0.0005		0.00903	6.49	-0.00001	83.2	2.17	-0.00001	-0.0001	0.011	0.00105	-0.001	-0.003
474	E5 - Tailings Impoundment Main Embank Drain Comp	7/10/2013 10:02	0.185		0.181	-0.0005		0.0147	4.42	-0.00001	74.8	1.6	-0.00001	-0.0001	-0.01	0.000971	0.0018	-0.003
475	E7 - Perimeter Pond	8/3/2001	0.0279	-0.00005	0.00903	-0.0005		0.0058	3.5	0.00001	10.7	0.742	-0.00005	0.00012	0.00748	0.00114	0.00139	0.004
476	E7 - Perimeter Pond	8/10/2001 10:30	0.0243	-0.00005	0.00872	-0.0005		0.0061	3.1	-0.00001	12.1	0.802	-0.00005	0.00026	0.00494	0.00125	0.0012	0.0035
478	E7 - Perimeter Pond	8/30/2001 14:15	0.0297	-0.00005	0.00849	-0.0005		0.0058	2.6	-0.00001	13.9	0.574	-0.00005	0.00048	0.00629	0.00148	0.00136	0.0033
479	E7 - Perimeter Pond	10/23/2001 15:00	0.0866	-0.00005	0.0061	-0.0005		0.0047	4.7	0.00001	10.4	0.636	-0.00005	0.00026	0.0147	0.0012	0.00233	0.0094
480	E7 - Perimeter Pond	11/13/2001 8:30	0.0956	-0.00005	0.00814	-0.0005		0.0072	5	0.00002	15.2	0.886	-0.00005	0.00099	0.00924	0.00165	0.00146	0.0067
485	E7 - Perimeter Pond	5/22/2002 9:15	0.0395	-0.00005	0.00948	-0.0005		0.0102	3.65	0.00002	6.8	0.293	-0.00005	0.0001	0.02	0.00065	0.0019	0.0268
487	E7 - Perimeter Pond	7/31/2002 16:15	0.159	-0.00005	0.00665	-0.0005		0.0018	1.38	-0.00001	21.3	0.638	-0.00005	-0.00005	0.0054	0.0016	0.00065	0.009
496	E7 - Perimeter Pond	5/5/2003 16:20	0.114	-0.00005	0.00653	-0.0005		0.0028	1.87	-0.00001	10.4	0.481	-0.00005	0.00007	0.008	0.00141	0.00136	0.003
497	E7 - Perimeter Pond	5/29/2003 9:10	0.0832	-0.00005	0.00703	-0.0005		0.0027	0.88	-0.00001	11.5	0.537	-0.00005	0.00005	0.0064	0.00161	0.00084	0.0024
498	E7 - Perimeter Pond	6/24/2003 6:30	0.528	-0.00005	0.00661	-0.0005		0.0019	1.76	-0.00001	14.1	0.59	-0.00005	0.00008	0.007	0.00178	0.00111	0.01
499	E7 - Perimeter Pond	8/5/2003 14:05	0.134	-0.00005	0.00606	-0.0005		0.0015	1.81	-0.00001	15.3	0.628	-0.00005	0.00008	0.0056	0.00193	0.00128	0.0026
500	E7 - Perimeter Pond	8/20/2003 10:30	0.0658	-0.00005	0.00571	-0.0005		0.0007	2.07	-0.00001	15.6	0.677	-0.00005	0.00007	0.0054	0.00178	0.0008	0.0031
501	E7 - Perimeter Pond	10/16/2003 15:10	0.0565	-0.00005	0.00499	-0.0005		0.0026	2.98	-0.00001	13	0.47	-0.00005	-0.00005	0.0052	0.0016	0.001	0.0021
502	E7 - Perimeter Pond	5/1/2004 14:53	0.458	-0.00005	0.0113	-0.0005		0.007	3.35	-0.00001	9.57	0.551	-0.00005	0.00007	0.005	0.00171	0.00068	0.0052
503	E7 - Perimeter Pond	7/5/2004	0.121	-0.00005	0.00754	-0.0005		0.0033	2.93	-0.00001	12.3	0.565	-0.00005	-0.00005	0.0077	0.00206	0.00093	0.0024
505	E7 - Perimeter Pond	8/25/2004	0.238	-0.00005	0.00739	-0.0005		0.0032	3.88	-0.00001	13.4	0.607	-0.00005	-0.00005	0.0012	0.00187	0.00046	0.0014
506	E7 - Perimeter Pond	10/17/2004	0.701	-0.00005	0.00988	-0.0005		0.0107	6.21	-0.00001	13.2	0.569	-0.00005	-0.00005	0.0097	0.00269	0.00121	0.0027
507	E7 - Perimeter Pond	12/8/2004	0.152	-0.00005	0.0103	-0.0005		0.0123	4.73	-0.00001	9.29	0.448	-0.00005	-0.00005	0.0037	0.00139	0.00059	0.0033
508	E7 - Perimeter Pond	1/27/2005	0.153	-0.00005	0.00481	0.0007		0.0075	6.34	-0.00001	5.9	0.291	-0.00005	-0.00005	0.0097	0.00074	0.00154	0.0038
509	E7 - Perimeter Pond	3/16/2005	0.295		0.0114	0.0015		0.005	7.76	-0.00001	10.8	0.328	-0.00005	-0.00005	0.0206	0.00102	0.00298	0.0047
511	E7 - Perimeter Pond	4/11/2005	0.235		0.0106	0.0019		0.0065	4.69	-0.00001	9.98	0.404	-0.00005	-0.00005	0.023	0.00159	0.00175	0.0023
512	E7 - Perimeter Pond	5/4/2005	0.0428		0.0144	-0.0005		0.01	3.15	-0.00001	13.2	0.501	-0.00005	-0.00005	0.0044	0.00198	0.00072	0.0017
513	E7 - Perimeter Pond	9/6/2006	1.55		0.00755	0.0032		-0.005	9.21	-0.00005	17.4	1.2	-0.0005	-0.0005	-0.01	0.0132	-0.005	-0.005
515	E7 - Perimeter Pond	11/15/2006	0.0228		0.0993	-0.001		0.0235	4.2	-0.00002	11.5	1.6	-0.0002	-0.0002	-0.01	0.00277	-0.002	0.0037
516	E7 - Perimeter Pond	2/13/2007	0.671		0.0724	0.00083		0.0282	7.19	-0.00002	18.5	1.5	-0.0002	-0.0002	0.012	0.00401	0.0017	0.0169
517	E7 - Perimeter Pond	3/27/2007	0.107		0.14	-0.002		0.0302	6.85	-0.00002	12.6	1.82	-0.0002	-0.0002	0.036	0.00236	0.0031	0.0181
518	E7 - Perimeter Pond	4/17/2007 10:07	0.0604		0.0989	-0.001		0.0184	4.52	0.000047	7.64	1.15	-0.0002	-0.0002	0.028	0.00142	0.0026	-0.008
519	E7 - Perimeter Pond	5/8/2007 8:48	0.0669		0.286	-0.0025		0.0294	3.53	-0.00005	18.2	2.74	-0.0005	-0.0005	-0.01	0.00305	-0.005	-0.005
520	E7 - Perimeter Pond	6/11/2007 12:09	0.0376		0.212	-0.001		0.0245	1.7	-0.00002	18.5	2.07	-0.0002	-0.0002	-0.01	0.00455	-0.002	0.0025
521	E7 - Perimeter Pond	7/3/2007 10:14	0.0118		0.192	-0.001		0.022	2.02	-0.00002	17.8	2.05	-0.0002	-0.0002	-0.01	0.00404	-0.002	-0.002
522	E7 - Perimeter Pond	8/8/2007 9:18	0.0047		0.153	-0.001		0.0212	1.51	-0.00002	25.9	2.15	-0.0002	-0.0002	-0.01	0.00485	-0.002	-0.002
523	E7 - Perimeter Pond	9/6/2007 11:48	0.0308		0.174	-0.001		0.0145	2.22	-0.00002	38.3	2.57	-0.0002	-0.0002	-0.01	0.00621	-0.002	0.0023
524	E7 - Perimeter Pond	10/2/2007 14:46	0.0136		0.21	-0.001		0.0126	4.22	-0.00002	43.4	2.59	-0.0002	-0.0002	-0.01	0.00558	-0.002	0.0053
525	E7 - Perimeter Pond	11/5/2007 12:49	0.0265		0.248	-0.001		0.0175	5.09	-0.00002	52.5	3.33	-0.0002	-0.0002	-0.01	0.00523	-0.002	0.0265
526	E7 - Perimeter Pond	1/14/2008 11:39	0.0243		0.187	-0.001		0.0093	4.78	-0.00002	70	2.96	-0.0002	-0.0002	-0.01	0.00396	-0.002	0.0547
527	E7 - Perimeter Pond	6/16/2008 10:50	0.0325		0.199	-0.001		0.0069	3.42	-0.00002	54.2	1.79	-0.0002	-0.0002	0.011	0.00271	-0.002	0.0124
528	E7 - Perimeter Pond	4/22/2009 14:44	0.0573		0.0223	0.00383		0.0058	7.11	0.00002	4.25	0.38	-0.0001	-0.0001	0.066	0.000256	0.0047	0.0061
529	E7 - Perimeter Pond	6/8/2011 10:17	0.059		0.212	0.00105		0.0487	5.58	-0.00001	32.6	4.48	-0.00001	-0.0001	0.022	0.00236	0.0011	0.0037
530	E7 - Perimeter Pond	8/3/2011 9:34	0.0438		0.146	-0.001		0.0282	5.7	0.00004	31.8	3.87	-0.00002	-0.0002	0.023	0.00202	-0.002	-0.006
531	E7 - Perimeter Pond	9/8/2011 10:25	0.241		0.18	0.0011		0.0119	7.04	-0.00002	38.7	5.3	-0.00002	-0.0002	0.011	0.00485	-0.002	0.0088
532	E7 - Perimeter Pond	10/5/2011 13:40	0.0262		0.155	-0.001		0.0125	5.05	-0.00002	66.6	4.48	-0.00002	-0.0002	-0.01	0.00201	-0.002	-0.006
533	E7 - Perimeter Pond	11/1/2011 11:48	0.101		0.12	0.0009		0.013	6.02	-0.00001	37.9	3.47	-0.00001	-0.0001	0.018	0.00202	0.0012	0.0071
534	E7 - Perimeter Pond	2/8/2012 10:45	0.113		0.141	0.00076		0.00867	7.18	-0.00001	47.6	4.3	0.000031	-0.0001	0.021	0.00289	0.0013	0.0119
535	E7 - Perimeter Pond	5/2/2012 10:19	0.095		0.111	0.00327		0.0251	8.37	0.000025	19.7	2.64	-0.00001	-0.0001	0.075	0.00132	0.0051	0.011
538	E7 - Perimeter Pond	8/1/2012 11:26	0.0986		0.15	0.001		0.0312	6.07	0.000011	33.1	4.21	-0.00001	-0.0001	0.018	0.0022	0.0013	0.0042
541	E7 - Perimeter Pond	11/15/2012 13:39	0.0379		0.086	0.00083		0.0288	5.46	-0.00001	22.7	2.53	-0.00001	-0.0001	0.023	0.000929	0.0012	0.0046
542	E7 - Perimeter Pond	12/6/2012 11:02	0.169		0.148	0.00067		0.0136	7.12	-0.00001	41.4	5.03	-0.00001	-0.0001	0.011	0.00298	-0.001	0.0076
543	E7 - Perimeter Pond	1/2/2013 14:40	0.23		0.125	0.00086		0.0182	7.92	-0.00001	24.4	4.86	-0.00001	-0.0001	0.022	0.00359	0.0011	0.0084
544	E7 - Perimeter Pond	2/6/2013 10:13	0.0451		0.0771	0.00063		0.0217	6.65	-0.00001	20	3.14	-0.00001	-0.0001	-0.01	0.00136	-0.001	0.0038
545	E7 - Perimeter Pond	5/1/2013 13:28	0.0684		0.152	0.00129		0.0519	5.65	-0.00001	24.7	2.89	-0.00001	-0.0001	0.025	0.00109	0.0014	0.0077
546	E7 - Perimeter Pond	8/8/2013 11:24	0.0261	-0.00001	0.276	0.0006		0.0308	4.58	-0.00001	54.6	4.35	-0.00001	-0.0001	0.016	0.00185	0.0012	-0.003
547	E7 - Perimeter Pond	11/5/2013 9:20	0.245		0.166	0.00112		0.0169	7.65	0.000012	51.4	5.08	-0.00001	-0.0001	0.022	0.0029	0.002	0.009
548	E7 - Perimeter Pond	12/5/2013 12:20	0.4		0.18	0.00171		0.028	11.9	0.00002	47.8	4.68	0.000015	-0.0001	0.075	0.00486	0.0038	0.0104
549	E7 - Perimeter Pond	12/10/2013 13:52	0.317		0.137	0.00339		0.0302	14.7	0.000022	36.2	3.25	0.000018	-0.0001	0.179	0.00502	0.0069	0.0154
550	E7 - Perimeter Pond	12/12/2013 11:44	0.275		0.124	0.00217		0.0258	10.2	0.000018	37.6	3.32	0.000015	-0.0001	0.08	0.00367	0.005	0.0184
551	E7 - Perimeter Pond	12/16/2013 13:36	0.317		0.126	0.00225		0.0255	12.5	0.000034	41.8	2.42	0.00002	-0.0001	0.135	0.00425	0.0059	0.0135
552	E7 - Perimeter Pond	12/19/2013 8:23	0.376		0.154	0.00109		0.016	8.05	-0.00001	41.5	4.37	0.000017	-0.0001	0.036	0.00326	0.0021	0.0081
553	E7 - Perimeter Pond	1/7/2014 11:37	0.418		0.111	0.00534		0.0252	19.6	0.000034	39.9	1.83	0.00003	-0.0001	0.28	0.00402	0.0123	0.0265
555	E7 - Perimeter Pond	1/27/2014 13:44	0.38		0.135	0.00369		0.0157	9.69	0.000016	38.9	3.73	0.000015	-0.0001	0.084	0.00335	0.0052	0.012
556	E7 - Perimeter Pond	1/28/2014 14:01	0.383		0.158	0.00246		0.0138	8.56	0.000018	43.8	4.22	0.000013	-0.0001	0.059	0.0029	0.0038	0.0121
557	E7 - Perimeter Pond	1/29/2014 14:37	0.355		0.144	0.00225		0.0147	8.89	0.000012	37.3	4.02	0.000014	-0.0001	0.069	0.00301	0.0041	0.0107
558	E7 - Perimeter Pond	1/30/2014 13:48	0.342		0.142	0.00744		0.0173	9.98	0.000012	40	3.65	0.000015	0.00011	0.078	0.00431	0.0046	0.0266
559	E7 - Perimeter Pond	2/11/2014 14:01	0.32	-0.00001	0.129	0.00097		0.0207	7.52	0.000028	44.2	2.7	-0.00001	-0.0001	0.031	0.00369	0.0023	0.0076
560	E7 - Perimeter Pond	3/4/2014 8:54	0.396		0.18	0.00092		0.0283	8.34	0.000011	64.3	2.81	-0.00001	-0.0001	0.035	0.0048	0.0025	0.0032
561	E7 - Perimeter Pond	4/1/2014 11:20	0.199		0.0632	0.00249		0.0362	10.1	0.000019	18.6	0.723	0.000014	-0.0001	0.11	0.00596	0.006	0.0077
562	E7 - Perimeter Pond	5/1/2014 11:12	0.145		0.117	0.00264		0.0376	7.96	0.000017	15.4	2.45	0.000011	-0.0001	0.074	0.00174	0.0042	0.0109
563	E7 - Perimeter Pond	6/3/2014 11:11	0.0686		0.136	0.00097		0.0401	5.61	-0.00001	37.7	2.47	-0.00001	-0.0001	0.017	0.00132	0.0014	0.0046
564	E7 - Perimeter Pond	7/3/2014 8:38	0.0645		0.193	0.00103		0.0408	5.64	-0.00001	45	3.51	-0.00001	-0.0001	0.037	0.00178	0.002	0.0039
565	E7 - Perimeter Pond	9/2/2014 11:22	0.101		0.174	0.0005		0.0152	6.14	-0.00001	68.9	1.95	-0.00001	-0.0001	0.024	0.00153	0.0021	-0.003

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
566	E7 - Perimeter Pond	10/15/2014 10:26	sample taken	1179	8.197	8.9	22.8	90	1170	449	8.12	865	20.4	15.1	-0.005	23.3	0.67	2.07	2.16	0.086	
Incomplete Data																					
482	E7 - Perimeter Pond	2/26/2002 14:30		575	7.34	0.8		165		263					0.023						9.64
11	E4 - Main Embankment Seepage Pond	2/26/2002 13:30		569	7.6	2		181		158					0.192						3.21
54	E4 - Main Embankment Seepage Pond	10/11/2005		548	8.48	8.4															
65	E4 - Main Embankment Seepage Pond	9/6/2006		593	7.97	16.8															
69	E4 - Main Embankment Seepage Pond	1/8/2007 10:59																			
71	E4 - Main Embankment Seepage Pond	2/5/2007 10:59																			
76	E4 - Main Embankment Seepage Pond	6/4/2007 10:34																			
78	E4 - Main Embankment Seepage Pond	6/11/2007 10:59																			
93	E4 - Main Embankment Seepage Pond	12/4/2007 13:57																			
99	E4 - Main Embankment Seepage Pond	2/6/2008 10:09																			
101	E4 - Main Embankment Seepage Pond	3/4/2008 10:09																			
103	E4 - Main Embankment Seepage Pond	4/16/2008 10:14																			
128	E4 - Main Embankment Seepage Pond	12/16/2009		1072	7.7	0.2															
151	E4 - Main Embankment Seepage Pond	10/31/2011 14:29		1254	8.22	6															
168	E4 - Main Embankment Seepage Pond	3/10/2013 8:48	sample taken	1255	7.92	7.92															
207	East Main Toe Drain	8/30/2011 14:36		1120	8.25	11.7															
220	East Main Toe Drain	3/10/2013 9:00	Sample taken	1187	7.996	8															
232	East Main Toe Drain	2/18/2014 11:24	Sample Taken	1239	7.692	6.8	0.07														
237	East Main Toe Drain	6/18/2014 15:21	20L bucket test used for Q	1206	8.104	8															
245	West Main Toe Drain	3/10/2013 8:58	Sample taken	1114	8.051	7.9															
258	West Main Toe Drain	6/18/2014 15:30	20L bucket test used for Q	1192	8.008	8.7															
260	West Main Toe Drain	7/8/2014 10:30	Incorrectly calculated as 0.00032 previously	1180	8.014	9.5	0														
262	West Main Toe Drain	9/16/2014 12:20	No power in shed. No flow from East MTD, FD1, FD2, FD3, FD4 or FD5.	1146	7.671	8.5															
281	Perimeter Toe Drain	8/31/2011 10:40		1359	7.93	7.4															
282	Perimeter Toe Drain	9/15/2011 8:40		1354	7.84	7.4															
284	Perimeter Toe Drain	10/27/2011 14:00		1403	7.84	7.7															
290	Perimeter Toe Drain	6/14/2012		1312	7.9	7.5															
291	Perimeter Toe Drain	7/5/2012 9:15	Average, meter didnt settle	1300	7.85	7.2															
292	Perimeter Toe Drain	7/26/2012 11:50		1314	7.93	7.8															
294	Perimeter Toe Drain	8/14/2012 15:19		1297		7.5															
295	Perimeter Toe Drain	10/4/2012 10:55	Hard to find a good spot for the flow	1295	7.6	8															
296	Perimeter Toe Drain	10/25/2012 14:33	FlowTracker	1321	7.812	8.3															
298	Perimeter Toe Drain	11/20/2012 14:02		1338	7.907	8.7															
300	Perimeter Toe Drain	4/22/2013 14:06		1322	7.795	7.5															
302	Perimeter Toe Drain	5/23/2013 6:48		834	7.79	7.1															
303	Perimeter Toe Drain	6/18/2013 15:49		836	7.73	7.1															
304	Perimeter Toe Drain	7/18/2013 13:55		1261	7.957	6.9															
306	Perimeter Toe Drain	8/19/2013 9:51		1264	8.068	7															
308	Perimeter Toe Drain	4/30/2014 8:36		1307	7.74	8.8															
310	Perimeter Toe Drain	6/16/2014 9:37		1268	7.864	8.1															
311	Perimeter Toe Drain	7/7/2014 12:47		1254	7.975	7.8															
316	South Toe Drain	9/15/2011 9:15		1271	7.58	14.4															
317	South Toe Drain	9/29/2011 9:55		1274	7.58	13.7															
319	South Toe Drain	10/27/2011 13:10		1326	7.57	10.6															
325	South Toe Drain	6/6/2012 15:00		1236	7.81	6.9															
326	South Toe Drain	7/11/2012 15:25		1256	7.86	8.9															
327	South Toe Drain	7/24/2012 15:00	Lot's of errors	1254	7.82	10.7															
329	South Toe Drain	8/9/2012 10:29		1267	7.851	12.3															
330	South Toe Drain	8/31/2012 11:35		1276	7.75	13.5															
331	South Toe Drain	9/5/2012 11:25		1292	7.709	13.5															
332	South Toe Drain	9/26/2012 10:57		1293	7.6	12.9															
333	South Toe Drain	10/24/2012 15:00		1308	7.763	11.6															
335	South Toe Drain	11/20/2012 13:27	okay	1309	7.835	9															
337	South Toe Drain	4/22/2013 13:25		1278	8.414	5.8															
339	South Toe Drain	5/23/2013 7:23		553	7.78	6.5															
340	South Toe Drain	6/19/2013 12:50		1240	8.1	8.3															
341	South Toe Drain	7/18/2013 14:35		1195	7.81	11.5															
343	South Toe Drain	8/13/2013 12:00		1281	7.85	13.17															
344	South Toe Drain	10/17/2013 12:50		998	7.8	14															
346	South Toe Drain	11/14/2013 13:50	FULL pipe	1273	7.802	11.7															
347	South Toe Drain	4/30/2014 7:50		1242	7.86	4.5															
349	South Toe Drain	6/16/2014 10:05		1150	7.829	7.1															
350	South Toe Drain	7/7/2014 12:10		1166	7.821	8.9															
352	South Toe Drain	9/16/2014 11:41	South Seepage Pond piped into STD Ditch-not flowing at present	1216	7.774	10.4															
353	South Toe Drain	10/1/2014 13:42	No sample.	1240	7.856	9.9															
356	E5 - Tailings Impoundment Main Embank Drain Comp	7/28/1998 13:00		458	7.37	12.5		226		233			-4	0.6	0.009					0.006	
357	E5 - Tailings Impoundment Main Embank Drain Comp	11/26/1998 11:05		442	7.35	8		178		238			-4	0.53	0.006					0.007	
358	E5 - Tailings Impoundment Main Embank Drain Comp	12/7/1999 10:00		457	7.1	5.1		196		228			-4	0.56	-0.005					0.008	
359	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/1999 15:30		360	6.86	5.9		192		219			-4	0.33	0.011					0.004	
360	E5 - Tailings Impoundment Main Embank Drain Comp	12/15/1999 14:30		441	6.88	5.3		190		220			-4	0.28	0.011					0.005	
361	E5 - Tailings Impoundment Main Embank Drain Comp	7/17/2000 12:00		681	7.23	8.4		133		183			-4	0.47	-0.005					-0.001	
362	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2000 9:15		855	7.18	8.6		134		419			-4	0.72	0.247					0.289	
363	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:00		669	7.37	7.7		174		377			-4	0.52	-0.005					0.617	
364	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:05						189		413			-4	0.36	-0.005					0.746	
452	E5 - Tailings Impoundment Main Embank Drain Comp	9/8/2011 8:11		1141	7.89	7.4															
504	E7 - Perimeter Pond	8/3/2004																			
514	E7 - Perimeter Pond	10/12/2006		968	7.85	9.5															
536	E7 - Perimeter Pond	6/7/2012 10:50	Actual field reading	893	7.86	8.5															
537	E7 - Perimeter Pond	7/5/2012 11:07	Actual field reading	925	8.35	16.5															
539	E7 - Perimeter Pond	9/6/2012 11:07		1356	7.852	12.4															
540	E7 - Perimeter Pond	10/3/2012 10:15		1366	7.89	3.9							10.1								
554	E7 - Perimeter Pond	1/21/2014 2:47	Took a 55 Gallon bulk sample Newalta? Regular sampls taken aswell pH re-check 7.045	1115	8.533	1.1	6.02														
394	E5 - Tailings Impoundment Main Embank Drain Comp	1/8/2007 10:30		738	7.46	6.4		144		215		470	-3	0.2	0.0757			0.758		0.0113	
70	E4 - Main Embankment Seepage Pond	1/8/2007 10:59		700	7.58	3.3		162		234		443	8.7	8.9	-0.005			0.534		0.0343	
95	E4 - Main Embankment Seepage Pond	1/3/2008 13:54		845	7.77	2		151		303		571	-3	2.28	0.0275			1.92		0.041	
230	East Main Toe Drain	1/7/2014 10:45	Sample taken	1212	7.981	7.6		76.8	1190	460	8	891	-3	-0.1	0.0504	29	0.93	1.67	1.93	0.259	
510	E7 - Perimeter Pond	4/4/2005		573				184		270		330	6	9.4	0.043				1.95		
477	E7 - Perimeter Pond	8/16/2001						106		253			-4	1.79	0.895				21		
366	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2001 13:00						113		421			-4	2.24	-0.005				74.3	0.034	
370	E5 - Tailings Impoundment Main Embank Drain	8/16/2001						169		586			-4	0.66	-0.005				92.4		
2	E4 - Main Embankment Seepage Pond	7/19/2001 13:00						90		126			11	24.5	0.014				11.4	0.079	
47	E4 - Main Embankment Seepage Pond	4/4/2005		495		5.2		126		150		278	18.8	14	0.163				0.074		
51	E4 - Main Embankment Seepage Pond	7/5/2005						145		180		304	14.8	14	0.066						
6	E4 - Main Embankment Seepage Pond	8/16/2001						61		157			-4	0.64	-0.005				20.9		
193	E4 - Main Embankment Seepage Pond	4/9/2015 10:20						102	1180	534	8.27	840	5.3	2.13	-0.005	15.6	0.58	5.41	5.44	0.0287	
195	E4 - Main Embankment Seepage Pond	6/2/2015 11:37						38.2	1210	493	7.87	879	-3	0.92	0.0169	15.3	0.54	5.40	5.43	0.0301	
196	E4 - Main Embankment Seepage Pond	7/9/2015 10:32						46.2	1180	490	7.89	933	-3	0.87	0.0131	16.6	0.55	3.95	3.98	0.0247	
157	E4 - Main Embankment Seepage Pond	4/3/2012 10:10	pH meter not working	957		1.3		103	1050	458	7.58	786	3.7	5.52	0.017	17.5	0.52	2.99	3.04	0.047	
194	E4 - Main Embankment Seepage Pond	5/5/2015 14:05						67.0	1240	509	8.14	922	-3	0.80	0.0116	17.3	0.59	5.59	5.62	0.0288	
437	E5 - Tailings Impoundment Main Embank Drain Comp	6/3/2010 8:30				7.8		123	1060	398	8.04	1040	-3	0.52	0.0799	21		2.17	2.19	0.0167	
459	E5 - Tailings Impoundment Main Embank Drain Comp	4/3/2012 10:10	pH meter not working	1320		6.3		99.2	1230	541	7.57	962	-3	0.26	0.0424	20.9	1.05	3.8	3.93	0.134	
431	E5 - Tailings Impoundment Main Embank Drain Comp	12/9/2009 12:45						135		336		705	-3	0.35	0.0951	22.5		1.79		-0.01	
137	E4 - Main Embankment Seepage Pond	9/1/2010		1082		12.5		102	1060	399	8.15	770	-3	0.93	0.0269	24.6		0.497	0.513	0.016	

Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
566	E7 - Perimeter Pond	10/15/2014 10:26	-0.001	0.0062	0.0277	501			2.24	3.45		0.0071	0.00068	0.00238	0.0509	-0.0001	-0.0005	0.13	0.000019	144	-0.0005	0.0003
Incomplete Data																						
482	E7 - Perimeter Pond	2/26/2002 14:30	-0.005	0.01	0.013				9.64			0.0051	0.00024	0.0007	0.049	-0.00005	-0.00005		0.00001	92.1	0.0014	-0.00002
11	E4 - Main Embankment Seepage Pond	2/26/2002 13:30	-0.005	0.034	0.052				3.21			0.0027	0.00017	0.0021	0.0476	-0.00005	-0.00005		0.00006	49.5	0.0014	0.00028
54	E4 - Main Embankment Seepage Pond	10/11/2005		0.009	0.033																	
65	E4 - Main Embankment Seepage Pond	9/6/2006		0.0145	0.0229																	
69	E4 - Main Embankment Seepage Pond	1/8/2007 10:59																				
71	E4 - Main Embankment Seepage Pond	2/5/2007 10:59																				
76	E4 - Main Embankment Seepage Pond	6/4/2007 10:34																				
78	E4 - Main Embankment Seepage Pond	6/11/2007 10:59																				
93	E4 - Main Embankment Seepage Pond	12/4/2007 13:57		0.0138	0.0411																	
99	E4 - Main Embankment Seepage Pond	2/6/2008 10:09																				
101	E4 - Main Embankment Seepage Pond	3/4/2008 10:09																				
103	E4 - Main Embankment Seepage Pond	4/16/2008 10:14																				
128	E4 - Main Embankment Seepage Pond	12/16/2009		0.109	0.202																	
151	E4 - Main Embankment Seepage Pond	10/31/2011 14:29																				
168	E4 - Main Embankment Seepage Pond	3/10/2013 8:48																				
207	East Main Toe Drain	8/30/2011 14:36																				
220	East Main Toe Drain	3/10/2013 9:00																				
232	East Main Toe Drain	2/18/2014 11:24					-0.02															
237	East Main Toe Drain	6/18/2014 15:21																				
245	West Main Toe Drain	3/10/2013 8:58																				
258	West Main Toe Drain	6/18/2014 15:30																				
260	West Main Toe Drain	7/8/2014 10:30																				
262	West Main Toe Drain	9/16/2014 12:20																				
281	Perimeter Toe Drain	8/31/2011 10:40																				
282	Perimeter Toe Drain	9/15/2011 8:40																				
284	Perimeter Toe Drain	10/27/2011 14:00																				
290	Perimeter Toe Drain	6/14/2012																				
291	Perimeter Toe Drain	7/5/2012 9:15																				
292	Perimeter Toe Drain	7/26/2012 11:50																				
294	Perimeter Toe Drain	8/14/2012 15:19																				
295	Perimeter Toe Drain	10/4/2012 10:55																				
296	Perimeter Toe Drain	10/25/2012 14:33																				
298	Perimeter Toe Drain	11/20/2012 14:02																				
300	Perimeter Toe Drain	4/22/2013 14:06																				
302	Perimeter Toe Drain	5/23/2013 6:48																				
303	Perimeter Toe Drain	6/18/2013 15:49																				
304	Perimeter Toe Drain	7/18/2013 13:55																				
306	Perimeter Toe Drain	8/19/2013 9:51																				
308	Perimeter Toe Drain	4/30/2014 8:36																				
310	Perimeter Toe Drain	6/16/2014 9:37																				
311	Perimeter Toe Drain	7/7/2014 12:47																				
316	South Toe Drain	9/15/2011 9:15																				
317	South Toe Drain	9/29/2011 9:55																				
319	South Toe Drain	10/27/2011 13:10																				
325	South Toe Drain	6/6/2012 15:00																				
326	South Toe Drain	7/11/2012 15:25																				
327	South Toe Drain	7/24/2012 15:00																				
329	South Toe Drain	8/9/2012 10:29																				
330	South Toe Drain	8/31/2012 11:35																				
331	South Toe Drain	9/5/2012 11:25																				
332	South Toe Drain	9/26/2012 10:57																				
333	South Toe Drain	10/24/2012 15:00																				
335	South Toe Drain	11/20/2012 13:27																				
337	South Toe Drain	4/22/2013 13:25																				
339	South Toe Drain	5/23/2013 7:23																				
340	South Toe Drain	6/19/2013 12:50																				
341	South Toe Drain	7/18/2013 14:35																				
343	South Toe Drain	8/13/2013 12:00																				
344	South Toe Drain	10/17/2013 12:50																				
346	South Toe Drain	11/14/2013 13:50																				
347	South Toe Drain	4/30/2014 7:50																				
349	South Toe Drain	6/16/2014 10:05																				
350	South Toe Drain	7/7/2014 12:10																				
352	South Toe Drain	9/16/2014 11:41																				
353	South Toe Drain	10/1/2014 13:42																				
356	E5 - Tailings Impoundment Main Embank Drain Comp	7/28/1998 13:00	0.007			10.9						0.0036		0.0004						66.3		
357	E5 - Tailings Impoundment Main Embank Drain Comp	11/26/1998 11:05	0.031	0.009		23.5						0.0021	0.00006	0.00052	0.0231	-0.0001	-0.0001		0.00002	56.3	-0.0005	0.00027
358	E5 - Tailings Impoundment Main Embank Drain Comp	12/7/1999 10:00	-0.001			37.5						0.0032	0.00026	0.0012	0.0214	-0.00005	-0.00005		0.00009	69.7	0.0011	0.00017
359	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/1999 15:30	0.005			31.7						0.0046	0.00024	0.0011	0.0232	-0.00005	-0.00005		0.00006	67.8	0.0017	0.00026
360	E5 - Tailings Impoundment Main Embank Drain Comp	12/15/1999 14:30	0.006			35.4						0.004	0.00028	0.0012	0.0219	-0.00005	-0.00005		0.00018	68	0.0009	0.00018
361	E5 - Tailings Impoundment Main Embank Drain Comp	7/17/2000 12:00	0.004			172						0.0049	0.00023	0.0051	0.0418	-0.00005	-0.00005		0.00022	56.1	0.0017	0.00042
362	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2000 9:15	0.008			71.5						0.0032	0.00013	0.0007	0.156	-0.00005	-0.00005		0.00005	125	-0.0002	0.0017
363	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:00	0.004			82.8						0.0028	-0.00005	0.0018	0.121	-0.00005	-0.00005		0.00005	115	0.0008	0.00182
364	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:05	0.019			59.7						0.0024	-0.00005	0.0013	0.115	-0.00005	-0.00005		0.00003	126	0.0007	0.00165
452	E5 - Tailings Impoundment Main Embank Drain Comp	9/8/2011 8:11																				
504	E7 - Perimeter Pond	8/3/2004		-0.005	0.014																	
514	E7 - Perimeter Pond	10/12/2006		0.0068	0.0192																	
536	E7 - Perimeter Pond	6/7/2012 10:50																				
537	E7 - Perimeter Pond	7/5/2012 11:07																				
539	E7 - Perimeter Pond	9/6/2012 11:07																				
540	E7 - Perimeter Pond	10/3/2012 10:15																				
554	E7 - Perimeter Pond	1/21/2014 2:47																				
394	E5 - Tailings Impoundment Main Embank Drain Comp	1/8/2007 10:30	0.0228	0.04	0.0446	185			0.89	3.3		0.0026	0.00063	0.00214	0.089	-0.0005	-0.0005	0.137	-0.00005	66.4	-0.0005	0.00035
70	E4 - Main Embankment Seepage Pond	1/8/2007 10:59	-0.001	0.0136	0.0501	158			0.73	3.68		0.0016	0.00045	0.00227	0.0705	-0.0005	-0.0005	0.117	-0.00005	71.7	-0.0005	0.00028
95	E4 - Main Embankment Seepage Pond	1/3/2008 13:54	-0.001	0.0117	0.0329	243			3.43	3.56		0.0016	0.00042	0.00218	0.0749	-0.0005	-0.0005	0.127	-0.00004	95	-0.0005	-0.0001
230	East Main Toe Drain	1/7/2014 10:45	0.0226	0.0332	0.0315	526				2.68												
510	E7 - Perimeter Pond	4/4/2005	0.003	0.023	0.016	82.5				2.3		0.0027	0.00024	0.0004	0.055	-0.00005	-0.00005	0.028	0.00005	87.1	-0.0002	0.00033
477	E7 - Perimeter Pond	8/16/2001	0.014	0.014	0.022	92.7		0.36	21.4			0.0079	0.00054	0.0007	0.0564	-0.00005	0.00102		0.00003	78.2	0.0006	0.00027
366	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2001 13:00	0.073	0.096	0.097	63		-0.1	74.3	5.4		0.0043	0.00011	0.0007	0.152	-0.00005	-0.00005		0.00006	144	0.0005	0.00081
370	E5 - Tailings Impoundment Main Embank Drain Comp	8/16/2001	0.052	0.04	0.04	122		-0.1	92.4			0.0066	0.00015	0.001	0.151	-0.00005	-0.00005		0.00002	186	0.0007	0.00081
2	E4 - Main Embankment Seepage Pond	7/19/2001 13:00	0.039	0.043	0.061	64.2		0.36	11.8	6.6		0.0183	0.00022	0.0018	0.0437	-0.00005	-0.00005		0.0001	38	-0.0002	0.00018
47	E4 - Main Embankment Seepage Pond	4/4/2005	0.016	0.055	0.05	90.6				3.5		0.005	0.00018	0.0012	0.0508	-0.00005	-0.00005	0.069	0.00018	47.9	-0.0002	0.00014
51	E4 - Main Embankment Seepage Pond	7/5/2005	0.014	0.02	0.071	99.9				5.5		0.0029	0.00017	0.002	0.0502	-0.00005	-0.00005	0.085	0.00012	54.9	-0.0002	0.00017
6	E4 - Main Embankment Seepage Pond	8/16/2001	-0.005	0.02	0.036	100		0.35	21.3			0.0048	0.00033	0.0021	0.0611	-0.00005	-0.00005		0.00014	42.8	0.0004	0.00019
193	E4 - Main Embankment Seepage Pond	4/9/2015 10:20	-0.001	0.0075	0.0162	515			5.26	3.97		0.0673	0.00036	0.00162	0.0477	-0.0001	-0.00005	0.091	0.0000202	168	-0.0005	0.00017
195	E4 - Main Embankment Seepage Pond	6/2/2015 11:37	-0.001	0.0051	0.0064	554			5.35	4.43		0.0326	0.00046	0.00182	0.0427	-0.0001	-0.00005	0.118	0.0000096	149	-0.0005	0.00011
196	E4 - Main Embankment Seepage Pond	7/9/2015 10:32	-0.001	0.0057	0.0099	545			3.88	4.40		0.0349	0.00039	0.00185	0.0478	-0.0001	-0.00005	0.132	-0.000015	148	-0.0005	0.00011
157	E4 - Main Embankment Seepage Pond	4/3/2012 10:10	0.0053	0.0111	0.0218	422			3.92	5.06		0.0049	0.0005	0.0014	0.0432	-0.0001	-0.0005	0.095	-0.00017	149	-0.0005	0.00018
194	E4 - Main Embankment Seepage Pond	5/5/2015 14:05	-0.001	0.0046	0.0136	561			5.77	3.76		0.0368	0.00036	0.00160	0.0508	-0.0001	-0.00005	0.112	0.0000144	156	-0.0005	0.00011
437	E5 - Tailings Impoundment Main Embank Drain Comp	6/3/2010 8:30	0.0192	0.031	0.0432	401			3.25	3.3		0.0021	0.00057	0.00146	0.0744	-0.001	-0.001	0.122	0.0001	128	-0.001	0.0003
459	E5 - Tailings Impoundment Main Embank Drain Comp	4/3/2012 10:10	0.0183	0.0275	0.0309	557			4.84	3.15		-0.003	0.00038	0.00138	0.0682	-0.0001	-0.0005	0.126	-0.00019	174	-0.0005	0.00032
431	E5 - Tailings Impoundment Main Embank Drain Comp	12/9/2009 12:45	0.0211	0.0349	0.04	359			2.53	2.62		0.0022	0.00038	0.00176	0.0773	-0.001	-0.001	0.168	-0.00056	107	-0.001	0.00031
137	E4 - Main Embankment Seepage Pond	9/1/2010	-0.001	0.0072	0.0151	421			0.78	4.52		-0.001	0.00038	0.00202	0.0423	-0.0001	-0.0005	0.147	-0.00003	125	-0.0005	-0.0001

Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
566	E7 - Perimeter Pond	10/15/2014 10:26	0.0127	-0.03	-0.00005	0.00811	22.1	0.484		0.2	0.00065	10.5	0.00832	5.26	-0.00001	79.6	1.95	-0.00001	-0.0001
Incomplete Data																			
482	E7 - Perimeter Pond	2/26/2002 14:30	0.0042	0.024	-0.00002	0.0019	13.7	0.0348	-0.00005	0.00891	-0.0005	2.6	0.0036	6.85	-0.00001	15.6	0.562	-0.00005	0.00017
11	E4 - Main Embankment Seepage Pond	2/26/2002 13:30	0.0018	-0.005	-0.00002	0.0028	11.8	0.612	-0.00005	0.0454	-0.0005	4.35	0.0013	7.01	-0.00001	35.7	0.463	-0.00005	0.00009
54	E4 - Main Embankment Seepage Pond	10/11/2005																	
65	E4 - Main Embankment Seepage Pond	9/6/2006																	
69	E4 - Main Embankment Seepage Pond	1/8/2007 10:59																	
71	E4 - Main Embankment Seepage Pond	2/5/2007 10:59																	
76	E4 - Main Embankment Seepage Pond	6/4/2007 10:34																	
78	E4 - Main Embankment Seepage Pond	6/11/2007 10:59																	
93	E4 - Main Embankment Seepage Pond	12/4/2007 13:57																	
99	E4 - Main Embankment Seepage Pond	2/6/2008 10:09																	
101	E4 - Main Embankment Seepage Pond	3/4/2008 10:09																	
103	E4 - Main Embankment Seepage Pond	4/16/2008 10:14																	
128	E4 - Main Embankment Seepage Pond	12/16/2009																	
151	E4 - Main Embankment Seepage Pond	10/31/2011 14:29																	
168	E4 - Main Embankment Seepage Pond	3/10/2013 8:48																	
207	East Main Toe Drain	8/30/2011 14:36																	
220	East Main Toe Drain	3/10/2013 9:00																	
232	East Main Toe Drain	2/18/2014 11:24																	
237	East Main Toe Drain	6/18/2014 15:21																	
245	West Main Toe Drain	3/10/2013 8:58																	
258	West Main Toe Drain	6/18/2014 15:30																	
260	West Main Toe Drain	7/8/2014 10:30																	
262	West Main Toe Drain	9/16/2014 12:20																	
281	Perimeter Toe Drain	8/31/2011 10:40																	
282	Perimeter Toe Drain	9/15/2011 8:40																	
284	Perimeter Toe Drain	10/27/2011 14:00																	
290	Perimeter Toe Drain	6/14/2012																	
291	Perimeter Toe Drain	7/5/2012 9:15																	
292	Perimeter Toe Drain	7/26/2012 11:50																	
294	Perimeter Toe Drain	8/14/2012 15:19																	
295	Perimeter Toe Drain	10/4/2012 10:55																	
296	Perimeter Toe Drain	10/25/2012 14:33																	
298	Perimeter Toe Drain	11/20/2012 14:02																	
300	Perimeter Toe Drain	4/22/2013 14:06																	
302	Perimeter Toe Drain	5/23/2013 6:48																	
303	Perimeter Toe Drain	6/18/2013 15:49																	
304	Perimeter Toe Drain	7/18/2013 13:55																	
306	Perimeter Toe Drain	8/19/2013 9:51																	
308	Perimeter Toe Drain	4/30/2014 8:36																	
310	Perimeter Toe Drain	6/16/2014 9:37																	
311	Perimeter Toe Drain	7/7/2014 12:47																	
316	South Toe Drain	9/15/2011 9:15																	
317	South Toe Drain	9/29/2011 9:55																	
319	South Toe Drain	10/27/2011 13:10																	
325	South Toe Drain	6/6/2012 15:00																	
326	South Toe Drain	7/11/2012 15:25																	
327	South Toe Drain	7/24/2012 15:00																	
329	South Toe Drain	8/9/2012 10:29																	
330	South Toe Drain	8/31/2012 11:35																	
331	South Toe Drain	9/5/2012 11:25																	
332	South Toe Drain	9/26/2012 10:57																	
333	South Toe Drain	10/24/2012 15:00																	
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344	South Toe Drain	10/17/2013 12:50																	
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347	South Toe Drain	4/30/2014 7:50																	
349	South Toe Drain	6/16/2014 10:05																	
350	South Toe Drain	7/7/2014 12:10																	
352	South Toe Drain	9/16/2014 11:41																	
353	South Toe Drain	10/1/2014 13:42																	
356	E5 - Tailings Impoundment Main Embank Drain Comp	7/28/1998 13:00	0.0119	0.002	0.00005		16.5	0.0504		0.0018	0.00005	0.093	0.0001	7.58		10.6	0.427		
357	E5 - Tailings Impoundment Main Embank Drain Comp	11/26/1998 11:05	0.0115	-0.002	-0.00005		11.8	0.0673		0.0016	-0.00005	1.14	0.0012	7.37	-0.00001	8.03	0.42		
358	E5 - Tailings Impoundment Main Embank Drain Comp	12/7/1999 10:00	0.0099	-0.005	0.00008	0.0022	13	0.0527	-0.00005	0.00891	-0.0005	1.16	0.0097	7.91	-0.00001	14.5	0.493	-0.00005	0.00016
359	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/1999 15:30	0.0098	-0.005	0.00004	0.0021	12.1	0.0546	-0.00005	0.00764	-0.0005	1.15	0.0071	11.8	-0.00001	13.1	0.548	-0.00005	-0.00005
360	E5 - Tailings Impoundment Main Embank Drain Comp	12/15/1999 14:30	0.0095	-0.005	0.00003	0.0023	12.3	0.0564	-0.00005	0.00976	-0.0005	1.16	0.0096	11.7	-0.00001	14.1	0.534	-0.00005	-0.00005
361	E5 - Tailings Impoundment Main Embank Drain Comp	7/17/2000 12:00	0.0057	-0.005	0.00009	0.0056	10.5	0.431	-0.00005	0.0985	-0.0005	7.96	0.0025	5.99	-0.00001	73	0.608	-0.00005	-0.00005
362	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2000 9:15	0.0048	0.064	-0.00002	0.0018	20.7	0.261	-0.00005	0.0127	-0.0005	3.99	0.0029	7.64	-0.00001	24	0.769	-0.00005	0.00011
363	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:00	0.0059	0.017	-0.00002	0.0023	21.7	0.239	-0.00005	0.0206	-0.0005	3.99	0.0056	8.33	-0.00001	25.2	0.99	-0.00005	-0.00005
364	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:05	0.0056	0.007	-0.00002	0.0018	23.8	0.12	-0.00005	0.00193	-0.0005	-0.05	0.0058	8.46	-0.00001	15.5	1.02	-0.00005	-0.00005
452	E5 - Tailings Impoundment Main Embank Drain Comp	9/8/2011 8:11																	
504	E7 - Perimeter Pond	8/3/2004																	
514	E7 - Perimeter Pond	10/12/2006																	
536	E7 - Perimeter Pond	6/7/2012 10:50																	
537	E7 - Perimeter Pond	7/5/2012 11:07																	
539	E7 - Perimeter Pond	9/6/2012 11:07																	
540	E7 - Perimeter Pond	10/3/2012 10:15																	
554	E7 - Perimeter Pond	1/21/2014 2:47																	
394	E5 - Tailings Impoundment Main Embank Drain Comp	1/8/2007 10:30	0.00097	-0.03	-0.00005	0.0054	12	0.315		0.119	-0.0005	11	0.0038	7.24	-0.00001		0.729	-0.0001	-0.0001
70	E4 - Main Embankment Seepage Pond	1/8/2007 10:59	0.00063	-0.03	-0.00005	-0.005	13.4	0.463		0.0902	-0.0005	7.65	0.0032	7.34	-0.00001	49.3	0.729	-0.0001	-0.0001
95	E4 - Main Embankment Seepage Pond	1/3/2008 13:54	0.00124	-0.03	-0.00005	0.0054	16.1	0.293		0.103	0.00059	9.43	0.0067	6.61	-0.00001		1.07	-0.0001	-0.0001
230	East Main Toe Drain	1/7/2014 10:45																	
510	E7 - Perimeter Pond	4/4/2005	0.0041	-0.005	-0.00002	0.0028	13.6	0.362		0.00953	0.0005	2.58	0.0067	4.51	-0.00001	11	0.455	-0.00005	-0.00005
477	E7 - Perimeter Pond	8/16/2001	0.0086	-0.005	0.00005	0.002	13.9	0.0107	-0.00005	0.009	-0.0005	3.72	0.0064	2.79	0.00001	13.6	0.838	-0.00005	0.00078
366	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2001 13:00	0.0047	-0.005	0.00006	0.0023	24.3	0.0557	-0.00005	0.00141	-0.0005	4.65	0.0049	7.73	-0.00001	16.7	1.28	-0.00005	-0.00005
370	E5 - Tailings Impoundment Main Embank Drain Comp	8/16/2001	0.0051	-0.005	-0.00002	0.0024	29.6	0.059	-0.00005	0.00263	-0.0005	4.14	0.0079	7.85	-0.00001	18.8	2.1	-0.00005	0.0001
2	E4 - Main Embankment Seepage Pond	7/19/2001 13:00	0.0068	-0.005	0.00007	0.0031	10.1	0.0198	-0.00005	0.0379	-0.0005	6.04	0.003	1.99	-0.00001	36.6	0.495	-0.00005	0.00009
47	E4 - Main Embankment Seepage Pond	4/4/2005	0.0023	-0.005	-0.00002	0.0049	8.5	0.0386		0.0963	0.0006	5.66	0.0006	4.28	-0.00001	38.3	0.419	-0.00005	0.00008
51	E4 - Main Embankment Seepage Pond	7/5/2005	0.0023	0.083	0.00004	0.002	10.2	0.106		0.0712	0.0005	4.47	0.0008	5.25	-0.00001	41.6	0.475	-0.00005	-0.00005
6	E4 - Main Embankment Seepage Pond	8/16/2001	0.0064	-0.005	0.00003	0.004	12.1	0.00346	-0.00005	0.0574	-0.0005	7.32	0.0039	0.33	-0.00001	44.2	0.907	-0.00005	0.00021
193	E4 - Main Embankment Seepage Pond	4/9/2015 10:20	0.00429	0.097	0.00007	0.005	28.6	0.0961		0.19	-0.0005	0.0276	4.51		0.000011	54.1	2.95	-0.00001	-0.0001
195	E4 - Main Embankment Seepage Pond	6/2/2015 11:37	0.00540	0.048	-0.00005	0.0069	31.9	0.0760		0.179	-0.0005	8.47	0.0288	3.30	-0.00001	60.3	2.54	0.000026	-0.0001
196	E4 - Main Embankment Seepage Pond	7/9/2015 10:32	0.00474	0.042	-0.00005	0.0065	30.6	0.116		0.159	-0.0005	9.43	0.0248	4.74	-0.00001	65.7	2.30	-0.00001	-0.0001
157	E4 - Main Embankment Seepage Pond	4/3/2012 10:10	0.00251	-0.03	-0.00005	0.00459	20.9	0.233		0.145	-0.0005	10.2	0.0106	5.22	-0.00001	64.4	1.6	-0.00001	-0.0001
194	E4 - Main Embankment Seepage Pond	5/5/2015 14:05	0.00423	0.058	-0.00005	0.0071	29.5	0.0597		0.191	-0.0005	9.95	0.0264	2.75	-0.00001	69.4	2.81	-0.00001	-0.0001
437	E5 - Tailings Impoundment Main Embank Drain Comp	6/3/2010 8:30	0.00346	-0.03	-0.0001	-0.01	19.2	0.271		0.131	-0.001	12.3	0.0077	6.56	-0.00002	69.3	1.4	-0.0002	-0.0002
459	E5 - Tailings Impoundment Main Embank Drain Comp	4/3/2012 10:10	0.00104	-0.03	-0.00005	0.00559	26.1	0.323		0.202	-0.0005	13.2	0.0128	6.49	-0.00001	72.8	2.29	-0.00001	-0.0001
431	E5 - Tailings Impoundment Main Embank Drain Comp	12/9/2009 12:45	0.00181	-0.03	-0.0001	-0.01	16.6	0.437		0.15	0.001	13.6	0.007	6.46	-0.00002	71.5	1.5	-0.0002	-0.0002
137	E4 - Main Embankment Seepage Pond	9/1/2010	0.0013	-0.03	-0.00005	0.0053	21.3	0.152		0.125	-0.0005	13.5	0.0043	2.43	-0.00001	74.7	1.74	-0.0001	-0.0001

Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
566	E7 - Perimeter Pond	10/15/2014 10:26	0.014	0.00166	0.0016	-0.003	0.694	0.00065	0.00258	0.0596	-0.0001	-0.0005	0.135	0.000041	135	0.00054	0.00083	0.0424	0.586	0.00039	0.00832	21.4
Incomplete Data																						
482	E7 - Perimeter Pond	2/26/2002 14:30	0.00183	0.00129	0.00199	0.0007	0.108	0.00025	0.0008	0.0524	-0.00005	-0.00005		0.00001	84.3	0.0012	-0.00002	0.0047	0.205	-0.00002	0.002	12.8
11	E4 - Main Embankment Seepage Pond	2/26/2002 13:30	0.00073	0.00125	0.00214	0.0097	0.0595	0.00021	0.0027	0.0568	-0.00005	-0.00005		0.00007	46	0.0009	0.00041	0.0034	0.104	-0.00002	0.003	10.5
54	E4 - Main Embankment Seepage Pond	10/11/2005																				
65	E4 - Main Embankment Seepage Pond	9/6/2006																				
69	E4 - Main Embankment Seepage Pond	1/8/2007 10:59																				
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352	South Toe Drain	9/16/2014 11:41																				
353	South Toe Drain	10/1/2014 13:42																				
356	E5 - Tailings Impoundment Main Embank Drain Comp	7/28/1998 13:00				0.00005																
357	E5 - Tailings Impoundment Main Embank Drain Comp	11/26/1998 11:05	0.0009		0.00141	0.0013																
358	E5 - Tailings Impoundment Main Embank Drain Comp	12/7/1999 10:00	0.00045	0.00054	0.00427	0.0167																
359	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/1999 15:30	0.00044	0.00091	0.00165	0.0168																
360	E5 - Tailings Impoundment Main Embank Drain Comp	12/15/1999 14:30	0.00052	0.00099	0.00193	0.0168																
361	E5 - Tailings Impoundment Main Embank Drain Comp	7/17/2000 12:00	0.00212	0.00169	0.00134	0.0017																
362	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2000 9:15	0.00066	0.00115	0.0008	0.001												0.0053				
363	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:00	0.00104	0.00181	0.00136	0.001																
364	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:05	0.00082	0.00171	0.00119	0.0009	0.0018	0.0001	0.0008	0.115	-0.00005	-0.00005		0.00003		0.0003	0.00171	0.0055	0.006	-0.00002	0.0019	
452	E5 - Tailings Impoundment Main Embank Drain Comp	9/8/2011 8:11																				
504	E7 - Perimeter Pond	8/3/2004																				
514	E7 - Perimeter Pond	10/12/2006																				
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537	E7 - Perimeter Pond	7/5/2012 11:07																				
539	E7 - Perimeter Pond	9/6/2012 11:07																				
540	E7 - Perimeter Pond	10/3/2012 10:15																				
554	E7 - Perimeter Pond	1/21/2014 2:47																				
394	E5 - Tailings Impoundment Main Embank Drain Comp	1/8/2007 10:30	-0.01	0.00217	-0.001	-0.001	0.0051	0.00064	0.00223	0.0888	-0.0005	-0.0005	0.138	-0.00005	67.2	-0.0005	0.00035	0.00297	0.053	-0.00005	0.0054	12.1
70	E4 - Main Embankment Seepage Pond	1/8/2007 10:59	-0.01	0.00174	-0.001	0.0019	0.184	0.00043	0.00277	0.075	-0.0005	-0.0005	0.115	-0.00005	70.8	-0.0005	0.00042	0.00244	0.307	0.000113	-0.005	13.6
95	E4 - Main Embankment Seepage Pond	1/3/2008 13:54	-0.01	0.002	-0.001	-0.003	0.017	0.00046	0.00233	0.0841	-0.0005	-0.0005	0.129	-0.00004	91.3	-0.0005	0.00027	0.0014	0.039	-0.00005	0.0053	15.7
230	East Main Toe Drain	1/7/2014 10:45					0.004	0.00052	0.00173	0.057	-0.0001	-0.0005	0.13	-0.00012	146	-0.0005	0.00033	0.00353	-0.03	-0.00005	0.00697	
510	E7 - Perimeter Pond	4/4/2005	-0.0005	0.00196	0.0002	0.0027	0.256	0.00026	0.0009	0.0612	-0.00005	-0.00005	0.023	0.00005	85.3	0.0013	0.00052	0.011	0.281	0.00024	0.0021	13.4
477	E7 - Perimeter Pond	8/16/2001	0.00255	0.00135	0.00098	0.002	0.072	0.00068	0.001	0.0576	-0.00005	0.00265		0.00004	73.8	0.0007	0.00034	0.0098	0.055	0.00016	0.0022	13.4
366	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2001 13:00	0.00153	0.00075	0.00094	0.0029	0.0501	0.00013	0.0007	0.157	-0.00005	-0.00005		0.00002	132	0.0007	0.0007	0.0047	0.133	0.00006	0.0021	22.1
370	E5 - Tailings Impoundment Main Embank Drain Comp	8/16/2001	0.00385	0.0015	0.00071	0.0022	0.0069	0.00014	0.001	0.151	-0.00005	-0.00005		0.00002	181	0.0007	0.00095	0.0064	-0.005	-0.00002	0.0025	29.2
2	E4 - Main Embankment Seepage Pond	7/19/2001 13:00	0.00144	0.00102	0.00133	0.005	0.836	0.00023	0.0021	0.0536	-0.00005	-0.00005		0.00009	34.8	0.0013	0.00065	0.0153	0.898	0.00058	0.0034	9.55
47	E4 - Main Embankment Seepage Pond	4/4/2005	-0.0005	0.00148	0.00058	0.0024	0.581	0.00021	0.0018	0.0618	-0.00005	-0.00005	0.074	0.00025	47.3	0.0018	0.00055	0.0055	0.749	0.00037	0.0034	8.63
51	E4 - Main Embankment Seepage Pond	7/5/2005	-0.0005	0.00089	0.00102	0.0007	0.375	0.00018	0.0024	0.0585	-0.00005	-0.00005	0.096	0.00015	54.9	0.0008	0.00042	0.0063	0.587	0.00031	0.0023	10.3
6	E4 - Main Embankment Seepage Pond	8/16/2001	0.00302	0.00122	0.00058	0.0024	0.0219	0.00033	0.0022	0.0633	-0.00005	0.00006		0.00014	40.4	0.0004	0.00021	0.0073	0.01	0.00003	0.0042	11.7
193	E4 - Main Embankment Seepage Pond	4/9/2015 10:20	0.019	0.00152	0.00101	-0.003	-0.003	0.00029	0.0015	0.047	-0.0001	-0.00005	0.098	0.0000129	166	-0.0005	-0.0001	0.00244	-0.03	-0.00005	0.0059	28.9
195	E4 - Main Embankment Seepage Pond	6/2/2015 11:37	-0.01	0.00149	0.00091	-0.003	-0.003	0.00040	0.00158	0.0424	-0.0001	-0.00005	0.112	0.0000080	146	-0.0005	-0.0001	0.00412	-0.03	-0.00005	0.0065	31.4
196	E4 - Main Embankment Seepage Pond	7/9/2015 10:32	-0.01	0.00137	0.00126	-0.003	-0.003	0.00039	0.00174	0.0475	-0.0001	-0.00005	0.132	-0.000015	149	-0.0005	-0.0001	0.00304	-0.03	-0.00005	0.0066	29.0
157	E4 - Main Embankment Seepage Pond	4/3/2012 10:10	-0.01	0.000941	-0.001	-0.003	0.233	0.00052	0.00156	0.0468	-0.0001	-0.0005	0.103	0.000062	152	-0.001	0.00028	0.00461	0.245	0.000076	0.00503	21.5
194	E4 - Main Embankment Seepage Pond	5/5/2015 14:05	-0.01	0.00165	0.00090	-0.003	0.0034	0.00035	0.00151	0.0505	-0.0001	-0.00005	0.109	-0.000005	155	-0.0005	-0.0001	0.00250	-0.03	-0.00005	0.0070	29.8
437	E5 - Tailings Impoundment Main Embank Drain Comp	6/3/2010 8:30	-0.01	0.00133	-0.002	-0.002	0.0083	0.00071	0.00162	0.0785	-0.001	-0.001	0.131	0.000102	124	-0.001	0.00032	0.0497	0.111	-0.0001	-0.01	18.8
459	E5 - Tailings Impoundment Main Embank Drain Comp	4/3/2012 10:10	-0.01	0.0012	-0.001	-0.003	0.0047	0.00039	0.0015	0.0701	-0.0001	-0.0005	0.131	-0.0002	172	-0.0005	0.0003	0.0024	0.034	-0.00005	0.00587	25.9
431	E5 - Tailings Impoundment Main Embank Drain Comp	12/9/2009 12:45	-0.01	0.00131	-0.002	-0.002	0.004	0.0004	0.00195	0.0774	-0.001	-0.001	0.171	-0.00056	109	-0.001	0.0003	0.0122	0.056	-0.0001	-0.01	17
137	E4 - Main Embankment Seepage Pond	9/1/2010	-0.01	0.00106	-0.001	-0.001	0.036	0.00038	0.00207	0.0442	-0.0005	-0.0005	0.153	-0.00003	126	-0.0005	0.00012	0.00253	0.081	-0.00005	0.0054	21.5

Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
566	E7 - Perimeter Pond	10/15/2014 10:26	0.5		0.193	0.00102		0.00809	6.47	0.000014	78.3	1.79	-0.00001	-0.0001	0.054	0.00161	0.0036	0.004
Incomplete Data																		
482	E7 - Perimeter Pond	2/26/2002 14:30	0.0428	-0.00005	0.00939	-0.0005		0.0035	6.7	-0.00001	14.8	0.577	-0.00005	0.00019	0.00624	0.00136	0.00165	0.0014
11	E4 - Main Embankment Seepage Pond	2/26/2002 13:30	0.743	-0.00005	0.0535	-0.0005		0.0012	7	-0.00001	39.1	0.481	-0.00005	0.00016	0.00308	0.00123	0.00175	0.0082
54	E4 - Main Embankment Seepage Pond	10/11/2005						-0.0005				0.449						
65	E4 - Main Embankment Seepage Pond	9/6/2006						0.0011				0.58						
69	E4 - Main Embankment Seepage Pond	1/8/2007 10:59																
71	E4 - Main Embankment Seepage Pond	2/5/2007 10:59																
76	E4 - Main Embankment Seepage Pond	6/4/2007 10:34																
78	E4 - Main Embankment Seepage Pond	6/11/2007 10:59																
93	E4 - Main Embankment Seepage Pond	12/4/2007 13:57						0.011			49.4	1.17						
99	E4 - Main Embankment Seepage Pond	2/6/2008 10:09						0.0042				0.856						
101	E4 - Main Embankment Seepage Pond	3/4/2008 10:09						0.0038				0.791						
103	E4 - Main Embankment Seepage Pond	4/16/2008 10:14						0.005				0.867						
128	E4 - Main Embankment Seepage Pond	12/16/2009						0.0078				1.43						
151	E4 - Main Embankment Seepage Pond	10/31/2011 14:29																
168	E4 - Main Embankment Seepage Pond	3/10/2013 8:48																
207	East Main Toe Drain	8/30/2011 14:36																
220	East Main Toe Drain	3/10/2013 9:00																
232	East Main Toe Drain	2/18/2014 11:24																
237	East Main Toe Drain	6/18/2014 15:21																
245	West Main Toe Drain	3/10/2013 8:58																
258	West Main Toe Drain	6/18/2014 15:30																
260	West Main Toe Drain	7/8/2014 10:30																
262	West Main Toe Drain	9/16/2014 12:20																
281	Perimeter Toe Drain	8/31/2011 10:40																
282	Perimeter Toe Drain	9/15/2011 8:40																
284	Perimeter Toe Drain	10/27/2011 14:00																
290	Perimeter Toe Drain	6/14/2012																
291	Perimeter Toe Drain	7/5/2012 9:15																
292	Perimeter Toe Drain	7/26/2012 11:50																
294	Perimeter Toe Drain	8/14/2012 15:19																
295	Perimeter Toe Drain	10/4/2012 10:55																
296	Perimeter Toe Drain	10/25/2012 14:33																
298	Perimeter Toe Drain	11/20/2012 14:02																
300	Perimeter Toe Drain	4/22/2013 14:06																
302	Perimeter Toe Drain	5/23/2013 6:48																
303	Perimeter Toe Drain	6/18/2013 15:49																
304	Perimeter Toe Drain	7/18/2013 13:55																
306	Perimeter Toe Drain	8/19/2013 9:51																
308	Perimeter Toe Drain	4/30/2014 8:36																
310	Perimeter Toe Drain	6/16/2014 9:37																
311	Perimeter Toe Drain	7/7/2014 12:47																
316	South Toe Drain	9/15/2011 9:15																
317	South Toe Drain	9/29/2011 9:55																
319	South Toe Drain	10/27/2011 13:10																
325	South Toe Drain	6/6/2012 15:00																
326	South Toe Drain	7/11/2012 15:25																
327	South Toe Drain	7/24/2012 15:00																
329	South Toe Drain	8/9/2012 10:29																
330	South Toe Drain	8/31/2012 11:35																
331	South Toe Drain	9/5/2012 11:25																
332	South Toe Drain	9/26/2012 10:57																
333	South Toe Drain	10/24/2012 15:00																
335	South Toe Drain	11/20/2012 13:27																
337	South Toe Drain	4/22/2013 13:25																
339	South Toe Drain	5/23/2013 7:23																
340	South Toe Drain	6/19/2013 12:50																
341	South Toe Drain	7/18/2013 14:35																
343	South Toe Drain	8/13/2013 12:00																
344	South Toe Drain	10/17/2013 12:50																
346	South Toe Drain	11/14/2013 13:50																
347	South Toe Drain	4/30/2014 7:50																
349	South Toe Drain	6/16/2014 10:05																
350	South Toe Drain	7/7/2014 12:10																
352	South Toe Drain	9/16/2014 11:41																
353	South Toe Drain	10/1/2014 13:42																
356	E5 - Tailings Impoundment Main Embank Drain Comp	7/28/1998 13:00																
357	E5 - Tailings Impoundment Main Embank Drain Comp	11/26/1998 11:05																
358	E5 - Tailings Impoundment Main Embank Drain Comp	12/7/1999 10:00																
359	E5 - Tailings Impoundment Main Embank Drain Comp	12/14/1999 15:30																
360	E5 - Tailings Impoundment Main Embank Drain Comp	12/15/1999 14:30																
361	E5 - Tailings Impoundment Main Embank Drain Comp	7/17/2000 12:00																
362	E5 - Tailings Impoundment Main Embank Drain Comp	11/15/2000 9:15			0.0142													
363	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:00																
364	E5 - Tailings Impoundment Main Embank Drain Comp	12/12/2000 10:05	0.119		0.00193	-0.0005		0.0062		-0.00001		1.02	-0.00005	-0.00005	0.0008	0.00171	0.0011	0.0006
452	E5 - Tailings Impoundment Main Embank Drain Comp	9/8/2011 8:11																
504	E7 - Perimeter Pond	8/3/2004						0.0035				0.504						
514	E7 - Perimeter Pond	10/12/2006						0.0256				1.39						
536	E7 - Perimeter Pond	6/7/2012 10:50																
537	E7 - Perimeter Pond	7/5/2012 11:07																
539	E7 - Perimeter Pond	9/6/2012 11:07																
540	E7 - Perimeter Pond	10/3/2012 10:15																
554	E7 - Perimeter Pond	1/21/2014 2:47																
394	E5 - Tailings Impoundment Main Embank Drain Comp	1/8/2007 10:30	0.328		0.119	-0.0005		0.0038	7.32	-0.00001		0.742	-0.0001	-0.0001	-0.01	0.00217	-0.001	-0.001
70	E4 - Main Embankment Seepage Pond	1/8/2007 10:59	0.462		0.088	-0.0005		0.0031	7.81	-0.00001		0.718	-0.0001	-0.0001	-0.01	0.00166	0.0011	0.0027
95	E4 - Main Embankment Seepage Pond	1/3/2008 13:54	0.555		0.107	0.00056		0.0066	6.45	-0.00001		1.1	-0.0001	-0.0001	-0.01	0.00199	-0.001	0.002
230	East Main Toe Drain	1/7/2014 10:45			0.213	-0.0005		0.00642							-0.01	0.00117	-0.001	-0.003
510	E7 - Perimeter Pond	4/4/2005	0.38		0.0111	0.001		0.0058	5.08	-0.00001	10.8	0.461	-0.00005	-0.00005	0.0091	0.00206	0.00104	0.0023
477	E7 - Perimeter Pond	8/16/2001	0.0189	-0.00005	0.00927	-0.0005		0.0067	2.9	0.00005	13.3	0.837	0.00006	0.00153	0.00493	0.00126	0.00131	0.0028
366	E5 - Tailings Impoundment Main Embank Drain Comp	7/19/2001 13:00	0.0412	-0.00005	0.00174	-0.0005		0.0054	7.2	0.00001	15.2	1.3	-0.00005	0.00011	0.0031	0.00075	0.00098	0.0016
370	E5 - Tailings Impoundment Main Embank Drain Comp	8/16/2001	0.0734	-0.00005	0.00387	-0.0005		0.0082	7.9	-0.00001	17.8	2.15	-0.00005	0.0001	0.00386	0.00143	0.0007	0.0017
2	E4 - Main Embankment Seepage Pond	7/19/2001 13:00	0.0584	-0.00005	0.0386	0.0011		0.0031	3.2	0.00001	34.1	0.473	-0.00005	0.0001	0.0288	0.00108	0.00322	0.0058
47	E4 - Main Embankment Seepage Pond	4/4/2005	0.164		0.106	0.0012		-0.0005	5.38	-0.00001	37.9	0.445	-0.00005	0.00007	0.024	0.00158	0.00219	0.004
51	E4 - Main Embankment Seepage Pond	7/5/2005	0.127		0.078	0.0011		0.0006	6.08	0.00002	42.7	0.506	-0.00005	0.00006	0.0152	0.00092	0.00194	0.0028
6	E4 - Main Embankment Seepage Pond	8/16/2001	0.0142	-0.00005	0.0569	-0.0005		0.0036	0.3	0.00001	43.6	0.932	-0.00005	0.00014	0.00354	0.00122	0.00062	0.0036
193	E4 - Main Embankment Seepage Pond	4/9/2015 10:20	0.00067		0.175	-0.0005		0.0251	4.27	-0.00001	56.2	2.79	-0.00001	-0.0001	0.015	0.00143	0.00066	-0.003
195	E4 - Main Embankment Seepage Pond	6/2/2015 11:37	0.0310		0.171	-0.0005	8.20	0.0286	3.11	-0.00001	58.9	2.43	-0.00001	-0.0001	-0.01	0.00146	0.00075	-0.003
196	E4 - Main Embankment Seepage Pond	7/9/2015 10:32	0.0927		0.157	-0.0005	9.46	0.0243	4.63	-0.00001	65.4	2.28	-0.00001	-0.0001	-0.01	0.00136	0.00090	-0.003
157	E4 - Main Embankment Seepage Pond	4/3/2012 10:10	0.243		0.153	0.00062		0.0108	5.8	-0.00001	65.8	1.67	-0.00001	-0.0001	0.017	0.000958	0.0013	0.004
194	E4 - Main Embankment Seepage Pond	5/5/2015 14:05	0.0534		0.192	-0.0005	9.62	0.0254	2.64	-0.00001	67.1	2.80	-0.00001	-0.0001	-0.01	0.00167	0.00072	-0.003
437	E5 - Tailings Impoundment Main Embank Drain Comp	6/3/2010 8:30	0.281		0.133	-0.001		0.0071	6.41	-0.00002	71.9	1.43	-0.0002	-0.0002	-0.01	0.00135	-0.002	-0.002
459	E5 - Tailings Impoundment Main Embank Drain Comp	4/3/2012 10:10	0.333		0.207	-0.0005		0.0129	6.44	-0.00001	74.2	2.35	-0.00001	-0.0001	-0.01	0.00125	-0.001	-0.003
431	E5 - Tailings Impoundment Main Embank Drain Comp	12/9/2009 12:45	0.448		0.149	0.001		0.0069	6.63	-0.00002	74.5	1.5	-0.0002	-0.0002	-0.01	0.00124	-0.002	-0.002
137	E4 - Main Embankment Seepage Pond	9/1/2010	0.166		0.125	-0.0005		0.0043	2.55	-0.00001	77.4	1.75	-0.0001	-0.0001	0.012	0.00111	-0.001	0.0021

Index	Sample Point	Date	Comment	Conductivity (in situ) (µs/cm)	pH (in situ) (pH)	Temperature (in situ) (Degrees Celcius)	Turbidity (in situ) (ntu)	Alkalinity (CaCO3) (mg/L)	Conductivity (µs/cm)	Hardness (as CaCO3) (mg/L)	pH (pH)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (ntu)	Ammonia (as N) (mg/L)	Chloride (Cl) (mg/L)	Fluoride (F) (mg/L)	Nitrate (as N) (mg/L)	Nitrate and Nitrite (as N) (mg/L)	Nitrite (as N) (mg/L)	Nitrogen N-WDGWA (mg/L)
440	E5 - Tailings Impoundment Main Embank Drain Comp	9/1/2010		1081		7.9		104	1060	375	8.05	767	-3	0.25	0.0929	25.9		1.05	1.08	0.031	
445	E5 - Tailings Impoundment Main Embank Drain Comp	2/3/2011 11:40						110	1140	421	7.95	835	-3	10	0.0715	26		1.64	1.7	0.0653	
142	E4 - Main Embankment Seepage Pond	2/3/2011 12:00						76.9	1510	668	7.84	1230	5.3	2.77	0.0399	30.2		5.45	5.47	0.022	
276	Perimeter Toe Drain	7/8/2010						94.4	1220	502	8.06	972	-3	0.49	0.0973	25.8		0.459	0.473	0.015	
212	East Main Toe Drain	2/8/2012 15:00						107	1110	394	8.06	753	-3	1.48	0.138	26.7	0.95	0.76	0.865	0.105	
143	E4 - Main Embankment Seepage Pond	3/8/2011 10:45						101	1340	558	8.01	1070	10.1	6.96	0.0616	27		3.61	3.64	0.027	
280	Perimeter Toe Drain	8/31/2011						77.6	1340	562	7.87	1040	-3	0.3	0.0775	23.3		1.76	1.84	0.076	
355	South Toe Drain	5/6/2015 11:53						60.8	1250	436	8.06	919	-3	0.16	0.173	24.9	0.68	-0.025	0.042	0.0418	
243	East Main Toe Drain	6/2/2015 11:46						86.3	1240	404	8.18	859	-3	0.50	0.0967	26.4	0.84	-0.025	-0.025	0.0068	
242	East Main Toe Drain	5/4/2015 13:18						70.2	1190	389	8.08	844	-3	0.36	0.0814	26.2	0.82	-0.025	-0.025	0.0248	
211	East Main Toe Drain	12/5/2011 11:20						103	1110	397	8.11	804	-3	0.32	0.107	25.7	0.96	0.968	1.08	0.108	
244	East Main Toe Drain	7/9/2015 10:13						87.0	1200	418	7.89	920	-3	0.17	0.0828	26.4	0.85	-0.025	-0.025	-0.005	
271	West Main Toe Drain	6/2/2015 11:52						86.0	1220	382	8.21	836	-3	0.30	0.0869	27.4	0.93	-0.025	-0.025	0.0145	
270	West Main Toe Drain	5/4/2015 13:28						92.1	1180	366	8.13	829	-3	0.16	0.0702	27.4	0.95	-0.025	0.039	0.0390	
272	West Main Toe Drain	7/9/2015 10:17						90.5	1190	389	7.97	888	-3	0.22	0.0781	26.9	0.90	-0.025	-0.025	-0.005	
10	E4 - Main Embankment Seepage Pond	2/5/2002 12:14		618	7.51	1.2		-1		167		338		0.319					4.74		
12	E4 - Main Embankment Seepage Pond	3/29/2002 16:15		350	8.38	2		-1		116			6	9.13	0.043				6.71		7.48
13	E4 - Main Embankment Seepage Pond	4/27/2002 15:45		370	8.02	12.2		-1		140		232		12.8	-0.005				11.3		
14	E4 - Main Embankment Seepage Pond	5/5/2002 10:15		372	8.1	11.5		-1		152		230		12	-0.005				11.4		12.2
16	E4 - Main Embankment Seepage Pond	6/30/2002 6:50		543	7.69	16.4		-1		162		260	-4	1.15	0.103				4.75		
18	E4 - Main Embankment Seepage Pond	8/31/2002 16:20		418	8.76	10.6		-1		112		256	-4	3.47	-0.005				1.12		
19	E4 - Main Embankment Seepage Pond	9/29/2002 9:15		407	8.1	9.1		-1		115		266	-4	6.31	0.028				1.4		
20	E4 - Main Embankment Seepage Pond	10/31/2002 13:50		437	8.12	3.7		-1		156		282	4	2.17	-0.005				3.19		
21	E4 - Main Embankment Seepage Pond	11/28/2002 16:00		374	7.98	4.4		-1		167		296	4	2.41	0.006				3.44		
22	E4 - Main Embankment Seepage Pond	12/30/2002 14:40		497	7.61	3.3		-1		179		342	-4	1.07	0.05				3.3		
23	E4 - Main Embankment Seepage Pond	1/30/2003 15:55		494	7.75	2.3		-1		185		330	-4	1.54	0.048				3.09		
24	E4 - Main Embankment Seepage Pond	2/28/2003 16:20		437	7.72	2.3		-1		158		276	5	2.05	0.014				1.85		
25	E4 - Main Embankment Seepage Pond	3/31/2003 9:40		315	8.34	3.2		-1		134		208	8	11.8	0.058				1.75		
82	E4 - Main Embankment Seepage Pond	7/3/2007 11:21		730	8.27	18.3		-1		248		487	-3	3.4	0.0455			2.33		0.0198	
373	E5 - Tailings Impoundment Main Embank Drain Comp	4/27/2002 15:10		539	7.07	5.3		-1		240		432		2	-0.005				22.5		
481	E7 - Perimeter Pond	2/5/2002 12:30		688	7.22	0.2		-1		291		372			0.081				4.29		
483	E7 - Perimeter Pond	3/29/2002 17:00		396	7.38	3.9		-1		169			6	11.3	-0.005				6.46		7.04
484	E7 - Perimeter Pond	4/26/2002 14:45		303	7.22	6		-1		127		208		10	-0.005				6.95		
486	E7 - Perimeter Pond	6/30/2002 8:00		664	7.29	16.1		-1		266		362	-4	2.49	0.07				1.66		
488	E7 - Perimeter Pond	8/30/2002 15:30		667	8.08	11.7		-1		319		442	-4	3.49	-0.005				0.28		
489	E7 - Perimeter Pond	9/30/2002 10:55		627	8.12	9.2		-1		305		430	-4	2.31	0.03				0.7		
490	E7 - Perimeter Pond	10/31/2002 15:55		629	8.26	5.7		-1		333		444	-4	1.85	-0.005				1.85		
491	E7 - Perimeter Pond	11/28/2002 13:15		691	8.35	3.1		-1		348		458	-4	1.3	-0.005				1.96		
492	E7 - Perimeter Pond	12/30/2002 14:10		743	7.36	3.4		-1		350		496	-4	4.31	0.036				2.07		
493	E7 - Perimeter Pond	1/30/2003 15:40		710	7.73	1.8		-1		382		524	-4	3.2	0.077				1.98		
494	E7 - Perimeter Pond	2/28/2003 15:35		176	8.34	1.8		-1		154		254	-4	1.66	0.012				1.13		
495	E7 - Perimeter Pond	3/31/2003 9:10		193	8.1	2.8		-1		50.6		60	-4	1.4	0.083				0.28		
P5																					
P50																					
P95																					
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Index	Sample Point	Date	Orthophosphate-Dissolved (as P) (mg/L)	Phosphorus (P) Total Dissolved (mg/L)	Phosphorus (P) Total (mg/L)	Sulphate (mg/L)	Sulphide as S (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)	Aluminum (Al)-Total	Antimony (Sb)-Total	Arsenic (As)-Total	Barium (Ba)-Total	Beryllium (Be)-Total	Bismuth (Bi)-Total	Boron (B)-Total	Cadmium (Cd)-Total	Calcium (Ca)-Total	Chromium (Cr)-Total	Cobalt (Co)-Total
440	E5 - Tailings Impoundment Main Embank Drain Comp	9/1/2010	0.0236	0.0352	0.038	412			1.59	3.56		0.002	0.00045	0.0017	0.0756	-0.0005	-0.0005	0.155	-0.00008	119	-0.0005	0.00038
445	E5 - Tailings Impoundment Main Embank Drain Comp	2/3/2011 11:40	0.0165	0.0275	0.0327	451			1.92	3.89		-0.003	0.00038	0.00164	0.0798	-0.0005	-0.0005	0.143	-0.00007	135	-0.0005	0.00043
142	E4 - Main Embankment Seepage Pond	2/3/2011 12:00	0.0044	0.0121	0.0223	715			6.7	7.06		-0.003	0.0016	0.00163	0.0495	-0.0005	-0.0005	0.107	0.000177	220	-0.0005	0.00024
276	Perimeter Toe Drain	7/8/2010	0.0036	0.0108	0.0152	565			0.52	2.89		-0.002	0.00048	0.00141	0.0388	-0.001	-0.001	0.156	-0.00051	158	-0.001	0.00023
212	East Main Toe Drain	2/8/2012 15:00	0.0418	0.0544	0.0605	458			1.07	4.43		-0.003	0.00038	0.00176	0.0949	-0.0001	-0.0005	0.136	-0.00012	122	-0.0005	0.00049
143	E4 - Main Embankment Seepage Pond	3/8/2011 10:45	0.0039	0.0125	0.0305	597			3.73	5.22		-0.003	0.00083	0.00173	0.0528	-0.0005	-0.0005	0.108	-0.00015	181	-0.0005	0.00024
280	Perimeter Toe Drain	8/31/2011	0.0068		0.0108	635			6.61	2.68		-0.003	0.00064	0.00137	0.0404	-0.0001	-0.0005	0.147	-0.00015	183	-0.0005	0.00074
355	South Toe Drain	5/6/2015 11:53	-0.001	0.0061	0.0110	568			0.288	4.40		0.0041	0.00069	0.00252	0.0268	-0.0001	-0.00005	0.116	0.000106	153	-0.0005	0.00048
243	East Main Toe Drain	6/2/2015 11:46	0.0279	0.0373	0.0363	497			0.159	4.14		0.0032	0.00037	0.00189	0.0566	-0.0001	-0.00005	0.142	0.0000222	128	-0.0005	0.00027
242	East Main Toe Drain	5/4/2015 13:18	0.0296	0.0380	0.0412	494			0.159	4.20		0.0043	0.00044	0.00211	0.0573	-0.0001	-0.00005	0.130	0.0000402	125	-0.0005	0.00029
211	East Main Toe Drain	12/5/2011 11:20	0.0396	0.0558	0.0558	453			1.23	4.76		-0.003	0.00038	0.00174	0.0932	-0.0001	-0.0005	0.125	0.000112	123	-0.0005	0.00051
244	East Main Toe Drain	7/9/2015 10:13	0.0287	0.0383	0.0376	505			0.140	3.98		0.0040	0.00035	0.00200	0.0559	-0.0001	-0.00005	0.130	0.0000215	130	-0.0005	0.00028
271	West Main Toe Drain	6/2/2015 11:52	0.0158	0.0273	0.0330	490			0.136	3.77		0.0036	0.00028	0.00223	0.0570	-0.0001	-0.00005	0.165	0.0000301	122	-0.0005	0.00042
270	West Main Toe Drain	5/4/2015 13:28	0.0172	0.0247	0.0286	495			0.159	3.94		0.0040	0.00031	0.00232	0.0625	-0.0001	-0.00005	0.156	0.0000353	116	-0.0005	0.00043
272	West Main Toe Drain	7/9/2015 10:17	0.0173	0.0283	0.0314	495			0.130	4.02		0.0036	0.00026	0.00245	0.0586	-0.0001	-0.00005	0.152	0.0000298	125	-0.0005	0.00042
10	E4 - Main Embankment Seepage Pond	2/5/2002 12:14	-0.005	0.047	0.079	61.9		-0.1	4.74			0.0038	0.0001	0.0029	0.0627	-0.00005	-0.00005		0.00017	51.3	0.0002	0.00063
12	E4 - Main Embankment Seepage Pond	3/29/2002 16:15	0.006	0.026	0.054	19.8		0.77		10.3		0.0038	0.00009	0.007	0.0395	-0.00005	-0.00005		0.00002	38.8	-0.0002	0.00013
13	E4 - Main Embankment Seepage Pond	4/27/2002 15:45	-0.005			43.5						0.0112	0.00016	0.0007	0.0449	-0.00005	0.00015		0.00004	47.9	0.0003	0.0001
14	E4 - Main Embankment Seepage Pond	5/5/2002 10:15	-0.005			37.9		0.87		5		0.0102	0.00015	0.0008	0.0442	-0.00005	-0.00005		0.00003	44.2	0.0006	0.00016
16	E4 - Main Embankment Seepage Pond	6/30/2002 6:50	-0.005	0.009	0.007	62.7				6.2		0.0028	0.00015	0.0015	0.0452	-0.00005	-0.00005		0.00009	48.4	-0.0002	-0.00002
18	E4 - Main Embankment Seepage Pond	8/31/2002 16:20	0.007	0.019	0.034	59.4				5		0.003	0.00012	0.0031	0.0284	-0.00005	-0.00005		0.00015	31.4	0.0004	0.00006
19	E4 - Main Embankment Seepage Pond	9/29/2002 9:15	-0.005	0.02	0.036	59.8				4.4		0.0083	0.00016	0.0027	0.0311	-0.00005	-0.00005		0.0001	32	-0.0002	-0.00002
20	E4 - Main Embankment Seepage Pond	10/31/2002 13:50	0.006	0.026	0.03	62.2				4.6		0.0031	0.00013	0.0018	0.0422	-0.00005	-0.00005		-0.00001	46.5	-0.0002	-0.00002
21	E4 - Main Embankment Seepage Pond	11/28/2002 16:00	-0.005	0.022	0.026	75.4				3.9		0.0015	0.00015	0.0018	0.047	-0.00005	-0.00005		0.00006	50	-0.0002	-0.00002
22	E4 - Main Embankment Seepage Pond	12/30/2002 14:40	0.013	0.04	0.044	72.9				5.2		0.0012	0.00014	0.0021	0.0555	-0.00005	-0.00005		0.00017	54.8	-0.0002	0.00006
23	E4 - Main Embankment Seepage Pond	1/30/2003 15:55	0.01	0.03	0.046	72.1				4.7		0.0017	0.00013	0.0022	0.0557	-0.00005	-0.00005		0.00002	56.2	-0.0002	-0.00002
24	E4 - Main Embankment Seepage Pond	2/28/2003 16:20	-0.005	0.024	0.044	55.2				5.9		0.0135	0.00015	0.0022	0.0524	-0.00005	0.00008		0.00014	48.5	-0.0002	0.00055
25	E4 - Main Embankment Seepage Pond	3/31/2003 9:40	0.006	0.023	0.056	36.2				9.1		0.0167	0.00012	0.001	0.0321	-0.00005	0.00013		0.00004	39	-0.0002	0.00019
82	E4 - Main Embankment Seepage Pond	7/3/2007 11:21	0.001	0.0108	0.0183	225			4.59	4.43		0.0029	0.00029	0.00192	0.0596	-0.0005	-0.0005	0.098	-0.000017	73.8	-0.0005	-0.0001
373	E5 - Tailings Impoundment Main Embank Drain Comp	4/27/2002 15:10	0.006			67.2						0.0015	0.00017	0.0009	0.0762	-0.00005	-0.00005		0.00007	82.9	0.0004	0.00068
481	E7 - Perimeter Pond	2/5/2002 12:30	-0.005	0.009	0.034	83.2		-0.1	4.29			0.0035	0.00011	0.0009	0.0476	-0.00005	-0.00005		0.00005	96.5	-0.0002	0.00089
483	E7 - Perimeter Pond	3/29/2002 17:00	0.009	0.014	0.038	45.5		0.58		5.3		0.103	0.00021	0.0006	0.0366	-0.00005	-0.00005		0.00001	57.5	0.0004	0.00034
484	E7 - Perimeter Pond	4/26/2002 14:45	-0.005			54.8						0.0682	0.00016	0.0005	0.0258	-0.00005	-0.00005		0.00002	44.3	0.0004	0.0001
486	E7 - Perimeter Pond	6/30/2002 8:00	-0.005	0.007	0.01	136				7.9		0.0033	0.00029	0.0011	0.0467	-0.00005	-0.00005		0.00011	82.3	-0.0002	-0.00002
488	E7 - Perimeter Pond	8/30/2002 15:30	-0.005	0.01	0.016	166				6.7		0.001	0.00015	0.001	0.0461	-0.00005	-0.00005		0.00002	99.8	0.0024	-0.00002
489	E7 - Perimeter Pond	9/30/2002 10:55	-0.005	0.01	0.013	166				5.8		0.0034	0.00018	0.0009	0.042	-0.00005	-0.00005		0.00002	93.5	-0.0002	-0.00002
490	E7 - Perimeter Pond	10/31/2002 15:55	-0.005	0.011	0.014	176				6.9		0.0028	0.00018	0.0006	0.0475	-0.00005	-0.00005		-0.00001	104	-0.0002	-0.00002
491	E7 - Perimeter Pond	11/28/2002 13:15	-0.005	0.007	0.008	183				5.1		0.0008	0.00021	0.0008	0.0502	-0.00005	-0.00005		0.0001	107	0.0004	0.00006
492	E7 - Perimeter Pond	12/30/2002 14:10	0.011	0.015	0.019	185				7		0.0013	0.00026	0.0005	0.0546	-0.00005	-0.00005		0.00007	109	-0.0002	-0.00002
493	E7 - Perimeter Pond	1/30/2003 15:40	-0.005	0.009	0.02	199				7		0.0025	0.00021	0.0008	0.0575	-0.00005	-0.00005		-0.00001	123	-0.0002	-0.00002
494	E7 - Perimeter Pond	2/28/2003 15:35	-0.005	-0.005	0.014	113				5		0.0093	0.0001	0.0004	0.0202	-0.00005	-0.00005		0.00003	47.3	-0.0002	-0.00002
495	E7 - Perimeter Pond	3/31/2003 9:10	0.005	0.012	0.022	11				4.1		0.0144	0.00009	0.0001	0.0104	-0.00005	-0.00005		0.00001	16.8	-0.0002	0.00005
P5																						
P50																						
P95																						
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Index	Sample Point	Date	Copper (Cu)-Total	Iron (Fe)-Total	Lead (Pb)-Total	Lithium (Li)-Total	Magnesium (Mg)-Total	Manganese (Mn)-Total	Mercury (Hg)-Total	Molybdenum (Mo)-Total	Nickel (Ni)-Total	Potassium (K)-Total	Selenium (Se)-Total	Silicon (Si)-Total	Silver (Ag)-Total	Sodium (Na)-Total	Strontium (Sr)-Total	Thallium (Tl)-Total	Tin (Sn)-Total
440	E5 - Tailings Impoundment Main Embank Drain Comp	9/1/2010	0.00137	-0.03	-0.00005	0.0054	18.9	0.443		0.149	-0.0005	14.8	0.0034	6.48	-0.00001	79.8	1.63	-0.0001	-0.0001
445	E5 - Tailings Impoundment Main Embank Drain Comp	2/3/2011 11:40	0.00175	-0.03	-0.00005	0.0055	20.3	0.38		0.145	-0.0005	14.7	0.0055	6.76	-0.00001	81.5	1.79	-0.0001	-0.0001
142	E4 - Main Embankment Seepage Pond	2/3/2011 12:00	0.00571	-0.03	-0.00005	0.0073	29	0.244		0.173	-0.0005	14.6	0.0151	6.03	-0.00001	85.3	1.98	-0.0001	-0.0001
276	Perimeter Toe Drain	7/8/2010	0.00166	-0.03	-0.0001	0.012	26.1	0.393		0.153	-0.001	20.6	-0.002	5.28	-0.00002	87.2	5.25	-0.0002	-0.0002
212	East Main Toe Drain	2/8/2012 15:00	0.0038	-0.03	0.000059	0.00607	21.9	1.1		0.184	0.00067	13.4	0.00143	6.34	-0.00001	87.1	1.65	0.000017	-0.0001
143	E4 - Main Embankment Seepage Pond	3/8/2011 10:45	0.00374	-0.03	-0.00005	0.0067	25.5	0.406	-0.00005	0.15	0.0006	12.9	0.00952	6.27	-0.00001	82.3	1.86	-0.0001	-0.0001
280	Perimeter Toe Drain	8/31/2011	0.0032	-0.03	-0.00005	0.0121	25.7	0.768		0.178	0.00069	21.4	0.00364	5.08	-0.00001	86.7	5.36	-0.00001	-0.0001
355	South Toe Drain	5/6/2015 11:53	0.00576	-0.03	-0.00005	0.0071	15.7	0.363		0.196	-0.0005	11.3	0.00255	6.02	-0.00001	93.0	2.12	-0.00001	-0.0001
243	East Main Toe Drain	6/2/2015 11:46	0.00226	0.030	-0.00005	0.0082	21.2	0.589		0.221	-0.0005	16.1	0.000256	6.13	-0.00001	93.5	2.15	-0.00001	-0.0001
242	East Main Toe Drain	5/4/2015 13:18	0.00269	-0.03	-0.00005	0.0081	19.7	0.574		0.210	-0.0005	16.0	0.000448	5.76	0.000015	94.9	2.06	-0.00001	-0.0001
211	East Main Toe Drain	12/5/2011 11:20	0.00294	-0.03	-0.00005	0.0073	22	1.14		0.184	0.00069	15.6	0.00156	6.27	-0.00001	95.4	1.73	-0.00001	-0.0001
244	East Main Toe Drain	7/9/2015 10:13	0.00183	0.034	-0.00005	0.0080	21.1	0.565		0.213	-0.0005	15.9	0.000184	5.95	-0.00001	94.9	2.06	-0.00001	-0.0001
271	West Main Toe Drain	6/2/2015 11:52	0.00202	0.061	-0.00005	0.0082	20.0	0.389		0.196	-0.0005	17.5	0.00106	6.67	-0.00001	98.8	2.19	-0.00001	-0.0001
270	West Main Toe Drain	5/4/2015 13:28	0.00268	0.041	-0.00005	0.0083	18.3	0.395		0.189	-0.0005	17.6	0.00130	6.22	0.000015	102	2.18	-0.00001	-0.0001
272	West Main Toe Drain	7/9/2015 10:17	0.00153	0.077	-0.00005	0.0078	20.5	0.392		0.191	-0.0005	17.7	0.000629	6.69	-0.00001	103	2.23	-0.00001	-0.0001
10	E4 - Main Embankment Seepage Pond	2/5/2002 12:14	0.0022	-0.005	0.00004	0.0026	10.3	0.719	-0.00005	0.067	-0.0005	6.56	0.0012	7.19	-0.00001	48.8	0.484	-0.00005	0.00017
12	E4 - Main Embankment Seepage Pond	3/29/2002 16:15	0.0042	0.057	0.00007	0.0007	8.08	0.142	-0.00005	0.00762	-0.0005	2.47	0.0008	4.33	-0.00001	11.3	0.303	-0.00005	-0.00005
13	E4 - Main Embankment Seepage Pond	4/27/2002 15:45	0.0022	-0.005	-0.00002	0.0009	7.84	0.0548	-0.00005	0.0133	-0.0005	2.94	0.0007	4.64	-0.00001	13.4	0.357	-0.00005	0.00009
14	E4 - Main Embankment Seepage Pond	5/5/2002 10:15	0.0026	0.008	-0.00002	0.0009	7.33	0.0559	-0.00005	0.0133	-0.0005	3.18	0.0014	4.52	-0.00001	12.5	0.35	-0.00005	0.00009
16	E4 - Main Embankment Seepage Pond	6/30/2002 6:50	0.0036	-0.005	0.0001	0.0018	9.45	0.00016	-0.00005	0.0445	-0.0005	4.44	0.001	1.15	-0.00001	32.4	0.418	-0.00005	-0.00005
18	E4 - Main Embankment Seepage Pond	8/31/2002 16:20	0.0033	-0.005	0.00038	0.0021	9.6	0.0289	-0.00005	0.0613	-0.0005	4.6	0.0009	6.18	-0.00001	44.7	0.345	-0.00005	0.00007
19	E4 - Main Embankment Seepage Pond	9/29/2002 9:15	0.0031	0.011	0.00027	-0.0002	8.98	0.0496	-0.00005	0.0537	-0.0005	5.04	0.0007	5.76	-0.00001	38.8	0.324	-0.00005	0.00005
20	E4 - Main Embankment Seepage Pond	10/31/2002 13:50	0.0025	-0.005	0.00048	0.0024	10.6	0.0238	-0.00005	0.0472	-0.0005	4.09	0.0008	5.54	-0.00001	35.7	0.37	-0.00005	-0.00005
21	E4 - Main Embankment Seepage Pond	11/28/2002 16:00	0.0049	-0.005	0.00013	0.002	10.9	0.0385	-0.00005	0.0497	-0.0005	4.16	0.0009	5.62	-0.00001	36	0.419	-0.00005	0.00008
22	E4 - Main Embankment Seepage Pond	12/30/2002 14:40	0.0018	-0.005	0.00025	0.0022	11.2	0.261	-0.00005	0.0585	-0.0005	5.14	0.0011	5.99	-0.00001	40.7	0.48	-0.00005	0.00008
23	E4 - Main Embankment Seepage Pond	1/30/2003 15:55	0.0014	-0.005	0.00003	0.0019	11.4	0.351	-0.00005	0.0586	-0.0005	5.27	0.0013	6.17	-0.00001	41.9	0.458	-0.00005	-0.00005
24	E4 - Main Embankment Seepage Pond	2/28/2003 16:20	0.0029	0.03	0.00006	0.0018	10.1	0.769	-0.00005	0.0531	-0.0005	4.88	0.001	5.66	-0.00001	36.3	0.435	-0.00005	-0.00005
25	E4 - Main Embankment Seepage Pond	3/31/2003 9:40	0.0029	0.03	-0.00002	0.001	7.79	0.199	-0.00005	0.0194	-0.0005	2.7	0.0013	3.9	-0.00001	17	0.297	-0.00005	0.00007
82	E4 - Main Embankment Seepage Pond	7/3/2007 11:21	0.00347	-0.03	-0.00005	-0.005	15.5	0.0544		0.12	-0.0005	6.59	0.0107	3.88	-0.00001	52.3	1.02	-0.0001	-0.0001
373	E5 - Tailings Impoundment Main Embank Drain Comp	4/27/2002 15:10	0.0025	-0.005	-0.00002	0.002	12.2	0.222	-0.00005	0.0255	-0.0005	3.95	0.0018	7.49	-0.00001	24.7	0.576	-0.00005	-0.00005
481	E7 - Perimeter Pond	2/5/2002 12:30	0.003	0.018	0.00009	0.0026	12.9	0.774	-0.00005	0.00394	-0.0005	3.04	0.0024	7.48	-0.00001	10.3	0.485	-0.00005	0.00019
483	E7 - Perimeter Pond	3/29/2002 17:00	0.007	0.341	0.00003	0.0008	8.08	0.129	-0.00005	0.0033	-0.0005	2.48	0.0027	4.18	-0.00001	8.33	0.354	-0.00005	0.00012
484	E7 - Perimeter Pond	4/26/2002 14:45	0.0031	0.062	-0.00002	0.0006	6.28	0.047	-0.00005	0.00418	-0.0005	1.86	0.0032	3.07	-0.00001	4.87	0.259	-0.00005	-0.00005
486	E7 - Perimeter Pond	6/30/2002 8:00	0.0062	-0.005	0.00008	0.0029	14.2	0.00003	-0.00005	0.0103	-0.0005	2.92	0.0068	1	-0.00001	14	0.489	-0.00005	0.00014
488	E7 - Perimeter Pond	8/30/2002 15:30	0.0039	-0.005	0.00029	0.0023	18.4	0.184	-0.00005	0.00726	0.0006	3.24	0.003	1.45	-0.00001	20.1	0.647	-0.00005	0.0001
489	E7 - Perimeter Pond	9/30/2002 10:55	0.0037	-0.005	0.00023	-0.0002	16.9	0.113	-0.00005	0.00653	-0.0005	3.29	0.0025	1.74	-0.00001	17.4	0.56	-0.00005	-0.00005
490	E7 - Perimeter Pond	10/31/2002 15:55	0.0034	-0.005	0.00024	0.0014	18.4	0.0783	-0.00005	0.00711	-0.0005	3.23	0.0027	2.55	-0.00001	17.2	0.596	-0.00005	-0.00005
491	E7 - Perimeter Pond	11/28/2002 13:15	0.0039	-0.005	-0.00002	0.0017	18.8	0.0751	-0.00005	0.00755	-0.0005	3.48	0.0031	2.45	-0.00001	17.2	0.63	-0.00005	0.00009
492	E7 - Perimeter Pond	12/30/2002 14:10	0.003	-0.005	-0.00002	0.002	18.6	0.00612	-0.00005	0.00837	-0.0005	3.37	0.0034	3.02	-0.00001	15.7	0.651	-0.00005	0.0007
493	E7 - Perimeter Pond	1/30/2003 15:40	0.0034	-0.005	0.00005	0.0018	21.4	0.0423	-0.00005	0.00829	-0.0005	3.8	0.0039	2.97	-0.00001	18.4	0.691	-0.00005	0.00027
494	E7 - Perimeter Pond	2/28/2003 15:35	0.0025	-0.005	0.00005	0.0009	9.71	0.0243	-0.00005	0.0039	-0.0005	2.06	0.0015	1.5	-0.00001	9	0.306	-0.00005	0.00006
495	E7 - Perimeter Pond	3/31/2003 9:10	0.0024	0.019	-0.00002	0.0003	1.87	0.0397	-0.00005	0.00165	-0.0005	0.93	-0.0005	1.13	-0.00001	2.89	0.0931	-0.00005	0.00008
P5																			
P50																			
P95																			
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Index	Sample Point	Date	Titanium (Ti)-Total	Uranium (U)-Total	Vanadium (V)-Total	Zinc (Zn)-Total	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
440	E5 - Tailings Impoundment Main Embank Drain Comp	9/1/2010	-0.01	0.0012	-0.001	-0.001	0.0158	0.00045	0.00174	0.0767	-0.0005	-0.0005	0.158	-0.00007	118	-0.0005	0.00038	0.00299	0.038	-0.00005	0.0056	18.9
445	E5 - Tailings Impoundment Main Embank Drain Comp	2/3/2011 11:40	-0.01	0.0013	-0.001	-0.003	0.0068	0.00039	0.00185	0.0819	-0.0005	-0.0005	0.151	-0.00008	138	-0.0005	0.00044	0.00311	0.062	0.000053	0.0058	20.9
142	E4 - Main Embankment Seepage Pond	2/3/2011 12:00	-0.01	0.000983	-0.001	-0.003	0.109	0.00158	0.00179	0.049	-0.0005	-0.0005	0.11	0.000178	221	-0.0005	0.0003	0.00901	0.162	0.000051	0.0071	29.3
276	Perimeter Toe Drain	7/8/2010	-0.01	0.00215	-0.002	-0.002	0.0834	0.00047	0.00137	0.0399	-0.001	-0.001	0.151	-0.00051	155	-0.001	0.00054	0.00325	0.102	-0.0001	0.013	25.4
212	East Main Toe Drain	2/8/2012 15:00	-0.01	0.00125	-0.001	-0.003	0.0056	0.00036	0.00178	0.0935	-0.0001	-0.0005	0.136	-0.00012	120	-0.0005	0.00049	0.00479	0.043	0.00101	0.00604	21.4
143	E4 - Main Embankment Seepage Pond	3/8/2011 10:45	0.015	0.0011	-0.001	-0.003	0.345	0.00087	0.00206	0.0578	-0.0005	-0.0005	0.112	-0.00015	185	0.00054	0.00043	0.0135	0.347	0.000151	0.0072	26.3
280	Perimeter Toe Drain	8/31/2011	-0.01	0.00191	-0.001	-0.003	0.0125	0.00065	0.00139	0.0415	-0.0001	-0.0005	0.149	-0.00015	187	-0.0005	0.0008	0.00436	-0.03	-0.00005	0.0122	26.4
355	South Toe Drain	5/6/2015 11:53	-0.01	0.00112	0.00175	-0.003	0.0034	0.00065	0.00233	0.0263	-0.0001	-0.00005	0.112	0.0000992	150	-0.0005	0.00036	0.00400	-0.03	-0.00005	0.0069	15.3
243	East Main Toe Drain	6/2/2015 11:46	-0.01	0.00109	0.00085	-0.003	-0.003	0.00042	0.00188	0.0559	-0.0001	-0.00005	0.138	0.0000191	128	-0.0005	0.00025	0.00124	-0.03	-0.00005	0.0078	20.8
242	East Main Toe Drain	5/4/2015 13:18	-0.01	0.00104	0.00098	-0.003	0.0037	0.00043	0.00206	0.0572	-0.0001	-0.00005	0.128	0.0000372	124	-0.0005	0.00028	0.00157	-0.03	-0.00005	0.0079	19.5
211	East Main Toe Drain	12/5/2011 11:20	-0.01	0.00116	-0.001	-0.003	0.0076	0.00038	0.00175	0.0905	-0.0001	-0.0005	0.118	-0.0002	120	-0.0005	0.00051	0.00722	0.046	0.000592	0.00652	21.2
244	East Main Toe Drain	7/9/2015 10:13	-0.01	0.00107	0.00100	-0.003	0.0030	0.00040	0.00201	0.0564	-0.0001	-0.00005	0.124	0.0000180	132	-0.0005	0.00027	0.00121	-0.03	-0.00005	0.0079	21.5
271	West Main Toe Drain	6/2/2015 11:52	-0.01	0.000875	0.00061	-0.003	-0.003	0.00026	0.00199	0.0573	-0.0001	-0.00005	0.160	0.0000658	120	-0.0005	0.00039	0.00134	-0.03	-0.00005	0.0080	19.9
270	West Main Toe Drain	5/4/2015 13:28	-0.01	0.000865	0.00074	-0.003	0.0031	0.00029	0.00210	0.0610	-0.0001	-0.00005	0.152	0.0000370	116	-0.0005	0.00042	0.00109	-0.03	-0.00005	0.0082	18.4
272	West Main Toe Drain	7/9/2015 10:17	-0.01	0.000918	0.00085	-0.003	-0.003	0.00026	0.00215	0.0570	-0.0001	-0.00005	0.141	0.0000167	122	-0.0005	0.00041	0.00096	-0.03	-0.00005	0.0075	20.2
10	E4 - Main Embankment Seepage Pond	2/5/2002 12:14	0.00145	0.00131	0.00146	0.0058	0.0904	0.00013	0.0027	0.0644	-0.00005	-0.00005		0.00012	50.4	0.0005	0.00091	0.0038	0.237	0.00012	0.0025	10.1
12	E4 - Main Embankment Seepage Pond	3/29/2002 16:15	0.0014	0.00031	0.00118	0.0123	0.333	0.00012	0.0009	0.0431	-0.00005	-0.00005		-0.00001	34.2	0.0008	0.00075	0.0057	0.542	0.00023	0.0009	7.54
13	E4 - Main Embankment Seepage Pond	4/27/2002 15:45	0.00121	0.00054	0.00115	-0.0005	0.473	0.00016	0.0009	0.05	-0.00005	0.00017		0.00003	43.9	0.0009	0.0006	0.0057	0.62	0.00027	0.0011	7.4
14	E4 - Main Embankment Seepage Pond	5/5/2002 10:15	0.00109	0.00053	0.0012	0.0011	0.476	0.00017	0.0009	0.0504	-0.00005	-0.00005		0.00003	47.8	0.001	0.00061	0.0068	0.572	0.0003	0.0013	7.93
16	E4 - Main Embankment Seepage Pond	6/30/2002 6:50	0.00087	0.00099	0.00116	0.0046	0.0731	0.00015	0.0017	0.0509	-0.00005	-0.00005		0.0001	49.7	-0.0002	-0.00002	0.0052	0.097	0.00018	0.0019	9.3
18	E4 - Main Embankment Seepage Pond	8/31/2002 16:20	0.00125	0.00089	0.0015	0.0007	0.131	0.00014	0.0032	0.032	-0.00005	-0.00005		0.00014	29.6	0.0012	0.00016	0.0042	0.139	0.00056	0.0025	9.15
19	E4 - Main Embankment Seepage Pond	9/29/2002 9:15	0.00182	0.00096	0.00119	0.0014	0.267	0.00017	0.003	0.0349	-0.00005	0.00006		0.0001	31.6	-0.0002	0.00014	0.0046	0.255	0.00038	0.0003	8.84
20	E4 - Main Embankment Seepage Pond	10/31/2002 13:50	0.00141	0.00116	0.0006	-0.0005	0.0911	0.00013	0.0018	0.0438	-0.00005	-0.00005		-0.00001	45.3	-0.0002	-0.00002	0.0033	0.092	0.00052	0.0023	10.4
21	E4 - Main Embankment Seepage Pond	11/28/2002 16:00	0.00126	0.00118	0.00058	0.0008	0.105	0.00016	0.0019	0.0496	-0.00005	-0.00005		0.00005	49.4	0.0004	0.00007	0.0036	0.1	0.00004	0.0023	10.7
22	E4 - Main Embankment Seepage Pond	12/30/2002 14:40	0.00171	0.00117	0.00127	0.0013	0.0221	0.00014	0.0022	0.0778	-0.00005	-0.00005		0.00016	53.5	-0.0002	0.00011	0.0026	0.045	0.00027	0.0024	11
23	E4 - Main Embankment Seepage Pond	1/30/2003 15:55	0.00201	0.00115	0.0012	0.0017	0.0407	0.00014	0.0023	0.0726	-0.00005	-0.00005		0.00003	55.5	-0.0002	0.00006	0.0027	0.028	0.00004	0.0022	11.2
24	E4 - Main Embankment Seepage Pond	2/28/2003 16:20	0.00178	0.00097	0.0019	0.0119	0.0995	0.00012	0.0023	0.0597	-0.00005	-0.00005		0.00013	46.7	-0.0002	0.00068	0.0034	0.162	0.0001	0.0018	10.1
25	E4 - Main Embankment Seepage Pond	3/31/2003 9:40	0.00205	0.00071	0.00111	0.0021	0.304	0.00015	0.0011	0.038	-0.00005	0.00017		0.00005	40.4	-0.0002	0.00038	0.0041	0.267	0.00011	0.0012	8.01
82	E4 - Main Embankment Seepage Pond	7/3/2007 11:21	-0.01	0.00143	0.001	0.0014	0.117	0.0003	0.00205	0.0625	-0.0005	-0.0005	0.1	-0.000029	75.3	-0.0005	0.00014	0.00437	0.139	0.000063	-0.005	15.8
373	E5 - Tailings Impoundment Main Embank Drain Comp	4/27/2002 15:10	0.00181	0.00074	0.00163	-0.0005	0.0481	0.00016	0.0011	0.0712	-0.00005	-0.00005		0.00006	77.3	0.0002	0.00112	0.0046	0.135	0.00004	0.002	11.5
481	E7 - Perimeter Pond	2/5/2002 12:30	0.00138	0.00105	0.00121	0.0029	0.0489	0.00013	0.0009	0.0464	-0.00005	-0.00005		0.00003	95.6	0.0003	0.00102	0.004	0.211	0.00021	0.0026	12.8
483	E7 - Perimeter Pond	3/29/2002 17:00	0.00333	0.00075	0.00085	0.0083	0.343	0.00023	0.0006	0.04	-0.00005	0.00041		-0.00001	54.3	0.0009	0.00072	0.0065	0.675	0.00019	0.001	8.06
484	E7 - Perimeter Pond	4/26/2002 14:45	0.00365	0.00046	0.0009	0.0043	0.506	0.00016	0.0004	0.0294	-0.00005	-0.00005		0.00002	41.1	0.001	0.00054	0.0057	0.594	0.00021	0.0007	6.03
486	E7 - Perimeter Pond	6/30/2002 8:00	0.002	0.00109	0.00063	0.005	0.0843	0.00032	0.0014	0.0528	-0.00005	-0.00005		0.00052	83.7	-0.0002	0.00006	0.0093	0.141	0.00021	0.0033	13.8
488	E7 - Perimeter Pond	8/30/2002 15:30	0.00399	0.00161	0.002	0.0039	0.106	0.00016	0.001	0.0477	-0.00005	-0.00005		0.00003	98.4	0.0024	0.00007	0.0053	0.111	0.00031	0.0021	17.8
489	E7 - Perimeter Pond	9/30/2002 10:55	0.00381	0.00178	0.00061	0.0055	0.102	0.00019	0.001	0.0436	-0.00005	-0.00005		0.00004	94.7	-0.0002	-0.00002	0.0046	0.099	0.00031	-0.0002	16.7
490	E7 - Perimeter Pond	10/31/2002 15:55	0.0039	0.00187	0.00039	0.0023	0.068	0.00018	0.0006	0.0476	-0.00005	-0.00005		-0.00001	103	-0.0002	-0.00002	0.0039	0.079	0.00049	0.0018	18.4
491	E7 - Perimeter Pond	11/28/2002 13:15	0.00352	0.00186	0.00037	0.0019	0.0474	0.0002	0.0007	0.0501	-0.00005	-0.00005		0.00002	108	0.0003	-0.00002	0.0041	0.048	0.00013	0.0024	18.9
492	E7 - Perimeter Pond	12/30/2002 14:10	0.00442	0.00185	0.001	0.0061	0.121	0.0003	0.0007	0.0571	-0.00005	-0.00005		0.00006	109	-0.0002	-0.00002	0.0042	0.124	0.00058	0.0023	18.8
493	E7 - Perimeter Pond	1/30/2003 15:40	0.00586	0.00205	0.00105	0.0068	0.0432	0.00025	0.0008	0.0611	-0.00005	-0.00005		-0.00001	119	-0.0002	-0.00002	0.005	0.053	0.00017	0.002	20.6
494	E7 - Perimeter Pond	2/28/2003 15:35	0.00256	0.0008	0.00087	0.0343	0.0659	0.0001	0.0005	0.0209	-0.00005	-0.00005		0.00004	45.8	-0.0002	0.00004	0.0027	0.046	0.00014	0.001	9.68
495	E7 - Perimeter Pond	3/31/2003 9:10	0.001	0.00021	0.00045	0.0024	0.0835	0.00009	0.0002	0.0114	-0.00005	-0.00005		0.00002	17.1	-0.0002	0.00009	0.0027	0.066	0.00004	0.0003	1.91
P5																						
P50																						
P95																						
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Index	Sample Point	Date	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
440	E5 - Tailings Impoundment Main Embank Drain Comp	9/1/2010	0.452		0.151	-0.0005		0.0033	6.47	-0.00001	80.3	1.65	-0.0001	-0.0001	0.011	0.00122	-0.001	-0.001
445	E5 - Tailings Impoundment Main Embank Drain Comp	2/3/2011 11:40	0.396		0.154	-0.0005		0.0055	6.93	-0.00001	84.2	1.86	-0.0001	-0.0001	-0.01	0.00137	-0.001	-0.003
142	E4 - Main Embankment Seepage Pond	2/3/2011 12:00	0.247		0.177	0.00054		0.0152	6.29	-0.00001	84.3	1.99	-0.0001	-0.0001	-0.01	0.000997	0.0011	0.0034
276	Perimeter Toe Drain	7/8/2010	0.502		0.149	-0.001		-0.002	5.29	-0.00002	86.1	5.23	-0.0002	-0.0002	-0.01	0.00215	-0.002	-0.002
212	East Main Toe Drain	2/8/2012 15:00	1.09		0.182	0.00061		0.00146	6.2	-0.00001	86.2	1.64	0.000017	-0.0001	-0.01	0.00122	-0.001	-0.003
143	E4 - Main Embankment Seepage Pond	3/8/2011 10:45	0.439	-0.00005	0.154	0.00095		0.01	7.15	-0.00001	86.2	1.94	-0.0001	-0.0001	0.03	0.00114	0.0017	0.0045
280	Perimeter Toe Drain	8/31/2011	0.807		0.187	0.00068		0.00371	5.25	-0.00001	89.6	5.62	-0.00001	-0.0001	-0.01	0.002	-0.001	-0.003
355	South Toe Drain	5/6/2015 11:53	0.328		0.191	-0.0005	11.1	0.00251	5.87	-0.00001	90.8	2.07	-0.00001	-0.0001	-0.01	0.00109	0.00143	-0.003
243	East Main Toe Drain	6/2/2015 11:46	0.569		0.215	-0.0005	15.7	0.00115	6.02	-0.00001	91.0	2.07	-0.00001	-0.0001	-0.01	0.00107	0.00077	-0.003
242	East Main Toe Drain	5/4/2015 13:18	0.566		0.206	-0.0005	15.8	0.00109	5.72	-0.00001	93.5	2.03	-0.00001	-0.0001	-0.01	0.00102	0.00085	-0.003
211	East Main Toe Drain	12/5/2011 11:20	1.16		0.184	0.00064		0.00143	6.05	-0.00001	93.7	1.72	-0.00001	-0.0001	-0.01	0.00115	-0.001	-0.003
244	East Main Toe Drain	7/9/2015 10:13	0.564		0.210	-0.0005	15.9	0.00121	6.06	-0.00001	95.5	2.03	-0.00001	-0.0001	-0.01	0.00107	0.00072	-0.003
271	West Main Toe Drain	6/2/2015 11:52	0.381		0.191	-0.0005	17.2	0.000991	6.65	-0.00001	96.8	2.14	-0.00001	-0.0001	-0.01	0.000894	0.00055	-0.003
270	West Main Toe Drain	5/4/2015 13:28	0.381		0.182	-0.0005	16.9	0.00128	6.18	-0.00001	98.2	2.10	-0.00001	-0.0001	-0.01	0.000853	0.00063	-0.003
272	West Main Toe Drain	7/9/2015 10:17	0.381		0.181	-0.0005	17.4	0.000575	6.56	-0.00001	101	2.10	-0.00001	-0.0001	-0.01	0.000873	0.00053	-0.003
10	E4 - Main Embankment Seepage Pond	2/5/2002 12:14	0.703	-0.00005	0.0664	-0.0005		0.0007	7	-0.00001	47.7	0.472	-0.00005	0.00013	0.00545	0.00129	0.00119	0.0063
12	E4 - Main Embankment Seepage Pond	3/29/2002 16:15	0.153	-0.00005	0.00888	-0.0005		0.0006	4.74	0.00001	10.7	0.311	-0.00005	-0.00005	0.0137	0.00038	0.00149	0.011
13	E4 - Main Embankment Seepage Pond	4/27/2002 15:45	0.103	-0.00005	0.0125	-0.0005		0.0008	5.24	-0.00001	12.8	0.346	-0.00005	-0.00005	0.0173	0.00052	0.00196	0.0021
14	E4 - Main Embankment Seepage Pond	5/5/2002 10:15	0.104	-0.00005	0.0137	-0.0005		0.001	5.43	-0.00001	13.3	0.357	-0.00005	0.00012	0.016	0.00055	0.00173	0.0044
16	E4 - Main Embankment Seepage Pond	6/30/2002 6:50	0.057	-0.00005	0.0457	-0.0005		0.0011	1.29	-0.00001	30.8	0.438	-0.00005	-0.00005	0.0035	0.00103	0.00192	0.0128
18	E4 - Main Embankment Seepage Pond	8/31/2002 16:20	0.063	-0.00005	0.0611	0.001		-0.0005	6.18	-0.00001	42.3	0.367	-0.00005	-0.00005	0.0068	0.00089	0.00216	0.0007
19	E4 - Main Embankment Seepage Pond	9/29/2002 9:15	0.0749	-0.00005	0.0543	-0.0005		0.0008	6.24	-0.00001	36.4	0.326	-0.00005	-0.00005	0.0113	0.00094	0.00213	0.0018
20	E4 - Main Embankment Seepage Pond	10/31/2002 13:50	0.0272	-0.00005	0.0461	-0.0005		0.0007	5.41	-0.00001	34	0.383	-0.00005	-0.00005	0.0044	0.00114	0.00085	0.0008
21	E4 - Main Embankment Seepage Pond	11/28/2002 16:00	0.0451	-0.00005	0.0492	-0.0005		0.0009	5.49	-0.00001	35	0.429	-0.00005	0.00007	0.0053	0.00117	0.00086	-0.0005
22	E4 - Main Embankment Seepage Pond	12/30/2002 14:40	0.301	-0.00005	0.058	-0.0005		0.0012	5.85	-0.00001	39.5	0.486	-0.00005	-0.00005	0.0032	0.00111	0.00127	0.0015
23	E4 - Main Embankment Seepage Pond	1/30/2003 15:55	0.378	-0.00005	0.0599	-0.0005		0.0011	6.15	-0.00001	40.4	0.483	-0.00005	-0.00005	0.0035	0.00108	0.00108	0.0018
24	E4 - Main Embankment Seepage Pond	2/28/2003 16:20	0.855	-0.00005	0.053	-0.0005		0.0011	5.66	-0.00001	36.3	0.439	-0.00005	-0.00005	0.0042	0.00096	0.00248	0.0145
25	E4 - Main Embankment Seepage Pond	3/31/2003 9:40	0.291	-0.00005	0.0182	-0.0005		0.0011	5	-0.00001	16.6	0.304	-0.00005	-0.00005	0.0105	0.00069	0.00184	0.006
82	E4 - Main Embankment Seepage Pond	7/3/2007 11:21	0.063		0.123	-0.0005		0.011	4.18	-0.00001	52.1	1.05	-0.0001	-0.0001	-0.01	0.00143	0.0013	0.0016
373	E5 - Tailings Impoundment Main Embank Drain Comp	4/27/2002 15:10	0.256	-0.00005	0.026	-0.0005		0.0017	7.66	-0.00001	24.7	0.58	-0.00005	0.00006	0.0027	0.00068	0.00099	-0.0005
481	E7 - Perimeter Pond	2/5/2002 12:30	0.755	-0.00005	0.00342	-0.0005		0.0022	7.3	-0.00001	10.3	0.471	-0.00005	0.00008	0.00407	0.00099	0.00058	0.0029
483	E7 - Perimeter Pond	3/29/2002 17:00	0.135	-0.00005	0.00401	-0.0005		0.0029	4.82	0.00002	8.41	0.389	-0.00005	0.00006	0.0144	0.00085	0.00157	0.0077
484	E7 - Perimeter Pond	4/26/2002 14:45	0.061	-0.00005	0.0041	-0.0005		0.0024	3.76	-0.00001	4.68	0.249	-0.00005	0.00008	0.0166	0.00048	0.00172	0.0076
486	E7 - Perimeter Pond	6/30/2002 8:00	0.141	-0.00005	0.0107	-0.0005		0.0079	1.21	-0.00001	12.9	0.517	-0.00005	-0.00005	0.0049	0.00113	0.00179	0.0161
488	E7 - Perimeter Pond	8/30/2002 15:30	0.204	-0.00005	0.00692	-0.0005		0.0027	1.61	-0.00001	18.7	0.674	-0.00005	0.00006	0.0085	0.00156	0.00229	0.0063
489	E7 - Perimeter Pond	9/30/2002 10:55	0.129	-0.00005	0.00697	-0.0005		0.0024	1.83	-0.00001	16.3	0.582	-0.00005	-0.00005	0.0075	0.00177	0.001	0.0075
490	E7 - Perimeter Pond	10/31/2002 15:55	0.0903	-0.00005	0.00715	-0.0005		0.0028	2.59	-0.00001	16.4	0.611	-0.00005	-0.00005	0.0066	0.00184	0.00059	0.0044
491	E7 - Perimeter Pond	11/28/2002 13:15	0.0846	-0.00005	0.00766	-0.0005		0.0029	2.42	-0.00001	16.8	0.641	-0.00005	-0.00005	0.006	0.00189	0.00052	0.0024
492	E7 - Perimeter Pond	12/30/2002 14:10	0.0775	-0.00005	0.00865	-0.0005		0.0033	3.27	-0.00001	15.6	0.644	-0.00005	0.00013	0.0083	0.00183	0.0013	0.0119
493	E7 - Perimeter Pond	1/30/2003 15:40	0.0935	-0.00005	0.00854	-0.0005		0.0039	2.94	-0.00001	17.3	0.713	-0.00005	0.00028	0.0077	0.00193	0.00092	0.0082
494	E7 - Perimeter Pond	2/28/2003 15:35	0.0266	-0.00005	0.00378	-0.0005		0.0019	1.57	-0.00001	8.75	0.308	-0.00005	0.00006	0.005	0.0008	0.00099	0.0634
495	E7 - Perimeter Pond	3/31/2003 9:10	0.0494	-0.00005	0.00139	-0.0005		-0.0005	1.34	-0.00001	2.58	0.0942	-0.00005	-0.00005	0.0031	0.00021	0.00057	0.005
P5																		
P50																		
P95																		
P99																		

Appendix I – Tailings Source Terms

Tailings Source Terms

Source: C:\Users\sday\Dropbox\Projects\Mount_Polley\SourceTermReport\[TailingsReview_1CI008007_SJD_REV07.xlsx]

		Alkalinity	Cl	F	NO3	NO2	NH3	PO4	SO4	DOC	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	U	V	Zn
		mgCaCO3/l	mg/L	mg/L	mgN/L	mgN/L	mgN/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Seepage	P95	99.1	23.4	0.81	1.85	0.037	0.04465	0.006	374	3.81	0.0412	0.0004	0.00179	0.0575	0.00005	0.126	0.00006	119	0.00025	0.00033	0.00417	0.082	0.00005	0.0052	19.1	0.279	0.142	0.00025	15.7	0.0055	0.000005	65.1	0.000025	0.001255	0.001	0.0015
Seepage	P99	163.5	28.9	1.0705	7.702	0.2793	0.15125	0.03025	601.75	7.012	0.7499	0.001107	0.002733	0.09226	0.0005	0.17515	0.000274	190.7	0.002187	0.001077	0.02122	1.023	0.000563	0.009877	30.075	0.7898	0.214	0.001989	17.3	0.0251	0.00002	94.3	0.0001	0.002952	0.003467	0.012
Drained Down	P95	114.8	3.98	1.202	0.1434	0.005	0.04465	0.00844	837.2	0	0.03042	0.005892	0.01198	0.05418	0.00005	0.1408	0.000134	234	0.00025	0.000156	0.03894	0.015	0.000025	0.02572	28.3	0.279	0.8714	0.00066	15.34	0.08372	0.000005	72.18	0.000018	0.001255	0.00744	0.0034
Drained Down	P99	123.28	22.6	1.528	0.7504	0.01	0.15125	0.009424	2016.8	0	0.034336	0.006073	0.012928	0.057736	0.0001	0.2442	0.000527	600.96	0.00025	0.000486	0.049476	0.015	0.00005	0.043632	70.48	0.7898	1.6712	0.001212	29.984	0.40336	0.00001	173.68	2.62E-05	0.002952	0.007628	0.0077

		Alkalinity	Cl	F	NO3	NO2	NH3	PO4	SO4	DOC	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	U	V	Zn
		mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t	mg/t
Ore Processing	P5	73485	1500	11167.89	2266.319	19.50684	606.3256	2758.065	32790	0	281.88	0.4725	6.255	32.61	1.5	33	0.15	25875	1.5	0.3	3	90	0.3	15	2125.65	2.2035	50.52	1.5	2867.85	12.078	0.15	12150	0.3	0.10725	12.48	30
Ore Processing	P50	86550	1545	13680.37	3021.759	26.00912	808.4341	2758.065	48150	0	484.5	1.23	9	42.15	1.5	39	0.15	30330	1.5	0.3	8.1	90	0.3	15	4110	3.135	68.55	1.5	5820	48.75	0.15	14280	0.3	0.222	29.7	30
Ore Processing	P95	92100	2766	14823.01	3777.199	32.5114	1010.543	2758.065	95655	0	578.85	2.3085	20.475	118.8	1.5	75.45	0.15	46005	1.5	0.3	25.755	90	0.3	15	5497.5	14.496	133.515	1.5	8092.5	61.485	0.15	18079.5	0.3	0.33525	53.22	30

Mount Polley Mine
Geochemical Characterization of Ore Stockpiles

Prepared for

Mount Polley Mining Corporation

Prepared by

SRK Consulting (Canada) Inc.
1CI008.005
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Geochemical Characterization of Ore Stockpiles

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Executive Summary

The Mount Polley Mining Corporation (MPMC) built four ore-grade rock stockpiles that are intended for processing to recover copper. *Mines Act* Permit M-200 contains a new condition to characterize the metal leaching and acid rock drainage (ML/ARD) potential of the stockpiles.

SRK Consulting (Canada) Inc. was retained by MPMC to develop a plan to characterize the geochemical stability of the ore stockpiles, including the following considerations:

- ARD potential using acid-base accounting data.
- Evaluation of element enrichment relative to other stockpiles.
- Evaluation of whether stockpile seepage chemistry can be expected to differ from existing drainage chemistry, using shake flask data as a proxy for stockpile seepage.

This report provides the results and interpretations from implementation of the ore stockpile geochemical characterization plan, which indicated that:

- The ore stockpiles have low ARD potential. It is not expected that acid conditions will develop in the stockpiles in the long term should they not be processed.
- Some differences between stockpiles were apparent (lower sulphide content of high oxide stockpile), but the bulk characteristics of the stockpiles are generally not significantly different from waste rock at the site with the exception of copper content which is elevated in the ore stockpiles.
- Contact water chemistry for the ore stockpiles is expected to be similar to waste rock with both being pH basic and chemistry controlled by secondary gypsum, primary calcite, iron oxides and copper oxides. Selenium may be more leachable from the ore stockpiles than waste rock though this depends on the mineralogical association of selenium.
- The presence of leachable selenium is a consideration for processing of the stockpiled ore. Operating conditions may result in a flush of selenium into process waters.

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Appendices

Appendix A – Field Notes

Appendix B – Analytical Results

List of Abbreviations

AP	acid potential
CRC	collision reaction cell
CVAFS	cold vapour atomic fluorescence spectroscopy
FAL	Freshwater Aquatic Life
HCT	humidity cell test
ICP-AES	inductively coupled plasma atomic emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
LCL	lower confidence limit
LOD	limit of detection
MPM	Mount Polley Mine
MPMC	Mount Polley Mining Corporation
ML/ARD	metal leaching and acid rock drainage
ND	not detected
NP	neutralization potential
NPR	neutralization potential ratio
RPD	relative percent difference
SFE	shake flask extraction
SI	saturation index
TIC	total inorganic carbon
UCL	upper confidence limit
QA/QC	quality assurance and quality control

1 Introduction

The Mount Polley Mining Corporation (MPMC) built four ore-grade rock stockpiles at the Mount Polley Mine (MPM), located approximately 55 km north-east of Likely, British Columbia, between 2006 and 2014. The ore stockpiles total about 8 million tonnes and the MPMC plans to process these stockpiles to recover copper. *Mines Act* Permit M-200 contains a new condition to characterize the metal leaching and acid rock drainage (ML/ARD) potential of the stockpiles.

SRK Consulting (Canada) Inc. was retained by MPMC to develop a plan to characterize the geochemical stability of the ore stockpiles. The outcomes of implementation of the plan were to consider:

- ARD potential using acid-base accounting data.
- Evaluation of element enrichment relative to other stockpiles.
- In the absence of specific seepage from the stockpile, interpretation of shake flask data to determine if seepage chemistry for the stockpiles can be expected to be different from other existing drainage chemistry on site.

This report provides the results and interpretations from implementation of the plan by MPMC personnel.

2 Background

2.1 Solids Geochemistry

The ore characterization plan provided a summary of the geological and geochemical characteristics expected in the ore stockpiles (SRK 2015). In summary, the main features of the Mount Polley deposit are:

- The deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008).
- The host rocks for porphyry mineralization are intrusions into the Nicola Volcanics varying in composition from diorite to syenite.
- Sulphide mineralization is predominantly chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5).
- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$); iron carbonates have not been reported.
- A significant portion of the copper at the MPM is not associated with sulphides (upwards of 50% in the upper portions of each pit).

The characteristics of the four ore stockpiles as provided by MPMC are summarized in Table 2-1. The relative locations of the stockpiles are shown in Figure 2-1. More than 50% of stockpiled ore is contained in the High-Oxide Stockpile which originated from the oxide cap of the Springer Zone. Stockpile #1 also originates from the Springer Zone but has lower copper grade dominated by copper sulphide (oxide ratio 18%). The other two stockpiles (#3 and Cariboo) originated from the Cariboo and Bell Zones. The maximum age of the stockpiled rock is 9 years.

SRK's current assessment of site data is that there is no correlation between copper grade and ARD potential. ARD potential at Mount Polley reflects the balance between sulphide as pyrite and calcite which is not correlated with the presence of copper sulphide. For this reason, the designation of rock as ore means that its ARD potential is not expected to be different from waste rock.



Figure 2-1: Location of Ore Stockpiles. The figure is approximately 1.7 km across (Source: MPMC)

Table 2-1: Description of Ore Stockpiles

Stockpile	Primary Source	Approximate Construction Time	Mass tonnes	Total Copper (%)	Oxide Copper (%)	Oxide Ratio
#1 Stockpile	Springer - Low Oxide	2008-2014	1,200,000	0.26	0.047	18%
#3 Stockpile	Cariboo/Bell	2006-2007	1,900,000	0.26	0.12	44%
High-Oxide Stockpile	Springer - Oxide Cap	2007-2009	4,100,000	0.35	0.26	76%
Cariboo Stockpile	Cariboo	2014	730,000	0.19	0.066	36%
Total			*8,000,000*	*0.30*	*0.18*	*56%*

Source: MPMC

Note: values rounded to two significant figures.

2.2 Aqueous Geochemistry – Seep Sampling

Results from seep sampling from across the site (not specifically ore stockpiles) at seven different locations between 2010 and 2014 were provided to SRK as part of this assessment. Table 2-2 is a statistical summary of results for parameters with guidelines for the protection of freshwater aquatic life in British Columbia (BC FAL guidelines) and also concentrations above detection limits in the seep samples and laboratory testing.

Table 2-2: Statistical Summary of Selected Parameters in Mount Polley Seep Samples.

Statistic	pH (field)	Alkalinity mg $CaCO_3$/L	Sulphate mg/L	Nitrate mg/L	As mg/L	Ba mg/L	Ca mg/L	Cu mg/L	Fe mg/L	Mo mg/L	Se mg/L
Minimum	6.9	21	110	0.05	<0.0005	0.024	55	0.00025	<0.03	0.0017	0.0017
5th Percentile	7.5	34	170	0.39	<0.0005	0.029	84	0.002	<0.03	0.0045	0.0045
25th Percentile	7.8	87	470	6.4	0.0003	0.048	170	0.006	<0.03	0.043	0.022
Median	8	100	630	9.3	0.00055	0.054	240	0.012	<0.03	0.076	0.038
Average	8	110	610	19	0.00076	0.063	230	0.02	<0.03	0.089	0.042
75th Percentile	8.1	130	790	32	0.0014	0.077	300	0.016	<0.03	0.12	0.05
95th Percentile	8.5	180	1000	55	0.0017	0.11	350	0.036	0.057	0.21	0.13
Maximum	8.8	220	1100	58	0.0029	0.13	360	0.52	0.33	0.26	0.16

Source: P:\01_SITES\Mt_Polley\1CI008.005_2015_ReStart_Source_Terms\!080_Deliverables\2015-08_Stockpile_SFE\[StockpileSFE_1CI008005_REV02.xlsx]

3 Methods

3.1 Sample Collection

Samples were collected from test pits in each of the ore stockpiles by MPMC personnel under direction by SRK. Six test pits per stockpile were spread evenly over the dump platform of each of the three smaller stockpiles (#1, #3 and Cariboo). Twelve test pits were sampled in the larger oxide stockpile. Thirty-three samples were collected using a backhoe to excavate to a depth of approximately two metres. Each sample was 5 kg.

During excavation, MPMC geologists documented distinctive features such as differences in rock types and degree of oxidation. Distinctive materials were segregated into piles by the test pit, photographed and logged for:

- Sulphide content.
- Copper oxide content as indicated by green and blue colours.
- Iron oxide content as indicated by red-brown colouration.
- Reaction of rock fines with 10% hydrochloric acid (degree of fizz) rated as none, moderate or strong.
- Any other mineral precipitates (such as gypsum).

Field observations are provided in Appendix A.

3.2 Laboratory Analysis

Samples were shipped by MPMC to ALS Environmental in Burnaby, BC.

Following drying, each sample was split into two parts. One part was sieved to yield the -2 mm fraction which is assumed to represent the more reactive component of the rock. This fraction was analysed as follows:

- Moisture content.
- Rinse pH and conductivity.
- Total sulphur and sulphur as sulphate (hydrochloric acid leach).
- Total carbonate and modified neutralization potential.
- Ultra-trace level 51 element scan by ICP-MS and ICP-AES following aqua regia digestion.

Based on review of the results obtained, a sub-set of samples were selected by SRK for shake flask extraction (SFE) tests as per the MEND (2009) method. Two samples per stockpile were selected on the basis of high selenium content and high electrical conductivity values within their stockpile. Samples with high selenium content were chosen in order to obtain conservative results for leachable components.

SFE leachates were analysed for:

- pH
- Conductivity
- Leachable anions and nutrients
  - Alkalinity
  - Nitrate
  - Sulphate
  - Chloride

  - Total phosphate
- Leachable Metals
  - 33 element scan by collision reaction cell (CRC) ICP-MS
  - Mercury by CVAFS

Laboratory reports are provided in Appendix B.

3.3 Interpretation Methods

3.3.1 ARD Potential

ARD potential was evaluated using the neutralization potential ratio (NPR) calculated from total inorganic carbon (TIC) as a proxy for reactive (calcium and magnesium) carbonate content, and acid potential (AP) calculated from sulphide content:

$$\text{NPR} = \frac{\text{TIC}}{\text{AP}}$$

Potentially ARD generating (PAG) rock is indicated by NPR≤2.

3.3.2 Element Enrichment

Element enrichment relative to other waste rock stockpiles (as indicated by previous analysis of drill cores) was evaluated by calculating confidence limits on mean concentrations for selected parameters and considering overlap in the resulting ranges. 95% confidence limits were calculated conventionally using standard error and a Student's t-statistic.

3.3.3 Interpretation of Shake Flask Leachate Chemistry

Concentrations in shake flask leachate chemistry must be corrected to address the high dilution factor (3 L/kg) relative to full-scale conditions. To interpret concentrations obtained by the method, it was assumed that natural moisture in the sample is in equilibrium with sample solids, and that the extraction test dilutes this contact water. Using this assumption, concentrations in the contact water ($[C]_{contact}$) can be calculated from the moisture content of the sample using the following equation:

$$[C]_{\text{contact}} = \frac{[C]_{\text{SFE}}\,(\text{mg of C/L of water}) \times V_{\text{SFE}}\,(\text{L of water})}{M_{\text{SFE}}\,(\text{kg of rock})} \times \frac{1000\ \text{g of water/L of water}}{u(\text{g of } H_2O/100\ \text{g of rock}) \times 10(100\ \text{g/ kg})}$$

$[C]_{SFE}$ is the concentration of an ion in the SFE leachate obtained by leaching M_{SFE} rock using V_{SFE} of water. The gravimetric water content is u expressed as a percentage.

The resulting up-scaled concentrations were evaluated using PHREEQC (Parkhurst and Appelo 1999) to determine mineral saturation indices (SIs). If the resulting SIs are near 0, it is likely the contact water is in equilibrium with the secondary minerals. If the SIs are well above 0, it is interpreted that the extraction test is leaching additional load from the solids during the procedure.

3.4 Quality Assurance and Quality Control

The QA/QC checks and their associated outcomes are outlined in Table 3-1. SRK's assessment was that the quality of the analytical data was acceptable, pending duplicate outcomes (described in Table 3-1).

Table 3-1: Summary of QA/QC Checks and Outcomes

Parameter	Criterion	Result
Sulphur balance	Total Sulphur ≥ Sulphate Sulphur, for samples >10X DL.	Passed
Neutralization potential consistent with fizz test	NP does not exceed maximum NP indicated by acid strength and acid volume indicated by fizz.	Passed
Neutralization potential consistent with carbonate content	NP correlated with carbonate and values near parity.	Passed
Field Duplicates	Relative percent difference (RPD) better than about ±30% for levels >10 times limit of detection (LOD).	In-progress.
Leachate Ion Balance	Imbalance not greater than ±10%.	Passed

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4 Results and Discussion

4.1 Test Pit Sampling

The majority of test pits showed homogeneous material and there was no segregation into distinctive material types. There were three exceptions that showed two distinct materials, and two samples were taken at the following locations:

- Cariboo SP-14
- #1 SP-21
- High Oxide SP-7

A duplicate was taken from the Cariboo, #1, and High Oxide stockpiles as part of quality assurance and quality control measures.

Overall, material properties were comparable between the piles. The main rock type as described by MPM geologists was monzodiorite with variations to monzonite. Sulphides were generally absent and only observed some of the time in minor amounts. Secondary minerals included malachite in minor to moderate amounts in all samples, with iron oxide distribution following a similar distribution. All samples showed moderate to strong HCl fizz test reaction. This was consistent with calcite observed in all but one sample.

4.2 Assessment of ARD Potential

4.2.1 Sulphur Form

Sulphate-sulphur concentrations were near or below the limit of detection for all samples, therefore; total sulphur was used to represent sulphide content in the stockpiles, which is consistent with the known mineralogy at the site.

Sulphur content ranged from a minimum of 0.01% to a maximum of 0.62%, with an overall average value of 0.15% (Table 4-1). The High Oxide Stockpile had the lowest average sulphur content (0.04%) which was statistically different from the #1 and #3 stockpiles (Table 4-1). These latter stockpiles had higher sulphur contents which were not statistically different from each other.

Table 4-1. 95% Confidence Limits on Means for Selected Parameters

Stockpile	Statistic	Total S %	As ppm	Cd ppm	Cu ppm	Se ppm
Stockpiles						
Cariboo	LCL	0.05	17	0.14	1600	2.4
n=7	UCL	0.22	23	0.27	3500	3.7
#1	LCL	0.18	12	0.12	2600	3.9
n=7	UCL	0.33	18	0.35	4600	7.1
High-Oxide	LCL	0.02	11	0.22	2200	1.4
n=13	UCL	0.06	18	0.37	4000	2.8
#3	LCL	0.07	14	0.18	2500	2.8
n=6	UCL	0.46	19	0.40	3900	6
Zone Samples						
Springer	LCL	0.24	11	0.27	390	1.2
n=30	UCL	0.78	17	0.49	590	2.8
Bell	LCL	ND	20	0.057	1700	ND
n=2963	UCL	ND	27	0.072	1800	ND
NE	LCL	0.49	11	0	460	ND
n=20	UCL	1.3	17	0.33	940	ND
SE	LCL	0.89	12	0.049	170	0.99
n=48	UCL	1.2	14	0.1	240	1.6
Pond	LCL	0.3	14	0	390	1.5
n=27	UCL	1.2	21	3	810	2.6

Source: P:\01_SITES\Mt_Polley\1CI008.005_2015_ReStart_Source_Terms\!080_Deliverables\2015-08_Stockpile_SFE\[StockpileStatics_1CI008005_REV03_SJD.xlsx]

ND – No data; LCL – Lower confidence limit; UCL – Upper confidence limit

4.2.2 Carbonate Content and Neutralization Potential

Carbonate and neutralization potential (NP) results are summarized in Table 4-2.

Total inorganic carbon (TIC) ranged from a minimum of 4.2 to a maximum of 93 kg $CaCO_3$/t, with an average value of 29 kg $CaCO_3$/t. The High Oxide Stockpile had the lowest average TIC

(21 kg $CaCO_3$/t), whereas as the #1 Stockpile had the highest average TIC (43 kg $CaCO_3$/t). TIC averaged 31 kg $CaCO_3$/t for the Cariboo Stockpile and 29 kg $CaCO_3$/t for the #3 Stockpile.

Modified NP determined by titration was always greater than TIC as shown in Figure 4-1. The higher modified NP compared to TIC is attributed to weakly reactive silicates that would consume acid during testing, but may not provide neutralization capacity under field conditions. TIC was used for buffering potential in this assessment because it is a proxy for acid neutralizing carbonate minerals. Iron carbonates, which do not consume acid, have not been documented at the MPM.

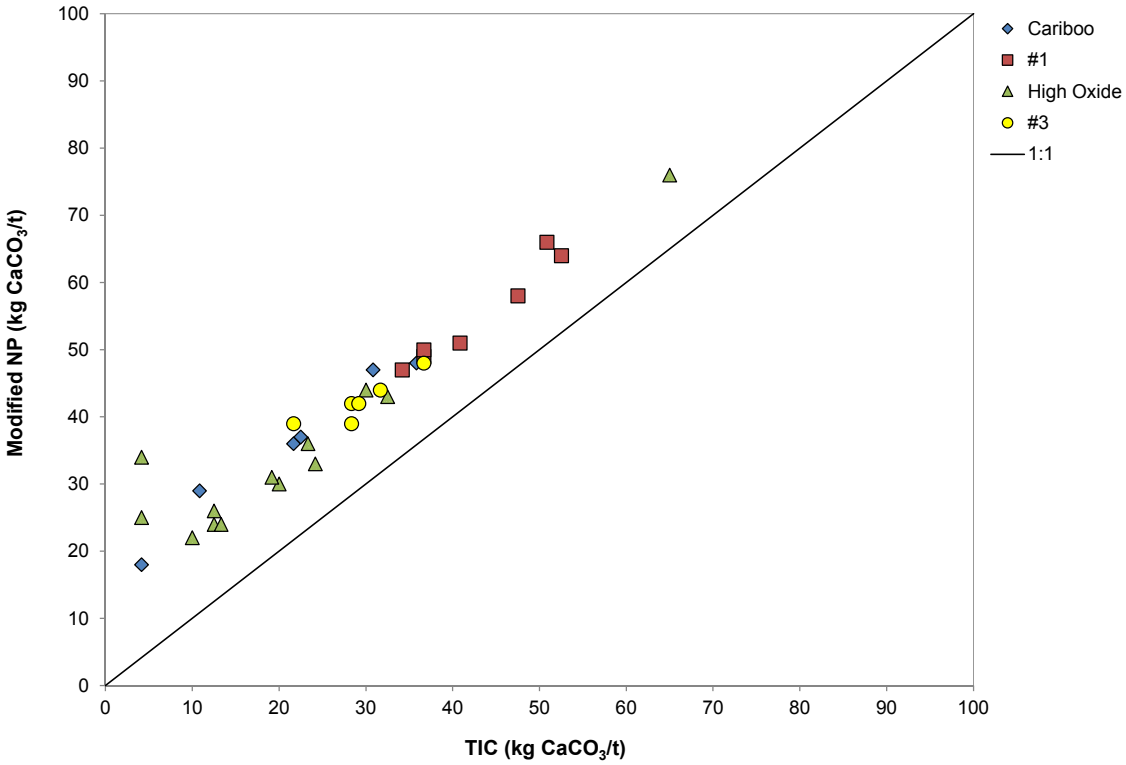

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Figure 4-1: Comparison of Modified NP and Total Inorganic Carbon

4.2.3 Acid Rock Drainage Potential

Paste pH values (Table 4-2) for all samples taken were basic, indicating that net acidity had not developed in any of the samples at the time of sampling. This is also consistent with the presence of abundant calcite and malachite observed during test pit sampling.

Based on NPR calculated as described in Section 3.3.1, all but one sample (#3 Stockpile-27, with NPR = 1.4) were determined to be non-PAG.

Based on the samples collected in this assessment, the ARD potential for the ore stockpiles is low.

Table 4-2: Summary of Acid-Base Accounting and Trace Element Results

Stockpile	Statistic	Paste pH	Total Sulphur	AP	Modified NP	TIC	TIC/AP	As	Cd	Cr	Cu	Fe	Hg	Mn	Mo	Ni	Pb	Se	U	V	Zn
			%	kgCaCO3/t				mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Cariboo (n=7)	Average	8.4	0.13	4.2	45	31	7.5	20	0.2	12	2600	5.2	0.11	660	9.9	11	5	3	0.77	210	53
#1 (n=7)	Average	8.4	0.25	7.9	55	43	5.4	15	0.23	15	3600	6	0.13	670	13	22	6.6	5.5	1.2	190	52
High Oxide (n=13)	Average	8.4	0.042	1.3	34	21	16	15	0.3	23	3100	5.6	0.11	830	5.8	40	9.1	2.1	0.97	180	70
#3 (n=6)	Average	8.4	0.26	8.2	42	29	3.6	16	0.29	13	3200	6.4	0.14	750	12	16	12	4.4	1.4	190	63
All Stockpiles (n=33)	Minimum	8.1	0.01	0.31	18	4.2	1.5	1.5	0.09	5	130	3.6	0.01	460	0.42	5	2.9	0.7	0.18	120	31
	P25	8.3	0.04	1.3	31	19	5.5	14	0.18	9	2300	5.2	0.1	640	3.5	9.4	4.9	1.9	0.82	170	48
	Median	8.4	0.12	3.8	42	28	6.9	16	0.23	14	3100	5.6	0.12	740	7.5	12	6.9	3.6	1.1	180	60
	P75	8.4	0.2	6.3	48	37	13	19	0.3	22	3800	6.4	0.14	840	11	24	9.9	3.8	1.3	200	69
	Maximum	8.7	0.62	19	100	93	52	25	0.54	62	6600	8.5	0.2	1200	30	190	19	8.1	1.6	450	120
	Average	8.4	0.15	4.6	43	29	6.4	16	0.26	17	3100	5.7	0.12	750	9.2	26	8.1	3.4	1	190	61

Source: P:\01_SITES\Mt_Polley\1CI008.005_2015_ReStart_Source_Terms\!080_Deliverables\2015-08_Stockpile_SFE\[StockpileSFE_1CI008005_REV02.xlsx]

4.3 Element Enrichment

Confidence limits on mean concentrations for selected elements are shown in Table 4-1 by stockpile and compared to other zones. For the stockpiles, a statistically significant difference is apparent for #1 which has distinctively higher selenium concentrations. The lower confidence limit is 3.9 mg/kg compared to the highest upper confidence limit of 3.7 mg/kg for the Cariboo stockpile.

Compared to other zones waste rock samples, copper concentrations are clearly enriched, which is consistent with the classification of the stockpiles as ore. Other than for copper, the Southeast Zone and Pond Zone had lower average selenium concentrations than the #1 and #3 stockpiles. There is some indication of subtle differences for arsenic, such as the lower arsenic concentrations for the Southeast Zone compared to the Cariboo stockpile. However, there is a lack of strong (e.g. order-of-magnitude) differences for any of the parameters. Variability in element content is not expected to generally influence drainage chemistry.

4.4 Contact Water Chemistry

4.4.1 Shake Flask Results

Shake flask extraction (SFE) test results for parameters with BC FAL guidelines and above analytical detection limits are shown in Table 4-3.

The SFE leachates had pHs near 9 for most samples, which is higher than is typical of carbonate-buffered waters in equilibrium with the atmosphere (closer to pH 8.6). The elevated pHs may reflect abrasion of silicate minerals during sample processing (drying and sieving) and shaking in the extraction procedure. Hydrolysis of abraded silicate surfaces yields hydroxyl ions (OH^-) that result in higher pHs. The higher pHs are potentially important for interpreting leaching of oxyanions such as selenium and arsenic.

Leachate chemistry was dominated by sulphate, alkalinity and calcium, with lesser amounts of sodium, silicon, potassium and magnesium. Sulphate was significantly correlated with bulk rock sulphur content at the 99% confidence level (r = 0.87) implying that it is derived from oxidation of pyrite rather than a primary sulphate mineral.

4.4.2 Interpretation

Upscaled Concentrations

Results of applying the SFE upscaling methodology described in Section 3.3.3 yielded the results shown in Table 4-4.

Raw SFE sulphate concentrations were in the tens of mg/L (Table 4-3) which, based on concentration factors of about 100, became scaled up concentrations in the thousands of mg/L. PHREEQC indicated that these concentrations were generally consistent with moisture being in equilibrium with gypsum (calcium sulphate dehydrate) because saturation indices were close to 0. Barite (barium sulphate) saturation indices in contrast were well above 0, implying that raw

barium concentrations in the SFE leachates resulted from equilibration of weakly soluble barite with the SFE leachates, and therefore that barium concentrations in the contact water are not at the levels indicated by the calculation.

Following similar interpretation approaches, alkalinity and calcium concentrations in the raw SFE leachates reflect dissolution of calcite during the procedure because up-scaled concentrations yielded saturation indices well above 0. Scaled up copper concentrations appear to realistically reflect rock moisture equilibration with copper carbonate (malachite) and oxide (tenorite) as shown by saturation indices near 0.

Scaled up concentrations for three elements occurred as oxyanions (As, Mo, Se) are shown. Molybdenum concentrations were assessed using saturation indices for calcium molybdate. Since saturation indices were typically between 0 and 1, upscaled molybdenum concentrations may realistically reflect molybdenum concentrations in pore waters. In addition, since upscaled calcium concentrations are probably in reality controlled by calcite, $CaMoO_4$ saturation indices would decrease.

Arsenic and selenium concentrations are not readily assessed with respect to known secondary minerals in this geological setting because they occur as trace elements. Mobile arsenic probably occurs as a trace component of secondary iron oxides or adsorbed to the secondary oxides; however, iron oxides have low solubility at these pHs as shown by undetected iron concentrations in the shake flask leachates (<0.03 mg/L). Saturation indices for iron oxides are not shown in Table 4-4 but are well above 0. Scaled up arsenic concentrations therefore do not realistically represent concentrations in contact water and pore water arsenic concentrations are not expected to exceed those shown in the raw SFE leachates (Table 4-3).

Scaled up selenium concentrations approached 3 mg/L. Selenium may occur as a trace component of secondary sulphate (gypsum, barite) or in association with iron oxide (either adsorbed or co-precipitated). If associated with gypsum, the up-scaled selenium concentrations reflect concentrations in the contact water because the water chemistry appears to be controlled by gypsum dissolution. If barite is the host, the low solubility of barite would limit Se concentrations to those observed in the raw SFE leachates (approximately two orders of magnitude below those indicated by scale-up).

If selenium is being leached by de-sorption, concentrations may be controlled by several factors (pH, kinetics of de-sorption, distribution coefficients for the solutions). Due to the elevated pH, selenium leaching may be unrealistically accelerated compared to natural conditions resulting in elevated raw and upscaled concentrations.

Comparison with Observed Seepage Chemistry

Raw (Table 4-3) and upscaled pore water (Table 4-4) concentrations for selected parameters were compared to observed seep chemistry (Table 2-2). For the latter, concentrations at the 95th percentile and higher probably reflect the least dilution and are therefore the relevant comparison point for the SFE data.

Table 4-3: Summary of SFE Leachate Concentrations

Sample ID	pH	SO_4 mg/L	Alkalinity $mgCaCO_3/L$	As mg/L	Ba mg/L	Ca mg/L	Cu mg/L	Fe mg/L	Mo mg/L	Se mg/L
CARIBOO SP-15 (1)	9	12	27	0.007	0.011	8.2	0.0013	<0.03	0.023	0.021
CARIBOO SP-16 (1)	8.9	18	29	0.0065	0.016	11	<0.001	<0.03	0.04	0.007
#1 SP-20(1)	8.9	17	27	0.0034	0.011	9.7	0.0026	<0.03	0.017	0.016
#1 SP-24(1)	8.9	26	23	0.0028	0.021	11	<0.001	<0.03	0.045	0.016
HIGH OXIDE SP-12 (1)	8.7	15	31	0.003	0.042	13	0.0089	<0.03	0.022	0.0024
HIGH OXIDE SP-3 (1)	9	10	29	0.0028	0.012	9.3	0.008	<0.03	0.017	0.018
#3 SP-29 (1)	9	13	29	0.003	0.011	9.6	0.0028	<0.03	0.023	0.016
#3 SP-27 (1)	8.8	35	29	0.0017	0.034	17	0.004	<0.03	0.043	0.02

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Table 4-4. Results of Upscaling Shake Flask Extraction Results

		Up-Scaled Concentrations									Saturation Indices					
Sample ID	pH	SO_4 mg/L	Alkalinity $mgCaCO_3/L$	As mg/L	Ba mg/L	Ca mg/L	Cu mg/L	Fe mg/L	Mo mg/L	Se mg/L	Calcite	Malachite	Tenorite	Barite	Gypsum	$CaMoO_4$
CARIBOO SP-15 (1)	9.0	1500	3400	0.89	1.4	1000	0.16	<3.8	2.8	2.6	3.2	-0.9	-0.4	2.1	-0.1	0.7
CARIBOO SP-16 (1)	8.9	3100	4900	1.1	2.7	1900	<0.17	<5.1	6.9	1.2	3.5	-1.0	-0.6	2.5	0.2	1.1
#1 SP-20(1)	8.9	2100	3500	0.43	1.4	1200	0.33	<3.8	2.2	2.1	3.2	-0.3	-0.1	2.2	0.0	0.6
#1 SP-24(1)	8.9	3500	3100	0.37	2.8	1400	<0.13	<4.0	6	2.1	3.2	-1.0	-0.4	2.7	0.3	1.0
HIGH OXIDE SP-12 (1)	8.7	940	1900	0.18	2.6	780	0.54	<1.8	1.4	0.15	2.8	0.9	0.5	2.3	-0.3	0.4
HIGH OXIDE SP-3 (1)	9.0	1400	4000	0.38	1.7	1300	1.1	<4.1	2.3	2.5	3.4	0.6	0.4	2.1	-0.1	0.6
#3 SP-29 (1)	9.0	1100	2300	0.24	0.86	760	0.22	<2.4	1.8	1.3	3.0	-0.1	0.1	1.8	-0.3	0.5
#3 SP-27 (1)	8.8	4000	3300	0.19	3.9	1900	0.45	<3.4	4.9	2.3	3.2	-0.1	0.0	2.8	0.4	0.0

Source: P:\01_SITES\Mt_Polley\1CI008.005_2015_ReStart_Source_Terms\!080_Deliverables\2015-08_Stockpile_SFE\[StockpileStatics_1CI008005_REV03_SJD.xlsx]

Observed sulphate concentrations in seeps are comparable to up-scaled concentrations. Highest seep concentrations were above 1000 mg/L which approaches gypsum saturation though some dilution is indicated. Likewise, pH and alkalinity concentrations are consistent with control by calcite dissolution. Iron has been generally undetected (<0.03 mg/L) in seeps with 95th percentile concentrations at 0.06 mg/L. These concentrations are consistent with the low solubility of iron oxides at basic pHs.

95th percentile copper concentrations in seeps are 0.04 mg/L ranging up to 0.5 mg/L as a maximum concentration compared to 0.1 to 1 mg/L for upscaled concentrations. Considering that seeps reflect some dilution (as indicated by sulphate concentrations), the upscaled concentrations are comparable to the seeps.

Higher arsenic concentrations in seeps show a narrow range from 0.001 to 0.003 mg/L which are comparable to the raw concentrations from SFE (0.002 to 0.007 mg/L) indicating control by the low solubility of secondary iron oxides as described above.

Higher molybdenum concentrations likewise show a narrow range from 0.1 to 0.3 mg/L. This concentration range is between that of the raw SFE leachates (0.02 to 0.05 mg/L) and upscaled concentrations (1 to 7 mg/L). Molybdenum concentrations in the stockpile rock averaged 9 mg/kg and are therefore probably associated with iron oxides rather than discrete mineral phases. Leaching of molybdenum may therefore be controlled by iron solubility rather than solubility of calcium molybdate.

Likewise, seep selenium concentrations of about 0.1 to 0.2 mg/L are between the range indicated for the raw SFE leachates (0.002 to 0.02 mg/L) and the upscaled concentration range of 0.2 to 3 mg/L. At these pHs, and oxidizing conditions, selenium is expected to be mobile as the selenate ion (SeO_4^{2-}) resulting in the conclusion that the ore stockpiles may leach selenium at higher concentrations than waste rock. The presence of leachable selenium is also a consideration for the influence of processing oxide ore on process water chemistry.

5 Conclusions

The following are concluded:

- The ore stockpiles have low ARD potential. It is not expected that acid conditions will develop in the stockpiles in the long term should they not be processed.
- Some differences between stockpiles were apparent (lower sulphide content of high oxide stockpile) but the bulk characteristics of the stockpiles are generally not significantly different from waste rock at the site with the exception of copper content which is elevated in the ore stockpiles.
- Contact water chemistry for the ore stockpiles is expected to be similar to waste rock with both being pH basic and chemistry controlled by secondary gypsum, primary calcite, iron oxides and copper oxides. Selenium may be more leachable from the ore stockpiles than waste rock though this depends on the mineralogical association of selenium.
- The presence of leachable selenium is a consideration for processing of the stockpiled ore. Operating conditions may result in a flush of selenium into process waters.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

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Appendix A – Field Notes

Stockpile	Test Pit(Sample) ID	Depth (m)	Material (Rock) Type	No. of Material Types	Sulphides	Copper Oxides	Iron Oxides	Fizz Reaction	Other Observations
Cariboo	Cariboo SP-17 (1)	2.2	Monzodiorite to diorite	1	None observed	Malachite (low)	Low	Strong	Calcite, low degree of oxidation
	Cariboo SP-14 (1)	2.4	Monzonite	2	None observed	Malachite	Present	Moderate	Calcite, moderate to strong oxidation (red/pink/brown)
	Cariboo SP-14 (2)	2.4	Monzodiorite to diorite		None observed	Malachite	Present	Moderate	Calcite, low oxidation (grey)
	Cariboo SP-13 (1)	2.6	Monzodiorite	1	Pyrite (low)	Malachite	Present	Moderate	Calcite, low oxidation
	Cariboo SP-15 (1)	2.7	Monzodiorite	1	Pyrite (low)	Malachite	Low	Moderate	Calcite, low oxidation (grey/pink)
	Cariboo SP-16 (1)	2.6	Diorite to monzonite	1	None observed	Low	Present	Strong	Calcite, low oxidation (grey)
	Cariboo SP-18 (1)	2.5	Monzonite to monzodiorite	1	Pyrite	Malachite	None observed	Strong	Calcite, moderate oxidation (pink with grey (dioritic) brecciation)
#1	#1 SP-21 (1)	3	Monzonite	2	Pyrite to chalcopyrite (low)	Malachite	Present	Strong	Calcite, low oxidation, dendritic manganese present
	#1 SP-21 (2)	3	Monzodiorite to diorite			Malachite	Present	Strong	Calcite, low oxidation
	#1 SP-20 (1)	3.2	Monzodiorite	1	Pyrite to chalcopyrite (low)	Malachite	Present	Strong	Calcite, low oxidation, homogenous-brecciated monzodiorite
	#1 SP-22 (1)	2.7	Monzodiorite	1	None observed	Malachite	Present	Strong	Calcite, low oxidation (grey)
	#1 SP-23 (1)	2.4	Monzodiorite	1	Pyrite to chalcopyrite	Malachite	Present	Strong	Calcite, low oxidation (grey)
	#1 SP-24 (1)	3.3	Monzodiorite	1	Pyrite (low)	Malachite (low)	Present (moderate)	Strong	Calcite, low oxidation, dendritic manganese present
	#1 SP-19 (1)	3	Monzodiorite	1	Pyrite (low)	Malachite	Present (moderate)	Moderate	Calcite, low to moderate oxidation, dendritic manganese present
High Oxide	High Oxide SP-9 (1)	2.8	Monzonite to monzodiorite	1	Pyrite (low)	Malachite (high)	Present (moderate)	Moderate	Calcite, moderate oxidation
	High Oxide SP-8 (1)	3.1	Monzonite to monzodiorite	1	Pyrite to chalcopyrite (low)	Malachite (high)	Present (moderate)	Moderate	Calcite, low oxidation
	High Oxide SP-7 (1)	2.6	Dioritic (dark, crumbly, grt, albite, zeolites)	2	None observed	None observed	Present (high)	None	No mineral precipitates observed, moderate oxidation
	High Oxide SP-7 (2)	2.6	Monzodiorite		None observed	Malachite (moderate)	Present (moderate)	None	Calcite, moderate oxidation
	High Oxide SP-5 (1)	3.2	Monzodiorite	1	None observed	Malachite	Present (high)	Strong	Calcite, strong oxidation (brown), similar to SP-6
	High Oxide SP-6 (1)	3	Monzodiorite	1	None observed	Malachite	Present (high)	Moderate	Calcite, strong oxidation (brown)
	High Oxide SP-12 (1)	2.9	Monzonite to monzodiorite	1	None observed	Malachite (moderate)	Present (moderate)	Moderate	Calcite, moderate to strong oxidation (light brown)
	High Oxide SP-11 (1)	2.9	Monzonite to monzodiorite	1	None observed	Malachite (low to moderate)	Present (moderate)	Moderate	Calcite, moderate oxidation (brown)
	High Oxide SP-10 (1)	2.7	Monzonite to monzodiorite	1	Pyrite (low)	Malachite (moderate to high)	Present (moderate to high)	Moderate	Calcite, moderate to strong oxidation, high manganese alteration
	High Oxide SP-4 (1)	2.7	Brecciated monzonite to monzodiorite	1	None observed	Malachite (high)	Present	Moderate	Calcite, strong oxidation (red/brown), high manganese alteration
	High Oxide SP-3 (1)	2.5	Monzodiorite	1	Pyrite to chalcopyrite	Malachite (low to moderate)	Present	Moderate	Calcite, moderate to high oxidation
	High Oxide SP-1 (1)	2.6	Monzodiorite to diorite	1	Pyrite to chalcopyrite (low)	Malachite (moderate)	Present (moderate)	Strong	Calcite, moderate oxidation
	High Oxide SP-2 (1)	2.7	Monzodiorite	1	Pyrite (low)	Malachite (moderate)	Present (moderate)	Strong	Calcite, moderate oxidation, manganese alteration
#3	#3 SP-26 (1)	2.2	Monzodiorite	1	Pyrite to chalcopyrite (low)	Malachite (low)	Low	Moderate	Calcite, low oxidation
	#3 SP-25 (1)	2.2	Monzodiorite	1	Pyrite to chalcopyrite (low)	Malachite (low)	Low	Moderate	Calcite, low to moderate oxidation
	#3 SP-29 (1)	2.5	Monzodiorite	1	Pyrite to chalcopyrite (moderate)	Malachite (low)	Low	Moderate	Calcite, low oxidation (grey, light brown)
	#3 SP-28 (1)	2.6	Monzodiorite	1	Pyrite to chalcopyrite (moderate), bornite (low)	Malachite (low)	Low	Moderate	Calcite, low to moderate oxidation
	#3 SP-27 (1)	2.2	Monzodiorite to diorite	1	Pyrite to chalcopyrite (moderate)	Malachite (low)	Low to moderate	Moderate	Calcite, low to moderate oxidation
	#3 SP-30 (1)	2.6	Monzodiorite	1	Pyrite to chalcopyrite (low)	Malachite (low)	Low to moderate	Moderate	Calcite, low to moderate oxidation (grey, light brown)

Appendix B – Analytical Results

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22-JUL-2015
Account: NOU

CERTIFICATE VA15101982

Project: One Stockpile Project 2015

This report is for 33 Sediment samples submitted to our lab in Vancouver, BC, Canada on 7-JUL-2015.

The following have access to data associated with this certificate:

MCLEAN DONOHOE	COLLEEN HUGHES	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-22	Sample login - Rcd w/o BarCode
OA-GRA10b	Moisture - Bulk Samples
PUL-QC	Pulverizing QC Test
PUL-31	Pulverize split to 85% <75 um
SCR-51	Screening
SPL-21	Split sample - riffle splitter

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
S-GRA06a	Sulfate Sulfur (HCl leachable)	WST-SEQ
S-CAL06	Sulfide Sulfur (calculated)	LECO
C-GAS05	Inorganic Carbon (CO2)	
OA-ELE04	Specific Conductivity 1:10	
ME-MS41	51 anal. aqua regia ICPMS	
OA-VOL08mn	NP MEND 1991	
S-IR08	Total Sulphur (Leco)	LECO
OA-ELE07	Paste pH	
S-GRA06	Sulfate Sulfur-carbonate leach	WST-SEQ

To: **MOUNT POLLEY MINING CORPORATION**
ATTN: MCLEAN DONOHOE
PO BOX 12
LIKELY BC V0L 1N0

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:
Colin Ramshaw, Vancouver Laboratory Manager

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22- JUL- 2015
Account: NOU

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

Sample Description	Method Analyte Units LOR	WEI- 21 Recvd Wt. kg 0.02	SCR- 51 WT.+2mm g 0.1	SCR- 51 WT.- 2mm g 0.1	OA- VOL08m MPA tCaCO3/1Kt 0.3	OA- VOL08m FIZZ RAT Unity 1	OA- VOL08m NNP tCaCO3/1Kt 1	OA- VOL08m NP tCaCO3/1Kt 1	OA- ELE07 pH Unity 0.1	OA- VOL08m Ratio (N Unity 0.01	S- IR08 S % 0.01	S- GRA06 S % 0.01	S- GRA06a S % 0.01	S- CAL06 S % 0.01	C- GAS05 C % 0.05	C- GAS05 CO2 % 0.2
Cariboo SP- 17 (1)		11.84	5320	278.7	2.5	2	35	37	8.4	14.80	0.08	<0.01	<0.01	0.08	0.27	1.0
Cariboo SP- 14 (1)		10.68	4820	276.0	0.6	1	17	18	8.4	28.80	0.02	0.01	<0.01	0.01	0.05	0.2
Cariboo SP- 14 (2)		11.48	5180	256.1	3.4	2	26	29	8.4	8.44	0.11	<0.01	<0.01	0.11	0.13	0.5
Cariboo SP- 13 (1)		10.54	4720	167.8	3.8	2	32	36	8.3	9.60	0.12	<0.01	<0.01	0.12	0.26	1.0
Cariboo SP- 15 (1)		12.18	4800	288.8	3.8	2	44	48	8.4	12.80	0.12	<0.01	<0.01	0.12	0.43	1.6
Cariboo SP- 16 (1)		11.02	4960	186.1	9.7	2	91	101	8.1	10.43	0.31	<0.01	0.02	0.31	1.12	4.1
Cariboo SP- 18 (1)		10.22	4660	171.7	5.6	2	41	47	8.6	8.36	0.18	<0.01	0.01	0.18	0.37	1.3
#1 SP- 21 (1)		10.22	4860	247.1	5.3	2	44	49	8.7	9.22	0.17	<0.01	0.01	0.17	0.44	1.6
#1 SP- 21 (2)		11.44	5400	191.1	5.6	2	44	50	8.6	8.89	0.18	<0.01	0.01	0.18	0.44	1.6
#1 SP- 20 (1)		9.60	4420	167.1	11.3	2	47	58	8.2	5.16	0.36	<0.01	0.01	0.36	0.57	2.1
#1 SP- 22 (1)		10.68	4620	261.9	7.5	2	57	64	8.4	8.53	0.24	<0.01	0.01	0.24	0.63	2.3
#1 SP- 23 (1)		9.34	4080	166.2	10.0	2	56	66	8.3	6.60	0.32	<0.01	<0.01	0.32	0.61	2.2
#1 SP- 24 (1)		10.14	4560	299.8	10.0	2	41	51	8.2	5.10	0.32	<0.01	<0.01	0.32	0.49	1.8
#1 SP- 19 (1)		9.98	4780	205.7	5.6	2	41	47	8.4	8.36	0.18	<0.01	0.02	0.18	0.41	1.5
High Oxide SP- 9 (1)		10.38	4500	435.9	1.6	2	24	26	8.3	16.64	0.05	<0.01	0.01	0.05	0.15	0.6
High Oxide SP- 8 (1)		10.82	5020	275.8	0.6	2	23	24	8.5	38.40	0.02	<0.01	0.01	0.02	0.15	0.5
High Oxide SP- 7 (1)		8.38	3400	450.6	0.3	1	34	34	8.5	108.80	0.01	0.01	<0.01	<0.01	<0.05	<0.2
High Oxide SP- 7 (2)		10.48	4520	429.9	0.6	1	24	25	8.5	40.00	0.02	<0.01	0.02	0.02	<0.05	<0.2
High Oxide SP- 5 (1)		11.06	4900	233.8	1.6	2	28	30	8.4	19.20	0.05	<0.01	0.02	0.05	0.24	0.9
High Oxide SP- 6 (1)		10.40	4620	212.0	1.3	2	32	33	8.3	26.40	0.04	<0.01	0.01	0.04	0.29	1.1
High Oxide SP- 12 (1)		10.72	4840	211.7	2.8	2	28	31	8.4	11.02	0.09	<0.01	0.01	0.09	0.23	0.8
High Oxide SP- 11 (1)		8.94	4220	139.6	0.6	2	21	22	8.4	35.20	0.02	<0.01	0.01	0.02	0.12	0.4
High Oxide SP- 10 (1)		10.20	4700	133.6	0.6	2	43	44	8.5	70.40	0.02	<0.01	<0.01	0.02	0.36	1.3
High Oxide SP- 4 (1)		9.44	4280	128.0	0.6	2	23	24	8.3	38.40	0.02	<0.01	0.01	0.02	0.16	0.6
High Oxide SP- 3 (1)		7.28	3380	135.5	4.1	2	39	43	8.2	10.58	0.13	<0.01	<0.01	0.13	0.39	1.4
High Oxide SP- 1 (1)		10.86	5000	241.9	1.3	2	75	76	8.4	60.80	0.04	<0.01	0.01	0.04	0.78	2.9
High Oxide SP- 2 (1)		10.72	4740	210.9	1.3	2	35	36	8.4	28.80	0.04	<0.01	0.04	0.04	0.28	1.0
#3 SP- 26 (1)		9.12	3880	319.7	6.3	2	33	39	8.3	6.24	0.20	<0.01	0.02	0.20	0.34	1.2
#3 SP- 25 (1)		10.70	4600	484.8	3.1	2	41	44	8.5	14.08	0.10	<0.01	0.02	0.10	0.38	1.4
#3 SP- 29 (1)		10.12	4480	223.2	7.2	2	41	48	8.3	6.68	0.23	<0.01	0.01	0.23	0.44	1.6
#3 SP- 28 (1)		10.70	4840	252.1	5.0	2	37	42	8.3	8.40	0.16	<0.01	0.01	0.16	0.34	1.2
#3 SP- 27 (1)		10.12	4400	184.5	19.4	2	23	42	8.3	2.17	0.62	<0.01	0.02	0.62	0.35	1.3
#3 SP- 30 (1)		9.98	4440	351.2	8.4	2	31	39	8.4	4.62	0.27	<0.01	0.02	0.27	0.26	1.0

***** See Appendix Page for comments regarding this certificate *****

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22- JUL- 2015
Account: NOU

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

Sample Description	Method Analyte Units LOR	OA- ELE04 Conducti uS/cm 1	ME- MS41 Ag ppm 0.01	ME- MS41 Al % 0.01	ME- MS41 As ppm 0.1	ME- MS41 Au ppm 0.2	ME- MS41 B ppm 10	ME- MS41 Ba ppm 10	ME- MS41 Be ppm 0.05	ME- MS41 Bi ppm 0.01	ME- MS41 Ca % 0.01	ME- MS41 Cd ppm 0.01	ME- MS41 Ce ppm 0.02	ME- MS41 Co ppm 0.1	ME- MS41 Cr ppm 1	ME- MS41 Cs ppm 0.05
Cariboo SP- 17 (1)		144	0.86	2.30	22.2	2.9	<10	220	0.80	0.06	2.69	0.14	18.25	21.7	13	0.88
Cariboo SP- 14 (1)		94	0.36	1.82	16.3	0.5	<10	300	1.12	0.07	1.47	0.29	17.45	22.2	16	1.27
Cariboo SP- 14 (2)		133	0.29	3.28	19.4	<0.2	<10	280	1.14	0.10	2.54	0.12	13.75	18.1	8	2.78
Cariboo SP- 13 (1)		156	0.47	2.27	20.3	0.2	<10	320	0.98	0.14	2.67	0.25	19.80	21.9	14	1.23
Cariboo SP- 15 (1)		149	0.54	2.08	24.5	0.3	<10	260	0.90	0.11	3.03	0.28	21.8	19.0	12	0.84
Cariboo SP- 16 (1)		275	0.33	2.13	16.3	0.2	<10	240	0.91	0.09	4.77	0.14	20.0	20.9	14	0.98
Cariboo SP- 18 (1)		150	0.30	1.89	21.4	0.3	10	350	1.25	0.06	2.56	0.19	25.4	20.7	9	0.83
#1 SP- 21 (1)		130	0.53	2.67	10.8	0.2	<10	360	0.65	0.06	4.05	0.15	14.20	22.2	7	1.24
#1 SP- 21 (2)		130	0.52	2.77	11.3	0.2	<10	360	0.70	0.07	4.10	0.15	16.10	23.2	9	1.33
#1 SP- 20 (1)		215	1.36	2.38	20.5	0.3	<10	250	0.98	0.16	3.59	0.29	19.95	26.2	15	1.40
#1 SP- 22 (1)		150	0.80	2.40	16.2	0.4	<10	340	0.99	0.09	4.50	0.29	19.70	20.6	12	1.97
#1 SP- 23 (1)		203	0.90	2.20	14.6	0.4	<10	270	0.98	0.18	3.38	0.45	23.0	23.1	24	1.21
#1 SP- 24 (1)		273	0.45	2.07	16.2	0.2	<10	300	0.90	0.14	3.46	0.09	20.5	22.8	15	0.89
#1 SP- 19 (1)		132	0.92	2.24	13.2	0.8	<10	380	0.83	0.14	3.04	0.21	18.00	24.3	22	1.22
High Oxide SP- 9 (1)		102	0.72	2.66	19.0	0.9	<10	680	1.12	0.11	1.93	0.20	20.5	34.9	28	2.63
High Oxide SP- 8 (1)		93	0.41	2.54	14.0	0.2	<10	460	0.85	0.08	2.62	0.16	16.35	25.4	11	1.78
High Oxide SP- 7 (1)		80	0.06	3.01	1.5	<0.2	<10	3320	2.11	0.03	2.02	0.12	167.5	32.8	62	1.30
High Oxide SP- 7 (2)		77	0.17	2.69	5.6	0.2	<10	2130	1.92	0.05	1.81	0.20	112.0	29.3	39	2.44
High Oxide SP- 5 (1)		95	0.96	2.42	22.5	0.3	<10	230	1.17	0.14	2.72	0.22	20.7	24.2	6	2.32
High Oxide SP- 6 (1)		105	0.87	2.67	18.6	<0.2	<10	120	1.08	0.15	3.02	0.44	23.0	24.6	5	2.48
High Oxide SP- 12 (1)		115	0.56	2.15	17.2	<0.2	<10	390	0.79	0.10	2.65	0.35	20.0	20.3	23	2.22
High Oxide SP- 11 (1)		89	0.72	2.06	15.2	0.4	<10	520	0.87	0.10	2.76	0.30	18.10	23.7	14	2.14
High Oxide SP- 10 (1)		103	0.29	2.71	13.8	<0.2	<10	560	0.92	0.07	2.91	0.30	19.05	26.6	48	1.59
High Oxide SP- 4 (1)		96	0.46	2.31	13.4	0.3	<10	590	0.94	0.11	1.97	0.23	19.95	24.7	17	1.80
High Oxide SP- 3 (1)		128	0.78	2.97	18.3	<0.2	<10	240	1.38	0.09	3.38	0.39	22.5	26.5	8	2.39
High Oxide SP- 1 (1)		100	0.35	2.46	14.4	<0.2	<10	520	0.84	0.06	4.45	0.54	17.95	20.0	30	1.94
High Oxide SP- 2 (1)		114	0.51	2.63	17.2	<0.2	<10	360	0.91	0.09	2.83	0.43	23.4	24.2	11	3.30
#3 SP- 26 (1)		135	0.53	2.56	15.5	0.2	<10	530	0.95	0.07	2.79	0.20	21.5	28.9	8	2.58
#3 SP- 25 (1)		108	0.55	2.35	14.7	<0.2	<10	540	1.02	0.09	2.61	0.22	24.1	28.3	26	2.09
#3 SP- 29 (1)		138	0.58	2.80	15.4	0.2	<10	370	0.88	0.06	3.55	0.18	17.60	27.7	12	3.32
#3 SP- 28 (1)		125	0.84	2.55	19.1	0.3	<10	240	1.07	0.09	3.27	0.42	20.9	29.5	7	1.87
#3 SP- 27 (1)		169	0.99	2.51	20.3	0.2	<10	240	1.02	0.14	2.92	0.41	21.1	28.2	14	2.03
#3 SP- 30 (1)		115	0.63	2.23	13.9	0.2	<10	700	0.89	0.11	2.59	0.30	21.3	23.9	10	1.66

***** See Appendix Page for comments regarding this certificate *****

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

Sample Description	Method Analyte Units LOR	ME- MS41 Cu ppm 0.2	ME- MS41 Fe % 0.01	ME- MS41 Ga ppm 0.05	ME- MS41 Ge ppm 0.05	ME- MS41 Hf ppm 0.02	ME- MS41 Hg ppm 0.01	ME- MS41 In ppm 0.005	ME- MS41 K % 0.01	ME- MS41 La ppm 0.2	ME- MS41 Li ppm 0.1	ME- MS41 Mg % 0.01	ME- MS41 Mn ppm 5	ME- MS41 Mo ppm 0.05	ME- MS41 Na % 0.01	ME- MS41 Nb ppm 0.05
Cariboo SP- 17 (1)		1825	5.35	10.05	0.25	0.37	0.14	0.049	0.14	9.9	14.6	1.30	566	3.49	0.11	0.07
Cariboo SP- 14 (1)		4620	4.50	8.66	0.31	0.32	0.09	0.128	0.16	9.0	10.5	0.93	897	2.81	0.14	0.08
Cariboo SP- 14 (2)		2100	3.63	9.51	0.33	0.21	0.07	0.056	0.30	7.5	17.2	1.37	593	6.24	0.49	0.16
Cariboo SP- 13 (1)		3060	4.92	10.00	0.36	0.39	0.10	0.081	0.16	11.1	14.5	1.29	740	5.20	0.10	0.08
Cariboo SP- 15 (1)		2210	4.83	10.10	0.30	0.37	0.14	0.062	0.14	12.3	14.7	1.43	618	7.61	0.06	0.07
Cariboo SP- 16 (1)		1975	4.77	10.35	0.22	0.31	0.14	0.073	0.13	10.5	15.8	1.54	737	29.6	0.04	<0.05
Cariboo SP- 18 (1)		2160	8.52	13.60	0.50	0.40	0.06	0.112	0.21	13.7	13.1	1.55	498	14.50	0.06	0.15
#1 SP- 21 (1)		2750	6.39	11.50	0.43	0.37	0.14	0.165	0.15	8.3	17.6	1.17	588	4.29	0.09	0.07
#1 SP- 21 (2)		2730	6.56	11.85	0.44	0.40	0.12	0.169	0.16	9.5	18.7	1.22	610	4.81	0.09	0.10
#1 SP- 20 (1)		5530	5.77	10.85	0.40	0.37	0.17	0.204	0.12	11.4	15.0	1.23	639	14.60	0.06	0.05
#1 SP- 22 (1)		3070	5.65	10.95	0.45	0.48	0.15	0.159	0.13	11.5	18.9	1.20	1060	11.20	0.07	0.07
#1 SP- 23 (1)		3820	5.21	10.45	0.46	0.39	0.10	0.161	0.18	13.2	17.2	2.04	603	21.6	0.06	0.08
#1 SP- 24 (1)		2700	6.38	11.60	0.53	0.44	0.10	0.216	0.13	11.9	13.2	1.26	458	26.2	0.05	0.07
#1 SP- 19 (1)		4590	6.35	10.80	0.49	0.35	0.11	0.186	0.13	10.3	16.3	1.48	756	7.12	0.06	0.06
High Oxide SP- 9 (1)		6590	6.62	12.45	0.46	0.41	0.13	0.184	0.13	12.0	21.4	1.89	813	3.26	0.06	0.06
High Oxide SP- 8 (1)		3390	6.35	12.45	0.43	0.40	0.07	0.132	0.13	9.7	20.1	1.30	781	2.05	0.05	<0.05
High Oxide SP- 7 (1)		134.0	4.86	11.35	0.31	0.50	0.01	0.016	1.08	92.7	12.6	3.41	737	0.42	0.14	1.73
High Oxide SP- 7 (2)		2260	4.98	10.25	0.35	0.48	0.04	0.071	0.68	60.7	14.0	2.37	834	1.21	0.13	0.32
High Oxide SP- 5 (1)		3900	5.60	12.75	0.57	0.47	0.20	0.160	0.19	11.8	19.7	1.17	669	8.11	0.04	0.06
High Oxide SP- 6 (1)		4000	5.57	12.05	0.52	0.40	0.16	0.191	0.21	13.1	20.9	1.26	683	7.53	0.04	0.05
High Oxide SP- 12 (1)		2260	5.17	10.15	0.31	0.41	0.12	0.102	0.17	11.2	21.6	1.17	919	5.20	0.10	0.12
High Oxide SP- 11 (1)		3530	5.99	11.20	0.53	0.40	0.14	0.242	0.14	10.4	21.5	1.08	957	19.80	0.08	0.08
High Oxide SP- 10 (1)		2570	5.40	10.60	0.31	0.40	0.09	0.100	0.14	10.5	20.6	2.00	850	3.41	0.06	<0.05
High Oxide SP- 4 (1)		3940	5.61	10.85	0.37	0.29	0.08	0.163	0.13	11.5	17.2	1.19	769	2.74	0.05	0.10
High Oxide SP- 3 (1)		3770	6.32	12.30	0.45	0.35	0.12	0.151	0.16	12.8	19.6	1.33	691	10.85	0.05	0.05
High Oxide SP- 1 (1)		1245	4.63	10.50	0.25	0.35	0.12	0.084	0.11	9.9	19.1	1.46	1240	2.47	0.10	0.06
High Oxide SP- 2 (1)		2630	5.53	11.30	0.36	0.40	0.14	0.122	0.25	13.1	25.7	1.23	894	8.10	0.10	0.08
#3 SP- 26 (1)		3560	6.68	12.25	0.49	0.41	0.13	0.181	0.14	13.5	21.3	1.31	695	10.15	0.08	0.05
#3 SP- 25 (1)		3100	6.62	11.60	0.35	0.39	0.10	0.183	0.13	14.2	20.5	1.64	855	6.33	0.08	0.06
#3 SP- 29 (1)		2550	5.94	12.50	0.41	0.44	0.20	0.202	0.13	10.9	19.3	1.29	681	9.71	0.14	0.05
#3 SP- 28 (1)		4060	7.25	12.15	0.51	0.37	0.15	0.176	0.12	12.3	22.1	1.23	715	11.90	0.05	0.05
#3 SP- 27 (1)		3790	6.27	12.00	0.53	0.43	0.14	0.148	0.17	12.2	24.5	1.51	704	22.2	0.07	0.07
#3 SP- 30 (1)		2430	5.46	11.15	0.38	0.42	0.14	0.151	0.14	12.3	19.5	1.22	841	9.40	0.07	0.06

***** See Appendix Page for comments regarding this certificate *****

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22- JUL- 2015
Account: NOU

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

Sample Description	Method	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41	ME- MS41
	Analyte	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti
	Units	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
	LOR	0.2	10	0.2	0.1	0.001	0.01	0.05	0.1	0.2	0.2	0.2	0.01	0.01	0.2	0.005
Cariboo SP- 17 (1)		12.8	1910	4.3	6.7	0.012	0.10	0.73	7.1	3.0	0.9	386	<0.01	0.05	1.0	0.153
Cariboo SP- 14 (1)		9.5	1950	7.4	7.3	0.004	0.03	0.31	6.6	1.9	1.2	202	<0.01	0.03	1.1	0.124
Cariboo SP- 14 (2)		6.1	1560	2.9	18.9	0.018	0.15	0.39	4.8	2.2	0.9	414	<0.01	0.04	1.1	0.126
Cariboo SP- 13 (1)		12.8	1790	6.5	8.0	0.013	0.15	0.61	7.1	3.4	1.1	295	<0.01	0.05	1.1	0.155
Cariboo SP- 15 (1)		12.1	1510	4.5	6.4	0.019	0.16	0.82	8.1	3.7	0.9	257	<0.01	0.04	1.0	0.150
Cariboo SP- 16 (1)		9.8	1420	4.9	6.3	0.104	0.35	0.70	9.7	3.7	0.9	154.0	<0.01	0.04	1.0	0.130
Cariboo SP- 18 (1)		15.8	1900	4.7	10.3	0.072	0.20	0.55	8.8	3.3	1.2	161.0	<0.01	0.05	1.3	0.201
#1 SP- 21 (1)		7.4	1170	4.3	9.0	0.013	0.19	0.47	8.0	3.6	1.6	175.0	<0.01	0.21	0.7	0.198
#1 SP- 21 (2)		8.5	1190	4.4	9.5	0.014	0.19	0.49	8.6	3.8	1.7	189.5	<0.01	0.19	0.8	0.205
#1 SP- 20 (1)		17.1	1240	7.1	5.2	0.044	0.41	0.39	6.4	8.1	2.4	166.5	<0.01	0.38	1.1	0.126
#1 SP- 22 (1)		9.4	1270	9.4	6.4	0.030	0.30	0.46	6.4	7.1	2.0	297	<0.01	0.30	1.1	0.147
#1 SP- 23 (1)		78.4	1420	10.5	10.4	0.090	0.38	0.55	6.6	6.4	1.9	282	<0.01	0.21	1.3	0.175
#1 SP- 24 (1)		12.3	1230	4.8	6.6	0.089	0.38	0.48	6.9	5.1	2.2	159.5	<0.01	0.26	1.1	0.161
#1 SP- 19 (1)		24.0	1330	5.7	6.7	0.021	0.20	0.38	8.1	4.6	2.0	144.0	<0.01	0.12	0.9	0.160
High Oxide SP- 9 (1)		46.7	1410	5.3	7.8	0.004	0.06	0.45	9.5	3.8	2.1	158.0	<0.01	0.10	0.9	0.184
High Oxide SP- 8 (1)		11.8	1470	4.8	7.6	0.002	0.04	0.44	8.3	1.5	1.7	177.5	<0.01	0.09	0.7	0.141
High Oxide SP- 7 (1)		190.5	5320	17.4	41.4	0.001	0.03	0.08	4.8	0.7	0.7	432	0.01	0.01	1.7	0.613
High Oxide SP- 7 (2)		112.0	4100	13.6	28.6	0.001	0.02	0.16	7.4	0.8	0.8	420	<0.01	0.03	1.8	0.400
High Oxide SP- 5 (1)		5.9	1440	8.2	10.1	0.004	0.07	0.51	8.0	3.7	2.3	209	<0.01	0.64	1.2	0.152
High Oxide SP- 6 (1)		5.0	1400	11.9	13.1	0.004	0.06	0.35	8.6	3.7	2.4	126.5	<0.01	0.32	1.2	0.160
High Oxide SP- 12 (1)		21.8	1470	11.1	8.5	0.009	0.12	0.52	7.6	1.7	1.3	176.5	<0.01	0.07	1.2	0.159
High Oxide SP- 11 (1)		10.4	1650	6.5	7.1	0.014	0.04	0.40	8.3	1.6	2.6	184.5	<0.01	0.08	0.8	0.146
High Oxide SP- 10 (1)		61.3	1440	6.9	6.9	0.003	0.04	0.39	8.2	1.4	1.3	163.5	<0.01	0.09	1.1	0.170
High Oxide SP- 4 (1)		10.5	1240	6.2	6.6	0.003	0.03	0.35	7.5	1.7	1.6	161.5	<0.01	0.11	1.0	0.140
High Oxide SP- 3 (1)		9.6	1590	9.9	9.4	0.023	0.16	0.41	8.3	3.6	2.2	193.0	<0.01	0.18	1.2	0.139
High Oxide SP- 1 (1)		27.9	1320	6.9	5.6	0.005	0.05	0.46	8.0	1.2	1.0	187.0	<0.01	0.05	1.0	0.120
High Oxide SP- 2 (1)		10.3	1520	9.3	14.9	0.011	0.07	0.44	8.5	2.2	1.7	275	<0.01	0.14	1.2	0.157
#3 SP- 26 (1)		7.3	1300	7.5	8.1	0.032	0.24	0.41	7.7	3.7	2.0	282	<0.01	0.17	1.0	0.150
#3 SP- 25 (1)		25.8	1310	8.1	7.4	0.015	0.15	0.35	8.2	2.7	1.9	157.0	<0.01	0.08	1.2	0.148
#3 SP- 29 (1)		14.8	1180	5.4	7.2	0.026	0.31	0.39	8.3	4.1	2.3	266	<0.01	0.18	0.8	0.151
#3 SP- 28 (1)		9.0	1710	14.1	6.3	0.034	0.19	0.55	7.6	5.4	2.0	248	<0.01	0.17	1.3	0.148
#3 SP- 27 (1)		28.1	1490	19.0	10.9	0.075	0.67	0.56	8.1	6.9	2.1	319	<0.01	0.24	1.3	0.173
#3 SP- 30 (1)		9.4	1190	14.9	8.2	0.019	0.30	0.37	7.2	3.5	1.6	202	<0.01	0.11	1.0	0.155

***** See Appendix Page for comments regarding this certificate *****

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22- JUL- 2015
Account: NOU

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

Sample Description	Method / Analyte / Units / LOR	ME- MS41 Tl ppm 0.02	ME- MS41 U ppm 0.05	ME- MS41 V ppm 1	ME- MS41 W ppm 0.05	ME- MS41 Y ppm 0.05	ME- MS41 Zn ppm 2	ME- MS41 Zr ppm 0.5	OA- GRA10b H2O % 0.01
Cariboo SP- 17 (1)		0.02	0.63	191	1.02	12.70	45	11.5	3.01
Cariboo SP- 14 (1)		0.02	0.75	157	0.74	15.05	48	9.5	2.97
Cariboo SP- 14 (2)		0.04	0.49	128	0.60	10.65	44	6.8	3.02
Cariboo SP- 13 (1)		0.03	0.96	171	0.82	13.35	60	11.7	2.73
Cariboo SP- 15 (1)		0.03	1.17	176	0.75	13.20	80	11.8	2.37
Cariboo SP- 16 (1)		0.02	0.55	179	0.53	16.40	45	8.5	1.76
Cariboo SP- 18 (1)		0.03	0.82	451	0.89	14.55	46	11.3	1.30
#1 SP- 21 (1)		0.02	0.82	190	0.58	11.55	43	11.2	1.52
#1 SP- 21 (2)		0.02	0.87	195	0.59	12.35	43	13.0	1.84
#1 SP- 20 (1)		0.02	1.41	172	0.87	14.35	51	12.1	2.35
#1 SP- 22 (1)		0.02	1.49	170	1.38	15.15	66	15.1	2.26
#1 SP- 23 (1)		0.04	1.37	178	0.75	14.90	75	12.9	1.53
#1 SP- 24 (1)		0.02	1.19	206	0.74	13.50	31	13.7	2.25
#1 SP- 19 (1)		0.02	1.02	204	0.82	14.30	58	10.1	2.35
High Oxide SP- 9 (1)		0.02	1.32	200	0.80	15.55	60	13.6	4.99
High Oxide SP- 8 (1)		<0.02	0.91	191	0.71	12.20	51	12.7	2.80
High Oxide SP- 7 (1)		0.19	0.18	119	0.23	12.65	72	20.7	6.81
High Oxide SP- 7 (2)		0.14	0.41	155	0.37	13.40	66	20.6	4.12
High Oxide SP- 5 (1)		0.02	1.22	188	1.00	14.30	47	16.3	3.66
High Oxide SP- 6 (1)		0.04	1.34	187	0.80	14.55	67	14.0	4.32
High Oxide SP- 12 (1)		0.03	0.97	176	1.01	13.90	80	13.8	4.93
High Oxide SP- 11 (1)		0.02	1.12	227	1.16	14.55	69	14.9	3.04
High Oxide SP- 10 (1)		0.02	0.91	180	0.71	14.80	66	13.6	3.11
High Oxide SP- 4 (1)		0.02	1.18	173	0.79	14.40	52	10.4	3.35
High Oxide SP- 3 (1)		0.02	1.27	227	0.64	14.75	64	13.1	2.19
High Oxide SP- 1 (1)		0.02	0.76	155	0.81	13.35	122	11.5	1.97
High Oxide SP- 2 (1)		0.03	1.03	187	1.01	16.60	89	13.8	2.62
#3 SP- 26 (1)		0.02	1.46	182	0.78	15.65	50	14.3	3.68
#3 SP- 25 (1)		0.02	1.30	213	0.97	17.65	67	13.2	2.75
#3 SP- 29 (1)		0.02	1.35	166	0.82	13.55	52	15.6	3.78
#3 SP- 28 (1)		0.03	1.42	227	1.01	15.70	73	12.6	3.04
#3 SP- 27 (1)		0.04	1.62	199	0.98	15.80	74	14.0	2.65
#3 SP- 30 (1)		0.03	1.13	176	1.02	16.85	63	13.0	2.55

***** See Appendix Page for comments regarding this certificate *****

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To: **MOUNT POLLEY MINING CORPORATION**
PO BOX 12
LIKELY BC V0L 1N0

Finalized Date: 22- JUL- 2015
Account: NOU

Project: One Stockpile Project 2015

CERTIFICATE OF ANALYSIS VA15101982

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: Gold determinations by this method are semi- quantitative due to the small sample weight used (0.5g).
ME- MS41

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

C- GAS05	LOG- 22	ME- MS41	OA- ELE04
OA- ELE07	OA- GRA10b	OA- VOL08mn	PUL- 31
PUL- QC	S- CAL06	SCR- 51	S- GRA06
S- GRA06a	S- IR08	SPL- 21	WEI- 21

MOUNT POLLEY MINING CORP.
ATTN: McLean Donohue
PO Box 12
Likely BC V0L 1N0

Date Received: 14-SEP-15
Report Date: 23-SEP-15 15:25 (MT)
Version: FINAL

Client Phone: 250-790-2215

Certificate of Analysis

Lab Work Order #: L1672948

Project P.O. #: NOT SUBMITTED
Job Reference: ONE STOCKPILE PROJECT 2015
C of C Numbers:
Legal Site Desc:

Can Dang
Senior Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1672948-1 Soil CARIBOO SP-15 (1)	L1672948-2 Soil CARIBOO SP-16 (1)	L1672948-3 Soil #1 SP-20(1)	L1672948-4 Soil #1 SP-24(1)	L1672948-5 Soil HIGH OXIDE SP-12 (1)
SOIL						
Physical Tests	Moisture (%)	0.51	0.60	0.77	0.39	0.65
Leachable Anions & Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	26.9	28.8	27.2	23.2	31.4
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	0.87
	Conductivity (uS/cm)	80.5	110	91.0	112	99.9
	Nitrate (as N) (mg/L)	0.0973	1.40	0.0401	0.837	0.0297
	pH (pH)	8.95	8.94	8.87	8.91	8.69
	Sulfate (SO4) (mg/L)	12.1	17.9	16.7	26.1	15.4
Leachable Metals	Aluminum (Al)-Leachable (mg/L)	0.143	0.178	0.0920	0.167	0.165
	Antimony (Sb)-Leachable (mg/L)	0.00062	0.00085	0.00019	0.00045	0.00037
	Arsenic (As)-Leachable (mg/L)	0.0070	0.0065	0.0034	0.0028	0.0030
	Barium (Ba)-Leachable (mg/L)	0.0110	0.0160	0.0113	0.0207	0.0424
	Beryllium (Be)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Leachable (mg/L)	0.012	0.018	0.011	0.011	0.014
	Cadmium (Cd)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Leachable (mg/L)	8.24	11.1	9.72	10.5	12.8
	Chromium (Cr)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Leachable (mg/L)	0.0013	<0.0010	0.0026	<0.0010	0.0089
	Iron (Fe)-Leachable (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Lithium (Li)-Leachable (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Leachable (mg/L)	1.01	1.80	1.60	1.85	1.14
	Manganese (Mn)-Leachable (mg/L)	0.00099	0.00104	0.00071	0.00078	0.00549
	Mercury (Hg)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Molybdenum (Mo)-Leachable (mg/L)	0.0225	0.0402	0.0171	0.0451	0.0222
	Nickel (Ni)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Leachable (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Leachable (mg/L)	1.97	2.96	1.24	1.85	1.94
	Selenium (Se)-Leachable (mg/L)	0.0206	0.00699	0.0161	0.0161	0.00243
	Silicon (Si)-Leachable (mg/L)	4.35	3.95	5.74	4.07	4.68
	Silver (Ag)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)-Leachable (mg/L)	4.05	4.70	4.76	4.76	4.05
	Strontium (Sr)-Leachable (mg/L)	0.0475	0.170	0.0768	0.0636	0.138
	Thallium (Tl)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Leachable (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1672948-6	L1672948-7	L1672948-8		
	Description	Soil	Soil	Soil		
	Sampled Date					
	Sampled Time					
	Client ID	HIGH OXIDE SP-3 (1)	#3 SP-29 (1)	#3 SP-27 (1)		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	0.77	0.86	0.70		
Leachable Anions & Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	29.4	28.9	29.3		
	Chloride (Cl) (mg/L)	0.95	0.53	0.71		
	Conductivity (uS/cm)	83.8	88.7	141		
	Nitrate (as N) (mg/L)	0.0897	0.0334	0.0607		
	pH (pH)	9.04	8.95	8.76		
	Sulfate (SO4) (mg/L)	10.3	13.3	35.0		
Leachable Metals	Aluminum (Al)-Leachable (mg/L)	0.201	0.158	0.0976		
	Antimony (Sb)-Leachable (mg/L)	0.00014	0.00025	0.00046		
	Arsenic (As)-Leachable (mg/L)	0.0028	0.0030	0.0017		
	Barium (Ba)-Leachable (mg/L)	0.0121	0.0108	0.0344		
	Beryllium (Be)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050		
	Bismuth (Bi)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Leachable (mg/L)	0.014	0.012	0.029		
	Cadmium (Cd)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050		
	Calcium (Ca)-Leachable (mg/L)	9.34	9.61	16.7		
	Chromium (Cr)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050		
	Cobalt (Co)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Leachable (mg/L)	0.0080	0.0028	0.0040		
	Iron (Fe)-Leachable (mg/L)	<0.030	<0.030	<0.030		
	Lead (Pb)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010		
	Lithium (Li)-Leachable (mg/L)	<0.0050	<0.0050	<0.0050		
	Magnesium (Mg)-Leachable (mg/L)	0.669	0.782	1.75		
	Manganese (Mn)-Leachable (mg/L)	0.00105	0.00112	0.00361		
	Mercury (Hg)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050		
	Molybdenum (Mo)-Leachable (mg/L)	0.0167	0.0232	0.0434		
	Nickel (Ni)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050		
	Phosphorus (P)-Leachable (mg/L)	<0.30	<0.30	<0.30		
	Potassium (K)-Leachable (mg/L)	2.21	0.803	1.94		
	Selenium (Se)-Leachable (mg/L)	0.0182	0.0164	0.0203		
	Silicon (Si)-Leachable (mg/L)	5.35	5.21	4.48		
	Silver (Ag)-Leachable (mg/L)	<0.000050	<0.000050	<0.000050		
	Sodium (Na)-Leachable (mg/L)	5.15	5.76	6.17		
	Strontium (Sr)-Leachable (mg/L)	0.0376	0.0297	0.225		
	Thallium (Tl)-Leachable (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Leachable (mg/L)	<0.00050	<0.00050	<0.00050		
	Titanium (Ti)-Leachable (mg/L)	<0.010	<0.010	<0.010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1672948-1 Soil CARIBOO SP-15 (1)	L1672948-2 Soil CARIBOO SP-16 (1)	L1672948-3 Soil #1 SP-20(1)	L1672948-4 Soil #1 SP-24(1)	L1672948-5 Soil HIGH OXIDE SP-12 (1)
Sample ID		L1672948-1	L1672948-2	L1672948-3	L1672948-4	L1672948-5
Description		Soil	Soil	Soil	Soil	Soil
Sampled Date						
Sampled Time						
Client ID		CARIBOO SP-15 (1)	CARIBOO SP-16 (1)	#1 SP-20(1)	#1 SP-24(1)	HIGH OXIDE SP-12 (1)
SOIL						
Leachable Metals	Uranium (U)-Leachable (mg/L)	0.000053	0.000027	0.000083	0.000102	0.000117
	Vanadium (V)-Leachable (mg/L)	0.0154	0.0190	0.0095	0.0103	0.0060
	Zinc (Zn)-Leachable (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1672948-6	L1672948-7	L1672948-8		
	Description	Soil	Soil	Soil		
	Sampled Date					
	Sampled Time					
	Client ID	HIGH OXIDE SP-3 (1)	#3 SP-29 (1)	#3 SP-27 (1)		
Grouping	**Analyte**					
SOIL						
Leachable Metals	Uranium (U)-Leachable (mg/L)	0.000052	0.000072	0.000076		
	Vanadium (V)-Leachable (mg/L)	0.0052	0.0116	0.0036		
	Zinc (Zn)-Leachable (mg/L)	<0.010	<0.010	<0.010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Leachable	MS-B	L1672948-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Magnesium (Mg)-Leachable	MS-B	L1672948-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Leachable	MS-B	L1672948-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SHKFLSK-PCT-VA	Soil	Alkalinity by PCT (SHAKEFLASK)	BC MINISTRY OF ENERGY AND MINES

TThis analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter and analysed using procedures adapted from APHA Method 2320 "Alkalinity".

CL-SHKFLSK-IC-VA Soil Chloride by IC (SHAKEFLASK) BC MIN. OF ENERGY AND MINES/APHA 4110 B.

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter. The analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

EC-SHKFLSK-PCT-VA Soil EC by PCT (SHAKEFLASK) BC MINISTRY OF ENERGY AND MINES

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter and analysed using procedures adapted from APHA Method 2510 "Conductivity".

HG-SHKFLSK-CVAFS-VA Soil Mercury by CVAFS (SHAKEFLASK) BC MINISTRY OF ENERGY AND MINES

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter and analysed using cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-SHKFLSK-MS-VA Soil Metals by ICPMS (SHAKEFLASK) BC MINISTRY OF ENERGY AND MINES

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter and analysed using inductively coupled plasma - mass spectrophotometry (EPA Method 6020A).

MOISTURE-VA Soil Moisture content ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

NO3-SHKFLSK-IC-VA Soil Nitrate by IC (SHAKEFLASK) BC MIN. OF ENERGY AND MINES/APHA 4110 B.

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter. The analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

PH-SHKFLSK-MAN-VA Soil pH by Manual Meter (SHAKEFLASK) BC MINISTRY OF ENERGY AND MINES

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently analysed using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

SO4-SHKFLSK-IC-VA Soil Sulfate by IC (SHAKEFLASK) BC MIN. OF ENERGY AND MINES/APHA 4110 B.

This analysis is based upon the extraction procedure outlined in "Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report 1.20.1)" (William A. Price, 2009). In summary, a sample is extracted with deionized water at a 3:1 liquid to solids ratio for 24 hours. The extract is then allowed to settle and subsequently filtered through a 0.45 micron membrane filter. The analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1672948-COFC

Analysis Request Form

Date:	9/3/2015
Workorder Number:	VA15101982
Analyzing Laboratory:	ALSE - ALS Environmental
Client Contact Name:	McLean Donohoe
Client Company Name:	Mount Polley Mining Corporation
Project Name:	One Stockpile Project 2015
Number of Samples & Country of Origin:	8 Samples - Canada
Sample IDs:	Cariboo SP-15 (1); Cariboo SP-16(1); #1 SP-20(1); #1 SP-24(1); High Oxide SP-12(1); High Oxide SP-3(1); #3 SP-29(1); #3 SP-27(1)
Sample Type:	☐ Drill Core ☐ Percussion ☐ Rock ☐ Soil ☐ Pulp ☐ Other
Analysis Required:	Shake Flask Analysis
Special Instructions:	MET-SHKFLSK-MS-VA: pH Alkalinity; Total (as CaCO3); Chloride; Conductivity; Nitrate (as N); pH; Sulfate (SO4). Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, P, K, Se, Si, Ag, Na, Sr Tl, Sn, Ti, U, V, Zn
Sample Disposition:	☐ Return ☒ Dispose after analysis
Results to:	**Please send the results to the client directly** **Attention:** McLean Donohue Address: PO Box 12, Likely, BC, V0L 1N0 Phone: 250-790-2215 Email: mdonohoe@mountpolley.com
Invoice to:	**Please send the results to the client directly at:** **Attention:** McLean Donohue Address: PO Box 12, Likely, BC, V0L 1N0 Phone: 250-790-2215 Email: mdonohoe@mountpolley.com

Shake/Sept. 14/100C/23, 23°C

FINAL

Mount Polley Heap Leach Decommissioning Plan

Mount Polley Mine, BC, Canada
Mount Polley Mining Corporation



SRK Consulting (Canada) Inc. ▪ 1CM017.010 ▪ April 2022

srk consulting

FINAL

Mount Polley Heap Leach Decommissioning Plan

Mount Polley Mine, BC, Canada

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Sampling on the Heap Leach Facility

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Appendices

Appendix A Heap Leach Facility Geochemical Characterization Plan

1 Introduction

Mount Polley Mining Corporation (MPMC) retained SRK Consulting (Canada) Inc. (SRK) to develop a plan to decommission the Test Heap Leach Facility at Mount Polley Mine. The plan is a requirement under MPMC's amalgamated Mines Act Permit M-200 (EMLI 2020) s. D3(c)(v) and must be submitted to the BC Ministry of Energy, Mines and Low Carbon Innovation (EMLI) by June 30, 2021. Specifically, the M-200 condition reads:

> *The Permittee shall provide a report that includes a detailed plan and timeline for the removal of the test heap leach facility and all stockpiled sulphur by June 30, 2021, to the satisfaction of the Chief Inspector. The Permittee shall ensure the plan includes, but is not limited to, the removal and disposal of the leached ore, sulphur stockpile, waste rock, contaminated soil, reagents or chemicals, and all associated infrastructure.*

The plan should also include an approach to identify and remediate any contaminated material beneath the facility. No timeline for disposal is provided in the M-200 Permit.

Results from testing were not available in time for the June 30, 2021 submission deadline. In the interim, the geochemical characterization program, detailed in SRK (2021) and provided as Appendix A, was submitted.

1.1 Development of the Plan

Management strategies for each material were established based on Geochemical Conceptual Models (GCMs) developed for each of the waste types currently stored in the Test Heap Leach Facility. They were developed using existing information, geochemical first principles, and experience. GCMs are an effective way to capture the key geochemical reactivity considerations for the Test Heap Leach Facility and how its reactivity may be impacting water quality on site now, and how it may do so in the future under various long-term storage scenarios.

Material characteristics and reactivity were evaluated through observations, sampling, testwork, and interpretation. Results were presented during a virtual options analysis with Mount Polley Mine personnel and SRK geochemists in attendance. Potential disposal options were discussed based on short- and long-term impacts, as well as time and cost considerations.

Disposal options selected during this workshop formed the basis for the management plan of each material.

1.2 Structure of the Plan

Section 2 describes the location, background, and materials inventory of the Test Heap Leach Facility.

Geochemical characterization for each material stored on the Test Heap Leach Facility is described in Section 3. The geochemical characterization program was detailed in SRK (2021) and was designed to address data gaps identified during the development of the GCMs for each material. Remedial and

disposal options for each material are presented in Section 6. Potential risks identified are presented along with mitigation strategies.

Material disposal and management criteria are presented in Section 7. Reagents, chemicals, and all associated infrastructure, including the leach pad liner, that need to be removed were not considered in the geochemical characterization program, as this program focused on material reactivity and disposal. Disposal of these components is also presented in Section 7.

2 Overview of the Test Heap Leach Facility

2.1 Location

The Test Heap Leach Facility is located on top of the East Rock Disposal Site (East RDS) and includes the lined heap leach pad, operations building, and former sulphur stockpile footprint (Figure 1).

2.2 Background

The pilot-scale high-density polyethylene (HDPE) double-lined Test Heap Leach Facility was constructed in 2007 for research into leaching non-sulphide copper ore. From 2006-2008, approximately 11,000 m^3 of elemental sulphur was procured for sulphuric acid production for the heap leach trial. Between 2007 and 2012, different layering and blending techniques of ore and sulphur were tested to optimize leaching. In 2012, the Test Heap Leach Facility was placed into Care and Maintenance due to economic considerations but was not loaded out prior to shut down. Roughly 7,000 m^3 of ore mixed with elemental sulphur remain on the leach pad. The heap leach pad also contains metal-contaminated soils from an off-site disposal clean-up. Approximately 19,000 tonnes of the metal-contaminated soil were loaded out and processed in the mill in 2019. An estimated 30,000 t remains on the heap leach pad.

Excess sulphur was stored in a nearby stockpile, first in the Cariboo Pit (2006-2009) and then moved to a crushed rock pad beside the heap leach pad (2009-2018) when mining resumed in the Cariboo Pit. In 2018, the excess sulphur was relocated on top of the lined leach pad after evidence showed that water quality on the mine may be affected by contaminated drainage from below the sulphur stockpile. The affected drainage is seepage from the NEZ Dump, located east of the Test Heap Leach Facility. Approximately 1 m thickness of waste rock was removed from the sulphur stockpile pad footprint (about 9,200 tonnes) and was relocated to the TSF after the sulphur stockpile was moved to the Test Heap Leach Facility as clean-up.

Leachate from within the lined heap leach pad facility is managed by treatment with lime at the ore processing plant and conveyance to the TSF. A copper recovery system using sodium hydrosulfide (NaHS) to precipitate copper sulfide in the tailings thickener is being developed by MPMC within the concentrator building.

Data exist for 21 leachate samples from the heap leach pad that were collected between 2017 to 2021 (Table 1). Element concentrations in the leachate reflected the acidic pH and sulphate is above 10,000 mg/L.

Table 1: Summary Statistics of Leachate Chemistry from the Heap Leach Pad (2017 – 2021)

Statistic (n = 21)	pH[1]	Sulphate (mg/L)	Aluminum (mg/L)	Copper (mg/L)	Iron (mg/L)
Min	2.9	12,000	1,000	260	15
P50	3.3	13,000	1,400	710	130
Max	3.4	25,000	2,800	1,400	230

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Leach_Decom_Compiled_data_1CM017.010_Rev02_NK_SJL.xlsx?web=1

Notes:

[1] n = 20 for pH

2.3 Materials Inventory

Materials stored at the Test Heap Leach Facility are shown in Figure 1 (plan view) and Figure 2 (cross-sectional schematic to show layering). The material inventory is provided in Table 2.

Figure 1: Plan View of Heap Leach Facility Showing Location of Different Materials Stored on Leach Pad



Sources: Photo provided by MPMC, https://srk.sharepoint.com/sites/NA1CM017.010/Deliverables/!080_Deliverables/3_Final_Decom_Plan/040_Figures/HeapLeach_CrossSections_1CM017.010_Rev00_SJL.pptx?web=1

Notes: Flyover photo taken October 21, 2019.

Figure 2: Cross-Section Schematic of Materials on Heap Leach Pad

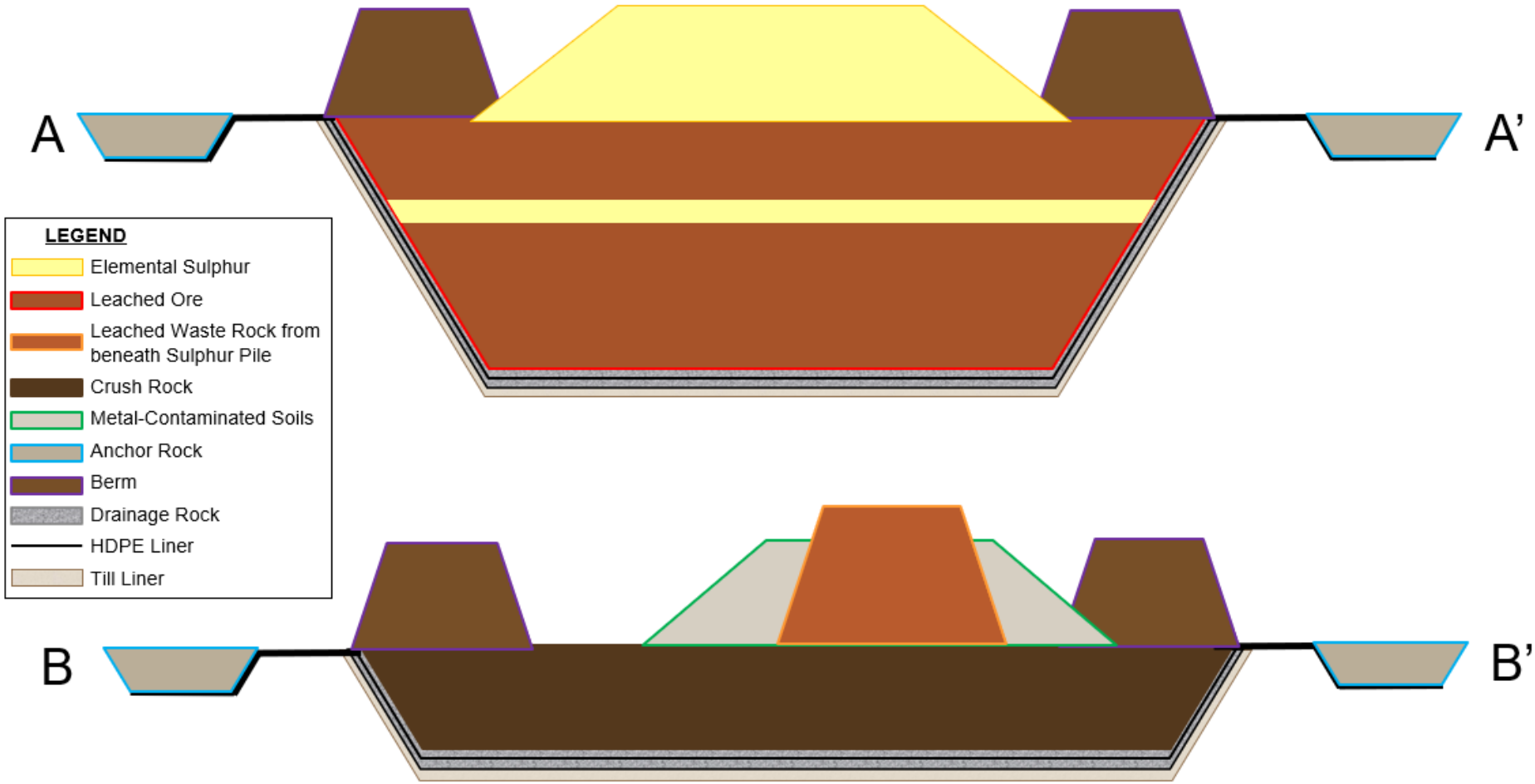

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Deliverables/!080_Deliverables/3_Final_Decom_Plan/040_Figures/HeapLeach_CrossSections_1CM017.010_Rev00_SJL.pptx?web=1

Notes: Drawings are for illustrative purpose and not drawn to scale. Lines A-A' and B-B' are shown on Figure 1.

Table 2: Inventory of Materials Stored at the Heap Leach Facility

Material	Earlier Placement	Current Storage Location	Estimated Tonnage Stored on Leach Pad (t)
Elemental sulphur	Placed on top of waste rock pile on crush pad	Stored on top of leached ore on leach pad	23,000
	Stored in sulphur stockpile before loaded onto leach pad	Stored in layers between ore on leach pad	Unknown amount
Leached waste rock from beneath sulphur stockpile	Beneath sulphur stockpile	Stored on top of leached ore on leach pad	9,200
Leached ore	Placed on leach pad, layered with elemental sulphur	Stored on top of leach pad	19,000
	Placed on leach pad, layered with elemental sulphur	Stored on top of leach pad	
Crush Rock	Waste rock sourced from pits	Stored on leach pad surrounding and underneath contaminated soils	20,000[1]
Metal-contaminated soils	Metal-impacted soils clean-up of lead-zinc concentrate from Kinder Morgan/Vancouver Wharves	Stored on top of leached ore on leach pad	30,000
Facility Construction Materials			
Anchor rock for liner	Waste rock sourced from pits during construction	Outside of heap leach pad footprint	5,400[1,2]
Berm	Waste rock sourced from pits during construction	Around leached ore on leach pad, within heap leach pad footprint	22,000[1]
Drainage material	Waste rock sourced from pits during construction, crushed on-site	Drainage rock above and between liner layers	Unknown amount
Till liner (Zone S)	Borrow Source #3	Underneath heap leach facility	Unknown amount
Liner[3]	-	Bottom of heap leach pad	-

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task100_Develop_GCM\Materials_Inventory_1CM017.010_Rev00_SJL.xlsx

Notes: Estimated material amounts were provided by MPMC.

[1] Estimated based on volume estimates

[2] Stored outside of leach pad footprint

[3] Liner comprises two HDPE liners that are 19,000 m^2 with one geonet placed between.

3 Regulatory Context

SRK understands from MPMC that these materials are considered mine wastes and are therefore managed under the requirements of Mines Act permit M-200, and EMLI's policies and guidance. SRK assumes that all materials will have approval from regulatory agencies for disposal on-site.

4 Geochemical Characterization Program

4.1 Characterization Program

The Decommissioning Plan required geochemical characterization of the materials stored on the Test Heap Leach Facility. The geochemical characterization program designed to address data gaps identified during the development of the GCMs for each material was detailed in SRK (2021) and is provided as Appendix A. An overview of this program is provided in the following sub-sections.

4.2 Data Collected Prior to 2021

Previous data were available for elemental sulphur, leached waste rock from beneath the sulphur stockpile, and leached ore (Figure 3). These data were included in the interpretation as appropriate.

Figure 3: Summary of Existing Datasets Available by Material Stored in the Test Heap Leach Facility

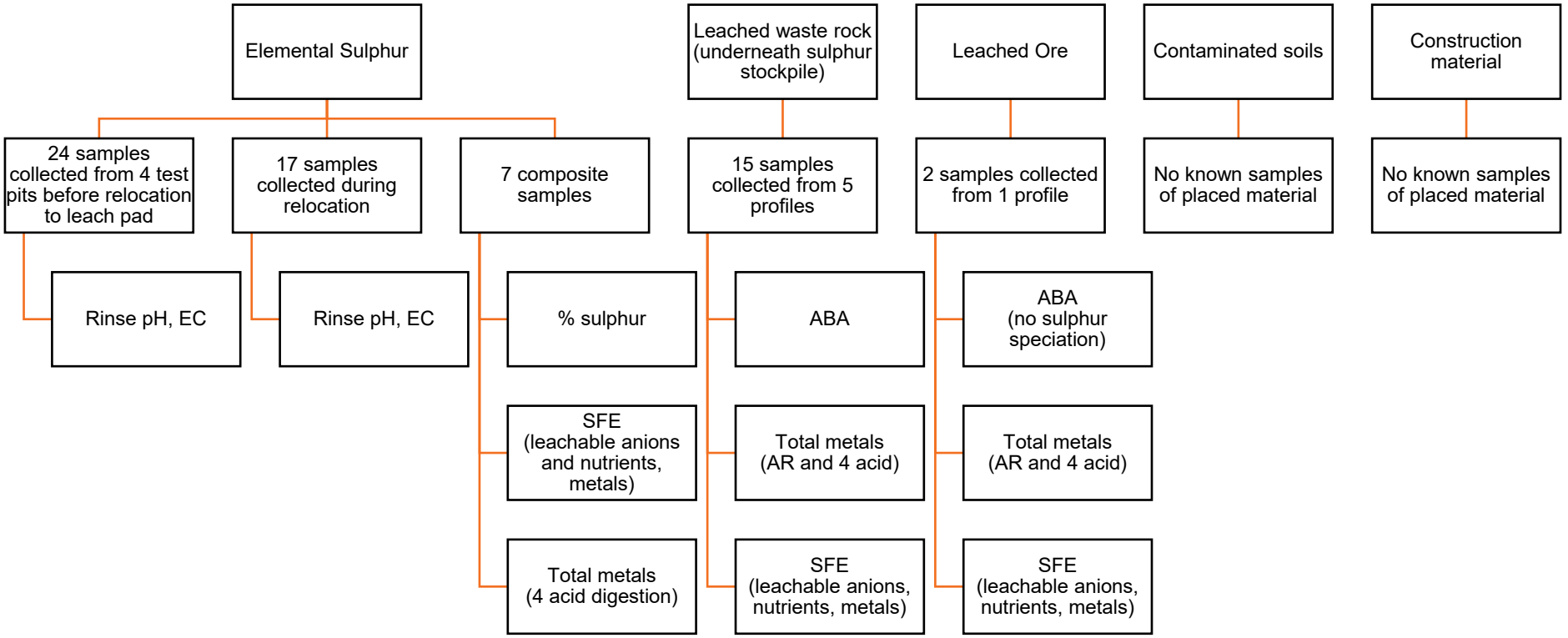

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

Notes: EC: electrical conductivity; ABA: acid-base accounting; SFE: shake flask extraction; AR: aqua regia

4.3 Characterization Program in 2021

SRK geochemist Shauna Litke, PEng, sampled materials stored on the Test Heap Leach Facility from May 5 – 6, 2021 after snow melt. To ensure the liner was not punctured during sampling, the depth to liner was estimated at each sampling location using historical survey data.

Elemental sulphur, leached ore, crush rock, and contaminated soils samples were collected using an excavator. Test pits were dug at each sampling location using an excavator. Each test pit was logged after excavation.

Construction materials were collected as one composite approximately every 25 m. This includes the anchor rock and berm materials. Drainage materials and the compacted till liner can not be sampled before decommissioning because they are below the HDPE liner, so no samples of these materials were collected. Instead, a sampling and analysis plan is provided in Section 6.6 to guide management decisions.

Table 3 summarizes the samples submitted for analysis as part of the characterization program.

Table 3: Summary of Samples Submitted for Analysis During the Current Characterization Program

Material	Current Storage Location	Number of Samples Collected
Elemental Sulphur	Stored on top of leached ore on leach pad	2 (+1 duplicate)
	Stored in layers between ore on leach pad	2
Leached Ore	Stored on the leach pad, beneath the elemental sulphur, contaminated soils, and leached waste rock	9 (4 profiles) (+1 duplicate)
Crush Rock	Stored on the leach pad	9 (3 profiles)
Metal-Contaminated Soils	Stored on the leach pad	11 (+2 duplicate)
Anchor Rock for Liner	Stored outside leach pad footprint	10 (+1 duplicate)
Berm	Berm	10 (+1 duplicate)

Sources: Compiled in text

4.3.1 Sample Locations

Sample locations are shown on Figure 4.

Figure 4: Leach Pad Sample Locations

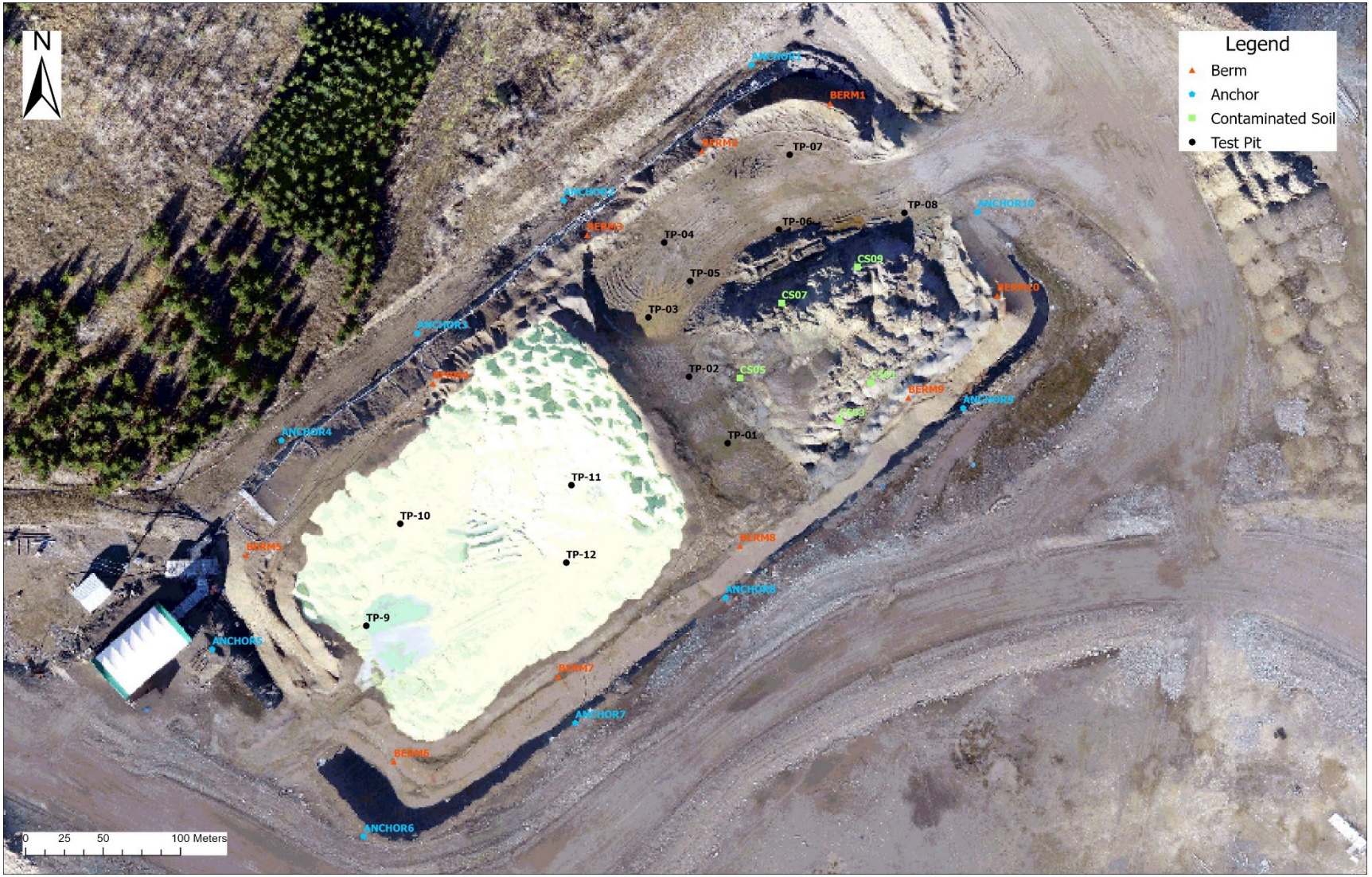

Sources: Photo provided by MPMC; https://srk.sharepoint.com/sites/NA1CM017.010/Internal/!020_Project_Data/010_SRK/Leach%20Pad%20Site%20Map.pptx

Notes: Flyover photo taken October 21, 2019.

4.3.2 Analytical Methods

All samples were shipped to Bureau Veritas Laboratory in Richmond, BC. All samples were air dried.

Elemental sulphur samples were analyzed for the following:

- Metals by aqua regia digestion with ICP-MS finish
- Shake Flask Extraction (SFE) test (MEND method) on as-received particle size
  - Leachate analyzed for: pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
- Total sulphur by Leco furnace (performed at ALS Minerals in North Vancouver, BC)

Rock samples were analyzed the following:

- Total carbon
- Total inorganic carbon
- Acid Base Accounting: paste pH, total sulphur (Leco), sulphate sulphur (HCl method), sulphate sulphur (by pyrolysis), and modified Sobek NP
- Metals by aqua regia digestion with ICP-MS finish
- SFE test (MEND method) on -2 mm fraction
  - Leachate analyzed for: pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS

4.3.3 Interpretation Methods

Sulphur Speciation

For leached ore, crush rock, metal-contaminated soils, and berm samples, three types of sulphur analyses were performed on all samples in the 2021 Characterization Program and were interpreted as follows to provide a basis for calculating acid potential (AP):

- Total sulphur (S_{Total})
- Hydrochloric acid soluble sulphur indicates sulphur in the form of sulphates (S_{HCl})
- Sulphate sulphur by pyrolysis (S_{Pyro})
  - In case of the presence of insoluble sulphate salts (e.g., barite), the pyrolysis method volatizes the sulphide and elemental sulphur. The residue contains sulphur as sulphate.

Sulphide and elemental sulphur concentrations could not be differentiated using these methods and are reported together. For consistency, sulphide + elemental sulphur concentrations ($S_{sulphide+}S^0$) were calculated for all materials as follows:

$$S_{sulphide+}S^0 = S_{Total} - S_{Pyro}$$

The pyrolysis method was not analyzed on samples collected prior to the 2021 Characterization Program. Therefore, sulphide concentrations were calculated using S_{HCl} instead of S_{Pyro}. This may over-predict the sulphide + elemental sulphur content for these samples.

Sulphide and elemental sulphur generate 2 moles of acid per mole of sulphur. Acid potential (AP) was therefore calculated for all rock samples as:

$$AP\ (kg\ CaCO_3/t) = 31.25 \times (S_{sulphide} + S^0)\ (\%)$$

Neutralization Potential

Neutralizing rock components for other materials were evaluated by the Mod Sobek NP method and total inorganic carbonate (TIC) analysis. Since carbonate mineralization is principally calcite and iron carbonates have not been reported at Mount Polley, carbonate content indicates calcite.

Acid Rock Drainage Potential

Acid rock drainage (ARD) potential was assessed using NP/AP. An NP/AP greater than 3 indicates negligible potential for ARD (not potentially acid generating, Non-PAG), whereas an NP/AP equal or less than 3 indicates the material has potential to generate ARD. Materials with an NP/AP ratio equal or less than 3 are classified as potentially acid generating (PAG).

In addition to the NP/AP ratio classification described above, an additional parameter was used to classify ARD potential. At low sulphide concentrations, interpretation of ARD potential using NP/AP ratios may not be meaningful because oxidation of small concentrations of sulphide produces low amounts of acid that are readily neutralized by other rock components in addition to carbonate. An $S_{Sulphide}$ concentration less than 0.1% was selected to represent low sulphur concentrations (AP = 3.1 kg $CaCO_3$/t). Below 0.1% $S_{Sulphide}$, rock was classified as NAG regardless of the NP/AP ratio.

Metal Leaching Potential

Trace element concentrations provide an indication of the degree to which rock may contain elevated concentrations compared to global average values. Enrichment of trace elements was evaluated by comparison with global average values in similar rock types (Price 1997).

All samples were compared to 10 times the high calcium granitic rock global values. Values exceeding 10 times the global value average were considered “enriched.” Enrichment of trace elements compared to global averages may or may not be correlated with leaching potential but is the basis for initial screening of metal leaching potential.

Assessment of Current Metal Leaching and Acid Rock Drainage

To determine current available acidity and ARD onset, the following assessment was used.

Measurements of paste pH less than 5.5 and Mod Sobek NPs that are less than 0 indicate the immediately available acidity upon contact with water.

SFE tests provide an indication of readily soluble acidity and metals. Measurements of leachate pH less than 5.5 also indicate the immediately available acidity upon contact with water. If the paste or leachate pH was less than 5.5, the material was classified as acidic.

4.3.4 Quality Assurance and Quality Control

Table 4 provides the QA/QC summary for samples collected during the 2021 Field Program. Field duplicates had relative percent differences above the acceptable criteria, indicating heterogeneity. SRK considers these data acceptable.

Table 4: QA/QC Summary of Samples Collected as Part of the 2021 Field Program

QC Test	SRK QC Criteria	Results
paste pH		
Method Blank (n=0)	<2X detection limit (DL)	-
Field Duplicate (n=11)	For any samples, +/- 0.5 difference pH unit	All passed except for BERM-11 and BERM-2 - pH difference >1
Lab Duplicate (n=7)	For any samples, +/- 0.5 difference pH unit	All passed.
Standard Reference Material (n=4)	Within specified tolerance ranges.	All passed.
Total C and TIC		
Method Blank (n=1) for TIC and Total C	<2X detection limit (DL)	All passed.
Carbon balance (Total C > TIC) (n=60)	For samples > 10X the detection limit (DL), Total Carbon should be greater than Total Inorganic Carbon, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=11) for TIC and Total C	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed except for BERM-2 and BERM-2 SPLIT DUP for Total C - 89% RPD, >10X DL
Lab Duplicate (n=4) for TIC and (n=2) for Total C	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Standard Reference Material (n=2) for TIC and (n=1) for Total C	Within specified tolerance ranges.	All passed.
Total S & Total Sulphate (HCl Extractable)		
Method Blank (n=2) for Total S, (n=2) for SO4	<2X detection limit (DL)	All passed.
Sulphur balance (total S > sulphate S) (n=60)	For samples > 10X the detection limit (DL), Total Sulphur should be greater than Total Sulphate, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=9) for Total S and (n=11) for SO4	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed except for CS-09 and CS-08 for SO4 - 40% RPD, >10X DL
Lab Duplicate (n=2) for Total S and (n=7) for SO4	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Standard Reference Material (n=1) for Total S and (n=4) for SO4	Within specified tolerance ranges.	All passed.
Total S & Total Sulphate (by Pyrolysis)		
Sulphur balance (total S > sulphate S) (n=39)	For samples > 10X the detection limit (DL), Total Sulphur should be greater than Total Sulphate, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=7) for SO4	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed.
Lab Duplicate (n=2) for SO4 and (n=1) for Total S	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.

QC Test	SRK QC Criteria	Results
Standard Reference Material (n=1) for Total S	Within specified tolerance ranges.	Passed.
Modified NP		
Method Blank (n=4) for NP	<2X detection limit (DL)	All passed.
NP consistent with paste pH (n=60)	Negative NP has paste pH <= 5	All passed.
Field Duplicate (n=11) for NP and Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Lab Duplicate (n=7) for NP and Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Fizz test rating with NP (n=60)	Max NP does not exceed fizz test rating	All passed.
Standard Reference Material (n=4) for NP	Within specified tolerance ranges.	All passed.
Modified NP and TIC		
Comparison between Modified NP and TIC (n=60)	Check for trends/co-relation	NP generally higher than TIC
Total S-Leco and S-ICP		
Comparison between Total S-Leco and S-ICP (n=60)	For samples >10X detection limit (DL), % RPD within +/-20%	All passed except forANCHOR-9 SPLIT DUP and ANCHOR-11 - both Total S-Leco and S-ICP are >10X DL.
Trace Elements (Aqua Regia Digestion with ICP Finish)		
Method Blank (n=1)	<2X Detection Limit	All passed.
Field Duplicate (n=13)	For samples >10X detection limit (DL), % RPD within +/- 30%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed except for TP-12-1M & TP-12-1M SPLIT DUP; BERM-2 & BERM-2 SPLIT DUP; TP-09-1M & TP-13-1M; BERM-11 & BERM-2; ANCHOR-11 & ANCHOR-6 are >30% RPD, >10X DL.
Lab Duplicate (n=2)	For samples >10X detection limit (DL), % RPD within +/- 20%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.
Standard Reference Material (n=2)	Within +/-15 % Difference or within the tolerance ranges	All passed.
Shake Flask Extraction		
Method Blank (n=4)	<5X Detection Limit	All passed.
Ion Balance (n=59)	EC>100uS/cm, % difference should be within +/-10%	All passed except for:TP-06-0.5M, TP-13-0.5M, TP-09-1M, TP-13-1M, TP-09-5M, TP-12-1M, TP-12-1M SPLIT DUP, TP-13-5M, CS-07, BERM-9, BERM-10, and BERM-11.
Field Duplicate (n=6)	For samples >10X detection limit (DL), % RPD within +/- 30%, For ICP metal scan,	TP-06-0.5M and TP-13-0.5M - Al, Be, Co, Cu, Fe, Ni and U failed. TP-12-5M and TP-13-5M -

QC Test	SRK QC Criteria	Results
	it is acceptable for 10% of parameters to be outside of this criterion.	Cr, Se, Si, W, Th and Ti failed. CS-08 and CS-09 - Acidity to pH4.5, Al, Be, Cr, Pb, Li, P, K, Ag, W and U failed. BERM-11 and BERM-2 - EC, SO4, Acidity to pH 8.3, Bicarbonate, Total Ammonia, Hardness CaCO3, Al, Cd, Ca, Co, Cu, Pb, Mg, Mn, Ni, K, Rb, Se, Si, Sr, S and Zn failed. ANCHOR-11 and ANCHOR-6 - Acidity to pH 8.3, Total Alkalinity, Bicarbonate, Nitrate-N, Total Ammonia, Dissolved Organic Carbon, Co, Cu, La, Fe, Hardness, Al, Sb, As, Be, Cs, Cd, Ca, Pb, Mo, Ni, Se, Si, U and Zn failed.
Split Duplicate (n=6)	For samples >10X detection limit (DL), % RPD within +/- 30%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed except for: TP-12-1M & TP-12-1M SPLIT DUP for Total Ammonia;BERM-2 & BERM-2 SPLIT DUP for parameters Al, Cu, Pb, K and Na. ANCHOR-9 &ANCHOR-9 SPLIT DUP failed for parameters Cu, Fe, Mg, Mn, Na and Sr, U
Pulp Duplicate (n=16)	For samples >10X detection limit (DL), % RPD within +/- 20%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed except for TP-01-1M and TP-01-1M Dup for EC at 196% RPD
SO4-S vs S-ICP (n=59)	For samples > 10X the detection limit (DL), the % difference should be within +/-20%	All passed except for TP-13-0.5M, BERM-1, BERM-11, ANCHOR-5 and ANCHOR-10.

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/!020_Project_Data/040_Laboratory_Data/C145475-Mt%20Polley%20Heap%20Leach%20Decomissioning_Final_QAQC_1CM017.010_mlt_rtc_rev03.xlsx

5 Results

5.1 Elemental Sulphur

Elemental sulphur stored on top of leached ore on the leach pad contained higher sulphur content than elemental sulphur stored in layers between ore on the leach pad and were similar to the composite samples collected in 2018 (Table 5). The solids analysis indicated the majority of these samples were sulphur by weight, with the balance made up of aluminum, calcium, iron, potassium, and sodium. Layered elemental sulphur samples contained higher metal concentrations (e.g., aluminum, copper, and iron were all greater than one order of magnitude), which may indicate metals that have leached from the ore and accumulated on in these sulphur layers.

Table 5: Selected ABA and SFE Results for Elemental Sulphur

Storage Location	Statistics[1]/ Sample ID	ABA	SFE			
		Total Sulphur (%)	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)
On top of leach pad and samples collected in 2018	n	9	9	2[2]	9	2[2]
	Min	85	1.4	6,300	1,600	1,300
	P50	89	1.7	-	4,100	-
	Max	91	2.0	8,500	4,500	1,400
Between layers of ore on leach pad	TP-09-5M	73	2.8	2,000	1,200	750
	TP-12-4M	68	3.8	1,200	740	270

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes:

[1] Where a result was less than the detection limit, the detection limit was used for statistical calculations.

[2] Analysis not performed on samples collected in 2018.

Elemental sulphur had some of the highest leachable sulphate concentrations of the materials stored on the leach pad. Leachable metal concentrations were high in the elemental sulphur due to the low pH of the leachate (Figure 9). Elemental sulphur contained the highest leachable iron concentrations of any material, but other leachable metal concentrations, although high, were lower than other materials. Solid phase concentrations of trace elements were lower compared to other materials but were within the same order of magnitude.

The elemental sulphur characteristics can be summarized as follows:

- Elemental sulphur samples were assumed to have no neutralization potential.
- The elemental sulphur is composed of about 90% sulphur. The balance of 10% are impurities which create a leachable source of other elements including iron and aluminum. Smaller amounts of elemental sulphur are stored in layers between ore on the leach pad. These layers contain less sulphur than the elemental sulphur stored on top of the facility and more impurities.

- Oxidation of the sulphur has generated sulphuric acid, which has markedly increased the solubility of metals in the surrounding materials that would not otherwise be leachable at neutral pH.

5.2 Rock-Containing Materials

5.2.1 General Findings

Sulphur Species and Acid Potential

Figure 5 compares S_{HCl} to S_{Total} for the rock samples, indicating that not all total sulphur components are acid generating. Figure 6 shows the comparison between the two sulphate methods for samples four different rock materials collected from the leach pad. The HCl leach method under-predicted the sulphate content for contaminated soils and berm samples, indicating the presence of some insoluble sulphate salts. Sulphate content from both methods were similar for crush rock and leached ore samples.

Figure 5: Sulphate (HCl Leach) Concentrations Compared to Total Sulphur

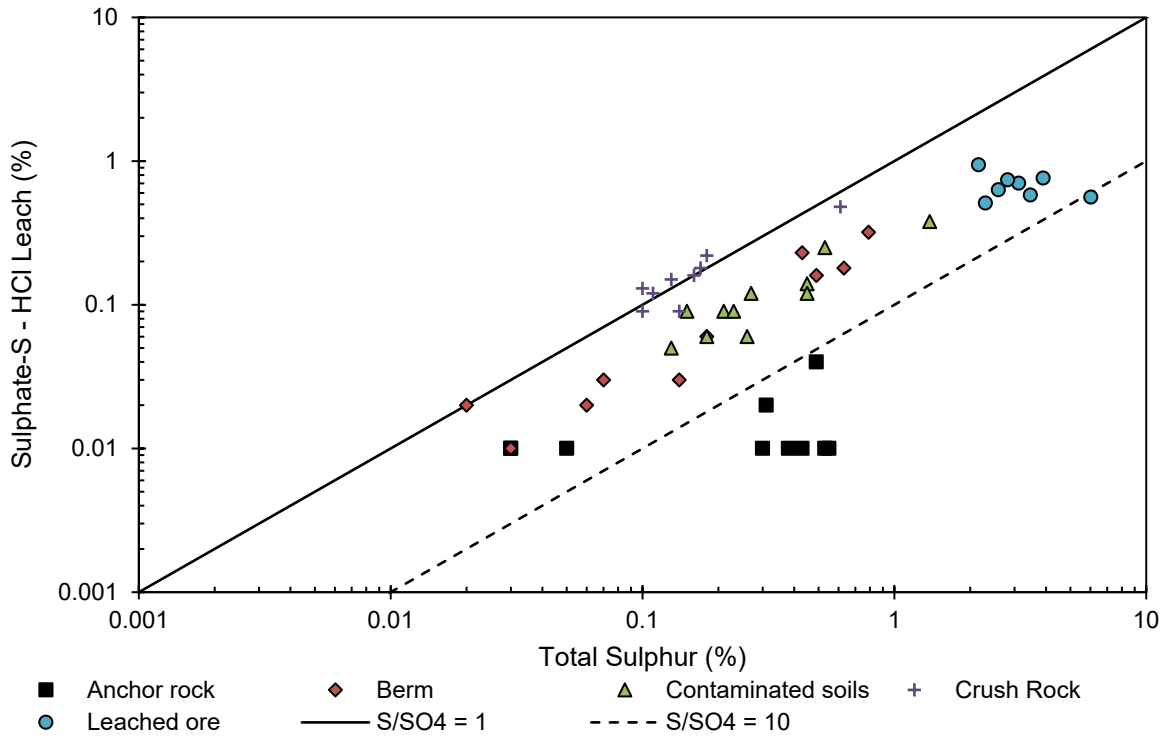

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Figure 6: Comparison of Sulphate Content by HCl Leach Versus Pyrolysis

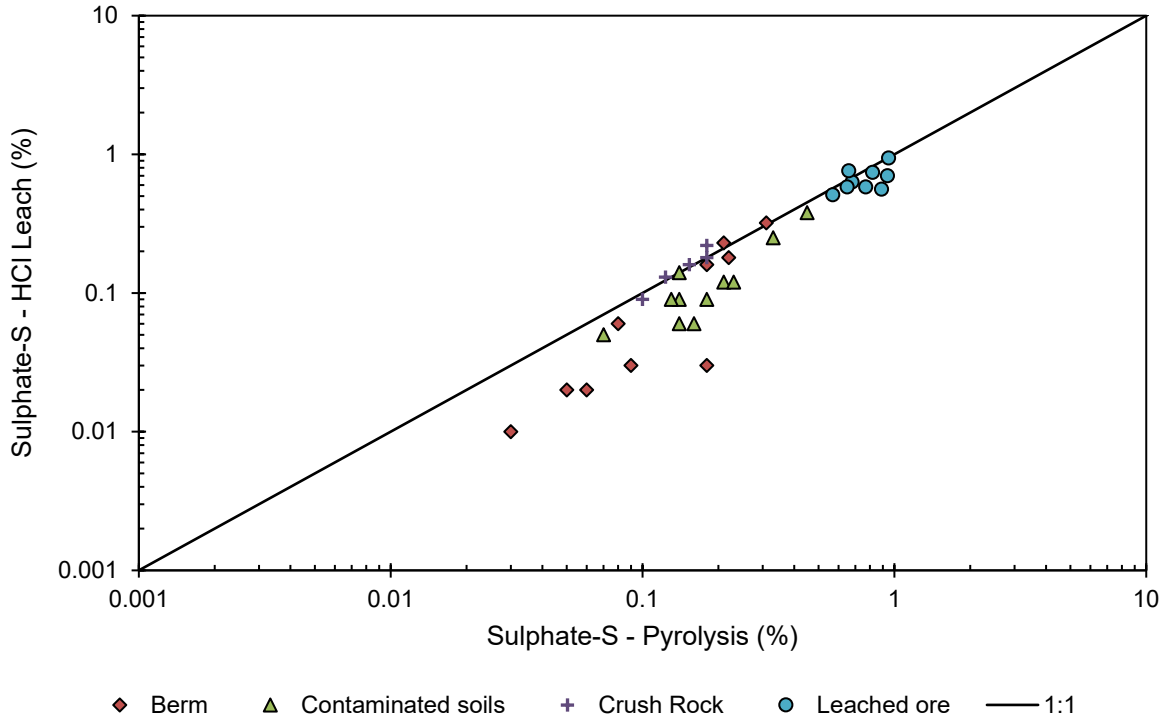

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Neutralization Potential

Results show that for all materials that carbonates were detected, TIC was lower than Mod Sobek NP (Figure 7), indicating the presence of minerals other than carbonates that provide some neutralization (e.g., silicates). TIC was therefore used in subsequent calculations for classification of ARD potential.

Figure 7: Total Inorganic Carbon Compared to Modified Sobek Neutralization Potential

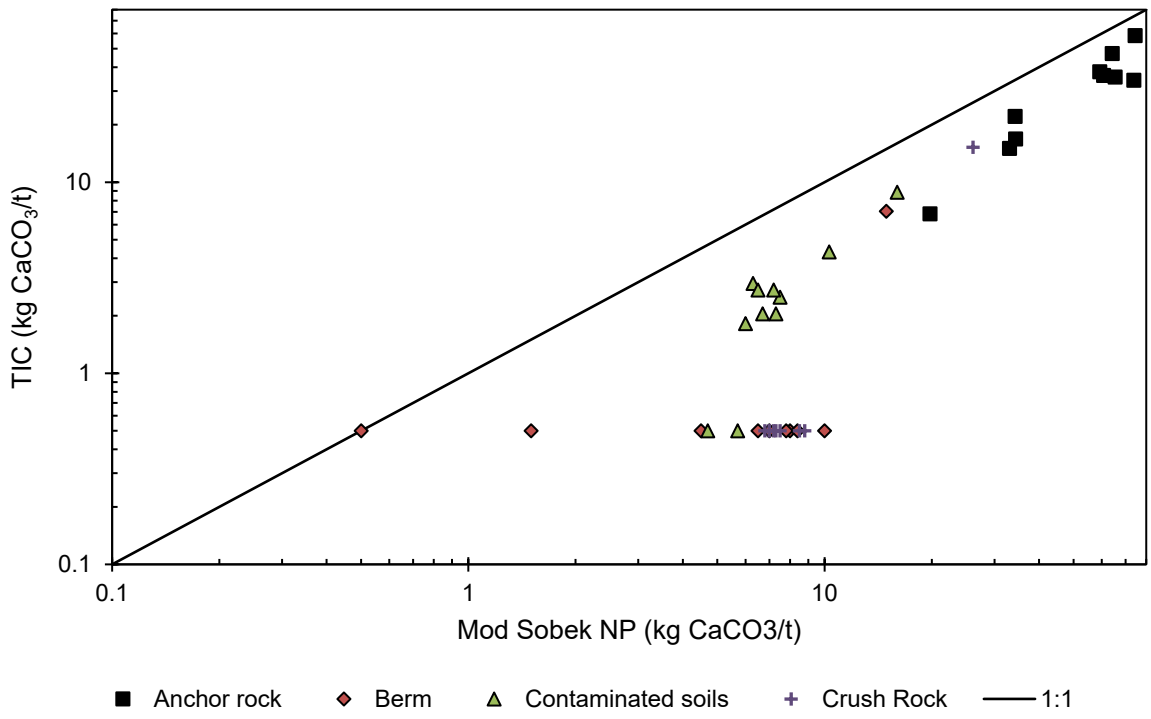

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Acid Rock Drainage Potential

Calculated NP/AP ratios indicate future potential for ARD if sulphides oxidize through exposure to atmospheric oxygen. As discussed above, TIC was compared to AP represented by acid potential measured from the sulphide content of the sample (Figure 8).

Figure 8: Carbonate NP/AP of Materials on Heap Leach Pad

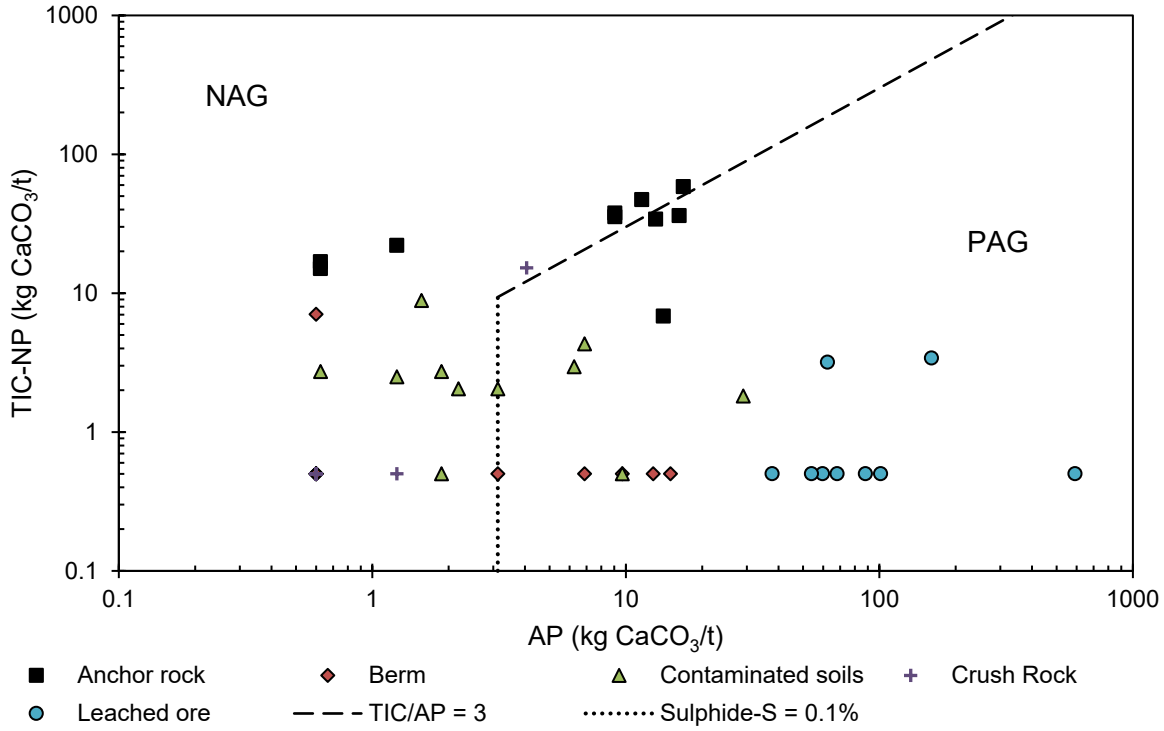

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

5.2.2 Assessment of Current Metal Leaching and Acid Rock Drainage

Leachable metal concentrations of all materials were pH-controlled (Figure 9). Elemental sulphur had the highest leachable iron concentrations and had similar leachable aluminum concentrations to leached ore. Although elemental sulphur had the lowest leachate pH of all materials tested, it did not have the highest leachable concentrations of other trace elements (e.g., cobalt, copper, nickel, etc.). This is likely because the elemental sulphur is mostly sulphur while other materials contain higher solid content of these trace elements. For example, leached ore had the highest leachable copper content while the contaminated soils had the highest leachable zinc concentrations.

Figure 9: Leachable Element Concentrations versus pH

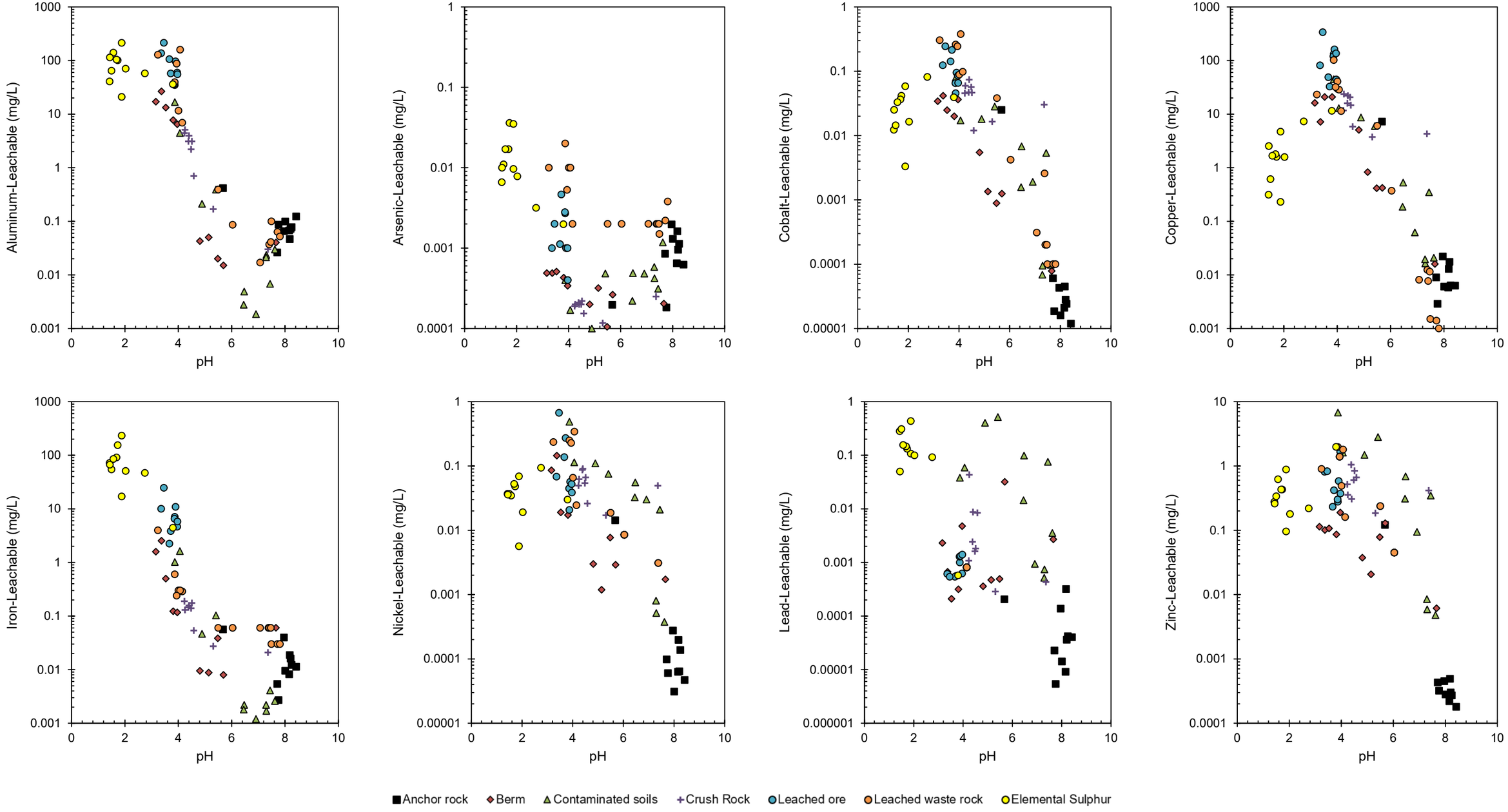

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

5.2.3 Leached Waste Rock from Beneath Sulphur Stockpile

Material that was previously underneath the sulphur stockpile was well characterized, as documented in Litke (2019) and Litke et al. (2019). No additional static testwork of this material was recommended in 2021. Leached waste rock is currently stored on the southwest corner of the leach pad, surrounded by contaminated soils. Table 6 provides distribution statistics (minimum, 5th percentile, 25th percentile, median, 75th percentile, 95th percentile, and maximum) for acid base accounting (ABA) parameters and selected elemental concentrations. Table 7 provides distribution statistics for selected leachable constituents.

Litke et al. (2019) and Litke (2019) showed pH-controlled weathering fronts developed in the material underneath the sulphur stockpile. Acidification was observed at one sampling profile location, but the amount and degree to which the waste rock was acidified was variable underneath the sulphur stockpile. Jarosite was observed at this location, which typically forms under acidic conditions and needs iron. This is possibly an indication that the acid generated from the sulphur pile was interacting with the waste rock underneath and was contributing to accelerated weathering of this rock. Carbonate depletion was apparent at all locations, but excess carbonate to maintain neutral pH was observed at some sampling locations below the sulphur stockpile. The leached waste rock was NAG based on sulphide content or AP calculated from sulphide and NP from remaining carbonate (Table 6). Sulphur prills were observed interspersed in the material.

Because of the wide range of leachate pH in the leached waste rock samples (ranging from 3.2 to 7.8), leachable metal concentrations varied (Table 7). The acidic conditions are currently resulting in accelerated metal leaching (Figure 9).

5.2.4 Leached Ore

Leached ore is currently stored on the leach pad, beneath the elemental sulphur. The majority of the leached ore is stored on the southwest end of the leach pad, beneath the elemental sulphur. Table 8 provides distribution statistics for ABA parameters and selected elemental concentrations. Table 9 provides distribution statistics for selected leachable constituents.

Data from samples collected prior to 2021 were not included because they were collected before the elemental sulphur was moved for storage on the leach pad in 2018/2019. Results were not consistent with current data because the storage conditions had changed and altered the material. A previous study by Henry (2009) showed precipitation of copper sulphide minerals was occurring in water-saturated and anaerobic microenvironments in the leach pad. This is also reflected in the higher sulphide content in the leached ore compared to other rock at Mount Polley.

Sulphur prills were observed mixed with the leached ore on the heap leach pad and results indicate carbonates are depleted and the material is classified as PAG. Acidification is evident in all samples, where the paste pH ranges from 3.6 to 4.3. All leached ore samples had leachable acidity and associated metal concentrations (Figure 9).

Table 6: Selected ABA and Elemental Results for Leached Waste Rock Beneath the Elemental Sulphur Stockpile

Statistics	ABA											Aqua Regia Digestible Elements						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis[1] (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^{02} (%)	Mod Sobek NP[1] (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
n	15	15	15	12	0	12	12	0	12	12	-	15	15	15	15	15	15	15
Min	6.3	<0.05	<0.5	0.2	-	0.04	<0.02	-	<0.6	<0.1	Acidic, NAG	8.6	<0.10	**940**	3.2	2.8	**0.8**	34
P5	6.5	<0.05	<0.5	0.21	-	0.068	<0.02	-	0.64	<0.1	Acidic, NAG	9.7	<0.10	**1000**	3.6	2.9	**0.87**	35
P25	7.0	0.06	3.7	0.33	-	0.18	0.062	-	1.9	0.65	Acidic, NAG	12	0.12	**1100**	4.1	3.4	**1.2**	38
P50	7.5	0.14	11	0.46	-	0.25	0.1	-	3.1	3.6	NAG	13	0.14	**1300**	4.6	3.8	**1.3**	42
Average	7.6	0.22	18	0.55	-	0.43	0.15	-	4.5	3.9	NAG	13	0.16	**1600**	4.8	4.3	**1.5**	43
P75	8	0.3	24	0.74	-	0.71	0.24	-	7.5	5.4	NAG	15	0.18	**1900**	5.2	5.2	**1.5**	47
P95	8.8	0.64	53	1.0	-	1.0	0.31	-	9.5	31	NAG	17	0.26	**3200**	6.4	6.7	**2.9**	57
Max	8.9	0.8	66	1.1	-	1.1	0.32	-	10	60	NAG	18	0.29	**3500**	7.0	6.8	**4.9**	60

Sources: Litke (2019)

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

[3] Analyses not performed on any samples

[4] Calculated from the difference of total sulphur and sulphate sulphur (HCl leach)

Table 7: Selected SFE Leachate Results for Leached Waste Rock

Statistics	SFE - Leachable														
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	15	0	15	0	15	15	15	15	15	15	15	15	15	15	15
Min	3.2	-	53	-	<2.0	0.01	0.0015	<0.000050	<0.00010	<0.0010	<0.030	<0.0005	<0.00010	0.001	<0.010
P5	3.7	-	91	-	<2.0	0.015	0.0019	0.000085	<0.00010	0.0013	<0.030	<0.0005	<0.00010	0.0014	<0.010
P25	4.0	-	1,000	-	<2.0	0.047	0.002	0.00010	0.0002	0.0079	<0.060	<0.0010	<0.00020	0.0023	<0.020
P50	6.0	-	1,700	-	<2.0	0.1	0.002	0.0037	0.0042	0.37	<0.060	0.0085	<0.00020	0.005	0.045
Average	5.8	-	1,500	-	12	29	0.0051	0.0048	0.095	16	0.41	0.079	0.00052	0.005	0.47
P75	7.4	-	1,900	-	21	26	0.0077	0.0070	0.17	26	0.29	0.15	0.00091	0.0072	0.7
P95	7.7	-	2,600	-	29	140	0.013	0.014	0.33	59	1.6	0.28	0.0013	0.01	1.9
Max	7.8	-	2,600	-	30	160	0.02	0.025	0.38	100	4.0	0.34	0.0020	0.01	2.0

Sources: Litke (2019)

Table 8: Selected ABA and Element Concentrations for Leached Ore

Statistics	ABA											Aqua Regia Metals						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^0 (%)	Modified Sobek NP (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
n	8	8	8	8	8	8	8	8	8	8	-	8	8	7[1]	8	8	8	8
Min	3.6	0.03	<0.5	2.2	0.57	0.51	1.2	-4.5	38	0	Acidic, PAG	5.9	0.08	**2200**	4.1	3.5	0.4	32
P5	3.6	0.03	<0.5	2.2	0.6	0.53	1.4	-4.3	44	0	Acidic, PAG	6.0	0.084	**2300**	4.2	3.5	0.47	34
P25	3.7	0.04	<0.5	2.5	0.66	0.58	1.9	-3.4	58	0	Acidic, PAG	7.4	0.09	**2400**	4.6	3.7	**0.75**	39
P50	3.9	0.05	<0.5	3.0	0.75	0.67	2.1	-0.25	65	0	Acidic, PAG	8.9	0.10	**3300**	4.9	4.1	**0.90**	46
Average	3.9	0.05	<0.5	3.3	0.77	0.68	2.5	-0.19	79	0	Acidic, PAG	8.7	0.17	**3300**	5	5.1	**1.1**	48
P75	4.0	0.05	<0.5	3.6	0.9	0.75	2.9	1.9	91	<0.1	Acidic, PAG	10	0.16	**3500**	5.4	4.3	**1.1**	50
P95	4.3	0.06	3.3	5.3	0.95	0.88	4.5	4.9	140	<0.1	Acidic, PAG	11	0.42	**5000**	6.1	9.9	**2.5**	70
Max	4.3	0.07	3.4	6.0	0.95	0.94	5.1	5.0	160	<0.1	Acidic, PAG	12	0.49	**5600**	6.1	13	**3.0**	80

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

[1] TP-12-2M was >10,000 mg/kg copper and was not included in the statistical calculations

Table 9: Selected SFE Leachate Results for Leached Ore

Statistics	SFE - Leachable													
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Min	3.4	2,500	1,700	420	35	0.0004	0.003	0.045	33	2.2	5.2	0.00054	0.00071	0.23
P5	3.4	2,600	1,800	420	35	0.00061	0.0036	0.052	37	2.8	5.3	0.00054	0.00074	0.25
P25	3.6	2,700	1,900	430	51	0.001	0.005	0.066	48	5.3	5.6	0.00055	0.0008	0.3
P50	3.8	2,900	2,200	590	77	0.0016	0.0054	0.11	100	6.8	9.0	0.00081	0.002	0.4
Average	3.7	3,100	2,500	760	92	0.002	0.0085	0.12	120	8.9	20	0.00091	0.0018	0.48
P75	3.9	3,200	2,800	890	110	0.0027	0.008	0.16	140	10	26	0.0013	0.002	0.64
P95	3.9	3,900	3,700	1500	190	0.004	0.021	0.23	280	20	57	0.0014	0.0033	0.82
Max	4.0	4,200	4,100	1800	210	0.0046	0.027	0.24	340	25	65	0.0014	0.004	0.83

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

5.2.5 Crush Rock

Crush rock is currently stored on the leach pad, some beneath the contaminated soils and leached waste rock. This was previously classified as leached ore in SRK (2021), but upon receipt of results, this material was more similar to leached waste rock than leached ore, based on copper concentrations, but was more acidified than leached waste rock.

Table 10 provides distribution statistics for ABA parameters and selected elemental concentrations for the crush rock material. This material contains low sulphide (all samples < 0.13 %) and the majority of sulphur occurs as sulphate, most likely from sulphate precipitates. Table 11 provides distribution statistics for selected leachable constituents. Leachate pH ranged from 4.2 to 7.4 (median = 4.5), indicating leachable acidity and associated metal concentrations.

5.3 Metal-Contaminated Soils

Metal-contaminated soils are currently stored on top of the leached ore on the northeast end of the leach pad. Some samples of the contaminated soils were collected and tested before the material was brought to Mount Polley Mine and placed on the heap leach pad. This material was sourced from various soil clean-up sites and no sampling of placed material occurred during initial placement. The sampling and testing methods were not provided, and the data were not able to be related with the remaining material on the leach pad.

Table 12 provides distribution statistics for ABA parameters and selected elemental concentrations for the contaminated soils collected during the 2021 Characterization Program. Table 13 provides distribution statistics for selected leachable constituents. Because of the wide range of leachate pH in the contaminated soils samples (ranging from 4.2 to 7.4), leachable metal concentrations varied (Figure 9). Leachable lead and zinc concentrations were highest in the contaminated soils.

Table 10: Selected ABA and Elemental Results for Crush Rock

Statistics	ABA											Aqua Regia Metals						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^0 (%)	Mod Sobek NP (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
n	9	9	9[1]	9	5	9	9[2]	9	9	1	-	9	9	9	9	9	9	9
Min	4.6	0.03	<0.5	0.10	0.10	0.09	<0.02	6.8	0.6	-	Acidic, NAG	9.9	0.11	**1300**	5.3	5	**0.7**	48
P5	4.6	0.03	-	0.10	0.10	0.09	<0.02	6.9	0.6	-	Acidic, NAG	10	0.12	**1400**	5.3	5.4	**0.74**	51
P25	4.7	0.03	-	0.11	0.12	0.12	<0.02	7.0	0.6	-	Acidic, NAG	10	0.13	**1800**	5.6	9.1	**0.9**	58
P50	5.2	0.04	-	0.14	0.15	0.15	<0.02	7.3	0.6	-	Acidic, NAG	11	0.16	**2400**	5.9	11	**1.0**	59
Average	5.3	0.064	-	0.19	0.15	0.18	0.034	9.6	1.1	-	Acidic, NAG	12	0.17	**2200**	5.9	13	**1.1**	61
P75	5.6	0.05	-	0.17	0.18	0.18	<0.02	8.5	0.6	-	Acidic, NAG	14	0.18	**2700**	6.1	14	**1.1**	62
P95	6.2	0.18	-	0.44	0.18	0.38	0.094	19	2.9	-	NAG	15	0.29	**2800**	6.5	28	**1.5**	77
Max	6.5	0.25	15	0.61	0.18	0.48	0.13	26	4.1	3.7	NAG	16	0.35	**2800**	6.7	36	**1.7**	84

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

[1] All samples were <DL except one (reported as maximum)

[2] Calculated using S_{HCl} (n=9) instead of S_{Pyro} (n=5)

Table 11: Selected SFE Leachate Results for Crush Rock

Statistics	SFE - Leachable														
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	9	9	9	9	9[1]	9	9	9	9	9	9	9	9	9	9
Min	4.2	1,100	560	17	<0.5	0.03	0.00012	0.0015	0.012	3.8	0.021	0.017	0.00029	0.00034	0.19
P5	4.2	1,100	600	19	-	0.086	0.00013	0.0018	0.014	4.0	0.024	0.021	0.00034	0.00037	0.23
P25	4.4	1,300	760	28	-	0.7	0.00019	0.0030	0.03	5.9	0.054	0.050	0.0011	0.00049	0.36
P50	4.5	1,500	910	59	-	3.1	0.00020	0.0034	0.047	15	0.14	0.054	0.0018	0.00056	0.52
Average	4.8	1,600	970	52	-	2.5	0.00019	0.0035	0.043	14	0.12	0.056	0.0076	0.00062	0.55
P75	4.6	1,500	930	60	-	4.0	0.00021	0.004	0.057	21	0.16	0.066	0.0084	0.00064	0.66
P95	6.5	2,300	1,500	83	-	4.8	0.00024	0.0055	0.068	23	0.18	0.089	0.029	0.001	0.97
Max	7.4	2,300	1,600	83	38	5.1	0.00025	0.0063	0.074	24	0.19	0.091	0.043	0.0013	1.1

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes:

[1] All samples were <DL except one (reported as maximum)

Table 12: Selected ABA and Element Concentrations for Metal-Contaminated Soils

Statistics	ABA											Aqua Regia Metals						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^0 (%)	Modified Sobek NP (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
n	11	11	11	11	11	11	11	11	11	9	-	11	11	11	11	11	11	11
Min	5.6	0.23	<0.5	0.13	0.07	0.05	0.02	4.7	0.63	<0.1	Acidic, NAG	4.4	0.28	**580**	2.3	**210**	0.3	87
P5	5.7	0.26	<0.5	0.14	0.1	0.055	0.03	5.2	0.94	0.20	Acidic, NAG	4.9	0.36	**740**	2.4	**240**	0.35	97
P25	6.2	0.31	1.9	0.2	0.14	0.075	0.055	6.2	1.7	0.63	Acidic, NAG	7.6	0.49	**1300**	2.6	**390**	**0.7**	150
P50	7.0	0.43	2.5	0.26	0.16	0.09	0.07	6.7	2.2	0.94	NAG	10	0.83	**1800**	2.6	**700**	**1.0**	200
Average	6.8	0.41	2.8	0.39	0.2	0.13	0.19	7.7	5.9	0.1	PAG	9.8	0.79	**1700**	2.9	**770**	**0.93**	200
P75	7.5	0.47	2.8	0.45	0.22	0.13	0.21	7.4	6.6	2.0	PAG	12	0.94	**2000**	3.1	**1100**	**1.1**	240
P95	7.7	0.60	6.6	0.96	0.39	0.32	0.62	13	19	5.1	NAG	14	1.4	**2600**	3.7	**1400**	**1.6**	280
Max	7.8	0.69	8.9	1.4	0.45	0.38	0.93	16	29	5.7	NAG	15	1.5	**2800**	4.1	**1500**	**1.9**	280

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

Table 13: Selected SFE Leachate Results for Metal-Contaminated Soils

Statistics	SFE - Leachable														
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Min	3.9	470	210	2.3	<0.5	0.0019	0.0001	0.00029	0.000069	0.016	0.0012	0.00038	0.00052	0.0002	0.0048
P5	4.0	480	220	2.4	<0.5	0.0023	0.00014	0.00031	0.000082	0.018	0.0015	0.00045	0.00063	0.00021	0.0054
P25	5.2	570	260	3.1	<0.5	0.0059	0.00027	0.00088	0.00084	0.042	0.002	0.011	0.0022	0.00045	0.052
P50	6.5	840	490	7.7	1.6	0.024	0.00042	0.0037	0.0054	0.35	0.0026	0.033	0.038	0.00073	0.35
Average	6.2	890	490	32	5.9	2.0	0.00044	0.0072	0.014	6.7	0.26	0.084	0.11	0.00071	1.3
P75	7.3	1,000	560	28	8.0	0.3	0.00049	0.0082	0.018	7.3	0.075	0.093	0.087	0.0009	1.6
P95	7.5	1,600	960	130	20	11	0.00088	0.023	0.054	29	1.3	0.3	0.46	0.0013	4.8
Max	7.6	1,800	1,100	200	23	17	0.0012	0.024	0.08	45	1.6	0.49	0.52	0.0016	6.8

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

5.4 Construction Materials

5.4.1 Anchor Rock

This material was waste rock sourced from pits and is possibly similar to other NAG waste rock from Mount Polley. Anchor rock is currently stored outside the main footprint of the leach pad. Table 14 provides distribution statistics for ABA parameters and selected elemental concentrations for anchor rock. Table 15 provides distribution statistics for selected leachable constituents.

Anchor rock is mostly NAG with some PAG components, due to low sulphide content and the presence of carbonates. No acidification was identified. Samples collected near the contaminated soils storage location had higher Pb and Zn content, while samples collected near the elemental sulphur load out contained higher AP and lower leachate pH, indicating some contamination with other materials stored on the leach pad.

5.4.2 Berm Materials

This material was waste rock sourced from pits but is currently stored inside the footprint of the leach pad. It is contaminated with leachate and dust from elemental sulphur. Table 16 provides distribution statistics for ABA parameters and selected elemental concentrations for the berm materials. Table 17 provides distribution statistics for selected leachable constituents.

Berm materials were PAG with some components classified as NAG due to low sulphide content. Carbonates were depleted and acidification was evident for the majority of the material. Higher Pb and Zn content was observed in samples collected near the contaminated soils storage location on the leach pad, indicating some contamination with this material.

Table 14: Selected ABA and Element Concentrations for Anchor Rock

Statistics	ABA											Aqua Regia Metals						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis[1] (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^0 (%)	Modified Sobek NP (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
	10	10	10	10	0	10	10	10	10	10	-	10	10	10	10	10	10	10
Min	8.0	0.22	6.8	0.03	-	<0.01	0.03	20	0.63	0.48	NAG	6.5	0.14	270	3.2	5.9	0.2	56
P5	8.1	0.29	11	0.03	-	<0.01	0.03	26	0.63	1.3	NAG	6.8	0.16	**350**	3.3	6.4	0.2	57
P25	8.2	0.46	18	0.11	-	<0.01	0.10	34	3.2	2.8	PAG	8.0	0.19	**520**	3.6	7.2	0.23	60
P50	8.3	0.68	35	0.35	-	<0.01	0.33	60	10	4.0	NAG	12	0.27	**580**	3.7	9.0	**0.65**	70
Average	8.3	0.62	31	0.31	-	0.014	0.30	52	9.3	3.3	NAG	11	0.30	**740**	3.8	10	**0.71**	75
P75	8.3	0.77	37	0.48	-	0.01	0.44	65	14	14	NAG	13	0.40	**820**	4.0	11	**0.78**	89
P95	8.5	0.90	53	0.54	-	0.031	0.53	74	17	26	NAG	16	0.49	**1500**	4.4	18	**1.7**	100
Max	8.5	0.92	58	0.55	-	0.04	0.54	75	17	27	NAG	17	0.53	**1700**	4.5	22	**2.1**	100

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

[1] Analysis not performed on anchor rock

Table 15: Selected SFE Leachate Results for Anchor Rock

Statistics	SFE - Leachable														
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10
Min	5.7	110	12	<0.5	1.5	0.026	0.00018	0.0000075	0.000012	0.0029	0.0027	0.000031	0.0000054	0.00018	0.00018
P5	6.6	120	19	<0.5	11	0.035	0.00019	0.0000077	0.000014	0.0042	0.0039	0.000038	0.0000071	0.00023	0.00020
P25	7.8	160	44	<0.5	24	0.066	0.00063	0.0000088	0.000019	0.0061	0.0085	0.000061	0.000016	0.00048	0.00027
P50	8.1	160	51	<0.5	29	0.075	0.00090	0.000012	0.000026	0.0077	0.012	0.000081	0.000038	0.00066	0.00031
Average	7.8	240	86	3.7	27	0.11	0.00095	0.00022	0.0025	0.73	0.018	0.0015	0.000083	0.0007	0.012
P75	8.2	270	100	1.2	35	0.096	0.0013	0.000016	0.000044	0.016	0.018	0.00018	0.00011	0.001	0.00045
P95	8.3	550	240	17	39	0.28	0.0018	0.0012	0.014	4.0	0.049	0.0080	0.00027	0.0011	0.067
Max	8.4	750	340	29	41	0.42	0.0020	0.0019	0.025	7.3	0.056	0.014	0.00032	0.0012	0.12

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Table 16: Selected ABA and Element Concentrations for Berm Materials

Statistics	ABA											Aqua Regia Metals						
	Paste pH	Total Carbon (%)	Total Inorganic Carbon (kg $CaCO_3$/t)	Total Sulphur (%)	SO_4-S Pyrolysis (%)	SO_4-S HCl Leach (%)	Sulphide-S + S^0 (%)	Modified Sobek NP (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	TIC/AP	Classification	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Fe (%)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
n	10	10	10[1]	10	10	10	10	10	10	10[1]	-	10	10	10	10	10	10	10
Min	4.0	0.030	<0.5	<0.02	0.03	<0.01	<0.02	0.5	<0.6	<0.1	Acidic, NAG	9.4	0.06	**1100**	4.8	3.7	**0.6**	36
P5	4.1	0.035	-	0.03	0.04	0.015	<0.02	0.95	<0.6	-	Acidic, NAG	9.4	0.065	**1100**	4.9	4.0	**0.74**	37
P25	4.9	0.043	-	0.06	0.07	0.023	<0.02	5.0	<0.6	-	Acidic, NAG	9.7	0.09	**1600**	5.5	4.8	**0.9**	44
P50	6.2	0.06	-	0.16	0.14	0.045	0.06	7.4	1.9	-	Acidic, NAG	10	0.095	**2000**	5.6	5.5	**1.0**	49
Average	6.0	0.11	-	0.28	0.14	0.11	0.16	6.9	5.1	-	Acidic, PAG	10	0.18	**1900**	5.6	66	**1.0**	82
P75	6.8	0.093	-	0.48	0.2	0.18	0.29	8.3	9.0	-	Acidic, PAG	11	0.22	**2100**	5.8	45	**1.2**	83
P95	7.5	0.34	-	0.72	0.27	0.28	0.45	13	14	-	PAG	11	0.47	**2700**	6.0	**300**	**1.3**	210
Max	7.7	0.46	7.0	0.79	0.31	0.32	0.48	15	15	12	NAG	11	0.60	**2800**	6.0	**430**	**1.3**	230

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes: **Bolded** values indicate concentrations are greater than 10x crustal abundance

[1] All samples were <DL except one (reported as maximum)

Table 17: Selected SFE Leachate Results for Berm Materials

Statistics	SFE - Leachable														
	pH	EC (µS/cm)	SO_4 (mg/L)	Total Acidity as $CaCO_3$ (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Zn (mg/L)
n	10	10	10	10	9[1]	10	10	10	10	10	10	10	10	10	10
Min	3.2	27	10	<2.0	<0.5	0.015	0.00011	0.000061	0.000079	0.016	0.008	0.0012	0.00021	0.00011	0.0061
P5	3.3	37	13	<2.0	-	0.017	0.00015	0.000073	0.00044	0.20	0.0084	0.0014	0.00026	0.00016	0.013
P25	3.6	83	20	2.6	-	0.041	0.00022	0.00026	0.0013	0.52	0.017	0.0029	0.00039	0.00032	0.048
P50	4.4	890	510	60	-	3.3	0.00033	0.00072	0.013	6.1	0.089	0.013	0.00058	0.00051	0.094
Average	4.7	1,100	640	78	-	7.1	0.00034	0.00078	0.017	10	0.5	0.034	0.0044	0.00048	0.087
P75	5.4	2,000	1,200	140	-	12	0.00048	0.001	0.032	20	0.41	0.044	0.0026	0.00066	0.11
P95	6.8	2,400	1,500	200	-	22	0.0005	0.0018	0.039	26	2.1	0.12	0.02	0.00078	0.16
Max	7.7	2,600	1,600	210	29	27	0.00051	0.0021	0.042	30	2.5	0.15	0.032	0.00086	0.19

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes:

[1] All samples were <DL except one (reported as maximum)

5.4.3 Drainage Material and Compacted Till Liner

No geochemical data exists for this material and sampling of these materials will not be possible until decommissioning. The amount of drainage material and till is small in proportion to other materials, so sampling and analysis is for inventory development and estimating potential amendments. It is also unknown if acidic drainage broke through the till liner, resulting in contamination of the flow path underneath the facility.

A sampling and testing plan to characterize this material as the facility is decommissioned and determine if treatment of the flow path beneath the facility is required is provided in Section 6.6.

6 Material Management

6.1 Overview

Table 18 summarizes the ML/ARD current conditions and potential of each material stored on the leach pad.

Table 18: ML/ARD Current Conditions and Potential of Materials Stored on Leach Pad

Material	ARD Potential[1]	ML Potential[2]	Current ML/ARD Conditions[3]	Rinse pH		Comments
				Min	Max	
Elemental Sulphur	High	Medium Cu	High	1.4	3.8	■ Generates sulphuric acid when oxidized ■ Immediately available acidity and soluble metals
Leached Waste Rock	Low	High Cu, Se	Medium	3.2	7.8	■ Some sulphides present ■ Carbonates depleted ■ Immediately available acidity and soluble metals
Leached Ore	High	High Cu, Se	High	3.4	4.0	■ Some sulphides present ■ Carbonates depleted ■ Immediately available acidity and soluble metals
Crush Rock	Low	High Cu, Se	High	4.2	7.4	■ Low sulphide concentrations (P75 < 0.02 %) ■ Carbonates depleted ■ Immediately available acidity and soluble metals
Contaminated Soils	Med	High Cu, Pb, Se	Medium	3.9	7.6	■ Sulphide concentrations range from < 0.02 - 0.9 % ■ Some carbonates depleted ■ Immediately available acidity and soluble metals
Berm Materials	Med	High Cu, Se	High	3.2	7.7	■ Sulphide concentrations range from < 0.02 - 0.5 % ■ Some carbonates depleted ■ Immediately available acidity and soluble metals
Anchor Rock	Low	High Cu, Se	Low	5.7	8.4	■ Sulphide concentrations range from < 0.02 - 0.5 % ■ Carbonates still present ■ ML potential similar to other NAG waste rock at Mount Polley

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task300_Material_Testing_Program\SubTask330_DataInterpretation\Leach_Decom_Compiled_data_1CM017.010_Rev01_NK_SJL.xlsx

Notes:

[1] Low = no PAG components, Medium = some PAG components, High = > P50 PAG components.

[2] Low = no ML components, Medium = some ML components, High = > P50 ML components.

[3] Low = no acidic components, Medium = some acidic components, High = > P50 acidic components.

6.2 Disposal Options

A virtual options analysis workshop was conducted on October 8, 2021, with Mount Polley Mine personnel and SRK geochemists in attendance. Potential disposal options were discussed based on short- and long-term impacts (Table 19). Time and cost for each disposal option were also considered.

Table 19: Impacts and Considerations for Disposal Options

Impacts and Considerations	Disposal Options		
	Transport and dispose materials off-site	Store on surface in existing facility	Submergence in TSF
Short-Term Impacts	■ Immediate removal of material	■ Continual release of acidity and associated metals ■ Can be managed in the short-term by addition of neutralization amendments	■ Initial flush of soluble acidity and associated metals ■ TSF is largest water reservoir on-site ■ Can be managed by addition of neutralization amendments
Long-Term Impacts	■ Moves long-term risk off-site	■ Continual release of acidity and associated metals ■ May require a cover for material with high ML/ARD potential (high long-term care and maintenance)	■ Disposal underwater can be expected to arrest oxidation, providing a long-term solution for material with high ML/ARD potential ■ Material in TSF will remain submerged into closure ■ Long-term sulphate leaching
Time Consideration	■ Materials can be transported off-site immediately ■ Fastest option	■ Materials can be amended and stored at the same time	■ Materials need to be added gradually due to initial flush ■ Slowest and most time-consuming option
Cost Consideration	■ Most expensive	■ Starts low, but costs will increase depending on required amendments and potential need for cover	■ Costs from material transport to TSF and other logistical considerations ■ Possible long-term sulphate treatment

Sources: Compiled in text

The potential disposal options by material are summarized in Table 20. Considerations for each material were as follows:

- Only materials that were not sourced from site were considered for transport and management off-site.
- Materials that had low ARD potential, similar ML potential to Mount Polley NAG waste rock, and low to medium current ML/ARD conditions were considered for amendments and storing on surface.
- Submergence in TSF will achieve objective of isolating material from atmospheric oxygen and effectively prevent further oxidation and generation of sulphuric acid from elemental sulphur prills and remaining sulphides. This was the best disposal option for materials with medium to high ML/ARD potential, but all materials can be disposed with this option. However, this would result in

a source of $CaSO_4$ that may result in long-term sulphate leaching perhaps leading to long-term sulphate treatment.

Table 20: Disposal Options by Material

Material	Disposal Options		
	Transport and dispose materials off-site	Amend and store on surface	Submergence in TSF
Elemental Sulphur	✓	×	✓
Leached Waste Rock	×	×	✓
Leached Ore	×	×	✓
Crush Rock	×	×	✓
Contaminated Soils	✓	×	✓
Berm Materials	×	×	✓
Anchor Rock	×	✓	✓

Sources: Compiled in text

Notes: ✓ - Material considered for disposal option; × - Material not considered for disposal option

6.3 Selected Disposal Options

Based on the material characterization, and time and cost considerations described above, submergence of elemental sulphur, leached waste rock, leached ore, crush rock, contaminated soils, and berm materials in the TSF was selected as the disposal option.

The disposal option selected for anchor rock was amend (if required) and store on surface.

6.4 Scheduling and Disposal Considerations

Disposal underwater can be expected to arrest oxidation but will rapidly leach the soluble acidity. The acidity may be neutralized by contact with tailings or could be amended with lime during disposal.

As described in Table 19, submergence in the TSF was the most time-consuming option considered. Therefore, this option drives scheduling considerations. To allow for a cover of tailings over disposed materials in the TSF and sufficient blending with neutralizing amendments, disposal should be started during operations and completed before the last year of processing.

6.5 Effects on TSF Water Quality

6.5.1 Background

“Source terms” refer to predicted concentrations for waters in contact with geologically-sourced waste and surfaces under the expected disposal or exposure conditions at the site. These predictions

become inputs (or terms) which can be used to evaluate the influence of material disposal into the TSF on the water chemistry in the TSF.

Predicted loads from each material during submergence were calculated to estimate the influence of material disposal on the water chemistry in the TSF. All source terms are considered upper limit estimates.

6.5.2 Conceptual Model

Materials excavated from the heap leach pad are deposited into the ponded area of the TSF. Mixing of different materials from the leach pad was not considered.

All materials have undergone prior oxidation resulting in accumulation of potentially soluble weathering products. In most cases, these are expected to be sulphates which might include sulphuric acid (in the case of elemental sulphur), iron, and other metal sulphates (acidic wastes such as contaminated soil) or gypsum (non-acidic rock). For non-acidic rock, oxidation products may include oxides and carbonates.

Upon contact with the water in the TSF, the soluble load will be flushed until solubility limits are reached and will react with the pond water and existing tailings. In general, these processes can be expected to result in neutralization of acidity resulting in precipitation of sulphates, oxides, and hydroxides. Leached sulphuric acid can be expected to be neutralized leading to precipitation of gypsum. Metal in metal sulphates will be hydrolyzed to form oxides and hydroxides. As submergence occurs, residual soluble solids will continue to dissolve as pore waters are displaced and replaced by diluted water. For example, gypsum will likely continue to dissolve adding sulphate to pore waters. Under the expected non-acidic conditions, oxides and hydroxides should be stable unless reducing conditions develop allowing reductive dissolution of iron oxyhydroxides.

Submergence will also essentially arrest oxidation of elemental sulphur and sulphide-containing wastes. The rate of oxidation under these conditions will depend on the availability of oxygen dissolved in water.

6.5.3 Approach

To evaluate the influence of the disposal of each material into the TSF, two scenarios were considered (Table 21).

Table 21: Summary of Disposal Scenarios Considered for Calculation Loadings in the TSF

Scenario	Description
1	The entire stockpile of each material is disposed into the ponded area of the TSF all at once. This scenario represents an upper limit estimate of potential water quality changes in the TSF and did not consider the addition of neutralizing amendments.
2	One truck per day of a material is disposed into the ponded area of the TSF. This scenario represents an estimate of potential water quality changes in the TSF based on a more likely loading rate during disposal. A lime addition rate per truckload was also calculated for this scenario (see Section 6.5.6).

Sources: Compiled in text

The approach and assumptions used to calculate loadings to the TSF during submergence were as follows:

- Mixing of different materials from the leach pad was not considered.
- Calculate a conservative water to solid ratio:
  - The volume of TSF water was assumed to be the minimum required in the TSF for processing (1,000,000 m^3), as provided by MPMC.
- Water-rock contact factor was assumed to be 100% since all material is in contact with water when submerged.
- The trucking rate for Scenario 2 assumed a CAT 785 haul truck, capable of hauling a maximum of 135 tonnes of material per load. The maximum loading rate per day considered for each material was 135 tonnes/day for Scenario 2.
- Upper limit estimates were only considered using the P95 SFE leachate results for each material.
  - Sulphate concentrations in the majority of SFE tests for all materials except elemental sulphur and contaminated soils were solubility constrained by dissolution of gypsum, so were not used to estimate sulphate loadings. Instead, the sulphate loading from these materials was estimated by assuming all sulphate content (from ABA results) dissolve into the TSF supernatant.
- Anchor rock was not considered because it will not be submerged in the TSF.
- The flushed loadings assume that the soluble load completely dissolves into the TSF pond water.

6.5.4 Screening Parameters

The following methods were used to flag potential changes in the water quality of the TSF from the disposal of each material.

- The scaled P95 acidity loading for each material was added to the P25 alkalinity load of the TSF (calculated using monitoring data from the TSF Barge Station E1a collected from 2015 – 2020). The material was flagged if acidity load added was greater than alkalinity load in the TSF.
- Other parameters were compared to discharge limits listed in MPMC's *Environmental Management Act* Permit 11678 for screening (Table 22). If the calculated concentration of the parameter in the

TSF was above the permitted limit, the parameter was flagged as a parameter of interest (POI) for the material.

- Solubility constraints in the TSF were not considered for the screening-level test.

Table 22: Permit Limits and P75 Concentration of the TSF Supernatant

Parameters	Units	Permit Limits[1]
pH	pH units	6 < pH < 9.5
Total Acidity	mg $CaCO_3$/L	No limit
Total Alkalinity	mg $CaCO_3$/L	No limit
Sulfate	mg/L	1100
Total Ammonia	mg-N/L	1.3
Nitrate	mg-N/L	34
Nitrite	mg-N/L	0.78
Total Phosphorus	mg/L	0.09
Fluoride	mg/L	17
Aluminum	mg/L	0.75
Arsenic	mg/L	0.028
Cadmium	mg/L	0.034
Chromium	mg/L	0.004
Copper	mg/L	0.033
Iron	mg/L	0.35
Lead[2]	mg/L	0.026
Manganese	mg/L	3.4
Molybdenum	mg/L	0.36
Silver	mg/L	0.00024
Selenium	mg/L	0.075
Zinc	mg/L	0.059

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Loadings_Calc_1CM017.010_Rev01_SJL.xlsx?web=1

Notes:

[1] From Section 1.2.3 in EMA PE-11678 (April 7, 2017); used dissolved concentration limits where available and total concentrations if no dissolved concentration limits are specified.

[2] Lead limit is chronic BC Water Quality Guideline for aquatic life using TSF Supernatant P75 hardness concentration for calculation.

6.5.5 Calculations

Sulphate Loadings using Solid Sulphate Content

For leached ore, leached waste rock, crush rock, and berm rock, the soluble mass of sulphate ($m_{SO4,material}$) was calculated using the solid sulphate content ($c_{SO4,material}$) and mass of material deposited ($M_{material}$):

$$m_{SO4,material}[mg] = c_{SO4,material}\ [mg/kg] \times M_{material}\ [kg]$$

Loadings using SFE Concentrations

The soluble mass of all other parameters, i ($m_{i,material}$), was calculated using the concentration from the SFE ($c_{i,material}$), mass of material deposited ($M_{material}$), and the SFE dilution factor (DF_{SFE}):

$$m_{i,material}[mg] = c_{i,material}\ [mg/L] \times M_{material}\ [kg] \times DF_{SFE}\ [L/kg]$$

Estimated TSF Concentrations

The soluble mass was then added to the TSF pond water (V_{TSF}) in addition to the calculated mass already in the TSF pond based on the P75 concentration for each parameter ($c_{i,TSF}$) to calculate the concentration of the TSF after submergence ($c_{i,submerge}$):

$$c_{i,submerge}[mg/L] = \frac{m_{i,material}[mg] + (c_{i,TSF}[mg/L] \times V_{TSF}[L])}{V_{TSF}[L]}$$

6.5.6 Inputs

Table 23 summarizes the inputs used in the calculations. The background water quality for the TSF supernatant was calculated using the P75 concentration of the TSF supernatant (E1a). For conservatism, the P25 concentration for total alkalinity was used instead.

Table 23: Summary of Inputs

Inputs	Units	Value
SFE Dilution Factor	L/kg	3
Physical Inputs		
Pond Volume	m^3	1,000,000
Mass of Elemental Sulphur	t	22,880
Mass of Leached Waste Rock	t	9,200
Mass of Leached Ore	t	18,900
Mass of Contaminated Soils	t	30,000
Mass of Crushed Rock on Leach Pad	t	20,000
Mass of Berm Material	t	21,600
Mass per Truckload	t	135
Pond Water Chemistry (TSF Supernatant – P75 2015 – 2020)		
pH	pH units	7.7
Total Acidity	mg $CaCO_3$/L	-
Total Alkalinity	mg $CaCO_3$/L	49[2]
Sulfate	mg/L	542
Total Ammonia	mg-N/L	0.050
Nitrate	mg-N/L	6.8
Nitrite	mg-N/L	0.13
Total Phosphorus	mg/L	0.028
Fluoride	mg/L	0.82
Aluminum	mg/L	0.039
Arsenic	mg/L	0.0016
Cadmium	mg/L	0.000093
Chromium	mg/L	0.00050
Copper	mg/L	0.090
Iron	mg/L	0.030
Lead	mg/L	0.000050
Manganese	mg/L	0.088
Molybdenum	mg/L	0.22
Silver	mg/L	0.000010
Selenium	mg/L	0.035
Zinc	mg/L	0.0041

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Loadings_Calc_1CM017.010_Rev01_SJL.xlsx?web=1

Notes:

[1] P25 concentration

6.5.7 Results

Table 24 summarizes concentration estimates for Scenario 1 using the upper limit material estimates for all materials. Loadings for Scenario 2 are shown for comparison (i.e., soluble mass added per truckload) in Table 25. All concentrations are estimated as “dissolved”.

Elemental sulphur and leached ore were the only materials that had a greater acidity loading compared to alkalinity. Leachable acidity results were not available for leached waste rock, so the acidity loading was calculated based on H^+, iron, aluminum, and copper concentrations.

The P95 copper concentrations in the TSF already surpass the Permit limits. Leachable aluminum and zinc were flagged for most materials (Table 24). Elemental sulphur contained the largest estimated loads per truckload for most constituents, but leached ore contained the highest estimated load for copper (Table 25). Contaminated soils contained the highest estimated loads for cadmium, lead, and zinc.

Table 24: Estimated TSF Concentrations for Scenario 1

Parameters	Permit Limits[1]	TSF Supernatant (P75 2015 – 2020)	Materials					
			Elemental Sulphur	Leached Ore	Leached Waste Rock	Crush Rock	Contaminated Soils	Berm
Total Acidity (mg $CaCO_3$/L)	No limit	-	**93**	**84**	23	5.0	12	13
Total Alkalinity (mg $CaCO_3$/L)	No limit	49[2]	-	-	50	51	51	51
Sulfate (mg/L)	1100	542	850	721	634	620	630	600
Total Ammonia (mg-N/L)	1.3	0.050	0.075	0.088	0.050	0.059	0.059	0.088
Nitrate (mg-N/L)	34	6.8	6.9	6.8	6.9	6.8	6.9	6.9
Nitrite (mg-N/L)	0.78	0.13	0.16	0.13	0.13	0.13	0.13	0.13
Total Phosphorus (mg/L)	0.09	0.028	**0.42**	0.062	0.045	0.030	0.031	0.033
Fluoride (mg/L)	17	0.82	0.95	0.89	1.0	0.85	0.84	0.85
Aluminum (mg/L)	0.75	0.039	**12**	**11**	**3.8**	0.33	**1.0**	**1.5**
Arsenic (mg/L)	0.028	0.0016	0.0040	0.0018	0.0019	0.0016	0.0016	0.0016
Cadmium (mg/L)	0.034	0.000093	0.00045	0.0013	0.00049	0.00042	**0.0022**	0.00021
Chromium (mg/L)	0.004	0.00050	**0.0093**	**0.0050**	0.00090	0.00056	0.0007	0.0012
Copper (mg/L)	0.033	**0.090**	**0.74**	**16**	**1.7**	**1.5**	**2.7**	**1.8**
Iron (mg/L)	0.35	0.030	**13**	**1.2**	0.074	0.041	0.15	0.17
Lead (mg/L)	0.026	0.000050	0.026	0.00013	0.000086	0.0018	**0.041**	0.0013
Manganese (mg/L)	3.4	0.088	0.28	0.54	1.0	0.30	0.3	0.18
Molybdenum (mg/L)	0.36	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Silver (mg/L)	0.00024	0.000010	0.000061	0.000033	0.000028	0.000013	0.000037	0.000017
Selenium (mg/L)	0.075	0.035	0.036	0.036	0.036	0.036	0.036	0.036
Zinc (mg/L)	0.059	0.0041	**0.10**	0.051	0.055	**0.062**	**0.44**	0.015

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Loadings_Calc_1CM017.010_Rev02_SJL.xlsx?web=1

Notes: **Bolded** values indicate parameter exceeded screening level parameter. Bolded acidity means acidic load is greater than alkalinity load in the TSF, indicating potential for the TSF supernatant to go acidic.

[1] See Table 22

[2] P25 concentration

Table 25: Estimated Loadings per Truckload (Fixed Mass: 135 Tonnes) for Scenario 2

Parameters	Materials					
	Elemental Sulphur	Leached Ore	Leached Waste Rock	Crush Rock	Contaminated Soils	Berm
Total Acidity (kg $CaCO_3$)	550	**600**	340	34	54	81
Total Alkalinity (kg $CaCO_3$)	**0.20**	**0.20**	12	9.3	7.9	7.1
Sulfate (kg)	**1,800**	1,300	1,400	510	390	360
Total Ammonia (kg-N)	0.14	**0.27**	0.0025	0.059	0.038	0.24
Nitrate (kg-N)	0.20	0.081	**0.31**	0.081	0.081	0.10
Nitrite (kg-N)	**0.20**	0.020	0.0081	0.020	0.020	0.020
Total Phosphorus (kg)	**2.3**	0.25	0.24	0.0094	0.012	0.033
Fluoride (kg)	**0.81**	0.52	2.7	0.22	0.13	0.24
Aluminum (kg)	71	**76**	56	2.0	4.3	9.0
Arsenic (kg)	**0.014**	0.0016	0.0053	0.00010	0.00036	0.00020
Cadmium (kg)	0.0021	0.0085	0.0058	0.0022	**0.0095**	0.00073
Chromium (kg)	**0.052**	0.032	0.0059	0.00041	0.0011	0.0045
Copper (kg)	3.8	**112**	24	9.3	12	10
Iron (kg)	**78**	8.0	0.65	0.074	0.54	0.86
Lead (kg)	0.15	0.00056	0.00053	0.012	**0.19**	0.01
Manganese (kg)	1.1	3.2	**14**	1.4	0.80	0.56
Molybdenum (kg)	0.0057	0.0017	**0.054**	0.0006	0.013	0.0027
Silver (kg)	**0.00030**	0.00017	0.00026	0.00002	0.00012	0.000043
Selenium (kg)	0.0030	0.0013	**0.0041**	0.00042	0.00053	0.00032
Zinc (kg)	0.58	0.33	0.75	0.39	**1.9**	0.066

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Loadings_Calc_1CM017.010_Rev02_SJL.xlsx?web=1

Notes: **Bolded** values indicate material will the highest load per truckload for each parameter (lowest for alkalinity).

6.5.8 Lime Addition Rate

If materials are crushed and blended during disposal, there will be better contact between sources of acidity and neutralization. The TSF supernatant will also provide neutralization during disposal. Lime may also be added as an amendment to neutralize the soluble acidity. Using the scaled average acidity measurements for each material, a lime addition rate per truckload (assuming 135 tonnes of material per truckload) was estimated (Table 26). Further refinement of these rates may be required depending on disposal methods.

Table 26: Estimated Lime Addition Rate by Material (Fixed Truck Mass: 135 Tonnes)

Material	Average Soluble Acidity (mg $CaCO_3$/L)	Estimated Lime Addition Rate per Truckload (kg)
Elemental Sulphur	930	300
Leached Ore	760	200
Leached Waste Rock	190[1]	90
Crush Rock	52	20
Contaminated Soils	32	10
Berm	78	20

Sources: https://srk.sharepoint.com/sites/NA1CM017.010/Internal/Task300_Material_Testing_Program/SubTask330_DataInterpretation/Loadings_Calc_1CM017.010_Rev01_SJL.xlsx?web=1

Notes:

[1] Calculated

6.5.9 Monitoring of TSF Supernatant during Material Disposal

During disposal of any material into the TSF, monitoring of the TSF supernatant (E1a) will be conducted as summarized in Table 27. The purpose of this monitoring is to identify if the water chemistry of the TSF significantly changes during material disposal. A trigger response plan was also developed to determine when material disposal can continue or should cease based on field measurements (i.e., pH) for instant feedback and laboratory analyses (i.e., total alkalinity) (Figure 10).

Table 27: Monitoring Overview of TSF Supernatant during Disposal

Parameter Group	Location	Analyses	Frequency
Field Parameters	In-situ	pH	Daily
Physical Parameters	External laboratory	pH, conductivity, total acidity, total alkalinity	Weekly
Anions	External laboratory	Sulphate	Weekly
Metals	External laboratory	Dissolved	Weekly

Sources: Compiled in text

Figure 10: Trigger Response for TSF Monitoring during Material Disposal

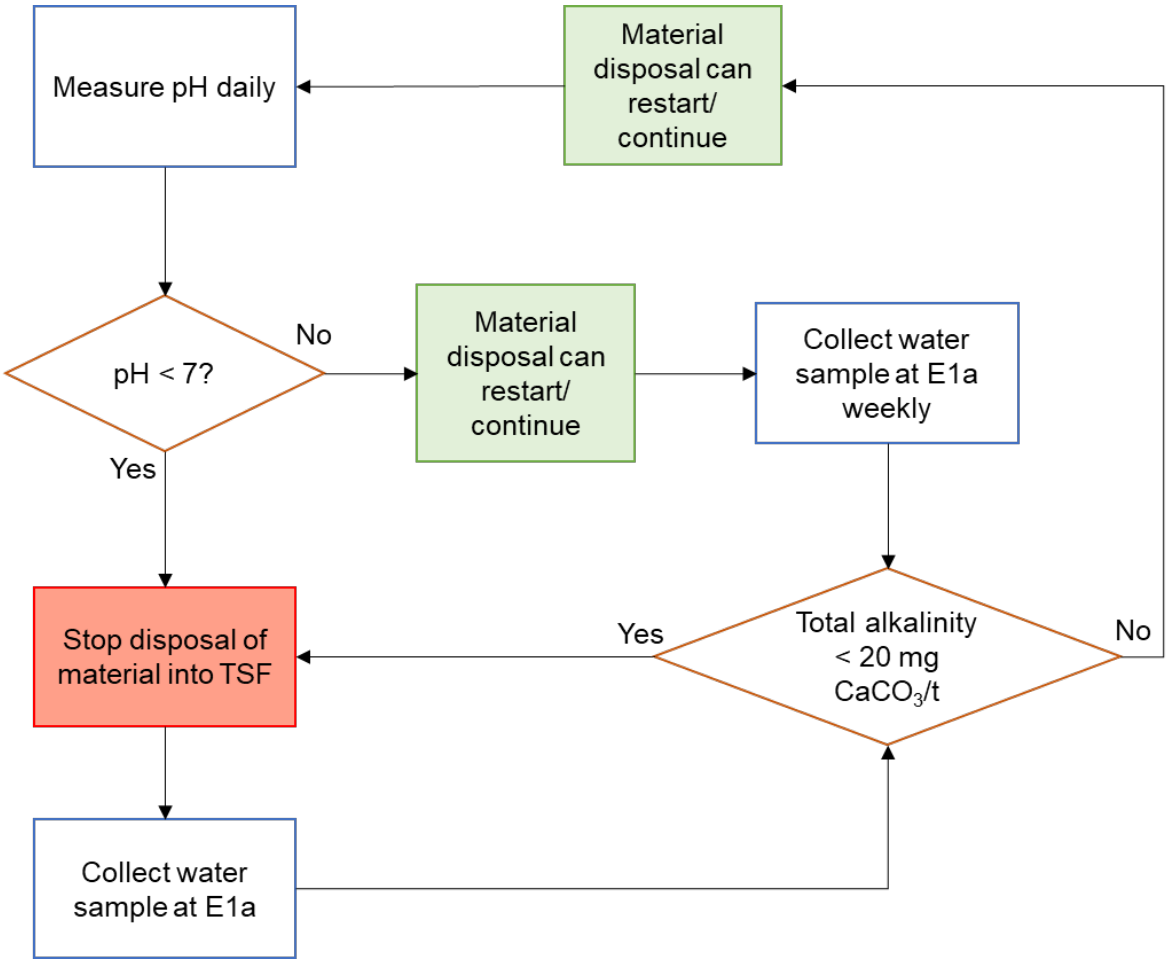

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!080_Deliverables\3_Final_Decom_Plan\040_Figures\Trigger_TSF_Monitoring_1CM017.010_Rev00_SJL.pptx

6.6 Drainage Materials and Till Liner Monitoring

Representative samples of the drainage materials and till should be collected during decommissioning and analyzed as described in Section 4.3.2.

It is anticipated that drainage materials will be similar to crush rock since they are from similar sources and would have been exposed to acidic drainage since commissioning. If sampling confirms this hypothesis, these materials can be managed similar to crush rock. If testing shows drainage materials are not similar to previously characterized material, then further assessment may be warranted including assessing effects on TSF water quality and potential amendments.

Till materials are underneath liner and therefore the amount of acidification and ML/ARD potential is unknown. Till material should be assessed by ML/ARD potential as well as current ML/ARD condition before disposal option is selected.

7 Material Disposal and Management Criteria

Table 28 summarizes the disposal and management criteria for all materials currently stored on the heap leach pad as well as other associated infrastructure and reagents.

Table 28: Material Disposal Summary and Other Associated Infrastructure and Reagents Management

Material	Management Criteria	Disposal Location	Disposal Method	Monitoring During Disposal
Materials Stored on Leach Pad				
Elemental Sulphur	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 6.5.9)
Leached Waste Rock	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Crush and blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 6.5.9)
Leached Ore	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Crush and blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 4.5.8)
Crush Rock	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Crush and blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 4.5.8)
Contaminated Soils	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Process through mill or crush and blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 4.5.8)
Berm	All managed as material with high ML/ARD potential and high current ML/ARD conditions	Submerged in TSF	Crush and blend in hopper with lime. Dispose in tailings line.	TSF Supernatant (see Section 4.5.8)
Anchor Rock	Managed as either NAG or PAG, depending on sampling before placement	**If Non-PAG:** Stored on surface **If PAG:** Submerged in TSF	**If Non-PAG:** Store on waste rock dump. Can be used as fill material for heap leach pad hole left after other materials are disposed. **If PAG:** Follow disposal described for Berm Materials. Crush and blend in hopper with lime. Dispose in tailings line.	One composite is collected every truckload. Sample is screened to -2 mm and +2 mm fractions. The -2 mm fraction is analyzed for total carbon and total sulphur at on-site laboratory. ARD classification of each fraction follows MPMC ML/ARD Management Procedure Manual (MPMC 2016 or most recent version).
Associated Infrastructure and Reagents				
Heap Leach Pad Excavation	Once material has been removed from the heap leach pad, the exposed hole should be filled with Non-PAG rock.	-	-	Sampling of placed rock should follow MPMC (2016) (or most recent version) to confirm ARD potential of placed material.
Leach Pad Liner	-	Heap leach excavation	Folded in place and covered with Non-PAG rock.	-
Reagents and Chemicals	The only reagent or chemical related to the leach pad is the leach pad leachate.	TSF	Continually manage leach pad level by pumping down to mill or TSF.	-
Remaining Infrastructure	-	-	Auxiliary buildings should be dismantled and disposed as per other management plans. They can be re-used for other reclamation activities as required	-

Sources: Compiled in text

Closure

This report, Mount Polley Heap Leach Decommissioning Plan, was prepared by

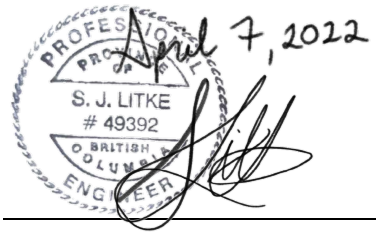

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A Heap Leach Facility Geochemical Characterization Plan

FINAL

Heap Leach Decommissioning Plan – Heap Leach Facility Geochemical Characterization Plan

Mount Polley Mine, BC, Canada

Mount Polley Mining Corporation



SRK Consulting (Canada) Inc. ▪ 1CM017.010 ▪ June 2021

srk consulting

Heap Leach Decommissioning Plan – Heap Leach Facility Geochemical Characterization Plan

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Sampling on the Heap Leach Facility

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1 Introduction

Mount Polley Mining Corporation (MPMC) retained SRK Consulting (Canada) Inc. (SRK) to develop a plan to decommission the Test Heap Leach Facility at Mount Polley Mine. The plan is a requirement under MPMC's amalgamated Mines Act Permit M-200 (EMPR 2020) s. D3(c)(v) and must be submitted to the BC Ministry of Energy, Mines and Low Carbon Innovation (EMLI) by June 30, 2021. Specifically, the M-200 condition reads:

> *The Permittee shall provide a report that includes a detailed plan and timeline for the removal of the test heap leach facility and all stockpiled sulphur by June 30, 2021, to the satisfaction of the Chief Inspector. The Permittee shall ensure the plan includes, but is not limited to, the removal and disposal of the leached ore, sulphur stockpile, waste rock, contaminated soil, reagents or chemicals, and all associated infrastructure.*

The plan also should include an approach to identify and remediate any contaminated material beneath the facility. No timeline for disposal is provided in the M-200 Permit.

The Test Heap Leach Facility is located on top of the East Rock Disposal Site (East RDS) and includes the lined heap leach pad, operations building, and former sulphur stockpile footprint. Background of the facility is provided in Section 2.

The Decommissioning Plan requires geochemical characterization of the materials stored on the Test Heap Leach Facility. This document provides the geochemical characterization program that is currently underway to address data gaps identified during the development of the Geochemical Conceptual Models (GCMs) for each material. Results from the characterization program are not yet available in time for reporting and management options will be selected after the additional characterization is completed.

Reagents or chemicals and all associated infrastructure that need to be removed have not been considered as the Geochemical Characterization Plan focuses on material reactivity and disposal.

To finalize the Decommissioning Plan, the results from the geochemical characterization program will be used to update the GCMs and develop a management plan for each material. This will comprise an options analysis for potential remedial options for each material. The options analysis will be based on the updated GCMs and include considerations for site (e.g., disposal during operations versus closure, tailings deposition plan into the Tailings Storage Facility (TSF), Life of Mine Plan and scheduling, etc.).

The final Decommissioning Plan, which will include all components listed above, is expected by the end of Q3 2021.

2 Overview of the Test Heap Leach Facility

2.1 Background

The pilot-scale Test Heap Leach Facility was constructed in 2007 for research into leaching non-sulphide copper ore. From 2006-2008, approximately 11,000 m^3 of sulphur was procured for sulphuric acid production for the heap leach trial. Between 2007 and 2012, different layering and blending techniques of ore and sulphur were tested to optimize leaching. In 2012, the Test Heap Leach Facility was placed into Care and Maintenance due to economic considerations but was not loaded out prior to shut down. Roughly 7,000 m^3 of ore remain on the leach pad. The heap leach pad also contains contaminated soils from an off-site disposal clean-up. Approximately 19,000 tonnes were loaded out and processed in the mill in 2019. An estimated 30,000 t remains on the heap leach pad.

Excess sulphur was stored in a nearby stockpile, first in the Cariboo Pit (2006-2009) and then moved to a crushed rock pad beside the heap leach pad (2009-2018) when mining resumed in the Cariboo Pit. In 2018, the excess sulphur was relocated on top of the lined leach pad after evidence showed that water quality on the mine may be affected by contaminated drainage from below the sulphur stockpile. The affected drainage is seepage from the NEZ Dump, located east of the Test Heap Leach Facility. Approximately 1 m of material was removed from the sulphur stockpile pad (about 9,200 tonnes) and was relocated to the TSF after the sulphur stockpile was moved to the Test Heap Leach Facility.

Leachate from within the lined heap leach pad facility is managed by treatment with lime at the plant and conveyance to the TSF. A copper recovery system using Sodium Hydrosulfide (NaHS) to precipitate copper sulfide in the tailings thickener is being developed by MPMC within the concentrator building. The sprinkler system over top of the facility is operational.

2.2 Materials Inventory

Materials stored at the Test Heap Leach Facility are shown in Figure 1 and summarized in Table 1. The plan view will be updated after sampling if the location of materials become better delineated and a cross-section will be developed to be included in the Decommissioning Plan.

Figure 1: Plan View of Heap Leach Facility Showing Location of Different Materials Stored on Leach Pad



Sources: Photo provided by MPMC, \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx
Notes: Flyover photo taken October 21, 2019.

Table 1: Inventory of Materials Stored at the Heap Leach Facility

Material	Earlier Placement	Current Storage Location	Estimated Tonnage Stored on Leach Pad (t)
Elemental sulphur	Placed on top of waste rock pile on crush pad	Stored on top of leached ore on leach pad	22,880
	Stored in sulphur stockpile before loaded onto leach pad	Stored in layers of between ore on leach pad	Unknown amount
Leached waste rock from beneath sulphur stockpile	Beneath sulphur stockpile	Stored on top of leached ore on leach pad	9,200
Leached ore	Placed on leach pad, layered with elemental sulphur	Stored on top of leach pad	18,900
	Placed on leach pad, layered with elemental sulphur	Stored on top of leach pad	
Contaminated soils	Metal-impacted soils clean-up from Kinder Morgan/Vancouver Wharves	Stored on top of leached ore on leach pad	30,000
Construction Materials			
Anchor Rock	Waste rock sourced from pits during construction	Outside of heap leach pad footprint	0[1]
Berm	Waste rock sourced from pits during construction	Around leached ore on leach pad, within heap leach pad footprint	Unknown amount
Drainage Material	Waste rock sourced from pits during construction, crushed on-site	Drainage rock above and between liner layers	Unknown amount
Till Liner (Zone S)	Borrow Source #3	Underneath heap leach facility	Unknown amount
Liner[2]	-	Bottom of heap leach pad	-

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\Task100_Develop_GCM\Materials_Inventory_1CM017.010_Rev00_SJL.xlsx

Notes: Estimated material amounts were provided by MPMC.

[1] Stored outside of leach pad footprint

[2] Liner comprises two HDPE liners that are 19,000 m^2 with one geonet placed between.

2.3 Existing Data

Available data are summarized in Figure 2. Data exist for elemental sulphur, leached waste rock from beneath the sulphur stockpile, and leached ore.

Figure 2: Summary of Existing Datasets Available by Material Stored in the Test Heap Leach Facility

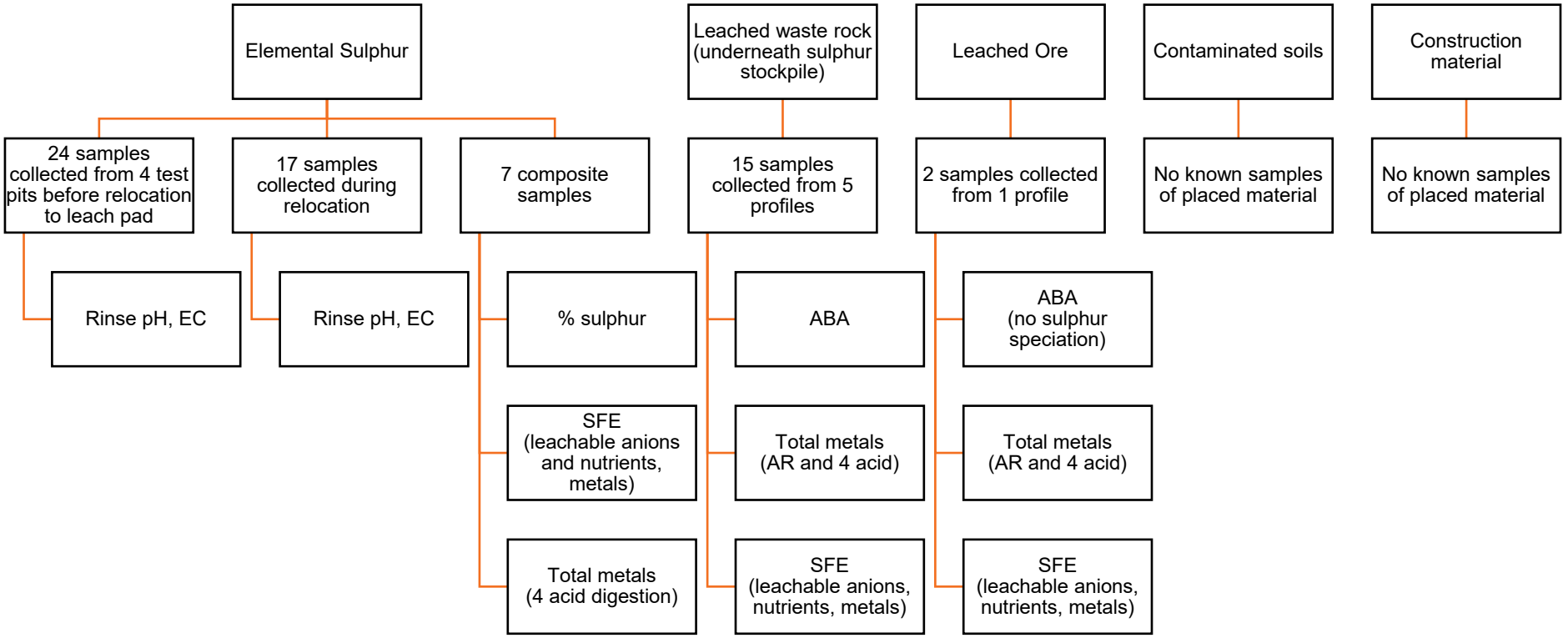

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

3 Geochemical Conceptual Models

GCMs were developed for each of the waste types currently stored in the Test Heap Leach Facility using existing information, geochemical first principles, and experience. GCMs are an effective way to capture the key geochemical reactivity considerations for the Test Heap Leach Facility and how its reactivity may be impacting water quality on site now, and how it may do so in the future under various long-term storage scenarios.

The GCMs effectively represent hypotheses about material characteristics and reactivity which are subsequently evaluated through observations, sampling, testwork, and interpretation. A gap analysis was performed to inform need for additional testing, which is described in the following section. The results from additional characterization will test the assumptions in the GCM concerning the reactivity of the materials stored in the Test Heap Leach Facility and ultimately be used to develop management options. The characterization program currently underway is described in Section 4.

3.1 Elemental Sulphur

Prior to relocation onto the Test Heap Leach Facility, elemental sulphur was stored on top of the East RDS on a crush pad in a stockpile (see Figure 1). The elemental sulphur was previously sampled and tested in 2018 prior to and during its relocation to the heap leach pad, as summarized in SRK (2019). The following was found:

- The elemental sulphur in the stockpile was composed of about 90% sulphur. Some impurities were present which created a leachable source of other elements including iron and aluminum.
- Oxidation of the sulphur has generated sulphuric acid which is readily soluble.
  - pH of Shake Flask Extraction (SFE) leachates ranged from 1.4 – 1.9.

Elemental sulphur is currently stored in two locations: on top of the leached ore on the leach pad and stored in layers between ore on the leach pad. It is expected that elemental sulphur currently stored on top of the leached ore is similar to the previously characterized material. No existing data are available for elemental sulphur stored in layers between ore on the leach pad, but it is expected to be similar to the bulk pile.

The GCM for elemental sulphur for both storage locations is shown in Figure 3 and summarized in Table 2. A potential decommissioning option and unknowns identified in the gap analysis are also included in Table 2. Additional testwork to address these unknowns is described in Section 4.1.

The potential decommissioning option that was considered for the elemental sulphur was submergence. Disposal underwater can be expected to arrest oxidation but will rapidly leach the soluble acidity. The final location for submergence (e.g., TSF, flooded pit, etc.) has not yet been considered.

Figure 3: Geochemical Conceptual Model – Elemental Sulphur



Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx
Notes: Left: Elemental sulphur stored on top of leached ore on leach pad. Right: Elemental sulphur stored in layers of between ore on leach pad.

Table 2: Geochemical Conceptual Model – Elemental Sulphur

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored on top of leached ore on leach pad	■ Unsaturated ■ Exposed to precipitation (rain and snowmelt) ■ Atmospheric oxygen exposure	■ Sulphur oxidation ■ Acidic pH run-off, low metals ■ Little to no pH buffering	Submergence	■ Initial flush of acidity expected during submergence ■ No sulphur oxidation once fully saturated	■ Similar to previously characterized material
Stored in layers between ore on leach pad	■ Varying water saturation over time ■ Exposed to acidic drainage from elemental sulphur and leached ore (see Section 3.3) ■ Atmospheric oxygen exposure	■ Sulphur oxidation when not fully saturated ■ Acidic pH run-off, low metals ■ Little to no pH buffering	Submergence	■ Initial flush of acidity expected during submergence ■ No sulphur oxidation once fully saturated	■ Quantity ■ Degree and duration of saturation/exposure to atmospheric oxygen

Sources: Compiled in text

3.2 Leached Waste Rock from Beneath Sulphur Stockpile

Litke et al. (2019) and Litke (2019) showed pH-controlled weathering fronts developed in the material underneath the sulphur stockpile. Acidification was observed at one sampling profile location, but the amount and degree to which the waste rock was acidified was variable underneath the sulphur stockpile. Jarosite was observed at this location, which typically forms under acidic conditions and needs iron. This is possibly an indication that the acid generated from the sulphur pile was interacting with the waste rock underneath and was contributing to accelerated weathering of this rock. Carbonate depletion was apparent at all locations, but excess carbonate to maintain neutral pH was observed at some sampling locations below the sulphur stockpile. The leached waste rock was dominantly potentially acid generating (PAG), based on acid potential (AP) calculated from sulphide and neutralizing potential (NP) from remaining carbonate. Sulphur prills were observed interspersed in the material.

Material that was previously underneath the sulphur stockpile was well characterized, as documented in Litke (2019) and Litke et al. (2019). No additional static testwork of this material was recommended.

The GCM for leached waste rock from beneath sulphur stockpile is shown in Figure 4 and summarized in Table 3. Two potential decommissioning options and unknowns identified in the gap analysis are also included in Table 3.

One potential decommissioning option that was considered for the leached waste rock was submergence. Disposal underwater can be expected to arrest oxidation but will rapidly leach the soluble acidity and associated metals. The final location for submergence (e.g., TSF, flooded pit, etc.) has not yet been considered.

The other potential decommissioning option considered was disposal on surface with lime amendment. The final location and management approach has not yet been considered.

Figure 4: Geochemical Conceptual Model – Leached Waste Rock from beneath Sulphur Stockpile

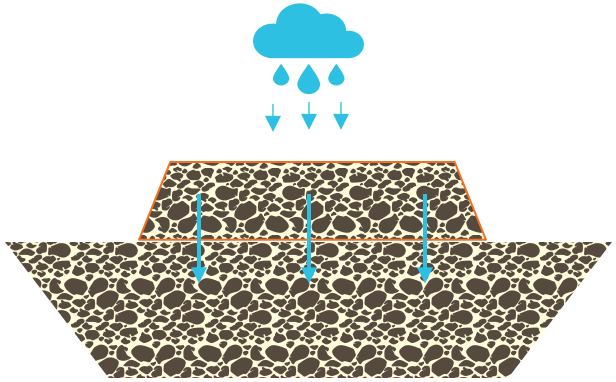

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

Table 3: Geochemical Conceptual Model – Leached Waste Rock from Beneath Sulphur Stockpile

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored on top of leached ore on leach pad	■ Water unsaturated ■ Exposed to precipitation (rain and snowmelt) ■ Atmospheric oxygen exposure	■ Soluble acidic salts leach to run-off ■ Acidic pH run-off, more soluble metals than at neutral pH ■ Sulphide/sulphur oxidation continues to generate acidity ■ Some carbonate remaining might buffer pH	Submergence	■ Initial flush of acidity and associated metals from soluble acidic salts expected during submergence ■ No sulphur/sulphide oxidation once fully saturated ■ Reductive dissolution of secondary minerals (e.g., Fe oxyhydroxides) may develop in sub-oxic/anoxic conditions if sufficient labile carbon is present	■ Stored acidity
			Amendment with lime	■ Depends on ARD potential with remaining sulphide/sulphur content ■ Lime neutralizes acidic porewater ■ Neutral pH run-off	■ ARD potential

Sources: Compiled in text

3.3 Leached Ore

Data from two samples collected for one depth profile exist, as previously documented in Litke (2019). Carbonates were depleted and sulphur prills were observed mixed with the leached ore on the heap leach pad and acidification was evident along the profile (Litke 2019). Henry (2009) showed precipitation of copper sulphide minerals was occurring in water-saturated and anaerobic microenvironments in the leach pad.

Leached ore is currently stored on the leach pad, beneath the elemental sulphur, contaminated soils, and leached waste rock. The majority of the leached ore is stored on the southwest end of the leach pad, beneath the elemental sulphur.

The GCM for leached ore is shown in Figure 5 and summarized in Table 4. A potential decommissioning option and unknowns identified in the gap analysis are also included in Table 4. Additional testwork to address these unknowns is described in Section 4.4.

The potential decommissioning option that was considered for the leached ore was submergence. Disposal underwater can be expected to arrest oxidation but will rapidly leach the soluble acidity and associated metals. The final approach for decommissioning has not yet been determined.

Figure 5: Geochemical Conceptual Model – Leached Ore

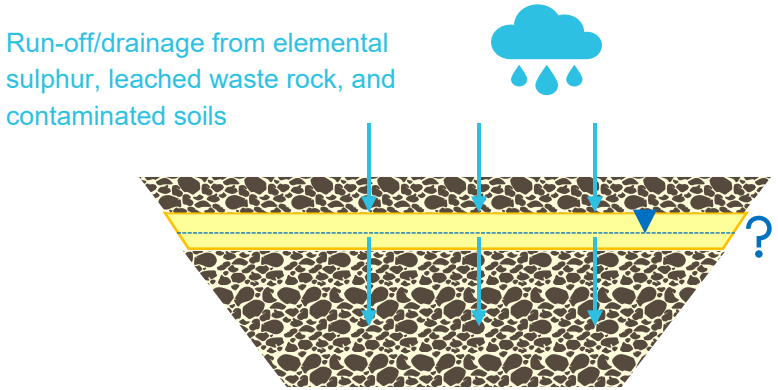

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

Table 4: Geochemical Conceptual Model – Leached Ore

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored on the leach pad, beneath the elemental sulphur, contaminated soils, and leached waste rock	■ Varying water saturation over time ■ Exposed to precipitation (rain and snowmelt), acidic drainage from elemental sulphur, and recirculated leachate ■ Atmospheric oxygen exposure	■ Acidic pH run-off, more soluble metals than at neutral pH ■ Sulphide/sulphur oxidation continues to generate acidity	Submergence	■ Initial flush of acidity and associated metals from soluble acidic salts expected during submergence ■ No sulphur/sulphide oxidation once fully saturated ■ Reductive dissolution of secondary minerals (e.g., Fe oxyhydroxides) may develop in sub-oxic/anoxic conditions if sufficient labile carbon is present	■ Degree and duration of saturation/ exposure to atmospheric oxygen ■ Stored acidity

Sources: Compiled in text

3.4 Contaminated Soils

Contaminated soils are currently stored on top of the leached ore on the northeast end of the leach pad. Some samples of the contaminated soils were collected and tested before the material was brought to Mount Polley Mine and placed on the heap leach pad. This material was sourced from various soil clean-up sites and no sampling of placed material occurred during initial placement. The sampling and testing methods were not provided, and the data were not able to be related with the remaining material on the leach pad.

The GCM for contaminated soils is shown in Figure 6 and summarized in Table 5. Unknowns identified in the gap analysis are also provided in Table 5. Potential decommissioning options could not be considered until key aspects are determined and additional testwork to address these unknowns is described in Section 4.5.

Figure 6: Geochemical Conceptual Model – Contaminated Soils

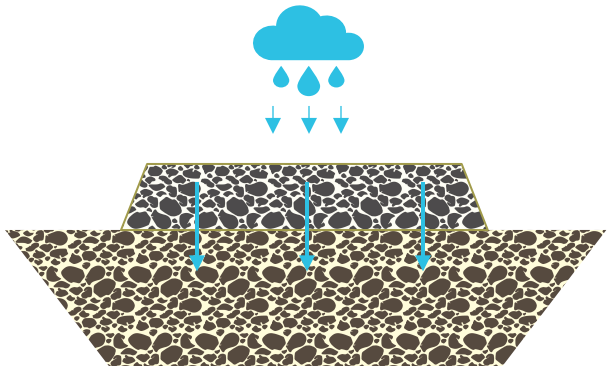

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

Table 5: Geochemical Conceptual Model – Contaminated Soils

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored on the leach pad	■ Exposed to precipitation (rain and snowmelt) ■ Atmospheric oxygen exposure	■ Unknown until testing for geochemical characterization is complete	None yet considered	■ Unknown until testing for geochemical characterization is complete	■ Reactivity and impact on water quality

Sources: Compiled in text

3.5 Construction Material

3.5.1 Anchor Rock

This material was waste rock sourced from pits and is possibly similar to other NAG waste rock from Mount Polley. Anchor rock is currently stored outside the main footprint of the leach pad. No geochemical data exists for this material.

The GCM for anchor rock is summarized in Table 6. A potential decommissioning option considered was to leave material on the East RDS as part of the NAG waste rock pile, depending on the ARD potential of the anchor rock. However, there may be possible contamination of the anchor rock with dust from the elemental sulphur due to its proximity to the leach pad and former stockpile location. Additional testwork to address this is described in Section 4.5.

3.5.2 Berm

This material was waste rock sourced from pits but is currently stored inside the footprint of the leach pad. It is contaminated with leachate and dust from elemental sulphur. No geochemical data exists for this material.

The GCM for berm material is summarized in Table 7. Two potential decommissioning options and unknowns identified in the gap analysis are also included in Table 7.

One potential decommissioning option that was considered for the berm material was submergence. Disposal underwater can be expected to arrest oxidation but will rapidly leach the soluble acidity and associated metals. The final location for submergence (e.g., TSF, flooded pit, etc.) has not yet been considered.

The other potential decommissioning option considered was disposal on surface with lime amendment. The final location for disposal has not yet been considered.

3.5.3 Drainage Material and Compacted Till Layer

No geochemical data exists for this material; however sampling of these materials will not be possible until decommissioning. The amount of drainage material and till is small in proportion to other materials, so sampling and analysis is for inventory development and estimating potential amendments. A sampling and testing plan to characterize this material as the facility is decommissioned will be provided in the final Decommissioning Plan.

Table 6: Geochemical Conceptual Model – Anchor Rock

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored outside leach pad footprint on top of East RDS	■ Exposed to precipitation (rain and snowmelt) ■ Atmospheric oxygen exposure ■ Possibly contaminated with dust from elemental sulphur	■ Sulphide oxidation occurring ■ Carbonate buffering pH	Leave in place as part of East RDS	■ Depends on ARD potential with remaining sulphide content ■ Carbonate in rock neutralizes generated acid ■ Neutral pH run-off	■ Degree of contamination with elemental sulphur dust due to proximity to leach pad and former sulphur stockpile location

Sources: Compiled in text

Table 7: Geochemical Conceptual Model – Berm

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Stored on outer edges of leach pad within footprint	■ Exposed to precipitation (rain and snowmelt) ■ Atmospheric oxygen exposure ■ Contaminated with leachate and dust from elemental sulphur	■ Sulphide oxidation occurring ■ Carbonate buffering pH	Submergence	■ Initial flush of acidity and associated metals from soluble acidic salts expected during submergence ■ No sulphur/sulphide oxidation once fully saturated ■ Reductive dissolution of secondary minerals (e.g., Fe oxyhydroxides) may develop in sub-oxic/anoxic conditions if sufficient labile carbon is present	■ Stored acidity.
			Amendment with lime	■ Depends on ARD potential with remaining sulphide content ■ Lime neutralizes acidic porewater ■ Neutral pH run-off	■ ARD potential

Sources: Compiled in text

Figure 7: Geochemical Conceptual Model – Drainage Material and Till Liner

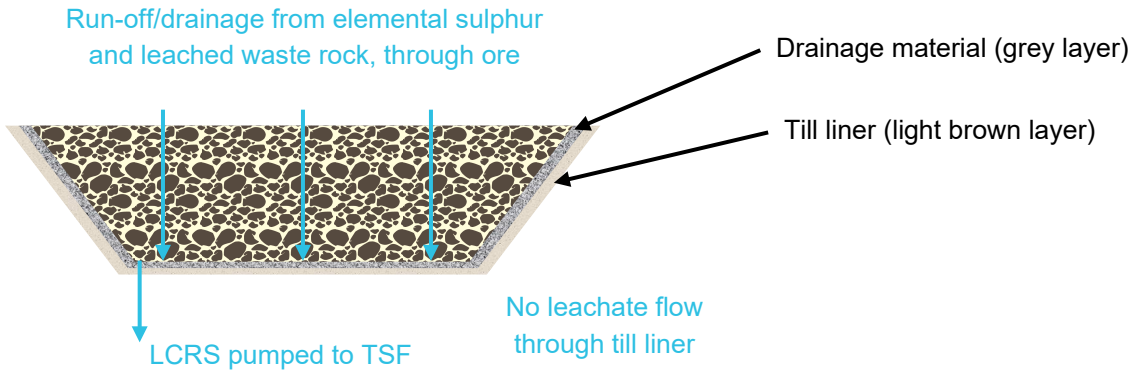

Sources: \\van-svr0.van.na.srk.ad\Projects\01_SITES\Mt_Polley\1CM017.010_Heap_Leach_Facility_Decomissioning\!060_Presentations\GCM_SamplingPlan_1CM017.010_Rev02_SJL.pptx

Table 8: Geochemical Conceptual Model – Drainage Material and Till Liner

Current Storage Location	Current Storage Environment	Reactivity and Impacts on Current Water Quality	Potential Decommissioning Option	Reactivity and Impacts on Future Water Quality	Unknowns
Underneath leach pad	■ Exposed to leachate from heap leach ■ Atmospheric oxygen exposure ■ Varying saturation over time	■ Unknown until testing for geochemical characterization is complete	None yet considered	■ Unknown until testing for geochemical characterization is complete	■ Uncertainty around impact of acidic leachate on materials

Sources: Compiled in text

4 Current Characterization Program

4.1 Overview

Sampling of material stored on the Test Heap Leach Facility was done by SRK personnel from May 5 – 6, 2021 after snow melt. To ensure the liner was not punctured during sampling, the depth to liner was estimated at each sampling location using historical survey data.

Elemental sulphur, leached ore, and contaminated soils samples were collected using an excavator. Test pits were dug at each sampling location using an excavator. Each test pit was logged after excavation. Elemental sulphur, leached ore, and contaminated soils samples were collected using this method.

Construction materials were collected as one composite approximately every 25 m. This includes the anchor rock and berm materials. Drainage materials and the compacted till liner can not be sampled before decommissioning because they are below the HDPE liner, so no samples of these materials were collected.

Table 9 summarizes the samples submitted for analysis as part of the characterization program.

Table 9: Summary of Samples Submitted for Analysis During the Current Characterization Program

Material	Current Storage Location	Number of Samples Collected	GCM Section	Characterization Program Section
Elemental Sulphur	Stored on top of leached ore on leach pad	2	3.1	4.2
	Stored in layers between ore on leach pad	2	3.1	4.2
Leached Ore	Stored on the leach pad, beneath the elemental sulphur, contaminated soils, and leached waste rock	9 (4 profiles)	3.3	4.4
Contaminated Soils	Stored on the leach pad	11	3.4	4.5
Anchor Rock	Stored outside leach pad footprint	10	3.5.1	4.6.1
Berm	Berm	10	3.5.2	4.6.2

Sources: Compiled in text

4.2 Elemental Sulphur

Further sampling and testing of the elemental sulphur was completed as follows:

- Four confirmatory samples from material placed on leach pad were collected. The number of samples were based on heterogeneity of material. The samples were analyzed for:
  - Rinse pH and EC in field.
  - Subset (n=2) submitted for:
    - Total sulphur
    - Metals by aqua regia digestion with ICP-MS finish
    - Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
- Two samples were collected from layered sulphur in leach pad. The number of samples were based on heterogeneity of material and sampling access (i.e., present within safe depth of test pit). The samples were analyzed for:
  - Rinse pH and EC in field.
  - Subset (n=2) submitted for:
    - Total sulphur
    - Metals by aqua regia digestion with ICP-MS finish
    - Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS

4.3 Leached Waste Rock from Beneath Sulphur Stockpile

No further sampling of this material was recommended, but pulps and rejects from the previous characterization work by Litke (2019) are available for further analysis if required.

4.4 Leached Ore

Further sampling and testing of the leached ore was completed as follows:

- Four test pits were excavated and nine samples in total were collected. The number of samples were based on heterogeneity of material. The samples were analyzed for:
  - ABA
    - paste pH, total sulphur, sulphate sulphur by HCl leach, sulphate sulphur by pyrolysis, total carbon, total inorganic carbon, modified Sobek NP)
  - Metals by aqua regia digestion with ICP-MS finish

- Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
- A subset may be submitted for mineralogy once results are received

4.5 Contaminated Soils

Further sampling and testing of the contaminated soils was completed as follows:

- In total, 11 samples were collected. The samples were analyzed for:
  - ABA
    - paste pH, total sulphur, sulphate sulphur by HCl leach, sulphate sulphur by pyrolysis, total carbon, total inorganic carbon, modified Sobek NP
  - Metals by aqua regia digestion with ICP-MS finish
  - Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
  - A subset may be submitted for mineralogy once results are received

4.6 Construction Material

4.6.1 Anchor Rock

Further sampling and testing of the anchor rock was completed as follows:

- In total, 10 composite samples of the anchor rock were collected. The samples were analyzed for:
  - ABA
    - paste pH, total sulphur, sulphate sulphur by HCl leach, sulphate sulphur by pyrolysis, total carbon, total inorganic carbon, modified Sobek NP)
  - Metals by aqua regia digestion with ICP-MS finish
  - Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
  - A subset may be submitted for mineralogy once results are received

4.6.2 Berm

Further sampling and testing of the berm material was completed as follows:

- In total, 10 composite samples of the berm material were collected. The samples were analyzed for:
  - ABA
    - paste pH, total sulphur, sulphate sulphur by HCl leach, sulphate sulphur by pyrolysis, total carbon, total inorganic carbon, modified Sobek NP
  - Metals by aqua regia digestion with ICP-MS finish
  - Readily soluble forms testing: SFE (MEND method) on as-received particle size. Leachate analyzed for pH, conductivity, ORP, acidity, alkalinity, sulphate, chloride, nitrate, nitrite, ammonia, fluoride, dissolved organic carbon, dissolved metals by ICP-MS
  - A subset may be submitted for mineralogy once results are received

4.6.3 Drainage Material and Compacted Till Layer

Sampling of these materials will not be possible until decommissioning and no samples could be collected.

5 Summary

Table 10 summarizes the potential decommissioning options for components of the Heap Leach Facility. Options will be selected after the GCMs are updated and an options analysis is completed.

Table 10: Heap Leach Facility Decommissioning Inventory

Material	Current Storage Location	Potential Decommissioning Options	Estimated Tonnage Stored on Leach Pad (t)
Elemental sulphur	Stored on top of leached ore on leach pad	Submergence	22,880
	Stored in layers of between ore on leach pad	Submergence	Unknown amount
Leached waste rock from beneath sulphur stockpile	Stored on top of leached ore on leach pad	Submergence Amendment with lime	9,200
Leached ore	Stored on top of leach pad	Submergence	18,900
Contaminated soils	Stored on top of leached ore on leach pad	None yet considered	30,000
Construction Materials			
Anchor Rock	Outside of heap leach pad footprint	Leave in place as part of East RDS	0[1]
Berm	Around leached ore on leach pad, within heap leach pad footprint	Submergence Amendment with lime	Unknown amount
Drainage Material	Drainage rock above and between liner layers	None yet considered. Sampling and analysis plan to characterize this material as the facility is decommissioned will be provided in the final Decommissioning Plan	Unknown amount
Till Liner (Zone S)	Underneath heap leach facility	None yet considered. Sampling and analysis plan to characterize this material as the facility is decommissioned will be provided in the final Decommissioning Plan	Unknown amount
Liner[2]	Bottom of heap leach pad	None yet considered	-
Other Components			
Reagents or chemicals	None stored at the heap leach facility	-	-
Associated infrastructure	Infrastructure outside heap leach pad footprint	None yet considered	-

Sources: Compiled in text

Notes: Estimated material amounts were provided by MPMC.

[1] Stored outside of leach pad footprint

[2] Liner comprises two HDPE liners that are 19,000 m^2 with one geonet placed between.

Closure

This report, Heap Leach Facility Geochemical Characterization Plan, was prepared by



Shauna Litke, PEng
Consultant (Geochemistry)

and reviewed by



Chris Kennedy, PGeo
Principal Consultant (Geochemistry)

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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DRAFT

Memo

To	Mathieu O'Leary	**Client**	Mount Polley Mining Corporation
From	Stephen Day	**Project**	CAPR001713
Cc	Lee Nikl, Golder Don Parsons, MPMC Shauna Litke, SRK	**Date**	March 22, 2022
Subject	Review of Geochemical Source Terms – Mount Polley Mine		

1 Introduction

Mount Polley Mining Corporation (MPMC) is applying to extend its Environmental Management Act (EMA) authorization (Permit 11678) to allow discharge of treated water to Quesnel Lake beyond the current expiry date of December 31, 2022. The original authorization issued in 2016 was based on a site wide water quality model inputs to which were geochemical source terms developed by SRK Consulting (SRK 2016). To support the application, SRK was requested by MPMC to review the basis for the source terms and provide commentary on the need for an update to the model to reflect changes in source water chemistry.

This memorandum provides results of the review.

2 Background

SRK (2016) described development of the original geochemical source terms beginning with conceptual geochemical models to describe the anticipated performance of each source of contact water. The main sources of chemical load are the waste rock dumps and tailings. Numerical source terms were developed by statistically summarizing water chemistry monitoring data for near source seeps. The higher concentrations in the monitoring datasets were assumed to represent contact water with minimal dilution. This approach avoids the limitation of interpreting laboratory test data. The main assumption when using monitoring data is that the wastes are geochemically stable.

SRK (2016) did not recommend separate source terms to indicate chemical loads originating from two small sources (elemental sulphur stockpile and magnetite stockpile) based on the assumption that the loads were reflected in the waste rock dump seep monitoring. In 2018, the sulphur stockpile was relocated to a lined pad already containing waste rock mixed with elemental sulphur. Acidic drainage from the pad is pumped to the tailings storage facility (TSF).

3 Method

SRK evaluated whether a statistically significant change in near source concentrations had occurred between data collected up to December 2015 and subsequent data collected from January 2016 to December 2021. December 2015 was the cutoff for data used by SRK (2016). 95% confidence limits on geometric averages for the two data periods were compared. If the ranges overlapped, it was concluded that no change in near source concentrations had occurred.

For selected parameters, box and whisker plots were prepared to examine the distributions in more detail.

4 Results

4.1 Waste Rock

Table 1 summarizes findings on statistically significant changes in seepage chemistry of waste rock and tailings seeps. All metals and related elements are expressed as dissolved concentrations. For waste rock, the difference is shown by decrease in pH and increased concentrations of elements neutralizing sulphuric acid by reaction with calcium and magnesium carbonates and potassic silicates. The depression in pH increased the solubility of several heavy metals (Cd, Cu, Ni and Zn).

Table 1: Summary of Statistically Significant Changes in Seepage Chemistry

Waste Rock Seeps		Tailings Seeps	
Significant Decrease	**Significant Increase**	**Significant Decrease**	**Significant Increase**
Alkalinity, NH_3, As, Ba, Cl, DOC, Mn, NO_3, NO_2, PO_4, V	H^+, **Cd**, Ca, Cu, **Li**, Mg, Mo, Ni, K, **Se**, Na, SO_4, Zn	Al, Sb, Ba, DOC, Ni, NO_3, NO_2, Se, V	H^+, alkalinity, NH_3, As, B, Ca, Co, Fe, Li, Mg, Mn, Mo, K, Na, SO_4, U, Zn

Source: https://srk.sharepoint.com/sites/NACAPR001713/Internal/2022-02_SourceTermReview/[SourceTermDataReview_CAPR001713_SJD_R0.xlsx]

Notes: Parameters shown in bold show significant increases in average concentrations when seeps influenced by the sulphur stockpile are removed from the geometric mean.

For the most part, these differences can be accounted for by increased sulphate and metal concentrations at NEZ Seep 1 and 2, which are believed to be influenced by oxidation and leaching of the elemental sulphur. Monitoring of the drainage from the leach pad containing ore, waste rock and elemental sulphur showed average pH, sulphate and copper of 3.3, 15 g/L and 750 mg/L, respectively. Parameters shown in bold still showed a significant increase after removal of these seeps from the calculation of averages. At Seep 1, pHs declined below 7 sporadically in 2017 and one reading was just below 6 in 2019 (Figure 1). The decline in pH and increase in copper concentrations appears to have plateaued as would be expected since the sulphur pile was removed in 2018.

While average selenium concentrations increased as shown in Table 1, the statistics used to define the source term (95th and 99th percentiles) did not change markedly.

Figure 1: Copper and pH Trends for NEZ Dump Seep 1

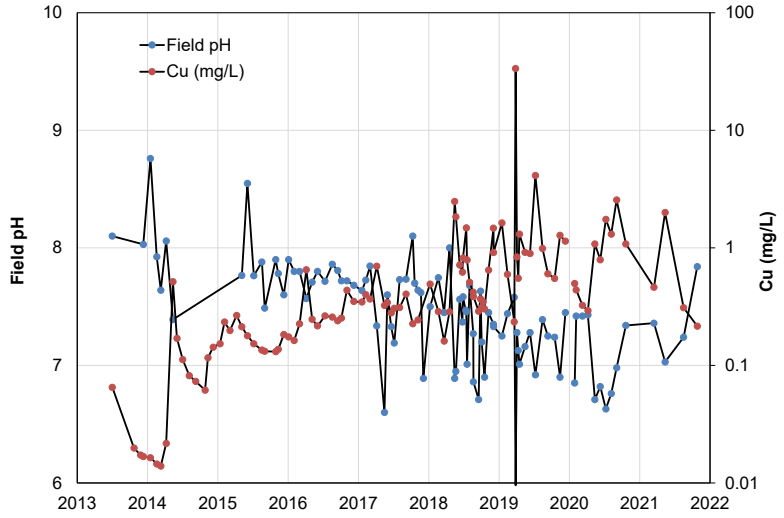

https://srk.sharepoint.com/sites/NACAPR001713/Internal/2022-02_SourceTermReview/[SourceTermDataReview_CAPR001713_SJD_R0.xlsx]

Figure 2: Box and Whisker Plot for Selenium

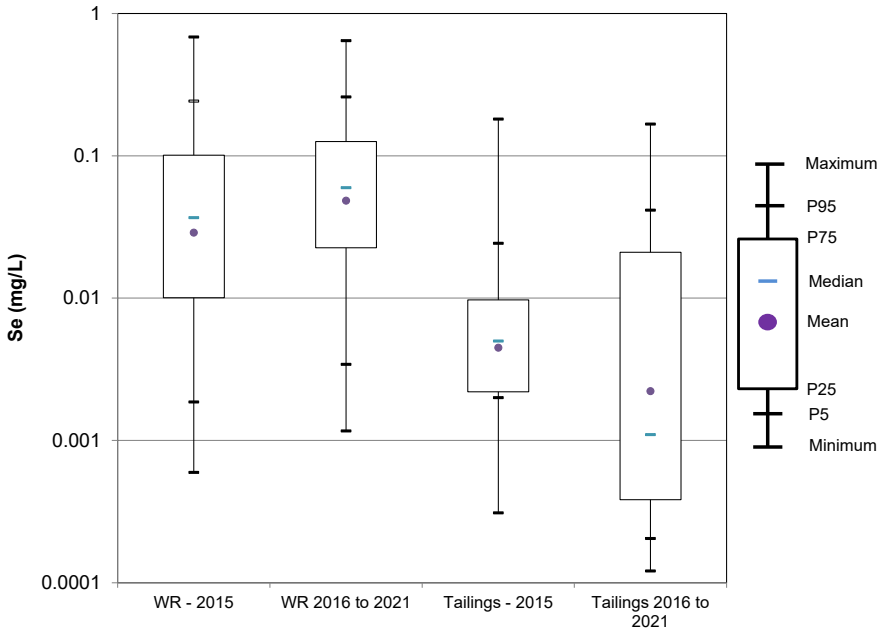

Source: https://srk.sharepoint.com/sites/NACAPR001713/Internal/2022-02_SourceTermReview/[SourceTermDataReview_CAPR001713_SJD_R0.xlsx]

4.2 Tailings

Table 1 shows statistically significant increases for a number of parameters in the tailing seeps. Statistics for this period reflect the long-term record of monitoring prior to the tailings breach in August 2014, the subsequent period when the tailings were drained following the breach and re-activation of the TSF after the dam was reconstructed. Of those parameters shown in Table 1, the greater increases were apparent for sulphate and molybdenum. Seepage concentrations for these two parameters are correlated which is consistent with the expectation that they both originate by oxidation of pyrite since molybdenite is uncommon in the mineralization at Mount Polley.

Inspection of sulphate and molybdenum trends for individual seeps shows the upward trend but also stabilization of the trend in recent years (Figure 3). The explanation for the trends is not clear. It may reflect dewatering of the tailings following the breach resulting in greater oxidation of tailings. pHs have declined (Table 1) but remain above 7 which might indicate greater acid generation with neutralization by carbonates. A second explanation is that acidic water from the leach pad containing elemental sulphur is pumped to the tailings pond, but molybdenum is not detected in the leach pad water and sulphate and molybdenum are strongly correlated. It seems unlikely that the acid drainage from the leach pad would be affecting the chemistry of seepage from the TSF. The apparent flattening of the trend may indicate that the solubility of secondary minerals is controlling concentrations. Sulphate concentrations in these seeps are below the solubility limit resulting from the formation of gypsum (typically near 1500 mg/L in waters dominated by calcium and sulphate) but this is expected because seeps are not pure contact waters. At these pH conditions, molybdenum concentrations may be controlled by the solubility of calcium molybdate (powellite).

Figure 3: Sulphate and Molybdenum Trends for East Main Toe Drain

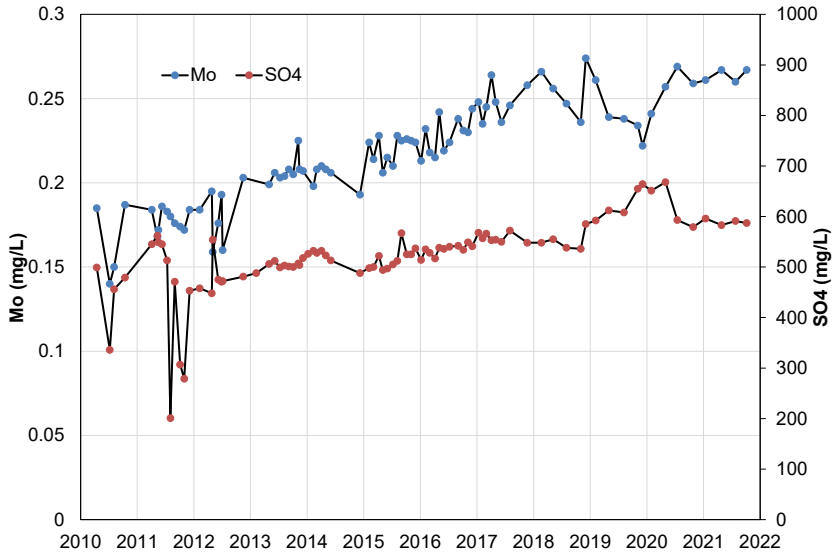

Source: https://srk.sharepoint.com/sites/NACAPR001713/Internal/2022-02_SourceTermReview/[SourceTermDataReview_CAPR001713_SJD_R0.xlsx]

Selenium shows a statistically significant but small (0.002 mg/L) decrease in average concentrations, but the dataset has become more variable particularly as shown by the spread in quartiles (Figure 2). Trends for individual seeps are variable.

5 Discussion

Seepage from the waste rock dumps has been mostly stable for key parameters (pH, sulphate, copper and selenium) over the monitoring period with the exception of localized influence of sulphuric acid waters likely originating from oxidation of the elemental sulphur pile. The acidity has been neutralized by reaction with carbonate and silicate minerals in the waste rock but it resulted in depressed pHs and occasional breakthrough of acidic waters to waste rock seeps. The removal of the elemental sulphur pile seems to have arrested the downward trend in pH and upward trend in copper.

There was a risk that depletion of acid neutralizing minerals from the waste rock could have triggered acidification of the waste rock on the infiltrating water flowpath but this does not seem to have occurred based on sampling of the foundation materials (Litke et al. 2019). It is expected that the seeps influenced by the sulphur stockpile will show a downward trend in parameters such as sulphate and copper.

Based on the current dataset, the waste rock source terms do not need to be modified because the source term method would result in source terms that are biased by these localized effects. However, monitoring of these seeps should continue and a sector-specific term developed if warranted.

Seepages from the TSF have shown significant increases in some parameters which may be a result in greater exposure of tailings due to dewatering of the tailings following the breach. It appears that trends in sulphate and molybdenum have stabilized over recent years which might be due to control by known secondary minerals (gypsum and powellite) in the tailings. The possible effect of secondary mineral solubilities means that current seepage chemistry should be a good indication of future water chemistry.

6 Conclusions

As a result of this review, SRK finds:

- Recent seepage chemistry statistics are influenced by seeps affected by leaching of sulphuric acid from the elemental sulphur stockpile which has now been relocated to the lined pad. Seepage chemistry is expected to improve as acidic waters are flushed from the pile. As a result, the source terms should not be updated to reflect the influence of these seeps.
- Upward trends in tailings seepage chemistry for some parameters appear to have stabilized over recent years which may reflect the influence of secondary mineral solubility. On this basis, higher concentrations would not be expected in the future.

SRK Consulting (Canada) Inc.

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Appendix C
Mount Polley Project – Environmental Baseline Report

Mount Polley Mine Site Baseline Environmental Setting and Land Capability

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The following sections are primarily excerpts from *The Mount Polley Mine Project Reclamation Plan* (Hallam Knight Piésold, 1996a), supplemented with information from more recent reports (references included).

1. SOILS

1.1. Terrain

Using airphoto interpretation, Blashill (1995a) conducted a preliminary terrain analysis of the Mount Polley project area. The principal terrain units are blankets and veneers of glacial atill (Mb and Mv), colluvial veneers (Cv), and gently to steeply sloping bedrock knobs (Rj to Rk). He also identified units of organic terrain (Ob and Obv) overlying glaciolacustrine materials (L^G). There are many small outcrops of bedrock, most of which are covered by thin veneers of glacial till, colluvium, or mixtures of the two. Even where soils are deeper, bedrock is usually found at depths of approximately 3 to 7.6m.

Veneers (less than 50cm thick) and blankets (more than 50cm thick) of morainal material are the most extensive landforms in the Mount Polley area. These morainal materials, also known as glacial till, were laid down by glacier ice, and they show little evidence of any subsequent reworking by water. Tills are generally poorly sorted, so that they contain a wide range of particle sizes, and the particles are often rounded and derived from a variety of rock sources. The morainal deposits at Mount Polley correspond to the Lanezi soil association of Lord (1984). Lanezi soils are loams oils developed on morainal materials deposited along the boundary zone of the Quesnel Highland. Parent materials range from load to clay loam with an acid to neutral reaction, and with moderate amounts of stones and gravel. In the Mount Polley are, Lanezi soils often occur in complexes with the Dragon soil association, which is described below. Soils mapped as Lanezi-Dragon units may contain 30 to 50% inclusions of the colluvial soils of the Dragon Association.

Veneers of colluvium, less than 1m thick, are the second most common landform in the project area. They are best expressed on the bedrock knobs and ridges in the Bell Pit and Springer/Cariboo Pit areas, as well as near the summit of Mount Polley itself, in Terrain Units #1 and #3 (Blashill, 1995a). “Colluvium” refers to soil materials that have been redistributed by gravity. Colluvium sometimes shows a degree of sorting by size, with the larger particles occurring farther downslope than the smaller ones. In contrast to till, coluvial particles often have rougher, more angular edges and they have the same lithology as the betrock occurring upslope from a colluvial deposit. The colluvial units recognized by Blashill (1995a) correspond to the Dragon and Lanezi-Dragon soil associations. Dragon soils are loamy and sandy soils developed on strongly sloping terrain at elevations above 900m.

Galciolacustrin landforms (L^G) ar those that have originated within the basins of proglacial lakes. Although Lord (1984) did not map glaciolacustrine landforms within the Mount Pole area itself, he showed extensive glaciolacustrine areas adjacent to the upper Quesnel and lower Cariboo rivers. He assigned these units to the Bednesti soil association, which includes fine loamy soils developed on silty, stratified glaciolacustrine deposits. These soils generally have a low stone content, are fine-textured, and often have a varved or layered appearance. Blashill (1005) reported that deep excavations by

engineering staff found glaciolacustrine deposits beneath a surficial till in the proposed tailings area, although the glaciolacustrine deposits were not continuous. IN that area, the sediments were up to 20m thick over bedrock.

Glaciofluvial landforms include both erosion and depositional landforms that have been formed by the water from melting glaciers. Lord (1984) did not recognize any glaciofluvial deposits within the Mount Polley area itself, although he mapped two such areas nearby. One such area ws int eh valley northwest of Polley Lake, and a second in the valley containing Prior and Little Lakes. He assigned these units to the Ptarmigan-Catfish Creek soil complex, which referes to sandy-sekeltal soils developed on glaciofluvial material at elevations from 900 to 1200m, which also contain significant inclusions of sedge fen peat. Blashill (1995a) did no note any glaciofluvial landforms within the Mount Polley area.

Organic landforms are the result of biological activity. In the Moutn Polley area, organic landforms are the result of the centrurues if accumu.ation sedge or moss peat. Lord (1984) assigned these units to the Catfish Creek-Spakwaniko (CC-SW) soil landscape complex, and mapped two such units in the Mount Polley area. The units are the small wetland at the south end of Polley Lake, and that within the southern portion of the tailings area. Blashill (1995a) mapped a small area of organic terrain northeast of the Main Pit (Terrain Unit #5), and two small organic unites within the tailings area.

A terrain classification map for the site and a soil/landform classifications map are provided as Figures 2.1 and 2.3[1] (extracted from Hallam Knight Piésold Ltd., 1996a).

Detailed soil and landform inventories have been completed across the site prior to development of the mine (Blashill, 1995a; Blashill, 1995b; Meister, 1998; Meister, 2001; Meister, 2004; Meister, 2005; Meister 2006; Meister, 2010), and can be referenced for further details.

1.2. Soil Land Capability

The Land Capability for Agriculture in BC contains 7 classes differentiated on the basis of the inherent capability of soils and climate to support agricultural crops. There was no agriculture practiced in the area and agriculture is not planned as an end land use at mine closure; however, agriculture land capability was assessed in soil and landform inventories completed across the site (Blashill, 1995a; Blashill, 1995b; Meister, 1998; Meister, 2001; Meister, 2004; Meister, 2005; Meister 2006; Meister, 2010). There is no climatic moisture deficit (CMD) number for the Mount Polley area, but the climatic capability for most of the site was mapped as 3GF. The CMD was estimated to be the minimum for the Class 3 unit, 116 mm, and based on average site soil conditions, the soil moisture deficit (SMD) was estimated to be 56.5 mm. This places the mine site in Class 2A for moisture limitations. The SMD calculated for each soil pit does not improve or increase the moisture limitations beyond Class 2A. Improved ratings were based on topographic changes due to bedrock removal, stone picking and improved drainage, although classes 6 and 7 normally have no improved rating. The depth to bedrock (R) and the climatic capability (3C) (limited by a short frost-free period and low thermal class) remain the

[1] MPMC is currently working to develop digitized versions of these map.

limiting factors for agricultural production. Overall the agricultural capability for the site is poor. None of the land in the project area is included in the Agricultural Land Reserve.

The soil map units are rated as suitable for forestry. The Ministry of Forests and Range site index estimates by site series for Mount Polley are 24 meters for Douglas-fir and lodgepole pine, and 21 meters for spruce. This site index provides a numeric description of site productivity for a particular target species; this is the height of the largest diameter (at breast height) site tree on a 0.01 ha plot at age 50, provided the tree is suitable for measurement (Ministry of Forests and Range, 2006). Due to favorable climatic and soil conditions, this site is very productive in terms of timber for a B.C. Interior site.

2. VEGETATION CLASSIFICATION

Biogeoclimatic maps of the Cariboo Forest Region indicate that the Mount Polley site is located within the Horsefly Moist Cool variant of the Interior Cedar-Hemlock Biogeoclimatic Zone (ICHmk3), which occurs between Quesnel and Horsefly Lakes, in the valley of McKinley Creek, and near Canim Lake. Table 2.1 provides a summary of the ICHmk3 site series. The dominant trees on upland sites in the ICHmk3 are Douglas-fir, Western red cedar, hybrid spruce, and subalpine fir. Lodgepole pine, trembling aspen, and paper birch are also present in the early stages of forest succession. The forests in lower valley bottoms are often dominated by hybrid spruce and black cottonwood.

Field surveys of the Mount Polley site have found that the dominant trees in mature and old growth stands are Western red cedar, Douglas-fir, and subalpine fir. Subalpine fir usually dominates the seedling regeneration in mid-seral, mature, and old forests. Black cottonwood dominates the early stages of forest succession after logging, while trembling aspen and paper birch are usually secondary species. Western hemlock is present in the area, but rare. Large portions of the project area have been selectively logged to remove the largest Douglas-firs and Western red-cedars, and some clearcut sites have been replanted with lodgepole pine seedlings. Hybrid spruce occur sparingly on lower, middle and upslope positions in the Mount Polley site area, and is most common near streams and lakeshores.

Table 2.1 Interior Cedar Hemlock Horsefly Moist Cool Variant vegetation summary

Site Association	Moisture Regime	Slope Position	Gradient (%)	Aspect	Parent Material	Vegetation
ICHmk3/01	mesic, submesic	middle	0 - 20	variable	gravelly, loamy morainal blanket	western redcedar, subalpine fir, falsebox, black huckleberry, bunchberry round-leaved violet, foamflower, rosy twistedstalk, red stemmed feathermoss
ICHmk3/02	xeric, subxeric	crest	0 - 10	variable	loamy gravelly moraina veneer over	Douglas-fir, western redcedar, saskatoon, soopolallie, pussytoes, wild strawberry, white hawkweed, juniper haircap moss, lichens
ICHmk3/03	subxeric, xeric	upper	50 - 70	variable	gravelly loamy colluvial veneer over morainal blanket	Douglas-fir, western redcedar, saskatoon, soopolallie, rough-leaved ricegrass, wavy-leaved moss, Peltigera sp. Mosses not forming carpet-like ground cover.
ICHmk3/04	subhygric, mesic	lower, middle	10 - 35	variable	loamy morainal blanket	western redcedar, falsebox, devil's club, (10% cover or less), foamflower, oak fern (average cover 30%), leafy mosses, red-stemmed feathermoss
ICHmk3/05	subhygric	middle, lower	10 - 35	variable	loamy morainal blanket, silty fluvial blanket	hybrid white spruce, subalpine fir, thimbleberry, black twinberry, red-osier dogwood, fringed aster, sweet-cicely, ragged moss. Shrubs diverse and abundant up to 70% cover.
ICHmk3/06	subhygric, mesic	lower, middle	0 - 25	variable	loamy morainal blanket, loamy to silty fluvial blanket	hybrid white spruce, subalpine fir, devil's club (up to 40% cover), black gooseberry, lady fern, oak fern, enchanter's nightshade, stream violet, leafy mosses. Trees and shrubs show good to excellent vigour.
ICHmk3/07	hygric	toe or depression	0	level	loamy morainal or fuvial blanket	hybrid white spruce, western redcedar, red-osier dogwood, black twinberry, devil's club (average 10% cover), horsetails, soft-leaved sedge, American brooklime, leafy mosses, ragged moss. Thallose liverworts in depressions and moss layer very diverse.
Non-forested unit	subhygric	depression	0	level	organic blanket	hybrid white spruce and lodgepole pine, when present occur as stunted trees. Scrub birch, Labrador-tea, hardhack, sedges, sphagnum mosses.

2.1. Zonal Site Series (ICHmk3/01)

"Zonal" sites are those of average moisture and nutrient conditions, on moderate to gentle slopes. This site series occurs on gentle slopes of 0 to 50°, generally on till blankets, which are sometimes mantled with colluvial veneers where slopes range from 35 to 50°.

According to Steen (1989), mature and old stands on zonal sites are dominated by Western red cedar and subalpine fir, with an understory of falsebox, black huckleberry, bunchberry, round-leaved violet, and foamflower. The herb and shrub layers are relatively poorly developed (especially on north and northeastern aspects), and the forest floor tends to be carpeted with feather mosses, especially red-stemmed feather moss.

Baseline field studies found that the vegetation of zonal sites to be much richer and more diverse. Much of the project area was selectively logged in the 1970's, when the larger, merchantable Douglas-firs and Western redcedars were removed. Selective logging removed the tallest trees in the canopy, but left smaller conifers, advance seedling regeneration by subalpine fir, and large back cottonwoods in place. Much of the mine development area now supports a mixed forest with a sparse canopy of veteran conifers; a moderately dense pole sapling cover of subalpine fir, Western red cedar, and Douglas; and a dense tall shrub canopy of black cottonwood, Sitka alder, Douglas maple, Scouler willow and Bebbian willow. Most cut-over stands have a luxuriant low shrub understory dominated by red elderberry, black huckleberry, black twinberry, various willows, thimbleberry, western mountain-ash, prickly currant, and wild red raspberry. The herb layer in cut-over areas is also well-developed on zonal sites and is dominated by fireweed, bluejoint, and other grasses, Solomon's seal, twinflower, and bunchberry.

2.2. Xeric to Subxeric Site Series (ICHmk3/02, ICHmk3/03)

The driest sites on steep south-facing slopes and ridge crests belong to the ICHmk3/02 and ICHmk3/03 site series. Such sites are dominated by open to closed forests of Douglas-fir and Western red cedar. Common shrub species in the understorey are Saskatoon, soopalallie, and common herbs, including pussytoes, wild strawberry, white-flowered hawkweed, and rough-leaved rice grass. Juniper hair cap moss and lichens dominate the forest floor on very dry sites, while rough-leaved rice grass, wavy-leaved moss, and dog's-tongue lichen are characteristic species of slightly moisture sites (Steen, 1989).

Baseline field surveys found the driest sites (on ridge crests) with thin, rapidly drained soils conforming to 02 and 03 site series. The 02 site series is found on south- or west-facing ridge crests where soil depths less than 20 cm and it has a very localized distribution. They are dominated by an open forest of lodgepole pine and Douglas-fir. The tall shrub understorey is dominated by an advance regeneration of subalpine fir seedlings, but is otherwise poorly developed. The low shrub understory is dominated by black huckleberry, birch-leaved spiraea, falsebox, prickly rose and prince's pine. Common juniper is very scarce at Mount Polley. The herb layer is generally poorly developed, usually making up less than 1% of the groundcover. Twinflower, white hawkweed, and hear-leaved arnica are the most prominent herbs. The common mosses are red stemmed feather moss, juniper hair cap moss and dog's tongue lichen. Though usually present with low cover, coral lichen is never dominant.

Stands conforming to the 03 site series are more widespread, generally where soils are 20 to 50 cm deep, on upper slope positions. These sites are distinguished from the 02 by:

- A somewhat more vigorous growth of Douglas-fir, lodgepole pine, and subalpine fir;
- The presence of occasional Western red cedar;

- The presence of Sitka alder, Saskatoon, Western mountain-ash, and tall willows in the tall shrub understory;
- Higher coverage and greater species diversity in the low shrub and herb understory;
- Fair to good development of bear's hair and witches' hair lichens in the epiphyte layer.

An 03 site immediately west of the mill area was selectively logged in the 1970's, resulting in the removal of some very large Douglas-firs and Western red cedars with stump diameters of 70 to 100 cm. The cut-over area was slash-burned, and the natural vegetation was allowed to regenerate. The resulting forest provides excellent summer range for mule deer and moose. This stand has a very variable, patchy cover by Western red cedar, subalpine fir, black cottonwood, alder, and willow, and a very rich shrub understory with several very palatable species, such as Western mountain-ash, Saskatoon, wild rose, and willows. Many of the common shrub species are berry-producing, and important factor for black bears and birds, such as cedar waxwing, bohemian waxwing, America robin, and other thrushes.

2.3. Mesic to Moist Nutrient-Rich Site Series (ICHmk3/04, ICHmk3/05)

These sites occupy middle and lower slopes, with gradients of 10 to 35°. They often receive inputs of moisture and nutrients from overland seepage, and are usually associated with deep blankets (soil depths greater than 50 cm) of glacial till or fluvial deposits.

According to Steen (1989), site series 04 is dominated by western red-cedar, oak fern (30% cover), falsebox, foamflower, and red-stemmed feather moss. Devil's club has a cover of less than 10%. On the slightly moisture 05 site series, hybrid spruce and subalpine fir become increasingly dominant in the tree canopy. The shrub layer is much better developed than on zonal sites, and is dominated by thimbleberry, black twinberry, black gooseberry, and red-osier dogwood. The herb layer is also much lusher, and is dominated by species such as oak fern, fringed aster, wild sarsaparilla, lady fern and sweet-cicely. Leafy mosses and ragged mosses become increasingly important in the moss layer as moisture and nutrient levels increase.

Field studies at Mount Polley found many sites that generally conform to the 04 and 05 series, however many of these sites have been selectively logged, then slash-burned, so that the actual vegetation is atypical. Selectively logged areas are dominated by a mixed forest of black cottonwood, Douglas-fir, and subalpine fir. These sites typically have a very well-developed tall shrub understory dominated by black cottonwood seedlings, aspen poplar, Sitka alder, Douglas maple, Scouler willow, and Bebbian willow. The low shrub understory is also well developed, and often includes thimbleberry, black huckleberry, oval-leaved blueberry, red elderberry, black twinberry, black gooseberry, and wild raspberry. The herb understory is often very rich, and usually includes oak fern, lady fern, false Solomon's-seal, star-flowered Solomon's –seal, rosy twisted stalk, bunchberry, fireweed, and one-leaved foamflower. Some 04 and 05 sites near Bootjack Lake have been set back to a very early stage of succession, and are dominated by black cottonwood, alder, willows, fireweed, pearly everlasting, dandelion and various tame grasses, legumes, and weeds.

Mature and older forests in the 04 and 05 site series tend to be dominated by species that are of relatively low palatability to ungulates, the main exception being red-osier. These mature stands almost always have excellent growths of arboreal lichens, notably witches' hair and bear's hair, growing in thick beards up to 30 cm long. These arboreal lichens may provide an important forage source for mule deer, particularly in the early spring. Many of the dominant shrub species are good berry-producers, a feature that may be important to black bears and some songbirds.

Forest regeneration following logging has had varying degrees of success in the Mount Polley area. In some areas, selective logging has actually improved the area's capability as summer habitat for moose and mule deer by removing the tree canopy and allowing more light on the herb and shrub understory. Removal of the coniferous tree canopy has increased the cover of several highly palatable forage species, notably black cottonwood, trembling aspen, Scouler and Bebbian willow, Western mountain-ash, Saskatoon, red-osier dogwood, and red elderberry.

2.4. Moist, Very Rich Sites (ICHmk3/06, ICHmk3/07)

They are found at the toes of long slopes in riparian habitats and in topographic depressions. These sites are associated with deep blankets of morainal or fluvial materials. They are often dominated by forests of hybrid spruce and Western red cedar, with an understory of red-osier, black twinberry, devil's club, horsetails, soft-leaved sedge, American speedwell, and various mosses. Tree growth is good to excellent in these sites, and the shrub cover is usually lush and diverse.

At Mount Polley, site series 06 is readily recognized by the devil's club cover of up to 40%. Other prominent plant indicators include oak fern, spiny wood-fern, lady fern, foamflower, false Solomon's-seal, rosy twisted stalk, and clasping twisted stalk. As good example, is SE of the mill site. Another is adjacent to the Bootjack Lake Recreation Site. A small tract of mature forest of the 06 site association occurred in the north-central portion of the Tailings Storage Facility (TSF) area, and extensive areas of large stumps indicate that it may have been much more extensive before clear-cutting in the 1970's.

Site series 07 is not found within the mine development area itself, although a good example of this vegetation occurs in the riparian zone of Hazeltine Creek, about 3 km east of the tailings area. That area supports very tall, vigorous stands of hybrid spruce and black cottonwood. Smaller examples may occur near the shores of Bootjack and Polley Lakes. These areas may be important foraging areas for bears, and wintering for moose and mule deer. Horsetail, sedges and red-osier dogwood are particularly important forage species.

2.5. Non-Forested Organic Sites

There was a wetland in the south-western portion of the tailings area. The vegetation adjacent to the pond is dominated by poor-fen sphagnum, common green sphagnum, and narrow-leaved cottongrass, and it had many plant indicators of true bog conditions, such as Labrador-tea, buck-bean, narrow-leaved sundew, bog laurel and sphagnum mosses. The pond itself was surrounded by floating mats of sphagnum and cotton grass, but there is no emergent zone of sedges, cattails, or bulrushes. The

submergent zone is also poorly developed, consisting of a single plant of yellow pond lily. A shrub wetland northeast of the pond was dominated by dense thickets of hardhack, Sitka alder, and tall willows. Where willows were a significant component of the vegetation, these shrub carrs may be important wintering areas for moose. In this wetland, scrub birch, Sitka alder, Labrador-tea, and hardhack were the only important shrub species, and its value for ungulates was low.

3. WILDLIFE AND WILDLIFE HABITAT

Baseline wildlife and wildlife habitat reconnaissance was completed in 1995 by Knight Piésold to guide reclamation activities for optimising wildlife habitat after mine closure. The major findings of this study were:

1. The project will have negligible effects on local and regional populations of raptors, waterfowl, other water birds, and shorebirds.
2. The songbirds found in the mine development area also found outside the mine development area in large populations.
3. The project will not cause any wildlife population to disappear from the local area or from the surrounding region.
4. So far as can be determined, the project will not result in the loss of mineral licks, winter yarding areas, migration corridors, or rutting areas used by ungulates.
5. The project will not affect specialized wildlife habitats such as caves, cliffs, or canyons.
6. The wetland in the tailings area has a small area of less than 10 ha, and it has a low capability for waterfowl, shorebirds, wetland songbirds and moose. Mine development will displace one colony of beavers in this wetland.
7. The project will not affect the ability of wildlife to use or gain access to Polley or Bootjack Lakes.
8. Although most mine development will take place on the areas that have been selectively logged or clear-cut, the project will displace small areas of mature forest habitat.
9. The project will displace small numbers of mule deer and moose from summer and autumn rages that they currently use. However, alternate ranges of comparable quality exist in adjacent areas and improved grazing will be available in reseeded areas.

3.1. Wildlife Species Present

The baseline wildlife study identified 44 bird species and 10 mammal species in the project area, with another 18 bird species identified in the surrounding region. These species are listed in Table 3.1.

Table 3.1 Checklist of the wildlife of the Mount Polley Mine and adjacent areas near Likely, B.C.

Notes:

BIRDS	
* Common Loon	*Gavia immer*
*Green-winged Teal	*Anas crecca*
*Mallard	*Anas Pltyrhynchos*
*Bufflehead	*Bucephala albeola*
*Bald Eagle	*Haliaeetus leucocephalus*
*Sharp-shinned Hawk	*Accipiter striatus*
*Blue Grouse	*Dendragapus obscurus*
Spruce Grouse	*Dendragapus Canadensis*
Ruffed Grouse	*Bonasa umbellus*
*Sharp-tailed Grouse	*Tympanuchus phasianellus*
White-tailed Ptarmigan	*Lagopus leucurus*
*Killdeer	*Charadrius vociferus*
*Greater Yellowlegs	*Tringa melanoleuca*
Spotted Sandpiper	*Actitis macularia*
*Common Snipe	*Gallinago gallinago*
*Sandhill Crane	*Grus Canadensis*
*Great Blue Heron	Ardea herodias
Belted Kingfisher	*Ceryle alcyon*
*Northern Flicker	*Colaptes auratus*
*Yellow-bellied Sapsucker	*Sphyrapicus varius*
Downy Woodpecker	*Picoides pubescens*
*Three-toed Woodpecker	*Picoides tridactylus*
*Black-backed Woodpecker	*Picoides arcticus*
*Pileated Woodpecker	*Dryocopus pileatus*
*Western Wood-Pewee	*Contopus sordidulus*
*Olive-sided Flycatcher	*Contopus borealis*
*Hammond's Flycatcher	*Empidonax hammondii*
*Willow Flycatcher	*Empidonax traillii*
Violet-green Swallow	*Tachycineta thalassina*
Cliff Swallow	*Hirundo pyrrhonota*
*Barn Swallow	*Hirundo rustica*
*Gray Jay	*Perisoreus Canadensis*
Steller's Jay	*Cyanocitta stelleri*
*Common Raven	*Corvus corax*
*Common Crow	*Corvus brachyrhynchos*
Black-capped Chickadee	*Parus atricapillus*
*Mountain Chikadee	*Parus gambeli*
*Boreal Chikadee	*Parus hudsonicus*
*Red-breasted Nuthatch	*Sitta Canadensis*
*Winter Wren	*Troglodytes troglodytes*
*Golden-crowned Kinglet	*Regulus strapa*
*Ruby-crowned Kinglet	*Regulus calendula*
*Townsend's Solitaire	*Myadestes townsendi*
*Swainson's Thrush	*Catharus usstulatus*
*American Robin	*Turdus migratorius*
*Varied Thrush	*Ixoreus naevius*
European Starling	*Sturnus vulgaris*

BIRDS (continued)	
*Warbling Vireo	*Vireo gilvus*
*Solitary Vireo	*Vireo solitaries*
*Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
*Yellow-rumped Warbler	*Dendroica coronate*
*Magnolia Warbler	*Dendroicamagnolia*
*Blackpoll Warbler	*Dendroicastriata*
*Townsend's Warbler	*Dendroica townsendi*
*MacGillivray's Warbler	*Oporornis tolmiei*
*Common Yellowthroat	*Geothlypis trichas*
*Wilson's Warbler	*Wilsonia pusilla*
*Common Redstart	*Setophaga ruticilla*
*Western Tanager	*Piranga ludoviciana*
*Chipping Sparrow	*Spizella passerine*
*Lincoln's Sparrow	*Melospiza lincolnii*
*Song Sparrow	*Melospiza melodia*
*Dark-eyed Junco	*Junco hyemalis*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
*Pine Siskin	*Carduelis pinus*
*Evening Grosbeak	*Coccothraustes vespertinus*

MAMMALS	
*Snowshoe Hare	*Lepus americanus*
*Northwestern Chipmunk	*Tamias amoenus*
*Red Squirrel	*Tamiasciurus hudsonicus*
*Beaver	*Castor Canadensis*
*Coyote	*Canis latrans*
*Gray Wolf	*Canis lupus*
Red Fox	*Vulpes vulpes*
*Marten	*Martes americana*
Fisher	*Martes pennanti*
*Long-tailed Weasel	*Mustela frenata*
River Otter	*Lontra canadensis*
Wolverine	*Gulo gulo*
* Cougar	*Felis concolor*
* Lynx	*Lynx canadensis*
*Black Bear	*Ursus americanus*
* Grizzly Bear	*Ursus arctos*
*Mule Deer	*Odocoileus hemionus*
*Moose	*Alces alces*

1) Asterisk (*) indicates the species has been recorded in the Mount Polley Mine area. Note that some bird species without an asterisk have likely been observed, but not recorded.
2) Species names follow the system of scientific names currently used in British Columbia (Luttmerding et al., 1991).

3.1.1.*Amphibians*

During field studies in the mine development area in May-June 1995, only one adult frog or toad was seen, which escaped before it could be identified. Frog tadpoles, which could not be identified to species, were recorded in a beaver pond outside the project area, near “Ditch Road” Forest Service Road.

3.1.2.*Waterfowl, Shorebirds and other Water-Oriented Birds*

The Mount Polley project area has a relatively diverse land bird fauna, but relatively few species of waterfowl, shorebirds and other water-oriented birds. There is a greater diversity of aquatic habitats outside the project area, at Bootjack, Polley, Morehead, Prior and Quesnel Lakes, and at Hazeltine Creek and the Quesnel River. There is a correspondingly greater diversity of water birds and wetland species outside the project area.

Within the project area itself, potential habitat for waterfowl and shorebirds is limited to a small 3-ha bog pond in the southwestern portion of the proposed tailings area, the surrounding 2-ha wetlands, and to short sections of the tributary to South Edney Creek. In May-June 1995, the known waterfowl population of the mine development area consisted of one pair of green-winged teal, and a trio of a male and two female buffleheads. At most, the shorebird population may have amounted to one or two pairs of killdeer, greater yellowlegs and common snipe.

Two sandhill cranes were recorded in the tailings area on 27 July 1989, and a greater blue heron was recorded at the Upper Hazeltine Bridge on 15 August 1989 (Imperial Metals Corporation 1990). Neither of these species was recorded in the project area in May-June 1995, and their present status in the project area is uncertain.

The only other water-oriented birds recorded in the project area in May-June 1995 were songbirds that characteristically occur in wetlands, such as willow flycatcher, common yellowthroat, song sparrow and Lincoln’s sparrow.

3.1.3.*Upland Game Birds*

The only grouse record for the mine area is one of a pile of winter grouse droppings in the Maine Pit area, in a cut-over tract of red cedar-Douglas-fir forest. However, according to Mr. Robert Toupin, a long-time resident, five grouse species occur in the Likely area. These are the ruffed grouse, blue grouse, spruce grouse, sharp-tailed grouse and white-tailed ptarmigan. Of these species, the ruffed grouse is usually found in deciduous and mixed-wood forest, and the blue grouse is usually found in mature to old coniferous forests dominated by western red cedar and Douglas-fir. Mr. Toupin reports that a flock 10-20 sharp-tailed grouse regularly frequents the East corner of the tailings area.

3.1.4.*Birds of Prey*

Though they actively looked for them, Hallam Knight Piésold staff did not record any birds of prey in the mine development area during field studies in May-June 1995. Though they searched for them intensively in the mine area, HKP did not find any large stick nests, large nesting cavities, "whitewashed" cliffs or rock outcrops, which could indicate potential nest sites for a variety of raptors.

An unidentified hawk was recorded at Bootjack Creek on 15 October 1989 (Imperial Metals Corporation 1990). Only two species of raptors were recorded during field studies in May-June 1995, both well outside the proposed mine development area. These records were of a sharp-shinned hawk at Km 11 on the "Ditch Road", and of a pair of barred owls heard calling at Likely in the early morning of 30 May 1995.

Robert Toupin states that there was a pair of bald eagles on Polley Lake in 1995, although he did not record a nest location. HKP did not record any eagles on Polley, Bootjack or Morehead Lakes during field studies in May-June 1995. There appears to be little or no foraging habitat for bald eagles within the mine development area. The bog pond does not contain fish, while the small creeks draining the mine and mill area dry up by mid-summer. There may be a small amount of fish habitat in the tributary to South Edney Creek, which could provide a limited amount of foraging habitat for eagles.

3.1.5.*Woodpeckers and Songbirds*

Five woodpecker species were recorded in the mine development area, and a sixth was recorded in the village of Likely. None of these species is considered rare in British Columbia. The yellow-bellied sapsucker is often associated with deciduous woodlands, particularly those dominated by aspens or birches. The northern flicker is a common and widespread species, found in both deciduous and coniferous forests, as well as in aspen parkland. The downy woodpecker, which was recorded twice at Likely, is more characteristic of deciduous or mixed forests. Pileated woodpecker diggings were found in large western red cedars at four locations in the mine development area. Both the black-backed woodpecker and its close relative, the three-toed woodpecker, occur in mature cedar and Douglas-fir forests in the mine development area. An active nest of three-toed woodpeckers was found on 10 June 1995 in an old growth western red cedar – Douglas-fir forest, east of the North Pit area.

Between 29 May and 12 June 1995, nearly 30 species of songbirds were recorded in the mine development area, and another 10-15 species were recorded between Mount Polley and Likely. Songbirds were the most numerous and frequently recorded wildlife group in the Mount Polley area. From 8-12 June 1995, Hallam Knight Piésold used call counts to index the relative abundance of songbirds in the project area. Twelve locations in the mine development area were sampled, over a total of 17.6 km of transect length. Results of call counts are discussed in Section 3 of Hallam Knight Piésold (1995b).

Songbirds that are typically associated with young clear cuts and recent burns include chipping sparrow, dark-eyed junco, Hammond's flycatcher, western wood-pewee, warbling vireo, orange-crowned

warbled and American robin. As clear cuts and burns mature, they become increasingly dominated by thickets of deciduous trees and shrubs. At this stage, the pioneer bird species are joined by gray jay, Swainson's trush, yellow-rumped warbler and pine siskin. Typical songbirds of shrub thickets in wet areas are willow flycatcher, Wilson's warbler, common yellowthroat, song sparrow and Lincoln's sparrow.

Common bird species in mixed forests of deciduous trees and conifers include: Hammond's flycatcher, olive-sided flycatcher, ruby-crowned kinglet, American robin, Swainson's trush, varied trush, warbling vireo, solitary vireo, orange-crowned warbler, yellow-rumped warbler, Wilson's warbler, MacGillivray's warbler, chipping sparrow, dark-eyed junco and pine siskin. Typical species in dry forest of lodgepole pine and Douglas-fir include dark-eyed junco, chipping sparrow, yellow-rumped warbler, pine siskin, red-breasted nuthatch, Swainson's thrush and gray jay.

Characteristic songbird species in mature and old growth stands at Mount Polley include: Hammond's flycatcher, western-wood-pewee, red-breasted nuthatch, golden-crowned kinglet, Swainson's thrush, American robin, varied thrush, solitary vireo, yellow-rumped warbler, blackpoll warbler, magnolia warbler, Wilson's warbler, Townsend's warbler, chipping sparrow, dark-eyed junco and pine siskin. Of these species, the blackpoll, Townsend's and Magnolia warblers appear to be more common in mature and old forests than in any other habitat type.

3.1.6.*Small Mammals (Insectivores, Hares and Rodents)*

No shrews, moles or bats were recorded in the Mount Polley project area in 1989 or 1995.

Snowshoe hare sign, such as droppings and girdled shrubs, were relatively common in most forested habitats in the Mount Polley project area. However, hare droppings were not abundant enough to develop a reliable relative index of hare abundance in the various habitat types.

Hallam Knight Piésold recorded only three northwestern chipmunks in the Mount Polley project area in May-June 1995. Analysis of call-count data indicated low densities of 10 to 31 chipmunks/ 100 ha in the tailings area. No chipmunks were recorded on call-count transects in other parts of the mine area.

During 29 May to 12 June, Hallam Knight Piésold obtained only five records of red squirrels in the Mount Polley project area, including visual observations, calls and middens. Red squirrels were recorded on only 2 of the 12 call-count transects, at densities estimated at 6 to 8 squirrels /100ha. The Observer considered red squirrels numbers at Mount Polley to be low in comparison to other parts of the B.C Interior.

Fur harvest summaries do not distinguish between red squirrel and flying squirrel, and both species are reported simply as "squirrel". Squirrel is in fourth place among the species reported in fur harvest returns from Registered Trapping Area no. TR0502T056, which includes the Mount Polley area. The largest fur harvest of squirrels in this trapping area was in 1985, when 22 squirrels were trapped. Two or three squirrels were reported in each of the years 1986 to 1989, but none were reported from 1990 to

1994. In other trap lines in the region (TR0502T032, TR0502T037, TR0502T043 and TR00515T008), squirrel is in third position in terms of the total number of fur bearers harvested.

The beaver was recorded at only one location in the project area, in the small bog pond in the southwestern corner of the tailings area. Two beaver lodges, and one medium-sized adult were seen there between 29 May and 12 June 1995. Beaver sign (girdled or felled trees, beaver dams or beaver lodges) were not found anywhere else in the project area. There is an active beaver colony outside the project area, in a small wetland near Km 11 on the "Ditch Road". Next to marten, beaver is the second-most important fur-bearer in the five trap lines in the region surrounding Mount Polley. In trapping area TR0502T056 (which includes the Mount Polley project area), from 7 to 15 beaver per year were harvested in 1985-89, none were harvested from 1989 to 1993 and 4 were taken in 1994. Fur returns do not specify exactly where beaver were harvested within this large trapping area.

No muskrat were recorded during field studies in May-June 1995, although they were actively searched for. Neither muskrat nor muskrat lodges were found in the small bog pond in the southwestern part of the proposed tailings area, and little or no potential muskrat habitat exists elsewhere in the mine development area. However, from 11 to 24 muskrat were harvested annually from 1984 to 1988 from trapping area TR0502T056, the trap line that surrounds the mine development area. No muskrat have been harvested there in the years 1989 to 1994. Fur returns do not specify where the muskrats were harvested in this large trapping area.

There is no information on which species of mice and voles occur in the Mount Polley area, or on their status. The deer mouse, northern red-backed vole and meadow vole are expected to be the most common mice in the project area.

3.1.7.*Carnivores*

Red fox, coyote and grey wolf have been trapped in several of the registered trapping areas surrounding Mount Polley, from 1985 to 1994. On most of these trap lines, one or two animals were harvested per trap line per year. However from 1985 to 1994, only one fox and no wolves or coyotes were taken from TR0502T056, the trap line which includes Mount Polley.

There are a few sight records of wolves and coyotes in or near the project area. One wolf was seen in the Morehead Lake area on 19 November 1989 (Imperial Metals Corporation 1990). No wolves or wolf sign were recorded during field work on May-June 1995. One coyote was seen in the proposed tailings area on 26 July 1989 (Imperial Metals Corporation 1990). Four coyote tracks and scats were recorded in the proposed tailings area in May-June 1995, but none were recorded elsewhere in the mine development area. One fox was recorded at Bootjack Creek on 2 November 1989 (Imperial Metals Corporation 1990).

The Ministry of Environment Lands and Parks believe that gray wolves are regularly present in the Mount Polley area (P. Deilman to M. Demers, 17 Oct 1995). A few years ago, the Ministry monitored a radio-collared pack of five wolves, whose home range may have been centred around Antoine Lake. This

radio-collared pack was subsequently destroyed, so that by November 1995, there was no longer any radio-collared wolves in the Mount Polley are (Pat Deilman pers. Comm to D. Karasiuk).

Black bears appear to be relatively common in the area surrounding Mount Polley, while grizzly bears are either very scarce or absent. Mr. Robert Toupin, a long-time resident of Likely, believes that black bears are quite common in the Likely area generally, and in the Mount Polley project area specifically. The ministry of Environment Lands and Parks believes that the Mount Polley project area has a healthy black bear population, and that numbers are stable (P. Deilman letter to M. Demers, 17 October 1995).

Imperial Metals Corporation (1990) compiled nine black bear records for the Mount Polley area in 1989, consisting of at least two males, one female and four cubs. These records did not appear to be grouped around any single location. No grizzly bears were recorded in 1989. Hallam Knight Piésold recorded six bear scats in the project area, mainly on abandoned roads to the north and northeast pf the open pits. HKP recorded another scat near Morehead Lake, where black bears are regularly seen, and a sight record of a three-year-old black-phase bear on the “Ditch Road” near Polley Lake. All of the sightings and scats were from black bear, and no grizzly or grizzly sign were recorded.

The Ministry of Environment Lands and Parks completes a Compulsory Inspection data (CID) Form for every grizzly bear kill that comes to its attention (A. Bowser, pers Comm to D. Karasiuk). During the years 1983 to 1995, only one CID form has been completed for a grizzly kill in Wildlife Management Unit 5-02, which includes Mount –Polley. This kill took place at Edwards Lake, far to the south of the project area, in September 1983. In contrast, 28 CID forms were completed for Wildlife Management Unit 5-15, which lies east of Quesnel Lake and the Quesnel River. The nearest CID kill was for an animal control action at the community of Likely in June 1992. When the location of CID kills is plotted, it appears that grizzly bears are scarce in the Mount Polley area, but much more common in the highlands and mountains farther to the east.

The marten is probably the most important mustelid species at Mount Polley. No mustelids were recorded during field studies in 1989 (Imperial Metals Corporation). Field studies in May-June 1995 yielded a few additional records of weasels and marten, but none for other mustelids. In May 1995, Mr. Wayne Blashill reported a long-tailed weasel in the project area. In May-June 1995, Hallam Knight Piésold obtained a sight record of a marten near the mill area, and recorded two marten scats in the North Dump area. There are no sight records of other weasels, mink, fisher, otter, skunks or wolverine within the footprint of the mine development area.

Mount Polley is in the northern part of trapping area TR0502T056. From 1985 to 1994, more marten were trapped in this trapping area than any other fur-bearer, but few weasel and mink were taken. Small numbers of river otter, fisher and wolverine were trapped in neighbouring trapping areas (TR0502T056, TR0502T043 and TR0515T008) but none of these species were trapped in TR0502T056 from 1985 to 1994.

There is little information on the occurrence of the fisher in the Mount Polley project area. No fishers were recorded during filed investigations of the project area in 1989 or 1995, and no fishers were

reported in fur returns from TR0502T056 from 1985 to 1994. Mount Polley is about 10-15 km east of the study area where Richard Weir (1995) investigated of the diet, spatial organisation and habitat preferences of a transplanted, radio-collared population of fishers. None of these fishers established permanent home ranges in the Mount Polley area, although there were no obvious geographic barriers to prevent them from doing so. All of these fishers established permanent home ranges in the Sub-Boreal Spruce zone, in the area of Beaver Creek, Beedy Creek, Sheridan Creek and Moffat Creek. Perhaps the fishers preferred to establish permanent home ranges in the zone of lower snow accumulation, which is 5-10 km west of the project area.

No wolverine or wolverine signs were recorded during fields investigations of the project area in 1989 and 1995, and no wolverine have been reported in fur returns from TR0505T056, which includes the project area, from 1985 to 1994. No wolverine were reported in fur returns for this periods from the adjacent trap lines in Management Zone 5-02 (TR0502T032, TR0502T037 and TR0505T043). Five wolverine were taken from TR0515T008, which is east of Quesnel Lake and Quesnel River in Management Zone 5-15. Because they often maintain large home ranges, it is possible that wolverine may enter the project area from time to time, but would probably do so very infrequently.

No cougar, lynx or bobcat were recorded during the field studies of the project area in 1989 or 1995 (Imperial Metals Corporation 1990, Hallam Knight Piésold 1995). Only one lynx was trapped in TR0502T056 from 1985 to 1994. The lynx harvest in the neighbouring trapping areas TR0502T037, TR0502T043 and TR0515T008 was also low. In contrast, 16 lynx were harvested from TR0502T032 between 1985 to 94, though there was some year-to –year variation in the number of animals trapped.

Compulsory Inspection Data (CID) forms are completed by the Ministry of Environment Lands and Parks for every cougar kill that comes to its attention (A. Bowser, pers. Comm. to D. Karasiuk). There is only one CID form for cougar in Management Unit 5-15 for the year 1982-95, compared to 51 records for Management unit 5-02 for the same period. This suggests that the cougar is much less common in the Quesnel Highlands Ecosection than it is at lower elevations in the Cariboo Plateau Ecosection. The only CID record for Management Unit 5-15 refers to a female cougar that was trapped at Cariboo Lake in 1987. No CID forms have been completed for cougar in the immediate area of Mount Polley. The nearest CID location is Gavin Lake, where a male cougar was killed by hunters in December 1987. When the 51 CID records for cougar are plotted on a map, they are concentrated in an axis along the Beaver Creek valley, which extends from Gerimi Creek to the village of Horsefly. Most of these records within the Cariboo Plateau Ecosection, and the Sub-Boreal Spruce zone.

3.1.8.*Ungulates (Hoofed Animals)*

Moose and mule deer are the only ungulates that have been recorded during wildlife studies in the Mount Polley area. There does not appear to be any suitable habitat for either the bighorn sheep or mountain goat at Mount Polley. Neither elk nor mule deer are listed by the Technical Working Group (1993) as species of special management interest for the Cariboo Region. There is a herd of 200-300 caribou in the Quesnel Highland and Cariboo Mountains east of Quesnel Lake, but there is little information on caribou use of the Mount Polley area.

Hallam Knight Piésold (1995b) conducted pellet group counts and range surveys at 12 locations in the Mount Polley project area. Pellet counts were counted on 60 plots, each measuring 5 x 5 m, and forage preferences were assessed on each plot. Section 4 of Hallam Knight Piésold (1995b) discusses these results in detail.

Aerial surveys of the project area in March 1995, when the snow pack was still more than 1 m deep, found no moose or moose tracks at higher elevations in the project area (that is, near the open pits, waste rock dumps, and the mill area). Low numbers of moose tracks and feeding craters were recorded at lower elevations with less snow, especially near Bootjack and Hazeltine Creeks. Although no moose were seen in the project area during field investigations in May-June 1995, moose signs were common throughout the project area. Moose droppings were found in low to medium densities throughout the project area, and in higher densities along abandoned logging trails. Most of the droppings were the so-called “winter pellets”.

Selective logging appears to have been especially favourable for moose, as it has decreased the cover of the coniferous tree canopy, and thereby fostered the growth of a wide variety of palatable browse species. Unlogged mature and old stands tend to have a poorly developed shrub understorey, which is often dominated by species of lower palatability to moose. The interior of such stands typically have very low densities of moose pellets, and show little evidence of browsing. Areas with large amounts of deadfall are typically lightly utilized.

Wetlands vary greatly in the amount of moose utilization they receive. Wetlands that are dominated by tall willows, herbs and sedges appear to be well used by moose, particularly if they are located near patches of coniferous forest that are used as bedding areas. Wetlands dominated by hardhack, Sitka alder and scrub birches are little used. The most heavily used part of the project area is a well-drained gravel ridge west of the mill area, which formerly supported an open forest of Douglas-fir and western red cedar. The area was selectively cut and slash-burned, and now supports a mixed forest with rich and diverse tall shrub, low shrub and herb understoreys. It has exceptionally high concentration of moose scats and browsed bushes.

Eleven mule deer were seen during field studies in May-June 1995, eight of which were in the mine area. The largest group was five animals, about 600 m north of the tailings area. Most observations were of single animals. Deer tracks were common in the project area, especially near the main pit and in the tailings area. Tracks were most commonly observed near mud puddles in roads, and the tracks sometime followed abandoned roads for several hundred meters. Pellet group counts found that deer pellet were less numerous than moose pellets.

3.2. Species at Risk

SNC Lavalin (SNC; Golder, 2015) compiled an updated list of at-risk species for the ICHwk2 and ICHmk3 Cariboo Region that are potentially in the Mount Polley area (Table 3.2). Species presence and the timing and duration of their residence time in the project area will vary with habitat characteristics and other factors, such as social interactions, timing of life history events, seasonal and inter-annual

variation in habitat use, population cycling, immigration routes and timing, and weather. The following is an excerpt from SNC's assessment (Golder, 2015) which outlines possible use of the project area.

- Hagen's bluet (*Enallagma hageni*) is a blue damselfly that inhabits marshy lake edges, slow streams, and ponds. It is associated with marsh and fen wetland types (Wm01-02, Wm04-07, and Wf01) and flies in June and July (Royal British Columbia Museum and the Spencer Entomological Museum, 2004).
- The magnum mantleslug (*Magnipelta mycophaga*) has rarely been detected in Canada (COSEWIC, 2012a). Only 13 records of the species exist for BC, and the closest occurrence to Mount Polley Mine is in Wells Gray Park. COSEWIC (2012a) does not list any surveys for terrestrial gastropods completed near Quesnel Lake. The magnum mantleslug has been found in moist microsites in heavily shaded coniferous forests in the ICH and ESSF biogeoclimatic zones. Individuals have been located both on the ground surface and under bark, logs or rocks. Important habitat features may include seepage sites, coarse woody debris, and undisturbed forests with intact duff layers (COSEWIC 2012a).
- The western toad (*Anaxyrus boreas*) is an amphibian that is widely distributed across the province (COSEWIC 2012b). Adult western toads may be found in a variety of habitats including grasslands, forests, shrublands, riparian areas, and wetlands. Adult toads congregate to breed communally in the spring and exhibit fidelity to their breeding sites. Females lay strings of eggs in stream margins, wetlands, river backchannels, ponds, and human-made sites such as ditches, road ruts, and tailings ponds (COSEWIC 2012b). The eggs hatch into tadpoles that metamorphose in 4-12 weeks and leave the water by late July or August. Adults may move up to several kilometres away from breeding sites, and show a strong fidelity to summer foraging sites. Adult western toads feed on invertebrates including worms (Clitellata), slugs (Gastropoda), spiders (Arachnida), bees (Hymenoptera), beetles (Coleoptera), sow bugs (Isopoda), grasshoppers (Orthoptera), caddisflies (Trichoptera), moths and butterflies (Lepidoptera), flies (Diptera), true bugs (Hemiptera), and ants (Formicidae) (reviewed in COSEWIC 2012b). Larvae eat organic detritus, filamentous algae and carrion (ibid). Adult toads hibernate underground during the winter.
- The Great Blue Heron (*Ardea herodias*) is a large wading bird that feeds on fish, amphibians, small mammals, snakes, and aquatic insects (Gebauer and Moul 2001). The *arodias* subspecies is provincially Blue-listed and is the subspecies present in the Cariboo region. Herons are present in the Cariboo region between April and November (Roberts et al. 2013). During the rest of the year, they winter in southern BC or further south. Herons are colonial nesters and build bulky stick nests in coniferous or deciduous trees. The closest known colony to the study area is the Big Lake Forest Service Road colony (Colony 502-005), which was active between 1997 and 1999 and was located 2.4 km west of the north end of Polley Lake (Great Blue Heron Management Team 2015).
- The Common Nighthawk (*Chordeiles minor*) is a brown, black and grey-mottled bird that forages aerially for flying insects. Nighthawks are migratory and may be present in the Cariboo region between the beginning of June and mid-September (Roberts et al. 2013). Nighthawks lay their eggs

on the ground in sparsely-vegetated areas and may nest in disturbed sites such as roadsides, gravel pits and recent clear-cuts.

- The Olive-sided Flycatcher (*Contopus cooperi*) is a robin-sized songbird that frequents forest edges. It forages from a perch on a tree or snag from which it makes short flights in pursuit of flying insects. Olive-sided Flycatchers are migratory and are present in the Cariboo region between May and mid-August (Roberts et al. 2013).
- The wolverine (*Gulo gulo*) is a large mustelid that feeds on a wide variety of prey from small mammals to ungulates. The *luscus* subspecies is provincially Blue-listed and is the subspecies present in the Cariboo region. Although it is associated with high-elevation forests and large areas of wilderness, wolverine distribution is governed more by food supply than by particular habitats. It is both a generalist and an opportunist and will readily scavenge carrion. Wolverines range widely (50-100 km^2 for females and up to 1580 km^2 for males) and may become nomadic if food is scarce (COSEWIC 2014).
- The little brown myotis (*Myotis lucifugus*) and northern myotis (*M. septentrionalis*) are small insectivorous bats that roost in tree cavities, under loose bark, in buildings, and in rock fissures. Although the little brown myotis has been described as the most common and widely distributed Canadian bat species (van Zyll de Jong 1985), both it and the northern myotis are now listed under SARA as endangered due to a fungal disease known as white-nose syndrome (Government of Canada 2014). The disease is not currently present in western Canada, but is spreading westward from the eastern provinces. The northern myotis is very difficult to distinguish from similar species in the field and its identification must be confirmed via DNA typing. Little brown myotis and one individual field-identified as a northern myotis were captured in 2012 near Spanish Lake (approximately 11 km northeast of the mouth of Hazeltine Creek) (data file at http://a100.gov.bc.ca/pub/siwe/details.do?id=5044). A species model for little brown myotis and northern myotis is presented in Golder (2015).
- The fisher (*Pekania pennanti*) is a large mustelid or weasel. Fishers are forest-dwellers that feed primarily on small mammals. Females require cavities in large deciduous trees for use as reproductive dens. There are large-diameter *Populus balsamifera* present along Hazeltine Creek that are potential natal den sites for fishers. A fisher species account is presented in Golder (2015).
- Grizzly bears (*Ursus arctos*) are considered by the province to be extirpated in the area west of the west arm of Quesnel Lake (Province of BC 2014). A viable grizzly population (the Quesnel Lake North grizzly bear population unit) is present east of the west arm of Quesnel Lake.
- Mountain caribou (*Rangifer tarandus*) was removed from consideration within this assessment as caribou have been extirpated from the area west of the west arm of Quesnel Lake (Province of BC 2014).

Table 3.2 Species at risk potentially present in the Mount Polley area

Scientific Name	Common Name	BC List	Other List
Enallagma hageni	Hagen's Bluet	Blue	-
Magnipelta mycophaga	Magnum Mantleslug	Blue	-
Anaxyrus boreas	Western Toad	Blue	SARA Schedule 1 –Special Concern
Ardea herodias herodias	Great Blue Heron, *herodias* subspecies	Blue	-
Chordeiles minor	Common Nighthawk	Yellow	SARA Schedule 1 - Threatened
Contopus cooperi	Olive-sided Flycatcher	Blue	SARA Schedule 1 - Threatened
Gulo gulo luscus	Wolverine, *luscus* subspecies	Blue	-
Myotis lucifugus	Little Brown Myotis	Yellow	SARA Schedule 1 - Endangered
Myotis septentrionalis	Northern Myotis	Blue	SARA Schedule 1 - Endangered
Pekania pennanti	Fisher	Blue	-
Ursus arctos	Grizzly Bear	Blue	SARA Schedule 1 – Extirpated
Rangifer tarandus	Mountain Caribou		SARA Schedule 1 – Threatened

3.3. Wildlife Habitat Classification

At the time that wildlife studies were being planned for the Mount Polley Project, there was no formal system of wildlife habitat classification for the Cariboo Forest Region. The only available wildlife habitat mapping for the surrounding region was a generalized draft map at 1:250,000 scale, showing winter habitat capability for moose, deer and bear. An *ad hoc* wildlife habitat classification for the Mount Polley area was carried out based on the habitat classifications of the ICH Biogeoclimatic Zone, the Prince Rupert Forest District, and of the wildlife branch for the Omineca Sub-Region of the Prince George Region.

With an elevation range of 920 m (Polley Lake) to 1260 m (the summit of Polley Mountain), all of the project area is in the ICH. There are no alpine or subalpine habitats, and the summit of Polley Mountain is below the lower elevation limits of the Engelmann Spruce – Subalpine Fir Zone. There are no avalanche tracks, talus slopes, or other mountain features that would be considered significant wildlife

habitats. There are no cliffs or canyons, and no arable agricultural land. Man-made habitats include logging clear-cuts and the network of roads for logging.

Before European contact, the primeval vegetation of the project area was probably a continuous closed forest of Douglas-fir and lodgepole pine on drier sites, and of western red cedar, hybrid spruce and black cottonwood on riparian sites. Much of the mine development area was selectively logged or clear-cut in the 1970s, and is now covered by open, young seral forests. The different baseline habitat types are delineated in Figure 2.18[2] (extracted from Hallam Knight Piésold Ltd., 1996a), and described in the following sections.

A summary of habitat types present at Mount Polley is provided in Table 3.3.

Table 3.3 Habitat types at the Mount Polley Mine

Habitat Grouping	**Habitat Type**	**Present in the Mount Polley Area?**
1	Alpine Habitats	No
2	Habitats of the Engelmann Spruce-Subalpine Fir Zone	No
3	Forest Habitats of the ICH Zone	
	3.1 Clearcuts and burns (0-20 years +)	Yes
	3.2 Young stands (20-40 years)	Yes
	3.3 Mid-seral stands (40-120 years)	Yes
	3.4 Mature and old growth stands (120+ years)	Yes
	3.5 Douglas-fir – Lodgepole Pine Forest (south slopes and ridge crests)	Yes
	3.6 Rocky cliffs and talus	No
4	Wetland and Aquatic Habitats	
	4.1 Riparian forest complex	No
	4.2 Riparian habitats near small streams	No
	4.3 Shrub carr/sedge fen habitat complex	Yes
	4.4 Marsh/shallow open water habitat complex	No
	4.5 Small and medium-sized lakes (<1000 ha)	Yes
	4.6 Large lakes and reservoirs (>1000 ha)	No
5	Man-Made Habitats	
	5.1 Urban areas	No
	5.2 Transportation / Transmission Corridor	No
	5.3 Agricultural areas	No

3.3.1.*Clear-cuts*

Clear-cutting, followed by moderate to intense slash burning, has been practiced in several locations on the Bootjack Lake road, and throughout much of the Tailings Storage Facility Area. Although harvested at approximately the same time, clear-cut areas have reverted to a much earlier stage of forest succession than those that were selectively logged, and the existing vegetation is quite different. In

[2] MPMC is currently working to develop a digitized version of this map.

general, clear-cutting followed by slash burning has removed most of the advance regeneration by subalpine fir and western red cedar, and the area has not been sufficiently restocked from natural sources. Cover by conifer seedlings in such areas is well under 5%. Black cottonwood, aspen, Sitka alder, and paper birch have re-sprouted in a few favoured spots, but much of the clear-cuts in the tailings area are dominated by low shrubs, grasses and herbs. Typical herbs and legumes are bluejoint, tame wheatgrasses, broom, dandelion, fireweed, big-leaved avens, fescues and thistles. North of the tailings area, some clear-cut areas have been hand-planted with lodgepole pine plantations, which are now 3 – 4 m tall, with 20 to 30% ground cover. Portions of the tailings area have been replanted with spruce seedlings, in an area that once supported well-grown stands of western red cedar and Douglas fir. Re-stocking of clear-cuts in the tailings area has generally been unsuccessful, as the spruce seedlings are widely spaced, with poor vigour and high mortality.

Pellet counts and general observations in the tailings area indicate that ungulates make little use of open areas in the centres of large clear-cuts, where there is little cover. However, ecotonal areas at the boundaries of clear-cuts and mature forests appear to be quite heavily used by both moose and mule deer. Such areas offer a combination of thermal and predator avoidance cover (in the forests), as well as palatable forage (in the clear-cuts). Small bird densities appear to be very low in the clear-cut areas, where chipping sparrow and dark-eyed junco are the principal species. Warbling vireo, orange-crowned warbler and Hammond's flycatcher are strongly associated with dense thickets of black cottonwood, trembling aspen, tall willow and Sitka alder. Varying hare and northwestern chipmunk were the only small mammals recorded in clear-cuts. Coyote tracks and scats were also recorded in the tailings area.

3.3.2.*Mid-Seral Forests*

Mid-seral stands at Mount Polley have many of the same species as mature and older stands discussed below. The number of individuals and the diversity of species may increase somewhat as mid-seral stands mature, and as the complexity and structural diversity of the habitat increases; however, species that prefer open woodlands and herb- or shrub-dominated habitats tend to decrease.

3.3.3.*Selectively Logged Areas*

Much of the mine development area was selectively logged during the mid-1970s. During selective logging, most of the large Douglas-firs and western red cedars were removed from the site, but smaller conifers were left in place, as were both large and small black cottonwoods. During the 25 years prior to mining, this advanced regeneration matured, resulting in a complex and variable mixed-wood forest, with a diverse and well-developed tall shrub, low shrub and herb understorey. The height, crown cover and species composition of the tree canopy are quite variable in selectively logged areas. Typically, the tree canopy is 10 – 15 m high, with a crown cover of 10 to 20%, and it is dominated by a mixture of western red cedar, subalpine fir, Douglas-fir and black cottonwood. A few veteran black cottonwoods and western red cedars reach heights of 20 – 25 m. The tall shrub understorey is dominated by a variable mixture of black cottonwood and subalpine fir saplings, Sitka alder, trembling aspen, Scouler willow, Bebbian willow and unidentified willows. The low shrub understorey is lush and diverse, and is typically dominated by thimbleberry, black twinberry, western mountain-ash, red elderberry, black

currant, black huckleberry, and falsebox. There is also a rich and diverse her understorey, where fireweed, bunchberry, twinflower, foamflower, star-flowered Solomon's-seal, false Solomon's-seal, rosy twisted stalk and queen's cup are typical species.

At Mount Polley, areas that were selectively logged in the 1970s now support a complex, patchy vegetation that provides fair to good spring and summer habitat for mule deer, moose and black bears. Removal of the continuous, dense and shady canopy of western red cedar and Douglas fir has favoured the development of deciduous trees and shrubs, some of which are highly palatable to moose and deer. It has also increased the cover of a wide variety of berry-producing shrubs, which is favourable for bears and fruit-eating birds such as thrushes. Dense thickets of tall shrubs provide good escape cover for mule deer. MacGillivray's warbler, Wilson's warbler, orange-crowned warbler and the warbling vireo are all strongly associated with this second-growth vegetation.

3.3.4.*Mature and Old Growth Forests*

According to Ketcheson et al. (1991), moose, mule deer, black bear, wolverine, marten, southern red-backed vole, various owls, pileated woodpecker, Steller's jay, gray jay, varied thrush, golden-crowned kinglet, Townsend's warbler, bohemian waxwing, red crossbill, winter wren, and mountain chickadee are representative species of mature and old growth forests in the ICH Zone in general. Some of these species have been recorded in the Mount Polley project area, although they are not restricted to mature or old growth forests.

3.3.5.*Forests on Southern and Western Aspects*

These slopes may be significant for moose and mule deer in the late winter, spring, and summer. Due to favourable insolation, these slopes are likely to have a lighter snow cover than average during the winter. These slopes are likely to be snow-free earlier in the season, and to green up earlier than most other habitats. Even with a favourable insolation regime, south-facing slopes in the project area are likely to be too deeply covered with snow to be suitable for mule deer in the winter. However, in spring, these slopes may be important for mule deer, due to rapid snowmelt and early green-up. For the same reasons, they may also be important for bears emerging from winter hibernation. Ketcheson et al. (1991) list several other species that they consider to be closely associated with south-facing slopes in the ICH Zone (e.g. yellow bellied marmot, rubber boa, elk), but it is doubtful that these species occur in the Mount Polley area.

3.3.6.*Non-forested Rock Cliffs and Talus*

There are no rocky cliff or talus habitats in the Mount Polley project area.

3.3.7.*Riparian Forest Habitat Complex*

There are no riparian forest habitats in the Mount Polley project area, such as would be associated with rivers or large creeks with channel widths greater than 5 m. The project area does not contain any landscape features that are typically associated with large streams, and which may be significant to

wildlife, such as: alluvial fans, alluvial terraces, braided channels, oxbows, meander scrolls, backwaters, floodplains, canyons or gallery forests.

3.3.8.*Riparian Habitats near Small Streams*

There are five riparian areas associated with small streams in the Mount Polley project area: Hazeltine Creek; Bootjack Creek; Mine Drainage Creek; W20 Creek; and North Dump Creek. All of these are small creeks, with channels less than 5 m wide. Bootjack Creek is entrenched in a ravine for much of its length with two small wetlands near its inlet and one near its outlet. The riparian zone of Hazeltine Creek is somewhat more conspicuous on aerial photographs than that of Bootjack Creek. Hazeltine Creek has an area of shrub carr and sedge meadow near its mouth in Polley Lake, and smaller areas of shrub carr in its upper reaches. No lakes or backwaters are associated with any of the creeks, and all of the creeks except North Dump Creek are fish-bearing. Beaver and mink are the main wildlife species that are likely to be found in the riparian zones of these small creeks. The streamside vegetation may provide above-average habitat for black bears, moose, and mule deer.

3.3.9.*Shrub Carr/Sedge Fen Habitat Complex*

The only example of this habitat complex within the mine development area is a 5 to 10 hectare area located in the southwest part of the tailings area, about 300 m northeast of the bog pond. The centre of this wetland is a sedge meadow, dominated by beaded sedge, and dead spruce snags, and standing water from 20 to 50 cm deep. The sedge meadow is surrounded by dense thickets of hardhack, black twinberry, and Sitka alder, where shrub clumps grow on elevated hummocks, and where standing water occupies the intervening low spots. Surveys prior to mine construction show no evidence of moose browsing or pellets in the thicket. None of these shrubs are considered to be palatable to ungulates. In June 1995, this wetland had one or two pairs each of willow flycatcher, orange-crowned warbler, Wilson's warbler and song sparrow. These are all common and widespread songbird species typical of wet shrub carrs. No waterfowl or shorebirds were recorded within the shrub carr.

Additional examples of this complex are found outside the mine development area, southeast of Morehead Lake, near the outlet of Bootjack Lake, about 500 m downstream from the outlet of Bootjack Lake, and along Hazeltine Creek. The largest shrub carr and fen complex in the local area is at the south end of Polley Lake. No large ponds are associated with this complex. At the southern end of Polley Lake, fen and shrub carr grade into a swamp forest. There are a few widenings of Hazeltine Creek, which may be due to beaver damming.

A few moose tracks were seen in these habitats during aerial surveys of the mine area in March 1995, but no moose were seen. For the present analysis, riparian habitats along Bootjack and Hazeltine Creeks can be considered Class 3 or Class 4 winter range, and Class 3 summer range for moose. Due to heavy winter snow accumulations, these habitats should be considered Class 5 or Class 6 winter range for deer.

3.3.10. *Marsh/Shallow Open Water Habitat Complex*

If a marsh is defined as a permanently flooded wetland dominated by tall emergent plants, such as cattails, bulrushes, or *Phragmintes* reeds, then there are no marshes in the project area. If a shallow open water habitat is defined as an area dominated by lush beds of submergent plants, such as yellow pond lily, hornwort, milfoil, or pondweeds, then there are not shallow water habitats in the project area.

3.3.11. *Small and Medium-sized Lakes (< 1000 hectares)*

Both Polley and Bootjack Lakes support a good to very good sport fishery based on rainbow trout. Bald eagles and the common loon have been observed on both lakes, however; there is no foraging or nesting habitat for either species within the mine development area. The Canada Land Inventory assigned a rating of 6-JZ to both lakes. This rating implies severe limitations to waterfowl production. The major limitations being excessively deep waters and a limited area of marsh edge development.

The only lake within the mine development area is a bog pond of approximately 3 ha located in the south-western corner of the tailings area. During a survey on May 30, 1995, the waterfowl population of this pond amounted to one male green-winged teal, and two females and one male bufflehead. One greater yellowlegs, and one common snipe were also seen. On June 9, 2005, a female green-winged teal with five young were present on the lake, as well as the trio of buffleheads. A common snipe was heard, but the yellowlegs was no longer present. The lake had two beaver lodges, and one beaver was observed during these surveys. One or two pairs of willow flycatcher, common yellowthroat, Wilson's Warbler and song sparrow were recorded in shrub thickets near the lake. These are all common and widespread songbird species, which are also present in shrub-dominated wetlands near Morehead and Bootjack Lake. Development of the tailings area would not cause significant losses of habitat for local or regional populations of any of these species.

A single frog or toad, which swam away before it was accurately identified, was recorded at the pond. No amphibian egg masses or tadpoles were recorded in either survey.

3.3.12. *Large Lakes and Reservoirs (>1000 hectares)*

There are no large lakes in the project area, although the site is within the Quesnel Lake Watershed. Quesnel Lake is located approximately 10 km east of the mine.

3.3.13. *Urban Areas*

The Wildlife Branch (1994) defines urban areas as man-made habitats, such as residential, commercial and industrial areas. Agricultural lands are considered a distance habitat type. There were no urban areas in the Mount Polley project areas prior to exploration and mine development.

3.3.14. *Transportation/Transmission Corridors*

Transportation and transmission corridors are linear facilities that carry people, goods, and services from one point to another. There are no major roads or power line corridors in the project area;

however, there is a large network of logging and skid roads throughout the area, and a further network of trails to reach exploration drilling sites.

Roads typically occupy a small proportion of the land area, but they may be significant to wildlife. Early stages of forest succession often include plants that are palatable to wildlife, such as willows, prickly rose, fireweed, and elderberry. Commercial seed mixes are sometimes sown to stabilize roadsides and ditches, and they often contain plants that are palatable to wildlife, such as Kentucky bluegrass, red fescue, timothy and red clover. Consequently, moose, deer and black bear sometimes forage preferentially along transportation and transmission corridors. Where winter snows are deep, moose coyotes and wolves sometimes used plowed roads as travel routes, and may be killed in collisions with vehicles. Forest road networks make the back-country more accessible to outdoor recreationists. Unregulated hunting and wildlife harassment become a concern for wildlife managers.

Moose, deer, coyotes, and bears regularly use roads and trails in the project area as travel routes. During surveys in June 1995, animal tracks appeared to follow roads, rather than crossing roads by the shortest and most direct route. There were substantially more moose and deer pellet groups on roads than in the nearby natural vegetation, particularly if there were large amounts of deadfall.

4. FISHERIES AND AQUATIC RESOURCES

4.1. Limnology

There are four major lakes in Mount Polley area: Bootjack Lake, Polley Lake, Morehead Lake, and Kay Lake (also known locally as Fry Pan). Morehead Lake is a man-made and relatively shallow reservoir. The other three are all natural, accessible to the public. Bootjack and Polley Lakes have been manipulated for water storage and diversion.

Bootjack Lake is essentially a long and narrow basin, with two depressions over 15m deep. Polley Lake is a long narrow lake that is almost twice as deep and has almost twice the surface area and four times the volume of Bootjack Lake. Polley Lake does not have multiple depressions. Shoal areas occur at both ends of the lake but are severely restricted along the steep sides of the basin. One permanent stream enters Polley Lake from the north draining Kay Lake. Kay Lake is smaller, but is very deep for its surface area. Its shoreline resembles a bog with floating vegetation mats. There is no distinguishing inlet stream and the outlet is impounded by beaver dams. This small stream between these two lakes flows through swamp and meadow and is heavily braided with numerous beaver dams and minimal recognized surface flow. The steep slopes on either side of Polley Lake are drained by intermittent drainage channels, but no permanent streams. Polley Lake is some 64m lower in elevation than Bootjack and has a maximum depth of 35m.

The outlet of Polley Lake forms Hazeltine Creek, which flows a distance of 7,900m to its confluence with Edney Creek drainage, 500m upstream of the discharge to Quesnel Lake. Bootjack Creek is a 2,800m long tributary of Hazeltine Creek, which flows in an easterly direction to its confluence 450m downstream of Polley Lake outlet.

Morehead Lake was created by damming Morehead Creek. It is a shallow lake, usually less than 6m deep (Ron Williams, personal communication). Small tributary streams flowing into Morehead Lake include Morehead Creek, which contains the discharge from Bootjack Lake, Trio Lake, 4K Creek and other intermittent drainages off the hill sides. A concrete culvert and long spillway control the downstream from Morehead Lake. A ditch on the east side of the lake, which was once used to carry lake discharge to the placer mines, has now been abandoned and blocked.

In Bootjack Lake, both basins thermally stratify with the epilimnion extending down to a depth of six meters. The two basins exhibit similar patterns of stratification with only minor indications of differences in the hypolimnion in the vicinity of 10m depth. Surveys in June and October 1989 indicate that the lake was probably unstratified at those times. In mid-summer, the hypolimnion of both basins exhibits some reduction in dissolved oxygen. These patterns reflect productive lake conditions, and probable light attenuation in maximum depths. These observations indicate that Bootjack Lake is a mesotrophic lake that does not become anoxic.

In Polley Lake, thermal stratification is apparent with the epilimnion extending down to a depth of approximately 7 m. The hypolimnion extends from around 14m to the bottom. In late fall thermal stratification was still evident but was being eroded by decreasing temperatures in the epilimnion. The

narrow, deep, north-south orientation of Polley Lake and the steep slopes surrounding it probably shield it from wind action and results in a somewhat different stratification pattern from Bootjack Lake. The hypolimnion of Polley Lake is better oxygenated than Bootjack Lake, both in mid-summer and late fall, suggesting Polley Lake is slightly less productive.

In Kay Lake strong stratification is apparent with the epilimnion extending to approximately 4m depth mid-summer. By late fall, stratification broke down with the epilimnion extending to a depth of about 8m. The lake surface is protected from the strong winds that dissipate stratification. The hypolimnion extends from a depth of approximately 8 or 9m to the bottom. Dissolved oxygen is markedly depressed in the hypolimnion in the summer, although it is not anoxic. Kay Lake is probably mesotrophic, and perhaps, more dystrophic than either Bootjack or Polley Lakes. The heavily organic deposits on the lake margins and the peaty souks surrounding it support dystrophic characterization.

In 1995, a total of four limnology stations were established: two in Bootjack Lake and two in Polley Lake (Figure 2.8[3], extracted from Hallam Knight Piésold Ltd., 1996a). Dissolved oxygen and temperature profiles were collected at 1m intervals from each station once a month from May until October of 1995. In addition, one set of profiles was completed in January, 1996. The results are summarized by Hallam Knight Piésold Ltd. (1996b).

Results from the 1995 sampling season showed that for Bootjack Lake, stratification began in May. Water temperatures were colder during this month and consequently, oxygen concentration were higher than those measured later in the year. From June to September, the thermocline dropped in the water column, reaching a maximum depth of 8 to 12m in September. Water temperatures were highest in July (20.0^{o}C at the surface), and dissolved oxygen concentrations reached their seasonal low during this month. In October, the thermocline had completely disappeared, indicating that the fall overturn had occurred in the previous months. Water temperatures in January were the lowest recorded during the year, and dissolved oxygen concentrations were similar to those recorded in May.

Profiles collected from Polley Lake in 1995 indicate thermal stratification throughout the summer and into the fall. Beginning in May, surface warming established a minor thermocline at about 2m depth. Average water temperatures were coldest during this month (except for January), and concentrations f dissolved oxygen were higher than those measured later in the year. As surface temperatures increased, the thermocline became more pronounced, reaching a maximum in July when the difference between surface (21.8^{o}C) and bottom (4.9^{o}C) temperatures was more than 15.0^{o}C. From August to October, surface temperatures dropped and the thermocline sank in the water column, reaching its maximum depth of 15 to 17m in October. Water temperatures below 17m depth were relatively constant between 4.0^{o}C to 5.5^{o}C throughout all months (except January). Oxygen profiles indicated only minor stratification during all months. A surface layer with relatively constant concentrations of dissolved oxygen indicated near complete mixing in that zone. Below the mixed layer, dissolved oxygen concentrations slowly decreased down through the water column. Oxygen concentrations were lowest in September, when DO at the lake bottom dropped to 2.1ppm.

[3] MPMC is currently working to develop a digitized version of this map.

4.2. Fisheries Resources

4.2.1.*Regional*

Fisheries resources in the Quesnel River and Quesnel Lake system consists of diverse populations of sport fish including anadromous chinook and coho salmon and resident kokanee, rainbow and lake trout, Dolly Varden char, whitefish and several forage species. In addition, large populations of Horsefly sockeye salmon annually migrate from the Fraser River to spawn in tributary streamswhich drain into Quesnel Lake. Salmonoid enhancement facilities have been constructed by the Department of Fisheries and Oceans on the Horsefly River for sockeye and on the Quesnel River for chinook to improve survival of upper Fraser River stocks. The lakes in the vicinity of Mount Polley provide good recreational angling for rainbow trout. These trout populations are natural and maintained without stocking. A summary of creel surveys carried out on Bootjack and Polley Lake is presented in section 2.8.5.2.

4.2.2.*Local Fisheries*

1989 Surveys

No streams flow into Bootjack Lake that would support spawning. Thus its rainbow trout must spawn downstream in Morehead Creek, with fish from Trio and Morehead Lakes. The storage dam and spillway at the outlet of Morehead Lake prohibit the return of any fish or their offspring that migrate down the spillway. In addition, an active beaver dam also restricts movement of both to and from Bootjack Lake. Given this, it would appear that fish production in these three lakes may be limited by spawning area available. Large numbers of juvenile trout were captured with baited Gee traps in the streams in June, August and October. This suggests the streams may be the principal nurseries where trout rearing occurs. Recruitment into the lake population depends on the rearing and successful returns to the lake of the offspring. Because of their apparent success in coexisting with rough fish, Bootjack Lake rainbow trout populations are being investigated as a potential source of brood stock for the provincial fish culture program (Demers, M., personal communication). Fisheries biophysical inventory is presented on Figure 2.15[4] to (extracted from Hallam Knight Piésold Ltd., 1996a) show the habitat characteristics and species distribution.

Rearing salmonoid populations ranged from 0.071/m^2 (Upper Hazeltine Creek) to 1.50/m^2 in Bootjack Creek, the highest density of rearing juvenile rainbow trout in the entire study area. The results illustrate the importance of Bootjack Creek and Hazeltine Creek for rearing of Polley Lake rainbow trout populations. Reconnaissance along the streams revealed numerous locations where trout were actively spawning at the time. The greatest frequency of spawning was in the upper reaches of Morehead Creek and Hazeltine Creek but spawning was common in all creeks.

The Edney /Hazeltine Creek system is physically divided by topography which creates water velocity barriers in a steep gradient canyon located 1,650m upstream of Edney Creek confluence. This canyon

[4] MPMC is currently working to prepare a digitized version of this map.

barrier isolated the rainbow trout populations in the headwater lakes and streams and prevents encroachment by the mixed residents and anadromous salmonoid and forage fish populations found in the lower reaches. In lower Hazeltine and Edney Creeks mixed populations of rainbow trout, mountain whitefish, burbot, suckers, rearing juvenile chinooks, and adult sockeye salmon were documented in 1989. The lower reaches of Hazeltine and Edney Creeks are low gradient streams consisting of deep pools and riffles, large log jams and areas with excellent spawning gravels for salmon. On the Morehead Creek system barrier is even more dramatic. A waterfall exists about 1,500m upstream of the confluence with the Quesnel River and the spillway at the outlet of Morehead Lake further divides the system to migrating fish. Watercourses located at higher elevations such as Bootjack Creek, upper Hazeltine Creek, upper Edney Creek, upper Morehead Creek, 4K Creek and 6K Creek are also relatively low gradient streams associated with the lake systems and are used mainly by rainbow trout populations for spawning and rearing.

The lower reaches of Morehead Creek, near the Quesnel River, were investigated on October 20, 1989 with baited Gee traps. The creek contained good populations of rearing chinook salmon. The lower reaches of Hazeltine Creek and Edney Creek sampled in May, August and October 1989 always contained rearing populations of rainbow trout. Juvenile chinook salmon (greater than 1 year old) were found there in August and October, suggesting they entered the stream from Quesnel Lake. Lower Edney Creek provided good spawning habitat for sockeye salmon when it was inventoried in October 1989, coinciding with record runs to the Horsefly River System. Heavy spawning activity by sockeye was evident in this reach at that time.

Headwater lakes in the vicinity of Mount Polley were historically used for water storage in connection with early placer mining. The redirection of flow from Bootjack Lake by the construction of an earth-filled dam in about 1913 at the southern end of the lake prevented further use of important spawning and nursery areas in Bootjack and Hazeltine Creeks by the trout populations from Bootjack Lake. The outlet of Bootjack Lake presently consists of a large excavated channel which redirects flow to Morehead Lake. A beaver dam at the outlet of Bootjack Lake restricts movement of rainbow trout both to and from the steam habitat particularly during the summer low flow period. Nevertheless, during the fish inventory of May 31 – June 2, 1989 rainbow trout populations were observed in large numbers spawning in the vicinity of the Morehead Creek bridge crossing when the water temperature was 14.5^{o}C. It is not certain which lake they came from. The spawning habitat between Morehead, Bootjack and Trio Lakes is probably used by spawners from all three systems.

1995 Surveys

A fisheries assessment of the two Edney Creek tributaries was implemented in 1995, to determine the potential fish habitat losses and develop corresponding compensation options in accordance with federal government policy. Survey sites are shown in Figure 2.16[5] (extracted from Hallam Knight Piésold Ltd., 1996a). The only fish captured during sampling in the Edney Creek watershed were rainbow trout. Surveys were conducted during the peak spawning time for Bootjack and Polley Lakes fish (May 12-21)

[5] MPMC is currently working to develop a digitized verson of this map.

and again during base flow conditions, well after rainbow trout fry emergence (July 31-August 4). Hallam Knight Piésold (1996c) discusses these results in detail.

An additional objective of the May sampling program was to characterize the adult rainbow trout populations using the potentially impacted tributaries. The distributions of rainbow trout in Edney Tributary 1, Edney Tributary 2, and the Edney Creek mainstem are presented in Figure 2.16[6] (extracted from Hallam Knight Piésold Ltd., 1996a), as are the locations of presence/absence sampling sites.

The largest specimen captured had a fork length of 17cm (from Edney Tributary 2), but most were much smaller. This may reflect the size adult fish can be expected to attain in these small tributaries.

Only male fish were captured, suggesting that the population of adults use these tributaries for spawning and earl life history phases only, and that they have migrated from a larger stream or lake (Edney Creek/Edney Lake). The utilization of these streams by large, Quesnel Lake resident rainbow trout may be ruled out because the habitat structure is simply too small.

During the August field trip, spot-check electrofishing revealed that the upstream extent of fish distribution in Edney Tributaries 1 and 2 had not changed since May, even though stream discharges had been greatly reduced. An important result was that fish were still present in the upstream section of Edney Tributary 1, even though flow was subsurface for approximately 50% of the distance at that location. These fish appear capable of surviving in pools with no surface of the distance at that location. These fish appear capable of surviving in pools with no surface inflow, although their presence appeared to be dependent on good cover and depth (20cm achieved somewhere in the pool). Because there was no measurable discharge at several of these locations, fish presence cannot be correlated to a threshold minimum discharge, and therefore this parameter cannot be used to predict post-impact distribution in these tributaries.

Presence/absence electrofishing was also conducted on Edney Creek above Edney Lake. Importantly, Edney Creek was found to be barren of all species at two road-accessible locations above the lake (Sites F3, P/A 11, shown in Figure 2.16[7], extracted from Hallam Knight Piésold Ltd., 1996a), even though the rearing habitat at these locations was of high quality. A series of falls in a short canyon was later discovered between Edney Lake and the road crossing approximately 1km upstream, and is an absolute barrier to fish migration.

A summary of the fry and juvenile density estimates from the August survey is presented in Table 4.1 (Hallam Knight Piésold 1996c). Fry densities ranged from 0 fish/m^2 at site F3 to 1.02 fish/m^2 at site F2. The high densities at site F2 may be due to very high nitrate levels at the site, or due to a recent extensive fry emergence at this site, as habitat appeared highly suitable from spawning (Hallam Knight Piésold 1996c).

Visual estimation of critical habitat types in August revealed that Edney Tributary 1 provides totals of 3554m^2 of fry rearing, 1045m^2 of juvenile rearing, and 92m^2 of spawning habitat over the 3604m of its

[6] MPMC is currently working to develop a digitized version of this map.
[7] MPMC is currently working to develop a digitized version of this map.

useable length. Edney Tributary 2 was found to provide totals of 7059m^2 of fry rearing, 1696m^2 of juvenile rearing, and 15m^2 of spawning habitat over the 5073m of its useable length (Hallam Knight Piésold 1996c). These two streams are obviously highly suited to rainbow trout fry production at base flow conditions, mainly because water velocities are typically low across the entire wetted width.

A maximum 46% reduction in discharge s predicted for the Edney Tributary 1, and 12% for Edney Tributary 2 (see section 3.5.6) based on reduction in catchment area. Following mine closure, reclamation activities will restore the diverted flows to their pre-impact native channels, restoring the habitat capability to pre-impact levels. Post-closure reclamation planning specifies the return of the pre-impact flow regime to these channels.

Table 4.1 Rainbow trout density estimates (fish/m^2) for August, 1995 Edney Creek watershed survey

Sampling Site Location	F1 (lower Edney)	F1 (replicate)	F2 (below Edney Lake)	F3 (upper Edney)	F4 (Edney Tributary 1)	F6 (Edney Tributary 2)
Capture density (fry)	0.015	0.015	3.43	0	>1.09	1
Capture density (juvenile)	0.075	0.075	1.02	0	>0.29	0.26
Capture density (total)	0.09	0.09	4.45	0	>1.38	1.26

4.2.3.*Fish Tissue Analysis*

1989 Sampling

In October 1989 nine sexually mature rainbow trout were captured using a 2.0 inch monofilament gill net in Bootjack Lake. Metal analysis was conducted of muscle and liver tissues from these fish to establish baseline conditions prior to mining operations. Metal concentrations varied among fish. Metals that were above the detection limits are presented in Table 4.2.

Table 4.2 Fish tissue metals above detection limit in Bootjack Lake (1989)

	Tissue	Liver
Copper	0.83 – 1.86 mg/kg	205 mg/kg
Iron	14.7 – 33.5 mg/kg	1042 mg/kg
Manganese	0.49 – 1.31 mg/kg	4.66 mg/kg
Lead	0.05 – 0.30 mg/kg	0.10 mg/kg
Zinc	19.9 – 27.1 mg/kg	162 mg/kg

1995 Sampling

Fish tissue sampling in both Bootjack and Polley lakes was conducted in September and October, 1995 in order to establish a baseline for fish tissue metal content. The species targeted for this sampling effort were rainbow trout (*Oncorhynchus mykiss*) and longnose suckers (*Catostomus catostomus*). The fish tissue was analyzed for antimony, arsenic, cadmium, chromium, lead, mercury, nickel and selenium. The complete results are presented in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b).

Bootjack Lake

In Bootjack Lake rainbow trout, mean muscle and liver levels of antimony were found to be below the minimum detection level. However, cadmium levels exceeded the minimum detection level. In addition, mean levels of lead, chromium and selenium were well above those found in muscle tissue. In particular, mean liver selenium levels exceeded muscle levels by more than 10 times. In contrast, mean levels of mercury and nickel were slightly higher in muscle tissue. Metal levels were found to vary widely between samples for any given metal.

With the exception of mercury, the mean muscle metal content of Bootjack Lake longnose suckers appeared to be very similar to that of Bootjack Lake rainbow trout. The mean mercury level, however, exceeded the equivalent rainbow trout level by more than two times. As with the rainbow trout results, antimony readings were below the detection limit, while the majority of the samples exhibited cadmium levels below the detection limit, as well. With the exception of arsenic, chromium and selenium, metal levels were found to vary between samples.

While the mean liver levels of antimony, cadmium and lead appeared similar between Bootjack Lake longnose suckers and Bootjack Lake rainbow trout, rainbow trout mean liver selenium levels are nearly three times higher than the longnose suckers levels. In addition, mean levels of arsenic, mercury, chromium and nickel appeared to be higher in longnose suckers than in rainbow trout.

With the exception of mercury, mean longnose suckers liver metal content levels exceeded those found in longnose sucker muscle tissue. Mean muscle mercury levels, however, were more than two times higher than in liver tissue. Variability in metal levels among the samples appeared high, with the exceptions being selenium and antimony.

Polley Lake

Mean rainbow trout muscle levels of antimony and cadmium in Polley Lake were below detection limits. Polley lake rainbow trout exhibited higher mean muscle levels of mercury and lead, and lower mean levels of chromium, nickel, and selenium than Bootjack rainbow trout. With the exceptions of lead and mercury, variation in metal levels between samples appeared to be low.

Mean Polley Lake rainbow trout levels of arsenic, cadmium, chromium, lead, nickel and selenium were all higher in liver tissue. Only mean mercury levels were higher in muscle tissue. As seen in the Bootjack Lake samples, mean liver selenium levels exceeded mean muscle selenium levels by more than ten

times. A comparison between Bootjack Lake and Polley Lake rainbow trout liver metal content reveals that Bootjack Lake rainbow trout contained higher mean levels of arsenic, lead, mercury and nickel. Mean cadmium and selenium levels were found to be higher in Polley Lake rainbow trout. The level of variability of the metal content between samples appeared high, with the exception of arsenic.

In Polley Lake longnose suckers, mean muscle antimony and cadmium levels were found to be below the detection limit. This finding is consistent with the results of rainbow trout and longnose sucker muscle analyses from Bootjack and Polley Lakes. Mean muscle levels of the remaining metals appear to be comparable to those found in most of the Bootjack Lake longnose suckers. It should be noted, however, that the mean muscle level of arsenic in Polley Lake longnose suckers was more than twice that found in Bootjack Lake fish. In addition, mean arsenic muscle levels in longnose suckers were more than three times higher, and nickel and chromium muscle levels were more than two times higher than in Polley Lake rainbow trout muscle. On the other hand, mean chromium muscle levels were nearly three times higher in rainbow trout. These results differ from Bootjack Lake results, where the only major difference between the two species appeared to be the mercury muscle levels. With the exceptions of antimony, cadmium and selenium, metal muscle levels appeared to be quite variable between samples.

As with Bootjack Lake longnose suckers, Polley Lake longnose sucker mean liver antimony levels were below detection limits. Mean liver levels of cadmium, nickel and selenium also appear to compare well with those seen in the Bootjack Lake fish. However, mean liver levels of lead and arsenic were higher in Polley Lake fish, while Bootjack Lake fish were characterized by higher mean liver levels of chromium and mercury. Mean liver levels of antimony, arsenic, lead and nickel appeared to be comparable to Polley Lake rainbow trout liver levels. However, mean liver levels of cadmium and chromium were higher in longnose suckers, while mean liver levels of mercury and selenium were higher in rainbow trout. This situation differs from that in Bootjack Lake, where mercury, arsenic and nickel liver levels were higher in longnose suckers. With the exceptions of antimony and selenium, metal liver levels appeared to be quite variable between samples.

4.3. Sediments

4.3.1. *Creeks*

On September 21 and 25, 1995 sediment samples were collected under summer low flow conditions from ten spatially-separated, normalized locations in conjunction with benthic invertebrate sampling. The objectives of the sediment program are to provide:

- Baseline benthic invertebrate habitat quality data, both physically and chemically, for benthos studies;
- Baseline characterization of sediment quality of potentially impacted streams for future monitoring purposes; and
- Baseline data to develop site-specific sediment quality guidelines

Collected samples were divided into coarse and fine fractions at the laboratory. The coarse fractions were submitted for particle size analysis (Wentworth scale). The fine fraction underwent physical tests

(loss on ignition of the minus 200 mesh fraction, as well as moisture content) as well as total metal content analysis for Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag and Zu. Mean metal levels were compared to the BC provincial sediment quality guidelines (1994). The complete results are presented in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b)

In addition, power analyses of copper concentrations for each sampled station were carried out to determine adequate sample size to detect a 50% change in concentration.

Mean metal levels for all stations were below the lowest effect levels for cadmium, lead, selenium, silver and zinc. However, exceedances for the lowest effect levels included arsenic (eight stations), chromium (four stations), copper and manganese (all stations), iron (nine stations) and nickel (six stations). The station W5 reading exceeded the severe effect level of manganese (Hallam Knight Piésold, 1996b).

The results of the power analysis indicated that six were not sampled to level of effort required to detect a change of 50% while remaining stations were sampled to an equal, or higher, level of effort required to detect a change of 50%. Copper concentrations from stations which were not sampled to an adequate level of effort typically showed four replicate samples with fairly similar copper concentrations, while the other two replicates showed elevated levels of copper. Isolated areas of elevated copper levels would not be unexpected in an area known for copper occurrence. In addition, stations which were not sampled to an adequate level of effort were, with the exception of station W7, of narrower wetted width than the remaining stations. These smaller sites contained less available substrate for replicate sampling, and were typically more abundant in gravels and cobbles than in suitable sediment substrate. It was therefore more difficult to find enough suitable sediments for the required number of replicates at these sites, and in order to satisfy this requirement, samples may have been taken from sites which were not suitable similar with respect to substrate composition , flows and other physical parameters. This heterogeneity in substrate is further illustrated by the fact that laboratory subsamples taken from replicates from sites W6 and W10 varied considerably in copper levels (Hallam Knight Piésold, 1996b). Due to this limited supply of appropriate stream sediments at these sites, it may not be feasible to take as many replicate samples as prescribed by the power if analysis results. One solution may be to take more, but smaller volumes of sample per replicate for these sites, ie. Stratify into larger and smaller systems, and adjust sample volume appropriately.

Comparison of total copper levels to B.C. provincial guidelines show that mean levels, which ranged from 19.50 to 57.67mg/g (Hallam Knight Piésold, 1996b), are above recommended lowest effect level of 16mg/g but are less than the level of “severe effects” of 110mg/g.

4.3.2.*Lakes*

Sediments were collected from Bootjack Lake and Polley Lake in 1989 and again in 1995. Sediment samples were analyzed in the laboratory for metal concentrations, distribution of particle size and relative concentration of combustible (organic) fractions. Results of the 1995 analyses are presented by Hallam Knight Piésold (1996b).

Samples collected from deep water in both lakes show relatively high concentrations of organics and low concentrations of large particle sizes. The sediment material in these circumstances is what would be expected in lakes exhibiting relatively high pelagic productivity. The continual settling of dead and dying plankton organisms to the deeper water creates these sediments characterized by high concentration of fine particles and high organics. These sediments would overlay any sand and gravel deposit that might have been left in the basin at the time of lake formation during the last glaciation.

At shallower stations these analyses illustrate transition from the deep water sediments to the shallower shoals where sand and silt composition are predominant. Wave disturbance of the shoals probably reduces accumulation of organic sediments unlike in deeper parts of the lake.

Bootjack Lake sediments have generally higher concentrations of total and dissolved copper than Polley Lake. Deep water sediments show greater accumulations or arsenic, chromium, copper, mercury, molybdenum and nickel (in addition, Polley Lake sediments are elevated in arsenic, lead and manganese). Comparison of the 1995 metals analysis results to the 1994 BC government sediment quality criteria indicated that lake sediments in both lakes are slightly acidic and naturally contain metals above government criteria levels for arsenic, chromium, copper, mercury and nickel.

4.4. Gravel Quality

Gravel sampling was conducted in lower Edney and lower Hazeltine Creeks in the fall of 1995 in order to document the baseline gravel quality in these systems. Withdrawal of water from the Edney tributary catchment system for mine use may affect the gravel size distribution, which in turn many affect the success of salmon spawning in the lower Edney and Hazeltine systems. A gravel quality monitoring program will be able to use the baseline results to detect any changes in gravel due to withdrawal of water for mine use.

Gravel sampling was conducted on September 18, 1995 at gravel sampling sites G1 and G2 (Figure 2.8[8], extracted from Hallam Knight Piésold Ltd., 1996a). These sites were chosen as they are located in sections of lower Hazeltine and Edney creeks which are used for salmon spawning. At each site, three replicate samples were obtained using a McNeil Sampler. Approximately 3 to 7kg of sample were obtained for each replicate site. Samples were then shipped to Golder Associates Ltd. for sieve analysis. Complete results of the sieve analysis can be found in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b).

4.5. Benthic Invertebrates

4.5.1. *Creeks*

A baseline study of benthic macroinvertebrates was conducted at selected stations on Bootjack Creek, Edney Creek, Edney creek tributaries and Hazeltine Creek in the fall of 1995. The objective of this sampling program was to establish a master species list for each site, and to determine the baseline

[8] MPMC is currently working to develop a digitized version of this map.

species composition and abundance at each site. These baseline data will serve as a reference for comparison to future stream benthos sampling results over the life of the mine monitoring program.

The location of the sites is given in Figure 2.8[9] (extracted from Hallam Knight Piésold Ltd., 1996a). The sites were sampled over three consecutive weeks, from September 27 to October 15, 1995. A complete summary of the results of the taxonomic analyses of the samples is presented in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b).

Abundance

The order which contained the species with the greatest abundance throughout the sampling period was Diptera, which peaked in the third sampling week at 40,044.4 individuals/m^2 (Chironomidae). The taxum which contained the species with the second-greatest abundance in weeks one and two was the order Ephemeroptera, with a peak in week two of 25,644.4 individuals/m^2 (*Baetis sp.*), followed by the order Plecoptera, which peaked in a week three at 14,577.8 individuals/m^2 (Plecoptera, unidentified). In week three, abundance of *Nais sp.*in the order Oligochaeta was 31,644.4 individuals/m^2, making it the second-most abundant species during that week (Hallam Knight Piésold 1996b).

Tolerance

The general trend observed at all stations was a decrease in the number of sensitive organism, along with an increase in the number of facultative organisms. At stations W1, W5, W8 and W9, the tolerance ratio shifted predominantly sensitive organisms in week one to predominantly facultative organisms by week three. At station W8a, facultative organisms dominated throughout the sample period, while at stations W7 and W10, sensitive organisms dominated throughout the sample period (Hallam Knight Piésold, 1996b).

The sample from W6 site (Hazeltine Creek) was the only one with a tolerance ratio that indicated more tolerant organisms than sensitive organisms. The ratio of sensitive to facultative to tolerant at this site was approximately 1:10:5 (Hallam Knight Piésold, 1996b). IT should be kept in mid that this site was located in a very slow-flowing channel, and therefore represents significantly different habitat from the remaining sites.

EPT Ratio

This section examines the changes in the EPT ratio over the three week sample period. When examining the results presented here, it should be kept in mind that the ratios are calculated by dividing both Ephemeroptera and Plecoptera mean counts by the Trichoptera mean count.

At stations W1, W7 and W11, the EPT ratio favoured Ephemeroptera over Plecoptera over the entire sampling period. At stations W8 and W8a, the EPT ratio shifted from predominantly Ephemeroptera in week one to predominantly Plecoptera by week three. At stations W5, W9 and W10, Plecoptera were more abundant than Ephemeroptera throughout the entire sampling period. Station W6, which was

[9] MPMC is currently working to develop a digitized version of this map.

only sampled during the first week also indicated a greater abundance of Plecoptera over Ephemeroptera (Hallam Knight Piésold, 1996b).

4.5.2.*Lakes*

1989 Survey

As an early development of an ongoing environmental monitoring program for the Mount Polley mining operation, benthic invertebrate samples were collected in August, 1989 to document baseline conditions in the lakes. Results using diversity indices are summarized in Table 4.3.

Table 4.3 Benthic invertebrate diversity indices for Bootjack and Polley Lakes (1989)

	Bootjack Lake				**Polley Lake**	
Date	**Aug 18**				**Aug 19**	
Sampling Stations	LN	B2	B3	LS	B	L
Depth (M)	12	7	3	11	8	20
Group 3 Organisms	4	-	-	-	-	-
Group 2 Organisms	316	7	81	12	90	7
Group 1 Organisms	9	2	2	7	-	-
Total No. of Organisms (N)	329	9	83	19	90	7
Total No. of Taxa (S)	17	5	9	8	13	6
Diversity (d)	2.16	1.88	0.97	2.71	2.55	2.52
Total No. of Organisms/m^2	6663	172	158	364	1723	134

The invertebrate populations of Bootjack Lake on August 18, 1989 consisted predominantly of Group 2 pollution facultative organism composed of Chironomidae species which are commonly associated with lake bottom substrates. Pollution tolerant Group 1 organisms were found at all sampling locations in low numbers represented by Tubificidae. Pollution sensitive Group 3 organisms were found in low numbers only at the north basin at 11.0m depth. This location contained the highest total number of organisms/m^2 (6663), the highest number of taxa per sample (17) and high diversity (2.61).

Benthic populations near shore (Station B2) were in low numbers (9) and diversity of species present (1.88). In the south basin, populations consisted of similar species dominated by Group 2 organisms (Chironomidae larvae) at both the shallow and deep sites. Total number of organisms/m^2 was higher on the shallow depth (1583) compared to (364) and the diversity was lower (0.97 compared to 2.71).

In Polley Lake August 19, 1989 the shallower sampling site contained a diverse population of benthic organisms/m^2 (1723) dominated by Group 2 Cammaridae, Pelecypoda and several Chironomidae species. The deeper site contained lower numbers of organisms/m^2 (134) represented by only a few taxonomic groups (6). Species diversity was similar for both sites.

1995 Survey

Results from the taxonomic analysis of the 1995 samples are presented in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b). In 1995, two stations in each of Bootjack and Polley Lakes were sampled at spring and fall overturns.

At the time of spring overturn both the number of species and abundance of benthic invertebrates found at Bootjack Lake sampling stations was very low. Abundance ranged from 43.48 to 173.91 #/m^2, and only three of the replicates contained more than 2 species. The most common species (found in 60% of the samples) was *Chironomus sp.* Other species detected included one species each from the taxa Hydracarina, Chaoborinae, Nematoda and Oligochaeta. Fall overturn samples appeared to contain greater abundances (43.48 to 1,086.96 #/m^2) and more species than the spring overturn samples. The most common species was *Chaoborus sp.* (found in 80% of the replicates), while the most abundant species were of the order Cyclopoida (86.96 to 1086.96 #/m^2). In contrast to the spring overturn results, species from the orders Cladocera and Copepoda were found, while species from the order Oligochaeta were absent.

Polley Lake benthos samples taken at the time of spring overturn contained a greater variety of species, as well as higher abundances (43.48 to 1913.04 #/m^2) than the Bootjack Lake samples. The most common species was *Chironomus sp.*, which was found in ever replicate sample from both stations P1 and P2. The most abundant species belonged to the order Cyclopoida (1913.04 #/m^2). In contrast to the Bootjack Lake samples, the Polley Lake samples also contained species from the orders Ephemeroptera and Ostracoda. However, species from the orders Hydracarina and Chaoborina were not detected in the Polley Lake samples. In contrast to the spring overturn samples, Polley Lake benthos samples contained fewer species and showed lower abundances (43.48 to 304.35 #/m^2) than the Bootjack Lake samples. The most common (found in 60% of the replicates) and abundant (43.48 to 305.35 #/m^2) species were of the order Harpaticoida (Copepoda). Species from the orders Ostracoda and Nematoda, which were found at spring overturn, were absent from these samples.

The low abundances and low number of species indicates that Bootjack and Polley Lakes may be very oligotrophic.

4.6. Zooplankton

1989 Survey

Zooplankton samples were collected form the water column in the lake to establish baseline conditions for the monitoring program. The data summary in Table 4.4 describes the results of the 1989 sampling program.

Table 4.4 Zooplankton sample results for Bootjack and Polley Lakes (1989)

	Bootjack Lake			**Polley Lake**		**Kay Lake**
Date (1989)	**Aug 18**	**Aug 18**	**Oct 16**	**Aug 19**	**Oct 16**	**Oct 17**
Sampling Location	LN	LS	LS	L	L	L
Tow Distance (m)	7	7	10	7	15	12
Total No. of Organisms (N)	157	85	137	344	2851	142
Total No. of Taxa (S)	9	12	13	9	15	9
Diversity (d)	2.03	2.84	2.72	2.30	1.29	2.65
Total No. Per m^3	345.4	1700.6	1412.9	625.7	2162.7	1785.6

The zooplankton community in the August 18-19, 1989 survey for Bootjack and Polley Lakes displayed wide variability in the species present, relative abundance of organisms density and species dominance between lake and also between basins in Bootjack Lake. The south basin of Bootjack Lake contained the highest number of species present (12) and highest diversity (2.84) but no species was clearly dominant and the cladoceran, *Daphnia rosea* was the most abundant zooplankton species present. In the north basin only 9 species were represented and diversity was lower (2.03). A rotifer*, Keratella quadrata* and *Cladoceran ocelli* were dominant species. In Polley Lake only 9 speices were present with a cladoceran, *Daphnia galeata mendota*, and copepods, *Cryptocyclops bicolour*, and *Ospranticum labronectum* being dominant.

The comminutes in the October survey again displayed considerable variety in species presence, relative abundance of organisms, density and species dominance as well as changes since August. The south basin of Bootjack Lake contained 13 zooplankton species with the rotifers, *Asplanchna sp*. and *Kellicottia longispina* now being dominant. Species diversity was also the highest observed (2.72). Polley Lake now contained the highest number of species present (15) dominated by a copepod, *Cryptocyclops bicolour*. The very high density of unidentifiable cladeceran naupii distorted the diversity index (1.29) and the total density estimates. The other two dominant species found in the August survey were present but at low levels. Kay Lakes contained 9 species in the October survey with two copepods, *Ectocyclops phaleratus* and *Paracyclops fimriata poppei* the most abundant zooplankton present. Once again high naupii density created distortions in some indicators.

These differences may be reflections of differences in the basins (nutrient availability, phytoplankton productivity, physical-chemical environment, predation, etc.). Only long term trends will clarify that. The Mount Polley samples contained several species widely distributed in B.C. including *Cryptocyclops bicolour, Daphnia pulex, Daphnia rosea, Diacyclops bicuspidatus, Ectocyclops phaleratus, Leptodora kindti*, and *Tropocyclops prasinus*. Also present in the study area were several species that tend to be

found in more saline and more alkaline environments. These included *Daphnia schoedleri, Daphnia magna, Daphnia similis, Moina hutchinsoni, Paracyclops fimbriatus* (Pennack, 1989).

1995 Survey

In both Bootjack and Polley Lakes, vertical plankton hauls were conducted monthly from spring overturn to fall overturn (May to October) in order to establish preliminary information on zooplankton diversity and abundance. The results of the taxonomic analyses are summarized in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b).

During the May 14-15 sampling period, more species in the order Rotifera were present at the Polley Lake sites than at the Bootjack Lake sites. In addition, the Poley Lake sites had greater Rotifera abundances. While a greater number of Cladocera species were present at the Polley Lake sites, the abundances of Calonoia species were higher at Bootjack Lake. A greater number of Cyclopoida species were present at the Polly Lake sites, with abundances ranging from 0.47 to 7403.87 #/m^3. Insecta species were not found at Bootjack Lake sites and in only very low abundances (0.47 #/m^3) at Polley Lake sites. Benthic organisms such as *Hydracarina* and *Tanytarsus sp.* were present in low abundances at both Polley and Bootjack Lake sites.

Abundance data for the June 14, 1995 sampling period indicated that species from the order Protozoa were present in low abundances at both Bootjack and Polley Lakes sites. Species in the order Rotifera were present at high abundances at both Polley Lake sites (to 10416.71 #/m^3) and at the Bootjack Lake sites (to 26316.37 #/m^3). While a greater number of Cladocera species were present at the Polley Lake sites, the abundances of the Cladocera species were again higher at Bootjack Lake. Similarly, abundances of Calonoia species were higher at Bootjack Lake. A greater number of Cyclopoida species were present at the Polley Lake sites, with abundances ranging from 86.27 to 17727.54 #/m^3. Insecta species were found at both Polley and Bootjack Lake sites, but only in very low abundances (0.74 to 2.36 #/m^3). Benthic organisms such as Hydracarina, Oligochaeta, *Procladius sp.* and *Tanytarsus sp.* were present in low abundances at both Polley and Bootjack Lake sites.

For the August 24, 1995 sampling period, a different mesh haul net was used, and consequently direct comparisons to abundance from other sampling periods cannot be made. Only comparisons with regard to species presence/absence are thus warranted. There appear to be more species from the orders Rotifera (*Tetramatrix sp., Polyartha sp., Keratella cochlearis*) and Cladocera (*Leptodora kindti* and *Polyphemous pediculous*) present than in the month of June, while the species composition in the remaining taxa appears to be similar to that seen in June.

During the September 20-22, 1995 sampling species from the order Protozoa were present in low abundances at both Bootjack and Polley Lake sites. Species in the order Rotifera were present at medium abundances at but Polley sites (to 928.43 #/m^3) and at the Bootjack Lake sites (to 769.96 #/m^3). The number and abundance of Cladocera species appeared similar between the Polley Lake and Bootjack Lake sites. Abundances of Calanoia species were higher at Bootjack Lake. A greater number of Cyclopoida were present at the Polley Lake sites, with abundances ranging from 44.21 to 8400.09 #/m^3. Insecta species were found at both Polley and Bootjack Lake sites, but only in very low abundances (2.30

to 30.56 #/m^3). Benthic organisms such as Hydracarina, Oligochaeta, *Prodcladium sp.* and *Tanytarsus sp.* were present in low abundances at both Polley and Bootjack Lake sites.

Results from the October 16-17, 1995 sampling showed that species from the order Protozoa were present in low abundances at only the Polley Lake site P2. Species in the order Rotifera were present at medium abundances at both Polley Lake sites (to 373.78 #/m^3) and at the Bootjack Lake sites (to 979.44 #/m^3). While a greater number of Cladocera species were present at the Polley Lake sites, the abundances of the Cladocera species were higher at Bootjack Lake (to 4979.93 #/m^3). While the number of Calanoia species was low at both Polley and Bootjack Lake sites, the abundances at the Bootjack Lake sites was slightly higher (to 631.20 #/m^3). Cyclopoida species were more abundant at the Polley Lake sites, with abundances ranging from 373.78 to 1997.70 #/m^3. Insecta species were found at both Polley and Bootjack Lake sites, but only in very low abundances (0.53 to 1.88 #/m^3). Benthic organism such as Naididae, Hyrdacarina and *Procladius sp.* were present in low abundances at both Polley and Bootjack Lake sites.

4.7. Phytoplankton

1989 Survey

Phytoplankton samples were also collected from the lakes in August and October in conjunction with limnology studies. The data summary in Table 4.5describes the result of the 1989 sampling program.

Table 4.5 Phytoplankton sample results for Bootjack and Polley Lakes (1989)

	Bootjack Lake			**Polley Lake**		**Kay Lake**
Date (1989)	**Aug 18**	**Aug 18**	**Oct 16**	**Aug 19**	**Oct 16**	**Oct 17**
Sampling	Ln	LS	Ls	L	L	L
Location Sampling						
Depth (m)	4	4	4	6	4	3
Total No. of Organisms (N)	264	275	140	502	402	331
Total No. of Taxa (S)	19	19	23	19	21	17
Diversity (d)	1.77	2.08	2.87	1.39	2.38	2.27
Total No. per mL	252.9	263.5	134.1	480.9	385.1	317.1

The august sampling of both basins of Bootjack Lake contained 19 phytoplankton taxa, and a cryptophyte species, *Chroomonas acuta* was dominant at both sites. Polley Lake also contained 19 species and the highest density (480.9 per mL) and was also dominated by *Chroomonas acuta.*

During the October survey total taxa and diversity had increased in Bootjack and Polley Lakes. The Kay Lake contained 17 species, a moderate species diversity (2.27) and moderate density (317.1 per mL). The dominant species continued to be *Chroomonas acuta* in all three lakes. In Bootjack and Polley Lakes a blue-green algae, *Aphanizomenon flos-aquae* displayed a strong seasonal response (bloom) in October but was not even present in Kay Lake.

1995 Survey

Bootjack and Polley lakes were sampled on a monthly basis from May to October in order to obtain information on the baseline diversity and abundance of phytoplankton in these lakes over time. Chlorophyll "a" analysis was carried out to determine phytoplankton standing crop. Results of the taxonomic and chlorophyll "a" analyses of these samples are available in the Mount Polley Environmental Baseline Report (Hallam Knight Piésold, 1996b).

All May samples were similar in the overwhelming abundance of small chrysophytes (*Ochromonas* and *Chromulina sp.*). However, Polley Lake samples differed in species composition from the Bootjack Lake samples. In Polley Lake, the diatoms *Synedra radians* and *Melosira italica* were abundant along with the chrysophytes. In Bootjack Lake, these diatoms were rare, but the cryptophyte *Rhodomonas minuta* and chrysophyte *Chrysochromulina parva* were abundant along with the chrysophytes.

The predominant species in all June samples was the chrysophyte *Uroglena Americana* accounting for between 25.6% and 46.6% of the total cells counted. Uroglena was not found in the May samples. All five June samples again had very high numbers of small chrysophytes (*Ochromonas, Chromulina spp.* and *Chrysochromulina parva*). Among the Bootjack Lake samples, *Rhodomonas minuta* (cryptophyte), *Stephanodiscus niagare* and *Asterionella formosa* (diatoms) appear common. *Mallomonas akrokomas* (chrysophyte) and *Gloeocystis sp.* (green) were common in B2. In contrast, Polley Lake samples showed high concentrations of *Aphanothece spp.* and *Anabaena flos-aquae* (blue-greens), *Eudorina elegans* (green), *Synedra radians* and *Melosira italica,* predominant in May, were much less abundant in June.

The July samples contained a much higher incidence of blue-green algae than either the May or June samples. All July samples had high numbers of small chrysophytes (*Ochromonas, Chromulina spp.* and *Chrysochromulina parva*). The colonial blue-green *Aphanothece clathrata* was predominant in both Bootjack and Polley Lake samples, accounting for between 11.9% and 23.6% of the counts. Large species *such as the diatom Asterionella formosa and dinoflagellate Ceratium hirudinella were common in the* Bootjack Lake samples. The chrysophyte *Dinobryon cylindricum* was predominant and the blue-green *Anabaena flos-aquae* was common in the Polley Lake samples.

During August, small chrysophytes (*Ochromonas spp., Chromulina spp.*) continued to dominate the cell numbers. In addition, blue-green algae continued to increase in abundance. In Polley Lake, the colonial blue-green *Aphanothece spp.* and filamentous blue-green *Aphanizomenon flos-aquae* were predominant, while the filamentous blue-green *Anabaena spp.* were common. While Bootjack Lake samples did not exhibit any clear predominant species, the most common species were the diatoms *Asterionella formosa* and *Cyclotella bodanica*, the colonial blue-greens *Gomphosphaeria lacustris,*

Gomphosphaeria aponica, and *Aphanothece spp.*, the filamentous blue-greens *Aphanizomenon flos-aquae* and *Anabaena spp.* and the cryptoflagellate *Rhodomonas minuta*.

The September samples were similar in comparison to the August Samples. Small chrysophytes (*Ochromonas spp.* and *Chromulina spp.*) continued to dominate the cells numbers in Bootjack Lake samples, accounting for between 50.2% and 71.9% of the total cell count. However, the blue-green algae were much more abundant in September than earlier in the season. In the Polley Lake samples, the colonial blue-green *Aphanothece spp.* were the most abundant phytoplankton, constituting from 38.8% to 42.9% off the total cell count. In Polley Lake, the colonial blue-green *Aphanothece spp.* and filamentous blue-green *Aphanizomenon flos-aquae* continued to be predominant. The filamentous blue-green *Anabaena spp.* were common. In Bootjack Lake, *Anabaena spp.* and *Aphanizomenon flos-aquae* were predominant. The common species were the diatoms *Asterionella formosa* and *Cyclotella bodanica*, the colonials blue-greens *Gomphosphaeria lacustris, Gomphosphaeria aponica,* and *Aphanothece spp.*, and the cryptoflagellate *Rhodomonas minuta*.

The October samples were fairly similar in composition to the September and August samples. Small chrysophytes (*Ochromonas spp.* and *Chromulina spp.*) continue to dominate the cell numbers, accounting for between 57.2% and 67.5% of the total count. Blue-green algae continued to be abundant, as well. In samples from all four sites, the filamentous blue-green *Aphanizomenon flos-aquae* continued to be predominant. The filamentous blue-green *Anabaena spp.* were much less abundant in September. The cryptoflagellate *Rhodomonas minuta* and varieties, blue-green *Anabaena spp.*, diatoms *Asterionella formosa and Tabellaria fenestrata* were common in all five samples. In Polly Lake, the blue-green *Aphanothece spp.* and chrysophyte *Dinobryon cylindricum* were common. In Bootjack, the blue-green *Gomphosphaeria lacustris* and diatom *Stephanodiscus niagare* were common.

Total cells numbers decreased steadily from a spring bloom high in May of 10000cells/mL to approximately 2000cells/mL for August, September and October. This decline in the total cell count appears to be due to the decline of the cell count associated with the 1000X size. In addition, the August, September and October samples were composed of colonies of small (1-5µm) cells, whereas the May samples consisted of small flagellates and large diatoms. Chlorophyll “a” measurements may show more similar quantities of phytoplankton over time than raw counts suggest. The decrease in numbers may also be related to the sampling depth of 0.5m, where surface water temperatures and light levels are high and nutrients are becoming depleted over the course of the summer.

Results from the chlorophyll “a” analysis indicated that the chlorophyll “a” content ranged from 0.28 µg/L to 4.17 µg/L, with an overall mean of 1.22 µg/L. The chlorophyll “a”content appeared to remain fairly stable from May through September, but increased greatly in October.

4.8. Periphyton

Periphyton sampling was conducted in mid-summer 1995 during maximum periphyton growth, in order to establish baseline periphyton diversity and abundance in selected stream within the study area. Complete results are presented by Hallam Knight Piésold (1996b).

The periphyton sample collection was carried out at water quality (W) sites 7 (Hazeltine Creek), 8 (Edney Creek tributary 1), 8a (Edney Creek tributary 2) and 9 (Edney Creek mainstem) on August 25, 1995 (Figure 2.8[10], extracted from Hallam Knight Piésold Ltd., 1996a). At each site, 3 replicate samples were randomly collected using a "Stockner sampler", a modified wide-barrelled syringe fitted with a toothbrush. In addition, samples were analyzed for chlorophyll "a" content, to determine periphyton standing crop.

The samples from site W7 contained some sediment, mostly silt and detritus with relatively little algae. All three samples had similar composition. Diatoms comprised 99% to 100% of periphyton. Empty frustules (dead cells) were common in these samples. The predominant species were *Nitzschia spp., Synedra ulna,* and *Navicula spp.*

[10] MPMC is currently working to develop a digitized version of this map.

5. HISTORIC LAND USES

5.1. Forest Resources

All of the project area is within the ICHmk3 biogeoclimatic zone, and with very few exceptions, the land is Crown owned. Under the administration of the Ministry of Forests, commercial forestry has been the predominant land use activity in the project area.

Clear-cut and selective logging occurred over a significant portion of the project area and its surroundings. Many of these cut blocks were replanted for commercial timber species, although a few blocks were replanted for a combination of silviculture and cattle grazing uses. The cut blocks planted for cattle grazing are mostly south of Polley Lake, as shown in Figure 2.20[11] (extracted from Hallam Knight Piésold Ltd., 1996a). The wildlife capability map in Figure 2.18[12] (extracted from Hallam Knight Piésold, 1996a) shows.

Forest capability varies greatly over the project area due to varying stages of regeneration from previous logging activity, mine exploration activity, and scattered marshy areas. Overall forest capability is medium to good class timber.

5.2. Range Management

There are two ranchers with range tenures neighbouring the site. Fred Tillitson is authorized to graze cattle to the southeast of the mine, adjacent to the TSF, and Dan Hamblin is authorized to graze cattle to the north and east of the mine site on either side of the access road (encompassing the area around Bootjack Lake and Trio Lake, stretching to Frypan Lake). Contact with each of these ranchers was established in 1988 by Imperial Metals Corporation prior to development (and infringement on grazing land) to verify grazing activities, and to discuss potential points of contact and mechanisms for avoiding conflicts between the mine and grazing. The ranchers identified a spring used by their cattle near the Gavin Lake Road south of Polley Lake, and asked to have it preserved for cattle watering. It was also confirmed that the most productive and successfully re-vegetated grazing areas are located south of Polley Lake and outside of the project area.

Areas disturbed by logging have created opportunity for cattle grazing in the area. In some cases, whole cut blocks were re-vegetated with a combination of forage species for cattle, as well as commercial timber species. Road sites, abandoned roads and tracks, and log landing areas were typically planted with species suitable for cattle grazing. The selected species include several domestic grasses and legumes. This has resulted in the creation of summer grazing areas on Crown owned lands by regional ranches. Prior to mine development, several cut blocks in the vicinity of Bootjack Creek were used for

[11] MPMC is currently working to develop a digitized version of this map.
[12] MPMC is currently working to develop a digitized version of this map.

grazing and were either re-vegetated or in a transitional state from 1970s logging, as shown in Figure 2.20[13] (Hallam Knight Piésold, 1996a).

5.3. Hunting, Guiding, and Trapping

There is an extensive system of logging roads surrounding the Mount Polley area, giving vehicle access to areas on both sides of Bootjack and Polley Lake. These roads also connect with north-south and east-west forestry roads, giving hunters convenient access loops. Hunting is a common recreational activity in the region, and local moose and deer populations attract both local and non-resident hunters. The roads in the areas surrounding the mine are used frequently by resident hunters during hunting season. Out-of-province hunters must hire guide-outfitters to assist them in hunting. The boundary between two guide-outfitting territories runs through the Mount Polley Mine site as shown in Figure 1. The project area was not previously an important destination for either guide-outfitter, as it does not contain substantial amounts of prime moose habitat. Both guide-outfitters were contacted by Imperial Metals Corporation prior to project development, and both confirmed that the area only formed a minor element in their annual hunting and guiding activity. They recognized that no-shooting areas around the mine would be necessary for safety, and agreed to make adjustments. Black bear have been hunted in the past from the Mount Polley project area, particularly during the spring bear hunt. Grouse and rabbits were sometimes taken by hunters seeking deer and moose. The area had low waterfowl capability and was used little by duck and goose hunters.

Marten, weasel, muskrat, beaver, and squirrel are the major fur-bearers in the region surrounding Mount Polley, although fox, lynx, mink, otter, wolf, and coyote are trapped in small numbers. The Mount Polley project area is entirely within the registered trapping area TR0502T056 as shown in Figure 1.

5.4. Recreation

Recreational activities in the area are centred around lake fishing, hunting, and camping. The natural populations of rainbow trout in the lakes attract both local residents and tourists.

The Forest Service maintains campgrounds that are equipped with boat launches, campsites, toilets, and picnic tables on both Bootjack and Polley Lakes, which are used steadily throughout the camping season, often by fishermen with canoes or boats. Hunters often use the campsites as well. Because no fees are collected for campsite use, no accurate utilization records exist. Hiking, nature study, cross country skiing, snowmobiling, and vehicles touring might be expected as minor components in the recreational use of the area, particularly on the network of logging roads and tracks.

Two private parcels (L11560, L11559) at the north end of Polley Lake are owned by Imperial Metals Corporation, and there is also a private cabin (L12023) at the northeast end of Bootjack Lake.

[13] MPMC is currently working to develop a digitized version of this map.

The Morehead Lake Resort on the Likely Road at the north end of Morehead Lake is the closest accommodation to the project site. Hunters, fishermen, tourists, and mining and forest industry workers stay in the cabins or use the campsites. Parcels of private land with cabins and homes can be found near Morehead Lake.

5.4.1.*Creel Surveys*

BC Fisheries Branch personnel in Williams Lake indicated that during a creel survey conducted in August 1982, catch rates of rainbow trout in Polley Lake were 1.9 fish per hour (8.4 fish per angler day) and 0.94 fish per hour (6.6 fish per angler day) in Bootjack Lake. Creel survey information for Bootjack and Polley Lakes also exists for the years 1987 to 1990. During the period of June to September 1990, angler catch rates on Polley Lake ranged from 0.97 fish per hour in September to 3.37 fish per hour in June. Bootjack Lake catch rates for the same period ranged from 0.71 fish per hour in July to 1.68 fish per hour in June (Lirette and Tredger, 1991).

Judged on the basis of angler effort and success, Polley Lake is among the top three unstocked (wild) Cariboo lakes, and Bootjack Lake is among the top ten (M. Lirette, personal communication).

Imperial Metals Corporation conducted weekend boat counts and creel surveys at Polley Lake and Bootjack Lake from May 20 to September 16, 2,995. Anglers fished an estimated 1,744 weekend hours or 761 weekend days on Bootjack Lake, and 4,095 weekend hours or 1,087 weekend days on Polley Lake. For the period of May 1 to September 30 1995, anglers on Polley Lake caught an estimated 9,009 trout and kept an estimated 7,248 trout. For the same time period, anglers on Bootjack Lake caught an estimated 4,884 trout and kept an estimated 4,253 trout (Hallam Knight Piésold, 1996c).

5.5. Culturally and Environmentally Sensitive Areas

There are no reserves in the Mount Polley project area; however it falls on the traditional territory of the Xat'sull Cm'etem (Soda Creek/Deep Creek Band) and the T'exelc (Williams Lake Band). A traditional use study was conducted in 2012 by Points West Heritage Consulting Ltd. The report summary states:

Points West Heritage Consulting Ltd. conducted an overview assessment of the heritage resources in the project area prior to mine construction. The abstract of their report (which was filed with the Archaeology and Outdoor Recreation Branch in Victoria) states:

"Most of the development area has a low heritage resource potential. A few isolated areas have a low-moderate potential. All have been disturbed to some degree, and involve narrow corridors. Two locations have moderate heritage resource potential. Area A is adjacent to Bootjack Lake and appears to be undisturbed. No additional studies of this site are contemplated, because it is outside of the mine development area. The other is adjacent to a potential transmission line corridor, and it appears to have been disturbed by previous land use activities. "

No parks or protected areas fall within the project development area.

6. PRIOR LAND USES OF SITE RECLAMATION UNITS

6.1. Mill and Plant Area

The mill area was previously a gently-sloping south-facing plateau, most of which is blanketed with glacial till deposits to seven meters deep, although there was a small inclusion of organic soils in the center of the area (Blashill 1995a, 1995b). The Mill area was clear-cut in 1972, except for isolated red cedar stands, and was labelled NSR (not sufficiently restocked) on forest cover maps prior to mining. Areas to the east, north, and west of the mill area were selectively logged in 1972, and these areas have had good natural regeneration by Douglas-fir, western red cedar, and subalpine fir. In general, the mill area had a medium site class capability for commercial forestry. South and west-facing slopes, located west of the mill site, have good capability (Class 2) as summer range for moose and mule deer, but a fair to poor capability for winter range (Classes 3,4). These high-quality ranges will not be cleared for mine development. The selectively logged areas surrounding the mill have a fair capability for marten, weasel, hare, squirrel, and lynx. Breeding bird densities and bird species diversity are both high. Prior to clearing, the mill area had a very low capability for waterfowl and aquatic furbearers such as beaver, muskrat or mink. The two small intermittent streams that drained the mill area did not constitute fisheries habitat. There are no heritage resources or historic features within the mill area.

6.2. Open Pits

The southern portions of the Cariboo Pit were selectively logged in the 1970's, leaving a variable forest with some advance regeneration by western red cedar and subalpine fir. The remaining portion of the Cariboo Pit and the now backfilled Bell Pit were not logged, but consisted of mid-seral Douglas-fir and lodgepole pine stands which dated back to forest fires some 120 to 160 years ago. Forest cover maps indicate that most of this area had a poor to low site class rating for commercial forestry.

The area of the Springer Pit does not appear to have been logged, but consisted of mid-seral Douglas-fir and lodgepole pine stands, which date back to forest fires some 120-160 years ago. Forest cover maps indicate that most of the area for the Springer Pit has a poor (P) to low (L) site class rating for commercial forestry.

Pellet group counts and range surveys indicate that the Springer, Cariboo and Bell Pits offer poor to fair summer range for mule deer and moose, poor winter range for moose, and very poor winter range for mule deer. Better mule deer and moose habitat exists on the west-facing slopes below this, overlooking Bootjack Lake. The pit area probably has low to moderate capability as black bear habitat, due to the high cover by black huckleberry and kinnikinnick, which provide some berries in season. Habitat capability for marten, squirrel and hare appears low to moderate. Call count transects indicate that breeding bird densities are low, with few species. The pit area had no capability for waterfowl, or aquatic fur bearers such as beaver, mink, or muskrat. There were no permanent ponds, lakes, or streams in the pit area, and thus the area has no potential as fish habitat. No wildlife trees, cliffs, caves or other special wildlife features were been found in the pit area.

The Wight Pit is located in an area identified as MOG (mature and old growth habitat), CL (clear-cut) and RSS (riparian zone of small stream). It contains a mixture of Western red cedar, Douglas-fir, spruce and balsam trees. The stands were all greater than 141 years, with some greater than 251 year. Forest cover Maps indicate that the area for the Wight Pit had a poor (P), medium (M) to good (G) site class rating for commercial forestry. While there were no studies in the specific area where the Wight Pit will be located, mature and old growth forests in the Interior Cedar-Hemlock zone may be home to the following wildlife: moose, mule deer, black beer, wolverine, marten, owls, woodpeckers and several passerine species. In a field study during the spring of 2004, riparian vegetation near the creeks flowing into Polley Lake from the west were dominated by devils club, ferns, alder, huckleberry and willow species. The area of the Wight Pit will encompass the mid and upper reaches of an un-named creek. Fisheries studies in the spring of 2004 concluded that this drainage does not provide rearing or spawning habitat for the rainbow trout in Polley Lake. Further, it provided no nutrients (benthic invertebrates), as this drainage does not connect with the lake.

While the rock borrow at the TSF is included with the areas associated with the pits, all prior land uses are similar or the same as those for the TSF. Please refer to Section 6.4 on the TSF for more information.

6.3. Waste Rock Dumps

Most of the North Bell Dump occupies a side valley enclosed by rock knobs that was logged in 1975, and regenerated to a dense second-growth mixed forested dominated by alder, willow, cottonwood and tall shrubs, with a scattered veteran Douglas-fir and Western red cedar, and with strong advance regeneration by subalpine fir. Forest cover maps rate the site capability of this area as good (G). There was no evidence of livestock grazing in this unit prior to mining.

The North Bell Dump area had moderate densities of breeding birds, but fewer species than the East RDS, Wight RDS and Leach Pad areas. No pellet groups were found on pellet group plots, but moose dropping groups and deer tracks were found along an abandoned road. Ungulate browsing was very localized, but tall willows, Douglas maple and western mountain-ash were heavily browsed at favoured locations. Some individual alders and willows in the North Bell Dump area were girdled and killed by snowshoe hares.

The East Rock Disposal Site occupies a sloping eastward aspect plateau. Prior to mining disturbance, the vegetation was a complex mosaic of young seral, mid-seral and mature forest. Much of the area east of the mill site was selectively logged in 1972, and supported a rich and diverse patchwork of deciduous shrub thicket, veteran black cottonwoods, and vigorous advance regeneration by Douglas-fir, western redcedar and subalpine fir. Parts of the waste dump overlap stands of mature forest, dominated by large, well-grown western redcedars and Douglas-firs, with a rich a variable shrub understory, of the 05 and 07 site series. Forest cover maps rate the forest site capability as medium (M) to good (G). There is no evidence of livestock grazing in this unit prior to mining activity.

Neither of these areas had permanent lakes or ponds, although there were small seepages and swampy areas in both the North Bell Dump and East Rock Disposal Site. The creeks draining the ravines were small and intermittent, and were reduced to a trickle by mid-June. They had very low capability for

waterfowl, shorebirds or aquatic mammals, such as beaver, due to their small sizes and intermittent flows. No amphibian eggs, larvae or adults were found near any of the creeks draining these waste rock dumps. These streams did not support fish. There were no cliffs, caves, canyons, talus slopes, permanent streams, lakes, wetlands or mineral licks in either of these areas.

The areas for the East Rock Disposal Site, NEZ Dump, and North Bell Dump did not have permanent lakes or ponds, although there are small seepages and swampy areas in ravines of all four locations. The creeks draining the ravines are small, and intermittent. By mid-June, these creeks are reduced to small trickles. These creeks have a very low capability for waterfowl, shorebirds or aquatic mammals such as beach, due to their small sizes and intermittent flows. No amphibian eggs, larvae or adults were found near any of the creeks draining these existing or proposed waste rock locations. These streams do not support fish. There are no cliffs, caves canyons, talus slopes, permanent streams, lakes, wetlands or mineral licks in either of these areas.

6.4. Tailings Storage Facility

Large portions of the tailings area were clearcut logged in 1970, 1979 and 1983. Cut stumps indicate that the original vegetation was a closed forest of large, vigorous western red cedars and Douglas-firs. After harvest, these clear cuts were subjected to moderate to intense slash-burning. Portions of the clear cuts were re-planted with spruce seedlings, which show poor vigour and high mortality. Forest cover maps assign a poor (P) site class code to most of the tailings area. Most of the clear cuts would probably be judged NSR (not sufficiently re-stocked). There was no evidence of recent cattle grazing in these clear cuts in 1995. However, throughout the mining operations from 1997 through 2001, as well as the care and maintenance period of 2001 through 2004, the TSF area was used extensively by various herds of cattle for summer grazing.

Breeding bird densities are very low in these clearcut areas, and there are very few bird species. This habitat has moderate numbers of northwestern chipmunk. Moose and mule deer appear to make little use of open, exposed areas in the clear cuts, although use of forest edge areas with better cover may be high to very high. Several coyote tracks were seen in this habitat.

Approximately 20% of the tailings area is occupied by a stand of mature to old growth forest, dominated by western red cedar, with lesser cover by sub-alpine fir and Douglas-fir. Breeding bird densities and the number of bird species in this forested area are both high. Red squirrels are present in low densities. Neither moose nor deer appear to use the interior of this stand, as little of the available vegetation is palatable to ungulates. However, the edges of this stand appear to be heavily used by moose. Stand edges combine good thermal cover with abundant forage.

The remaining 20% is occupied by a small wetland dominated by wet shrub thickets of Sitka alder, scrub birch and hardhack, containing a 3 ha bog pond. It is the only permanent wetland in the mine development area, but it is neither unique nor important in a regional context. It supports one or two pairs of each of green-winged teal, bufflehead, common snipe, willow flycatcher, common yellowthroat, Lincoln's sparrow and song sparrow. Although the first four species are not found elsewhere in the mine development area, they are widespread and common in British Columbia. Moose and mule deer

do not appear to utilize the surrounding shrub vegetation, probably due to the low palatability of hardhack and alder, the dominant shrubs.

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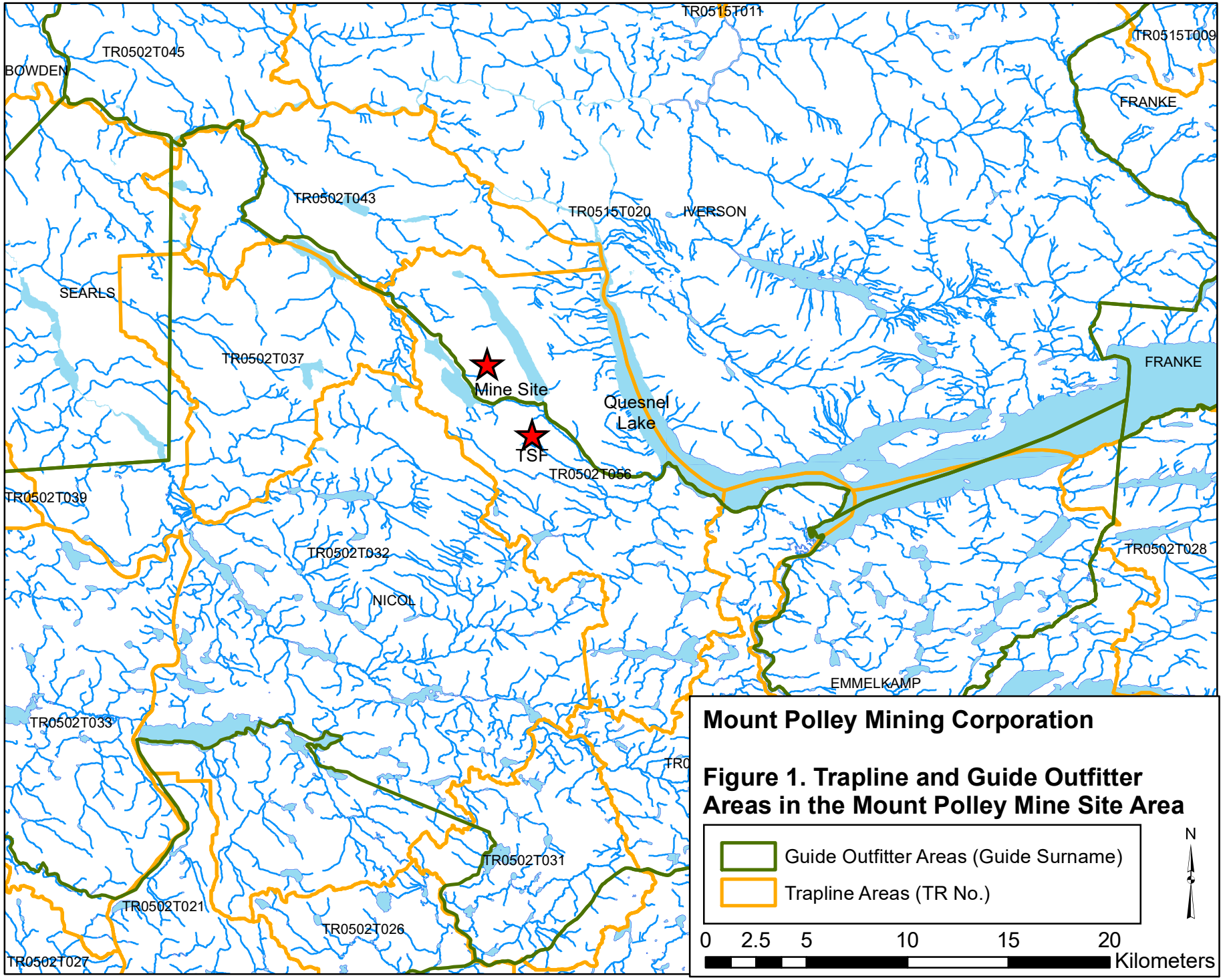
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TR0515T009
TR0502T045
BOWDEN
FRANKE
TR0502T043
TR0515T020
IVERSON
SEARLS
TR0502T037
FRANKE
Mine Site
Quesnel
Lake
TSF
TR0502T056
TR0502T039
TR0502T032
TR0502T028
NICOL
EMMELKAMP
TR0502T033
TR0502T031
TR0502T021
TR0502T026
TR0502T027
Mount Polley Mining Corporation
Figure 1. Trapline and Guide Outfitter Areas in the Mount Polley Mine Site Area
Guide Outfitter Areas (Guide Surname)
Trapline Areas (TR No.)
N
0 2.5 5 10 15 20
Kilometers

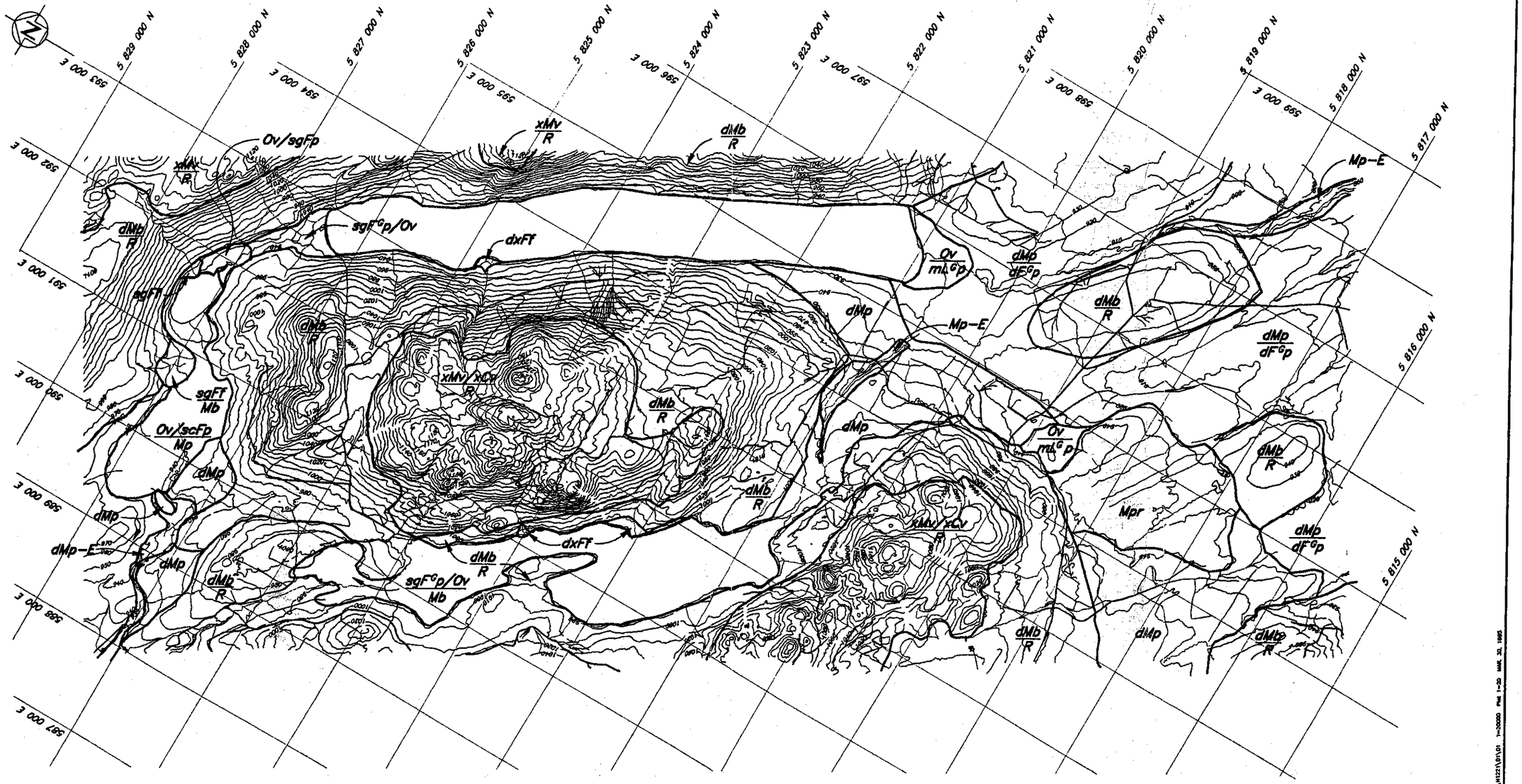

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

HALLAM KNIGHT PIESOLD LTD.
ENVIRONMENTAL CONSULTANTS - VANCOUVER, B.C.

DESIGNED	MBS
DRAWN	VY
CHECKED	DJR
APPROVED	

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

TERRAIN CLASSIFICATION
SHEET 1 OF 2
FIGURE 2.1

DATE MARCH 14, 1995 | SCALE AS SHOWN | DRG. NO. H1221 | REV. —

TEXTURE

Symbol	Name	Size(mm)	Other Characteristics
a	blocks	>256	angular particles
b	boulders	>256	rounded & subrounded particles
k	cobbles	64–256	rounded & subrounded particles
p	pebbles	2–64	rounded & subrounded particles
s	sand	.062–2	
ŧ	silt	.002–.062	
c	clay	<.002	
d	mixed fragments	>2	mix of rounded and angular particles
g	gravel	>2	mix of boulders, cobbles and pebbles
x	angular fragments	>2	mix of rubble and blocks
r	rubble	2–256	angular particles
m	mud	<.062	mix of clay and silt
y	shells	–	shell or shell fragments
e	fibric	well-preserved fibre; (40%) identified after rubbing	
u	mesic	intermediate decomposition between fibric and mesic	
h	humic	decomposed organic material; (10%) identified after rubbing	

SURFACE EXPRESSION

Symbol	Name	Description
a	moderate slope	Unidirectional surface; >15° to ≤26°
b	blanket	A mantle of unconsolidated material: >1m thick
c	cone	A cone or segment of a cone: >15°
d	depression	A lower area enclosed by higher surrounding terrain
f	fan	A segment of a cone; up to 15°
h	hummocky	Hillocks and hollows, irregular in plan; 15–35°
j	gentle slope	Unidirectional surface; >3° and ≤15°
k	moderately steep	Unidirectional surface; >26° and ≤35°
m	rolling	Elongate hillocks; 3 to 15° ; parallel forms in plan
p	plain	Unidirectional surface; up to 3°
r	ridged	Elongate hillocks; 15 to 35° ; parallel forms in plan
s	steep	Steep slopes; >35°
t	terraced	Step-like topography
u	undulating	Hillocks and hollows; up to ≤15° ; irregular in plan
v	veneer	Mantle of unconsolidated material; 10cm to 1m thick

SURFICIAL MATERIALS

Symbol	Name	(Assumed Status of Formative Process)	Description
A	anthropogenic	(A)	Man-made or man-modified materials
C	colluvial	(A)	Products of mass wastage
D	weathered bedrock	(A)	In situ, decomposed bedrock
E	eolian	(I)	Materials deposited by wind action
F	fluvial	(I)	River deposits
F^G	glaciofluvial	(I)	Ice contact fluvial materials
I	ice	(A)	Permanent snow, glaciers and icefields
L	lacustrine	(I)	Lake sediments; includes wave deposits
L^G	glaciolacustrine	(I)	Ice contact lacustrine materials
M	morainal	(I)	Material deposited directly by glaciers
O	organic	(A)	Accumulation/decay of vegetative matter
R	bedrock	(–)	Outcrops/rock covered by less than 10cm
U	undifferentiated	(–)	Layered sequence; three materials or more
V	volcanic	(I)	Unconsolidated pyroclastic sediments
W	marine	(I)	Marine sediments; includes wave deposits
W^G	glaciomarine	(I)	Ice contact marine sediments

GEOLOGICAL PROCESSES

Symbol	Name	(Assumed Process Status)	Description
A	avalanches	(A)	Terrain modified by snow avalanches
B	braiding	(A)	Diverging/converging channels; unvegetated bars
C	cryoturbation	(A)	Sediments modified by frost heaving and churning
D	deflation	(A)	Removal of sand and silt by wind action
E	channelled	(I)	Channel formation by meltwater
F	slow mass movement	(A)	Slow downslope movement of masses of cohesive or non-cohesive material and/or bedrock
H	kettled	(I)	Depressions due to the melting of buried glacier ice
I	irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends
J	anastamosing channel	(A)	A channel zone where channels diverge and converge around many vegetated islands
K	karst	(A)	Processes associated with the solution of carbonates
M	meandering channel	(A)	Channel characterized by a regular pattern of bends with uniform amplitude and wave length
N	nivation	(A)	Erosion beneath and along the margin of snow patches
P	piping	(A)	Subterranean erosion by flowing water
R	rapid mass movement	(A)	Rapid downslope movement of dry, moist or saturated debris
S	solifluction	(A)	Slow downslope movement of saturated overburden across a frozen or otherwise impermeable substrate
U	inundation	(A)	Seasonally under water due to high watertable
V	gully erosion	(A)	Parallel/subparallel ravines due to running water
W	washing	(A)	Modification by wave action
X	permafrost	(A)	Processes controlled by the presence of permafrost
Z	periglacial processes	(A)	Solifluction, cryoturbation and nivation processes occurring within a single unit

ON-SITE SYMBOLS

drumlin
crag and tail
roches moutoneés
striae
undifferintiated lineations
moraine ridge (major)
moraine ridge (minor)
esker
kettle holes (small/large)
meltwater channel (large)
meltwater channel (small)
cirques
blockfield
rock glaciers
tors
gravel occurrence
observation site (frozen ground)
stratigraphic site
anthropogenic site

snow avalanches
landslide headwall (large)
landslide headwall area (large)
landslide headwall (small)
landslide scar/track (small)
tension cracks
sackung (sagging slopes)
dunes (active/inactive)
escarpment
strandline
piping depression
karst depression
gully
spring
gravel pit
Quaternary fossil site
Observation site (ground/air)
^{14}C site
mine/quarry
cinder cone

QUALIFYING DESCRIPTORS

Symbol	Name	Description
G	glacial	Used to qualify surficial materials where there is evidence that glacier ice affected the mode of deposition of materials
A	active	Used to qualify surficial materials and geological processes with regard to their current state of activity
I	inactive	

MAP UNIT LETTER NOTATION

A terrain map unit symbol is composed of a combination of letters which designate different characteristics of the terrain. The relative position of letters within the symbol indicates the characteristics that they represent.

SAMPLE TERRAIN UNIT SYMBOL

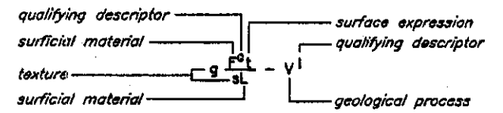

This map unit consists of a gravelly glaciofluvial terrace that overlies sandy lacustrine materials and is modified by gullies that are no longer active.

Explanatory Notes

1. Units consisting of two or more types of terrain are designated by two or more groups of letters separated by slashes and/or dots

CAD FILE: \PROJECT\1000\H1221\FIG\81 1:1000 Plot 1=1 MAR. 30, 1995

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

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IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

TERRAIN CLASSIFICATION LEGEND
SHEET 2 OF 2
FIGURE 2.1

DESIGNED	MBS
DRAWN	W.A. Lakoda
CHECKED	DJR
APPROVED	

DATE MARCH 14, 1995 | SCALE AS SHOWN | DRG. NO. H1221 | REV. A

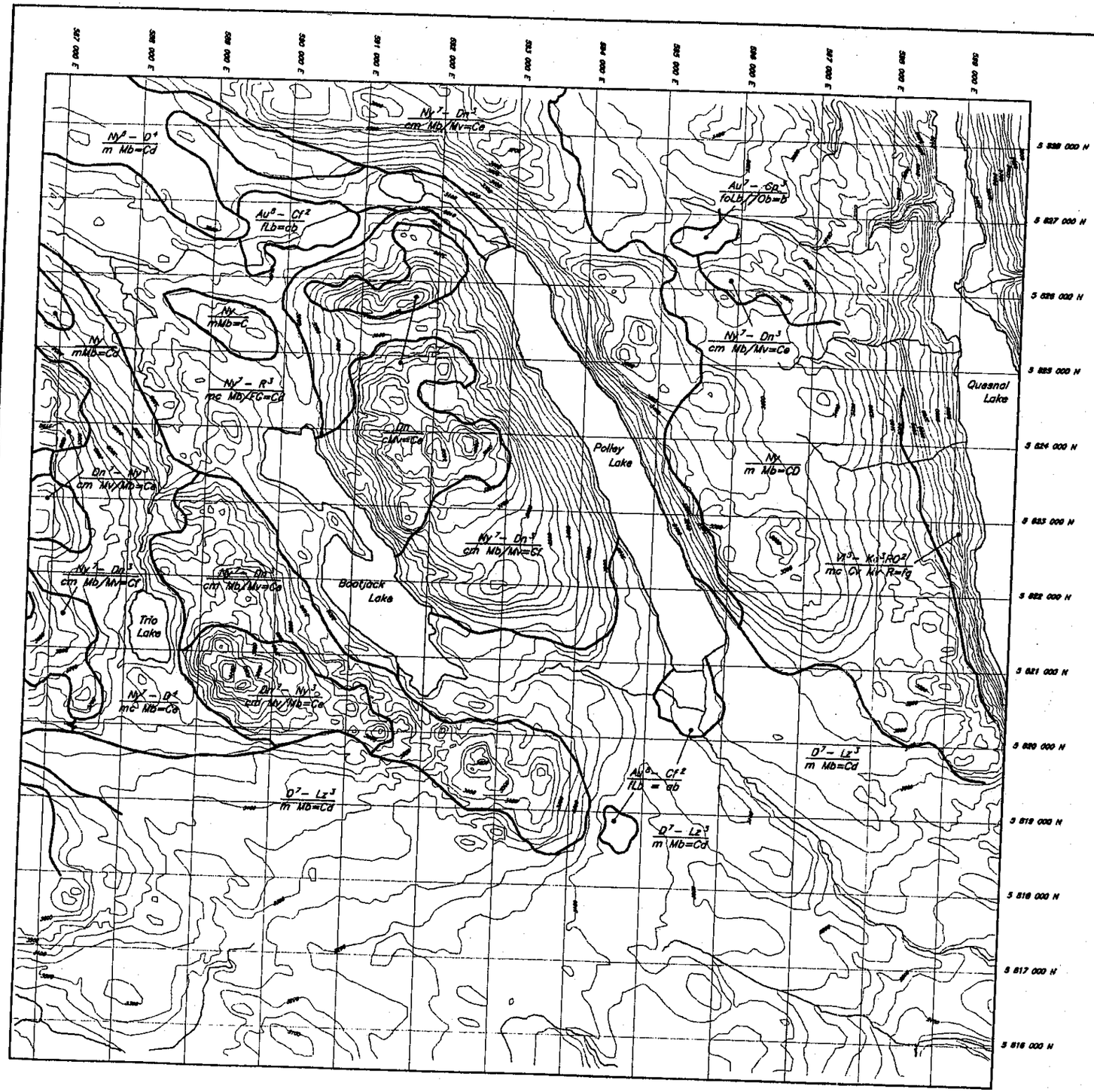

NOTE:
Contours are in feet.

Scale 1000 500 0 1000 2000 3000 Metres

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

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DESIGNED DJR
DRAWN VY
CHECKED –
APPROVED

IMPERIAL METALS CORPORATION

MT. POLLEY PROJECT

SOILS AND LANDFORMS IN THE MOUNT POLLEY AREA
SHEET 1 OF 2
FIGURE 2.3

DATE ---- | SCALE AS SHOWN | DRG. NO. H1221 | REV. –

IMPERIAL METALS CORPORATION
MT. POLLEY PROJECT
SOILS AND LANDFORMS MAP LEGEND

1. Explanatory Notes

The information contained in the following boxes explains some important characteristics of the soils and landforms that were mapped at a reconnaissance level of investigation. Each of the individual boxes is cross referenced.

The information provided in this legend is brief. Further details on the soils and their environment are provided in the soil reports and maps for adjoining soil survey areas No. 24,25,31,36 and 40. The report and maps Soils of the Horsefly Area is in preparation for printing.

This key describes all soils and landforms mapped at a scale of 1:50 000 for maps 93A/3,4,5,6,11,12,13,14

2. Example

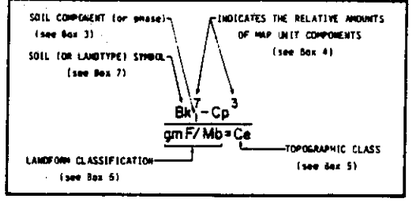

3. Soil Components

Where soil components are used they are shown and characterized in Box 7. Some map unit numbers refer to soil component numbers used in adjoining survey areas.

4. Composite Units

Composite units are employed where two or three types of map unit components are intermixed or occupy such small areas that they cannot be designated as separate units at the scale of mapping.

Numbers show the relative amounts of each soil or land type component of a map unit as: 9 (90%), 8 (80%), 7 (70%), 6 (60%), 5 (50%), 4 (40%), 3 (30%), 2 (20%), 1 (10%).

The components of the denominator are described in Boxes 5 and 6.

5. Topographic Classes[1]

Simple Topography		Complex Topography		Slope
Single Slopes (regular surface)		Complex Slopes (irregular surface)		%
A	depressional to level	a	nearly level	0-0.5
B	very gently sloping	b	gently undulating	0.5-2
C	gently sloping	c	undulating	2-5
D	moderately sloping	d	gently rolling	5-9
E	strongly sloping	e	moderately rolling	9-15
F	steeply sloping	f	strongly rolling	15-30
G	very steeply sloping	g	hilly	30-60
H	extremely sloping	h	very hilly	over 60

[1]Ref. The System of Soil Classification for Canada 1974, (revised).

6. Landform Classification

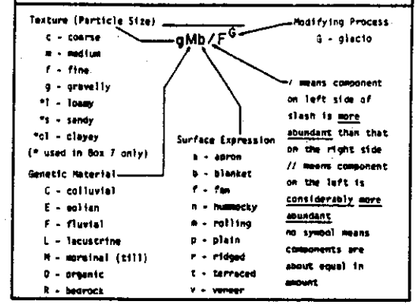

7. SOIL ASSOCIATION DESCRIPTIONS

Symbol	Map Unit	Biogeoclimatic Zones and Sub-Zones (see Box 8)	Soil Parent Material (see Box 6)	Most Common Soil	Most Common Soil Drainage (see Box 9)	Comments
Au	Ahbau	SBS b,c	1 & clM	Orthic Luvic Gleysol	p	associated with Chief soils
B	Bednesti	SBS b	IL	Brunisolic Gray Luvisol	m	in soil Reports No. 2, 4, 10, 31
Cf	Chief	SBS b,c	O	Typic Mesisol	vp	in Soil Reports No. 2, 31
Cp	Captain Creek	IWH b, ESSF b	glm	Orthic Humo-Ferric Podzol	m	seepage areas common
D	Deserters	SBS b	gslm	Brunisolic Gray Luvisol	m	drumlinized areas of Fraser Plateau
Dn	Dragon	SBS b, IWH a	slMv	Orthic Humo-Ferric Podzol	w	on high areas of the plateau
(E)	eroded phase					
Hr	Heger	SBS b, ESSF b	gsC	Eluviated Dystric Brunisol	w	associated with lithic soils overlying metamorphic rock
Ko_1	Keno Lake	IWH b	gsM	Orthic Humo-Ferric Podzol	w	
Ko_2	Keno Lake	IWH b	gsM	Orthic Humo-Ferric Podzol	w	associated with imperfectly drained soils
Lz	Lanezi	IWh a	lm	Luvisolic Humo-Ferric Podzol	m	similar to Dominion soils
Hy	Hyland	SBS b	lM	Podzolic Gray Luvisol	m	similar to Dominion soils (Report 23)
R	Ramsey	SBS b, IWH b	gsFG	Orthic Humo-Ferric Podzol	r	wetter valleys
RO	Rockland	land type				
Vl	Vieuland	ESSF b	gslM	Lithic Humo-Ferric Podzol	r	similar to Keno Lake soils

8. Forest Zonation Symbols[1]

Biogeoclimatic zones and subzones are used instead of forest zones.

AT	Alpine Tundra Zone
ESSFb	Engelmann Spruce - Subalpine Fir (wet subzone)
IWHa	Interior Western Hemlock (cedar subzone)
IWHb	Interior Western Hemlock (wet subzone)
SBSb	Subboreal Spruce (Douglas fir - white spruce subzone)
SBSc	Subboreal Spruce (white spruce - subalpine fir - Douglas fir subzone)
IDF b	Interior Douglas fir (pinegrass subzone)

[1]Ref. Annas & Coupé 1979

9. Drainage Classes

r	Rapidly drained	The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.
w	Well drained	The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.
m	Moderately well drained	The soil moisture in excess of field capacity remains for a small but significant period of the year.
i	Imperfectly drained	The soil moisture in excess of field capacity remains in sub-surface horizons for moderately long periods during the year.
p	Poorly drained	The soil moisture in excess of field capacity remains in all horizons a larger part of the year.
vp	Very poorly drained	Free water remains at or within 12 inches (30 cm) of the surface most of the year.

10. References

E.L.U.C. Secretariat, 1976 - Terrain Classification System

Canada Soil Survey Committee (C.S.S.C.), 1978 - The Canadian System of Soil Classification, Can. Dep. Agric. Publ. 1646

Annas, R.M. and R. Coupe 1979. Biogeoclimatic zones and subzones of the Cariboo Forest Region.

Soil Survey Reports No. 2, 4, 10, 25, 31, 36.

Background Materials

Holland, S.S., 1976 - Landforms of British Columbia: A Physiographic Outline, B.C. Dept. of Mines and Petroleum Resources, Bull. 48

Soil Data File contains physical and chemical data of most soil associations described in the area.

Maps and reports available from and information from SDF (see key):

The Map Library
Assessment and Planning Division
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X4

11. Credits

Mapping by T. Lord, Agriculture Canada

Mapping correlated by T. Lord, Agriculture Canada

Date of field mapping: 1971-73

Photography used for Mapping:

Date: 1970

Scale: 80ch .40ch

Drafted by Cartography Section, Resource Analysis Branch, Ministry of Environment, Victoria, British Columbia

Date: 1972

Revision Dates: 1976, 1980, ____, ____

Base map provided by Map Production Division, Surveys and Mapping Branch, Ministry of Environment, Victoria, British Columbia

SOILS LEGEND
For the Horsefly River – Keithley Creek Map Area
Sheet 2 of 2

CAD FILE: \PROJECT\1980\H1221\FIG.B4 Plot 1of1

Mar. 23, 1995

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FIGURE 2.3

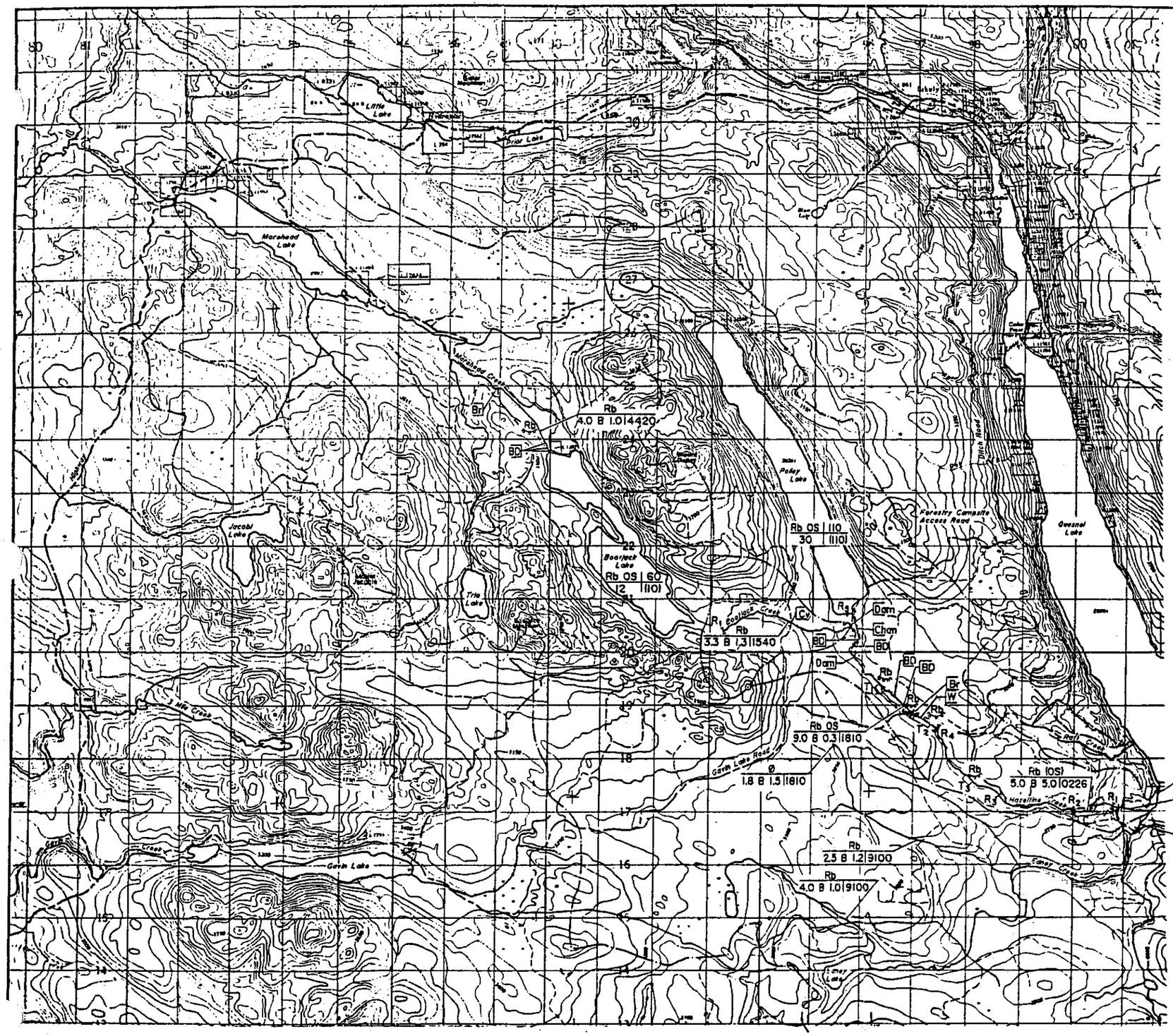

1007.85

AQUATIC BIOPHYSICAL

STREAM SYMBOL

Rb Ch (Co)
9 8 1.5 2 3 4 1

- Fish Species: Rainbow trout (present); Chinook (migration); Cohe (probable)
- Channel Components (see Box 4): Width = 9 metres; Valley flat to channel ratio is between 2 and 5; Average reach slope = 1.5%
- Box (Substrate) Materials (see Box 5): Fines = 20%; Gravels = 30%; Larges = 40%; Bedrock = 10%

CHANNEL COMPONENTS

1. Channel width in metres. Equal to distance between rooted vegetation, including islands.
2. Valley flat to channel ratio. The ratio between width of valley flat and width of channel.

Map Designation	Ratio
A	0-2
B	2-5
C	5-10
D	10+
E	N/A (e.g. Fan or delta)

3. Slope (elevation gain/reach length) calculated as an average for the reach, expressed as a percentage; measured from topographic base map.
   - >3% rounded off to the nearest percent
   - <3% rounded off to 1 decimal place.

BED (SUBSTRATE) MATERIALS

Fines, gravels, larges and bedrock are listed in sequence to nearest 10%, expressed as an integer.

1. Fines 'F'; materials in the 0-2 mm size class
   Gravels 'G'; materials in the 2-64 mm size class
   Larges 'L'; materials greater than 64 mm
   Bedrock 'R'; consolidated materials
2. F, G, L or R used alone indicates 90-100% reach is in that size class.
3. A trace of bedrock (0-5%) may be indicated by R following the 3 material components (e.g. 253R). Traces (0-5%) of fine, gravel, or large material are indicated by a 0 (e.g. 0073).

LAKE SYMBOL

General: Fish species | T.D.S.
Max. depth | Littoral area

1. Fish species:
2. T.D.S.: total dissolved solids, if available
3. Maximum depth: measured to nearest metre
4. Littoral area: measurement or visual estimate of % of total area <6m. When estimate is made, the symbol is placed in parenthesis.

FISH SPECIES

1. Fish Species Abbreviations (known or inferred in this map area at time of survey).

Map Abbrev.	Common Name	Map Abbrev.	Common Name
Ø	no fish detected at time and place of sampling	Gr	Arctic grayling
		GSg	Green sturgeon
		HW	Humpbacked whitefish
AC	Arctic char	In	Inconnu
Act	anad. (ana-trus) Cutthroat trout	Ko	Kokanee
		LMB	Largemouth bass
ADV	anad. Dolly Varden char	LT	Lake (trout) char
		LW	Lake whitefish
AEB	anad. Eastern Brook trouts (char)	MW	Mountain whitefish
		NP	Northern pike
AGB	anad. Brown trout	OS	forage, unseen fishes
AS	Atlantic salmon	P	Perch, general
BB	Burbot (Ling)	Pk	Pink salmon
BCB	Black crappie	PMB	Pumkinseed
BS	Bass/sunfish, gen.	PW	Pigmy whitefish
BW	Broad whitefish	Rb	Rainbow trout
CA	Arctic cisco	RW	Round whitefish
Ch	Chinook salmon	Sa	Salmon, general
CL	Lake cisco(tullibee)	Sg	Sturgeon, general
Cm	Chum salmon	Sk	Sockeye salmon
Co	Coho salmon	SMB	Smallmouth bass
Cp	Carp	Sp	fish observed, unidentified
CS	Least cisco	St	Steelhead trout
Ct	Coastal Cutthroat trout	Tr	trout, general
DV	Dolly Varden char	WF	Whitefish, general
EB	Eastern Brook trout char	WP	Walleye
		WSg	White Sturgeon
Es	Eulachon	YCt	Yellowstone & Westslope Cutthroat trout
GB	Brown trout		
GE	Goldeneye	YP	Yellow perch

2. OS - indicates known but non-sport or non-commercial species, data bank must be consulted for complete species list.
3. Absence of any fish species symbol indicates that no sampling information was available.
4. (Co) - indicates probable but unconfirmed presence.
5. Sh!- indicates reach used by species for migration only, no resident population.
6. Ch - Underlined fish abbrev. indicates special circumstances. Refer to B.C. Aquatic Data Base for clarification.
7. Note: no specific symbol exists for a barren stream. When such a condition is suspected, it may be indicated by (Ø which is an inference that if sampling took place, fish would not be detected.

LEGEND

- R_1 — Upstream extent of Reach 1
- B — Bridge
- Cv — Culvert
- BD — Beaver Dam
- Chan
- DAM
- T_1 — Transects 1,3 Cross sections 1
- Rb SPWN — Rainbow Trout Spawning

Species: Channel Components | Substrate Materials

Fisheries Biophysical

Scale 1000 500 0 1000 2000 3000 4000 m

REFERENCE DRAWINGS			REVISIONS				REVISIONS			
SYS NO	DESCRIPTION	REV	DATE	DESCRIPTION	APPROVED	REV	DATE	DESCRIPTION	APPROVED

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DESIGNED
DRAWN JW
CHECKED
APPROVED

DATE | SCALE AS SHOWN

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FISHERIES BIOPHYSICAL INVENTORY

FIGURE 2.15 | REV

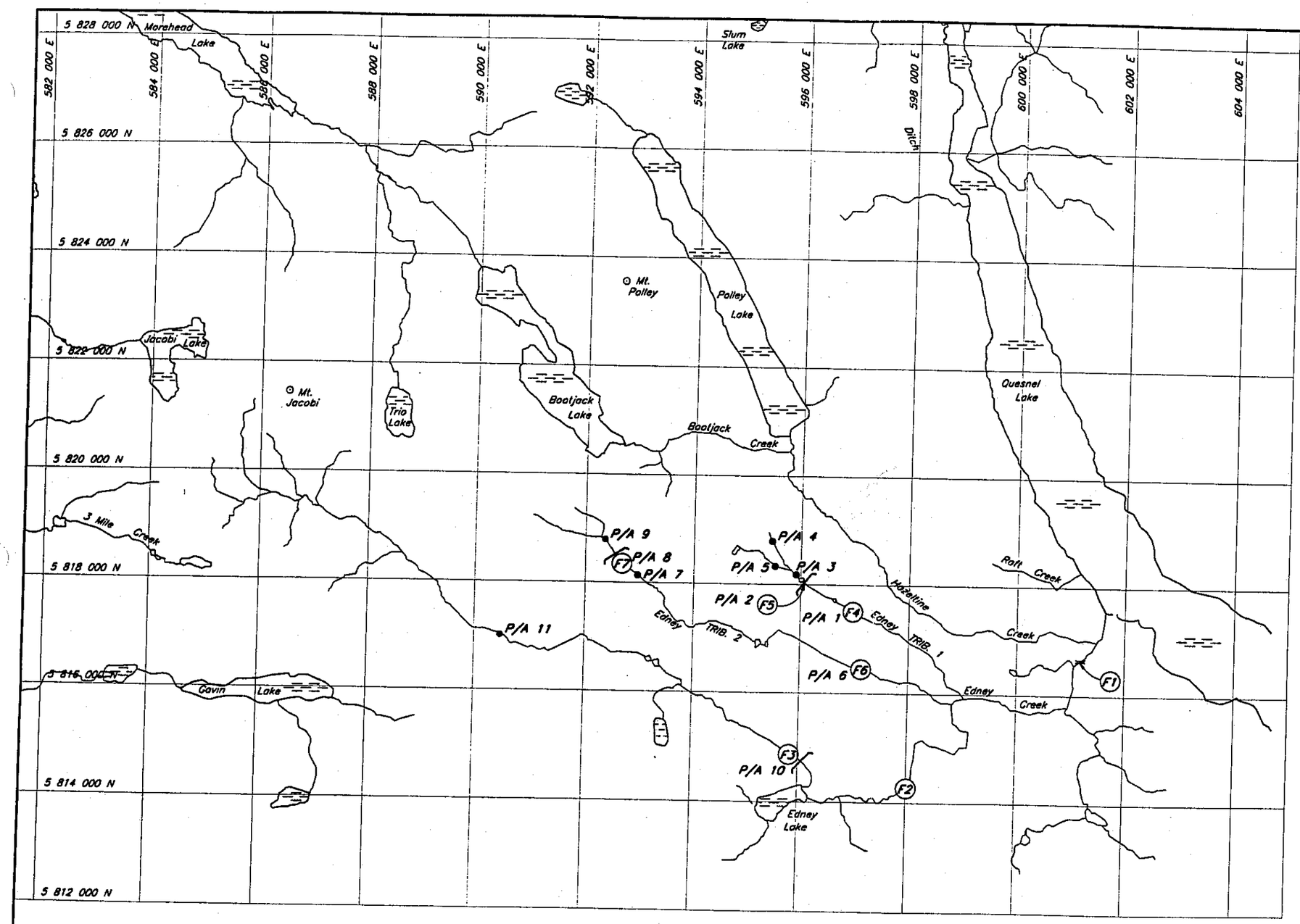

LEGEND

- Extent of fish distribution
- P/A 5 ● Presence / Absence Sample Site
- (F6) Electrofishing / Density Sample Site

Scale 1000 0 2000 4000 m

CAD FILE: \1000\H1221\0150.016 1:40000 Plot 1=40 March 27, 1996

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

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MT. POLLEY PROJECT

FIGURE 2.16
CREEKS OF THE MT. POLLEY AREA
AND FISHERIES STUDY SITES

DESIGNED	DJR
DRAWN	TAM
CHECKED	DJR
APPROVED	

DATE JAN. 5, 1996 | SCALE AS SHOWN | DRG. NO. H1221 | REV. —

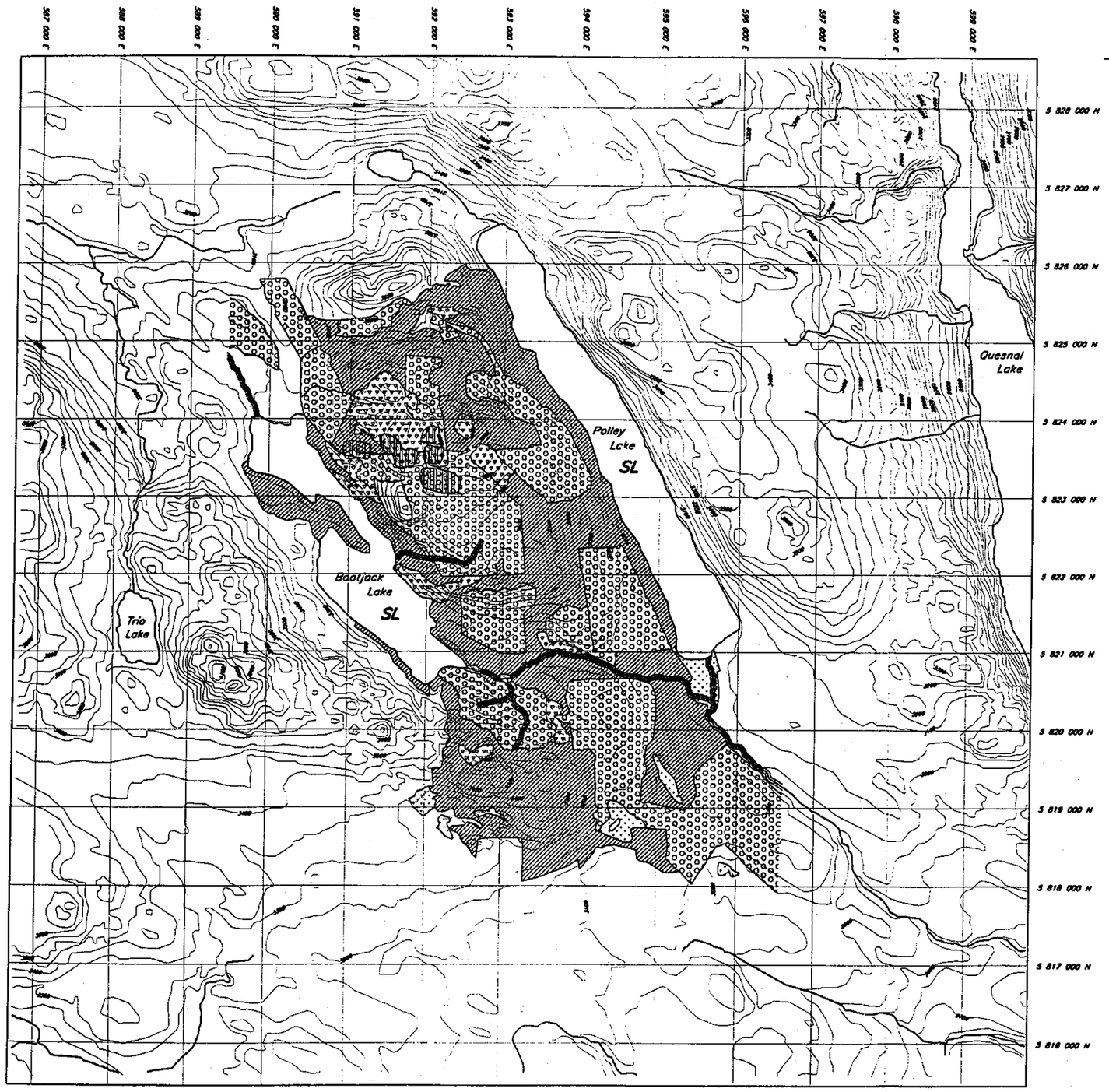

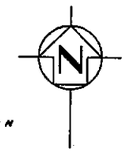

LEGEND

FOREST HABITATS OF THE INTERIOR CEDAR-HEMLOCK (ICH) ZONE

- Clearcuts and Burns (0–20 years+) Young Stands (20–40 years)
- Mid-seral Stands (40–120 years)
- Mature and Old Growth Stands (120 years+)
- Douglas-Fir-Lodgepole Pine Forest (South Slopes)

WETLAND AND AQUATIC HABITATS

- Riparian Habitats near Small Streams
- Shrub Carr / Sedge Fen Habitat Complex
- SL — Small and Medium-sized Lakes (<1000 ha)

NOTE: Contours are in feet.

Scale 1000 500 0 1000 2000 3000 Metres

CAD FILE: \PROJECT\1000\H1221\MXD\MAP1.MXD 1:30000 Plot 1=30 MAR 30, 1998

DRG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REFERENCE DRAWINGS		REVISIONS				REVISIONS			

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MT. POLLEY PROJECT

FIGURE 2.18
WILDLIFE CAPABILITY

DESIGNED	DJR		
DRAWN	NAR		
CHECKED	–		
APPROVED			
DATE	------	SCALE AS SHOWN	DRG. NO. H1221 REV. –

Appendix D
2022 Climate Baseline Update – Mount Polley Mine

REPORT

Climate Baseline Update

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely, BC V0L 1N0

Submitted by:

Golder Associates Ltd.
Suite 200 - 2920 Virtual Way, Vancouver, British Columbia, V5M 0C4, Canada

+1 604 296 4200

Reference No. 22514095-066-R-Rev0-31547

30 August 2022

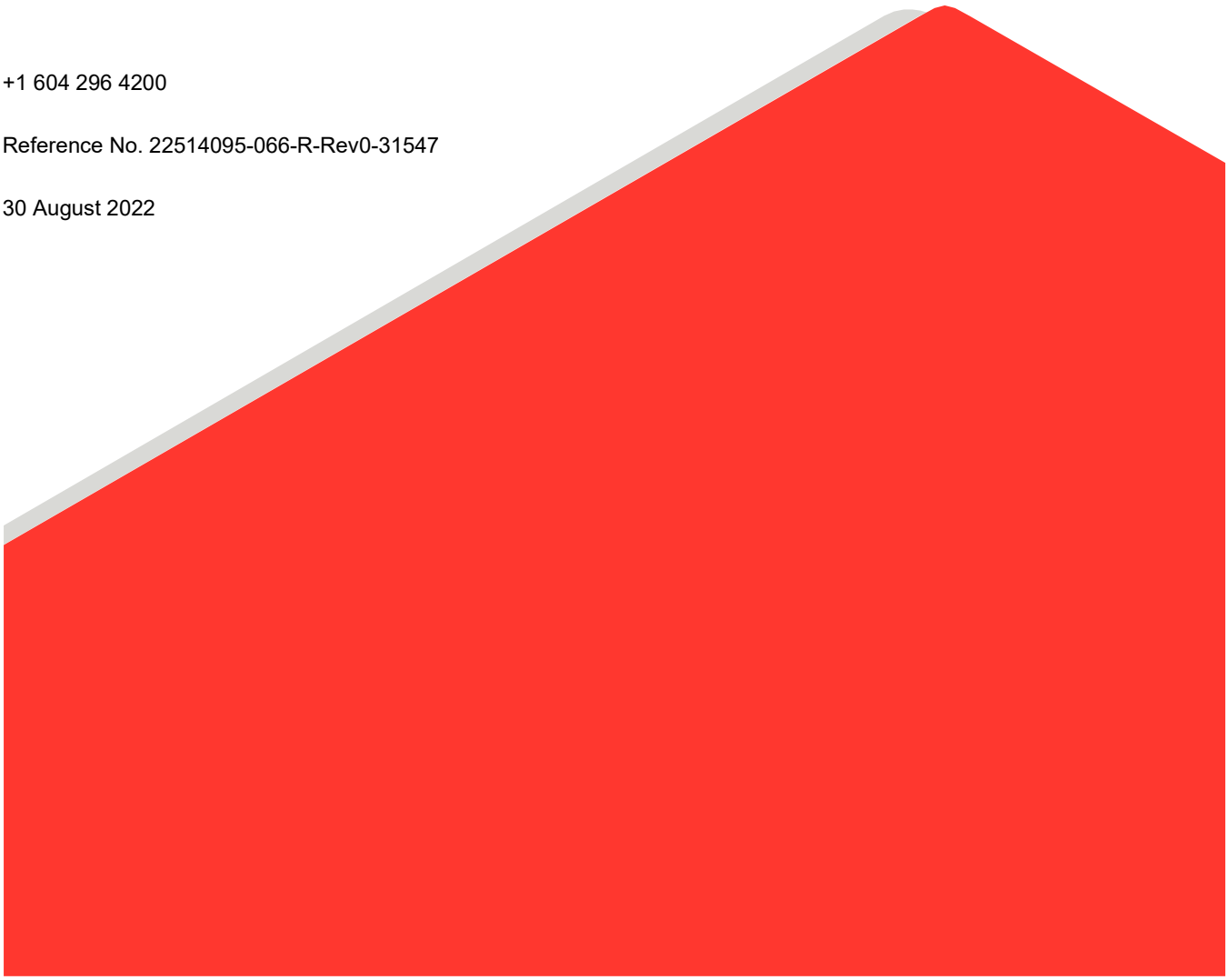

Distribution List

Electronic Copy - Mount Polley Mining Corporation

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Executive Summary

This report provides a five-year update of climate baseline at Mount Polley Mine site (the Site) owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. Updated baseline statistics are presented for precipitation (total precipitation, rainfall), air temperature, relative humidity, solar radiation, evaporation, snow depths, wind speed and directions. Updated climate change projections for the Site are also provided.

The 1974 to 1993 climate records from the nearby Environment and Climate Change Canada (ECCC) Likely climate station and 1995 to 2021 climate records from the local MPMC climate stations served as the basis for developing statistics for describing precipitation and temperature conditions for the Site. Records from regional and MPMC climate stations were reviewed to assist in characterizing climate parameters, such as relative humidity and solar radiation, and to support the identification of spatial trends. Local and regional climate station data were interrogated for inconsistencies or gaps, and then infilled using regional data and translation factors.

A summary of the updated baseline climate parameters developed in this study is provided in Table 1. The trends in climate parameters at the Site are similar to those at the ECCC regional stations considered in the study. An evaluation of future climate change projections indicates future climate at the Site will likely be warmer and wetter, with larger variations throughout the months.

Table 1: Summary of Key Mount Polley Climate Parameters

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050's (%)	+5
Projected annual total precipitation anomaly from baseline for 2080's (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Projected annual air temperature anomaly from baseline for 2050's (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080's (°C)	+2.7
Mean annual relative humidity (%)	68.1
Mean annual solar radiation (W/m^2)	135
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863
Mean snow water equivalent for the month of March (mm)	185

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).
mm = millimetre; ˚C = degrees Celsius; W/m^2 = watts per square metre.

Study Limitations

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1.0 INTRODUCTION

1.1 Overview

Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation, owns and operates the Mount Polley Mine (the Mine). The Mine is a copper-gold mine located 56 km northeast of Williams Lake, British Columbia (BC).

1.2 Purpose

Guidance from the Global Industry Standard on Tailings Management (GISTM) published by the International Council on Mining & Metals (ICMM) (2020) stipulates under Requirement 2.1 that the environmental knowledge base including climate parameters should be updated every five years to capture uncertainties due to climate change.

The last climate baseline for the Mine site (the Site) was carried out by Golder Associates Ltd., a member of WSP (WSP Golder) in 2016, and MPMC has retained WSP Golder to prepare an update. The purpose of the update is to extend the existing long-term climate dataset for the Site using local and regional data collected in the last 5 years in support of design activities.

This report provides a climate baseline update for precipitation, air temperature, relative humidity, solar radiation, evaporation, wind speed and direction, and snow depths, and includes updated climate change projections for the Site.

1.3 Scope

The scope of work for this climate study included:

- Literature review of previous descriptions of climate conditions near the Site study area.
- Statistical analysis of historical climate records at different locations near the Site study area to develop statistics for climate variables, including precipitation (total precipitation, rainfall), air temperature, relative humidity, solar radiation, wind speed and direction, and snow cover properties.
- Mathematical modelling to calculate evaporation and potential evapotranspiration statistics for the Site study area.
- Statistical analysis of point climate data from downscaled circulation models using Shared Socioeconomic Pathways scenarios (ECCC 2022c) for future climate projections for the Site study area.

2.0 STUDY AREAS

The Site is located 56 km northwest of Williams Lake, British Columbia (BC) near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976).

2.1 Local Study Area

Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

The Site is located on the divide of two sub-watersheds within the Quesnel Lake watershed. The western watershed, which includes drainage from Bootjack Lake, discharges to the Quesnel River via Morehead Creek and drained approximately 60% of the Mount Polley area prior to Mine construction. The eastern watershed includes Polley Lake, which discharges to the east via Hazeltine Creek, Edney Creek, and the West Arm of Quesnel Lake. The Hazeltine Creek and Edney Creek watershed areas at Quesnel Lake are approximately 30.2 km^2 and 87.4 km^2, respectively. Approximately 10.5 km^2 that historically reported to this watershed is now within the Site contact water runoff collection system catchment.

Bootjack Creek is a small tributary of Hazeltine Creek downstream of Polley Lake. Historically, Bootjack Lake discharged into Hazeltine Creek via Bootjack Creek, but in 1913 a dam was constructed at the south end of Bootjack Lake and the flow direction was reversed in order to direct water into Morehead Lake for hydropower production. This resulted in 14 km^2 being diverted from the Hazeltine Creek catchment. The old Bootjack Lake Dam was upgraded by MPMC in 1997 as fulfillment of a Fish Habitat Compensation Agreement signed between MPMC and the regulating federal and provincial agencies. The Bootjack Lake watershed area is 11.2 km^2; approximately 2.3 km^2 that historically reported to this watershed is now within the Site contact water runoff collection system catchment. Currently, Bootjack Creek reports to Polley Lake.

The regional topography, water bodies, and pre-mining watersheds are shown in Figure 1. Mine Site water collection systems and catchment areas are not included in the scope of this report.

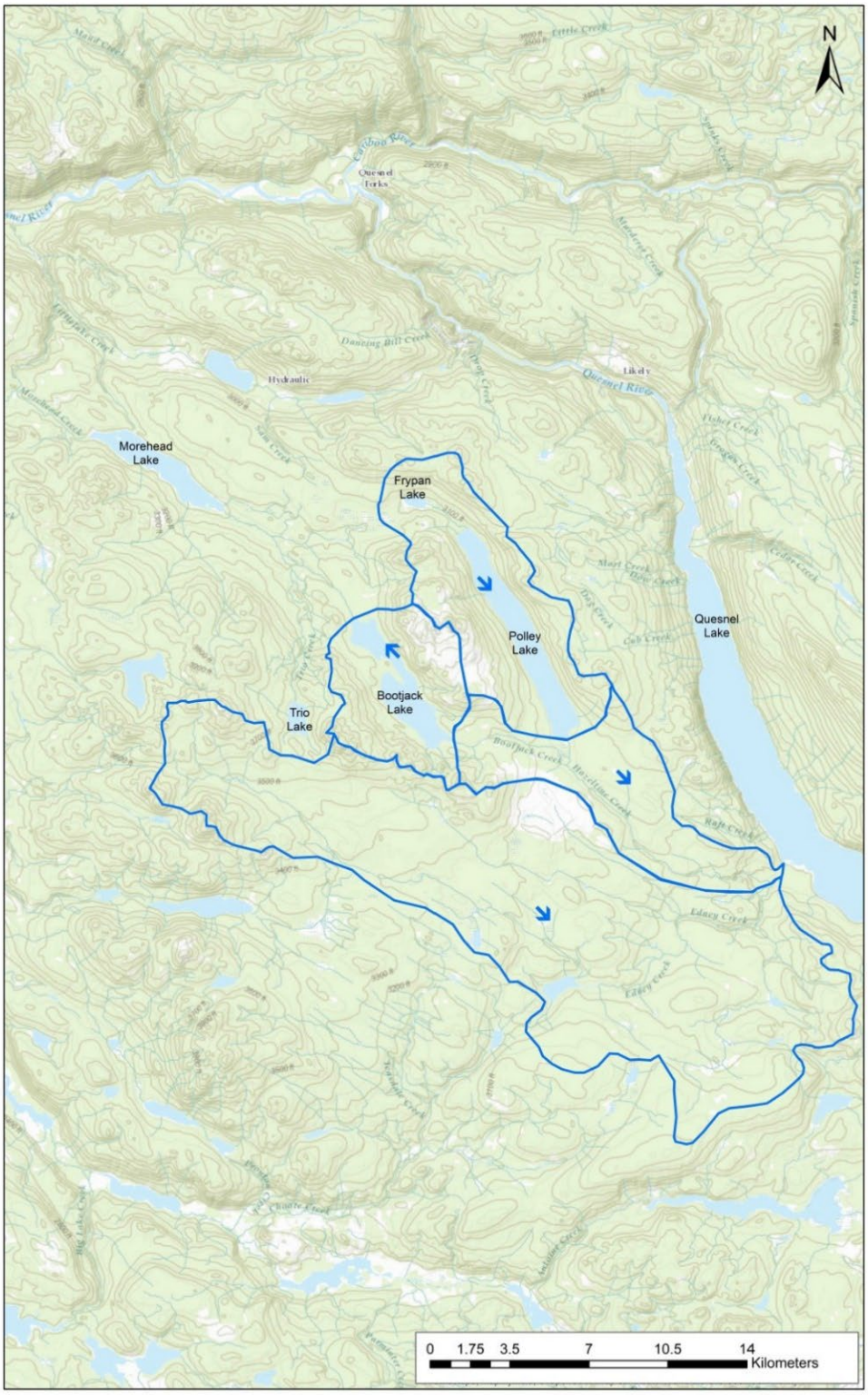

Figure 1: Mount Polley Mine Site and Surrounding Area Water Bodies and Topography Pre-Mining Activities

The Site study area is presented in Figure 2 The Site study area comprises the footprint of the physical infrastructure of the Mine and the tailings storage facility (TSF).

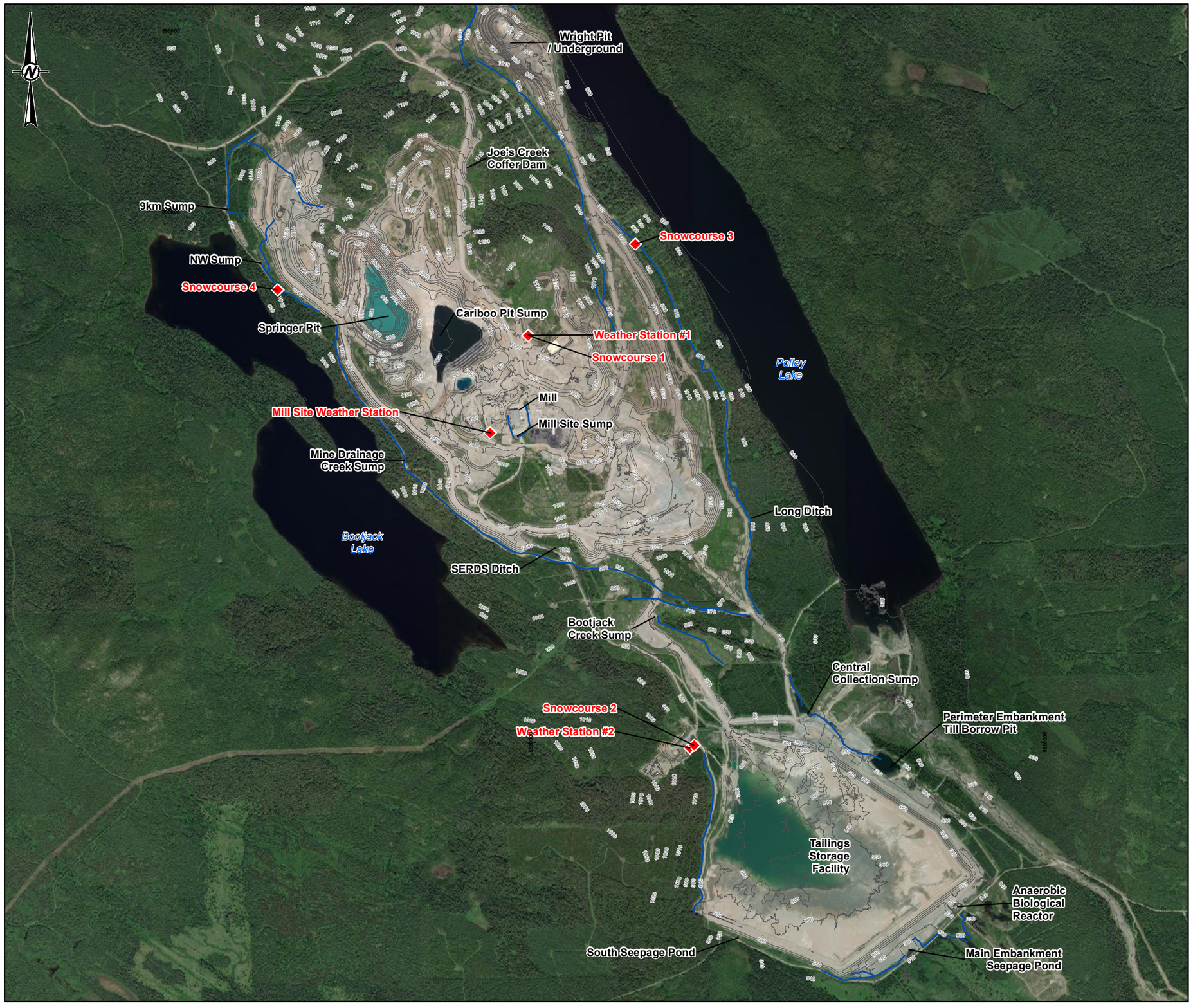

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- CLIMATE STATION
- WATER COLLECTION DITCH
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REFERENCE(S)

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM SNC LAVALIN (2014)
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD.
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
WATER MANAGMENT PLAN - BASELINE CLIMATE UPDATE

TITLE
MOUNT POLLEY SITE STUDY AREA CLIMATE STATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-08-29
DESIGNED	DM
PREPARED	CDB
REVIEWED	DRW
APPROVED	JD

PROJECT NO.	CONTROL	REV.	FIGURE
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2.2 Regional Study Area

The regional study area (RSA) is comprised of the nearest Environment and Climate Change Canada (ECCC) climate stations (Figure 3). The RSA ECCC climate stations have elevations ranging from 1,283 m to 545 m with a mean elevation of 908 m, 130 m below the mean elevation of the Site study area.

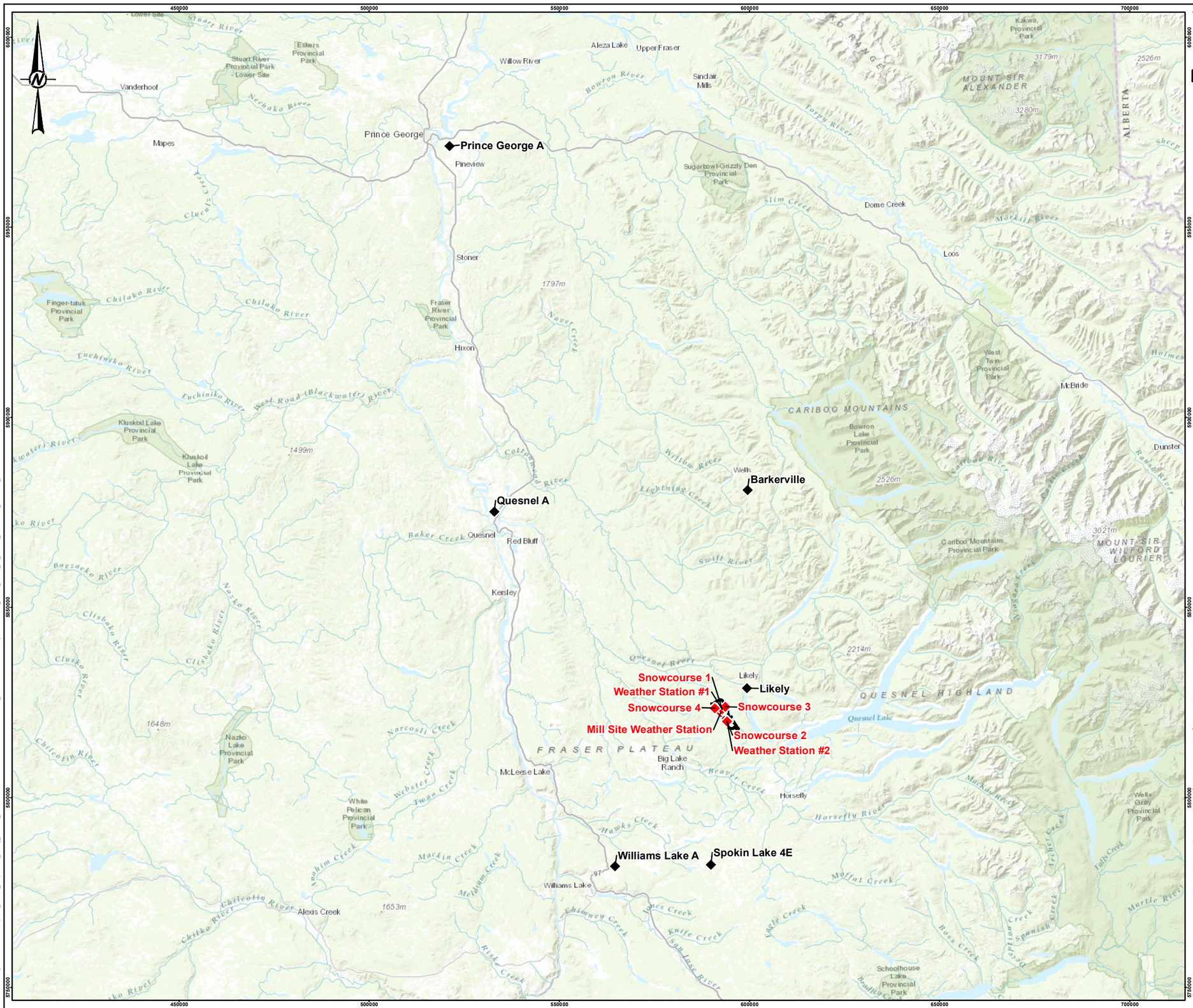

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1. BASE IMAGERY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
WATER MANAGMENT PLAN - BASELINE CLIMATE UPDATE

TITLE
LOCAL AND REGIONAL CLIMATE STATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-08-29
DESIGNED	DM
PREPARED	CDB
REVIEWED	DRW
APPROVED	JD

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3.0 METHODS

3.1 Study Design

Climate parameters (e.g., precipitation, temperature, and evaporation) vary both spatially and temporally. They vary spatially in response to changes in elevation and/or overall circulation patterns, and temporally, across the seasons, and from year to year. Describing the climate conditions for a certain area means presenting the climate statistics that capture the variation, including both the average expected values and the extent of the variation around the average.

The summary statistics for precipitation, temperature, evaporation, relative humidity, solar radiation, wind speed and directions, and snow depths presented herein were prepared from historical measurements recorded at local climate stations, supported by data collected from nearby regional climate stations. Raw station data were interrogated for inconsistencies or gaps then infilled using regional data and translation factors to generate short duration (daily and sub-daily) and long-duration (Annual) estimates for a range of return periods (precipitation only) or percentiles (temperature, evaporation, relative humidity, and solar radiation only). Except for wind and snow cover, the datasets were extended using historical regional data and translation factors to include a range of possible weather events and climatic trends.

Future climate projections come from publicly available statistical downscaled future climate projections on a daily scale. Recognizing the inherent uncertainty with projections, multiple projections from multiple models and scenarios were included in the analysis. Therefore, the future projections are provided in terms of percentiles or exceedance probabilities. The following sections provide a summary of the climate stations used in this report.

3.2 Review of Existing Information

Climate conditions for the Site were estimated based on data from several meteorological stations in the region and at the Site (Figure 3). The meteorological stations are listed in Table 2 and Table 4.

3.2.1 Local Climate Stations

MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and directions (1997 to 2003). In 2012, this station was replaced with two stations: one near the mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall.

Rainfall was measured using a manual rain gauge from 1997 to present at each climate station, and in 2019 automated tipping rain gauges were added at WS1 and WS2. For this study, rainfall for the Site was averaged across all instruments that recorded rainfall on a given day. Relative humidity and solar radiation were recorded at WS1 and WS2 from 2019 to 2021, although records are not continuous. In addition, solar radiation was recorded at the Mill Site station from 2001 to 2003.

Details of these stations are provided in Table 2 and their locations are shown in Figure 2.

Table 2: Local Climate Stations for the Mount Polley Mine

Station Name	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)[2]	Data Type	Period of Record
Mill Site Weather Station	5822420	592495	1,118	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	R, T, RH, SR, E, WS	2012-2021[3]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	R, T, RH, SR, E, WS	2012-2021[3]

1) UTM Coordinate system – Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

3) Station still in operation.

TSF = tailings storage facility; masl = metres above sea level.

R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation; E = Evaporation; WS = Wind Speed; WD = Wind Direction.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically taken during the melt phase. The details of these snow course stations are provided in Table 3 and their locations are shown in Figure 2.

Table 3: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[1]	Easting (m E)[1]	Approximate Elevation (masl)[2]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

1) UTM Coordinate system - Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

3.2.2 Regional Climate Stations

Five Environment and Climate Change Canada (ECCC) climate stations: Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, were selected for the update due to their proximity to the Site, length of record, elevation range, and concurrent period of record with the local climate stations at the Site. In addition, the ECCC Prince George climate station was added to include an additional station with solar radiation data. Historical records were retrieved from ECCC's Historical Climate Data web server (ECCC 2022a). More recent records were compiled through e-mail correspondence with ECCC staff (ECCC 2022b). The regional climate station details are provided in Table 4, and their respective locations are shown in Figure 3.

Table 4: Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[2]
Likely (1094616)	5828785	599332	724	9	P, R, S, T	1974-1993
Williams Lake A (1098940)	5781820	564666	940	50	P, R, S, T, RH, SR	1961-2021[4]
Spokin Lake 4E (1097646)	5782274	589827	1,033	40	P, R, S, T	1983-2021[4]
Barkerville (1090660)	5880996	599515	1,283	59	P, R, S, T	1888-2021[3, 4]
Quesnel A[5] (1096630)	5873987	546720	545	80	P, R, S, T, RH	1946-2021[4]
Prince George A (1096450)	5971423	521103	691	163	P, R, S, T, RH, SR	1973-1995

1) UTM Coordinate system – Zone 10U.
2) Length of record from start year to end year may not reflect the number of complete years of data.
3) Provisional data for the period January 2016 to December 2021 were provided by ECCC.
4) Station still in operation.
5) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

ID = Identification; masl = metres above sea level; km = kilometre.
P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation.

3.3 Data Processing

Climate parameter statistics for the Site were prepared using data from the three on-site climate stations operated by MPMC, and the five regional climate stations operated by ECCC (Sections 3.2.1 and 3.2.2). Data were interrogated for gaps and errors, and where appropriate, extended and filled with data from regional stations using translation factors derived from the available periods of record as described in Section 3.4. Local data were screened for outliers in the time series that may be indicative of errors or equipment malfunction. Potential high outliers were identified in the Mount Polley rainfall record in April 2009 but were not removed from the time series as there was insufficient evidence to support removal. In addition, climate parameter records were checked using the World Meteorological Organization (WMO) guidelines (WMO 2018) as reference. Monthly records were removed if there were more than five days missing, or more than 3 consecutive days missing. Annual records were only calculated using years with a complete dataset (twelve months).

3.4 Data Analysis

3.4.1 Precipitation

The MPMC precipitation dataset was extended and infilled using the available data record from the five regional stations as described below to derive a daily and 24-hour long-term synthetic precipitation dataset for the Site.

Extended MPMC Precipitation Data Record

The Likely ECCC Station data were considered to extend the precipitation record for the Site given the station's length of record and proximity to the Site. As the Likely ECCC station and MPMC climate stations do not have concurrent data sets, the mean monthly April-to-November rainfall distribution for the available data records were compared to evaluate the suitability of using the Likely station data to represent precipitation conditions at the Site. As shown in Figure 4, the Likely and Site station monthly precipitation distributions show a similar trend overall, with MPMC recording notably greater rainfall in April, and notably less rainfall in June and August relative to Likely. The notable differences in monthly rainfall between the MPMC and Likely datasets for the months of April, June, and August were investigated with the following observations:

- April: the length of record for MPMC is relatively short and is not continuous, and outliers have potential to bias mean monthly rainfall. As previously mentioned, potential high outliers were identified in the Mount Polley rainfall record in April 2009 but were not removed from the time series as there was insufficient evidence to support removal. However, if the potential high outlier data were to be removed, the mean monthly April values would be more aligned between the data sets (48.8 mm for MPMC versus of 33.1 mm for Likely).
- June: review of the MPMC and concurrent regional June monthly rainfall records for Barkerville, Spokin Lake, and Williams Lake indicate that relatively low June rainfall totals (compared to average values for the complete available data set from the regional stations) were recorded in several years during the 1997 to 2021 period of record (2002, 2003, 2006, 2009, 2014, 2019, and 2021). These years represent approximately 40% of the available June records for MPMC, suggesting the MPMC mean June rainfall may be biased low (i.e., due to shorter period of record used in computing the mean) compared to Likely.
- August: review of regional rainfall records for Barkerville, Spokin Lake, and Williams Lake from 1997 to 2021 (i.e., concurrent with the MPMC precipitation data set), indicate that regional mean August monthly rainfall records were 84%, 87%, and 85% of the mean of the full period of record, respectively, indicating that there has been reduction (compared to the longer-term mean) in August rainfall regionally in more recent years. In other words, the differences between MPMC and Likely mean August rainfall values may be attributed to differing precipitation trends in the respective reporting periods.

Based on above, the historical Likely ECCC Station record was considered acceptable for extending the historical precipitation record for the Site. Owing to the elevation difference between the Site and Likely ECCC Station, a precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the Likely ECCC climate station to the Site. The adjustment was based on the April-to-November rainfall ranking factor of the raw Likely ECCC climate station and Site rainfall records.

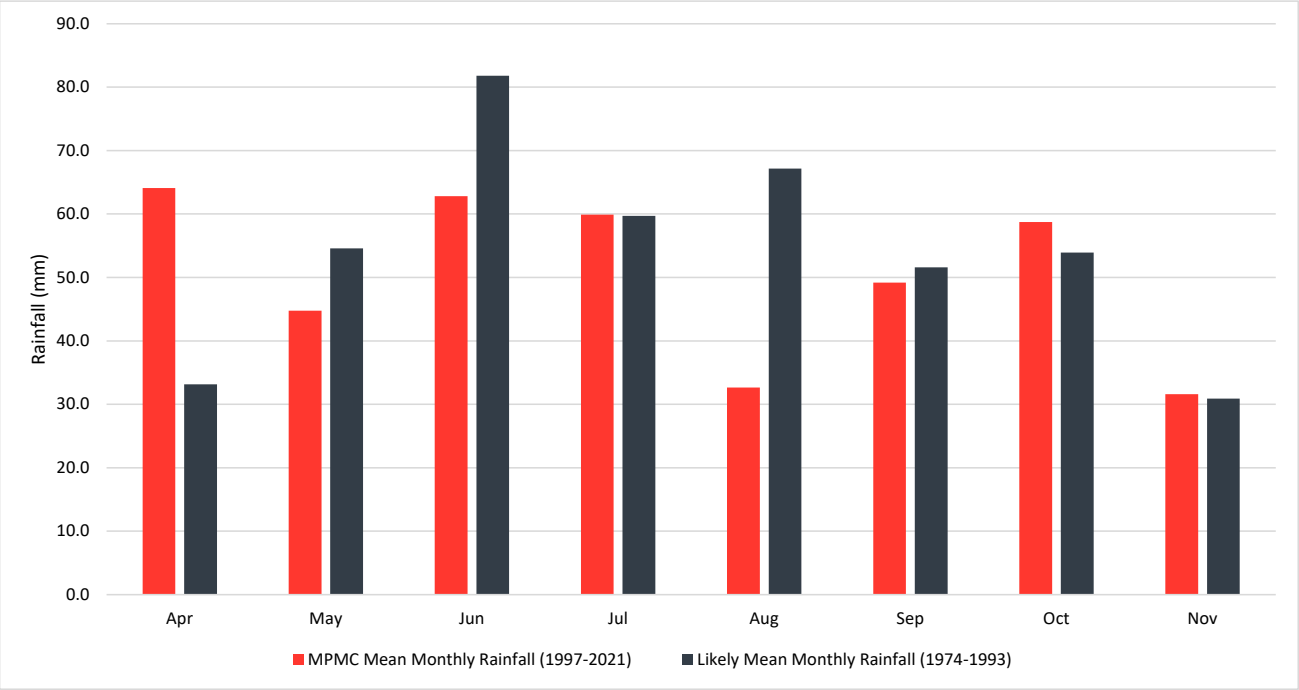

Figure 4: April-to-November Rainfall Distributions at Mount Polley Mine and ECCC Likely Climate Stations

MPMC Precipitation Data Gap Infilling

The priority sequence of concurrent regional climate station data used to infill gaps in the extended Site precipitation record was determined by analyzing measured daily rainfall from April to November for all climate stations; it was assumed that precipitation occurring between December and March occurred as snowfall. The regional climate station priority sequence considered the best-fit measured concurrent daily rainfall correlation (Rainfall Correlation), rainfall ranking correlation (Rainfall Rank), and percentage of time rain was recorded on the same day (Concurrent Daily Rain) between the raw data collected at the MPMC climate stations and each ECCC climate station (Table 5). Regional climate station precipitation data replaced missing rainfall data in the extended Site data record following the priority sequence, and all precipitation data from December to March as it was assumed precipitation during this period occurs as snowfall and daily snowfall is not recorded at the Site.

Table 5: Regional Climate Stations Priority Sequence for Precipitation Data Gap Infilling in Extended Record for MPMC

Priority	Station	Rainfall Correlation (R^2)	Rainfall Rank (R^2)	Concurrent Daily Rain (%)	Period of Record	Currently Active	Distance from site (km)
1	Williams Lake A	0.1950	0.9872	61.8	1960-2021	Yes	50
2	Spokin Lake 4E	0.1829	0.9747	65.8	1983-2021	Yes	40
3	Barkerville	0.1579	0.9216	66.4	1888-2021	Yes	59
4	Quesnel A	0.0502	0.9556	23.3	1946-2021	Yes	80

A precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the ECCC climate stations used to infill gaps. The adjustment was based on the April-to-November rainfall ranking factor of the raw ECCC climate station and Site rainfall records.

Daily to 24-Hour, 3-day, and 10-day Precipitation

The daily long-term synthetic precipitation dataset was converted to 24-hour, 3-day, and 10-day precipitation by applying a factor of 1.13 (WMO 2009), 1.03, and 1.01 (Miller 1964), respectively.

3.4.2 Temperature

Similar to precipitation analysis above, the MPMC temperature dataset was extended and infilled using the available data record from the five regional stations to derive a long-term synthetic temperature dataset for the Site.

Extended MPMC Temperature Data Record

The Likely ECCC Station data were considered to extend the temperature record for the Site given the station's length of record and proximity to the Site. As the Likely ECCC station and MPMC climate stations do not have concurrent data sets, the mean monthly air temperature distributions for the Site and Likely climate stations were compared to evaluate the suitability of using the Likely station data to represent temperature conditions at the Site. As shown in Figure 5, the monthly distributions show similar trend with MPMC and the historical Likely ECCC Station record was considered acceptable for extending the historical temperature record for the Site. Owing to the elevation difference between the Site and Likely ECCC Station, a temperature-elevation orographic factor was applied to adjust the raw precipitation data from the Likely ECCC climate station used to extend the historical record. The adjustment was based on monthly regional lapse-rates as discussed below.

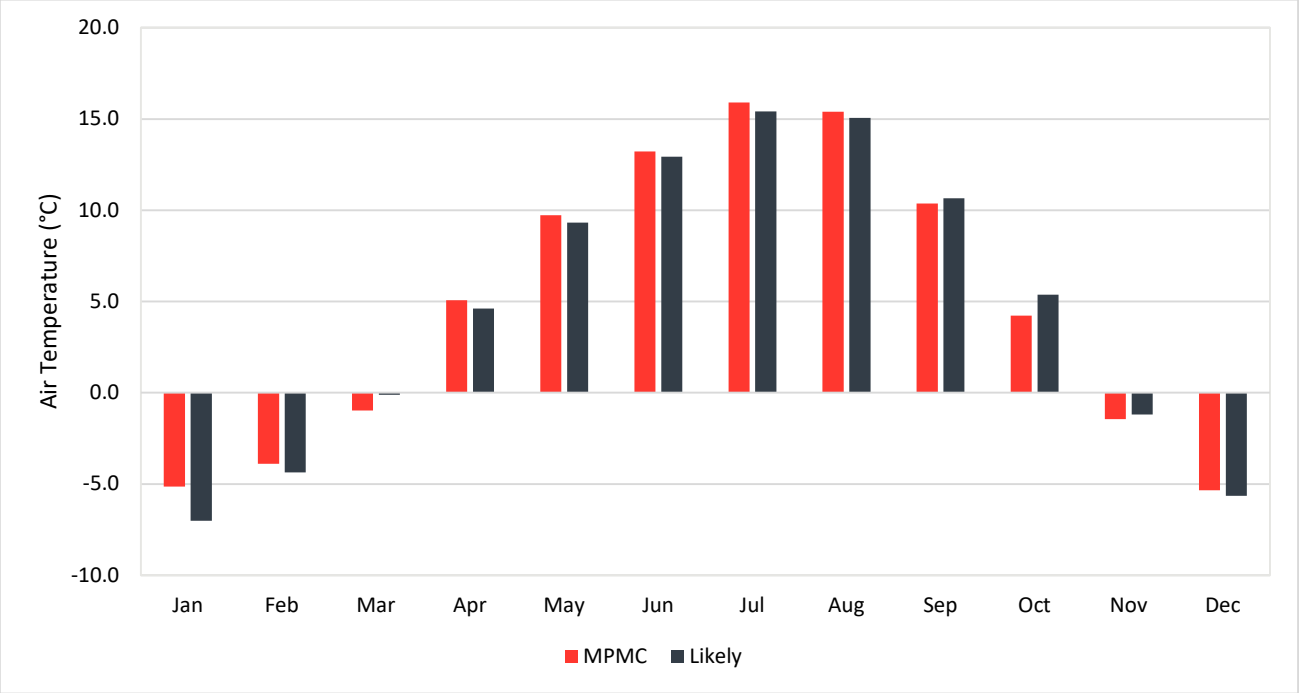

Figure 5: Mean Monthly Air Temperature Distributions for the Site and Likely ECCC Climate Station

ECCC Climate Normals for the regional climate stations were reviewed and are summarized in Table 6 and mean monthly air temperatures are presented in Figure 6. Comparing the Normals for the five regional ECCC Climate stations, there is an evident trend (the temperature lapse rate) of decreasing mean annual temperature with increasing elevation. The annual temperature lapse rate for the region is -0.47 °C / 100 m elevation increase. The lapse rate is larger for warmer months (April to October -0.55 °C / 100 m) and smaller for colder months (November to March -0.33 °C / 100 m). When analysed at a monthly level, the lapse rate is lowest for January (-0.09°C / 100 m) and highest for April, May, June, and July (-0.61°C / 100 m, -0.61°C / 100 m, -0.60°C / 100 m, and -0.59°C / 100 m, respectively). The R^2 of the linear trend is markedly lower for January (0.43) than for all the other months of the year (0.79 to 0.92), which suggests that temperature inversion may occur in the region in January. Lapse rates are presented in Table 7 and Figure 7.

Table 6: Monthly and Annual Air Temperature Climate Normals for Regional ECCC Climate Stations

Station Name	Quesnel A (545 masl)	Williams Lake A (940 masl)	Spokin Lake 4E (1,033 masl)	Barkerville (1,283 masl)	Likely (740 masl)
Time period for EC Climate Normals	1981-2010	1981-2010	1981-2010	1981-2010	1971-2000
Month	**Temperature (°C)**				
January	-6.9	-6.7	-7.6	-7.5	-7.0
February	-3.6	-4.1	-5.4	-5.9	-4.4
March	1.3	0.3	-1.2	-2.8	-0.1
April	6.4	4.9	3.7	1.4	4.6
May	11.1	9.6	8.0	6.2	9.3
June	14.7	13.3	11.4	10.0	12.9
July	16.8	16.0	13.4	12.3	15.4
August	16.4	15.3	12.8	12.8	15.1
September	11.5	10.6	8.5	8.0	10.7
October	5.5	4.6	3.4	2.4	5.4
November	-1.4	-2.3	-3.2	-4.3	-1.2
December	-5.9	-7.3	-7.7	-7.8	-5.7
Annual	**5.5**	**4.5**	**3.0**	**2.0**	**4.6**

masl = metres above sea level.

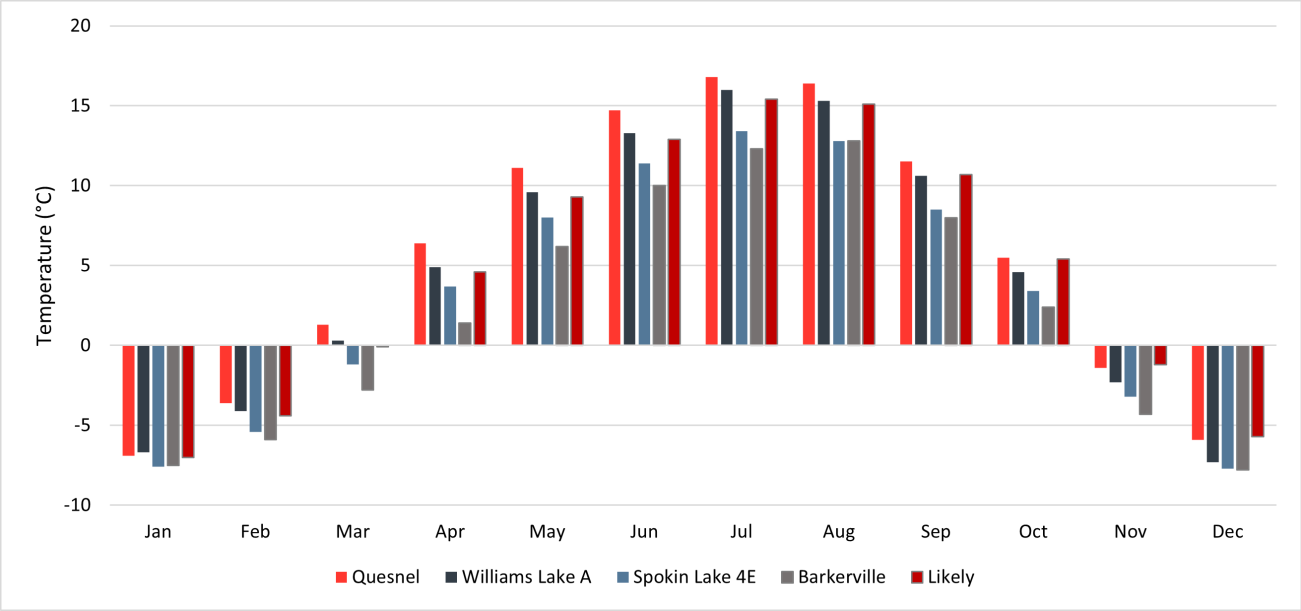

Figure 6: Mean Monthly Air Temperature for Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

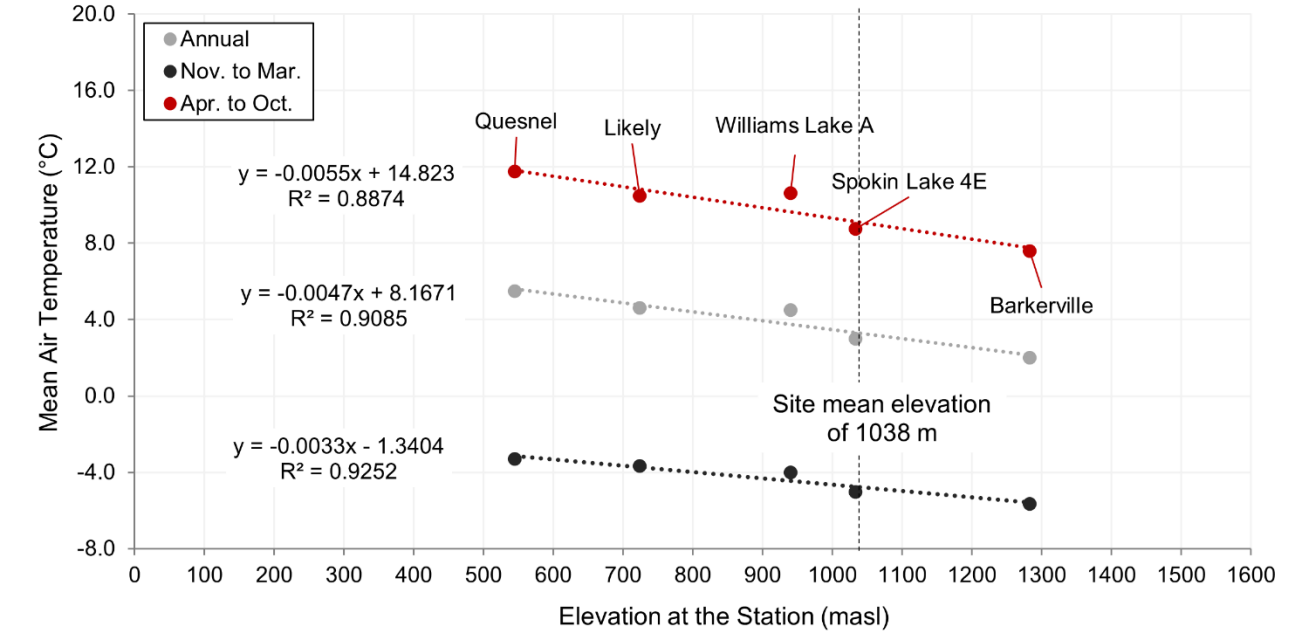

Figure 7 : Annual, April-to-October, and November-to-March Air Temperature Lapse Rates for Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

Table 7: Monthly Air Temperature Lapse Rate Variation Among Five Regional ECCC Climate Stations (1971 to 2000 period of record for ECCC Likely; 1981 to 2010 period of record for remaining stations)

Month	Lapse Rate = °C Difference / 100 m Elevation Increase	R^2 of the Linear Trend
January	-0.09	0.43
February	-0.30	0.82
March	-0.51	0.86
April	-0.61	0.88
May	-0.61	0.89
June	-0.60	0.87
July	-0.59	0.81
August	-0.50	0.79
September	-0.49	0.85
October	-0.45	0.92
November	-0.43	0.90
December	-0.32	0.82
Annual	-0.47	0.91

MPMC Temperature Data Gap Infilling

The priority sequence of regional climate station data used to infill gaps in the extended Site air temperature record was based on the best-fit daily air temperature correlation (Temperature Correlation), air temperature ranking (Temperature Ranking), and concurrent daily temperature recordings between the MPMC climate stations and each ECCC climate station (Table 8).

Table 8: Regional Climate Stations Priority Sequence for Temperature Data Gap Infilling in Extended Record for MPMC

Priority	Station	Temperature Correlation (R^2)	Temperature Rank (R^2)	Concurrent Daily Temperature (%)	Period of Record	Currently Active	Distance from site (km)
1	Williams Lake A	0.8917	0.9942	93.5	1960-2021	Yes	50
2	Barkerville	0.8834	0.9951	99.0	1888-2021	Yes	59
3	Quesnel A	0.8628	0.9861	97.5	1946-2021	Yes	80
4	Spokin Lake 4E	0.8525	0.9810	99.5	1983-2021	Yes	40

Regional ECCC climate station daily air temperature data were adjusted using the monthly air temperature lapse-rate presented in Table 7 to derive representative air temperature at the Site.

3.4.3 Relative Humidity

Relative humidity data are available for the Site from 2019 to 2021 and for ECCC climate stations Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). The MPMC WS1 relative humidity record is more complete than WS2's record; therefore, WS1 data were used for the analysis and infilled with WS2 data where necessary and if available. However, relative humidity data for the Site are insufficient for characterizing long-term climatic conditions of the Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative relative humidity estimate for the Site. Comparisons between the Site data and each ECCC climate station data were made to determine which station best represents the potential relative humidity at the Site.

Figure 8 and Figure 9 present the comparison between concurrent daily relative humidity values at the ECCC Quesnel and MPMC climate stations (January 2019 to December 2021). The 15-day moving average indicates that the relative humidity is generally higher at the Site than at the ECCC Quesnel climate station. The two datasets are well correlated (R^2=0.96).

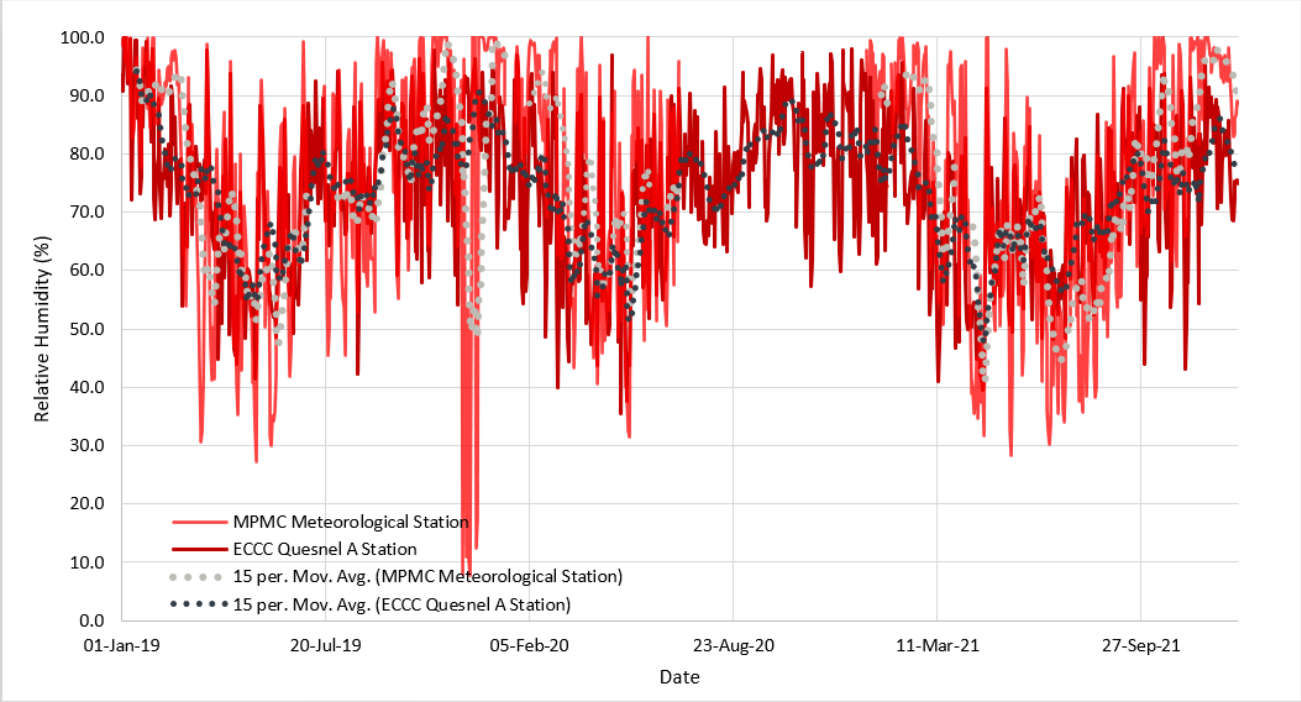

Figure 8: Concurrent Daily Relative Humidity Values at the MPMC and ECCC Quesnel Climate Stations (2019-2021)

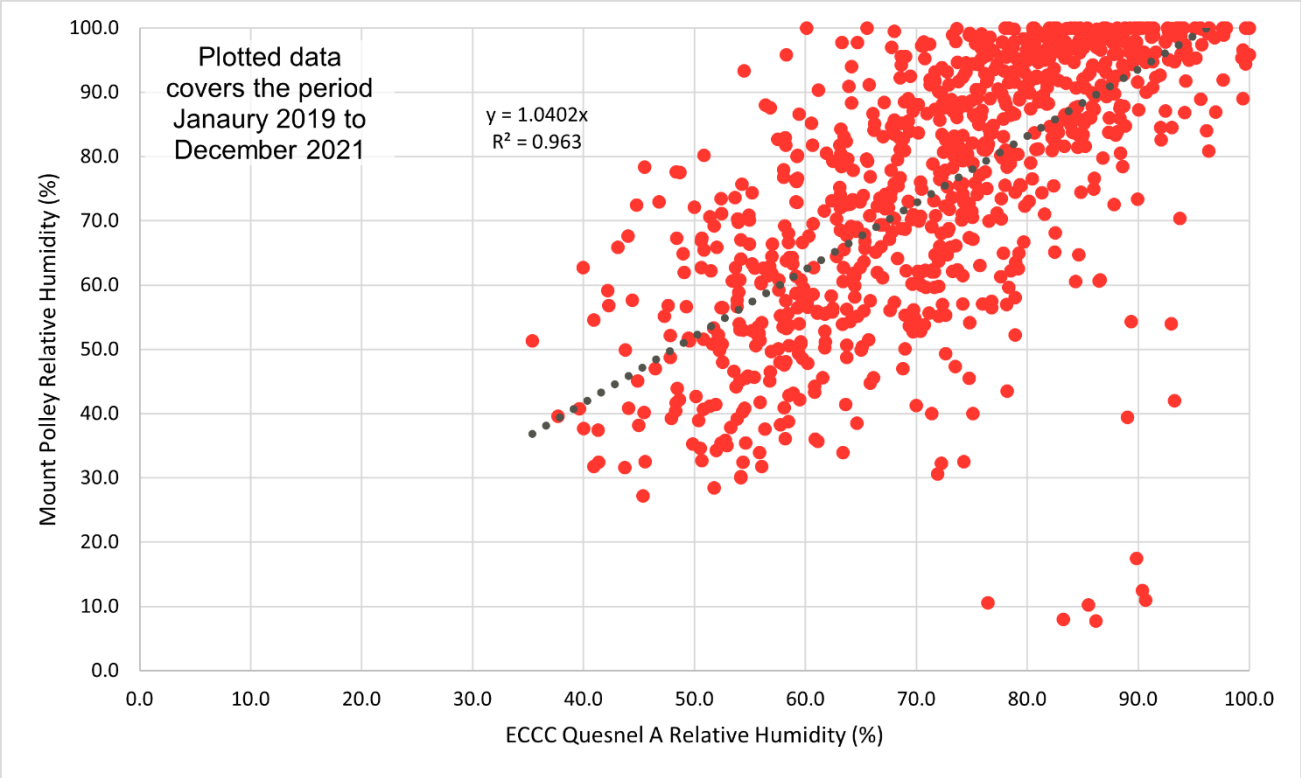

Figure 9: Correlation Relationship of Daily Relative Humidity Values at MPMC and ECCC Quesnel Climate Stations (2019-2021)

Figure 10 and Figure 11 present the comparison between concurrent daily relative humidity values at the ECCC Williams Lake and MPMC climate stations (January 2019 to December 2021). The 15-day moving average indicates that the relative humidity is generally higher at the Site than at ECCC Williams Lake climate station. The two datasets are very well correlated (R^2=0.98).

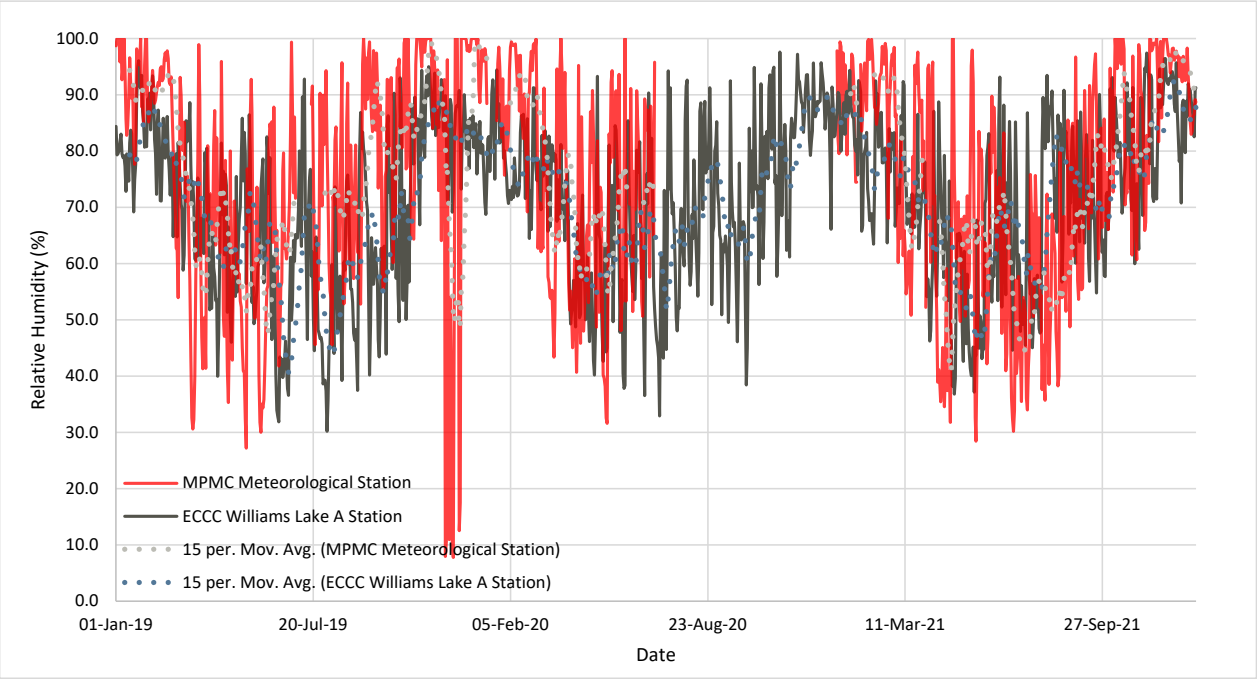

Figure 10 : Concurrent Daily Relative Humidity Values at MPMC and ECCC Williams Lake Climate Stations (2019-2021)

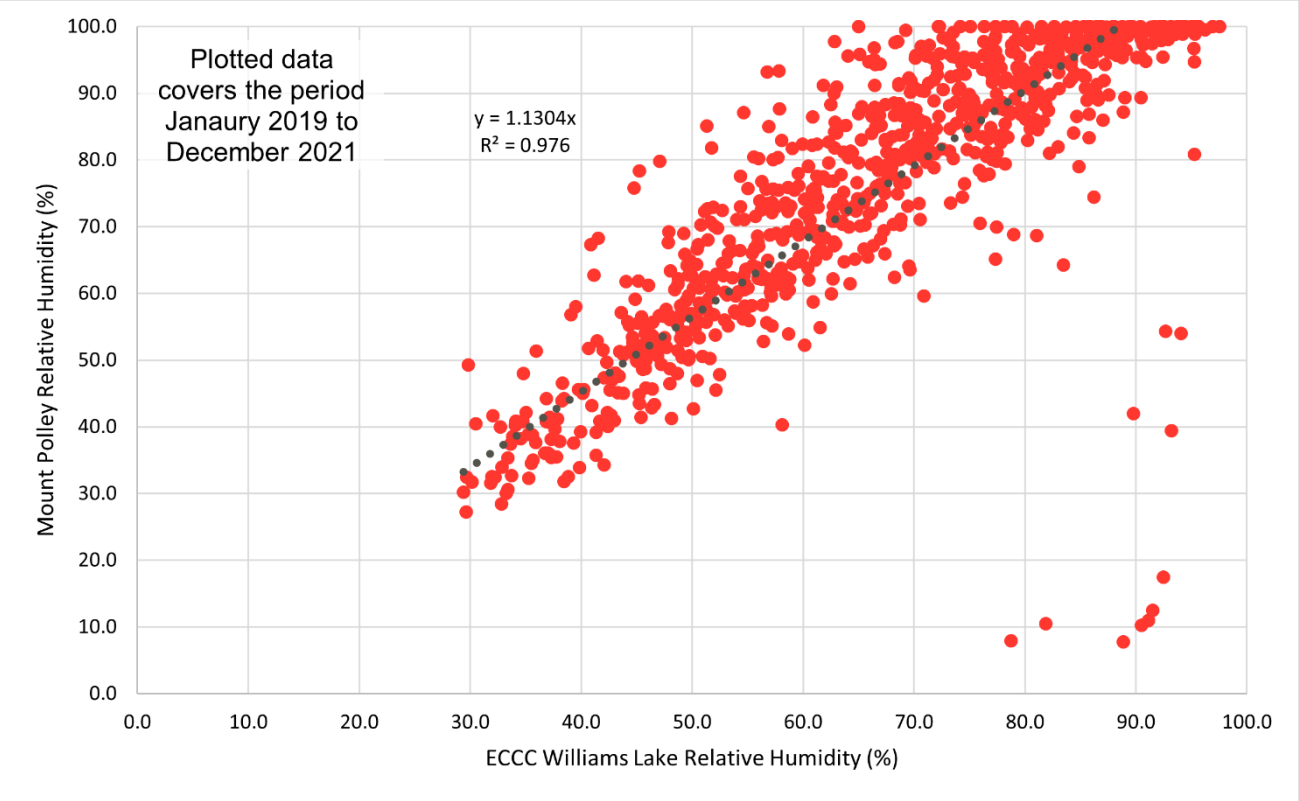

Figure 11 : Correlation Relationship of Daily Relative Humidity Values at MPMC and ECCC Williams Lake Climate Stations (2019-2021)

A long-term relative humidity time series for the Site was developed using ECCC Williams Lake A data infilled with ECCC Quesnel A data with an adjustment factor of 1.13 and 1.04 based on the relationships presented in Figure 11 and Figure 9, respectively.

3.4.4 Solar Radiation

Solar radiation data are available for the Site from 2001 to 2003 and 2019 to 2021, and for ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data for the Site are insufficient for characterizing climatic conditions of the Site due to the short period of record, and as the data recorded in 2001 is incomplete and not concurrent with either ECCC climate station. However, as presented in Figure 12, a discernible trend in mean monthly solar radiation is apparent for MPMC solar radiation (2019 to 2021) and in data from the ECCC Williams Lake and Prince George climate stations. Figure 13 presents ECCC Williams Lake and Prince George mean monthly solar radiation correlation (R^2 = 0.98) from 1973 to 1995.

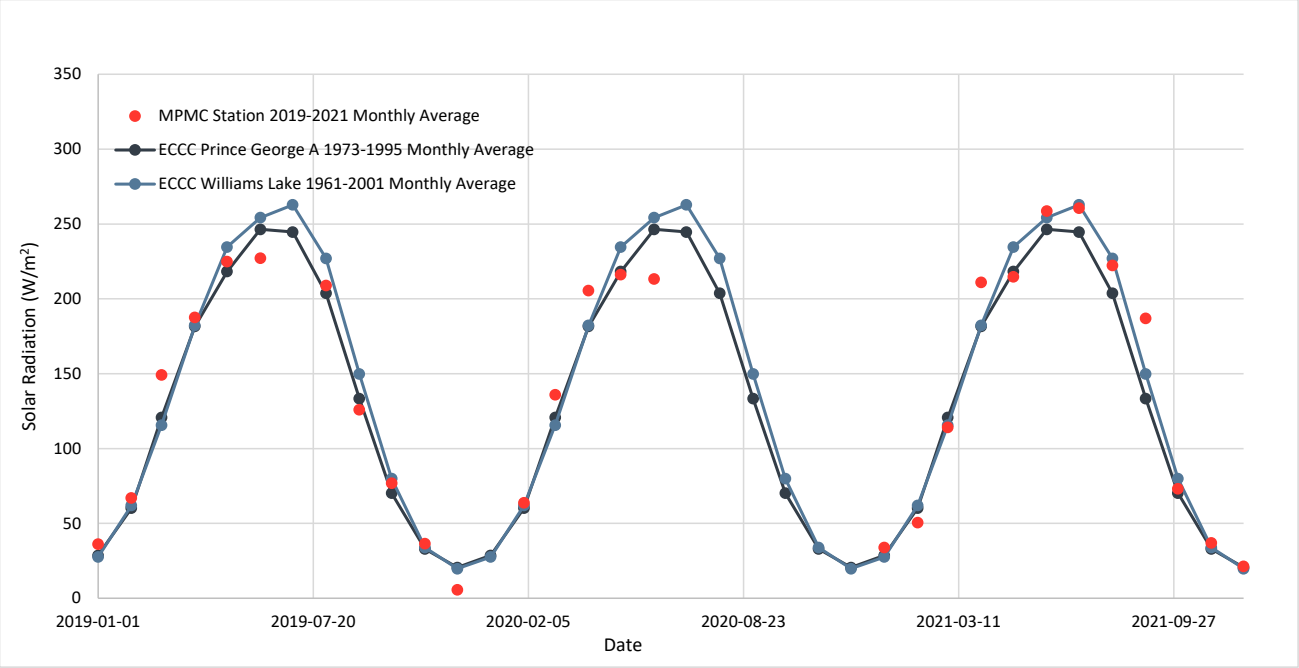

Figure 12 : Mean Monthly Solar Radiation for MPMC and ECCC Regional Climate Stations

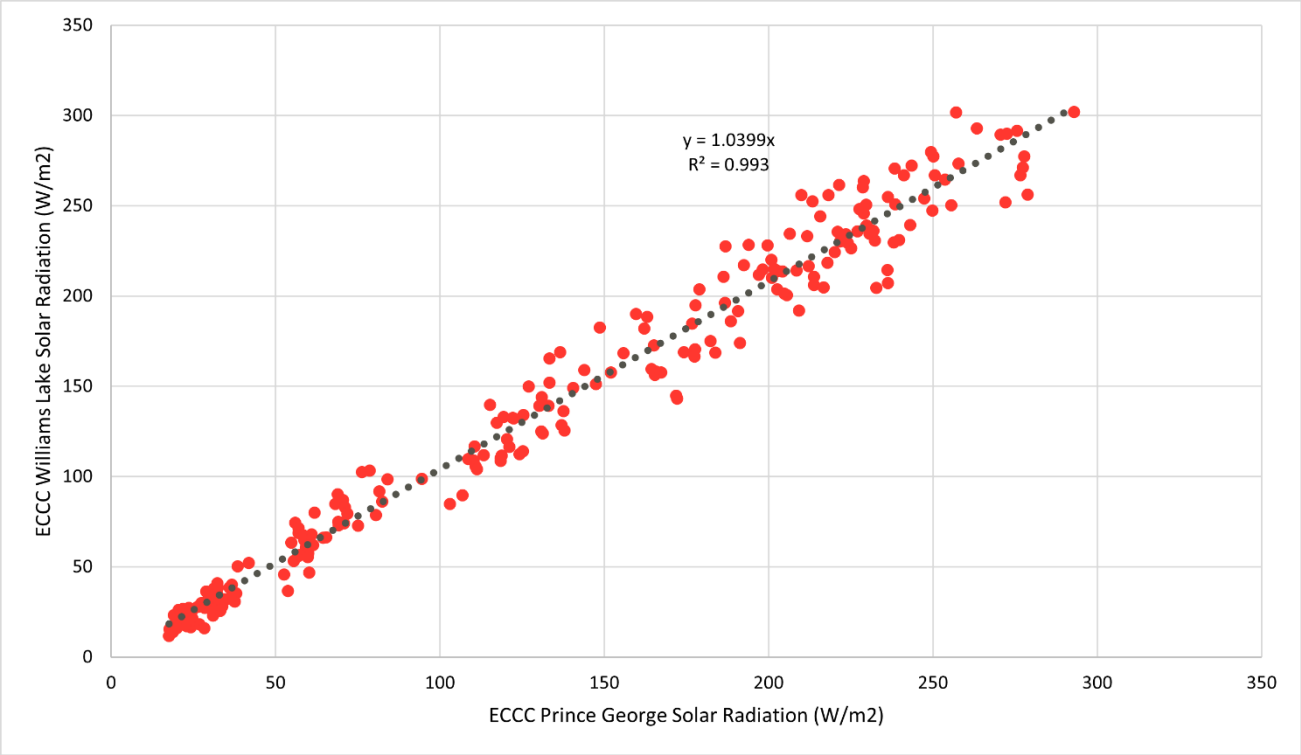

Figure 13 : Daily Solar Radiation Correlation Between ECCC Williams Lake and Prince George Climate Stations (1973-1995)

The strong correlation between ECCC Williams Lake and Prince George climate stations suggest there is little variation in solar radiation across the region. Based on the comparison of mean monthly solar radiation records and the proximity in distance to the Site, solar radiation statistics for the Site were determined from the ECCC Williams Lake data. Missing values were infilled by adjusting the Prince George records by a factor of 1.04 based on the relationship presented in Figure 13.

3.4.5 Evaporation and Evapotranspiration

Evaporation monitoring data are available for the Site from 2019 to 2021; however, the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Site. Therefore, a mathematical model (Morton 1983) was used to calculate evaporation and evapotranspiration (actual and potential) for the Site based on the long-term synthetic records for air temperature, relative humidity, and solar radiation. Evaporation in this study is defined as free water evaporation, or the amount of evaporation from open/free water surfaces (i.e., the water is returned to the atmosphere from lakes, ponds, and watercourses). Potential evapotranspiration is the water loss that occurs from a vegetated natural surface if there is no deficiency of water in the soil for use by vegetation (Thornthwaite 1948).

3.4.6 Wind Speed and Direction

Hourly wind speed and direction data are available for the Site from 1997 to 2003, and daily wind speed data are available from 2019 to 2021; however, the data are not continuous. The hourly wind speed and direction data available from 1997 to 2003 were used to develop wind rose plots. A wind rose depicts the relative frequency of wind from a given direction on a 16-point compass. Each ring on the wind rose represents a frequency of 2% of the data period. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a defined wind speed range. A wind rose is provided for the period of August 1997 to November 2003, and seasonal wind roses are presented to display seasonal variability in wind patterns, where the seasons have been defined as follows:

- Winter – December to February
- Spring – March to May
- Summer – June to August
- Autumn – September to November

Daily wind data recorded from 2019 to 2021 from WS1 and WS2 were wind speed only, no direction. The period of record for WS2 and 2020 are incomplete and are not included in the analysis. The relative frequency (%) of the magnitude of the daily wind speed data recorded at WS1 for 2019 and 2021 were compared in this study to the relative frequency (%) of wind speed magnitude of the data from 1997 to 2003.

3.4.7 Snow Cover Properties

Snow cover is an important climatic variable as it influences the spring freshet flow volume and distribution. Snow cover data at the Site are available monthly from manual measurements from 1997 to 2022, recorded as snow-water-equivalent (SWE). Measurements, although not continuous, are typically recorded at the beginning and end of a month, with the latter being representative of the monthly SWE.

4.0 RESULTS

The following section summarizes the precipitation, air temperature, relative humidity, solar radiation, evaporation and evapotranspiration, wind speed and direction, and snow cover baseline conditions at the Site.

4.1 Annual Precipitation

The Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Site is estimated to be 612 mm with a standard deviation of 118 mm. Frequency analyses of the derived long-term precipitation time series for the Site were undertaken to generate the variability in monthly and annual precipitation of the Site. Estimated annual wet and dry precipitation depths for a range of return periods are shown in Table 9, Figure 14, and Figure 15.

Table 9: Annual Precipitation Depths for the Site (1974-2021)

Return Period (yr)	Wet (mm)[1]	Dry (mm)[1]
5	714	508
10	768	459
25	825	412
50	861	386
100	893	366
200	922	349
Average	612	

1) Weibull distribution was selected based on the statistical distribution goodness-of-fit-test.

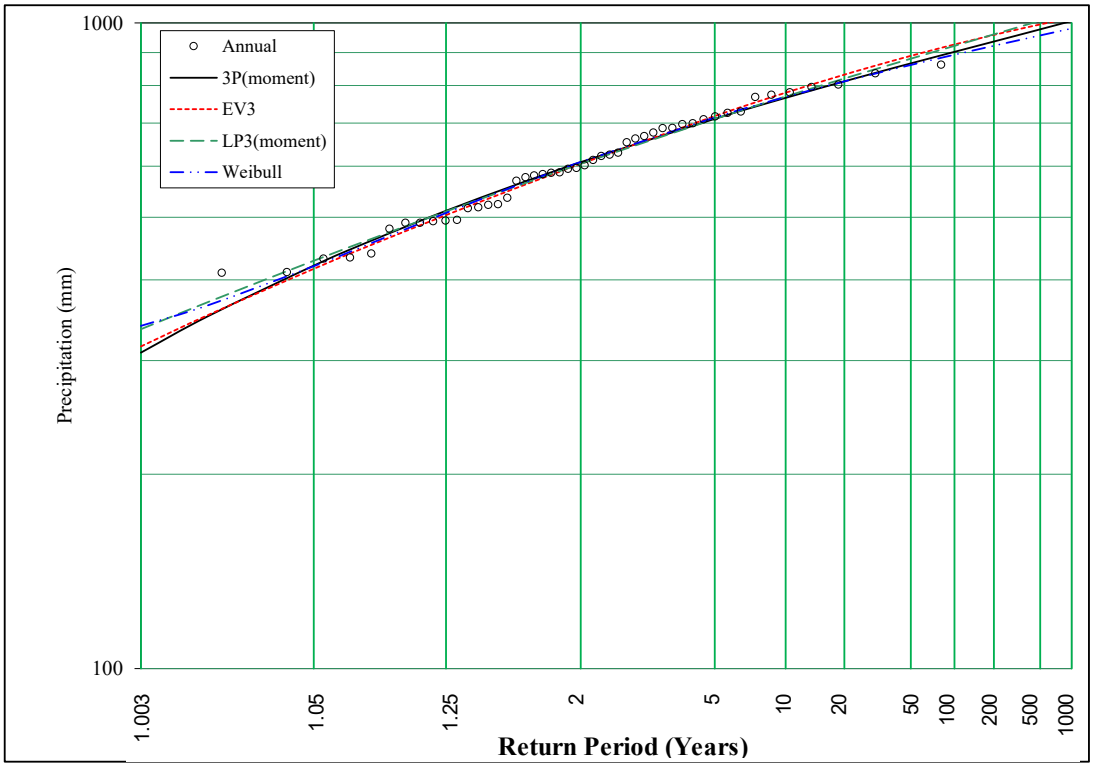

Figure 14 : Annual Precipitation Frequency Analysis – Wet Results

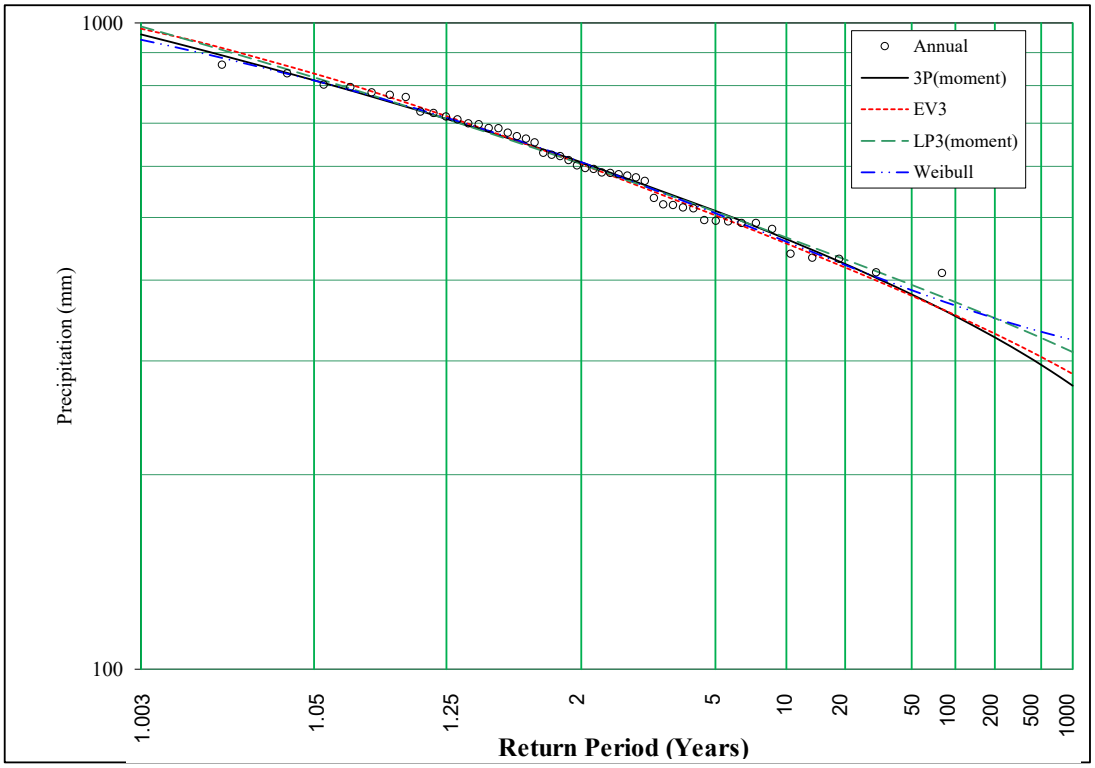

Figure 15 : Annual Precipitation Frequency Analysis - Dry Results

Monthly values for the 25- and 200-year return periods for wet and dry precipitation depths are presented in Table 10. Monthly values for the 1:25 year dry and wet precipitation for the 1:200 year dry and wet precipitation were assumed to follow the same monthly distribution as the average precipitation.

Table 10: Monthly Precipitation Depths for the Site (1974-2021)

Month[1]	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	74.3	66.5	33.2	28.2
February	35.8	54.0	48.3	24.1	20.5
March	29.7	44.7	40.0	20.0	16.9
April	44.7	67.3	60.2	30.1	25.5
May	49.9	75.2	67.2	33.6	28.5
June	70.8	107	95.4	47.7	40.4
July	63.6	95.8	85.7	42.9	36.3
August	50.6	76.2	68.1	34.1	28.8
September	52.3	78.8	70.5	35.2	29.9
October	58.1	87.5	78.2	39.1	33.1
November	49.8	75.0	67.1	33.5	28.4
December	57.6	86.8	77.7	38.8	32.9
Annual Total[2]	**612**	**922**	**825**	**412**	**349**

1) Wet and Dry Monthly values assumed to follow the same monthly distribution as the Average.

2) Annual total precipitation depths were rounded to the nearest mm for presentation purposes; therefore, it may appear the sum of the monthly values do not equal the annual total.

4.2 Rainfall

Annual maximum series for 24-hour precipitation from the derived historical data set was used to undertake a frequency analysis to provide rainfall design values. Results are shown in Table 10. The 24-hour, 3-day, and 10-day annual, spring, and summer probable maximum precipitation (PMP) depths were estimated using the Hershfield method (WMO 2009).

Table 11: 24-hour Precipitation Depths for the Site (1974-2021)

Return Period (yr)	Depth (mm) [1, 2]
2	**33**
10	**47**
25	**54**
100	**64**
200	**69**
1000	**80**

1) Log Pearson III distribution was selected based on the statistical distribution goodness-of-fit test.

2) Values rounded up to the nearest mm.

Table 12: Annual, Spring, and Summer PMP Depths for the Site (1974-2021)

Period	Annual PMP[1] (mm)	Spring PMP[1, 2] (mm)	Summer PMP[1, 3] (mm)
24-Hour	224	192	191
3-Day[4]	339	272	294
10-Day[5]	562	295	486

1) The PMP does not have a return period.
2) Spring = March, April, May.
3) Summer = June, July, August.
4) Adjusted from fixed-time interval by a factor of 1.03 (Miller 1964).
5) Adjusted from fixed time interval by a factor of 1.01 (Miller 1964).

4.3 Air Temperature

Air temperature statistics for the Site were developed using historical data from the nearby ECCC climate station in Likely approximately 9 km northeast of the Site. The historical Likely data set was adjusted to the average elevation of the Mount Polley mine by applying the regional monthly lapse rate presented in Table 7. Data gaps were infilled using data from the four regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

Monthly and annual air temperature statistics for the Site (1974-2021) are presented in Table 13 and Figure 16. The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between –6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively. Mean monthly air temperatures generally turn positive in April and negative in November. The percentiles presented in Table 13 indicate the probability of the air temperature to be less than the calculated value for each period, i.e. the 25th percentile for the month of March indicates the monthly air temperature for March is 25% probable to be less than -2.2°C, or 75% probable to exceed -2.2°C. Larger variation between the 25th and 75th percentiles indicate greater variation in air temperature from the median during the month with the largest variations occurring in the winter months (December, January, and February).

Table 13: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**38.1**	**-39.8**

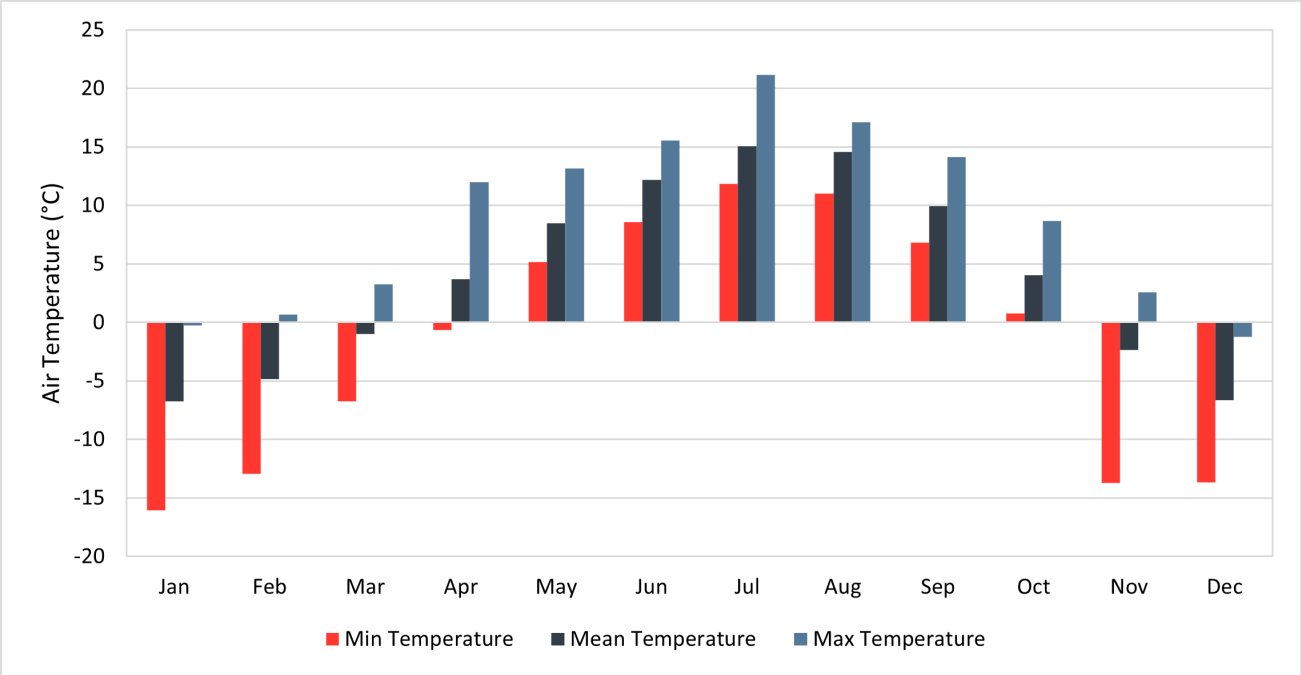

Figure 16 : Derived Monthly Air Temperature Statistics for Mount Polley Mine (1974-2021)

4.4 Relative Humidity

Statistics for relative humidity are presented in Table 14 and Figure 17. Mean annual relative humidity is 68.1%. Monthly mean values vary between 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity show little variation from the median indicating the Site experiences relatively constant relative humidity on a monthly basis from year to year.

Table 14: Derived Monthly and Annual Relative Humidity Statistics for the Site (1974-2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

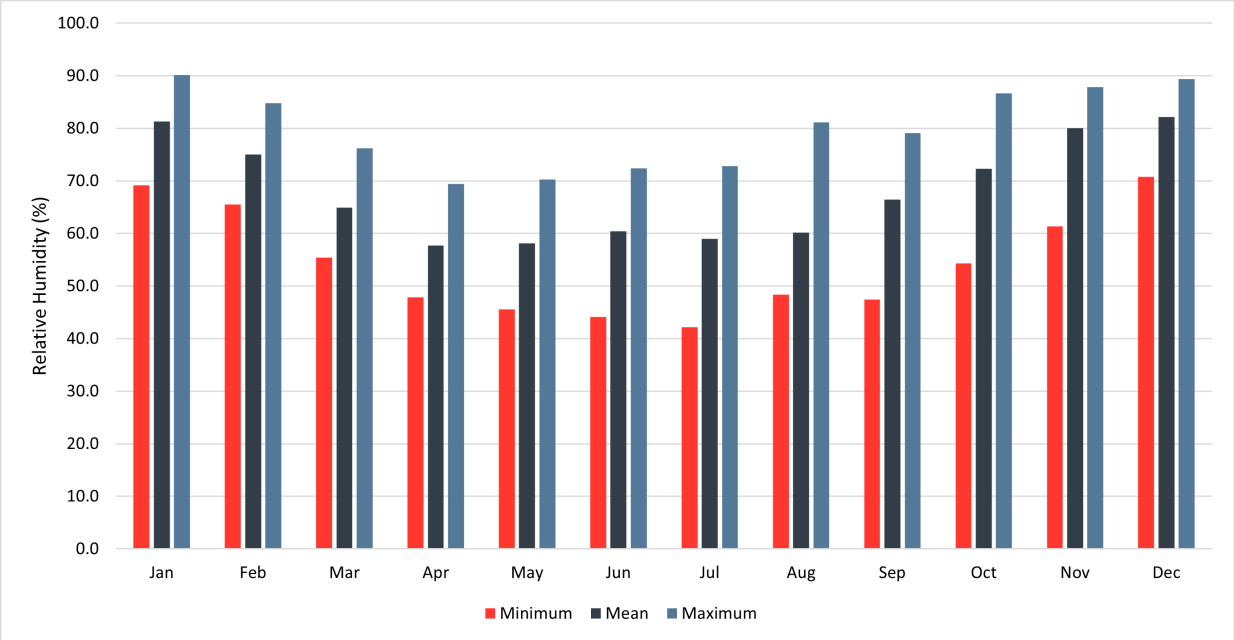

Figure 17 : Derived Monthly Relative Humidity for the Site (1974-2021)

4.5 Solar Radiation

Table 15 and Figure 16 present solar radiation statistics for the Site. Mean annual solar radiation is 135 W/m^2, with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July following the same seasonal pattern for monthly air temperature. The 25th and 75th percentiles show greatest variation in solar radiation occurs in the summer months when solar radiation is greatest during the year, and less variation in winter months when solar radiation is lowest.

Table 15: Estimated Solar Radiation Statistics for the Site (1974-2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

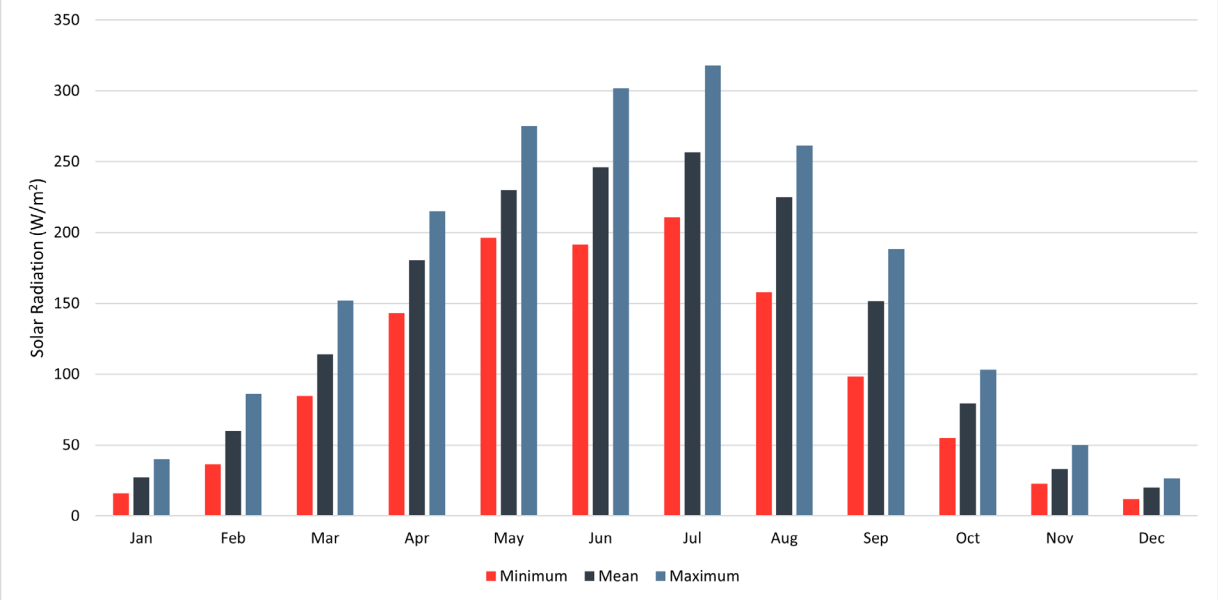

Figure 18 : Estimated Monthly Solar Radiation for the Site (1974-2001)

4.6 Evaporation and Evapotranspiration

The Morton model (Morton 1983) was applied to calculate monthly evaporation, potential evapotranspiration (PET), and actual evapotranspiration (AET) for the Site based on the air temperature, relative humidity, and solar radiation data presented in Sections 4.3, 4.4, and 4.5, respectively. The calculated evaporation rates are considered reflective of potential shallow lake evaporation rates; that is, there is no thermal impact of deeper water levels.

4.6.1 Shallow Lake Evaporation

Table 16 and Figure 19 present monthly statistics for shallow lake evaporation using the Morton Model. The mean annual evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates vary between 0 mm in December to 138 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly evaporation occurs in July when evaporation is greatest, and lowest variation occurs in January and December when evaporation is lowest.

Table 16 : Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**670**	**699**

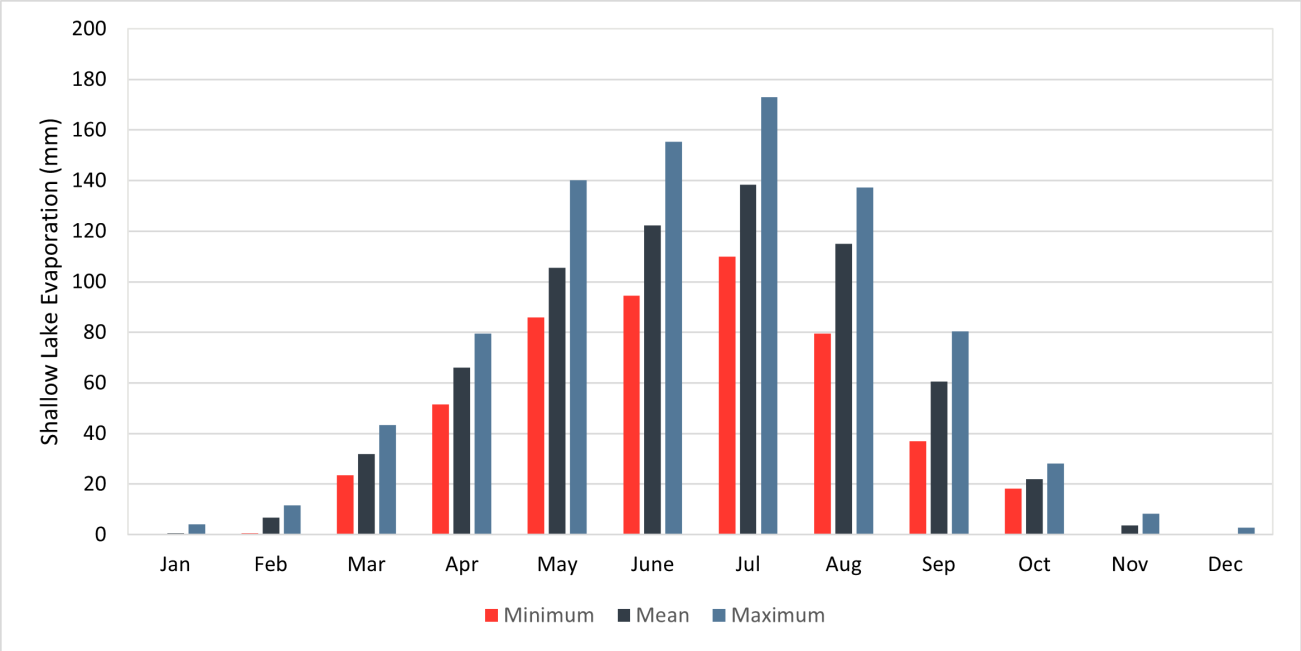

Figure 19 : Estimated Shallow Lake Evaporation Statistics for the Site (1974-2001)

4.6.2 Potential Evapotranspiration

Table 17 and Figure 20 present monthly statistics for PET using the Morton Model. The mean annual PET rate is estimated to be 863 mm, varying between 744 mm and 1022 mm. Mean monthly PET rates vary between 1 mm in December and January to 171 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly PET occurs in July when PET is greatest, and lowest variation occurs in January and December when PET is lowest. On an annual basis, PET rates are greater than shallow lake evaporation and AET since PET is not limited by the availability of water.

Table 17 : Estimated Monthly and Annual Potential Evapotranspiration Statistics for the Site (1974-2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

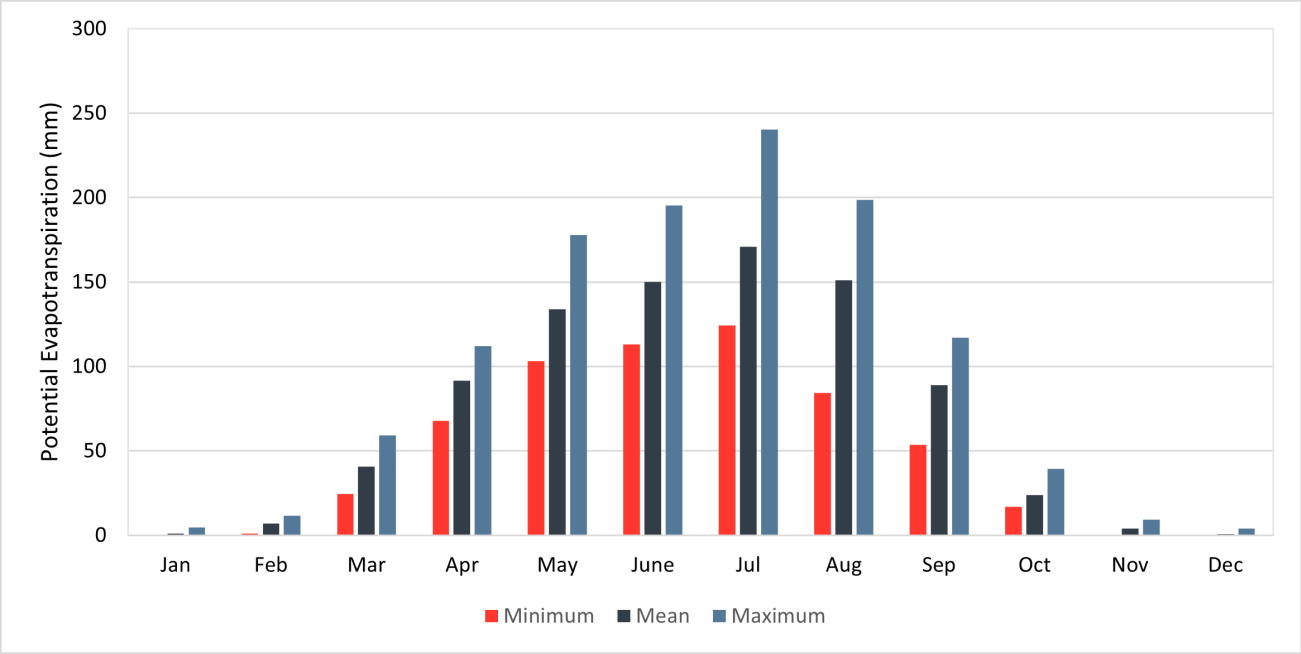

Figure 20 : Estimated Potential Evapotranspiration Statistics for the Site (1974-2001)

4.6.3 Actual Evapotranspiration

Table 18 and Figure 21 present monthly statistics for AET as calculated using the Morton Model. The mean annual AET rate is estimated to be 399 mm, varying between 319 mm and 449 mm. Mean monthly AET rates vary between 1 mm in December and January to 89 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly AET occurs in July when AET is greatest, and lowest variation occurs in January and December when AET is lowest. On an annual basis, AET at the Site is less than shallow lake evaporation and PET rates because AET is limited by the availability of water, particularly during the summer months when the air temperature is highest.

Table 18 : Estimated Monthly and Annual Actual Evapotranspiration Statistics for the Site (1974-2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

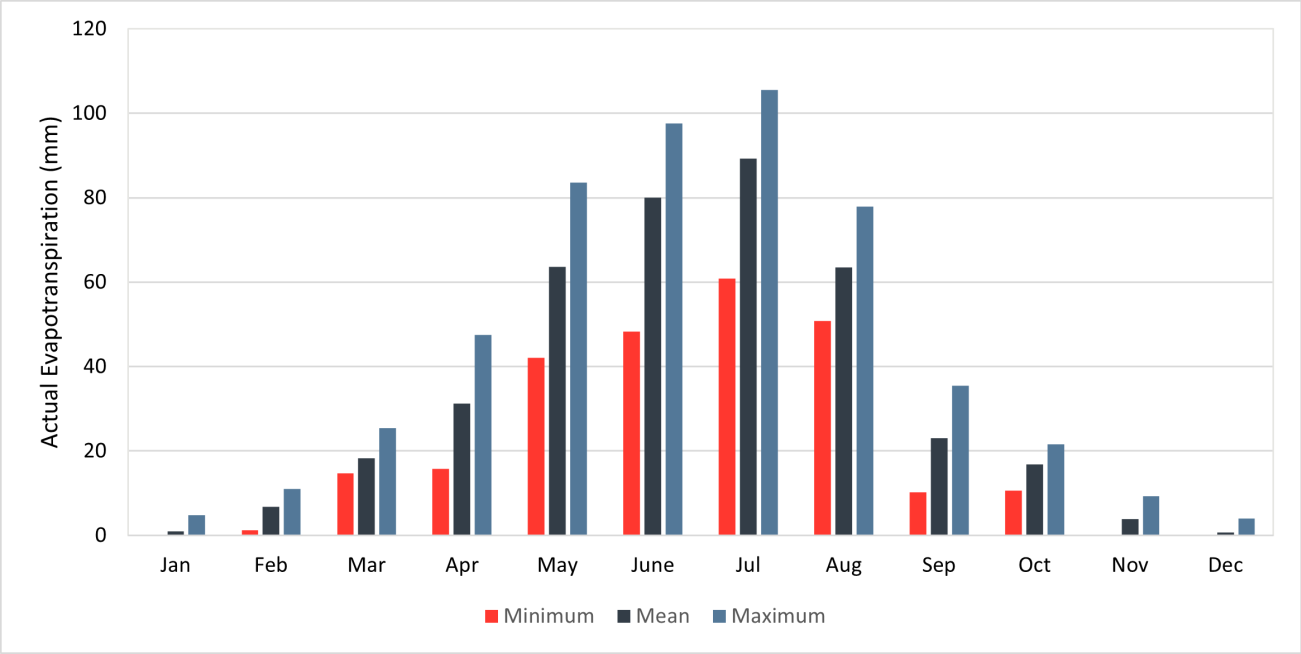

Figure 21 : Estimated Actual Evapotranspiration Statistics for the Site (1974-2001)

4.7 Wind Speed and Direction

A wind rose plot for the Site depicting the relative frequency of mean hourly wind speed and direction, and the seasonal distribution, between 29 August 1997 and 27 November 2003 is shown in Figure 22.

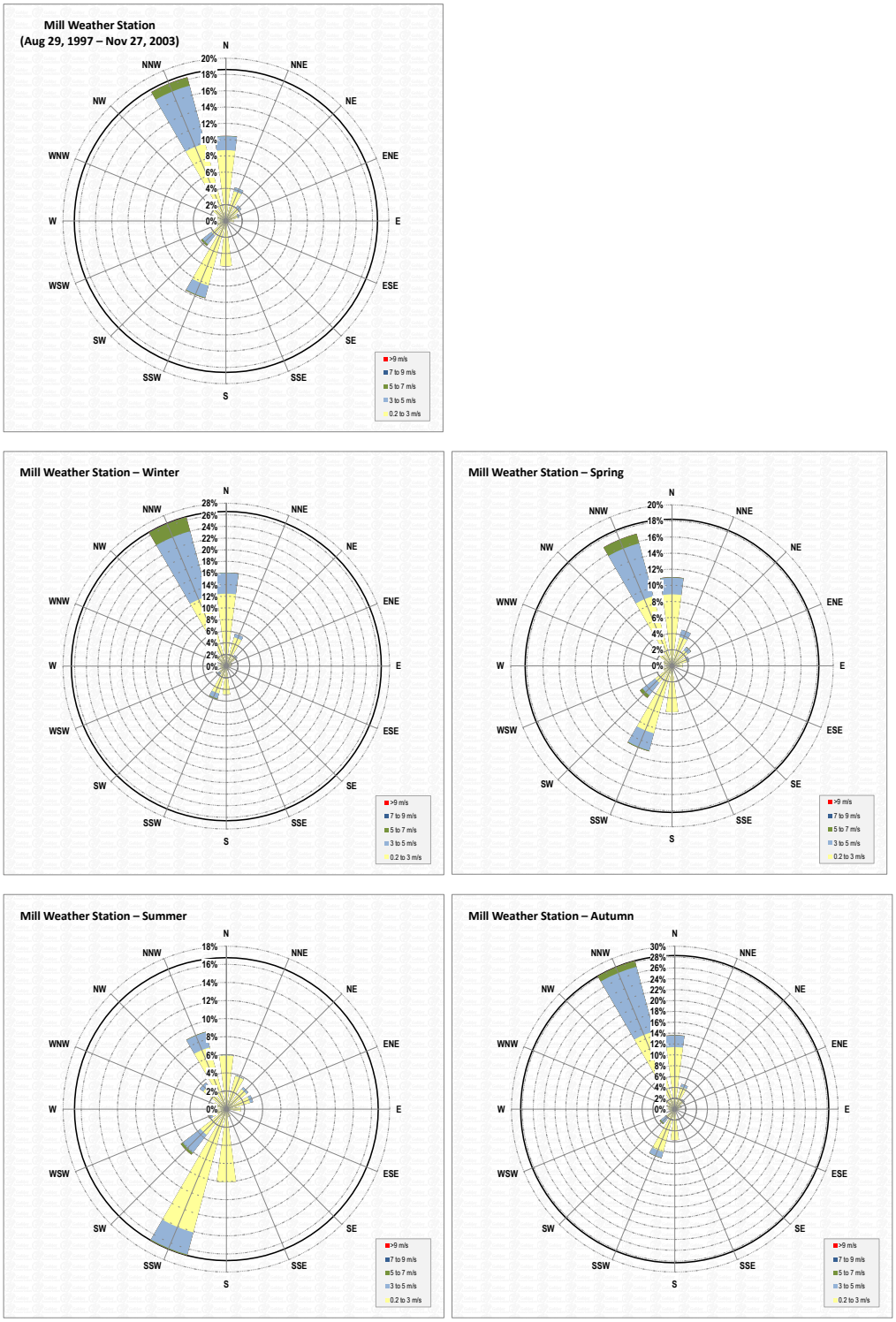

Figure 22: MPMC Station Monitoring Period and Seasonal Wind Roses - 29 August 1997 to 27 November 2003

Spring = March, April, May; Summer = June, July, August; Autumn = September, October, November; Winter = December, January, February.

Winds measured at the Site typically blew from the north-northwest, north, and south-southwest directions, with minimal winds from the east and the west. The spring, autumn, and winter seasonal wind roses were consistent with the wind rose pattern for the entire monitoring period; however, during the summer months, the majority of winds were from the south-southwest. Similarly, wind speeds in spring, autumn, and winter were generally consistent with the wind rose for the entire monitoring period, while wind speeds in summer were generally lower.

Wind speed measured and seasonal distributions at the Site from 2019 to 2021 were consistent with the relative frequency of wind speed magnitudes and the seasonal distributions recorded between 29 August 1997 and 27 November 2003 (Table 19 and Figure 23). A similar seasonal pattern in wind speed is identifiable with lower wind speeds in the summer months and higher wind speeds in the spring, autumn, and winter months (Table 20 and Figure 24). It is noted that the data from 2019 and 2021 are daily wind speed rather than hourly wind speed and only the relative frequency (%) of wind speed magnitude was compared.

Table 19: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station 29 August 1997 to 27 November 2003[1]	Weather Station 1 1 January 2019 to 31 December 2021[2]
calm	35%	28%
0.2 to 3 m/s	50%	56%
3 to 5 m/s	14%	13%
5 to 7 m/s	2%	3%
7 to 9 m/s	0%	0%
>9 m/s	0%	0%

1) Recorded as hourly wind speed.

2) Recorded as daily wind speed.

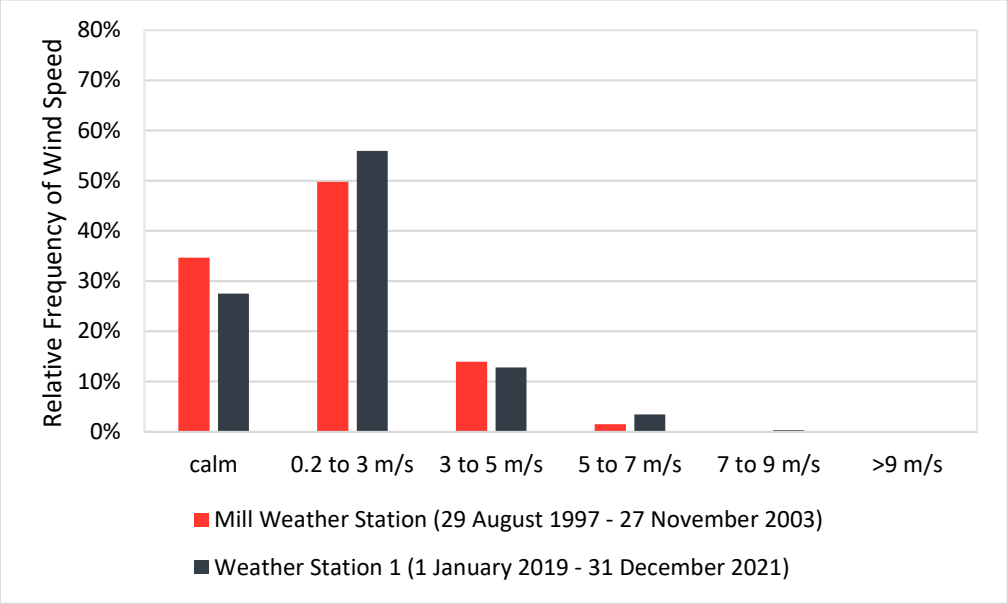

Figure 23: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Table 20: Comparison of Relative Frequency of Wind Speed Seasonal Distributions from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station 29 August 1997 to 27 November 2003[1]				Weather Station 1 1 January 2019 to 31 December 2021[2]			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
calm	31%	32%	22%	27%	23%	18%	31%	37%
0.2 to 3 m/s	51%	59%	57%	52%	58%	75%	46%	44%
3 to 5 m/s	16%	9%	19%	19%	13%	7%	17%	15%
5 to 7 m/s	2%	0%	2%	3%	5%	0%	6%	3%
7 to 9 m/s	0%	0%	0%	0%	1%	0%	0%	1%

1) Recorded as hourly wind speed.

2) Recorded as daily wind speed.

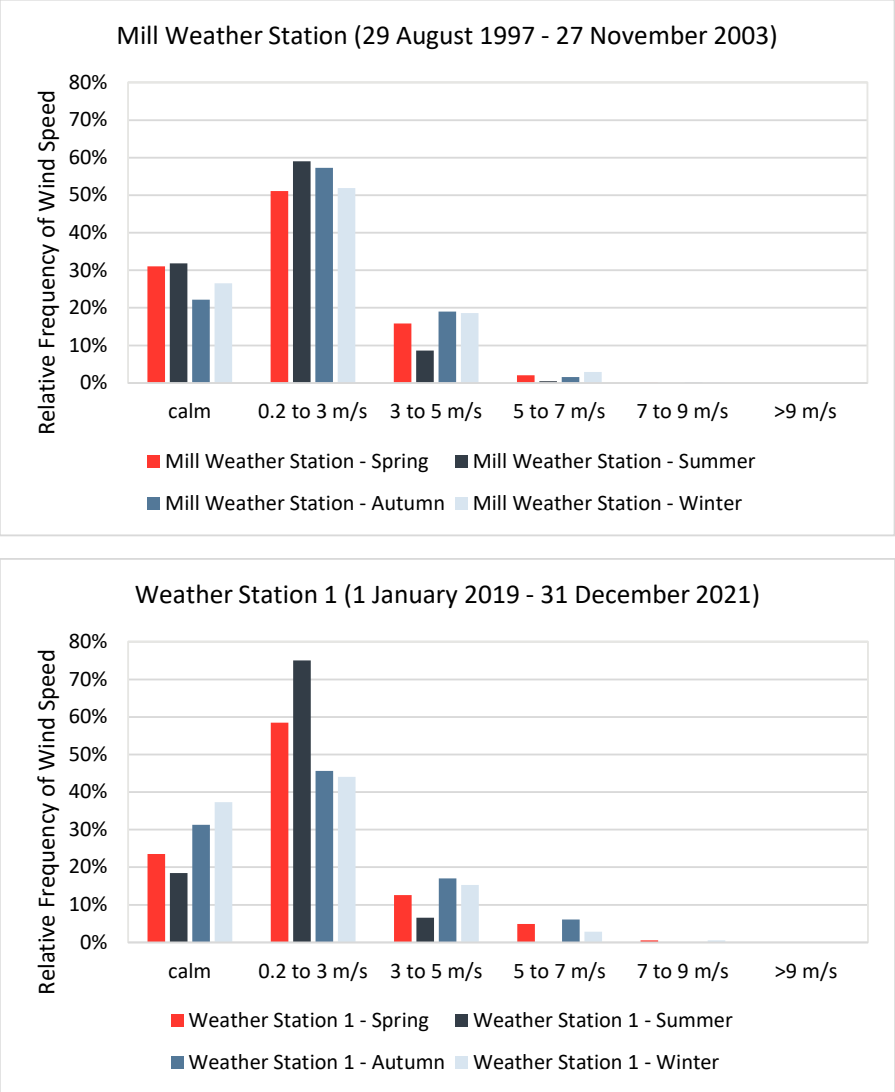

Figure 24: Comparison of Relative Frequency of Wind Speed Seasonal Distribution from Mill Weather Station and Weather Station 1 for the Site

4.8 Snow Cover Properties

Snow cover monthly statistics, reported as SWE, are presented in Table 21. At 50% exceedance, snow begins accumulating in November and achieves its maximum in March, reducing to 0 mm in April. The 5th and 95th percentiles and standard deviation values demonstrate the variability in the amount of SWE at the Site, with March having the greatest variability from year to year.

Table 21: Snow Water Equivalent for the Site (1997-2021)

Month	Number of Measurements	Mean (mm)	Minimum (mm)	Percentile					Maximum (mm)	Standard Deviation (mm)
				5%	25%	50%	75%	95%		
January	22	147	76	88	120	139	164	327	339	56
February	22	182	99	104	131	193	222	338	344	61
March	22	185	0	6	97	198	257	403	411	108
April	21	33	0	0	0	0	81	177	177	58
November	22	17	0	0	0	9	37	72	72	25
December	22	102	32	50	77	101	122	193	196	44

5.0 CLIMATE CHANGE PROJECTIONS

Future climate projections are important for understanding how climate is projected to change at the Site from the climate baseline. Future climate projections come from publicly available statistical downscaled future climate projections on a daily scale. Recognizing the inherent uncertainty with projections, multiple projections from multiple models and scenarios were included in the analysis presented herein, and the future projections are presented in terms of percentiles or exceedance probabilities. Changes to climate may influence how representative the statistics estimated based on historical data are for future time periods.

5.1 Data Sources for Future Climate

The Intergovernmental Panel on Climate Change (IPCC) is generally considered to be the definitive source of information related to past and future climate change as well as climate science. As an international body, the IPCC provides a common source of information relating to emission scenarios, provides third party reviews of models, and recommends approaches to document future climate projections. Periodically, the IPCC issues assessment reports summarizing the current state of climate science. The Sixth Assessment Report (AR6) (IPCC 2021) represents the most currently available complete synthesis of information regarding climate change.

5.2 Global Climate Change Projections

Future climate is typically projected using global circulation models (GCMs) that involve the mathematical representation of global land, sea, and atmosphere interactions over a long period of time. These GCMs have been developed by various government agencies, but they share a number of common elements as described by the IPCC (2021). The IPCC does not run the models but acts as a clearinghouse for the distribution and sharing of the model forecasts.

Global climate models require extensive inputs to characterize the physical processes and social development paths that could alter climate in the future. To represent the wide range of the possible inputs to global climate models, the IPCC has established a series of Shared Socioeconomic Pathways (SSPs) that help define the future levels of radiative forcing terms. Future climate projection data are available from approximately 30 GCMs and four main SSPs (SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5) in AR6 (ECCC 2022c).

The primary differentiating aspect of each model are the SSPs developed by the IPCC and presented in AR6 to quantify potential emission output scenarios (ECCC 2022c). The SSPs were created with varying assumptions about human developments and are designed to work in combination with an updated version of the Representative Concentration Pathways (RCPs) from the previous IPCC Fifth Assessment Report (AR5) (ECCC 2022c). The SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5 scenarios are the four common greenhouse gas concentration profiles that are widely used; SSP5-8.5 represents the most extreme scenario with the highest volume of greenhouse gases emitted (ECCC 2022c).

5.3 Regional Climate Change Projections

The climate change projection data available from ClimateData.ca portal provided by ECCC uses GCMs with RCP pathways from IPCC AR5 rather than the latest SSPs from AR6. Therefore, the data used in this study will be obtained from ClimateBC.ca provided by the University of British Columbia (UBC). This tool downscales PRISM (Daly et al. 2008) 1971-2000 gridded monthly climate normal data (800 x 800 m) to scale-free point locations and uses the scale-free data as a baseline to downscale more than 200 future climate variables for individual years and periods between 1901 and 2100 (Wang et al. 2016).

The ClimateBC (UBC 2022) tool that is currently managed by UBC uses the same data management framework as Coupled Model Intercomparison Project Number 6 (CMIP6) where the SSP emission profiles are coupled with GCMs. ClimateBC selected a subset of eight GCMs from the models contributing to the CMIP6 ScenarioMIP project based on the following criteria (UBC 2022):

- Minimum of three historical runs available.
- Minimum temperature and maximum temperature available for all runs.
- At least one run for each of the four main SSP marker scenarios.
- One model per institution.
- No closely related models based on Figure 5 in *Reduced global warming from CMIP6 projections when weighting models by performance and independence* (Brunner et al. 2020).
- No large biases over BC.
- Are within IPCCs transient climate response "likely[1]" range and Earth's equilibrium climate sensitivity "very likely[2]" range.

The eight GCMs presented in this report are ACCESS-ESM1-5, BC-CSM2-MR, CNRM-ESM2-1, GFDL-ESM4, GISS-E2-1-G, MIROC6, MPI-ESM1-2-HR, and MRI-ESM2-0.

Table 22: Inventory of Global Climate Models Referenced in this Study

Model	Source / Institution
ACCESS-ESM1-5	Commonwealth Scientific and Industrial Research Organisation
BC-CSM2-MR	Beijing Climate Center
CNRM-ESM2-1	CNRM (Centre National de Recherches Meteorologiques) and CERFACS (Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique)
GFDL-ESM4	National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory
GISS-E2-1-G	Goddard Institute for Space Studies
MIROC6	JAMSTEC (Japan Agency for Marine-Earth Science and Technology), AORI (Atmosphere and Ocean Research Institute), NIES (National Institute for Environmental Studies), and R-CCS (RIKEN Center for Computational Science)
MPI-ESM1-2-HR	Max Planck Institute for Meteorology
MRI-ESM2-0	Meteorological Research Institute

The Site coordinates and elevation were entered into ClimateBC to extract site-specific model outputs (i.e., projections) for precipitation, air temperature, solar radiation, relative humidity, and precipitation as snowfall.

[1] Transient climate response metric in the range 1.4 to 2.2°C (66% likelihood) deemed as "likely" in AR6 (Hausfather et al. 2022).

[2] Equilibrium climate sensitivity metric in the range 2 to 5°C deemed as "very likely" in AR6 (Hausfather et al. 2022).

5.4 Climate Change Projections Results

The following sections build on the current climate baseline by providing the projected changes under future climate conditions for two future time horizons (2041-2070; 2050s, and 2071-2100; 2080s). Time horizons used for the available projections are by periods. Section 5.4.1 provides a description of future projected conditions for temperature and precipitation. Sections 5.4.2 through 5.4.5 provide the projected changes in relative humidity, solar radiation, evaporation, and snow cover. In all sections, projections are provided in terms of exceedance probability measured over the 32-member multi-model ensemble (i.e., 8 models and 4 SSPs). The focus of the results discussion is on the 50th percentile (median), while additional exceedance probabilities are available in the tables presented, including the maximum and minimum. Using the median, or 50th percentile, provides an indication of the middle of the projected changes from the multi-model ensemble.

5.4.1 Future Temperature and Precipitation Projections

This section provides the projected future mean temperature and total precipitation for the Site. The future climate projections are benchmarked against a modelled baseline (e.g., ClimateBC output of the baseline information available for the 32-member multi-model ensemble for the normal period of 1991-2020) and are described in terms of “anomaly” or change from the baseline.

Annual Temperature and Precipitation Projections

Comparisons of the future climate projections of temperature and precipitation for the Site for the 2050s (2041-2070) and 2080s (2071-2100) projection periods are shown as a scatter plot in Figure 25. The plots illustrate the projected change in temperature (vertical axis) and precipitation (horizontal axis) from the current climate baseline (1991 through 2020 normal period) for each of the models and the four SSPs considered in the IPCC’s AR6 (IPCC 2021). For reference, the current climate is shown as a solid circle where the axes intersect. The model projections are generally in the upper right quadrant of the plots, suggesting a future climate that will likely be warmer and wetter. There is a larger spread of future projected precipitation, with a majority of model runs projecting a wetter future climate. Precipitation projections typically have larger uncertainty than temperature projections due to the challenge of capturing precipitation in the climate models (temperature is better understood) (Araya-Osses et al. 2020).

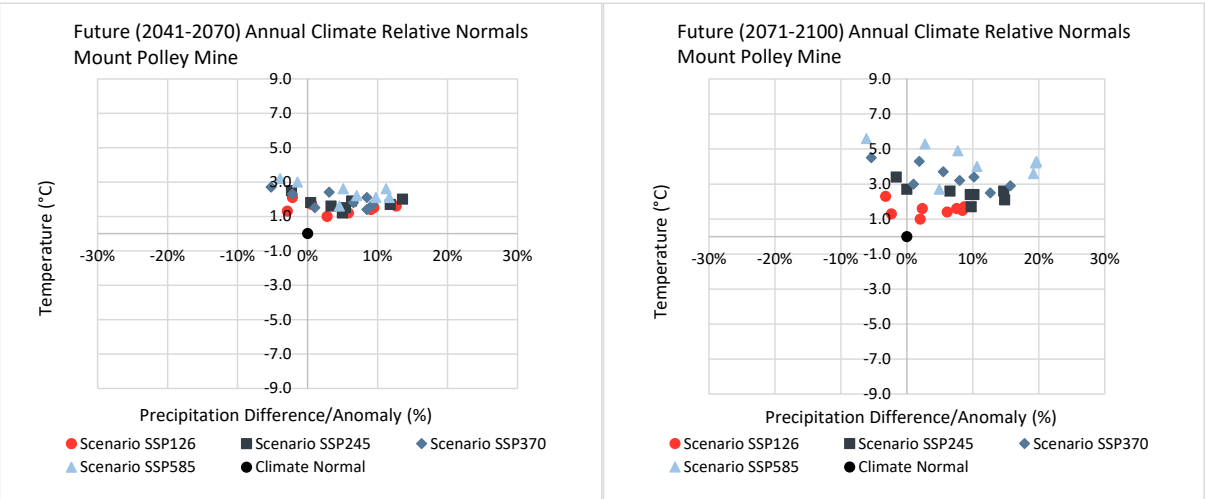

Figure 25: Scatter Plots Presenting Annual Temperature and Precipitation Projections for the 2050s and the 2080s for the Mount Polley Mine Area

Monthly Temperature and Precipitation Projections

Figure 26 and Figure 27 depict the projected anomalies in monthly temperatures for the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represents the spread between the 5th percentile and the 95th percentile of the ensemble. The figures show projected increases in temperature for all months for the 2050s and the 2080s. For the 2050s (Figure 26) the projected increase in the median temperature (dashed line) is less in winter months and greater in the summer months, with an annual average increase of 1.8ºC. The 5th and 95th percentiles of the 2050s ensembles range from an increase of 1.2ºC to around 2.9ºC. The 95th percentile shows a larger variation throughout the months of the year compared to the 5th percentile, and a seasonal pattern arises for the summer months, with larger projected increases of 4.3°C.

The projected increase in the median temperature for the 2080s (Figure 27) is less in winter months and greater in the summer months, with an annual average increase of 2.7ºC. The 5th and 95th percentiles of the 2080s ensemble range from an increase of approximately 1.4ºC to 5.1ºC on average. The 95th percentile shows a larger variation throughout the months of the year and greatest variation in the summer months, with projected increases of 7ºC.

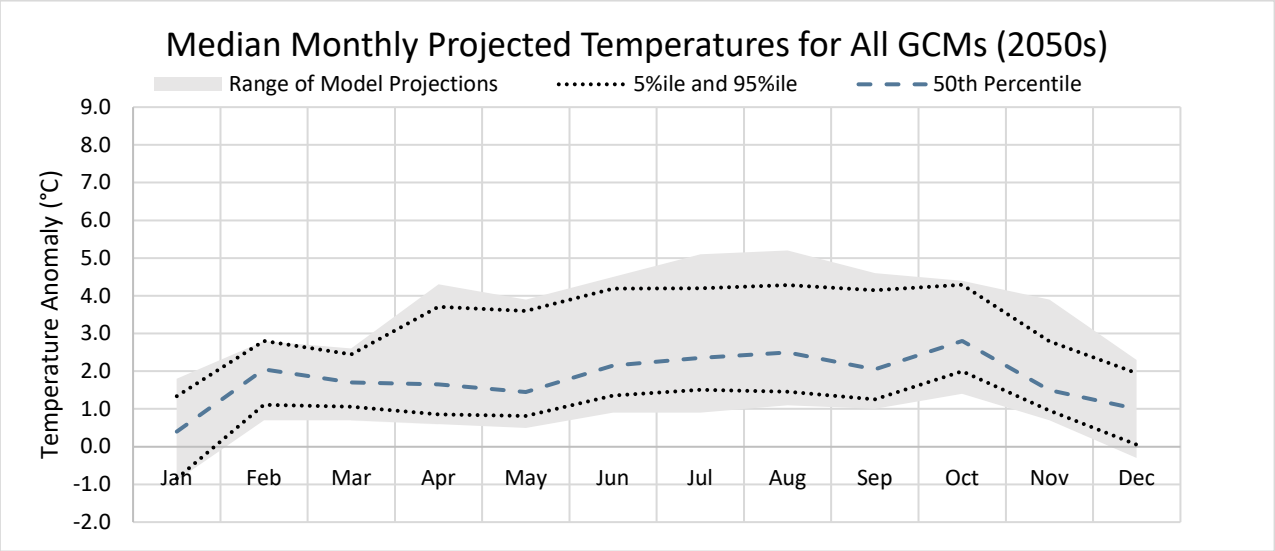

Figure 26: Monthly Projected Temperature Anomalies for the Mount Polley Mine Area (2050s)

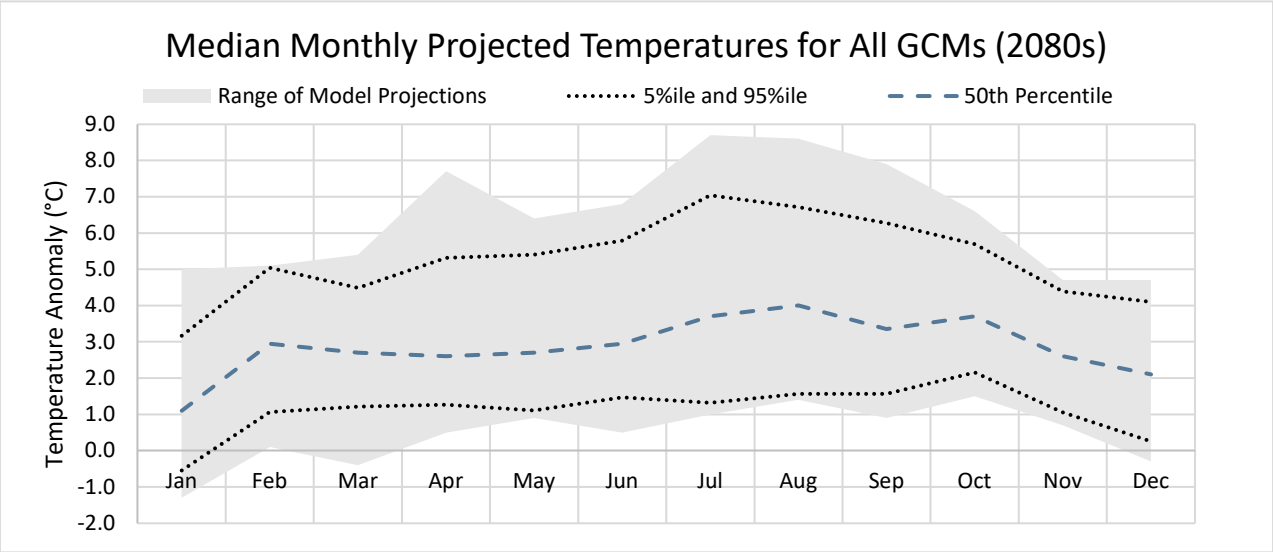

Figure 27: Monthly Projected Temperature Anomalies for the Mount Polley Mine Area (2080s)

Figure 28 and Figure 29 present the monthly projected precipitation anomalies for the Site for the 2050s and 2080s, respectively. For the 2050s (Figure 28) the projected median anomaly (dashed line) indicates changes in the seasonal distribution throughout the year, with an annual average increase of 5%, except for the summer where a slight decrease is projected for the months of June and July. The summer and fall months also present a larger spread in projections from the ensemble (shaded area on the graph), indicating less agreement between the projections. The 2080s (Figure 29) present similar behaviour to the 2050s except for an overall higher projected increase (around 8%), except for the months of June and July, where a decrease in precipitation is projected.

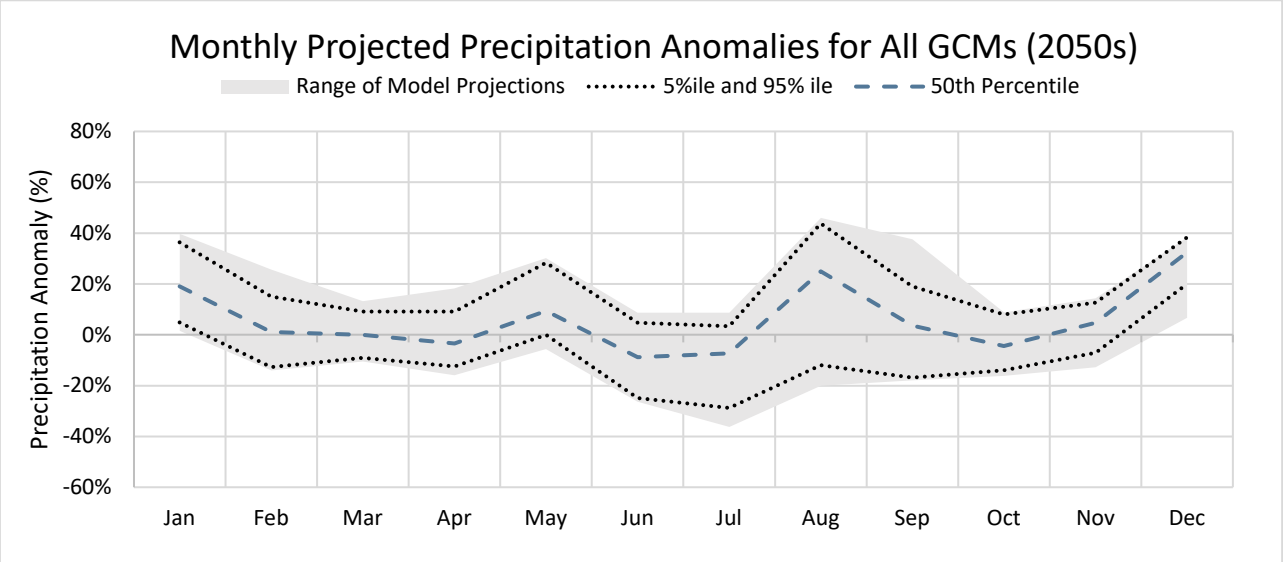

Figure 28: Monthly Projected Precipitation Anomalies for the Mount Polley Mine Area (2050s)

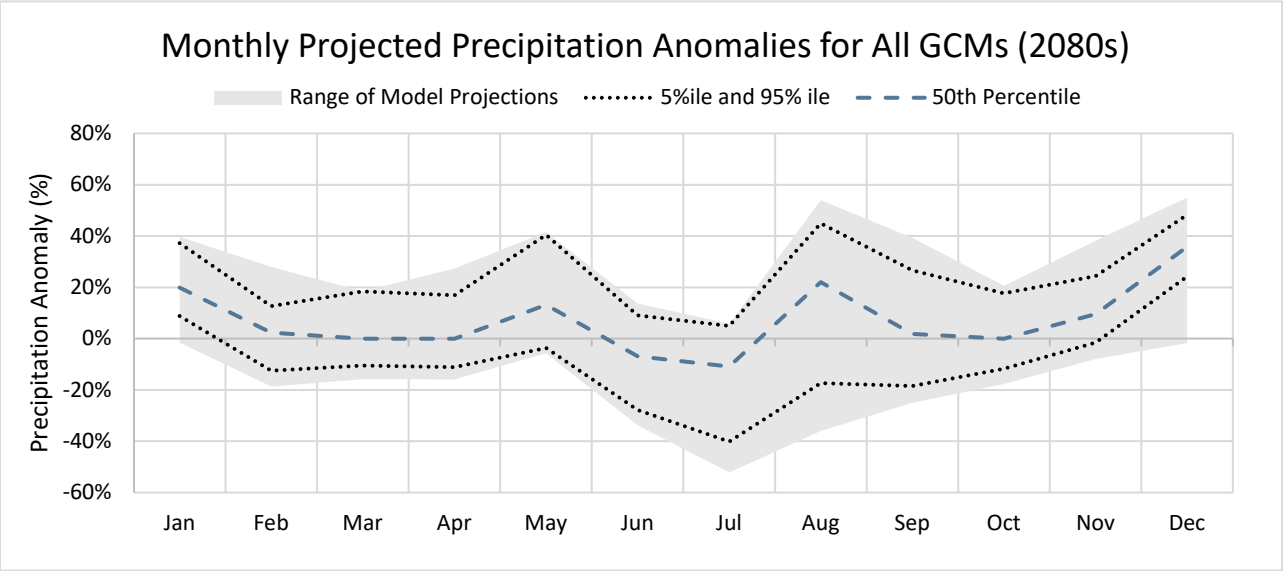

Figure 29: Monthly Projected Precipitation Anomalies for the Mount Polley Mine Area (2080s)

Overall, there is less variability and uncertainty (measured as the agreement within the ensemble or range of projected anomalies) during the 2050s. However, variability increases for both the precipitation and temperature anomalies during the 2080s.

Annual and Monthly Temperature and Precipitation Projections Summary

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual temperatures are summarized in Table 23 and Table 24. In the 2050s, at 50% exceedance probability, the annual temperature is projected to increase by 1.8°C, with the biggest monthly increase of 2.8°C in October, and smallest monthly increase of 0.4°C in January. In the 2080s, at 50% exceedance probability, the annual temperature is projected to increase by 2.7°C, with the biggest monthly increase of 4.0°C in August, and smallest monthly increase of 1.1°C in January.

Table 23: Projected Anomalies in Monthly and Annual Temperature in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-0.9	-0.8	-0.4	0.1	0.4	0.6	1.1	1.3	1.7	1.8	0.3	0.6
February	0.7	1.1	1.2	1.6	2.1	2.4	2.8	2.8	2.8	2.8	2.0	0.6
March	0.7	1.1	1.1	1.4	1.7	2.1	2.2	2.4	2.6	2.6	1.7	0.5
April	0.6	0.9	0.9	1.3	1.7	2.1	3.1	3.7	4.3	4.3	1.9	0.9
May	0.5	0.8	0.9	1.2	1.5	2.7	3.5	3.6	3.8	3.9	1.9	1.0
June	0.9	1.4	1.4	1.7	2.2	2.5	3.2	4.2	4.4	4.5	2.2	0.9
July	0.9	1.5	1.6	1.8	2.4	3.1	4.1	4.2	4.8	5.1	2.6	1.0
August	1.1	1.5	1.7	2.2	2.5	3.2	3.9	4.3	5.0	5.2	2.7	0.9
September	1.0	1.3	1.5	1.7	2.1	2.8	4.0	4.1	4.5	4.6	2.4	0.9
October	1.4	2.0	2.2	2.4	2.8	3.6	4.0	4.3	4.4	4.4	2.9	0.8
November	0.7	1.0	1.1	1.2	1.5	2.1	2.6	2.8	3.6	3.9	1.7	0.7
December	-0.3	0.1	0.2	0.7	1.0	1.3	1.8	1.9	2.2	2.3	1.0	0.6
Annual	1.0	1.2	1.3	1.5	1.8	2.3	2.6	2.9	3.2	3.2	1.9	0.8

Table 24: Projected Anomalies in Monthly and Annual Temperature in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-1.3	-0.5	-0.2	0.4	1.1	1.8	2.7	3.2	4.5	5.0	1.2	1.3
February	0.1	1.1	1.4	2.1	3.0	3.6	5.0	5.0	5.1	5.1	3.0	1.3
March	-0.4	1.2	1.3	1.8	2.7	3.3	4.2	4.5	5.2	5.4	2.6	1.2
April	0.5	1.3	1.5	1.9	2.6	3.7	4.5	5.3	7.1	7.7	2.9	1.5
May	0.9	1.1	1.3	1.8	2.7	3.7	4.8	5.4	6.1	6.4	2.9	1.4
June	0.5	1.5	1.7	2.3	3.0	3.9	4.9	5.8	6.5	6.8	3.2	1.4
July	1.0	1.3	1.9	2.6	3.7	4.8	6.1	7.0	8.2	8.7	3.9	1.8
August	1.4	1.6	2.1	2.9	4.0	5.1	6.4	6.7	8.1	8.6	4.1	1.7
September	0.9	1.6	1.8	2.3	3.4	4.2	5.6	6.3	7.5	7.9	3.5	1.6
October	1.5	2.2	2.3	2.9	3.7	4.7	5.1	5.7	6.4	6.6	3.8	1.2
November	0.7	1.1	1.1	1.6	2.6	3.4	4.2	4.4	4.6	4.7	2.6	1.1
December	-0.3	0.3	0.6	1.2	2.1	2.9	3.5	4.1	4.5	4.7	2.1	1.2
Annual	1.0	1.4	1.5	2.0	2.7	3.8	4.5	5.1	5.5	5.6	3.0	1.4

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual precipitation are summarized in Table 25 and Table 26. The annual precipitation in the 2050s is projected to increase by 5% from the baseline at the 50% exceedance probability. The projected highest monthly increases in the 2050s occur in the winter and August while small and negative changes are expected in June and July. The 2080s annual precipitation is projected to increase by 8% from the baseline, with the largest increases occurring in winter and August, and a small decrease in the summer months of June and July.

Table 25: Projected Anomalies in Monthly and Annual Precipitation in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	2%	5%	8%	13%	19%	23%	35%	36%	39%	40%	19%	9%
February	-14%	-13%	-9%	-7%	1%	7%	14%	15%	23%	26%	1%	10%
March	-11%	-9%	-8%	-5%	0%	5%	8%	9%	12%	13%	0%	6%
April	-16%	-12%	-11%	-7%	-3%	2%	7%	9%	15%	18%	-2%	7%
May	-6%	0%	4%	8%	9%	15%	21%	28%	30%	30%	11%	8%
June	-26%	-25%	-21%	-18%	-9%	-3%	1%	5%	8%	9%	-9%	9%
July	-36%	-29%	-23%	-13%	-7%	-3%	0%	3%	8%	9%	-9%	10%
August	-20%	-12%	-2%	8%	25%	32%	34%	44%	46%	46%	20%	17%
September	-18%	-17%	-16%	-11%	4%	8%	14%	19%	34%	38%	1%	13%
October	-16%	-14%	-10%	-8%	-4%	-1%	4%	8%	9%	9%	-4%	6%
November	-13%	-7%	-5%	0%	5%	8%	11%	13%	14%	14%	4%	6%
December	7%	20%	22%	28%	33%	35%	38%	38%	38%	38%	31%	7%
Annual	-5%	-3%	-2%	1%	5%	9%	12%	12%	13%	14%	5%	5%

Table 26: Projected Anomalies in Monthly and Annual Precipitation in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-2%	9%	11%	14%	20%	27%	30%	37%	39%	40%	21%	9%
February	-19%	-12%	-7%	-2%	2%	7%	12%	13%	24%	28%	2%	9%
March	-16%	-11%	-8%	-5%	0%	8%	13%	18%	18%	18%	1%	9%
April	-16%	-11%	-9%	-7%	0%	12%	16%	17%	24%	27%	2%	11%
May	-6%	-4%	2%	8%	13%	19%	35%	40%	42%	42%	15%	12%
June	-34%	-28%	-24%	-18%	-7%	0%	5%	9%	13%	14%	-9%	12%
July	-52%	-40%	-30%	-19%	-11%	-3%	4%	5%	6%	6%	-13%	15%
August	-36%	-17%	-8%	8%	22%	29%	41%	45%	52%	54%	18%	20%
September	-25%	-18%	-15%	-4%	2%	15%	21%	27%	36%	39%	4%	15%
October	-18%	-12%	-10%	-6%	0%	9%	15%	18%	20%	21%	1%	10%
November	-8%	-2%	0%	4%	10%	16%	22%	24%	35%	38%	11%	9%
December	-2%	24%	25%	33%	36%	42%	47%	48%	53%	55%	36%	10%
Annual	-6%	-4%	-2%	2%	8%	10%	16%	19%	20%	20%	7%	7%

Comparison to Regional Projections

Within Canada there are two major sources of regional projections available: the ClimateData.ca portal (ClimateData 2022) and Canada's Changing Climate Report (Bush and Lemmen 2019). The ClimataData.ca portal provides summarized information about selected locations within Canada using a multi-model ensemble across multiple emission scenarios following IPCC AR5 RCPs (IPCC 2013). Canada's Changing Climate Report (Bush and Lemmen 2019) looks at changing climate trends across Canada and how regional changes fit within the national and global context of climate change. Both resources are used to provide context for the analysis of projections presented in Section 5.4.1 above.

Under a high emissions scenario (RCP 8.5), the ClimateData.ca portal projects a mean annual average temperature increase of 1.6ºC for the 2021 to 2050 period at the Site, 3.6ºC for the 2051 to 2080 period, and 5.1ºC for the end of the century relative to the climate normal period from 1981 to 2010 (ClimateData.ca 2022). This is consistent with the ensemble projections presented above that show increases of 1.8ºC for the 2050s (2041-2070) and 2.7ºC for the 2080s (2071-2100) relative to the modelled climate normal period from 1991 to 2020. Similarly, average annual precipitation is projected by ClimateData.ca to increase by 5% for the 2021 to 2050 period, 12% for the 2051 to 2080 period, and by 15% for the end of the century relative to climate normal period from 1951 to 1980 (ClimateData.ca 2022). These projected changes are consistent with the projections presented above considering the difference in the projection and normal periods (i.e., projection of 5% increase for the 2041 to 2070 period above compared to the 7% increase for the 2051 to 2080 period relative to normal period from 1991 to 2020).

Bush and Lemmen (2019) (Canada's Change Climate Report) does not include trends specifically for the Mine area; however, projections indicate an increase in both mean annual temperature and precipitation, with northern Canada expected to experience larger increases. Under a low emissions scenario (RCP 2.6) temperature is projected to increase by 1.8°C and by more than 6°C under a high emissions scenario (RCP 8.5) by the end of the century. Annual mean precipitation is projected to increase by 7% under a low emissions scenario (RCP 2.6) and by 24% under a high emissions scenario (RCP 8.5) by the end of the century (Bush and Lemmen 2019).

5.4.2 Future Relative Humidity Projections

Annual Projections

Comparison of the future mean annual relative humidity projections from all GCMs for the Mine area and 2050s and 2080s projection periods are shown in Table 27 and Figure 30, and Table 28 and Figure 31, respectively. Projections for the 2050s period shows little variation compared to the baseline period (1991 to 2020) for all climate models and all SSPs with an anomaly range of -2% to 2%. Projections for the 2080s period shows similar pattern to the 2050s period (-1% to 2% anomaly range) for SSP1-2.6 and SSP2-4.5, and greater variation for higher emissions scenarios SSP3-7.0 and SSP5-8.5 (-2% to 5% anomaly range).

Table 27: Projected Mean Annual Relative Humidity for all GCMs (2050s)

Climate Model	Relative Humidity Anomaly (%)			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	1.0	2.0	2.0	2.0
BCC-CSM2-MR	0.0	0.0	0.0	1.0
CNRM-ESM2-1	0.0	0.0	0.0	0.0
GFDL-ESM4	0.0	-1.0	-2.0	-1.0
GISS-E2-1-G	1.0	0.0	1.0	1.0
MIROC6	1.0	1.0	1.0	1.0
MPI-ESM1-2-HR	-1.0	-1.0	-1.0	1.0
MRI-ESM2-0	0.0	0.0	-1.0	-1.0
Baseline	0.0	0.0	0.0	0.0
Anomaly Range	-1 to 1	-1 to 2	-2 to 2	-1 to 2

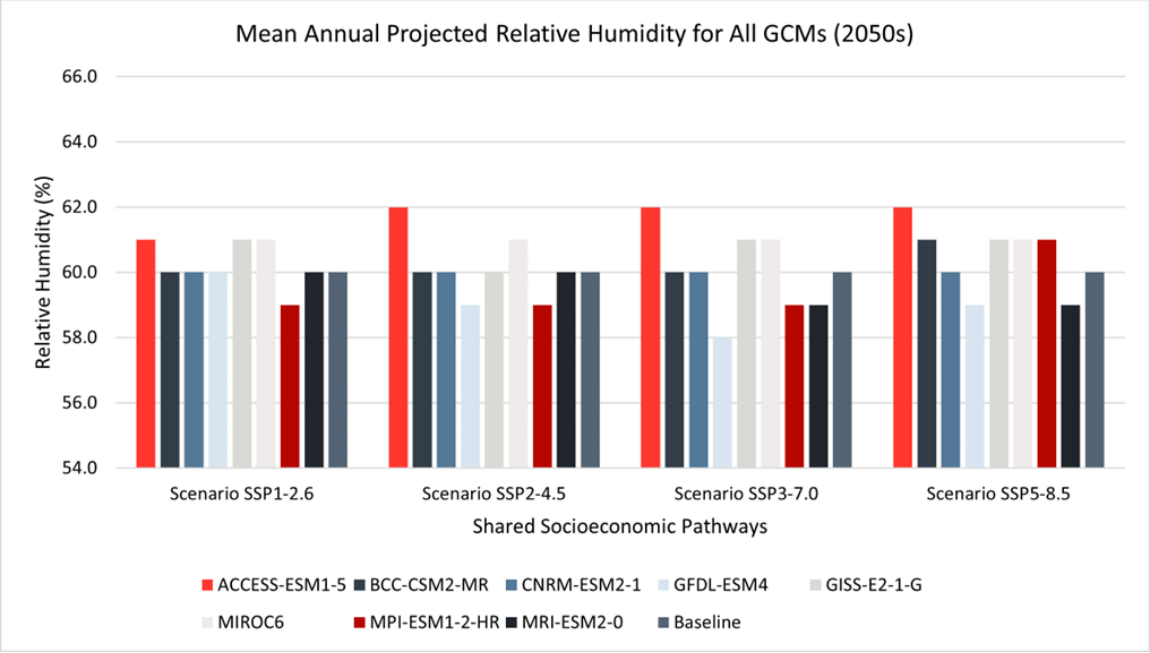

Figure 30: Projected Mean Annual Relative Humidity for all GCMs (2050s)

Table 28: Projected Mean Annual Relative Humidity for all GCMs (2080s)

Climate Model	Relative Humidity Anomaly (%)			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	2.0	2.0	4.0	4.0
BCC-CSM2-MR	1.0	1.0	0.0	2.0
CNRM-ESM2-1	0.0	1.0	1.0	1.0
GFDL-ESM4	0.0	-1.0	-2.0	-1.0
GISS-E2-1-G	1.0	1.0	2.0	1.0
MIROC6	1.0	1.0	1.0	2.0
MPI-ESM1-2-HR	-1.0	-1.0	-1.0	5.0
MRI-ESM2-0	0.0	-1.0	-1.0	-1.0
Baseline	0.0	0.0	0.0	0.0
Anomaly Range	-1 to 2	-1 to 2	-2 to 4	-1 to 5

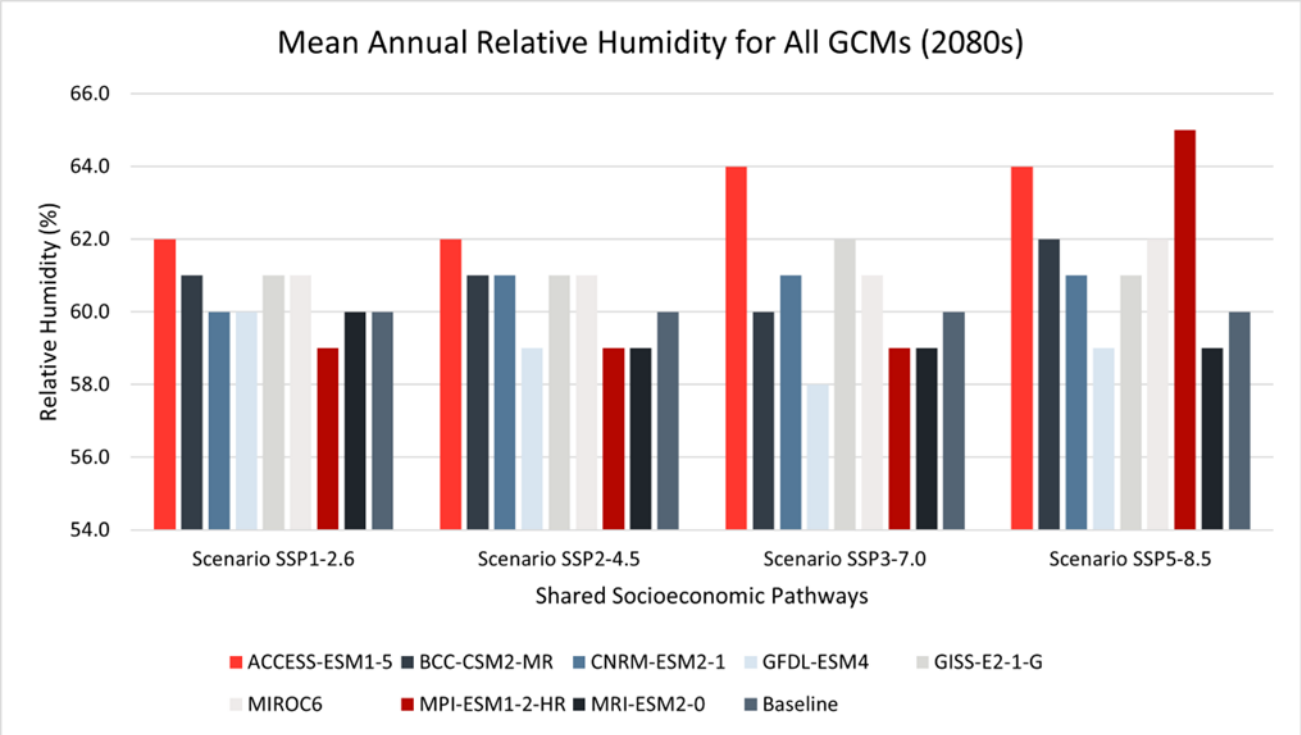

Figure 31: Projected Mean Annual Relative Humidity for all GCMs (2080s)

Monthly Projections

Figure 32 and Figure 33 depict the projected anomalies in monthly median relative humidity at the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represent the spread between the 5th percentile and the 95th percentile of the ensemble. The figures show the projected seasonal pattern with increases in relative humidity for spring and summer months and decreases in relative humidity for winter months, with no change to the annual average. The 5th and 95th percentiles of the 2050s ensembles range from a decrease of -1.0% to an increase of 2.2% on average. The 5th and 95th percentile variations follow the projected median throughout the months of the year, with no discernible seasonal pattern. The 5th and 95th percentiles of the 2080s ensemble, range from a decrease of -1.0% to an increase of 4.0% on average. The 5th and 95th percentile variations are similar throughout the winter months of the year with larger projected uncertainty in the spring and summer months.

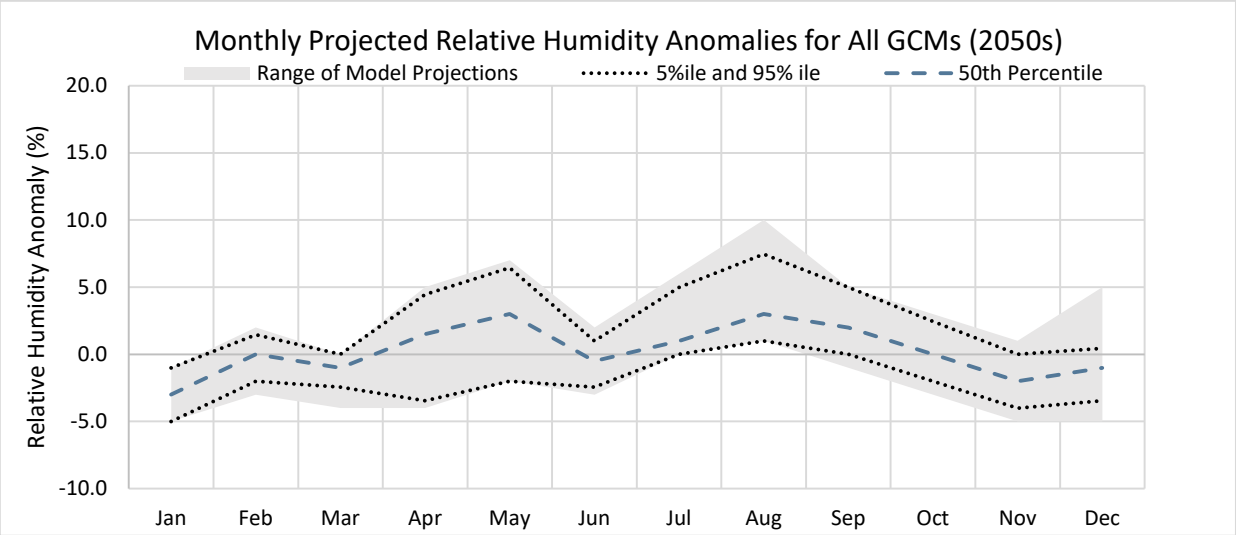

Figure 32: Monthly Projected Relative Humidity Anomalies for Mount Polley Mine Area (2050s)

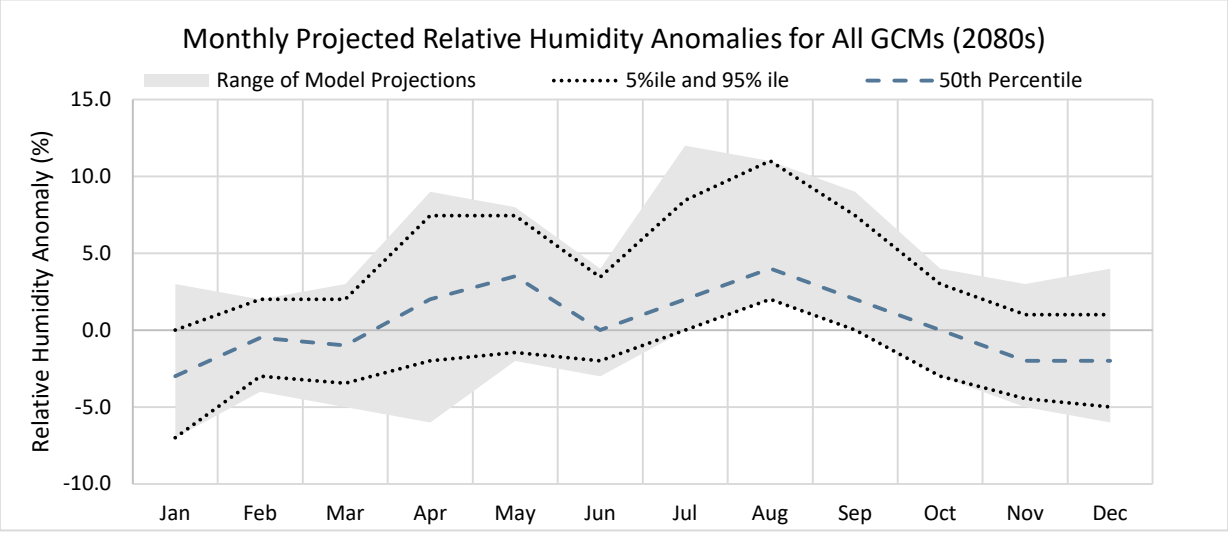

Figure 33: Monthly Projected Relative Humidity Anomalies for Mount Polley Mine Area (2080s)

Summary of Annual and Monthly Projections

The projected future changes in the 2050s and 2080s from the baseline period (1991 through 2020) in monthly and annual relative humidity are summarized in Table 29 and Table 30. In the 2050s, at 50% exceedance probability, the annual relative humidity is projected to remain the same as baseline conditions with monthly relative humidity increasing in spring and summer months (up to 3% absolute increase in May and August) and decreasing in fall and winter months (up to -3% absolute decrease in January). In the 2080s, at 50% exceedance probability, the annual relative humidity is projected to remain the same as baseline conditions with monthly relative humidity increasing in spring and summer months (up to 4% absolute increase in August) and decreasing in fall and winter months (up to -3% in January). There is greater variability in the range of relative humidity in the summer months (Figure 33).

Table 29: Projected Anomalies in Monthly and Annual Relative Humidity in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-5%	-5%	-5%	-4%	-3%	-1%	-1%	-1%	-1%	-1%	-3%	1%
February	-3%	-2%	-2%	-1%	0%	1%	1%	1%	2%	2%	0%	1%
March	-4%	-2%	-2%	-2%	-1%	0%	0%	0%	0%	0%	-1%	1%
April	-4%	-3%	-2%	0%	2%	3%	4%	4%	5%	5%	1%	2%
May	-2%	-2%	-1%	2%	3%	4%	6%	6%	7%	7%	3%	2%
June	-3%	-2%	-2%	-1%	-1%	1%	1%	1%	2%	2%	0%	1%
July	0%	0%	0%	1%	1%	2%	4%	5%	6%	6%	2%	2%
August	1%	1%	1%	2%	3%	5%	7%	7%	9%	10%	4%	2%
September	-1%	0%	1%	1%	2%	3%	4%	5%	5%	5%	2%	2%
October	-3%	-2%	-2%	-1%	0%	1%	2%	2%	3%	3%	0%	1%
November	-5%	-4%	-4%	-3%	-2%	-1%	0%	0%	1%	1%	-2%	2%
December	-5%	-3%	-3%	-3%	-1%	0%	0%	0%	4%	5%	-1%	2%
Annual	-2%	-1%	-1%	0%	0%	1%	1%	2%	2%	2%	0%	1%

Table 30: Projected Anomalies in Monthly and Annual Relative Humidity in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	-7%	-7%	-6%	-5%	-3%	-1%	0%	0%	2%	3%	-3%	2%
February	-4%	-3%	-3%	-1%	-1%	1%	1%	2%	2%	2%	0%	2%
March	-5%	-3%	-2%	-2%	-1%	0%	1%	2%	3%	3%	-1%	2%
April	-6%	-2%	-2%	1%	2%	3%	5%	7%	9%	9%	2%	3%
May	-2%	-1%	0%	2%	4%	5%	7%	7%	8%	8%	3%	3%
June	-3%	-2%	-2%	-1%	0%	2%	3%	3%	4%	4%	0%	2%
July	0%	0%	0%	1%	2%	4%	7%	8%	11%	12%	3%	3%
August	2%	2%	2%	2%	4%	6%	9%	11%	11%	11%	5%	3%
September	0%	0%	1%	1%	2%	3%	7%	7%	9%	9%	3%	2%
October	-3%	-3%	-2%	-1%	0%	1%	3%	3%	4%	4%	0%	2%
November	-5%	-4%	-4%	-3%	-2%	0%	0%	1%	2%	3%	-2%	2%
December	-6%	-5%	-5%	-4%	-2%	0%	1%	1%	3%	4%	-2%	2%
Annual	-2%	-1%	-1%	-1%	1%	1%	2%	4%	5%	5%	1%	2%

5.4.3 Future Solar Radiation Projections

Annual Projections

Comparison of the future mean annual solar radiation projections for the Mine area for the 2050s and 2080s projection periods are shown in Table 31 and Figure 34, and Table 32 and Figure 35, respectively. Baseline solar radiation for the Site is from ECCC Williams Lake climate station for the period from 1961 through 2001 as modelled baseline solar radiation for the Site is not available. Projections for the 2050s period shows a mean annual solar radiation increase of 4.3% from baseline, with a range of 2.1% to 11.3% increase from baseline across all climate models and SSPs. Projections for the 2080s period shows a mean annual solar radiation increase of 5% from baseline, with a range of 1.2% to 12.2% increase from baseline across all climate models and SSPs.

Table 31: Projected Mean Annual Solar Radiation for all GCMs (2050s)

Climate Model	Solar Radiation Anomaly			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	7.1%	6.3%	7.1%	7.1%
BCC-CSM2-MR	7.1%	7.1%	9.7%	11.3%
CNRM-ESM2-1	3.7%	3.7%	2.9%	2.9%
GFDL-ESM4	4.6%	4.6%	2.9%	2.9%
GISS-E2-1-G	4.6%	2.1%	2.1%	2.1%
MIROC6	4.6%	2.1%	2.1%	2.1%
MPI-ESM1-2-HR	2.1%	2.1%	2.9%	2.1%
MRI-ESM2-0	4.6%	4.6%	2.9%	4.6%
Baseline[a]	0%	0%	0%	0%
Anomaly Range	2.1% to 7.1%	2.1% to 7.1%	2.1% to 9.7%	2.1% to 11.3%

a) Baseline solar radiation for the Site is from ECCC Williams Lake climate station for a period from 1961 through 2001.

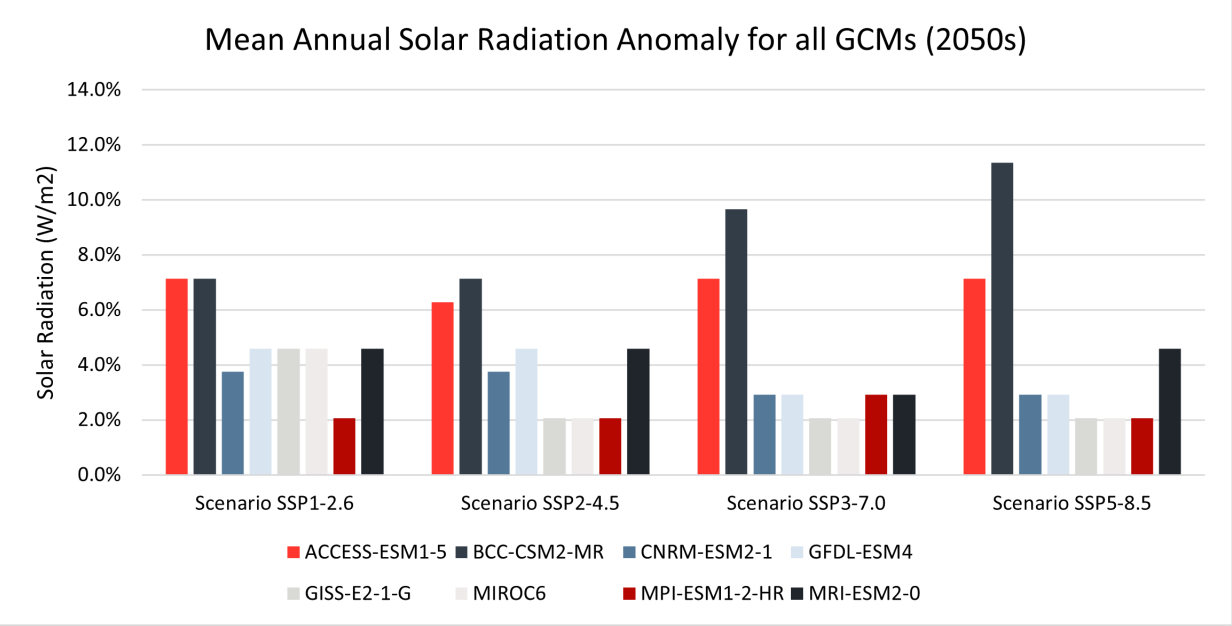

Figure 34: Projected Mean Annual Solar Radiation Anomaly for all GCMs (2050s)

Table 32: Projected Mean Annual Solar Radiation for all GCMs (2080s)

Climate Model	Solar Radiation Anomaly			
	Scenario SSP1-2.6	Scenario SSP2-4.5	Scenario SSP3-7.0	Scenario SSP5-8.5
ACCESS-ESM1-5	7.1%	7.1%	8.0%	8.0%
BCC-CSM2-MR	9.7%	10.5%	13.9%	12.2%
CNRM-ESM2-1	3.7%	2.1%	2.9%	0.4%
GFDL-ESM4	5.4%	4.6%	6.3%	2.1%
GISS-E2-1-G	5.4%	2.9%	2.9%	0.4%
MIROC6	4.6%	2.9%	2.1%	1.2%
MPI-ESM1-2-HR	2.9%	1.2%	2.9%	1.2%
MRI-ESM2-0	7.1%	4.6%	3.7%	2.9%
Baseline[a]	0%	0%	0%	0%
Anomaly Range	2.9% to 9.7	1.2% to 10.5%	2.1% to 13.9%	0.4% to 12.2%

a) Baseline solar radiation for the Site is from ECCC Williams Lake climate station for a period from 1961 through 2001.

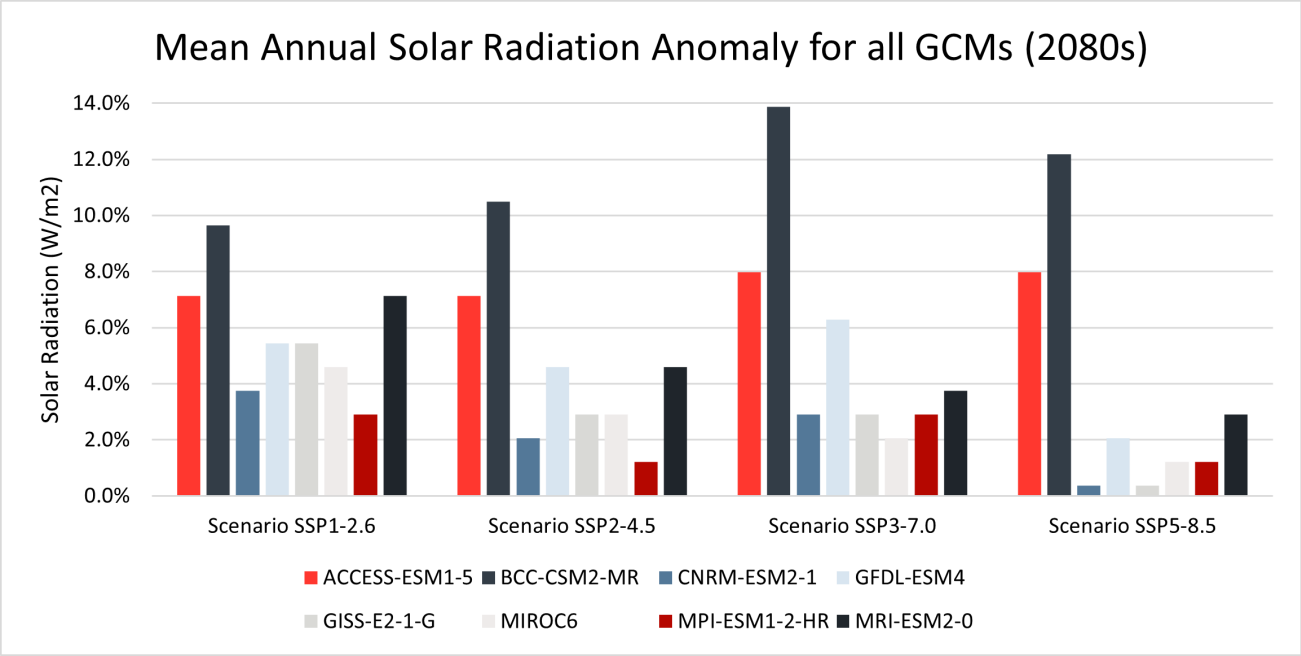

Figure 35: Projected Mean Annual Solar Radiation Anomaly for all GCMs (2080s)

Monthly Projections

Figure 36 and Figure 37 depict the projected anomalies in monthly solar radiation at the Site for the 2050s and 2080s, respectively. The figures also show a dashed line which represents the median of all the modelled projections. The dotted lines in the figures represents the spread between the 5th percentile and 95th percentile of the ensemble. The figures show projected increases in solar radiation for all months for the 2050s and the 2080s except for April, May, and October. For the 2050s (Figure 36) the projected increase in the solar radiation (dashed line) is greater in winter months and less in the summer months, with an annual average increase of 5.1 W/m^2. The 5th and 95th percentiles of the 2050s ensembles range from 2.8 W/m^2 to 11.3 W/m^2 on average with the largest variation occurring in the summer months. The 95th percentile shows a larger variation during the summer months, with projected increases of nearly 21.7 W/m^2.

The projected increase in the mean solar radiation for the 2080s (Figure 37) show a similar pattern to the 2050s period. The projected increase (dotted line) is greater in winter months and less in summer months, with an average annual increase of 5.1 W/m^2. The 5th and 95th percentiles of the 2080s ensemble range from 1.2 W/m^2 to 15.4 W/m2 on average. The 95th percentile shows a larger variation throughout the summer months, with projected increases of nearly 41.2 W/m^2. There is greater uncertainty in the projected solar radiation in July and August.

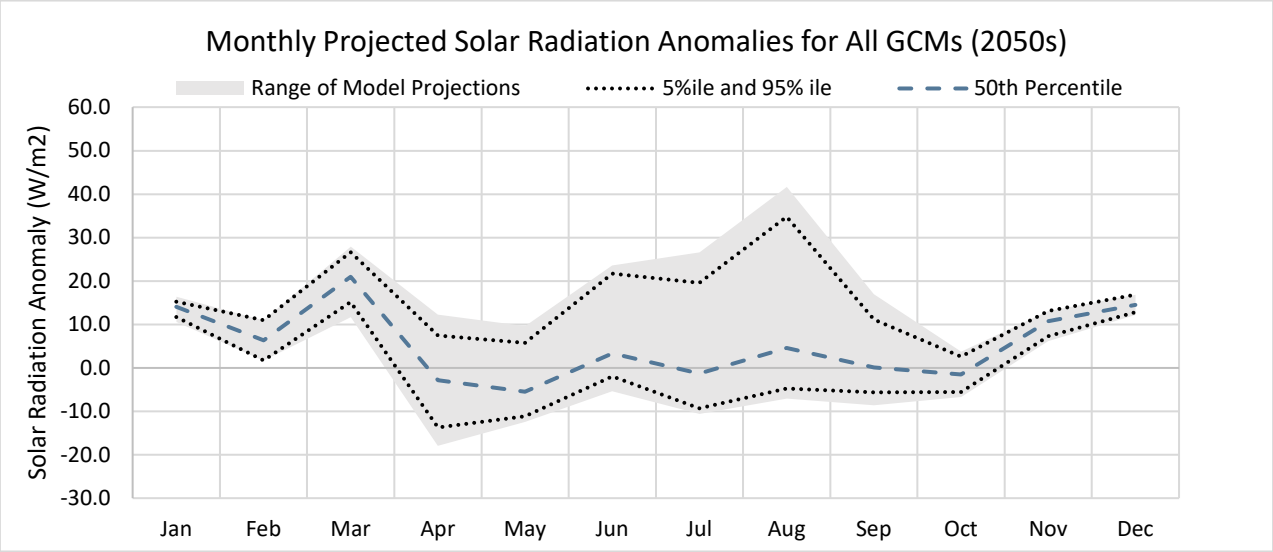

Figure 36: Projected Monthly Solar Radiation Anomalies for Mount Polley Mine Area (2050s)

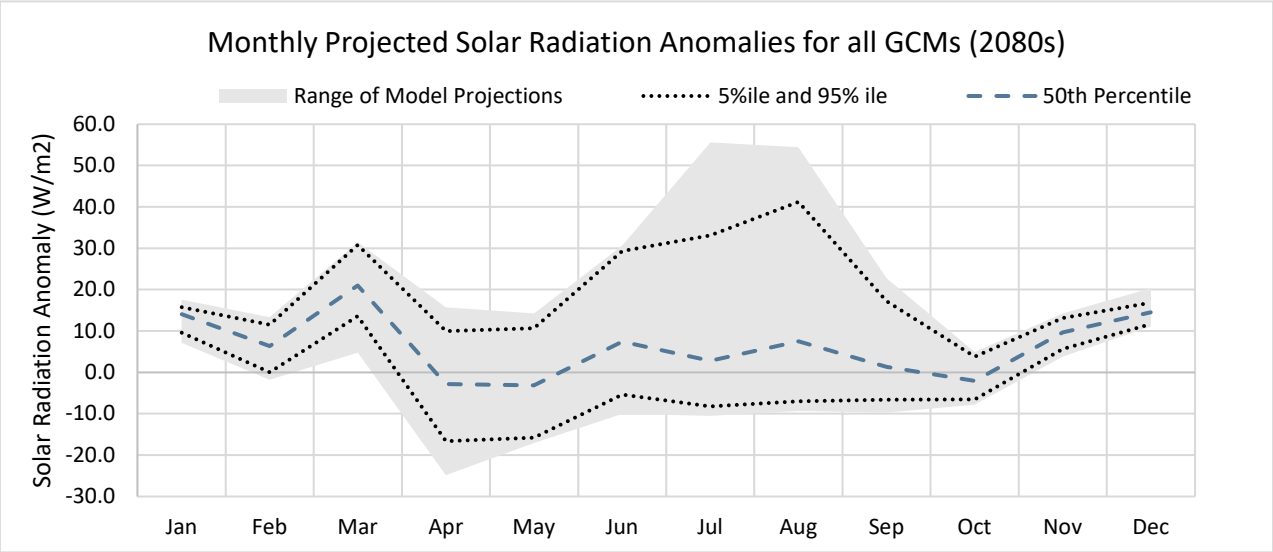

Figure 37: Projected Monthly Solar Radiation Anomalies for Mount Polley Mine Area (2080s)

Summary of Annual and Monthly Projections

The projected future changes in the 2050s and 2080s from the baseline period (Williams Lake 1961 through 2001) in monthly and annual solar radiation are summarized in Table 33 and Table 34. In the 2050s and 2080s, at 50% exceedance probability, the median annual solar radiation is projected to increase by 5.1 W/m^2. Monthly solar radiation is projected to increase for all months except April, May, and October.

Table 33: Projected Anomalies in Monthly and Annual Solar Radiation in the 2050s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	10.6	11.8	12.9	13.8	14.1	15.2	15.2	15.2	16.0	16.4	14.0	1.2
February	1.7	1.7	2.9	5.2	6.3	8.7	10.9	11.0	11.0	11.0	6.7	2.8
March	11.7	15.2	16.5	18.4	21.0	23.3	25.5	26.7	27.9	27.9	21.0	3.7
April	-17.9	-13.7	-8.6	-4.0	-2.8	1.2	4.0	7.5	11.2	12.2	-2.0	6.3
May	-12.4	-11.2	-10.1	-7.8	-5.5	-0.8	1.3	5.8	9.6	9.6	-4.4	5.3
June	-5.4	-1.9	-1.9	0.4	3.3	9.7	17.8	21.7	23.6	23.6	6.1	7.6
July	-10.5	-9.3	-8.2	-4.2	-1.3	4.2	11.3	19.6	26.6	26.6	1.2	9.1
August	-7.0	-4.7	-4.7	-0.1	4.6	10.4	27.3	34.8	41.3	41.7	7.7	12.1
September	-8.6	-5.6	-3.9	-2.8	0.1	4.5	8.7	11.1	15.1	16.9	1.1	5.8
October	-6.7	-5.5	-4.4	-2.0	-1.5	0.6	2.5	2.6	3.4	3.8	-1.0	2.6
November	6.2	7.3	7.4	9.6	10.8	10.8	12.0	13.1	13.1	13.1	10.2	1.7
December	12.2	12.8	13.4	14.5	14.5	15.7	16.7	16.8	16.8	16.8	14.8	1.2
Annual	2.8	2.8	2.8	2.8	5.1	6.9	9.8	11.3	14.8	15.6	5.9	3.3

Table 34: Projected Anomalies in Monthly and Annual Solar Radiation in the 2080s from Baseline

Month	Min	Percentiles								Max	Mean	Std. Dev.
		5%	10%	25%	50%	75%	90%	95%	99%			
January	7.1	9.5	10.6	12.6	14.1	14.4	15.2	15.8	17.2	17.6	13.3	2.2
February	-1.8	0.0	1.7	2.9	6.3	8.7	11.0	11.5	12.9	13.3	6.1	3.7
March	4.7	13.6	15.2	17.5	21.0	24.5	27.7	30.8	31.4	31.4	20.5	5.7
April	-24.9	-16.6	-15.4	-6.9	-2.8	3.3	8.7	9.9	13.9	15.7	-2.8	9.1
May	-17.1	-15.8	-14.5	-10.7	-3.1	-0.8	4.9	10.7	13.5	14.3	-4.0	8.0
June	-10.0	-5.4	-1.9	0.4	7.4	15.5	23.5	29.3	30.6	30.6	8.2	10.6
July	-10.5	-8.2	-5.9	-3.6	2.8	11.5	18.3	33.1	52.0	55.6	6.2	14.3
August	-9.4	-7.0	-0.1	2.2	7.5	12.7	32.8	41.2	51.9	54.4	10.3	14.2
September	-9.7	-6.7	-5.1	-3.9	1.3	5.6	9.8	17.2	22.0	22.7	2.0	7.5
October	-7.8	-6.6	-5.5	-4.4	-2.0	0.6	2.6	3.8	4.6	4.9	-1.6	3.3
November	3.8	5.6	7.3	8.5	9.6	10.8	12.0	13.1	13.9	14.3	9.4	2.3
December	11.0	11.7	12.2	13.4	14.5	15.7	15.7	16.8	19.3	20.3	14.3	1.9
Annual	0.5	1.2	1.7	3.7	5.1	9.8	13.0	15.4	18.3	19.0	6.6	4.7

5.4.4 Future Evaporation Projections

Evaporation and evapotranspiration projections are not available from ClimateBC or ClimateData.ca. However, evaporation and evapotranspiration are likely to change as dependent variables change, in particular air temperature. The extent of the change will depend on the climate change scenario.

5.4.5 Snow Cover Properties Projections

Potential changes in winter air temperature will likely lead to changes in snow cover properties and the annual SWE available for freshet. ClimateBC does not project snow cover and instead projects precipitation-as-snow (PAS) for future climate periods. PAS projections are indicative of the trends in total snow cover and SWE available to contribute to freshet flows, with less PAS resulting in less SWE. Table 35 summarizes ClimateBC projected PAS for future normal periods relative to the modelled baseline period (1991 through 2020) and indicates an overall decrease in PAS in the future. At 50% exceedance probability, the annual PAS is projected to decrease by 30 mm and 59 mm on average for the 2050s and 2080s, respectively.

Climate change model data published for the province of BC by ECCC (2019) project snow depth reduction relative to the 1986 to 2005 reference normal period using CMIP5 RCP (Table 36). At 50% exceedance, the snow cover depth is projected to decrease by 83 mm and 117 mm on average for the 2046-2065 and 2081-2100 normal periods, respectively.

Table 35: Projected Annual Precipitation-As-Snow Anomaly for the Mount Polley Mine Area

Shared Socioeconomic Pathway	Normal Period	Precipitation-as-Snow Anomaly Percentiles (mm)		
		25%	50%	75%
SSP1-2.6	2011-2040	-7	-4	2
	2041-2070	-23	-17	-13
	2071-2100	-25	-21	-18
SSP2-4.5	2011-2040	-11	-5	2
	2041-2070	-32	-27	-18
	2071-2100	-50	-47	-38
SSP3-7.0	2011-2040	-5	-2	2
	2041-2070	-41	-33	-16
	2071-2100	-78	-72	-55
SSP5-8.5	2011-2040	-6	-1	3
	2041-2070	-50	-43	-29
	2071-2100	-110	-95	-80
Average	2011-2040	-7	-3	2
	2041-2070	-36	-30	-19
	2071-2100	-66	-59	-48

Table 36: Snow Depth Change Relative to 1986 to 2005 Predictions for British Columbia (ECCC 2019)

Representative concentration Pathway	Normal Period	Snow Depth Change (mm)		
		25%	50%	75%
RCP2.6	2016-2035	-46.5	-41.4	-12.7
	2046-2065	-67.5	-61.3	-17.4
	2081-2100	-72.6	-68.4	-21.3
RCP4.5	2016-2035	-43.8	-39	-10
	2046-2065	-80.4	-80.5	-33.4
	2081-2100	-109.1	-105.4	-37
RCP8.5	2016-2035	-52.8	-50.1	-14.1
	2046-2065	-101	-105.7	-35.4
	2081-2100	-159.4	-176.4	-58.9

6.0 CONCLUSION AND RECOMMENDATIONS

This report provides the five-year update of climate baseline at Mount Polley Mine Site as per Requirement 2.1 of the Global Industry Standards on Tailings Management (GISTM). The purpose of the update is to extend the existing long-term climate data for the Site using local and regional data collected in the last five years. The last climate baseline update was carried out by WSP Golder in 2016.

This report provides an updated climate baseline for precipitation, air temperature, relative humidity, solar radiation, evaporation, wind speed and direction, and snow depths, and includes updated climate change projections for the Site. Overall, trends in these climate parameters at Mount Polley are similar to those at Environment and Climate Change Canada (ECCC) regional stations. Future climate projections for Mount Polley show that the future climate at the Site would likely be warmer and wetter, with larger variations throughout the months. The greatest variation would likely be in summer months with a projected summer temperature increase of 7°C and less summer precipitation by the year 2100. Annual temperature is projected to increase by 2.7°C and annual precipitation is projected to increase by 8% from the baseline by 2100.

The updated climate parameters and extended long-term climate dataset are deemed to be representative of the climate at the Site and are suitable for support of design and modelling activities. It is recommended that MPMC continue to monitor and record climate data, and that the climate parameters be updated a minimum of every five years to encompass local and regional data collected, and to reflect uncertainties due to climate change.

Signature Page

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/066-r-31547-climate baseline update/22514095-066-r-rev0-31547-climate baseline update 30aug_22.docx

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Appendix E
Mill Flow Sheet

Mount Polley Mill PFD 2022

Main Flow
Primary Bypass
Conveyor Belt
Reagent Addition

VFD pump numbers are coloured blue and underlined.

Flotation Feed
P80 – 150 µm

431 / 432

PM3 Cyclone Pack
CV #15C
Pebble Mill 3
16'6" Ø x 32'
4000 HP

PM2 Cyclone Pack
CV #15B
Pebble Mill 2
17'6" Ø x 24'
3500 HP

Pebble Pile / Secondary Crusher Feed

Added to the pebble mill on demand

PM1 Cyclone Pack
CV #15A
Pebble Mill 1
17'6" Ø x 24'
3500 HP

Pebble Mill Pump Box
428
427
426
PAX
W22C
Lime (optional)

Flash Conc.

Flash Float Splitter Box
Flash Float 2
Flash Float 2 Conc
Flash Float 1
Flash Float 1 Conc.
P80 – 360 µm
416

Grinding Line B
BM2 Cyclone Pack
Ball Mill 2
13'6" Ø x 28'
3600 HP
Rod Mill 2
13'6" Ø x 18'
1800 HP
CV #11B
RM2/BM2 Pump Box
424
423
PAX
W22C
Lime (optional)

Fine Ore Stockpile
F80 – 13,356 µm

Grinding Line A
Rod Mill 1
13'6" Ø x 18'
1800 HP
CV #11A
P80 – 550 µm
BM1/BM3 Cyclone Pack
Ball Mill 1
13'6" Ø x 28'
3600 HP
Ball Mill 3
13'6" Ø x 18'
1800 HP
RM1/BM1/BM3 Pump Box
422
421
PAX
W22C
Polyfloat 7150
Lime (optional)

Regrind O/F
P80 – 35 µm
Regrind Cyclone Pack
Regrind
8' Ø x 9'
250 HP

2nd Cleaner Feed Box
Cleaner Sump 534
Regrind Sump 442
433
1st Cleaner Splitter Box
Rougher 502/505/506 Splitter Box

2nd Cleaner Columns 503
Polyclear
528 / 550
2nd Cleaner Columns Tails
1st Cleaner Columns 504
1st Cleaner Columns 501
1st Cleaner Columns Conc.
526 / 527
1st Cleaner Columns Tails

Rougher 505
Rougher 506
Rougher Column Conc.
Rougher 502
411
Rougher Column Tails

PAX
W22C
NaHS
520 / 521

Cleaner Scav. Tails
PAX
W22C
NaHS
Cleaner Scavenger Bank
524 A/B
Cleaner Scav. Conc.

Flotation Sump 525/622
OK Cell Splitter Box
OK Cell
A A A A B B B B
OK Tails
Lime
OK Conc.
964
519

2nd Cleaner Columns Conc.
Flocculant
Thickener
Polyclear
Stock Tank
938
939
723

Rougher Mag Tails
Rougher Mag Separator
Rougher Mag Conc.
CanMag Plant
CanMag Cleaner Tails

Filter Press
CV #21
Final Copper Concentrate

NaHS
Lime
Tails Box

Appendix F
Predictions of Hydrogeological Conditions near the Springer and Cariboo Pits

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-151-TM-Rev0-16000

TO Dale Reimer, General Manager
Mount Polley Mining Corporation

FROM Willy Zawadzki and Don Chorley **EMAIL** Willy_Zawadzki@golder.com; Don_Chorley@golder.com

PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – TECHNICAL ASSESSMENT REPORT – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum presents seepage predictions for the Springer Pit and Cariboo Pit at the Mount Polley Mine, which is operated by Mount Polley Mining Corporation (MPMC). These predictions consider the mine plan that is incorporated into the Technical Assessment Report (TAR) being prepared for the mine by Golder Associates Ltd. (Golder). The predictions are based on the hydrogeological model (Figure 1) that was previously developed for the area adjacent to these open pits (Golder 2010, 2014) and that has been recently updated (Golder 2016) to include the results of the field program that was completed in the spring of 2015 (Golder 2015) and subsequent monitoring. The reader is referred to these documents for details of model development, the underlying assumptions, and the approach adopted to simulate open pit seepage.

This memorandum documents predictions of groundwater seepage near the Springer Pit and Cariboo Pit for the TAR. It is understood that the pit lake hydrology and the pit lake water quality and resulting seepage quality are assessed by concurrent studies conducted by MPMC and Golder.

2.0 MINE PLAN

MPMC provided the ultimate pit shells for the Springer and Cariboo pits that represent final configuration of the mine workings after four years of mining (Figure 2). From the perspective of seepage assessment, the key assumptions in the mine plan for these open pits are as follows:

- The Springer Pit and Cariboo Pit will be mined to the ultimate depths of approximately 878 m and 938 m elevation, respectively.
- The ground elevation along the pit wall separating the Springer Pit and Cariboo Pit will be approximately 1,028 m.
- Potentially acid generating materials will be placed in the Springer Pit and Cariboo Pit for subaqueous disposal up to an elevation of approximately 1,004 m.
- Tailings will not be deposited in the Springer Pit and Cariboo Pit (i.e., tailings currently deposited in the Springer Pit will be removed and transported to the Tailings Storage Facility).

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3.0 SEEPAGE PREDICTIONS

The hydrogeological model was used to simulate groundwater conditions near the Springer Pit and Cariboo Pit for the scenario representing the fully dewatered conditions, scenarios representing rising pit lake levels up to the spillway elevation of 1,050 m, and fully developed pit lake with lake surface at 1,050 m elevation. In these model simulations, it was assumed that the potentially acid generating materials that will be placed in the Springer Pit have hydraulic conductivity significantly higher than the surrounding rockmass, and thus offer no resistance to seepage entering or exiting the pit lake.

For comparison purposes, Figure 3 and Figure 4 present hydrogeological conditions predicted by the calibrated model for the existing Springer Pit in mid-2014, when this pit was fully dewatered, and for July 2015, when the pit lake level was at an elevation of approximately 1,017.2 m. Figure 5 and Figure 6 present predictions for the fully dewatered Springer Pit at its ultimate configuration (Figure 5, panel A) and at increased pit lake levels up to the spillway elevation of 1,050 m (Figure 6, panel C). The corresponding seepage quantities predicted by the model are summarized in Table 1.

Table 1: Predicted Seepage Quantities for the Ultimate Configuration of the Springer Pit and Cariboo Pit

	Springer Pit		Cariboo Pit	
Pit Lake Elevation (m)	**Groundwater Flow (m^3/d)**		**Groundwater Flow (m^3/d)**	
	Into the Lake	**Out of the Lake**	**Into the Lake**	**Out of the Lake**
Base Case				
880 (dewatered pit)	520	0	600[a]	0[a]
940	510	0	610	0
960	490	0	610	0
980	460	0	590	0
1,000	420	0	540	0
1,020	320	10	460	0
1,030	300	100	420	0
1,040	280	250	380	0
1,050 (spillover elevation)	270	400	320	20
Upper Bound				
1,050 (spillover elevation)	440	880	500	90
Lower Bound				
1,050 (spillover elevation)	190	220	250	0

a) These values represent conditions when the Cariboo Pit is fully dewatered (i.e. the base of the Cariboo Pit is at ~938 m elevation).

Model results indicated that when the Springer Pit and Cariboo Pit are at the ultimate configuration and are fully dewatered, the respective groundwater inflow to these pits would be approximately 520 m^3/d and 600 m^3/d, respectively. When fully dewatered, both pits would act as strong groundwater sinks that would reverse groundwater flow between Bootjack Lake and the pit such that the seepage from Bootjack Lake to the underlying bedrock would occur. As the pit lake level is raised, the groundwater seepage into the pit lake was predicted to gradually decrease to approximately 270 m^3/d in the Springer Pit and 320 m^3/d in the Cariboo Pit once the spillway elevation of 1,050 m is reached.

In addition, as the pit lake level increases between 1,020 m and 1,030 m elevation, seepage in the range of 10 m^3/d to 100 m^3/d from the Springer Pit lake into the subsurface was predicted to occur. This seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillover elevation of 1,050 m. In the Cariboo Pit, seepage towards Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 m elevation. At this elevation, the pit lake was predicted to act as a "flow-through" lake with groundwater recharge occurring from the uplands located northeast from both pits and recharge to groundwater occurring towards the southwest.

Seepage pathways predicted for the conditions representing the pit lake at the spillway elevation are presented in Figure 7. Uncertainty in the predicted seepage rates, as presented in Table 1, was quantified using the same approach as the one that was adopted in previous analyses (e.g., Golder 2014).

4.0 CLOSURE

We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

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Oct. 17 2016
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Don Chorley, PGeo
Principal, Senior Hydrogeologist

WZ/DWC/pn/jc

Attachments: Figure 1: Hydrogeological Model Extents
Figure 2: Ultimate Configuration of Springer Pit and Cariboo Pit
Figure 3: Hydrogeological Model Calibration – Mid-2014 Dewatered Conditions
Figure 4: Hydrogeological Model Calibration – July 2015 Pit Lake Conditions
Figure 5: Predicted Hydrogeological Conditions – Pit Lake Level 880 m to 980 m Elevation
Figure 6: Predicted Hydrogeological Conditions – Pit Lake Level 1,000 m to 1,050 m Elevation
Figure 7: Predicted Seepage Pathways for Springer Pit and Cariboo Pit Lake at 1,050 m Elevation
Attachment 1: Study Limitations

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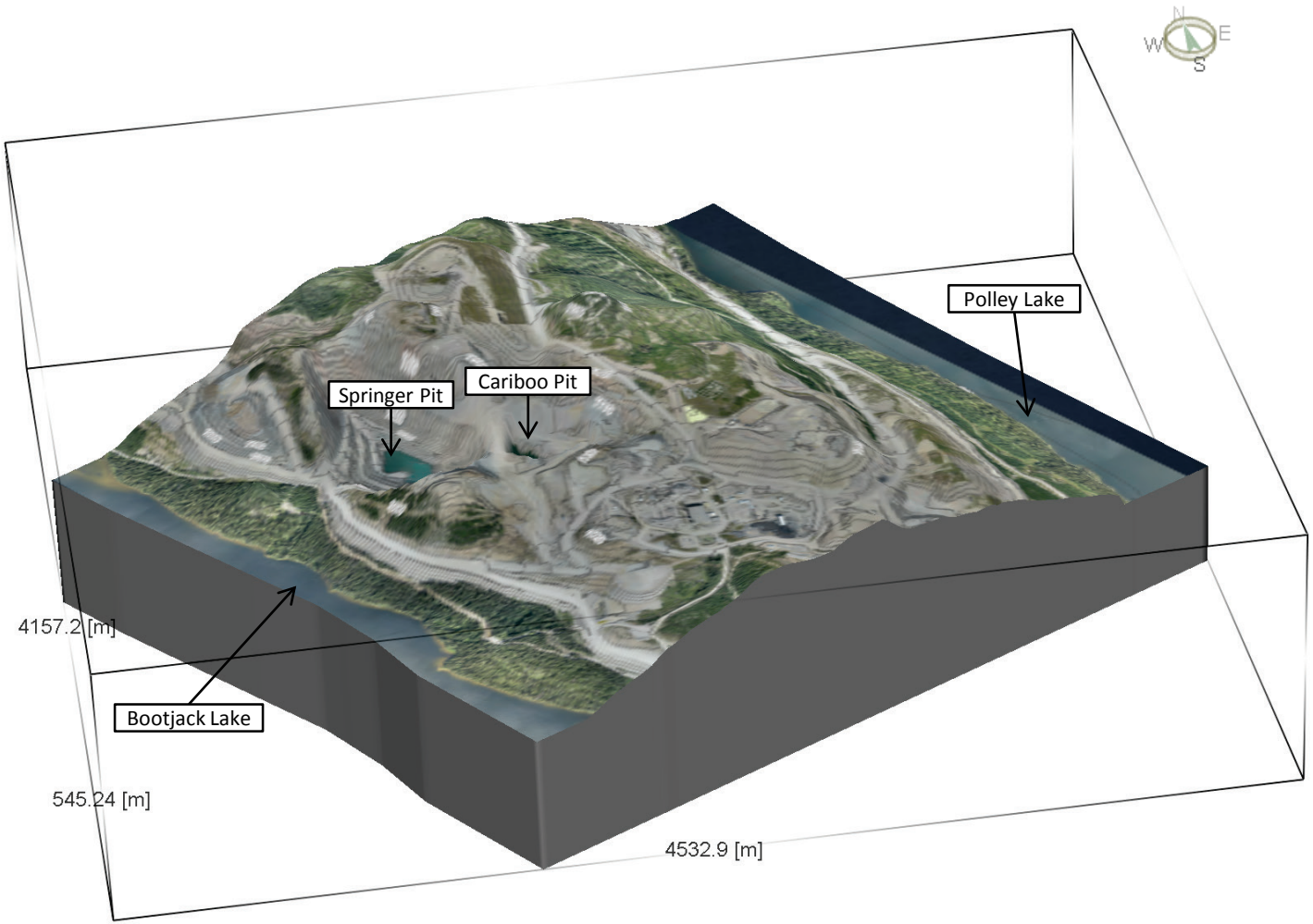

Notes:
Orthophoto was provided by MPMC

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MOUNT POLLEY MINING CORPORATION
LIKELY, BC

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-29
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

TITLE
HYDROGEOLOGICAL MODEL EXTENTS

PROJECT No.		Rev.	
1411734	**16000**	**0**	**1**

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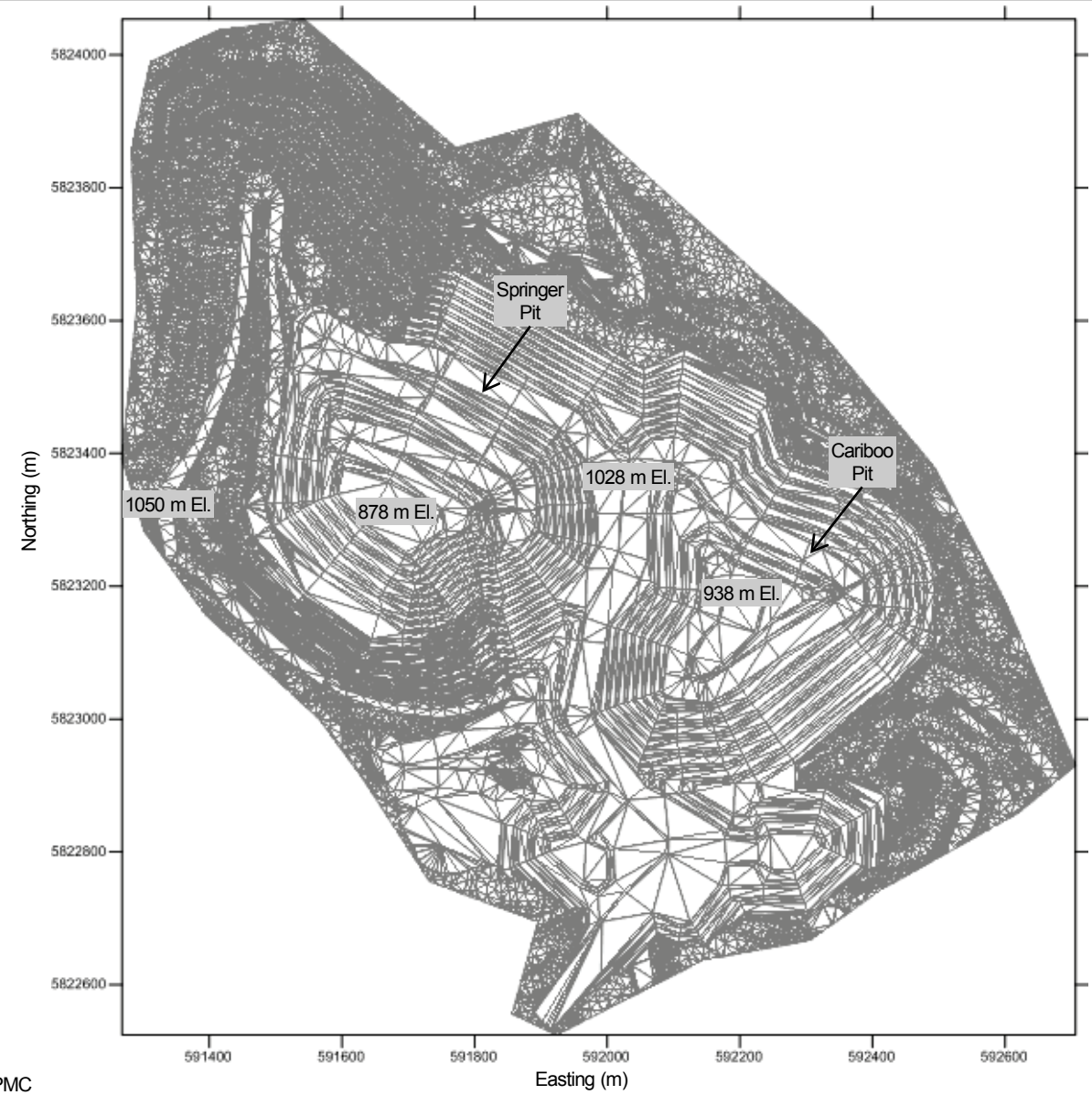

Notes:
AutoCad drawing was provided by MPMC in file Total Pit Walls - Cariboo-SP4.dxf

CLIENT
MOUNT POLLEY MINING CORPORATION
LIKELY, BC

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-29
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

TITLE
ULTIMATE CONFIGURATION OF SPRINGER PIT AND CARIBOO PIT

PROJECT No. **1411734** **16000** Rev. **0** **2**

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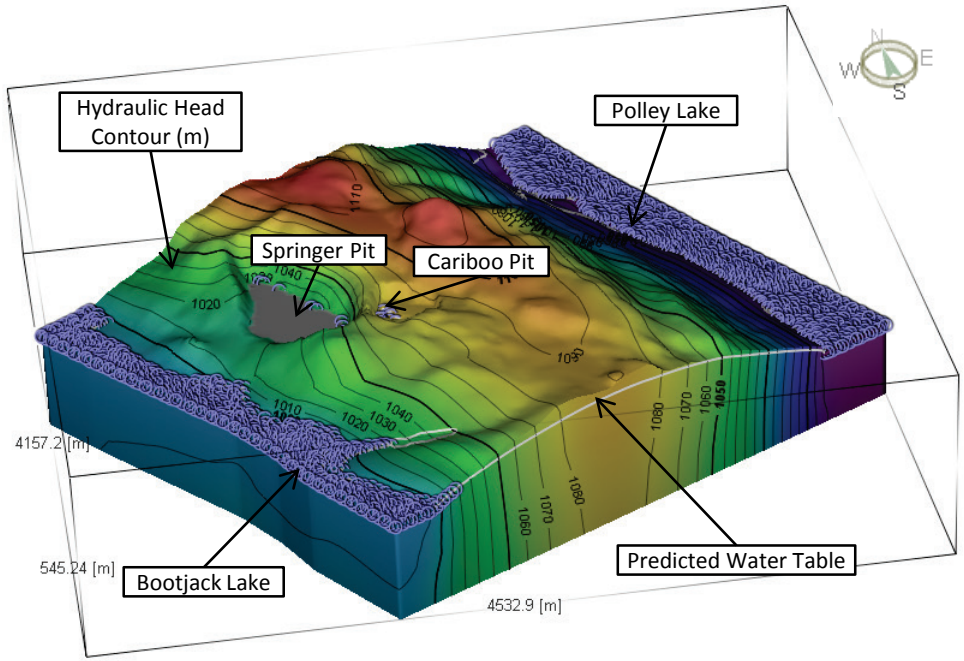

A. Oblique View Looking Northeast

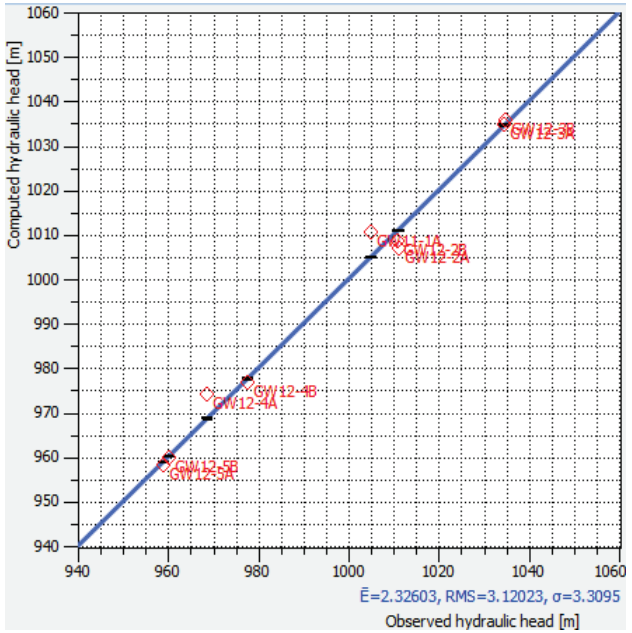

C. Comparison of Predicted vs. Observed Hydraulic Heads

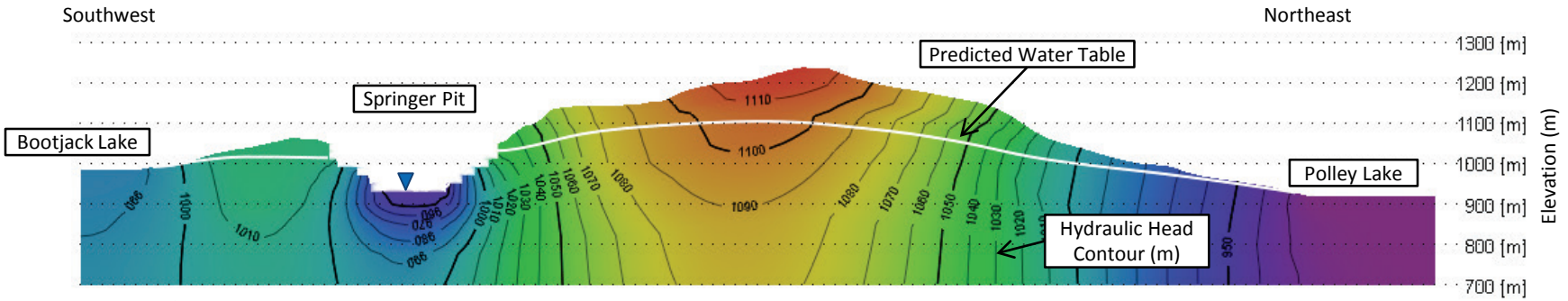

B. SW-NE Cross-section

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LIKELY, BC

CONSULTANT
Golder Associates

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

YYYY-MM-DD	2016-02-29
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

TITLE
HYDROGEOLOGICAL MODEL CALIBRATION MID-2014 DEWATERED CONDITIONS

PROJECT No. **1411734** **16000** Rev. **0**

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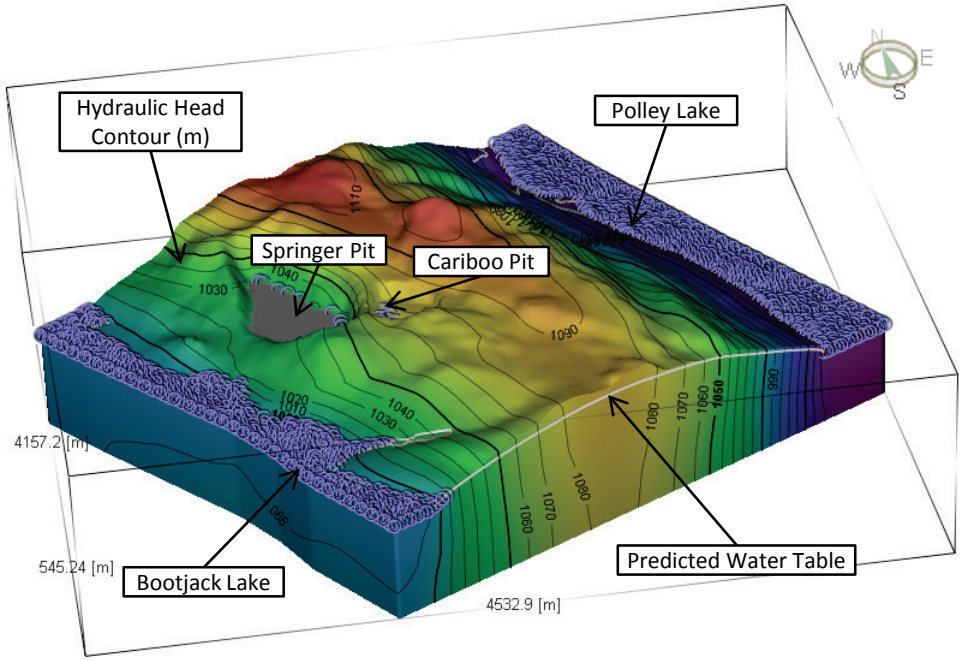

A. Oblique View Looking Northeast

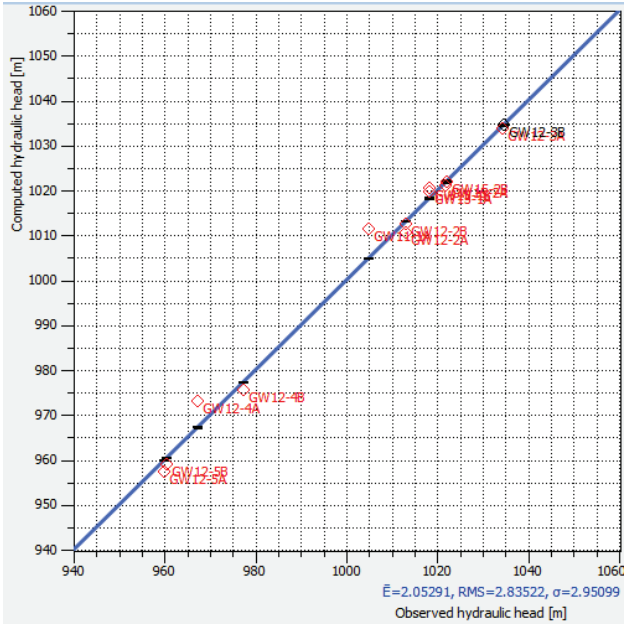

C. Comparison of Predicted vs. Observed Hydraulic Heads

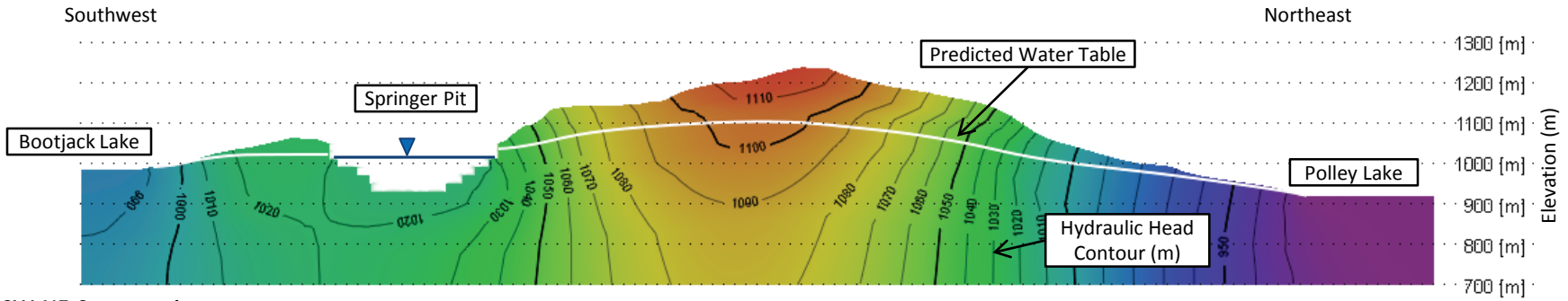

B. SW-NE Cross-section

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PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

TITLE
HYDROGEOLOGICAL MODEL CALIBRATION JULY 2015 PIT LAKE CONDITIONS

PROJECT No.		Rev.	
1411734	**16000**	**0**	**4**

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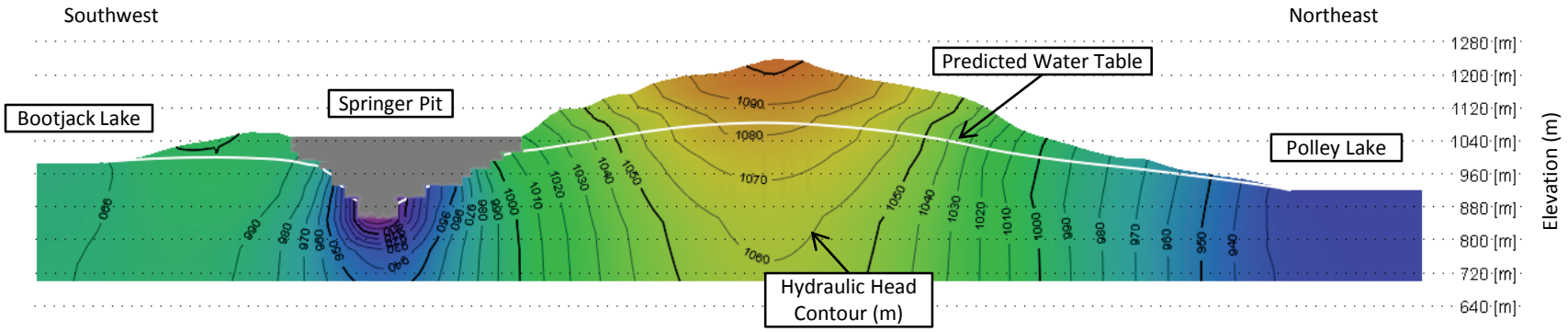

A. Open Pits Fully Dewatered (880 m Elevation)

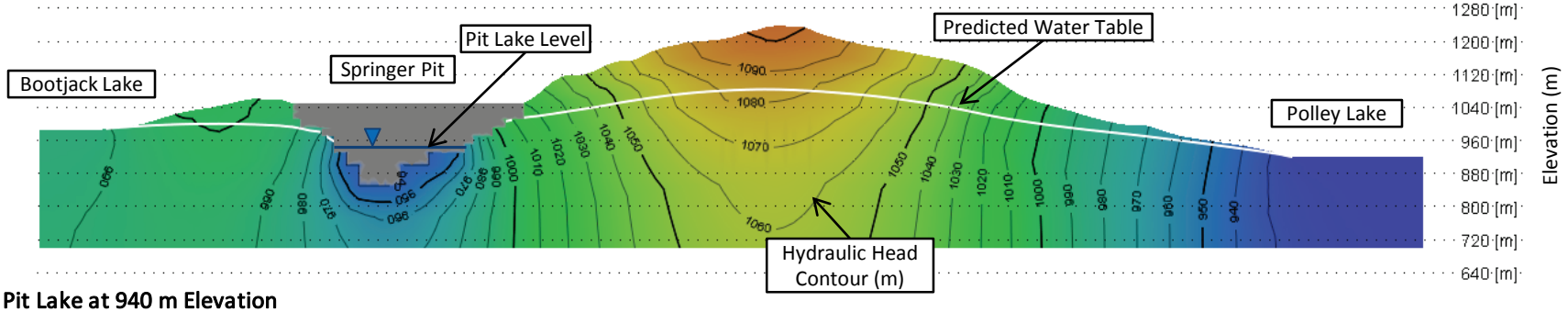

B. Pit Lake at 940 m Elevation

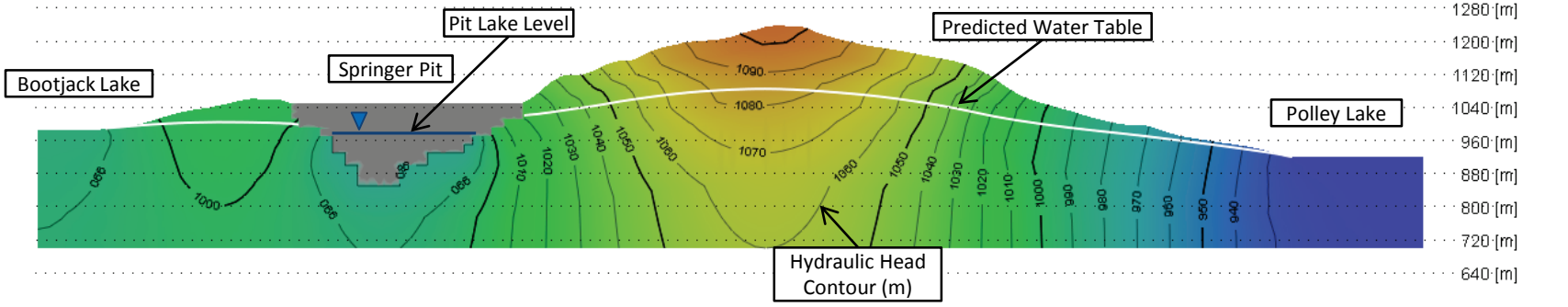

C. Pit Lake at 980 m Elevation

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DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

TITLE
PREDICTED HYDROGEOLOGICAL CONDITIONS – PIT LAKE LEVEL 880 M TO 980 M ELEVATION

PROJECT No.		Rev.	
1411734	**16000**	**0**	**5**

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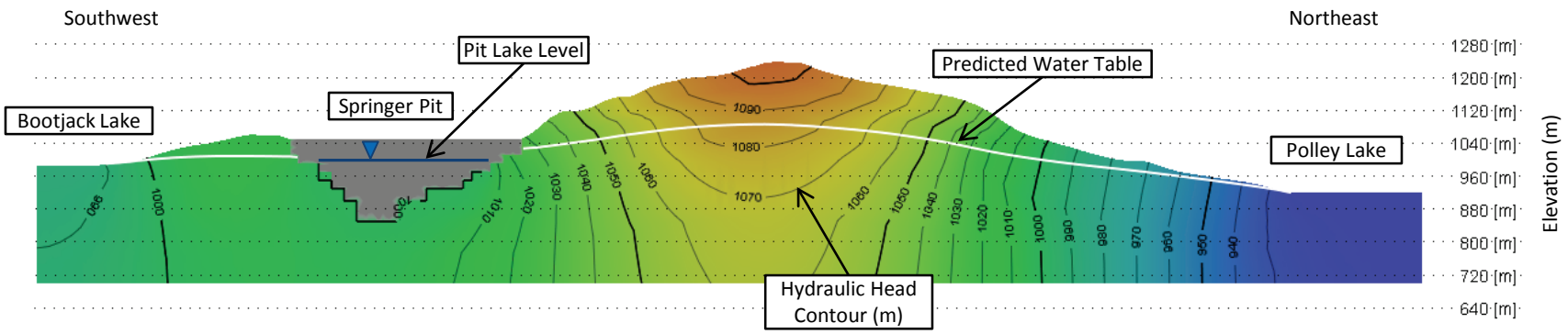

A. Pit Lake at 1000 m Elevation

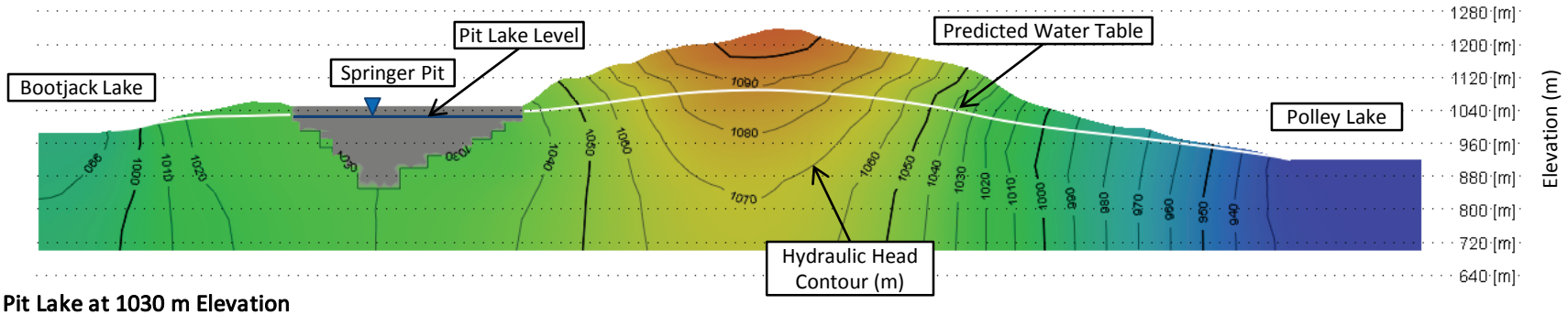

B. Pit Lake at 1030 m Elevation

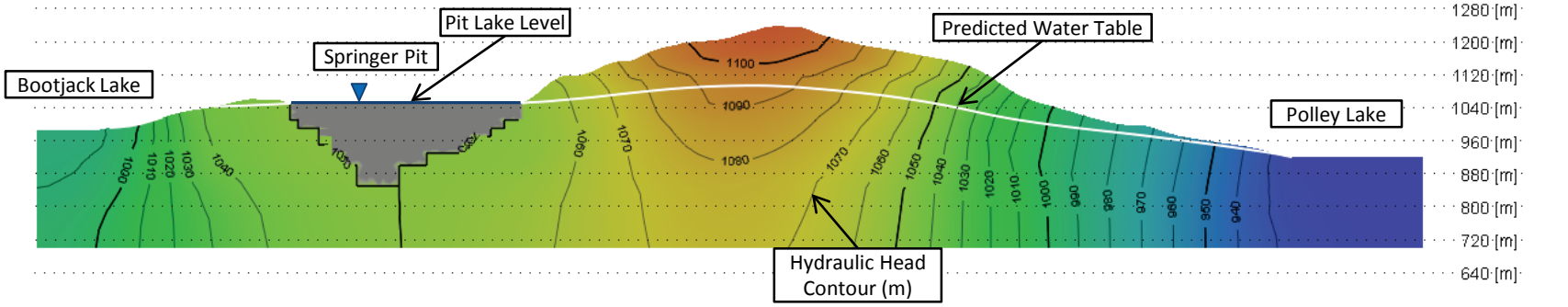

C. Pit Lake at 1050 m Elevation

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PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-29
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

TITLE
PREDICTED HYDROGEOLOGICAL CONDITIONS – PIT LAKE LEVEL 1000 M TO 1050 M ELEVATION

PROJECT No. **1411734** **16000** Rev. **0**

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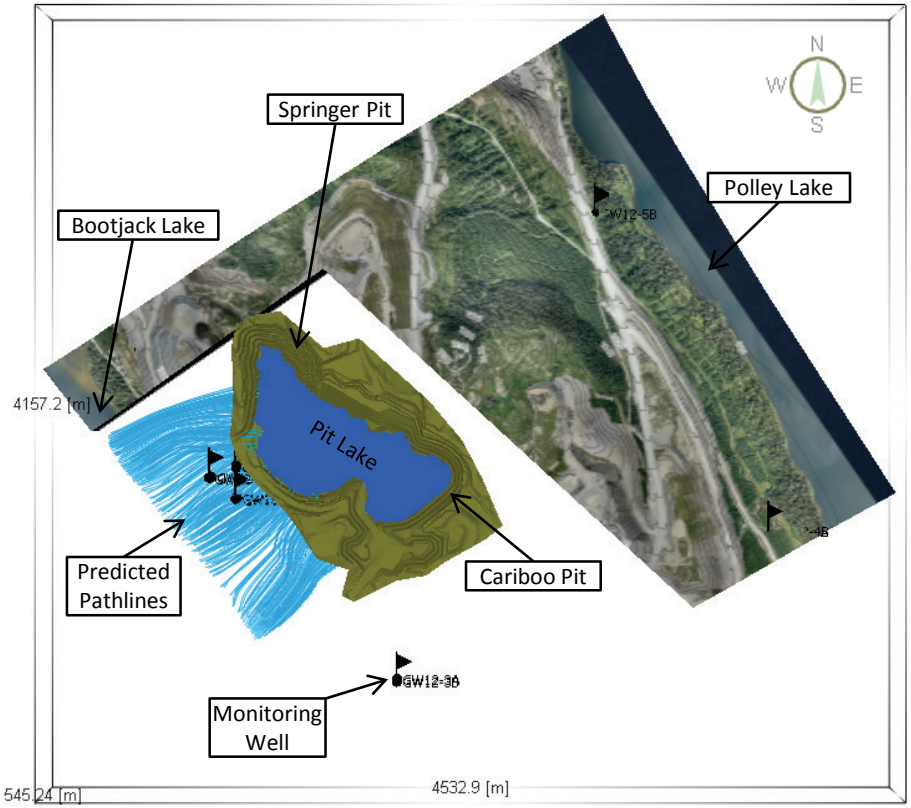

A. Map View

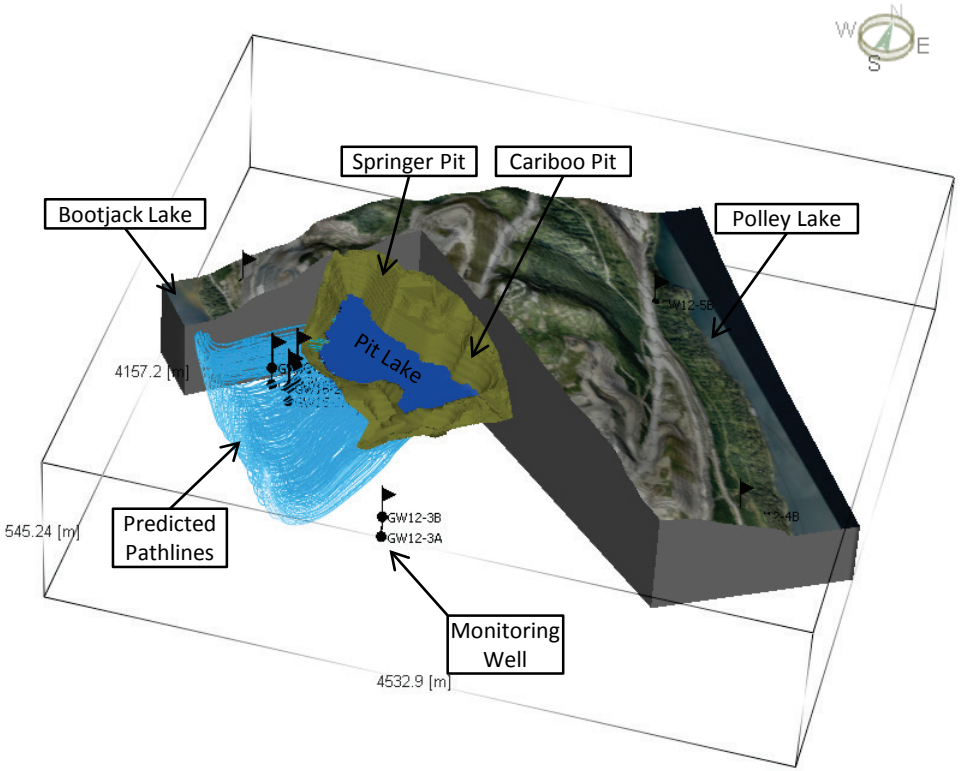

B. Oblique View Looking Northwest

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YYYY-MM-DD	2016-02-29
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

PROJECT
PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE SPRINGER AND CARIBOO PITS – LONG-TERM TAR

TITLE
PREDICTED SEEPAGE PATHWAYS FOR SPRINGER PIT AND CARIBOO PIT LAKE AT 1050 M ELEVATION

PROJECT No.		Rev.	
1411734	**16000**	**0**	**7**

Study Limitations

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Hydrogeologic/hydrologic investigations and groundwater modelling are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time, and in the sense that the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that groundwater systems are complicated beyond human capability to evaluate them comprehensively in detail, and we invariably do not have sufficient data to do so. A groundwater model uses the laws of science and mathematics to draw together the available data into a mathematical or computer-based representation of the essential features of an existing hydrogeologic system. While the model itself obviously lacks the detailed reality of the existing hydrogeologic system, the behaviour of a valid groundwater model reasonably approximates that of the real system. The validity and accuracy of the model depends on the amount of data available relative to the degree of complexity of the geologic formations, the site geochemistry, the fate and transport of the dissolved compounds, and on the quality and degree of accuracy of the data entered. Therefore, every groundwater model is a simplification of a reality and the models described herein are not an exception.

The professional groundwater modelling services performed as described in this document were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the quantity and quality of available data, the time limits and financial and physical constraints applicable to the services. Unless otherwise specified, the results of previous or simultaneous work provided by sources other than Golder and quoted and/or used herein are considered as having been obtained according to recognised and accepted professional rules and practices, and therefore deemed valid. This model provides a predictive scientific tool to evaluate the impacts on a real groundwater system of specified hydrological stresses and/or to compare various scenarios in a decision-making process. However and despite the professional care taken during the construction of the model and in conducting the simulations, its accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, expressed or implied, is made.

Appendix G
2022 Water Treatment Memo

TECHNICAL MEMORANDUM

DATE 21 December 2022 **Reference No.** 22514095-091-TM-Rev0-31715

TO Mathieu O'Leary
Mount Polley Mining Corporation

FROM Jesse Maddaloni and Darryl Howard **EMAIL Jesse.Maddaloni@wsp.com; Darryl.Howard@wsp.com**

WATER TREATMENT UPDATE TO MINE PLAN AND RECLAMATION PROGRAM UPDATE 2022 – MOUNT POLLEY MINE

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has developed a Mine Plan and Reclamation Program Update 2022 (herein referred to as the 2022 MRP) that is being submitted to the Ministry of Energy, Mines, and Low Carbon Innovation (EMLI) in compliance with the conditions outlined in the amendment to *Mines Act* Permit M-200. As required in the *Mines Act* Permit M-200 amendment, the 2022 MRP is being provided to EMLI as an update to the 2017 MRP. This technical memorandum provides an update on water treatment activities and progression since the 2017 MRP and discusses water treatment for the remaining operating phase of the mine as well as water treatment during closure/post-closure. The 2022 MRP incorporates the planned disturbance and corresponding reclamation requirements associated with continued mining until September 2024.

This water treatment update memorandum provides:

- A brief overview of the water management and treatment components that currently exist at the mine.
- Predicted and observed water quantity and quality design criteria for water treatment during operations and closure/post-closure.
- A summary the Best Achievable Technology (BAT) assessment previously completed for the mine and the associated technologies that are currently used for operations and considered for closure/post-closure.
- An update on work completed to investigate and advance various treatment technologies.
- An update on anticipated future work to support water treatment during closure/post-closure.

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2.0 MINE WATER MANAGEMENT SUMMARY

A network of channels, ponds, and pumping systems is operated by MPMC for managing surface water at the mine. Contact and non-contact water systems are managed with the objective of avoiding the mixing of these waters.

The non-contact water system includes channels to divert runoff from undisturbed catchments away from mine infrastructure. Contact water from within the mine site is actively managed using on-site water management infrastructure and conveyed to the Tailings Storage Facility (TSF) or to the Perimeter Embankment Till Borrow Pond (PETBP) for re-use as part of mine operations or for treatment through the Water Treatment Plant (WTP) and subsequent discharge through a pipeline to Quesnel Lake. The ability to cycle water through the mine mill and back to the TSF or PETBP allows mill components to provide lime pre-treatment for precipitation of metals (copper) when required.

The mine has a positive water balance, with discharge required during mine operations to prevent year-on-year accumulation of water. The only currently permitted discharge of treated contact water from site occurs through the existing WTP and the Quesnel Lake pipe and diffusers. Water management during operations will continue per the current water management infrastructure. The existing WTP (Actiflo patented high-rate ballasted coagulation and flocculation process, with lime pre-treatment as required) is considered the BAT for treatment and discharge through assumed future operations (Golder 2015).

The design capacity of the existing WTP is 0.23 m^3/s. Additional temporary treatment capacity of 0.05 m^3/s has been recently added in 2022 to assist in treating and discharging surplus contact water currently on-site (rental system of the same Actiflo technology). The allowable maximum annual discharge volume from site is currently 10.59 Mm^3/year (average of 0.33 m^3/s), as per Environmental Management Act (EMA) Permit 11678. The design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate).

The mine's water management plan assumes minimal storage of contact water on site, although during freshet (April through June) and extreme storm events, the volume of mine water runoff will exceed the discharge and treatment capacity, and temporary retention will be necessary to store water prior to discharge. Temporary water accumulation will occur in the TSF or in available pit volume(s). Temporary stored water will be discharged to the environment through the WTP following the freshet period or the storm event.

As the mine moves into closure and post-closure, the objectives of water management are to return the impacted land to pre-mining land functions. As the mine is constructed across a watershed divide, it is desired that during the post-closure period, drainages will be distributed back to their natural watersheds (i.e., to Bootjack Lake, Polley Lake, and Hazeltine Creek), provided that this can be achieved in an environmentally appropriate and permittable manner. MPMC has been proceeding with a program of evaluating and developing passive, semi-passive, and active water treatment technologies for their possible use during mine closure to support the goal of distributing discharge back into the pre-mining configuration. Two treatment options are considered the BAT for treatment during closure and post-closure: Option A – distributed passive/semi-passive treatment systems (applied to select sources), and Option B – pit-lake treatment followed by the centralized Actiflo plant (Golder 2016a). Option B is the current assumption for water treatment during closure/post-closure, but MPMC has also been progressing technology evaluations to support Option A.

3.0 WATER TREATMENT DESIGN BASIS

A Site-Wide Water Balance and Water Quality Model (SWWBM) was used to predict flow rates and water quality for mine contact water requiring treatment during operations, closure, and post-closure (Golder 2022a, Golder 2022b). The SWWBM uses a stochastic function to estimate the level of modeled precipitation. Out of 1,000 realizations, 90th percentile results represent the highest 10% of precipitation. The 90th percentile scenario was modeled for the remaining duration of the operational period, and the analysis showed that the existing WTP capacity provides sufficient treatment capacity for this period (Golder 2022a). For closure and post-closure, the model was again used to predict 90th percentile treatment flow rates for the period of 2025 to 2124. For the closure period of 2025 to 2034, results showed that an average treatment capacity of 0.19 m^3/s would be sufficient for the 90th percentile precipitation amount (Golder 2022a). For the post-closure period of 2035 to 2124, results showed than an average treatment capacity of 0.08 m^3/s would be sufficient for the 90th percentile precipitation amount (Golder 2022a).

3.1 Operations Water Quality

The SWWBM was used to predict water quality at the PETBP during operations (the current influent source to the WTP). Table 1 provides a list of constituents of interest determined following review of modeled water quality predictions during operations (Golder 2022b). Table 1 compares the current EMA Permit 11678 WTP discharge limits with the predicted 95th percentile parameter concentrations in the PETBP.

Table 1: WTP Influent Water Quality During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP 95th Percentile Predicted Concentrations
Major Ions			
Total Sulphate	mg/L	1,100	705
Nutrients			
Total Ammonia	mg/L (as N)	1.3	0.24
Total Nitrate	mg/L (as N)	34	21
Total Phosphorus	mg/L	0.09	0.04
Total Metals			
Arsenic	mg/L	0.028	0.002
Chromium	mg/L	0.004	0.001
Copper	mg/L	0.033	**0.273**
Iron	mg/L	1.0	0.62
Manganese	mg/L	3.4	0.70
Molybdenum	mg/L	0.36	0.19
Selenium	mg/L	0.075	**0.105**
Zinc	mg/L	0.059	0.019

Notes:

1) **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to be PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter.
2) The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 1 shows that total copper and total selenium are predicted to require treatment during operations. Total Suspended Solids (TSS), not listed in Table 1, is also required for treatment during operations. The existing WTP has been shown to effectively treat both TSS and total copper for the majority of operating conditions (discussed in more detail in Golder 2022c). WTP influent and effluent quality were assessed over six years between 2016 and 2021, showing effluent TSS consistently below permit limit and effluent total copper only occasionally above permit limit, with high influent copper instances managed through temporary WTP recirculation without discharge and a Trigger Response Plan (Golder 2022c).

Total selenium is modeled to require treatment during operations, as predicted by the 95th percentile PETBP concentration shown in Table 1. Even though predictions show that PETBP total selenium concentration could be above the permit limit, monitoring data has shown actual total selenium in the PETBP consistently below the permit limit (Golder 2022c). The water treatment system during operations has not required selenium treatment and it is not anticipated to require selenium treatment for the remainder of operations.

3.2 Closure/Post-Closure Water Quality

The SWWBM was used to predict water quality at the PETBP during closure/post-closure. The PETBP may not collect all treatment influent water in the final post-closure water treatment configuration (particularly if distributed treatment and discharge can be permitted), but collection to this location has been assumed for the purposes of the 2022 MRP as it represents the currently permitted system configuration. Table 2 provides a list of constituents of interest and the 95th percentile predicted concentrations in the PETBP during closure and post-closure (Golder 2022b). Table 2 also compares predicted PETBP water quality to MPMC's current EMA Permit 11678 WTP discharge limits. These WTP discharge limits have been assumed for closure/post-closure as they represent the currently permitted treatment requirements. Distributed treatment during closure/post-closure may discharge to different receiving environments with different discharge limits than the existing EMA Permit, but the current limits have been assumed for closure/post-closure for the purposes of the 2022 MRP.

Table 2: WTP Influent Water Quality During Closure/Post-Closure

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP 95th Percentile Predicted Concentrations – Closure	PETBP 95th Percentile Predicted Concentrations – Post-Closure
Major Ions				
Total Sulphate	mg/L	1,100	654	282
Nutrients				
Total Ammonia	mg/L (as N)	1.3	0.24	0.027
Total Nitrate	mg/L (as N)	34	19	5.2
Total Phosphorus	mg/L	0.09	0.036	0.036
Total Metals				
Arsenic	mg/L	0.028	0.0018	0.0019
Chromium	mg/L	0.004	0.0014	0.0018
Copper	mg/L	0.033	**0.3**	**0.17**
Iron	mg/L	1.0	0.68	0.23
Manganese	mg/L	3.4	0.75	0.23
Molybdenum	mg/L	0.36	0.17	0.074
Selenium	mg/L	0.075	**0.078**	0.033
Zinc	mg/L	0.059	0.014	0.0067

Notes:

1) **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to be PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter.
2) The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 2 shows that total copper and total selenium are predicted to require treatment during closure, with only total copper requiring treatment during post-closure. TSS, not listed in Table 2, is also required for treatment during closure/post-closure.

The assumed treatment system during closure/post-closure is pit-lake treatment followed by the centralized Actiflo plant (existing WTP), with the possibility of distributed passive/semi-passive treatment if systems are environmentally appropriate and permittable. TSS treatment is assumed to be required through closure and post-closure and will be achieved with the Actiflo plant. Total copper treatment is predicted to be required through closure and post-closure and will be achieved with a combination of the Actiflo plant (total copper removal through TSS removal), and future trimercapto-striazine trisodium salt (TMT) pre-treatment, if required (for dissolved copper precipitation).

Total selenium treatment is predicted to be required during closure, but not during post-closure. If required, the assumed method of selenium treatment is semi-passive pit-lake pre-treatment (active dosing of carbon source to pit-lake), followed by treatment by the Actiflo plant. It is not currently known whether selenium treatment will be required during the closure/post-closure phases, as existing monitoring data has consistently shown total selenium in site contact water to be below discharge limits. If selenium treatment is required, MPMC has been progressing the development of multiple treatment technologies that target selenium.

Details on modeled water quality concentrations for all parameters and various site locations (in addition to the PETBP) can be found in Golder 2022b.

4.0 WATER TREATMENT TECHNOLOGY DEVELOPMENT

MPMC has been progressing and evaluating multiple technologies to support the treatment of identified constituents of concern (COCs) and to support potential decentralized treatment and discharge during closure/post-closure. Various studies have been completed since 2017 to support these efforts as an important component of closure refinement. An inventory of treatment technologies and a summary of their development is presented in Table 3.

Good engineering practice typically requires a project to follow a standardized engineering design process for the selection and progressive refinement of the final project concept. A project progresses from a pre-concept phase for the identification of multiple treatment options, through concept, pre-feasibility, and feasibility phases to project execution. Generally, the engineering studies performed for each of these project phases are supported by test work that progresses from proof-of-concept and detailed bench-scale testing to pilot-scale and demonstration-scale test work. Some of the treatment technologies tested may not progress to the next stage of development. For example, a treatment technology may be eliminated if its treatment capacity is insufficient to treat the forecast volumes. This framework takes a staged approach, such that input assumptions, design, and cost for the total system can be refined as each stage is completed and the information that the plan relies on becomes more certain. This allows input assumptions to be less conservative as they become more accurate with accumulated knowledge. The technology development stages presented in Table 3 align with this approach. Additional details regarding this project development framework and how it aligns with the BC Ministry of Environment and Climate Change Strategy's BAT policy is provided in Golder 2020a.

This water treatment update technical memorandum assumes that the reader is familiar with the technologies in Table 3 and only provides updates on work completed by MPMC since 2017 to support the development of these technologies. Detailed descriptions of the technologies and associated process flow schematics can be found in Golder 2020a.

Table 3: Treatment Technology Inventory and Stage of Development

Technology / Stage of Development	Targeted COCs	Proof-of-Concept Bench-Scale Testing	Detailed Bench-Scale Testing	Pilot-Scale Testing	Demo-Scale Testing	Full-Scale Execution	Work Completed
Actiflo	TSS, total copper					→	Bench and full-scale testing.
Lime Treatment	Dissolved copper					→	N/A
TMT Treatment	Dissolved copper	→	→	→	→		Bench and full-scale testing. Toxicity evaluation.
Pit-Lake Treatment	Selenium, nitrate	→	→	→			Preliminary concept design and proof-of-concept bench-scale testing. Pilot-scale testing workplan.
Saturated Rock Fill (SRF)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, detailed bench-scale testing workplan (in progress), and long-term substrate leach testing. Wight Pit SRF assessments.
Packed Bed Reactor (PBR)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, and detailed bench scale testing workplan (in progress).
Biochemical Reactor (BCR)	Selenium, nitrate	—	—				Concept design and proof-of-concept bench-scale testing.
Submerged Sand Reactor (SSR)	Selenium, nitrate	—					Screening analysis.
Constructed Wetland Treatment (CWT)	Selenium, nitrate	→	→	→			Concept design, bench-scale testing, and on-site pilot scale testing (by others).

Implemented → Under Consideration → Eliminated/Paused —

4.1 Actiflo

Actiflo, the tradename of a technology supplied by Veolia, is the technology currently in use as the site's WTP and is considered the BAT for TSS removal during operations and closure/post-closure. The main targeted COC of this technology is TSS, with total copper removal also occurring via TSS removal. Polyaluminum chloride (PAC) is dosed into the influent water in the Actiflo process, which produces aluminum hydroxide precipitates that adsorb to copper complexes, thus removing copper during the solids-liquids separation step of the process. The Actiflo technology is currently implemented at full-scale on-site, as indicated in Table 3.

Concept design, bench-scale, and full-scale testing have been completed for the Actiflo technology, including assessment and optimization of PAC and various chelating agent dosages (including TMT) to assist copper removal (Golder 2016b, Golder 2017a, Golder 2018a, Golder 2019a, Golder 2019b, Golder 2020b).

Actiflo treatment is currently operating as the core component of the treatment system during operations and is currently assumed as the core component of treatment during closure/post-closure.

4.2 Lime Treatment

Active treatment with lime is currently in use at the site, where existing process plant infrastructure is used to raise contact water pH, resulting in the precipitation of metal hydroxides, particularly dissolved copper. The main targeted COC of this technology is dissolved copper. Lime treatment is currently implemented on-site, as indicated in Table 3, and used as a pre-treatment step of the Actiflo water treatment system to target dissolved copper removal. Use of this technology is well known to industry and technology development to support this has not been required.

Lime treatment, when required, is currently a component of the water treatment system during operations.

4.3 TMT Treatment

TMT is a chelating agent that aids with dissolved copper precipitation that allows copper treatment through TSS removal. The main targeted COC of this technology is dissolved copper.

Bench-scale test work completed showed that TMT is able to effectively precipitate dissolved copper (Golder 2016b, Golder 2017a, Golder 2018a) and the full-scale trials completed showed that the existing Actiflo treatment system was able to remove the copper bound with TMT to below the permit limit (Golder 2019a, Golder 2019b, Golder 2020b). Full-scale trials also showed that copper removal to lower concentrations (total copper <0.012 mg/L) was challenging for Actiflo with TMT treatment, not due to limitations in dissolved copper precipitation but due to limitations in TSS removal. TMT was effective in precipitating dissolved copper, but the Actiflo system was not effective in subsequently removing the precipitate to result in low effluent copper concentrations. The toxicity of TMT has also been evaluated and showed that its use would not result in an acutely lethal effluent (Golder 2018b).

TMT treatment is still being considered for full-scale implementation.

4.4 Pit-Lake Treatment

Pit-lake treatment targeting COCs of selenium and nitrate is an in-situ technology that requires nutrient and carbon source dosing to create conditions for biological treatment within the pit-lake.

A conceptual assessment of full-scale pit-lake selenium treatment was completed (Golder 2017b) and the technology was deemed a cost-effective approach to managing selenium and was recommended for further bench and pilot-scale testing. Proof-of-concept bench-scale testing for pit-lake selenium treatment was also completed and showed effective removal of selenium and nitrate, with further pilot-scale testing recommended (Golder 2019c). A pilot-scale study for pit-lake treatment was designed for Cariboo Pit (Golder 2020c), but the pit is being dewatered to support future mining activities and this work has not yet been completed.

Pit-lake treatment targeting selenium and nitrate is still being considered for full-scale implementation and is currently assumed as part of the treatment system during closure/post-closure if required.

4.5 Saturated Rock Fill (SRF)

SRF treatment is a fixed-film anaerobic system targeting the treatment of selenium and nitrate and ideally utilizes a mined-out open pit as a bioreactor operated in a horizontal flow configuration.

A concept study for SRF treatment was completed (Golder 2020d) and SRF was recommended for further bench-scale and pilot-scale testing. Proof-of-concept bench-scale testing for SRF was also completed (Golder 2021), which showed effective removal of selenium and nitrate, but also indicated metal leaching. Detailed bench-scale testing and waste rock SRF substrate metal leach testing was recommended following completion of the proof-of-concept work. Bench-scale leach testing using anticipated SRF substrate waste rock from site was completed (Golder 2022d – draft RevA), which monitored leached metals over a long-term test period of 52 weeks. Results showed that metal leaching varies over time and differs between metals and must be considered during the start-up phase of SRF implementation (and may lead to additional required polishing treatment steps downstream of the SRF). Detailed bench-scale testing for SRF has been proposed for 2023 and a test plan has been submitted in draft to MPMC (Golder 2022e – draft RevA). Geotechnical and geochemical substrate characterization for SRF media waste rock is currently ongoing and anticipated for completion in 2023. It is anticipated that geochemical substrate characterization will be conducted by MPMC's geochemical consultant SRK.

SRF treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive treatment of selenium and nitrate during closure/post-closure if required.

4.6 Packed Bed Reactor (PBR)

PBR treatment is another fixed-film anaerobic system targeting the treatment of selenium and nitrate. PBR treatment differs from SRF treatment through the use of a vertical flow (top to bottom) reactor.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and PBR treatment was shown to be effective in reducing selenium and nitrate. Further detailed bench-scale and pilot-scale testing was recommended following completion of the initial testing. Detailed bench-scale testing for PBR has been proposed for 2023 and a test plan has been submitted in draft to MPMC (Golder 2022f – draft RevA).

PBR treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive distributed treatment of selenium and nitrate during closure/post-closure if required.

4.7 Biochemical Reactor (BCR)

BCR treatment is another fixed-film anaerobic treatment technology that consists of a lined pond filled with a submerged organic substrate media mix. The main targeted COCs of this technology are selenium and nitrate. BCR treatment is passive and does not involve continuous dosing of a carbon source to the media bed.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and BCR treatment was shown to be effective in reducing selenium and nitrate, but redox sensitive metals were present in the BCR effluent.

Upon review of the BCR technology in comparison to other passive and semi-passive technologies, MPMC decided to not proceed with further development of this technology (MPMC 2021) for the following reasons:

- Limited lifespan of BCR passive treatment systems based on the availability of a carbon source that is encapsulated in the system during construction – this needs to be replaced periodically at significant cost.
- Emission of elevated levels of biochemical oxygen demand (BOD) from the system during commissioning and start-up of operation that exceed standards for discharge to the environment.
- Persistent emission of phosphorus from the BCR during operation that will likely exceed plausible standards for discharge to the environment.

BCR treatment is no longer being developed as a passive treatment technology option during closure/post-closure.

4.8 Submerged Sand Reactor (SSR)

SSR is similar to other anaerobic reactor technologies, with the use of the existing tailings as media for the bioreactor. The main targeted COCs of this technology are selenium and nitrate.

A concept study was completed for SSR (Golder 2020d), as well as proof-of-concept bench-scale testing (Golder 2019d). Use of MPMC tailings as SSR bioreactor media or use of the site's TSF as an in-situ SSR was not recommended for further investigation. Bench-scale testing resulting in metal release in the reactor effluent when using site tailings as the reactor media. The concept study also concluded that further investigation of SSR was not warranted, based on a review of literature, an evaluation of historical water quality monitoring data, and an evaluation of the feasibility of utilizing the TSF from a hydrogeological and permitting perspective.

SSR treatment is no longer being developed as a treatment technology option during closure/post-closure.

4.9 Constructed Wetland Treatment (CWT)

MPMC retained Ensero Solutions Inc. (Ensero), formerly known as Contango Strategies Ltd., to conduct a detailed assessment and evaluation of the feasibility of a CWT system for passive/semi-passive treatment during closure/post-closure. The main targeted COCs of this technology are selenium and nitrate.

Pilot-scale design, sizing, and testing for CWT was completed by Ensero (Ensero 2020), and the technology demonstrated promising results for treatment of targeted COCs; however other passive/semi-passive technologies have indicated improved treatment capability in comparison. MPMC may choose to proceed with demonstration-scale on-site testing of CWT once the pilot-scale results have been fully understood and if the performance of competing technologies (SRF and others) indicates an advantage for CWT.

CWT is still being evaluated for full-scale implementation and is currently considered a technology option for passive/semi-passive and distributed treatment of selenium and nitrate during closure/post-closure if required.

5.0 ANTICIPATED FUTURE WORK

The existing and assumed water treatment systems for operations, closure, and post-closure have been outlined in this memorandum; however, changes may still be implemented during all phases of the mine as knowledge and needs evolve. The water treatment system for closure/post-closure will continue to develop in more detail as MPMC better understands technology capabilities and refines their final approach to water treatment for the closure period.

Table 3 provides a summary of the development stage of the treatment technologies implemented or being considered for operations, closure, and post-closure. Future work is anticipated for any technology still under consideration that has not achieved full-scale implementation. The following items describe the priority treatment work anticipated over approximately the next three years, but do not exhaustively describe all potential remaining work for technologies still under consideration:

- Actiflo technology is a component of the operations and closure/post-closure BAT and a main component of the existing treatment system during operations and assumed treatment system during closure/post-closure. Further development of the technology is anticipated with respect to PAC and TMT usage, as well improving the solid-liquid separation in the process to address potential high-copper instances. Several recommendations for future system improvements have been outlined in Golder 2020b, including supporting bench-scale and field trials. Recommendations are mainly focused on improving removal of particulate copper from the WTP effluent and improving the effectiveness of PAC and TMT use.
- Pit-lake treatment is currently assumed as a component of the closure/post-closure treatment system. Pilot-scale pit-lake work was anticipated for Cariboo pit, but recent mine operational changes have resulted in the draining of both Springer and Cariboo pits and pit-lake treatment trials are no longer feasible at these locations. Operational changes have also resulted in Wight pit being filled. The previous pilot-scale study designed for Cariboo pit (Golder 2020c) could be redesigned for Wight pit if operational conditions in the near future are deemed appropriate, further advancing the development of this technology.
- Two options exist as the BAT for treatment during closure/post-closure: distributed passive/semi-passive treatment systems, and pit-lake treatment followed by the centralized Actiflo plant. Golder has proposed to undertake a treatment option life cycle cost comparison study between the two options, informed by the knowledge gained during recent technology development, to assess pros/cons and capital and operating costs between the options and inform future treatment program development decisions.
- SRF and PBR detailed bench scale testing have been proposed to MPMC and this work is expected for completion in the near future to continue the development of these technologies.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this memorandum. We trust that the information provided herein is sufficient for your needs at this time. If you have any questions or need additional information, please do not hesitate to contact us.

Golder Associates Ltd.

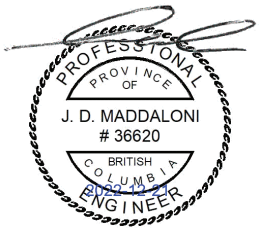



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Appendix H
2022 Water Balance Model Update

TECHNICAL MEMORANDUM

DATE 22 December 2022 **Reference No.** 22514095-089-TM-Rev0-31715

TO Matt O'Leary
Mount Polley Mining Corporation

FROM Stella Cheng, John Diiwu and Gonzalo Donoso **EMAIL Stella.Cheng@wsp.com; John.Diiwu@wsp.com; Gonzalo.Donoso@wsp.com**

MOUNT POLLEY MINE WATER BALANCE MODEL – RECLAMATION AND CLOSURE

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained Golder Associates Ltd., a member of WSP (WSP Golder) to update the Site Wide Water Balance Model (SWWBM) to support the water management information requirements for the Five Year Mine Reclamation and Closure Plan. This exercise is a requirement outlined in MPMC's Ministry of Energy, Mines and Low Carbon Innovation (EMLI) Mines Act Permit M-200 (amended 10 December 2020).

The SWWBM was developed using GoldSim™, a highly graphical software for carrying out dynamic, probabilistic simulations to support decision-making (GoldSim 2018). GoldSim™ is frequently used to evaluate water management alternatives, perform sensitivity analyses, and conduct mass balance simulations.

The SWWBM was developed as part of the Mount Polley Mine Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water management across the site. The details of the SWWBM are described in the Mount Polley Mine Water Balance Report (Golder 2016b). The SWWBM was updated in the Water Management Plan that addresses water management through future operations (Golder 2020).

The SWWBM in this exercise was updated to include the closure and post-closure phases for the period of 1 September 2024 to 1 September 2124. The updated SWWBM simulates the site water circuitry (the logic driving water transfers, discharges, and flows on site) during the closure and post-closure phases. The closure phase is planned to commence on 1 September 2024 and will include closure and reclamation activities as identified in the Mine Reclamation and Closure Plan Update. The post-closure phase is assumed to commence on 1 September 2034 and extends, for the purposes of this analysis, to 2124.

This technical memorandum presents the updates made to the SWWBM for consistency with the remaining currently permitted mine plan and the proposed closure configuration. Included herein is a summary of the model updates, the assumptions made for the five year mine and reclamation plan, the model inputs, and a discussion of the model results.

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2.0 MODEL UPDATE

This section describes the implementation of updates to reflect the currently approved mine plan and the closure configuration, and the model inputs for the SWWBM during the closure and post-closure phases.

2.1 Summary of Model Updates

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). The SWWBM was originally developed for the TAR to support the effects predictions in the Mount Polley Mine Long Term Water Management Plan (Golder 2016a) for the mine and has since been calibrated on an annual basis (refer to Golder 2022 for 2021 annual calibration). The SWWBM was updated to include the closure and post-closure phases for the period of 1 September 2024 to 1 September 2124. The model updates were as follows:

- Included a closure phase extending from 1 September 2024 to 31 August 2034.
- Included a post-closure phase commencing on 1 September 2034 and extending, for the purposes of this analysis, to 2124.
- Updated the SWWBM with the currently approved mine plan.
- Updated flows for the closure configuration, including discharges to the environment and the transfer flows.
- Added the combined Springer-Cariboo Pit (Springer Pit and Cariboo Pit will combine into one pit in the closure phase), including updated stage storage curve and updated direct precipitation, runoff and groundwater inflows from 1 September 2024 based on the Springer-Cariboo Pit closure design surface provided by MPMC.
- Added configuration of the TSF to reflect a 970 m dam crest elevation for the purpose of closure phase modelling.
- Updated climate inputs according to the Climate Baseline Update Report (Golder 2022).
- Added climate change scenarios.

2.2 Model Scope and Flow Diagram

The scope and structure of the SWWBM is outlined in the conceptual flow diagrams for assumed closure phase and post closure phase in Figure 1 and Figure 2, respectively. The flow diagrams illustrate the water circuit system at the Mine, including the storage and conveyance of water. A description of the model flows is provided in Attachment A. The water management infrastructure within the SWWBM for the closure and post-closure phases are summarized in Table 1. The flow types that are programmed into the SWWBM are outlined in Table 2.

Table 1: Water Management Infrastructure for Closure and Post-closure

Ditches	Sumps and Ponds
▪ Long Ditch ▪ SERDS Ditch	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ TSF ▪ PETBP ▪ CCS ▪ Bootjack Creek Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9k Sump ▪ Springer-Cariboo Pit ▪ Wight pit sump ▪ Boundary pit

Source: Golder 2017

SERDS = Southeast Rock Disposal Site; CCS = Central Collection Sump; NW = Northwest; TSF = Tailings Storage Facility; PETBP = Perimeter Embankment Till Borrow Pond.

Table 2: Types of Flows Represented in the SWWBM for Closure and Post-closure

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows) ▪ Groundwater flows	▪ Open water evaporation ▪ Transfer flows (gravity flows between facilities) ▪ Pumped flows between facilities ▪ Groundwater flows ▪ Overflows

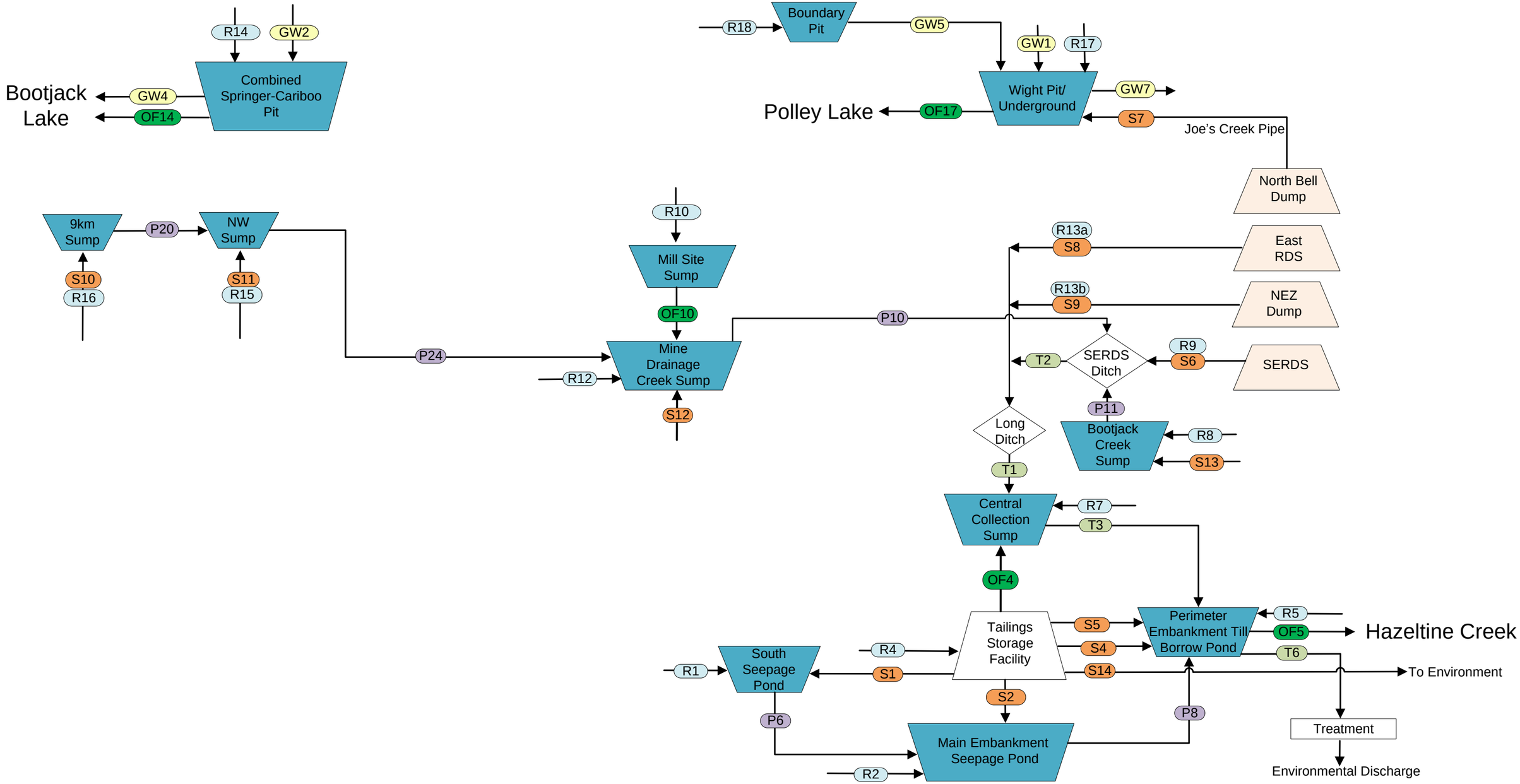

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)

Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	14 December 2022
CHECKED	GD
DATE	14 December 2022
SCALE	Not to Scale
PROJECT No	22514095/31700
FIGURE No	1
REV No	0

TITLE

Site Wide Water Balance
Closure Phase
1 September 2024 – 31 August 2034

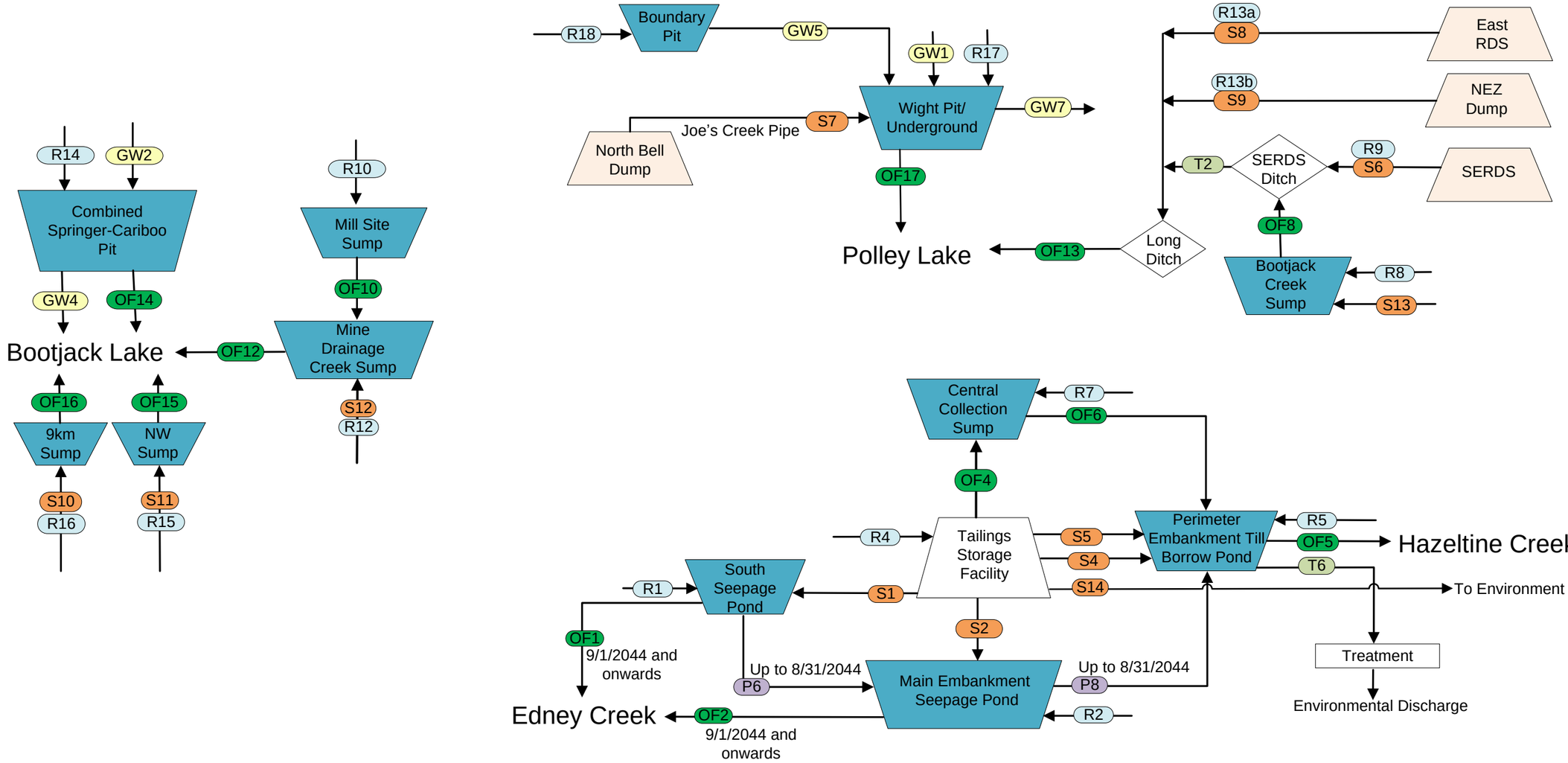

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 14 December 2022

CHECKED: GD
DATE: 14 December 2022

SCALE: Not to Scale
PROJECT No: 22514095/31700

TITLE

Site Wide Water Balance
Post-closure Phase
1 September 2034 Onwards

FIGURE No: 2
REV No: 0

2.3 Key Input Parameter Values and Assumptions

Key initial parameter values and assumptions for the closure phase model simulations are presented in Table 3.

Table 3: Key Initial Parameter Values and Assumptions for Closure Phase

Parameter	Value	Notes
Spillway Invert Elevation	965.7 masl	Deposition of tailings in the TSF is assumed to be complete.
Initial Springer-Cariboo Pit Water Volume	0 m^3	Combined Springer-Cariboo Pit assumed to be empty at the start of the closure phase.
PAG Waste Rock Void Ratio	0.33	PAG waste rock is stacked uniformly to an elevation of 1,004 masl in the base of the Springer-Cariboo Pit, and no water is stored within the pit.
Initial TSF Volume	264,102 m^3	Assumes that at the end of the operations, the TSF pond is drained to the spillway invert elevation.
Initial Boundary Pit Water Volume	1,601 m^3	Arbitrarily assumed. There is no plan to dewater this pit.
Initial Wight Pit Water Volume	0 m^3	Pit is assumed to be empty at the start of the closure phase.
Initial 9K Sump Water Volume	100 m^3	Arbitrarily assumed.
Initial NW Sump Water Volume	100 m^3	Arbitrarily assumed.
Initial South Seepage Pond Water Volume	100 m^3	Arbitrarily assumed.
Snowpack	Stochastically generated	The summation of precipitation depths for December, January, and February (3 months).

3.0 MODEL INPUTS

3.1 Climate Inputs

Climate datasets are used in the SWWBM to run various deterministic and stochastic scenarios. The climate datasets were derived from local and site-based climate stations as described in Mount Polley Mine Climate Baseline Update (Golder 2022).

3.1.1 Deterministic Climate Inputs

The model features a deterministic simulation mode, where two climate scenarios have been predefined, based on long-term Environment and Climate Change Canada and local data:

- Average annual precipitation data: The associated annual precipitation is repeated for each year of the simulation period. Annual average lake evaporation is assumed, and snowpack is accumulated within the model based on the assumption that snow accumulates from December to February, with 5%, 90%, and 5% of the accumulated snowpack melting in March, April, and May, respectively.

- Climate change: An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 9 climate models and 2 emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the Goldsim model) was used to extend these projections from the year 2100 to 2200 by resampling monthly data from 2071 to 2100 projections and relating projected changes in temperature and precipitation climate variables to a set of extended greenhouse gas concentration pathways beyond the year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emission scenarios using a range of values. The mean and upper bound results have been included in the deterministic simulation mode of SWWBM to analyze the potential effects of climate change. Lake evaporation, snow accumulation and snowmelt are calculated in the same way as for the average climate scenario.

3.1.2 Stochastic Climate Inputs

GoldSim™ has stochastic elements, allowing uncertainty to be represented in model input data. GoldSim™ uses the Monte Carlo method to sample stochastic elements for probabilistic simulations. A stochastic generator is included in the model to probabilistically simulate natural climatic variation at the mine. The stochastic generator operates on a monthly basis and generates random sequences of monthly precipitation over the simulation period; one such random sequence over the simulation period is called a “realization”. Stochastic climate input is used to model a wide range of precipitation inputs and acts as a sensitivity analysis that can be easily viewed as results in the form of percentile values.

To simulate stochastic conditions, monthly precipitation data were fitted to a log-normal probability distribution. A probability distribution is a mathematical representation of the relative likelihood of an uncertain variable having specific values; all distribution types use a set of arguments to specify the relative likelihood for each possible value. The arguments for log-normal distribution are the dataset’s mean and standard deviation. The mean and standard deviation for the monthly precipitation values are shown in Table 4.

Table 4: Stochastic Climate Generator Log-Normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the normal distribution of the dataset. The stochastic generator was set to perform 1000 realizations to create a sample size that was sufficiently large to account for a range of conceivable monthly climatic precipitation scenarios for the study period. The probabilistic results from each realization were compiled to generate percentile values, the value below which a certain percentage of the realizations occur. For example, the 90th percentile is the value for which 90% of the realizations are equal to or less than. Conversely, 10% of the realizations are greater than this value.

3.2 Hydrology Inputs

The following sections describe the hydrologic processes and inputs used in the closure and post-closure phases.

3.2.1 Runoff Parameters

Runoff for closure and post-closure phases in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)** – mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)** – highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 5.

Table 5: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020.

3.2.2 Catchment Areas

The catchment areas for each storage element included within the SWWBM are unchanged from the TAR (Golder 2016a) and are shown in Table 6.

Table 6: Catchment Areas for SWWBM Storage/Conveyance Elements for Closure and Post-closure

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF upstream catchment (external)	622,800
TSF impoundment catchment (internal)	2,269,700
PETBP	524,300
CCS	438,600
Bootjack Creek Sump	175,200
SERDS Ditch	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Springer-Cariboo Pit	1,974,000
NW Sump	330,200
9K Sump	698,800
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

Source: Golder 2016a

3.3 Storage Capacities

Free water volumes in storage ponds, sumps, and tailings facilities depend on a balance between inflows and outflows. The stage (water elevation) can be directly correlated to a specific storage volume using site bathymetric (sub-aqueous surface) and topographic (land surface) data. These relationships are referred to as stage storage curves.

Stage storage curves were used for the following major storage elements:

- Combined Springer-Cariboo Pit (closure design surface from MPMC).
- TSF (step 15 of 2% slope tailings deposition plan from 2017 Closure and Reclamation Mount Polley Mine Water Balance Model [Golder 2017]).
- Wight Pit (13 January 2022 bathymetric survey).

Dynamic storage facilities such as the TSF (tailings deposition changes the available storage) require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. An updated stage storage curve for the TSF up to a dam crest elevation of 970 m for the closure and post-closure phases was not available at the time of writing of this technical memorandum; therefore, the start of closure stage storage curve estimated in the 2017 Closure and Reclamation Mount Polley Mine Water Balance Model (Golder 2017) was used in this analysis.

The estimated volume capacities for the facilities listed above are presented in Table 7.

Table 7: Maximum Capacities for Major Storage Facilities

Storage Facility	Estimated Capacity ($M\text{-}m^3$)
Springer-Cariboo Pit Final Mine-Out (Phase 4 – M-200 Permitted Mine Plan)	30.3
TSF – Final Layout	0.26
Wight Pit	3.8

3.4 Discharge Locations

During the closure phase, Springer-Cariboo Pit and Wight Pit are allowed to discharge surface water flows directly to the environment. Outside of the TSF, surface water flows will either flow or be pumped to SERDS/Long Ditch, which flows to Central Collection Sump (CCS). Water from CCS reports by gravity to Perimeter Embankment Till Borrow Pond (PETBP) where it will be treated and discharged. Water from TSF will be pumped to CCS for treatment prior to discharge. Water from South Seepage Pond and Main Embankment Seepage Pond will be pumped to PETBP for treatment before discharge to the environment.

During the post-closure phase, surface water flows outside of the TSF will directly flow to the environment. Water from South Seepage Pond and Main Embankment Seepage Pond will continue be pumped to PETBP for the first 10 years of the post-closure phase, South Seepage Pond and Main Embankment Seepage Pond will be allowed to discharge to the environment directly starting from 10 years after the post-closure phase. Water treatment and discharge at the mine is decentralized with flows discharging to the environment during the post-closure phase as listed in Table 8.

Table 8: Discharge Locations during Post-closure Phase

Water Management Infrastructure	Discharge Destination
Wight Pit	Polley Lake
SERDS/ Long Ditch	
Perimeter Embankment Till Borrow Pond	Hazeltine Creek
Main Embankment Seepage Pond	Edney Creek
South Seepage Pond	
9K Sump	Bootjack Lake
NW Sump	
Springer-Cariboo Pit	
Mine Drainage Creek Sump	

4.0 MODEL SCENARIOS AND SUMMARY OF RESULTS

Two SWWBM modules were developed to evaluate the simulated water storage time-series for TSF and the pit lakes, and flow time-series from the individual mine catchments during the closure and the post-closure phases.

- **Base case module** – reflects the closure and post-closure plan for the Project with stochastically generated mean monthly precipitation depths. The base case module was run stochastically for 1000 realizations to present the model results for the mean, the 90th, and the 99.5th percentiles. The probabilistic results can be considered equivalent to extreme climate scenarios: 90th percentile equivalent to 1:10-year (10% probability of exceedance) and 99.5th equivalent to 1:200-year (0.5% probability of exceedance) climate scenarios, respectively.
- **Climate change module** – deterministic module (Section 3.1.1), using the mean and the upper bound of precipitation inputs from 9 climate models and 2 emissions scenarios (SSP2-4.5 and SSP5-8.5).

The following sections present the model results from the base case and climate change modules.

4.1 Base Case Results

4.1.1 TSF

At the end of operations, a spillway will be constructed at the north abutment (Corner 5) of the TSF at an elevation of 965.7 masl, which is 4.3 m below the TSF embankment crest at 970 masl. Water will discharge from the TSF and flow to the PETBP for treatment, if necessary, prior to discharge to Hazeltine Creek. During the closure and post-closure phases, the TSF pond volume will vary seasonally, limited by the spillway invert to a maximum of approximately 260,000 m^3 (Figure 3).

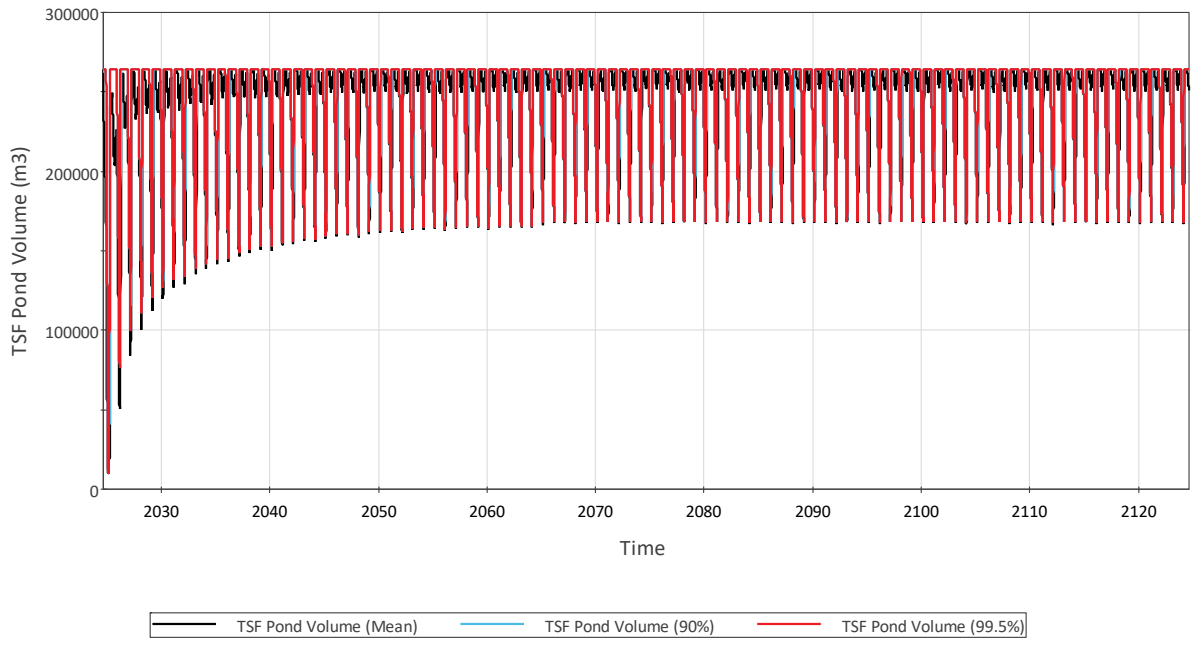

Figure 3: TSF Pond Volume during Closure and Post-closure

4.1.2 Pit Lakes

The formation of pit lakes in the combined Springer-Cariboo Pit, the Boundary Pit, and the Wight Pit were also assessed during closure and post-closure. The simulations consider direct rainfall and runoff, groundwater seepage in and out of the pits, and evaporation losses.

4.1.2.1 Springer-Cariboo Pit Lake

A result comparison between different climate conditions for Springer-Cariboo Pit Lake volume during closure and post-closure is provided in Figure 4. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2028 under each of the climate conditions simulated. Under the mean condition, the combined Springer-Cariboo Pit Lake is estimated to start overflowing in 2054, while under the 90th percentile condition it is estimated to start overflowing in 2050, and in 2049 under the 99.5th percentile condition.

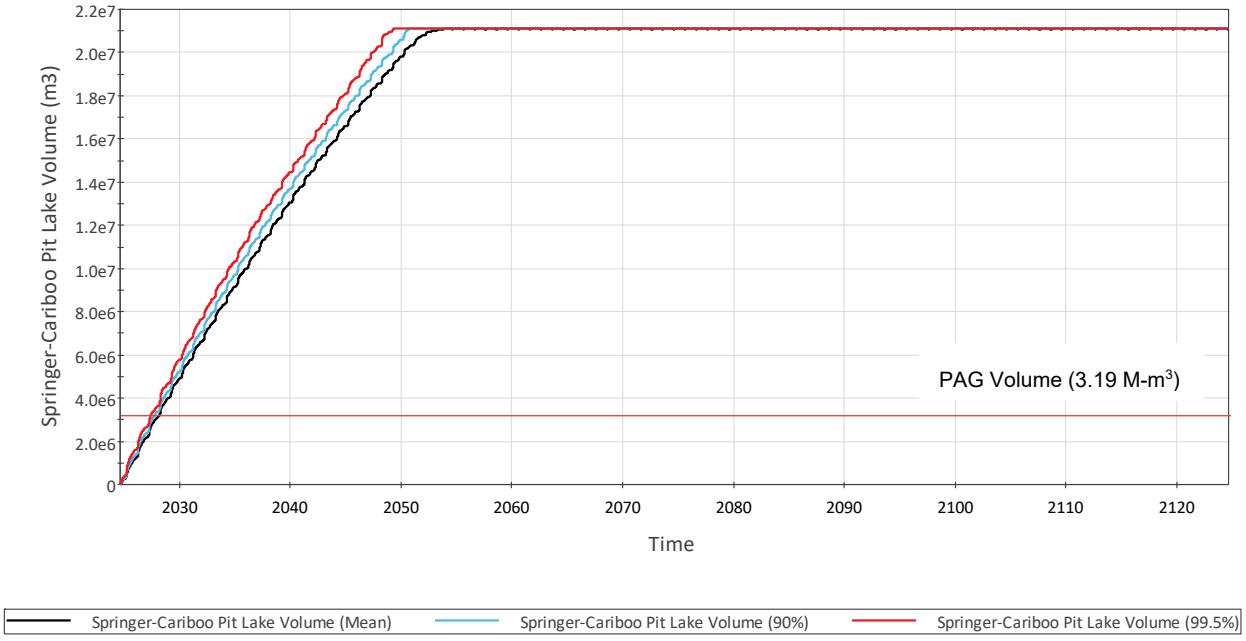

Figure 4: Combined Springer-Cariboo Pit Lake Volume during Closure and Post-closure

4.1.2.2 Wight Pit Lake

The Wight Pit Lake is projected to start overflowing in 2028 under the mean, 90th percentile, and 99.5th percentile climate conditions (Figure 5). Overflow from the Wight Pit Lake will discharge to Polley Lake.

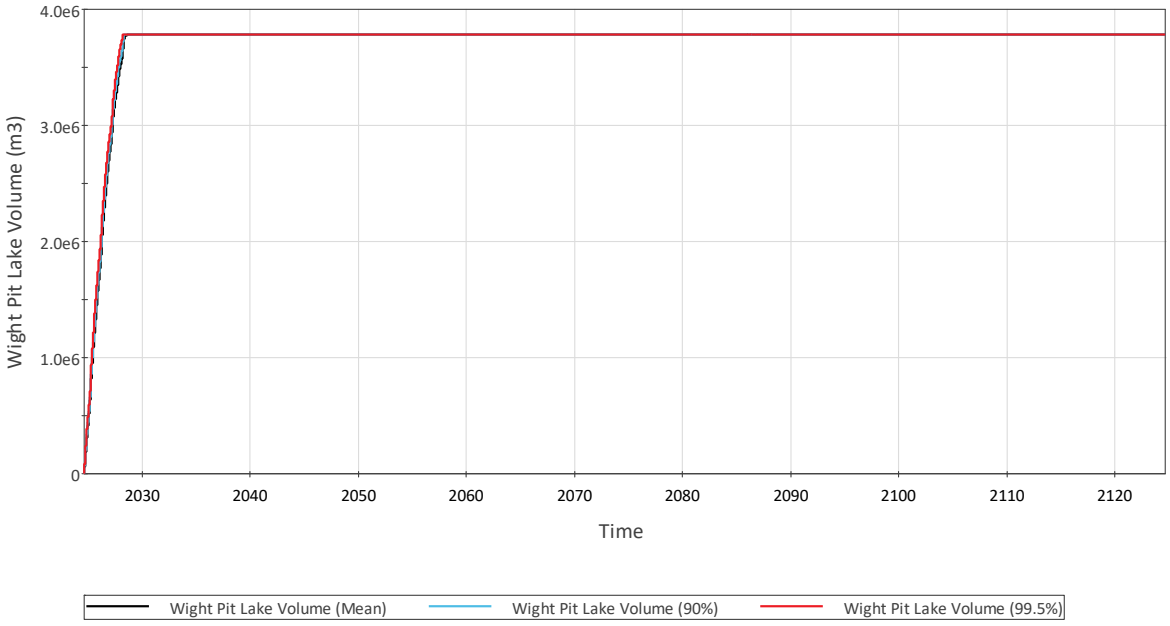

Figure 5: Wight Pit Lake Volume during Closure and Post-closure

4.1.2.3 Boundary Pit Lake

A seasonal pond is expected to develop in the Boundary Pit during closure and post-closure and is not projected to overflow during the simulation period (1 September 2024 to 1 September 2124) (Figure 6).

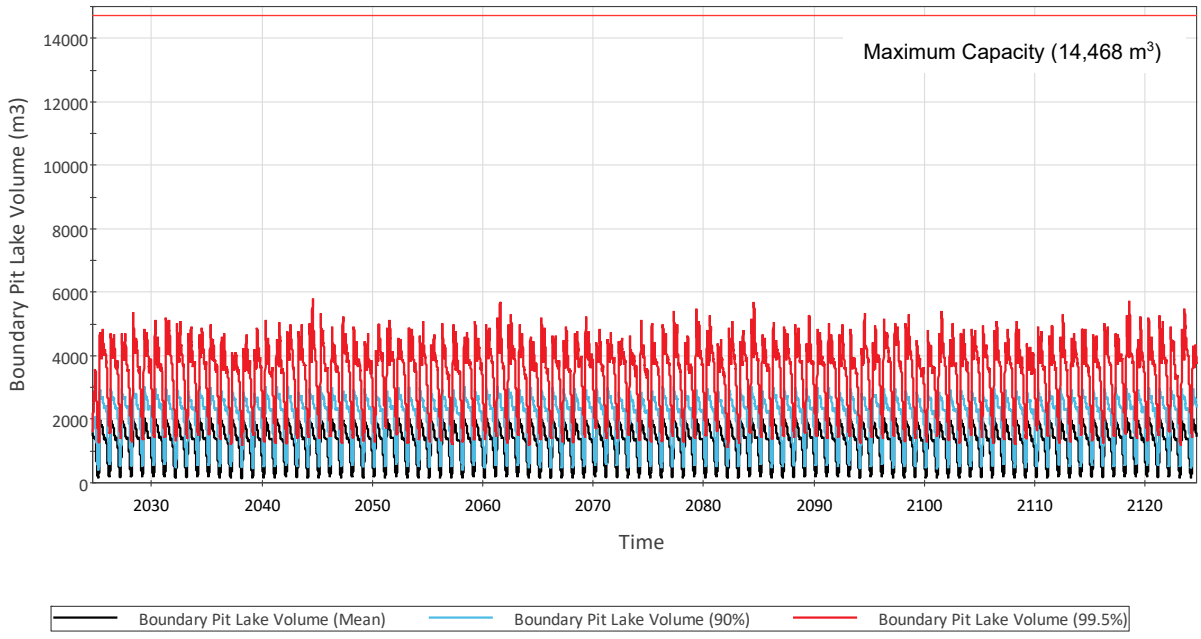

Figure 6: Boundary Pit Lake Volume during Closure and Post-closure

4.1.3 Mine Catchment Results

Discharge results from the individual mine catchments during closure and post-closure are summarized in this section for following discharge destinations (Table 8):

- Polley Lake
- Hazeltine Creek
- Edney Creek
- Bootjack Lake

For each of the 9 decentralised discharge locations, daily discharges (m^3/d) are presented graphically for the average, and the 90th and 99.5th percentiles for years 2024 to 2124, and a summary of annual discharge volumes are presented for selected years.

4.1.3.1 Polley Lake

The mine catchments discharging to Polley Lake during closure and post-closure are:

- Wight Pit Lake
- Long Ditch/SERDS Ditch

Wight Pit

Estimated daily discharge rates from Wight Pit during the closure and post-closure phases are presented in Figure 7, and annual discharge volumes are provided in Table 9. Wight Pit Lake is projected to reach its overflow elevation by about 2027, and the annual discharge volume to Polley Lake is expected to remain relatively constant from 2029 through 2124.

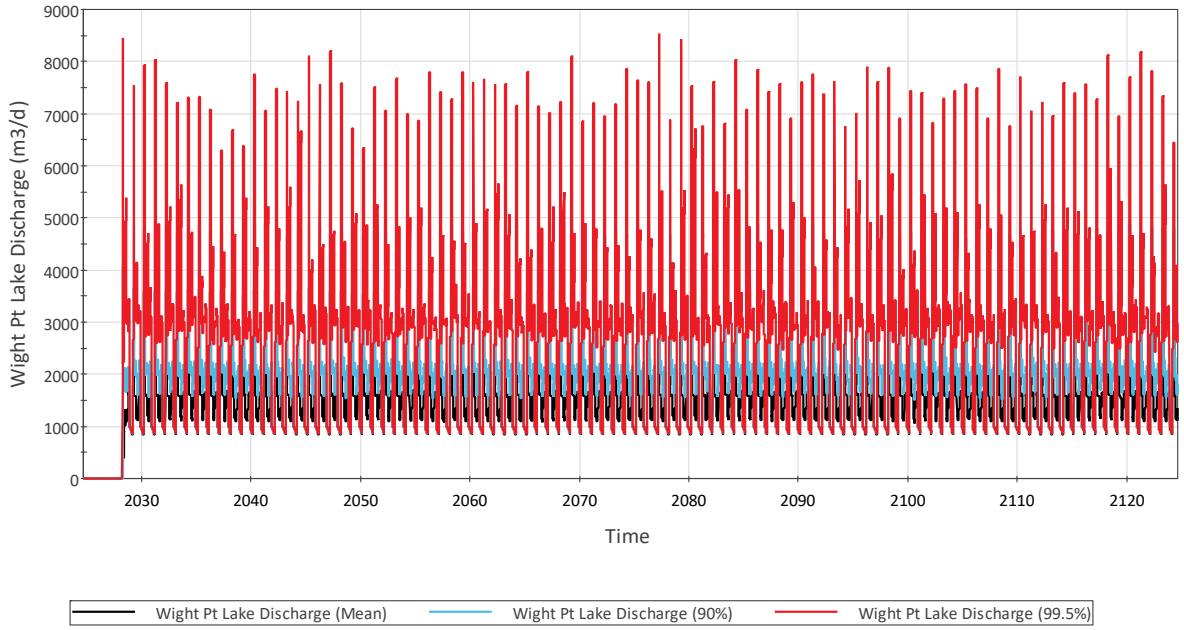

Figure 7: Wight Pit Lake Discharge to Polley Lake during Closure and Post-closure (m^3/d)

Table 9: Annual Discharge Quantity from Wight Pit Lake during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	0	0	0
2035	553,581	620,777	722,972
2045	553,651	616,848	734,620
2085	550,155	612,999	706,107
2115	553,220	618,910	705,562

Long Ditch / SERDS Ditch

Estimated annual discharge volumes from Long Ditch during the closure and post-closure phases are presented in Table 10, and Figure 8 illustrates daily discharge rates. Discharge from Long Ditch is projected to start in 2034 and remain relatively constant from 2035 through 2124.

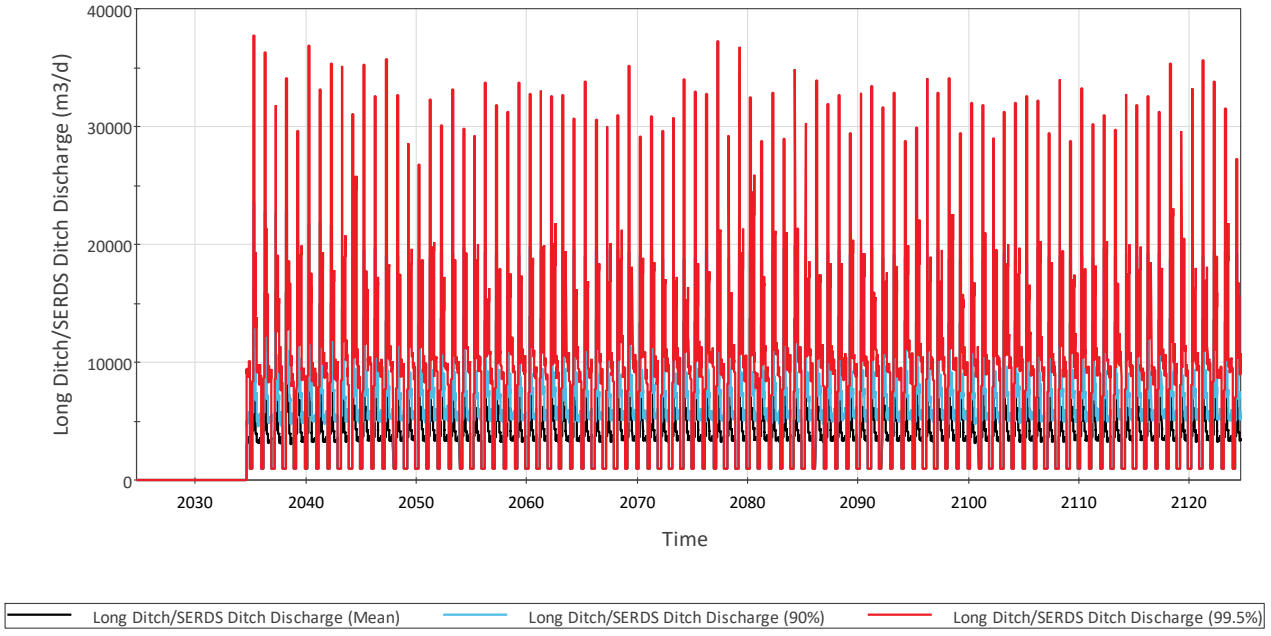

Figure 8: Long Ditch/SERDS Ditch Discharge to Polley Lake during Closure and Post-closure (m^3/d)

Table 10: Annual Discharge Quantity from Long Ditch/SERDS Ditch during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	0	0	0
2035	1,627,200	1,948,600	2,453,800
2045	1,504,300	1,783,900	2,339,500
2085	1,488,100	1,763,100	2,129,200
2115	1,502,000	1,792,700	2,164,300

4.1.3.2 Hazeltine Creek

The mine catchments discharging to Hazeltine Creek during closure and post-closure are:

- Perimeter Embankment Till Borrow Pond

Perimeter Embankment Till Borrow Pond

Estimated annual untreated discharge volumes from the Perimeter Embankment Till Borrow Pond (PETBP) during the closure and post-closure phases are presented in Table 11, and Figure 9 illustrates daily untreated discharge rates. Annual discharge volumes from the PETBP are simulated to decrease from 2027 through 2034, and then remain relatively constant from 2035 through 2124.

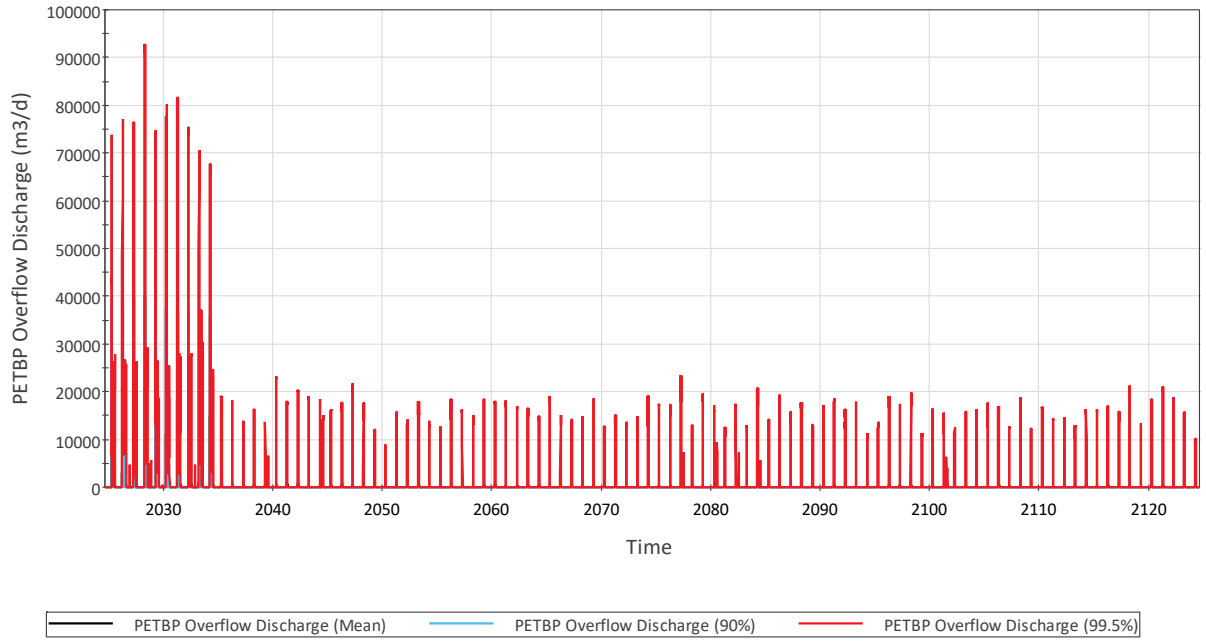

Figure 9: PETBP Untreated Discharge to Hazeltine Creek during Closure and Post-closure (m^3/d)

Table 11: Annual Untreated Discharge Quantity from the PETBP during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	341,889	884,065	2,252,200
2035	12,875	0	423,672
2045	9,789	0	361,134
2085	5,709	0	305,570
2115	8,716	0	454,162

Estimated annual treated discharge volumes from the PETBP during the closure and post-closure phases are presented in Table 12, and Figure 10 illustrates daily treated discharge rates.

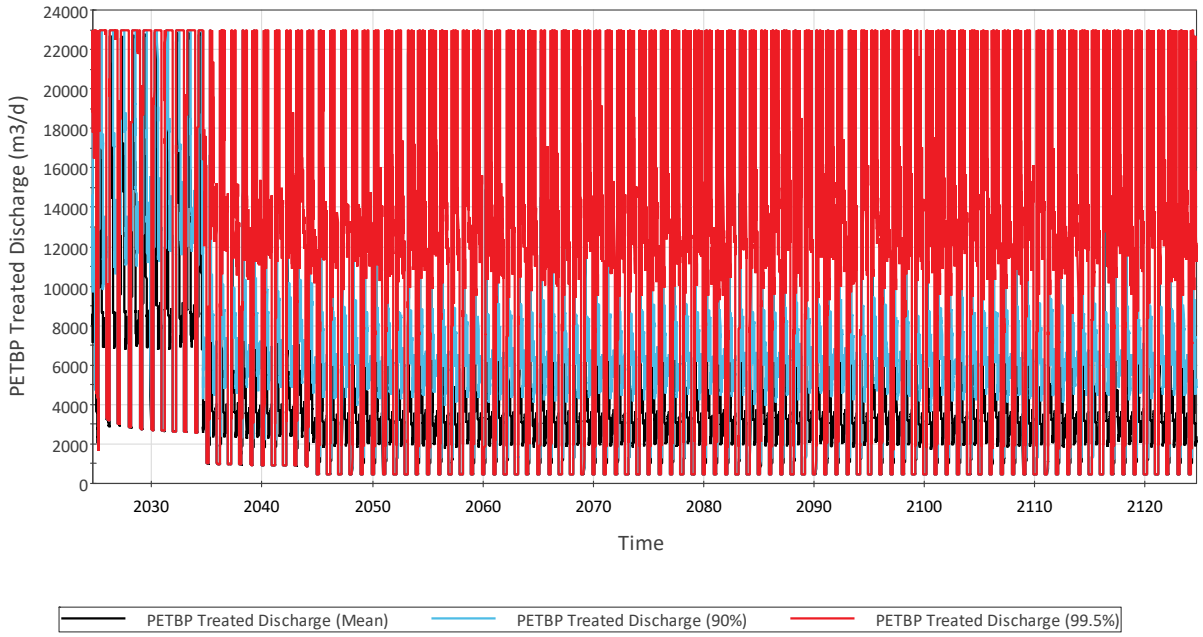

Figure 10: PETBP Treated Discharge to Hazeltine Creek during Closure and Post-closure (m^3/d)

Table 12: Annual Treated Discharge Quantity from the PETBP during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	3,427,000	4,000,900	4,770,300
2035	1,397,400	1,833,600	2,405,800
2045	1,140,700	1,534,500	2,066,400
2085	1,152,200	1,544,400	1,971,800
2115	1,169,000	1,565,900	1,943,500

4.1.3.3 Edney Creek

The mine catchments discharging to Edney Creek during closure and post-closure are:

- South Seepage Pond
- Main Embankment Seepage Pond

South Seepage Pond

Estimated annual discharge volumes from the South Seepage Pond during the closure and post-closure phases are presented in Table 13, and Figure 11 illustrates daily discharge rates. The South Seepage Pond is simulated to reach its overflow elevation in 2044, and the annual discharge volume to Edney Creek is expected to remain relatively constant from 2066 through 2124.

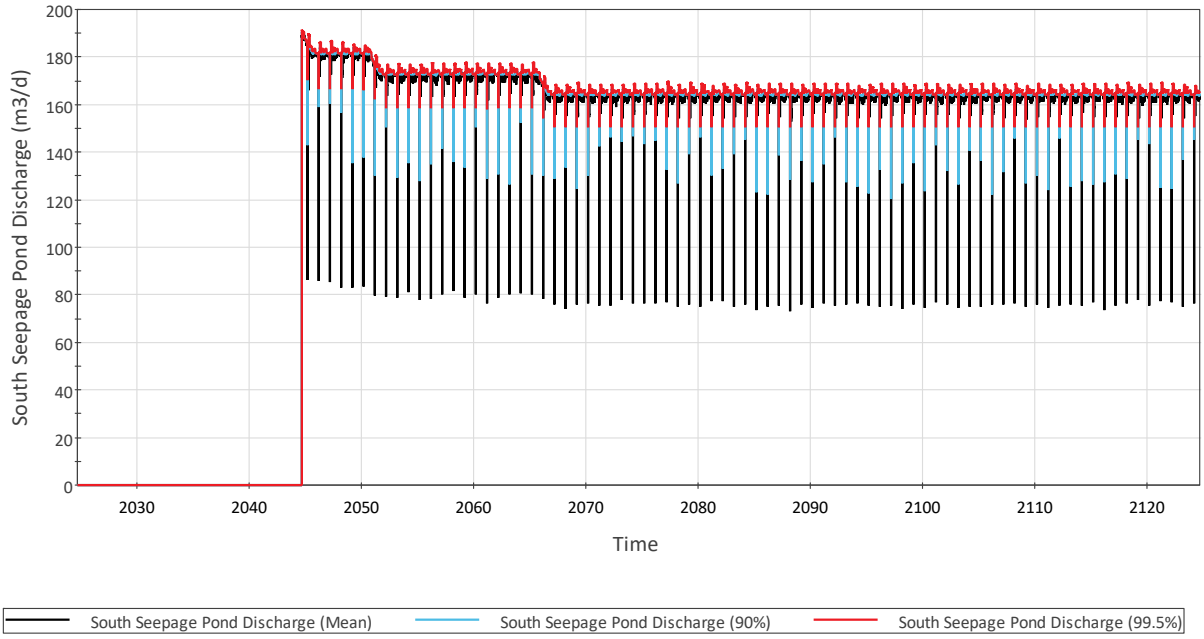

Figure 11: South Seepage Pond Discharge to Edney Creek during Closure and Post-closure (m^3/d)

Table 13: Annual Discharge Quantity from South Seepage Pond during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	56	245	593
2035	0	0	0
2045	66,721	66,776	66,879
2085	59,732	59,784	59,866
2115	59,734	59,789	59,860

Main Embankment Seepage Pond

Estimated annual discharge volumes from the Main Embankment Seepage Pond during the closure and post-closure phases are presented in Table 14, and Figure 12 illustrates daily discharge rates. The Main Embankment Seepage Pond is simulated to reach its overflow elevation in 2045, and the peak daily discharge and annual discharge volume to Edney Creek is expected to remain relatively constant from 2045 through 2124.

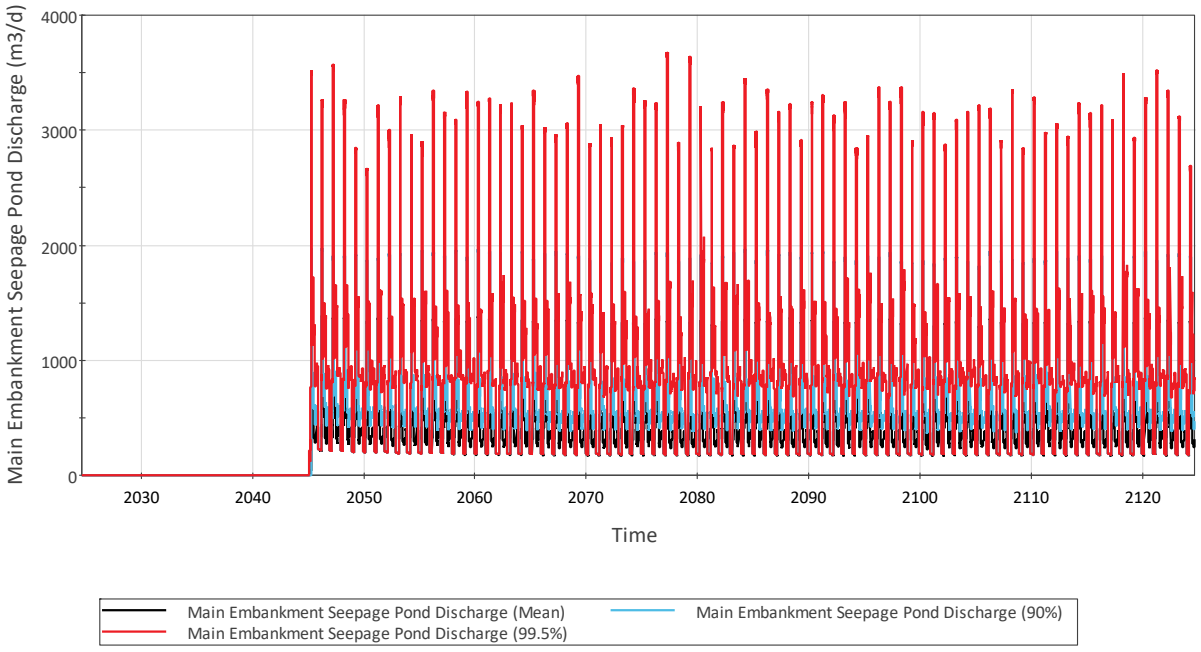

Figure 12: Main Embankment Seepage Pond to Edney Creek during Closure and Post-closure (m^3/d)

Table 14: Annual Discharge Quantity from Main Embankment Seepage Pond during Closure and Post- closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	0	0	0
2035	0	0	0
2045	127,606	155,078	215,272
2085	147,446	172,634	208,607
2115	148,688	175,921	214,352

4.1.3.4 Bootjack Lake

The mine catchments discharging to Bootjack Lake during closure and post-closure are:

- 9K Sump
- NW Sump
- Springer-Cariboo Pit Lake
- Mine Drainage Creek Sump

9K Sump

Estimated annual discharge volumes from 9K Sump during the closure and post-closure phases are presented in Table 15, and Figure 13 illustrates daily discharge rates. The 9K Sump is simulated to reach its overflow elevation by about 2034, and the annual discharge volume to Bootjack Lake is expected to remain constant from 2035 through 2124.



Figure 13: 9K Sump Daily Discharge to Bootjack Lake during Closure and Post-closure (m^3/d)

Table 15: Annual Discharge Quantity from 9K Sump during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	0	0	0
2035	314,761	360,387	434,492
2045	311,197	353,197	457,335
2085	308,547	351,324	410,887
2115	310,559	356,203	421,621

NW Sump

Estimated annual discharge volumes from the NW Sump during the closure and post-closure phases are presented in Table 16, and Figure 14 illustrates daily discharge rates. The NW Sump is simulated to reach its overflow elevation in 2025, and the annual discharge volume to Bootjack Lake is expected to remain relatively constant from 2035 through 2124.

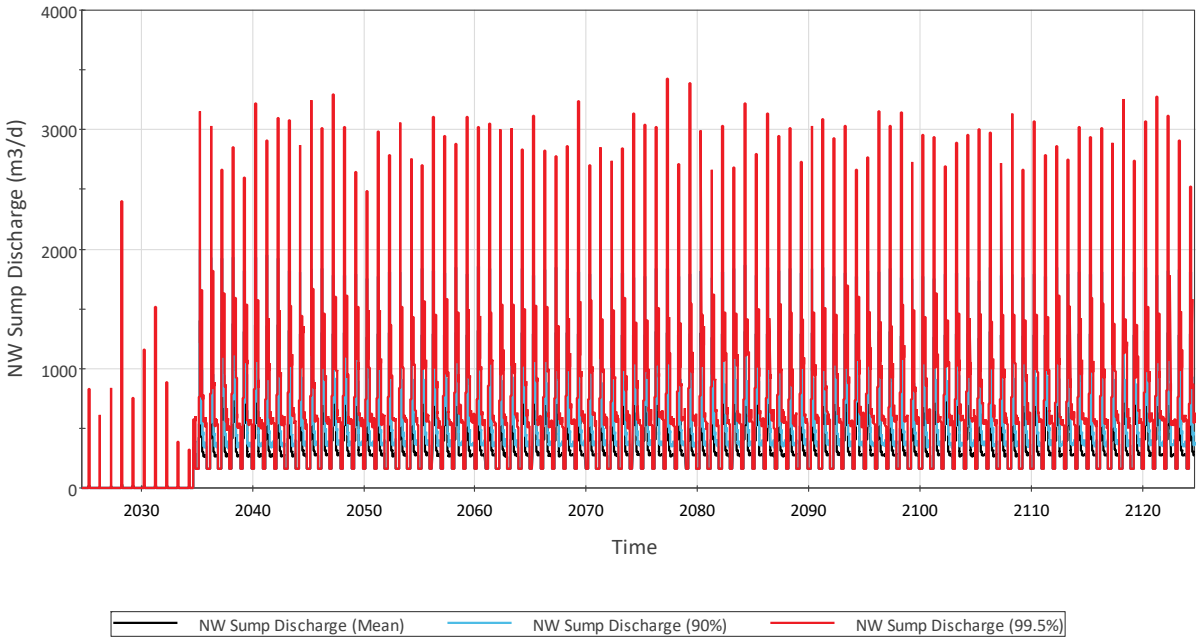

Figure 14: NW Sump Daily Discharge to Bootjack Lake during Closure and Post-closure (m^3/d)

Table 16: Annual Discharge Quantity from NW Sump during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	460	0	24,742
2035	148,675	172,613	211,955
2045	144,080	165,940	221,189
2085	142,719	164,676	194,788
2115	143,716	166,292	201,693

Springer-Cariboo Pit

Estimated annual discharge volumes from the Springer-Cariboo Pit during the closure and post-closure phases are presented in Table 17, and Figure 15 illustrates daily discharge rates. Springer-Cariboo Pit is projected to reach its overflow elevation by about 2048, and the peak daily discharge and annual discharge volume to Bootjack Lake is expected to remain constant from 2051 to 2124.

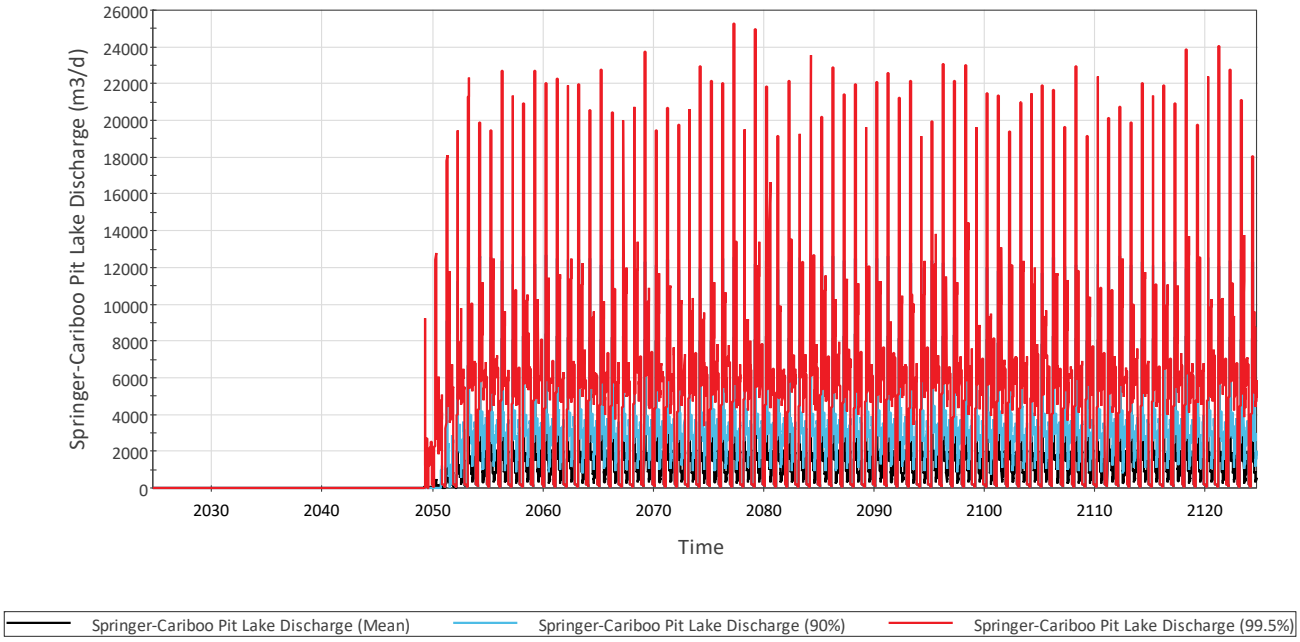

Figure 15: Springer-Cariboo Pit Lake Daily Discharge to Bootjack Lake during Closure and Post-closure (m^3/d)

Table 17: Annual Discharge Quantity from Springer-Cariboo Pit Lake during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	0	0	0
2035	0	0	0
2045	0	0	0
2085	579,882	782,137	1,056,900
2115	589,823	797,252	1,100,100

Mine Drainage Creek Sump

Estimated annual discharge volumes from the Mine Drainage Creek Sump during closure and post-closure are presented in Table 18, and Figure 16 illustrates daily discharge rates. Discharge from the Mine Drainage Creek Sump is simulated to decrease from 2028 through 2034, and then remain relatively constant through the post-closure phase to 2124.

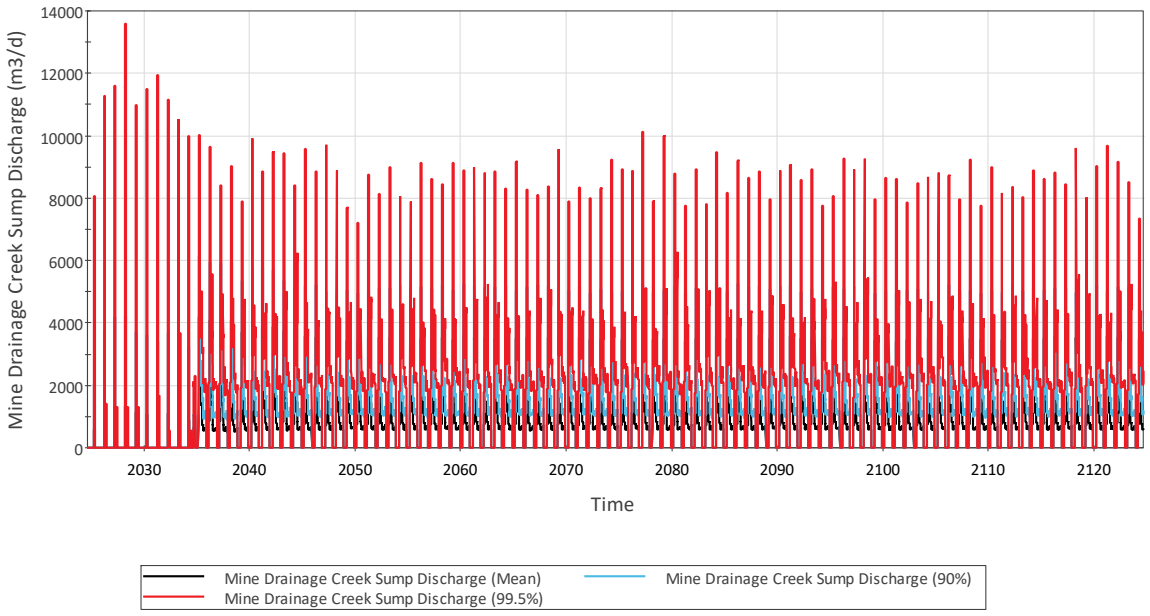

Figure 16: Mine Drainage Creek Sump Daily Discharge to Bootjack Lake during Closure and Post-closure (m^3/d)

Table 18: Annual Discharge Quantity from Mine Drainage Creek Sump during Closure and Post-closure

Year	Annual Discharge Quantity (m^3)		
	Average (mean)	1:10-year (90th percentile)	1:200-year (99.5^{th} percentile)
2025	17,216	61,257	240,564
2035	338,252	424,805	560,075
2045	308,851	383,050	543,058
2085	304,379	378,285	477,521
2115	308,093	387,792	493,379

4.2 Climate Change Results

The climate change module results are provided in Attachment B. A comparison between the climate change results and base case results is provided in the following:

- In general, climate change results follow similar patterns to the base case results.
- The mean results of the climate change projections during the closure and the post-closure phases are approximately 15% higher than the mean results of the base case, while the upper bound of the climate change results are approximately 10% lower than the base case 90th percentile results.
- The pit filling times with climate change projections are similar to the base case 90th and 99.5^{th} percentile results.

5.0 SUMMARY

The SWWBM was updated to incorporate the closure and post-closure phases for the Mount Polley Mine using GoldSim™ (Version 14.0). The SWWBM is being used to support water management planning and the assessment of water quality and associated water treatment and discharge options for the closure and post- closure phases of the mine.

The base case module was run stochastically for 1000 realizations to present mean, 90th, and 99.5th percentile model results. The climate change module was run using a range of projected precipitation inputs to derive mean and the upper bound deterministic results.

The main conclusions for the modelling are as follows:

- The Wight Pit is expected to initiate spilling in 2028 under both the base case and climate change.
- The Boundary Pit is not expected to spill during the modelling period from 1 September 2024 to 1 September 2124 under both the base case and climate change.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2049 and 2054 under the base case, and between 2048 and 2049 under climate change.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake in approximately 2028 under the base case, and by 2027 under climate change.

6.0 CLOSURE

This technical memorandum summarizes the update of the SWWBM to support the water management information requirements for the Five Year Mine and Reclamation Plan. The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust this technical memorandum satisfies your current requirements. Please contact the undersigned should you have any questions.

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Attachments: Attachment A: Site-wide Water Balance Model Flow Inventory
Attachment B: Climate Change Result Figures

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ATTACHMENT A

Site-wide Water Balance Model Flow Inventory

Table A-1: Description of Flows for Closure Phase

Flow Group	Component	Flow Label
Hydrology	Precipitation	N/A[(a)]
	Evaporation	N/A[(a)]
	Runoff	All flows labelled R[(b)]
Seepage (from Tailings Storage Facility)	South Seepage Pond Inflow	S1
	Perimeter Embankment Till Borrow Pond (PETBP)	S4, S5
	Main Embankment Seepage Pond	S2
	Seepage to Environment	S14
Seepage (from Other Facilities)	SERDS Dump to SERDS Ditch	S6
	North Bell Dump to Wight Pit	S7
	East RDS to Long Ditch	S8
	NEZ Dump to Long Ditch	S9
	To 9km Sump	S10
	To NW Sump	S11
	To Mine Drainage Creek Sump	S12
	To Bootjack Creek Sump	S13
Groundwater Flows	Wight Pit Groundwater Inflow	GW1
	Springer-Cariboo Pit Groundwater Inflow	GW2
	Springer-Cariboo Pit Groundwater Outflow	GW4
	Boundary Pit to Wight Pit	GW5
	Wight Pit Groundwater Outflow	GW7
	TSF to Central Collection Sump (CCS)	OF4
	PETBP to Environment/Hazeltine Creek	OF5
	Mill Site Sump to Mine Drainage Creek Sump	OF10
	Springer-Cariboo Pit to Bootjack Lake	OF14
	Wight Pit to Polley Lake	OF17
Transfers	Long Ditch to CCS	T1
	SERDS Ditch to Long Ditch	T2
	CCS to PETBP	T3
	PETBP to Water Treatment Plant (WTP)	T6
Pumped Flows	South Seepage Pond to Main Embankment Seepage Pond	P6
	Main Embankment Seepage Pond to PETBP	P8
	Mine Drainage Creek Sump to SERDS Ditch	P10
	Bootjack Creek Sump to SERDS Ditch	P11
	9K Sump to NW Sump	P20
	NW Sump to Mine Drainage Creek Sump	P24

(a) Evaporation and direct precipitation flows not shown on process flow diagram.

(b) No flows were assigned specifically for snowmelt. Instead, snowpack was accumulated in the model and snowmelt was included in the runoff flows.

Source: SWWBM.

Table A-2: Description of Flows for Post-closure Phase

Flow Group	Component	Flow Label
Hydrology	Precipitation	N/A[a]
	Evaporation	N/A[a]
	Runoff	All flows labelled R[b]
Seepage (from Tailings Storage Facility)	South Seepage Pond Inflow	S1
	Perimeter Embankment Till Borrow Pond	S4, S5
	Main Embankment Seepage Pond	S2
	Seepage to Environment	S14
Seepage (from Other Facilities)	SERDS Dump to SERDS Ditch	S6
	North Bell Dump to Wight Pit	S7
	East RDS to Long Ditch	S8
	NEZ Dump to Long Ditch	S9
	To 9km Sump	S10
	To NW Sump	S11
	To Mine Drainage Creek Sump	S12
	To Bootjack Creek Sump	S13
Groundwater Flows	Wight Pit Groundwater Inflow	GW1
	Springer-Cariboo Pit Groundwater Inflow	GW2
	Springer-Cariboo Pit Groundwater Outflow	GW4
	Boundary Pit to Wight Pit	GW5
	Wight Pit Groundwater Outflow	GW7
Overflow	South Seepage Pond to Edney Creek	OF1[c]
	Main Embankment Pond to Edney Creek	OF2[c]
	TSF to CCS	OF4
	PETBP to Environment/Hazeltine Creek	OF5
	CCS to PETBP	OF6
	Bootjack Creek Sump to SERDS Ditch	OF8
	Mill Site Sump to Mine Drainage Creek Sump	OF10
	Mine Drainage Creek Sump to Bootjack Lake	OF12
	Long Ditch to Polley Lake	OF13
	Springer-Cariboo Pit to Bootjack Lake	OF14
	NW Sump to Bootjack Lake	OF15
	9km Sump to Bootjack Lake	OF16
	Wight Pit to Polley Lake	OF17
Transfers	SERDS Ditch to Long Ditch	T2
	PETBP to WTP	T6
Pumped Flows	South Seepage Pond to Main Embankment Seepage Pond	P6[d]
	Main Embankment Seepage Pond to PETBP	P8[d]

Evaporation and direct precipitation not shown on process flow diagram.

No flows were assigned specifically for snowmelt. Instead, snowpack was accumulated in the model and snowmelt was included in the runoff .

OF1 and OF2 will be active from 1 September 2044.

Pumped flows will be active up to 31 August 2044.

Source: SWWBM.

ATTACHMENT B

Climate Change Result Figures

1.0 TSF AND PIT LAKE VOLUMES

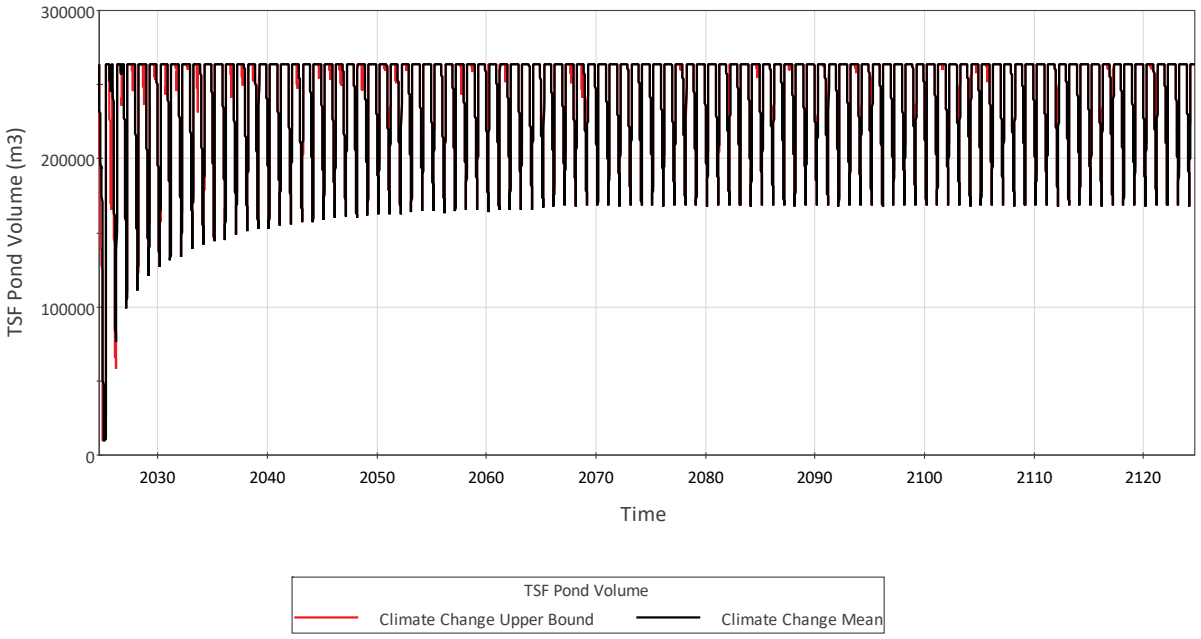

Figure B-1: TSF Pond Volume during Closure and Post-closure with Climate Change

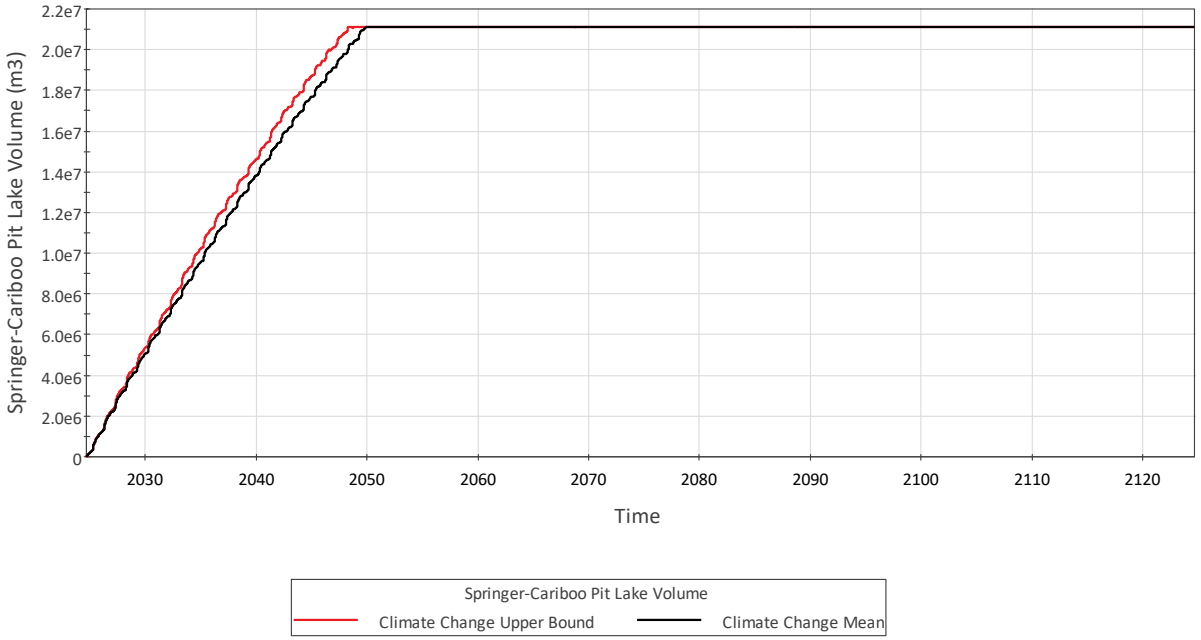

Figure B-2: Springer-Cariboo Pit Lake Volume during Closure and Post-closure with Climate Change

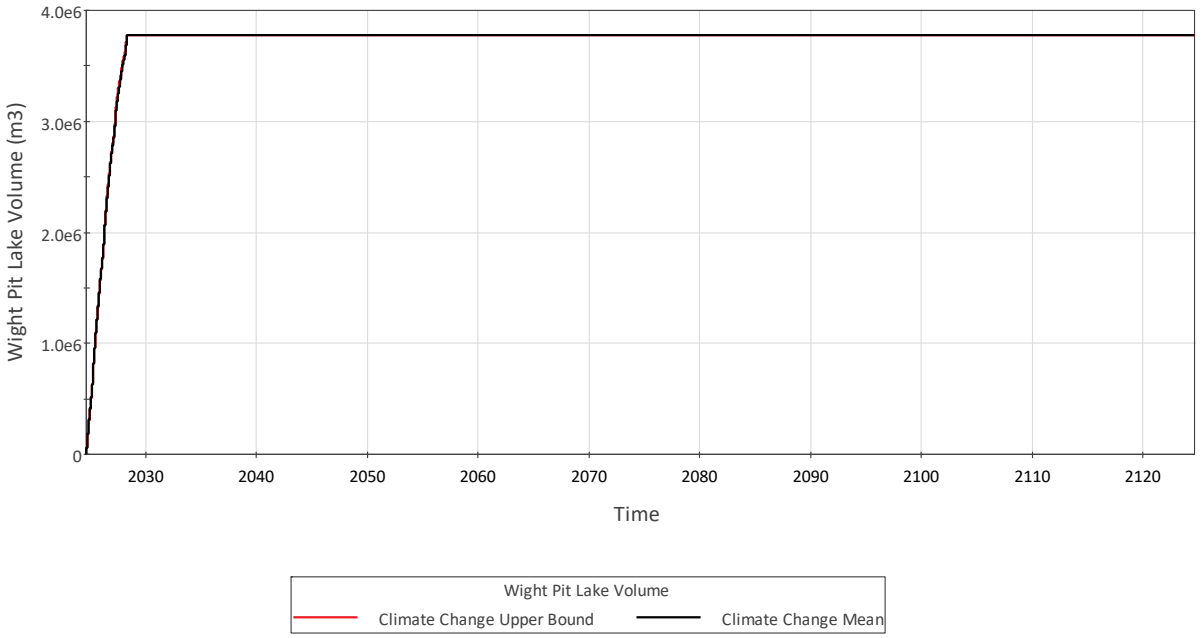

Figure B-3: Wight Pit Lake Volume during Closure and Post-closure with Climate Change

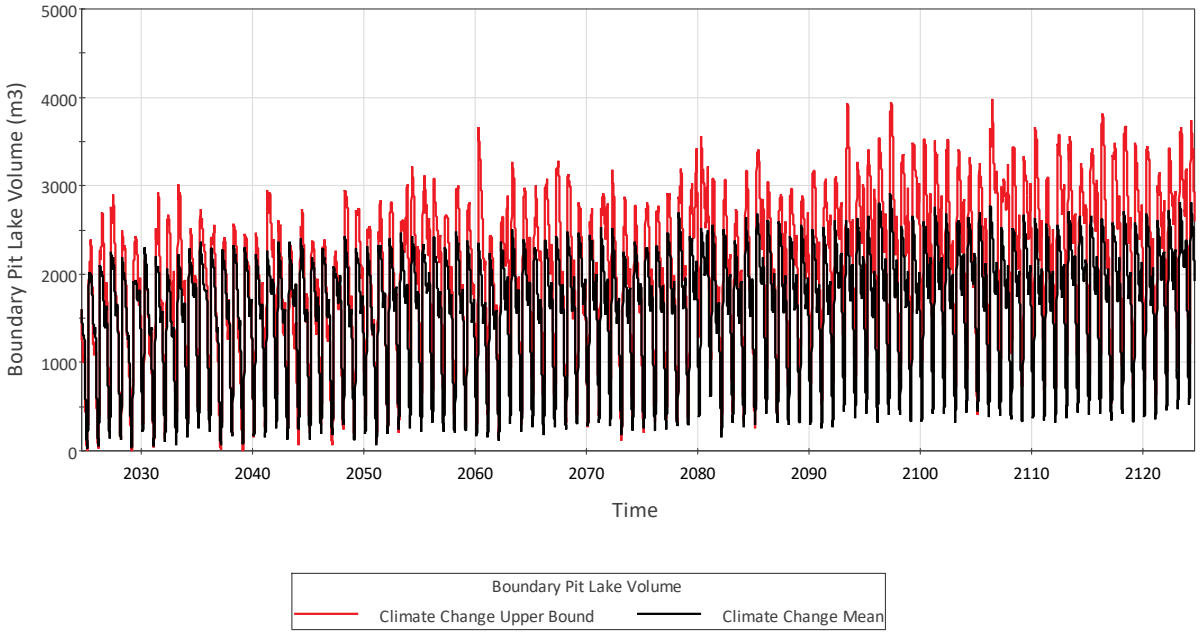

Figure B-4: Boundary Pit Lake Volume during Closure and Post-closure with Climate Change

2.0 MINE CATCHMENT DISCHARGE FLOWS

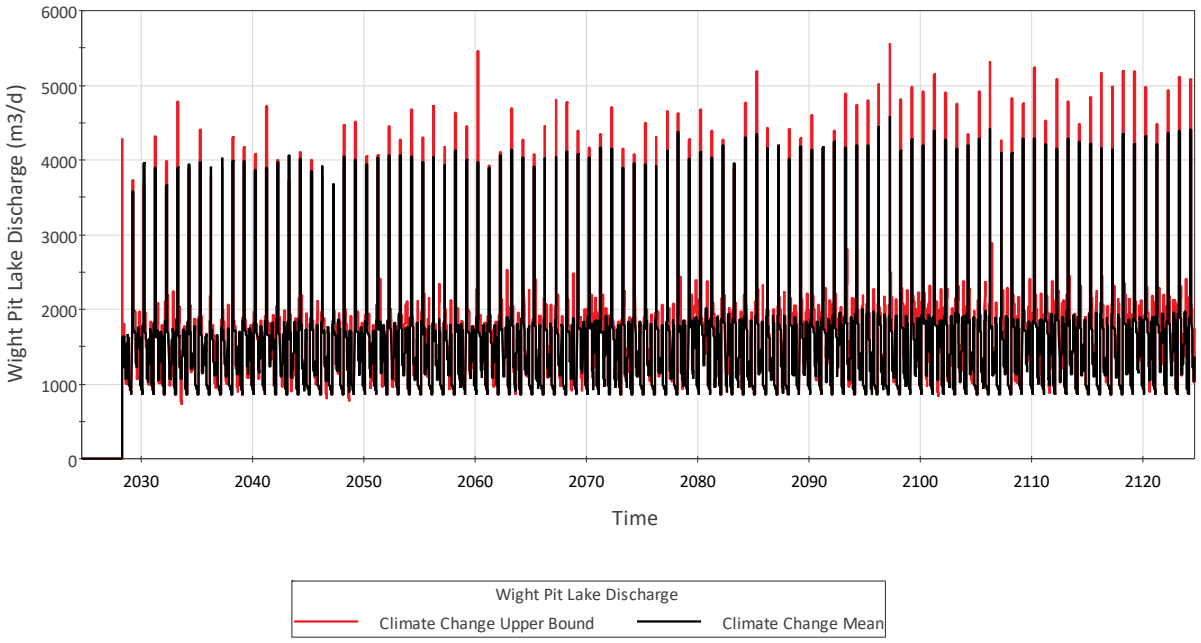

Figure B-5: Wight Pit Lake Discharge during Closure and Post-closure with Climate Change

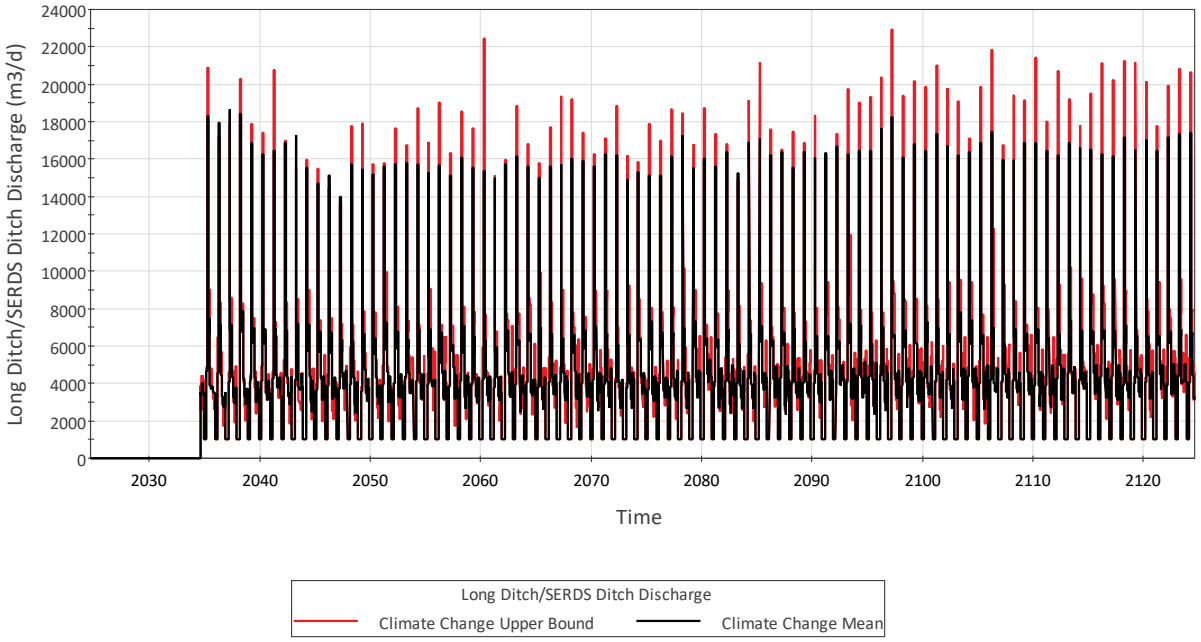

Figure B-6: Long Ditch/SERDS Ditch Discharge during Closure and Post-closure with Climate Change

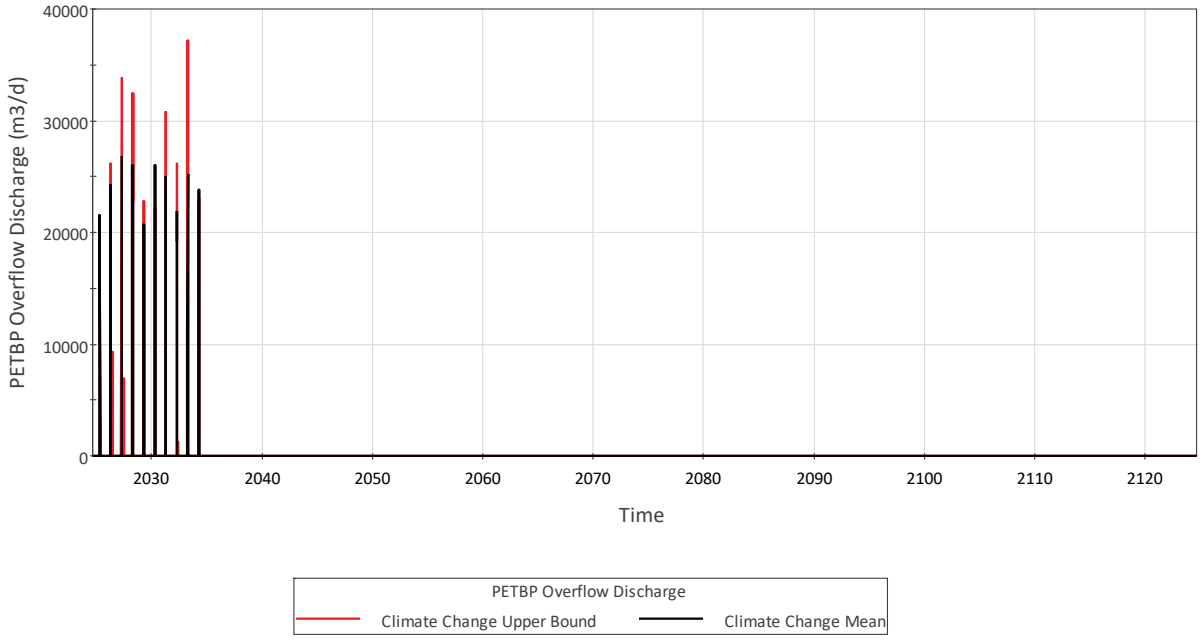

Figure B-7: PETBP Overflow Discharge during Closure and Post-closure with Climate Change

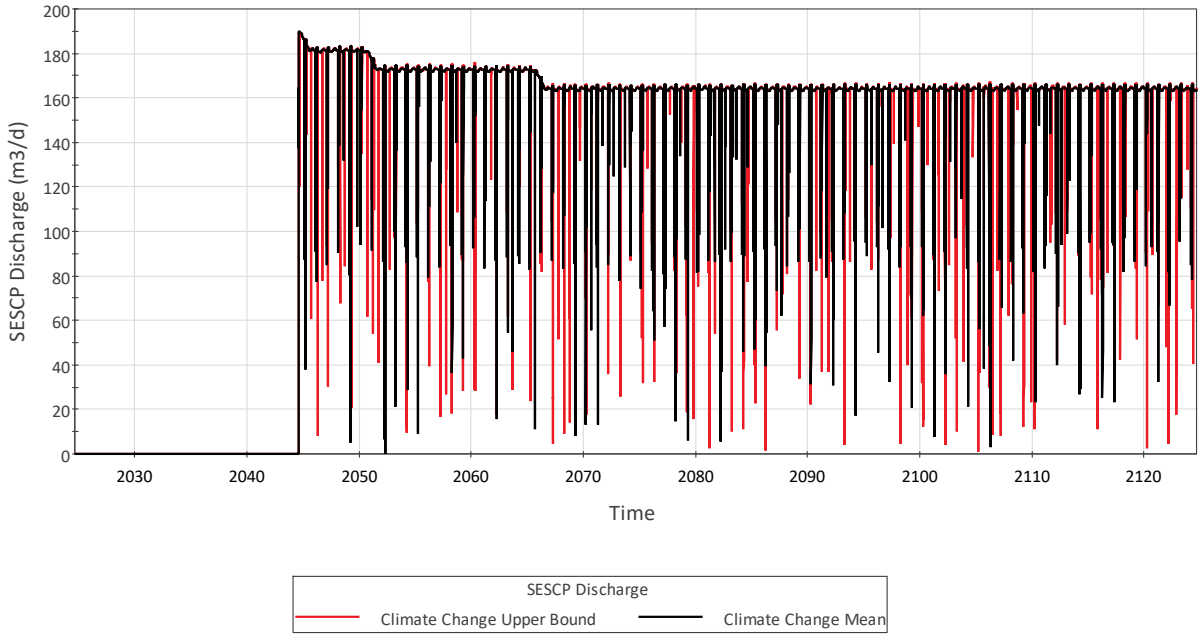

Figure B-8: SESCP Discharge during Closure and Post-closure with Climate Change

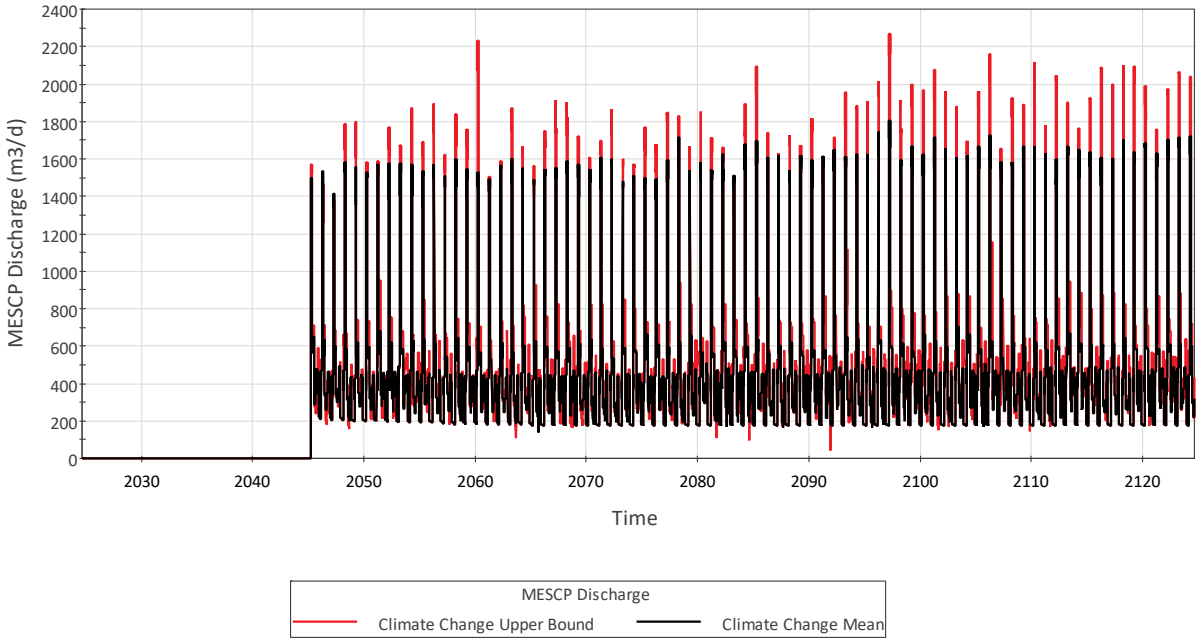

Figure B-9: MESCP Discharge during Closure and Post-closure with Climate Change

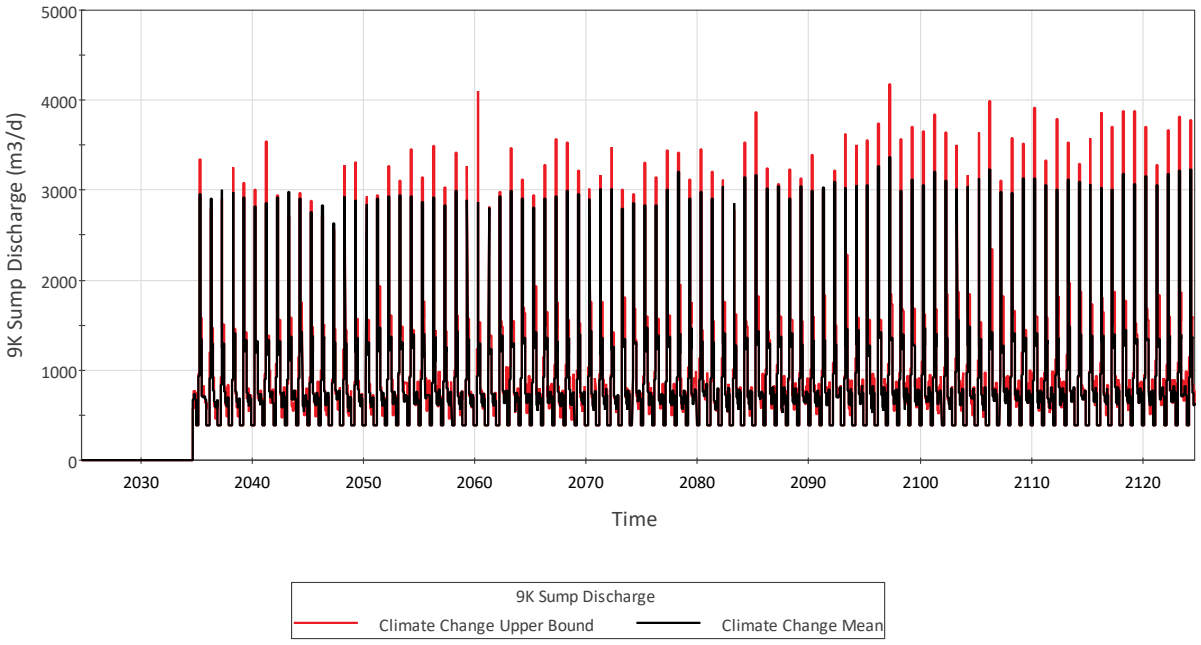

Figure B-10: 9K Sump Discharge during Closure and Post-closure with Climate Change

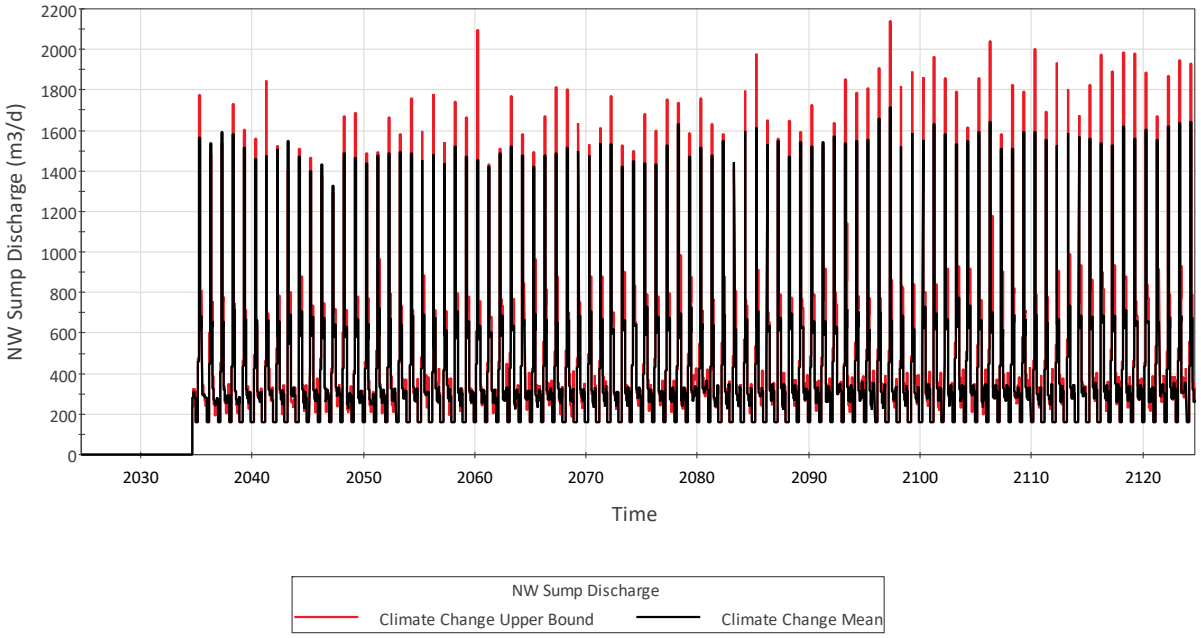

Figure B-11: NW Sump Discharge during Closure and Post-closure with Climate Change

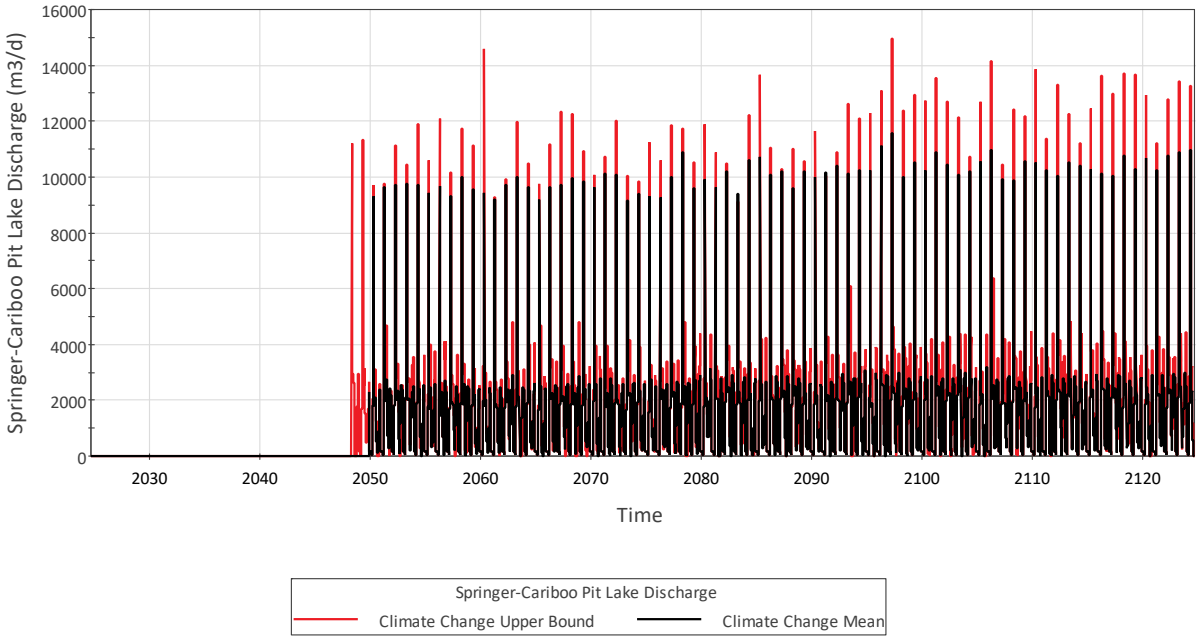

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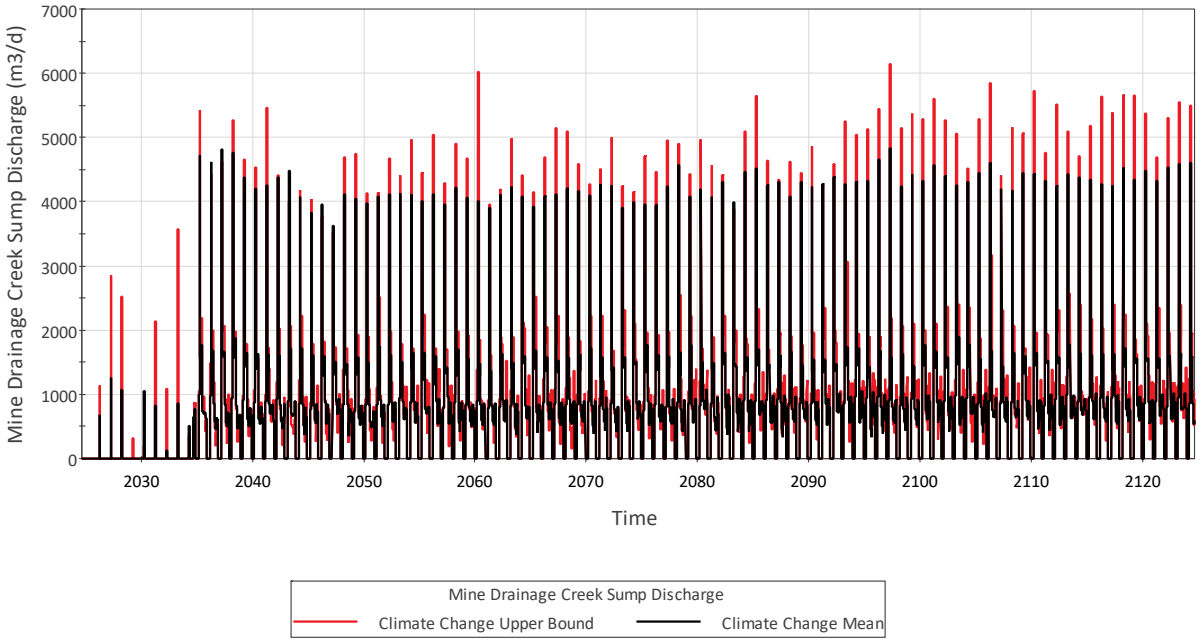

Figure B-13: Mine Drainage Creek Sump Discharge during Closure and Post-closure with Climate Change

Appendix I
2022 Water Quality Predictions

REPORT

Mount Polley Mine Water Quality Model

Reclamation and Closure

Submitted to:

Mount Polley Mining Corporation

Mount Polley Mining Corporation
PO Box 12
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Attention: Matt O'Leary

Submitted by:

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Reference No. 22514095-090-R-Rev0-31715

21 December 2022

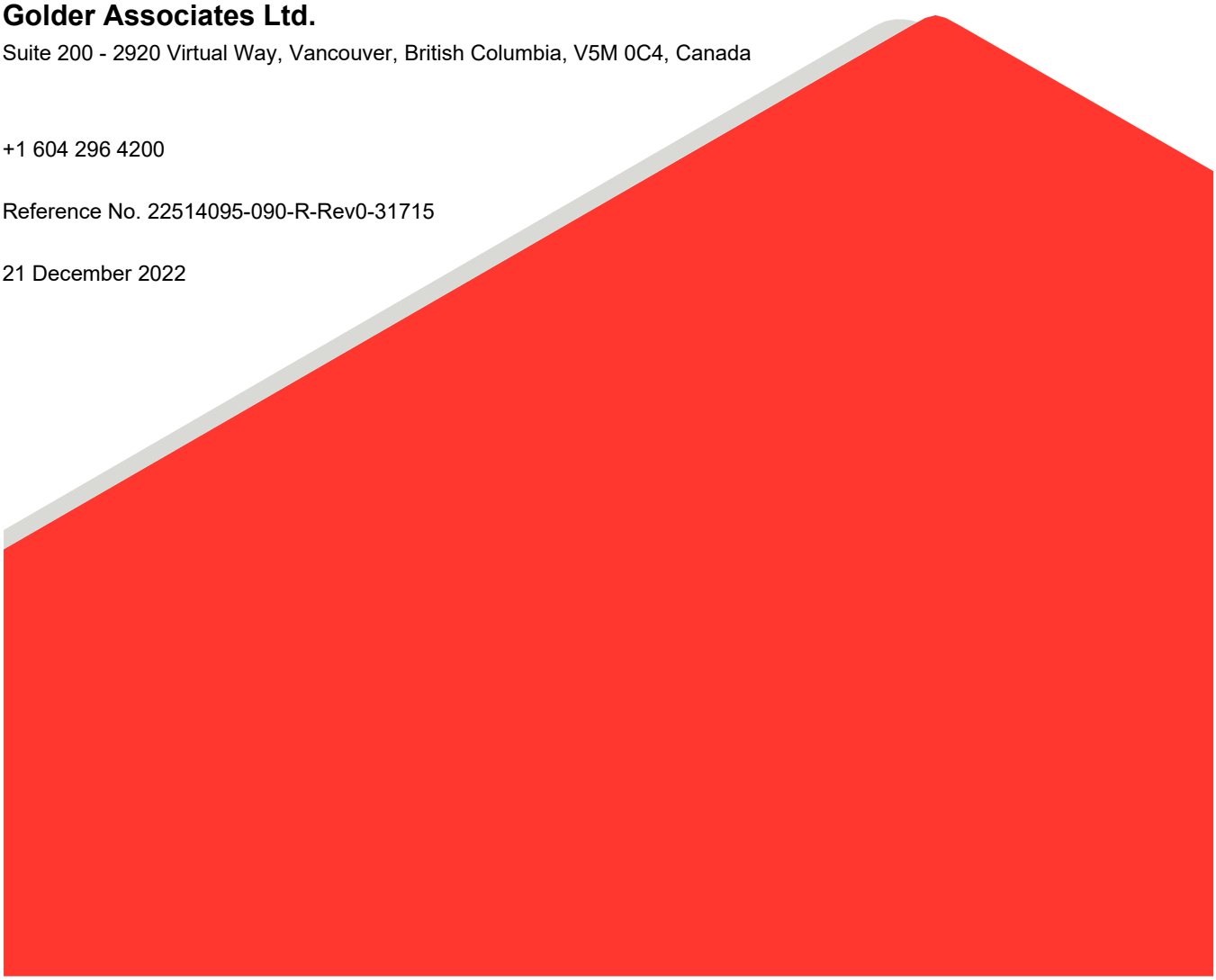

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APPENDICES

APPENDIX A
Site-Wide Water Quality Model Calibration Results

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Golder to update the Site Wide Water Quality Model (SWWQM) to support the water management requirements for the Five Year Mine and Reclamation Plan (RCP). This exercise is a requirement outlined in MPMC's Ministry of Energy, Mines and Low Carbon Innovation (EMLI) Mines Act Permit M-200 (amended 10 December 2020).

The SWWQM was developed as part of the Mount Polley Mine (Mine) Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water quality across the site. The SWWQM was updated in 2020 as part of the Water Management Plan that addressed the water management through future operations (Golder 2020).

The SWWQM was updated as part of the RCP to include the closure and post-closure phases for the period of 1 September 2024 to 1 September 2124. The closure phase will commence on 1 September 2024, and will include closure and reclamation activities as identified in the Mine Reclamation and Closure Plan Update. The post-closure phase will commence on 1 September 2034 and extends to 2124.

This report presents the updates made to the SWWQM for consistency with the remaining currently permitted mine plan and the proposed closure configuration. Included herein is a summary of the model, the assumptions made for the RCP, and the model inputs and results.

2.0 MODEL APPROACH

A reclamation and closure site wide surface water balance model (SWWBM) was developed to predict flow at the Mine and potential discharges to the receiving environment, and comprises the underlying framework for evaluating mass transfers in the SWWQM (Appendix H of the RCP). The SWWQM is directly linked to the reclamation and closure SWWBM and includes mass transfers for each flow.

The SWWQM model does not include treatment of drainage or mixing in the receiving environment. Rather, water quality was simulated in Mine facilities so that treatment technologies can be selected and applied, as described in the Closure Water Treatment memorandum that was prepared along with this report (Appendix G of the RCP).

2.1 Model Platform

The model was developed using GoldSim Version 14.0 (GoldSim 2021). GoldSim is a graphical, object-oriented mathematical modelling program where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the program is designed to facilitate an understanding of the various factors that control an engineered or natural system and to predict potential changes in the system.

GoldSim was selected for the current assessment for the following reasons:

- It facilitates probabilistic simulations, allowing descriptive statistics and probabilities to be assigned to the model outputs.
- The model framework can be easily adjusted to account for changing/future conditions on a mine site, allowing the model to be used as a planning tool.
- Water quantity and water quality models can be directly linked, allowing both models to be updated simultaneously when conducting sensitivity scenarios for alternate water management strategies.

2.2 Model Periods

The model simulations included four time periods:

- **Calibration** (1 January 2017 to 31 December 2021) – the calibration period includes care and maintenance of the Mine site. During this period, water in the Perimeter Embankment Till Borrow Pond (PETBP) is treated at the water treatment plant and discharged to Quesnel Lake.
- **Operations** (1 January 2023 to 31 August 2024) – the resumed operations period when, similar to the calibration period, water in the PETBP is treated at the water treatment plant and discharged to Quesnel Lake.
- **Closure** (1 September 2024 to 31 August 2034) – a ten-year active closure period is assumed, during which potentially acid generating (PAG) stockpile material from the Temporary Northwest (NW) PAG stockpile is deposited into the Springer-Cariboo Pit and other facilities are reclaimed. The closure phase will include reclamation activities as identified in the RCP. Details on the closure and post-closure management of mine facilities is provided in Section 8 of the RCP, and the SWWBM Report (Appendix H of the RCP).

- **Post-closure** (1 September 2034 to 31 August 2124) – this period includes filling of pits, discharge, and establishment of steady-state conditions for the drainage from mine facilities. Results are presented for two periods within post-closure:
  - Early post-closure (1 September 2034 to 31 August 2044) – Represents the first ten years of post-closure during which drainage from Mine facilities is assumed to progressively return to undisturbed water quality.
  - Long-term post-closure (1 September 2044 to 1 August 2124) – this time period has been selected to represent steady-state conditions after all closure and post-closure changes have taken place.

Uncertainty exists regarding the exact timing of these transitions. The time periods are intended to show, at a conceptual level, the difference in site drainage quality as the site progresses through the post-closure period; it is not intended to imply that the transitions will occur on precisely those dates.

2.3 Facilities

The SWWQM includes the following facilities (grouped into five categories):

- **Open Pits**: Springer-Cariboo Pit, Wight Pit, and Boundary Pit.
- **Sumps**: NW Sump, 9K Sump, Mine Drainage Creek Sump (MDCS), Bootjack Creek Sump (BCS), Central Collection Sump (CCS), Perimeter Embankment Till Borrow Pond (PETBP), South Embankment Seepage Collection Pond (SESCP), and Main Embankment Seepage Collection Pond (MESCP).
- **Ditches/Drains**: Long Ditch and Southeast Rock Disposal Site (SERDS) Ditch.
- **Rock Disposal Sites (RDSs)**: East RDS, SERDS, Northeast Zone (NEZ) RDS, North Bell RDS, and Boundary RDS.
- **Other Facilities**: Tailings Storage Facility (TSF), TSF Quarry, Temporary NW PAG Stockpile, and haul roads.

2.4 Mine Site Flows

The SWWBM accounts for mine waste and water management plans, which are described in detail in Section 2.4 of the RCP. During the calibration and operations periods, the Mine facilities are used to manage water within the Mine site and the only Mine discharge to the receiving environment is from the water treatment plant (Table 1 and Figure 1). During closure, water will continue to be managed within the Mine facilities and the combined Springer-Cariboo Pit will be allowed to fill before discharging to Bootjack Lake (Table 2 and Figures 2 and 3). To the extent possible, flows from the Mine site will be returned to pre-disturbance watershed flows as the facilities are reclaimed during closure (Table 3).

During post-closure, most site catchment areas are expected to drain directly to their pre-disturbance watersheds; this applies to 9K Sump, NW Sump, Springer-Cariboo Pit, Mine Drainage Creek, Wight Pit, Joe's Creek, SESCP, and the MESCP. Some sumps, ponds, and ditches are expected to flow together and to be discharged as a combined flow to their pre-disturbance watersheds; Long Ditch discharge will include flow from SERDS Ditch and Bootjack Creek Sump, and PETBP discharge will include overflows from the TSF and CCS (Table 3).

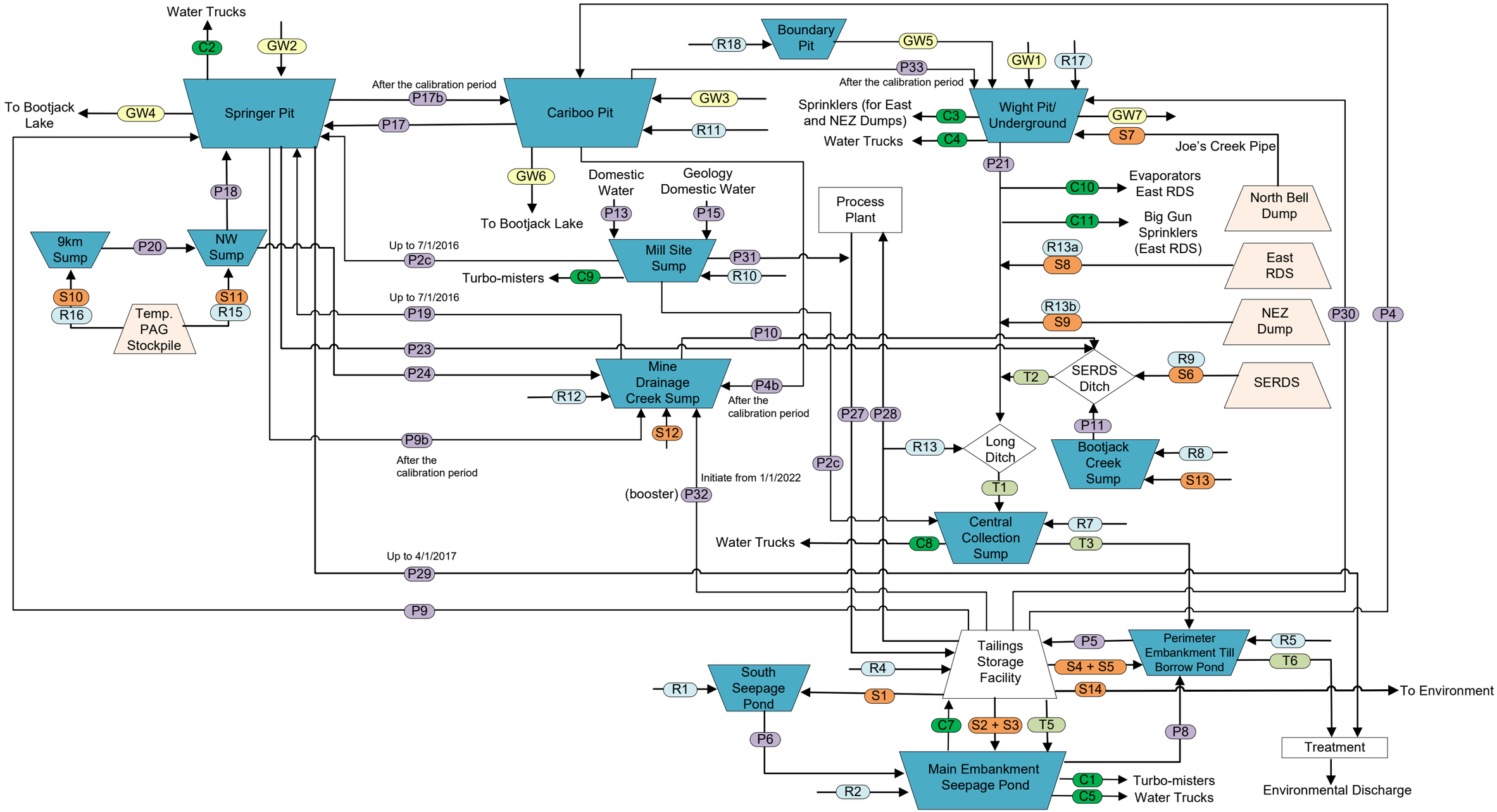

Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 16 December 2022

CHECKED: GD
DATE: 16 December 2022

SCALE: Not to Scale
PROJECT No: 22514095/31500

TITLE

Site Wide Water Balance Calibration and Operations

FIGURE No: 1
REV No: A

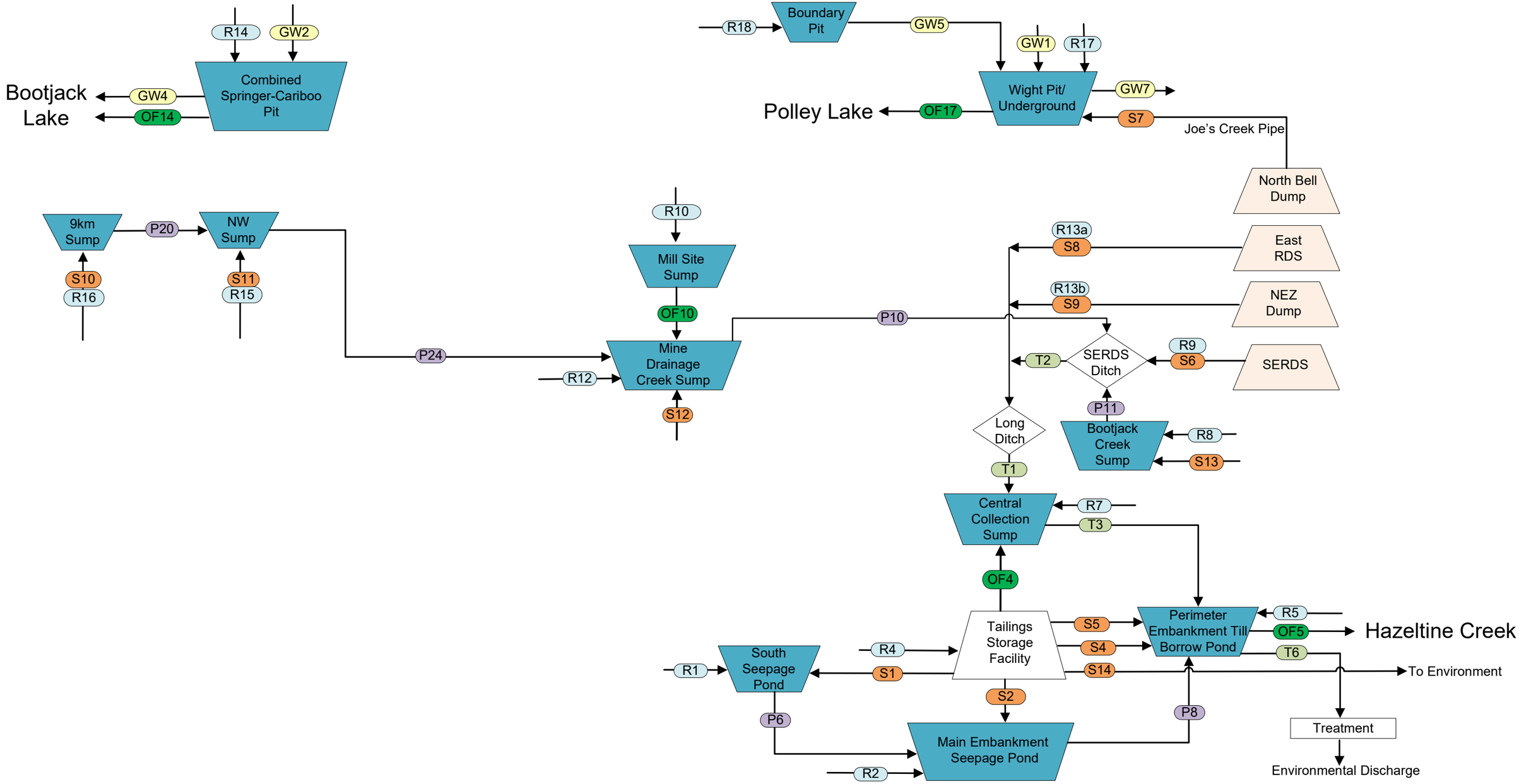

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	16 December 2022
CHECKED	GD
DATE	16 December 2022
SCALE	Not to Scale
PROJECT No	22514095/31700
FIGURE No	2
REV No	A

TITLE

Site Wide Water Balance
Closure Phase
1 September 2024 – 31 August 2034

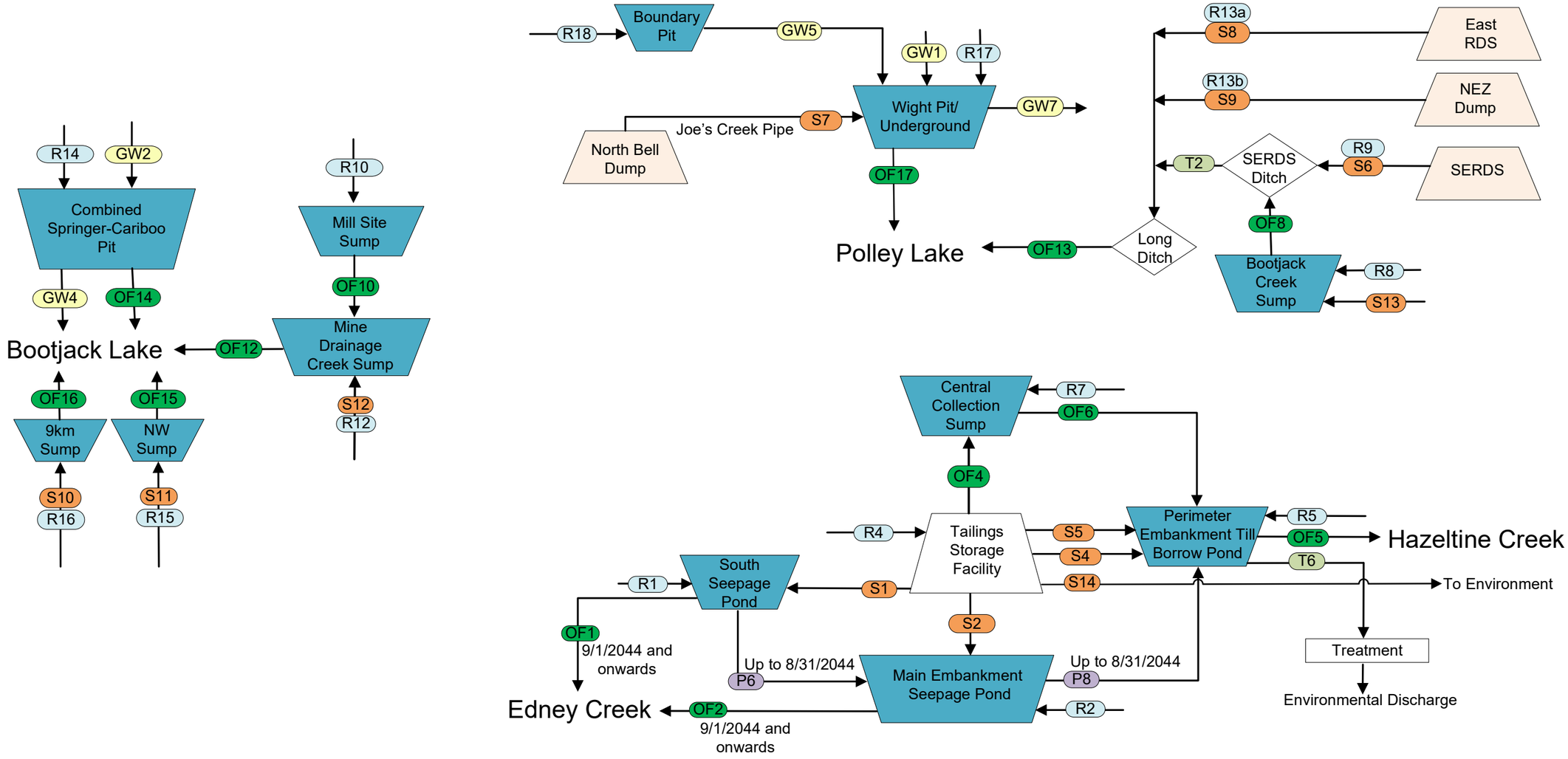

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note: Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.

GOLDER

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 16 December 2022

CHECKED: GD
DATE: 16 December 2022

SCALE: Not to Scale
PROJECT No: 22514095/31700

TITLE

Site Wide Water Balance
Post-closure Phase
1 September 2034 Onwards

FIGURE No: 3
REV No: A

Table 1: Facility Flows during Calibration and Operations

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas	Springer Pit
Springer Pit	Pumping from NW Sump; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas	Cariboo Pit and TSF
Cariboo Pit	Pumping from Springer Pit; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas	Wight Pit and TSF
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas	SERDS Ditch
Wight Pit Lake	Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas	SERDS Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area	Influent to the water treatment plant

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 2: Facility Flows during Closure

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas	Springer Pit
Springer-Cariboo Pit	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas	Bootjack Lake
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas	SERDS Ditch
Wight Pit Lake	Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas	SERDS Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 3: Facility Flows during Post-closure

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas	Bootjack Lake
NW Sump	Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas	
Springer-Cariboo Pit Lake	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas	
MDCS	Runoff and seepage from haul roads, disturbed, undisturbed and RDS areas	
Wight Pit Lake	Pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas	Polley Lake
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas	
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas	Edney Creek
MESCP	TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas	
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

2.5 Scenarios

Two SWWBM scenarios (outlined in Appendix H of the RCP) were modelled for the closure and post-closure periods.

- A climate change scenario – deterministic SWWBM simulation, using the mean and the upper bound of precipitation inputs from 9 climate models and 2 emissions scenarios. The water quality inputs are sampled stochastically (1000 realizations) in this scenario.
- A base case scenario – reflects the closure and post-closure plan for the Mine with stochastically generated mean monthly precipitation depths. The SWWBM and SWWQM were run stochastically for 1000 realizations.

These scenarios only apply to the closure and post-closure periods of the SWWQM. The calibration period uses historical data for the climate inputs and the operations period uses an average annual climate input.

2.6 Model Setup

The model simulated concentrations on a daily time step from January 2017 to December 2021 (calibration period), January 2023 to September 2024 (operations) and from September 2024 to September 2124 (closure and post-closure). As described above, the SWWQM was run stochastically for 1000 realizations for both the climate change and base case scenarios. For each realization, a unique concentration for each parameter was selected based on randomly sampled values from within a statistical probability distribution function that was derived for each input.

To interpret the results, median and 95th percentile concentrations were calculated for each Mine facility. To put the results in context, a 95th percentile prediction indicates the maximum concentration that is likely to be reached over the duration of the simulation, with a 95% likelihood that concentrations will be at or below that concentration (it does not suggest that concentrations will exceed this value 5% of the time).

2.6.1 Modelled Parameters and Particulate Addition

The parameters in the SWWQM include physical parameters, major ions, nutrients, and dissolved metals and metalloids (Table 4). The dissolved fractions of metals and metalloids are used in all mixing calculations in the model. The total concentrations of metals and metalloids are calculated by adding particulate fractions to the dissolved concentrations as described below.

Table 4: Parameters in the Site Wide Water Quality Model

Category	Parameters
Physical parameters	Total dissolved solids (calculated), hardness (calculated)
Major ions	Calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate
Nutrients	Nitrate, nitrite, total ammonia, total phosphorus
Dissolved metals and metalloids	Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc

Total metal predictions were calculated using dissolved metal predictions and empirical particulate metal concentrations. Monitoring data for the SERDS Ditch and Long Ditch were used to establish the empirical particulate metal concentrations because these facilities are expected to represent the majority of particulate load to site discharges. The model assumes that TSS will be settled to 15 mg/L (i.e., the current average authorized discharge concentrations) prior to discharge.

Monitored data for total and dissolved metals were used to calculate observed particulate metal concentrations in the SERDS Ditch and Long Ditch. The strength of correlation of measured particulate metal concentrations to TSS concentrations was calculated using linear regressions. An empirical particulate metal concentration for each parameter was established by grouping each parameter into the following categories:

- Correlated parameters ($R^2 \geq 0.75$)—a particulate concentration corresponding to 15 mg/L TSS was calculated using the regression equation, and this concentration was added to both the maximum median and 95th percentile dissolved metal predictions to calculate a total metal concentration.

- Poorly-correlated parameters ($0.25 < R^2 < 0.75$)—median and 95th percentile particulate concentrations were calculated based on observed data for samples with a TSS below 15 mg/L, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.
- Non-correlated parameters ($R^2 \leq 0.25$)—median and 95th percentile particulate concentrations were calculated based on all observed data, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.

A summary of the correlated and non-correlated parameters and the particulate concentrations used in the model are presented in Table 5.

Table 5: Particulate Metal Concentrations

Parameter	Coefficient of Determination (R^2)	Category	Median Particulate Concentration (mg/L)	95th Percentile Particulate Concentration (mg/L)
Aluminum	0.82	Correlated	0.41	0.41
Antimony	0.022	Non-correlated	0.000020	0.00014
Arsenic	0.87	Correlated	0.00019	0.00019
Barium	0.74	Poorly-correlated	0.0015	0.0083
Beryllium	0.39	Poorly-correlated	-	-
Boron	0.0015	Non-correlated	0.0040	0.031
Cadmium	0.37	Poorly-correlated	0.0000017	0.000073
Chromium	0.76	Correlated	0.00049	0.00049
Cobalt	0.84	Correlated	0.00032	0.00032
Copper	0.023	Non-correlated	0.0090	0.16
Iron	0.85	Correlated	0.49	0.49
Lead	0.86	Correlated	0.00013	0.00013
Lithium	0.51	Poorly-correlated	0.00020	0.0010
Manganese	0.79	Correlated	0.014	0.014
Mercury	0.017	Non-correlated	-	-
Molybdenum	0.0073	Non-correlated	0.00010	0.011
Nickel	0.83	Correlated	0.00047	0.00047
Selenium	0.0061	Non-correlated	-	0.0056
Silver	0.63	Poorly-correlated	-	0.0000051
Strontium	0.0035	Non-correlated	0.017	0.34
Thallium	0.41	Poorly-correlated	-	0.000000050
Tin	0.22	Non-correlated	-	0.000080
Titanium	0.8	Correlated	0.022	0.022
Uranium	0.0071	Non-correlated	0.000023	0.00031
Vanadium	0.84	Correlated	0.0012	0.0012
Zinc	0.76	Correlated	0.0014	0.0014

2.6.2 Water Quality Prediction Calculations

In the SWWQM, Mine facilities were grouped into four categories: open pits, water management ponds sumps and ditches, RDSs, and TSF. The concentrations of parameters at each Mine facility were estimated as described below.

2.6.2.1 Pits, Ponds and Ditches

Conveyance facilities on site (Long Ditch and SERDS Ditch) that are flow-through systems (i.e. they do not retain volumes of water for more than a single timestep) were modelled by assigning a water quality to each inflow and calculating a mixed water quality based on the proportions of each inflow (Equation 1). For pits, sumps, and ponds where water can be stored (9K Sump, NW Sump, Springer-Cariboo Pit, MDCS, Wight Pit, SESCP, MESCP and the PETBP), the concentration and volume retained from the previous time step is included in the calculation (Equation 2).

$$C_{pond} = \frac{\sum C_i Q_i}{\sum Q_i}$$ Equation 1

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*

$$C_{pond} = \frac{C_x V_x + \sum C_i Q_i - \sum C_x Q_o}{V_x + \sum Q_i - \sum Q_o}$$ Equation 2

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*
C_x = concentration in facility in previous timestep *x*
V_x = volume of water in facility in previous timestep *x*
Q_o = flow rate of outflow *o*

Evaporation from water surfaces was included as a decrease in total volume (V_i); in other words, evaporation was a water quantity reduction only and did not remove mass of modelled parameters from the system.

2.6.2.2 Rock Disposal Sites and Tailings Storage Facility

Runoff and seepage volumes from RDS and the TSF were predicted by the SWWBM and input water quality was assigned to these flows based on site monitoring data. Concentrations at these Mine facilities were calculated using Equation 1.

2.6.3 Model Inputs

Water quality inputs in the SWWQM were derived from site water quality monitoring data. A summary of the water quality inputs assigned to each flow in the SWWQM is presented in Table 6 and described below. Site water quality monitoring data from 2006 to 2022 (depending on the input) were used to develop water quality inputs in the SWWQM. For each parameter, water quality inputs were represented in the model by probability distribution functions. The development of the distribution inputs is described in Section 2.6.3.1, and a summary of the distributions selected, the maximum, 95th percentile, and mean values used for each parameter, and the number of samples for each water quality input are presented in Table 7.

As areas in the mine site are reclaimed, the assigned water quality inputs are adjusted in the SWWQM (Table 6):

- Before reclamation of the RDS facilities, the water quality of runoff is assigned either PAG, non-potentially acid-generating (NAG), Boundary Dump (in the Boundary Pit RDS runoff), or Joe' s Creek Pipe (in the Wight Pit RDS runoff) water quality depending on the RDS location. The water quality of runoff is assumed to be equal to disturbed runoff while the facilities are being reclaimed, and then gradually return to undisturbed watershed runoff.
- Seepage from the RDS facilities is conservatively assumed to remain as contact water in perpetuity.
- For Wight Pit and Boundary Pit, the pit wall runoff is assigned the same water quality input during the calibration, operations, closure and post-closure periods. The water quality input assigned to runoff from each of the pit walls is calculated using monitoring data from the corresponding pit (for example, the water quality distribution assigned to pit wall runoff into Wight Pit is calculated using monitoring data from Wight Pit).
- Pit wall runoff into the Springer-Cariboo Pit during closure and post-closure is assigned water quality from two source terms:
  - For pit walls of the former Springer Pit, the source term is calculated based on observed data from Springer Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
  - For pit walls of the former Cariboo Pit, the source term is calculated based on observed data from Cariboo Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
- During the calibration, operations, closure and post-closure periods, disturbed areas are assigned a water quality input calculated using monitoring data from the North Dump Creek and Bootjack Creek (Stations W4 and W5).
- During the calibration, operations, closure and post-closure periods, undisturbed areas are assigned a water quality input calculated using monitoring data from undisturbed runoff (Stations W8 and W8z).
- During the calibration, operations and closure periods, runoff from the TSF beach, impoundment and embankment is assigned a water quality input calculated using monitoring data from the TSF supernatant (Stations E1 and E1a). The water quality of TSF beach, impoundment and embankment runoff is assumed to be equal to undisturbed runoff once the area has been reclaimed in post-closure.
- The proportion of seepage from saturated and unsaturated tailings in the TSF during closure and post-closure are based on hydrogeologic modelling of seepage from the facility (Appendix F). Seepage from unsaturated tailings is assigned the water quality input calculated using monitoring data from the MESCP (Stations E4 and E5). Seepage from the saturated tailings is assigned predicted water quality from the TSF.

- Runoff from the Haul Road is assigned NAG water quality until it is reclaimed in post-closure. Once the Haul Road is reclaimed, runoff from this area is assigned the undisturbed water quality input.
- During the calibration, operations, closure and post-closure periods, groundwater inflow into the combined Springer-Cariboo Pit is assigned a water quality input calculated using monitoring data from Springer Pit Wells (Stations GW12-1/2 and GW15-1/2).

Table 6: Site-Wide Water Quality Model Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Rock Disposal Site Contact Water	RDS Runoff to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 - October 2021)	Disturbed Runoff: W4 and W5 site monitored data (n = 225, January 2014 to January 2022)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	RDS Seepage to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 - October 2021)		
	RDS Runoff to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 62, August 2014 to March 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 225, January 2014 to January 2022)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	RDS Seepage to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 62, August 2014 to March 2022)		
	NAG Waste Rock Runoff	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 510, May 2013 to March 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 225, January 2014 to January 2022)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	NAG Waste Rock Seepage	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 510, May 2013 to March 2022)		
	Temporary NW PAG Stockpile Runoff	PAG Dump Seep water quality (n = 88, May 2013 - March 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 225, January 2014 to January 2022)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	Temporary NW PAG Stockpile Seepage	PAG Dump Seep water quality (n = 88, May 2013 - March 2022)	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 510, May 2013 to March 2022)	
Pit Wall Runoff	Boundary Pit Wall Runoff	Boundary Pit water quality (n = 14, February 2016 - October 2021)		
	Wight Pit Wall Runoff	Wight Pit water quality (n = 50, January 2016 - July 2022)		
	Springer Pit Wall Runoff	Springer Pit water quality (n = 45, January 2016 - January 2022)		
	Cariboo Pit Wall Runoff	Cariboo Pit water quality (n = 16, January 2016 - December 2021)		
Tailings Storage Facility	TSF Beach, Impoundment, and Embankment Runoff	TSF supernatant water quality (n = 70, May 2011 to January 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	Unsaturated TSF Seepage	TSF Main Embankment Seepage Collection Pond (n = 129, January 2006 - October 2021)		
	Saturated TSF Seepage	Predicted concentration in the TSF		
Other	Haul Road Runoff	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 510, May 2013 to October 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)
	Disturbed Runoff	W4 and W5 site monitored data (n = 225, January 2014 to January 2022)		
	Undisturbed Runoff	W8 and W8z site monitored water quality (n = 219, January 2006 to January 2022)		
	Groundwater Inflow to Springer-Cariboo Pit	GW12-1/2, GW15-1/2 site monitored data (n = 244, June 2013 to February 2022)		

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site.

Table 7. Summary of Stochastic Water Quality Inputs

Parameter	Units	Boundary Pit Waste Rock Contact Water					Wight Pit Waste Rock Contact Water/Joe's Creek Pipe				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	760	267	1,190	70	Lognormal	1,558	1.1	2,050	62
Major Ions											
Calcium	mg/L	Normal	183	62	300	70	Normal	325	32	422	62
Chloride	mg/L	Delta-lognormal	1.2	1.6	2.5	69	Lognormal	5.0	1.7	18	62
Fluoride	mg/L	Lognormal	0.19	2.0	1.0	70	Normal	0.17	0.07	0.37	62
Magnesium	mg/L	Normal	23	10	47	70	Normal	65	7.4	79	62
Potassium	mg/L	Normal	1.4	0.29	2.0	70	Normal	2.3	0.28	2.8	62
Sodium	mg/L	Normal	6.3	1.5	9.9	70	Normal	17	1.8	20	62
Sulphate	mg/L	Normal	402	173	731	70	Normal	920	84	1,171	54
Nutrients											
Ammonia	mg/L (as N)	Delta-lognormal	0.029	3.6	0.41	70	Lognormal	0.0032	1.7	0.018	62
Nitrate	mg/L (as N)	Delta-lognormal	0.26	3.0	2.0	70	Normal	26	11	46	62
Nitrite	mg/L (as N)	Delta-lognormal	0.0049	2.5	0.026	31	Constant	-	-	0.0025	11
Total Phosphorus	mg/L	Delta-lognormal	0.041	3.4	0.32	68	Lognormal	0.045	1.1	0.062	61
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0027	1.8	0.012	68	Normal	0.0038	0.0016	0.0086	62
Antimony	mg/L	Normal	0.00013	0.000054	0.00029	58	Lognormal	0.00051	1.1	0.00065	62
Arsenic	mg/L	Lognormal	0.00075	1.6	0.0029	70	Normal	0.0014	0.00011	0.0018	62
Barium	mg/L	Normal	0.038	0.0095	0.056	69	Normal	0.058	0.011	0.09	62
Beryllium	mg/L	Constant	-	-	0.00005	66	Constant	-	-	0.0001	31
Boron	mg/L	Normal	0.05	0.014	0.076	70	Normal	0.076	0.0096	0.095	62
Cadmium	mg/L	Lognormal	0.000029	2.3	0.00023	70	Lognormal	0.000042	1.3	0.000075	60
Chromium	mg/L	Constant	-	-	0.00025	70	Constant	-	-	0.00025	62
Cobalt	mg/L	Lognormal	0.00015	2.6	0.0016	70	Lognormal	0.000079	1.5	0.00021	62
Copper	mg/L	Delta-lognormal	0.005	2.3	0.023	67	Lognormal	0.018	1.1	0.023	62
Iron	mg/L	Lognormal	0.035	2.7	0.34	70	Constant	-	-	0.015	62
Lead	mg/L	Delta-lognormal	0.000095	1.5	0.0002	70	Constant	-	-	0.000025	62
Lithium	mg/L	Lognormal	0.0023	2.2	0.014	70	Normal	0.0041	0.00051	0.0057	62
Manganese	mg/L	Lognormal	0.041	5.1	1.9	70	Lognormal	0.013	2.0	0.07	62
Mercury	mg/L	Constant	-	-	0.0000025	0	Constant	-	-	0.0000025	1.0
Molybdenum	mg/L	Lognormal	0.03	2.4	0.24	70	Lognormal	0.074	1.2	0.12	62
Nickel	mg/L	Constant	-	-	0.00025	68	Constant	-	-	0.00025	32
Selenium	mg/L	Lognormal	0.0038	2.8	0.044	70	Lognormal	0.065	1.3	0.12	62
Silicon	mg/L	Normal	5.6	1.3	7.6	70	Normal	6.0	0.32	7.0	62
Silver	mg/L	Constant	-	-	0.000005	65	Constant	-	-	0.000005	34
Strontium	mg/L	Normal	2.2	0.86	4.0	70	Lognormal	3.3	1.1	4.5	62
Thallium	mg/L	Constant	-	-	0.000005	69	Constant	-	-	0.000005	34
Tin	mg/L	Constant	-	-	0.00005	68	Constant	-	-	0.00005	34
Titanium	mg/L	Normal	0.0082	0.0052	0.024	70	Lognormal	0.0065	1.7	0.029	62
Uranium	mg/L	Lognormal	0.001	2.4	0.0082	70	Lognormal	0.0013	1.2	0.002	62
Vanadium	mg/L	Lognormal	0.00041	1.6	0.0015	70	Lognormal	0.00059	1.3	0.0012	62
Zinc	mg/L	Constant	-	-	0.0015	64	Normal	0.0057	0.00094	0.0085	59

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Non-PAG Waste Rock Contact Water					PAG Waste Rock Contact Water				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	1,310	1.6	4,000	507	Normal	1,237	538	2,851	84
Major Ions											
Calcium	mg/L	Normal	299	100	626	510	Normal	266	116	613	84
Chloride	mg/L	Delta-lognormal	5.2	1.7	21	510	Lognormal	2.7	2.4	23	84
Fluoride	mg/L	Delta-lognormal	0.33	1.8	1.0	398	Lognormal	0.098	1.6	0.44	84
Magnesium	mg/L	Normal	57	21	124	510	Normal	47	18	102	84
Potassium	mg/L	Normal	2.2	0.7	4.2	489	Normal	3.4	1.5	9.0	84
Sodium	mg/L	Normal	19	6.4	44	510	Lognormal	19	1.8	70	84
Sulphate	mg/L	Normal	834	311	1,768	475	Normal	669	356	1,736	84
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0038	2.0	0.039	476	Delta-lognormal	0.019	2.6	0.12	68
Nitrate	mg/L (as N)	Delta-lognormal	2.7	4.3	50	470	Delta-lognormal	9.5	4.6	60	88
Nitrite	mg/L (as N)	Delta-lognormal	0.023	2.2	0.078	64	Lognormal	0.0018	3.1	0.05	13
Total Phosphorus	mg/L	Lognormal	0.013	2.4	0.2	497	Delta-lognormal	0.025	2.0	0.077	75
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0051	2.6	0.05	480	Lognormal	0.0048	2.2	0.048	85
Antimony	mg/L	Delta-lognormal	0.00029	1.7	0.00091	510	Normal	0.00022	0.00013	0.00061	88
Arsenic	mg/L	Lognormal	0.00032	2.1	0.0028	510	Delta-lognormal	0.00042	1.4	0.00093	77
Barium	mg/L	Normal	0.037	0.012	0.08	510	Normal	0.072	0.039	0.19	88
Beryllium	mg/L	Constant	-	-	0.00005	310	Constant	-	-	0	65
Boron	mg/L	Normal	0.063	0.02	0.14	510	Lognormal	0.058	2.4	0.51	88
Cadmium	mg/L	Delta-lognormal	0.00009	3.7	0.0012	255	Lognormal	0.000023	4.4	0.0008	54
Chromium	mg/L	Constant	-	-	0.00025	2.0	Constant	-	-	0.00025	87
Cobalt	mg/L	Delta-lognormal	0.00055	2.5	0.0025	340	Delta-lognormal	0.0005	2.5	0.0035	63
Copper	mg/L	Normal	0.006	0.0025	0.1	281	Normal	0.006	0.0026	0.014	81
Iron	mg/L	Lognormal	0.056	2.2	0.4	32	Lognormal	0.022	1.9	0.2	80
Lead	mg/L	Lognormal	0.000033	1.5	0.0002	510	Constant	-	-	0.000025	61
Lithium	mg/L	Lognormal	0.0028	2.4	0.022	508	Lognormal	0.0013	2.2	0.0092	88
Manganese	mg/L	Delta-lognormal	0.012	7.3	0.4	384	Delta-lognormal	0.16	13	5.9	82
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Normal	0.13	0.074	0.4	510	Normal	0.077	0.07	0.4	88
Nickel	mg/L	Delta-lognormal	0.0021	2.5	0.0092	373	Lognormal	0.00042	1.9	0.0032	88
Selenium	mg/L	Lognormal	0.046	3.2	0.7	510	Normal	0.063	0.052	0.22	85
Silicon	mg/L	Lognormal	5.7	1.2	9.5	507	Lognormal	7.2	1.1	10	84
Silver	mg/L	Lognormal	0.0000066	1.5	0.000044	510	Constant	-	-	0.000005	59
Strontium	mg/L	Normal	3.4	1.8	9.3	510	Normal	1.1	0.39	2.3	88
Thallium	mg/L	Constant	-	-	0.000005	328	Constant	-	-	0	65
Tin	mg/L	Constant	-	-	0.00005	325	Constant	-	-	0.00005	65
Titanium	mg/L	Lognormal	0.0062	1.6	0.031	510	Delta-lognormal	0.018	1.3	0.031	88
Uranium	mg/L	Normal	0.0018	0.0012	0.006	510	Normal	0.0011	0.0007	0.0032	88
Vanadium	mg/L	Lognormal	0.0004	1.7	0.004	510	Lognormal	0.00047	1.6	0.0014	78
Zinc	mg/L	Lognormal	0.0035	3.0	0.047	469	Lognormal	0.002	1.7	0.0089	85

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Boundary Pit Wall Runoff					Wight Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	383	122	749	14	Lognormal	1,036	1.1	1,700	50
Major Ions											
Calcium	mg/L	Normal	95	31	188	14	Lognormal	242	1.1	410	50
Chloride	mg/L	Delta-lognormal	1.1	1.5	2.0	14	Lognormal	1.4	1.3	2.9	50
Fluoride	mg/L	Normal	0.64	0.2	1.2	14	Normal	0.86	0.066	1.1	50
Magnesium	mg/L	Normal	8.8	3.2	18	14	Lognormal	27	1.2	48	50
Potassium	mg/L	Normal	1.4	0.32	2.4	14	Lognormal	1.5	1.1	2.2	50
Sodium	mg/L	Normal	5.3	1.7	11	14	Lognormal	27	1.2	47	50
Sulphate	mg/L	Normal	175	70	385	14	Lognormal	621	1.1	984	50
Nutrients											
Ammonia	mg/L (as N)	Normal	0.0078	0.0035	0.018	13	Delta-lognormal	0.037	3.3	0.2	50
Nitrate	mg/L (as N)	Normal	1.5	1.6	6.2	14	Lognormal	0.22	4.0	6.0	50
Nitrite	mg/L (as N)	Lognormal	0.0032	4.1	0.081	14	Lognormal	0.0033	1.9	0.031	50
Total Phosphorus	mg/L	Delta-lognormal	0.0055	1.6	0.024	13	Lognormal	0.0056	1.5	0.063	50
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0025	1.8	0.016	13	Lognormal	0.0018	1.5	0.0074	50
Antimony	mg/L	Normal	0.001	0.0005	0.0025	14	Lognormal	0.00059	1.3	0.0013	50
Arsenic	mg/L	Normal	0.00055	0.00017	0.0011	14	Normal	0.00061	0.00019	0.0016	50
Barium	mg/L	Normal	0.035	0.017	0.087	14	Lognormal	0.024	1.2	0.045	50
Beryllium	mg/L	Constant	-	-	0	12	Constant	-	-	0	50
Boron	mg/L	Delta-lognormal	0.028	1.3	0.067	14	Lognormal	0.31	1.2	0.56	50
Cadmium	mg/L	Normal	0.000073	0.000034	0.00018	14	Normal	0.00031	0.00013	0.00075	50
Chromium	mg/L	Constant	-	-	0	14	Lognormal	0.0003	1.4	0.00074	50
Cobalt	mg/L	Constant	-	-	0	10	Lognormal	0.00056	1.9	0.0025	50
Copper	mg/L	Normal	0.021	0.01	0.052	14	Normal	0.014	0.0051	0.03	50
Iron	mg/L	Constant	-	-	0	14	Constant	-	-	0.02	35
Lead	mg/L	Constant	-	-	0	14	Constant	-	-	0	50
Lithium	mg/L	Delta-lognormal	0.0079	1.7	0.018	14	Lognormal	0.0088	1.1	0.013	50
Manganese	mg/L	Lognormal	0.014	3.4	0.55	14	Normal	0.16	0.081	0.41	50
Mercury	mg/L	Constant	-	-	0	14	Constant	-	-	0.0000	50
Molybdenum	mg/L	Normal	0.13	0.061	0.31	14	Normal	0.13	0.0079	0.26	50
Nickel	mg/L	Constant	-	-	0	14	Lognormal	0.0007	1.6	0.003	50
Selenium	mg/L	Normal	0.021	0.011	0.055	14	Lognormal	0.012	1.7	0.04	50
Silicon	mg/L	Normal	3.6	1.4	7.9	14	Lognormal	7.4	1.1	10	50
Silver	mg/L	Constant	-	-	0	10	Normal	0.0000065	0.0000024	0.000014	50
Strontium	mg/L	Normal	2.7	1.1	6.0	14	Lognormal	6.4	1.3	12	50
Thallium	mg/L	Constant	-	-	0	14	Normal	0.000011	0.0000034	0.000021	50
Tin	mg/L	Constant	-	-	0	13	Constant	-	-	0.00005	37
Titanium	mg/L	Constant	-	-	0	13	Lognormal	0.0061	1.4	0.02	50
Uranium	mg/L	Normal	0.0045	0.002	0.008	14	Lognormal	0.003	1.2	0.005	50
Vanadium	mg/L	Constant	-	-	0	14	Normal	0.0004	0.00018	0.00093	50
Zinc	mg/L	Constant	-	-	0	14	Delta-lognormal	0.013	1.5	0.03	48

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Springer Pit Wall Runoff					Cariboo Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	792	134	1,000	45	Lognormal	771	1.6	2,987	16
Major Ions											
Calcium	mg/L	Normal	143	23	200	45	Lognormal	143	1.6	584	16
Chloride	mg/L	Normal	9.7	2.8	16	45	Lognormal	5.6	1.9	27	16
Fluoride	mg/L	Normal	0.51	0.1	0.81	45	Lognormal	0.5	1.3	1.1	16
Magnesium	mg/L	Normal	27	4.9	40	45	Lognormal	27	1.7	123	16
Potassium	mg/L	Normal	11	4.7	25	45	Lognormal	2.9	1.8	16	16
Sodium	mg/L	Normal	47	12	70	45	Lognormal	27	1.6	87	16
Sulphate	mg/L	Normal	478	88	600	45	Lognormal	367	1.9	1,610	16
Nutrients											
Ammonia	mg/L (as N)	Delta-lognormal	0.046	3.2	0.4	45	Lognormal	0.0088	1.7	0.034	8.0
Nitrate	mg/L (as N)	Normal	6.5	2.8	12	45	Normal	18	16	65	16
Nitrite	mg/L (as N)	Normal	0.042	0.024	0.11	45	Lognormal	0.025	1.7	0.13	9.0
Total Phosphorus	mg/L	Lognormal	0.012	2.1	0.11	45	Delta-lognormal	0.014	2.3	0.06	15
Dissolved Metals											
Aluminum	mg/L	Normal	0.013	0.0074	0.036	45	Lognormal	0.0068	2.6	0.07	16
Antimony	mg/L	Normal	0.0013	0.0004	0.0022	45	Lognormal	0.0018	2.4	0.014	15
Arsenic	mg/L	Lognormal	0.0012	1.3	0.0027	45	Lognormal	0.0015	1.7	0.0051	16
Barium	mg/L	Normal	0.051	0.014	0.093	45	Lognormal	0.05	1.2	0.084	15
Beryllium	mg/L	Constant	-	-	0.00005	42	Constant	-	-	0.00005	13
Boron	mg/L	Normal	0.13	0.024	0.2	44	Lognormal	0.19	2.2	1.2	16
Cadmium	mg/L	Delta-lognormal	0.000015	2.1	0.0001	44	Lognormal	0.00006	1.8	0.00025	15
Chromium	mg/L	Constant	-	-	0.00025	45	Constant	-	-	0.00025	16
Cobalt	mg/L	Normal	0.00012	0.00006	0.0003	43	Delta-lognormal	0.0006	1.7	0.0016	15
Copper	mg/L	Lognormal	0.0063	2.8	0.07	45	Normal	0.049	0.017	0.1	15
Iron	mg/L	Constant	-	-	0.015	45	Constant	-	-	0.015	16
Lead	mg/L	Constant	-	-	0.000025	45	Constant	-	-	0.000025	15
Lithium	mg/L	Normal	0.013	0.0045	0.024	45	Lognormal	0.0071	1.7	0.03	16
Manganese	mg/L	Normal	0.033	0.017	0.085	45	Lognormal	0.071	2.4	0.6	15
Mercury	mg/L	Constant	-	-	0.0000025	26	Constant	-	-	0.0000025	16
Molybdenum	mg/L	Normal	0.16	0.029	0.25	44	Normal	0.13	0.1	0.26	15
Nickel	mg/L	Normal	0.00054	0.0002	0.0011	44	Normal	0.00081	0.00036	0.0019	15
Selenium	mg/L	Normal	0.036	0.0041	0.048	43	Normal	0.065	0.0	0.12	15
Silicon	mg/L	Lognormal	4.2	1.2	6.9	45	Normal	7.0	2.1	13	16
Silver	mg/L	Constant	-	-	0.000005	44	Constant	-	-	0.000005	14
Strontium	mg/L	Normal	2.1	0.67	4.1	45	Normal	1.3	0.53	2.9	16
Thallium	mg/L	Constant	-	-	0.000005	44	Constant	-	-	0.000005	15
Tin	mg/L	Constant	-	-	0.00005	45	Constant	-	-	0.00005	15
Titanium	mg/L	Normal	0.0089	0.0055	0.026	45	Constant	-	-	0.005	16
Uranium	mg/L	Normal	0.0016	0.00037	0.0027	45	Lognormal	0.0023	1.7	0.008	13
Vanadium	mg/L	Lognormal	0.0011	1.5	0.0041	45	Normal	0.0022	0.0	0.0044	14
Zinc	mg/L	Constant	-	-	0.0015	39	Normal	0.0024	0.0011	0.0056	16

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Tailings Pumped Draindown					Tailings Supernatant				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	898	1.2	1,438	95	Normal	824	163	1,140	122
Major Ions											
Calcium	mg/L	Normal	145	24	218	76	Normal	139	21	203	118
Chloride	mg/L	Normal	21	3.7	32	101	Delta-lognormal	13	1.9	34	124
Fluoride	mg/L	Lognormal	0.66	1.2	0.96	56	Normal	0.6	0.22	1.3	116
Magnesium	mg/L	Lognormal	24	1.3	42	84	Normal	22	5.1	38	118
Potassium	mg/L	Normal	12	1.9	14	111	Normal	14	9.0	36	118
Sodium	mg/L	Normal	78	11	110	84	Normal	60	29	146	118
Sulphate	mg/L	Lognormal	503	1.2	784	95	Normal	489	101	684	124
Nutrients											
Ammonia	mg/L (as N)	Normal	0.045	0.032	0.11	93	Delta-lognormal	0.046	4.3	0.8	117
Nitrate	mg/L (as N)	Normal	2.1	1.1	5.0	78	Normal	4.3	3.7	15	122
Nitrite	mg/L (as N)	Delta-lognormal	0.016	3.5	0.1	86	Delta-lognormal	0.053	3.7	0.35	122
Total Phosphorus	mg/L	Normal	0.026	0.011	0.061	96	Lognormal	0.017	2.0	0.13	122
Dissolved Metals											
Aluminum	mg/L	Delta-lognormal	0.0031	1.3	0.0051	63	Lognormal	0.026	1.5	0.07	117
Antimony	mg/L	Lognormal	0.00036	1.5	0.001	129	Lognormal	0.00082	2.3	0.0058	118
Arsenic	mg/L	Lognormal	0.0018	1.2	0.0028	129	Lognormal	0.0013	1.4	0.003	118
Barium	mg/L	Normal	0.057	0.016	0.09	84	Lognormal	0.049	1.5	0.13	118
Beryllium	mg/L	Constant	-	-	0.00005	4.0	Constant	-	-	0.00005	105
Boron	mg/L	Lognormal	0.13	1.2	0.18	129	Normal	0.11	0.04	0.23	118
Cadmium	mg/L	Lognormal	0.000049	2.8	0.00055	129	Normal	0.000036	0.000018	0.000089	110
Chromium	mg/L	Constant	-	-	0	1.0	Constant	-	-	0.00025	117
Cobalt	mg/L	Normal	0.00024	0.00013	0.00046	128	Lognormal	0.00022	3.5	0.004	118
Copper	mg/L	Lognormal	0.0021	2.8	0.029	129	Normal	0.065	0.1	0.5	117
Iron	mg/L	Lognormal	0.019	1.7	0.08	5.0	Constant	-	-	0.015	115
Lead	mg/L	Constant	-	-	0.000025	2.0	Constant	-	-	0.000025	118
Lithium	mg/L	Normal	0.0058	0.0017	0.011	127	Delta-lognormal	0.0086	1.6	0.025	118
Manganese	mg/L	Normal	0.24	0.16	0.51	82	Normal	0.053	0.04	0.17	117
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0.000003	8.0
Molybdenum	mg/L	Lognormal	0.16	1.3	0.3	129	Normal	0.17	0.043	0.29	118
Nickel	mg/L	Lognormal	0.00031	1.5	0.0011	128	Lognormal	0.00069	2.2	0.0047	118
Selenium	mg/L	Lognormal	0.011	2.1	0.07	83	Normal	0.027	0.0078	0.043	117
Silicon	mg/L	Normal	6.1	0.83	7.0	80	Lognormal	3.9	1.4	8.2	118
Silver	mg/L	Constant	-	-	0.000005	105	Constant	-	-	0.000005	115
Strontium	mg/L	Lognormal	1.5	1.6	4.5	120	Normal	1.6	0.28	2.5	113
Thallium	mg/L	Constant	-	-	0.000005	61	Constant	-	-	0.000005	114
Tin	mg/L	Constant	-	-	0.00005	4.0	Constant	-	-	0.00005	116
Titanium	mg/L	Constant	-	-	0.005	72	Constant	-	-	0.005	111
Uranium	mg/L	Lognormal	0.0014	1.2	0.0027	81	Normal	0.0011	0.00042	0.0024	118
Vanadium	mg/L	Delta-lognormal	0.00068	1.2	0.0012	30	Lognormal	0.0013	2.3	0.01	118
Zinc	mg/L	Lognormal	0.0012	1.8	0.0068	127	Delta-lognormal	0.0066	1.6	0.014	118

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Disturbed Runoff					Undisturbed Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	162	1.5	450	225	Normal	169	69	499	216
Major Ions											
Calcium	mg/L	Lognormal	34	1.9	227	215	Normal	30	15	73	203
Chloride	mg/L	Lognormal	0.49	2.1	4.5	225	Delta-lognormal	3.2	2.1	12	130
Fluoride	mg/L	Lognormal	0.067	1.3	0.16	225	Lognormal	0.069	1.6	0.25	92
Magnesium	mg/L	Lognormal	5.2	1.6	16	215	Lognormal	9.9	2.2	72	203
Potassium	mg/L	Lognormal	0.58	1.5	1.8	215	Normal	0.97	0.29	2.0	203
Sodium	mg/L	Lognormal	3.3	1.5	11	215	Lognormal	5.8	1.7	22	201
Sulphate	mg/L	Lognormal	20	2.9	250	223	Delta-lognormal	6.1	2.3	24	210
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0039	1.8	0.016	221	Normal	0.0052	0.0033	0.015	204
Nitrate	mg/L (as N)	Lognormal	0.028	4.4	0.9	205	Lognormal	0.037	4.8	1.5	202
Nitrite	mg/L (as N)	Lognormal	0.00055	1.4	0.0044	208	Lognormal	0.00064	1.9	0.009	183
Total Phosphorus	mg/L	Lognormal	0.017	1.4	0.07	225	Normal	0.023	0.0068	0.043	212
Dissolved Metals											
Aluminum	mg/L	Delta-lognormal	0.027	4.0	0.4	214	Delta-lognormal	0.046	3.4	0.4	201
Antimony	mg/L	Constant	-	-	0.00005	204	Lognormal	0.00005	1.2	0.001	203
Arsenic	mg/L	Lognormal	0.0003	1.3	0.00057	215	Normal	0.00087	0.00043	0.0018	203
Barium	mg/L	Lognormal	0.015	1.4	0.045	215	Normal	0.0093	0.0021	0.017	203
Beryllium	mg/L	Constant	-	-	0.00005	183	Constant	-	-	0.00003	14
Boron	mg/L	Normal	0.025	0.01	0.06	215	Normal	0.017	0.0073	0.041	203
Cadmium	mg/L	Normal	0.0000066	0.0000036	0.000018	164	Lognormal	0.0000082	1.9	0.000066	203
Chromium	mg/L	Delta-lognormal	0.00056	1.7	0.0012	214	Normal	0.00077	0.00027	0.0017	203
Cobalt	mg/L	Lognormal	0.000057	1.5	0.00047	211	Lognormal	0.000056	1.4	0.00028	202
Copper	mg/L	Lognormal	0.0061	1.6	0.021	211	Normal	0.0022	0.0016	0.0071	203
Iron	mg/L	Lognormal	0.044	2.9	0.58	215	Normal	0.11	0.082	0.4	203
Lead	mg/L	Delta-lognormal	0.000078	1.4	0.00016	215	Delta-lognormal	0.000069	1.3	0.00013	200
Lithium	mg/L	Lognormal	0.00048	1.3	0.0021	214	Delta-lognormal	0.001	1.7	0.0025	65
Manganese	mg/L	Lognormal	0.0045	3.3	0.075	213	Lognormal	0.0065	2.3	0.05	201
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Lognormal	0.0029	2.5	0.025	210	Normal	0.0017	0.0011	0.005	199
Nickel	mg/L	Normal	0.00044	0.00026	0.0012	211	Delta-lognormal	0.00107	1.39533	0.0026	203
Selenium	mg/L	Lognormal	0.00069	3.2	0.012	205	Lognormal	0.00025	1.8	0.0015	114
Silicon	mg/L	Lognormal	5.6	1.2	8.0	215	Lognormal	5.7	1.3	12	203
Silver	mg/L	Delta-lognormal	0.0000128	1.2	0.00002	215	Delta-lognormal	0.0000151	1.3	0.000039	203
Strontium	mg/L	Lognormal	0.19	1.5	0.8	215	Normal	0.24	0.11	0.5	200
Thallium	mg/L	Constant	-	-	0.000005	215	Constant	-	-	0.000005	88
Tin	mg/L	Constant	-	-	0.00005	215	Constant	-	-	0.00005	11
Titanium	mg/L	Constant	-	-	0.005	208	Lognormal	0.0047	1.4	0.015	203
Uranium	mg/L	Lognormal	0.00015	1.9	0.0007	214	Normal	0.00054	0.00038	0.0017	203
Vanadium	mg/L	Normal	0.00055	0.00025	0.0013	215	Lognormal	0.00054	1.3	0.0018	203
Zinc	mg/L	Lognormal	0.0064	2.3	0.05	214	Lognormal	0.0012	1.9	0.008	203

Table 7. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Groundwater Flow				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters						
Total Dissolved Solids	mg/L	Normal	210	130	639	234
Major Ions						
Calcium	mg/L	Normal	45	29	145	237
Chloride	mg/L	Delta-lognormal	3.1	3.5	34	236
Fluoride	mg/L	Delta-lognormal	0.26	1.6	0.8	223
Magnesium	mg/L	Lognormal	5.1	2.8	58	236
Potassium	mg/L	Normal	0.42	0.24	1.2	231
Sodium	mg/L	Normal	22	11	70	237
Sulphate	mg/L	Normal	86	56	341	209
Nutrients						
Ammonia	mg/L (as N)	Delta-lognormal	0.0095	1.7	0.037	233
Nitrate	mg/L (as N)	Delta-lognormal	0.25	3.4	1.2	197
Nitrite	mg/L (as N)	Delta-lognormal	0.0027	2.0	0.0091	187
Total Phosphorus	mg/L	Lognormal	0.013	1.5	0.04	237
Dissolved Metals						
Aluminum	mg/L	Lognormal	0.0021	1.7	0.01	235
Antimony	mg/L	Lognormal	0.000066	1.7	0.00052	235
Arsenic	mg/L	Normal	0.0024	0.0013	0.0052	235
Barium	mg/L	Lognormal	0.017	2.3	0.12	236
Beryllium	mg/L	Constant	-	-	0.00005	217
Boron	mg/L	Delta-lognormal	0.22	2.2	0.8	229
Cadmium	mg/L	Lognormal	0.0000064	2.1	0.000065	237
Chromium	mg/L	Delta-lognormal	0.00069	1.7	0.001	235
Cobalt	mg/L	Delta-lognormal	0.00018	1.5	0.0004	237
Copper	mg/L	Lognormal	0.00035	1.8	0.0027	231
Iron	mg/L	Delta-lognormal	0.096	1.8	0.2	235
Lead	mg/L	Constant	-	-	0.000025	232
Lithium	mg/L	Normal	0.0033	0.00067	0.0054	237
Manganese	mg/L	Normal	0.024	0.02	0.083	226
Mercury	mg/L	Constant	-	-	0.0000025	2.0
Molybdenum	mg/L	Normal	0.032	0.013	0.071	237
Nickel	mg/L	Delta-lognormal	0.0013	2.0	0.0058	237
Selenium	mg/L	Delta-lognormal	0.00024	2.6	0.0012	166
Silicon	mg/L	Normal	7.9	1.0	11	237
Silver	mg/L	Constant	-	-	0.000005	231
Strontium	mg/L	Lognormal	0.13	2.5	1.2	236
Thallium	mg/L	Constant	-	-	0.000005	235
Tin	mg/L	Delta-lognormal	0.00021	1.6	0.0005	235
Titanium	mg/L	Constant	-	-	0.005	226
Uranium	mg/L	Delta-lognormal	0.00023	2.8	0.0015	237
Vanadium	mg/L	Delta-lognormal	0.0015	1.9	0.003	235
Zinc	mg/L	Delta-lognormal	0.0077	2.0	0.027	233

2.6.3.1 Development of Water Quality Inputs

The following standardized process was used to develop a statistical distribution for each parameter (Table 7):

- Step 1: Determine if data are available and if values are less than the method detection limit (MDL). Except for special cases listed below under Step 5, values below the MDL were set equal to half of the MDL.
- Step 2: Examine time-series of available data to select the most representative range of data to use for input:
  - The following general rules were used to select the data used for input to the model:
    - Where no trend was apparent in the monitored data over time, the whole data set was used as input to the model.
    - Where a decreasing trend was observed in the monitored data, the whole data set was used, including the earlier, higher values, thereby adding conservatism and representing a potential return to conditions that led to higher concentrations (without specifying what those conditions were).
    - Where an increasing trend was observed in the monitored data, input data were limited to the range of data most representative of current or recent conditions.
- Step 3: Remove outliers from selected data:
  - Three statistical tests were used to identify outliers. These included the three times standard deviation (3σ) rule, the Hampel identifier, and combined Rosner-Dixon test. A data point was considered an outlier only if it was flagged by all three tests. By using multiple tests, the possibility of misdiagnoses was reduced (Beckman and Cook 1983; Jain 1981; Kottegoda 1984; Pearson 2001).
- Step 4: Fit suitable statistical distributions to the resulting data:
  - The probability distributions considered for the water quality data were normal, lognormal, or delta-lognormal, as these are typical distributions for water quality data (AEP 1995; US EPA 1991). To identify which distribution best described a constituent, all three distributions were initially fitted to the available data. Statistical goodness of fit tests, consisting of the Chi-squared test, the Kolmogorov-Smirnov test and the squared correlation coefficient (Sokal and Rohlf 1981) were used to determine which distribution was most appropriate.
- Step 5: Process data with a single value:
  - Where all data were at a single value a constant input was used equal to this value.
  - Where all data were below detection limits, a constant input was used at half the detection limit.
  - Where dissolved mercury data were not available for a location, a constant input was used equal to half the lowest detection limit measured on site, consistent with other locations.
- Step 6: Determine the minimum and maximum bounds to define a reasonable range for the selected distribution:
  - When possible, the maximum observed value was used as the maximum bound of all distributions. In cases where the maximum observed value was too low to result in a fitted distribution, the lowest maximum value acceptable for a fitted distribution was used as the maximum bound. The maximum is considered reasonable because there is a large dataset of mine water chemistry and parameter concentrations in drainage water are not expected to increase significantly from the period of observed data to closure.

- The minimum value of a distribution was set to zero for the normal distribution, a value very close to zero (e.g., 0.00000001) for the lognormal distribution, or half the detection limit for the delta-lognormal distribution.

2.6.4 Initial Water Quality

Concentrations in ponds, sumps, and pits at the beginning of the calibration period are based on monitoring data in 2017. Concentrations in ponds, sumps, and pits at the beginning of the operations period are based on monitoring data in 2022. For closure, stochastic initial concentrations were based on a triangular distribution using the median, the 5th percentile, and 95th percentile predicted concentrations from operations in September 2024 as the lower and upper bounds on the distribution.

2.7 Model Assumptions

The key assumptions that have been made in the SWWQM are:

- The input water qualities used in the SWWQM are representative of their respective input sources and will continue to be representative over the modelled timeframe. Water quality data for model inputs were selected from available lab testing and field monitoring, augmented by professional judgement where necessary.
- Concentrations of parameters from monitoring data that were lower than the analytical detection limit were set equal to half the detection limit.
- Concentrations of parameters in direct precipitation onto the water surface of water management facilities were assumed to be zero.
- All open pits, ponds, and sumps are fully mixed systems. No stratification is considered over the modelled timeframe. All inputs are mixed with existing water volumes to calculate concentrations of parameters.
- All parameters are assumed to behave conservatively. That is, they are assumed to not settle, precipitate, sorb, degrade, or undergo any other process that would reduce concentrations. This assumption is likely to have negligible effects on major ion predictions but may lead to over-estimation of some nutrients and metals.
- All PAG waste rock will be disposed sub-aqueously in the Springer-Cariboo Pit at closure to mitigate onset of acid generation. Acid generation is not expected to occur prior to subaqueous disposal, and disposal in the Springer-Cariboo Pit Lake will prevent acid onset in the future by limiting oxidation in the waste rock. Geochemical characterization studies estimate the time to the onset of acid generation varies between decades and 100 years (MPMC 2015).
- The combined Springer-Cariboo Pit is assumed to be empty at the start of closure.
- Rock disposal sites are assumed to be reclaimed in post-closure following the reclamation schedule described in Section 2.3. Following revegetation, the runoff from these facilities is assumed to return to undisturbed runoff quality over the course of ten years.
- Diffusive flux from the submerged PAG waste rock into the Springer-Cariboo Pit Lake water cap was not modelled.
- Accumulation and flushing of oxidation products from weathered PAG material prior to subaqueous disposal was not modelled.
- No mass was removed or added to modelled systems through evaporation or direct precipitation. These processes affected water quantity only and did not affect mass of modelled parameters in the system.

3.0 MODEL CALIBRATION

The SWWQM was set up to hindcast concentrations from 1 January 2017 to 31 December 2021 at six locations:

- Springer Pit
- Wight Pit
- CCS
- PETBP
- TSF
- NW Sump

Where discrepancies between model results and monitoring data existed, the model was adjusted to better reflect monitoring data. The same adjustments, made during calibration of the SWWQM in the 2020 Water Management Plan (Golder 2020), were maintained in this update to achieve calibration with monitoring data:

- Adjusting the proportion of Wight Pit runoff and groundwater inflows assumed to be waste rock contact water based on storage of waste rock in the pit.
- Adjusting the proportion of runoff from waste rock that is assigned an undisturbed water quality input.
- In the TSF, applying calibration factors greater than 1.0 to improve the model calibration for chloride, fluoride, potassium, sodium, nitrite, antimony, arsenic, barium, lithium, molybdenum, and vanadium.

3.1 Calibration Results

Model calibration results are shown compared to monitoring data in Figures 4 to 9 (model calibration results for all parameters and locations are provided in Appendix A). Monitoring data were generally between the projected 5th and 95th percentile model calibration results for all parameters.

Where monitoring data fell within the 5th and 95th percentile model calibration results, the model was considered to be in good agreement with monitoring data. The good agreement indicates that model inputs were well characterized and that these parameters had low sensitivity to assumptions or model conditions not matching site conditions.

Where monitoring data were consistently below the 5th percentile predictions, the model was considered to be over predicting concentrations. Possible reasons why the model may be over-predicting concentrations are:

- The model was developed to predict water quality conservatively; where uncertainty exists in model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected. For example, seepage from RDS was assigned a NAG water quality for the entire model simulation period, which is a conservative assumption.
- Metal concentrations that are far below detection limits may be skewed upward by model inputs where half-detection limits were applied.
- Settling of particulate material is not accounted for in the model.

- Geochemical processes, such as precipitation and adsorption, are not accounted for in the model.

Although these factors may lead to over-prediction of concentrations, the model is considered valid for the purpose of predicting concentrations of parameters on the mine site and in the influent to the WTP because deviations in model predictions from monitoring data in this category tend toward additional environmental protection.

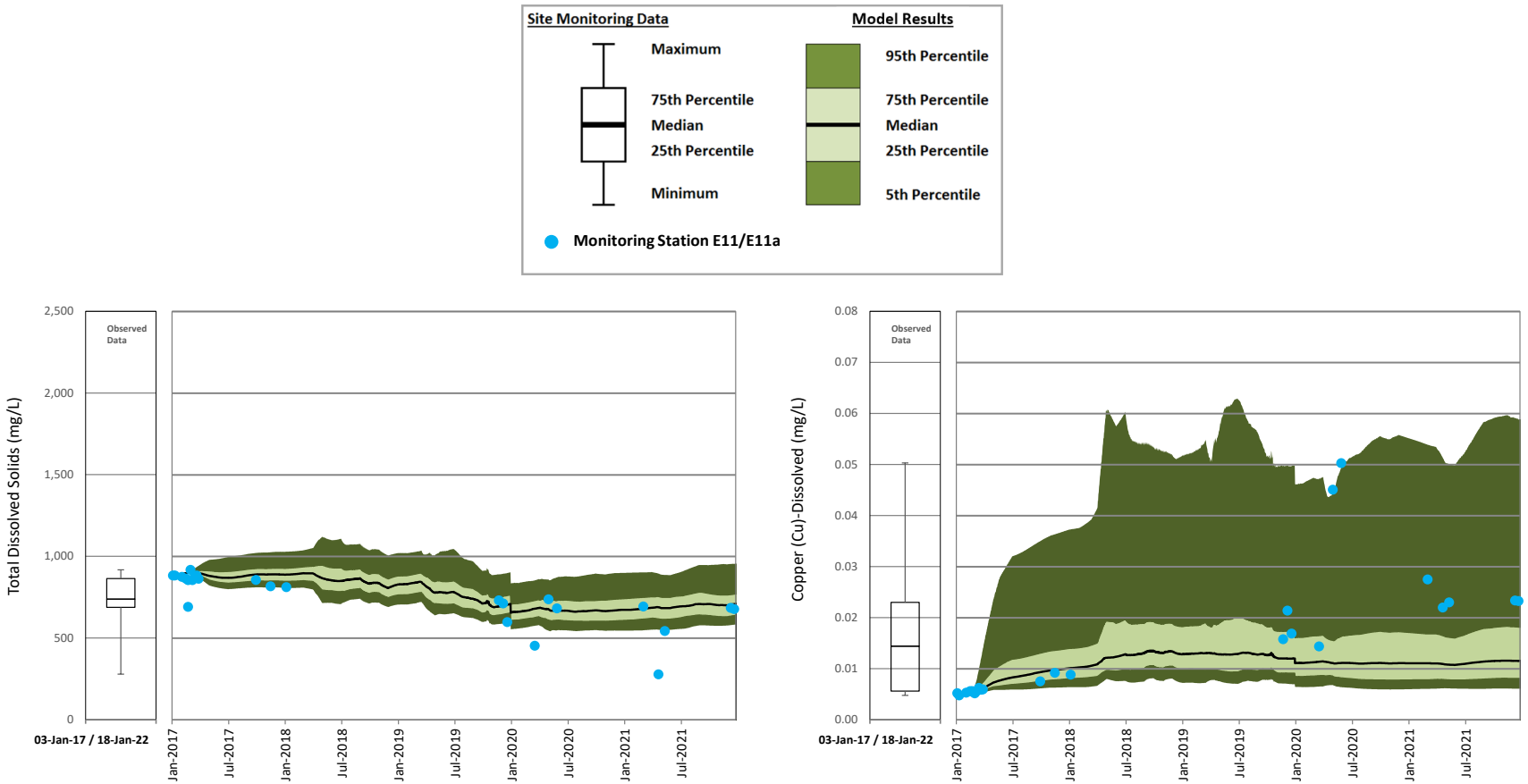

Figure 4: Springer Pit Calibration – Total Dissolved Solids and Dissolved Copper

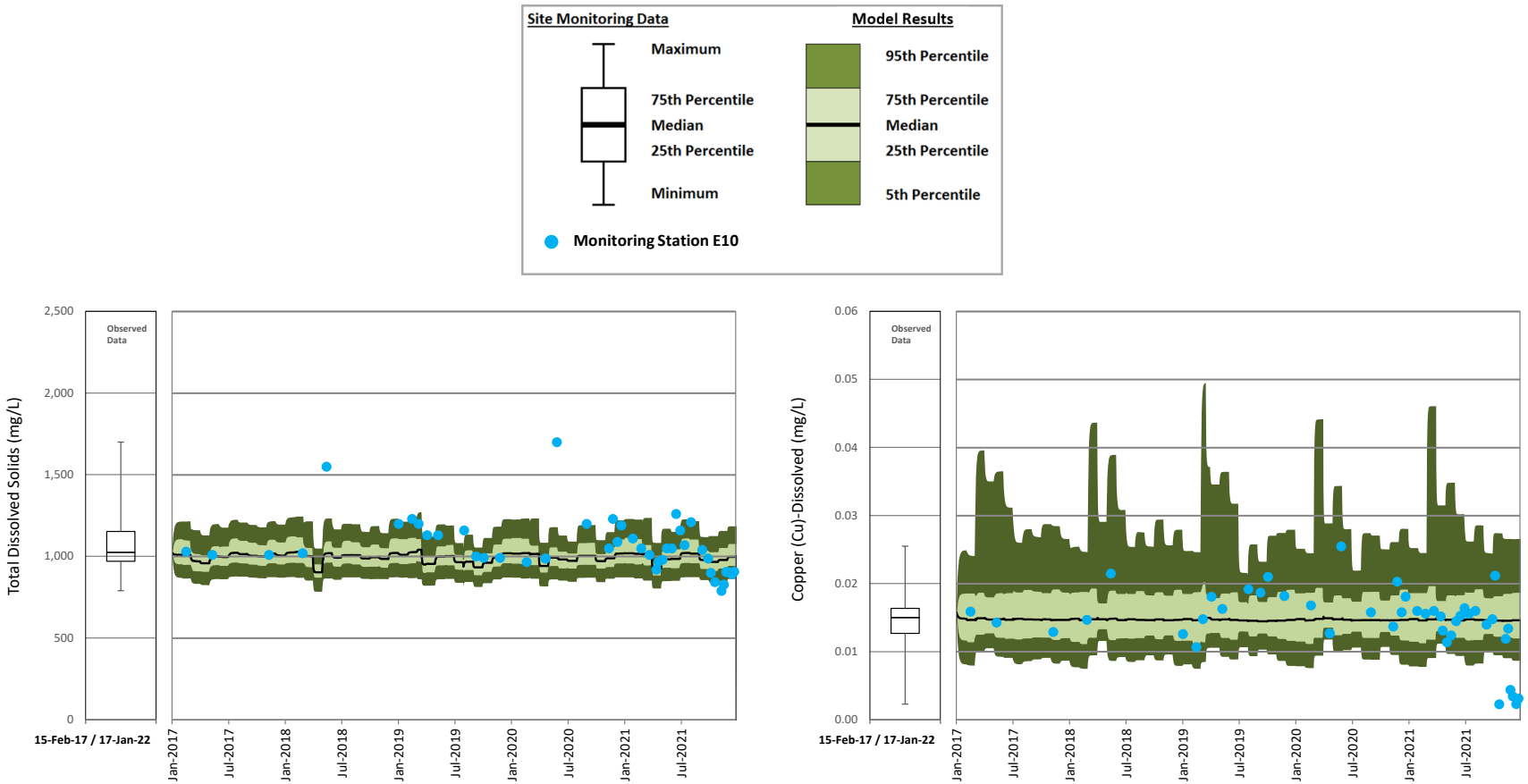

Figure 5: Wight Pit Calibration – Total Dissolved Solids and Dissolved Copper

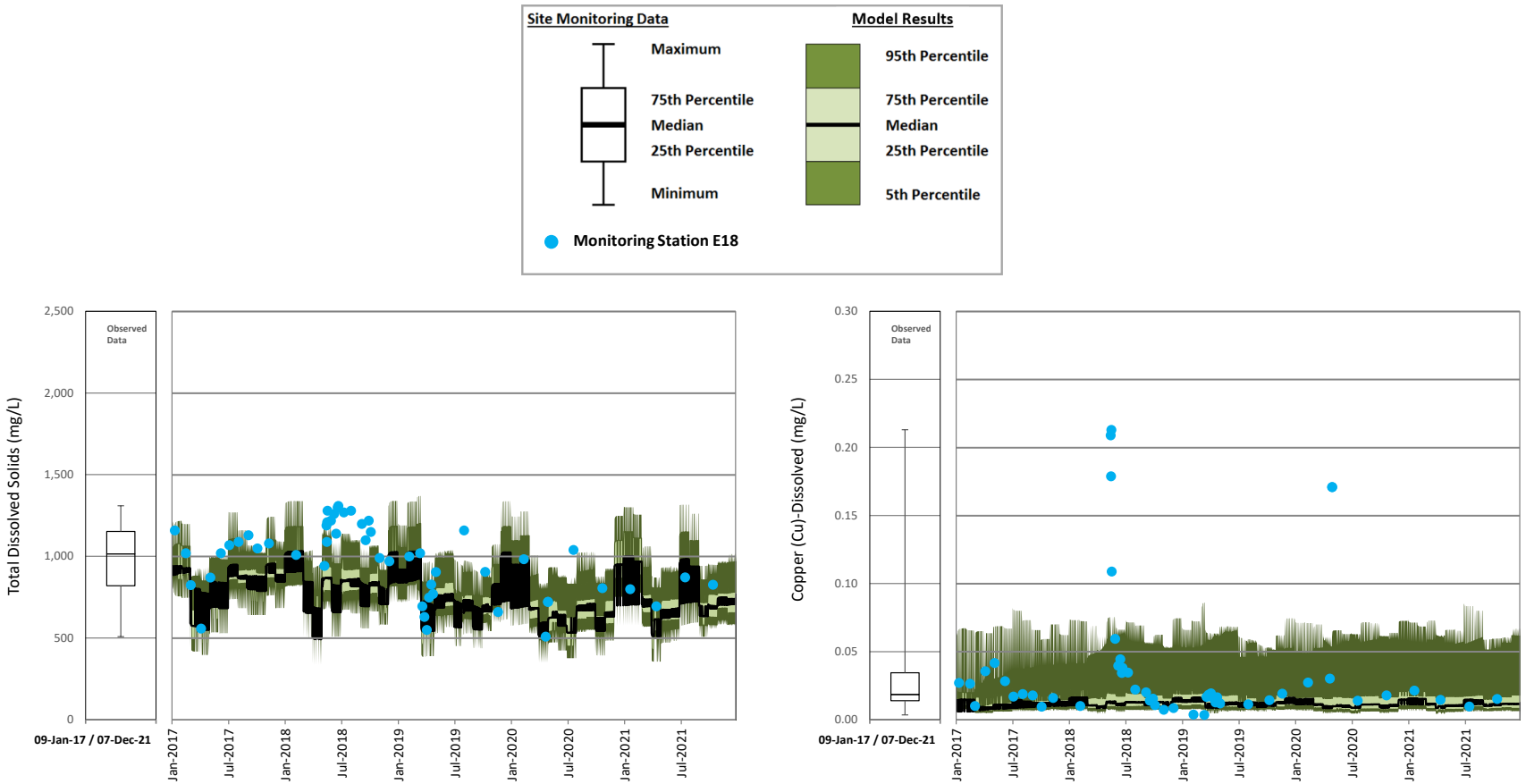

Figure 6: Central Collection Sump Calibration – Total Dissolved Solids and Dissolved Copper

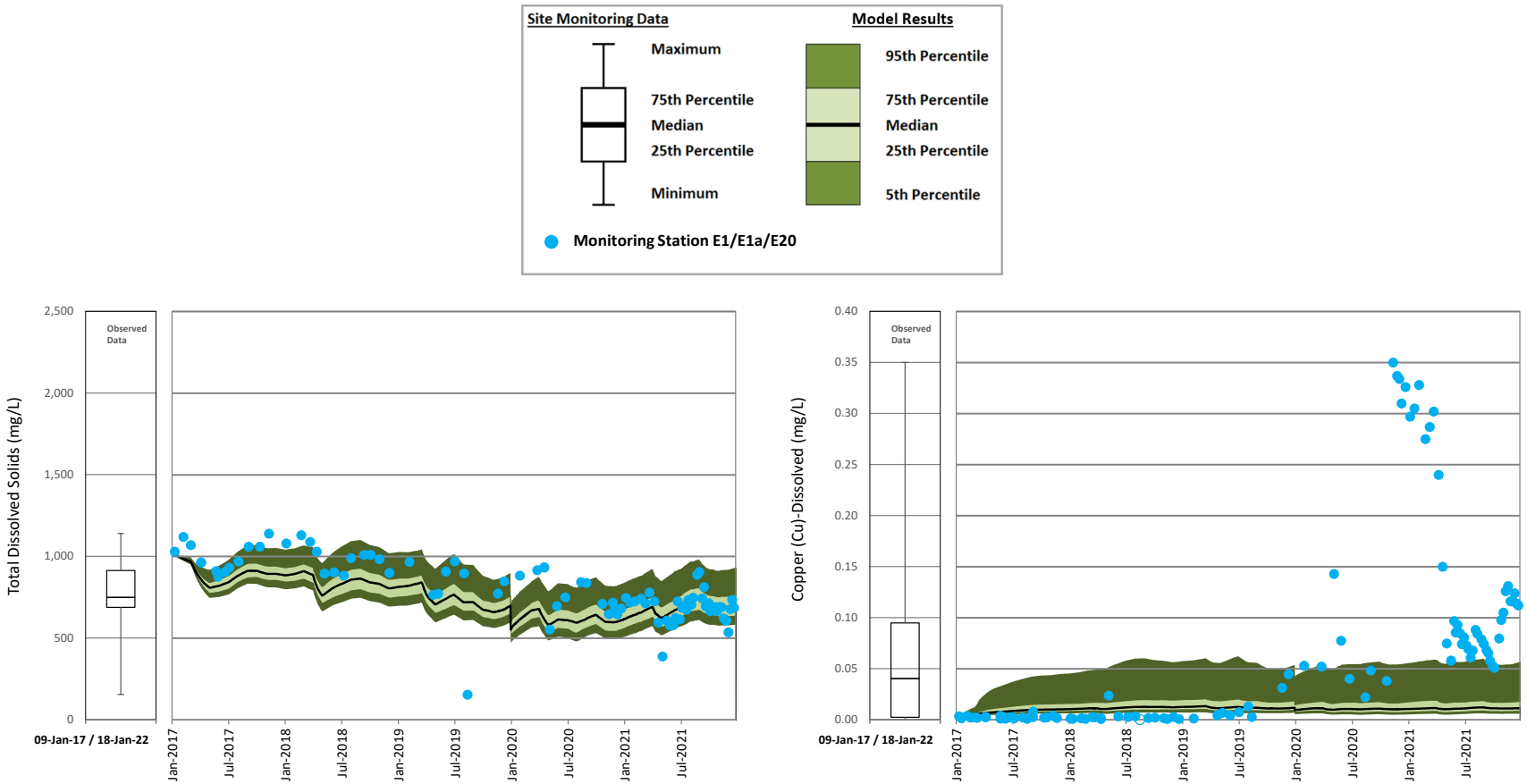

Figure 7: Tailings Storage Facility Supernatant Pond – Total Dissolved Solids and Dissolved Copper

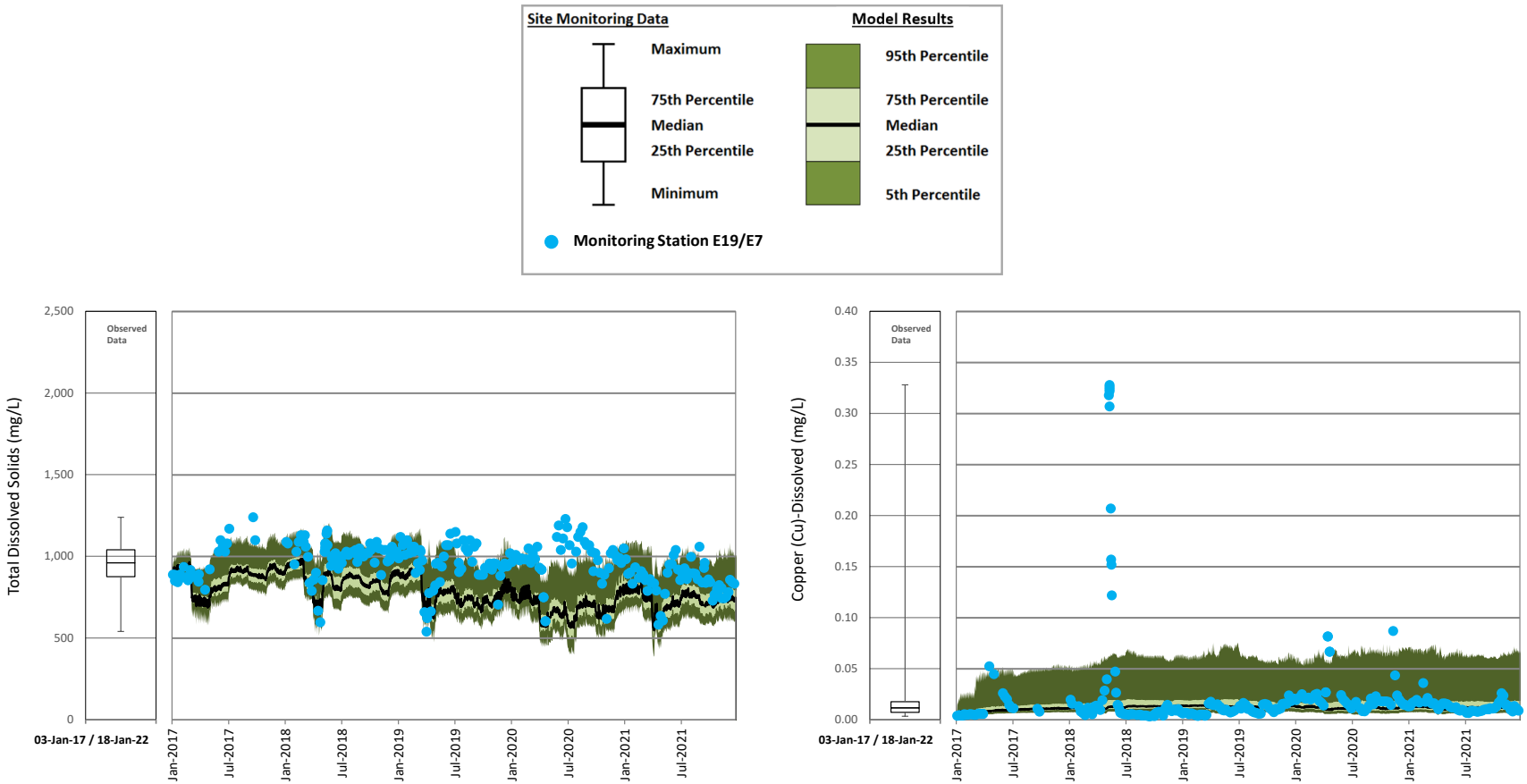

Figure 8: Perimeter Embankment Till Borrow Pond – Total Dissolved Solids and Dissolved Copper

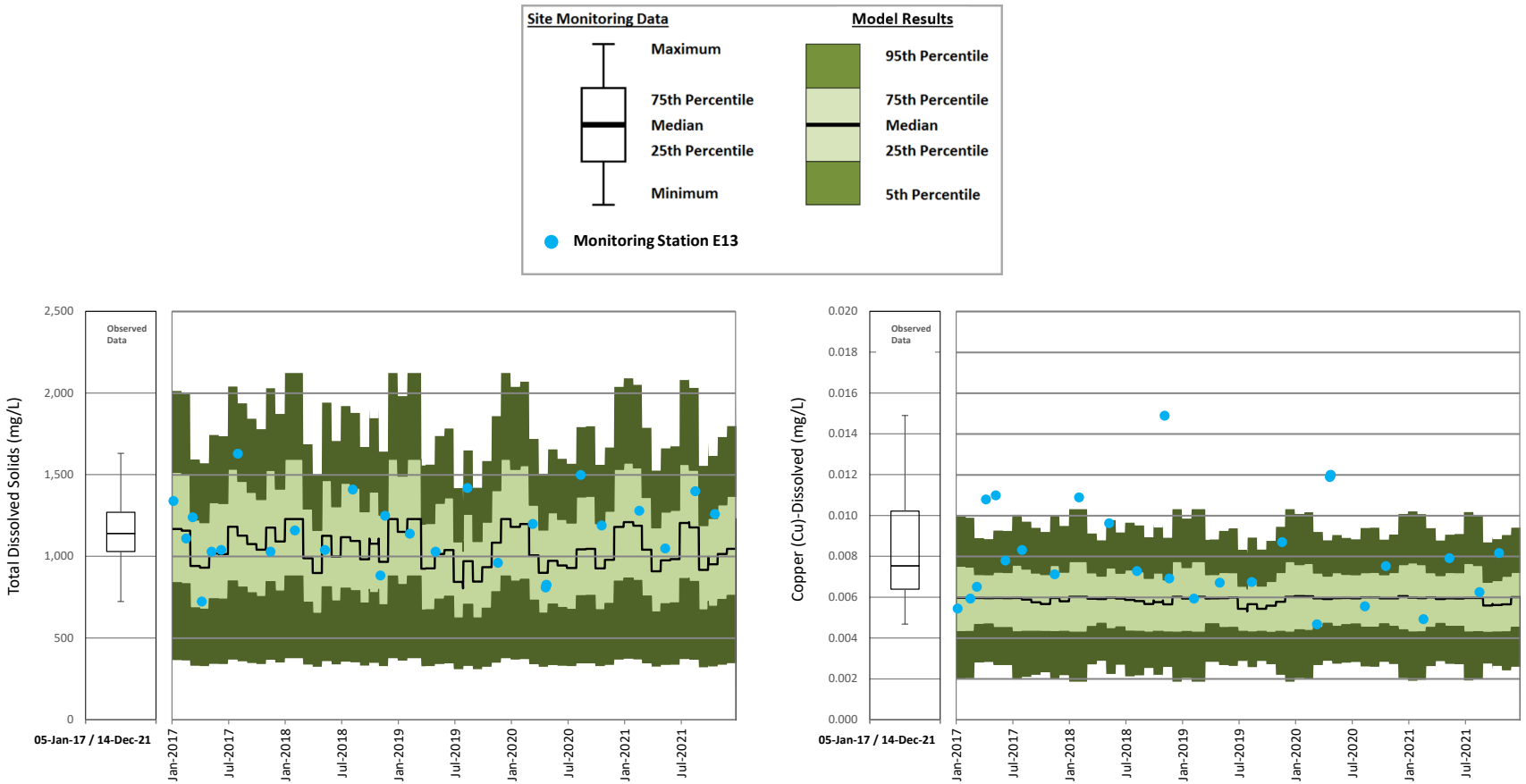

Figure 9: Northwest Sump – Total Dissolved Solids and Dissolved Copper

4.0 MODEL RESULTS

After the model calibration was completed, model simulations were performed for the following periods:

- Operations (1 January 2023 to 8 September 2024, Section 4.1)
- Closure (9 September 2024 to 8 September 2034, Section 4.2)
- Post-closure (9 September 2034 to 9 September 2124, Section 4.3)

Maximum predicted concentrations and time series results for these time periods are presented below.

4.1 Operations Model Results

The PETBP is the influent water to the water treatment plant, which discharges to Quesnel Lake. Maximum of the daily median and maximum of the daily 95th percentile concentrations in the PETBP are presented in Table 8. Predictions are shown assuming no treatment (with the exception of removal of TSS to a maximum monthly average of 15 mg/L), so that water treatment can be added or modified if necessary. Time series for predicted concentrations in the PETBP are presented for key parameters (i.e., parameters with permit limits) in Figures 10 to 15. In general, concentrations in the PETBP are predicted to remain relatively consistent during operations. This consistency is due to the assumption that the entire surface area of the RDS are accounted for at the beginning of the model simulation. Therefore, the runoff and seepage volumes from the RDS do not change. Changes in predicted concentrations in the PETBP (for example, from 600 mg/l to 300 mg/L for sulphate several times within a year [Figure 10]) are due to:

- Variable pumping from the TSF to the MDCS during operations. During periods when the TSF is pumped to the MDCS (P100 booster pumping in Figure 1), concentrations of most parameters increase in the MDCS. Concentrations decrease in the MDCS when there is no pumping from the TSF. Changes in MDSC water quality reach the PETBP through the pathway connecting the MDCS to the PETBP:
  - TSF → MDCS → SERDS Ditch → Long Ditch → CCS → PETBP
- Surface runoff at the mine site causes fluctuations in concentrations depending on the proportions of the catchment areas flowing into the facilities (e.g., RDS areas, disturbed areas, undisturbed areas). Parameter concentrations reach steady-state during the winter months (e.g., between November 2023 and February 2023) because surface runoff is low.

Table 8. Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

Parameter	Units	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters			
Hardness[(a)]	mg CaCO3/L	653	752
Total Dissolved Solids	mg/L	994	1,219
Major Ions			
Calcium	mg/L	207	236
Chloride	mg/L	24	26
Fluoride	mg/L	0.91	1.0
Magnesium	mg/L	33	40
Potassium	mg/L	23	25
Sodium	mg/L	89	94
Sulphate	mg/L	593	674
Nutrients			
Ammonia	mg/L (as N)	0.14	0.21
Nitrate	mg/L (as N)	8.4	18
Nitrite	mg/L (as N)	0.085	0.11
Total Phosphorus	mg/L	0.023	0.034
Total Metals			
Aluminum	mg/L	0.46	0.54
Antimony	mg/L	0.0018	0.002
Arsenic	mg/L	0.0017	0.0019
Barium	mg/L	0.066	0.079
Beryllium	mg/L	0.000053	0.000053
Boron	mg/L	0.19	0.25
Cadmium	mg/L	0.00016	0.00033
Chromium	mg/L	0.00085	0.00094
Cobalt	mg/L	0.00069	0.0012
Copper	mg/L	0.024	0.23
Iron	mg/L	0.54	0.61
Lead	mg/L	0.00018	0.00019
Lithium	mg/L	0.017	0.018
Manganese	mg/L	0.12	0.77
Mercury	mg/L	0.0000027	0.0000027
Molybdenum	mg/L	0.2	0.24
Nickel	mg/L	0.0012	0.002
Selenium	mg/L	0.039	0.091
Silver	mg/L	0.000011	0.000016
Strontium	mg/L	3.5	5.3
Thallium	mg/L	0.0000069	0.0000093
Tin	mg/L	0.000065	0.00016
Titanium	mg/L	0.028	0.03
Uranium	mg/L	0.002	0.0028
Vanadium	mg/L	0.0029	0.0033
Zinc	mg/L	0.01	0.02
Dissolved Metals			
Aluminum	mg/L	0.059	0.14
Antimony	mg/L	0.0018	0.0019
Arsenic	mg/L	0.0015	0.0017
Barium	mg/L	0.065	0.071
Beryllium	mg/L	0.000053	0.000053
Boron	mg/L	0.18	0.22
Cadmium	mg/L	0.00016	0.00026
Chromium	mg/L	0.00037	0.00045
Cobalt	mg/L	0.00037	0.00089
Copper	mg/L	0.015	0.076
Iron	mg/L	0.045	0.12
Lead	mg/L	0.000051	0.000058
Lithium	mg/L	0.017	0.017
Manganese	mg/L	0.11	0.76
Mercury	mg/L	0.0000027	0.0000027
Molybdenum	mg/L	0.2	0.23
Nickel	mg/L	0.00071	0.0015
Selenium	mg/L	0.039	0.085
Silicon	mg/L	7.1	7.8
Silver	mg/L	0.000011	0.000011
Strontium	mg/L	3.4	4.9
Thallium	mg/L	0.0000069	0.0000092
Tin	mg/L	0.000065	0.000079
Titanium	mg/L	0.0062	0.0082
Uranium	mg/L	0.002	0.0025
Vanadium	mg/L	0.0017	0.0021
Zinc	mg/L	0.0089	0.019

a) Calculated based on predicted calcium and magnesium concentrations.

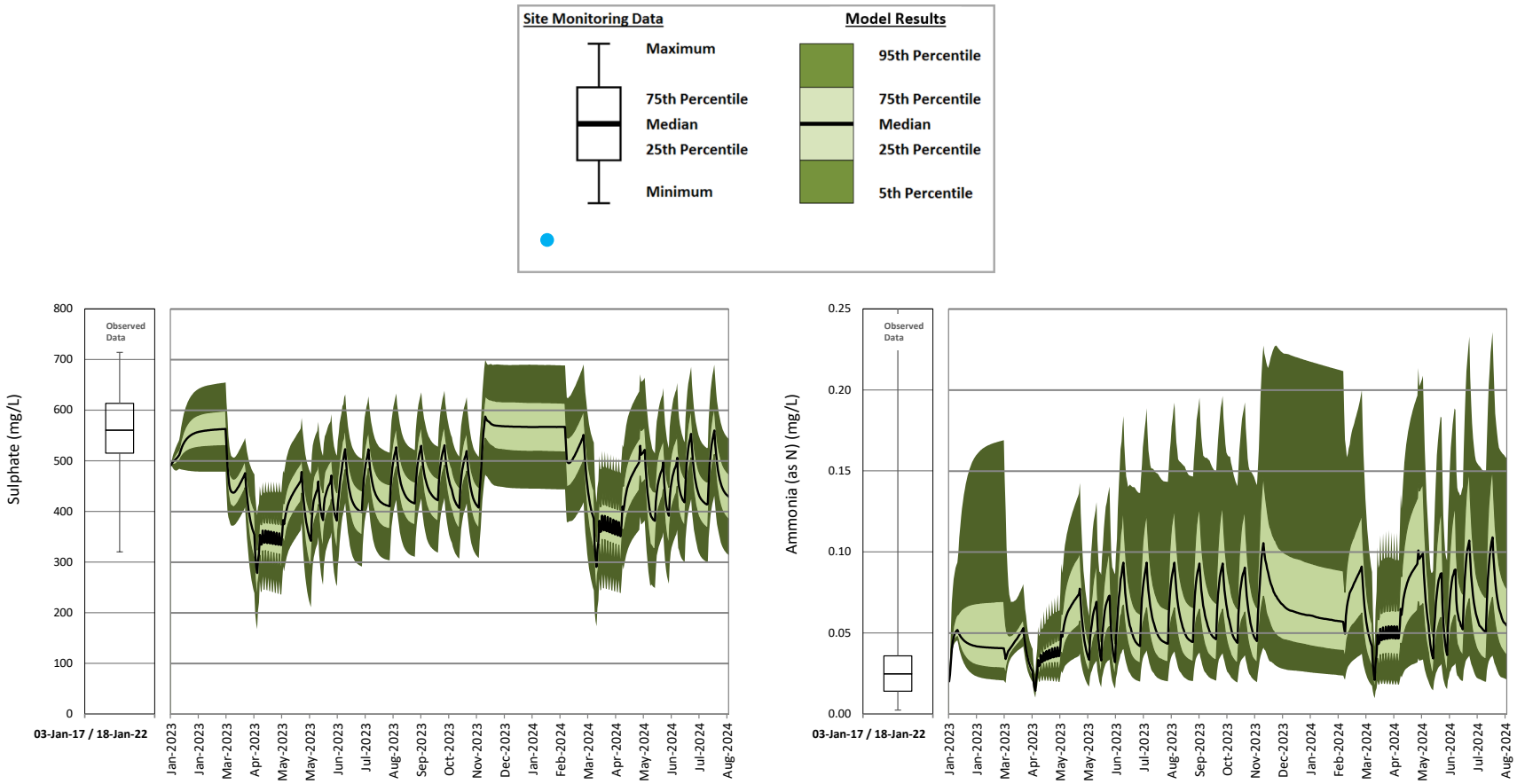

Figure 10: Predicted Sulphate and Total Ammonia Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

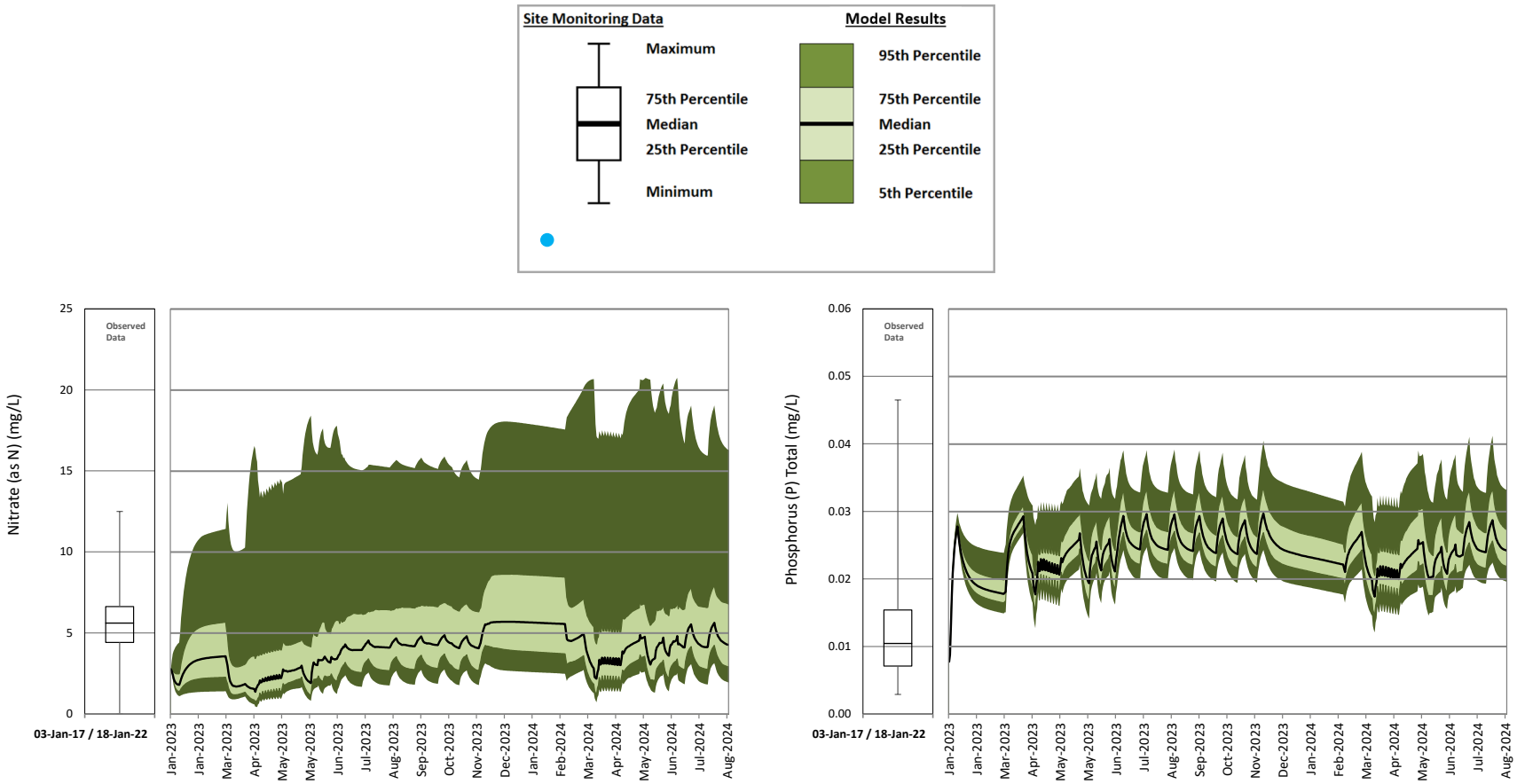

Figure 11: Predicted Nitrate and Total Phosphorus Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

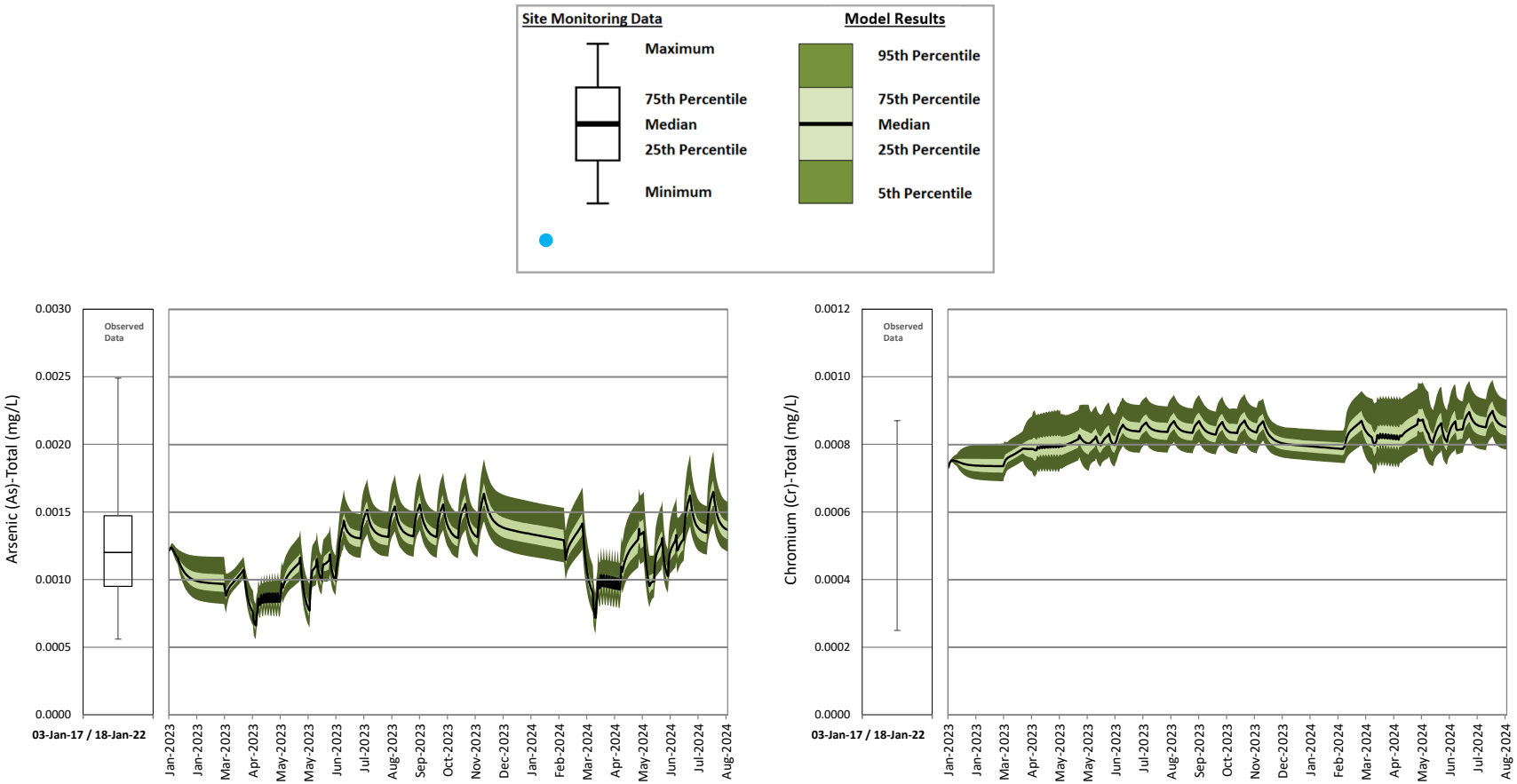

Figure 12: Predicted Total Arsenic and Total Chromium Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

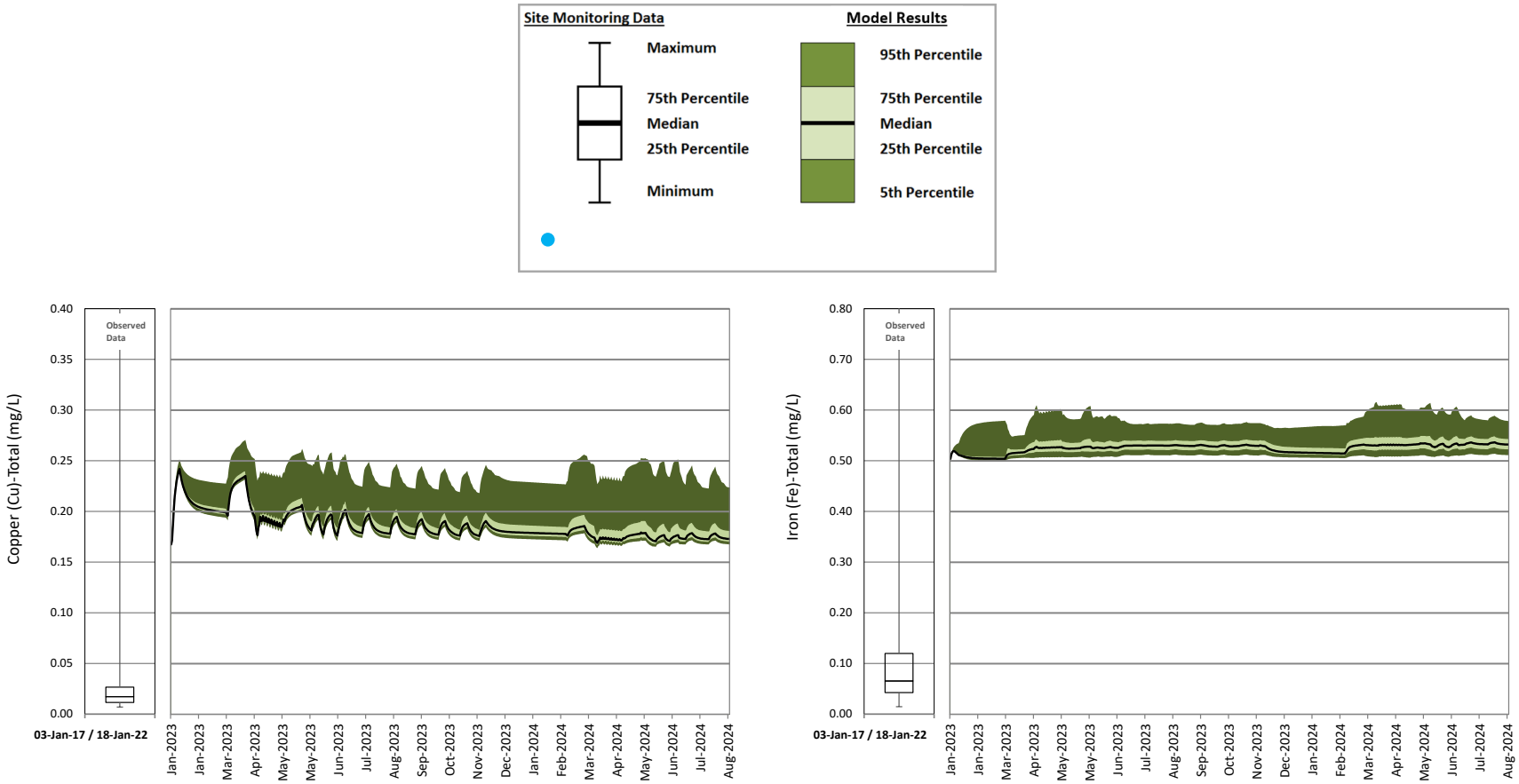

Figure 13: Predicted Total Copper and Total Iron Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

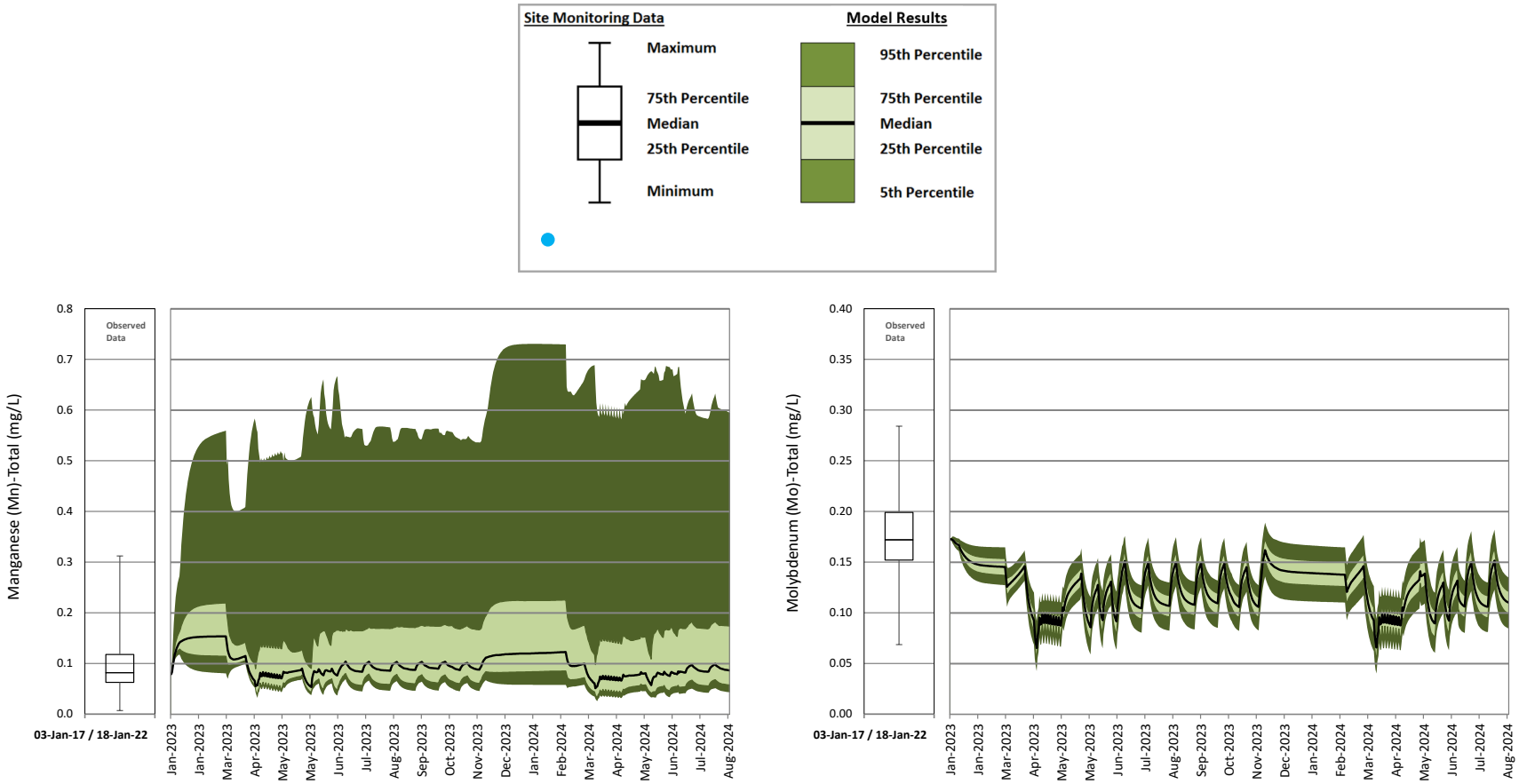

Figure 14: Predicted Total Manganese and Total Molybdenum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

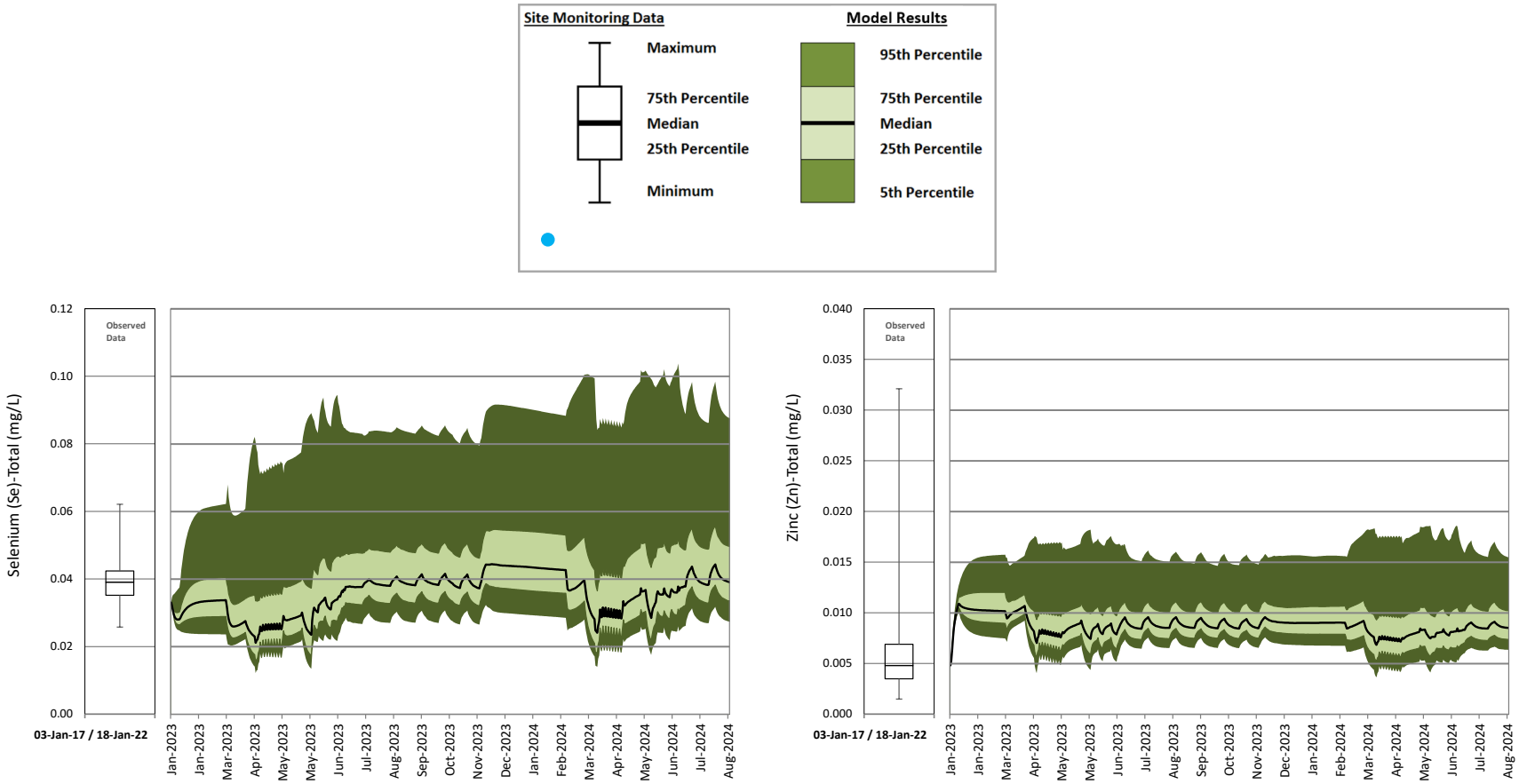

Figure 15: Predicted Total Selenium and Total Zinc Concentrations in the Perimeter Embankment Till Borrow Pond – Operations

4.2 Closure and Post-closure Model Results

The following sections present predicted discharge water quality for each of the nine discharge locations in closure and post-closure (Section 2.4):

- 9 km Sump
- NW Sump
- Springer-Cariboo Pit Sump
- Mine Drainage Creek Sump
- Wight Pit
- Long Ditch
- South Embankment Seepage Collection Pond (SESCP)
- Main Embankment Seepage Collection Pond (MESCP)
- Perimeter Embankment Till Borrow Pond (PETBP)

Predicted concentrations for both the climate change and the base case water balance scenarios are presented. Trends in water quality predictions are similar in each of the water balance scenarios.

Maximum of median and 95th percentile predicted concentrations are presented for all modelled parameters. Time series for predicted discharge water qualities are presented for key parameters (i.e. parameters with permit limits). Time series predictions are also compared to historical observed data for each facility in the model as a quality control check.

4.2.1 9 km Sump and Northwest Sump

The 9K Sump and the NW Sump receive drainage from undisturbed and disturbed areas in their catchment areas, as well as runoff and seepage from the Temporary NW PAG Stockpile and East RDS. Discharge from the 9K Sump and NW Sump is assumed to be directed to Bootjack Lake.

Time series plots for key parameters in the 9K Sump for closure and post-closure are shown in Figures 16 to 18 for the climate change module results and in Figures 19 to 21 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 9 and 10 for the climate change and base case modules, respectively. Time series plots for key parameters in the Northwest Sump for closure and post-closure are shown in Figures 22 to 24 for the climate change module results and in Figures 25 to 27 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 11 and 12 for the climate change and base case modules, respectively.

Peak concentrations for most key parameters in the 9K Sump and NW Sump occur in the first two years of closure (2024 – 2025). During this period, the stockpiled PAG waste material is re-handled and placed in the Springer-Cariboo Pit. During re-handling, runoff and seepage from the Temporary NW PAG Stockpile is assigned a PAG waste rock water quality, hence the higher predicted concentrations.

Trends for all key parameters reach steady state conditions in the 9K Sump and NW Sump by approximately 2037, or ten years after the Temporary NW PAG Stockpile is assumed to be reclaimed (Figures 16 to 21 for the 9K Sump; Figures 22 to 27 for the NW Sump). Concentrations of most parameters gradually decrease as runoff water qualities from all facilities reporting to the 9K Sump are predicted to return to background water (Table 6). After the PAG material has been removed from the 9K Sump catchment area, runoff from the Temporary NW PAG Stockpile is assigned the disturbed runoff water quality and progressively returns to undisturbed over ten years, which causes concentrations of most parameters to decrease.

Seasonal concentration peaks during winter are associated with continued seepage through the reclaimed Temporary NW PAG Stockpile. During winter months, the relative flow contribution of seepage from the Temporary NW PAG Stockpile is high compared to runoff because snowfall is assumed to accumulate on the stockpile and not melt until spring. Seepage from the Temporary NW PAG Stockpile is assigned a PAG water quality input during reclamation and then a NAG water quality input in perpetuity once reclamation is complete. The NAG and PAG water quality in the seepage flows during the winter results in the seasonal winter peaks in concentrations.

The only parameters with predicted maximum concentrations greater in post-closure than closure are aluminum, arsenic, chromium, iron, lead, silver and silicon. These parameters have higher concentrations in the statistical distributions assigned for undisturbed runoff water quality than the statistical distributions assigned for PAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more flows on the Mine site, which results in predicted concentrations of aluminum, arsenic, chromium, iron, lead, silver and silicon to be higher in post-closure than closure.

Table 9. Predicted Maximum Concentrations in the 9K Sump during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	809	1,350	725	1,215	747	1,249
Total Dissolved Solids	mg/L	1,158	1,967	1,044	1,759	1,074	1,812
Major Ions							
Calcium	mg/L	248	422	223	378	230	389
Chloride	mg/L	2.9	10.0	3.1	9.2	3.1	9.4
Fluoride	mg/L	0.23	0.51	0.095	0.2	0.096	0.2
Magnesium	mg/L	46	72	41	66	42	67
Potassium	mg/L	3.2	5.5	2.9	5.0	3.0	5.2
Sodium	mg/L	17	42	16	38	17	39
Sulphate	mg/L	647	1,156	559	1,027	578	1,061
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0054	0.011	0.0054	0.011
Nitrate	mg/L (as N)	6.7	43	0.04	0.43	0.036	0.43
Nitrite	mg/L (as N)	0.012	0.053	0.00064	0.0018	0.00064	0.0018
Total Phosphorus	mg/L	0.023	0.057	0.024	0.053	0.024	0.054
Total Metals							
Aluminum	mg/L	0.43	0.53	0.45	0.62	0.45	0.63
Antimony	mg/L	0.00024	0.00059	0.00022	0.0005	0.00022	0.00051
Arsenic	mg/L	0.00081	0.0012	0.0010	0.0016	0.001	0.0016
Barium	mg/L	0.07	0.13	0.063	0.12	0.065	0.12
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.06	0.25	0.054	0.23	0.055	0.23
Cadmium	mg/L	0.000066	0.00047	0.000022	0.00027	0.000023	0.00027
Chromium	mg/L	0.00099	0.0012	0.0012	0.0016	0.0012	0.0016
Cobalt	mg/L	0.00051	0.0018	0.00044	0.0016	0.00045	0.0017
Copper	mg/L	0.015	0.17	0.014	0.17	0.014	0.17
Iron	mg/L	0.58	0.66	0.6	0.72	0.61	0.72
Lead	mg/L	0.00016	0.00019	0.00016	0.00021	0.00016	0.00021
Lithium	mg/L	0.0024	0.0084	0.0015	0.0051	0.0015	0.0052
Manganese	mg/L	0.13	2.8	0.12	2.5	0.12	2.6
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.098	0.19	0.073	0.17	0.076	0.18
Nickel	mg/L	0.0012	0.004	0.0012	0.002	0.0012	0.002
Selenium	mg/L	0.065	0.14	0.058	0.13	0.059	0.13
Silver	mg/L	0.0000049	0.000016	0.0000046	0.00002	0.0000047	0.000021
Strontium	mg/L	2.4	4.4	0.94	1.8	0.97	1.8
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.028	0.042	0.027	0.04	0.027	0.04
Uranium	mg/L	0.0014	0.0029	0.0011	0.0023	0.0011	0.0023
Vanadium	mg/L	0.0017	0.0021	0.0017	0.0021	0.0017	0.0021
Zinc	mg/L	0.0042	0.019	0.0033	0.0053	0.0033	0.0053
Dissolved Metals							
Aluminum	mg/L	0.028	0.13	0.04	0.22	0.041	0.23
Antimony	mg/L	0.00022	0.00045	0.0002	0.00036	0.0002	0.00037
Arsenic	mg/L	0.00062	0.00098	0.00081	0.0014	0.00083	0.0014
Barium	mg/L	0.068	0.13	0.062	0.11	0.063	0.12
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.056	0.22	0.05	0.2	0.051	0.2
Cadmium	mg/L	0.000064	0.00039	0.000021	0.00019	0.000021	0.0002
Chromium	mg/L	0.0005	0.00072	0.00071	0.0011	0.00073	0.0011
Cobalt	mg/L	0.00019	0.0015	0.00012	0.0013	0.00013	0.0013
Copper	mg/L	0.0059	0.0098	0.0055	0.009	0.0055	0.0091
Iron	mg/L	0.089	0.17	0.11	0.22	0.11	0.23
Lead	mg/L	0.000029	0.000054	0.000023	0.000073	0.000023	0.000075
Lithium	mg/L	0.0022	0.0074	0.0013	0.0041	0.0013	0.0042
Manganese	mg/L	0.12	2.8	0.1	2.5	0.11	2.6
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.098	0.18	0.073	0.16	0.076	0.17
Nickel	mg/L	0.00069	0.0035	0.00072	0.0015	0.00073	0.0015
Selenium	mg/L	0.065	0.14	0.058	0.12	0.059	0.13
Silicon	mg/L	7.1	8.8	7.0	8.8	7.0	8.9
Silver	mg/L	0.0000049	0.000011	0.0000046	0.000015	0.0000047	0.000016
Strontium	mg/L	2.4	4.1	0.93	1.4	0.95	1.5
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0059	0.02	0.0048	0.018	0.0048	0.018
Uranium	mg/L	0.0014	0.0026	0.0011	0.002	0.0011	0.002
Vanadium	mg/L	0.00051	0.00093	0.00054	0.00089	0.00054	0.0009
Zinc	mg/L	0.0028	0.017	0.002	0.004	0.0019	0.0039

a) Calculated based on predicted calcium and magnesium concentrations.

Table 10. Predicted Maximum Concentrations in the 9K Sump during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	800	1,267	590	1,060	590	1,071
Total Dissolved Solids	mg/L	1,115	1,856	838	1,539	847	1,560
Major Ions							
Calcium	mg/L	245	397	180	327	179	330
Chloride	mg/L	2.9	9.3	3.1	8.4	3.1	8.7
Fluoride	mg/L	0.22	0.5	0.092	0.18	0.092	0.18
Magnesium	mg/L	46	67	34	59	35	60
Potassium	mg/L	3.0	5.2	2.5	4.4	2.5	4.4
Sodium	mg/L	17	39	14	33	14	33
Sulphate	mg/L	651	1,083	431	880	434	883
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0054	0.011	0.0054	0.011
Nitrate	mg/L (as N)	6.7	43	0.04	0.43	0.036	0.43
Nitrite	mg/L (as N)	0.012	0.053	0.00064	0.0018	0.00064	0.0018
Total Phosphorus	mg/L	0.023	0.054	0.024	0.048	0.024	0.049
Total Metals							
Aluminum	mg/L	0.43	0.53	0.45	0.61	0.44	0.62
Antimony	mg/L	0.00024	0.00058	0.00018	0.00046	0.00018	0.00046
Arsenic	mg/L	0.00081	0.0011	0.00098	0.0015	0.00099	0.0016
Barium	mg/L	0.066	0.13	0.051	0.11	0.051	0.11
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.06	0.24	0.047	0.2	0.048	0.2
Cadmium	mg/L	0.000067	0.00045	0.00002	0.00023	0.00002	0.00024
Chromium	mg/L	0.00098	0.0012	0.0012	0.0015	0.0012	0.0016
Cobalt	mg/L	0.00051	0.0017	0.00043	0.0014	0.00043	0.0015
Copper	mg/L	0.015	0.17	0.014	0.17	0.014	0.17
Iron	mg/L	0.58	0.65	0.6	0.71	0.6	0.71
Lead	mg/L	0.00016	0.00019	0.00015	0.0002	0.00015	0.00021
Lithium	mg/L	0.0024	0.008	0.0014	0.0045	0.0015	0.0046
Manganese	mg/L	0.12	2.6	0.098	2.1	0.1	2.1
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.097	0.18	0.057	0.15	0.057	0.15
Nickel	mg/L	0.0012	0.0039	0.0012	0.002	0.0012	0.002
Selenium	mg/L	0.062	0.13	0.044	0.11	0.044	0.11
Silver	mg/L	0.0000047	0.000016	0.0000044	0.00002	0.0000044	0.00002
Strontium	mg/L	2.3	4.3	0.78	1.6	0.79	1.6
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.028	0.04	0.026	0.037	0.027	0.038
Uranium	mg/L	0.0014	0.0028	0.00099	0.0021	0.0010	0.0021
Vanadium	mg/L	0.0017	0.0021	0.0017	0.002	0.0017	0.002
Zinc	mg/L	0.0042	0.018	0.0033	0.0052	0.0032	0.0051
Dissolved Metals							
Aluminum	mg/L	0.028	0.12	0.04	0.21	0.039	0.21
Antimony	mg/L	0.00022	0.00044	0.00016	0.00032	0.00016	0.00032
Arsenic	mg/L	0.00062	0.00096	0.00079	0.0013	0.00081	0.0014
Barium	mg/L	0.065	0.12	0.05	0.097	0.05	0.10
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.056	0.21	0.043	0.17	0.044	0.17
Cadmium	mg/L	0.000065	0.00038	0.000018	0.00016	0.000019	0.00016
Chromium	mg/L	0.00049	0.00071	0.00069	0.0011	0.00069	0.0011
Cobalt	mg/L	0.00019	0.0014	0.00011	0.0011	0.00011	0.0011
Copper	mg/L	0.0059	0.0095	0.0048	0.008	0.0047	0.0081
Iron	mg/L	0.088	0.16	0.11	0.22	0.11	0.22
Lead	mg/L	0.000029	0.000053	0.000022	0.000071	0.000022	0.000072
Lithium	mg/L	0.0022	0.007	0.0012	0.0035	0.0013	0.0036
Manganese	mg/L	0.11	2.6	0.084	2.1	0.086	2.1
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.097	0.17	0.057	0.14	0.057	0.14
Nickel	mg/L	0.00068	0.0034	0.00071	0.0015	0.00072	0.0015
Selenium	mg/L	0.062	0.13	0.044	0.1	0.044	0.11
Silicon	mg/L	7.0	8.5	6.8	8.8	6.8	8.8
Silver	mg/L	0.0000047	0.00001	0.0000044	0.000015	0.0000044	0.000015
Strontium	mg/L	2.3	4.0	0.77	1.3	0.77	1.3
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0059	0.019	0.0048	0.016	0.0048	0.016
Uranium	mg/L	0.0014	0.0025	0.00096	0.0018	0.00098	0.0018
Vanadium	mg/L	0.00051	0.00091	0.00054	0.00084	0.00054	0.00085
Zinc	mg/L	0.0029	0.017	0.002	0.0039	0.0018	0.0037

a) Calculated based on predicted calcium and magnesium concentrations.

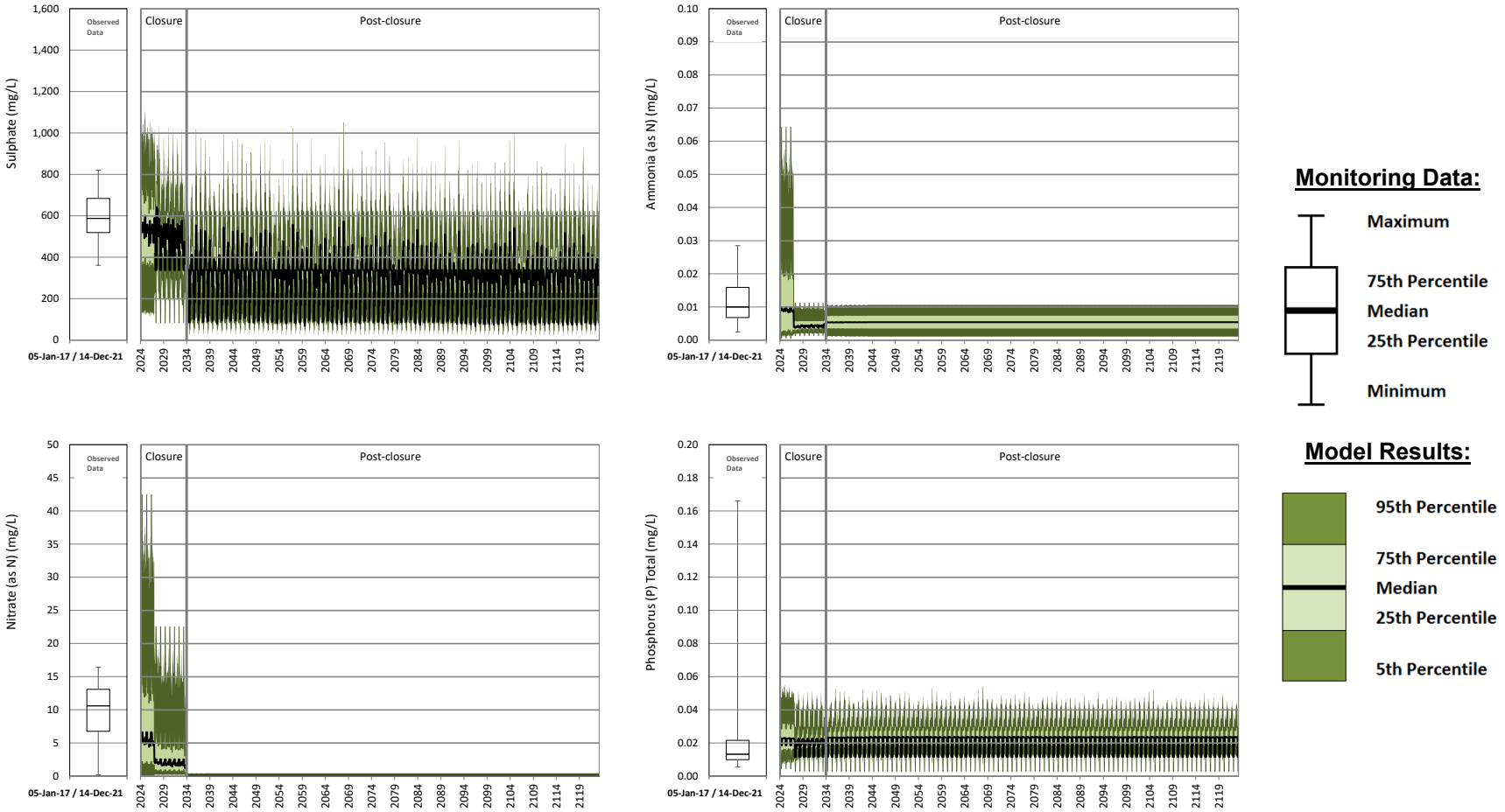

Figure 16: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the 9K Sump during Closure and Post-closure – Climate Change Module

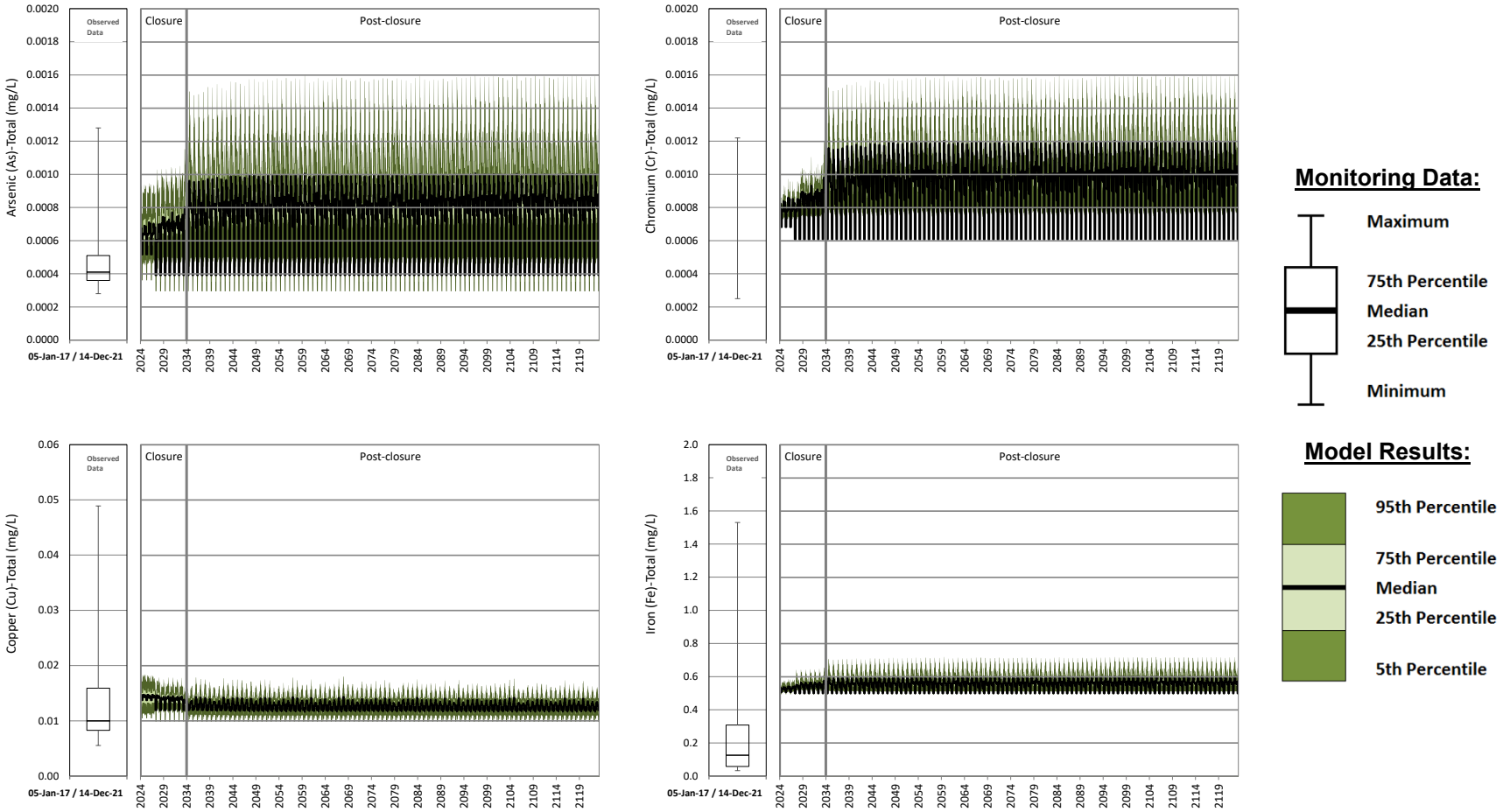

Figure 17: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the 9K Sump during Closure and Post-closure – Climate Change Module

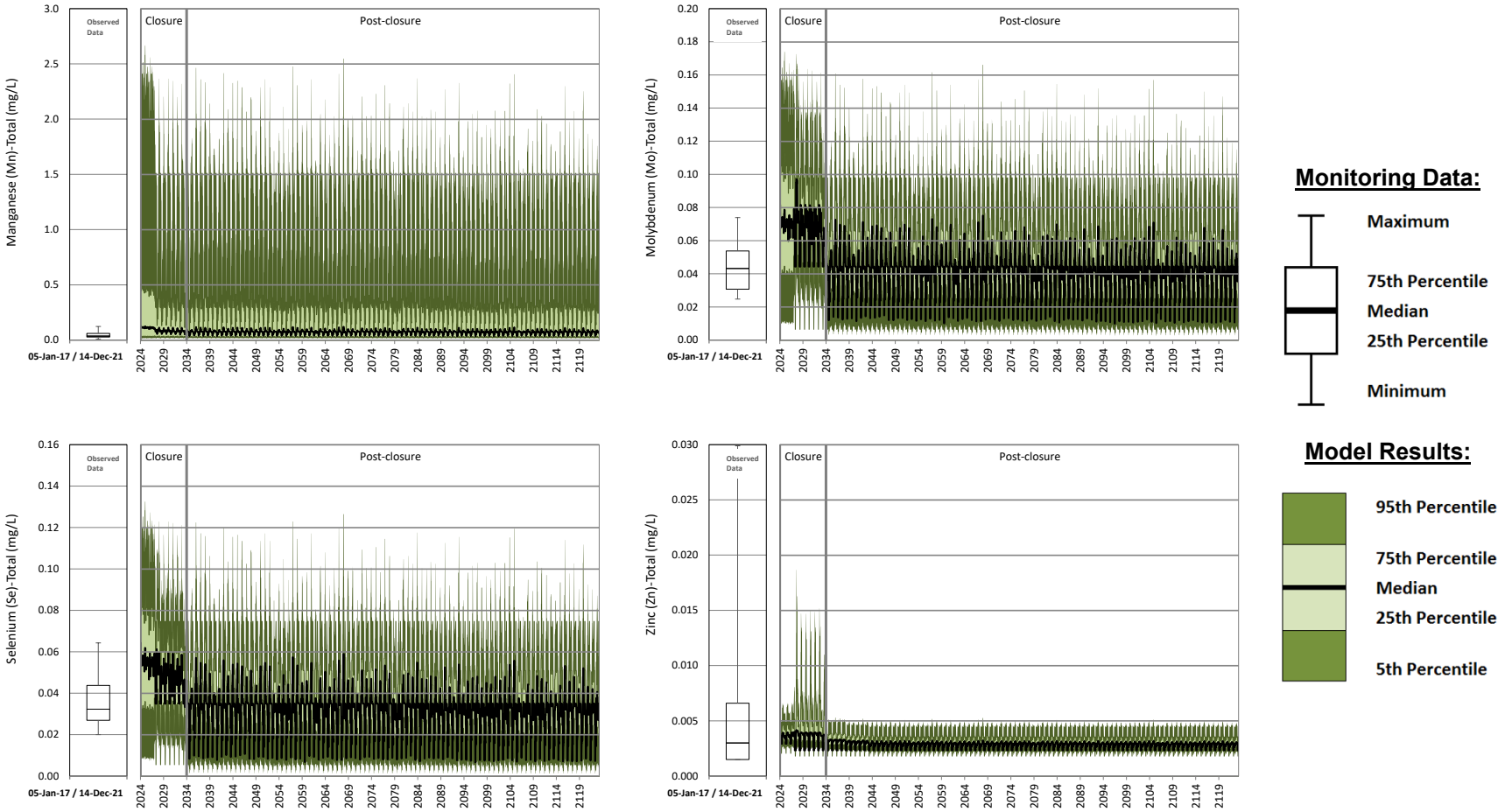

Figure 18: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the 9K Sump during Closure and Post-closure – Climate Change Module

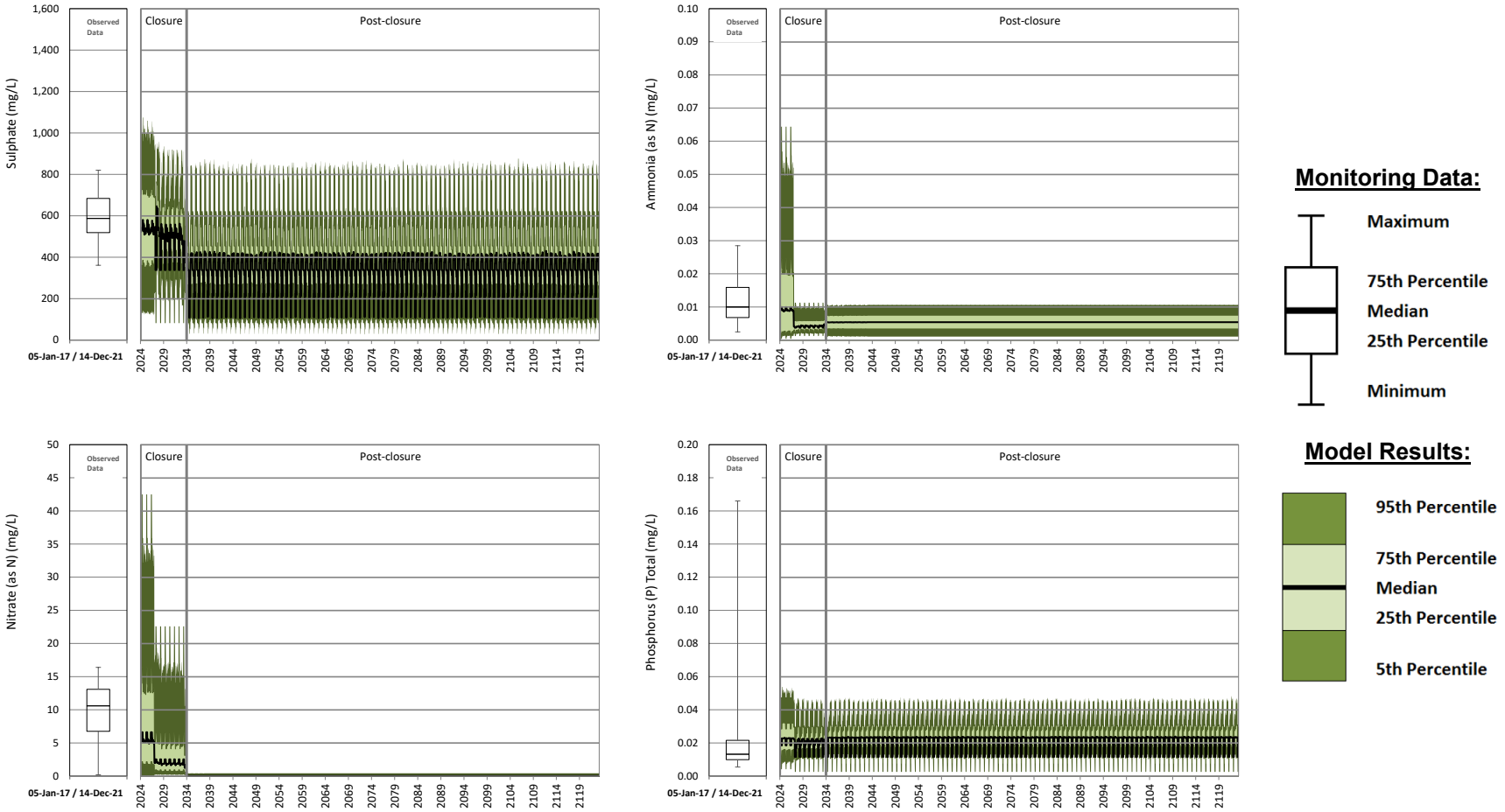

Figure 19: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the 9K Sump during Closure and Post-closure – Base Case Module

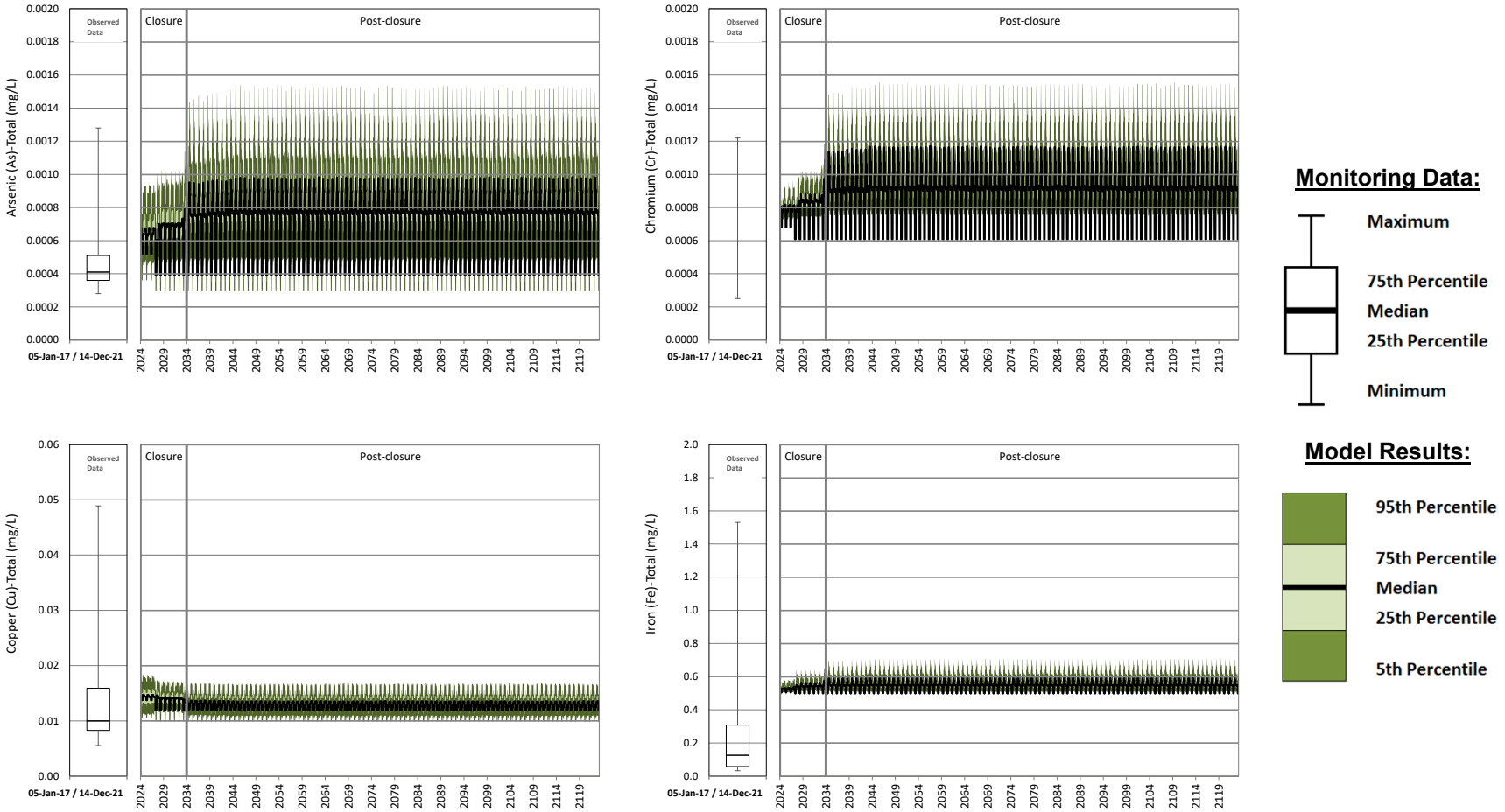

Figure 20: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the 9K Sump during Closure and Post-closure – Base Case Module

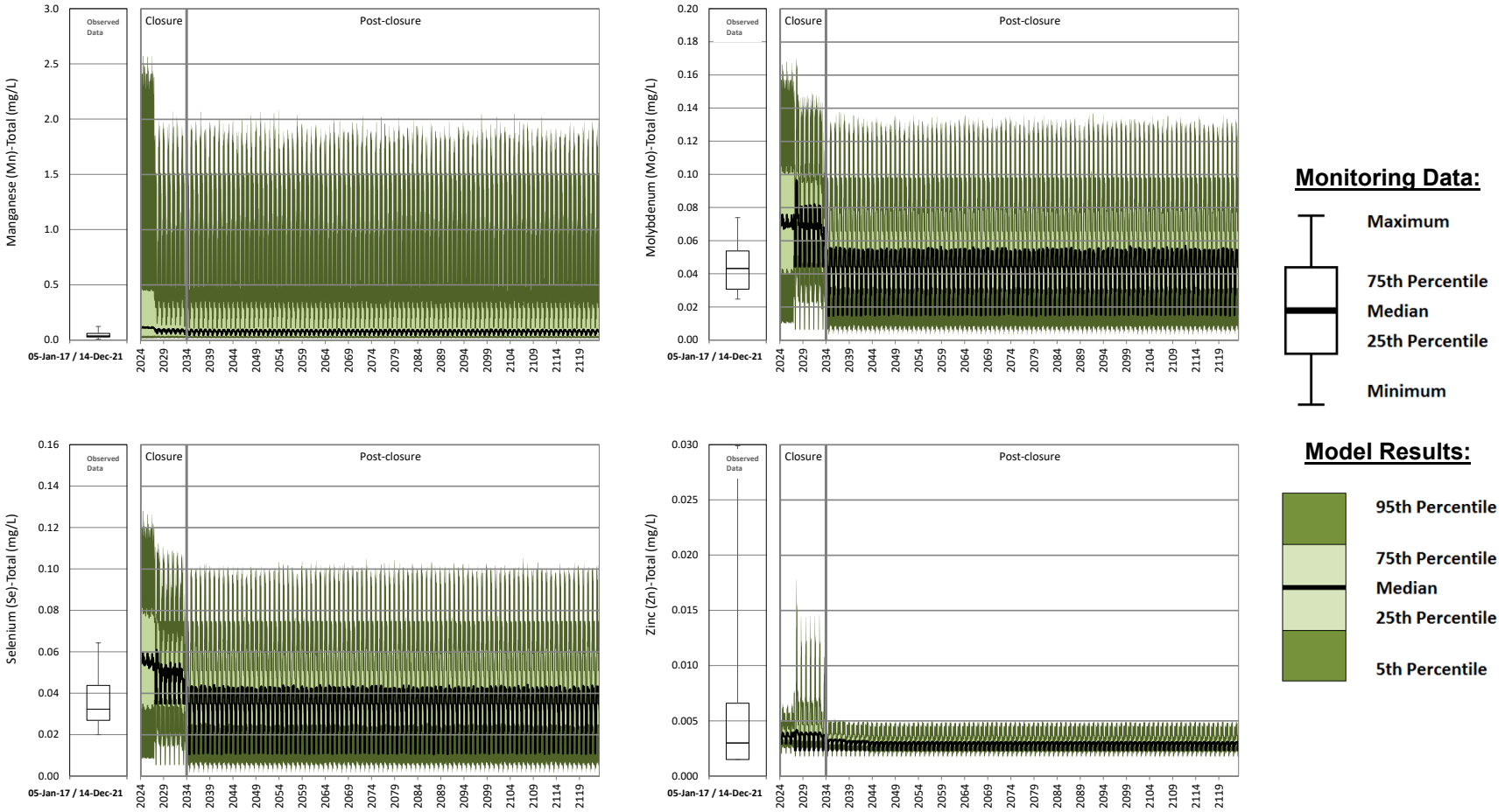

Figure 21: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the 9K Sump during Closure and Post-closure – Base Case Module

Table 11. Predicted Maximum Concentrations in the Northwest Sump during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	805	1,353	722	1,209	739	1,238
Total Dissolved Solids	mg/L	1,159	1,972	1,041	1,751	1,063	1,794
Major Ions							
Calcium	mg/L	249	423	222	377	227	385
Chloride	mg/L	2.9	10.0	3.1	9.0	3.1	9.3
Fluoride	mg/L	0.21	0.47	0.095	0.19	0.095	0.2
Magnesium	mg/L	45	72	41	65	42	67
Potassium	mg/L	3.2	5.5	2.9	5.0	3.0	5.1
Sodium	mg/L	17	42	16	38	16	39
Sulphate	mg/L	631	1,160	557	1,025	571	1,050
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0053	0.011	0.0054	0.011
Nitrate	mg/L (as N)	6.7	43	2.5	23	2.5	23
Nitrite	mg/L (as N)	0.012	0.053	0.012	0.053	0.012	0.053
Total Phosphorus	mg/L	0.023	0.057	0.024	0.053	0.024	0.054
Total Metals							
Aluminum	mg/L	0.44	0.53	0.45	0.63	0.45	0.63
Antimony	mg/L	0.00023	0.00056	0.00021	0.0005	0.00022	0.00051
Arsenic	mg/L	0.00081	0.0012	0.001	0.0016	0.001	0.0016
Barium	mg/L	0.07	0.13	0.063	0.12	0.064	0.12
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.059	0.25	0.054	0.23	0.055	0.23
Cadmium	mg/L	0.000061	0.00043	0.000022	0.00027	0.000023	0.00027
Chromium	mg/L	0.00099	0.0012	0.0012	0.0016	0.0012	0.0016
Cobalt	mg/L	0.0005	0.0018	0.00044	0.0016	0.00045	0.0016
Copper	mg/L	0.015	0.17	0.015	0.17	0.014	0.17
Iron	mg/L	0.58	0.66	0.6	0.72	0.61	0.73
Lead	mg/L	0.00016	0.00019	0.00016	0.00021	0.00016	0.00021
Lithium	mg/L	0.0022	0.0077	0.0015	0.005	0.0015	0.0051
Manganese	mg/L	0.13	2.8	0.12	2.5	0.12	2.5
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.091	0.19	0.073	0.17	0.075	0.18
Nickel	mg/L	0.0012	0.0037	0.0012	0.002	0.0012	0.002
Selenium	mg/L	0.065	0.15	0.057	0.13	0.059	0.13
Silver	mg/L	0.0000048	0.000016	0.0000047	0.000021	0.0000047	0.000021
Strontium	mg/L	2.2	4.1	0.94	1.8	0.96	1.8
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.028	0.042	0.027	0.04	0.027	0.04
Uranium	mg/L	0.0013	0.0027	0.0011	0.0023	0.0011	0.0023
Vanadium	mg/L	0.0017	0.0021	0.0017	0.002	0.0017	0.0021
Zinc	mg/L	0.0051	0.018	0.0038	0.0064	0.0032	0.0053
Dissolved Metals							
Aluminum	mg/L	0.03	0.13	0.043	0.22	0.041	0.23
Antimony	mg/L	0.00021	0.00042	0.00019	0.00036	0.0002	0.00037
Arsenic	mg/L	0.00062	0.00098	0.00082	0.0014	0.00083	0.0014
Barium	mg/L	0.069	0.13	0.062	0.11	0.063	0.12
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.055	0.22	0.05	0.2	0.051	0.2
Cadmium	mg/L	0.00006	0.00036	0.00002	0.00019	0.000021	0.0002
Chromium	mg/L	0.00051	0.00072	0.00072	0.0011	0.00073	0.0011
Cobalt	mg/L	0.00018	0.0015	0.00012	0.0013	0.00013	0.0013
Copper	mg/L	0.006	0.0098	0.0056	0.009	0.0055	0.0091
Iron	mg/L	0.09	0.17	0.11	0.23	0.11	0.24
Lead	mg/L	0.000027	0.000054	0.000023	0.000074	0.000023	0.000076
Lithium	mg/L	0.002	0.0067	0.0013	0.004	0.0013	0.0041
Manganese	mg/L	0.12	2.8	0.1	2.5	0.11	2.5
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.09	0.18	0.073	0.16	0.075	0.17
Nickel	mg/L	0.00068	0.0033	0.00073	0.0015	0.00074	0.0016
Selenium	mg/L	0.065	0.14	0.057	0.12	0.059	0.13
Silicon	mg/L	7.1	8.8	7.0	8.9	7.0	9.0
Silver	mg/L	0.0000048	0.000011	0.0000047	0.000016	0.0000047	0.000016
Strontium	mg/L	2.2	3.7	0.92	1.4	0.94	1.5
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0058	0.02	0.0048	0.018	0.0048	0.018
Uranium	mg/L	0.0013	0.0024	0.0011	0.002	0.0011	0.002
Vanadium	mg/L	0.00051	0.00093	0.00054	0.00088	0.00054	0.00089
Zinc	mg/L	0.0038	0.017	0.0024	0.005	0.0019	0.0039

a) Calculated based on predicted calcium and magnesium concentrations.

Table 12. Predicted Maximum Concentrations in the Northwest Sump during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	762	1,223	582	1,052	579	1,060
Total Dissolved Solids	mg/L	1,060	1,764	832	1,525	831	1,534
Major Ions							
Calcium	mg/L	234	382	177	324	176	327
Chloride	mg/L	2.8	8.9	3.1	8.2	3.1	8.6
Fluoride	mg/L	0.21	0.46	0.091	0.18	0.092	0.18
Magnesium	mg/L	43	65	34	59	34	59
Potassium	mg/L	2.9	5.1	2.5	4.4	2.5	4.4
Sodium	mg/L	16	38	14	32	14	33
Sulphate	mg/L	614	1,041	429	875	422	869
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0053	0.011	0.0054	0.011
Nitrate	mg/L (as N)	6.7	43	2.5	23	2.5	23
Nitrite	mg/L (as N)	0.012	0.053	0.012	0.053	0.012	0.053
Total Phosphorus	mg/L	0.023	0.053	0.024	0.047	0.024	0.048
Total Metals							
Aluminum	mg/L	0.43	0.53	0.45	0.61	0.44	0.63
Antimony	mg/L	0.00023	0.00055	0.00018	0.00045	0.00018	0.00045
Arsenic	mg/L	0.00081	0.0011	0.0010	0.0016	0.001	0.0016
Barium	mg/L	0.064	0.13	0.051	0.11	0.05	0.11
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.058	0.23	0.047	0.2	0.047	0.19
Cadmium	mg/L	0.000062	0.00042	0.00002	0.00023	0.00002	0.00023
Chromium	mg/L	0.00099	0.0012	0.0012	0.0016	0.0012	0.0016
Cobalt	mg/L	0.00051	0.0016	0.00043	0.0014	0.00043	0.0014
Copper	mg/L	0.015	0.17	0.014	0.17	0.014	0.17
Iron	mg/L	0.58	0.65	0.6	0.71	0.6	0.72
Lead	mg/L	0.00016	0.00019	0.00015	0.00021	0.00015	0.00021
Lithium	mg/L	0.0022	0.0075	0.0014	0.0045	0.0014	0.0045
Manganese	mg/L	0.12	2.5	0.097	2.1	0.098	2.1
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.091	0.17	0.056	0.15	0.056	0.15
Nickel	mg/L	0.0012	0.0036	0.0012	0.002	0.0012	0.002
Selenium	mg/L	0.058	0.13	0.044	0.11	0.043	0.11
Silver	mg/L	0.0000047	0.000016	0.0000044	0.00002	0.0000044	0.000021
Strontium	mg/L	2.1	4.0	0.78	1.6	0.77	1.6
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.028	0.04	0.027	0.037	0.027	0.038
Uranium	mg/L	0.0013	0.0026	0.00097	0.0021	0.00098	0.0021
Vanadium	mg/L	0.0017	0.0021	0.0017	0.002	0.0017	0.002
Zinc	mg/L	0.0051	0.018	0.0037	0.0064	0.0031	0.005
Dissolved Metals							
Aluminum	mg/L	0.03	0.12	0.042	0.21	0.039	0.22
Antimony	mg/L	0.00021	0.00041	0.00016	0.00031	0.00016	0.00031
Arsenic	mg/L	0.00062	0.00096	0.00081	0.0014	0.00082	0.0014
Barium	mg/L	0.062	0.12	0.049	0.097	0.049	0.098
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.054	0.2	0.043	0.17	0.043	0.16
Cadmium	mg/L	0.00006	0.00035	0.000018	0.00016	0.000019	0.00016
Chromium	mg/L	0.0005	0.00072	0.0007	0.0011	0.00071	0.0011
Cobalt	mg/L	0.00019	0.0013	0.00011	0.0011	0.00011	0.0011
Copper	mg/L	0.006	0.0095	0.005	0.0082	0.0047	0.008
Iron	mg/L	0.088	0.16	0.11	0.22	0.11	0.23
Lead	mg/L	0.000027	0.000054	0.000022	0.000072	0.000022	0.000074
Lithium	mg/L	0.002	0.0065	0.0012	0.0035	0.0012	0.0035
Manganese	mg/L	0.1	2.5	0.083	2.1	0.084	2.0
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.09	0.16	0.056	0.14	0.056	0.14
Nickel	mg/L	0.00069	0.0031	0.00073	0.0015	0.00073	0.0015
Selenium	mg/L	0.058	0.12	0.044	0.1	0.043	0.1
Silicon	mg/L	6.9	8.4	6.8	8.9	6.8	8.9
Silver	mg/L	0.0000047	0.000011	0.0000044	0.000015	0.0000044	0.000016
Strontium	mg/L	2.1	3.7	0.76	1.3	0.76	1.3
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0058	0.018	0.0048	0.015	0.0048	0.016
Uranium	mg/L	0.0013	0.0023	0.00094	0.0018	0.00096	0.0018
Vanadium	mg/L	0.00051	0.00089	0.00054	0.00084	0.00054	0.00085
Zinc	mg/L	0.0037	0.016	0.0023	0.005	0.0018	0.0037

a) Calculated based on predicted calcium and magnesium concentrations.

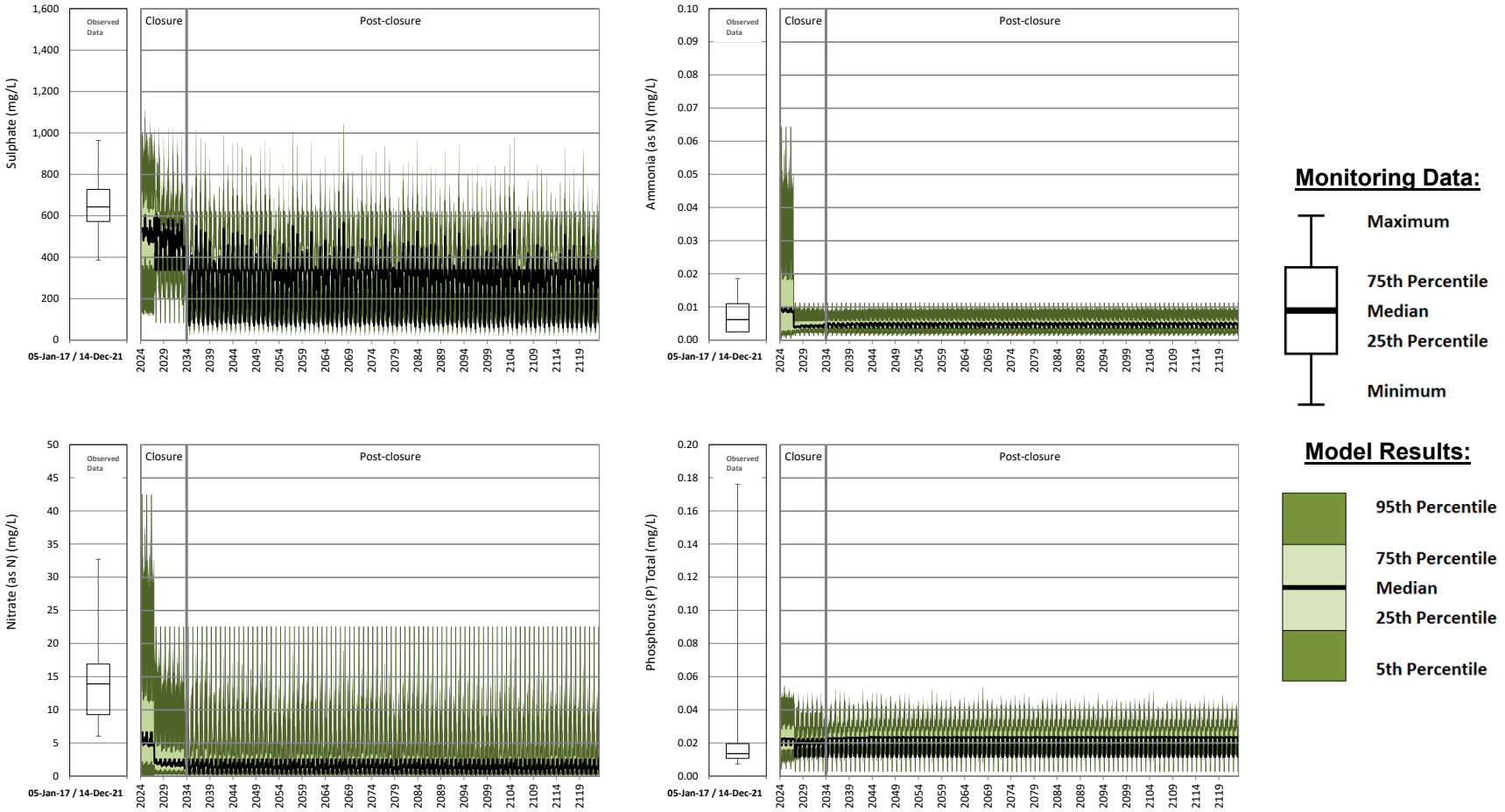

Figure 22: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Northwest Sump during Closure and Post-closure – Climate Change Module

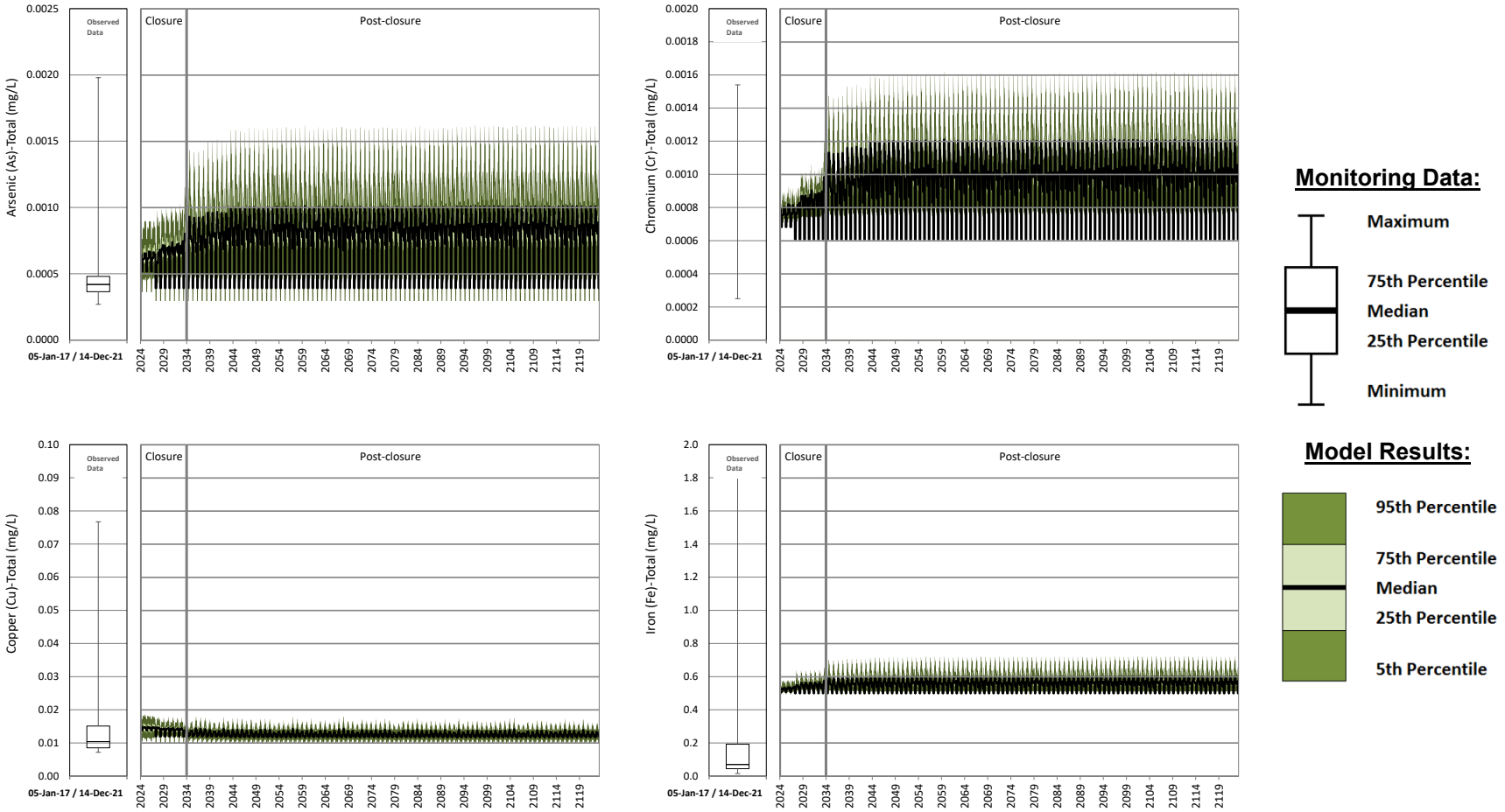

Figure 23: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Northwest Sump during Closure and Post-closure – Climate Change Module

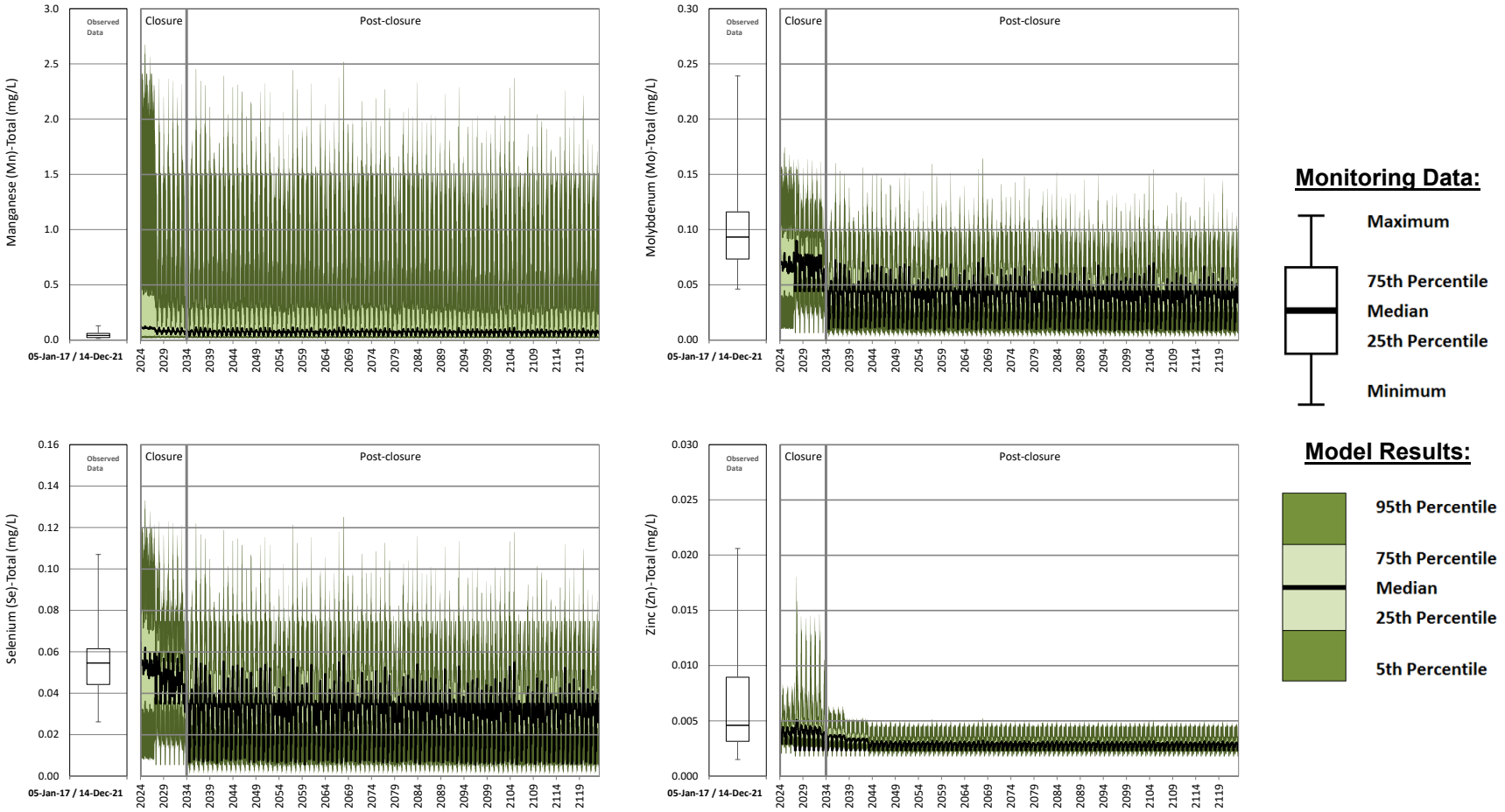

Figure 24: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Northwest Sump during Closure and Post-closure – Climate Change Module

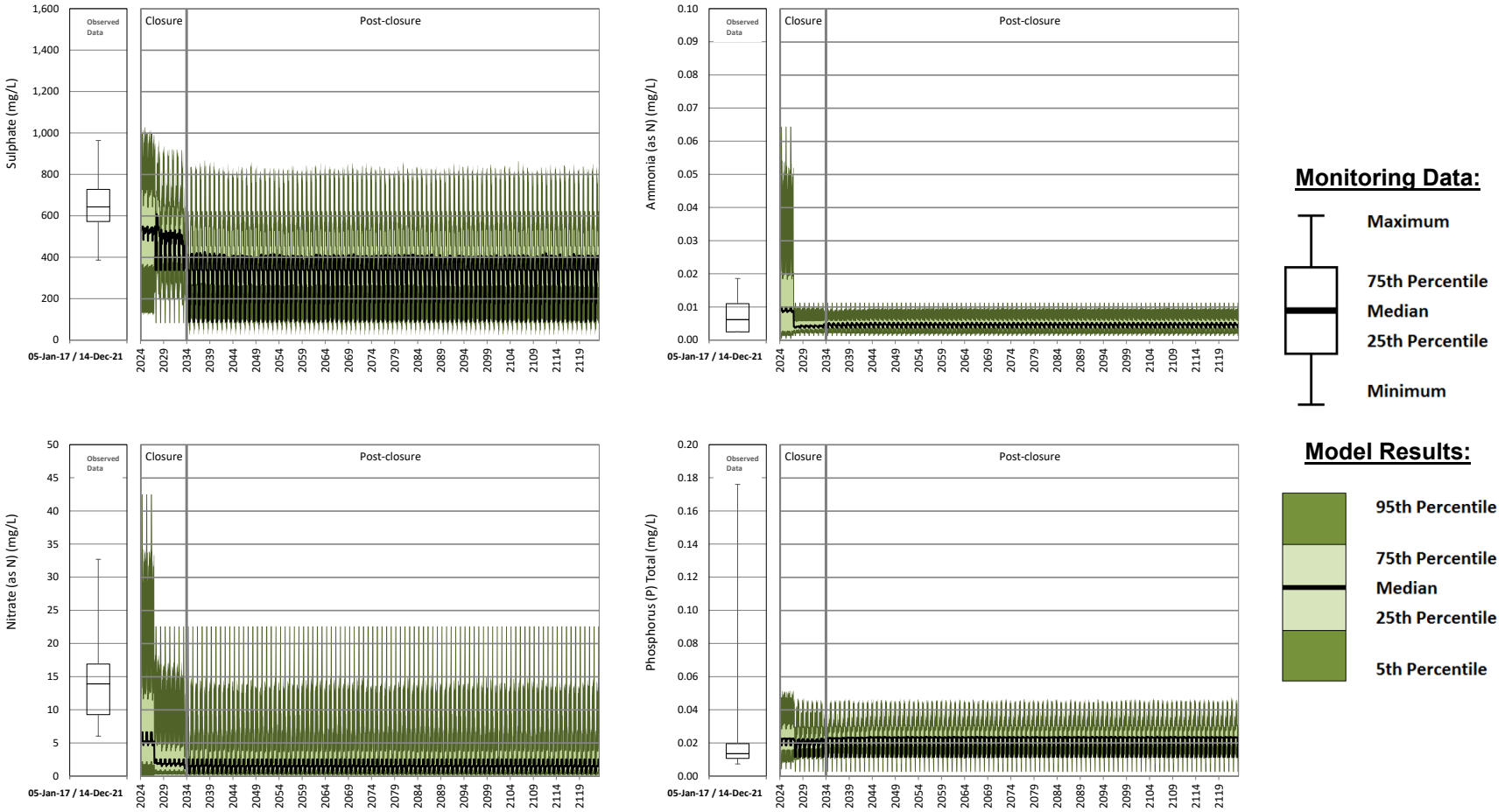

Figure 25: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Northwest Sump during Closure and Post-closure – Base Case Module

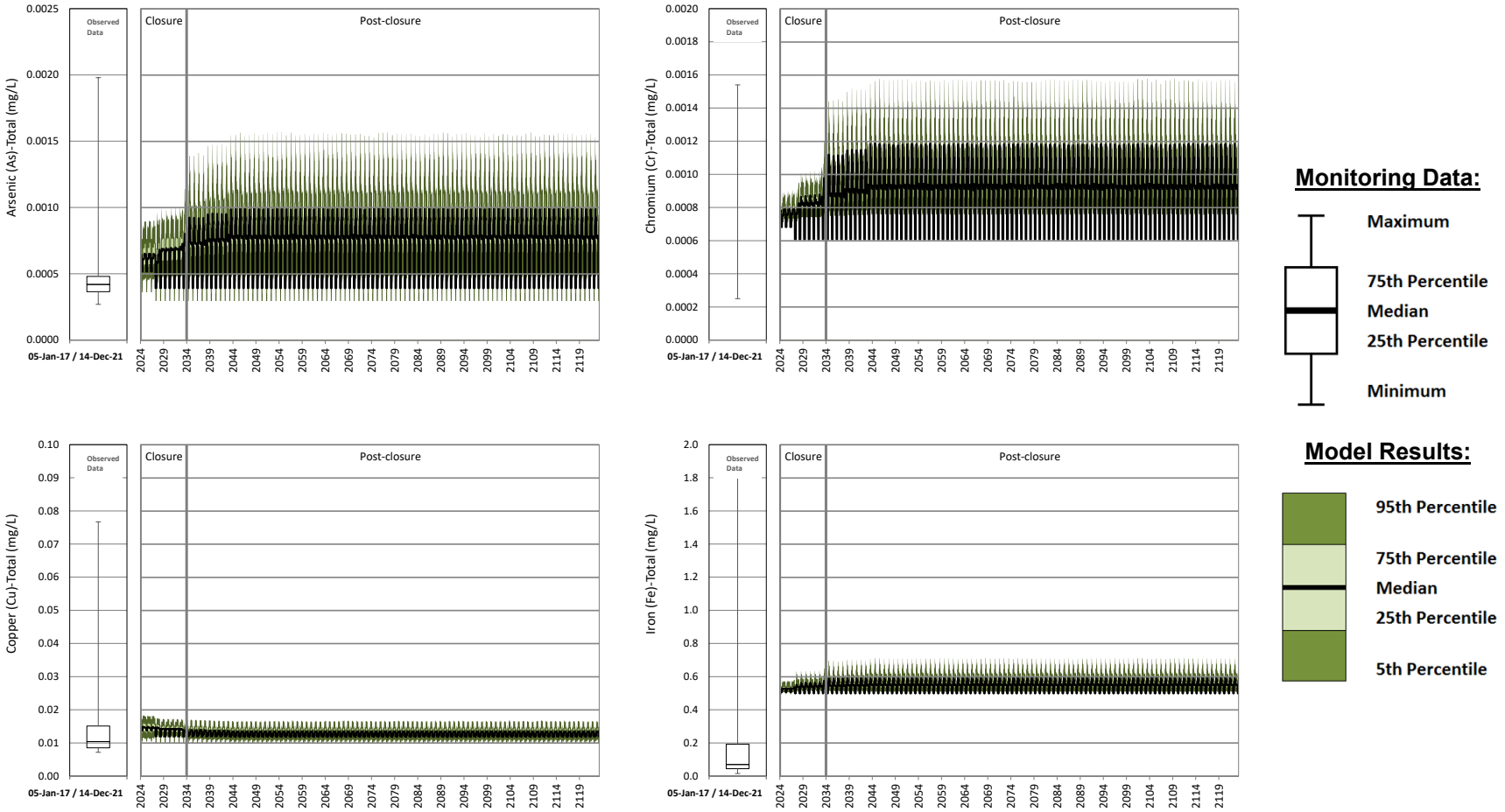

Figure 26: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Northwest Sump during Closure and Post-closure – Base Case Module

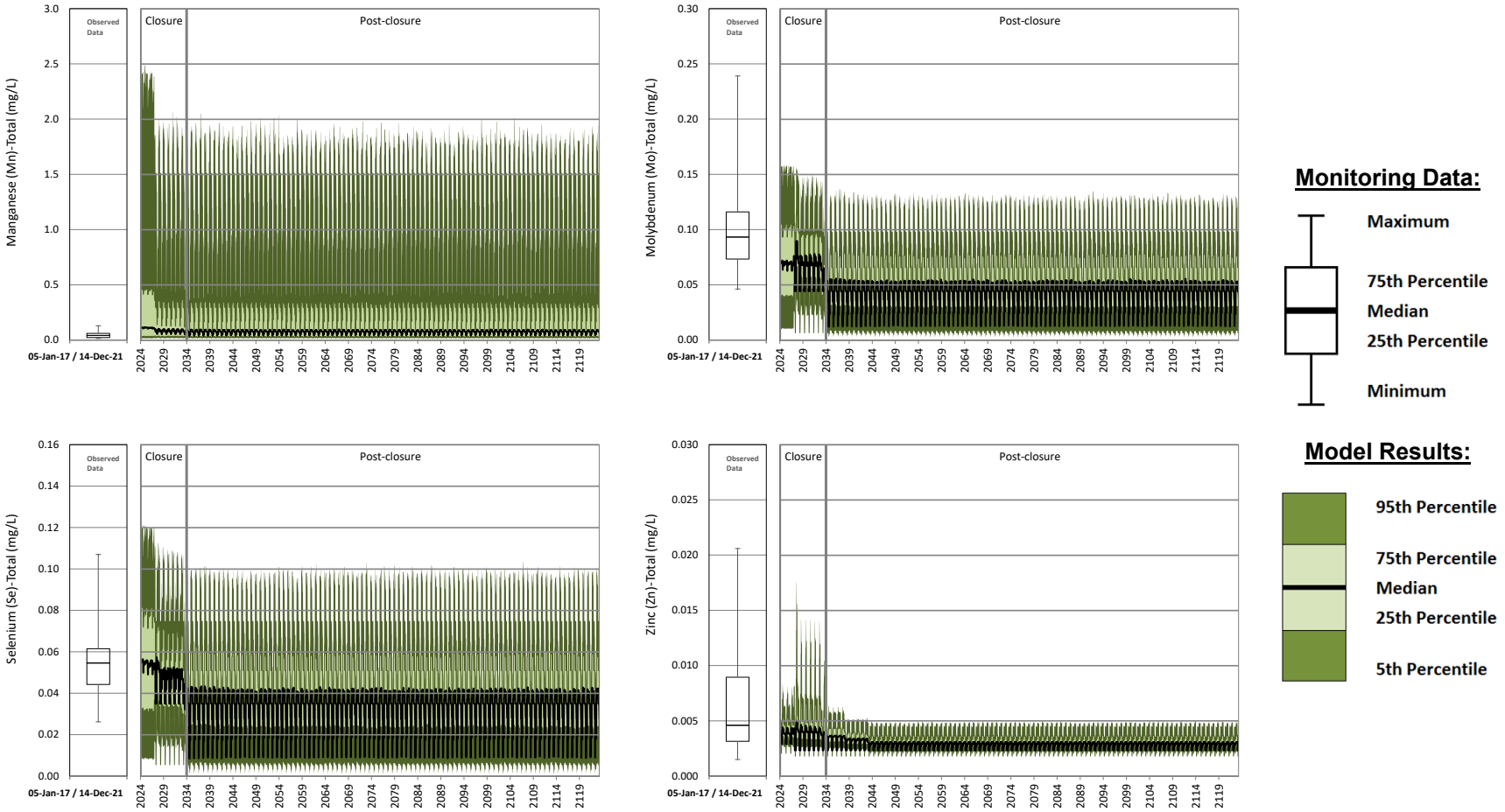

Figure 27: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Northwest Sump during Closure and Post-closure – Base Case Module

4.2.2 Springer-Cariboo Pit

At closure, the PAG material from the Temporary NW PAG Stockpile will be placed in the Springer-Cariboo Pit, and a pit lake will form. The pit will fill passively with groundwater and surface runoff from the pit catchment area. The groundwater inflow to the pit is assumed to flow into the stored PAG material in closure and post-closure. The surface runoff includes runoff and seepage from North Bell RDS, East RDS, and the haul roads. These facilities will be reclaimed in closure according to the schedule presented in Section 2.3. The pit lake is predicted to fill by 2048, at which point, overflow from the pit will discharge to Bootjack Lake.

Time series plots for key parameters in the Springer-Cariboo Pit for closure and post-closure are shown in Figures 28 to 30 for the climate change module results and in Figures 31 to 33 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 13 and 14 for the climate change and base case modules, respectively. It is anticipated that particulate metals such as aluminum and copper will be lower in pit lake waters compared to model predictions, as has been observed in operational monitoring (Golder 2016b).

Peak concentrations are predicted to occur before the post-closure period, around 2026 (Figures 28 to 33) because:

- The PAG material in the Springer-Cariboo Pit contains pore water with a PAG Dump Seep water quality (Table 6).
- The groundwater inflow to the pit, which has a groundwater water quality (Table 6), is assumed to flow into the PAG material and displace the pore water upwards into the forming pit lake.
- The displacement of pore water from the PAG material into the pit lake causes pit lake concentrations to peak in closure.

The only parameters with predicted maximum concentrations greater in post-closure than closure are potassium, aluminum, antimony, arsenic, chromium, copper, iron, lead, silver and silicon. Potassium, antimony and copper concentrations are higher in the statistical distributions assigned to the Cariboo and Springer pit wall runoff than the statistical distributions for the NAG waste rock water quality. Aluminum, antimony, chromium, iron, lead, silver and silicon have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to PAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to a greater proportion of the total inflows to the Springer-Cariboo pit.

Table 13. Predicted Maximum Concentrations in the Springer-Cariboo Pit during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	466	635	425	578	340	467
Total Dissolved Solids	mg/L	667	1,054	622	949	508	715
Major Ions							
Calcium	mg/L	144	193	130	175	104	138
Chloride	mg/L	4.0	15	4.2	9.4	4.5	9.0
Fluoride	mg/L	0.34	0.53	0.32	0.45	0.3	0.41
Magnesium	mg/L	26	37	24	34	20	30
Potassium	mg/L	2.6	3.8	2.6	3.8	2.7	4.0
Sodium	mg/L	25	37	23	30	21	29
Sulphate	mg/L	378	532	341	478	256	378
Nutrients							
Ammonia	mg/L (as N)	0.01	0.033	0.011	0.035	0.011	0.037
Nitrate	mg/L (as N)	5.3	11	5.3	11	5.0	9.6
Nitrite	mg/L (as N)	0.013	0.024	0.013	0.024	0.012	0.021
Total Phosphorus	mg/L	0.016	0.029	0.017	0.027	0.017	0.025
Total Metals							
Aluminum	mg/L	0.42	0.44	0.42	0.46	0.43	0.51
Antimony	mg/L	0.00058	0.0016	0.00058	0.0016	0.00058	0.0017
Arsenic	mg/L	0.0024	0.004	0.0016	0.0023	0.0016	0.0023
Barium	mg/L	0.033	0.066	0.032	0.054	0.03	0.05
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.2	0.56	0.15	0.32	0.14	0.3
Cadmium	mg/L	0.000042	0.00025	0.00004	0.00022	0.000033	0.00016
Chromium	mg/L	0.00072	0.00081	0.00078	0.00089	0.0009	0.0011
Cobalt	mg/L	0.00049	0.00082	0.00049	0.00077	0.00049	0.00066
Copper	mg/L	0.02	0.18	0.021	0.18	0.021	0.18
Iron	mg/L	0.53	0.57	0.54	0.57	0.55	0.6
Lead	mg/L	0.00016	0.00017	0.00016	0.00017	0.00016	0.00018
Lithium	mg/L	0.0053	0.0084	0.0051	0.0083	0.0049	0.0077
Manganese	mg/L	0.05	0.1	0.047	0.097	0.046	0.087
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.086	0.13	0.082	0.12	0.07	0.1
Nickel	mg/L	0.00094	0.0022	0.00099	0.002	0.001	0.0016
Selenium	mg/L	0.033	0.061	0.031	0.055	0.025	0.04
Silver	mg/L	0.000005	0.000011	0.0000047	0.000012	0.0000044	0.000014
Strontium	mg/L	1.4	2.5	1.3	2.3	1.0	1.7
Thallium	mg/L	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.000042	0.00013	0.000043	0.00013	0.000043	0.00013
Titanium	mg/L	0.028	0.03	0.028	0.03	0.027	0.029
Uranium	mg/L	0.0012	0.0021	0.0012	0.0021	0.0011	0.0019
Vanadium	mg/L	0.002	0.0032	0.002	0.0026	0.0021	0.0026
Zinc	mg/L	0.0042	0.01	0.0041	0.0094	0.0039	0.0075
Dissolved Metals							
Aluminum	mg/L	0.013	0.035	0.018	0.054	0.022	0.10
Antimony	mg/L	0.00056	0.0014	0.00056	0.0015	0.00056	0.0016
Arsenic	mg/L	0.0022	0.0038	0.0014	0.0022	0.0014	0.0021
Barium	mg/L	0.032	0.057	0.031	0.045	0.029	0.042
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.2	0.53	0.14	0.28	0.14	0.27
Cadmium	mg/L	0.00004	0.00018	0.000038	0.00015	0.000031	0.000088
Chromium	mg/L	0.00024	0.00033	0.00029	0.00041	0.00041	0.00059
Cobalt	mg/L	0.00017	0.0005	0.00017	0.00045	0.00017	0.00034
Copper	mg/L	0.011	0.017	0.012	0.017	0.012	0.018
Iron	mg/L	0.036	0.077	0.043	0.077	0.055	0.11
Lead	mg/L	0.000026	0.000035	0.000026	0.000034	0.000023	0.000044
Lithium	mg/L	0.0051	0.0074	0.0049	0.0073	0.0047	0.0067
Manganese	mg/L	0.036	0.087	0.033	0.082	0.031	0.073
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.086	0.12	0.082	0.11	0.07	0.093
Nickel	mg/L	0.00046	0.0017	0.00052	0.0015	0.00057	0.0011
Selenium	mg/L	0.033	0.056	0.031	0.049	0.025	0.034
Silicon	mg/L	7.5	8.9	6.4	7.4	6.4	7.5
Silver	mg/L	0.000005	0.0000059	0.0000047	0.0000067	0.0000044	0.0000093
Strontium	mg/L	1.4	2.2	1.3	1.9	0.99	1.4
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.000042	0.00005	0.000043	0.00005	0.000043	0.00005
Titanium	mg/L	0.0059	0.0081	0.0059	0.0078	0.0058	0.0072
Uranium	mg/L	0.0012	0.0018	0.0012	0.0018	0.0011	0.0016
Vanadium	mg/L	0.00084	0.0021	0.00088	0.0015	0.00093	0.0014
Zinc	mg/L	0.0028	0.009	0.0027	0.0081	0.0025	0.0062

a) Calculated based on predicted calcium and magnesium concentrations.

Table 14. Predicted Maximum Concentrations in the Springer-Cariboo Pit during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	439	619	415	565	338	468
Total Dissolved Solids	mg/L	635	1,021	610	926	509	717
Major Ions							
Calcium	mg/L	135	187	128	170	103	138
Chloride	mg/L	4.3	14	4.2	10	4.9	10.0
Fluoride	mg/L	0.34	0.52	0.33	0.47	0.3	0.43
Magnesium	mg/L	25	37	24	34	20	30
Potassium	mg/L	2.6	4.2	2.6	3.8	2.8	4.2
Sodium	mg/L	26	37	23	31	22	30
Sulphate	mg/L	356	515	331	467	254	376
Nutrients							
Ammonia	mg/L (as N)	0.01	0.037	0.01	0.035	0.012	0.039
Nitrate	mg/L (as N)	5.2	11	5.2	10	5.1	10
Nitrite	mg/L (as N)	0.013	0.024	0.013	0.023	0.012	0.021
Total Phosphorus	mg/L	0.016	0.027	0.017	0.027	0.018	0.027
Total Metals							
Aluminum	mg/L	0.42	0.44	0.42	0.46	0.43	0.51
Antimony	mg/L	0.00059	0.0017	0.00057	0.0016	0.00061	0.0018
Arsenic	mg/L	0.0022	0.0037	0.0017	0.0025	0.0018	0.0025
Barium	mg/L	0.033	0.064	0.032	0.055	0.03	0.053
Beryllium	mg/L	0.000051	0.000052	0.000051	0.000052	0.000052	0.000053
Boron	mg/L	0.19	0.49	0.16	0.34	0.15	0.32
Cadmium	mg/L	0.00004	0.00024	0.000039	0.00021	0.000033	0.00016
Chromium	mg/L	0.00072	0.00081	0.00077	0.00089	0.00092	0.0011
Cobalt	mg/L	0.00049	0.0008	0.00049	0.00075	0.00049	0.00065
Copper	mg/L	0.02	0.18	0.021	0.18	0.021	0.18
Iron	mg/L	0.53	0.57	0.53	0.57	0.55	0.6
Lead	mg/L	0.00016	0.00017	0.00016	0.00017	0.00016	0.00018
Lithium	mg/L	0.0055	0.0086	0.0051	0.0083	0.005	0.008
Manganese	mg/L	0.051	0.099	0.048	0.096	0.047	0.091
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.084	0.13	0.081	0.12	0.071	0.1
Nickel	mg/L	0.00093	0.0021	0.00099	0.0019	0.0011	0.0016
Selenium	mg/L	0.031	0.059	0.03	0.052	0.024	0.039
Silver	mg/L	0.0000049	0.000011	0.0000048	0.000012	0.0000046	0.000015
Strontium	mg/L	1.4	2.4	1.3	2.2	0.99	1.7
Thallium	mg/L	0.0000051	0.0000052	0.0000051	0.0000053	0.0000052	0.0000053
Tin	mg/L	0.000042	0.00013	0.000043	0.00013	0.000045	0.00013
Titanium	mg/L	0.028	0.03	0.028	0.03	0.028	0.029
Uranium	mg/L	0.0012	0.0021	0.0012	0.0021	0.0011	0.002
Vanadium	mg/L	0.002	0.0031	0.002	0.0027	0.0021	0.0027
Zinc	mg/L	0.0041	0.01	0.004	0.0091	0.0039	0.0075
Dissolved Metals							
Aluminum	mg/L	0.013	0.033	0.017	0.052	0.022	0.1
Antimony	mg/L	0.00057	0.0016	0.00055	0.0015	0.00059	0.0016
Arsenic	mg/L	0.002	0.0035	0.0015	0.0023	0.0016	0.0023
Barium	mg/L	0.031	0.056	0.031	0.047	0.029	0.044
Beryllium	mg/L	0.000051	0.000052	0.000051	0.000052	0.000052	0.000053
Boron	mg/L	0.19	0.46	0.15	0.3	0.15	0.29
Cadmium	mg/L	0.000039	0.00016	0.000037	0.00014	0.000031	0.000082
Chromium	mg/L	0.00024	0.00032	0.00029	0.0004	0.00043	0.00061
Cobalt	mg/L	0.00017	0.00048	0.00017	0.00043	0.00017	0.00033
Copper	mg/L	0.011	0.019	0.012	0.017	0.012	0.018
Iron	mg/L	0.035	0.074	0.041	0.077	0.057	0.11
Lead	mg/L	0.000026	0.000034	0.000026	0.000035	0.000024	0.000047
Lithium	mg/L	0.0053	0.0076	0.0049	0.0073	0.0048	0.007
Manganese	mg/L	0.037	0.085	0.034	0.082	0.033	0.076
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.084	0.12	0.081	0.11	0.07	0.094
Nickel	mg/L	0.00046	0.0016	0.00052	0.0014	0.00059	0.0011
Selenium	mg/L	0.031	0.053	0.03	0.047	0.024	0.034
Silicon	mg/L	7.2	8.5	6.7	7.7	6.7	8.1
Silver	mg/L	0.0000049	0.0000059	0.0000048	0.0000067	0.0000046	0.0000098
Strontium	mg/L	1.3	2.0	1.2	1.8	0.98	1.3
Thallium	mg/L	0.0000051	0.0000052	0.0000051	0.0000052	0.0000052	0.0000053
Tin	mg/L	0.000042	0.000051	0.000043	0.000052	0.000045	0.000053
Titanium	mg/L	0.0059	0.0079	0.0059	0.0078	0.0059	0.0075
Uranium	mg/L	0.0011	0.0018	0.0011	0.0017	0.0011	0.0017
Vanadium	mg/L	0.00083	0.002	0.00088	0.0015	0.00098	0.0015
Zinc	mg/L	0.0027	0.0087	0.0027	0.0078	0.0025	0.0061

a) Calculated based on predicted calcium and magnesium concentrations,

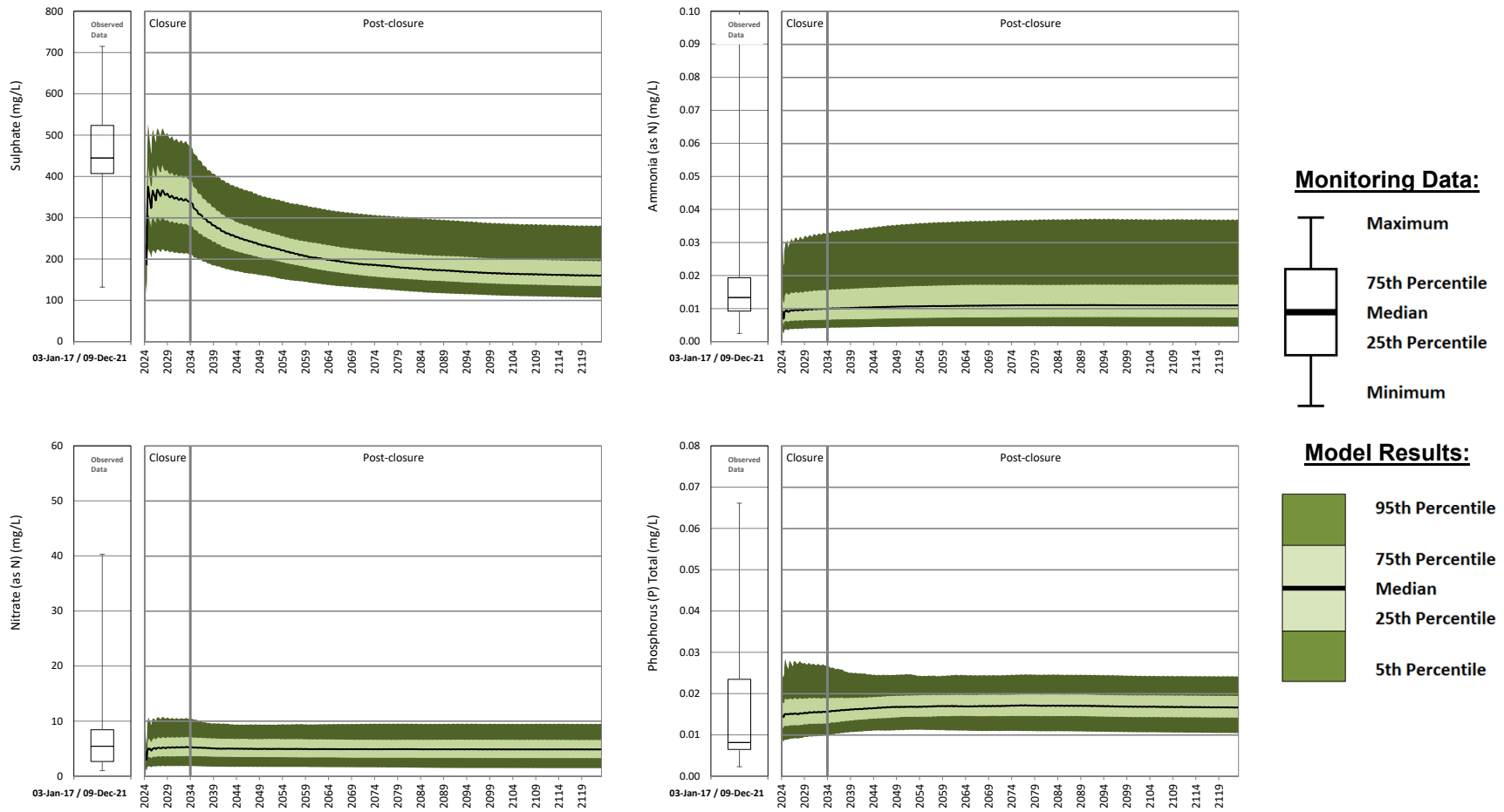

Figure 28: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Climate Change Module

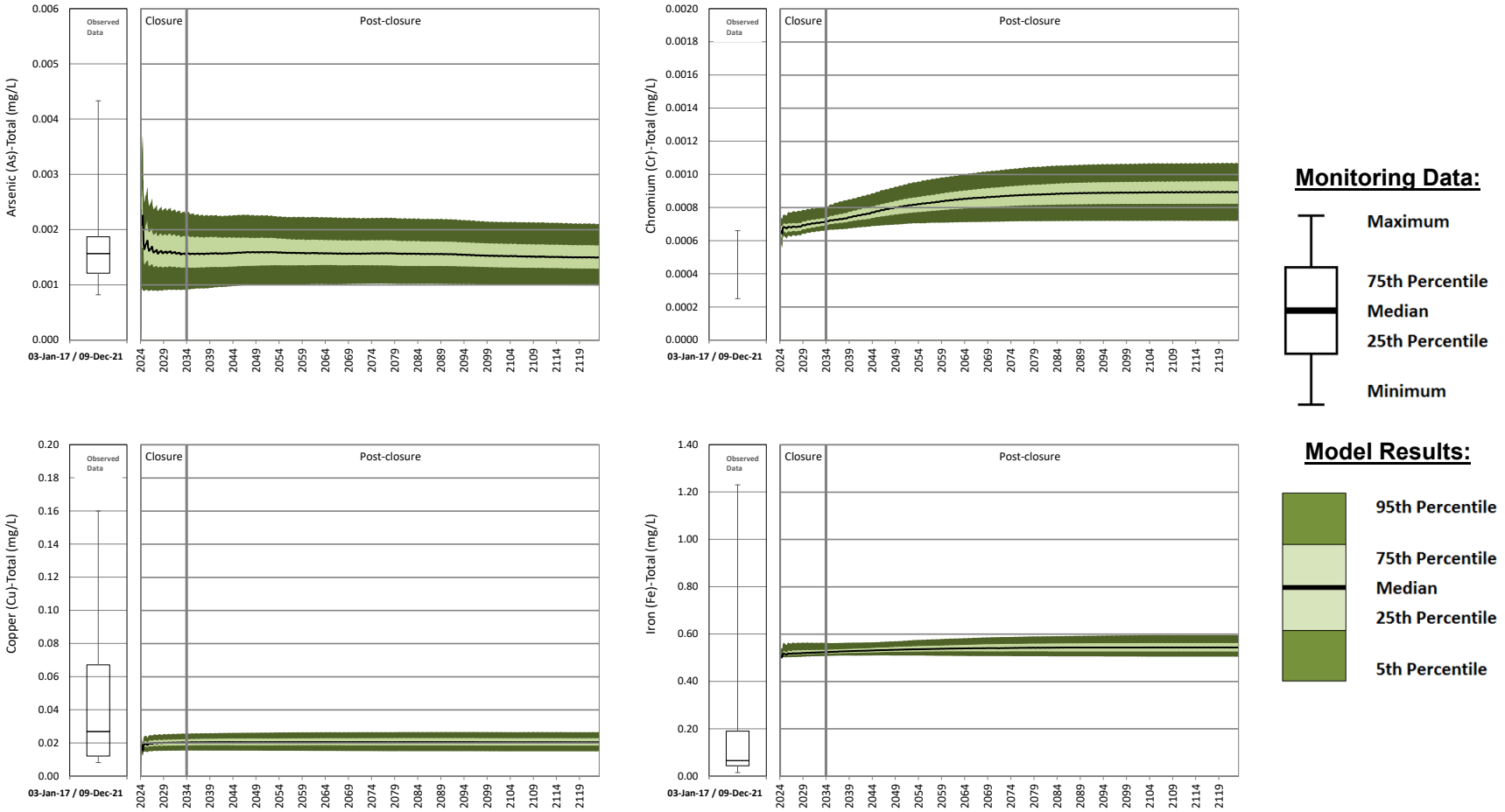

Figure 29: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Climate Change Module

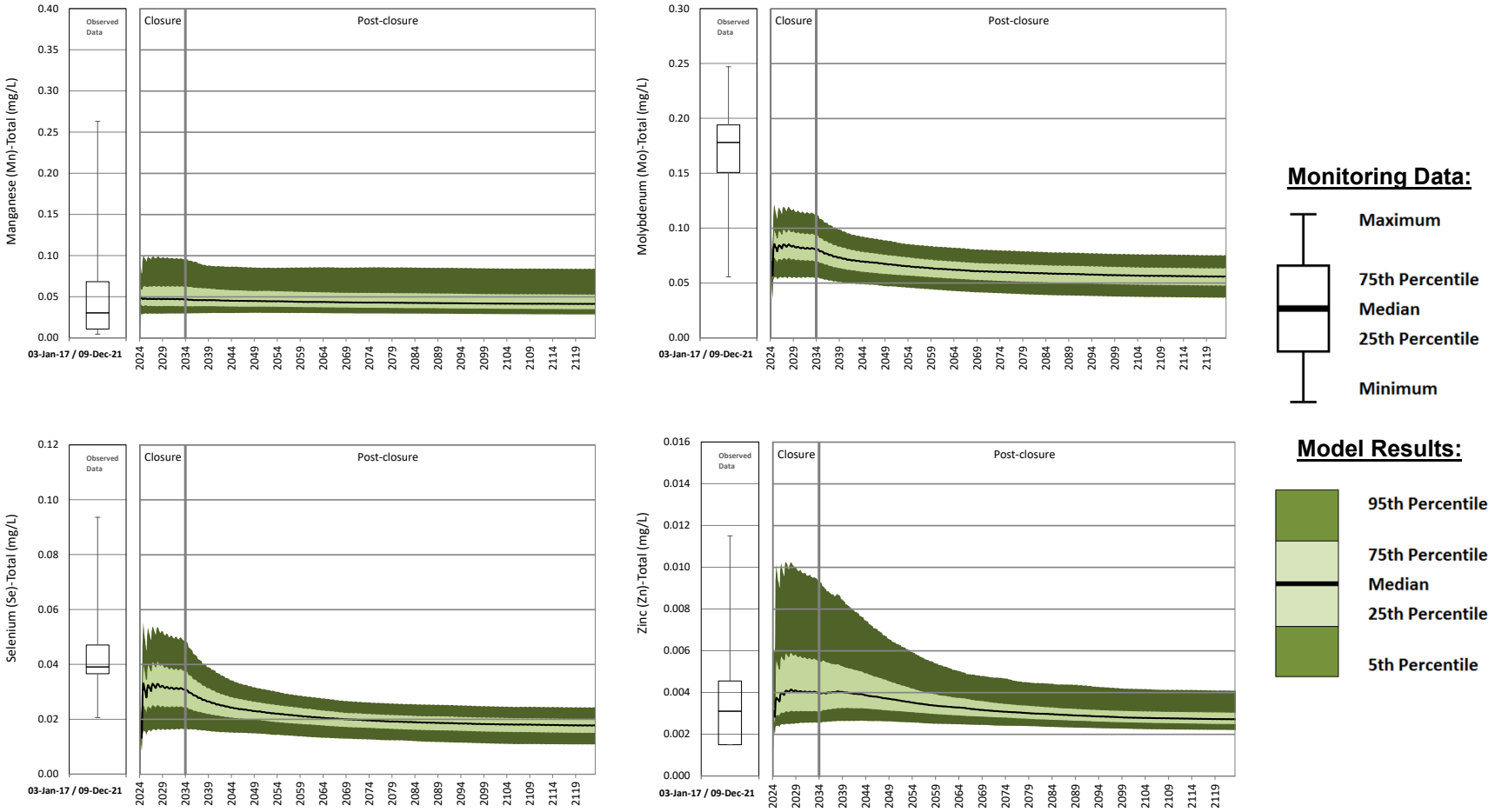

Figure 30: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Climate Change Module

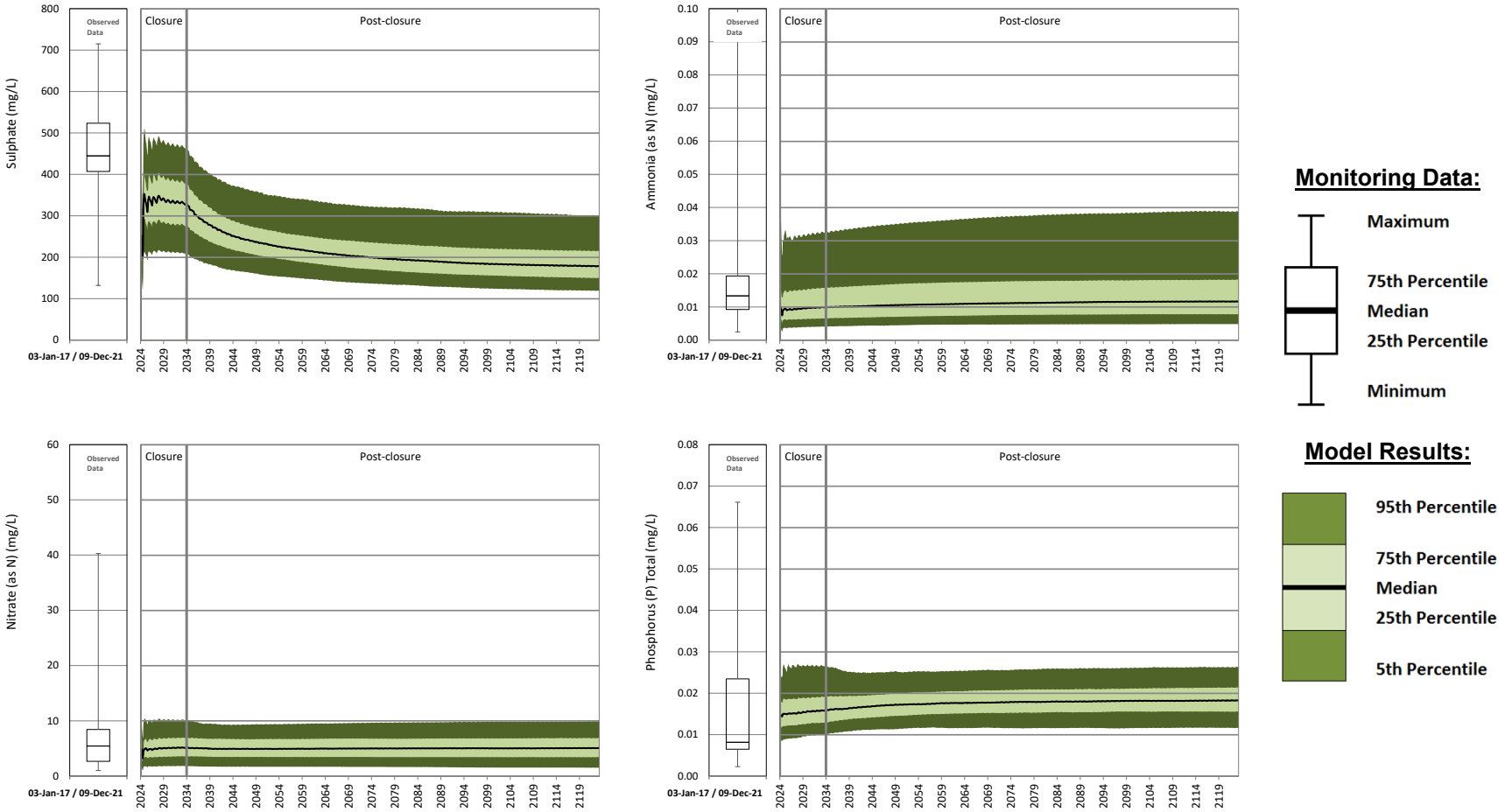

Figure 31: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Base Case Module

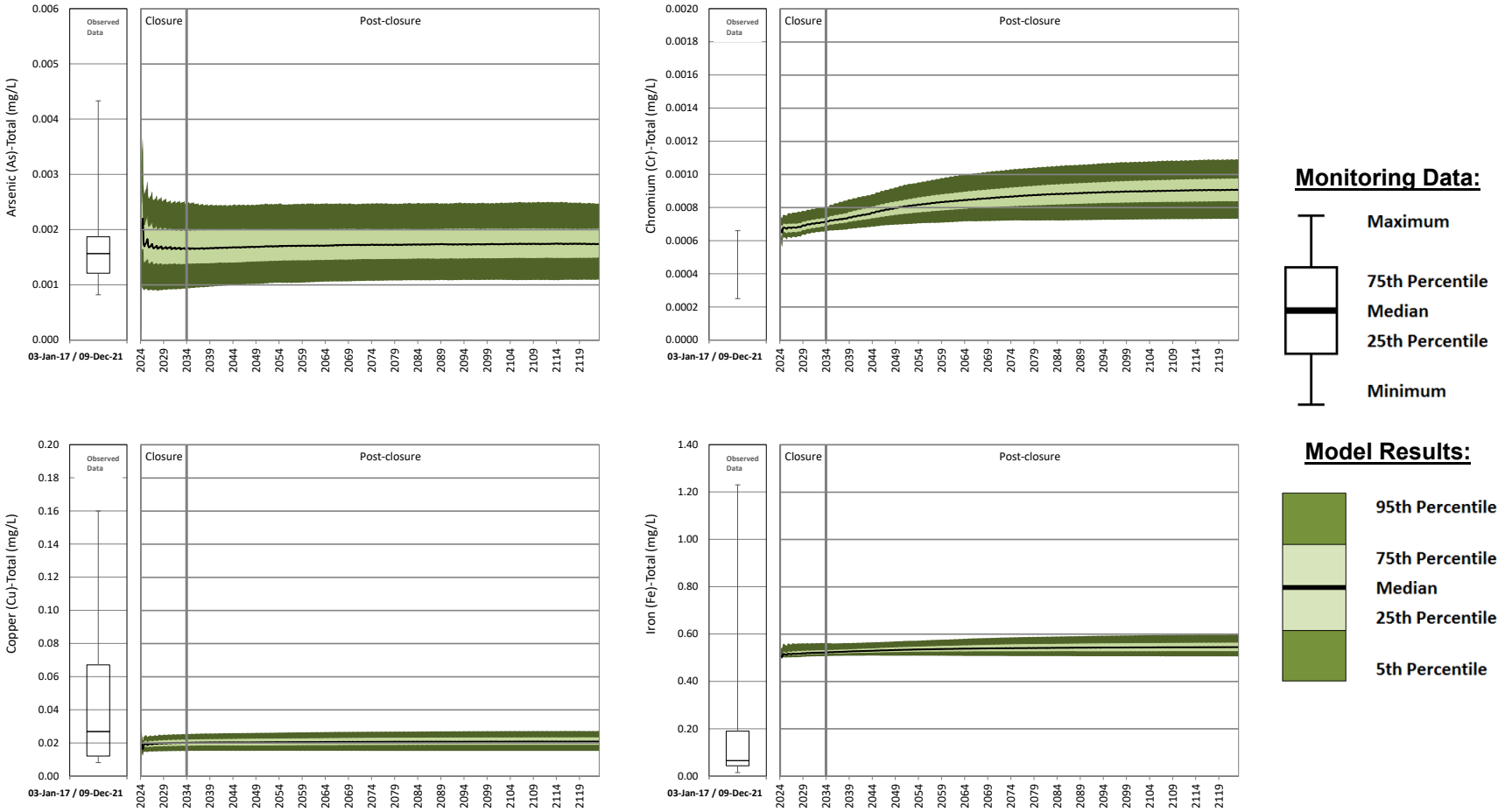

Figure 32: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Base Case Module

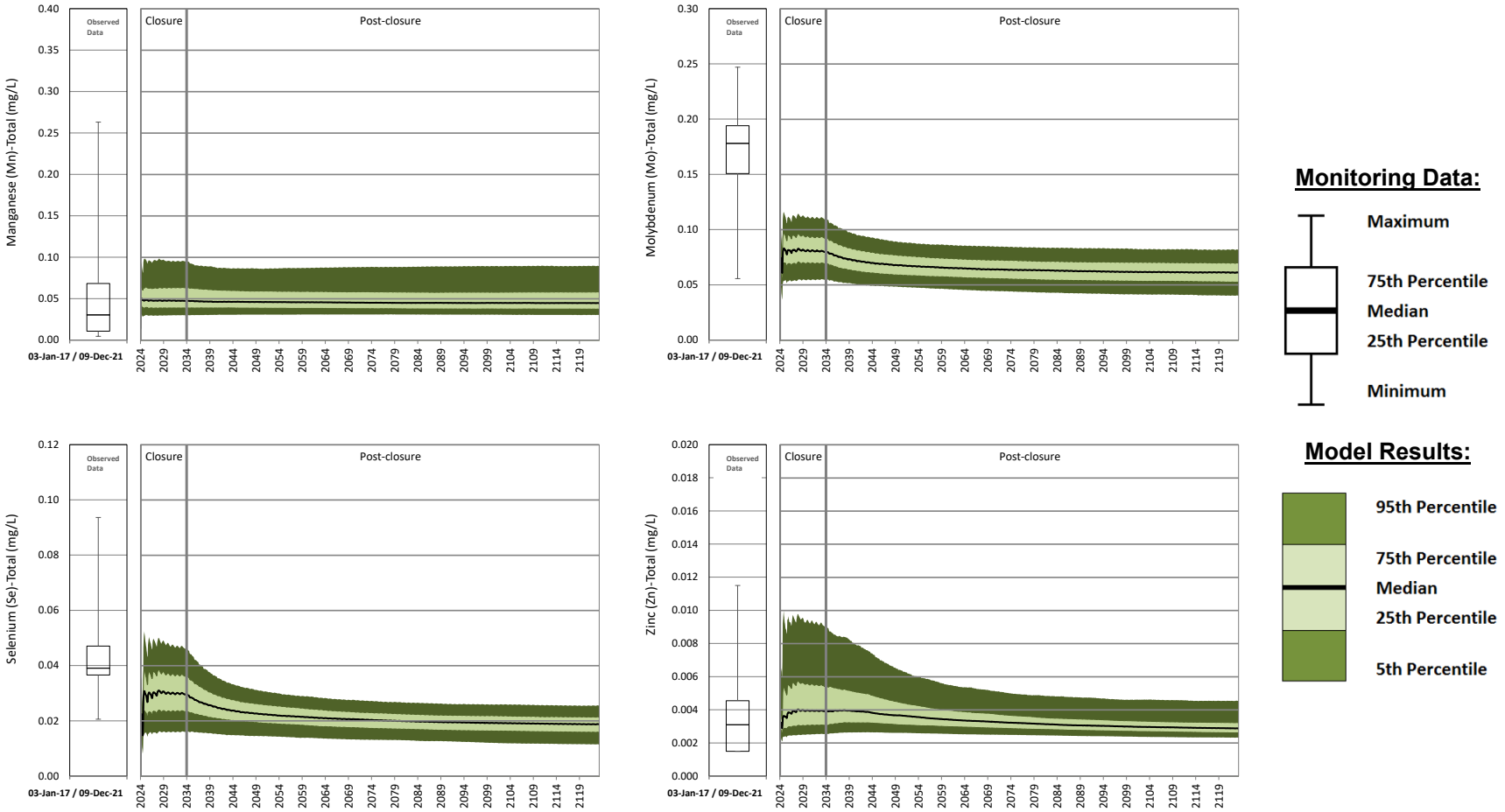

Figure 33: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Springer-Cariboo Pit during Closure and Post-closure – Base Case Module

4.2.3 Mine Drainage Creek Sump

The Mine Drainage Creek Sump receives drainage from undisturbed and disturbed areas, haul roads, and RDSs in its catchment area. Discharge from the Mine Drainage Creek Sump is planned to be directed to Bootjack Lake.

Time series plots for key parameters in the Mine Drainage Creek Sump for closure and post-closure are shown in Figures 34 to 36 for the climate change module results and in Figures 37 to 39 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 15 and 16 for the climate change and base case modules, respectively.

For most parameters, predicted peak concentrations in the Mine Drainage Creek Sump occur at the beginning of closure, and then decrease as disturbed areas, haul roads, and RDS areas are reclaimed (Figures 34 to 39). Concentrations are highest at the beginning of closure for most parameters because RDS and haul road runoff is assigned the NAG water quality input until reclamation, which will occur throughout closure (Section 2.3). Water qualities from these facilities are predicted to return to background water quality (Table 6). Predicted water quality reaches steady state conditions by 2044, after all watershed areas have been reclaimed.

Seasonal peak concentrations during winter are driven by seepage from the East RDS. During winter months, when precipitation occurs as snowfall, East RDS seepage represents a high proportion of the total flow to the Mine Drainage Creek Sump and causes concentrations of parameters to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the Mine Drainage Creek Sump, which causes concentrations of parameters, such as aluminum, to increase from closure to post-closure.

Table 15. Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	754	1,245	299	460	164	322
Total Dissolved Solids	mg/L	1,078	1,810	408	659	237	356
Major Ions							
Calcium	mg/L	233	390	89	125	45	70
Chloride	mg/L	2.8	9.1	2.8	8.5	2.8	8.5
Fluoride	mg/L	0.18	0.37	0.12	0.2	0.073	0.15
Magnesium	mg/L	42	66	19	36	12	36
Potassium	mg/L	3.0	5.0	1.2	1.6	1.1	1.6
Sodium	mg/L	16	38	8.0	14	6.8	14
Sulphate	mg/L	586	1,056	182	275	49	88
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0062	0.012	0.0063	0.012
Nitrate	mg/L (as N)	6.7	43	0.96	4.6	0.53	2.8
Nitrite	mg/L (as N)	0.012	0.053	0.0028	0.01	0.0008	0.0021
Total Phosphorus	mg/L	0.023	0.052	0.023	0.034	0.024	0.034
Total Metals							
Aluminum	mg/L	0.44	0.56	0.45	0.64	0.45	0.64
Antimony	mg/L	0.00022	0.00051	0.00011	0.0003	0.000083	0.00023
Arsenic	mg/L	0.00085	0.0012	0.001	0.0017	0.001	0.0017
Barium	mg/L	0.065	0.12	0.02	0.032	0.015	0.027
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.000051	0.000051
Boron	mg/L	0.056	0.23	0.034	0.071	0.025	0.066
Cadmium	mg/L	0.000049	0.00035	0.000026	0.00019	0.000012	0.0001
Chromium	mg/L	0.001	0.0013	0.0012	0.0017	0.0012	0.0017
Cobalt	mg/L	0.00048	0.0016	0.0004	0.00063	0.00039	0.00048
Copper	mg/L	0.015	0.17	0.013	0.17	0.012	0.16
Iron	mg/L	0.59	0.67	0.61	0.74	0.61	0.74
Lead	mg/L	0.00016	0.00019	0.00015	0.00021	0.00015	0.00021
Lithium	mg/L	0.0019	0.0062	0.0014	0.0038	0.0012	0.003
Manganese	mg/L	0.12	2.5	0.035	0.24	0.032	0.21
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.077	0.18	0.029	0.062	0.0075	0.025
Nickel	mg/L	0.0012	0.0031	0.0012	0.0021	0.0012	0.0021
Selenium	mg/L	0.06	0.13	0.016	0.037	0.0047	0.015
Silver	mg/L	0.0000047	0.000017	0.0000035	0.000022	0.0000032	0.000022
Strontium	mg/L	1.7	3.2	0.84	1.7	0.31	0.8
Thallium	mg/L	0.000005	0.0000051	0.000005	0.0000051	0.0000051	0.0000051
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.000051	0.00013
Titanium	mg/L	0.027	0.04	0.027	0.03	0.027	0.03
Uranium	mg/L	0.0011	0.0023	0.00075	0.0015	0.00065	0.0015
Vanadium	mg/L	0.0017	0.0021	0.0017	0.002	0.0017	0.002
Zinc	mg/L	0.0063	0.017	0.0051	0.011	0.0026	0.0047
Dissolved Metals							
Aluminum	mg/L	0.039	0.16	0.043	0.24	0.043	0.24
Antimony	mg/L	0.0002	0.00037	0.000093	0.00016	0.000063	0.000086
Arsenic	mg/L	0.00066	0.001	0.00086	0.0015	0.00086	0.0015
Barium	mg/L	0.063	0.11	0.018	0.023	0.013	0.018
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.000051	0.000051
Boron	mg/L	0.052	0.2	0.03	0.04	0.021	0.036
Cadmium	mg/L	0.000047	0.00027	0.000025	0.00012	0.000011	0.000032
Chromium	mg/L	0.00055	0.00082	0.00076	0.0012	0.00076	0.0012
Cobalt	mg/L	0.00016	0.0013	0.000084	0.00031	0.000069	0.00016
Copper	mg/L	0.0059	0.0094	0.0043	0.0067	0.0026	0.0049
Iron	mg/L	0.095	0.18	0.12	0.25	0.12	0.25
Lead	mg/L	0.000024	0.000056	0.000019	0.000078	0.000016	0.000078
Lithium	mg/L	0.0017	0.0052	0.0012	0.0028	0.001	0.002
Manganese	mg/L	0.1	2.5	0.021	0.22	0.018	0.2
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.077	0.17	0.029	0.051	0.0074	0.014
Nickel	mg/L	0.0007	0.0026	0.00075	0.0016	0.00075	0.0016
Selenium	mg/L	0.06	0.13	0.016	0.031	0.0047	0.0098
Silicon	mg/L	7.0	8.4	5.9	9.1	5.9	9.1
Silver	mg/L	0.0000047	0.000012	0.0000035	0.000017	0.0000032	0.000017
Strontium	mg/L	1.7	2.8	0.83	1.3	0.29	0.46
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.0000051	0.0000051
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.000051	0.000051
Titanium	mg/L	0.0056	0.018	0.0052	0.0078	0.0049	0.0078
Uranium	mg/L	0.0011	0.002	0.00072	0.0012	0.00063	0.0012
Vanadium	mg/L	0.00054	0.00089	0.00055	0.00085	0.00054	0.00086
Zinc	mg/L	0.005	0.016	0.0037	0.0096	0.0013	0.0033

a) Calculated based on predicted calcium and magnesium concentrations.

Table 16. Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	690	1,163	300	461	160	323
Total Dissolved Solids	mg/L	996	1,694	409	661	233	354
Major Ions							
Calcium	mg/L	214	364	89	126	44	69
Chloride	mg/L	2.8	8.5	2.8	8.5	2.8	8.7
Fluoride	mg/L	0.18	0.37	0.12	0.2	0.073	0.15
Magnesium	mg/L	38	62	19	36	12	36
Potassium	mg/L	2.7	4.7	1.2	1.6	1.1	1.6
Sodium	mg/L	15	36	8.0	14	6.8	14
Sulphate	mg/L	546	1,004	182	275	45	84
Nutrients							
Ammonia	mg/L (as N)	0.01	0.065	0.0062	0.011	0.0062	0.012
Nitrate	mg/L (as N)	6.7	43	0.92	4.6	0.5	2.6
Nitrite	mg/L (as N)	0.012	0.053	0.0029	0.01	0.00079	0.0021
Total Phosphorus	mg/L	0.023	0.048	0.023	0.034	0.023	0.034
Total Metals							
Aluminum	mg/L	0.44	0.56	0.45	0.65	0.45	0.65
Antimony	mg/L	0.0002	0.00049	0.00011	0.0003	0.000081	0.00023
Arsenic	mg/L	0.00084	0.0012	0.001	0.0017	0.001	0.0017
Barium	mg/L	0.06	0.12	0.02	0.032	0.015	0.027
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.000051
Boron	mg/L	0.053	0.22	0.034	0.071	0.025	0.066
Cadmium	mg/L	0.000049	0.00034	0.000026	0.00019	0.000012	0.0001
Chromium	mg/L	0.001	0.0013	0.0012	0.0017	0.0012	0.0017
Cobalt	mg/L	0.00049	0.0016	0.0004	0.00063	0.00039	0.00048
Copper	mg/L	0.015	0.17	0.013	0.17	0.012	0.16
Iron	mg/L	0.58	0.67	0.61	0.74	0.61	0.74
Lead	mg/L	0.00016	0.00019	0.00015	0.00021	0.00015	0.00021
Lithium	mg/L	0.0019	0.0061	0.0014	0.0038	0.0012	0.003
Manganese	mg/L	0.11	2.4	0.035	0.22	0.032	0.2
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.071	0.17	0.029	0.062	0.007	0.025
Nickel	mg/L	0.0012	0.003	0.0012	0.0021	0.0012	0.0021
Selenium	mg/L	0.056	0.13	0.016	0.037	0.0043	0.015
Silver	mg/L	0.0000045	0.000016	0.0000035	0.000022	0.0000032	0.000022
Strontium	mg/L	1.7	3.2	0.85	1.7	0.3	0.8
Thallium	mg/L	0.000005	0.0000051	0.000005	0.0000052	0.000005	0.0000052
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.027	0.039	0.027	0.03	0.027	0.03
Uranium	mg/L	0.0011	0.0021	0.00075	0.0015	0.00064	0.0015
Vanadium	mg/L	0.0017	0.002	0.0017	0.002	0.0017	0.002
Zinc	mg/L	0.0063	0.017	0.0051	0.011	0.0026	0.0047
Dissolved Metals							
Aluminum	mg/L	0.038	0.15	0.043	0.24	0.043	0.24
Antimony	mg/L	0.00018	0.00035	0.000093	0.00016	0.000061	0.000085
Arsenic	mg/L	0.00065	0.001	0.00086	0.0015	0.00086	0.0015
Barium	mg/L	0.059	0.11	0.018	0.023	0.013	0.018
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.000051
Boron	mg/L	0.049	0.19	0.03	0.04	0.021	0.035
Cadmium	mg/L	0.000047	0.00027	0.000025	0.00012	0.000011	0.000031
Chromium	mg/L	0.00054	0.00081	0.00076	0.0012	0.00076	0.0012
Cobalt	mg/L	0.00017	0.0013	0.000082	0.00031	0.000069	0.00016
Copper	mg/L	0.0059	0.0091	0.0043	0.0067	0.0026	0.005
Iron	mg/L	0.092	0.18	0.12	0.25	0.12	0.25
Lead	mg/L	0.000024	0.000055	0.000019	0.000078	0.000016	0.000079
Lithium	mg/L	0.0017	0.0051	0.0012	0.0028	0.0010	0.002
Manganese	mg/L	0.10	2.4	0.021	0.21	0.017	0.19
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.071	0.16	0.029	0.051	0.0069	0.014
Nickel	mg/L	0.0007	0.0026	0.00075	0.0016	0.00076	0.0016
Selenium	mg/L	0.056	0.12	0.016	0.031	0.0043	0.0095
Silicon	mg/L	6.7	8.0	5.9	9.1	5.9	9.2
Silver	mg/L	0.0000045	0.000011	0.0000035	0.000017	0.0000032	0.000017
Strontium	mg/L	1.6	2.8	0.83	1.3	0.29	0.46
Thallium	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000051
Tin	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.000051
Titanium	mg/L	0.0056	0.017	0.0052	0.0078	0.0049	0.0079
Uranium	mg/L	0.0011	0.0018	0.00072	0.0012	0.00062	0.0012
Vanadium	mg/L	0.00054	0.00082	0.00055	0.00085	0.00055	0.00086
Zinc	mg/L	0.0049	0.016	0.0037	0.0096	0.0013	0.0034

a) Calculated based on predicted calcium and magnesium concentrations.

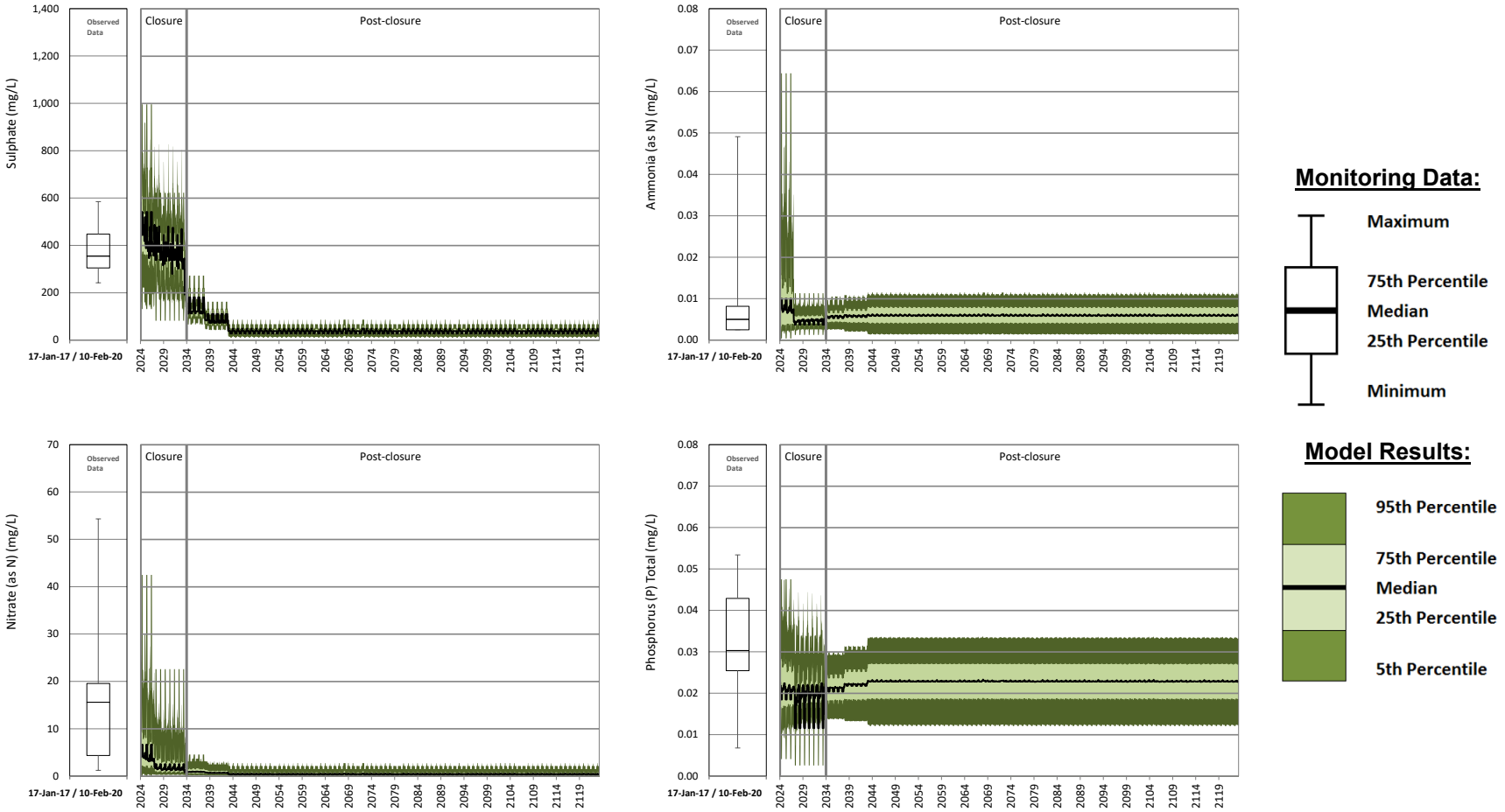

Figure 34: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Climate Change Module

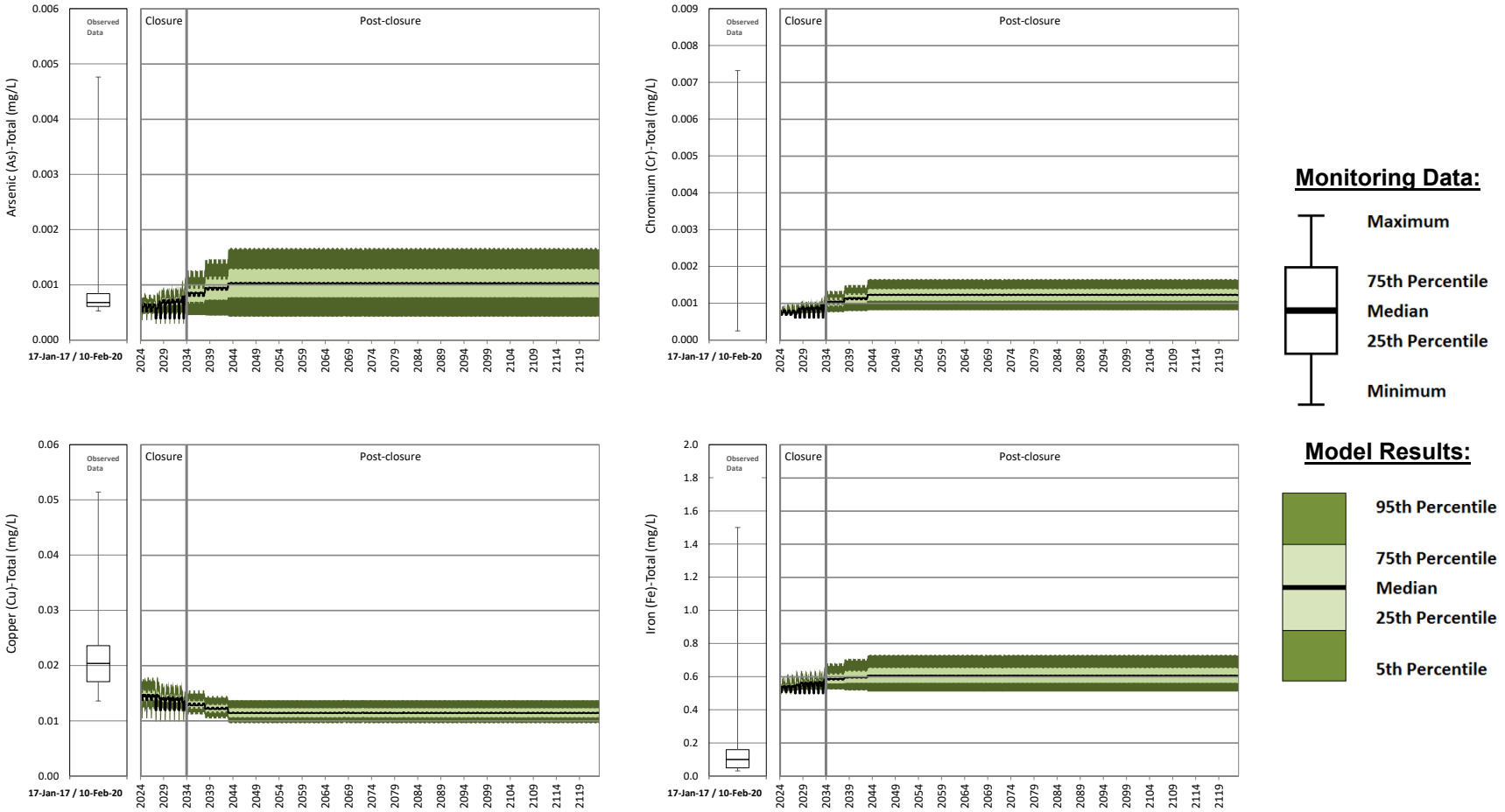

Figure 35: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Climate Change Module

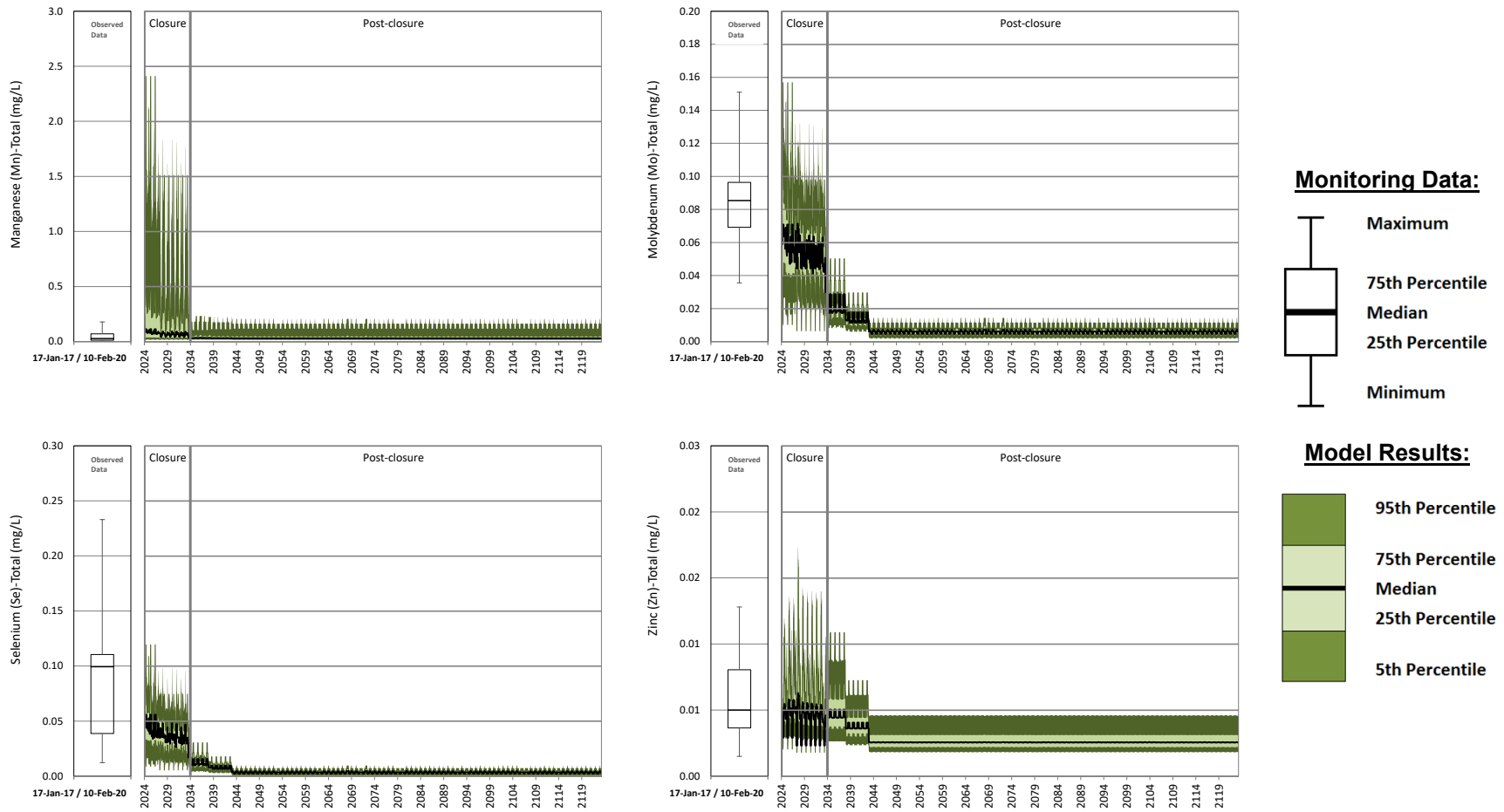

Figure 36: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Climate Change Module

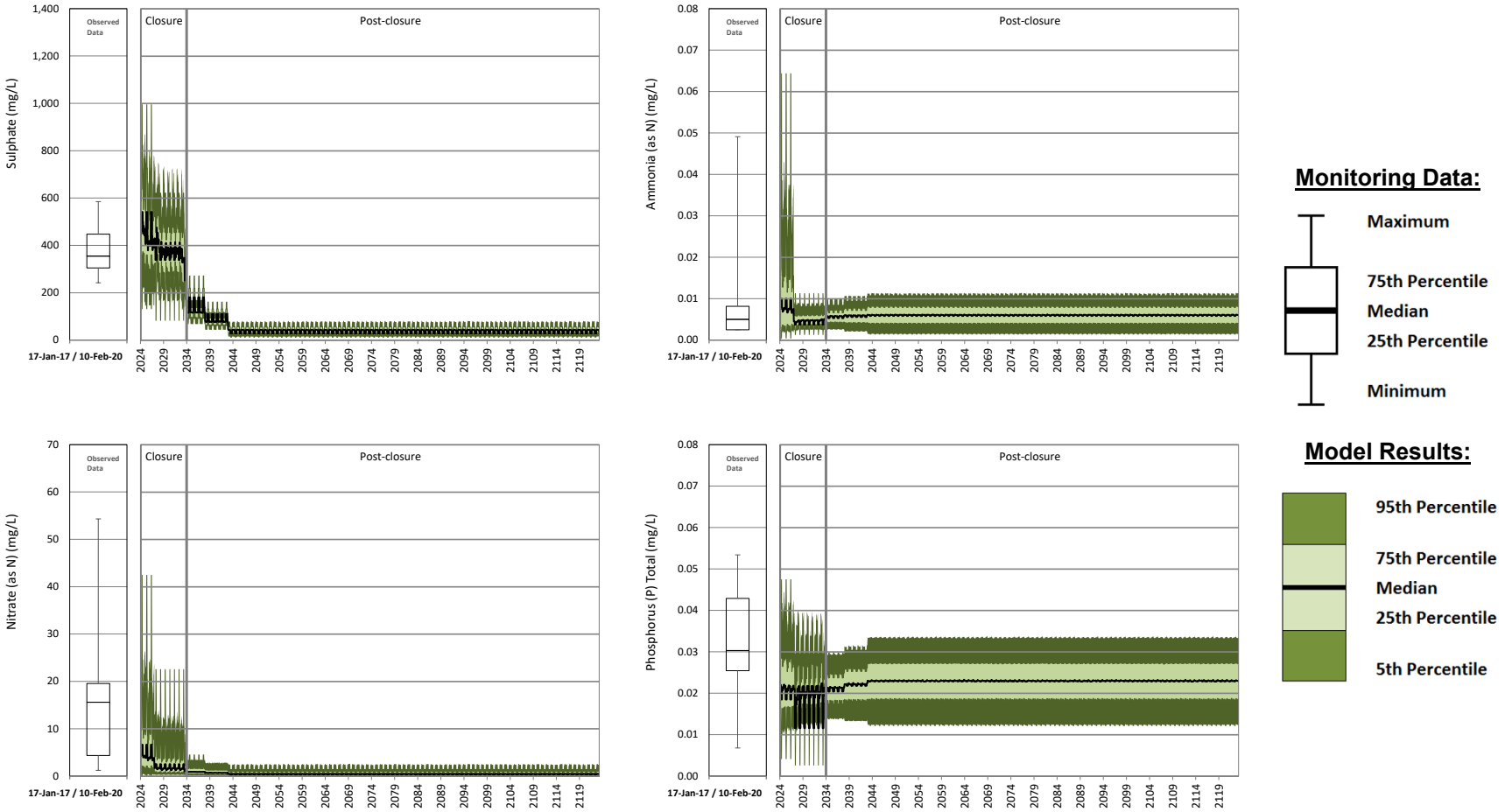

Figure 37: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Base Case Module

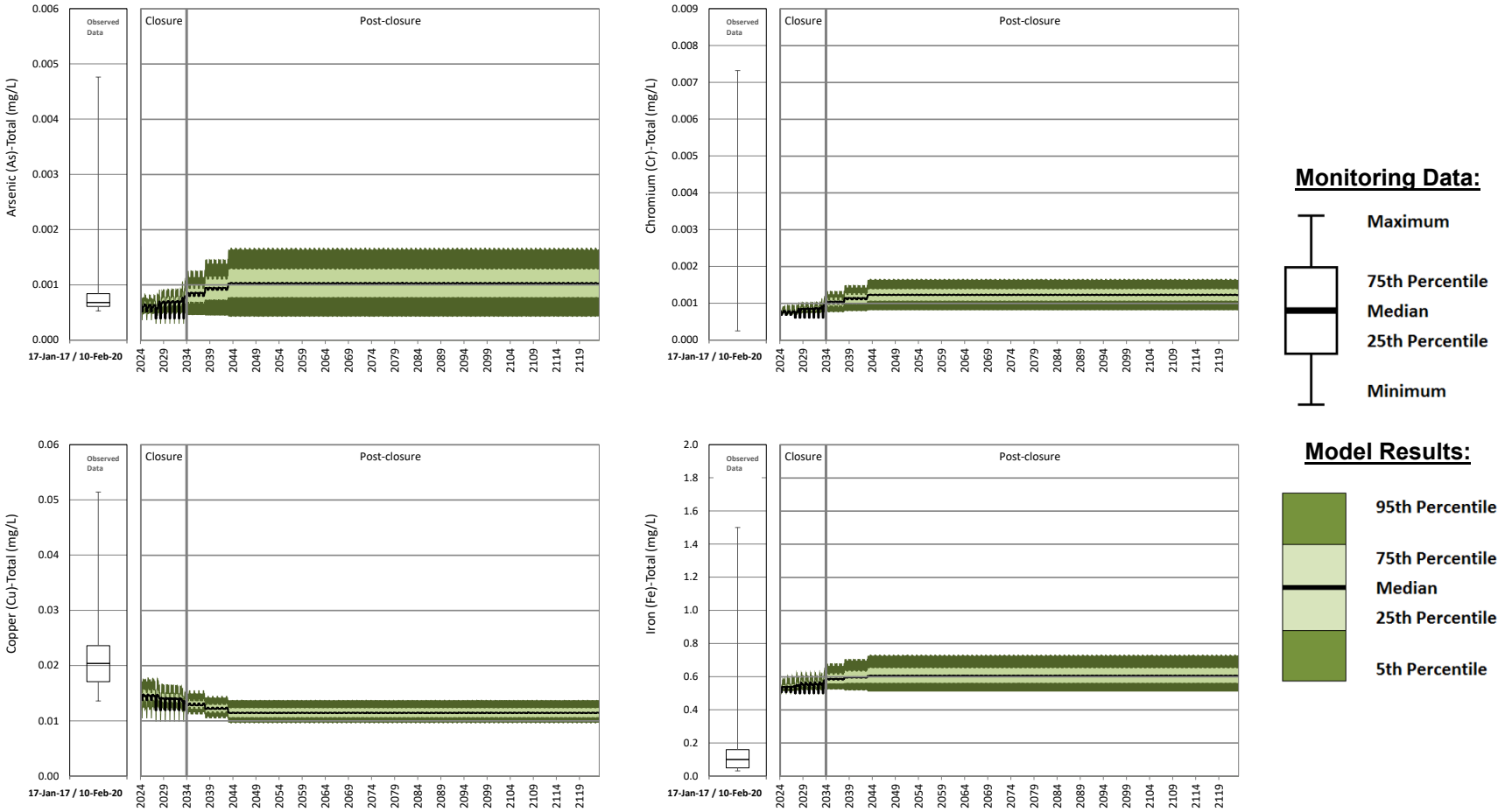

Figure 38: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Base Case Module

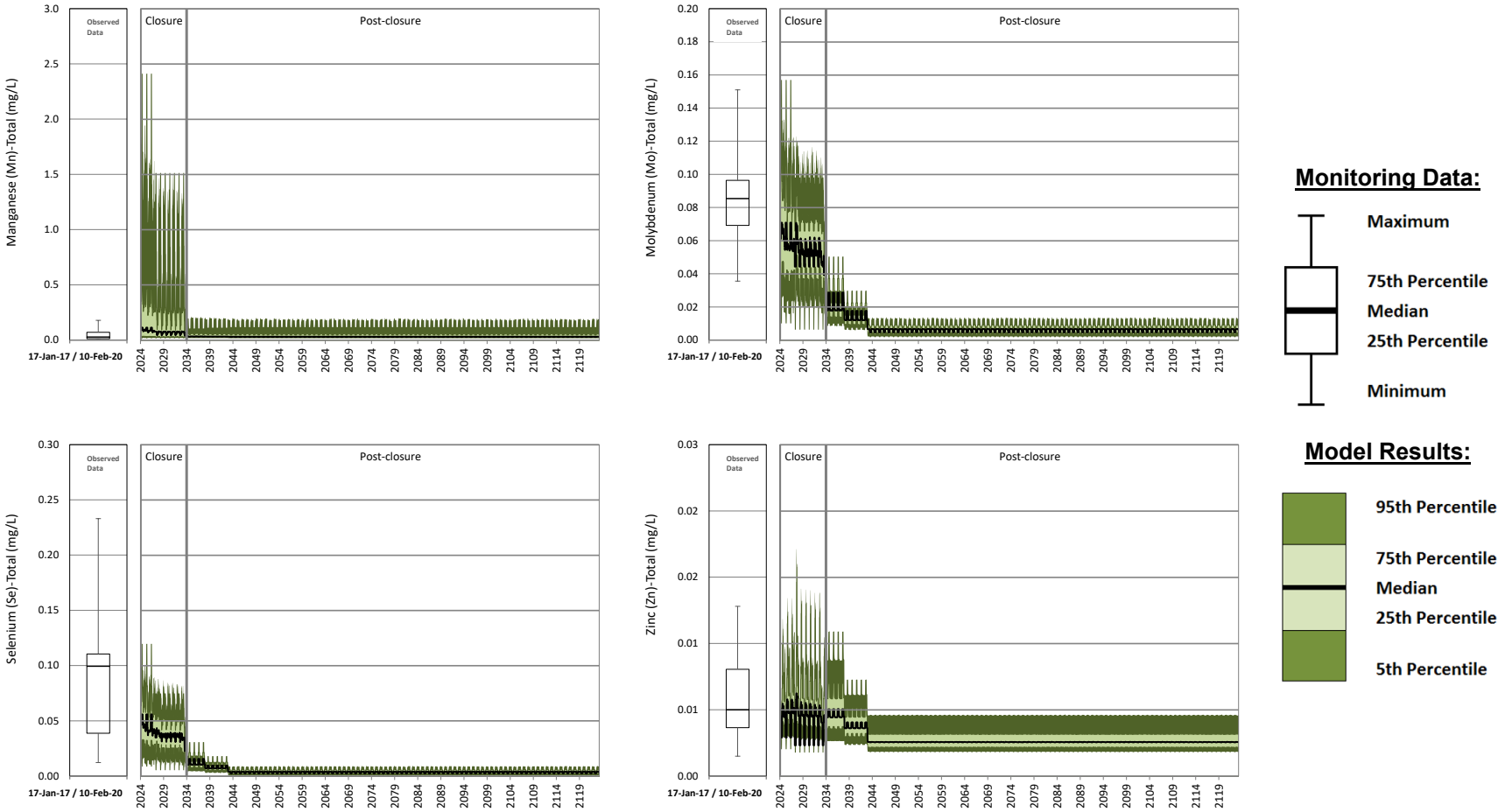

Figure 39: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Mine Drainage Creek Sump during Closure and Post-closure – Base Case Module

4.2.4 Wight Pit

A pit lake will form in Wight Pit during closure as the mined-out pit refills passively with groundwater, seepage from Boundary Pit, surface runoff from pit walls, disturbed areas, and haul roads in the Wight Pit catchment. The pit lake is predicted to fill approximately five years into closure (2028), at which point overflow will be directed to Polley Lake. Reclamation of the disturbed areas and haul roads is assumed to occur throughout closure (see Section 2.1). Runoff water quality from these facilities is predicted to return to background water quality as presented in Table 6.

Time series plots for key parameters in Wight Pit for closure and post-closure are shown in Figures 40 to 42 for the climate change module results and in Figures 43 to 45 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 17 and 18 for the climate change and base case modules, respectively.

Predicted concentrations of key parameters in Wight Pit are generally stable in post-closure by 2050 (Figures 40 to 45). Concentrations of key parameters decrease slightly through early post-closure after the pit has filled and is flushed with runoff from reclaimed disturbed areas and haul roads in the Wight Pit catchment area.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Wight Pit.

Table 17. Predicted Maximum Concentrations in the Wight Pit during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	738	909	722	888	694	851
Total Dissolved Solids	mg/L	1,062	1,300	1,037	1,289	997	1,227
Major Ions							
Calcium	mg/L	245	301	239	292	229	280
Chloride	mg/L	1.6	2.6	1.7	2.7	1.7	2.7
Fluoride	mg/L	0.82	0.92	0.74	0.85	0.72	0.82
Magnesium	mg/L	31	38	31	38	30	37
Potassium	mg/L	1.6	1.9	1.6	1.9	1.5	1.8
Sodium	mg/L	26	35	25	33	24	32
Sulphate	mg/L	633	777	616	758	588	722
Nutrients							
Ammonia	mg/L (as N)	0.0023	0.089	0.0025	0.078	0.0026	0.076
Nitrate	mg/L (as N)	2.4	5.1	2.2	5.1	1.5	4.7
Nitrite	mg/L (as N)	0.0048	0.011	0.0049	0.012	0.0049	0.012
Total Phosphorus	mg/L	0.0081	0.015	0.0087	0.015	0.0089	0.015
Total Metals							
Aluminum	mg/L	0.41	0.42	0.41	0.43	0.41	0.44
Antimony	mg/L	0.00059	0.00097	0.00054	0.0009	0.00053	0.00087
Arsenic	mg/L	0.00079	0.0011	0.00079	0.001	0.0008	0.001
Barium	mg/L	0.027	0.042	0.027	0.042	0.026	0.041
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.29	0.43	0.26	0.38	0.25	0.37
Cadmium	mg/L	0.0003	0.00057	0.00028	0.00053	0.00027	0.00051
Chromium	mg/L	0.0008	0.00096	0.00082	0.00097	0.00083	0.00099
Cobalt	mg/L	0.00086	0.0017	0.00082	0.0016	0.0008	0.0016
Copper	mg/L	0.023	0.18	0.022	0.18	0.021	0.18
Iron	mg/L	0.52	0.54	0.52	0.54	0.53	0.55
Lead	mg/L	0.00016	0.00016	0.00016	0.00016	0.00016	0.00017
Lithium	mg/L	0.0085	0.011	0.0078	0.01	0.0076	0.01
Manganese	mg/L	0.17	0.29	0.15	0.26	0.15	0.25
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.13	0.16	0.13	0.16	0.12	0.15
Nickel	mg/L	0.0012	0.002	0.0012	0.002	0.0012	0.002
Selenium	mg/L	0.021	0.042	0.021	0.042	0.019	0.04
Silver	mg/L	0.0000064	0.000015	0.0000062	0.000014	0.0000061	0.000014
Strontium	mg/L	6.1	9.6	5.7	8.8	5.4	8.4
Thallium	mg/L	0.000011	0.000016	0.0000098	0.000014	0.0000096	0.000014
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00013
Titanium	mg/L	0.028	0.032	0.028	0.032	0.028	0.032
Uranium	mg/L	0.0029	0.0041	0.0027	0.0038	0.0027	0.0037
Vanadium	mg/L	0.0016	0.0018	0.0016	0.0018	0.0016	0.0018
Zinc	mg/L	0.014	0.023	0.013	0.021	0.012	0.02
Dissolved Metals							
Aluminum	mg/L	0.005	0.015	0.0067	0.025	0.0079	0.034
Antimony	mg/L	0.00057	0.00083	0.00052	0.00076	0.00051	0.00073
Arsenic	mg/L	0.0006	0.00089	0.00061	0.00085	0.00062	0.00086
Barium	mg/L	0.026	0.034	0.026	0.033	0.025	0.032
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.29	0.4	0.26	0.35	0.25	0.34
Cadmium	mg/L	0.0003	0.00049	0.00028	0.00046	0.00027	0.00044
Chromium	mg/L	0.00031	0.00047	0.00033	0.00049	0.00035	0.00051
Cobalt	mg/L	0.00054	0.0014	0.0005	0.0013	0.00048	0.0012
Copper	mg/L	0.014	0.021	0.013	0.019	0.012	0.019
Iron	mg/L	0.027	0.047	0.031	0.052	0.034	0.055
Lead	mg/L	0.000026	0.00003	0.000026	0.000031	0.000025	0.000032
Lithium	mg/L	0.0083	0.01	0.0076	0.0095	0.0074	0.0092
Manganese	mg/L	0.15	0.27	0.14	0.24	0.13	0.24
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.13	0.15	0.13	0.15	0.12	0.14
Nickel	mg/L	0.00077	0.0016	0.00076	0.0016	0.00076	0.0015
Selenium	mg/L	0.021	0.037	0.021	0.037	0.019	0.034
Silicon	mg/L	7.3	8.6	7.1	8.3	7.0	8.2
Silver	mg/L	0.0000064	0.00001	0.0000062	0.0000094	0.0000061	0.0000093
Strontium	mg/L	6.1	9.3	5.6	8.4	5.4	8.1
Thallium	mg/L	0.000011	0.000016	0.0000098	0.000014	0.0000096	0.000014
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0062	0.011	0.0061	0.01	0.0061	0.0099
Uranium	mg/L	0.0029	0.0038	0.0027	0.0035	0.0026	0.0034
Vanadium	mg/L	0.00041	0.00067	0.00042	0.00065	0.00042	0.00065
Zinc	mg/L	0.012	0.022	0.011	0.02	0.011	0.019

a) Calculated based on predicted calcium and magnesium concentrations.

Table 18. Predicted Maximum Concentrations in the Wight Pit during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	740	912	732	903	710	874
Total Dissolved Solids	mg/L	1,063	1,314	1,054	1,310	1,020	1,259
Major Ions							
Calcium	mg/L	245	301	242	297	235	288
Chloride	mg/L	1.6	2.7	1.7	2.7	1.7	2.7
Fluoride	mg/L	0.81	0.91	0.76	0.86	0.73	0.84
Magnesium	mg/L	31	39	31	39	30	38
Potassium	mg/L	1.6	1.9	1.6	1.9	1.6	1.9
Sodium	mg/L	26	35	25	33	25	32
Sulphate	mg/L	633	778	628	769	603	739
Nutrients							
Ammonia	mg/L (as N)	0.0024	0.089	0.0025	0.08	0.0026	0.078
Nitrate	mg/L (as N)	2.3	5.0	2.1	5.2	1.4	4.8
Nitrite	mg/L (as N)	0.0049	0.012	0.0051	0.012	0.0051	0.013
Total Phosphorus	mg/L	0.0081	0.015	0.0087	0.016	0.0091	0.016
Total Metals							
Aluminum	mg/L	0.41	0.42	0.41	0.43	0.41	0.44
Antimony	mg/L	0.00058	0.00097	0.00055	0.00091	0.00054	0.00089
Arsenic	mg/L	0.00079	0.0011	0.0008	0.0011	0.00082	0.0011
Barium	mg/L	0.028	0.042	0.027	0.042	0.027	0.041
Beryllium	mg/L	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Boron	mg/L	0.29	0.43	0.27	0.39	0.26	0.38
Cadmium	mg/L	0.0003	0.00057	0.00028	0.00054	0.00028	0.00052
Chromium	mg/L	0.0008	0.00096	0.00082	0.00098	0.00084	0.001
Cobalt	mg/L	0.00085	0.0017	0.00083	0.0016	0.00081	0.0016
Copper	mg/L	0.023	0.18	0.022	0.18	0.021	0.18
Iron	mg/L	0.52	0.54	0.52	0.55	0.53	0.55
Lead	mg/L	0.00016	0.00016	0.00016	0.00016	0.00016	0.00017
Lithium	mg/L	0.0085	0.011	0.008	0.011	0.0077	0.01
Manganese	mg/L	0.17	0.29	0.16	0.26	0.15	0.26
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.13	0.16	0.13	0.16	0.12	0.15
Nickel	mg/L	0.0012	0.0021	0.0012	0.0021	0.0012	0.002
Selenium	mg/L	0.021	0.042	0.021	0.042	0.02	0.04
Silver	mg/L	0.0000064	0.000015	0.0000063	0.000015	0.0000063	0.000015
Strontium	mg/L	6.1	9.6	5.8	8.9	5.6	8.7
Thallium	mg/L	0.00001	0.000016	0.000010	0.000015	0.0000099	0.000014
Tin	mg/L	0.000051	0.00013	0.000051	0.00013	0.000051	0.00013
Titanium	mg/L	0.028	0.032	0.028	0.032	0.028	0.032
Uranium	mg/L	0.0029	0.0041	0.0028	0.0039	0.0027	0.0038
Vanadium	mg/L	0.0016	0.0018	0.0016	0.0018	0.0016	0.0018
Zinc	mg/L	0.014	0.023	0.013	0.022	0.013	0.021
Dissolved Metals							
Aluminum	mg/L	0.005	0.015	0.0066	0.024	0.0077	0.032
Antimony	mg/L	0.00056	0.00083	0.00053	0.00077	0.00052	0.00075
Arsenic	mg/L	0.0006	0.00089	0.00062	0.00086	0.00063	0.00088
Barium	mg/L	0.026	0.034	0.026	0.034	0.025	0.033
Beryllium	mg/L	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Boron	mg/L	0.29	0.4	0.26	0.36	0.25	0.35
Cadmium	mg/L	0.0003	0.0005	0.00028	0.00047	0.00027	0.00045
Chromium	mg/L	0.00032	0.00048	0.00033	0.00049	0.00035	0.00051
Cobalt	mg/L	0.00053	0.0014	0.00051	0.0013	0.00049	0.0013
Copper	mg/L	0.014	0.021	0.013	0.02	0.012	0.019
Iron	mg/L	0.027	0.047	0.031	0.053	0.034	0.055
Lead	mg/L	0.000026	0.000031	0.000026	0.000032	0.000026	0.000033
Lithium	mg/L	0.0083	0.01	0.0078	0.0097	0.0075	0.0094
Manganese	mg/L	0.15	0.27	0.14	0.25	0.14	0.24
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.13	0.15	0.13	0.15	0.12	0.14
Nickel	mg/L	0.00077	0.0016	0.00077	0.0016	0.00077	0.0015
Selenium	mg/L	0.021	0.037	0.021	0.037	0.02	0.035
Silicon	mg/L	7.3	8.6	7.2	8.4	7.2	8.4
Silver	mg/L	0.0000064	0.0000099	0.0000063	0.0000095	0.0000063	0.0000095
Strontium	mg/L	6.1	9.2	5.7	8.6	5.5	8.3
Thallium	mg/L	0.00001	0.000016	0.000010	0.000014	0.0000099	0.000014
Tin	mg/L	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Titanium	mg/L	0.0062	0.01	0.0062	0.01	0.0062	0.01
Uranium	mg/L	0.0029	0.0038	0.0028	0.0036	0.0027	0.0035
Vanadium	mg/L	0.00042	0.00067	0.00043	0.00067	0.00043	0.00067
Zinc	mg/L	0.012	0.022	0.012	0.02	0.011	0.02

a) Calculated based on predicted calcium and magnesium concentrations.

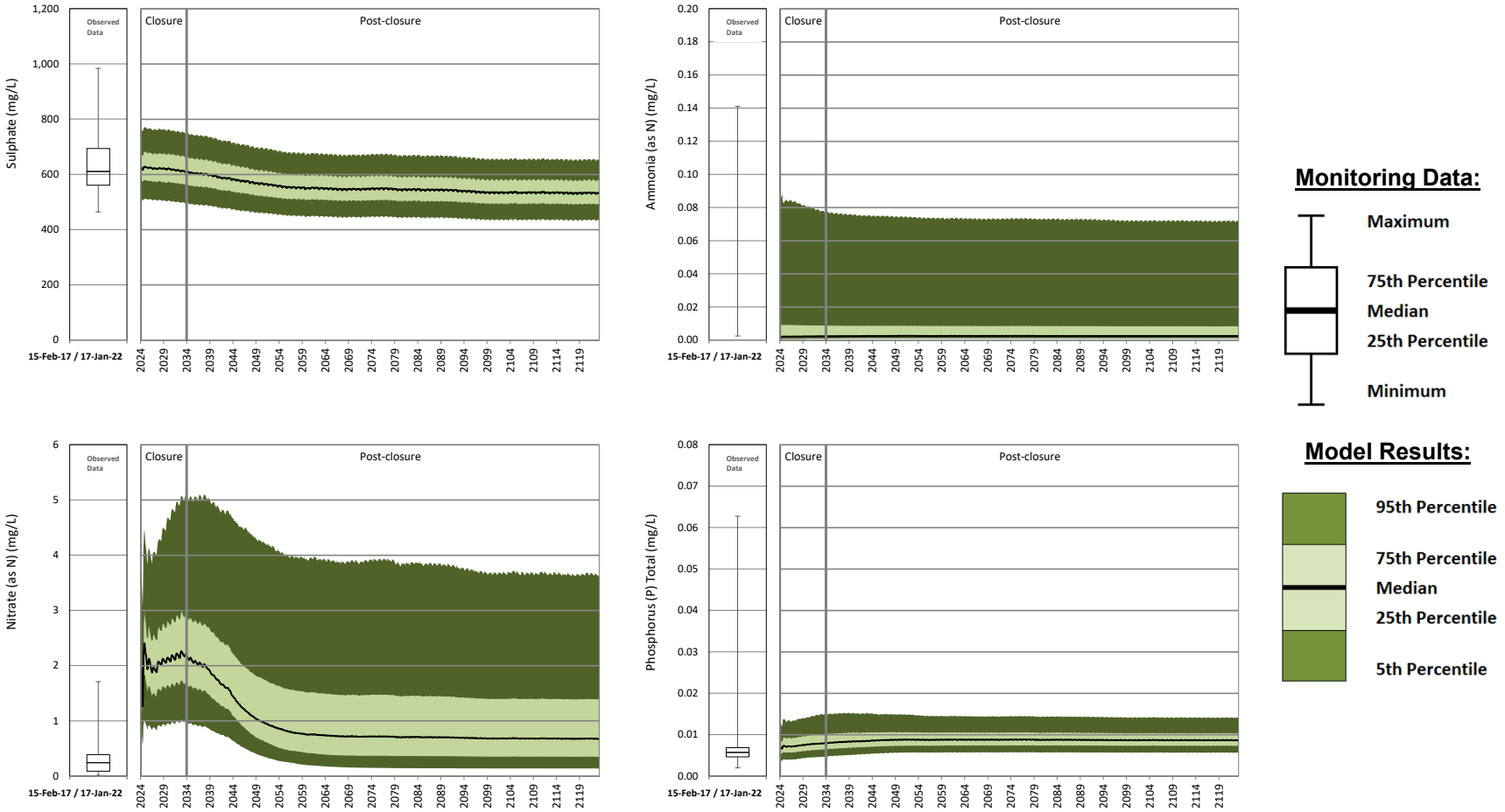

Figure 40: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Wight Pit during Closure and Post-closure – Climate Change Module

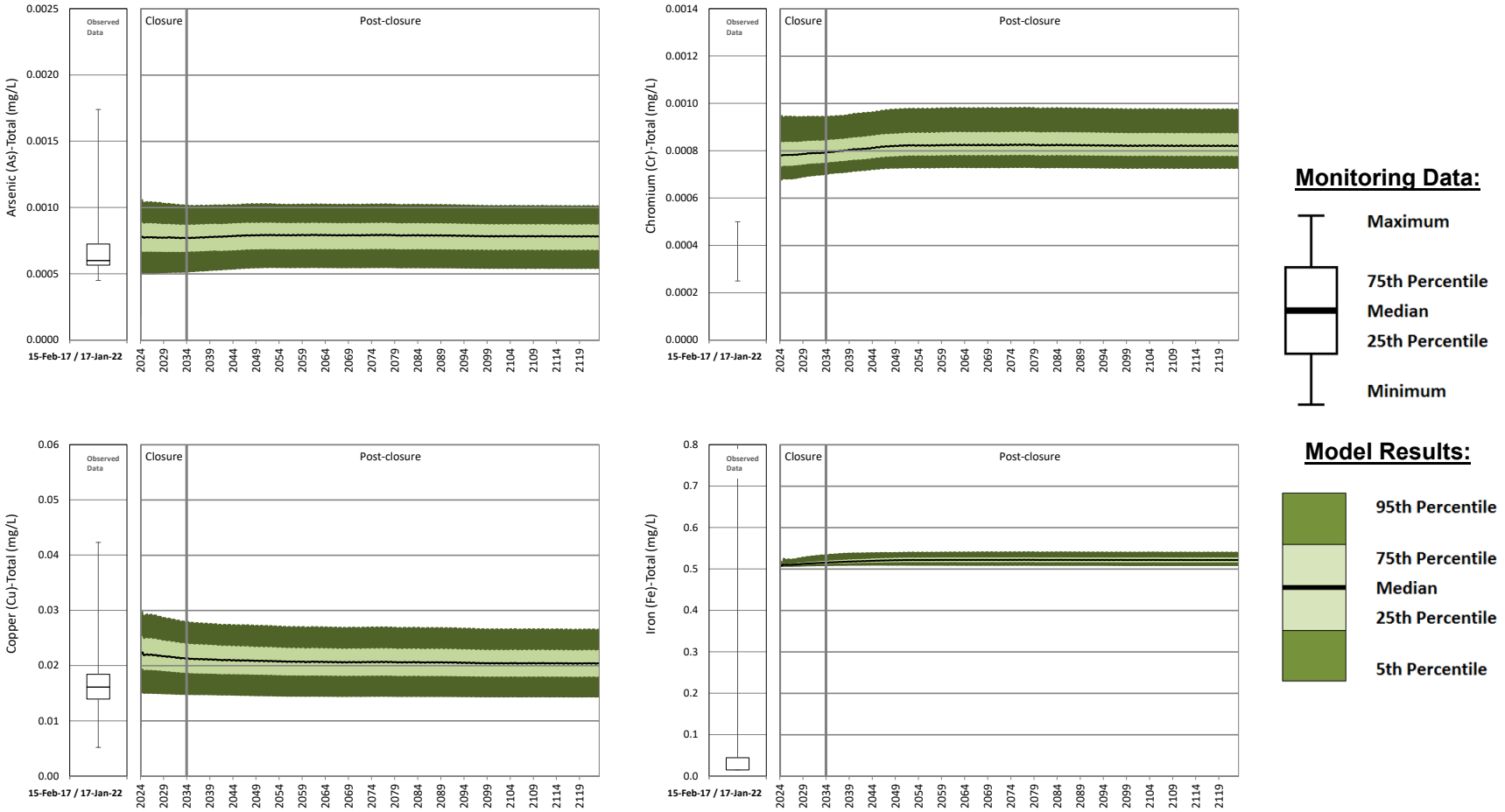

Figure 41: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Wight Pit during Closure and Post-closure – Climate Change Module

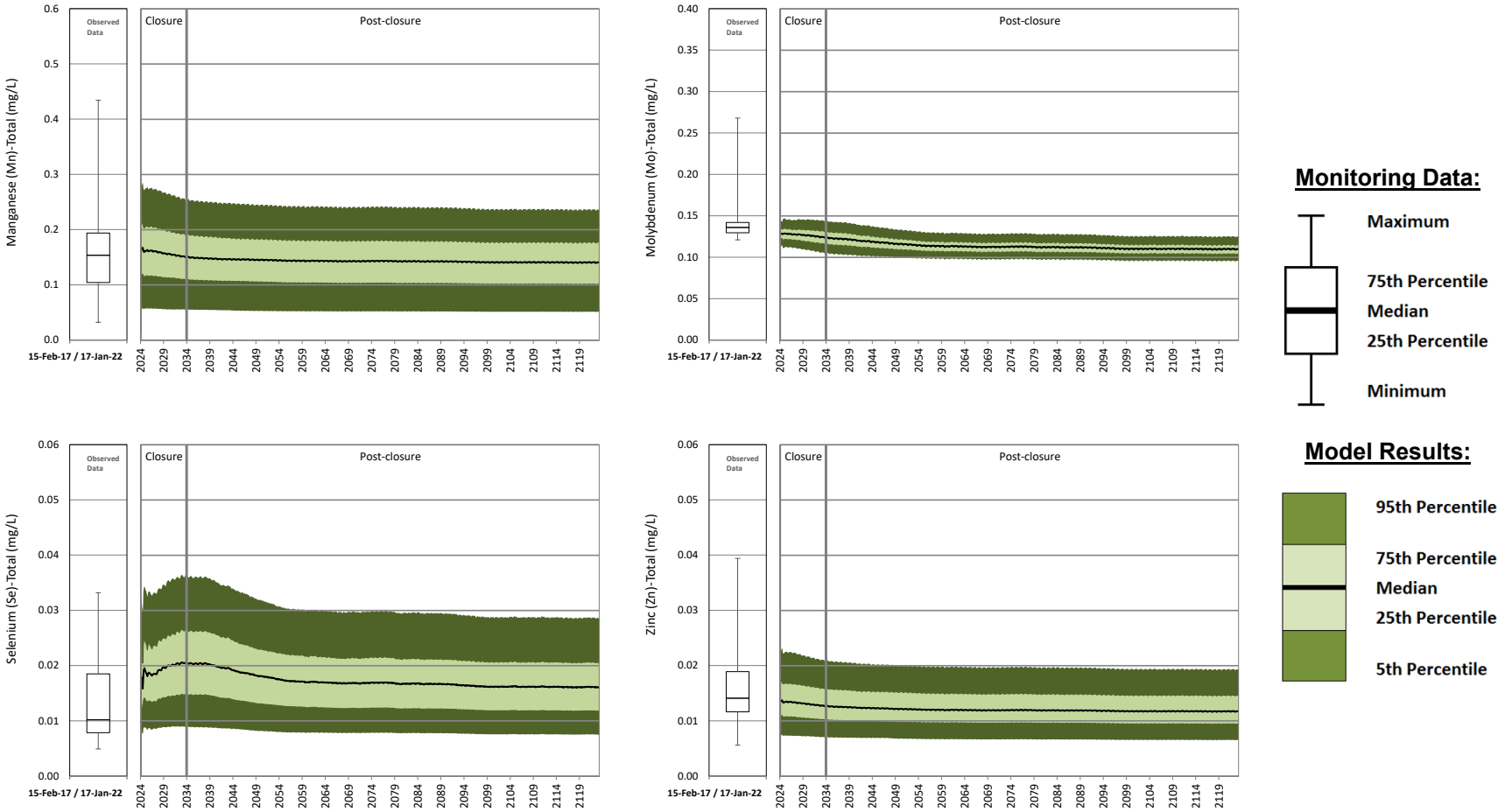

Figure 42: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Wight Pit during Closure and Post-closure – Climate Change Module

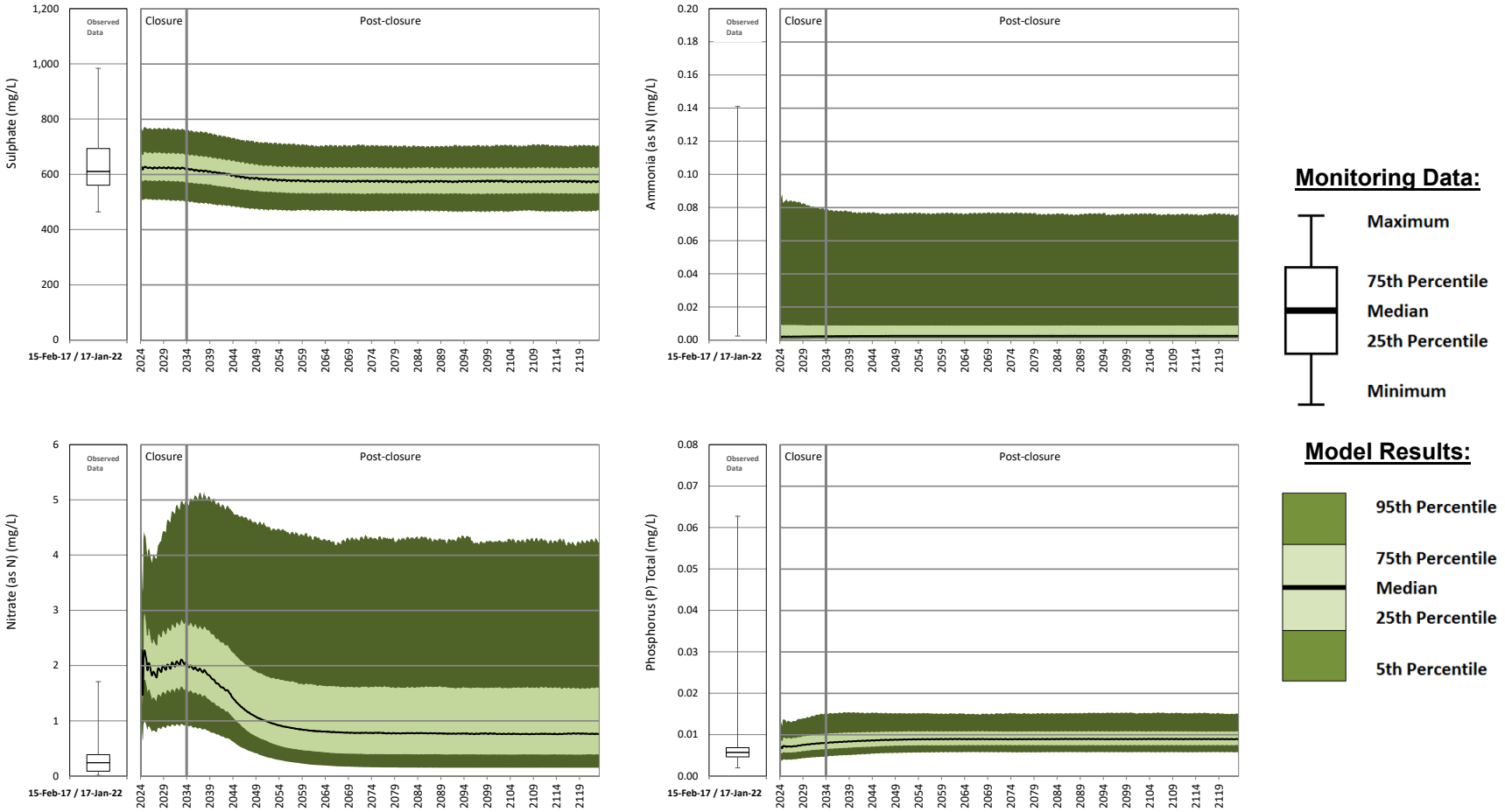

Figure 43: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Wight Pit during Closure and Post-closure – Base Case Module

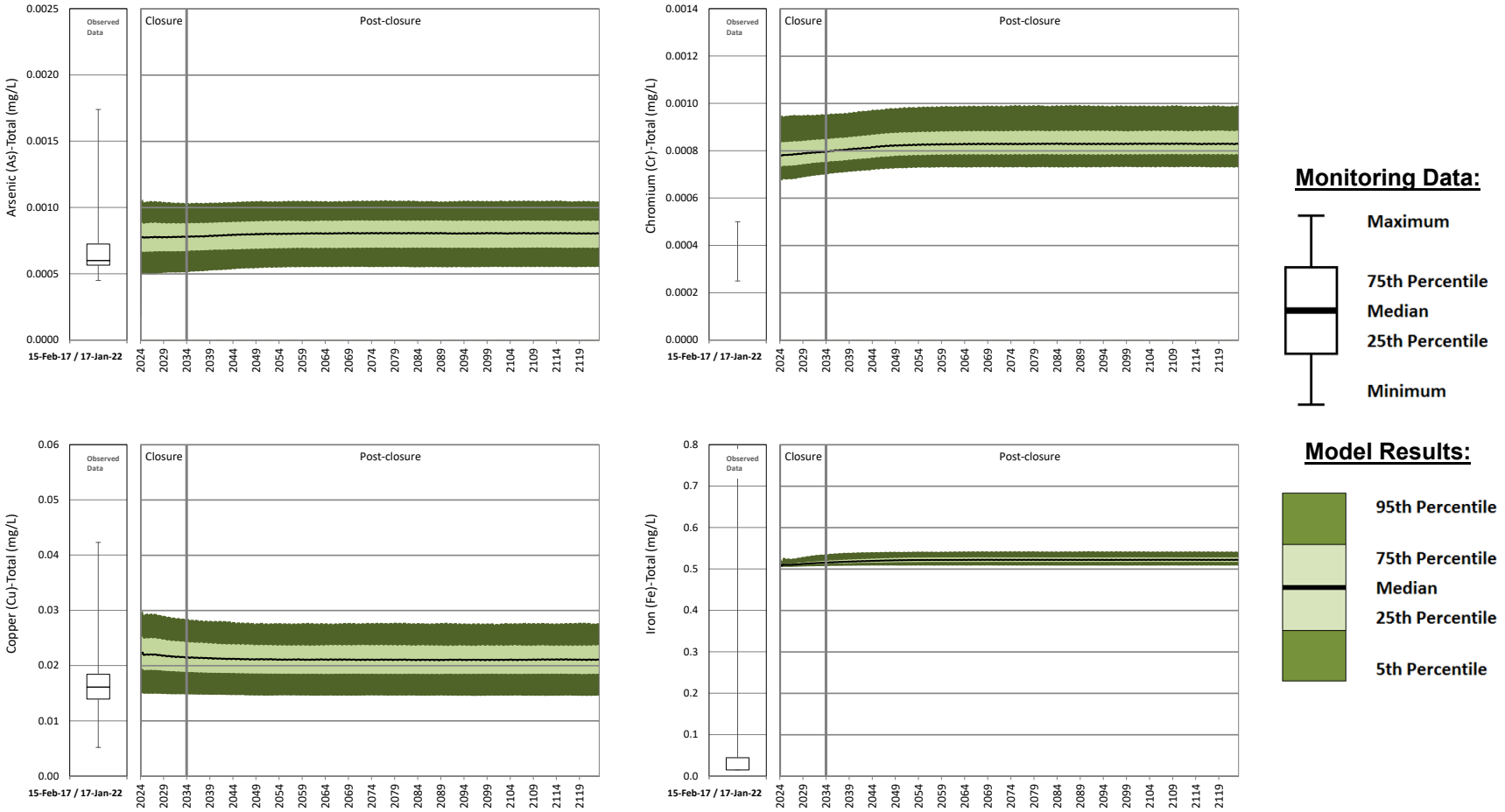

Figure 44: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Wight Pit during Closure and Post-closure – Base Case Module

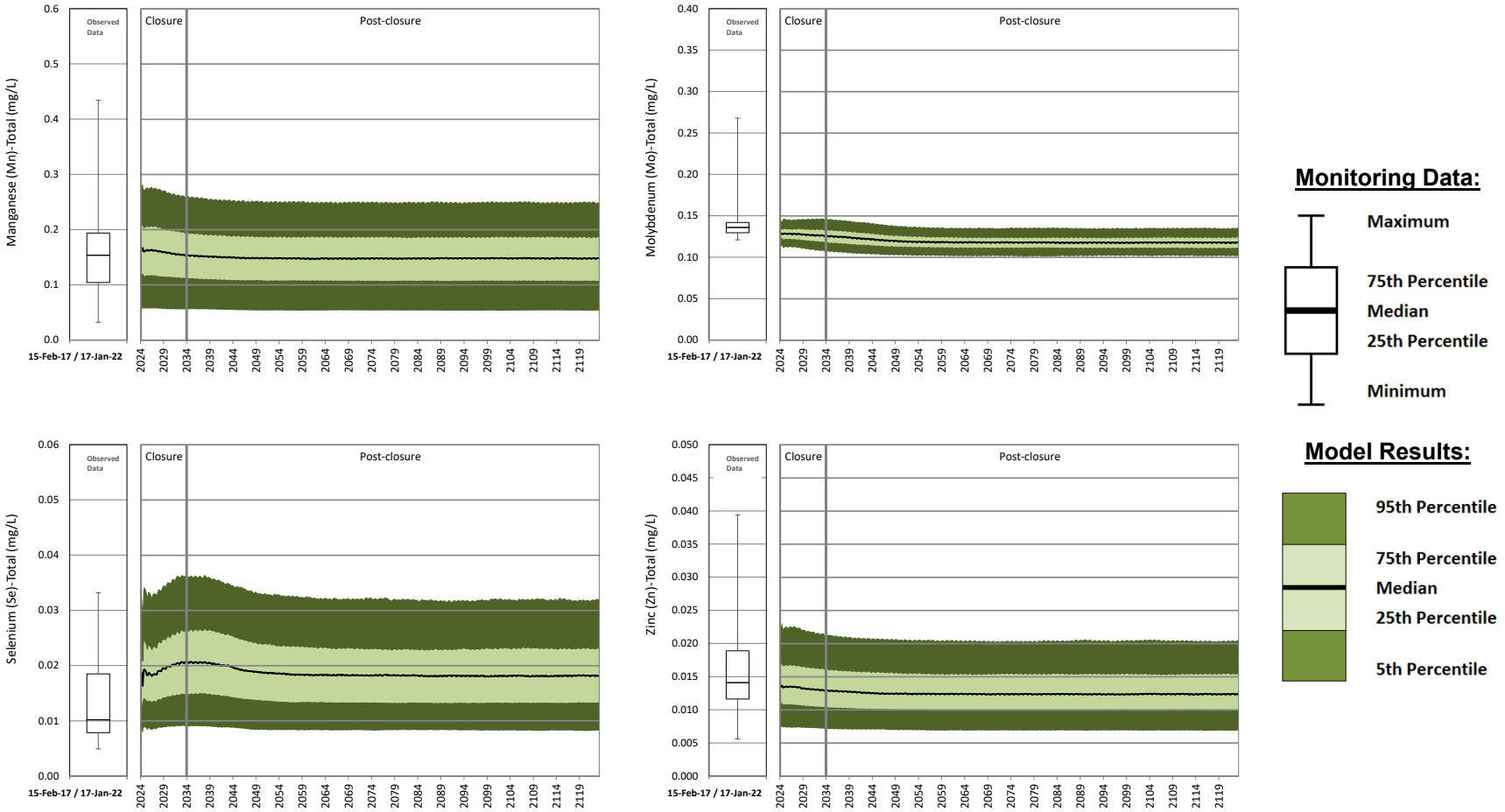

Figure 45: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Wight Pit during Closure and Post-closure – Base Case Module

4.2.5 Long Ditch

In closure, the Long Ditch continues to receive flow from the SERDS Ditch and overflow from Bootjack Creek Sump (via SERDS Ditch). Discharge from the Long Ditch will be directed to Polley Lake. The combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek includes the SERDS RDS, NEZ RDS, and East RDS along with haul roads, disturbed areas, and undisturbed catchment area.

Time series plots for key parameters in Long Ditch for closure and post-closure are shown in Figures 46 to 48 for the climate change module results and in Figures 49 to 51 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 19 and 20 for the climate change and base case modules, respectively.

Peak concentrations in the Long Ditch are predicted to occur early in closure, representing runoff and seepage from un-reclaimed RDS areas within the combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek (Figures 46 to 51). These facilities are reclaimed throughout closure, at which point runoff is assigned undisturbed water quality (Table 6). Parameter concentrations in the Long Ditch are predicted to decrease through closure, reaching steady state conditions in early post-closure, around 2044.

Seasonal peak concentrations in winter are driven by seepage from the RDS area within the watershed which is assigned the NAG water quality in perpetuity. During winter months, when precipitation occurs as snowfall, RDS seepage represents a higher proportion of the total flow to the Long Ditch and causes concentrations to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Bootjack Creek Sump, SERDS Ditch, and Long Ditch which causes concentrations of some parameters, such as aluminum, to increase.

Table 19. Predicted Maximum Concentrations in the Long Ditch during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	621	882	503	759	500	758
Total Dissolved Solids	mg/L	862	1,401	676	1,237	671	1,232
Major Ions							
Calcium	mg/L	190	272	149	219	147	215
Chloride	mg/L	4.7	7.7	3.1	9.4	3.1	9.4
Fluoride	mg/L	0.28	0.43	0.18	0.37	0.19	0.37
Magnesium	mg/L	35	49	32	52	32	53
Potassium	mg/L	2.3	2.9	1.6	2.2	1.6	2.2
Sodium	mg/L	17	25	12	18	12	19
Sulphate	mg/L	507	726	358	566	353	559
Nutrients							
Ammonia	mg/L (as N)	0.038	0.083	0.006	0.011	0.0061	0.012
Nitrate	mg/L (as N)	5.4	23	2.5	23	2.5	23
Nitrite	mg/L (as N)	0.015	0.053	0.012	0.053	0.012	0.053
Total Phosphorus	mg/L	0.019	0.035	0.026	0.041	0.026	0.042
Total Metals							
Aluminum	mg/L	0.45	0.55	0.45	0.67	0.45	0.67
Antimony	mg/L	0.00035	0.00061	0.00016	0.00045	0.00016	0.00044
Arsenic	mg/L	0.0013	0.0016	0.0011	0.0018	0.0011	0.0018
Barium	mg/L	0.04	0.067	0.025	0.04	0.024	0.04
Beryllium	mg/L	0.000048	0.000048	0.000057	0.000057	0.000058	0.000058
Boron	mg/L	0.11	0.21	0.044	0.086	0.043	0.085
Cadmium	mg/L	0.000075	0.00032	0.000045	0.00033	0.000045	0.00033
Chromium	mg/L	0.001	0.0013	0.0013	0.0018	0.0013	0.0018
Cobalt	mg/L	0.00051	0.0011	0.0004	0.00094	0.0004	0.00093
Copper	mg/L	0.019	0.17	0.014	0.17	0.013	0.17
Iron	mg/L	0.59	0.67	0.63	0.77	0.63	0.77
Lead	mg/L	0.00018	0.00019	0.00016	0.00022	0.00016	0.00022
Lithium	mg/L	0.0036	0.0071	0.0021	0.0063	0.0021	0.0063
Manganese	mg/L	0.11	0.9	0.03	0.1	0.03	0.099
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.08	0.14	0.058	0.12	0.057	0.12
Nickel	mg/L	0.0012	0.0027	0.0014	0.0031	0.0014	0.0031
Selenium	mg/L	0.046	0.089	0.031	0.071	0.03	0.07
Silver	mg/L	0.0000087	0.000016	0.0000043	0.000023	0.0000043	0.000023
Strontium	mg/L	1.6	3.0	1.6	3.0	1.6	3.0
Thallium	mg/L	0.0000049	0.000005	0.0000057	0.0000058	0.0000058	0.0000058
Tin	mg/L	0.000049	0.00013	0.000057	0.00014	0.000058	0.00014
Titanium	mg/L	0.027	0.032	0.028	0.032	0.028	0.032
Uranium	mg/L	0.0013	0.0022	0.0012	0.0023	0.0012	0.0024
Vanadium	mg/L	0.0021	0.0024	0.0018	0.0021	0.0018	0.0021
Zinc	mg/L	0.0059	0.015	0.0049	0.014	0.0035	0.013
Dissolved Metals							
Aluminum	mg/L	0.041	0.14	0.047	0.26	0.048	0.26
Antimony	mg/L	0.00033	0.00047	0.00014	0.00031	0.00014	0.0003
Arsenic	mg/L	0.0011	0.0014	0.00095	0.0017	0.00095	0.0017
Barium	mg/L	0.039	0.058	0.023	0.032	0.023	0.032
Beryllium	mg/L	0.000048	0.000048	0.000057	0.000057	0.000058	0.000058
Boron	mg/L	0.1	0.18	0.04	0.055	0.039	0.055
Cadmium	mg/L	0.000073	0.00025	0.000044	0.00026	0.000044	0.00026
Chromium	mg/L	0.00052	0.00077	0.00084	0.0013	0.00084	0.0013
Cobalt	mg/L	0.00019	0.00073	0.000077	0.00062	0.000077	0.00061
Copper	mg/L	0.0096	0.014	0.0046	0.007	0.0042	0.0067
Iron	mg/L	0.093	0.17	0.13	0.27	0.13	0.27
Lead	mg/L	0.000043	0.000055	0.000026	0.000086	0.000026	0.000087
Lithium	mg/L	0.0034	0.0061	0.0019	0.0053	0.0019	0.0053
Manganese	mg/L	0.096	0.89	0.016	0.087	0.016	0.084
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.08	0.13	0.058	0.11	0.057	0.11
Nickel	mg/L	0.00068	0.0022	0.00088	0.0026	0.00091	0.0026
Selenium	mg/L	0.046	0.083	0.031	0.065	0.03	0.064
Silicon	mg/L	6.3	7.2	6.6	10	6.6	10
Silver	mg/L	0.0000087	0.000011	0.0000043	0.000018	0.0000043	0.000018
Strontium	mg/L	1.6	2.6	1.6	2.7	1.6	2.7
Thallium	mg/L	0.0000049	0.000005	0.0000057	0.0000057	0.0000058	0.0000058
Tin	mg/L	0.000049	0.000053	0.000057	0.000057	0.000058	0.000058
Titanium	mg/L	0.0055	0.01	0.0063	0.0099	0.0062	0.0099
Uranium	mg/L	0.0013	0.0019	0.0012	0.002	0.0012	0.0021
Vanadium	mg/L	0.00092	0.0012	0.00061	0.00094	0.00061	0.00095
Zinc	mg/L	0.0045	0.013	0.0036	0.012	0.0021	0.012

a) Calculated based on predicted calcium and magnesium concentrations.

Table 20. Predicted Maximum Concentrations in the Long Ditch during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	620	882	405	657	405	644
Total Dissolved Solids	mg/L	862	1,401	544	1,003	544	1,003
Major Ions							
Calcium	mg/L	190	272	119	186	119	180
Chloride	mg/L	4.4	6.5	3.1	9.3	3.2	9.4
Fluoride	mg/L	0.24	0.39	0.15	0.3	0.15	0.3
Magnesium	mg/L	35	49	26	47	26	47
Potassium	mg/L	2.1	2.6	1.4	2.0	1.4	1.9
Sodium	mg/L	17	25	10	17	10.0	17
Sulphate	mg/L	507	726	284	473	284	455
Nutrients							
Ammonia	mg/L (as N)	0.036	0.079	0.006	0.011	0.0061	0.012
Nitrate	mg/L (as N)	5.4	23	2.5	23	2.5	23
Nitrite	mg/L (as N)	0.013	0.053	0.012	0.053	0.012	0.053
Total Phosphorus	mg/L	0.018	0.034	0.025	0.038	0.026	0.039
Total Metals							
Aluminum	mg/L	0.45	0.55	0.45	0.67	0.45	0.67
Antimony	mg/L	0.00031	0.00054	0.00014	0.00039	0.00014	0.00039
Arsenic	mg/L	0.0011	0.0015	0.0011	0.0018	0.0011	0.0018
Barium	mg/L	0.04	0.067	0.021	0.036	0.02	0.035
Beryllium	mg/L	0.000046	0.000052	0.000058	0.000059	0.000058	0.000059
Boron	mg/L	0.095	0.21	0.038	0.08	0.036	0.079
Cadmium	mg/L	0.000065	0.00032	0.000037	0.00028	0.000037	0.00028
Chromium	mg/L	0.001	0.0013	0.0013	0.0018	0.0013	0.0018
Cobalt	mg/L	0.0005	0.0011	0.0004	0.00082	0.0004	0.00082
Copper	mg/L	0.018	0.17	0.014	0.17	0.013	0.16
Iron	mg/L	0.59	0.67	0.63	0.77	0.63	0.77
Lead	mg/L	0.00017	0.00019	0.00016	0.00022	0.00015	0.00022
Lithium	mg/L	0.0031	0.0064	0.0018	0.0054	0.0018	0.0054
Manganese	mg/L	0.1	0.9	0.03	0.086	0.03	0.083
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.08	0.14	0.046	0.097	0.046	0.097
Nickel	mg/L	0.0011	0.0027	0.0014	0.0027	0.0014	0.0026
Selenium	mg/L	0.046	0.089	0.024	0.058	0.024	0.058
Silver	mg/L	0.0000081	0.000016	0.000004	0.000023	0.000004	0.000023
Strontium	mg/L	1.6	3.0	1.3	2.6	1.3	2.6
Thallium	mg/L	0.0000046	0.0000052	0.0000058	0.0000059	0.0000058	0.0000059
Tin	mg/L	0.000047	0.00013	0.000058	0.00014	0.000058	0.00014
Titanium	mg/L	0.027	0.032	0.028	0.031	0.028	0.031
Uranium	mg/L	0.0011	0.0021	0.0010	0.0021	0.0010	0.002
Vanadium	mg/L	0.002	0.0023	0.0018	0.0021	0.0018	0.0021
Zinc	mg/L	0.0058	0.014	0.0049	0.012	0.0034	0.011
Dissolved Metals							
Aluminum	mg/L	0.043	0.14	0.047	0.26	0.047	0.26
Antimony	mg/L	0.00029	0.0004	0.00012	0.00025	0.00012	0.00025
Arsenic	mg/L	0.00094	0.0013	0.00094	0.0016	0.00095	0.0017
Barium	mg/L	0.039	0.058	0.02	0.028	0.018	0.027
Beryllium	mg/L	0.000046	0.000052	0.000058	0.000059	0.000058	0.000059
Boron	mg/L	0.091	0.18	0.034	0.049	0.032	0.048
Cadmium	mg/L	0.000063	0.00024	0.000036	0.00021	0.000036	0.00021
Chromium	mg/L	0.00052	0.00077	0.00083	0.0013	0.00084	0.0013
Cobalt	mg/L	0.00018	0.00073	0.000076	0.0005	0.000077	0.0005
Copper	mg/L	0.0093	0.014	0.0045	0.0068	0.0036	0.0061
Iron	mg/L	0.093	0.18	0.13	0.27	0.13	0.27
Lead	mg/L	0.000039	0.000056	0.000023	0.000085	0.000022	0.000086
Lithium	mg/L	0.0029	0.0054	0.0016	0.0044	0.0016	0.0044
Manganese	mg/L	0.088	0.89	0.016	0.072	0.016	0.069
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.08	0.13	0.046	0.086	0.046	0.086
Nickel	mg/L	0.00067	0.0022	0.00092	0.0022	0.00093	0.0022
Selenium	mg/L	0.046	0.083	0.024	0.052	0.024	0.052
Silicon	mg/L	5.9	7.4	6.7	10.0	6.7	10
Silver	mg/L	0.0000081	0.000011	0.000004	0.000018	0.000004	0.000018
Strontium	mg/L	1.6	2.6	1.3	2.2	1.3	2.2
Thallium	mg/L	0.0000046	0.0000052	0.0000058	0.0000059	0.0000058	0.0000059
Tin	mg/L	0.000047	0.000052	0.000058	0.000059	0.000058	0.000059
Titanium	mg/L	0.0051	0.010	0.0059	0.0091	0.006	0.0092
Uranium	mg/L	0.0011	0.0018	0.00097	0.0018	0.00097	0.0017
Vanadium	mg/L	0.00089	0.0011	0.00061	0.00094	0.00061	0.00094
Zinc	mg/L	0.0045	0.013	0.0036	0.011	0.0021	0.0095

a) Calculated based on predicted calcium and magnesium concentrations.

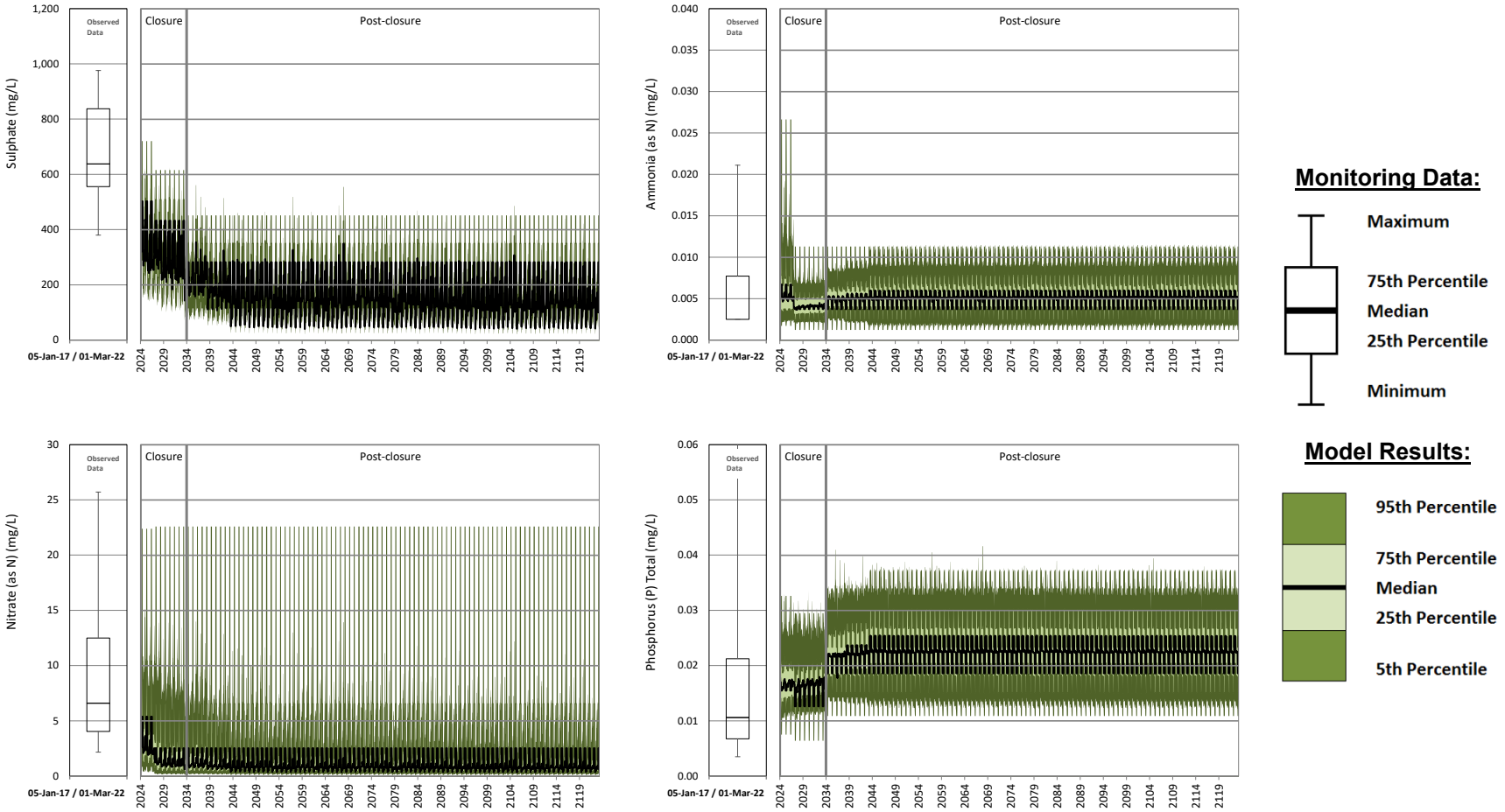

Figure 46: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Long Ditch during Closure and Post-closure – Climate Change Module

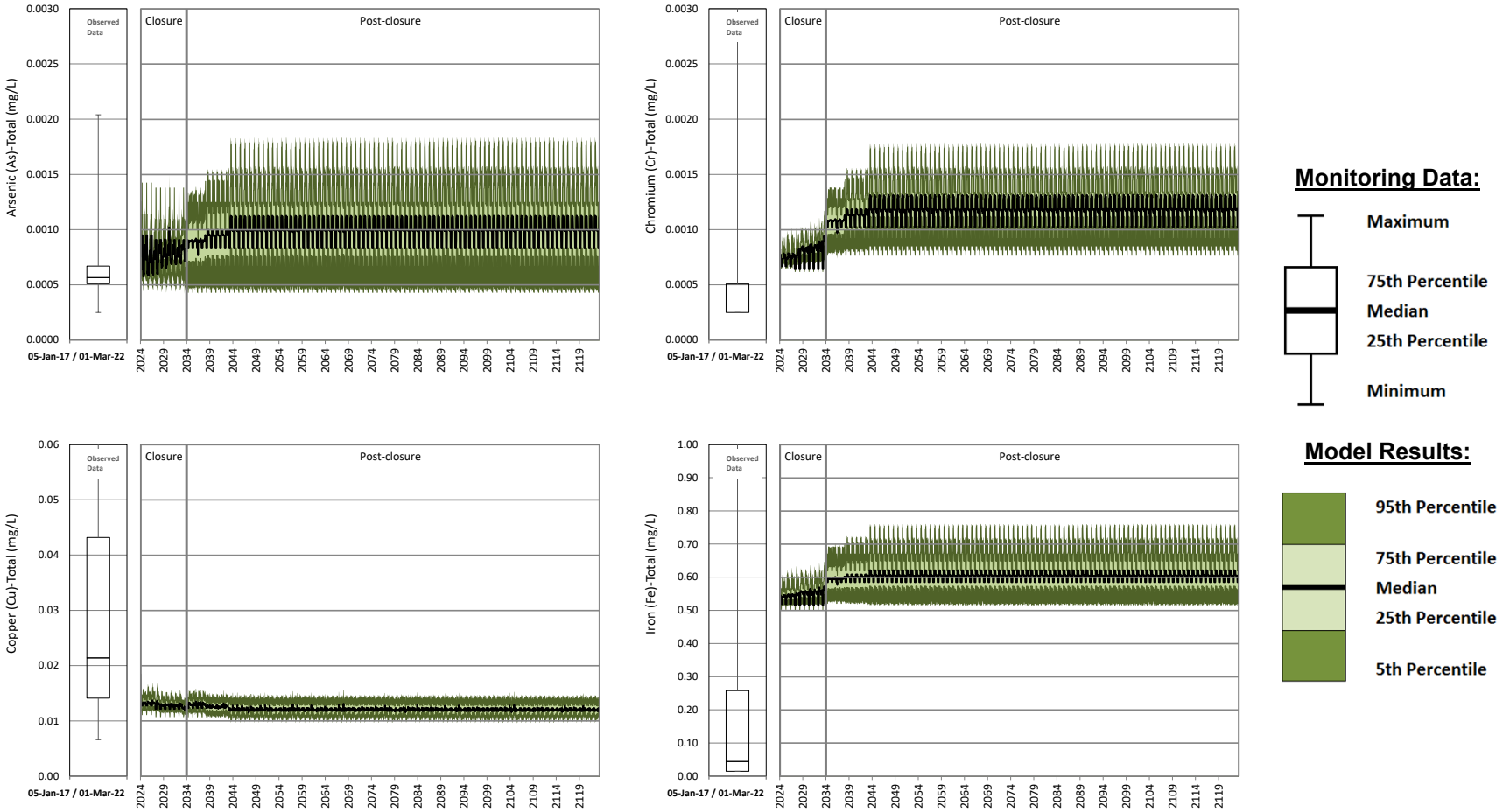

Figure 47: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Long Ditch during Closure and Post-closure – Climate Change Module

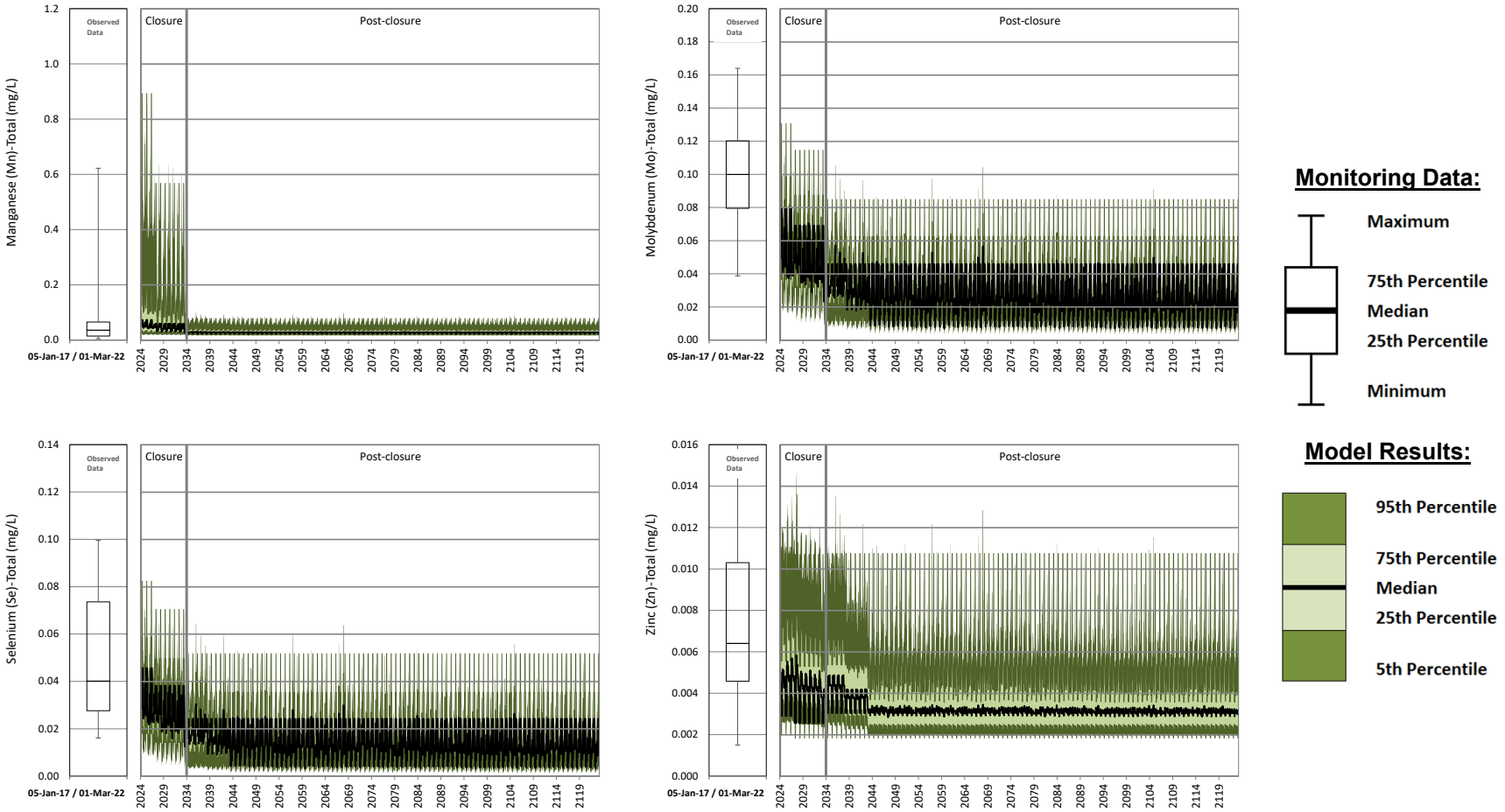

Figure 48: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Long Ditch during Closure and Post-closure – Climate Change Module

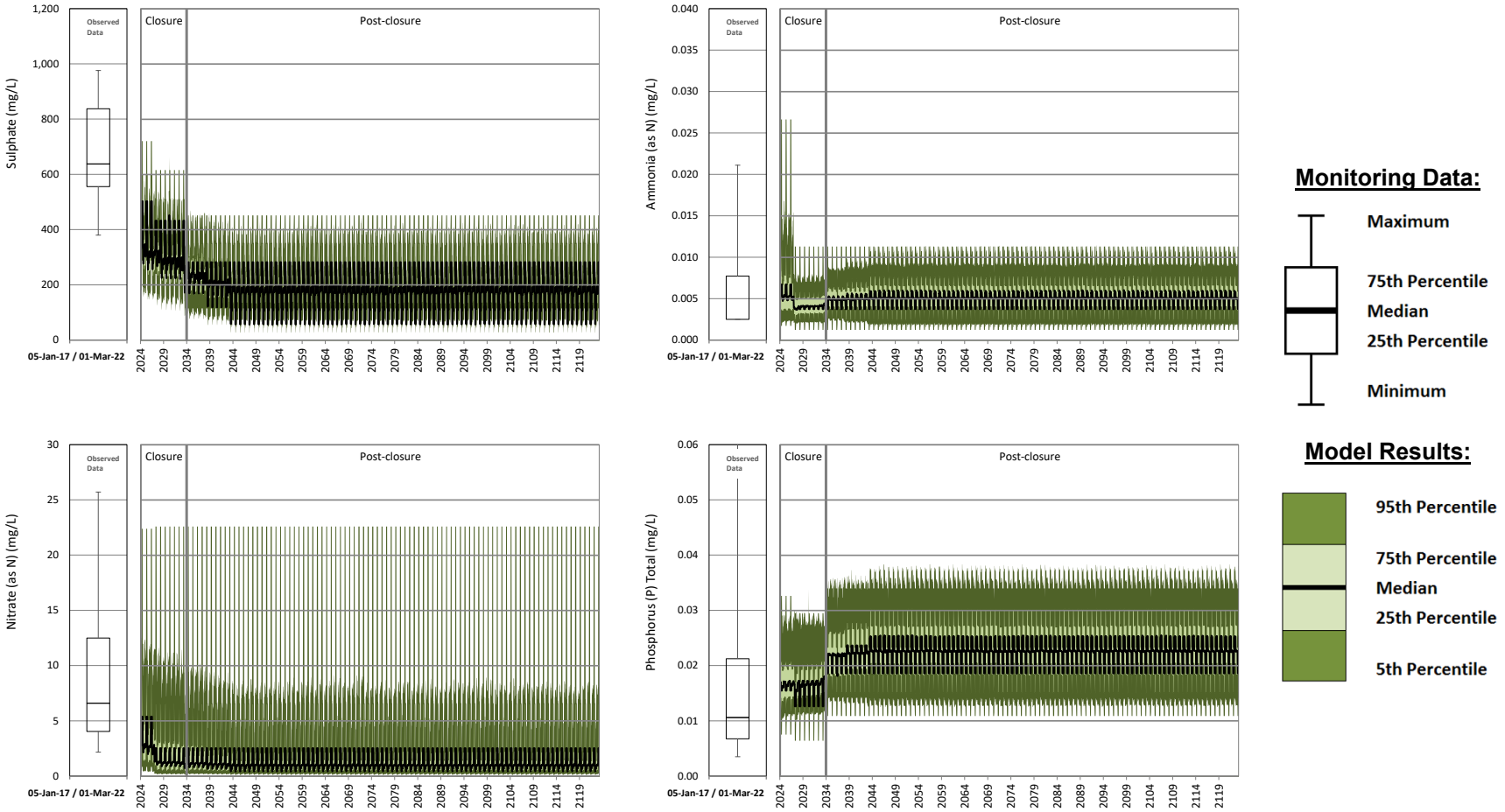

Figure 49: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Long Ditch during Closure and Post-closure – Base Case Module

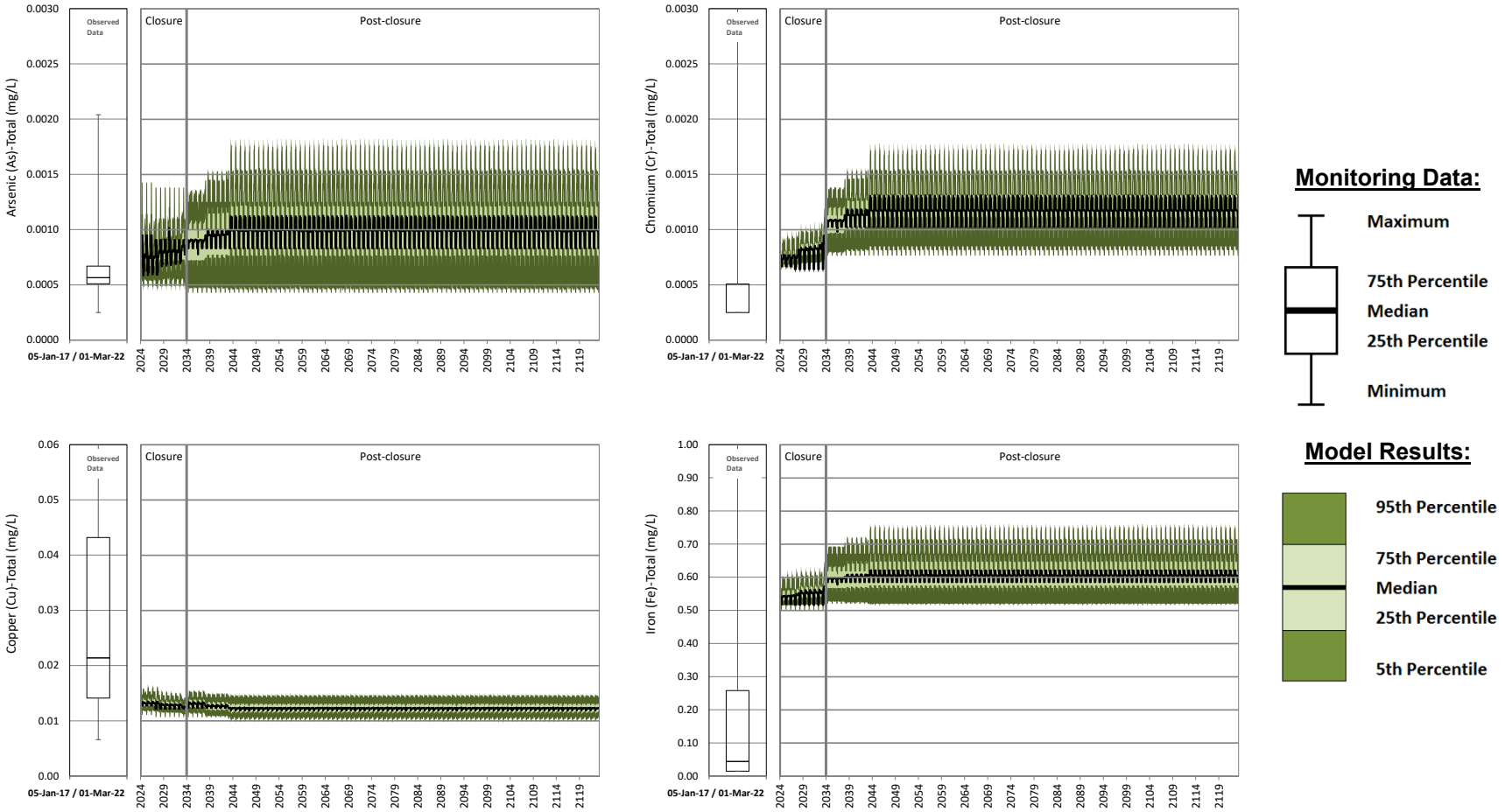

Figure 50: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Long Ditch during Closure and Post-closure – Base Case Module

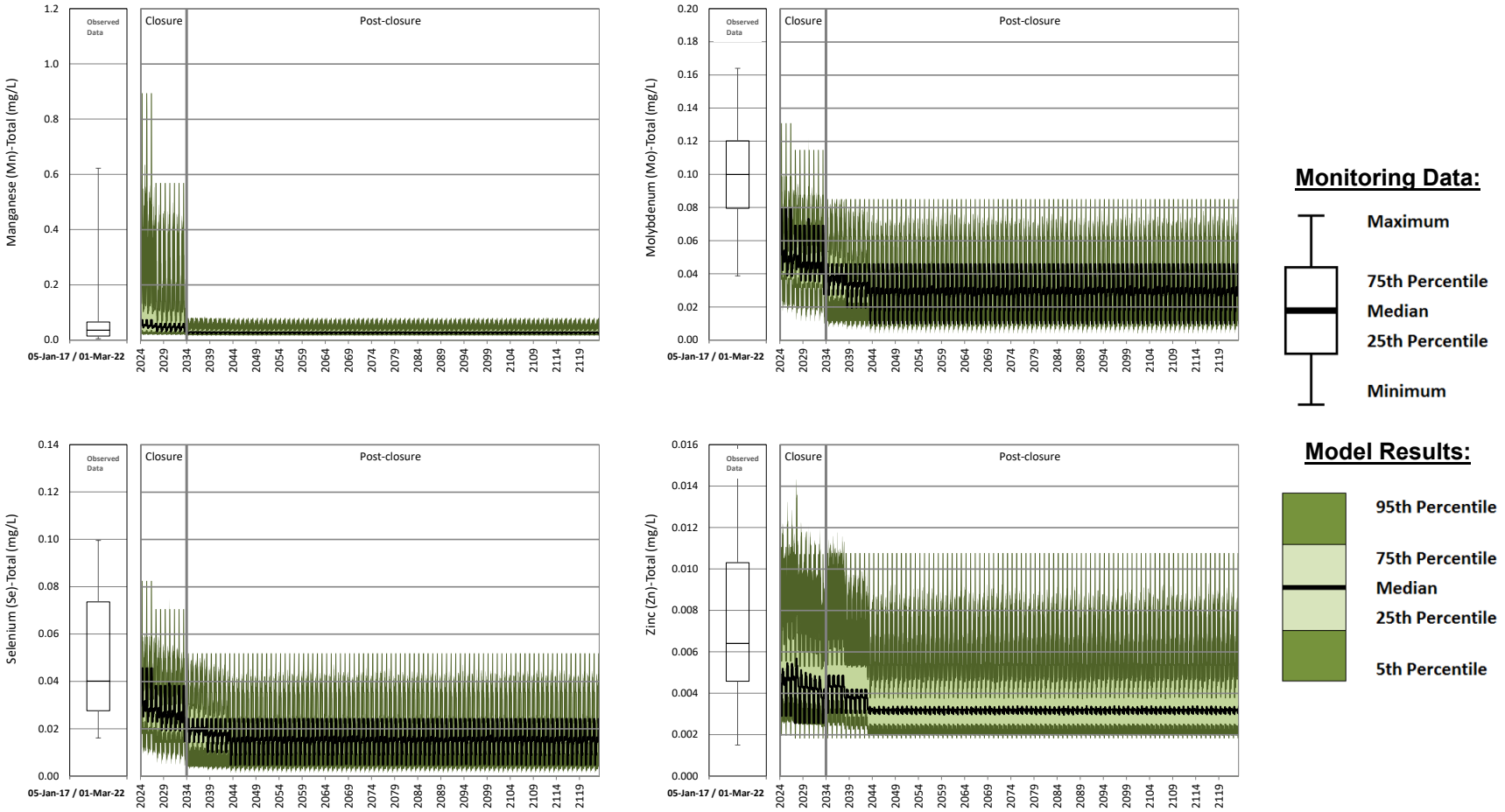

Figure 51: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Long Ditch during Closure and Post-closure – Base Case Module

4.2.6 South Embankment Seepage Collection Pond

The SWWBM assumes that the SESCP has a small catchment area, and receives mostly TSF seepage in closure. Time series plots for key parameters in SESCP for closure and post-closure are shown in Figures 52 to 54 for the climate change module results and in Figures 55 to 57 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 21 and 22 for the climate change and base case modules, respectively.

Predicted peak concentrations in the SESCP occur at the beginning of closure, and then decrease as TSF beach and impoundment areas are reclaimed. Water quality is predicted to reach steady-state conditions by 2044, after the TSF surface has been reclaimed. Because the saturated TSF seepage is assumed to be the same water quality as the TSF beach, impoundment, and embankment areas, the decrease in SESCP concentrations is coincident with the decrease in parameter concentrations in the TSF beach and impoundment. The assigned TSF beach, impoundment and embankment water quality changes progressively from the TSF supernatant input to undisturbed water quality during the closure period causing the decrease in concentration in the TSF. As TSF concentrations decrease, concentrations in the SESCP decrease due to saturated seepage from the TSF. The increase in concentrations from 2034 to 2074 is due to a proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility (Appendix F). While the range in predicted concentrations is considered reasonable, the timing of this transition is uncertain because the amount of time it may take to flush process water from the tailings is unknown.

Table 21. Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	755	850	245	390	284	420
Total Dissolved Solids	mg/L	1,268	1,473	407	519	484	600
Major Ions							
Calcium	mg/L	237	264	71	93	84	107
Chloride	mg/L	17	28	7.3	13	8.9	14
Fluoride	mg/L	0.74	0.98	0.23	0.31	0.29	0.36
Magnesium	mg/L	40	46	16	38	18	37
Potassium	mg/L	14	35	3.9	4.9	4.9	6.2
Sodium	mg/L	65	109	25	35	32	42
Sulphate	mg/L	698	795	154	191	208	260
Nutrients							
Ammonia	mg/L (as N)	0.18	0.53	0.0097	0.034	0.011	0.044
Nitrate	mg/L (as N)	10	18	0.78	3.9	1.0	5.3
Nitrite	mg/L (as N)	0.076	0.21	0.0071	0.033	0.0093	0.044
Total Phosphorus	mg/L	0.036	0.053	0.025	0.036	0.024	0.035
Total Metals							
Aluminum	mg/L	0.49	0.64	0.45	0.64	0.44	0.62
Antimony	mg/L	0.0012	0.003	0.00014	0.00036	0.00017	0.00041
Arsenic	mg/L	0.002	0.0026	0.0014	0.002	0.0015	0.002
Barium	mg/L	0.069	0.1	0.021	0.033	0.024	0.038
Beryllium	mg/L	0.00007	0.00007	0.000058	0.000058	0.000057	0.000057
Boron	mg/L	0.18	0.22	0.05	0.089	0.06	0.10
Cadmium	mg/L	0.00014	0.00027	0.000021	0.00011	0.000024	0.00011
Chromium	mg/L	0.0013	0.0017	0.0013	0.0017	0.0012	0.0016
Cobalt	mg/L	0.001	0.0018	0.00039	0.00043	0.00039	0.00044
Copper	mg/L	0.058	0.49	0.013	0.17	0.013	0.17
Iron	mg/L	0.61	0.73	0.61	0.74	0.6	0.71
Lead	mg/L	0.00019	0.00021	0.00015	0.00021	0.00015	0.00021
Lithium	mg/L	0.011	0.019	0.003	0.0048	0.0036	0.0054
Manganese	mg/L	0.26	0.54	0.049	0.081	0.058	0.099
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.25	0.055	0.09	0.074	0.12
Nickel	mg/L	0.0018	0.003	0.0012	0.0021	0.0012	0.002
Selenium	mg/L	0.057	0.094	0.0057	0.021	0.0077	0.027
Silver	mg/L	0.000012	0.000022	0.000004	0.000022	0.0000041	0.000021
Strontium	mg/L	2.8	3.6	0.91	1.5	1.1	1.8
Thallium	mg/L	0.0000071	0.0000079	0.0000058	0.0000058	0.0000057	0.0000058
Tin	mg/L	0.000082	0.00017	0.000058	0.00014	0.000057	0.00014
Titanium	mg/L	0.03	0.032	0.027	0.03	0.027	0.03
Uranium	mg/L	0.0019	0.0026	0.00097	0.0018	0.0011	0.0019
Vanadium	mg/L	0.0038	0.0059	0.0018	0.0022	0.0018	0.0022
Zinc	mg/L	0.011	0.016	0.0028	0.005	0.0028	0.0051
Dissolved Metals							
Aluminum	mg/L	0.082	0.23	0.042	0.24	0.038	0.21
Antimony	mg/L	0.0012	0.0029	0.00012	0.00022	0.00015	0.00027
Arsenic	mg/L	0.0018	0.0025	0.0012	0.0018	0.0013	0.0018
Barium	mg/L	0.067	0.093	0.02	0.025	0.023	0.03
Beryllium	mg/L	0.00007	0.00007	0.000058	0.000058	0.000057	0.000057
Boron	mg/L	0.17	0.19	0.046	0.058	0.056	0.069
Cadmium	mg/L	0.00013	0.0002	0.000019	0.000036	0.000022	0.000041
Chromium	mg/L	0.00078	0.0012	0.00078	0.0012	0.00074	0.0011
Cobalt	mg/L	0.0007	0.0015	0.000071	0.00011	0.000072	0.00012
Copper	mg/L	0.049	0.33	0.0039	0.0093	0.0041	0.011
Iron	mg/L	0.12	0.24	0.12	0.24	0.11	0.22
Lead	mg/L	0.000054	0.000081	0.00002	0.000081	0.00002	0.000076
Lithium	mg/L	0.011	0.018	0.0028	0.0038	0.0034	0.0044
Manganese	mg/L	0.24	0.53	0.035	0.067	0.044	0.085
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.24	0.055	0.079	0.074	0.11
Nickel	mg/L	0.0014	0.0025	0.00077	0.0016	0.00073	0.0015
Selenium	mg/L	0.057	0.088	0.0057	0.016	0.0077	0.021
Silicon	mg/L	9.2	9.9	6.7	9.8	6.6	9.6
Silver	mg/L	0.000012	0.000017	0.000004	0.000017	0.0000041	0.000016
Strontium	mg/L	2.8	3.2	0.9	1.2	1.1	1.5
Thallium	mg/L	0.0000071	0.0000079	0.0000058	0.0000058	0.0000057	0.0000057
Tin	mg/L	0.000082	0.00009	0.000058	0.000058	0.000057	0.000057
Titanium	mg/L	0.0083	0.01	0.0055	0.0084	0.0055	0.0082
Uranium	mg/L	0.0019	0.0023	0.00095	0.0015	0.0011	0.0016
Vanadium	mg/L	0.0026	0.0047	0.00067	0.0010	0.00068	0.00099
Zinc	mg/L	0.0099	0.015	0.0014	0.0036	0.0014	0.0037

a) Calculated based on predicted calcium and magnesium concentrations.

Table 22. Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	745	844	244	400	285	428
Total Dissolved Solids	mg/L	1,247	1,458	407	522	486	607
Major Ions							
Calcium	mg/L	234	263	71	94	84	108
Chloride	mg/L	16	27	7.3	13	9.0	14
Fluoride	mg/L	0.72	0.96	0.23	0.31	0.29	0.37
Magnesium	mg/L	39	46	16	40	18	39
Potassium	mg/L	13	34	3.8	4.9	4.9	6.3
Sodium	mg/L	63	107	25	35	32	43
Sulphate	mg/L	685	786	153	191	208	260
Nutrients							
Ammonia	mg/L (as N)	0.18	0.54	0.01	0.033	0.011	0.044
Nitrate	mg/L (as N)	10	18	0.77	3.9	1.0	5.3
Nitrite	mg/L (as N)	0.075	0.21	0.0071	0.033	0.0094	0.045
Total Phosphorus	mg/L	0.035	0.052	0.025	0.037	0.024	0.035
Total Metals							
Aluminum	mg/L	0.49	0.65	0.45	0.65	0.44	0.63
Antimony	mg/L	0.0012	0.0029	0.00015	0.00036	0.00017	0.00042
Arsenic	mg/L	0.002	0.0026	0.0014	0.002	0.0015	0.002
Barium	mg/L	0.067	0.098	0.021	0.033	0.024	0.038
Beryllium	mg/L	0.000068	0.00007	0.000058	0.000064	0.000057	0.000062
Boron	mg/L	0.17	0.22	0.05	0.089	0.06	0.1
Cadmium	mg/L	0.00014	0.00027	0.000021	0.00011	0.000024	0.00012
Chromium	mg/L	0.0013	0.0018	0.0013	0.0018	0.0012	0.0016
Cobalt	mg/L	0.001	0.0017	0.00039	0.00044	0.00039	0.00044
Copper	mg/L	0.055	0.47	0.013	0.17	0.013	0.17
Iron	mg/L	0.62	0.75	0.62	0.75	0.6	0.72
Lead	mg/L	0.00019	0.00022	0.00015	0.00022	0.00015	0.00021
Lithium	mg/L	0.01	0.018	0.003	0.0049	0.0036	0.0055
Manganese	mg/L	0.26	0.54	0.049	0.081	0.058	0.1
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.18	0.25	0.055	0.089	0.075	0.12
Nickel	mg/L	0.0018	0.0029	0.0013	0.0022	0.0012	0.002
Selenium	mg/L	0.057	0.094	0.0057	0.021	0.0077	0.027
Silver	mg/L	0.000012	0.000023	0.000004	0.000023	0.0000042	0.000021
Strontium	mg/L	2.8	3.6	0.92	1.5	1.2	1.9
Thallium	mg/L	0.0000069	0.0000077	0.0000058	0.0000064	0.0000057	0.0000063
Tin	mg/L	0.00008	0.00017	0.000058	0.00014	0.000057	0.00014
Titanium	mg/L	0.03	0.032	0.027	0.031	0.027	0.03
Uranium	mg/L	0.0019	0.0026	0.00097	0.0019	0.0011	0.002
Vanadium	mg/L	0.0037	0.0058	0.0018	0.0022	0.0018	0.0022
Zinc	mg/L	0.011	0.016	0.0028	0.0051	0.0028	0.0052
Dissolved Metals							
Aluminum	mg/L	0.082	0.25	0.044	0.25	0.039	0.22
Antimony	mg/L	0.0012	0.0028	0.00013	0.00022	0.00015	0.00028
Arsenic	mg/L	0.0018	0.0024	0.0012	0.0018	0.0013	0.0018
Barium	mg/L	0.066	0.09	0.02	0.025	0.023	0.03
Beryllium	mg/L	0.000068	0.00007	0.000058	0.000064	0.000057	0.000062
Boron	mg/L	0.17	0.19	0.046	0.059	0.056	0.07
Cadmium	mg/L	0.00013	0.0002	0.000019	0.000036	0.000023	0.000042
Chromium	mg/L	0.00082	0.0013	0.0008	0.0013	0.00074	0.0011
Cobalt	mg/L	0.00069	0.0014	0.000074	0.00012	0.000072	0.00012
Copper	mg/L	0.046	0.32	0.0041	0.011	0.0042	0.012
Iron	mg/L	0.13	0.26	0.12	0.25	0.11	0.23
Lead	mg/L	0.000053	0.000084	0.00002	0.000084	0.00002	0.000077
Lithium	mg/L	0.01	0.017	0.0028	0.0039	0.0034	0.0045
Manganese	mg/L	0.24	0.53	0.035	0.067	0.044	0.086
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.18	0.24	0.055	0.078	0.074	0.11
Nickel	mg/L	0.0013	0.0024	0.0008	0.0017	0.00072	0.0015
Selenium	mg/L	0.057	0.088	0.0057	0.016	0.0077	0.021
Silicon	mg/L	9.1	10	6.7	10	6.6	9.8
Silver	mg/L	0.000012	0.000018	0.000004	0.000018	0.0000042	0.000016
Strontium	mg/L	2.7	3.2	0.9	1.2	1.1	1.5
Thallium	mg/L	0.0000069	0.0000077	0.0000058	0.0000064	0.0000057	0.0000062
Tin	mg/L	0.00008	0.000089	0.000058	0.000064	0.000057	0.000062
Titanium	mg/L	0.0081	0.01	0.0055	0.0088	0.0054	0.0083
Uranium	mg/L	0.0019	0.0023	0.00094	0.0015	0.0011	0.0016
Vanadium	mg/L	0.0026	0.0047	0.00067	0.001	0.00068	0.001
Zinc	mg/L	0.0099	0.015	0.0014	0.0037	0.0014	0.0038

a) Calculated based on predicted calcium and magnesium concentrations.

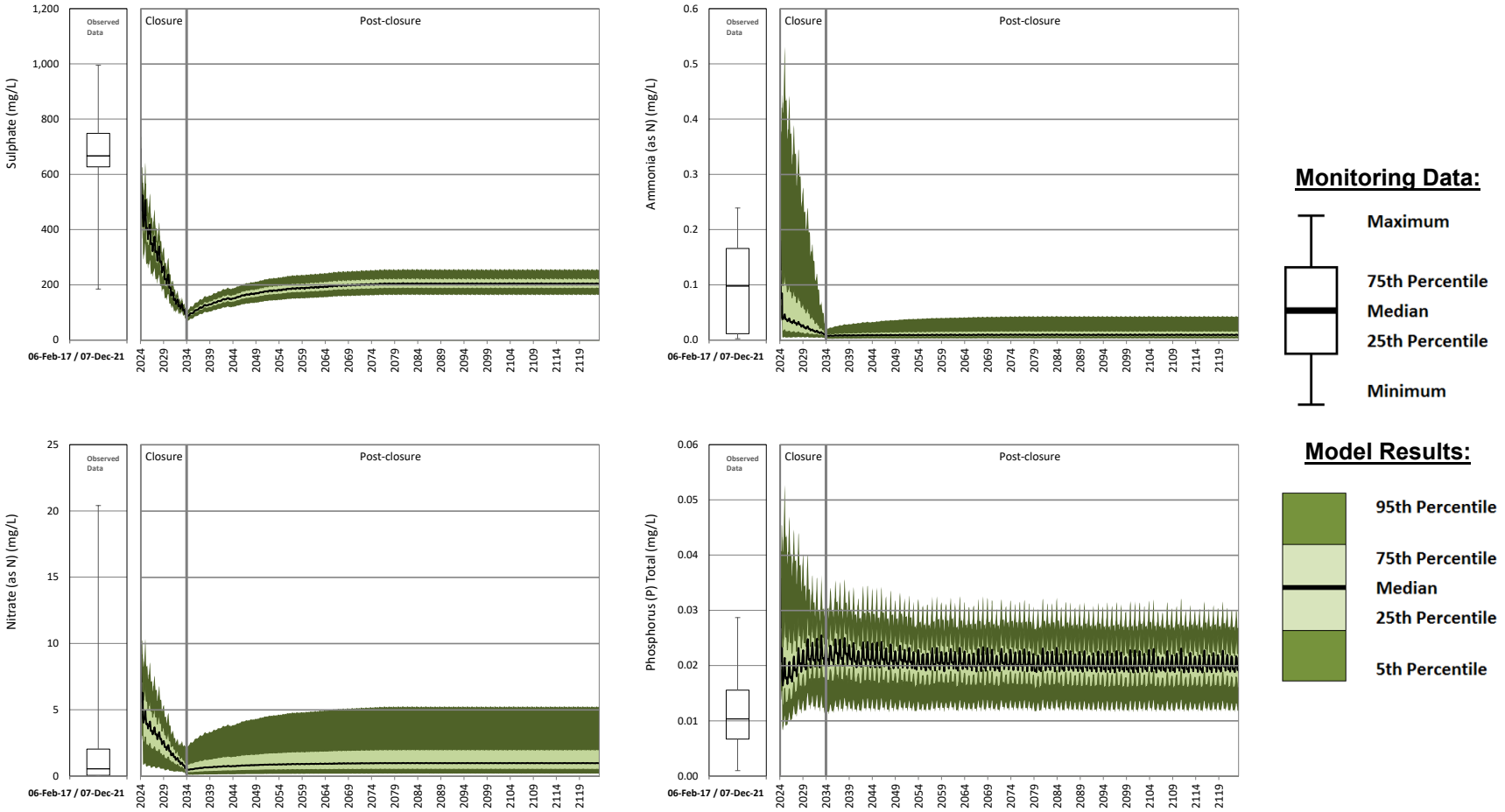

Figure 52: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

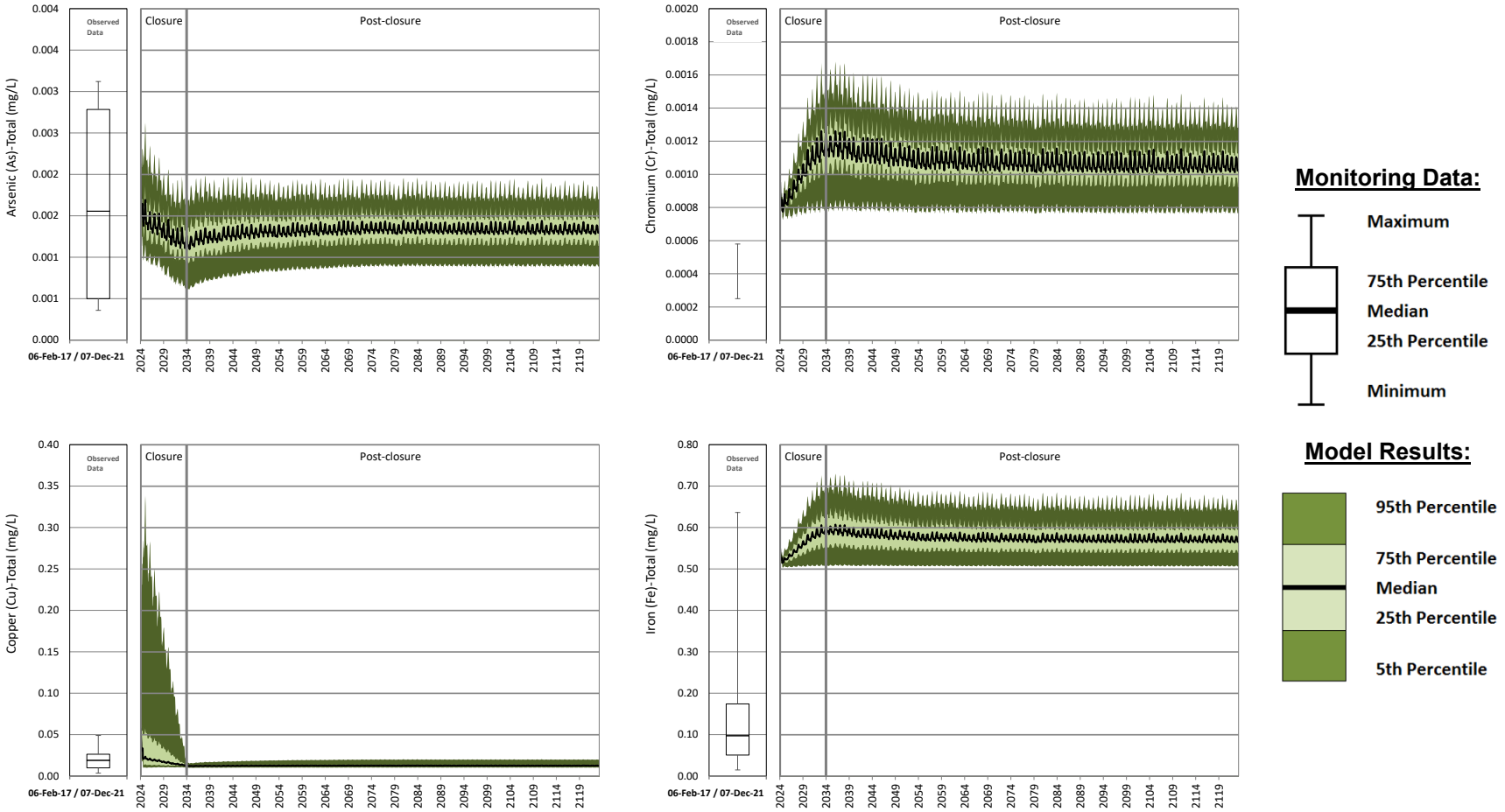

Figure 53: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

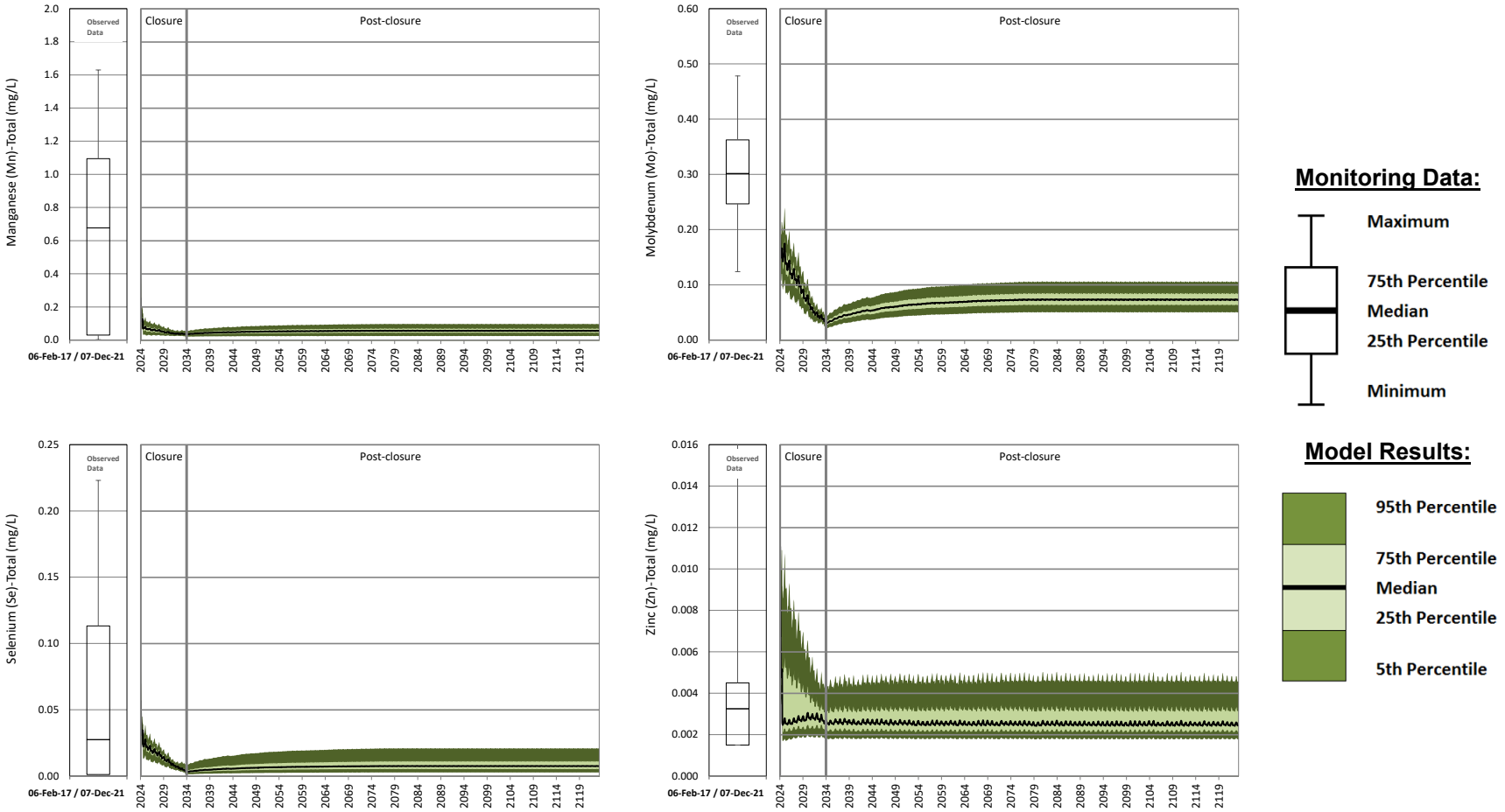

Figure 54: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

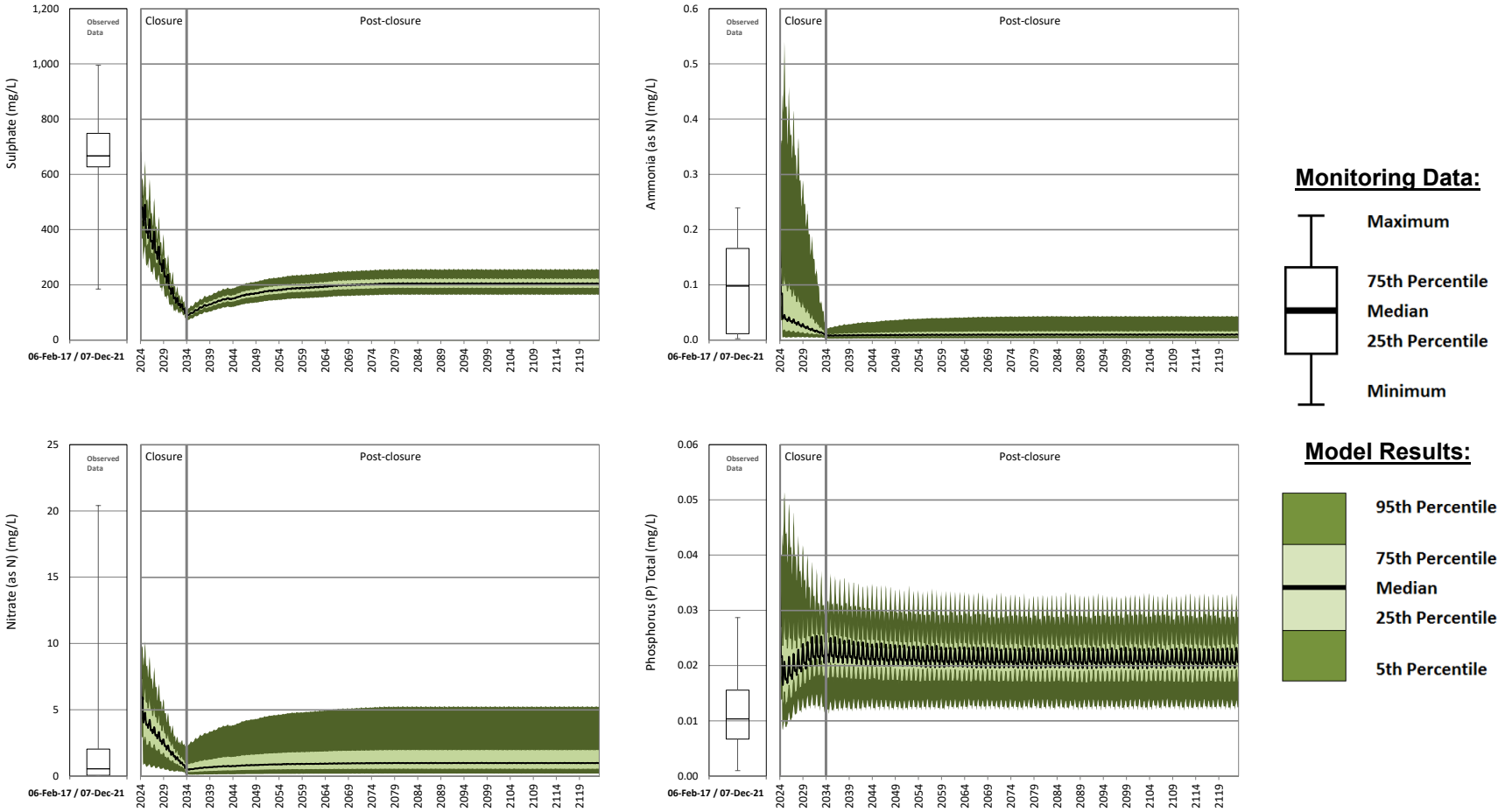

Figure 55: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

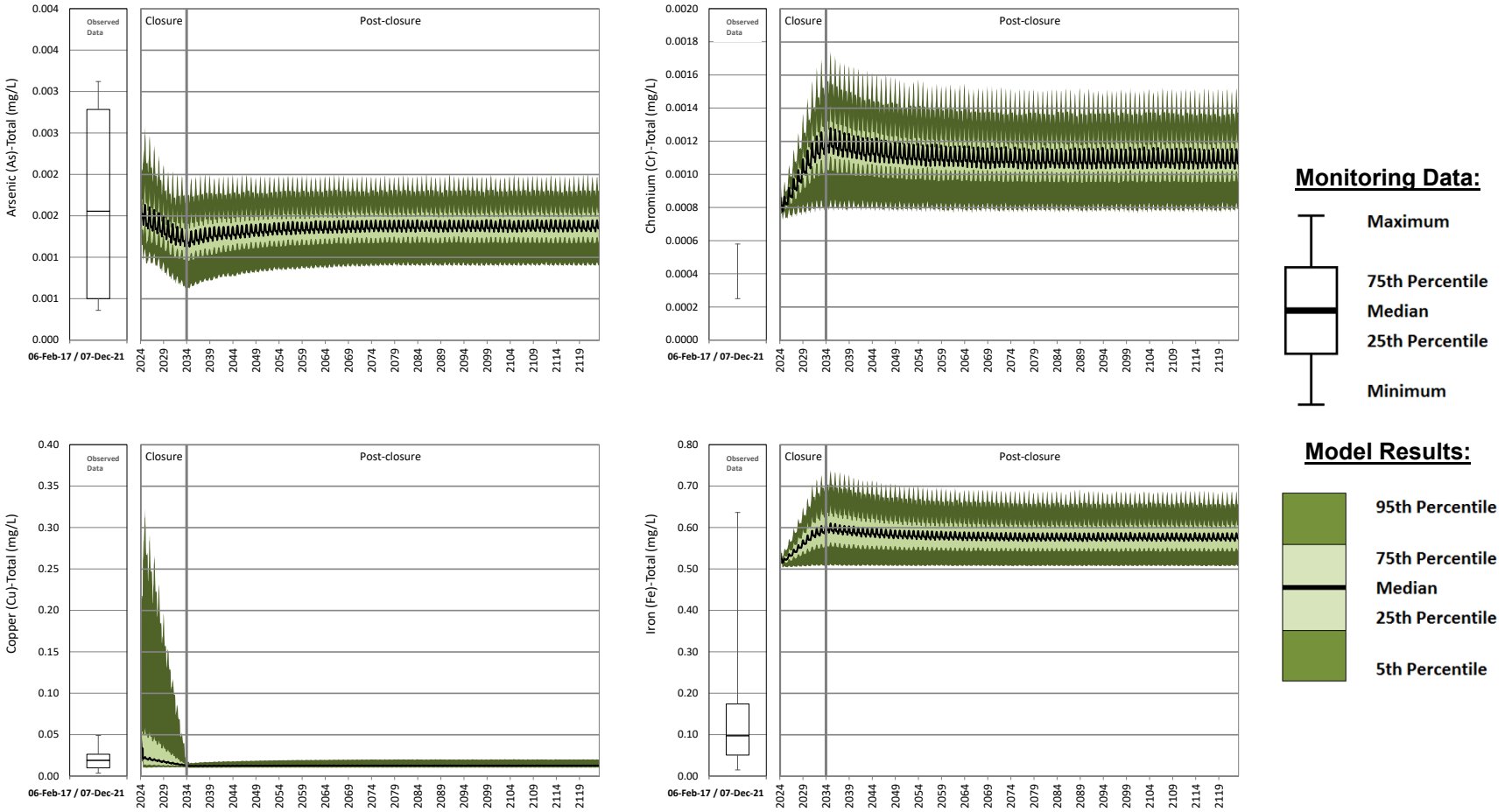

Figure 56: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

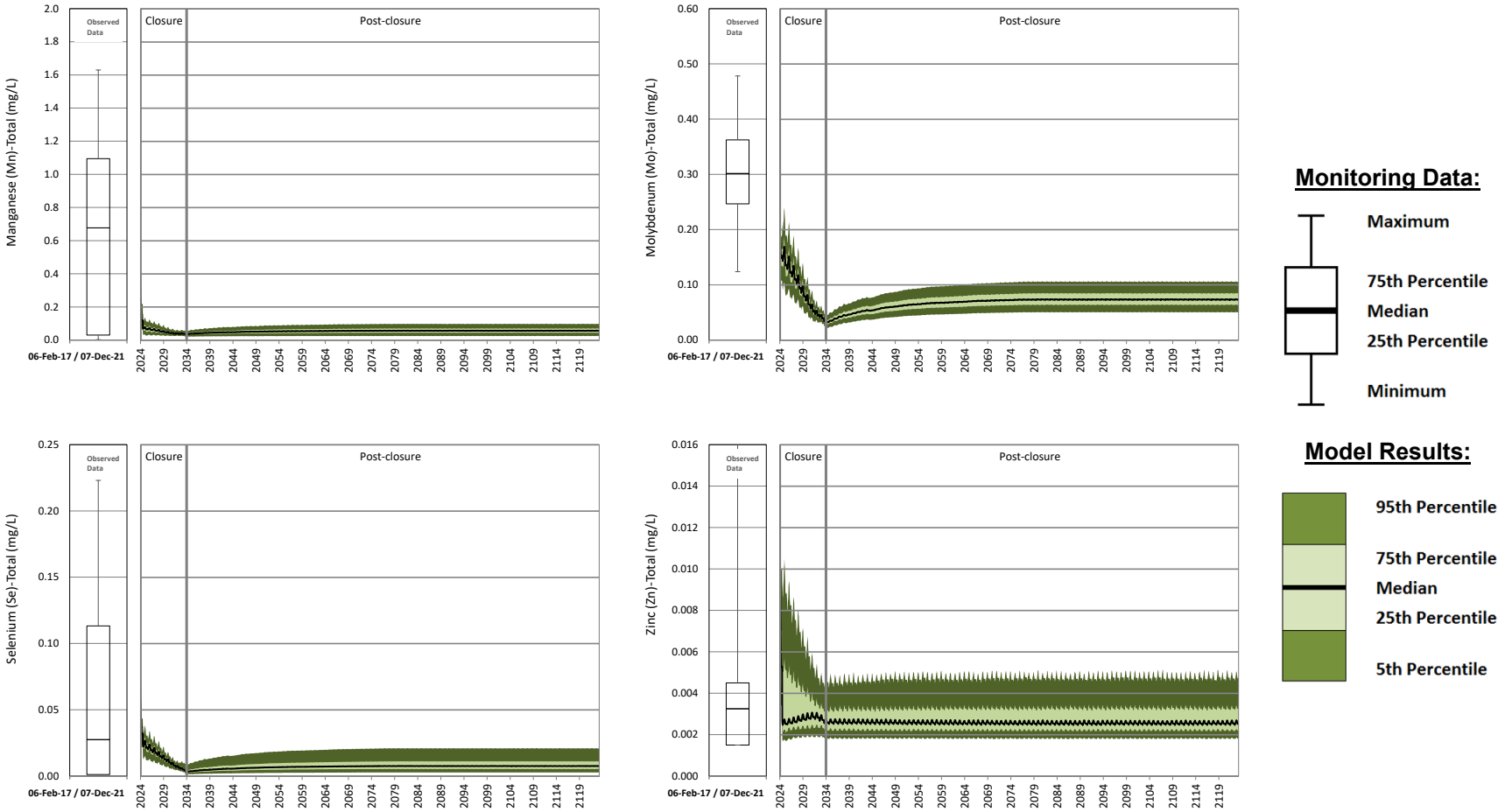

Figure 57: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

4.2.7 Main Embankment Seepage Collection Pond

The SWWBM assumes that the MESCP has minimal surface catchment area from TSF area and undisturbed catchment area and receives mostly TSF seepage in closure. Discharge from the MESCP will be directed to upper Edney Creek. Time series plots for key parameters in MESCP for closure and post-closure are shown in Figures 58 to 59 for the climate change module results and in Figures 60 to 62 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 23 and 24 for the climate change and base case modules, respectively.

Peak concentrations in the MESCP occur at the beginning of closure, and then are predicted to decrease as TSF beach and impoundment areas are reclaimed (Figures 58 to 62). Reclaimed areas of the TSF beach and impoundment are assigned an undisturbed water quality. Predicted water quality reaches steady state conditions by 2044, after all watershed areas have been reclaimed. The increase in concentration from 2034 to 2044 for most parameters in the MESCP is caused by increased pumping rates from the SESCP. Pumping from the SESCP to the MESCP ends in 2044. Similar to the SESCP, the range in predicted concentrations is considered reasonable. However, the timing is uncertain because the amount of time it might take to flush process water from the tailings is unknown.

Table 23. Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	788	900	248	406	244	406
Total Dissolved Solids	mg/L	1,309	1,548	406	525	400	524
Major Ions							
Calcium	mg/L	247	280	72	96	70	95
Chloride	mg/L	17	28	7.1	13	7.1	13
Fluoride	mg/L	0.75	0.98	0.22	0.31	0.22	0.31
Magnesium	mg/L	42	49	17	40	17	41
Potassium	mg/L	14	35	3.7	4.8	3.6	4.6
Sodium	mg/L	66	109	25	34	24	33
Sulphate	mg/L	719	829	153	191	136	170
Nutrients							
Ammonia	mg/L (as N)	0.18	0.53	0.01	0.033	0.01	0.031
Nitrate	mg/L (as N)	11	19	0.76	3.9	0.71	3.5
Nitrite	mg/L (as N)	0.077	0.21	0.007	0.033	0.0064	0.029
Total Phosphorus	mg/L	0.037	0.053	0.028	0.039	0.027	0.039
Total Metals							
Aluminum	mg/L	0.49	0.65	0.45	0.65	0.45	0.65
Antimony	mg/L	0.0013	0.003	0.00014	0.00035	0.00014	0.00034
Arsenic	mg/L	0.002	0.0027	0.0014	0.0021	0.0014	0.0021
Barium	mg/L	0.07	0.1	0.022	0.034	0.021	0.033
Beryllium	mg/L	0.000073	0.000073	0.000064	0.000064	0.000062	0.000062
Boron	mg/L	0.18	0.23	0.05	0.09	0.049	0.089
Cadmium	mg/L	0.00014	0.0003	0.000021	0.00011	0.000021	0.00011
Chromium	mg/L	0.0013	0.0017	0.0013	0.0018	0.0013	0.0018
Cobalt	mg/L	0.0011	0.0018	0.0004	0.00044	0.0004	0.00044
Copper	mg/L	0.058	0.49	0.014	0.17	0.013	0.17
Iron	mg/L	0.62	0.75	0.62	0.76	0.62	0.75
Lead	mg/L	0.00019	0.00022	0.00015	0.00022	0.00015	0.00022
Lithium	mg/L	0.011	0.019	0.0029	0.0048	0.0029	0.0048
Manganese	mg/L	0.28	0.6	0.048	0.079	0.047	0.076
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.25	0.055	0.089	0.049	0.081
Nickel	mg/L	0.0019	0.003	0.0013	0.0022	0.0013	0.0022
Selenium	mg/L	0.061	0.1	0.0057	0.021	0.0051	0.019
Silver	mg/L	0.000012	0.000023	0.0000044	0.000023	0.0000043	0.000023
Strontium	mg/L	2.9	3.8	0.89	1.5	0.86	1.5
Thallium	mg/L	0.0000072	0.0000082	0.0000064	0.0000065	0.0000062	0.0000063
Tin	mg/L	0.000086	0.00017	0.000064	0.00014	0.000062	0.00014
Titanium	mg/L	0.03	0.033	0.028	0.031	0.028	0.031
Uranium	mg/L	0.002	0.0027	0.00098	0.0019	0.00099	0.0019
Vanadium	mg/L	0.0038	0.0059	0.0019	0.0022	0.0019	0.0022
Zinc	mg/L	0.012	0.018	0.0047	0.012	0.003	0.0053
Dissolved Metals							
Aluminum	mg/L	0.088	0.24	0.05	0.25	0.045	0.25
Antimony	mg/L	0.0012	0.0029	0.00012	0.00021	0.00012	0.0002
Arsenic	mg/L	0.0019	0.0025	0.0012	0.0019	0.0013	0.0019
Barium	mg/L	0.068	0.094	0.02	0.026	0.02	0.025
Beryllium	mg/L	0.000073	0.000073	0.000064	0.000064	0.000062	0.000062
Boron	mg/L	0.18	0.2	0.046	0.059	0.045	0.058
Cadmium	mg/L	0.00014	0.00023	0.000019	0.000036	0.000019	0.000036
Chromium	mg/L	0.00083	0.0013	0.00083	0.0013	0.00084	0.0013
Cobalt	mg/L	0.00075	0.0015	0.000079	0.00012	0.000077	0.00012
Copper	mg/L	0.049	0.33	0.0046	0.0093	0.0041	0.009
Iron	mg/L	0.13	0.26	0.13	0.26	0.13	0.26
Lead	mg/L	0.000056	0.000084	0.000021	0.000085	0.000021	0.000086
Lithium	mg/L	0.011	0.018	0.0027	0.0038	0.0027	0.0038
Manganese	mg/L	0.26	0.58	0.034	0.065	0.033	0.062
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.24	0.055	0.078	0.049	0.07
Nickel	mg/L	0.0014	0.0025	0.00083	0.0017	0.00083	0.0017
Selenium	mg/L	0.061	0.097	0.0057	0.016	0.0051	0.014
Silicon	mg/L	9.7	11	7.4	11	7.2	11
Silver	mg/L	0.000012	0.000018	0.0000044	0.000018	0.0000043	0.000018
Strontium	mg/L	2.9	3.4	0.87	1.2	0.84	1.1
Thallium	mg/L	0.0000072	0.0000082	0.0000064	0.0000064	0.0000062	0.0000062
Tin	mg/L	0.000086	0.000095	0.000064	0.000064	0.000062	0.000062
Titanium	mg/L	0.0087	0.011	0.0061	0.0091	0.0059	0.0091
Uranium	mg/L	0.002	0.0024	0.00096	0.0016	0.00097	0.0016
Vanadium	mg/L	0.0026	0.0047	0.00074	0.0011	0.00072	0.0011
Zinc	mg/L	0.011	0.017	0.0034	0.01	0.0016	0.0039

a) Calculated based on predicted calcium and magnesium concentrations.

Table 24. Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	788	900	248	433	236	419
Total Dissolved Solids	mg/L	1,309	1,548	403	561	389	547
Major Ions							
Calcium	mg/L	247	280	71	102	67	98
Chloride	mg/L	17	27	7.2	14	6.9	13
Fluoride	mg/L	0.74	0.96	0.23	0.33	0.22	0.33
Magnesium	mg/L	42	49	17	43	17	42
Potassium	mg/L	14	33	3.7	5.1	3.5	4.8
Sodium	mg/L	61	107	25	36	23	34
Sulphate	mg/L	719	829	153	197	131	179
Nutrients							
Ammonia	mg/L (as N)	0.18	0.52	0.01	0.033	0.01	0.03
Nitrate	mg/L (as N)	11	19	0.76	3.9	0.68	3.4
Nitrite	mg/L (as N)	0.076	0.19	0.007	0.033	0.006	0.028
Total Phosphorus	mg/L	0.037	0.052	0.027	0.041	0.027	0.04
Total Metals							
Aluminum	mg/L	0.49	0.65	0.46	0.67	0.45	0.66
Antimony	mg/L	0.0012	0.0028	0.00014	0.00036	0.00014	0.00034
Arsenic	mg/L	0.002	0.0026	0.0015	0.0022	0.0014	0.0022
Barium	mg/L	0.07	0.098	0.022	0.036	0.021	0.034
Beryllium	mg/L	0.000073	0.000074	0.000064	0.000075	0.000062	0.000073
Boron	mg/L	0.18	0.23	0.05	0.095	0.047	0.092
Cadmium	mg/L	0.00014	0.00028	0.000021	0.00011	0.00002	0.00011
Chromium	mg/L	0.0013	0.0018	0.0013	0.0018	0.0013	0.0018
Cobalt	mg/L	0.0011	0.0017	0.0004	0.00045	0.0004	0.00045
Copper	mg/L	0.058	0.48	0.014	0.17	0.013	0.17
Iron	mg/L	0.62	0.77	0.62	0.77	0.62	0.76
Lead	mg/L	0.00019	0.00022	0.00015	0.00022	0.00015	0.00022
Lithium	mg/L	0.011	0.018	0.0029	0.0051	0.0028	0.0049
Manganese	mg/L	0.28	0.6	0.048	0.08	0.045	0.075
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.26	0.055	0.089	0.046	0.085
Nickel	mg/L	0.0019	0.0027	0.0013	0.0023	0.0013	0.0023
Selenium	mg/L	0.061	0.1	0.0057	0.021	0.0048	0.019
Silver	mg/L	0.000012	0.000024	0.0000044	0.000024	0.0000041	0.000024
Strontium	mg/L	2.9	3.8	0.89	1.6	0.83	1.5
Thallium	mg/L	0.0000072	0.0000082	0.0000064	0.0000076	0.0000062	0.0000073
Tin	mg/L	0.000086	0.00017	0.000064	0.00016	0.000062	0.00015
Titanium	mg/L	0.03	0.033	0.028	0.031	0.028	0.031
Uranium	mg/L	0.002	0.0027	0.00099	0.002	0.00096	0.002
Vanadium	mg/L	0.0038	0.0057	0.0019	0.0023	0.0019	0.0023
Zinc	mg/L	0.012	0.018	0.0047	0.011	0.003	0.0055
Dissolved Metals							
Aluminum	mg/L	0.088	0.25	0.051	0.26	0.046	0.26
Antimony	mg/L	0.0012	0.0027	0.00012	0.00022	0.00012	0.0002
Arsenic	mg/L	0.0018	0.0024	0.0013	0.002	0.0012	0.002
Barium	mg/L	0.068	0.09	0.02	0.027	0.019	0.026
Beryllium	mg/L	0.000073	0.000074	0.000064	0.000075	0.000062	0.000073
Boron	mg/L	0.17	0.19	0.046	0.065	0.043	0.061
Cadmium	mg/L	0.00014	0.00021	0.000019	0.000038	0.000018	0.000037
Chromium	mg/L	0.00083	0.0013	0.00084	0.0014	0.00083	0.0013
Cobalt	mg/L	0.00075	0.0014	0.000078	0.00013	0.000076	0.00013
Copper	mg/L	0.049	0.32	0.0045	0.01	0.0041	0.0086
Iron	mg/L	0.13	0.27	0.13	0.28	0.13	0.27
Lead	mg/L	0.000056	0.000086	0.000021	0.000088	0.000021	0.000087
Lithium	mg/L	0.01	0.017	0.0027	0.0041	0.0026	0.0039
Manganese	mg/L	0.26	0.58	0.034	0.066	0.031	0.061
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.19	0.25	0.055	0.078	0.046	0.074
Nickel	mg/L	0.0014	0.0023	0.00083	0.0018	0.00082	0.0018
Selenium	mg/L	0.061	0.097	0.0057	0.016	0.0048	0.013
Silicon	mg/L	9.7	11	7.3	11	7.2	11
Silver	mg/L	0.000012	0.000019	0.0000044	0.000019	0.0000041	0.000018
Strontium	mg/L	2.9	3.4	0.87	1.2	0.82	1.2
Thallium	mg/L	0.0000072	0.0000082	0.0000064	0.0000075	0.0000062	0.0000073
Tin	mg/L	0.000086	0.000095	0.000064	0.000075	0.000062	0.000073
Titanium	mg/L	0.0087	0.011	0.0061	0.0096	0.0059	0.0093
Uranium	mg/L	0.002	0.0024	0.00096	0.0017	0.00094	0.0017
Vanadium	mg/L	0.0026	0.0046	0.00074	0.0011	0.00072	0.0011
Zinc	mg/L	0.011	0.017	0.0033	0.01	0.0016	0.0041

a) Calculated based on predicted calcium and magnesium concentrations.

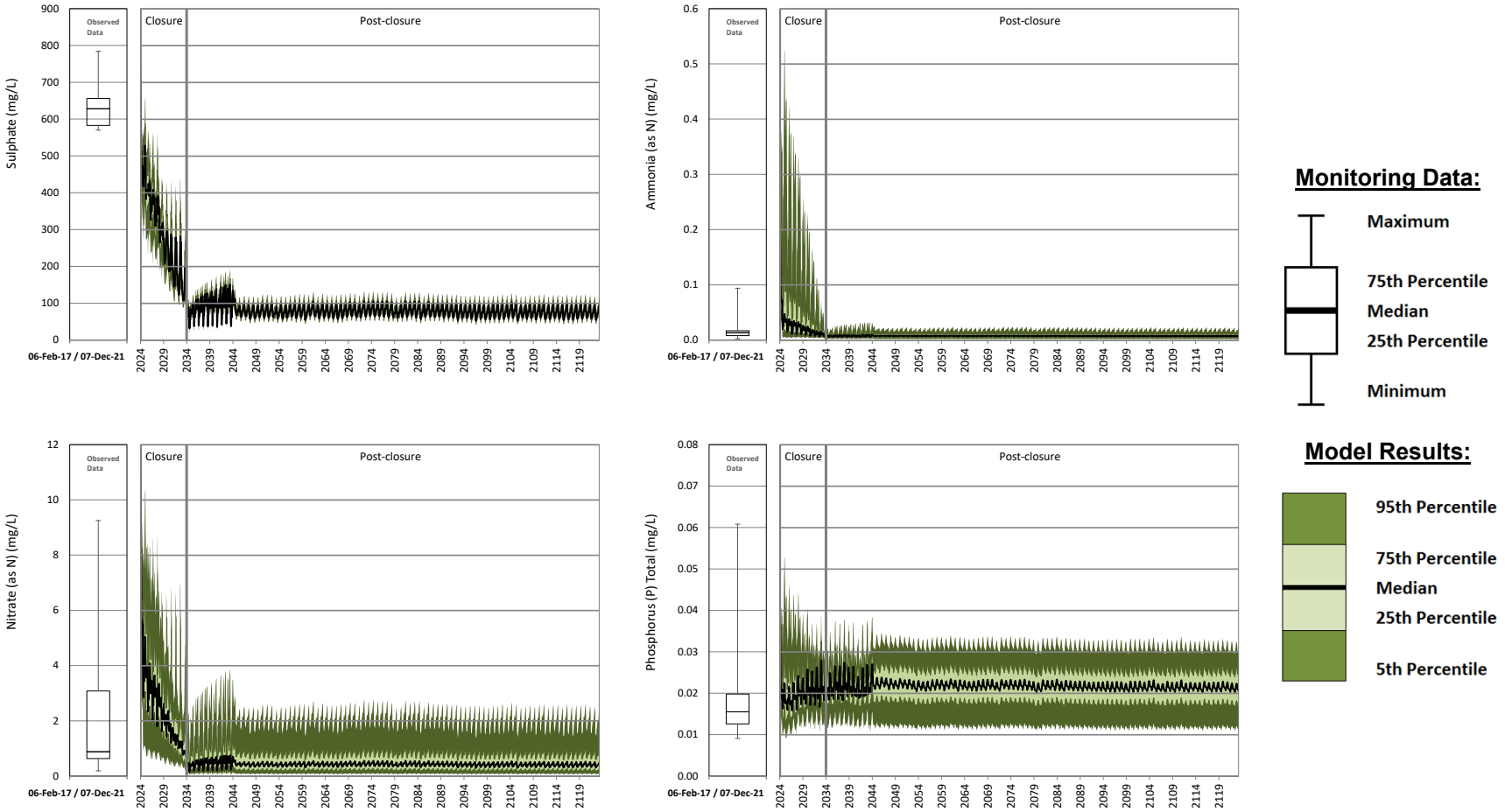

Figure 58: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

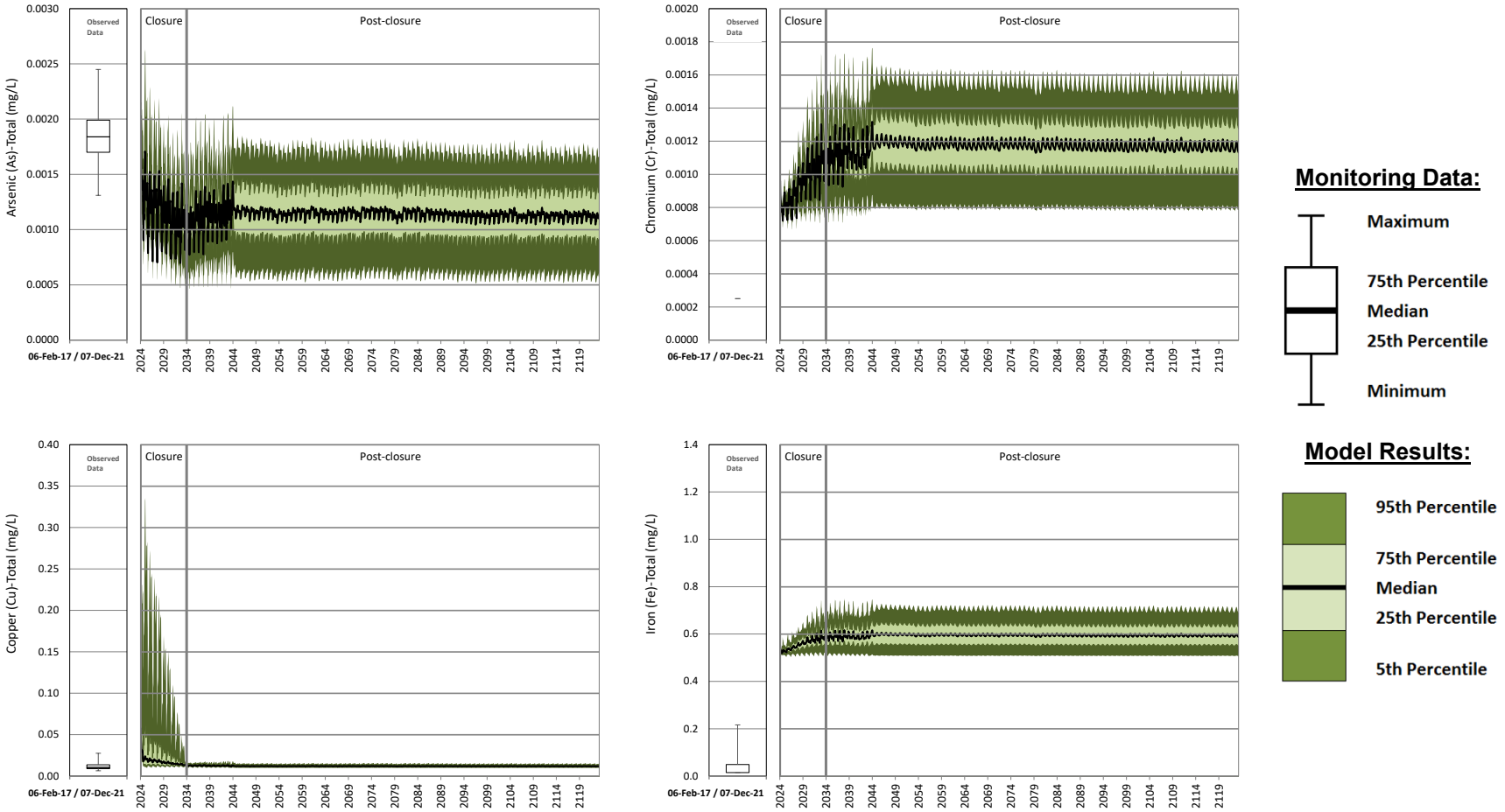

Figure 59: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

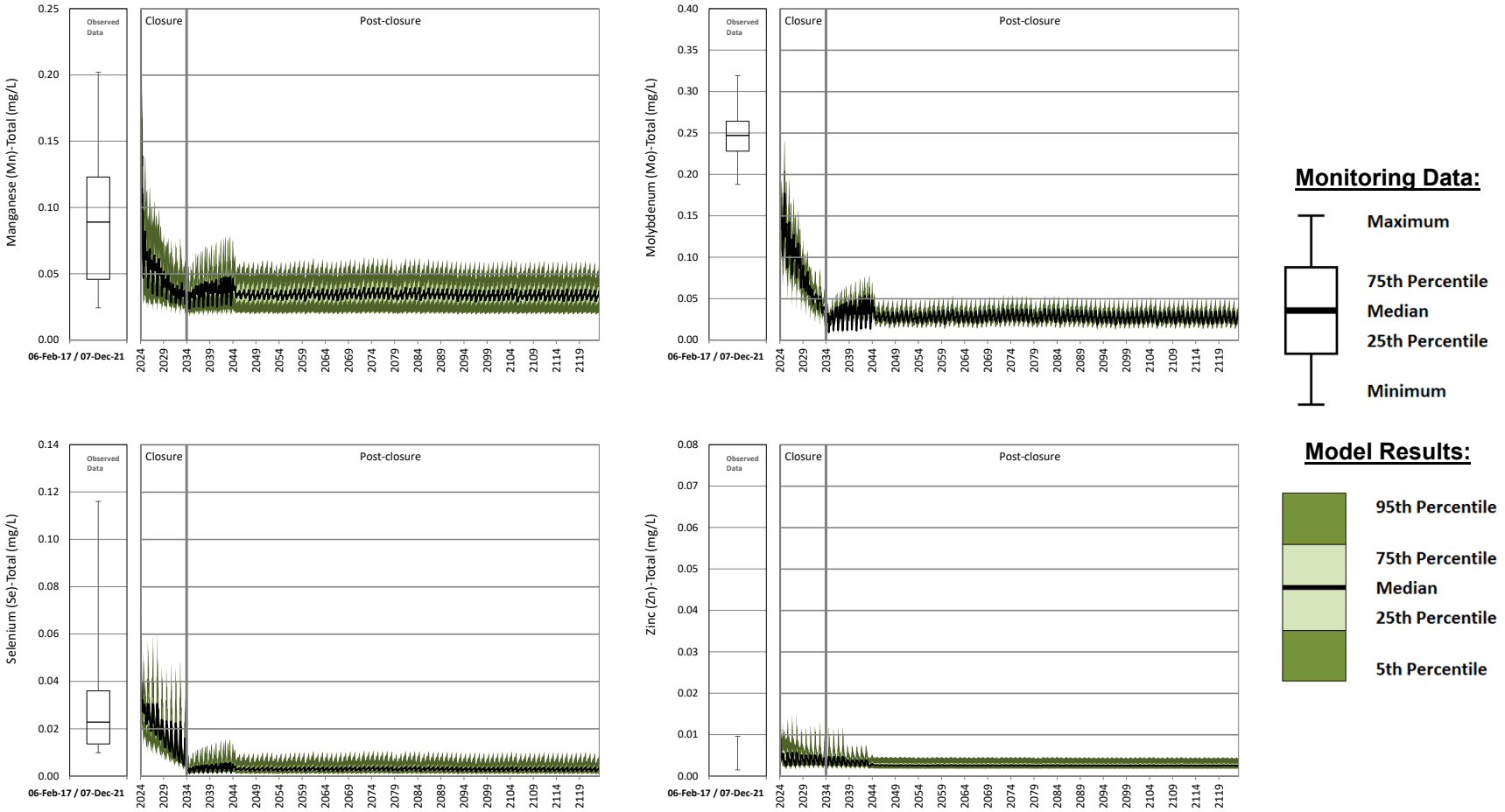

Figure 60: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Climate Change Module

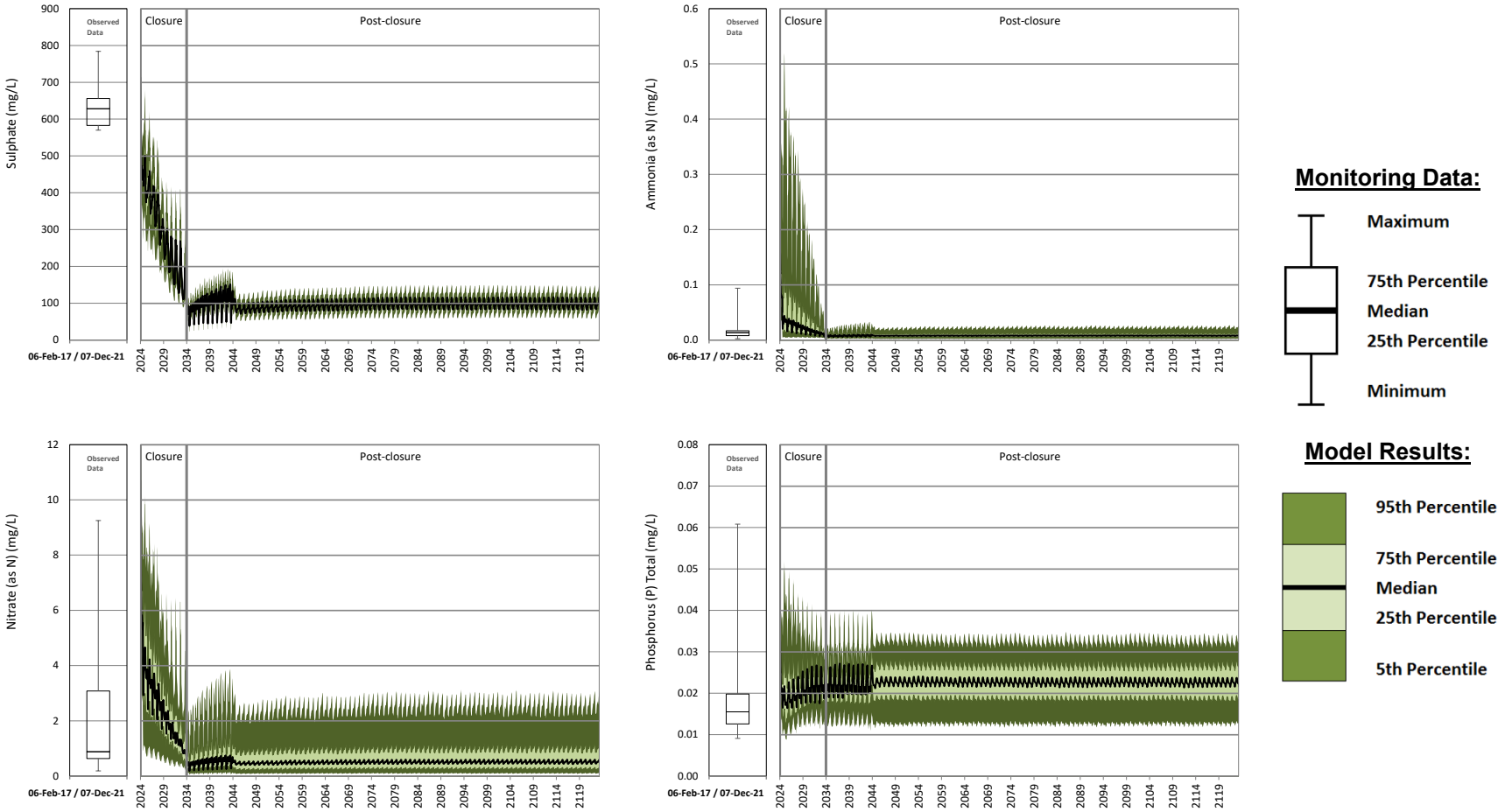

Figure 61: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

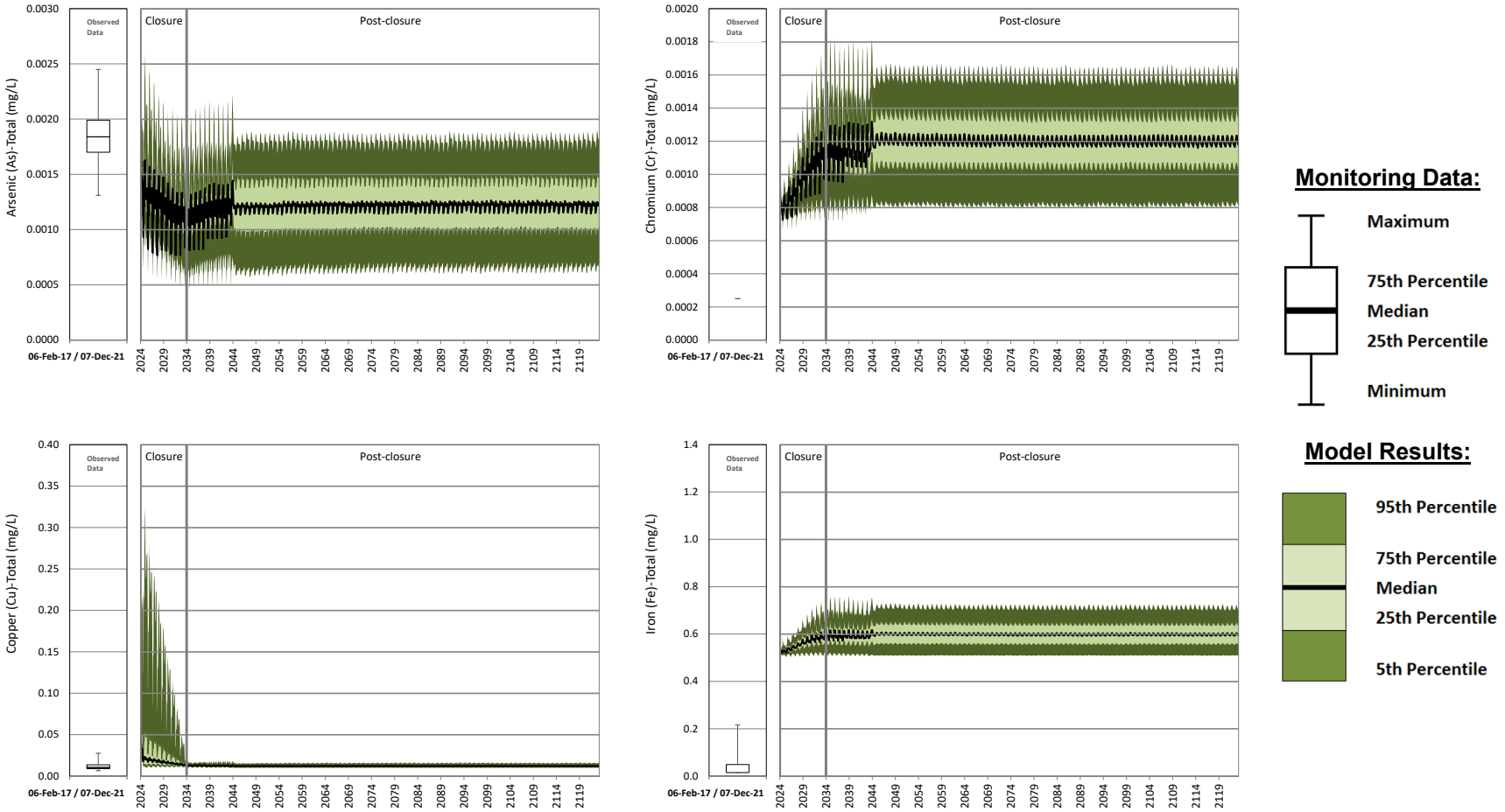

Figure 62: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

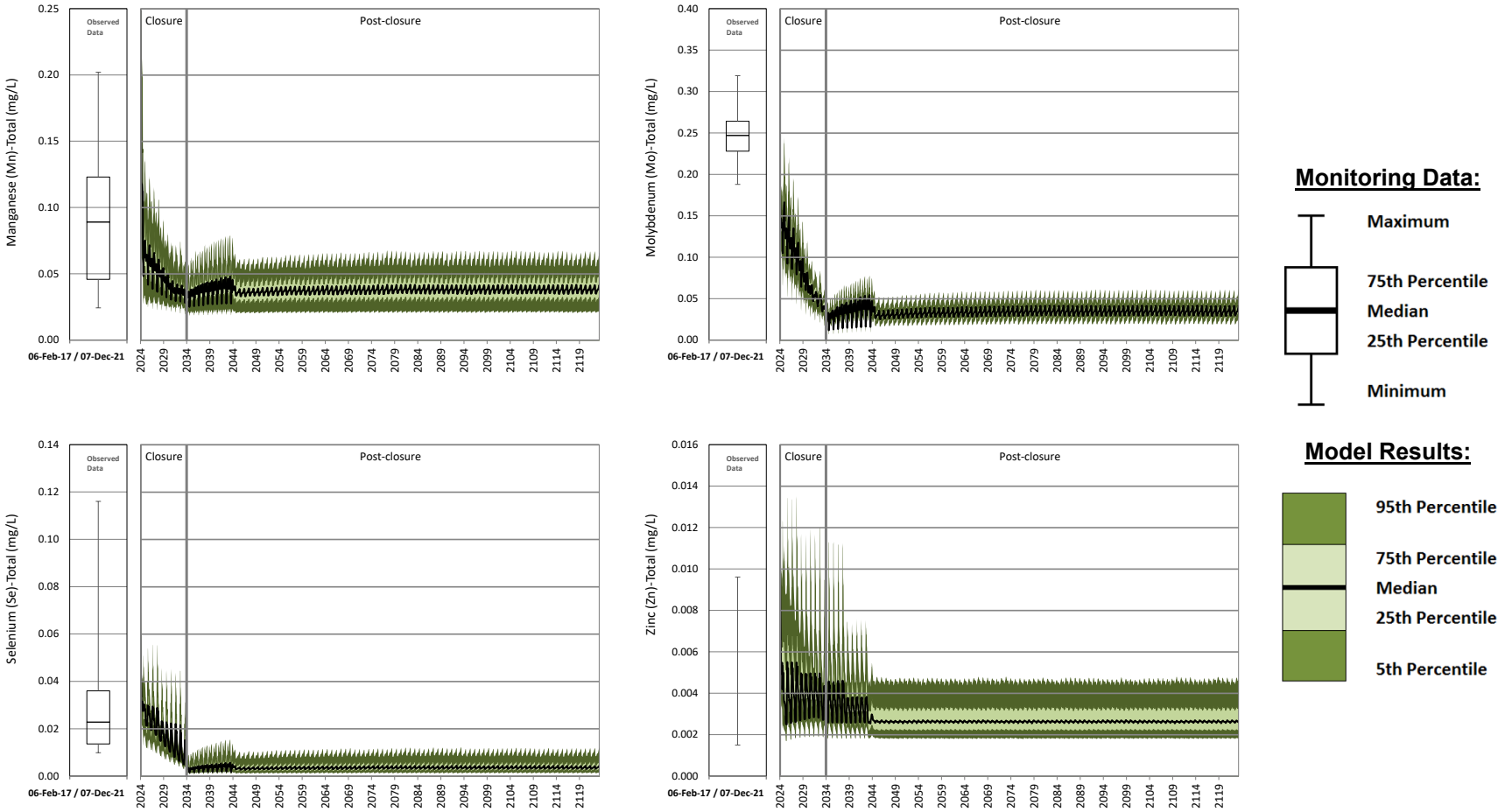

Figure 63: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure – Base Case Module

4.2.8 Perimeter Embankment Till Borrow Pond

Discharge from the PETBP will be directed to Hazeltine Creek in closure. This discharge includes overflow and seepage from the TSF, as well as runoff from catchment areas of the PETBP, TSF, and CCS. Time series plots for key parameters in PETBP for closure and post-closure are shown in Figures 64 to 66 for the climate change module results and in Figures 67 to 69 for the base case module results. Maximum of median and 95th percentile predictions are presented in Tables 25 and 26 for the climate change and base case modules, respectively.

Predicted peak concentrations in the PETBP occur at the beginning of closure, and then decrease as TSF beach and impoundment areas are reclaimed (Figures 61 to 66). Reclaimed areas of the TSF beach and impoundment are assigned an undisturbed water quality (Table 6). The increase in concentrations of most parameters in the PETBP from 2034 to 2044 is caused by the increase in concentrations in the MESCP. Predicted water quality reaches steady state conditions by 2044, after all watershed areas have been reclaimed.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the PETBP

Table 25. Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond Pond during Closure and Post-closure - Climate Change Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	666	787	240	391	175	331
Total Dissolved Solids	mg/L	1,071	1,257	354	490	280	392
Major Ions							
Calcium	mg/L	208	242	69	95	49	72
Chloride	mg/L	11	14	5.8	11	4.8	11
Fluoride	mg/L	0.54	0.6	0.18	0.25	0.14	0.22
Magnesium	mg/L	36	44	16	37	13	37
Potassium	mg/L	8.7	16	3.0	3.8	2.3	2.9
Sodium	mg/L	41	56	20	27	15	23
Sulphate	mg/L	578	652	136	181	72	91
Nutrients							
Ammonia	mg/L (as N)	0.11	0.24	0.0086	0.026	0.008	0.018
Nitrate	mg/L (as N)	8.5	19	0.76	3.8	0.4	1.9
Nitrite	mg/L (as N)	0.047	0.1	0.0053	0.024	0.0035	0.015
Total Phosphorus	mg/L	0.03	0.036	0.025	0.036	0.024	0.036
Total Metals							
Aluminum	mg/L	0.48	0.57	0.45	0.66	0.45	0.66
Antimony	mg/L	0.00084	0.0015	0.00012	0.00031	0.00011	0.00027
Arsenic	mg/L	0.0016	0.0018	0.0013	0.0019	0.0012	0.0019
Barium	mg/L	0.054	0.067	0.019	0.03	0.016	0.026
Beryllium	mg/L	0.000061	0.000061	0.000057	0.000057	0.000055	0.000055
Boron	mg/L	0.15	0.19	0.041	0.079	0.034	0.073
Cadmium	mg/L	0.00013	0.00027	0.000022	0.00014	0.000015	0.0001
Chromium	mg/L	0.0011	0.0014	0.0013	0.0017	0.0013	0.0017
Cobalt	mg/L	0.00091	0.0013	0.0004	0.00052	0.00038	0.00042
Copper	mg/L	0.044	0.3	0.013	0.17	0.012	0.16
Iron	mg/L	0.59	0.68	0.62	0.75	0.62	0.75
Lead	mg/L	0.00019	0.00019	0.00015	0.00022	0.00015	0.00022
Lithium	mg/L	0.0076	0.01	0.0024	0.0041	0.002	0.0038
Manganese	mg/L	0.25	0.75	0.041	0.17	0.033	0.054
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.14	0.17	0.041	0.069	0.026	0.047
Nickel	mg/L	0.0016	0.0023	0.0013	0.0022	0.0013	0.0022
Selenium	mg/L	0.052	0.078	0.011	0.024	0.0027	0.013
Silver	mg/L	0.000012	0.000017	0.0000038	0.000023	0.0000036	0.000023
Strontium	mg/L	2.3	3.0	0.71	1.3	0.56	1.1
Thallium	mg/L	0.0000063	0.0000068	0.0000057	0.0000058	0.0000055	0.0000055
Tin	mg/L	0.000071	0.00016	0.000057	0.00014	0.000055	0.00013
Titanium	mg/L	0.029	0.031	0.027	0.03	0.027	0.03
Uranium	mg/L	0.0017	0.0022	0.00082	0.0017	0.00078	0.0017
Vanadium	mg/L	0.003	0.0036	0.0018	0.0021	0.0018	0.0021
Zinc	mg/L	0.01	0.014	0.0037	0.0065	0.0027	0.0048
Dissolved Metals							
Aluminum	mg/L	0.077	0.16	0.047	0.25	0.045	0.25
Antimony	mg/L	0.00082	0.0014	0.0001	0.00017	0.000085	0.00013
Arsenic	mg/L	0.0014	0.0016	0.0011	0.0017	0.001	0.0017
Barium	mg/L	0.053	0.059	0.017	0.021	0.014	0.018
Beryllium	mg/L	0.000061	0.000061	0.000057	0.000057	0.000055	0.000055
Boron	mg/L	0.14	0.16	0.037	0.048	0.03	0.042
Cadmium	mg/L	0.00012	0.0002	0.00002	0.000065	0.000014	0.000029
Chromium	mg/L	0.00057	0.00087	0.00081	0.0013	0.0008	0.0013
Cobalt	mg/L	0.00059	0.00098	0.000082	0.0002	0.000065	0.0001
Copper	mg/L	0.035	0.14	0.0038	0.0073	0.0033	0.0062
Iron	mg/L	0.094	0.19	0.13	0.26	0.13	0.26
Lead	mg/L	0.000055	0.00006	0.000019	0.000082	0.000017	0.000083
Lithium	mg/L	0.0074	0.0094	0.0022	0.0031	0.0018	0.0028
Manganese	mg/L	0.23	0.74	0.027	0.16	0.019	0.04
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.14	0.16	0.041	0.058	0.026	0.036
Nickel	mg/L	0.0011	0.0018	0.00079	0.0017	0.00079	0.0017
Selenium	mg/L	0.052	0.072	0.011	0.018	0.0027	0.0072
Silicon	mg/L	8.1	8.5	6.6	9.8	6.3	9.6
Silver	mg/L	0.000012	0.000012	0.0000038	0.000018	0.0000036	0.000018
Strontium	mg/L	2.3	2.6	0.7	0.93	0.54	0.73
Thallium	mg/L	0.0000063	0.0000068	0.0000057	0.0000057	0.0000055	0.0000055
Tin	mg/L	0.000071	0.000076	0.000057	0.000057	0.000055	0.000055
Titanium	mg/L	0.0072	0.0091	0.0054	0.0084	0.0052	0.0082
Uranium	mg/L	0.0017	0.0019	0.00079	0.0014	0.00076	0.0014
Vanadium	mg/L	0.0019	0.0024	0.00064	0.00097	0.00061	0.00094
Zinc	mg/L	0.0089	0.013	0.0023	0.0051	0.0014	0.0035

a) Calculated based on predicted calcium and magnesium concentrations.

Table 26. Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure - Base Case Module

Parameter	Units	Closure (September 2024 to August 2034)		Post-closure - First Ten Years (September 2034 to August 2044)		Post-closure - Long Term/Steady State (September 2044 to August 2124)	
		Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations	Predicted Maximum of Median Concentrations	Predicted Maximum of 95th Percentile Concentrations
Physical Parameters							
Hardness(a)	mg CaCO3/L	581	769	282	464	177	343
Total Dissolved Solids	mg/L	916	1,237	409	640	280	419
Major Ions							
Calcium	mg/L	181	236	82	122	49	75
Chloride	mg/L	9.6	14	6.0	11	4.9	11
Fluoride	mg/L	0.46	0.55	0.19	0.26	0.15	0.24
Magnesium	mg/L	32	44	19	38	13	38
Potassium	mg/L	6.9	16	3.1	4.0	2.3	3.3
Sodium	mg/L	37	53	21	29	15	25
Sulphate	mg/L	485	654	170	282	78	109
Nutrients							
Ammonia	mg/L (as N)	0.092	0.23	0.0084	0.027	0.0079	0.02
Nitrate	mg/L (as N)	7.4	18	0.87	5.2	0.44	2.1
Nitrite	mg/L (as N)	0.037	0.093	0.0056	0.026	0.0039	0.017
Total Phosphorus	mg/L	0.027	0.033	0.025	0.036	0.025	0.036
Total Metals							
Aluminum	mg/L	0.48	0.56	0.45	0.65	0.45	0.66
Antimony	mg/L	0.00069	0.0014	0.00013	0.00032	0.00011	0.00028
Arsenic	mg/L	0.0014	0.0016	0.0012	0.0019	0.0012	0.0019
Barium	mg/L	0.046	0.066	0.021	0.036	0.015	0.028
Beryllium	mg/L	0.000056	0.00006	0.000057	0.000062	0.000056	0.000061
Boron	mg/L	0.14	0.19	0.045	0.095	0.035	0.077
Cadmium	mg/L	0.00012	0.00026	0.000025	0.00015	0.000015	0.0001
Chromium	mg/L	0.001	0.0013	0.0013	0.0017	0.0013	0.0018
Cobalt	mg/L	0.00083	0.0013	0.00041	0.00058	0.00039	0.00043
Copper	mg/L	0.039	0.3	0.013	0.17	0.012	0.17
Iron	mg/L	0.59	0.67	0.62	0.75	0.62	0.75
Lead	mg/L	0.00019	0.00019	0.00015	0.00022	0.00015	0.00022
Lithium	mg/L	0.0064	0.0099	0.0025	0.0043	0.002	0.0039
Manganese	mg/L	0.22	0.68	0.042	0.23	0.035	0.057
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.12	0.16	0.043	0.074	0.028	0.054
Nickel	mg/L	0.0014	0.0021	0.0013	0.0022	0.0013	0.0022
Selenium	mg/L	0.045	0.076	0.013	0.033	0.003	0.014
Silver	mg/L	0.000012	0.000017	0.0000037	0.000023	0.0000036	0.000023
Strontium	mg/L	2.1	2.8	0.75	1.5	0.57	1.2
Thallium	mg/L	0.000006	0.0000068	0.0000057	0.0000063	0.0000056	0.0000061
Tin	mg/L	0.000067	0.00015	0.000057	0.00014	0.000056	0.00014
Titanium	mg/L	0.028	0.03	0.027	0.03	0.027	0.03
Uranium	mg/L	0.0015	0.0022	0.00083	0.0017	0.00078	0.0017
Vanadium	mg/L	0.0028	0.0035	0.0018	0.0021	0.0018	0.0021
Zinc	mg/L	0.0099	0.014	0.0037	0.0067	0.0027	0.005
Dissolved Metals							
Aluminum	mg/L	0.077	0.16	0.048	0.25	0.045	0.25
Antimony	mg/L	0.00067	0.0013	0.00011	0.00018	0.000086	0.00014
Arsenic	mg/L	0.0013	0.0015	0.0011	0.0017	0.001	0.0018
Barium	mg/L	0.044	0.058	0.019	0.028	0.014	0.019
Beryllium	mg/L	0.000056	0.00006	0.000057	0.000062	0.000056	0.000061
Boron	mg/L	0.13	0.16	0.041	0.065	0.031	0.046
Cadmium	mg/L	0.00012	0.00019	0.000023	0.000081	0.000014	0.000029
Chromium	mg/L	0.00055	0.00082	0.0008	0.0012	0.00081	0.0013
Cobalt	mg/L	0.00051	0.00098	0.000087	0.00026	0.000066	0.00011
Copper	mg/L	0.03	0.14	0.004	0.0078	0.0032	0.0064
Iron	mg/L	0.093	0.18	0.13	0.26	0.13	0.26
Lead	mg/L	0.000055	0.00006	0.000019	0.000084	0.000018	0.000084
Lithium	mg/L	0.0062	0.0089	0.0023	0.0033	0.0018	0.0029
Manganese	mg/L	0.21	0.66	0.028	0.21	0.021	0.042
Mercury	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025
Molybdenum	mg/L	0.12	0.14	0.043	0.063	0.028	0.043
Nickel	mg/L	0.00097	0.0017	0.00079	0.0017	0.0008	0.0017
Selenium	mg/L	0.045	0.07	0.013	0.027	0.003	0.0082
Silicon	mg/L	7.4	8.1	6.5	10	6.4	10.0
Silver	mg/L	0.000012	0.000012	0.0000037	0.000018	0.0000036	0.000018
Strontium	mg/L	2.1	2.5	0.73	1.2	0.56	0.83
Thallium	mg/L	0.000006	0.0000067	0.0000057	0.0000062	0.0000056	0.0000061
Tin	mg/L	0.000067	0.000074	0.000057	0.000062	0.000056	0.000061
Titanium	mg/L	0.0065	0.0087	0.0054	0.0085	0.0053	0.0085
Uranium	mg/L	0.0015	0.0019	0.0008	0.0014	0.00076	0.0014
Vanadium	mg/L	0.0016	0.0023	0.00063	0.00097	0.00063	0.00096
Zinc	mg/L	0.0085	0.012	0.0023	0.0053	0.0014	0.0036

a) Calculated based on predicted calcium and magnesium concentrations.

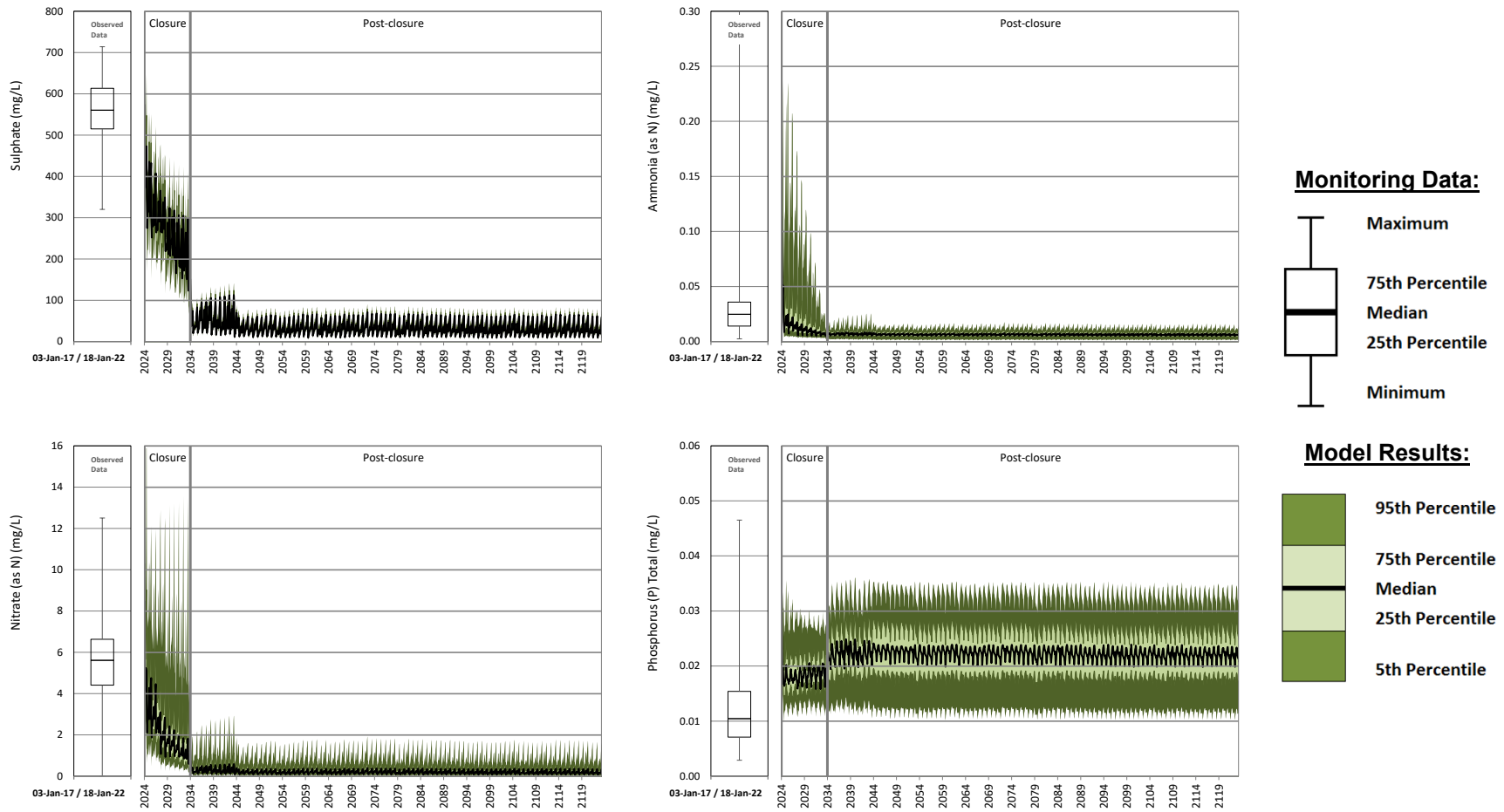

Figure 64: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Climate Change Module

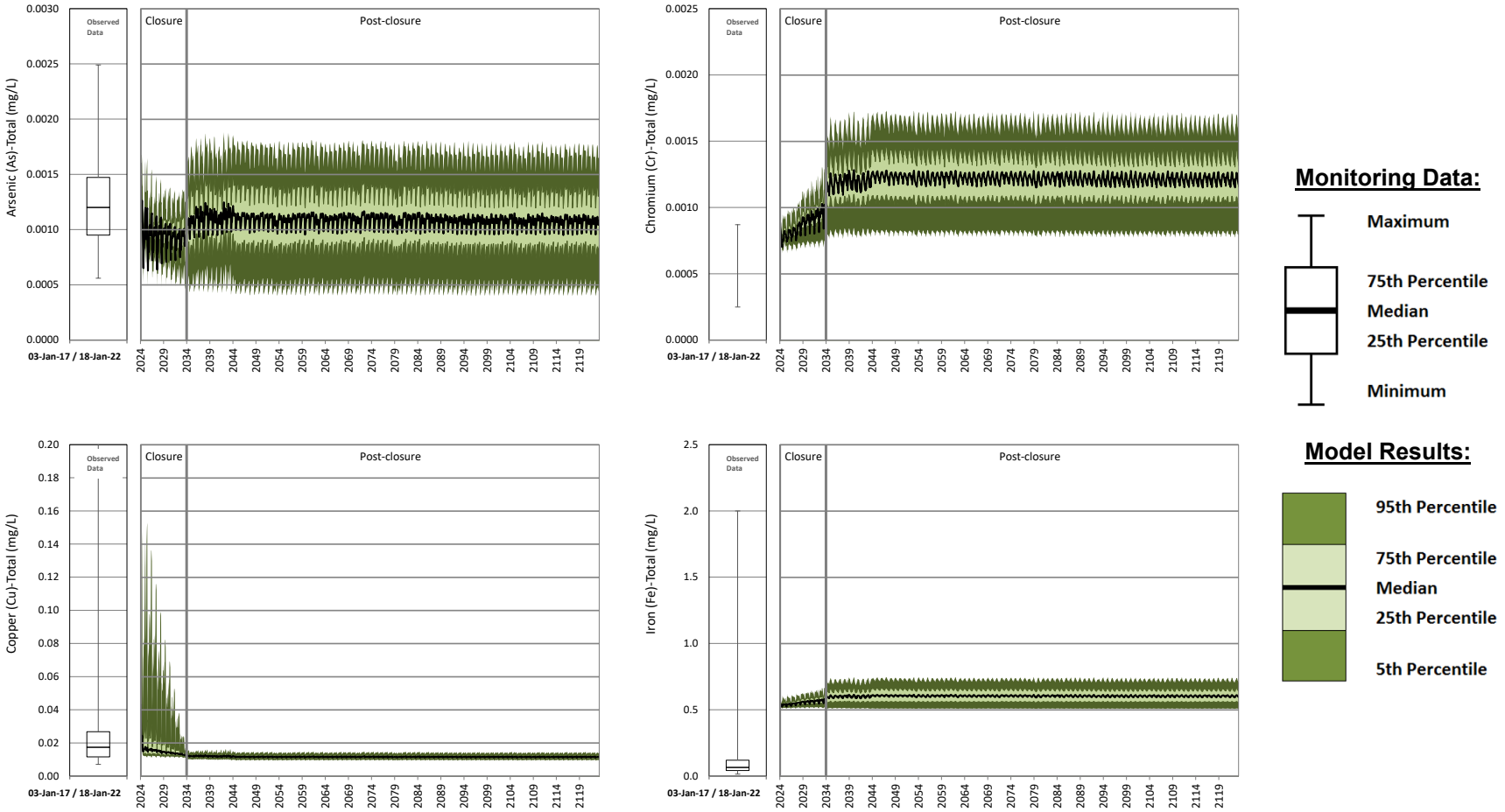

Figure 65: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Climate Change Module

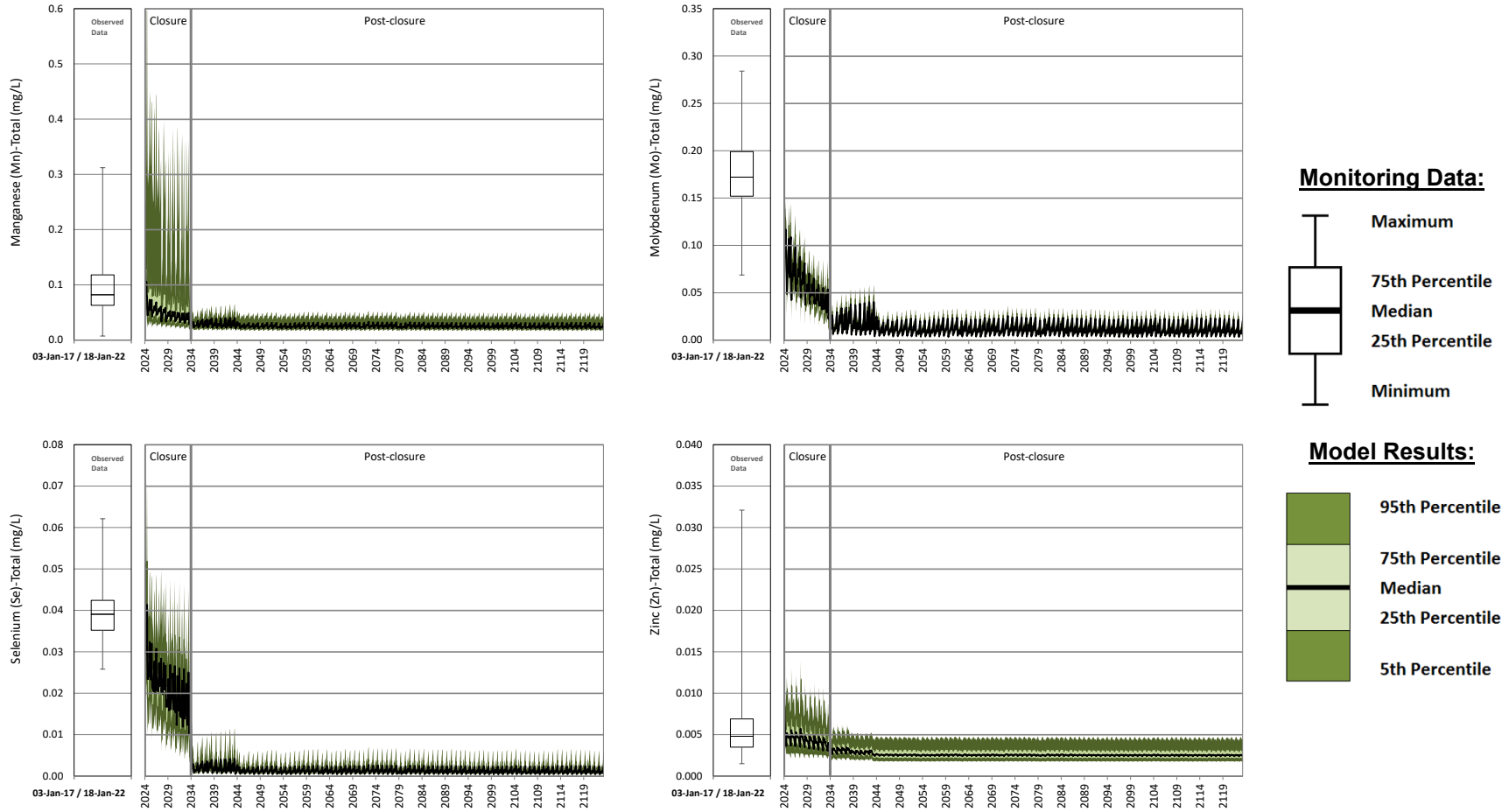

Figure 66: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Climate Change Module

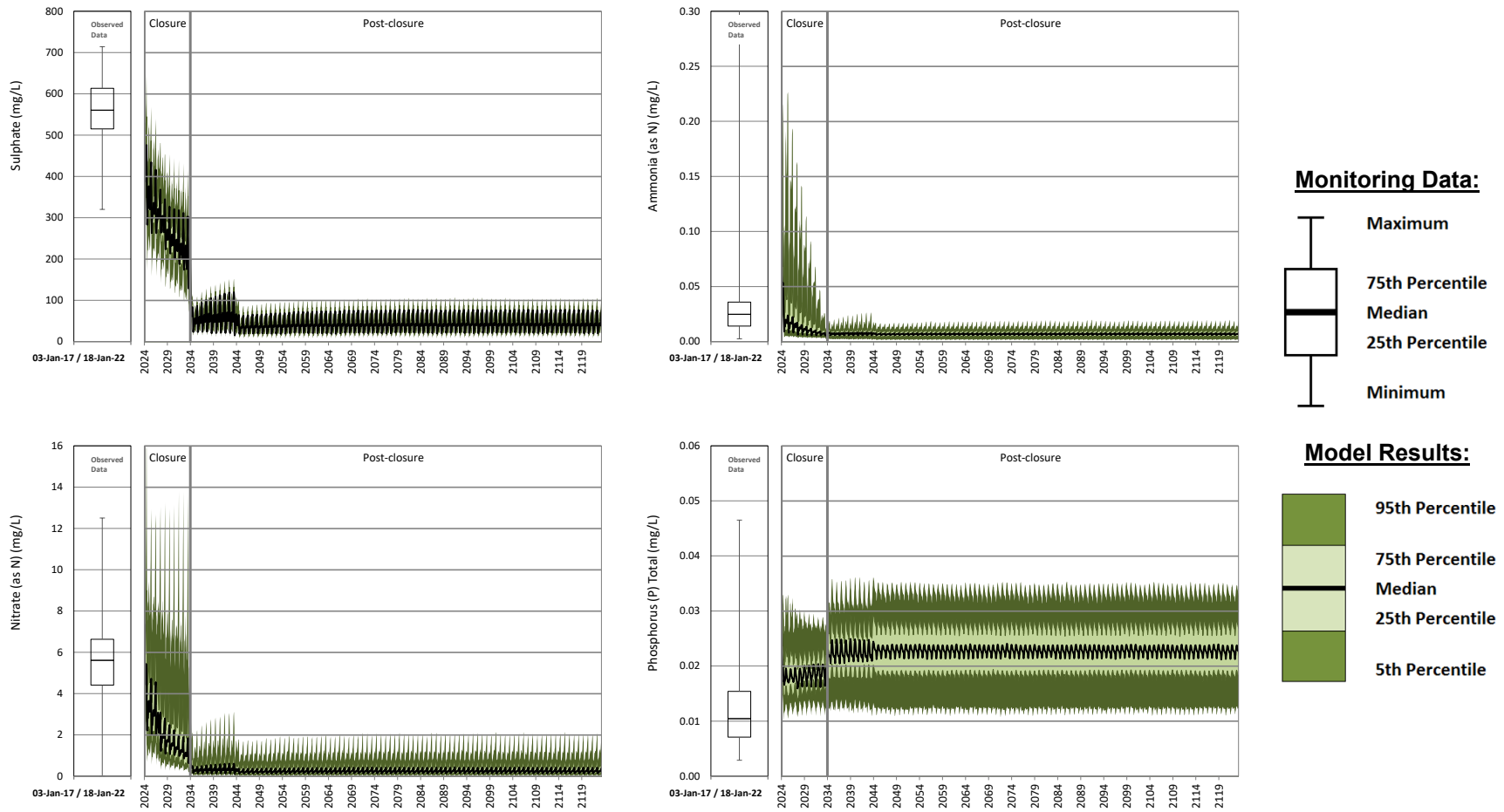

Figure 67: Predicted Sulphate, Total Ammonia, Nitrate and Total Phosphorus Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Base Case Module

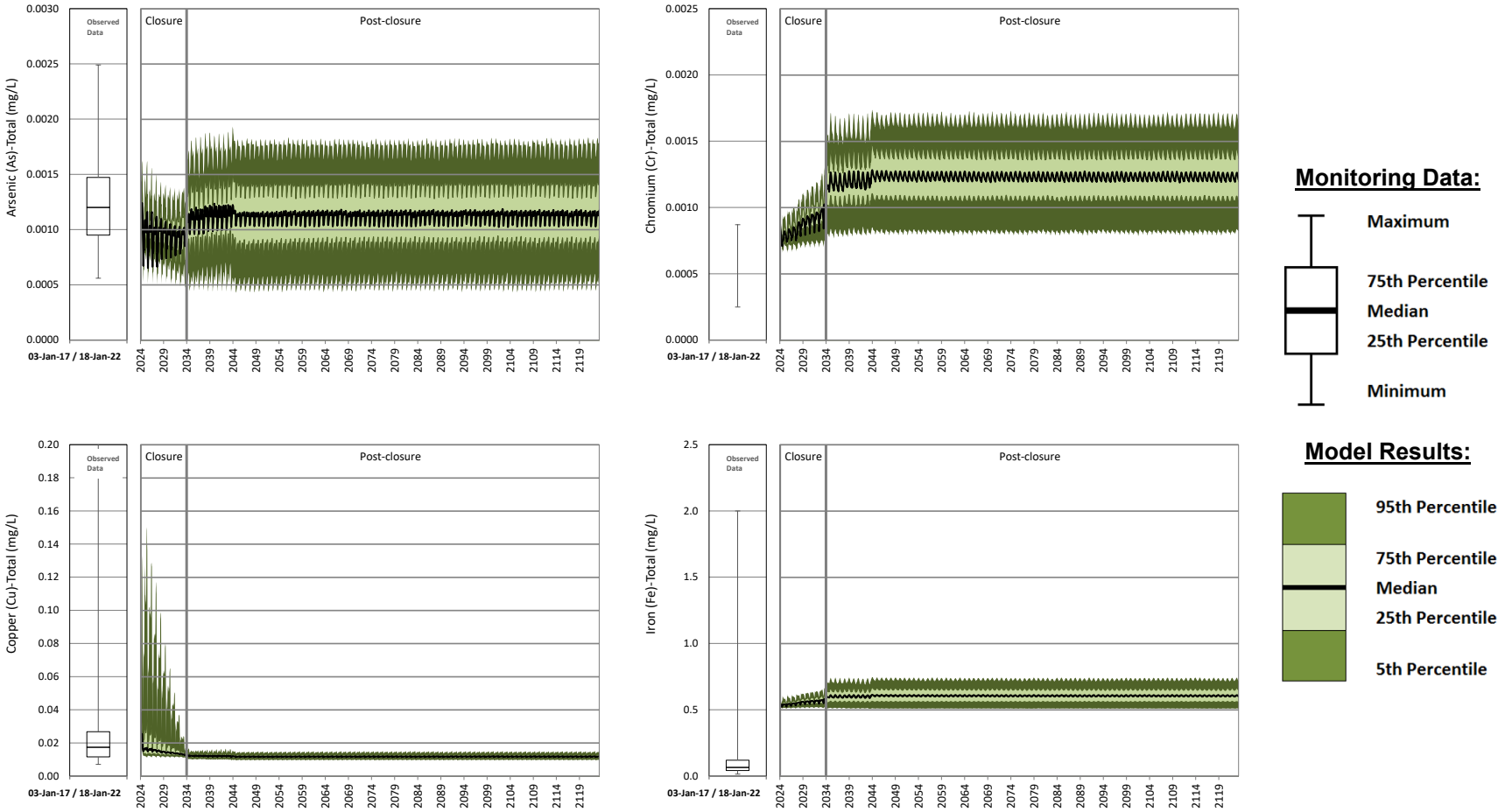

Figure 68: Predicted Total Arsenic, Chromium, Copper and Iron Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Base Case Module

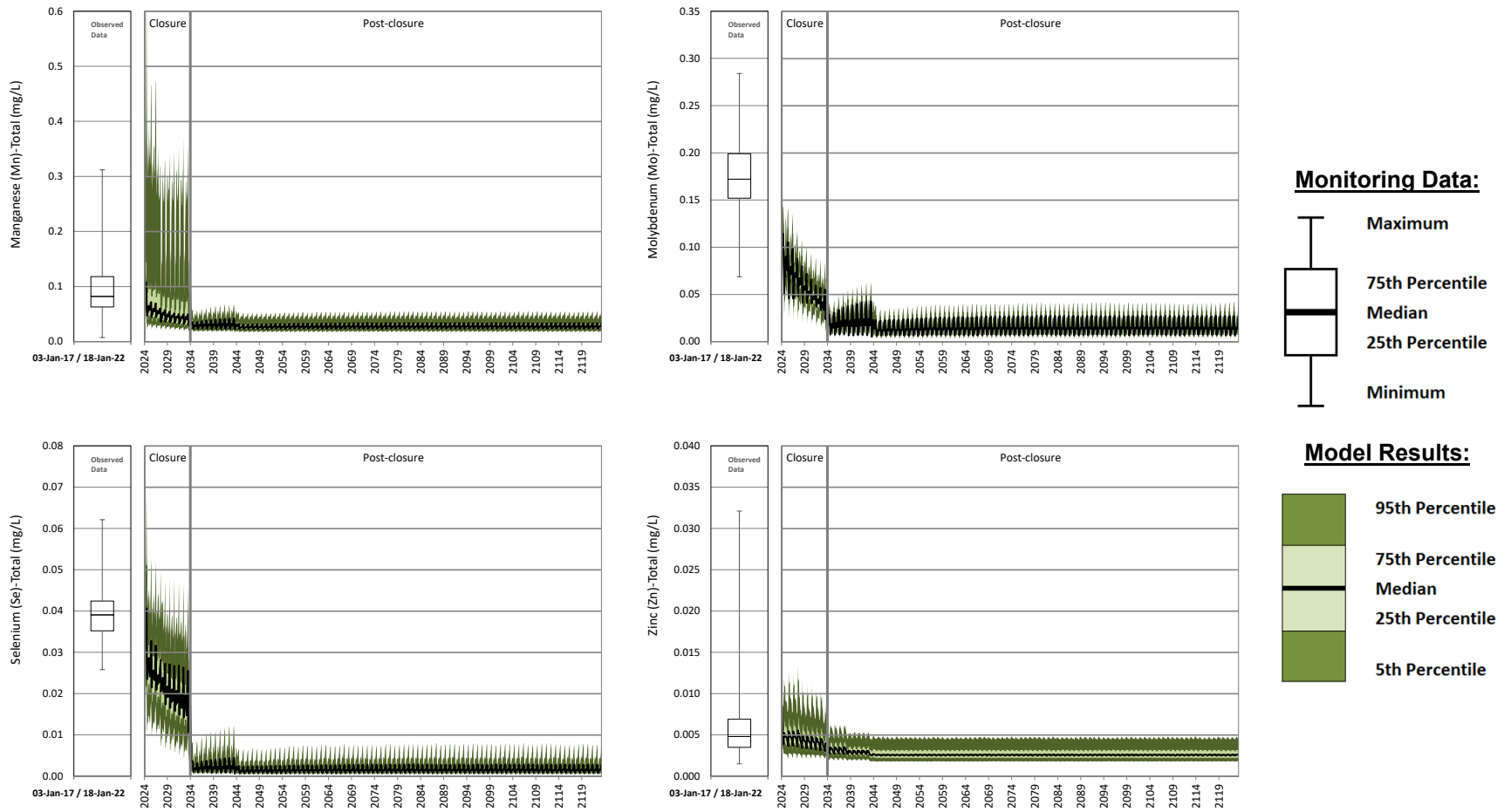

Figure 69: Predicted Total Manganese, Molybdenum, Selenium and Zinc Concentrations in the Perimeter Embankment Till Borrow Pond during Closure and Post-closure – Base Case Module

5.0 SUMMARY

The GoldSim model that was developed for the 2017 RCP to predict discharge water quality at the mine during closure and post-closure was updated with the latest RCP and water balance (base case and climate change scenarios) to reflect the closure and post-closure conditions on the mine site from 2024 to 2124. The model was also updated with additional monitoring data for assigned water quality inputs to refine the distribution inputs into the model. The updated model was calibrated against monitoring data from the mine site. During closure and post-closure, discharges from the mine will preferably be returned to their undisturbed watersheds, to the extent possible. Specifically, nine potential mine discharge locations are expected to drain to Polley Lake, Bootjack Lake, Edney Creek, and Hazeltine Creek.

Model results were generated for each potential discharge to inform treatment planning for closure and post-closure (Appendix G). In general, the model predicted higher concentrations in the closure period, relative to the post-closure period for most parameters with the exception of parameters that are predicted to be higher in the assigned undisturbed runoff water quality than in the assigned disturbed, NAG or PAG waste rock water quality.

6.0 CLOSURE

This report summarizes the reclamation and closure update of the SWWQM.

We trust this report satisfies your current requirements. Please contact the undersigned should you have any questions.

Signature Page

Golder Associates Ltd.



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SM/AS/LN/ca/anr

https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/090-r-31715-water quality model mrp/22514095-090-r-rev0-31715-rcp wq model 21dec_22.docx

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APPENDIX A

Site-Wide Water Quality Model Calibration Results

This attachment presents the water quality calibration figures for Springer Pit, Wight Pit, the Central Collection Sump, the Tailings Storage Facility, the Perimeter Embankment Till Borrow Pond and the Northwest Sump. The calibration period was from January 2017 to December 2021.

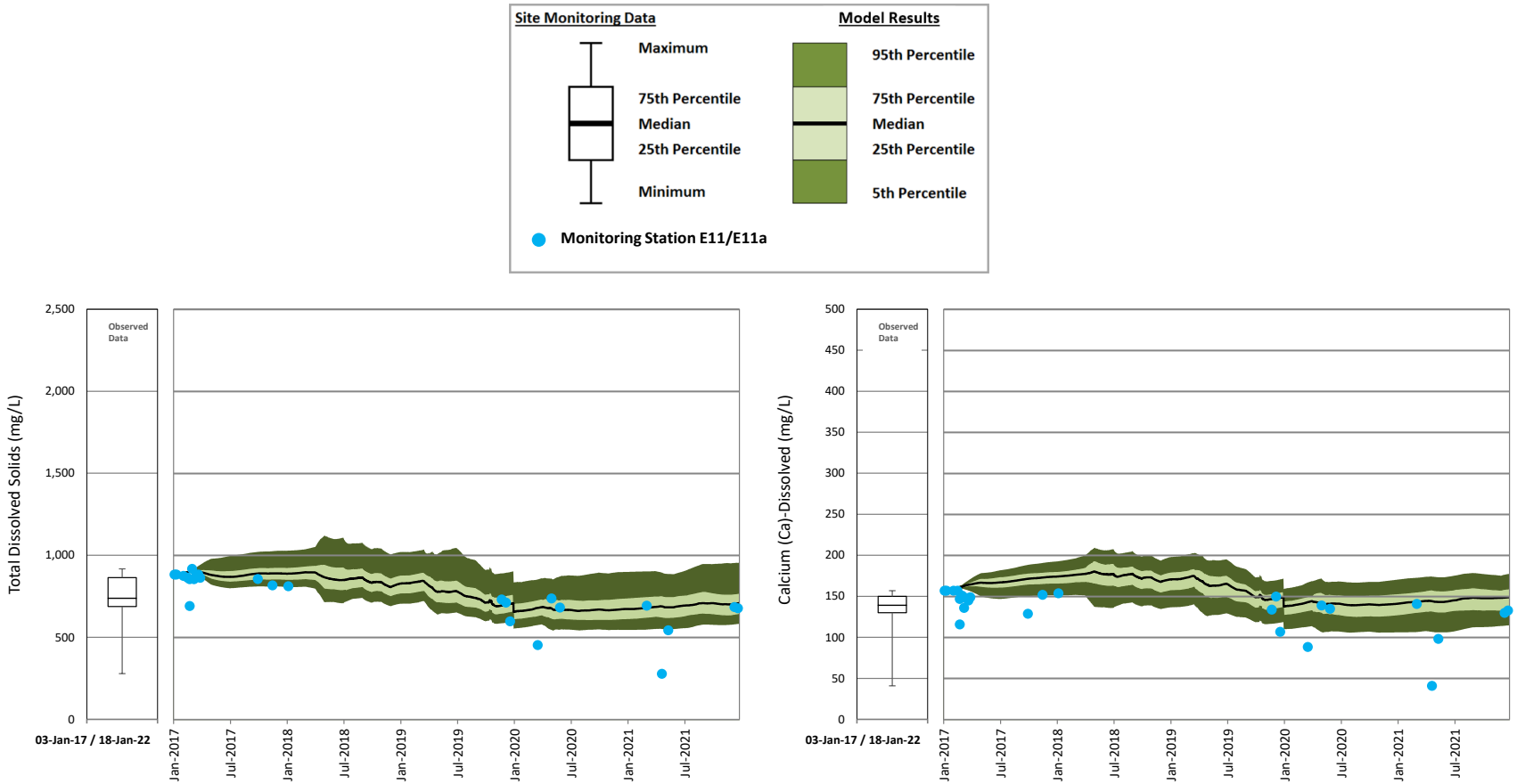

Figure 1: Springer Pit Calibration – Total Dissolved Solids and Calcium

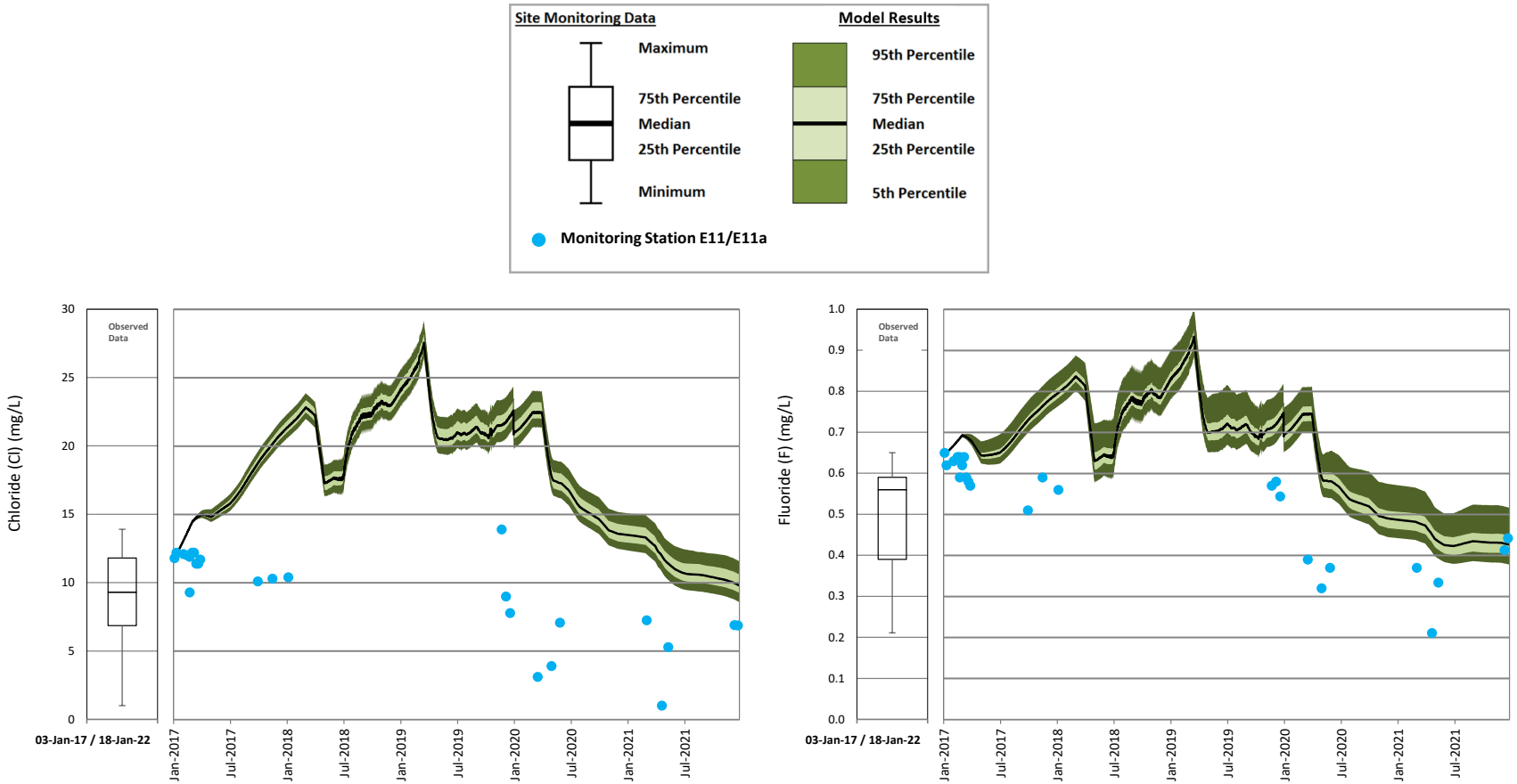

Figure 2: Springer Pit Calibration – Chloride and Fluoride

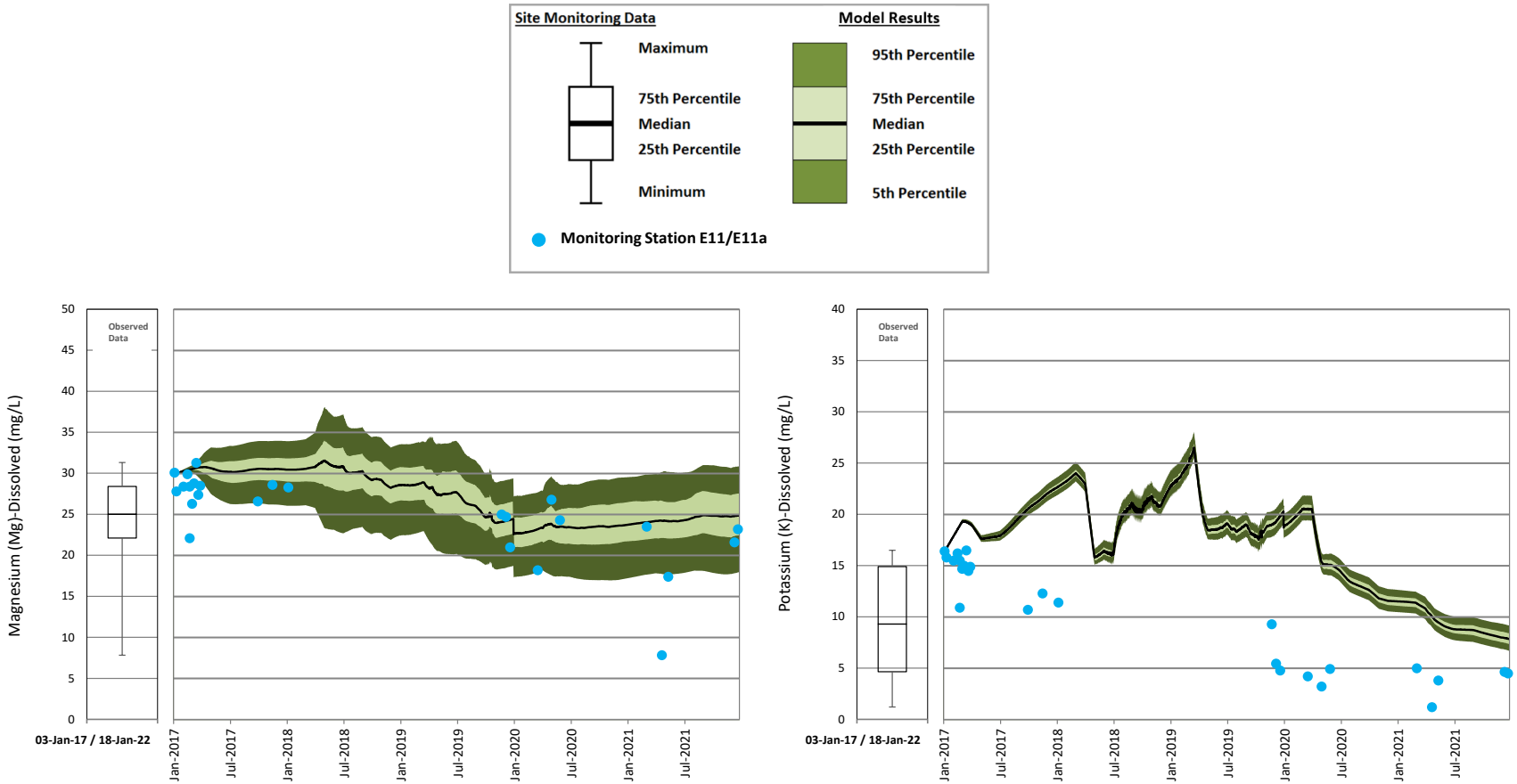

Figure 3: Springer Pit Calibration – Magnesium and Potassium

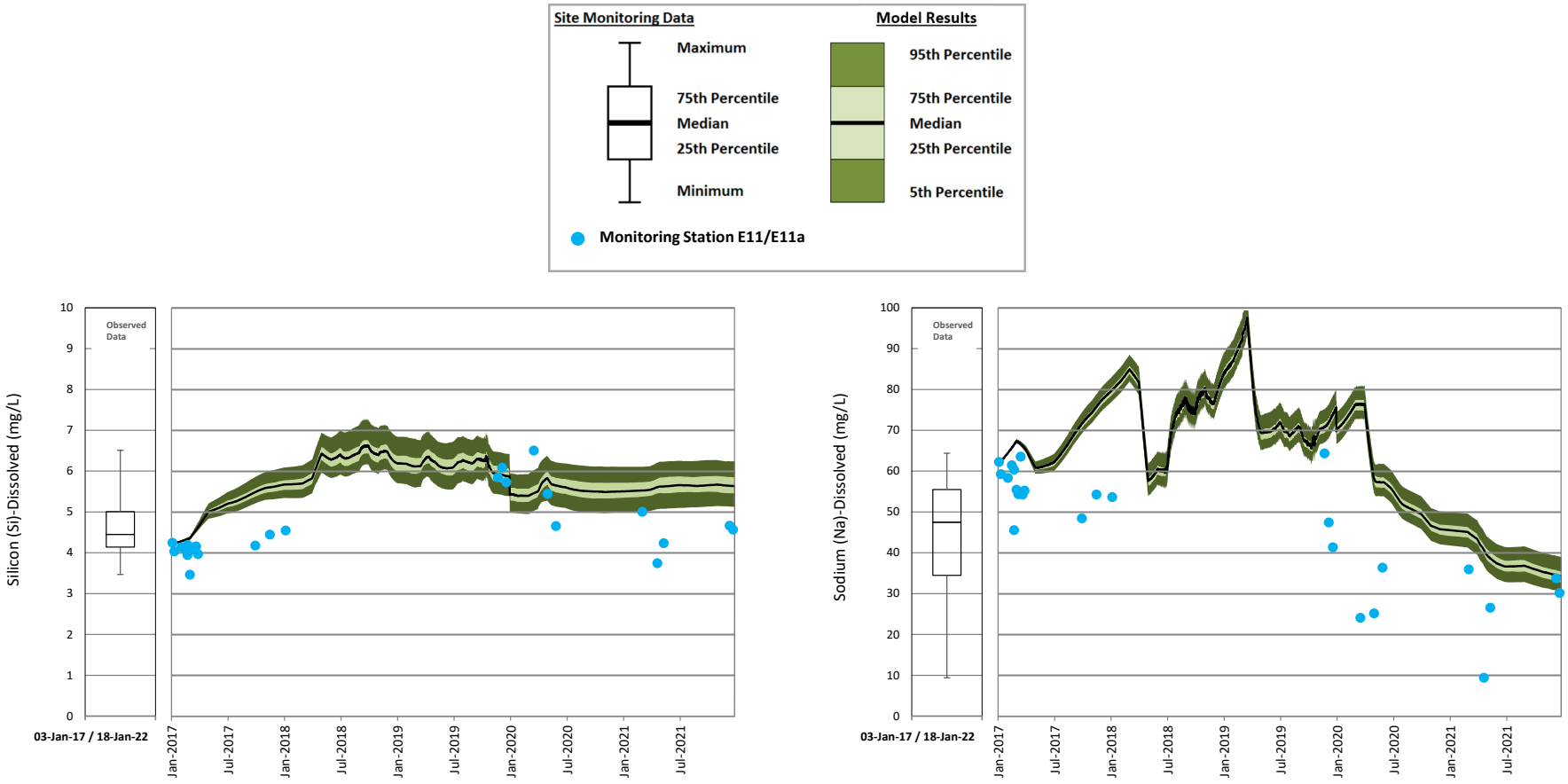

Figure 4: Springer Pit Calibration – Silicon and Sodium

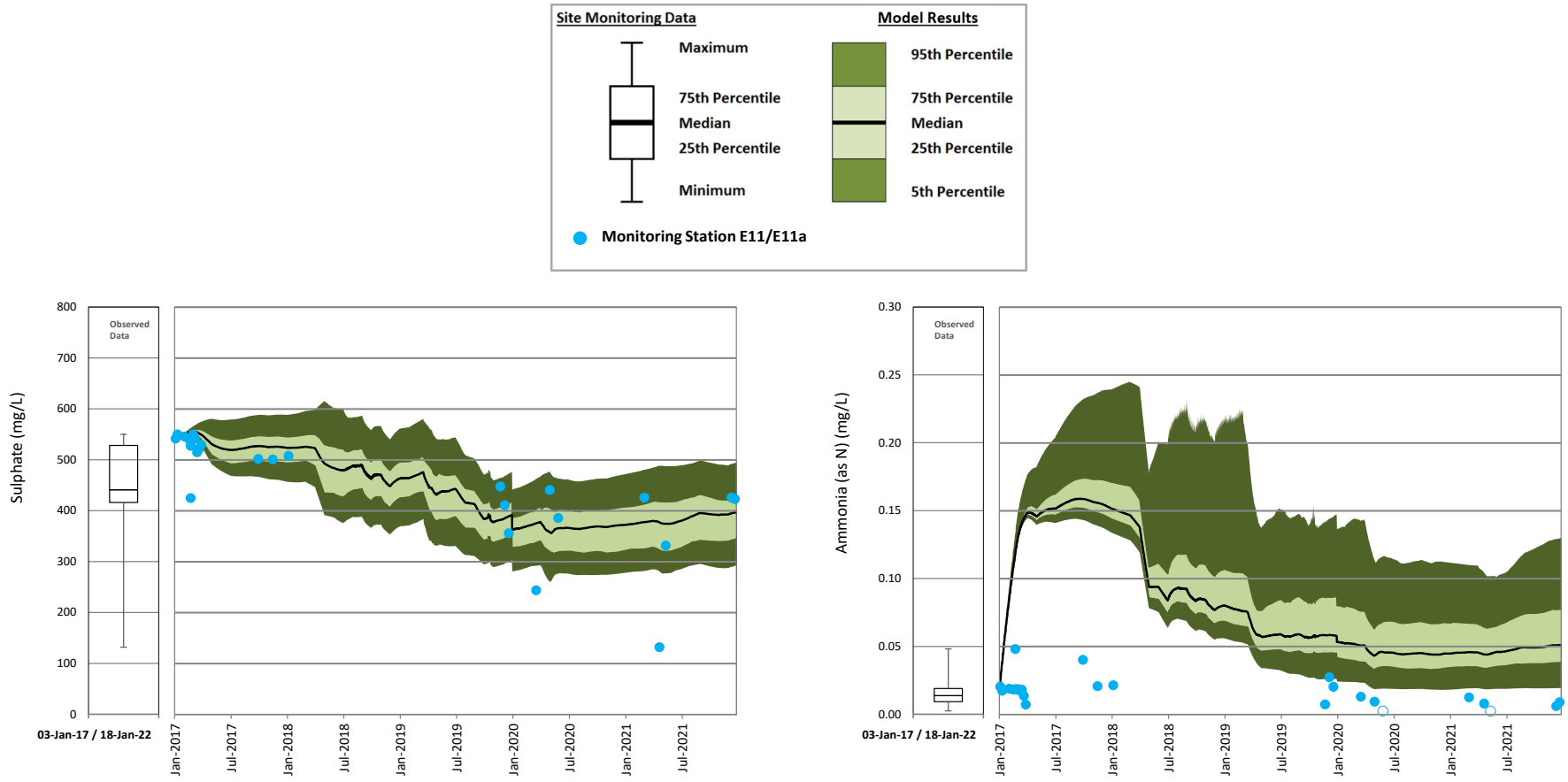

Figure 5: Springer Pit Calibration – Sulphate and Total Ammonia

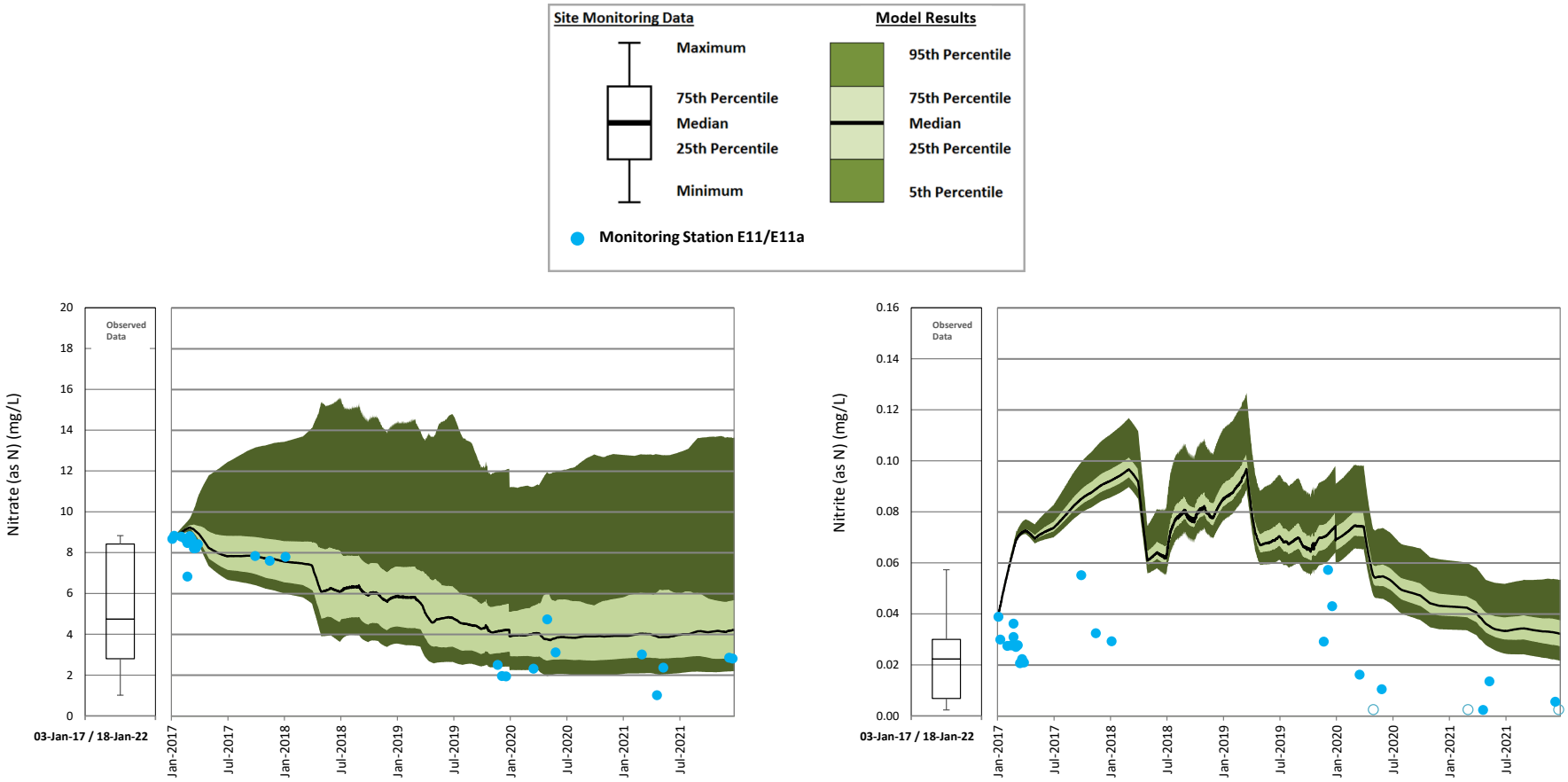

Figure 6: Springer Pit Calibration – Nitrate and Nitrite

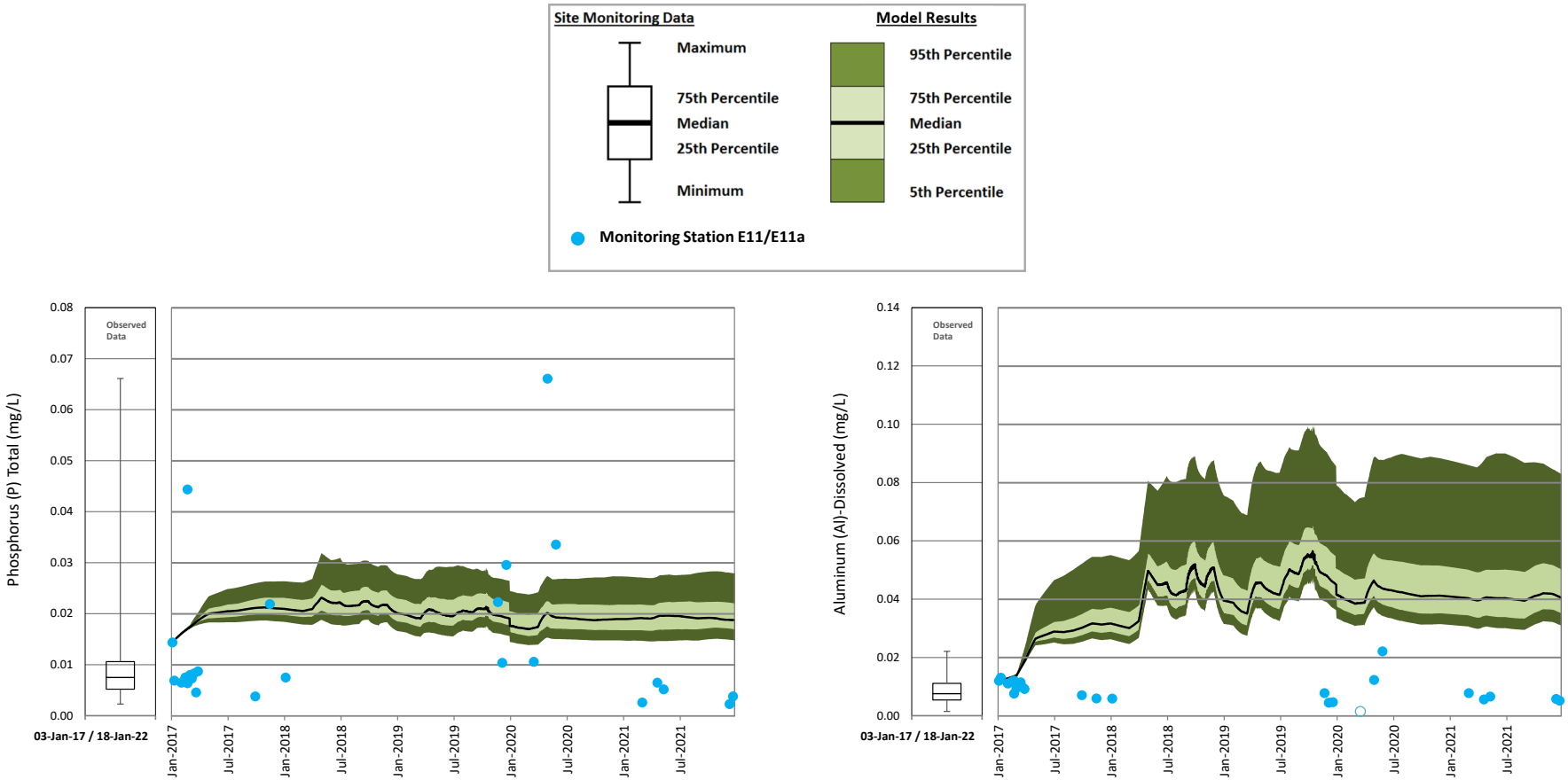

Figure 7: Springer Pit Calibration – Total Phosphorus and Dissolved Aluminum

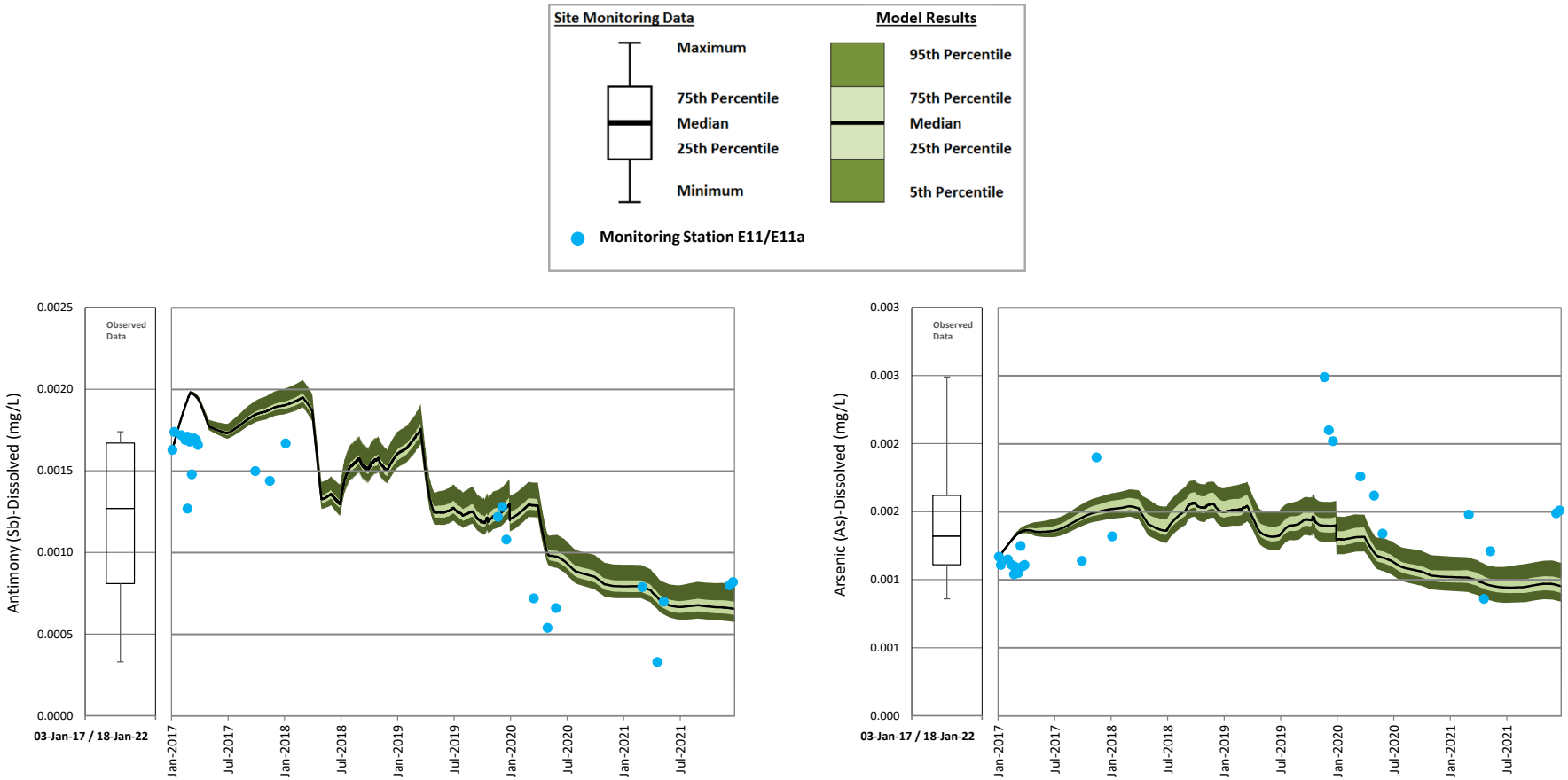

Figure 8: Springer Pit Calibration – Dissolved Antimony and Dissolved Arsenic

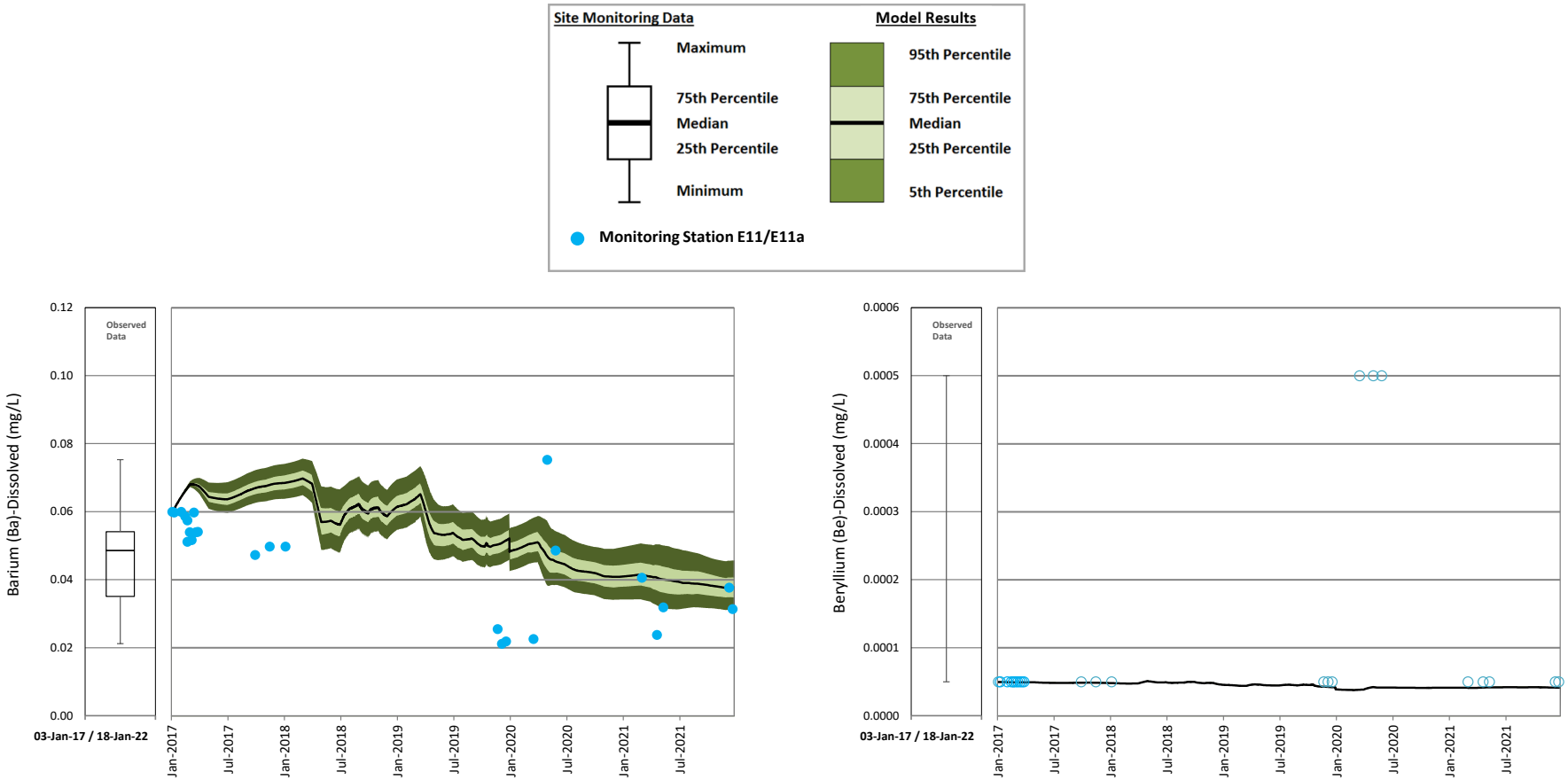

Figure 9: Springer Pit Calibration – Dissolved Barium and Dissolved Beryllium

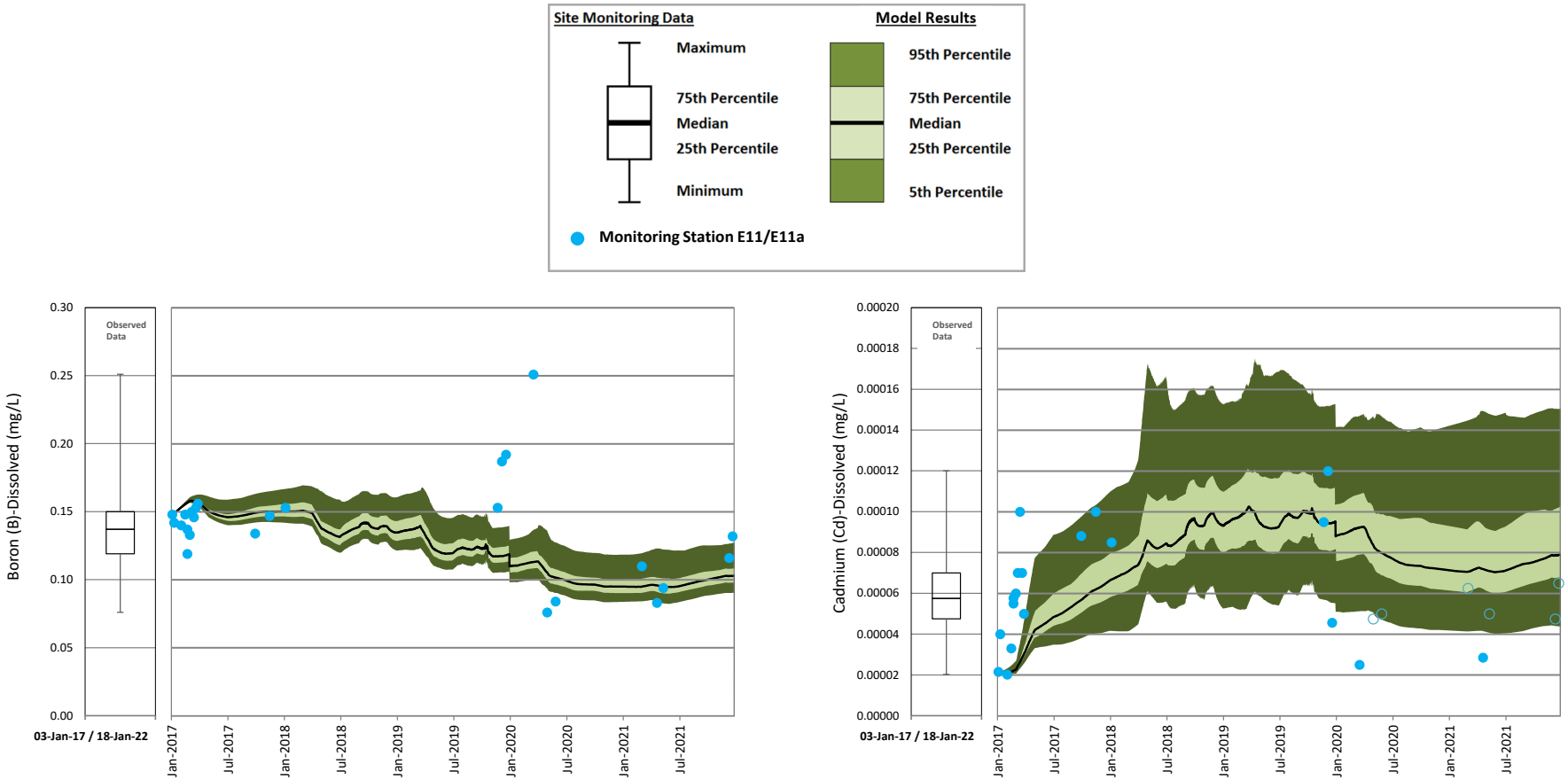

Figure 10: Springer Pit Calibration – Dissolved Boron and Dissolved Cadmium

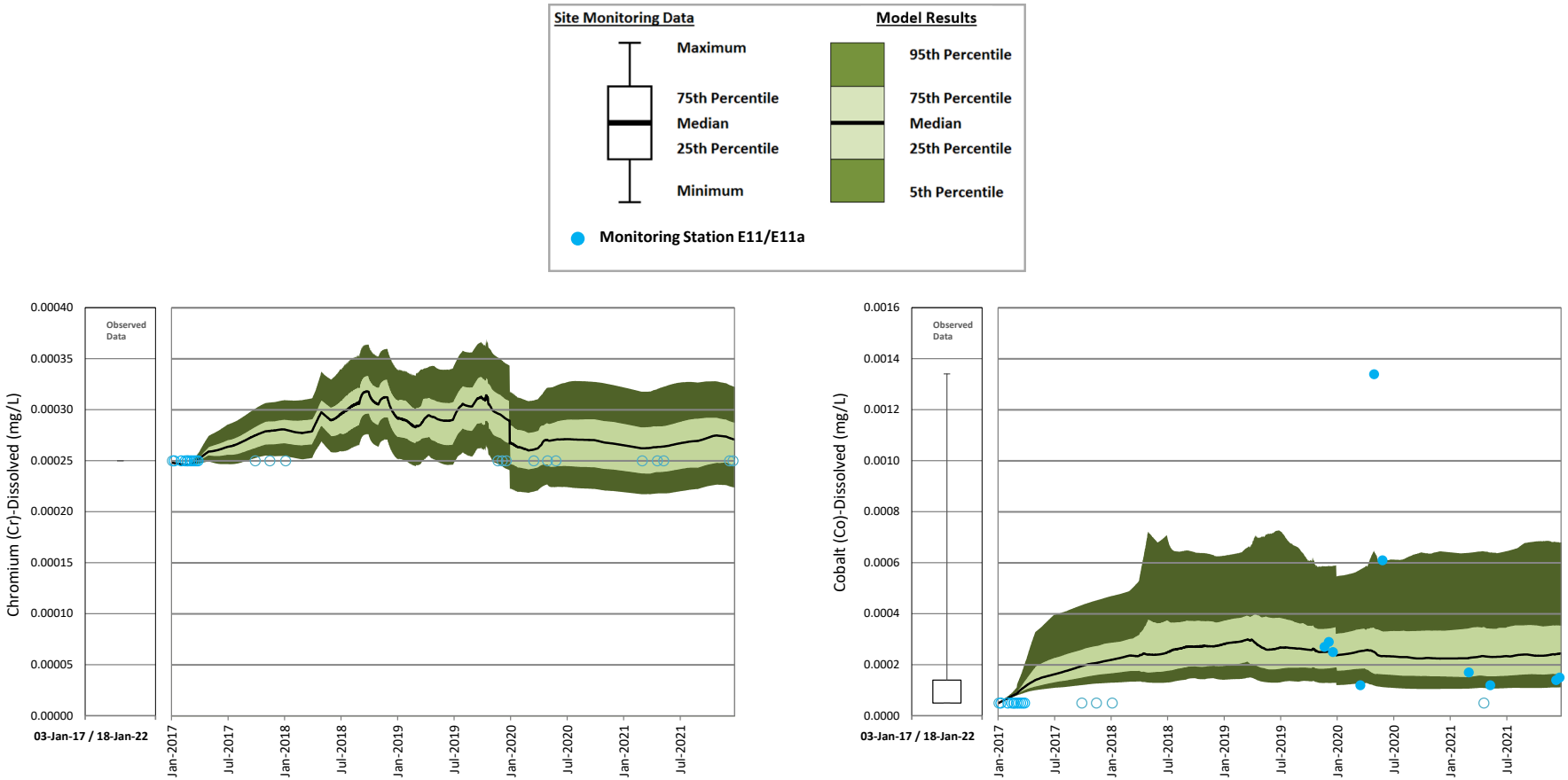

Figure 11: Springer Pit Calibration – Dissolved Chromium and Dissolved Cobalt

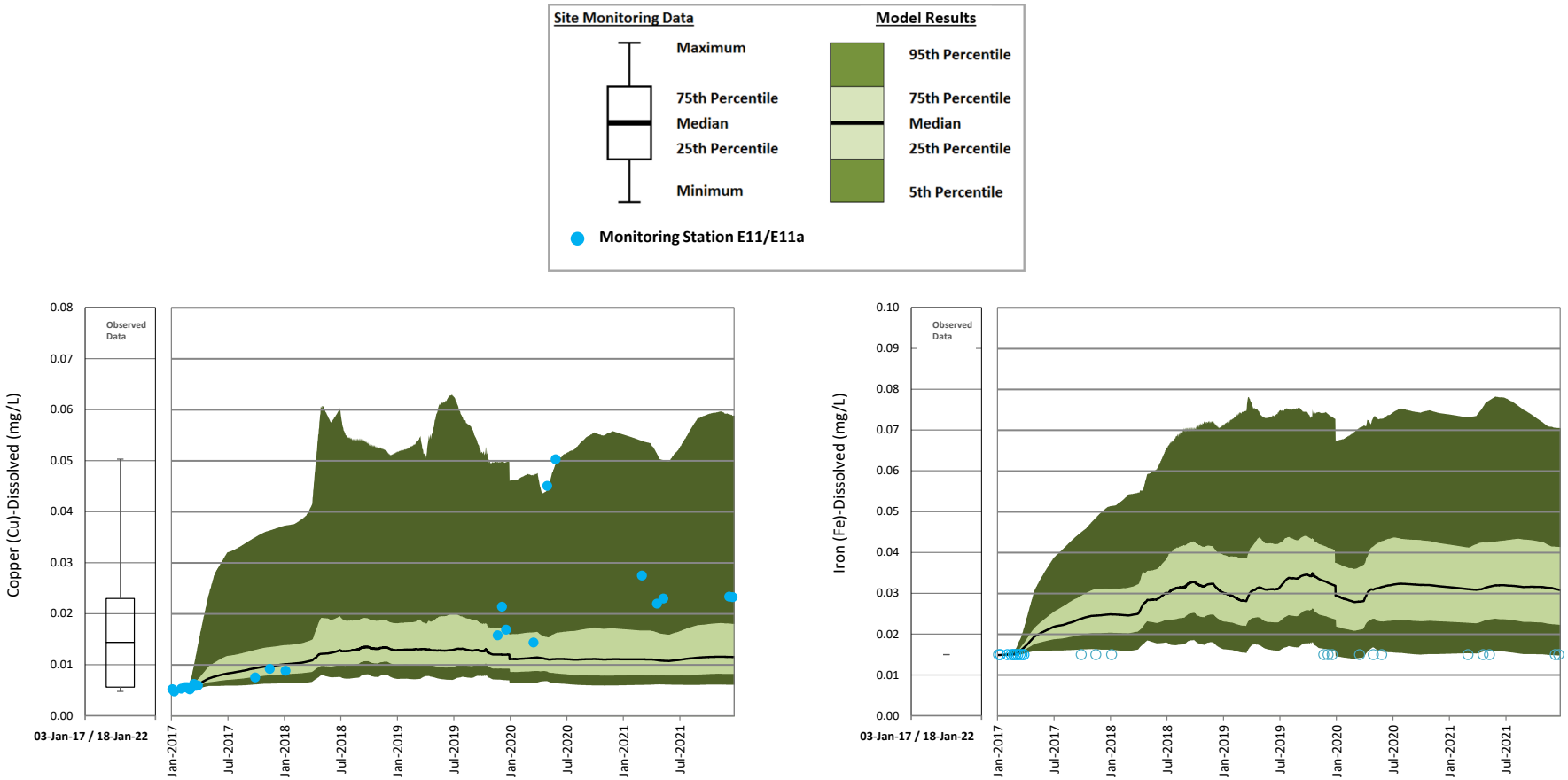

Figure 12: Springer Pit Calibration – Dissolved Copper and Dissolved Iron

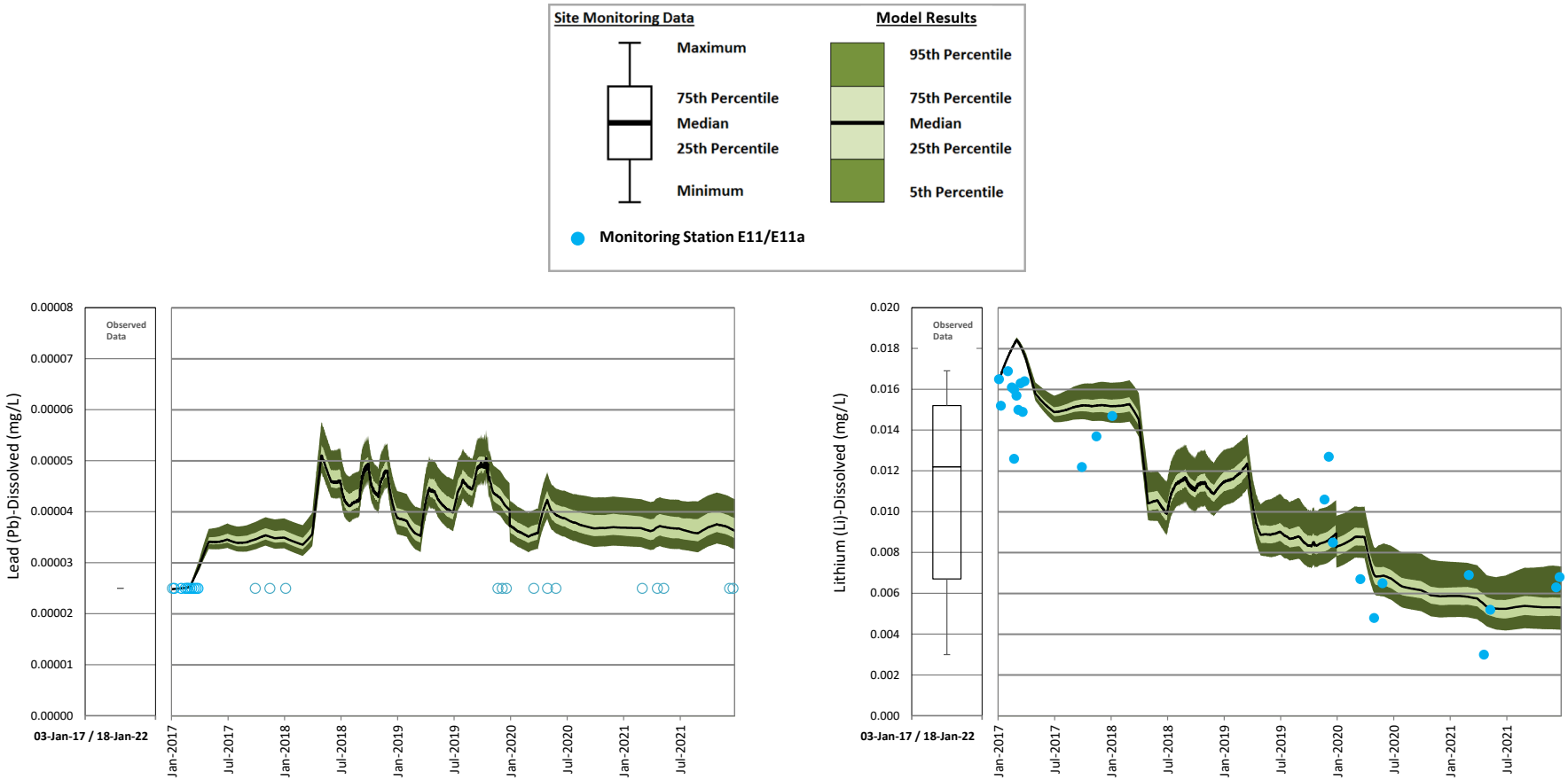

Figure 13: Springer Pit Calibration – Dissolved Lead and Dissolved Lithium

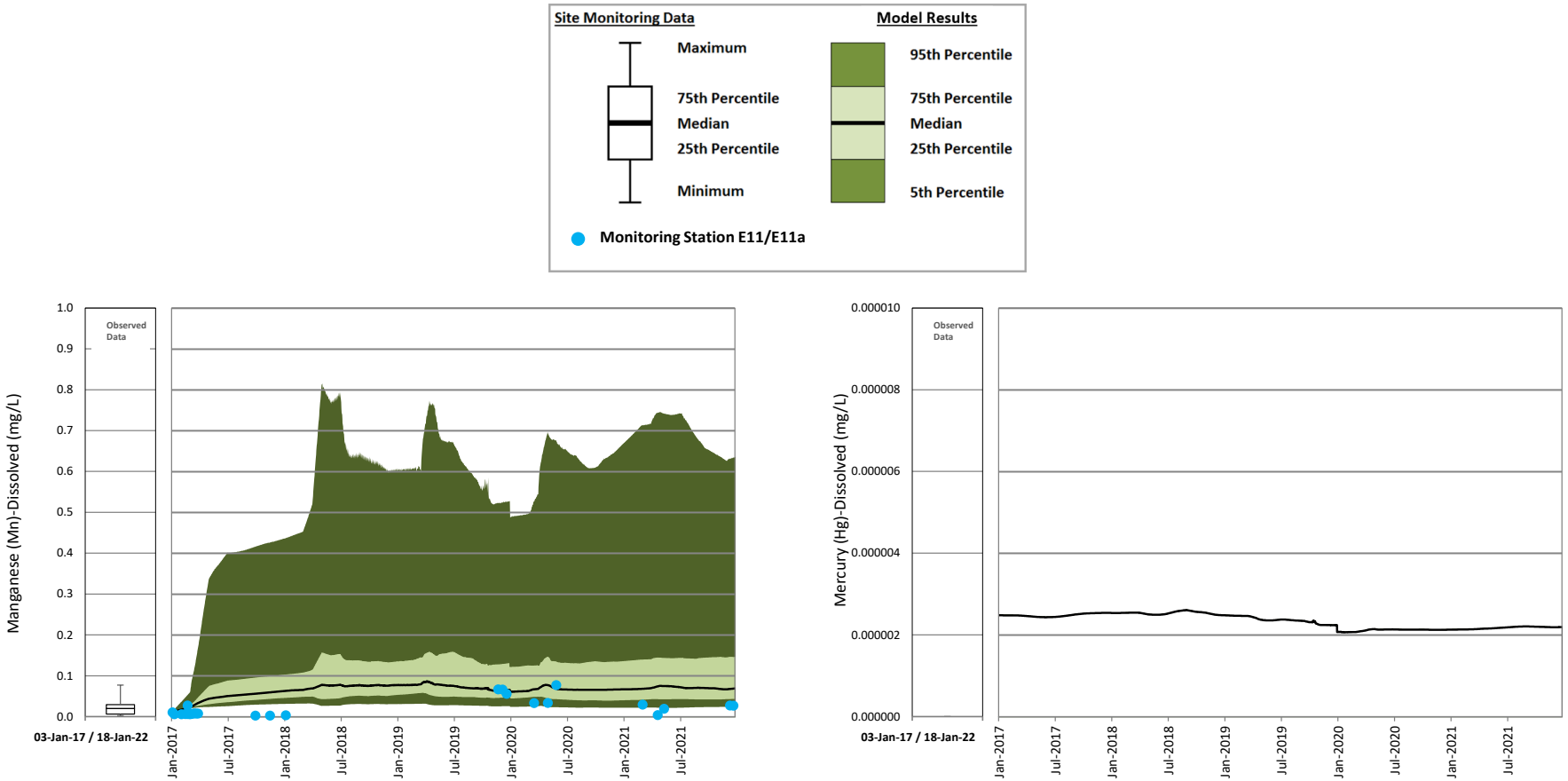

Figure 14: Springer Pit Calibration – Dissolved Manganese and Dissolved Mercury

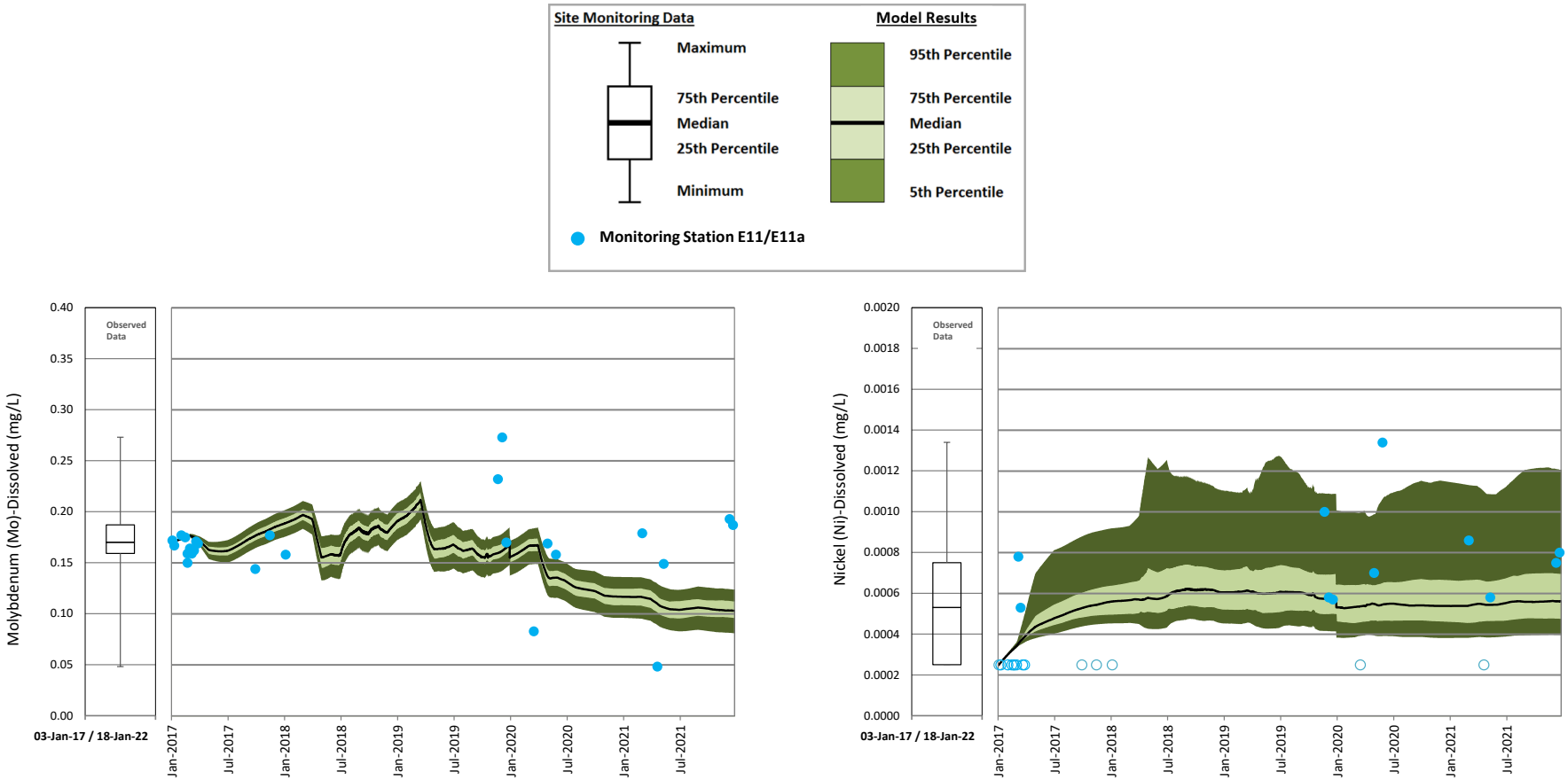

Figure 15: Springer Pit Calibration – Dissolved Molybdenum and Dissolved Nickel

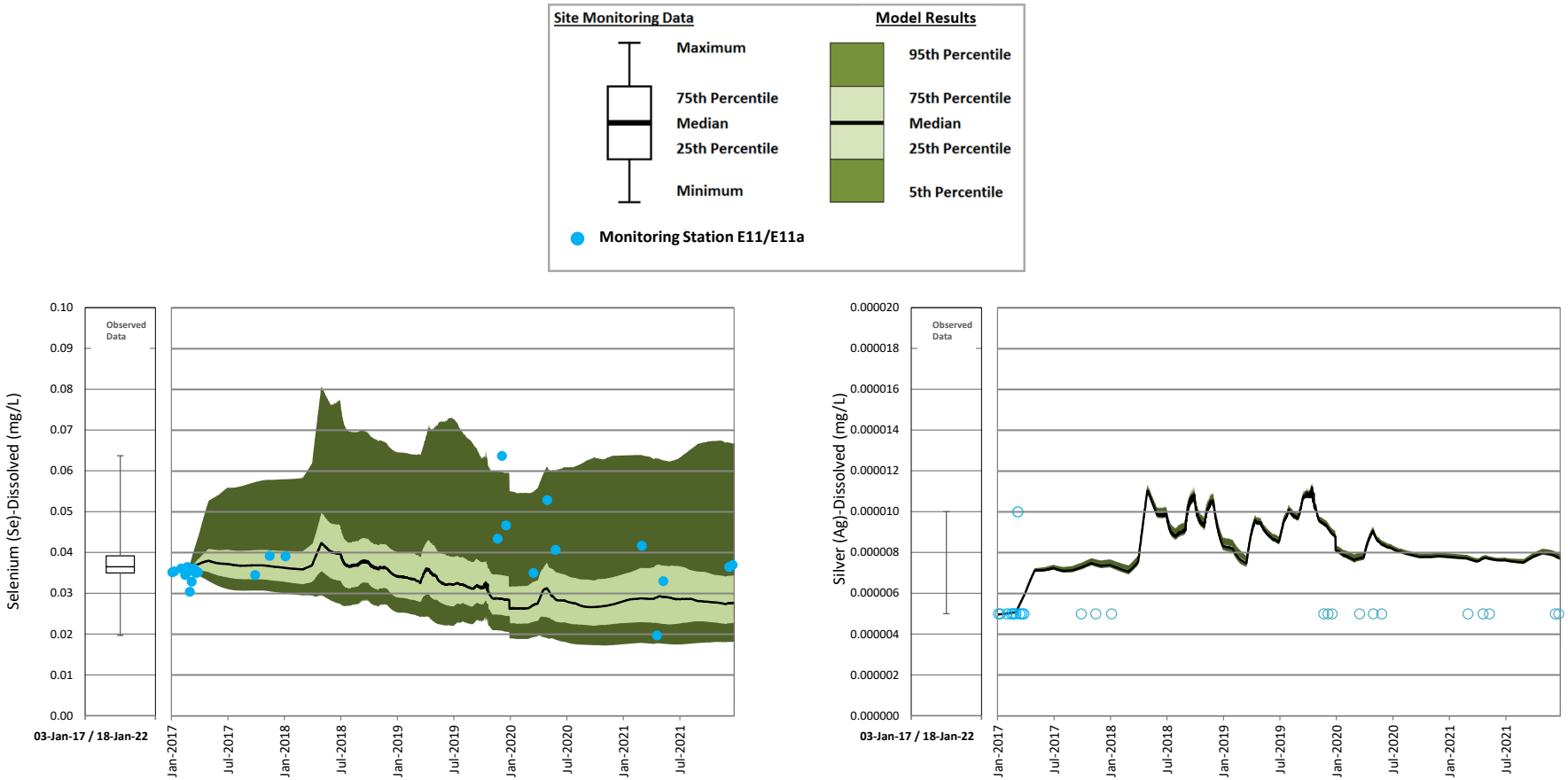

Figure 16: Springer Pit Calibration – Dissolved Selenium and Dissolved Silver

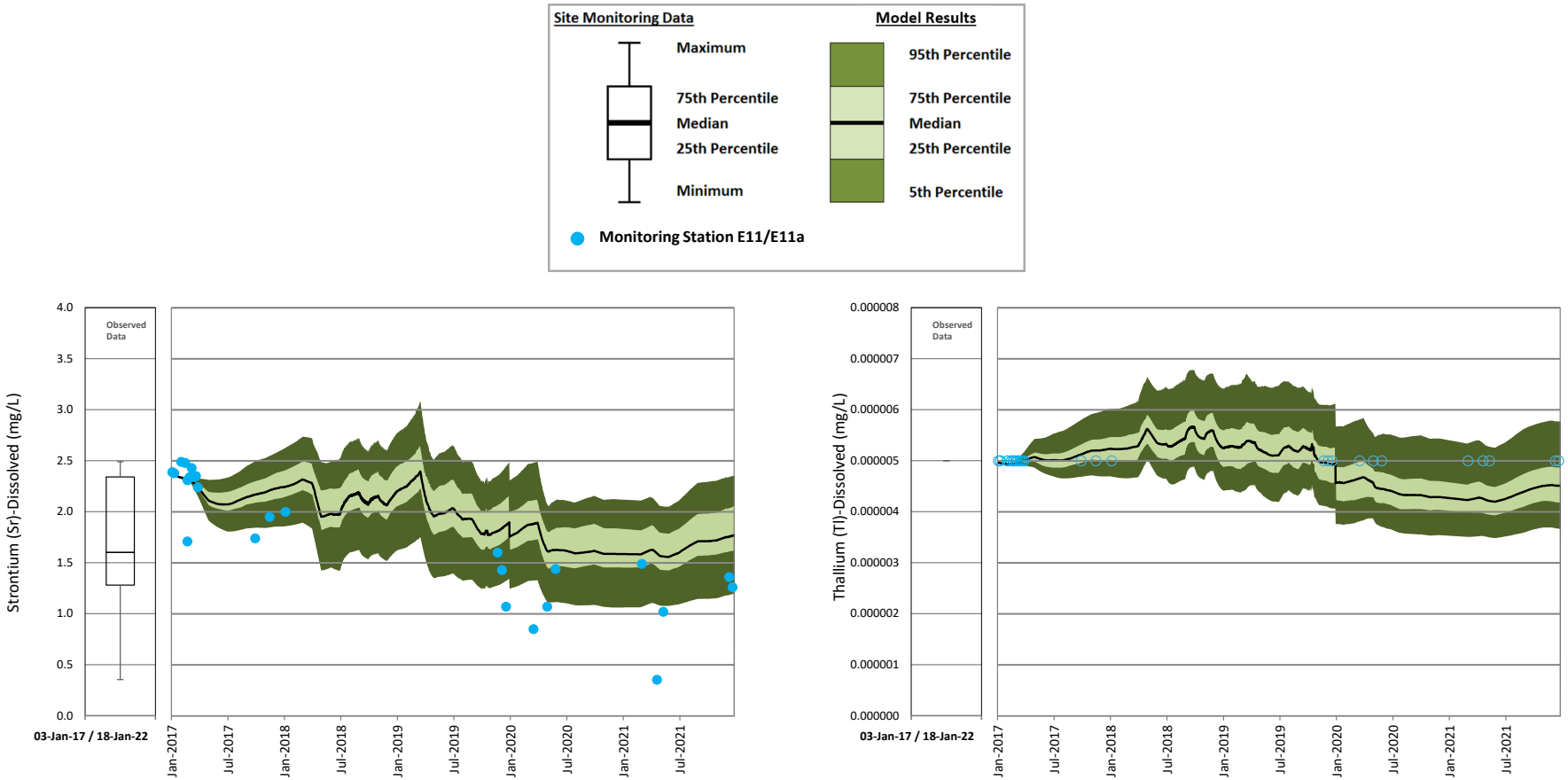

Figure 17: Springer Pit Calibration – Dissolved Strontium and Dissolved Thallium

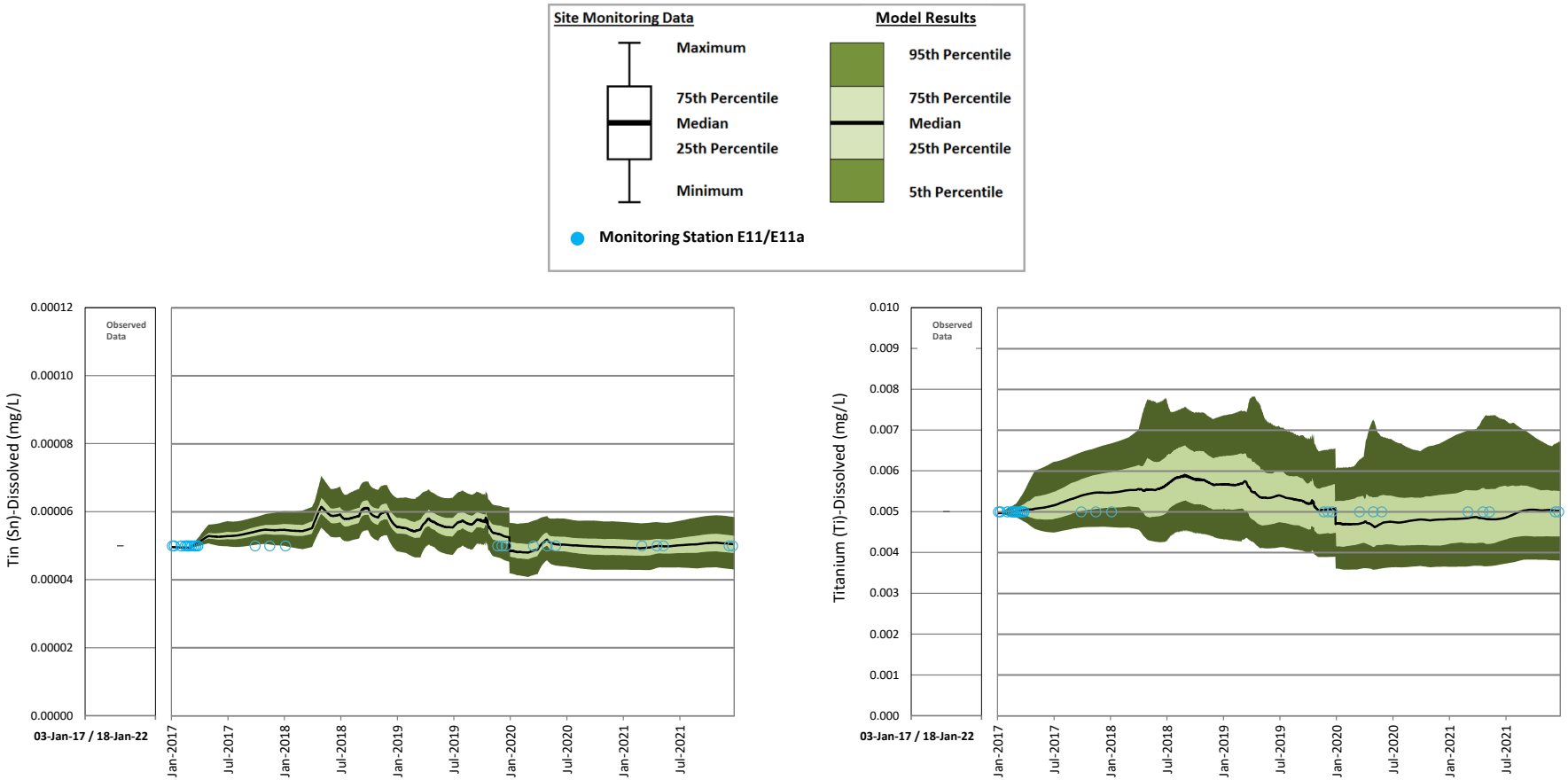

Figure 18: Springer Pit Calibration – Dissolved Tin and Dissolved Titanium

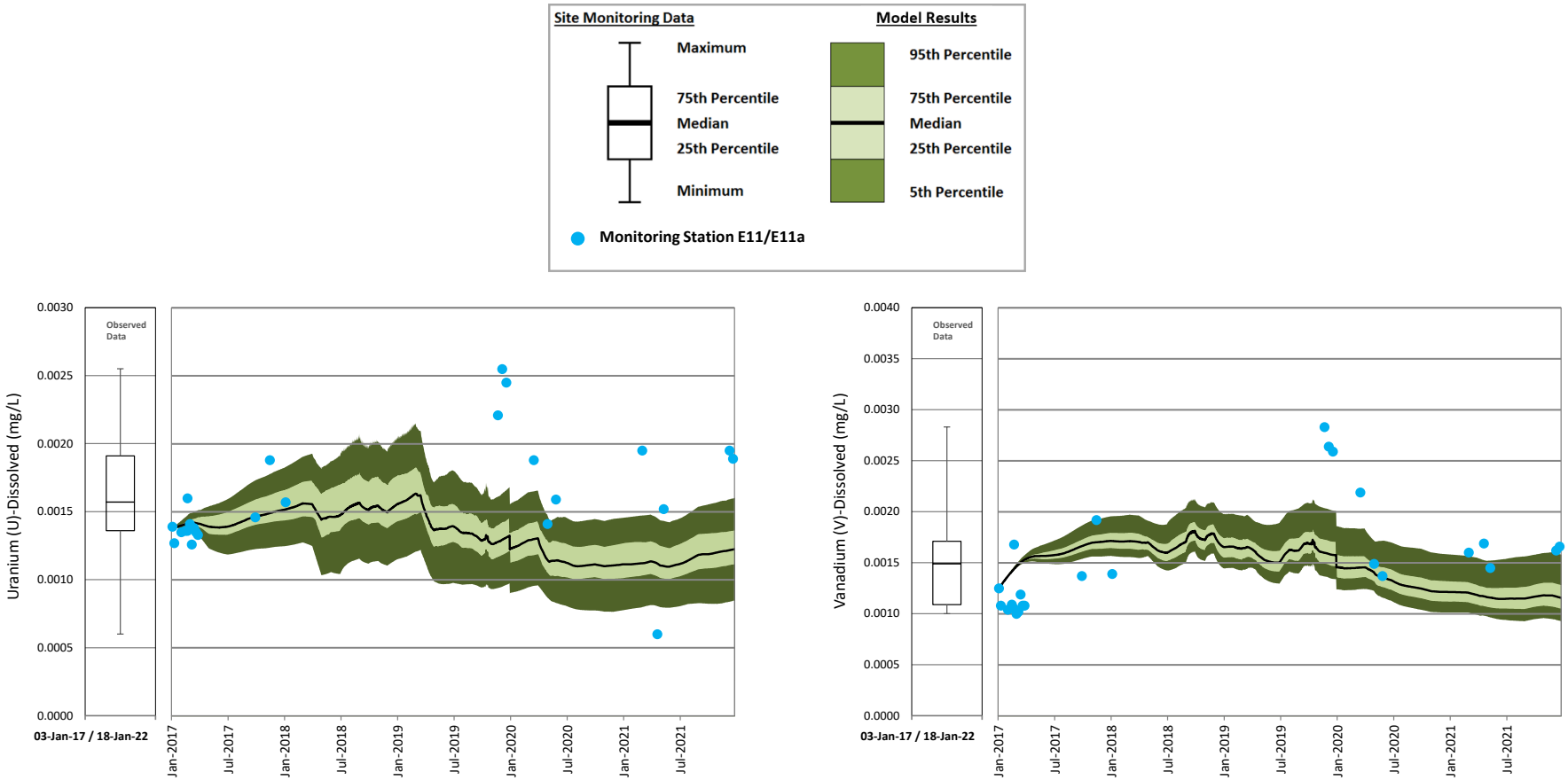

Figure 110: Springer Pit Calibration – Dissolved Uranium and Dissolved Vanadium

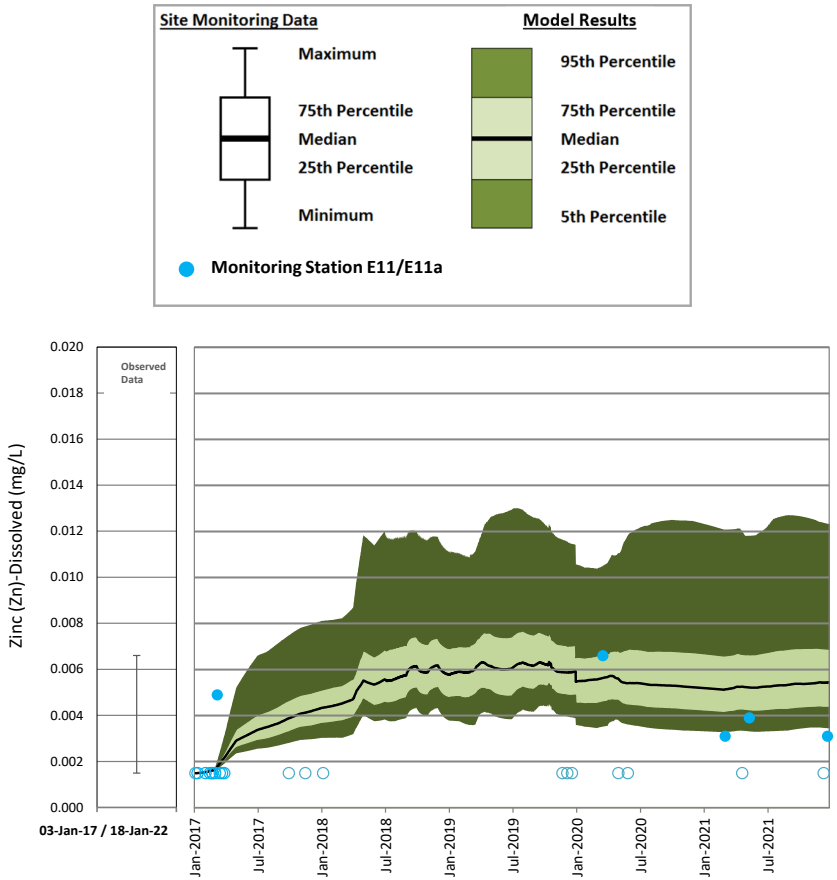

Figure 20: Springer Pit Calibration – Dissolved Zinc

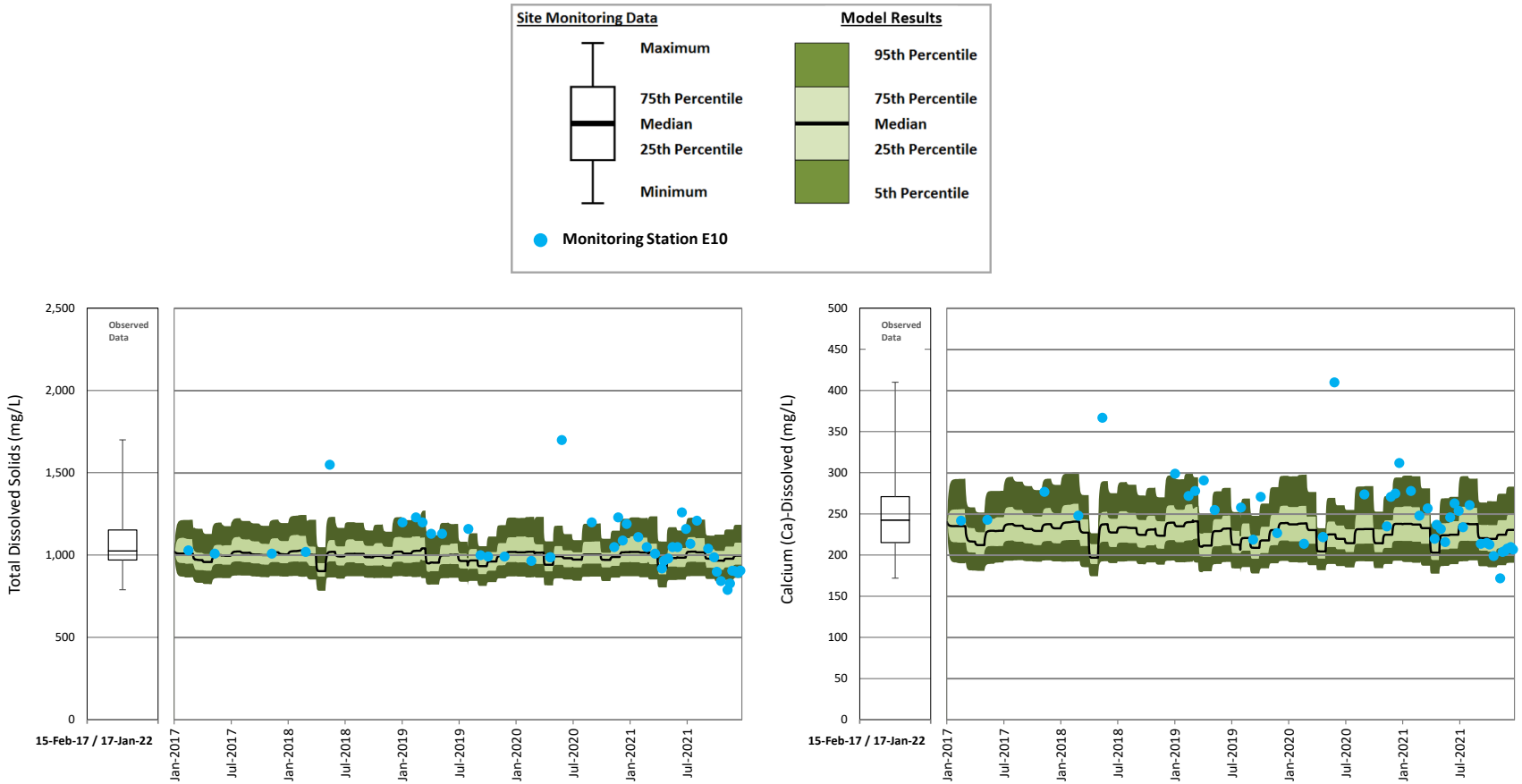

Figure 211: Wight Pit Calibration – Total Dissolved Solids and Calcium

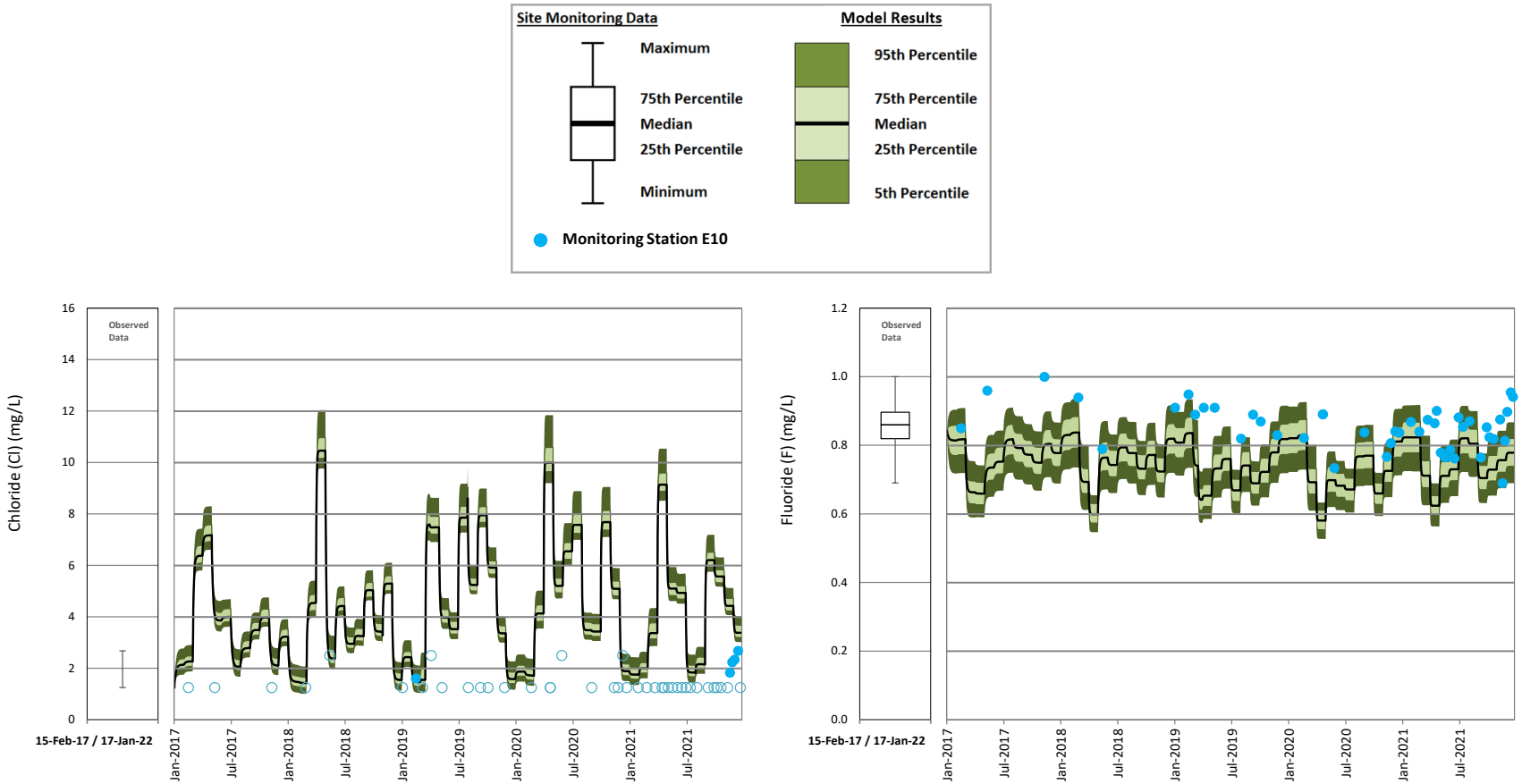

Figure 122: Wight Pit Calibration – Chloride and Fluoride

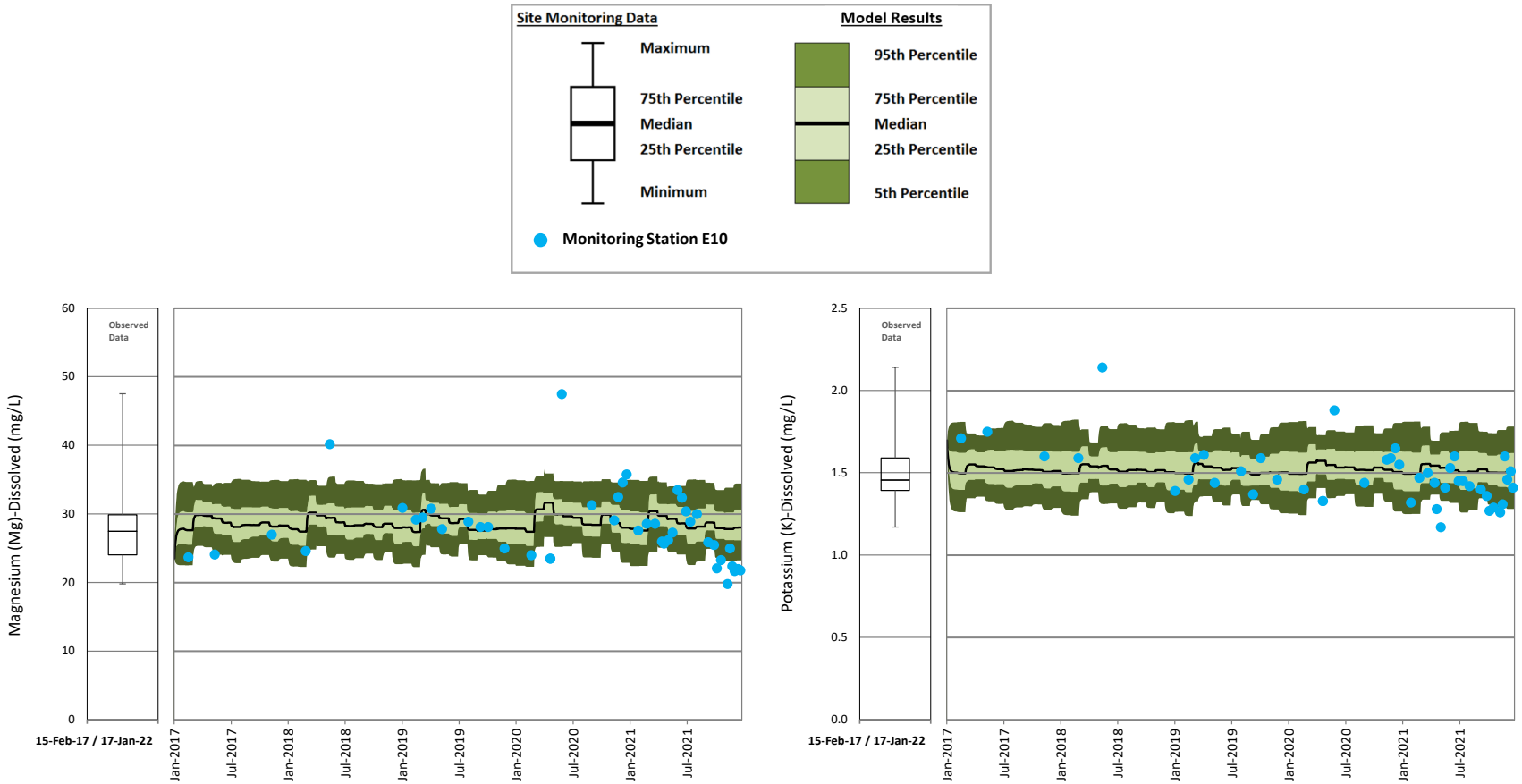

Figure 213: Wight Pit Calibration – Magnesium and Potassium

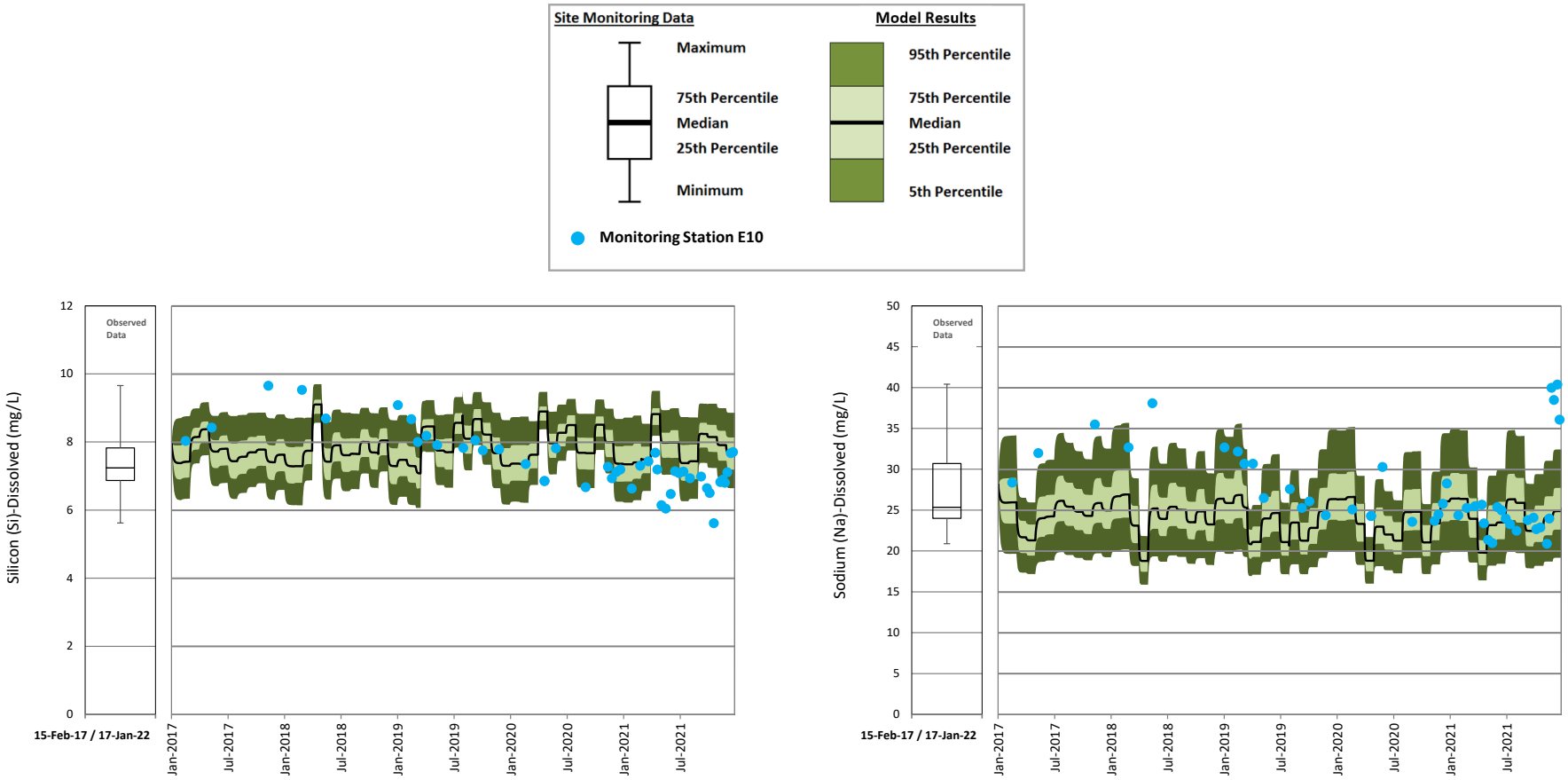

Figure 214: Wight Pit Calibration – Silicon and Sodium

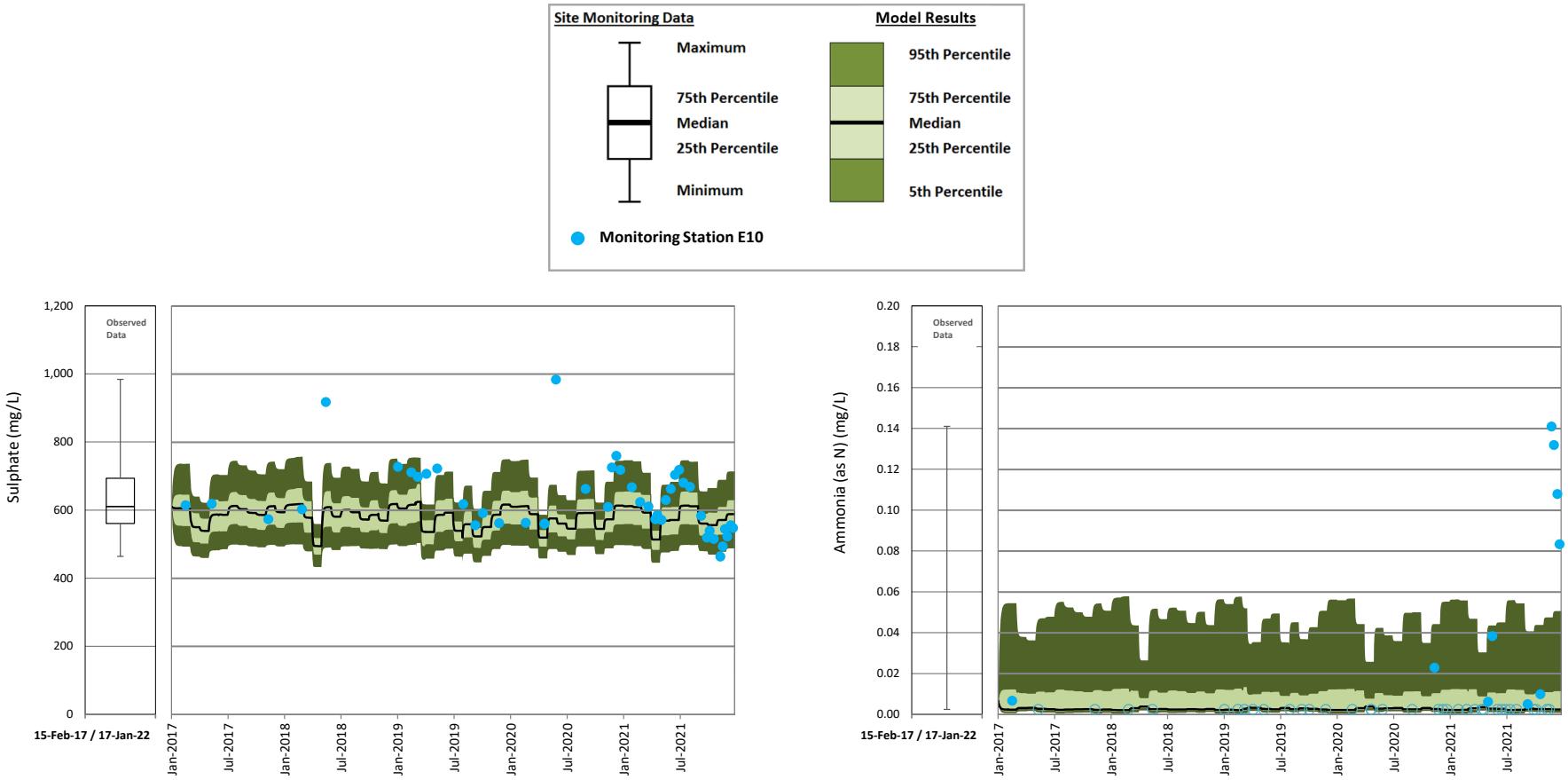

Figure 215: Wight Pit Calibration – Sulphate and Total Ammonia

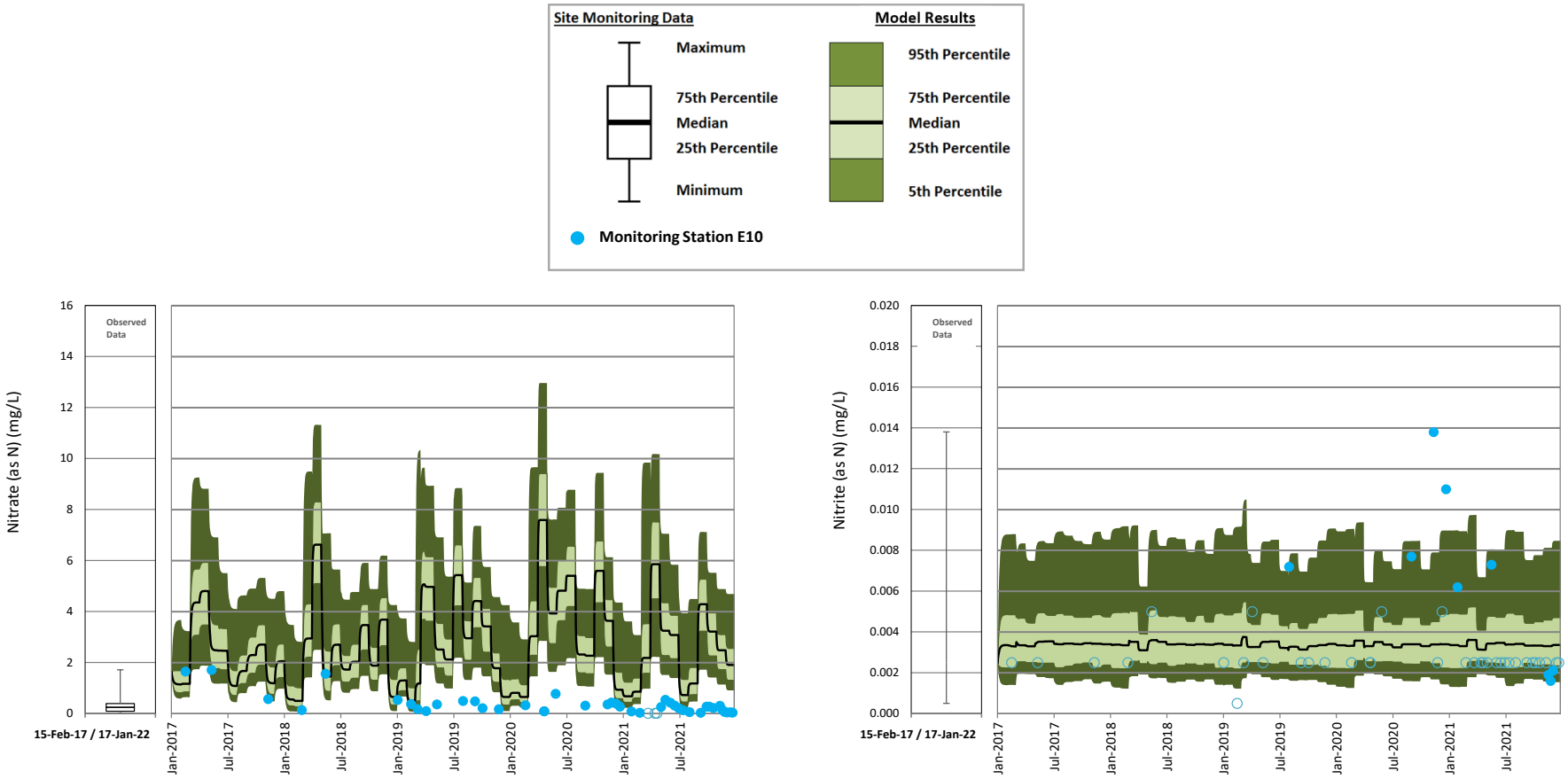

Figure 216: Wight Pit Calibration – Nitrate and Nitrite

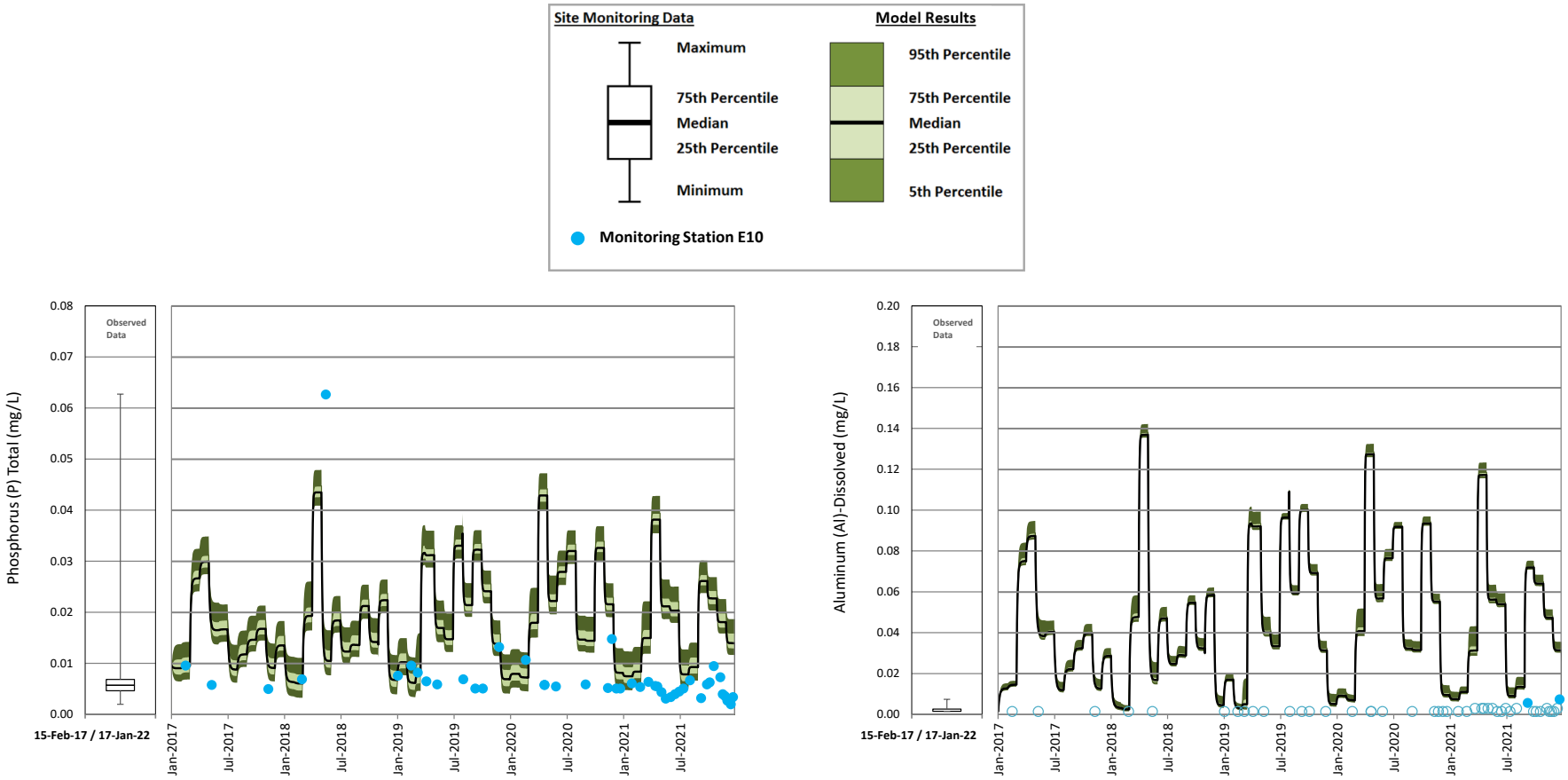

Figure 217: Wight Pit Calibration – Total Phosphorus and Dissolved Aluminum

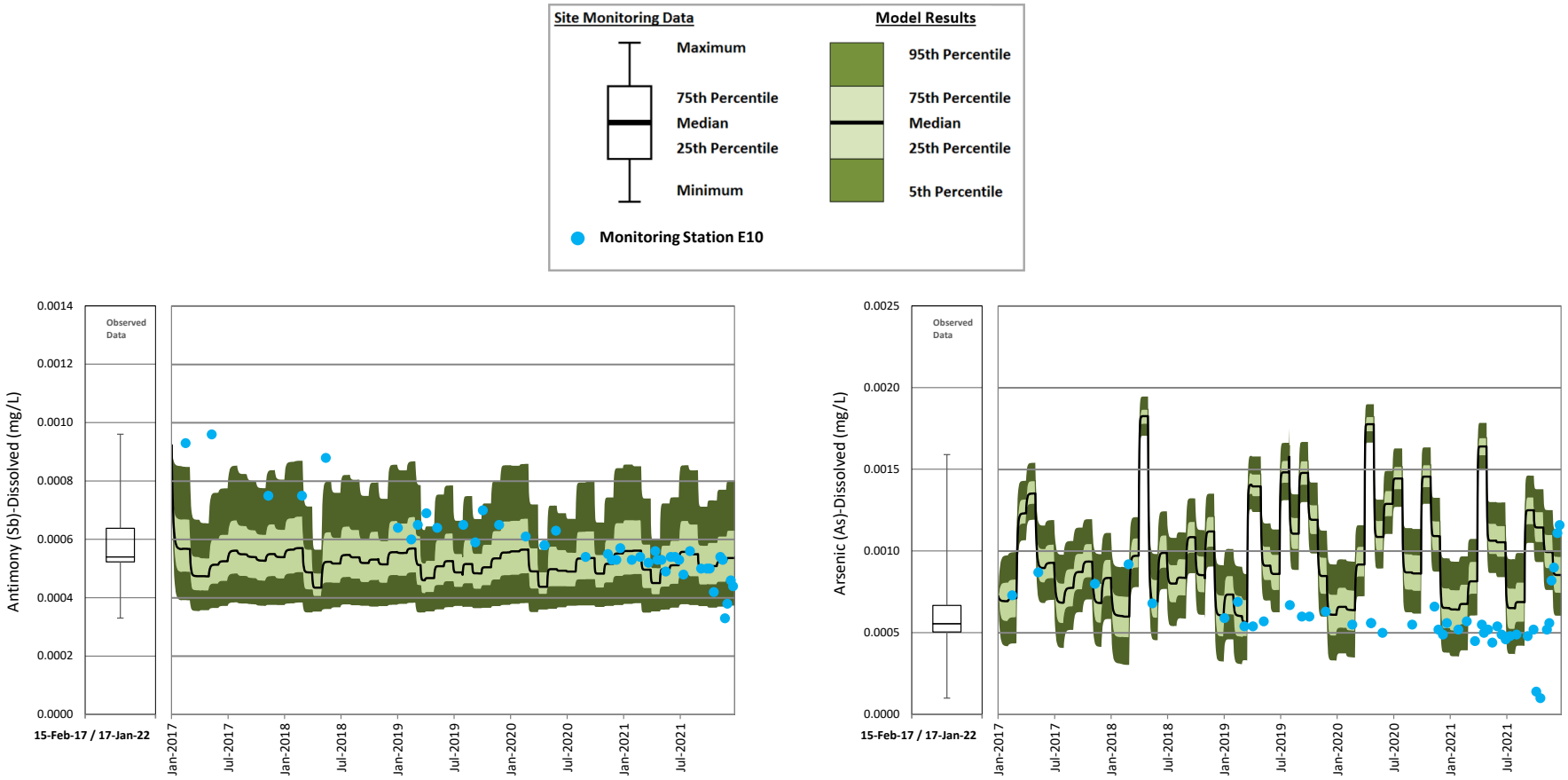

Figure 218: Wight Pit Calibration – Dissolved Antimony and Dissolved Arsenic

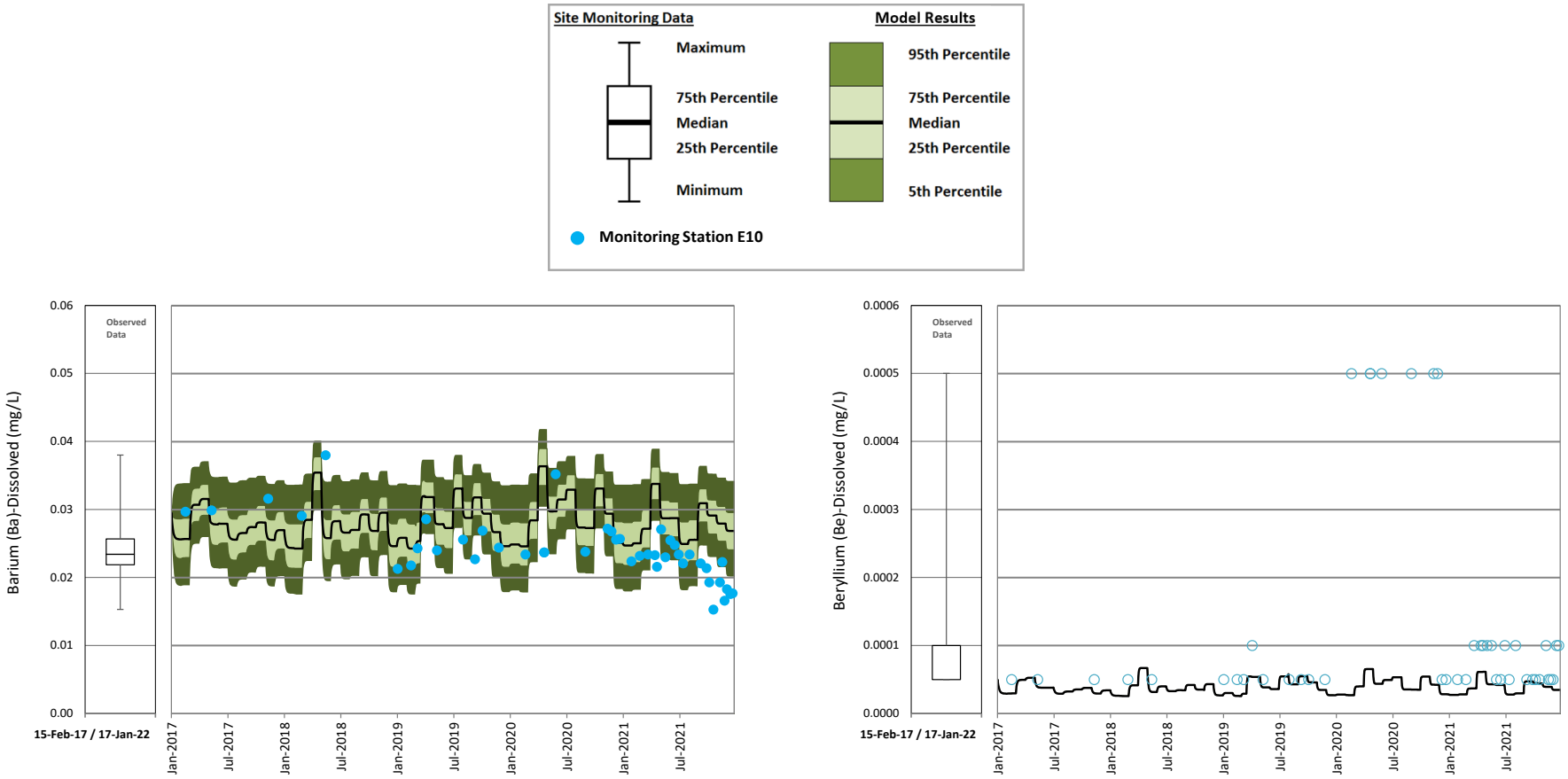

Figure 219: Wight Pit Calibration – Dissolved Barium and Dissolved Beryllium

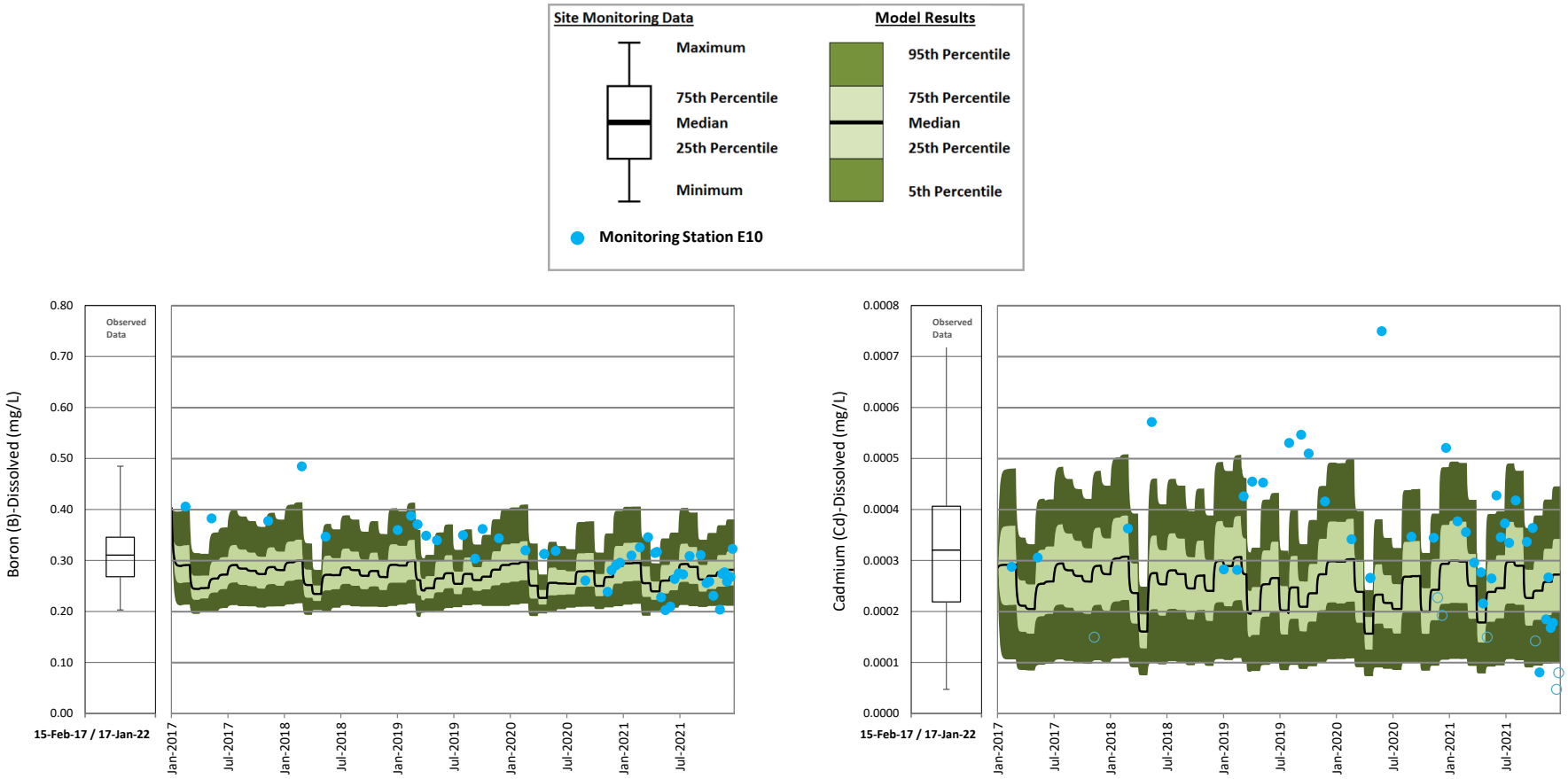

Figure 30: Wight Pit Calibration – Dissolved Boron and Dissolved Cadmium

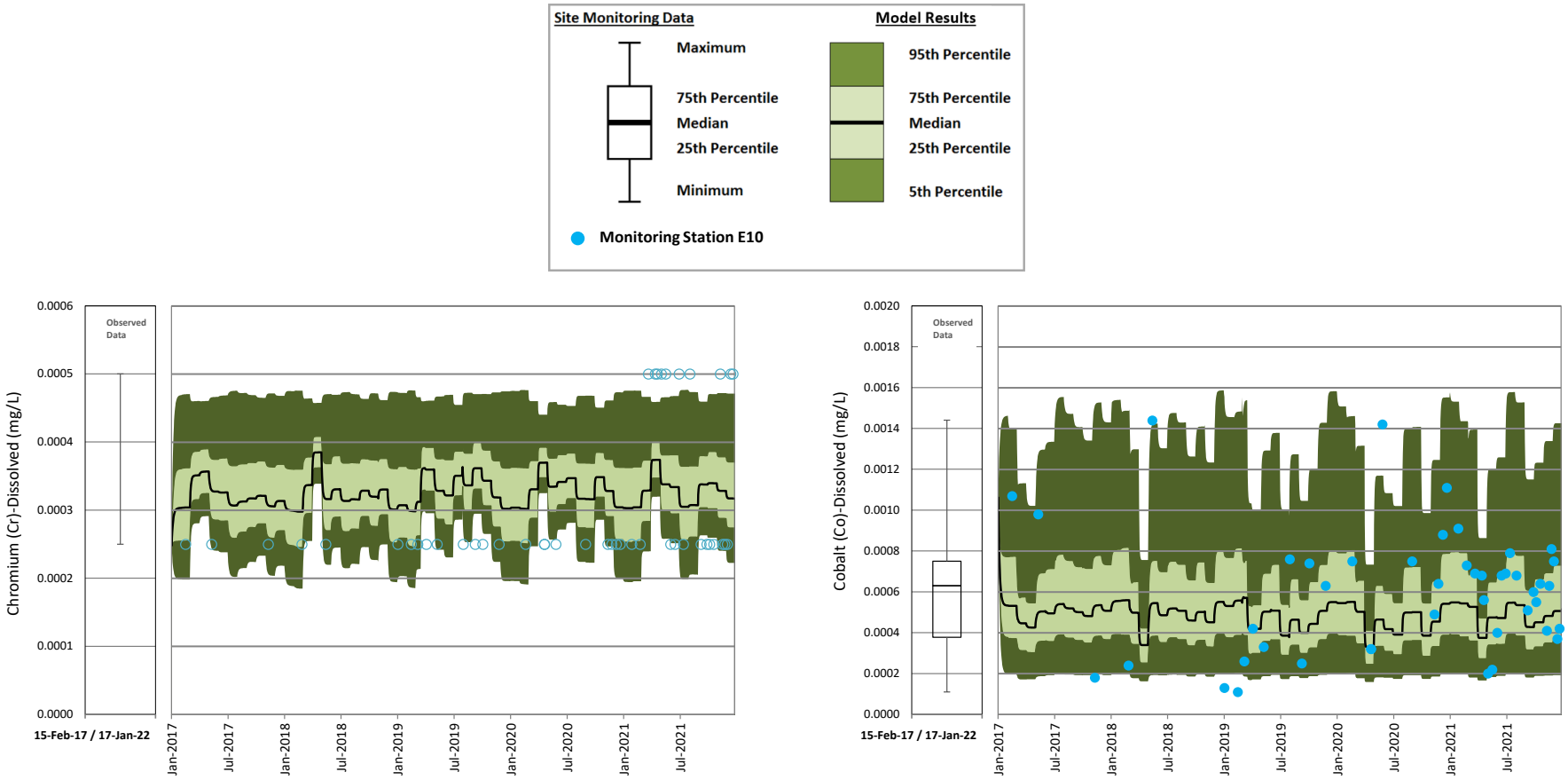

Figure 31: Wight Pit Calibration – Dissolved Chromium and Dissolved Cobalt

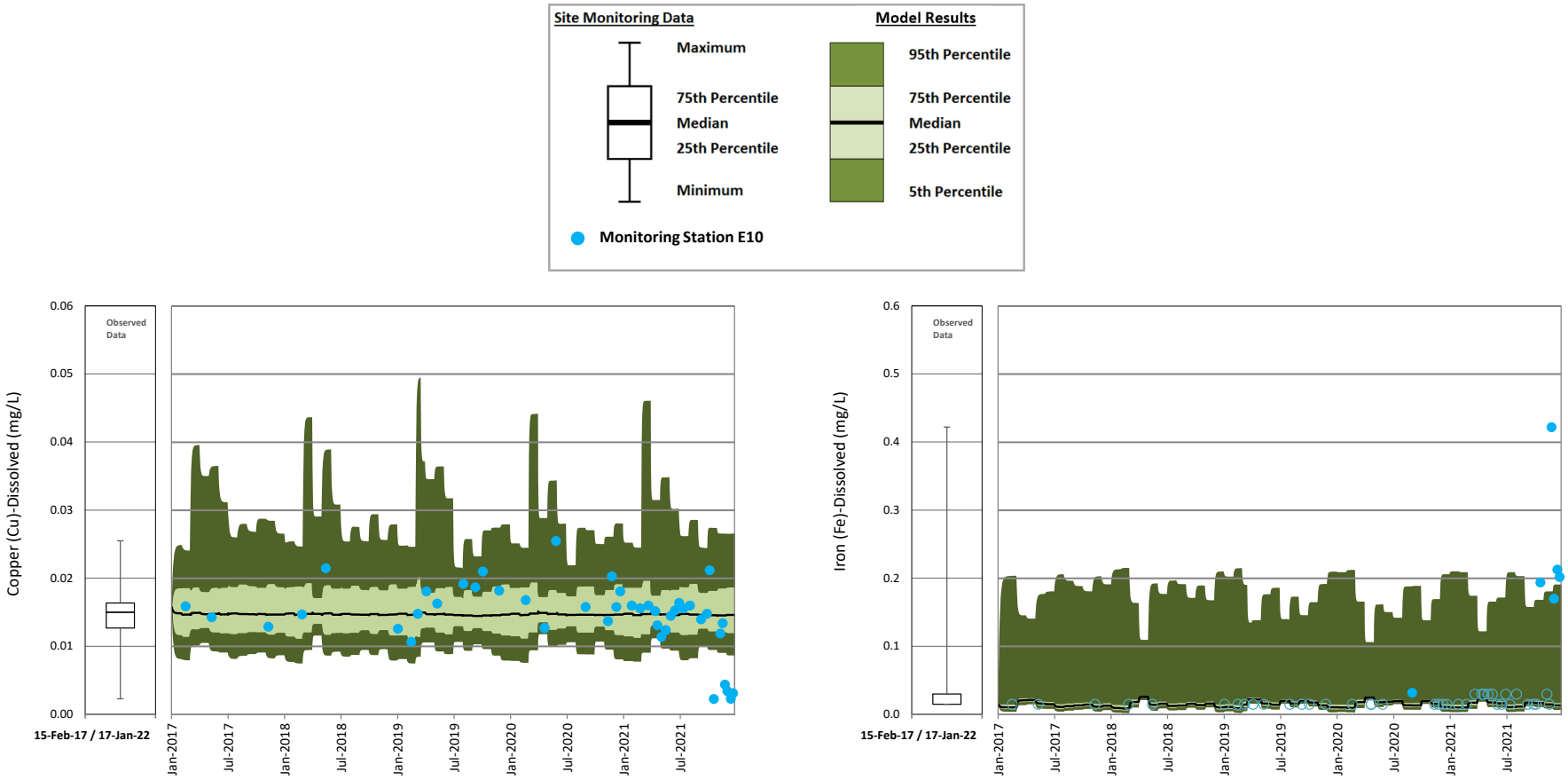

Figure 32: Wight Pit Calibration – Dissolved Copper and Dissolved Iron

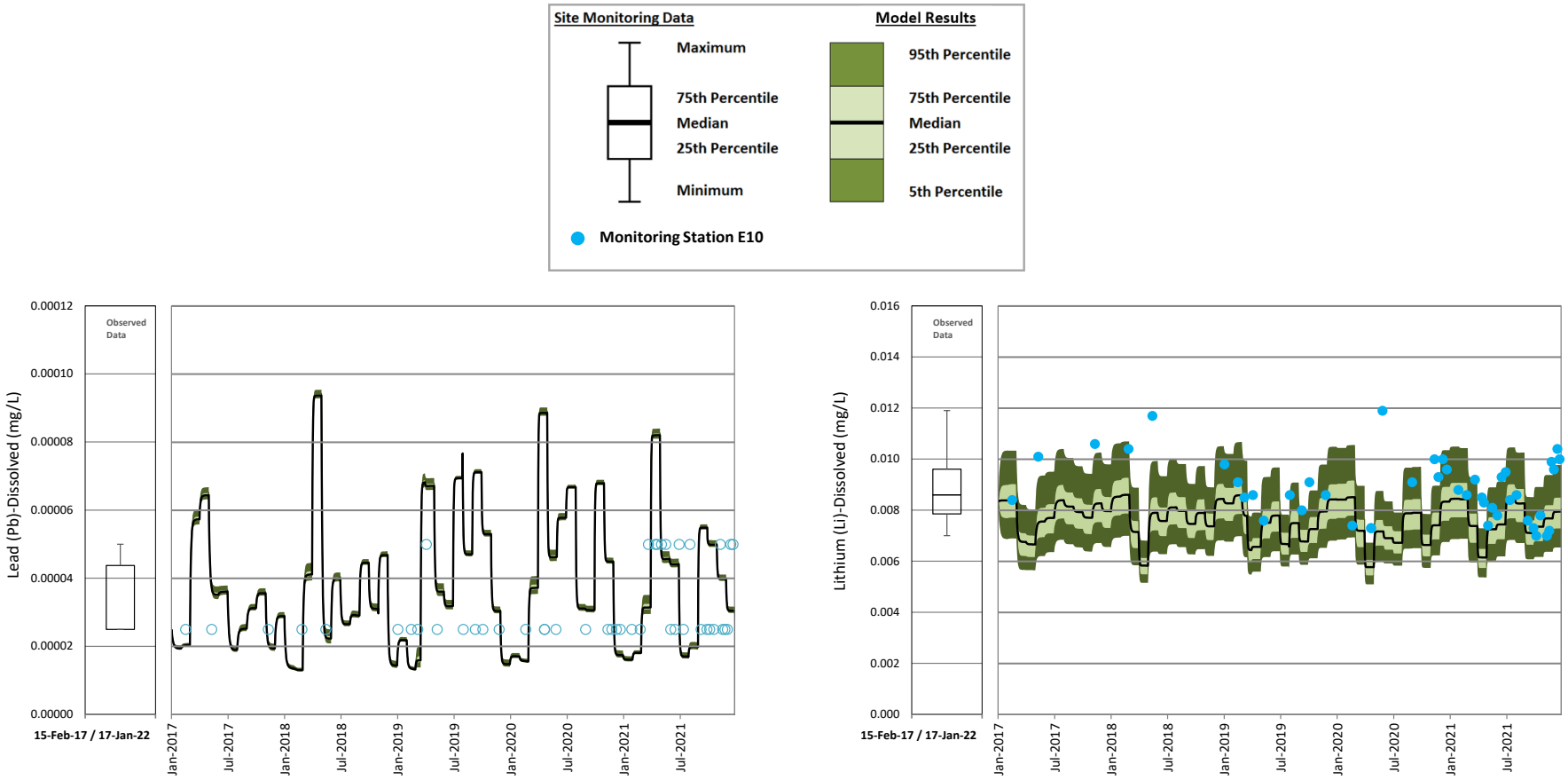

Figure 33: Wight Pit Calibration – Dissolved Lead and Dissolved Lithium

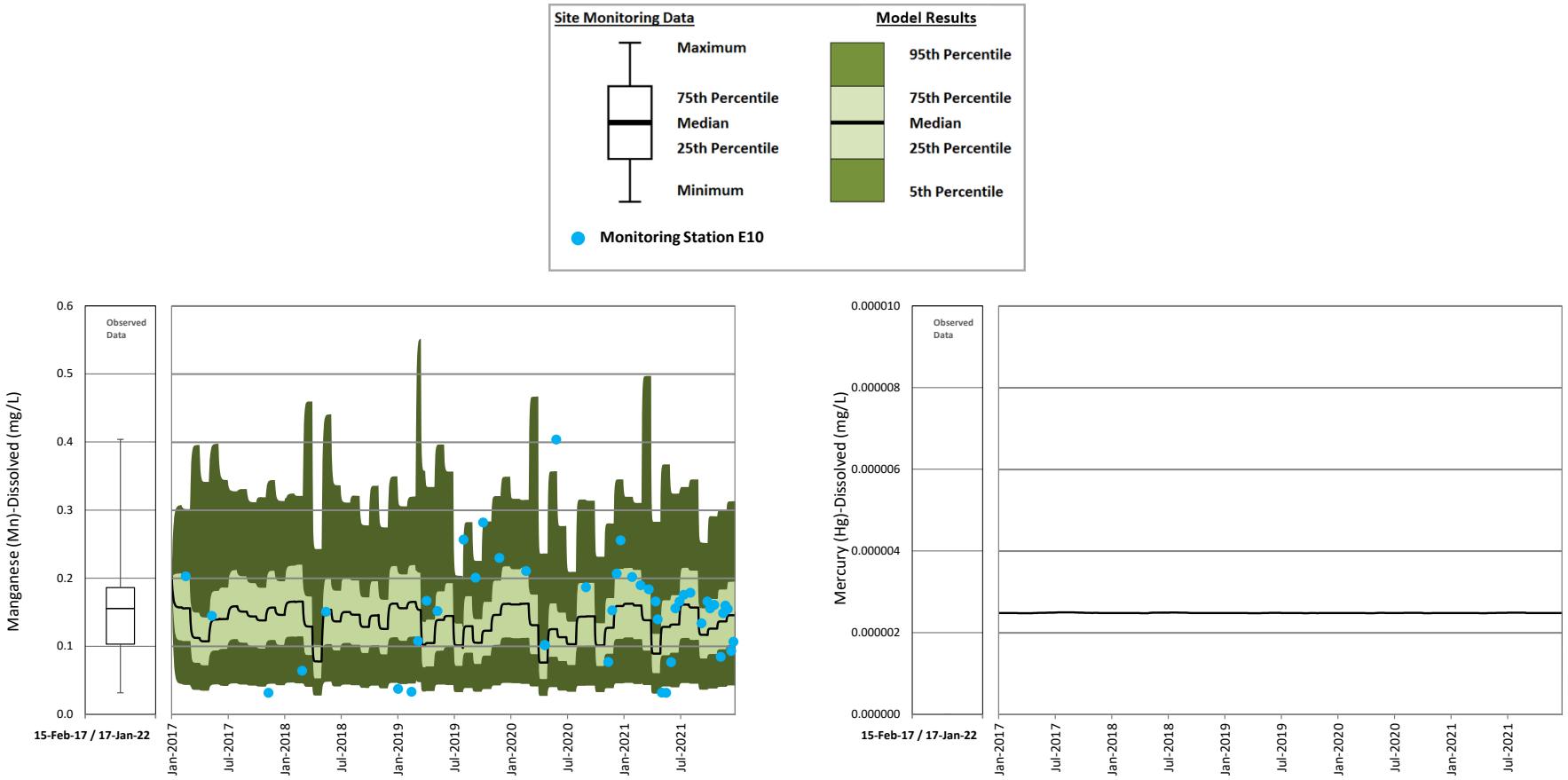

Figure 34: Wight Pit Calibration – Dissolved Manganese and Dissolved Mercury

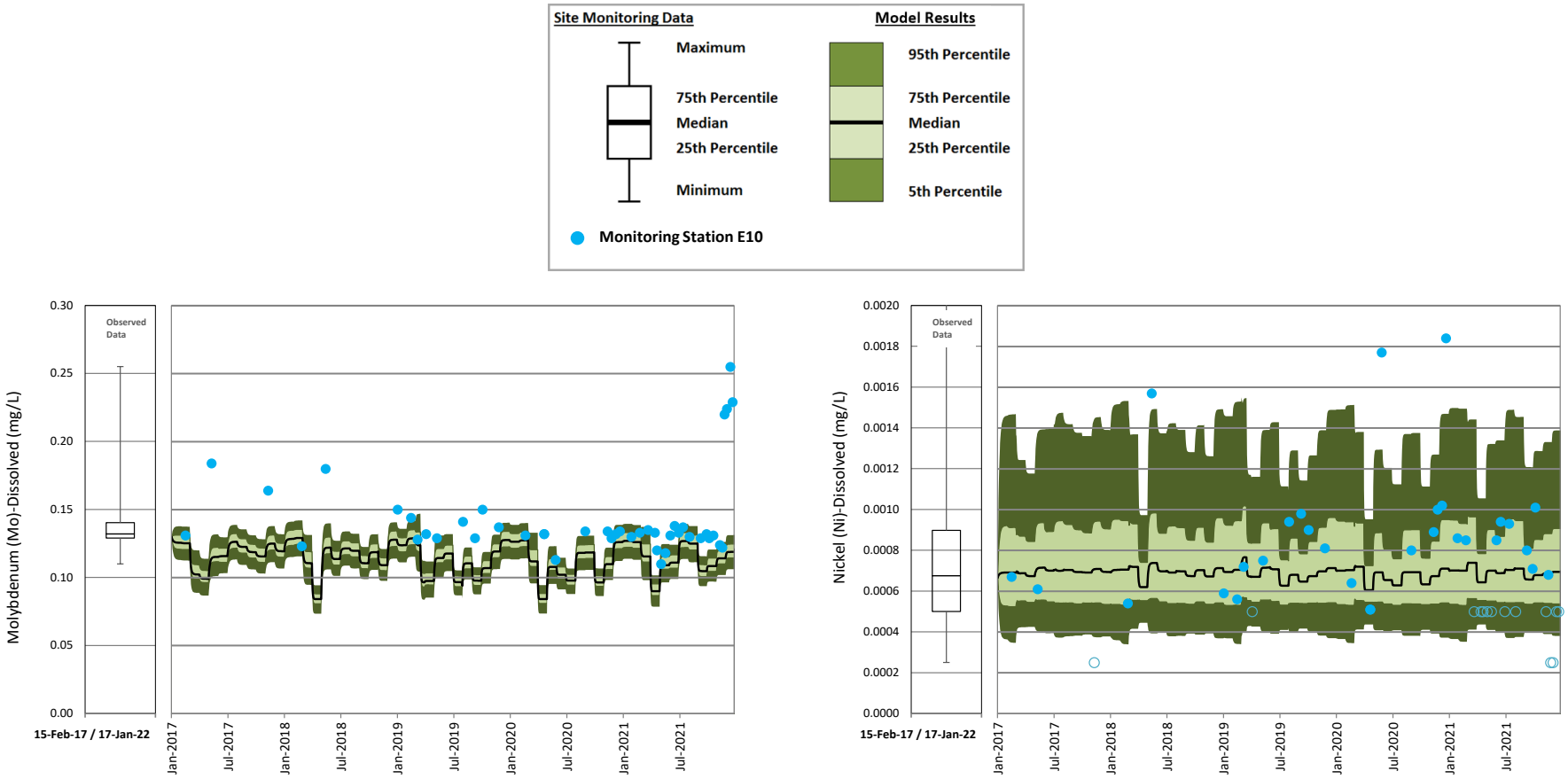

Figure 35: Wight Pit Calibration – Dissolved Molybdenum and Dissolved Nickel

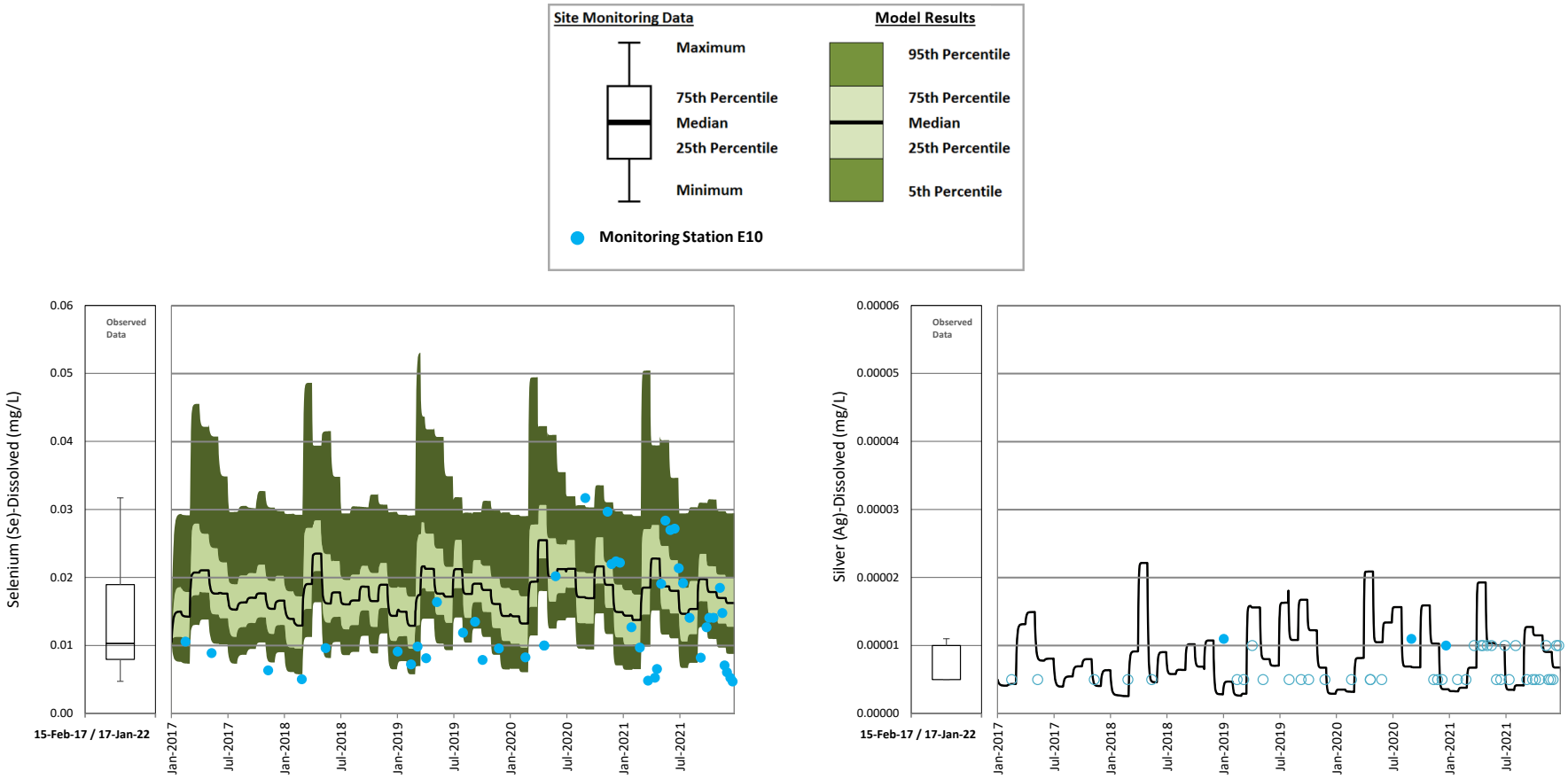

Figure 36: Wight Pit Calibration – Dissolved Selenium and Dissolved Silver

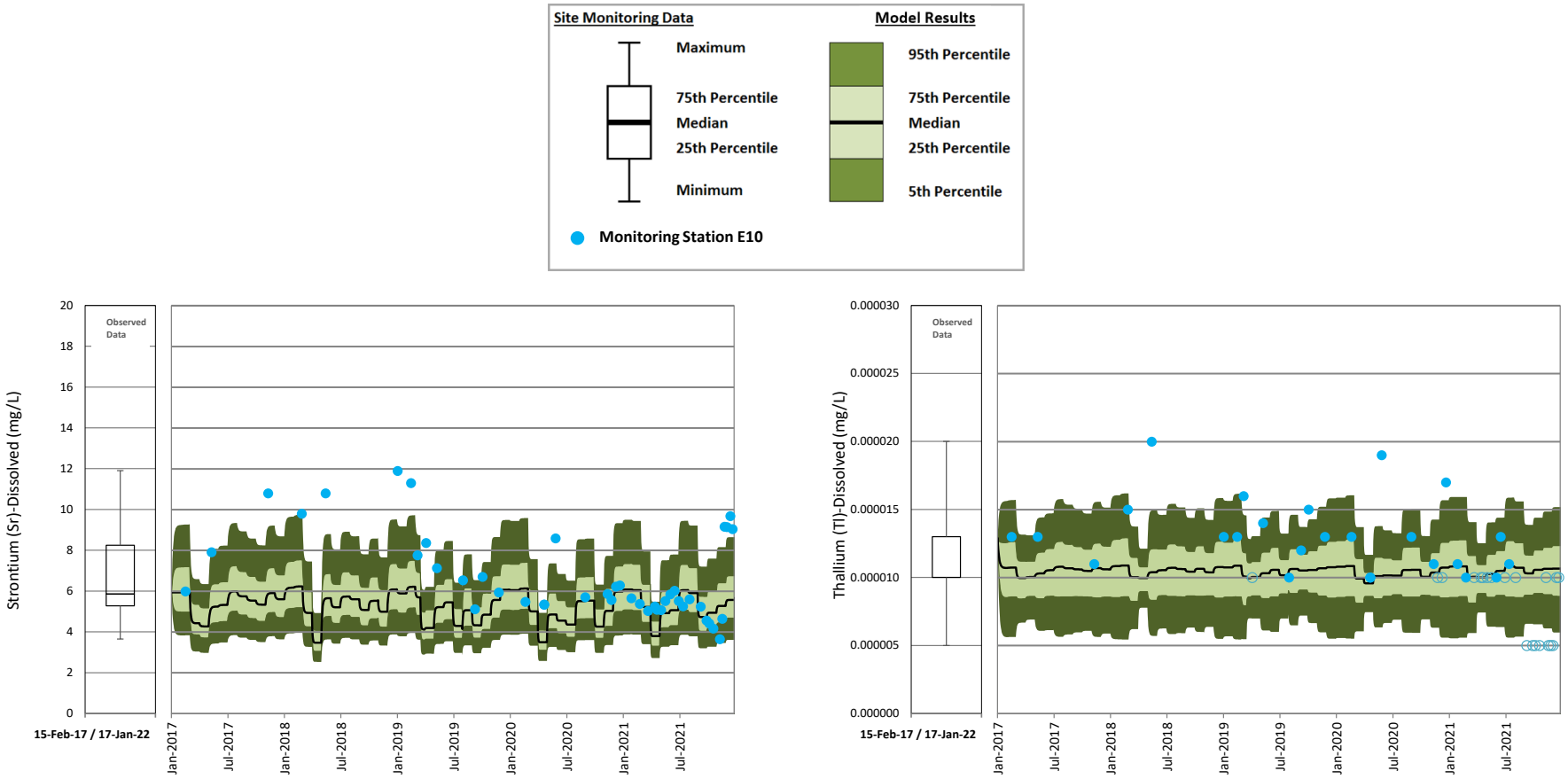

Figure 37: Wight Pit Calibration – Dissolved Strontium and Dissolved Thallium

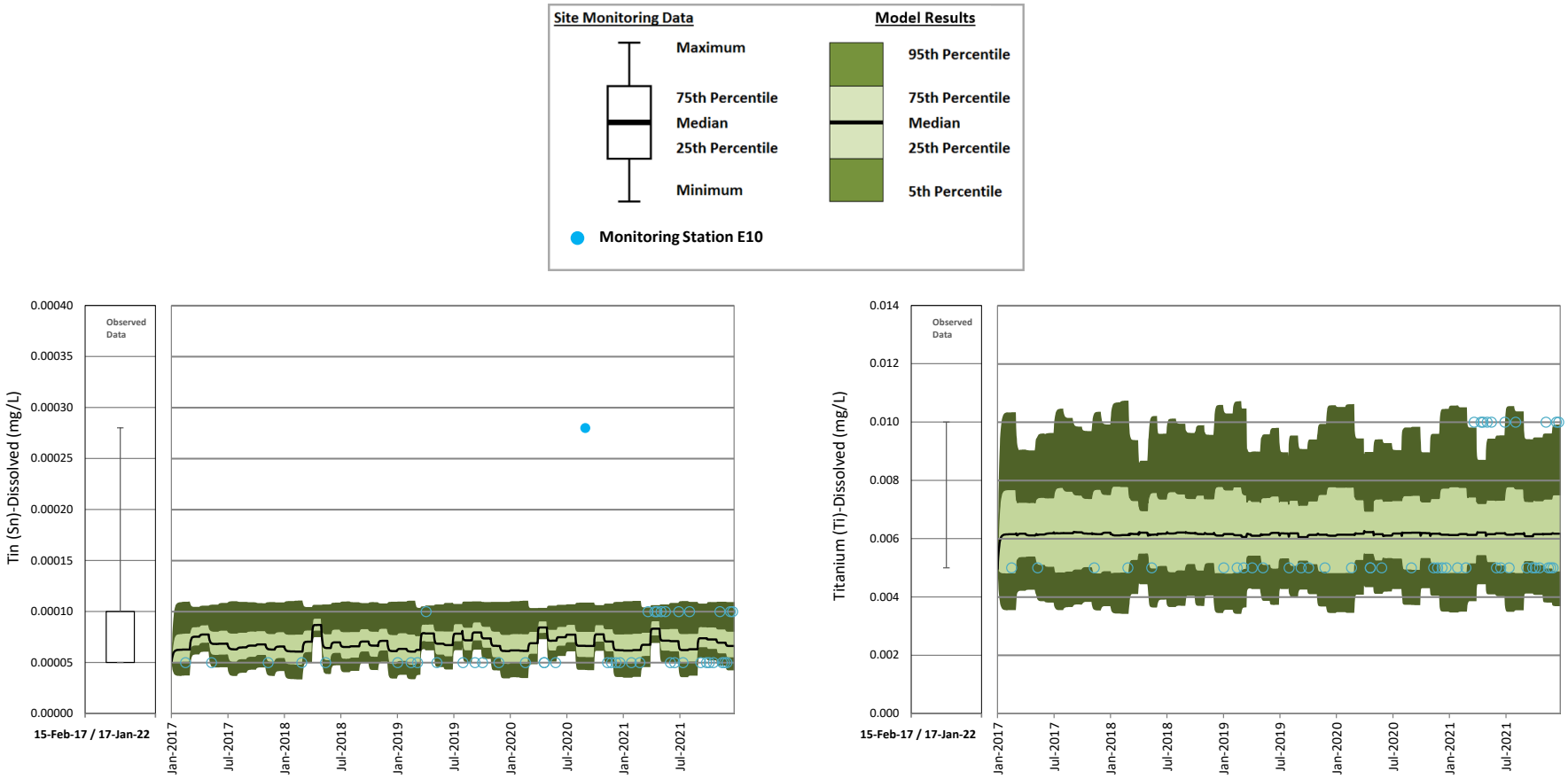

Figure 38: Wight Pit Calibration – Dissolved Tin and Dissolved Titanium

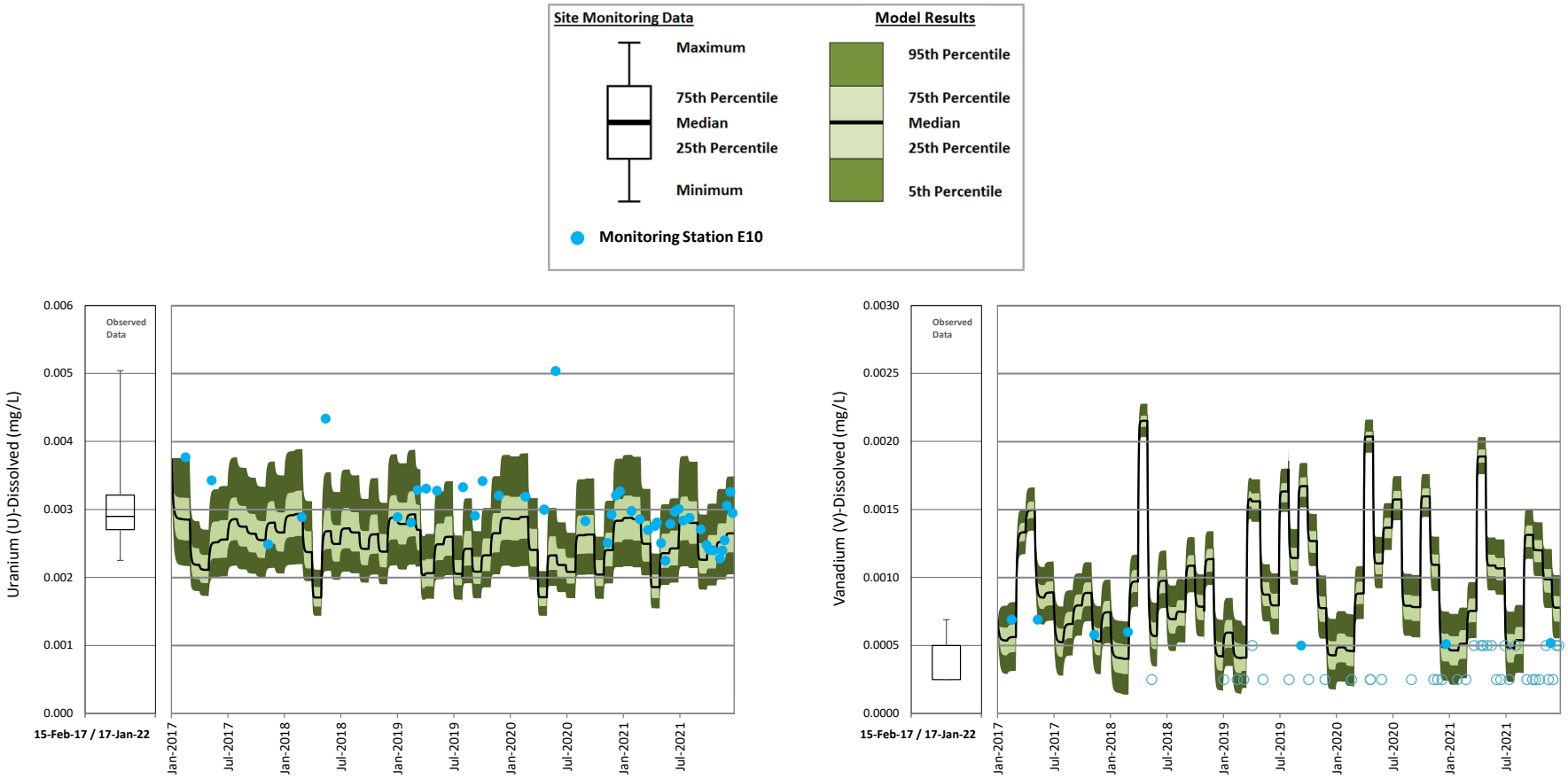

Figure 320: Wight Pit Calibration – Dissolved Uranium and Dissolved Vanadium

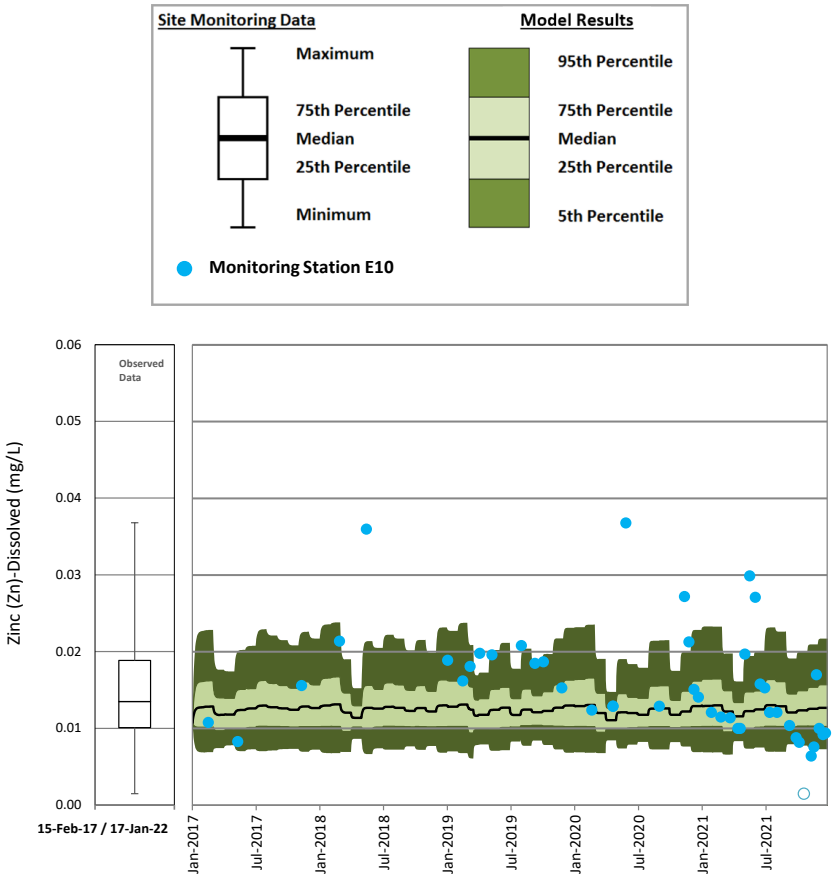

Figure 40: Wight Pit Calibration – Dissolved Zinc

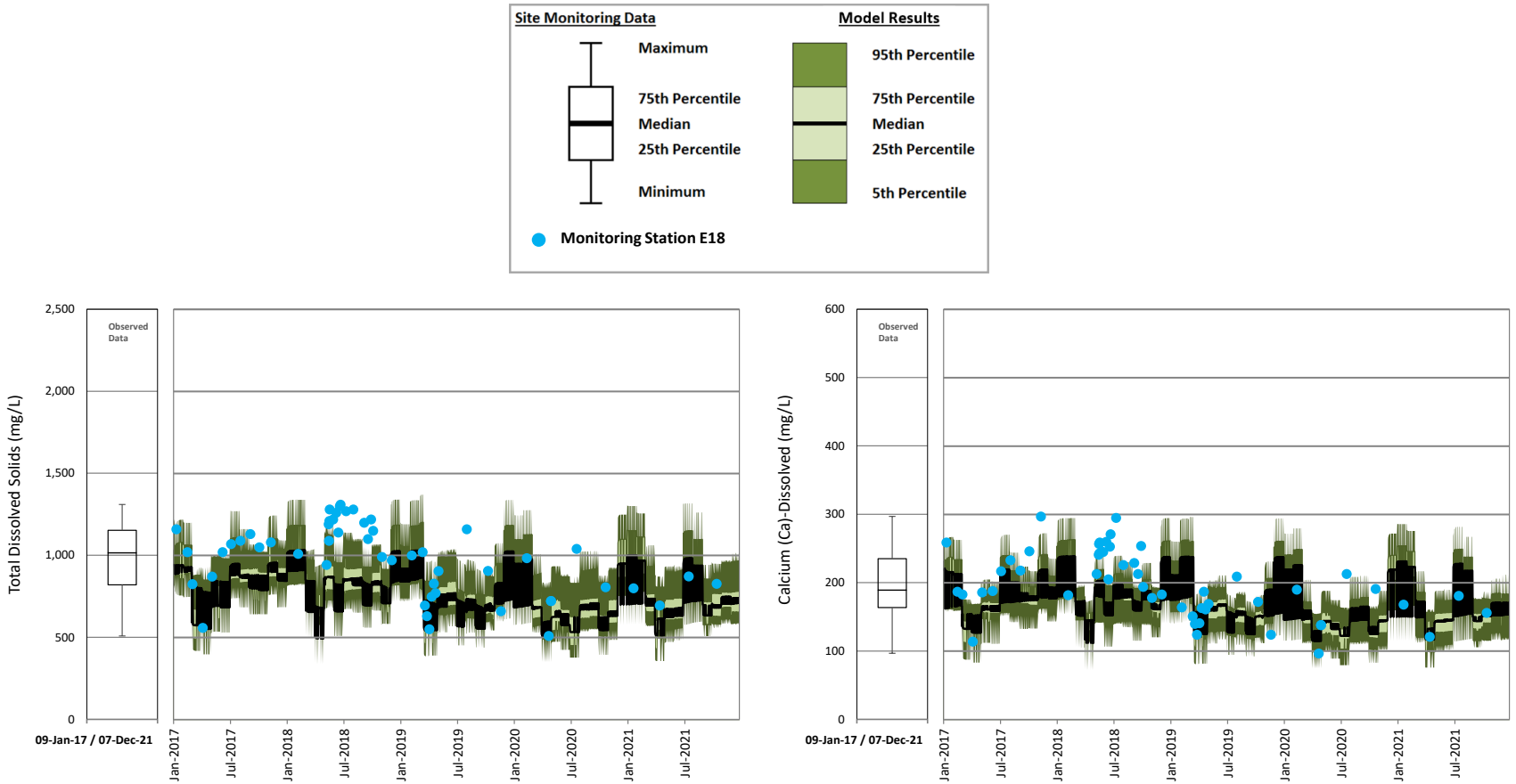

Figure 421: Central Collection Sump Calibration – Total Dissolved Solids and Calcium

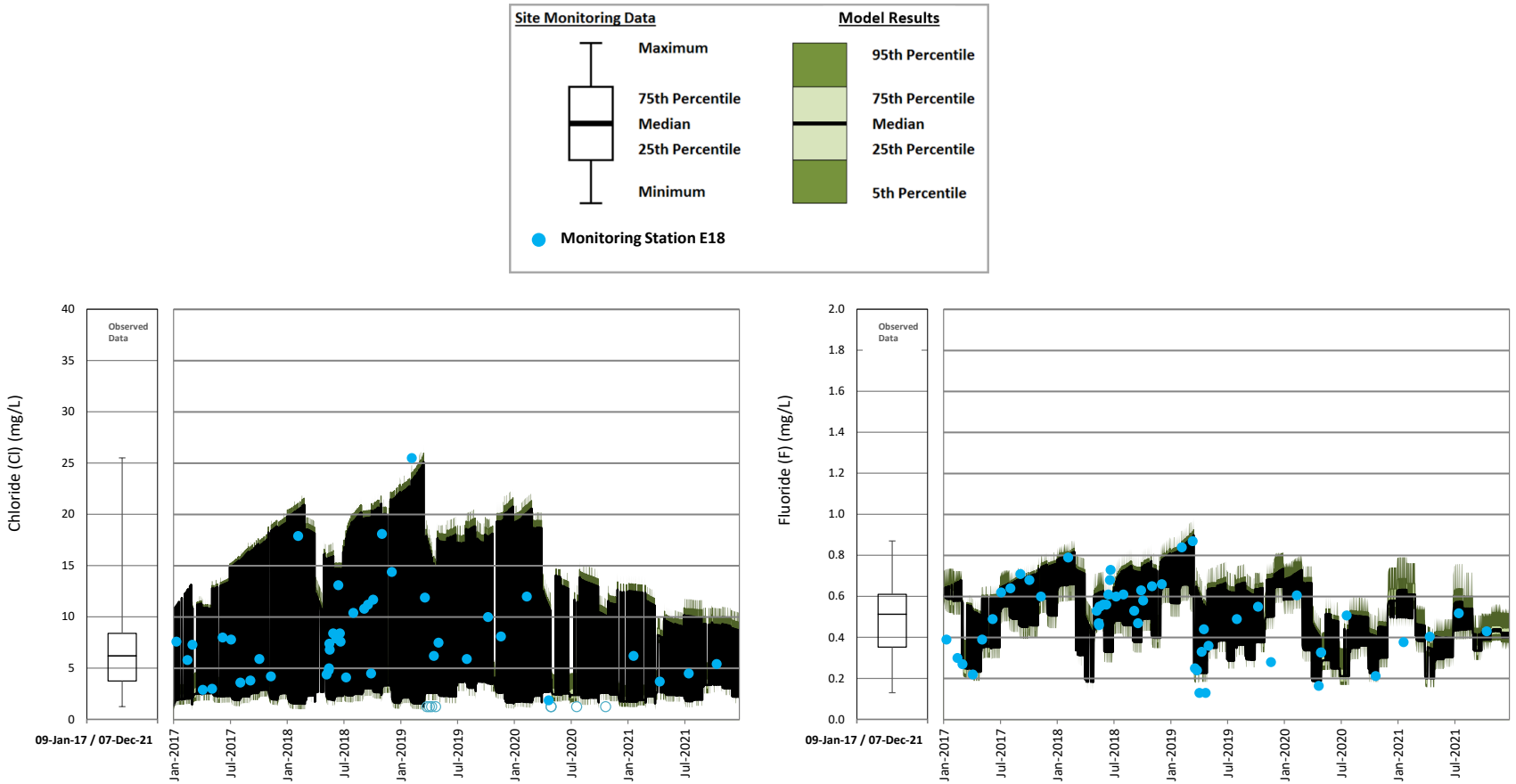

Figure 422: Central Collection Sump Calibration – Chloride and Fluoride

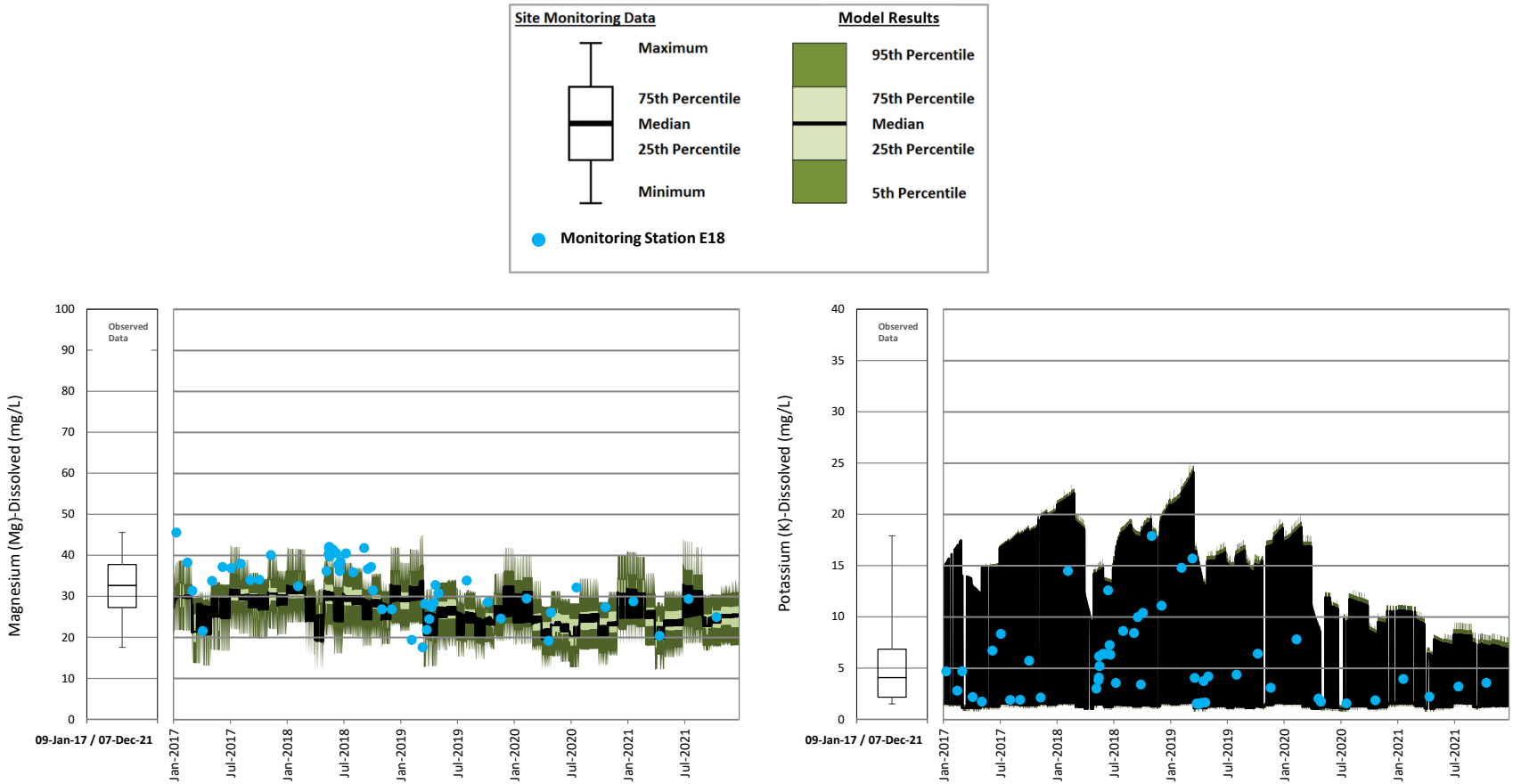

Figure 423: Central Collection Sump Calibration – Magnesium and Potassium

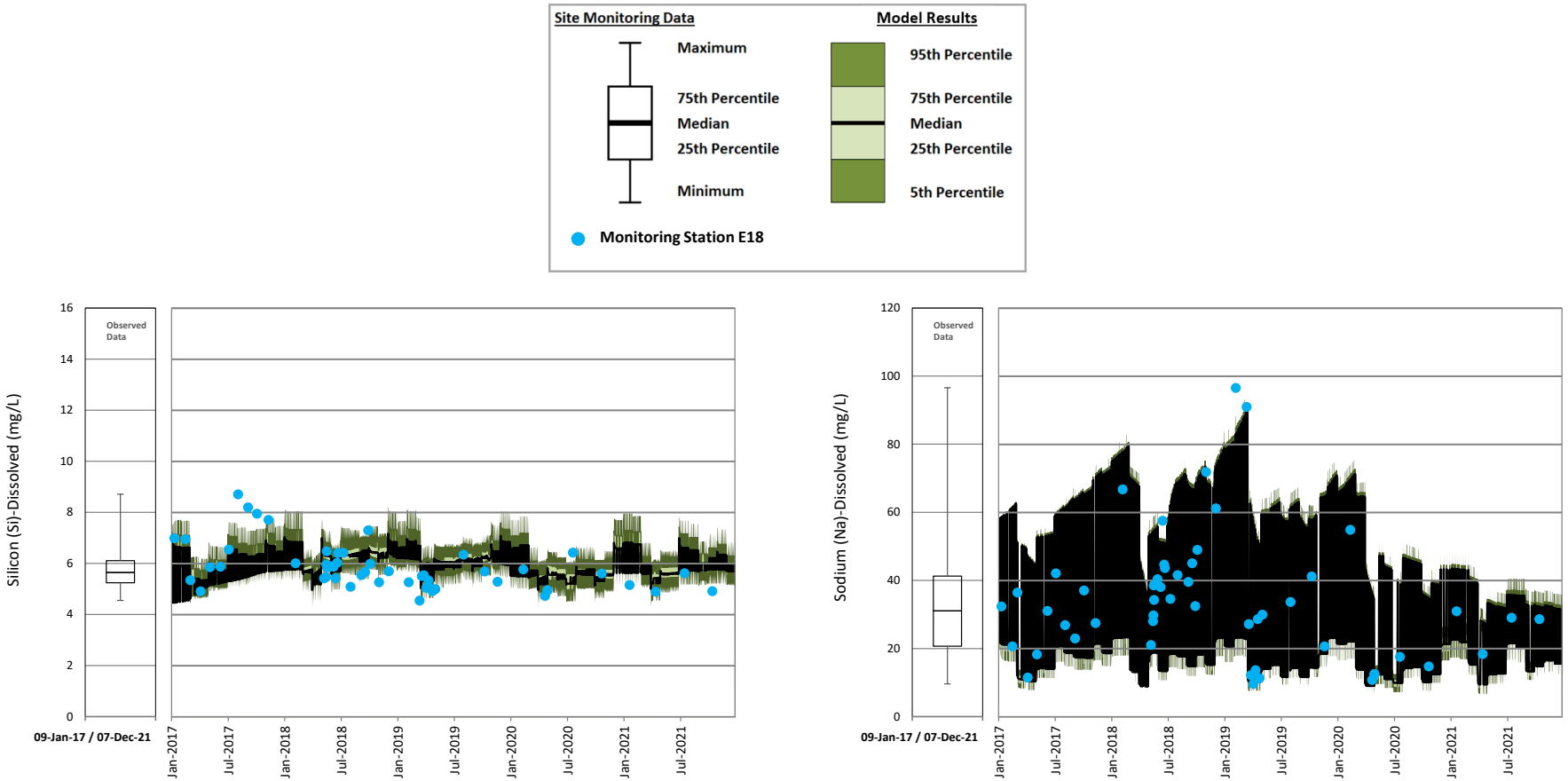

Figure 424: Central Collection Sump Calibration – Silicon and Sodium

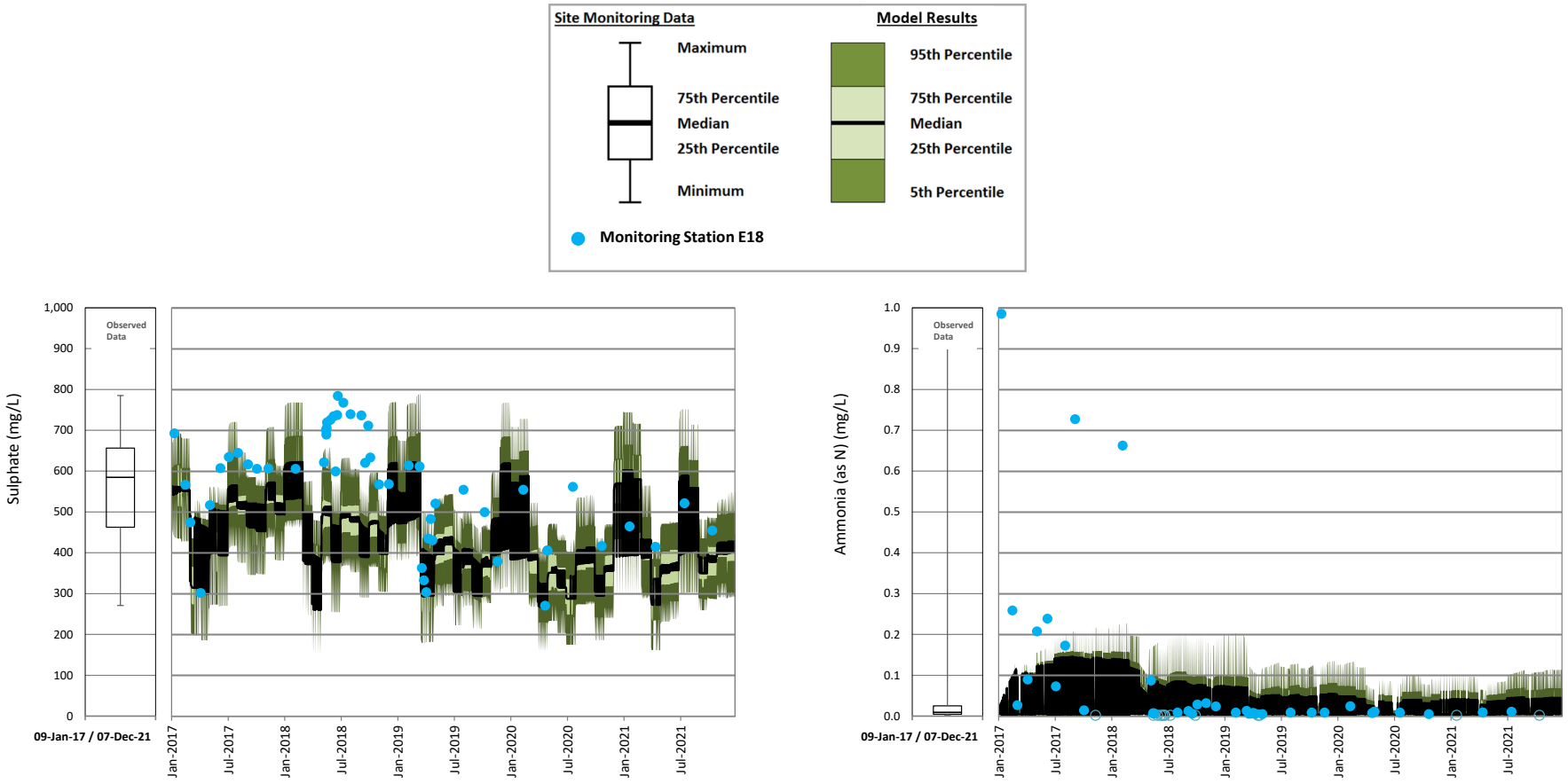

Figure 425: Central Collection Sump Calibration – Sulphate and Total Ammonia

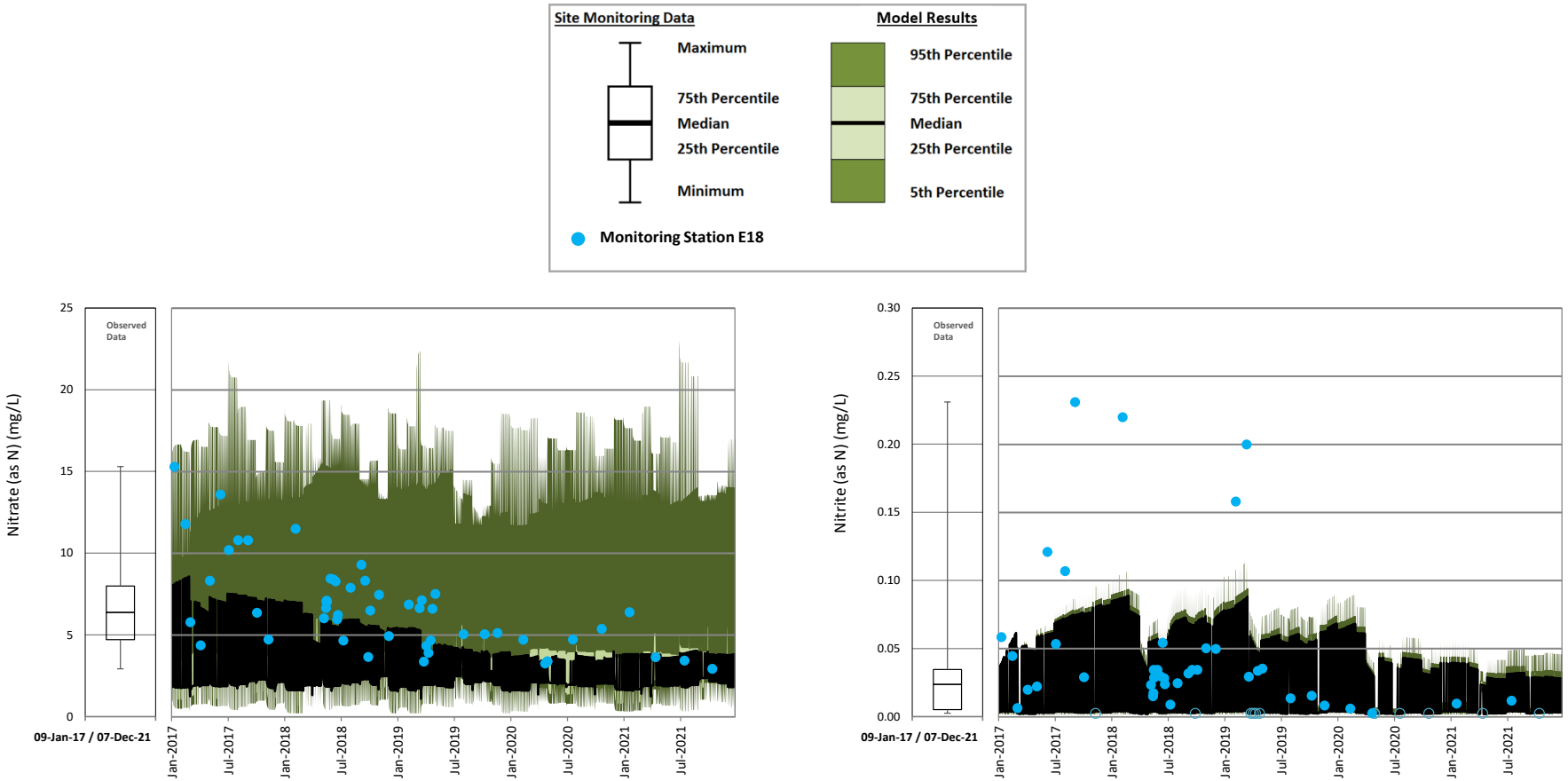

Figure 426: Central Collection Sump Calibration – Nitrate and Nitrite

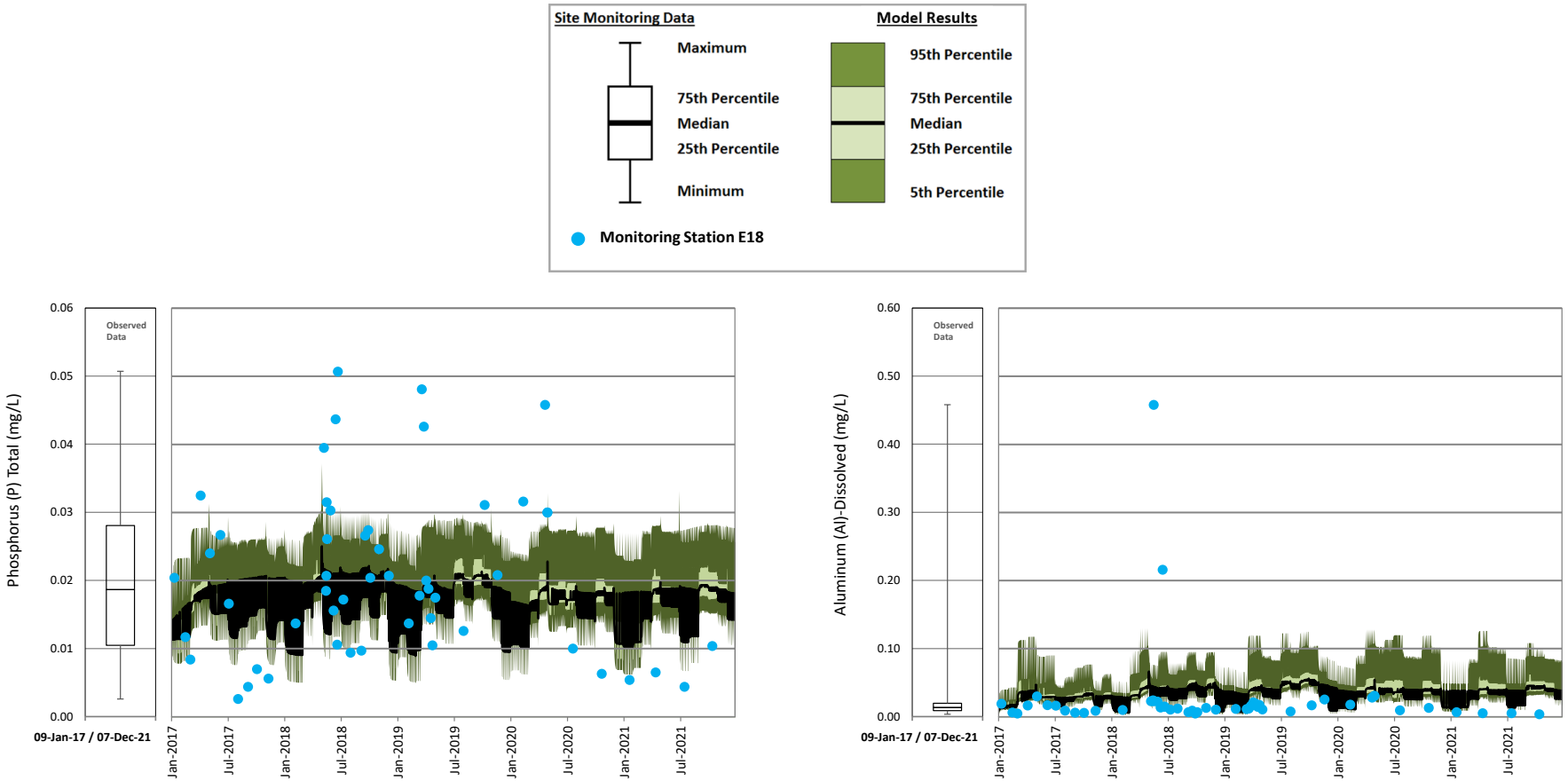

Figure 427: Central Collection Sump Calibration – Total Phosphorus and Dissolved Aluminum

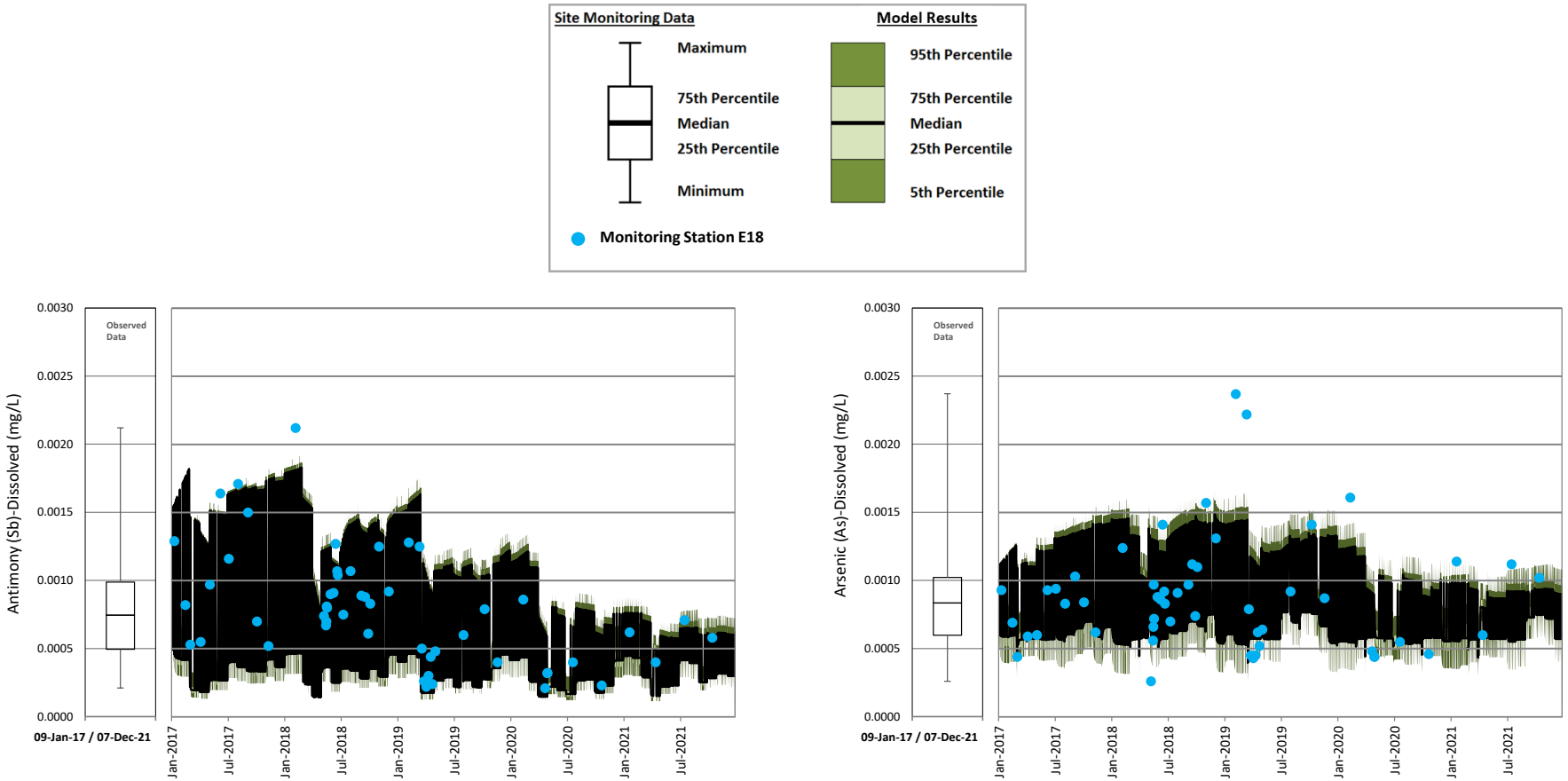

Figure 428: Central Collection Sump Calibration – Dissolved Antimony and Dissolved Arsenic

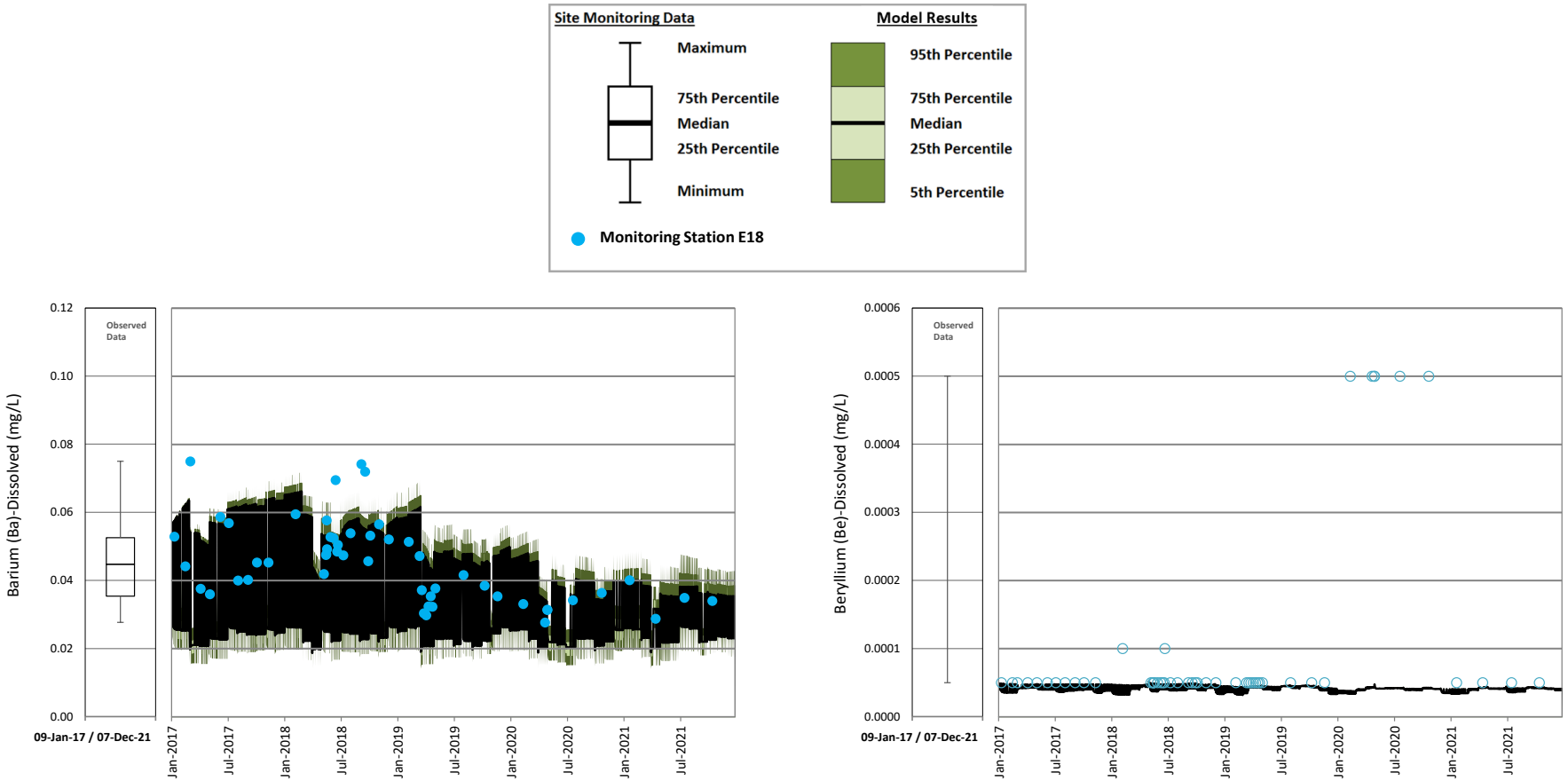

Figure 429: Central Collection Sump Calibration – Dissolved Barium and Dissolved Beryllium

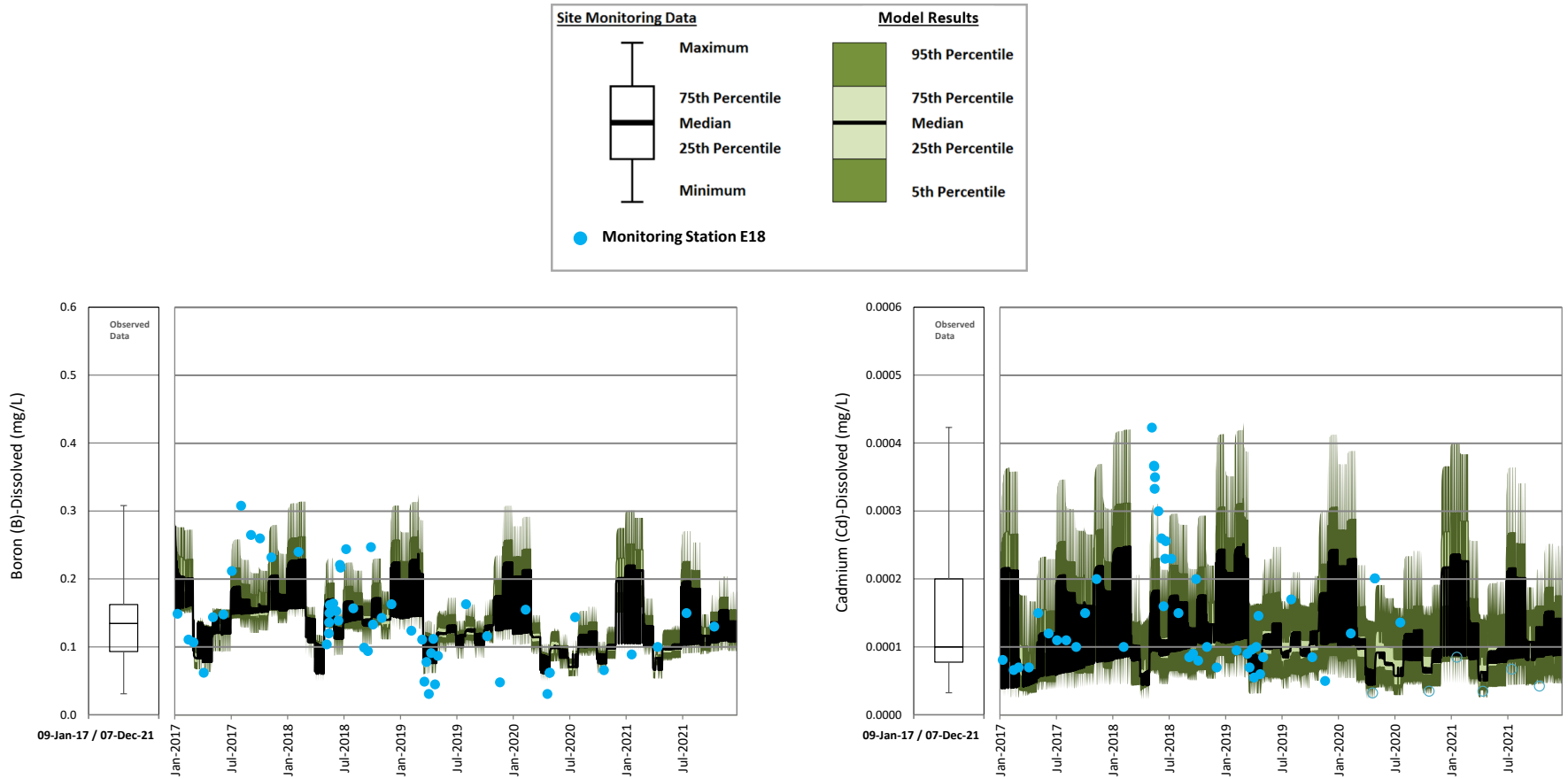

Figure 50: Central Collection Sump Calibration – Dissolved Boron and Dissolved Cadmium

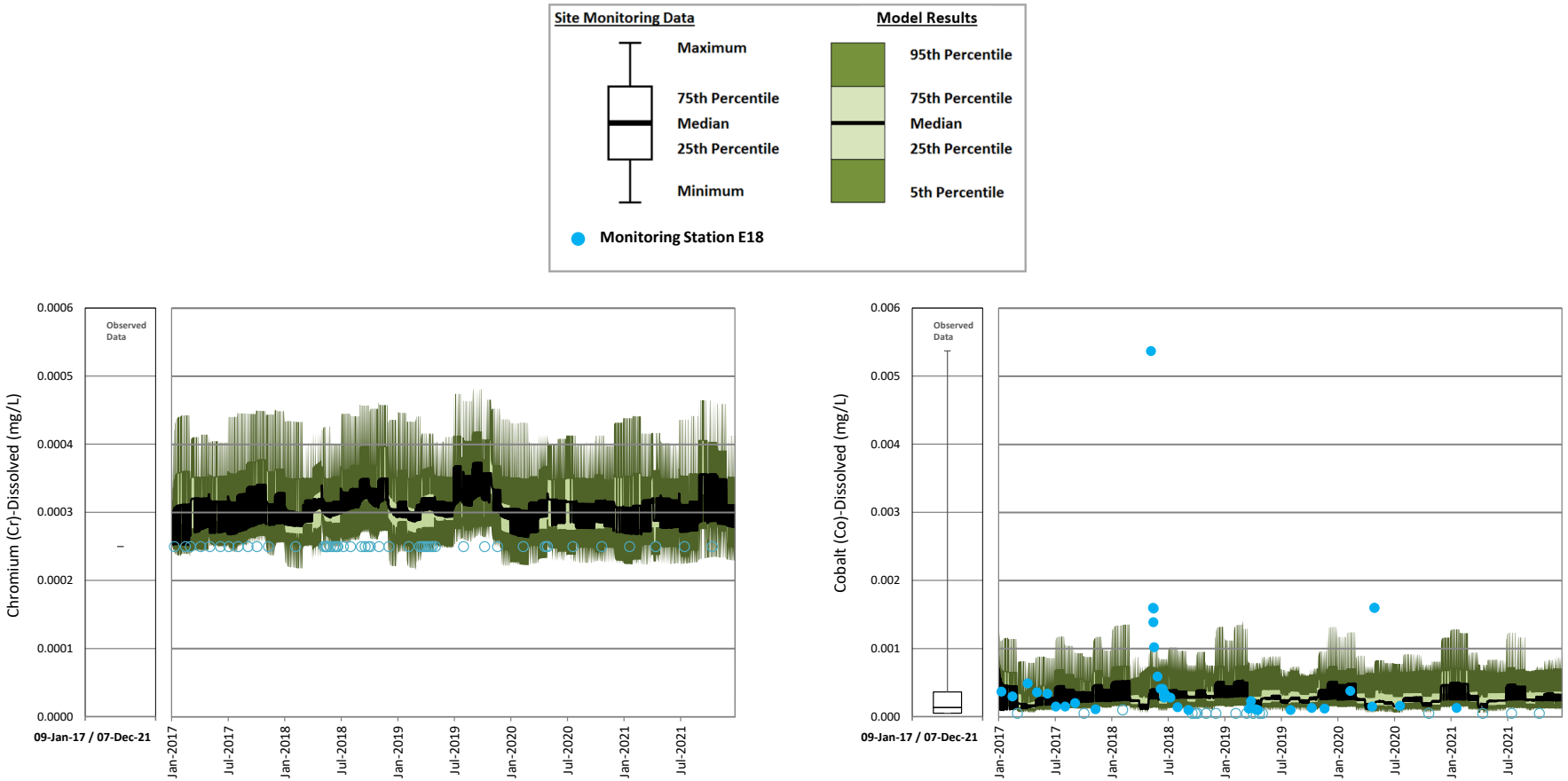

Figure 51: Central Collection Sump Calibration – Dissolved Chromium and Dissolved Cobalt

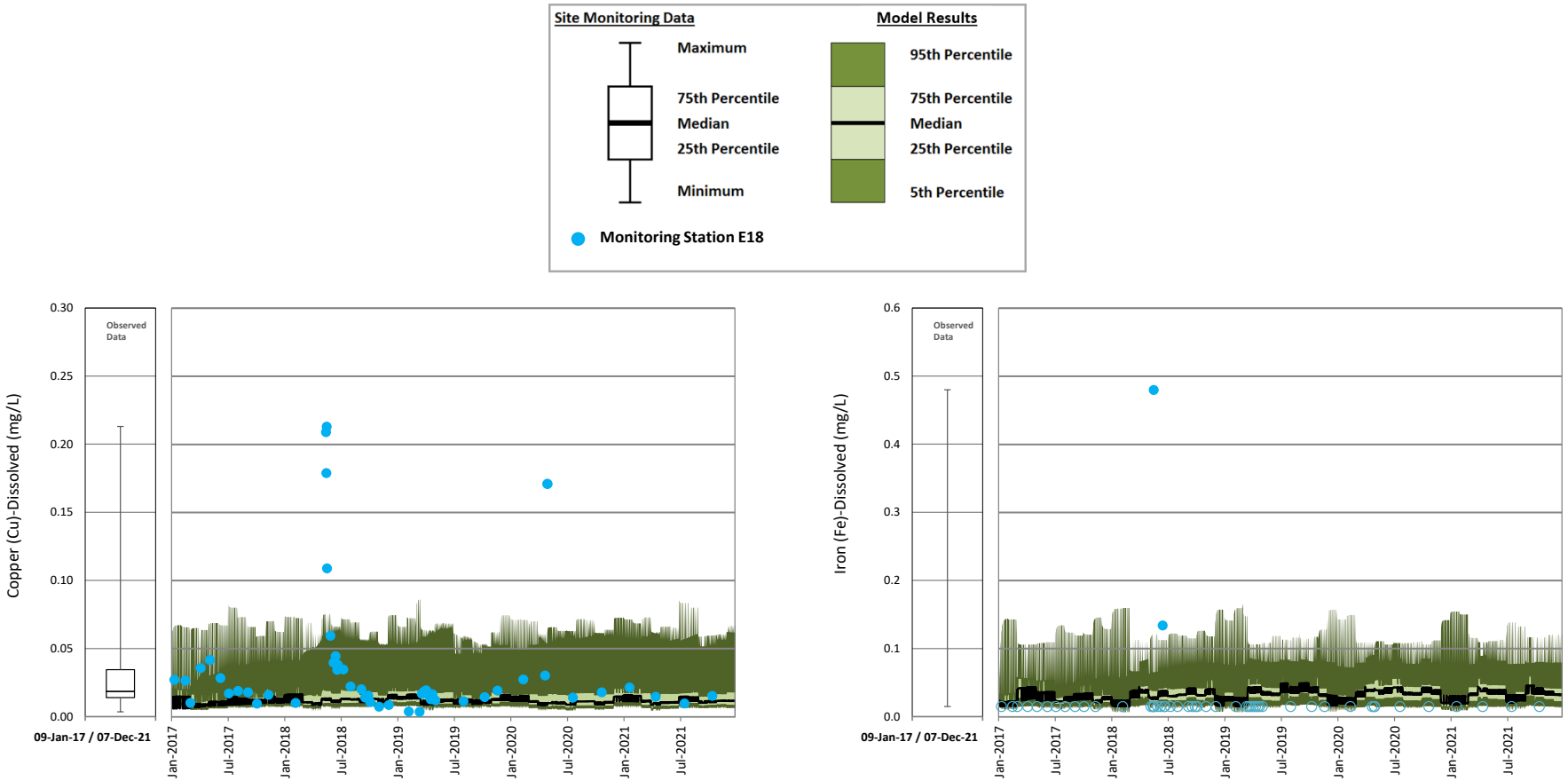

Figure 52: Central Collection Sump Calibration – Dissolved Copper and Dissolved Iron

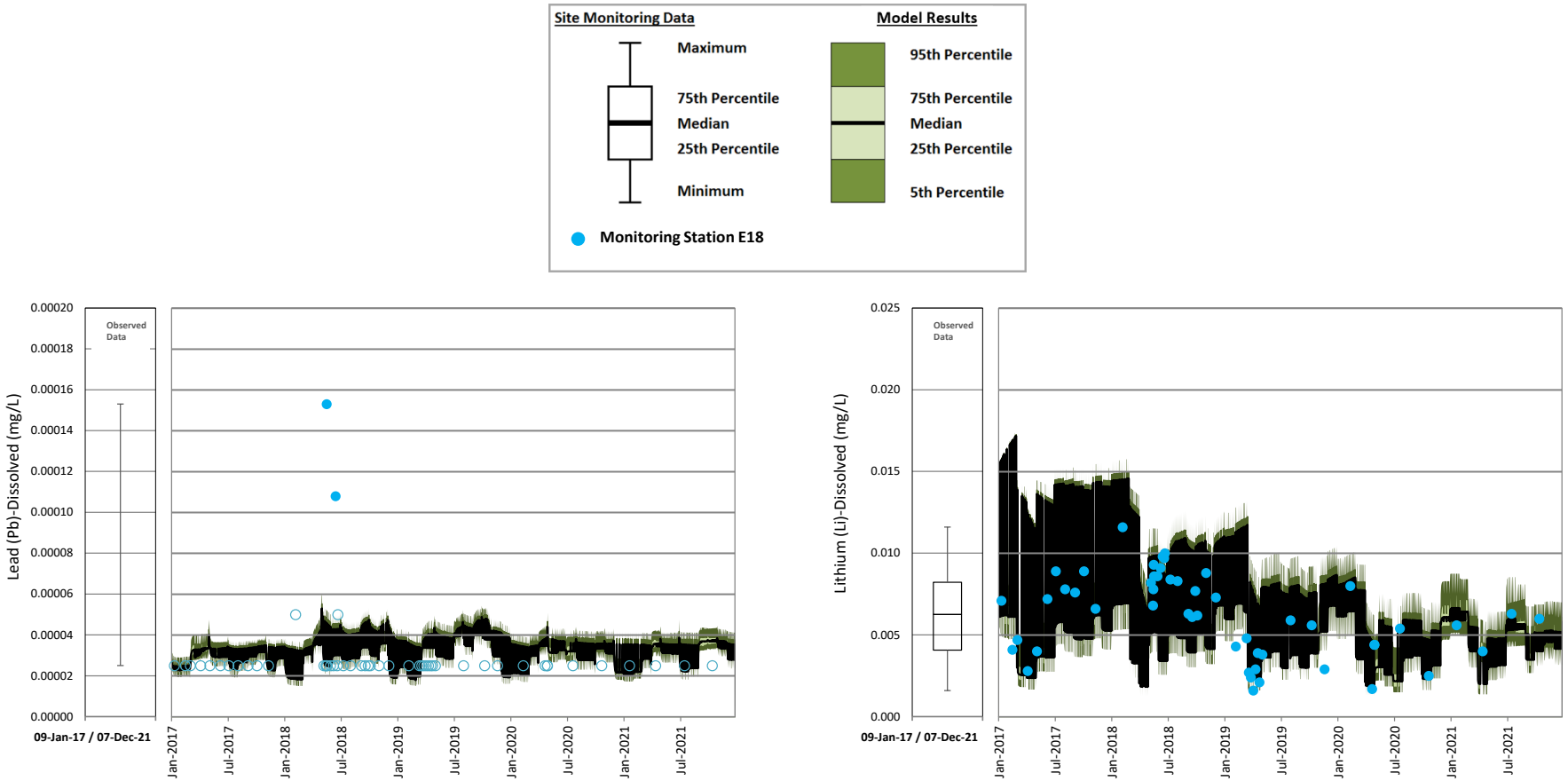

Figure 53: Central Collection Sump Calibration – Dissolved Lead and Dissolved Lithium

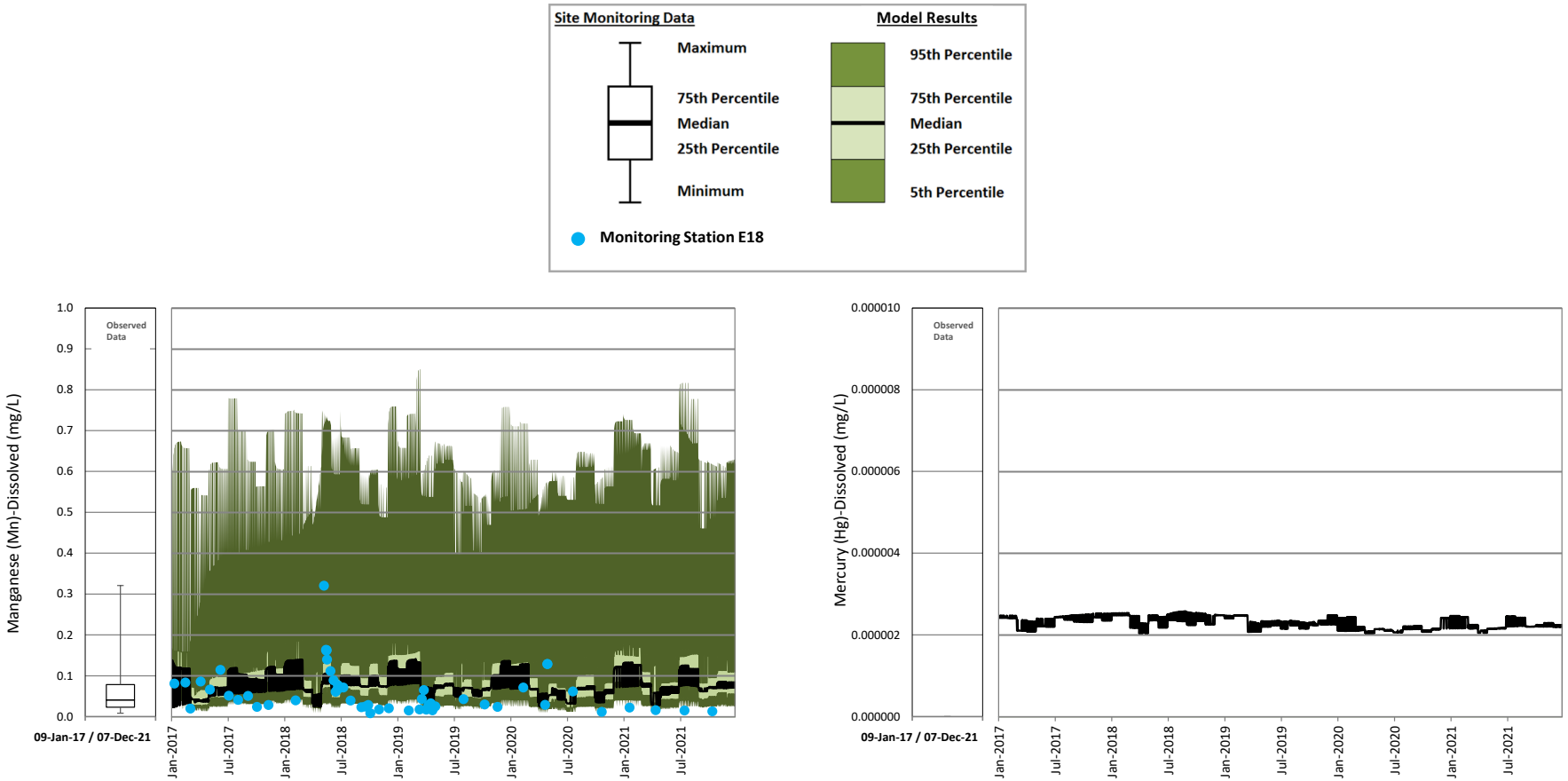

Figure 54: Central Collection Sump Calibration – Dissolved Manganese and Dissolved Mercury

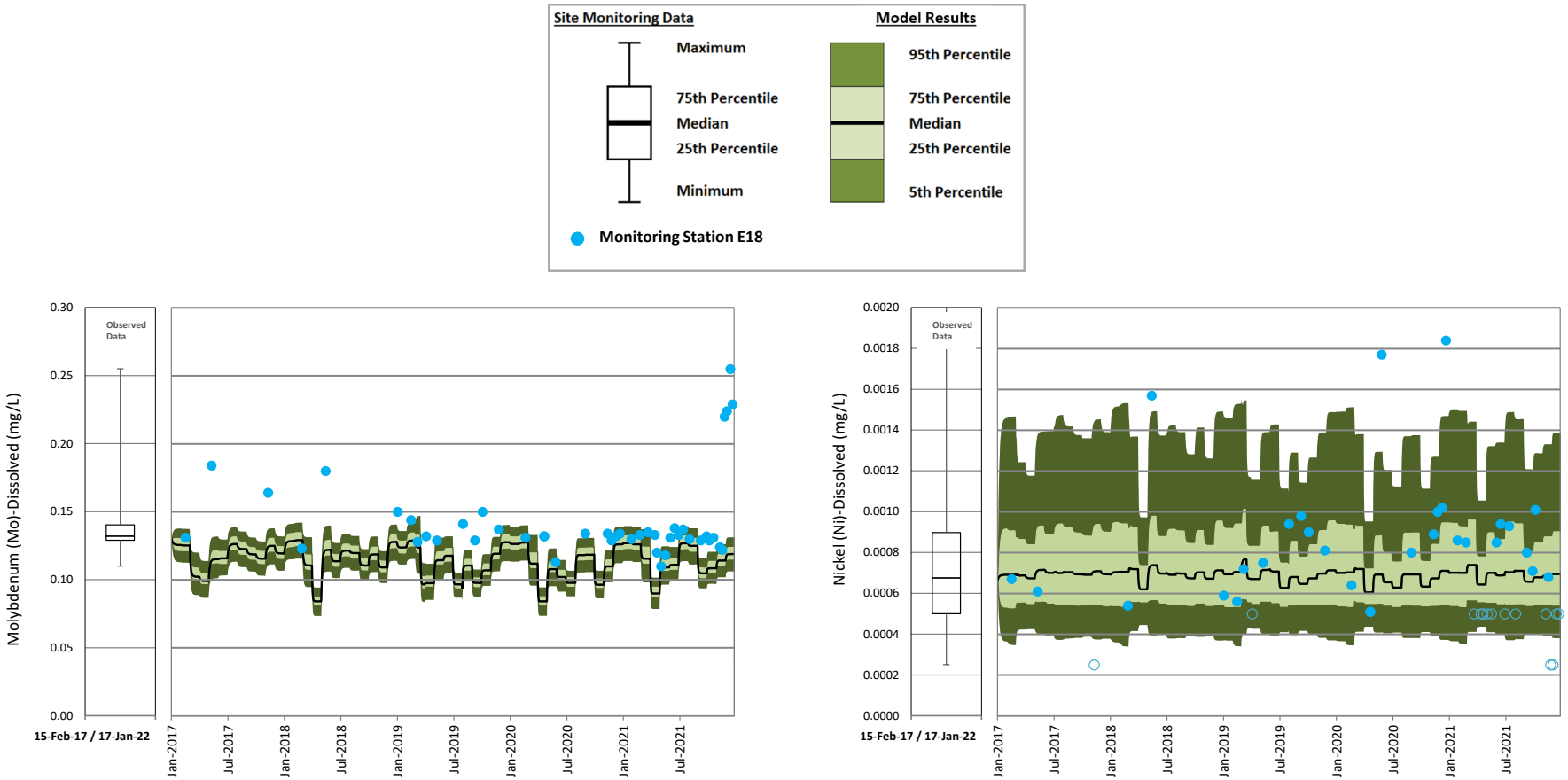

Figure 55: Central Collection Sump Calibration – Dissolved Molybdenum and Dissolved Nickel

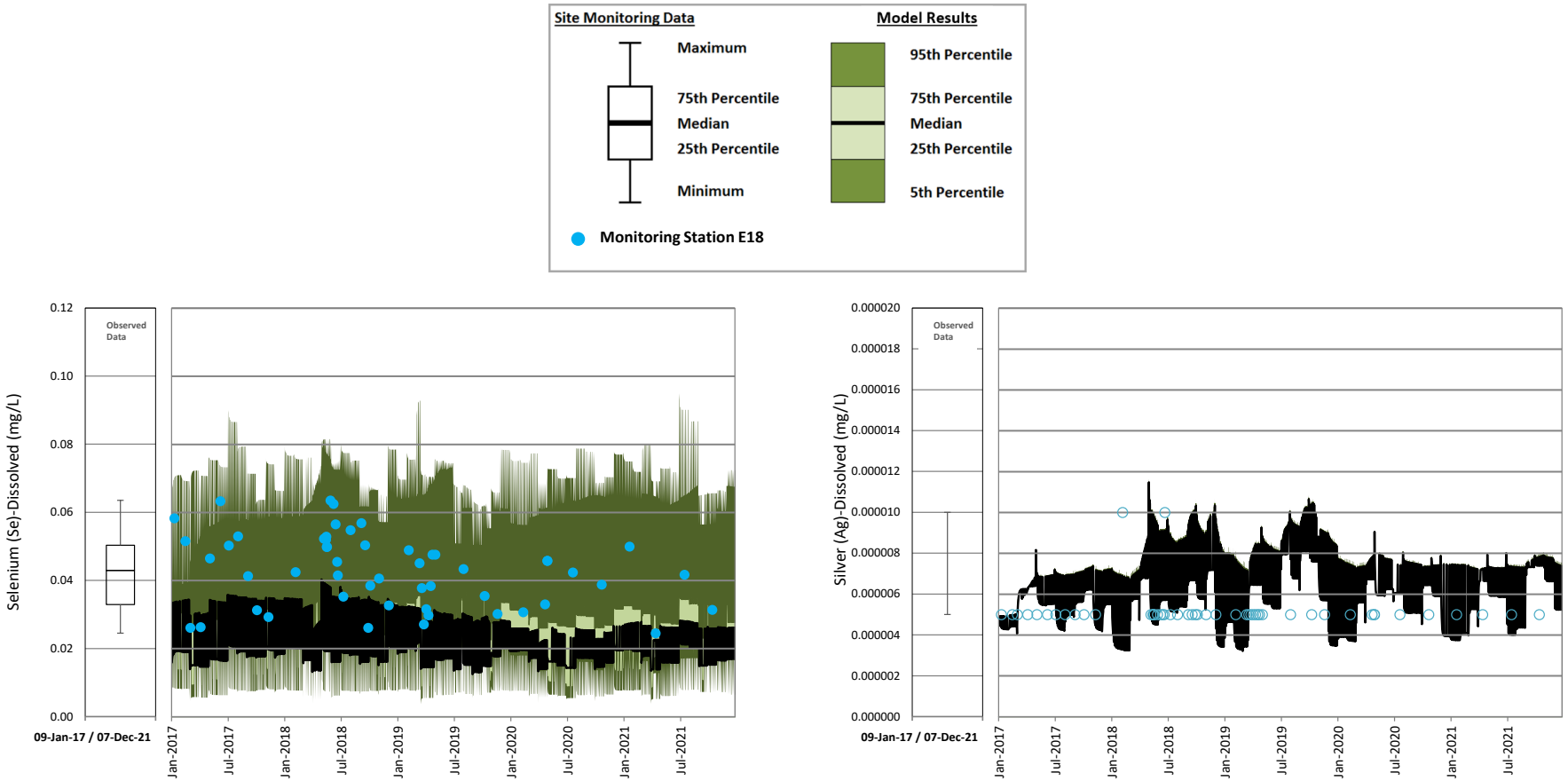

Figure 56: Central Collection Sump Calibration – Dissolved Selenium and Dissolved Silver

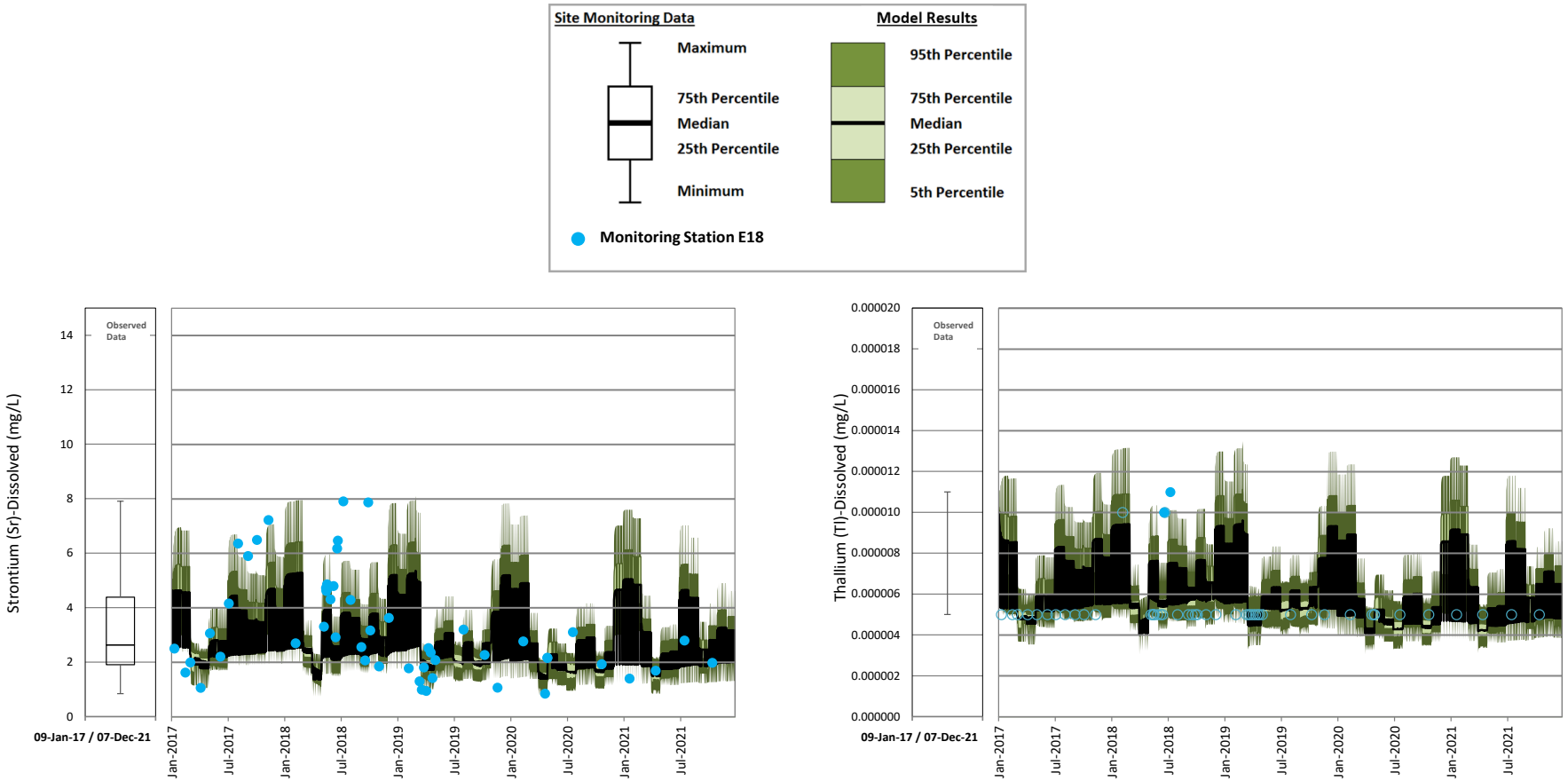

Figure 57: Central Collection Sump Calibration – Dissolved Strontium and Dissolved Thallium

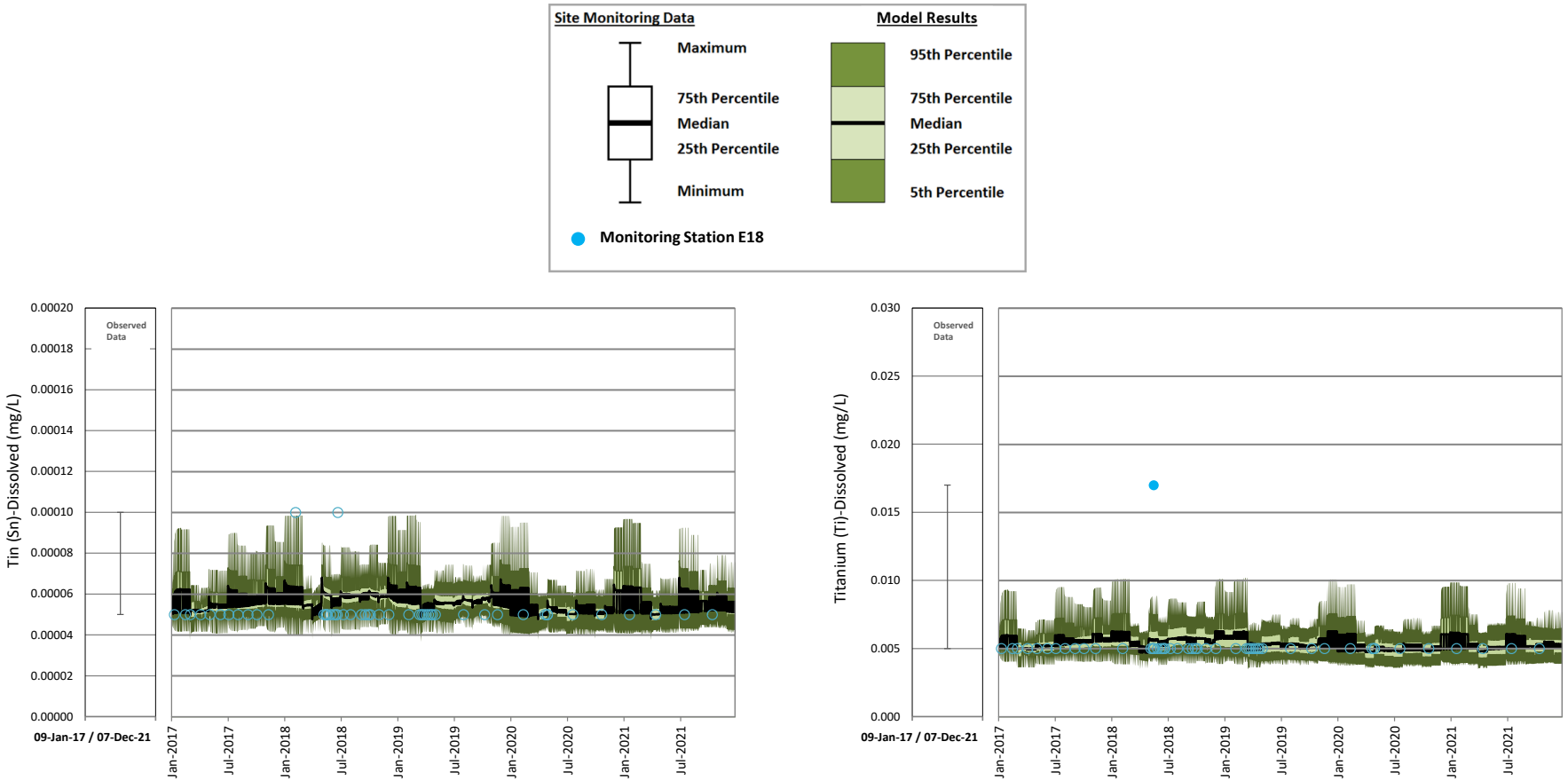

Figure 58: Central Collection Sump Calibration – Dissolved Tin and Dissolved Titanium

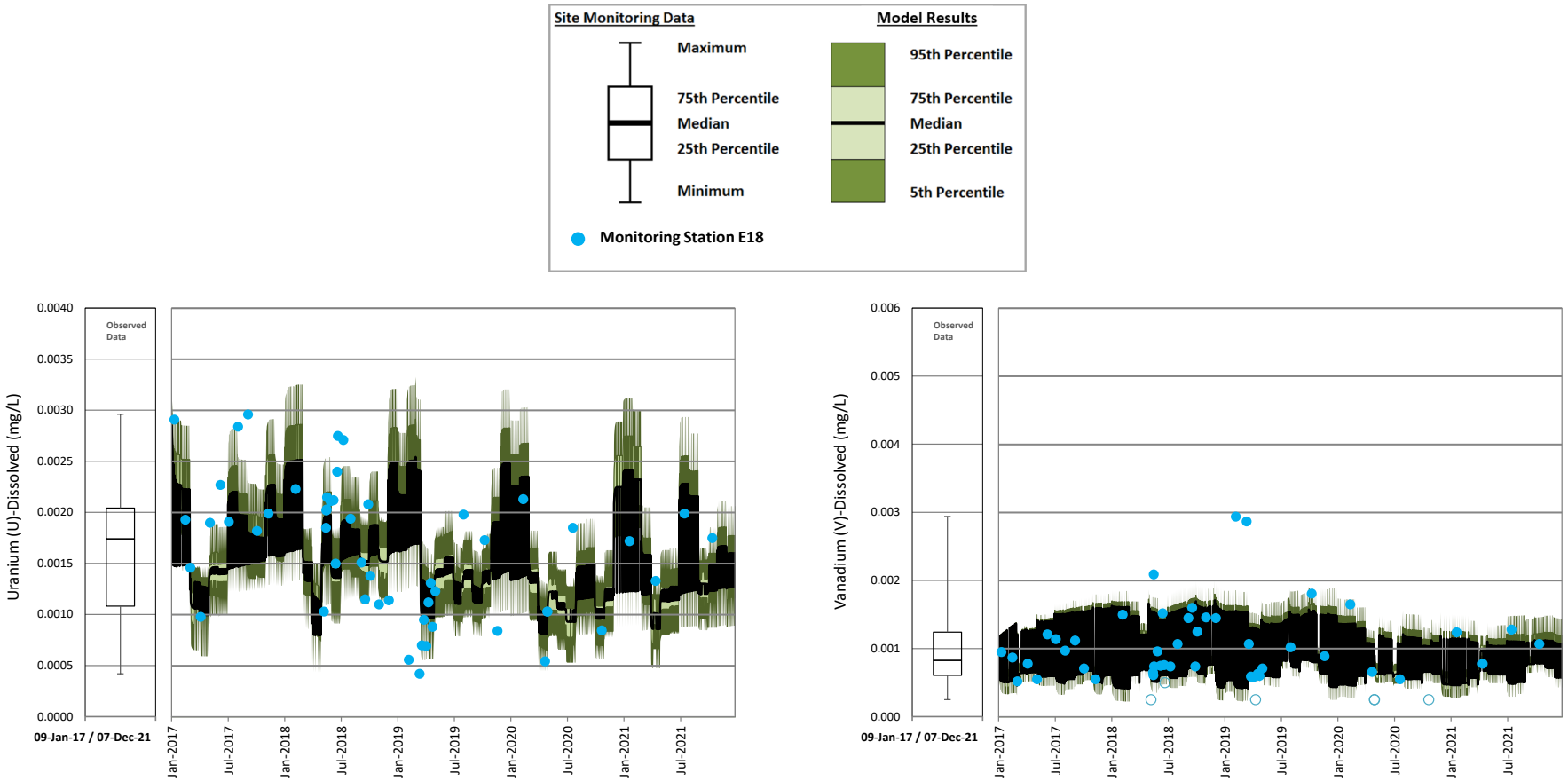

Figure 530: Central Collection Sump Calibration – Dissolved Uranium and Dissolved Vanadium

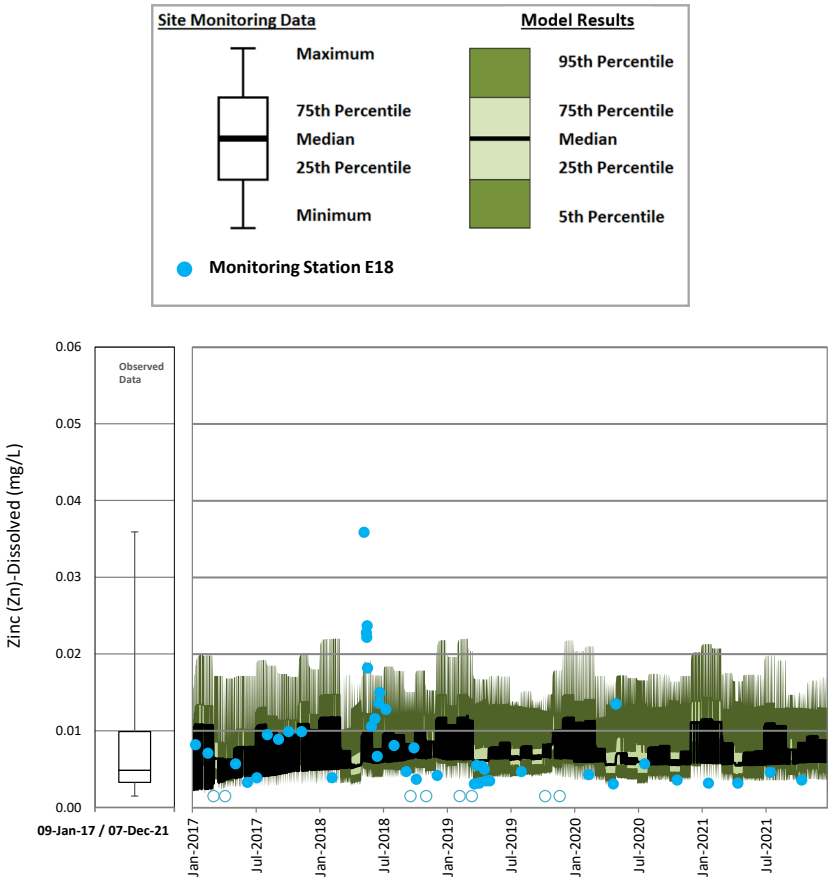

Figure 60: Central Collection Sump Calibration – Dissolved Zinc

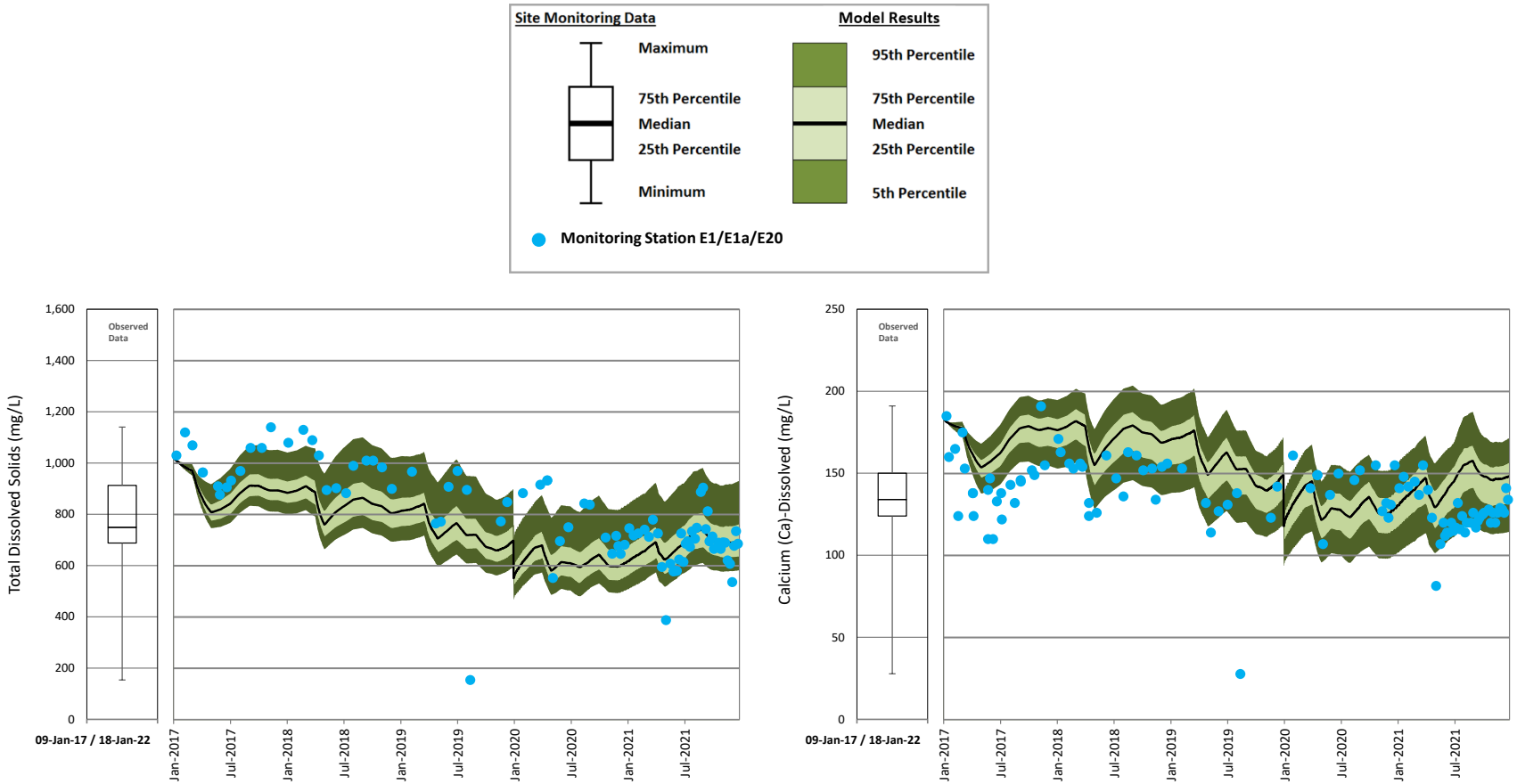

Figure 631: Tailings Storage Facility Calibration – Total Dissolved Solids and Calcium

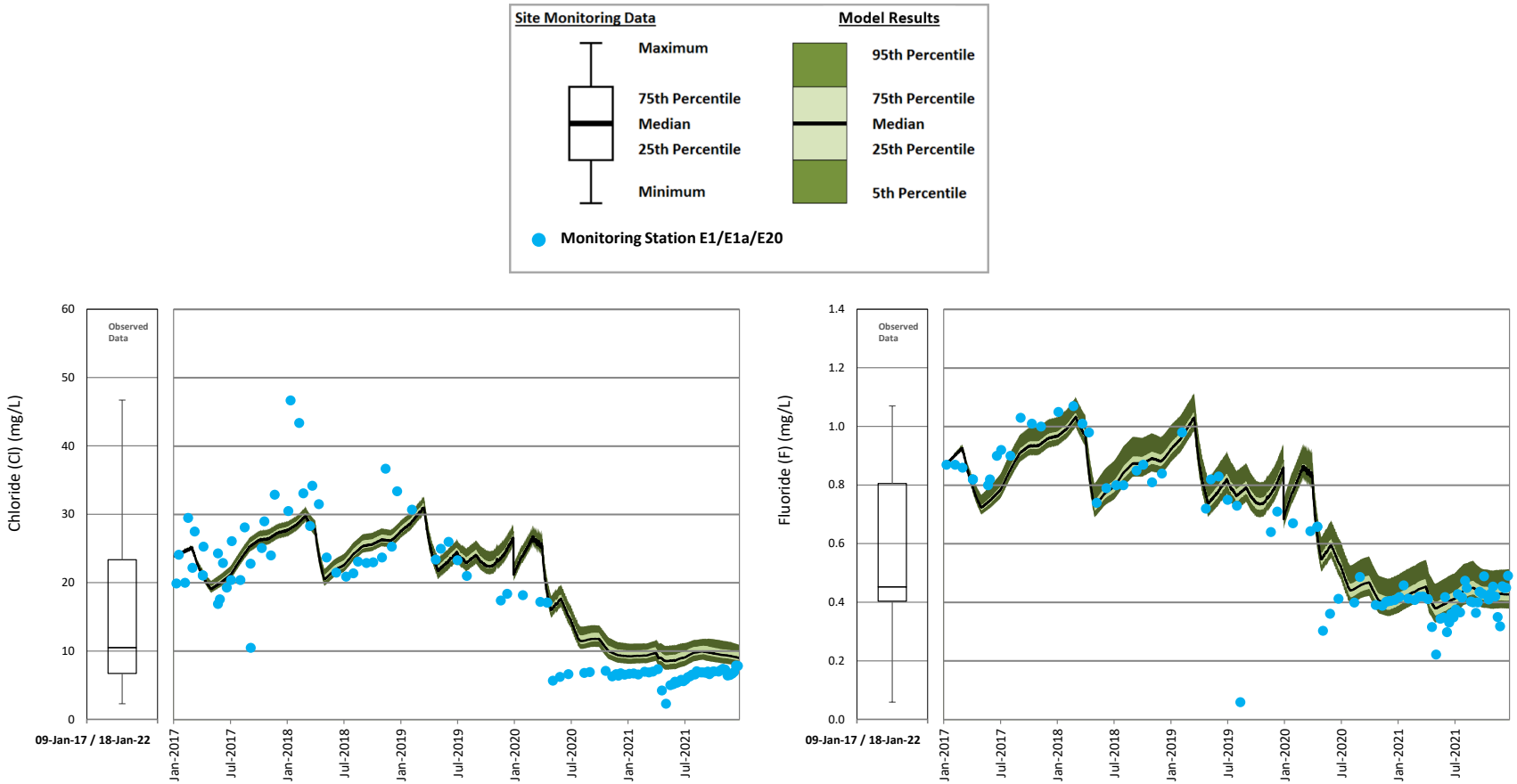

Figure 632: Tailings Storage Facility Calibration – Chloride and Fluoride

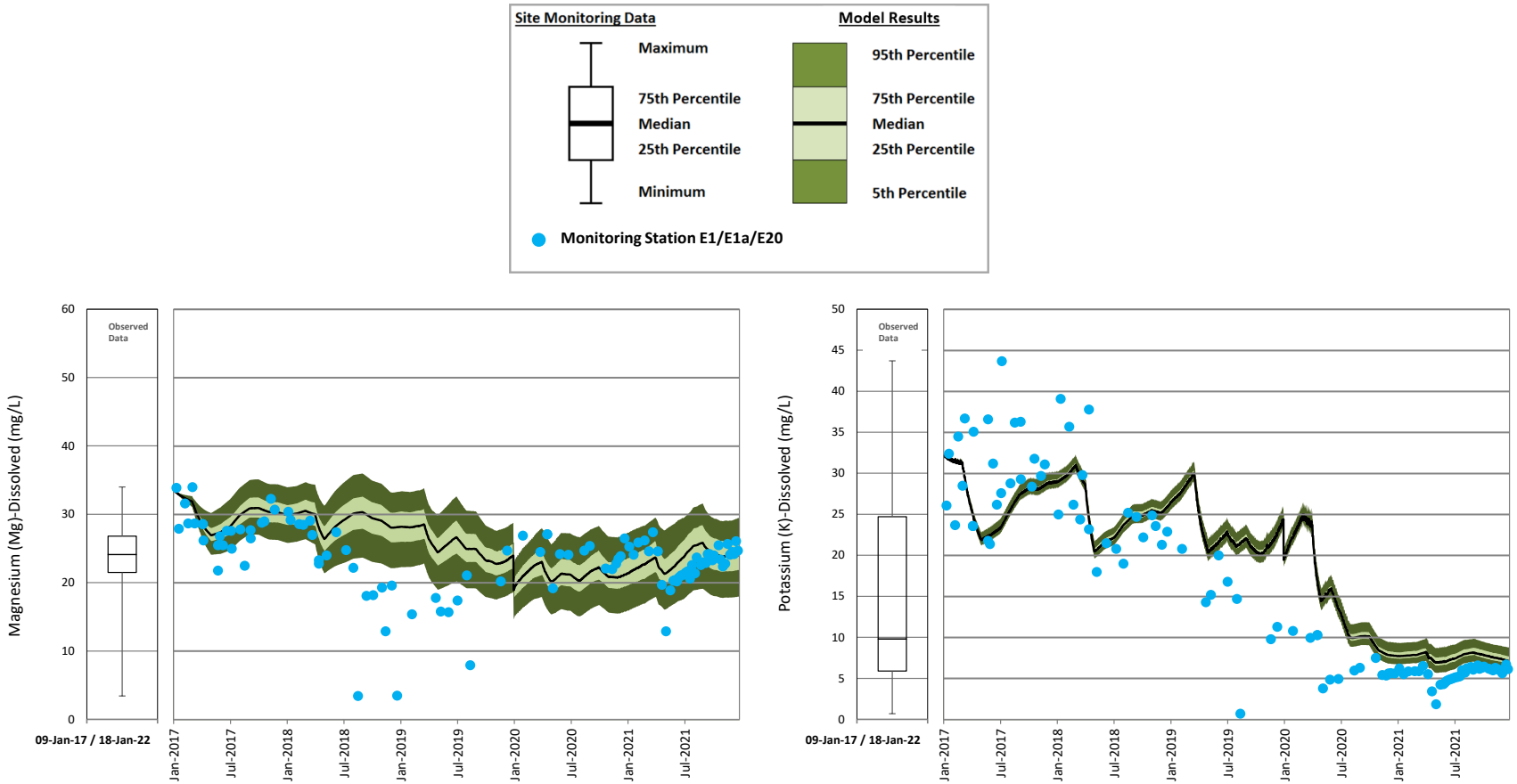

Figure 633: Tailings Storage Facility Calibration – Magnesium and Potassium

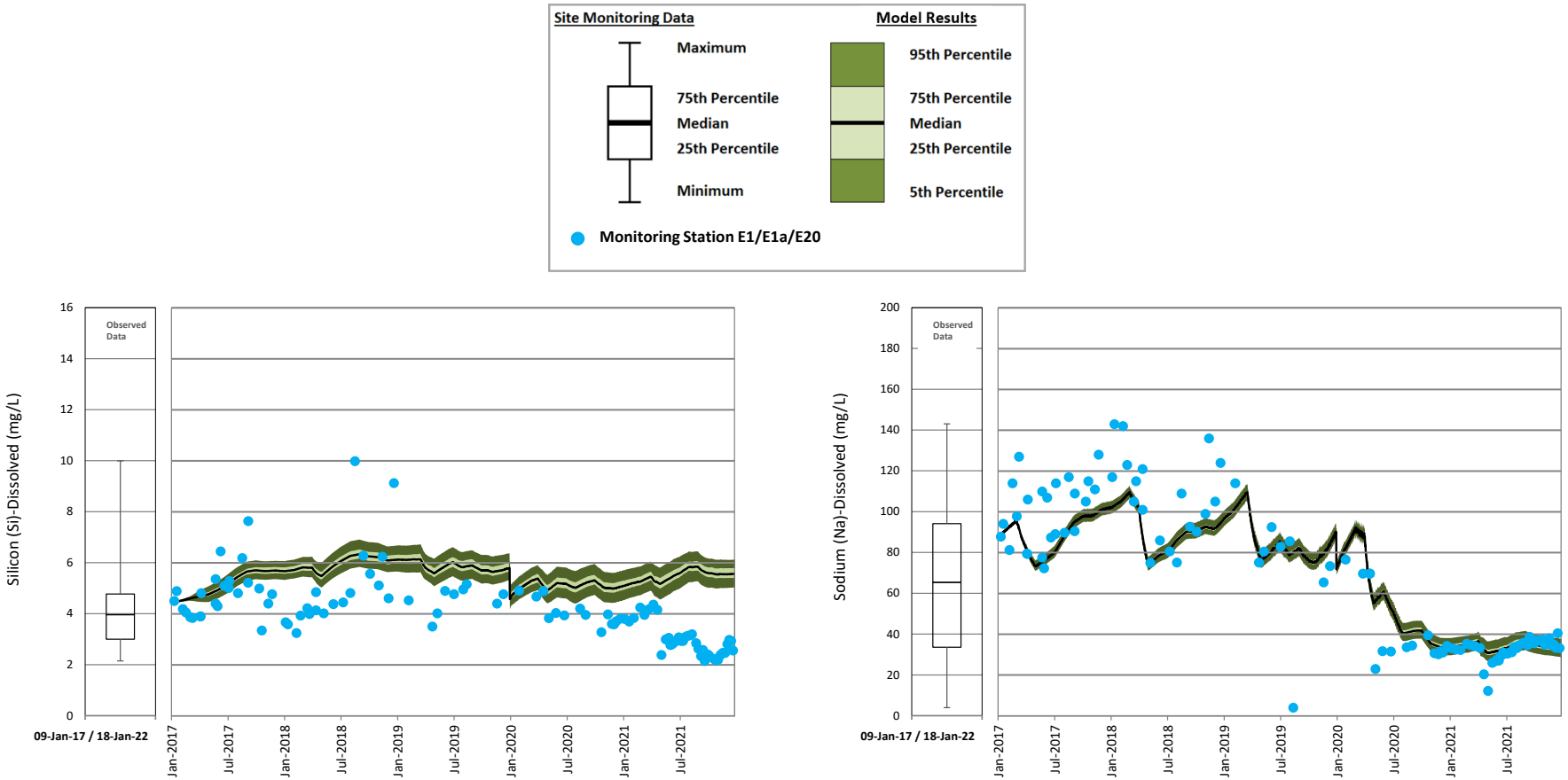

Figure 634: Tailings Storage Facility Calibration – Silicon and Sodium

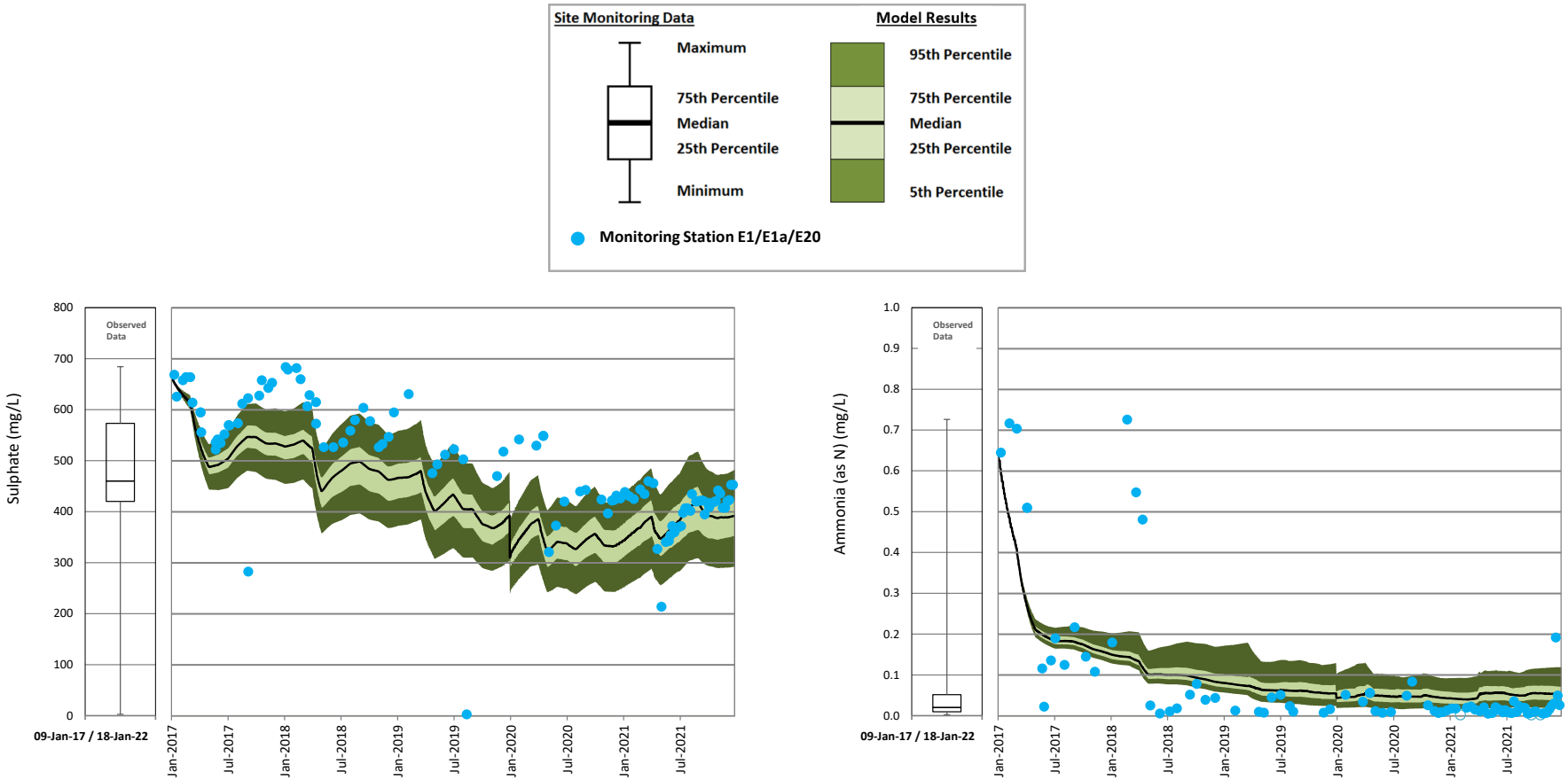

Figure 635: Tailings Storage Facility Calibration – Sulphate and Total Ammonia

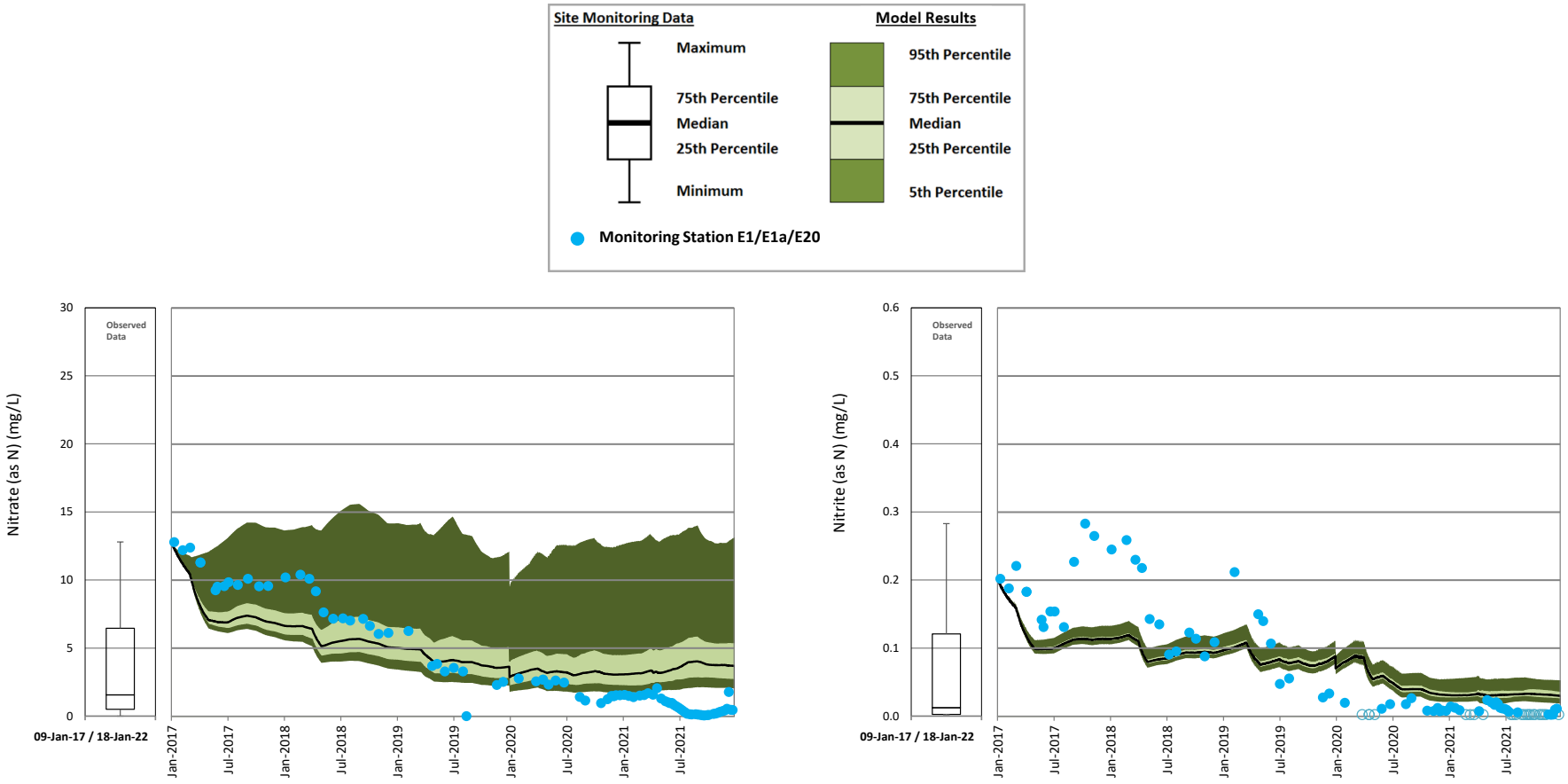

Figure 366: Tailings Storage Facility Calibration – Nitrate and Nitrite

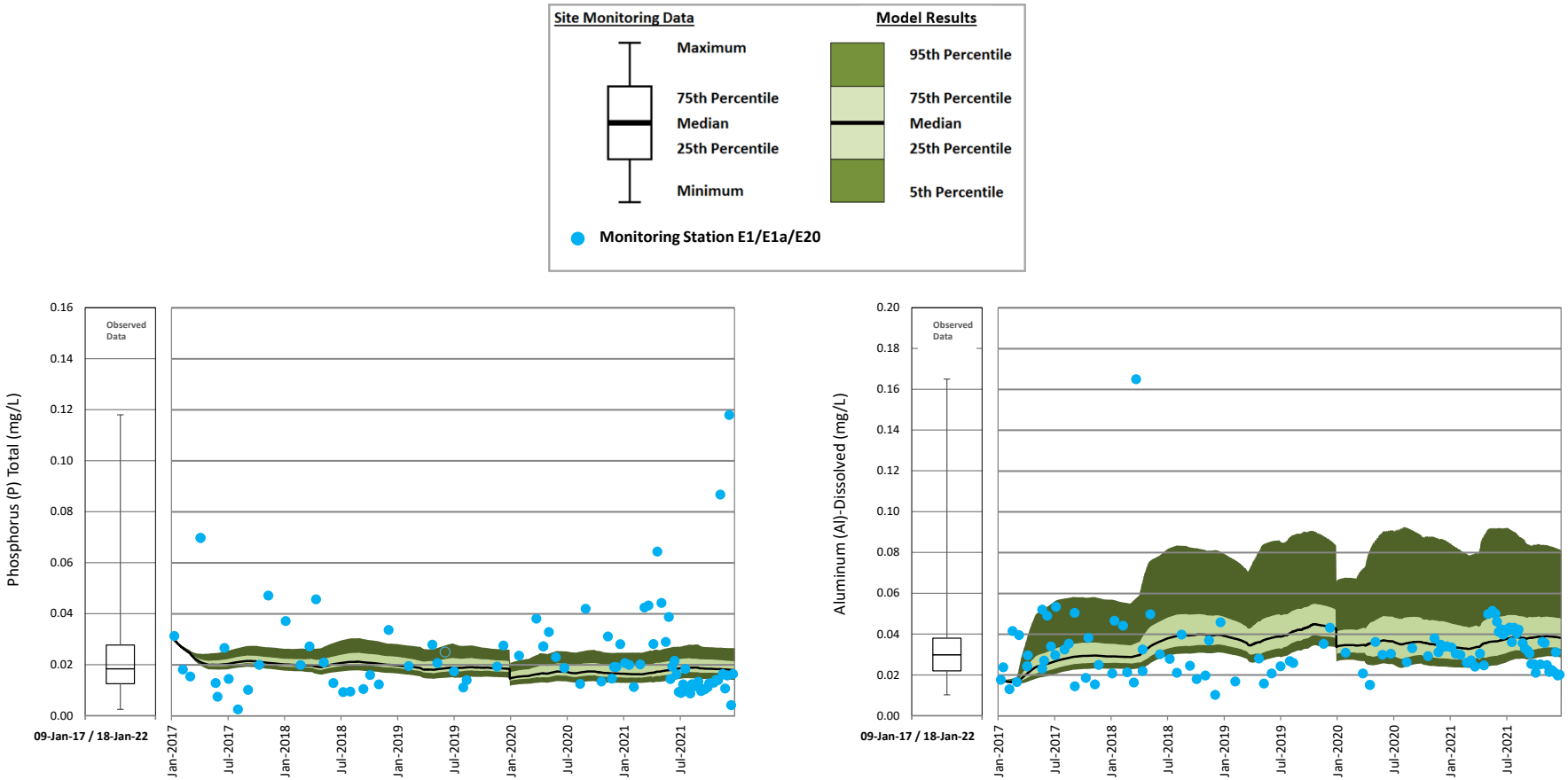

Figure 637: Tailings Storage Facility Calibration – Total Phosphorus and Dissolved Aluminum

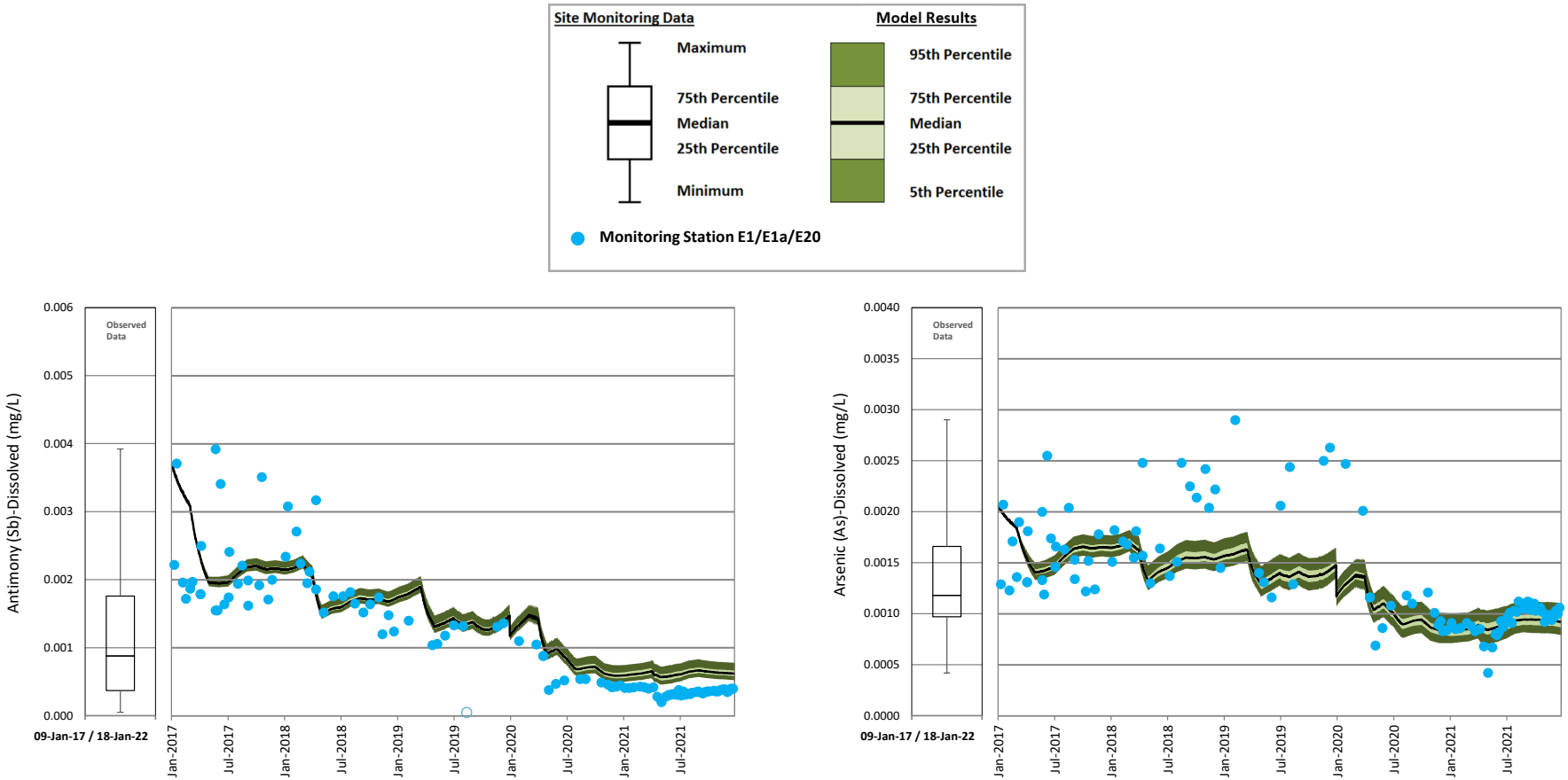

Figure 638: Tailings Storage Facility Calibration – Dissolved Antimony and Dissolved Arsenic

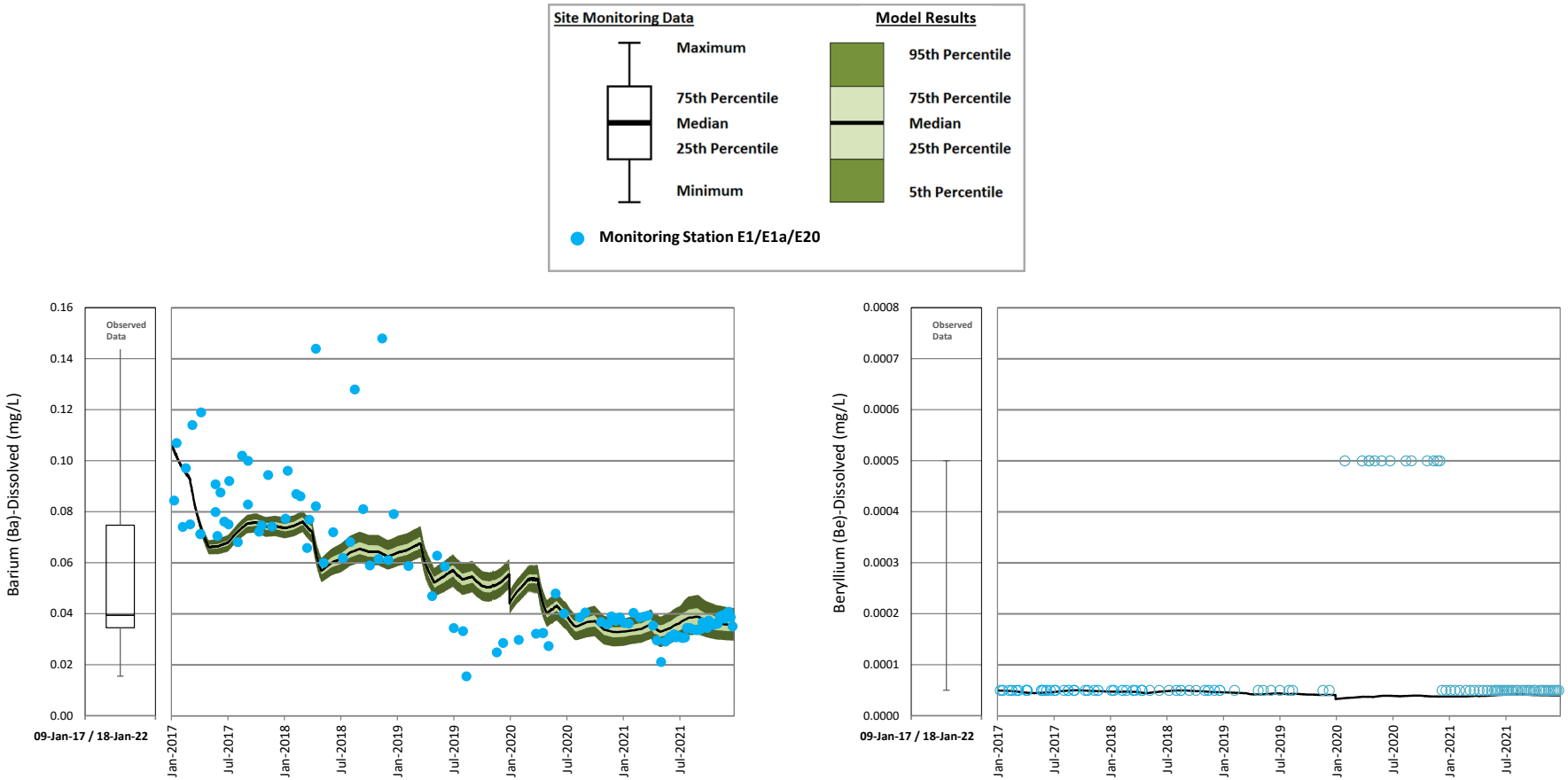

Figure 639: Tailings Storage Facility Calibration – Dissolved Barium and Dissolved Beryllium

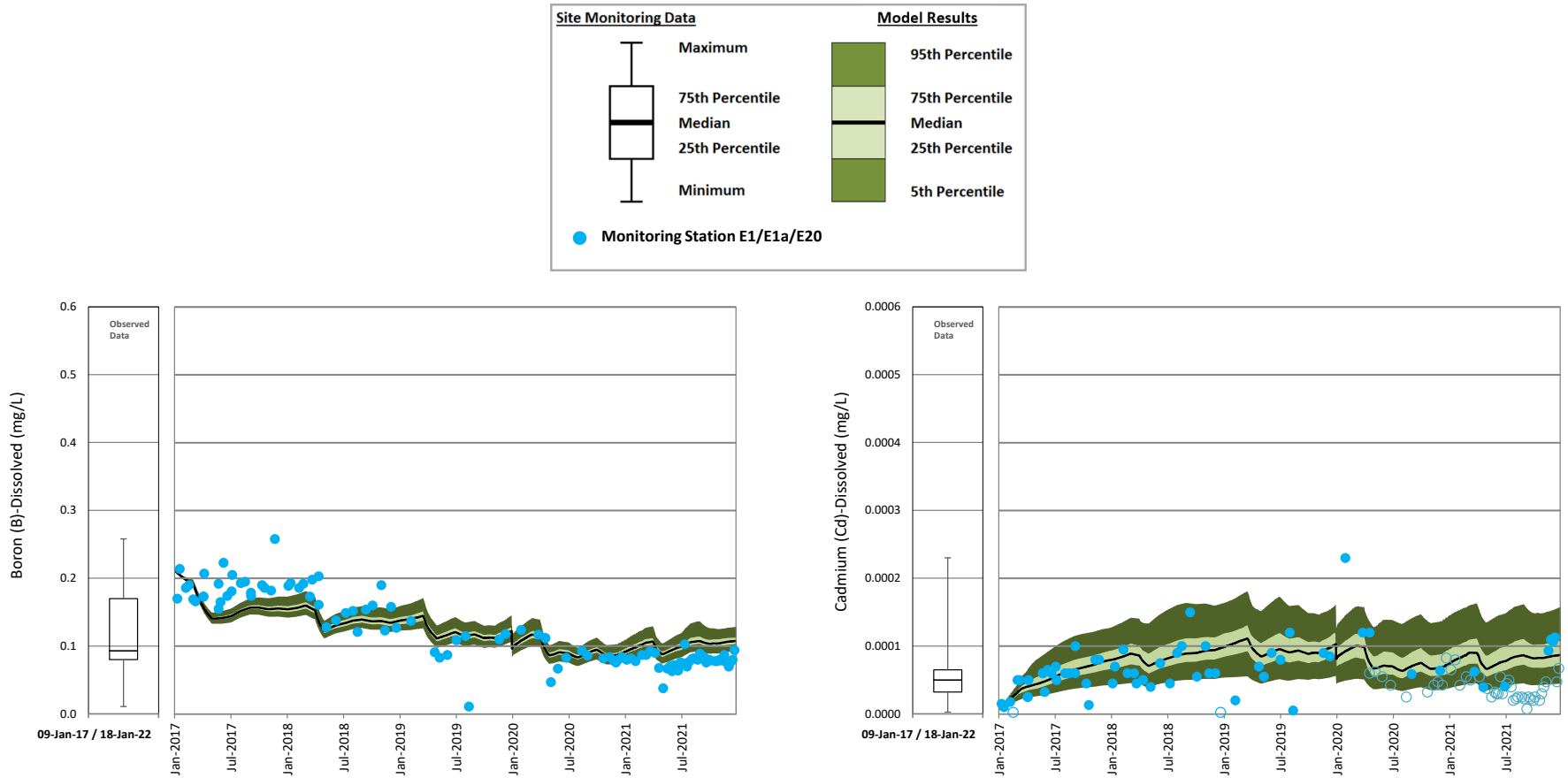

Figure 70: Tailings Storage Facility Calibration – Dissolved Boron and Dissolved Cadmium

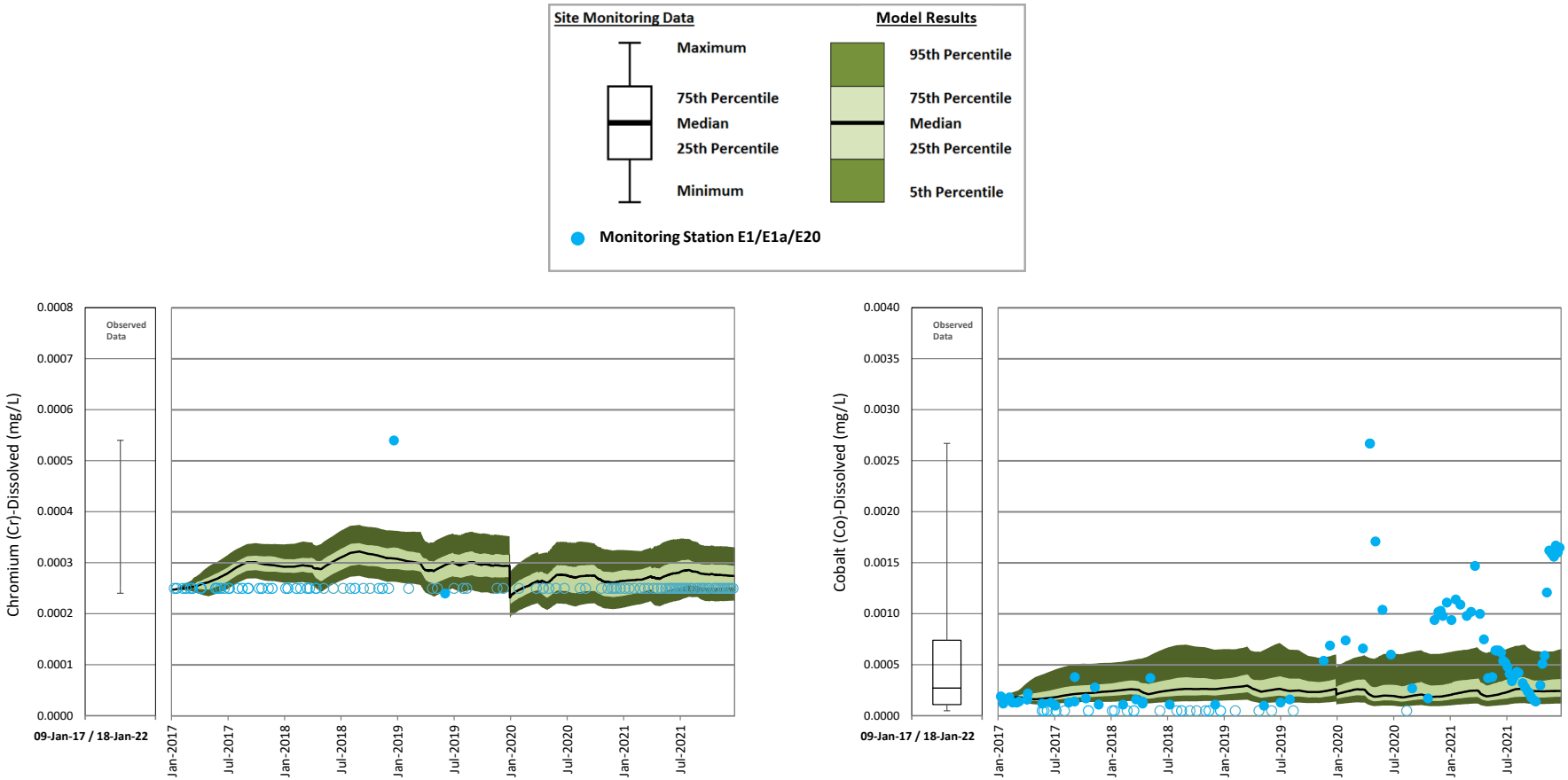

Figure 71: Tailings Storage Facility Calibration – Dissolved Chromium and Dissolved Cobalt

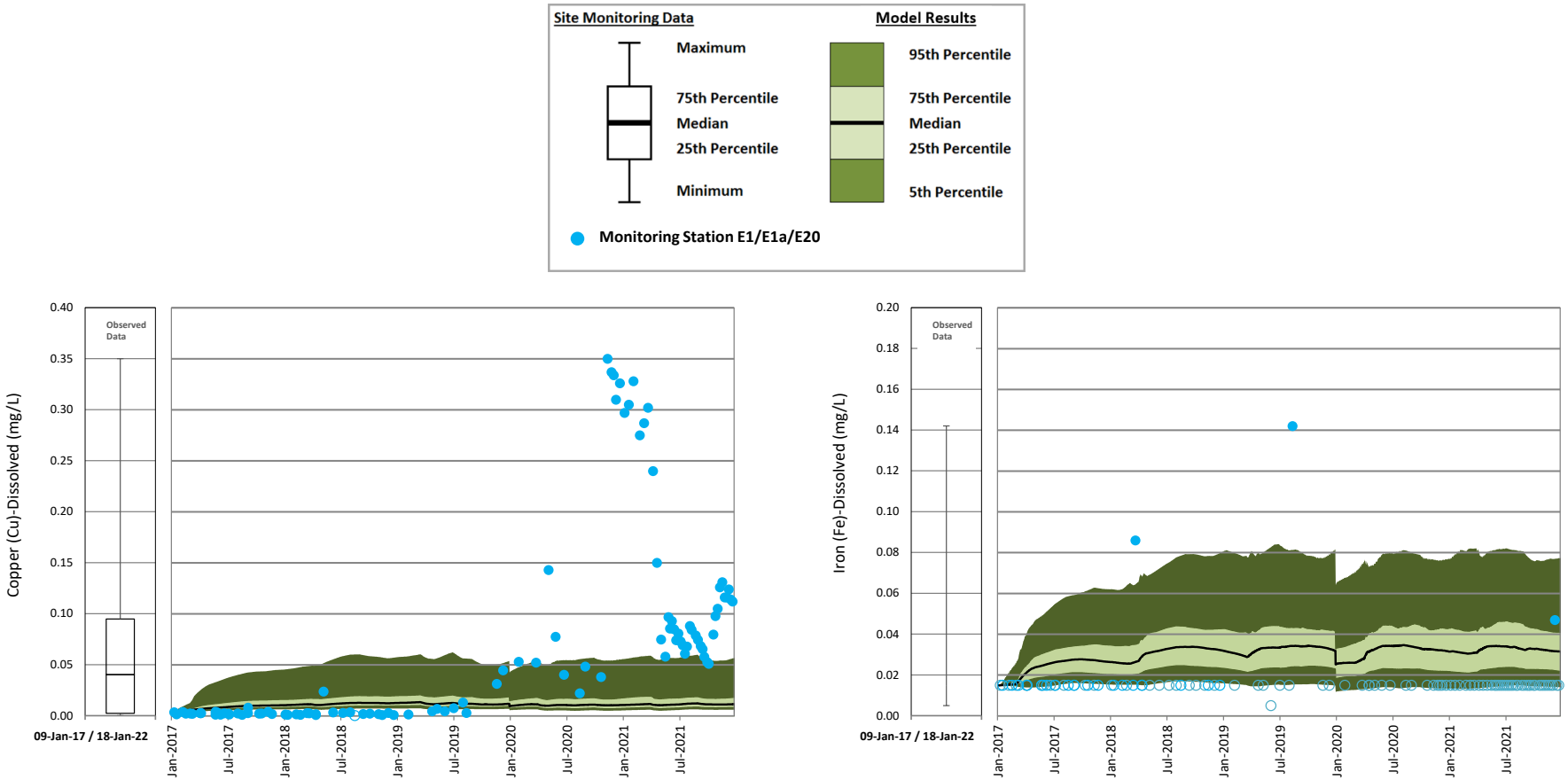

Figure 72: Tailings Storage Facility Calibration – Dissolved Copper and Dissolved Iron

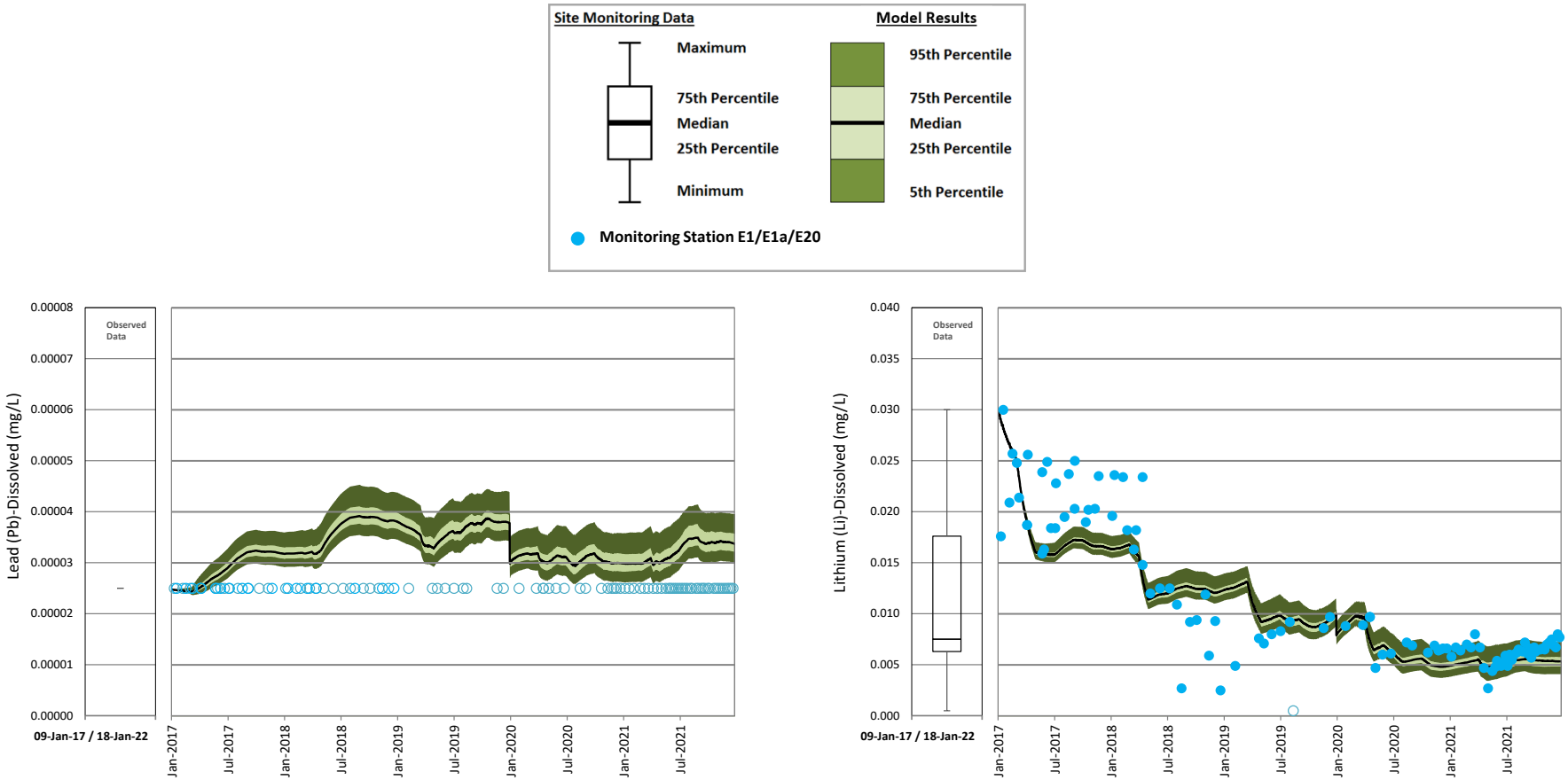

Figure 73: Tailings Storage Facility Calibration – Dissolved Lead and Dissolved Lithium

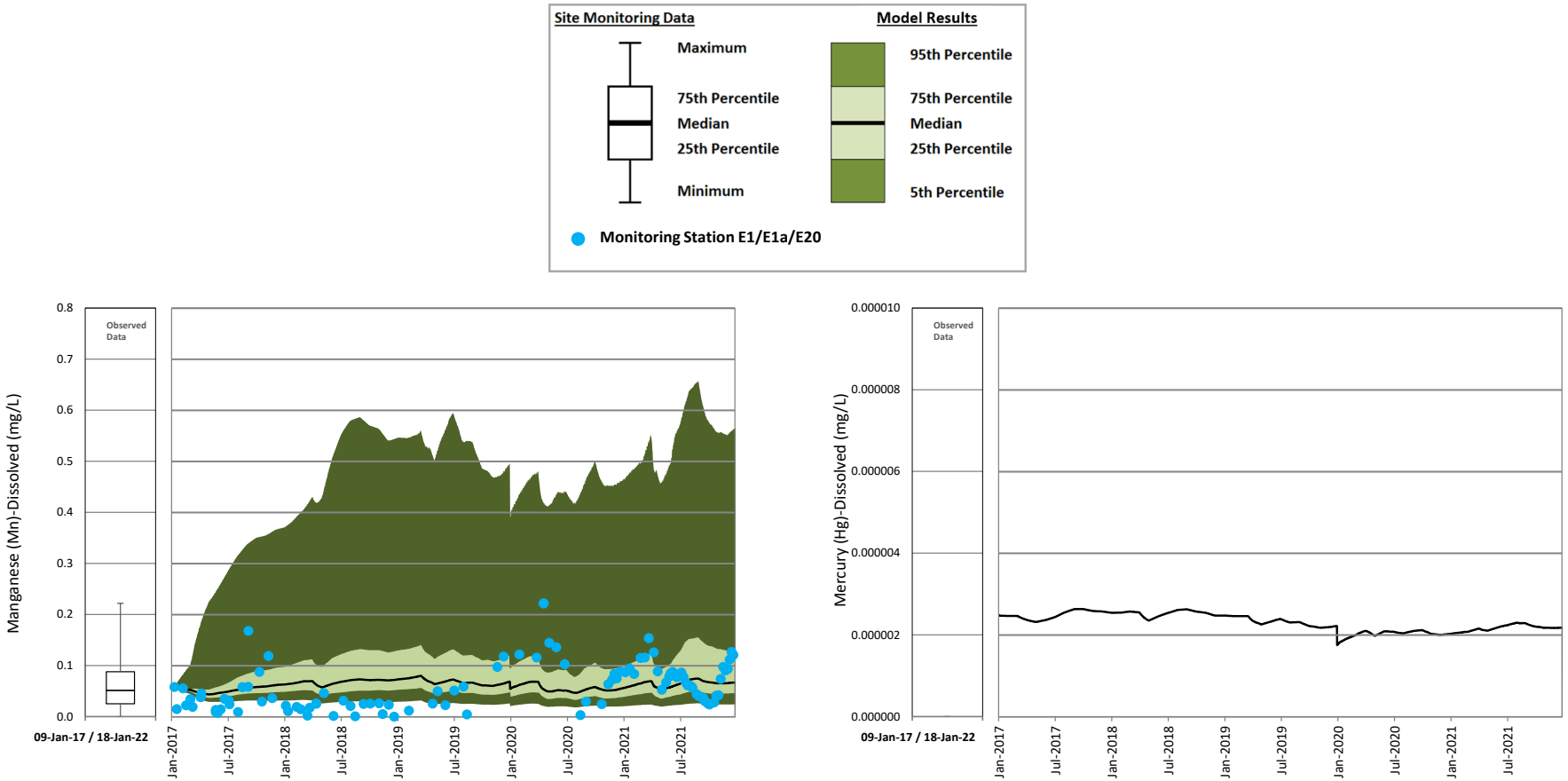

Figure 74: Tailings Storage Facility Calibration – Dissolved Manganese and Dissolved Mercury

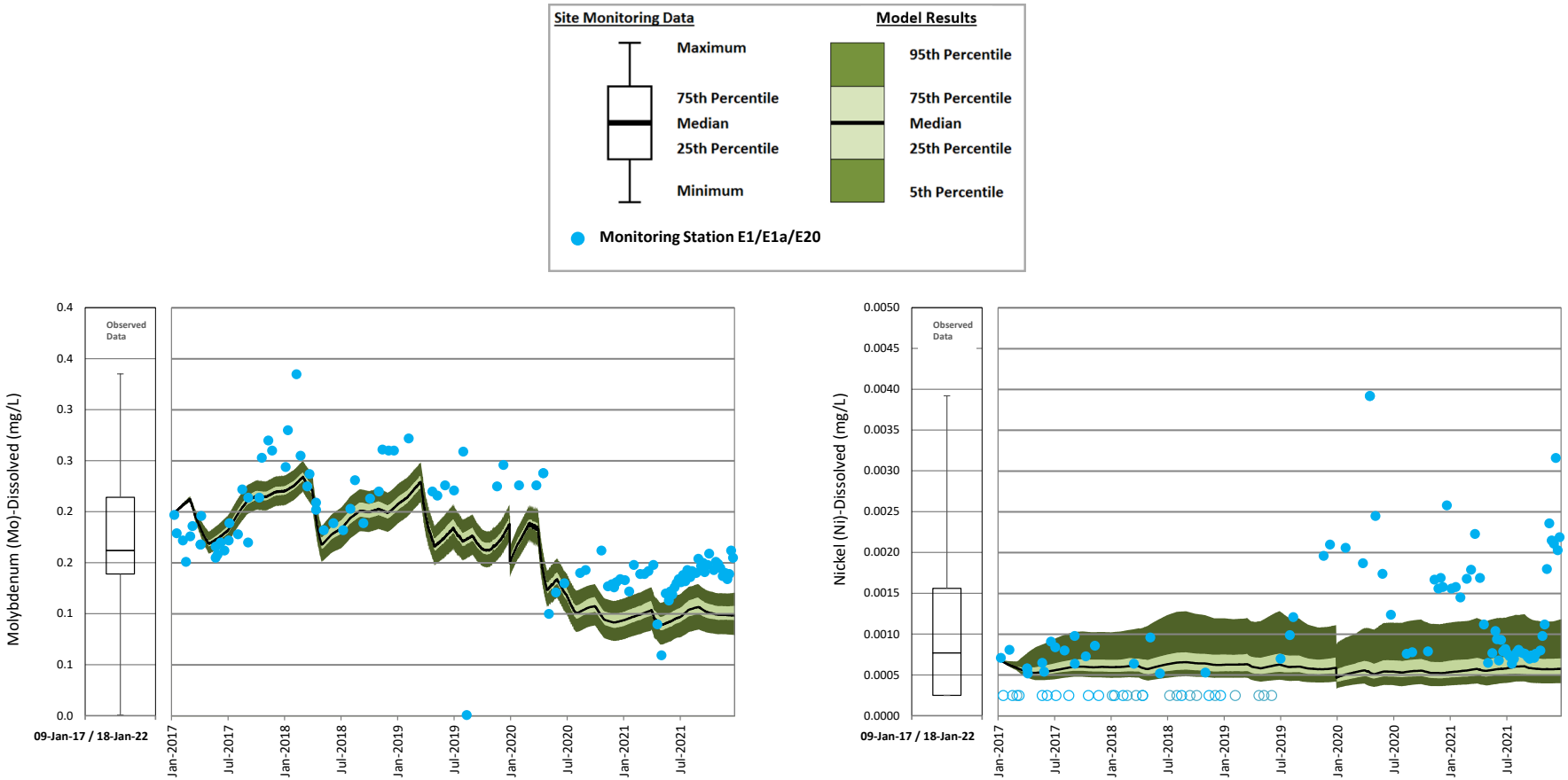

Figure 75: Tailings Storage Facility Calibration – Dissolved Molybdenum and Dissolved Nickel

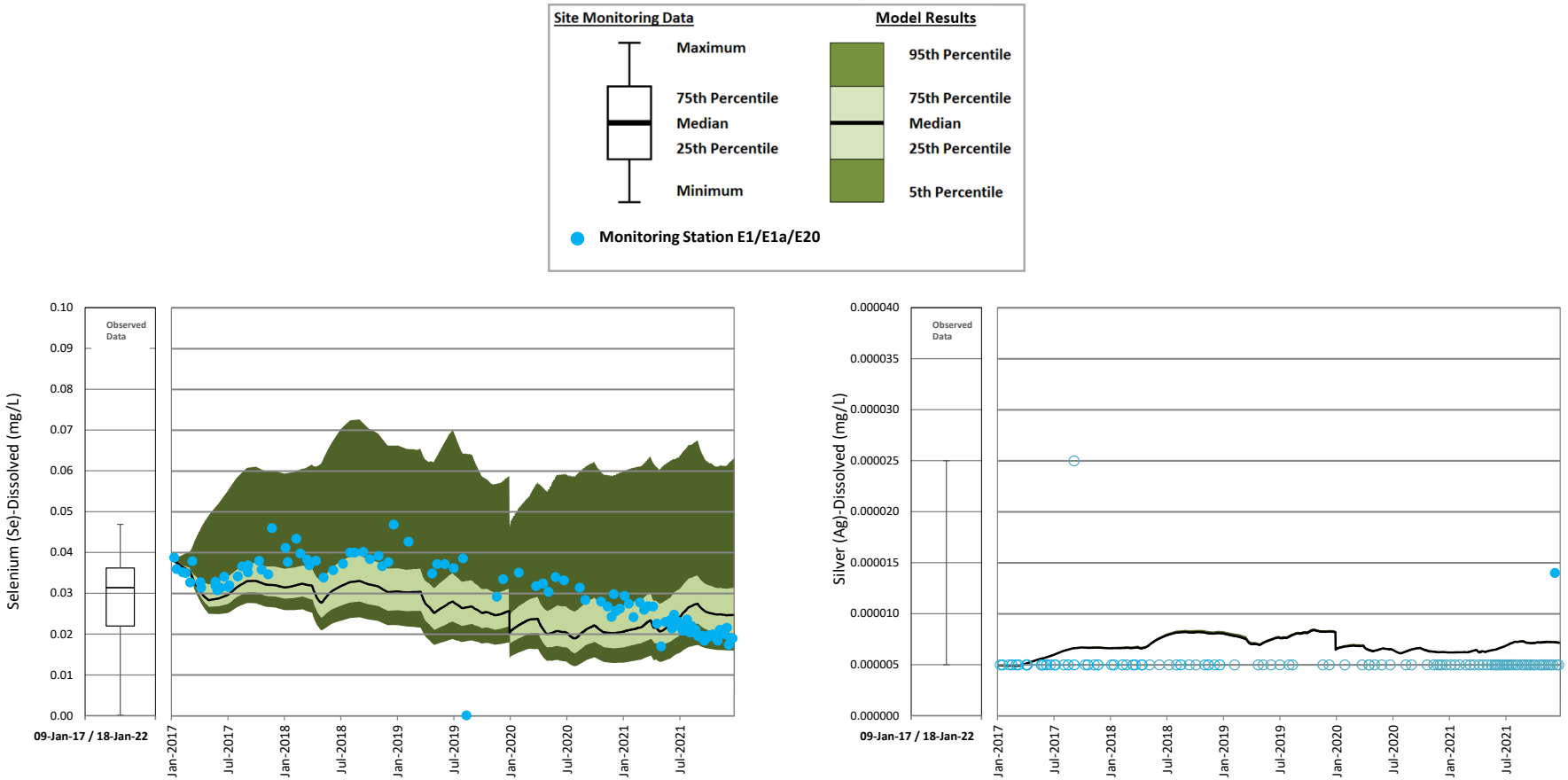

Figure 76: Tailings Storage Facility Calibration – Dissolved Selenium and Dissolved Silver

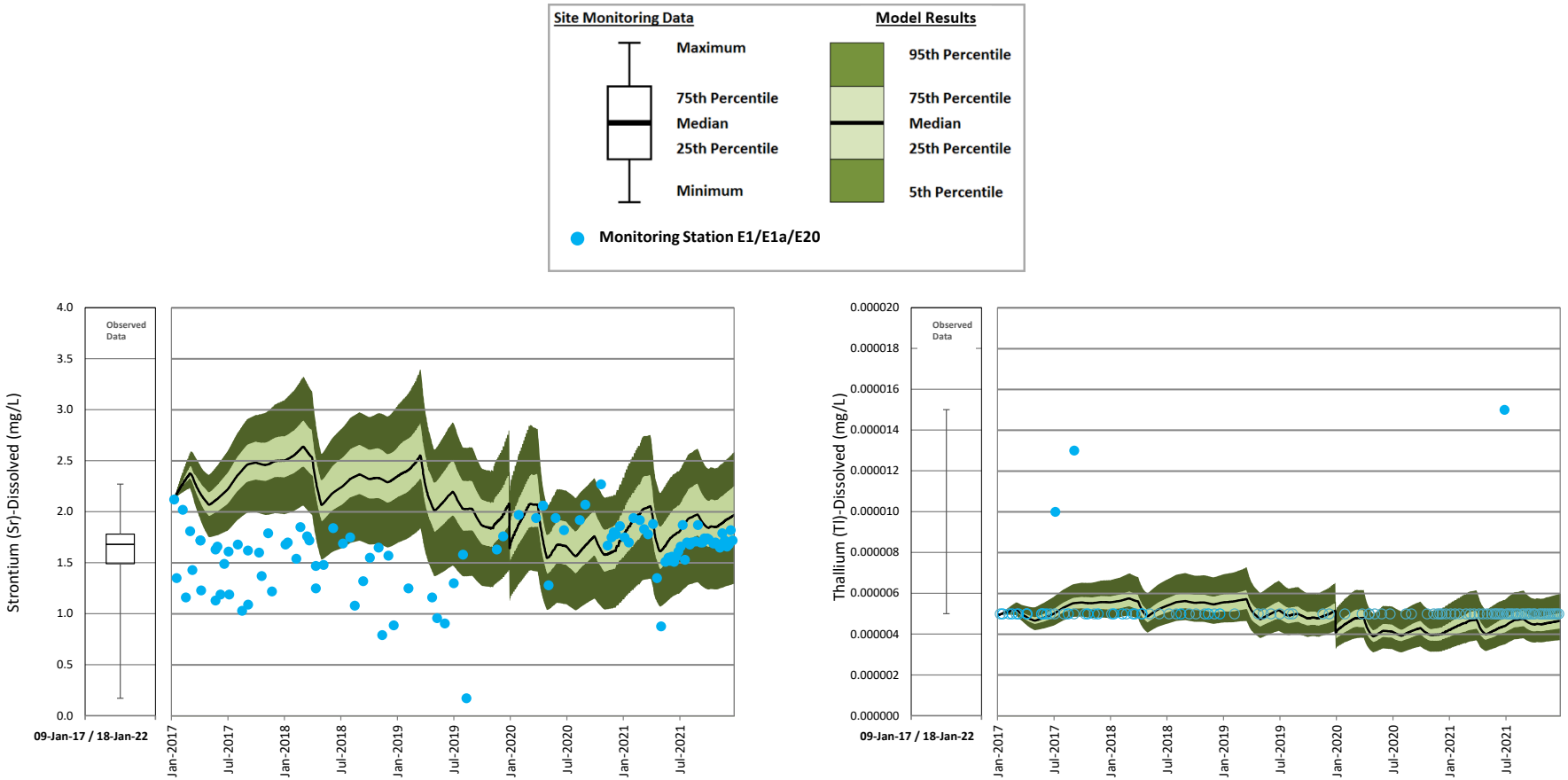

Figure 77: Tailings Storage Facility Calibration – Dissolved Strontium and Dissolved Thallium

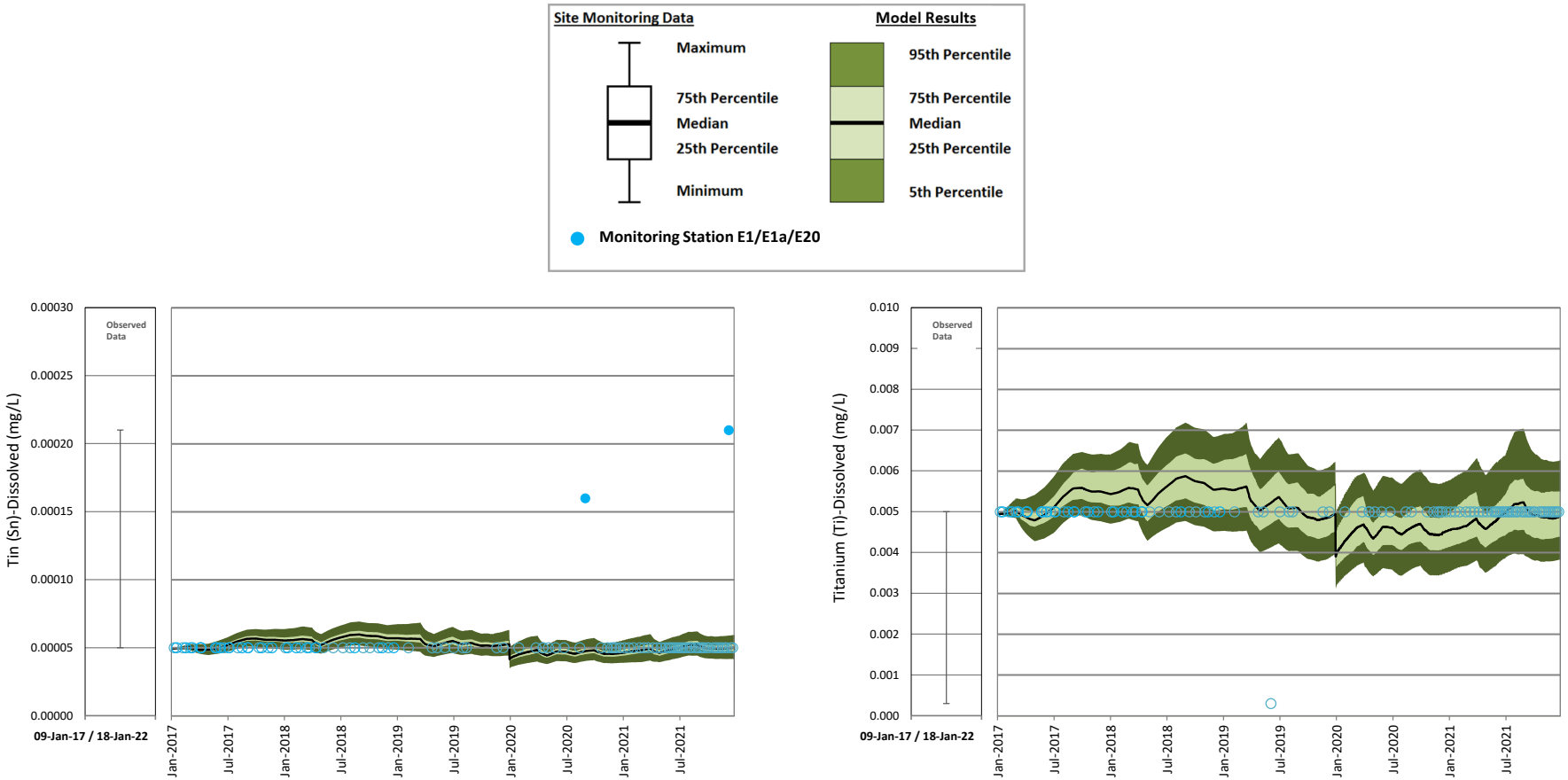

Figure 78: Tailings Storage Facility Calibration – Dissolved Tin and Dissolved Titanium

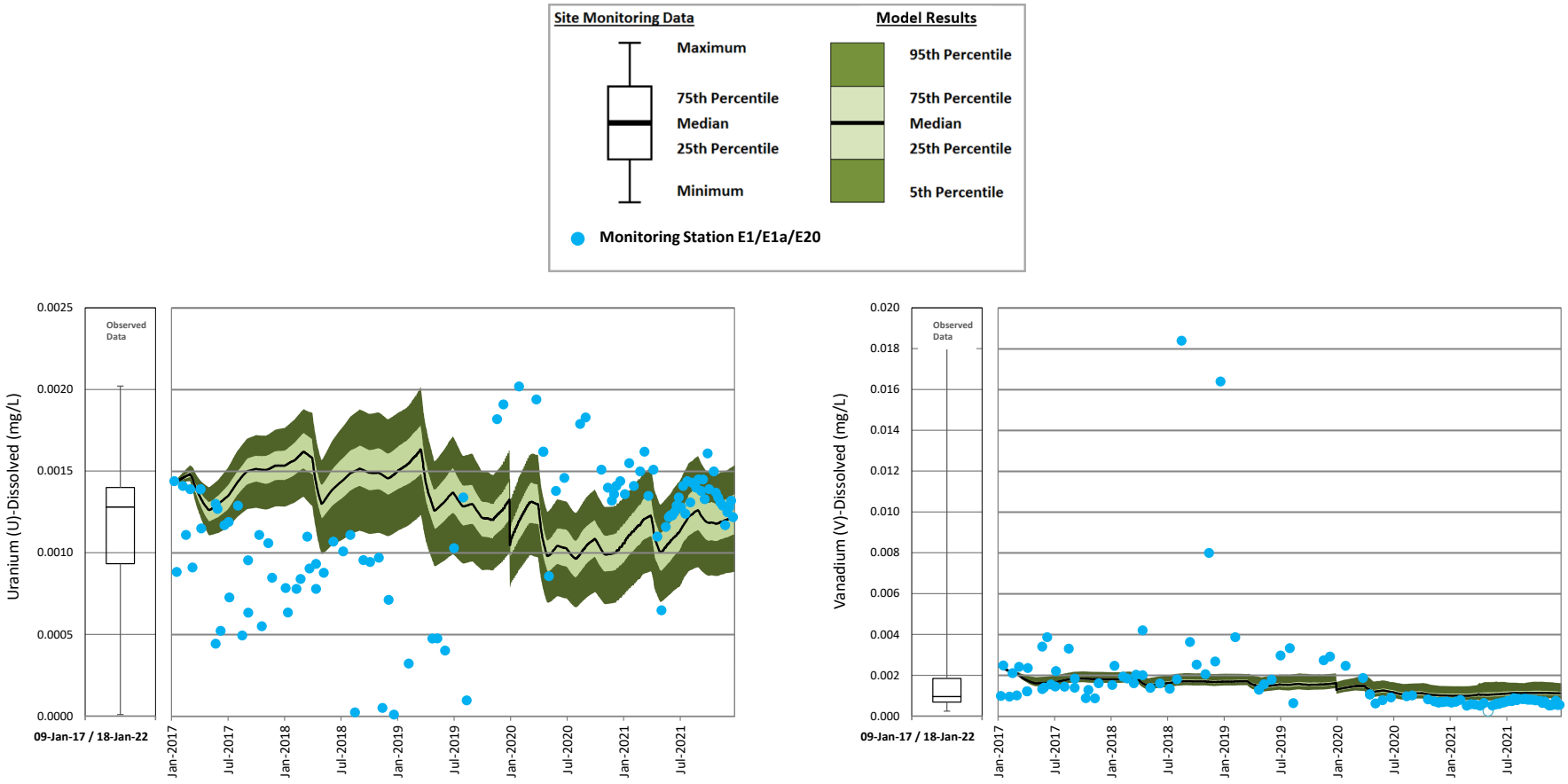

Figure 740: Tailings Storage Facility Calibration – Dissolved Uranium and Dissolved Vanadium

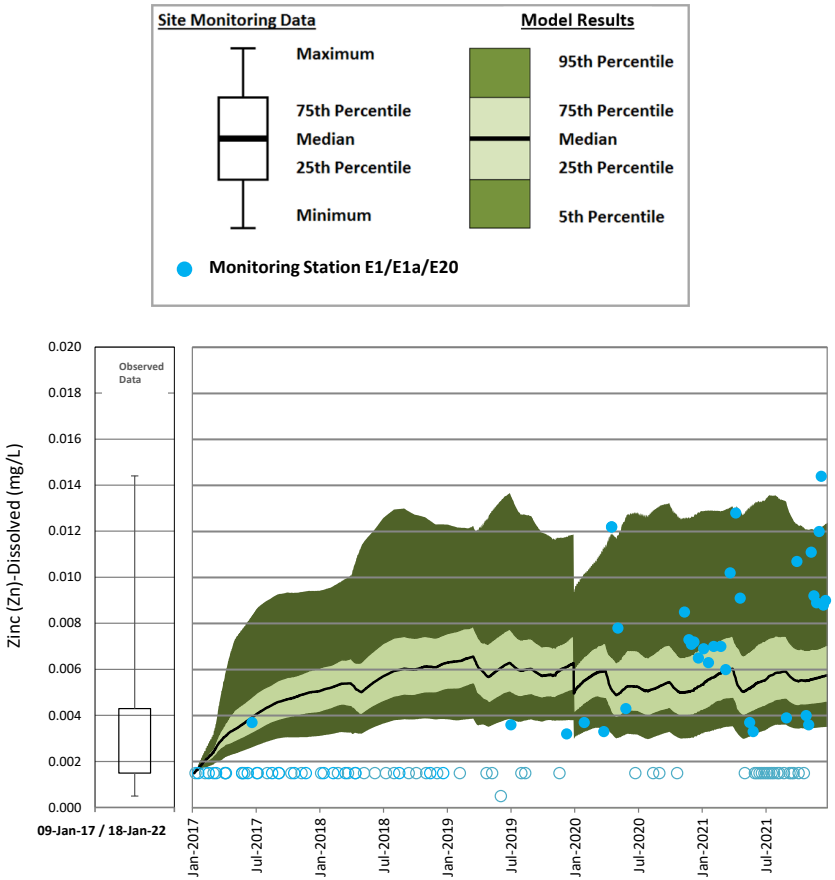

Figure 80: Tailings Storage Facility Calibration – Dissolved Zinc

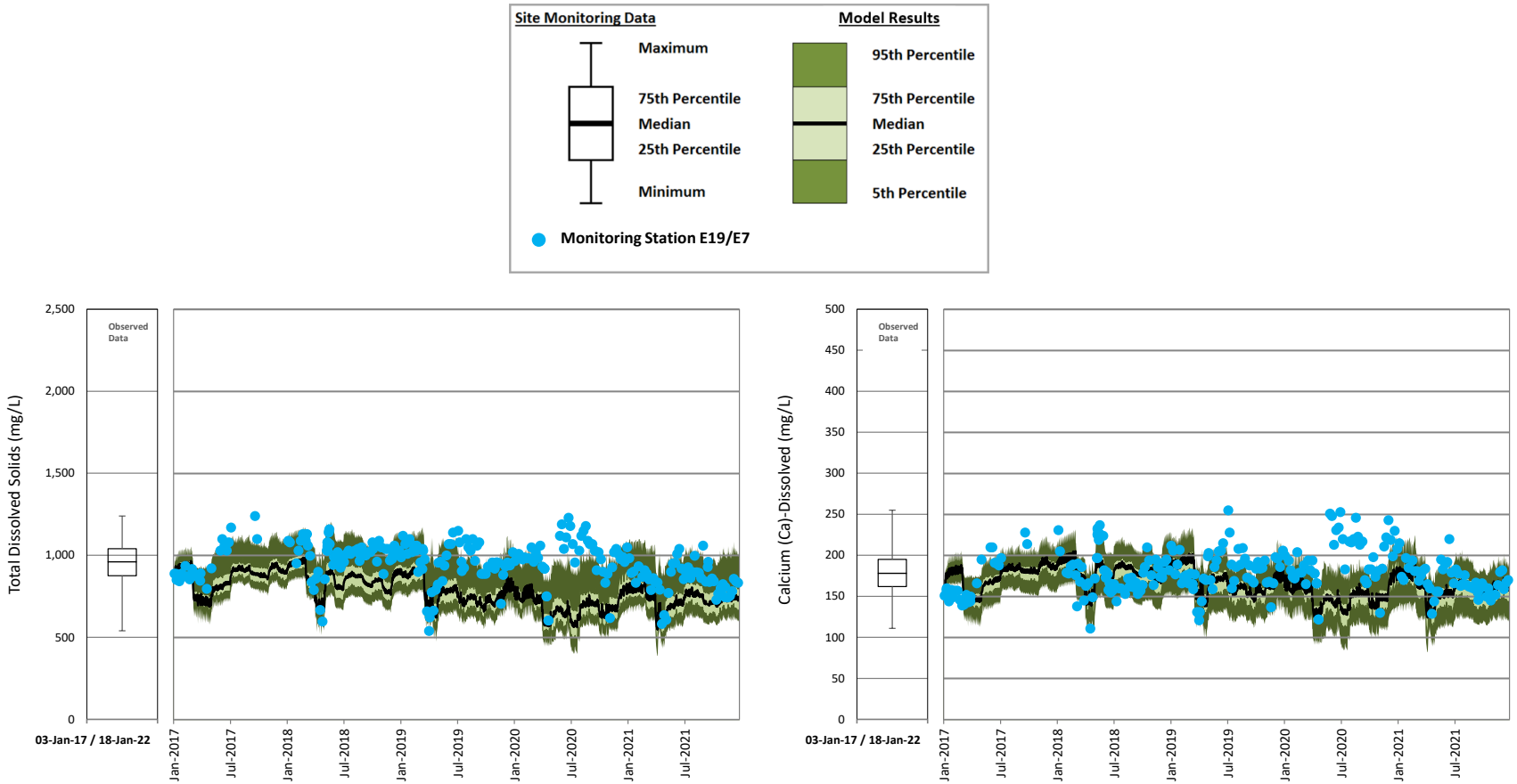

Figure 841: Perimeter Embankment Till Borrow Pond Calibration – Total Dissolved Solids and Calcium

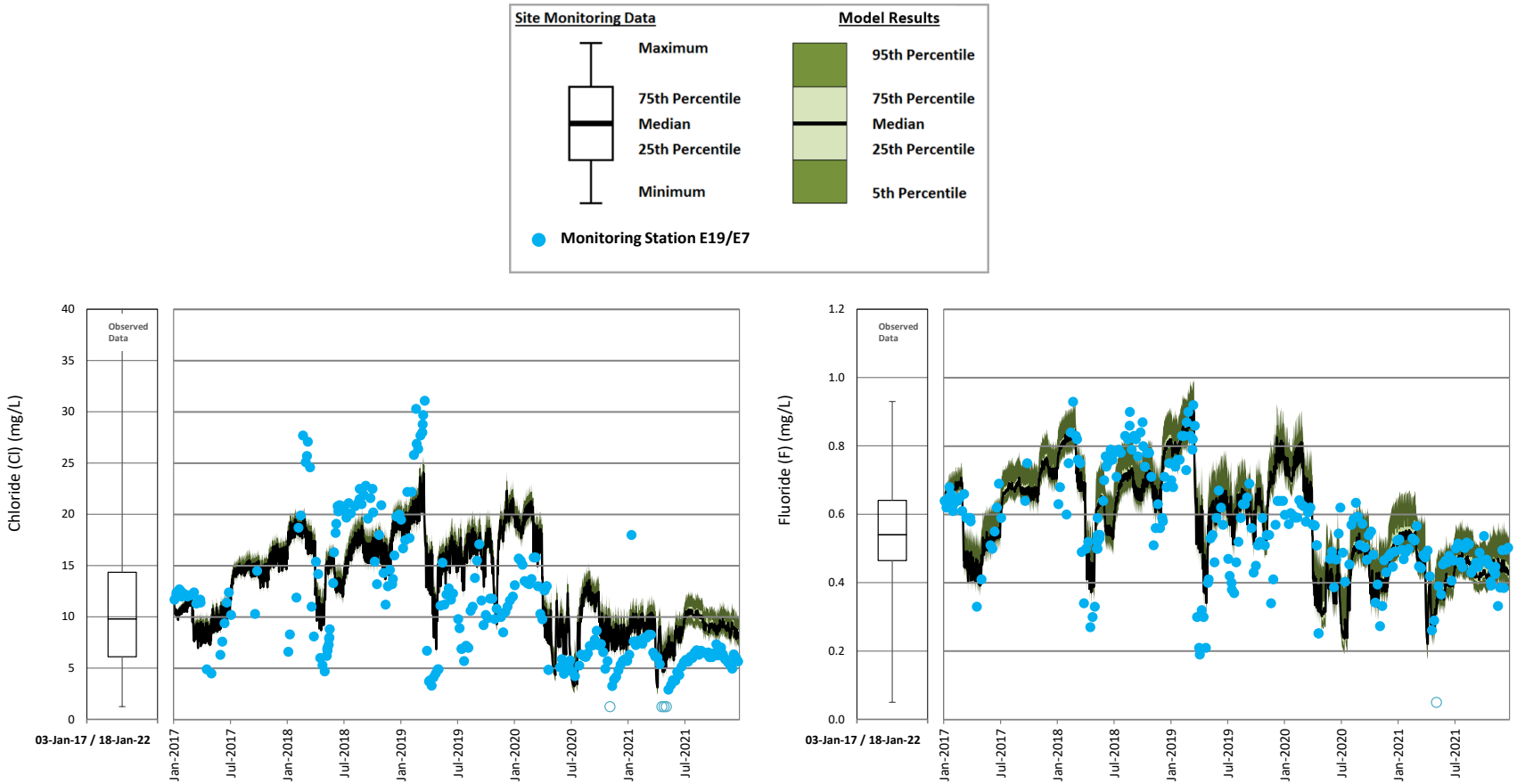

Figure 842: Perimeter Embankment Till Borrow Pond Calibration – Chloride and Fluoride

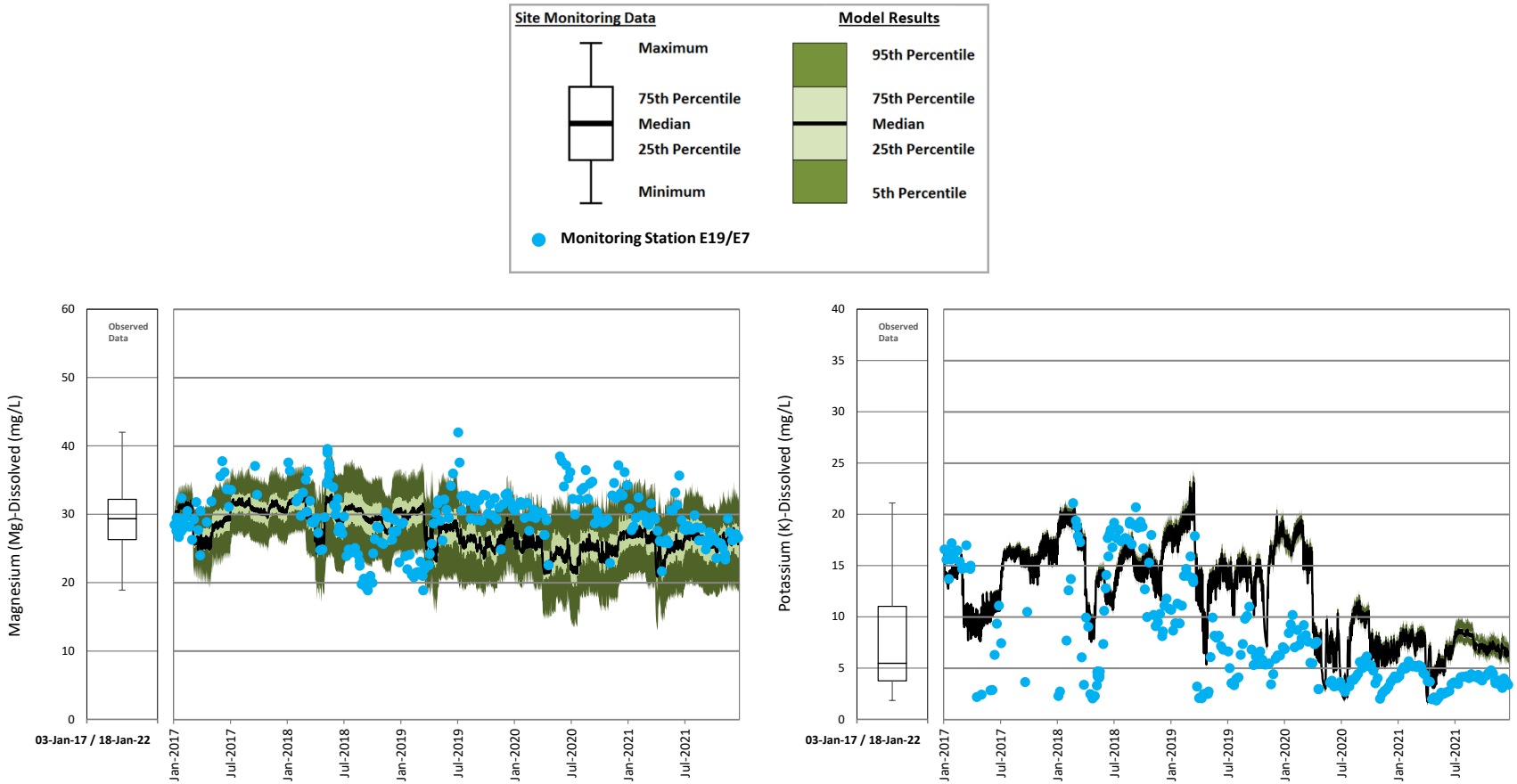

Figure 843: Perimeter Embankment Till Borrow Pond Calibration – Magnesium and Potassium

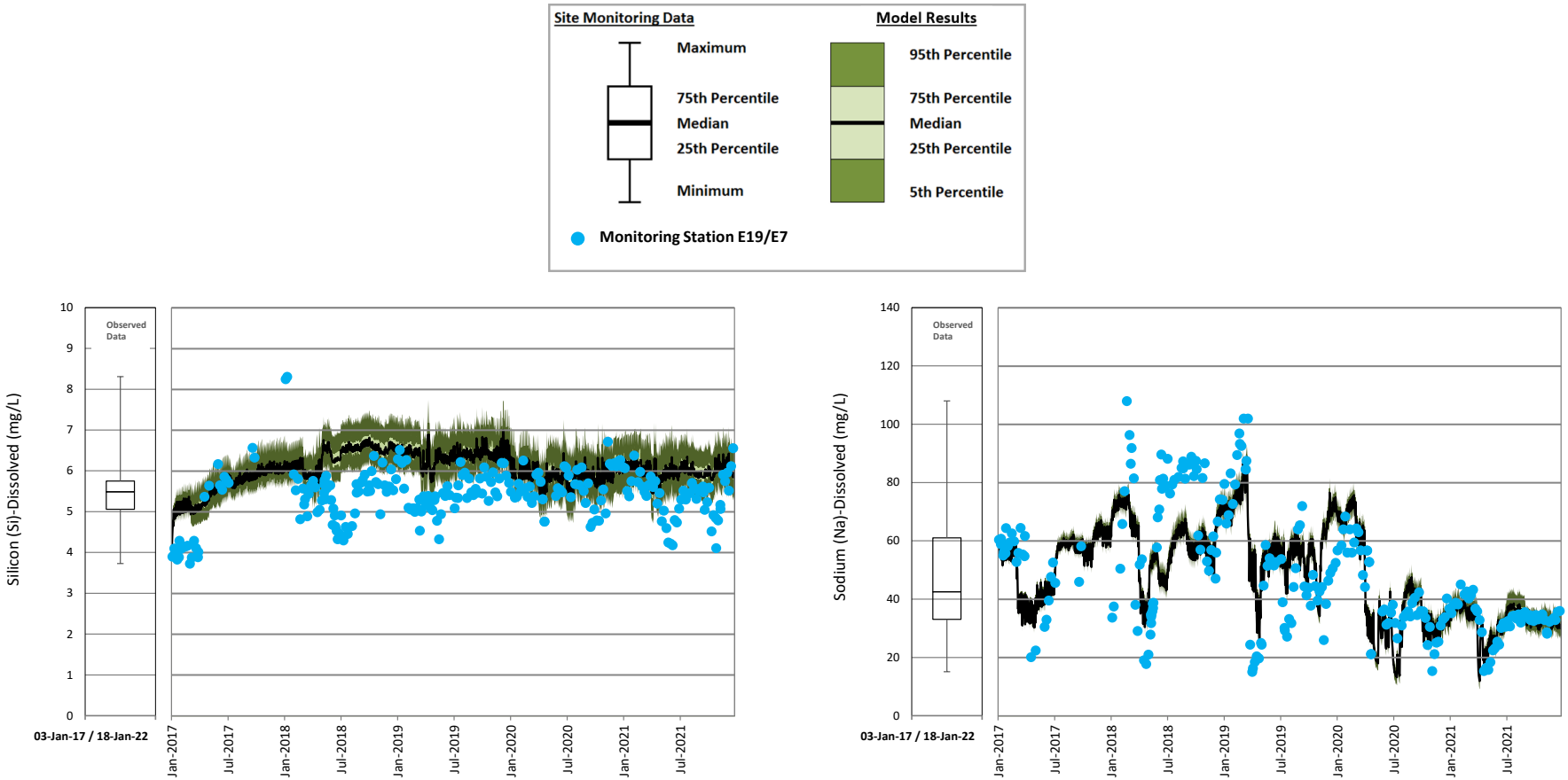

Figure 844: Perimeter Embankment Till Borrow Pond Calibration – Silicon and Sodium

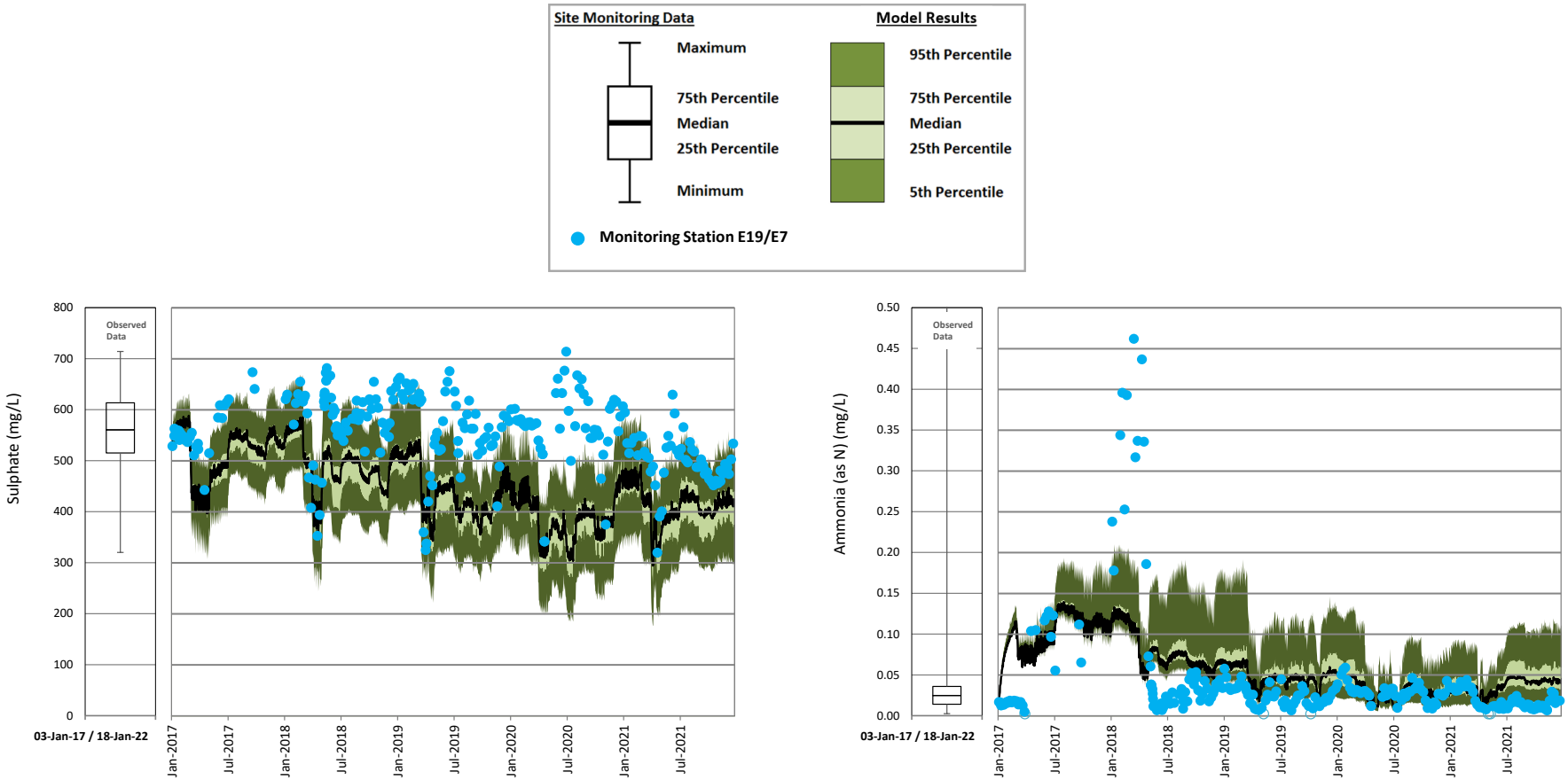

Figure 845: Perimeter Embankment Till Borrow Pond Calibration – Sulphate and Total Ammonia

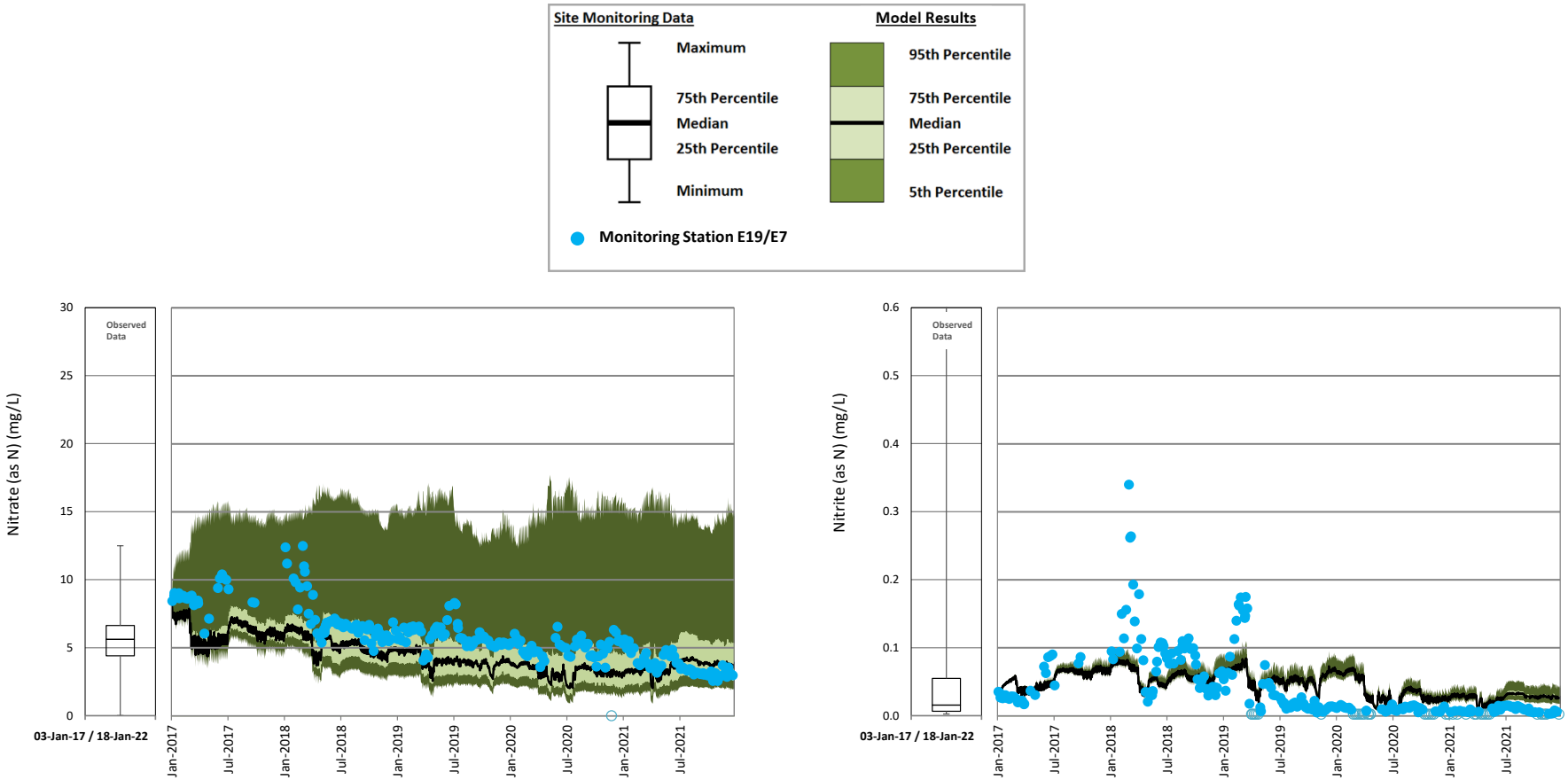

Figure 846: Perimeter Embankment Till Borrow Pond Calibration – Nitrate and Nitrite

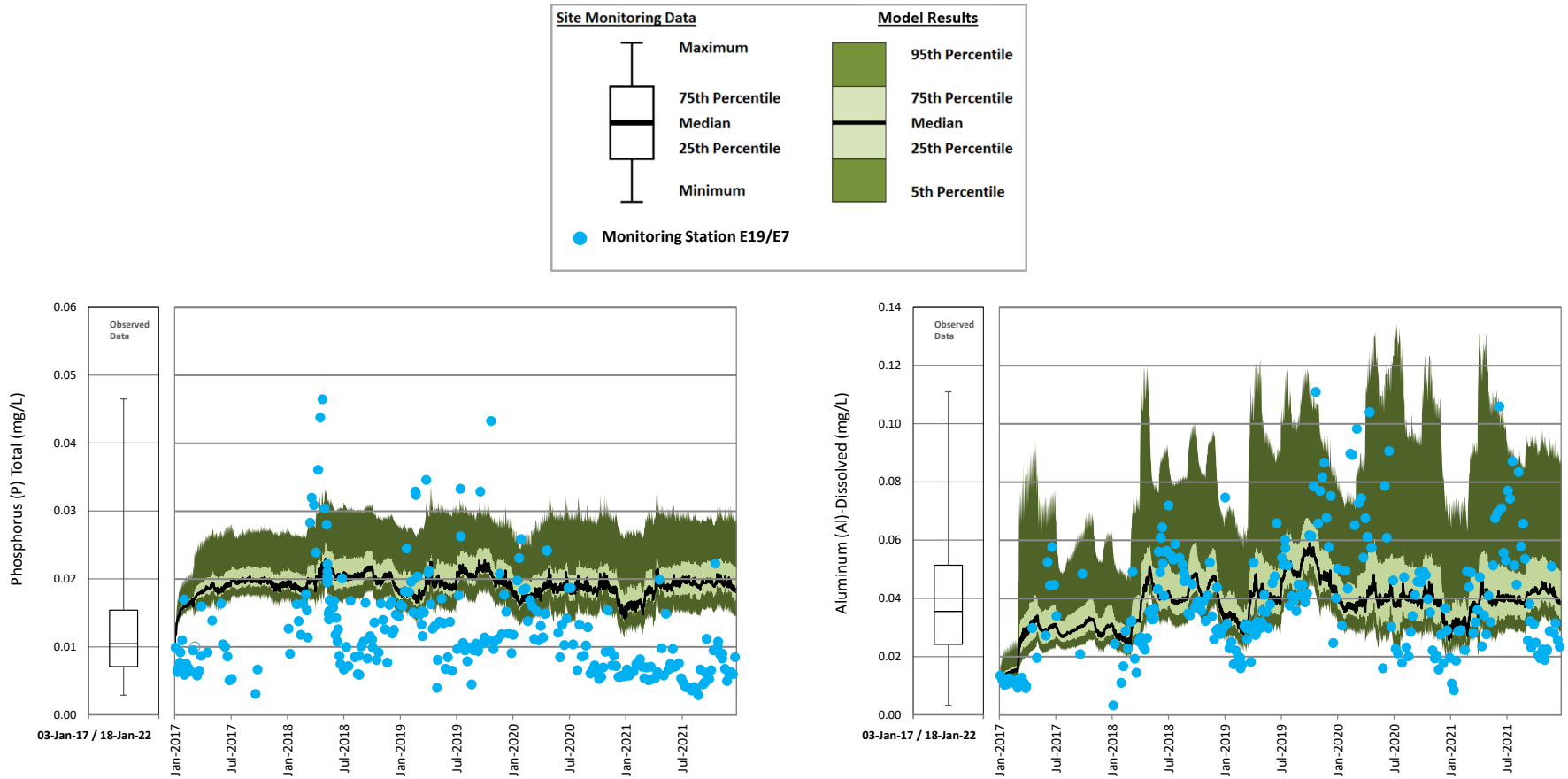

Figure 847: Perimeter Embankment Till Borrow Pond Calibration – Total Phosphorus and Dissolved Aluminum

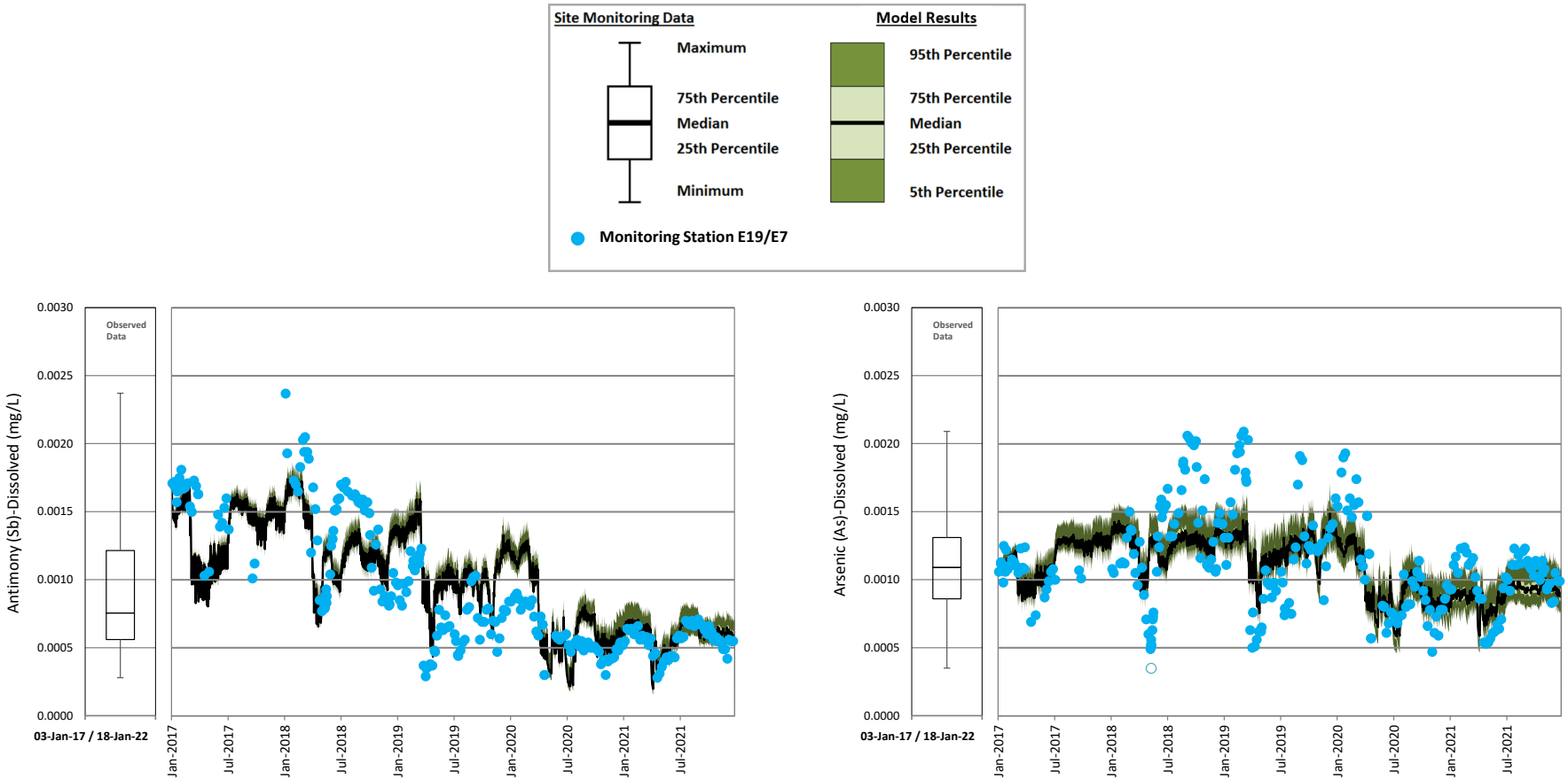

Figure 848: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Antimony and Dissolved Arsenic

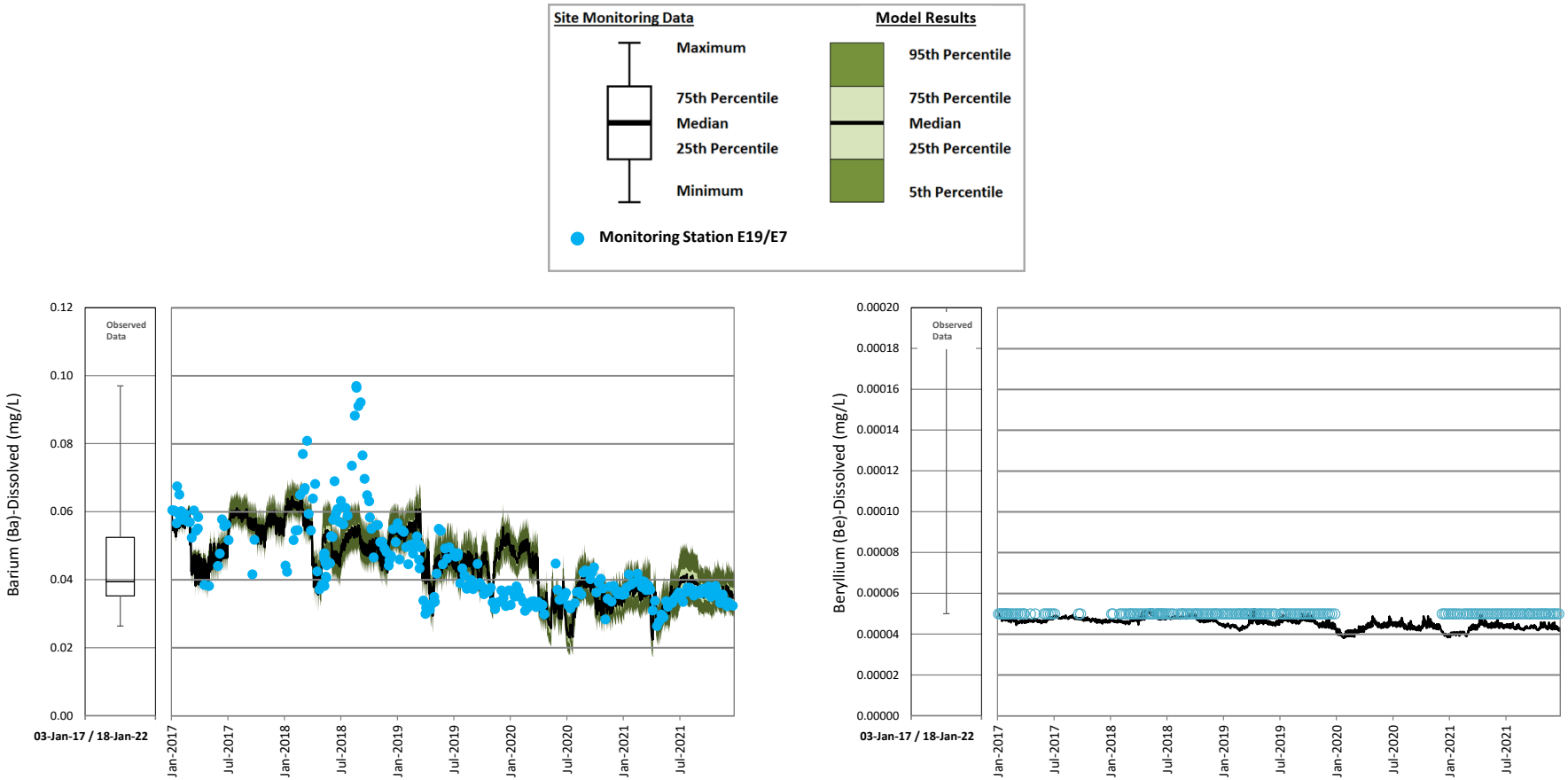

Figure 849: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Barium and Dissolved Beryllium

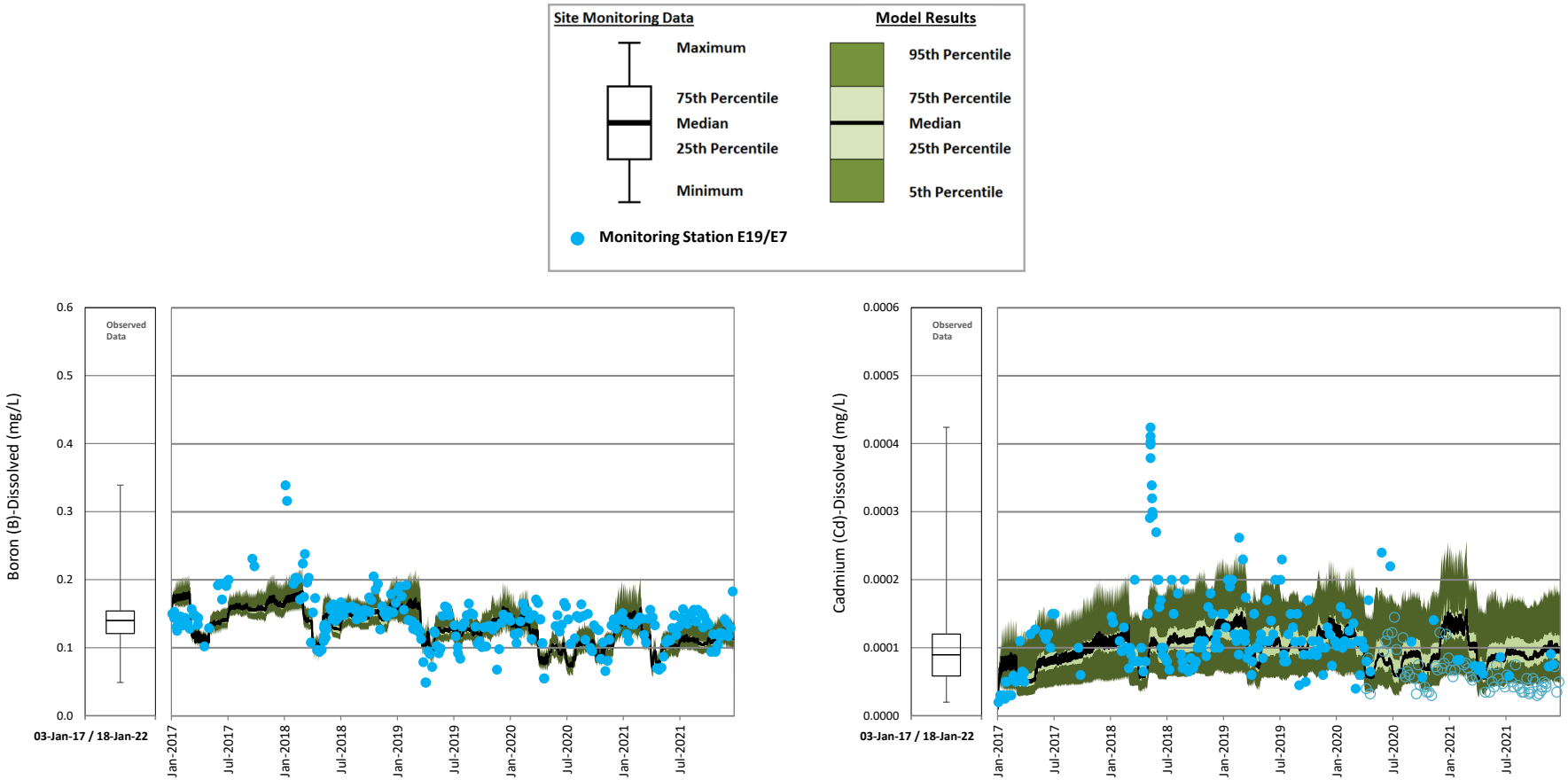

Figure 500: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Boron and Dissolved Cadmium

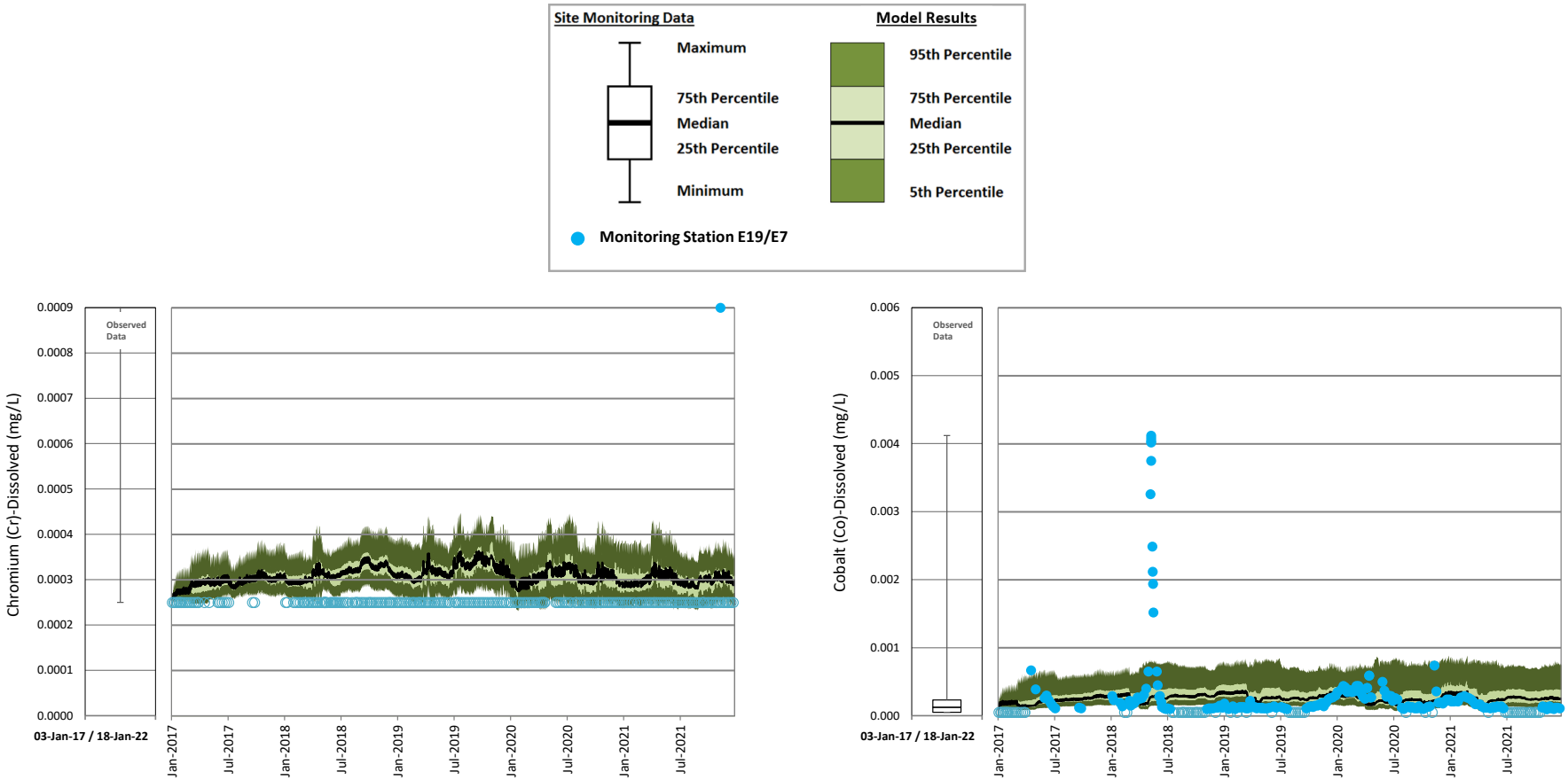

Figure 511: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Chromium and Dissolved Cobalt

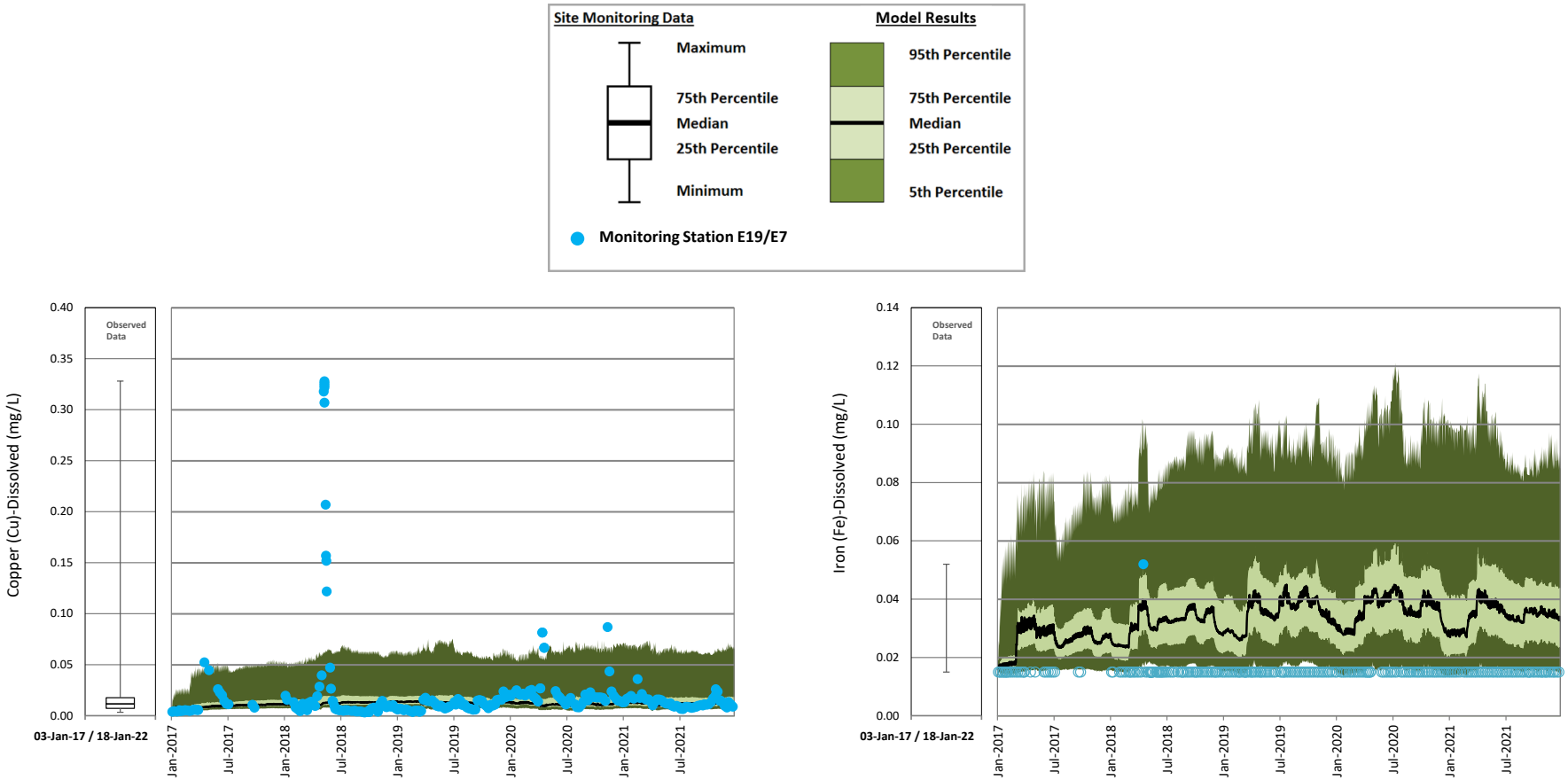

Figure 522: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Copper and Dissolved Iron

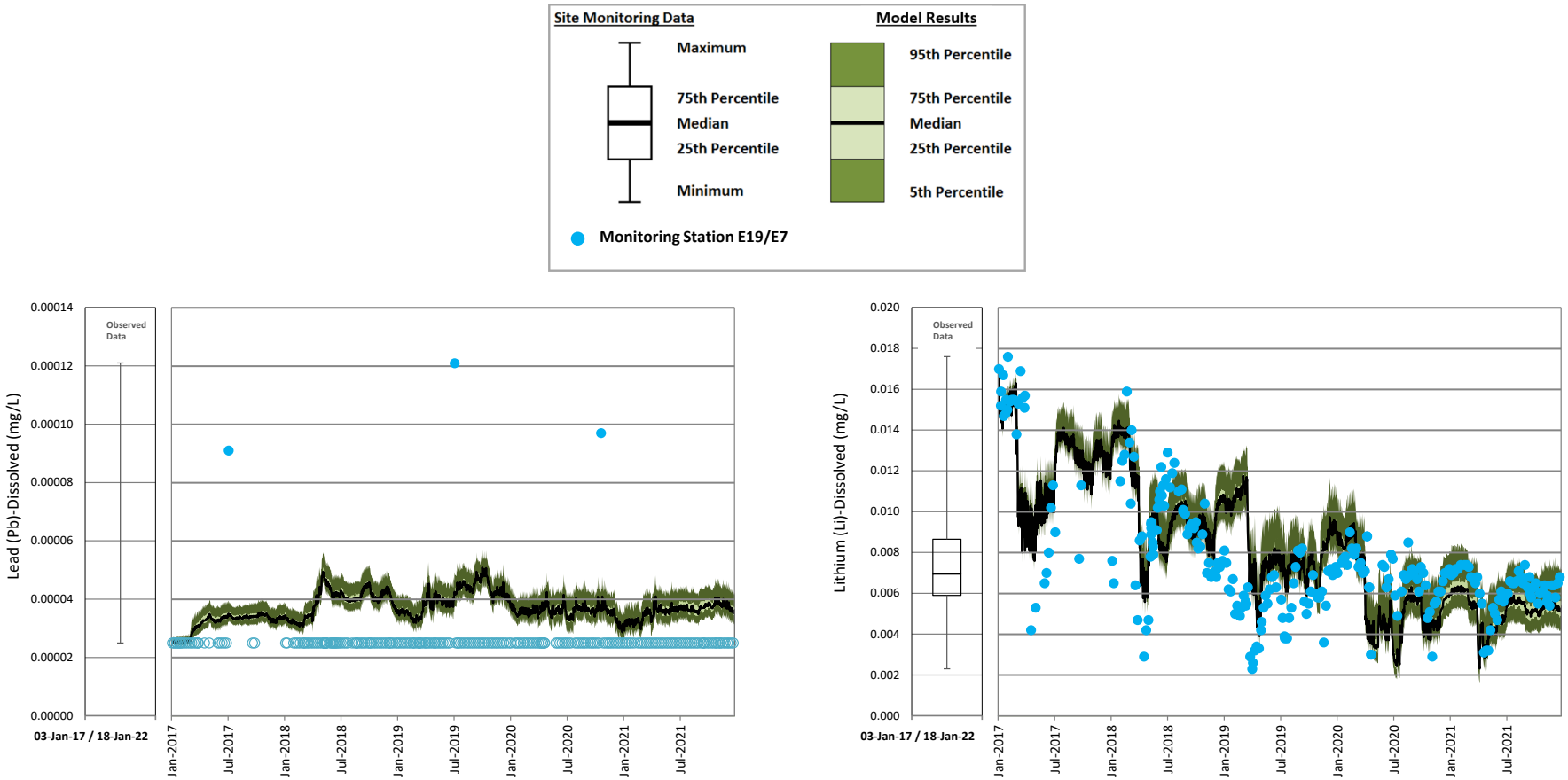

Figure 533: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Lead and Dissolved Lithium

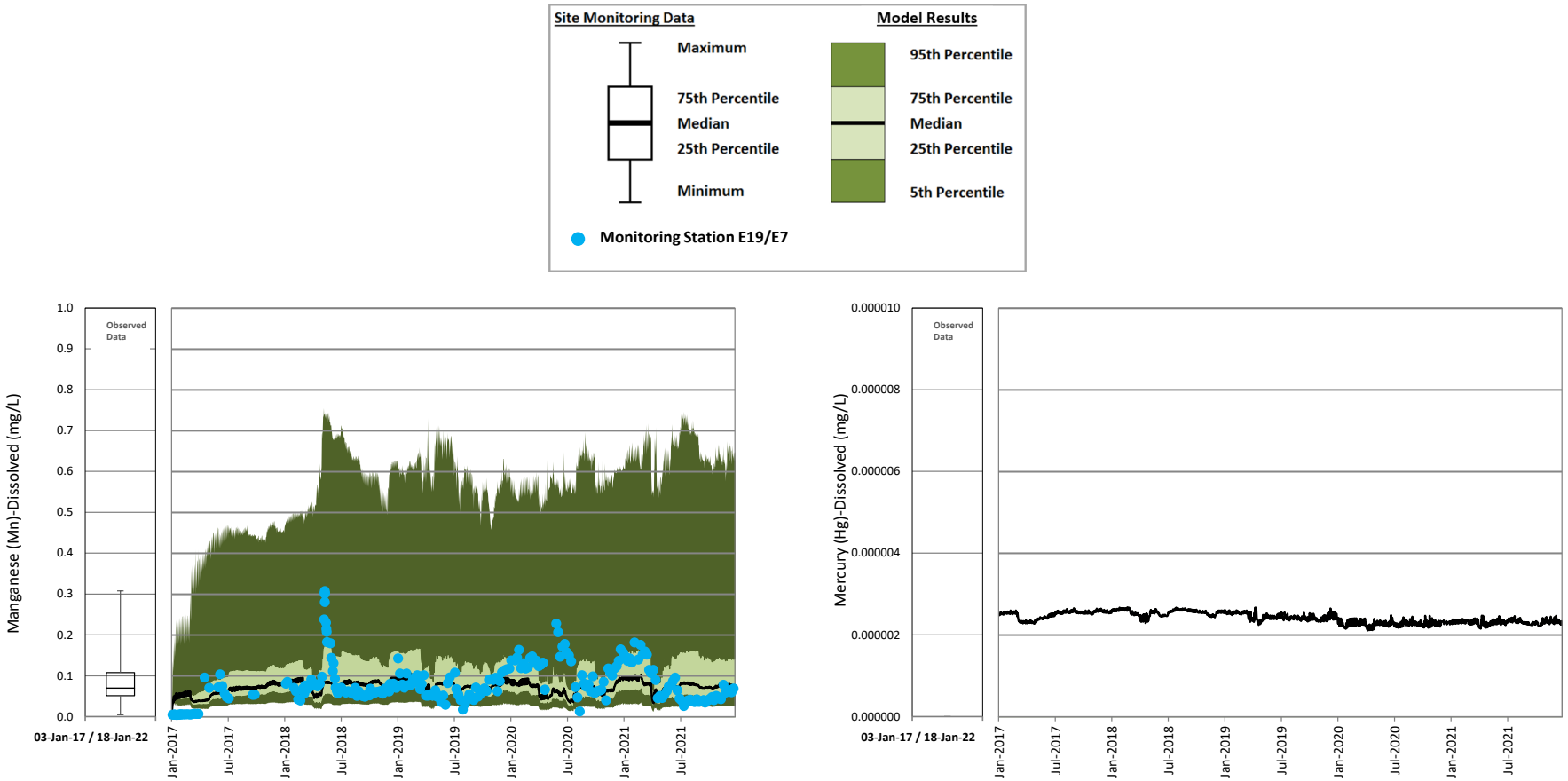

Figure 544: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Manganese and Dissolved Mercury

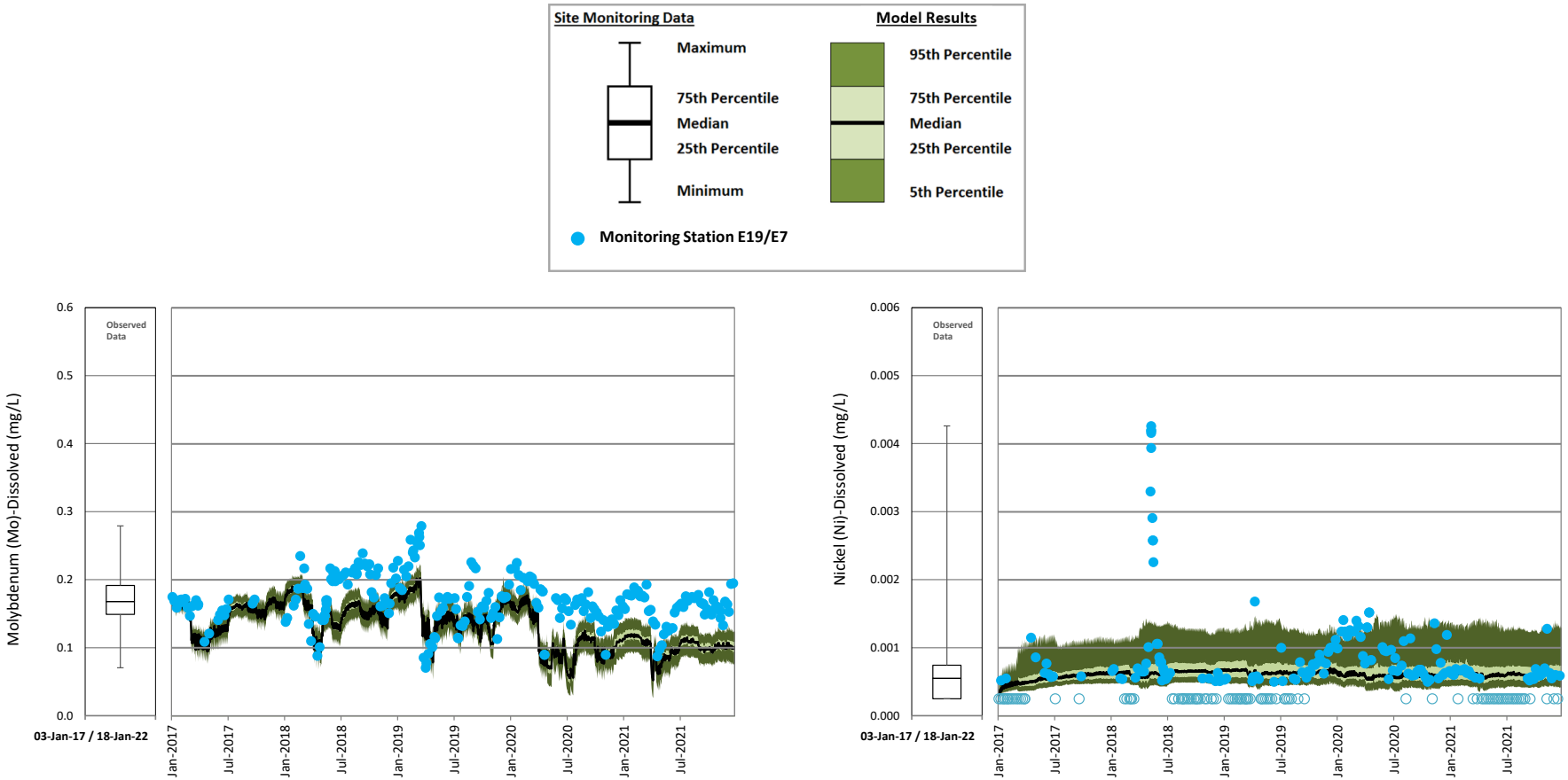

Figure 555: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Molybdenum and Dissolved Nickel

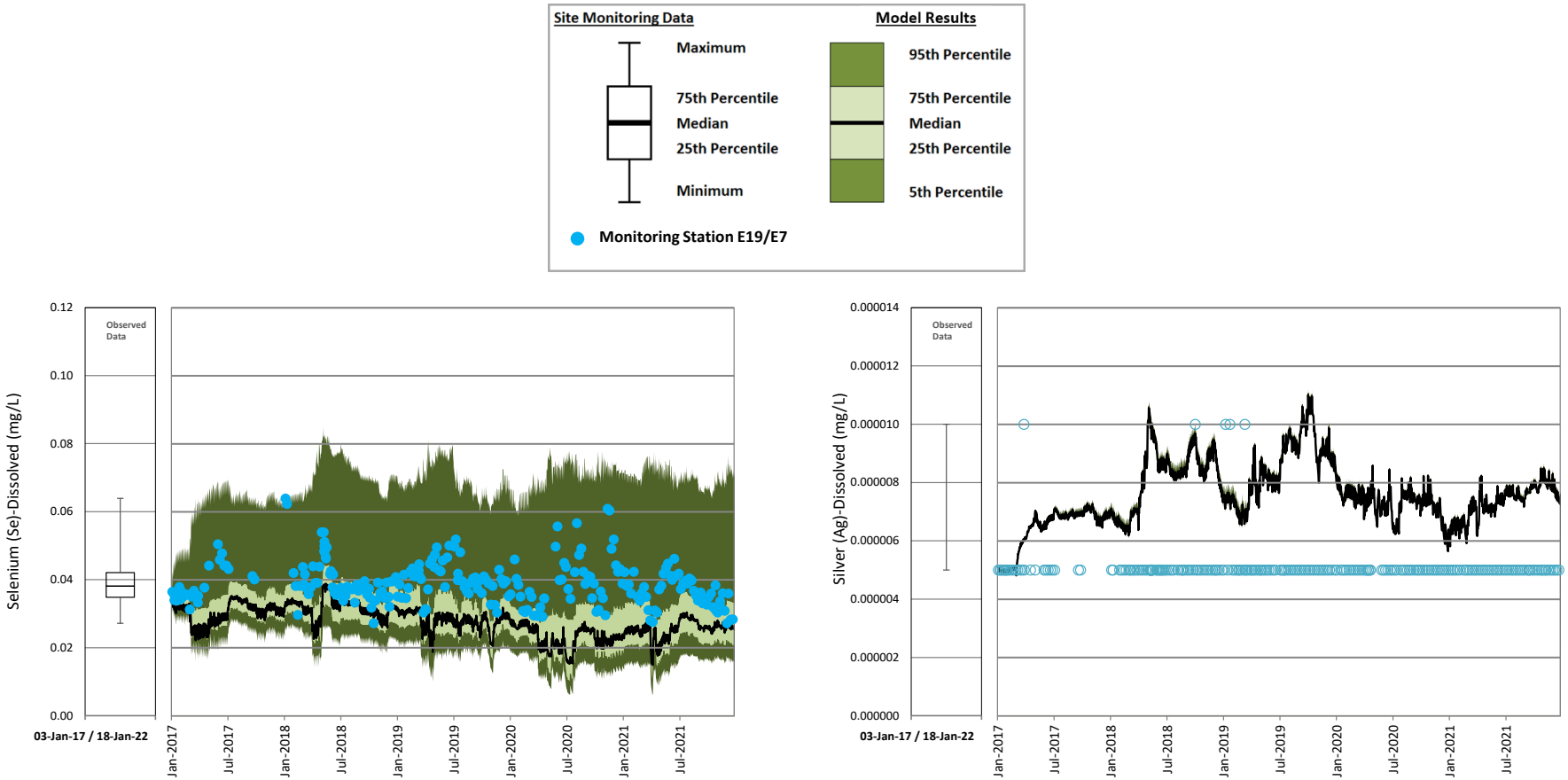

Figure 566: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Selenium and Dissolved Silver

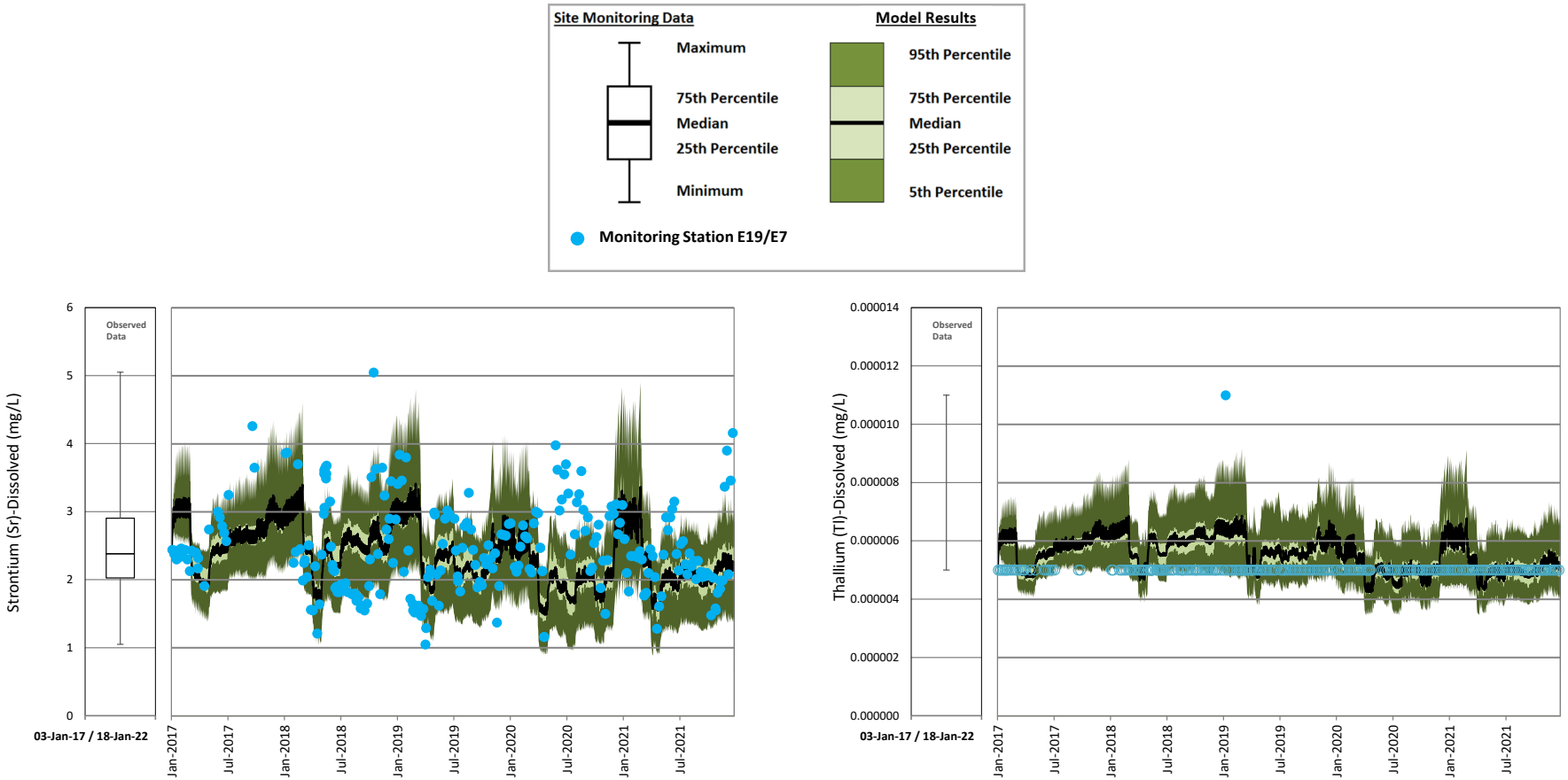

Figure 577: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Strontium and Dissolved Thallium

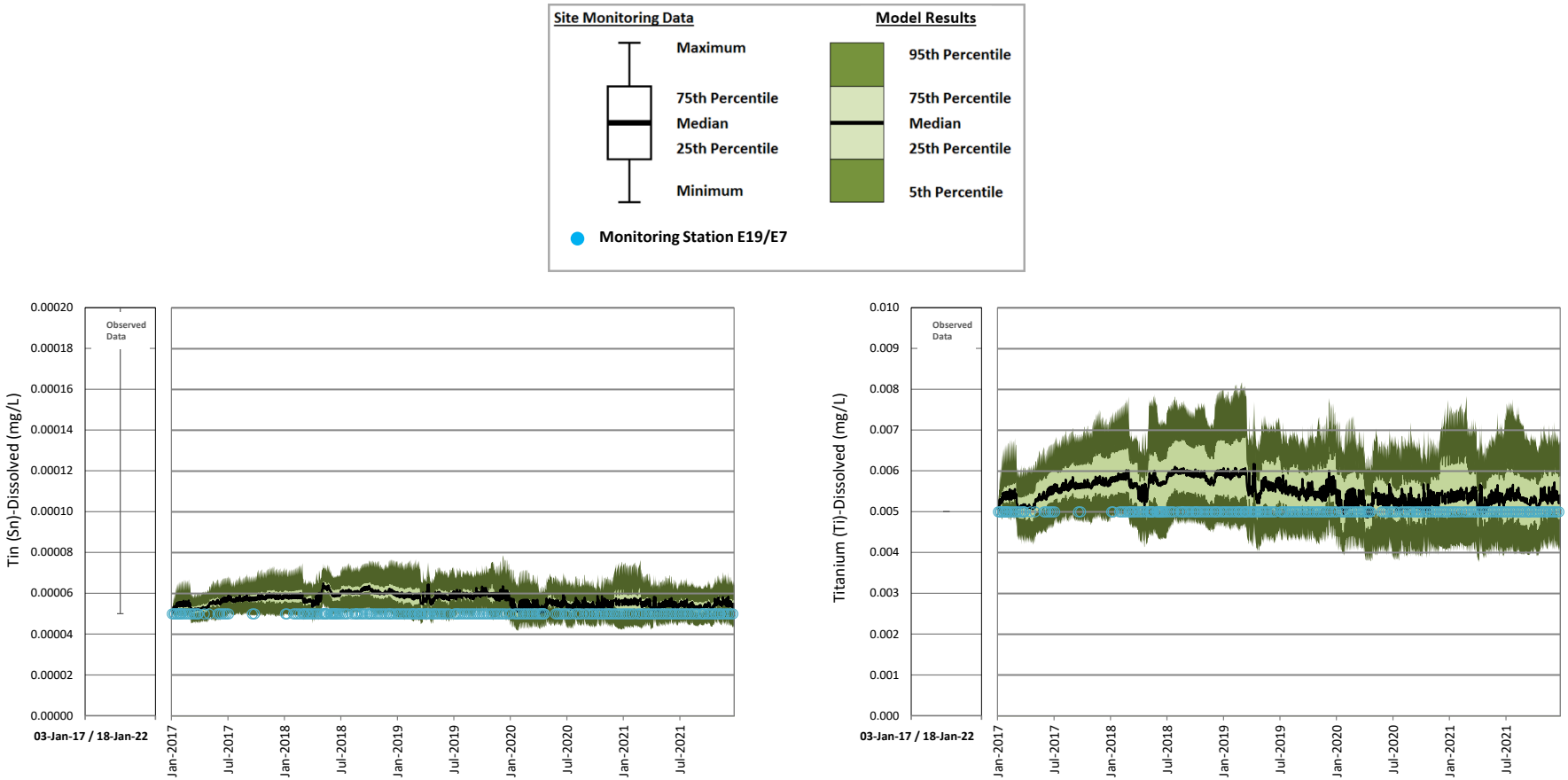

Figure 588: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Tin and Dissolved Titanium

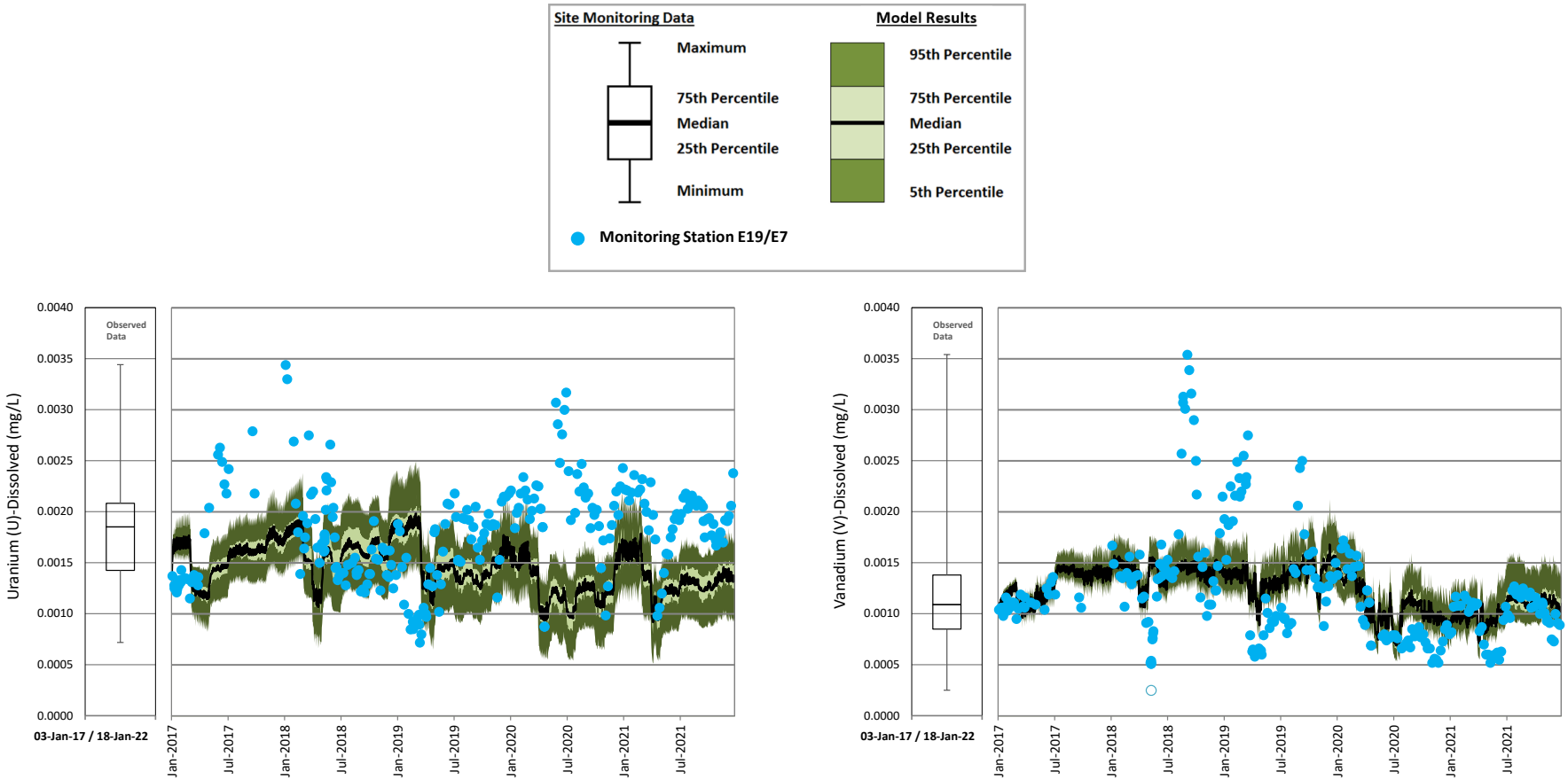

Figure 599: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Uranium and Dissolved Vanadium

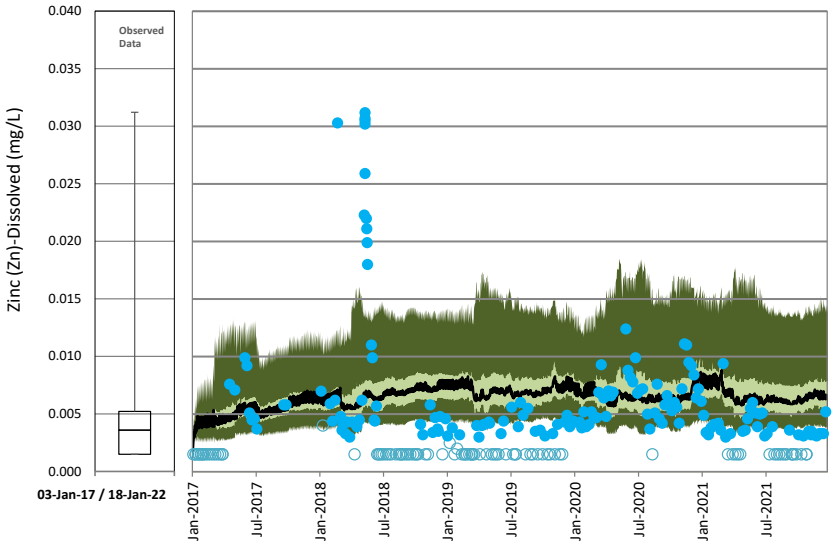

Figure 100: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Zinc

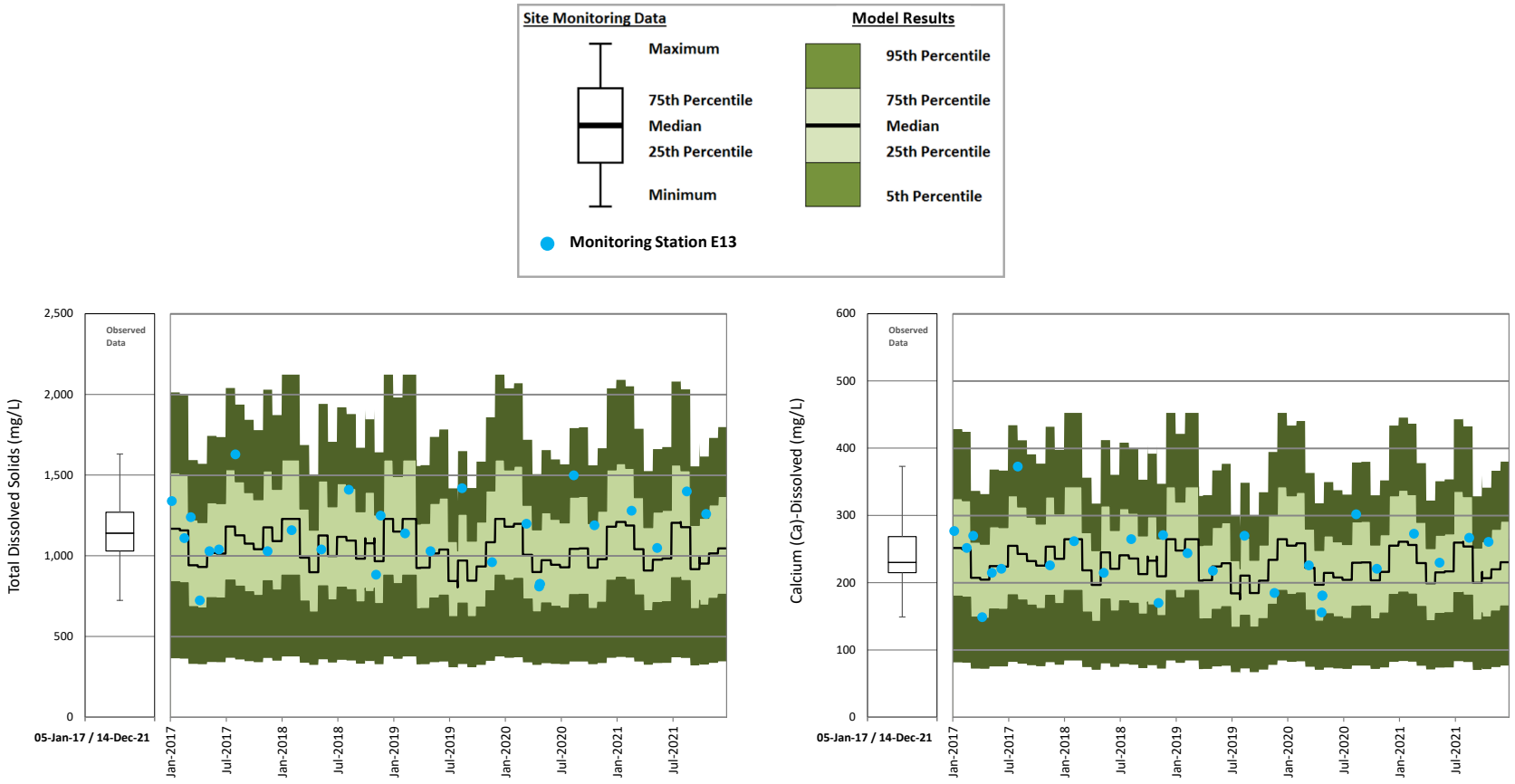

Figure 6001: Northwest Sump Calibration – Total Dissolved Solids and Calcium

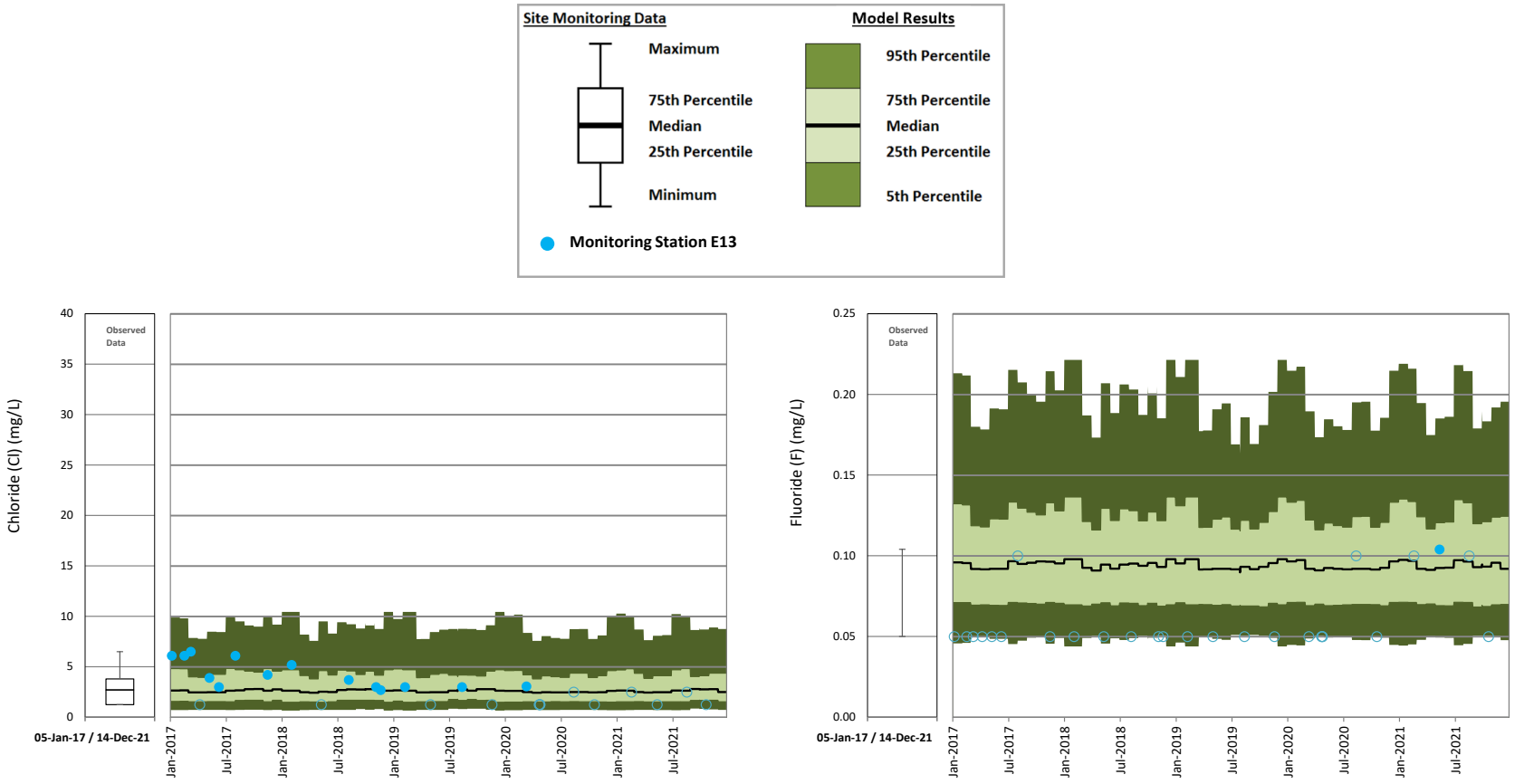

Figure 1061: Northwest Sump Calibration – Chloride and Fluoride

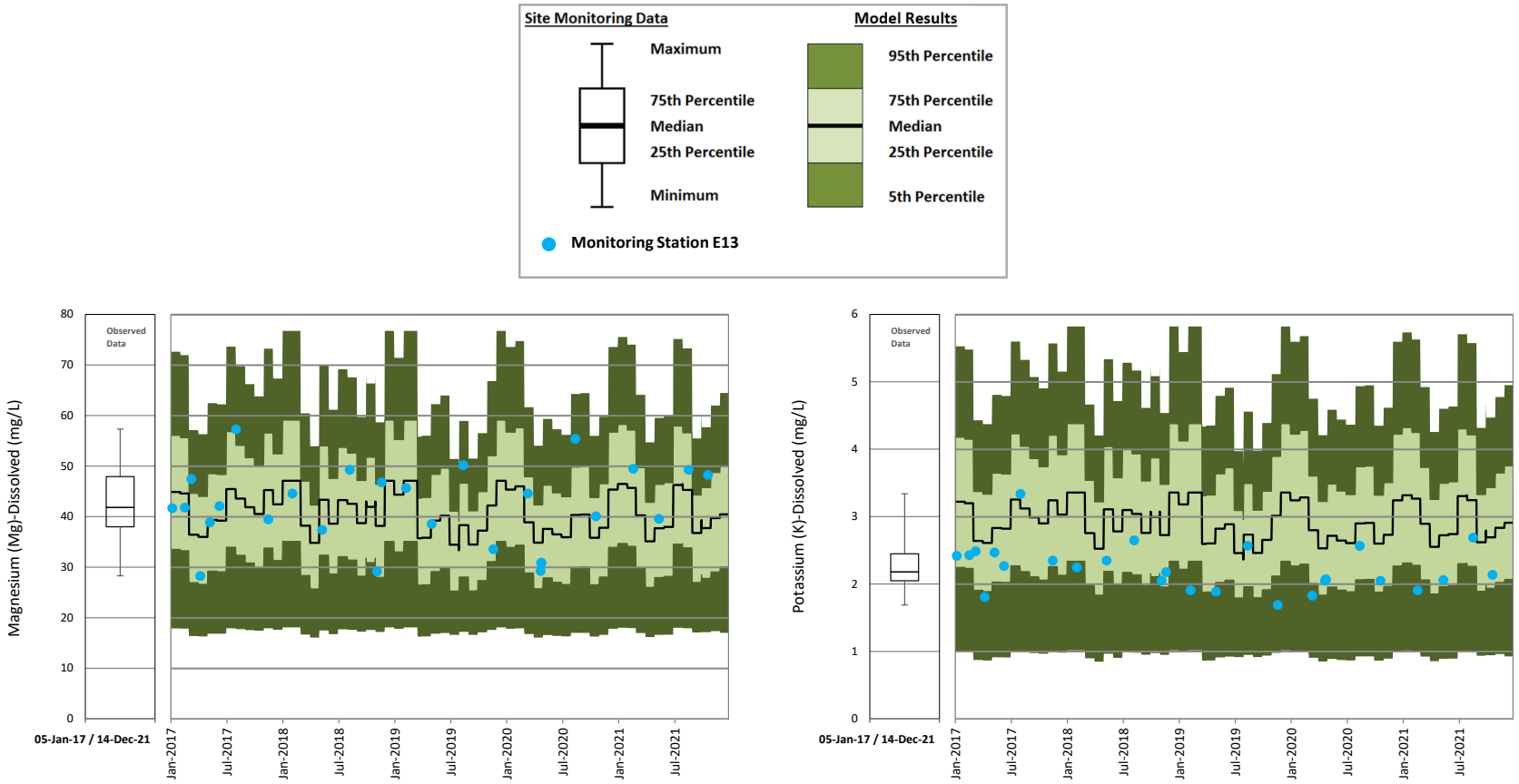

Figure 1062: Northwest Sump Calibration – Magnesium and Potassium

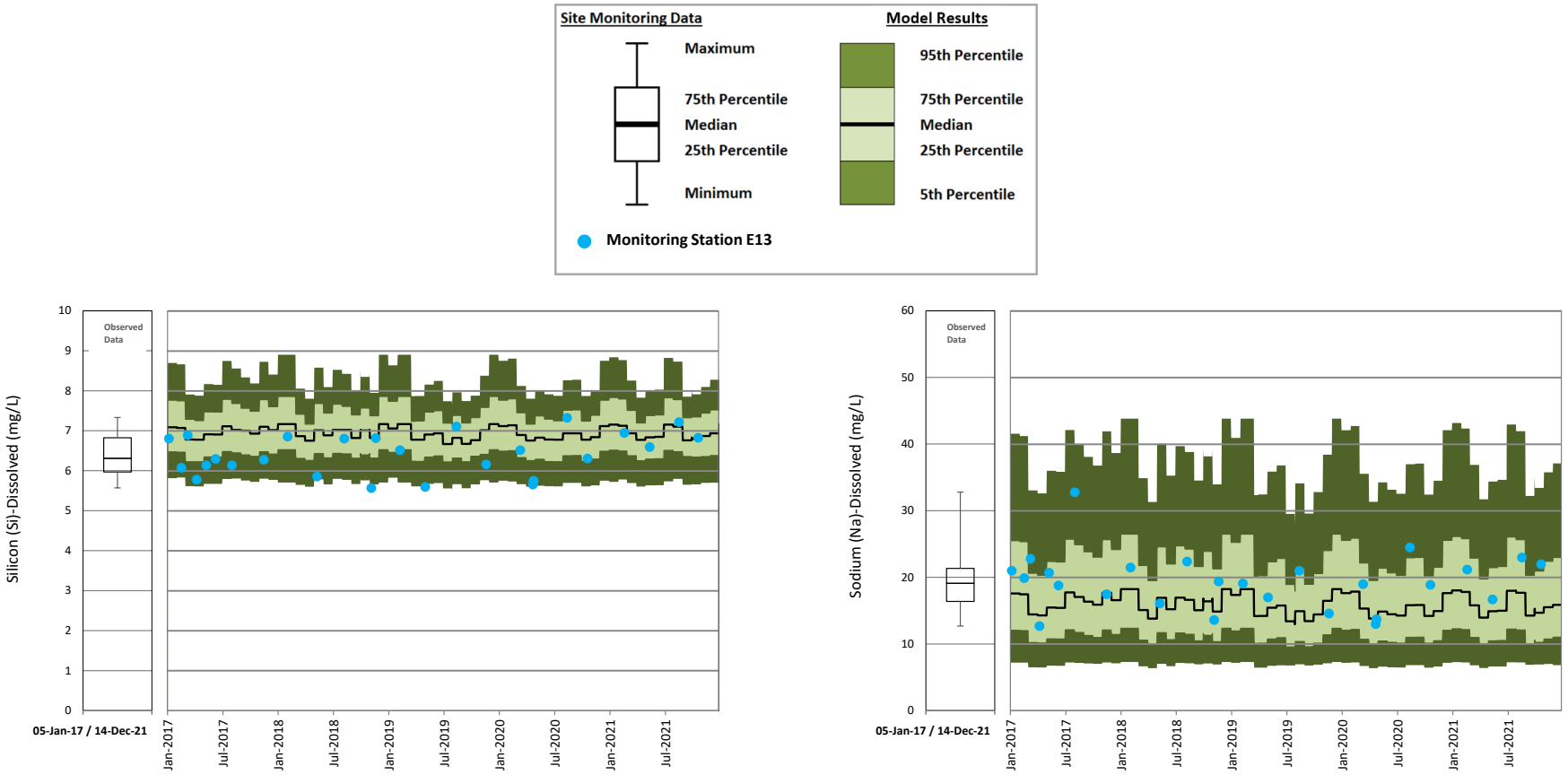

Figure 1063: Northwest Sump Calibration – Silicon and Sodium

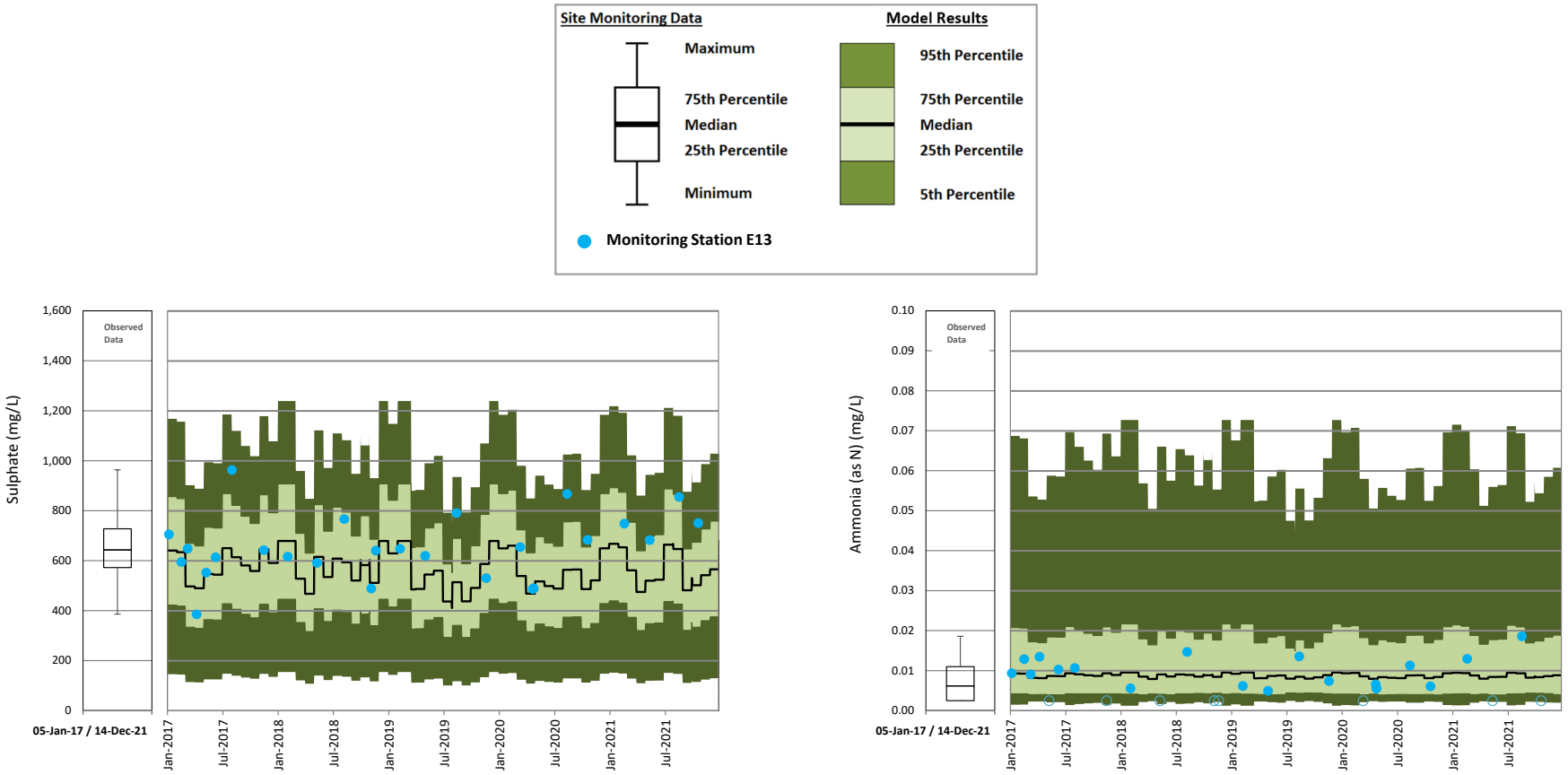

Figure 1064: Northwest Sump Calibration – Sulphate and Total Ammonia

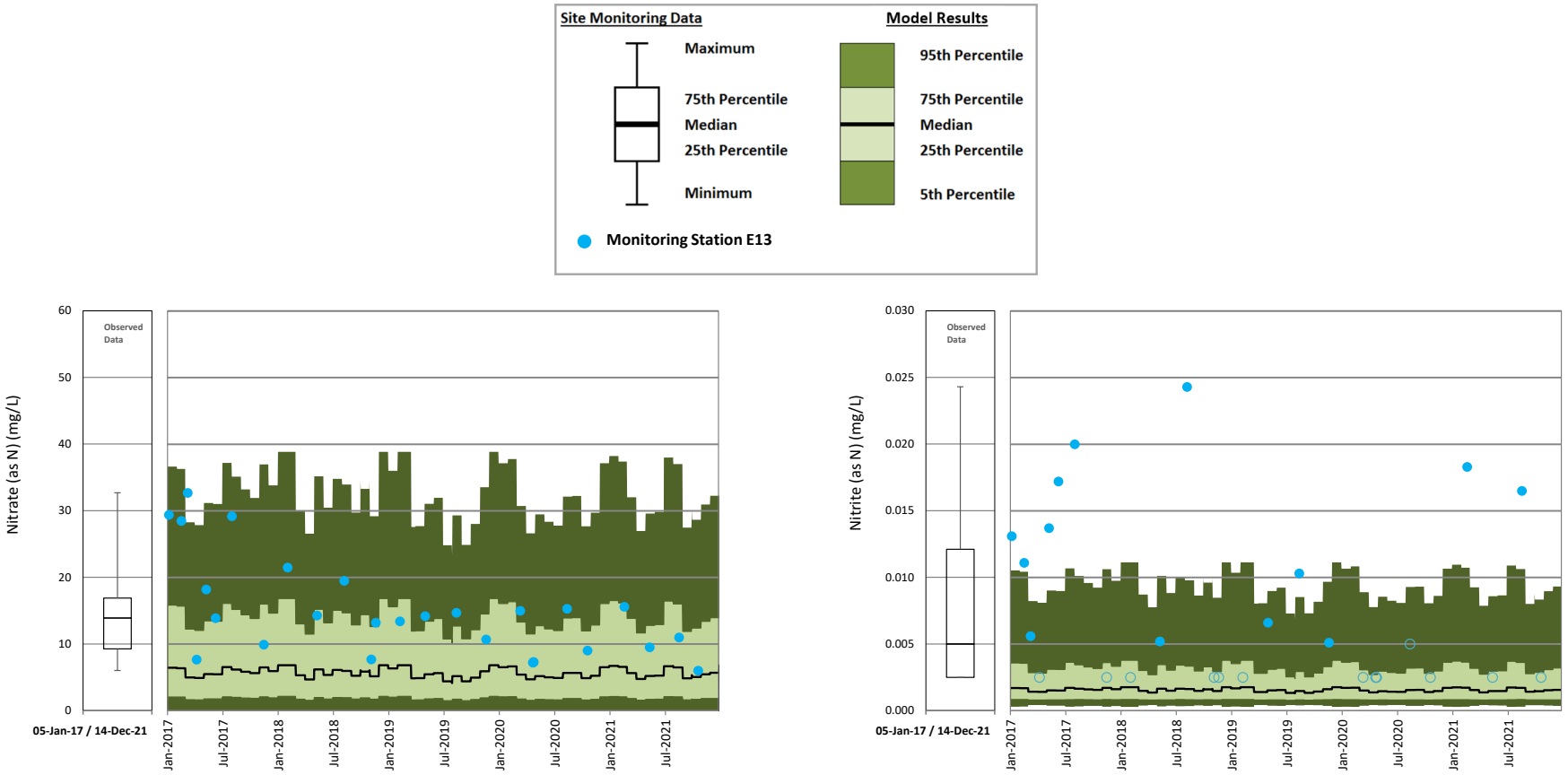

Figure 1065: Northwest Sump Calibration – Nitrate and Nitrite

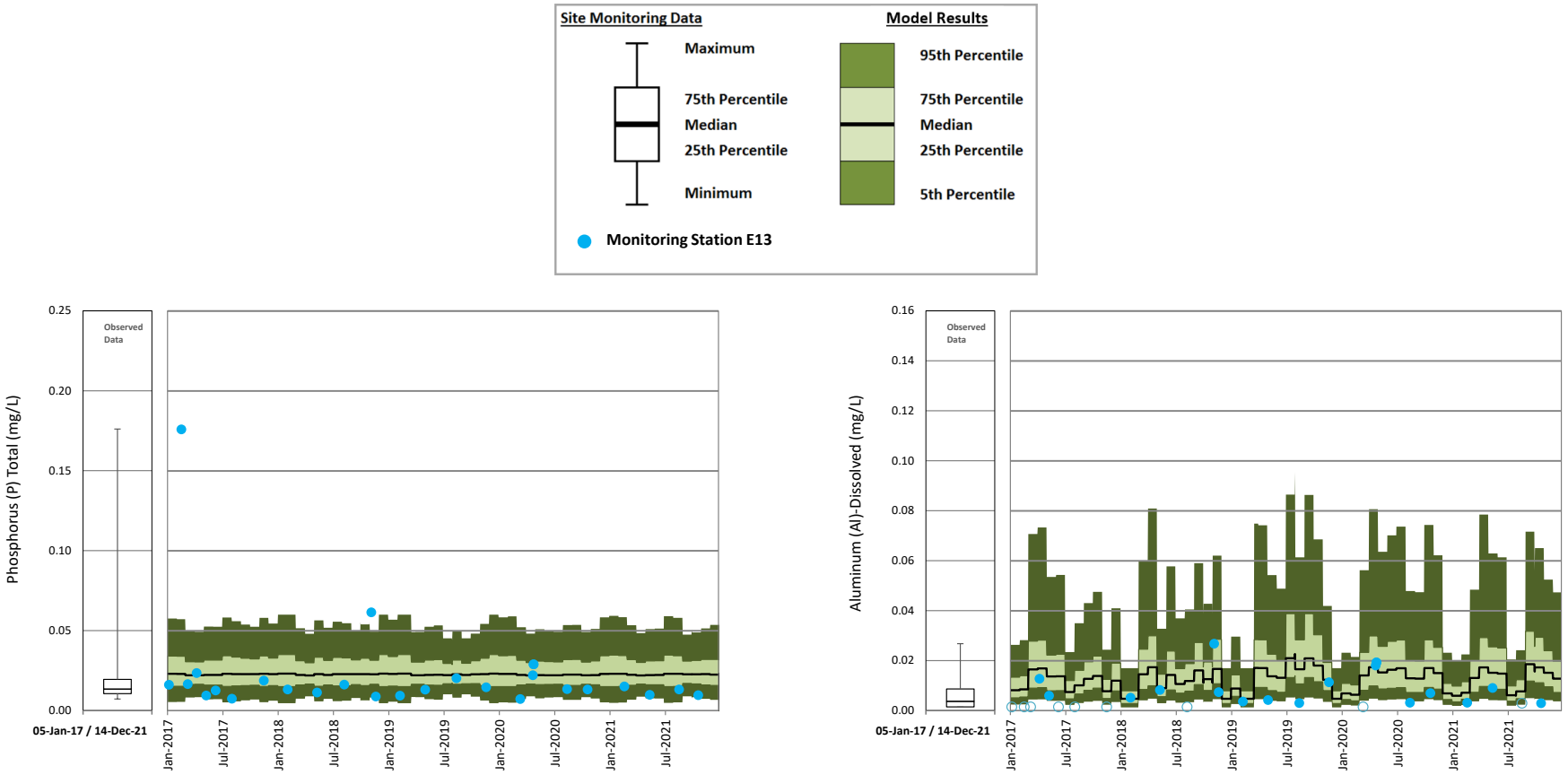

Figure 1066: Northwest Sump Calibration – Total Phosphorus and Dissolved Aluminum

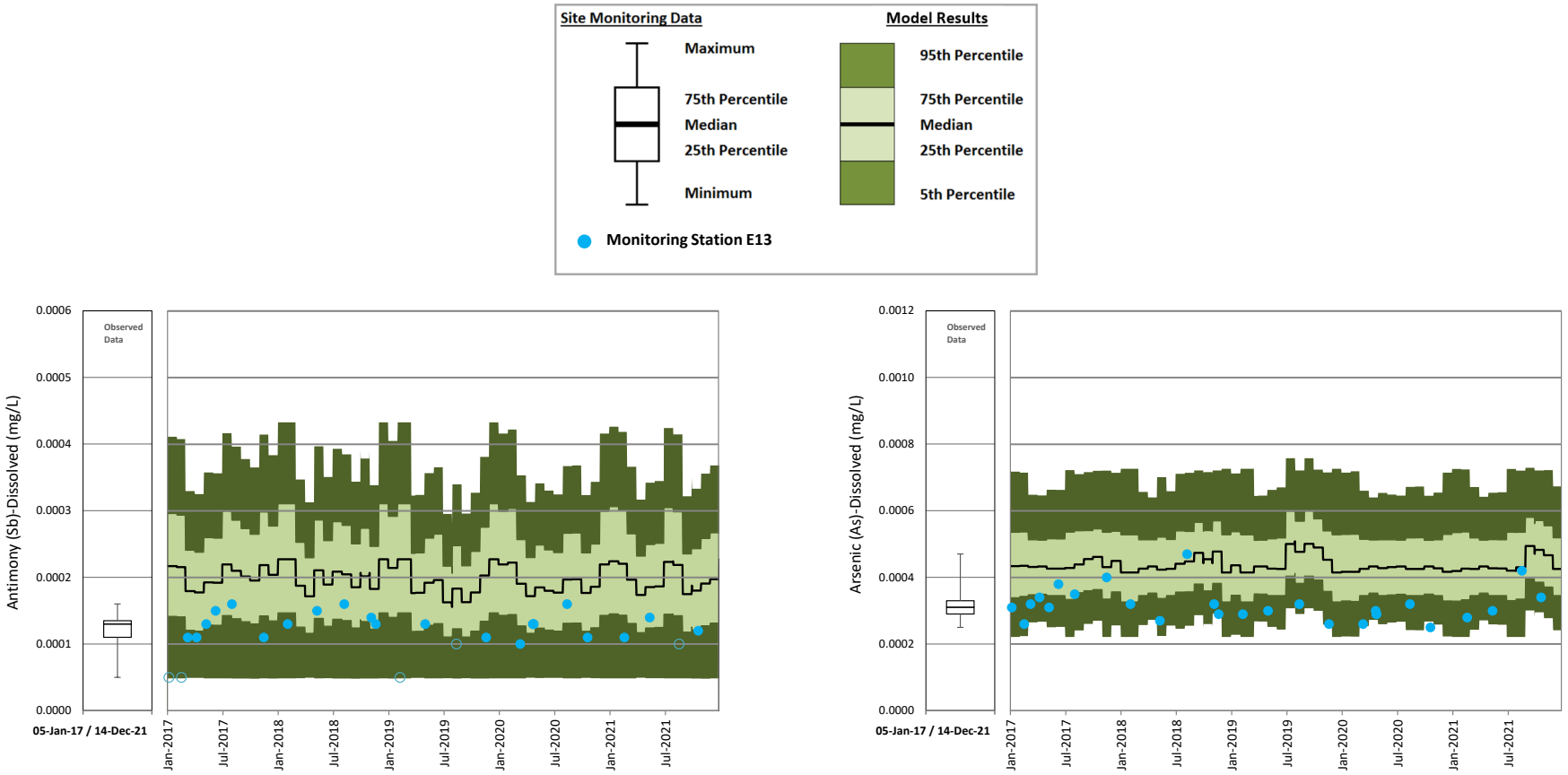

Figure 1067: Northwest Sump Calibration – Dissolved Antimony and Dissolved Arsenic

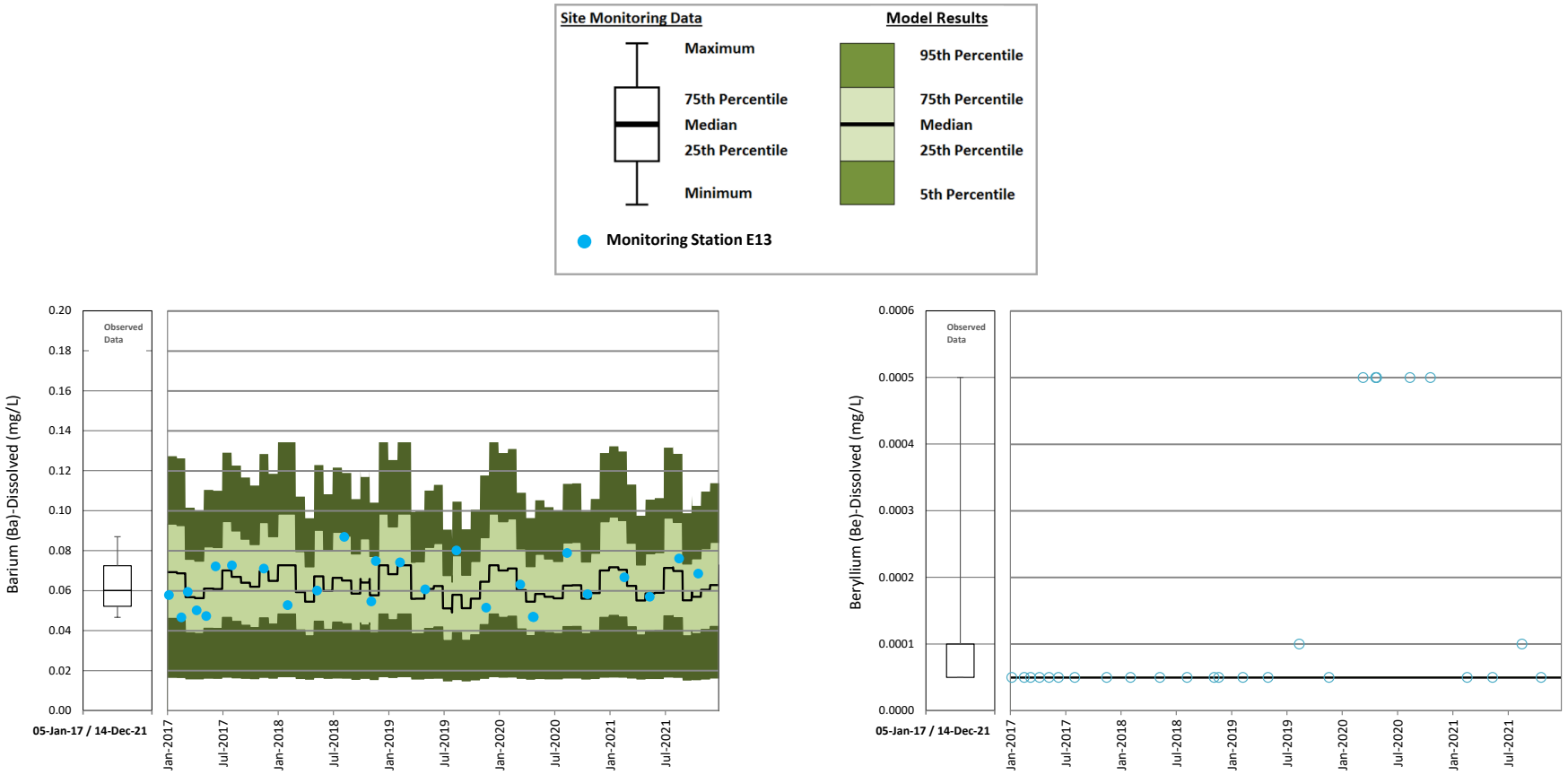

Figure 1068: Northwest Sump Calibration – Dissolved Barium and Dissolved Beryllium

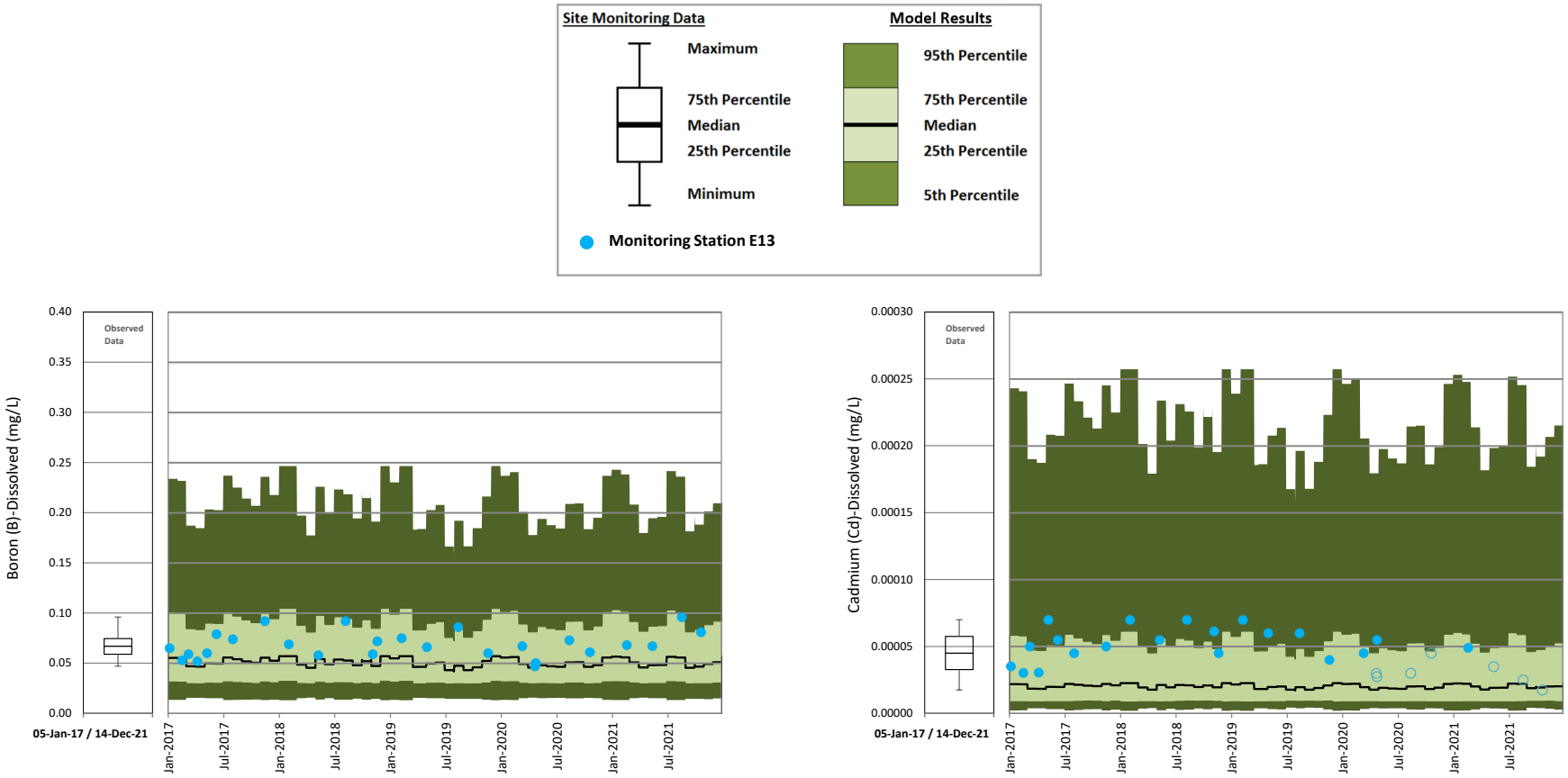

Figure 110: Northwest Sump Calibration – Dissolved Boron and Dissolved Cadmium

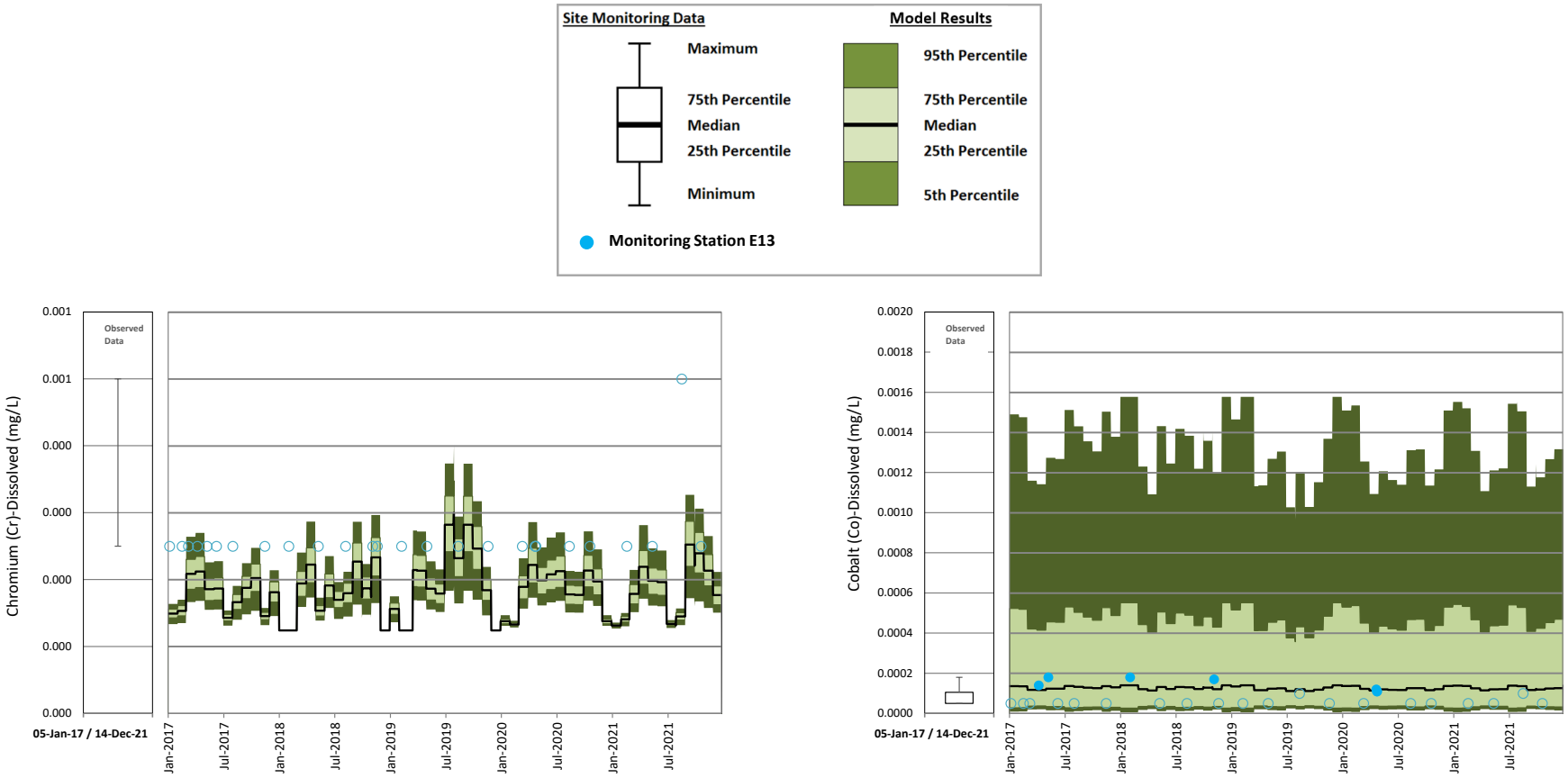

Figure 111: Northwest Sump Calibration – Dissolved Chromium and Dissolved Cobalt

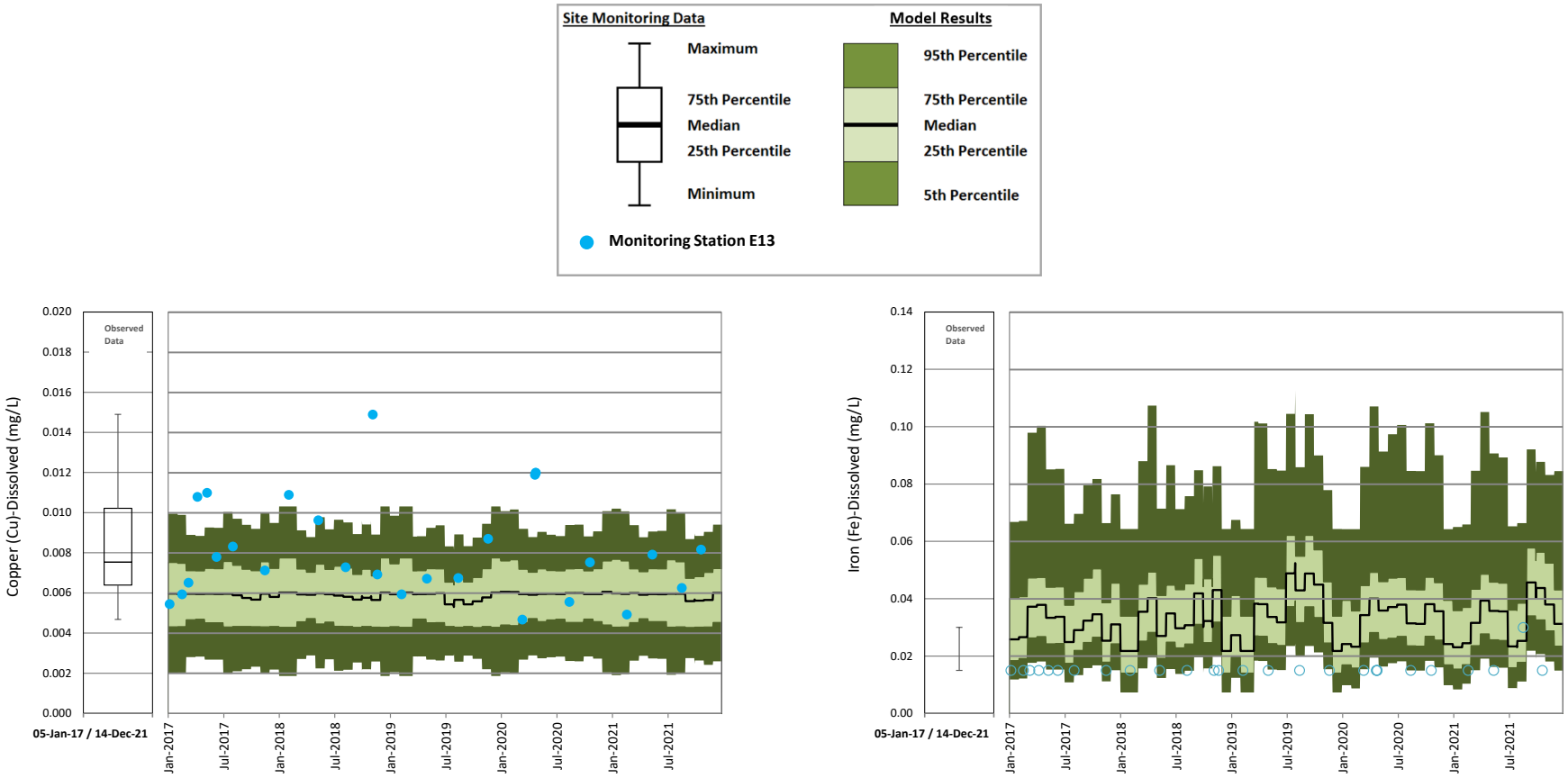

Figure 112: Northwest Sump Calibration – Dissolved Copper and Dissolved Iron

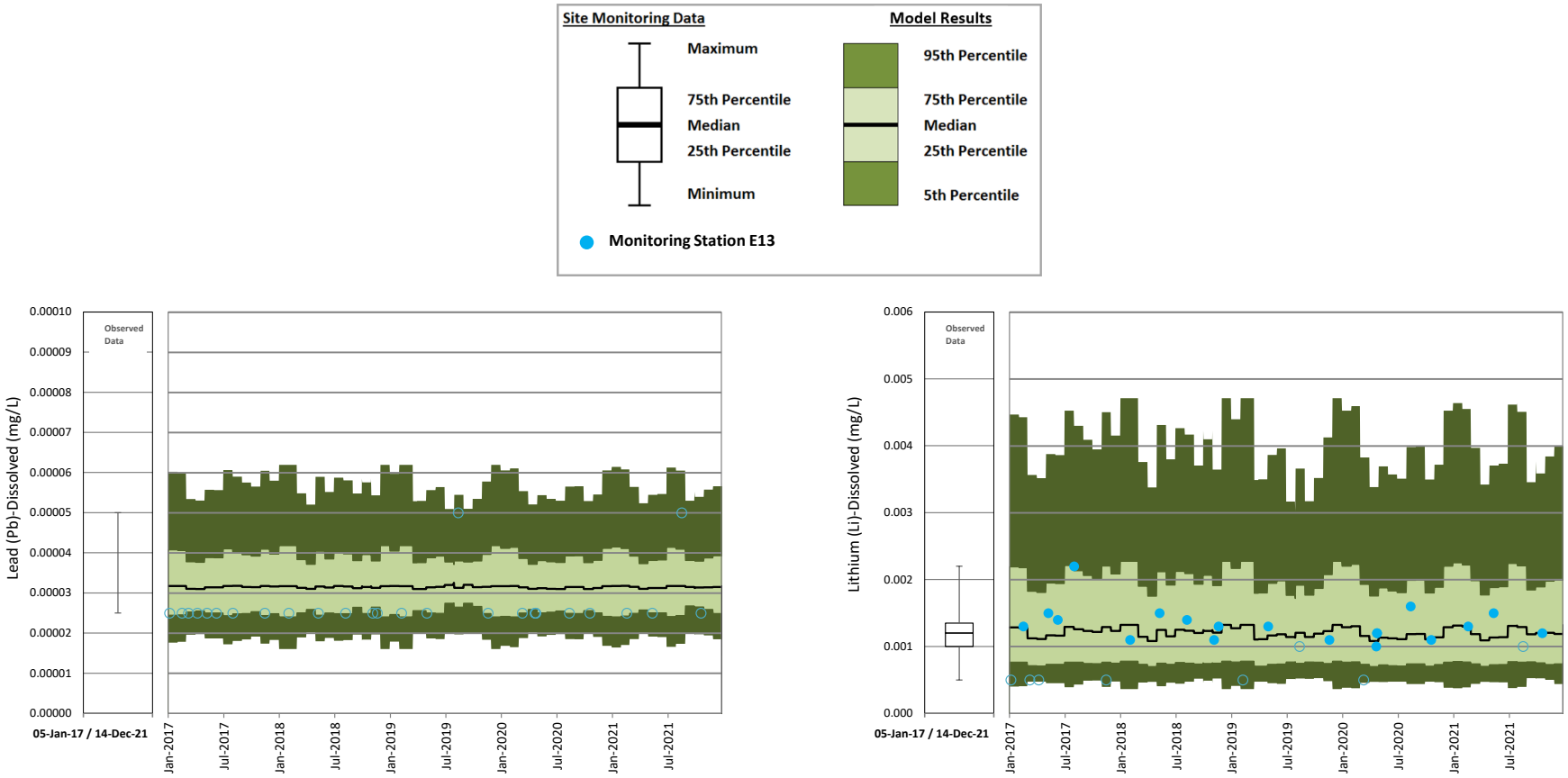

Figure 113: Northwest Sump Calibration – Dissolved Lead and Dissolved Lithium

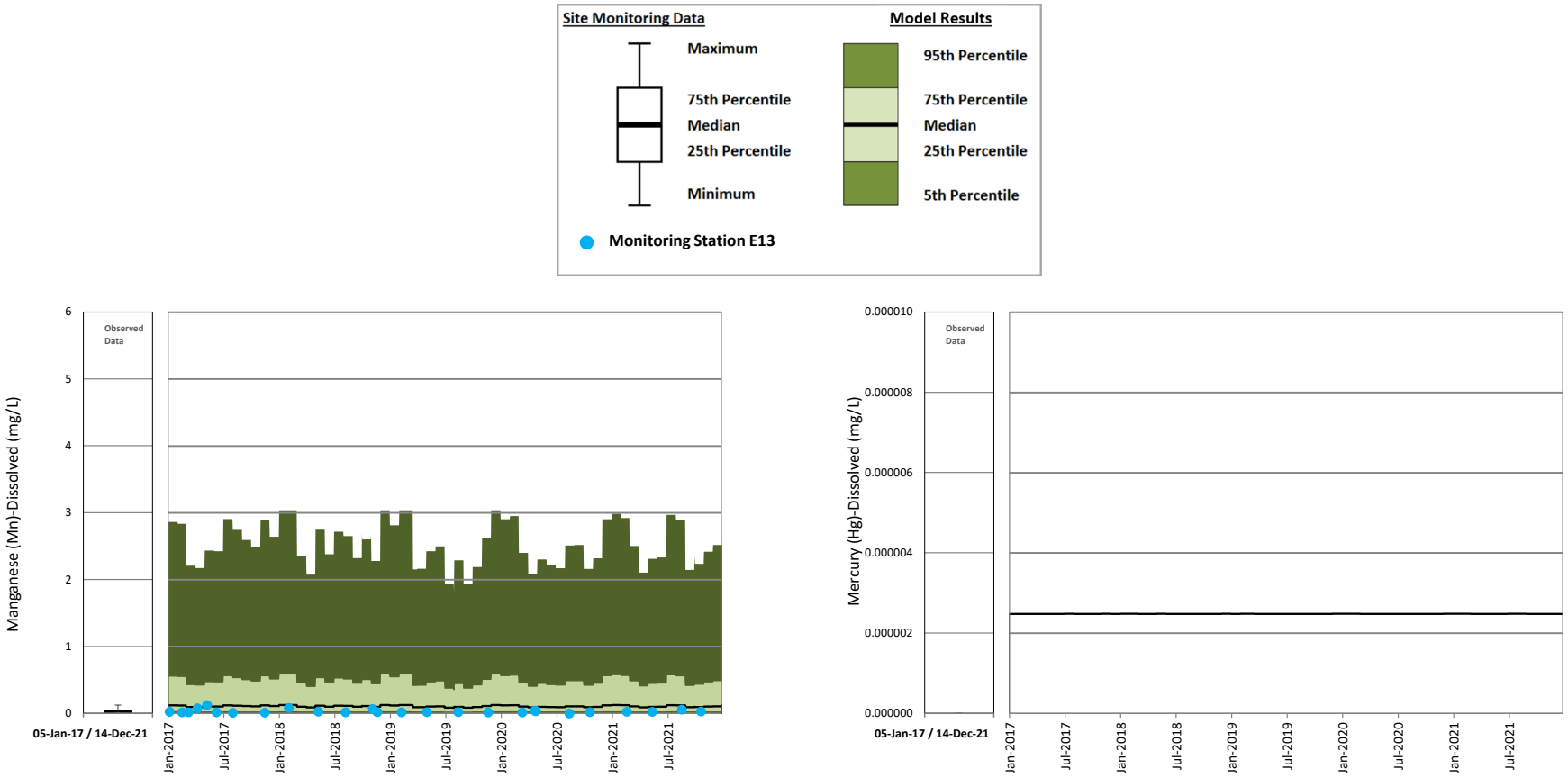

Figure 114: Northwest Sump Calibration – Dissolved Manganese and Dissolved Mercury

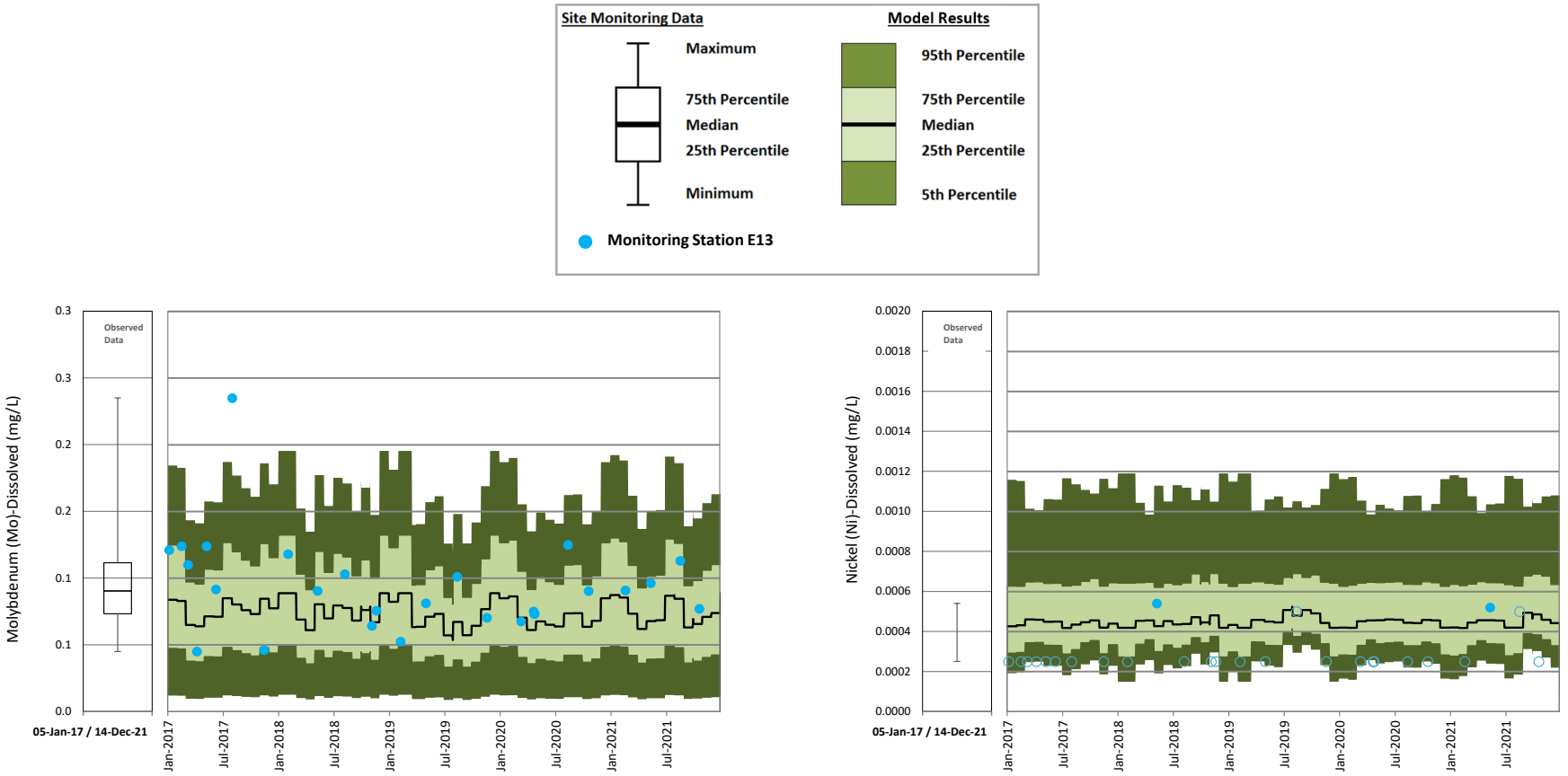

Figure 115: Northwest Sump Calibration – Dissolved Molybdenum and Dissolved Nickel

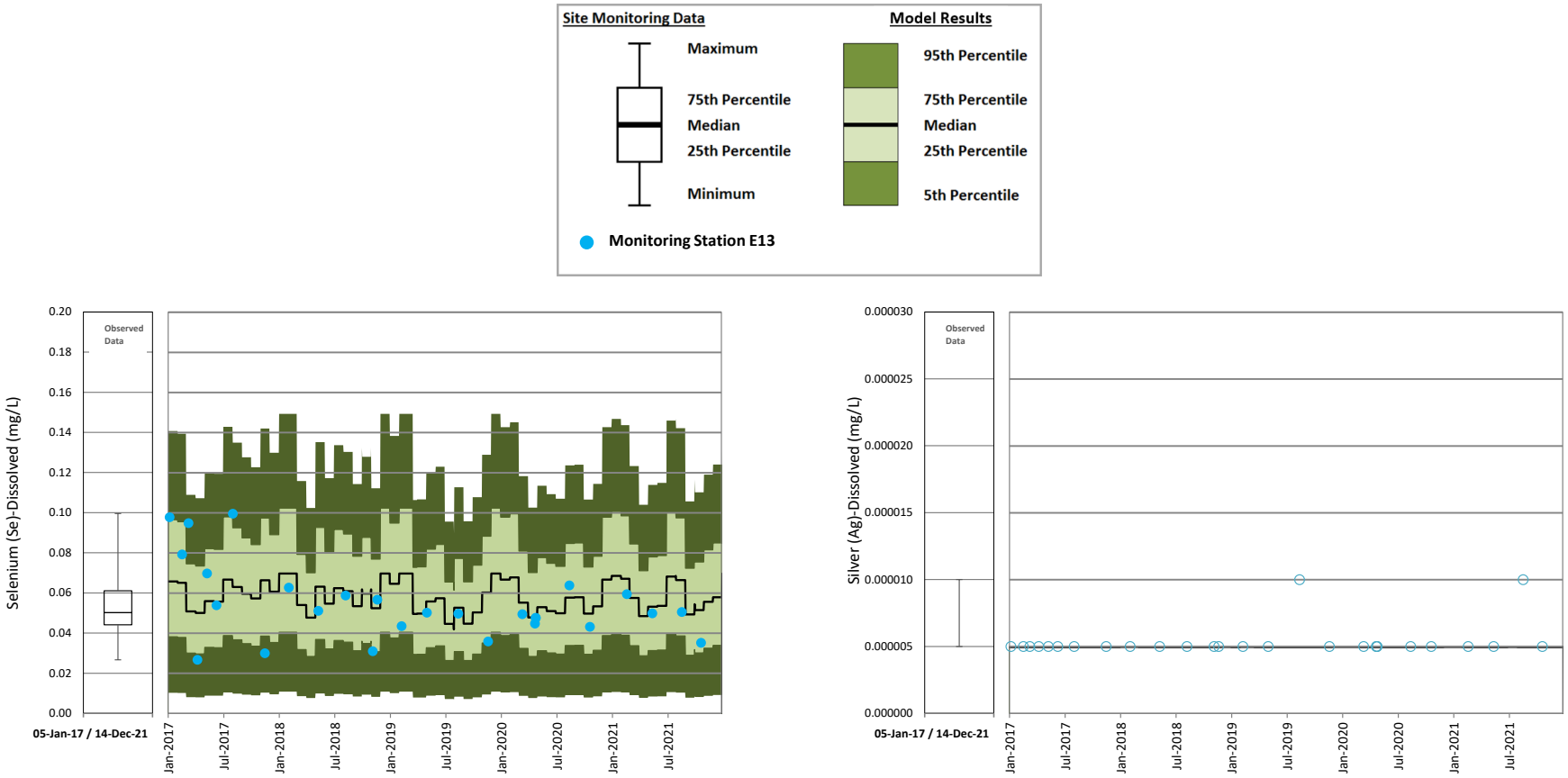

Figure 116: Northwest Sump Calibration – Dissolved Selenium and Dissolved Silver

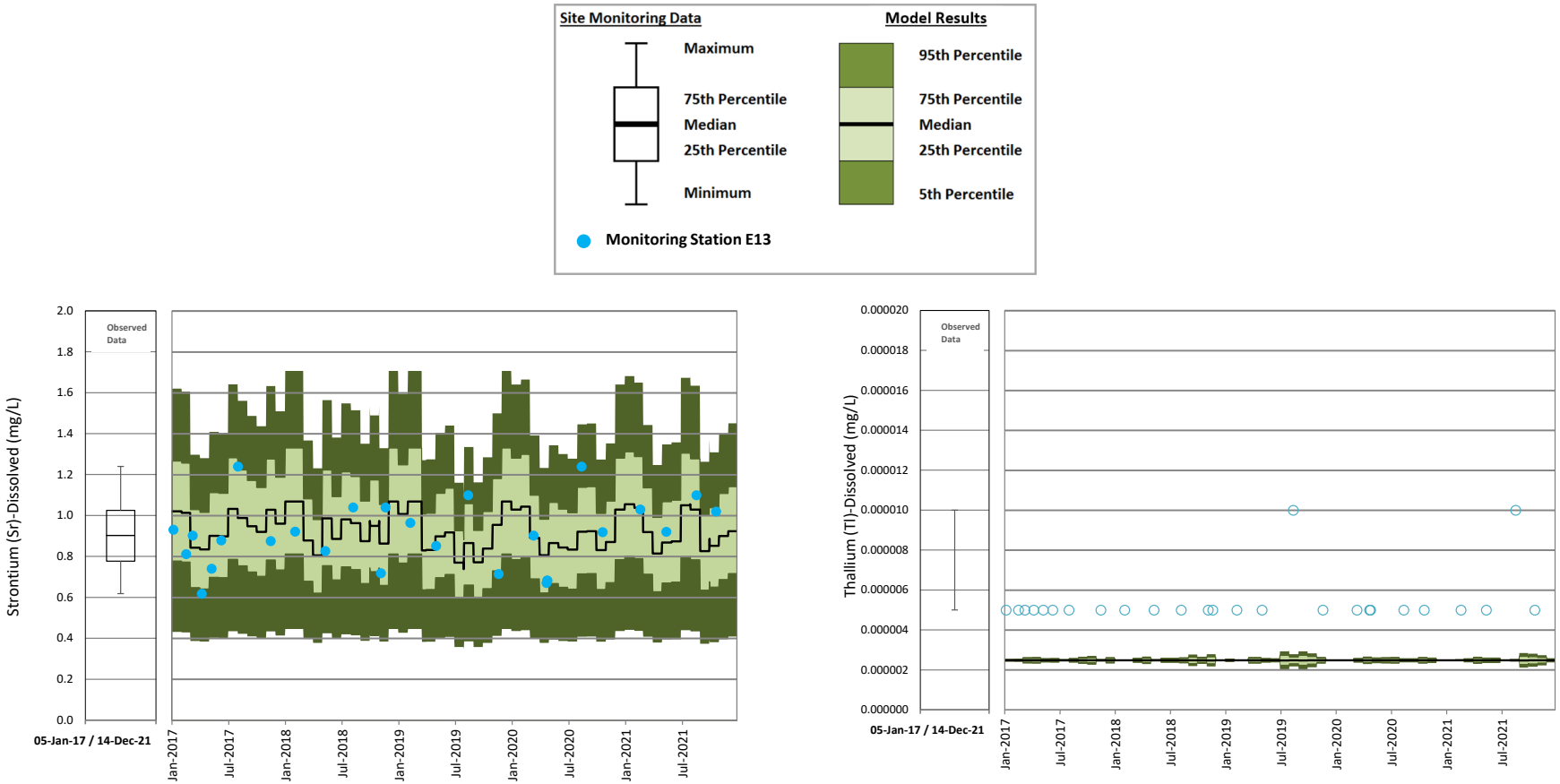

Figure 117: Northwest Sump Calibration – Dissolved Strontium and Dissolved Thallium

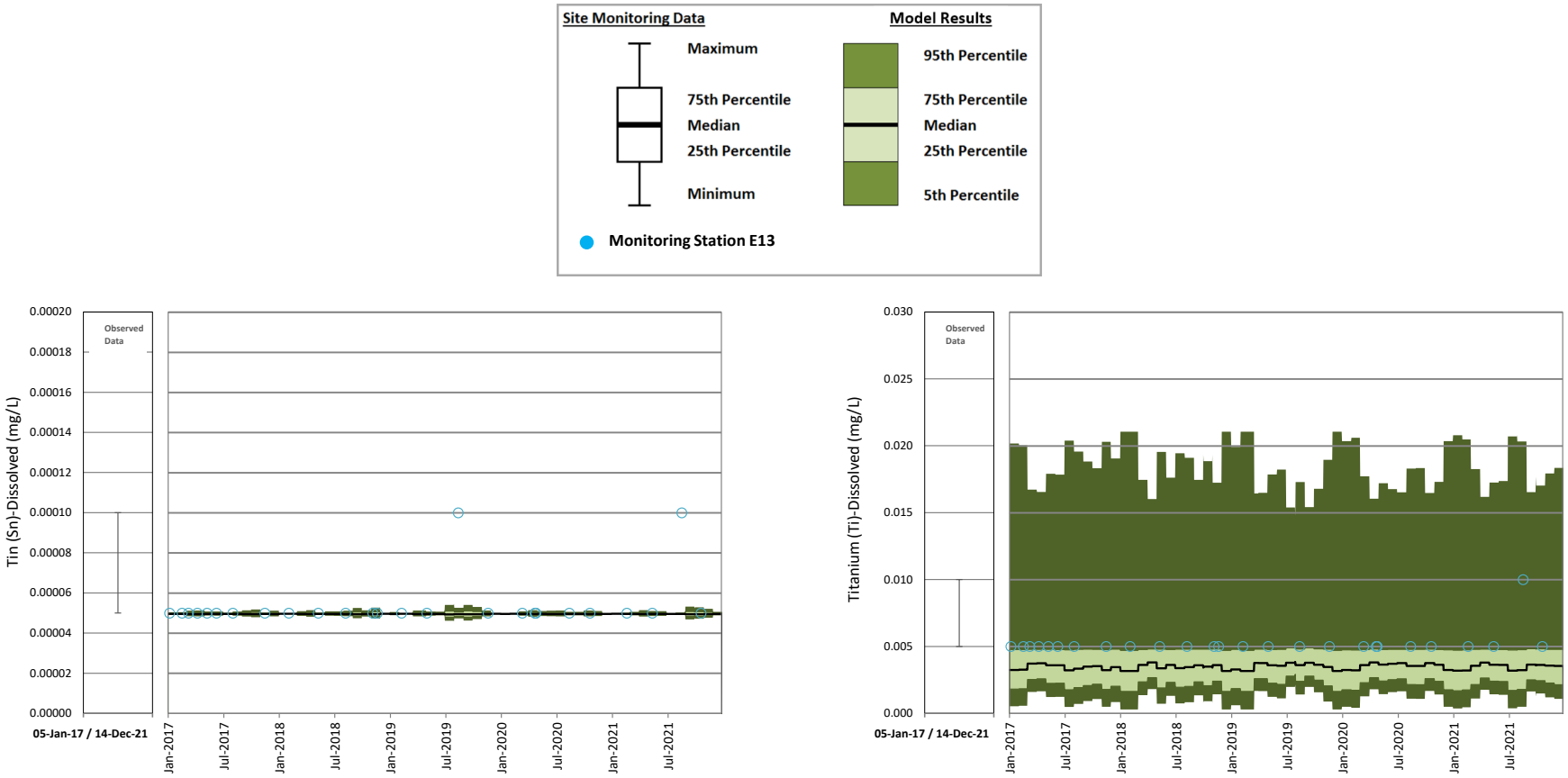

Figure 118: Northwest Sump Calibration – Dissolved Tin and Dissolved Titanium

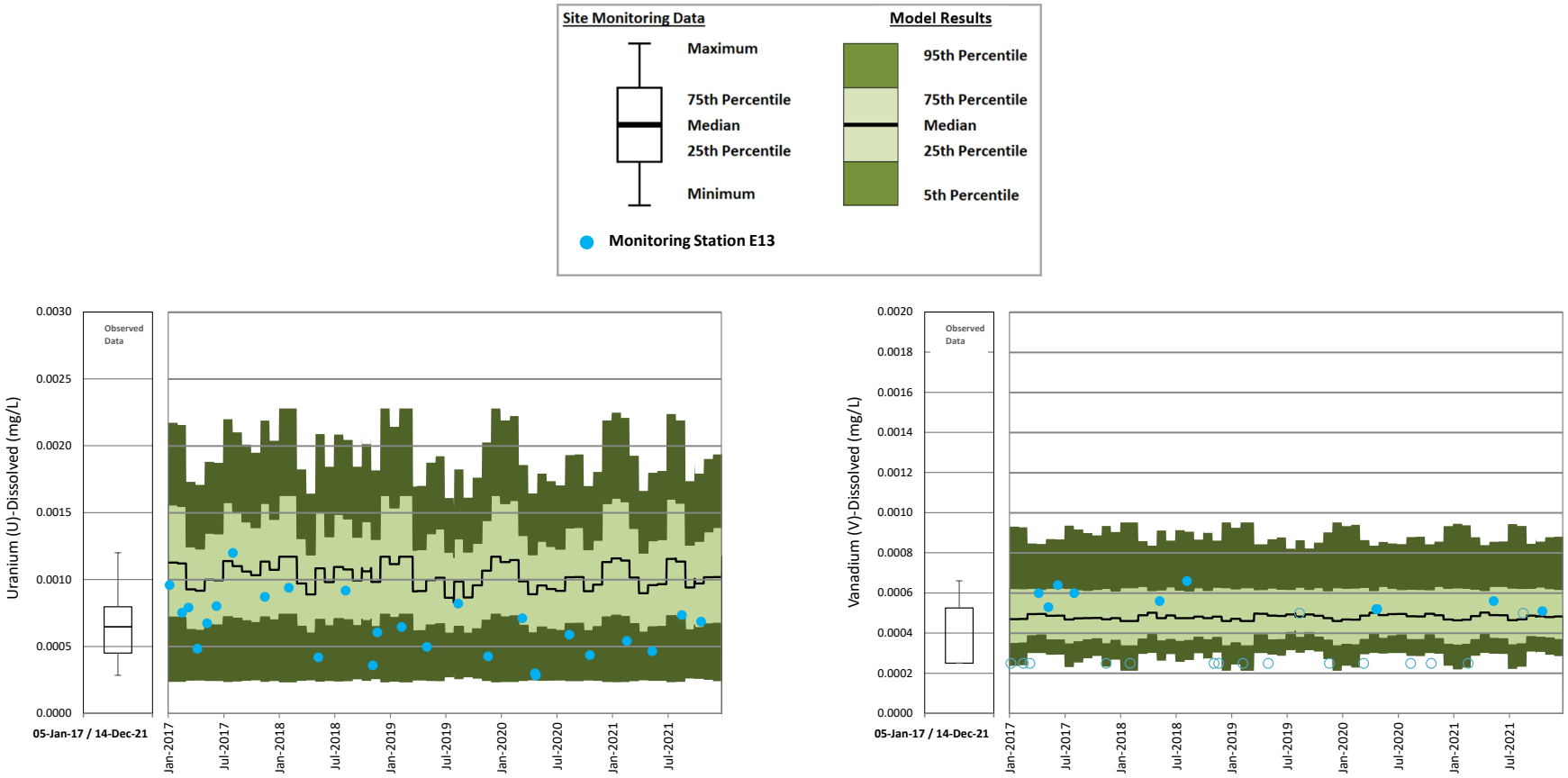

Figure 1169: Northwest Sump Calibration – Dissolved Uranium and Dissolved Vanadium

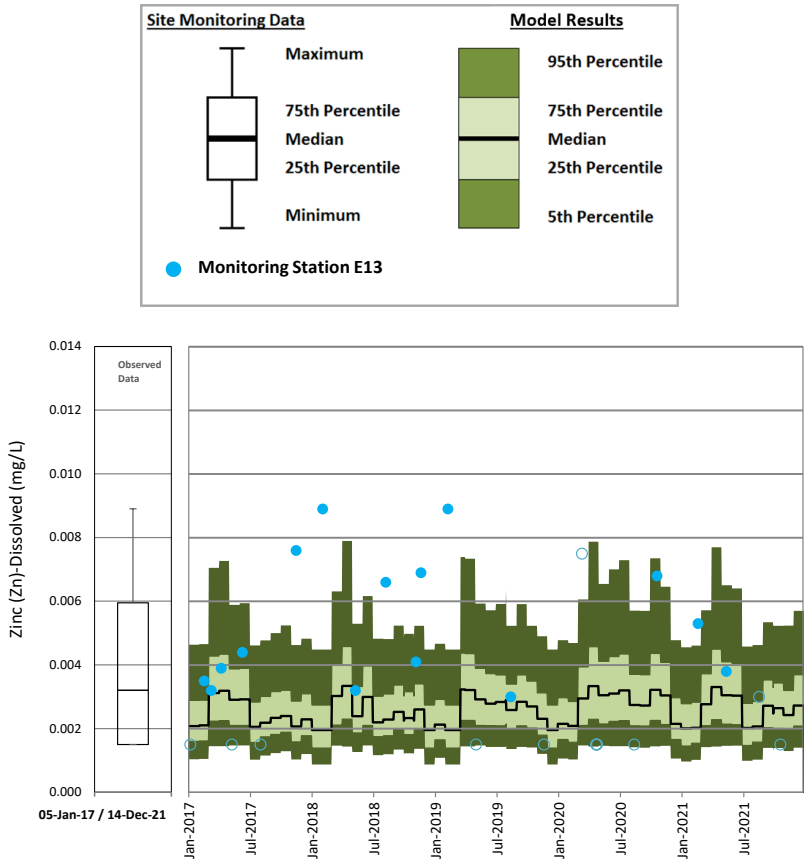

Figure 120: Northwest Sump Calibration – Dissolved Zinc



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Appendix J
2016 Underground Stability Memo

Mount Polley Mining Corporation
IMPERIAL METALS CORPORATION

30 November 2016

Doina Priscu M.Eng, P.Eng
Golder Associates Ltd.

This letter evaluates the risk of surface subsidence following the closure of the underground mining operation at Mount Polley Mine.

The current situation in the mine is reflected in the following attached figures:

Figure 1 shows an oblique view of the underground workings beneath the Wight Pit. The Portal and Alimak Raise are both shown on the drawing as well as the active exploration site from which the Martel Zone is being diamond drilled. There are three completely extracted mining zones in the current mine:

- The Zuke Zone has very little void space, as the caved backs have nearly completely filled the stope voids with swelled muck. The prospect of caving to surface was presented as highly event unlikely in a report entitled “An Assessment of the Zuke Zone Back Caving”, prepared for MEM on 15 January 2016 by Asterisk Mining Services Ltd.
- The Boundary Zone is partially filled. The entire back of the Boundary Zone was cablebolted, and the system appears to be very effective, as no caving is evidenced anywhere in the back of the stope. The maximum void space is estimated to be 75,000 m^3, comprising 100% of the light blue (“D” stopes) and red (“C” stopes) shapes plus half of the dark blue (“B” stopes) shape in Figure 1. The white zone (“A” Stopes) were completely filled. It has exhibited stable walls and back at every stage of the mining process and minimal dilution was generated during mining. It is currently set up as a loose waste receiver, with the rock generated by the Martel exploration development drives placed in the stope without cement.
- The Halo Zone is completely open with a 26m x 26m open back and a void space of approximately 10,000 m^3. Unlike the Boundary Zone, no cable bolts were installed in the back. The ground of the Halo Zone was found to be the strongest and most competent unit in the mine and is still standing without any evidence of back or wall failure. The brow is still open.

Figure 2 shows a plan view of the underground workings with the surface projected over it, demonstrating the relative locations of the underground workings relative to the Wight Pit.

Figure 3 shows that the closest mining zone to surface is the 25m x 25m Halo Zone, with a rock covering of 185 m.

Figure 3 also shows the larger and deeper Boundary Zone, with a maximum open span of 67 m (25 m of which is reasonably tightly filled). The average width is 22 m, as demonstrated on Figure 4. The Boundary Zone is covered by a minimum of 217 m of rock.

Mine Management considers the risk of subsidence to surface to be minimal for four reasons:

1. The backs and walls of all open stopes exhibit no signs of failure.
2. There will be no future mining in the current zones to expand the current voids beyond their current dimensions.
3. The largest void, in the Boundary Zone, is already past its “worst case” scenario with a maximum open void of 75,000 m^3. It is actively being filled as part of ongoing operations with development muck, reducing this void on a daily basis.
4. Were any of the existing stope backs to fail, the open voids would be completely filled by muck due to the swell factor of the rock, estimated to be 30%. This would completely confine any back failure before it was able to propagate to surface. This phenomenon has been exhibited in the Zuke Zone back failures, which continue to be monitored and appear to have stopped. The Halo Zone would be anticipated to be confined after a failure of 33,000 m^3, representing a vertical distance of 53m above the stope (29% of the distance to surface). The Boundary Zone would be completely confined after a failure of 250,000 m^3, representing a failure distance of 170 m above the stope (78% of the distance to surface).

I trust that this memorandum addresses your concerns. Please let me know if additional information is required.

Regards,

R. Goodwin

Richard Goodwin, P.Eng

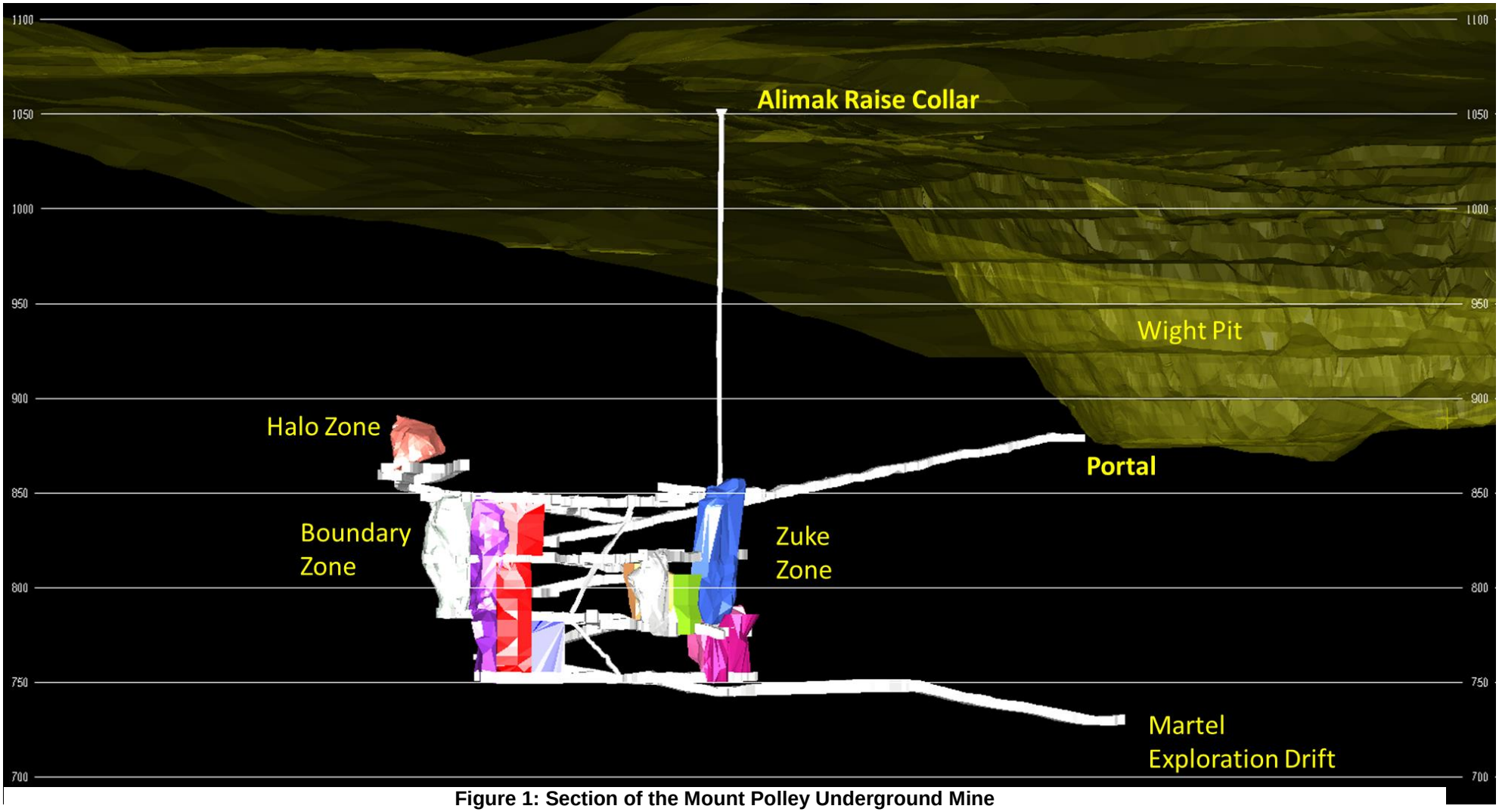

Figure 1: Section of the Mount Polley Underground Mine



Figure 2: Plan View of Underground Mine and Surface Topography

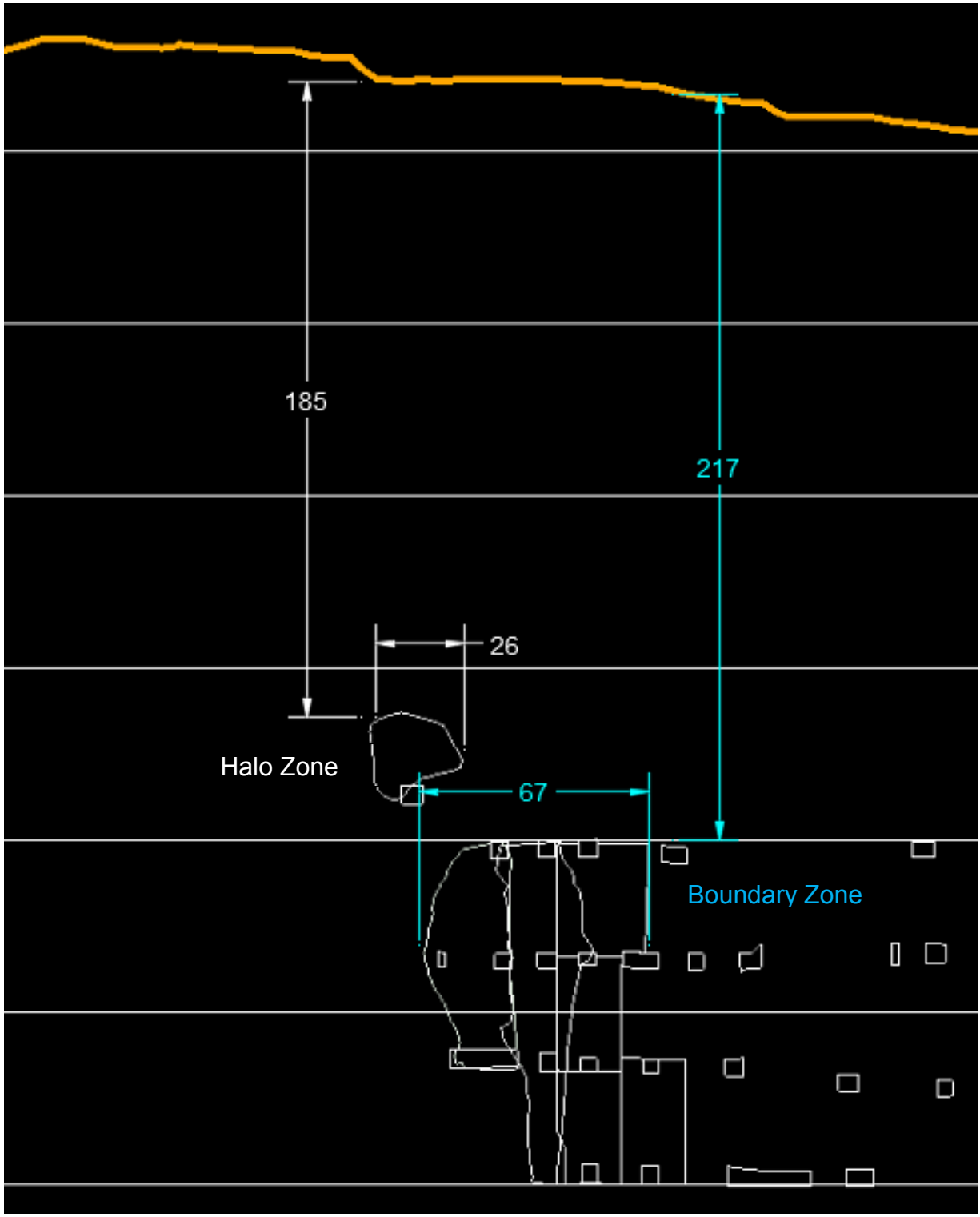

Figure 3: Spans of Mining Zones and Proximity to Surface (Longsection)

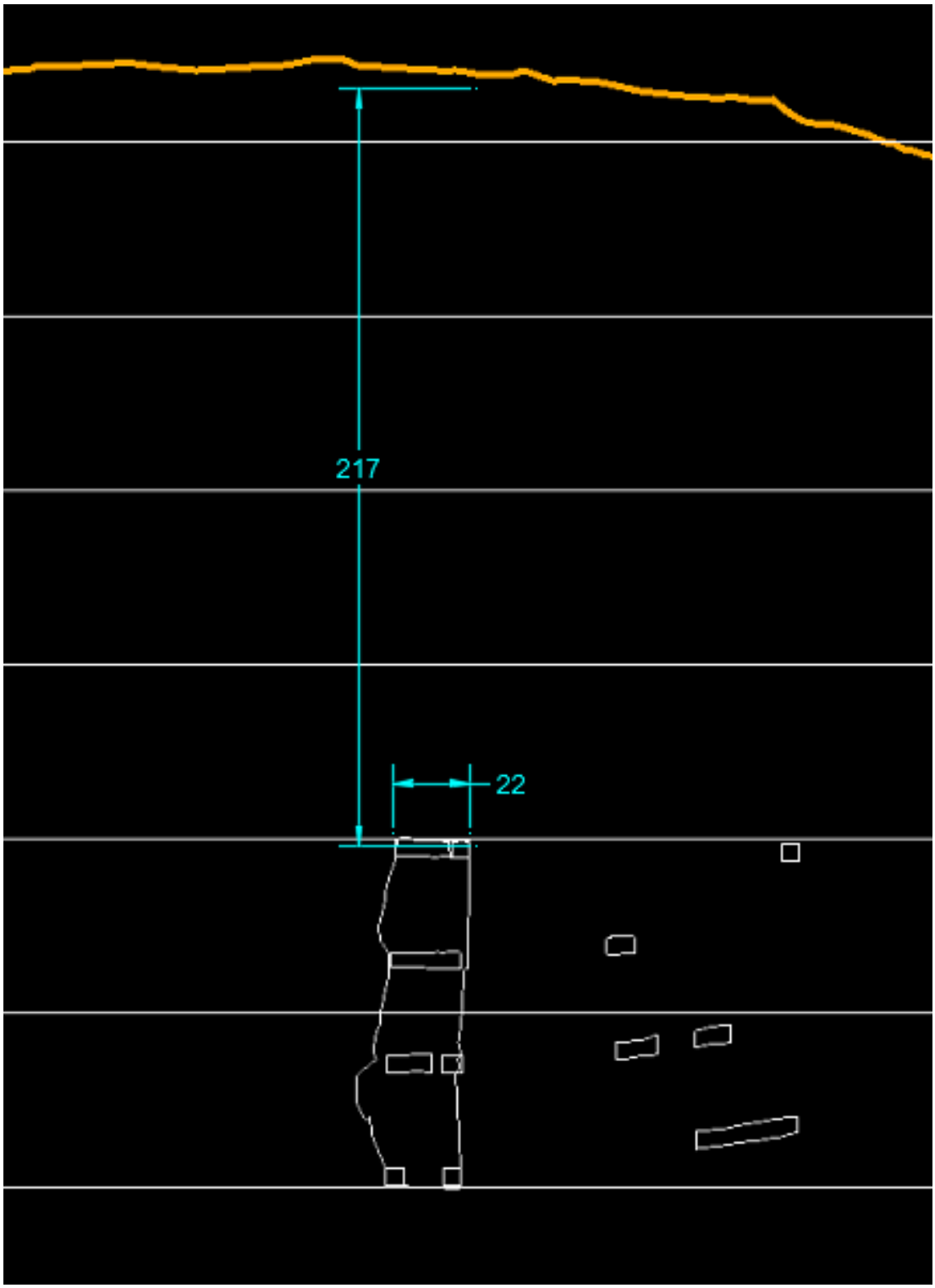

Figure 4: Span of Boundary Zone and Proximity to Surface (Cross Section)

Appendix K
2021 Erosion and Sediment Control Plan

Mount Polley Mine
Environmental Management Plan:

Sediment and Erosion Control Management Plan

Last Update: December 2, 2016

Document Revision Control

Rev. No.	Revision	Date	Approved
0	Original	2010	RM
1	Incorporation of available best practices	July 7, 2014	CH
2	Minor update	February 12, 2015	KM
3	Inclusion of site-specific components	April 30, 2015	KM
4	Update of site-specific components	March 2016	CH
5	Update of site-specific components	December 2, 2016	KM
5	Annual Review	December 4, 2019	GH
5	Annual Review	November 23, 2020	GH
5	Annual Review	December 7, 2021	GH

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Appendix A – Water Management Inspection Checklist
Appendix B – Bi-annual Water Management Inspection Checklist
Appendix C – Water Release Report Form
Appendix D – Reclamation Revegetation Assessment Form

1 INTRODUCTION

Erosion results in the loss of soil particles, mineral nutrients and organic matter that support vegetation, and in turn, wildlife. In addition, eroded materials entering adjacent watercourses may adversely affect water quality, fish and fish habitat. This "Sediment and Erosion Control Plan" (the Plan) is a tool to provide direction for the management of surface erosion at Mount Polley Mine. The Plan addresses existing and potential surface erosion impacts associated with mine expansion (construction activities), operation, and decommissioning phases, and applies to all Mount Polley personnel and contractors. The main objective of this Plan is to minimize erosion and intercept potential sediments as close to the source as possible. Erosion and sediment control measures and best management practices (BMPs) are incorporated in the Plan as approaches to prevent erosion and the introduction of sediment into natural water bodies and watercourses. Guidelines for monitoring the efficacy of measures in this Plan are also outlined. This Plan is a "live" document that is to be routinely updated to reflect changes in site conditions and operations, as well as industry BMPs.

1.1 Legislation and Best Management Practices

The following lists the federal and provincial regulatory requirements with regards to surface erosion prevention and sediment control. The guidance in the subsequent sections is designed to help works proceed in accordance with these regulations:

- BC *Water Act*
- BC *Environmental Management Act*
- Canada *Fisheries Act*

The following are examples of BMPs and guidelines applicable to surface erosion prevention and sediment control. These documents may be used as resource when developing project specific environmental management plans (EMPs). This Plan is designed to incorporate BMPs from these resources:

- "Environmental Best Management Practices for Urban and Rural Land Development in British Columbia" (Draft) (MWLAP, 2004)
- "Best Management Practices Guide for Storm water: Appendix H Construction Site Erosion and Sediment Control Guide" (Dayton and Knight, 1999)
- "Standards and Best Practices for Instream Works" (MWLAP, 2004)
- "Developing a Mining Erosion and Sediment Control Plan Version 1.0" (BC Ministry of Environment [MoE], 2015)
- "Land Development Guidelines for the Protection of Aquatic Habitat" (DFO, 1993).

1.2 Environmental Protection and Mitigation

The general approach applied in this document is to reduce sediment sources and minimize contact between sediment sources and water. Where avoidance is not possible, mitigation measures are adopted to reduce erosion. Sediment and erosion control measures are, and will continue to be, used during construction, operation, and decommissioning activities at the Mount Polley Mine site. Such activities may include clearing vegetation and stripping topsoil, stockpiling topsoil, and constructing roads, infrastructure, tailings and water management structures. Potential hazards from these activities, in the absence of planned mitigation measures, include increased surface erosion from disturbed areas, increased sediment load to downstream receiving environments, and siltation or erosion of downstream watercourses or water bodies.

The subsequent sections discuss short- and long-term procedures for sediment retention and erosion control measures for work with potential for land surface disturbance..

2 SURFACE DEVELOPMENT/CONSTRUCTION PROJECTS

This section provides general guidelines to be followed for future construction projects and/or surface development on the mine site.

2.1 Pre-Project Planning

The guidance documents referenced in Section 1.1 and, when necessary, qualified consulting professionals, are available to support planning of a specific project. Prior to starting any new construction work, the following should be considered:

- Design of projects to minimize the amount of ground cleared and disturbed.
- Design of projects to minimize disturbance adjacent to receiving environment watercourses and water bodies.
- Planning of works such that areas adjacent to waterways and drainage lines remain undisturbed or protected from erosion for as long as practicable.
- Planning of work to minimize the use of heavy equipment and have equipment conduct work as efficiently as possible.
- Planning of interim water and runoff management strategies to reduce erosion and identify available mitigation techniques in the event that sediment is mobilized.
- Planning of long-term erosion control measures to be implemented after project completion.
- Identification of monitoring and inspection requirements for during and after the project.
- Design of project criteria, construction plans, and mitigation for stream and other watercourse crossings to meet or exceed all standards and codes established by relevant authorities for the project.
- Obtaining the appropriate approvals prior to conducting works in and around watercourses and water bodies, and ensure works are being conducted in accordance with the regulated in stream work windows, or as otherwise agreed with relevant agencies. Permitting, notification, and reporting requirements for projects will vary based on their location and proximity to natural water bodies and water courses. These permits and notifications may include:
    - DFO Project Review;
    - Section 9 approval (*Water Act*);
    - MoE approval; and
    - Ministry of Energy and Mines (MEM) approval.

If the project has potential to impact natural watercourses or water bodies (i.e., if the work is outside site contact water collection systems and/or is adjacent to natural waterways), a site-specific EMP for project work should be developed. The EMP should include, at minimum:

- A summary of how information requirements in the bullets above have or are being implemented.
- Details of drainage patterns over the area, both clean water and potential construction runoff.
- Locations of adjacent environmentally sensitive areas that could be impacted.
- Details of existing or planned erosion and sedimentation control methods to filter or collect construction runoff.
- The locations of spill kits and extra sediment and erosion control materials.
- The location of any existing or planned drainage diversions.
- A general outline of the planned work.
- The location of any existing or planned required pumping or sediment ponds.
- An inspection and monitoring schedule.
- A revision number and date.

For projects requiring an EMP, appropriate training and awareness to involved supervisors, workers (employees and contractors) regarding their legal responsibilities of complying with general water quality related legislation should be conducted. Workers are to be made aware of the required mitigation measures for a task, in addition to any requirements contained in any public or private approvals and agreement documents.

The following subsections outline potential sediment and erosion control techniques that may be incorporated into planning, either as preventative or contingency measures.

2.1.1 Stabilization and Treatment Methods

Sediment control measures are to be planned and, if required, installed prior to any clearing or earthwork activities. Stabilization measures are put in place to prevent or reduce the mobilization of sediment by stabilizing the source (e.g., exposed soils). Typical interim measures that may be used to stabilize areas that have the potential to be sources of sediment to water bodies or watercourses include:

- Non-vegetative cover (e.g., gravel and straw);
- Rip-rap placement;
- Slope modification to reduce erosive energy (e.g., flattening or benching);
- Surface ripping and roughening to promote infiltration;
- Diversion berms and drains (in particular to intercept upstream runoff);
- Chute construction;
- Sandbags;
- Buffer zones; and
- Erosion blankets.

While pro-active stabilization measures are used to avoid the presence of sediment laden water, treatment measures may be necessary when it is not possible to completely prevent the mobilization of sediment. Typical treatment measures that may be used to manage sediment in contact water include the following:

- Check dams or weir drop structures;

- Outlet protection;
- Sediment retention ponds, sediment traps and sediment basins;
- Silt fence or similar barrier, such as straw; and
- Swales.

2.1.2 Runoff Collection Ditches

Runoff collection ditches may be either temporary or permanent structures. Permanent surface runoff control works should be sized to convey runoff from a 1 in 10 year 24-hour flood flow and to withstand a 1 in 200 year 24 hour event without significant damage as per MoE Permit 11678.

The design of sections of ditch may depend on topography, excavation material (till or bedrock) and design discharge. Different material gradations or design approaches may be used for armoring depending on site-specific conditions and material availability. Any convergences with other ditches or streams should be armored.

Some initial flushing, erosion and self-armoring are expected following construction, and appropriate measures should be taken for ditches discharging into the receiving environment. For example, small ponds with rock overflow weirs can be constructed or this water can temporarily be collected in mine contact water systems until it is of appropriate quality to discharge. With aging, erosion and sediment runoff will be controlled to be comparable to natural conditions; however, inspections and monitoring (refer to Section 5) are required to confirm appropriate sediment control.

2.1.3 Sediment Control Ponds

A sediment control pond is used to detain runoff from a disturbed area so that sediment can settle out of the water column. Sediment control ponds should be designed according to the “Guidelines for the Design, Size, and Operation of Sedimentation Ponds used in Mining” (MoE, 2002), where applicable.

2.2 Construction

Construction should comply with the plans developed in the pre-construction phase (Section 2.1) so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment or other deleterious substances into any watercourse. Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control plans to be revised accordingly.

Monitoring is to be carried out as per Section 5 of this document. Actions and maintenance that may be required based on monitoring observations include:

- Correcting deficiencies of the erosion and sediment control measures as soon as they are observed.
- Removal of any sediment and debris accumulation that compromises the effectiveness of the erosion and sediment control measures.
- Implementation of additional stabilization and treatment measures listed in Section 2.2.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.

- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.
- Follow the project EMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

2.2.1 Soil Salvage

Under MPMC's *Mines Act* Permit M-200, surficial soils are required to be stripped from the areas to be disturbed in advance of construction of works including waste rock dumps, waste or ore stockpiles, and roads. Stockpiles are often required to store salvaged soils for later use in reclamation, and further erosion control considerations apply, in addition to the earthworks project considerations discussed above. Stockpile locations should have minimal exposure to wind, southwest sun, and runoff pathways. Stockpiles should be promptly seeded with a native seed mixture containing grasses and/or forbes. If stockpiles have the potential to impact natural watercourses or water bodies, temporary erosion and control measures should be installed and maintained until a vegetative cover is established. Refer to the MPMC Soil Management Plan for additional details on the site protocol for soil salvage.

2.3 Post-Construction

When a project is completed, long-term sediment retention and erosion control measures should be implemented. These measures may include elements of the stabilization and treatment options in Section 2.1.1, as well as:

- Restricting access to areas being rehabilitated.
- Establishing a vegetative cover.
- Armoring areas receiving surface runoff.
- Slope modification to reduce erosive energy, such as flattening or benching.
- Surface ripping and roughening to promote infiltration.
- Diversion berms and drains (in particular to intercept upstream runoff).

Any interim measures should remain in place until long-term controls are established. When monitoring and inspections (as described in Section 5) find long-term measures are sufficient, interim or temporary erosion and sediment control features may be reclaimed.

3 MINE OPERATIONS

Sediment and erosion control practices for new disturbances at the mine site are to follow the procedures outlined in Sections 2.1 to 2.3, but measures are also to be implemented and maintained on a site-wide scale.

3.1.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Thus, runoff from disturbed areas that potentially contains sediments is not directly released to the environment. Water from these collection systems is stored on site, and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels, necessitating removal of suspended sediments through active or passive treatment prior to discharge.

To minimize the volume of contact water collected and stored at the site, upstream ditches to divert non-site contact water may be constructed. As water from these works enters the receiving environment, for construction of new diversion ditches, an EMP should be developed and followed for construction, and the guidelines in Sections 2.1 to 2.3 followed.

Inspection and monitoring requirements for site water collection systems and diversion ditches are outlined in Section 5.

3.1.2 Emergency Release of Water

If emergency release of water from the site water collection system should occur, sediment and erosion control materials are to be installed, as required, to avoid the displacement of sediment as water moves over land. These materials are stored in the Environmental C-Can located beside the Leach Pad, and the Environmental Department staff is available to guide proper installation. The Mount Polley Emergency Response Plan and Water Management Inspection Manual outline in more detail response protocol for such events, and Section 5 outlines event-based monitoring procedures.

3.1.3 Adaptive Management

This Plan is designed to be updated as sediment and erosion control science and BMPs develop over time. It is also designed to be adapted for operational changes and water management needs at the mine site. Continuous improvements that may be carried out include (but are not limited to):

- Changes to the design of works to eliminate deficiencies that are noted during inspections and require regular maintenance.
- Implementation of mitigation measures in response to water quality trends noted in the receiving environment.
- Implementation of measures that reduce treatment needs prior to discharging water.
- Implementation of measures to reduce maintenance costs.
- Implementation of measures to reduce environmental risk.

Measures in place to identify areas where maintenance or mitigative measures are required are (or opportunities for improvements exist) are described in Section 5.

4 DECOMMISSIONING AND RECLAMATION

At closure, MPMC is responsible for leaving the mine site in compliance with all regulations, including site runoff water quality and revegetation to meet end land use and land capability objectives. The following steps should be implemented during reclamation works to reduce erosion:

- Grade and contour any disturbed areas to promote drainage and conform to adjacent topography.
- Apply soil in a rough manner to create microtopography.
- Apply coarse woody debris, as available, to the reclamation site if it is not already incorporated into the soil.
- Seed and/or plant disturbed areas with a suitable mixture of grass, legume and woody species to establish ground cover and provide stabilization in a timely manner.
- On disturbed areas with potential to impact natural water bodies or watercourses, maintain temporary stabilization measures, such as geotextile or mulch until a vegetative cover is established.

Detailed soil application and revegetation plans that include methods for reducing erosion are included in the site Reclamation and Closure Plan. Monitoring and inspections requirements for reclaimed sites are included in Section 5.

5 MONITORING AND INSPECTIONS

Site monitoring and inspections of sediment and erosion control systems are based on associated risk to the environment. Figure 1 identifies environmentally sensitive areas (i.e., receiving environment waterways) adjacent to the Mount Polley Mine footprint that could potentially be impacted by sedimentation. It also shows the location of contact water conveyance structures, areas undergoing progressive reclamation and soil stockpile locations, which are potential sources of sediment. Table 1 relates potential sediment sources to these sensitive areas and assigns a level of risk based on sensitivity of the receiving environment (receiver size, fish bearing status, etc.) and erosion potential. Note that Hazeltine Creek and adjacent areas impacted by the August 4, 2014 TSF breach are outside of the scope of this document.

Based on the risk matrix and site conditions, water management works appear to be the largest risk to receiving environment systems, because:

- Reclamation areas and soil stockpiles on site (with the exception of localized active stripping and stockpile locations) have all been seeded or inspected to confirm natural revegetation is underway. Site-specific observations from routine reclamation inspections and annual soil stockpile surveys indicate that minimal erosion is occurring at these sites.
- Mine site hydrology systems are snowmelt dominated, and periods of high flow are experienced annually during freshet, meaning that:
    - There is higher potential for in-ditch erosion;
    - There is higher potential for erosion by surface runoff that reports to collection ditches; and
    - Risk of an emergency release of water is elevated.
- Collection ditches are located downstream of disturbed areas on site, and collect and convey any turbid water that is generated from disturbed areas on site.

Thus, water management inspections are the primary focus of the monitoring program. In the following subsections, monitoring and inspection requirements, roles and responsibilities, and reporting protocol are outlined. Protocol is broken into the following areas:

1. Water Monitoring;
2. Reclamation areas (soil stockpiles and progressive reclamation sites); and
3. Construction projects.

Note that these monitoring programs are reflective of current conditions (operations phase of the mine life). At closure, they revisions for post-closure conditions will be made to this document and it will be incorporated into the site Closure Management Manual.

Table 1. Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Sources(s)[1]	Erosion Potential Considerations[2]	Risk[3]
6km Creek	- Not fish bearing in upper reaches - Variable forest buffer	- Access Road - Junction Zone Ditch or 9km Sump	- NW PAG Stockpile soil stockpiles - NW PAG Stockpile/Junction Zone Ditch access roads - NW Sump	- Established gravel ditch bottom - Upstream area mostly covered with waste rock - Soil stockpiles revegetating - Two high traffic road crossings	Medium
Mine Drainage Creek	- Not fish bearing - Connected to Bootjack Lake	- Mine Drainage Creek Sump - West Ditch	- Waste Haul Road - Helipad reclamation parcel - Crusher Access Road - Ore Switchback Road - Cariboo Stockpile and soil stockpiles - Pipeline from Springer Pit to water treatment plant	- Some unarmoured ditch sections - Some till placed on outer slope of Waste Haul Road - Active haul traffic on roads (can develop sediment-laden puddles) - Cariboo Stockpile soil stockpiles new - Helipad reclamation parcel revegetating - Majority of runoff into ditch (including from reclamation and soil stockpile areas) filters through rock haul road - Water in pipeline to treatment plant contains low total suspended solids	Medium
W20 Creek	- Fish bearing (very low productivity) - Variable forest buffer	- West Ditch - West Ditch Access Road	- Light Vehicle Tailings Road - Waste Haul Road - Above Waste Haul Road reclamation parcel - Pipeline from Springer Pit to water treatment plant	- Ditch armoured - Reclamation parcel revegetating; upstream of Waste Haul Road - Active haul traffic on roads (can develop sediment-laden puddles) - Water in pipeline to treatment plant contains low total suspended solids - Majority of runoff into ditch filters through rock haul road	Medium
Bootjack Lake	- Fish bearing, - Medium sized receiver - Variable forest buffer	- NW Sump - NW Ditch - Mine Drainage Creek Sump - West Ditch - West Ditch Access Road - Mine Drainage Creek - W20 Creek	- Waste Haul Road - Helipad reclamation parcel - Crusher Access Road - Ore Switchback Road - Cariboo Stockpile and soil stockpiles - Light Vehicle Tailings Road - Waste Haul Road - Above Waste Haul Road reclamation parcel - Pipeline from Springer Pit to water treatment plant	- Some unarmoured ditch sections - Some till placed on outer slope of Waste Haul Road - Active haul traffic on roads (can develop sediment-laden puddles) - Cariboo Stockpile soil stockpiles new - Reclamation parcels revegetating - Water in pipeline to treatment plant contains low total suspended solids - Majority of runoff into ditch filters through rock dumps and rock haul road	Medium
North Dump Creek	- Not fish bearing in upper reaches - Variable forest buffer	- Joe's Creek Coffer Dam - Joe's Creek Pipeline - Gavin's Ditch (clean water diversion) - Wight Pit Ditch (clean water diversion) - Wight Pit Haul Road	- North Bell Dump reclamation areas and soil stockpiles - Access Road - East Dump reclamation areas and soil stockpiles	-Joe's Creek Coffer Dam/Pipeline water very low turbidity/suspended solids - Ditches armoured or have established low-erodibility substrates except some potentially erodible sections in Wight Pit Ditch - East Dump reclamation area in early stages of revegetation - Varying levels of soil stockpile revegetation (some new) - Two moderate use road crossings	Medium
Bootjack Creek	- Not fish bearing - Connected to Polley Lake	- Bootjack Creek Sump - Tailings Access Road Ditch - SERDS Ditch	- Tailings Access Road - Tailings Access Road soil stockpiles - SERDS access roads - Southeast Zone soil stockpiles	- Some erodible ditch sections - Portion of runoff into ditches filters through waste rock roads/dumps - Three high use road crossings	Medium
Polley Lake	- Fish bearing, - Large sized receiver - Forest buffer	- Wight Pit Ditch (clean water diversion) - Long Ditch - North Dump Creek - Bootjack Creek	- North Bell Dump reclamation areas and soil stockpiles - Access Road - NEZ Dump reclamation area and soil stockpiles - East Dump reclamation areas and soil stockpiles - Tailings Access Road - Tailings Access Road soil stockpiles - SERDS access roads - Southeast Zone/SERDS soil stockpiles	- Varying levels of revegetation of upstream reclamation areas and soil stockpiles - Ditches armoured or have established low-erodibility substrates except some potentially erodible sections in Wight Pit Ditch	Low
Hazeltine Creek[4]	- Not fish bearing - Undergoing rehabilitation - Sedimentation ponds constructed at outflow	- Polley Lake - Long/SERDS Ditch (combined) - Central Collection Sump - Perimeter Till Borrow Pit and ditch from Central Collection Sump - Pipeline from Springer Pit to water treatment plant - Edney Creek	- TSF and associated infrastructure - TSF Perimeter Embankment and PAR soil stockpiles - TSF Ditch (clean water diversion) - TSF South Seepage Pond - TSF South Toe Drain Ditch - TSF Main Seepage Pond - ABR/Main Seepage Pond Ditch	- High volume water transfers - Water has time to settle in the TSF and Perimeter Embankment Till Borrow Pit - Water in pipeline to treatment plant contains low total suspended solids - Soil stockpiles varying levels of revegetated - South Till Borrow area revegetation is advanced - Active TSF construction upstream	Medium (risk will increase when the creek returns to fish-bearing status)
Edney Creek	- Fish bearing - Forest/wetland buffer	- TSF Ditch (clean water diversion) - TSF South Seepage Pond - TSF South Toe Drain Ditch - TSF Main Seepage Pond - ABR/Main Seepage Pond Ditch - South Till Borrow reclamation area	- TSF and associated infrastructure - South and Main Embankment soil stockpiles	- Few erodible ditch sections - Low water volumes managed - Water seepage ponds contain low turbidity/suspended solids -New soil stockpiles (early stages of revegetation) - Active TSF construction upstream - South Till Borrow area revegetation is progressing	Low

Notes:

1) Secondary sources are potential sources of sediment that are upstream of (i.e., potentially contribute to) primary sources

2) Historic turbidity and total suspended data in relevant water collection infrastructure were considered when assessing erosion potential; water management contingency measures in place across water management system

3) Based on combination of area sensitivity and erosion potential

4) Sediment and erosion control in Hazeltine Creek beyond the mine footprint related to the Tailings Storage Facility embankment breach is managed under a separate program

5.1 Water Monitoring (Site Infrastructure and Receiving Environment)

5.1.1 Inspections

Daily inspections of site water containment infrastructure are completed as per the Water Management Inspection Manual to verify the collection system is working as designed. As per this document, inspections are completed at least once on day shift and night shift during high risk periods (i.e. freshet). The inspection form template is included as Appendix A. Completed forms are provided to the Environmental Department for review and filing at the end of each seven (7) day set. Note that protocol and triggers are in place for immediate notifications to occur if deficiencies are observed. Daily inspections are the responsibility of Mill Maintenance, and the Environmental and Engineering Departments are responsible for updating the Water Management Inspection Manual, which is a component of the site Operation Maintenance and Surveillance (OMS) Manual.

Thorough inspections of all site water management infrastructure (sumps, ditches, culverts, etc.) are completed in spring after freshet and in fall prior to freeze up, as per *Environmental Management Act* Permit 11678. This is the responsibility of the Environmental Department. Results are documented in the inspection form (refer to the template provided as Appendix B) and filed internally. Inspection results are used to inform upgrades of water management structures. Noted deficiencies, including areas of sedimentation or erosion, are compiled and prioritized in a project list which is provided to the Engineering Department to address, based on the identified levels of urgency.

As per the Water Management Inspection Manual, supplemental inspections are to be completed by Mill Maintenance, Mine Operations, and the Environmental Department during high risk periods (i.e., precipitation and/or snowmelt runoff events), with support from the Engineering Department. Aside from the frequency changes, the inspection procedure is consistent with the one previously described. Inspection reports from high flow periods provide feedback on the functioning of site water collection systems under conditions when erosion potential is higher. Noted deficiencies are incorporated into project planning for continuous improvements along with findings from routine inspections as described above.

5.1.2 Contact Water Monitoring

Routine monitoring of mine site contact water conveyed through various infrastructure components is conducted as per *Mines Act* Permit M-200. This sampling program, including sample locations, frequencies, and QA/QC procedures, is detailed in the site OMS Manual, which is regularly updated to account for operational changes at the mine site. All routine samples collected on site are analysed for physical parameters (including total suspended solids and turbidity), anions, nutrients, and total and dissolved metals. Monitoring locations and frequencies (at the time of this update) are shown in Figure 1.

These sample results are included in the Annual Environmental and Reclamation Report to MoE and the MEM, which is written and submitted by the Environmental Department.

Results from these samples are used, along with inspection results, to identify potential upgrade opportunities for site water conveyance structures as described in Section 5.1.1

5.1.3 Receiving Environment Monitoring

The Environmental Department conducts water quality monitoring in receiving environment water bodies and watercourses as per MPMC's Comprehensive Monitoring Plan (CEMP), which is required under *Environmental Management Act* Permit 11678. Note that chemistry and flow monitoring at a few contact water sites is included under this program, as opposed to the MEM program, including monitoring related to the permitted effluent discharge. In addition to regular sampling (e.g., monthly, quarterly), a five (5) week intensive turbidity and total suspended solids monitoring program is conducted in spring and fall in receiving environment streams that could potentially be impacted by erosion from the mine. This includes the following creeks downstream of inflows from runoff diversion ditches:

- North Dump Creek;
- Bootjack Creek;
- Edney Creek; and
- Hazeltine Creek (temporarily suspended due to the TSF breach).

All routine samples collected on site are analysed for physical parameters (including total suspended solids and turbidity), anions, nutrients, and total and dissolved metals. Monitoring locations and frequency (at the time of this update) are shown in Figure 1. More detail on this monitoring program, including sample locations, frequencies, and QA/QC procedures, is available in the CEMP.

The CEMP is, at minimum, updated every three years, based on the results of detailed three-year monitoring program interpretive reports. More frequent changes are, however, anticipated to reflect changing site conditions and, as per the mechanisms described in the CEMP, written notice of proposed changes will be provided to the MoE. First Nations and stakeholders will also be updated, as per MPMC's Communication Plan. The CEMP is also referenced in the site OMS Manual, which is regularly updated to account for operational changes at the mine site.

Results from monitoring completed as per the CEMP are submitted to the MoE quarterly, and are also included in the Annual Environmental and Reclamation Report, which is submitted to the MoE and the MEM annually. The Environmental Superintendent or their designate (the Environmental Coordinator) is responsible for ensuring this reporting is carried out.

Results from routine or freshet/fall rainy period monitoring of receiving environment or general observations from carrying out other work at the mine site may indicate increased sedimentation from mine-related sources. Table 3 outlines the triggers for further monitoring and required follow up actions if elevated suspended sediment levels are observed or measured.

Table 3. Event-based monitoring protocol for receiving environment waterways

Trigger	Actions and Responsibilities
Receiving environment waterway or waterbody is observed to have a "cloudy" appearance	- Observer to report observation to the Environmental Coordinator (or member of the Environmental Department if Environmental Coordinator cannot be reached) - Environmental Coordinator or their delegate from the Environmental Department is to carry out in situ monitoring at this site, following the turbidity triggers and associated protocol below.
80-100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to a mine activities: - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to a mine activities: - Stop any construction or mine activities that may contribute to or exacerbate erosion and sedimentation. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.

5.1.4 Emergency Release of Water

In the event that an emergency release of water from the site collection system occurs, the protocol in the Water Management Inspection Manual outlining responsibilities, notification requirements, documentation (refer to the form in Appendix C), and actions to carry out. One key action is the installation of sediment and erosion control materials and/or structures.

Monitoring associated with an emergency release of water is the responsibility of the Environmental Department, and should include the following:

- Assessment of the spatial extent of the release and if the release reached receiving environment waterways or water bodies;
- Monitoring of water released (visual observations, flow measurements/estimates, field parameters including turbidity, and/or sampling, based on the observed location, conditions and size of the release); and

- Monitoring (visual observations, field parameters including turbidity, and sampling) of downstream waterways or waterbodies into which water was released.

Reporting to Emergency Management BC and follow up reporting to provincial regulatory agencies will likely require this information, in addition to the information required to be collected as per the Water Management Inspection Manual (refer to the form in Appendix C).

5.2 Reclamation Areas

Formal and/or informal inspections of reclamation areas are conducted routinely to document the progression of revegetation. Soil stockpiles are also inspected annually as part of the soil stockpile inventory tracking program under MPMC's Soil Management Plan. During these inspections, erosion concerns are documented in the site Reclamation Field Notebook or on printed forms, such as the Reclamation Vegetation Assessment Form included as Appendix D. Results from reclamation assessments are included in the Annual Environmental and Reclamation Report. Remedial works, including revegetation are scheduled, as required for any identified erosion concerns, and general site reclamation prescriptions may updated if improved methods for erosion control based are identified based on observed issues.

A regular seeding program is another component of the reclamation program. Each spring and fall, when conditions are ideal for seeding, a list of areas that require revegetation is developed based on planned reclamation and results of site inspections. Areas included include progressive reclamation sites, recent disturbances from known operational activity, areas where erosion has been observed (and seeding is a reasonable mitigation method), and any previously seeded areas where growth was poor. Areas seeded are reported in the Annual Environmental and Reclamation Report. Note that this does not preclude seeding that occurs at other times of year associated with specific construction projects. Supplemental investigations of soil stockpiles and reclamation areas are carried out, as necessary, if an investigation into a sediment source is being conducted.

Monitoring and inspections of reclamation areas outlined in this section are the responsibility of the Mount Polley Environmental Department, and ultimately the Environmental Superintendent or their designate (Environmental Coordinator).

5.3 Construction Projects

5.3.1 General Monitoring

Monitoring should be carried out in accordance with project specific EMPs developed as per Section 2.1 and regulatory permits and legislation.

If the project has the potential to impact natural water courses, and requires an EMP, a designated, designated environmental monitor should oversee the project. The monitor's daily tasks are to be defined in the EMP, and should include:

- Visual inspections of erosion and sedimentation controls;
- Visual inspections of equipment for leaks;
- Visual inspections of spill kits to confirm appropriate supplies are available;

- Visual inspections of potential sedimentation sources, such as soil stockpiles, new disturbances, and active construction areas;
- Monitoring of the weather forecast and current conditions; and
- Documentation of the above.

If a project does not have the potential to impact natural water courses, and EMP is not developed, monitoring is still expected and BMPs for sediment and erosion control should still be applied. Inspections should be conducted by a designated, qualified member of the Mount Polley Environmental or Engineering Department for the tasks outlined above.

In active construction areas where activities could impact receiving environment water quality, additional monitoring may be required beyond routine sampling described in Section 5.1. Monitoring may include in situ turbidity testing and/or partial or full suite water quality sampling (full suite = parameters listed for routine samples in Section 5.1.2). Results should be compared against pre-construction data and the BC Water Quality Guidelines for Freshwater Aquatic Life. Downstream monitoring site(s) should be located at a sufficient distance to ensure mixing of construction runoff and ambient stream water. An upstream control site of sufficient distance to be isolated from any construction-related impacts may be monitored simultaneously and compared to downstream monitoring results. Monitoring requirements and sampling frequency depend on the specific project and a monitoring plan should be included in the project EMP.

5.3.2 Event-based Monitoring

A detailed event-based monitoring program for the receiving environment should be included in project EMPs. Table 4 provides recommended protocol to incorporate.

Table 4. Recommended event-based monitoring protocol for a construction project

Trigger	Actions and Responsibilities
80-100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all sediment and erosion control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring.
/100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. - Construction supervisor to stop all local construction work. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all sediment and erosion control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. Work is not to recommence until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
Rainfall (or snowmelt) ≤ 10 mm/h or 25 mm/d	During minor rainfall or snowmelt runoff events, the Environmental Monitor is to: - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of potential sediment sources (soil stockpiles, sediment ponds, etc.).
Rainfall (or snowmelt) /10 mm/h or 25 mm/d	During major rainfall or snowmelt runoff events, the Environmental Monitor is to: - Notify the Environmental Coordinator and construction supervisor. - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of high risk areas (soil stockpiles, sediment ponds, etc.). Environmental Coordinator and/or construction supervisor are to consider full work stop in the area based on conditions.

*Upstream monitoring site may be used as “background” reference

7 REFERENCES

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Soil Stockpiles

Progressive Reclamation Sites

Waterways

Environmentally Sensitive Areas

Surface Water Monitoring Sites

Frequency

- Bi-annually
- Monthly
- Quarterly
- Weekly
- Semi-monthly (non-freezing periods)

Water Collection Systems

Type

- Clean Water Ditch
- Contact Water Ditch
- Pipeline
- Sumps

6km Creek

North Dump Creek

Polley Lake

Mine Drainage Creek

Bootjack Lake

W20 Creek

Bootjack Creek

Hazeltine Creek

Edney Creek

Figure 1: Mount Polley Mine Sediment and Erosion Control Plan Map

Date: 06-Dec-2016

N

0 250 500 1,000 1,500 2,000

Meters

APPENDIX A:

Daily Water Management Inspection Checklist

Daily Water Management Inspection Checklist

Inspector: _____ Date: _____

Shift (Crew, D or N):_____ Weather Conditions (ex. hot, windy): _____

Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes/ Comments
WTP Well		(m)	
WTP Slurry Line		GOOD / ISSUE	
Perimeter Embankment Till Borrow		RED YELLOW BLACK	
CCS		GOOD / ISSUE	
Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
Breach Sump		GOOD / ISSUE	
Weir		GOOD / ISSUE	
Polley Fish Fence (Day Shift)		GOOD / ISSUE	Cleaned? Y / N
SERDS Sump		RED YELLOW BLACK	
Long Ditch Sump (Upper)		RED YELLOW BLACK	
Long Ditch Sump (Lower)		RED YELLOW BLACK	
Long Ditch/SERDS Outflow Pipes		GOOD / ISSUE	
South Seepage Collection Pond		RED YELLOW BLACK	
Main Seepage Collection Pond		RED YELLOW BLACK	
Sprinklers		GOOD / ISSUE	
Lower Hazeltine Pond Water Level		(m)	
TSF Settling Pond		GOOD / ISSUE	
Tailings outflow pipe		GOOD / ISSUE	
TSF Upstream		GOOD / ISSUE	
Cariboo Pit Sump		GOOD / ISSUE	
Springer Pit Lake		GOOD / ISSUE	
Junction Zone Seepage Sump		GOOD / ISSUE	
9K Sump **# Starts** _____		RED YELLOW BLACK	
NW PAG Sump **# Starts** _____		RED YELLOW BLACK	
Mine Drainage Creek Sump		RED YELLOW BLACK	
West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
Springer Pit Dewatering Outflow		GOOD / ISSUE	
Bootjack Creek Sump - Upstream Side		GOOD / ISSUE	
Bootjack Creek Sump		RED YELLOW BLACK	
Wight Pit Water Level		(m)	
Joe's Creek Pipe		GOOD / ISSUE	

Updated November 2, 2016

Is the TSF Generating Dust?

No Minor Moderate Major

Is the Polley Lake Plug Generating Dust?

No Minor Moderate Major

REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING IN FREEZING CONDITIONS

ADDITIONAL COMMENTS/OBSERVATIONS (ex. erosion):

WILDLIFE OBSERVATIONS (include locations):

APPENDIX B:

Bi-annual Water Management Infrastructure Inspection Checklist

Bi-Annual Water Management Infrastructure Inspection Checklist (September 2016)

Location	Initials	Date	OK	Not OK	Photo (Y/N)	Comments/Actions Required
Junction Zone Ditch						
9km Sump						
Junction Zone Seepage Collection Sump						
Northwest Ditch						
Northwest Sump						
West Ditch						
Mine Drainage Creek Sump						
Waste Haul Road Culvert (at MDC)						
Orica Site Settling Pond						
Orica Ditch						
Bootjack Lake Dam						
Bootjack Cr Culverts at TAR						
Bootjack Cr Culverts under Light Vehicle TSF Road						
Bootjack Creek Sump (Upstream)						
Bootjack Creek Sump						
TAR Ditch						
SERDS Ditch						
SERDS Culverts at TSF Road						
SERDS Culverts at TAR						
SERDS Sump						
SERDS Ditch Pipeline						
Wight Pit Clean Water Ditch (N)						
Wight Pit Clean Water Ditch (SW)						
SEZ Ditch						
Gavin's Ditch						
Access Road Culverts						
Joe's Creek Coffer Dam						
Joe's Creek Pipeline						
Long Ditch						
Long Ditch Sump (Upper)						
Long Ditch Pipeline						
Long Ditch Sump (Lower)						
Bootjack Creek Bridge Crossing						
Bootjack Creek Channel						
Mill Site Ditch						
Mill Site Sump						
Crusher Site Ditch						
Tailings Ditch (Mill to Booster Station)						
Tailings Ditch (Booster Station to 5 Corner)						
Tailings Ditch (5 corner to TSF)						
Central Collection Sump						
Breach Sump Ditch						
Perimeter Embankment Till Borrow Pit						
Hazeltine Discharge Pipeline						
Main Seepage Pond						
Ditch below 3 Corner						
South Toe Drain Ditch						
South Seepage Pond						
South Seepage Pond Pipeline						
Borrow Pit Ditch & Settling Pond across from Horsefly-Gavin FSR						
Horsefly-Gavin FSR under permit obligation with MOF (Gavin Lake Road Bridge to W8z)						
TSF Clean Water Ditch						

Daily Water Management Inspection Checklist

*(Controlled Document – **DO NOT COPY**: please ask Environment Department for print out)*

Inspector: _____ Date: _____

Shift: (Crew, D or N) _____ Weather Conditions: (ex. hot, windy, sunny): _____

	Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes / Comments
1	Junction Zone Seepage Sump		GOOD / ISSUE	
2	9K Sump # Starts _____		RED YELLOW BLACK	
3	CWTS (Wetland)		GOOD / ISSUE	
4	NW PAG Sump # Starts _____		RED YELLOW BLACK	
5	Mine Drainage Creek Sump		RED YELLOW BLACK	
6	West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
7	Booster Station		GOOD / ISSUE	
8	Bootjack Creek Sump – Upstream side		GOOD / ISSUE	
9	Corner 1 Buttress Culverts/Ditch		GOOD / ISSUE	
10	TSF Barge		GOOD / ISSUE	
11	Dredge Outflow Pipe		GOOD / ISSUE	Location:
12	South Seepage Collection Pond		RED YELLOW BLACK	
13	Main Seepage Collection Pond		RED YELLOW BLACK	Percent Full ____%
14	Fish fence at outlet to Quesnel Lake		GOOD / ISSUE	
15	Fish Fences above Gavin Lake Bridge		GOOD / ISSUE	Cleaned? Y / N
16	WTP Well		(m)	
17	WTP Slurry Line		GOOD / ISSUE	
18	Perimeter Embankment Till Borrow Pond		RED YELLOW BLACK	
19	Breach Sump/COW Drain/Upstream Drain		GOOD / ISSUE	
20	CCS		GOOD / ISSUE	
21	Long Ditch Outflow Pipes		GOOD / ISSUE	
22	Long Ditch Sump (Lower)		RED YELLOW BLACK	
23	Long Ditch Sump (Upper)		RED YELLOW BLACK	
24	SERDS Sump		RED YELLOW BLACK	
25	Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
26	**NEZ Seep Sump**		GOOD / ISSUE	
27	Wight Pit Water Level		(m)	
28	Joe's Creek Pipe		GOOD / ISSUE	
29	**Leachpad LCRS**		(m)	Pumped? Y / N
30	West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
31	Bootjack Creek Sump		RED YELLOW BLACK	
32	Mill Site Sump		Pump Hours	

Updated May 25, 2019

Is the TSF Generating Dust? *(Circle one)* No Minor Moderate Major

**REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING FREEZING CONDITIONS **

ADDITIONAL COMMENTS/OBSERVATIONS (EX. EROSION):

NOTE* - Please clean up and report all spills of hydrocarbons or chemicals

WILDLIFE OBSERVATIONS (include locations):

APPENDIX C:

Water Release Report Form

Water Management Incident Report Form

Please complete and forward to the Environmental Department.

DATE OF REPORT	
DATE AND TIME INCIDENT DISCOVERED	
NAME(S) OF PERSON/PEOPLE REPORTING INCIDENT	
LOCATION OF INCIDENT	
IS WATER RELEASING TO THE ENVIRONMENT?	
If yes, what time did it start releasing, and at what rate is the water flowing?	
If no, at what rate is it approaching release?	
DESCRIPTION OF HOW/WHY INCIDENT OCCURRED	
HAS THE PROBLEM BEING FIXED? HOW?	
If yes, what time did the water stop releasing to the environment (if released)?	
If no, describe actions being taken to fix problem (record timeline of events).	

DESCRIPTION OF MEASURES TAKEN TO PROTECT ENVIRONMENT (ex. sediment and erosion control materials)	
PREVENTATIVE MEASURES TAKEN TO ENSURE INCIDENT DOES NOT OCCUR AGAIN	
SUPERVISOR NAME	
SUPERVISOR SIGNATURE	
FOLLOW UP REQUIRED?	
Environmental Department: Name: _____ Sign: _____	Comments:

APPENDIX D:

Reclamation Revegetation Assessment Form

MOUNT POLLEY RECLAMATION RE-VEGETATION ASSESSMENT FORM

Date: _____ Transect: _____
Assessor(s): _____ Plot: _____
Reclamation Site: _____ Plot Size: _____
Site Conditions (slope position, slope angle, aspect): _____

Ground Surface

Surface Roughening (present, description):	
Coarse Woody Debris (% cover, types):	

Understorey Vegetation

General

% Cover (all species)	
% Cover (invasive species)	
Average Height (m)	
Vigor (0 - 5)	

Species Specific

Species	# Species	% Cover	Height (m)	Vigor (0 - 5)	Planted/Ingress/Invasive

Trees/Shrubs

Species	# Present	Average Height (m)		Vigour (0 - 5)	Planted/Ingress

Wildlife Value

Wildlife Observations:	
Habitat Types Present:	

Comments

(ex. erosion, variation across plot)

Appendix L
ML/ARD Management Procedure Manual Final

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

ML/ARD MANAGEMENT PROCEDURE MANUAL

OBJECTIVE

The objective of this Metal Leaching/Acid Rock Drainage (ML/ARD) Management Procedure Manual is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). This document summarizes all the various procedures and considerations related to ML/ARD potential through mine life processes.

DOCUMENT REVISION HISTORY

This document replaces earlier versions of similar documents that directed ML/ARD Management at MPM in response to *Mines Act* Permit M-200 issued on August 3, 1995. The procedures as described have been in the place since that date.

Document Update Summary

Revision Date	Author	Comment
June 30, 2016	Chad Cameron Ben Harding Katie McMahen Luke Moger Ryan Brown Stephen Day (SRK)	Original Document
August 04, 2022	Mathieu O'Leary Gabriel Holmes Aaron Zwiebel (DWB) Shauna Litke (SRK)	Added contacts, water treatment plant waste ML/ARD characterization, QA/QC sampling, and PAG misplacement action plan.

KEY CONTACTS AND QUALIFIED PROFESSIONALS

Numerous personnel at Mount Polley are responsible for carrying out the procedures written in this plan. Key mine personnel and their contact information are as follows.

Name	Role	Phone	Email
Don Parson	General Manager	604-488-2652	don.parsons@imperialmetals.com
Mathieu O'Leary	Technical Services Superintendent	236-317-4938	mathieu.oleary@mountpolley.com
Gary Roste	Senior Mine Geologist	250-991-0438	gary.roste@mountpolley.com
Gabriel Holmes	Environmental Coordinator	236-317-4939	gabriel.holmes@mountpolley.com
Bill Grieves	Foreman	236-602-3203	bill.grieves@mountpolley.com
Al Trottier	Mill Ops Foreman	236-602-3203	al.trottier@mountpolley.com
Bill Smith	Lab Manager	236-597-1181	goldag2700@gmail.com

Any update to this document is reviewed by a Qualified Professional (QP) in the area of practice of ML/ARD management, as required by *Mines Act* Permit M-200 Condition A.5. Qualified professionals reviewing this document are as follows:

Version	Qualified Professional	Phone	Email
June 30, 2016	Stephen Day, PGeo (SRK)	604-862-4097	sday@srk.com
August 04, 2022	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com

BACKGROUND

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of: weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulphur (e.g. sulphide and elemental sulphur) are exposed to the weathering effects of oxygen and water. In iron sulphide minerals (e.g. pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid. ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at MPM is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due

to the potential consequences of acid generation for long term management of the site, Mount Polley Mining Corporation (MPMC) actively manages waste rock based on its ARD potential as described in the following sections.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for ML. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at MPM).

UNDERSTANDING OF THE DISTRIBUTION OF ARD POTENTIAL

Like other alkalic porphyry deposits (e.g. Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g. Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPMC geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit.

This ML/ARD Management Procedure Manual applies to waste rock and ore stockpiles. Tailings are consistently NAG due to removal of copper sulphides by ore processing.

MANAGEMENT OF PAG ROCK

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored subaqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit
- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo-Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

DETERMINATION OF ML/ARD POTENTIAL

Waste rock on site is separated into two categories, NAG and PAG, using Neutralizing Potential Ratio (NPR) defined as:

NPR = NP/AP.

Acid Potential (AP) (in kg $CaCO_3$/t) is measured from:

- Total sulphur (%) x 31.25

Neutralizing Potential (NP) (in kg $CaCO_3$/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate.

As required by *Mines Act* Permit M-200, PAG is defined as:

- NPR≤2 and total S>0.1%.

This *Mines Act* Permit M-200 requirement was specified in terms of NP determined by a whole-rock acid extraction and titration method; however, MPMC chose to use total carbonate which yields lower NP than the titration methods.

MATERIAL CHARACTERIZATION OVERVIEW

This section provides an overview of characterization procedures.

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument , allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be

submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries, and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Millfeed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

Water treatment wastes are quantified monthly and sampled quarterly, with material characterization performed to assess ML/ARD potential and contribute to a material inventory.

As a confirmatory sampling measure, the Environmental Department takes random weekly grab samples from the NAG waste dump when NAG is being dumped and/or used for construction, to verify that material is being appropriately characterized and handled.

In the event that a confirmatory sample or other activities result in the discovery of PAG material in a NAG-designated area, a QP is to be informed without delay, who will dictate the response actions in coordination with site contacts. Mount Polley is permitted to blend pockets of less than 1,000 t of PAG materials with non-PAG materials at a ratio of 20:1, as described in *Mines Act* Permit M-200 Section D.3.(c)(i)(d). If these conditions cannot be met, it may be necessary to remove PAG material from NAG areas.

Water chemistry monitoring of seepage from rock dumps, water treatment plant wastes, and contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third-party laboratory for metals analysis as an additional source of data for site geochemical models.

IN-PIT SEGREGATION

Blasthole Samples:

1. After the production drill has completed and moved away from the hole, the sample may be taken.
2. Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3. Samples are to be collected in a clean plastic sample bag.
4. The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5. The sample bag is to be tied off using ribbon.

6. In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7. Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1. Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2. The sample is to be dried at 105°C.
3. The sample is then to be crushed in the Primary Crusher.
4. The sample is then to be crushed in the Fine Crusher.
5. The sample is to be split until the sample size is approximately 200 g.
    a. Reject from the sample is to be wasted.
6. The sample is then to be pulverized for 75 seconds.
7. The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.
8. If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1. The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the LIMS database.
2. The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3. The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1. Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.
2. Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is included as Figure 1.

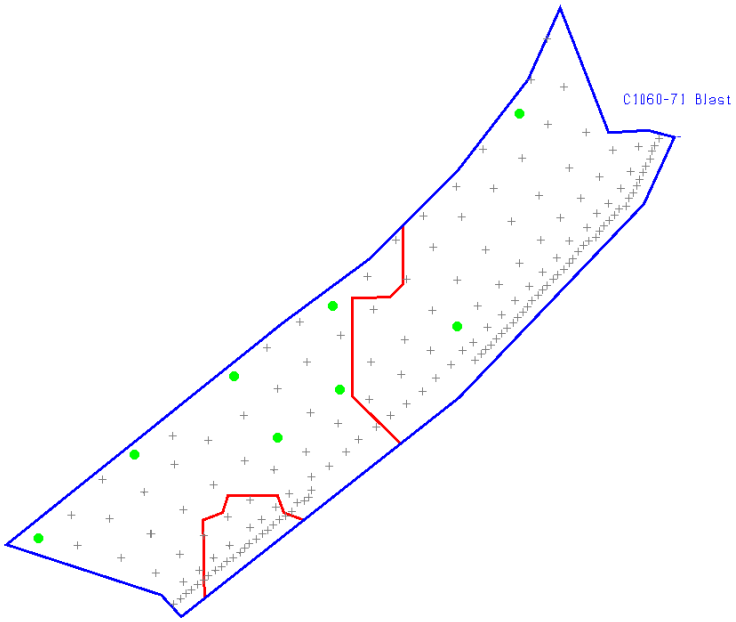

Figure 1: Location of ABA samples (green dots) within a blast. Red polygons denote mill feed ore, remainder is waste. The Ore Control Technician focuses sampling on areas which are designated waste and/or stockpile ore by the blasthole model. Reference blast = 149,173 t.

3. The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1. If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2. The Assay Lab will run the sample through the LECO CS230 Carbon Sulphur Analyzer.
3. Once analyzed, the machine transfers the carbon percentage (C%) and the sulphur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4. The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5. The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1. Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2. Modeling the blast
    a. The software used is MineSight.
    b. The model is based on a 5 metre (m) x 5 m x 12 m block system.
    c. The block closest to the ABA sample will closely match the sample.
    d. The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.

e. Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
f. Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.

3. The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor. An example of a sample layout is included as Figure 2.

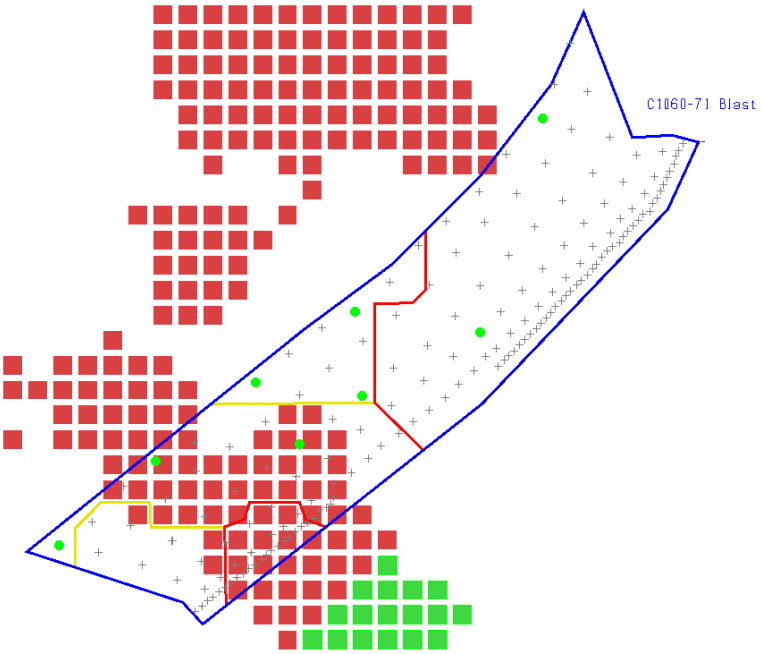

Figure 2. ABA results from samples shown in Figure 1 are used to update the blasthole PAG model item which identifies blocks which meet PAG criteria (red). The Ore Control Technician then marks up the PAG waste (yellow polygon) and the complete ore/waste markup is released to the Surveyor.

Surveyor:

1. The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.

2. Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.
   a. Red Placard = High Grade Ore
   b. White Placard = Super High Grade Ore
   c. Green Placard = Low Grade Ore
   d. Yellow Placard = PAG
   e. Blue Placard = NAG
   f. Pink Ribbon = High Grade Mill Feed Ore
3. Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

MATERIAL HANDLING

Shovel/Haul Truck Operators:

1. The Shovel Operator will mine the rock, following the contacts laid out by the Surveyor.
2. The Shovel Operator will ensure that all material contained within the contact stakes is routed as described by the markup and that any uncertainty in material classification is resolved by seeking the assistance of either the Pit Supervisor or the Engineering Department.
3. Upon loading a haul truck, the Shovel Operator shall direct the Haul Truck Driver as to the material type being hauled, and destination, using a horn sequence. The Haul Truck Driver will then take the material to the designated area.

IN-PIT MONITORING

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC analyzed for total sulfur and total carbon at the Assay Lab to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are summarized in the Comprehensive Environmental Management Plan.

TAILINGS MONITORING

Mill Metallurgy

1. The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    - Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    - The shift composite is then to be added to a monthly composite.
    - At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for ABA total sulfur and carbon analysis.
2. The Environmental Department is to send the monthly tailings composite sample to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion to provide data for site geochemical modelling.

WATER TREATMENT PLANT WASTE

Environmental Department:

1. Record the value on the waste line totalizer monthly when Water Treatment Plant (WTP) data are downloaded.
2. Collect samples of waste which has exited the WTP quarterly to characterize WTP wastes. Samples shall be taken of material that has exited the sludge line, to the West of the WTP and down-flow from where microsand is cycloned for re-use.
3. Sampling Method for liquid wastes (adapted from MPMC-WORK-002):
    - Record in-situ measures: pH, temperature, conductivity, and turbidity.
    - Take a water sample from the pipe outflow and send for lab analysis corresponding with other contact water samples as described in the Comprehensive Environmental Monitoring Plan, including but not limited to: physical parameters, pH, total and dissolved metals.
4. Sampling method for solid wastes (adapted from MPMC-WORK-016):
    - Take a composite sample of solids from the sludge pile adjacent to the WTP, with samples from at least 5 locations on the pile.
    - Send to an external laboratory for total sulfur, total inorganic carbon, elemental analysis by ICP-MS following aqua regia digestion and shake flask extraction testing to assess the ML/ARD potential of solids.
5. Review and archive lab data in a timely manner for use by personnel responsible for the Annual Reclamation Report.
6. The TSS concentration in wastewater will be used along with the waste line totalizer values to quantify the solids delivered to the TSF. The relationship between total and dissolved metals in the WTP waste line sample will be used to quantify the suspended (filterable) metals in this sample.

7. This information will be included in the MLARD materials inventory, and reported to EMLI in the Annual Reclamation Report as per Code Section 10.5.7 on water treatment wastes and by-products.

NAG Material Monitoring

Environment Department

1. As a confirmatory sampling measure, the Environmental Department is to take ABA grab samples from the NAG Dump and any area where NAG rock is used for construction on a weekly basis, while NAG dumping and/or NAG rock construction is occurring. Sampling will conform with MPMC-SOP-016: ABA and Soil Sampling.
2. To assure data quality, as recommended in the BC Field Sampling Manual, a minimum of one in ten samples will be a duplicate sample, as written in MPMC-SOP-016.
3. Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site are summarized in the Comprehensive Environmental Management Plan.

Response to Finding PAG in NAG Areas

Environmental Department

1. Upon reviewing data indicating PAG material has been found in a NAG area, without delay contact one or more Qualified Professionals listed in this document, and the Pit Supervisor or designate to pass along the relevant data and sampling location.
2. Return to the location where PAG material was discovered and stake the sampling location. Note that material may have been dozed, buried or pushed down the dump face, in which case personnel are to mark as close as possible.
3. At the discretion of Qualified Professionals, undertake additional ABA sampling to assess the prevalence of PAG material.

Pit Supervisor:

1. Discuss NAG/PAG separation with shovel and haul truck operators and investigate the possibility of a loading or dumping mix-up. This is not a punitive activity but meant to identify potential causes and estimate material volume.
2. At the discretion of Qualified Professionals, organize the removal of PAG material from the non-PAG area.

ML/ARD Qualified Professional

1. Work with site contacts to develop an appropriate plan of action to address the situation.
2. If it is not possible to demonstrate that PAG material meets conditions outlined in M-200 Section D.3.(c)(i)(d), it may be necessary to remove recoverable PAG material.

REVIEW OF RESULTS AND PROGRAM EFFICACY

Data collected and corresponding interpretation regarding the ML/ARD program are included in the Annual Environmental and Reclamation Report (AERR), due annually to the British Columbia Ministry of Environment and Ministry of Energy and Mines on March 31 of each year, reflective of the previous calendar year. Personnel responsible for the AERR may recommend updates to the ML/ARD program based on operational changes or findings of annual reporting. The AERR includes sections on: waste rock characterization and disposal; drainage water quality monitoring; and, updates to long-term predictions (kinetic testing).

Appendix M
Soil Management Plan

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Environmental Management Plan:

Soil Management Plan

Last Update: January 8, 2016

Document Revision Control

Rev. No.	Revision	Date	Author
0	Original Soil Salvage and Stockpile Protocol	1997	RM
1	Update to reflect site changes	2012	KM
2	Update to reflect site changes and results of site soil stockpile assessment; addressed *Mines Act P*ermit M-200 conditions	March 2014	KM
3	Update of site specific components; added document tracking and formatting to be consistent with other MPMC EMPs	January 2017	KM

1 Introduction

All surficial soil at the Mount Polley Mine (the Mine) identified through soil surveys as being appropriate for plant growth are salvaged and either used immediately in the reclamation program or stored in a suitable manner for future use. This is a requirement of the British Columbia (BC) *Mines Act* and associated BC Health Safety Reclamation Code. In addition, Mount Polley Mining Corporation's (MPMC's) *Mines Act* Permit M-200 contains specific conditions related to soil management that are addressed in this Soil Management Plan (the Plan).

The purpose of this Plan is to outline the procedures to characterize, salvage, store, and apply all suitable growth material in accordance with regulatory requirements and to support reclamation of the Mine site to the desired land capability and end land uses.

2 Soil Handling and Management

The following subsections outline procedures for soil handling and management through the different stages of the mine life at the Mount Polley Mine.

2.1 Soil Characterization

Site-specific soil surveys must be completed for areas scheduled for disturbance by a qualified individual and submitted to the BC Ministry of Energy and Mine (MEM) Chief Inspector for approval. The following survey procedure is recommended and is consistent with soil surveys previously conducted at Mount Polley Mine; however, this methodology may be modified by a qualified individual based on site conditions, existing information, and their experience.

1. Pre-stratify the area according to terrain using aerial photographs. Confirm the stratification is appropriate with a site inspection.

2. Select soil pit locations at representative sites or using a predetermined systematic grid or transect. Soil pit density may range from one pit per half hectare to one pit per two hectares, depending on site variability.

3. Expose the soil profile by machine excavation or hand-dug holes. Existing road cuts and excavations can also be cleaned for use.

4. Describe the soil and site characteristics at each soil profile location as per the BC Ministry of Environment standards and guidance in the "Field Manual for Describing Terrestrial Ecosystems" (MoE, 2010).

5. Sample soils at select, representative sites to provide local soil quality data. Sampling intensity may be adapted based on the level of preexisting soil quality data for the area.

6. Present and interpret the soil survey data in a report and recommend salvage depths for (1) soil appropriate for reclamation, and (2) subsoil which could be used in reclamation with soil amendments or as a subsoil.

For reference, soil and landform inventories completed to date for the Mount Polley Mine include:

- Southeast Dump, Boundary Pit and West PAG Projects (2010)
- Wight Pit Rock Waste Dump Extension Project (2006)

- Southeast Pit Project, Wight Pit to Tailings Pond Road, and Southeast Pit to Tailings Pond Road (2005)
- Northeast Extension Project (2004)
- Springer Pit (2001)
- Baseline Soil Survey and Agricultural Assessment of proposed Tailings Storage Facility, Open Pit, and Waste Rock Dumps (1995).

2.2 Soil Salvage

2.2.1 Salvage Materials and Depths

Material to be salvaged is grouped into four types as described below, which should be stripped and stockpiled separately. Delineation of these materials in the field is to be supported by a qualified individual, as described in Section 2.2, however, some general field guidance is as follows.

1. Non-merchantable woody debris is to be salvaged prior to removing soil and stockpiled for use in reclamation (or immediately used in reclamation, if possible). Small woody debris may be stripped with soil and incorporated into soil stockpiles.

2. Soil appropriate for reclamation should be salvaged to the depth pre-determined in the site-specific survey described in Section 2.1; however, as a general guide, soils are to be salvaged to the effective rooting depth.

3. Underlying subsoil is classified as the material between the soil horizons appropriate for reclamation and the soil parent material.

4. Organic soils from wetlands are recognizable by their black colour and “mucky” texture.

2.2.2 Procedure

A qualified individual representing the Environmental Department should train and oversee equipment operators to ensure salvage operations are completed to the specifications described in this Plan.

Non-merchantable coarse woody debris is to be salvaged first and stockpiled (small woody debris can be mixed in with topsoil piles). Organic matter (grass, plants, chipped woody material, etc.) is to be incorporated into the topsoil piles by salvaging plant materials on the surface with the topsoil. To minimize compaction caused by equipment, use single lift operations rather than repeatedly driving over the surface scraping off thin layers. With a single pass, a bulldozer or backhoe can push the soil into a pile or windrow for storage or for loading into a truck by an excavator or backhoe for transport. If suitable soil is still visible after the initial scraping (this can generally be identified by the presence of roots), another pass will be required to salvage all soil materials appropriate for use in reclamation. Soil inventory and strata delineation information collected prior to salvaging will guide the stripping depths and are to be verified in the field by the Environmental Department representative overseeing salvage operations. Desired volumes of subsoil material are to be stripped in a second lift and stored in separate stockpiles from the topsoil.

Soil should ideally be handled when it is in a loose friable state; operations are to be ceased if the soil is too wet or dry to prevent degradation of its physical structure. If wet soil is sticking to the equipment, wait until the soil has dried. Conversely, if the soil is dry and hard to handle resembling flour, wait until the soil is wetted through precipitation (or active methods, such as sprinkling). In addition, stripping should be ceased in high wind events, if the wind is mobilizing soil as it is being handled. Scheduling stripping work to avoid wet and dry months (e.g., freshet and late summer, respectively) can reduce the risk of having to temporarily stop operations. It is possible to strip in winter months and freezing conditions decrease

compaction of the soil being handled, however, snow should be removed prior to stripping and should not be incorporated into soil stockpiles.

2.3 Soil Stockpiling

When possible, it is preferable for soil to be directly applied for reclamation, allowing microbes and viable seeds to remain in the soil. If this is not possible:

1. Carefully select the storage location because once stockpiled, the soil should not be disturbed again until it is used in final reclamation. Minimize exposure to wind, southwest sun, and water/flooding. To minimize risk of sedimentation of natural water courses, stockpiles should, where possible, be located upstream of site water collection ditches.

2. Stockpile the soil in a manner that maximizes surface area and minimizes soil depth. When possible, the maximum depth should be the height of a pile dumped from a haul truck (~2.5m).

3. Promptly seed stockpiles with the custom MPMC native grasses and forbes blend or, in areas where invasive plant establishment is a concern (i.e., seed sources are present nearby), the custom MPMC aggressive seed mix. Both seed mixes are certified weed free. Revegetation will help to mitigate wind and water erosion, reduce risk of weedy species ingress, and maintain microbial activity.

4. Take a representative sample of the stockpile to assess soil quality, as per the procedure in Appendix A.

5. Place signage on the stockpiles to avoid accidental disturbance.

6. Enter stockpile construction date, soil type, location, and soil volume into the Soil Stockpile Inventory spreadsheet and associated GIS map file. Document seeding in the Environmental Department Reclamation Field Book.

7. Add stockpile locations to site maps and plans for Mine Operations to avoid disturbance or loss of stockpiles.

2.4 Soil Stockpile Inspections

Inspection of soil stockpiles is to be completed annually. For each soil stockpile, the following information should be documented: date; photo number (if a photo is taken); percent vegetation coverage; percent invasive plant coverage; species present; signs of erosion and/or sedimentation; any erosion prevention works; and any additional comments or observations. Where possible, inspections should be completed in the summer months when vegetation is actively growing and easiest to identify.

Results are to be reviewed and any stockpiles exhibiting erosion and/or poor vegetation coverage are to be added to MPMC's bi-annual seeding list for re-seeding in spring or fall when weather conditions are most appropriate for seeding. Alternative options for more significant erosion may be implemented, as per the MPMC Sediment and Erosion Control Plan, such as berms or silt fences. Occurrences of invasive species are to be managed as per MPMC's Invasive Plant Management Plan. If a stockpile has been seeded twice, and still exhibits low vegetation cover, alternative vegetation options can be investigated, including:

- Amending the soil with compost tea or compost;

- Hydroseeding with a mulch/tackifier mixture designed for poor soil and/or steep slopes;

- Installation of horizontally placed logs to act as catch berms and retain moisture;
- Development of a seed mixture specifically designed for poor quality soils;
- Planting with primary successional shrubs. Willow and cottonwood can be planted using bioengineering techniques, such as live stakes and wattles, for additional erosion control.

2.5 Soil Amendment

Recommendations for amendment of soils to be used in reclamation are based on results from a site soil stockpile quality assessment conducted in September 2013, as well as results from ongoing reclamation research and progressive reclamation. Soil amendments may include biosolids and fertilizer, and recommendations for use are detailed in the site Reclamation and Closure Plan. Results from the September 2013 assessment are presented in Appendix B.

If biosolids are used as a soil amendment, they can be mixed with the soil prior to application to ensure thorough mixing and to reduce compaction caused by the dual application of soil followed by biosolids.

2.6 Soil Application

Soil should be replaced to the depths specified for that Mine site unit in the site Reclamation and Closure Plan or research trial design.

To reduce compaction, soil placement should only occur under appropriate moisture conditions. Work should be stopped under wet conditions (i.e., if the soil is sticking to the equipment) and very dry conditions (i.e., if the soil resembles flour). In addition, equipment traffic on the reclamation area should be minimized. This can be done by working systematically and planning access routes so equipment do not have to pass over completed areas, and, if applicable, equipment can do multiple tasks at a time (e.g., site preparation and placing of coarse woody debris).

Site preparation of placed soil should be conducted to create increased microtopography, which reduces erosion and provides more diverse plant microsites, including microsites with improved moisture retention. Site preparation methods are described in detail in Appendix C.

If woody debris is not already incorporated into the soil being placed, it should be applied onto the soil surface concurrently with or following site preparation. Even if woody debris is already in the soil, it may be desirable to place additional coarse woody debris as habitat features or for erosion control. Woody debris can help create more diverse microsites and habitats, retain moisture, contribute to long-term soil organic matter, and improve catch of native seeds. Recommendations for coarse woody debris application are:

- Create occasional pyramids or stacks of multiple pieces of woody debris to create more complex habitat structures and vertical structure.
- Lay logs horizontally across the slope, so they’re more likely to stop the flow of water and erosion. This is especially helpful if logs are placed downslope of depressions to help them retain soil and organic matter.
- Mix tree species of the debris, where possible, as different species decompose at different rates, staggering the release of nutrients for vegetation.

If coarse woody debris is not available or only in small amounts, boulders or rock fragments can be placed in piles and individually. Although rocks are not a source of nutrients over time, similar to woody debris they can increase moisture retention, promote plant microsite diversity, provide habitat, and reduce soil erosion.

Following soil application, the site should be inspected and test pits dug to verify that the target soil depth was achieved across the site (accounting for the variability associated with site preparation).

3 Reporting

The following information will be submitted to the MEM, as well as the BC Ministry of Environment, each year in the MPMC Annual Environmental and Reclamation Report:

- An update of soil management and handling activities, including erosion and sediment control measures, and soil replacement depths on reclamation sites;
- An updated soil stockpile inventory, including stockpile volumes and locations;

MPMC also is required to submit an updated Reclamation and Closure Plan to MEM every five years (at minimum), as well as with all major permit amendment applications for changes to the mine plan. The Reclamation and Closure Plan is to include an updated material balance to verify that sufficient quantities of suitable soil are present to reclaim existing and planned disturbed areas to the recommended prescriptions (i.e., soil depths) for meeting land capability objectives. Contingency options are to be assessed if sufficient volumes of suitable soil may not be available.

4 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Coordinator):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan.
- Be aware of high level mine planning, to ensure that soil characterization and stripping supervision are incorporated into plans.
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including soil baseline characterizations, overseeing stripping operations, annual inspections, seeding, and reporting.
- Ensure that individuals conducting soil characterization surveys, overseeing soil stripping, and inspecting soil stockpiles have appropriate training.
- Ensure that this Plan is routinely updated to reflect changes in site conditions and procedures, and that the revised plan is submitted to MEM in the Annual Environmental and Reclamation Report and/or a Reclamation and Closure Plan update.

Qualified individual overseeing salvage operations (likely an Environmental Technician/Technologist):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Coordinate with and supervise Mine Operations to ensure soil handling and management procedures are followed during stripping operations.

- Maintain an up to date soil stockpile inventory and provide a soil management update in the Annual Environmental and Reclamation Report, as directed by the Environmental Superintendent.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances that will require soil salvaging. Work with that individual to ensure that the soil is characterized prior to stripping and a qualified individual is present to oversee salvage operations.
- Assign appropriate equipment for handling soil.
- Work with the Environmental Superintendent or designate to assign areas for soil to be stockpiled or directly placed.
- Ensure that all material suitable for reclamation is stripped prior to expansion of mine works.

Mine Operations Supervisors:

- Coordinate with the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist).
- Only allow operations to proceed when weather and soil moisture conditions are appropriate.
- Notify the General Foreman and qualified individual overseeing the salvage operation of any concerns that arise and address these concerns prior to proceeding with the work.

Mine Operations Operators:

- Follow instructions from the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist) and Mine Operations Supervisors.
- Clarify uncertainties or address any concerns that arise with the Mine Operations Supervisor and/or qualified individual overseeing the salvage operation prior to proceeding with work.

References

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Meister, R. 2010. Southeast Dump, Boundary Pit and West PAG Projects Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. October 24, 2010.

MoE (BC Ministry of Environment). 2010. Field Manual for Describing Terrestrial Ecosystems in the Field – 2nd Ed. Land Management Handbook 25. Victoria, British Columbia: Crown Publications Inc.

Appendix A: Soil Stockpile Sampling Procedure

When taking soil chemistry samples from stockpiles, the following procedure is recommended:

1. Take a photo of the stockpile to document characteristics, including size and vegetative cover.

2. For each sample, use a new (clean), plastic sample bag.

3. Collect a composite sample from a minimum of three locations that are representative of the different sections of the stockpile. Record the GPS coordinates for each location.

4. If the stockpile has recently been created (within one year), samples can be collected from the surface. If stockpiles are older, at each sample location dig a profile using a shovel or mini back-hoe to greater than 1m (from all surfaces of the stockpile). Take a sample from 0.1 to 0.2m and 1.0m depths (this encompasses the more biologically active surface soils, as well as less active soils at depth). Ensure that equal volumes are sampled at every location and depth so that the composite is representative. The minimum total sample volume is approximately 500ml.Label each sample with a unique sample ID and the date.

5. Document sample collection in the MPMC Environmental Department Reclamation Field Book, including date, sample ID and description, collector, and any additional relevant observations or details.

6. Store samples in the refrigerator until ready for shipment to the lab (typically ALS Environmental in Burnaby, BC). Ship in coolers with ice packs within the time frame required to meet lab hold times.

7. Request lab analysis for parameters including, but not limited to:

    - Moisture content
    - Texture
    - pH
    - Electrical conductivity
    - Total nitrogen
    - Available phosphorus
    - Organic matter
    - Micronutrients including sulphur and potassium

Appendix B Soil Stockpile Sample Results

Methods

Soil samples were collected on September 3, 2013 from 23 soil stockpiles across the Mount Polley Mine site. At each stockpile three profiles representing variability across the stockpile were dug to greater than 1m with a mini backhoe. Equal volume samples were collected from 0.3m and 1m depths at each of the three locations and all samples from each stockpile were composited in a clean, labeled plastic sampling bag. Samples were stored in a cooler with ice upon collection, and then transferred to a refrigerator for storage until shipping. Samples were shipped in coolers on ice to ALS Environmental in Burnaby, BC, then were subsequently transported to the ALS Environmental Saskatoon laboratory for analysis. Fertilizer recommendations were generated by ALS, using wheat growing at 36 bushels per acre as a proxy.

Results

Results are presented in Tables B. 1 – B.3. General findings based on analytical results are:

- pH has increased from a baseline average of approximately 5.5 to between 6 and 8.
- Soil is deficient in nitrogen.
- Soil has marginal to deficient phosphorus and organic matter levels.
- Soil is marginal to deficient for potassium levels; however, concentrations are similar to levels in baseline soil samples.
- Micronutrients levels are sufficient for copper, iron, manganese, and zinc.
- Micronutrient levels are marginal to deficient for boron and chloride.
- Nutrient loss increases with stockpile storage time.

Soil Amendments

Direct application of stripped soil helps maintain soil microbial communities, native seed viability, and nutrient levels. When using stockpiled soil, incorporation of woody debris and other organic matter and including nitrogen fixing species in revegetation prescriptions are methods for rebuilding deficient nutrient pools. Soil amendments can also be used for improving levels of nutrients in which soil is deficient. Based on laboratory agricultural recommendations for grass cover:

- Average nutrient requirements to meet target nutrient levels of stockpiled soil are: 52 mg/kg of nitrogen, 13 mg/kg of phosphorus, and 19 mg/kg of potassium, which corresponds to a need for 61.9-15.7-22.5 (nitrogen-phosphorus-potassium) fertilizer at 187 kg/ha.
- Average micronutrient requirements to meet target nutrient levels are 0.2 mg/kg of boron and 7 mg/kg of chloride.

MPMC has historically accepted biosolids from Metro Vancouver for use in reclamation. Typical biosolids (Attachment 1) contain sufficient levels of potassium and phosphorus to ameliorate deficiencies identified in the 2013 soil sampling results. Routine biosolids assessment does not test for boron or chloride; however, these results show that in general, metal and anion levels are elevated. Biosolids also contain

an average of 11 mg/kg of Nitrate-N, which provides more than a six-fold increase over the average soil stockpile concentration of 1.7 mg/kg.

These results are to be incorporated into reclamation prescriptions in the MPMC Reclamation and Closure Plan, which include recommendations for use of soil amendments. Recommendations should be supported by site research and mine reclamation best practices, which will provide guidance on when soil amendments are necessary, and what types and quantities to use. This should include long-term considerations, as soil amendments may only provide a short-term nutrient source.

Table B.1 Soil stockpile sample soil characteristic results

Location	Soil Climatic Zone	Texture	pH (1S:2W)	EC (1S:2W - mS/cm)	EC (Calc. Sat Extr - mS/cm)	Salinity Rating	Organic Matter (%)
Mill Site	Dark Gray	Clay Loam	6.8	0.1	0.2	Non Saline	2.2
SERDS	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	4.4
SEZ 2	Dark Gray	Loam	6.5	0.3	0.7	Non Saline	6.4
Perimeter Embankment 1	Dark Gray	Clay Loam	6.4	0.2	0.4	Non Saline	4.4
PAG Dump	Dark Gray	Clay Loam	7.1	0.3	0.7	Non Saline	3.2
NW Sump Road	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	1.7
North Bell Dump Till	Dark Gray	Clay Loam	8.3	0.2	0.4	Non Saline	0.9
Springer North	Dark Gray	Clay Loam	7.9	0.1	0.2	Non Saline	1.0
North Bell Dump Top	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.6
Access Road km 12	Dark Gray	Clay Loam	7.6	0.1	0.2	Non Saline	1.5
EAST RDS	Dark Gray	Clay Loam	8.0	0.1	0.2	Non Saline	1.3
Ore Switchback	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	3.6
NEZ Dump	Dark Gray	Clay Loam	7.0	0.2	0.4	Non Saline	2.5
Highway to Heaven	Dark Gray	Clay Loam	6.9	0.2	0.4	Non Saline	2.6
Wight Pit Till	Dark Gray	Clay Loam	7.7	0.3	0.7	Non Saline	0.9
Wrap Around Road	Dark Gray	Clay Loam	7.4	0.2	0.4	Non Saline	1.9
Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	3.3
Perimeter Embankment 2	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	3.8
South Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	5.2
Main Embankment	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.2
TSF Corner 1	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	1.6
TRR	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	3.1
Cariboo Stockpile		Sandy Loam	7.5				2.1
AVERAGE			7.0	0.2	0.3		2.7
1995 Test Pits (Average)			5.7		0.2		2.5
1997 Test Pits (Average)			5.3		0.4		4.4
2006 Test Pits (Average)			6.0		0.2		2.8

Table B.2 Soil stockpile sample soil nutrient results

	Soil Test Nutrient Levels (mg/kg)															
Location	**NO_3-N**		**P**		**K**		**SO_4-S**		**Cu**		**Mn**		**Zn**		**B**	
Mill Site	1	Deficient	2	Deficient	79.5	Marginal	12	Sufficient	70	Excess	5.1	Sufficient	0.75	Sufficient	0.2	Deficient
SERDS	1.5	Deficient	>27	Marginal	70.5	Deficient	4	Marginal	1.25	Sufficient	24.7	Excess	1.05	Sufficient	0.2	Deficient
SEZ 2	1.5	Deficient	26.5	Marginal	109.5	Sufficient	>24	Sufficient	82.5	Excess	21.75	Excess	1.6	Sufficient	0.4	Marginal
Perimeter Embankment 1	4.5	Deficient	4	Deficient	53.5	Deficient	19	Sufficient	3.85	Sufficient	55	Excess	0.85	Sufficient	0.2	Deficient
PAG Dump	1	Deficient	13	Marginal	96	Marginal	>21.5	Sufficient	144	Excess	7.4	Sufficient	1.2	Sufficient	0.6	Sufficient
NW Sump Road	1	Deficient	>27	Marginal	91.5	Marginal	5	Marginal	9.8	Sufficient	20.3	Excess	0.85	Sufficient	0.15	Deficient
North Bell Dump Till	1	Deficient	8.5	Deficient	101	Marginal	>21.5	Sufficient	25.5	Excess	5.55	Sufficient	0.7	Sufficient	0.25	Deficient
Springer North	1	Deficient	13.5	Marginal	59	Deficient	3	Deficient	102.5	Excess	5.95	Sufficient	1.1	Sufficient	0.1	Deficient
North Bell Dump Top	2	Deficient	>27	Marginal	75.5	Deficient	>21.5	Sufficient	18.05	Excess	25.95	Excess	0.8	Sufficient	0.15	Deficient
Access Road km 12	1	Deficient	20	Marginal	63	Deficient	3	Deficient	33.35	Excess	6.05	Sufficient	0.6	Marginal	0.1	Deficient
EAST RDS	1	Deficient	3.5	Deficient	45.5	Deficient	4	Marginal	10.4	Sufficient	5.85	Sufficient	0.5	Marginal	0.15	Deficient
Ore Switchback	1.5	Deficient	>27	Marginal	86.5	Marginal	14.5	Sufficient	9.85	Sufficient	21.6	Excess	1.75	Sufficient	0.3	Marginal
NEZ Dump	2.5	Deficient	23.5	Marginal	69.5	Deficient	>21.5	Sufficient	156.5	Excess	7.35	Sufficient	1.7	Sufficient	0.15	Deficient
Highway to Heaven	1	Deficient	13	Marginal	79	Marginal	15.5	Sufficient	92.5	Excess	16.75	Sufficient	0.8	Sufficient	0.15	Deficient
Wight Pit Till	1	Deficient	10	Deficient	60.5	Deficient	>21.5	Sufficient	15.05	Sufficient	4.35	Sufficient	0.85	Sufficient	0.15	Deficient
Wrap Around Road	1	Deficient	8	Deficient	79.5	Marginal	17	Sufficient	60	Excess	6.45	Sufficient	0.85	Sufficient	0.1	Deficient
Till Borrow	1	Deficient	5	Deficient	78.5	Marginal	0.5	Deficient	2.1	Sufficient	16.3	Sufficient	1.1	Sufficient	0.15	Deficient
Perimeter Embankment 2	7.5	Deficient	6.5	Deficient	81.5	Marginal	5.5	Marginal	2.65	Sufficient	7.35	Sufficient	0.8	Sufficient	0.25	Deficient
South Till Borrow	1.5	Deficient	9.5	Deficient	85.5	Marginal	1	Deficient	2.4	Sufficient	65	Excess	0.55	Marginal	0.15	Deficient
Main Embankment	1	Deficient	1	Deficient	76.5	Deficient	12	Sufficient	3.25	Sufficient	12.3	Sufficient	0.4	Marginal	0.15	Deficient
TSF Corner 1	1.5	Deficient	2.5	Deficient	53.5	Deficient	5	Marginal	5.3	Sufficient	14.65	Sufficient	0.3	Marginal	0.1	Deficient
TRR	1	Deficient	9.5	Deficient	54	Deficient	3.5	Deficient	1.25	Sufficient	17.05	Sufficient	2.3	Sufficient	0.3	Marginal
Cariboo Stockpile	<1.0	Deficient	10.1	Marginal	92	Marginal	14.6	Sufficient	491	Excess	910	Excess	93.8	Excess		
AVERAGE	1.7		10.0		75.7		8.2		58.4		55.8		5.0		0.2	
1995 Test Pits (Average)			30.0		73.0				305		778		89		19	
1997 Test Pits (Average)			26.7		99.8											
2006 Test Pits (Average)			27.9		91.0											

Table B.3 Fertilizer recommendations based on soil stockpile sample soil characteristic results

	Fertilizer Recommendations (lbs/ac / kg/ha)											
Location	**N**		**P2O5**		**K2O**		**S**		**B**		**Cl**	
Mill Site	105	117.6	37.5	42	20	22.4	5	5.6	0.25	0.28	17.5	19.6
SERDS	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
SEZ 2	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
Perimeter Embankment 1	115	128.8	22.5	25.2	55	61.6	12.5	14	0.5	0.56	7.5	8.4
PAG Dump	90	100.8	37.5	42	85	95.2	0	0	0.5	0.56	7.5	8.4
NW Sump Road	105	117.6	22.5	25.2	20	22.4	0	0	0	0	7.5	8.4
North Bell Dump Till	105	117.6	17.5	19.6	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Springer North	105	117.6	27.5	30.8	20	22.4	0	0	0.5	0.56	17.5	19.6
North Bell Dump Top	105	117.6	22.5	25.2	85	95.2	12.5	14	0.5	0.56	17.5	19.6
Access Road km 12	100	112	17.5	19.6	20	22.4	0	0	0.5	0.56	7.5	8.4
EAST RDS	105	117.6	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Ore Switchback	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
NEZ Dump	105	117.6	17.5	19.6	20	22.4	0	0	0.25	0.28	7.5	8.4
Highway to Heaven	100	112	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Wight Pit Till	105	117.6	22.5	25.2	20	22.4	0	0	0.5	0.56	17.5	19.6
Wrap Around Road	105	117.6	27.5	30.8	55	61.6	0	0	0.5	0.56	17.5	19.6
Till Borrow	105	117.6	27.5	30.8	17.5	19.6	0	0	0.5	0.56	17.5	19.6
Perimeter Embankment 2	105	117.6	37.5	42	20	22.4	12.5	14	0.5	0.56	17.5	19.6
South Till Borrow	80	89.6	27.5	30.8	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Main Embankment	105	117.6	27.5	30.8	17.5	19.6	12.5	14	0.5	0.56	17.5	19.6
TSF Corner 1	105	117.6	37.5	42	20	22.4	5	5.6	0.5	0.56	17.5	19.6
TRR	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
Cariboo Stockpile						0						
AVERAGE	103	116	26	29	38	42	4	5	0	0.5	14	16

Appendix C: Site Preparation Methods

Surface roughening is a key element for reducing erosion, retaining moisture, and reducing compaction.

Some approaches that can be used are:

1. Ripping (Figure C.1) is used as a soil roughening technique in areas too large to economically roughen with a backhoe or excavator, and is typically best for dry soils. Ripping breaks up compacted layers of soil. Rip soils when they are dry to permit shattering beneath the surface. Ripping guidelines:
    a. Rip to a depth of ~0.5 to 1m (or as deep as possible given the soil texture and coarse fragments).
    b. Make rips contour to the slope.
    c. The distance between rippers should be equal to the depth ripped.
    d. Lift the ripper from the soil every 3 to 6m to allow for some downslope water drainage. Offset drainage breaks in the ripping rows.

2. Trenching can be used for medium moisture level soils. The easiest method is to use a bull dozer and angle the blade to make “horizontal windrows”. Lift the blade every 3 to 6m to allow for some downslope water drainage. Offset the drainage breaks in the trenches.

3. Mounding (Figure C.1) is typically best for wetter sites and can be carried out on slopes or on flat terrain. Mounding can be done with a backhoe or excavator with a digging bucket to create microbasins for extreme surface roughening as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Dig, poke, or push a basin that is ~0.5m deep and has the width of the equipment bucket. This allows the basin to be up to ~1 to 1.5m wide.
    c. Drop the excavated soil on the soil surface adjacent to the basin (on the upslope side if working on a slope).
    d. Create one mound every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope. The frequency can be increased or decreased depending on erosion risk associated with the terrain.

4. Mechanical Screefing (Figure C.2) can be applied on level ground or on slopes and can be utilized in snowy conditions, as this technique reduces the likelihood of incorporating snow into the soil. The results are similar to mounding, but shallower. Mechanical screefing can an be done with an excavator with a digging bucket as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Push bucket into snow and up to ~0.5m into the underlying soil.
    c. Rake bucket downslope ~1m creating a shallow depression with a shallow downslope berm.
    d. Create one screef every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope.



Figure C.1 Mounding (left) and ripping (right) site preparation methods

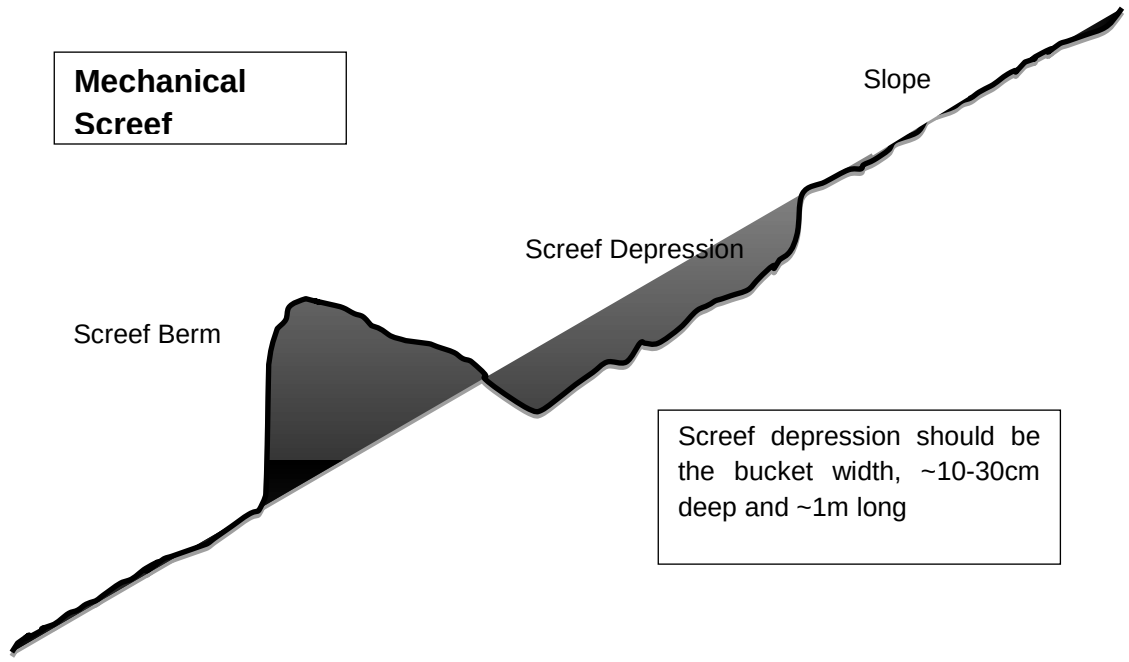

Figure C.2 Mechanical screefing schematic

Attachment 1:
Metro Vancouver Biosolids Composition (2013)

METRO VANCOUVER'S BIOSOLIDS COMPOSITION

	BC Organic Matter Recycling Regulation		Annacis I. WWTP (Routine QC Station)			
			Numbers of Samples Collected	Dewatered Biosolids (Class A)		
				Period:	15-Apr-13	- 15-Oct-13
	Class A Biosolids	Class B Biosolids		Mean	Min	Max
Physical Parameters						
Total Solids (%)			32	26.5	23.4	30.3
Volatile Solids (%)			6	70.3	69.1	72.1
Electrical Conductivity (ds/m)			6	6.07	5.50	6.60
Bulk Density						
pH			6	8.1	7.8	8.4
Macronutrients (mg/kg dw)						
Total Kjeldahl Nitrogen (TKN)			6	52,633	49,400	55,300
Ammonia distillation			6	9,560	9,040	10,100
Nitrate/Nitrite-N			0	0.0	0.0	0.0
Nitrate/Nitrite-N (Available)			5	11.0	11.0	11.0
Phosphorus (Total)			31	24,568	22,600	29,200
Phosphorus (Available)			5	2,680	1,900	3,500
Potassium (Total)			20	1,730	1,550	2,050
Potassium (Available)			5	1,282	1,110	1,470
Calcium (Total)			27	23,756	21,900	25,500
Magnesium (Total)			27	6,132	5,460	6,990
Total Trace Elements (mg/kg)						
Aluminum			27	7,701	6,650	8,730
Arsenic	**75**	**75**	27	5.2	4.0	7.0
Barium			14	318	294	343
Cadmium	**20**	**20**	27	2.4	2.0	3.4
Chromium		**1,060**	27	64	42	99
Cobalt	**150**	**150**	27	4.3	3.7	4.9
Copper		**2,200**	27	894	759	1,030
Iron			27	33,137	28,500	37,600
Lead	**500**	**500**	27	56	36	71
Manganese			27	349	315	395
Mercury	**5**	**15**	27	1.8	1.0	3.2
Molybdenum	**20**	**20**	27	13.9	10.7	19.5
Nickel	**180**	**180**	27	26	18	38
Selenium	**14**	**14**	27	7.0	6.1	9.0
Silver			27	6.8	4.6	9.7
Zinc	**1,850**	**1,850**	27	1312	1090	1550
Bacteriology (MPN/g)						
Fecal Coliform - discrete	**<1,000**		79	125	19	820

Appendix N
2022 Environmental Risk Assessment

REPORT

Ecological Risk Assessment

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

Mount Polley Mining Corporation
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Likely BC V0L 1N0

Submitted by:

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5 December 2022



Distribution List

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1.0 BACKGROUND

1.1 Introduction

Golder Associates Ltd., a member of WSP Canada Inc. (WSP Golder) was retained by Mount Polley Mining Corporation (MPMC; a wholly owned subsidiary of Imperial Metals Corporation) to complete an Ecological Risk Assessment (ERA) to meet Mount Polley's *Mines Act* (M-200) permit, condition D.15.

The Mount Polley Mine (Mount Polley or the Mine Site), operated by MPMC is an open pit copper/gold mine with an underground component and mill, located in south-central British Columbia (BC). The Mine Site is located eight kilometres (km) southwest of Likely, BC, and 56 km (100 km by road) northeast of Williams Lake, BC (Figure 1). The Mount Polley property covers 18,892 hectares (ha), which consist of seven mining leases totaling 2,007 hectares (ha) and 43 mineral claims encompassing 16,855 ha. Mount Polley concentrates are trucked to facilities at the Port of Vancouver and then shipped to overseas smelters or transported by rail to smelters in North America.

Clearing of the Mine Site and construction of the entire facility began in 1995, with the mill being commissioned in June 1997. In May 1997, Mount Polley received a Ministry of Environment (MoE) (previously the Ministry of Water, Land and Air Protection) Effluent Permit, Permit 11678, issued under the provisions of the provincial *Environmental Management Act*. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a tailings impoundment. Approval of the "Mount Polley Mine Reclamation and Closure Plan" by the Ministry of Energy and Mines resulted in the issuance of Permit M-200 in July 1997. The first full year of mining and milling at Mount Polley Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004, with mill production commencing again in March 2005. Further details on the current Mine status are provided in the 2022 Mine Plan and Reclamation Plan (MPMC 2022).

The Mount Polley Mine Site is currently operational. Progressive reclamation and reclamation research projects are testing the efficacy of different soil prescriptions to achieve reclamation and closure objectives. Prior to Mine Site development, the predominant land uses within the area developed were commercial forestry and wildlife habitat. Portions of the development area were also used for cattle grazing, recreational activities, hunting, and trapping, as this area was determined to have poor agricultural capability.

The main objective of the Mine Site's reclamation program is to return all areas that have been disturbed by mining operations (except pit walls) to equivalent or greater land capacity than existed prior to mining, on an average property basis. As such, MPMC has proposed end land use objectives that are focused on an ecosystem approach, encompassing items such as forest cover, wildlife habitat, hunting, trapping, guide outfitting, traditional use, livestock grazing, and recreation. Establishment of self-sustaining vegetation covers, consistent with the end land uses, is an important reclamation goal.

The purpose of this ERA is to assess the potential risk to terrestrial ecological receptors in the post-closure environment (e.g., reclaimed landscape). The premise behind this ERA is that if no unacceptable risks are identified within the reclaimed areas now, unacceptable risks are unlikely to materialize in the future as the reclaimed areas continue to naturalize over time. Verification monitoring in the post-closure future is assumed. However, if unacceptable risks are identified in the ERA, additional closure remediation activities and/or long-term monitoring requirements will be recommended. Metals in the terrestrial environment (as outlined in the *Mines Act* M-200 permit) are the primary focus of the ERA.

The ERA objectives are as follows:

1) Evaluate the risk to terrestrial ecological receptors based on exposure to parameters of potential concern (POPCs), including metals, within the reclaimed areas of the Mine Site; and,

2) Use the results of the ERA to:

    a) Undertake meaningful consultation with Williams Lake and Xatśūll First Nations and other parties as appropriate, on the results so far.

    b) Based on this risk assessment and the consultation noted, identify whether additional remediation activities and/or monitoring is required for the Mine Site.

Water quality is not included in this ERA because:

- Water at Mount Polley is being intercepted and treated;
- Water may continue to be intercepted and treated during closure; and,
- Water will be part of a regulatory process that will include discharge quality considerations (which may be informed by risks evaluated for those scenarios) at closure.

The results of the ERA will inform the 2022 Five Year Mine Plan and Reclamation Plan (MPMC 2022).

1.2 Approach and Scope of Work

The ERA follows the general guidance for a Screening Level Risk Assessment (SLRA) in BC (Protocol 13: BC ENV 2021) as adapted to this Mine Site and its context. The SLRA framework was used to identify the POPCs, ecological receptors, and exposure pathways that warrant quantitative evaluation in the ERA. A field investigation was undertaken in September 2022 to collect data to support the ERA.

The scope of field work carried out in 2022 was as follows:

- Soil sampling throughout reclaimed areas of the Mine Site as well as reference locations (e.g., representative undisturbed sites).
- Vegetation tissue sampling throughout reclaimed areas of the Mine Site as well as reference locations (e.g., representative undisturbed sites).

Soil and vegetation tissue samples were paired and collected from the same general area. Portions of vegetation edible to wildlife (e.g., grass, shrub [e.g., berry], forb, leaves) were targeted to improve the assessment of the potential risk to ecological receptors from ingestion of terrestrial vegetation. Where soil POPC concentrations were high enough to indicate a potential for concern based on the initial screening step, a quantitative assessment based on the Canadian Council of Ministers of the Environment (CCME) Ecological Risk Assessment Guidance (CCME 2020) was undertaken.

The results of the field investigation were incorporated into the ERA, which is arranged into the following key components:

- **Problem Formulation**: identifies the POPCs, the ecological receptors of concern, and how exposure to the POPCs could occur. These elements are integrated into an ecological conceptual site model, which illustrates the pathways by which a receptor may be exposed to a POPC. An overview of the approach for the Problem Formulation is presented below:
    - Source: surface soil

  - Identification of POPCs: soil data were compared to applicable standards and guidelines, as well as reference conditions
  - Receptors of Concern: relevant terrestrial ecological receptor groups
  - Exposure Pathways: major operable exposure pathways that were retained for evaluation in the ERA
- **Exposure Assessment**: describes the concentration or dose of the POPC received by each receptor for each exposure pathway identified in the Problem Formulation.
- **Toxicity Assessment**: the relationship between POPC concentration and potential effects to ecological receptors.
- **Risk Characterization**: integrates the Exposure Assessment and Toxicity Assessment into an estimate of the potential for unacceptable risk to ecological receptors of concern to occur.

1.3 Professional Statements

Ms. Melissa Paliouras, Mr. Jorden Laskosky, Ms. Lindsay Furtado, and Ms. Samantha Lundquist were the authors of the ERA. Mr. Lee Nikl was the Project Director who provided oversight, technical guidance and was responsible for senior review of the ERA. The work was carried out under his direct supervision. The qualifications of the report contributors are summarized below.

Mr. Lee Nikl, M.Sc., RPBio.
Lee Nikl is a Senior Environmental Scientist and Fellow with WSP Golder, based in Vancouver, Canada. He has over 30 years of professional experience and has managed local and international projects in the areas of ecological risk assessment, aquatic and riparian habitat management, natural resource damage assessment and quantification, ecotoxicology, environmental impact assessment, permitting, and rehabilitation of damaged landscapes and river systems due to dam failures. Lee has led several ecological risk assessments of similar and larger scopes and scales in British Columbia and internationally.

Ms. Melissa Paliouras, BSc., EP
Melissa Paliouras is an Environmental Risk Assessor with 14 years of experience in human health and ecological risk assessment (HHERA) and data analysis. She is based in Kitchener, Canada. She is certified as an Environmental Professional (EP) in Site Assessment and Reclamation through the Canadian Environmental Certifications Approvals Board (CECAB) and a Qualified Person for Risk Assessment (QPRA) in Ontario. Melissa's HHERA experience supports the redevelopment of brownfields to increase beneficial reuse of these formerly contaminated sites. Her work also serves to support environmental permitting initiatives across North America under a variety of regulatory programs.

Ms. Samantha Lundquist, BSc., BIT
Samantha Lundquist is an Environmental Scientist with WSP Golder, based in Vancouver, Canada. She has 2 years of professional experience in the mining and environmental consulting industry. She has a background in Environmental Toxicology and has experience working on various project areas including human health and ecological risk assessments, aquatic effects monitoring programs, dam environment consequence classifications, ecotoxicology and permit baseline studies. She has experience analysing data and calculating site specific bioaccumulation for HHERAs.

Mr. Jorden Laskosky, M.Sc., P.Ag (AB)
Jorden Laskosky is Mine Closure and Reclamation Consultant with WSP Golder, and is based in Edmonton, Alberta. Jorden has 11 years of experience (excluding M.Sc. work) in the mining and environmental consulting industry. He has a strong background in land reclamation, pre-disturbance soil survey and classification, and soil fertility. Jorden's M.Sc. work focused on improving soil quality of stockpiled soils using organic amendments (e.g., biochar, peat, and humalite) through a growth room bioassay and by evaluating mineralization and GHG emission rates of amended soils.

Ms. Lindsay Furtado, M.Sc., RPBio
Lindsay Furtado is an Environmental Risk Assessor with WSP Golder and is based in Kitchener, ON. Lindsay has over 8 years of experience in environmental consulting related to risk assessment. She has a B.Sc. and M.Sc. in environmental toxicology and is a Registered Professional Biologist (RPBio). Lindsay has worked on risk assessments across Canada and for various private and federal clients, including for brownfield redevelopment, mine closure, contaminated harbours, and federal liability estimates.

2.0 FIELD INVESTIGATION AND SAMPLE COLLECTION

WSP Golder visited the Mine Site and collected soil and vegetation samples between 13 and 16 September 2022. The field work was undertaken in accordance with the project-specific Sampling and Analysis Plan (SAP; Appendix A). The scope of field work carried out in 2022 involved the collection of paired soil and vegetation. Sampling locations were selected based on prior knowledge of the Mine Site and reclamation areas. Sampling was conducted at 18 sites within Mount Polley's Permit Boundary representing the following reclaimed areas of the Mine:

- Boundary Dump
- Bell Dump Parcels 1-10
- Area beside Research Plots
- Biosolids Parcel
- NBD Phase 2
- South Triangle
- Highway to Heaven
- NEZ Dump

Additionally, paired soil and vegetation samples were collected from six undisturbed reference sites. Reference sites were selected based on their proximity to reclamation areas to approximate similar underlying geology; these reference areas were not logged for the purpose of mine activity and are not subject to mine activity or mine disposal waste. Geological mapping or other techniques were not carried out to confirm similarity, it was based on the presumption that spatial proximity was appropriate for this early tier of assessment. Reference stations R-4, R-5, and R-6 are located in the northern portion of the Mine Site, proximal to the Boundary Dump and Bell Dump areas. Reference Stations R-1, R-2, and R-3 are located in the southern portion of the Mine Site, proximal to Highway to Heaven and NEZ Dump areas.

Table 1: ERA Sampling Locations

Areas	Area Type	Stations Sampled
Northern Areas		
North Reference Area	Reference	R-4, R-5, R-6
Boundary Dump	Reclaimed	S-10, S-15
Bell Dump Parcels 1-10	Reclaimed	S-1, S-2, S-3
Area beside Research Plots	Reclaimed	S-4, S-5, S-6
NBD Phase 2	Reclaimed	A-4 (replaces S-7), A-5 (replaces S-18)
Biosolids Parcel	Reclaimed	S-8
South Triangle	Reclaimed	S-9
Southern Areas		
South Reference Area	Reference	R-1, R-2, R-3
Highway to Heaven	Reclaimed	S-11, S-12, S-13, S-14
NEZ Dump	Reclaimed	S-16, S-17

The location of all on-site reclaimed and reference sampling stations is shown on Figure 2. Photographs of the reclamation areas are provided in Figure 3. Alternate stations A-4 and A-5 were sampled in place of S-7 and S-18 as these stations ended up being outside of the active reclamation area.

Soil and plant tissue samples were submitted to ALS Environmental (Burnaby, BC; ALS) for analysis of nutrient, physical and chemical parameters (soil only), metals, and moisture content. For quality assurance and quality control (QA/QC), field duplicates were collected for 10% of the plant and soil samples.

2.1 Soil

A total of 27 soil samples (18 on-site, 6 reference, 3 duplicates) were collected during the 2022 field event. The soil samples were collected in-line with the BC Field Sampling Manual – Part D1 (Soils). Dead leaf litter and organic matter on the top of the mineral soil was removed and excluded from the mineral soil sample. Each soil sample was a composite of three aliquots of soil collected from the base of the sampled plant, within a 5 m radius of the area where plant tissue was collected. Subsamples of equal volume were collected from the top 20 centimetres (cm) of soil using a clean hand shovel or trowel to provide consistency across samples and to represent plant rooting depth. The soil was homogenized in a clean stainless-steel bowl prior to being transferred to 2 clean, laboratory-supplied 125-milliliter (mL), glass sample jars.

Field equipment was decontaminated between sampling stations to prevent cross-contamination of samples. Samples were labelled and kept cool using ice packs in a cooler after collection until transferred to a refrigerator at the end of each sampling day.

Photographs were taken at each sampling location to document the physical characteristics of the sample, field sampling methodology, and habitat present at each sample location. A photo log is presented in Appendix B.

2.2 Vegetation

As described above, paired soil and vegetation samples were collected. Portions of vegetation edible to wildlife were targeted during field activities to improve the assessment of the potential risk to ecological receptors from ingestion of terrestrial vegetation.

Above ground biomass from each of the main vegetative lifeforms (e.g., grass, forb, tree, and shrub [e.g., berry]) was collected by field staff, based on availability at each sampling location. Sampling methods for vegetation consisted of the following steps:

- Tissue was hand-picked by field staff using nitrile gloves (new at each sampling location) from an area of 25 square metres (m^2) or less. Vegetation that appeared to have been browsed by wildlife was preferentially sampled. For each vegetative lifeform, plant tissue was composited from multiple plants of the same species within the area if sufficient volume could not be collected from one plant. Tissue samples were weighed in the field to ensure that sufficient sample was collected to meet laboratory requirements (i.e., >5 grams fresh weight).
- All plant tissue samples were rinsed using deionized (DI) water and blotted dry before being transferred to clean Ziploc bags and labelled according to tissue type and sample location. Samples were kept cool until transferred to the lab for analysis.
- Due to being late in the growing season, some fruiting species had already dropped their fruit. Berries were handpicked, where available.

- For grass and leaf samples, leaves and grass were cut with scissors (decontaminated between sites) and placed in a labeled Ziploc bag.
- Signs of plant distress (e.g., spotting, discolouration) were noted by photograph and in the field logs if observed.
- For plant duplicate samples, 2 samples from the same plant (preferred) or from the plant next to the original sample (should be the same species) were collected. The same collection instructions were followed two separate times (i.e., one sample was bagged, followed by collection of the next sample using the same process).

Photographs were taken at each sampling location to document the physical characteristics of the sample, field sampling methodology, and habitat present at each sample location. A photo log is presented in Appendix B. A list of identified vegetation species during the September 2022 field event is provided in Table E-1 (Appendix E).

2.3 Data Analysis and Data Quality Assurance/Quality Control

2.3.1 Soil

The soil nutrient, chemical, and physical parameters that were analyzed for the ERA are presented in Table 2. Detailed information about the analytical methods is provided in the appended laboratory reports (Appendix C).

Table 2: Soil Nutrient, Chemical, and Physical Parameters Analyzed

Soil Nutrient and Physical Parameters		
Total Organic Carbon (C)	Available Phosphorus (P)	Soil Texture
Total Nitrogen (N)	Available Potassium (K)	Moisture Content
Total Kjeldahl Nitrogen (N)	Available Sulphate (SO4-)	-
Soil Chemical Parameters		
pH (CaCl2)	Soluble Chloride (Cl-)	Soluble Sulphate (SO4-)
Electrical Conductivity	Soluble Calcium (Ca2+)	Theoretical Gypsum Requirement
Sodium Adsorption Ratio	Soluble Magnesium (Mg2+)	Total Metals
Soluble Sodium (Na+)	Soluble Potassium (K+)	-

2.3.2 Vegetation

Vegetation tissue samples were analyzed by the laboratory for total metals and moisture content.

2.3.3 QA/QC Methods

Laboratory samples included analysis of method blanks, laboratory duplicates, spiked samples, and control samples using certified reference materials to assess precision and accuracy of chemical analyses. Laboratory data quality control reports were reviewed upon receipt to confirm that the laboratory data quality objectives had been met and that the appropriate quality control information had been reported.

- Method Blank: consists of a sample of a matrix similar to the barogram.
- Duplicate samples were collected at a subset of stations to assess reproducibility.
- Chain-of-custody forms were updated as samples were collected and were checked to verify the information recorded before samples were submitted for chemical analysis.

For QA/QC purposes, field duplicate samples were collected at 10% of locations samples and analyzed to assess the variability in analytical results that could be related to field sampling procedures and/or laboratory analysis.

The comparison of repeatability of analysis of duplicate samples is expressed as Relative Percent Difference (RPD). The RPD is an indicator of laboratory precision and sample heterogeneity. Lower RPD numbers indicate better precision in laboratory analysis and sample homogeneity.

The formula for computing the RPD is shown below:

$$RPD = \frac{abs(sample - duplicate)}{mean} \times 100$$

Where:

- RPD is the relative percent difference.
- abs (sample - duplicate) is the absolute difference of the original sample and the duplicate sample.
- mean is the average between the two samples.

In accordance with *BC Field Sampling Manual* (BC ENV 2013), a DQO of an RPD value of 50% was used to identify notable differences between original and duplicate tissue samples, when values were greater than or equal to five times the method detection limit (MDL). The RPD value used for tissue is higher than for other matrices because a higher degree of natural variability is expected for this biological matrix.

An RPD value of >35% was used for soil samples as some heterogeneity is still expected. For values less than five times the MDL, a difference factor (DF) was calculated. A DF is the absolute difference between the two sample values divided by the MDL. In general, samples should have a difference factor of less than 2.0.

2.3.4 QA/QC Results

The laboratory reports and chains of custody (COCs) are provided in Appendix C. Tabulated results are presented in Appendix D (Soil) and Appendix E (Vegetation), respectively. Duplicate samples were collected at stations R-3, S-13, and S-15 during the sampling program. The RPDs for duplicate soil samples were less than the DQOs, except for the following:

Soil samples with RPDs exceeding 35% include:

22-S13-S-01

- carbonate alkalinity (as $CaCO_3$ mg/kg) – 66%
- total Kjeldahl nitrogen – 85%

22-S15-S-01

- total Kjeldahl nitrogen – 52%

Soil sample DFs exceeding 2.0 include:

22-S13-S-01

- carbonate alkalinity (as $CaCO_3$ mg/L) – 3.0

The parameters with DQO exceedances were below BC CSR Standards and thus would not affect the interpretation of the data or the conclusions reached.

Vegetation tissue samples with RPDs exceeding 50% are identified in Table E-6 (Appendix E). Parameters include: aluminum, arsenic, barium, cadmium, calcium, cesium, chromium, iron, lead, manganese, molybdenum, phosphorus, sodium, strontium, uranium, vanadium, and zinc. There were no RPD exceedances observed for copper, and only 1 exceedance for selenium with an RPD of 62% for a wet weight leaf tissue sample at station S-15. As expected, the RPD results for tissue highlight a higher degree of natural variability within the biological matrix. Although this variability could affect the precision of individual results, selection of the duplicate samples was random and there was no apparent systematic bias in the results. Overall, the data were considered acceptable.

3.0 PROBLEM FORMULATION

The problem formulation was developed based on knowledge of the Mine Site informed by prior studies and updated based on data collected during the 2022 field investigation. The problem formulation identifies the POPCs, the ecological receptors of concern, and how exposure to POPCs could occur. The problem formulation includes a screening of POPC concentrations and considers the degree to which the observed exceedances of applicable numerical standards or guidelines provide a valid exposure pathway to be evaluated further in the ERA. The framework for this evaluation incorporates the general SLRA concepts described in Protocol 13 for Contaminated Sites: *Screening Level Risk Assessment* (BC ENV 2021).

The following assumptions were applied in the problem formulation:

- The assessment relied on surficial soil data (within 20 cm of ground surface) collected during the 2022 field investigation. Each representative soil sample was a composite of three aliquots of soil collected within a 5 m radius of the area where plants were collected.
- The assessment relied on plant tissue data representative of edible browse or forage species. Subject to availability at each sampling location, samples of grass, forb, leaves, and berries were collected during the 2022 field investigation.

3.1 Identification of Receptors

A functioning ecosystem involves interactions of multiple species ranging in size and complexity from bacteria to predators. Each species has adapted to respond to concentrations of constituents in environmental media in different ways. Because it is not possible to directly assess the risk for each individual species, it is necessary to simplify the complexity of an ecosystem into organism groups and trophic linkages. Ecological receptors were selected to be representative of groups of species considered native to the natural ecosystems of south-central BC. Ecological receptors that are known to be present within reclaimed areas, play a key role in the food web, and are of special conservation interest were identified.

3.1.1 Terrestrial Setting and Species at Risk

The Mine Site occurs in the Horsefly Moist cool variant of the Interior Cedar-Hemlock Biogeoclimatic Zone (ICHmk3), which occurs between Quesnel and Horsefly Lakes, in the valley of McKinley Creek, near Canim Lake. The dominant trees on upland sites in the ICHmk3 are Douglas-fir, Western red cedar, hybrid spruce, and subalpine fir. Lodgepole pine, trembling aspen, and paper birch are also present in the early stages of forest succession. The forests in lower valley bottoms are often dominated by hybrid spruce and black cottonwood. Large portions of the Mine Site were selectively logged in the 1970s to remove the largest Douglas-firs and Western red-cedars, and some clearcut sites have since been replanted. Selective logging removed the tallest trees in the canopy, but left smaller conifers, advance seedling regeneration by subalpine fir, and large back cottonwoods in place. Much of the mine development area now supports a mixed forest with a sparse canopy of veteran conifers; a moderately dense pole sapling cover of subalpine fir, Western red cedar, and Douglas-firs; and a dense tall shrub canopy of black cottonwood, Sitka alder, Douglas maple, Scoular willow, and Bebbian willow. Most cut-over stands have a luxuriant low shrub understory dominated by red elderberry, black huckleberry, black twinberry, various willows, thimbleberry, western mountain-ash, prickly currant, and wild red raspberry. Many of the common shrub species are berry-producing and important food sources for black bears and birds, such as cedar waxwing, bohemian waxwing, American robin, and other thrushes. The herb layer in cut-over areas is also well developed on zonal sites and is dominated by fireweed, bluejoint, and other grasses, Solomon's seal, twinflower, and bunchberry.

The Mine Site and surrounding area are home to a wide variety of wildlife including ungulates, carnivores, raptors, waterfowl, songbirds, mustelids, amphibians and a host of terrestrial and aquatic organisms. Baseline wildlife studies identified 44 bird species and 10 mammal species in the Mount Polley project area, with another 18 bird species identified in the surrounding region. These animals represent receptors at all trophic levels. The complete list is provided within *Appendix B: Baseline Environmental Setting and Land Capability* of the 2017 Reclamation and Closure Plan Update (MPMC 2017). Only one adult frog or toad was observed during field studies in the mine development area in May-June 1995, which escaped before it could be identified. Frog tadpoles, which could not be identified to species, were recorded in a beaver pond outside of the Mount Polley project area (MPMC 2017).

A list of species at risk for the ICHwk2 and ICKmk3 Caribou Region that are potentially in the Mount Polley area was compiled (Golder 2015). Species at Risk (SAR) potentially present in the Mount Polley area included: Hagen's Bluet (*Enallagma hageni*), Magnum Mantleslug (*Magnipelta mycophaga*), Western Toad (*Anaxyrus boreas*), Great Blue Heron (*Ardea herodias herodias*), Common Nighthawk (*Chordeiles minor*), Olive-sided Flycatcher (*Contopus cooperi*), Wolverine (*Gulo gulo luscus*), Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), Fisher (*Pekania pennanti*), Grizzly Bear (*Ursus arctos*), and Mountain Caribou (*Rangifer tarandus*). Species presence and the timing and duration of their residence time on-Site will vary with habitat characteristics and other factors, such as social interactions, timing of life history events, seasonal and inter-annual variation in habitat use, population cycling, immigration routes and timing, and weather (Golder 2015).

WSP Golder carried out a desktop review to identify documented species and ecosystems at risk and critical habitat for federally or provincially listed species at risk. The review included the following resources: Important Bird Areas (IBA Canada 2022), iMapBC (BC ENV 2022), and BC Conservation Data Centre iMap (BC CDC 2022). No SAR or critical habitats were identified within the reclaimed areas of the Mine Site. The Western Toad, federally listed as Special Concern on the Species at Risk Act (SARA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), was reported within a 5 km buffer of the Mine Site. This amphibian species breeding habitat includes various shallow and sandy waterbodies, with the adults typically remaining near riparian areas or wetlands of the breeding sites (COSEWIC 2012). The Western Toad is not expected to carry out important life history stages within the reclaimed areas and is therefore not considered a receptor of concern for the ERA.

3.1.2 Receptors of Concern

Based on the Mine Site location, setting, habitat observations and documentation of SAR, the following receptors of concern (ROCs) were identified:

- Terrestrial plants, represented by grass, forb, tree, shrub [e.g., berry] communities
- Herbivorous birds, represented by Ruffed Grouse
- Herbivorous mammals, represented by Meadow Vole and Mule Deer. The Mule Deer was represented by the surrogate receptor White-tailed Deer, for which standardized receptor characteristics are readily available (FCSAP, 2012). Mule Deer are abundant in the region, while White-tailed deer are relatively uncommon. The uncertainty associated with the use of the White-tailed deer as a surrogate receptor for Mule deer is discussed further in Section 6.3.

No SAR were identified within the reclaimed areas. Additional details related to ROCs are provided in Section 4 below.

3.2 Assessment and Measurement Endpoints

In order to undertake a quantitative evaluation of risk, assessment endpoints must first be established for the ERA. Assessment endpoints in an ERA are explicit expressions of the environmental value that is to be protected. Often they cannot be measured directly and as such, a set of surrogate endpoints (measurement endpoints) are used. Measurement endpoints are the physical, chemical, or biological aspects of the ecological system that are measured and relate to the valued characteristic chosen as the assessment endpoint. The endpoints evaluated in this ERA are presented below:

- **Assessment Endpoint 1**: Re-establish terrestrial plant communities within reclaimed areas consistent with the planned end land uses described in the 2022 Mine Plan and Reclamation Plan.
  - Measurement Endpoint 1-1: Measured plant tissue concentrations from reclaimed sites were assessed against measured plant tissue concentrations from reference sites, as well as acceptable thresholds for soil fertility parameters.
- **Assessment Endpoint 2**: Protect terrestrial wildlife communities from reductions in survival, growth, and reproduction as a result of ingestion of soil and food items containing POPCs.
  - Measurement Endpoint 2-1: Measured soil and plant tissue concentrations were used to determine an exposure dose for plant-eating birds and mammals and compared to an appropriate exposure limit.

3.3 Identification of Parameters of Potential Concern

3.3.1 Soil Screening Criteria

To identify POPCs that required assessment in the ERA, soil concentrations were compared to the BC Contaminated Sites Regulation (CSR) Schedule 3.1 (BC Reg. 375/96, OC 1480/96) reverted wildlands land use standards. For those parameters with concentrations greater than BC CSR Standards, an additional screening step was completed against the CCME Soil Quality Guidelines for Environmental Health (SQG_E) for the protection of wildlife species from soil and food ingestion (CCME 1997b, 1999, 2009). Data collected from on-site reclaimed areas were also compared to reference concentrations to identify POPCs that are elevated relative to reference conditions.

Table 3 presents a summary of the parameters exceeding the BC CSR Standards (and CCME SQG_E , if applicable) at on-site reclaimed areas and reference locations, as well as general summary statistics for those exceedances. The full soil screening results are presented in Table D-1 (Appendix D).

Table 3: Summary of the Parameters Exceeding Soil Screening Criteria

Parameter	BC CSR Soil Standards	CCME SQG_E	Reference (n=6)		Reclaimed Sites (n=18)	
	Wildlands Reverted TSIP mg/kg	Soil and Food Ingestion Guideline mg/kg	Mean (Min – Max) mg/kg	# Samples Exceeding[1]	Mean (Min – Max) mg/kg	# Samples Exceeding[1]
Copper	**150**	**300**	131 (18 – 300)	2/6	566 (191 – 830)	18/18
Selenium	**1.5**	4.5	0.21 (<0.20 – 0.27)	0/6	0.80 (0.24 – 1.63)	2/18

Table 3: Summary of the Parameters Exceeding Soil Screening Criteria

Parameter	BC CSR Soil Standards	CCME SQG_E	Reference (n=6)		Reclaimed Sites (n=18)	
	Wildlands Reverted TSIP mg/kg	Soil and Food Ingestion Guideline mg/kg	Mean (Min – Max) mg/kg	# Samples Exceeding[1]	Mean (Min – Max) mg/kg	# Samples Exceeding[1]
Sodium	**<u>200</u>**	NA	120 (88 – 216)	1/6	282 (151 – 592)	14/18
Vanadium	<u>150</u>	130	100 (66 – 160)	1/6	118 (90 – 134)	0/18

Notes:

BC CSR = British Columbia Contaminated Sites Regulation Schedule 3.1 (CSR; BC Reg. 375/96, OC 1480/96); mg/kg = milligrams per kilogram; n = number of samples; NA = not applicable; TSIP = toxicity to soil invertebrates and plants; CCME = Canadian Council of Ministers of the Environment; SQG_E = Soil Quality Guideline for Environmental Health.

Bold – indicates exceedance of criteria by the maximum concentration on reclaimed sites.

<u>Bold and Underline</u> - indicates exceedance of criteria by the maximum concentration on reference and reclaimed sites.

<u>Underline</u> – indicates exceedance of criteria by maximum concentration on reference sites.

1 – Number of samples exceeding BC CSR Soil Standard.

Copper - Copper concentrations in all 18 soil samples collected from reclaimed sites exceeded the CSR screening criterion protective of toxicity to soil invertebrates and plants (TSIP). Two of six soil samples collected from references sites also exceeded this screening criterion. Copper concentrations in 15 of 18 samples from reclaimed areas also exceeded the CCME SQG_E protective of wildlife. Further, copper concentrations on reclaimed areas were elevated compared to concentrations measured in reference site soils (Figure 5). As overburden is sourced from the pit and used as reclamation material, the elevated copper levels are expected. Copper is retained as a POPC for further evaluation in the ERA.

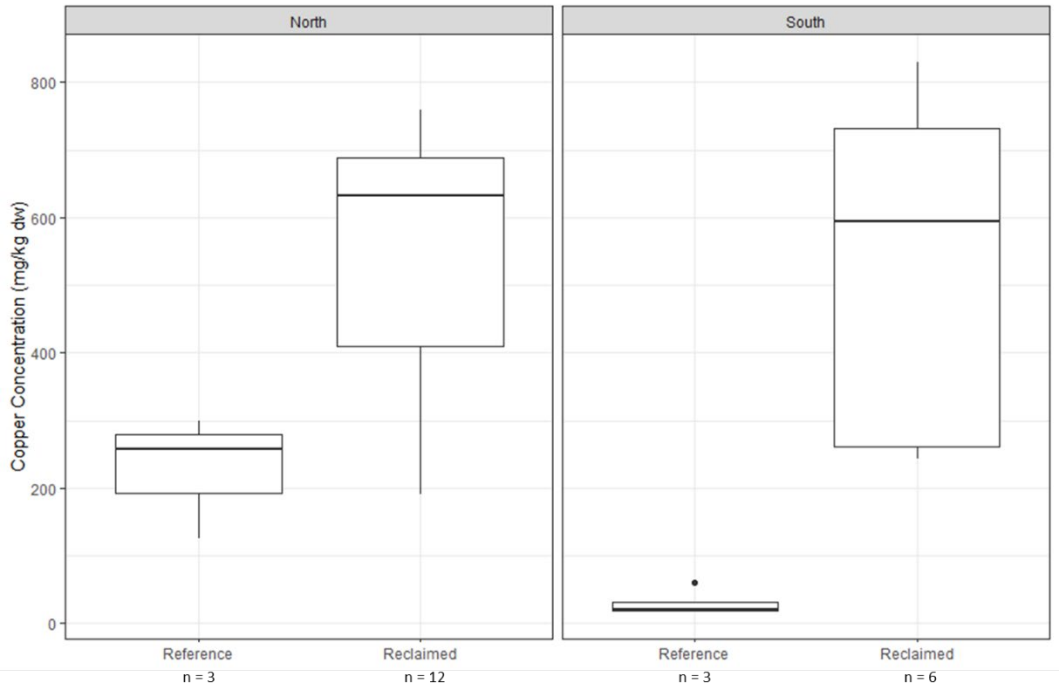

Notes: North: Reference Stations: R4, R5, and R6, Reclaimed Stations: S1, S2, S3, S4, S5, S6, S8, S9, S10, and S15.
South: Reference Stations: R1, R2, and R3, Reclaimed Stations: S11, S12, S13, S14, S16, and S17.

Figure 5: Copper Soil Concentrations (CSR Standard = 150 mg/kg; CCME SQG_E = 300 mg/kg)

Selenium - Selenium concentrations in 2 of 18 soil samples collected from reclaimed sites exceeded the CSR screening criterion protective of TSIP. These samples, 22-S8-S-01 (1.63 mg/kg) and 22-A4-S-01 (1.52 mg/kg), are located in the Biosolids Parcel and in NBD Phase 2. None of the six soil samples collected from reference sites exceeded the CSR screening criterion. Selenium concentrations from reclaimed sites were also elevated compared to concentrations measured in reference soils (Figure 6), however, none of the reclaimed soils exceeded the CCME SQG_E. Selenium concentrations were below CSR standards at all but two locations, which were spatially separated across the Mine Site (A-4 and S-8). The average concentration of selenium across the reclaimed sites met the CSR standard. Given the isolated exceedances, impacts to plant communities are not expected. On this basis, selenium is not retained as a POPC for further evaluation in the ERA.

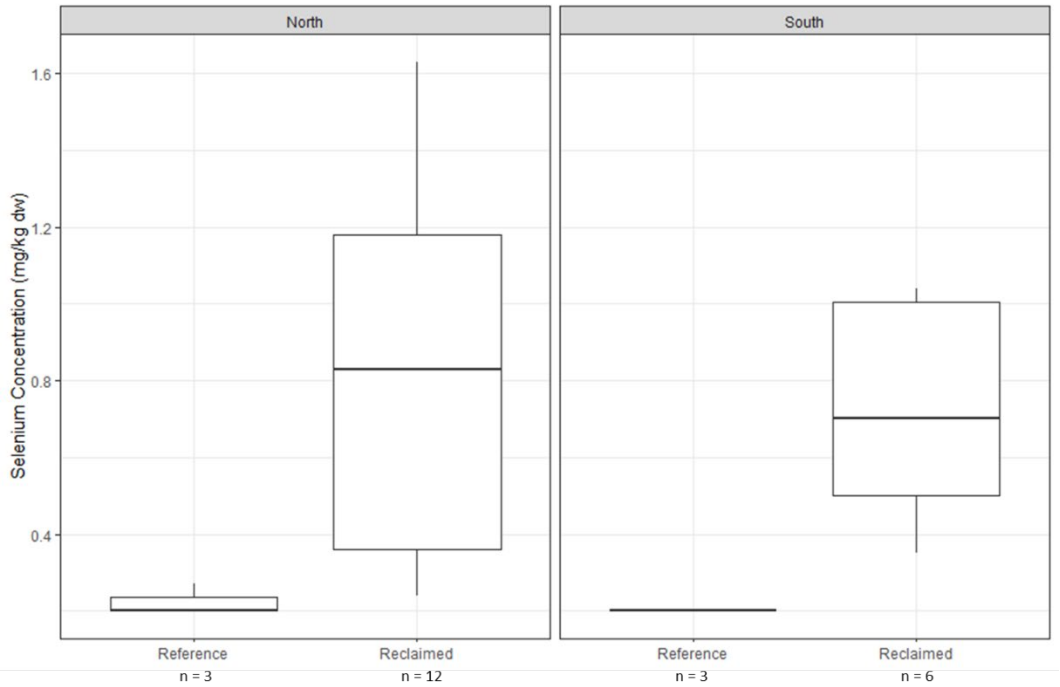

Notes: North: Reference Stations: R4, R5, and R6, Reclaimed Stations: S1, S2, S3, S4, S5, S6, S8, S9, S10, and S15.
South: Reference Stations: R1, R2, and R3, Reclaimed Stations: S11, S12, S13, S14, S16, and S17.

Figure 6: Selenium Soil Concentrations (CSR Standard = 1.5 mg/kg; CCME SQG_E = 4.5 mg/kg)

Sodium – Sodium concentrations in 14 of 18 samples collected from reclaimed sites exceeded the CSR screening criterion protective of TSIP. One of 6 soil samples collected from reference sites also exceeded this screening criterion. Further discussion of salinity parameters (electrical conductivity, sodium absorption ratio, and soluble cations) is provided below in Section 3.3.2, which highlight that adverse effects from the salinity levels at the Mine Site are not expected. Sodium is not retained as a POPC for further evaluation in the ERA.

Vanadium – None of the 18 soil samples collected from reclaimed sites exceeded the vanadium CSR screening criterion protective of TSIP. One of six soil samples collected from reference sites exceeded this screening criterion. Vanadium is not retained as a POPC for further evaluation in the ERA.

Based on the results of this initial soil screening step, only copper is retained as a POPC and carried forward for further evaluation in the ERA.

3.3.2 Interpretation of Soil Fertility Parameters

The following section evaluates the potential for adverse effects from the parameters that influence soil fertility and the establishment of plant communities on reclaimed lands. The full soil results for these parameters are presented in Table D-1 (Appendix D). As no standard for soil fertility parameters exists for reclaimed soils in a non-agronomic setting, soil samples collected from reclaimed stations at the Mine Site are compared to their respective reference sites. Agronomic thresholds are also discussed, as they provide additional context for nutrient values observed in the collected soil samples.

Total Organic Carbon (TOC) – TOC is the carbon stored in the organic matter of soil and acts as a feedstock for the soil microbial community. Soil TOC values ranged between 0.11% and 15.4% and had an average of 3.2%. Except for R-2 and S-9, soil TOC levels were relatively comparable between reference and reclaimed soils. As there are generally no standards for TOC (i.e., values depend on desired vegetative community needs) reference sites tend to be the best indicator for evaluating reclaimed soil TOC values.

Total Nitrogen (TN) – TN represents the nitrogen present in a soil system and includes organic and inorganic forms of N. TN is used along with TOC to determine C:N ratios, which help define carbon:nitrogen dynamics within the soil (e.g., N immobilization).

Nitrogen sufficiency values are species specific; however, in agricultural soils, they typically range from 0.1 to 0.15% (Horneck et al. 2011) and are generally much lower for natural areas. Except for a few isolated occurrences, TN values for reclaimed sites met the 0.1% threshold (i.e., indicating that N is not limiting for plants), and were generally comparable to their reference sites.

Available Nitrogen (N) (Nitrate [NO_3^-] and Nitrite [(NO_2^-]) – Available N values (i.e., N forms that are easily taken up by biota) were below detection limits for all sites. However, this is expected as both forms of available N are highly mobile in the soil given their negative charge (i.e., do not adhere to the soil cation exchange sites within the soil). Available N forms tend to be poorly retained in reclaimed soils; particularly those that have been stockpiled (Williamson and Johnson 1990). While plant available N is low within the soils at the Mine Site, the overall pool of N (i.e., TN) is sufficient to promote plant growth (Horneck et al. 2011), and the C:N ratios of the reclaimed soils indicate that plant uptake of N is likely not restricted.

C:N Ratio – The C:N Ratio is a metric that indicates whether mobilization of N is occurring within the soil. Above a C:N ratio of 24:1 (USDA 2011), immobilization of N occurs, making it less available to the plant community. The severity and length of immobilization depend on how high the C:N ratio is. All reclaimed soils showed C:N ratios below the 24:1 threshold, indicating N immobilization is not an issue limiting plant growth.

Phosphorus (P) – Soil P is an important parameter for plant growth. Levels below 8 mg/kg tend to limit plant growth in an agronomic setting (Dinkins and Jones 2013). Soil P values were below this threshold at eight locations (e.g., S-9 to S-17), indicating that soil P may be limiting plant growth. Additionally, soil P was below reference site (R-1 to R-3) values at these eight locations. While a risk of poor plant establishment and plant growth exists at these locations, chemical fertilization could alleviate this risk, should signs of P deficiency or poor plant growth present themselves.

Soil P values in the Bell Dump were above the 8 mg/kg threshold and ranged between 13.1 mg/kg and 123.5 mg/kg; elevated P may be due to biosolid applications in this area during progressive reclamation. The Bell Dump soil P values met or exceeded their reference site location values in all cases.

Potassium (K) – Soil K is a macronutrient used in plant growth. Soil K across the NEZ Dump Trial and Highway to Heaven reclamation trials (e.g., S-11 to S-17) ranged from 73 mg/kg to 136 mg/kg, with an average of 110 mg/kg. The corresponding reference sites (e.g., R-1 to R-3) ranged between 76 mg/kg and 193 mg/kg, with an average of 124 mg/kg. While soil K average values differed between the two locations, the difference is not likely meaningful.

The northern reference sites had soil K values ranging between 159 mg/kg and 251 mg/kg (with an average of 211 mg/kg), while their reclaimed counterparts (S-1 to S-9) ranged from below detection limits (e.g., <20 mg/kg; S-1, S-9), to 207 mg/kg, with an average of 105 mg/kg. As such, the reclaimed sites have lower soil K values than their reference counterparts. While a risk of poor plant establishment and growth exists for the reclaimed locations in question, chemical fertilization can be used to alleviate K deficiency, should the plants show the associated symptoms, or growth is poor.

Sulphate (SO_4^{2-}) – Sulphate levels, like N levels, are dependent upon species specific needs; however, values below 2 mg/kg are considered very low, and those above 20 mg/kg are considered high but non-toxic (Horneck et al. 2011). Sulphate values in reclaimed soils were above the 2 mg/kg threshold, and generally reflected reference values.

pH – Soil pH directly influences micronutrient and metal availability in the soil. Most nutrients become increasingly less available below a pH of 6. The pH values within reference soils ranged between 4.2 and 5.8. Reclaimed soils ranged from 5.7 to 7.3.

Higher pH values in reclaimed soils are not uncommon, as carbonates that may be present lower in the soil profile (e.g., 50 cm to 100 cm+ depths in Ck horizons) are mixed into subsoil/overburden, and then redistributed on the landscape during placement (e.g., within the rooting zone) due to topsoil shortages. This practice of using overburden as reclamation material is common on mine sites like Mount Polley, where pre-disturbance soil profiles are thin, historic practices did not salvage soil, or the post-closure landscape has different topography (and therefore more surface area to reclaim). Finally, reclaimed soils at the Mine Site show suitable pH values (e.g., as defined by AAFRD [1987]). As such, the pH levels within reclaimed soils likely do not have issues with micronutrient availability. Metal availability is also likely not an issue given that measured values (discussed elsewhere) apart from copper do not exceed CSR values.

Electrical Conductivity (EC) – EC is a measurement of soil salinity. EC values above 2 deciSiemens per metre (dS/m) have negative impacts on plant growth, and values above 8 dS/m are considered unsuitable for reclamation (AAFRD 1987). Give that EC values at the Mine Site are below this threshold, salinity is not a concern for plant establishment.

Sodium Adsorption Ratio (SAR) – SAR is the ratio of sodium (Na^+) to calcium (Ca^{2+}) and magnesium (Mg^{2+}). Ratios above 12 are considered sodic and unsuitable for reclamation material (AAFRD 1987). Given that SAR at the Mine Site is below this threshold, SAR is not likely influencing plant growth.

Soluble Na^+, Ca^{2+}, Mg^{2+} etc. – Soluble parameters are typically used to assess issues observed with EC and SAR. While thresholds for these parameters exist, EC and SAR are better indicators of their overall effect on plant health. As SAR and EC are below their thresholds in reclaimed soils at the Mine Site, soluble ions are likely not influencing plant growth.

Moisture – Percent moisture can influence vegetation establishment; however, its values are highly transitory, and are often reported with other parameters in laboratory data. Moisture values ranged between 3.9% and 19% for reference and reclaimed soil samples, with no trend apparent in the data.

Theoretical Gypsum Requirement (TGR) –TGR is a calculated parameter that indicates how much gypsum would be required to treat sodic or saline soils. As the soils at the Mine Site are not sodic or saline, the TGR for all sample locations was below detection limits.

Soil Texture – Soil texture can influence water holding capacity, and in turn, nutrient availability. Coarser soils have lower water holding capacity (which can dictate plant growth and establishment) and poorer nutrient availability than finer textured soils. Conversely, clay or heavy clay textured soils can have negative effects on some plant species, as too much water can result in poor plant growth. The soils sampled at the Mine Site were generally sandy loam to loam in texture, indicating acceptable growing conditions for plant establishment.

3.4 Identification of Exposure Pathways for Wildlife Receptors

Exposure pathways are routes by which ecological receptors could potentially be exposed to POPCs in the environment. A complete exposure pathway requires the following four elements:

1) The presence of a POPC;

3) A migration pathway (environmental transport);

4) An exposure point for contact (e.g., soil); and

5) An exposure route (e.g., direct contact).

An exposure pathway is not complete unless all four elements are present. If a pathway is incomplete, no significant exposure will occur. The following exposure pathways were evaluated in the ERA as they are drivers for ecological risk:

- Terrestrial Plants: exposure to POPCs in soil from direct contact (root uptake).
- Mammals and Birds: exposure to POPCs in soil via incidental ingestion of soil and consumption of food items (e.g., plants) that have accumulated POPCs from soil.

The ecological conceptual site model (ECSM) is provided in Figure 4 and depicts the exposure pathways relevant to the Mine Site.

4.0 EXPOSURE ASSESSMENT

The exposure assessment stage of the ERA estimates the potential concentration or dose of the POPC received by each receptor for each exposure pathway identified in the problem formulation.

4.1 Terrestrial Plants

Exposure concentrations in plants were determined by sampling this media type directly. Measured tissue concentrations for grasses, forbs, berries, and leaves are presented in Appendix E.

4.2 Birds and Mammals

The exposure estimate for higher-trophic-level receptors is presented as a total dose, which represents the intake of the POPC expressed as milligrams per kilogram of body mass per day (mg/kg BW/d). Estimated doses may be calculated for higher-trophic-level receptors for ingestion of soil, water, and dietary food items. For this assessment, copper intake from incidental soil and food ingestion was evaluated as they are considered the major sources of exposure.

To estimate the exposure dose, several characteristics about the receptor need to be known or assumed: the receptor's dietary ingestion rates, soil ingestion rate, body weight, and proportion of the diet represented by important food items, as well as the concentration of the POPC in each of the relevant exposure media.

The exposure equations used to estimate the daily dose from soil and food ingestion are based on CCME (2020) and are presented in Appendix F, along with sample calculations.

The calculations assumed that:

- Copper was 100% bioavailable from the gastrointestinal tract (i.e., a dietary uptake efficiency of 1).
- The receptor would forage exclusively in the reclaimed area such that 100% of the receptor's diet would come from areas with the most elevated POPC concentrations (i.e., foraging range factor of 1).

These conservative assumptions were applied to not underestimate risk to birds and mammals. They are likely to result in a higher than realistic estimate of risk.

4.2.1 Exposure Point Concentration

The maximum measured copper soil concentration (830 mg/kg from station S-11) was used to estimate the dose from incidental soil ingestion and the maximum measured copper concentration in plant tissues was used to estimate the dose from food ingestion. For smaller herbivores such as grouse and vole, the maximum measured copper concentration from grasses and berries was used (23.3 mg/kg dry weight in grasses at S-9), while for larger species such as deer, the maximum measured copper concentration from all tissue types was used (31.4 mg/kg dry weight measured in red raspberry leaves at S-1).

4.2.2 Wildlife Receptor Characteristics

In the problem formulation step, ecological receptors were selected based on the following criteria: ecological relevance, availability of toxicity data, representation of different exposure pathways, availability of effects data and SAR present on the Mine Site. As an ecosystem is dependent on the successful interaction of multiple species and components, a select number of representative species were selected. The representative species are referred to as receptors of concern (ROCs). Terrestrial ROCs at the Mine Site were conservatively selected in the context of surrounding natural land use and potential for that habitat to be present on the Mine Site in the future. ROCs for common mammals and birds are represented by populations and are representative and protective of all species within a given trophic group that may be present at the Mine Site. ROCs selected to represent terrestrial wildlife at the Mine Site, along with their characteristics necessary for food chain modelling, are presented in Table 4. The ROCs are based on the surrogate receptors provided by the Federal Contaminated Sites Action Plan (FCSAP 2012) that are used to evaluate and protect a receptor group/feeding guild.

For receptors for which an incidental soil ingestion rate is not provided, a value of 2% of the dry food ingestion rate is applied as recommended in FCSAP (2012). Where food ingestion rates are provided in wet weight, a conversion to dry weight based on the percent moisture of the food items is required. This is consistent with the POPC concentration data (reported as dry weight) and the soil ingestion rates (listed as a percentage of the dry food ingestion rate). Conversion of food ingestion rates from wet weight to dry weight was calculated using the following equation:

$$\textit{Dry food ingestion rate} = \textit{wet food ingestion rate} * (1 - \textit{moisture}_{diet})$$

where the moisture_{diet} represents the weighted average moisture content in the diet. The percent moisture was assumed to be 60% for plants, based on the average moisture content from samples collected across the Mine Site.

Table 4: Wildlife Receptor Characteristics (Based on FCSAP 2012)

Receptor	Body Weight (kg)	Soil Ingestion Rate (kg dw/ kg bw/ d)	Food Ingestion Rate (kg dw/ kg bw/ d)	Proportion of Plants in Diet
Ruffed Grouse	0.55	1.2E-03[2]	6.0E-02	100%
Meadow Vole	0.035	1.2E-03[2]	1.3E-01[1]	100%
White-tailed Deer[3]	75	6.0E-04[2]	3.0E-02	100%

Notes: kg dw/ kg bw /d = kilograms per dry weight per kilograms of body weight / day.

1) Converted from wet food ingestion rate assuming 60% moisture of plant tissues.
2) Assumed to be 2% of dry food ingestion rate, 2.4% for meadow vole (FCSAP 2012).
3) Surrogate for Mule Deer

4.2.3 Exposure Doses

Exposure doses were calculated for the soil ingestion pathway and the food ingestion pathway and then summed to estimate the total daily dose. The exposure doses for the ROCs are provided in Table 5. The food chain modelling equations and sample calculations are provided in Appendix F.

Table 5: Exposure Doses for Mammals and Birds from Copper in Reclaimed Areas (mg/kg bw/d)

Receptor	Soil Ingestion Dose	Food Ingestion Dose	Total Daily Dose
Ruffed Grouse	1.0E+00	1.4E+00	2.4E+00
Meadow Vole	2.6E+01	3.1E+00	5.7E+00
White-tailed Deer[1]	5.0E-01	9.4E-01	1.4E+00

Notes:
1) Surrogate for Mule Deer

5.0 TOXICITY ASSESSMENT

The toxicity assessment stage of the ERA involves the evaluation of available species-specific toxicology data and identification of an appropriate exposure limit.

5.1 Terrestrial Plants

Copper is an essential element in both plants and animals. In plants, copper plays an important role in oxidation, photosynthesis, and protein and carbohydrate metabolism (USEPA 2007, Mir et al. 2021). The primary route of uptake by plants is through soil as opposed to atmospheric deposition. Toxic effects of excess copper can impact seed germination, plant growth and development, photosynthesis, and antioxidant response (Mir et al. 2021). Symptoms of copper toxicity in plants can also include dark green leaves followed by induced iron chlorosis, thick, short or barbed-wire roots, and depressed tillering (CCME 1999). Whereas copper deficiency in plants is demonstrated by wilting leaves, melanism (an increased amount of black pigmentation), white twisted tips, and reduction in panicle formation (USEPA 2007).

For evaluating toxicity to terrestrial plants, benchmark values have been developed by regulatory agencies that represent a soil concentration that protects against adverse effects to plant communities as a whole. These benchmark concentrations are derived from multiple toxicity studies (e.g., 10th percentile or geometric mean of data from several different endpoints and species). Adverse effects related to growth and reproduction are preferentially used to derive the benchmark concentrations.

However, soil pH directly influences copper availability for uptake by plants which brings in high uncertainty with using soil benchmark values for evaluating toxicity, as the underlying studies used to define toxic thresholds are typically done under laboratory conditions that favour metal bioavailability. For example, the majority of toxicity studies used for deriving the CCME benchmark concentrations had pH values <5.5 (CCME 1997a). The pH values for reference soils ranged between 4.2 and 5.8, while pH in reclaimed soils ranged from 5.7 to 7.3. The capacity of soil to adsorb copper increases with increasing pH, with a maximum holding capacity at neutral to slightly alkaline conditions (pH 6.7-7.8) (CCME 1999). Furthermore, soils with alkaline conditions tend to favour precipitation of copper; thus, copper is more mobile under acidic than alkaline conditions (CCME 1999). These higher pH values on reclaimed lands will lessen the availability of copper in the soil for uptake by plants. Evaluation of plant tissue concentrations is therefore a better indicator of site-specific risks.

Based on a toxicological review completed by the CCME, normal concentrations of copper in mature leaf tissues range from 5 to 30 mg/kg and concentrations of 20 mg/kg in tissues was considered by the CCME to be the maximum threshold above which toxic effects could occur (CCME 1997a). Hochmuth et al. (2015) determined that a “normal” concentration to meet the nutritional needs of a plant generally lies between 4 to 20 mg/kg dry weight and varies by species and soil conditions. A threshold of 20 mg/kg in plant tissues is therefore used in the ERA to evaluate the potential for risk to individual plant species.

5.2 Birds and Mammals

Toxicity Reference Values (TRVs) are defined as an exposure concentration or dose of a chemical that is not expected to cause an unacceptable level of effect in a ROC (FCSAP 2021). TRVs are chemical-specific and receptor-specific and for the purposes of this ERA are expressed in the units of mg chemical/kg body mass/day.

TRVs have been reviewed and summarized by various regulatory agencies. They are derived from toxicity bioassays with representative species that examine various doses of a chemical that causes a particular level of effect (or absence of an effect). TRVs may be represented by Effect Concentrations associated with a known level of effect, such as the concentration that causes 20% reduction in growth (i.e., EC20). TRVs may also be represented by No Observed Adverse Effect Levels (NOAELs), the highest concentration or dose that does not cause a statistically significant adverse effect, or Lowest Observed Adverse Effect Levels (LOAELs), the lowest concentration or dose that causes a statistically significant adverse effect. TRVs that represent chronic effects related to growth and reproduction (which may alter the ROCs population levels) are preferentially selected. Where data related to these assessment endpoints is limited, TRVs based on survival are sometimes applied.

The TRVs selected for copper are presented in Table 6. They were obtained from FCSAP (2021), who selected TRVs based on a detailed review of existing values from commonly used literature sources.

Table 6: Toxicity Reference Values for Copper

Receptor Type	TRV (mg/kg bw/d)	Source	Basis
Mammal	5.6 (NOAEL) 6.79 (LOAEL)	FCSAP (2021) (adopted from USEPA, 2007)	USEPA develops their TRVs based on a statistical interpretation of datasets that include multiple studies and multiple representative species. The TRV for copper was derived as the highest bounded NOAEL below the lowest bounded LOAEL for growth, reproduction, and survival endpoints. No uncertainty factors or allometric scaling was applied. The TRV adopted from USEPA is based on a NOAEL for reduced body weight in pigs. The lowest bounded LOAEL from the data considered by the USEPA in the development of their TRV was 6.79 based on a study that looked at reproduction in minks.
Bird	4.5	FCSAP (2021) (adopted from CEAEQ 2012)	Centre d'expertise en analyse environnementale du Quebec (Quebec centre of expertise in environmental analysis; CEAEQ) develops their TRVs from selected literature studies that met their data quality criteria, including effects based on reproduction, growth, and survival endpoints. The TRV for copper was derived using the Weibull model to determine a dose-response relationship for effects data from five studies. The EC20 was then extrapolated from each study and divided by an uncertainty factor of 2 to account for a less-than chronic exposure duration. The lowest EC20 was selected as the TRV.

6.0 RISK CHARACTERIZATION

Risk characterization is the final stage of the ERA and involves integrating the results of the exposure assessment with the results of the toxicity assessment to assess the potential for risk to ecological receptors.

6.1 Terrestrial Plants

Risks to plant communities was qualitatively evaluated in the ERA through the comparison of plant tissue concentrations to both reference concentrations and to effect threshold (20 mg/kg) defined in the literature (Section 4.1).

Figure 7 and Figure 8 below present the range of copper concentrations measured in plant tissue. Concentrations in plant tissue were generally lower across the southern sites compared to the northern sites, where a select number of samples at northern sites representing forbs, grasses, and leaves were reported at concentrations greater than 20 mg/kg dry weight (Figure 7). Overall, the majority of plant tissue samples collected within reclaimed areas fell within the “normal” concentration range of 4 to 20 mg/kg dry weight required for plant health and the isolated, elevated concentrations of copper are not expected to impact the viability of the plant community at each reclaimed site as a whole. Further, there were no signs of plant distress observed by field staff during the tissue sampling event.

Hochmuth et al. (2015) reported that copper is not highly mobile in plants, but some copper can be translocated from older to newer leaves to support their development. It is noted that fresh growth was targeted during tissue sampling, indicating that the results represent the worst case scenario of potential exposures. Further, the CCME defined the threshold limit of 20 mg/kg based on shoot concentrations rather than leaf concentrations (which are known to have higher copper content).

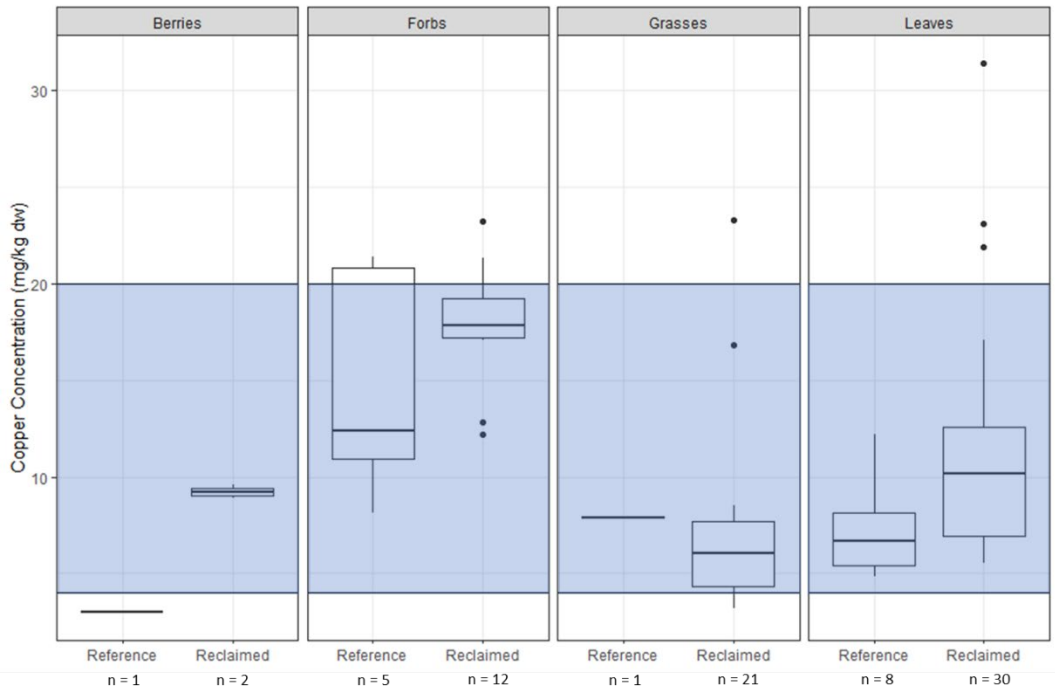

Note: Blue shading represents “normal” concentration range to meet plant nutritional needs (4- 20 mg/kg; reported by Hochmuth et al. 2015).

Figure 7: Copper Plant Tissue Concentrations (North Reference, North Bell Dump, Boundary Dump)

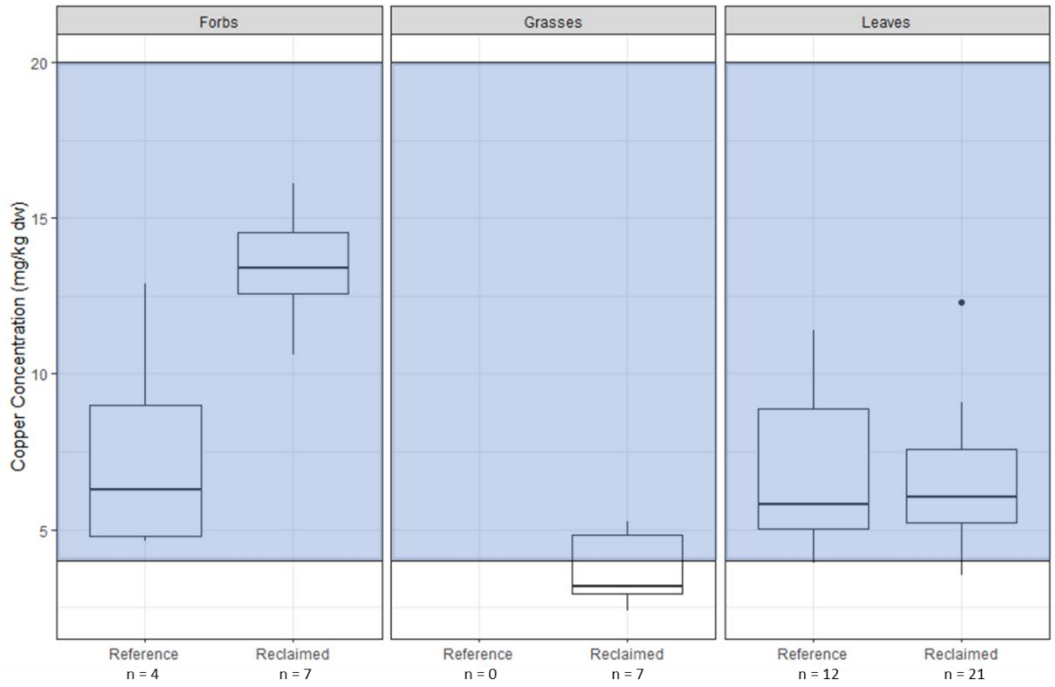

Note: Blue shading represents "normal" concentration range to meet plant nutritional needs (4- 20 mg/kg; reported by Hochmuth et al. 2015).

Figure 8: Copper Plant Tissue Concentrations (South Reference, Highway to Heaven, NEZ Dump)

6.2 Birds and Mammals

Risks to mammals and birds are expressed through the hazard quotient (HQ), which is derived by comparing the exposure dose for each receptor (Section 4) to the TRV (Section 5). Conservative assumptions were applied, as detailed in Section 4, to not underestimate risk. A HQ of less than one suggests negligible risk to a receptor from exposure to the POPC, while HQs greater than one suggest that a receptor is potentially at risk from exposure to the POPC and additional evaluation may be warranted. The HQs calculated for mammals and birds are presented in Table 7.

HQs were less than or equal to one for all ROCs; therefore, there is negligible risk to mammals and birds from exposure to copper within the reclaimed areas.

Table 7: Hazard Quotients for Mammals and Birds within Reclaimed Areas

Receptor	Total Daily Dose (mg/kg bw/d)	TRV (mg/kg bw/d)	HQ - Copper
Ruffed Grouse	2.4	4.5	0.6
Meadow Vole	5.7	5.6	1.0 (HQ_{LOAEL} = 0.8)
White-tailed Deer	1.4	5.6	0.3

6.3 Uncertainty

Uncertainty is inherent in all risk assessments. Uncertainty in risk assessment is introduced by the necessary use of assumptions concerning various aspects or characteristics of the ecological system that cannot be measured accurately. Uncertainty is acknowledged, documented, and addressed primarily using conservative assumptions to ensure risk is overestimated rather than underestimated. Table 8 presents the uncertainties in the ERA.

Table 8: Evaluation of Uncertainty in the Ecological Risk Assessment

Assumption	Uncertainty	Under / Overestimate of Risk	Rationale
Reclaimed areas have similar biochemical characteristics to disturbed areas that are within the current operational footprint and are representative of future closure conditions.	Low	Neutral	Reclamation projects are an ongoing portion of Mine operations. Therefore, this was a necessary assumption of the ERA. Uncertainty was reduced by sampling within various reclamation units representative of the different reclamation and soil amendment approaches used in progressive reclamation across the Mine Site.
Risks are present if parameters exceed standards or guidelines.	High	Overestimate	The use of BC CSR Standards or CCME SQGE during the initial screening step is a conservative first pass for identifying potential risks to ecological receptors. An exceedance of a standard or guideline does not imply that unacceptable risk is present, only that it has the potential to be present. Screening values based on studies conducted under laboratory conditions, using bioavailable forms of metals and sensitive species, are useful in attempting to find an environmental concentration protective of all species across all site conditions; however, many physicochemical characteristics of environmental media alter the concentration-response relationships, and conditions in the laboratory may not be reflected in the field. Comparison of site data to similar data from reference locations provides meaningful information as to the relative risk under closure conditions and can highlight areas of elevated risk that are not a result of anthropogenic activities.
100% bioavailability of metals in environmental media.	High	Overestimate	There are many potential bindings phases for metals that may limit bioavailability in soil and tissue. These factors may include: pH, organic carbon content, and redox potential. The assumption of 100% bioavailability of metals likely overestimates risk. Particularly for copper in reclaimed soils, where the slightly alkaline conditions decrease bioavailability.
Essential nutrient (e.g., copper) requirements of plants	Low	Overestimate	The “normal” concentration of copper to support plant health, as determined by Hochmuth et al. (2015) is based on agricultural crops, which represent different species than what is found at the Mine Site. This range was adopted for use in the ERA. Agricultural crops are generally considered sensitive, and a toxicological review by CCME (1997a) demonstrated that LC50 values for crop species were much lower than native species. This suggests that this uncertainty is more likely to overestimate rather than underestimate potential risks. No observations of plant distress were made by field staff during the tissue sampling event.

Table 8: Evaluation of Uncertainty in the Ecological Risk Assessment

Assumption	Uncertainty	Under / Overestimate of Risk	Rationale
White-tailed deer is an appropriate surrogate receptor for Mule deer.	Low	Neutral	White-tailed deer was used as a surrogate receptor (herbivorous mammal) in the ERA as standardized receptor characteristics (e.g., body weight, food ingestion rate [FIR]) were available from Environment Canada in their FCSAP guidance. Mule deer are abundant in the region, while White-tailed deer are less common. A literature search identified 1 paper (Alldredge et al., 1974) reporting an average body weight of 66 kg for the Mule deer, which is less than the average body weight of 75 kg for the White-tailed deer (FCSAP, 2012). The FIR for herbivorous mammals referenced in FCSAP (2012) is based on an allometric equation[1] which factors in the receptor-specific body weight. Both body weights (66 kg and 75 kg) result in the same FIR, rounded to 2 significant figures (FIR = 0.03 kg dw/ kg bw /d). The incidental soil ingestion rate is assumed to remain 2% as feeding habits (browsing) are similar between species. As such, the results for White-tailed deer are considered to be applicable to the Mule deer.

Overall, the uncertainties do not affect the conclusions of the ERA.

[1] Allometric equation by Nagy 1987 in USEPA 1993: FIR (g/day) = 0.577*Body Weight$^{0.727}$ divided by Body Weight (kg).

6.4 Conclusions

The results of the ERA are summarized below:

- The initial step of the ERA involved screening soil concentrations against soil screening criteria protective of lower-trophic-level receptors (i.e., plants and soil invertebrates) (BC CSR standards) and wildlife (CCME SQG_E). Measured concentrations of POPCs in reclaimed soils (copper, selenium, sodium) exceeded soil screening criteria and in some cases were also elevated compared to reference soil concentrations.
  - Copper was retained as a POPC for further evaluation in the ERA for both plants and wildlife as concentrations within reclaimed soil exceeded ecological screening criteria across the Mine Site and exceeded reference concentrations.
  - Selenium concentrations in reclaimed soils were marginally elevated at 2 of 18 stations, which were spatially separated across the Mine Site. The average selenium concentration met the CSR screening criterion for TSIP and none of the reclaimed soils exceeded the CCME SQG_E. Given the isolated exceedances, impacts to plant communities are not expected and, on this basis, selenium was not retained as a POPC for further evaluation in the ERA.
  - Sodium soil concentrations at 14 of 18 stations were elevated compared to the CSR screening criterion for TSIP. Adverse effects from the salinity levels at the Mine Site were not expected and therefore sodium was not retained as a POPC for further evaluation in the ERA.
- Copper is an essential element in both plants and animals. Detrimental effects can be observed in plants and animals with copper deficiency as well as with excess copper. No signs of plant distress were observed by field staff during the tissue sampling event. Measured tissue concentrations of copper in reclaimed area grass, forbs, berries, and leaves were generally within the “normal” range of concentrations required to meet the nutritional needs of a plant (4-20 mg/kg dry weight reported by Hochmuth et al. 2015). Plant tissue concentrations were generally lower across the southern sites compared to the northern sites, where a select number of samples at northern sites were reported at concentrations greater than 20 mg/kg dry weight. Hochmuth et al. (2015) reports that copper is not highly mobile in plants, but some copper can be translocated from older to newer leaves. Fresh growth was targeted during tissue sampling, representing what would be considered areas of highest copper within the tissues. The isolated, elevated concentrations of copper within plant tissues at northern sites are not expected to impact the viability of the plant community as a whole.
- With respect to potential risk to birds and mammals as a result of soil and food (plant) consumption, the ERA concluded that there is negligible risk to plant-eating wildlife based on the conservative food chain assessment, which considered that ROCs feed exclusively from the Mine Site in the area of maximum copper concentrations. HQs for ruffed grouse, meadow vole, and deer were all equal to or below 1.

7.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or require additional information, please contact the undersigned by phone (604-296-4200) or by email (lee.nikl@wsp.com).

Signature Page

Golder Associates Ltd.



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Mine Reclamation and Closure Consultant



Samantha Lundquist, B.Sc., BIT
Environmental Scientist

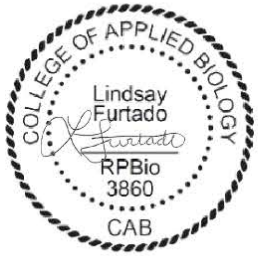

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/083-r-42214-ecological risk assessment/rev0/22514095-083-r-rev0-42214-ecological risk assessment 05dec_22.docx

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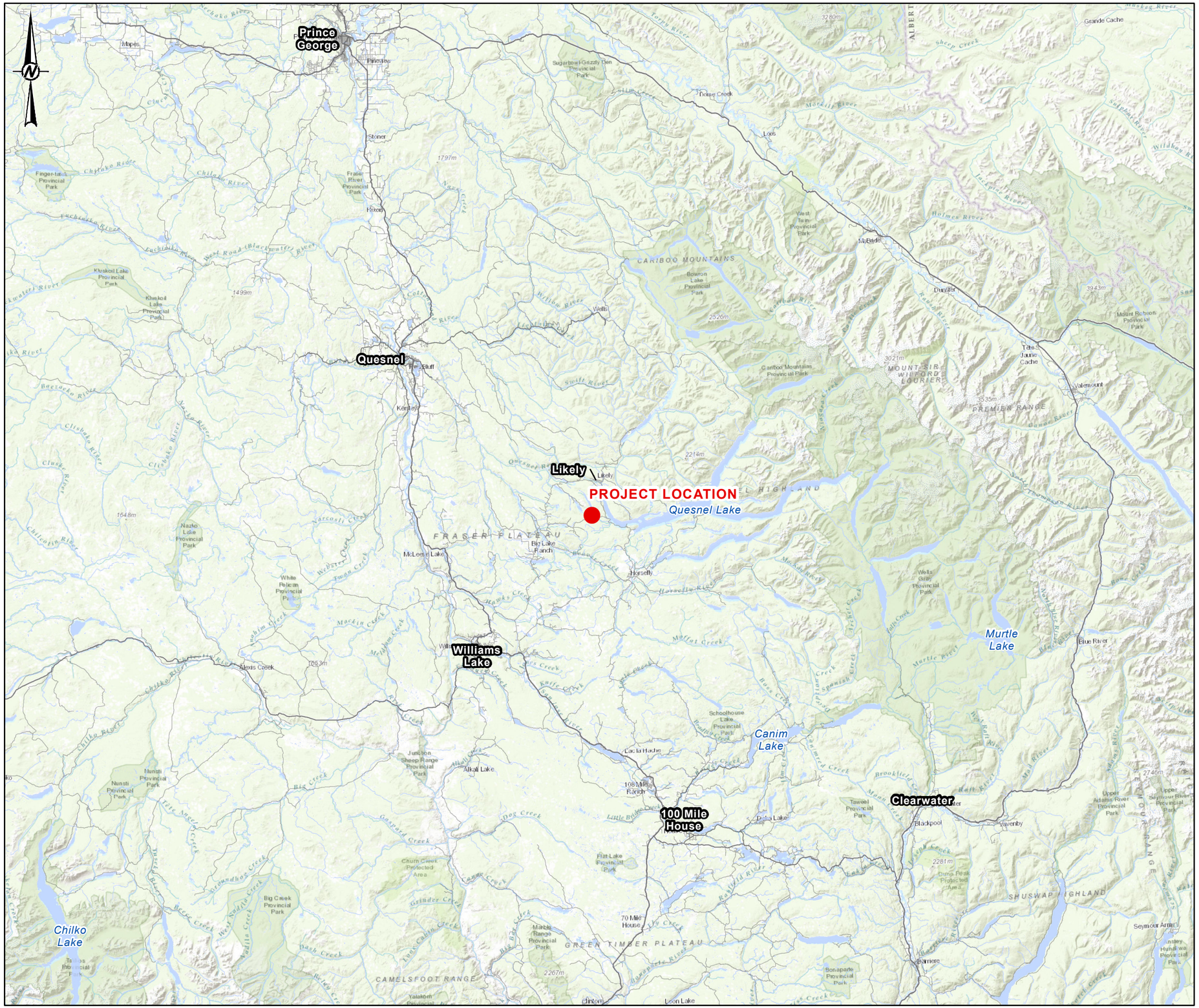

REFERENCES

1. INSET MAP DATA OBTAINED FROM GEOBASE®.
2. BASEMAP OBTAINED FROM ESRI. USED UNDER LICENCE, ALL RIGHTS RESERVED.
3. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM IHS INC.
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
MOUNT POLLEY ECOLOGICAL RISK ASSESSMENT

TITLE
LOCATION OF MOUNT POLLEY MINE

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-15
DESIGNED	JH
PREPARED	CD
REVIEWED	JMO
APPROVED	PC

PROJECT NO.	PHASE	REV.	FIGURE
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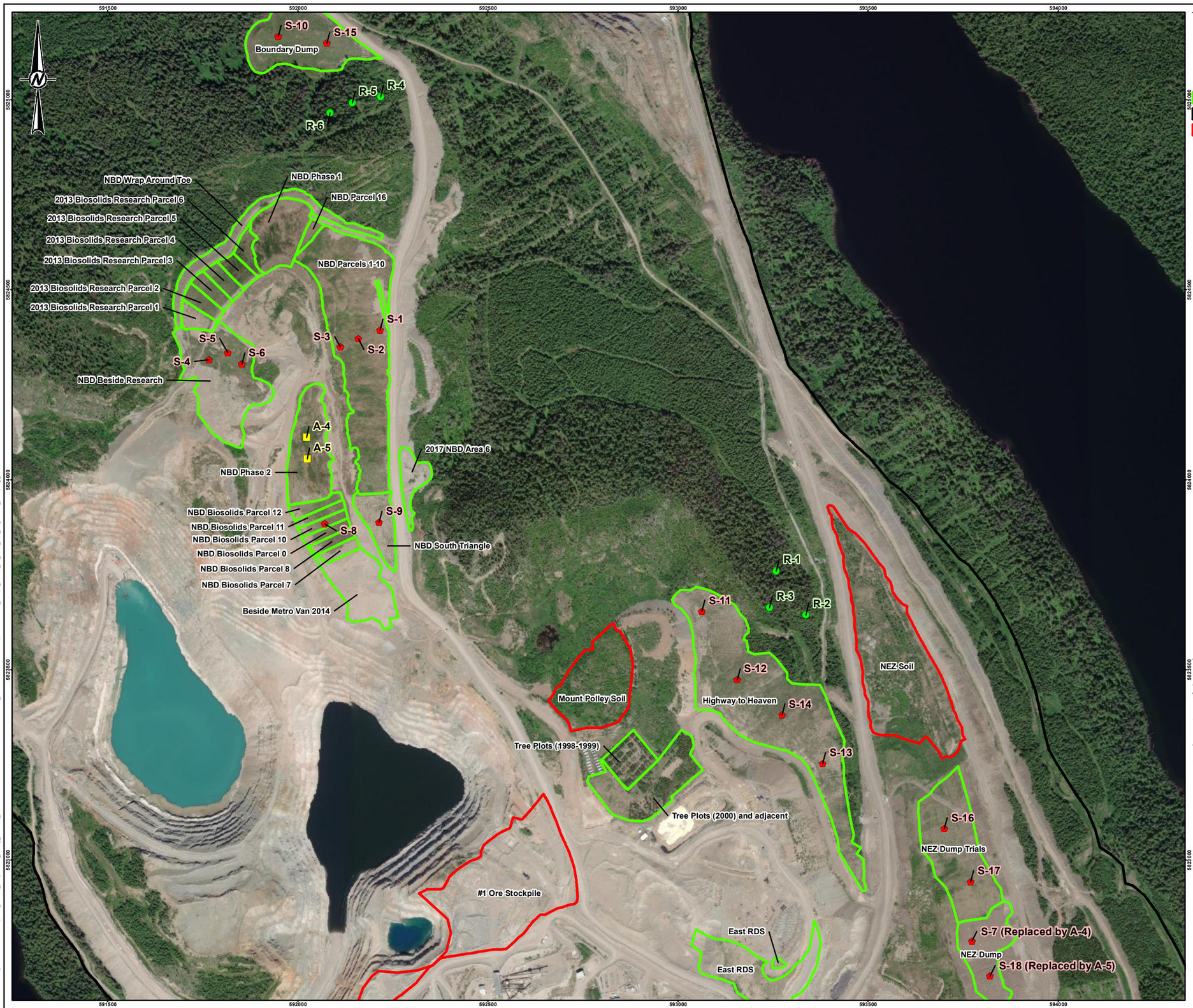

LEGEND

LOCATION IDs

- ALTERNATE LOCATION
- REFERENCE LOCATION
- SAMPLE LOCATION
- RECLAMATION AREA
- PERMIT BOUNDARY
- STOCKPILE

DRAFT

0 200 400

1:10,000 METRES

NOTE(S)

1. STATIONS S-7 AND S-18 WERE NOT FOUND TO BE VIABLE. ALTERNATE STATIONS A-4 AND A-5 WERE SAMPLED INSTEAD.

REFERENCE(S)

1. SITE FACILITIES OBTAINED FROM MOUNT POLLEY MINING CORPORATION.
2. IMAGERY COPYRIGHT © 20220829 ESRI AND ITS LICENSORS. SOURCE: MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.
DATUM: NAD 83 PROJECTION: UTM ZONE 10

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT
MOUNT POLLEY ECOLOGICAL RISK ASSESSMENT

TITLE
ERA SOIL AND VEGETATION SAMPLING LOCATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-11-15
DESIGNED	MP
PREPARED	CDB
REVIEWED	
APPROVED	

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Notes: A) Boundary Dump (S-10) facing east, B) Beside Research Plots (S-6) facing north, C) Bell Dump Parcels 1-10 (S-1) facing west, D) South Triangle (S-9) facing north, E) Highway to Heaven (S-13) facing east, F) NEZ Dump (S-17) facing east

Figure 3: Reclamation Areas (September 2022)

Conceptual Site Model for Ecological Receptors

FIGURE 4

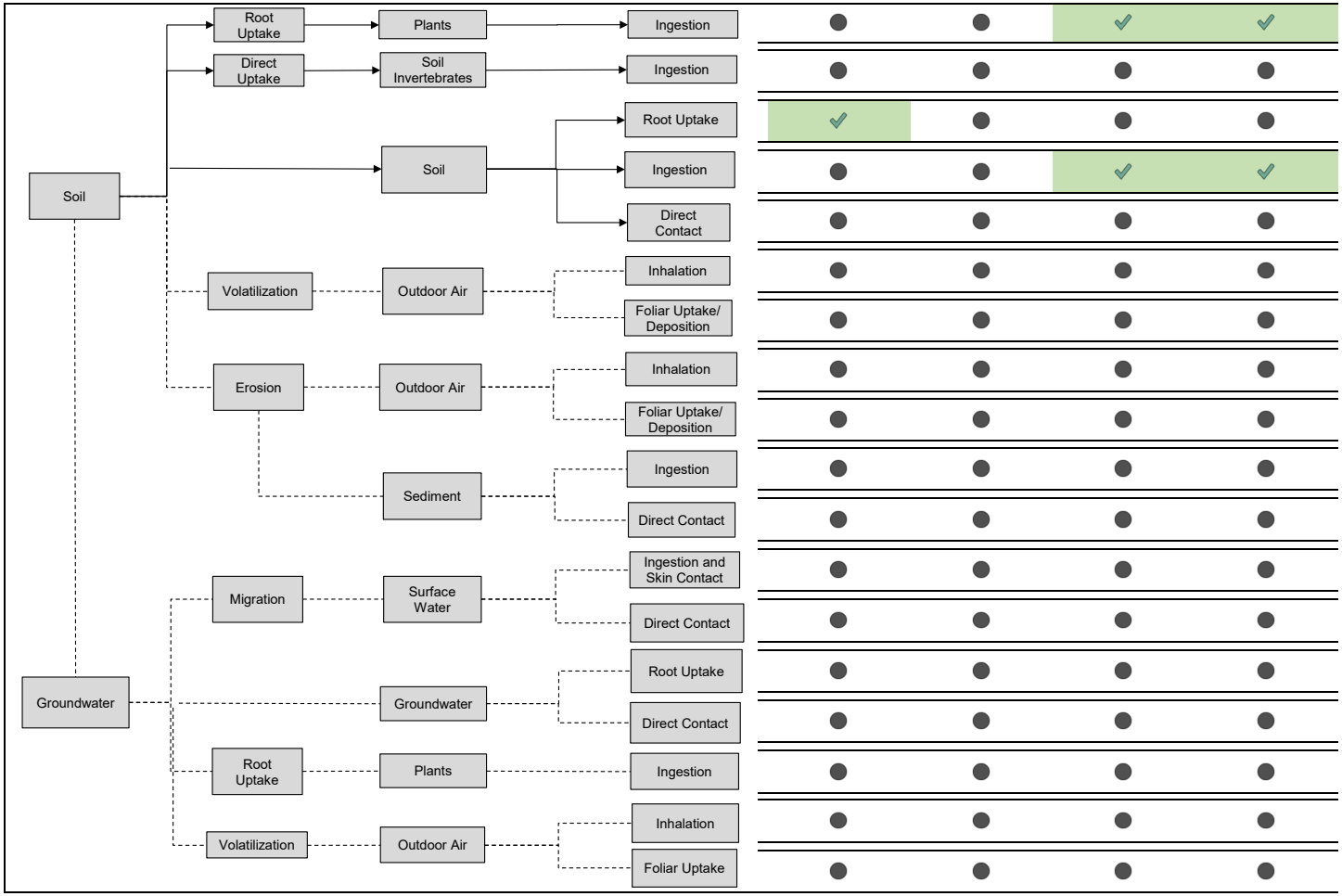

Solid lines indicate pathways that are considered to be complete or operative.
Dotted lines indicate pathways that are considered to be incomplete or inoperative.
Exposure pathway is evaluated in the Ecological Risk Assessment
Exposure pathway is not evaluated in the Ecological Risk Assessment

Date: November 2022

Project Number: 22514095

WSP GOLDER

APPENDIX A

Sampling and Analysis Plan

Ecological Risk Assessment - Sampling and Analysis Plan

FOR FIELD SAMPLING

INTRODUCTION

This Sampling and Analysis Plan (SAP) was developed to guide the field program for the Ecological Risk Assessment (ERA) at Mount Polley Mining Corporation's (MPMC) Mount Polley Mine (Mount Polley). The ERA is required under Mount Polley's *Mines Act* M-200 permit condition D.15. The ERA is limited to the assessment of the potential residual risk to ecological receptors, within the reclaimed areas of Mount Polley.

Sampling Purpose and Objectives

While mining operations are ongoing at Mount Polley, progressive reclamation of on-site areas has begun as part of closure planning. For example, some reclamation research projects involve testing the efficacy of different soil prescriptions (e.g., placement of soil and soil amendments over waste rock and tailings) to achieve reclamation and closure objectives.

The objective of the sampling program is to collect representative soil and terrestrial vegetation samples from within the reclaimed areas of the mine as well as reference locations (e.g., representative undisturbed sites) for inclusion in this first tier of ERA. This is an early-stage risk assessment that is intended to provide data to facilitate consultation with First Nations and government on the role, purpose and focus of the subsequent tier of ecological risk assessment

SITE AND AREA DESCRIPTION

Sampling locations were selected to represent reclaimed areas (including reclamation research plots) as well as representative reference locations (e.g., undisturbed sites). Sample sites in reclamation areas were selected to represent the different reclamation and soil amendment approaches used in progressive reclamation. To avoid site selection bias in the field, sample locations were pre-selected. **Figure 1** identifies the proposed sampling locations. Eighteen (18) sites within Mount Polley's *Mines Act* permit boundary (e.g., reclaimed sites) and six (6) undisturbed reference sites have been proposed for the September 2022 field event. Nine (9) alternate sites are also proposed should field conditions dictate that sampling at the original location is not feasible.

As shown on **Figure 1**, the reclamation units selected for sampling are the:

- Boundary Dump
- Bell Dump Parcels 1-10
- Area beside Research Plots
- Biosolids Parcel
- South Triangle
- Highway to Heaven
- NEZ Dump

GPS coordinates for these sampling locations are provided in **Table 1**.

FOR FIELD SAMPLING

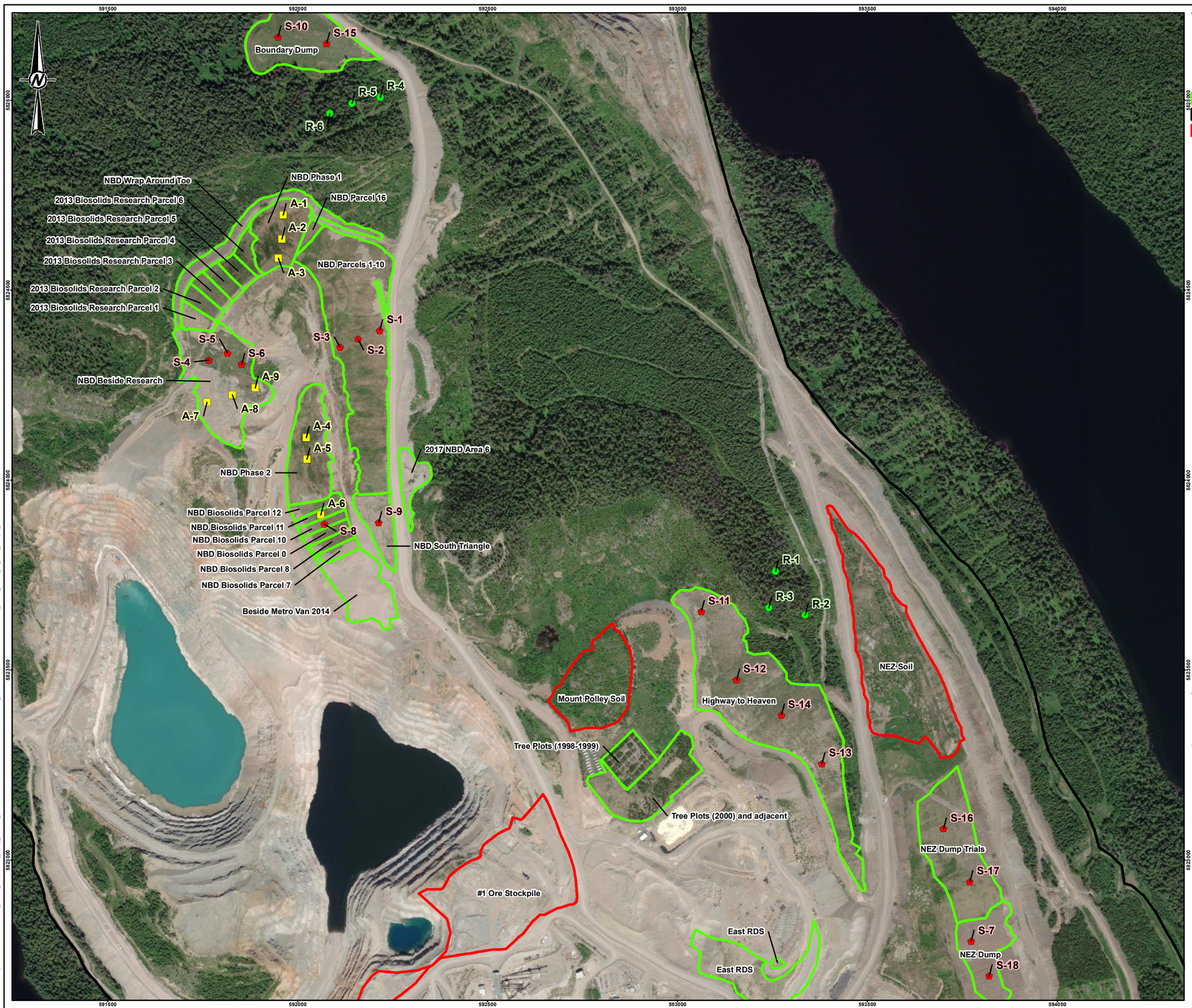

LEGEND

SOIL AND VEGETATION SAMPLE LOCATION

- ALTERNATE LOCATION
- REFERENCE LOCATION
- SAMPLE LOCATION
- RECLAMATION AREA
- PERMIT BOUNDARY
- STOCKPILE

DRAFT

0 200 400

1:10,000 METRES

REFERENCE(S)

1. SITE FACILITIES OBTAINED FROM MOUNT POLLEY MINING CORPORATION.
2. IMAGERY COPYRIGHT © 20220829 ESRI AND ITS LICENSORS. SOURCE: MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.

DATUM: NAD 83 PROJECTION: UTM ZONE 10

CLIENT

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS

PROJECT

MOUNT POLLEY ENVIRONMENTAL RISK ASSESSMENT

TITLE

ERA SOIL AND VEGETATION SAMPLE LOCATIONS

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-08-31
DESIGNED	JL
PREPARED	CDB
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
22514095	42200/42213	A	1

PATH: Y:\burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\22514095\42200\42213\Doc zzz\2_PRODUCTION\MXD\Field\22514095_42200_42213_01_ERA_Sample_Locations.mxd PRINTED ON: 2022-08-31 AT: 10:28:02 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Table 1 – GPS Coordinates for ERA Soil and Vegetation Sample Locations

Station ID	Description	EASTING	NORTHING
R-1	Reference Location	593258.3542	5823759.916
R-2	Reference Location	593336.474	5823644.148
R-3	Reference Location	593240.5624	5823663.991
R-4	Reference Location	592217.328	5825007.798
R-5	Reference Location	592142.7924	5824991.718
R-6	Reference Location	592084.8616	5824964.974
S-1	On-site Sample Location	592216.0937	5824393.846
S-10	On-site Sample Location	591948.1642	5825166.439
S-11	On-site Sample Location	593062.762	5823654.334
S-12	On-site Sample Location	593155.3664	5823474.417
S-13	On-site Sample Location	593380.2627	5823253.489
S-14	On-site Sample Location	593273.1062	5823381.813
S-15	On-site Sample Location	592076.3934	5825148.968
S-16	On-site Sample Location	593700.2768	5823081.907
S-17	On-site Sample Location	593769.7301	5822943
S-18	On-site Sample Location	593820.6625	5822694.953
S-2	On-site Sample Location	592159.2081	5824371.356
S-3	On-site Sample Location	592111.583	5824350.19
S-4	On-site Sample Location	591766.3011	5824315.794
S-5	On-site Sample Location	591815.2492	5824334.315
S-6	On-site Sample Location	591852.2909	5824305.21
S-7	On-site Sample Location	593773.1697	5822786.499
S-8	On-site Sample Location	592070.5725	5823884.522
S-9	On-site Sample Location	592213.4478	5823888.491
A-1	Alternate Location	591962.0932	5824698.117
A-2	Alternate Location	591958.1244	5824634.617
A-3	Alternate Location	591948.864	5824584.346
A-4	Alternate Location	592022.9474	5824112.064
A-5	Alternate Location	592024.2704	5824055.179
A-6	Alternate Location	592061.3121	5823908.334
A-7	Alternate Location	591761.0094	5824204.668
A-8	Alternate Location	591828.4783	5824224.512
A-9	Alternate Location	591888.0097	5824243.033

Notes:
UTM Zone 10, NAD 83
Station ID codes: A – Alternate; R – Reference; S – On-Site
Alternate locations are provided in case field conditions dictate that sampling at the original location is not feasible.

FIELD SAMPLING

Sampling Rationale

The September 2022 sampling event serves as a first step in the ERA process. Sampling locations were selected based on prior knowledge of the Site and reclamation areas. It has been proposed that initial data (e.g., soil, vegetation) be collected during the 2022 field season and then data will be compiled, reviewed, and discussed during consultation with the Ministry of Environment and Climate Change Strategy (ENV), Williams Lake First Nation, and Xatśūll First Nation in the fall of 2022. Should there be gaps that are identified during the consultation step, these gaps could be filled in subsequent tiers of risk assessment, aided by the information obtained in this sample collection trip. .

Paired soil and vegetation samples will be collected. Portions of vegetation edible to wildlife will be targeted during field activities. Analysis of edible vegetation will improve the assessment of the potential risk to ecological receptors from ingestion of terrestrial vegetation.

WSP Golder will collect above ground biomass from each of the main vegetative lifeforms (e.g., grass, forb, tree, and shrub [e.g., berry]), based on availability at each sampling location. **The same plant species for each lifeform will be targeted across all sampling locations to provide consistency in the data set. If the same plant species is not available at all locations, the same lifeform (i.e., grass in general) will be collected.** As described above, paired soil and vegetation samples will be collected to support the ERA and as such, it is anticipated that at each sampling location, one composite soil sample and four plant samples (e.g., one grass, one forb, one shrub [e.g., berry], and one tree) will be sampled, based on availability.

FIELD METHODS

Soil samples will be collected in-line with the British Columbia Field Sampling Manual – Part D1 (Soils). Dead leaf litter and organic matter on the top of the mineral soil should be removed and excluded from the mineral soil sample. Each soil sample will be a composite of three aliquots of soil collected from the base of the sampled plant, within a 5 metre (m) radius of the area where plants were collected. Sample aliquots of equal volume will be collected from the top 20 centimetres (cm) of soil using a clean hand shovel or trowel to provide consistency across samples and to represent plant rooting depth. The soil will then be homogenized in a clean stainless-steel bowl prior to being transferred to 2 clean, laboratory-supplied 125-milliliter (mL), glass sample jars. One duplicate sample for every 10 samples will be targeted for collection. Tissue duplicates at the same location as soil duplicates will be collected.

Field equipment (ie. hand shovel or trowel and stainless-steel bowl) will be decontaminated between sampling stations to prevent cross-contamination using a three step rinse: first cleaning with water and liquinox detergent, followed by potable water rinse, and then a deionized water rinse.

Samples will be labelled and kept cool using ice packs in a cooler after collection. The soil samples will be transferred to a fridge at the end of each sampling day, keeping cool until submitted for analysis to the laboratory in a single batch at the conclusion of the field program.

Photographs will be taken at each sampling location to document the physical characteristics and habitat present. Additional photographs will be taken to record field sampling methodology (e.g., soil sampling, vegetation sampling). All soil and vegetation samples should be photographed (close-up) showing the corresponding sample ID.

Samples should be labelled as follows: YEAR-LOCATION-MEDIA-NUMBER (S for Soil, B for Berries, G for Grass, LV for Leaves, N for Needles, F for Forb) – add “D” for duplicate if applicable. Make sure the co-located soil and tissue samples have the same number.

FOR FIELD SAMPLING

Example: **22-S14-B-01 (berry sample at S-14), 22-S14-L-01 (leaf sample at S-14)**
22-S14-B-01D (duplicate of berry sample -01)
22-S14-S-01 (co-located soil sample at S-14)

Samples of the edible portions of plants will be collected by WSP Golder personnel. As described above, the focus of plant tissue sampling is on reclaimed areas to provide information about plants growing in soils that are representative of closure conditions.

Sampling methods for vegetation will consist of the following steps:

- Tissue will be hand-picked by field staff using nitrile gloves (new at each sampling location) from an area of 25 square metres (m^2) or less. Vegetation that appears to have been browsed will be preferentially sampled. For each vegetative lifeform, plant tissue should be composited from multiple plants of the same species within the area if sufficient volume cannot be collected from one plant. The laboratory requires a minimum of 5 grams (g) of tissue (fresh weight) after sample homogenization for analysis (more is better). Weigh all tissue samples with a spring scale and record weight of sample.
- Plant samples will be rinsed using deionized (DI) water and blotted dry before being transferred to clean Ziploc bags and labelled as specified above. Samples will be placed in a cooler containing ice during shipping. While the sampling program is underway, the ice packs should be replaced twice daily, cycling partly melted ice packs and fresh ice packs from the freezer in the environmental trailer at the mine site
- Handpick berries. If necessary, use clean scissors to remove the fruit. Do not collect unhealthy berries if possible. Bag each berry type separately, with separate sample number if more than one type of berry is collected from a single location. Place berry sample in a labeled Ziploc bag. Squeeze air out of bag and seal closed. Place sample in cooler on ice packs.
- Grass and leaves consumed by wildlife will be targeted. For grass and leaf samples, cut leaves and grass with scissors and place in a labeled Ziploc bag. Squeeze air out of bag and seal closed. Place sample in cooler on ice packs.
- Signs of plant distress (e.g., spotting, discolouration) will be noted by photograph and in the field logs.
- For plant duplicates, collect 2 samples from the same plant (preferred) or from the plant next to the sample already collected (should be the same species). Follow the same collection instructions two separate times (i.e., bag and store one sample, the collect the next sample using the same process). Clearly label samples and note where the duplicate sampling was conducted.

Soil and plant tissue samples will be submitted to ALS Environmental (Burnaby, BC; ALS) for analysis of nutrient, physical and chemical parameters (soil only), metals and moisture content. For quality assurance and quality control (QA/QC), field duplicates will be collected for 10% of the plant and soil samples. As Mount Polley has a standing contractual relationship with ALS, be sure to indicate on COC that Mount Polley should be billed directly for the analyses [Invoice: Gabriel Holmes (MPMC); PO# 5590008044]. Coolers will be delivered to ALS Burnaby upon your return. Data is to be sent to Melissa Paliouras (melissa.paliouras@wsp.com) and Samantha Lundquist (samantha.lundquist@wsp.com).

FOR FIELD SAMPLING

Laboratory and Contact Information:

ALS Laboratory
Amber Springer (WSP Golder Client Rep)
100-8081 Lougheed Hwy
Burnaby, BC, V5A 1W9
Phone: (604) 253-4188 Mobile: (604) 312-4738
Email: Amber.Springer@ALSGlobal.com

Table 2 and **Table 3** provide information about the vegetation incorporated into the reclamation prescriptions at Mount Polley. The following species will be targeted for sampling:

- Grass – e.g., Rocky Mountain fescue (*Festuca saximontana*), red fescue (*Festuca rubra*), or other native grasses. Above ground biomass will be collected. Select species based on initial site reconnaissance and availability across sampling locations.
- Forb – e.g., Fireweed (*Chamerion angustifolium*), yarrow (*Achilles millefolium*), lupine (*Lupinus sp.*), or other native forbes. Young leaves and flowering shoots will be collected. Select species based on initial site reconnaissance and availability across sampling locations.
- Fruiting Shrub – e.g., Raspberry (*Rubus occidentalis),* saskatoon *(Amelanchier alnifolia),* soopolallie/soapberry/buffaloberry *(Shepherdia canadensis).* Berries will be collected. Select species based on initial site reconnaissance and availability across sampling locations.
- Tree – e.g., Paper birch (*Betula papyrifera*), Sitka alder (*Alnus viridis*), willow (*Salix sp.*), Lodgepole pine (*Pinus contorta*). Leaves (or needles from conifers) will be collected. Select species based on initial site reconnaissance and availability across sampling locations. Species in active growth should be preferentially sampled.

Table 2. Mount Polley Native Species Grasses and Forbes Seed Mix [Source: MPMC, 2017]

Species	% (by weight)	% (by seed count)
Mountain brome	20	8.61
Native red rescue	10	17.81
Rocky mountain fescue[1]	15	28.94
Bluebunch wheatgrass[1]	25	10.76
Blue wildrye[1]	25	3.34
Junegrass[1]	3	17.81
Ticklegrass	1	11.87
Big leaf lupine	0.97	0.07
Fireweed	0.03	0.81

Notes: 1) Forage species

FIELD SAMPLING

Table 3. Traditionally Important Species in Reclamation Prescriptions [Source: MPMC, 2017]

Species Common Name	Species Scientific Name	MPMC Comment
Lodgepole pine	*Pinus contorta*	Incorporated into revegetation prescriptions.
Western redcedar	*Thuja plicata*	A later successional species – underplanting of reclamation sites may be required if natural ingress is not observed.
Balsam fir	*Abies balsamea*	This species is only present east of the Rocky Mountains.
Paper birch	*Betula papyrifera*	Incorporated into revegetation prescriptions. Moderate performance to date.
Chamomile	*Matricaria* sp.	Not native to the area (species introduced and is only found to naturally occur in southwestern BC).
Black huckleberry	*Vaccinium membranaceum*	Difficult to establish, but a trial was planted in 2014. Poor performance to date.
Blueberry	*Vaccinium myrtilloides*	Difficult to establish, consider based on outcome of huckleberry trial.
Highbush cranberry	*Viburnum edule*	Not documented in the baseline vegetation survey – consider in future reclamation of wet areas.
Raspberry	*Rubus idaeus*	Strong natural ingress observed on reclamation sites.
Saskatoon	*Amelanchier alnifolia*	Incorporated into revegetation prescriptions. Moderate performance to date.
Red elderberry	*Sambucus racemosa*	Natural ingress into reclamation areas observed; incorporation into revegetation prescriptions being considered.
Wild strawberry	*Fragaria virginiana*	Incorporation into revegetation prescriptions to be considered if a seed or plant source is found.
Soapberry	*Shepherdia canadensis*	A trial plot was planted in 2014. Has performed well in trials to date.
Cow parsnip	*Heracleum lanatum*	Expected to naturally ingress at late stages of natural succession in moist areas.
Common juniper	*Juniperus communis*	Not native to the area; however, a trial plot was planted in 2015 on a hot dry reclamation site. Has performed well in trials to date.
Kinnikinnick	*Arctostaphylos uva-ursi*	Not documented in the baseline vegetation survey – a trial is being considered for a dry site if a seed or plant source is found.
Falsebox	*Paxistima myrsinites*	Expected to naturally ingress at late stages of natural succession in moist areas.
Labrador tea	*Ledum groenlandicum*	Consider in future reclamation of non-forested organic site (wet areas).
Devil's club	*Oplopanax horridus*	Expected to naturally ingress at late stages of natural succession in established conifer forests.
Yarrow	*Achilles millefolium*	Included in the forbe mixture used in Metro Vancouver trial plots.
Tiger lily	*Lilum columbianum*	Not documented in the baseline vegetation survey – lake margins reported to grow this species in the traditional use study will not be disturbed by the Mine.
Wild potatoes[a]	-	Not documented in the baseline vegetation survey.
Mosses	Moss spp.	Expected to naturally ingress at late stages of natural succession in moist areas.
Fiddlehead ferns	Fern spp.	Expected to naturally ingress at late stages of natural succession in moist areas.

[a] Additional consultation regarding this species is required.

ANALYTICAL METHODS

The M-200 permit focuses the ERA on metals; however, there are toxicity modifying factors (e.g., soil pH, total organic carbon) that are relevant to the question of ecological risk. **Table 2** presents the soil nutrient, chemical, and physical parameters to be analyzed for the ERA.

Table 1: Soil Nutrient, Chemical, and Physical Parameters to be Analyzed for the ERA

Soil Nutrient and Physical Parameters		
Total Organic Matter	Total Kjeldahl Nitrogen (N)	Available Sulphate (SO_4^-)
Total Organic Carbon (C)	Available Phosphorus (P)	Particle Size Analysis
Total Nitrogen (N)	Available Potassium (K)	Moisture Content
Soil Chemical Parameters		
pH ($CaCl_2$)	Soluble Chloride (Cl)	Soluble Sulphate (SO_4^-)
Electrical Conductivity	Soluble Calcium (Ca)	Theoretical Gypsum Requirement
Sodium Adsorption Ratio	Soluble Magnesium (Mg)	Total Metals
Soluble Sodium (Na)	Soluble Potassium (K)	-

Plant tissue samples will be analyzed for total metals and moisture content. Analytical results will be provided with the ERA.

Quality Assurance/Quality Control

Results of analyses for field chemistry duplicates (soil and vegetation) will be provided with the ERA. WSP Golder will assess representativeness and suitability of results based on the data quality objectives (DQOs) outlined below.

All deviations from the SAP due to field conditions, or any other reason, will be documented in field logs and discussed in the ERA.

Field Quality Assurance/Quality Control

Soil samples will be collected using stainless steel tools. Plant samples will be hand-picked by field staff wearing nitrile gloves and placed in labelled collection bags. Re-usable equipment (e.g., mixing bowls, shovels, and trowels) will be decontaminated between samples. Care will be taken to minimize the introduction of foreign material (e.g., rocks) into the samples or loss of plant material of interest during sample collection. In addition to photographs, field notes will be maintained to document the field sampling program.

Each sample will be labelled with a unique identifier and the date sampled. Soil samples will be refrigerated, and plant samples will be frozen after collection for storage before submission for chemical analysis. Samples will be delivered to the laboratory under chain-of-custody at the conclusion of the field event; chain-of-custody forms will be updated as samples are collected and will be checked to verify the information recorded before samples are submitted to the laboratory for chemical analysis.

FOR FIELD SAMPLING

It is expected that field duplicates for soil and plant tissue will be collected at a rate of 10% of total (primary) samples. Plant tissue duplicate samples will be selected to represent different species, based on availability at each sampling location.

Sample duplicates are collected to provide an indication of sample variation and the reproducibility of the laboratory test methods. Duplicate samples will be collected using the same methods as described above.

The results of the duplicate samples are expressed as Relative Percent Difference (RPD). The RPD is an indicator of laboratory precision and sample heterogeneity. Lower RPD numbers indicate better precision in laboratory analysis and sample homogeneity. The formula for computing the RPD is shown below:

$$RPD = \frac{abs(sample - duplicate)}{mean} \times 100$$

Where:

- RPD is the relative percent difference.
- Abs (sample-duplicate) is the absolute value of the original sample minus the duplicate sample.
- Mean is the average between the two samples.

In accordance with *BC Field Sampling Manual* (BC ENV 2013), a DQO of an RPD value of 50% was used to identify notable differences between original and duplicate tissue samples, when values were greater than or equal to five times the method detection limit (MDL). The RPD value used for tissue is relatively high because a higher degree of natural variability is expected for this biological matrix.

An RPD value of >35% was used for soil samples as some heterogeneity is still expected. For values less than five times the MDL, a difference factor (DF) was calculated. A DF is the absolute difference between the two sample values divided by the MDL. In general, samples should have a difference factor of less than 2.0.

Laboratory Quality Assurance/Quality Control

ALS Laboratory (ALS, Burnaby BC) is an accredited laboratory (locally, Canadian Association for Laboratory Accreditation Inc. and Standard Council of Canada) and their analytical methods are based on the BC Laboratory Manual (BC ENV 2016) and United States Environmental Protection Agency and the American Public Health Association. All approved methods included quality control and performance criteria that must be achieved prior to releasing the data.

Laboratory quality control for chemistry samples includes analysis of method blanks, laboratory duplicates, spiked samples, and control samples using certified reference materials to assess precision and accuracy of chemical analyses. Laboratory data quality control reports will be reviewed upon receipt to confirm that the laboratory DQOs have been met and that the appropriate quality control information had been reported.

FOR FIELD SAMPLING

REFERENCES

BC ENV (British Columbia Ministry of Environment and Climate Change Strategy). 2013. B.C. Field Sampling Manual. Victoria BC: Ministry of Environment and Climate Change; [accessed July 2022]. https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/bc_field_sampling_manual_complete.pdf.

BC ENV. 2016. B.C. Environmental Laboratory Manual. Environmental Monitoring, Reporting & Economics Knowledge Management Branch. Approved: 25 February 2016.

Mount Polley Mining Corporation (MPMC). 2017. Mine Reclamation and Closure Plan – Update January 2017. Prepared for: The Ministry of Energy and Mines. 15 January 2017.

FOR FIELD SAMPLING

Attachment 1 – ERA Field Program Daily Report

FOR FIELD SAMPLING

MPMC September 2022 Field Event- Co-Located Soil and Vegetation for ERA	
Field Program Date:	
Daily Report Date:	
Field Crew:	
Hours:	
Activities Completed:	
Activities Planned for Tomorrow:	
Notes on Site Conditions:	
Any Cautions or Potential Hazards Identified:	
Sightings of Wildlife:	
Other Notes:	

FOR FIELD SAMPLING

Attachment 2 – Soil and Vegetation Sample Identification Form

FOR FIELD SAMPLING

Soil and Vegetation Sample Identification Form

Date: _____ Time: _____ Samplers: _____

Weather: _____

Sampling Area (circle one): Reference On-Site

Location/Site: _____

GPS Coordinates: UTM Zone _____ N: _____ E: _____

Elevation: _____

Vegetation Type	Vegetation Sample ID	Vegetation Species	Weight (g)	Photo Numbers

Vegetation Types (Sample IDs): soil (S), berries (B), grass (G), leaves (LV), forb (F)
Sample ID Naming Convention: YEAR-LOCATION-MEDIA-NUMBER

Co-located Soil Sample ID: _____

Soil Depth: _____ cm (Top 20 cm is the target)

Soil Type (circle one):

Coarse (gravel) Sand Silt

Clay Loam (sandy/silt/clay mixture) Peat/organic material

Growing Environment (terrestrial sites only):

Trees (%): _____ Shrubs (%): _____ Grass (%): _____

Moss/Lichen (%): _____Rock/Bare ground (%): _____

Duplicate Collected: Yes No

Other Observations: _____

_____

_____

FOR FIELD SAMPLING

APPENDIX B

Photo Log

1.0 REFERENCE STATIONS

1.1 R1



Photograph 1: Site R1, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (western redcedar (*Thuja plicata*) leaves) sample 22-R1-L-01, 14-Sep-2022

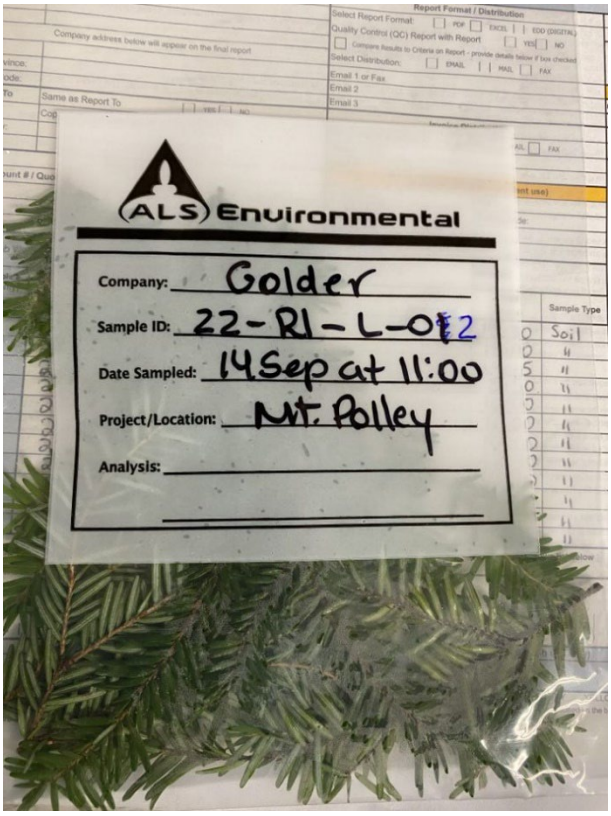

Photograph 3: Vegetation leaf tissue (western hemlock (*Tsuga heterophylla*) leaves)sample 22-R1-L-02, 14-Sep-2022

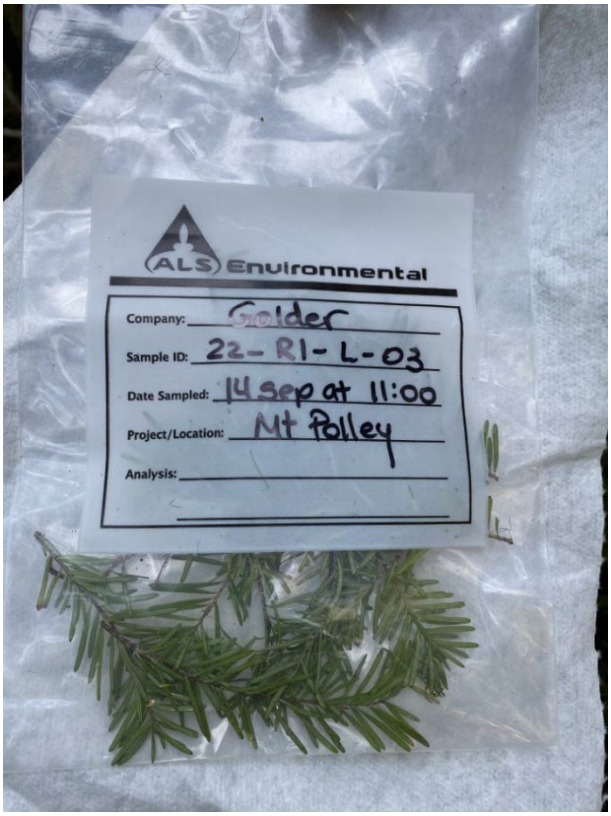

Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R1-L-03, 14-Sep-2022



Photograph 5: Vegetation forb tissue (bunchberry (*Cornus canadensis*) leaves) sample 22-R1-F-01, 14-Sep-2022

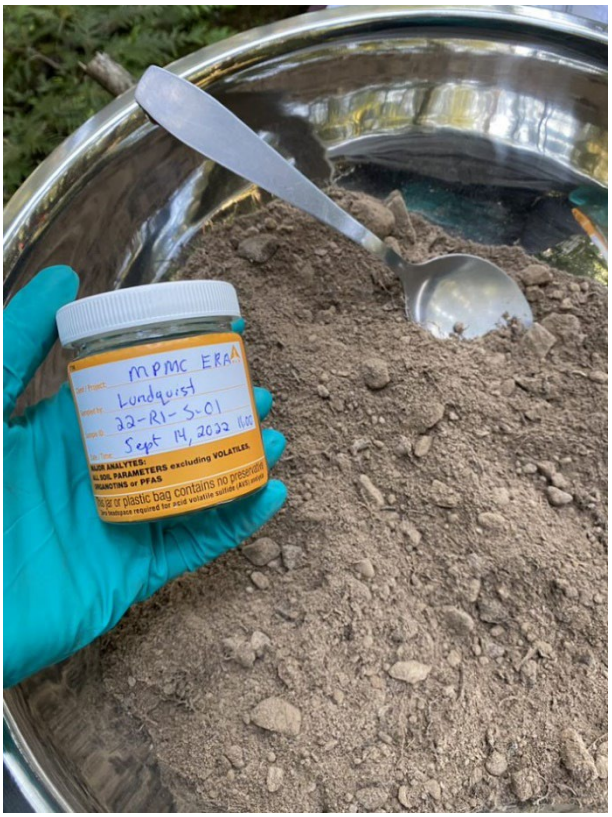

Photograph 6: Soil sample 22-R4-S-01, 14-Sep-2022

1.2 R2



Photograph 1: Site R2, 14-Sep-2022

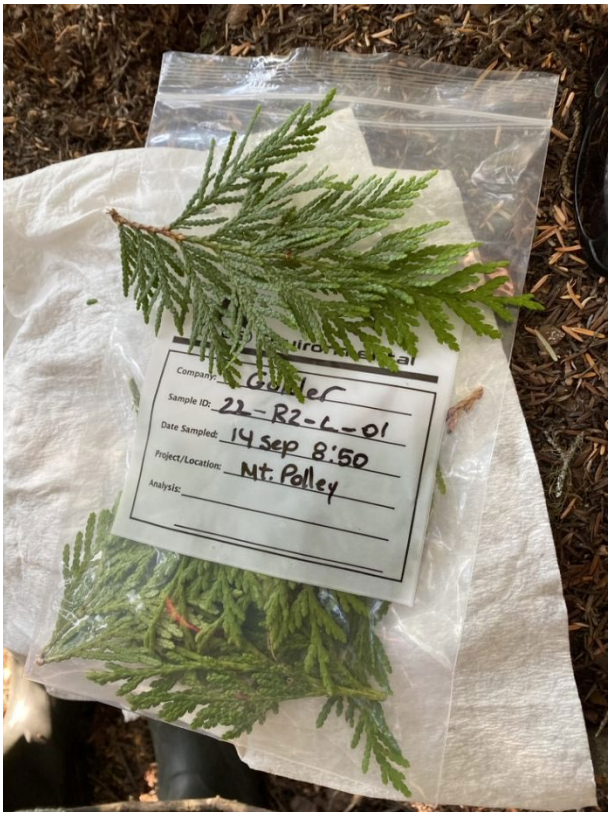

Photograph 2: Vegetation leaf tissue (western redcedar (*Thuja plicata)* leaves) sample 22-R2-L-01, 14-Sep-2022



Photograph 3: Vegetation forb tissue (rattlesnake-plantain (*Goodyera oblongifolia*) leaves)sample 22-R2-F-01, 14-Sep-2022

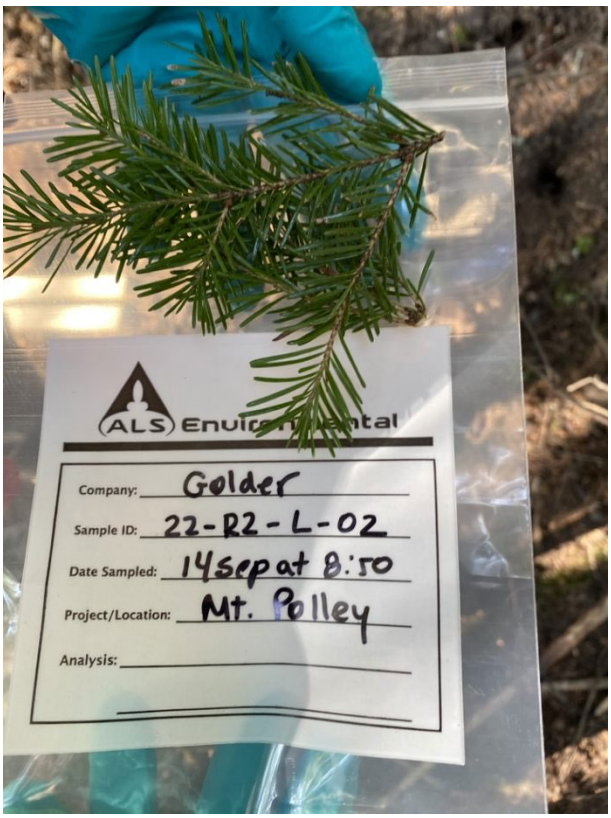

Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R2-L-02, 14-Sep-2022

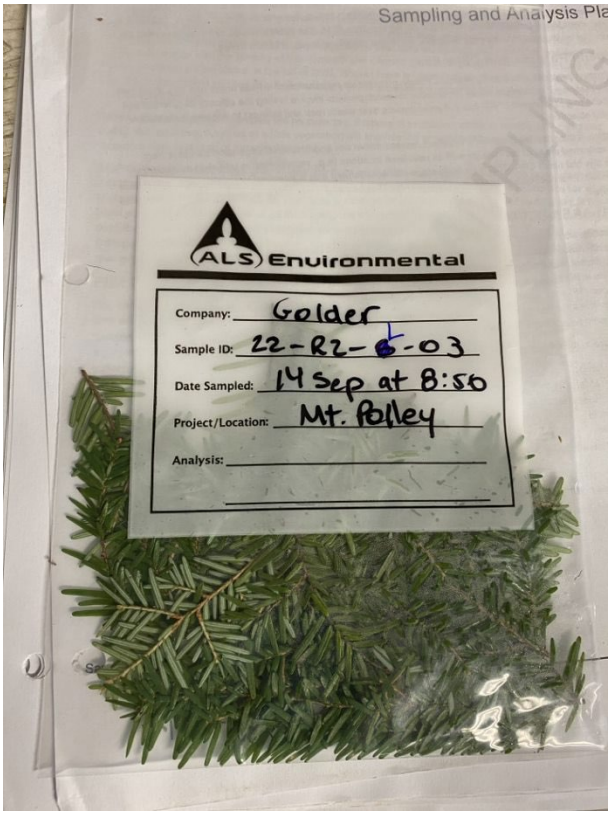

Photograph 5: Vegetation leaf tissue (western hemlock (*Tsuga heterophylla*) leaves) sample 22-R2-L-03, 14-Sep-2022



Photograph 6: Soil sample 22-R2-S-01, 14-Sep-2022

1.3 R3



Photograph 1: Site R3, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R3-L-01, 14-Sep-2022



Photograph 3: Vegetation leaf tissue (western redcedar (*Thuja plicata)* leaves) sample 22-R3-L-02, 14-Sep-2022



Photograph 4: Vegetation leaf tissue (western hemlock (*Tsuga heterophylla*) leaves) sample 22-R3-L-03, 14-Sep-2022



Photograph 5: Vegetation forb tissue (pink wintergreen (*Pyrola asarifolia* ssp. *asarifolia*) leaves)sample 22-R3-F-01, 14-Sep-2022

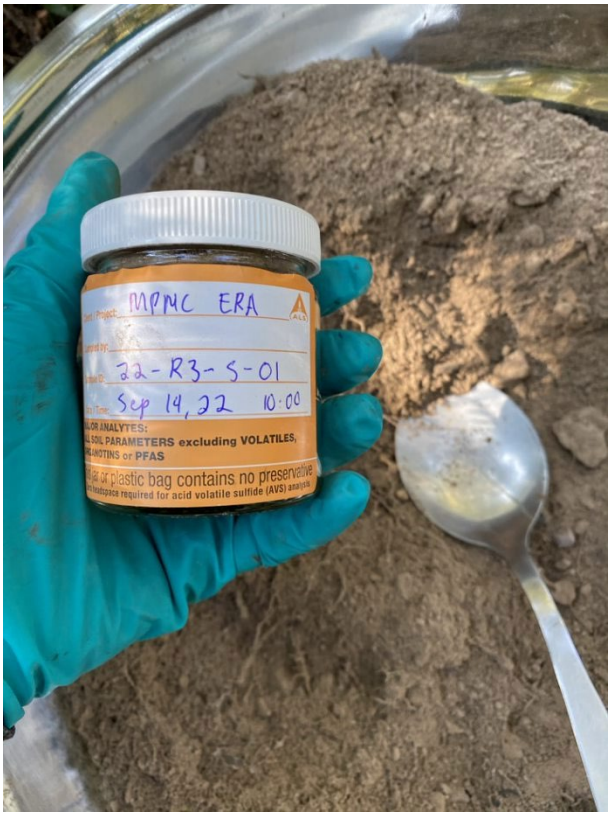

Photograph 6: Soil sample 22-R3-S-01, 14-Sep-2022



Photograph 7: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R3-L-01D, 14-Sep-2022

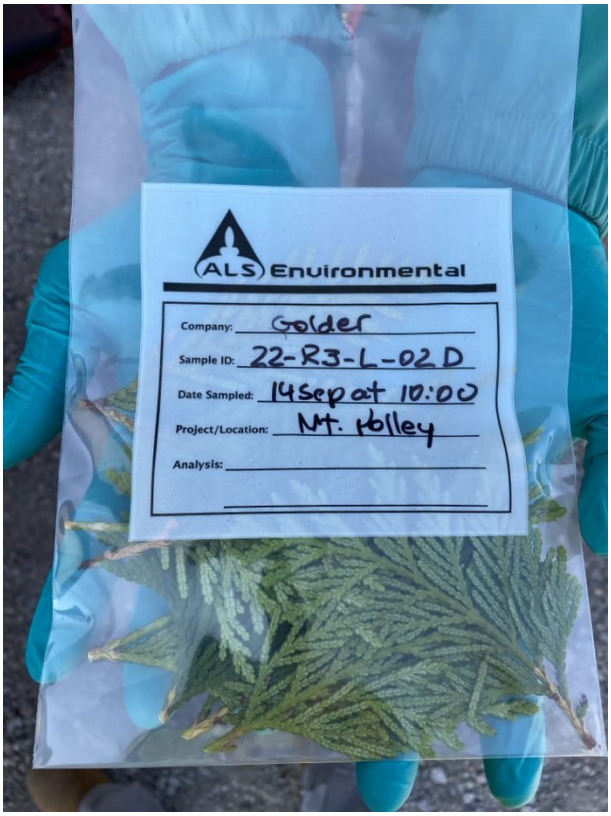

Photograph 8: Vegetation leaf tissue western redcedar (*Thuja plicata)* leaves sample 22-R3-L-02D, 14-Sep-2022

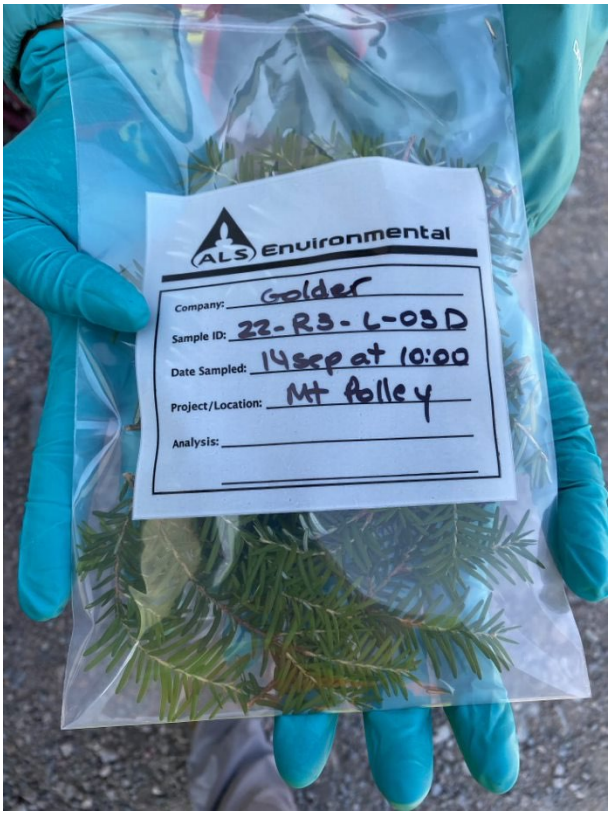

Photograph 9: Vegetation leaf tissue (western hemlock (*Tsuga heterophylla*) leaves) sample 22-R3-L-03D, 14-Sep-2022



Photograph 10: Vegetation forb tissue (pink wintergreen (*Pyrola asarifolia* ssp. *asarifolia*) leaves) sample 22-R3-F-01D, 14-Sep-2022



Photograph 11: Soil sample 22-R4-S-01D, 14-Sep-2022

1.4 R4



Photograph 1: Site R4, 15-Sep-2022



Photograph 2: Vegetation leaf tissue Sitka alder (*Alnus alnobetula ssp. Sinuate*) leaves sample 22-R4-L-01, 15-Sep-2022

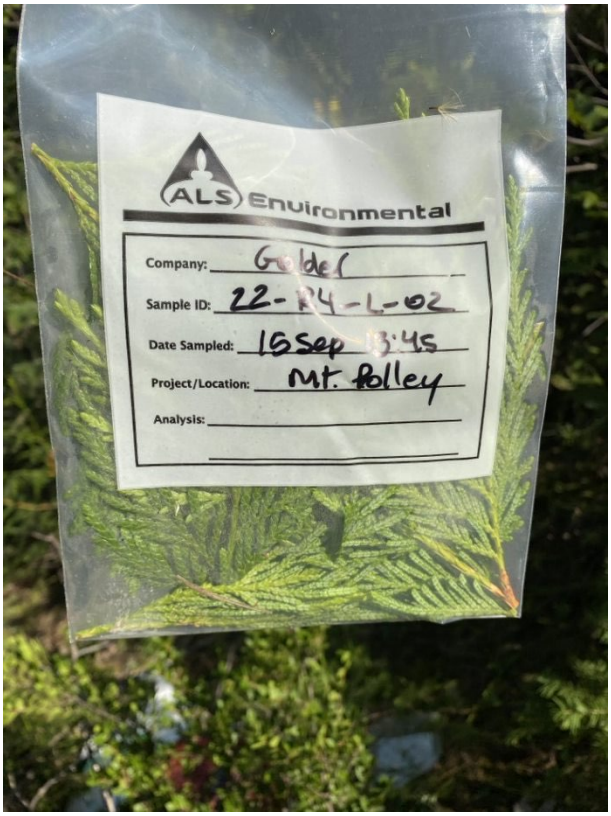

Photograph 3: Vegetation leaf tissue western redcedar (*Thuja plicata)* leaves sample 22-R4-L-02, 15-Sep-2022

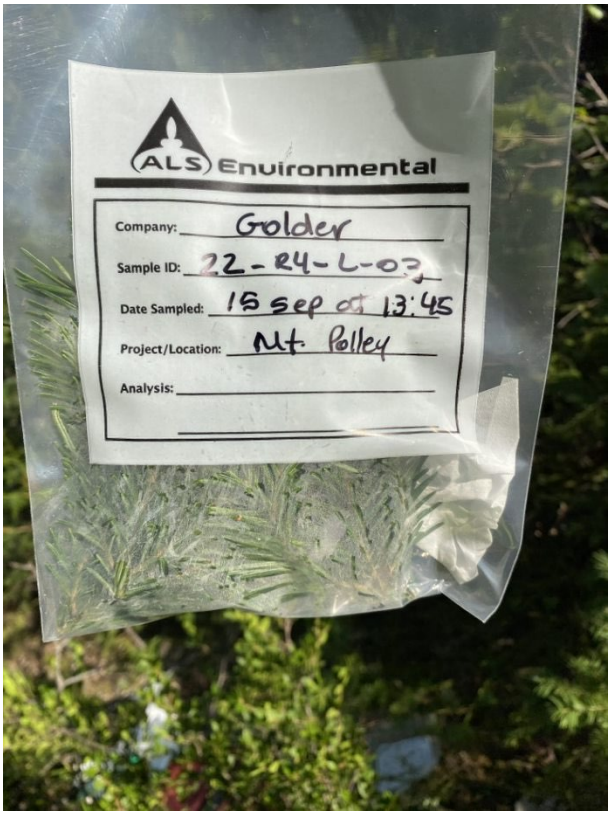

Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R4-L-03, 15-Sep-2022

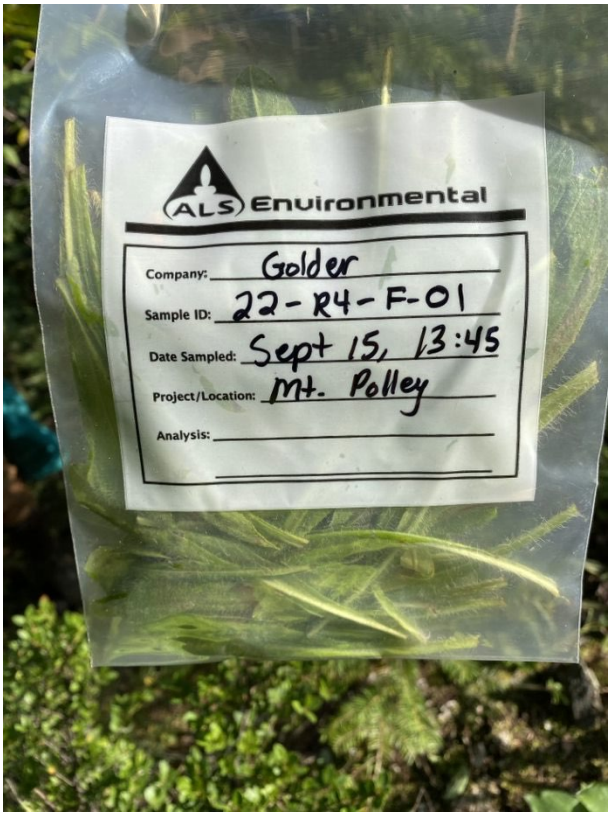

Photograph 5: Vegetation forb tissue (hawkweed (*Hieracium* sp.) leaves sample 22-R4-F-01, 15-Sep-2022

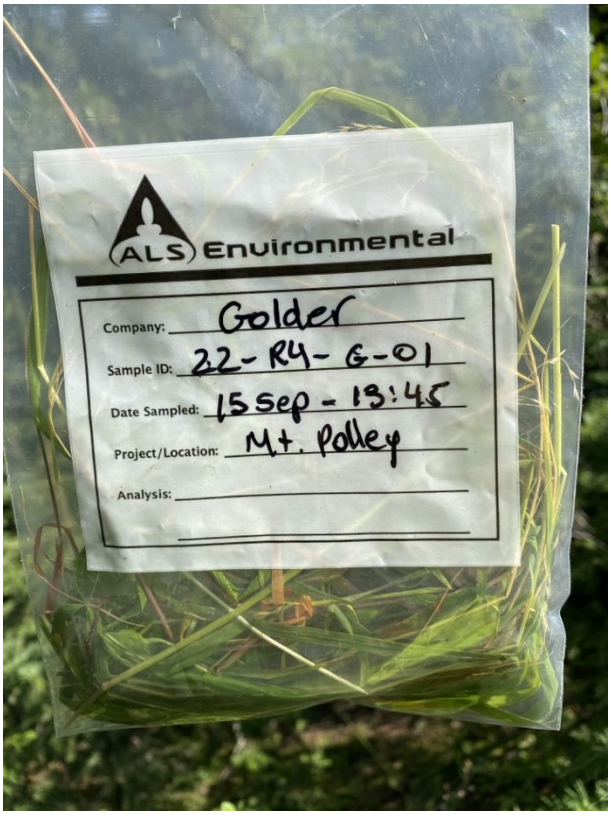

Photograph 6: Vegetation grass tissue (nodding trisetum (*Trisetum cernuum* Trin) inflorescences and leaves) sample 22-R4-G-01, 15-Sep-2022

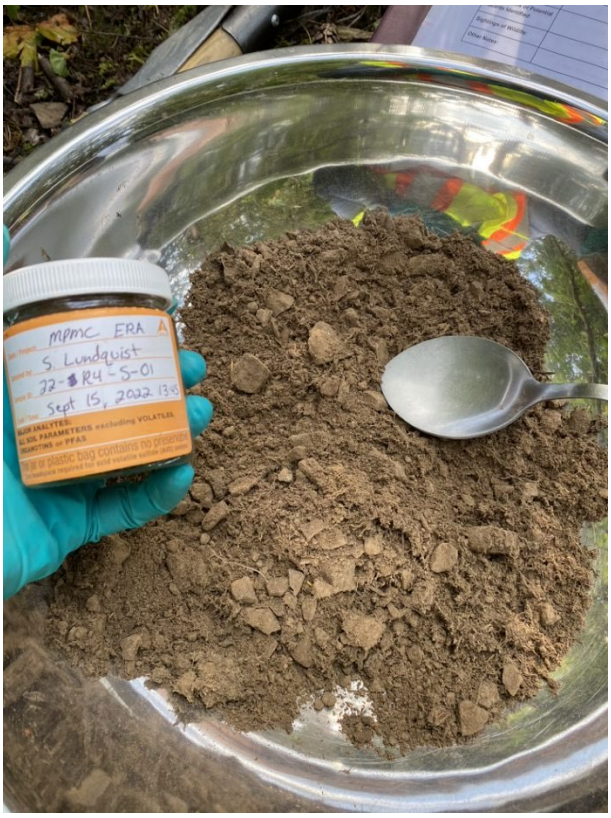

Photograph 7: Soil sample 22-R4-S-01, 15-Sep-2022

1.5 R5



Photograph 1: Site R5, 15-Sep-2022



Photograph 2: Vegetation leaf tissue (western redcedar (*Thuja plicata)* leaves)sample 22-R5-L-01, 15-Sep-2022



Photograph 3: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-R5-L-02, 15-Sep-2022

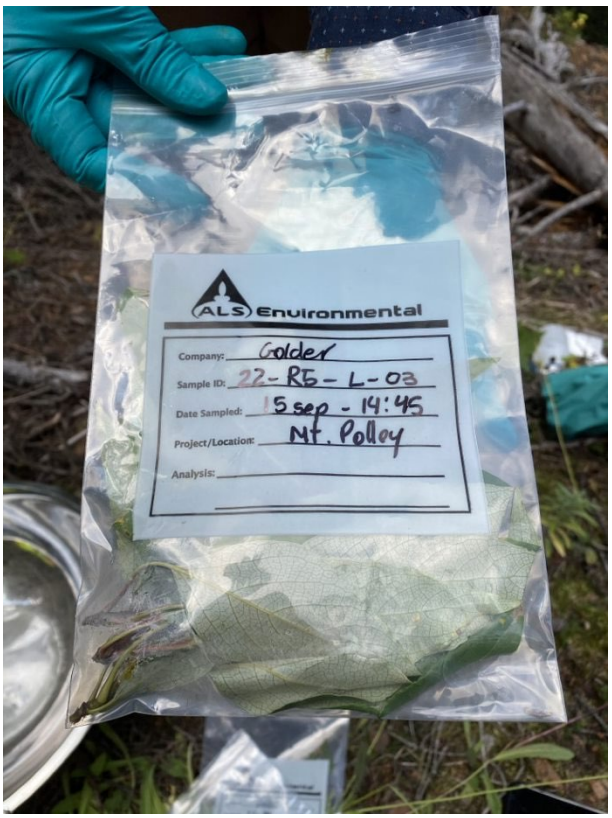

Photograph 4: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-R5-L-03, 15-Sep-2022



Photograph 5: Vegetation forb tissue (pearly everlasting (*Anaphalis margaritacea*) flowers and leaves) sample 22-R5-F-01, 15-Sep-2022

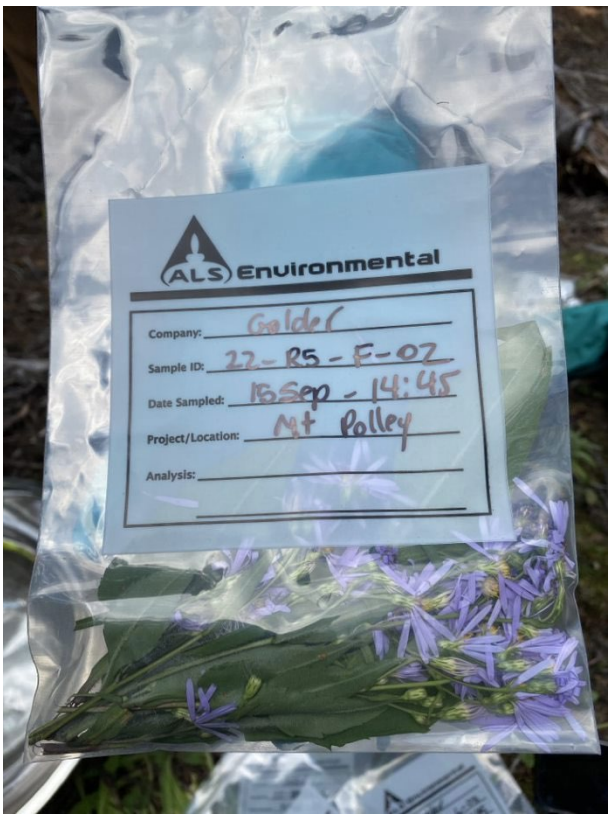

Photograph 6: Vegetation forb tissue (Lindley's aster (*Symphyotrichum ciliolatum*) flowers and leaves) sample 22-R5-F-02, 15-Sep-2022



Photograph 7: Soil sample 22-R5-S-01, 15-Sep-2022

1.6 R6



Photograph 1: Site R6, 15-Sep-2022



Photograph 2: Vegetation leaf tissue (western redcedar (*Thuja plicata)* leaves) sample 22-R6-L-01, 15-Sep-2022



Photograph 3: Vegetation leaf tissue sample (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) 22-R6-L-02, 15-Sep-2022

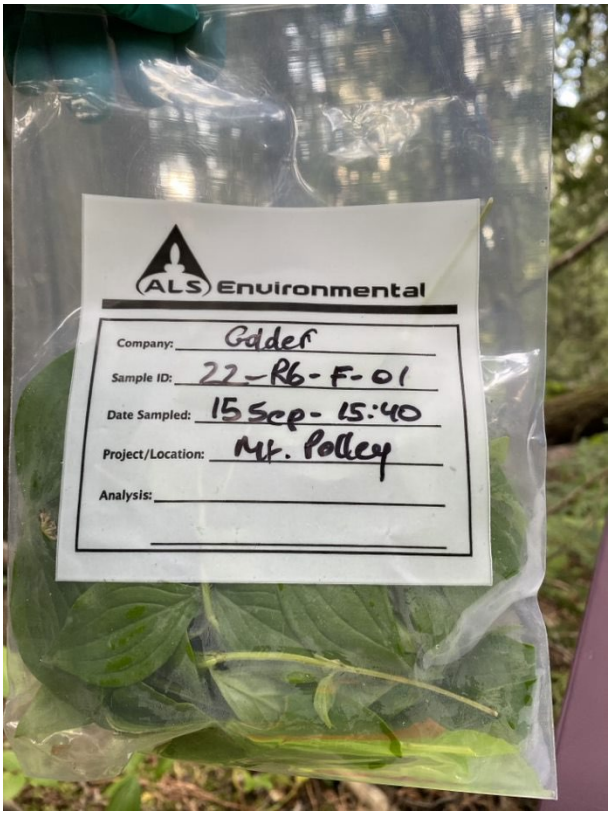

Photograph 4: Vegetation forb tissue (bunchberry (*Cornus canadensis*) leaves) sample 22-R6-F-01, 15-Sep-2022



Photograph 5: Vegetation forb tissue (false Solomon's-seal (*Maianthemum racemosum* ssp. *Amplexicaule*) leaves) sample 22-R6-F-02, 15-Sep-2022



Photograph 6: Vegetation berry tissue (false Solomon's-seal (*Maianthemum racemosum* ssp. *Amplexicaule*) berries) sample 22-R6-B-01, 15-Sep-2022



Photograph 7: Soil sample 22-R6-S-01, 15-Sep-2022

2.0 RECLAIMED STATIONS

2.1 S1



Photograph 1: Site S1, 15-Sep-2022



Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S1-L-01, 15-Sep-2022



Photograph 3: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S1-L-02, 15-Sep-2022



Photograph 4: Vegetation forb tissue (wild chamomile (*matricaria chamomilla*) flowers and leaves) sample 22-S1-F-01, 15-Sep-2022



Photograph 5: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves)sample 22-S1-G-01, 15-Sep-2022

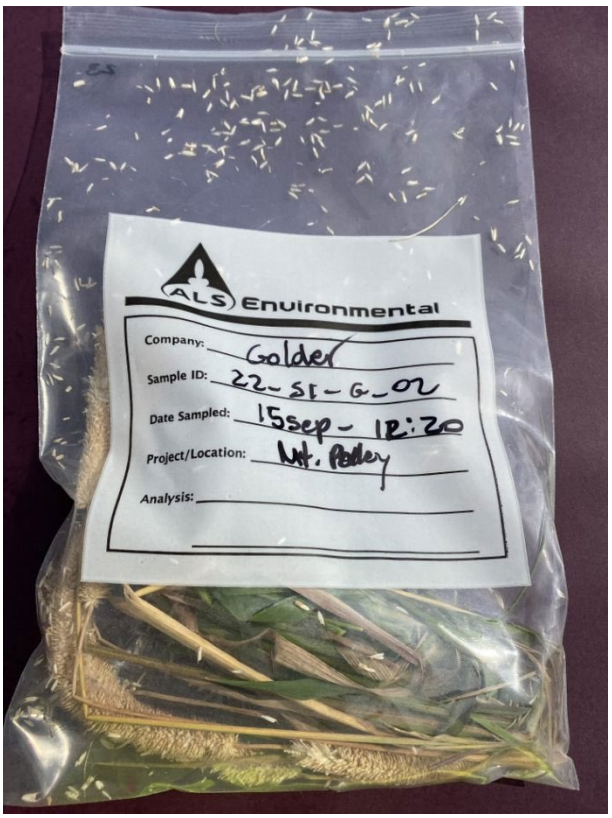

Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S1-G-02, 15-Sep-2022



Photograph 7: Soil sample 22-S1-S-01, 15-Sep-2022

2.2 S2



Photograph 1: Site S2, 15-Sep-2022



Photograph 2: Vegetation leaf tissue *(black elderberry (Sambucus racemosa* var. *melanocarpa*) leaves) sample 22-S2-L-01, 15-Sep-2022



Photograph 3: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S2-L-02, 15-Sep-2022



Photograph 4: Vegetation forb tissue (yellow salsify (*Tragopogon dubius*) leaves) sample 22-S2-F-01, 15-Sep-2022

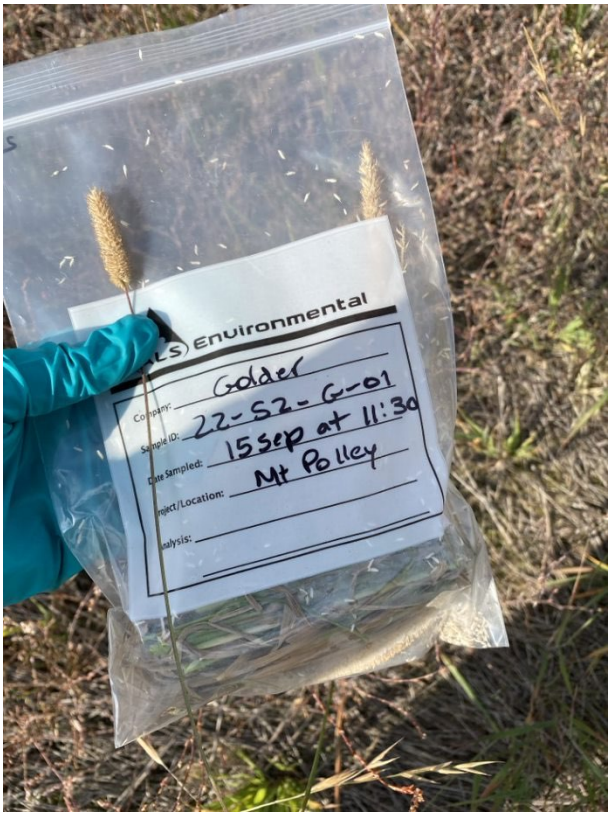

Photograph 5: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S2-G-01, 15-Sep-2022

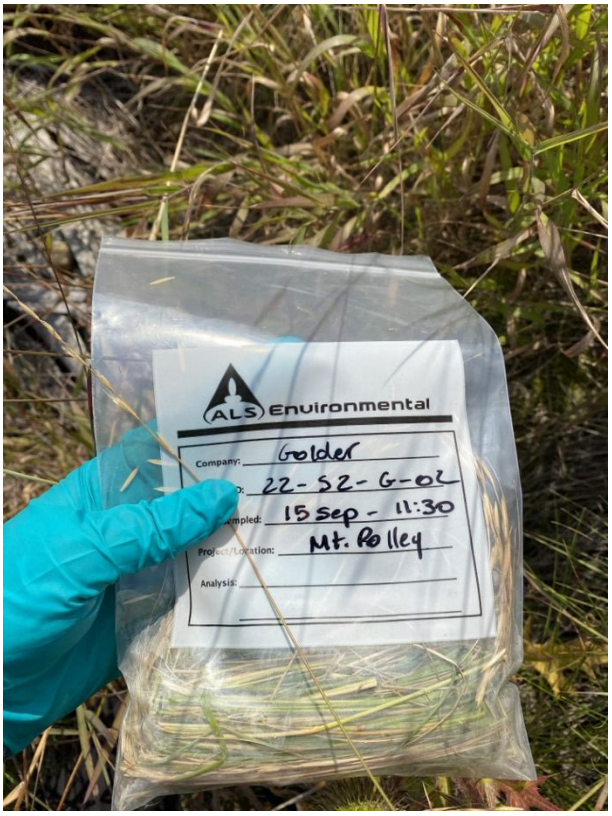

Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S2-G-02, 15-Sep-2022



Photograph 7: Soil sample 22-S2-S-01, 15-Sep-2022

2.3 S3



Photograph 1: Site S3, 13-Sep-2022



Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S3-L-01, 13-Sep-2022



Photograph 3: Vegetation leaf tissue *(black elderberry (Sambucus racemosa* var. *melanocarpa*) leaves) sample 22-S3-L-02, 13-Sep-2022



Photograph 4: Vegetation forb tissue (yarrow (*Achillea millefolium*) flowers and leaves) sample 22-S3-F-01, 13-Sep-2022



Photograph 5: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S3-G-01, 13-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S3-G-02, 13-Sep-2022



Photograph 7: Soil sample 22-S3-S-01, 13-Sep-2022

2.4 S4



Photograph 1: Site S4, 15-Sep-2022



Photograph 2: Vegetation leaf tissue (black cottonwood *(Populus trichocarpa)* leaves) sample 22-S4-L-01, 15-Sep-2022

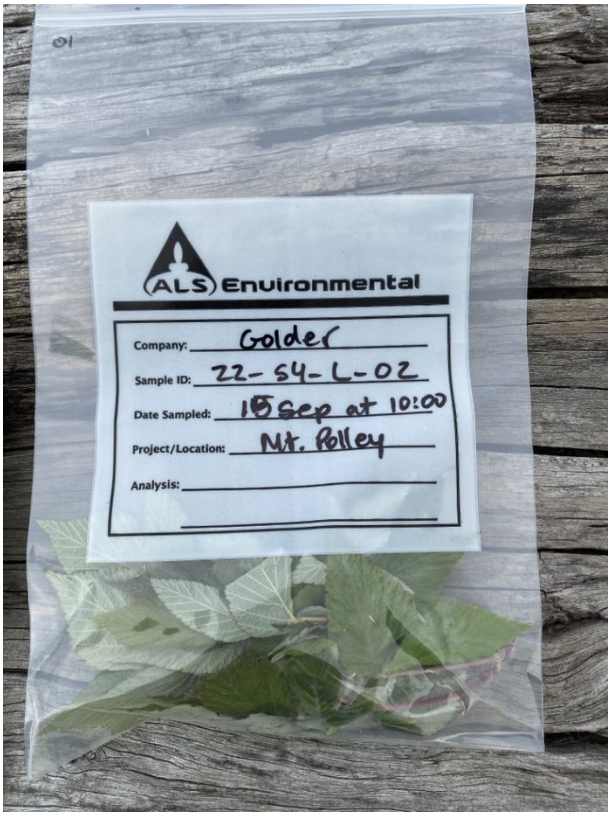

Photograph 3: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S4-L-02, 15-Sep-2022

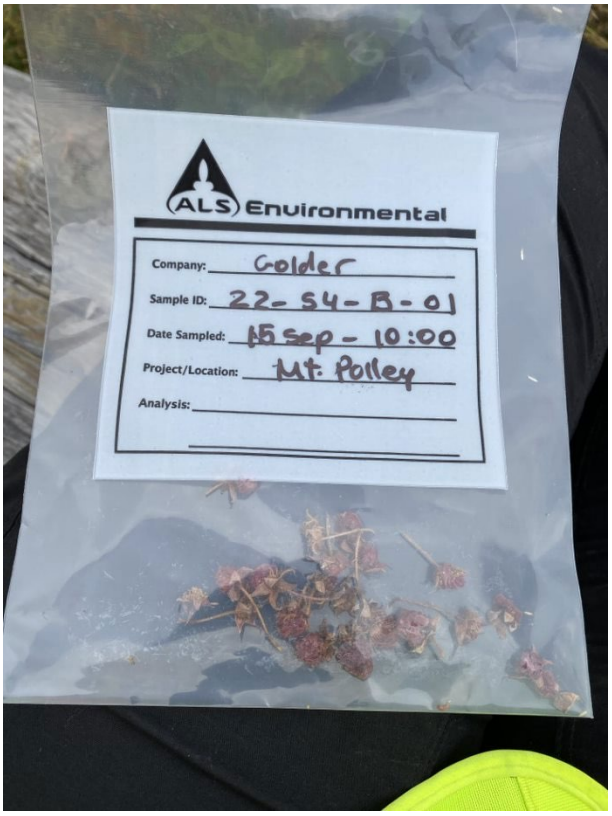

Photograph 4: Vegetation berry tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) berries) sample 22-S4-B-01, 15-Sep-2022



Photograph 5: Vegetation forb tissue (red clover *Trifolium pratense*) flowers and leaves) sample 22-S4-F-01, 15-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S4-G-01, 15-Sep-2022

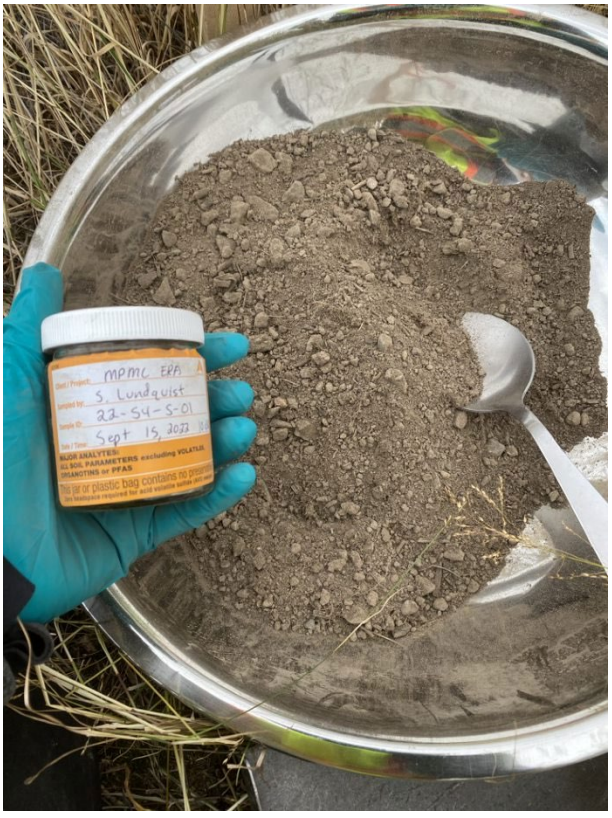

Photograph 7: Soil sample 22-S4-S-01, 15-Sep-2022

2.5 S5



Photograph 1: Site S5, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S5-L-01, 14-Sep-2022



Photograph 3: Vegetation leaf tissue (black cottonwood *(Populus trichocarpa)* leaves) sample 22-S5-L-02, 14-Sep-2022



Photograph 4: Vegetation berry tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) berries) sample 22-S5-B-01, 14-Sep-2022

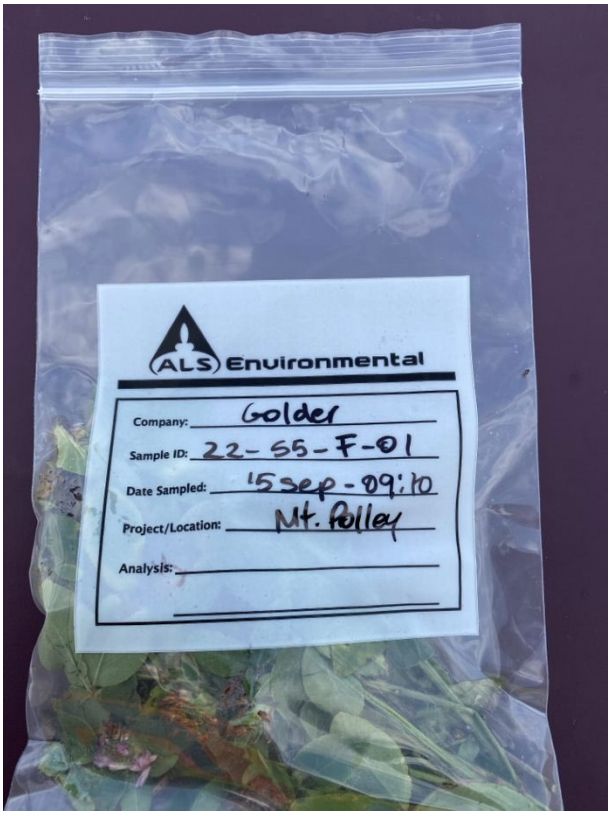

Photograph 5: Vegetation forb tissue (red clover *Trifolium pratense*) flowers and leaves) sample 22-S5-F-01, 14-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S5-G-01, 14-Sep-2022

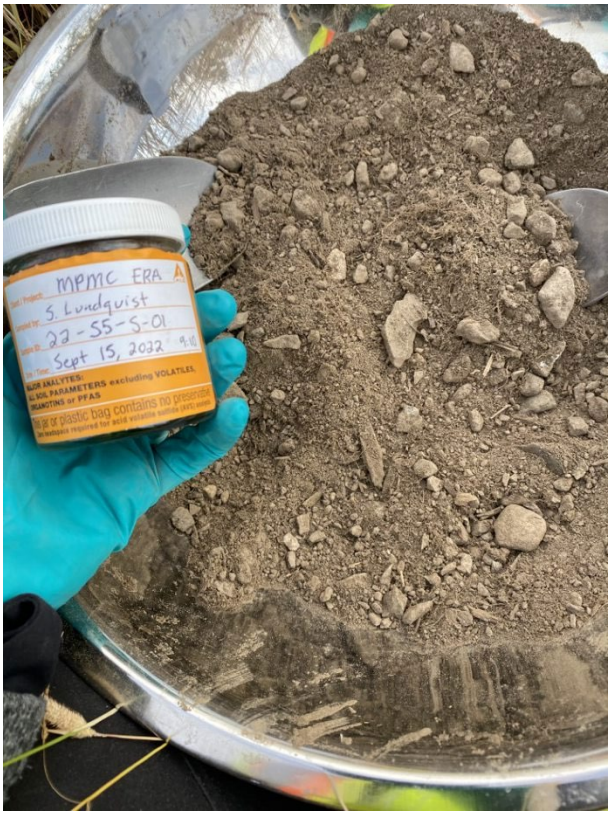

Photograph 7: Soil sample 22-S5-S-01, 14-Sep-2022

2.6 S6



Photograph 1: Site S6, 15-Sep-2022



Photograph 2: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S6-L-01, 15-Sep-2022



Photograph 3: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S6-L-02, 15-Sep-2022



Photograph 4: Vegetation forb tissue (red clover *Trifolium pratense*) flowers and leaves) sample 22-S6-F-01, 15-Sep-2022



Photograph 5: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S6-G-01, 15-Sep-2022



Photograph 6: Vegetation grass tissue (Grass sp. inflorescences and leaves) sample 22-S6-G-02, 15-Sep-2022

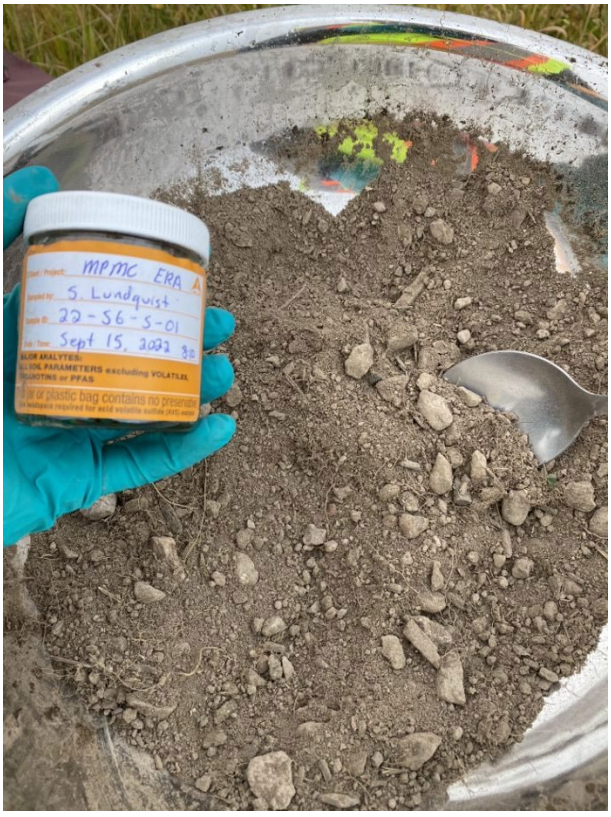

Photograph 7: Soil sample 22-S6-S-01, 15-Sep-2022

2.7 S8



Photograph 1: Site S8, 13-Sep-2022

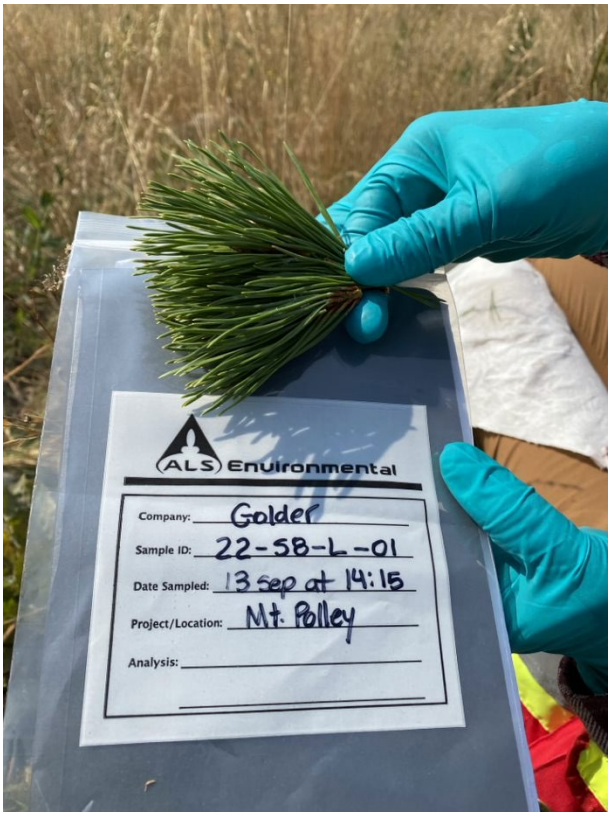

Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S8-L-01, 13-Sep-2022

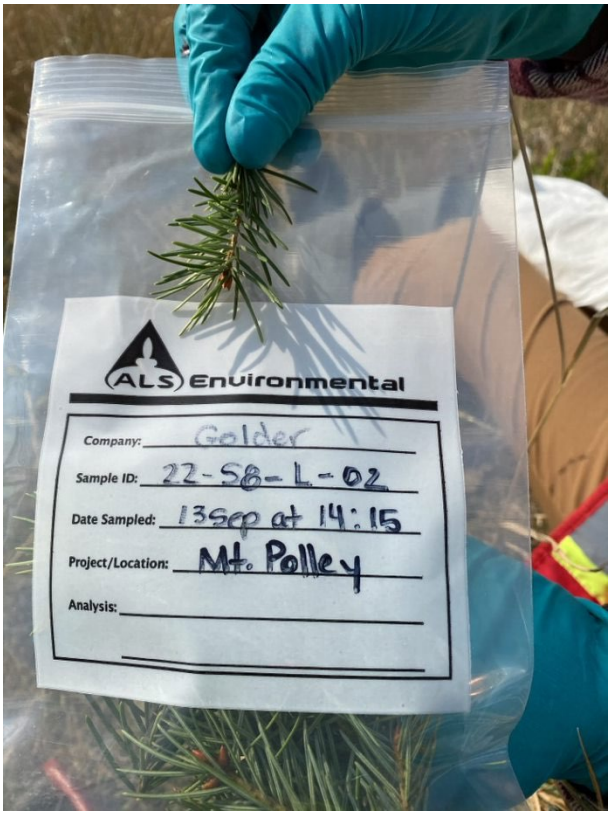

Photograph 3: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S8-L-02, 13-Sep-2022



Photograph 4: Vegetation forb tissue (dandelion (*Taraxacum* sp.) leaves sample 22-S8-F-01, 13-Sep-2022



Photograph 5: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S8-G-01, 13-Sep-2022



Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S8-G-02, 13-Sep-2022



Photograph 7: Soil sample 22-S8-S-01, 13-Sep-2022

2.8 S9



Photograph 1: Site S9, 13-Sep-2022



Photograph 2: Vegetation leaf tissue (Sitka alder (*Alnus alnobetula ssp. Sinuate*) leaves) sample 22-S9-L-01, 13-Sep-2022



Photograph 3: Vegetation leaf tissue (soopolallie (*Shepherdia canadensis*) leaves) sample 22-S9-L-02, 13-Sep-2022

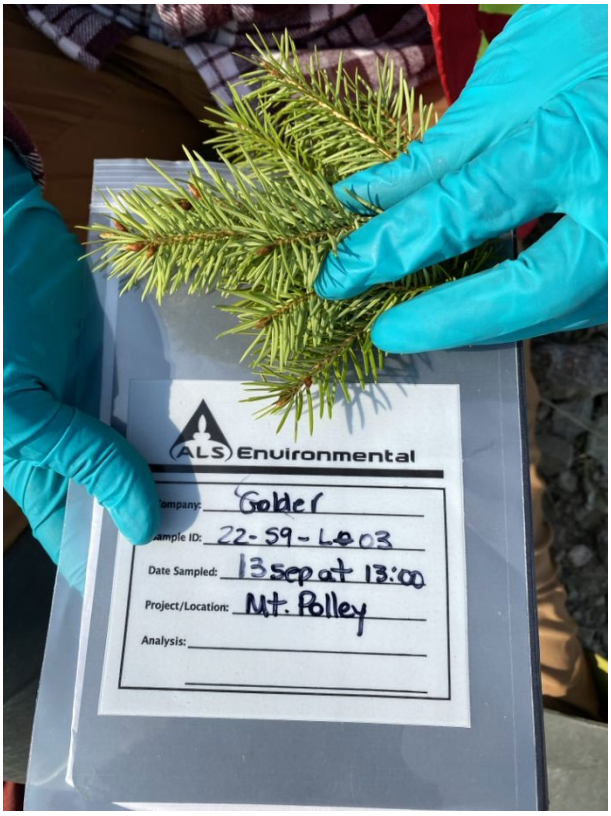

Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S9-L-03, 13-Sep-2022

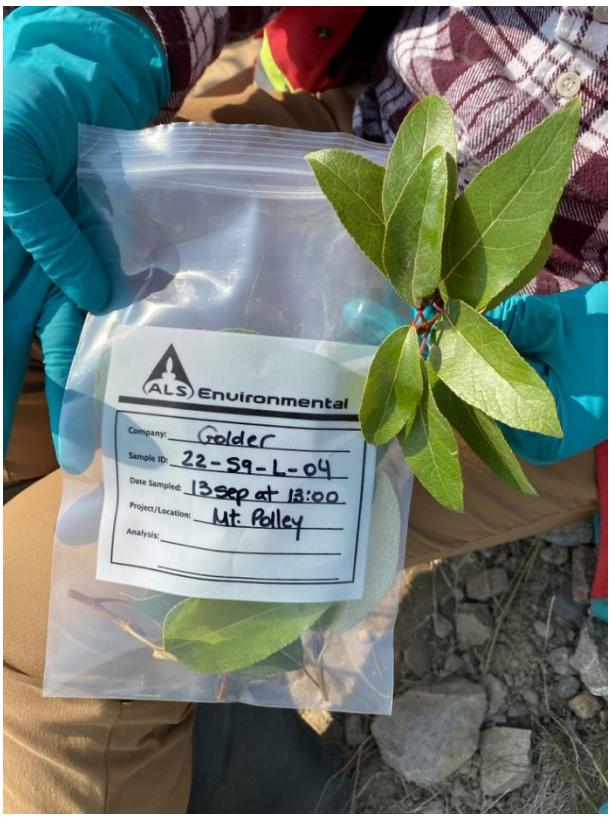

Photograph 5: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S9-L-04, 13-Sep-2022



Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S9-G-01, 13-Sep-2022



Photograph 7: Soil sample 22-S9-S-01, 13-Sep-2022

2.9 S10



Photograph 1: Site S10, 16-Sep-2022

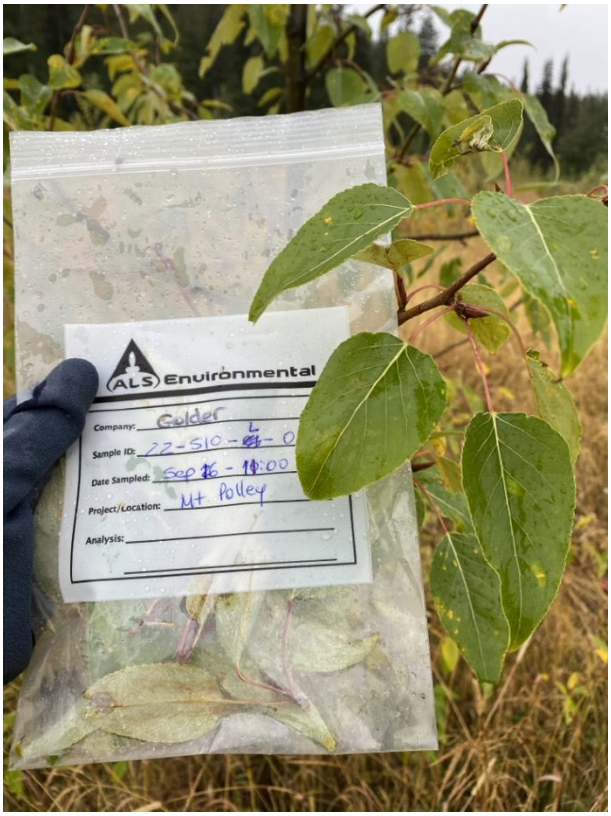

Photograph 2: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S10-L-01, 16-Sep-2022

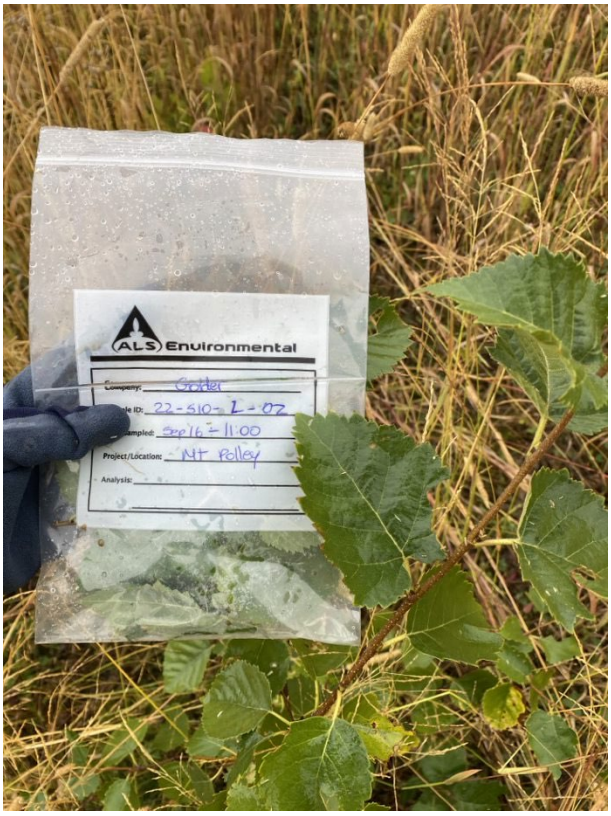

Photograph 3: Vegetation leaf tissue (Sitka alder (*Alnus alnobetula ssp. Sinuate*) leaves) sample 22-S10-L-02, 16-Sep-2022



Photograph 4: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S10-L-03, 16-Sep-2022

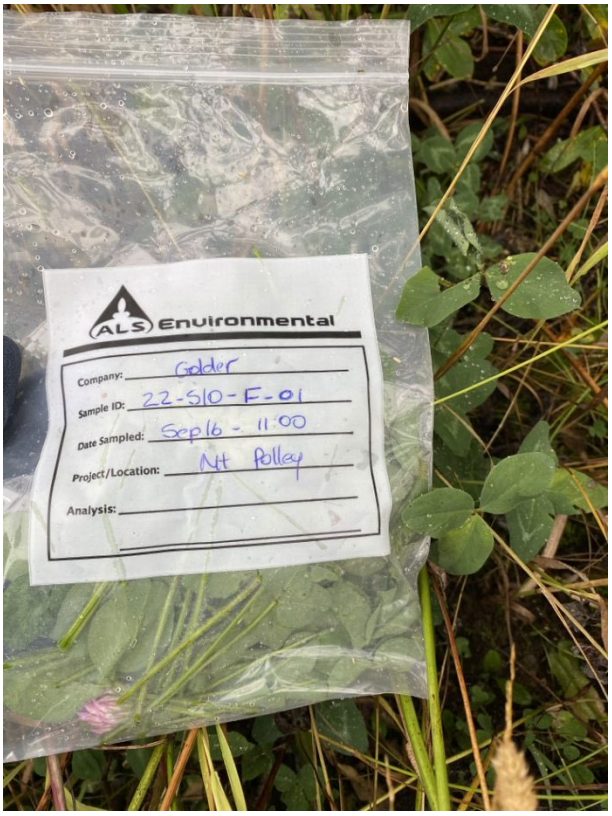

Photograph 5: Vegetation forb tissue (red clover *Trifolium pratense*) flowers and leaves) sample 22-S10-F-01, 16-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S10-G-01, 16-Sep-2022



Photograph 7: Soil sample 22-S10-S-01, 16-Sep-2022

2.10 S11



Photograph 1: Site S11, 14-Sep-2022

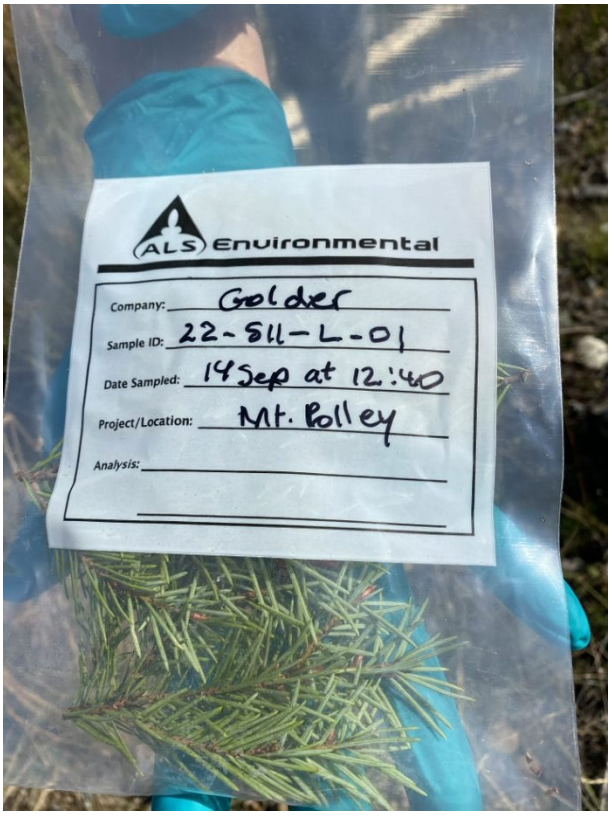

Photograph 2: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S11-L-01, 14-Sep-2022



Photograph 3: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S11-L-02, 14-Sep-2022

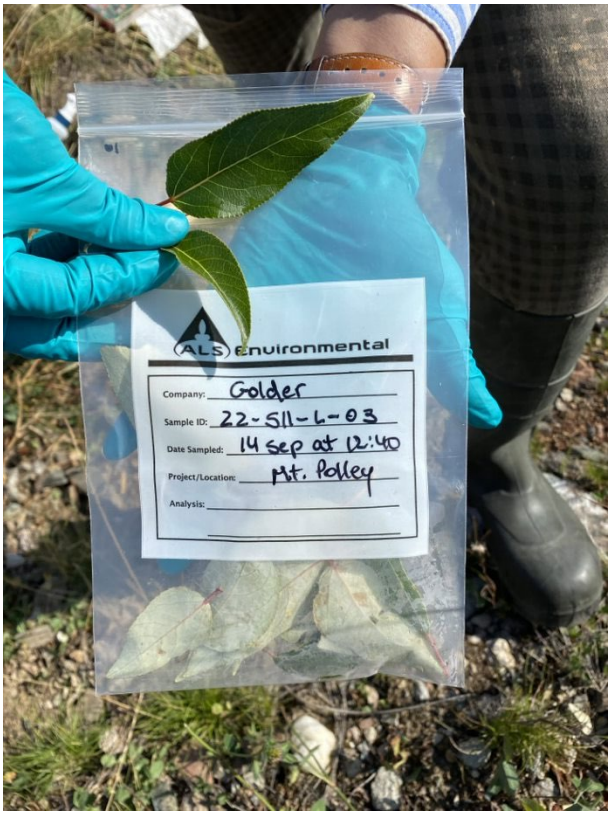

Photograph 4: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S11-L-03, 14-Sep-2022



Photograph 5: Vegetation forb tissue (red clover *Trifolium pratense*) flowers and leaves) sample 22-S11-F-01, 14-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S11-G-01, 14-Sep-2022

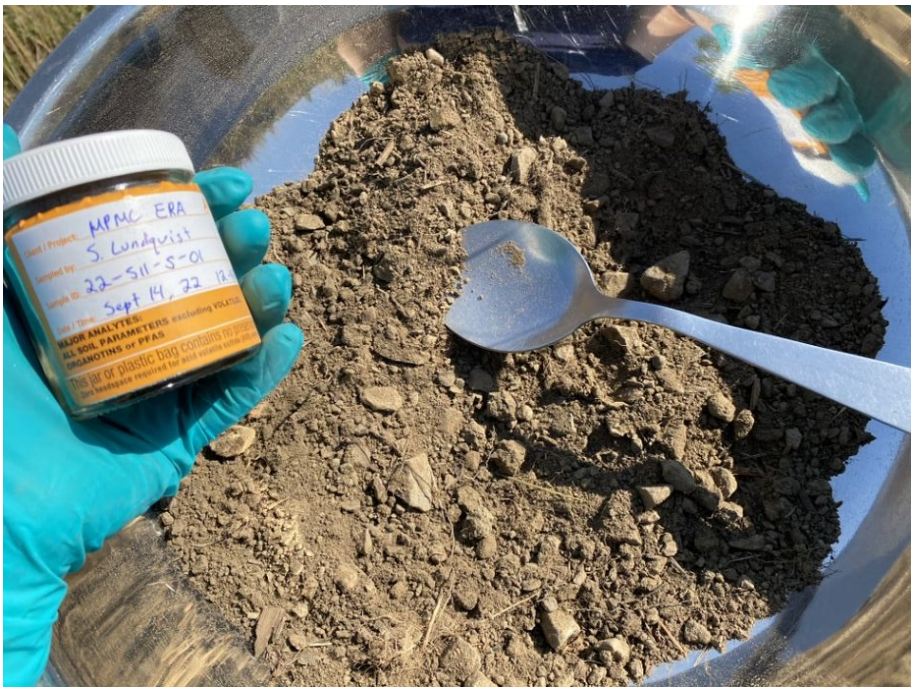

Photograph 7: Soil sample 22-S11-S-01, 14-Sep-2022

2.11 S12



Photograph 1: Site S12, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S12-L-01, 14-Sep-2022



Photograph 3: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S12-L-02, 14-Sep-2022



Photograph 4: Vegetation leaf tissue *(black elderberry (Sambucus racemosa* var. *melanocarpa*) leaves) sample 22-S12-L-03, 14-Sep-2022

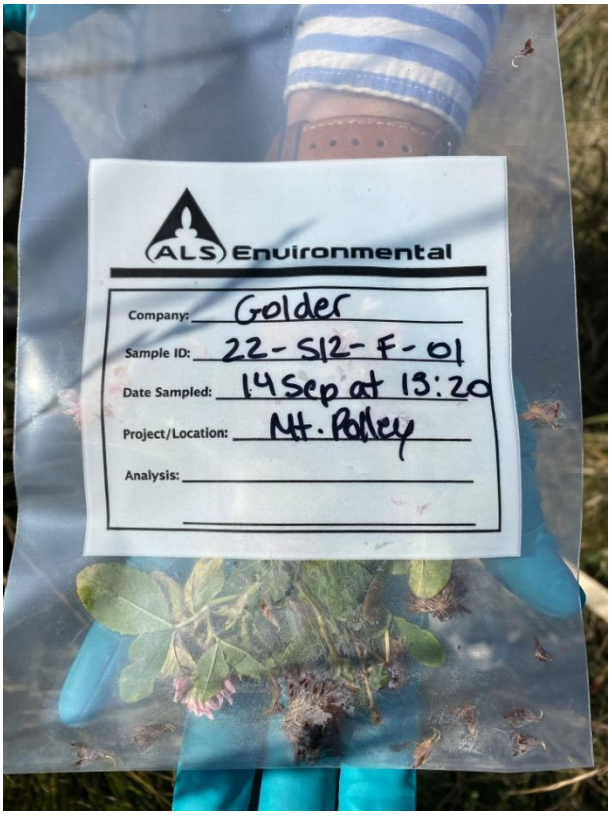

Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S12-F-01, 14-Sep-2022

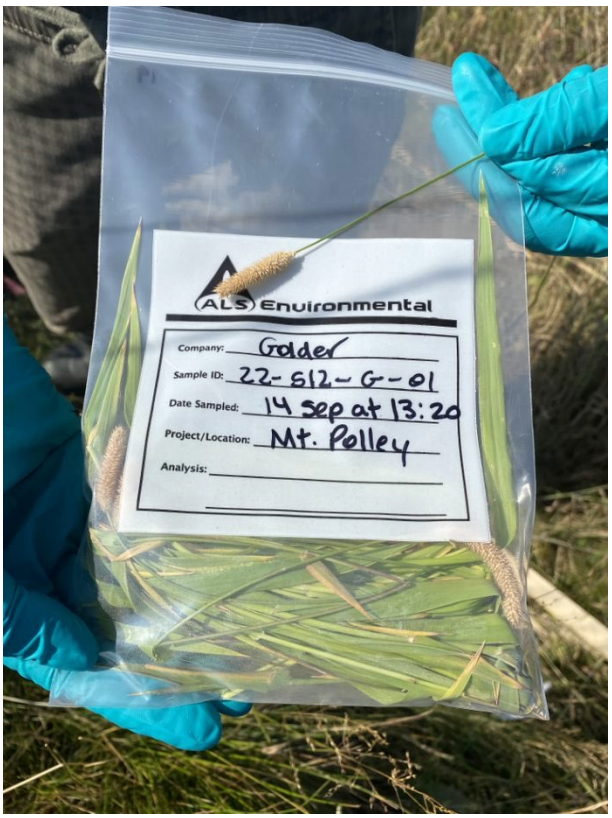

Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S12-G-01, 14-Sep-2022



Photograph 7: Soil sample 22-S12-S-01, 14-Sep-2022

2.12 S13



Photograph 1: Site S13, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S13-L-01 and 22-S13-L-01D, 14-Sep-2022

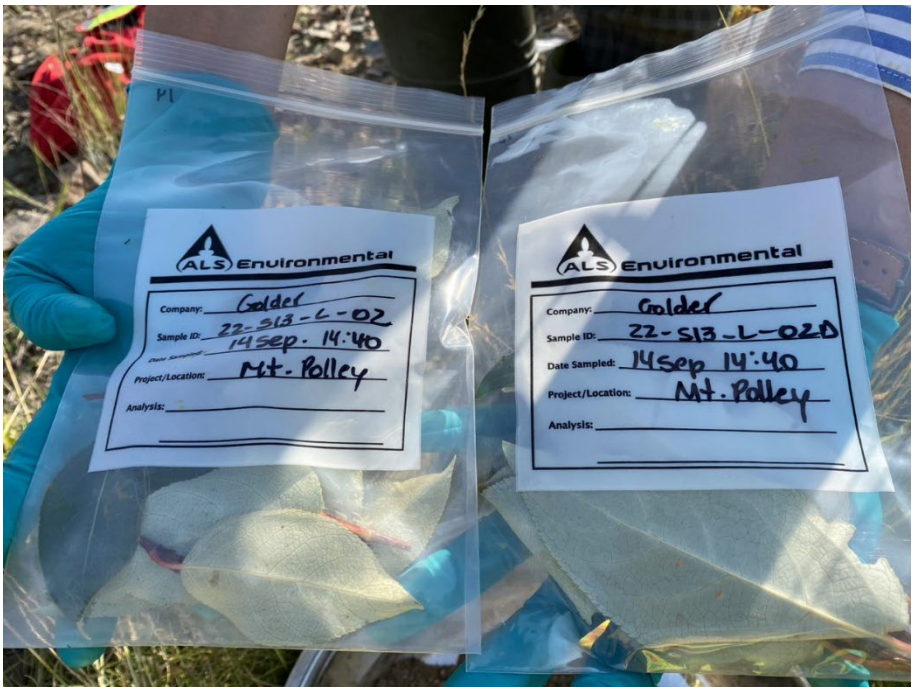

Photograph 3: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S13-L-02 and 22-S13-L-02D, 14-Sep-2022



Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S13-L-03 and 22-S13-L-03D, 14-Sep-2022



Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S13-F-01 and 22-S13-F-01D, 14-Sep-2022

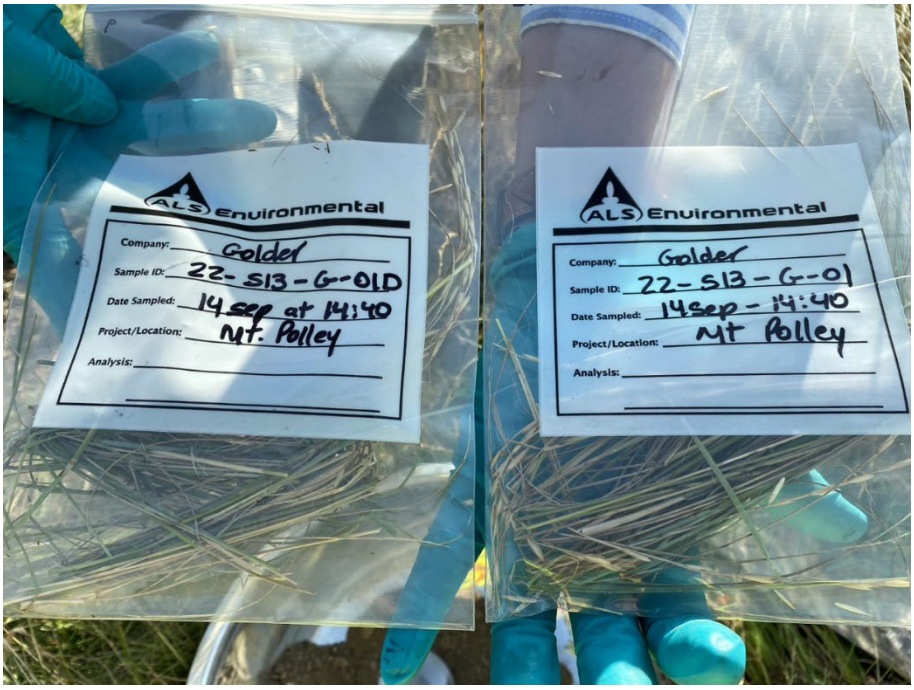

Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S13-G-01 and 22-S13-G-01D, 14-Sep-2022

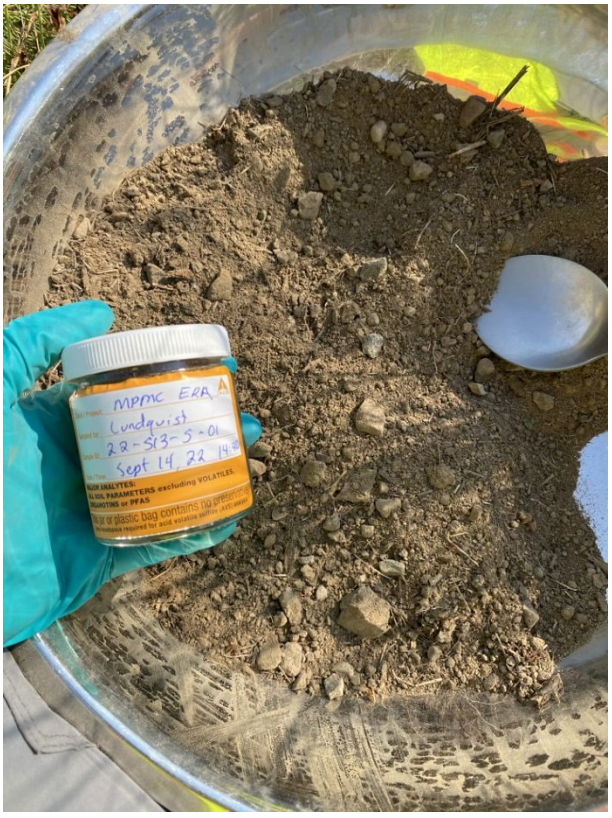

Photograph 7: Soil sample 22-S13-S-01, 14-Sep-2022

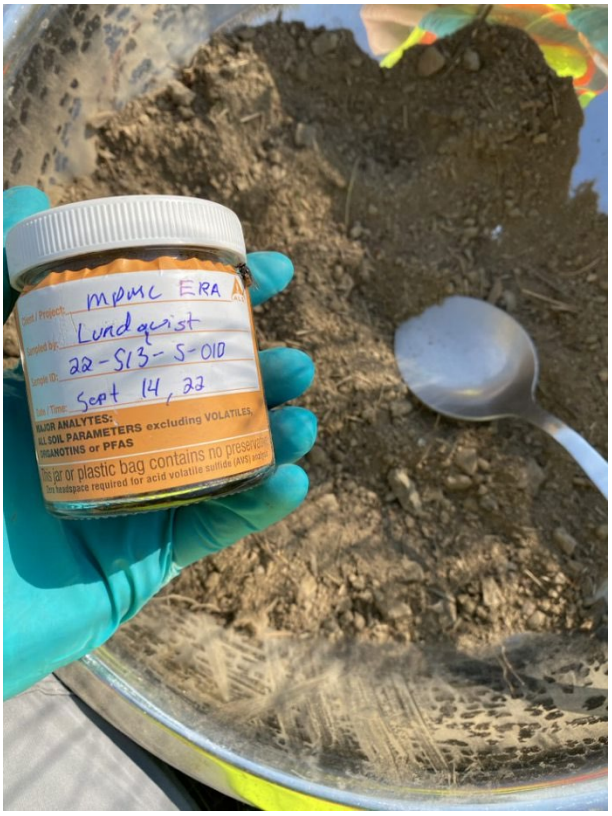

Photograph 8: Soil sample 22-S13-S-01D, 14-Sep-2022

2.13 S14



Photograph 1: Site S14, 14-Sep-2022

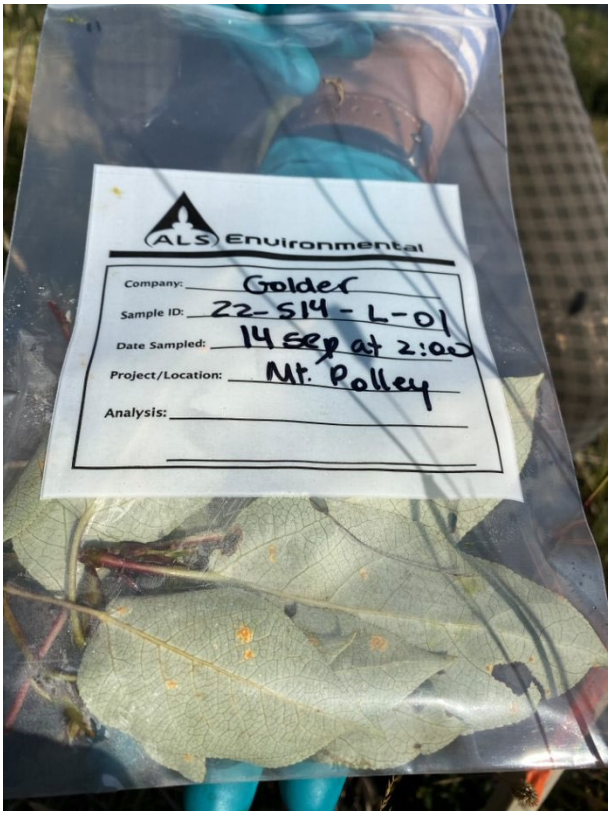

Photograph 2: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S14-L-01, 14-Sep-2022

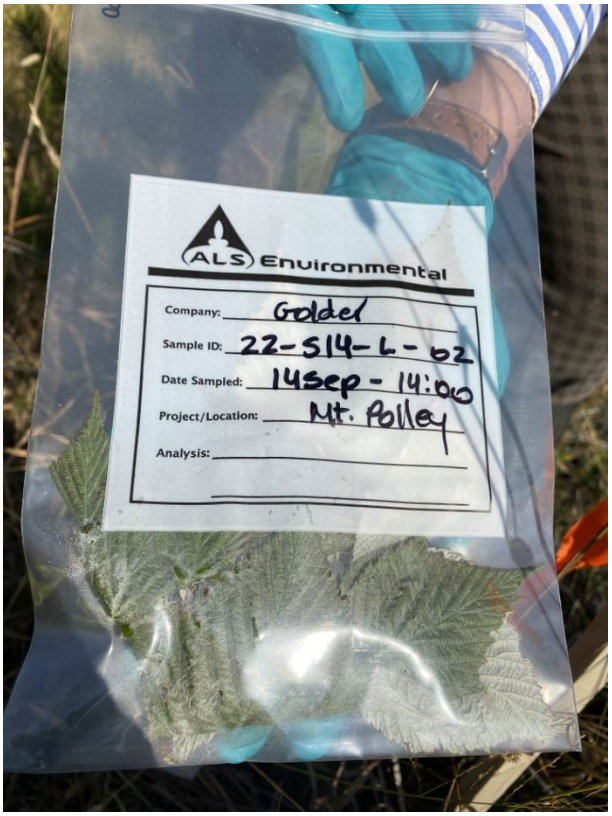

Photograph 3: Vegetation leaf tissue (red raspberry (*Rubus idaeus ssp. Strigosus*) leaves) sample 22-S14-L-02, 14-Sep-2022



Photograph 4: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S14-L-03, 14-Sep-2022



Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S14-F-01, 14-Sep-2022



Photograph 6: Soil sample 22-S14-S-01, 14-Sep-2022

2.14 S15



Photograph 1: Site S15, 16-Sep-2022



Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S15-L-01 and 22-S15-L-01D, 16-Sep-2022



Photograph 3: Vegetation leaf tissue (trembling aspen (*Populus tremuloides*) leaves) sample 22-S15-L-02 and 22-S15-L-02D, 16-Sep-2022



Photograph 4: Vegetation leaf tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S15-L-03 and 22-S15-L-03D, 16-Sep-2022



Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S15-F-01 and 22-S15-F-01D, 16-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S15-G-01 and 22-S15-G-01D, 16-Sep-2022



Photograph 7: Soil sample 22-S15-S-01, 16-Sep-2022



Photograph 8: Soil sample 22-S15-S-01D, 16-Sep-2022

2.15 S16



Photograph 1: Site S16, 14-Sep-2022



Photograph 2: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S16-L-01, 14-Sep-2022



Photograph 3: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S16-L-02, 14-Sep-2022



Photograph 4: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S16-L-03, 14-Sep-2022



Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S16-F-01, 14-Sep-2022



Photograph 6: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-S16-G-01, 14-Sep-2022



Photograph 7: Soil sample 22-S16-S-01, 14-Sep-2022

2.16 S17



Photograph 1: Site S17, 14-Sep-2022

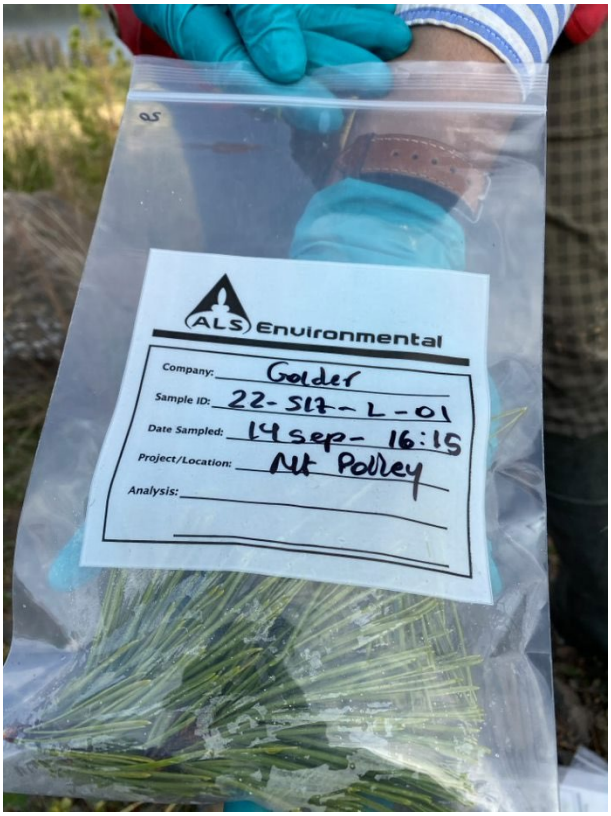

Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-S17-L-01, 14-Sep-2022

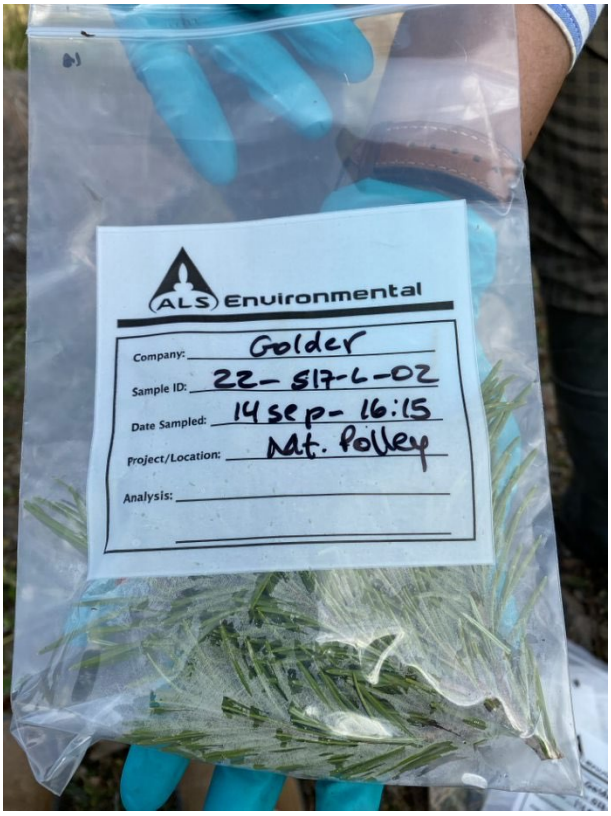

Photograph 3: Vegetation leaf tissue (Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*) sample 22-S17-L-02, 14-Sep-2022

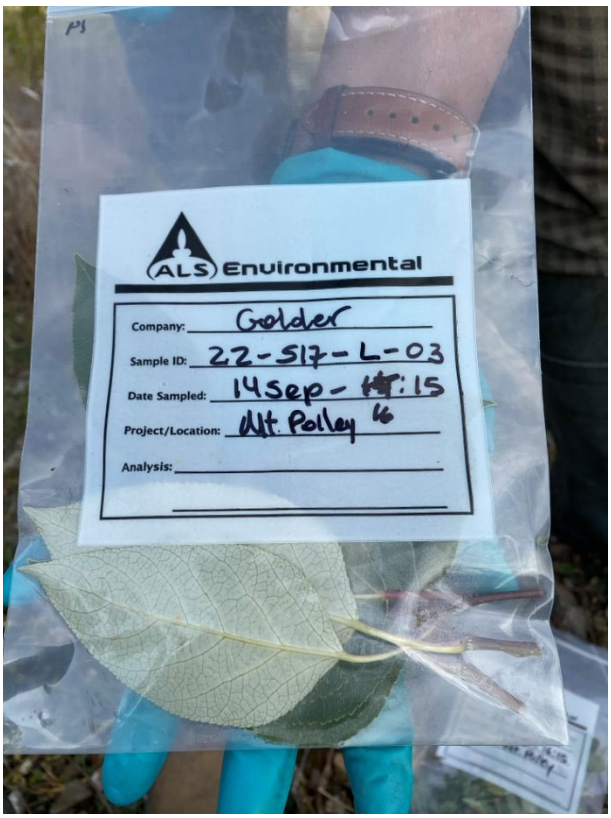

Photograph 4: Vegetation leaf tissue (black cottonwood (*Populus trichocarpa*) leaves) sample 22-S17-L-03, 14-Sep-2022

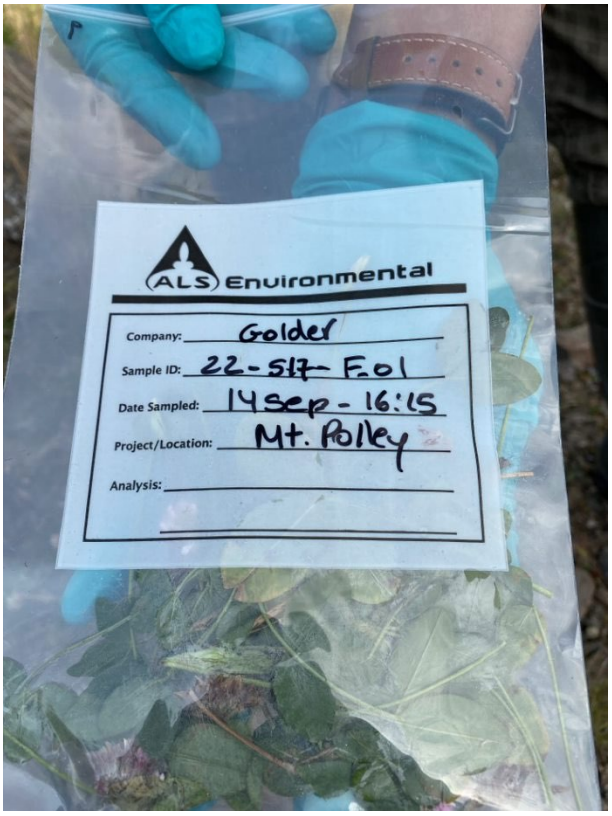

Photograph 5: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-S17-F-01, 14-Sep-2022



Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-S17-G-01, 14-Sep-2022

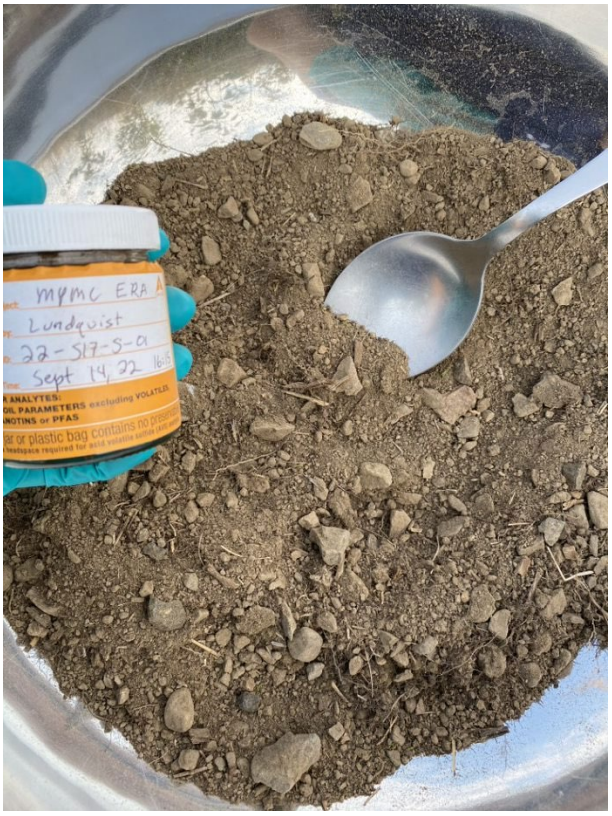

Photograph 7: Soil sample 22-S17-S-01, 14-Sep-2022

2.17 A4



Photograph 1: Site A4, 14-Sep-2022

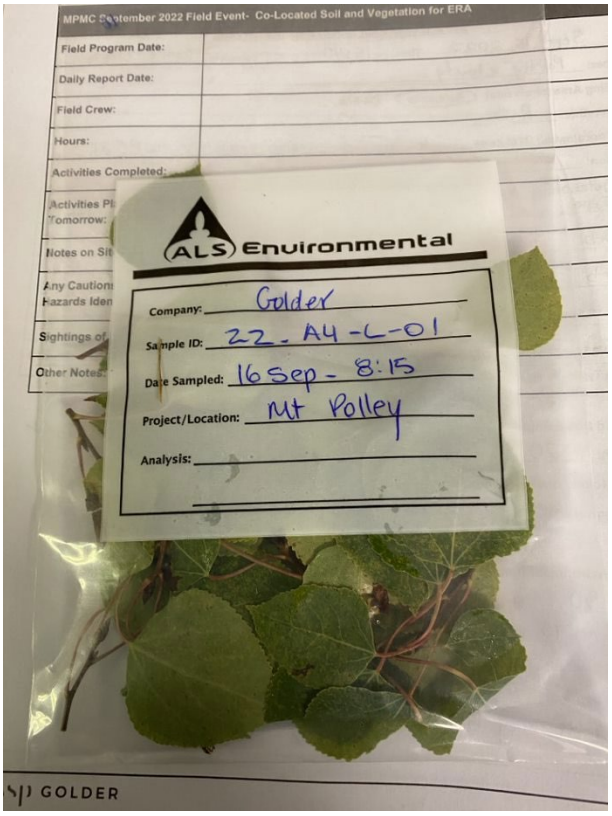

Photograph 2: Vegetation leaf tissue (trembling aspen (*Populus tremuloides*) sample 22-A4-L-01, 14-Sep-2022

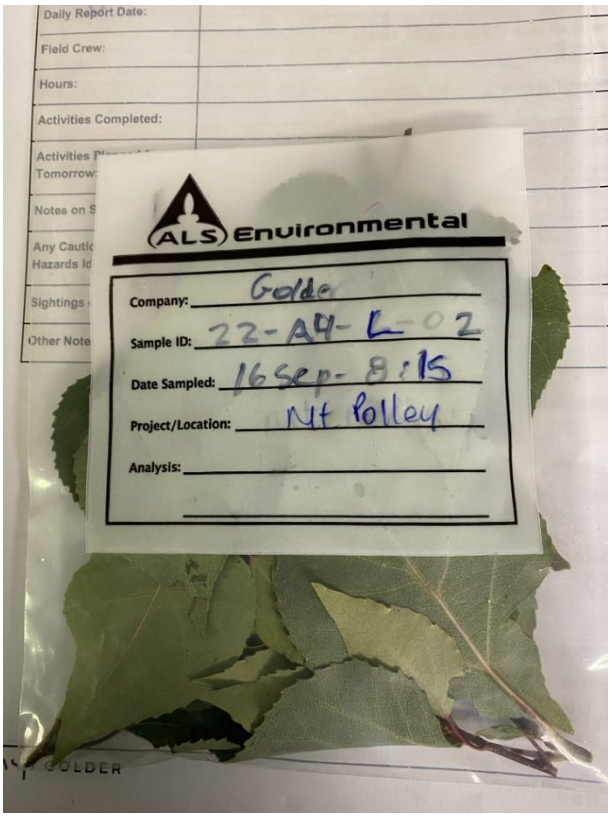

Photograph 3: Vegetation leaf tissue (Sitka alder (*Alnus alnobetula ssp. Sinuate*) leaves) sample 22-A4-L-02, 14-Sep-2022

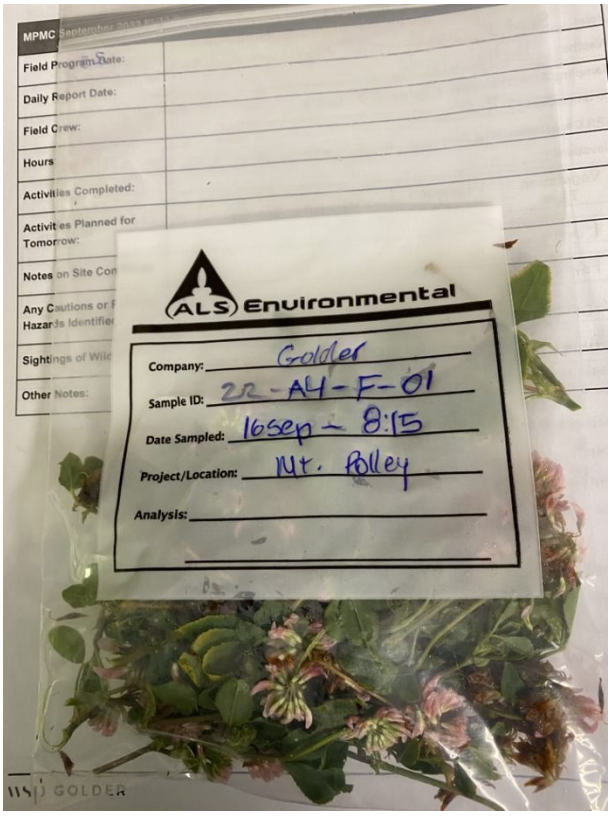

Photograph 4: Vegetation forb tissue (red clover (*Trifolium pratense*) flowers and leaves) sample 22-A4-F-01, 14-Sep-2022

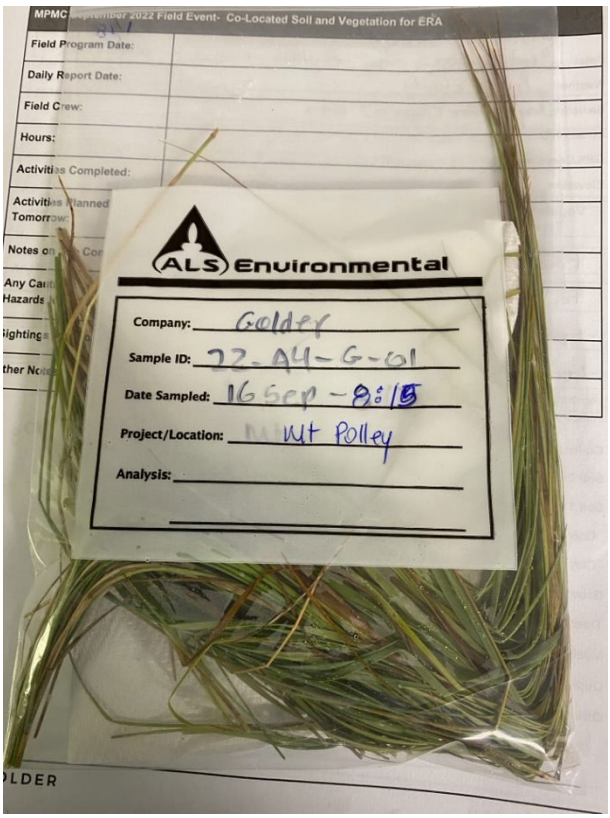

Photograph 5: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-A4-G-01, 14-Sep-2022



Photograph 6: Vegetation grass tissue (mountain brome (*Bromus carinatus var. marginatus*) inflorescences and leaves) sample 22-A4-G-02, 14-Sep-2022



Photograph 7: Soil sample 22-A4-S-01, 14-Sep-2022

2.18 A5



Photograph 1: Site A5, 14-Sep-2022

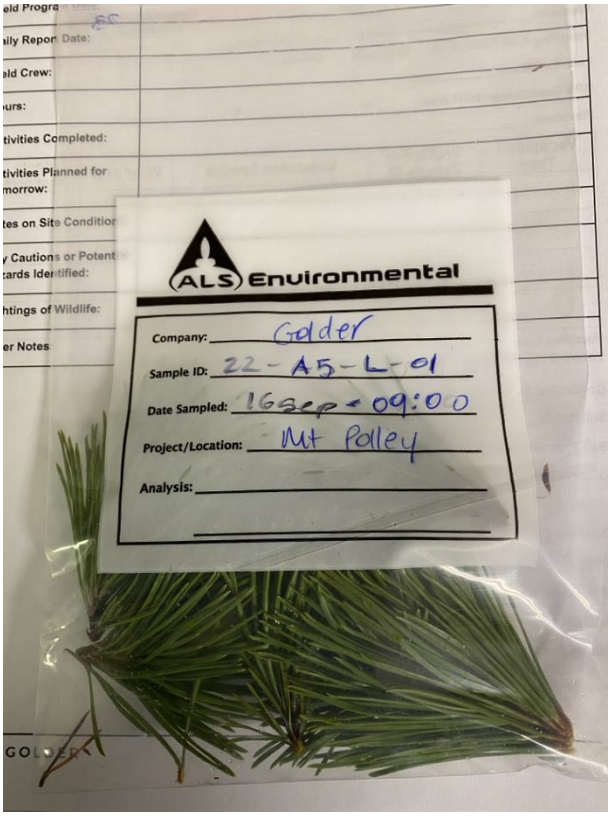

Photograph 2: Vegetation leaf tissue (lodgepole pine (*Pinus contorta* var. *latifolia*) leaves) sample 22-A5-L-01, 14-Sep-2022



Photograph 3: Vegetation forb tissue (Loesel's tumble-mustard (*Sisymbrium loeselii*) flowers and leaves) sample 22-A5-F-01, 14-Sep-2022



Photograph 4: Vegetation grass tissue (mountain brome (*Bromus carinatus var. marginatus*) inflorescences and leaves) sample 22-A5-G-01, 14-Sep-2022

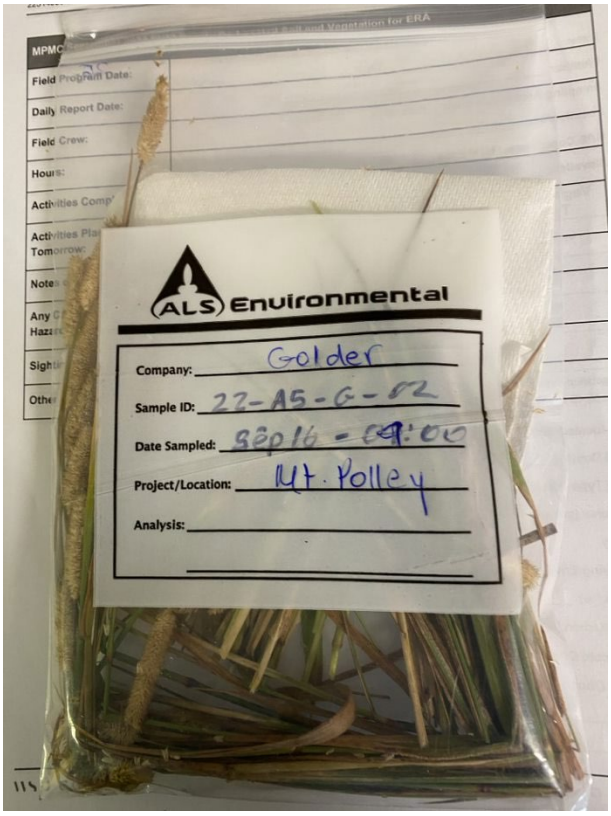

Photograph 5: Vegetation grass tissue (common timothy (*Phleum pratense* ssp. *pratense*) inflorescences and leaves) sample 22-A5-G-02, 14-Sep-2022

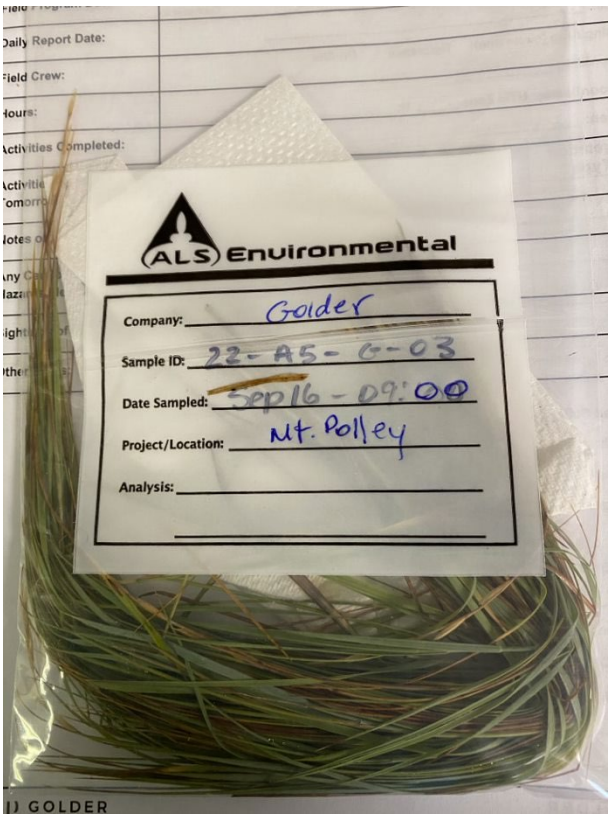

Photograph 6: Vegetation grass tissue (slender wheatgrass (*Elymus trachycaulus* ssp. *Trachycaulus*) inflorescences and leaves) sample 22-A5-G-03, 14-Sep-2022



Photograph 7: Soil sample 22-A5-S-01, 14-Sep-2022

APPENDIX C

Analytical Reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2359**	Page	: 1 of 14
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686091	Issue Date	: 14-Oct-2022 17:14
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 12		
No. of samples analysed	: 12		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
dS/m	decisiemens per metre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units
t/ha	tonnes per hectare

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Due to limited available leachate volume, conductivity was performed on a diluted sample and factored for dilution on sample 1.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
FR5	*As per applicable reference method(s), soil:water ratio for Fixed Ratio Leach was modified to 1:5 due to high soil organic content*
RRR	*Refer to report comments for issues regarding this analysis.*

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-S-01	22-S9-S-01	22-S8-S-01	22-R2-S-01	22-R3-S-01
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 13:00	13-Sep-2022 14:15	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2359-001	VA22C2359-002	VA22C2359-003	VA22C2359-004	VA22C2359-005
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		9.0	1.9	9.6	53.5	8.4
moisture	----	E144	0.25	%		7.51	5.11	9.69	19.0	9.00
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.17	7.20	7.33	4.29 FR5	4.18
pH (1:2 soil:water)	----	E108	0.10	pH units		6.60	8.33	6.78	4.98	4.82
ash content @ 550°C	----	E205D	1.0	%		91.0	98.0	90.4	46.5	91.6
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		95.5	91.8	95.8	92.2	80.6
passing (4.75 mm)	----	E181	1.0	%		85.4	79.3	84.8	82.9	71.2
passing (19 mm)	----	E181	1.0	%		100	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		64.6	57.9	63.7	64.0	55.4
passing (0.841 mm)	----	E182	1.0	%		63.4	56.7	62.4	62.8	54.3
passing (0.50 mm)	----	E182	1.0	%		58.1	51.3	57.0	58.8	50.3
passing (0.420 mm)	----	E182	1.0	%		56.7	50.0	55.6	57.8	49.3
passing (0.250 mm)	----	E182	1.0	%		51.4	44.6	50.4	53.9	45.3
passing (0.149 mm)	----	E182	1.0	%		46.1	39.6	45.4	50.4	41.1
passing (0.125 mm)	----	E182	1.0	%		43.8	37.8	43.2	48.5	39.4
passing (0.075 mm)	----	E182	1.0	%		38.9	34.0	38.6	44.5	35.9
passing (0.063 mm)	----	E182	1.0	%		33.5	33.1	32.8	36.4	30.5
passing (0.05 mm)	----	E182	1.0	%		27.6	32.2	26.5	27.7	24.6
passing (0.0312 mm)	----	E183	1.0	%		21.9	29.0	21.9	21.5	19.0
passing (0.020 mm)	----	E183	1.0	%		17.3	25.1	19.1	18.0	14.5
passing (0.005 mm)	----	E183	1.0	%		10.3	16.6	12.3	10.3	8.3
passing (0.004 mm)	----	E183	1.0	%		9.3	15.0	11.4	9.3	7.4
passing (0.002 mm)	----	E183	1.0	%		7.7	12.1	9.3	7.9	5.6
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-S-01	22-S9-S-01	22-S8-S-01	22-R2-S-01	22-R3-S-01
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 13:00	13-Sep-2022 14:15	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2359-001	VA22C2359-002	VA22C2359-003	VA22C2359-004	VA22C2359-005
						Result	Result	Result	Result	Result
Particle Size										
passing (2.0 mm)	----	E181	1.0	%		71.7	65.3	70.9	71.1	62.2
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.269	0.021	0.485	0.347	0.129
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		3.60	0.280	4.32	15.5	3.28
carbon, inorganic [IC]	----	E354	0.050	%		0.142	0.167	0.149	0.132	0.060
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		1.18	1.39	1.24	1.10	0.50
carbon, total organic [TOC]	----	EC356	0.050	%		3.46	0.113	4.17	15.4	3.22
organic matter	----	EC356	0.10	%		5.96	0.19	7.19	26.5	5.55
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		159	11.0	212	37.7	64.4
potassium, available	7440-09-7	E390	20	mg/kg		138	<20	207	193	76
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		4.2	3.3	5.6	7.6	<3.0
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	<1.0	1.3	<2.5 DLM	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.270 RRR	0.210	0.148	0.071	0.068
sodium adsorption ratio [SAR]	----	EC102	0.10	-		0.14	0.12	<0.10	<0.10	0.14
pH, saturated paste	----	E114	0.10	pH units		6.65	7.97	6.74	5.06	4.88
TGR (brine)	----	EC106	0.1	t/ha		----	----	Incalculable	Incalculable	----
TGR (brine)	----	EC106	0.10	t/ha		<0.10	<0.10	----	----	<0.10
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		56.3	40.7	73.6	174	50.3
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		9.06	13.7	15.8	27.3	6.49
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		16.1	33.7	21.5	15.7	12.9
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		1.35	1.10	2.72	3.13	0.90
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		2.4	2.7	3.7	1.8	1.8
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		2.4	<2.0	5.7	15.1	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		4.3	<4.0	7.8	8.7	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		1.24	1.14	<1.47	<3.49	1.06
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		2.2	2.8	<2.0	<2.0	2.1
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<11.2	<8.1	<14.7	<34.9	<10.1

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-S-01	22-S9-S-01	22-S8-S-01	22-R2-S-01	22-R3-S-01
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 13:00	13-Sep-2022 14:15	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2359-001	VA22C2359-002	VA22C2359-003	VA22C2359-004	VA22C2359-005
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		8.1	9.2	17.8	<8.7	2.6
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		14.4	22.5	24.2	<5.0	5.1
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.87	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		<5.6	22.0	16.2	<17.4	<6.0
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		<10	54	22	<10	<12
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.8	<5.1	<3.7	<8.7	<6.3
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<5.0	<12.5	<5.0	<5.0	<12.5
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		<28.1	22.0	16.2	<17.4	<6.0
alkalinity, total (as CaCO3)	----	E293	10	mg/L		<50	54	22	<10	<12 DLIS
Metals										
aluminum	7429-90-5	E440	50	mg/kg		21200	19800	18100	13000	12200
antimony	7440-36-0	E440	0.10	mg/kg		0.72	0.60	0.90	0.25	0.26
arsenic	7440-38-2	E440	0.10	mg/kg		11.5	14.1	12.1	4.37	5.30
barium	7440-39-3	E440	0.50	mg/kg		224	206	231	150	99.5
beryllium	7440-41-7	E440	0.10	mg/kg		0.63	0.67	0.55	0.28	0.29
bismuth	7440-69-9	E440	0.20	mg/kg		2.13	<0.20	10.8	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		7.4	9.7	8.3	<5.0	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg		0.479	0.437	0.811	0.527	0.390
calcium	7440-70-2	E440	50	mg/kg		14100	19400	16400	6240	4060
chromium	7440-47-3	E440	0.50	mg/kg		29.7	20.6	27.9	26.4	29.6
cobalt	7440-48-4	E440	0.10	mg/kg		14.9	17.0	15.0	7.57	6.81
copper	7440-50-8	E440	0.50	mg/kg		619	635	716	59.5	18.5
iron	7439-89-6	E440	50	mg/kg		37500	38200	38400	21400	24200
lead	7439-92-1	E440	0.50	mg/kg		13.7	10.5	16.2	8.03	7.36
lithium	7439-93-2	E440	2.0	mg/kg		15.5	19.0	15.4	10.1	11.8
magnesium	7439-95-4	E440	20	mg/kg		7840	10600	9720	3840	2910
manganese	7439-96-5	E440	1.0	mg/kg		1010	1000	900	704	570
mercury	7439-97-6	E510	0.0050	mg/kg		0.199	0.114	0.353	0.0818	0.0355
molybdenum	7439-98-7	E440	0.10	mg/kg		4.02	2.83	3.51	1.42	0.90

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-S-01	22-S9-S-01	22-S8-S-01	22-R2-S-01	22-R3-S-01
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 13:00	13-Sep-2022 14:15	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2359-001	VA22C2359-002	VA22C2359-003	VA22C2359-004	VA22C2359-005
						Result	Result	Result	Result	Result
Metals										
nickel	7440-02-0	E440	0.50	mg/kg		18.0	16.7	17.8	13.4	10.5
phosphorus	7723-14-0	E440	50	mg/kg		2380	1220	4350	615	1080
potassium	7440-09-7	E440	100	mg/kg		1510	1360	1510	840	610
selenium	7782-49-2	E440	0.20	mg/kg		1.04	0.95	1.63	<0.20	<0.20
silver	7440-22-4	E440	0.10	mg/kg		0.70	0.31	1.05	0.21	0.14
sodium	7440-23-5	E440	50	mg/kg		274	384	287	96	88
strontium	7440-24-6	E440	0.50	mg/kg		176	210	177	65.9	60.7
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		0.065	<0.050	0.052	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		4.2	<2.0	8.7	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		868	1150	603	636	800
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	0.50	0.96	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.837	0.657	0.703	0.368	0.331
vanadium	7440-62-2	E440	0.20	mg/kg		114	130	110	65.8	71.7
zinc	7440-66-6	E440	2.0	mg/kg		156	102	269	95.5	94.2
zirconium	7440-67-7	E440	1.0	mg/kg		1.1	6.6	1.7	2.6	1.7
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.239	<0.070 DLM	0.415	0.278	0.091

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-S-01	22-R3-S-01D	22-S11-S-01	22-S12-S-01	22-S14-S-01
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 10:00	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 14:00
						VA22C2359-006	VA22C2359-007	VA22C2359-008	VA22C2359-009	VA22C2359-010
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		7.8	8.4	5.9	6.9	5.3
moisture	----	E144	0.25	%		9.40	9.59	6.78	9.39	6.78
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		4.22	4.17	6.73	6.56	6.95
pH (1:2 soil:water)	----	E108	0.10	pH units		4.94	4.93	7.52	7.12	7.60
ash content @ 550°C	----	E205D	1.0	%		92.1	91.6	94.1	93.1	94.7
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		82.2	84.3	91.4	93.4	92.6
passing (4.75 mm)	----	E181	1.0	%		68.4	74.4	83.3	86.5	86.5
passing (19 mm)	----	E181	1.0	%		100	96.2	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		51.8	58.6	66.5	71.4	71.1
passing (0.841 mm)	----	E182	1.0	%		51.0	57.5	65.4	70.4	69.9
passing (0.50 mm)	----	E182	1.0	%		47.5	53.5	60.4	65.9	64.9
passing (0.420 mm)	----	E182	1.0	%		46.6	52.5	59.1	64.8	63.6
passing (0.250 mm)	----	E182	1.0	%		43.0	48.2	54.0	59.9	58.5
passing (0.149 mm)	----	E182	1.0	%		39.2	43.9	48.8	54.8	53.4
passing (0.125 mm)	----	E182	1.0	%		37.6	42.1	46.9	52.8	51.3
passing (0.075 mm)	----	E182	1.0	%		34.4	38.3	43.0	48.6	47.0
passing (0.063 mm)	----	E182	1.0	%		30.4	32.4	39.9	46.0	44.6
passing (0.05 mm)	----	E182	1.0	%		26.2	26.0	36.4	43.2	42.0
passing (0.0312 mm)	----	E183	1.0	%		20.6	19.7	31.3	38.4	36.6
passing (0.020 mm)	----	E183	1.0	%		17.2	14.6	26.8	33.7	31.9
passing (0.005 mm)	----	E183	1.0	%		8.9	8.0	17.2	22.9	21.2
passing (0.004 mm)	----	E183	1.0	%		8.0	7.2	16.1	21.2	19.5
passing (0.002 mm)	----	E183	1.0	%		6.8	5.7	13.4	17.3	16.1
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
passing (2.0 mm)	----	E181	1.0	%		56.9	65.6	73.0	77.1	78.0

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-S-01	22-R3-S-01D	22-S11-S-01	22-S12-S-01	22-S14-S-01
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 10:00	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 14:00
						VA22C2359-006	VA22C2359-007	VA22C2359-008	VA22C2359-009	VA22C2359-010
						Result	Result	Result	Result	Result
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.117	0.112	0.125	0.171	0.127
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		2.86	3.16	2.02	2.71	1.69
carbon, inorganic [IC]	----	E354	0.050	%		0.067	0.062	0.135	0.151	0.131
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		0.56	0.52	1.13	1.26	1.09
carbon, total organic [TOC]	----	EC356	0.050	%		2.79	3.10	1.88	2.56	1.56
organic matter	----	EC356	0.10	%		4.81	5.34	3.24	4.41	2.69
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		82.2	54.7	15.1	13.9	12.5
potassium, available	7440-09-7	E390	20	mg/kg		102	67	136	118	97
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		<3.0	3.6	4.0	8.0	5.9
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.056	0.065	0.176	0.164	0.192
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	0.15	<0.10	<0.10	<0.10
pH, saturated paste	----	E114	0.10	pH units		4.96	4.88	7.34	6.83	7.37
TGR (brine)	----	EC106	0.1	t/ha		Incalculable	----	----	Incalculable	----
TGR (brine)	----	EC106	0.10	t/ha		----	<0.10	<0.10	----	<0.10
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		48.8	50.5	48.6	47.4	43.4
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		4.06	6.36	22.4	15.8	16.2
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		8.33	12.6	46.0	33.3	37.4
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		0.78	0.91	2.04	1.56	2.08
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		1.6	1.8	4.2	3.3	4.8
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		2.9	<2.0	2.6	<2.0	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		6.0	<4.0	5.4	<4.0	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		<1.00	1.06	1.26	<1.00	<1.00
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		<2.0	2.1	2.6	<2.0	2.2
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<9.8	<10.1	<9.7	<9.5	<8.7
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		<2.5	2.7	10.1	25.1	14.2

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-S-01	22-R3-S-01D	22-S11-S-01	22-S12-S-01	22-S14-S-01
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 10:00	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 14:00
						VA22C2359-006	VA22C2359-007	VA22C2359-008	VA22C2359-009	VA22C2359-010
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		<5.0	5.3	20.8	53.0	32.8
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		<5.8	<6.0	31.6	<11.8	22.1
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		<12	<12	65	<25	51
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<6.1	<6.3	<4.9	<11.8	<4.3
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<12.5	<12.5	<10.0	<25.0	<10.0
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		<5.8	<6.0	31.6	<11.8	22.1
alkalinity, total (as CaCO3)	----	E293	10	mg/L		<12 DLIS	<12 DLIS	65	<25 DLIS	51
Metals										
aluminum	7429-90-5	E440	50	mg/kg		13800	13300	23300	26400	21600
antimony	7440-36-0	E440	0.10	mg/kg		0.36	0.28	0.69	0.74	0.55
arsenic	7440-38-2	E440	0.10	mg/kg		5.38	4.89	14.5	15.1	12.0
barium	7440-39-3	E440	0.50	mg/kg		133	106	167	173	140
beryllium	7440-41-7	E440	0.10	mg/kg		0.25	0.26	0.84	0.92	0.66
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		<5.0	<5.0	12.1	9.0	6.2
cadmium	7440-43-9	E440	0.020	mg/kg		0.379	0.392	0.322	0.372	0.298
calcium	7440-70-2	E440	50	mg/kg		3140	3860	15600	14200	11600
chromium	7440-47-3	E440	0.50	mg/kg		34.0	30.6	30.1	38.9	34.9
cobalt	7440-48-4	E440	0.10	mg/kg		8.32	7.54	17.2	19.0	16.4
copper	7440-50-8	E440	0.50	mg/kg		22.7	18.1	830	761	595
iron	7439-89-6	E440	50	mg/kg		25200	24600	37800	41200	34600
lead	7439-92-1	E440	0.50	mg/kg		6.20	6.77	8.76	10.2	8.99
lithium	7439-93-2	E440	2.0	mg/kg		13.5	12.2	18.3	20.4	16.8
magnesium	7439-95-4	E440	20	mg/kg		3820	2900	8660	9490	8420
manganese	7439-96-5	E440	1.0	mg/kg		588	630	981	1100	829
mercury	7439-97-6	E510	0.0050	mg/kg		0.0348	0.0334	0.126	0.144	0.112
molybdenum	7439-98-7	E440	0.10	mg/kg		0.57	0.80	3.68	4.79	2.94
nickel	7440-02-0	E440	0.50	mg/kg		13.5	11.1	18.8	23.9	21.4
phosphorus	7723-14-0	E440	50	mg/kg		967	1020	1060	1120	971

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-S-01	22-R3-S-01D	22-S11-S-01	22-S12-S-01	22-S14-S-01
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 10:00	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 14:00
						VA22C2359-006	VA22C2359-007	VA22C2359-008	VA22C2359-009	VA22C2359-010
						Result	Result	Result	Result	Result
Metals										
potassium	7440-09-7	E440	100	mg/kg		880	650	1560	1820	1430
selenium	7782-49-2	E440	0.20	mg/kg		<0.20	<0.20	1.04	1.03	0.70
silver	7440-22-4	E440	0.10	mg/kg		0.13	0.12	0.26	0.37	0.21
sodium	7440-23-5	E440	50	mg/kg		114	100	220	225	194
strontium	7440-24-6	E440	0.50	mg/kg		47.4	63.8	178	179	148
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	0.050	0.078	0.098	0.081
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		1000	897	1270	1360	1110
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.365	0.384	1.18	1.29	1.02
vanadium	7440-62-2	E440	0.20	mg/kg		76.2	74.3	130	134	112
zinc	7440-66-6	E440	2.0	mg/kg		108	98.5	91.4	103	85.9
zirconium	7440-67-7	E440	1.0	mg/kg		<2.0 DLM	1.8	3.6	3.6	3.8
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.090	0.099	0.117	0.147	0.106

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-S-01	22-S13-S-01D	----	----	----
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 14:40	----	----	----
						VA22C2359-011	VA22C2359-012	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		4.2	4.2	----	----	----
moisture	----	E144	0.25	%		5.48	5.56	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		7.03	7.10	----	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units		7.63	7.57	----	----	----
ash content @ 550°C	----	E205D	1.0	%		95.8	95.8	----	----	----
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		94.7	93.9	----	----	----
passing (4.75 mm)	----	E181	1.0	%		87.2	85.5	----	----	----
passing (19 mm)	----	E181	1.0	%		100	100	----	----	----
passing (25.4 mm)	----	E181	1.0	%		100	100	----	----	----
passing (38.1 mm)	----	E181	1.0	%		100	100	----	----	----
passing (50.8 mm)	----	E181	1.0	%		100	100	----	----	----
passing (76.2 mm)	----	E181	1.0	%		100	100	----	----	----
passing (1.0 mm)	----	E182	1.0	%		69.8	69.0	----	----	----
passing (0.841 mm)	----	E182	1.0	%		68.8	67.9	----	----	----
passing (0.50 mm)	----	E182	1.0	%		63.5	62.6	----	----	----
passing (0.420 mm)	----	E182	1.0	%		62.1	61.2	----	----	----
passing (0.250 mm)	----	E182	1.0	%		56.3	55.5	----	----	----
passing (0.149 mm)	----	E182	1.0	%		50.5	49.6	----	----	----
passing (0.125 mm)	----	E182	1.0	%		48.2	47.4	----	----	----
passing (0.075 mm)	----	E182	1.0	%		43.5	43.0	----	----	----
passing (0.063 mm)	----	E182	1.0	%		40.7	40.4	----	----	----
passing (0.05 mm)	----	E182	1.0	%		37.6	37.6	----	----	----
passing (0.0312 mm)	----	E183	1.0	%		33.2	34.0	----	----	----
passing (0.020 mm)	----	E183	1.0	%		29.3	29.9	----	----	----
passing (0.005 mm)	----	E183	1.0	%		18.6	19.2	----	----	----
passing (0.004 mm)	----	E183	1.0	%		17.3	17.9	----	----	----
passing (0.002 mm)	----	E183	1.0	%		14.0	14.2	----	----	----
grain size curve	----	E185	-	-		See Attached	See Attached	----	----	----
passing (2.0 mm)	----	E181	1.0	%		76.2	75.6	----	----	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-S-01	22-S13-S-01D	----	----	----
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 14:40	----	----	----
						VA22C2359-011	VA22C2359-012	--------	--------	--------
						Result	Result	----	----	----
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.056	0.076	----	----	----
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		1.10	1.24	----	----	----
carbon, inorganic [IC]	----	E354	0.050	%		0.112	0.108	----	----	----
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		0.93	0.90	----	----	----
carbon, total organic [TOC]	----	EC356	0.050	%		0.988	1.13	----	----	----
organic matter	----	EC356	0.10	%		1.70	1.95	----	----	----
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		14.4	14.5	----	----	----
potassium, available	7440-09-7	E390	20	mg/kg		127	119	----	----	----
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		3.4	3.4	----	----	----
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	<1.0	----	----	----
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.291	0.282	----	----	----
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	<0.10	----	----	----
pH, saturated paste	----	E114	0.10	pH units		7.67	7.44	----	----	----
TGR (brine)	----	EC106	0.10	t/ha		<0.10	<0.10	----	----	----
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	----	----	----
% saturation	----	E141	1.0	%		48.3	48.6	----	----	----
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		27.1	24.8	----	----	----
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		56.2	51.1	----	----	----
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		3.43	3.40	----	----	----
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		7.1	7.0	----	----	----
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		2.1	2.0	----	----	----
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		4.3	4.2	----	----	----
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		1.26	1.22	----	----	----
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		2.6	2.5	----	----	----
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<9.6	<9.7	----	----	----
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	----	----	----
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		4.9	4.7	----	----	----
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		10.2	9.7	----	----	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-S-01	22-S13-S-01D	----	----	----
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 14:40	----	----	----
						VA22C2359-011	VA22C2359-012	--------	--------	--------
						Result	Result	----	----	----
Saturated Paste Extractables										
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	----	----	----
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		54.6	58.3	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		113	120	----	----	----
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<12.1	<6.1	----	----	----
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<25.0	<12.5	----	----	----
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		54.6	58.3	----	----	----
alkalinity, total (as CaCO3)	----	E293	10	mg/L		113	120	----	----	----
Metals										
aluminum	7429-90-5	E440	50	mg/kg		19300	17600	----	----	----
antimony	7440-36-0	E440	0.10	mg/kg		0.61	0.55	----	----	----
arsenic	7440-38-2	E440	0.10	mg/kg		13.1	12.4	----	----	----
barium	7440-39-3	E440	0.50	mg/kg		134	136	----	----	----
beryllium	7440-41-7	E440	0.10	mg/kg		0.62	0.54	----	----	----
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	----	----	----
boron	7440-42-8	E440	5.0	mg/kg		8.0	6.9	----	----	----
cadmium	7440-43-9	E440	0.020	mg/kg		0.290	0.275	----	----	----
calcium	7440-70-2	E440	50	mg/kg		14900	12700	----	----	----
chromium	7440-47-3	E440	0.50	mg/kg		38.7	30.0	----	----	----
cobalt	7440-48-4	E440	0.10	mg/kg		18.7	16.4	----	----	----
copper	7440-50-8	E440	0.50	mg/kg		269	243	----	----	----
iron	7439-89-6	E440	50	mg/kg		37700	33400	----	----	----
lead	7439-92-1	E440	0.50	mg/kg		9.53	8.74	----	----	----
lithium	7439-93-2	E440	2.0	mg/kg		16.8	14.4	----	----	----
magnesium	7439-95-4	E440	20	mg/kg		9060	8440	----	----	----
manganese	7439-96-5	E440	1.0	mg/kg		905	862	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg		0.0847	0.0776	----	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg		2.45	2.23	----	----	----
nickel	7440-02-0	E440	0.50	mg/kg		18.5	15.6	----	----	----
phosphorus	7723-14-0	E440	50	mg/kg		1190	1120	----	----	----
potassium	7440-09-7	E440	100	mg/kg		1510	1390	----	----	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-S-01	22-S13-S-01D	----	----	----
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 14:40	----	----	----
						VA22C2359-011	VA22C2359-012	--------	--------	--------
						Result	Result	----	----	----
Metals										
selenium	7782-49-2	E440	0.20	mg/kg		0.55	0.45	----	----	----
silver	7440-22-4	E440	0.10	mg/kg		0.19	0.18	----	----	----
sodium	7440-23-5	E440	50	mg/kg		251	221	----	----	----
strontium	7440-24-6	E440	0.50	mg/kg		208	188	----	----	----
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	----	----	----
thallium	7440-28-0	E440	0.050	mg/kg		0.064	0.060	----	----	----
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	----	----	----
titanium	7440-32-6	E440	1.0	mg/kg		1330	1200	----	----	----
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	----	----	----
uranium	7440-61-1	E440	0.050	mg/kg		0.687	0.666	----	----	----
vanadium	7440-62-2	E440	0.20	mg/kg		132	113	----	----	----
zinc	7440-66-6	E440	2.0	mg/kg		92.5	84.5	----	----	----
zirconium	7440-67-7	E440	1.0	mg/kg		5.0	4.7	----	----	----
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.175	<0.071 DLM	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2359**	Page	: 1 of 45
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 14-Oct-2022 17:14
C-O-C number	: 17-686091		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 12		
No. of samples analysed	: 12		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	antimony	7440-36-0	E440	37.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	arsenic	7440-38-2	E440	32.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S3-S-01	E366	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S8-S-01	E366	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S9-S-01	E366	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R1-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R2-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R3-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R3-S-01D	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S11-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S12-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S13-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S13-S-01D	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S14-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S3-S-01	E319	13-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S8-S-01	E319	13-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S9-S-01	E319	13-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R1-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R2-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R3-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R3-S-01D	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S11-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S12-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S13-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S13-S-01D	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S14-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R1-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E510	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E510	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E510	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E510	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E440	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E440	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E440	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E440	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	11 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R1-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R2-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R3-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R3-S-01D	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S11-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S12-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S13-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S13-S-01D	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S14-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S3-S-01	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S8-S-01	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S9-S-01	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R1-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R2-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R3-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R3-S-01D	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S11-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S12-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S13-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S13-S-01D	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S14-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S3-S-01	E354	13-Sep-2022	----	----	----		23-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S8-S-01	E354	13-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S9-S-01	E354	13-Sep-2022	----	----	----		23-Sep-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R1-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R2-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R3-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R3-S-01D	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S11-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S12-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S13-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S13-S-01D	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S14-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S3-S-01	E185	13-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S8-S-01	E185	13-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S9-S-01	E185	13-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R1-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R2-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R3-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R3-S-01D	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S11-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S12-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S13-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S13-S-01D	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S14-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S3-S-01	E183	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S8-S-01	E183	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S9-S-01	E183	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R1-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R2-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R3-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R3-S-01D	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S11-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S12-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S13-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S13-S-01D	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S14-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S3-S-01	E182	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S8-S-01	E182	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S9-S-01	E182	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R1-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R2-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R3-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R3-S-01D	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S11-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S12-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S13-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S13-S-01D	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S14-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S3-S-01	E181	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S8-S-01	E181	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S9-S-01	E181	13-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R1-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R2-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R3-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R3-S-01D	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S11-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S12-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S13-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S13-S-01D	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S14-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S3-S-01	E205D	13-Sep-2022	----	----	----		22-Sep-2022	365 days	9 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S8-S-01	E205D	13-Sep-2022	----	----	----		22-Sep-2022	365 days	9 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S9-S-01	E205D	13-Sep-2022	----	----	----		22-Sep-2022	365 days	9 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R1-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E144	14-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E144	13-Sep-2022	----	----	----		21-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E144	13-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E144	13-Sep-2022	----	----	----		21-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R1-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R2-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R3-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R3-S-01D	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-S11-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-S12-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-S13-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S13-S-01D	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S14-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S3-S-01	E108B	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S8-S-01	E108B	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S9-S-01	E108B	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S3-S-01	E108	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S8-S-01	E108	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S9-S-01	E108	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R1-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E108	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	9 days	✓
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag										
22-S3-S-01	E269.N+N	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	10 days	× EHTR-FM

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S8-S-01	E269.N+N	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	10 days	× EHTR-FM
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S9-S-01	E269.N+N	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	10 days	× EHTR-FM
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R1-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R2-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R3-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R3-S-01D	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S11-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S12-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S13-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S13-S-01D	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S14-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S3-S-01	E384	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S8-S-01	E384	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S9-S-01	E384	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R1-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R2-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R3-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R3-S-01D	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S11-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S12-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S13-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S13-S-01D	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S14-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S3-S-01	E390	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S8-S-01	E390	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S9-S-01	E390	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R1-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R2-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R3-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R3-S-01D	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S11-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S12-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S13-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S13-S-01D	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S14-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R1-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R2-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R3-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R3-S-01D	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S11-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S12-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S13-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S13-S-01D	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S14-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S3-S-01	E497.SO4	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S8-S-01	E497.SO4	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S9-S-01	E497.SO4	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E293	13-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E293	13-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E293	13-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	0 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E293	14-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	14 days	19 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E442	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E442	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E442	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E442	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E442	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E442	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E239.Cl	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E239.Cl	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E239.Cl	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E239.Cl	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E102	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E102	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E102	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E102	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E102	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E102	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	10 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	10 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	10 days	× EHTL	24-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	10 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E239.NO3	13-Sep-2022	23-Sep-2022	3 days	10 days	× EHTR	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E239.NO3	13-Sep-2022	23-Sep-2022	3 days	10 days	× EHTR	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E239.NO3	13-Sep-2022	23-Sep-2022	3 days	10 days	× EHTR	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	9 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	9 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	9 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	9 days	× EHTL	24-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E239.NO3	14-Sep-2022	23-Sep-2022	3 days	9 days	× EHTL	24-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E114	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E114	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E114	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E114	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	1	20	5.0	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	1	20	5.0	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	1	20	5.0	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	1	20	5.0	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	1	12	8.3	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	1	12	8.3	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	1	12	8.3	5.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	1	18	5.5	5.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Particle Size Analysis - Hydrometer	E183	658748	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658747	1	12	8.3	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	1	20	5.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	657035	1	18	5.5	5.0	✓
pH by Meter (Saturated Paste)	E114	657040	1	12	8.3	5.0	✓
Saturation Percentage	E141	657039	1	12	8.3	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	1	12	8.3	5.0	✓
Total Carbon by Combustion	E351	658686	1	20	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	658687	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	20	10.0	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	20	10.0	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	20	10.0	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	20	10.0	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	2	12	16.6	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	2	12	16.6	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	2	12	16.6	10.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	2	12	16.6	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	2	18	11.1	10.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Particle Size Analysis - Hydrometer	E183	658748	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658747	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658746	1	12	8.3	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	2	20	10.0	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	657035	1	18	5.5	5.0	✓
pH by Meter (Saturated Paste)	E114	657040	2	12	16.6	10.0	✓
Saturation Percentage	E141	657039	2	12	16.6	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	2	12	16.6	10.0	✓
Total Carbon by Combustion	E351	658686	2	20	10.0	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	20	10.0	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	2	19	10.5	10.0	✓
Total Nitrogen by Combustion	E366	658687	2	20	10.0	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	1	20	5.0	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	1	20	5.0	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	1	20	5.0	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	1	20	5.0	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	1	12	8.3	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	1	12	8.3	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	1	12	8.3	5.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	1	18	5.5	5.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Saturation Percentage	E141	657039	1	12	8.3	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	1	12	8.3	5.0	✓
Total Carbon by Combustion	E351	658686	1	20	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	658687	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **VA22C2359**	Page	: 1 of 14
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686091	Issue Date	: 14-Oct-2022 17:14
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 12		
No. of samples analysed	: 12		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 657035)											
VA22C2342-044	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	6.01	6.08	1.2%	5%	----
Physical Tests (QC Lot: 657044)											
VA22C2342-044	Anonymous	moisture	----	E144	0.25	%	67.0	67.3	0.542%	20%	----
Physical Tests (QC Lot: 659685)											
VA22C2359-001	22-S3-S-01	loss on ignition @ 550°C	----	E205D	1.0	%	9.0	8.8	0.2	Diff <2x LOR	----
Physical Tests (QC Lot: 660583)											
VA22C2359-006	22-R1-S-01	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.22	4.24	0.473%	10%	----
Particle Size (QC Lot: 658747)											
VA22C2359-001	22-S3-S-01	passing (0.05 mm)	----	E182	1.0	%	27.6	28.4	2.80%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	33.5	34.2	2.27%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	38.9	39.7	1.92%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	43.8	44.4	1.45%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	46.1	46.7	1.26%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	51.4	51.9	1.06%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	56.7	57.2	0.777%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	58.1	58.5	0.685%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	63.4	63.6	0.338%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	64.6	64.8	0.281%	15%	----
Particle Size (QC Lot: 658748)											
VA22C2359-001	22-S3-S-01	passing (0.002 mm)	----	E183	1.0	%	7.7	8.4	0.7	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	9.3	10.0	0.7	Diff <2x LOR	----
		passing (0.005 mm)	----	E183	1.0	%	10.3	11.0	6.86%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	17.3	18.6	7.30%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	21.9	22.7	3.39%	20%	----
Anions and Nutrients (QC Lot: 658687)											
VA22C2359-001	22-S3-S-01	nitrogen, total	7727-37-9	E366	0.020	%	0.269	0.260	3.40%	20%	----
Organic / Inorganic Carbon (QC Lot: 658686)											
VA22C2359-001	22-S3-S-01	carbon, total [TC]	----	E351	0.050	%	3.60	3.41	5.37%	20%	----
Organic / Inorganic Carbon (QC Lot: 662066)											
VA22C2359-001	22-S3-S-01	carbon, inorganic [IC]	----	E354	0.050	%	0.142	0.141	0.0009	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660552)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Plant Available Nutrients (QC Lot: 660552) - continued											
VA22C2359-004	22-R2-S-01	nitrate + nitrite, available (as N)	----	E269.N+N	2.5	mg/kg	<2.5	<2.5	2.5	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660553)											
VA22C2359-004	22-R2-S-01	sulfate, available (as S)	14808-79-8	E497.SO4	7.5	mg/kg	7.6	7.7	0.1	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660644)											
VA22C2364-006	Anonymous	phosphate, available (as P)	14265-44-2	E384	10.0	mg/kg	156	166	6.48%	30%	----
Plant Available Nutrients (QC Lot: 660645)											
VA22C2364-006	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	198	204	3.32%	30%	----
Saturated Paste Extractables (QC Lot: 657036)											
VA22C2359-001	22-S3-S-01	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	14.4	14.0	0.4	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657037)											
VA22C2359-001	22-S3-S-01	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657038)											
VA22C2359-001	22-S3-S-01	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657039)											
VA22C2359-001	22-S3-S-01	% saturation	----	E141	1.0	%	56.3	53.0	6.08%	20%	----
Saturated Paste Extractables (QC Lot: 657040)											
VA22C2359-001	22-S3-S-01	pH, saturated paste	----	E114	0.10	pH units	6.65	6.56	1.36%	5%	----
Saturated Paste Extractables (QC Lot: 657041)											
VA22C2359-001	22-S3-S-01	conductivity, saturated paste	----	E102	100	µS/cm	0.270 dS/m	168	102	Diff <2x LOR	RRQC
Saturated Paste Extractables (QC Lot: 657042)											
VA22C2359-001	22-S3-S-01	alkalinity, total (as CaCO3)	----	E293	50	mg/L	<50	<50	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657043)											
VA22C2359-001	22-S3-S-01	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	16.1	15.6	3.00%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	2.4	2.3	0.07	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	4.3	4.2	0.08	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	2.2	2.4	0.2	Diff <2x LOR	----
Metals (QC Lot: 657033)											
VA22C2342-044	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	10500	9780	7.17%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.76	1.10	37.4%	30%	DUP-H
		arsenic	7440-38-2	E440	0.10	mg/kg	16.7	12.0	32.9%	30%	DUP-H
		barium	7440-39-3	E440	0.50	mg/kg	94.4	93.8	0.706%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.20	0.20	0.004	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.212	0.192	9.74%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 657033) - continued											
VA22C2342-044	Anonymous	calcium	7440-70-2	E440	50	mg/kg	13400	12700	5.19%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	21.9	20.4	7.03%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	4.47	4.29	3.93%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	20.6	18.7	9.51%	30%	----
		iron	7439-89-6	E440	50	mg/kg	11100	9990	10.2%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	18.6	16.5	11.7%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	5.6	5.2	0.4	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	3300	3660	10.4%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	301	274	9.37%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	13.0	10.0	26.2%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	15.6	14.4	8.27%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	473	469	0.895%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	380	340	40	Diff <2x LOR	----
		selenium	7782-49-2	E440	0.20	mg/kg	1.16	1.19	0.03	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	277	267	3.66%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	72.4	69.4	4.18%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	3600	3400	300	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.050	<0.050	0.00006	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	386	402	3.88%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	1.26	1.07	0.19	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	1.00	0.946	5.73%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	43.8	42.1	4.00%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	57.5	50.0	13.9%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	2.4	1.9	0.5	Diff <2x LOR	----
Metals (QC Lot: 657034)											
VA22C2359-001	22-S3-S-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.199	0.174	13.6%	40%	----
Leachable Anions & Nutrients (QC Lot: 660214)											
VA22C2359-006	22-R1-S-01	Kjeldahl nitrogen, total [TKN]	----	E319	730	mg/kg	0.090 %	<730	900	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*
RRQC	*Refer to report comments for information regarding this QC result.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 657044)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 658687)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 658686)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662066)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 660552)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 660553)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 660644)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Plant Available Nutrients (QCLot: 660645)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Saturated Paste Extractables (QCLot: 657036)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 657037)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----
Saturated Paste Extractables (QCLot: 657038)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 657039)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 657041)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 657042)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 657043)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 657033)						

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 657033) - continued						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 657034)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 660214)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 657035)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 657044)									
moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Physical Tests (QCLot: 660583)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Anions and Nutrients (QCLot: 658687)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 658686)									
carbon, total [TC]	----	E351	0.05	%	48 %	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662066)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	93.3	90.0	110	----
Plant Available Nutrients (QCLot: 660552)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	105	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.0	70.0	130	----
Saturated Paste Extractables (QCLot: 657036)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	103	80.0	120	----
Saturated Paste Extractables (QCLot: 657037)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	103	80.0	120	----
Saturated Paste Extractables (QCLot: 657038)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 657039)									
% saturation	----	E141	1	%	100 %	97.7	80.0	120	----
Saturated Paste Extractables (QCLot: 657040)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.8	95.0	105	----
Saturated Paste Extractables (QCLot: 657041)									

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Saturated Paste Extractables (QCLot: 657041) - continued									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	102	80.0	120	----
Saturated Paste Extractables (QCLot: 657042)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	107	85.0	115	----
Saturated Paste Extractables (QCLot: 657043)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	110	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	105	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	110	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	120	80.0	120	----
Metals (QCLot: 657033)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	114	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	96.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	102	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	90.3	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	99.5	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	95.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	101	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	98.8	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	95.5	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	103	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	98.9	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	98.9	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	93.0	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	101	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	92.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	105	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	106	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 657033) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	96.9	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	97.0	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	98.0	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	107	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	97.4	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	95.1	80.0	120	----
Metals (QCLot: 657034)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.3	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660214)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	81.0	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 659685)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	97.6	80.0	120	----
Physical Tests (QCLot: 660583)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658746)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Particle Size (QCLot: 658747)									
	RM	passing (0.05 mm)	----	E182	49.81 %	100	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	99.2	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	98.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	97.8	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	97.7	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	99.0	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.6	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.7	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.8	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.8	94.9	105	----
Particle Size (QCLot: 658748)									
	RM	passing (0.002 mm)	----	E183	21.14 %	92.0	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	96.4	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	98.9	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	98.7	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	100	88.0	112	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 658687)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	108	80.0	120	----
Organic / Inorganic Carbon (QCLot: 658686)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662066)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	111	80.0	120	----
Plant Available Nutrients (QCLot: 660552)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	76.2	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	100	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	88.8	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	88.3	70.0	130	----
Saturated Paste Extractables (QCLot: 657036)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	106	70.0	130	----
Saturated Paste Extractables (QCLot: 657038)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	102	70.0	130	----
Saturated Paste Extractables (QCLot: 657039)									
	RM	% saturation	----	E141	48.3 %	99.1	70.0	130	----
Saturated Paste Extractables (QCLot: 657040)									
	RM	pH, saturated paste	----	E114	7.59 pH units	96.8	95.0	105	----
Saturated Paste Extractables (QCLot: 657041)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	106	70.0	130	----
Saturated Paste Extractables (QCLot: 657043)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	102	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	103	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	103	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	97.0	70.0	130	----
Metals (QCLot: 657033)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	102	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.3	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	100	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	96.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Reference Material (RM) Report: Recovery (%) RM	Reference Material (RM) Report: Recovery Limits (%) Low	Reference Material (RM) Report: Recovery Limits (%) High	Reference Material (RM) Report: Qualifier
Metals (QCLot: 657033) - continued									
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	98.7	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	114	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	92.0	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	92.4	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	106	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	96.3	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	93.6	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	95.2	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	97.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	99.1	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	99.8	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	104	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	95.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	95.1	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	92.5	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	110	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	99.5	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	94.9	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	105	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	87.2	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	112	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	100	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	101	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	92.8	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	84.4	70.0	130	----
Metals (QCLot: 657034)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	102	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660214)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	84.4	80.0	120	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686091

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	~~604~~ 437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mount Polley Mining Corp
Contact:	gabriel.holmes@mountpolley.com

Project Information

ALS Account # / Quote #:	BR368337
Job #:	
PO / AFE:	5590008044
LSD:	
ALS Lab Work Order # (lab use only):	2359

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: melissa.paliouras@wsp.com
Email 2: samantha.lundquist@wsp.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Amber Springer	Sampler: Samantha Lundquist

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO-4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (Ca Cl2)	Soluble Na, Cl, Ca, Mg	Soluble K, SO-4	Theoretical Gypsum Req	Total Metals	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S3-S-01	13-Sep-22	15:30	Soil																3
	22-S9-S-01	"	13:00	"																"
	22-S8-S-01	"	14:15	"																"
	22-R2-S-01	14-Sep-22	8:50	"																"
	22-R3-S-01	"	10:00	"																"
	22-R1-S-01	"	11:00	"																"
	22-R3-S-01D	"	10:00	"																"
	22-S11-S-01	"	12:40	"																"
	22-S12-S-01	"	13:10	"																"
	22-S14-S-01	"	14:00	"																"
	22-S13-S-01	"	14:40	"																"
	22-S13-S-01D	"	14:40	"																"

Environmental Division
Vancouver
Work Order Reference
VA22C2359

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

...port by clicking on the drop-down list below
...C only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C (avg 6)		

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
S. Lundquist	Sept 17, 2022	14:30

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
JC	SEP 17 2022	14:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2364**	Page	: 1 of 10
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686092	Issue Date	: 30-Sep-2022 10:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Jwan Abdalla	Laboratory Analyst	Sask Soils, Saskatoon, Saskatchewan
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
dS/m	decisiemens per metre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units
t/ha	tonnes per hectare

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
DUPH	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		4.8	9.3	7.2	6.6	8.6
moisture	----	E144	0.25	%		3.90	7.41	5.86	5.67	4.76
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.54	6.35	6.44	6.31	5.90
pH (1:2 soil:water)	----	E108	0.10	pH units		7.10	6.99	6.93	6.93	6.50
ash content @ 550°C	----	E205D	1.0	%		95.2	90.7	92.8	93.4	91.4
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		90.3	92.3	93.4	90.5	94.8
passing (4.75 mm)	----	E181	1.0	%		78.6	84.5	82.2	78.4	85.8
passing (19 mm)	----	E181	1.0	%		100	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		59.3	67.6	62.4	58.0	64.0
passing (0.841 mm)	----	E182	1.0	%		58.1	66.6	61.4	56.9	62.9
passing (0.50 mm)	----	E182	1.0	%		52.7	62.2	56.7	52.0	58.1
passing (0.420 mm)	----	E182	1.0	%		51.4	61.1	55.6	50.7	57.0
passing (0.250 mm)	----	E182	1.0	%		46.0	56.8	50.5	45.7	52.0
passing (0.149 mm)	----	E182	1.0	%		41.3	52.6	45.3	40.9	47.2
passing (0.125 mm)	----	E182	1.0	%		39.3	50.7	43.2	39.0	45.1
passing (0.075 mm)	----	E182	1.0	%		35.3	47.0	38.6	34.9	40.8
passing (0.063 mm)	----	E182	1.0	%		32.2	42.8	34.7	31.9	36.8
passing (0.05 mm)	----	E182	1.0	%		28.8	38.3	30.5	28.7	32.4
passing (0.0312 mm)	----	E183	1.0	%		23.3	32.1	24.9	23.5	26.5
passing (0.020 mm)	----	E183	1.0	%		19.9	28.2	20.8	20.1	22.8
passing (0.005 mm)	----	E183	1.0	%		12.1	18.6	12.9	13.1	13.6
passing (0.004 mm)	----	E183	1.0	%		11.2	16.9	11.6	11.9	12.1
passing (0.002 mm)	----	E183	1.0	%		8.7	13.6	8.6	9.4	8.8
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Particle Size										
passing (2.0 mm)	----	E181	1.0	%		66.2	73.2	68.3	64.5	70.6
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.106	0.219	0.136	0.093	0.146
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		1.38	3.96	3.00	2.30	3.62
carbon, inorganic [IC]	----	E354	0.050	%		0.116	0.149	0.139	0.125	0.117
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		0.97	1.24	1.16	1.04	0.98
carbon, total organic [TOC]	----	EC356	0.050	%		1.26	3.81	2.86	2.18	3.50
organic matter	----	EC356	0.10	%		2.17	6.57	4.93	3.76	6.03
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		10.0	7.4	26.2	26.8	45.0
potassium, available	7440-09-7	E390	20	mg/kg		73	99	110	77	84
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		6.9	7.3	8.7	5.5	4.4
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.222	0.184	0.332	0.195	0.136
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	<0.10	<0.10	<0.10	0.10
pH, saturated paste	----	E114	0.10	pH units		6.90	6.69	6.91	6.84	6.44
TGR (brine)	----	EC106	0.1	t/ha		Incalcuable	Incalcuable	----	----	----
TGR (brine)	----	EC106	0.10	t/ha		----	----	<0.10	<0.10	<0.10
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		47.4	55.0	52.6	52.8	49.0
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		16.7	15.4	29.8	17.3	12.0
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		35.3	28.1	56.6	32.7	24.6
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		1.75	1.38	2.37	1.80	1.62
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.7	2.5	4.5	3.4	3.3
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		<2.0	<2.2	3.2	<2.1	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		<4.0	<4.0	6.0	<4.0	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		<1.00	<1.10	1.16	<1.06	1.03
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		<2.0	<2.0	2.2	2.0	2.1
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<9.5	<11.0	<10.5	<10.6	<9.8

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		14.0	20.0	22.5	12.9	8.0
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		29.5	36.3	42.7	24.5	16.3
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		27.0	16.5	64.2	37.0	12.2
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		57	30	122	70	25
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<12.5 DLIS	<12.5 DLIS	<10.0 DLIS	<10.0 DLIS	<10.0 DLIS
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		27.0	16.5	64.2	37.0	12.2
alkalinity, total (as CaCO3)	----	E293	10	mg/L		57	30	122	70	25
Metals										
aluminum	7429-90-5	E440	50	mg/kg		17700	21200	15600	15500	13800
antimony	7440-36-0	E440	0.10	mg/kg		0.58	0.64	0.46	0.43	0.39
arsenic	7440-38-2	E440	0.10	mg/kg		10.0	13.9	9.23	9.86	8.11
barium	7440-39-3	E440	0.50	mg/kg		90.6	142	264	252	185
beryllium	7440-41-7	E440	0.10	mg/kg		0.57	0.72	0.48	0.47	0.37
bismuth	7440-69-9	E440	0.20	mg/kg		0.28	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		6.0	6.2	9.5	<5.0	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg		0.298	0.404	0.236	0.237	0.197
calcium	7440-70-2	E440	50	mg/kg		9950	11100	10500	10000	7190
chromium	7440-47-3	E440	0.50	mg/kg		33.2	31.6	25.8	26.9	28.1
cobalt	7440-48-4	E440	0.10	mg/kg		14.0	15.9	13.7	13.5	11.9
copper	7440-50-8	E440	0.50	mg/kg		254	703	642	324	191
iron	7439-89-6	E440	50	mg/kg		34100	35300	33300	33200	29400
lead	7439-92-1	E440	0.50	mg/kg		8.31	7.68	6.96	6.56	6.09
lithium	7439-93-2	E440	2.0	mg/kg		16.9	16.0	13.3	13.7	11.9
magnesium	7439-95-4	E440	20	mg/kg		7880	7760	6700	7120	5920
manganese	7439-96-5	E440	1.0	mg/kg		800	858	733	738	688
mercury	7439-97-6	E510	0.0050	mg/kg		0.274 DUPH	0.156	0.357	0.0647	0.0554
molybdenum	7439-98-7	E440	0.10	mg/kg		2.04	4.66	3.60	2.75	2.22

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Metals										
nickel	7440-02-0	E440	0.50	mg/kg		21.1	19.8	17.7	17.1	17.4
phosphorus	7723-14-0	E440	50	mg/kg		1070	1010	914	988	910
potassium	7440-09-7	E440	100	mg/kg		1100	1500	1210	1020	990
selenium	7782-49-2	E440	0.20	mg/kg		0.35	0.98	0.79	0.45	0.36
silver	7440-22-4	E440	0.10	mg/kg		0.26	0.29	0.29	0.20	0.17
sodium	7440-23-5	E440	50	mg/kg		342	213	224	197	151
strontium	7440-24-6	E440	0.50	mg/kg		142	158	95.6	99.2	73.8
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	0.075	<0.050	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		1020	1060	1020	968	885
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.664	1.18	0.611	0.513	0.506
vanadium	7440-62-2	E440	0.20	mg/kg		110	114	107	103	89.8
zinc	7440-66-6	E440	2.0	mg/kg		75.1	92.5	65.2	69.3	64.3
zirconium	7440-67-7	E440	1.0	mg/kg		4.8	3.2	2.8	2.9	2.4
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.095	0.199	0.117	0.099	0.119

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		7.8	8.1	12.5	12.5	13.2
moisture	----	E144	0.25	%		8.65	7.67	9.97	11.3	14.1
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.44	6.29	4.86	4.89	5.75
pH (1:2 soil:water)	----	E108	0.10	pH units		7.03	6.85	5.55	5.59	6.28
ash content @ 550°C	----	E205D	1.0	%		92.2	91.8	87.5	87.4	86.8
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		86.2	90.7	77.8	68.6	94.5
passing (4.75 mm)	----	E181	1.0	%		72.4	77.4	59.1	44.8	81.5
passing (19 mm)	----	E181	1.0	%		100	100	97.6	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		50.3	54.7	39.4	24.1	58.3
passing (0.841 mm)	----	E182	1.0	%		49.1	53.6	38.5	23.2	56.9
passing (0.50 mm)	----	E182	1.0	%		44.5	49.0	35.3	20.2	51.5
passing (0.420 mm)	----	E182	1.0	%		43.3	47.8	34.5	19.5	50.2
passing (0.250 mm)	----	E182	1.0	%		39.2	43.6	31.5	17.1	44.7
passing (0.149 mm)	----	E182	1.0	%		35.5	39.6	28.8	15.3	39.6
passing (0.125 mm)	----	E182	1.0	%		34.1	37.7	27.7	14.6	37.6
passing (0.075 mm)	----	E182	1.0	%		31.0	33.9	25.3	13.2	33.5
passing (0.063 mm)	----	E182	1.0	%		27.3	28.6	22.6	11.9	28.6
passing (0.05 mm)	----	E182	1.0	%		23.4	22.9	19.6	10.4	23.3
passing (0.0312 mm)	----	E183	1.0	%		19.1	18.1	15.4	8.3	19.1
passing (0.020 mm)	----	E183	1.0	%		16.8	14.8	13.0	7.1	16.5
passing (0.005 mm)	----	E183	1.0	%		10.6	9.1	7.8	4.5	10.1
passing (0.004 mm)	----	E183	1.0	%		10.0	8.4	7.3	4.1	9.6
passing (0.002 mm)	----	E183	1.0	%		8.3	6.6	6.1	3.5	8.0
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
passing (2.0 mm)	----	E181	1.0	%		57.5	61.3	44.6	29.5	66.3

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.241	0.332	0.194	0.185	0.231
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		2.82	3.40	5.40	4.01	4.70
carbon, inorganic [IC]	----	E354	0.050	%		0.150	0.146	0.104	0.101	0.117
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		1.25	1.22	0.87	0.84	0.97
carbon, total organic [TOC]	----	EC356	0.050	%		2.67	3.25	5.30	3.91	4.58
organic matter	----	EC356	0.10	%		4.60	5.60	9.14	6.74	7.90
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		156	217	18.2	32.0	36.3
potassium, available	7440-09-7	E390	20	mg/kg		198	<20	225	159	251
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		5.5	4.1	<7.4 DLM	9.5	22.9
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		1.1	<1.0	<2.5 DLM	<2.5 DLM	<2.5 DLM
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.216	0.172	0.078	0.062	0.143
sodium adsorption ratio [SAR]	----	EC102	0.10	-		0.11	0.12	<0.10	<0.10	<0.10
pH, saturated paste	----	E114	0.10	pH units		6.95	6.84	5.62	5.65	6.29
TGR (brine)	----	EC106	0.1	t/ha		----	----	Incalcuable	Incalcuable	Incalcuable
TGR (brine)	----	EC106	0.10	t/ha		<0.10	<0.10	----	----	----
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		54.1	65.0	108	68.5	88.2
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		18.0	15.6	8.54	5.97	23.5
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		33.3	24.0	7.91	8.71	26.6
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		2.06	2.14	1.30	0.75	2.03
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.8	3.3	1.2	1.1	2.3
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		4.8	6.0	6.8	<2.7	9.8
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		8.8	9.2	6.3	<4.0	11.1
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		1.41	1.50	<2.16	<1.37	<1.76
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		2.6	2.3	<2.0	<2.0	<2.0
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<10.8	<13.0	<21.6	<13.7	<17.6
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		9.3	7.0	5.6	<3.4	7.3

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		17.2	10.7	5.2	<5.0	8.3
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.54	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		43.3	28.0	<2.0	<2.0	23.8
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		80	43	<10	<10	27
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<10.0 DLIS	<5.0	<5.0	<5.0	<5.0
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		43.3	28.0	<2.0	<2.0	23.8
alkalinity, total (as CaCO3)	----	E293	10	mg/L		80	43	<10	<10	27
Metals										
aluminum	7429-90-5	E440	50	mg/kg		18900	21100	22900	18500	14800
antimony	7440-36-0	E440	0.10	mg/kg		0.70	0.79	0.56	0.34	0.55
arsenic	7440-38-2	E440	0.10	mg/kg		12.5	13.2	13.7	11.6	8.59
barium	7440-39-3	E440	0.50	mg/kg		210	246	146	147	126
beryllium	7440-41-7	E440	0.10	mg/kg		0.61	0.63	0.61	0.71	0.50
bismuth	7440-69-9	E440	0.20	mg/kg		2.00	3.72	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		5.8	7.3	5.9	6.0	6.8
cadmium	7440-43-9	E440	0.020	mg/kg		0.545	0.578	0.590	0.561	0.382
calcium	7440-70-2	E440	50	mg/kg		14300	15800	5960	6540	7800
chromium	7440-47-3	E440	0.50	mg/kg		25.3	30.2	40.2	26.4	23.9
cobalt	7440-48-4	E440	0.10	mg/kg		15.6	16.5	16.7	12.2	11.1
copper	7440-50-8	E440	0.50	mg/kg		688	759	300	258	125
iron	7439-89-6	E440	50	mg/kg		37200	42500	45800	33900	34200
lead	7439-92-1	E440	0.50	mg/kg		12.5	17.4	13.6	16.8	10.2
lithium	7439-93-2	E440	2.0	mg/kg		15.2	15.8	23.4	22.6	17.4
magnesium	7439-95-4	E440	20	mg/kg		8020	9030	8600	5480	5320
manganese	7439-96-5	E440	1.0	mg/kg		978	950	1220	2000	1350
mercury	7439-97-6	E510	0.0050	mg/kg		0.200	0.280	1.98	0.104	0.0751
molybdenum	7439-98-7	E440	0.10	mg/kg		3.73	4.03	4.12	2.14	1.50
nickel	7440-02-0	E440	0.50	mg/kg		16.6	18.1	23.6	12.0	13.4
phosphorus	7723-14-0	E440	50	mg/kg		2320	3530	1260	1200	848

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Metals										
potassium	7440-09-7	E440	100	mg/kg		1500	1700	1600	1240	1270
selenium	7782-49-2	E440	0.20	mg/kg		0.83	1.39	0.27	<0.20	<0.20
silver	7440-22-4	E440	0.10	mg/kg		0.60	0.90	0.50	0.36	0.35
sodium	7440-23-5	E440	50	mg/kg		422	388	216	109	118
strontium	7440-24-6	E440	0.50	mg/kg		188	182	78.7	77.1	87.4
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	0.064	0.072	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		3.8	6.9	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		701	839	1090	522	1140
tungsten	7440-33-7	E440	0.50	mg/kg		0.58	0.74	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.750	0.858	0.708	0.642	0.584
vanadium	7440-62-2	E440	0.20	mg/kg		114	127	160	125	130
zinc	7440-66-6	E440	2.0	mg/kg		158	201	168	154	116
zirconium	7440-67-7	E440	1.0	mg/kg		1.1	1.1	2.0	<1.0	4.5
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.252	0.362	0.169	0.213	0.214

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2364**	Page	: 1 of 40
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 30-Sep-2022 10:04
C-O-C number	: 17-686092		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22C2364-001	22-S17-S-01	mercury	7439-97-6	E510	58.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R4-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S1-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S2-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S4-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S5-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S6-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R5-S-01	E366	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R6-S-01	E366	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S16-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S17-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R4-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R5-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R6-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S1-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S2-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S4-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S5-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S6-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S16-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S17-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R4-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R5-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R6-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S1-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S2-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E510	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	12 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E510	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	12 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E440	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	12 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E440	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	12 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R4-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R5-S-01	E351	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R6-S-01	E351	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S16-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S17-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S1-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S2-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S4-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S5-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S6-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R4-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R5-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R6-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S16-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S17-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S1-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S2-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S4-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S5-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S6-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R4-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R5-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R6-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S16-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S17-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S1-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S2-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S4-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S5-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S6-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R4-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R5-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R6-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S1-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S2-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S4-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S5-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S6-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S16-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S17-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R4-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R5-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R6-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S1-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S2-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S4-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S5-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S6-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S16-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S17-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R4-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R5-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R6-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S1-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S2-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S4-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S5-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S6-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S16-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S17-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R4-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R5-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R6-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S1-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S2-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S4-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S5-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S6-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S16-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S17-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R4-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R5-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R6-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S16-S-01	E144	14-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S17-S-01	E144	14-Sep-2022	----	----	----		25-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R4-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R5-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R6-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-S16-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S17-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S1-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S2-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S4-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S5-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S6-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R4-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R5-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R6-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E108	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E108	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	12 days	✓
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag										
22-R4-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag										
22-R5-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R6-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S1-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S2-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S4-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S5-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S6-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S16-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S17-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R4-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R5-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R6-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S1-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S2-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S4-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S5-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S6-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S16-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S17-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R4-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R5-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R6-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S1-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S2-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S4-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S5-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S6-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S16-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S17-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R4-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R5-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R6-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S16-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S17-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S1-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S2-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S4-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S5-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S6-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E293	14-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E293	14-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E442	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E442	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.Cl	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.Cl	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E102	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E102	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.NO3	14-Sep-2022	26-Sep-2022	3 days	12 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	12 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.NO3	14-Sep-2022	26-Sep-2022	3 days	12 days	× EHTL	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E114	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E114	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E141	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E141	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.SO4	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.SO4	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	38	5.2	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	38	5.2	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	34	5.8	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	27	7.4	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	2	31	6.4	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	658686	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	39	5.1	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	1	10	10.0	5.0	✓
Total Nitrogen by Combustion	E366	658687	2	26	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	4	38	10.5	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	4	38	10.5	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	4	34	11.7	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	4	27	14.8	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	2	15	13.3	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	2	15	13.3	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	2	15	13.3	10.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	2	15	13.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658741	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	4	31	12.9	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	2	15	13.3	10.0	✓
Saturation Percentage	E141	665003	2	15	13.3	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	2	15	13.3	10.0	✓
Total Carbon by Combustion	E351	658686	4	40	10.0	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	4	39	10.2	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	2	10	20.0	10.0	✓
Total Nitrogen by Combustion	E366	658687	4	26	15.3	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	38	5.2	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	38	5.2	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	34	5.8	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	27	7.4	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	658686	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	39	5.1	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	1	10	10.0	5.0	✓
Total Nitrogen by Combustion	E366	658687	2	26	7.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **VA22C2364**	Page	: 1 of 16
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686092	Issue Date	: 30-Sep-2022 10:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 659685)											
VA22C2359-001	Anonymous	loss on ignition @ 550°C	----	E205D	1.0	%	9.0	8.8	0.2	Diff <2x LOR	----
Physical Tests (QC Lot: 659686)											
VA22C2364-009	22-R5-S-01	loss on ignition @ 550°C	----	E205D	1.0	%	12.5	13.1	4.64%	20%	----
Physical Tests (QC Lot: 660583)											
VA22C2359-006	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.22	4.24	0.473%	10%	----
Physical Tests (QC Lot: 660592)											
VA22C2364-009	22-R5-S-01	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.89	4.91	0.408%	10%	----
Physical Tests (QC Lot: 664998)											
VA22C2364-001	22-S17-S-01	pH (1:2 soil:water)	----	E108	0.10	pH units	7.10	7.19	1.3%	5%	----
Physical Tests (QC Lot: 665008)											
VA22C2364-001	22-S17-S-01	moisture	----	E144	0.25	%	3.90	3.96	1.55%	20%	----
Particle Size (QC Lot: 658739)											
VA22C2364-001	22-S17-S-01	passing (0.002 mm)	----	E183	1.0	%	8.7	9.8	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.2	12.0	7.31%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.1	13.2	8.70%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	19.9	20.6	3.28%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	23.3	23.7	1.75%	20%	----
Particle Size (QC Lot: 658740)											
VA22C2364-001	22-S17-S-01	passing (0.05 mm)	----	E182	1.0	%	28.8	28.7	0.134%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	32.2	32.0	0.487%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	35.3	35.0	0.754%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	39.3	39.2	0.312%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	41.3	41.2	0.131%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	46.0	46.1	0.254%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	51.4	51.6	0.390%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	52.7	52.9	0.293%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	58.1	58.0	0.112%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	59.3	59.2	0.101%	15%	----
Anions and Nutrients (QC Lot: 658687)											
VA22C2359-001	Anonymous	nitrogen, total	7727-37-9	E366	0.020	%	0.269	0.260	3.40%	20%	----
Anions and Nutrients (QC Lot: 660320)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 660320) - continued											
FC2202271-006	Anonymous	nitrogen, total	7727-37-9	E366	0.020	%	0.110	0.095	0.015	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 658686)											
VA22C2359-001	Anonymous	carbon, total [TC]	----	E351	0.050	%	3.60	3.41	5.37%	20%	----
Organic / Inorganic Carbon (QC Lot: 660319)											
FC2202271-006	Anonymous	carbon, total [TC]	----	E351	0.050	%	1.26	1.22	3.14%	20%	----
Organic / Inorganic Carbon (QC Lot: 662066)											
VA22C2359-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	0.142	0.141	0.0009	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 662076)											
EO2207816-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	4.39	4.24	3.66%	20%	----
Plant Available Nutrients (QC Lot: 660552)											
VA22C2359-004	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	2.5	mg/kg	<2.5	<2.5	2.5	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660553)											
VA22C2359-004	Anonymous	sulfate, available (as S)	14808-79-8	E497.SO4	7.5	mg/kg	7.6	7.7	0.1	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660644)											
VA22C2364-006	22-S2-S-01	phosphate, available (as P)	14265-44-2	E384	10.0	mg/kg	156	166	6.48%	30%	----
Plant Available Nutrients (QC Lot: 660645)											
VA22C2364-006	22-S2-S-01	potassium, available	7440-09-7	E390	20	mg/kg	198	204	3.32%	30%	----
Plant Available Nutrients (QC Lot: 661785)											
YL2201594-002	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg	1.4	1.7	0.3	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661786)											
VA22C2364-009	22-R5-S-01	sulfate, available (as S)	14808-79-8	E497.SO4	7.4	mg/kg	9.5	8.1	1.4	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661886)											
FC2202278-001	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	269	271	0.629%	30%	----
Plant Available Nutrients (QC Lot: 661887)											
FC2202278-001	Anonymous	phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665000)											
VA22C2364-001	22-S17-S-01	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	29.5	26.3	3.2	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665001)											
VA22C2364-001	22-S17-S-01	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665002)											
VA22C2364-001	22-S17-S-01	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665003)											
VA22C2364-001	22-S17-S-01	% saturation	----	E141	1.0	%	47.4	46.0	3.02%	20%	----
Saturated Paste Extractables (QC Lot: 665004)											
VA22C2364-001	22-S17-S-01	pH, saturated paste	----	E114	0.10	pH units	6.90	6.96	0.866%	5%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Saturated Paste Extractables (QC Lot: 665005)											
VA22C2364-001	22-S17-S-01	conductivity, saturated paste	----	E102	30	µS/cm	0.222 dS/m	230	8	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665006)											
VA22C2364-001	22-S17-S-01	alkalinity, total (as CaCO3)	----	E293	12	mg/L	57	58	1	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665007)											
VA22C2364-001	22-S17-S-01	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	35.3	34.8	1.63%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	3.7	3.8	0.08	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	<4.0	<4.0	0	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Metals (QC Lot: 664995)											
VA22C2364-001	22-S17-S-01	aluminum	7429-90-5	E440	50	mg/kg	17700	18300	3.11%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.58	0.47	0.10	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	10.0	10.4	4.08%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	90.6	88.0	2.86%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.57	0.57	0.0008	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	0.28	0.25	0.03	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	6.0	5.8	0.3	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.298	0.327	9.41%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	9950	10800	8.69%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	33.2	36.2	8.47%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	14.0	15.4	9.71%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	254	243	4.49%	30%	----
		iron	7439-89-6	E440	50	mg/kg	34100	35300	3.49%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	8.31	8.22	1.09%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	16.9	17.7	4.68%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	7880	8760	10.6%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	800	832	3.83%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	2.04	2.00	1.88%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	21.1	26.4	22.2%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1070	1120	4.01%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1100	1070	3.23%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	0.35	0.33	0.02	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.26	0.25	0.006	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	342	390	13.0%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	142	144	1.24%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 664995) - continued											
VA22C2364-001	22-S17-S-01	thallium	7440-28-0	E440	0.050	mg/kg	<0.050	0.053	0.003	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1020	1020	0.00286%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.664	0.808	19.5%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	110	118	6.69%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	75.1	75.4	0.360%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	4.8	4.9	0.2	Diff <2x LOR	----
Metals (QC Lot: 664996)											
VA22C2364-001	22-S17-S-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.274	0.150	58.6%	40%	DUP-H
Leachable Anions & Nutrients (QC Lot: 660516)											
VA22C2364-010	22-R6-S-01	Kjeldahl nitrogen, total [TKN]	----	E319	690	mg/kg	0.214 %	2140	1	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 665008)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 658687)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Anions and Nutrients (QCLot: 660320)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 658686)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 660319)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662066)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662076)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 660552)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 660553)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 660644)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Plant Available Nutrients (QCLot: 660645)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661785)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 661786)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 661886)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661887)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Saturated Paste Extractables (QCLot: 665000)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 665001)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Saturated Paste Extractables (QCLot: 665002)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 665003)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 665005)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 665006)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 665007)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 664995)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 664995) - continued						
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 664996)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Leachable Anions & Nutrients (QCLot: 660516)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 660583)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 660592)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 664998)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 665008)									
moisture	----	E144	0.25	%	50 %	98.9	90.0	110	----
Anions and Nutrients (QCLot: 658687)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Anions and Nutrients (QCLot: 660320)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	99.7	90.0	110	----
Organic / Inorganic Carbon (QCLot: 658686)									
carbon, total [TC]	----	E351	0.05	%	48 %	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 660319)									
carbon, total [TC]	----	E351	0.05	%	48 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662066)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	93.3	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662076)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	95.2	90.0	110	----
Plant Available Nutrients (QCLot: 660552)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	105	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.0	70.0	130	----
Plant Available Nutrients (QCLot: 661785)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	111	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	106	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Plant Available Nutrients (QCLot: 661886)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.7	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	96.5	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	104	80.0	120	----
Saturated Paste Extractables (QCLot: 665001)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665002)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665003)									
% saturation	----	E141	1	%	100 %	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665004)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.7	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	105	80.0	120	----
Saturated Paste Extractables (QCLot: 665006)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	108	85.0	115	----
Saturated Paste Extractables (QCLot: 665007)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	107	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	101	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	101	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	109	80.0	120	----
Metals (QCLot: 664995)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	92.9	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	100.0	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	92.4	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	88.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	88.4	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	83.5	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	94.2	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	90.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	95.9	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	94.1	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	92.8	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 664995) - continued									
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	99.2	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	91.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	85.7	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	95.2	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	95.2	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	100	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	92.5	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	100	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	95.9	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	97.3	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	89.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	96.4	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	94.0	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	88.2	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	95.6	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	90.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	93.4	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	96.2	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	97.6	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.3	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Metals (QCLot: 664996)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660516)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	80.6	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Reference Material (RM) Report									
					RM Target Concentration	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method		RM	Low	High	Qualifier
Physical Tests (QCLot: 659685)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	97.6	80.0	120	----
Physical Tests (QCLot: 659686)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	93.4	80.0	120	----
Physical Tests (QCLot: 660583)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Physical Tests (QCLot: 660592)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658739)									
	RM	passing (0.002 mm)	----	E183	21.14 %	105	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	102	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	102	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	105	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	106	88.0	112	----
Particle Size (QCLot: 658740)									
	RM	passing (0.05 mm)	----	E182	49.81 %	104	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	101	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	99.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	98.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	98.8	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.1	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.3	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.3	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.4	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.5	94.9	105	----
Particle Size (QCLot: 658741)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Particle Size (QCLot: 658741) - continued									
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Anions and Nutrients (QCLot: 658687)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	108	80.0	120	----
Anions and Nutrients (QCLot: 660320)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	109	80.0	120	----
Organic / Inorganic Carbon (QCLot: 658686)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 660319)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662066)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	111	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662076)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	109	80.0	120	----
Plant Available Nutrients (QCLot: 660552)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	76.2	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	100	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	88.8	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	88.3	70.0	130	----
Plant Available Nutrients (QCLot: 661785)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	78.0	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	99.0	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	98.0	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	91.6	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	99.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Saturated Paste Extractables (QCLot: 665002)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	94.6	70.0	130	----
Saturated Paste Extractables (QCLot: 665003)									
	RM	% saturation	----	E141	48.3 %	102	70.0	130	----
Saturated Paste Extractables (QCLot: 665004)									
	RM	pH, saturated paste	----	E114	7.59 pH units	97.1	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	104	70.0	130	----
Saturated Paste Extractables (QCLot: 665007)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	95.3	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	92.3	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	94.8	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	93.0	70.0	130	----
Metals (QCLot: 664995)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	95.0	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.8	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	98.2	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	89.8	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	94.2	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	97.7	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	88.1	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	90.3	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	101	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	95.6	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	92.4	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	97.3	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	87.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	91.2	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	95.7	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	97.9	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	93.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	94.3	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	91.7	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	103	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 664995) - continued									
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	97.3	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	95.7	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	89.3	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	84.9	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	101	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	95.3	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	98.5	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	94.3	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	81.1	70.0	130	----
Metals (QCLot: 664996)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	97.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660516)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	85.1	80.0	120	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364001
Project Number:	
Client Sample ID	22-S17-S-01
Lab Sample ID	VA22C2364001
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

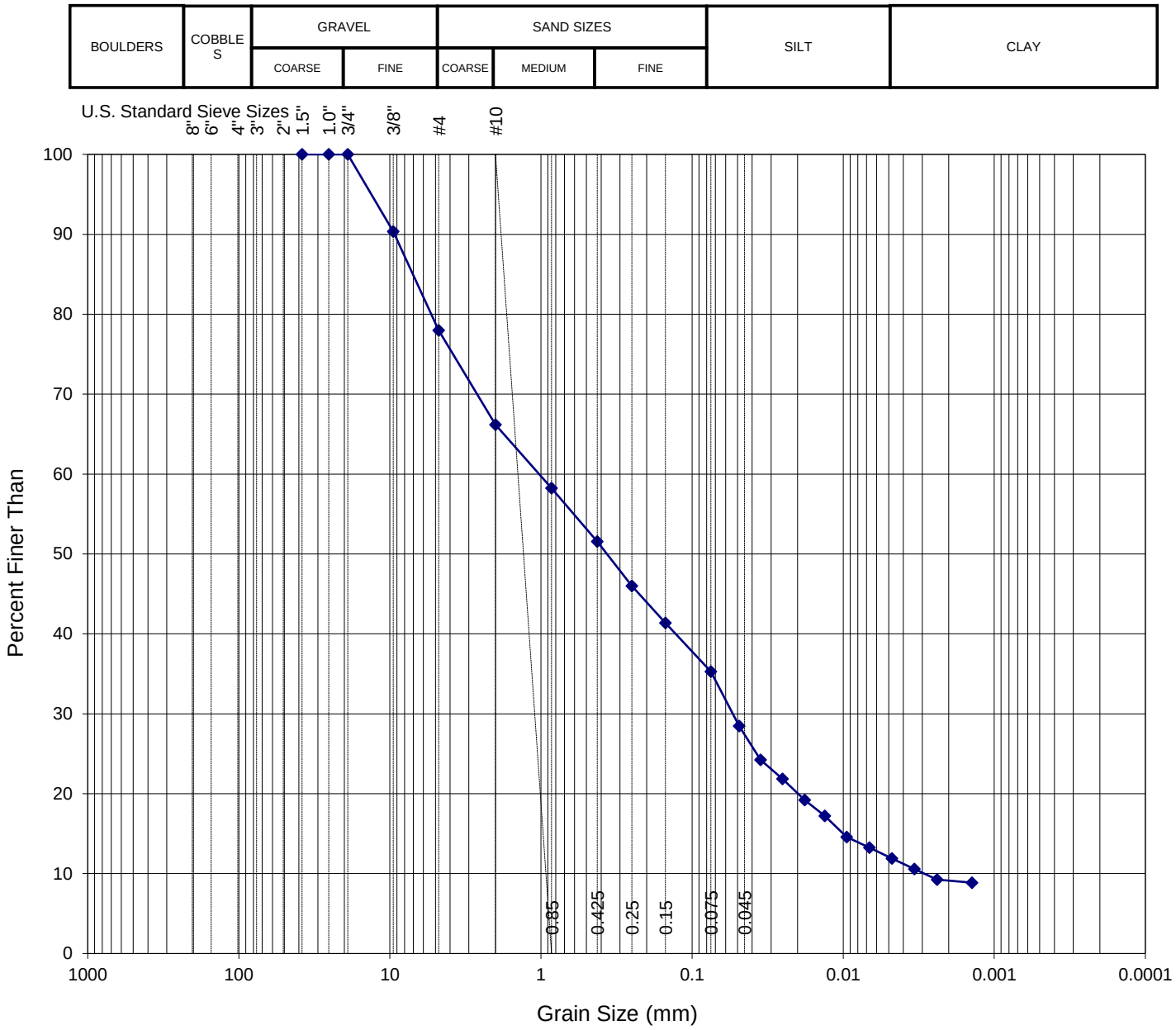

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.02	> 4.75
% COARSE SAND :	11.80	2.0 - 4.75
% MEDIUM SAND :	14.63	0.425 - 2.0
% FINE SAND :	16.26	0.075 - 0.425
% SILT :	23.18	0.075 - 0.005
% CLAY :	12.11	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364002
Project Number:	
Client Sample ID	22-S16-S-01
Lab Sample ID	VA22C2364002
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

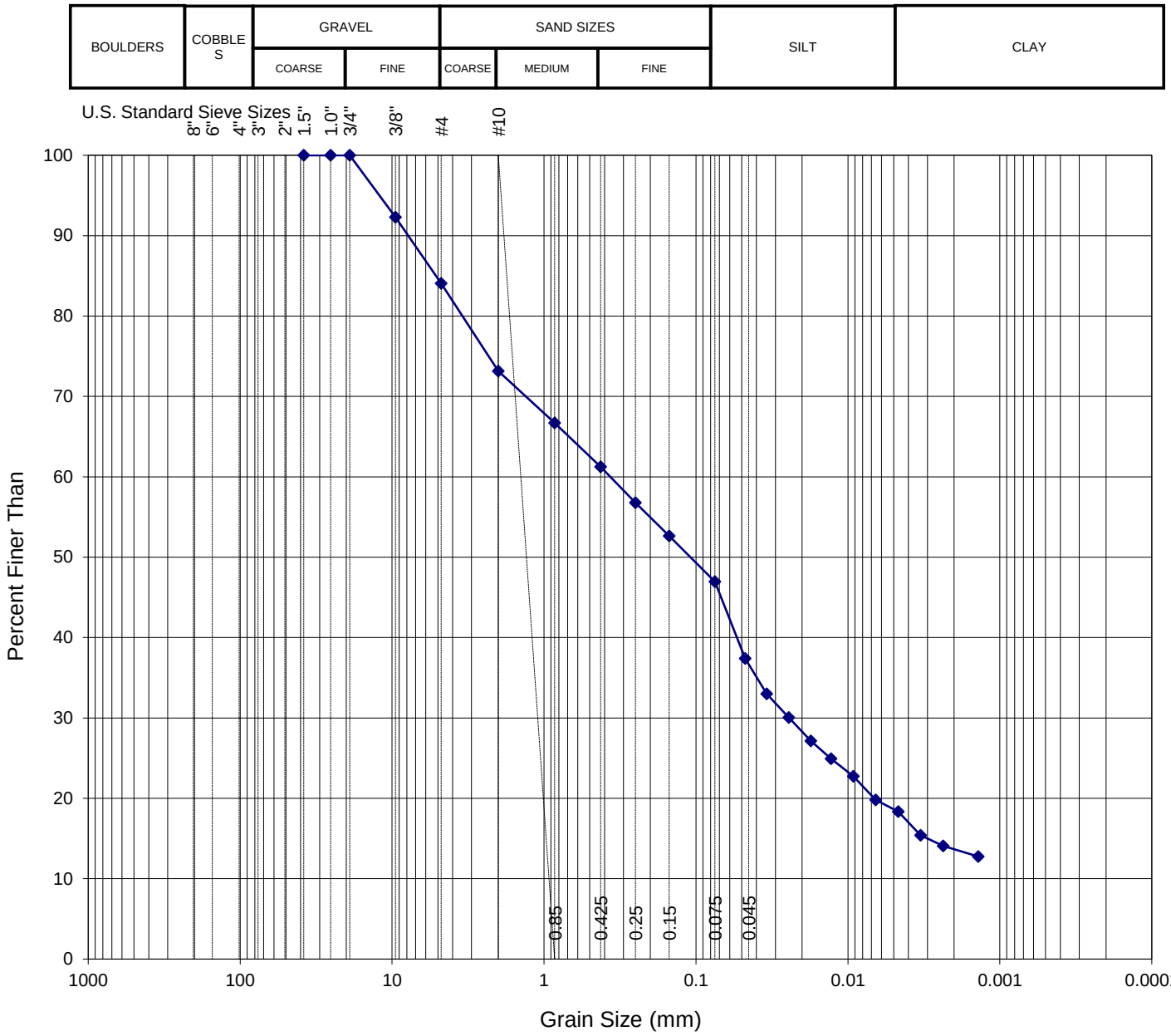

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	15.95	> 4.75
% COARSE SAND :	10.89	2.0 - 4.75
% MEDIUM SAND :	11.91	0.425 - 2.0
% FINE SAND :	14.29	0.075 - 0.425
% SILT :	28.33	0.075 - 0.005
% CLAY :	18.63	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364003
Project Number:	
Client Sample ID	22-S6-S-01
Lab Sample ID	VA22C2364003
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

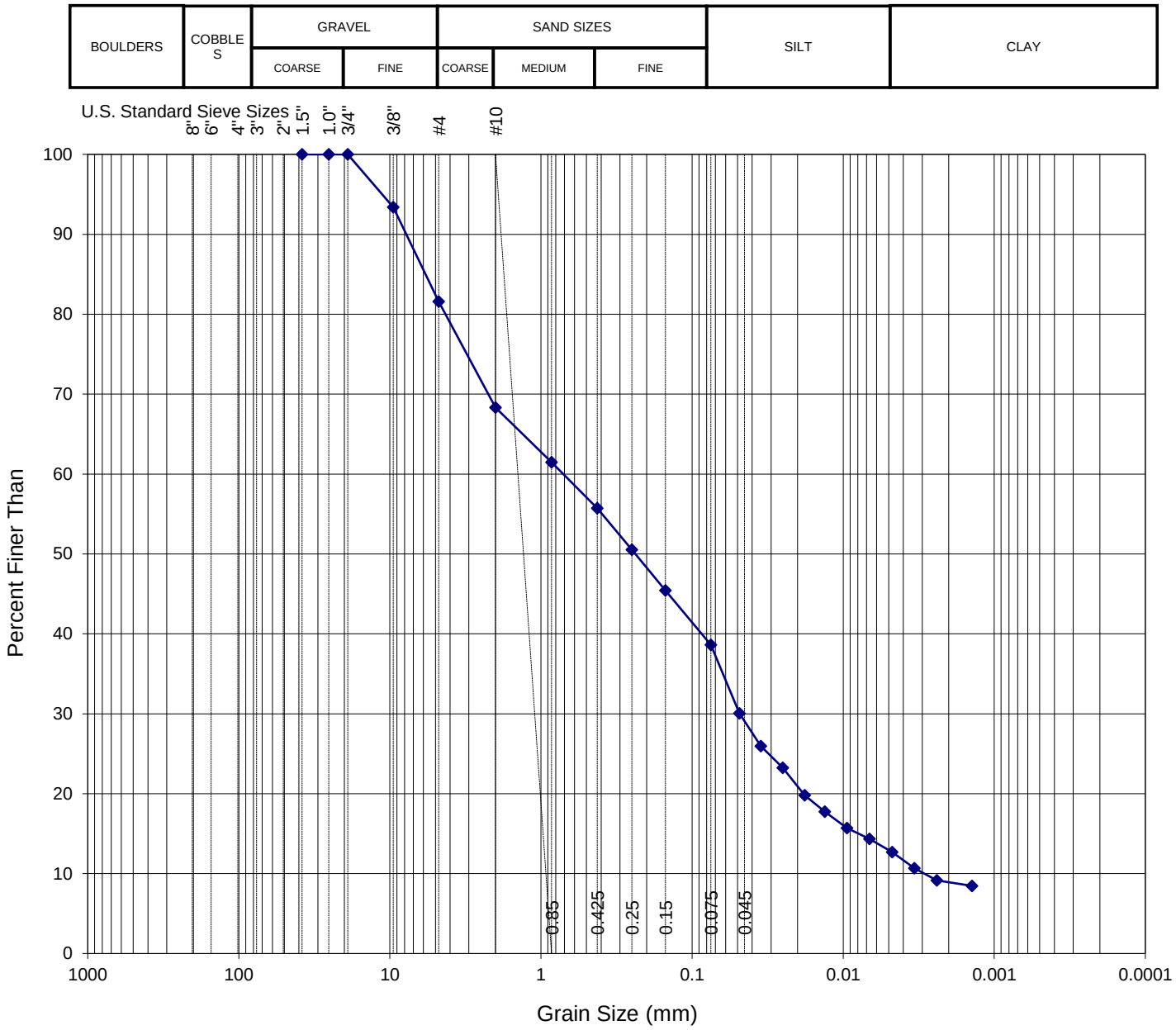

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	18.40	> 4.75
% COARSE SAND :	13.29	2.0 - 4.75
% MEDIUM SAND :	12.60	0.425 - 2.0
% FINE SAND :	17.10	0.075 - 0.425
% SILT :	25.65	0.075 - 0.005
% CLAY :	12.96	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2364004
Project Number:
Client Sample ID 22-S5-S-01
Lab Sample ID VA22C2364004
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH

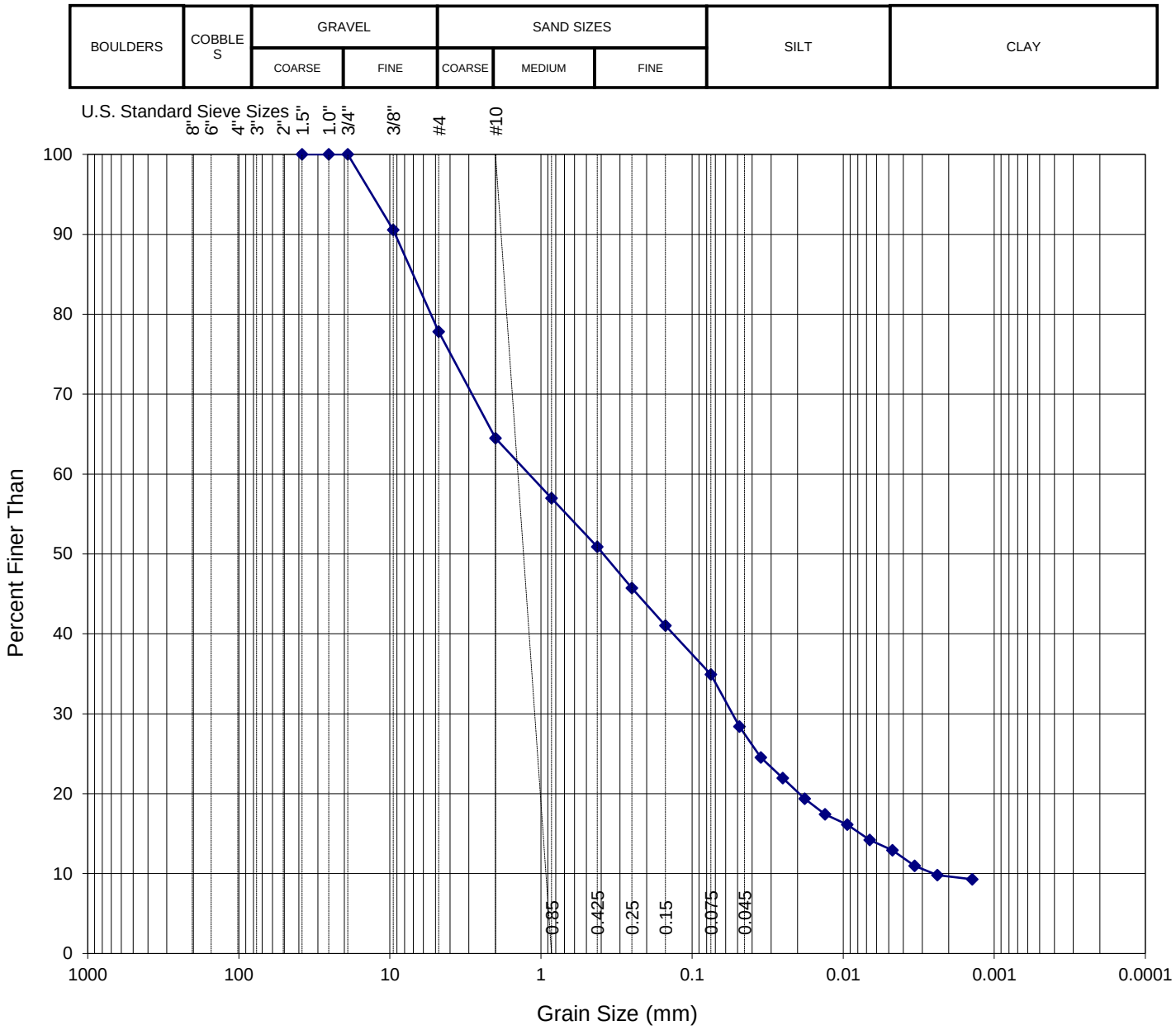

METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.18	> 4.75
% COARSE SAND :	13.35	2.0 - 4.75
% MEDIUM SAND :	13.58	0.425 - 2.0
% FINE SAND :	15.98	0.075 - 0.425
% SILT :	21.79	0.075 - 0.005
% CLAY :	13.12	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364005
Project Number:	
Client Sample ID	22-S4-S-01
Lab Sample ID	VA22C2364005
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

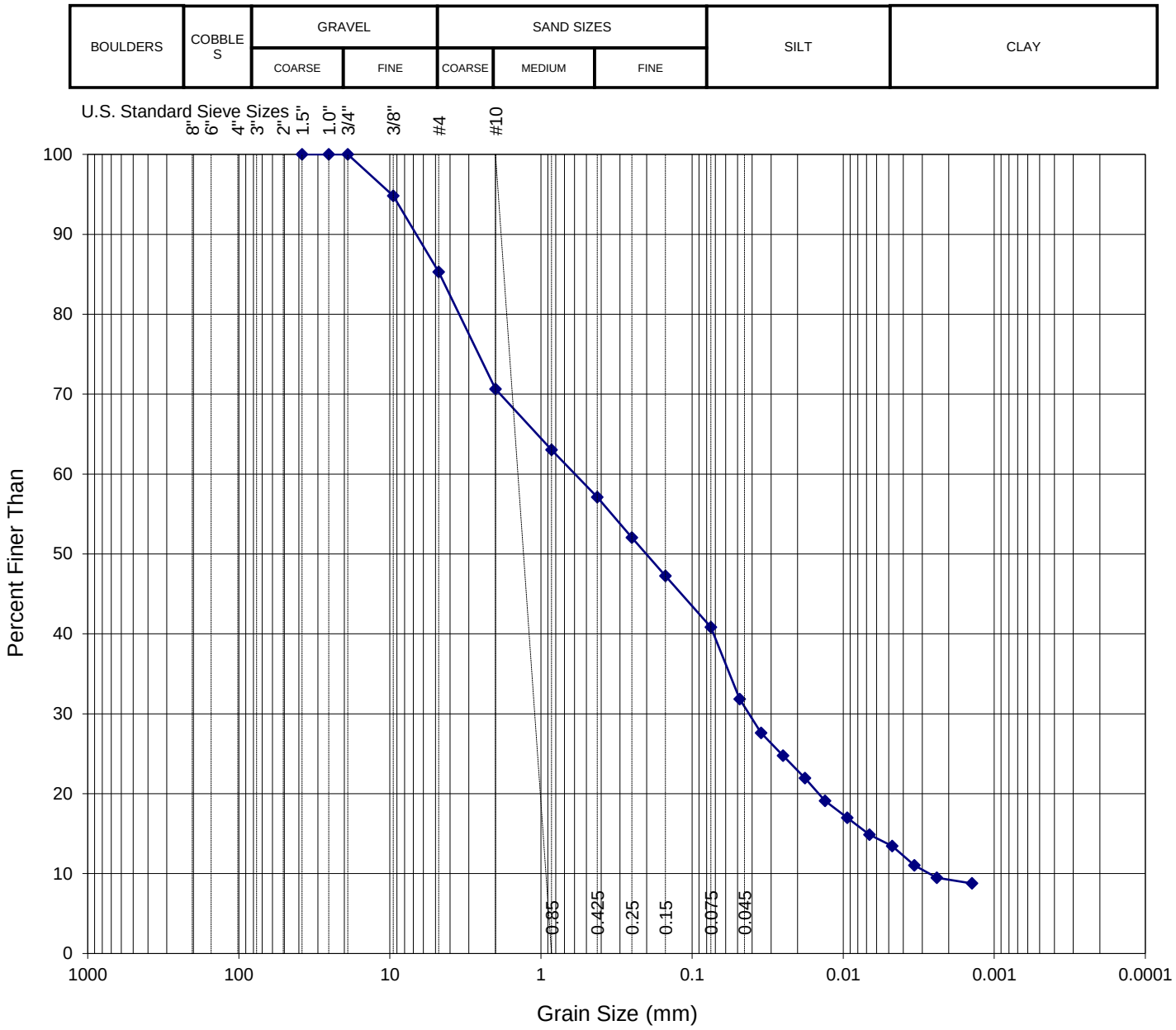

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	14.70	> 4.75
% COARSE SAND :	14.65	2.0 - 4.75
% MEDIUM SAND :	13.54	0.425 - 2.0
% FINE SAND :	16.26	0.075 - 0.425
% SILT :	27.18	0.075 - 0.005
% CLAY :	13.67	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364006
Project Number:	
Client Sample ID	22-S2-S-01
Lab Sample ID	VA22C2364006
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

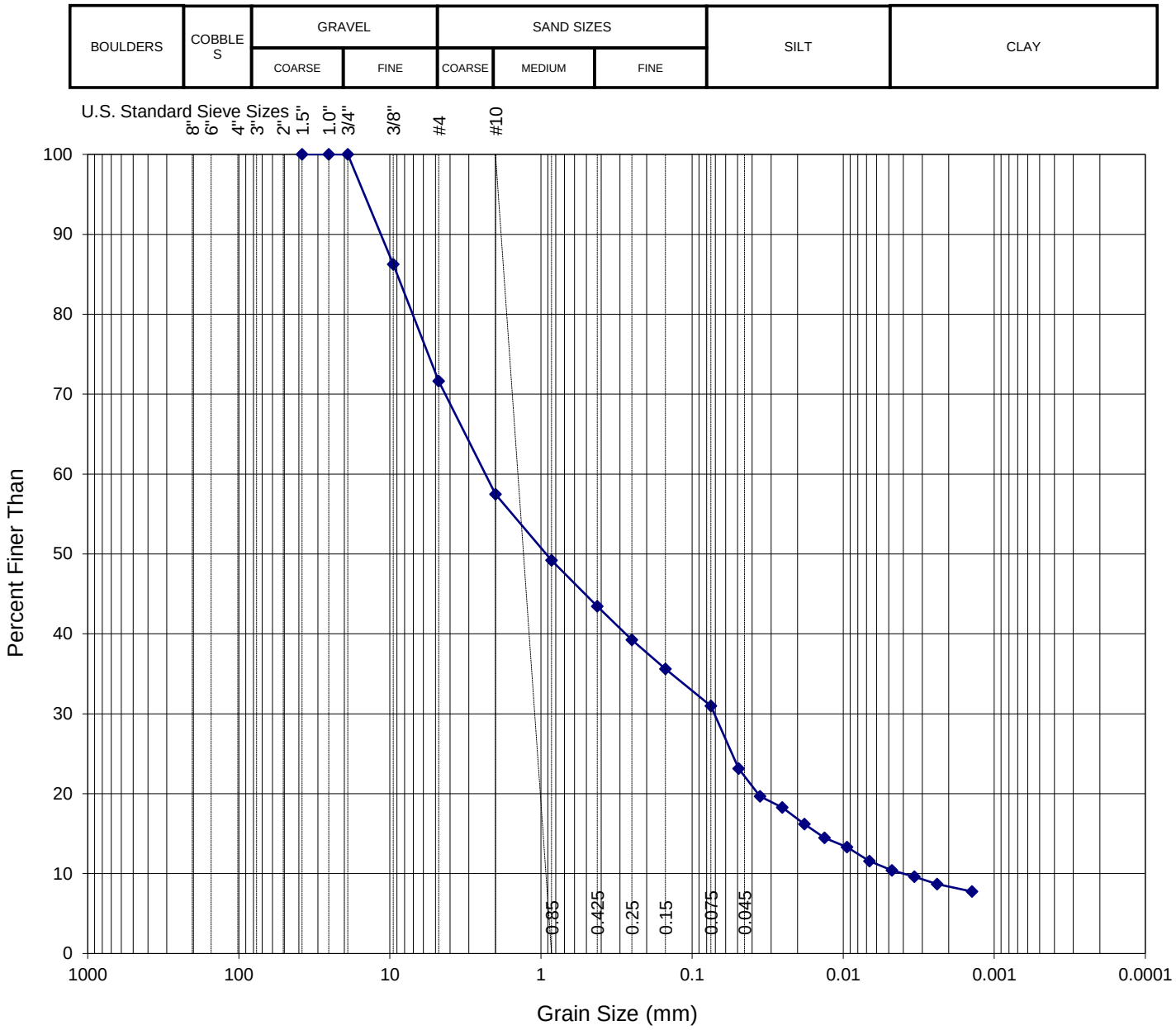

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	28.37	> 4.75
% COARSE SAND :	14.17	2.0 - 4.75
% MEDIUM SAND :	14.00	0.425 - 2.0
% FINE SAND :	12.48	0.075 - 0.425
% SILT :	20.39	0.075 - 0.005
% CLAY :	10.59	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364007
Project Number:	
Client Sample ID	22-S1-S-01
Lab Sample ID	VA22C2364007
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

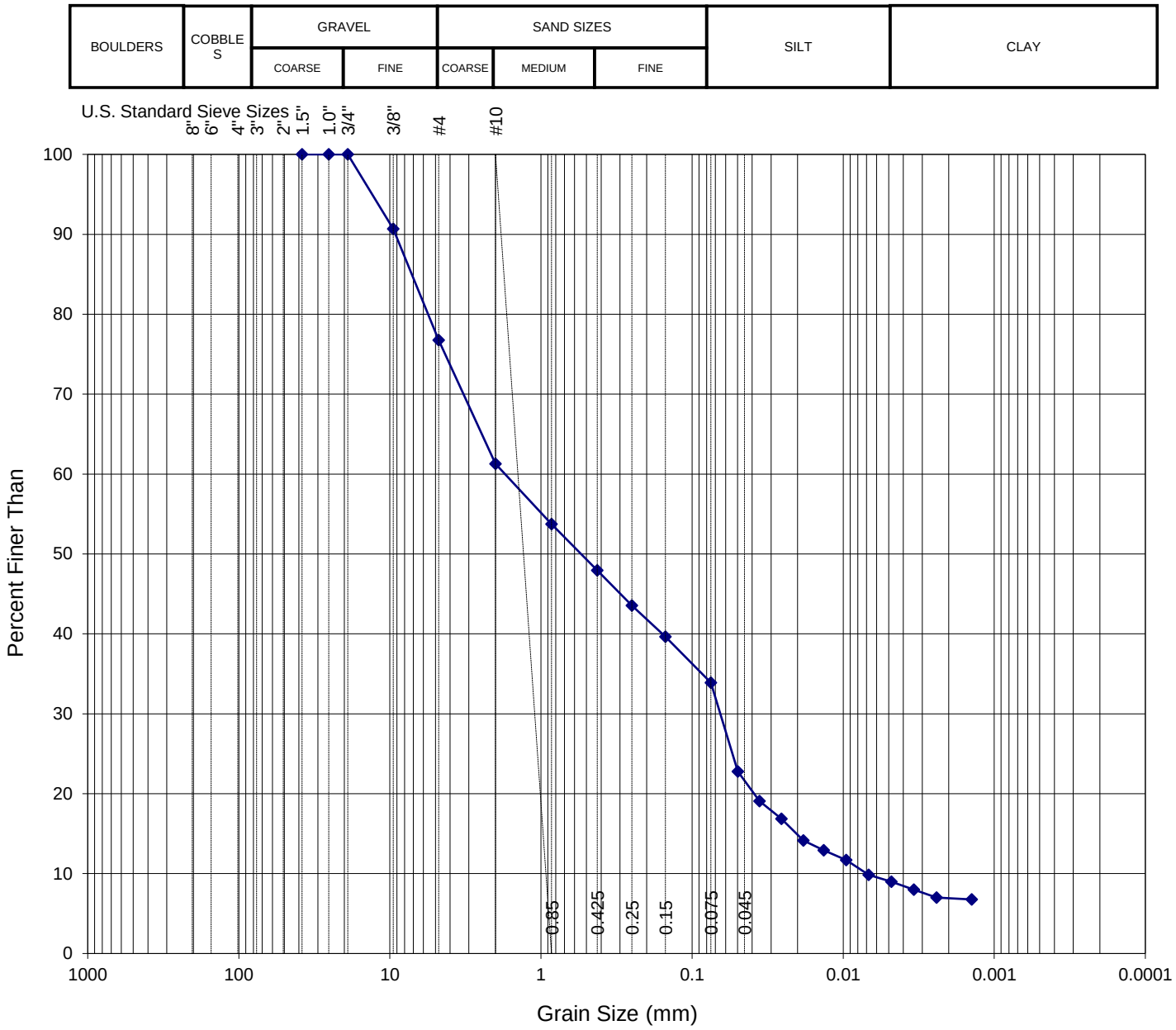

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	23.24	> 4.75
% COARSE SAND :	15.48	2.0 - 4.75
% MEDIUM SAND :	13.32	0.425 - 2.0
% FINE SAND :	14.07	0.075 - 0.425
% SILT :	24.80	0.075 - 0.005
% CLAY :	9.09	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2364008
Project Number:
Client Sample ID 22-R4-S-01
Lab Sample ID VA22C2364008
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH

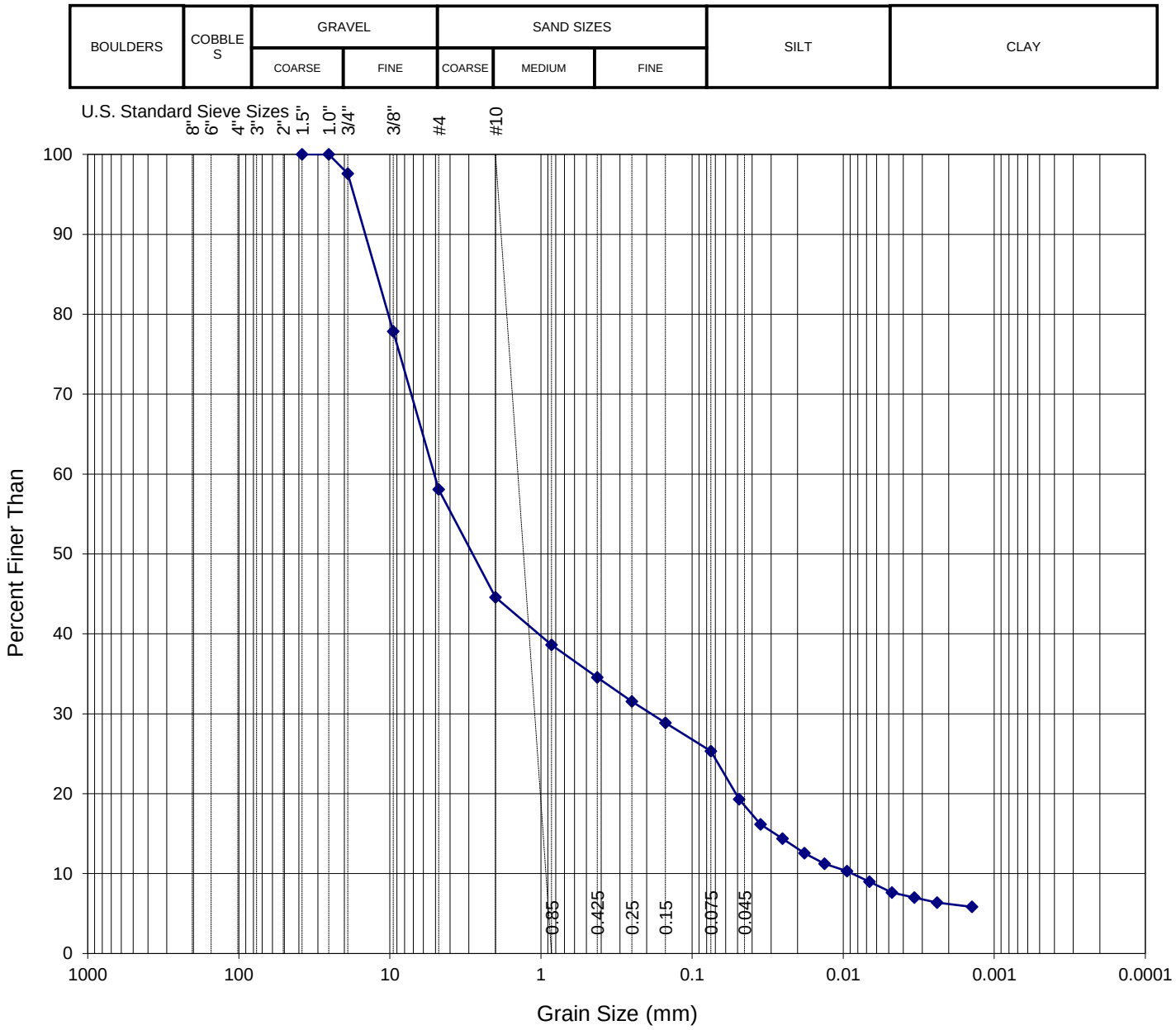

METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	41.92	> 4.75
% COARSE SAND :	13.51	2.0 - 4.75
% MEDIUM SAND :	10.02	0.425 - 2.0
% FINE SAND :	9.24	0.075 - 0.425
% SILT :	17.49	0.075 - 0.005
% CLAY :	7.82	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364009
Project Number:	
Client Sample ID	22-R5-S-01
Lab Sample ID	VA22C2364009
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

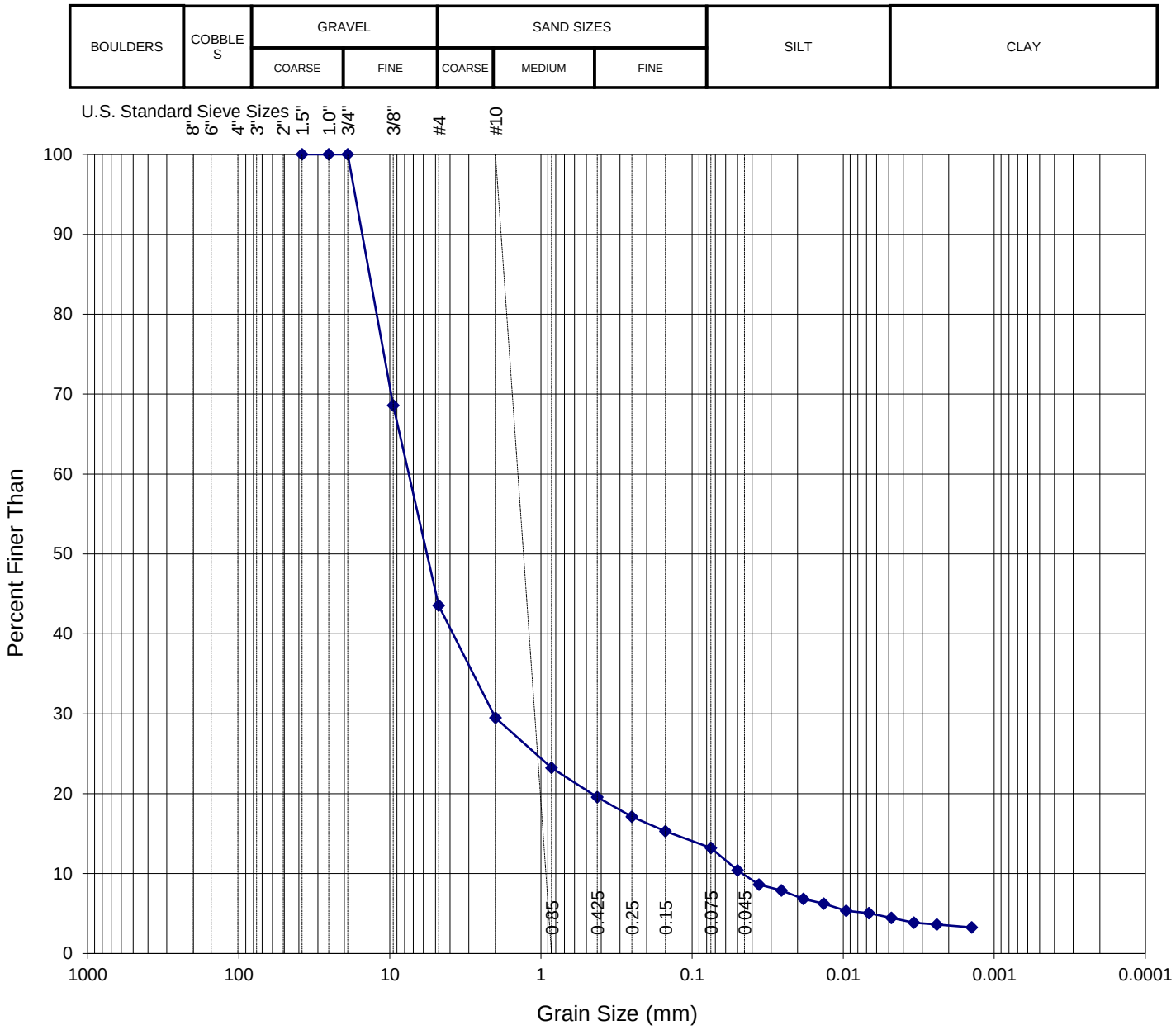

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	56.46	> 4.75
% COARSE SAND :	14.03	2.0 - 4.75
% MEDIUM SAND :	9.92	0.425 - 2.0
% FINE SAND :	6.35	0.075 - 0.425
% SILT :	8.70	0.075 - 0.005
% CLAY :	4.53	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364010
Project Number:	
Client Sample ID	22-R6-S-01
Lab Sample ID	VA22C2364010
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

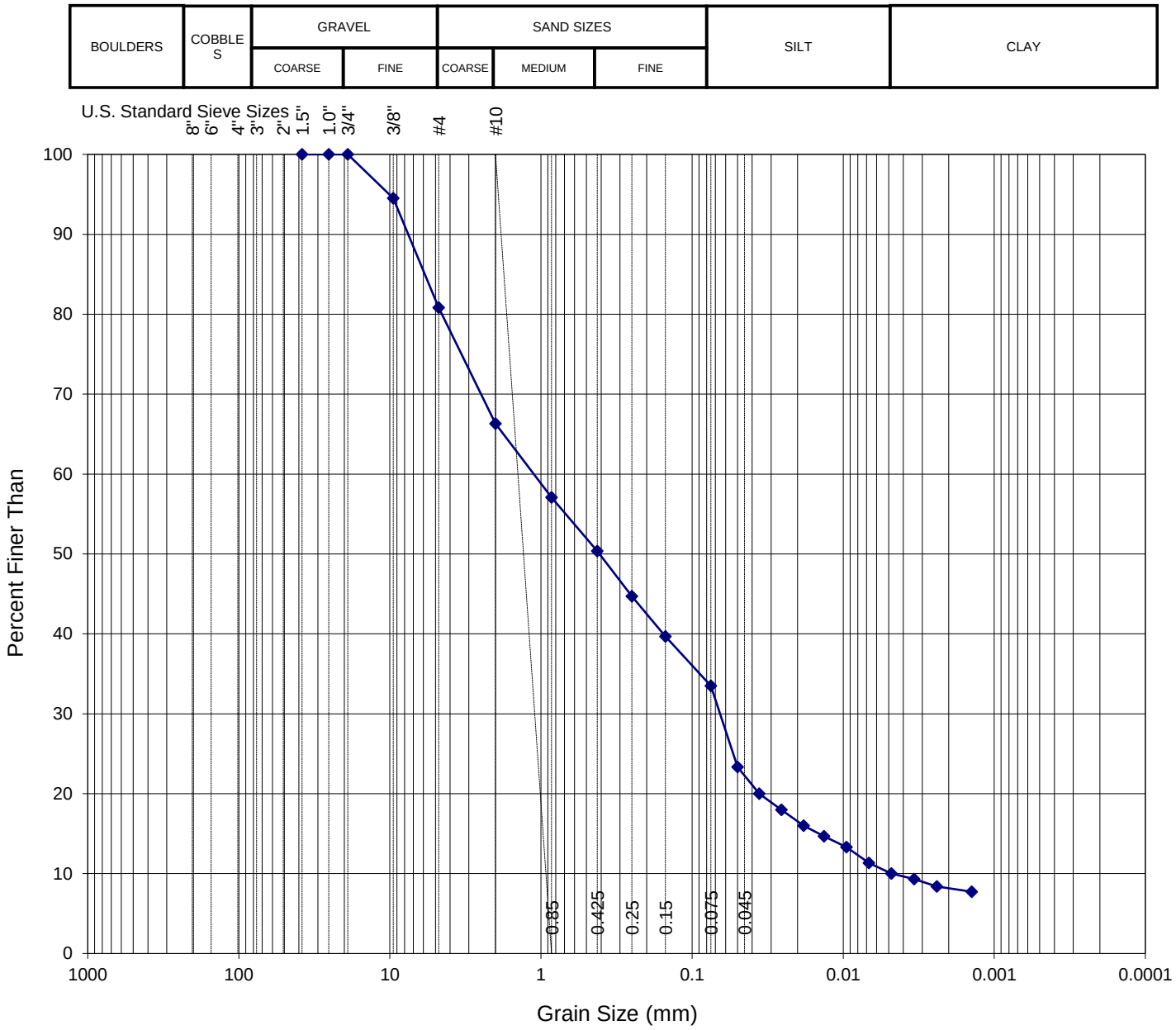

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	19.18	> 4.75
% COARSE SAND :	14.51	2.0 - 4.75
% MEDIUM SAND :	15.95	0.425 - 2.0
% FINE SAND :	16.86	0.075 - 0.425
% SILT :	23.33	0.075 - 0.005
% CLAY :	10.16	< 0.005

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686092

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [ ] EXCEL [X] EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	[X] Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	[ ]
3 day [P3-25%]	[ ]
2 day [P2-50%]	[ ]
EMERGENCY 1 Business day [E-100%]	[ ]
Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	[ ]
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	Mount Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	

Oil and Gas Required Fields (client use)		
AFE/Cost Center:		PO#
Major/Minor Code:		Routing Code:
Requisitioner:		
Location:		

ALS Lab Work Order # (lab use only): 2364

ALS Contact: Amber Springer

Sampler: Samantha Lundquist

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (CaCl2)	Soluble Na, Cl, Ca, Mg	Soluble K, SO4	Theoretical Gypsum Req	Total Metals	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S17-S-01	14-Sep-22	16:15	Soil																3
	22-S16-S-01	"	17:00	"																"
	22-S6-S-01	15-Sep-22	8:10	"																"
	22-S5-S-01	"	9:10	"																"
	22-S4-S-01	"	10:00	"																"
	22-S2-S-01	"	11:30	"																"
	22-S1-S-01	"	12:20	"																"
	22-R4-S-01	"	13:45	"																"
	22-R5-S-01	"	14:45	"																"
	22-R6-S-01	"	15:40	"																"

Environmental Division
Vancouver
Work Order Reference
VA22C2364

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? YES [ ] NO [X]

Are samples for human consumption/ use? YES [ ] NO [X]

report by clicking on the drop-down list below
COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice Packs [X] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
S. Lundquist	Sept 17, 2022	14:30				JC	17 Sep 22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2367**	Page	: 1 of 6
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686093	Issue Date	: 30-Sep-2022 10:05
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
dS/m	decisiemens per metre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units
t/ha	tonnes per hectare

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		9.2	8.3	6.3	6.1	5.3
moisture	----	E144	0.25	%		16.0	13.3	8.46	9.27	7.02
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.46	6.35	5.71	5.64	5.90
pH (1:2 soil:water)	----	E108	0.10	pH units		7.01	6.90	6.49	6.48	6.64
ash content @ 550°C	----	E205D	1.0	%		90.8	91.7	93.7	93.8	94.7
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		72.0	83.8	81.6	85.3	87.5
passing (4.75 mm)	----	E181	1.0	%		58.0	67.0	68.3	70.8	74.5
passing (19 mm)	----	E181	1.0	%		94.1	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		38.4	43.6	43.4	47.5	50.4
passing (0.841 mm)	----	E182	1.0	%		37.4	42.4	42.2	46.2	49.1
passing (0.50 mm)	----	E182	1.0	%		33.5	37.9	36.5	40.1	43.3
passing (0.420 mm)	----	E182	1.0	%		32.5	36.7	35.1	38.6	41.9
passing (0.250 mm)	----	E182	1.0	%		28.9	32.5	30.1	33.2	36.5
passing (0.149 mm)	----	E182	1.0	%		26.0	28.8	26.1	28.8	31.8
passing (0.125 mm)	----	E182	1.0	%		24.6	27.4	24.5	27.0	29.8
passing (0.075 mm)	----	E182	1.0	%		21.7	24.5	21.0	23.0	25.7
passing (0.063 mm)	----	E182	1.0	%		18.6	21.6	19.2	21.0	24.3
passing (0.05 mm)	----	E182	1.0	%		15.2	18.4	17.1	19.0	22.9
passing (0.0312 mm)	----	E183	1.0	%		12.1	13.8	15.0	16.2	19.7
passing (0.020 mm)	----	E183	1.0	%		10.1	12.0	13.0	14.4	17.4
passing (0.005 mm)	----	E183	1.0	%		6.3	7.8	7.7	9.6	11.3
passing (0.004 mm)	----	E183	1.0	%		6.0	7.1	7.3	8.9	10.5
passing (0.002 mm)	----	E183	1.0	%		5.6	6.5	6.1	7.3	9.1
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Particle Size										
passing (2.0 mm)	----	E181	1.0	%		44.4	50.6	50.3	55.3	58.4
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.526	0.368	0.117	0.107	0.117
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		4.72	3.27	2.31	2.05	1.93
carbon, inorganic [IC]	----	E354	0.050	%		0.209	0.174	0.097	0.099	0.100
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		1.74	1.45	0.81	0.83	0.84
carbon, total organic [TOC]	----	EC356	0.050	%		4.51	3.10	2.21	1.95	1.83
organic matter	----	EC356	0.10	%		7.78	5.34	3.81	3.36	3.15
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		222	247	12.5	11.7	10.3
potassium, available	7440-09-7	E390	20	mg/kg		197	221	86	82	102
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		9.1	7.5	<3.0	<3.0	3.6
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	1.2	<1.0	<1.0	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.208	0.199	0.077	0.064	0.129
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	0.15	<0.10	0.16	<0.10
pH, saturated paste	----	E114	0.10	pH units		7.06	6.85	6.18	6.19	6.37
TGR (brine)	----	EC106	0.1	t/ha		Incalcuable	----	Incalcuable	----	Incalcuable
TGR (brine)	----	EC106	0.10	t/ha		----	<0.10	----	<0.10	----
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		66.4	66.1	43.1	48.1	40.4
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		21.0	17.0	4.65	4.62	7.60
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		31.7	25.8	10.8	9.61	18.8
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		2.39	2.05	0.86	0.91	1.05
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.6	3.1	2.0	1.9	2.6
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		5.9	8.4	<2.0	<2.0	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		8.9	12.7	<4.0	<4.0	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		<1.33	1.98	<1.00	1.01	<1.00
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		<2.0	3.0	<2.0	2.1	<2.0
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<13.3	<13.2	<8.6	<9.6	<8.1

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		9.8	10.9	<2.5	<2.5	6.7
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		14.8	16.5	<5.0	<5.0	16.5
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		51.8	46.9	6.9	6.2	<2.0
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		78	71	16	13	<25 DLIS
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<10.0 DLIS	<10.0 DLIS	<12.5 DLIS	<12.5 DLIS	<25.0 DLIS
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		51.8	46.9	6.9	6.2	<2.0
alkalinity, total (as CaCO3)	----	E293	10	mg/L		78	71	16	13	<25 DLIS
Metals										
aluminum	7429-90-5	E440	50	mg/kg		17400	16500	18100	15900	17200
antimony	7440-36-0	E440	0.10	mg/kg		0.80	0.74	1.22	1.01	0.87
arsenic	7440-38-2	E440	0.10	mg/kg		13.1	11.8	15.8	14.0	14.4
barium	7440-39-3	E440	0.50	mg/kg		230	223	136	135	152
beryllium	7440-41-7	E440	0.10	mg/kg		0.56	0.49	0.60	0.51	0.55
bismuth	7440-69-9	E440	0.20	mg/kg		6.25	5.15	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		8.0	7.0	6.5	6.0	7.2
cadmium	7440-43-9	E440	0.020	mg/kg		0.669	0.624	0.279	0.259	0.240
calcium	7440-70-2	E440	50	mg/kg		18000	15600	12000	10700	10600
chromium	7440-47-3	E440	0.50	mg/kg		22.8	23.2	25.8	22.1	26.2
cobalt	7440-48-4	E440	0.10	mg/kg		14.8	14.6	14.4	12.7	13.7
copper	7440-50-8	E440	0.50	mg/kg		713	633	479	410	372
iron	7439-89-6	E440	50	mg/kg		40000	37400	38200	34300	36400
lead	7439-92-1	E440	0.50	mg/kg		19.1	16.3	7.89	6.54	9.13
lithium	7439-93-2	E440	2.0	mg/kg		13.8	13.8	18.7	16.9	17.6
magnesium	7439-95-4	E440	20	mg/kg		8800	8720	8010	7540	7720
manganese	7439-96-5	E440	1.0	mg/kg		902	828	891	747	922
mercury	7439-97-6	E510	0.0050	mg/kg		0.334	0.255	0.114	0.0935	0.109
molybdenum	7439-98-7	E440	0.10	mg/kg		3.79	3.40	3.90	3.18	2.54

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Metals										
nickel	7440-02-0	E440	0.50	mg/kg		14.6	13.1	15.5	14.1	15.0
phosphorus	7723-14-0	E440	50	mg/kg		3860	3350	1140	958	1090
potassium	7440-09-7	E440	100	mg/kg		1370	1430	1050	960	1150
selenium	7782-49-2	E440	0.20	mg/kg		1.52	1.18	0.27	0.24	0.28
silver	7440-22-4	E440	0.10	mg/kg		1.07	1.00	0.26	0.20	0.22
sodium	7440-23-5	E440	50	mg/kg		592	412	192	188	263
strontium	7440-24-6	E440	0.50	mg/kg		186	181	115	112	95.4
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	<0.050	0.050	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		6.4	5.4	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		697	635	1170	1120	1030
tungsten	7440-33-7	E440	0.50	mg/kg		1.35	1.07	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.704	0.610	1.10	0.881	0.766
vanadium	7440-62-2	E440	0.20	mg/kg		121	114	131	122	126
zinc	7440-66-6	E440	2.0	mg/kg		256	228	77.6	68.2	71.4
zirconium	7440-67-7	E440	1.0	mg/kg		1.1	1.1	3.8	3.6	3.6
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.446	0.455	0.118	<0.069 DLM	0.096

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2367**	Page	: 1 of 25
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 30-Sep-2022 10:05
C-O-C number	: 17-686093		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	mercury	7439-97-6	E510	58.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-A4-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-A5-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S10-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S15-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S15-S-01D	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-A4-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-A5-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S10-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S15-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S15-S-01D	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-A4-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-A5-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S10-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S15-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 22-A4-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-A4-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-A5-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S10-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S15-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S15-S-01D	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-A4-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-A5-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S10-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S15-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S15-S-01D	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-A4-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-A5-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S10-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S15-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S15-S-01D	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-A4-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-A5-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S10-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S15-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S15-S-01D	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-A4-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-A5-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S10-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S15-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S15-S-01D	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-A4-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-A5-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S10-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S15-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S15-S-01D	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-A4-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-A5-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S10-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S15-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S15-S-01D	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-A4-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-A5-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S10-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S15-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-A4-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-A5-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S10-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S15-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S15-S-01D	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-A4-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-A5-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S10-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S15-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-A4-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-A5-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S10-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S15-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S15-S-01D	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-A4-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-A5-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S10-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S15-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S15-S-01D	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-A4-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-A5-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S10-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S15-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S15-S-01D	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-A4-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-A5-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S10-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S15-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S15-S-01D	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	1	18	5.5	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	1	18	5.5	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	1	14	7.1	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	1	7	14.2	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660592	1	11	9.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	664230	1	18	5.5	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	664231	1	18	5.5	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	2	18	11.1	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	2	18	11.1	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	2	14	14.2	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	2	7	28.5	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	2	15	13.3	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	2	15	13.3	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	2	15	13.3	10.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	2	15	13.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658741	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660592	2	11	18.1	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	2	15	13.3	10.0	✓
Saturation Percentage	E141	665003	2	15	13.3	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	2	15	13.3	10.0	✓
Total Carbon by Combustion	E351	664230	2	18	11.1	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	2	19	10.5	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	2	19	10.5	10.0	✓
Total Nitrogen by Combustion	E366	664231	2	18	11.1	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	1	18	5.5	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	1	18	5.5	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	1	14	7.1	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	1	7	14.2	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	664230	1	18	5.5	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	664231	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **VA22C2367**	Page	: 1 of 14
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686093	Issue Date	: 30-Sep-2022 10:05
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 659686)											
VA22C2364-009	Anonymous	loss on ignition @ 550°C	----	E205D	1.0	%	12.5	13.1	4.64%	20%	----
Physical Tests (QC Lot: 660592)											
VA22C2364-009	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.89	4.91	0.408%	10%	----
Physical Tests (QC Lot: 664998)											
VA22C2364-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	7.10	7.19	1.3%	5%	----
Physical Tests (QC Lot: 665008)											
VA22C2364-001	Anonymous	moisture	----	E144	0.25	%	3.90	3.96	1.55%	20%	----
Particle Size (QC Lot: 658739)											
VA22C2364-001	Anonymous	passing (0.002 mm)	----	E183	1.0	%	8.7	9.8	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.2	12.0	7.31%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.1	13.2	8.70%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	19.9	20.6	3.28%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	23.3	23.7	1.75%	20%	----
Particle Size (QC Lot: 658740)											
VA22C2364-001	Anonymous	passing (0.05 mm)	----	E182	1.0	%	28.8	28.7	0.134%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	32.2	32.0	0.487%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	35.3	35.0	0.754%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	39.3	39.2	0.312%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	41.3	41.2	0.131%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	46.0	46.1	0.254%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	51.4	51.6	0.390%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	52.7	52.9	0.293%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	58.1	58.0	0.112%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	59.3	59.2	0.101%	15%	----
Anions and Nutrients (QC Lot: 664231)											
VA22C2367-002	22-A5-S-01	nitrogen, total	7727-37-9	E366	0.020	%	0.368	0.405	9.57%	20%	----
Organic / Inorganic Carbon (QC Lot: 662076)											
EO2207816-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	4.39	4.24	3.66%	20%	----
Organic / Inorganic Carbon (QC Lot: 664230)											
VA22C2367-002	22-A5-S-01	carbon, total [TC]	----	E351	0.050	%	3.27	3.56	8.70%	20%	----
Plant Available Nutrients (QC Lot: 661785)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Plant Available Nutrients (QC Lot: 661785) - continued											
YL2201594-002	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg	1.4	1.7	0.3	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661786)											
VA22C2364-009	Anonymous	sulfate, available (as S)	14808-79-8	E497.SO4	7.4	mg/kg	9.5	8.1	1.4	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661886)											
FC2202278-001	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	269	271	0.629%	30%	----
Plant Available Nutrients (QC Lot: 661887)											
FC2202278-001	Anonymous	phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665000)											
VA22C2364-001	Anonymous	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	29.5	26.3	3.2	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665001)											
VA22C2364-001	Anonymous	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665002)											
VA22C2364-001	Anonymous	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665003)											
VA22C2364-001	Anonymous	% saturation	----	E141	1.0	%	47.4	46.0	3.02%	20%	----
Saturated Paste Extractables (QC Lot: 665004)											
VA22C2364-001	Anonymous	pH, saturated paste	----	E114	0.10	pH units	6.90	6.96	0.866%	5%	----
Saturated Paste Extractables (QC Lot: 665005)											
VA22C2364-001	Anonymous	conductivity, saturated paste	----	E102	30	µS/cm	0.222 dS/m	230	8	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665006)											
VA22C2364-001	Anonymous	alkalinity, total (as CaCO3)	----	E293	12	mg/L	57	58	1	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665007)											
VA22C2364-001	Anonymous	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	35.3	34.8	1.63%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	3.7	3.8	0.08	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	<4.0	<4.0	0	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Metals (QC Lot: 664995)											
VA22C2364-001	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	17700	18300	3.11%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.58	0.47	0.10	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	10.0	10.4	4.08%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	90.6	88.0	2.86%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.57	0.57	0.0008	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	0.28	0.25	0.03	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	6.0	5.8	0.3	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.298	0.327	9.41%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 664995) - continued											
VA22C2364-001	Anonymous	calcium	7440-70-2	E440	50	mg/kg	9950	10800	8.69%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	33.2	36.2	8.47%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	14.0	15.4	9.71%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	254	243	4.49%	30%	----
		iron	7439-89-6	E440	50	mg/kg	34100	35300	3.49%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	8.31	8.22	1.09%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	16.9	17.7	4.68%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	7880	8760	10.6%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	800	832	3.83%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	2.04	2.00	1.88%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	21.1	26.4	22.2%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1070	1120	4.01%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1100	1070	3.23%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	0.35	0.33	0.02	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.26	0.25	0.006	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	342	390	13.0%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	142	144	1.24%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	0.053	0.003	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1020	1020	0.00286%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.664	0.808	19.5%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	110	118	6.69%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	75.1	75.4	0.360%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	4.8	4.9	0.2	Diff <2x LOR	----
Metals (QC Lot: 664996)											
VA22C2364-001	Anonymous	mercury	7439-97-6	E510	0.0050	mg/kg	0.274	0.150	58.6%	40%	DUP-H
Leachable Anions & Nutrients (QC Lot: 660214)											
VA22C2359-006	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E319	730	mg/kg	0.090 %	<730	900	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 665008)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 664231)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 662076)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 664230)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 661785)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 661786)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 661886)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661887)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Saturated Paste Extractables (QCLot: 665000)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 665001)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----
Saturated Paste Extractables (QCLot: 665002)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 665003)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 665005)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 665006)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 665007)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 664995)						

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 664995) - continued						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 664996)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 660214)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 660592)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 664998)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 665008)									
moisture	----	E144	0.25	%	50 %	98.9	90.0	110	----
Anions and Nutrients (QCLot: 664231)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662076)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	95.2	90.0	110	----
Organic / Inorganic Carbon (QCLot: 664230)									
carbon, total [TC]	----	E351	0.05	%	48 %	103	90.0	110	----
Plant Available Nutrients (QCLot: 661785)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	111	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	106	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.7	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	96.5	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	104	80.0	120	----
Saturated Paste Extractables (QCLot: 665001)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665002)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665003)									
% saturation	----	E141	1	%	100 %	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665004)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.7	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Saturated Paste Extractables (QCLot: 665005) - continued									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	105	80.0	120	----
Saturated Paste Extractables (QCLot: 665006)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	108	85.0	115	----
Saturated Paste Extractables (QCLot: 665007)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	107	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	101	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	101	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	109	80.0	120	----
Metals (QCLot: 664995)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	92.9	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	100.0	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	92.4	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	88.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	88.4	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	83.5	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	94.2	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	90.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	95.9	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	94.1	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	92.8	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	99.2	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	91.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	85.7	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	95.2	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	95.2	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	100	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	92.5	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	100	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	95.9	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	97.3	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	89.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	96.4	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	94.0	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	88.2	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 664995) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	95.6	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	90.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	93.4	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	96.2	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	97.6	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.3	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Metals (QCLot: 664996)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660214)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	81.0	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 659686)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	93.4	80.0	120	----
Physical Tests (QCLot: 660592)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658739)									
	RM	passing (0.002 mm)	----	E183	21.14 %	105	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	102	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	102	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	105	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	106	88.0	112	----
Particle Size (QCLot: 658740)									
	RM	passing (0.05 mm)	----	E182	49.81 %	104	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	101	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	99.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	98.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	98.8	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.1	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.3	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.3	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.4	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.5	94.9	105	----
Particle Size (QCLot: 658741)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 664231)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	107	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662076)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	109	80.0	120	----
Organic / Inorganic Carbon (QCLot: 664230)									
	RM	carbon, total [TC]	----	E351	1.4 %	102	80.0	120	----
Plant Available Nutrients (QCLot: 661785)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	78.0	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	99.0	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	98.0	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	91.6	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	99.9	70.0	130	----
Saturated Paste Extractables (QCLot: 665002)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	94.6	70.0	130	----
Saturated Paste Extractables (QCLot: 665003)									
	RM	% saturation	----	E141	48.3 %	102	70.0	130	----
Saturated Paste Extractables (QCLot: 665004)									
	RM	pH, saturated paste	----	E114	7.59 pH units	97.1	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	104	70.0	130	----
Saturated Paste Extractables (QCLot: 665007)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	95.3	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	92.3	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	94.8	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	93.0	70.0	130	----
Metals (QCLot: 664995)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	95.0	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.8	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	98.2	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	89.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 664995) - continued									
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	94.2	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	97.7	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	88.1	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	90.3	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	101	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	95.6	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	92.4	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	97.3	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	87.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	91.2	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	95.7	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	97.9	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	93.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	94.3	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	91.7	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	103	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	97.3	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	95.7	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	89.3	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	84.9	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	101	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	95.3	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	98.5	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	94.3	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	81.1	70.0	130	----
Metals (QCLot: 664996)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	97.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660214)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	84.4	80.0	120	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367001
Project Number:	
Client Sample ID	22-A4-S-01
Lab Sample ID	VA22C2367001
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

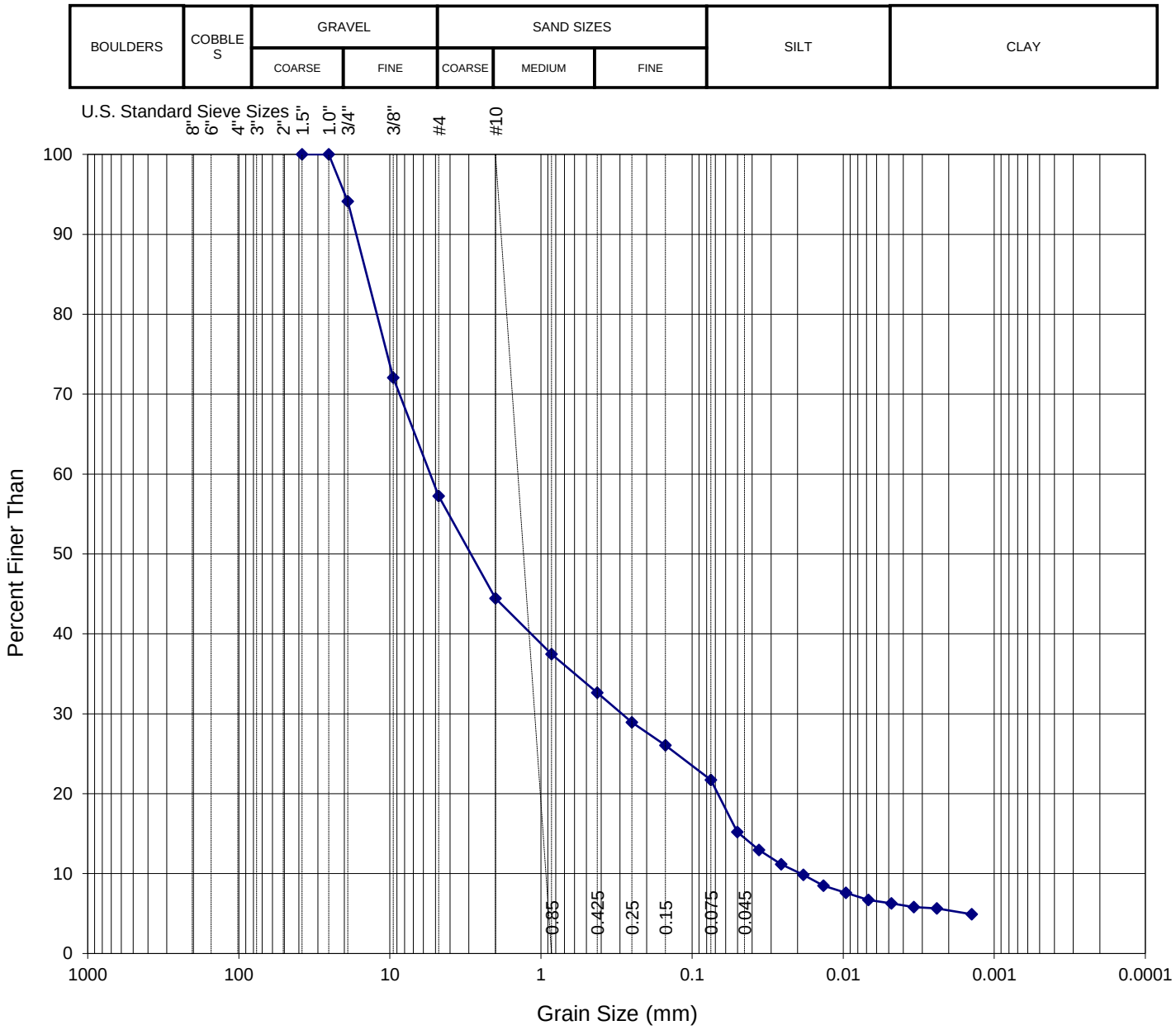

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	42.77	> 4.75
% COARSE SAND :	12.80	2.0 - 4.75
% MEDIUM SAND :	11.80	0.425 - 2.0
% FINE SAND :	10.92	0.075 - 0.425
% SILT :	15.41	0.075 - 0.005
% CLAY :	6.31	< 0.005

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PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367002
Project Number:	
Client Sample ID	22-A5-S-01
Lab Sample ID	VA22C2367002
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

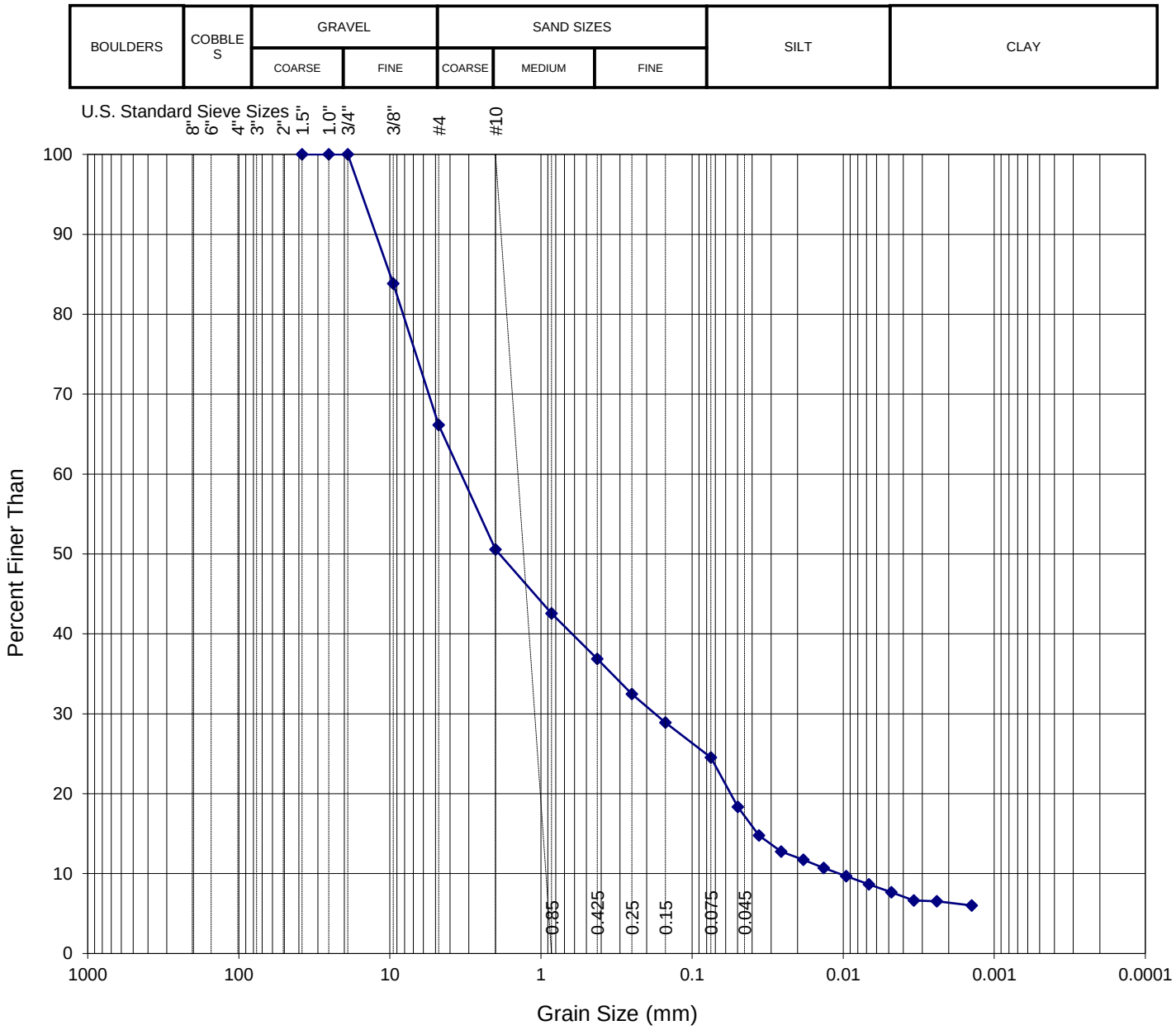

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	33.87	> 4.75
% COARSE SAND :	15.56	2.0 - 4.75
% MEDIUM SAND :	13.71	0.425 - 2.0
% FINE SAND :	12.34	0.075 - 0.425
% SILT :	16.75	0.075 - 0.005
% CLAY :	7.77	< 0.005

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PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2367003
Project Number:
Client Sample ID 22-S15-S-01
Lab Sample ID VA22C2367003
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH

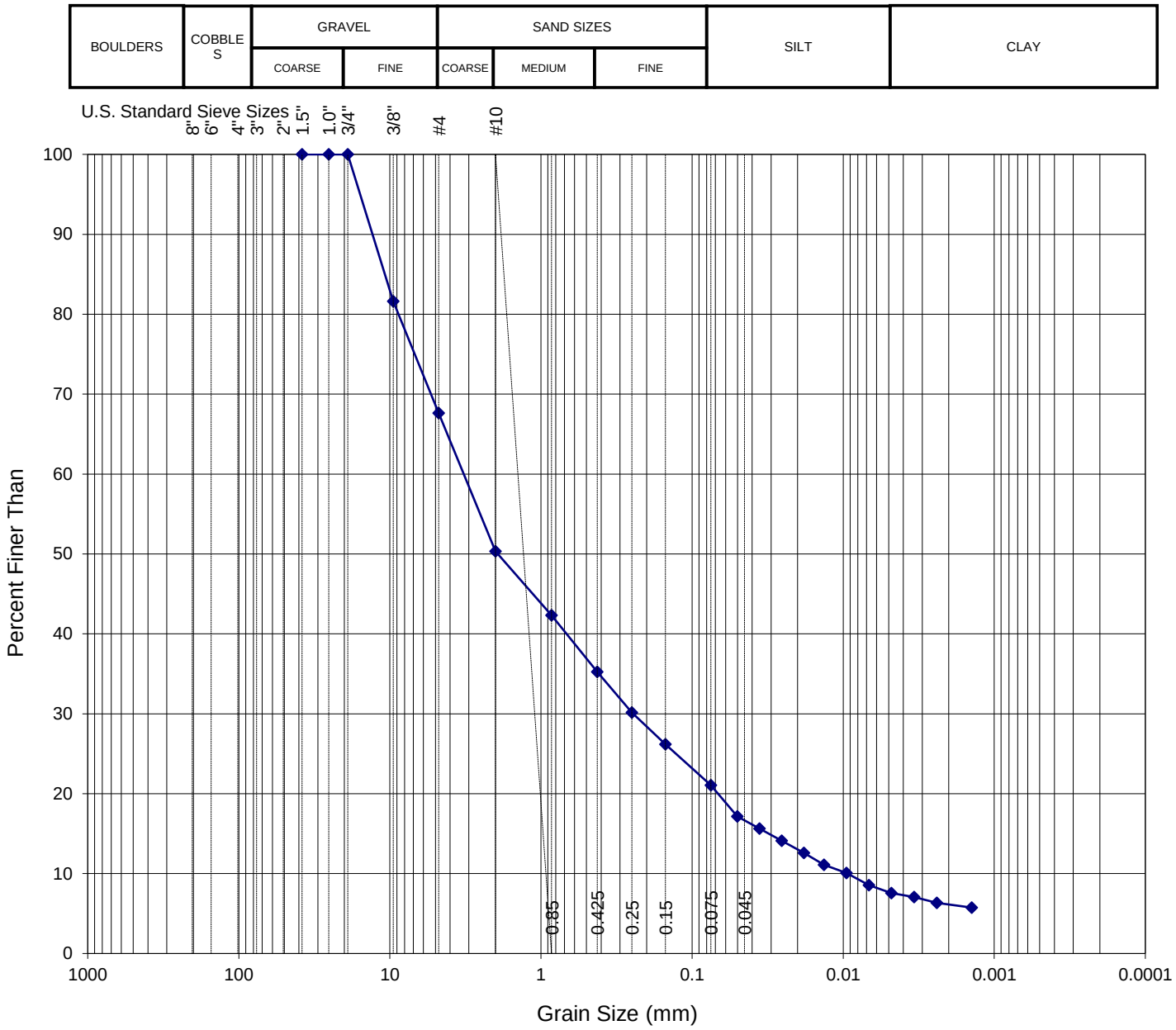

METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	32.38	> 4.75
% COARSE SAND :	17.29	2.0 - 4.75
% MEDIUM SAND :	15.10	0.425 - 2.0
% FINE SAND :	14.18	0.075 - 0.425
% SILT :	13.37	0.075 - 0.005
% CLAY :	7.69	< 0.005

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PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2367004
Project Number:
Client Sample ID 22-S15-S-01D
Lab Sample ID VA22C2367004
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH

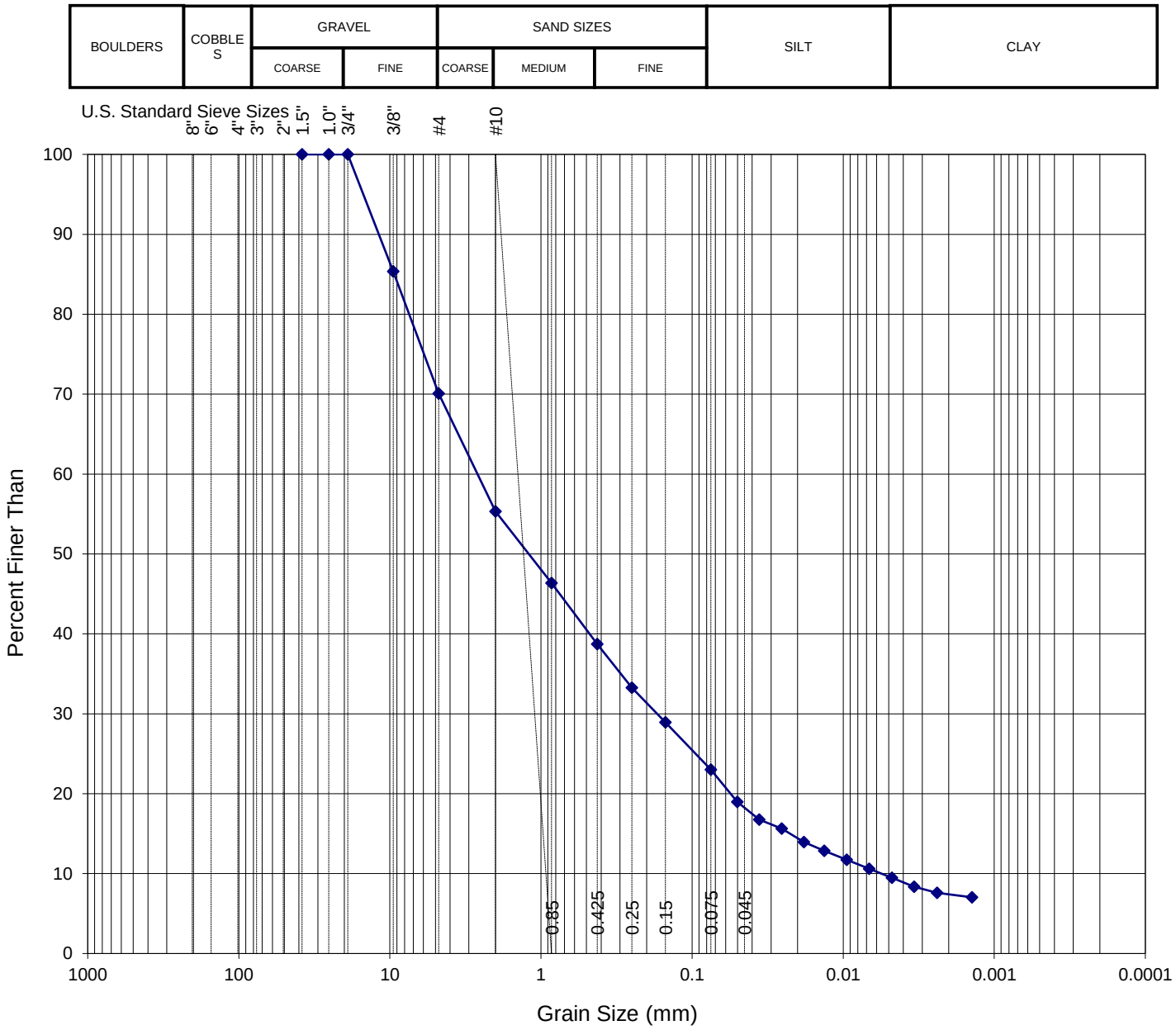

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	29.93	> 4.75
% COARSE SAND :	14.76	2.0 - 4.75
% MEDIUM SAND :	16.60	0.425 - 2.0
% FINE SAND :	15.72	0.075 - 0.425
% SILT :	13.35	0.075 - 0.005
% CLAY :	9.65	< 0.005

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PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367005
Project Number:	
Client Sample ID	22-S10-S-01
Lab Sample ID	VA22C2367005
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH

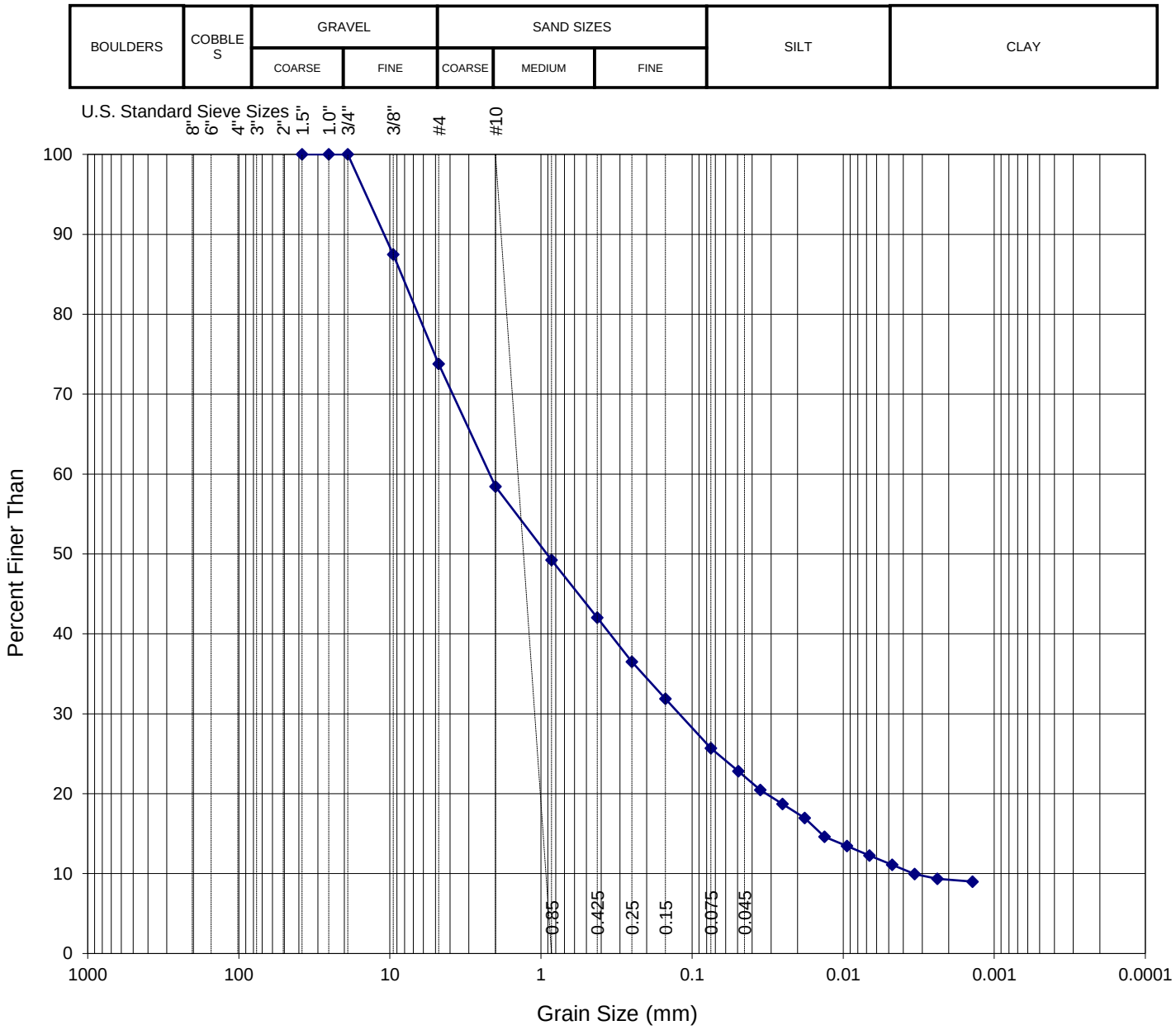

METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	26.22	> 4.75
% COARSE SAND :	15.36	2.0 - 4.75
% MEDIUM SAND :	16.39	0.425 - 2.0
% FINE SAND :	16.33	0.075 - 0.425
% SILT :	14.41	0.075 - 0.005
% CLAY :	11.29	< 0.005

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686093

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mount Polley Mining Corp
Contact:	Gabriel Holmes

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL | MAIL ☐ FAX
Email 1 or Fax: melissa.paliouras@wsp.com
Email 2: samantha.lundquist@wsp.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #:
PO / AFE: 5590008044
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only): 23647

ALS Contact: Amber Springer | Sampler: Samantha Lundquist

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (CaCl2)	Sorting Na, Cl, Ca, Mg	Soluble K, SO4	Theoretical Gypsum Requirement		Total Metals		SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-A4-S-01	16-Sep-22	8:15	Soil	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				3
	22-A5-S-01	"	9:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S15-S-01	"	10:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S16-S-01D	"	10:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S10-S-01	"	11:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"

Environmental Division
Vancouver
Work Order Reference
VA22C2367

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client us

Are samples taken from a Regulated DW System?
☐ YES ☒ NO

Are samples for human consumption/ use?
☐ YES ☒ NO

to add on report by clicking on the drop-down list below
electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lundquist	Date: Sept 17, 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17 Sep 22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2369**	Page	: 1 of 83
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: 17-686095A-095M	Issue Date	: 03-Nov-2022 16:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLI	*Detection Limit Raised: Dilution required to address Internal Standard response problems caused by matrix interference.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		50.2	66.6	39.8	53.5	62.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		92.6	310	394	230	178
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		46.1	103	237	107	66.7
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	0.012	0.012	0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0024	0.0041	0.0072	0.0047	0.0030
arsenic	7440-38-2	E440	0.020	mg/kg		0.108	0.268	0.339	6.11	0.158
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0540	0.0896	0.204	2.84	0.0594
barium	7440-39-3	E440	0.050	mg/kg		9.03	12.3	62.3	18.4	7.75
barium	7440-39-3	E440A	0.010	mg/kg wwt		4.49	4.10	37.5	8.56	2.90
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	0.010	0.012	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0035	0.0072	0.0025	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.3	22.8	3.8	16.0	52.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.10	7.60	2.27	7.43	19.7
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0150 DLM	0.0672	0.147	0.0506	1.92
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0060 DLM	0.0224	0.0886	0.0235	0.719
calcium	7440-70-2	E440	20	mg/kg		11500	10500	9860	2640	21300
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5720	3500	5930	1230	7980
cesium	7440-46-2	E440	0.0050	mg/kg		0.598	0.104	0.0912	0.176	0.191
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.297	0.0348	0.0549	0.0816	0.0715
chromium	7440-47-3	E440	0.050	mg/kg		0.177	0.475	0.486	0.200	0.197
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.088	0.159	0.293	0.093	0.074
cobalt	7440-48-4	E440	0.020	mg/kg		0.244	0.305	0.343	0.297	0.604
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.122	0.102	0.206	0.138	0.226
copper	7440-50-8	E440	0.10	mg/kg		13.1	23.1	23.3	10.7	15.3
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.53	7.72	14.0	4.99	5.73
iron	7439-89-6	E440	3.0	mg/kg		149	653	681	301	262

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E440A	0.60	mg/kg wwt		74.3	218	410	140	98.1
lead	7439-92-1	E440	0.020	mg/kg		0.062	0.170	0.216	0.092	0.084
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0308	0.0569	0.130	0.0426	0.0315
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	0.54	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	0.32	<0.10	0.14
magnesium	7439-95-4	E440	2.0	mg/kg		1500	1940	617	983	2490
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		747	646	372	457	934
manganese	7439-96-5	E440	0.050	mg/kg		164	91.3	280	146	94.2
manganese	7439-96-5	E440A	0.010	mg/kg wwt		81.7	30.5	168	68.0	35.3
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0076	0.0084	0.0052	0.0055
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0022	0.0025	0.0050	0.0024	0.0020
molybdenum	7439-98-7	E440	0.020	mg/kg		18.6	1.35	10.4	0.562	5.28
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		9.24	0.450	6.25	0.261	1.98
nickel	7440-02-0	E440	0.20	mg/kg		0.28	0.75	0.38	0.22	0.42
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.140	0.249	0.226	0.100	0.159
phosphorus	7723-14-0	E440	10	mg/kg		2850	1100	711	1310	2020
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1420	366	428	611	758
potassium	7440-09-7	E440	20	mg/kg		10100	8170	4050	7170	11800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5010	2730	2440	3340	4410
rubidium	7440-17-7	E440	0.050	mg/kg		20.9	8.82	3.35	8.64	10.4
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		10.4	2.94	2.02	4.02	3.89
selenium	7782-49-2	E440	0.050	mg/kg		1.28	4.32	3.63	1.19	3.26
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.636	1.44	2.19	0.556	1.22
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0135	0.0103	0.0296	0.0126	0.0140
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0067	0.0034	0.0178	0.0058	0.0052
sodium	7440-23-5	E440	20	mg/kg		39	64	94	23	45
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.3	21.2	56.8	10.7	16.7
strontium	7440-24-6	E440	0.050	mg/kg		33.2	32.7	41.6	21.8	51.6
strontium	7440-24-6	E440A	0.010	mg/kg wwt		16.5	10.9	25.0	10.1	19.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0178	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00058	<0.00040	0.00120	0.00827	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.051	<0.020	0.027	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0138	0.0154	0.0068	0.0046
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00120	0.00461	0.00930	0.00318	0.00174
vanadium	7440-62-2	E440	0.10	mg/kg		0.40	2.20	2.29	1.05	0.79
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.200	0.733	1.38	0.488	0.295
zinc	7440-66-6	E440	0.50	mg/kg		21.6	13.4	19.0	22.8	96.3
zinc	7440-66-6	E440A	0.10	mg/kg wwt		10.8	4.49	11.4	10.6	36.1
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	0.30	0.59	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	0.100	0.354	0.072	0.052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		61.4	41.3	29.6	58.5	81.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		97.0	41.7	55.1	67.9	51.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		37.4	24.5	38.8	28.2	9.76
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0022	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.077	0.056	0.061	2.87	0.066
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0298	0.0331	0.0433	1.19	0.0125
barium	7440-39-3	E440	0.050	mg/kg		2.66	6.08	9.96	25.5	5.04
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.03	3.57	7.02	10.6	0.959
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.5	3.7	3.3	20.8	33.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		5.60	2.16	2.32	8.66	6.31
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0568	0.0158	0.0235	0.0667	0.458
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0219	0.0093	0.0166	0.0277	0.0872
calcium	7440-70-2	E440	20	mg/kg		2440	3120	2250	3810	8940
calcium	7440-70-2	E440A	4.0	mg/kg wwt		941	1830	1590	1580	1700
cesium	7440-46-2	E440	0.0050	mg/kg		0.0512	0.0740	0.0210	0.106	0.530
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0198	0.0434	0.0148	0.0439	0.101
chromium	7440-47-3	E440	0.050	mg/kg		0.160	0.084	0.076	0.095	0.139
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.062	0.049	0.054	0.040	0.026
cobalt	7440-48-4	E440	0.020	mg/kg		0.142	0.051	0.047	0.087	0.083
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0549	0.0302	0.0331	0.0362	0.0157
copper	7440-50-8	E440	0.10	mg/kg		12.4	6.36	6.70	8.12	18.0
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.80	3.73	4.72	3.37	3.43
iron	7439-89-6	E440	3.0	mg/kg		187	80.8	78.2	130	129
iron	7439-89-6	E440A	0.60	mg/kg wwt		72.1	47.4	55.0	53.8	24.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.042	0.027	0.038	0.035	0.032
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0163	0.0160	0.0266	0.0146	0.0061
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.60
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.11
magnesium	7439-95-4	E440	2.0	mg/kg		957	657	598	1260	3000
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		370	386	421	524	570
manganese	7439-96-5	E440	0.050	mg/kg		80.7	86.8	34.5	53.9	57.0
manganese	7439-96-5	E440A	0.010	mg/kg wwt		31.2	50.9	24.3	22.4	10.8
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0053	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0015	0.0016	0.0030	0.0022	<0.0010
molybdenum	7439-98-7	E440	0.020	mg/kg		3.02	2.09	3.01	3.25	4.90
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.17	1.23	2.12	1.35	0.932
nickel	7440-02-0	E440	0.20	mg/kg		1.60	0.33	<0.20	0.27	0.54
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.616	0.195	0.130	0.111	0.104
phosphorus	7723-14-0	E440	10	mg/kg		1510	1600	1600	2260	6300
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		582	940	1130	938	1200
potassium	7440-09-7	E440	20	mg/kg		5570	7650	5560	6780	51600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2150	4490	3920	2810	9810
rubidium	7440-17-7	E440	0.050	mg/kg		3.17	7.56	3.58	5.46	47.4
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.22	4.44	2.52	2.27	9.03
selenium	7782-49-2	E440	0.050	mg/kg		0.342	0.241	0.183	0.358	10.3
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.132	0.141	0.129	0.149	1.96
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0498	0.0087	<0.0050	0.0165	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0192	0.0051	0.0027	0.0068	<0.0010
sodium	7440-23-5	E440	20	mg/kg		20	21	24	29	176
sodium	7440-23-5	E440A	4.0	mg/kg wwt		7.8	12.5	17.0	12.2	33.5
strontium	7440-24-6	E440	0.050	mg/kg		3.79	9.61	9.28	46.9	18.2
strontium	7440-24-6	E440A	0.010	mg/kg wwt		1.46	5.64	6.54	19.5	3.47
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0093	0.0033
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	0.00386	0.00063
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0038	<0.0020	<0.0020	0.0030	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00146	0.00088	0.00097	0.00123	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.60	0.23	0.20	0.37	0.27
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.231	0.138	0.141	0.152	0.052
zinc	7440-66-6	E440	0.50	mg/kg		77.8	72.8	31.6	47.8	61.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		30.0	42.7	22.2	19.9	11.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.080 DLM	<0.080 DLM	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		47.0	46.1	64.0	70.2	74.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		51.2	59.4	68.4	150	68.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		27.1	32.0	24.7	44.6	17.3
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0025	<0.0020	<0.0020	0.0023	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.159	0.066	0.050	0.149	0.151
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0841	0.0357	0.0182	0.0444	0.0381
barium	7440-39-3	E440	0.050	mg/kg		48.3	6.71	1.61	11.5	165
barium	7440-39-3	E440A	0.010	mg/kg wwt		25.6	3.62	0.582	3.43	41.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		9.3	7.8	12.6	36.7	82.0
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.94	4.18	4.55	10.9	20.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.254	<0.0050	0.0492	0.160	<0.0100 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.134	0.0021	0.0177	0.0476	<0.0020 DLM
calcium	7440-70-2	E440	20	mg/kg		8780	3210	2640	14800	25600
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4650	1730	950	4410	6460
cesium	7440-46-2	E440	0.0050	mg/kg		0.250	0.0553	0.108	0.208	0.181
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.132	0.0298	0.0388	0.0620	0.0456
chromium	7440-47-3	E440	0.050	mg/kg		0.170	0.074	0.084	0.158	0.116
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.090	0.040	0.030	0.047	0.029
cobalt	7440-48-4	E440	0.020	mg/kg		0.041	0.050	0.125	0.164	0.065
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0218	0.0271	0.0449	0.0489	0.0164
copper	7440-50-8	E440	0.10	mg/kg		8.28	6.05	6.68	23.2	6.96
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.39	3.26	2.41	6.89	1.75
iron	7439-89-6	E440	3.0	mg/kg		105	92.1	114	196	117
iron	7439-89-6	E440A	0.60	mg/kg wwt		55.6	49.6	41.3	58.5	29.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.036	0.027	0.024	0.067	0.048
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0194	0.0148	0.0088	0.0200	0.0120
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		824	1360	1480	2400	3760
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		437	735	533	714	948
manganese	7439-96-5	E440	0.050	mg/kg		93.7	48.6	95.9	106	85.9
manganese	7439-96-5	E440A	0.010	mg/kg wwt		49.6	26.2	34.6	31.5	21.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0077	<0.0050	<0.0050	0.0069	0.0112
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0041	0.0020	0.0013	0.0020	0.0028
molybdenum	7439-98-7	E440	0.020	mg/kg		8.83	3.56	0.598	1.97	30.6
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		4.68	1.92	0.216	0.586	7.71
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.22	0.35	0.86	0.40
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.051	0.118	0.125	0.255	0.102
phosphorus	7723-14-0	E440	10	mg/kg		1010	2390	1580	5840	8110
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		536	1290	571	1740	2040
potassium	7440-09-7	E440	20	mg/kg		9440	8660	4100	24200	21800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5000	4660	1480	7210	5490
rubidium	7440-17-7	E440	0.050	mg/kg		8.44	5.86	3.39	20.9	8.96
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.48	3.16	1.22	6.21	2.26
selenium	7782-49-2	E440	0.050	mg/kg		0.376	0.413	0.512	0.261	0.366
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.199	0.223	0.184	0.078	0.092
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0079	0.0055	0.0230	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0042	0.0030	0.0083	0.0012	<0.0010
sodium	7440-23-5	E440	20	mg/kg		45	<20	<20	61	53
sodium	7440-23-5	E440A	4.0	mg/kg wwt		24.0	8.6	6.1	18.2	13.5
strontium	7440-24-6	E440	0.050	mg/kg		35.0	12.2	5.90	38.1	95.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		18.6	6.55	2.12	11.3	24.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0054
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00064	<0.00040	0.00137
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0033	0.0022
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00097	0.00071	0.00067	0.00098	0.00055
vanadium	7440-62-2	E440	0.10	mg/kg		0.31	0.24	0.32	0.59	1.72
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.164	0.129	0.117	0.175	0.435
zinc	7440-66-6	E440	0.50	mg/kg		38.6	60.1	42.3	57.4	25.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		20.5	32.4	15.2	17.1	6.40
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.089	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		61.6	83.9	57.0	62.7	60.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		63.5	147	118	260	146
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		24.4	23.7	50.8	97.0	57.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.013	0.011	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0057	0.0042	0.0027
arsenic	7440-38-2	E440	0.020	mg/kg		0.046	0.115	0.046	0.104	0.028
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0177	0.0185	0.0196	0.0387	0.0109
barium	7440-39-3	E440	0.050	mg/kg		26.1	16.6	43.2	5.80	84.0
barium	7440-39-3	E440A	0.010	mg/kg wwt		10.0	2.67	18.6	2.16	33.0
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		16.5	13.7	16.8	21.7	14.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.33	2.21	7.24	8.08	5.78
cadmium	7440-43-9	E440	0.0050	mg/kg		0.141	0.0605	0.0440	0.293	0.0991
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0540	0.0097	0.0189	0.109	0.0389
calcium	7440-70-2	E440	20	mg/kg		7440	5790	5150	4310	6750
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2860	932	2210	1610	2650
cesium	7440-46-2	E440	0.0050	mg/kg		0.0218	0.0410	0.0387	0.106	0.102
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0084	0.0066	0.0166	0.0394	0.0399
chromium	7440-47-3	E440	0.050	mg/kg		0.176	0.235	0.130	0.367	0.078
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.067	0.038	0.056	0.137	0.030
cobalt	7440-48-4	E440	0.020	mg/kg		0.079	0.124	0.122	0.173	0.161
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0305	0.0199	0.0525	0.0646	0.0634
copper	7440-50-8	E440	0.10	mg/kg		5.09	12.9	6.40	11.4	3.91
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.96	2.07	2.75	4.23	1.54
iron	7439-89-6	E440	3.0	mg/kg		136	315	138	317	80.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		52.4	50.7	59.5	118	31.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.042	0.096	0.061	0.118	0.032
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0163	0.0155	0.0262	0.0441	0.0125
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	0.58	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.12	0.14	0.19
magnesium	7439-95-4	E440	2.0	mg/kg		1110	1410	899	1460	1490
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		425	226	387	543	586
manganese	7439-96-5	E440	0.050	mg/kg		94.4	42.3	340	438	663
manganese	7439-96-5	E440A	0.010	mg/kg wwt		36.2	6.81	146	163	260
mercury	7439-97-6	E510	0.0050	mg/kg		0.0112	0.0253	0.0171	0.0281	0.0111
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0043	0.0041	0.0073	0.0105	0.0044
molybdenum	7439-98-7	E440	0.020	mg/kg		0.674	0.234	0.669	0.080	0.077
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.259	0.0377	0.288	0.0296	0.0303
nickel	7440-02-0	E440	0.20	mg/kg		2.12	0.33	0.50	0.58	0.76
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.814	0.054	0.215	0.214	0.300
phosphorus	7723-14-0	E440	10	mg/kg		1200	3040	1550	1780	2070
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		462	489	666	664	813
potassium	7440-09-7	E440	20	mg/kg		6640	12800	7320	6350	7020
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2550	2070	3150	2370	2760
rubidium	7440-17-7	E440	0.050	mg/kg		6.22	10.6	6.44	5.57	13.1
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.39	1.71	2.77	2.08	5.16
selenium	7782-49-2	E440	0.050	mg/kg		0.063	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.024	<0.010	0.013	0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0050	0.0078	0.0235	0.0211	0.0087
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0019	0.0013	0.0101	0.0079	0.0034
sodium	7440-23-5	E440	20	mg/kg		49	164	62	80	76
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.0	26.4	26.8	29.6	29.9
strontium	7440-24-6	E440	0.050	mg/kg		90.1	24.4	29.0	9.22	38.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		34.6	3.94	12.5	3.43	14.9
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0080	0.0084	0.0221
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00344	0.00312	0.00868
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.21	0.14	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.031	0.034	0.062	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0026	0.0057	0.0028	0.0070	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00098	0.00092	0.00121	0.00260	0.00064
vanadium	7440-62-2	E440	0.10	mg/kg		0.45	1.01	0.50	1.11	0.22
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.171	0.163	0.214	0.413	0.088
zinc	7440-66-6	E440	0.50	mg/kg		14.0	32.6	26.2	11.9	32.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.40	5.25	11.3	4.43	12.9
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	0.24	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	0.090	0.059

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		59.0	62.5	63.9	65.7	63.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		198	65.8	48.4	510	372
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		81.0	24.7	17.4	175	136
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.037	0.027	0.028	0.025	0.055
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0152	0.0101	0.0101	0.0085	0.0203
barium	7440-39-3	E440	0.050	mg/kg		93.4	39.3	46.8	1.43	3.76
barium	7440-39-3	E440A	0.010	mg/kg wwt		38.3	14.7	16.9	0.491	1.38
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		0.0022	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.3	16.3	20.9	22.0	21.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.64	6.12	7.53	7.54	7.81
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0747	0.146	0.207	0.204	0.373
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0306	0.0549	0.0747	0.0700	0.137
calcium	7440-70-2	E440	20	mg/kg		7860	7250	7300	2980	3350
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3220	2720	2630	1020	1230
cesium	7440-46-2	E440	0.0050	mg/kg		0.0914	0.0233	0.0305	0.153	0.0727
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0374	0.0087	0.0110	0.0525	0.0267
chromium	7440-47-3	E440	0.050	mg/kg		0.138	0.111	0.081	0.093	0.114
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.057	0.042	0.029	0.032	0.042
cobalt	7440-48-4	E440	0.020	mg/kg		0.186	0.088	0.093	0.102	0.104
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0762	0.0331	0.0334	0.0351	0.0380
copper	7440-50-8	E440	0.10	mg/kg		5.08	4.43	4.92	6.74	8.86
copper	7440-50-8	E440A	0.020	mg/kg wwt		2.08	1.66	1.78	2.31	3.25
iron	7439-89-6	E440	3.0	mg/kg		119	93.7	89.0	84.3	152
iron	7439-89-6	E440A	0.60	mg/kg wwt		48.6	35.1	32.1	28.9	55.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.047	0.027	<0.020	0.020	0.054
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0192	0.0100	0.0072	0.0069	0.0197
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.15	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1660	1180	1380	1550	1300
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		680	443	499	532	479
manganese	7439-96-5	E440	0.050	mg/kg		564	236	292	1310	1280
manganese	7439-96-5	E440A	0.010	mg/kg wwt		231	88.5	105	451	470
mercury	7439-97-6	E510	0.0050	mg/kg		0.0172	0.0123	0.0089	0.0078	0.0114
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0070	0.0046	0.0032	0.0027	0.0042
molybdenum	7439-98-7	E440	0.020	mg/kg		0.098	1.04	1.16	0.416	0.152
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0402	0.389	0.420	0.143	0.0557
nickel	7440-02-0	E440	0.20	mg/kg		0.85	2.92	3.80	0.23	0.29
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.348	1.10	1.37	0.078	0.105
phosphorus	7723-14-0	E440	10	mg/kg		1670	1550	1910	1880	1870
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		686	582	688	647	685
potassium	7440-09-7	E440	20	mg/kg		5630	8830	11500	7460	7200
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2300	3310	4160	2560	2640
rubidium	7440-17-7	E440	0.050	mg/kg		11.4	6.14	9.02	13.7	8.54
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.66	2.30	3.25	4.69	3.14
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0087	<0.0050	0.0051	0.0076	0.0117
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0036	0.0014	0.0018	0.0026	0.0043
sodium	7440-23-5	E440	20	mg/kg		62	<20	<20	30	42
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.4	6.6	7.0	10.3	15.6
strontium	7440-24-6	E440	0.050	mg/kg		48.9	61.8	64.8	3.31	6.35
strontium	7440-24-6	E440A	0.010	mg/kg wwt		20.0	23.2	23.4	1.14	2.33
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0271	<0.0020	<0.0020	0.0021	0.0043
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.0111	<0.00040	<0.00040	0.00074	0.00158
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.028	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0023	<0.0020	<0.0020	<0.0020	0.0028
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00095	0.00064	0.00055	<0.00040	0.00101
vanadium	7440-62-2	E440	0.10	mg/kg		0.38	0.34	0.26	0.17	0.43
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.155	0.128	0.092	0.058	0.159
zinc	7440-66-6	E440	0.50	mg/kg		33.9	15.5	16.8	9.46	11.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		13.9	5.83	6.06	3.24	4.11
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		66.9	66.9	63.8	62.6	73.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		124	176	64.4	377	482
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		41.2	58.3	23.3	141	129
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0027	0.0027	0.0027
arsenic	7440-38-2	E440	0.020	mg/kg		0.053	0.038	0.045	0.113	0.093
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0174	0.0125	0.0162	0.0423	0.0248
barium	7440-39-3	E440	0.050	mg/kg		97.6	166	51.1	5.67	102
barium	7440-39-3	E440A	0.010	mg/kg wwt		32.2	54.8	18.5	2.12	27.2
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.2	11.7	21.0	27.3	54.9
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.70	3.88	7.60	10.2	14.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0488	0.0819	0.125	0.127	0.0636
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0161	0.0271	0.0451	0.0474	0.0170
calcium	7440-70-2	E440	20	mg/kg		5480	8320	8510	3370	28100
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1810	2750	3080	1260	7530
cesium	7440-46-2	E440	0.0050	mg/kg		0.0863	0.0655	0.0140	0.0862	0.0285
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0285	0.0217	0.0051	0.0322	0.0076
chromium	7440-47-3	E440	0.050	mg/kg		0.113	0.115	0.120	0.213	0.370
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.037	0.038	0.043	0.080	0.099
cobalt	7440-48-4	E440	0.020	mg/kg		0.090	0.308	0.082	0.186	0.094
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0297	0.102	0.0295	0.0695	0.0252
copper	7440-50-8	E440	0.10	mg/kg		4.61	4.86	5.20	11.2	7.68
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.52	1.61	1.88	4.19	2.06
iron	7439-89-6	E440	3.0	mg/kg		56.9	69.3	116	324	219
iron	7439-89-6	E440A	0.60	mg/kg wwt		18.8	22.9	42.0	121	58.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.023	0.029	0.028	0.119	0.076
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0076	0.0096	0.0100	0.0444	0.0203
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.56
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.10	0.15
magnesium	7439-95-4	E440	2.0	mg/kg		1890	2580	1340	1290	5850
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		626	852	487	483	1570
manganese	7439-96-5	E440	0.050	mg/kg		67.8	96.4	108	1250	105
manganese	7439-96-5	E440A	0.010	mg/kg wwt		22.4	31.9	39.3	466	28.0
mercury	7439-97-6	E510	0.0050	mg/kg		0.0175	0.0233	0.0127	0.0246	0.0100
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0058	0.0077	0.0046	0.0092	0.0027
molybdenum	7439-98-7	E440	0.020	mg/kg		0.119	0.094	0.443	0.228	0.250
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0393	0.0312	0.160	0.0853	0.0671
nickel	7440-02-0	E440	0.20	mg/kg		0.52	0.83	1.62	0.40	0.44
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.171	0.275	0.586	0.152	0.117
phosphorus	7723-14-0	E440	10	mg/kg		1920	2380	1880	2650	4050
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		636	786	680	992	1090
potassium	7440-09-7	E440	20	mg/kg		14200	14900	8600	6530	13600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4700	4920	3110	2440	3640
rubidium	7440-17-7	E440	0.050	mg/kg		16.6	15.0	5.99	6.80	8.73
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.49	4.98	2.17	2.54	2.34
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.075	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.012	0.025	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0050	0.0057	0.0145	0.0779
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0013	0.0016	0.0021	0.0054	0.0209
sodium	7440-23-5	E440	20	mg/kg		27	32	29	57	161
sodium	7440-23-5	E440A	4.0	mg/kg wwt		8.9	10.4	10.6	21.5	43.1
strontium	7440-24-6	E440	0.050	mg/kg		32.3	61.6	80.8	7.80	199
strontium	7440-24-6	E440A	0.010	mg/kg wwt		10.7	20.4	29.2	2.91	53.4
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0056	0.0058	<0.0020	0.0054	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00187	0.00193	<0.00040	0.00202	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	0.62
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	0.166
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0024	0.0057	0.0044
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00040	0.00087	0.00214	0.00119
vanadium	7440-62-2	E440	0.10	mg/kg		0.14	0.17	0.37	0.99	0.68
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.047	0.057	0.135	0.370	0.183
zinc	7440-66-6	E440	0.50	mg/kg		17.4	34.6	12.9	14.3	21.3
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.74	11.4	4.67	5.36	5.72
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.70 DLM
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	0.046	0.069	<0.170 DLM

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		62.8	52.9	38.6	61.9	64.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		159	71.7	19.9	155	16.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		59.1	33.7	12.2	59.1	5.87
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.015	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0056	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.072	7.14	0.025	0.110	0.085
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0270	3.36	0.0152	0.0417	0.0306
barium	7440-39-3	E440	0.050	mg/kg		151	21.4	5.97	9.93	4.51
barium	7440-39-3	E440A	0.010	mg/kg wwt		56.1	10.1	3.66	3.78	1.62
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		20.3	16.9	4.4	46.4	49.1
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.56	7.94	2.73	17.7	17.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.137	0.0389	<0.0050	0.0452	1.33
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0509	0.0183	<0.0025 DLM	0.0172	0.478
calcium	7440-70-2	E440	20	mg/kg		7540	4760	3640	16000	11700
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2800	2240	2230	6090	4220
cesium	7440-46-2	E440	0.0050	mg/kg		0.0341	0.0992	0.0150	0.0465	0.0662
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0127	0.0467	0.0092	0.0177	0.0238
chromium	7440-47-3	E440	0.050	mg/kg		0.112	0.066	0.071	0.264	<0.050
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.042	0.031	0.043	0.101	0.013
cobalt	7440-48-4	E440	0.020	mg/kg		0.125	0.150	0.030	0.126	0.717
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0466	0.0705	0.0186	0.0480	0.258
copper	7440-50-8	E440	0.10	mg/kg		8.95	6.05	3.05	8.88	6.02
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.33	2.85	1.87	3.38	2.17
iron	7439-89-6	E440	3.0	mg/kg		149	101	38.4	271	44.9
iron	7439-89-6	E440A	0.60	mg/kg wwt		55.6	47.3	23.6	103	16.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.080	0.034	<0.020	0.090	<0.020
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0298	0.0160	0.0074	0.0342	<0.0040
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1130	835	659	6210	4000
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		422	393	404	2370	1440
manganese	7439-96-5	E440	0.050	mg/kg		1200	171	41.7	101	79.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		446	80.3	25.6	38.5	28.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0307	0.0075	<0.0050	0.0097	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0114	0.0035	0.0021	0.0037	<0.0020 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		0.118	0.837	4.70	4.64	2.06
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0439	0.394	2.88	1.77	0.740
nickel	7440-02-0	E440	0.20	mg/kg		0.70	<0.20	<0.20	0.22	0.24
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.259	0.065	0.059	0.083	0.086
phosphorus	7723-14-0	E440	10	mg/kg		2930	2000	1080	6530	2430
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1090	943	661	2490	876
potassium	7440-09-7	E440	20	mg/kg		7280	6480	6250	9040	8380
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2710	3050	3830	3440	3020
rubidium	7440-17-7	E440	0.050	mg/kg		5.74	5.91	3.85	6.02	6.55
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.14	2.78	2.36	2.29	2.36
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.287	0.158	0.392	0.494
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.135	0.097	0.149	0.178
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0159	0.0211	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0059	0.0099	0.0014	0.0012	0.0015
sodium	7440-23-5	E440	20	mg/kg		69	26	<20	34	25
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.7	12.1	8.1	13.0	9.2
strontium	7440-24-6	E440	0.050	mg/kg		44.1	218	31.5	468	170
strontium	7440-24-6	E440A	0.010	mg/kg wwt		16.4	102	19.3	178	61.1
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	0.0045	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0106	0.0162	<0.0020	0.0028	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00393	0.00763	<0.00040	0.00108	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.17	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.024	<0.020	0.065	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0032	0.0021	<0.0020	0.0061	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00121	0.00099	0.00046	0.00232	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.46	0.25	<0.10	0.81	<0.10
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.172	0.118	0.057	0.310	0.027
zinc	7440-66-6	E440	0.50	mg/kg		64.9	37.2	13.8	18.1	147
zinc	7440-66-6	E440A	0.10	mg/kg wwt		24.1	17.5	8.47	6.91	53.0
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.070 DLM	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		72.0	54.6	54.5	60.5	59.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		33.1	70.8	8.4	38.6	35.8
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		9.26	32.2	3.81	15.3	14.4
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0020	0.0027	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.037	0.062	<0.020	<0.020	0.026
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0104	0.0284	0.0060	0.0069	0.0104
barium	7440-39-3	E440	0.050	mg/kg		9.61	6.46	7.15	1.43	16.9
barium	7440-39-3	E440A	0.010	mg/kg wwt		2.69	2.93	3.26	0.565	6.81
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		16.4	46.4	7.1	8.8	13.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.59	21.1	3.24	3.47	5.45
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0200 DLM	0.0432	<0.0050	0.0254	<0.0100 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0050 DLM	0.0196	<0.0010	0.0100	<0.0030 DLM
calcium	7440-70-2	E440	20	mg/kg		18900	9200	5830	2030	30000
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5290	4180	2650	803	12000
cesium	7440-46-2	E440	0.0050	mg/kg		1.01	0.0385	0.0058	0.0266	0.240
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.283	0.0175	0.0026	0.0105	0.0967
chromium	7440-47-3	E440	0.050	mg/kg		0.134	1.21	<0.050	0.076	0.130
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.037	0.548	0.020	0.030	0.052
cobalt	7440-48-4	E440	0.020	mg/kg		0.416	0.079	<0.020	0.063	0.236
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.116	0.0359	0.0044	0.0250	0.0951
copper	7440-50-8	E440	0.10	mg/kg		15.0	7.58	2.82	6.52	13.4
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.19	3.44	1.28	2.58	5.37
iron	7439-89-6	E440	3.0	mg/kg		118	140	21.7	64.6	117
iron	7439-89-6	E440A	0.60	mg/kg wwt		32.9	63.7	9.87	25.5	46.9

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.022	0.038	<0.020	<0.020	0.020
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0063	0.0175	0.0064	0.0054	0.0082
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		4240	4860	1030	832	5600
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1180	2210	467	329	2250
manganese	7439-96-5	E440	0.050	mg/kg		105	73.2	44.1	63.7	75.7
manganese	7439-96-5	E440A	0.010	mg/kg wwt		29.3	33.2	20.1	25.2	30.4
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0057	<0.0050	<0.0050	0.0062
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0012 DLI	0.0026	0.0015	0.0012	0.0025
molybdenum	7439-98-7	E440	0.020	mg/kg		36.5	1.34	1.05	2.17	12.7
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		10.2	0.610	0.477	0.858	5.11
nickel	7440-02-0	E440	0.20	mg/kg		0.35	0.43	<0.20	0.32	0.22
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.098	0.196	<0.040	0.127	0.089
phosphorus	7723-14-0	E440	10	mg/kg		2260	3320	1080	1370	2280
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		632	1500	492	543	919
potassium	7440-09-7	E440	20	mg/kg		18100	6910	7560	5230	11000
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5060	3140	3440	2070	4430
rubidium	7440-17-7	E440	0.050	mg/kg		32.4	4.19	2.50	2.90	13.9
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		9.07	1.90	1.14	1.14	5.58
selenium	7782-49-2	E440	0.050	mg/kg		0.345	0.143	0.057	0.063	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.097	0.065	0.026	0.025	0.019
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0405	0.0062
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0011	<0.0010	<0.0010	0.0160	0.0025
sodium	7440-23-5	E440	20	mg/kg		50	61	22	<20	40
sodium	7440-23-5	E440A	4.0	mg/kg wwt		14.0	27.6	10.1	4.9	16.1
strontium	7440-24-6	E440	0.050	mg/kg		469	130	44.6	8.00	206
strontium	7440-24-6	E440A	0.010	mg/kg wwt		131	59.2	20.3	3.16	83.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0029	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00042	0.00130	<0.00040	0.00041	0.00074
vanadium	7440-62-2	E440	0.10	mg/kg		0.17	0.31	<0.10	0.15	0.13
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.047	0.142	0.022	0.061	0.051
zinc	7440-66-6	E440	0.50	mg/kg		27.2	10.9	11.9	42.0	24.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		7.60	4.96	5.40	16.6	9.72
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		76.5	69.0	58.9	61.1	63.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		109	33.3	23.4	112	34.8
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		25.7	10.3	9.63	43.5	12.9
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0031	0.0024
arsenic	7440-38-2	E440	0.020	mg/kg		0.071	0.033	<0.020	0.071	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0168	0.0102	0.0076	0.0278	0.0145
barium	7440-39-3	E440	0.050	mg/kg		46.3	13.0	1.30	10.1	7.14
barium	7440-39-3	E440A	0.010	mg/kg wwt		10.9	4.04	0.537	3.92	2.64
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		65.0	14.0	9.3	33.3	32.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		15.3	4.36	3.81	13.0	11.9
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0100 DLM	<0.0200 DLM	0.0408	0.0137	0.842
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0020 DLM	<0.0060 DLM	0.0168	0.0053	0.312
calcium	7440-70-2	E440	20	mg/kg		12500	13700	2300	11600	14200
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2940	4270	947	4510	5260
cesium	7440-46-2	E440	0.0050	mg/kg		0.244	1.39	0.198	0.0353	0.559
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0573	0.432	0.0813	0.0137	0.207
chromium	7440-47-3	E440	0.050	mg/kg		0.230	0.179	0.176	0.318	0.258
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.054	0.056	0.072	0.124	0.095
cobalt	7440-48-4	E440	0.020	mg/kg		0.096	0.340	0.099	0.086	0.367
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0224	0.105	0.0408	0.0335	0.136
copper	7440-50-8	E440	0.10	mg/kg		8.47	10.6	12.3	8.03	9.08
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.99	3.29	5.05	3.12	3.36
iron	7439-89-6	E440	3.0	mg/kg		203	106	64.7	203	73.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		47.6	32.8	26.6	78.8	27.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.044	0.023	<0.020	0.051	0.024
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0103	0.0071	0.0048	0.0198	0.0089
lithium	7439-93-2	E440	0.50	mg/kg		0.51	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.12	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3670	2860	802	5000	3130
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		863	886	329	1940	1160
manganese	7439-96-5	E440	0.050	mg/kg		31.6	72.5	37.7	72.4	60.9
manganese	7439-96-5	E440A	0.010	mg/kg wwt		7.42	22.5	15.5	28.1	22.6
mercury	7439-97-6	E510	0.0050	mg/kg		0.0109	<0.0050	<0.0050	0.0097	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0026	<0.0012	0.0012	0.0038	0.0015
molybdenum	7439-98-7	E440	0.020	mg/kg		12.4	31.5	6.50	8.10	1.30
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.90	9.76	2.67	3.15	0.481
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.54	0.65	<0.20	0.34
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.043	0.167	0.266	0.077	0.126
phosphorus	7723-14-0	E440	10	mg/kg		7700	2100	1540	3730	2130
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1810	651	635	1450	790
potassium	7440-09-7	E440	20	mg/kg		26200	16800	3450	7320	8640
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6160	5220	1420	2850	3200
rubidium	7440-17-7	E440	0.050	mg/kg		23.8	25.6	7.76	3.16	6.12
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.61	7.95	3.19	1.23	2.27
selenium	7782-49-2	E440	0.050	mg/kg		0.228	0.166	<0.050	0.208	0.362
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.054	0.051	0.013	0.081	0.134
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0069	<0.0050	0.0247	<0.0050	0.0069
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0016	<0.0010	0.0102	0.0013	0.0025
sodium	7440-23-5	E440	20	mg/kg		107	121	<20	56	33
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.2	37.6	4.4	21.6	12.3
strontium	7440-24-6	E440	0.050	mg/kg		335	404	34.2	141	616
strontium	7440-24-6	E440A	0.010	mg/kg wwt		78.6	125	14.1	55.0	228
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	0.0068

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0058	<0.0020	<0.0020	0.0039	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00137	0.00046	0.00075	0.00152	0.00050
vanadium	7440-62-2	E440	0.10	mg/kg		0.49	0.18	0.14	0.56	0.15
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.114	0.056	0.056	0.218	0.056
zinc	7440-66-6	E440	0.50	mg/kg		18.1	26.6	40.4	11.6	69.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		4.26	8.26	16.6	4.52	25.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		48.4	56.9	58.4	53.4	70.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		16.9	77.3	36.9	54.2	101
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		8.74	33.4	15.3	25.3	30.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0026	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		<0.020	0.038	0.061	8.45	0.076
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0094	0.0163	0.0253	3.94	0.0225
barium	7440-39-3	E440	0.050	mg/kg		3.68	2.41	5.98	17.1	11.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.90	1.04	2.49	7.98	3.30
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.5	8.6	39.5	8.4	18.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.82	3.71	16.4	3.94	5.48
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	0.0821	0.648	0.0145	<0.0150 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0022	0.0354	0.270	0.0067	<0.0050 DLM
calcium	7440-70-2	E440	20	mg/kg		3310	3000	10300	2160	15600
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1710	1290	4310	1010	4640
cesium	7440-46-2	E440	0.0050	mg/kg		0.0132	0.0175	0.0460	0.0260	0.550
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0068	0.0075	0.0191	0.0121	0.163
chromium	7440-47-3	E440	0.050	mg/kg		0.063	0.339	0.137	0.252	0.385
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.032	0.146	0.057	0.117	0.114
cobalt	7440-48-4	E440	0.020	mg/kg		0.023	0.187	0.319	0.065	0.585
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0117	0.0806	0.133	0.0304	0.173
copper	7440-50-8	E440	0.10	mg/kg		2.38	6.00	6.53	4.84	14.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.22	2.59	2.72	2.25	4.19
iron	7439-89-6	E440	3.0	mg/kg		33.5	112	63.4	104	248
iron	7439-89-6	E440A	0.60	mg/kg wwt		17.3	48.5	26.4	48.4	73.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.027	0.024	0.032	0.046
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0070	0.0116	0.0100	0.0149	0.0136
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.11
magnesium	7439-95-4	E440	2.0	mg/kg		607	1530	3020	770	3780
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		313	662	1260	359	1120
manganese	7439-96-5	E440	0.050	mg/kg		41.6	76.6	31.6	147	96.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		21.5	33.0	13.1	68.5	28.6
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0013	<0.0011 DLI	0.0014	<0.0022 DLA	0.0012
molybdenum	7439-98-7	E440	0.020	mg/kg		2.14	1.63	1.60	2.47	38.0
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.10	0.704	0.667	1.15	11.3
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.21	<0.20	<0.20	0.74
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.050	0.090	0.077	0.066	0.220
phosphorus	7723-14-0	E440	10	mg/kg		850	1100	1580	1460	2830
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		438	475	656	678	838
potassium	7440-09-7	E440	20	mg/kg		5860	4400	5380	7960	23100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3020	1900	2240	3710	6860
rubidium	7440-17-7	E440	0.050	mg/kg		3.54	2.58	5.39	5.98	38.7
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.83	1.11	2.24	2.78	11.5
selenium	7782-49-2	E440	0.050	mg/kg		0.054	<0.050	0.112	<0.050	0.105
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.028	0.015	0.046	0.022	0.031
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0305	0.0055	0.0097	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0131	0.0023	0.0045	<0.0010
sodium	7440-23-5	E440	20	mg/kg		<20	21	40	<20	116
sodium	7440-23-5	E440A	4.0	mg/kg wwt		9.7	9.0	16.5	8.7	34.4
strontium	7440-24-6	E440	0.050	mg/kg		34.9	24.4	324	44.5	330
strontium	7440-24-6	E440A	0.010	mg/kg wwt		18.0	10.5	135	20.7	98.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	0.0031	<0.0020	0.0093	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00133	<0.00040	0.00432	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0031	<0.0020	<0.0020	0.0034
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00133	0.00054	0.00080	0.00100
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	0.34	0.15	0.30	0.52
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.049	0.148	0.061	0.142	0.154
zinc	7440-66-6	E440	0.50	mg/kg		12.2	66.2	72.5	23.4	35.6
zinc	7440-66-6	E440A	0.10	mg/kg wwt		6.31	28.6	30.2	10.9	10.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		35.9	57.5	62.5	62.4	31.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		69.2	20.1	45.4	60.7	38.1
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		44.3	8.53	17.0	22.8	26.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	0.011	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0028	0.0045	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.069	0.022	0.043	13.3	0.044
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0445	0.0094	0.0163	5.01	0.0306
barium	7440-39-3	E440	0.050	mg/kg		35.8	8.56	1.51	20.0	5.23
barium	7440-39-3	E440A	0.010	mg/kg wwt		22.9	3.64	0.565	7.51	3.59
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.3	41.1	16.3	17.8	2.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		2.10	17.4	6.12	6.71	1.57
cadmium	7440-43-9	E440	0.0050	mg/kg		0.111	1.23	0.0363	0.0127	0.0117
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0714	0.525	0.0136	0.0048	0.0081
calcium	7440-70-2	E440	20	mg/kg		4060	15900	2840	3440	1610
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2600	6740	1070	1290	1110
cesium	7440-46-2	E440	0.0050	mg/kg		0.0427	0.259	0.0696	0.162	0.0161
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0274	0.110	0.0261	0.0611	0.0110
chromium	7440-47-3	E440	0.050	mg/kg		0.112	0.088	0.095	0.246	0.176
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.072	0.037	0.036	0.092	0.121
cobalt	7440-48-4	E440	0.020	mg/kg		0.058	0.370	0.086	0.114	0.046
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0370	0.157	0.0322	0.0427	0.0318
copper	7440-50-8	E440	0.10	mg/kg		4.94	6.39	5.05	5.12	3.18
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.17	2.72	1.89	1.93	2.18
iron	7439-89-6	E440	3.0	mg/kg		124	52.6	59.2	104	73.3
iron	7439-89-6	E440A	0.60	mg/kg wwt		79.5	22.3	22.2	39.1	50.3

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.041	0.021	<0.020	0.026	0.028
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0264	0.0090	0.0052	0.0096	0.0195
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.15	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		510	2520	1140	1000	341
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		327	1070	427	378	234
manganese	7439-96-5	E440	0.050	mg/kg		64.6	38.3	91.4	94.1	43.5
manganese	7439-96-5	E440A	0.010	mg/kg wwt		41.4	16.3	34.3	35.4	29.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0073	0.0050	<0.0050	0.0061	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0047	0.0021	<0.0017 DLA	0.0023	<0.0018 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		10.4	1.32	1.67	1.87	1.02
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		6.68	0.561	0.627	0.702	0.704
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	0.21	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.056	0.075	0.080	<0.040	0.050
phosphorus	7723-14-0	E440	10	mg/kg		774	1550	1420	1470	220
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		496	659	533	553	151
potassium	7440-09-7	E440	20	mg/kg		4690	8500	4230	5860	5400
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3010	3610	1580	2200	3710
rubidium	7440-17-7	E440	0.050	mg/kg		3.67	6.28	3.54	8.69	2.53
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.35	2.66	1.33	3.27	1.74
selenium	7782-49-2	E440	0.050	mg/kg		0.075	0.235	0.311	0.273	0.054
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.048	0.100	0.116	0.103	0.037
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0058	0.0270	0.0071	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0020	0.0024	0.0101	0.0027	<0.0010
sodium	7440-23-5	E440	20	mg/kg		31	52	35	22	<20
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.6	22.1	13.2	8.3	12.1
strontium	7440-24-6	E440	0.050	mg/kg		106	434	35.6	159	30.9
strontium	7440-24-6	E440A	0.010	mg/kg wwt		68.3	184	13.4	59.7	21.2
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	0.0042	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0026	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00042	0.00099	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0031	<0.0020	<0.0020	0.0032	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00199	0.00060	0.00050	0.00119	0.00120
vanadium	7440-62-2	E440	0.10	mg/kg		0.41	0.10	0.14	0.28	0.25
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.260	0.045	0.052	0.107	0.175
zinc	7440-66-6	E440	0.50	mg/kg		15.3	143	44.9	18.9	6.93
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.82	60.7	16.8	7.12	4.76
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.060	0.043	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		69.9	62.9	67.3	43.7	70.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		61.7	107	17.4	22.0	33.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		18.6	39.6	5.71	12.4	10.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0022	0.0033	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.054	0.075	0.041	0.021	0.034
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0162	0.0278	0.0135	0.0120	0.0101
barium	7440-39-3	E440	0.050	mg/kg		12.3	23.8	10.1	9.13	24.5
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.70	8.80	3.30	5.14	7.32
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		19.8	34.1	40.2	3.6	13.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		5.95	12.6	13.2	2.04	3.98
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0150 DLM	0.0623	0.437	<0.0050	0.0122
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0040 DLM	0.0231	0.143	0.0015	0.0036
calcium	7440-70-2	E440	20	mg/kg		19800	11200	15600	2440	18000
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5950	4150	5100	1370	5370
cesium	7440-46-2	E440	0.0050	mg/kg		0.618	0.0223	0.0812	0.0092	0.554
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.186	0.0083	0.0266	0.0052	0.165
chromium	7440-47-3	E440	0.050	mg/kg		0.228	0.350	0.072	0.144	0.130
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.068	0.130	0.024	0.081	0.039
cobalt	7440-48-4	E440	0.020	mg/kg		0.257	0.103	0.394	0.026	0.153
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0773	0.0380	0.129	0.0144	0.0455
copper	7440-50-8	E440	0.10	mg/kg		16.1	10.1	5.55	3.17	12.8
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.84	3.74	1.82	1.78	3.81
iron	7439-89-6	E440	3.0	mg/kg		143	211	48.7	45.7	108
iron	7439-89-6	E440A	0.60	mg/kg wwt		43.1	78.1	16.0	25.7	32.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.039	0.060	0.023	<0.020	0.024
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0116	0.0222	0.0075	0.0084	0.0073
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2990	5350	2020	594	2710
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		901	1980	661	334	809
manganese	7439-96-5	E440	0.050	mg/kg		62.5	225	21.1	42.2	70.1
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.8	83.5	6.91	23.7	20.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0054	0.0063	<0.0050	<0.0050	0.0056
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0022 DLA	0.0023	0.0016	0.0019	0.0017
molybdenum	7439-98-7	E440	0.020	mg/kg		20.1	2.69	2.90	1.96	4.40
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		6.05	0.996	0.950	1.10	1.31
nickel	7440-02-0	E440	0.20	mg/kg		0.26	0.69	0.21	0.22	0.76
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.077	0.257	0.070	0.122	0.226
phosphorus	7723-14-0	E440	10	mg/kg		1290	4540	2510	1460	1500
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		388	1680	822	820	448
potassium	7440-09-7	E440	20	mg/kg		18600	7370	12500	9590	17300
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5610	2730	4080	5400	5170
rubidium	7440-17-7	E440	0.050	mg/kg		24.8	3.47	8.11	5.40	22.7
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		7.47	1.29	2.66	3.04	6.78
selenium	7782-49-2	E440	0.050	mg/kg		0.181	0.065	0.116	<0.050	0.071
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.054	0.024	0.038	0.016	0.021
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0096	<0.0050	<0.0050	<0.0050	0.0084
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0029	<0.0010	0.0011	<0.0010	0.0025
sodium	7440-23-5	E440	20	mg/kg		79	100	36	21	36
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.9	37.2	11.7	11.7	10.8
strontium	7440-24-6	E440	0.050	mg/kg		557	43.0	55.6	11.7	71.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		168	15.9	18.2	6.60	21.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		0.0046	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0032	0.0032	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00096	0.00120	<0.00040	<0.00040	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.32	0.56	<0.10	0.10	0.22
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.096	0.207	0.030	0.059	0.065
zinc	7440-66-6	E440	0.50	mg/kg		18.9	20.7	28.0	19.4	26.6
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.68	7.66	9.16	10.9	7.94
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		42.8	58.2	58.6	53.7	69.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		46.9	45.8	27.3	64.6	71.7
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		26.8	19.1	11.3	30.0	22.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0036	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.038	0.032	0.056	10.9	0.057
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0215	0.0134	0.0233	5.04	0.0176
barium	7440-39-3	E440	0.050	mg/kg		20.6	1.85	5.56	15.5	12.8
barium	7440-39-3	E440A	0.010	mg/kg wwt		11.8	0.775	2.30	7.18	3.95
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		2.3	7.9	36.6	8.0	15.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.33	3.29	15.2	3.72	4.76
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0066	0.0482	0.984	0.0140	<0.0225 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0038	0.0202	0.408	0.0065	<0.0065 DLM
calcium	7440-70-2	E440	20	mg/kg		2160	2440	11100	1940	11900
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1230	1020	4580	900	3660
cesium	7440-46-2	E440	0.0050	mg/kg		0.0080	0.0193	0.0628	0.0302	0.331
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0046	0.0080	0.0260	0.0140	0.102
chromium	7440-47-3	E440	0.050	mg/kg		0.143	0.109	0.116	0.080	1.51
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.082	0.046	0.048	0.037	0.464
cobalt	7440-48-4	E440	0.020	mg/kg		0.052	0.154	0.371	0.067	0.367
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0300	0.0645	0.154	0.0311	0.113
copper	7440-50-8	E440	0.10	mg/kg		3.94	6.12	5.64	5.23	13.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		2.25	2.56	2.34	2.42	4.04
iron	7439-89-6	E440	3.0	mg/kg		76.4	97.0	75.9	112	180
iron	7439-89-6	E440A	0.60	mg/kg wwt		43.7	40.6	31.4	51.7	55.3

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.031	0.025	0.073	0.028	0.039
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0176	0.0105	0.0302	0.0130	0.0119
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.71
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.22
magnesium	7439-95-4	E440	2.0	mg/kg		473	1300	3180	737	2930
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		271	544	1320	341	900
manganese	7439-96-5	E440	0.050	mg/kg		28.1	68.4	37.9	122	63.4
manganese	7439-96-5	E440A	0.010	mg/kg wwt		16.1	28.6	15.7	56.6	19.5
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0021	0.0014	0.0012	0.0023	<0.0022 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		3.74	2.35	2.09	2.58	37.3
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.14	0.984	0.866	1.20	11.5
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.21	<0.20	<0.20	0.58
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.068	0.089	0.064	0.048	0.180
phosphorus	7723-14-0	E440	10	mg/kg		565	973	1640	1550	3380
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		323	407	679	718	1040
potassium	7440-09-7	E440	20	mg/kg		3320	3840	7610	7360	24800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		1900	1600	3150	3410	7620
rubidium	7440-17-7	E440	0.050	mg/kg		1.75	2.94	5.33	7.42	36.3
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.00	1.23	2.21	3.44	11.2
selenium	7782-49-2	E440	0.050	mg/kg		0.054	<0.050	0.184	<0.050	0.099
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.031	0.014	0.076	0.022	0.030
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0374	0.0054	0.0082	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0014	0.0156	0.0022	0.0038	<0.0010
sodium	7440-23-5	E440	20	mg/kg		33	<20	<20	<20	105
sodium	7440-23-5	E440A	4.0	mg/kg wwt		18.7	4.5	5.8	7.9	32.3
strontium	7440-24-6	E440	0.050	mg/kg		12.7	18.6	347	38.0	290
strontium	7440-24-6	E440A	0.010	mg/kg wwt		7.26	7.78	144	17.6	89.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0078	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00048	<0.00040	0.00360	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0023	<0.0020	0.0021	0.0021
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00114	0.00096	<0.00040	0.00096	0.00066
vanadium	7440-62-2	E440	0.10	mg/kg		0.21	0.24	0.12	0.31	0.36
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.123	0.101	0.048	0.146	0.111
zinc	7440-66-6	E440	0.50	mg/kg		10.5	52.7	96.1	21.0	34.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		6.03	22.0	39.8	9.75	10.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		38.4	61.1	60.5	62.6	29.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		69.8	38.4	37.3	11.7	40.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		43.0	15.0	14.7	4.38	28.6
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0025	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.087	0.025	3.96	<0.020	0.071
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0535	0.0097	1.56	0.0050	0.0501
barium	7440-39-3	E440	0.050	mg/kg		47.8	1.65	12.3	3.32	30.0
barium	7440-39-3	E440A	0.010	mg/kg wwt		29.4	0.644	4.84	1.24	21.2
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		5.1	10.7	11.9	38.1	4.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.13	4.16	4.71	14.2	3.16
cadmium	7440-43-9	E440	0.0050	mg/kg		0.104	0.0516	0.0599	1.50	0.0642
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0642	0.0201	0.0237	0.562	0.0453
calcium	7440-70-2	E440	20	mg/kg		5790	3020	3190	10900	5390
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3560	1180	1260	4070	3800
cesium	7440-46-2	E440	0.0050	mg/kg		0.0429	0.110	0.111	0.489	0.140
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0264	0.0429	0.0437	0.183	0.0985
chromium	7440-47-3	E440	0.050	mg/kg		0.173	0.055	0.071	<0.050	0.100
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.107	0.021	0.028	<0.010	0.070
cobalt	7440-48-4	E440	0.020	mg/kg		0.060	0.118	0.123	0.476	0.036
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0372	0.0459	0.0485	0.178	0.0254
copper	7440-50-8	E440	0.10	mg/kg		5.26	4.53	3.53	6.03	4.69
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.24	1.76	1.39	2.25	3.31
iron	7439-89-6	E440	3.0	mg/kg		124	80.8	61.3	37.2	80.0
iron	7439-89-6	E440A	0.60	mg/kg wwt		76.3	31.5	24.2	13.9	56.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.041	0.022	<0.020	<0.020	0.031
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0251	0.0086	0.0063	0.0046	0.0221
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	0.71	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.14	<0.10	<0.10	0.26	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		708	1110	731	3360	414
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		436	431	289	1260	292
manganese	7439-96-5	E440	0.050	mg/kg		96.9	63.0	73.9	54.4	85.8
manganese	7439-96-5	E440A	0.010	mg/kg wwt		59.6	24.5	29.2	20.4	60.5
mercury	7439-97-6	E510	0.0050	mg/kg		0.0073	<0.0050	<0.0050	<0.0050	0.0065
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0045	0.0013	0.0018	0.0013	0.0046
molybdenum	7439-98-7	E440	0.020	mg/kg		19.6	2.67	0.749	1.84	4.86
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		12.0	1.04	0.296	0.688	3.43
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.32	<0.20	0.46	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.063	0.125	0.042	0.171	0.052
phosphorus	7723-14-0	E440	10	mg/kg		996	1110	1440	1880	579
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		613	432	570	705	408
potassium	7440-09-7	E440	20	mg/kg		5540	3760	6190	7520	4320
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3410	1460	2440	2810	3040
rubidium	7440-17-7	E440	0.050	mg/kg		4.26	3.28	4.84	5.82	3.40
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.62	1.28	1.91	2.17	2.40
selenium	7782-49-2	E440	0.050	mg/kg		0.093	0.063	0.098	0.816	0.056
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.057	0.024	0.039	0.305	0.040
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0086	0.0062	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0021	0.0034	0.0025	0.0014	0.0022
sodium	7440-23-5	E440	20	mg/kg		45	36	24	<20	23
sodium	7440-23-5	E440A	4.0	mg/kg wwt		27.7	14.1	9.3	7.1	16.0
strontium	7440-24-6	E440	0.050	mg/kg		146	49.4	121	469	112
strontium	7440-24-6	E440A	0.010	mg/kg wwt		90.2	19.2	47.9	175	78.9
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	0.0041	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0037	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00146	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.022	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0030	<0.0020	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00182	0.00059	0.00058	0.00044	0.00109
vanadium	7440-62-2	E440	0.10	mg/kg		0.39	0.22	0.15	<0.10	0.24
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.242	0.085	0.058	0.021	0.172
zinc	7440-66-6	E440	0.50	mg/kg		15.1	44.4	20.6	82.1	15.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.30	17.3	8.13	30.7	11.2
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.056	<0.040	<0.040	<0.040	0.086

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		69.0	58.7	61.1	47.0	60.1
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		32.0	117	95.9	27.5	19.9
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		9.93	48.2	37.3	14.6	7.92
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0028	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.032	0.089	0.079	0.035	0.027
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0098	0.0368	0.0308	0.0184	0.0109
barium	7440-39-3	E440	0.050	mg/kg		9.72	15.5	9.23	6.64	4.67
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.02	6.41	3.59	3.52	1.86
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		20.8	29.8	23.2	3.9	39.4
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.44	12.3	9.00	2.06	15.7
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0200 DLM	0.0146	0.0180	<0.0050	0.220
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0060 DLM	0.0060	0.0070	<0.0020 DLM	0.0879
calcium	7440-70-2	E440	20	mg/kg		15600	10700	7660	2520	9960
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4830	4410	2980	1340	3970
cesium	7440-46-2	E440	0.0050	mg/kg		1.04	0.0480	0.111	0.0297	0.648
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.323	0.0198	0.0433	0.0157	0.258
chromium	7440-47-3	E440	0.050	mg/kg		0.077	0.280	0.097	0.095	0.061
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.024	0.115	0.038	0.050	0.024
cobalt	7440-48-4	E440	0.020	mg/kg		0.298	0.108	0.116	0.032	0.382
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0924	0.0447	0.0452	0.0171	0.152
copper	7440-50-8	E440	0.10	mg/kg		12.0	11.2	9.59	4.33	6.95
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.73	4.63	3.73	2.30	2.77
iron	7439-89-6	E440	3.0	mg/kg		106	194	154	48.7	50.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		32.8	80.2	60.0	25.8	20.0

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.024	0.067	0.030	0.021	0.031
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0074	0.0276	0.0118	0.0110	0.0123
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.13	<0.10	<0.10	<0.10	0.12
magnesium	7439-95-4	E440	2.0	mg/kg		4320	3390	2410	633	2950
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1340	1400	938	336	1180
manganese	7439-96-5	E440	0.050	mg/kg		99.3	85.3	41.6	33.6	32.4
manganese	7439-96-5	E440A	0.010	mg/kg wwt		30.8	35.2	16.2	17.8	12.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0060	0.0068	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0018	0.0028	0.0013	0.0020	0.0015
molybdenum	7439-98-7	E440	0.020	mg/kg		27.4	2.11	1.72	4.42	2.95
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		8.50	0.872	0.668	2.34	1.18
nickel	7440-02-0	E440	0.20	mg/kg		0.69	0.40	0.43	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.215	0.167	0.167	0.083	0.077
phosphorus	7723-14-0	E440	10	mg/kg		1830	3970	3270	1350	2670
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		568	1640	1270	715	1060
potassium	7440-09-7	E440	20	mg/kg		15600	10100	12300	8410	12100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4850	4190	4790	4450	4810
rubidium	7440-17-7	E440	0.050	mg/kg		27.1	6.60	12.6	6.06	10.8
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		8.40	2.72	4.88	3.21	4.31
selenium	7782-49-2	E440	0.050	mg/kg		0.124	0.163	0.273	0.081	1.21
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.039	0.067	0.106	0.043	0.484
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0013	0.0011	<0.0010	<0.0010
sodium	7440-23-5	E440	20	mg/kg		119	59	22	<20	57
sodium	7440-23-5	E440A	4.0	mg/kg wwt		37.0	24.5	8.7	10.6	22.7
strontium	7440-24-6	E440	0.050	mg/kg		409	40.9	30.4	10.9	38.7
strontium	7440-24-6	E440A	0.010	mg/kg wwt		127	16.9	11.8	5.79	15.4
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	1.17	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	0.456	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0035	0.0023	<0.0020	0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00044	0.00144	0.00090	0.00050	0.00080
vanadium	7440-62-2	E440	0.10	mg/kg		0.18	0.54	0.41	0.13	<0.10
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.057	0.223	0.158	0.068	0.037
zinc	7440-66-6	E440	0.50	mg/kg		37.0	12.2	22.6	12.6	24.5
zinc	7440-66-6	E440A	0.10	mg/kg wwt		11.5	5.02	8.80	6.67	9.75
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		67.7	55.7	61.6	48.6	72.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		73.0	169	25.0	31.3	42.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		23.6	74.9	9.59	16.1	11.8
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0034	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.056	0.110	0.053	0.039	0.052
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0182	0.0486	0.0205	0.0199	0.0146
barium	7440-39-3	E440	0.050	mg/kg		29.7	22.6	9.11	12.9	23.4
barium	7440-39-3	E440A	0.010	mg/kg wwt		9.61	10.0	3.50	6.65	6.56
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0023	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.5	38.1	35.7	4.7	19.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.68	16.9	13.7	2.41	5.48
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0100 DLM	0.0454	0.613	0.0069	<0.0125 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0030 DLM	0.0201	0.235	0.0035	<0.0035 DLM
calcium	7440-70-2	E440	20	mg/kg		21900	13800	12500	2710	25400
calcium	7440-70-2	E440A	4.0	mg/kg wwt		7100	6110	4820	1390	7110
cesium	7440-46-2	E440	0.0050	mg/kg		0.278	0.0538	0.254	0.0209	0.822
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0898	0.0238	0.0975	0.0107	0.230
chromium	7440-47-3	E440	0.050	mg/kg		0.092	0.223	0.052	<0.050	0.118
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.030	0.099	0.020	0.020	0.033
cobalt	7440-48-4	E440	0.020	mg/kg		0.257	0.128	0.207	0.032	0.226
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0831	0.0570	0.0796	0.0164	0.0633
copper	7440-50-8	E440	0.10	mg/kg		21.3	12.7	6.78	4.56	17.7
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.90	5.62	2.60	2.34	4.95
iron	7439-89-6	E440	3.0	mg/kg		146	273	51.4	57.6	114
iron	7439-89-6	E440A	0.60	mg/kg wwt		47.2	121	19.7	29.6	32.0

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.032	0.070	<0.020	<0.020	0.029
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0103	0.0309	0.0060	0.0081	0.0081
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.52
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.16	0.13	<0.10	0.15
magnesium	7439-95-4	E440	2.0	mg/kg		4050	4910	2880	722	3590
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1310	2180	1100	371	1000
manganese	7439-96-5	E440	0.050	mg/kg		56.0	176	37.0	48.5	102
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.1	78.2	14.2	24.9	28.5
mercury	7439-97-6	E510	0.0050	mg/kg		0.0071	0.0082	<0.0050	<0.0050	0.0056
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0036	0.0015	0.0014	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		10.5	3.86	2.18	1.40	15.9
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		3.40	1.71	0.838	0.722	4.45
nickel	7440-02-0	E440	0.20	mg/kg		0.33	0.43	0.41	0.21	0.35
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.107	0.190	0.159	0.107	0.098
phosphorus	7723-14-0	E440	10	mg/kg		2300	3890	1740	1730	2050
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		744	1720	667	887	575
potassium	7440-09-7	E440	20	mg/kg		13000	8100	7080	11800	18900
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4210	3590	2720	6090	5300
rubidium	7440-17-7	E440	0.050	mg/kg		15.3	4.92	7.95	8.22	24.9
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.95	2.18	3.05	4.22	6.96
selenium	7782-49-2	E440	0.050	mg/kg		0.576	0.475	0.670	0.101	1.10
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.186	0.210	0.257	0.052	0.307
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0104	<0.0050	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0034	0.0016	<0.0010	<0.0010	0.0011
sodium	7440-23-5	E440	20	mg/kg		72	117	34	31	170
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.5	52.0	13.1	15.8	47.7
strontium	7440-24-6	E440	0.050	mg/kg		84.1	45.8	45.6	11.1	73.8
strontium	7440-24-6	E440A	0.010	mg/kg wwt		27.2	20.3	17.5	5.70	20.7
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0063	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00077	0.00278	<0.00040	0.00053	0.00043
vanadium	7440-62-2	E440	0.10	mg/kg		0.33	0.74	0.14	0.16	0.21
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.106	0.331	0.053	0.084	0.059
zinc	7440-66-6	E440	0.50	mg/kg		28.1	15.2	31.0	20.8	30.9
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.09	6.74	11.9	10.7	8.65
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.060 DLM	<0.040	<0.050 DLM	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		27.6	73.6	60.7	40.2	40.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		81.6	126	122	75.3	80.2
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		59.1	33.2	47.7	45.1	47.5
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0028	0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.071	0.123	0.086	0.094	0.120
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0516	0.0324	0.0336	0.0561	0.0707
barium	7440-39-3	E440	0.050	mg/kg		9.45	67.4	2.33	4.19	41.3
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.84	17.8	0.914	2.51	24.5
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		26.0	116	14.6	8.9	4.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		18.8	30.6	5.73	5.32	2.77
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0190	<0.0100 DLM	0.0397	0.0085	0.0382
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0137	<0.0025 DLM	0.0156	0.0051	0.0226
calcium	7440-70-2	E440	20	mg/kg		7050	20900	3200	4210	4570
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5110	5510	1250	2520	2700
cesium	7440-46-2	E440	0.0050	mg/kg		0.0881	0.212	0.132	0.0280	0.0634
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0638	0.0560	0.0518	0.0168	0.0375
chromium	7440-47-3	E440	0.050	mg/kg		0.105	0.151	0.165	0.096	0.120
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.076	0.040	0.065	0.057	0.071
cobalt	7440-48-4	E440	0.020	mg/kg		0.087	0.103	0.112	0.061	0.062
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0630	0.0271	0.0438	0.0363	0.0367
copper	7440-50-8	E440	0.10	mg/kg		8.87	10.2	9.45	7.69	7.07
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.42	2.69	3.71	4.60	4.19
iron	7439-89-6	E440	3.0	mg/kg		130	228	199	102	142
iron	7439-89-6	E440A	0.60	mg/kg wwt		94.1	60.4	78.0	61.2	84.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.027	0.063	0.038	0.034	0.035
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0196	0.0167	0.0149	0.0205	0.0210
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	<0.10	<0.10	0.13
magnesium	7439-95-4	E440	2.0	mg/kg		2250	5030	1180	981	475
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1630	1330	463	587	281
manganese	7439-96-5	E440	0.050	mg/kg		26.8	22.5	100	41.8	58.1
manganese	7439-96-5	E440A	0.010	mg/kg wwt		19.4	5.95	39.3	25.0	34.4
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0125	<0.0050	<0.0050	0.0060
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0033	0.0018	0.0029	0.0036
molybdenum	7439-98-7	E440	0.020	mg/kg		1.45	26.5	2.38	7.17	7.80
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.05	7.00	0.936	4.29	4.62
nickel	7440-02-0	E440	0.20	mg/kg		0.50	0.27	0.51	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.362	0.071	0.202	0.085	0.050
phosphorus	7723-14-0	E440	10	mg/kg		3040	6090	1600	1910	850
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		2200	1610	630	1140	503
potassium	7440-09-7	E440	20	mg/kg		8130	22500	5650	8020	5330
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5890	5950	2220	4800	3150
rubidium	7440-17-7	E440	0.050	mg/kg		10.6	10.7	4.10	3.71	2.62
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		7.65	2.84	1.61	2.22	1.55
selenium	7782-49-2	E440	0.050	mg/kg		0.326	0.368	0.300	0.227	0.151
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.236	0.097	0.118	0.136	0.089
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0374	<0.0050	0.0107
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0020	<0.0010	0.0147	0.0017	0.0063
sodium	7440-23-5	E440	20	mg/kg		26	88	22	28	62
sodium	7440-23-5	E440A	4.0	mg/kg wwt		18.6	23.3	8.7	16.7	36.5
strontium	7440-24-6	E440	0.050	mg/kg		26.9	65.0	5.57	14.6	17.8
strontium	7440-24-6	E440A	0.010	mg/kg wwt		19.5	17.2	2.19	8.70	10.5
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00047	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.54	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.392	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0021	0.0038	0.0036	0.0023	0.0026
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00155	0.00100	0.00141	0.00137	0.00157
vanadium	7440-62-2	E440	0.10	mg/kg		0.34	1.67	0.61	0.30	0.48
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.243	0.441	0.241	0.176	0.286
zinc	7440-66-6	E440	0.50	mg/kg		24.2	24.2	43.6	46.3	33.0
zinc	7440-66-6	E440A	0.10	mg/kg wwt		17.5	6.39	17.1	27.7	19.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.045	<0.040	<0.040	<0.060 DLM	0.106

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		60.9	77.3	67.0	42.9	41.4
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		79.2	127	475	78.2	219
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		31.0	28.8	157	44.6	128
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.016	<0.010	0.011
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0053	0.0024	0.0064
arsenic	7440-38-2	E440	0.020	mg/kg		0.083	0.095	0.350	0.078	0.179
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0326	0.0216	0.115	0.0446	0.105
barium	7440-39-3	E440	0.050	mg/kg		4.25	3.04	14.1	7.39	45.6
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.66	0.691	4.64	4.22	26.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	0.016	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0053	<0.0020	0.0040
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.8	13.4	28.5	6.0	5.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.64	3.03	9.41	3.43	3.30
cadmium	7440-43-9	E440	0.0050	mg/kg		0.572	0.0258	0.0981	0.0134	0.108
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.224	0.0059	0.0323	0.0077	0.0635
calcium	7440-70-2	E440	20	mg/kg		8430	2940	9720	3940	6180
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3300	669	3200	2250	3620
cesium	7440-46-2	E440	0.0050	mg/kg		0.529	0.277	0.0888	0.0382	0.155
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.207	0.0628	0.0293	0.0218	0.0910
chromium	7440-47-3	E440	0.050	mg/kg		0.114	0.129	0.501	0.106	0.280
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.044	0.029	0.165	0.060	0.164
cobalt	7440-48-4	E440	0.020	mg/kg		0.077	0.170	0.404	0.072	0.164
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0300	0.0387	0.133	0.0414	0.0964
copper	7440-50-8	E440	0.10	mg/kg		12.2	11.1	31.4	8.49	16.8
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.78	2.52	10.4	4.85	9.85
iron	7439-89-6	E440	3.0	mg/kg		138	256	1070	144	375
iron	7439-89-6	E440A	0.60	mg/kg wwt		54.0	58.2	353	82.0	220

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.025	0.041	0.160	0.033	0.082
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0099	0.0094	0.0529	0.0187	0.0478
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	0.64	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.21	<0.10	0.14
magnesium	7439-95-4	E440	2.0	mg/kg		2740	984	5280	996	922
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1070	223	1740	569	540
manganese	7439-96-5	E440	0.050	mg/kg		49.8	75.3	163	57.2	73.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		19.5	17.1	53.6	32.7	43.1
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	0.0052
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0012 DLA	<0.0010	0.0014	0.0024	0.0031
molybdenum	7439-98-7	E440	0.020	mg/kg		1.23	1.45	2.36	3.58	10.8
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.482	0.330	0.776	2.04	6.36
nickel	7440-02-0	E440	0.20	mg/kg		0.72	0.48	0.88	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.282	0.109	0.292	0.095	0.109
phosphorus	7723-14-0	E440	10	mg/kg		4050	1420	4920	2220	1010
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1580	324	1620	1270	590
potassium	7440-09-7	E440	20	mg/kg		17600	4620	14900	12800	5740
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6890	1050	4920	7320	3370
rubidium	7440-17-7	E440	0.050	mg/kg		17.0	5.15	5.37	5.47	5.21
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		6.64	1.17	1.77	3.12	3.06
selenium	7782-49-2	E440	0.050	mg/kg		0.183	0.127	0.204	0.128	0.502
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.072	0.029	0.067	0.073	0.294
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0378	0.0080	0.0076	0.0072
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0086	0.0026	0.0044	0.0042
sodium	7440-23-5	E440	20	mg/kg		55	23	114	20	34
sodium	7440-23-5	E440A	4.0	mg/kg wwt		21.4	5.3	37.6	11.7	20.0
strontium	7440-24-6	E440	0.050	mg/kg		26.9	4.96	34.0	13.4	28.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		10.5	1.13	11.2	7.67	16.6
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0043	0.0162	0.0022	0.0076
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00071	0.00097	0.00533	0.00124	0.00448
vanadium	7440-62-2	E440	0.10	mg/kg		0.33	0.89	3.69	0.46	1.37
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.131	0.203	1.22	0.265	0.802
zinc	7440-66-6	E440	0.50	mg/kg		52.0	68.9	63.6	55.7	33.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		20.3	15.6	21.0	31.8	19.8
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	0.32	<0.20	0.30
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.057	<0.040	0.104	0.046	0.175

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		71.7	59.4	58.6	62.0	60.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		134	88.3	59.4	53.7	246
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		37.8	35.8	24.6	20.4	96.9
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0028	0.0035	<0.0020	0.0023	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.102	0.108	0.024	0.036	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0289	0.0439	0.0101	0.0138	0.0154
barium	7440-39-3	E440	0.050	mg/kg		4.42	21.3	27.2	25.9	98.4
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.25	8.66	11.2	9.83	38.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0024	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		21.9	3.5	23.6	15.1	9.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.20	1.44	9.74	5.72	3.66
cadmium	7440-43-9	E440	0.0050	mg/kg		0.232	0.0335	0.0095	0.121	0.264
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0655	0.0136	0.0039	0.0459	0.104
calcium	7440-70-2	E440	20	mg/kg		7120	3610	11400	8110	5500
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2010	1460	4720	3080	2160
cesium	7440-46-2	E440	0.0050	mg/kg		0.693	0.0305	0.157	0.0107	0.0086
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.196	0.0124	0.0648	0.0041	0.0034
chromium	7440-47-3	E440	0.050	mg/kg		0.252	0.208	0.133	0.118	0.074
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.071	0.084	0.055	0.045	0.029
cobalt	7440-48-4	E440	0.020	mg/kg		0.141	0.097	0.307	0.075	0.136
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0398	0.0394	0.127	0.0283	0.0536
copper	7440-50-8	E440	0.10	mg/kg		18.1	7.90	12.2	4.86	6.85
copper	7440-50-8	E440A	0.020	mg/kg wwt		5.12	3.21	5.04	1.85	2.69
iron	7439-89-6	E440	3.0	mg/kg		207	183	108	111	134
iron	7439-89-6	E440A	0.60	mg/kg wwt		58.4	74.3	44.4	42.1	52.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.046	0.062	0.040	0.025	0.040
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0130	0.0251	0.0165	0.0095	0.0157
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.20	<0.10	<0.10	0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2590	760	1380	1020	1170
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		731	309	572	387	460
manganese	7439-96-5	E440	0.050	mg/kg		64.3	797	202	174	363
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.2	324	83.3	66.3	143
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0071	0.0072	0.0075	0.0124
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0010	0.0029	0.0030	0.0028	0.0049
molybdenum	7439-98-7	E440	0.020	mg/kg		4.15	2.28	0.809	2.26	0.099
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.17	0.928	0.334	0.857	0.0388
nickel	7440-02-0	E440	0.20	mg/kg		0.32	0.44	1.22	2.14	1.09
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.091	0.178	0.505	0.811	0.428
phosphorus	7723-14-0	E440	10	mg/kg		5950	2250	1490	1960	2900
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1680	914	615	745	1140
potassium	7440-09-7	E440	20	mg/kg		27800	22900	5230	8880	9100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		7850	9300	2160	3370	3570
rubidium	7440-17-7	E440	0.050	mg/kg		33.4	16.3	8.44	3.13	4.04
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		9.45	6.62	3.49	1.19	1.59
selenium	7782-49-2	E440	0.050	mg/kg		0.275	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.078	0.014	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0076	0.0152	<0.0050	0.0108
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0031	0.0063	0.0011	0.0042
sodium	7440-23-5	E440	20	mg/kg		73	152	54	52	39
sodium	7440-23-5	E440A	4.0	mg/kg wwt		20.8	61.7	22.2	19.8	15.4
strontium	7440-24-6	E440	0.050	mg/kg		16.3	19.8	39.3	45.9	19.6
strontium	7440-24-6	E440A	0.010	mg/kg wwt		4.60	8.02	16.2	17.4	7.69
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0022	<0.0020	<0.0020	<0.0020	0.0044
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00064	<0.00040	<0.00040	<0.00040	0.00174
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.14	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.059	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0030	0.0031	<0.0020	0.0038	0.0022
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00086	0.00125	0.00062	0.00145	0.00086
vanadium	7440-62-2	E440	0.10	mg/kg		0.53	0.56	0.24	0.34	0.38
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.149	0.227	0.100	0.131	0.151
zinc	7440-66-6	E440	0.50	mg/kg		59.3	17.4	38.4	15.3	52.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		16.8	7.08	15.9	5.82	20.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	0.075	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		83.7	55.6	61.4	63.8	70.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		249	50.2	102	56.4	86.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		40.6	22.3	39.2	20.4	25.9
antimony	7440-36-0	E440	0.010	mg/kg		0.013	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0020	<0.0020	<0.0020	<0.0020	0.0026
arsenic	7440-38-2	E440	0.020	mg/kg		0.151	0.033	5.94	0.036	0.069
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0246	0.0145	2.29	0.0128	0.0208
barium	7440-39-3	E440	0.050	mg/kg		37.6	38.6	40.8	44.4	124
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.12	17.1	15.7	16.0	37.1
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0045	0.0022
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		25.8	11.5	16.4	37.4	37.4
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.21	5.09	6.33	13.5	11.2
cadmium	7440-43-9	E440	0.0050	mg/kg		0.944	0.105	0.0158	2.56	2.29
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.154	0.0464	0.0061	0.927	0.686
calcium	7440-70-2	E440	20	mg/kg		17600	6660	2290	20700	13100
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2860	2960	884	7480	3930
cesium	7440-46-2	E440	0.0050	mg/kg		0.0872	0.0078	0.0444	0.0262	0.0837
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0142	0.0034	0.0171	0.0094	0.0251
chromium	7440-47-3	E440	0.050	mg/kg		0.782	0.068	0.063	0.122	0.198
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.127	0.030	0.024	0.044	0.059
cobalt	7440-48-4	E440	0.020	mg/kg		0.398	0.054	0.038	0.820	0.202
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0648	0.0242	0.0147	0.296	0.0605
copper	7440-50-8	E440	0.10	mg/kg		21.4	5.11	6.48	8.12	12.4
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.48	2.27	2.50	2.93	3.73
iron	7439-89-6	E440	3.0	mg/kg		361	107	56.1	80.2	166
iron	7439-89-6	E440A	0.60	mg/kg wwt		58.8	47.7	21.6	29.0	49.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.102	0.028	<0.020	0.043	0.050
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0166	0.0126	0.0043	0.0157	0.0152
lithium	7439-93-2	E440	0.50	mg/kg		0.61	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3740	931	1240	1980	1740
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		609	413	479	714	524
manganese	7439-96-5	E440	0.050	mg/kg		126	196	130	159	159
manganese	7439-96-5	E440A	0.010	mg/kg wwt		20.5	86.9	50.0	57.4	47.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0252	0.0078	0.0055	0.0064	0.0053
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0041	0.0035	0.0021	0.0023	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		1.95	0.827	0.045	0.202	2.26
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.317	0.367	0.0174	0.0730	0.678
nickel	7440-02-0	E440	0.20	mg/kg		0.49	1.58	1.26	0.42	1.42
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.080	0.700	0.484	0.154	0.427
phosphorus	7723-14-0	E440	10	mg/kg		5700	1570	2320	3150	3530
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		927	696	892	1140	1060
potassium	7440-09-7	E440	20	mg/kg		37700	9020	9390	9870	22600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6140	4000	3620	3560	6780
rubidium	7440-17-7	E440	0.050	mg/kg		33.1	2.30	5.22	4.82	18.5
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.39	1.02	2.01	1.74	5.56
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0286	0.0057	0.0285	0.0187	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0046	0.0025	0.0110	0.0068	<0.0010
sodium	7440-23-5	E440	20	mg/kg		212	<20	26	36	77
sodium	7440-23-5	E440A	4.0	mg/kg wwt		34.5	8.3	9.9	13.0	23.1
strontium	7440-24-6	E440	0.050	mg/kg		59.6	35.9	21.2	78.2	50.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		9.70	15.9	8.15	28.3	15.1
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.039	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0058	<0.0020	<0.0020	<0.0020	0.0028
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00094	0.00080	<0.00040	<0.00040	0.00083
vanadium	7440-62-2	E440	0.10	mg/kg		1.20	0.34	0.11	0.17	0.45
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.196	0.149	0.041	0.060	0.134
zinc	7440-66-6	E440	0.50	mg/kg		56.2	16.2	28.5	290	72.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.16	7.21	11.0	105	21.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		74.9	73.0	86.9	60.4	60.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		62.2	376	176	65.7	116
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		15.6	102	23.0	26.0	45.7
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.011	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0024	<0.0020	0.0022	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.041	0.095	0.144	0.043	0.075
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0102	0.0257	0.0188	0.0171	0.0297
barium	7440-39-3	E440	0.050	mg/kg		14.3	161	408	29.4	87.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.59	43.4	53.3	11.6	34.4
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		34.9	38.1	21.7	18.5	22.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		8.76	10.3	2.83	7.31	8.74
cadmium	7440-43-9	E440	0.0050	mg/kg		0.866	0.0385	0.797	0.0400	0.209
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.217	0.0104	0.104	0.0158	0.0826
calcium	7440-70-2	E440	20	mg/kg		7260	27600	21600	11400	6520
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1820	7450	2830	4520	2570
cesium	7440-46-2	E440	0.0050	mg/kg		0.0330	0.164	0.0747	0.0379	0.0229
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0083	0.0443	0.0098	0.0150	0.0090
chromium	7440-47-3	E440	0.050	mg/kg		0.145	0.267	0.328	0.092	0.121
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.036	0.072	0.043	0.036	0.048
cobalt	7440-48-4	E440	0.020	mg/kg		0.077	0.104	0.126	0.080	0.124
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0193	0.0281	0.0165	0.0316	0.0490
copper	7440-50-8	E440	0.10	mg/kg		20.8	8.15	10.9	5.48	8.24
copper	7440-50-8	E440A	0.020	mg/kg wwt		5.23	2.20	1.43	2.17	3.25
iron	7439-89-6	E440	3.0	mg/kg		147	266	329	144	194
iron	7439-89-6	E440A	0.60	mg/kg wwt		36.8	71.9	43.0	56.8	76.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.031	0.118	0.099	0.036	0.044
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0078	0.0318	0.0129	0.0142	0.0173
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.13	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1770	4830	2340	1510	1090
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		443	1310	306	597	432
manganese	7439-96-5	E440	0.050	mg/kg		72.3	94.5	131	127	1400
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.1	25.5	17.1	50.2	552
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0121	0.0226	0.0132	0.0147
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0012	0.0033	0.0029	0.0052	0.0058
molybdenum	7439-98-7	E440	0.020	mg/kg		3.46	1.10	0.428	2.28	0.124
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.866	0.296	0.0559	0.902	0.0491
nickel	7440-02-0	E440	0.20	mg/kg		1.94	0.34	1.40	0.83	0.62
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.486	0.091	0.183	0.328	0.244
phosphorus	7723-14-0	E440	10	mg/kg		3720	2980	4620	1710	2660
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		933	804	604	676	1050
potassium	7440-09-7	E440	20	mg/kg		29800	13400	35300	8270	8630
potassium	7440-09-7	E440A	4.0	mg/kg wwt		7470	3610	4610	3270	3400
rubidium	7440-17-7	E440	0.050	mg/kg		12.2	13.3	28.8	6.93	5.84
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		3.06	3.60	3.76	2.74	2.30
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0170	0.0087	0.0060
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0011	0.0022	0.0034	0.0024
sodium	7440-23-5	E440	20	mg/kg		94	52	133	94	48
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.7	14.0	17.4	37.3	19.2
strontium	7440-24-6	E440	0.050	mg/kg		14.4	218	188	86.8	24.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		3.61	58.9	24.6	34.4	9.60
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0043
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	0.00171
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.26	0.36	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.070	0.047	<0.020	0.033
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0048	0.0063	0.0028	0.0030
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00059	0.00131	0.00082	0.00112	0.00118
vanadium	7440-62-2	E440	0.10	mg/kg		0.37	0.90	1.07	0.46	0.62
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.093	0.244	0.140	0.180	0.247
zinc	7440-66-6	E440	0.50	mg/kg		44.3	17.5	13.0	16.5	47.0
zinc	7440-66-6	E440A	0.10	mg/kg wwt		11.1	4.74	1.70	6.55	18.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		60.5	61.0	61.3	55.4	76.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		28.8	105	19.8	14.6	73.7
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		11.4	40.8	7.65	6.51	17.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0023	<0.0020	<0.0020	0.0022
arsenic	7440-38-2	E440	0.020	mg/kg		0.047	0.086	0.054	0.064	0.081
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0186	0.0336	0.0207	0.0284	0.0188
barium	7440-39-3	E440	0.050	mg/kg		80.2	51.3	25.8	48.4	33.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		31.7	20.0	9.97	21.6	7.73
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		7.0	23.8	37.9	6.4	13.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		2.76	9.28	14.7	2.85	3.17
cadmium	7440-43-9	E440	0.0050	mg/kg		0.466	0.464	0.590	0.0324	0.0186
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.184	0.181	0.228	0.0144	0.0043
calcium	7440-70-2	E440	20	mg/kg		2030	28600	23300	8750	19800
calcium	7440-70-2	E440A	4.0	mg/kg wwt		802	11100	9020	3900	4630
cesium	7440-46-2	E440	0.0050	mg/kg		0.0187	0.0446	0.0516	0.0513	1.69
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0074	0.0174	0.0200	0.0228	0.394
chromium	7440-47-3	E440	0.050	mg/kg		0.051	0.134	<0.050	0.062	0.120
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.020	0.052	0.018	0.028	0.028
cobalt	7440-48-4	E440	0.020	mg/kg		0.023	0.301	0.361	<0.020	0.456
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0091	0.117	0.139	0.0053	0.106
copper	7440-50-8	E440	0.10	mg/kg		2.99	11.6	8.18	4.31	17.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.18	4.54	3.16	1.92	3.99
iron	7439-89-6	E440	3.0	mg/kg		51.8	176	65.7	31.8	214
iron	7439-89-6	E440A	0.60	mg/kg wwt		20.4	68.7	25.4	14.2	49.9

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.070	0.043	0.052	0.061
lead	7439-92-1	E440A	0.0040	mg/kg wwt		<0.0040	0.0272	0.0166	0.0231	0.0142
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		500	1570	2260	572	2410
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		198	610	874	255	562
manganese	7439-96-5	E440	0.050	mg/kg		12.2	56.9	59.8	108	164
manganese	7439-96-5	E440A	0.010	mg/kg wwt		4.84	22.2	23.1	48.0	38.2
mercury	7439-97-6	E510	0.0050	mg/kg		0.0065	0.0120	0.0077	0.0070	0.0059
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0026	0.0047	0.0030	0.0031	0.0014
molybdenum	7439-98-7	E440	0.020	mg/kg		0.678	0.704	1.80	11.3	10.6
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.268	0.274	0.698	5.02	2.47
nickel	7440-02-0	E440	0.20	mg/kg		0.54	0.22	0.25	<0.20	0.46
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.212	0.084	0.098	<0.040	0.107
phosphorus	7723-14-0	E440	10	mg/kg		1940	1970	2730	1170	2930
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		764	769	1060	520	683
potassium	7440-09-7	E440	20	mg/kg		11900	7250	8060	6800	17900
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4700	2820	3120	3030	4180
rubidium	7440-17-7	E440	0.050	mg/kg		15.4	4.95	5.18	3.56	31.3
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		6.09	1.93	2.00	1.58	7.30
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.395	1.29	0.193	0.881
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.154	0.497	0.086	0.206
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0239	0.0052	0.0056	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0094	0.0020	0.0022	0.0014	<0.0010
sodium	7440-23-5	E440	20	mg/kg		<20	36	41	74	57
sodium	7440-23-5	E440A	4.0	mg/kg wwt		6.5	14.2	15.8	32.8	13.2
strontium	7440-24-6	E440	0.050	mg/kg		20.5	114	119	26.8	118
strontium	7440-24-6	E440A	0.010	mg/kg wwt		8.10	44.4	46.0	11.9	27.5
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		1.50	<0.10	0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.592	<0.020	0.039	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0029	<0.0020	<0.0020	0.0025
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00113	0.00050	<0.00040	0.00059
vanadium	7440-62-2	E440	0.10	mg/kg		0.14	0.47	0.10	<0.10	0.39
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.057	0.182	0.040	0.034	0.091
zinc	7440-66-6	E440	0.50	mg/kg		5.95	202	149	32.9	54.5
zinc	7440-66-6	E440A	0.10	mg/kg wwt		2.35	78.7	57.7	14.6	12.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		59.8	64.6	60.4	62.1	53.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		25.0	48.3	31.2	35.8	33.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		10.0	17.1	12.3	13.6	15.3
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0022	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.084	0.036	0.077	0.060	0.094
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0336	0.0127	0.0306	0.0226	0.0436
barium	7440-39-3	E440	0.050	mg/kg		10.2	1.93	8.15	5.39	58.3
barium	7440-39-3	E440A	0.010	mg/kg wwt		4.11	0.681	3.23	2.04	27.0
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.4	9.6	3.4	4.9	3.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.38	3.38	1.37	1.86	1.70
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0335	0.0777	0.0724	0.0117	0.0733
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0134	0.0275	0.0286	0.0044	0.0340
calcium	7440-70-2	E440	20	mg/kg		4130	2810	3990	3160	5700
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1660	993	1580	1200	2640
cesium	7440-46-2	E440	0.0050	mg/kg		0.0511	0.0353	0.0843	0.0419	0.0595
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0205	0.0125	0.0334	0.0159	0.0276
chromium	7440-47-3	E440	0.050	mg/kg		0.072	0.074	0.106	0.105	0.123
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.029	0.026	0.042	0.040	0.057
cobalt	7440-48-4	E440	0.020	mg/kg		0.026	0.101	0.033	0.043	0.029
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0107	0.0356	0.0130	0.0163	0.0134
copper	7440-50-8	E440	0.10	mg/kg		4.88	6.37	8.38	5.35	6.56
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.96	2.25	3.32	2.03	3.04
iron	7439-89-6	E440	3.0	mg/kg		49.4	100	62.7	66.0	70.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		19.9	35.4	24.8	25.0	32.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.051	0.033	0.053	0.047	0.058
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0206	0.0116	0.0211	0.0179	0.0267
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.18	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		554	867	511	766	471
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		223	307	202	290	219
manganese	7439-96-5	E440	0.050	mg/kg		40.8	76.1	74.4	33.5	58.5
manganese	7439-96-5	E440A	0.010	mg/kg wwt		16.4	26.9	29.4	12.7	27.2
mercury	7439-97-6	E510	0.0050	mg/kg		0.0058	<0.0050	0.0057	<0.0050	0.0086
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0012	0.0022	0.0014	0.0040
molybdenum	7439-98-7	E440	0.020	mg/kg		7.00	4.01	3.26	2.38	5.50
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.81	1.42	1.29	0.903	2.55
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.66	<0.20	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		<0.040	0.235	0.044	0.063	<0.040
phosphorus	7723-14-0	E440	10	mg/kg		2140	1090	1510	1340	850
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		859	387	597	508	394
potassium	7440-09-7	E440	20	mg/kg		9000	4500	8330	7350	5080
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3620	1590	3300	2780	2360
rubidium	7440-17-7	E440	0.050	mg/kg		5.72	4.36	6.14	5.88	2.67
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.30	1.54	2.43	2.23	1.24
selenium	7782-49-2	E440	0.050	mg/kg		0.237	0.062	0.131	0.129	0.168
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.095	0.022	0.052	0.049	0.078
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0149	0.0124	0.0063	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0010	0.0053	0.0049	0.0024	0.0022
sodium	7440-23-5	E440	20	mg/kg		41	<20	43	39	55
sodium	7440-23-5	E440A	4.0	mg/kg wwt		16.6	6.1	17.1	14.7	25.7
strontium	7440-24-6	E440	0.050	mg/kg		15.9	5.06	12.0	10.6	24.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		6.40	1.79	4.76	4.01	11.2
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.14	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.056	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0021	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00074	0.00050	0.00050	0.00060
vanadium	7440-62-2	E440	0.10	mg/kg		0.13	0.29	0.17	0.18	0.20
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.052	0.104	0.068	0.067	0.094
zinc	7440-66-6	E440	0.50	mg/kg		35.4	64.2	49.8	34.4	47.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		14.2	22.7	19.7	13.0	21.9
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		80.5	63.4	59.9	60.8	55.9
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		40.4	93.8	130	369	45.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		7.89	34.4	52.0	144	19.8
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.020	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0033	0.0077	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.034	0.058	0.117	0.282	0.059
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0066	0.0212	0.0469	0.110	0.0262
barium	7440-39-3	E440	0.050	mg/kg		6.02	2.52	22.2	23.9	8.18
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.18	0.923	8.92	9.36	3.61
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0022	0.0048	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0030	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		18.5	13.3	41.0	63.1	4.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.62	4.87	16.4	24.7	2.00
cadmium	7440-43-9	E440	0.0050	mg/kg		0.102	0.0965	1.54	0.0984	0.0087
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0200	0.0354	0.619	0.0385	0.0038
calcium	7440-70-2	E440	20	mg/kg		11900	2630	19000	13000	1690
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2330	964	7620	5090	747
cesium	7440-46-2	E440	0.0050	mg/kg		0.251	0.0652	0.112	0.0528	0.0603
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0491	0.0239	0.0449	0.0207	0.0266
chromium	7440-47-3	E440	0.050	mg/kg		0.125	0.116	0.164	0.577	0.092
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.024	0.042	0.066	0.226	0.040
cobalt	7440-48-4	E440	0.020	mg/kg		0.060	0.117	0.590	0.297	0.049
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0118	0.0428	0.236	0.116	0.0217
copper	7440-50-8	E440	0.10	mg/kg		20.6	7.96	12.6	21.9	5.21
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.03	2.92	5.04	8.59	2.30
iron	7439-89-6	E440	3.0	mg/kg		124	175	246	838	101
iron	7439-89-6	E440A	0.60	mg/kg wwt		24.3	64.2	98.6	328	44.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.089	0.054	0.101	0.221	0.046
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0174	0.0199	0.0404	0.0866	0.0202
lithium	7439-93-2	E440	0.50	mg/kg		0.96	<0.50	<0.50	0.68	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.19	<0.10	<0.10	0.27	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2800	1320	3460	5150	459
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		547	485	1390	2020	202
manganese	7439-96-5	E440	0.050	mg/kg		26.4	93.2	140	242	74.3
manganese	7439-96-5	E440A	0.010	mg/kg wwt		5.15	34.1	56.2	94.6	32.8
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	0.0110	0.0138	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0010	0.0012	0.0044	0.0054	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		1.63	4.82	3.35	65.1	7.37
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.319	1.76	1.34	25.5	3.25
nickel	7440-02-0	E440	0.20	mg/kg		0.48	1.04	0.61	0.56	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.094	0.382	0.246	0.220	0.043
phosphorus	7723-14-0	E440	10	mg/kg		6000	1480	2080	4610	278
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1170	541	836	1800	122
potassium	7440-09-7	E440	20	mg/kg		21900	4820	6270	7560	7670
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4270	1770	2510	2960	3380
rubidium	7440-17-7	E440	0.050	mg/kg		24.5	4.14	3.37	2.75	5.90
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.79	1.52	1.35	1.08	2.60
selenium	7782-49-2	E440	0.050	mg/kg		0.367	<0.050	0.133	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.072	<0.010	0.053	0.016	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0074	0.0410	0.0237	0.0070	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0014	0.0150	0.0095	0.0028	0.0016
sodium	7440-23-5	E440	20	mg/kg		332	32	45	168	44
sodium	7440-23-5	E440A	4.0	mg/kg wwt		64.9	11.6	18.2	65.8	19.3
strontium	7440-24-6	E440	0.050	mg/kg		35.6	8.79	360	92.1	11.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		6.96	3.22	145	36.1	4.85
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0152	<0.0020	0.0040	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00298	0.00049	0.00163	0.00054	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	0.22	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	0.086	0.031	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0033	0.0053	0.0152	0.0024
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00120	0.00211	0.00594	0.00106
vanadium	7440-62-2	E440	0.10	mg/kg		0.23	0.56	0.73	2.91	0.34
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.044	0.205	0.293	1.14	0.150
zinc	7440-66-6	E440	0.50	mg/kg		80.1	60.2	261	23.3	10.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		15.6	22.0	105	9.13	4.59
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	0.050	0.069	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.3	63.9	61.7	62.6	54.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		58.4	79.8	63.6	294	42.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		13.2	28.8	24.4	110	19.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.014	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0051	0.0026
arsenic	7440-38-2	E440	0.020	mg/kg		0.056	0.046	0.053	0.234	0.046
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0128	0.0164	0.0203	0.0876	0.0209
barium	7440-39-3	E440	0.050	mg/kg		22.5	2.02	13.5	21.0	6.73
barium	7440-39-3	E440A	0.010	mg/kg wwt		5.10	0.728	5.18	7.86	3.06
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0033	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		26.8	14.4	31.0	58.9	2.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.09	5.20	11.9	22.0	1.23
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0198	0.0726	1.16	0.134	<0.0050
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0045	0.0262	0.444	0.0500	<0.0030 DLM
calcium	7440-70-2	E440	20	mg/kg		17700	2410	11900	12600	1380
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4010	870	4560	4720	624
cesium	7440-46-2	E440	0.0050	mg/kg		0.519	0.0685	0.133	0.0672	0.0187
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.118	0.0247	0.0510	0.0252	0.0085
chromium	7440-47-3	E440	0.050	mg/kg		0.136	0.092	0.114	0.444	0.147
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.031	0.033	0.044	0.166	0.067
cobalt	7440-48-4	E440	0.020	mg/kg		0.188	0.092	0.430	0.244	0.043
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0428	0.0332	0.165	0.0914	0.0194
copper	7440-50-8	E440	0.10	mg/kg		18.8	6.49	8.94	17.1	3.76
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.27	2.34	3.43	6.41	1.71
iron	7439-89-6	E440	3.0	mg/kg		170	139	118	583	85.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		38.6	50.3	45.3	218	38.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.092	0.039	0.062	0.176	0.051
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0209	0.0142	0.0236	0.0658	0.0230
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.14	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3280	1150	3120	4730	452
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		745	416	1200	1770	205
manganese	7439-96-5	E440	0.050	mg/kg		60.7	93.0	79.7	204	48.7
manganese	7439-96-5	E440A	0.010	mg/kg wwt		13.8	33.6	30.5	76.3	22.1
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	0.0080	0.0130	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0010	0.0015	0.0031	0.0048	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		7.99	5.63	2.15	29.8	8.14
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.81	2.03	0.826	11.2	3.70
nickel	7440-02-0	E440	0.20	mg/kg		1.07	0.96	0.63	0.58	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.243	0.346	0.240	0.215	0.081
phosphorus	7723-14-0	E440	10	mg/kg		1940	1360	1860	3330	568
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		439	491	713	1240	258
potassium	7440-09-7	E440	20	mg/kg		20200	4530	5200	6310	6160
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4580	1640	1990	2360	2800
rubidium	7440-17-7	E440	0.050	mg/kg		20.0	3.94	2.82	3.38	3.91
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.54	1.42	1.08	1.26	1.77
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	0.073	0.053	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	0.028	0.020	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0154	0.0479	0.0148	0.0062	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0035	0.0173	0.0057	0.0023	0.0017
sodium	7440-23-5	E440	20	mg/kg		115	27	49	64	36
sodium	7440-23-5	E440A	4.0	mg/kg wwt		26.1	9.9	18.7	23.8	16.4
strontium	7440-24-6	E440	0.050	mg/kg		247	8.13	235	138	8.02
strontium	7440-24-6	E440A	0.010	mg/kg wwt		56.1	2.93	89.9	51.6	3.64
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0021	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00082	0.00055	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	0.032
uranium	7440-61-1	E440	0.0020	mg/kg		0.0029	0.0027	0.0026	0.0111	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00066	0.00099	0.00100	0.00414	0.00067
vanadium	7440-62-2	E440	0.10	mg/kg		0.44	0.42	0.31	1.99	0.27
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.099	0.153	0.118	0.745	0.123
zinc	7440-66-6	E440	0.50	mg/kg		31.6	49.7	129	21.9	8.77
zinc	7440-66-6	E440A	0.10	mg/kg wwt		7.17	17.9	49.3	8.20	3.98
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.1	61.3	64.8	63.9	52.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		36.1	52.6	97.5	66.7	42.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		8.27	20.3	34.4	24.1	20.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0025	0.0027	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.046	0.108	0.110	0.041	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0105	0.0420	0.0387	0.0148	0.0187
barium	7440-39-3	E440	0.050	mg/kg		29.1	19.6	41.4	2.24	7.44
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.65	7.58	14.6	0.811	3.53
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		31.5	53.6	62.9	15.4	4.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.21	20.8	22.2	5.56	2.18
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0162	1.03	0.180	0.0468	0.0053
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0037	0.398	0.0633	0.0169	0.0025
calcium	7440-70-2	E440	20	mg/kg		21200	20100	11500	2730	1240
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4860	7770	4040	986	586
cesium	7440-46-2	E440	0.0050	mg/kg		0.475	0.276	0.107	0.0538	0.0232
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.109	0.107	0.0379	0.0194	0.0110
chromium	7440-47-3	E440	0.050	mg/kg		0.086	0.098	0.164	0.068	0.082
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.020	0.038	0.058	0.024	0.039
cobalt	7440-48-4	E440	0.020	mg/kg		0.161	0.771	0.169	0.150	0.043
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0368	0.298	0.0596	0.0543	0.0206
copper	7440-50-8	E440	0.10	mg/kg		17.2	5.92	11.3	5.64	3.82
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.95	2.29	3.97	2.04	1.81
iron	7439-89-6	E440	3.0	mg/kg		129	98.9	236	108	86.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		29.6	38.2	83.4	39.0	40.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.051	0.090	0.143	0.032	0.044
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0117	0.0349	0.0503	0.0117	0.0211
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.14	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		4030	2700	2560	1230	455
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		922	1040	902	445	216
manganese	7439-96-5	E440	0.050	mg/kg		76.2	75.2	153	99.8	51.8
manganese	7439-96-5	E440A	0.010	mg/kg wwt		17.4	29.1	54.0	36.1	24.6
mercury	7439-97-6	E510	0.0050	mg/kg		0.0053	0.0072	0.0074	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0012	0.0028	0.0026	0.0012	0.0012
molybdenum	7439-98-7	E440	0.020	mg/kg		8.42	1.10	1.33	2.98	2.32
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.93	0.426	0.467	1.08	1.10
nickel	7440-02-0	E440	0.20	mg/kg		1.42	0.22	0.63	0.48	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.326	0.087	0.223	0.175	0.059
phosphorus	7723-14-0	E440	10	mg/kg		2090	1380	2540	1300	784
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		479	535	896	470	372
potassium	7440-09-7	E440	20	mg/kg		23600	5580	6790	4520	6320
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5400	2160	2390	1630	3000
rubidium	7440-17-7	E440	0.050	mg/kg		20.8	2.33	3.88	2.56	4.01
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.77	0.901	1.37	0.926	1.90
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.163	0.320	0.090	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.063	0.113	0.032	0.012
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0125	<0.0050	0.0152	0.0358	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0029	0.0014	0.0053	0.0130	<0.0010
sodium	7440-23-5	E440	20	mg/kg		52	27	38	48	52
sodium	7440-23-5	E440A	4.0	mg/kg wwt		11.8	10.5	13.6	17.4	24.8
strontium	7440-24-6	E440	0.050	mg/kg		233	126	73.2	8.94	7.86
strontium	7440-24-6	E440A	0.010	mg/kg wwt		53.3	48.6	25.8	3.23	3.73
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0031	0.0042	0.0021	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00122	0.00149	0.00077	0.00077
vanadium	7440-62-2	E440	0.10	mg/kg		0.24	0.27	0.75	0.30	0.30
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.055	0.106	0.265	0.108	0.142
zinc	7440-66-6	E440	0.50	mg/kg		35.6	79.0	102	46.6	9.75
zinc	7440-66-6	E440A	0.10	mg/kg wwt		8.16	30.6	36.0	16.8	4.62
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
					VA22C2369-131	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Physical Tests										
moisture	----	E144	0.50	%		80.5	----	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		26.6	----	----	----	----
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		5.18	----	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	----	----	----
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.031	----	----	----	----
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0060	----	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		20.1	----	----	----	----
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.92	----	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	----	----	----
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	----	----	----
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		20.9	----	----	----	----
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.08	----	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	----	----	----	----
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0010	----	----	----	----
calcium	7440-70-2	E440	20	mg/kg		15400	----	----	----	----
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3000	----	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.153	----	----	----	----
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0299	----	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.070	----	----	----	----
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.014	----	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.180	----	----	----	----
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0351	----	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		17.4	----	----	----	----
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.39	----	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		112	----	----	----	----
iron	7439-89-6	E440A	0.60	mg/kg wwt		21.8	----	----	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22C2369-131	--------	--------	--------	--------	
					Result	----	----	----	----	
Metals										
lead	7439-92-1	E440	0.020	mg/kg	0.064	----	----	----	----	
lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0126	----	----	----	----	
lithium	7439-93-2	E440	0.50	mg/kg	<0.50	----	----	----	----	
lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	----	----	----	----	
magnesium	7439-95-4	E440	2.0	mg/kg	2840	----	----	----	----	
magnesium	7439-95-4	E440A	0.40	mg/kg wwt	554	----	----	----	----	
manganese	7439-96-5	E440	0.050	mg/kg	43.8	----	----	----	----	
manganese	7439-96-5	E440A	0.010	mg/kg wwt	8.54	----	----	----	----	
mercury	7439-97-6	E510	0.0050	mg/kg	0.0051	----	----	----	----	
mercury	7439-97-6	E510A	0.0010	mg/kg wwt	<0.0010	----	----	----	----	
molybdenum	7439-98-7	E440	0.020	mg/kg	1.43	----	----	----	----	
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.279	----	----	----	----	
nickel	7440-02-0	E440	0.20	mg/kg	0.42	----	----	----	----	
nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.082	----	----	----	----	
phosphorus	7723-14-0	E440	10	mg/kg	2730	----	----	----	----	
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	533	----	----	----	----	
potassium	7440-09-7	E440	20	mg/kg	27700	----	----	----	----	
potassium	7440-09-7	E440A	4.0	mg/kg wwt	5410	----	----	----	----	
rubidium	7440-17-7	E440	0.050	mg/kg	17.2	----	----	----	----	
rubidium	7440-17-7	E440A	0.010	mg/kg wwt	3.36	----	----	----	----	
selenium	7782-49-2	E440	0.050	mg/kg	<0.050	----	----	----	----	
selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	----	----	----	----	
silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0119	----	----	----	----	
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0023	----	----	----	----	
sodium	7440-23-5	E440	20	mg/kg	133	----	----	----	----	
sodium	7440-23-5	E440A	4.0	mg/kg wwt	25.9	----	----	----	----	
strontium	7440-24-6	E440	0.050	mg/kg	56.5	----	----	----	----	
strontium	7440-24-6	E440A	0.010	mg/kg wwt	11.0	----	----	----	----	
tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	----	----	----	----	
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	----	----	----	----	

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22C2369-131	--------	--------	--------	--------	
					Result	----	----	----	----	
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	----	----	----	----	
thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	----	----	----	----	
tin	7440-31-5	E440	0.10	mg/kg	<0.10	----	----	----	----	
tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	----	----	----	----	
uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	----	----	----	----	
uranium	7440-61-1	E440A	0.00040	mg/kg wwt	<0.00040	----	----	----	----	
vanadium	7440-62-2	E440	0.10	mg/kg	0.17	----	----	----	----	
vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.033	----	----	----	----	
zinc	7440-66-6	E440	0.50	mg/kg	29.5	----	----	----	----	
zinc	7440-66-6	E440A	0.10	mg/kg wwt	5.76	----	----	----	----	
zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	----	----	----	----	
zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	----	----	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2369**	Page	: 1 of 109
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 03-Nov-2022 16:04
C-O-C number	: 17-686095A-095M		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Metals	QC-MRG6-7231200 01	----	zinc	7440-66-6	E440	0.66 mg/kg B	0.5 mg/kg	Blank result exceeds permitted value
Metals	QC-MRG6-7231200 01	----	zinc	7440-66-6	E440A	0.13 mg/kg wwt B	0.1 mg/kg wwt	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Reference Material (RM) Sample								
Metals	QC-MRG6-7231100 03	----	chromium	7440-47-3	E440	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7154750 03	----	lead	7439-92-1	E440	132 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	lead	7439-92-1	E440	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	chromium	7440-47-3	E440A	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7154750 03	----	lead	7439-92-1	E440A	132 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	lead	7439-92-1	E440A	134 % MES	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-01D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-G-01D	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-B-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-B-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-G-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-L-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-G-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-02D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-03D	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-F-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-G-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-L-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-L-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-F-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-F-02	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-F-03	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-F-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-03	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-L-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-L-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-G-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-02	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-G-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-G-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-B-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-L-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-G-02	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-B-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-B-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-G-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-L-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-L-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-F-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-G-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-G-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-L-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-L-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-F-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-02	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-03	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-G-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-03	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-G-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-03	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-02	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-G-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-F-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-F-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-G-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-F-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-G-02	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-03	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-04	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01D	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
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LDPE bag 22-S2-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
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LDPE bag 22-S4-B-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
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LDPE bag 22-S5-L-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-03D	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-F-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-L-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-02	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-F-03	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-03	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-B-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-G-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-02	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-G-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-03	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-F-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-B-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-B-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-G-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-F-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-F-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-02	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-03	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-G-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-03	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-02	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-F-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-F-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-02	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-03	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-04	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01D	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-B-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-B-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-G-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-G-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-02D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-03D	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-F-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-L-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-02	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-F-03	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-03	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-B-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-G-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-02	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-G-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-03	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-F-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-B-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-B-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-G-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-F-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-F-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-02	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-03	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-G-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-03	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-02	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-F-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-F-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-02	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-03	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-04	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-F-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-G-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-03	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-F-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-02D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-03D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-F-03	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-03	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-F-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-03	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-B-01	E144	16-Sep-2022	----	----	----		20-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-F-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-F-02	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-L-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-02	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-03	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-F-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-G-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-01D	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-02D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-03D	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-F-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-02	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-F-01D	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-G-01D	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-01D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-02D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-03	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-03D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-G-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-02	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-F-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-G-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-B-01	E144	15-Sep-2022	----	----	----		20-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-F-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-B-01	E144	15-Sep-2022	----	----	----		20-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-F-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-F-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-G-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-03	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag										
22-S9-L-04	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	7	131	5.3	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	7	131	5.3	5.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	7	131	5.3	5.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	7	131	5.3	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	14	131	10.6	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	14	131	10.6	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	14	131	10.6	10.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	14	131	10.6	10.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	14	131	10.6	10.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	14	131	10.6	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	7	131	5.3	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	7	131	5.3	5.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	7	131	5.3	5.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	7	131	5.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO_3, HCl, and H_2O_2 and is intended to provide a conservative estimate of bio-available metals.

ALS Canada Ltd.

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QUALITY CONTROL REPORT

Work Order	: **VA22C2369**	Page	: 1 of 65
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: 17-686095A-095M	Issue Date	: 03-Nov-2022 16:05
Sampler	: SL ----		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 699199)											
VA22C2369-094	22-R4-L-02	moisture	----	E144	0.50	%	62.0	61.7	0.457%	20%	----
Physical Tests (QC Lot: 699290)											
VA22C2369-107	22-A4-L-01	moisture	----	E144	0.50	%	61.0	59.8	2.12%	20%	----
Physical Tests (QC Lot: 703846)											
VA22C2369-041	22-S12-L-03	moisture	----	E144	0.50	%	76.5	75.4	1.40%	20%	----
Physical Tests (QC Lot: 703855)											
VA22C2369-001	22-S9-L-01	moisture	----	E144	0.50	%	50.2	47.8	5.04%	20%	----
Physical Tests (QC Lot: 703865)											
VA22C2369-021	22-R3-L-01D	moisture	----	E144	0.50	%	59.0	58.2	1.33%	20%	----
Physical Tests (QC Lot: 703872)											
VA22C2369-069	22-S17-L-03	moisture	----	E144	0.50	%	62.6	63.0	0.553%	20%	----
Physical Tests (QC Lot: 703880)											
VA22C2369-118	22-S15-L-02	moisture	----	E144	0.50	%	59.9	61.2	2.08%	20%	----
Physical Tests (QC Lot: 705539)											
VA22C2369-073	22-S5-B-01	moisture	----	E144	0.50	%	61.1	59.7	2.36%	20%	----
Metals (QC Lot: 715475)											
VA22C2369-014	22-S3-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0012	<0.0010	0.0002	Diff <2x LOR	----
Metals (QC Lot: 715476)											
VA22C2369-014	22-S3-F-01	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0020	0.0026	0.0005	Diff <2x LOR	----
Metals (QC Lot: 715477)											
VA22C2369-014	22-S3-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0069	0.0087	0.0018	Diff <2x LOR	----
Metals (QC Lot: 715478)											
VA22C2369-014	22-S3-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	44.6	44.6	0.0694%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0023	0.0020	0.0002	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0444	0.0364	19.7%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	3.43	3.46	0.755%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	10.9	11.3	3.16%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0476	0.0485	1.82%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 715478) - continued											
VA22C2369-014	22-S3-F-01	calcium	7440-70-2	E440A	4.0	mg/kg wwt	4410	4550	3.27%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0620	0.0634	2.27%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.047	0.043	0.004	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0489	0.0478	2.20%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	6.89	7.15	3.73%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	58.5	49.8	15.9%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0200	0.0212	5.89%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	714	736	3.08%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	31.5	33.4	5.76%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.586	0.614	4.66%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.255	0.262	2.73%	40%	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	1740	1800	3.40%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	7210	7380	2.33%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	6.21	6.36	2.28%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.078	0.088	12.6%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	18.2	16.7	1.4	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	11.3	11.2	1.10%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00098	0.00093	0.00004	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.175	0.163	6.98%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	17.1	18.1	5.67%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 715479)											
VA22C2369-014	22-S3-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	150	150	0.0694%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.149	0.122	19.7%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	11.5	11.6	0.755%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	36.7	37.9	3.16%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.160	0.163	1.82%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 715479) - continued											
VA22C2369-014	22-S3-F-01	calcium	7440-70-2	E440	20	mg/kg	14800	15300	3.27%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.208	0.213	2.27%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.158	0.144	0.013	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.164	0.161	2.20%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	23.2	24.0	3.73%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	196	168	15.9%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.067	0.071	0.004	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	2400	2470	3.08%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	106	112	5.76%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	1.97	2.06	4.66%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.86	0.88	0.02	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	5840	6040	3.40%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	24200	24800	2.33%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	20.9	21.4	2.28%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.261	0.296	12.6%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	61	56	5	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	38.1	37.7	1.10%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0033	0.0031	0.0002	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.59	0.55	6.98%	40%	----
		zinc	7440-66-6	E440	0.50	mg/kg	57.4	60.8	5.67%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 715480)											
VA22C2369-014	22-S3-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 716122)											
VA22C2369-049	22-S13-L-03	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	25.3	24.3	3.98%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	3.94	5.38	31.0%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	7.98	8.56	7.02%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716122) - continued											
VA22C2369-049	22-S13-L-03	boron	7440-42-8	E440A	0.20	mg/kg wwt	3.94	4.04	2.57%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0067	0.0070	3.74%	40%	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	1010	1050	4.08%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0121	0.0122	0.879%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.117	0.119	1.54%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0304	0.0312	2.41%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	2.25	2.32	2.72%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	48.4	45.3	6.62%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0149	0.0124	0.0024	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	359	378	5.03%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	68.5	67.4	1.64%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	1.15	1.20	4.15%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.066	0.069	0.003	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	678	704	3.68%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	3710	3900	5.14%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	2.78	2.98	6.89%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.022	0.022	0.0003	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	8.7	7.7	1.0	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	20.7	21.0	1.26%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	0.00432	0.00460	6.22%	40%	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00080	0.00074	0.00005	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.142	0.130	8.89%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	10.9	11.6	6.04%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 716123)											
VA22C2369-049	22-S13-L-03	aluminum	7429-90-5	E440	2.0	mg/kg	54.2	52.1	3.98%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	8.45	11.6	31.0%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	17.1	18.4	7.02%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716123) - continued											
VA22C2369-049	22-S13-L-03	boron	7440-42-8	E440	1.0	mg/kg	8.4	8.7	2.57%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.0145	0.0150	0.0006	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	2160	2250	4.08%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0260	0.0262	0.879%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.252	0.255	1.54%	40%	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.065	0.067	0.002	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	4.84	4.97	2.72%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	104	97.3	6.62%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.032	0.027	0.005	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	770	810	5.03%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	147	144	1.64%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	2.47	2.57	4.15%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1460	1510	3.68%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	7960	8380	5.14%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	5.98	6.40	6.89%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	<20	<20	0	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	44.5	45.1	1.26%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	0.0093	0.0099	0.0006	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.30	0.28	0.03	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	23.4	24.8	6.04%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 716124)											
VA22C2369-049	22-S13-L-03	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0045	0.0044	0.0002	Diff <2x LOR	----
Metals (QC Lot: 716125)											
VA22C2369-049	22-S13-L-03	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0097	0.0094	0.0004	Diff <2x LOR	----
Metals (QC Lot: 716126)											
VA22C2369-049	22-S13-L-03	mercury	7439-97-6	E510A	0.0022	mg/kg wwt	<0.0022	<0.0022	0.0000008	Diff <2x LOR	----
Metals (QC Lot: 716127)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716127) - continued											
VA22C2369-049	22-S13-L-03	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 716145)											
VA22C2369-076	22-S5-F-01	mercury	7439-97-6	E510A	0.0014	mg/kg wwt	0.0023	0.0020	0.0003	Diff <2x LOR	----
Metals (QC Lot: 716146)											
VA22C2369-076	22-S5-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0071	0.0061	0.0010	Diff <2x LOR	----
Metals (QC Lot: 716147)											
VA22C2369-076	22-S5-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	23.6	22.7	3.69%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0182	0.0173	0.0009	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	9.61	9.62	0.114%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	4.68	4.82	2.88%	40%	----
		cadmium	7440-43-9	E440A	0.0030	mg/kg wwt	<0.0030	<0.0030	0	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	7100	6790	4.39%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0898	0.0904	0.594%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.030	0.030	0.0002	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0831	0.0818	1.52%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	6.90	7.08	2.48%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	47.2	45.5	3.61%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0103	0.0142	0.0039	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	1310	1310	0.124%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	18.1	17.1	5.71%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	3.40	3.54	3.89%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.107	0.113	0.006	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	744	765	2.79%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	4210	4430	5.14%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.95	5.23	5.44%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.186	0.189	1.43%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	23.5	20.4	13.9%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	27.2	27.6	1.60%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716147) - continued											
VA22C2369-076	22-S5-F-01	tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00077	0.00076	0.000004	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.106	0.104	1.86%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	9.09	8.87	2.50%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 716148)											
VA22C2369-076	22-S5-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	73.0	70.3	3.69%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.056	0.053	0.003	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	29.7	29.7	0.114%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	14.5	14.9	2.88%	40%	----
		cadmium	7440-43-9	E440	0.0100	mg/kg	<0.0100	<0.0100	0	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	21900	21000	4.39%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.278	0.280	0.594%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.092	0.092	0.0007	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.257	0.253	1.52%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	21.3	21.9	2.48%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	146	141	3.61%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.032	0.044	0.012	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	4050	4060	0.124%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	56.0	52.9	5.71%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	10.5	10.9	3.89%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.33	0.35	0.02	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	2300	2370	2.79%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	13000	13700	5.14%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	15.3	16.2	5.44%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.576	0.584	1.43%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	72	63	9	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	84.1	85.4	1.60%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716148) - continued											
VA22C2369-076	22-S5-F-01	tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0024	0.0024	0.00001	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.33	0.32	0.006	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	28.1	27.4	2.50%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 716149)											
VA22C2369-076	22-S5-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0034	0.0032	0.0002	Diff <2x LOR	----
Metals (QC Lot: 716150)											
VA22C2369-076	22-S5-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0104	0.0099	0.0005	Diff <2x LOR	----
Metals (QC Lot: 720236)											
VA22C2369-121	22-S15-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	58.4	57.8	1.02%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.056	0.058	0.002	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	22.5	22.8	1.58%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	26.8	26.2	2.59%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.0198	0.0211	0.0013	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	17700	18100	2.42%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.519	0.529	1.77%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.136	0.168	0.032	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.188	0.194	3.15%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	18.8	20.0	5.95%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	170	165	3.18%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.092	0.098	0.006	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	3280	3430	4.32%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	60.7	69.1	12.9%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	7.99	7.74	3.16%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	1.07	1.18	9.39%	40%	----
		phosphorus	7723-14-0	E440	10	mg/kg	1940	2120	9.28%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	20200	20000	0.892%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	20.0	20.4	1.95%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720236) - continued											
VA22C2369-121	22-S15-F-01	sodium	7440-23-5	E440	20	mg/kg	115	127	9.86%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	247	240	2.94%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0029	0.0025	0.0004	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.44	0.38	0.05	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	31.6	34.5	8.76%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 720237)											
VA22C2369-121	22-S15-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0154	0.0183	0.0030	Diff <2x LOR	----
Metals (QC Lot: 720238)											
VA22C2369-121	22-S15-F-01	mercury	7439-97-6	E510A	0.0012	mg/kg wwt	0.0010	0.0012	0.0002	Diff <2x LOR	----
Metals (QC Lot: 720239)											
VA22C2369-121	22-S15-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	0.0055	0.0005	Diff <2x LOR	----
Metals (QC Lot: 720240)											
VA22C2369-121	22-S15-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	13.2	13.1	1.02%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	0.0020	0.00002	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0128	0.0133	0.0005	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	5.10	5.18	1.58%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	6.09	5.93	2.59%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0045	0.0048	0.0003	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	4010	4110	2.42%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.118	0.120	1.77%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.031	0.038	0.007	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0428	0.0441	3.15%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	4.27	4.53	5.95%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	38.6	37.4	3.18%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0209	0.0222	6.10%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	745	777	4.32%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	13.8	15.7	12.9%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720240) - continued											
VA22C2369-121	22-S15-F-01	molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	1.81	1.76	3.16%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.243	0.267	9.39%	40%	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	439	482	9.28%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	4580	4540	0.892%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.54	4.63	1.95%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	26.1	28.8	9.86%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	56.1	54.5	2.94%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	0.021	0.001	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00066	0.00057	0.00008	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.099	0.087	0.012	Diff <2x LOR	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	7.17	7.82	8.76%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 720241)											
VA22C2369-121	22-S15-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0035	0.0042	0.0007	Diff <2x LOR	----
Metals (QC Lot: 720263)											
VA22C2369-024	22-R3-L-03	aluminum	7429-90-5	E440	2.0	mg/kg	510	585	13.6%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.025	0.028	0.003	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	1.43	1.66	14.7%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	22.0	26.2	17.4%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.204	0.235	14.0%	40%	----
		calcium	7440-70-2	E440	20	mg/kg	2980	3480	15.5%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.153	0.176	13.9%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.093	0.123	0.029	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.102	0.119	15.3%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	6.74	7.84	15.0%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	84.3	95.8	12.7%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.020	0.024	0.003	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720263) - continued											
VA22C2369-024	22-R3-L-03	magnesium	7439-95-4	E440	2.0	mg/kg	1550	1810	15.2%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	1310	1550	16.7%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.416	0.482	14.5%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.23	0.27	0.04	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1880	2160	13.6%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	7460	8590	14.1%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	13.7	16.0	15.5%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	30	38	8	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	3.31	3.86	15.2%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	0.0021	0.0026	0.0004	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.17	0.18	0.01	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	9.46	10.7	12.2%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 720264)											
VA22C2369-024	22-R3-L-03	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0026	0.0035	0.0009	Diff <2x LOR	----
Metals (QC Lot: 720265)											
VA22C2369-024	22-R3-L-03	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0076	0.0101	0.0026	Diff <2x LOR	----
Metals (QC Lot: 720266)											
VA22C2369-024	22-R3-L-03	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0027	0.0024	0.0003	Diff <2x LOR	----
Metals (QC Lot: 720267)											
VA22C2369-024	22-R3-L-03	mercury	7439-97-6	E510	0.0050	mg/kg	0.0078	0.0070	0.0008	Diff <2x LOR	----
Metals (QC Lot: 720268)											
VA22C2369-024	22-R3-L-03	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	175	201	13.6%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0085	0.0096	0.0011	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	0.491	0.568	14.7%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	7.54	8.98	17.4%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0700	0.0806	14.0%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720268) - continued											
VA22C2369-024	22-R3-L-03	calcium	7440-70-2	E440A	4.0	mg/kg wwt	1020	1190	15.5%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0525	0.0604	13.9%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.032	0.042	0.010	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0351	0.0409	15.3%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	2.31	2.69	15.0%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	28.9	32.8	12.7%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0069	0.0081	0.0012	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	532	620	15.2%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	451	533	16.7%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.143	0.165	14.5%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.078	0.093	0.015	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	647	741	13.6%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	2560	2950	14.1%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.69	5.48	15.5%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	10.3	13.1	2.8	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	1.14	1.32	15.2%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	0.00074	0.00089	0.00015	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	<0.00040	0.00042	0.00002	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.058	0.062	0.004	Diff <2x LOR	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	3.24	3.66	12.2%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 723110)											
VA22C2369-011	22-S3-G-01	aluminum	7429-90-5	E440	2.0	mg/kg	51.2	57.2	11.0%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.159	0.164	3.19%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	48.3	52.2	7.58%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	9.3	9.6	2.85%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.254	0.266	4.76%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723110) - continued											
VA22C2369-011	22-S3-G-01	calcium	7440-70-2	E440	20	mg/kg	8780	9190	4.62%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.250	0.260	4.00%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.170	0.167	0.003	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.041	0.042	0.0005	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	8.28	8.32	0.438%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	105	112	6.64%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.036	0.038	0.001	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	824	859	4.16%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	93.7	98.7	5.25%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	8.83	9.29	5.00%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1010	1050	3.82%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	9440	10000	6.07%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	8.44	8.83	4.47%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.376	0.389	3.54%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	45	50	4	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	35.0	36.3	3.67%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.31	0.33	0.02	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	38.6	37.8	2.18%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 723111)											
VA22C2369-011	22-S3-G-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0042	0.0044	0.0002	Diff <2x LOR	----
Metals (QC Lot: 723112)											
VA22C2369-011	22-S3-G-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0079	0.0083	0.0004	Diff <2x LOR	----
Metals (QC Lot: 723113)											
VA22C2369-011	22-S3-G-01	mercury	7439-97-6	E510A	0.0018	mg/kg wwt	0.0041	0.0041	0.00005	Diff <2x LOR	----
Metals (QC Lot: 723114)											
VA22C2369-011	22-S3-G-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0077	0.0078	0.00010	Diff <2x LOR	----
Metals (QC Lot: 723115)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723115) - continued											
VA22C2369-011	22-S3-G-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	27.1	30.3	11.0%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0025	0.0020	0.0005	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0841	0.0868	3.19%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	25.6	27.6	7.58%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	4.94	5.08	2.85%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.134	0.141	4.76%	40%	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	4650	4870	4.62%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.132	0.138	4.00%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.090	0.089	1.55%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0218	0.0220	1.28%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	4.39	4.41	0.438%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	55.6	59.5	6.64%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0194	0.0200	0.0006	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	0.10	0.002	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	437	455	4.16%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	49.6	52.3	5.25%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	4.68	4.92	5.00%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.051	0.050	0.0007	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	536	557	3.82%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	5000	5320	6.07%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.48	4.68	4.47%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.199	0.206	3.54%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	24.0	26.2	8.77%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	18.6	19.2	3.67%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00097	0.00105	0.00008	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.164	0.175	6.36%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	20.5	20.0	2.18%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	0.089	0.078	0.011	Diff <2x LOR	----
Metals (QC Lot: 723120)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723120) - continued											
VA22C2369-125	22-S15-G-01D	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0016	0.0015	0.0001	Diff <2x LOR	----
Metals (QC Lot: 723121)											
VA22C2369-125	22-S15-G-01D	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 723122)											
VA22C2369-125	22-S15-G-01D	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	19.2	17.6	8.78%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0026	<0.0020	0.0006	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0209	0.0192	8.66%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	3.06	2.78	9.68%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	1.23	1.21	2.06%	40%	----
		cadmium	7440-43-9	E440A	0.0030	mg/kg wwt	<0.0030	<0.0030	0	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	624	599	4.10%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0085	0.0086	0.731%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.067	0.056	17.9%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0194	0.0187	0.0008	Diff <2x LOR	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	1.71	1.63	4.73%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	38.6	38.3	0.917%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0230	0.0282	20.1%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	205	196	4.81%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	22.1	21.1	4.74%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	3.70	3.60	2.52%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.081	0.071	0.009	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	258	243	6.05%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	2800	2710	3.08%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	1.77	1.69	4.63%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	16.4	15.8	0.5	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	3.64	3.67	0.826%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	0.032	<0.020	0.012	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00067	0.00068	0.000009	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723122) - continued											
VA22C2369-125	22-S15-G-01D	vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.123	0.112	9.05%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	3.98	3.70	7.20%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 723123)											
VA22C2369-125	22-S15-G-01D	aluminum	7429-90-5	E440	2.0	mg/kg	42.3	38.8	8.78%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.046	0.042	0.004	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	6.73	6.11	9.68%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	2.7	2.6	0.06	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	1380	1320	4.10%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0187	0.0189	0.0001	Diff <2x LOR	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.147	0.122	0.024	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.043	0.041	0.002	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	3.76	3.58	4.73%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	85.1	84.3	0.917%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.051	0.062	0.011	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	452	431	4.81%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	48.7	46.5	4.74%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	8.14	7.94	2.52%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	568	535	6.05%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	6160	5980	3.08%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	3.91	3.73	4.63%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	36	35	1	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	8.02	8.09	0.826%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723123) - continued											
VA22C2369-125	22-S15-G-01D	vanadium	7440-62-2	E440	0.10	mg/kg	0.27	0.25	0.02	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	8.77	8.16	7.20%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 723124)											
VA22C2369-125	22-S15-G-01D	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0017	0.0014	0.0003	Diff <2x LOR	----
Metals (QC Lot: 723125)											
VA22C2369-125	22-S15-G-01D	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 699199)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 699290)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703846)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703855)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703865)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703872)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703880)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 705539)						
moisture	----	E144	0.5	%	<0.50	----
Metals (QCLot: 715475)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 715476)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 715477)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 715478)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 715478) - continued						
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 715479)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 715479) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 715480)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716122)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716122) - continued						
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 716123)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716123) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 716124)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716125)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716126)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716127)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716145)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716146)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716147)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716147) - continued						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 716148)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716148) - continued						
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 716149)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716150)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716150) - continued						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720236)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720237)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720238)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720239)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720240)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720240) - continued						
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 720241)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720263)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720263) - continued						
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 720264)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720265)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720266)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720267)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720268)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720268) - continued						
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723110)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723110) - continued						
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 723111)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723112)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723113)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723114)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723115)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723115) - continued						
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723120)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723121)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723122)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723122) - continued						
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	# 0.13	B
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723123)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723123) - continued						
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	# 0.66	B
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 723124)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723125)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----

Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 699199)									
moisture	----	E144	0.5	%	50 %	99.7	90.0	110	----
Physical Tests (QCLot: 699290)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 703846)									
moisture	----	E144	0.5	%	50 %	99.4	90.0	110	----
Physical Tests (QCLot: 703855)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 703865)									
moisture	----	E144	0.5	%	50 %	98.8	90.0	110	----
Physical Tests (QCLot: 703872)									
moisture	----	E144	0.5	%	50 %	99.8	90.0	110	----
Physical Tests (QCLot: 703880)									
moisture	----	E144	0.5	%	50 %	95.8	90.0	110	----
Physical Tests (QCLot: 705539)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Metals (QCLot: 715475)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	93.5	80.0	120	----
Metals (QCLot: 715476)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	96.4	80.0	120	----
Metals (QCLot: 715477)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	96.4	80.0	120	----
Metals (QCLot: 715478)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	106	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	96.4	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	99.9	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 715478) - continued									
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	104	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	97.7	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	110	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	104	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	100.0	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	107	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	112	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	109	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	101	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	103	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	95.4	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	101	80.0	120	----
Metals (QCLot: 715479)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	96.4	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	99.9	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 715479) - continued									
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	100	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	97.7	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	110	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	104	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	100.0	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	107	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	112	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	109	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	95.4	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	101	80.0	120	----
Metals (QCLot: 715480)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	93.5	80.0	120	----
Metals (QCLot: 716122)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	104	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	97.6	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	105	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716122) - continued									
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	97.3	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	107	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	100.0	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	110	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	99.9	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	106	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	96.0	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
Metals (QCLot: 716123)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	108	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	107	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	101	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	97.6	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	97.3	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716123) - continued									
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	105	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	108	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	107	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	108	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	100.0	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	110	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	99.9	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	103	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	104	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	96.0	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 716124)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	94.5	80.0	120	----
Metals (QCLot: 716125)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	94.5	80.0	120	----
Metals (QCLot: 716126)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	100	80.0	120	----
Metals (QCLot: 716127)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	100	80.0	120	----
Metals (QCLot: 716145)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.2	80.0	120	----
Metals (QCLot: 716146)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.2	80.0	120	----
Metals (QCLot: 716147)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	108	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716147) - continued									
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	99.8	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	99.6	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	107	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	102	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	105	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	111	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	104	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	106	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	112	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	103	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	102	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	99.1	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	98.8	80.0	120	----
Metals (QCLot: 716148)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	108	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	107	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716148) - continued									
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	99.8	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	99.6	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	102	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	100	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	106	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	105	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	111	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	112	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	105	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	102	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	106	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.1	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	98.8	80.0	120	----
Metals (QCLot: 716149)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.2	80.0	120	----
Metals (QCLot: 716150)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.2	80.0	120	----
Metals (QCLot: 720236)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	105	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720236) - continued									
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	99.7	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	103	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	96.3	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	96.7	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	98.9	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	96.0	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	102	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	99.6	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	98.4	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	98.2	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	98.3	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	103	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	105	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	100	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	99.1	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	92.6	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	94.3	80.0	120	----
Metals (QCLot: 720237)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.4	80.0	120	----
Metals (QCLot: 720238)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	100	80.0	120	----
Metals (QCLot: 720239)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	100	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720240)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	104	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.7	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	96.3	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	96.7	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	101	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	98.9	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	96.0	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	102	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	106	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.6	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	98.4	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	108	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	98.2	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	98.3	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	105	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	100	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	99.1	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	101	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	92.6	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	94.3	80.0	120	----
Metals (QCLot: 720241)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.4	80.0	120	----
Metals (QCLot: 720263)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720263) - continued									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	108	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	98.4	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	101	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	98.6	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	105	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	102	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	105	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	108	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	104	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	103	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	97.4	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	102	80.0	120	----
Metals (QCLot: 720264)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.5	80.0	120	----
Metals (QCLot: 720265)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720265) - continued									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.5	80.0	120	----
Metals (QCLot: 720266)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	98.4	80.0	120	----
Metals (QCLot: 720267)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	98.4	80.0	120	----
Metals (QCLot: 720268)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	105	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	102	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	98.4	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	101	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	98.6	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	109	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	105	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720268) - continued									
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	97.4	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
Metals (QCLot: 723110)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	99.4	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	107	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	98.3	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	103	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	100.0	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	104	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	98.4	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	97.0	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	103	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	99.2	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	102	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	108	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	97.1	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	105	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	99.3	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	109	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.3	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723110) - continued									
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	98.5	80.0	120	----
Metals (QCLot: 723111)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	87.7	80.0	120	----
Metals (QCLot: 723112)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	87.7	80.0	120	----
Metals (QCLot: 723113)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	94.0	80.0	120	----
Metals (QCLot: 723114)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	94.0	80.0	120	----
Metals (QCLot: 723115)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	105	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	99.4	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	98.3	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	100.0	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	98.4	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	97.0	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	103	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	99.2	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	109	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	108	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723115) - continued									
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	97.1	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	99.3	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	109	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	99.3	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	98.5	80.0	120	----
Metals (QCLot: 723120)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.6	80.0	120	----
Metals (QCLot: 723121)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	93.6	80.0	120	----
Metals (QCLot: 723122)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	98.8	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	95.3	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	97.8	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	100	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	95.3	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	94.7	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	100	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	95.5	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	99.8	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	99.0	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	98.6	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	107	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.1	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	97.2	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	98.2	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	108	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	97.4	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	99.2	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	99.8	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723122) - continued									
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	95.6	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	96.4	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	97.3	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	103	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	100	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	96.7	80.0	120	----
Metals (QCLot: 723123)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	98.8	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	95.3	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	103	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	97.8	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	100	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	95.3	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	94.7	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	100	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	95.5	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	100	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	99.8	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	99.0	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	98.6	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	107	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	101	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	99.1	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	97.2	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	98.2	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	97.4	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	99.2	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	99.8	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723123) - continued									
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	95.6	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	96.4	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	97.3	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	103	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	100	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	101	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	96.7	80.0	120	----
Metals (QCLot: 723124)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	86.5	80.0	120	----
Metals (QCLot: 723125)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	86.5	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 715475)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	93.2	70.0	130	----
Metals (QCLot: 715476)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	113	70.0	130	----
Metals (QCLot: 715477)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	113	70.0	130	----
Metals (QCLot: 715478)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	88.7	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.4	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	117	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	94.2	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	95.8	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	97.1	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	108	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	92.8	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	96.1	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.0	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	# 132	70.0	130	MES
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	96.6	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	99.1	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	123	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	100	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.7	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	96.6	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	100.0	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	95.3	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 715478) - continued									
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	88.0	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	100	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	96.6	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	95.0	70.0	130	----
Metals (QCLot: 715479)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	88.7	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.4	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	117	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	94.2	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	95.8	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	97.1	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	108	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	92.8	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	96.1	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.0	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	# 132	70.0	130	MES
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	96.6	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.1	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	123	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.7	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	96.6	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	100.0	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	95.3	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.8	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	88.0	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	100	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	96.6	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	95.0	70.0	130	----
Metals (QCLot: 715480)									

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 715480) - continued									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	93.2	70.0	130	----
Metals (QCLot: 716122)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	106	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.8	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	91.9	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	91.9	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	98.9	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	101	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	108	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	95.9	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.0	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.0	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	95.0	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	98.2	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	95.2	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	96.8	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	95.9	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	97.8	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	98.2	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	95.7	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	97.4	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	86.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	106	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.7	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	95.5	70.0	130	----
Metals (QCLot: 716123)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	106	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 716123) - continued									
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	91.9	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	91.9	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	98.9	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	101	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	108	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	95.9	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.0	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.0	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	95.0	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	98.2	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	95.2	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	96.8	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	95.9	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	97.8	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	98.2	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	95.7	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	97.4	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	86.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	106	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.7	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	95.5	70.0	130	----
Metals (QCLot: 716124)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	95.9	70.0	130	----
Metals (QCLot: 716125)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	95.9	70.0	130	----
Metals (QCLot: 716126)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----
Metals (QCLot: 716127)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	111	70.0	130	----
Metals (QCLot: 716145)									

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 716145) - continued									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	112	70.0	130	----
Metals (QCLot: 716146)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	112	70.0	130	----
Metals (QCLot: 716147)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	94.5	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	102	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	73.6	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	95.8	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	100	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	93.8	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	116	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	100	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	99.7	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	103	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	99.8	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	102	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	95.8	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	97.8	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	102	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	101	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	100.0	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	105	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	106	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	92.1	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	85.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	100	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.0	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	99.9	70.0	130	----
Metals (QCLot: 716148)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	94.5	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 716148) - continued									
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	102	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	73.6	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	95.8	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	100	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	93.8	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	116	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	100	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	99.7	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	103	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	99.8	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	102	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	95.8	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	97.8	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	102	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	101	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	100.0	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	105	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	106	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	92.1	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	85.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	100	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.0	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	99.9	70.0	130	----
Metals (QCLot: 716149)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	89.8	70.0	130	----
Metals (QCLot: 716150)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	89.8	70.0	130	----
Metals (QCLot: 720236)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	117	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.7	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	97.7	60.0	140	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 720236) - continued									
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	93.0	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	88.0	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	89.5	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	104	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	94.1	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.6	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.9	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	88.6	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	104	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	95.8	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	91.2	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	104	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.4	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	95.1	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	98.9	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	96.5	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	88.1	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	81.2	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	99.6	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	95.9	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	93.7	70.0	130	----
Metals (QCLot: 720237)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	89.0	70.0	130	----
Metals (QCLot: 720238)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	112	70.0	130	----
Metals (QCLot: 720239)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	112	70.0	130	----
Metals (QCLot: 720240)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	117	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.7	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 720240) - continued									
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	97.7	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	93.0	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	88.0	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	89.5	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	104	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	94.1	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.6	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.9	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	88.6	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	104	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	95.8	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	91.2	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	104	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	100	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.4	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	95.1	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	98.9	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	96.5	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	88.1	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	81.2	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	99.6	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	95.9	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	93.7	70.0	130	----
Metals (QCLot: 720241)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	89.0	70.0	130	----
Metals (QCLot: 720263)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	105	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	96.5	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	113	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	90.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 720263) - continued									
	RM	calcium	7440-70-2	E440	550 mg/kg	97.5	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	97.4	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	97.1	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	94.8	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.5	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	96.0	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	95.9	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	95.1	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	109	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	97.2	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.9	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	96.3	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	101	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	94.8	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.9	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	98.2	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	101	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	95.8	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	96.3	70.0	130	----
Metals (QCLot: 720264)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	93.9	70.0	130	----
Metals (QCLot: 720265)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	93.9	70.0	130	----
Metals (QCLot: 720266)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----
Metals (QCLot: 720267)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	111	70.0	130	----
Metals (QCLot: 720268)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	105	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	96.5	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 720268) - continued									
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	113	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	90.2	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	97.5	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	97.4	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	97.1	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	94.8	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.5	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	96.0	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	95.9	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	95.1	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	109	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	97.2	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.9	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	96.3	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	101	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	94.8	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.9	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	98.2	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	101	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	95.8	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	96.3	70.0	130	----
Metals (QCLot: 723110)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	99.6	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.8	70.0	130	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	97.1	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	93.0	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	94.7	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	# 134	70.0	130	MES
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	98.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 723110) - continued									
	RM	copper	7440-50-8	E440	35 mg/kg	100	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	103	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	# 134	70.0	130	MES
	RM	magnesium	7439-95-4	E440	940 mg/kg	102	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	99.7	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	105	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	99.6	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	99.2	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	101	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	102	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.3	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	89.1	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	105	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.9	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	97.8	70.0	130	----
Metals (QCLot: 723111)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	91.1	70.0	130	----
Metals (QCLot: 723112)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	91.1	70.0	130	----
Metals (QCLot: 723113)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	104	70.0	130	----
Metals (QCLot: 723114)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	104	70.0	130	----
Metals (QCLot: 723115)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	99.6	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	99.8	70.0	130	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	97.1	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	93.0	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	94.7	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	# 134	70.0	130	MES

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 723115) - continued									
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	98.0	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	100	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	103	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	# 134	70.0	130	MES
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	102	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	99.7	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	99.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	105	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	99.6	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	99.2	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	101	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	102	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.3	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	89.1	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	105	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.9	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	97.8	70.0	130	----
Metals (QCLot: 723120)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	106	70.0	130	----
Metals (QCLot: 723121)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	106	70.0	130	----
Metals (QCLot: 723122)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	114	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	99.3	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	83.7	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	96.4	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	91.7	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	86.1	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	120	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	96.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 723122) - continued									
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	98.7	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	98.3	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	108	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	102	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	98.0	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	85.7	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	92.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	103	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	98.5	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	94.6	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	97.5	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	100	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	87.2	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	80.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	95.8	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	96.8	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	102	70.0	130	----
Metals (QCLot: 723123)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	114	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.3	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	83.7	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	96.4	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	91.7	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	86.1	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	120	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	96.2	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	98.7	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	98.3	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	108	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	102	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	98.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Reference Material (RM) Report: Recovery (%) RM	Reference Material (RM) Report: Recovery Limits (%) Low	Reference Material (RM) Report: Recovery Limits (%) High	Qualifier
Metals (QCLot: 723123) - continued									
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	85.7	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	92.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	103	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	98.5	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	94.6	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	97.5	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	100	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	87.2	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	80.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	95.8	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	96.8	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	102	70.0	130	----
Metals (QCLot: 723124)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	83.1	70.0	130	----
Metals (QCLot: 723125)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	83.1	70.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095A

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Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa Pallouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437 - 332 - 5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Street:	2920 Virtual way # 200	Email 1 or Fax melissa.pallouras@wsp.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To ☐ YES ☒ NO		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Company:	Mount Polley Mining Corp	Email 1 or Fax gabriel.homes@mountpolley.com	
Contact:	Gabriel Homes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	2369	ALS Contact: Amber Springer	Sampler: D. Sales

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22 - SG - L - 01	13 SEP 22	13:00	veg	X	X			1
	22 - SG - L - 02	"	"	"	X	X			"
	22 - SG - G - 01	"	"	"	X	X			"
	22 - SG - L - 03	"	"	"	X	X			"
	22 - SG - L - 04	"	"	"	X	X			"
	22 - SB - L - 01	13sep 22	14:15	veg	X	X			"
	22 - SB - G - 01	"	"	"	X	X			"
	22 - SB - G - 02	"	"	"	X	X			"
	22 - SB - L - 02	"	"	"	X	X			"
10	22 - SB - F - 01	"	"	"	X	X			"

Environmental Division
Vancouver
Work Order Reference
VA22C2369

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO		Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human consumption/ use? ☐ YES ☒ NO		Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
		Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C	
				7°C (avg 6)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17 Sep 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17 Sep 22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 6860951 3

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Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437 - 332 - 5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt. Polley Mining Corp.
Contact:	Gabriel Homes

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	
ALS Lab Work Order # (lab use only):	

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☒ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: melissa.paliouras@wsp.com

Email 2: samantha.lundquist@wsp.com

Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.homes@mountainpolley.com

Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact: Amber Springer Sampler: D. Sales

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S3-G-01	13-SEP-22	15:30	Veg	X	X			1
	22-S3-G-02	"	"	"	X	X			"
	22-S3-L-01	"	"	"	X	X			"
	22-S3-F-01	"	"	"	X	X			"
	22-S3-L-02	"	"	"	X	X			"
	22-R2-L-01	14-SEP-22	8:50	Veg	X	X			"
	22-R2-F-01	"	"	"	X	X			"
	22-R2-L-02	"	"	"	X	X			"
19	22-R2-L-03	"	"	"	X	X			"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Debo Sales	17 Sep 22	14:30

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
JC	17/9/22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 C

Page 3 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lindquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt. Polley Mining Corp
Contact:	Gabriel Homes

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.homes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	6590008044
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
20	22-R3-L-01	14SEP22	10:00	veg	✓	✓			1
	22-R3-L-01D	"	"	"	✓	✓			"
	22-R3-L-02	"	"	"	✓	✓			"
	22-R3-L-02D	"	"	"	✓	✓			"
	22-R3-L-03	"	"	"	✓	✓			"
	22-R3-L-03D	"	"	"	✓	✓			"
	22-R3-F-01	"	"	"	✓	✓			"
	22-R3-F-01D	"	"	"	✓	✓			"
	22-R1-L-01	14SEP22	11:00	veg	✓	✓			"
	22-R1-L-02	"	"	"	✓	✓			"
	22-R1-F-01	"	"	"	✓	✓			"
32.31	22-R1-L-03	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)		
Released by: Deb Sales	Date: 17Sep2022	Time: 14:30

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: JC	Date: 17/9/22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 D

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt Polley Mining Corp.
Contact:	Gabriel Holmes

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax melissa.paliouras@wsp.com
Email 2 samantha.lundquist@wsp.com
Email 3

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax gabriel.holmes@mountpolley.com
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #:
PO / AFE: 5590008044
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
3/7/332	22-S11-L-01	14Sep22	12:40	Veg	✓	✓		/	1
	22-S11-G-01	"	"	"	✓	✓		/	"
	22-S11-L-02	"	"	"	✓	✓		/	"
	22-S11-L-03	"	"	"	✓	✓		/	"
	22-S11-F-01	"	"	"	✓	✓		/	"
	22-S12-L-01	14Sep22	13:10	Veg	✓	✓		/	"
	22-S12-G-01	"	"	"	✓	✓		/	"
	22-S12-L-02	"	"	"	✓	✓		/	"
	22-S12-F-01	"	"	"	✓	✓		/	"
414	22-S12-L-03	"	"	"	✓	✓		/	"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human consumption/ use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: 7 C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095E

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL | MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lindquist@wsp.com
Email 3	

Invoice To		
	Same as Report To	☐ YES ☒ NO
	Copy of Invoice with Report	☐ YES ☐ NO
Company:	Mt Polley Mining Corp.	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E-100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
4248	22-S14-F-01	14 Sep 22	14:00	veg	✓	✓			1
	22-S14-L-03	"	"	"	✓	✓			1
	22-S14-L-02	"	"	"	✓	✓			1
	22-S14-L-01	"	"	"	✓	✓			1
	22-S14-G-01	"	"	"	✓	✓			1
	22-S13-L-01	14 Sep 22	14:40	veg	✓	✓			1
	22-S13-L-02	"	"	"	✓	✓			1
	22-S13-L-03	"	"	"	✓	✓			1
	22-S13-F-01	"	"	"	✓	✓			1
4252	22-S13-G-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				1°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: Sep 17, 2022	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095G

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa. Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 Samantha.lundquist@wsp.com	
Postal Code:	V6M 0C4	Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☐ YES ☐ NO		
Company:	Mt. Polley Mining Corp	Email 1 or Fax galenel.holmes@mountpolley.com	
Contact:	Galenel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590000844	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
62 63	22-S16-L-01	14sep22	17:00	Veg	✓	✓			1
	22-S16-L-02	"	"	"	✓	✓			"
	22-S16-L-03	"	"	"	✓	✓			"
	22-S16-G-01	"	"	"	✓	✓			"
	22-S16-F-01	"	"	"	✓	✓			"
	22-S5-L-01	15sep22	8:10	Veg	✓	✓			"
	22-S6-L-02	"	"	"	✓	✓			"
	22-S6-G-01	"	"	"	✓	✓			"
	22-S6-F-01	"	"	"	✓	✓			"
71 72	22-S6-G-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice Packs	☑	Ice Cubes ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	7°C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Deb Sales	17sep22	14:32				JC	17 Sep 22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — JULY 2017 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 F

Page 6 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	melissa. Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 virtual way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R]	☒ Standard TAT if received by 3 pm - business days - no surcharges apply		
PRIORITY (Business Days)	4 day [P4-20%] ☐	EMERGENCY	1 Business day [E-100%] ☐
	3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	2 day [P2-50%] ☐		
Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To		
	Same as Report To	☐ YES ☒ NO
	Copy of Invoice with Report	☐ YES ☐ NO
Company:	Mt. Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
S254	22-S13-L-01D	14sep22	14:40	veg	✓	✓			1
	22-S13-L-02D	"	"	"	✓	✓			1
	22-S13-L-03D	"	"	"	✓	✓			1
	22-S13-F-01D	"	"	"	✓	✓			1
	22-S13-G-01D	"	"	"	✓	✓			1
	22-S17-L-01	14sep22	16:15	veg	✓	✓			1
	22-S17-L-02	"	"	"	✓	✓			1
	22-S17-L-03	"	"	"	✓	✓			1
	22-S17-G-01	"	"	"	✓	✓			1
61 62	22-S17-F-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐ No ☐
Ice Packs	☒	Ice Cubes ☐	Custody seal intact Yes ☐ No ☐
Cooling Initiated	☐		

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Deb Sales	17Sep22	14:30				JC	Sep 17/22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095H

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-352-5990
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [X] EXCEL [ ] EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	[X] Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	[ ]
PRIORITY (Business Days) 3 day [P3-25%]	[ ]
PRIORITY (Business Days) 2 day [P2-50%]	[ ]
EMERGENCY 1 Business day [E-100%]	[ ]
EMERGENCY Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	[ ]
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To	
Same as Report To	YES [ ] NO [X]
Copy of Invoice with Report	YES [ ] NO [ ]
Company:	M.T. Polley Mining Corp.
Contact:	Gabriel Holmes

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountainpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590006044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
7178	22-S5-L-01	15Sep22	09:10	veg	✓	✓		/	1
	22-S5-B-01	"	"	"	✓	✓		/	1
	22-S5-G-01	"	"	"	✓	✓		/	1
	22-S5-L-02	"	"	"	✓	✓		/	1
	22-S5-F-01	"	"	"	✓	✓		/	1
	22-S4-L-02	15Sep22	10:00	veg	✓	✓		/	1
	22-S4-L-01	"	"	"	✓	✓		/	1
	22-S4-G-01	"	"	"	✓	✓		/	1
	22-S4-F-01	"	"	"	✓	✓		/	4
8182	22-S4-B-01	"	"	"	✓	✓		/	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES [ ] NO [X]	
Are samples for human consumption/ use? YES [ ] NO [X]	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No	[ ]
Ice Packs	[✓]	Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2pm
Deb Sales	17Sep22	14:30						

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 I

Page 9 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa.Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ YES ☐ NO	
Company:	Mt Polley Mining Corp	Email 1 or Fax gabriel.holmes@mountpolley.com
Contact:	Gabriel Holmes	Email 2

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
					☒	☒			
82 83	22-S2-L-01	15Sep22	11:30	Veg	✓	✓			1
	22-S2-L-02	"	"	"	✓	✓			"
	22-S2-G-01	"	"	"	✓	✓			"
	22-S2-G-02	"	"	"	✓	✓			"
	22-S2-F-01	"	"	"	✓	✓			"
	22-S1-L-01	15Sep22	12:30	Veg	✓	✓			"
	22-S1-L-02	"	"	"	✓	✓			"
	22-S1-G-02	"	"	"	✓	✓			"
	22-S1-G-01	"	"	"	✓	✓			"
91 92	22-S1-F-01	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	7°C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 J

Page 10 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [ ] EXCEL [X] | EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] | MAIL [ ] FAX [ ]
Email 1 or Fax	
Email 2	
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R]	[X]	Standard TAT if received by 3 pm - business days - no surcharges apply	
PRIORITY (Business Days)	4 day [P4-20%]	[ ]	EMERGENCY: 1 Business day [E-100%] [ ]
	3 day [P3-25%]	[ ]	Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]
	2 day [P2-50%]	[ ]	
Date and Time Required for all E&P TATs:			dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	Mt. Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008844
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
92	22-R4-G-01	15Sep22	13:45	Veg	✓	✓			1
	22-R4-L-01	"	"	"	✓	✓			"
	22-R4-L-02	"	"	"	✓	✓			"
	22-R4-L-03	"	"	"	✓	✓			"
	22-R4-F-03	"	"	"	✓	✓			"
	22-R5-L-01	15Sep22	14:45	Veg	✓	✓			"
	22-R5-L-02	"	"	"	✓	✓			"
	22-R5-L-03	"	"	"	✓	✓			"
	22-R5-F-01	"	"	"	✓	✓			"
101	22-R5-F-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES [ ] NO [X]	
Are samples for human consumption/ use? YES [ ] NO [X]	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No [ ]	
Ice Packs	[ ]	Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C (avg 6)		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
D. Sales	Sept 17, 2022	14:30				SC	17/9/22	2pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095K

Page 11 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Wsp Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa. Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☐ YES ☐ NO		
Company:	Mt Polley Mining Corp.	Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:	Gabriel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Spenger	Sampler: Delo Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
102 ~~103~~	22-R6-F-01	15Sep 01	15:40	veg	✓	✓			1
	22-R6-F-02	"	"	"	✓	✓			"
	22-R6-L-01	"	"	"	✓	✓			"
	22-R6-L-02	"	"	"	✓	✓			"
	22-R6-B-01	"	"	"	✓	✓			"
	22-A4-L-01	16Sep22	08:15	veg	✓	✓			"
	22-A4-L-02	"	"	"	✓	✓			"
	22-A4-G-01	"	"	"	✓	✓			"
	22-A4-F-01	"	"	"	✓	✓			"
111 ~~112~~	22-A4-G-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐	SIF Observations: Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐	Custody seal intact: Yes ☐ No ☐
Cooling Initiated ☐	

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C	(Cava 6)		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Dr. Sales	Date: Sept 17, 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2 pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095L

Page 12 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2420 Virtual Way #200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	
Invoice To	Same as Report To ☐ YES ☒ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Company:	Mt. Polley Mining Corp.	Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:	Gabriel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
112 1/3	22-A5-L-01	16Sep22	09:00	veg	✓	✓			1
	22-A5-G-01	"	"	"	✓	✓			1
	22-A5-G-02	"	"	"	✓	✓			1
	22-A5-G-03	"	"	"	✓	✓			1
	22-A5-F-01	"	"	"	✓	✓			1
	22-S15-L-01	16Sep22	10:00	veg	✓	✓			1
	22-S15-L-02	"	"	"	✓	✓			1
	22-S15-L-03	"	"	"	✓	✓			1
	22-S15-G-01	"	"	"	✓	✓			1
121 1/2	22-S15-F-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C	Cava	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Deb Sales	17Sep 22	14:30				JC	17/9/22	2pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095M

Report To	Contact and company name below will appear on the final report
Company:	WSP. Golder
Contact:	Melissa Paliouras
Phone:	437 332 5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt. Polley Mining Corp.
Contact:	Gabriel Holmes

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL | | MAIL ☐ FAX
Email 1 or Fax melissa.paliouras
Email 2
Email 3

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #:
PO / AFE: 5590008044
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):
ALS Contact:
Sampler: D. Sales

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
122 123	22-S15-L-01 D	16Sep 22	10:00	veg	✓	✓		/	1
124	22-S15-L-02 D	"	"	"	✓	✓		/	"
125	22-S15-L-03 D	"	"	"	✓	✓		/	"
X	~~22-S15-L-03~~				✓	✓		/	"
	22-S15-G-01 D	"	"	"	✓	✓		/	"
	22-S15-F-01 D	"	"	"	✓	✓		/	"
	22-S10-L-01	16 Sep 22	11:00	veg	✓	✓		/	"
	22-S10-L-02	"	"	"	✓	✓		/	"
	22-S10-L-03	"	"	"	✓	✓		/	"
	22-S10-G-01	"	"	"	✓	✓		/	"
131 132	22-S10-F-01	"	"	"	✓	✓		/	"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO
Are samples for human consumption/ use? | | YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C
FINAL COOLER TEMPERATURES °C: 7°C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep 22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

APPENDIX D

Soil Screening Results

Table D-1:
Soil Screening Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID					22-R1-S-01	22-R2-S-01	22-R3-S-01	22-R3-S-01D	22-R4-S-01	22-R5-S-01	22-R6-S-01	22-S1-S-01	22-S2-S-01	22-S3-S-01	22-S4-S-01	22-S5-S-01	22-S6-S-01	22-S8-S-01	22-S9-S-01	22-S10-S-01	22-S11-S-01	22-S12-S-01	22-S13-S-01	22-S13-S-01D	22-S14-S-01	22-S15-S-01	22-S15-S-01D	22-S16-S-01	22-S17-S-01	22-A4-S-01	22-A5-S-01
Date Sampled					14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled					11:00	08:50	10:00	10:00	13:45	14:45	15:40	12:20	11:30	15:30	10:00	09:10	08:10	14:15	13:00	11:00	12:40	13:10	14:40	14:40	11:00	10:25	08:15	17:00	16:15	08:15	09:00
ALS Sample ID					VA22C2359-006	VA22C2359-004	VA22C2359-005	VA22C2359-007	VA22C2364-008	VA22C2364-009	VA22C2364-010	VA22C2364-007	VA22C2364-006	VA22C2359-001	VA22C2364-005	VA22C2364-004	VA22C2364-003	VA22C2359-003	VA22C2359-002	VA22C2367-005	VA22C2359-008	VA22C2359-009	VA22C2359-011	VA22C2359-012	VA22C2359-010	VA22C2367-003	VA22C2367-004	VA22C2364-002	VA22C2364-001	VA22C2367-001	VA22C2367-002
QAQC							FDA	FD															FDA	FD			FDA	FD			
Analyte					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests																															
loss on ignition @ 550°C	1.0	%	-	-	7.8	53.5	8.4	8.4	12.5	12.5	13.2	8.1	7.8	9	8.6	6.6	7.2	9.6	1.9	5.3	5.9	6.9	4.2	4.2	5.3	6.3	6.1	9.3	4.8	9.2	8.3
moisture	0.25	%	-	-	9.4	19	9	9.59	9.97	11.3	14.1	7.67	8.65	7.51	4.76	5.67	5.86	9.69	5.11	7.02	6.78	9.39	5.48	5.56	6.78	8.46	9.27	7.41	3.9	16	13.3
pH (1:2 soil:CaCl2-aq)	0.1	pH units	-	-	4.2	4.3	4.2	4.2	4.9	4.9	5.8	6.3	6.4	6.2	5.9	6.3	6.4	7.3	7.2	5.9	6.7	6.6	7.0	7.1	7.0	5.7	5.6	6.4	6.5	6.5	6.4
pH (1:2 soil:water)	0.1	pH units	-	-	4.94	4.98	4.82	4.93	5.55	5.59	6.28	6.85	7.03	6.6	6.5	6.93	6.93	6.78	8.33	6.64	7.52	7.12	7.63	7.57	7.6	6.49	6.48	6.99	7.1	7.01	6.9
ash content @ 550°C	1.0	%	-	-	92.1	46.5	91.6	91.6	87.5	87.4	86.8	91.8	92.2	91	91.4	93.4	92.8	90.4	98	94.7	94.1	93.1	95.8	95.8	94.7	93.7	93.8	90.7	95.2	90.8	91.7
Particle Size																															
grain size curve			-	-	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached
passing (0.0312 mm)	1.0	%	-	-	20.6	21.5	19	19.7	15.4	8.3	19.1	18.1	19.1	21.9	26.5	23.5	24.9	21.9	29	19.7	31.3	38.4	33.2	34	36.6	15	16.2	32.1	23.3	12.1	13.8
passing (9.5 mm)	1.0	%	-	-	82.2	92.2	80.6	84.3	77.8	68.6	94.5	90.7	86.2	95.5	94.8	90.5	93.4	95.8	91.8	87.5	91.4	93.4	94.7	93.9	92.6	81.6	85.3	92.3	90.3	72	83.8
passing (0.020 mm)	1.0	%	-	-	17.2	18	14.5	14.6	13	7.1	16.5	14.8	16.8	17.3	22.8	20.1	20.8	19.1	25.1	17.4	26.8	33.7	29.3	29.9	31.9	13	14.4	28.2	19.9	10.1	12
passing (1.0 mm)	1.0	%	-	-	51.8	64	55.4	58.6	39.4	24.1	58.3	54.7	50.3	64.6	64	58	62.4	63.7	57.9	50.4	66.5	71.4	69.8	69	71.1	43.4	47.5	67.6	59.3	38.4	43.6
passing (4.75 mm)	1.0	%	-	-	68.4	82.9	71.2	74.4	59.1	44.8	81.5	77.4	72.4	85.4	85.8	78.4	82.2	84.8	79.3	74.5	83.3	86.5	87.2	85.5	86.5	68.3	70.8	84.5	78.6	58	67
passing (0.005 mm)	1.0	%	-	-	8.9	10.3	8.3	8	7.8	4.5	10.1	9.1	10.6	10.3	13.6	13.1	12.9	12.3	16.6	11.3	17.2	22.9	18.6	19.2	21.2	7.7	9.6	18.6	12.1	6.3	7.8
passing (0.841 mm)	1.0	%	-	-	51	62.8	54.3	57.5	38.5	23.2	56.9	53.6	49.1	63.4	62.9	56.9	61.4	62.4	56.7	49.1	65.4	70.4	68.8	67.9	69.9	42.2	46.2	66.6	58.1	37.4	42.4
passing (19 mm)	1.0	%	-	-	100	100	100	96.2	97.6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	94.1	100
passing (0.004 mm)	1.0	%	-	-	8	9.3	7.4	7.2	7.3	4.1	9.6	8.4	10	9.3	12.1	11.9	11.6	11.4	15	10.5	16.1	21.2	17.3	17.9	19.5	7.3	8.9	16.9	11.2	6	7.1
passing (0.50 mm)	1.0	%	-	-	47.5	58.8	50.3	53.5	35.3	20.2	51.5	49	44.5	58.1	58.1	52	56.7	57	51.3	43.3	60.4	65.9	63.5	62.6	64.9	36.5	40.1	62.2	52.7	33.5	37.9
passing (25.4 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.002 mm)	1.0	%	-	-	6.8	7.9	5.6	5.7	6.1	3.5	8	6.6	8.3	7.7	8.8	9.4	8.6	9.3	12.1	9.1	13.4	17.3	14	14.2	16.1	6.1	7.3	13.6	8.7	5.6	6.5
passing (0.420 mm)	1.0	%	-	-	46.6	57.8	49.3	52.5	34.5	19.5	50.2	47.8	43.3	56.7	57	50.7	55.6	55.6	50	41.9	59.1	64.8	62.1	61.2	63.6	35.1	38.6	61.1	51.4	32.5	36.7
passing (38.1 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.250 mm)	1.0	%	-	-	43	53.9	45.3	48.2	31.5	17.1	44.7	43.6	39.2	51.4	52	45.7	50.5	50.4	44.6	36.5	54	59.9	56.3	55.5	58.5	30.1	33.2	56.8	46	28.9	32.5
passing (50.8 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.149 mm)	1.0	%	-	-	39.2	50.4	41.1	43.9	28.8	15.3	39.6	39.6	35.5	46.1	47.2	40.9	45.3	45.4	39.6	31.8	48.8	54.8	50.5	49.6	53.4	26.1	28.8	52.6	41.3	26	28.8
passing (76.2 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.125 mm)	1.0	%	-	-	37.6	48.5	39.4	42.1	27.7	14.6	37.6	37.7	34.1	43.8	45.1	39	43.2	43.2	37.8	29.8	46.9	52.8	48.2	47.4	51.3	24.5	27	50.7	39.3	24.6	27.4
passing (2.0 mm)	1.0	%	-	-	56.9	71.1	62.2	65.6	44.6	29.5	66.3	61.3	57.5	71.7	70.6	64.5	68.3	70.9	65.3	58.4	73	77.1	76.2	75.6	78	50.3	55.3	73.2	66.2	44.4	50.6
passing (0.075 mm)	1.0	%	-	-	34.4	44.5	35.9	38.3	25.3	13.2	33.5	33.9	31	38.9	40.8	34.9	38.6	38.6	34	25.7	43	48.6	43.5	43	47	21	23	47	35.3	21.7	24.5
passing (0.063 mm)	1.0	%	-	-	30.4	36.4	30.5	32.4	22.6	11.9	28.6	28.6	27.3	33.5	36.8	31.9	34.7	32.8	33.1	24.3	39.9	46	40.7	40.4	44.6	19.2	21	42.8	32.2	18.6	21.6
passing (0.05 mm)	1.0	%	-	-	26.2	27.7	24.6	26	19.6	10.4	23.3	22.9	23.4	27.6	32.4	28.7	30.5	26.5	32.2	22.9	36.4	43.2	37.6	37.6	42	17.1	19	38.3	28.8	15.2	18.4
Anions and Nutrients																															
nitrogen, total	0.020	%	-	-	0.117	0.347	0.129	0.112	0.194	0.185	0.231	0.332	0.241	0.269	0.146	0.093	0.136	0.485	0.021	0.117	0.125	0.171	0.056	0.076	0.127	0.117	0.107	0.219	0.106	0.526	0.368
Organic / Inorganic Carbon																															
carbon, inorganic [IC]	0.050	%	-	-	0.067	0.132	0.06	0.062	0.104	0.101	0.117	0.146	0.15	0.142	0.117	0.125	0.139	0.149	0.167	0.1	0.135	0.151	0.112	0.108	0.131	0.097	0.099	0.149	0.116	0.209	0.174
carbon, total [TC]	0.050	%	-	-	2.86	15.5	3.28	3.16	5.4	4.01	4.7	3.4	2.82	3.6	3.62	2.3	3	4.32	0.28	1.93	2.02	2.71	1.1	1.24	1.69	2.31	2.05	3.96	1.38	4.72	3.27
carbon, total organic [TOC]	0.050	%	-	-	2.79	15.4	3.22	3.1	5.3	3.91	4.58	3.25	2.67	3.46	3.5	2.18	2.86	4.17	0.113	1.83	1.88	2.56	0.988	1.13	1.56	2.21	1.95	3.81	1.26	4.51	3.1
carbon, inorganic [IC], (as CaCO3 equivalent)	0.40	%	-	-	0.56	1.1	0.5	0.52	0.87	0.84	0.97	1.22	1.25	1.18	0.98	1.04	1.16	1.24	1.39	0.84	1.13	1.26	0.93	0.9	1.09	0.81	0.83	1.24	0.97	1.74	1.45
organic matter	0.10	%	-	-	4.81	26.5	5.55	5.34	9.14	6.74	7.9	5.6	4.6	5.96	6.03	3.76	4.93	7.19	0.19	3.15	3.24	4.41	1.7	1.95	2.69	3.81	3.36	6.57	2.17	7.78	5.34
Plant Available Nutrients																															
nitrate + nitrite, available (as N)	1.0	mg/kg	-	-	<1.0	<2.5	<1.0	<1.0	<2.5	<2.5	<2.5	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2
phosphate, available (as P)	2.0	mg/kg	-	-	82.2	37.7	64.4	54.7	18.2	32	36.3	217	156	159	45	26.8	26.2	212	11	10.3	15.1	13.9	14.4	14.5	12.5	12.5	11.7	7.4	10	222	247
potassium, available	20.0	mg/kg	-	-	102	193	76	67	225	159	251	<20	198	138	84	77	110	207	<20	102	136	118	127	119	97	86	82	99	73	197	221
sulfate, available (as S)	3.0	mg/kg	-	-	<3.0	7.6	<3.0	3.6	<7.4	9.5	22.9	4.1	5.5	4.2	4.4	5.5	8.7	5.6	3.3	3.6	4	8	3.4	3.4	5.9	<3.0	<3.0	7.3	6.9	9.1	7.5
Saturated Paste Extractables																															
calcium, soluble ion content	0.30	mg/kg	-	-	4.06	27.3	6.49	6.36	8.54	5.97	23.5	15.6	18	9.06	12	17.3	29.8	15.8	13.7	7.6	22.4	15.8	27.1	24.8	16.2	4.65	4.62	15.4	16.7	21	17
magnesium, soluble ion content	0.50	mg/kg	-	-	0.78	3.13	0.9	0.91	1.3	0.75	2.03	2.14	2.06	1.35	1.62	1.8	2.37	2.72	1.1	1.05	2.04	1.56	3.43	3.4	2.08	0.86	0.91	1.38	1.75	2.39	2.05
potassium, soluble ion content	2.0	mg/kg	-	-	2.9	15.1	<2.0	<2.0	6.8	<2.7	9.8	6	4.8	2.4	<2.0	<2.1	3.2	5.7	<2.0	<2.0	2.6	<2.0	2.1	2	<2.0	<2.0	<2.0	<2.2	<2.0	5.9	8.4
sodium, soluble ion content	1.0	mg/kg	**200**	WL_{ei}-T	<1.00	<3.49	1.06	1.06	<2.16	<1.37	<1.76	1.5	1.41	1.24	1.03	<1.06	1.16	<1.47	1.06	1.26	<1.00	1.26	<1.00	1.22	<1.00	<1.00	1.01	<1.10	<1.00	<1.33	1.98
% saturation	1.0	%	-	-	48.8	174	50.3	50.5	108	68.5	88.2	65	54.1	56.3	49	52.8	52.6	73.6	40.7	40.4	48.6	47.4	48.3	48.6	43.4	43.1	48.1	55	47.4	66.4	66.1
TGR (brine)	0.10	t/ha	-	-	Incalculable	Incalculable	<0.10	<0.10	Incalculable	Incalculable	Incalculable	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	Incalculable	<0.10	Incalculable	<0.10	Incalculable	<0.10	Incalculable	<0.10	Incalculable	<0.10	Incalculable	Incalculable	Incalculable	<0.10
TGR (sodic)	0.10	t/ha	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
alkalinity, total (as CaCO3)	10.0	mg/L	-	-	<12	<10	<12	<12	<10	<10	27	43	80	<50	25	70	122	22	54	<25	65	<25	113	120	51	16	13	30	57	78	71
alkalinity, total (as CaCO3)	2.0	mg/kg	-	-	<5.8	<17.4	<6.0	<6.0	<2.0	<2.0	23.8	28	43.3	<28.1	12.2	37	64.2	16.2	22	<2.0	31.6	<11.8	54.6	58.3	22.1	6.9	6.2	16.5	27	51.8	46.9
chloride, soluble ion content	1.0	mg/kg	**350**	WL_{ei}-T	<9.8	<34.9	<10.1	<10.1	<21.6	<13.7	<17.6	<13.0	<10.8	<11.2	<9.8	<10.6	<10.5	<14.7	<8.1	<8.1	<9.7	<9.5	<9.6	<9.7	<8.7	<8.6	<9.6	<11.0	<9.5	<13.3	<13.2
conductivity, saturated paste	0.030	dS/m	-	-	0.056	0.071	0.068	0.065	0.078	0.062	0.143	0.172	0.216	0.27	0.136	0.195	0.332	0.148	0.21	0.129	0.176	0.164	0.291	0.282	0.192	0.077	0.064	0.184	0.222	0.208	0.199
nitrate (as N), soluble ion content	0.50	mg/L	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
nitrate (as N), soluble ion content	0.50	mg/kg	-	-	<0.50	<0.87	<0.50	<0.50	<0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
pH, saturated paste	0.10	pH units	-	-	4.96	5.06	4.88	4.88	5.62	5.65	6.29	6.84	6.95	6.65	6.44	6.84	6.91	6.74	7.97	6.37	7.34	6.83	7.67	7.44	7.37	6.18	6.19	6.69	6.9	7.06	6.85
sodium adsorption ratio [SAR]	0.10		-	-	<0.10	<0.10	0.14	0.15	<0.10	<0.10	<0.10	<0.10	0.11	0.14	0.1	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15
sulfate, soluble ion content	5.0	mg/L	-	-	<5.0	<5.0	5.1	5.3	5.2	<5.0	8.3	10.7	17.2	14.4	16.3	24.5	42.7	24.2	22.5	16.5	20.8	53	10.2	9.7	32.8	<5.0	<5.0	36.3	29.5	14.8	16.5
sulfate, soluble ion content	2.50	mg/kg	-	-	<2.5	<8.7	2.6	2.7	5.6	<3.4	7.3	7	9.3	8.1	8	12.9	22.5	17.8	9.2	6.7	10.1	25.1	4.9	4.7	14.2	<2.5	<2.5	20	14	9.8	10.9
chloride, soluble ion content	20.0	mg/L	-	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
alkalinity, bicarbonate (as CaCO3)	10.0	mg/L	-	-	<12	<10	<12	<12	<10	<10	27	43	80	<10	25	70	122	22	54	<25	65	<25	113	120	51	16	13	30	57	78	71
alkalinity, carbonate (as CaCO3)	5.0	mg/L	-	-	<12.5	<5.0	<12.5	<12.5	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0	<10.0	<10.0	<5.0	<12.5	<25.0	<10.0	<25.0	<25.0	<12.5	<10.0	<12.5	<12.5	<12.5	<12.5	<10.0	<10.0
alkalinity, carbonate (as CaCO3)	2.0	mg/kg	-	-	<6.1	<8.7	<6.3	<6.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.8	<2.0	<2.0	<2.0	<3.7	<5.1	<2.0	<4.9	<11.8	<12.1	<6.1	<4.3	<4.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, bicarbonate (as CaCO3)	2.0	mg/kg	-	-	<5.8	<17.4	<6.0	<6.0	<2.0	<2.0	23.8	28	43.3	<5.6	12.2	37	64.2	16.2	22	<2.0	31.6	<11.8	54.6	58.3	22.1	6.9	6.2	16.5	27	51.8	46.9
sodium, soluble ion content	2.0	mg/L	-	-	<2.0	<2.0	2.1	2.1	<2.0	<2.0	<2.0	2.3	2.6	2.2	2.1	2	2.2	<2.0	2.8	<2.0	2.6	<2.0	2.6	2.5	2.2	<2.0	2.1	<2.0	<2.0	<2.0	3
potassium, soluble ion content	4.0	mg/L	-	-	6	8.7	<4.0	<4.0	6.3	<4.0	11.1	9.2	8.8	4.3	<4.0	<4.0	6	7.8	<4.0	<4.0	5.4	<4.0	4.3	4.2	<4.0	<4.0	<4.0	8.9	4.0	8.9	12.7
magnesium, soluble ion content	1.0	mg/L	-	-	1.6	1.8	1.8	1.8	1.2	1.1	2.3	3.3	3.8	2.4	3.3	3.4	4.5	3.7	2.7	2.6	4.2	3.3	7.1	7	4.8	2	1.9	2.5	3.7	3.6	3.1
calcium, soluble ion content	0.60	mg/L	-	-	8.33	15.7	12.9	12.6	7.91	8.71	26.6	24	33.3	16.1	24.6	32.7	56.6	21.5	33.7	18.8	46	33.3	56.2	51.1	37.4	10.8	9.61	26.1	35.3	31.7	25.8
Metals																															
aluminum	50	mg/kg	-	-	13800	13000	12200	13300	22900	18500	14800	21100	18900	21200	13800	15500	15600	18100	19800	17200	23300	26400	19300	17600	21600	18100	15900	21200	17700	17400	16500
antimony	0.10	mg/kg	**20**	WL_{ei}-G	0.36	0.36	0.25	0.26	0.28	0.56	0.34	0.55	0.79	0.7	0.72	0.39	0.43	0.46	0.9	0.6	0.87	0.69	0.74	0.61	0.55	0.55	1.22	1.01	0.64	0.8	0.74
arsenic	0.10	mg/kg	**25**	WL_{ei}-T	5.38	4.37	5.3	4.89	13.7	11.6	8.59	13.2	12.5	11.5	8.11	9.86	9.23	12.1	14.1	14.4	14.5	15.1	13.1	12.4	12	15.8	14	13.9	10	13.1	11.8
barium	0.50	mg/kg	**700**	WL_{ei}-T	133	150	99.5	106	146	147	126	246	210	224	185	252	264	231	206	152	167	173	134	136	140	136	135	142	90.6	230	223
beryllium	0.10	mg/kg	**150**	WL_{ei}-T	0.25	0.28	0.29	0.26	0.61	0.71	0.5	0.63	0.61	0.63	0.37	0.47	0.48	0.55	0.67	0.55	0.84	0.92	0.62	0.54	0.66	0.6	0.51	0.72	0.57	0.56	0.49
bismuth	0.20	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	3.72	2	2.13	<0.20	<0.20	<0.20	10.8	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.28	6.25	5.15
boron	5.0	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	5.9	6	6.8	7.3	5.8	7.4	<5.0	<5.0	9.5	8.3	9.7	7.2	12.1	9	8	6.9	6.2	6.5	6	6.2	6	8	7
cadmium	0.020	mg/kg	**30**	WL_{ei}-T	0.379	0.527	0.39	0.392	0.59	0.561	0.382	0.578	0.545	0.479	0.197	0.237	0.236	0.811	0.437	0.24	0.322	0.372	0.29	0.275	0.298	0.279	0.259	0.404	0.298	0.669	0.624
calcium	50.0	mg/kg	-	-	3140	6240	4060	3860	5960	6540	7800	15800	14300	14100	7190	10000	10500	16400	19400	10600	15600	14200	14900	12700	11600	12000	10700	11100	9950	18000	15600
chromium	0.50	mg/kg	**200**	WL_{ei}-T	34	26.4	29.6	30.6	40.2	26.4	23.9	30.2	25.3	29.7	28.1	26.9	25.8	27.9	20.6	26.2	30.1	38.9	38.7	30	34.9	25.8	22.1	31.6	33.2	22.8	23.2
cobalt	0.10	mg/kg	**45**	WL_{ei}-T	8.32	7.57	6.81	7.54	16.7	12.2	11.1	16.5	15.6	14.9	11.9	13.5	13.7	15	17	13.7	17.2	19	18.7	16.4	16.4	14.4	12.7	15.9	14	14.8	14.6
copper	0.50	mg/kg	**150**	WL_{ei}-T	22.7	59.5	18.5	18.1	**300**	**258**	125	**759**	**688**	**619**	**191**	**324**	**642**	**716**	**635**	**372**	**830**	**761**	**269**	**243**	**595**	**479**	**410**	**703**	**254**	**713**	**633**
iron	50.0	mg/kg	-	-	25200	21400	24200	24600	45800	33900	34200	42500	37200	37500	29400	33200	33300	38400	38200	36400	37800	41200	37700	33400	34600	38200	34300	35300	34100	40000	37400
lead	0.50	mg/kg	**550**	WL_{ei}-T	6.2	8.03	7.36	6.77	13.6	16.8	10.2	17.4	12.5	13.7	6.09	6.56	6.96	16.2	10.5	9.13	8.76	10.2	9.53	8.74	8.99	7.89	6.54	7.68	8.31	19.1	16.3
lithium	2.0	mg/kg	-	-	13.5	10.1	11.8	12.2	23.4	22.6	17.4	15.8	15.2	15.5	11.9	13.7	13.3	15.4	19	17.6	18.3	20.4	16.8	14.

Table D-2:
Soil Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-S-01	22-R3-S-01D				22-S13-S-01	22-S13-S-01D				22-S15-S-01	22-S15-S-01D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled			10:00	10:00				14:40	14:40				10:00	10:00			
ALS Sample ID	Lowest Detection Limit	Units	VA22C2359-005	VA22C2359-007	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2359-011	VA22C2359-012	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2367-003	VA22C2367-004	Mean	Relative Percent Difference (%)	Difference Factor
QAQC			FDA	FD				FDA	FD				FDA	FD			
Analyte			Soil	Soil				Soil	Soil				Soil	Soil			
Physical Tests																	
loss on ignition @ 550°C	1	%	8.4	8.4	8.4	0	NC	4.2	4.2	4.2	NC	0	6.3	6.1	6.2	3	NC
moisture	0.25	%	9	9.59	9.295	6	NC	5.48	5.56	5.52	1	NC	8.46	9.27	8.865	9	NC
pH (1:2 soil:CaCl2-aq)	0.1	pH units	4.18	4.17	4.175	0	NC	7.03	7.1	7.065	1	NC	5.71	5.64	5.675	1	NC
pH (1:2 soil:water)	0.1	pH units	4.82	4.93	4.875	2	NC	7.63	7.57	7.6	1	NC	6.49	6.48	6.485	0	NC
ash content @ 550°C	1	%	91.6	91.6	91.6	0	NC	95.8	95.8	95.8	0	NC	93.7	93.8	93.75	0	NC
Particle Size																	
grain size curve			See Attached	See Attached	-	-	NC	See Attached	See Attached	-	-	NC	See Attached	See Attached	-	-	NC
passing (0.0312 mm)	1	%	19	19.7	19.35	4	NC	33.2	34	33.6	2	NC	15	16.2	15.6	8	NC
passing (9.5 mm)	1	%	80.6	84.3	82.45	4	NC	94.7	93.9	94.3	1	NC	81.6	85.3	83.45	4	NC
passing (0.020 mm)	1	%	14.5	14.6	14.55	1	NC	29.3	29.9	29.6	2	NC	13	14.4	13.7	10	NC
passing (1.0 mm)	1	%	55.4	58.6	57	6	NC	69.8	69	69.4	1	NC	43.4	47.5	45.45	9	NC
passing (4.75 mm)	1	%	71.2	74.4	72.8	4	NC	87.2	85.5	86.35	2	NC	68.3	70.8	69.55	4	NC
passing (0.005 mm)	1	%	8.3	8	8.15	4	NC	18.6	19.2	18.9	3	NC	7.7	9.6	8.65	22	NC
passing (0.841 mm)	1	%	54.3	57.5	55.9	6	NC	68.8	67.9	68.35	1	NC	42.2	46.2	44.2	9	NC
passing (19 mm)	1	%	100	96.2	98.1	4	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.004 mm)	1	%	7.4	7.2	7.3	3	NC	17.3	17.9	17.6	3	NC	7.3	8.9	8.1	20	NC
passing (0.50 mm)	1	%	50.3	53.5	51.9	6	NC	63.5	62.6	63.05	1	NC	36.5	40.1	38.3	9	NC
passing (25.4 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.002 mm)	1	%	5.6	5.7	5.65	2	NC	14	14.2	14.1	1	NC	6.1	7.3	6.7	18	NC
passing (0.420 mm)	1	%	49.3	52.5	50.9	6	NC	62.1	61.2	61.65	1	NC	35.1	38.6	36.85	9	NC
passing (38.1 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.250 mm)	1	%	45.3	48.2	46.75	6	NC	56.3	55.5	55.9	1	NC	30.1	33.2	31.65	10	NC
passing (50.8 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.149 mm)	1	%	41.1	43.9	42.5	7	NC	50.5	49.6	50.05	2	NC	26.1	28.8	27.45	10	NC
passing (76.2 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.125 mm)	1	%	39.4	42.1	40.75	7	NC	48.2	47.4	47.8	2	NC	24.5	27	25.75	10	NC
passing (2.0 mm)	1	%	62.2	65.6	63.9	5	NC	76.2	75.6	75.9	1	NC	50.3	55.3	52.8	9	NC
passing (0.075 mm)	1	%	35.9	38.3	37.1	6	NC	43.5	43	43.25	1	NC	21	23	22	9	NC
passing (0.063 mm)	1	%	30.5	32.4	31.45	6	NC	40.7	40.4	40.55	1	NC	19.2	21	20.1	9	NC
passing (0.05 mm)	1	%	24.6	26	25.3	6	NC	37.6	37.6	37.6	0	NC	17.1	19	18.05	11	NC
Anions and Nutrients																	
nitrogen, total	0.02	%	0.129	0.112	0.1205	14	NC	0.056	0.076	0.066	NC	1	0.117	0.107	0.112	9	NC
Organic / Inorganic Carbon																	
carbon, inorganic [IC]	0.05	%	0.06	0.062	0.061	NC	0	0.112	0.108	0.11	NC	0	0.097	0.099	0.098	NC	0
carbon, total [TC]	0.05	%	3.28	3.16	3.22	4	NC	1.1	1.24	1.17	12	NC	2.31	2.05	2.18	12	NC
carbon, total organic [TOC]	0.05	%	3.22	3.1	3.16	4	NC	0.988	1.13	1.059	13	NC	2.21	1.95	2.08	13	NC
carbon, inorganic [IC], (as CaCO3 equivalent)	0.4	%	0.5	0.52	0.51	NC	0	0.93	0.9	0.915	NC	0	0.81	0.83	0.82	NC	0
organic matter	0.1	%	5.55	5.34	5.445	4	NC	1.7	1.95	1.825	14	NC	3.81	3.36	3.585	13	NC
Plant Available Nutrients																	
nitrate + nitrite, available (as N)	1	mg/kg	<1.0	<1.0	1	NC	0	<1.0	<1.0	1	NC	0	<1.0	<1.0	1	NC	0
phosphate, available (as P)	2	mg/kg	64.4	54.7	59.55	16	NC	14.4	14.5	14.45	1	NC	12.5	11.7	12.1	7	NC
potassium, available	20	mg/kg	76	67	71.5	NC	0	127	119	123	7	NC	86	82	84	NC	0
sulfate, available (as S)	3	mg/kg	<3.0	3.6	3.3	NC	0	3.4	3.4	3.4	NC	0	<3.0	<3.0	3	NC	0
Saturated Paste Extractables																	
calcium, soluble ion content	0.3	mg/kg	6.49	6.36	6.425	2	NC	27.1	24.8	25.95	9	NC	4.65	4.62	4.635	1	NC
magnesium, soluble ion content	0.5	mg/kg	0.9	0.91	0.905	NC	0	3.43	3.4	3.415	1	NC	0.86	0.91	0.885	NC	0
potassium, soluble ion content	2	mg/kg	<2.0	<2.0	2	NC	0	2.1	2	2.05	NC	0	<2.0	<2.0	2	NC	0
sodium, soluble ion content	1	mg/kg	1.06	1.06	1.06	NC	0	1.26	1.22	1.24	NC	0	<1.00	1.01	1.005	NC	0
% saturation	1	%	50.3	50.5	50.4	0	NC	48.3	48.6	48.45	1	NC	43.1	48.1	45.6	11	NC
TGR (brine)	0.1	t/ha	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	Incalcuable	<0.10	0.10	NC	NC
TGR (sodic)	0.1	t/ha	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
alkalinity, total (as CaCO3)	10	mg/L	<12	<12	12	NC	0	113	120	116.5	6	NC	16	13	14.5	NC	0
alkalinity, total (as CaCO3)	2	mg/kg	<6.0	<6.0	6	NC	0	54.6	58.3	56.45	7	NC	6.9	6.2	6.55	NC	0
chloride, soluble ion content	1	mg/kg	<10.1	<10.1	10.1	0	NC	<9.6	<9.7	9.65	1	NC	<8.6	<9.6	9.1	11	NC
conductivity, saturated paste	0.03	dS/m	0.068	0.065	0.0665	NC	0	0.291	0.282	0.2865	3	NC	0.077	0.064	0.0705	NC	0
nitrate (as N), soluble ion content	0.5	mg/L	<0.5	<0.5	0.5	NC	0	<0.5	<0.5	0.5	NC	0	<0.5	<0.5	0.5	NC	0
nitrate (as N), soluble ion content	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
pH, saturated paste	0.1	pH units	4.88	4.88	4.88	0	NC	7.67	7.44	7.555	3	NC	6.18	6.19	6.185	0	NC
sodium adsorption ratio [SAR]	0.1		0.14	0.15	0.145	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	0.16	0.13	NC	1

Table D-2:
Soil Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-S-01	22-R3-S-01D				22-S13-S-01	22-S13-S-01D				22-S15-S-01	22-S15-S-01D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled			10:00	10:00				14:40	14:40				10:00	10:00			
ALS Sample ID	Lowest Detection Limit	Units	VA22C2359-005	VA22C2359-007	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2359-011	VA22C2359-012	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2367-003	VA22C2367-004	Mean	Relative Percent Difference (%)	Difference Factor
QAQC			FDA	FD				FDA	FD				FDA	FD			
Analyte			Soil	Soil				Soil	Soil				Soil	Soil			
sulfate, soluble ion content	5	mg/L	5.1	5.3	5.2	NC	0	10.2	9.7	9.95	NC	0	<5.0	<5.0	5	NC	0
sulfate, soluble ion content	2.5	mg/kg	2.6	2.7	2.65	NC	0	4.9	4.7	4.8	NC	0	<2.5	<2.5	2.5	NC	0
chloride, soluble ion content	20	mg/L	<20	<20	20	NC	0	<20	<20	20	NC	0	<20	<20	20	NC	0
alkalinity, bicarbonate (as CaCO3)	10	mg/L	<12	<12	12	NC	0	113	120	116.5	6	NC	16	13	14.5	NC	0
alkalinity, carbonate (as CaCO3)	5	mg/L	<12.5	<12.5	12.5	NC	0	<25.0	<12.5	18.75	NC	3	<12.5	<12.5	12.5	NC	0
alkalinity, carbonate (as CaCO3)	2	mg/kg	<6.3	<6.3	6.3	NC	0	<12.1	<6.1	9.1	**66**	NC	<2.0	<2.0	2	NC	0
alkalinity, bicarbonate (as CaCO3)	2	mg/kg	<6.0	<6.0	6	NC	0	54.6	58.3	56.45	7	NC	6.9	6.2	6.55	NC	0
sodium, soluble ion content	2	mg/L	2.1	2.1	2.1	NC	0	2.6	2.5	2.55	NC	0	<2.0	2.1	2.05	NC	0
potassium, soluble ion content	4	mg/L	<4.0	<4.0	4	NC	0	4.3	4.2	4.25	NC	0	<4.0	<4.0	4	NC	0
magnesium, soluble ion content	1	mg/L	1.8	1.8	1.8	NC	0	7.1	7	7.05	1	NC	2	1.9	1.95	NC	0
calcium, soluble ion content	0.6	mg/L	12.9	12.6	12.75	2	NC	56.2	51.1	53.65	10	NC	10.8	9.61	10.205	12	NC
Metals																	
aluminum	50	mg/kg	12200	13300	12750	9	NC	19300	17600	18450	9	NC	18100	15900	17000	13	NC
antimony	0.1	mg/kg	0.26	0.28	0.27	NC	0	0.61	0.55	0.58	10	NC	1.22	1.01	1.115	19	NC
arsenic	0.1	mg/kg	5.3	4.89	5.095	8	NC	13.1	12.4	12.75	5	NC	15.8	14	14.9	12	NC
barium	0.5	mg/kg	99.5	106	102.75	6	NC	134	136	135	1	NC	136	135	135.5	1	NC
beryllium	0.1	mg/kg	0.29	0.26	0.275	NC	0	0.62	0.54	0.58	14	NC	0.6	0.51	0.555	16	NC
bismuth	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
boron	5	mg/kg	<5.0	<5.0	5	NC	0	8	6.9	7.45	NC	0	6.5	6	6.25	NC	0
cadmium	0.02	mg/kg	0.39	0.392	0.391	1	NC	0.29	0.275	0.2825	5	NC	0.279	0.259	0.269	7	NC
calcium	50	mg/kg	4060	3860	3960	5	NC	14900	12700	13800	16	NC	12000	10700	11350	11	NC
chromium	0.5	mg/kg	29.6	30.6	30.1	3	NC	38.7	30	34.35	25	NC	25.8	22.1	23.95	15	NC
cobalt	0.1	mg/kg	6.81	7.54	7.175	10	NC	18.7	16.4	17.55	13	NC	14.4	12.7	13.55	13	NC
copper	0.5	mg/kg	18.5	18.1	18.3	2	NC	269	243	256	10	NC	479	410	444.5	16	NC
iron	50	mg/kg	24200	24600	24400	2	NC	37700	33400	35550	12	NC	38200	34300	36250	11	NC
lead	0.5	mg/kg	7.36	6.77	7.065	8	NC	9.53	8.74	9.135	9	NC	7.89	6.54	7.215	19	NC
lithium	2	mg/kg	11.8	12.2	12	3	NC	16.8	14.4	15.6	15	NC	18.7	16.9	17.8	10	NC
magnesium	20	mg/kg	2910	2900	2905	0	NC	9060	8440	8750	7	NC	8010	7540	7775	6	NC
manganese	1	mg/kg	570	630	600	10	NC	905	862	883.5	5	NC	891	747	819	18	NC
mercury	0.005	mg/kg	0.0355	0.0334	0.03445	6	NC	0.0847	0.0776	0.08115	9	NC	0.114	0.0935	0.10375	20	NC
molybdenum	0.1	mg/kg	0.9	0.8	0.85	12	NC	2.45	2.23	2.34	9	NC	3.9	3.18	3.54	20	NC
nickel	0.5	mg/kg	10.5	11.1	10.8	6	NC	18.5	15.6	17.05	17	NC	15.5	14.1	14.8	9	NC
phosphorus	50	mg/kg	1080	1020	1050	6	NC	1190	1120	1155	6	NC	1140	958	1049	17	NC
potassium	100	mg/kg	610	650	630	6	NC	1510	1390	1450	8	NC	1050	960	1005	9	NC
selenium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	0.55	0.45	0.5	NC	1	0.27	0.24	0.255	NC	0
silver	0.1	mg/kg	0.14	0.12	0.13	NC	0	0.19	0.18	0.185	NC	0	0.26	0.2	0.23	NC	1
sodium	50	mg/kg	88	100	94	NC	0	251	221	236	13	NC	192	188	190	NC	0
strontium	0.5	mg/kg	60.7	63.8	62.25	5	NC	208	188	198	10	NC	115	112	113.5	3	NC
sulfur	1000	mg/kg	<1000	<1000	1000	NC	0	<1000	<1000	1000	NC	0	<1000	<1000	1000	NC	0
thallium	0.05	mg/kg	<0.050	0.05	0.05	NC	0	0.064	0.06	0.062	NC	0	0.05	<0.050	0.05	NC	0
tin	2	mg/kg	<2.0	<2.0	2	NC	0	<2.0	<2.0	2	NC	0	<2.0	<2.0	2	NC	0
titanium	1	mg/kg	800	897	848.5	11	NC	1330	1200	1265	10	NC	1170	1120	1145	4	NC
tungsten	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
uranium	0.05	mg/kg	0.331	0.384	0.3575	15	NC	0.687	0.666	0.6765	3	NC	1.1	0.881	0.9905	22	NC
vanadium	0.2	mg/kg	71.7	74.3	73	4	NC	132	113	122.5	16	NC	131	122	126.5	7	NC
zinc	2	mg/kg	94.2	98.5	96.35	4	NC	92.5	84.5	88.5	9	NC	77.6	68.2	72.9	13	NC
zirconium	1	mg/kg	1.7	1.8	1.75	NC	0	5	4.7	4.85	NC	0	3.8	3.6	3.7	NC	0
Leachable Anions & Nutrients																	
Kjeldahl nitrogen, total [TKN]	0.02	%	0.091	0.099	0.095	NC	0	0.175	<0.071	0.123	**85**	NC	0.118	<0.069	0.0935	**52**	NC

Notes:
Value = RPD is greater than 35%

BC ENV = British Columbia Ministry of Environment and Climate Change Strategy; dS/m = deciSiemens per metre; FDA = field duplicate available; FD = field duplicate; G = generic; mg/kg = milligram per kilogram; mg/L = milligram per liter; QAQC = quality assurance quality control sample type; T = toxicity to soil invertebrates and plants; t/ha = tonnes per hectare; WLR = wildlands reverted; % = percent; < = indicates parameter was below laboratory equipment detection limit.

APPENDIX E

Vegetation Screening Results

Table E-1: List of identified vegetation species at Mt. Polley (13-16 September 2022)

Common Name	Scientific Name
Trees	
black cottonwood	*Populus trichocarpa*
lodgepole pine	*Pinus contorta* var. *latifolia*
Rocky Mountain Douglas-fir	*Pseudotsuga menziesii* var. *glauca*
Sitka alder	*Alnus alnobetula* ssp. *Sinuate*
trembling aspen	*Populus tremuloides*
western hemlock	*Tsuga heterophylla*
western redcedar	*Thuja plicata*
Shrubs (Berries)	
black elderberry	*Sambucus racemosa* var. *melanocarpa*
red raspberry	*Rubus idaeus* ssp. *Strigosus*
soopolallie	*Shepherdia canadensis*
Forbs	
bunchberry	*Cornus canadensi*
dandelion	*Taraxacum* sp.
false Solomon's-seal	*Maianthemum racemosum* ssp. *Amplexicaule*
Lindley's aster	*Symphyotrichum ciliolatum*
Loesel's tumble-mustard	*Sisymbrium loeselii*
pearly everlasting	*Anaphalis margaritacea*
pink wintergreen	*Pyrola asarifolia* ssp. *asarifoli*
red clover	*Trifolium pratense*
wild chamomile	*matricaria chamomilla*
yarrow	*Achillea millefolium*
yellow salsify	*Tragopogon dubius*
rattlesnake-plantain	*Goodyera oblongifoli*
Graminoid	
common timothy	*Phleum pratense* ssp. *pratense*
mountain brome	*Bromus carinatus* var. *marginatus*
nodding trisetum	*Trisetum cernuum*
slender wheatgrass	*Elymus trachycaulus* ssp. *Trachycaulus*

Note: see Appendix B – Photo Log for Site photographs.

Table E-2:
Grass Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R4-G-01	22-S1-G-02	22-S1-G-01	22-S2-G-01	22-S2-G-02	22-S3-G-01	22-S3-G-02	22-S4-G-01	22-S5-G-01	22-S6-G-01	22-S6-G-02	22-S8-G-01	22-S8-G-02	22-S9-G-01	22-S10-G-01	22-S11-G-01	22-S12-G-01	22-S13-G-01	22-S13-G-01D	22-S14-G-01	22-S15-G-01	22-S15-G-01D	22-S16-G-01	22-S17-G-01	22-A4-G-01	22-A4-G-02	22-A5-G-01	22-A5-G-02	22-A5-G-03
Date Sampled			15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled			13:45	12:30	12:30	11:30	11:30	15:30	15:30	10:00	09:10	08:10	08:10	14:15	14:15	13:00	11:00	12:40	13:10	14:40	14:40	14:00	10:00	10:00	17:00	16:15	08:15	08:15	09:00	09:00	09:00
ALS Sample ID	Lowest Detection Limit	Units	VA22C2369-092	VA22C2369-089	VA22C2369-090	VA22C2369-084	VA22C2369-085	VA22C2369-011	VA22C2369-012	VA22C2369-079	VA22C2369-074	VA22C2369-059	VA22C2369-061	VA22C2369-007	VA22C2369-008	VA22C2369-003	VA22C2369-130	VA22C2369-033	VA22C2369-038	VA22C2369-051	VA22C2369-066	VA22C2369-046	VA22C2369-120	VA22C2369-125	VA22C2369-055	VA22C2369-070	VA22C2369-109	VA22C2369-111	VA22C2369-113	VA22C2369-114	VA22C2369-115
QAQC																				FDA	FD		FDA	FD							
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																														
moisture	0.50	%	59.4	42.9	41.4	40.2	40.8	47	46.1	48.6	47	43.7	42.8	41.3	29.6	39.8	52.6	38.6	54.5	35.9	38.4	48.4	55.9	54.6	31.3	29.5	55.4	59.8	60.4	62.1	53.6
Metals																														
aluminum	2.0	mg/kg	88.3	78.2	219	75.3	80.2	51.2	59.4	31.3	27.5	22	46.9	41.7	55.1	394	42.6	19.9	8.4	69.2	69.8	16.9	45	42.3	38.1	40.6	14.6	25	31.2	35.8	33
aluminum	0.40	mg/kg wwt	35.8	44.6	128	45.1	47.5	27.1	32	16.1	14.6	12.4	26.8	24.5	38.8	237	20.2	12.2	3.81	44.3	43	8.74	19.8	19.2	26.2	28.6	6.51	10	12.3	13.6	15.3
antimony	0.010	mg/kg	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	0.0035	0.0024	0.0064	0.0028	0.002	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0072	<0.0020	<0.0020	<0.0020	0.0028	0.0025	<0.0020	<0.0020	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.108	0.078	0.179	0.094	0.12	0.159	0.066	0.039	0.035	0.021	0.038	0.056	0.061	0.339	0.039	0.025	<0.020	0.069	0.087	<0.020	0.059	0.046	0.044	0.071	0.064	0.084	0.077	0.06	0.094
arsenic	0.0040	mg/kg wwt	0.0439	0.0446	0.105	0.0561	0.0707	0.0841	0.0357	0.0199	0.0184	0.012	0.0215	0.0331	0.0433	0.204	0.0187	0.0152	0.006	0.0445	0.0535	0.0094	0.0262	0.0209	0.0306	0.0501	0.0284	0.0336	0.0306	0.0226	0.0436
barium	0.050	mg/kg	21.3	7.39	45.6	4.19	41.3	48.3	6.71	12.9	6.64	9.13	20.6	6.08	9.96	62.3	7.44	5.97	7.15	35.8	47.8	3.68	8.18	6.73	5.23	30	48.4	10.2	8.15	5.39	58.3
barium	0.010	mg/kg wwt	8.66	4.22	26.7	2.51	24.5	25.6	3.62	6.65	3.52	5.14	11.8	3.57	7.02	37.5	3.53	3.68	3.26	22.9	29.4	1.9	3.61	3.06	3.59	21.2	21.6	4.11	3.23	2.04	27
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	0.004	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0072	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	3.5	6	5.6	8.9	4.7	9.3	7.8	4.7	3.9	3.6	2.3	3.7	3.3	3.8	4.6	4.4	7.1	3.3	5.1	3.5	4.5	2.7	2.3	4.5	6.4	3.4	3.4	4.9	3.6
boron	0.20	mg/kg wwt	1.44	3.43	3.3	5.32	2.77	4.94	4.18	2.41	2.06	2.04	1.33	2.16	2.32	2.27	2.18	2.73	3.24	2.1	3.13	1.82	2	1.23	1.57	3.16	2.85	1.38	1.37	1.86	1.7
cadmium	0.0050	mg/kg	0.0335	0.0134	0.108	0.0085	0.0382	0.254	<0.0050	0.0069	<0.0050	<0.0050	0.0066	0.0158	0.0235	0.147	0.0053	<0.0050	<0.0050	0.111	0.104	<0.0050	0.0087	<0.0050	0.0117	0.0642	0.0324	0.0335	0.0724	0.0117	0.0733
cadmium	0.0010	mg/kg wwt	0.0136	0.0077	0.0635	0.0051	0.0226	0.134	0.0021	0.0035	<0.0020	0.0015	0.0038	0.0093	0.0166	0.0886	0.0025	<0.0010	0.0022	0.0714	0.0642	0.0022	0.0038	<0.0030	0.0081	0.0453	0.0144	0.0134	0.0286	0.0044	0.034
calcium	20	mg/kg	3610	3940	6180	4210	4570	8780	3210	2710	2520	2440	2160	3120	2250	9860	1240	3640	5830	4060	5790	3310	1690	1380	1610	5390	8750	4130	3990	3160	5700
calcium	4.0	mg/kg wwt	1460	2250	3620	2520	2700	4650	1730	1390	1340	1370	1230	1830	1590	5930	586	2230	2650	2600	3560	1710	747	624	1110	3800	3900	1660	1580	1200	2640
cesium	0.0050	mg/kg	0.0305	0.0382	0.155	0.028	0.0634	0.25	0.0553	0.0209	0.0297	0.0092	0.008	0.074	0.021	0.0912	0.0232	0.015	0.0058	0.0427	0.0429	0.0132	0.0603	0.0187	0.0161	0.14	0.0513	0.0511	0.0843	0.0419	0.0595
cesium	0.0010	mg/kg wwt	0.0124	0.0218	0.091	0.0168	0.0375	0.132	0.0298	0.0107	0.0157	0.0052	0.0046	0.0434	0.0148	0.0549	0.011	0.0092	0.0026	0.0274	0.0264	0.0068	0.0266	0.0085	0.011	0.0985	0.0228	0.0205	0.0334	0.0159	0.0276
chromium	0.050	mg/kg	0.208	0.106	0.28	0.096	0.12	0.17	0.074	<0.050	0.095	0.144	0.143	0.084	0.076	0.486	0.082	0.071	<0.050	0.112	0.173	0.063	0.092	0.147	0.176	0.1	0.062	0.072	0.106	0.105	0.123
chromium	0.010	mg/kg wwt	0.084	0.06	0.164	0.057	0.071	0.09	0.04	0.02	0.05	0.081	0.082	0.049	0.054	0.293	0.039	0.043	0.02	0.072	0.107	0.032	0.04	0.067	0.121	0.07	0.028	0.029	0.042	0.04	0.057
cobalt	0.020	mg/kg	0.097	0.072	0.164	0.061	0.062	0.041	0.05	0.032	0.032	0.026	0.052	0.051	0.047	0.343	0.043	0.03	<0.020	0.058	0.06	0.023	0.049	0.043	0.046	0.036	<0.020	0.026	0.033	0.043	0.029
cobalt	0.0040	mg/kg wwt	0.0394	0.0414	0.0964	0.0363	0.0367	0.0218	0.0271	0.0164	0.0171	0.0144	0.03	0.0302	0.0331	0.206	0.0206	0.0186	0.0044	0.037	0.0372	0.0117	0.0217	0.0194	0.0318	0.0254	0.0053	0.0107	0.013	0.0163	0.0134
copper	0.10	mg/kg	7.9	8.49	16.8	7.69	7.07	8.28	6.05	4.56	4.33	3.17	3.94	6.36	6.7	23.3	3.82	3.05	2.82	4.94	5.26	2.38	5.21	3.76	3.18	4.69	4.31	4.88	8.38	5.35	6.56
copper	0.020	mg/kg wwt	3.21	4.85	9.85	4.6	4.19	4.39	3.26	2.34	2.3	1.78	2.25	3.73	4.72	14	1.81	1.87	1.28	3.17	3.24	1.22	2.3	1.71	2.18	3.31	1.92	1.96	3.32	2.03	3.04
iron	3.0	mg/kg	183	144	375	102	142	105	92.1	57.6	48.7	45.7	76.4	80.8	78.2	681	38.4	38.4	21.7	124	124	33.5	101	85.1	73.3	80	31.8	49.4	62.7	66	70.2
iron	0.60	mg/kg wwt	74.3	82	220	61.2	84.2	55.6	49.6	29.6	25.8	25.7	43.7	47.4	55	410	40.8	23.6	9.87	79.5	76.3	17.3	44.7	38.6	50.3	56.4	14.2	19.9	24.8	25	32.6
lead	0.020	mg/kg	0.062	0.033	0.082	0.034	0.035	0.036	0.027	<0.020	0.021	<0.020	0.031	0.027	0.038	0.216	0.044	<0.020	<0.020	0.041	0.041	<0.020	0.046	0.051	0.028	0.031	0.052	0.051	0.053	0.047	0.058
lead	0.0040	mg/kg wwt	0.0251	0.0187	0.0478	0.0205	0.021	0.0194	0.0148	0.0081	0.011	0.0084	0.0176	0.016	0.0266	0.13	0.0211	0.0074	0.0064	0.0264	0.0251	0.007	0.0202	0.023	0.0195	0.0221	0.0231	0.0206	0.0211	0.0179	0.0267
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	0.2	<0.10	0.14	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.32	<0.10	<0.10	<0.10	0.15	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	<0.10	<0.10
magnesium	2.0	mg/kg	760	996	922	981	475	824	1360	722	633	594	473	657	598	617	455	659	1030	510	708	607	459	452	341	414	572	554	511	766	471
magnesium	0.40	mg/kg wwt	309	569	540	587	281	437	735	371	336	334	271	386	421	372	216	404	467	327	436	313	202	205	234	292	255	223	202	290	219
manganese	0.050	mg/kg	797	57.2	73.6	41.8	58.1	93.7	48.6	48.5	33.6	42.2	28.1	86.1	34.5	280	31.8	44.1	64.6	96.9	41.6	74.3	48.7	43.5	85.8	108	40.8	74.4	33.5	58.5
manganese	0.010	mg/kg wwt	324	32.7	43.1	25	34.4	49.6	26.2	24.9	17.8	23.7	16.1	50.9	24.3	168	24.6	25.6	20.1	41.4	59.6	21.5	32.8	22.1	29.9	60.5	48	16.4	29.4	12.7	27.2
mercury	0.0050	mg/kg	0.0071	<0.0050	0.0052	<0.0050	0.006	0.0077	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084	<0.0050	<0.0050	<0.0050	0.0073	0.0073	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.007	0.0058	0.0057	<0.0050	0.0086
mercury	0.0010	mg/kg wwt	0.0029	0.0024	0.0031	0.0029	0.0036	0.0041	0.002	0.0014	0.002	0.0019	0.0021	0.0016	0.003	0.005	0.0012	0.0021	0.0015	0.0047	0.0045	0.0013	0.0016	0.0016	<0.0018	0.0046	0.0031	0.0023	0.0022	0.0014	0.004
molybdenum	0.020	mg/kg	2.28	3.58	10.8	7.17	7.8	8.83	3.56	1.4	4.42	1.96	3.74	2.09	3.01	10.4	2.32	4.7	1.05	3.64	19.6	2.14	7.37	8.14	1.02	4.86	11.3	2.7	3.26	2.38	5.5
molybdenum	0.0040	mg/kg wwt	0.928	2.04	6.36	4.29	4.62	4.68	1.92	0.722	2.34	1.1	2.14	1.23	2.12	6.25	1.1	2.88	0.477	6.68	12	1.1	3.25	3.7	0.704	3.43	5.02	2.81	1.29	0.903	2.55
nickel	0.20	mg/kg	0.44	<0.20	<0.20	<0.20	<0.20	<0.20	0.22	0.21	<0.20	0.22	<0.20	0.33	<0.20	0.38	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	0.178	0.095	0.109	0.085	0.05	0.051	0.118	0.107	0.083	0.122	0.068	0.195	0.13	0.226	0.059	0.059	<0.040	0.056	0.063	0.05	0.043	0.081	0.05	0.052	<0.040	<0.040	0.044	0.063	<0.040
phosphorus	10	mg/kg	2250	2220	1010	1910	850	1010	2390	1730	1350	1460	565	1600	1600	711	784	1080	774	996	850	278	568	220	579	1170	2140	1510	1340	850
phosphorus	2.0	mg/kg wwt	914	1270	590	1140	503	536	1290	887	715	820	323	940	1130	428	372	661	492	496	613	438	122	258	151	408	520	859	597	508	394
potassium	20	mg/kg	22900	12800	5740	8020	5330	9440	8660	11800	8410	9590	3320	7650	5560	4050	6320	6250	7560	4690	5540	5860	7670	6160	5400	4320	6800	9000	8330	7350	5080
potassium	4.0	mg/kg wwt	9300	7320	3370	4800	3150	5000	4660	6090	4450	5400	1900	4490	3920	2440	3000	3830	3440	3010	3410	3020	3380	2800	3710	3040	3030	3620	3300	2780	2360
rubidium	0.050	mg/kg	16.3	5.47	5.21	3.71	2.62	8.44	5.86	8.22	6.06	5.4	1.75	7.56	3.58	3.35	4.01	3.85	2.5	3.67	4.26	3.54	5.9	3.91	2.53	3.4	3.56	6.71	6.14	5.88	2.67
rubidium	0.010	mg/kg wwt	6.62	3.12	3.06	2.22	1.55	4.48	3.16	4.22	3.21	3.04	1	4.44	2.52	2.02	1.9	2.36	1.14	2.35	2.62	1.83	2.6	1.77	1.74	2.4	1.58	2.3	2.43	2.23	1.24
selenium	0.050	mg/kg	<0.050	0.128	0.502	0.227	0.151	0.376	0.413	0.101	0.081	<0.050	0.054	0.241	0.183	3.63	<0.050	0.158	0.057	0.075	0.093	0.054	<0.050	<0.050	0.054	0.056	0.193	0.237	0.131	0.129	0.168
selenium	0.010	mg/kg wwt	0.014	0.073	0.294	0.136	0.089	0.199	0.223	0.052	0.043	0.016	0.031	0.141	0.129	2.19	0.012	0.048	0.007	0.028	0.048	0.007	<0.010	<0.010	0.037	0.04	0.088	0.057	0.095	0.052	0.049
silver	0.0050	mg/kg	0.0076	0.0076	0.0072	<0.0050	0.0107	0.0079	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	0.0087	<0.0050	0.0296	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0124	0.0063	<0.0050
silver	0.0010	mg/kg wwt	0.0031	0.0044	0.0042	0.0017	0.0063	0.0042	0.003	<0.0010	<0.0010	<0.0010	0.0014	0.0051	0.0027	0.0178	<0.0010	0.0014	<0.0010	0.002	0.0021	<0.0010	0.0016	0.0017	<0.0010	0.0022	0.0014	0.001	0.0049	0.0024	0.0022
sodium	20	mg/kg	152	20	34	28	62	45	<20	31	<20	21	33	21	24	94	52	<20	22	31	45	<20	44	36	<20	23	74	41	43	39	55
sodium	4.0	mg/kg wwt	61.7	11.7	20	16.7	36.5	24	8.6	15.8	10.6	11.7	18.7	12.5	17	56.8	24.8	8.1	10.1	19.6	27.7	9.7	19.3	16.4	12.1	16	32.8	16.6	17.1	14.7	25.7
strontium	0.050	mg/kg	19.8	13.4	28.3	14.6	17.8	35	12.2	11.1	10.9	11.7	12.7	9.61	9.28	41.6	7.86	31.5	44.6	106	146	34.9	11	8.02	30.9	112	26.8	15.9	12	10.6	24.3
strontium	0.010	mg/kg wwt	8.02	7.67	16.6	8.7	10.5	18.6	6.55	5.7	5.79	6.6	7.26	5.64	6.54	25	3.73	19.3	20.3	68.3	90.2	18	4.85	3.64	21.2	78.9	11.9	6.4	4.76	4.01	11.2
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0012	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	0.059	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.027	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.032	<0.020	<0.020	<0.020	0.056	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0031	0.0022	0.0076	0.0023	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0154	<0.0020	<0.0020	<0.0020	0.0031	0.003	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	0.00125	0.00124	0.00448	0.00137	0.00157	0.00097	0.00071	0.00053	0.0005	<0.00040	0.00114	0.00088	0.00097	0.0093	0.00077	0.00046	<0.00040	0.00199	0.00182	<0.00040	0.00106	0.00067	0.0012	0.00109	<0.00040	<0.00040	0.0005	0.0005	0.0006
vanadium	0.10	mg/kg	0.56	0.46	1.37	0.3	0.48	0.31	0.24	0.16	0.13	0.1	0.21	0.23	0.2	2.29	0.3	<0.10	<0.10	0.41	0.39	<0.10	0.34	0.27	0.25	0.24	<0.10	0.13	0.17	0.18	0.2
vanadium	0.020	mg/kg wwt	0.227	0.265	0.802	0.176	0.286	0.164	0.129	0.084	0.068	0.059	0.123	0.138	0.141	1.38	0.142	0.057	0.022	0.26	0.242	0.049	0.15	0.123	0.175	0.172	0.034	0.052	0.068	0.067	0.094
zinc	0.50	mg/kg	17.4	55.7	33.8	46.3	33	38.6	60.1	20.8	12.6	19.4	10.5	72.8	31.6	19	9.75	13.8	11.9	15.3	15.1	12.2	10.4	8.77	6.93	15.8	32.9	35.4	49.8	34.4	47.2
zinc	0.10	mg/kg wwt	7.08	31.8	19.8	27.7	19.6	20.5	32.4	10.7	6.67	10.9	6.03	42.7	22.2	11.4	4.62	8.47	5.4	9.82	9.3	6.31	4.59	3.98	4.76	11.2	14.6	14.2	19.7	13	21.9
zirconium	0.20	mg/kg	<0.20	<0.20	0.3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.59	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	0.075	0.046	0.175	<0.060	0.106	0.089	<0.040	<0.050	<0.040	<0.040	<0.040	<0.080	<0.080	0.354	<0.040	<0.040	<0.040	0.06	0.056	<0.040	<0.040	<0.040	<0.040	0.086	<0.040	<0.040	<0.040	<0.040	0.04

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R1-L-01	22-R1-L-02	22-R1-L-03	22-R2-L-01	22-R2-L-02	22-R2-L-03	22-R3-L-01	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D	22-R4-L-01	22-R4-L-02	22-R4-L-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R6-L-01	22-R6-L-02	22-S1-L-01	22-S1-L-02	22-S2-L-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	16-Sep-2022	16-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022
Time Sampled	Lowest Detection Limit	Units	11:00	11:00	11:00	08:50	08:50	08:50	10:00	10:00	10:00	10:00	10:00	10:00	13:45	13:45	13:45	14:45	14:45	14:45	15:40	15:40	12:30	12:30	11:30
ALS Sample ID			VA22C2369-028	VA22C2369-029	VA22C2369-031	VA22C2369-016	VA22C2369-018	VA22C2369-019	VA22C2369-020	VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025	VA22C2369-093	VA22C2369-094	VA22C2369-095	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-104	VA22C2369-105	VA22C2369-087	VA22C2369-088	VA22C2369-082
QAQC									FDA	FD	FDA	FD	FDA	FD											
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	63.8	62.6	62.8	61.6	57	62.7	60.7	59	62.5	63.9	65.7	63.3	58.6	62	60.7	55.6	61.4	63.8	60.4	60.5	77.3	67	73.6
Metals																									
aluminum	2.0	mg/kg	64.4	377	159	63.5	118	260	146	198	65.8	48.4	510	372	59.4	53.7	246	50.2	102	56.4	65.7	116	127	475	126
aluminum	0.40	mg/kg wwt	23.3	141	59.1	24.4	50.8	97	57.2	81	24.7	17.4	175	136	24.6	20.4	96.9	22.3	39.2	20.4	26	45.7	28.8	157	33.2
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	0.013	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010
antimony	0.0020	mg/kg wwt	0.0027	0.0027	<0.0020	<0.0020	0.0057	0.0042	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	0.0053	<0.0020
arsenic	0.020	mg/kg	0.045	0.113	0.072	0.046	0.046	0.104	0.028	0.037	0.027	0.028	0.025	0.055	0.024	0.036	0.039	0.033	5.94	0.036	0.043	0.075	0.095	0.35	0.123
arsenic	0.0040	mg/kg wwt	0.0162	0.0423	0.027	0.0177	0.0196	0.0387	0.0109	0.0152	0.0101	0.0101	0.0085	0.0203	0.0101	0.0138	0.0154	0.0145	2.29	0.0128	0.0171	0.0297	0.0216	0.115	0.0324
barium	0.050	mg/kg	51.1	5.67	151	26.1	43.2	5.8	84	93.4	39.3	46.8	1.43	3.76	27.2	25.9	98.4	38.6	40.8	44.4	29.4	87.1	3.04	14.1	67.4
barium	0.010	mg/kg wwt	18.5	2.12	56.1	10	18.6	2.16	33	38.3	14.7	16.9	0.491	1.38	11.2	9.83	38.7	17.1	15.7	16	11.6	34.4	0.691	4.64	17.8
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	0.016	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	0.0045	<0.0020	<0.0020	<0.0020	0.0053	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	21	27.3	20.3	16.5	16.8	21.7	14.7	11.3	16.3	20.9	22	21.2	23.6	15.1	9.3	11.5	16.4	37.4	18.5	22.2	13.4	28.5	116
boron	0.20	mg/kg wwt	7.6	10.2	7.56	6.33	7.24	8.08	5.78	4.64	6.12	7.53	7.54	7.81	9.74	5.72	3.66	5.09	6.33	13.5	7.31	8.74	3.03	9.41	30.6
cadmium	0.0050	mg/kg	0.125	0.127	0.137	0.141	0.044	0.293	0.0991	0.0747	0.146	0.207	0.204	0.373	0.0095	0.121	0.264	0.105	0.0158	2.56	0.04	0.209	0.0258	0.0981	<0.0100
cadmium	0.0010	mg/kg wwt	0.0451	0.0474	0.0509	0.054	0.0189	0.109	0.0389	0.0306	0.0549	0.0747	0.07	0.137	0.0039	0.0459	0.104	0.0464	0.0061	0.927	0.0158	0.0826	0.0059	0.0323	<0.0025
calcium	20	mg/kg	8510	3370	7540	7440	5150	4310	6750	7860	7250	7300	2980	3350	11400	8110	5500	6660	2290	20700	11400	6520	2940	9720	20900
calcium	4.0	mg/kg wwt	3080	1260	2800	2860	2210	1610	2650	3220	2720	2630	1020	1230	4720	3080	2160	2960	884	7480	4520	2570	669	3200	5510
cesium	0.0050	mg/kg	0.014	0.0862	0.0341	0.0218	0.0387	0.106	0.102	0.0914	0.0233	0.0305	0.153	0.0727	0.157	0.0107	0.0086	0.0078	0.0444	0.0262	0.0379	0.0229	0.277	0.0888	0.212
cesium	0.0010	mg/kg wwt	0.0051	0.0322	0.0127	0.0084	0.0166	0.0394	0.0399	0.0374	0.0087	0.011	0.0525	0.0267	0.0648	0.0041	0.0034	0.0034	0.0171	0.0094	0.015	0.009	0.0628	0.0293	0.056
chromium	0.050	mg/kg	0.12	0.213	0.112	0.176	0.13	0.367	0.078	0.138	0.111	0.081	0.093	0.114	0.133	0.118	0.074	0.068	0.063	0.122	0.092	0.121	0.129	0.501	0.151
chromium	0.010	mg/kg wwt	0.043	0.08	0.042	0.067	0.056	0.137	0.03	0.057	0.042	0.029	0.032	0.042	0.055	0.045	0.029	0.03	0.024	0.044	0.036	0.048	0.029	0.165	0.04
cobalt	0.020	mg/kg	0.082	0.186	0.125	0.079	0.122	0.173	0.161	0.186	0.088	0.093	0.102	0.104	0.307	0.075	0.136	0.054	0.038	0.82	0.08	0.124	0.17	0.404	0.103
cobalt	0.0040	mg/kg wwt	0.0295	0.0695	0.0466	0.0305	0.0525	0.0646	0.0634	0.0762	0.0331	0.0334	0.0351	0.038	0.127	0.0283	0.0536	0.0242	0.0147	0.296	0.0316	0.049	0.0387	0.133	0.0271
copper	0.10	mg/kg	5.2	11.2	8.95	5.09	6.4	11.4	3.91	5.08	4.43	4.92	6.74	8.86	12.2	4.86	6.85	5.11	6.48	8.12	5.48	8.24	11.1	31.4	10.2
copper	0.020	mg/kg wwt	1.88	4.19	3.33	1.96	2.75	4.23	1.54	2.08	1.66	1.78	2.31	3.25	5.04	1.85	2.69	2.27	2.5	2.93	2.17	3.25	2.52	10.4	2.69
iron	3.0	mg/kg	116	324	149	136	138	317	80.2	119	93.7	89	84.3	152	108	111	134	107	56.1	80.2	144	194	256	1070	228
iron	0.60	mg/kg wwt	42	121	55.6	52.4	59.5	118	31.5	48.6	35.1	32.1	28.9	55.8	44.4	42.1	52.5	47.7	21.6	29	56.8	76.6	58.2	353	60.4
lead	0.020	mg/kg	0.028	0.119	0.08	0.042	0.061	0.118	0.032	0.047	0.027	<0.020	0.02	0.054	0.04	0.025	0.04	0.028	<0.020	0.043	0.036	0.044	0.041	0.16	0.063
lead	0.0040	mg/kg wwt	0.01	0.0444	0.0298	0.0163	0.0262	0.0441	0.0125	0.0192	0.01	0.0072	0.0069	0.0197	0.0165	0.0095	0.0157	0.0126	0.0043	0.0157	0.0142	0.0173	0.0094	0.0529	0.0167
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.64	<0.50
lithium	0.10	mg/kg wwt	<0.10	0.1	<0.10	<0.10	0.12	0.14	0.19	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	0.21	0.12
magnesium	2.0	mg/kg	1340	1290	1130	1110	899	1460	1490	1660	1180	1380	1550	1300	1380	1020	1170	931	1240	1980	1510	1090	984	5280	5030
magnesium	0.40	mg/kg wwt	487	483	422	425	387	543	586	680	443	499	532	479	572	387	460	413	479	714	597	432	223	1740	1330
manganese	0.050	mg/kg	108	1250	1200	94.4	340	438	663	564	236	292	1310	1280	202	174	363	196	130	159	127	1400	75.3	163	22.5
manganese	0.010	mg/kg wwt	39.3	466	446	36.2	146	163	260	231	88.5	105	451	470	83.3	66.3	143	86.9	50	57.4	50.2	552	17.1	53.6	5.95
mercury	0.0050	mg/kg	0.0127	0.0246	0.0307	0.0112	0.0171	0.0281	0.0111	0.0172	0.0123	0.0089	0.0078	0.0114	0.0072	0.0075	0.0124	0.0078	0.0055	0.0064	0.0132	0.0147	<0.0050	<0.0050	0.0125
mercury	0.0010	mg/kg wwt	0.0046	0.0092	0.0114	0.0043	0.0073	0.0105	0.0044	0.007	0.0046	0.0032	0.0027	0.0042	0.003	0.0028	0.0049	0.0035	0.0021	0.0023	0.0052	0.0058	<0.0010	0.0014	0.0033
molybdenum	0.020	mg/kg	0.443	0.228	0.118	0.674	0.669	0.08	0.077	0.098	1.04	1.16	0.416	0.152	0.809	2.26	0.099	0.827	0.045	0.202	2.28	0.124	1.45	2.36	26.5
molybdenum	0.0040	mg/kg wwt	0.16	0.0853	0.0439	0.259	0.288	0.0296	0.0303	0.0402	0.389	0.42	0.143	0.0557	0.334	0.857	0.0388	0.367	0.0174	0.073	0.902	0.0491	0.33	0.776	7
nickel	0.20	mg/kg	1.62	0.4	0.7	2.12	0.5	0.58	0.76	0.85	2.92	3.8	0.23	0.29	1.22	2.14	1.09	1.58	1.26	0.42	0.83	0.62	0.48	0.88	0.27
nickel	0.040	mg/kg wwt	0.586	0.152	0.259	0.814	0.215	0.214	0.3	0.348	1.1	1.37	0.078	0.105	0.505	0.811	0.428	0.7	0.484	0.154	0.328	0.244	0.109	0.292	0.071
phosphorus	10	mg/kg	1880	2650	2930	1200	1550	1780	2070	1670	1550	1910	1880	1870	1490	1960	2900	1570	2320	3150	1710	2660	1420	4920	6090
phosphorus	2.0	mg/kg wwt	680	992	1090	462	666	664	813	686	582	688	647	685	615	745	1140	696	892	1140	676	1050	324	1620	1610
potassium	20	mg/kg	8600	6530	7280	6640	7320	6350	7020	5630	8830	11500	7460	7200	5230	8880	9100	9020	9390	9870	8270	8630	4620	14900	22500
potassium	4.0	mg/kg wwt	3110	2440	2710	2550	3150	2370	2760	2300	3310	4160	2560	2640	2160	3370	3570	4000	3620	3560	3270	3400	1050	4920	5950
rubidium	0.050	mg/kg	5.99	6.8	5.74	6.22	6.44	5.57	13.1	11.4	6.14	9.02	13.7	8.54	8.44	3.13	4.04	2.3	5.22	4.82	6.93	5.84	5.15	5.37	10.7
rubidium	0.010	mg/kg wwt	2.17	2.54	2.14	2.39	2.77	2.08	5.16	4.66	2.3	3.25	4.69	3.14	3.49	1.19	1.59	1.02	2.01	1.74	2.74	2.3	1.17	1.77	2.84
selenium	0.050	mg/kg	<0.050	<0.050	<0.050	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.127	0.204	0.368
selenium	0.010	mg/kg wwt	<0.010	<0.010	<0.010	0.024	0.013	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.029	0.067	0.097
silver	0.0050	mg/kg	0.0057	0.0145	0.0159	0.005	0.0235	0.0211	0.0087	0.0087	<0.0050	0.0051	0.0076	0.0117	0.0152	<0.0050	0.0108	0.0057	0.0285	0.0187	0.0087	0.006	0.0378	0.008	<0.0050
silver	0.0010	mg/kg wwt	0.0021	0.0054	0.0059	0.0019	0.0101	0.0079	0.0034	0.0036	0.0014	0.0018	0.0026	0.0043	0.0063	0.0011	0.0042	0.0025	0.011	0.0068	0.0034	0.0024	0.0086	0.0026	<0.0010
sodium	20	mg/kg	29	57	69	49	62	80	76	62	<20	<20	30	42	54	52	39	<20	26	36	94	48	23	114	88
sodium	4.0	mg/kg wwt	10.6	21.5	25.7	19	26.8	29.6	29.9	25.4	6.6	7	10.3	15.6	22.2	19.8	15.4	8.3	9.9	13	37.3	19.2	5.3	37.6	23.3
strontium	0.050	mg/kg	80.8	7.8	44.1	90.1	29	9.22	38	48.9	61.8	64.8	3.31	6.35	39.3	45.9	19.6	35.9	21.2	78.2	86.8	24.3	4.96	34	65
strontium	0.010	mg/kg wwt	29.2	2.91	16.4	34.6	12.5	3.43	14.9	20	23.2	23.4	1.14	2.33	16.2	17.4	7.69	15.9	8.15	28.3	34.4	9.6	1.13	11.2	17.2
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	0.0054	0.0106	<0.0020	0.008	0.0084	0.0221	0.0271	<0.0020	<0.0020	0.0021	0.0043	<0.0020	<0.0020	0.0044	<0.0020	<0.0020	<0.0020	<0.0020	0.0043	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00202	0.00393	<0.00040	0.00344	0.00312	0.00868	0.0111	<0.00040	<0.00040	0.00074	0.00158	<0.00040	<0.00040	0.00174	<0.00040	<0.00040	<0.00040	<0.00040	0.00171	<0.00040	<0.00040	0.00047
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	0.031	0.062	<0.020	<0.020	0.028	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.039	<0.020	<0.020	<0.020	0.033	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0024	0.0057	0.0032	0.0026	0.0028	0.007	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	0.0038	0.0022	<0.0020	<0.0020	<0.0020	0.0028	0.003	0.0043	0.0162	0.0038
uranium	0.00040	mg/kg wwt	0.00087	0.00214	0.00121	0.00098	0.00121	0.0026	0.00064	0.00095	0.00064	0.00055	<0.00040	0.00101	0.00062	0.00145	0.00086	0.0008	<0.00040	<0.00040	0.00112	0.00118	0.00097	0.00533	0.001
vanadium	0.10	mg/kg	0.37	0.99	0.46	0.45	0.5	1.11	0.22	0.38	0.34	0.26	0.17	0.43	0.24	0.34	0.38	0.34	0.11	0.17	0.46	0.62	0.89	3.69	1.67
vanadium	0.020	mg/kg wwt	0.135	0.37	0.172	0.171	0.214	0.413	0.088	0.155	0.128	0.092	0.058	0.159	0.1	0.131	0.151	0.149	0.041	0.06	0.18	0.247	0.203	1.22	0.441
zinc	0.50	mg/kg	12.9	14.3	64.9	14	26.2	11.9	32.8	33.9	15.5	16.8	9.46	11.2	38.4	15.3	52.4	16.2	28.5	290	16.5	47	68.9	63.6	24.2
zinc	0.10	mg/kg wwt	4.67	5.36	24.1	5.4	11.3	4.43	12.9	13.9	5.83	6.06	3.24	4.11	15.9	5.82	20.6	7.21	11	105	6.55	18.6	15.6	21	6.39
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.24	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.32	<0.20
zirconium	0.040	mg/kg wwt	0.046	0.069	<0.070	<0.040	<0.040	0.09	0.059	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.104	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S2-L-02	22-S3-L-01	22-S3-L-02	22-S4-L-02	22-S4-L-01	22-S5-L-01	22-S5-L-02	22-S6-L-01	22-S6-L-02	22-S8-L-01	22-S8-L-02	22-S9-L-01	22-S9-L-02	22-S9-L-03	22-S9-L-04	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S11-L-01	22-S11-L-02	22-S11-L-03	22-S12-L-01	22-S12-L-02
Date Sampled			15-Sep-2022	13-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022
Time Sampled			11:30	15:30	15:30	10:00	10:00	09:10	09:10	08:10	08:10	14:15	14:15	13:00	13:00	13:00	13:00	11:00	11:00	11:00	12:40	12:40	12:40	13:10	13:10
ALS Sample ID	Lowest Detection Limit	Units	VA22C2369-083	VA22C2369-013	VA22C2369-015	VA22C2369-077	VA22C2369-078	VA22C2369-072	VA22C2369-075	VA22C2369-057	VA22C2369-058	VA22C2369-006	VA22C2369-009	VA22C2369-001	VA22C2369-002	VA22C2369-004	VA22C2369-005	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-032	VA22C2369-034	VA22C2369-035	VA22C2369-037	VA22C2369-039
QAQC																									
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	60.7	64	74.8	55.7	61.6	58.7	60.1	62.9	67.3	61.4	58.5	50.2	66.6	53.5	62.5	61.3	64.8	63.9	52.9	61.9	64	54.6	60.5
Metals																									
aluminum	2.0	mg/kg	122	68.4	68.6	169	25	117	19.9	107	17.4	97	67.9	92.6	310	230	178	52.6	97.5	66.7	71.7	155	16.3	70.8	38.6
aluminum	0.40	mg/kg wwt	47.7	24.7	17.3	74.9	9.59	48.2	7.92	39.6	5.71	37.4	28.2	46.1	103	107	66.7	20.3	34.4	24.1	33.7	59.1	5.87	32.2	15.3
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0034	<0.0020	0.0028	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	0.0024	0.0041	0.0047	0.003	0.0025	0.0027	<0.0020	<0.0020	0.0056	<0.0020	0.0027	<0.0020
arsenic	0.020	mg/kg	0.086	0.05	0.151	0.11	0.053	0.089	0.027	0.075	0.041	0.077	2.87	0.108	0.268	6.11	0.158	0.108	0.11	0.041	7.14	0.11	0.085	0.062	<0.020
arsenic	0.0040	mg/kg wwt	0.0336	0.0182	0.0381	0.0486	0.0205	0.0368	0.0109	0.0278	0.0135	0.0298	1.19	0.054	0.0896	2.84	0.0594	0.042	0.0387	0.0148	3.36	0.0417	0.0306	0.0284	0.0069
barium	0.050	mg/kg	2.33	1.61	165	22.6	9.11	15.5	4.67	23.8	10.1	2.66	25.5	9.03	12.3	18.4	7.75	19.6	41.4	2.24	21.4	9.93	4.51	6.46	1.43
barium	0.010	mg/kg wwt	0.914	0.582	41.7	10	3.5	6.41	1.86	8.8	3.3	1.03	10.6	4.49	4.1	8.56	2.9	7.58	14.6	0.811	10.1	3.78	1.62	2.93	0.565
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0035	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	14.6	12.6	82	38.1	35.7	29.8	39.4	34.1	40.2	14.5	20.8	14.3	22.8	16	52.5	53.6	62.9	15.4	16.9	46.4	49.1	46.4	8.8
boron	0.20	mg/kg wwt	5.73	4.55	20.7	16.9	13.7	12.3	15.7	12.6	13.2	5.6	8.66	7.1	7.6	7.43	19.7	20.8	22.2	5.56	7.94	17.7	17.7	21.1	3.47
cadmium	0.0050	mg/kg	0.0397	0.0492	<0.0100	0.0454	0.613	0.0146	0.22	0.0623	0.437	0.0568	0.0667	<0.0150	0.0672	0.0506	1.92	1.03	0.18	0.0468	0.0389	0.0452	1.33	0.0432	0.0254
cadmium	0.0010	mg/kg wwt	0.0156	0.0177	<0.0020	0.0201	0.235	0.006	0.0879	0.0231	0.143	0.0219	0.0277	<0.0060	0.0224	0.0235	0.719	0.398	0.0633	0.0169	0.0183	0.0172	0.478	0.0196	0.01
calcium	20	mg/kg	3200	2640	25600	13800	12500	10700	9960	11200	15600	2440	3810	11500	10500	2640	21300	20100	11500	2730	4760	16000	11700	9200	2030
calcium	4.0	mg/kg wwt	1250	950	6460	6110	4820	4410	3970	4150	5100	941	1580	5720	3500	1230	7980	7770	4040	986	2240	6090	4220	4180	803
cesium	0.0050	mg/kg	0.132	0.108	0.181	0.0538	0.254	0.048	0.648	0.0223	0.0812	0.0512	0.106	0.598	0.104	0.176	0.191	0.276	0.107	0.0538	0.0992	0.0465	0.0662	0.0385	0.0266
cesium	0.0010	mg/kg wwt	0.0518	0.0388	0.0456	0.0238	0.0975	0.0198	0.258	0.0083	0.0266	0.0198	0.0439	0.297	0.0348	0.0816	0.0715	0.107	0.0379	0.0194	0.0467	0.0177	0.0238	0.0175	0.0105
chromium	0.050	mg/kg	0.165	0.084	0.116	0.223	0.052	0.28	0.061	0.35	0.072	0.16	0.095	0.177	0.475	0.2	0.197	0.098	0.164	0.068	0.066	0.264	<0.050	1.21	0.076
chromium	0.010	mg/kg wwt	0.065	0.03	0.029	0.099	0.02	0.115	0.024	0.13	0.024	0.062	0.04	0.088	0.159	0.093	0.074	0.038	0.058	0.024	0.031	0.101	0.013	0.548	0.03
cobalt	0.020	mg/kg	0.112	0.125	0.065	0.128	0.207	0.108	0.382	0.103	0.394	0.142	0.087	0.244	0.305	0.297	0.604	0.771	0.169	0.15	0.15	0.126	0.717	0.079	0.063
cobalt	0.0040	mg/kg wwt	0.0438	0.0449	0.0164	0.057	0.0796	0.0447	0.152	0.038	0.129	0.0549	0.0362	0.122	0.102	0.138	0.226	0.298	0.0596	0.0543	0.0705	0.048	0.258	0.0359	0.025
copper	0.10	mg/kg	9.45	6.68	6.96	12.7	6.78	11.2	6.95	10.1	5.55	12.4	8.12	13.1	23.1	10.7	15.3	5.92	11.3	5.64	6.05	8.88	6.02	7.58	6.52
copper	0.020	mg/kg wwt	3.71	2.41	1.75	5.62	2.6	4.63	2.77	3.74	1.82	4.8	3.37	6.53	7.72	4.99	5.73	2.29	3.97	2.04	2.85	3.38	2.17	3.44	2.58
iron	3.0	mg/kg	199	114	117	273	51.4	194	50.1	211	48.7	187	130	149	653	301	262	98.9	236	108	101	271	44.9	140	64.6
iron	0.60	mg/kg wwt	78	41.3	29.4	121	19.7	80.2	20	78.1	16	72.1	53.8	74.3	218	140	98.1	38.2	83.4	39	47.3	103	16.2	63.7	25.5
lead	0.020	mg/kg	0.038	0.024	0.048	0.07	<0.020	0.067	0.031	0.06	0.023	0.042	0.035	0.062	0.17	0.092	0.084	0.09	0.143	0.032	0.034	0.09	<0.020	0.038	<0.020
lead	0.0040	mg/kg wwt	0.0149	0.0088	0.012	0.0309	0.006	0.0276	0.0123	0.0222	0.0075	0.0163	0.0146	0.0308	0.0569	0.0426	0.0315	0.0349	0.0503	0.0117	0.016	0.0342	<0.0040	0.0175	0.0054
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	0.16	0.13	<0.10	0.12	0.12	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	0.14	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1180	1480	3760	4910	2880	3390	2950	5350	2020	957	1260	1500	1940	983	2490	2700	2560	1230	835	6210	4000	4860	832
magnesium	0.40	mg/kg wwt	463	533	948	2180	1100	1400	1180	1980	661	370	524	747	646	457	934	1040	902	445	393	2370	1440	2210	329
manganese	0.050	mg/kg	100	95.9	85.9	176	37	85.3	32.4	225	21.1	80.7	53.9	164	91.3	146	94.2	75.2	153	99.8	171	101	79.6	73.2	63.7
manganese	0.010	mg/kg wwt	39.3	34.6	21.7	78.2	14.2	35.2	12.9	83.5	6.91	31.2	22.4	81.7	30.5	68	35.3	29.1	54	36.1	80.3	38.5	28.7	33.2	25.2
mercury	0.0050	mg/kg	<0.0050	<0.0050	0.0112	0.0082	<0.0050	0.0068	<0.0050	0.0063	<0.0050	<0.0050	0.0053	<0.0050	0.0076	0.0052	0.0055	0.0072	0.0074	<0.0050	0.0075	0.0097	<0.0050	0.0057	<0.0050
mercury	0.0010	mg/kg wwt	0.0018	0.0013	0.0028	0.0036	0.0015	0.0028	0.0015	0.0023	0.0016	0.0015	0.0022	0.0022	0.0025	0.0024	0.002	0.0028	0.0026	0.0012	0.0035	0.0037	<0.0020	0.0026	0.0012
molybdenum	0.020	mg/kg	2.38	0.598	30.6	3.86	2.18	2.11	2.95	2.69	2.9	3.02	3.25	18.6	1.35	0.562	5.28	1.1	1.33	2.98	0.837	4.64	2.06	1.34	2.17
molybdenum	0.0040	mg/kg wwt	0.936	0.216	7.71	1.71	0.838	0.872	1.18	0.996	0.95	1.17	1.35	9.24	0.45	0.261	1.98	0.426	0.467	1.08	0.394	1.77	0.74	0.61	0.858
nickel	0.20	mg/kg	0.51	0.35	0.4	0.43	0.41	0.4	<0.20	0.69	0.21	1.6	0.27	0.28	0.75	0.22	0.42	0.22	0.63	0.48	<0.20	0.22	0.24	0.43	0.32
nickel	0.040	mg/kg wwt	0.202	0.125	0.102	0.19	0.159	0.167	0.077	0.257	0.07	0.616	0.111	0.14	0.249	0.1	0.159	0.087	0.223	0.175	0.065	0.083	0.086	0.196	0.127
phosphorus	10	mg/kg	1600	1580	8110	3890	1740	3970	2670	4540	2510	1510	2260	2850	1100	1310	2020	1380	2540	1300	2000	6530	2430	3320	1370
phosphorus	2.0	mg/kg wwt	630	571	2040	1720	667	1640	1060	1680	822	582	938	1420	366	611	758	535	896	470	943	2490	876	1500	543
potassium	20	mg/kg	5650	4100	21800	8100	7080	10100	12100	7370	12500	5570	6780	10100	8170	7170	11800	5580	6790	4520	6480	9040	8380	6910	5230
potassium	4.0	mg/kg wwt	2220	1480	5490	3590	2720	4190	4810	2730	4080	2150	2810	5010	2730	3340	4410	2160	2390	1630	3050	3440	3020	3140	2070
rubidium	0.050	mg/kg	4.1	3.39	8.96	4.92	7.95	6.6	10.8	3.47	8.11	3.17	5.46	20.9	8.82	8.64	10.4	2.33	3.88	2.56	5.91	6.02	6.55	4.19	2.9
rubidium	0.010	mg/kg wwt	1.61	1.22	2.26	2.18	3.05	2.72	4.31	1.29	2.66	1.22	2.27	10.4	2.94	4.02	3.89	0.901	1.37	0.926	2.78	2.29	2.36	1.9	1.14
selenium	0.050	mg/kg	0.3	0.512	0.366	0.475	0.67	0.163	1.21	0.065	0.116	0.342	0.358	1.28	4.32	1.19	3.26	0.163	0.32	0.09	0.287	0.392	0.494	0.143	0.063
selenium	0.010	mg/kg wwt	0.118	0.184	0.092	0.21	0.257	0.067	0.484	0.024	0.038	0.132	0.149	0.636	1.44	0.556	1.22	0.063	0.113	0.032	0.135	0.149	0.178	0.065	0.025
silver	0.0050	mg/kg	0.0374	0.023	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0498	0.0165	0.0135	0.0103	0.0126	0.014	<0.0050	0.0152	0.0358	0.0211	<0.0050	<0.0050	<0.0050	0.0405
silver	0.0010	mg/kg wwt	0.0147	0.0083	<0.0010	0.0016	<0.0010	0.0013	<0.0010	<0.0010	0.0011	0.0192	0.0068	0.0067	0.0034	0.0058	0.0052	0.0014	0.0053	0.013	0.0099	0.0012	0.0015	<0.0010	0.016
sodium	20	mg/kg	22	<20	53	117	34	59	57	100	36	20	29	39	64	23	45	27	38	48	26	34	25	61	<20
sodium	4.0	mg/kg wwt	8.7	6.1	13.5	52	13.1	24.5	22.7	37.2	11.7	7.8	12.2	19.3	21.2	10.7	16.7	10.5	13.6	17.4	12.1	13	9.2	27.6	4.9
strontium	0.050	mg/kg	5.57	5.9	95	45.8	45.6	40.9	38.7	43	55.6	3.79	46.9	33.2	32.7	21.8	51.6	126	73.2	8.94	218	468	170	130	8
strontium	0.010	mg/kg wwt	2.19	2.12	24	20.3	17.5	16.9	15.4	15.9	18.2	1.46	19.5	16.5	10.9	10.1	19.3	48.6	25.8	3.23	102	178	61.1	59.2	3.16
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0045	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	0.0054	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0093	<0.0020	<0.0020	0.0178	<0.0020	<0.0020	<0.0020	<0.0020	0.0162	0.0028	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00064	0.00137	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00386	0.00058	<0.00040	0.00827	<0.00040	<0.00040	<0.00040	<0.00040	0.00763	0.00108	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.051	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.024	0.065	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0036	<0.0020	0.0022	0.0063	<0.0020	0.0035	0.002	0.0032	<0.0020	0.0038	0.003	0.0024	0.0138	0.0068	0.0046	0.0031	0.0042	0.0021	0.0021	0.0061	<0.0020	0.0029	<0.0020
uranium	0.00040	mg/kg wwt	0.00141	0.00067	0.00055	0.00278	<0.00040	0.00144	0.0008	0.0012	<0.00040	0.00146	0.00123	0.0012	0.00461	0.00318	0.00174	0.00122	0.00149	0.00077	0.00099	0.00232	<0.00040	0.0013	0.00041
vanadium	0.10	mg/kg	0.61	0.32	1.72	0.74	0.14	0.54	<0.10	0.56	<0.10	0.6	0.37	0.4	2.2	1.05	0.79	0.27	0.75	0.3	0.25	0.81	<0.10	0.31	0.15
vanadium	0.020	mg/kg wwt	0.241	0.117	0.435	0.331	0.053	0.223	0.037	0.207	0.03	0.231	0.152	0.2	0.733	0.488	0.295	0.106	0.265	0.108	0.118	0.31	0.027	0.142	0.061
zinc	0.50	mg/kg	43.6	42.3	25.4	15.2	31	12.2	24.5	20.7	28	77.8	47.8	21.6	13.4	22.8	96.3	79	102	46.6	37.2	18.1	147	10.9	42
zinc	0.10	mg/kg wwt	17.1	15.2	6.4	6.74	11.9	5.02	9.75	7.66	9.16	30	19.9	10.8	4.49	10.6	36.1	30.6	36	16.8	17.5	6.91	53	4.96	16.6
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.060	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.1	0.072	0.052	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S12-L-03	22-S13-L-01	22-S13-L-01D	22-S13-L-02	22-S13-L-02D	22-S13-L-03	22-S13-L-03D	22-S14-L-03	22-S14-L-02	22-S14-L-01	22-S15-L-01	22-S15-L-01D	22-S15-L-02	22-S15-L-02D	22-S15-L-03	22-S15-L-03D	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-A4-L-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022
Time Sampled			13:10	14:40	14:40	14:40	14:40	14:40	14:40	14:00	14:00	14:00	10:00	10:00	10:00	10:00	10:00	10:00	17:00	17:00	17:00	16:15	16:15	16:15	08:15
	Lowest Detection Limit	Units																							
ALS Sample ID			VA22C2369-041	VA22C2369-047	VA22C2369-062	VA22C2369-048	VA22C2369-063	VA22C2369-049	VA22C2369-064	VA22C2369-043	VA22C2369-044	VA22C2369-045	VA22C2369-117	VA22C2369-122	VA22C2369-118	VA22C2369-123	VA22C2369-119	VA22C2369-124	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-107
QAQC				FDA	FD	FDA	FD	FDA	FD				FDA	FD	FDA	FD	FDA	FD							
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	76.5	56.9	58.2	58.4	58.6	53.4	53.7	58.9	61.1	63	63.4	63.9	59.9	61.7	60.8	62.6	57.5	62.5	62.4	61.1	60.5	62.6	61
Metals																									
aluminum	2.0	mg/kg	109	77.3	45.8	36.9	27.3	54.2	64.6	23.4	112	34.8	93.8	79.8	130	63.6	369	294	20.1	45.4	60.7	38.4	37.3	11.7	105
aluminum	0.40	mg/kg wwt	25.7	33.4	19.1	15.3	11.3	25.3	30	9.63	43.5	12.9	34.4	28.8	52	24.4	144	110	8.53	17	22.8	15	14.7	4.38	40.8
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	0.014	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	0.0026	<0.0020	<0.0020	0.0036	<0.0020	<0.0020	<0.0020	0.0031	0.0024	<0.0020	<0.0020	0.0033	<0.0020	0.0077	0.0051	0.0045	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023
arsenic	0.020	mg/kg	0.071	0.038	0.032	0.061	0.056	8.45	10.9	<0.020	0.071	0.039	0.058	0.046	0.117	0.053	0.282	0.234	0.022	0.043	13.3	0.025	3.96	<0.020	0.086
arsenic	0.0040	mg/kg wwt	0.0168	0.0163	0.0134	0.0253	0.0233	3.94	5.04	0.0076	0.0278	0.0145	0.0212	0.0164	0.0469	0.0203	0.11	0.0876	0.0094	0.0163	5.01	0.0097	1.56	0.005	0.0336
barium	0.050	mg/kg	46.3	2.41	1.85	5.98	5.56	17.1	15.5	1.3	10.1	7.14	2.52	2.02	22.2	13.5	23.9	21	8.56	1.51	20	1.65	12.3	3.32	51.3
barium	0.010	mg/kg wwt	10.9	1.04	0.775	2.49	2.3	7.98	7.18	0.537	3.92	2.64	0.923	0.728	8.92	5.18	9.36	7.86	3.64	0.565	7.51	0.644	4.84	1.24	20
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0048	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.003	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	65	8.6	7.9	39.5	36.6	8.4	8	9.3	33.3	32.2	13.3	14.4	41	31	63.1	58.9	41.1	16.3	17.8	10.7	11.9	38.1	23.8
boron	0.20	mg/kg wwt	15.3	3.71	3.29	16.4	15.2	3.94	3.72	3.81	13	11.9	4.87	5.2	16.4	11.9	24.7	22	17.4	6.12	6.71	4.16	4.71	14.2	9.28
cadmium	0.0050	mg/kg	<0.0100	0.0821	0.0482	0.648	0.984	0.0145	0.014	0.0408	0.0137	0.842	0.0965	0.0726	1.54	1.16	0.0984	0.134	1.23	0.0363	0.0127	0.0516	0.0599	1.5	0.464
cadmium	0.0010	mg/kg wwt	<0.0020	0.0354	0.0202	0.27	0.408	0.0067	0.0065	0.0168	0.0053	0.312	0.0354	0.0262	0.619	0.444	0.0385	0.05	0.525	0.0136	0.0048	0.0201	0.0237	0.562	0.181
calcium	20	mg/kg	12500	3000	2440	10300	11100	2160	1940	2300	11600	14200	2630	2410	19000	11900	13000	12600	15900	2840	3440	3020	3190	10900	28600
calcium	4.0	mg/kg wwt	2940	1290	1020	4310	4580	1010	900	947	4510	5260	964	870	7620	4560	5090	4720	6740	1070	1290	1180	1260	4070	11100
cesium	0.0050	mg/kg	0.244	0.0175	0.0193	0.046	0.0628	0.026	0.0302	0.198	0.0353	0.559	0.0652	0.0685	0.112	0.133	0.0528	0.0672	0.259	0.0696	0.162	0.11	0.111	0.489	0.0446
cesium	0.0010	mg/kg wwt	0.0573	0.0075	0.008	0.0191	0.026	0.0121	0.014	0.0813	0.0137	0.207	0.0239	0.0247	0.0449	0.051	0.0207	0.0252	0.11	0.0261	0.0611	0.0429	0.0437	0.183	0.0174
chromium	0.050	mg/kg	0.23	0.339	0.109	0.137	0.116	0.252	0.08	0.176	0.318	0.258	0.116	0.092	0.164	0.114	0.577	0.444	0.088	0.095	0.246	0.055	0.071	<0.050	0.134
chromium	0.010	mg/kg wwt	0.054	0.146	0.046	0.057	0.048	0.117	0.037	0.072	0.124	0.095	0.042	0.033	0.066	0.044	0.226	0.166	0.037	0.036	0.092	0.021	0.028	<0.010	0.052
cobalt	0.020	mg/kg	0.096	0.187	0.154	0.319	0.371	0.065	0.067	0.099	0.086	0.367	0.117	0.092	0.59	0.43	0.297	0.244	0.37	0.086	0.114	0.118	0.123	0.476	0.301
cobalt	0.0040	mg/kg wwt	0.0224	0.0806	0.0645	0.133	0.154	0.0304	0.0311	0.0408	0.0335	0.136	0.0428	0.0332	0.236	0.165	0.116	0.0914	0.157	0.0322	0.0427	0.0459	0.0485	0.178	0.117
copper	0.10	mg/kg	8.47	6	6.12	6.53	5.64	4.84	5.23	12.3	8.03	9.08	7.96	6.49	12.6	8.94	21.9	17.1	6.39	5.05	5.12	4.53	3.53	6.03	11.6
copper	0.020	mg/kg wwt	1.99	2.59	2.56	2.72	2.34	2.25	2.42	5.05	3.12	3.36	2.92	2.34	5.04	3.43	8.59	6.41	2.72	1.89	1.93	1.76	1.39	2.25	4.54
iron	3.0	mg/kg	203	112	97	63.4	75.9	104	112	64.7	203	73.2	175	139	246	118	838	583	52.6	59.2	104	80.8	61.3	37.2	176
iron	0.60	mg/kg wwt	47.6	48.5	40.6	26.4	31.4	48.4	51.7	26.6	78.8	27.1	64.2	50.3	98.6	45.3	328	218	22.3	22.2	39.1	31.5	24.2	13.9	68.7
lead	0.020	mg/kg	0.044	0.027	0.025	0.024	0.073	0.032	0.028	<0.020	0.051	0.024	0.054	0.039	0.101	0.062	0.221	0.176	0.021	<0.020	0.026	0.022	<0.020	<0.020	0.07
lead	0.0040	mg/kg wwt	0.0103	0.0116	0.0105	0.01	0.0302	0.0149	0.013	0.0048	0.0198	0.0089	0.0199	0.0142	0.0404	0.0236	0.0866	0.0658	0.009	0.0052	0.0096	0.0086	0.0063	0.0046	0.0272
lithium	0.50	mg/kg	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.68	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.71	<0.50
lithium	0.10	mg/kg wwt	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.27	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.26	<0.10
magnesium	2.0	mg/kg	3670	1530	1300	3020	3180	770	737	802	5000	3130	1320	1150	3460	3120	5150	4730	2520	1140	1000	1110	731	3360	1570
magnesium	0.40	mg/kg wwt	863	662	544	1260	1320	359	341	329	1940	1160	485	416	1390	1200	2020	1770	1070	427	378	431	289	1260	610
manganese	0.050	mg/kg	31.6	76.6	68.4	31.6	37.9	147	122	37.7	72.4	60.9	93.2	93	140	79.7	242	204	38.3	91.4	94.1	63	73.9	54.4	56.9
manganese	0.010	mg/kg wwt	7.42	33	28.6	13.1	15.7	68.5	56.6	15.5	28.1	22.6	34.1	33.6	56.2	30.5	94.6	76.3	16.3	34.3	35.4	24.5	29.2	20.4	22.2
mercury	0.0050	mg/kg	0.0109	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0097	<0.0050	<0.0050	<0.0050	0.011	0.008	0.0138	0.013	0.005	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	0.012
mercury	0.0010	mg/kg wwt	0.0026	<0.0011	0.0014	0.0014	0.0012	<0.0022	0.0023	0.0012	0.0038	0.0015	0.0012	0.0015	0.0044	0.0031	0.0054	0.0048	0.0021	<0.0017	0.0023	0.0013	0.0018	0.0013	0.0047
molybdenum	0.020	mg/kg	12.4	1.63	2.35	1.6	2.09	2.47	2.58	6.5	8.1	1.3	4.82	5.63	3.35	2.15	65.1	29.8	1.32	1.67	1.87	2.67	0.749	1.84	0.704
molybdenum	0.0040	mg/kg wwt	2.9	0.704	0.984	0.667	0.866	1.15	1.2	2.67	3.15	0.481	1.76	2.03	1.34	0.826	25.5	11.2	0.561	0.627	0.702	1.04	0.296	0.688	0.274
nickel	0.20	mg/kg	<0.20	0.21	0.21	<0.20	<0.20	<0.20	<0.20	0.65	<0.20	0.34	1.04	0.96	0.61	0.63	0.56	0.58	<0.20	0.21	<0.20	0.32	<0.20	0.46	0.22
nickel	0.040	mg/kg wwt	0.043	0.09	0.089	0.077	0.064	0.066	0.048	0.266	0.077	0.126	0.382	0.346	0.246	0.24	0.22	0.215	0.075	0.08	<0.040	0.125	0.042	0.171	0.084
phosphorus	10	mg/kg	7700	1100	973	1580	1640	1460	1550	1540	3730	2130	1480	1360	2080	1860	4610	3330	1550	1420	1470	1110	1440	1880	1970
phosphorus	2.0	mg/kg wwt	1810	475	407	656	679	678	718	635	1450	790	541	491	836	713	1800	1240	659	533	553	432	570	705	769
potassium	20	mg/kg	26200	4400	3840	5380	7610	7960	7360	3450	7320	8640	4820	4530	6270	5200	7560	6310	8500	4230	5860	3760	6190	7520	7250
potassium	4.0	mg/kg wwt	6160	1900	1600	2240	3150	3710	3410	1420	2850	3200	1770	1640	2510	1990	2960	2360	3610	1580	2200	1460	2440	2810	2820
rubidium	0.050	mg/kg	23.8	2.58	2.94	5.39	5.33	5.98	7.42	7.76	3.16	6.12	4.14	3.94	3.37	2.82	2.75	3.38	6.28	3.54	8.69	3.28	4.84	5.82	4.95
rubidium	0.010	mg/kg wwt	5.61	1.11	1.23	2.24	2.21	2.78	3.44	3.19	1.23	2.27	1.52	1.42	1.35	1.08	1.08	1.26	2.66	1.33	3.27	1.28	1.91	2.17	1.93
selenium	0.050	mg/kg	0.228	<0.050	<0.050	0.112	0.184	<0.050	<0.050	<0.050	0.208	0.362	<0.050	<0.050	0.133	0.073	<0.050	0.053	0.235	0.311	0.273	0.063	0.098	0.816	0.395
selenium	0.010	mg/kg wwt	0.054	0.015	0.014	0.046	0.076	0.022	0.022	0.013	0.081	0.134	<0.010	<0.010	0.053	0.028	0.016	0.02	0.1	0.116	0.103	0.024	0.039	0.305	0.154
silver	0.0050	mg/kg	0.0069	0.0305	0.0374	0.0055	0.0054	0.0097	0.0082	0.0247	<0.0050	0.0069	0.041	0.0479	0.0237	0.0148	0.007	0.0062	0.0058	0.027	0.0071	0.0086	0.0062	<0.0050	0.0052
silver	0.0010	mg/kg wwt	0.0016	0.0131	0.0156	0.0023	0.0022	0.0045	0.0038	0.0102	0.0013	0.0025	0.015	0.0173	0.0095	0.0057	0.0028	0.0023	0.0024	0.0101	0.0027	0.0034	0.0025	0.0014	0.002
sodium	20	mg/kg	107	21	<20	40	<20	<20	<20	<20	56	33	32	27	45	49	168	64	52	35	22	36	24	<20	36
sodium	4.0	mg/kg wwt	25.2	9	4.5	16.5	5.8	8.7	7.9	4.4	21.6	12.3	11.6	9.9	18.2	18.7	65.8	23.8	22.1	13.2	8.3	14.1	9.3	7.1	14.2
strontium	0.050	mg/kg	335	24.4	18.6	324	347	44.5	38	34.2	141	616	8.79	8.13	360	235	92.1	138	434	35.6	159	49.4	121	469	114
strontium	0.010	mg/kg wwt	78.6	10.5	7.78	135	144	20.7	17.6	14.1	55	228	3.22	2.93	145	89.9	36.1	51.6	184	13.4	59.7	19.2	47.9	175	44.4
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0068	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0042	<0.0040	<0.0040	<0.0040	<0.0040	0.0041	<0.0040
thallium	0.0020	mg/kg	<0.0020	0.0031	<0.0020	<0.0020	<0.0020	0.0093	0.0078	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.004	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	0.0037	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00133	0.00048	<0.00040	<0.00040	0.00432	0.0036	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00163	0.00082	0.00054	0.00055	<0.00040	0.00042	0.00099	<0.00040	0.00146	<0.00040	<0.00040
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.086	<0.020	0.031	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0058	0.0031	0.0023	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	0.0039	<0.0020	0.0033	0.0027	0.0053	0.0026	0.0152	0.0111	<0.0020	<0.0020	0.0032	<0.0020	<0.0020	<0.0020	0.0029
uranium	0.00040	mg/kg wwt	0.00137	0.00133	0.00096	0.00054	<0.00040	0.0008	0.00096	0.00075	0.00152	0.0005	0.0012	0.00099	0.00211	0.001	0.00594	0.00414	0.0006	0.0005	0.00119	0.00059	0.00058	0.00044	0.00113
vanadium	0.10	mg/kg	0.49	0.34	0.24	0.15	0.12	0.3	0.31	0.14	0.56	0.15	0.56	0.42	0.73	0.31	2.91	1.99	0.1	0.14	0.28	0.22	0.15	<0.10	0.47
vanadium	0.020	mg/kg wwt	0.114	0.148	0.101	0.061	0.048	0.142	0.146	0.056	0.218	0.056	0.205	0.153	0.293	0.118	1.14	0.745	0.045	0.052	0.107	0.085	0.058	0.021	0.182
zinc	0.50	mg/kg	18.1	66.2	52.7	72.5	96.1	23.4	21	40.4	11.6	69.4	60.2	49.7	261	129	23.3	21.9	143	44.9	18.9	44.4	20.6	82.1	202
zinc	0.10	mg/kg wwt	4.26	28.6	22	30.2	39.8	10.9	9.75	16.6	4.52	25.7	22	17.9	105	49.3	9.13	8.2	60.7	16.8	7.12	17.3	8.13	30.7	78.7
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.05	<0.040	0.069	<0.040	0.043	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-A4-L-02	22-A5-L-01
Date Sampled			16-Sep-2022	16-Sep-2022
Time Sampled			08:15	09:00
ALS Sample ID	Lowest Detection Limit	Units	VA22C2369-108	VA22C2369-112
QAQC				
Analyte			Tissue	Tissue
Physical Tests				
moisture	0.50	%	61.3	64.6
Metals				
aluminum	2.0	mg/kg	19.8	48.3
aluminum	0.40	mg/kg wwt	7.65	17.1
antimony	0.010	mg/kg	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	0.0022
arsenic	0.020	mg/kg	0.054	0.036
arsenic	0.0040	mg/kg wwt	0.0207	0.0127
barium	0.050	mg/kg	25.8	1.93
barium	0.010	mg/kg wwt	9.97	0.681
beryllium	0.010	mg/kg	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020
boron	1.0	mg/kg	37.9	9.6
boron	0.20	mg/kg wwt	14.7	3.38
cadmium	0.0050	mg/kg	0.59	0.0777
cadmium	0.0010	mg/kg wwt	0.228	0.0275
calcium	20	mg/kg	23300	2810
calcium	4.0	mg/kg wwt	9020	993
cesium	0.0050	mg/kg	0.0516	0.0353
cesium	0.0010	mg/kg wwt	0.02	0.0125
chromium	0.050	mg/kg	<0.050	0.074
chromium	0.010	mg/kg wwt	0.018	0.026
cobalt	0.020	mg/kg	0.361	0.101
cobalt	0.0040	mg/kg wwt	0.139	0.0356
copper	0.10	mg/kg	8.18	6.37
copper	0.020	mg/kg wwt	3.16	2.25
iron	3.0	mg/kg	65.7	100
iron	0.60	mg/kg wwt	25.4	35.4
lead	0.020	mg/kg	0.043	0.033
lead	0.0040	mg/kg wwt	0.0166	0.0116
lithium	0.50	mg/kg	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10
magnesium	2.0	mg/kg	2260	867
magnesium	0.40	mg/kg wwt	874	307
manganese	0.050	mg/kg	59.8	76.1
manganese	0.010	mg/kg wwt	23.1	26.9
mercury	0.0050	mg/kg	0.0077	<0.0050
mercury	0.0010	mg/kg wwt	0.003	0.0012
molybdenum	0.020	mg/kg	1.8	4.01
molybdenum	0.0040	mg/kg wwt	0.698	1.42
nickel	0.20	mg/kg	0.25	0.66
nickel	0.040	mg/kg wwt	0.098	0.235
phosphorus	10	mg/kg	2730	1090
phosphorus	2.0	mg/kg wwt	1060	387
potassium	20	mg/kg	8060	4500
potassium	4.0	mg/kg wwt	3120	1590
rubidium	0.050	mg/kg	5.18	4.36
rubidium	0.010	mg/kg wwt	2	1.54
selenium	0.050	mg/kg	1.29	0.062
selenium	0.010	mg/kg wwt	0.497	0.022
silver	0.0050	mg/kg	0.0056	0.0149
silver	0.0010	mg/kg wwt	0.0022	0.0053
sodium	20	mg/kg	41	<20
sodium	4.0	mg/kg wwt	15.8	6.1
strontium	0.050	mg/kg	119	5.06
strontium	0.010	mg/kg wwt	46	1.79
tellurium	0.020	mg/kg	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040
tin	0.10	mg/kg	0.1	<0.10
tin	0.020	mg/kg wwt	0.039	<0.020
uranium	0.0020	mg/kg	<0.0020	0.0021
uranium	0.00040	mg/kg wwt	0.0005	0.00074
vanadium	0.10	mg/kg	0.1	0.29
vanadium	0.020	mg/kg wwt	0.04	0.104
zinc	0.50	mg/kg	149	64.2
zinc	0.10	mg/kg wwt	57.7	22.7
zirconium	0.20	mg/kg	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-4:
Forb Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R1-F-01	22-R2-F-01	22-R3-F-01	22-R3-F-01D	22-R4-F-03	22-R5-F-01	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-S1-F-01	22-S2-F-01	22-S3-F-01	22-S4-F-01	22-S5-F-01	22-S6-F-01	22-S8-F-01	22-S10-F-01	22-S11-F-01	22-S12-F-01	22-S13-F-01	22-S13-F-01D	22-S14-F-01	22-S15-F-01	22-S15-F-01D	22-S16-F-01	22-S17-F-01	22-A4-F-01	22-A5-F-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	16-Sep-2022	16-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled			11:00	08:50	10:00	10:00	13:45	14:45	14:45	15:40	15:40	12:30	11:30	15:30	10:00	09:10	08:10	14:15	11:00	12:40	13:10	14:40	14:40	14:00	10:00	10:00	17:00	16:15	08:15	08:00
ALS Sample ID			VA22C2369-030	VA22C2369-017	VA22C2369-026	VA22C2369-027	VA22C2369-096	VA22C2369-100	VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-091	VA22C2369-086	VA22C2369-014	VA22C2369-080	VA22C2369-076	VA22C2369-060	VA22C2369-010	VA22C2369-131	VA22C2369-036	VA22C2369-040	VA22C2369-050	VA22C2369-065	VA22C2369-042	VA22C2369-121	VA22C2369-126	VA22C2369-056	VA22C2369-071	VA22C2369-110	VA22C2369-116
QAQC	Lowest Detection Limit	Units			FDA	FD																FDA	FD		FDA	FD			
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																													
moisture	0.50	%	73.2	83.9	66.9	66.9	83.7	70	74.9	73	86.9	71.7	60.9	70.2	72	67.7	70.2	81	80.5	72	59.8	70.3	69.2	69	77.3	77.1	69.9	69	76.7	80.5
Metals																													
aluminum	2.0	mg/kg	482	147	124	176	249	86.3	62.2	376	176	134	79.2	150	42	73	33.6	51.3	26.6	33.1	35.8	101	71.7	33.3	58.4	36.1	61.7	32	73.7	40.4
aluminum	0.40	mg/kg wwt	129	23.7	41.2	58.3	40.6	25.9	15.6	102	23	37.8	31	44.6	11.8	23.6	10	9.76	5.18	9.26	14.4	30	22	10.3	13.2	8.27	18.6	9.93	17.2	7.89
antimony	0.010	mg/kg	0.01	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	0.0027	<0.0020	<0.0020	<0.0020	0.002	0.0026	<0.0020	0.0024	<0.0020	0.0028	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0022	<0.0020
arsenic	0.020	mg/kg	0.093	0.115	0.053	0.038	0.151	0.069	0.041	0.095	0.144	0.102	0.083	0.149	0.052	0.056	0.034	0.066	0.031	0.037	0.026	0.076	0.057	0.033	0.056	0.046	0.054	0.032	0.081	0.034
arsenic	0.0040	mg/kg wwt	0.0248	0.0185	0.0174	0.0125	0.0246	0.0208	0.0102	0.0257	0.0188	0.0289	0.0326	0.0444	0.0146	0.0182	0.0101	0.0125	0.006	0.0104	0.0104	0.0225	0.0176	0.0102	0.0128	0.0105	0.0162	0.0098	0.0188	0.0066
barium	0.050	mg/kg	102	16.6	97.6	166	168	37.6	124	14.3	161	408	4.42	4.25	11.5	23.4	29.7	24.5	5.04	9.61	16.9	11.1	12.8	13	22.5	29.1	12.3	9.72	33.1	6.02
barium	0.010	mg/kg wwt	27.2	2.67	32.2	54.8	6.12	37.1	3.59	43.4	53.3	1.25	1.66	3.43	6.56	9.61	7.32	0.959	3.92	2.69	6.81	3.3	3.95	4.04	5.1	6.65	3.7	3.02	7.73	1.18
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	54.9	13.7	11.2	11.7	25.8	37.4	34.9	38.1	21.7	21.9	11.8	36.7	19.6	14.5	13.3	33.2	20.9	16.4	13.5	18.5	15.5	14	26.8	31.5	19.8	20.8	13.6	18.5
boron	0.20	mg/kg wwt	14.7	2.21	3.7	3.88	4.21	11.2	8.76	10.3	2.83	6.2	4.64	10.9	5.48	4.68	3.98	6.31	4.08	4.59	5.45	5.48	4.76	4.36	6.09	7.21	5.95	6.44	3.17	3.62
cadmium	0.0050	mg/kg	0.0638	0.0605	0.0488	0.0819	0.944	2.29	0.866	0.0385	0.797	0.232	0.572	0.16	<0.0125	<0.0100	0.0122	0.458	<0.0050	<0.0200	<0.0100	<0.0150	<0.0225	<0.0200	0.0198	0.0162	<0.0150	<0.0200	0.0186	0.102
cadmium	0.0010	mg/kg wwt	0.017	0.0097	0.0161	0.0271	0.154	0.686	0.217	0.0104	0.104	0.0655	0.224	0.0476	<0.0035	<0.0030	0.0036	0.0872	<0.0010	<0.0050	<0.0030	<0.0050	<0.0065	<0.0060	0.0045	0.0037	<0.0040	<0.0060	0.0043	0.02
calcium	20	mg/kg	28100	5790	5480	8320	17600	13100	7260	27600	21600	7120	8430	14800	25400	21900	18000	8940	15400	18900	30000	15600	11900	13700	17700	21200	19800	15600	19800	11900
calcium	4.0	mg/kg wwt	7530	932	1810	2750	2860	3930	1820	7450	2830	2010	3300	4410	7110	7100	5370	1700	3000	5290	12000	4640	3660	4270	4010	4860	5950	4830	4630	2330
cesium	0.0050	mg/kg	0.0285	0.041	0.0863	0.0655	0.0872	0.0837	0.033	0.164	0.0747	0.693	0.529	0.208	0.822	0.278	0.554	0.53	0.153	1.01	0.24	0.55	0.331	1.39	0.519	0.475	0.618	1.04	1.69	0.251
cesium	0.0010	mg/kg wwt	0.0076	0.0066	0.0285	0.0217	0.0142	0.0251	0.0083	0.0443	0.0098	0.196	0.207	0.062	0.23	0.0898	0.165	0.101	0.0299	0.283	0.0967	0.163	0.102	0.432	0.118	0.109	0.186	0.323	0.394	0.0491
chromium	0.050	mg/kg	0.37	0.235	0.113	0.115	0.782	0.198	0.145	0.267	0.328	0.252	0.114	0.158	0.118	0.092	0.13	0.139	0.07	0.134	0.13	0.385	1.51	0.179	0.136	0.086	0.228	0.077	0.12	0.125
chromium	0.010	mg/kg wwt	0.099	0.038	0.037	0.038	0.127	0.059	0.036	0.072	0.043	0.071	0.044	0.047	0.033	0.03	0.039	0.026	0.014	0.037	0.052	0.114	0.464	0.056	0.031	0.02	0.068	0.024	0.028	0.024
cobalt	0.020	mg/kg	0.094	0.124	0.09	0.308	0.398	0.202	0.077	0.104	0.126	0.141	0.077	0.164	0.226	0.257	0.153	0.083	0.18	0.416	0.236	0.585	0.367	0.34	0.188	0.161	0.257	0.298	0.456	0.06
cobalt	0.0040	mg/kg wwt	0.0252	0.0199	0.0297	0.102	0.0648	0.0605	0.0193	0.0281	0.0165	0.0398	0.03	0.0489	0.0633	0.0831	0.0455	0.0157	0.0351	0.116	0.0951	0.173	0.113	0.105	0.0428	0.0368	0.0773	0.0924	0.106	0.0118
copper	0.10	mg/kg	7.68	12.9	4.61	4.86	21.4	12.4	20.8	8.15	10.9	18.1	12.2	23.2	17.7	21.3	12.8	18	17.4	15	13.4	14.1	13.1	10.6	18.8	17.2	16.1	12	17.1	20.6
copper	0.020	mg/kg wwt	2.06	2.07	1.52	1.61	3.48	3.73	5.23	2.2	1.43	5.12	4.78	6.89	4.95	6.9	3.81	3.43	3.39	4.19	5.37	4.19	4.04	3.29	4.27	3.95	4.84	3.73	3.99	4.03
iron	3.0	mg/kg	219	315	56.9	69.3	361	166	147	266	329	207	138	196	114	146	108	129	112	118	117	248	180	106	170	129	143	106	214	124
iron	0.60	mg/kg wwt	58.7	50.7	18.8	22.9	58.8	49.7	36.8	71.9	43	58.4	54	58.5	32	47.2	32.2	24.6	21.8	32.9	46.9	73.6	55.3	32.8	38.6	29.6	43.1	32.8	49.9	24.3
lead	0.020	mg/kg	0.076	0.096	0.023	0.029	0.102	0.05	0.031	0.118	0.099	0.046	0.025	0.067	0.029	0.032	0.024	0.032	0.064	0.022	0.02	0.046	0.039	0.023	0.092	0.051	0.039	0.024	0.061	0.089
lead	0.0040	mg/kg wwt	0.0203	0.0155	0.0076	0.0096	0.0166	0.0152	0.0078	0.0318	0.0129	0.013	0.0099	0.02	0.0081	0.0103	0.0073	0.0061	0.0126	0.0063	0.0082	0.0136	0.0119	0.0071	0.0209	0.0117	0.0116	0.0074	0.0142	0.0174
lithium	0.50	mg/kg	0.56	0.58	<0.50	<0.50	0.61	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.52	<0.50	<0.50	0.6	<0.50	<0.50	<0.50	<0.50	0.71	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.96
lithium	0.10	mg/kg wwt	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.11	0.22	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	0.19
magnesium	2.0	mg/kg	5850	1410	1890	2580	3740	1740	1770	4830	2340	2790	2740	2400	3590	4050	2710	3000	2840	4240	5600	3780	2930	2860	3280	4030	2990	4320	2410	2800
magnesium	0.40	mg/kg wwt	1570	226	626	852	609	524	443	1310	306	731	1070	714	1000	1310	809	570	554	1180	2250	1120	900	886	745	922	901	1340	562	547
manganese	0.050	mg/kg	105	42.3	67.8	96.4	126	159	72.3	94.5	131	64.3	49.8	106	102	56	70.1	57	43.8	105	75.7	96.6	63.4	72.5	60.7	76.2	62.5	99.3	164	26.4
manganese	0.010	mg/kg wwt	28	6.81	22.4	31.9	20.5	47.7	18.1	25.5	17.1	18.2	19.5	31.5	28.5	18.1	20.9	10.8	8.54	29.3	30.4	28.6	19.5	22.5	13.8	17.4	18.8	30.8	38.2	5.15
mercury	0.0050	mg/kg	0.01	0.0253	0.0175	0.0233	0.0252	0.0053	<0.0050	0.0121	0.0226	<0.0050	<0.0050	0.0069	0.0056	0.0071	0.0056	<0.0050	0.0051	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	0.0053	0.0054	0.006	0.0059	<0.0050
mercury	0.0010	mg/kg wwt	0.0027	0.0041	0.0058	0.0077	0.0041	0.0016	0.0012	0.0033	0.0029	<0.0010	<0.0012	0.002	0.0016	0.0023	0.0017	<0.0010	<0.0010	<0.0012	0.0025	0.0012	<0.0022	<0.0012	0.001	0.0012	<0.0022	0.0018	0.0014	<0.0010
molybdenum	0.020	mg/kg	0.25	0.234	0.119	0.094	1.95	2.26	3.46	1.1	0.428	4.15	1.23	1.97	15.9	10.5	4.4	4.9	1.43	36.5	12.7	38	37.3	31.5	7.99	8.42	20.1	27.4	10.6	1.63
molybdenum	0.0040	mg/kg wwt	0.0671	0.0377	0.0393	0.0312	0.317	0.678	0.866	0.296	0.0559	1.17	0.482	0.586	4.45	3.4	1.31	0.932	0.279	10.2	5.11	11.3	11.5	9.76	1.81	1.93	6.05	8.5	2.47	0.319
nickel	0.20	mg/kg	0.44	0.33	0.52	0.83	0.49	1.42	1.94	0.34	1.4	0.32	0.72	0.86	0.35	0.33	0.76	0.54	0.42	0.35	0.22	0.74	0.58	0.54	1.07	1.42	0.26	0.69	0.46	0.48
nickel	0.040	mg/kg wwt	0.117	0.054	0.171	0.275	0.08	0.427	0.486	0.091	0.183	0.091	0.282	0.255	0.098	0.107	0.226	0.104	0.082	0.098	0.089	0.22	0.18	0.167	0.243	0.326	0.107	0.215	0.107	0.094
phosphorus	10	mg/kg	4050	3040	1920	2380	5700	3530	3720	2980	4620	5950	4050	5840	2050	2300	1500	6300	2730	2260	2280	2830	3380	2100	1940	2090	1290	1830	2930	6000
phosphorus	2.0	mg/kg wwt	1090	489	636	786	927	1060	933	804	604	1680	1580	1740	575	744	448	1200	533	632	919	838	1040	651	439	479	388	568	683	1170
potassium	20	mg/kg	13600	12800	14200	14900	37700	22600	29800	13400	35300	27800	17600	24200	18900	13000	17300	51600	27700	18100	11000	23100	24800	16800	20200	23600	18600	15600	17900	21900
potassium	4.0	mg/kg wwt	3640	2070	4700	4920	6140	6780	7470	3610	4610	7850	6890	7210	5300	4210	5170	9810	5410	5060	4430	6860	7620	5220	4580	5400	5610	4850	4180	4270
rubidium	0.050	mg/kg	8.73	10.6	16.6	15	33.1	18.5	12.2	13.3	28.8	20.4	17	20.9	24.9	15.3	22.7	47.4	17	32.4	13.9	38.7	36.3	25.6	20	20.8	24.8	27.1	31.3	24.5
rubidium	0.010	mg/kg wwt	2.34	1.71	5.49	4.98	5.39	5.56	3.06	3.6	3.76	9.45	6.64	6.21	6.96	4.95	6.78	9.03	3.36	9.07	5.58	11.5	11.2	7.95	4.54	4.77	7.47	8.4	7.3	4.79
selenium	0.050	mg/kg	<0.050	<0.050	<0.050	0.075	<0.050	<0.050	<0.050	<0.050	<0.050	0.275	0.183	0.261	1.1	0.576	0.071	10.3	<0.050	0.345	<0.050	0.105	0.099	0.166	<0.050	<0.050	0.181	0.124	0.881	0.367
selenium	0.010	mg/kg wwt	<0.010	<0.010	0.012	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	0.078	0.072	0.078	0.307	0.186	0.021	1.96	<0.010	0.097	0.019	0.031	0.03	0.051	<0.010	<0.010	0.054	0.039	0.206	0.072
silver	0.0050	mg/kg	0.0779	0.0078	<0.0050	0.005	0.0286	<0.0050	<0.0050	<0.0050	0.017	<0.0050	<0.0050	<0.0050	<0.0050	0.0104	0.0084	<0.0050	0.0119	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	0.0154	0.0125	0.0096	<0.0050	<0.0050	0.0074
silver	0.0010	mg/kg wwt	0.0209	0.0013	0.0013	0.0016	0.0046	<0.0010	<0.0010	0.0011	0.0022	<0.0010	<0.0010	0.0012	0.0011	0.0034	0.0025	<0.0010	0.0023	0.0011	0.0025	<0.0010	<0.0010	<0.0010	0.0035	0.0029	0.0029	<0.0010	<0.0010	0.0014
sodium	20	mg/kg	161	164	27	32	212	77	94	52	133	73	55	61	170	72	36	176	133	50	40	116	105	121	115	52	79	119	57	332
sodium	4.0	mg/kg wwt	43.1	26.4	8.9	10.4	34.5	23.1	23.7	14	17.4	20.8	21.4	18.2	47.7	23.5	10.8	33.5	25.9	14	16.1	34.4	32.3	37.6	26.1	11.8	23.9	37	13.2	64.9
strontium	0.050	mg/kg	199	24.4	32.3	61.6	59.6	50.3	14.4	218	188	16.3	26.9	38.1	73.8	84.1	71.3	18.2	56.5	469	206	330	290	404	247	233	557	409	118	35.6
strontium	0.010	mg/kg wwt	53.4	3.94	10.7	20.4	9.7	15.1	3.61	58.9	24.6	4.6	10.5	11.3	20.7	27.2	21.3	3.47	11	131	83	98	89.3	125	56.1	53.3	168	127	27.5	6.96
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0046	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	0.0056	0.0058	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0152
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	0.00187	0.00193	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00064	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00063	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00298
tin	0.10	mg/kg	0.62	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	0.26	0.36	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	0.166	0.034	<0.020	<0.020	<0.020	<0.020	<0.020	0.07	0.047	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0044	0.0057	<0.0020	<0.0020	0.0058	0.0028	0.0024	0.0048	0.0063	0.003	<0.0020	0.0033	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0021	<0.0020	0.0029	<0.0020	0.0032	<0.0020	0.0025	<0.0020
uranium	0.00040	mg/kg wwt	0.00119	0.00092	<0.00040	0.0004	0.00094	0.00083	0.00059	0.00131	0.00082	0.00086	0.00071	0.00098	0.00043	0.00077	<0.00040	<0.00040	<0.00040	0.00042	0.00074	0.001	0.00066	0.00046	0.00066	<0.00040	0.00096	0.00044	0.00059	<0.00040
vanadium	0.10	mg/kg	0.68	1.01	0.14	0.17	1.2	0.45	0.37	0.9	1.07	0.53	0.33	0.59	0.21	0.33	0.22	0.27	0.17	0.17	0.13	0.52	0.36	0.18	0.44	0.24	0.32	0.18	0.39	0.23
vanadium	0.020	mg/kg wwt	0.183	0.163	0.047	0.057	0.196	0.134	0.093	0.244	0.14	0.149	0.131	0.175	0.059	0.106	0.065	0.052	0.033	0.047	0.051	0.154	0.111	0.056	0.099	0.055	0.096	0.057	0.091	0.044
zinc	0.50	mg/kg	21.3	32.6	17.4	34.6	56.2	72.4	44.3	17.5	13	59.3	52	57.4	30.9	28.1	26.6	61.2	29.5	27.2	24.2	35.6	34.8	26.6	31.6	35.6	18.9	37	54.5	80.1
zinc	0.10	mg/kg wwt	5.72	5.25	5.74	11.4	9.16	21.7	11.1	4.74	1.7	16.8	20.3	17.1	8.65	9.09	7.94	11.6	5.76	7.6	9.72	10.6	10.7	8.26	7.17	8.16	5.68	11.5	12.7	15.6
zirconium	0.20	mg/kg	<0.70	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.170	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.057	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-5:
Berry Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID Date Sampled Time Sampled ALS Sample ID QAQC Analyte	Lowest Detection Limit	Units	22-R6-B-01 16-Sep-2022 15:40 VA22C2369-106 Tissue	22-S4-B-01 15-Sep-2022 10:00 VA22C2369-081 Tissue	22-S5-B-01 15-Sep-2022 09:10 VA22C2369-073 Tissue
Physical Tests					
moisture	0.50	%	60.5	27.6	61.1
Metals					
aluminum	2.0	mg/kg	28.8	81.6	95.9
aluminum	0.40	mg/kg wwt	11.4	59.1	37.3
antimony	0.010	mg/kg	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.047	0.071	0.079
arsenic	0.0040	mg/kg wwt	0.0186	0.0516	0.0308
barium	0.050	mg/kg	80.2	9.45	9.23
barium	0.010	mg/kg wwt	31.7	6.84	3.59
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	7	26	23.2
boron	0.20	mg/kg wwt	2.76	18.8	9
cadmium	0.0050	mg/kg	0.466	0.019	0.018
cadmium	0.0010	mg/kg wwt	0.184	0.0137	0.007
calcium	20	mg/kg	2030	7050	7660
calcium	4.0	mg/kg wwt	802	5110	2980
cesium	0.0050	mg/kg	0.0187	0.0881	0.111
cesium	0.0010	mg/kg wwt	0.0074	0.0638	0.0433
chromium	0.050	mg/kg	0.051	0.105	0.097
chromium	0.010	mg/kg wwt	0.02	0.076	0.038
cobalt	0.020	mg/kg	0.023	0.087	0.116
cobalt	0.0040	mg/kg wwt	0.0091	0.063	0.0452
copper	0.10	mg/kg	2.99	8.87	9.59
copper	0.020	mg/kg wwt	1.18	6.42	3.73
iron	3.0	mg/kg	51.8	130	154
iron	0.60	mg/kg wwt	20.4	94.1	60
lead	0.020	mg/kg	<0.020	0.027	0.03
lead	0.0040	mg/kg wwt	<0.0040	0.0196	0.0118
lithium	0.50	mg/kg	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	500	2250	2410
magnesium	0.40	mg/kg wwt	198	1630	938
manganese	0.050	mg/kg	12.2	26.8	41.6
manganese	0.010	mg/kg wwt	4.84	19.4	16.2
mercury	0.0050	mg/kg	0.0065	<0.0050	<0.0050
mercury	0.0010	mg/kg wwt	0.0026	0.0023	0.0013
molybdenum	0.020	mg/kg	0.678	1.45	1.72
molybdenum	0.0040	mg/kg wwt	0.268	1.05	0.668
nickel	0.20	mg/kg	0.54	0.5	0.43
nickel	0.040	mg/kg wwt	0.212	0.362	0.167
phosphorus	10	mg/kg	1940	3040	3270
phosphorus	2.0	mg/kg wwt	764	2200	1270
potassium	20	mg/kg	11900	8130	12300
potassium	4.0	mg/kg wwt	4700	5890	4790
rubidium	0.050	mg/kg	15.4	10.6	12.6
rubidium	0.010	mg/kg wwt	6.09	7.65	4.88
selenium	0.050	mg/kg	<0.050	0.326	0.273
selenium	0.010	mg/kg wwt	<0.010	0.236	0.106
silver	0.0050	mg/kg	0.0239	<0.0050	<0.0050
silver	0.0010	mg/kg wwt	0.0094	0.002	0.0011
sodium	20	mg/kg	<20	26	22
sodium	4.0	mg/kg wwt	6.5	18.6	8.7
strontium	0.050	mg/kg	20.5	26.9	30.4
strontium	0.010	mg/kg wwt	8.1	19.5	11.8
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	1.5	0.54	1.17
tin	0.020	mg/kg wwt	0.592	0.392	0.456
uranium	0.0020	mg/kg	<0.0020	0.0021	0.0023
uranium	0.00040	mg/kg wwt	<0.00040	0.00155	0.0009
vanadium	0.10	mg/kg	0.14	0.34	0.41
vanadium	0.020	mg/kg wwt	0.057	0.243	0.158
zinc	0.50	mg/kg	5.95	24.2	22.6
zinc	0.10	mg/kg wwt	2.35	17.5	8.8
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	0.045	<0.040

Notes:
FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-L-01	22-R3-L-01D				22-R3-L-02	22-R3-L-02D				22-R3-L-03	22-R3-L-03D				22-R3-F-01	22-R3-F-01D				22-S13-L-01	22-S13-L-01D				22-S13-L-02	22-S13-L-02D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-020	VA22C2369-021				VA22C2369-022	VA22C2369-023				VA22C2369-024	VA22C2369-025				VA22C2369-026	VA22C2369-027				VA22C2369-047	VA22C2369-062				VA22C2369-048	VA22C2369-063			
QAQC			FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue			
Physical Tests																																
moisture	0.5	%	60.7	59	59.85	3	NC	62.5	63.9	63.2	2	NC	65.7	63.3	64.5	4	NC	66.9	66.9	66.9	0	NC	56.9	58.2	57.55	2	NC	58.4	58.6	58.5	0	NC
Metals																																
aluminum	2	mg/kg	146	198	172	30	NC	65.8	48.4	57.1	30	NC	510	372	441	31	NC	124	176	150	35	NC	77.3	45.8	61.55	**51**	NC	36.9	27.3	32.1	30	NC
aluminum	0.4	mg/kg wwt	57.2	81	69.1	34	NC	24.7	17.4	21.05	35	NC	175	136	155.5	25	NC	41.2	58.3	49.75	34	NC	33.4	19.1	26.25	**54**	NC	15.3	11.3	13.3	30	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
antimony	0.002	mg/kg wwt	0.0027	<0.0020	0.00235	NC	0.35	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0026	<0.0020	0.0023	NC	0.3	<0.0020	0.0036	0.0028	NC	0.8
arsenic	0.02	mg/kg	0.028	0.037	0.0325	NC	0.45	0.027	0.028	0.0275	NC	0.05	0.025	0.055	0.04	NC	1.5	0.053	0.038	0.0455	NC	0.75	0.038	0.032	0.035	NC	0.3	0.061	0.056	0.0585	NC	0.25
arsenic	0.004	mg/kg wwt	0.0109	0.0152	0.01305	NC	1.075	0.0101	0.0101	0.0101	NC	0	0.0085	0.0203	0.0144	**82**	NC	0.0174	0.0125	0.01495	NC	1.225	0.0163	0.0134	0.01485	NC	0.725	0.0253	0.0233	0.0243	8	NC
barium	0.05	mg/kg	84	93.4	88.7	11	NC	39.3	46.8	43.05	17	NC	1.43	3.76	2.595	**90**	NC	97.6	166	131.8	**52**	NC	2.41	1.85	2.13	26	NC	5.98	5.56	5.77	7	NC
barium	0.01	mg/kg wwt	33	38.3	35.65	15	NC	14.7	16.9	15.8	14	NC	0.491	1.38	0.9355	**95**	NC	32.2	54.8	43.5	**52**	NC	1.04	0.775	0.9075	29	NC	2.49	2.3	2.395	8	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
beryllium	0.002	mg/kg wwt	<0.0020	0.0022	0.0021	NC	0.1	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
boron	1	mg/kg	14.7	11.3	13	26	NC	16.3	20.9	18.6	25	NC	22	21.2	21.6	4	NC	11.2	11.7	11.45	4	NC	8.6	7.9	8.25	8	NC	39.5	36.6	38.05	8	NC
boron	0.2	mg/kg wwt	5.78	4.64	5.21	22	NC	6.12	7.53	6.825	21	NC	7.54	7.81	7.675	4	NC	3.7	3.88	3.79	5	NC	3.71	3.29	3.5	12	NC	16.4	15.2	15.8	8	NC
cadmium	0.005	mg/kg	0.0991	0.0747	0.0869	28	NC	0.146	0.207	0.1765	35	NC	0.204	0.373	0.2885	**59**	NC	0.0488	0.0819	0.06535	**51**	NC	0.0821	0.0482	0.06515	**52**	NC	0.648	0.984	0.816	41	NC
cadmium	0.001	mg/kg wwt	0.0389	0.0306	0.03475	24	NC	0.0549	0.0747	0.0648	31	NC	0.07	0.137	0.1035	**65**	NC	0.0161	0.0271	0.0216	**51**	NC	0.0354	0.0202	0.0278	**55**	NC	0.27	0.408	0.339	41	NC
calcium	20	mg/kg	6750	7860	7305	15	NC	7250	7300	7275	1	NC	2980	3350	3165	12	NC	5480	8320	6900	41	NC	3000	2440	2720	21	NC	10300	11100	10700	7	NC
calcium	4	mg/kg wwt	2650	3220	2935	19	NC	2720	2630	2675	3	NC	1020	1230	1125	19	NC	1810	2750	2280	41	NC	1290	1020	1155	23	NC	4310	4580	4445	6	NC
cesium	0.005	mg/kg	0.102	0.0914	0.0967	11	NC	0.0233	0.0305	0.0269	27	NC	0.153	0.0727	0.11285	**71**	NC	0.0863	0.0655	0.0759	27	NC	0.0175	0.0193	0.0184	NC	0.36	0.046	0.0628	0.0544	31	NC
cesium	0.001	mg/kg wwt	0.0399	0.0374	0.03865	6	NC	0.0087	0.011	0.00985	23	NC	0.0525	0.0267	0.0396	**65**	NC	0.0285	0.0217	0.0251	27	NC	0.0075	0.008	0.00775	6	NC	0.0191	0.026	0.02255	31	NC
chromium	0.05	mg/kg	0.078	0.138	0.108	NC	1.2	0.111	0.081	0.096	NC	0.6	0.093	0.114	0.1035	NC	0.42	0.113	0.115	0.114	NC	0.04	0.339	0.109	0.224	**103**	NC	0.137	0.116	0.1265	NC	0.42
chromium	0.01	mg/kg wwt	0.03	0.057	0.0435	**62**	NC	0.042	0.029	0.0355	NC	1.3	0.032	0.042	0.037	NC	1	0.037	0.038	0.0375	NC	0.1	0.146	0.046	0.096	**104**	NC	0.057	0.048	0.0525	17	NC
cobalt	0.02	mg/kg	0.161	0.186	0.1735	14	NC	0.088	0.093	0.0905	NC	0.25	0.102	0.104	0.103	2	NC	0.09	0.308	0.199	**110**	NC	0.187	0.154	0.1705	19	NC	0.319	0.371	0.345	15	NC
cobalt	0.004	mg/kg wwt	0.0634	0.0762	0.0698	18	NC	0.0331	0.0334	0.03325	1	NC	0.0351	0.038	0.03655	8	NC	0.0297	0.102	0.06585	**110**	NC	0.0806	0.0645	0.07255	22	NC	0.133	0.154	0.1435	15	NC
copper	0.1	mg/kg	3.91	5.08	4.495	26	NC	4.43	4.92	4.675	10	NC	6.74	8.88	7.8	27	NC	4.61	4.86	4.735	5	NC	6	6.12	6.06	2	NC	6.53	5.64	6.085	15	NC
copper	0.02	mg/kg wwt	1.54	2.08	1.81	30	NC	1.66	1.78	1.72	7	NC	2.31	3.25	2.78	34	NC	1.52	1.61	1.565	6	NC	2.59	2.56	2.575	1	NC	2.72	2.34	2.53	15	NC
iron	3	mg/kg	80.2	119	99.6	39	NC	93.7	89	91.35	5	NC	84.3	152	118.15	**57**	NC	56.9	69.3	63.1	20	NC	112	97	104.5	14	NC	63.4	75.9	69.65	18	NC
iron	0.6	mg/kg wwt	31.5	48.6	40.05	43	NC	35.1	32.1	33.6	9	NC	28.9	55.8	42.35	**64**	NC	18.8	22.9	20.85	20	NC	48.5	40.6	44.55	18	NC	26.4	31.4	28.9	17	NC
lead	0.02	mg/kg	0.032	0.047	0.0395	NC	0.75	0.027	<0.020	0.0235	NC	0.35	0.02	0.054	0.037	NC	1.7	0.023	0.029	0.026	NC	0.3	0.027	0.025	0.026	NC	0.1	0.024	0.073	0.0485	NC	2.45
lead	0.004	mg/kg wwt	0.0125	0.0192	0.01585	NC	1.675	0.01	0.0072	0.0086	NC	0.7	0.0069	0.0197	0.0133	NC	3.2	0.0076	0.0096	0.0086	NC	0.5	0.0116	0.0105	0.01105	NC	0.275	0.01	0.0302	0.0201	**100**	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
lithium	0.1	mg/kg wwt	0.19	0.15	0.17	NC	0.4	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
magnesium	2	mg/kg	1490	1660	1575	11	NC	1180	1380	1280	16	NC	1550	1300	1425	18	NC	1890	2580	2235	31	NC	1530	1300	1415	16	NC	3020	3180	3100	5	NC
magnesium	0.4	mg/kg wwt	586	680	633	15	NC	443	499	471	12	NC	532	479	505.5	10	NC	626	852	739	31	NC	662	544	603	20	NC	1260	1320	1290	5	NC
manganese	0.05	mg/kg	663	564	613.5	16	NC	236	292	264	21	NC	1310	1280	1295	2	NC	67.8	96.4	82.1	35	NC	76.6	68.4	72.5	11	NC	31.6	37.9	34.75	18	NC
manganese	0.01	mg/kg wwt	260	231	245.5	12	NC	88.5	105	96.75	17	NC	451	470	460.5	4	NC	22.4	31.9	27.15	35	NC	33	28.6	30.8	14	NC	13.1	15.7	14.4	18	NC
mercury	0.005	mg/kg	0.0111	0.0172	0.01415	NC	1.22	0.0123	0.0089	0.0106	NC	0.68	0.0078	0.0114	0.0096	NC	0.72	0.0175	0.0233	0.0204	NC	1.16	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0
mercury	0.001	mg/kg wwt	0.0044	0.007	0.0057	46	NC	0.0046	0.0032	0.0039	NC	1.4	0.0027	0.0042	0.00345	NC	1.5	0.0058	0.0077	0.00675	28	NC	<0.0011	0.0014	0.00125	NC	0.3	0.0014	0.0012	0.0013	NC	0.2
molybdenum	0.02	mg/kg	0.077	0.098	0.0875	NC	1.05	1.04	1.16	1.1	11	NC	0.416	0.152	0.284	**93**	NC	0.119	0.094	0.1065	23	NC	1.63	2.35	1.99	36	NC	1.6	2.09	1.845	27	NC
molybdenum	0.004	mg/kg wwt	0.0303	0.0402	0.03525	28	NC	0.389	0.42	0.4045	8	NC	0.143	0.0557	0.09935	**88**	NC	0.0393	0.0312	0.03525	23	NC	0.704	0.984	0.844	33	NC	0.667	0.866	0.7665	26	NC
nickel	0.2	mg/kg	0.76	0.85	0.805	NC	0.45	2.92	3.8	3.36	26	NC	0.23	0.29	0.26	NC	0.3	0.52	0.83	0.675	NC	1.55	0.21	0.21	0.21	NC	0	<0.20	<0.20	0.2	NC	0
nickel	0.04	mg/kg wwt	0.3	0.348	0.324	15	NC	1.1	1.37	1.235	22	NC	0.078	0.105	0.0915	NC	0.675	0.171	0.275	0.223	47	NC	0.09	0.089	0.0895	NC	0.025	0.077	0.064	0.0705	NC	0.325
phosphorus	10	mg/kg	2070	1670	1870	21	NC	1550	1910	1730	21	NC	1880	1870	1875	1	NC	1920	2380	2150	21	NC	1100	973	1036.5	12	NC	1580	1640	1610	4	NC
phosphorus	2	mg/kg wwt	813	686	749.5	17	NC	582	688	635	17	NC	647	685	666	6	NC	636	786	711	21	NC	475	407	441	15	NC	656	679	667.5	3	NC
potassium	20	mg/kg	7020	5630	6325	22	NC	8830	11500	10165	26	NC	7460	7200	7330	4	NC	14200	14900	14550	5	NC	4400	3840	4120	14	NC	5380	7610	6495	34	NC
potassium	4	mg/kg wwt	2760	2300	2530	18	NC	3310	4160	3735	23	NC	2560	2640	2600	3	NC	4700	4920	4810	5	NC	1900	1600	1750	17	NC	2240	3150	2695	34	NC
rubidium	0.05	mg/kg	13.1	11.4	12.25	14	NC	6.14	9.02	7.58	38	NC	13.7	8.54	11.12	46	NC	16.6	15	15.8	10	NC	2.58	2.94	2.76	13	NC	5.39	5.33	5.36	1	NC
rubidium	0.01	mg/kg wwt	5.16	4.66	4.91	10	NC	2.3	3.25	2.775	34	NC	4.69	3.14	3.915	40	NC	5.49	4.98	5.235	10	NC	1.11	1.23	1.17	10	NC	2.24	2.21	2.225	1	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0	<0.050	0.075	0.0625	NC	0.5	<0.050	<0.050	0.05	NC	0	0.112	0.184	0.148	NC	1.44
selenium	0.01	mg/kg wwt	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.012	0.025	0.0185	NC	1.3	0.015	0.014	0.0145	NC	0.1	0.046	0.076	0.061	49	NC
silver	0.005	mg/kg	0.0087	0.0087	0.0087	NC	0	<0.0050	0.0051	0.00505	NC	0.02	0.0076	0.0117	0.00965	NC	0.82	<0.0050	0.005	0.005	NC	0	0.0305	0.0374	0.03395	20	NC	0.0055	0.0054	0.00545	NC	0.02
silver	0.001	mg/kg wwt	0.0034	0.0036	0.0035	NC	0.2	0.0014	0.0018	0.0016	NC	0.4	0.0026	0.0043	0.00345	NC	1.7	0.0013	0.0016	0.00145	NC	0.3	0.0131	0.0156	0.01435	17	NC	0.0023	0.0022	0.00225	NC	0.1
sodium	20	mg/kg	76	62	69	NC	0.7	<20	<20	20	NC	0	30	42	36	NC	0.6	27	32	29.5	NC	0.25	21	<20	20.5	NC	0.05	40	<20	30	NC	1
sodium	4	mg/kg wwt	29.9	25.4	27.65	16	NC	6.6	7	6.8	NC	0.1	10.3	15.6	12.95	NC	1.325	8.9	10.4	9.65	NC	0.375	9	4.5	6.75	NC	1.125	16.5	5.8	11.15	NC	2.675
strontium	0.05	mg/kg	38	48.9	43.45	25	NC	61.8	64.8	63.3	5	NC	3.31	6.35	4.83	**63**	NC	32.3	61.6	46.95	**62**	NC	24.4	18.6	21.5	27	NC	324	347	335.5	7	NC
strontium	0.01	mg/kg wwt	14.9	20	17.45	29	NC	23.2	23.4	23.3	1	NC	1.14	2.33	1.735	**69**	NC	10.7	20.4	15.55	**62**	NC	10.5	7.78	9.14	30	NC	135	144	139.5	6	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	0.0221	0.0271	0.0246	20	NC	<0.0020	<0.0020	0.002	NC	0	0.0021	0.0043	0.0032	NC	1.1	0.0056	0.0058	0.0057	NC	0.1	0.0031	<0.0020	0.00255	NC	0.55	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	0.00868	0.0111	0.00989	24	NC	<0.00040	<0.00040	0.0004	NC	0	0.00074	0.00158	0.00116	NC	2.1	0.00187	0.00193	0.0019	NC	0.15	0.00133	0.00048	0.000905	NC	2.125	<0.00040	<0.00040	0.0004	NC	0
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	0.028	0.024	NC	0.4	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
uranium	0.002	mg/kg	<0.0020	0.0023	0.002215	NC	0.15	<0.0020	<0.0020	0.002	NC	0	<0.0020	0.0028	0.0024	NC	0.4	<0.0020	<0.0020	0.002	NC	0	0.0031	0.0023	0.0027	NC	0.4	<0.0020	<0.0020	0.002	NC	0
uranium	0.0004	mg/kg wwt	0.00064	0.00095	0.000795	NC	0.775	0.00064	0.00055	0.000595	NC	0.225	<0.00040	0.00101	0.000705	NC	1.525	<0.00040	0.0004	0.0004	NC	0	0.00133	0.00096	0.001145	NC	0.925	0.00054	<0.00040	0.00047	NC	0.35
vanadium	0.1	mg/kg	0.22	0.38	0.3	NC	1.6	0.34	0.26	0.3	NC	0.8	0.17	0.43	0.3	NC	2.6	0.14	0.17	0.155	NC	0.3	0.34	0.24	0.29	NC	1	0.15	0.12	0.135	NC	0.3
vanadium	0.02	mg/kg wwt	0.088	0.155	0.1215	**55**	NC	0.128	0.092	0.11	33	NC	0.058	0.159	0.1085	**93**	NC	0.047	0.057	0.052	NC	0.5	0.148	0.101	0.1245	38	NC	0.061	0.048	0.0545	NC	0.65
zinc	0.5	mg/kg	32.8	33.9	33.35	3	NC	15.5	16.8	16.15	8	NC	9.46	11.2	10.33	17	NC	17.4	34.6	26	**66**	NC	66.2	52.7	59.45	23	NC	72.5	96.1	84.3	28	NC
zinc	0.1	mg/kg wwt	12.9	13.9	13.4	7	NC	5.83	6.06	5.945	4	NC	3.24	4.11	3.675	24	NC	5.74	11.4	8.57	**66**	NC	28.6	22	25.3	26	NC	30.2	39.8	35	27	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	0.059	<0.040	0.0495	NC	0.475	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S13-L-03	22-S13-L-03D				22-S13-F-01	22-S13-F-01D				22-S13-G-01	22-S13-G-01D				22-S15-L-01	22-S15-L-01D				22-S15-L-02	22-S15-L-02D				22-S15-L-03	22-S15-L-03D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-049	VA22C2369-064				VA22C2369-050	VA22C2369-065				VA22C2369-051	VA22C2369-066				VA22C2369-117	VA22C2369-122				VA22C2369-118	VA22C2369-123				VA22C2369-119	VA22C2369-124			
QAQC			FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue			
Physical Tests																																
moisture	0.5	%	53.4	53.7	53.55	1	NC	70.3	69.2	69.75	2	NC	35.9	38.4	37.15	7	NC	63.4	63.9	63.65	1	NC	59.9	61.7	60.8	3	NC	60.8	62.6	61.7	3	NC
Metals																																
aluminum	2	mg/kg	54.2	64.6	59.4	18	NC	101	71.7	86.35	34	NC	69.2	69.8	69.5	1	NC	93.8	79.8	86.8	16	NC	130	63.6	96.8	**69**	NC	369	294	331.5	23	NC
aluminum	0.4	mg/kg wwt	25.3	30	27.65	17	NC	30	22	26	31	NC	44.3	43	43.65	3	NC	34.4	28.8	31.6	18	NC	52	24.4	38.2	**72**	NC	144	110	127	27	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.02	0.014	0.017	NC	0.6
antimony	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0028	0.0025	0.00265	NC	0.15	<0.0020	<0.0020	0.002	NC	0	0.0033	<0.0020	0.00265	NC	0.65	0.0077	0.0051	0.0064	NC	1.3
arsenic	0.02	mg/kg	8.45	10.9	9.675	25	NC	0.076	0.057	0.0665	NC	0.95	0.069	0.087	0.078	NC	0.9	0.058	0.046	0.052	NC	0.6	0.117	0.053	0.085	**75**	NC	0.282	0.234	0.258	19	NC
arsenic	0.004	mg/kg wwt	3.94	5.04	4.49	24	NC	0.0225	0.0176	0.02005	24	NC	0.0445	0.0535	0.049	18	NC	0.0212	0.0164	0.0188	26	NC	0.0469	0.0203	0.0336	**79**	NC	0.11	0.0876	0.0988	23	NC
barium	0.05	mg/kg	17.1	15.5	16.3	10	NC	11.1	12.8	11.95	14	NC	35.8	47.8	41.8	29	NC	2.52	2.02	2.27	22	NC	22.2	13.5	17.85	49	NC	23.9	21	22.45	13	NC
barium	0.01	mg/kg wwt	7.98	7.18	7.58	11	NC	3.3	3.95	3.625	18	NC	22.9	29.4	26.15	25	NC	0.923	0.728	0.8255	24	NC	8.92	5.18	7.05	**53**	NC	9.36	7.86	8.61	17	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.012	<0.010	0.011	NC	0.2
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0022	<0.0020	0.0021	NC	0.1	0.0048	0.0033	0.00405	NC	0.75
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.003	<0.0020	0.0025	NC	0.5
boron	1	mg/kg	8.4	8	8.2	5	NC	18.5	15.5	17	18	NC	3.3	5.1	4.2	43	NC	13.3	14.4	13.85	8	NC	41	31	36	28	NC	63.1	58.9	61	7	NC
boron	0.2	mg/kg wwt	3.94	3.72	3.83	6	NC	5.48	4.76	5.12	14	NC	2.1	3.13	2.615	39	NC	4.87	5.2	5.035	7	NC	16.4	11.9	14.15	32	NC	24.7	22	23.35	12	NC
cadmium	0.005	mg/kg	0.0145	0.014	0.01425	NC	0.1	<0.0150	<0.0225	0.01875	NC	1.5	0.111	0.104	0.1075	7	NC	0.0965	0.0726	0.08455	28	NC	1.54	1.16	1.35	28	NC	0.0984	0.134	0.1162	31	NC
cadmium	0.001	mg/kg wwt	0.0067	0.0065	0.0066	3	NC	<0.0050	<0.0065	0.00575	26	NC	0.0714	0.0642	0.0678	11	NC	0.0354	0.0262	0.0308	30	NC	0.619	0.444	0.5315	33	NC	0.0385	0.05	0.04425	26	NC
calcium	20	mg/kg	2160	1940	2050	11	NC	15600	11900	13750	27	NC	4060	5790	4925	35	NC	2630	2410	2520	9	NC	19000	11900	15450	46	NC	13000	12600	12800	3	NC
calcium	4	mg/kg wwt	1010	900	955	12	NC	4640	3660	4150	24	NC	2600	3580	3080	31	NC	964	870	917	10	NC	7620	4560	6090	**50**	NC	5090	4720	4905	8	NC
cesium	0.005	mg/kg	0.026	0.0302	0.0281	15	NC	0.55	0.331	0.4405	50	NC	0.0427	0.0429	0.0428	0	NC	0.0652	0.0685	0.06685	5	NC	0.112	0.133	0.1225	17	NC	0.0528	0.0672	0.06	24	NC
cesium	0.001	mg/kg wwt	0.0121	0.014	0.01305	15	NC	0.163	0.102	0.1325	46	NC	0.0274	0.0264	0.0269	4	NC	0.0239	0.0247	0.0243	3	NC	0.0449	0.051	0.04795	13	NC	0.0207	0.0252	0.02295	20	NC
chromium	0.05	mg/kg	0.252	0.08	0.166	**104**	NC	0.385	1.51	0.9475	**119**	NC	0.112	0.173	0.1425	NC	1.22	0.116	0.092	0.104	NC	0.48	0.164	0.114	0.139	NC	1	0.577	0.444	0.5105	26	NC
chromium	0.01	mg/kg wwt	0.117	0.037	0.077	**104**	NC	0.114	0.464	0.289	**121**	NC	0.072	0.107	0.0895	39	NC	0.042	0.033	0.0375	NC	0.9	0.066	0.044	0.055	40	NC	0.226	0.166	0.196	31	NC
cobalt	0.02	mg/kg	0.065	0.067	0.066	NC	0.1	0.585	0.367	0.476	46	NC	0.058	0.06	0.059	NC	0.1	0.117	0.092	0.1045	24	NC	0.59	0.43	0.51	31	NC	0.297	0.244	0.2705	20	NC
cobalt	0.004	mg/kg wwt	0.0304	0.0311	0.03075	2	NC	0.173	0.113	0.143	42	NC	0.037	0.0372	0.0371	1	NC	0.0428	0.0332	0.038	25	NC	0.236	0.165	0.2005	35	NC	0.116	0.0914	0.1037	24	NC
copper	0.1	mg/kg	4.84	5.23	5.035	8	NC	14.1	13.1	13.6	7	NC	4.94	5.26	5.1	6	NC	7.96	6.49	7.225	20	NC	12.6	8.94	10.77	34	NC	21.9	17.1	19.5	25	NC
copper	0.02	mg/kg wwt	2.25	2.42	2.335	7	NC	4.19	4.04	4.115	4	NC	3.17	3.24	3.205	2	NC	2.92	2.34	2.63	22	NC	5.04	3.43	4.235	38	NC	8.59	6.41	7.5	29	NC
iron	3	mg/kg	104	112	108	7	NC	248	180	214	32	NC	124	124	124	0	NC	175	139	157	23	NC	246	118	182	**70**	NC	838	583	710.5	36	NC
iron	0.6	mg/kg wwt	48.4	51.7	50.05	7	NC	73.6	55.3	64.45	28	NC	79.5	76.3	77.9	4	NC	64.2	50.3	57.25	24	NC	98.6	45.3	71.95	**74**	NC	328	218	273	40	NC
lead	0.02	mg/kg	0.032	0.028	0.03	NC	0.2	0.046	0.039	0.0425	NC	0.35	0.041	0.041	0.041	NC	0	0.054	0.039	0.0465	NC	0.75	0.101	0.062	0.0815	48	NC	0.221	0.176	0.1985	23	NC
lead	0.004	mg/kg wwt	0.0149	0.013	0.01395	NC	0.475	0.0136	0.0119	0.01275	NC	0.425	0.0264	0.0251	0.02575	5	NC	0.0199	0.0142	0.01705	NC	1.425	0.0404	0.0236	0.032	**53**	NC	0.0866	0.0658	0.0762	27	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	0.71	0.605	NC	0.42	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	0.68	<0.50	0.59	NC	0.36
lithium	0.1	mg/kg wwt	<0.10	<0.10	0.1	NC	0	0.11	0.22	0.165	NC	1.1	0.15	0.14	0.145	NC	0.1	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	0.27	0.14	0.205	NC	1.3
magnesium	2	mg/kg	770	737	753.5	4	NC	3780	2930	3355	25	NC	510	708	609	33	NC	1320	1150	1235	14	NC	3460	3120	3290	10	NC	5150	4730	4940	9	NC
magnesium	0.4	mg/kg wwt	359	341	350	5	NC	1120	900	1010	22	NC	327	436	381.5	29	NC	485	416	450.5	15	NC	1390	1200	1295	15	NC	2020	1770	1895	13	NC
manganese	0.05	mg/kg	147	122	134.5	19	NC	96.6	63.4	80	42	NC	64.6	96.9	80.75	40	NC	93.2	93	93.1	0	NC	140	79.7	109.85	**55**	NC	242	204	223	17	NC
manganese	0.01	mg/kg wwt	68.5	56.6	62.55	19	NC	28.6	19.5	24.05	38	NC	41.4	59.6	50.5	36	NC	34.1	33.6	33.85	1	NC	56.2	30.5	43.35	**59**	NC	94.6	76.3	85.45	21	NC
mercury	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0	0.0073	0.0073	0.0073	NC	0	<0.0050	<0.0050	0.005	NC	0	0.011	0.008	0.0095	NC	0.6	0.0138	0.013	0.0134	NC	0.16
mercury	0.001	mg/kg wwt	<0.0022	0.0023	0.00225	NC	0.1	0.0012	<0.0022	0.0017	NC	1	0.0047	0.0045	0.0046	NC	0.2	0.0012	0.0015	0.00135	NC	0.3	0.0044	0.0031	0.00375	NC	1.3	0.0054	0.0048	0.0051	12	NC
molybdenum	0.02	mg/kg	2.47	2.58	2.525	4	NC	38	37.3	37.65	2	NC	10.4	19.6	15	**61**	NC	4.82	5.63	5.225	16	NC	3.35	2.15	2.75	44	NC	65.1	29.8	47.45	**74**	NC
molybdenum	0.004	mg/kg wwt	1.15	1.2	1.175	4	NC	11.3	11.5	11.4	2	NC	6.68	12	9.34	**57**	NC	1.76	2.03	1.895	14	NC	1.34	0.826	1.083	47	NC	25.5	11.2	18.35	**78**	NC
nickel	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	0.74	0.58	0.66	NC	0.8	<0.20	<0.20	0.2	NC	0	1.04	0.96	1	8	NC	0.61	0.63	0.62	NC	0.1	0.56	0.58	0.57	NC	0.1
nickel	0.04	mg/kg wwt	0.066	0.048	0.057	NC	0.45	0.22	0.18	0.2	20	NC	0.056	0.063	0.0595	NC	0.175	0.382	0.346	0.364	10	NC	0.246	0.24	0.243	2	NC	0.22	0.215	0.2175	2	NC
phosphorus	10	mg/kg	1460	1550	1505	6	NC	2830	3380	3105	18	NC	774	996	885	25	NC	1480	1360	1420	8	NC	2080	1860	1970	11	NC	4610	3330	3970	32	NC
phosphorus	2	mg/kg wwt	678	718	698	6	NC	838	1040	939	22	NC	496	613	554.5	21	NC	541	491	516	10	NC	836	713	774.5	16	NC	1800	1240	1520	37	NC
potassium	20	mg/kg	7960	7360	7660	8	NC	23100	24800	23950	7	NC	4690	5540	5115	17	NC	4820	4530	4675	6	NC	6270	5200	5735	19	NC	7560	6310	6935	18	NC
potassium	4	mg/kg wwt	3710	3410	3560	8	NC	6860	7620	7240	10	NC	3010	3410	3210	12	NC	1770	1640	1705	8	NC	2510	1990	2250	23	NC	2960	2360	2660	23	NC
rubidium	0.05	mg/kg	5.98	7.42	6.7	21	NC	38.7	36.3	37.5	6	NC	3.67	4.26	3.965	15	NC	4.14	3.94	4.04	5	NC	3.37	2.82	3.095	18	NC	2.75	3.38	3.065	21	NC
rubidium	0.01	mg/kg wwt	2.78	3.44	3.11	21	NC	11.5	11.2	11.35	3	NC	2.35	2.62	2.485	11	NC	1.52	1.42	1.47	7	NC	1.35	1.08	1.215	22	NC	1.08	1.26	1.17	15	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	0.105	0.099	0.102	NC	0.12	0.075	0.093	0.084	NC	0.36	<0.050	<0.050	0.05	NC	0	0.133	0.073	0.103	NC	1.2	<0.050	0.053	0.0515	NC	0.06
selenium	0.01	mg/kg wwt	0.022	0.022	0.022	NC	0	0.031	0.03	0.0305	NC	0.1	0.048	0.057	0.0525	17	NC	<0.010	<0.010	0.01	NC	0	0.053	0.028	0.0405	**62**	NC	0.016	0.02	0.018	NC	0.4
silver	0.005	mg/kg	0.0097	0.0082	0.00895	NC	0.3	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0	0.041	0.0479	0.04445	16	NC	0.0237	0.0148	0.01925	NC	1.78	0.007	0.0062	0.0066	NC	0.16
silver	0.001	mg/kg wwt	0.0045	0.0038	0.00415	NC	0.7	<0.0010	<0.0010	0.001	NC	0	0.002	0.0021	0.00205	NC	0.1	0.015	0.0173	0.01615	14	NC	0.0095	0.0057	0.0076	50	NC	0.0028	0.0023	0.00255	NC	0.5
sodium	20	mg/kg	<20	<20	20	NC	0	116	105	110.5	10	NC	31	45	38	NC	0.7	32	27	29.5	NC	0.25	45	49	47	NC	0.2	168	64	116	**90**	NC
sodium	4	mg/kg wwt	8.7	7.9	8.3	NC	0.2	34.4	32.3	33.35	6	NC	19.6	27.7	23.65	34	NC	11.6	9.9	10.75	NC	0.425	18.2	18.7	18.45	NC	0.125	65.8	23.8	44.8	**94**	NC
strontium	0.05	mg/kg	44.5	38	41.25	16	NC	330	290	310	13	NC	106	146	126	32	NC	8.79	8.13	8.46	8	NC	360	235	297.5	42	NC	92.1	138	115.05	40	NC
strontium	0.01	mg/kg wwt	20.7	17.6	19.15	16	NC	98	89.3	93.65	9	NC	68.3	90.2	79.25	28	NC	3.22	2.93	3.075	9	NC	145	89.9	117.45	47	NC	36.1	51.6	43.85	35	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	0.0093	0.0078	0.00855	NC	0.75	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.004	0.0021	0.00305	NC	0.95	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	0.00432	0.0036	0.00396	18	NC	<0.00040	<0.00040	0.0004	NC	0	<0.00040	<0.00040	0.0004	NC	0	0.00049	<0.00040	0.000445	NC	0.225	0.00163	0.00082	0.001225	NC	2.025	0.00054	0.00055	0.000545	NC	0.025
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	0.22	<0.10	0.16	NC	1.2	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	0.022	0.021	NC	0.1	<0.020	<0.020	0.02	NC	0	0.086	<0.020	0.053	NC	3.3	0.031	<0.020	0.0255	NC	0.55
uranium	0.002	mg/kg	<0.0020	0.0021	0.00205	NC	0.05	0.0034	0.0021	0.00275	NC	0.65	0.0031	0.003	0.00305	NC	0.05	0.0033	0.0027	0.003	NC	0.3	0.0053	0.0026	0.00395	NC	1.35	0.0152	0.0111	0.01315	31	NC
uranium	0.0004	mg/kg wwt	0.0008	0.00096	0.00088	NC	0.4	0.001	0.00066	0.00083	NC	0.85	0.00199	0.00182	0.001905	NC	0.425	0.0012	0.00099	0.001095	NC	0.525	0.00211	0.001	0.001555	**71**	NC	0.00594	0.00414	0.00504	36	NC
vanadium	0.1	mg/kg	0.3	0.31	0.305	NC	0.1	0.52	0.36	0.44	36	NC	0.41	0.39	0.4	NC	0.2	0.56	0.42	0.49	29	NC	0.73	0.31	0.52	**81**	NC	2.91	1.99	2.45	38	NC
vanadium	0.02	mg/kg wwt	0.142	0.146	0.144	3	NC	0.154	0.111	0.1325	32	NC	0.26	0.242	0.251	7	NC	0.205	0.153	0.179	29	NC	0.293	0.118	0.2055	**85**	NC	1.14	0.745	0.9425	42	NC
zinc	0.5	mg/kg	23.4	21	22.2	11	NC	35.6	34.8	35.2	2	NC	15.3	15.1	15.2	1	NC	60.2	49.7	54.95	19	NC	261	129	195	**68**	NC	23.3	21.9	22.6	6	NC
zinc	0.1	mg/kg wwt	10.9	9.75	10.325	11	NC	10.6	10.7	10.65	1	NC	9.82	9.3	9.56	5	NC	22	17.9	19.95	21	NC	105	49.3	77.15	**72**	NC	9.13	8.2	8.665	11	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	0.06	0.056	0.058	NC	0.1	<0.040	<0.040	0.04	NC	0	0.05	<0.040	0.045	NC	0.25	0.069	<0.040	0.0545	NC	0.725

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S15-G-01	22-S15-G-01D				22-S15-F-01	22-S15-F-01D			
Date Sampled			16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-120	VA22C2369-125				VA22C2369-121	VA22C2369-126			
QAQC			FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue			
Physical Tests												
moisture	0.5	%	55.9	54.6	55.25	2	NC	77.3	77.1	77.2	0	NC
Metals												
aluminum	2	mg/kg	45	42.3	43.65	6	NC	58.4	36.1	47.25	47	NC
aluminum	0.4	mg/kg wwt	19.8	19.2	19.5	3	NC	13.2	8.27	10.735	46	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
antimony	0.002	mg/kg wwt	<0.0020	0.0026	0.0023	NC	0.3	<0.0020	<0.0020	0.002	NC	0
arsenic	0.02	mg/kg	0.059	0.046	0.0525	NC	0.65	0.056	0.046	0.051	NC	0.5
arsenic	0.004	mg/kg wwt	0.0262	0.0209	0.02355	23	NC	0.0128	0.0105	0.01165	NC	0.575
barium	0.05	mg/kg	8.18	6.73	7.455	19	NC	22.5	29.1	25.8	26	NC
barium	0.01	mg/kg wwt	3.61	3.06	3.335	16	NC	5.1	6.65	5.875	26	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
boron	1	mg/kg	4.5	2.7	3.6	NC	1.8	26.8	31.5	29.15	16	NC
boron	0.2	mg/kg wwt	2	1.23	1.615	48	NC	6.09	7.21	6.65	17	NC
cadmium	0.005	mg/kg	0.0087	<0.0050	0.00685	NC	0.74	0.0198	0.0162	0.018	NC	0.72
cadmium	0.001	mg/kg wwt	0.0038	<0.0030	0.0034	NC	0.8	0.0045	0.0037	0.0041	NC	0.8
calcium	20	mg/kg	1690	1380	1535	20	NC	17700	21200	19450	18	NC
calcium	4	mg/kg wwt	747	624	685.5	18	NC	4010	4860	4435	19	NC
cesium	0.005	mg/kg	0.0603	0.0187	0.0395	**105**	NC	0.519	0.475	0.497	9	NC
cesium	0.001	mg/kg wwt	0.0266	0.0085	0.01755	**103**	NC	0.118	0.109	0.1135	8	NC
chromium	0.05	mg/kg	0.092	0.147	0.1195	NC	1.1	0.136	0.086	0.111	NC	1
chromium	0.01	mg/kg wwt	0.04	0.067	0.0535	**50**	NC	0.031	0.02	0.0255	NC	1.1
cobalt	0.02	mg/kg	0.049	0.043	0.046	NC	0.3	0.188	0.161	0.1745	15	NC
cobalt	0.004	mg/kg wwt	0.0217	0.0194	0.02055	11	NC	0.0428	0.0368	0.0398	15	NC
copper	0.1	mg/kg	5.21	3.76	4.485	32	NC	18.8	17.2	18	9	NC
copper	0.02	mg/kg wwt	2.3	1.71	2.005	29	NC	4.27	3.95	4.11	8	NC
iron	3	mg/kg	101	85.1	93.05	17	NC	170	129	149.5	27	NC
iron	0.6	mg/kg wwt	44.7	38.6	41.65	15	NC	38.6	29.6	34.1	26	NC
lead	0.02	mg/kg	0.046	0.051	0.0485	NC	0.25	0.092	0.051	0.0715	NC	2.05
lead	0.004	mg/kg wwt	0.0202	0.023	0.0216	13	NC	0.0209	0.0117	0.0163	**56**	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
lithium	0.1	mg/kg wwt	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
magnesium	2	mg/kg	459	452	455.5	2	NC	3280	4030	3655	21	NC
magnesium	0.4	mg/kg wwt	202	205	203.5	1	NC	745	922	833.5	21	NC
manganese	0.05	mg/kg	74.3	48.7	61.5	42	NC	60.7	76.2	68.45	23	NC
manganese	0.01	mg/kg wwt	32.8	22.1	27.45	39	NC	13.8	17.4	15.6	23	NC
mercury	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	<0.0050	0.0053	0.00515	NC	0.06
mercury	0.001	mg/kg wwt	0.0016	0.0016	0.0016	NC	0	0.001	0.0012	0.0011	NC	0.2
molybdenum	0.02	mg/kg	7.37	8.14	7.755	10	NC	7.99	8.42	8.205	5	NC
molybdenum	0.004	mg/kg wwt	3.25	3.7	3.475	13	NC	1.81	1.93	1.87	6	NC
nickel	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	1.07	1.42	1.245	28	NC
nickel	0.04	mg/kg wwt	0.043	0.081	0.062	NC	0.95	0.243	0.326	0.2845	29	NC
phosphorus	10	mg/kg	278	568	423	**69**	NC	1940	2090	2015	7	NC
phosphorus	2	mg/kg wwt	122	258	190	**72**	NC	439	479	459	9	NC
potassium	20	mg/kg	7670	6160	6915	22	NC	20200	23600	21900	16	NC
potassium	4	mg/kg wwt	3380	2800	3090	19	NC	4580	5400	4990	16	NC
rubidium	0.05	mg/kg	5.9	3.91	4.905	41	NC	20	20.8	20.4	4	NC
rubidium	0.01	mg/kg wwt	2.6	1.77	2.185	38	NC	4.54	4.77	4.655	5	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0
selenium	0.01	mg/kg wwt	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
silver	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	0.0154	0.0125	0.01395	NC	0.58
silver	0.001	mg/kg wwt	0.0016	0.0017	0.00165	NC	0.1	0.0035	0.0029	0.0032	NC	0.6
sodium	20	mg/kg	44	36	40	NC	0.4	115	52	83.5	**75**	NC
sodium	4	mg/kg wwt	19.3	16.4	17.85	NC	0.725	26.1	11.8	18.95	**75**	NC
strontium	0.05	mg/kg	11	8.02	9.51	31	NC	247	233	240	6	NC
strontium	0.01	mg/kg wwt	4.85	3.64	4.245	29	NC	56.1	53.3	54.7	5	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	<0.00040	<0.00040	0.0004	NC	0	<0.00040	<0.00040	0.0004	NC	0
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	0.032	0.026	NC	0.6	<0.020	<0.020	0.02	NC	0
uranium	0.002	mg/kg	0.0024	<0.0020	0.0022	NC	0.2	0.0029	<0.0020	0.00245	NC	0.45
uranium	0.0004	mg/kg wwt	0.00106	0.00067	0.000865	NC	0.975	0.00066	<0.00040	0.00053	NC	0.65
vanadium	0.1	mg/kg	0.34	0.27	0.305	NC	0.7	0.44	0.24	0.34	NC	2
vanadium	0.02	mg/kg wwt	0.15	0.123	0.1365	20	NC	0.099	0.055	0.077	NC	2.2
zinc	0.5	mg/kg	10.4	8.77	9.585	17	NC	31.6	35.6	33.6	12	NC
zinc	0.1	mg/kg wwt	4.59	3.98	4.285	14	NC	7.17	8.16	7.665	13	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

APPENDIX F

Sample Calculations

SOIL AND FOOD INGESTION BY SMALL MAMMALS AND BIRDS

Exposure equations used to estimate the daily dose of copper to mammals and birds are based on CCME (2020), as presented below:

Estimated Dose via Ingestion of Soil

$$\textit{Soil dose (mg/kg bw/day)} = SIR \times C_s \qquad \text{(Equation 1)}$$

Where:

- SIR = soil ingestion rate (kg dw/kg bw/day)
- C_s = measured concentration of POPC in soil (mg/kg dw)
- mg = milligram
- kg = kilogram
- dw = dry weight concentration
- bw = body weight of receptor

Estimated Dose via Ingestion of Food

$$\textit{Food dose (mg/kg bw/day)} = FIR \times \sum_1^j (C_{Fj} \times P_{Fj}) \qquad \text{(Equation 2)}$$

Where:

- FIR = food ingestion rate (kg dw/kg bw/day)
- C_{Fj} = measured concentration of POPC in food item j in the diet of the receptor (mg/kg dw)
- p_{Fj} = proportion of food item j in the diet of the receptor (unitless)
- mg = milligram
- kg = kilogram
- dw = dry weight concentration
- bw = body weight of receptor

Total Dose

$$\textit{Total dose}^* = \textit{Soil dose} + \textit{Food dose} \qquad \text{(Equation 3)}$$

*The dose from water is not considered in this ERA.

Sample calculations

Sample calculations are provided below for the meadow vole (herbivore) exposure to **copper:**

STEP 1: CALCULATE DOSE VIA SOIL INGESTION

The dose from soil ingestion is calculated as follow:

$$Soil\ dose\ (mg/kg\ bw/day) = SIR \times C_s \qquad \text{(Equation 1)}$$

The input values are as follows:

Parameter	Value	Units	Source
SIR	3.2E-03	kg dw/kg bw/day	FCSAP, 2012
C_s	830	mg/kg	Maximum concentration measured in soil on-site (from Station S-11)

Based on the above parameter, the dose via soil ingestion:
2.6E+00

STEP 2: CALCULATE DOSE VIA FOOD INGESTION

The dose from food ingestion (comprised of plants) is calculated as follow:

$$Food\ dose\ (mg/kg\ bw/day) = FIR \times \sum_1^j (C_{Fj} \times P_{Fj}) \qquad \text{(Equation 2)}$$

The input values are as follows:

Parameter	Value	Units	Source
FIR	1.3E-01	kg dw/kg bw/day	FCSAP, 2012
C_{Fj}	2.3E+01	mg/kg dw	Maximum concentration of copper measured in plant tissue on-site (red raspberry leaves at S-1)
P_{Fj}	1.0	unitless	FCSAP, 2012 (Diet is assumed to be 100% plants)

Based on the above parameters, the dose from food ingestion (diet comprised exclusively of plants) is:
3.1E+00

STEP 3: CALCULATE THE TOTAL DAILY DOSE

The unadjusted total dose is calculated as follow:

$$Total\ dose^* = Soil\ dose + Food\ dose \qquad \text{(Equation 3)}$$

The input values are as follows:

Parameter	Value	Units	Source
Food dose	3.1E+00	mg/kg bw/day	Step 2
Soil dose	2.6E+00	mg/kg bw/day	Step 1

Based on the above parameters, the total daily dose is:
5.7E+00



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Appendix O
2017 Invasive Plant Management Plan

Mount Polley Mining Corporation
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Environmental Management Plan:

Invasive Plant Management Plan

Last Update: March 29, 2017

Document Review and Revision Control

Rev. No.	Review/Revision	Date	Author
0	Original	January 2014	GH
1	Update of site specific components and plans	July 9, 2015	KM
2	Update of site specific components and plans; updated to reflect current government regulations/documents; added document tracking and formatting to be consistent with other MPMC EMPs	March 29, 2016	KM
3	Annual Review	Dec. 2020	GH

1 Introduction

The BC Ministry of Forest, Lands and Natural Resource Operations (as per the British Columbia [BC] Inter-Ministry Invasive Plant Working Group) defines invasive plants as “non-native (alien) plants whose introduction into BC cause, or are likely to cause, economic or environmental damage, or harm to human health” (MFLNRO, 2014). The Invasive Species Council of BC has a similar definition, and notes that invasive plants can establish quickly and easily on both disturbed and un-disturbed sites, causing widespread negative economic, social, and environmental impacts (ISCBC, 2015).

Mining operations result in disturbed areas, which can be susceptible to invasion of invasive plants. Such invasions have the potential to hinder reclamation efforts or interfere with regional invasive plant management programs. To manage this risk, Mount Polley Mining Corporation (MPMC) has developed this Invasive Plant Management Plan (the “Plan”). The purpose of the Plan is to outline procedures for the prevention and, if necessary, control (mitigation) of the establishment of invasive plants or noxious weeds in the Mount Polley Mine (the “Mine”) area throughout the Mine project life, including closure.

1.1 Regulatory Framework

The BC *Weed Control Act* (RSBC, 1996) requires owners or occupiers of crown and private lands in BC (excluding those under federal jurisdiction) to control listed noxious weeds. As such, MPMC is under legal obligation to control these species. At the time of last update of this Plan, the BC Proposed Prohibited Noxious Weeds List (MFLNRO, 2016) was the most up to date applicable listing.

As per the BC *Mines Act* Section 10.7, mine land surfaces must be reclaimed to an approved end land use at closure, excluding lands that are not to be reclaimed, and the average land capability should be equal to or greater than the average land capability present prior to mining. While these requirements do not specifically mention invasive plants, they are inherently included; given the undesirable nature of invasive plants, their associated negative environmental and economic impacts, and the fact that invasive plants are non-native, such species are likely inconsistent with closure revegetation objectives and could result in a mining company not meeting their closure revegetation targets.

In addition, under MPMC’s *Mines Act* Permit M-200, the following additional specific conditions apply to invasive species management at the site:

- The Permittee shall manage and control invasive species that establish on the site and shall take reasonable efforts to ensure that invasive species do not move from the site to adjacent areas.
- The Permittee shall ensure that all seed mixes are certified as weed-free.
- Revegetation species shall be selected based on the principles of ecological succession and traditional use and cultural significance, including all reasonable efforts to use only native species unless short-lived agronomic species are required to temporarily control erosion or prevent ingress of invasive species.

While not associated with regulatory requirements, the Cariboo Chilcotin Coast Invasive Plant Council (CCCIPC) is a non-profit organization that coordinates the invasive plant management efforts of government agencies, individuals, communities and industry sectors, and promotes awareness and education about invasive plants in the region. Each year, the CCCIPC produces an Annual Strategic Plan (http://cccipc.ca/index.php/S=0/resources/regional-strategic-plans/) which incorporates provincial requirements (e.g., noxious weeds listings) and is to be used as a guide for invasive plant management activities and resource allocation in region.

2 Objectives

As described above, the purpose of the Plan is to outline procedures for the prevention and, if necessary, mitigation of the establishment of invasive plants or noxious weeds in the Mount Polley Mine area throughout the Mine project life and closure. The specific objectives are to:

- Control invasive plant establishment on the site, such that reclamation objectives are achieved. Reclamation objectives include establishing self-sustaining vegetative covers on disturbed areas at the Mine site with native vegetation this is appropriate to the target site series and consequently promotes the target end land use(s); and
- Implement invasive plant control measures consistent with the Regional Strategic Plan and the BC Proposed Prohibited Noxious Weeds List.

This Plan applies to the operations footprint of the Mine as well as areas being rehabilitated following the tailings dam embankment breach. However, only the Mine site is regulated under the BC *Mines Act* and associated items (e.g., permit requirements and land capability requirements) do not apply to breach rehabilitation areas. Instead, reclamation revegetation objectives for the breach area will be defined by the Remediation Plan due for submission in the third quarter of 2017.

The Plan follows the Plan, Do, Check, and Act cycle developed by the International Standards Organization guidelines. The cycle is described as follows:

- **PLAN** - identifies potential sources of invasive plant ingress that may challenge achieving the objectives of the program;
- **DO** - documents the prevention and control management practices in place at the Mine;
- **CHECK** - describes the monitoring procedures and methods for evaluating monitoring results against the objectives; and
- **ACT** - describes review of the management program and update of procedures based on monitoring results in order to promote its continuous improvement and mitigate identified deficiencies.

3 Plan: Identification of Potential Sources of Invasive Plant Ingress

Mining activities can facilitate the introduction or spread of invasive plants by removing native vegetation, which decreases competition for weedy plants, and creating exposed soil in disturbed areas. Exposed areas create a soil bed which may allow invasive plants to establish. These areas include:

- Soil stockpiles and areas from which the soil was salvaged;
- Soil applied to reclamation areas;
- Road and powerline construction and maintenance activities; and
- Exposed areas around the Mill site, maintenance areas and other associated infrastructure.

Table 1 provides an overview of potential sources of invasive plant ingress to the site. Each potential source is classified into if control is possible or not. If control is not possible, for example the movement of wildlife or wind transport of seed, only prevention methods (and, if necessary, mitigation measures) are applicable to management.

Table 1 Potential sources of invasive plant ingress and/or spread at the Mount Polley Mine site

Category	Source	Control Method Possible
Animals	Livestock	×
	Wildlife	×
Natural spread	Wind (long-distance)	×
	Rhizome spread or seed drop (short-distance)	✓ (within Mine site only)
Human-mediated spread	People – on-site (e.g., employees, and contractors)	✓
	People – off-site (e.g., tourists and recreationists; spread to areas immediately adjacent to site)	×
	Vehicles and equipment – on-site	✓
	Vehicles and equipment – off-site (spread to areas immediately adjacent to site)	×
Reclamation Activities	Application of soil from contaminated soil stockpiles	✓
	Use of contaminated seed or soil amendments	✓
	Use of contaminated soil amendments	✓

4 Do: Prevention and Control Measures

4.1 Preventative Measures

The primary goal involved in managing invasive plant infestations in the project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants and supports the ability to establish desired species during site reclamation activities.

MPMC is to implement the following best management practices for preventing invasive plant establishment on disturbed areas at the Mine, which are to minimize disturbance during all phases of the mining operation in order to limit the availability of exposed, un-vegetated ground to invasive plant seed deposition; and establish a vegetative cover as soon as possible after ground disturbance. Specifics for establishing ground cover vegetation are as follows:

- Seed ground disturbed due to construction or mining activity with a rapidly establishing seed mix for erosion protection and invasive plant control if reclamation of the area is not imminent. Active areas (e.g., open pits or areas without appropriate substrates for vegetation growth) at the Mine do not require invasive plant control as vegetation does not have a chance to become established;
- Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of mill site areas, storage and equipment yards; and generally any disturbed ground where invasive plant establishment is possible;
- Use only high quality grade seed in the reclamation and interim invasive plant control seed mixtures. Low quality grade seed may contain a higher portion of weed seed in the seed lot. At minimum, ensure that the seed used for revegetation is of the grade Common #1 Forage Mixture or Canada No. 1 Ground Cover Mixture.
- Assess soil amendments that may contain invasive plant seeds or propagules. This is currently only applicable to biosolids, and MPMC's supplier (Metro Vancouver) tests the material to verify that invasive plant seeds are not present.

MPMC typically conducts a seeding program annually in the spring and/or fall, and any disturbed areas (as described above) or areas that were previously seeded but lack appropriate native vegetative cover, should be added to the list of areas to be seeded.

4.2 Control Measures

If monitoring results (Section 5) show areas of invasive species infestation that are not consistent with the objectives of this Plan (Section 2), available control or mitigation options for managing established invasive plants include mechanical, biological, and chemical methods.

Mechanical methods include:

- Hand weeding or pulling (if plants are hand-pulled, propagules are to be removed from the site and disposed of in a way that does not allow the spread of seeds. i.e., burned, not composted);
- Mowing or cutting; and
- Burning.

Biological control agents are natural organisms that are another option for reducing invasive species populations. Typically, they are insects, nematodes, fungi or viruses that infect or invade the invasive plants and weaken the target species by decreasing seed production and reducing density. Biological control is only an option for select invasive species

Chemical control through application of herbicides will be the method of last resort because applications are limited by proximity to watercourses and can potentially have detrimental effects on native vegetation.

In addition to these mitigation methods, contingency control programs that could be reviewed for feasibility and implemented are:

- Inspection and/or cleaning of vehicles or equipment coming from offsite or moving from an infested area to an uninfested area within the site;
- Refraining from driving through areas infested with invasive plants;
- Limiting road maintenance to the road surface to retain vegetation along the roadsides;
- Keeping equipment yards and vehicle storage facilities free of invasive plants; and
- Training personnel on preventing invasive plant spread by checking and removing seeds from clothing and equipment.

It is important to note that majority of the invasive plants observed at the Mine are designated in the CCCIPC Regional Strategic Plans as “established” or are designated as non-native species (not invasive species), and management options are not implemented regionally because control of these species is not currently feasible. As such, MPMC does not actively manage these species, unless they are directly impeding reclamation efforts. These aforementioned control measures are listed as options for future use, as required, and are currently not a routine component of MPMC’s invasive plant management activities, as the Plan objectives are being met without their use.

Mitigation measures will focus on the “new invaders” and “containment” categories, as well as any “established” species if they are directly impeding reclamation efforts. Consistent with the Regional Strategic Plan, the treatment goal for “new invaders” is eradication (elimination of all individuals and their propagules), while the treatment objective for species listed for “containment” is prevention of invasive

plants from spreading to uninfested areas. For species that are impeding reclamation revegetation, but are regionally listed under “containment” or “established” categories, the primary option will be suppression (reduction in plant population size and abundance). These control measures generally follow the following process, based on the level of infestation:

1. Prevent new infestations from becoming established;
2. Eradicate small or isolated “satellite” infestations;
3. Contain the perimeter of large “core” infestations; and
4. Suppress the interior of large “core” infestations.

If control measures area applied in the future, any sites that have treatments applied will be monitored through the established methods (described in Section 5) in subsequent years to assess if treatment measures have been successful.

5 Check: Monitoring Program

The MPMC invasive plant monitoring program includes visual surveys conducted in combination with routine assessments of progressive reclamation sites and annual soil stockpiles inspections; invasive plant species present and their percent cover are documented and compiled with revegetation results.

In addition, more formal invasive plant inventories are to be conducted routinely at the Mine site. These inventories should encompass disturbed areas, including any that are undergoing reclamation, as well as adjacent undisturbed areas from which invasive plants could ingress. Inventories may be conducted by MPMC Environmental Department staff with sufficient expertise or an external consultant. Each inventory should include the following items, with the results presented in a report:

- Surveying and mapping of infestation locations, with a focus on reclamation areas and soil stockpiles;
- Identification of invasive plant species present;
- Assessment of the degree of invasive plant growth, distribution, and density present at infestation sites;
- Assessment of success of any prevention and control measures that were previously implemented;
- Recommendations for any prevention and control measures that should be implemented; and
- Recommendations for when the next inventory should be conducted.

Where possible, all assessments and inventories should take place in the late spring/early summer so that eradication measures can be undertaken prior to seed dispersal in late summer/early fall. Alternatively, assessments and inventories can be conducted in mid to late summer, when plants are readily identifiable, with interpretation of results to take place over winter and management applications to be implemented early the following growing season.

6 Act: Program Review and Continuous Improvement

Each year, the results of invasive species monitoring should be reviewed with respect to the objectives outlined in Section 2, and the Plan and associated site invasive plant management activities should be updated accordingly. Specific items that should be reviewed and associated actions are listed in Table 2. When the Plan is updated, it is to be submitted to the Ministry of Energy and Mine with the Annual Environmental and Reclamation Report. In addition, an update on invasive plant monitoring, prevention

and control activities at the Mine (including any pertinent results from progressive reclamation and soil stockpile inspections, and site invasive plant inventory reports) is to be included in the Annual Environmental and Reclamation Report each year.

Table 2 Invasive plant management program review process

Item to Review	Associated Actions
Verify that all seed mixes used were certified weed-free (i.e., comply with Canadian Food Inspection Agency standards).	If seed utilized is not certified weed-free (or invasive plants were suspected to be present in the seed mixtures used): • Change seed suppliers and/or seed mixtures.
Verify that all soil amendments (where appropriate) were tested to confirm they did not contain invasive plant propagules or seeds.	If soil amendments were not tested: • Conduct post-application assessments for any soil amendments not tested; • Discontinue use of any soil amendments not tested until appropriate testing has been completed; and • Plan appropriately to test all amendments prior to use in the future.
Verify that no invasive plants identified in monitoring are on provincial noxious weed lists.	If any noxious weeds are identified: • Implement appropriate control measures (Section 4.2), with the objective of eradication; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that all invasive plants identified in monitoring are being managed according to the most recent CCCIPC Annual Strategic Plan.	If invasive plant management is inconsistent with the Regional Strategic Plan: • Implement prevention and/or control actions (Section 4) until management actions are consistent with the Regional Strategic Plan; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that results from reclamation revegetation assessments are consistent with closure objectives (with respect to species composition and/or functional groups). If results are not consistent, verify that invasive plants are not a constraining factor. The prioritization matrix in Figure 1 can be used to aid in separating innocuous from disruptive species in reclamation areas and prioritize management actions accordingly.	If invasive plants are identified as a constraint to meeting revegetation objectives: • Delineate the specific species and areas of concern; • Implement prevention and/or control actions (Section 4) appropriate for the level of infestation, the life history of the identified invasive plants, and available control options; and • Ensure that measures taken and target native reclamation species are monitored in the identified reclamation areas as per the program in Section 5.

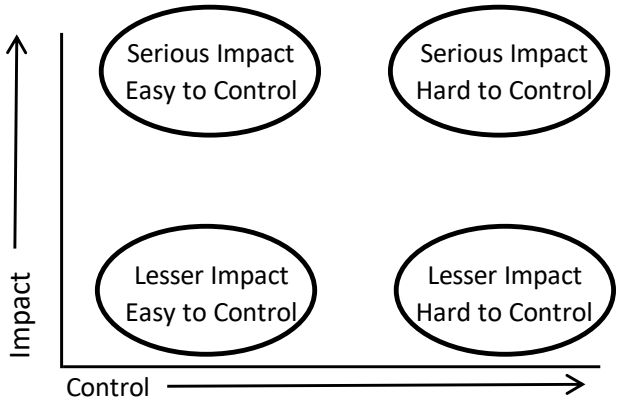

Figure 1 Invasive plant management prioritization matrix (adapted from USFWS, 2009)

7 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Supervisor):

- Be knowledgeable of, adhere to, and coordinate implementation of all aspects of this Plan;
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan;
- Ensure this Plan and monitoring data are reviewed annually and updated accordingly, with updates submitted in the Annual Environmental and Reclamation Report and appropriate management actions implemented;
- Be aware of high level mine planning to ensure that seeding of disturbed areas can be done in a timely manner and transport of soil is appropriately managed;
- Review updates to the MPMC *Mines Act* Permit 11678, BC *Mines* Act, CCCIPC Regional Strategic Plan and provincial noxious weed lists and regulations;
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including monitoring programs and reporting;
- Plan and budget for necessary invasive plant control measures;
- Obtain and permits or authorizations required for control measures that are implemented; and
- Ensure that individuals conducting monitoring, data interpretation, reporting, and planning and implantation of prevention and control measures have appropriate training.

Qualified individual conducting monitoring and reporting (e.g., Environmental Technician, contractor):

- Be knowledgeable of and adhere to all aspects of this Plan;
- Conduct assigned activities, such that all requirements of this Plan (at minimum) are met; and
- Have appropriate training and expertise for assigned components of this Plan.

Staff or contractors conducting control measures

- Have appropriate training and expertise for prevention and control actions they are implementing.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances and any transport of soil materials;
- Where possible, minimize the disturbance of vegetated areas; and
- Transmit relevant information related to the aforementioned points to the Mine Operations Supervisors.

Mine Operations Supervisors:

- Supervise operators such that new disturbances and soil handling are conducted as planned.

8 References

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Appendix P
Dust Management Plan

Mount Polley Mining Corporation

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Dust Management Plan

Submitted to:

BC Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
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(250) 790-2215

Date: February 27, 2020

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1 INTRODUCTION

The following describes the Dust Management Plan (the Plan) for the Mount Polley Mine (the Facility), which is located approximately 100 km northeast of the city of Williams Lake, British Columbia (BC), near the town of Likely, BC.

The purpose of the Plan is to:

- identify the sources of fugitive dust emissions associated with the Mount Polley Mine;
- describe how fugitive dust can be controlled from each significant source and describe the best management practices in place and planned for at the Mount Polley Mine;
- describe how the Plan will be implemented, including the training of personnel;
- describe inspection and maintenance procedures; and,
- describe methods of monitoring and appropriate actions/response framework to feedback into refining management actions, as needed, based on monitoring and inspection results (i.e., Act component described below).

The Plan is structured as follows:

- Section 2 provides an overview of the Facility;
- Section 3 provides an overview of the existing meteorological conditions;
- Section 4 provides an overview of the dust monitoring programs;
- Section 5 identifies the responsibilities for each employment level as they relate to the Plan; and,
- Section 6 describes the fugitive dust control measures that are implemented at the Facility. This section follows the Plan, Do, Check, and Act (PDCA) cycle according to the International Standards Organization guidelines. The PDCA cycle is described below:
    - Section 6.1 **PLAN** - identifies the emission sources at the Facility;
    - Section 6.2 **DO** - documents the schedule for implementation of the management practices;
    - Section 6.3 **CHECK** - describes the monitoring procedures and a record keeping system; and
    - Section 6.4 **ACT** - describes the management practice review and update procedures in order to promote its continuous improvement.

According to Section 2.5 of the BC Ministry of Environment (MoE) PA-15087, the Permittee (Mount Polley Mine) shall supress fugitive dust created within the operations area. This plan is an update to the *Fugitive Dust Management Plan Mount Polley* (Golder 2015a) for the tailings storage facility (TSF) submitted by Golder Associates Ltd. (Golder) on May 26, 2015 to the BC MoE. This update includes the entire site of Mount Polley Mine.

2 FACILITY DESCRIPTION

As shown in Figure 2.1, the Mount Polley Mine can be separated into:

- the TSF and surrounding areas (including Polley Flats);
- the crusher and mill processing site; and,
- operations areas (open pits, waste rock dumps, stockpiles, roads, etc.) and surrounding areas.

The Mount Polley mine has been in Care and Maintenance since May 31, 2019. Care and Maintenance operations are focussed on general site maintenance, predominantly ensuring that all pumps, sumps and water management systems are functioning properly. Eleven full time employees work in 4 shifts including day shifts and night shifts.

All environmental monitoring and samplings as per all permits and Comprehensive Monitoring Plan (CEMP) will be followed during this temporary care and maintenance period.

2.1 TSF AND SURROUNDING AREAS

The TSF at Mount Polley Mine consists of tailings material and a single embankment made up of three dams: the Main Embankment, the Perimeter Embankment, and the South Embankment. During the TSF dam failure which occurred on August 4, 2014, water (both supernatant and interstitial) was released from the TSF, resulting in much of the tailings within the TSF being exposed to the elements (i.e., no longer submerged).

The breach of the Mount Polley TSF resulted in the deposition of tailings between Polley Lake and Hazeltine Creek (known as the Polley Flats). Polley Flats covers an approximately 900 m long section of Hazeltine Creek south of Polley Lake. Prior to the breach, the area immediately south of Polley Lake included a wetland. The materials deposited in the Polley Flats are observed to include the following:

- tailings (sandy silt or silty sand, and clay-textured material);
- dam construction materials (gravel, rock fill and till);
- organic matter transported by the tailings flow (including trees and wood debris); and,
- re-worked organic and inorganic materials from the wetland.

Under current conditions, the exposed tailings are retaining moisture, particularly at depth, though the exposed tailings surface will dry in the summer. Dried and exposed tailings combined with high winds could cause the particulates to become airborne, which may potentially affect onsite and offsite air quality.

In addition to the exposed tailings in the TSF and those deposited in the Polley Flats, other identified potential sources for fugitive dust emissions at the Facility are construction emissions related to the disturbance of waste rock during TSF construction and Hazeltine Creek remediation activities. Planting of alder and conifer species has been conducted in the upper and lower Hazeltine Creek areas from 2016 to 2018, resulting in improved vegetation cover and therefore, reduced risk of airborne particulate in the area since the breach.

2.2 CRUSHER AND MILL PROCESSING SITE

The crusher and mill area includes the crusher and mill building, the coarse ore pile, the tertiary pile, the fine ore (mill feed) pile, and the pebble pile (Figure 2.1). No crushing operations are conducted during Care and Maintenance period.

2.3 PITS AND SURROUNDING AREAS

No mining activities are being conducted during Care and Maintenance period. Open pits include Cariboo and Springer Pits and waste rock dumps include the Temporary NW PAG Stockpile, North East Zone (NEZ) Rock Dump and the South East Rock Dump (SERD). Potential sources for fugitive dust include road dust. (Figure 2.1)

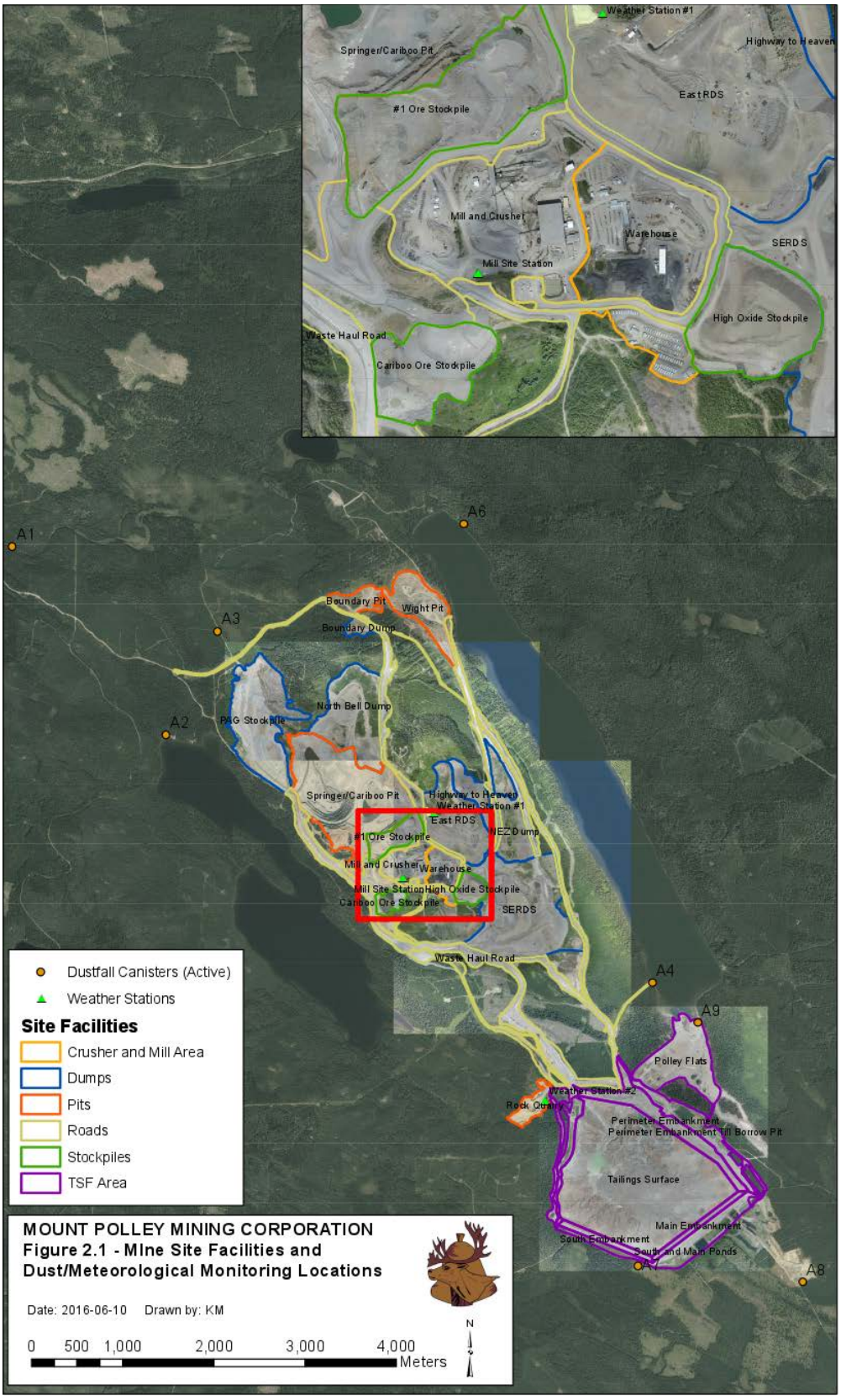

Figure 2.1. Mine Site Facilities and Dust/Meteorological Monitoring Locations

3 METEOROLOGY

Mount Polley Mine has two meteorological monitoring stations on site that have been operating since 2012 (see Figure 2.1). The first station (Station #1) is located southwest of the Polley Mountain summit, at an elevation of 1,171 metres above sea level (masl) near the Mill Site. The second station (Station #2) is located northwest of the TSF, along the access road to the old rock quarry. Station #2 is located atop a topographical rise at an elevation of 964 masl. The two stations are approximately 3.5 km apart, with an elevation difference of approximately 200 m. These stations monitor and record rainfall, temperature, relative humidity, wind speed, wind direction, and solar radiation every 30 minutes. From 1995 to 2012, a single meteorological station located beside the crusher building, northwest of the TSF, was in operation. This station monitored rainfall and temperature only. See Section 2.1 in *Fugitive Dust Management Plan Mount Polley* (Golder 2015a) for data from the three stations.

4 DUST MONITORING

4.1 DUSTFALL MONITORING

Five airborne particulate stations monitored dustfall at the Mount Polley Mine from November 2011 to December 2019; one was added in 2013 and three were added in June 2015. The station A5 was discontinued in August 2014. Station names and locations are presented in Table 4.1 and are shown in Figure 2.1. These air quality monitoring stations provided the fixed, volatile, and total dustfall measured in milligrams per decimetre squared per day (mg/dm^2/d) over a monthly period.

Table 4.1. Airborne Particulate Station Description

Station Name and Description	Easting (m)	Northing (m)	Years Active
A1 – by W12 (6km Creek water monitoring station)	588,221	5,826,043	2011-2019
A2 – at cabin on Bootjack Lake	589,906	5,823,978	2011-2019
A3 – near New Access Road	590,471	5,825,114	2011-2019
A4 – Polley Lake Boat Launch	595,241	5,821,259	2011-2019
A5 – by W7 (Hazeltine Creek water monitoring station)	597,010	5,819,075	2011-2014
A6 – Polley Lake Cabin	593,170	5,826,290	2013-2019
A7 – by Corner 3 (southwest) of TSF	592,969	5,818,320	2015-2019
A8 – southeast of TSF	596,911	5,817,991	2015-2019
A9 – Polley Flats (northeast of TSF)	596,020	5,821,407	2015-2019

The technical memorandum titled *Dustfall Monitoring and Pollution Control Objectives* written by the Air Quality Section of the MoE (2016), states that the Air Quality Section considers dustfall monitoring to be an outdated methodology and no longer recommends its use. For protection of human health, the Air Quality Section recommends particulate monitoring, specifically, monitoring of particulates with a diameter of 10 µm or less and 2.5 µm or less, be conducted instead of dustfall monitoring (MoE 2016; Appendix A). As such, dustfall monitoring will no longer be collected at the Mount Polley Mine. Particulate monitoring at the mine site in discussed in Section 4.2.

4.2 PARTICULATE MONITORING

Particulate matter is generally defined into three size fractions:

- Particulates of all size classes are referred to as total suspended particulate (TSP);
- Particulates with a diameter of 10 µm or less are referred to as PM_{10}; and
- Particulates with a diameter of 2.5 µm or less are referred to as $PM_{2.5}$.

Exposure to respirable (PM_{10}) and fine particulate matter ($PM_{2.5}$) may aggravate a number of respiratory illnesses. Smaller particles are generally thought to be of greater concern to human health than larger particles (US EPA 2016).

The deposition of TSP is generally considered dustfall. Deposition of PM_{10} and $PM_{2.5}$ are limited relative to TSP and these smaller particles can generally travel farther distances than TSP. Currently, there is no monitoring of TSP, PM_{10}, and $PM_{2.5}$ at the Facility, but these parameters were continuously monitored from July to October 2015 at four locations around the TSF and Polley Flats. The monitoring for TSP, PM_{10}, and $PM_{2.5}$ was discontinued based on the monitored results. Of the 82 days that were monitored, only three days had PM_{10} and $PM_{2.5}$ concentrations greater than the AAQO; however, these exceedances were most likely attributable to local and regional forest fires (Golder 2015b). Also, despite August 2015 being a dry month when compared to historical averages, particulate concentration data showed fugitive dust control measures were effective in the TSF and Plug area. For more information see *Continuous Particulate Monitoring at Mount Polley September 17 to 29, 2015: Summary of Particulate Monitoring July 7 to September 29, 2015* (Golder 2015b).

4.3 RECEPTORS

Table 4.3 summarizes offsite sensitive receptors near the Facility, arranged by the least distance from the Facility, which may be affected by fugitive dust (Golder 2015a). There are a number of recreational areas within 10 km of the Facility and the nearest town site is the community of Likely located 12 km northeast of the TSF and 9.5 km northeast of the Mount Polley Mine mill site.

Table 4.2. Sensitive Receptor Locations

Receptor Description	Receptor Name	Easting (m)	Northing (m)	Direction from Facility
Recreation	Polley Lake Campsite	596,031	5,821,197	North
Recreation	Polley Lake	595,508	5821,029	North
Recreation	Bootjack Lake	592,240	5,820,738	Northwest
Recreation	Raft Creek Campsite	601,094	5,818,449	East
Recreation	Bootjack Mountain	589,454	5,820,753	West northwest
Recreation	Quesnel Lake	599,055	5,823,901	Northeast
Recreation	Campsite at Bootjack Lake	590,183	5,823,874	Northwest
Residence	Cedar Creek Rd Residences by Quesnel Lake	599,755	5,826,365	Northeast
Residence	Cabins at Polley Lake	593,105	5,826,547	North northwest

Receptor Description	Receptor Name	Easting (m)	Northing (m)	Direction from Facility
Residence	Residential Dwelling	592,076	5,826,365	North northwest
Recreation	Cedar Point Provincial Park	598,954	5,826,215	Northeast
Recreation	Gavin Lake	587,195	5,816,268	Southwest
Recreation	Mount Jacobie	586,318	5,821,558	Northwest
Residence	Likely Road Residences by Quesnel Lake	598,207	5,829,330	Northeast
Recreation	Jacobie Lake	584,757	5,822,835	Northwest
Town Site	Community of Likely	596,739	5,830,494	Northeast
Recreation	Morehead Lake	586,301	5,826,856	Northwest
Recreation	Prior Lake	589,673	5,829,819	North northwest
Recreation	Little Lake	586,936	5,830,106	Northwest
Residence	Dwelling by Little Lake	586,878	5,830,576	Northwest
Recreation	Morehead Lake Cabins and Campsite	586,824	5,828,888	Northwest

5 RESPONSIBILITIES

The following sections detail the responsibilities held by each of the employment levels at the Facility as they pertain to this Plan.

5.1 SENIOR MANAGEMENT REPRESENTATIVE: MINE MANAGER

The Senior Management Representative, or designate, is responsible for:

- ensuring the required resources are in place to execute the Plan.

5.2 ACCOUNTABLE FACILITY REPRESENTATIVE: ACTING GENERAL MANAGER

The Accountable Facility Representative, or designate, is responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- scheduling and coordinating the implementation of fugitive dust control measures; and,
- training of site personnel and contractors on the Plan and best management practices to be implemented.

5.3 OPERATIONS SUPERVISOR: GENERAL FOREMAN

The Operations Supervisor, or designate, are responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- maintaining documentation of schedules and logs;
- implementing fugitive dust control measures;
- forwarding dust observation reports from site personnel to the Accountable Facility Representative; and,

- completing daily dustfall observations of the TSF and surrounding area as part of the daily Water Management Inspection Manual checklist (Appendix B).

5.4 FACILITY PERSONNEL AND CONTRACTORS

All Facility Personnel and Contractors are responsible for:

- following the dust control procedures that are currently in place; and,
- reporting dust observations to appropriate supervisor.

5.5 TECHNICAL SERVICES SUPERINTENDENT

The Technical Services Superintendent is responsible for:

- providing feedback on the effectiveness of the current dust control measures at the Facility;
- conducting internal audits of the dust control measures at the Facility;
- coordinating external audits of the dust control measures at the Facility;
- coordinating dust sampling programs; and,
- reporting results to regulatory authorities.

6 FUGITIVE DUST EMISSIONS MANAGEMENT

This section describes the fugitive dust control measures that are implemented at the Facility. This section follows the PDCA cycle as described below:

- Section 6.1 **PLAN** - identifies the emission sources at the Facility.
- Section 6.2 **DO** - documents the schedule for implementation of the management practice(s).
- Section 6.3 **CHECK** - describes the monitoring procedures and a record keeping system.
- Section 6.4 **ACT** - describes the management practice review and updating procedures in order to promote its continuous improvement.

6.1 PLAN – IDENTIFICATION AND CLASSIFICATION OF FUGITIVE DUST EMISSIONS

6.1.1 Identification of the Sources of Fugitive Dust Emissions

Fugitive dust emissions occur due to mechanical disturbances of granular materials exposed to the air. Dust generated from these open sources is termed "fugitive" as it is not discharged to the atmosphere in a confined flow stream, such as through an exhaust pipe or stack (US EPA 1995).

Mechanical disturbances are often created from activities such as vehicle movement, crushing and material transfer activities, but can also be created from wind action, which promotes lifting of fine particles from sources such as open fields and stockpiles. Therefore, some fugitive dust emissions occur, or are intensified during, certain operations and/or by natural means (e.g., wind action).

Factors that would affect the quantity of fugitive dust emitted from a source include the material's particulate size distribution, moisture content, and frequency of the mechanical and natural disturbances. Precipitation and evaporation conditions can affect the moisture content of the material being disturbed

and have an influence on the amount of fugitive dust emitted. Precipitation acts to prevent emissions through cohesive bonding of small particles, while evaporation elevates the potential for dust emissions.

Once dust is emitted (suspended in air), it will disperse from the source according to various factors such as wind speed and direction, precipitation rates, and particle size distribution (OMoE 2005). Higher wind speeds increase the potential distance travelled by the particulates, while precipitation can facilitate particulate deposition (wet deposition). Particles that are less than 2.5 µm in diameter can travel further before settling and are of higher concern as they have the potential to present a health problem to humans if inhaled.

Main sources of activities which contribute to fugitive dust emissions from the Facility are summarized in Table 6.1.

Table 6.1: Main Sources and Factors Contributing to Fugitive Dust

Process/Activity	Causes	Factors that may Produce Fugitive Dust Emissions
TSF	• Wind erosion off of surface of TSF from dried material	• Fines content of tailings • Surface moisture content of tailings • Wind speed and direction • Precipitation and snow cover (natural control measures) • Vegetation cover – control measures • Sprinklers – control measures • Pond volume – control measure
Polley Flats	• Wind erosion off of surface of Polley Flats from dried material	• Fines content of tailings • Surface moisture content of tailings • Wind speed and direction • Precipitation and snow cover (natural control measures) • Vegetation cover – control measures • Surface treatment – control measures
Material Handling (Limited)	• Disturbance of material (waste rock, ore and stockpiles) caused by loading/unloading (dumping into haul trucks and dumping onto stockpiles/dumps/gyratory crusher) • Wind erosion of material from material being handled	• Drop height of loading/unloading activities • Moisture content of material • Fines content of material • Wind speed
Ore Processing (No Activity)	• Processing of material (waste rock and ore) through crusher • Wind erosion off of stockpiles	• Drop height of loading/unloading activities • Moisture content of material • Fines content of material • Wind speed
Dozing Activity (Limited)	• Disturbance of material (waste rock, ore and stockpiles) caused by machinery • Wind erosion of material from material being dozed	• Height of material being dozed • Fines content in material handled • Moisture content in the material • Vehicle weight and speed • Wind speed
Grading (Limited)	• Disturbance of surface material caused by grading machinery	• Surface fines content • Surface material moisture content • Vehicle weight and speed
Hauling/Access Road Traffic	• Disturbance of granular material on the road surface caused by motion of vehicles • Wind erosion on the road surface	• Surface fines content • Surface material moisture content • Wind speed

(Light Vehicles Only)		• Vehicle weight and speed

6.1.2 Fugitive Dust Management Practices

Control measures to reduce fugitive dust emissions should take into account the sources of the dust emission, the dispersion conditions and the location of sensitive areas in order to avoid significant impacts of dust emissions on receptors. Control measures tend to impact one or more factors affecting the generation and/or dispersion of fugitive dust emissions. These control measures can be classified as follows:

- **Preventative Procedure**: Measure pertaining to the design and installation of structures and the operating procedures which are implemented on a regular basis in order to prevent the generation of dust and/or the dispersion of dust generated from reaching sensitive areas.
- **Reactive Control Measures**: Measures which are implemented in the event of unexpected circumstances which can lead to the generation of dust and/or the dispersion of dust generated reaching sensitive areas.

Table 6.2 provides a description of the preventative procedures and control measures at the Facility.

Table 6.2: Description of Preventative Procedures and Control Measures for Fugitive Dust Emissions

Preventative Procedure/ Control Measure	Emission Source Effected	Description	Application Frequency
Visual Inspection	TSF and Polley Flats	Daily visual inspections of the TSF and Polley Flats	Daily during non-frozen periods. If inspection indicates potential for dust emissions another follow up inspection will be conducted later that day
Wet Suppression	TSF and unpaved site roads	Fugitive dust generated from the TSF and unpaved site roads are controlled by using water	Daily observations (water management inspections, when wind speeds measured over 3.6 m/s are observed, and/or incidents)
Progressive Reclamation	TSF and Polley Flats	Growth media and vegetation applied progressively as either planting, broadcast seeding, heli-seeding or natural re-vegetation	One-time event, with ongoing planting, as required
Use of Dedicated Routes/Areas	Unpaved Site Roads (excluding the Mine and Ore Stockpile Area)	Haul traffic has designated routes. Have a procedure that all vehicles comply with these routes. Regular application of appropriate dust suppression (e.g. water, flocc, CaCl)	When necessary
Controlled Loading and Unloading Techniques	Dust from Material Handling	Trucks are loaded/unloaded in a slow and controlled manner to minimize drop height and avoid spillage	When necessary based on daily observations, inspections, and/or incidents

Fugitive dust may be emitted from the TSF and Polley Flats under strong wind conditions (wind speeds >5.4 m/s) (Golder 2015a). If wind erosion from the TSF is observed, it can be controlled by stabilizing the affected surfaces by use of chemical suppressants or regular watering. Control measures that have been implemented to reduce wind erosion from the TSF include:

- Installation of 5 water sprayers along the Main Embankment of the TSF. Each sprayer has a spray radius of 40-70 m and are adjacent to each other. Water is being pumped from the Main Embankment Seepage Collection Pond below the Main Embankment to a sprinkler line connected to all other sprinklers.
- Pond volume size parameters take into account dust management in regards to amount of surface area exposed.

Winter temperatures, below freezing, will prohibit the use of water as a dust suppressant; however, snow cover will act as dust suppressant in the winter months. Based on weather data presented in Golder (2015a), the average temperature is below freezing from November to March, where there is snow cover present.

Table 6.3 summarizes the fugitives dust emission activities and processes along with the proactive and reactive mitigation practices that can be implemented to control fugitive dust.

Table 6.3: Summary Table of Mitigation

Source	Proactive Mitigation Practices	Reactive Mitigation Practices
TSF	• Sprinklers as a dust suppressant on TSF • Rain/snow cover as a natural dust suppressant during winter • Interim seeding	• Wet suppression • Visual inspection of nearby sensitive receptor locations (<2 km) during dust events
Polley Flats	• Rain/snow cover as a natural dust suppressant during winter • Progressive reclamation (including ongoing removal and/or capping of tailings)	• Wet suppression • Visual inspection of nearby sensitive receptor locations (<2 km) during dust events
Crusher Building/Stockpiles (No or very limited activity during care and maintenance)	• Sprayers located on conveyers, transfer chutes, screens, and at the top of stockpiles • Dust control scrubber system for crusher building • Turbomister installed by crusher stockpiles	• Wet suppression • Removal of dust emissions from building
Road Dust	• Use of water trucks to wet roads	• Wet suppression

The effectiveness of watering practices for the TSF and Polley Flats are expected to be the same as for stockpiles. From Environment Canada (2014), wet suppression effectiveness rates are a function of the amount of water applied and range between 50-95% efficiency (Table 6.4).

Table 6.4: Wet Suppression Efficiency (Environment Canada 2014)

Efficiency (%)	Application Rate (L/m^2)
50	1.591
60	2.232
70	3.172
80	4.748
85	6.077
90	8.306
95	13.337

It is expected that there are 151 days during the year where there are either subfreezing ground conditions, based on average monthly temperature in Golder (2015a), or days where there is at least 1 cm of snow on the ground (Horsefly Lake Gruhs Lake Environment Canada Climate normal) which would act as a natural dust control measure. Furthermore, it is expected that during the non-freezing period there are approximately 98 days where there is at least 0.254 mm of rainfall (Station #1 and Station #2). Therefore, using the precipitation adjustment factor published by Environment Canada (2014) for stockpiles, it is expected that precipitation and snow cover would have approximately 68% percent effectiveness at controlling fugitive dust on an annual basis.

The effectiveness of vegetation covers to control fugitive dust has been observed to vary with the type and amount of cover. In the southwest regions of the United States, vegetation cover, which were sparse, resulted in dust control effectiveness of 25%; whereas, dense vegetation cover can result in dust control effectiveness of up to 100% (US EPA 1984). Visual inspections can be undertaken at receptor locations near (within 2 km of the Facility) during dust events (i.e., wind events >5.4 m/s).

6.2 DO – Implementation of the Dust Management Plan

Dust generating activities performed on-site should meet the requirements of this Plan.

6.3 CHECK – Inspection, Maintenance and Documentation

Routine inspections at the Facility should be performed to firstly check that the proactive and reactive mitigation measures are being implemented, and secondly, confirm that the mitigation practices are effectively reducing fugitive dust emissions. Daily inspections of the TSF and surrounding area are incorporated into MPMC's Water Management Inspection Manual checklist. Outstanding or overdue inspection findings are reviewed monthly by the Joint Occupational Health Safety and Environment Committee.

Routine reviews of results are also performed by MPMC's Environmental Department. This includes review of the documented observations to confirm that that mitigation (control) measures were implemented to reflect the observations recorded.

It is expected that all deficiencies identified in inspections will be addressed. Reasonable corrective action will be undertaken and documented. Reviews of the non-conformance should be done quarterly as a

method for continual improvement. The Operations Supervisor should be responsible for recordkeeping the information listed above.

The annual and monthly wind roses for Station #2 (the station with representative winds at the TSF and Polley Flats) demonstrates that the predominant wind directions during the summer months are from the north and south (with more southerly winds).

6.4 ACT – DUST MANAGEMENT PLAN REVIEW AND CONTINUOUS IMPROVEMENT

Inspections and monitoring procedures will assist MPMC personnel with the maintenance of an effective Dust Management Plan. The Dust Management Plan should be monitored and updated, as follows:

- when there are significant changes in the fugitive dust emissions sources;
- periodically, every five (5) years (minimum);
- when there are verified grievances associated with fugitive dust emissions from the Facility; and,
- when there are visible dust emissions occurring more frequently and/or at a higher rate (excluding seasonal conditions).

Review of the Plan is intended to evaluate the effectiveness of the proactive and reactive dust control practices and focus on the identification of improvement opportunities that can reduce the risk of complaints or health concerns related to fugitive dust emissions.

6.4.1 Contingency Measures

Possible contingency measures to be implemented at a later date, if required, include:

- Application of calcium chloride on Bootjack Forest Service Road.
- Installation of additional turbomisters, sprayers and sprinklers to periodically wet the TSF, thereby increasing the moisture content of the surface material which will result in greater surface cohesion and a reduction from fugitive windblown dust.

7 REFERENCES

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Appendix A

Dustfall Monitoring and Pollution Control Objectives Technical Memorandum

BRITISH COLUMBIA

Memorandum

Air Quality Section

Monitoring, Assessment and Stewardship

Date: January 21, 2016 **File: 21610-00\Dustfall**

To: Robyn Roome, Director, Monitoring, Assessment & Stewardship

Re: Dustfall Monitoring and Pollution Control Objectives

The Air Quality Section has recently reviewed the use of dustfall monitoring in mining assessments and EMA authorizations/permits. Based on the review, the Air Quality Section considers dustfall monitoring and the dustfall Pollution Control Objectives as outdated methodology/criteria and, with the exception of specific limited circumstances, is no longer recommending or supporting their use based on the following reasons:

- The BC dustfall objectives were originally developed under the old BC Pollution Control Objectives (PCOs) back in 1979 as a 'soiling index' or method of assessing the "dustiness" of an area from an aesthetic or nuisance perspective. Their effectiveness for determining impacts on human or environmental health (soil, water, vegetation) is extremely limited.
- The PCOs were rescinded in 2006, although the dustfall objectives were retained on the BC air quality website "for reference purposes".
- Dustfall sampling methodology (passive open canister exposure) does not perform well (severely underestimates) during high wind events (often associated with fugitive dust).
- Dustfall monitoring is often used around mining projects with the stated intention of tracking metals impacts associated with fugitive dust. However, results are poor indicators for metals effects monitoring as there is no indication of the bioavailability of any metal contained in the samples and no established relationship between deposition rates and protection of soil, water or vegetation health.
- Dustfall results cannot be used for dust episode management actions as the 30-day sample periods (and subsequent laboratory analyses) are too long to be of any use for this purpose.
- While dispersion modelling may assist with determining the possible affected areas from fugitive dust generated during mining operations, the modelled concentrations are highly uncertain due to the poor quality of the model inputs, namely simplistic emission factors, added to the inherent uncertainties and limitations in modelling dust dispersion and deposition. This is particularly the case with road dust.

Based on the rationale above, it is suggested that before requiring dustfall as a component of any assessment process or inclusion within a regulatory authorization, that the objectives of the monitoring and/or dust management plans be clearly defined. Some possible considerations:

- If the concern is simply one of an aesthetic or nuisance nature, the use of dustfall monitoring and the objectives may be justified, with careful selection of the appropriate criteria, e.g.
    - 'residential/parkland' PCO (1.75mg/dm^2/day),
    - 'industrial/other' PCO (2.90mg/dm^2/day), or
    - facility/site specific deposition rate.
- If the objective is to protect of human health (i.e. nearby human receptors), monitoring of $PM_{2.5}$/PM_{10} would be more appropriate, including compliance with associated Ambient Air Quality Objectives.
- If the objective is to the protect the soil/water/vegetation and/or tracking accumulation of metals or other contaminants in the environment, including impacts to 'country foods', sampling of the specific media of concern would be more appropriate and specialists from the related disciplines should be involved in the development of baseline and on-going monitoring programs and determination of protective criteria.
- For episode management of fugitive dust, continuous monitoring of TSP or PM_{10} would provide more timely information for triggering actions under a dust mitigation plan.
- If there are concerns regarding other emission sources and possible impacts to ambient air quality and the environment, the emissions/impacts should be characterized, assessed and the appropriate monitoring determined.

When dispersion modelling is used in an assessment, the BC modelling guidelines recommend that a modelling plan be developed with input and subsequent sign-off from an Air Quality Meteorologist; it is recommended that a similar approach be used when developing baseline monitoring plans used to support assessments, compliance monitoring programs, or permit monitoring clauses. Proponents and permitting staff should consult with Air Quality Meteorologists to determine the contaminant(s) of concern, the monitoring methods, sampling locations and air quality criteria to be used.

Sincerely,

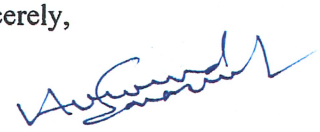

Arvind Saraswat, P.Eng.
Air Quality Section Head (Assessments)

Appendix B

The Daily Water Management Inspection Checklist

Daily Water Management Inspection Checklist

*(Controlled Document – **DO NOT COPY**: please ask Environment Department for print out)*

Inspector: _____ Date: _____

Shift: (Crew, D or N) _____ Weather Conditions: (ex. hot, windy, sunny): _____

	Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes / Comments
1	Junction Zone Seepage Sump		GOOD / ISSUE	
2	9K Sump # Starts _____ Op hrs_____		RED YELLOW BLACK	
3	CWTS (Wetland)		GOOD / ISSUE	
4	NW PAG Sump Starter 1: # Starts _____ Op hrs_____ Starter 2: # Starts _____ Op hrs_____		RED YELLOW BLACK	
5	Mine Drainage Creek Sump		RED YELLOW BLACK	
6	West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
7	Booster Station		GOOD / ISSUE	
8	Bootjack Creek Sump – Upstream side		GOOD / ISSUE	
9	Corner 1 Buttress Culverts/Ditch		GOOD / ISSUE	
10	TSF Barge		GOOD / ISSUE	
11	Dredge Outflow Pipe		GOOD / ISSUE	Location:
12	South Seepage Collection Pond		RED YELLOW BLACK	
13	Main Seepage Collection Pond		RED YELLOW BLACK	Percent Full ____%
14	Fish fence at outlet to Quesnel Lake		GOOD / ISSUE	
15	Fish Fences above Gavin Lake Bridge		GOOD / ISSUE	Cleaned? Y / N
16	WTP Well		(m)	
17	WTP Slurry Line		GOOD / ISSUE	
18	Perimeter Embankment Till Borrow Pond		RED YELLOW BLACK	
19	Breach Sump/COW Drain/Upstream Drain		GOOD / ISSUE	
20	CCS		GOOD / ISSUE	
21	Long Ditch Outflow Pipes		GOOD / ISSUE	
22	Long Ditch Sump (Lower)		RED YELLOW BLACK	
23	Long Ditch Sump (Upper)		RED YELLOW BLACK	
24	SERDS Sump		RED YELLOW BLACK	
25	Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
26	**NEZ Seep Sump**		GOOD / ISSUE	
27	Wight Pit Water Level		(m)	
28	Joe's Creek Pipe		GOOD / ISSUE	
29	**Leachpad LCRS**		(m)	Pumped? Y / N
30	West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
31	Bootjack Creek Sump		RED YELLOW BLACK	
32	Mill Site Sump		Pump Hours	

Updated Feb 16, 2019

Is the TSF Generating Dust?

No Minor Moderate Major | Corner 1 Corner 2 Corner 3 Corner 4 Corner 5

Is the Polley Lake Plug Generating Dust?

No Minor Moderate Major

REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING IN FREEZING CONDITIONS

ADDITIONAL COMMENTS/OBSERVATIONS (EX. EROSION):

NOTE* - Please clean up and report all spills of hydrocarbons or chemicals

WILDLIFE OBSERVATIONS (include locations):

Appendix Q
2015 Contaminated Sites Assessment Procedure

September 30, 2015 Reference No. 1411734-085-L-Rev0-15000-6000

Katie McMahen
Mount Polley Mining Corporation
Box 12
Likely, BC V0L 1N0

CONTAMINATED SITE ASSESSMENT PLAN

Dear Ms. McMahen:

This letter provides an outline of the conceptual contaminated sites assessment (CSA) plan for closure of the Mount Polley Mine ("the Site") required by the BC Ministry of Energy and Mines in a permit amendment issued to Mount Polley Mining Corporation on July 9, 2015. Specifically, the CSA plan to address potential contamination on closure of the mine will follow the technical guidance and protocols outlined in the Contaminated Sites Regulation (http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/laws-regulations-compliance), and tailored to the conditions of the Site. The CSA work will be conducted in consultation with a Contaminated Sites Approved Professional

Stage I Preliminary Site Investigation

MPMC has identified the activities or areas of potential environmental concern (APECs) associated with mining operations and the contaminants of potential concern (COPC) associated with these APECs (Table 1, Figure 1). On closure of the mine, or areas of the mine, each of the APECs will be inspected for visual signs of contamination. Photos of each APEC will be taken to include in documentation. Interviews will be held with MPMC personnel familiar with the APECs to determine standard practice for each APEC and records of spills or other historical activities that could have resulted in contamination. This process is consistent with a Stage I Preliminary Site Investigation. MPMC will track each APEC recording site inspections, interviews and photos of those closed, such that documentation can be supplied, if requested. The estimated costs associated with the Stage I PSI are outlined in Table 2.

Stage II Preliminary Site Investigation and Detailed Site Investigation

If there is evidence of contamination associated with the APEC, soil will be sampled and analyzed for the COPCs associated with the APEC in accordance with the guidelines and protocols for a Stage II Preliminary Investigation (Stage II PSI). If contamination is found, step out soil samples will be collected to delineate soil contamination in a Detailed Site Investigation (DSI). Depending on the extent of soil contamination found, an investigation of groundwater quality may be needed. If the COPCs are listed on Schedule 11 of the CSR, it may be necessary to conduct an investigation of soil vapour. The estimated costs associated with a Detailed Site Investigation are dependent on the results of the PSI, and are therefore difficult to predict. For planning purposes, an estimate is provided in Table 3.

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Using Site Knowledge

MPMC has conducted many detailed site investigations related to contamination, contaminant fate and transport, as well as restoration work including site-specific assessments of geochemistry and contaminant toxicity as part of their exploration work and work related to the tailings dam failure. Reclamation plans have been developed for both terrestrial and aquatic areas surrounding the mine. This work should be consulted if contamination is found related to the mine APECs, as this work provides valuable context for data interpretation.

Following delineation of contamination, a remediation plan will be developed to address contamination such that it meets the requirements of the BC *Environmental Management Act*. It is anticipated that the remediation plan will build off of studies conducted and lessons learned and successes from the remediation and restoration work conducted for the tailings dam failure.

The plan provides an outline of the CSA plan required in the July 9, 2015 permit amendment issued to MPMC. The cost associated with the stages of investigation are difficult to determine as it will depend the extent of contamination encountered. For planning purposes, MPMC should expect the costs to be similar to those estimated in this report. As APECs are investigated and closed, the costs should be updated such that they provide a meaningful budgeting tool moving forward.

Yours very truly,

GOLDER ASSOCIATES LTD.





Reidar Zapf-Gilje, Ph.D., P.Eng.
Contaminated Sites Expert

Trish Miller, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

RZG/TAM/ch

Attachments: Table 1: Areas of Potential Environmental Concern (APECs) and Contaminants of Potential Concern (COPC) for the Operational Areas of the Mount Polley Mine
Table 2: Stage 1 PSI Scope and Cost
Table 3: Scope of Work and Estimated Costs for a Stage II Preliminary Site Investigation (Stage II PSI) and Detailed Site Investigation (DSI) for Budget Planning Purposes

Figure 1 – CSR Conceptual Plan APECs

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Area	~Size(m^2)	Material(s) Stored/Used	COPC(s)
Fuel Island (light vehicle)	170	Diesel, gasoline	Hydrocarbons
Waste Disposal Area (adjacent to light vehicle fuel island)	90	Batteries, hydrocarbon contaminated waste, used paint, plastic jug recycling	Glass cleaner (Isopropyl alcohol; propoxy propanol; cipropylene glycol; monomethyl ether; monobutyl ether; ammonia),washer fluid (methanol), hydrocarbons, acid batteries (lead; lead sulphate; figer glass separator, ABS), aerosol paint cans/paint cans (liquified petroleum gas; acetone; toluene; limestone; xylene; titanium dioxide; aliphatic hydrocarbon; talc; naphtha, petrolume hydrogreated light; ethylbenzne; barium sulfate; mineral spirits; aliphatic hydrocarbon, and similar)
Fuel Island	1,600	Diesel	Hydrocarbons
Outside maintenance shop + wash bay	8,200	**Lube Products**, **Welding Products,** diesel	See list below
Maintenance laydown	17,700	**Lube Products**, diesel	See list below
Light vehicle maintenance shop + weld barn	1,100	**Lube Products**, **Welding Products,** diesel	See list below
Warehouse	1,400	waste hydrocarbons/contained hydrocarbon products, mill reagents, cleaning products, lube products	See lists below
Crusher Yard	6,500	**Lube Products**, diesel	See list below
Crusher Area	38,400	Ore	Metals (copper, sulphur, iron, silica, aluminua); liquid heat (diethylene glycol; non-hazardous ingredients held as trade secret); belt dressing and conditioner (N-hexane; petroleum gases, liquified, sweetened; polybutylene resin), Nordbak products (aluminum oxide, fibrous; epoxy resin; silicon carbide; silicon dioxide; magnesium oxide; treated fumed silica; neopentyl glycol diglycidyl ether; silicon carbine; aliphatic amines; amine adduct; amine reacted fatty acid; alkyl phenol; triethylenetetramine; lisane derivative; quartz; calcium carbonate epichlorohydrin-4-4'isopropylidene diphenol resin, butyl 2,3-epoxypropyl ether; triphenyl phosphite
Temporary PAG Stockpile	428,400	Potentially acid generating rock	Metals
#1 Ore Stockpile	55,500	Ore	Metals
Cariboo Ore Stockpile	39000	Ore	Metals
Sulphur Pile	5,200	Sulphur compounds	Sulphur compounds
Heap Leach (test facility)	24,000	Sulphur compounds	Metals, sulphur compounds
Underground Operation and Maintenance Area	6,000	Blasting products	?
Magnetite Plant	33,600	Magnetite	Metals (iron oxide)
Concentrate Sheds	2,600	Ore, magnetite	Metals (copper, sulphur, iron, silica, alumiuna)
Orica Site	14,400	Blasting products	Fortan Extra System (Dry product: Ammonium nitrate; petrolium distillates, hydrotreated light; mineral oil. Wet product: ammonium nitrate; diesel fuel; mineral oil)

Cleaning Products	Hazardous Constituents (from MSDS)
ACTION DSC	Didecyl Dimethyl Ammonium Chloride; sodium carbonate; ethyl acoho
ALL PURPOSE WASHROOM CLEANER	Organic acid salt
AQUARESS HAND & BODY SHAMPOO	Water, Sodium Laureth Sulfate, Cocamide DEA, Sodium Chloride, Citric Acid, Diazolidinyl Urea, Glycol Distearate, Tetrasodium EDTA, Fragrance, Cocamide MEA, Laureth-10, Magnesium Nitrate, Methylchloroisothiazolinone, Magnesium Chloride, Methylisothiazolinone, Blue 1 (CI 42090
BLEACH-SODIUM HYPOCHLORITE	Sodium Hypochlorite
BORAXO POWDERED HAND SOAP	Sodium Borate Decahydrate (Borax); sodium soap
CITRUS AIR	Ethanol; D-Limonene; propylene glycol; isobutane; propane
CITRUSOLV-HF	Distillates (petroleum), hydrotreated light; (R)-p-mentha-1,8-diene
CLEAN SPRAY	Ethylene glycol mono butyl ether; tetrapotassium pyrophosphate; tetrasodium salt of ethylenediaminetetraacetic acid
COMPARE	No hazardous ingredients listed on MSDS
COMET DISINFECTANT CLEANER WITH CHLORINOL	Dipropylene glycol N-butyl ether; citric acid
ENGINE DEGREASER	Diethylene gloycol monoethyl ether; ethanol; propane; butane; citrus terpenes; ethanol
FAST ORANGE PUMICE CLEANER	Pumic; ethoxylated C11-C16 alcohol; D-limonene
FLOOR SWEEP-CANOLA OIL BASED	No hazardous ingredients listed on MSDS
GLASS CLEANER WITH AMMONIA	Isopropyl alcohol; propoxy propanol; cipropylene glycol; monomethyl ether; monobutyl ether; ammonia
KLINGER BOWL CLEANER	Citric acid
KRYSTAL GREEN	Ethylene glycol mono butyl ether; monoethanolamine
LEMINEE 23 CLEANER-DISINF.	Alcohols, C12-15, ethoxylated; soda ash; alkyl dimethylbenzylammonium chloride; alkyl dimethyl ethylbenzylammonium chloride; ethyl alcohol
LIQUID HAND SOAP-6000	No hazardous ingredients listed on MSDS
MULTI-KLEEN	2-propanol; 2-propanol; Alcohol Ethoxylate; caustic potash (45%); sodium metasilicate; sodium tripolyphosphate
MULTI-KLEEN-INDUSTRIAL	Sodium metasilicates; 2-butoxyethanol; Alcohol Ethoxylated; sodium tripolyphosphates
NEUTRAL FLOOR CLEANER	Sodium lauriminodipropionate; alcohols C12-C13 ethoxylated; dipropylene glycol monomethyl ether; alcohol ethoxylate (C9-C11)
ORDERLY-DISINFECTAND	Di-(C8-10)-alkyl dimethyl ammonium chlorides; alkyl dimethyl benzyl ammonium chlorides; ethanol; alcohol ethoxylate
PINOSAN	Alkyl dimethyl ammonium chlorides; Didecyl dimethyl ammonium chloride
PLEDGE	Hydrocarbons, C16-C20, n-alkanes, isoalkanes, cyclics,<2% aromatics; white mineral oil (petroleum)
SHOWER SHINE	Phosphoric acid; ethoxylated nonionic detergent; lauryl dimethylamine oxide
STAIN REMOVER AND DEODORIZER-SR (unbelievable)	No hazardous ingredients listed on MSDS
STRATE FLUSH	Hydrochloric acid
SUNLIGHT DISH SOAP	Magnesium oxide; ethyl alcohol; dodecylbenzene sulfonic acid
SUPER-CLEAN DEGREASER (DETERGENT)	Sodium metasilicate; sodium hydroxide; surfactant, glycol blend
SUPER 90 FLOOR FINISH	No hazardous ingredients listed on MSDS
TOUGH GUY LAUNDRY DETERGENT	Sodium carbonate
TOUGH GUY NEUTRAL CLEANER	No hazardous ingredients listed on MSDS
TRISODIUM PHOSPHATE-TSP	Trisodium phosphate dodecahydrate
URINAL BLOCKS	1,4-Dichlorobenzene
VELVA SHEEN	1,8-p-menthadiene; isoparaffinic hydrocarbon; propane/N-butane

Lube Products	Hazardous Constituents (from MSDS)
2-CYCLE MOTOR OIL	Distillates, petroleum, solvent-refined heavy paraffinic; petroleum distillates, hydrotreated light
ANTIFREEZE/COOLANT 50/50	CH_2OHCH_2OH
ANTIFREEZE/COOLANT HEAVY DUTY	CH_2OHCH_2OH
ANTIFREEZE/COOLANT-UNIVERSAL	CH_2OHCH_2OH
ANTIFREEZE - AIR BREAK	CH_3OH
ATF-SUPER	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, hydrotreated light paraffinic
ATF-TYPE F	Distillates, petroleum, hydrotreated heavy paraffinic; N-Phenyl-1-naphthylamine
BATTERY CLEANER	2-butyloxyethanol; sodium bicarbonate; detergent; liquefied petroleum gas
BEARING MOUNTS FOR CLOSE FITS	Methacrylate monomer; 2-hydroxyethyl methylate; coumarone-indene resin (mixture); poly(ethyl methacrylate); dimethylbenzyl hydroperoxide
BREAK CLEAN	Heptane; methanol; 2-propane
BREAK FLUID DOT 3 HEAVY DUTY	http://armoredautogroup.com/pdf/STP/STP-Heavy-Duty-Brake-Fluid,-DOT-3-(1-2011).pdf
COMPRESSOR OIL	Hydrotreated light paraffinic distillates, petroleum
FUEL-DIESEL	Diesel; distillates (petroleum), hydrotreated middle; distillates, hydrotreated light (may contain: alkyl nitrate, polyisobutenyl succinic anhydride nitrogen functionalized dispersant, and mixed cyclic amines)
FUEL-GASOLINE	Gasoline, toluene, ethanol, benzene
FULL SYNTHETIC MITOR OIL-KENDALL	Distillates, petroleum, hydrotreated heavy paraffinic
FULL SYNTHETIC MITOR OIL-HIGH PERFORMANCE	Distillates, petroleum, hydrotreated heavy paraffinic
GEAR LUBE-EXTRA DUTY	Residual oils, petroleum, solvent-refined; distillates, petroleum, solvent-dewaxed heavy paraffinic; residual oils, petroleum, solvent-dewaxed; distillates, petroleum, hydrotreated heavy paraffinic; residuum resins
GEAR LUBE-MOLYLUBE SF 100 SEMI-SYN. LIGHT	Graphite, hydrotreated light distillates (petroleum); carbon black; Stoddard solvent; silica, crystalline, quartz; mineral oil; molybdenum compounds; trymethylbenzne
GEAR LUBE- MOLYLUBE SF 100 SEMI-SYN ARCTIC	Distillates (petroleum), hydrotreated heavy naphthenic; distillates (petroleum), hydrotreated heavy paraffinic; distillates (petroleum), solvent-refined heavy paraffinic; hydrotreated light distillates (petroleum); Stoddard solvent
GEAR LUBE-MP	Lubricant base oil (light)
GEAR LUBE- TRITON SYN	1-Decene, homopolymer, hydrogenated
GEAR SHIELD NC	Bitumen; distillates (petroleum), hydrotreated light; distillates (petroleum), hydrotreated middle; zinc compounds
GEAR SHIELD-HEAVY	Heavy hydrotreated naphthenic distillates (petroleum); petroleum hydrocarbon; residual oils (petroleum), solvent dewaxed; petroleum asphalt; zinc oxide; 12 hydroxystearic acid; carbon black; inedible animal grease; lithium hydroxide monohydrate
GUARDOL ECT-MOTOR OIL (TITANIUM)	Lubricant base oil (petroleum); proprietary additives
GUARDOL QLT-MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
HT/4 FLUID	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, solvent-refined heavy paraffinic; residual oils, petroleum, solvent-dewaxed; distillates, petroleum, solvent-dewaxed heavy paraffinic
HYDRAULIC/TRACTOR FLUID	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, solvent-dewaxed heavy paraffinic
HYDRAULIC OIL-MEGAFLOW AW	Distillates, petroleum, hydrotreated heavy paraffinic;
HYDRAULIC OIL-SUPER	Zinc compounds; lubricant base oil (petroleum)
KOPR-KOTE	Talc; graphite; copper; molybdenum disulphide
LUBRIPLATE CHAIN AND CABLE FLUID	Heavy and light hydrotreated naphthenic distillates (petroleum); carbon dioxide; 2-butoxyethanol; light distillate; aliphatic petroleum distillate
MAROK-ROCK DRILL OIL	Distillates, petroleum, hydrotreated light naphthenic
MEGAPLEX XD3	Lubricant base oil (petroleum); molybdenum disulfide; carbonic acid, calcium salt
MEGAPLEX XD5	Lubricant base oil (petroleum); molybdenum disulfide; zinc dialkyl dithiophosphate
MOLY LOW TEMP	Distillates, petroleum, hydrotreated light naphthenic; distillates, petroleum, hydrotreated heavy naphthenic; molybdenum (IV) sulfide
MULTIPLEX-RED	Phosphorodithioic acid, O,O-di-C1-14-alkyl esters, zinc salts; lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based; alkyl Imidazoline; lubricant base (petroleum)
OMNIGUARD	Lubricant base (petroleum); calcium carbonate
OSBORN BLUE LAYOUT FLUID	Acetone; methyl ethyl ketone; liquified petroleum gas; ethyl acetate; xylene; butyl acetate; isopropyl alcohol; nitrocellulose
POLYTAC EP	Distillates, petroleum, hydrotreated heavy naphthenic; distillates, petroleum, solvent-refined heavy paraffinic; N-Phenyl-1-naphthylamine
PYROSHIELD 9011	Amines, C12-14-alkyl, reaction products
QUIK PENETRATING SOLVENT	Mineral spirits; white mineral oil; propane
REDTAC	Naphthenic acids, zinc salts; lubricating oils (petroleum)
SKF GREASE (LGEP 2)	Phosphorodithioic acid, O,O-di-C1-14-alkyl esters, zinc salts; lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based
SOLVENT	Stoddard solvent
SUPER MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
SUPER SYNTHETIC BLEND MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
TRANSFORMER OIL	Distillates, petroleum, hydrotreated light naphthenic
TRITON 220	Synthetic lubricant base oil
UNIMIX 2-CYCLE OIL	Lubricant base oil (petroleum); hydrotreated distillate, light C9-C16
UNOBA EP	Lubricant base oil (petroleum); calcium carbonate; proprietary additives
VICTAULIC LUBRICANT	Fatty acids, tall-oil, potassium salts; 1,2-Propylene glycol; mica
WASHER FLUID	Methanol
WHITE LITHIUM GREASE	Hexane isomers; n-hexane; heavy napthenic petroleum distillates; liquefied petrolum gas

Chemial Products	Hazardous Constituents (from MSDS)
AERO 208 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, phosphorodithioic acid, o,o-diethyl ester, sodium salt, sodium hydroxide
AERO 3477 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium hydroxide
AERO 7048 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, carbamothioic acid, 2-propenyl-, O-(2-methylpropyl) ester, isobutanol, sec-butyl alcohol, sodium hydroxide
AERO 7279 PROMOTER (DISCONTINUED)	carbamothioic acid, 2-propenyl-, O-(2-methylpropyl) ester, isobutanol, phosphorodithioic acid, O,O-bis(2-methylpropyl) ester, sodium salt, nonylphenol ethoxylate, sec-butyl alcohol
AERO 5100 PROMOTER	modified thionocarbamate #1, sec-butyl alcohol, isobutanol, modified thionocarbamate #2
DANAFLOAT 262	carbamothioic acid, ethyl-, *O*-(1-methylethyl) ester, isopropanol
DANAFLOAT 262T (unavailable)	carbamothioic acid, ethyl-, O-(1-methylethyl) ester, isopropanol, 1-dodecanethiol
DANAFLOAT 468	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, phosphorodithioic acid, o,o-diethyl ester, sodium salt, sodium hydroxide
CARBON DIOXIDE	carbon dioxide
HELIUM	helium
HIGHT CALCIUM QUICKLIME	calcium oxide, crystalline silica quartz
IPAC 6832	no hazardous ingredents listed on MSDS
IRON CHIP ACCELERATOR	iron; iron oxide dust
LECOCEL II and II HP	tungsten, tin
LECOSORB	non-fibrous silicate
LIQUID HEAT	diethylene glycol; non-hazardous ingredients held as trade secret
MAGNETITE	iron oxide
MIBC	methyl isobutyl carbinol
POLYCLEAR 2529	anionic water-soluble polymer
POLYCLEAR 2528	anionic water-soluble polymer
POLYCLEAR 2532	long-chain polymer
POLYCLEAR 2530	long-chain polymer
POLYFROTH W22C FROTHER	polyoxyalkylene alkyl ether, methyl isobutyl carbinol
POTASSIUM AMYL XANTHATE 85%	potassium amyl xanthate
POTASSIUM AMYL XANTHATE 90%	potassium amyl xanthate
SODIUM HYDROSULFIDE 36% SOLUTION	sodium hydrosulfide, sodium carbonate, sodium sulfide, nonahydrate
SODIUM HYDROXIDE SOLUTIONS	sodium hydroxide
SULPHUR	sulphur
TMT 15	1,3,5-triazine-2,4,6(1H,3H,5H)-trithione, triosodium salt
VULTREX-TOOL JOINT COMPOUND-	zinc, talc, mixture of severely hydrotreated and hydrocracked base oil (petroleum

Welding Products	Hazardous Constituents (from MSDS)
Arcair Electrodes	Iron; manganese; copper; chromium; iron; molybdenum; nickel; silicon; niobium
Arcair Slice Cutting Rod	Nicel; steel
Hardfacing allyed electrode	Titanium dioxide; nickel; silicon dioxide; calcium fluride
ER70S2	Iron; carbon; copper; manganese; phosphorus; molybdenum; silicon; titanium; zirconium
Carbon ring	Sulfur dioxide; nitrogen
Welding rods	Iron; chromium; nickel; maganese; silicon; molybdenum; columbium; titanium dioxide; sodium fluoride; talc; calcium fluoride; crystalline silica respirable; silicon; molybdenum; titanium; cobalt; copper
Welding wire	Iron; manganese; titanium dioxide; nickel; calcium flouride
WIA Fabshield 4 Hobart	Metals (numberous)
Wearsheild BU	Iron; limestone and/or calcium carbonate; silicates; fluorides; silicon and/or silicon alloys and compounds; manganese and/or manganese alloys and compounds; chromium and chromium alloys and/or compounds; quartz; cellulose and other carbohydrates; iron oxides; carbon steel core wire
Wearhshield ME	Chromium and chromium alloys or compounds; titanium dioxides; mineral silicates; silicates; limestone and/or calcium carbonate; magnesite; fluride; cellulose and other carbohydrates; iron; silicon and/or silicon alloys and compounds; quartz
Acetylene	Acetylene
Blueshield	Argon

Stage 1 Preliminary Site Investigation Scope and Estimated Costs for Budget Planning Purposes

Task	Scope	Cost
Baseline report	MCMC collects information on all APECs, prepare working tables, figures and photos. Golder organizes report in CSR format and checks information in the field and through meetings with MCMC.	$25,000
Update reports	The Stage 1 PSI is updated when an APEC is decommissioned or at 5 year intervals. Estimated cost of $2,500/update	$25,000
Total		$50,000

Area	~Size(m^2)	Material(s) Stored/Used	Characteristics	Scope	Cost
Fuel Island (light vehicle)	170	Diesel, gasoline	AST with spill protection. No observed or reported spills. Likelihood of contamination is low.	> Limited soil sampling using hand dug pits or excavator test pits > no groundwater sampling > Reporting	$ 5,000
Waste Disposal Area (adjacent to light vehicle fuel island)	90	Batteries, hydrocarbon contaminated waste, used paint, plastic jug recycling	Potential for surface spills	> Soil sampling using hand dug test pits > No groundwater sampling > Reporting	$ 5,000
Fuel Island	1,600	Diesel	AST with spill protection. No observed or reported spills. Likelihood of contamination is low to moderate.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 25,000
Outside maintenance shop + wash bay	8,200	**Lube Products**, **Welding Products,** diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 25,000
Maintenance laydown	17,700	**Lube Products**, diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 25,000
Light vehicle maintenance shop + weld barn	1,100	**Lube Products**, **Welding Products,** diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 10,000
Warehouse	1,400	waste hydrocarbons contained hydrocarbon products, mill reagents, cleaning products, lube products	Indoor storage on concrete floor. Liklihood of contamination is neglible.	No sampling	$ -
Crusher Yard	6,500	**Lube Products**, diesel	Potential for surface spills	> Limited soil sampling using hand dug pits or excavator test pits > no groundwater sampling > Reporting	$ 25,000
Crusher Area	38,400	Ore	Potential for residual contamination of soil and shallow groundwater	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Temporary PAG Stockpile	428,400	Potentially acid generating rock	Potential for residual contamination of surface soil and groundwater after PAG stockpile has been backfilled into Springer Pit	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 50,000
#1 Ore Stockpile	55,500	Ore	Potential for residual contamination of surface soil and groundwater after ore stockpile has been removed.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Cariboo Ore Stockpile	39000	Ore	Potential for residual contamination of surface soil and groundwater after ore stockpile has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 35,000
Sulphur Pile	5,200	Sulphur compounds	Potential for residual contamination of surface soil and groundwater after sulphur pile has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 25,000
Heap Leach (test facility)	24,000	Sulphur compounds	Potential for residual contamination of surface soil and groundwater after sulphur has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 35,000
Underground Operation and Maintenance Area	6,000	Blasting products	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 15,000
Magnetite Plant	33,600	Magnetite	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Concentrate Sheds	2,600	Ore, magnetite	Indoor storage on concrete floor. Liklihood of contamination is neglible.	No sampling	$ -
Orica Site	14,400	Blasting products	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 25,000
					$ 410,000


0 250 500 1,000 1,500 2,000
Meters
N
MPMC APECs
Draft for Discussion Purposes
Drawn by: KM
Date: 2015 08 20
Underground Operation
Temporary PAG Stockpiles
Sulphur Pile
Heap Leach
#1 Ore Stockpile
Fuel Island
Crusher Yard
Wash Bay and Maintenance Area
Crusher Area
Maintenance Laydown
Warehouse
Magnetite Plant
Cariboo Ore Stockpile
Orica Site
Sulphur Pile
Heap Leach
#1 Ore Stockpile
Fuel Island
Crusher Yard
Wash Bay and Maintenance Area
Ligth Vehicle Shop
Crusher Area
Maintenance Laydown
Warehouse
Concentrate Sheds
Fountain Tire
Magnetite Plant
Cariboo Ore Stockpile

Appendix R
2015 Spillway Design

TECHNICAL MEMORANDUM

DATE October 30, 2015 **REFERENCE No.** 1411734-095-TM-Rev0-15000

TO Katie McMahen
Mount Polley Mining Corporation

CC Luke Moger, Art Frye

FROM James Ogilvie and Allan Bronsro **EMAIL** jogilvie@golder.com; abronsro@golder.com

SPRINGER PIT SPILLWAY CONCEPTUAL DESIGN

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has retained Golder Associates Ltd. (Golder) to develop a conceptual-level spillway design for the Springer Pit. The Springer Pit is located in the northwest part of the Mount Polley Mine site. The spillway is intended to operate after closure of the Springer Pit. The function of the spillway will be to safely discharge overflow from the Springer Pit caused by storm water runoff and other inflows from the surrounding catchment. This document reflects ultimate pit conditions following completion of the restricted operations and a return to full operations over a combined period of approximately four (4) years.

This document presents the data that Golder used to develop the spillway design.

2.0 DATA FOR DESIGN

2.1 Design Flows

Precipitation depths used to estimate inflows to Springer Pit for various return periods are presented in Table 1.

Table 1: 24-Hour Precipitation Depths

Return Period	Depth (mm)
2-year	34.2
10-year	46.8
25-year	52.5
100-year	60.7
200-year	64.7
1000-year	73.8
Probable Maximum Precipitation	188.1

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The total catchment area draining to the Springer Pit spillway is estimated to be 1.1 km^2. The design event for the Springer Pit was selected as the 1-in-200-year 24-hour rainfall plus the 1-in-2-year snowmelt. The flows to Springer Pit were calculated using Hydrologic Engineering Centre Hydrologic Modelling System (HEC-HMS) software (USACE 2010), and are presented below in Table 2. The Soil Conservation Service (SCS) curve number (CN) method (USDA 1986) was used to calculate catchment losses. A CN value of 95 and a lag time of 15 minutes were used for the HEC-HMS calculations.

The peak outflow was estimated by routing the inflow through the pit.

Table 2: Design Event Flows

Description	Flow (m^3/s)
Peak rainfall inflow	3.64
Peak snowmelt inflow	0.17
Peak combined inflow	3.81
Peak outflow	0.52

2.2 Design Elevations

Elevations used for the design are presented below in Table 3. All elevations are in MPMC's mine grid.

Table 3: Design Elevations

Description	Value (masl)
Spillway crest elevation	1050.0
Top of spillway channel	1050.5

3.0 DESIGN SUMMARY

A summary of the conceptual spillway design for the Springer Pit is provided in this section. The spillway design consists of a weir crest and a rock-lined, 40 m-long channel to convey flows, as shown on Drawings 100 through 300 in Attachment A.

The channel dimensions are shown below in Table 4.

Table 4: Spillway Channel Dimensions

Description	Value	Comment
Design flow depth	0.16 m	Calculated
Channel depth	0.5 m	Provides freeboard
Bottom width	3.0 m	Allows for vehicle passage across channel
Side slope	10H:1V	Allows for vehicle passage across channel

The spillway channel has been sized with constructability and vehicle passage along the existing haul road as main considerations. The wide channel base and gradually-sloped banks allow for vehicles using the existing haul road to cross the spillway channel safely when no water is flowing. The spillway channel has been sloped towards the Springer Pit to eliminate the risk of normal runoff from the haul road discharging into the environment. Additional design information is presented in the drawing package that was provided with this memorandum.

The outlet channel design does not include a specific termination point and is only intended to convey flows beyond the Springer Pit area. Golder recommends that the final discharge location for the spillway channel be confirmed at a later date and based on site conditions existing at the anticipated time of construction (i.e., water quality and closure scenario).

Golder understands that there are several scenarios that could apply for the closure of Springer Pit.

There are two potential discharge options for the case of permanent closure: Bootjack Lake or a temporary storage location (i.e., the Tailings Storage Facility (TSF) or the Perimeter Embankment Till Borrow Pit). The water quality in Springer Pit is an important factor in selecting one of these locations. If the water quality in Springer Pit, perhaps following enhancement with a passive treatment system, is suitable, the water could be discharged into Bootjack Lake. If it is not feasible to meet water quality targets, the water could be conveyed to and retained in a temporary storage location, where it would be treated and eventually discharged to Quesnel Lake.

If the closure of Springer Pit is temporary, the preferred option would be to pump the water into the West Ditch, which conveys water to the Central Collection Sump.

4.0 CLOSURE

We trust this document meets your present requirements. Please direct any questions, comments, or concerns to the undersigned.





James Ogilvie, P.Eng.
Water Resources Engineer

Allan Bronsro, MCIP, P.Eng.
Associate, Senior Water Resources Engineer

JMO/AB/pn
Attachments: A: Conceptual Design Drawings 100, 200, 300 Rev 2

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Golder (Golder Associates Ltd.). 2015. *Site Wide Water Balance.* Prepared for Mount Polley Mining Corporation. Submitted May 29, 2015. Vancouver, BC. Ref. #1411734-031-R-Rev0-12000.

USACE (US Army Corps of Engineers). 2010. *Hydrologic Modeling System HEC-HMS*. Version 3.5, released August 2010.

USDA-SCS (United States Department of Agriculture- Soil Conservation Service). 1986. *Urban Hydrology for Small Watersheds*. TR-55, 164 p.

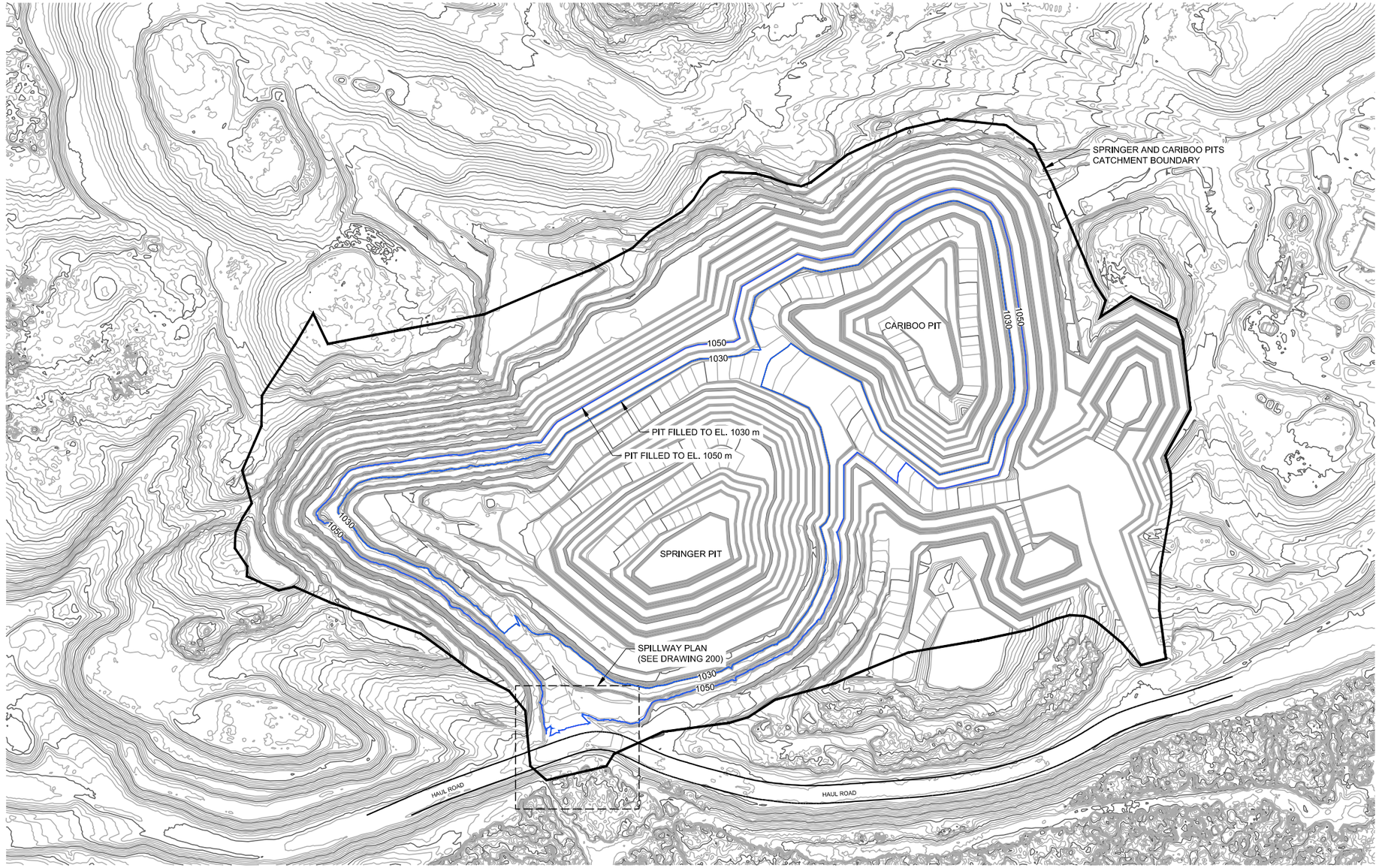

PLAN
SCALE 1:7500

NOTES
1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL 2 m MINOR AND 10 m MAJOR CONTOURS.

NOT FOR CONSTRUCTION

CONCEPT ONLY

0 125 250
1:7,500 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

SEAL

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

TITLE
PROJECT PLAN

PROJECT No.	PHASE	Rev.		DRAWING
1411734	15000	2	1 of 3	100

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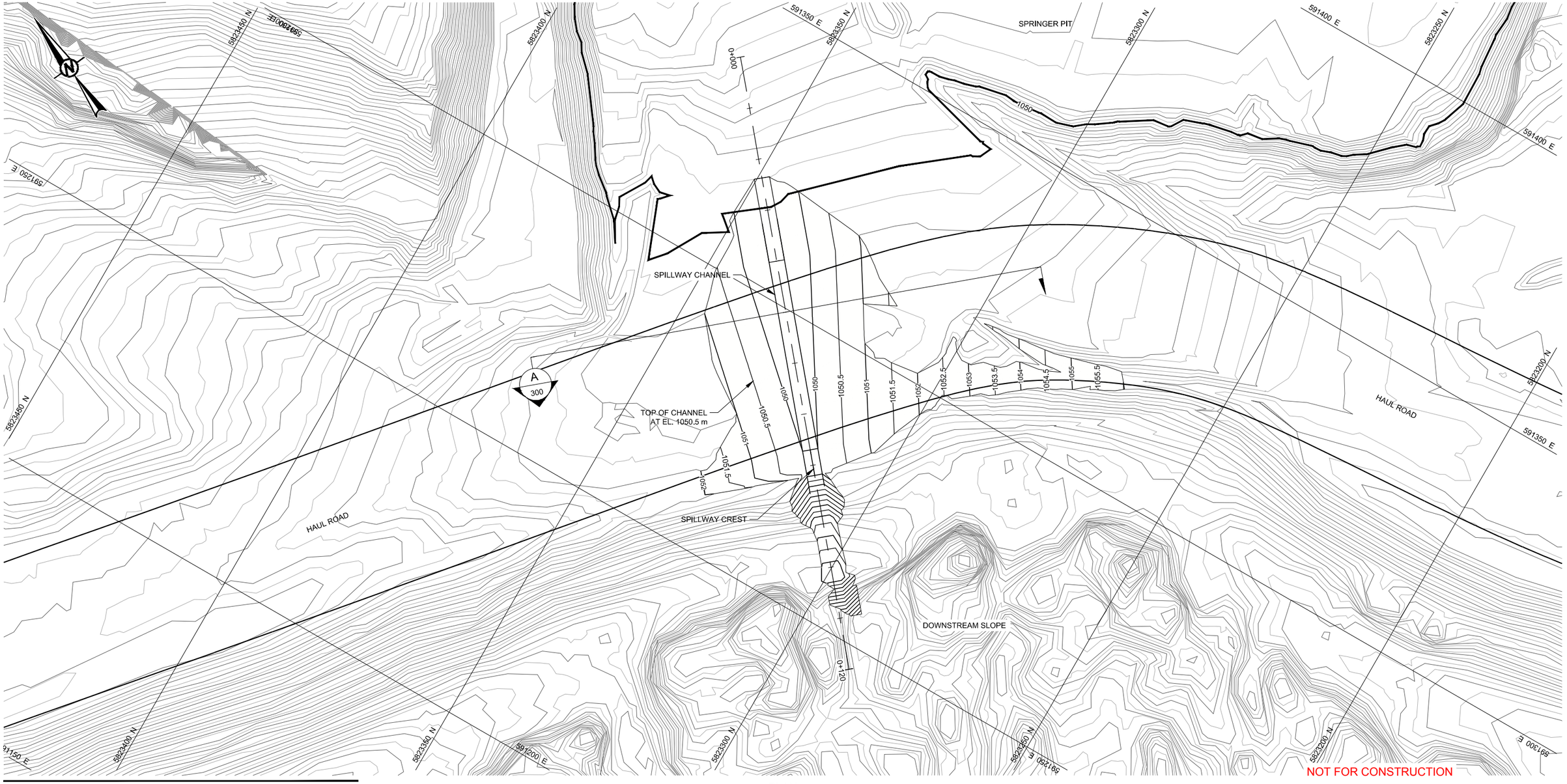

NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL 0.5 m MINOR AND 1 m MAJOR CONTOURS.

PLAN
SCALE 1:750

NOT FOR CONSTRUCTION

CONCEPT ONLY

0 12.5 25
1:750 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

SEAL

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

TITLE
SPILLWAY PLAN

PROJECT No.	PHASE	Rev.		DRAWING
1411734	15000	2	2 of 3	200

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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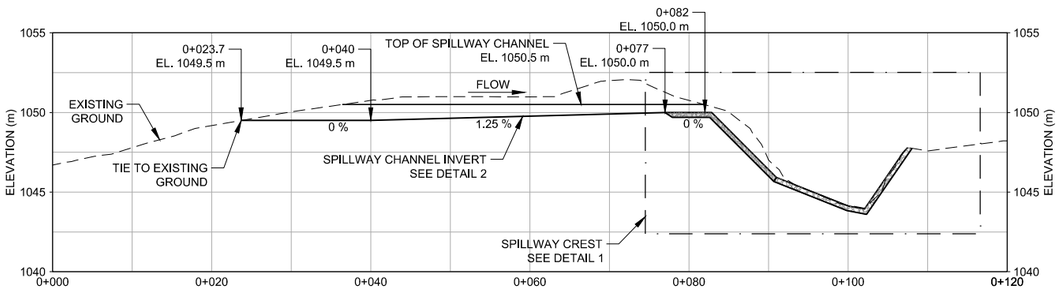

SPILLWAY PROFILE

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VERT. SCALE 1:375

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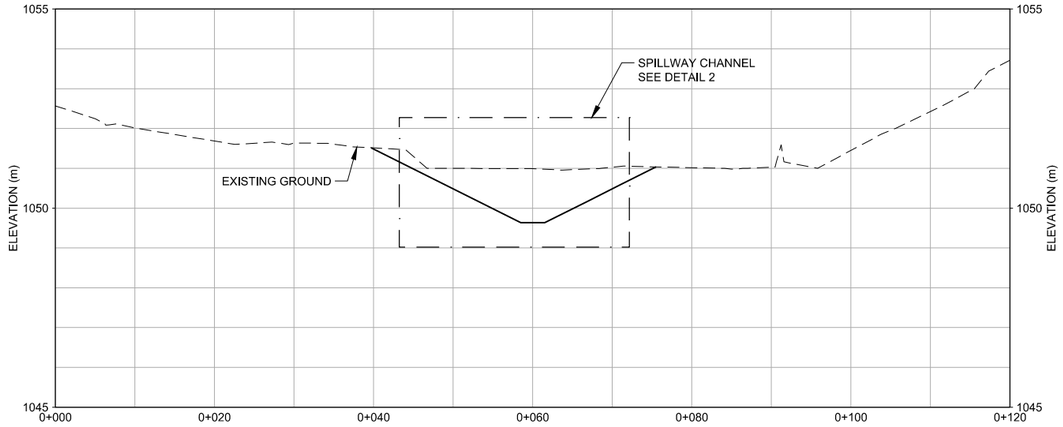

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VERT. SCALE 1:150

A
200

SPILLWAY CHANNEL SECTION

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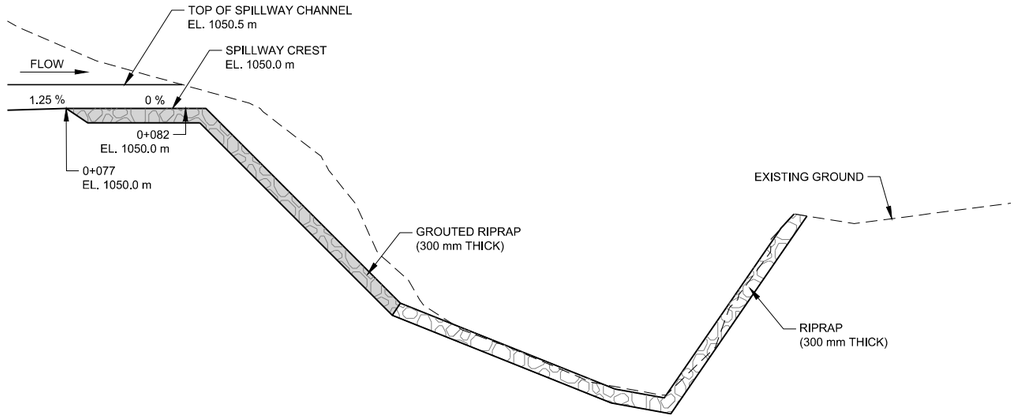

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VERT. SCALE 1:125

1

SPILLWAY CREST DETAIL

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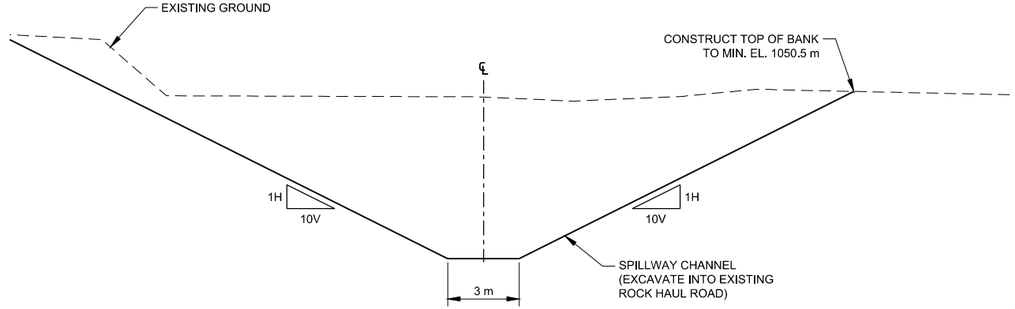

SCALE 1:250
VERT. SCALE 1:50

2

SPILLWAY CHANNEL TYPICAL DETAIL

0 5 10
1:250 METRES

NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. SPILLWAY CHANNEL SLOPED TO PROVIDE DRAINAGE BACK TO SPRINGER PIT.

NOT FOR CONSTRUCTION

CONCEPT ONLY

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

TITLE
PROFILE, SECTIONS, AND DETAILS

PROJECT No.	PHASE	Rev.		DRAWING
1411734	15000	2	3 of 3	300

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25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Appendix S
2021 Pit Slope and Rock Disposal Site (RDS) Stability

GOLDER
MEMBER OF WSP

REPORT

2021 Pit Slope and Waste Rock Dump Slope Stability Review

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Attention: Mathieu O'Leary

Submitted by:

Golder Associates Ltd.

Suite 200 - 2920 Virtual Way, Vancouver, BC, V5M 0C4, Canada

+1 604 296 4200

Reference No.: 22514095-001-R-Rev0-73100

4 February 2022

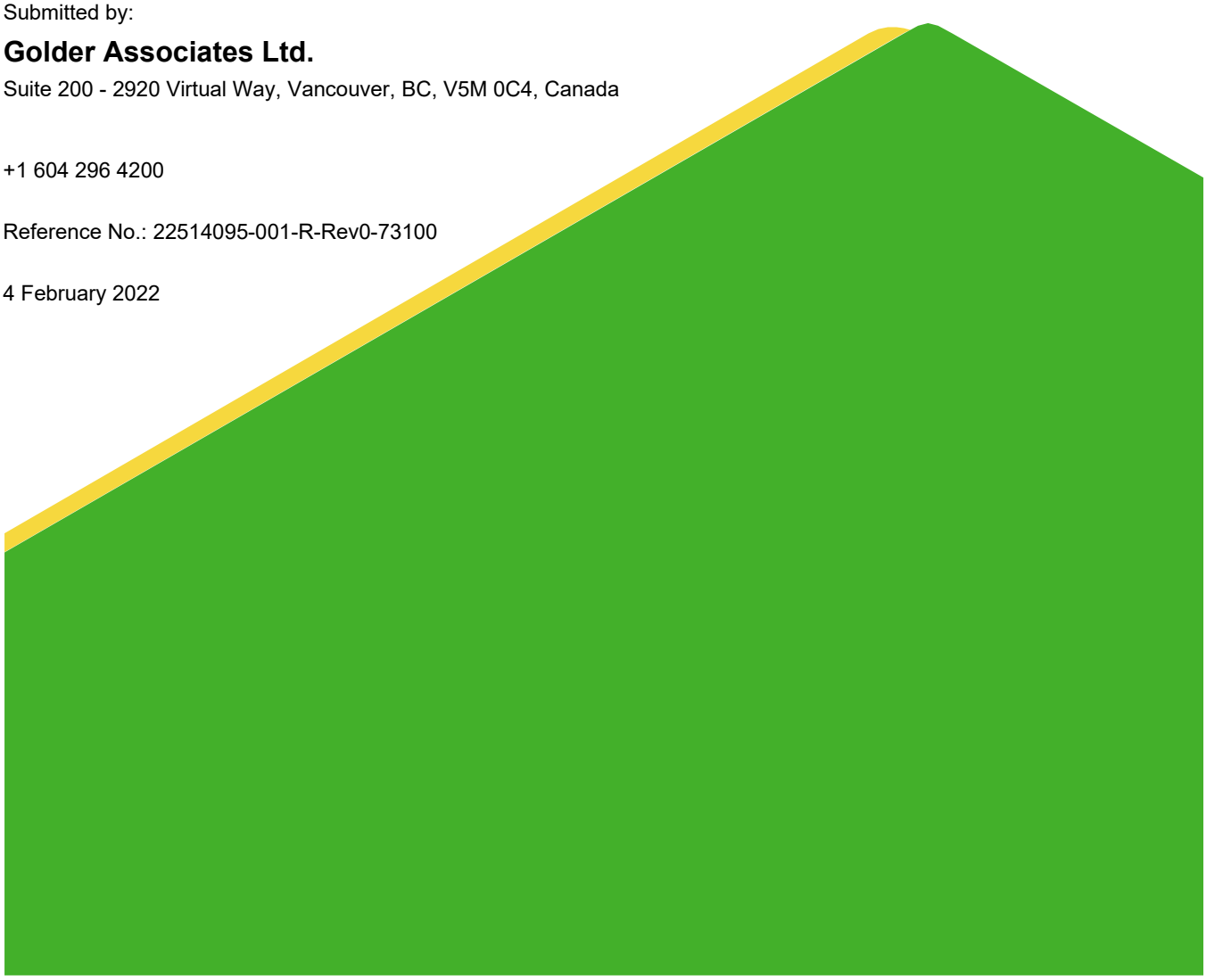

Executive Summary

This report presents a summary of the observations that were made and the discussions that were held with Mount Polley Mining Corporation (MPMC) staff during Golder Associates Ltd.'s (Golder) annual pit slope and waste rock dump slope stability review at the Mount Polley Mine. The report provides the following:

- a description of the engineering geology of Mount Polley Mine
- a description of the existing and proposed open pit mine and waste rock dump operations
- a summary of the slope stability performance of the existing pit slopes and waste rock dumps at the time of the 2021 review
- a discussion of the pit slope and waste rock dump monitoring data
- geotechnical recommendations for the pit slopes and the waste rock dumps, and the geotechnical monitoring program

The following mine areas were included in the review:

- the Cariboo Pit
- the Springer Pit
- the Wight Pit
- the Northwest Potentially Acid Generating (PAG) Dump
- the Southeast Rock Disposal Site (SERDS)
- the Northeast Non-acid Generating (NAG) Rock Dump (inactive)
- the Tailings Road

This slope stability review covers the time between October 2020 and October 2021.

The recommendations following the 2021 review are summarized in Table E-1. The ID column has a unique number for each recommendation, prefixed with the year the recommendation was originally made. New recommendations and comments from 2021 are marked with *italic text.*

Table E-1: Summary of Recommendations for 2021 Review

Area	ID	Recommendation	Timeline
Cariboo Pit	2019-03	If access is needed below the east wall on the haul road switchback or mining resumes, a rock rollout berm should be built and maintained below the east wall unload zone.	If access is needed or mining resumes, immediately.
	2020-01	Install three new prisms on the unload zone.	*Completed in fall 2020; however, the new prisms failed over the winter. These prisms should be replaced in Q2 2022, before monitoring resumes.*
		Replace broken head on existing prism.	*Completed in 2021; however, prism head broke again. Replace in Q2 2022 and install a cover to protect the prisms on the east wall from the elements. The cover could be made of plywood or metal.*
	2021-01	*Rock rollout berm in front of wedge instability along haul ramp and below C2 Pit due to limited catchment available.*	*Q2 2022 – personnel enter the Cariboo Pit to access the pumping infrastructure and a rollout berm should be in place to protect the pump equipment and personnel.*
Springer Pit	*2021-01*	*Remove boulders from haul ramp on west wall and establish a rock rollout berm in front of overhang in bench.*	*Q2 2022 – personnel enter the Springer Pit to access the pumping infrastructure.*
Wight Pit	2018-02	Clean catch ditch along east wall below Rusty Fault.	Once per year or as required
	2020-02	Install two to four additional prisms along the west wall, between Prisms 595 and 543.	*Complete – two prisms were installed on the west wall in early 2021.*
	2020-03	Move the location of the monitoring base station farther back from the crest of the east wall.	*Incomplete – a new station was installed that monitors the existing base station for movement.*
Tailings Road	2019-06	Remediate failure scarp area.	*Incomplete in 2020 and 2021. Divert water away from the Tailings Road to limit ponding in the area of the scarp area until it is remediated.*
All areas – prism monitoring data	2019-07	Collect slope distance measurements.	*Incomplete – Q2 2022*

Study Limitations

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1.0 INTRODUCTION

This report presents a summary of the observations that were made and the discussions that were held with Mount Polley Mining Corporation (MPMC) staff during Golder Associates Ltd.'s (Golder) annual pit slope and waste rock dump slope stability review at the Mount Polley Mine. The review was carried out on 20 October 2021 by Ms. Alannah Gray Hubbard, P.Eng., and Mr. Caleb Lee, P.Geo., of Golder, in the accompaniment of Mr. Mathieu O'Leary and Mr. Chad Cameron of MPMC. The report provides the following:

- a description of the engineering geology of Mount Polley Mine
- a description of the existing and proposed open pit mine and waste rock dump operations
- a summary of the slope stability performance of the existing pit slopes and waste rock dumps at the time of the 2021 review
- a discussion of the pit slope and waste rock dump monitoring data
- geotechnical recommendations for the pit slopes, waste rock dumps, and geotechnical monitoring program

The following mine areas were included in the review and are shown in Figure 1:

- the Cariboo Pit
- the Springer Pit
- the Wight Pit
- the Northwest Potentially Acid Generating (PAG) Dump
- the Southeast Rock Disposal Site (SERDS)
- the Northeast Non-acid Generating (NAG) Rock Dump (inactive)
- the Tailings Road

This slope stability review covers the time between October 2020 and October 2021.

All coordinates presented in this report are in mine grid coordinates, and elevations are relative to a local mine site datum.

2.0 MOUNT POLLEY MINE ENGINEERING GEOLOGY

The Mount Polley deposits are located within an alkalic intrusive complex within the northwest–southeast trending Quesnel Trough, a 35 km wide, northwest trending volcanic sedimentary belt. The copper and gold mineralization is contained predominately within north–south trending, elongated intrusive breccia stocks that have intruded late-phase diorites and monzonite porphyries. Later-stage north–south trending dykes have been intruded along the regional structural trend.

In general, the rocks in the Cariboo Pit consist of monzonite intrusion breccias that have intruded the host monzonite rocks. Monzonite is exposed in the majority of the pit walls, while breccias are exposed in the centre of the pit. However, localized blocks of diorite are exposed in the northeast wall – northwest segment and the east wall, while plagioclase porphyry is exposed along the southeast wall.

The mineralized hydrothermal breccia in the Springer Pit occurs along a north-northwest–south-southeast trend. To the west, the mineralized breccia zone is bounded by a “mix” of breccia and intrusive rocks, which are then bounded by monzonite rocks. Monzonite rocks are the dominant rock type along the south side of the Springer Pit. Intrusive diorite rocks bound the mineralized breccia to the north and northeast. Finally, a series of younger north–south trending augite porphyry dykes are interpreted to occur throughout the proposed pit area. These dykes are often chlorite and calcite-altered and commonly faulted. These younger dykes intersect the different rock types and the major faults.

For further discussion of the site geology and major geological structures at the Mount Polley Mine, refer to the 2016 Cariboo and Springer Pit design report (Golder 2016a).

The dyke and fault models for the Springer and Cariboo Pits are shown in Figures 2 and 3, together with the October 2019 topography. At the time of the 2021 review, the topography had not changed since LiDAR collection in October 2019; therefore, all figures within this report use the 2019 topography.

3.0 MOUNT POLLEY CURRENT MINE STATUS

A plan of the Mount Polley Mine and the locations of the existing pits and waste rock dumps at the time of the October 2021 review are shown in Figure 1. The review photographs are presented in Appendix A. The following sections provide an overview of the status of the pits and waste rock dumps at the Mount Polley Mine at the time of the 2021 review.

3.1 Open Pit Development and Status

3.1.1 Cariboo Pit

The status of the Cariboo Pit at the time of the 2021 review is shown in Figures 1 and 4. The Cariboo Pit is located between 2,800 N and 3,550 N, and 1,160 E and 1,990 E, to the southeast of the Springer Pit. Mining operations in the Cariboo Pit were carried out from 1996 to 2001 and, upon completion, the pit was backfilled with waste rock from other pits. Mining activities in the Cariboo Pit resumed in 2015, until the mine went into care and maintenance in May 2019. At the time of the 2021 review, the Cariboo Pit was flooded to approximately elev. 1,020 m.

Four walls have been excavated in the Cariboo Pit. These walls are labelled in Figure 4 and in Appendix A, Photograph A-2. A haul ramp enters the pit from the south, descends along the southeast wall, and wraps around the east, northeast, and west walls to the pit bottom on the east side (Figure 4). Six benches have been excavated on either side of the haul ramp that enters the pit from the south. The Cariboo Pit crest at its highest point is at approximately elev. 1,181 m on the east wall, and the pit floor was at elev. 921 m; however, the pit bottom was flooded and was not visible at the time of the review.

The northeast wall of the Cariboo Pit is an approximately 900 m long southwest-facing wall that includes three segments: the northwest, central, and southeast wall segments (Figure 4). The northwest segment includes about seven single benches that have been excavated to the elev. 1,894 m platform between the Cariboo and Springer Pits. The central segment of the northeast wall includes a waste rock rehandle slope and has a large catch-bench area at elev. 988 m (not visible at the time of the 2021 review). There are about six single benches excavated in the rehandle slope. On the southeast segment there is a nose that notches into the east wall. The crest of the northeast wall is at approximately elev. 1,168 m, and at the base of the wall is a haul road ramp at elev. 952 m. From the crest of the rehandle slope to the catch-bench area below the northwest segment of the northeast wall is about 180 m high, and the overall slope height from the crest to the pit bottom is 247 m.

The east wall experienced deep-seated toppling instability in April 2017 and unloading of the area was completed in 2018. The wall is currently stable. The crest of the unload zone is located at elev. 1,181 m. The wall is approximately 247 m high.

On the southeast side of the pit, the east wall curves and changes orientation from southwest-facing (east wall), through west-facing, and becomes northwest-facing (southeast wall). The southeast wall is approximately 380 m long. The crest of the southeast wall is located at elev. 1,146 m, and the toe of the wall was at the pit bottom (elev. 921 m). There are three double benches below the haul road ramp into the pit on the southeast wall and one single bench. The southeast wall is approximately 225 m high.

A saddle exists between the Springer and Cariboo Pits, and its elevation has remained unchanged since the 2019 review; the south side of the saddle is at elev. 1,096 m and at elev. 1,084 m on the north side. The saddle on the southwest side forms the west wall in the Cariboo Pit. The wall is approximately 163 m high.

3.1.2 WX Pit

The WX Pit is an east-facing alcove that was excavated into a ridge located to the south of the Springer Pit (Figures 1 and 4). The crest of the ridge is located at approximately elev. 1,156 m, and the floor of the WX Pit is located at elev. 1,053 m. Three double benches were excavated to form a maximum wall height in the alcove of approximately 80 m. Three single benches have been mined beneath the WX Pit to elev. 1,030 m as a continuation of the west wall on the west side of the haul ramp. The WX Pit has been excavated to its ultimate configuration.

3.1.3 C2 Pit

The C2 Pit is a west-facing alcove that is located at the southwest end of the Cariboo Pit (Figures 1 and 4). The crest of the wall is at elev. 1,159 m, and the pit floor is located at elev. 1,062 m. Three to four double benches have been excavated in the C2 Pit, to form a maximum wall height in the alcove of approximately 90 m. The C2 Pit has been excavated to its ultimate configuration.

3.1.4 Springer Pit

The Springer Pit is located to the northwest of the Cariboo Pit and to the southwest of the mined-out and backfilled Bell Pit (Figures 1 and 4). The Springer Pit is pear shaped and is approximately 1,000 m long and approximately 600 m wide. The pit floor at the south end of the pit is excavated to approximately elev. 940 m. In 2015 and 2016 tailings were discharged as slurry into Springer Pit from the saddle between the Cariboo and Springer Pits. Approximately ⅓ of the tailings have been dredged from Springer Pit and pumped as slurry to the tailings storage facility between March 2016 and October 2019. Approximately 3.5 Mt of tailings remain in the Springer Pit. The tailings had a free water cover (approximately elev. 986 m) at the time of the 2021 review and the water was actively being pumped. The long-term mine plan includes continued dewatering, removal of the tailings, and an expansion of the Springer Pit to merge with the Cariboo Pit.

3.1.5 Wight Pit

The Wight Pit is located at the northeast end of the mine property along the northwest shore of Polley Lake between 5,150 N and 5,820 N, and 2,380 E and 3,025 E (Figure 1). Mining of the open pit was completed in 2009 and underground operations were carried out via an adit that was driven into the base of the northwest wall of the pit. Underground operations ceased in 2018.

The Wight Pit trends northwest–southeast, and the entrance is located at the south end of the pit. The pit floor was initially mined down to elev. 804 m and was backfilled by 2016 to approximately elev. 875 m at the north end of the pit and approximately elev. 911 m at the south end of the pit. The west wall of the pit has a maximum crest of elev. 1,020 m, and approximately seven double benches have been excavated on this wall, of which six were visible above the backfill during the 2021 review. The west wall is approximately 146 m high. The east wall has a maximum crest of elev. 964 m and an approximate maximum wall height of 116 m. Approximately five double benches have been excavated on the east wall. The north wall has a maximum crest of elev. 996 m and a wall height of approximately 120 m. Approximately seven double benches have been excavated on the north wall, of which six were visible above the backfill during the 2021 review.

The south end of the Wight Pit was backfilled with waste rock in 2009 and used to access the underground portal located at the bottom of the north wall. The waste rock backfill extends approximately 140 m north from the mined-out south wall, and the top of the fill has a maximum elevation of elev. 911 m.

3.2 Waste Rock Dump Development and Status

3.2.1 Northwest Potentially Acid Generating Dump

The Northwest PAG Dump is located at the northwest end of the mine property to the west of the Springer Pit between 3,600 N and 4,630 N, and 470 E and 1,150 E (Figure 1). A layer of NAG rock was placed on the bottom lift, and PAG rock was end-dumped on top of the NAG lift in four lifts from the bottom up. No activities were occurring on the Northwest PAG Dump at the time of the 2021 review and there was no change in the dump configuration since the 2020 review. The dump at the north end of the upper platform is at elev. 1,140 m. The toe of the dump is located at approximately elev. 1,020 m, and the dump is approximately 120 m high.

Ultimately, the PAG material will be transferred into the open pits during mine closure.

3.2.2 Southeast Rock Disposal Site

The SERDS, previously referred to as the Southeast NAG Dump (Golder 2021) and the Life of Mine NAG Dump (Golder 2016b), is located at the southeast end of the mine property and covers the old Sandwich Dump, the Southeast Zone Pit, and the Pond Zone Pit (Figure 1). The SERDS is located between approximately 1,300 N and 2,500 N, and 3,100 E and 4,420 E. It is a southward extension of the existing Northeast NAG Dump. The top lift of the SERDS is at elev. 1,110 m and no additional dumping has occurred since the 2020 review.

3.2.3 Northeast Non-acid Generating Dump

The Northeast NAG Dump is located to the north of the SERDS and to the northeast of the East Waste Dump between 2,500 N and 4,200 N, along the west side of Polley Lake (Figure 1). Waste rock from the Wight Pit was consigned to the dump, and this dump has been inactive for several years.

4.0 REVIEW OF OPEN PIT SLOPE STABILITY PERFORMANCE

The following sections summarize open pit slope stability performance observations that were made during the 2021 review.

4.1 Cariboo Pit Slope Stability Performance

With the exception of localized zones within and adjacent to the Polley Fault causing bench-scale planar failure, overall rock mass quality in the Cariboo Pit is generally good. Slope stability continues to be favourable, and the pit walls have not exhibited any signs of large, multi-bench instability since the 2020 review. Bench-scale stability continues to be favourable and, in general, there is adequate catchment on the slopes. An overview of the Cariboo Pit is shown in Appendix A, Photograph A-2. The Cariboo Pit walls are labelled in Figure 4. The slope stability performance exhibited by the walls is presented in the following sections.

4.1.1 Northeast Wall – Northwest Segment

An overview of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-2. The northwest segment of the northeast wall is adjacent to the Springer Pit Phase 3 pushback. The two pit areas are separated by the Polley Fault (Appendix A, Photograph A-3). This area has not changed since the 2020 review.

Approximately seven single benches have been excavated along the northwest segment of the northeast wall of the Cariboo Pit. The wall was in good condition with no signs of overall wall instability at the time of the 2021 review. The majority of the major geological structures are favourably oriented with respect to the northwest segment of the northeast wall (Figure 2), and the benches were exhibiting good stability performance. North–south trending augite porphyry dykes are exposed in the wall and dip favourably to the east at steep angles (Appendix A, Photograph A-3). Moderately dipping features are evident on the northwest side of this segment where benches have broken back to these features (Appendix A, Photograph A-3). Catchment is still adequate in these areas where localized back-break has occurred.

The Polley Fault and adjacent faults trend at approximately 350 degrees and dip to the east-northeast at approximately 70 degrees (Figure 3 and Appendix A, Photograph A-3). The north-northwest–south-southeast striking regional trend intersects the northeast wall at an oblique angle. Ravel debris continues to accumulate at the base of fault traces on individual benches; however, adequate catchment has been maintained on the wall.

4.1.2 Northeast Wall – Central Segment

An overview of the central segment of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-4. A rehandle slope excavated in waste rock is located in the upper central portion of the northeast wall of the Cariboo Pit. Approximately six single benches have been excavated in the waste rock rehandle slope. The lower benches in the rehandle material have been re-sloped to reduce the bench face angles. This area has not changed since the 2020 review. The rehandle slope is exhibiting good overall slope stability with no signs of bulging or instability in the face of the slope and no cracking behind the crest of the slope.

Seven single benches have been excavated in rock down to elev. 998 m, below the waste rock rehandle slope. South-southeasterly dipping structures strike sub-parallel to the central segment of the northeast wall, and the bench faces are breaking back to these moderately dipping structures (Appendix A, Photograph A-4). These structures exhibit a dip on the order of 55 to 65 degrees, and a dip direction of 200 degrees true azimuth. The catch-benches range from 8 to 11 m in width. They currently have adequate catchment to contain the ongoing ravel material.

4.1.3 Northeast Wall – Southeast Segment

An overview of the southeast segment of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-5. This area has not changed since the 2020 review and was exhibiting good stability performance at the time of the 2021 review. The double bench faces on the wall are breaking back to moderately to steeply south-southeasterly dipping joints, and some localized raveling has occurred (Appendix A, Photograph A-5). The ravel debris was confined to localized areas of the benches, and adequate catchment is being maintained on the overall slope. There are some fault exposures on the northwest side of the wall segment around about mid-wall height (Appendix A, Photograph A-5). Minor ongoing raveling appears to be occurring along these faults; however, the overall wall catchment is adequate. The East Cariboo Fault is exposed in the upper northeast corner of the southeast wall segment (Appendix A, Photograph A-5).

4.1.4 East Wall

An overview of the east wall is shown in Figure 4 and Appendix A, Photograph A-6. The East Cariboo Fault intersects the southeast segment of the northeast wall (Figure 3) and forms the boundary between the southeast segment of the northeast wall and the east wall. The East Cariboo Fault generally follows an orientation trend similar to the Polley Fault; it strikes northwest–southeast and dips steeply to the northeast at approximately 60 degrees.

In previous years, multi-bench-scale toppling instability developed in the hangingwall of the East Cariboo Fault, at the top of the slope between approximately elev. 1,108 and 1,160 m and was being monitored with geotechnical visual reviews and prism monitoring. Toppling displacement began to accelerate in the spring of 2017, and the upper three to four benches failed on 7 April 2017. The slope was well monitored prior to the instability. A rockfall berm was constructed below the failure zone, based on the results of rockfall and runout analyses. The rockfall berm contained the failure debris. It was recommended that the crest of the east wall be mined down to elev. 1,120 m to remove failure debris that could continue to ravel. The crest of the east wall was unloaded by mining five single benches to elev. 1,120 m and this was completed in 2018 (Golder 2019). At the time of the 2021 review, the unload area and single benches were exhibiting good stability performance (Appendix A, Photograph A-6).

Appropriate ditching has been implemented around the unload zone to intercept and conduct water away from the east wall on the south side of the unload area. There is one area of wall seepage that was noted during the 2019 review on the unload area north of the interception ditch and was again observed during the 2021 review (Appendix A, Photographs A-6 and A-7). The source of the water could be due to a geologic structure in the wall that extends to higher ground to the northeast. The water is infiltrating into the fill material on the unload zone. The benches below the seepage zone are dry and there are no signs of increased raveling or instability (Appendix A, Photograph A-6). At the time of the 2021 review there were no concerns related to slope stability due to the seepage area. The unloaded area should continue to be inspected during routine visual inspections for excess seepage and raveling.

The benches below the unload zone are partially infilled with failure debris; however, there is adequate catchment below the two benches that are filled (Appendix A, Photograph A-6). A wide bench was excavated at the toe of the east wall beside the haul road ramp into the pit; however, at the time of the 2021 review, the wide bench was under water.

4.1.5 Southeast Wall

The status of the Cariboo Pit southeast wall at the time of the 2021 review is shown in Figure 4 and in Appendix A, Photograph A-8. One single bench and nine double benches (six double benches above the haul ramp and three double benches below the ramp) have been excavated in the southeast wall. The in-pit reservoir was at elev. 1,020 m at the time of the 2021 review; therefore, the lower southeast wall was not visible (Appendix A, Photograph A-8). The southeast wall continues to exhibit adequate slope stability performance. There are bench-scale wedge failures that continue to ravel on the north side of the southeast wall (Appendix A, Photograph A-8). The areas should be monitored for increased ravel debris. Once access is required into Cariboo Pit along the haul ramp on this wall as water is removed, maintain the rock rollout berm along the haul ramp to contain potential rockfall and to protect light vehicles or equipment that may need to enter the pit to access the pit lake or pumping equipment. Benches on the south end of the southeast wall have bench faces breaking back to moderate dipping, planar, continuous joints that dip toward the northwest (Appendix A, Photograph A-8).

Overall, the southeast wall is exhibiting adequate stability performance. Adequate catchment remains along the majority of the wall, and the benches have not been significantly infilled by ravel debris. The degree of available catchment along this wall should continue to be monitored, particularly if access is required to the in-pit reservoir as pumping continues.

4.1.6 West Wall

A saddle has been developed between the southeast side of the Springer Pit and the west side of the Cariboo Pit (Appendix A, Photograph A-9). The crest of the saddle is located at elev. 1,084 m, and the west wall of the Cariboo Pit has been mined down to elev. 921 m. At the time of the 2021 review, the bottom of the west wall was not visible due to the in-pit reservoir (Appendix A, Photograph A-9).

The Polley Fault is a broad zone of deformation 60 to 80 m wide that is exposed in the west wall. The fault zone strikes approximately north-northwest–south-southeast and dips steeply to the east. Bench-scale planar failure continues to be observed along a shallow easterly dipping fault within the Polley Fault Zone and in the immediate hangingwall. The degree of catchment and bench infilling along the portion of the west wall where the Polley Fault is exposed should continue to be monitored (Appendix A, Photograph A-9). If the in-pit reservoir is lowered and mining resumes, it may be necessary to increase catch-bench widths or construct rollout berms along the working bench along the west wall if rockfall hazards become a concern.

Bench stability performance is better outside of the Polley Fault Zone in the west wall. The rock along the upper south side of the wall and on the lower north side of the wall below the Polley Fault Zone exhibits good rock quality and favourable geological structure orientations.

4.1.7 Haul Ramp

The haul ramp into Cariboo Pit enters from the south heading north then wraps around the pit from the southeast, east, northeast, and west walls to the pit bottom (Figure 1). The haul ramp has pumping infrastructure that is located on the east side of the ramp to the in-pit reservoir's edge at elev. 1,020 m. There is a wedge instability that has continued to ravel over the years on the east side of the haul ramp entrance before the C2 Pit (Appendix A, Photograph A-10). Material has accumulated at the toe of the instability. There is a risk of rock rollout that could damage the pipe infrastructure for dewatering, and the ramp is going to be used for long-term access into the Springer Pit once mining activities reach this elevation. A berm should be constructed in front of the instability area. The ravel material could be used to cover the pipe for protection and a rock rollout berm should be constructed at the toe of the wedge instability. The berm should be inspected and cleaned annually while the haul ramp is actively being used by light and heavy traffic.

4.2 C2 Pit Slope Stability Performance

The C2 Pit is a small pit that was mined out immediately southeast of the Cariboo Pit (Appendix A, Photograph A-11). The C2 Pit has an in-pit reservoir (elev. 1,077 m) and only two double benches were visible above the water level. The benches appear to be in adequate condition and exhibiting good stability performance. There are five benches below the C2 Pit above the haul ramp in and out of the Cariboo Pit. The catch-benches are infilled and there is limited catchment available. A rock rollout berm should be established and maintained along the haul ramp to protect operations as well as the pumping infrastructure along the haul ramp (Appendix A, Photograph A-12).

4.3 WX Pit Slope Stability Performance

The WX Pit is a small pit that was mined out immediately west of the C2 Pit and southwest of the Cariboo Pit. The WX Pit has three double benches excavated. The benches in the west wall of the WX Pit have limited catchment available and the benches to the south appear to have more catchment available. As mining resumes on the saddle between the Springer and Cariboo Pits, overspill could infill these benches and potentially cause a rockfall risk to traffic along the haul ramp into Cariboo Pit. Limit the amount of overspill onto the catch-benches from new mining activities at the crest of the wall. If the catch-benches continue to become infilled, install a rockfall rollout berm at the base of wall to reduce the risk of rockfall to light vehicles and personnel (Appendix A, Photograph A-13).

4.4 Springer Pit Slope Stability Performance

The status of the Springer Pit at the time of the 2021 review is shown in Appendix A, Photograph A-14, and the pit walls are labelled in Figure 4. The pit has been partially backfilled with tailings and water, and mining has not been carried out in the Springer Pit for a few years. The inundation of the Springer Pit has not adversely impacted the overall slope stability performance of the pit slopes. Slope stability analyses to assess the impact of dewatering the Springer Pit slopes as the tailings are dredged from the pit have been carried out, and the results are presented in a separate document (Golder 2017). The analyses assessed a scenario where the backfill materials in the pit are removed and where high water tables remain in the pit slopes. The stability analyses indicated factors of safety between 1.7 and 2.0 for the southwest and northeast walls of the Springer Pit, respectively. Consequently, the removal of the tailings and water from the Springer Pit is not expected to adversely impact the overall pit slope stability of the Springer Pit. When mining resumes in the Springer Pit the walls should be monitored for seepage, particularly in the east and south walls where seepage has been noted previously (Golder 2016b). No dredging activities have been carried out in the Springer Pit since 2019 and dewatering was ongoing. The water level in the pit was at approximately elev. 986 m (Appendix A, Photograph A-14).

The overall rock mass quality in the Springer Pit is good, and the slopes continue to exhibit favourable overall and bench-scale slope stability. The slope stability performance exhibited by the walls at the time of the 2021 review is presented in the following sections.

4.4.1 North Wall

The north wall is continuing to exhibit favourable stability performance and there has been very little change to the wall since the 2020 review (Appendix A, Photograph A-14). Large-scale geological structures are favourably oriented with respect to the north wall (Figure 3). The catch-benches have some ravel infilling in areas where the Springer and Wishbone Faults are exposed in the wall (Appendix A, Photograph A-15).

4.4.2 East Wall

The east wall has not changed significantly over the last few years. The benches are infilled with old mining overspill (Appendix A, Photographs A-16). There is too much material on the elev. 1,000 m bench to safely clean and re-establish the catch-bench. Depending on the mine plan there are two options to proceed with mining (Figure 5 and Appendix A, Photograph A-16):

1) If MPMC plan to only mine along the saddle between the Springer and Cariboo Pits, there are no concerns with leaving the elev. 1,000 m bench as is.

2) If MPMC plan to mine concurrently at the Springer Pit bottom and along the saddle between the Springer and Cariboo Pits, additional catchment may be required below the current Springer Pit bottom. Once the Springer Pit is dewatered, the available catchment on the benches below the elev. 1,000 m catch-bench should be inspected. If adequate catchment is not available, a wider catch-bench will be required with a rock rollout berm.

4.4.3 South Wall

The south wall is exhibiting adequate stability performance, and some benches have broken back to moderately dipping joints over about three single benches mid-wall (Appendix A, Photograph A-17). There are some steeply dipping dykes in the south wall that are causing minor bench-scale raveling (Appendix A, Photograph A-17). Adequate catchment remains along the wider geotechnical bench at elev. 1,000 m to contain any ravel debris.

Preparations for mining activities were underway at the time of the 2021 review (Appendix A, Photograph A-18). When mining resumes, every effort should be made to limit overspill into the WX, Cariboo, and Springer Pits. Depending on the amount of overspill from mining activities a rock rollout berm may be required on the west side of the access ramp into Cariboo Pit (Appendix A, Photograph A-13).

4.4.4 West Wall

The west wall is continuing to exhibit favourable slope stability performance and there has been very little change to the wall since the 2020 review (Appendix A, Photograph A-19). Some large geological structures are visible in the west wall, and they are favourably oriented with no large-scale instability apparent (Figure 4). The catch-benches have some ravel infilling in localized areas, but there continues to be adequate catchment along the majority of the west wall. At the time of the 2021 review there had been a minor rock rollout on the ramp to the pumping equipment in the Springer Pit along the west wall (Appendix A, Photograph A-20). The boulders should be removed, and the area should be monitored. A rock rollout berm should be constructed in the area where the overhanging material is still visible since vehicles continue to utilize the ramp.

During the 2020 review, reduced catchment was identified on the north side of the west wall below the north nose where equipment was being stored. A rock rollout berm was established along the toe of the wall (Appendix A, Photographs A-21 and A-22). Continue to keep equipment and personnel at least 10 m from the wall to reduce the risk of rockfall.

4.5 Wight Pit Slope Stability Performance

The status of the Wight Pit at the time of the 2021 review is shown in Figure 1 and in Appendix A, Photograph A-23. With the exception of the rock within the Rusty Fault on the northeast side of the pit, and within the Green Dykes that bound the south side of the west wall toppling zone, overall rock mass quality in the Wight Pit is generally good. The slope stability performance exhibited by the various walls at the time of the 2021 review is presented in the following sections.

4.5.1 West Wall

An overview of the west wall of the Wight Pit is shown in Appendix A, Photographs A-23 and A-24. In 2007, toppling instability developed in the middle of west wall along the steeply dipping, north–south striking joints and faults. A steep west-northwest–east-southeast striking dyke swarm that intersects the middle of the west wall formed release structures for the south side of the toppling zone. The highest deformation rates occurred immediately adjacent to the north side of the dyke swarm, and deformation rates decrease toward the north and away from the dyke swarm. Ongoing monitoring data and visual observations have indicated that the portion of the west wall on the south side of the dyke swarm has not exhibited any deformation.

The toppling deformation to the north of the dykes decelerated after unloading of the crest was carried out and mining of the pit was completed. The toe of the south side of the west wall toppling zone has been buttressed with waste rockfill (Appendix A, Photograph A-24). The crest of the west wall was inspected during the 2021 review. The unloaded area appears to be in similar condition to what was observed in 2020 review, with some ongoing displacement and raveling caused by deformation and creep from within toppling zone (Appendix A, Photograph A-25). The cracks behind the crest of the west wall were in similar condition to the 2020 review, with some ongoing year-over-year displacement (Appendix A, Photograph A-26). This displacement trend is also indicated by the prism monitoring data and discussed further in Section 4.6.3.1. Prism monitoring and visual review of the cracks should continue to assess areas that exhibit ongoing creep displacements and to monitor for any sudden accelerations in the toppling zone.

The rockfill buttress in the bottom of the pit provides a very large catch-bench for the majority of rockfall from the toppling zone (Appendix A, Photograph A-27). To the north of the backfill, a rockfall ditch and berm was constructed several years ago along the toe of the west wall to keep the pit floor free of raveling rocks from the north side of the topple zone. This ditch and berm have been effective, as rockfalls have not been observed beyond the berm. An inactive wellhouse is located near the base of the north side of the west wall, and there was limited catchment on the bench immediately above (Appendix A, Photograph A-27). If the wellhouse is reactivated, the condition of the berm should be reviewed and, if required, cleaned out to provide sufficient catchment and rockfall protection to personnel accessing the wellhouse. Catchment along the west wall should continue to be monitored. There is sufficient room to expand the size and height of the catchment berm at the base of the north end of the west wall, if required.

4.5.2 North Wall

The status of the north wall at the time of the review is shown in Appendix A, Photograph A-28. The slopes along the northwest and north sides of the pit continue to remain stable and have only exhibited raveling along fault intersections, particularly in the northwest and northeast corners of the wall. This ravel material is infilling the catch-benches; however, there is adequate rockfall protection below the slope at the pit bottom (Appendix A, Photograph A-28).

4.5.3 East Wall

The status of the east wall at the time of the 2021 review is shown in Appendix A, Photograph A-29. The benches on the east wall are infilled with ravel debris. As well, ongoing raveling is occurring along the Rusty Fault in the northeast corner of the east wall (Appendix A, Photograph A-29). A talus slope has developed at the toe of the Rusty Fault, and ravel debris is continuing to accumulate at the base of the wall. A rockfall catch ditch and berm have been constructed along the toe of the east wall, and there is adequate rockfall protection on the pit floor (Appendix A, Photograph A-29). If access to the bottom of the pit is required, the degree of available catchment in the ditch should be inspected at least twice a year and, if the ditch becomes filled, it should be cleaned out with an excavator so that personnel working at the base of the wall remain protected from rockfall.

There is a potential undaylighted wedge developing at the north end of the east wall that was first observed in 2018 and has been inspected annually since (Appendix A, Photograph A-29). The undaylighted wedge is formed by the intersection of the Rusty Fault and a fault that dips toward the north-northwest. The line of intersection of the Rusty Fault and the fault that dips toward the north-northwest does not appear to be daylighted, but displacement could be occurring along the wedge between the two faults. Additional prisms were installed in 2019 and 2020. The prism monitoring data and locations are discussed further in Section 4.6.3.3.

Toppling deformation has previously occurred along the crest of the east wall; however, the toppling slowed and stopped after mining of the pit was completed. The cracks associated with the toppling deformation in the till at the crest of the east wall were inspected during the 2021 review (Appendix A, Photograph A-30). The cracks in the till behind the east wall are rounded and it appears that there has been little to no movement on the east wall.

A perimeter ditch was re-established around the north and east wall of the Wight Pit in 2021 (Appendix A, Photograph A-31). After the large storm event that occurred in 2020, the perimeter ditch was re-established to convey water around the Wight Pit. At the time of the 2021 review, the ditch was in good condition. The ditch should be inspected at least twice per year (in the fall and after freshet) and if any repairs are required, they should be completed.

4.6 Review of Pit Slope Stability Monitoring Data

Prisms are an integral part of the monitoring system for walls of the open pits at Mount Polley Mine. Long-term deformations can be detected in the prism data, and displacement vectors can be calculated to assist in determining failure mechanisms. Diligence and care should continue to be applied to the monitoring accuracy and frequency. The MPMC survey staff achieve a good level of accuracy in the prism monitoring surveys.

Monitoring data up to 31 October 2021 for the Cariboo, Springer, and Wight Pits have been provided by MPMC. The locations of the monitoring prisms in the Cariboo, Springer, and Wight Pits are presented in Appendix B, Figures B-1, B-11, and B-18. Monitoring prism plots are presented in Appendix B. All of the prisms were not read between December 2020 and May 2021 due to winter conditions.

Slope distance is not being recorded in the monitoring data spreadsheets. Every effort should be made to record slope distance as this is an integral component of the data review to understand apparent movement of the prisms relative to the base station.

As prisms are reset or moved, the prism maps should be updated. The inactive prisms should be clearly marked in the data collection spreadsheets.

Continue to measure the prisms in all the pits on a monthly basis (excluding winter months between December and May) and review the data for changes in the magnitude and rate of displacement.

4.6.1 Monitoring Prism Data – Cariboo Pit

Several prisms area located in the Cariboo Pit (Appendix B, Figure B-1). Since mining ceased in 2019, the trends in the prism data have been steady, with little indication of movement with the exception of ongoing slow-moving relaxation of the pit walls. The following sections provide a review of the prism readings from October 2019 to October 2020 for the Cariboo Pit. Due to the in-pit water reservoir increasing in elevation from elev. 1,000 m to elev. 1,020 m throughout 2021, several of the prisms on the lower benches of the pit were not read during the reporting period.

4.6.1.1 Northeast Wall – Northwest Segment

The Cariboo Pit northeast wall – northwest segment has five 700 series and seven 800 series prisms installed (Appendix B, Figure B-1). The prisms are showing small displacements that are within the accuracy of the system. A typical 700 series prism plot is shown in Appendix B, Figure B-2, and a typical 800 series prism plot is shown in Appendix B, Figure B-3.

The 700 series prisms show little movement, with total displacements of 10 mm or less over the reporting period. The 700 series prisms indicate a small upward vertical displacement within the accuracy of the system (unlikely that the base station is settling) and the horizontal displacement is generally to the south-southeast (out of the pit wall). The 700 series prisms are exhibiting low velocities and no indication of acceleration.

The 800 series prism show about 20 mm or less of total displacement over the reporting period. The prisms indicate downward vertical displacement and movement out of the pit wall to the south-southwest. The 800 series prisms are exhibiting very low velocities and no indication of acceleration.

Overall, the monitoring prism data indicate the wall appears to be stable, and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.2 Northeast Wall – Central Segment

There are 10 prisms installed on the northeast wall – central segment (Appendix B, Figure B-1). Four of these prisms are on the waste rock rehandle slope (two on the upper benches, two on the lower benches) and six on the bedrock below the rehandle slope.

All the prisms on the rehandle slope show similar movement out of the slope into the Cariboo Pit (south-southeast). Prisms 814 and 815 on the upper benches of the waste rock rehandle slope indicate between 7 and 15 mm of total displacement over the reporting period. A typical prism plot on the upper slopes of the waste rock rehandle slope is presented in Appendix B, Figure B-4. These prisms are exhibiting very low velocities and no indication of acceleration. These displacements are typical for long-term settlement of a waste rock slope and are not a concern.

Prisms 828 and 829 are on the lower benches of the waste rock rehandle slope. A typical prism plot on the lower slopes of the waste rock rehandle slope is presented in Appendix B, Figure B-5. The prisms indicate less than 15 mm of total displacement over the reporting period. Prism 828 is moving to the northeast whereas Prism 829 is moving to the west. Both prisms are exhibiting very low velocities with no indication of acceleration. Again, these trends are typical for long-term settlement of a waste rock slope and are not a concern.

The prisms on the bedrock benches below the waste rock rehandle slope that were visible during the 2021 reporting period are showing total displacements of less than 15 mm over the reporting period. A typical plot for the bedrock below the waste rock rehandle slope is shown in Appendix B, Figure B-6. All prisms are showing movement out of the pit wall.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.3 Northeast Wall – Southeast Segment

There are 10 prisms installed on the Cariboo Pit northeast wall – southeast segment (Appendix B, Figure B-1). A typical plot of a prism on the upper benches of the northeast wall – southeast segment is presented in Appendix B, Figure B-7. The prisms located on the upper benches of the wall are all moving out of the pit wall to the south-southwest and exhibit total displacements of less than 7 mm over the reporting period.
The displacements are within the accuracy of the system and there is no indication of acceleration.

A typical plot of a prism on the lower benches of the northeast wall – southeast segment is presented in Appendix B, Figure B-8. The prisms on the lower benches of the wall are all moving out of the pit wall to the south-southwest and indicate total displacements of less than 5 mm (very little movement) over the reporting period.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.4 East Wall

There are 10 prisms installed on the east wall of the Cariboo Pit (Appendix B, Figure B-1). The majority of the prisms were moved in 2017 due to the April 2017 toppling failure and subsequent unloading in the area.
The prisms installed on the single benches above the unload zone are all showing total displacements of less than 15 mm over the reporting period. The movement is out of the pit wall to the west. There is no indication of acceleration or large incremental velocities. A typical plot of a prism on the east wall on the benches above the unload zone is presented in Appendix B, Figure B-9.

Prism 844 is on the elev. 1,084 m bench below the unload zone. The prism is also moving out of the pit wall towards the southwest and the total displacement is about 5 mm over the reporting period.

Three additional prisms should be installed along the crest of the east wall unload zone and recommended locations for the additional prisms are shown in Figure 6. The prisms on the east wall continue to freeze and break over the winter months. Covers could be manufactured for these specific prisms to protect the prisms from the elements and water infiltration. The covers could be made of plywood or metal.

Overall, the wall appears to be stable and there is no indication or large incremental velocities or acceleration in the prism readings.

4.6.1.5 Southeast Wall

The southeast wall of the Cariboo Pit has 11 prisms installed. Prisms 821 and 823 are no longer reading. The prisms that are being monitored on the southeast wall exhibit total displacements between 2 and 10 mm over the reporting period. The prisms are all generally moving to the west-northwest out of the pit wall. There is no indication of acceleration or large incremental velocities. A typical prism plot for the southeast wall is shown in Appendix B, Figure B-10.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.6 Elevation 1,013 m Bench (All Pit Walls)

There are eight prisms installed on the elev. 1,013 m bench in the Cariboo Pit from the north wall notch to the haul ramp into the pit. The prisms have been read since May 2018; however, readings ceased in 2021 due to the in-pit reservoir elevation increasing above this bench height. When Cariboo Pit is dewatered, the prisms on the elev. 1,013 m bench should be re-shot and re-established if safe to do so.

4.6.2 Monitoring Prism Data – Springer Pit

The Springer Pit monitoring prism locations are shown in Appendix B, Figure B-11. Since mining ceased in 2014, the trends in the Springer Pit prism data have been steady, with ongoing relaxation of the pit walls occurring. MPMC began reading the majority of the prisms in the Springer Pit in 2010 in the upper benches, with a select few in 2011 and 2012 in the lower benches. The following sections provide a review of the prism readings from October 2020 to October 2021 for the Springer Pit.

4.6.2.1 East Wall

The prisms on north end of the east wall indicate between 2 and 10 mm of total displacement over the reporting period. The wander plots generally indicate movement out of the pit wall to the southwest. There is no increase in incremental velocity or indication of acceleration. Representative plots are shown in Appendix B, Figures B-12 and B-13.

4.6.2.2 North Wall / North Nose Area

The prisms on the north wall / north nose area are exhibiting small total displacements between 0 and 15 mm over the reporting period. Wander plots generally indicate the movement is out of the pit wall to the south. There is no increase in incremental velocity or indication of acceleration. Typical plots for the north wall / north nose area are shown in Appendix B, Figure B-14 and B-15.

4.6.2.3 West Wall

The prisms on the west wall indicate small total displacements between 2 and 10 mm over the reporting period. The wander plots generally indicate the movement is out of the pit wall to the south-southeast. There is no increase in incremental velocity or indication of acceleration. Representative plots are presented in Appendix B, Figures B-16 and B-17.

4.6.3 Monitoring Prism Data – Wight Pit

The Wight Pit monitoring prism locations are shown in Appendix B, Figure B-18. Since mining ceased in 2009 and the pit was backfilled, the movement within the pit walls has continued to exhibit similar displacement trends to previous years, indicating ongoing relaxation of the pit walls as well as ongoing toppling in the west wall.

The base station was reset in June 2020; therefore, the majority of the prisms in the Wight Pit show a jump in total displacement of approximately 50 mm at this time. The base station on the east wall (at Prism 587) is located on the south side of the east wall within about a metre of the wall crest, and evidence of erosion was visible on the slope below in 2020 (Golder 2021). It was recommended that the survey base station be re-installed farther back from the crest of the east wall to reduce the risk to survey personnel. Rather than move the base station, MPMC installed a new station (WP13) that monitors movement of the existing base station. The station indicates less than 10 mm of total displacement between October 2020 and June 2021. No further readings were available for

the station. Continue to collect readings at WP13 and Prism 587 at the same frequency that readings are taken in the Wight Pit to monitor movement of the base station. Use caution when working near the edge of the east wall.

The following sections provide a review of the prism readings from October 2020 to October 2021 for the Wight Pit.

4.6.3.1 West Wall

The prisms located at the crest of the west wall toppling instability have indicated a steady trend of toppling displacements over the years and prisms in this area continue to show ongoing displacements. Visual observations of the tension cracks were made during the 2021 review and there appears to be little change visually. The prisms above the unload area indicate, on average, 40 mm of total displacement over the reporting period downward in the vertical component and out of the pit wall to the northeast. There is no increase in incremental velocity or indication of acceleration. A representative plot of the prisms above the unload area is shown in Appendix B, Figure B-19. Prisms 530 and 523 show similar trends in total displacement; however, the movement is in the downward vertical component and to the southwest. The direction of movement is isolated to these two prisms and appears to have begun after the base station was reset. Prism 528 stopped being read in 2020.

The prisms at the crest of the unloaded area indicate between 30 and 80 mm of total displacement during the reporting period. The movement trend indicates ongoing settlement on the unload crest towards the north-northeast. There is no increase in incremental velocity or indication of acceleration. This movement is indicative that the cracks in the unload area are continuing to develop and that the wall continues to gradually deform. Representative plots for the west wall unload are shown in Appendix B, Figures B-20 to B-21. Prisms 594 and 595 were installed in September 2020 on the unload area crest. If prisms are lost on the unload area, replace these prisms when safe to do so and with good sightlines to the base station.

The prisms on the north end of the west wall (outside of the unload area) indicate between 30 and 90 mm of total displacement over the reporting period in the downward vertical component and out of the pit wall to the east-southeast. There is no increase in incremental velocity or indication of acceleration. A representative plot of the prisms north of the unload area on the west wall is shown in Appendix B, Figure B-22.

4.6.3.2 North Wall

The prisms on the north wall indicate between 27 and 41 mm of total displacement over the reporting period in the downward vertical component and movement out to the southeast. There is no increase in incremental velocity or indication of acceleration. Typical plots for the north wall are shown in Appendix B, Figures B-23 and B-24.

4.6.3.3 East Wall

As recommended by Golder in 2019 (Golder 2020), prisms have been installed on the east wall, and during the 2020 review, three additional prisms were installed along the crest of the east wall. The prisms on the east wall indicate between 90 and 192 mm of total displacements (120 mm average total displacement) over the reporting period with movement generally in the downward vertical component and towards the southeast to southwest. There is no increase in incremental velocity or indication of acceleration. A typical plot for the east wall is shown in Appendix B, Figure B-25. During the 2021 review it was observed that some of the prisms get knocked over by wildlife (Appendix A, Photograph A-30). These prisms need to be reset and re-shot by the base station as soon as damage is discovered, and these prism resets reduce the accuracy of the long-term monitoring data that are being collected along the east wall. It would be beneficial to determine a more permanent prism installation that cannot be knocked over by wildlife.

5.0 STABILITY CONSIDERATIONS FOR CARIBOO AND SPRINGER PITS

5.1 Slope Stability Considerations for Cariboo Pit

The Cariboo Pit continues to exhibit overall good slope stability performance with the exception of minor localized areas of displacement. The current pit slope design recommendations are still considered to be appropriate based on the current performance of the Cariboo Pit. The existing pit slope design criteria for the Cariboo Pit are presented in Table 1.

Table 1: Summary of Cariboo Pit Recommended Pit Slope Design Criteria

Wall Dip Direction Azimuth (degrees)	Pit Design Sector Azimuth (degrees)	Bench Height (m)	Bench Face Angle (degrees)	Inter-ramp Angle (degrees)	Bench Width (m)	Rationale
000	180	24	65	46	12	Use a double bench configuration with a 65 degree BFA.
030	210	24/12	65/70	46/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA.
060 to 090	240 to 270	24/12	70	49/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA.
120	300	24/12	65/70	46/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA
150	330	24	65	46	12	No slope stability controls.
180 to 240	000 to 060	24	70	49	12.13	No slope stability controls.
270	090	12	70	43	8.5	Current design is a single bench configuration due to toppling along East Cariboo Fault.
300	120	24	70	49	12.13	No slope stability controls.
330	150	24	65	46	12	Use a double bench configuration with a 65 degree BFA.

Source: Golder 2016a.

BFA = bench face angle.

The catch-bench widths for the double benches range from 11.5 to 12 m. The effective catch-bench width is likely to exceed the regulatory 8 m minimum requirement, after accounting for bench crest back-break and the accumulation of ravel debris on the benches. There is little concern over the availability of catchment on the double benched slopes. The design catch-bench width for single benches is 8.5 m. After bench crest back-break and the accumulation of ravel debris on the benches, the effective catch-bench widths may be less than 8 m on walls where single benches are recommended. Effective catch-bench widths can be maximized by ensuring that benches are scaled and cleaned prior to drilling and blasting the next bench. Standard Operating Procedures related to slope stability performance monitoring can be used to identify areas where available catchment is insufficient and where rockfall is creating a hazard to mining operations. A single wide catch-bench or a series of slightly wider catch-benches can be used in areas where rockfall becomes a safety issue.

With the exception of localized areas where the available catch-bench width has been lost due to failures or overspill from mining activities above, the majority of the pit slopes in the Cariboo Pit are achieving the intended design objectives.

If mining resumes, the following potential remedial measures should be considered in the Cariboo Pit:

- When the Cariboo Pit is dewatered, the area below the east wall unload zone should be visually inspected and a rollout berm in the east corner of the haul ramp switchback should be built and maintained to capture any potential ravel debris from the east wall toppling area.
- When the Cariboo Pit is dewatered, the west wall below the Polley Fault should be visually inspected. A rollout berm may be required below the west wall where planar failure is occurring within the Polley Fault Zone and the immediate hangingwall. If catchment decreases along the wall, a wider geotechnical catch-bench may be required when mining proceeds.

5.2 Slope Stability Considerations for Springer Pit

The Springer Pit is currently being used as temporary storage for tailings. During 2015 and 2016 tailings were discharged as slurry into Springer Pit from the saddle between the Cariboo and Springer Pits. Approximately ⅓ of the tailings were dredged from Springer Pit and pumped as slurry to the tailings storage facility between March 2016 and October 2019. Approximately 3.5 Mt of tailings remain in the Springer Pit. The tailings had a free water cover (approximately elev. 986 m) at the time of the 2021 review and the water was actively being pumped. The long-term mine plan includes continued dewatering, removal of the tailings, and an expansion of the Springer Pit to merge with the Cariboo Pit.

Overall, the walls are performing adequately, with the exception of overspill on the east wall. The current pit slope design recommendations are still considered to be appropriate based on the current performance of the Springer Pit. When mining resumes in the Springer Pit, the elev. 1,000 m bench should be cleaned or, alternatively, a new 12 m catch-bench should be excavated below the elev. 1,000 m bench (Figure 5). The existing pit slope design recommendations for the Springer Pit are presented in Table 2.

Table 2: Summary of Springer Pit Recommended Pit Slope Design Criteria

	Pit Design Sector Azimuth (degrees)	Bench Height (m)	Bench Face Angle (degrees)	Inter-ramp Angle (degrees)	Bench Width (m)	Rationale
000	180	12	70	43	8.5	Single bench due to the shallowest dipping structures within Set 3 in the south wall, which dip at angles that are less than the design bench face angle and undercut the current benches. These structures are shown in Appendix A, Photograph A-17.
030	210	24	70	50	11.5	No slope stability controls.
060 to 180	240 to 000	24	65	46.5	11.5	No slope stability controls.
210 to 240	030 to 060	12	70	43	8.5	Single bench through Polley and Springer Faults.
270	090	12	70	43	8.5	Single bench through Polley and Springer Faults. Single bench due to shallow, westerly dipping structures at the bottom of east wall.
300 to 330	120 to 150	12	70	43	8.5	Single bench due to the shallowest dipping structures within Set 3 in the south wall, which dip at angles that are less than the design bench face angle and undercut the current benches. These structures are shown in Appendix A, Photograph A-17.

Source: Golder 2016a.

6.0 REVIEW OF WASTE ROCK DUMP STABILITY PERFORMANCE

The waste rock dumps status at the time of the 2021 review is shown in Figure 1 and the photographs of the waste rock dumps taken during the review are presented in Appendix A. The following sections summarize the waste rock dump slope stability performance observations that were made during the 2021 review.

6.1 Northwest Potentially Acid Generating Dump Stability Performance

The Northwest PAG Dump was exhibiting good stability performance at the time of the 2021 review and there had been little change since the 2020 review (Appendix A, Photograph A-32). The upper PAG lifts were not exhibiting any signs of overall instability or deep-seated instability (Appendix A, Photograph A-33). No signs of dump face bulging or deformation were observed. There was no evidence of ponding or significant cracking on the dump platform (Appendix A, Photograph A-33). Continue to monitor any settlement cracks that could develop, and doze to mitigate the infiltration of water into the dump.

The haul road along the north end of the Northwest PAG Dump has previously shown evidence of water erosion. At the time of the 2021 review, the haul road was in adequate condition and ditching was controlling the flow of water (Appendix A, Photograph A-34).

The lower lifts of the Northwest PAG Dump are exhibiting good overall stability performance. All of the dump faces are at angle of repose and the lifts consist of good, coarse material (Appendix A, Photograph A-35). The berm at the toe of the lower lifts on the inside of the light vehicle road is performing adequately and no rock rollout was visible on the road. There is evidence of ponding in some areas on the lower lifts (Appendix A, Photograph A-36). The ponding water on the lower lifts should be drained, filled, and graded such that water will no longer pool on the lift (particularly near the crest edge) (Appendix A, Photograph A-37). There is also evidence of water ponding below one of the ramps to the lower lifts and fine-grained material has accumulated in this area (Appendix A, Photograph A-37). Water should be diverted away from the area and controlled down the haul ramp.

At the toe of the Northwest PAG Dump there are no signs of foundation failure or deformation observed along the toe of the dump (Appendix A, Photograph A-38). Future construction will progress the dump to the west and north. Construction of the expansion will be bottom-up starting with NAG material at the base and PAG material on top. The thickness of NAG material required in this area should be confirmed with the MPMC environmental team. The foundation soils for areas of the expansion that are on original ground are colluvium and till with localized depressions of saturated soils (Golder 2013). As previously recommended, the foundation materials should be loaded slowly with the initial NAG lift to preload the foundation. This has been achieved to date with the previous initial construction of the Northwest PAG Dump and can continue to be achieved by preloading the foundation with the NAG lift. Once the remaining foundation of the dump has been preloaded with NAG material, the PAG lifts can be advanced from south to north over the NAG material (Golder 2013).

6.2 Southeast Rock Disposal Site Stability Performance

Since the 2020 review, there has been no change to the SERDS (Appendix A, Photograph A-39). The dump platform is properly graded, no ponding was visible, and there were very few settlement cracks observed on the platform (Appendix A, Photograph A-40). The upper and lower dump faces are at angle of repose, with no signs of deformation or bulging in the face or in the foundation soils (Appendix A, Photographs A-41 to A-43). The dump height is relatively low, and the dump is continuing to exhibit adequate stability performance.

6.3 Northeast Non-acid Generating Rock Dump

The Northeast NAG Dump has been inactive for several years. The areas of the dump that were visible during the 2021 review were exhibiting good stability performance and there was no indication of deformation of the waste dump or the foundation (Appendix A, Photograph A-44). The platform has lots of vegetation growing and the berms in place around the perimeter of the platform are not showing any signs of deformation. As well, the lower slopes have good vegetation growth and there is no indication of foundation deformation (Appendix A, Photograph A-45).

6.4 Tailings Road

A minor instability of the Tailings Road occurred prior to the 2019 review. The instability and runout was likely due to flowing water over the road caused by runoff and the water infiltrating the fill material. This subsequently led to the instability.

The instability area was inspected by Golder during the 2021 review and has remained relatively unchanged since the instability occurred (Appendix A, Photograph A-46). The crest area is bermed off and there is no access at the toe of the slope. There is evidence of ponding water on the platform of the Tailings Road (Appendix A, Photograph A-47). Water needs to be redirected using appropriate ditching above the Tailings Road such that water doesn't flow past the berm at the entrance and onto the platform. If water continues to pond on the platform after appropriate ditching has been implemented above the Tailings Road, the platform may need to be regraded. Visual reviews should be carried out of the instability to check for changes to the instability area, backscarp, and toe of the slope.

When the Tailings Road construction restarts, it is possible that the road may be constructed over fine-grained foundation materials. The road may need to be constructed from south to north with smaller lift heights to control pore pressures in the foundation materials and loading rates. Using a dozer to pre-load the foundation materials, the Tailings Road construction could begin off the S-curve in the current road to the east with a lower lift height. The lower lift could be advanced north and south from this access road along the alignment of the proposed Tailings Road (Figure 10). Once the lower lift is advanced to the toe of the current Tailings Road fill, it would be tied into the failed area. The instability area should be remediated with good-quality, coarse-grained material that is dumped short and pushed into the instability area by a dozer to help tie the Tailings Road together.

6.5 Review of Waste Rock Dump Stability Monitoring Data

Prisms are an integral part of the monitoring system for the waste rock dumps at Mount Polley Mine. Long-term deformations and settlement of the dumps can be detected in the prism data, and displacement vectors can be calculated to assist in determining failure mechanisms. Diligence and care should continue to be applied to the monitoring accuracy and frequency. The MPMC survey staff achieve a good level of accuracy in the prism monitoring surveys.

The Northwest PAG Dump is the only dump on site that is currently being monitored by prisms. The location of the monitoring prisms on the Northwest PAG Dump are shown in Appendix B, Figure B-26. Monitoring prism plots are presented in Appendix B.

6.5.1 Northeast Potentially Acid Generating Dump Monitoring Prism Data

There are 27 prisms that were actively monitored on the Northwest PAG Dump through the reporting period (Appendix B, Figure B-26). The 100 series prisms were read six times between October 2020 and October 2021, and the 700 series prisms, Prisms 776 through 779, were read 14 times within the data review period.

The 100 series prisms are located on various lifts of the Northeast PAG Dump. On the north end of the dump, the 100 series prisms show approximately 0 to 20 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is generally to the northwest, which is out of the dump slope. The incremental velocity is low and there is no indication of acceleration for any of the 100 series prisms on the north end of the dump. Typical prism plots for the 100 series on the north end of the Northwest PAG Dump are shown in Appendix B, Figures B-27 and B-28. Prism 106 on the lower lift of the north end of the dump shows 170 mm of total displacement in readings between June and July 2021. The majority of the movement is in the horizontal component with about 40 mm in the vertical component downward. The wander plot indicates that the movement is to the south. The readings after July 2021 are constant and there is little indication of movement. It is possible that the prism was knocked over. The area should be inspected after freshet and the prism monitoring data that are collected after freshet should be reviewed to understand if the movement is the dump or potentially the prism being knocked over. The prism plot for Prism 106 is shown in Appendix B, Figure B-29.

The 100 series prisms located on the south end of the dump show between 0 and 25 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is generally to the southeast with some variability between prisms. The incremental velocity is low and there is no indication of acceleration for any of the 100 series prisms on the south end of the dump. A typical prism plot for the south end of the dump is shown in Appendix B, Figures B-30 and B-31. Prisms 103, 119, 120, 121, and 122 all have a sudden increase or decrease in total displacement (movement is in the horizontal and vertical components) that appears to revert back to normal readings between May and June 2021. Prism 119 is shown in Appendix B, Figure B-32. It is possible that there was an issue with the reading taken in June 2021 or that a backsight was not corrected for properly. Readings after June 2021 appear to follow the typical trend of a waste dump settling.

The 700 series prisms are all located on the southwest access road crest edge to the Northwest PAG Dump. The prisms all show approximately 30 mm to 65 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is to the southwest, which is out of the dump at an angle approximately perpendicular to the crest. The incremental velocity is low and there is no indication of acceleration for any of the 700 series prisms. A representative prism plot for the 700 series is shown in Appendix B, Figure B-33.

7.0 WASTE ROCK DUMP DESIGN CONSIDERATIONS

The proposed ultimate design of the Northwest PAG Dump has been updated since the slope stability review in 2020 and will include an expansion to increase the lift height of the northern portion of the dump to elev. 1,150 m and extend the dump to the west and north (Figure 7). Overall, the dump will be approximately 140 m high.

During the 2021 review, Golder discussed with MPMC staff how the extension should be progressed from the lower lifts of the Northwest PAG Dump towards the west then to the north (Appendix A, Photograph A-38). Future construction will progress the dump to the west and north. Construction of the expansion will be bottom-up, starting with NAG material at the base and PAG material on top. The thickness of NAG material required in this area should be confirmed with the MPMC environmental team. The foundation soils for areas of the expansion that are on original ground are colluvium and till with localized depressions of saturated soils (Golder 2013). As previously recommended (Golder 2013), the foundation materials should be loaded slowly with the initial NAG lift to preload the foundation. This has been achieved to date with the previous initial construction of the Northwest PAG Dump and can continue to be achieved by preloading the foundation with the NAG lift. Once the remaining foundation of the dump has been preloaded with NAG material, the PAG lifts can be advanced from south to north over the NAG material (Golder 2013).

The proposed ultimate design of the SERDS is currently under review as a co-disposal site. The detailed design will be complete in 2022.

8.0 SUMMARY OF GEOTECHNICAL CONSIDERATIONS

Slope stability monitoring and surface water management will be key to maintaining the stability of the existing pit slopes and waste rock dump slopes. The following sections describe the recommended actions.

8.1 Pit Slope Stability Performance Monitoring

The stability of the pit slopes is being monitored by survey prisms that are installed on benches in the Cariboo, Springer, and Wight Pits as well as by visual inspections. The prisms should be measured by the MPMC survey team on approximately a monthly basis. Readings are not required in winter when the prisms are covered in snow and the slopes are frozen. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements, as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceed a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data. The current system is functioning adequately and is being used to monitor pit slope displacements. The following general guidelines should be used in collecting and interpreting the monitoring data:

- Slope distance should be recorded in the prism monitoring spreadsheets.
  - Slope distance data should be used with caution. It is possible for a portion of the slope to move a significant distance perpendicular to the line of sight with very little change in the slope distance measurement. Therefore, the 3D displacements must also be reviewed for signs of long-term displacement.
- Velocity threshold criteria have been established for pit walls based on previous experience. However, these data must also be reviewed for signs of acceleration. If a prism is showing acceleration—regardless of the measured velocity—personnel should be told to avoid the area and the source of the displacement should be investigated. Displacement trend guidelines for the pit wall prisms are illustrated in Figure 8.
- If prisms are moved or reset, the prism should be renamed and a new data collection sheet should be completed. The old prism should become inactive in the data collection sheet.

A major part of the slope stability monitoring program will be the regular visual inspections of the bench faces and crest areas for early evidence of slope instability. Regular pit inspections should be carried out quarterly, and areas of instability should be inspected monthly. After a major rainfall event, an inspection of the pit walls should be completed to check for any adverse conditions after the event. These inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded in a diary so that a record of the stability performance is available should it be required in the event of instability.

8.2 Waste Rock Dump Stability Performance Monitoring

Similar to the pit slopes, the stability of the waste rock dump slopes is being monitored by survey prisms and visual inspections. The prisms should be measured by the MPMC survey team on approximately a quarterly basis when the dumps are not active. Readings are not required in winter when the prisms are covered in snow and the slopes are frozen. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceeds a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data. The current system is functioning adequately and is being used to monitor waste rock dump slope displacements. The following general guidelines should be used in collecting and interpreting the monitoring data:

- Slope distance should be recorded in the waste rock dump monitoring spreadsheets.
  - Slope distance data should be used with caution. It is possible for a portion of the slope to move a significant distance perpendicular to the line of sight with very little change in the slope distance measurement. Therefore, the 3D displacements must also be reviewed for signs of long-term displacement.
- Velocity threshold criteria have been established for the waste rock dumps based on previous experience. However, these data must also be reviewed for signs of acceleration. If a prism is showing acceleration—regardless of the measured velocity—personnel should be told to avoid the area and the source of the displacement should be investigated (Figure 9).
- If prisms are moved or reset, the prism should be renamed and a new data collection sheet should be completed. The old prism should become inactive in the data collection sheet.

A major part of the slope stability monitoring program will be the regular visual inspections of the waste rock dump crests, platforms, and slope faces for early evidence of slope instability. The waste rock dumps should be inspected once per quarter and during periods of high precipitation that may cause additional infiltration into the dump or additional erosion. These regular inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded so that a record of the stability performance is available should it be required in the event of instability.

The visual reviews should include the following:

- inspecting the crests for signs of cracking and localized settlement and ponding water
- inspecting the faces of the waste rock dumps for signs of over-steepening, bulging in the middle or at the toe of the face, seepage, and erosion
- inspecting the foundation, or toe of the waste rock dump, for signs of deformation

Visual observations should be documented on inspection forms.

8.3 Surface Water Management

Surface water management around the pits and waste rock dump areas is a key component of maintaining the stability of the slopes. The following areas should continue to be monitored and managed:

- The seepage area noted on the unload area of the east wall of the Cariboo Pit in 2019 should continue to be monitored as well as the benches below the seepage area within the unload zone.
- The Wight Pit perimeter ditch should be maintained to convey water around the pit.
- The platforms should be regraded to promote water draining away from the face of the dump if any ponding water is noted on the waste rock dumps.
- Appropriate ditching and/or water bars around the area of the Tailings Road failure should be maintained to promote water flowing away from the dump faces.

9.0 SUMMARY OF 2021 REVIEW RECOMMENDATIONS

The recommendations following the 2021 review are summarized in Table 3. The ID column has a unique number for each recommendation, prefixed with the year the recommendation was originally made. New recommendations and comments from 2021 are marked with *italic text.* Recommendations that were marked as complete in previous years are not included in the summary table.

Table 3: Summary of Recommendations for 2021 Review

Area	ID	Recommendation	Timeline
Cariboo Pit	2019-03	If access is needed below the east wall on the haul road switchback or mining resumes, a rock rollout berm should be built and maintained below the east wall unload zone.	If access is needed or mining resumes, immediately.
	2020-01	Install three new prisms on the unload zone.	*Completed in fall 2020; however, the new prisms failed over the winter. These prisms should be replaced in Q2 2022 before monitoring resumes.*
		Replace broken head on existing prism.	*Completed in 2021; however, the prism head broke again. Replace in Q2 2022 and install a cover to protect the prisms on the east wall from the elements. The cover could be made of plywood or metal.*
	2021-01	*Rock rollout berm in front of wedge instability along haul ramp and below C2 Pit due to limited catchment available.*	*Q2 2022 – personnel enter the Cariboo Pit to access the pumping infrastructure and a rollout berm should be in place to protect the pump equipment and personnel.*
Springer Pit	*2021-01*	*Remove boulders from haul ramp on west wall and establish a rock rollout berm in front of overhang in bench.*	*Q2 2022 – personnel enter the Springer Pit to access the pumping infrastructure.*
Wight Pit	2018-02	Clean catch ditch along east wall below Rusty Fault.	Once per year or as required.
	2020-02	Install two to four additional prisms along the west wall between Prisms 595 and 543.	*Complete – two prisms were installed on the west wall in early 2021.*
	2020-03	Move the location of the monitoring base station farther back from the crest of the east wall.	*Incomplete – a new station was installed that monitors the existing base station for movement.*
Tailings Road	2019-06	Remediate failure scarp area.	*Incomplete in 2020 and 2021. Divert water away from the Tailings Road to limit ponding in the area of the scarp area until it is remediated.*
All areas – prism monitoring data	2019-07	Collect slope distance measurements.	*Incomplete – Q2 2022*

10.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

Golder Associates Ltd.

4 February 2022

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/001-r-73114-2021 site visit report/rev0/22514095-001-r-rev0-73114_mount polley 2021 slope stability report-04feb_22.docx

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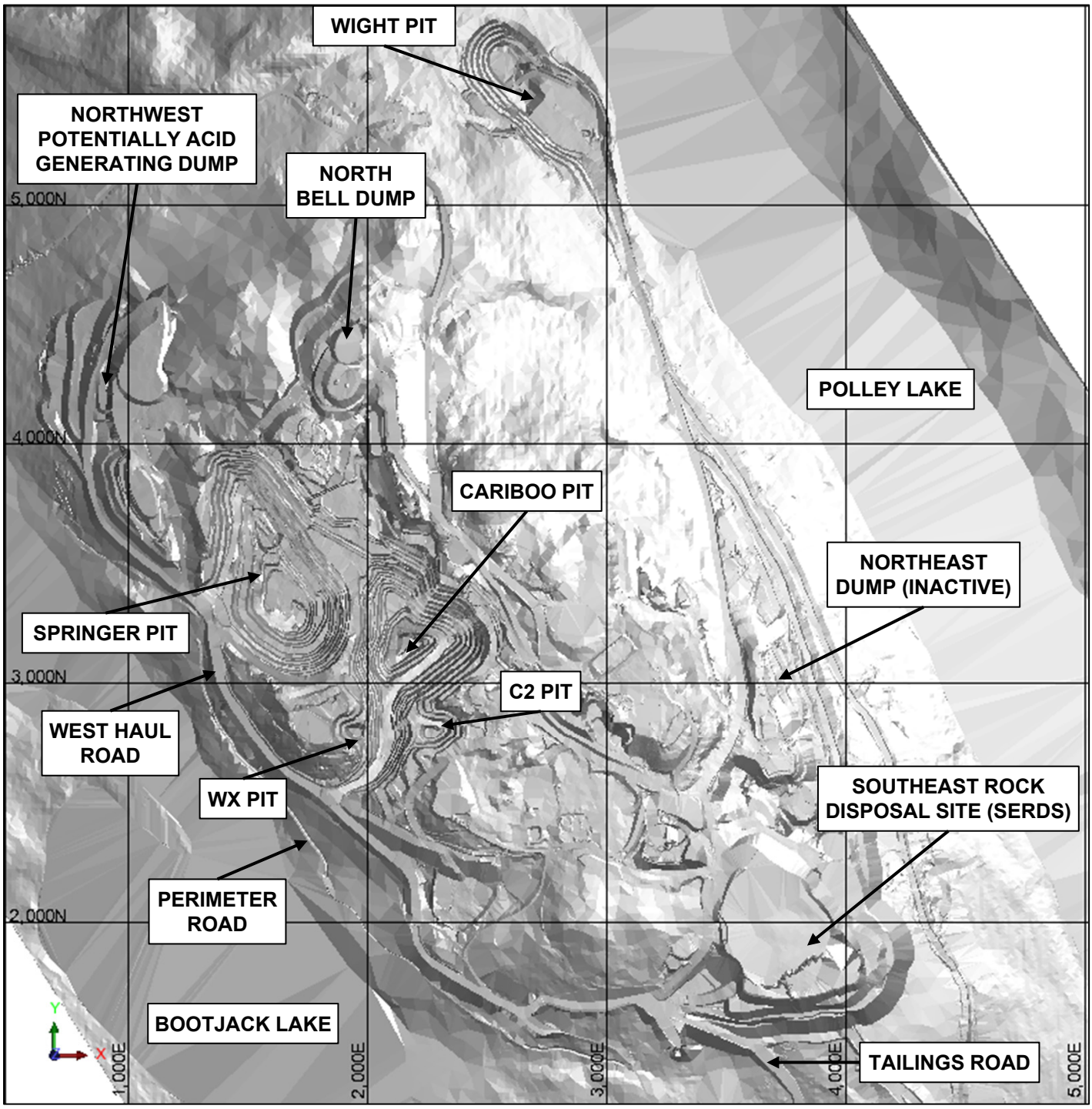

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GOLDER
MEMBER OF WSP

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PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
STATUS MAP – OCTOBER 2021

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**1**

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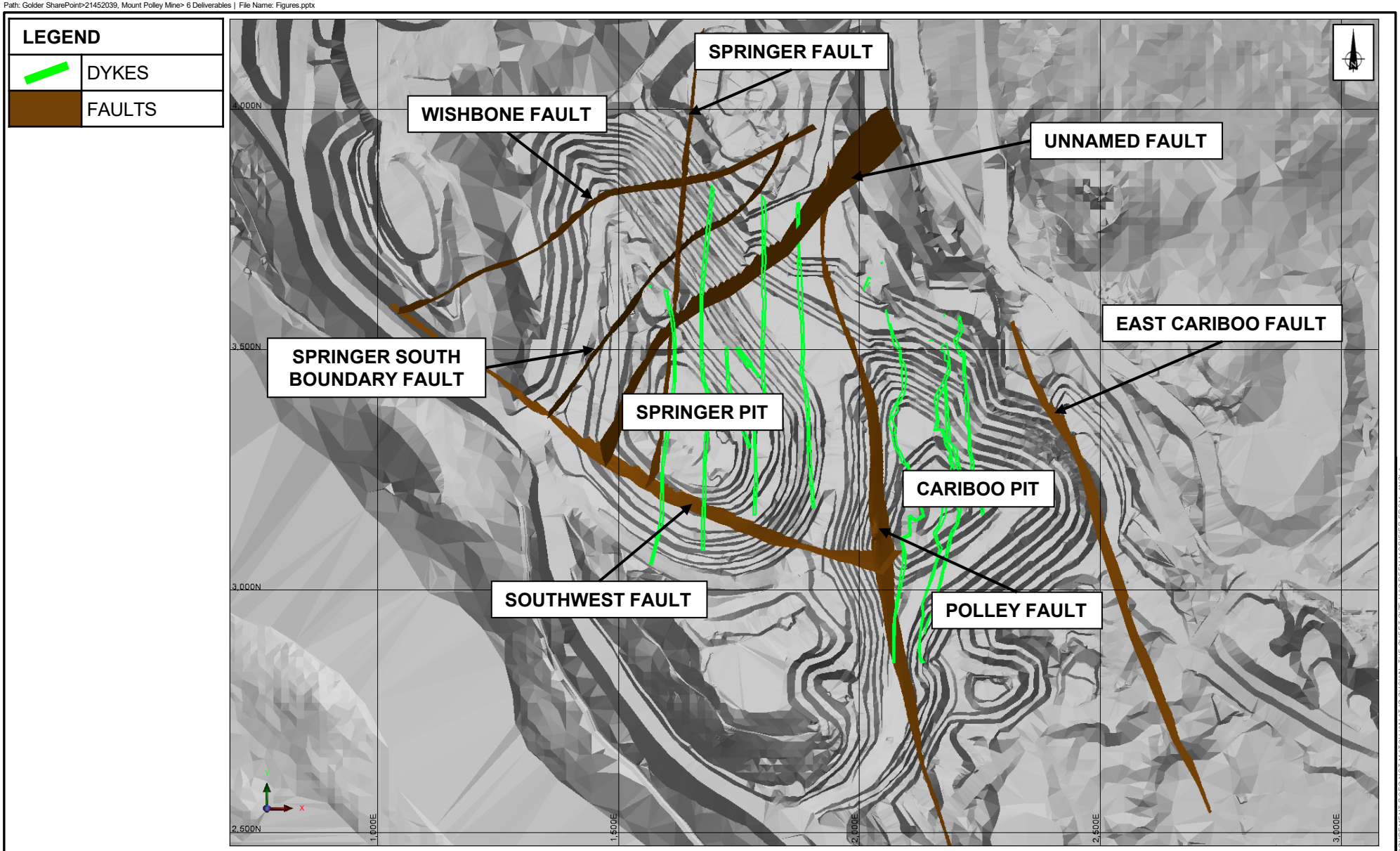

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2. FAULT SURFACES PROVIDED BY MPMC, 3 SEPTEMBER 2015.
3. DYKE STRINGS PROVIDED BY MPMC, 7 DECEMBER 2011.

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DESIGNED	AGH
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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
MAJOR FAULTS AND DYKES
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
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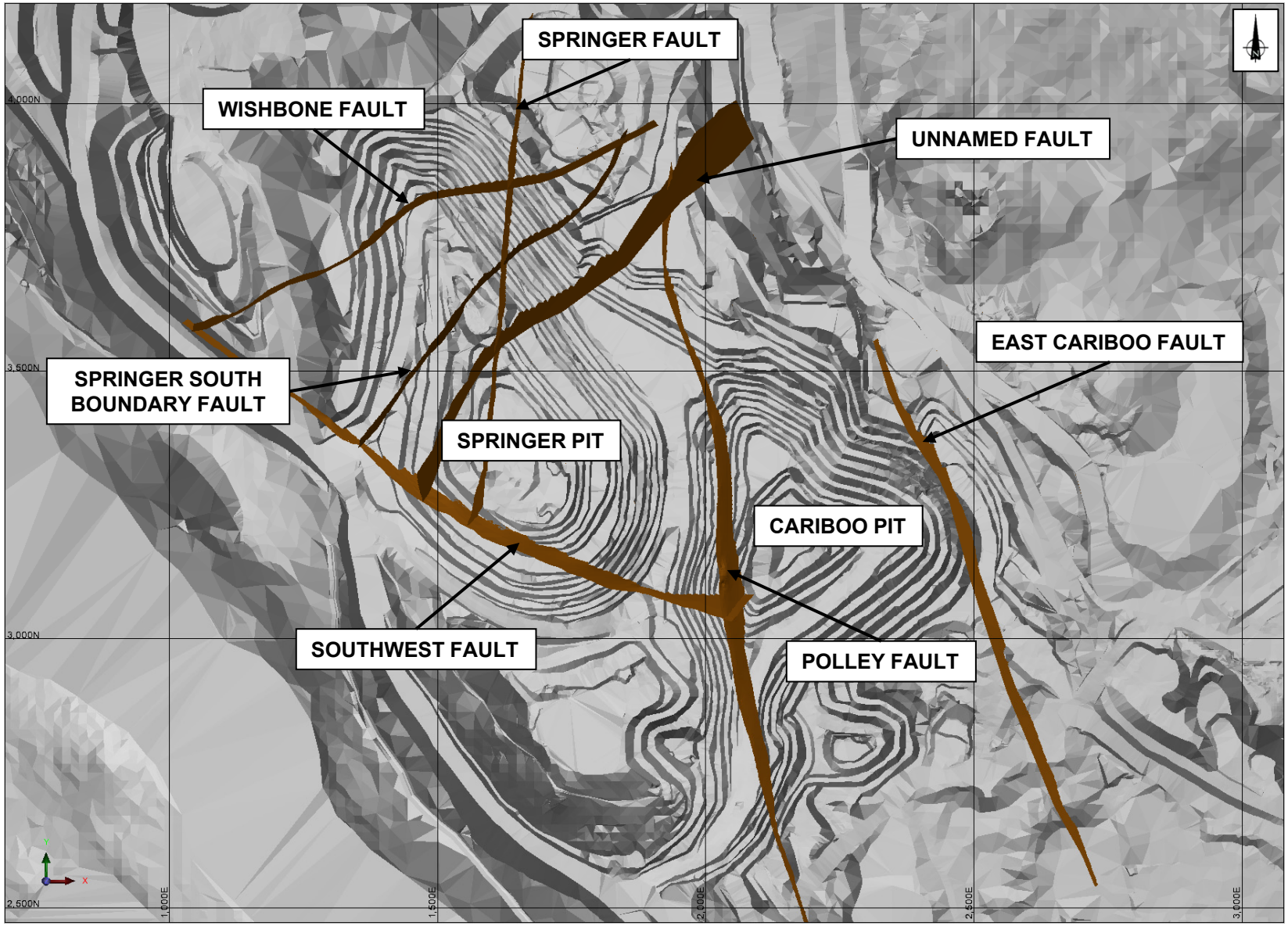

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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
MAJOR FAULTS
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
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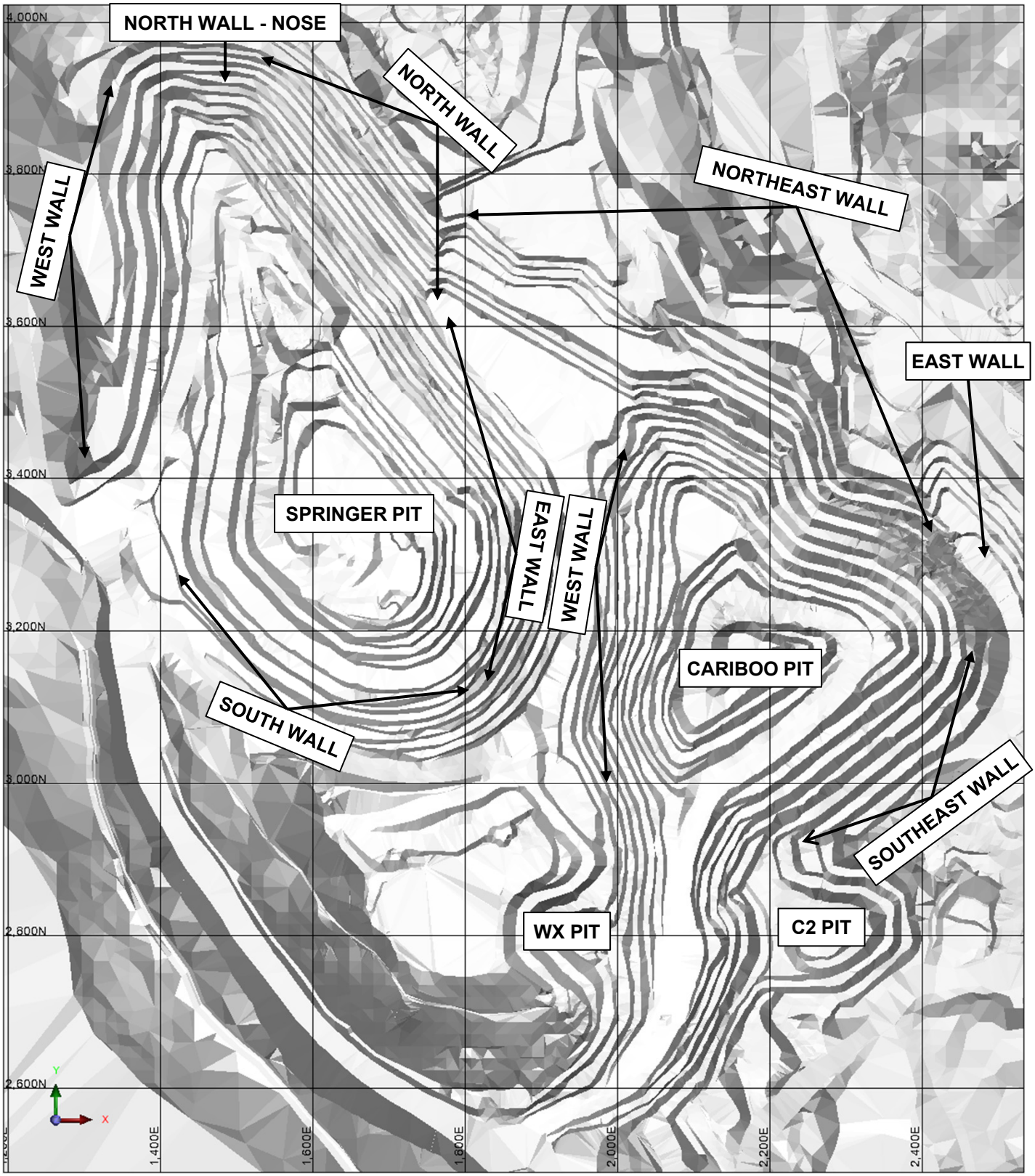

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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
WALL LOCATIONS
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
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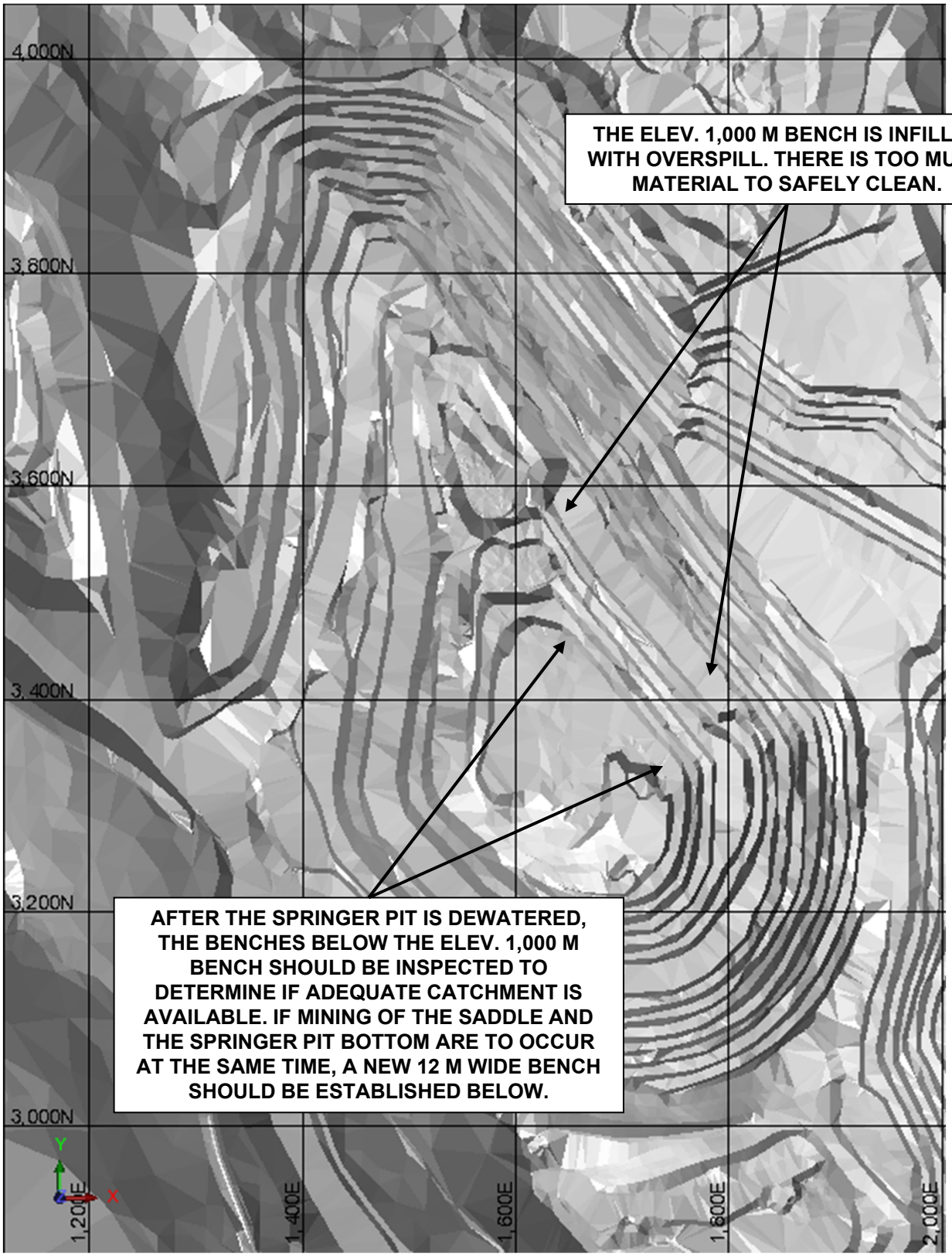

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TITLE
SPRINGER PIT
ELEV. 1,000 m BENCH AND POTENTIAL STEP-OUT LOCATION

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	5

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INSTALLED PRISM **RECOMMENDED ADDITIONAL PRISMS**

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1. PHOTOGRAPH TAKEN BY GOLDER 20 OCTOBER 2021.

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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT – EAST WALL UNLOAD ZONE
PRISM LOCATION RECOMMENDATIONS
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	FIGURE
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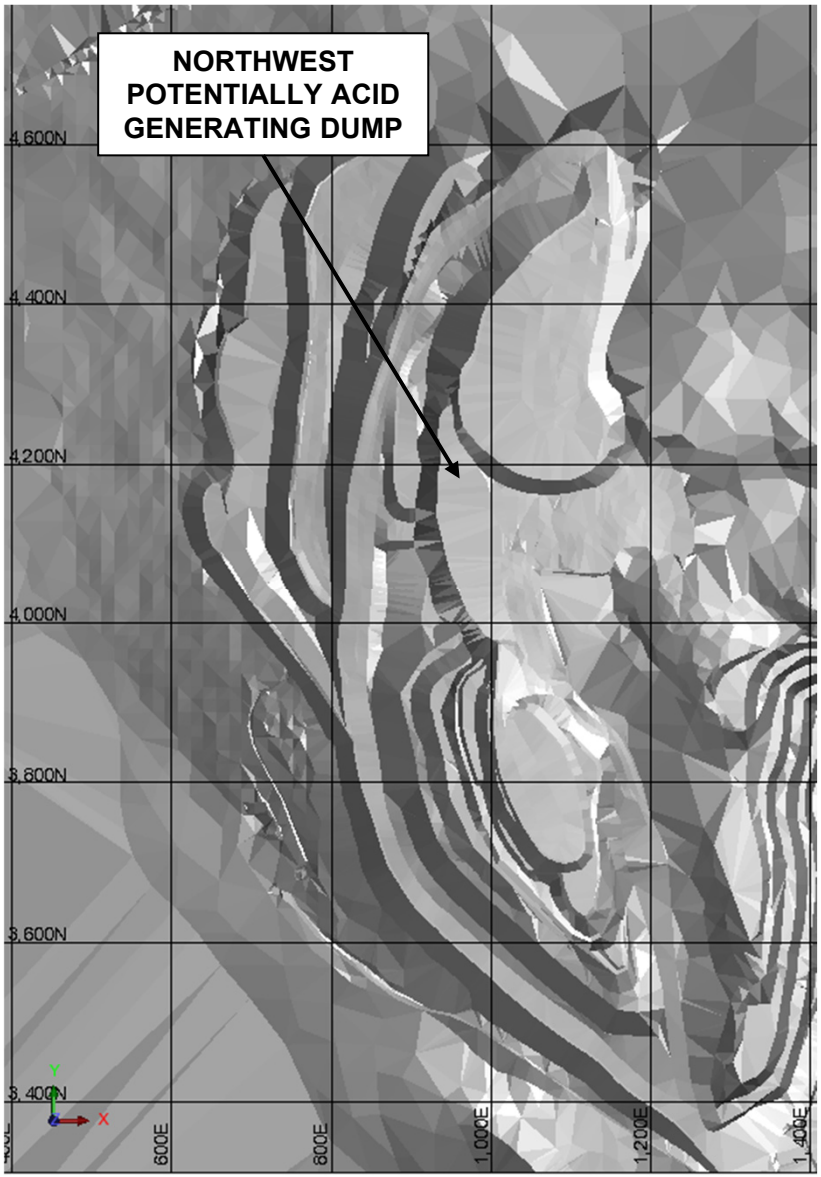

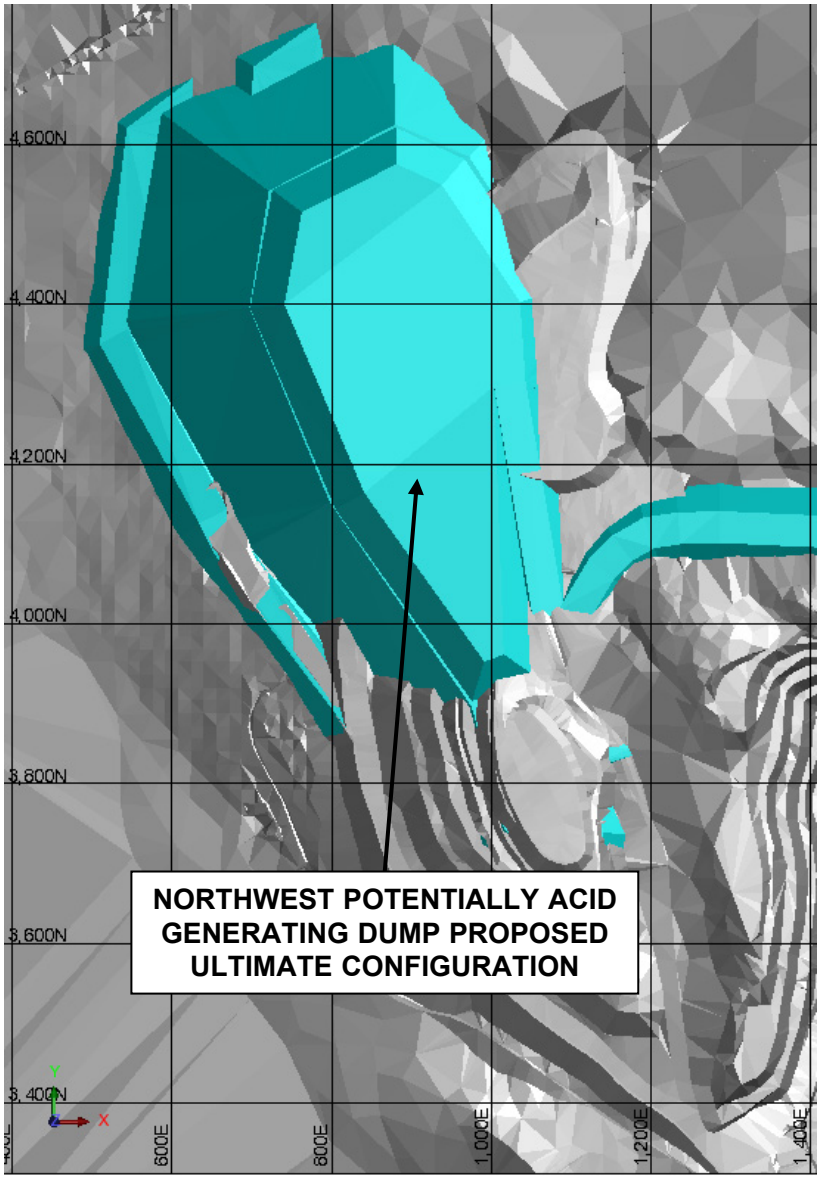

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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST POTENTIALLY ACID GENERATING DUMP PROPOSED ULTIMATE DESIGN CONFIGURATION

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25 mm

Prism Data Interpretation Procedures

A) Daily displacement (mm)
(How many millimetres did it move? Was this less than or more than the monitoring system accuracy?)

B) Daily velocity (mm/day)
(How fast is it moving?)

C) Direction of movement (azimuth)
(Does the direction of movement make sense? Is it moving away from the wall, parallel to the wall, or into the wall?)

D) Direction of movement (vertical)
(Are all of the prisms moving upward? If so, is it possible that the base station or back-sight is settling?)

E) Total displacement graph
(Is it accelerating?)

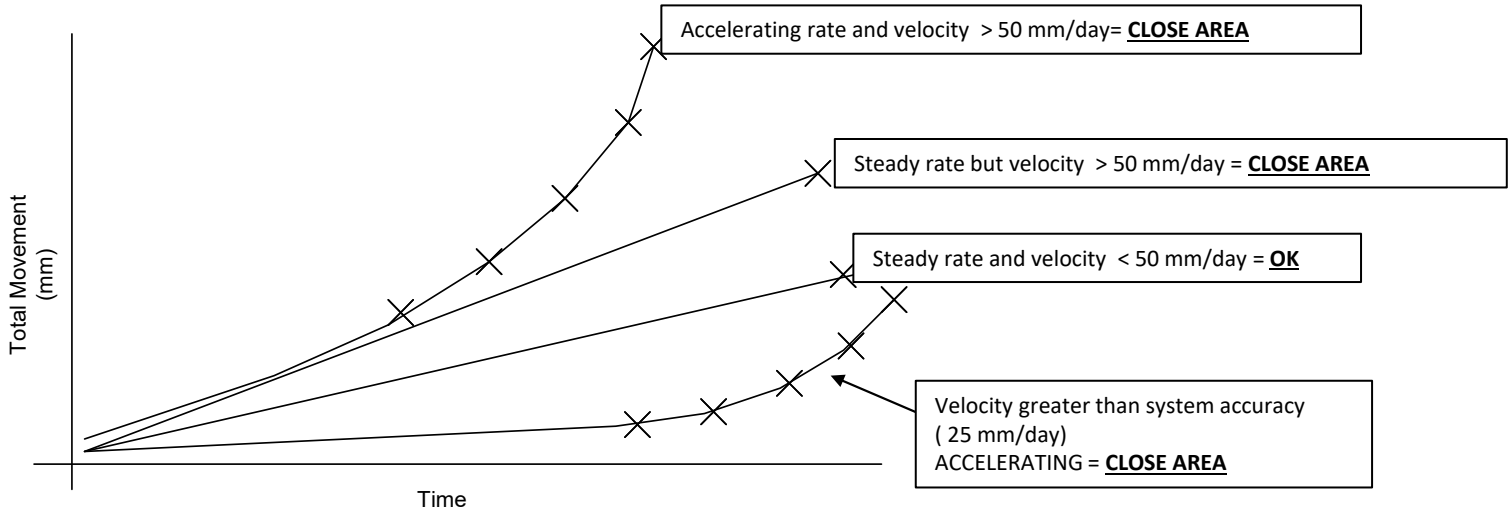

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MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
PIT SLOPE PRISM MONITORING DATA INTERPRETATION CRITERIA

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Prism Data Interpretation Procedures

A) Daily displacement (mm)
(How many millimetres did it move? Was this less than or more than the monitoring system accuracy?)

B) Daily velocity (mm/day)
(How fast is it moving?)

C) Direction of movement (azimuth)
(Does the direction of movement make sense? Is it moving away from the wall, parallel to the wall, or into the wall?)

D) Direction of movement (vertical)
(Are all of the prisms moving upward? If so, is it possible that the base station or back-sight is settling?)

E) Total displacement graph
(Is it accelerating?)

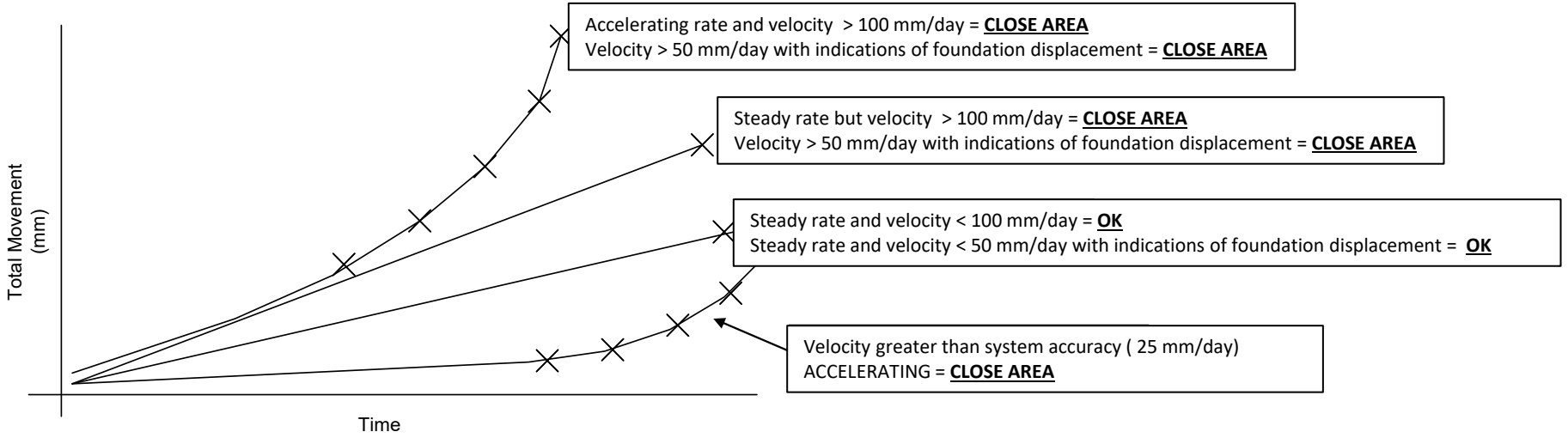

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MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WASTE ROCK DUMP PRISM MONITORING DATA INTERPRETATION CRITERIA

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**9**

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1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
PROPOSED CONSTRUCTION OF THE TAILINGS ROAD DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**10**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX A

Photographs



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

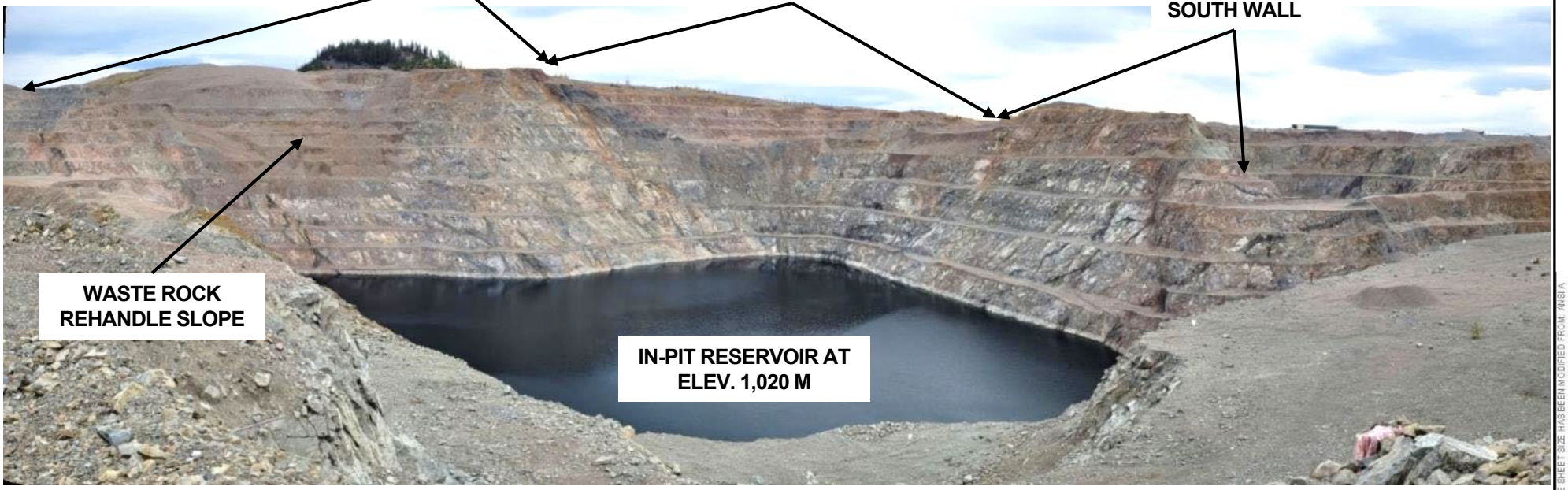

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT
OVERVIEW
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

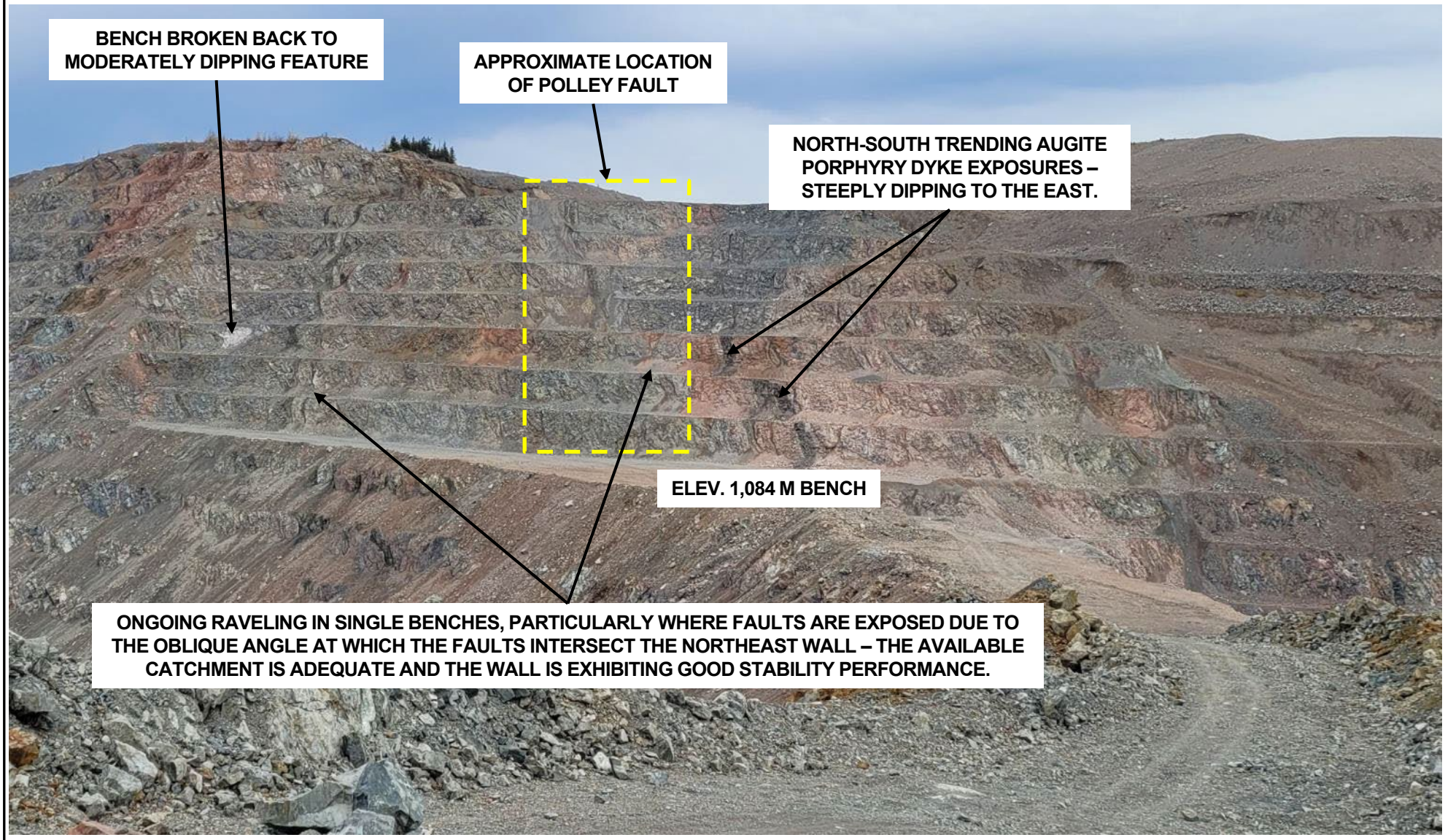

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER AND CARIBOO PITS NORTHEAST WALL NORTHWEST SEGMENT
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

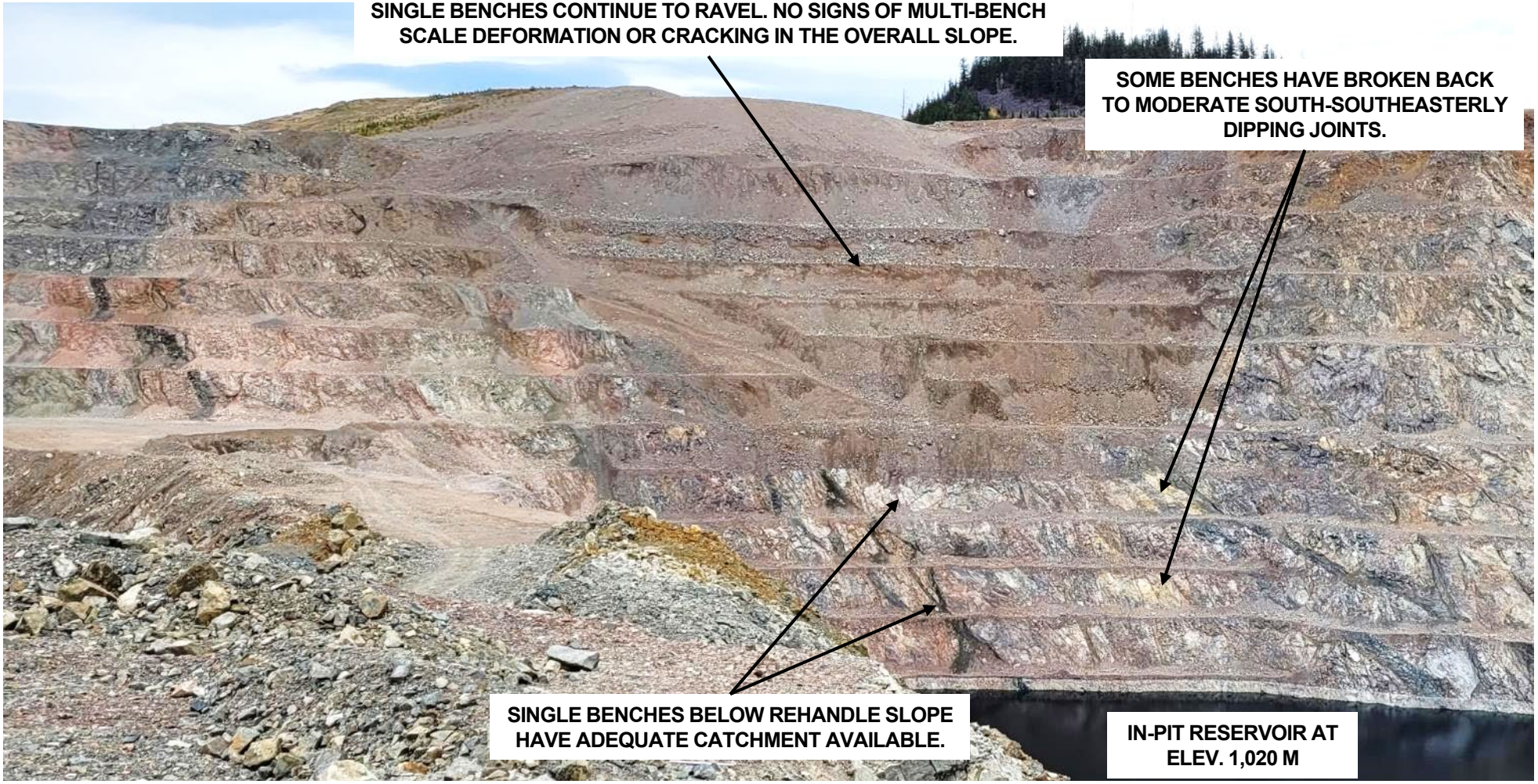

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL
CENTRAL SEGMENT
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

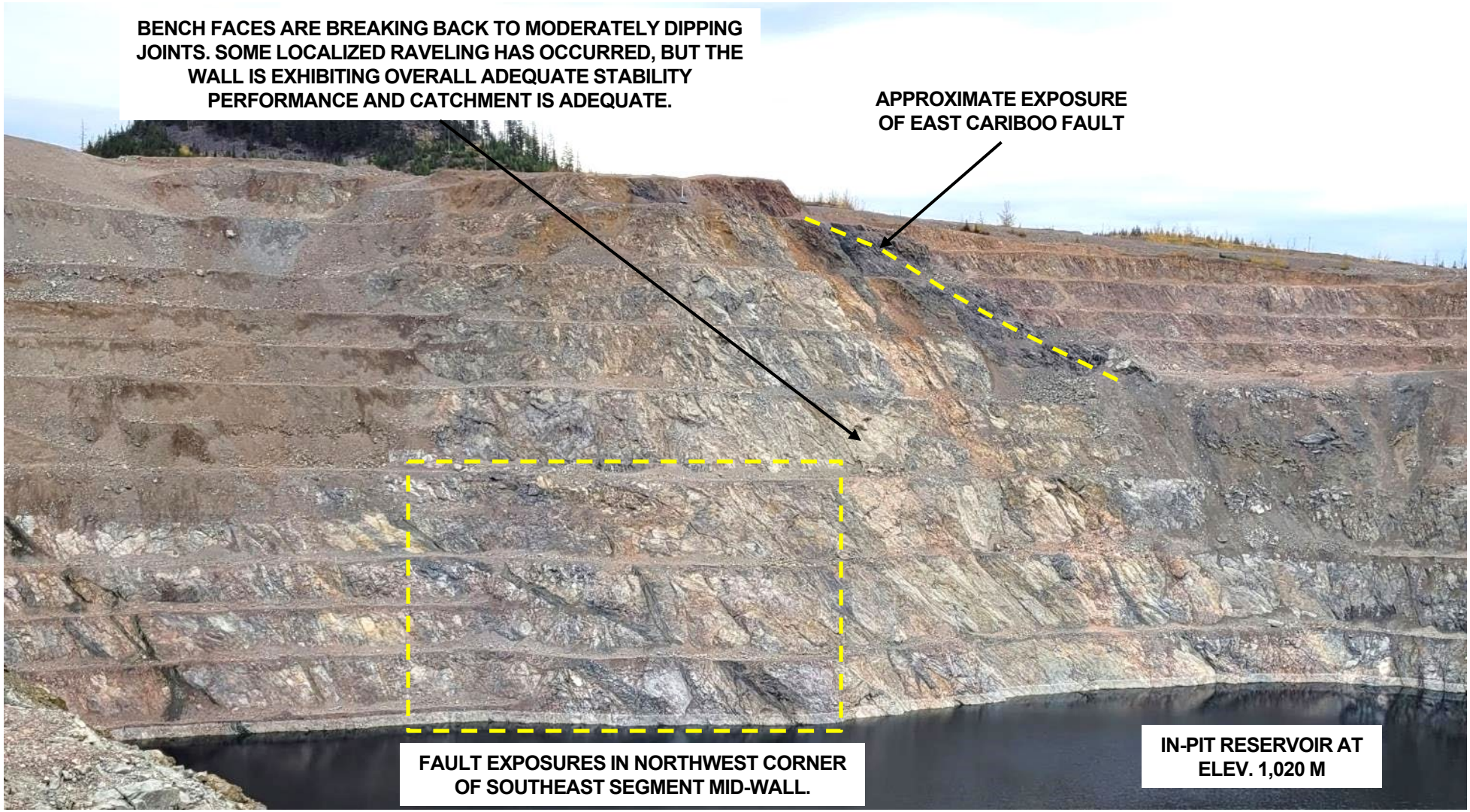

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL
SOUTHEAST SEGMENT
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

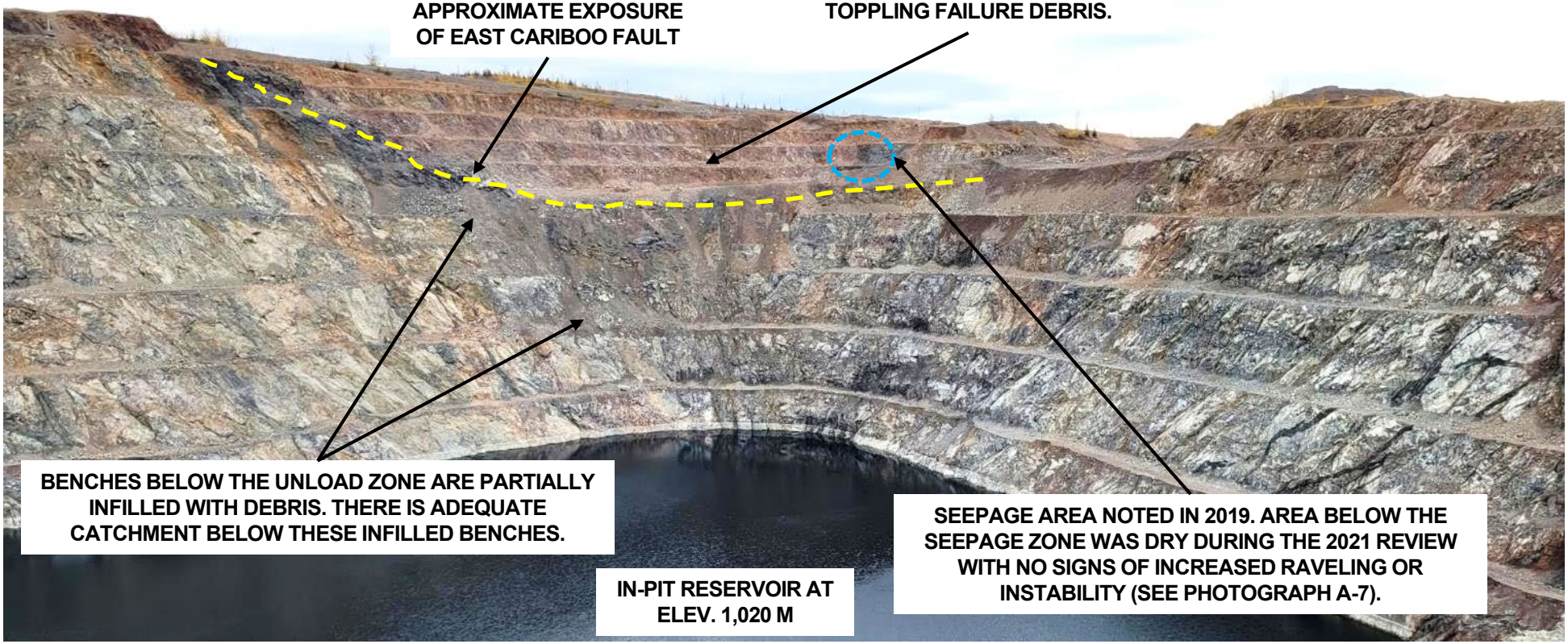

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT EAST WALL
UNLOAD AREA
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

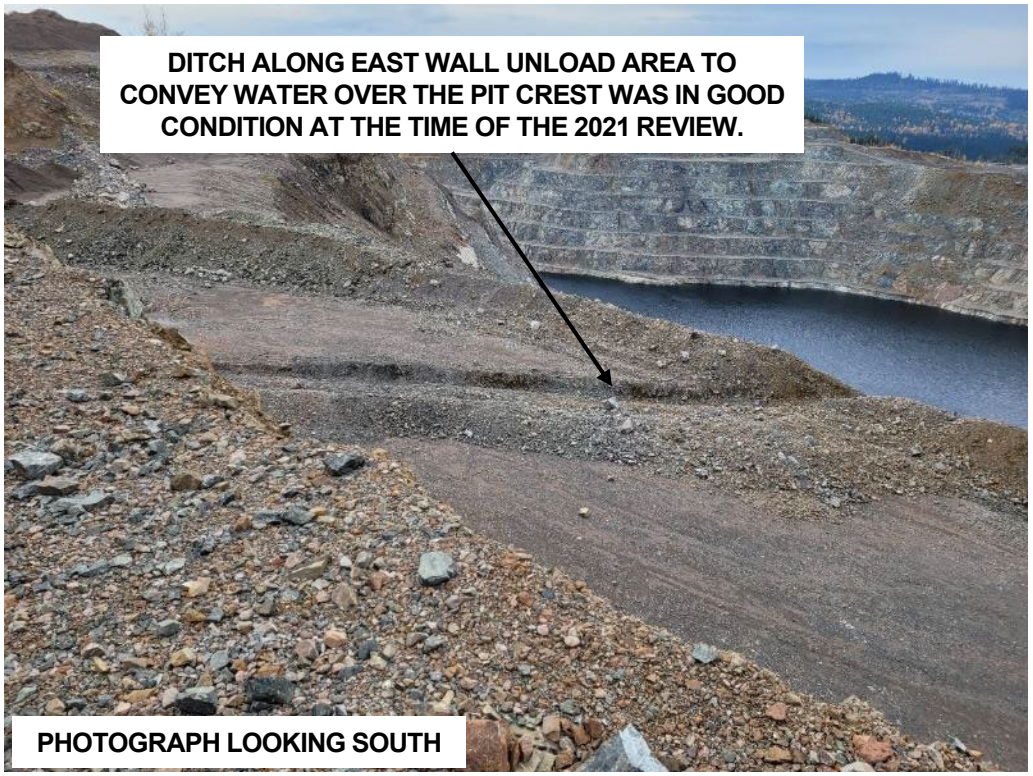

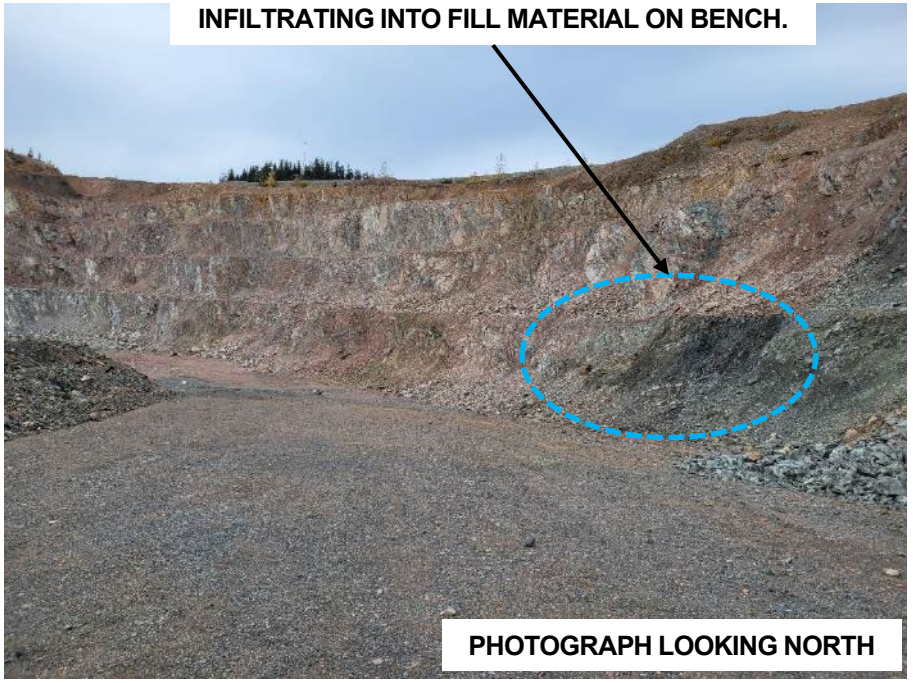

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT EAST WALL
UNLOAD AREA DITCHING AND SEEPAGE
PHOTOGRAPHS LOOKING SOUTH AND NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT SOUTHEAST WALL PHOTOGRAPH LOOKING EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

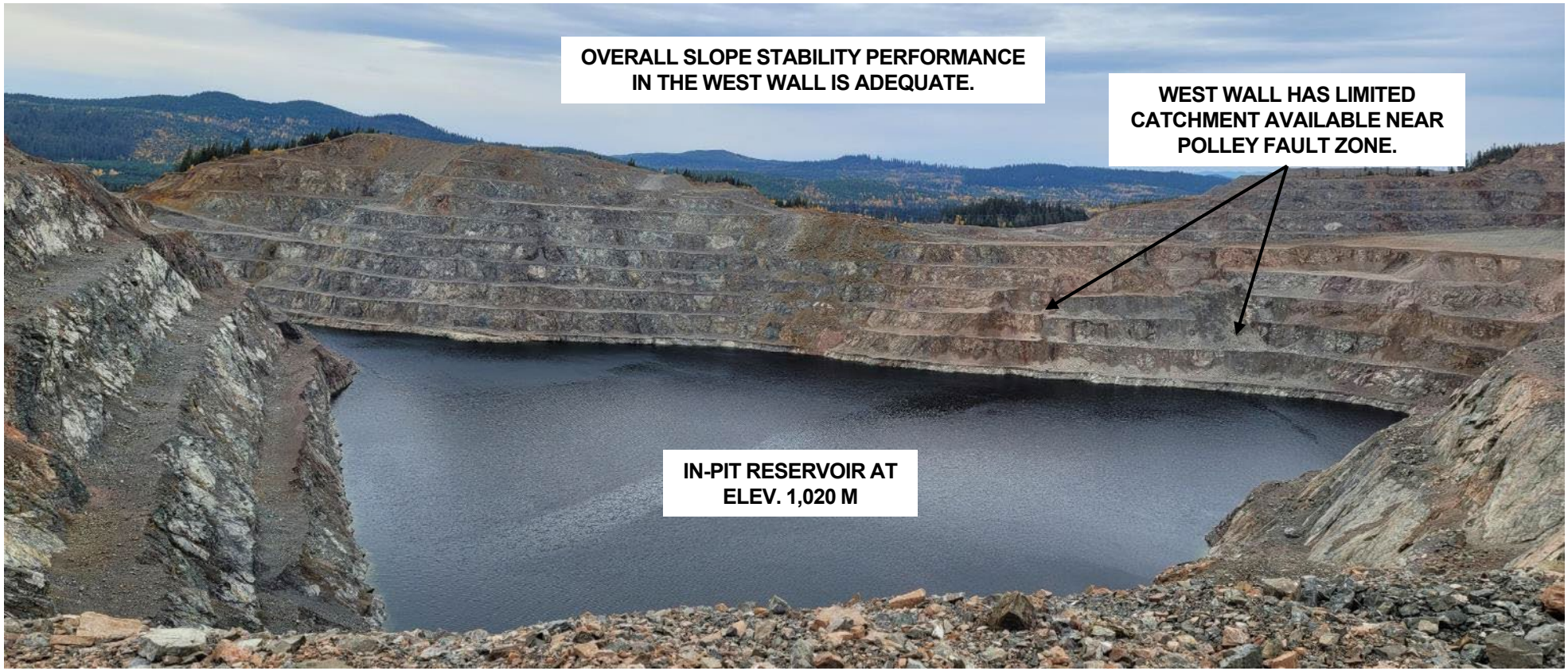

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT WEST WALL
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

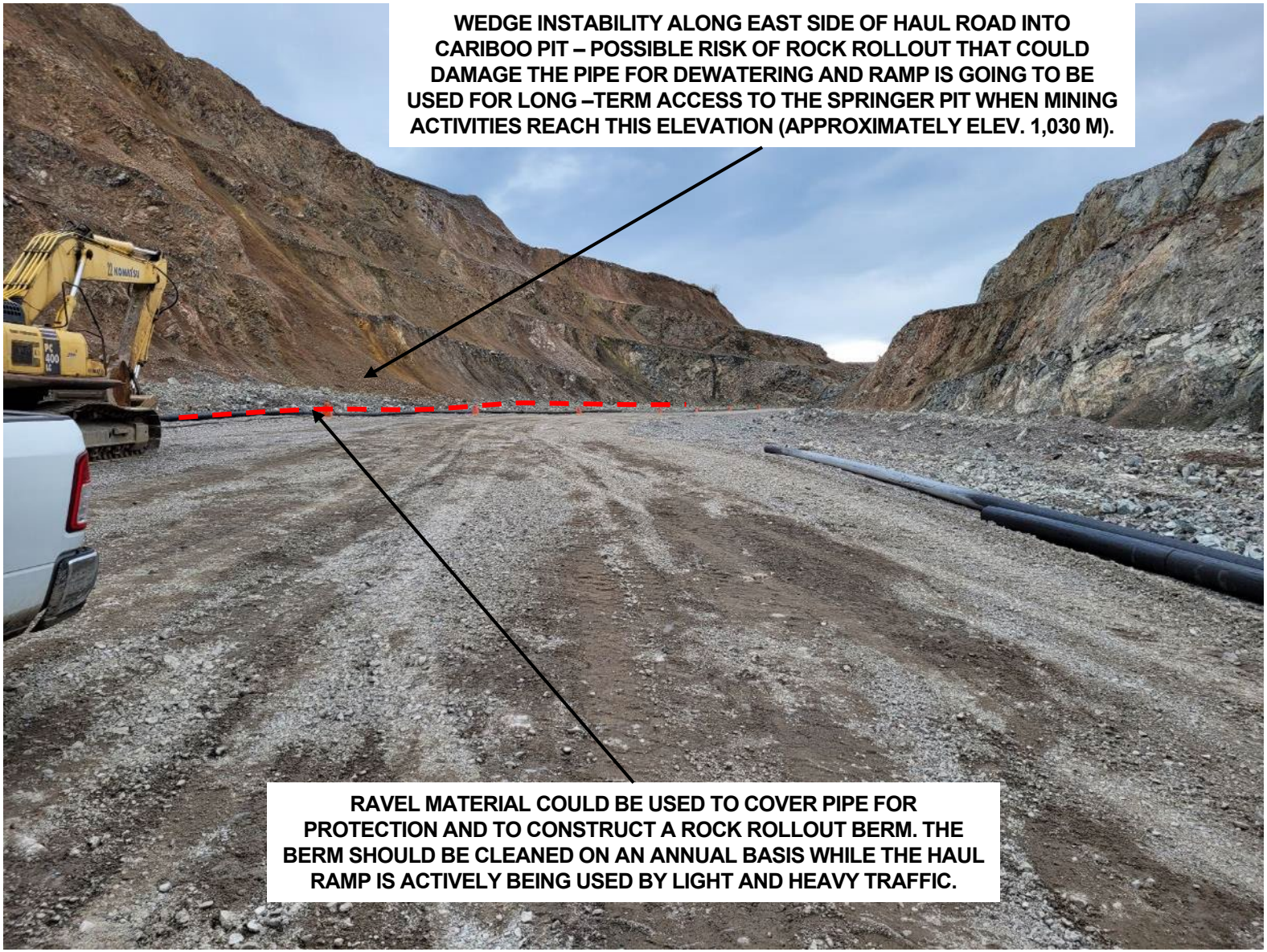

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT HAUL RAMP
PHOTOGRAPH LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

BENCHES IN THE C2 PIT HAVE ADEQUATE CATCHMENT WITH MINOR AREAS WHERE BENCHES ARE INFILLED. SLOPE STABILITY PERFORMANCE IS GOOD.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
C2 PIT
OVERVIEW
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

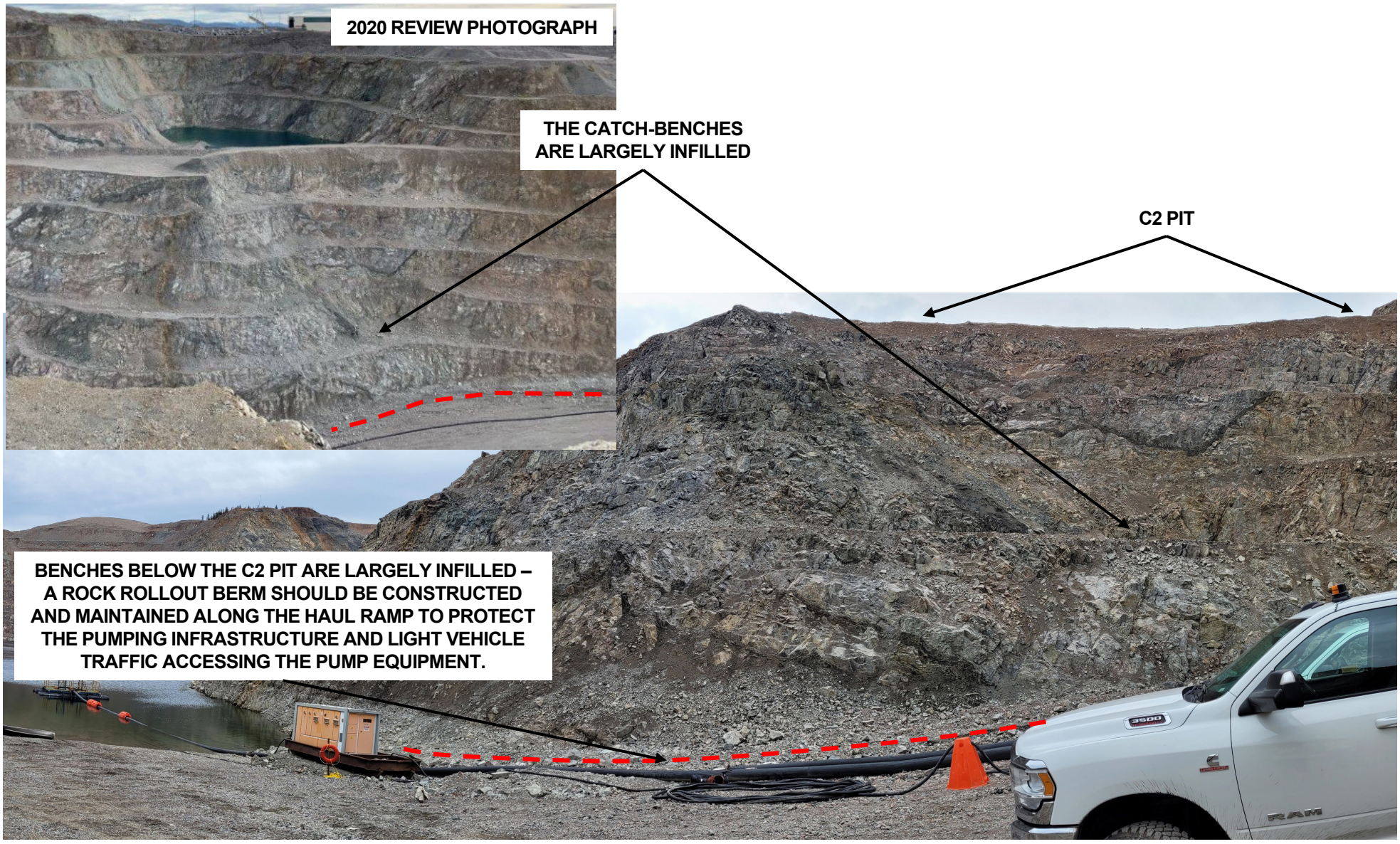

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER IN SEPTEMBER 2020 AND ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
C2 PIT
BENCHES BELOW PIT
PHOTOGRAPHS LOOKING EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WX PIT
BENCHES BELOW PIT
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

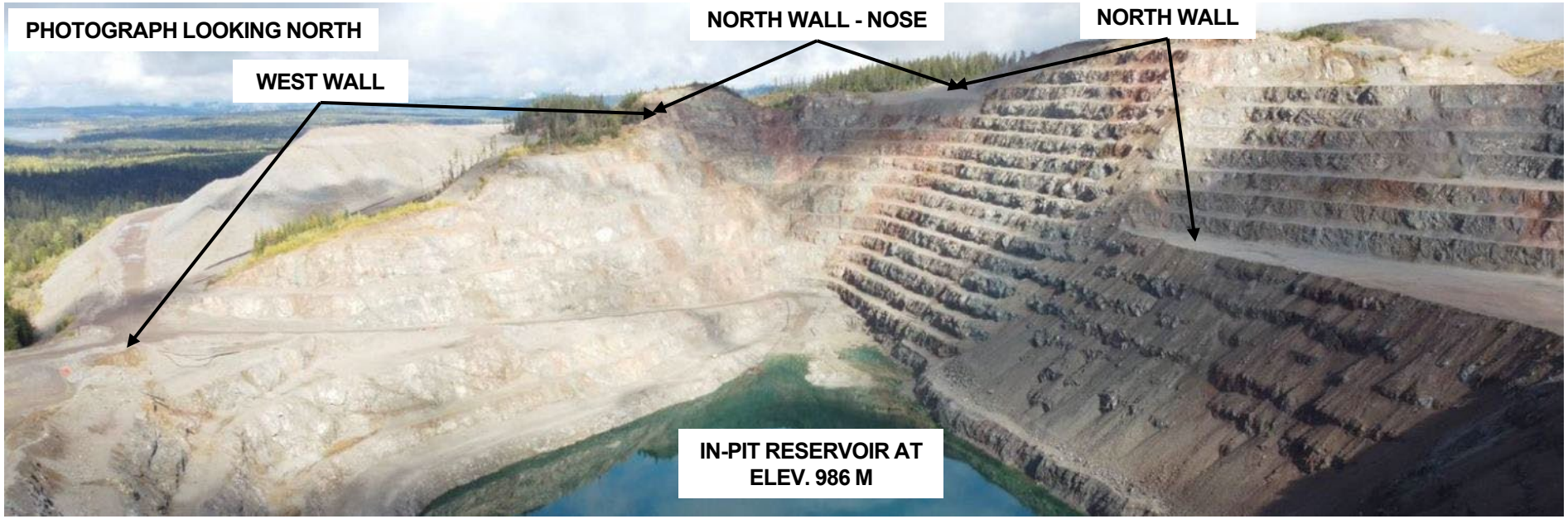

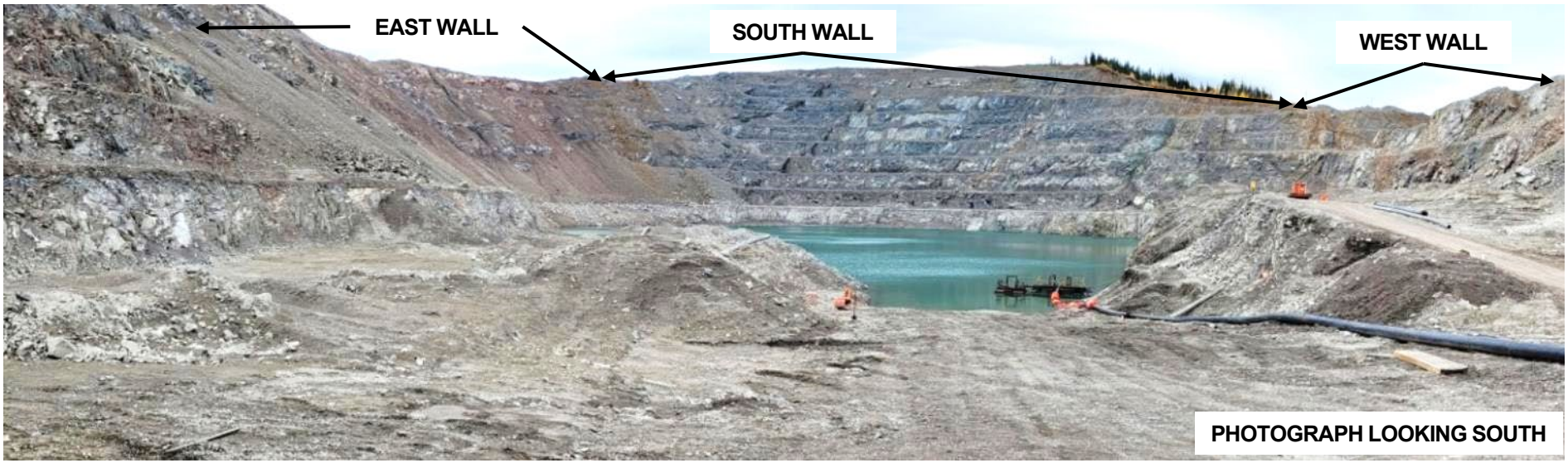

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021 AND BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT
OVERVIEW
PHOTOGRAPHS LOOKING NORTH AND SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0
25 mm



BENCHES ARE PERFORMING ADEQUATELY AND THERE IS LITTLE CHANGE SINCE THE 2020 REVIEW. BENCHES CONTINUE TO HAVE MINOR INFILLING ALONG FAULT EXPOSURES – CONTINUE TO MONITOR CATCHMENT IN AREAS WHERE FAULTS ARE EXPOSED AND RAVELING.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT NORTH WALL – EAST SIDE PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

OVERSPILL HAS INFILLED BENCHES ON THE EAST WALL. LITTLE CHANGE SINCE THE 2020 REVIEW DUE TO NO MINING ACTIVITIES.

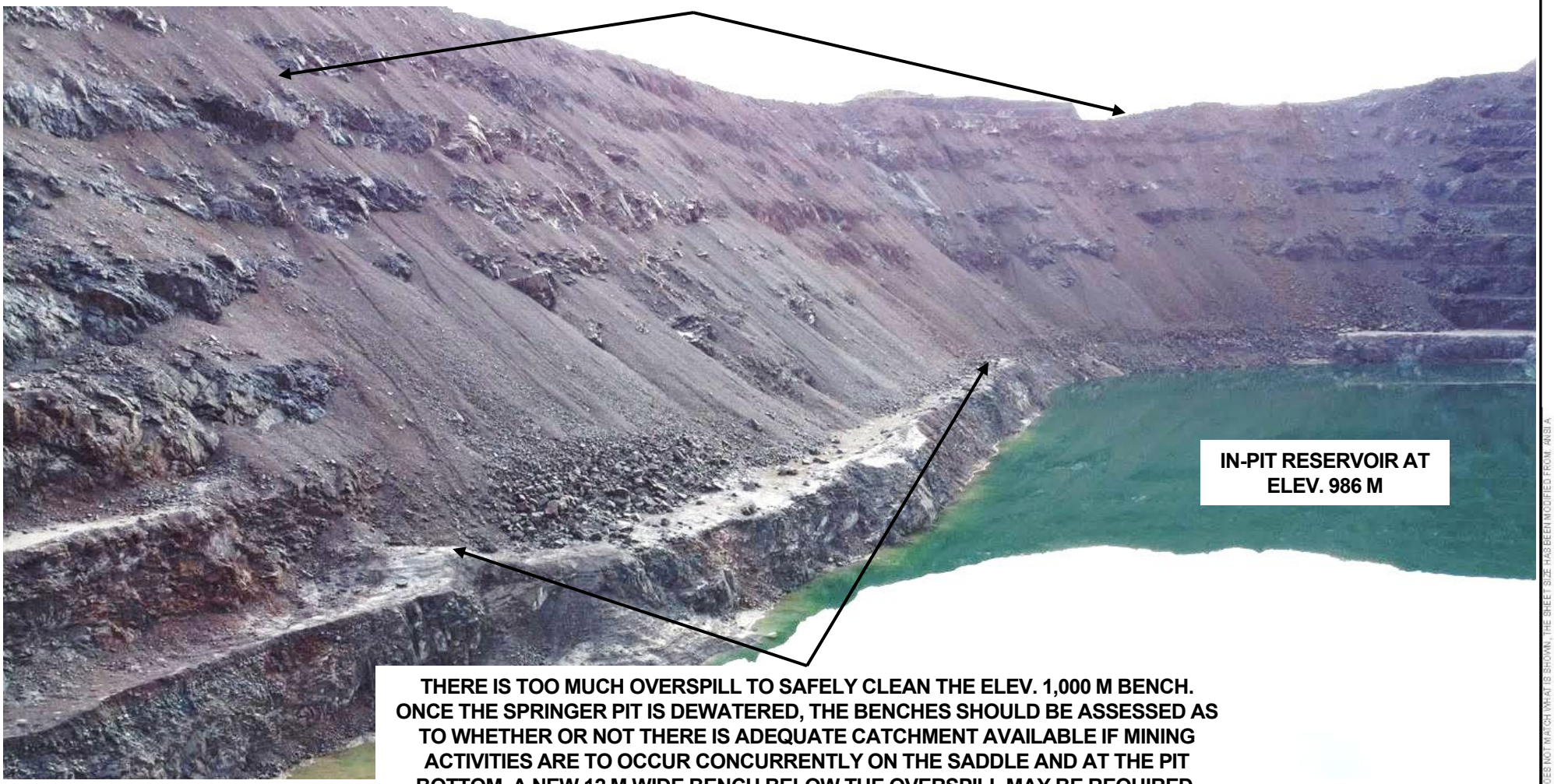

THERE IS TOO MUCH OVERSPILL TO SAFELY CLEAN THE ELEV. 1,000 M BENCH. ONCE THE SPRINGER PIT IS DEWATERED, THE BENCHES SHOULD BE ASSESSED AS TO WHETHER OR NOT THERE IS ADEQUATE CATCHMENT AVAILABLE IF MINING ACTIVITIES ARE TO OCCUR CONCURRENTLY ON THE SADDLE AND AT THE PIT BOTTOM. A NEW 12 M WIDE BENCH BELOW THE OVERSPILL MAY BE REQUIRED.

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT EAST WALL
DRONE PHOTOGRAPH IMAGERY LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

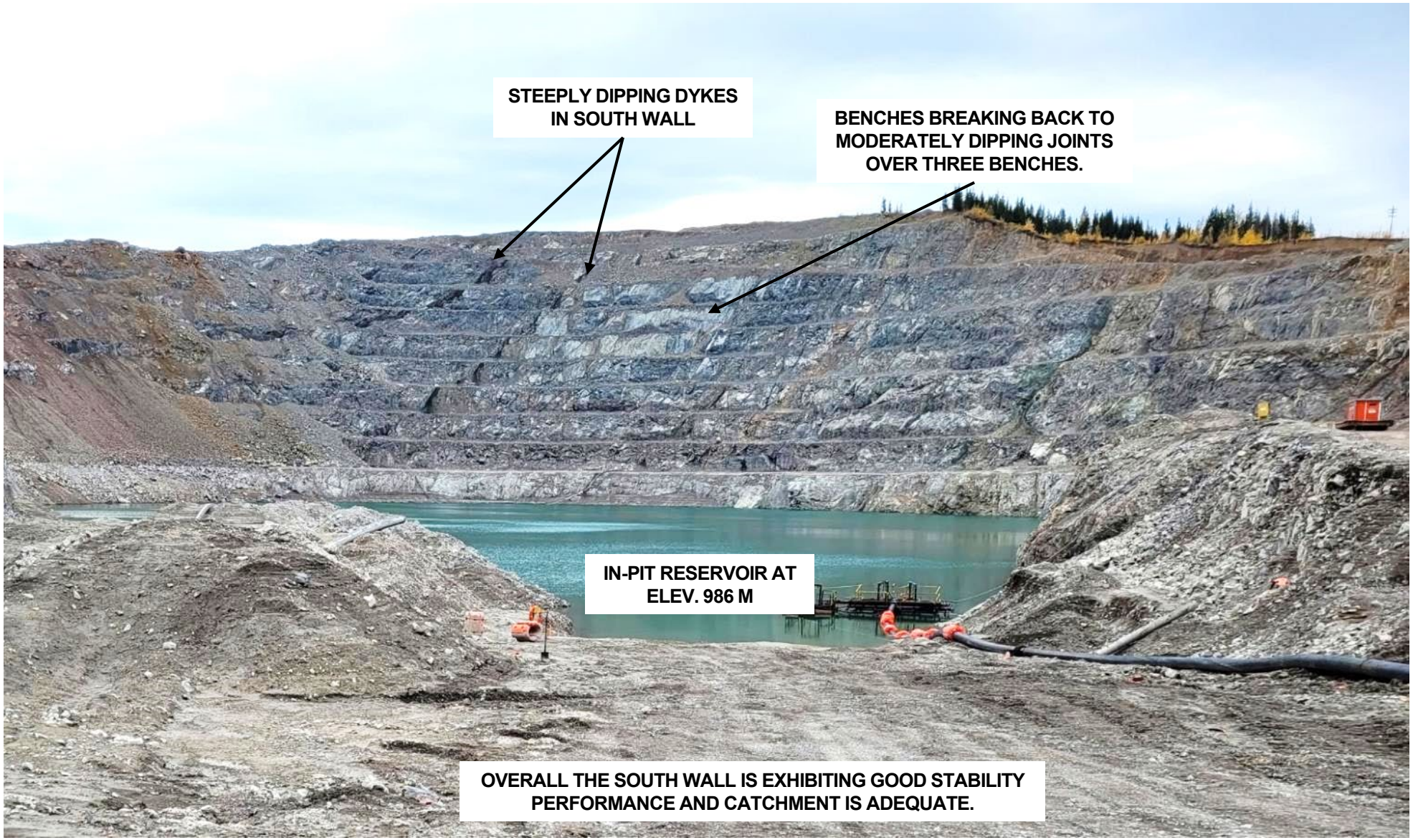

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT SOUTH WALL
PHOTOGRAPH LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

PREPARATIONS FOR ACTIVE MINING UNDERWAY ON UPPER BENCHES OF THE SOUTH WALL/SADDLE BETWEEN SPRINGER AND CARIBOO PITS. AS MINING ADVANCES, LIMIT OVERSPILL PARTICULARLY INTO THE CARIBOO PIT TO THE SOUTH DUE TO THE HAUL RAMP BEING USED BY LIGHT VEHICLES FOR PUMP INFRASTRUCTURE INSPECTIONS.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT SOUTH WALL
UPPER BENCHES
DRONE PHOTOGRAPH IMAGERY LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

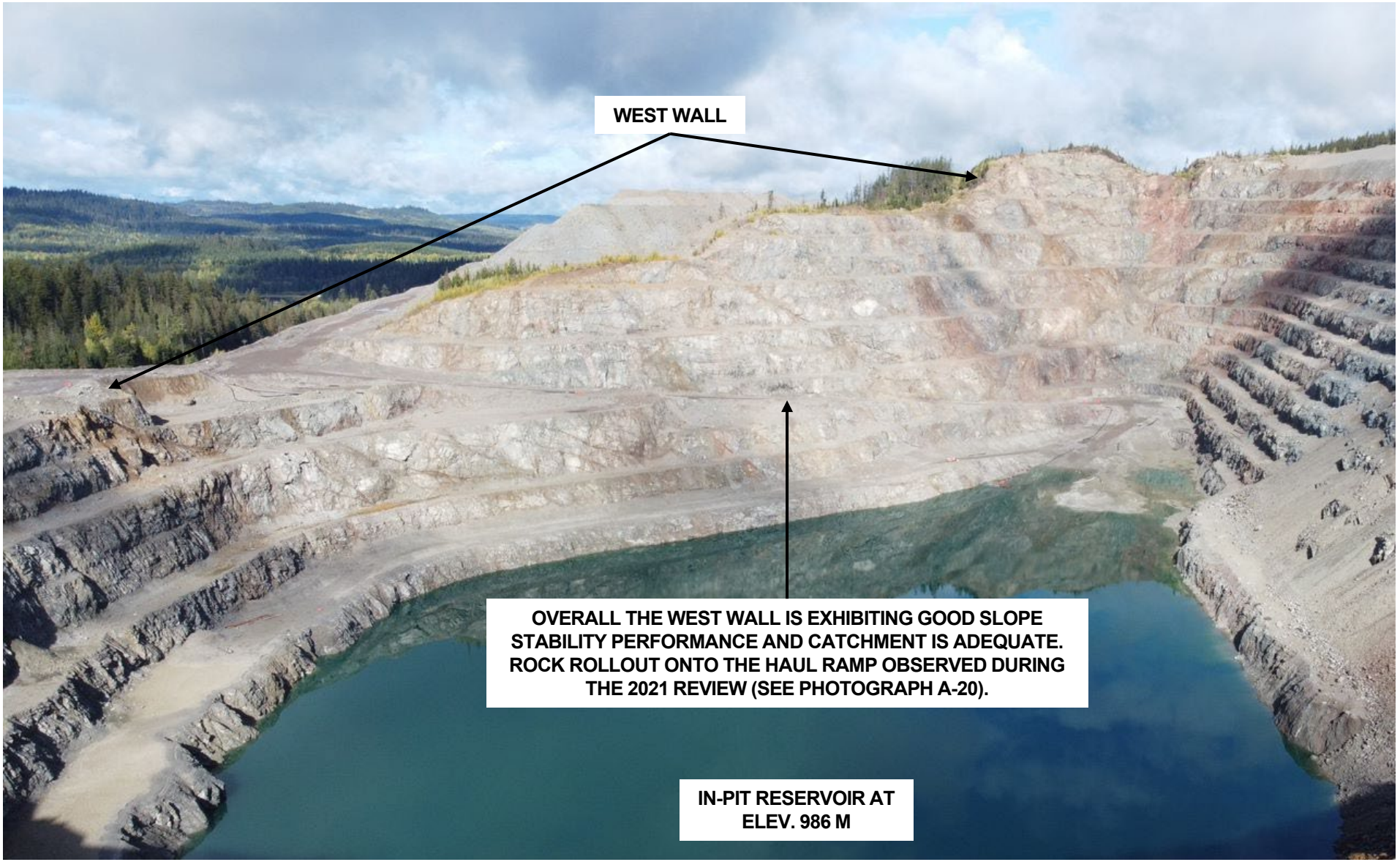

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

BOULDERS ON THE HAUL RAMP SHOULD BE REMOVED. AS DEWATERING AND MINING ACTIVITIES RESUME IN SPRINGER PIT, A ROLLOUT BERM IS REQUIRED ALONG THE HAUL RAMP IF BOULDERS CONTINUE TO ROLL ONTO THE ROAD. SLIGHT OVERHANG VISIBLE IN BENCH ABOVE THE HAUL RAMP.

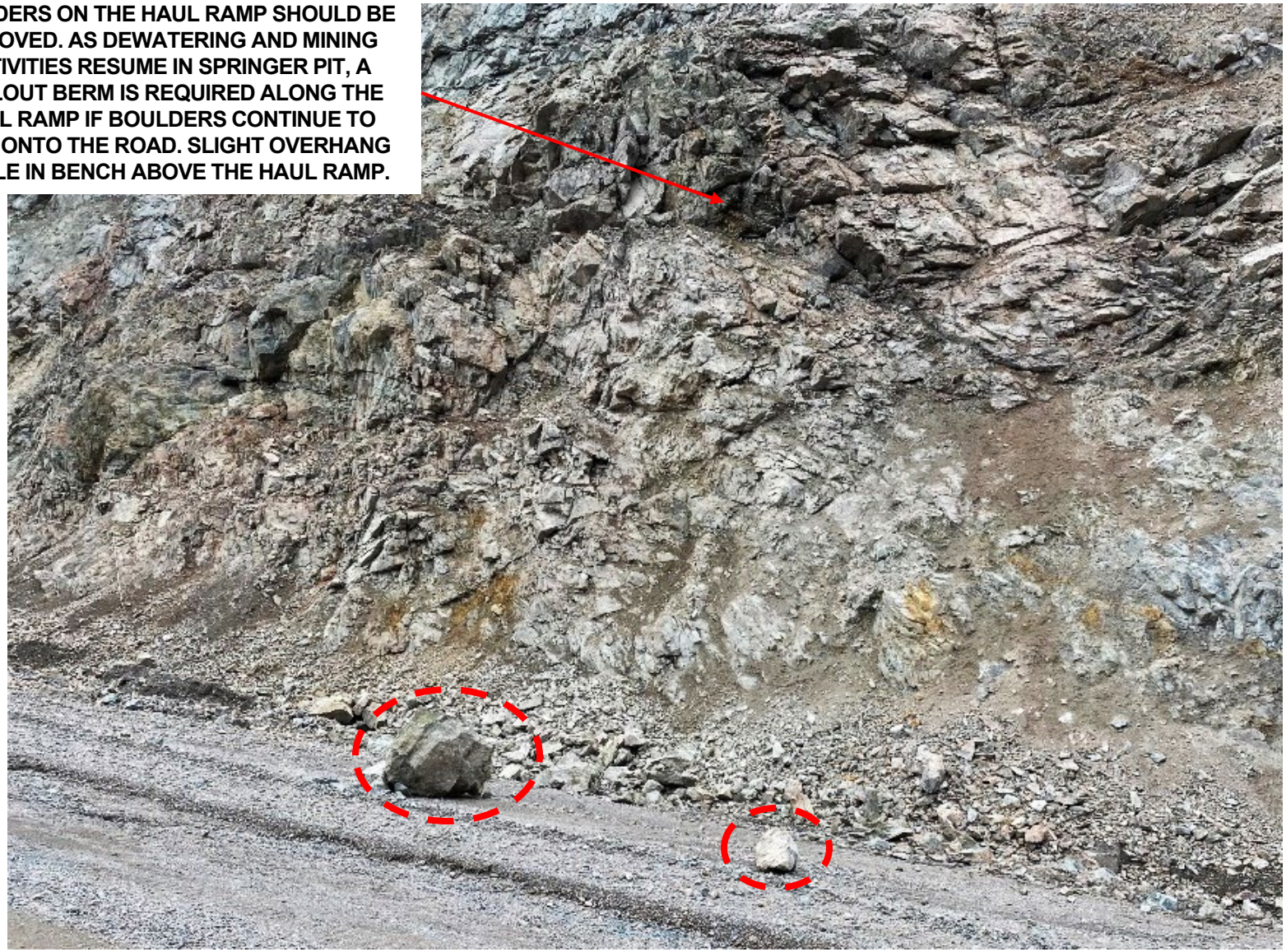

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL
HAUL RAMP ROCK ROLLOUT
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-20**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – NORTH SIDE NOSE LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-21**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

NOSE AREA IS EXHIBITING ADEQUATE SLOPE STABILITY, HOWEVER, LIMITED CATCHMENT IS AVAILABLE. A ROCK ROLLOUT BERM WAS CONSTRUCTED IN FRONT OF AN AREA OF THE NORTH WALL NOSE TO LIMIT POTENTIAL ROCK ROLLOUT. MONITOR THE BERM AND ANNUALLY CHECK IF THE BERM NEEDS TO BE CLEANED OF DEBRIS.

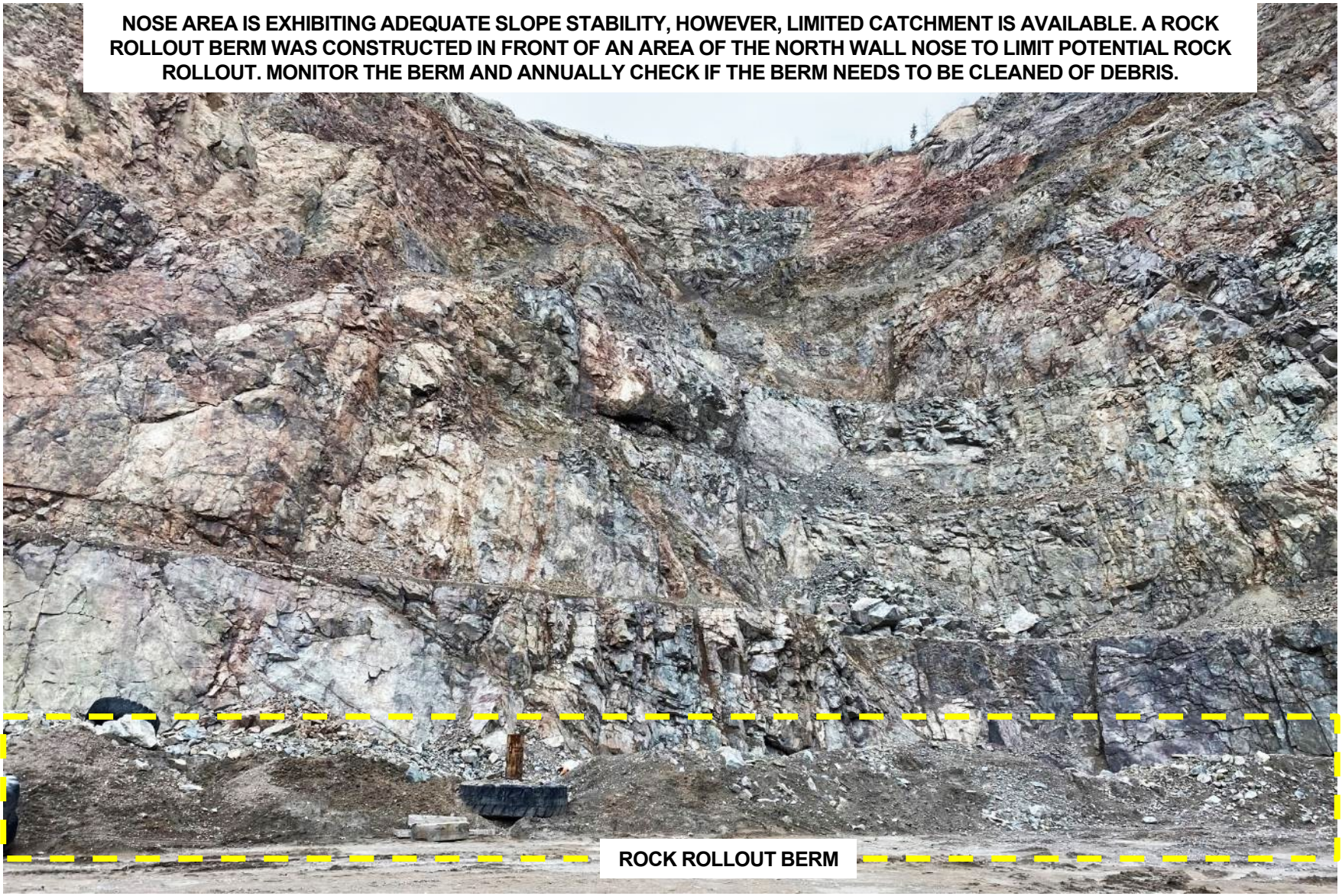

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – NORTH SIDE NOSE ROLLOUT BERM LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0

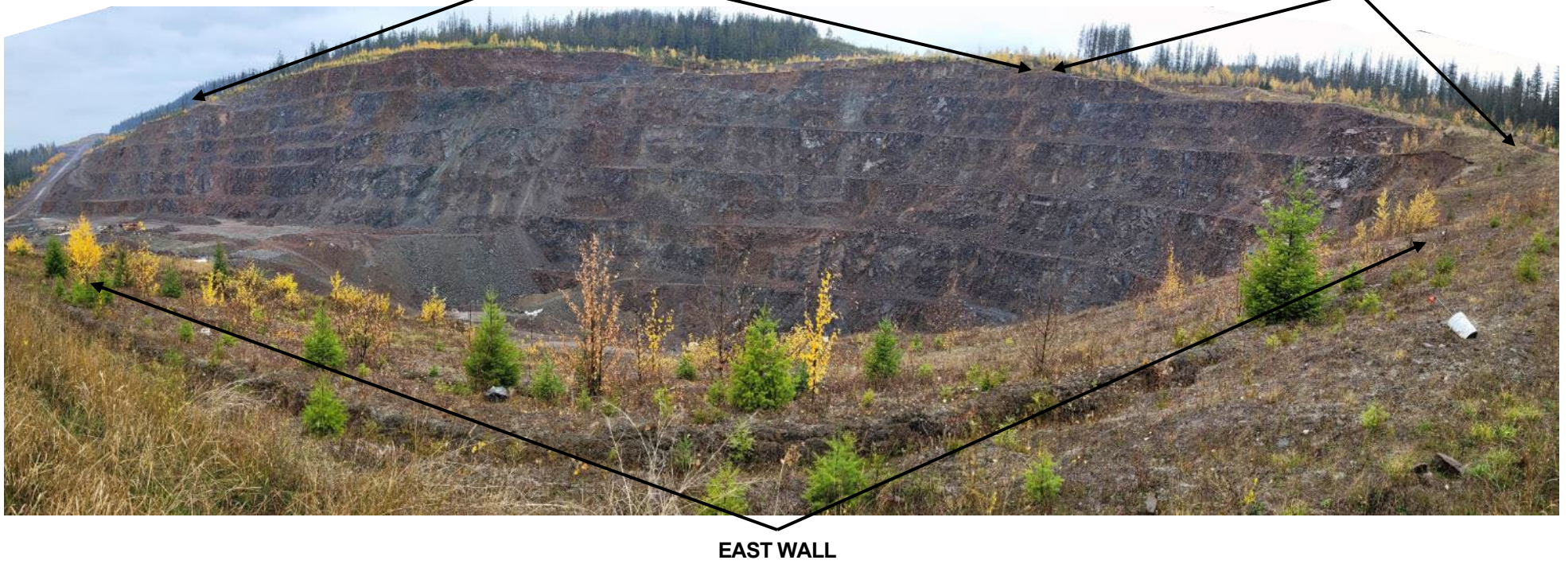

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT
OVERVIEW
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

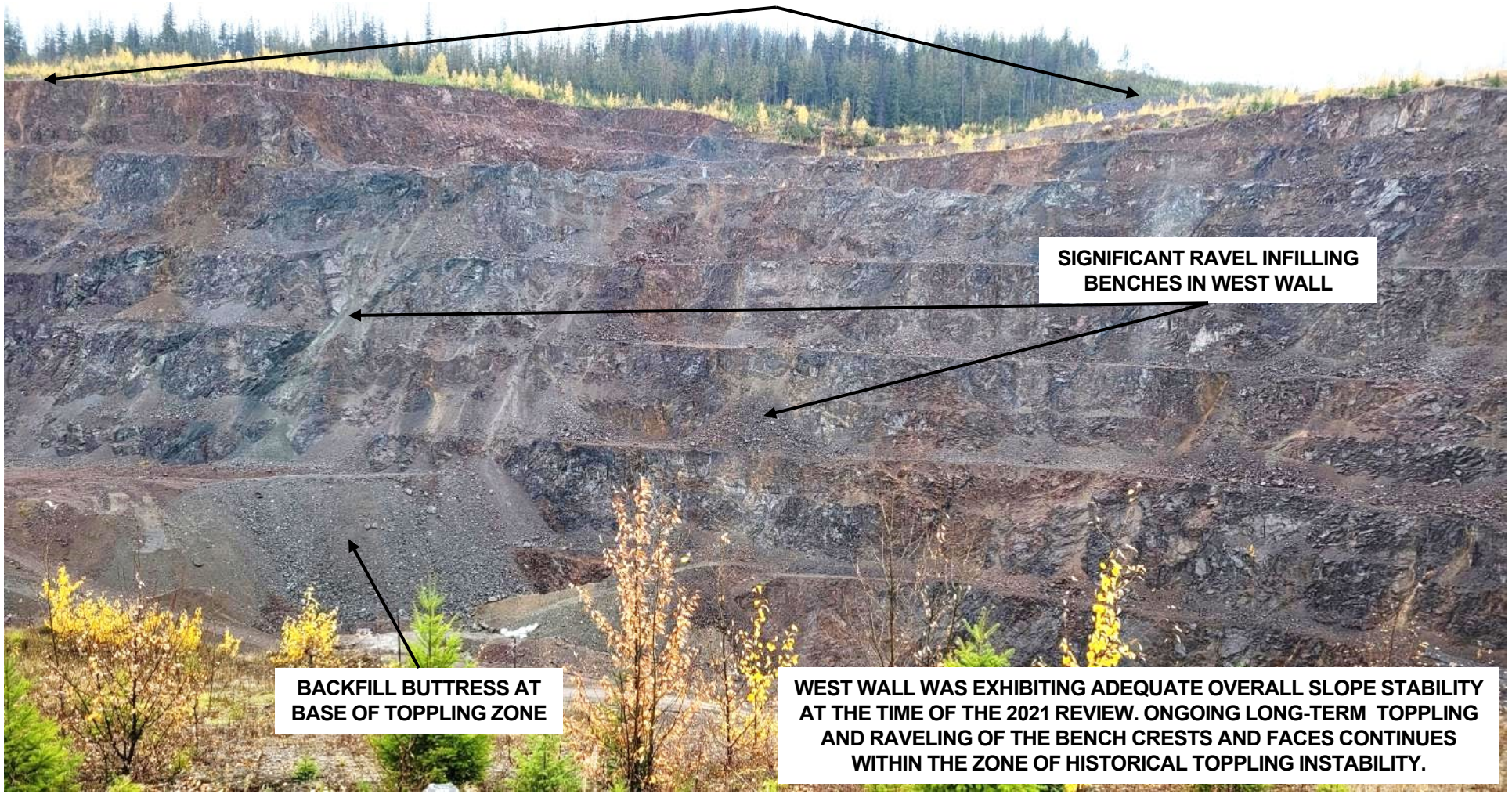

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
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IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
UNLOAD AREA
PHOTOGRAPH LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-25**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
UNLOAD AREA CRACKS
PHOTOGRAPH LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-26**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

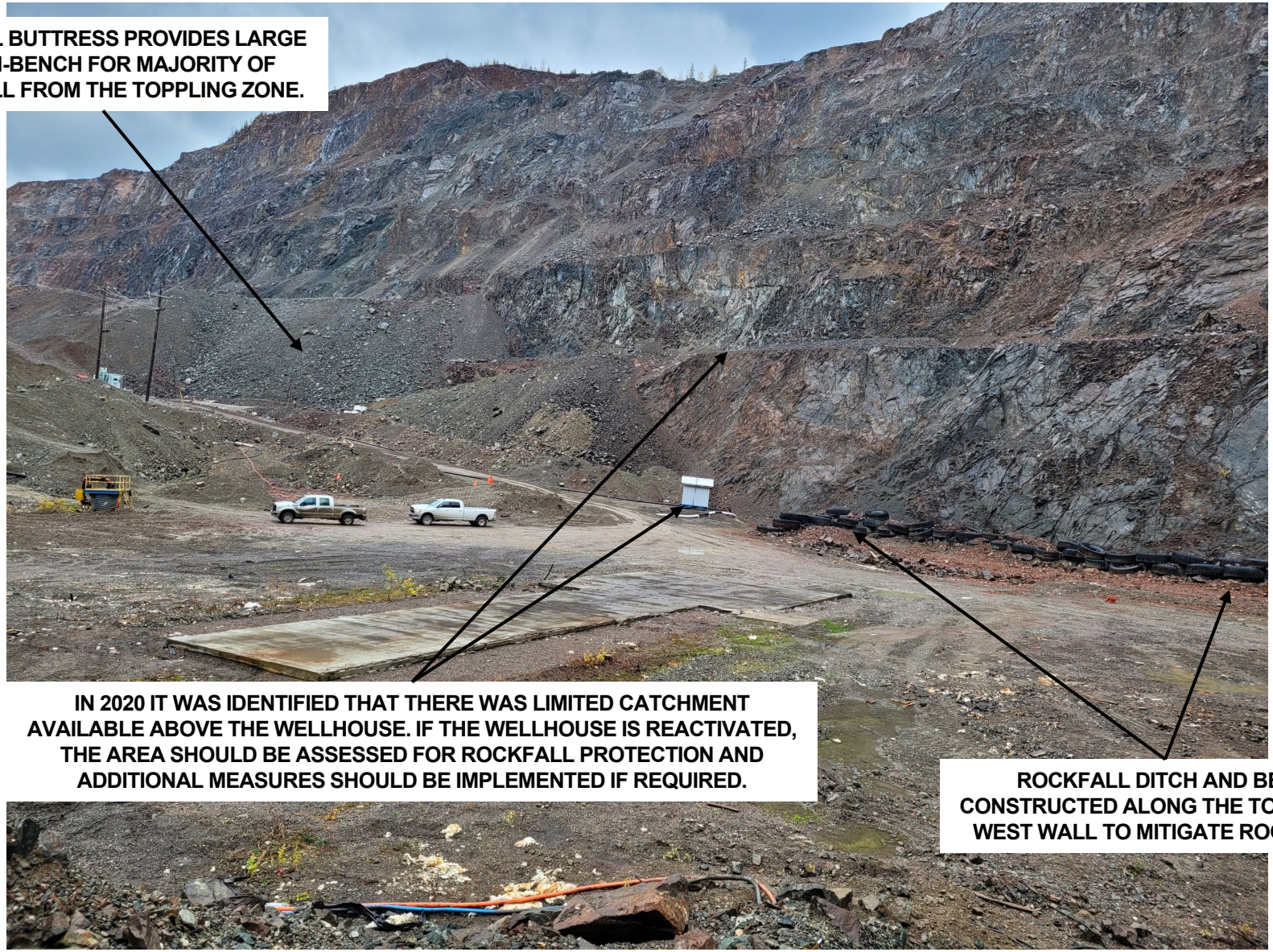

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
WELLHOUSE AND CATCHMENT
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-27

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT NORTH WALL
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-28

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

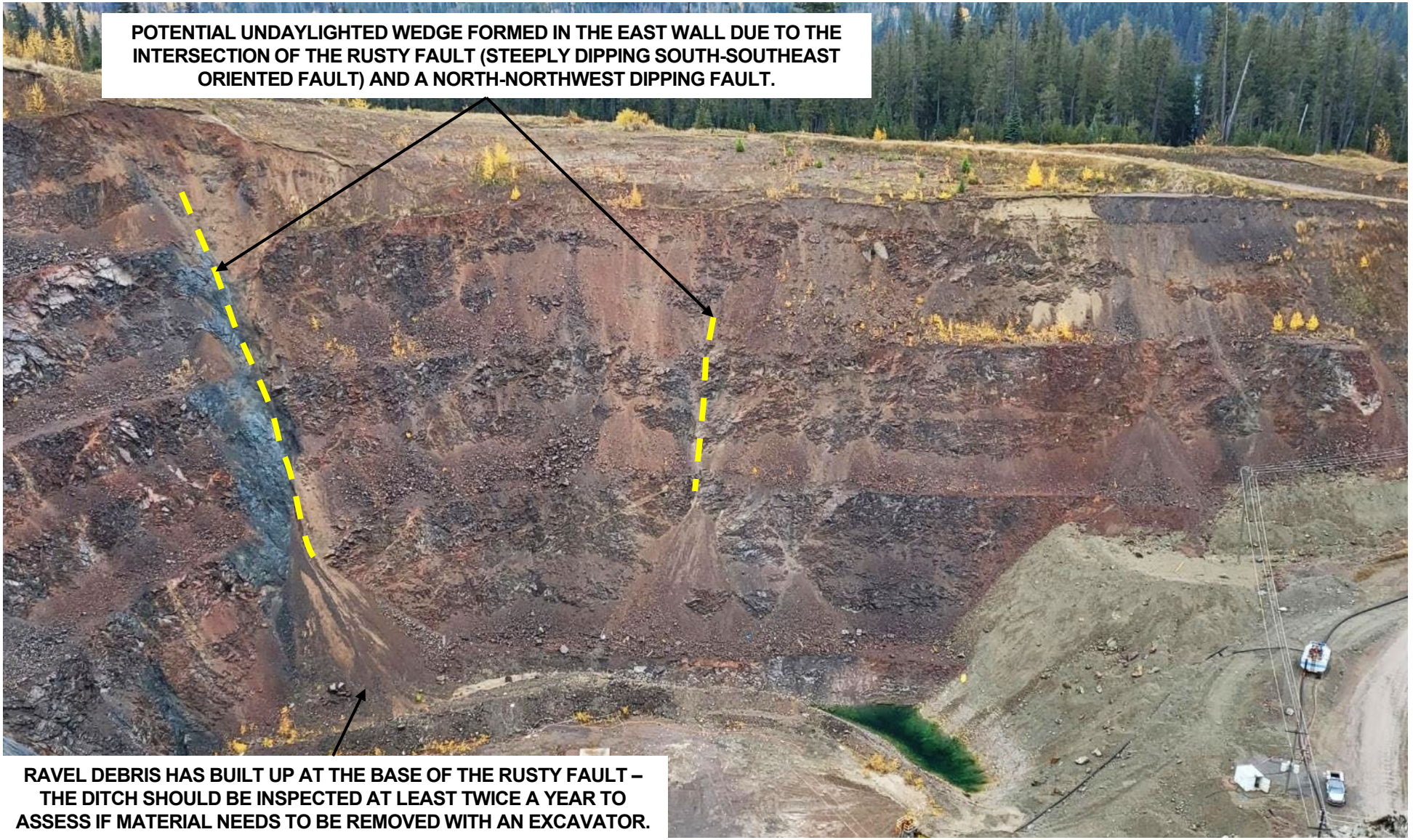

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-29

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
TILL OVERBURDEN AT CREST
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-30**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0
25 mm

DITCHING AROUND THE NORTH AND EAST SIDE OF THE WIGHT PIT WAS RE-ESTABLISHED IN 2021 TO CONTROL WATER FLOWS INTO THE PIT.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PERIMETER DITCHING
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-31**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

NORTHWEST PAG DUMP EXHIBITS GOOD OVERALL STABILITY PERFORMANCE AND IS IN SIMILAR CONDITION AS IT WAS DURING THE 2020 REVIEW. ALL SLOPES ARE AT ANGLE OF REPOSE AND THE DUMP CONSISTS OF COARSE MATERIAL.

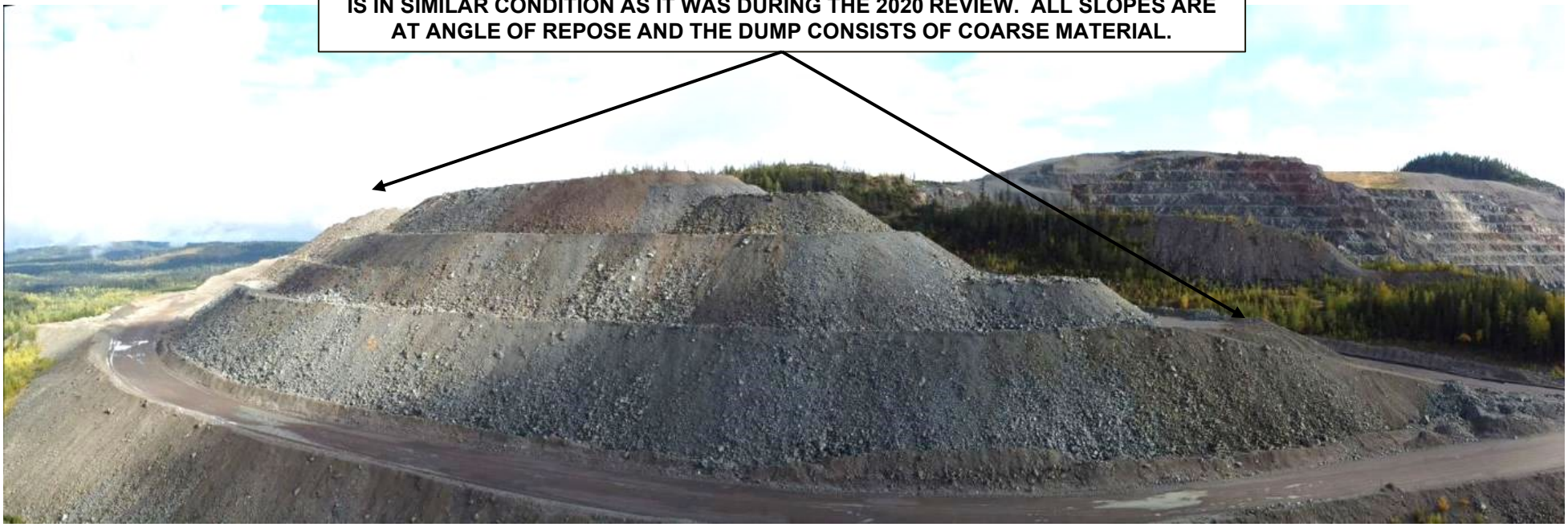

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-32**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
UPPER LIFTS
PHOTOGRAPHS LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-33

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
HAUL RAMP
PHOTOGRAPHS LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-34**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

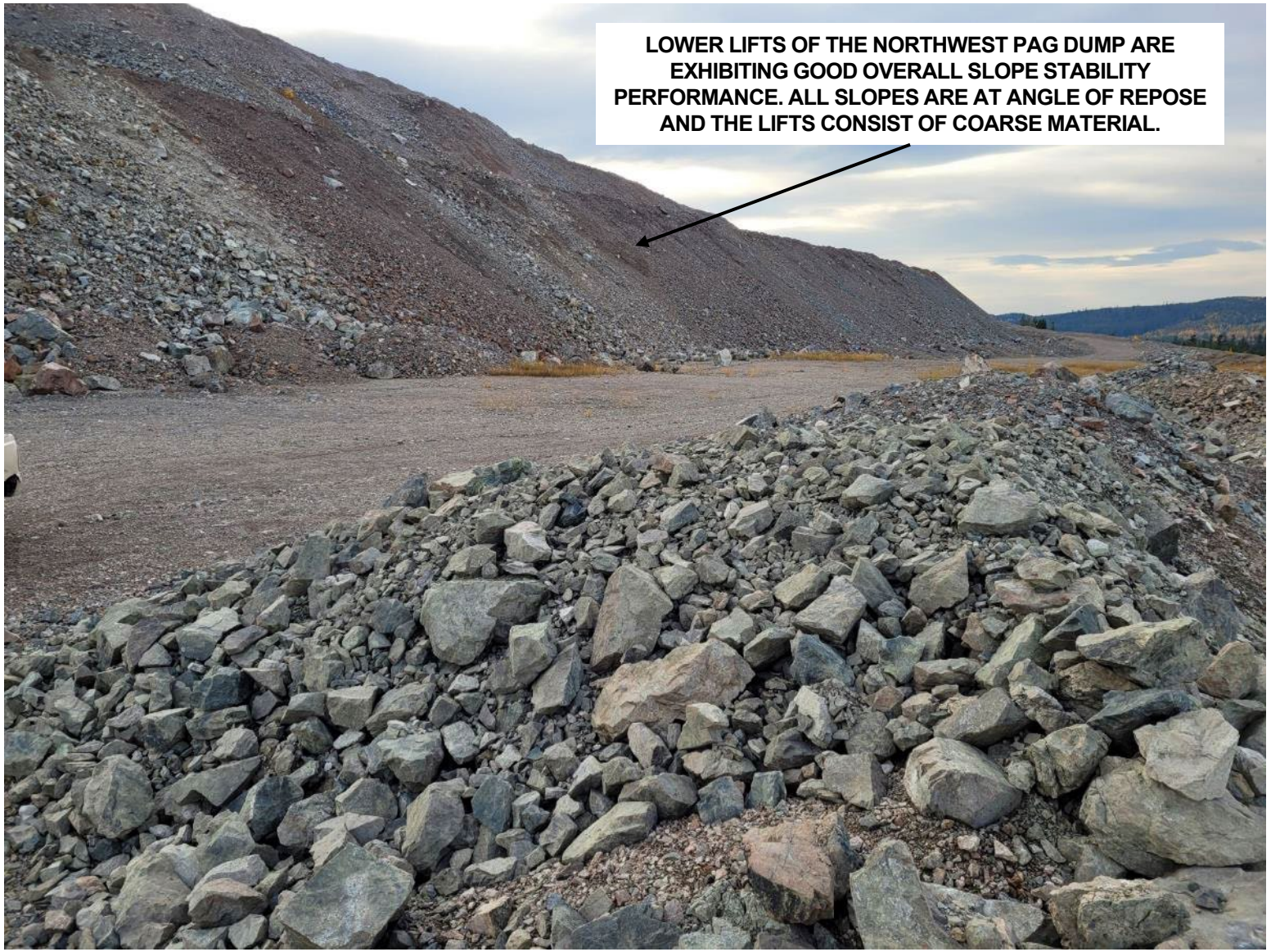

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
LOWER LIFTS
PHOTOGRAPHS LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-35**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



SOME EVIDENCE OF PONDING ALONG THE LOWER LIFTS, WHERE WATER IS COLLECTING ON THE OUTSIDE OF THE WASTE DUMP (SEE PHOTOGRAPH A-37).

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PONDING
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-36**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

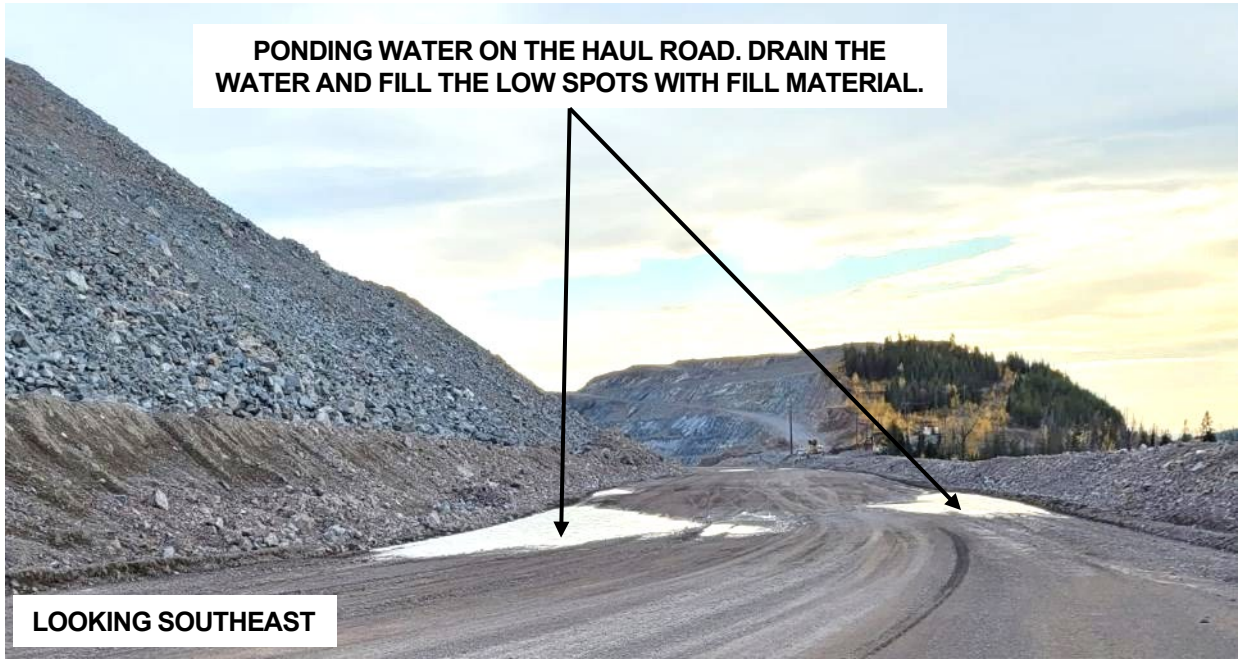



EVIDENCE OF WATER PONDING BELOW RAMP TO LOWER LIFT – FINE MATERIAL HAS ACCUMULATED IN THIS AREA. WATER SHOULD BE DIVERTED AWAY FROM THIS AREA SO THAT WATER DOES NOT POND.

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PONDING ON LOWER LIFTS
PHOTOGRAPHS LOOKING SOUTHEAST AND EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-37**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0

FUTURE CONSTRUCTION WILL PROGRESS THE DUMP TO THE WEST THEN NORTH. AREAS TO THE WEST ARE DAMP. CONSTRUCTION OF THE EXPANSION WILL BE BOTTOM-UP CONSTRUCTION STARTING WITH NAG MATERIAL AT THE BASE WITH PAG MATERIAL ON TOP. THE NAG LIFT FOR SHOULD BE PROGRESSED FROM SOUTH TO NORTH AT A LOW LIFT HEIGHT (SIMILAR TO WHAT HAS BEEN DONE PREVIOUSLY FOR THE CONSTRUCTION OF THIS DUMP) TO PRELOAD THE DAMP AREAS.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
LOWER PLATFORM ADVANCE
PHOTOGRAPHS LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-38

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

THE SERDS IS EXHIBITING GOOD OVERALL SLOPE STABILITY PERFORMANCE. ALL SLOPES ARE AT ANGLE OF REPOSE AND THE DUMP CONSIST OF COARSE MATERIAL.

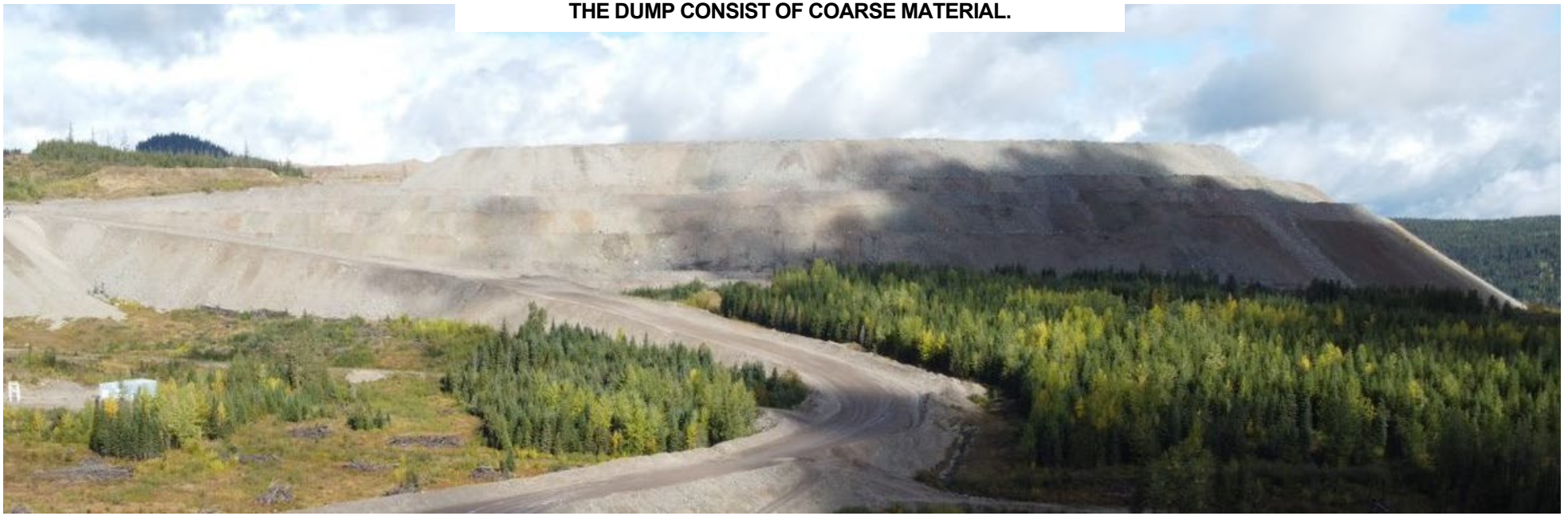

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-39**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
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LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
PLATFORM
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-40**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

UPPER PLATFORM OF THE SERDS IS WELL GRADED AND THERE IS NO EVIDENCE OF PONDING OR CRACKING. UPPER SLOPES ARE AT ANGLE OF REPOSE.

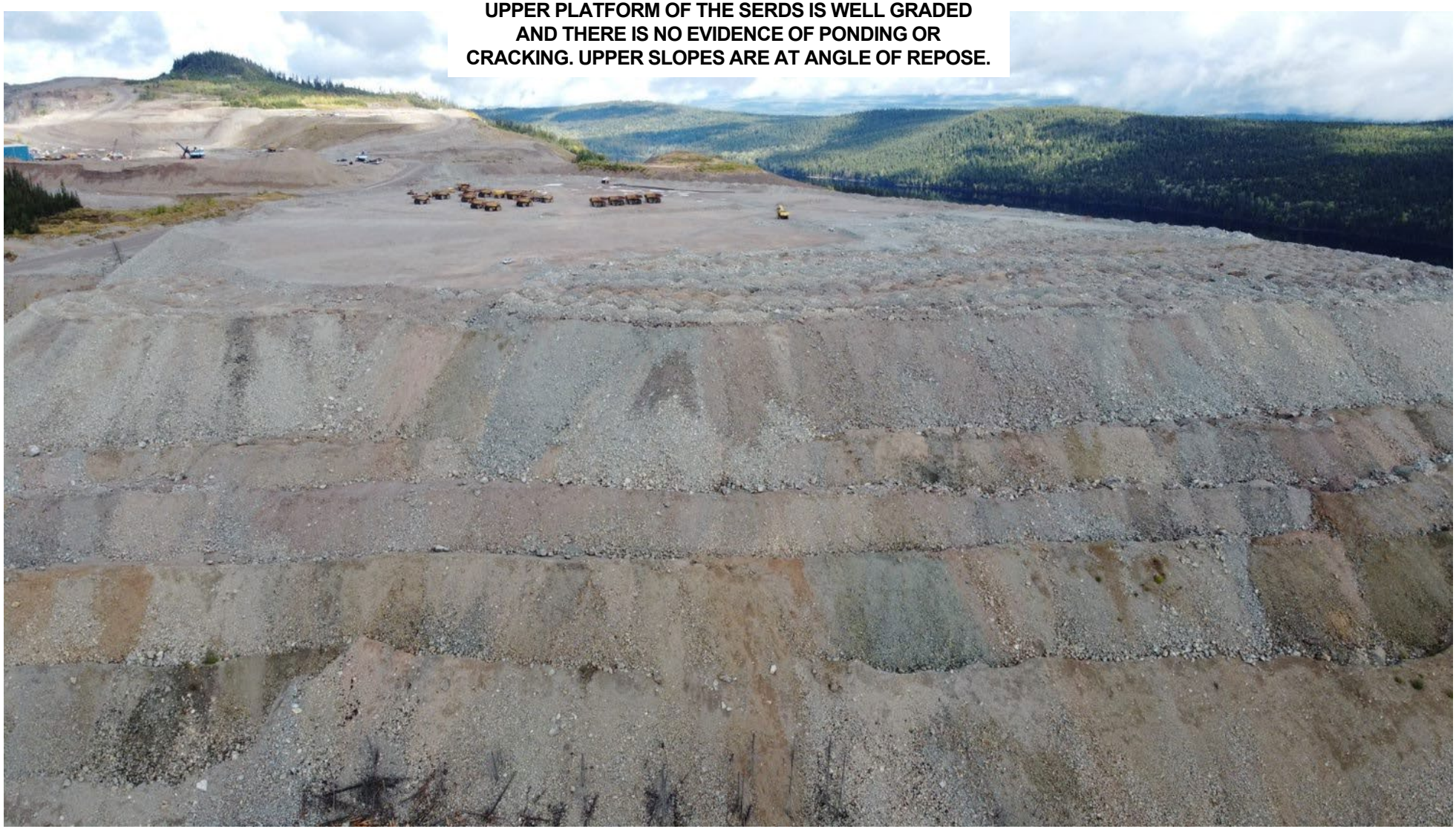

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
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IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
PLATFORM AND UPPER LIFTS
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-41**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

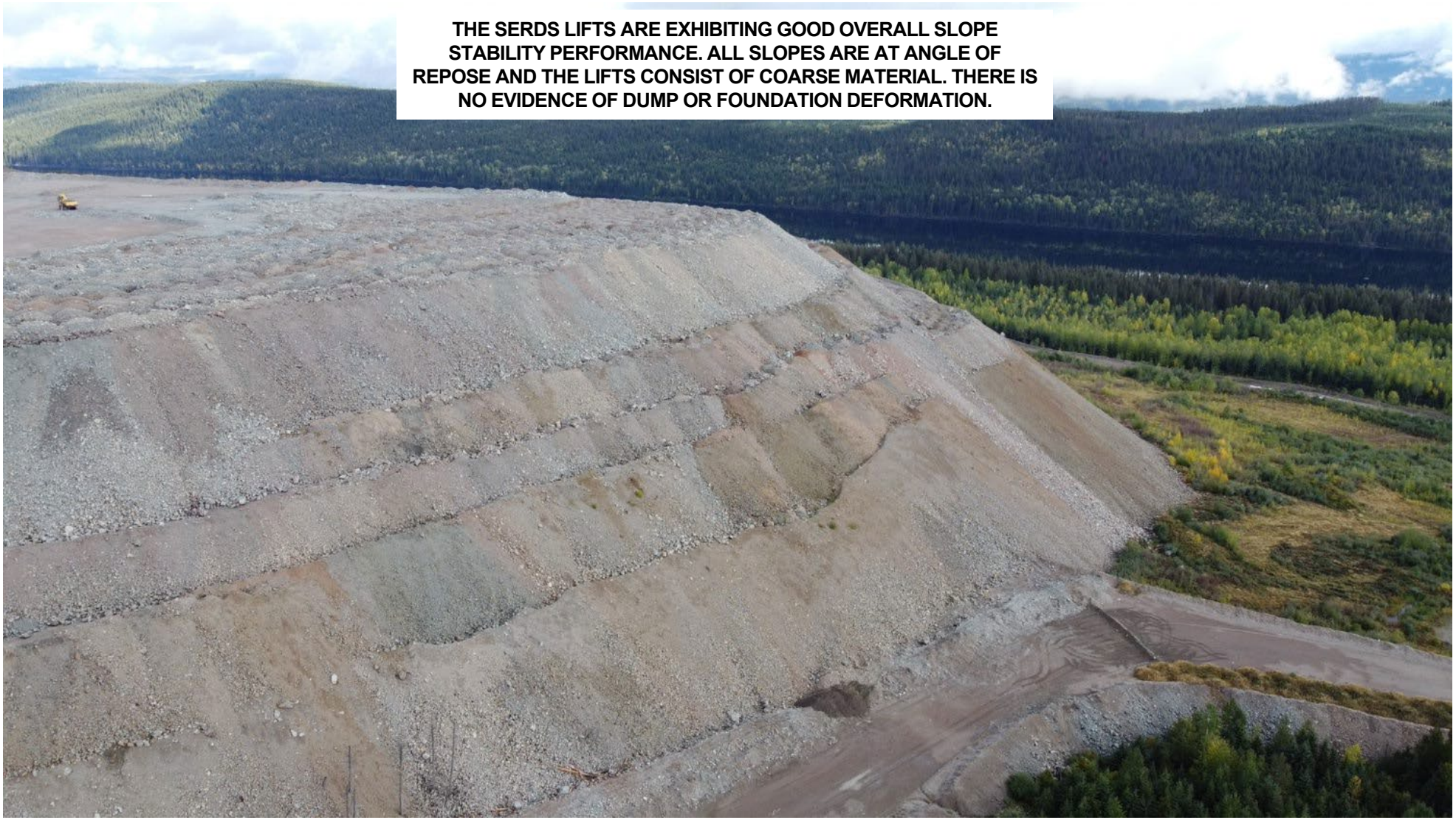

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
UPPER LIFTS
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-42

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



DUMP SLOPES ARE AT ANGLE OF REPOSE AND SLOPE STABILITY PERFORMANCE IS GOOD. THERE IS NO EVIDENCE OF DUMP OR FOUNDATION DEFORMATION.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
LOWER LIFTS
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-43**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

INACTIVE NORTHEAST NAG DUMP EXHIBITING GOOD STABILITY PERFORMANCE. PLATFORM AND SLOPES ARE PARTIALLY VEGETATED AND IN GOOD CONDITION.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHEAST NAG DUMP
OVERVIEW
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-44**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHEAST NAG DUMP
LOWER LIFTS
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-45**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

MINOR INSTABILITY OF THE TAILINGS ROAD OCCURRED IN 2019. WATER IS STILL PONDING ON THE CREST OF THE TAILINGS ROAD (SEE PHOTOGRAPH A-47).



WHEN CONSTRUCTION OF THE TAILINGS ROAD IS RESTARTED, REMEDIATE THE FAILURE BY ADDING GOOD QUALITY, COARSE-GRAINED MATERIAL, AND DUMPING SHORT AND PUSHING TO FILL THE SCARP. DO NOT END DUMP MATERIAL DIRECTLY OVER THE SCARP.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
TAILINGS ROAD INSTABILITY AND RUNOUT PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-46

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

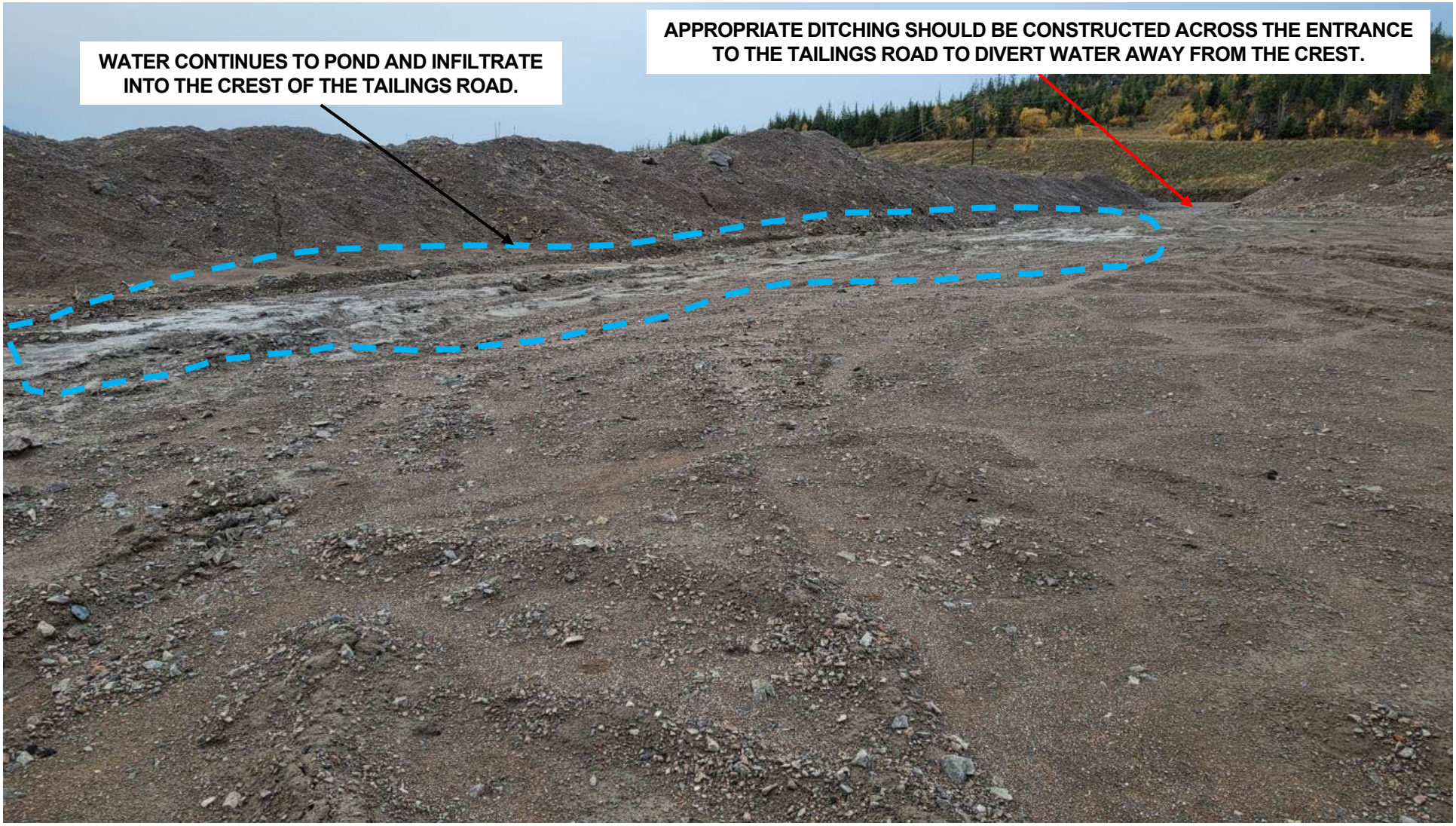

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
TAILINGS ROAD
PLATFORM AND MITIGATION
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-47**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

APPENDIX B

Prism Monitoring Data

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	

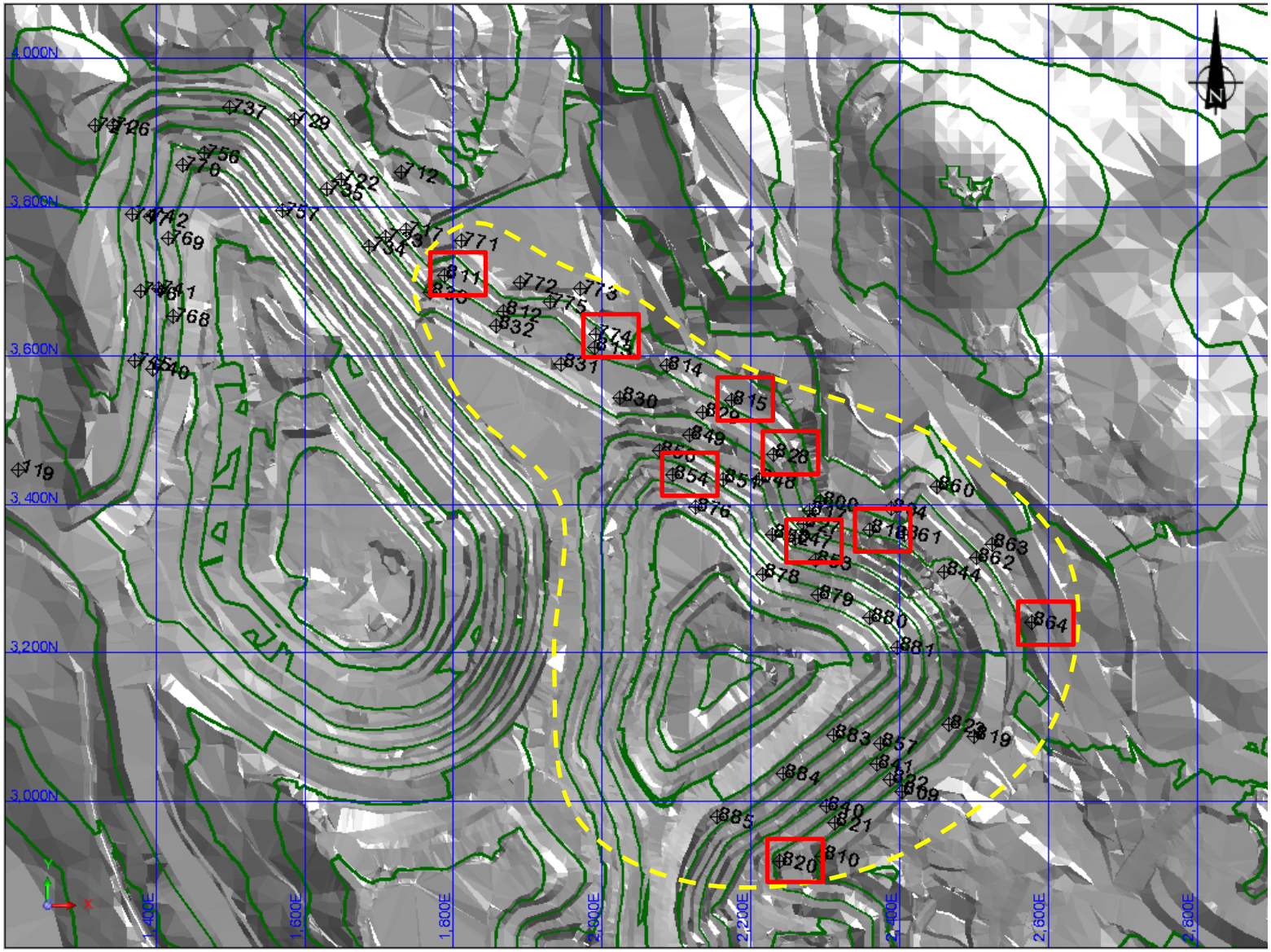

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

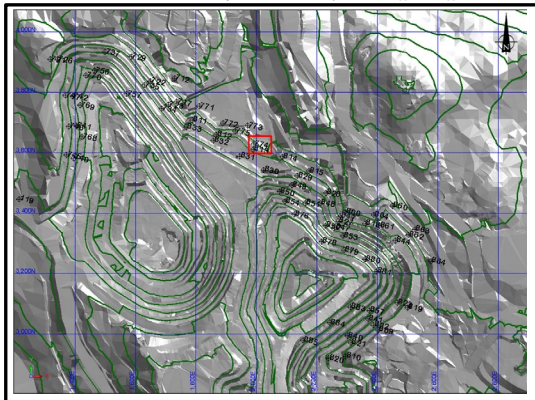

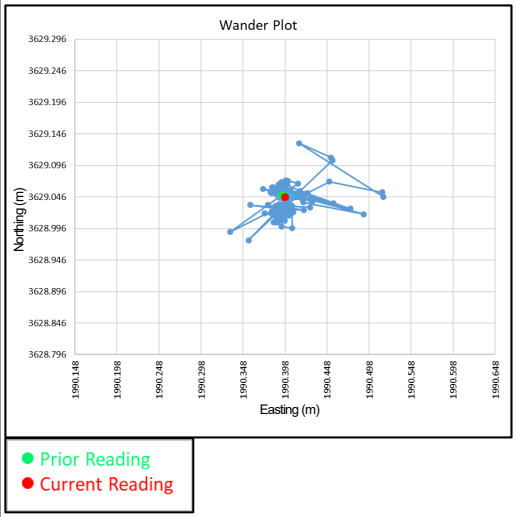

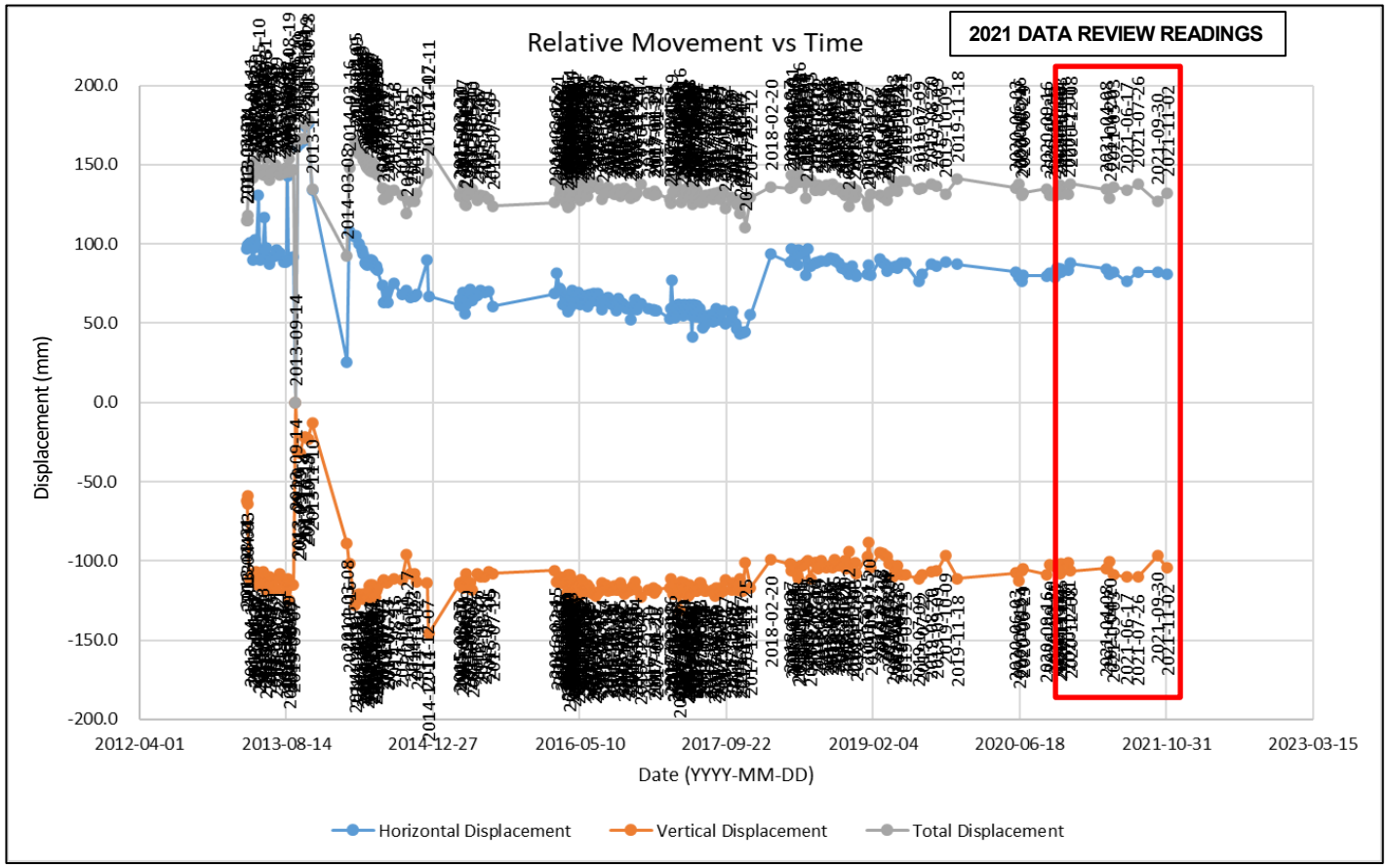

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – NORTHWEST SEGMENT PRISM 774

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

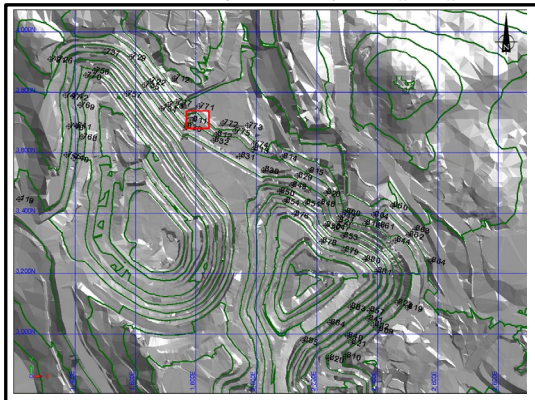

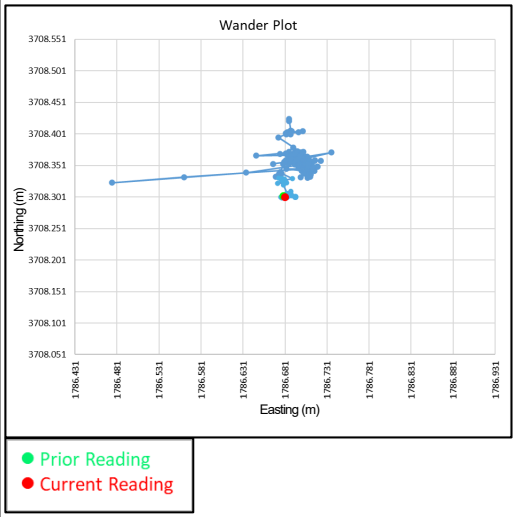

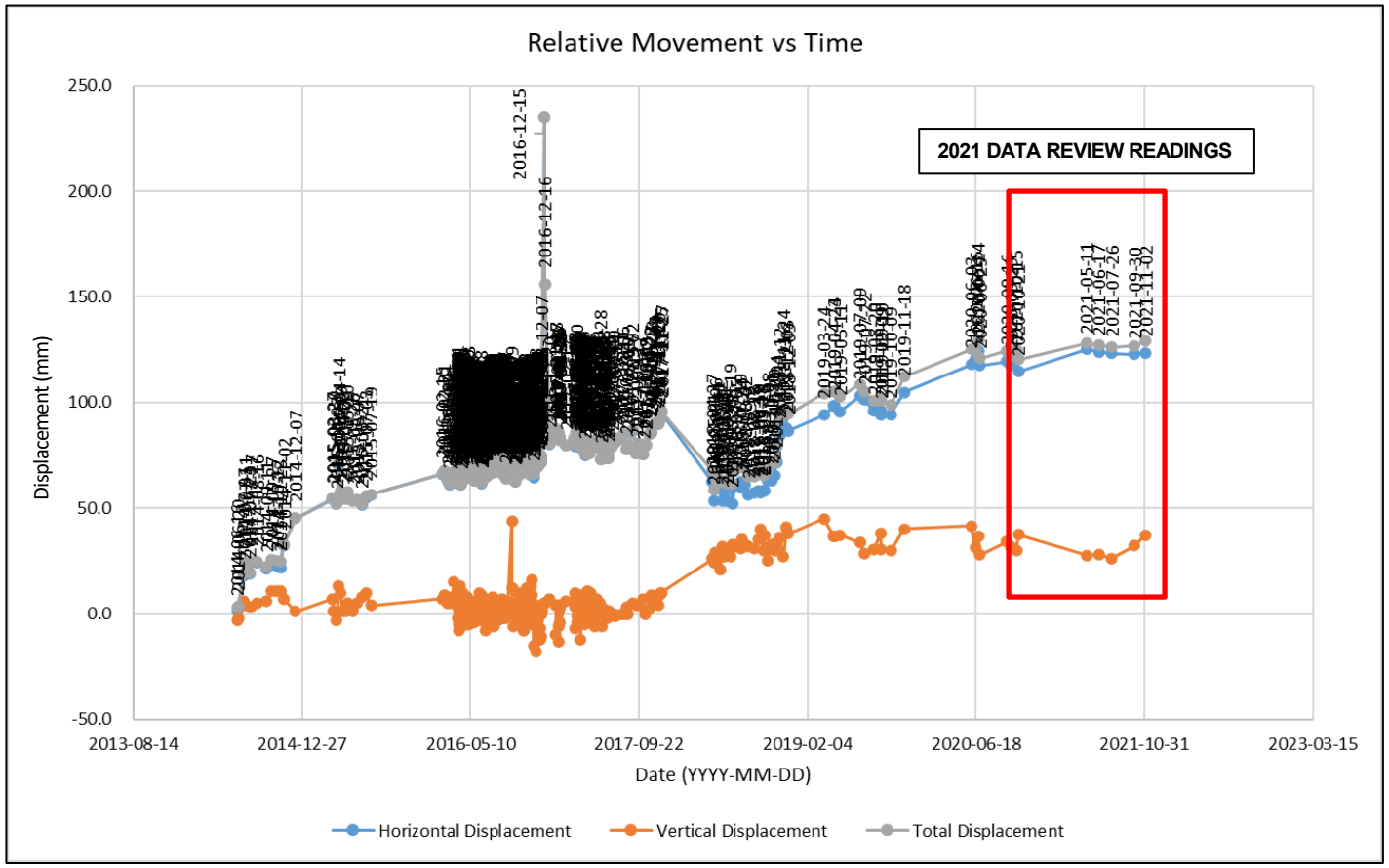

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – NORTHWEST SEGMENT PRISM 811

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

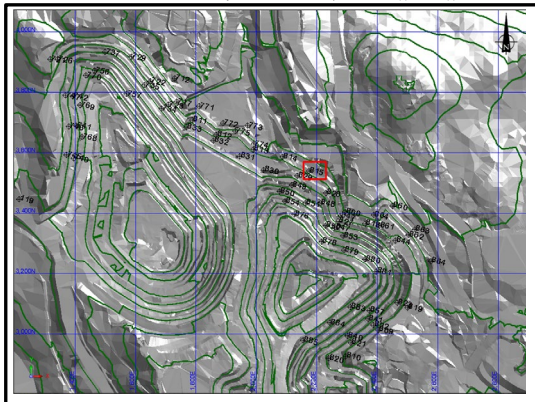

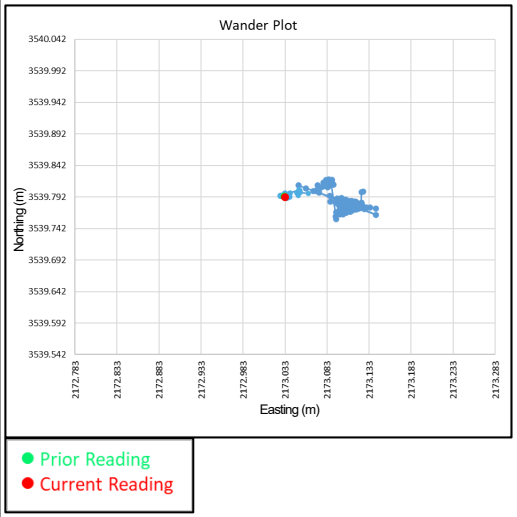

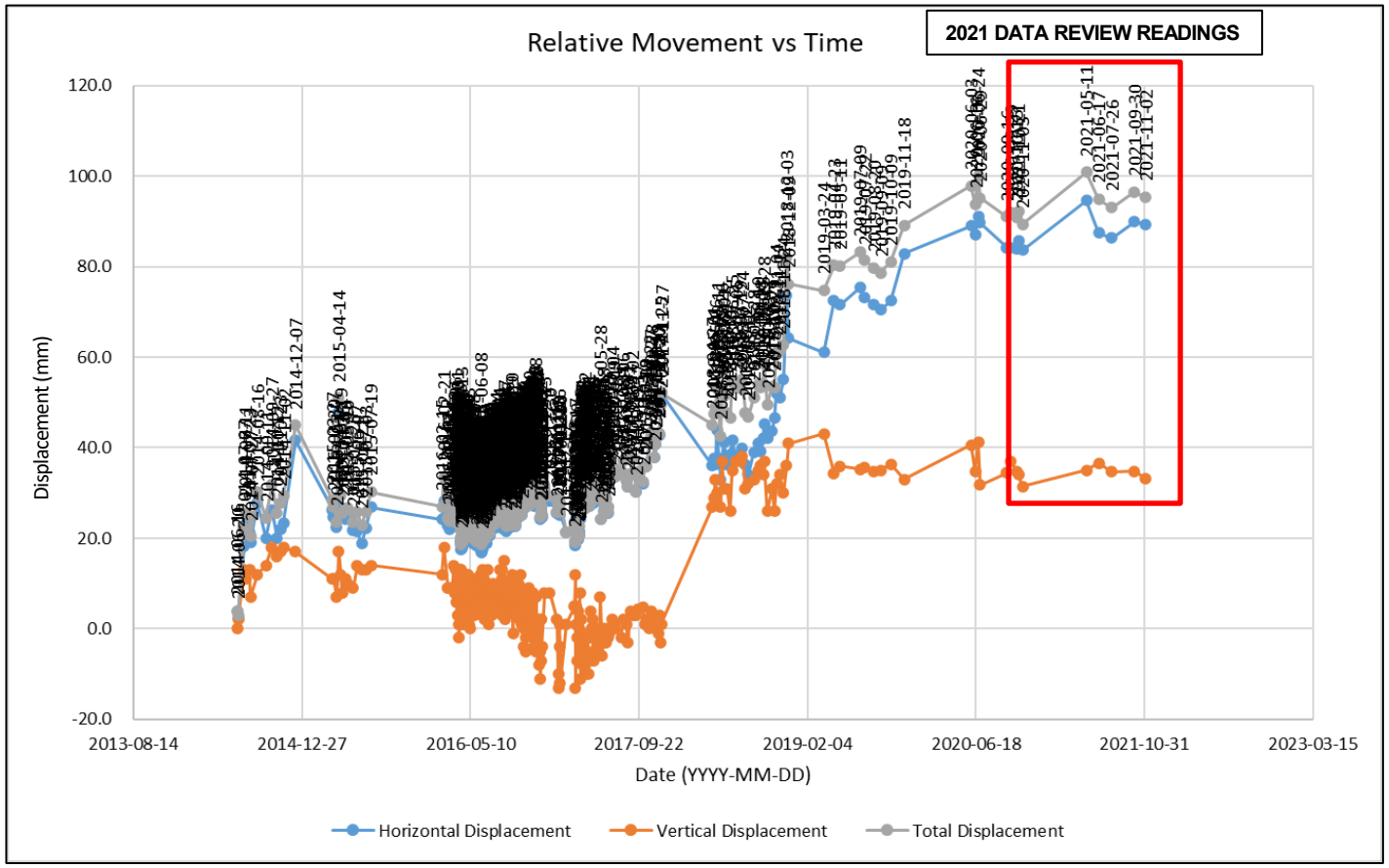

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT UPPER BENCHES OF WASTE ROCK REHANDLE SLOPE PRISM 815

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

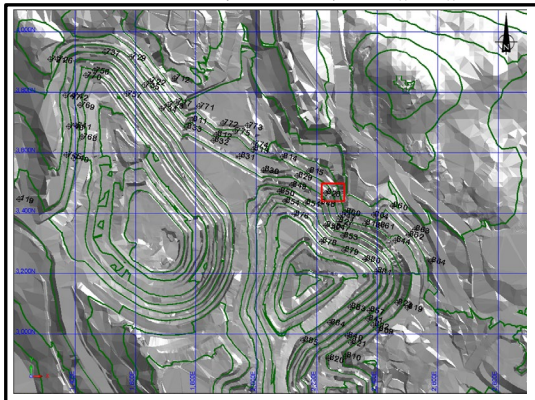

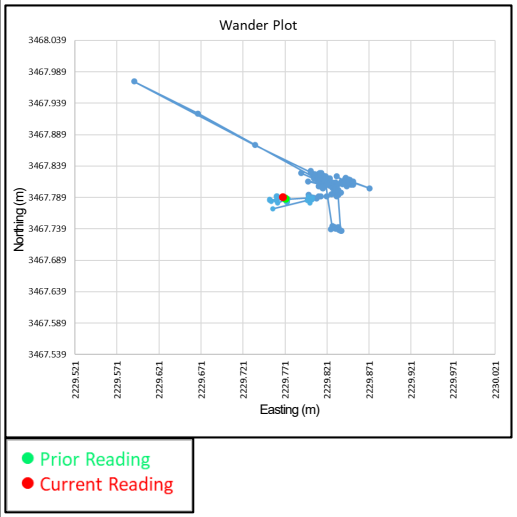

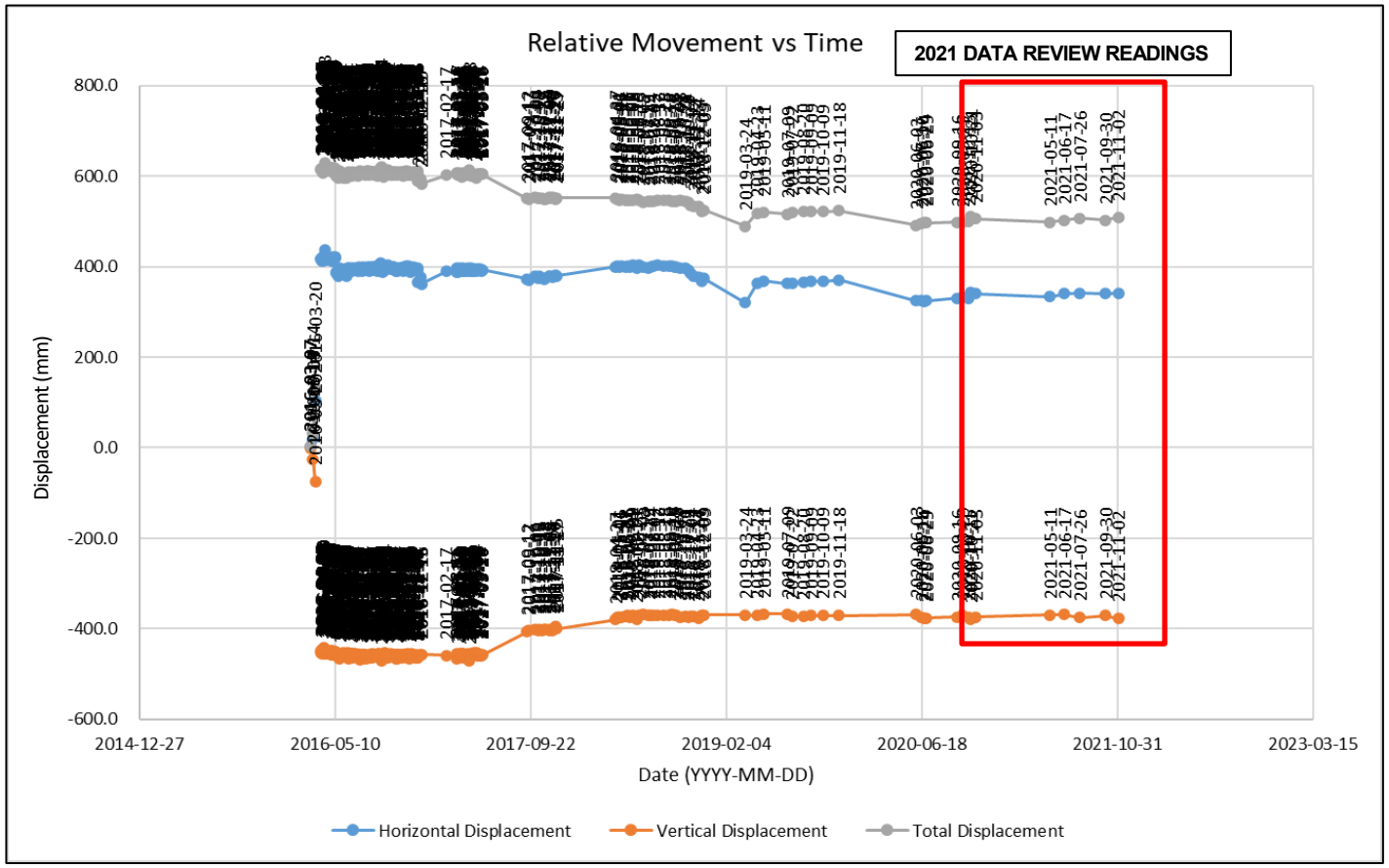

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT LOWER BENCHES OF WASTE ROCK REHANDLE SLOPE PRISM 828

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

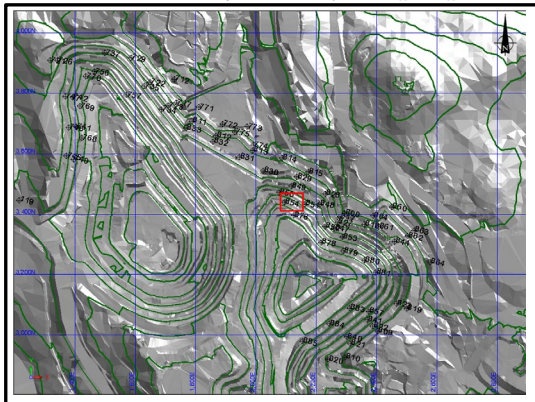

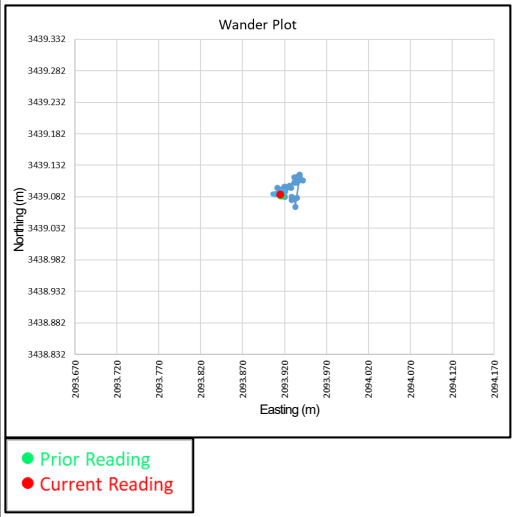

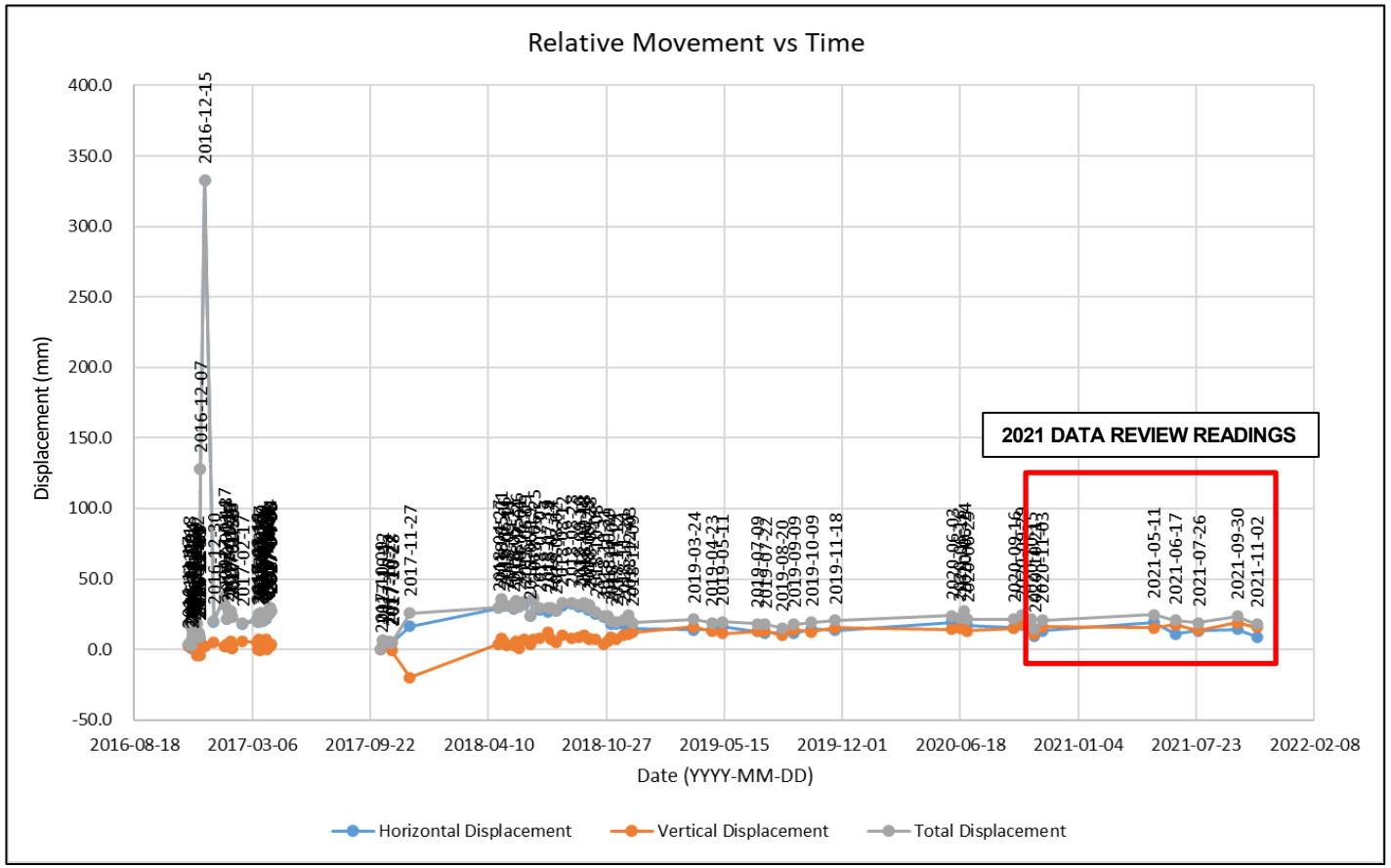

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT BEDROCK BENCHES BELOW WASTE ROCK REHANDLE SLOPE PRISM 854

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

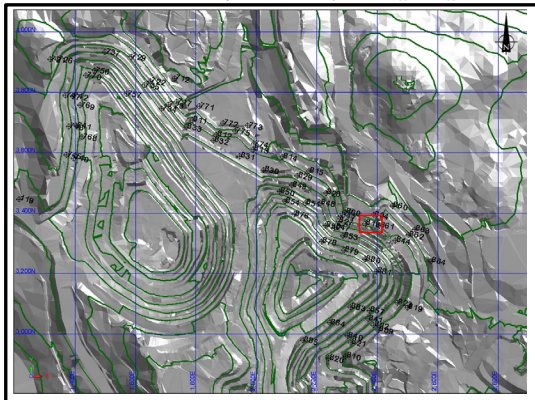

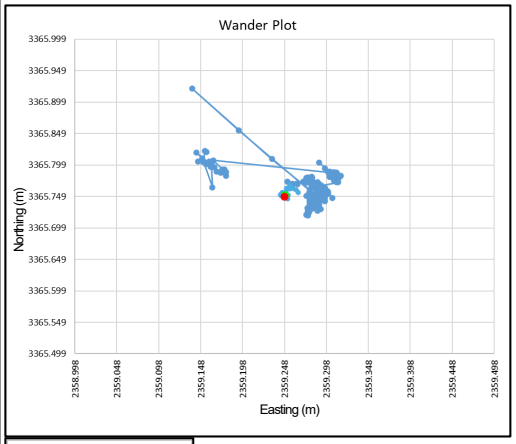

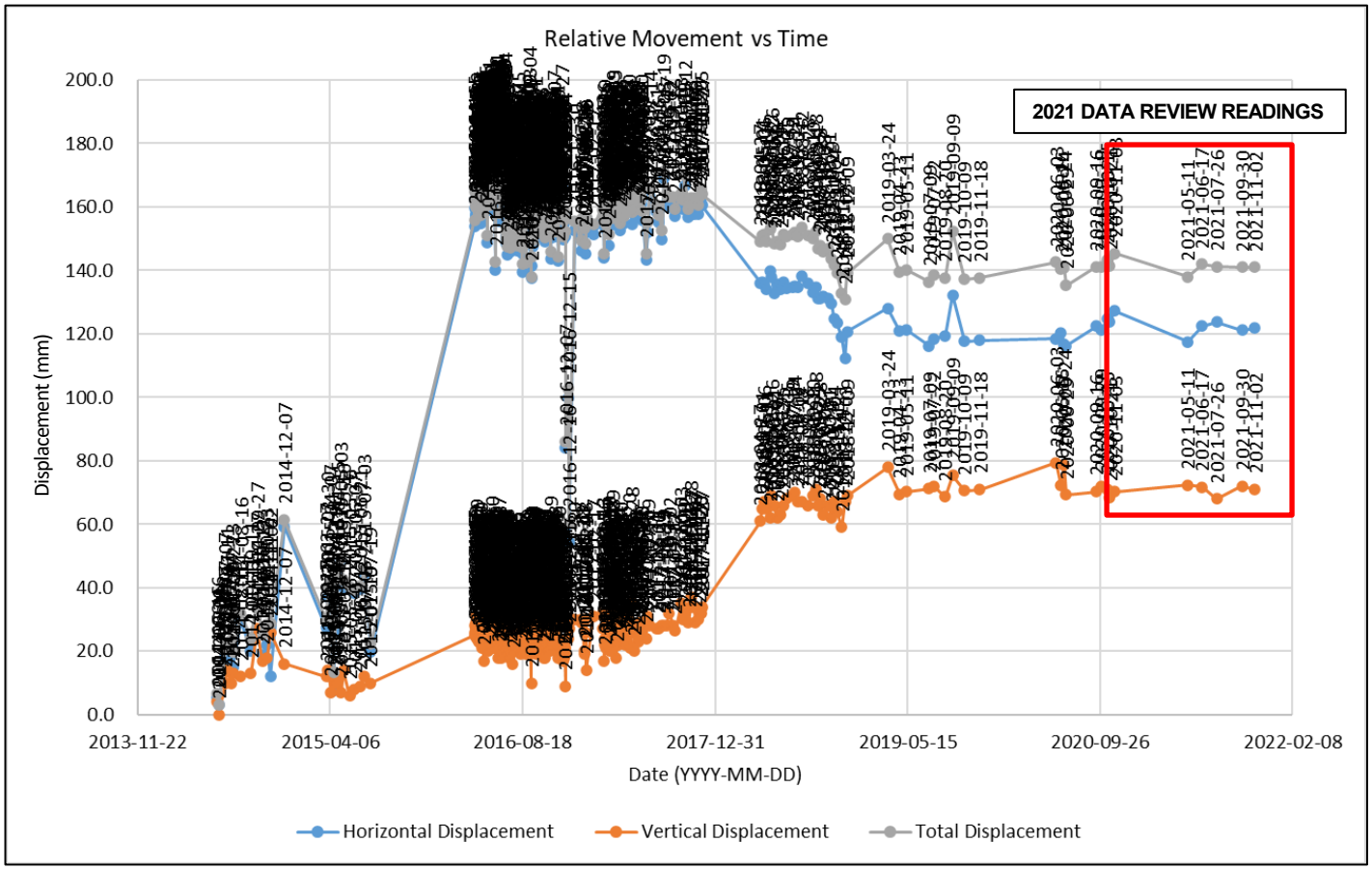

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – SOUTHEAST SEGMENT UPPER BENCHES
PRISM 818

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

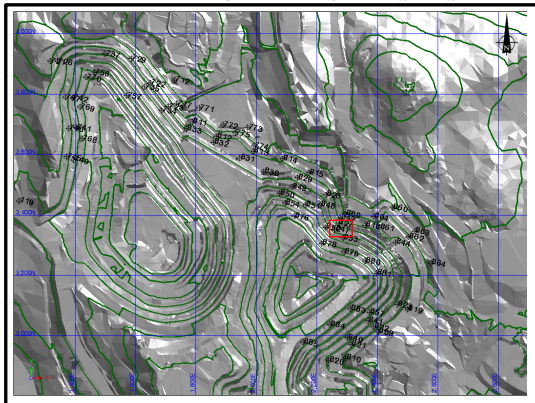

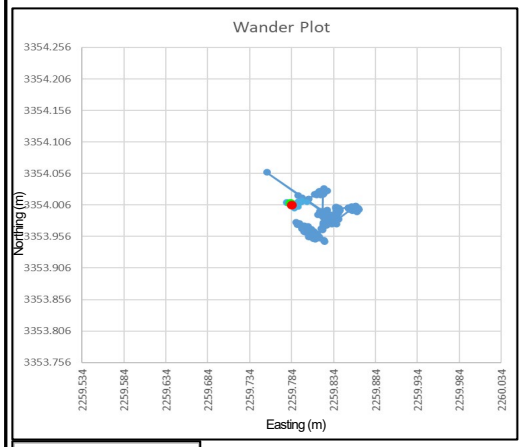

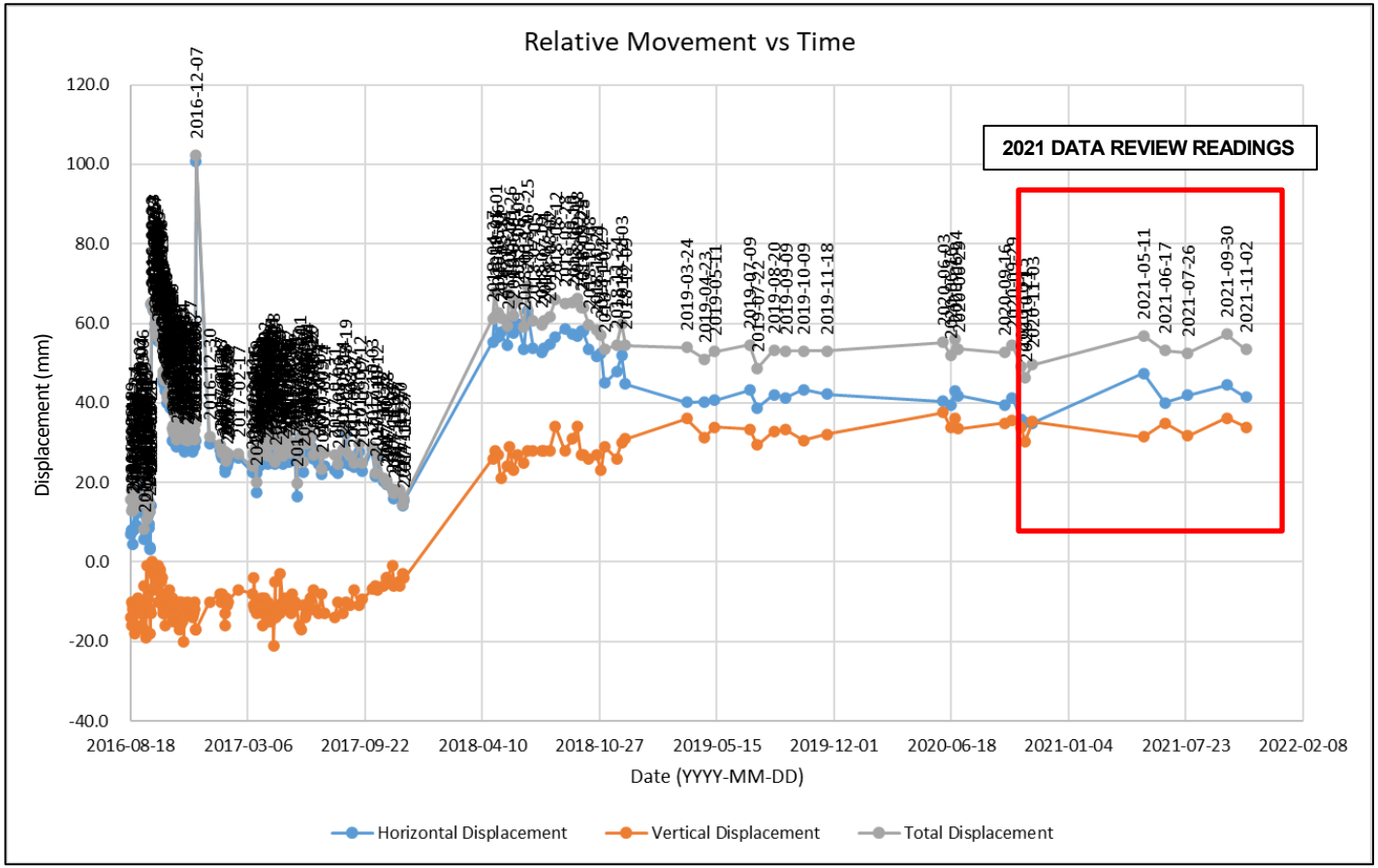

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – SOUTHEAST SEGMENT LOWER BENCHES
PRISM 847

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

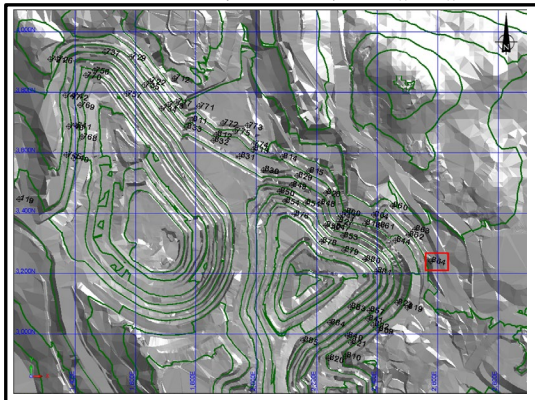

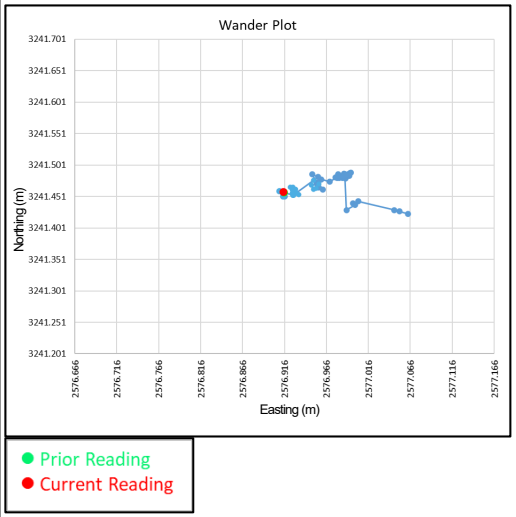

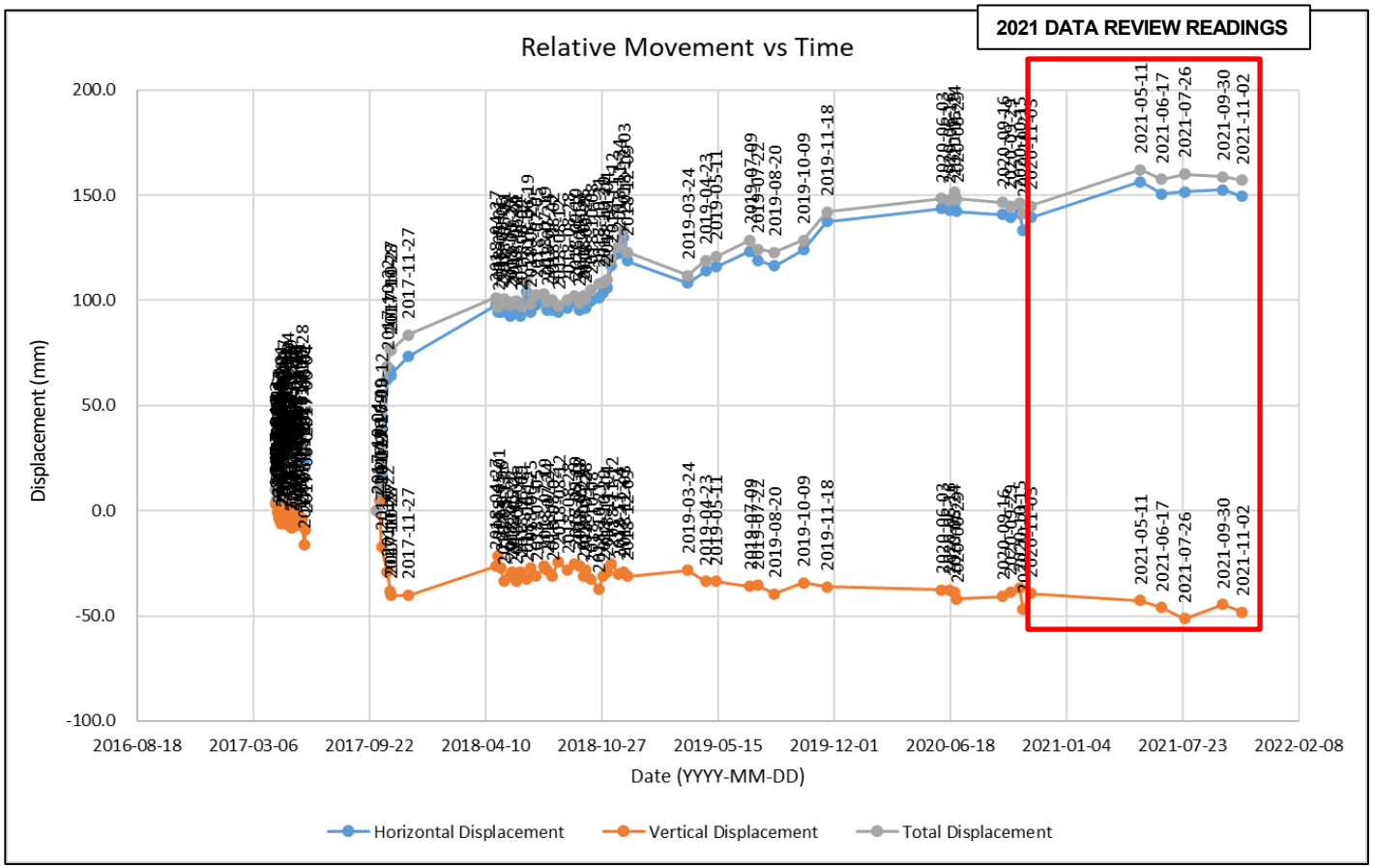

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT EAST WALL
PRISM 864

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

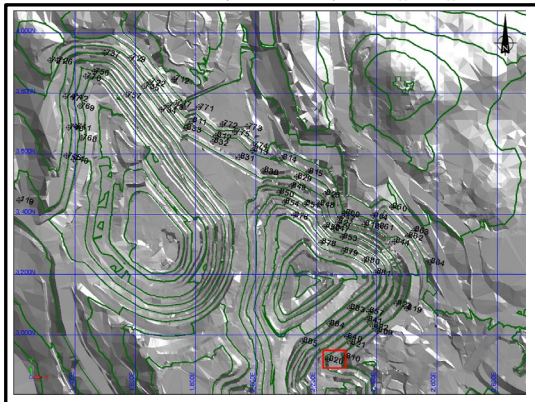

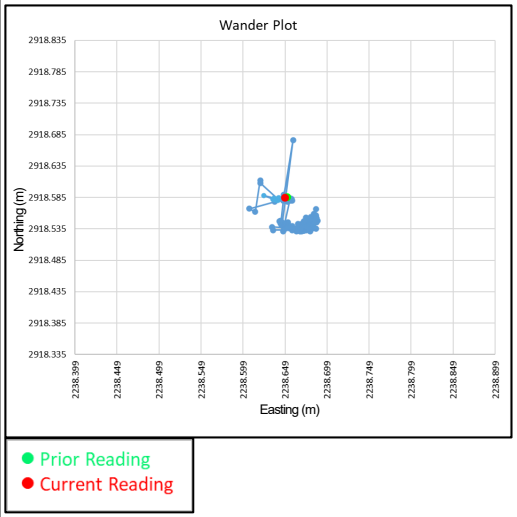

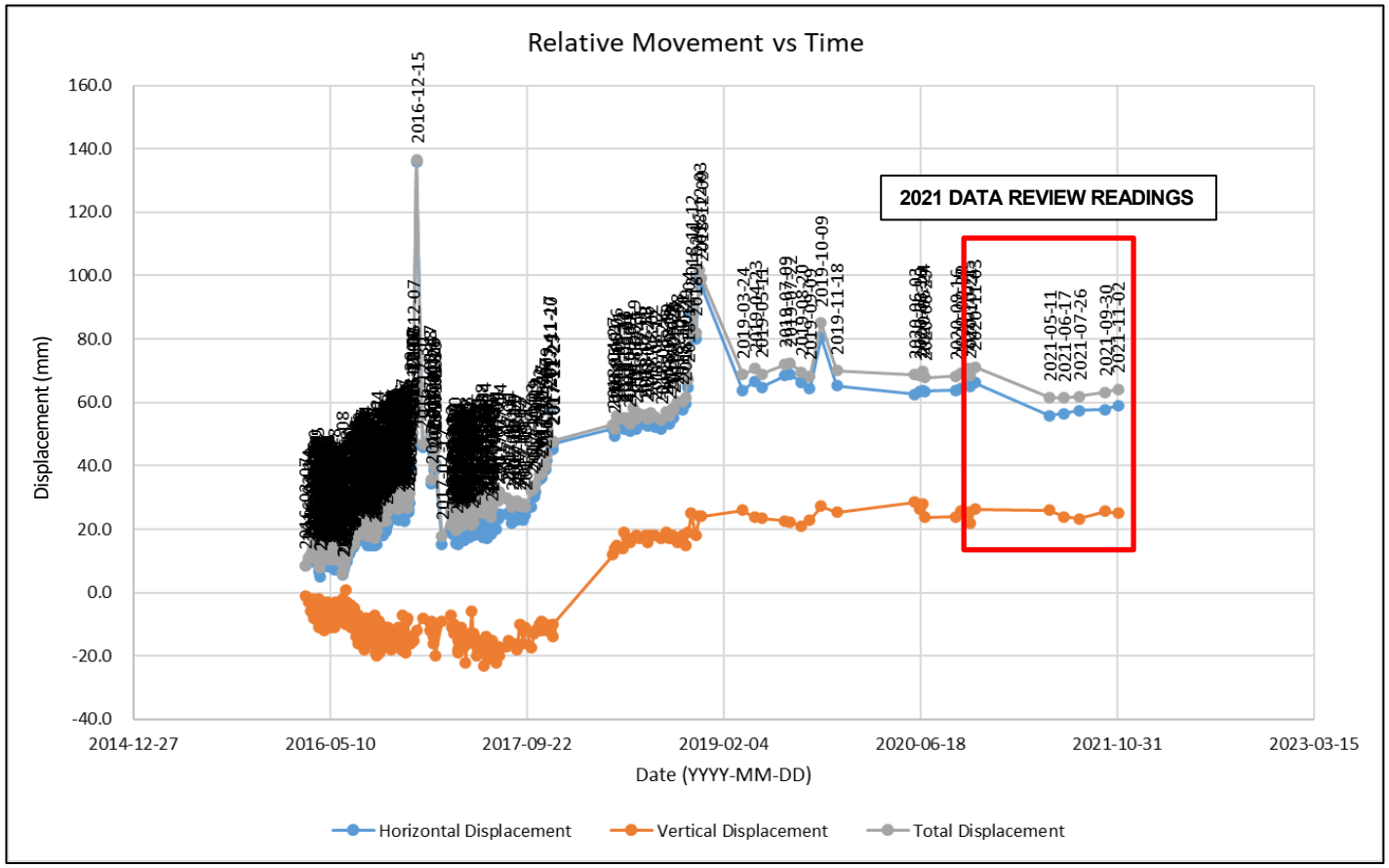

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT SOUTHEAST WALL
PRISM 820

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	

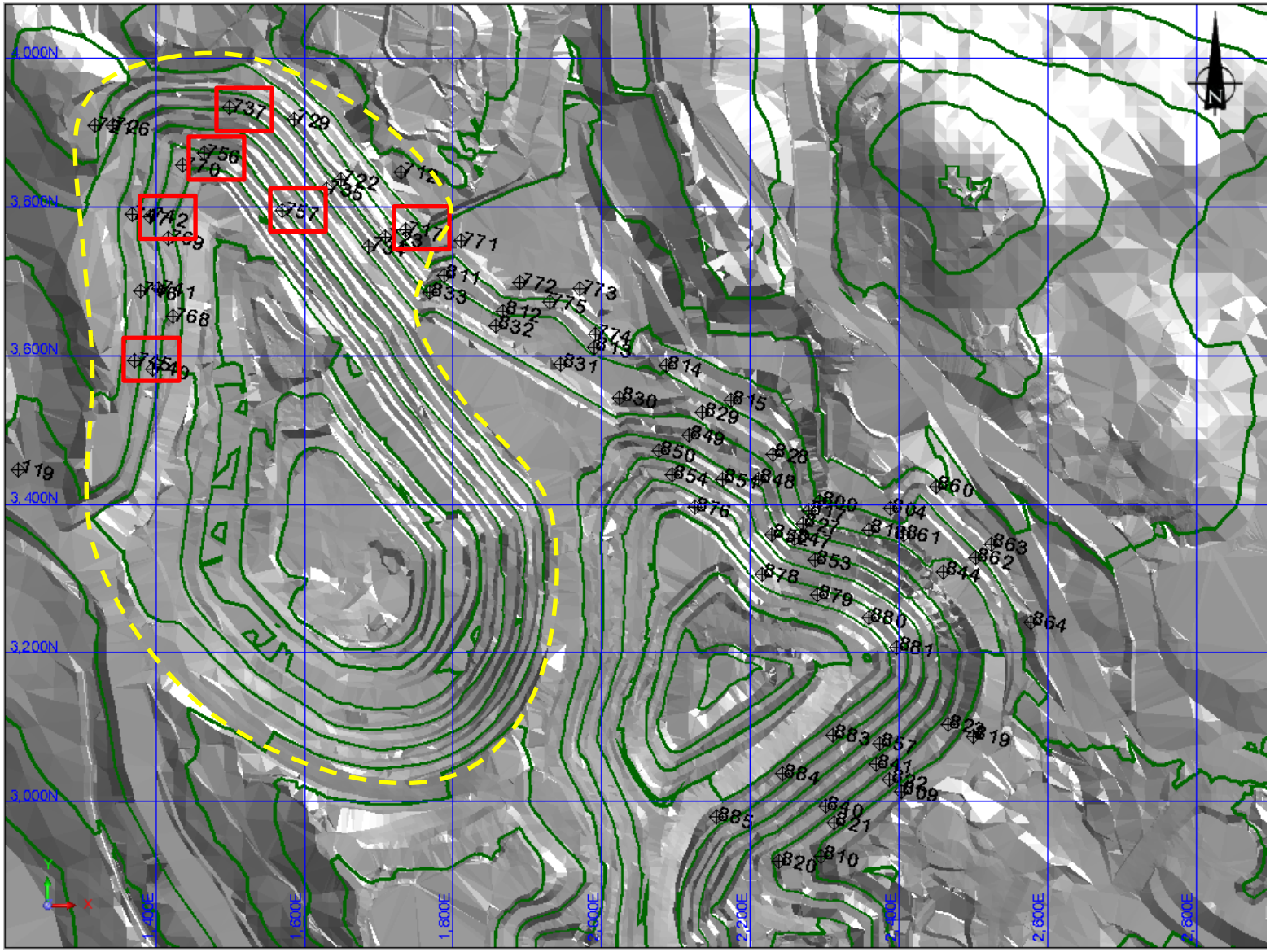

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

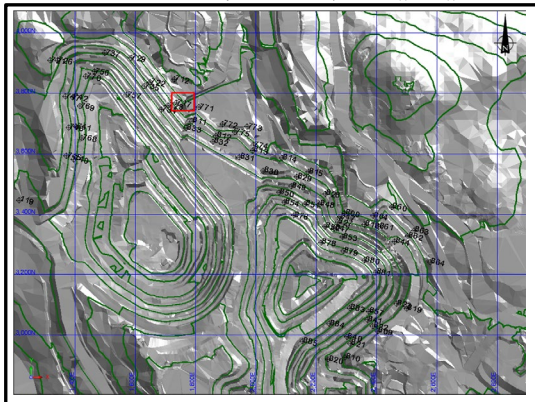

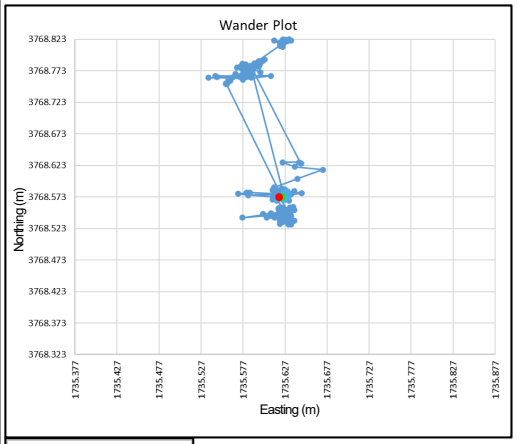

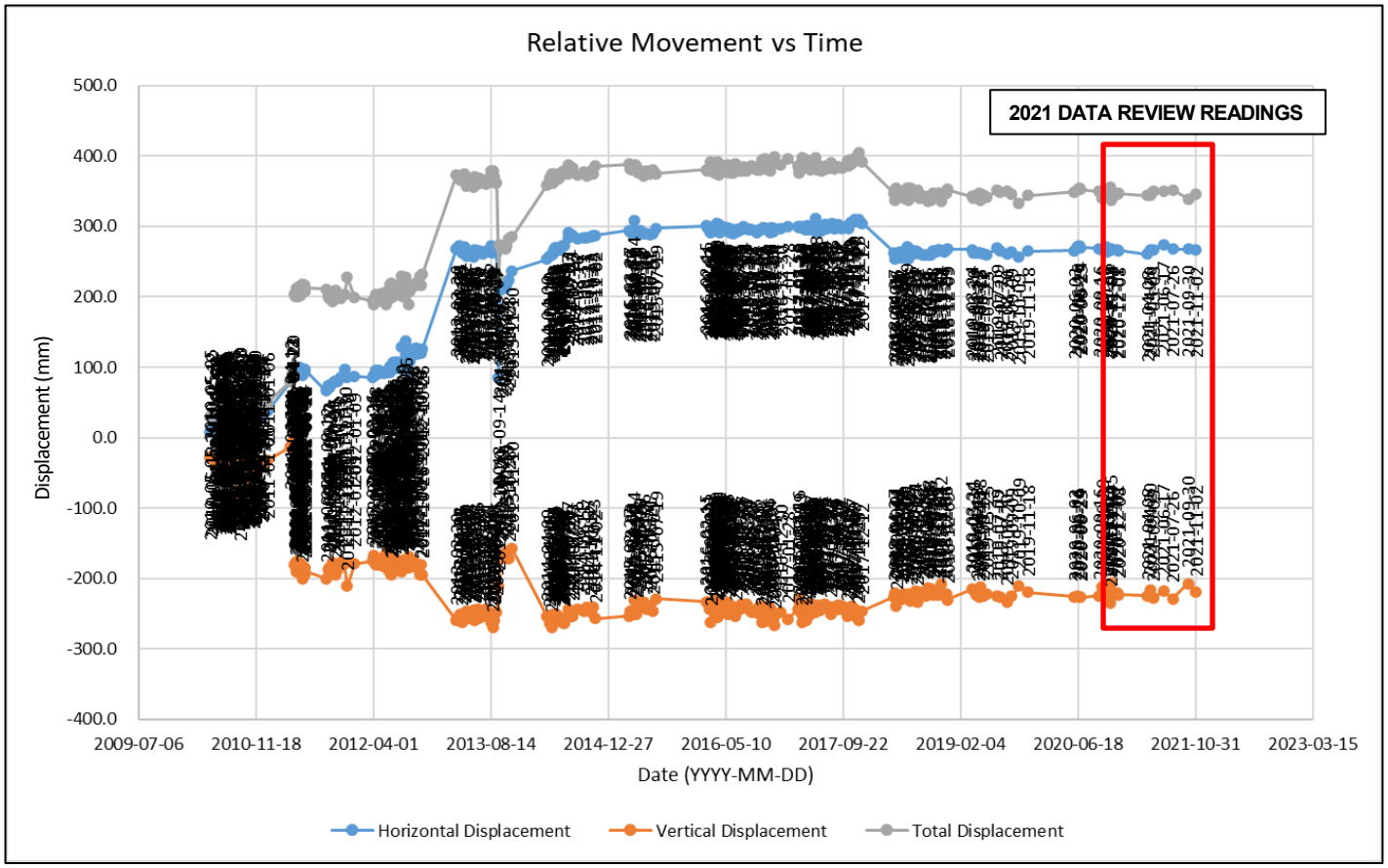

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT EAST WALL – CREST PRISM 717

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

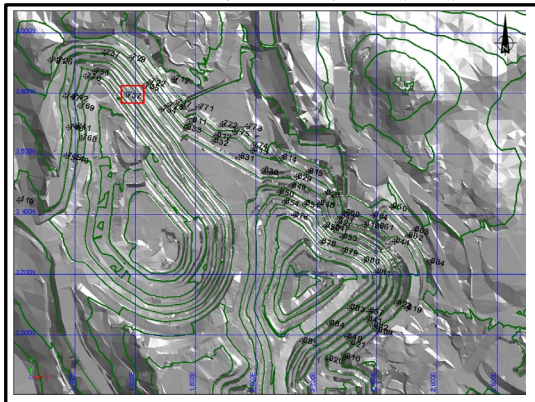

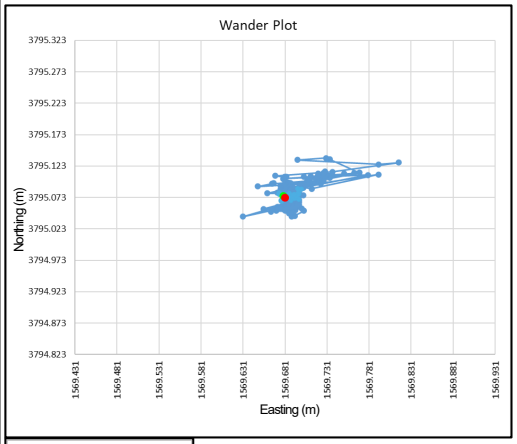

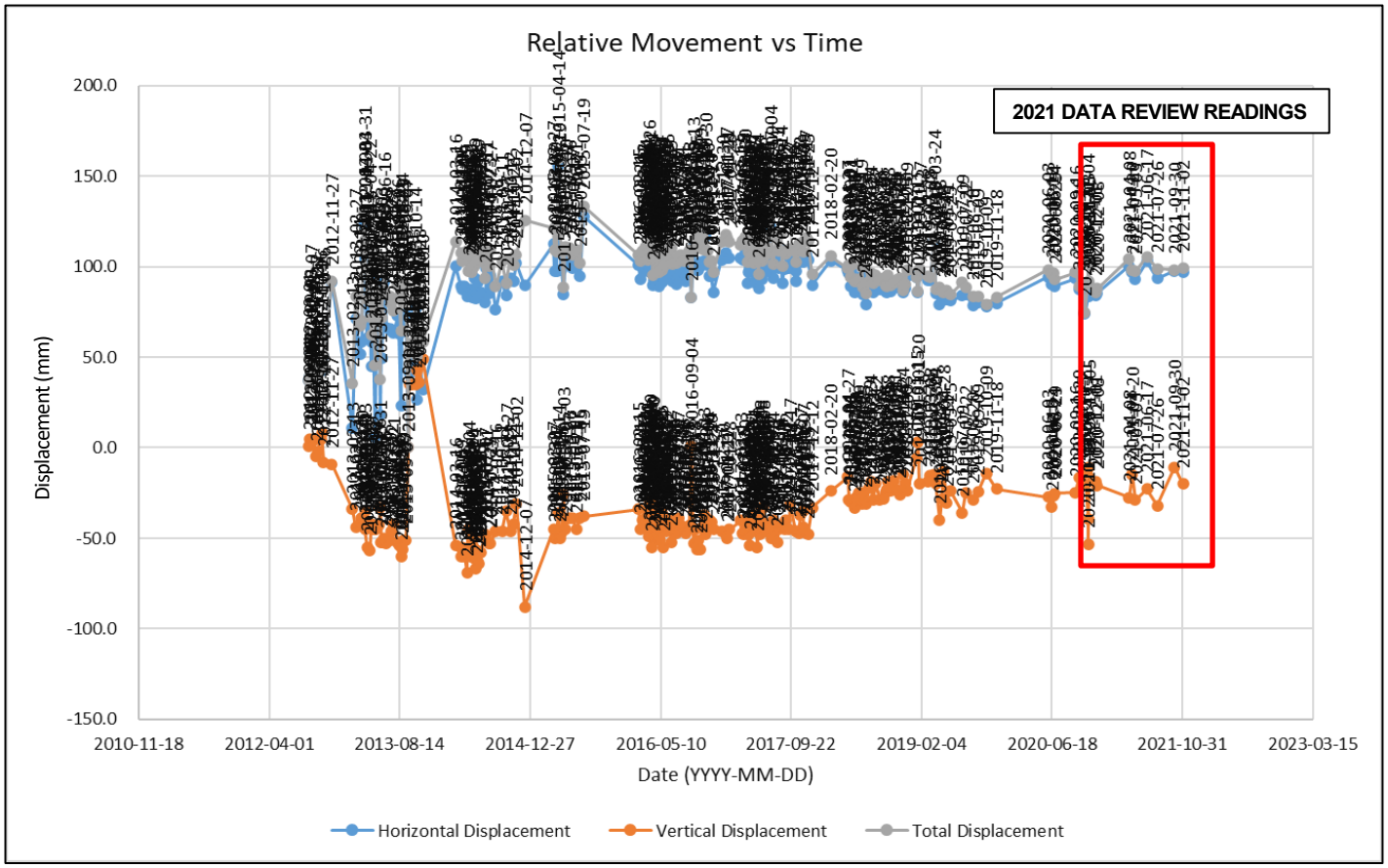

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT EAST WALL – LOWER PORTION
PRISM 757

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

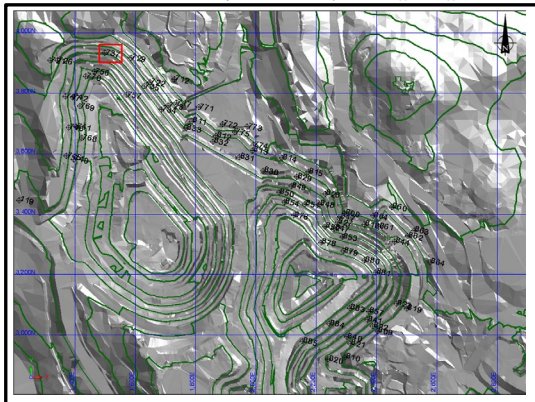

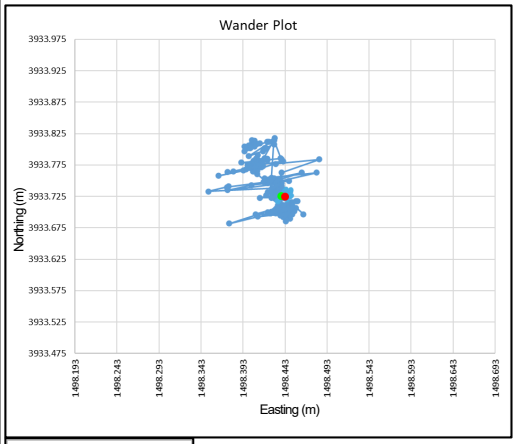

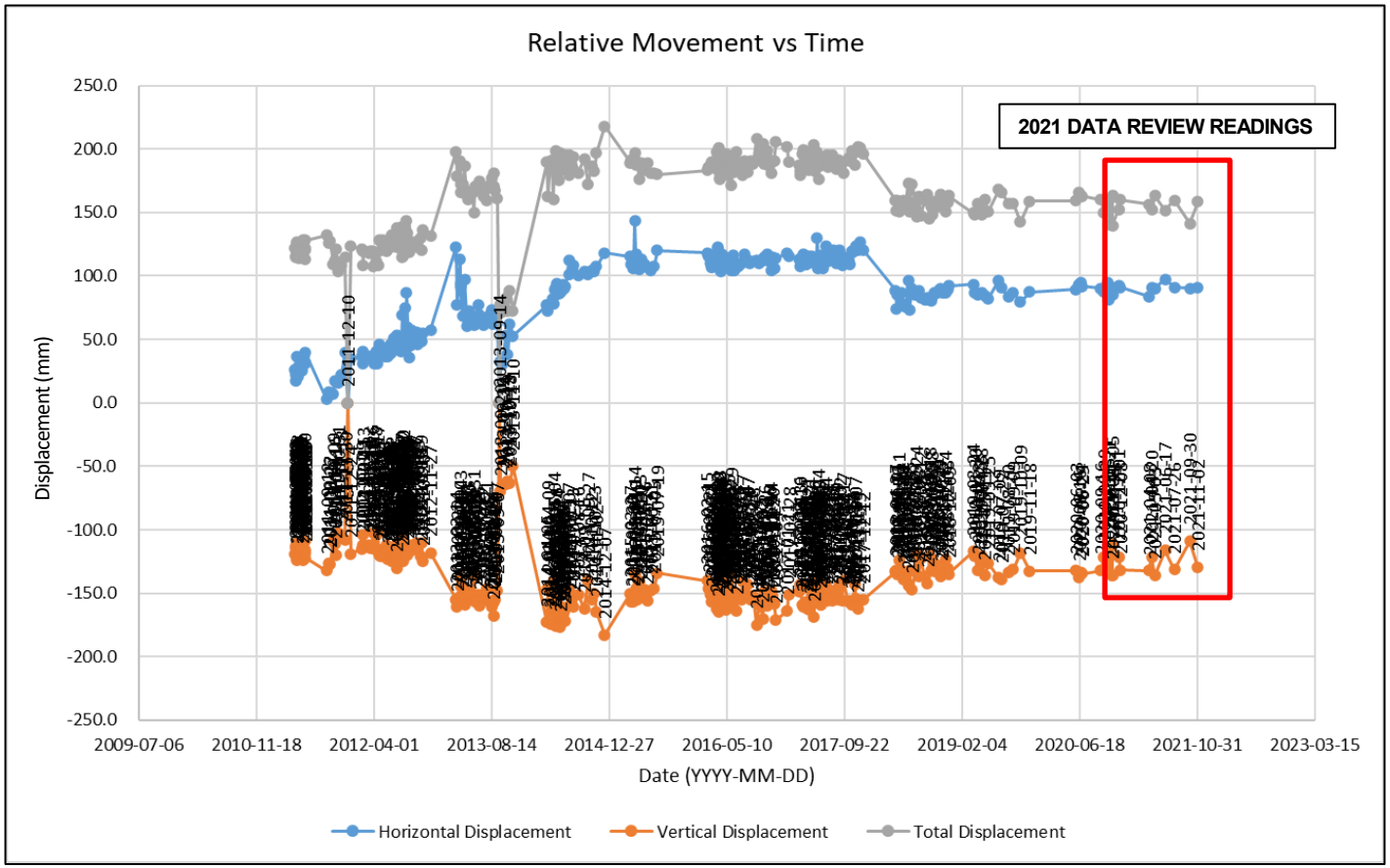

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT NORTH WALL – UPPER PORTION
PRISM 737

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

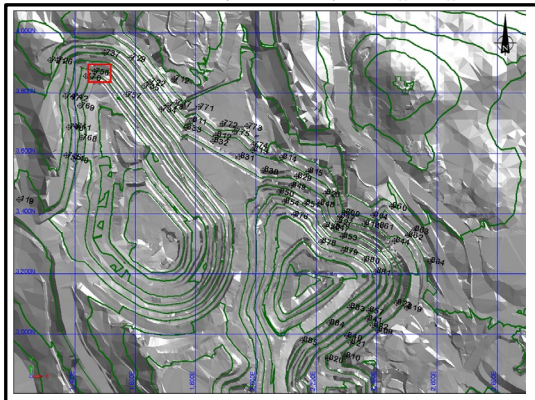

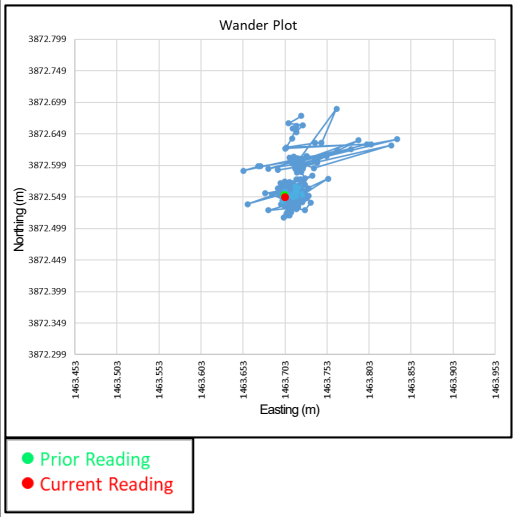

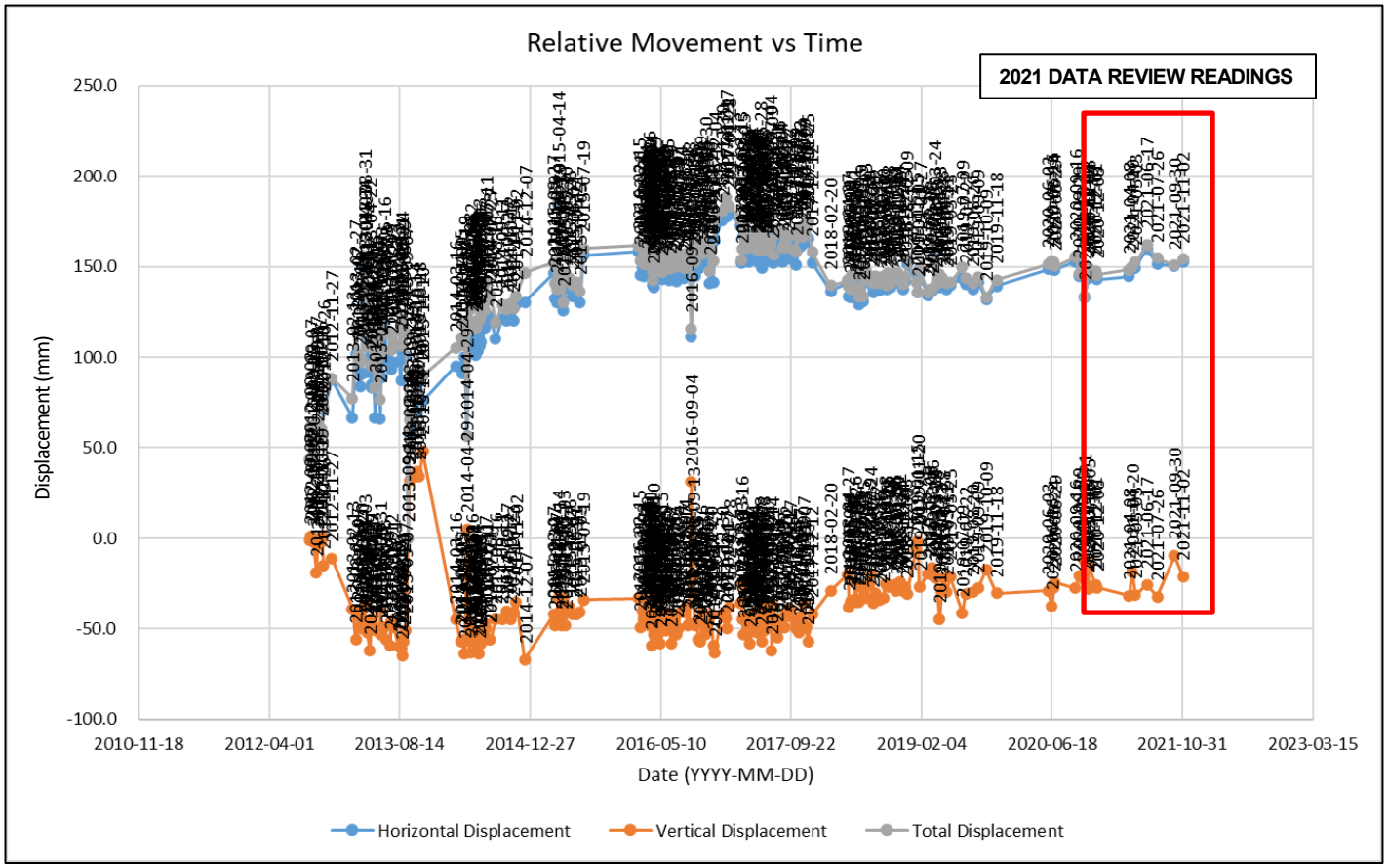

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT NORTH WALL – NOSE
PRISM 756

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

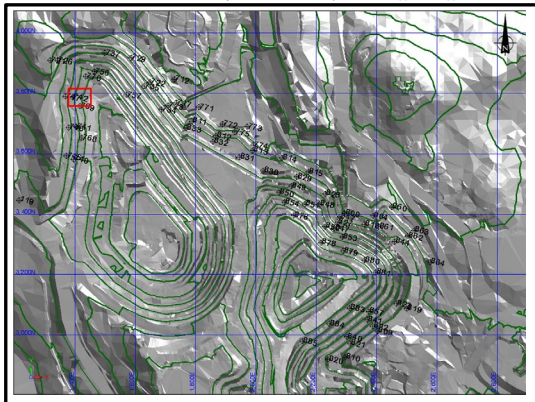

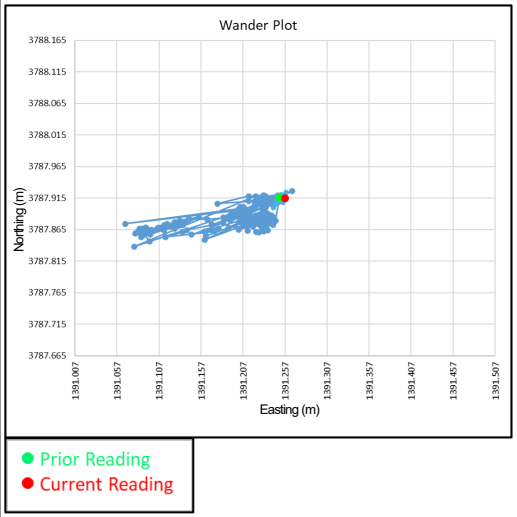

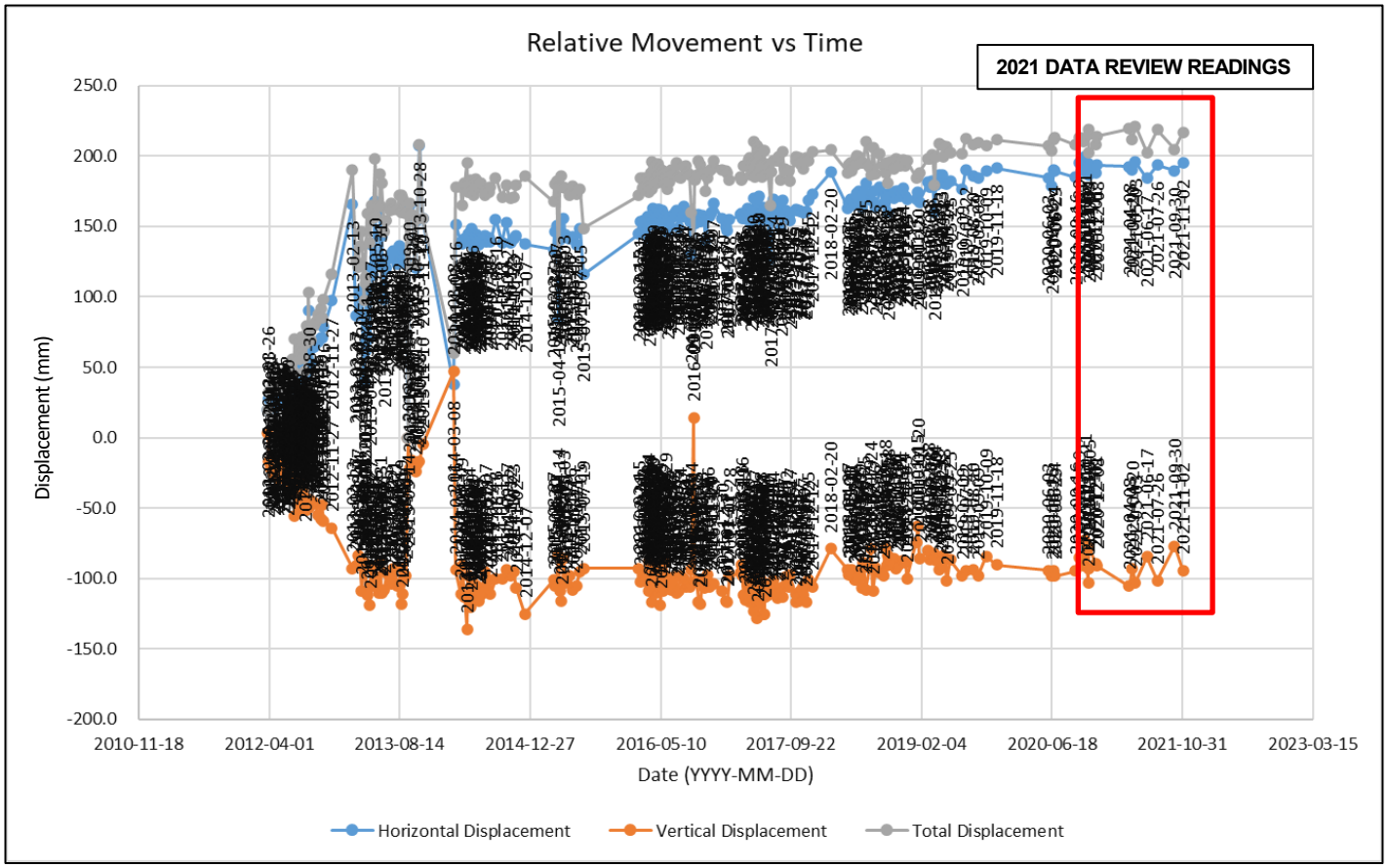

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – MID WALL
PRISM 742

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

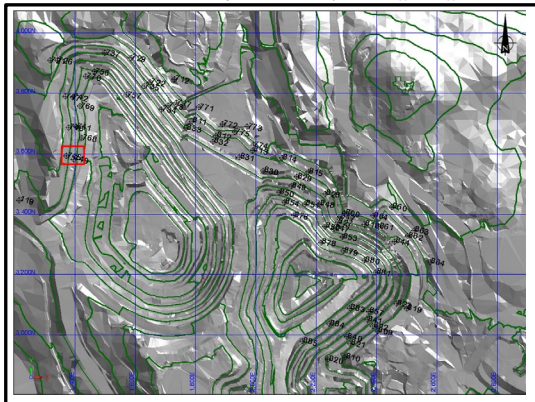

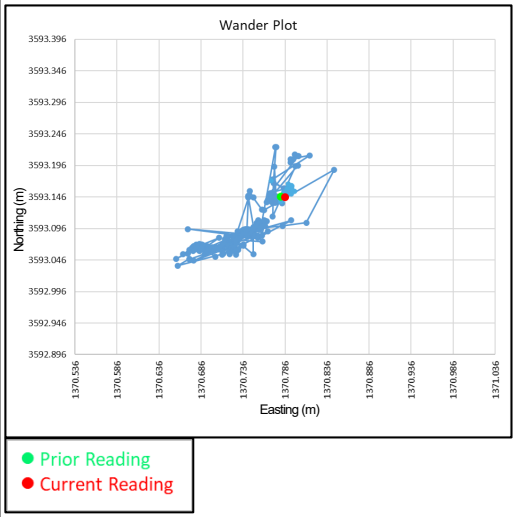

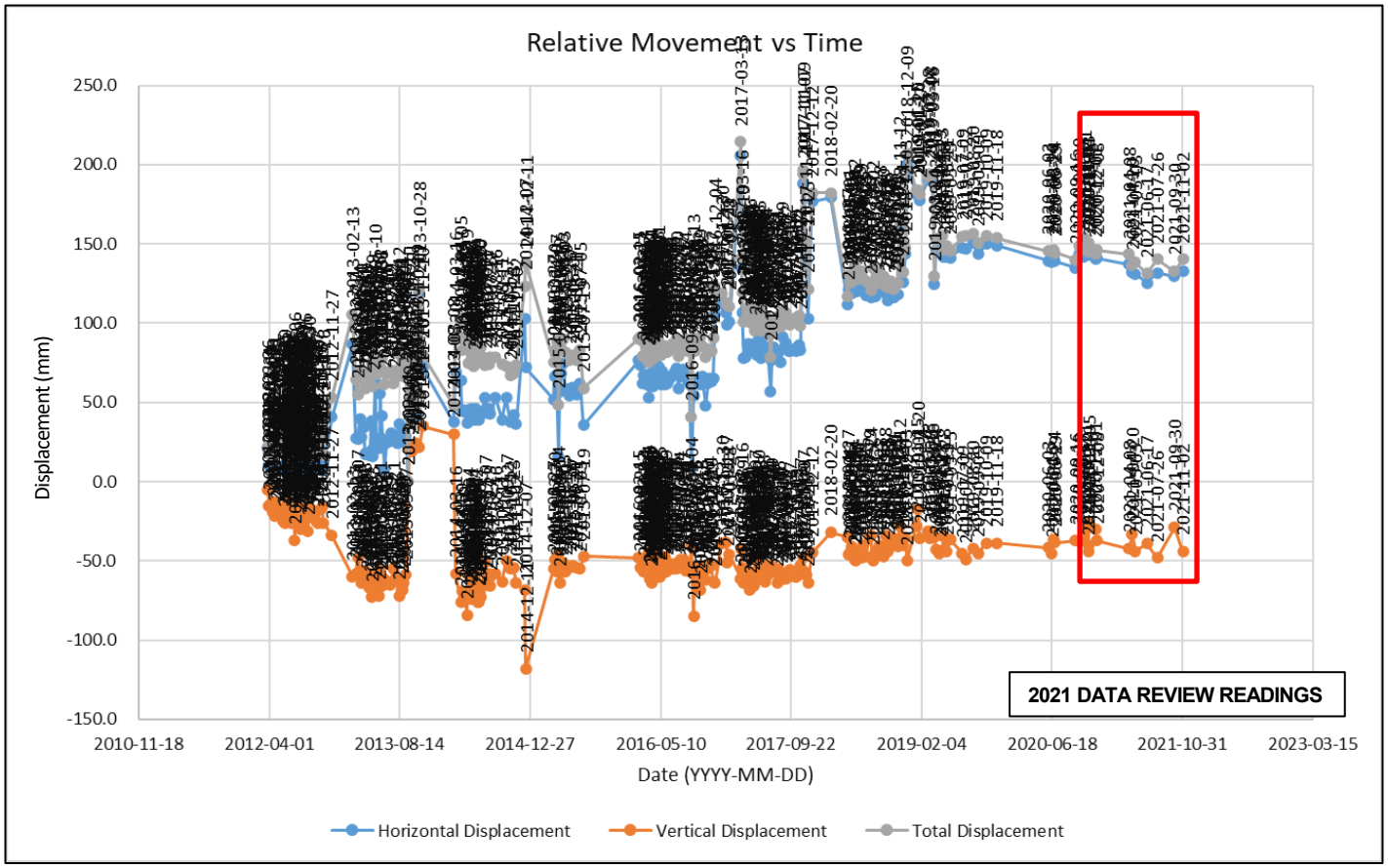

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – MID WALL
PRISM 745

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	

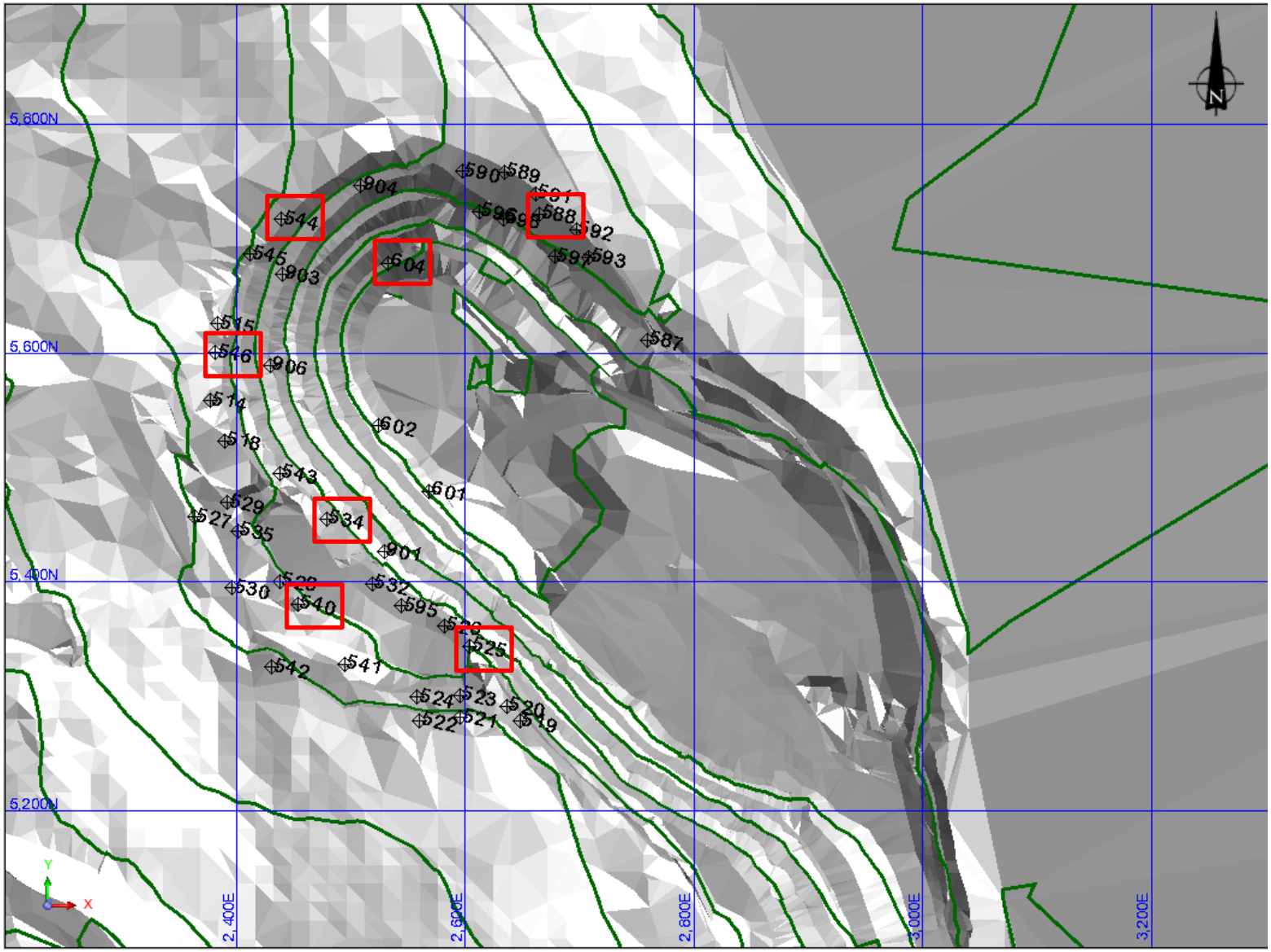

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

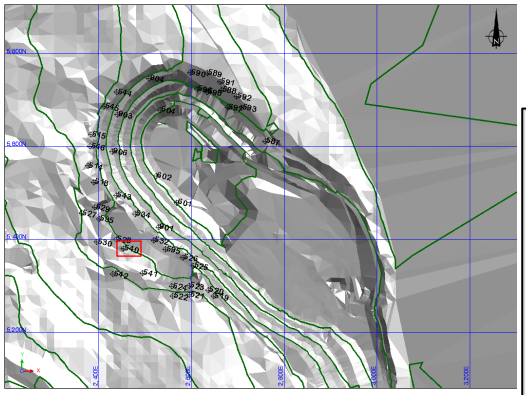

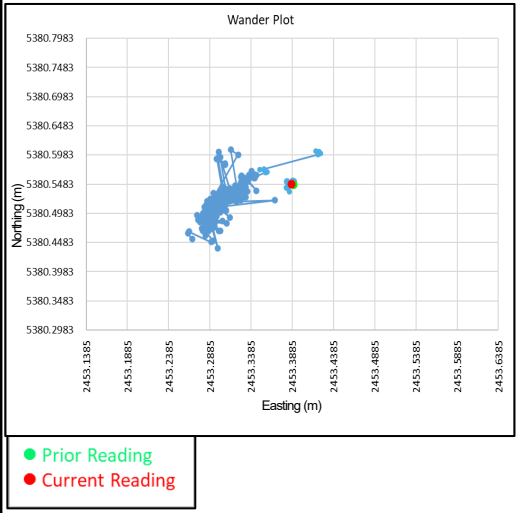

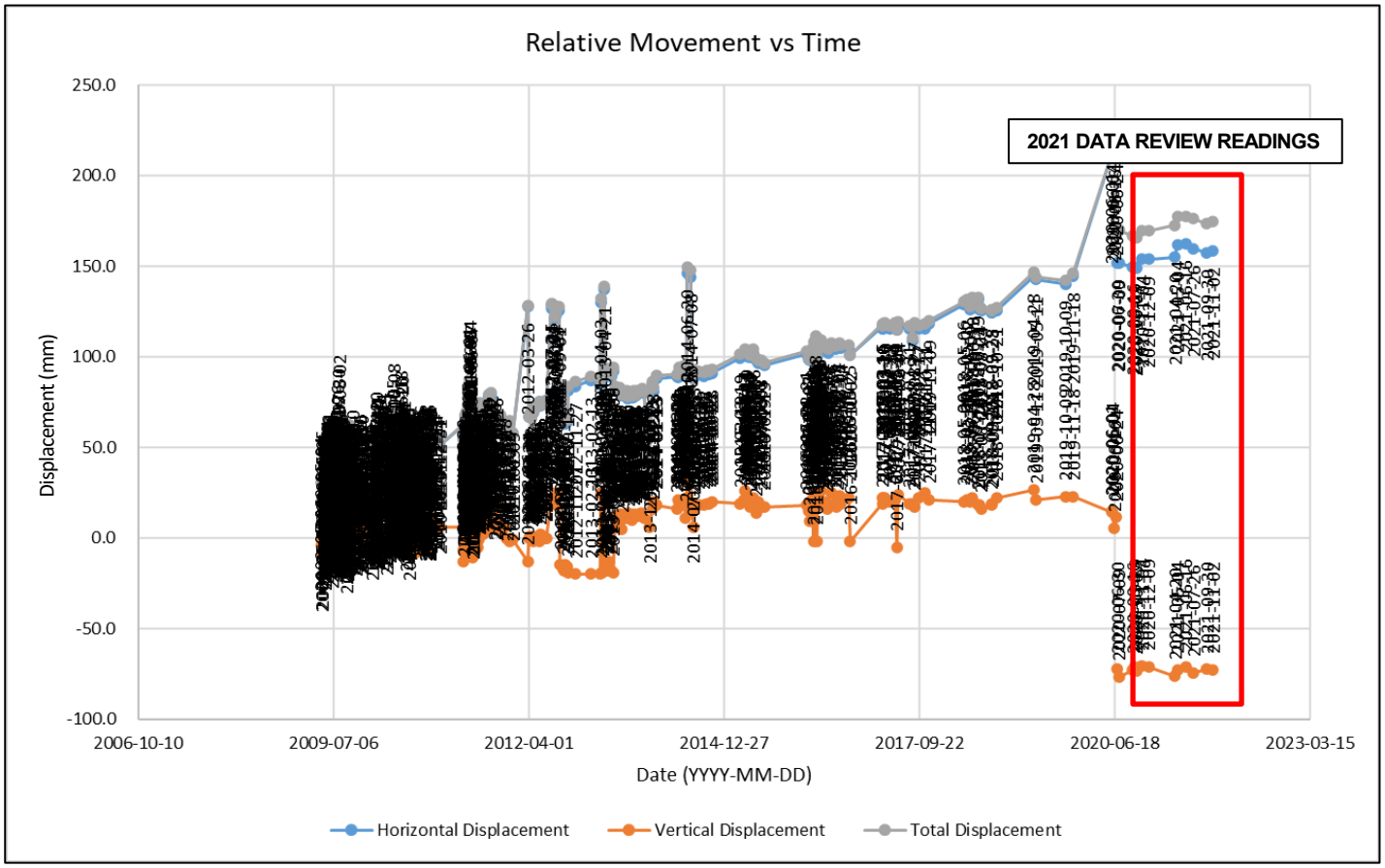

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL ABOVE UNLOAD AREA
PRISM 540

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

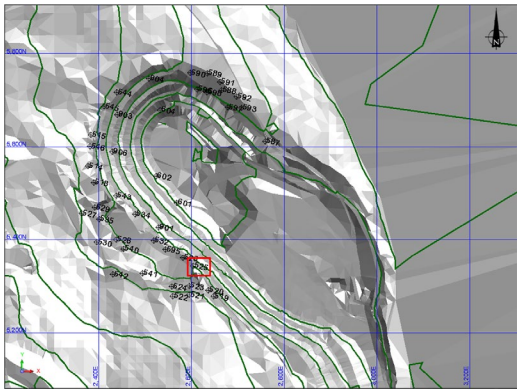

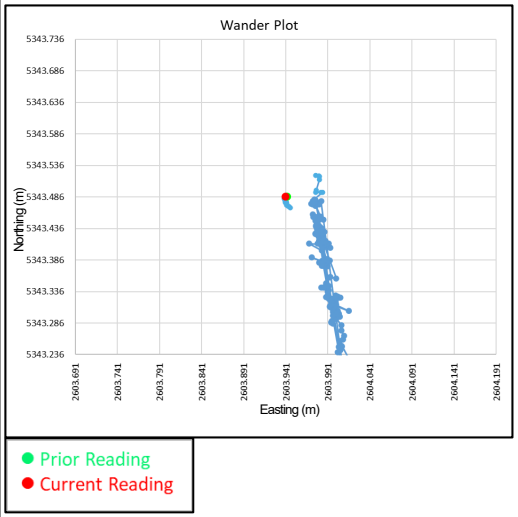

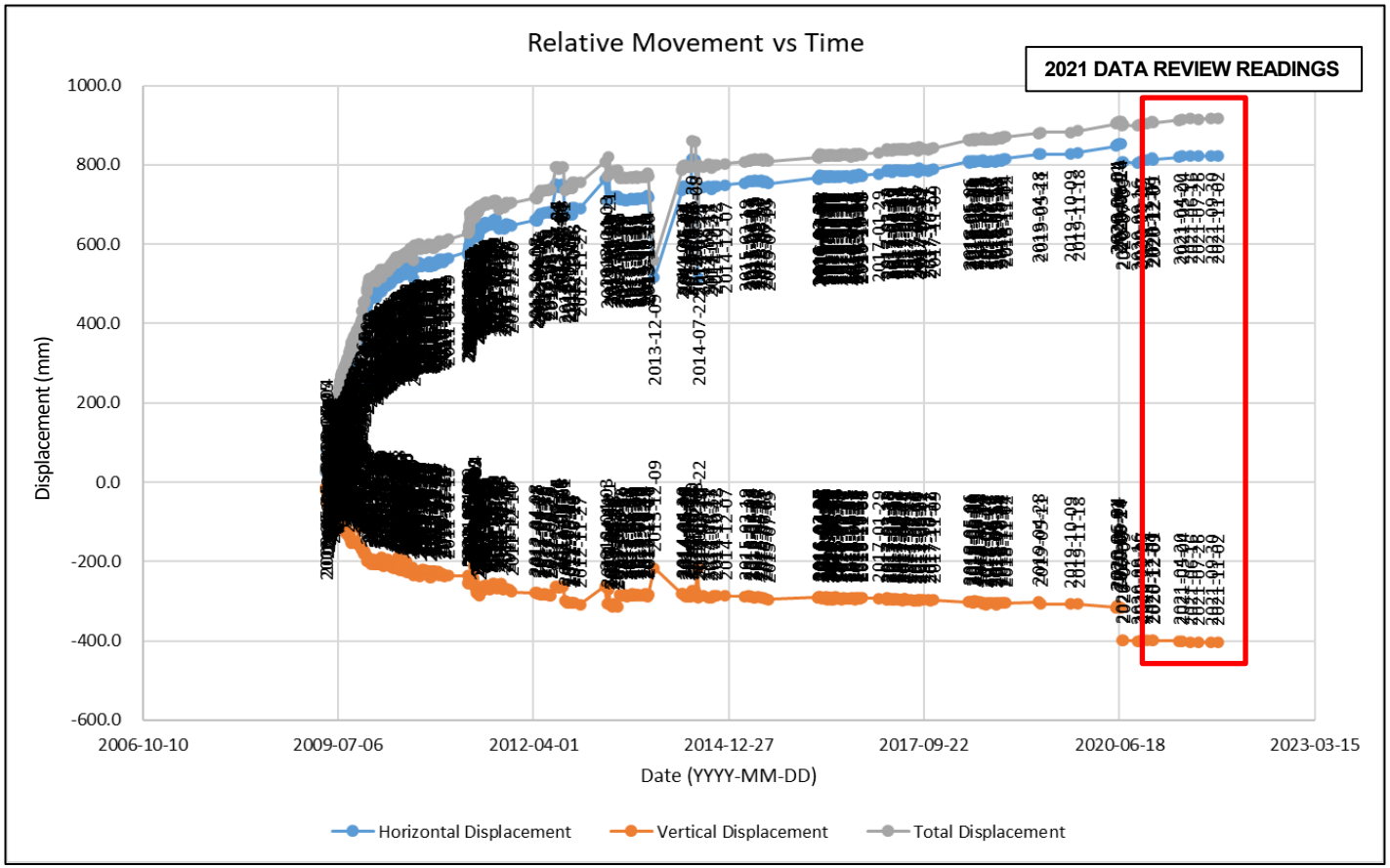

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL ON UNLOAD AREA CREST PRISM 525

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

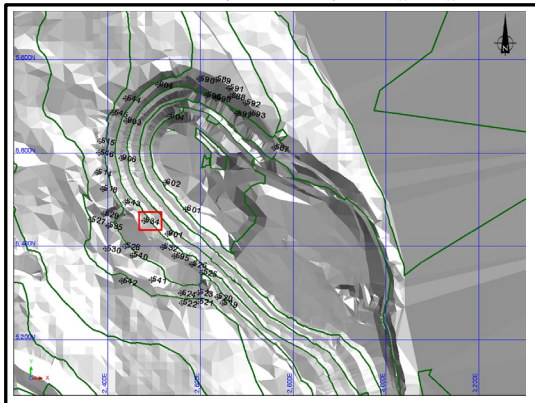

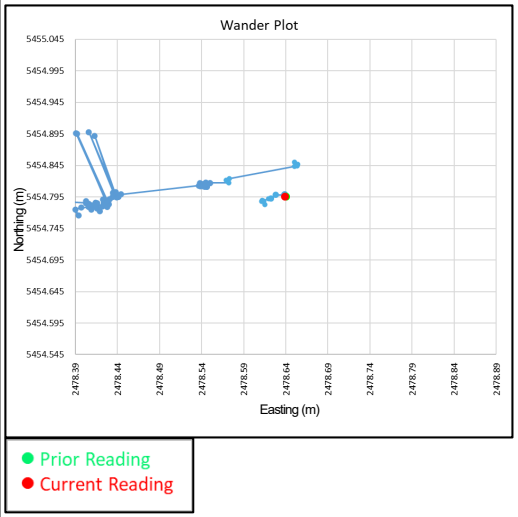

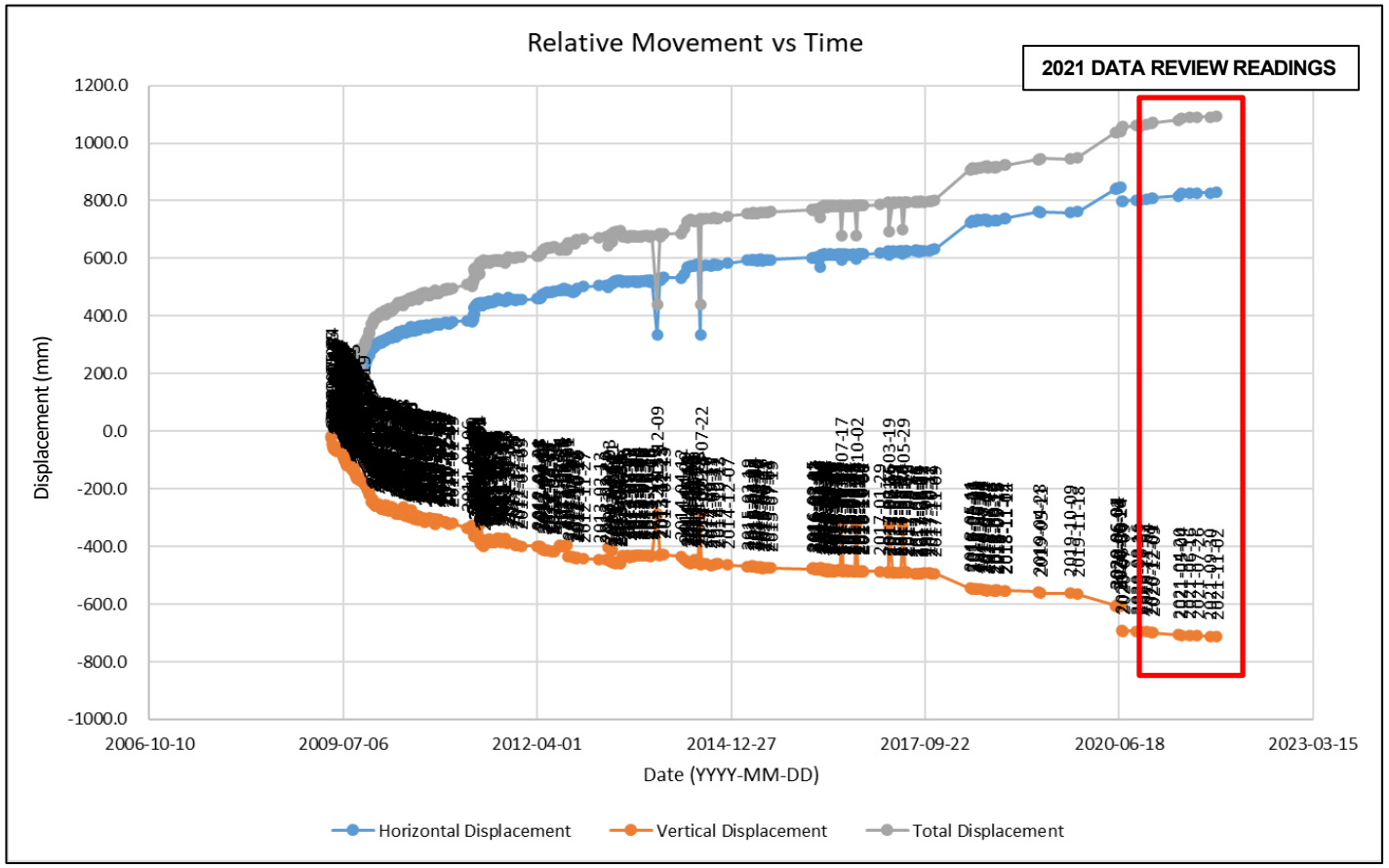

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL ON UNLOAD AREA CREST PRISM 534

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-21

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

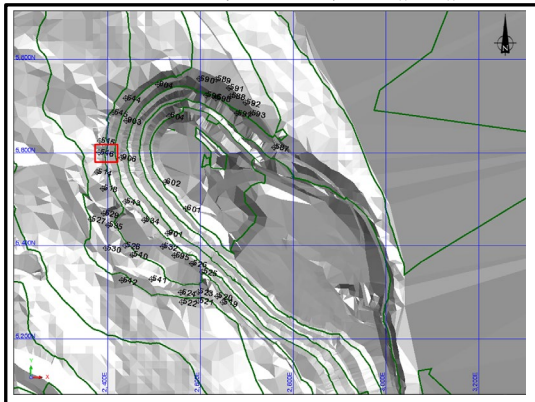

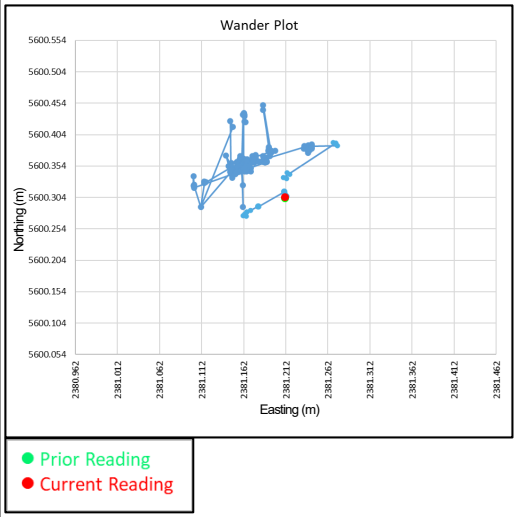

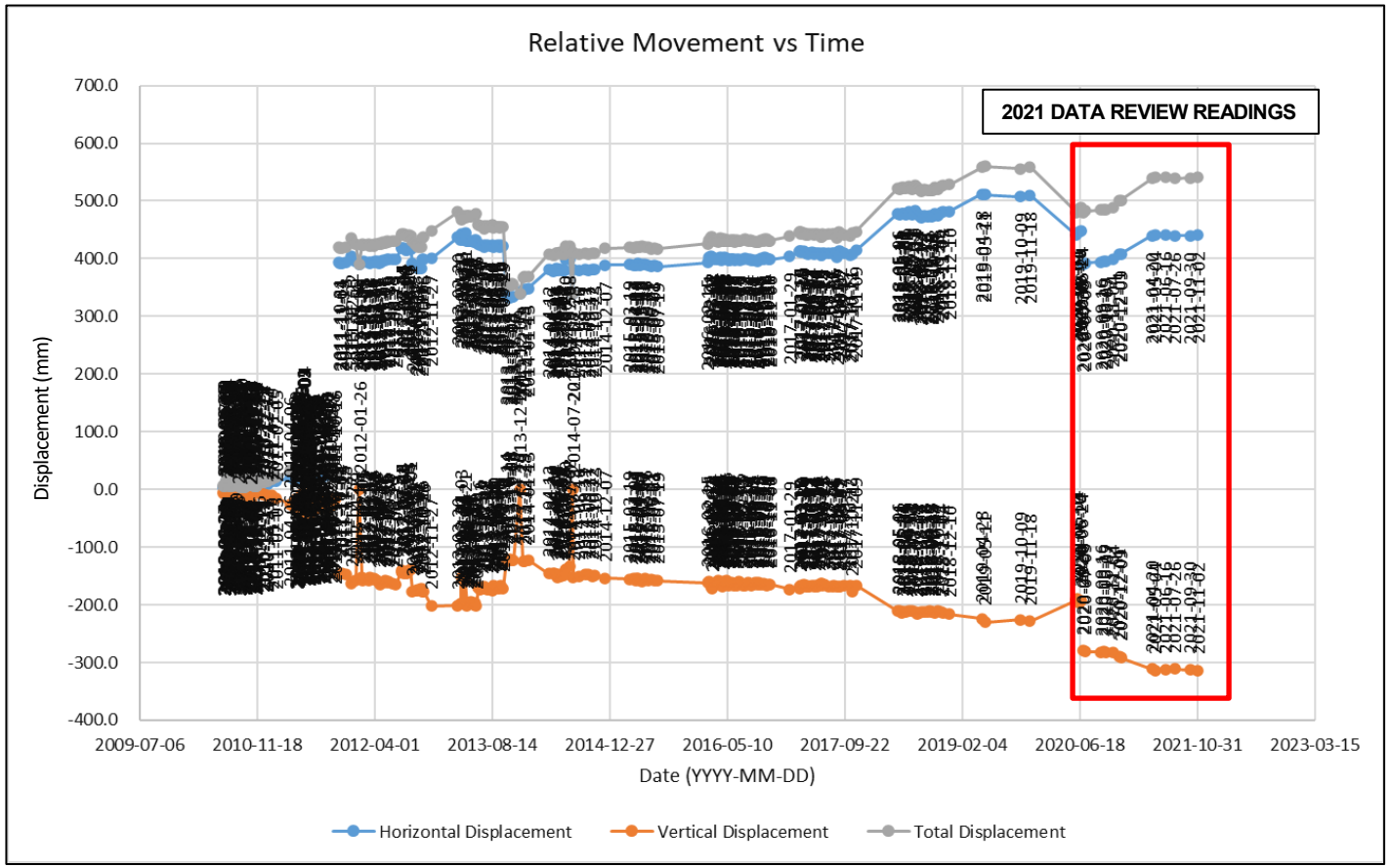

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
PRISM 546

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

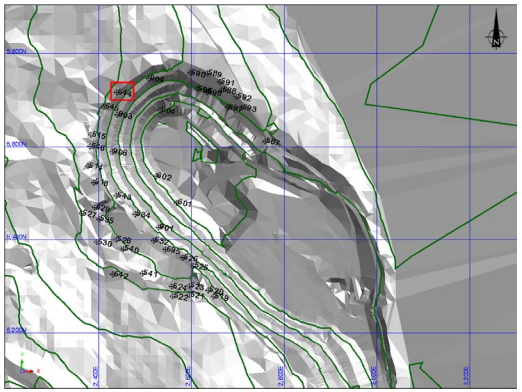

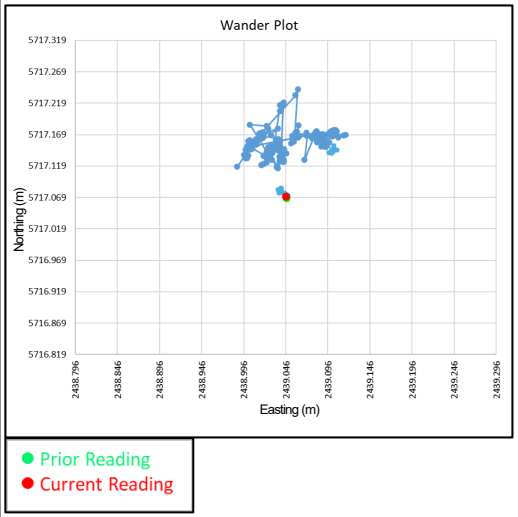

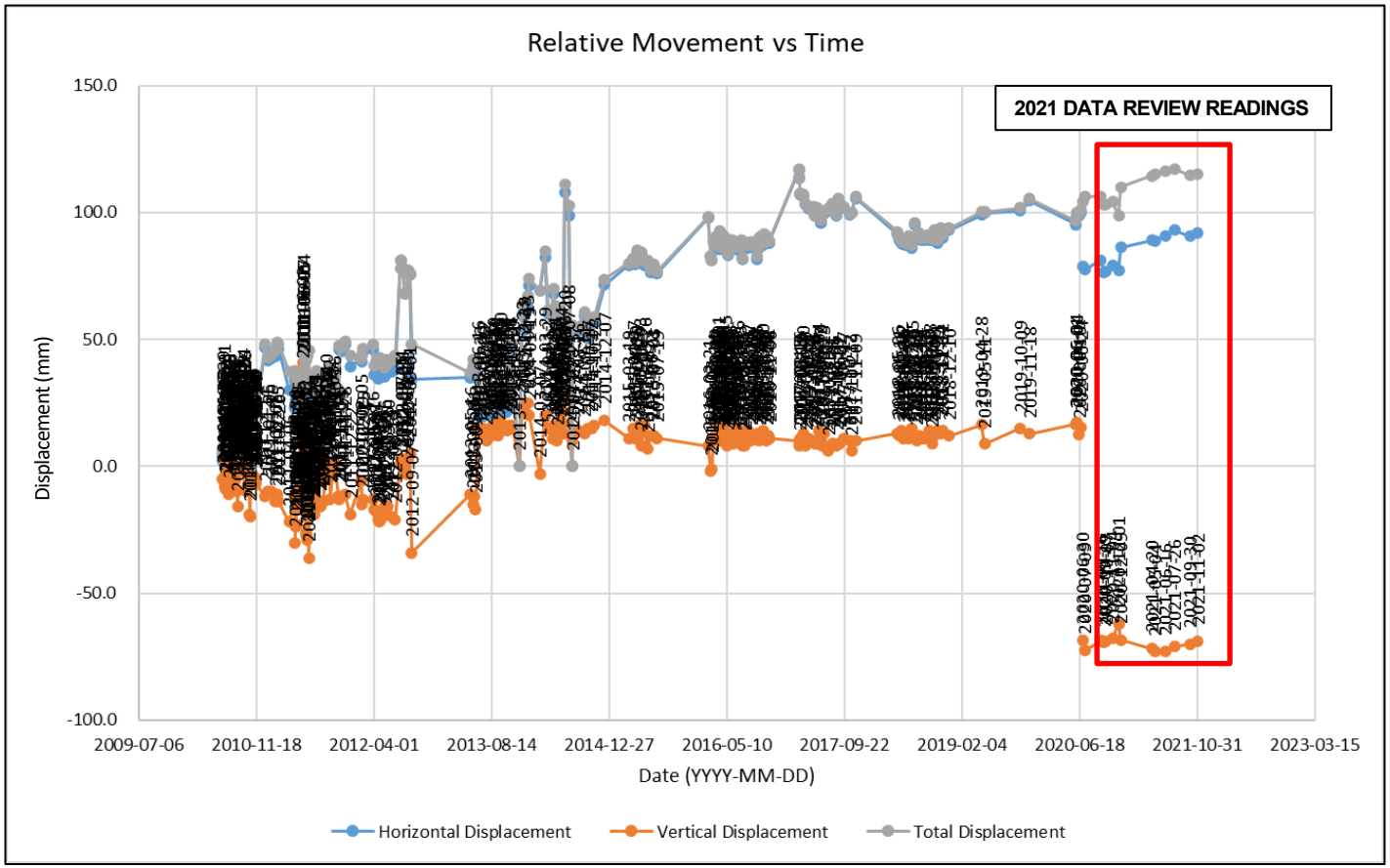

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT NORTH WALL
PRISM 544

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

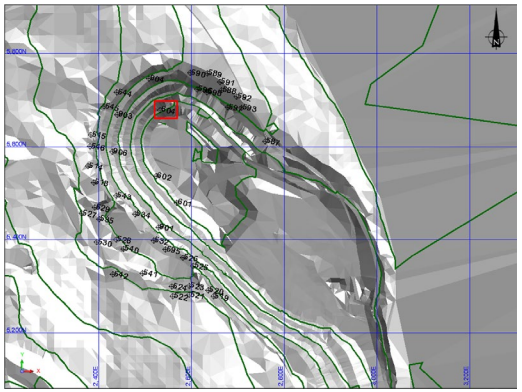

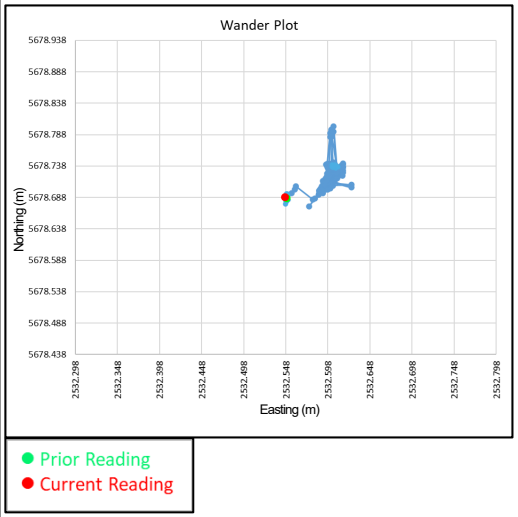

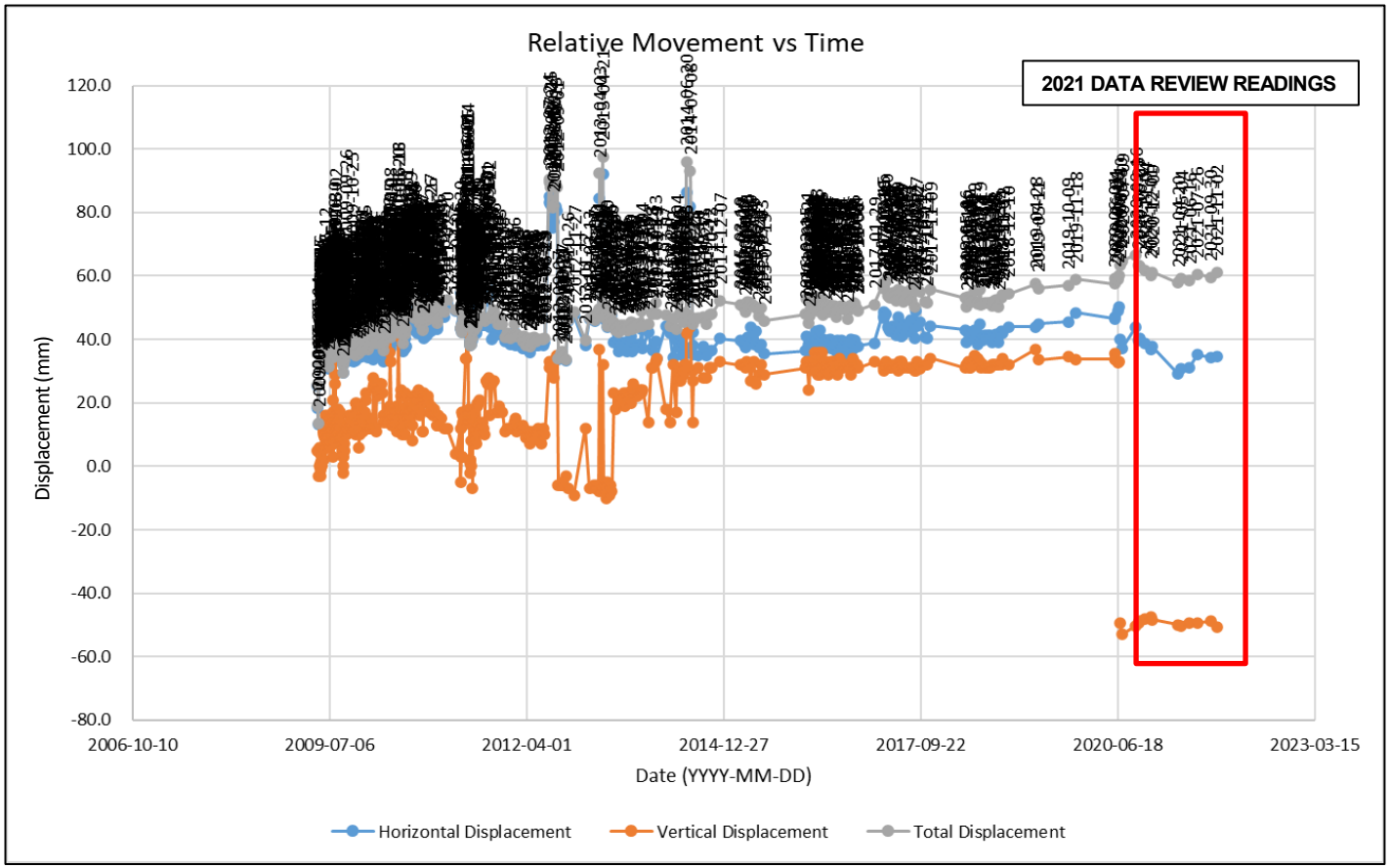

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT NORTH WALL
PRISM 604

PROJECT NO.	PHASE	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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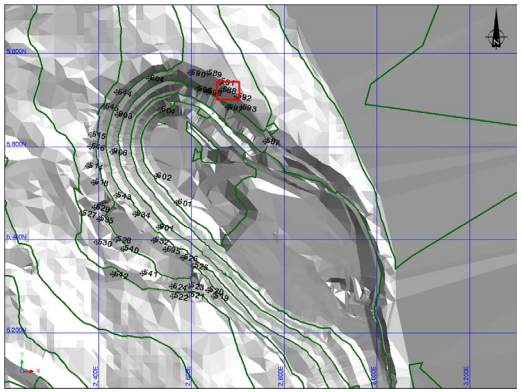

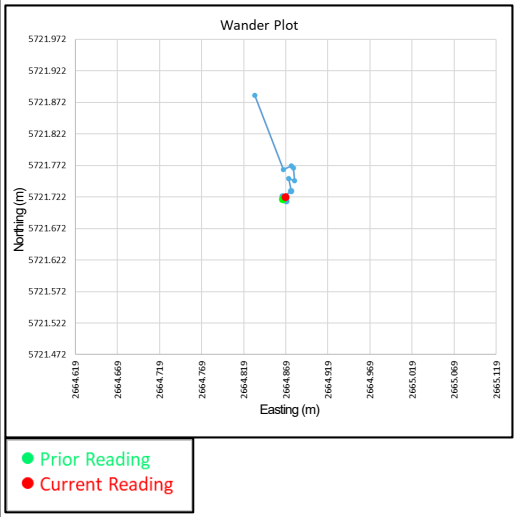

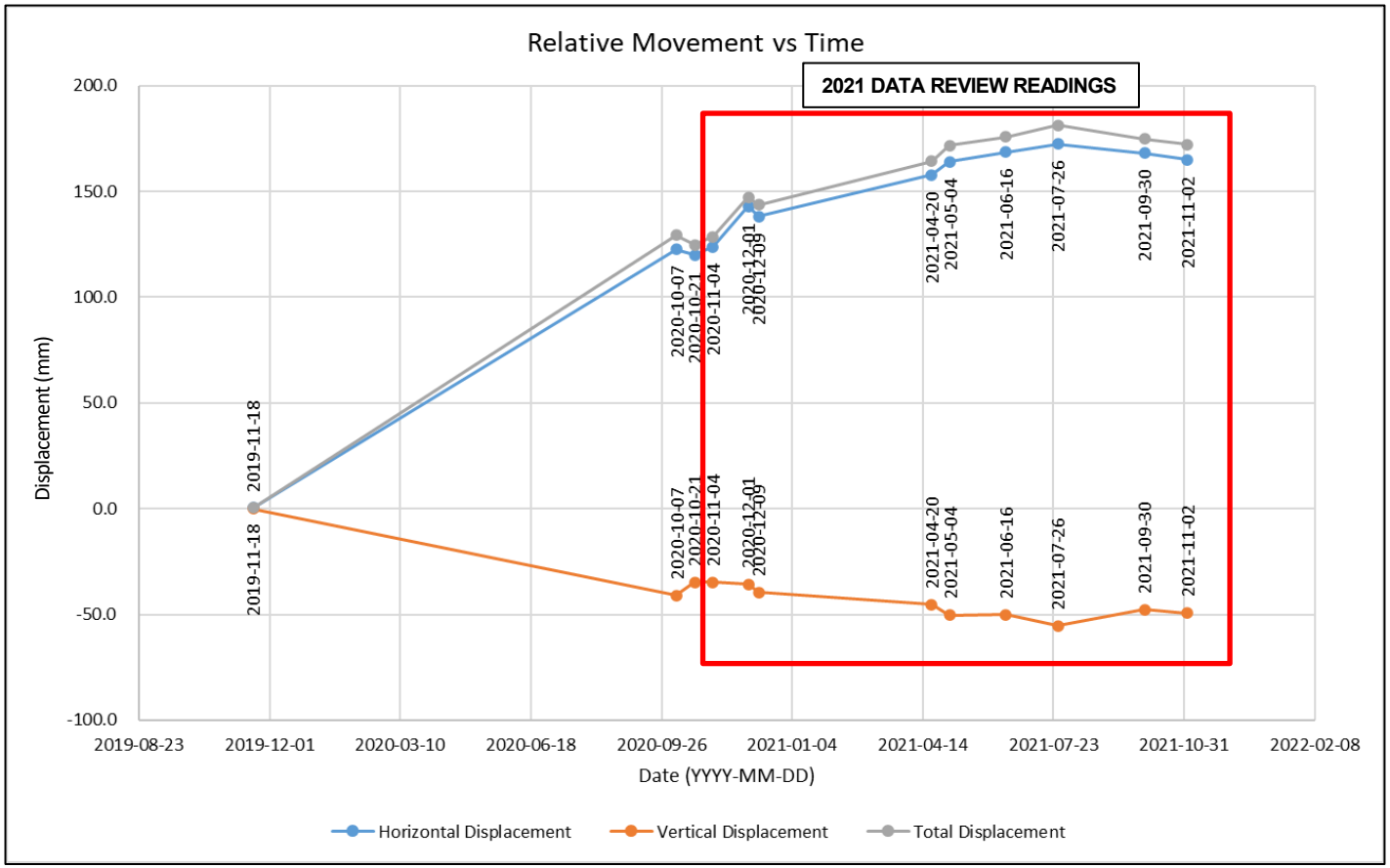

REFERENCES AND NOTES

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YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PRISM 588

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-25

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

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PRISM DATA PRESENTED	
25 M CONTOUR	

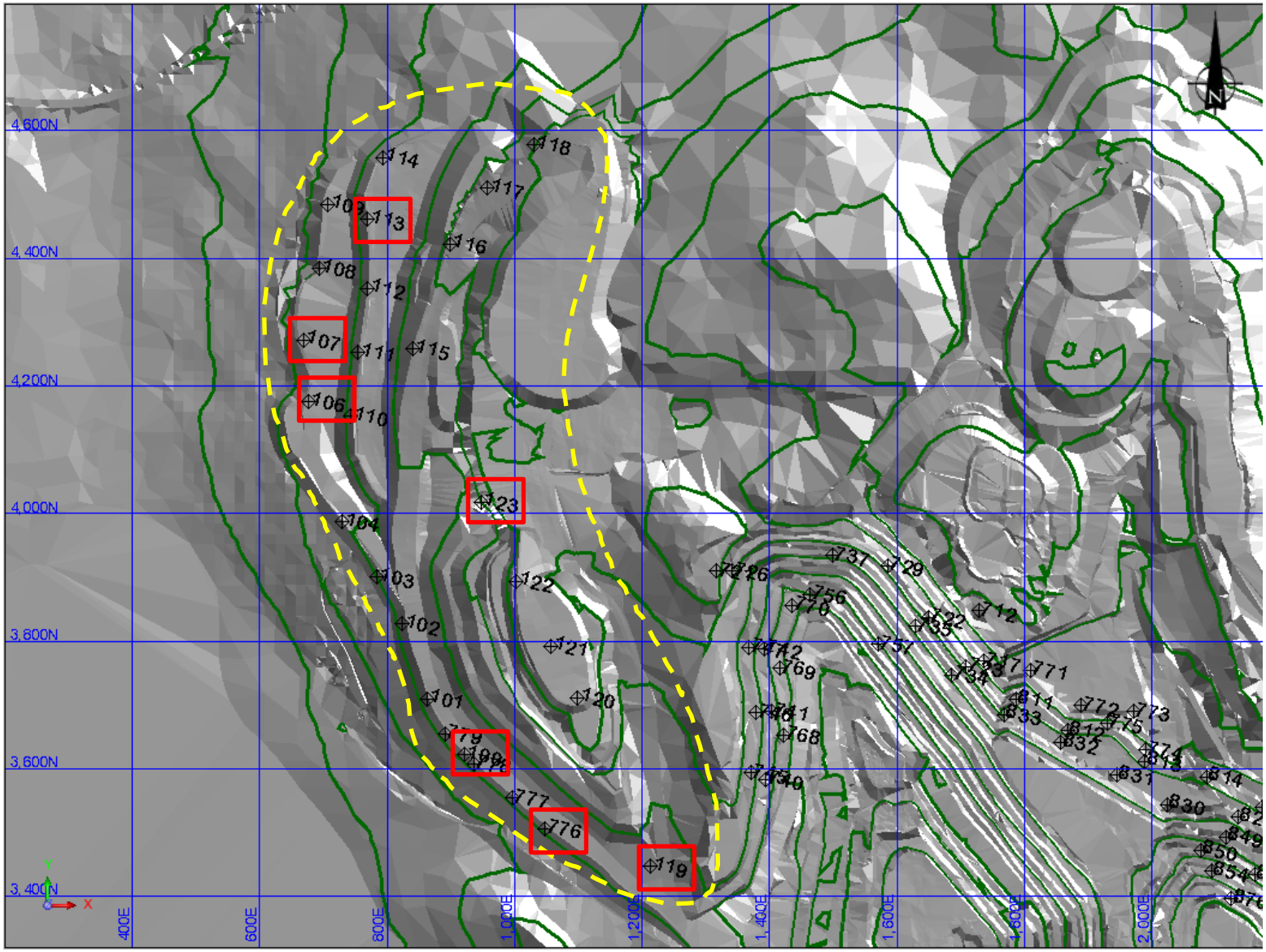

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DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-26**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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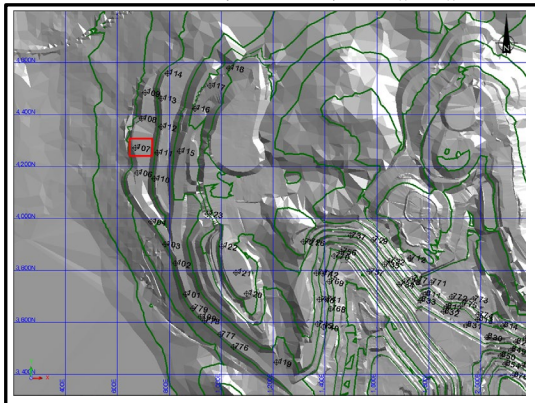

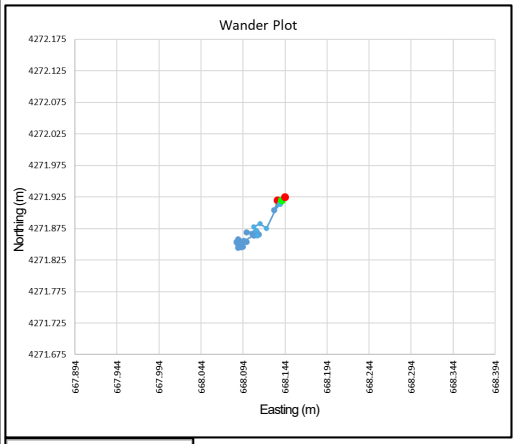

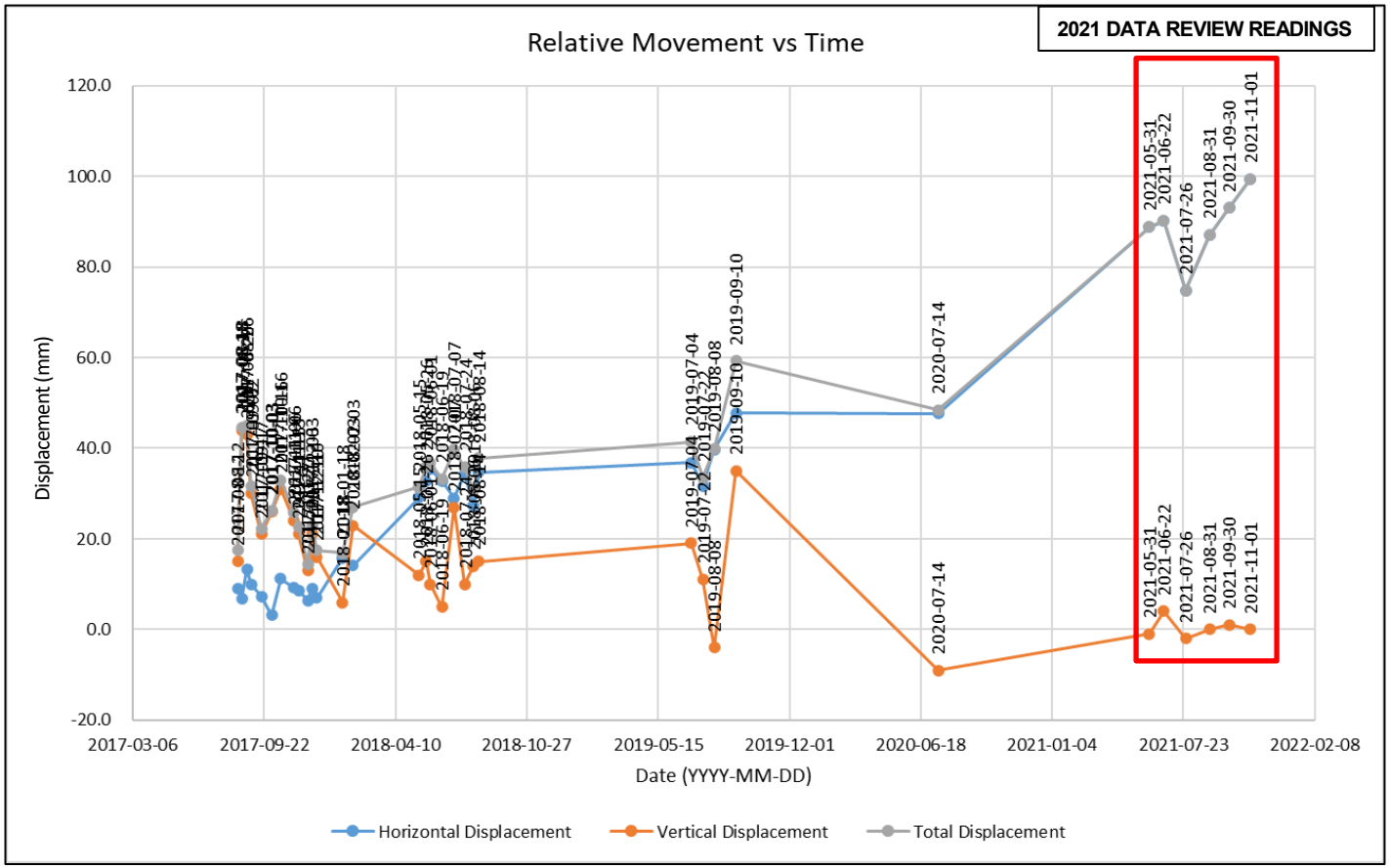

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YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 107

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-27**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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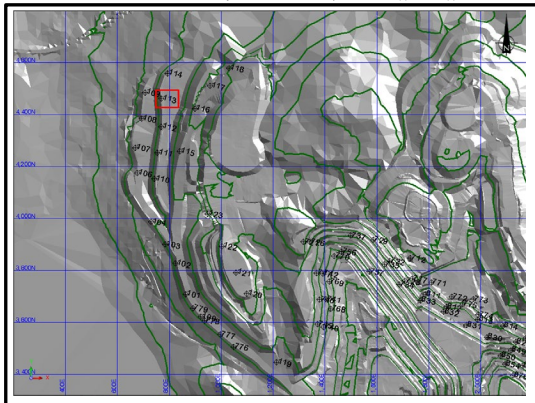

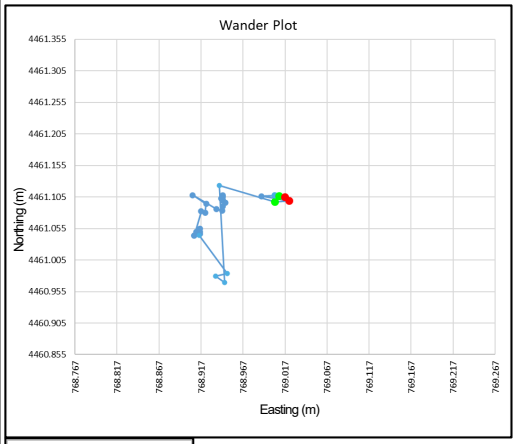

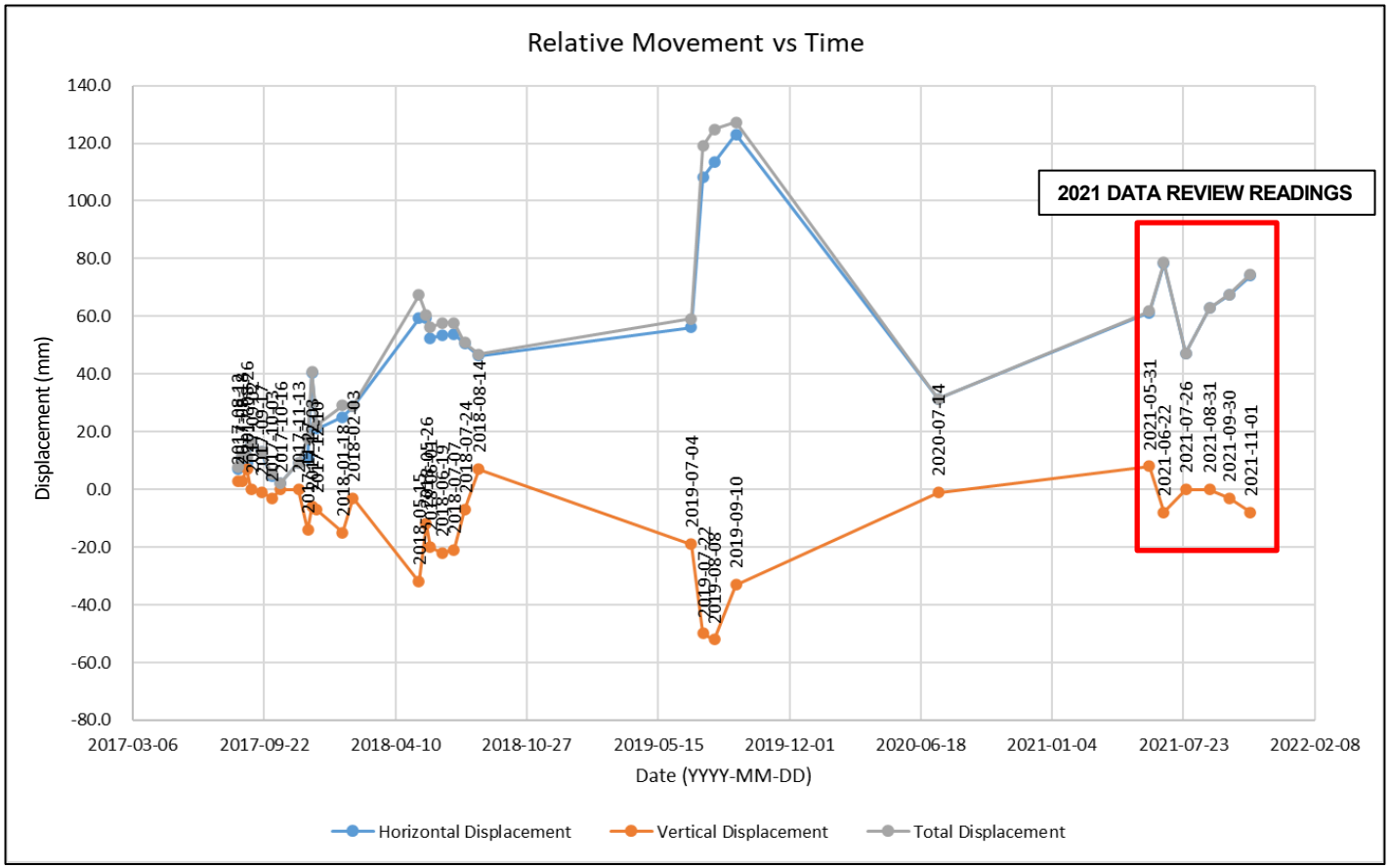

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PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 113

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-28**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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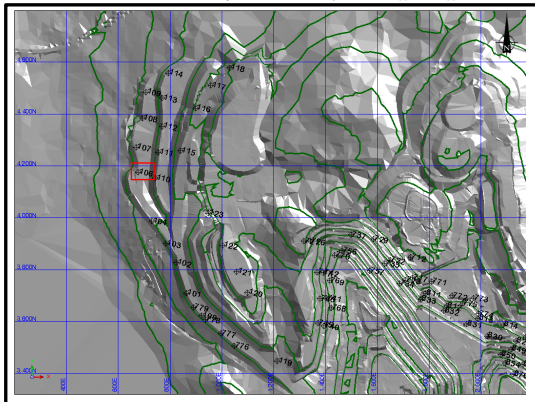

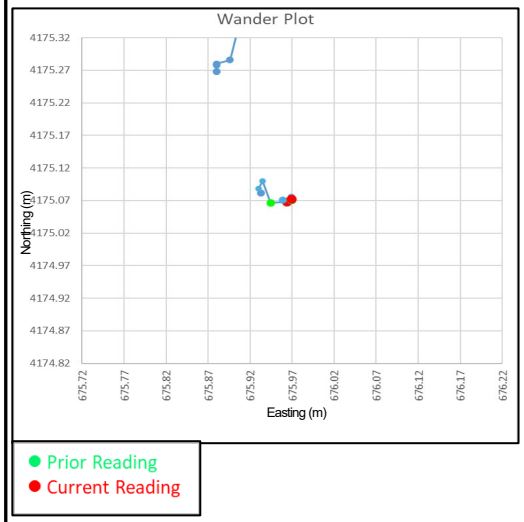

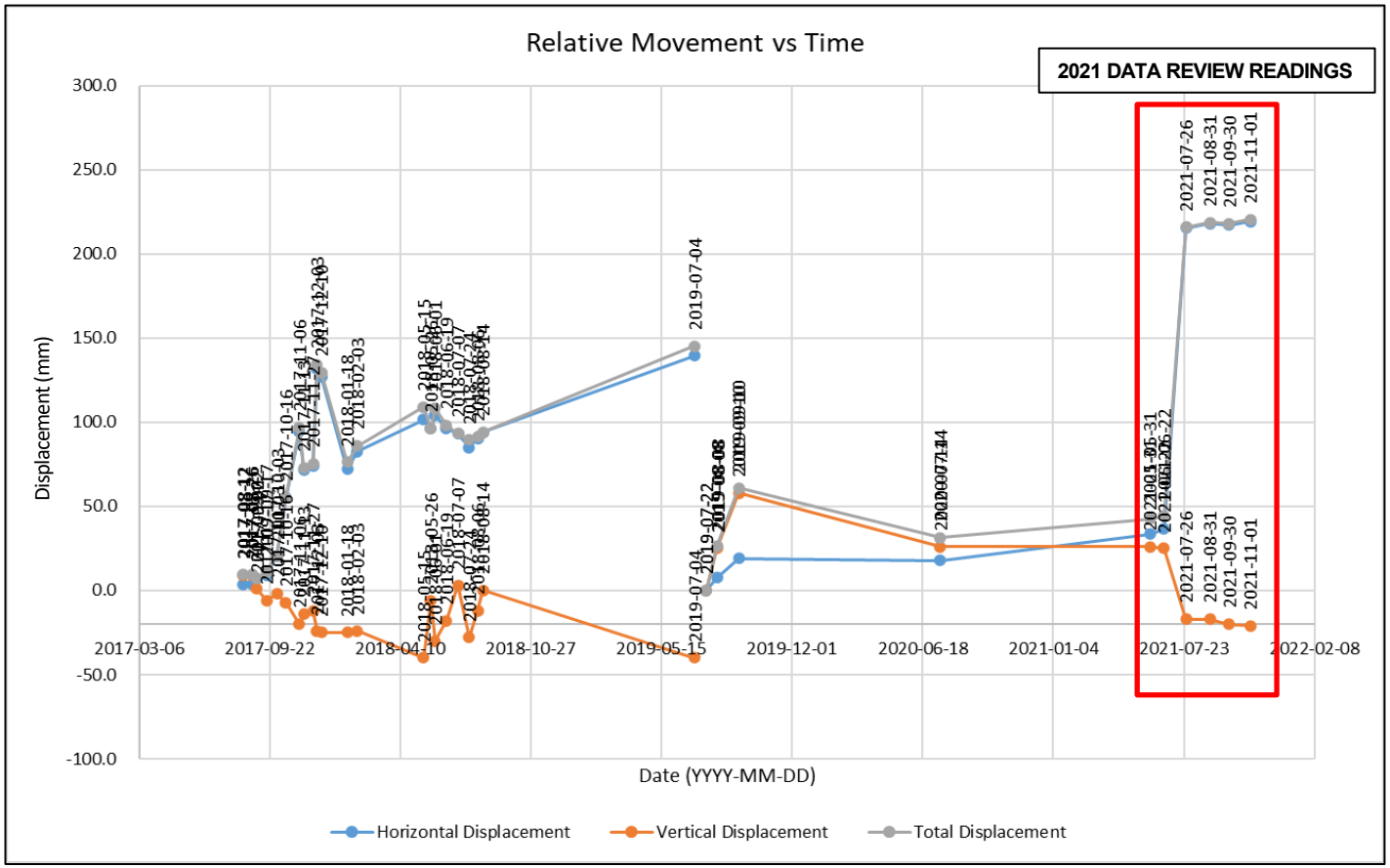

REFERENCES AND NOTES

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CONSULTANT
GOLDER
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YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 106

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-29**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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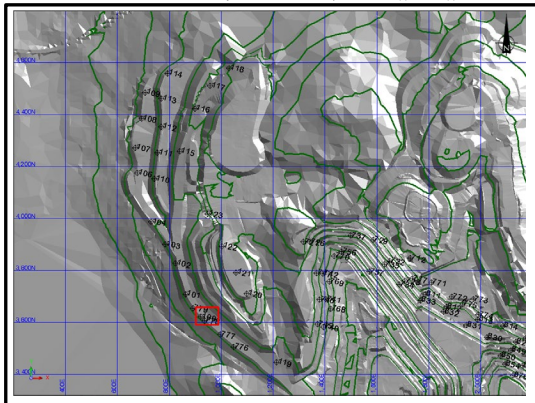

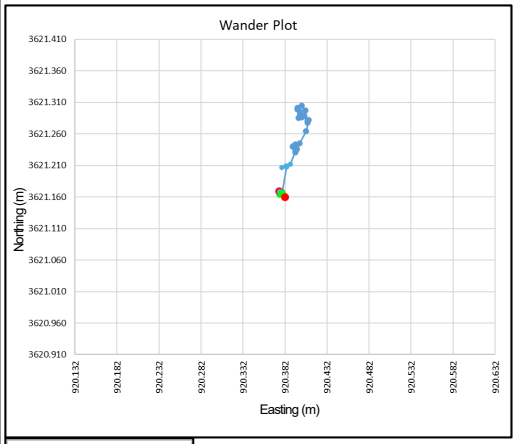

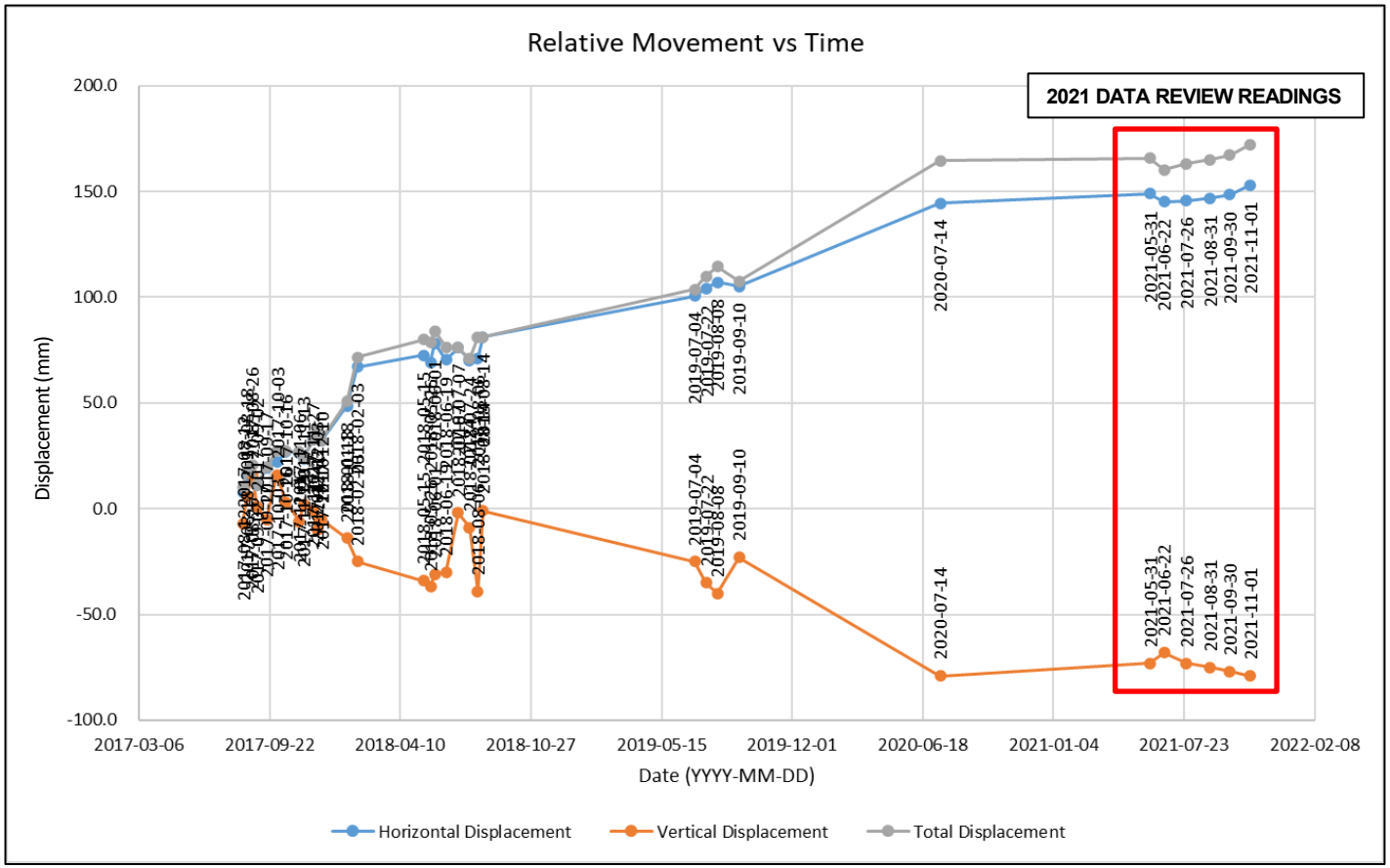

REFERENCES AND NOTES

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YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 100

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-30**

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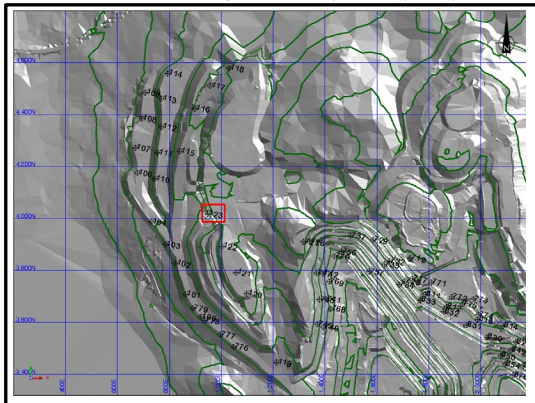

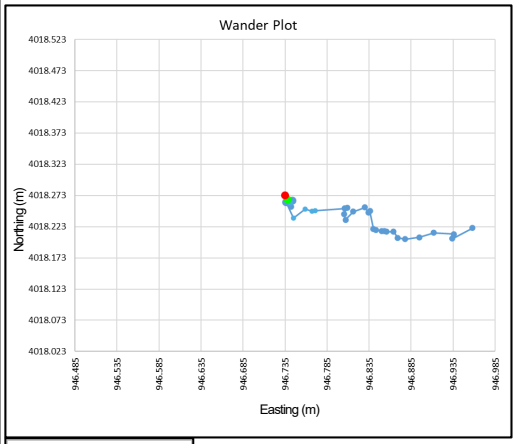

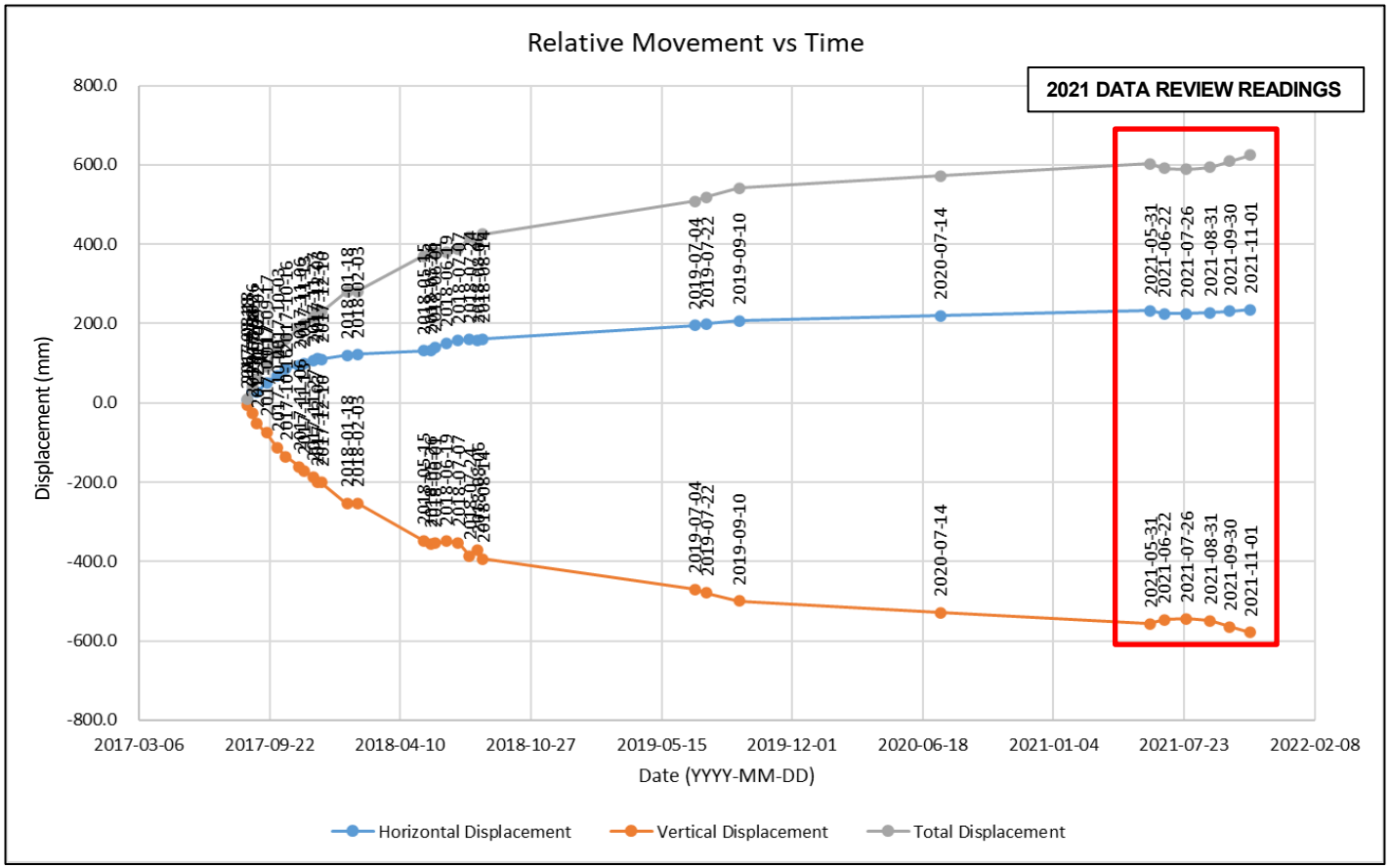

REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
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LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 123

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-31**

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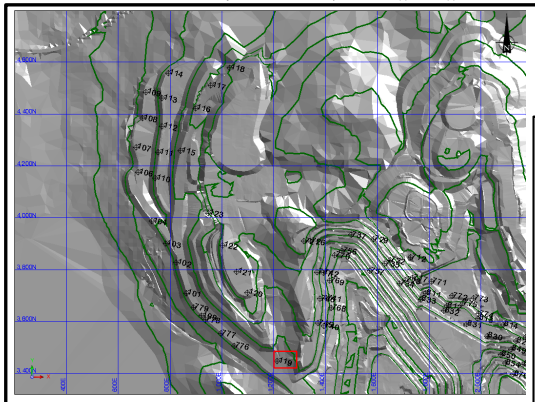

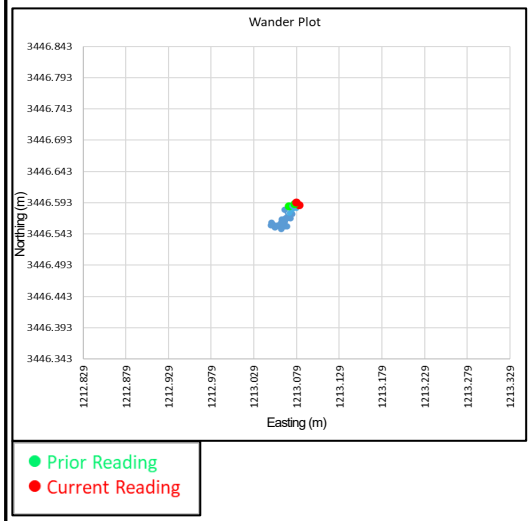

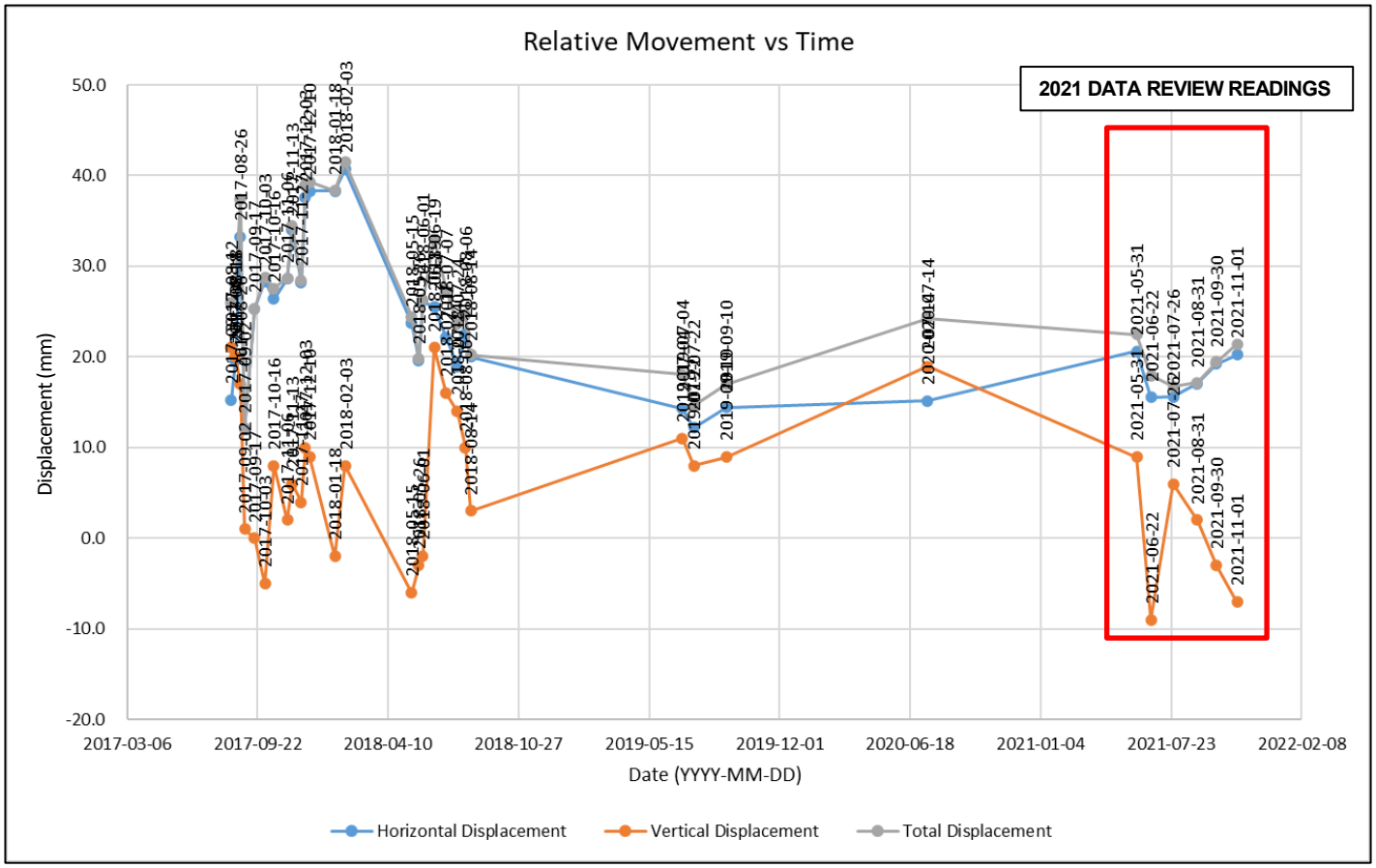

REFERENCES AND NOTES

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PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 119

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-32**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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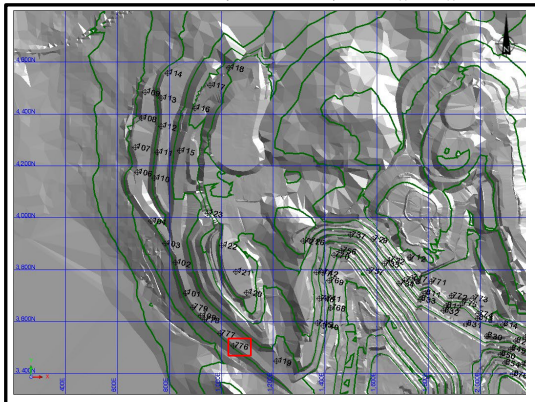

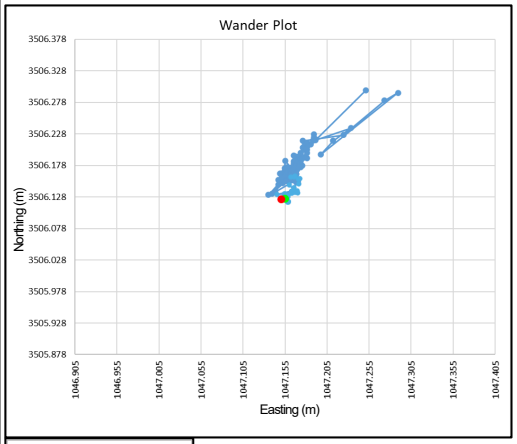

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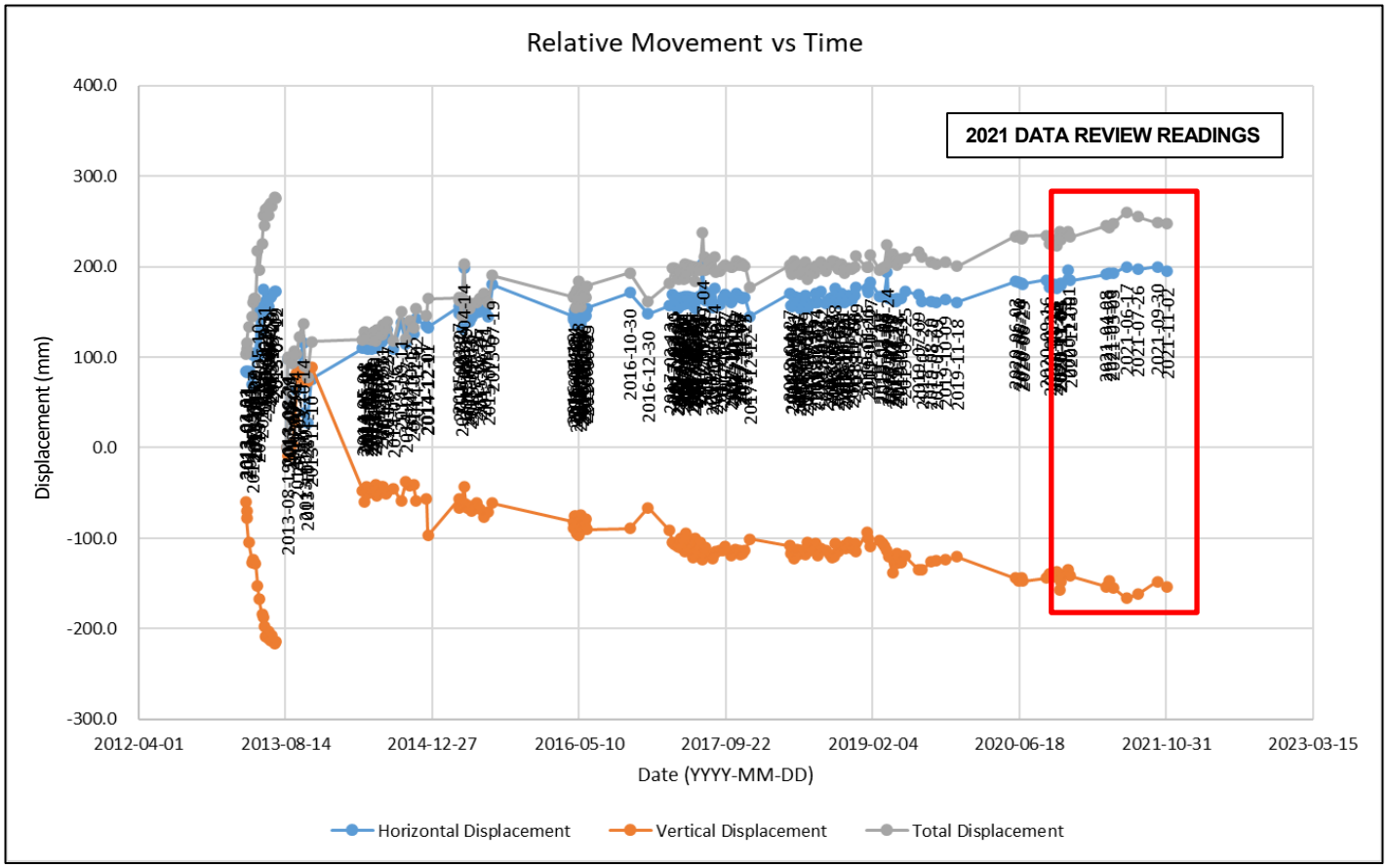

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YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 776

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-33

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



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Appendix T
2016 GW Wight Pit Predictions

TECHNICAL MEMORANDUM

DATE September 11, 2015 **PROJECT No.** 1411734-070-TM-Rev0-15000

TO Katie McMahen, P.Ag.
Mount Polley Mining Corporation

FROM Willy Zawadzki
Don Chorley

EMAIL wzawadzki@golder.com

PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE WIGHT OPEN PIT AT CLOSURE – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum presents preliminary predictions of groundwater seepage for the Wight Pit Lake at closure at the Mount Polley Mine that is operated by the Mount Polley Mining Corporation (MPMC). These predictions were made in support of the Reclamation and Closure Plan that is currently being prepared for the site. This Plan assumes that the Wight Pit will be allowed to flood to a spillover elevation of approximately 926 m.

This memorandum documents preliminary predictions of groundwater seepage from the Wight Pit Lake at closure. It is understood that the Wight Pit Lake hydrology, quality of pit lake water and resulting seepage quality is assessed by the concurrent studies conducted by MPMC and Golder.

2.0 BACKGROUND

Surface mining of the Wight Pit occurred between 1999 and 2009. The pit floor reached an elevation of approximately 804 m; however, since the mining stopped the pit has been partially filled with waste rock with the pit bottom presently at an elevation of approximately 875 m in the northwest and approximately 912 m in the southeast, as presented on Figure 1. In the northwest, the pit crest is located at a distance of approximately 200 m from the Polley Lake shore and in the southeast this distance is about 80 m. At both locations the pit bottom is below the average level of Polley Lake of approximately 920 m.

Similar to the nearby Springer Pit, the majority of the Wight Pit walls were excavated in monzonite bedrock that was intruded by hydrothermal breccias. Three northwest-southeast striking faults intersect the pit, and these faults have been intruded by thick and presently weathered mafic dykes. In 2014, groundwater seepage was observed in the southeast corner of the pit along the east-west striking dyke that is exposed in the pit wall (Golder, 2014a).

The southeast corner of the pit also intersected a relatively thick sequence of overburden deposits of glacio-lacustrine and glacio-fluvial origin. In 2004, Golder conducted hydrogeological investigations in these deposits that included installation and testing of two pumping wells (Golder, 2004) and in 2005 Golder assisted in the installation and testing of two dewatering wells that became part of pit wall dewatering/depressurization system (Golder, 2005). The location of these wells is presented in Attachment 1. Interpretation of hydrogeological data collected during these investigations suggested that the overburden southeast from the pit is highly variable, ranging in texture from silt/clay to sand/gravel, with coarser sediments present at depth and directly overlying bedrock.

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation.

MPMC provided information on the historical dewatering rates for the Wight Pit. In 2008, when the majority of the pit was mined out, MPMC estimated groundwater inflow to this pit to range between 950 m^3/day (175 USgpm) in winter and 1600 m^3/day (300 USgpm) during spring/summer. MPMC also indicated that in 2008 only one overburden dewatering well was operational; however, the dewatering records for this well are not available. In 2014, MPMC estimated that, during summer months, the groundwater inflow to the Wight Pit was approximately 1300 m^3/day (240 USgpm), and indicated that the dewatering wells were not active at this time.

3.0 PRELIMINARY ESTIMATES OF SEEPAGE AT CLOSURE

At present the hydrogeological data from the area of the Wight Pit is not sufficient for the development of a detailed hydrogeological model that could be used to estimate seepage near this pit during closure. Most importantly, current hydraulic head data from the overburden sediments and bedrock surrounding the dewatered pit are not available. However, the available information was considered sufficient for providing preliminary estimates of this seepage based primarily on the historical groundwater inflows to this pit and information from the nearby Springer Pit. These preliminary estimates relied on a simplified analytical model of groundwater seepage near the Wight Pit that was based on the following assumptions:

- Seepage in bedrock near the Wight Pit can be represented using the Thiem equation that describes radial flow of groundwater towards a circular sink under steady-state conditions. The portion of this seepage originating from the topographic high west of the pit was based on the effective radius to the inferred groundwater divide of approximately 700 m and hydraulic head near this divide of 1080 m elevation. The portion of this seepage originating from the east (i.e. from Polley Lake) was based on the effective radius to Polley Lake of 325 m and the Polley Lake level of 920 m;
- Seepage in the overburden along the southeast wall of the Wight Pit can be represented using Darcy's Law. The cross-sectional area for this seepage was estimated to be approximately 2000 m^2 based on Golder (2006) interpretation, and the effective distance between the seepage face along the pit wall and Polley Lake was assumed to be 80 m;
- Estimates of groundwater seepage to the Wight Pit in 2008 and 2014 ranging between 950 m^3/day (175 USgpm) and 1600 m^3/day (300 USgpm) were assumed to consist of 50% of inflow from bedrock and 50% inflow from the overburden, under the assumption that in 2008 only one dewatering well was operational (as indicated by MPMC) and that in 2014 the dewatering system was off. For the base case estimates of groundwater seepage, inflow to the dewatered pit originating from bedrock alone was thus assumed to be equal to 650 m^3/day (120 USgpm) or 50% of average inflow estimated in 2008 and 2014;
- Groundwater seepage from the overburden to the Wight Pit under dewatered conditions was assumed to be equivalent to the pumping rate of 1900 m^3/day (350 USgpm) that was utilized during testing of TW05-1 in 2005 (Golder, 2006).

The simplified analytical model was calibrated to the estimates of groundwater inflow during mining by adjusting hydraulic conductivity assigned to the overburden and bedrock. When these parameters for overburden and bedrock were set to 6×10^{-5} m/s and 2×10^{-7} m/s, respectively, the model calculated total inflow was 2,600 m^3/day (470 USgpm) and matched 700 m^3/day (120 USgpm) estimated to originate from bedrock and 1,900 m^3/day (350 USgpm) assumed to enter the pit from the overburden. The values of hydraulic conductivity adopted in the calibrated model are in good agreement with bulk hydraulic conductivity of bedrock estimated for the mine site (Golder, 2014b) and with results of overburden testing near the Wight Pit discussed in Golder (2004, 2006).

Following calibration, the simplified analytical model was used to predict groundwater seepage near the Wight Pit for the pit lake level ranging between 880 m (i.e. current pit bottom) to 926 m (i.e. spillover elevation). The results of these calculations are presented in Table 1. Groundwater inflow to the pit lake was predicted to gradually decrease as the pit lake level increases from approximately 2,600 m^3/day (470 USgpm) when the pit lake level is at 880 m elevation to about 600 m^3/day (100 USgpm) when the lake is at a spillover elevation of 926 m. Groundwater outflow from the pit lake was predicted to occur once the pit lake level is above the water level elevation of Polley Lake (i.e. approximately 920 m) and was calculated to reach approximately 500 m^3/day (90 USgpm) when the pit lake is at the spillover elevation. The majority of this outflow was calculated to occur via the overburden materials that are present in the southeast between the pit wall and Polley Lake.

Table 1: Predicted Groundwater Flows for Wight Pit Lake

Pit Lake Elevation (m)	Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake
Base Case		
880	2600	0
900	2500	0
910	2100	0
920	800	0
926	600	500
Lower Reasonable Bound		
926	400	300
Upper Reasonable Bound		
926	700	800

Table 1 also presents a range of potential groundwater inflow and outflow from the Wight Pit Lake that could be expected considering the uncertainty in the understanding of hydrogeological conditions near the facility. This range was calculated by considering the estimated range of historical pit inflows and the results of testing conducted previously in the overburden. The analysis indicated that, for the pit lake level at spillover elevation, the groundwater inflow to the pit could range from 400 m^3/day to 700 m^3/day: whereas, the outflow from the pit towards Polley Lake could vary from 300 m^3/day to 800 m^3/day.

4.0 SUMMARY AND RECOMMENDATIONS

The simplified hydrogeological analysis that was carried out for the Wight Pit Lake indicates that groundwater inflow to this lake could range between approximately 2600 m^3/day (470 USgpm) when the pit lake level is at 880 m elevation and 600 m^3/day (110 USgpm) when the spillover elevation of 926 m is reached. Once the pit lake level is above the average water level in Polley Lake of 920 m, groundwater seepage from the pit lake towards Polley Lake would occur. When the Wight Pit Lake is at spillover elevation this outflow was calculated to be approximately 500 m^3/day (90 USgpm).

Due to limited hydrogeological data available for the Wight Pit, the above predictions should be considered only as preliminary estimates of actual groundwater fluxes that could occur at closure. At present there is lack of understanding of groundwater levels in the area surrounding the Wight Pit and the hydrogeological significance of faults intersecting the east pit wall. In the absence of this information more accurate predictions of these fluxes cannot be made. The following activities are recommended to address these data gaps so that the estimates of groundwater seepage could be refined:

- Borehole survey: During the 2004 and 2005 investigations, several boreholes and wells were completed between the crest of the Wight Pit and Polley Lake (Attachment 1). It is recommended that the condition of these boreholes be assessed for their suitability for hydraulic head monitoring and water quality sampling;
- Installation of monitoring wells: If the borehole survey finds that wells installed in 2004-2005 are no longer accessible and/or suitable for groundwater monitoring, two multi-level monitoring wells should be installed between the Wight Pit and Polley Lake. At each location the shallow piezometer should target the more permeable portion of the overburden and the deep piezometer should be completed in bedrock. One of the deeper installations should target the fault/dike structure that is present in the southeast corner of the pit;
- Seepage survey: A seepage survey, focusing on major structure identified along the pit walls, should be conducted. If practicable, quantitative measurements of groundwater seepage from the fault/dyke structure in the southeast corner of the pit (and other visible seepage) should be made to facilitate estimates of hydrogeological properties of this feature;
- Groundwater monitoring: Monitoring wells near the Wight Pit should be included in the groundwater monitoring program for the site. Hydraulic heads at these installations should be measured at least weekly and groundwater quality should be assessed on a quarterly basis. After one year of monitoring, the groundwater quality data should be assessed for seasonal variability and the monitoring frequency should be adjusted appropriately;
- The existing hydrogeological model should be expanded to include the Wight Pit and its calibration should be updated to include new data sources described above. The expanded model should be used to refine the predictions of groundwater seepage that could occur at closure.

5.0 CLOSURE

We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

Willy Zawadzki, P.Geo.
Principal, Senior Hydrogeologist

ORIGINAL SIGNED

Don Chorley, P.Geo.
Principal, Senior Hydrogeologist

WZ/DWC/ch

Attachments: Figure 1: Site Plan
Attachment 1: Location of Pumping Wells Completed in the Overburden
Attachment 2: Study Limitations

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6.0 REFERENCES

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Golder Associates Ltd. 2006. *Preliminary Review of 2005 Hydrogeological Program – Dewatering Wells DW-2 and DW-3, Wight Pit, Mount Polley Mine Site*. submitted to MPMC on January 24, 2006.

Golder Associates Ltd. 2014a. *Review of Boundary Zone Underground Mine Blasting Effects on Wight Pit Slope Stability.* submitted to MPMC on January 7, 2014.

Golder Associates Ltd. 2014b. *Updated Predictions of Pit Lake Formation for the Springer Open Pit – Mount Polley Mine*. submitted to Mount Polley Mining Corporation on December 16, 2014.

Q:\05-1413-027 MtPolley\Wight Pit Lake\Mt Polley Figures WightPit Sep 2015.pptx

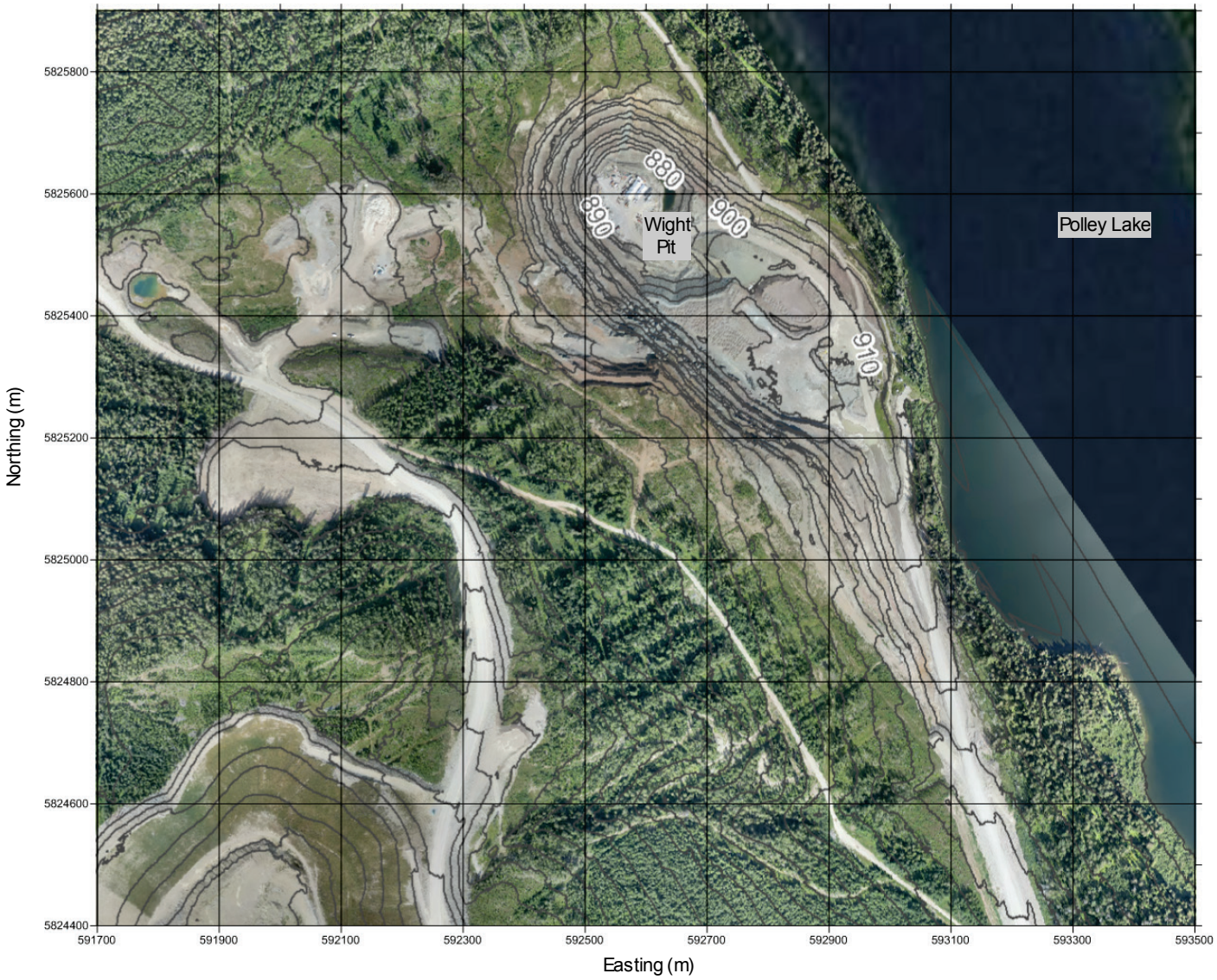

CLIENT
MOUNT POLLEY MINING CORPORATION
LIKELY, BC

PROJECT
PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE WIGHT OPEN PIT AT CLOSURE

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-09-03
PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

TITLE
SITE PLAN

PROJECT No. **1411734** **15000**
Rev. **0**
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ATTACHMENT 1

LOCATION OF PUMPING WELLS COMPLETED IN THE OVERBURDEN

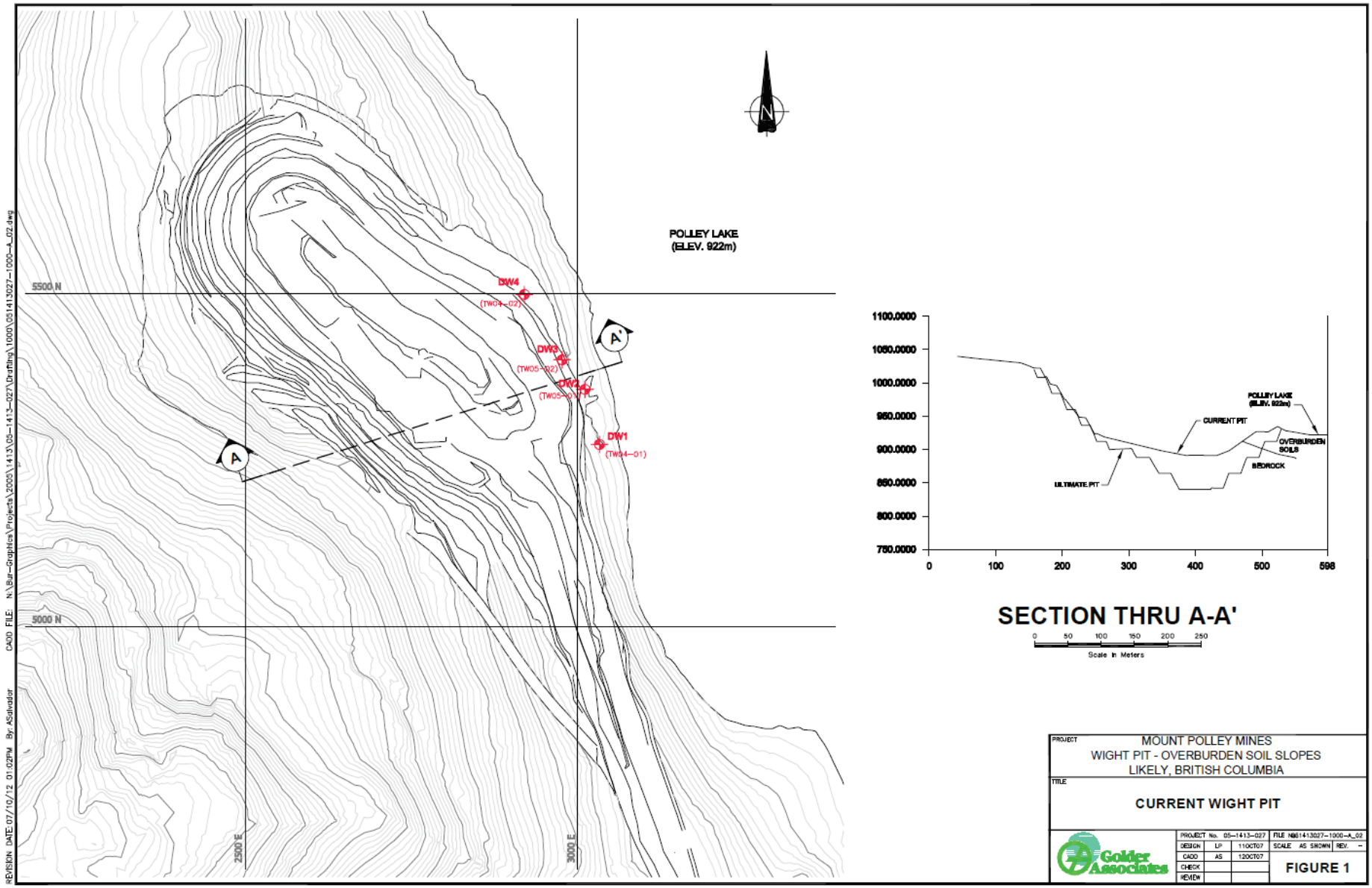

Note: This figure is reproduced from Golder letter report to MPMC dated October 31, 2007.

ATTACHMENT 2
STUDY LIMITATIONS

Study Limitations

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Hydrogeologic/hydrologic investigations and groundwater modelling are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time, and in the sense that the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that groundwater systems are complicated beyond human capability to evaluate them comprehensively in detail, and we invariably do not have sufficient data to do so. A groundwater model uses the laws of science and mathematics to draw together the available data into a mathematical or computer-based representation of the essential features of an existing hydrogeologic system. While the model itself obviously lacks the detailed reality of the existing hydrogeologic system, the behaviour of a valid groundwater model reasonably approximates that of the real system. The validity and accuracy of the model depends on the amount of data available relative to the degree of complexity of the geologic formations, the site geochemistry, the fate and transport of the dissolved compounds, and on the quality and degree of accuracy of the data entered. Therefore, every groundwater model is a simplification of a reality and the models described herein are not an exception.

The professional groundwater modelling services performed as described in this document were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the quantity and quality of available data, the time limits and financial and physical constraints applicable to the services. Unless otherwise specified, the results of previous or simultaneous work provided by sources other than Golder and quoted and/or used herein are considered as having been obtained according to recognised and accepted professional rules and practices, and therefore deemed valid. This model provides a predictive scientific tool to evaluate the impacts on a real groundwater system of specified hydrological stresses and/or to compare various scenarios in a decision-making process. However and despite the professional care taken during the construction of the model and in conducting the simulations, its accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, expressed or implied, is made.

Appendix U
2016 Boundary Pit Seepage

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-152-TM-Rev0-16000

TO Dale Reimer, General Manager
Mount Polley Mining Corporation

FROM Willy Zawadzki and Don Chorley **EMAIL** Willy_Zawadzki@golder.com; Don_Chorley@golder.com

PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE BOUNDARY PIT – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum presents preliminary predictions of groundwater seepage for the Boundary Pit Lake at closure at the Mount Polley Mine, which is operated by the Mount Polley Mining Corporation (MPMC). These predictions were made in support of water balance studies for the site. It is understood that the Boundary Pit hydrology and resulting seepage quality is assessed by the concurrent studies conducted by MPMC and Golder Associates Ltd.

2.0 BACKGROUND

Surface mining of the Boundary Pit started in 2008. The pit floor reached an elevation of approximately 1,068 m, or about 14 m below the original ground surface at the northwest pit crest. Similar to the adjacent Wight Pit, most of mining at the Boundary Pit occurred in monzonite bedrock that was intruded by hydrothermal breccias and intersected by northeast striking faults.

At present, hydrogeological data specific to the Boundary Pit are not available. However, MPMC indicated that during mining seepage was not observed along the pit walls. This lack of seepage is considered reasonable due to the relatively shallow depth of this pit and depth to water table measured at monitoring wells that were installed near other mine facilities. It is thus considered likely that the water table was located near or below the floor of the Boundary Pit before mining at this location commenced.

Although seepage to the Boundary Pit from the surrounding rock mass is not expected, seepage out of this pit could occur due to water entering the pit via surface water run-off and direct precipitation. An estimate of these potential seepage rates out of the pit was made to provide input to the pit water balance and to characterize a potential seepage pathway originating from the Boundary Pit.

3.0 PRELIMINARY ESTIMATES OF SEEPAGE

The preliminary estimates of seepage from the Boundary Pit were based on the following assumptions:

- The pit bottom is located at an elevation of 1,068 m, or approximately 14 m below the ground surface at the northeast pit crest, and approximately 5 m below the lowest point along the pit crest (towards northeast). It is likely that the pit bottom does not extend to a significant depth below the water table.

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- If the Boundary Pit is flooded, seepage from this pit would be directed northeast towards the Wight Pit and discharge to that pit. This could occur not only during operation, when the Wight Pit is dewatered, but also during closure due to water table depression that would develop southwest of the Wight Pit after it is flooded to an elevation of 926 m (Golder 2015).
- Seepage from the Boundary Pit would occur via the upper bedrock zone, as incorporated in the groundwater model for the Springer and Cariboo pits (Golder 2014). This zone is assumed to extend 40 m below the surface with a bulk hydraulic conductivity of 1×10^{-6} m/s (lower bound of 6×10^{-7} m/s, upper bound of 3×10^{-6} m/s). Due to a decrease in permeability with depth, potential seepage via deeper bedrock is assumed to be negligible.
- Seepage would occur under an average hydraulic gradient of 0.1 m/m, which corresponds to the approximate slope in ground surface between the crest of the Boundary Pit and the crest of the Wight Pit.
- The maximum depth of flooding could be approximately 5 m, considering pit wall height northeast from the pit bottom (approximately 1,073 m elevation).

Based on the above assumption and a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded, the seepage rate from the Boundary Pit when the pit lake level is 5 m above its base is estimated at approximately 60 m^3/d, and could range between 40 m^3/d and 180 m^3/d due to uncertainty in bedrock permeability. Seepage is estimated to decrease as the height of water column above the pit bottom decreases (Table 1).

Table 1: Predicted Seepage Quantities from the Boundary Pit

Water Level above Boundary Pit Bottom (m)	Estimated Groundwater Seepage (m^3/d)		
	Lower Bound	Base Case	Upper Bound
0	2	3	10
1	6	10	29
2	12	20	61
3	16	26	79
4	32	53	159
5	35	59	177

4.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

Willy Zawadzki, PGeo
Principal, Senior Hydrogeologist

ORIGINAL SIGNED

Don Chorley, PGeo
Principal, Senior Hydrogeologist

WZ/DWC/pn/it/kp

Attachment: Study Limitations

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REFERENCES

Golder (Golder Associates Ltd.). 2014. Updated Predictions of Pit Lake Formation for the Springer Open Pit – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 1411734-002-TM-Rev0. 16 December 2014.

Golder. 2015. Preliminary Predictions of Groundwater Seepage for the Wight Open Pit at Closure – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 1411734-070-TM-Rev0. 11 September 2015.

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Appendix V
2022 Visual Simulations

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PAG Stockpile Ditches
Boundary Pit
Boundary Dump
Temporary NW PAG Stockpile
VP1
Wight Pit
Boundary/Wight Pit Connector Road
North Bell Dump
New Access Road
Wight Pit Haul Road
East RDS Stockpile
Springer-Cariboo Pit
VP2
Highway to Heaven
VP3
Crusher Road
Ore Switchback Road
#1 Ore Stockpile
East RDS
NEZ Soil
Mill Area
Warehouse Area
NEZ Dump
Cariboo Ore Stockpile
Helipad
New Access Road
Old Wrap Around Road
Hydro Line
Geology Area
High Ox Stockpile
West Ditch
Pond Zone Soil
Long Ditch
SERDS
Old Orica Site
Old TSF Haul Road
Wight Pit/TSF Haul Road
SERDS Soil
VP4
SERDS Ditch
Mill/TSF Connector Road
Polley Lake Access Road
TSF Rock Quarry
Biosolids
West (Waste) Haul Road
Corner 4 to Corner 5
Perimeter Embankment
Corner 4 to Corner 5 Light Duty Access
Perimeter Embankment (East) Till Borrow Pit
Tailings Surface
South and Main Ponds
South Embankment
Hazeltine Discharge Pipe Grade
Main Embankment
South Till Borrow

LEGEND

- PHOTO SURVEY VIEWPOINT
- PERMIT BOUNDARY

INFRASTRUCTURE TYPE

- BORROW
- DUMPS
- LINEAR
- MISCELLANEOUS
- PITS
- ROADS
- STOCKPILE
- TSF AREA

MOUNT POLLEY MINING CORPORATION

FIGURE V-1-1
VISUAL SIMULATIONS
PHOTO SURVEY VIEWPOINTS

DATE: 2022-12-12 DRAWN: CDB

0 500 1,000

1:25,000 METRES

VP1 - EXISTING - CURRENT VIEW FROM BOOTJACK LAKE, NEAR THE EXISTING RECREATION AREA



VP1 - CLOSURE - FUTURE VIEW FROM BOOTJACK LAKE, NEAR THE EXISTING RECREATION AREA

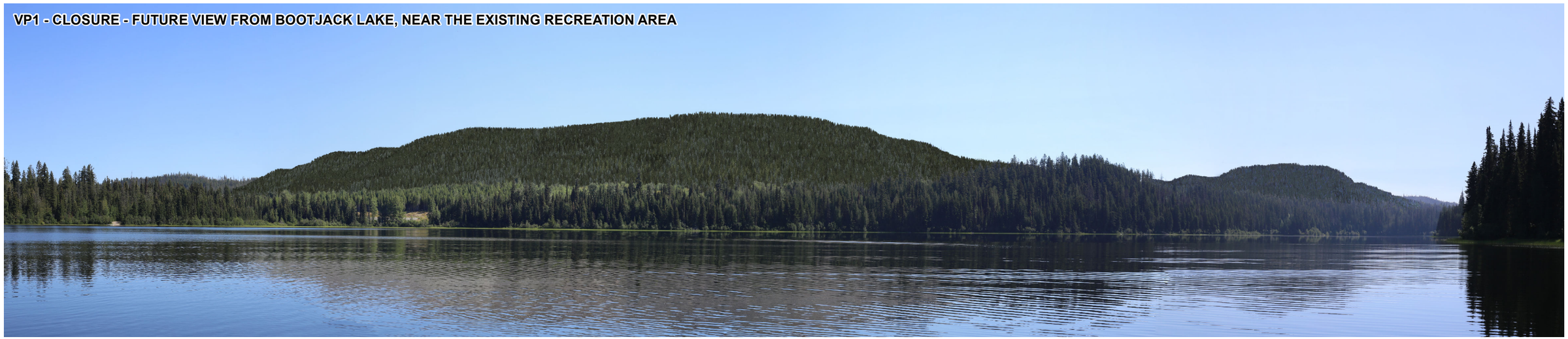

MOUNT POLLEY
MINING CORPORATION

FIGURE V-2-1
VISUAL SIMULATIONS - VP1

DATE: 2022-12-12 DRAWN: CDB

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MOUNT POLLEY
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FIGURE V-2-2
VISUAL SIMULATIONS - VP2

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FIGURE V-2-3
VISUAL SIMULATIONS - VP3

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VP4 - EXISTING - CURRENT VIEW FROM POLLEY LAKE, NEAR THE EXISTING BOAT LAUNCH



VP4 - CLOSURE - FUTURE VIEW FROM POLLEY LAKE, NEAR THE EXISTING BOAT LAUNCH



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FIGURE V-2-4
VISUAL SIMULATIONS - VP4

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Appendix W
2021 OMS Manual



MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL

MATT O'LEARY
WATER AND TSF SUPERINTENDENT

KELLY PARKER
GENERAL MANAGER

UPDATE CONTROL

Rev. No.	Revision	Date	Approved
0	Annual Revision	December 22, 2004	RM
1	Annual Revision	February 06, 2006	RM
2	Issued in Draft	March 31, 2006	RM
3	Issued in Draft	August 28, 2006	RM
4	Annual Revision	October 06, 2006	RM
5	Annual Revision	November 28, 2007	RM
6	Annual Revision	July 01, 2008	RM
7	Annual Revision	December 31, 2009	RM
8	Annual Revision	March 30, 2010	RM
9	Issued in Draft	January 01, 2012	LM
10	Annual Revision	July 01, 2012	LM
11	Annual Revision	July 01, 2013	LM
12	Revision for 2015 Freshet Embankment	March 27, 2015	LM/TE
13	Revision for Water Monitoring Update	May 20, 2015	LM/KM
14	Revision for Springer Pit Tailings Deposition	August 5, 2015	LM
15	Revision for Short-Term Effluent Discharge	December 15, 2015	LM
16	Revision for Water Management System Review	May 20, 2016	LM
17	Full Annual Update to Accommodate Return to Full Operations and TSF Discharge	December 15, 2016	SF
18	Annual Update	December 25, 2017	SF
19	Annual Update	December 31, 2019	MO
20	Revision - halt of mill operations and continued Springer Pit dredging and deposition in the TSF	August 31, 2019	MO
21	Annual Update	April 15, 2020	MO
22	Annual Update	January 30, 2021	MO
23	Annual Update - Operations	Aug 27, 2021	MO
24	Annual Update – Changes not finalized	Aug 13, 2022	MO
25	Annual Update – Incorporate suggestions from DSR. Tigger response updated to meet new regualtions	Aug 12, 2023	MO

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DEFINITIONS

°C	degree(s) Celsius
AMEC	AMEC Foster Wheeler (Previously AMEC Environment & Infrastructure)
CCS	Central Collection Sump
CEMP	Comprehensive Environmental Monitoring Plan
CEO	Chief Executive Officer
cm	centimetre(s)
COI	communities of interest
COO	Chief Operating Officer
DSR	Dam Safety Review
EMA	*Environmental Management Act*
EMLI	Engery, Mines and Low Carbon Inovation
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
ERP	Emergency Response Plan
GLU	glaciolacustrine unit(s)
Golder	Golder Associates Ltd.
HDPE	high density polyethylene
IERP	Independent Engineering Review Panel
Imperial	Imperial Metals Corporation
km	kilometre(s)
KP	Knight Piésold Ltd.
m	metre(s)
m/s	metres/second
MAC	Mining Association of Canada
MESCP	Main Embankment Seepage Collection Pond
HSRC	Health, Safety and Reclamation Code for Mines in British Columbia
mm	millimetre(s)
BC-ENV	British Columbia Ministry of Environment
MPIC	Mount Polley Intrusive Complex
MPMC	Mount Polley Mining Corporation
NAG	non-acid-generating
OMS	Operation, Maintenance and Surveillance
PAG	potentially-acid-generating
PETBP	Perimeter Embankment Till Borrow Pond
QA/QC	quality assurance/quality control
QPO	Quantative Performance Objective
RDS	rock disposal site
SAA	Shape Acceleration Array
SERDS	Southeast Rock Disposal Site
SESCP	South Embankment Seepage Collection Pond
SEZ	Southeast Zone
t	tonne(s)
tpd	tonnes per day
TSF	Tailings Storage Facility
WTP	Water Treatment Plant

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL

1.0 OBJECTIVE

This Operation, Maintenance and Surveillance Manual (OMS) is intended to fully describe and outline the personnel, infrastructure, and procedures for the Tailings Storage Facility (TSF) and related water management structures at the Mount Polley Mine.

Within this Manual are:

- Descriptions of the roles and responsibilities of the various personnel involved with the TSF and water management at Mount Polley, including their identities and contact information.
- Site Description, both the natural geography/geology and the mine infrastructure and access.
- Description of the TSF and water management infrastructure and their design.
- Operations procedures for all elements of the TSF and water management, including design and operating limitations and Quantitative Performance Objectives (QPOs).
- Maintenance procedures for the TSF and water management infrastructure.
- Surveillance activities for the TSF and water management infrastructure and systems.
- Record keeping and document control processes.
- Emergency procedures for tailings and water management.
- Incident Reporting

The main body of text is intended to form the background of the information and systems in place, with much of the detailed information contained within the appendices for ease of understanding and accessibility. In practical terms, not all information can be contained within a single source document such as this Manual. Certain, more detailed documents will be outlined and referenced by this Manual.

2.0 ROLES AND RESPONSIBILITIES

Personnel involved in the safe operation, maintenance, surveillance and supervision of the TSF and water management infrastructure are not limited to those employed by Mount Polley Mining Corporation (MPMC). According to the Health, Safety and Reclamation Code for Mines in British Columbia (*Mines Act*), the Mine Manager (General Manager [GM] in MPMC organization) shall be responsible for ensuring that the *Mines Act* is followed with respect to all aspects of the performance and management of tailings and water management structures.

Corporate responsibility for tailings management falls to the Chief Operating Officer (COO) of Imperial Metals Corporation. The COO is required to put in place the appropriate management structure and provide assurance to all parties concerned with the operation of MPMC tailings and water management facilities through proper stewardship. In addition to the MPMC employees interacting with the facilities on a first-hand basis, there is an extensive group of design professionals and regulatory representatives involved in the successful implementation of this Manual. The following text will outline the key personnel and a short description of their Roles & Responsibilities.

A full list of personnel and their roles and responsibilities can be found in Table 2-1. The reporting and communications structure can be found in

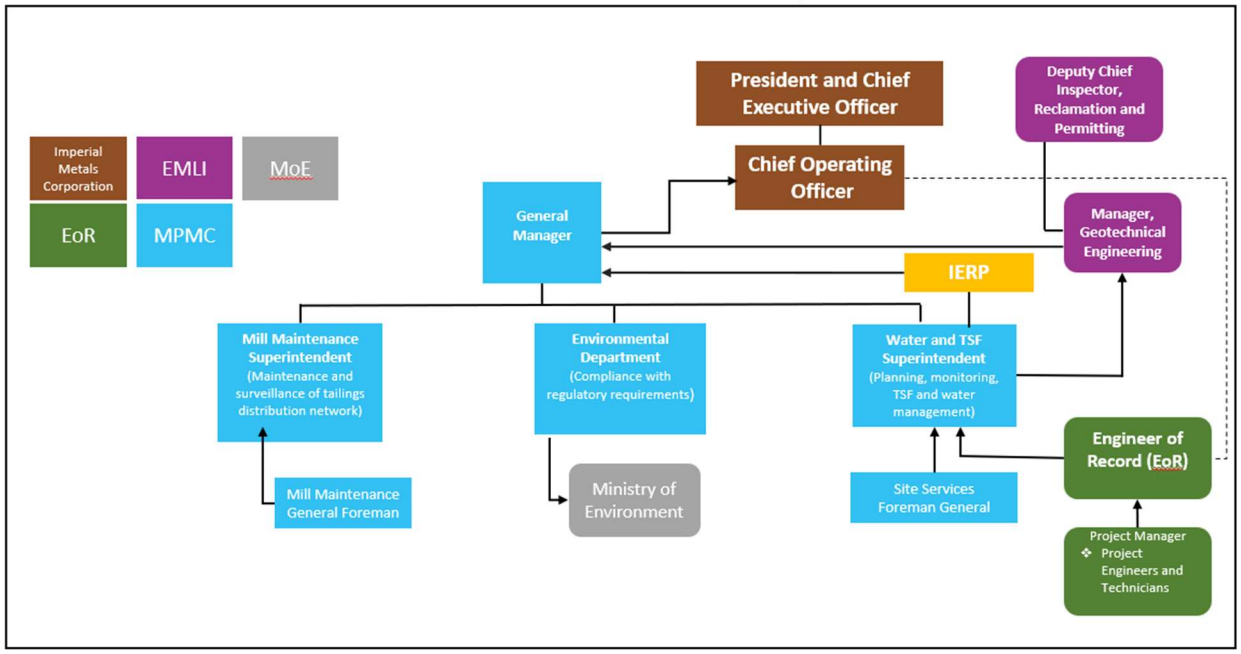

Figure 2.1.

Table 2-1 Key OMS Personnel Contact Information and Responsibilities

Title	Name	Contact Information				Responsibilities
General Manager	Kelly Parker	Home:		Cell:	250-423-8537	Responsible for the overall activities of the Mount Polley Mine, inclusive of the TSF.
		Office:	(236) 800-4771	Radio:	Channel 5	
		E-mail:	Kelly.Parker@mountpolley.com			
Water and TSF Superintendent	Matt O'Leary	Home:		Cell:	(250) 274-0658	Responsible for the planning, coordination and daily management of TSF monitoring and water management activities. Coordinates activities of the EoR, and plans for and submits required permit amendments. Responsible for updating the EPRP. Responsible for Environmental Permitting and Compliance
		Office:	(236) 317-4938	Radio:	Channel 5	
		E-mail:	Mathieu.o'leary@mountpolley.com			
Mine Operations Superintendent	Joe Grant	Home:	(250) 296-4447	Cell:	(250) 644-0975	Responsible for daily site services tasks including water infrastructor operation. Supervision of TSF construction crew
		Office:	(250) 790-2215 ext. 2108	Radio:	Channel 5	
		E-mail:	Joe.grant@MountPolley.com			
Environmental Superintendent	Designate: Matt O'Leary	Home:		Cell:	(250) 274-0658	Responible for Environmental permitting and complaince
		Office:	(236) 317-4938	Radio:	Channel 5	
		E-mail:	Mathieu.o'leary@mountpolley.com			
Mill Superintendent	Al Trottier	Home:		Cell:	(250) 267-4801	Responsible for the operation of the Mill facilities and coordination of the Mill Operations Department.
		Office:	(236) 362-1153	Radio:	Channel 2	
		E-mail:	Al.Trottier@MountPolley.com			
Corporate – President and CEO	Brian Kynoch	Home:		Cell:	(778) 836-7441	Responsible for providing appropriate resources to maintain conformance with regulatory requirements and applicable guidelines. Responsible for reporting to the Board of Directors on tailings stewardship.
		Office:	(604) 669-8959	Radio:		
		E-mail:	Brian.kynoch@ImperialMetals.com			
Corporate – COO	Randall Thompson	Home:		Cell:	(778) 895-0916	Responsible for allocation of required personnel and financial resources to ensure tailings stewardship is in conformance with regulatory requirements and applicable guidelines.
		Office:	(604) 669.8959	Radio:		
		E-mail:	Don.parsons@ImperialMetals.com			
Golder - Senior Geotechnical Engineer EoR	Germán Pizarro	Home:		Cell:	(604) 787-2166	Engineer of Record of the Mount Polley TSF
		Office:	(604) 296-2897	Radio:		
		E-mail:	German_Pizarro@Golder.com			
Ministry of Energy, Mines and Low Carbon Innovation Manager, Geotechnical Engineering	Victor Marques	Home:		Cell:		Familiar with the technical aspects as well as maintenance and inspection requirements of the TSF. Responsible for review of TSF documentation and associated Mines Act permitting.
		Office:	(778) 698-7269	Radio:		
		E-mail:	Victor.Marques@gov.bc.ca			
Ministry of Energy, Mines and Low Carbon Innovation Deputy Chief Inspector of Mines	Lowell Constable	Home:		Cell:		Required to be notified for a Level 2 and Level 3 condition
		Office:	(778) 698-7274	Radio:		
		E-mail:	Lowell.Constable@gov.bc.ca			
Ministry of Energy, Mines and Low Carbon Innovation Director - South Region	Ross Hyam	Home:		Cell:		Director - South Region
		Office:	(250) 985-0042	Radio:		
		E-mail:	Ross.Hyam@gov.bc.ca			
Ministry of Energy, Mines and Low Carbon Innovation Sr. Mines Inspector	Chris LeClair	Home:		Cell:		Sr. H&S Inspector
		Office:	(250) 312-6728	Radio:		
		E-mail:	Chris.LeClair@gov.bc.ca			
Ministry of Enviroment Section Head, Mining	Luc Lachance	Home:		Cell:		Statutory decision maker for MPMC environmental permitting
		Office:	(250) 739-8314	Radio:		
		E-mail:	Luc.Lachance@gov.bc.ca			

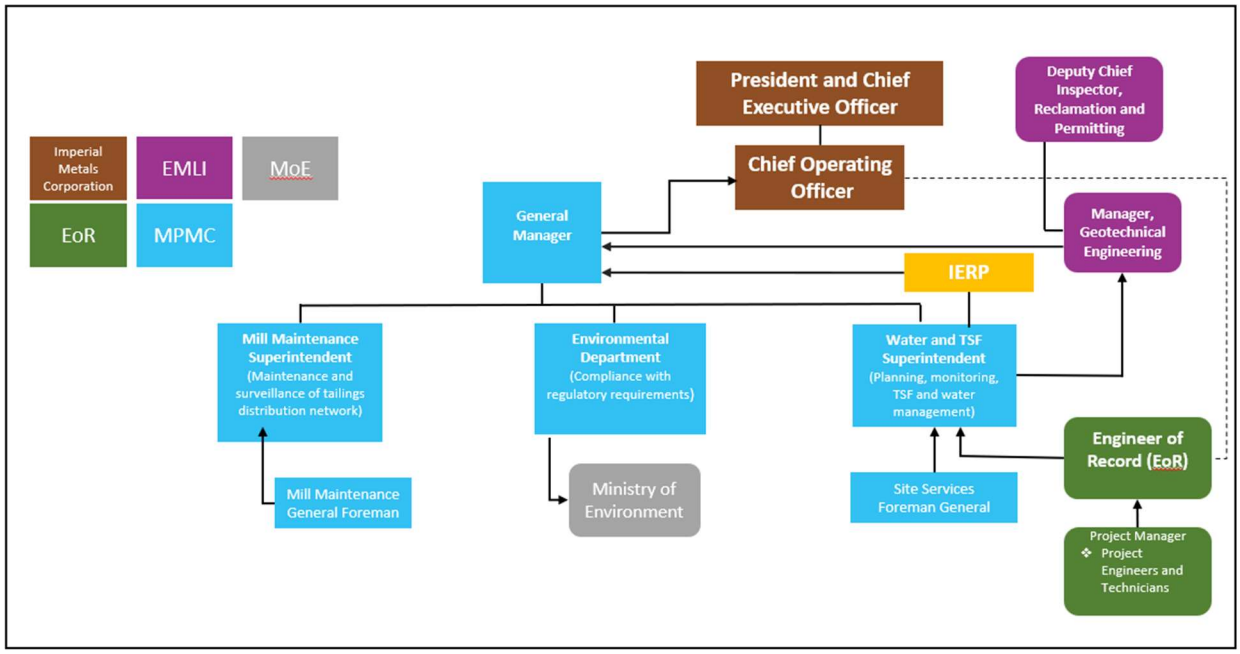

Figure 2.1 Organizational Structure

2.1 Imperial Metals Corporation

President and CEO:

- Ensures that MPMC is provided with all appropriate resources necessary to maintain conformance with all regulatory requirements and guidelines. Is also responsible for reporting to the Board of Directors regarding tailings stewardship.

Chief Operating Officer:

- Facilitates the proper allocation of personnel and financial resources in order to ensure tailings stewardship is in conformance with all regulatory requirements and guidelines. Reports to the President and CEO.

2.2 MPMC

Mine Manager (General Manager [GM]):

- Responsible for all activities occurring at the Mount Polley Mine site, inclusive of the TSF and all water management facilities, under the Mines Act. Reports to the COO.
    - Manager is ultimately responsible for the mine as per Act/Code
    - Designated under Section 21 of the Mines Act
    - Accountable for all aspects of the performance and management of Tailings and Water Retaining Structures.

- Responsible for compliance with regulatory requirements and relevant guidelines.
- Responsible to submit all compliance reports to the required regulatory agencies by the due dates.
- Defines site roles and responsibilities, authority and accountability.
- Allocates required human and financial resources.
- Reports Reportable Incidents including significant TSF or dam safety incidents to the Chief Inspector.

- In order to fulfill the Mines Act requirement of having a General Manager onsite every day, Water and TSF Superintendenta designate will be assigned when the GM is absent. The Water and TSF Superintendentdesignate will be responsible for communication directly with the General Manager and bringing them into the process as quickly as possible during an emergency or incident occurring.

Tailings Qualified Person Water and TSF Superintendent(Water and TSF Superintendent in MPMC organization):

> *"designate a TSF qualified person for safe management of the MPMC Tailings Storage Facility."*

- This includes, but is not limited to:
  - Develops and implements the tailings and water management plans for the TSFs under their supervision.
  - Coordinates the design, construction and overall management of tailings storage facilities on the site with the EoR as well as internal and external resources.
  - Develops succession plan for EoR.
  - Implements training programs for tailings and water management activities.
  - Implements the Operations, Maintenance and Surveillance Manual (OMS).
  - Provides QPOs for operational and maintenance activities for inclusion in the OMS. (Appendix I)
  - Reports to the General Manager regarding the status and performance of the Tailings Management System.

Site Services General Foreman/Supervisor

- Responsible for site maintenance activities including surveillance on dewatering/tailings pipelines as well as Water treatment plant operators and pump watch. Site Services General Foreman and Supervisor reports to Water and TSF Superintendent.

Mill Maintenance Superintendent / Mill Maintenance General Foreman

- Mill maintenance department, which deals with aspects of the operation and surveillance of the tailings distribution network to corner 5. Reports to the General Manager.

•

Environmental Department

- All activities involved in ensuring that MPMC activities remain compliant with all regulatory requirements as they pertain to the receiving environment. Reports to the General Manager or Designate.

2.3 WSP

Engineer of Record (EoR): Germán Pizarro, P. Eng

> *"The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations"*

- Is employed by WSP, a consulting company capable of providing a variety of professional engineering services regarding TSF and water management operations and surveillance.
- EoR is referenced throughout this manual, referring both to the specific individual and the organization (WSP). All communication dictated by this manual shall include the specific individual serving as EoR (Germán Pizarro, P.Eng.).
    - Is a qualified and competent engineer with experience commensurate with the consequence classification and complexity of the facility.
    - The responsibilities of the EoR must be assigned to an individual and not a firm.
    - Hold the professional responsibility for the facility design, and is responsible for evaluating the adequacy of the as-built facility relative to the design as well as applicable standards, criteria, and guidelines.
    - Report on annual Dam Safety Inspections.
    - Participates in Dam Safety Reviews.
    - Participates in risk assessments.
    - Provides Quantitative Performance Objectives and monitoring frequencies required to ensure the facility is functioning as designed for inclusion in the OMS.
    - In the event of a change of the EoR, participates in implementing the succession plan, including understanding the risks and liabilities associated with such changes and employing appropriate change management procedures.

EoR's Representatives

WSP employees who provide support in all manner of TSF design, construction, operations, maintenance and surveillance. Operate under the responsibility and authority of the EoR.

2.4 Governing Bodies

Ministry of Energy, Mines and Low Carbon Innovation (EMLI)

- Serves as the primary regulatory body for the mining industry in BC. Provides inspection services and issues the necessary operating permits on behalf of the Province regarding TSF and water management activities. Receives and coordinates the review of all designs, construction, operations and surveillance reports submitted to them.

Ministry of Environment and Climate Change (BC-ENV)

- The provincial ministry responsible for issuing effluent management permits and setting environmental standards with respect to the mining activities that have the potential to affect the receiving environment around the mine site. Provides inspection and oversight services to ensure and enforce compliance.

2.5 Independent Engineering Review Panel (IERP)

- The IERP is currently comprised of three (3) qualified experts and shall meet at a minimum annually.The objectives of the IERP are to confirm that the design and operation of the TSF is consistent with industry standards of best practice, to identify areas where risk reduction measures may be required and to provide advice that may add value to the safe operation, closure and long-term maintenance of the TSF.
    - Made up of independent subject matter experts not currently involved in or responsible for the design, operation or construction of the facility.
    - Provides an independent assessment to senior mine management and regulators whether the tailings storage facility is designed, constructed and operated appropriately, safely and effectively.
    - Provides the site team with practical guidance, perspective, experiences and standard/best practices from other operations.
    - Reviews and comments on the planning and design process, monitoring programs, data analysis methodology and work performed by site team and/or contract consultants.
    - Provides non-binding advice and guidance, but does not direct the work or perform the role of the Engineer of Record.
    - Size and make-up of the ITRB based on complexity of the tailings system, in terms of risk, consequence and disciplines of substance.

- The IERP acts only to advise MPMC and has no actual decision-making capability or responsibilities other than those listed within the Terms of Reference document (Appendix G). The IERP submits all formal communication to the GM.

3.0 COMPETENCY AND TRAINING

At the corporate level, the COO is responsible for ensuring that all individuals described within this Manual have the appropriate level of training and experience to perform their roles effectively. This is accomplished through the site GM, who is responsible under the *Mines Act* for all activities that occur at the mine site, inclusive of the TSF and water management systems.

On site, it is the responsibility of the supervisory personnel involved in the operation, maintenance and surveillance of the TSF to train individuals falling under their respective management. Competency in the various roles is provided through existing orientation and training programs and is to be administered in correspondence with the procedures existing at MPMC. Review of the applicable portions of this Manual with individual workers is the responsibility of each supervisor to whom the worker reports.

Each training session must be documented, and a record kept within the TSF partition on the mine server. The records will contain a detailed list of site activities for which the trainee was trained and be signed by the person who provided/supervised the training. The primary example of this will be the distribution of and orientation to this Manual. All individuals involved in the procedures within this Manual shall be introduced to the appropriate sections and appendices of this Manual and provided access to the relevant source documents.

4.0 MANAGING CHANGE

Over time, the physical and regulatory environment is almost certainly going to change. The embankments and water control structures will continue to be developed and the application of ever-improving Best Practices will require updates to this Manual.

Changes to the design or operating plan for the TSF and related pipelines and structures must be reviewed, approved and documented by the Water and TSF Superintendent. TSF design changes will be conducted by the EoR as required for operational or regulatory changes and submitted to MPMC for review. Changes requiring authorization under the *Mines Act* shall be submitted to EMLI by MPMC. Operational changes will be reviewed and approved by the General Manager. In all cases, documentation of the change, including as-built records, are required.

At a minimum, this Manual will be fully reviewed, updated, and distributed once per year. This shall ensure that the procedures contained within shall follow Good Practices in tailings management, are up to date and apply to the most current conditions regarding the facilities and the regulatory environment. The Manual will also be updated to reflect minor changes such as to

personnel and operating conditions. Though this may not result in a full re-issue of the Manual, all affected personnel will be updated as required.

It is the responsibility of the Water and TSF Superintendent to keep this Manual up to date, ensure it is properly distributed and accessible, and that the proper training is conducted and documented.

5.0 FACILITY DESCRIPTION

The Mount Polley Mine, operated by MPMC (a wholly owned subsidiary of Imperial Metals Corporation), is an open pit/underground copper/gold mine that is permitted to process up to 8.2M tonnes per year of ore. The mine is located in central British Columbia, 8 km southwest of the town of Likely, and 56 km (100 km by road) northeast of Williams Lake. Access to and from the mine is via road by turning east off the Cariboo Highway (97) onto the Likely Road at 150 Mile House, BC and following it for approximately 75 km to the Bootjack Forest Service Road (FSR). The Bootjack FSR leads directly to the mine parking lot after 14 km. The physical location of the mine is at 52º 33' North by 121º 38' West. See Figure 5.1.

Ore concentrates from the mine are trucked to facilities at the Port of Vancouver and then shipped to overseas smelters or transported by rail to smelters in North America. MPMC was formed in 1996, and mining activities commenced in May, 1997.

The current mine site infrastructure consists of the Mill Site, Springer Pit as the active mining area, Wight Pit for temporary storage of mine contact water and two (2) rock disposal sites (RDSs): The Southeast Rock Disposal Site (SERDS); and the Temporary Northwest (NW) Potentially-Acid Generating (PAG) Stockpile, as well as the access roads, power lines, a tailings pipeline, drainage collection systems, and sediment/seepage control ponds. The Underground, Boundary Zone Pit, the Pond Zone Pit, the Southeast Zone (SEZ) Pit, the Bell Pit, the Cariboo are not active. Back-filling of the Bell Pit and Pond Zone Pit with waste rock was completed in 2012, and the SEZ Pit was backfilled in 2013. On January 7, 2019 Imperial Metals announced the suspension of operations at MPMC commencing May 31, 2019. MPMC has entered into Care and Maintenance from May 31, 2019 to Sept 2021 and restarted operation in November 2021. Deposition of tailings into the TSF commenced on June 1, 2022 with limited mill feed during commissioning. Full mill throughput has been achieved in January 2023.

There is a magnetite processing facility on the mine site owned by MPMC. The facility uses tailings to filter and screen magnetite for resale. The facility will be operating as needed.

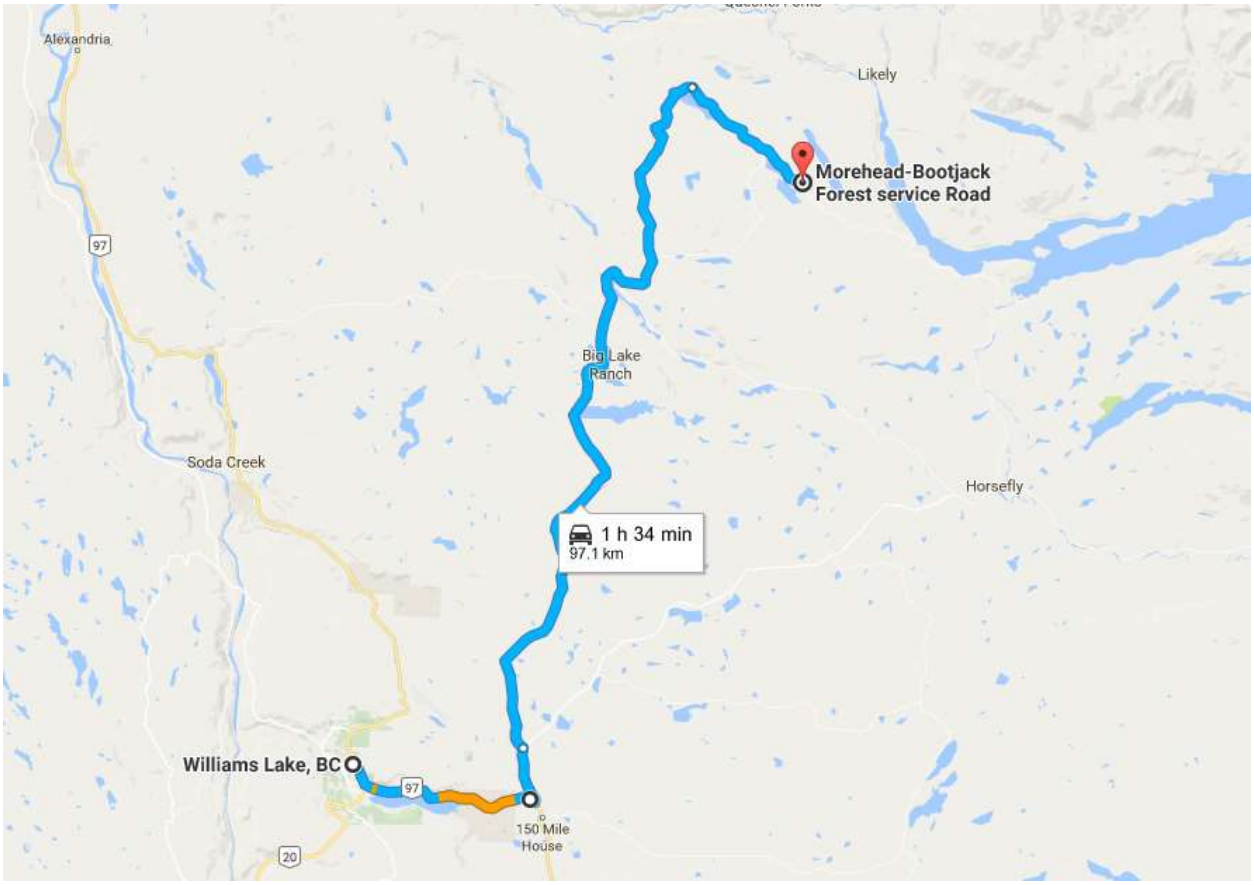

Figure 5.1 Site location and road access from Williams Lake

The TSF lies to the southeast of the mining and concentrator facilities. The Springer Pit has been partially filled with tailings and is being mined with conventional Truck/Shovel operation. Springer Pit tailings are being deposited in the SERDS Co-Disposal Tailings Facility authorized by EMLI. This facility is located on the top of the SERDS. A site aerial photograph taken in 2022 and indicating major mine components is included as Figure 5.2.

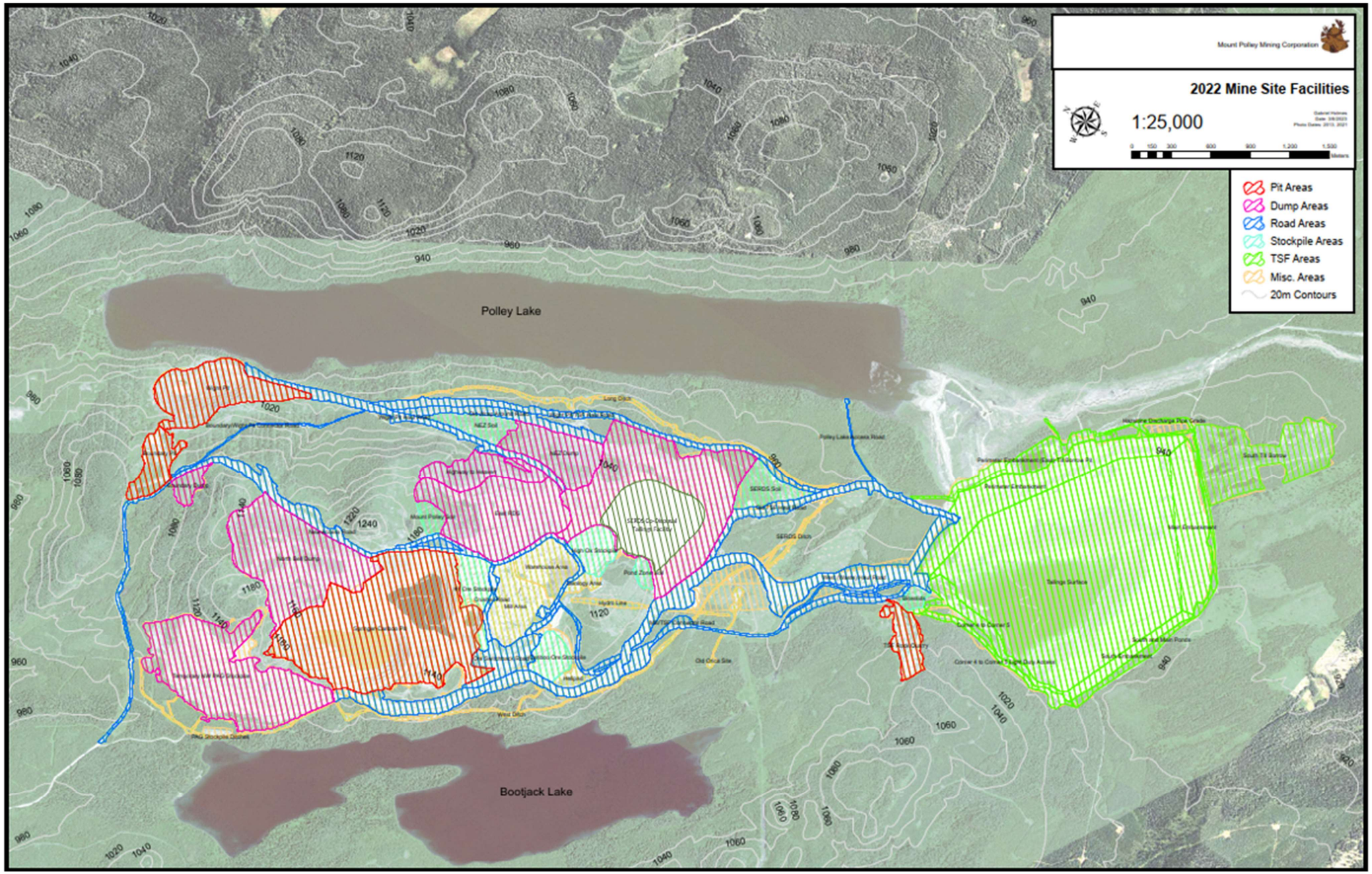

Figure 5.2 Mine Site Infrastructure

6.0 KEY TSF AND WATER MANAGEMENT COMPONENTS

All water management structures are designed in accordance with the environmental parameters as set out in the BC-ENV -issued *Environmental Management Act* (*EMA*) Permit 11678 and the EMLI-issued *Mines Act* Permit M-200.

As per clause 2.4.5 of *EMA* Permit 11678:

"Surface water control works must be provided for all areas disturbed by roads, open pits, rock disposal/storage sites, the mill site and ore storage sites. The surface water control works must be designed to convey all flows up to a 1 in 10 year 24-hour storm event and must be designed to withstand all flows up to a 1 in 200 year 24-hour storm event, without significant damage"

A formal Water Management System Review was completed in 2016, as required by condition C.2.(b) of a *Mines Act* Permit M-200 amendment from July 9, 2016 (entitled: Approving Return to Restricted Restart of Operations). The latest Water Management Plan was issued to EMLI and ENV for 2021. The Water Management System Review provides: an overview of water management planning for the Mount Polley Mine Site; an update on completed and ongoing site works; the review (and associated outcomes) of the design criteria and operational requirements of the water management system, and an outline of planned work.

The discussion is broken into the following parts:

- TSF
- West Ditch System
- Long Ditch System
- CCS, PETBP, and WTP
- Mill Site and Pit Dewatering
- Non-contact Water Ditch Systems
- Pumping and Piping

Lastly, in this section will be a sub-section referencing the various appendices and external documents which describe the tailings and water management systems in much greater detail.

6.1 TSF

The Tailings Storage Facility (TSF) at the Mount Polley Mine is located to the southeast and at lower elevation to the pits and mill site. The TSF is a constructed, (mostly) centerline embankment, currently built to a minimum crest elevation of approximately 969.6 m. At that elevation, the embankment constrains about 270° of the stored tailings, with natural ground to the west-northwest

completing the containment. Utilization of the TSF began in 1997 and served as the sole destination for mill process discharge until August 2014, when a breach of the embankment occurred. The breached embankment has since been repaired to a crest elevation of being built to the 970m in 2023.The TSF system consists of a constructed embankment, the core of which defines the boundary between the upstream and downstream elements of the facility. Upstream are the stored tailings and supernatant water, as well as the infrastructure to deposit the tailings slurry and return the supernatant water to the mill (reclaim system). Downstream are the additional structural elements including the buttress, seepage collection and pumping system to manage the seepage flows. The following subsections describe in detail the various elements of the TSF.

6.1.1 Construction History

The design and construction monitoring of the TSF embankments through 2010 was completed under the direction of Knight Piésold Ltd. (KP). AMEC Environment & Infrastructure (AMEC), now John Wood Group, assumed the role of EoR for the TSF on January 28, 2011. WSP assumed the role in November 2014, with Terry Eldridge, P.Eng. and on February 4, 2019, with Germán Pizarro, P.Eng.

The overall embankment has incorporated a staged expansion design utilizing a modified centerline construction methodology up to elevation 963.5 m, at which point it became centreline construction. The embankments were approaching elevation of 970 m when the Perimeter Embankment breach occurred.

The breach of the Perimeter Embankment occurred on August 4, 2014. The width of the breach was about 100 m, and overall damage occurred to about 400 m of the Perimeter Embankment.

The 2015 Freshet Embankment was built across the breach to manage the 2015 spring freshet and prevent any further uncontrolled release of water and/or tailings from the TSF. The 2015 Freshet Embankment consists of cement-soil-bentonite cut-off wall constructed within a granular core and supported by a wide rockfill embankment.

Significant buttressing of the Main Embankment and Perimeter Embankment was also completed to increase the factor of safety of the existing facility. The buttressing has been incorporated into the current design.

On June 23, 2016, MPMC received an amendment to *Mines Act* Permit M-200 authorizing the continued repair and construction of the TSF to elevation 970 m, as well as the return to use of the TSF facility for tailings and water management. The permitted works are based on the design report: *Mount Polley Mine Tailings Storage Facility Detailed Design to Elevation 970 m* as issued by WSP on November 3, 2015.

Construction of the Corner 1 buttress was completed in 2019 prior to Care and Maintenance. The 2022 construction consisted consists of:

- Testing filter and transition material on all embankments to ensure spec is achieved. Replace material as needed.
- Removing the rockfill material at corner 1
- Raise all embankments to 970m elevation as per design

The construction season of 2023construction was a continuous of 2022 by raising all zones to the 970m elevation

6.1.2 Embankment

The TSF comprises one (1) overall embankment that is approximately 4.5 km long. The embankment, based upon original, separate embankments, is subdivided into three (3) sections: The Perimeter, Main, and South Embankments, going clockwise starting from the NW abutment. Heights vary along the embankment and are approximately 40 m, 58 m, and 32 m respectively (based upon the Perimeter, Main and South nomenclature). Crest elevations of the embankment are between 969.6 m and 970 m.

Structurally, the embankments generally follow that of a typical low permeability core centerline dam. A till core provides the low permeability structure, with downstream filter and transition zones meant to protect the core from internal erosion and conduct any seepage water quickly to the toe of the embankment. Downstream of the filter and transition zones is the rockfill portion of the embankment and buttress. Upstream of the core is the upstream structural component, which varies from rockfill, discharged tailings, and constructed sand cell tailings along the embankment.

6.1.3 Breach

On August 4, 2014, a breach of the Perimeter Embankment occurred near station 4+300, releasing tailings, embankment material, and water. Subsequent investigative works determined that the primary cause was structural failure of the foundation along a Glaciolacustrine Unit (GLU). The large volume of water impounded in the TSF at the time exacerbated the resulting embankment damage and release of stored materials.

The width of the breach was about 100 m and overall damage occurred to about 400 m of the Perimeter Embankment. Soon after the breach, the Temporary Upstream Rockfill Berm was constructed within the TSF to contain any further release of water and mine waste. Once this berm was constructed, the investigation as to the cause of the breach and subsequent cleanup and repair work commenced.

Repair began in November 2014 with the construction of the Freshet Embankment. After the breach area investigation and footprint cleanup work was completed, an engineered rockfill was emplaced to completely replace the missing portion of the embankment to elevation 950 m. Once this was completed, a specialized, rig-based tool system (a cutter-soil mixer) was brought in that systematically reworked a portion of the fill into a low permeability plastic concrete barrier. This effectively reconnected the low permeability element of the embankment (till core) across the breach area and facilitated the storage of water in the TSF.

The next stage of repair involved the planning and design of a full reconstruction of the breach area, followed by submission to the EMLI for an amendment to *Mines Act* Permit M-200 allowing the return to the TSF for ongoing tailings storage. The amendment was granted in June, 2016. Construction activities in this area resumed soon after. Construction has been carried out in stages.

As a part of reconstruction, a rock drain was installed upstream of the breach repair at approx. elevation of 950m. This drain is connected to a system of pipes, which run across the core of the

embankment and connect to a single discharge pipe, which conveys the water to the ditch system upstream of the PETBP. This is intended to promote consolidation of the tailings and unsaturated tailings conditions in the beach above and around the drain and reduce the hydraulic head applied to the cut-off wall and core in this area.

6.1.4 Buttresses

The investigations within the breach area and along the extents of the Main and Perimeter Embankments identified glaciolacustrine soil layers in some areas that control the stability of the embankments. The foundation failure at Corner 1 was primarily due to units of this material, with the path of failure going through this material. To fully repair the embankment and return the otherwise unaffected portions of the embankment to use, buttressing was determined to be necessary.

Buttresses have been installed along the Perimeter and Main Embankments. Construction of these buttresses was completed in 2016 to provide stability for the final 970 m elevation configuration of the TSF.

The buttress at Corner 1 was completed for the 970 m TSF configuration in 2019.

6.1.5 Downstream

All mine-influenced (contact) water at the Mount Polley Mine must be collected and directed to the appropriate location. Over time, the TSF will convey contact water to the downstream area by way of seepage through the embankment and upstream drains and via precipitation falling directly onto the embankment downstream of the core. To intercept and collect this water, MPMC has constructed ditching systems and collection ponds at the base of the embankment.

The Main Embankment Seepage Collection Pond (MESCP) and South Embankment Seepage Collection Pond (SESCP) are located at the downstream toe of the Main Embankment and South Embankment, respectively. The ponds collect water from the toe and foundation embankment drains as well as local runoff. The SESCP is dewatered by a single 8.8 hp Grindex pump (run off a generator), pumping through 6” pipe into an open gravity-flow ditch reporting to the MESCP. The MESCP is dewatered by two (2) 200 hp 3-stage Peerless pumps (run off grid power), pumping through a single12” HDPE pipe to the TSF. There is an additional 12” HDPE pipe at the MESCP as contingency if the primary HPDE is plugged with ice. Additional pumps are on standby in case of emergency such as high precipitation or snowmelt event.

Based on site water management objectives, the MESCP is used as feed water for TSF dust control sprinklers.

Downstream of the Perimeter Embankment, from west to east, are the Central Collection Sump (CCS), and the Perimeter Embankment Till Borrow Pond (PETBP). In addition to collecting seepage water directly from the embankment, these ponds are also an integral part of the overall

site water management strategy. They will be further described later in this section after the description of the two main ditching systems.

6.1.6 Upstream

The settled tailings and reclaim pond, the tailings discharge piping system and the reclaim pumping and piping systems are located upstream of the embankment core. During operation, tailings slurry is discharged onto the TSF from 24" lines at locations based on the beach development plan. The coarsest fraction settles out of the slurry first, forming the beach, and the remaining water and finer material report to the reclaim pond for further settling and clarification.

The reclaim pond contains the reclaim barge and the beginning of the reclaim piping system. Water from the pond is pumped to the PETBP (via the Booster Station) and water treatment plant for discharge off site.

Clean water upstream and to the west of the TSF is directed away from the facility by the TSF clean water diversion ditch into a small wetland below the South Embankment, which discharges to the natural environment.

6.2 West Ditch System

The West Ditch System collects water between the west side of the Mount Polley Mine Site and Bootjack Lake. The West Ditch System spans from the Temporary Northwest (NW) PAG Stockpile to the SERDS Sump. Mine site geometry does not allow for a continuous, open-flow ditch through this distance, so the system comprises a series of ditches and sumps, which are progressively pumped into one another progressing downstream. The system consists of the following components, described from upstream to downstream:

6.2.1 Junction Zone Ditch and Junction Zone Seepage Sump

The Junction Zone Ditch has two (2) branches; one (1) of which is now partially buried by the Temporary NW PAG Stockpile and one (1) that remains out of the Temporary NW PAG Stockpile footprint. Of the 'buried' branch, 200 m of ditch remains exposed. For the second, 'exposed', branch, the ditch is 680 m in length with an average grade of 4%. Flows from the Junction Zone Ditch report to the 9K Sump by open-ditch gravity flow.

The Junction Zone Ditch also conveys water from the Junction Zone Seepage Sump. The Junction Zone Seepage Sump has two (2) 120V, pumps (running off grid power) installed and pumping into a double 2" line to the Junction Ditch.

6.2.2 9K Sump and Ditch System

The 9K Sump collects water from the Junction Zone Ditch and localized runoff from the west side of the Temporary NW PAG Stockpile through open-ditch gravity flow in the 9K Sump Ditch. The

9K Sump Ditch is 290 m long with an average grade of 5%. The 9K Sump has two (2) 50 hp low head, high volume, Flygt pumps (running off grid power) installed and pumping into a single 12" line, 480 m in length, to the NW PAG Sump.

6.2.3 NW PAG Sump and Ditch System

Two (2) open-flow ditches run parallel to the toe of the Temporary NW PAG Stockpile dump at an (approximate) 50 m offset. The upper ditch, flowing southwest, is partially buried, with 725 m of ditch remaining exposed at an average grade of 7%, and this flows into the NW Sump.

There are 2 pumping options for the NW PAG Sump utilizing two (2) 75 hp 2-stage Peerless pumps which running off grid power. The primary option is to pump from the NW PAG Sump to the gravity feed portion of the north branch of Mine Drainage Creek Ditch (an additional 150 m through existing 12" line), The second option is to pump into a 12" line, 850 m in length, to the Springer Pit.

6.2.4 Mine Drainage Creek Sump and Ditch System

The Mine Drainage Creek Ditch System runs along the west side of the West Haul Road and collects water through open-ditch gravity flow as well as, at times, pumped flow from the NW Sump. The north (flowing southeast) and south (flowing northwest) branches of the Mine Drainage Creek Ditch collect in Mine Drainage Creek Sump, which is situated in the low topography between the two (2) ditches. Water captured in the Mine Drainage Creek Sump is pumped up the south branch of the Mine Drainage Creek Ditch and into the gravity feed portion of the Lower West Ditch.

The north reach of Mine Drainage Creek Ditch is 1,160 m in length with an average grade of 4%. The south reach of Mine Drainage Creek Ditch is 400 m in length with an average grade of 5%. The Mine Drainage Creek Sump has two (2) 140 hp high head Flygt pumps installed (running off grid power). One (1) 140 hp low head, high volume, Flygt pump installed has the capability of pumping through a 16" line, 568 m in length, to the Lower West Ditch and a second 16" backup line, to the Lower West Ditch, 630 m in length, is also installed.

6.2.5 Lower West Ditch

The Lower West Ditch is a 575 m long open-flow rock-armored gravity ditch, which collects water along the south side of the West Haul Road. It has an average grade of 4%, and feeds into four (4) 24" HDPE pipes that convey water under the TSF light vehicle road and into the SERDS Ditch. An overflow structure has also been constructed at this location such that, if the four (4) 24" HDPE pipes were to be overwhelmed, overflowing water would be conveyed over the TSF light vehicle road and into the SERDS Ditch.

6.2.6 Orica Ditch

The Orica Ditch runs west-east and collects water flowing below (south) of the old Orica explosive storage site. Water is conveyed to the SERDS Ditch via open-ditch gravity flow (and French drain under the heavy-duty Tailings Access Road). The ditch is a 725 m long open-flow gravity ditch with an average grade of 1%.

6.2.7 Bootjack Creek Sump

Bootjack Creek Sump collects water from the east side of the Tailings Access Road and pumps it via pipeline to the SERDS Ditch. The sump has one (1) 50 hp high head Flygt pump installed (running off grid power) and pumping into a 10" line, 120 m in length, to the SERDS Ditch.

6.2.8 SERDS Ditch

The Lower West Ditch, Orica Ditch and Bootjack Creek Sump all feed into the SERDS Ditch. The SERDS Ditch is a 1,475m long open-flow rock-armored gravity ditch with an average grade of 3.5% that feeds into the SERDS Sump. The SERDS Ditch is conveyed under the heavy-duty Tailings Access Road by three (3) 24" HDPE pipes. An overflow structure has also been constructed at this location such that, if the three (3) 24" HDPE pipes were to be overwhelmed, an overflow structure is constructed such that additional water would be conveyed to the Orica Ditch.

6.2.9 SERDS Sump

The SERDS Sump is located adjacent (across the haul road) from the Long Ditch Sump. The sump is 25 m wide by 60 m long and averages 1 m deep, collecting water at the terminus of the SERDS Ditch (also the terminus of the West Ditch System). 590 m of 30" HDPE pipe with an overall grade of 2.2% carries water over Bootjack Creek and into the CCS. An overflow system consisting of a 24" HDPE pipe is installed that reports to the Lower Long Ditch Sump. An overflow structure has also been constructed at this location such that, if the 30" HDPE pipe and 24" HDPE pipe were to be overwhelmed, overflowing water would be conveyed over the road to the Upper Long Ditch Sump.

The general layout of the West Ditch System can be seen in Figure 6.1. Additional information is contained in the *Water Management Inspection Manual* (Appendix C).

6.3 Long Ditch System

The Long Ditch system collects water between the east side of the Mount Polley Mine Site and Polley Lake. The Long Ditch spans from below the site access (Bootjack) road to the Long Ditch Sump. As with the West Ditch System, the Long Ditch System is composed of a series of open ditches and pumped out sumps that progressively convey the water it collects to the CCS. The system consists of the following components:

6.3.1 Joe's Creek Coffer Dam and Pipe

Joe's Creek collects seepage from the North Bell Dump and consists of a sump and dam system with a secondary overflow sump constructed and fed by a buried culvert from the first sump to the second. Both sumps feed into a 1,400 m 12" HDPE pipe that carries the water to the start of the Long Ditch and can also be directed to the Wight Pit based on site water management objective.

6.3.2 Wight Pit Dewatering

Wight Pit is ultizaed as temporary mine contact water storage and has a capacity of 3.5M m^3. Water is pumped by a barge into a Booster Tank containing two (2) 140hp Flygt 2400MT pumps. From Booster water is pumped by a 12" HDPE/steel pipe to the Long Ditch. There is also a valve located to convey water into the NEZ Booster tank to pump Wight Pit water to the mill for processing.

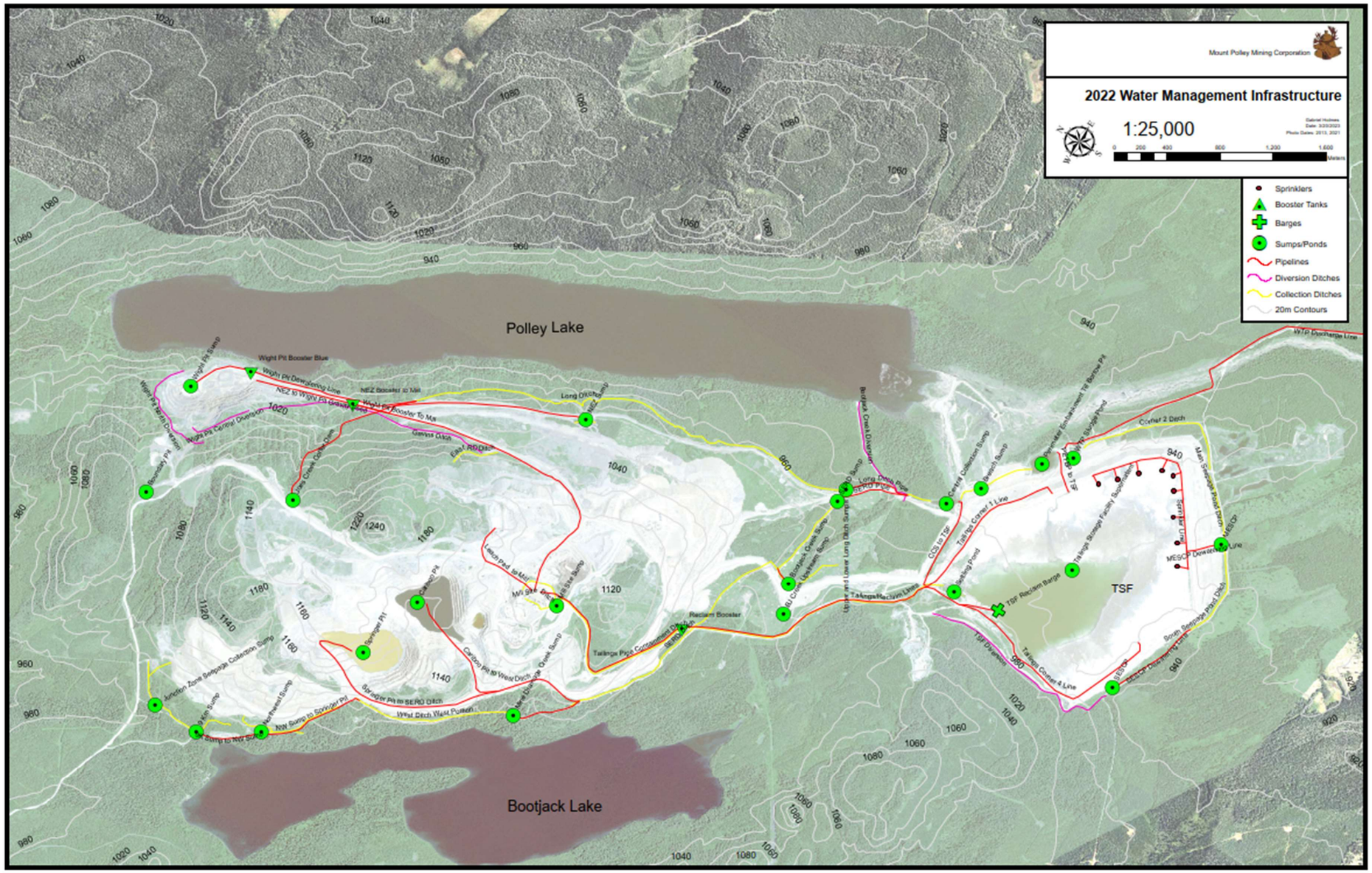
Mount Polley Mining Corporation
2022 Water Management Infrastructure
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Sprinklers
Booster Tanks
Barges
Sumps/Ponds
Pipelines
Diversion Ditches
Collection Ditches
20m Contours
Polley Lake
Bootjack Lake
TSF
WTP Discharge Line
Wight Pit Booster Blue
Wight Pit Dewatering Line
NEZ Booster to Mill
Wight Pit Booster To Mill
Wight Pit Sump
Wight Pit Carrier Diversion
Boundary Pit
Long Ditch Pump
Long Ditch Ridge
Bootjack Creek Ditch
Bootjack Creek Sump
Bootjack Creek Diversion
Bootjack Creek Diversion Sump
Bootjack Creek Collection Sump
Bootjack Creek Dam
Bootjack Creek Diversion Dam
Dewatering Embankment Till Borrow Pit
Wight Sludge Pond
Confluence 2 Ditch
Main Seepage Pond Ditch
MSCP
MSCP Downstream Line
Seepage Line
Tailings Storage Facility Supervision
Tailings Storage Facility Instrumentation
TSF Reclaim Barge
Tailings Corner 1 Line
Tailings Corner 4 Line
Tailings Receiving Lines
CCD to TSF
Seeding Pond
TSF Diversion
South Seepage Pond Ditch
SERO Ditch
SERO Pump
Reclaim Booster
Tailings Pipe Containment Ditch
Carbon Pit
Carbon Pit to West Ditch
Springer Pit
Springer Pit to SERO Ditch
West Ditch Wash Pumps
Mine Discharge
Quick Sump
Leach Pad to Mill
Mill Side Booster
Mill Side Sump
Junction Zone Seepage Collection Sump
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NW Sump to Springer Pit
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6.3.3 The Long Ditch

The Long Ditch is an open-ditch gravity flow system that runs along the east side of the Mount Polley Mine Site between the disturbance footprint and Polley Lake. The Long Ditch itself runs from the Wight Pit Haul Road to the Upper Long Ditch Sump. After receiving water from Joe's Creek Pipe and the Wight Pit (if directed there), the Long Ditch intercepts various surface and rock disposal sites runoff via an open-ditch gravity flow system before being collected in the Upper Long Ditch Sump.

The ditch is 3,650 m in length with an average grade of 0.9%.

6.3.4 NEZ Sump

The Northeast zone (NEZ) sump (which is located near seep 2) collects mine contact water from NEZ Seep 1 and NEZ Seep 2. These seeps have been identified as having high levels of dissolved copper levels. The seeps collect into a 24" gravity feed pipeline that conveys the water to the a booster station located on the Wight Pit ramp. From this location, the NEZ seeps water can be pumped to the mill for treatment or gravity flow to the Wight Pit sump via an open ditch along the highwall of the ramp. Water from the Wight Pit booster can also be directed into this tank as needed.

6.3.5 The Upper Long Ditch Sump

The Upper Long Ditch Sump collects water from the Long Ditch. At the end of the Long Ditch, prior to entering the sump, water is directed into a 610 m long 30" gravity-flow pipe conveying water to the CCS (over Bootjack Creek). Average pipe grade is 1.3%. An overflow structure is installed in the Upper Long Ditch Sump such that any overflow will report to the Lower Long Ditch Sump.

6.3.6 The Lower Long Ditch Sump

The Lower Long Ditch Sump is designed to convey overflow from the SERDS Sump and the Upper Long Ditch Sump. This back-up system consists of a gravity-fed 500 m, 22" HDPE pipe with an average grade of 2.1% reporting to the CCS (over Bootjack Creek) and also provides infrastructure for tie-in for mechanical pumping assistance (to supplement gravity-flow systems).

The components of the Long Ditch System can be seen in Figure 6.1. Additional information is contained in the *Water Management Inspection Manual*.

6.4 CCS, PETBP and WTP

6.4.1 The Central Collection Sump (CCS):

The CCS is at the confluence of the West Ditch and Long Ditch systems and receives water from these two systems as well as local runoff that reports directly to it. The CCS serves as a distribution

facility for the waters that report to it. Depending on water management needs, water from the CCS may be pumped into the TSF via diesel pump or allowed to overflow into the PETBP (via culvert under the Postage stamp) for discharge through the WTP.

6.4.2 Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP is immediately downstream of the Perimeter Embankment and receives direct flow from the immediate area through precipitation and seepage. It serves primarily as a storage area for the various ditching systems, with overflow coming from the CCS. Total available volume within the PETBP is approximately 190,000 m^3. The PETBP also serves as the sump for the WTP.

Two electrical pumps are in place using levels to pump from the PETBP to the TSF as contingency if:

1. Water level in the PETBP increases due to large inflow of water (rain events, etc)
2. WTP is shutdown

6.4.3 Water Treatment Plant (WTP)

The WTP consists of a Veolia Actiflo® ACP-650 unit and associated infrastructure. The plant receives mine-influenced water, treats it, and discharges the treated water through a 7 km 24'' HDPE pipeline into Quesnel Lake. 'Sludge' from the WTP reports to settling ponds and is pumped to the TSF. Overflow reports to the PETBP. The primary source of input water for the WTP is the PETBP.

The WTP may be passively operated should water meet full discharge requirements and written authorization is given from the ministry. Such water would flow through the plant without the addition of reagents or operation of the mechanical components of the facility.

Additional information is contained in the *Water Management Inspection Manual*.

The WTP will be operated to maintain the TSF pond size within the normal operating range as defined by the QPOs (Appendix I). Careful planning is required to ensure volume does not exceed the QPO. This may include using the Wight Pit to temporarily hold surplus water.

6.5 Mill Site Dewatering

The mill site and shops are situated in a local low area, with associated runoff and drainage reporting to the Mill Site Ditch system. The 270 m long Mill Site Ditch runs around the northeast side of the Mill Site starting at the wash bay and flows into the Mill site sump. Water from the Mill Site Sump is pumped into the tailings deposition line. Drainage on the west side of the mill is directed into the Mill basement and pumped into the tailings box then conveyed into the tailings deposition line.

6.6 Clean Water Ditch and Sump Systems

Wherever possible, clean (non-mine-influenced) water is kept separate from mine-influenced water and conveyed to the receiving environment surrounding the mine site.

6.6.1 Site Access Road

Clean water to the north and east of the Mount Polley Mine Site is controlled by a series of under-road culverts and roadside ditching along the Site Access Road to ensure that water reports to natural receiving environments.

6.6.2 Joe's Creek (Clean Water) aka North Dump Creek

Mine-influenced water in this system is collected through the aforementioned dam and buried pipe system at Joe's Creek (Section 6.3.1). Clean water collected below this point flows through an existing drainage towards Polley Lake (North Dump Creek); a culvert carrying it under the Wight Pit Haul Road.

6.6.3 TSF Clean Water Ditch (Corner 5 to Corner 4)

Clean water upstream and to the west of the TSF is directed away from the facility and into a small wetland below the South Embankment.

6.6.4 Bootjack Creek

Bootjack Creek is a natural creek running west-to-east along the southern half of the Mount Polley Mine Site. Bootjack Lake previously flowed into Bootjack Creek, but no longer does due to the construction of a dam (prior to work by MPMC). Bootjack Creek is crossed by mine infrastructure at three (3) locations: the TSF light vehicle road, the heavy-duty Tailings Access Road, and a heavy-duty access along the old TSF haul road. Bootjack Creek flows into Polley Lake.

6.6.5 Gavin's Ditch and Sump System

A ditch and sump system to stop water from entering the Wight Pit Haul Road and direct it into natural receiving environments via the North Dump Creek capture clean water to the north and northwest of the Wight Pit Haul Road, from the Highway to Heaven Dump to North Dump Creek.

6.7 Major Piping and Pumping Systems

There are numerous piping and pumping systems at the Mount Polley Mine, which are utilized to meet water management goals. Many of them are quite simple, involving small pumps and small diameter HDPE pipe conveying water from one small sump to another location. These small systems are sufficiently described under their respective area titles in previous sections. This section will focus on the major pumping and piping systems, namely the Tailings Distribution

Lines and the Reclaim Pumps and Line. See Figure 6.2 for a layout of the major pumping and piping systems; TSF Discharge and Reclaim.

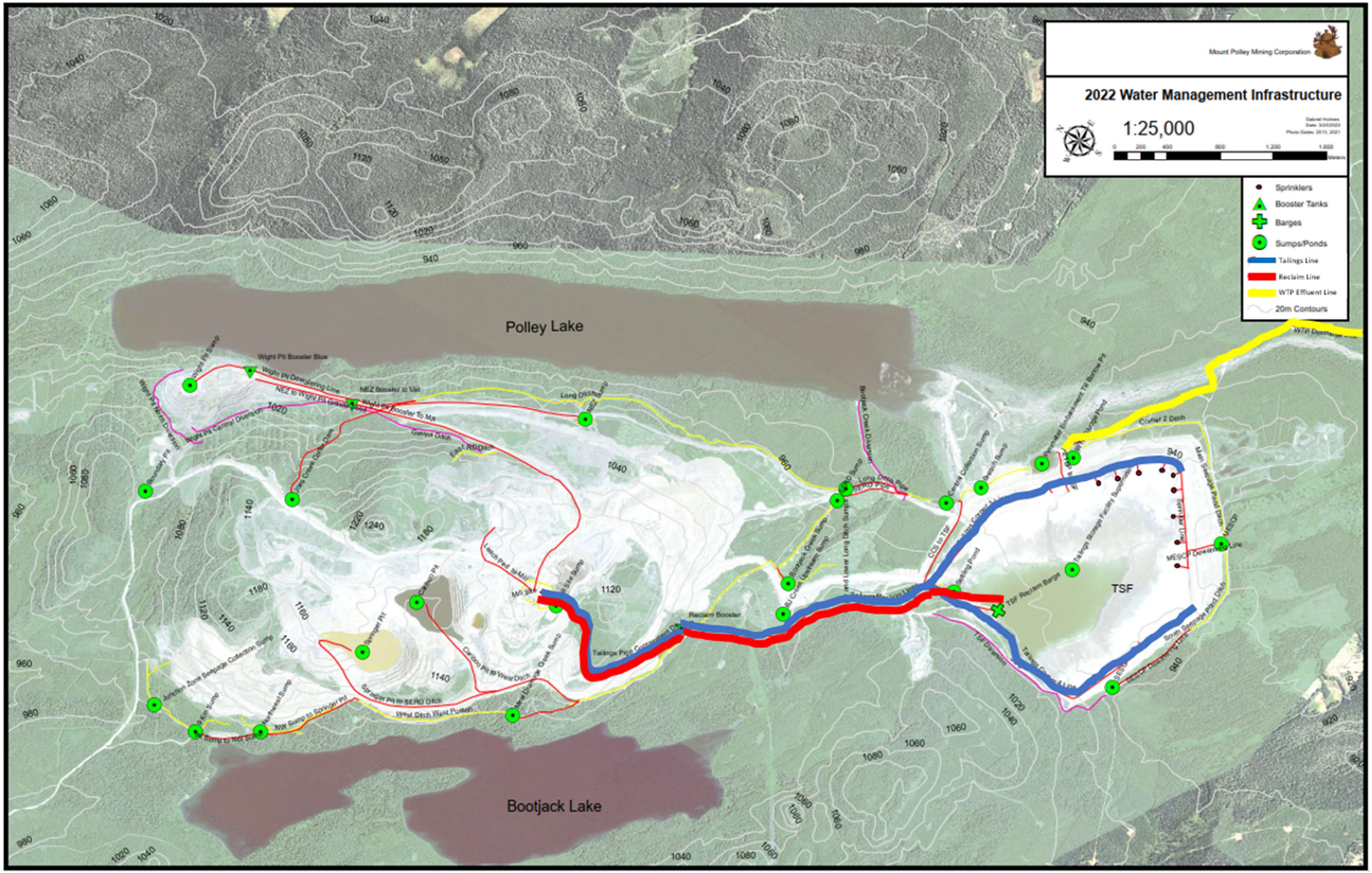

Figure 6.2 Major Pumping and Piping Systems Layout

6.7.1 Tailings Distribution Line

The Mill Tailings Distribution line is approximately 7,000m, 24" HDPE line sits within a containment ditch until just before entering onto the TSF. This ditch is meant to contain any potential spill. At the access onto the TSF, the CCS acts as the receiving structure should the tailings line develop a leak. On the embankment, the tailings line will be positioned just upstream of the core so as to deliver tailings to the areas that require beach development according to the deposition planning.

6.7.2 Reclaim Pumping and Piping System

Primary pumping occurs from a floating barge situated within the TSF Reclaim Pond, which outflows into a 24" HDPE pipe that extends to the Booster Station. Water pumped from the reclaim pond is deposited into a sump at the Booster Station. From the booster station, the reclaim water can be pumped to the mill for operations.

The reclaim line route follows that of the tailings distribution line from just above the TSF until the Booster Station. Any potential leakage of the reclaim line from the TSF to the Booster Station will be contained within the ditching systems or flow back into the TSF.

The pumping systems at the Reclaim Barge and Booster Station have been built-for-purpose by an offsite manufacturer. The Reclaim Barge system consists of four 250 hp vertical turbine Peerless pumps, and the Booster Station consists of five 250 hp vertical turbine pumps. More specific detail into both systems can be found in the information packages provided by the manufacturer, which are kept with the Mill Maintenance Superintendent and the Electrical Superintendent. Both pumping systems are connected to grid power and under the direct operational control of the mill, which monitors their operation in the Mill Control Room.

6.8 Reference Materials

There exists a great deal of documentation on the various TSF and water management systems described in this Manual. These documents can describe the design, operations, and regulatory permitting in much more detail than can be practically included in this Manual. Table 6.1 lists a few of the more frequently referenced documents in this Manual. Hard copies of these and additional reports are kept onsite in the Technical Services area of the main office on site at the Mount Polley Mine. Permit amendments are kept in digital format and distribution is limited due to some material being of a confidential nature. Finally, the procedural manuals are kept onsite and used regularly by Mine Technical Services department personnel. A copy of the *Water Management Inspection Manual* is included in this manual as Appendix C.

Table 6.1 Primary Resource Documents for Tailings & Water Management.

Reference Materials for Tailings and Water Management		
Document	Date	Comment
TSF		
Golder		
Tailings Storage Facility Detailed Design to elevation 970 m.	November 3, 2015	Detailed design of TSF to 970, including operational guidelines
Elevation 970 m Embankment Stability Analysis and Buttress Design	July 10, 2015	Detailed design for the Buttressing requirements for the 2015 TSF configuration
2015 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	January 5, 2016	Annual Facilities inspection performed by the EoR.
2016 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 9, 2017	Annual Facilities inspection performed by the EoR.
Mount Polley Mine Water Management Plan. Appendix B: Operations and Closure - Mount Polley Mine Water Balance	October 17, 2016	Mount Polley Mine Water Balance. Remaining document pertains to an outstanding permit amendment application.
Tailings Storage Facility Detailed Design to elevation 970 m Update	April 25, 2017	Detailed design update for TSF to 970 m including operational guidelines
SRK Dam safety Review for Tailings Storage Facility Embankment	April 4, 2017	Detailed safety evaluation of the TSF performance by a qualified engineer
2017 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	Q1 2018	Annual Facilities inspection performed by the EoR.
2018 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 27, 2019	Annual Facilities inspection performed by the EoR.
2019 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 23, 2020	Annual Facilities inspection performed by the EoR.
2020 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2021	Annual Facilities inspection performed by the EoR.
2021 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2022	Annual Facilities inspection performed by the EoR.
2022 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2023	Annual Facilities inspection performed by the EoR.
MPMC		
Water Management Inspection Manual	May 23, 2019	Inspection manual for onsite water management personnel. Detailed maps and pictures of various elements of the water management system. Inspection checklists. Reviewed annually
Site Water Management Plan (M-200)	March 30, 2021	2020 Water Management plan as per M-200 permit condition D.4.(a)
EMLI		
Approving Return to Full Operations and Use of Tailings Storage Facility	June 23, 2016	M-200 amendment covering the repair of and resumption of tailings discharge into the TSF.
Approving Main Embankment Buttress	October 22, 2015	Initial approval of the Main Embankment Buttress Design and Construction
Amalgamted M-200 Permit	December 20, 2020	M-200 permit with all amendments combined
M-200 Permit Update	May 3, 2023	IM-200 with SERDS Co-Disposal Authorization
BC-ENV		
PE 11678 Amendment (Hazeltine Creek Discharge)	February 1, 2020	MOE Permit amendment authorizing the tailings and water management activities into the Springer Pit.
PE 11678 Amendment (Hazeltine Creek Discharge)	December 31, 2020	Incorporates Sept 2020 consent order into 11678 permit
PE 11678 Amendment (Hazeltine Creek Discharge)	December 1, 2022	Interim Extension of Quesnel Lake Discharge

7.0 OPERATIONS

This section is meant to outline and describe the operational protocols for the TSF and water management systems. All systems are designed to handle the tailings and site water management conditions that MPMC will expect to see throughout the remaining mine life as well as to adhere to the most up to date regulatory permits from EMLI and BC-ENV.

It should be expected that the systems would evolve over time to accommodate additional information, site knowledge, the pursuit of Good Practices, and all regulatory changes that may occur. Necessary updates, including the annual review, shall be performed to keep this section current.

The following operations description will be presented in three sub-sections:

- Tailings Deposition and TSF Operations
- Site Water Management
- Flood Management

7.1 Tailings Deposition and TSF Operations

The TSF serves MPMC as the facility for storing tailings and supernatant water, as well as the temporary storage of site water pumped into it and rainfall that reports directly to it. Care must be taken to ensure that safe operations are maintained, and that the following primary storage conditions are met: QPO's were updated in Sept 2023 and TSF Water Management summarized below in Figure 7.1.

Normal Operating Pond Storage Volume	Inspection frequency	Once per week	Estimated based on storage curve determined from most recent topographic and bathymetric surveys. Surveys are to be completed a minimum of two times per year (spring and fall). The majority of water inflows to the TSF are pumped and therefore the pond volume is in the direct control of the operator; however, temporary detention of large runoff volumes in the TSF is required and the pond volume can increase above 1.7 million m^3 during large freshet events (e.g., about 2.1 million m^3 during a 1 in 10 year freshet event; about 3.5 million m^3 during a 1 in 200 year freshet event [Golder 2015]).
	Minimum	1.5 million m^3	Target provided by MPMC to allow reclaiming water for operation of the mill. Aimed to allow for an approximate 4 m deep pond at the barge location.
	Maximum	1.7 million m^3	To limit storage of water in the TSF.
Freeboard	Inspection frequency	Once per week	Difference in elevation between the pond and the lowest completed section along the crest of the embankment.
	Normal Operating Zone	≥ 1.1 m	Inflow design flood (IDF) based on the probable maximum precipitation (PMP) 72-hour event. Golder (2017).
	Concern Zone	1.0 to 1.1 m	Stop all pumps pumping water into the TSF. Increase monitoring frequency of freeboard and beach width, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, and increase pumping from TSF to other facilities.
	Buffer Zone	0.8 to 1.0 m	Stop all pumps pumping water into the TSF. Increase monitoring frequency of freeboard, beach width, piezometers and seepage rate/turbidity, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, and maximize pumping from TSF to other facilities.
	Unsafe or Out of Compliance Operating Zone	< 0.8 m	Stop all pumps pumping water into the TSF. Stop slurry deposition into the TSF Increase monitoring frequency of freeboard, beach width, piezometers and seepage rate/turbidity, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, maximize pumping from TSF to other facilities.

Figure 7.1 2023 QPO – TSF Water Management

Adhering to these conditions will require the careful planning of the transfer of waters into and out of the TSF.

7.1.1 Construction

Construction of the TSF occurs under the authority granted by the EMLI and must meet all conditions outlined in *Mines Act* Permit M-200 and its' amendments. All construction activities will occur under the surveillance of the EoR or designate and follow the designs outlined in the design report *Tailings Storage Facility Detailed Design to Elevation 970 m* as well as any updates received from the EoR. Regular communication between the EoR and MPMC will occur throughout the construction period to ensure that the intent of the design is met and any changes occur only with the appropriate engineering work to guide it.

At the end of the construction period, a Construction Record report shall be prepared by the EoR and submitted to EMLI by MPMC by March 31st of the following year. Any additional reporting stated in *Mines Act* Permit M-200 amendments shall be adhered to as well. Figure 7.2 indicates a typical cross section of the dam at Corner 1.

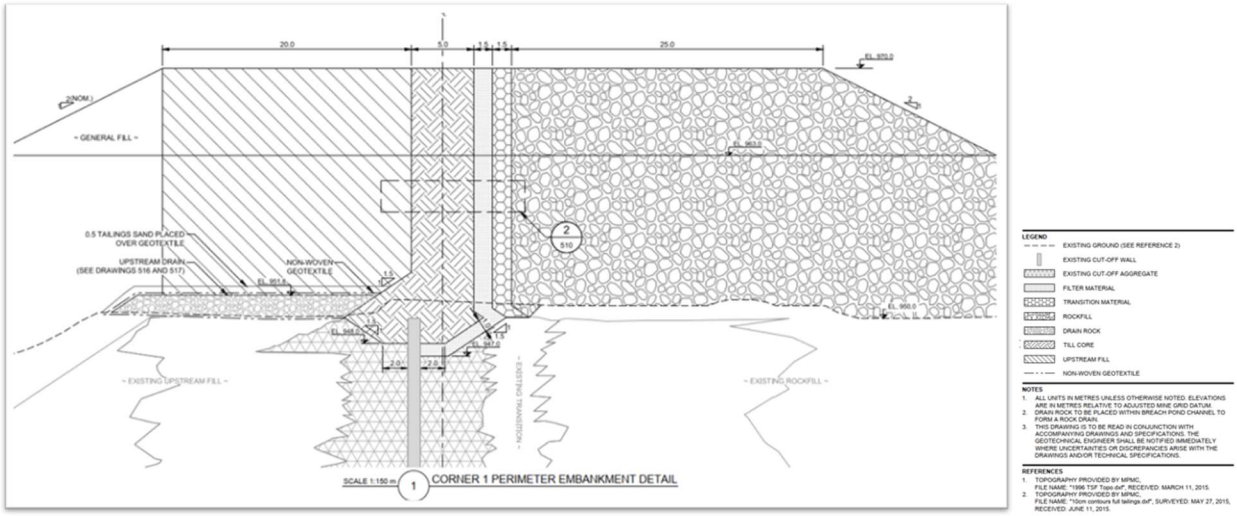

Figure 7.2 – Typical TSF Cross-section at Corner 1

Construction activities may begin or end at any time, so long as the conditions stated above are adhered to and QA/QC protocols are met. The primary intent of construction is to provide ongoing tailings and water storage as the TSF continues to fill, which will require planning and setting construction goals which ensure the appropriate amount of storage is available at all times.

7.1.2 Tailings Deposition and Beach Management

Tailings shall be delivered to the TSF from the Mill Tailings Distribution line when the mill is operating. Within the TSF, the line shall be situated in such a way to be upstream of the embankment core and emplaced in a way that, should a breach of the line occur, any unmanaged flow would not flow over the crest of the embankment. Discharge may occur via spigot or through the full pipe. A deposition plan will be updated on a regular basis using the latest bathymetric survey and mining plan available.

Figure 7.3 shows the zones of operation for the Beach Width from the QPO document.

Beach Width			
Normal Operating Beach Width	Inspection frequency	Daily	Portion of beach above pond level. The pond is to be maintained within the centre of the facility against the western boundary of the TSF against the natural topography. Temporary detention of large runoff volumes in the TSF is required and the beach widths are expected to decrease below 100 m during large freshet events.
	Normal Operating Zone	> 100 m	Minimum during normal operating conditions.
	Concern Zone	60 to 100 m	Regain 100 m beach along all the facility within 1 month (pumping to other facilities may be required [e.g., open pits]). Adjust tailings deposition to build tailings beach in area of reduced beach width. Increase pumping from TSF to the water treatment plant. Increase monitoring frequency of beach width, freeboard, piezometers, and seepage rate and turbidity, particularly in area of reduced beach width
	Buffer Zone	20 to 60 m	Regain 100 m beach along all the facility within 2 months (pumping to other facilities may be required [e.g., open pits]). Adjust tailings deposition to build tailings beach in area of reduced beach width. Maximize pumping from TSF to the water treatment plant. Increase monitoring frequency of beach width, freeboard, piezometers, and seepage rate and turbidity, particularly in area of reduced beach width

Figure 7.3 – QPO Beach Width Zones of operation

The area of discharge shall change according to beach development requirements, as determined by visual inspection. Water and TSF Superintendent is responsible for tailings deposition through written authorization on the weekly dewatering meeting. Site Services will be contacted to perform the necessary valve and line work to move the discharge. Occasionally, deposition will be controlled by line maintenance needs, but shall return to normal configuration once maintenance work is completed.

The objective of beach development will be to provide an adequate buffer between the free water within the reclaim pond and the embankment core throughout all foreseeable flood events. This will normally allow beaches of 300 m length or more around the entire facility, depending on elevation. Maintaining beaches of minimum 100 m width during normal operations ("normal" being defined as a pond volume between 1.5M m^3 to 1.7M m^3 after freshet and 3.5 million m^3 following a 1 in 200 year freshet event, respectively – see Pond Management sub section) is the minimum target. Of necessity, beaches will be constructed much greater than 100 m wide before

moving discharge to another location so that the loss of beach while discharging elsewhere does not reduce the beach to less than 100 m.

Beach width will be determined primarily by visual estimation based on the minimum distance from the TSF pond to the embankment. Drone flyover and Online resources (Figure 7.4) can also be used to determine beach width.

[Sentinel Playground | Sentinel Hub (sentinel-hub.com)]

Website:https://apps.sentinel-hub.com/sentinel-playground/?source=S2&lat=52.51458338709581&lng=-121.60340022935998&zoom=15&preset=1-NATURAL-COLOR&layers=B01,B02,B03&maxcc=64&gain=1.0&gamma=1.0&time=2022-11-01%7C2023-05-15&atmFilter=&showDates=false

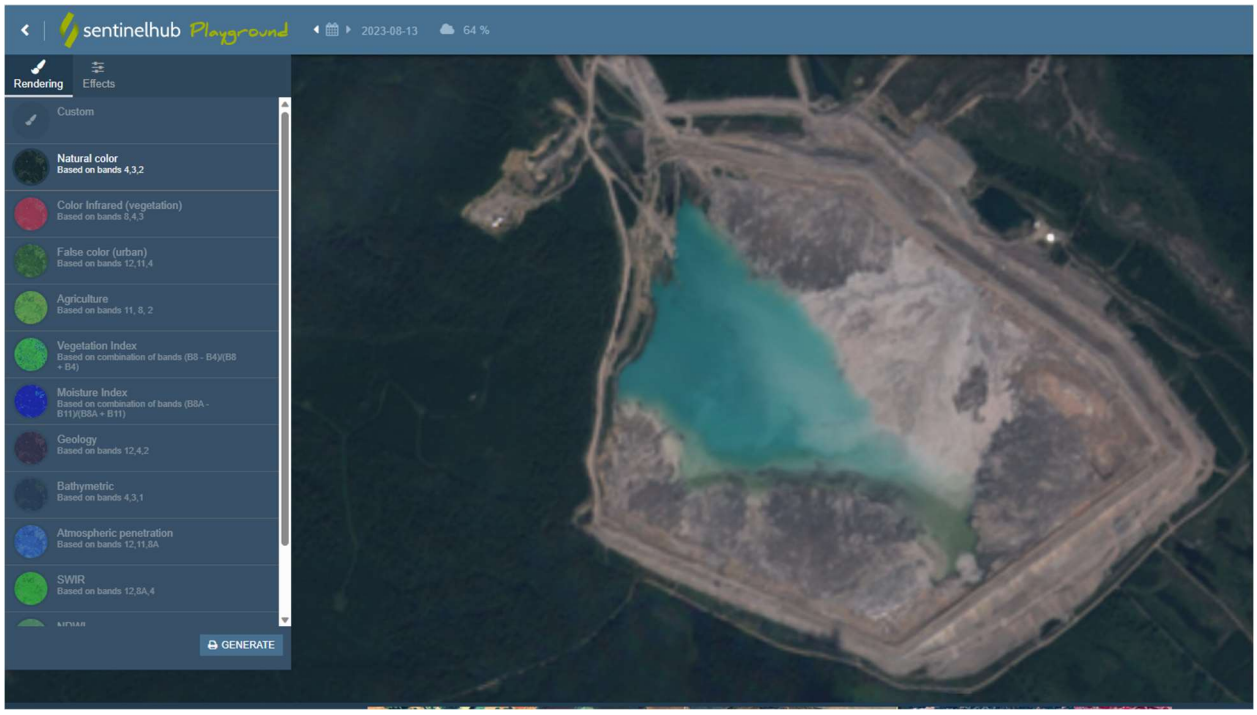

Figure 7.4 Sentinelhub – MPMC TSF location

Small ponds will occasionally form on the beaches themselves. If they are not connected to the main pond, they will not impact beach length consideration. Effort will be made to 'push' out these ponds via tailings deposition management.

Tailings Distribution lines which are in operation will be visually inspected every shift by Mill Maintenance personnel (Mill to corner 5) and Site Services personnel (Corner 5 to discharge). The person performing the inspection has the authority to stop tailings flow to the TSF by contacting the Mill Manager/Water and TSF Superintendent or designate. Changes to tailings deposition shall be communicated to the Water and TSF Superintendent.

The beaches are formally inspected weekly by Water and TSF personnel and informally by operations and supervisory personnel as a part of their daily routine. There are also many informal inspections performed by other individuals on the embankment performing their regular duties.

7.1.3 Reclaim Pond Management

Under normal operating conditions and average meteorological conditions, including freshet, the reclaim pond within the TSF shall contain between 1.5 and 1.7 million m^3 of water. The TSF is used for temporary detention and attenuation of flow rates; therefore, for example, the reclaim pond size could increase to 3.5 million m^3 during a 1 in 200 year freshet event. The fundamental basis of the water management on site is to ensure that water does not accumulate in the TSF, specifically to the point of increasing the onsite water reserve year-over-year. Exceeding the estimated reclaim pond volumes for average and 1 in 200 year freshet events does not necessarily compromise embankment safety but is not consistent with Best Practice.

The key parameters further restricting the allowable pond volume are freeboard, beach length and flood storage capacity. The site water balance does not predict the pond to contain more than 3.5million m^3 of free water except as the result of an event larger than a 1 in 200 year freshet event. Planning for freshet management is based upon being able to safely manage this scenario.

However, if an event or events lead to this happening, there are certain factors that must be checked. The primary factor will be freeboard and beach width, specifically any expectation of beach width going below 20 m. MPMC must engage all practical effort to prevent this from happening and the excess water would have to quickly be brought down to acceptable levels afterward.

Pond volume will be regularly tracked by the Water and TSF Superintendent on a spreadsheet utilizing pond elevation pickups and mass balance calculations based on flyover survey and communicated to the EoR weekly in the TSF Weekly Report. A pond sounding is conducted on an as needed basis to calibrate and confirm the accuracy of the water balance. Snow and beach ice do not contribute to the free water pond volume calculation, nor does pond ice. If determinable, snow and ice do count as impounded materials and will cause the lowering of total storage, and will be tracked, though likely by estimation.

7.1.4 Reclaim Barge

The reclaim barge shall be operated by an automated system controlled by Mill Operations. Water will be pumped through the reclaim piping system (i.e., via the Booster Station) back to the Mill on an as-needed basis. Instrumentation installed on the operating systems within the barge and Booster Station pumps monitor the systems' operation on a continual basis. Mill Operations shall formally inspect the reclaim line and supporting infrastructure at least once per shift.

Reclaim barge raises will be required at the elevation of the tailings deposition increase. Planning will be discussed in the weekly dewatering meetings. Execution will be carried out as quickly as possible to avoid interrupting the flow of reclaim water out of the TSF.

7.2 Site Water Management

This sub-section shall describe the operations of the various water management structures and systems (exclusive of the TSF reclaim). Some of the systems are described in much detail within the *Water Management Inspection Manual* (Appendix C), and will be referenced as such within this section.

In general, water management at the Mount Polley Mine is intended to ensure that the utmost care is given to manage the site water in a socially responsible way, adhering to all permits and making efficient use of the water resource utilized. The systems are designed to be robust and easily understood and implemented. Redundancy or overdesign is included wherever practical and MPMC will continue to improve upon these systems as water management experience continues to develop. MPMC also has a strong commitment to including the local community groups in the planning and implementation of the activities on site that affect the local receiving environment.

The site water management operations' section will be broken into the following topics:

- Cariboo Pit Sump
- Wight Pit Temporary water storage and dewatering
- West and Long Ditch Systems
- TSF Seepage
- CCS and PETBP
- Other Water Management Facilities

7.2.1 Springer and Cariboo Pit Storage and Dewatering

Cariboo Pit Sump

The Cariboo pit is an active dewatering sump for the Springer Pit. Water from the Springer pit is pumped into the Cariboo Pit Sump. Water from this sump is pumped into a booster station, from

there the water can be pumped to the mill process tank or to the West Ditch. This is shown in Figure 7.5 below.

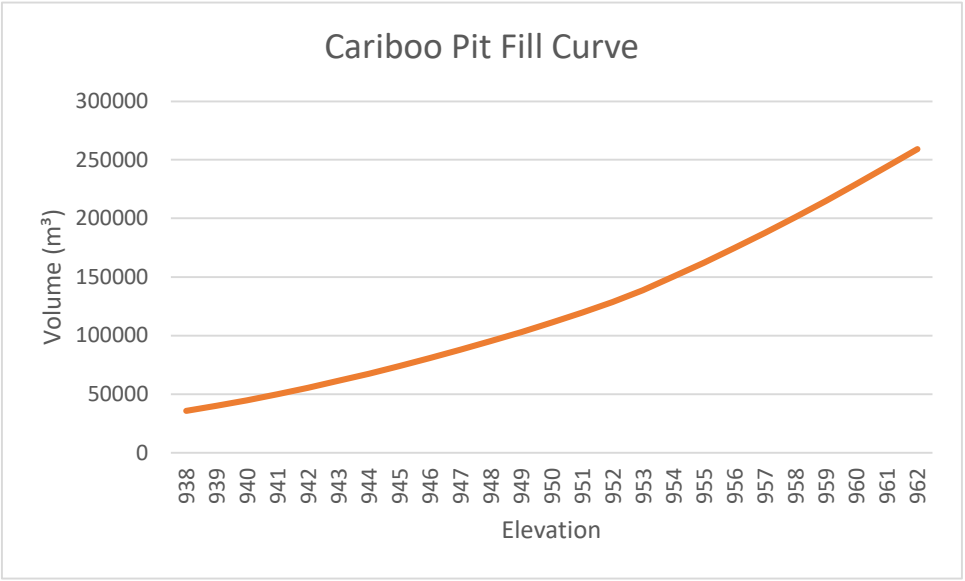

Figure 7.5 Cariboo Pit Sump Storage Curve 2023

Springer Pit

The Springer pit is the main mining location for Phase 4 and future mining once permitted. Temporary sumps are established as needed and the water is pumped to the Cariboo Pit Sump. It's noted that the maximum water elevation is permitted to 1025 masl (EMA 11678 section 1.3.1)

7.2.2 (1025m elevation) including the deposited tailings. This is shown in Figure 65. belowWest and Long Ditch Systems

A majority of the West Ditch and Long Ditch sub-systems performs automatically and do not require operational input, instead relying upon regular inspections and maintenance to ensure they continue to function properly. There are a few small components that do require manual interaction, and this is generally performed by the individuals performing the inspections according to the *Water Management Inspection Manual* (Appendix C).

As mentioned above, the seepage collection ponds and recycle pumps typically operate without requiring any external adjustments; however, the following special circumstances will require specific actions:

- In the event of an emergency that may compromise a water storage facility, all diversion ditches that feed the facility may need to be directed away. In addition, if water quality and permits allow, discharge of water to natural receiving environments may be possible. Many of the structures already include overflow devices or structures within them, and other bypasses

may need to be installed, if safe to do so at the time. See the *Water Management Inspection Manual* for detail.

- During freezing conditions, pumps may be operated on a timed pumping cycle (based on site conditions) to prevent conveyance pipes from freezing. Pumps may be turned on and off based on cycle time rather than water level (the latter representing the more standard level setting). Once temperatures return to those suitable, pumps can operate under normal conditions.

The West and Long Ditch systems are required to handle the following precipitation events:

- Safely contain and convey a 1 in 10 year 24-hour storm event.
- Be capable of withstanding all flows resulting from up to a 1 in 200-year 24-hour storm event without significant damage.

It is therefore expected that the system shall effectively manage all normal meteorological events, with environmental discharge being a distinct possibility in extreme weather events, but accommodation for this is included in the design. As it is not possible to determine the magnitude of an event in real time, the assumption shall be to contain and convey all flows until it is observed impractical under the guidance of the *Water Management Inspection Manual*. Trust in the design and ensuring the system is properly maintained are therefore necessary to ensure the systems operate as intended.

7.2.3 TSF Seepage

All waters that report through the TSF shall be considered contact water and must be managed accordingly. Seepage through the embankment (including the upstream drain), and precipitation that falls on the embankment, but downstream of the core will report to one of the seepage control structures and make its way to one of the seepage ponds. All collection ponds described below have permanently installed, color coded water level indicators. The appropriate response for a given water level is described within the *Water Management Inspection Manual*. The general goal will be to maintain as little water in any of these systems as is practical, reserving storage for times of high flow.

Seepage management for the Main and South Embankments is primarily automated. Flows report through a ditching system to one of the seepage ponds, which are then conveyed by pumping to the TSF. There are periods of time when the pumping systems are not on automatic, specifically the summer months, with pumping controlled by the individuals performing the inspection duties. Maintenance and surveillance following the *Water Management Inspection Manual* is essential for proper operability of this system.

Seepage at the Perimeter Embankment eventually reports to either the CCS, or PETBP. It is essentially a gravity driven system, and is therefore automated, and kept functional through the surveillance and maintenance protocols. The CCS and PETBP also serve other functions beyond that of purely TSF seepage control and are described in the following sub-section.

The MESCP and SESCP serve as the supply source for dust control waters on the TSF beaches as well as the utilization of water cannons (if setup) to optimize evaporation of excess water. Excess water in the MESCP may also be pumped back into the TSF via the same line that conveys water to the dust control sprinklers.

7.2.4 CCS and PETBP

As with the other water management systems, operational guidance for both the CCS and PETBP is contained within the *Water Management Inspection Manual*.

Overflow from the CCS reports to the PETBP. The PETBP is the central water management control structure for site waters outside of the TSF. Water level in the PETBP is controlled by the WTP discharge and 2 electric pumps in the PETBP on automatic floats to pump to the TSF. During the times of low site flow, the excess water in the TSF will be conveyed to the PETBP for eventual discharge through the WTP. This water transfer will occur by overflowing the Booster Stations allowing the water to flow into the west ditch. These systems are capable of meeting the design criteria to manage the 1 in 10 year 24-hour storm event (PETBP to TSF) and 0.3 m^3/s for the TSF to PETBP system to maximize site discharge through the WTP.

7.2.5 Other Water Management Facilities

Non-Contact Water Ditches

The non-contact water system is composed of fully self-functioning ditches and sumps. The key to ensuring this system remains operable lies in the regular inspection and maintenance of these structures, following the *Water Management Inspection Manual*.

Dust Control Systems

The primary method of dust control on site is to wet down the mine roads system. A fill station is setup at the crest of the Cariboo Pit and is supplied by water from the Cariboo Pit Sump. Temporary stations may also be utilized at other locations as needed, so long as any necessary protections are installed.

Secondarily, there is need to control dust on the large, dry surface within the TSF. There is a non-fixed system to supply water to large sprinklers, which are placed in various locations within the TSF. The system typically sources its water from the MESCP, but any location will suffice to get water to the appropriate locations. Mine Operations operated the fill stations and Site Services is responsible for the TSF sprinklers.

7.3 Water Management Meeting

To effectively manage the site water system and infrastructure, a water management meeting facilitated by the Water and TSF SuperintendentWater and TSF Superintendent shall be held at regular intervals. During periods of high water management activity, such as freshet, these meetings will occur weekly or bi-weekly, and occur monthly during times of little activity, such as winter and late summer.

The meetings will address all site water related matters such as pumping requirements, pit dewatering, projects, WTP, tailings discharge, water discharge, ponds, sumps and ditches. Representatives from the following Departments will attend the meeting:

1. Mill Maintenance / Electrical
2. Mine Operations
3. Environmental
4. Procurement (optional)

7.4 Emergency Flood Management

A great deal of effort has been undertaken to study, design, and implement the water management systems in place at MPMC to ensure that water is controlled and conveyed in an appropriate way without undue harm to the systems or the receiving environment. Each system is designed according to its own set of criteria, which is not common everywhere on site. When an unusually large precipitation or flood event occurs, it is essential to know how to deal with it.

First, it needs to be understood that, although there are definitions such as “1 in 10-year 24-hour storm event’ or “1 in 200-year freshet” there is no practical way of determining this while it is occurring. During such occurrence, the first priorities shall be the safety of the TSF, which will be guided by the TSF Operations Parameters, QPOs and the Water Management Inspection Manual. Facilities may need to be prioritized, and it may become necessary to abandon action for a lower priority facility to ensure that higher priority infrastructure is protected.

It will also be crucial to maintain the appropriate level of communication, through normal operating parameters or by way of the EPRP protocols, with the EoR and Regulators. Extreme events will present MPMC with a wide variety of potential problems, and decision making amongst the various stakeholders may become necessary. However, the responsibility to protect the facilities and the receiving environment is MPMC’s and it may become necessary to react without the consent of regulators or the EoR. Planning (and proper implementation of the plan) will be the corrective action to this type of action having to occur.

7.4.1 Systems Priority

The highest priority will be given to the health and welfare of personnel and, following this, the receiving environment. Stating the priority level for the various water management components will be based upon these two overarching goals.

The TSF is the most potentially hazardous component. The TSF is designed to a much higher standard than the other facilities on site as it is expected to handle a much greater flood event than any other (non-pit) component. Though the standard procedure for excess site water reporting to the CCS and PETBP will be to pump it into the TSF, this will need to cease if the water level increases too rapidly or freeboard requirements are approached. Conditions within the TSF at the time will form the basis of decision making regarding potential danger. Site Management and the EoR will have to be involved in the action planning surrounding any type of event that may cause an unsafe condition in the TSF.

Below is a list of possible actions to limit damage in an extreme run-off or precipitation event:

- Cease tailings delivery.
- Cease all water pump-back into the TSF.
- Maximize WTP throughput without compromising permit criteria
- Maximize reclaim and facilitate an alternative storage location.
- Re-direct into the Cariboo Pit from the Mill Process Water Tank.
- Re-direct into the Wight Pit from the Mill Process Water Tank.
- Cease all pit dewatering.
- Install additional pumps in a facility at risk. United Rental has pumps available for MPMC
- Direct as much water into the pits as possible. They are, practically speaking, unfillable by a single event.
- Engage the EoR to aid in evaluating the situation and formulating the appropriate action plan, which may include construction of a Spillway.
- Facilitate offsite discharge.
- Stop concentration of flows by shutting off pumping systems that pump from one sump to another and allowing individual sumps and ditches to overflow, ideally into a pre-existing channel.
- Install pumps in the TSF and pump water downstream.

Ideally, communication with the EoR, regulators and the directly affected communities will have been initiated. No assumption of permission being granted should be made. MPMC and/or the EoR may have to make the determination themselves, but it is preferable to have advanced notice to all affected groups.

The Water Management Inspection Manual (Appendix C) and the EPRP both contain pre-arranged information meant to aid in emergency level event decision making (cheat sheets).

7.4.2 Emergency Spillway

The emergency Spillway has been designed by WSP and the liner material has been procured and is available on site. The liner (ENVIRO 6000) material is approved by the EoR and is located in

the instrumentation seacan near the quarry. The Mine Operation Superintendent (or designate) holds the keys to this locked seacan. The design is referenced in Appendix F of this document.

8.0 MAINTENANCE

As outlined in this Manual, water management on site comprises multiple components and associated facilities. These components and facilities must be inspected and maintained regularly to ensure that any changes to their condition, performance, or a potentially hazardous condition can be identified and promptly addressed.

Maintenance will be broken into two groups: Equipment maintenance and Facility maintenance. Both types will be heavily dependent on proper surveillance of the associated systems.

8.1 Equipment Maintenance

Equipment maintenance refers to maintenance of the pumping and piping systems and their associated structures and power systems. Equipment maintenance is generally performed by certified tradespeople following common maintenance practices. The maintenance they perform will be that associated with regular operations, at regular intervals, as well as reactive maintenance as the result of an observed substandard condition. Equipment maintenance will follow the recommendations of the manufacturer or site specific Standard Operating Procedures (SOPs.)

Mill Maintenance Superintendent or designate

- 24" and larger pipes, valves, and gates for the reclaim and discharge lines from the Mill building, through the Booster Station, and down to the Corner 5 "Y" (discharge line) or the TSF Barge (reclaim line).

- Mechanical components of all fixed pumping systems, including:
    - Reclaim Barge, pumps and associated non-electrical equipment
    - Booster Station pumps and associated non-electrical equipment.
    - PETBP-TSF pump-back system.

- All water and tailings distribution equipment within the mill complex
- All fixed power distribution equipment – poles, lines, and transformers, all protective devices
- Installation and maintenance of electric motors and other components
- Instrumentation installation and maintenance. This does not refer to TSF performance monitoring instrumentation, rather instrumentation on the mechanical and electrical pumping systems.

Water and TSF Superintendent or designate

- All pumps, pipelines and associated equipment throughout the mine site not under the responsibility of the Mill department, including:
    - All discharge pipeline downstream of the Corner 5 "Y", and all other components of the discharge system on the TSF.
    - All non-electrical components of the ditch systems' dewatering infrastructure.

8.2 Facility Maintenance

Facility maintenance is maintenance on the TSF embankments, buttresses, seepage collection ponds, ditches, geotechnical instrumentation and groundwater wells. It is generally the maintenance of any structure made of earth materials. These structures do not move, and so typically only degrade because of outside forces, such as running water, gravity, and equipment activity. Following the proper surveillance protocols is crucial to ensure that facility maintenance items are properly identified in a timely fashion.

All facility maintenance is done under the Water and TSF Superintendent's authority through MPMC personnel and contractors. It can be the result of either an automatic response to an obvious deficiency, through instrumentation readings and analysis or indirect observations, such as seepage increases. The extent of the maintenance may need to be determined by the EoR and effective communication is essential for this to occur.

8.2.1 Embankments

The embankments will be subject to gravity, weather and equipment activity. The crests of the embankment shall be kept in such a way as to facilitate traffic and avoid water ponding. Ponded water should not be allowed to flow over the crest of the embankment as that could result in erosion of the downstream slope, rather it should be encouraged to flow through the coarse downstream shell or pumped into the TSF. Trenching across the core is not permitted.

Settlement of the embankment may result in cracking along the crest. Any crack(s) shall be documented and communicated with the EoR, who will determine the course of action to be taken.

8.2.2 Ditches and Sumps

Ditches and sumps will be kept clear of built up material and obstructions and shall be repaired after any damage that may occur to them is observed. Damaged areas should be built up beyond their original condition so as not to repeat the damage for a similar event. Culverts will be kept open and weirs will be kept free of debris and maintained such that they perform as required. The Site Services group will perform maintenance. There will also be the occasional need to clear plants and trees that may grow in the ditches and sumps.

8.2.3 Access

Roads, trails, ladders and all other means of accessing the various facilities need to be kept usable to ensure their proper functionality. The majority of this work is the plowing of roads (year round), but also includes snow shoveling, ice removal, and other types of access related maintenance issues. This is typically reaction-based maintenance and requires proper communication from the impacted individuals to Mine Operations.

8.2.4 Geotechnical Instrumentation

Generally, the instruments do not require regular maintenance, but may require occasional maintenance as follows:

- The piezometer wires may need to be cut and re-attached if the readout box is unable to acquire any data.
- Piezometer wires that are exposed may become corroded and may need to be trimmed until a fresh surface is exposed to allow readings to be taken.
- Extension of Slope Inclinometer casings to facilitate embankment buttress construction.
- Power systems for instrumentation, such as the SAA's, in-place inclinometer (IPI) and dataloggers.

The TSF Instrumentation Technician will facilitate the repairs of any of the Geotechnical Instrumentation with guidance from the Water and TSF Superintendent and EoR when necessary.

8.2.5 Groundwater Wells

Decommissioning and replacement of existing groundwater wells and construction of groundwater wells at new monitoring locations are addressed by a third party Qualified Professional in an assessment of the monitoring program and possible impacts for groundwater every three (3) years, as per *EMA* Permit 11678.

Well development is completed as soon as possible after installation of new wells and is completed on any wells where water being purged contains significant amounts of sediment (the presence of sediment is noted in sampling observations).

During bi-annual sampling, any wells missing PVC J-plugs, casing protector lids, or locks are noted and fixed. Additional maintenance items are noted during bi-annual sampling, based on observations of the physical state of the well and/or properties of the water.

9.0 SURVEILLANCE

As outlined in this Manual, water management on site comprises multiple components and associated facilities. These components and facilities must be inspected regularly to ensure that any changes to their condition, performance, or a potentially hazardous condition can be identified and promptly addressed.

The Mill Maintenance Superintendent and Water and TSF Water and TSF Superintendent are responsible for ensuring that surveillance is carried out regularly. The Water and TSF Superintendent is responsible for daily management of the TSF water management systems and ensures crew carries out routine activities. The Water and TSF Superintendent is also responsible for directing and coordinating all TSF surveillance and facility maintenance to the specifications of the EoR.

The Water and TSF Superintendent will conduct and document an embankment surveillance walkover at least once per quarter. Weekly Embankment surveillance reports, completed by the MPMC Instrumentation Technician, shall be reviewed by the Water and TSF SuperintendentWater and TSF Superintendent and filed at the Mount Polley Mine Site. Additional (non-routine), documented "drive-bys" of the TSF and associated facilities will be required following extreme or unusual events. The Water and TSF Superintendent must be made aware of any unusual events or observations and shall contact the EoR as required. Typical examples of unusual events and observations to be made during such walkovers are outlined in the "Unusual Event or Observation" section included in the *Water Management Inspection Manual*.

Guidance documents are included in the *Water Management Inspection Manual* (provided in Appendix C) to help guide the observation and surveillance process. The documents cover major items related to the TSF and associated facilities. Additional details are provided in the following sections.

9.1 Water Management Systems

Site Services personnel in accordance with the Water Management Inspection Manual, which includes water management checklists, shall inspect the seepage collection ponds and recycle pumps. Typical observations to be made during surveillance are as follows:

- Water levels in ditches, sumps, ponds and within the TSF;
- Pump back flow rates from pumps;
- Evidence indicating seepage from the ditches, sumps and/or ponds;
- Evidence indicating erosion or instability on the slopes of ditches, sumps and/or ponds;
- The overflow culverts and pipelines between sumps and/or ponds are free of any obstructions; and
- Ensuring that the discharge end of pipelines, culverts and spillways are not obstructed
- Ensuring that ditches are not obstructed/blocked.

Additional observations will also be required under special circumstances as follows:

- Monitor the pumping from sumps and/or ponds during freezing conditions to ensure that the pumping cycle is adequate at keeping the pipes from freezing and in keeping the pond level constant; and

- Monitor the water quality in the sumps and/or ponds during spring freshet to ensure that the seepage water is at acceptable levels if water permits allow for discharge.

The Unusual Event or Observation document identifies additional events and circumstances that may require increased observations and documentation.

Environmental Department personnel will also be indirectly inspecting the various facilities as they perform their required materials sampling.

9.2 Tailings Impoundment and Pond

The TSF is operated according to the protocols outlined in the Operations Section of this manual. Daily measurements of the pond level shall be carried out and instrumented flows into and out of the TSF will be measured. Increasing the number of measurements of, and improving upon the measurement of, flows into and out of the TSF will continue and provide for a more accurate TSF mass balance. This information will be utilized to form a materials balance for the TSF impoundment. This balance will be regularly checked against actual conditions and modified as information is gained and understanding of the facility improves. Topographic and bathymetric surveys will be carried out after freshet and during fall each year to confirm the pond size.

Visual inspection, specifically for beach condition and deposition line condition will also be performed daily. However, winter conditions will likely preclude proper beach inspection, and beaches may have to be determined indirectly via survey data.

The weekly TSF Field Inspection conducted by Instrumentation Technicians according to the *Water Management Inspection Manual* includes some areas of pond inspection. Freeboard and beach width are to be checked against the QPO triggers and any QPO dictated actions are to be followed. Pond depth is operational only. There are no directly related QPO dictated actions, and pond depth is not practical to determine for much of the year.

9.3 Tailings Embankment

Weekly surveillance of the embankments and associated structures should follow the Field Inspection Report (included in the *Water Management Inspection Manual*). Typical observations to be made during surveillance include:

- Evidence indicating embankment structure deformation (e.g. slope bulging, tension cracks on the crest or crest settlement);
- Evidence indicating seepage, runoff or erosion;
- Clarity and quantity (visual estimate) of seepage water entering the seepage collection sumps;
- Other unusual conditions in the TSF area.
-

The embankment and associated earthwork structures do not require regular maintenance; however, specific maintenance items may be identified as a result of regular observations and surveillance of the embankment.

The Unusual Event or Observation document outlines additional observations that may need to be documented after any unusual event.

In addition to regular inspections of the TSF by site personnel, the EoR will conduct an annual Dam Safety Inspection (DSI) and will include all elements of the TSF (Pond, Embankments, Buttresses, Seepage, and Operations). Recommendations from this inspection will be delivered to MPMC for review and implementation. The inspection report shall be completed and submitted to EMLI by March 31 of the year following the inspection. Additionally, the IERP may conduct a review of any structure or process at their discretion, followed up with a written report submitted to the Mount Polley General Manager.

9.4 Tailings Discharge Pipelines

The tailings discharge pipelines will be inspected each shift and maintained regularly to ensure that the system operates properly. The *Water Management Inspection Manual* includes a Daily (each shift) Tailings Line Inspection Checklist for regular surveillance of the pipelines. Typical observations to be made during surveillance include:

- Evidence indicating leakage from the pipelines;
- Evidence indicating grade variations and/or blockages;
- Confirmation that conveyance ditch lining (where appropriate) is continuous;
- Evidence of overhanging rock or objects that could fall and damage the pipelines

The Unusual Event or Observation document outlines additional observations that will need to be documented after any unusual event. Repairs to the discharge pipeline, and/or discharge sections may be required after any such unusual event.

Noted deficiencies shall be communicated to the Mill Maintenance Superintendentand the Water and TSF Superintendent. The individual performing the inspection has the authority to stop the tailings flow through communication with the Mill Manager or Mill Maintenance Superintendentand Water and TSF Superintendent if he or she feels a line deficiency has the potential to cause significant damage to a structure or the environment.

9.5 Beaches

MPMC Technical Service staff shall formally inspect and document the beaches weekly according to the protocols in the *Water Management Inspection Manual*. Daily, informal inspections shall also occur by the various operations and supervisory personnel. Beach maintenance will occur through proper deposition management, which will be done through the Water and TSF

Superintendent. Deposition will be moved according to beach development needs. A model of the tailings deposition is included in the TSF design report (*Tailings Storage Facility Detailed Design to Elevation 970 m*, Nov. 3, 2015) as Appendix D of that report. The latest deposition model was completed in March 2019 (reference number 1894924-073-PP-Rev0-51141). There are some assumptions within the model that may have to be modified as actual deposition conditions are observed.

Within the QPO's (Appendix I), beach width monitoring has trigger levels indicating the various response actions based upon the reading or change in reading. MPMC is responsible for implementing the QPO actions based upon the recorded data or through direction of the EoR. The EoR must be notified of any anomalous trends. Additional readings and inspections may also be required after any *Unusual Event or Observation*, at the direction of the EoR or at the direction of the Water and TSF Superintendent.

9.6 Drain Pipes/ditches and Seepage Pipes.

Measurements of the Seepage Turbidity and Seepage rates will be conducted by Environmental Technicians. Figure 9.1 summarizes the QPO zones and monitoring frequency

Quantitative Performance Objective		Value	Source/Comment/Action
Seepage turbidity (Field test)	Data gathering frequency	Once every two weeks.	South Embankment drain, Main Embankment east drain, Main Embankment west drain, Corner 1 cutoff wall seepage drain, Corner 1 upstream drain, South diversion ditch and North diversion ditch. Probe is highly sensitive to sampling quality. Re-test turbidity immediately if reading exceeds 1.5 NTU.
	Normal Operating Zone	Turbidity < 1.5 NTU	A copy of the figures reported in the 2022 annual dam safety inspection presenting the historical turbidity readings is attached.
	Concern Zone	Turbidity < 2.0 NTU	Increase monitoring frequency of seepage rate/turbidity and piezometers around the area of concern. Complete inspection of tailings beach, embankment, buttress, downstream toe and seepage collection ditch/pond near the area of concern.
	Buffer Zone	Turbidity < 3.0 NTU	Same actions as for Concern Zone and collect and submit seepage water samples for expedited laboratory testing.
	Unsafe or Out of Compliance Operating Zone	Turbidity > 3.0 NTU	Same actions as for Buffer Zone. If laboratory test results confirm the turbidity levels measured in the field: - increase pumping from TSF to other facilities - adjust tailings deposition to build tailings beach upstream of the embankment - stop all other pumps pumping water into the TSF
Seepage rate	Data gathering frequency	Once every two weeks.	If the seepage rate from the South Embankment drain, Main Embankment east drain, Main Embankment west drain, or Corner 1 upstream drain increase or decrease significantly (e.g., more than 50% between readings), notify the Engineer-of-Record (EoR) and the TSF Qualified Person within 24 hours.
	Normal Operating Zone	Corner 1 cutoff wall seepage drain: < 1.0 l/s	Maximum rate expected during normal operating conditions (i.e., beach width > 100 m, pond size < 1.5 million m³) based on readings since 2015. Higher rates can be expected during freshet or large precipitation events. A copy of the figures reported in the 2022 annual dam safety inspection presenting the historical seepage rates are attached.
	Concern Zone	Corner 1 cutoff wall seepage drain: < 3.0 l/s	Increase monitoring frequency of seepage rate/turbidity, piezometers and beach width around the area of concern. Complete inspection of tailings beach, embankment, buttress, downstream toe and seepage collection ditch/pond near the area of concern.
	Buffer Zone	Corner 1 cutoff wall seepage drain: < 6.0 l/s	Same actions as for Concern Zone. Increase pumping from TSF to the water treatment plant.
	Unsafe or Out of Compliance Operating Zone	Corner 1 cutoff wall seepage drain: > 6.0 l/s	Same actions as for Buffer Zone. Maximize pumping from TSF to the water treatment plant and increase pumping to other facilities (e.g., open pits). Adjust tailings deposition to build tailings beach upstream of the embankment. Stop all other pumps pumping water into the TSF.

Figure 9.1 – QPO Turbidity and Seepage Zones and monitoring frequency

- Bi-Weekly measurement of flow and field parameters (temp, pH, Specific conductivity, turbidity) at:
  - Upstream Drain (Turbidity & Seepage Rate)
  - South Diversion Ditch (Turbidity)
  - North Diversion Ditch (Turbidity)
  - Cut-off-Wall (COW) Drain (Turbidity)
  - East Main Toe Drain (MTD) (Turbidity & Seepage Rate)

- West MTD (Turbidity & Seepage Rate)
- South Toe Drain (STD) (Turbidity & Seepage Rate)

9.7 Reclaim System

The reclaim pipeline, Reclaim Barge (including pumps), and Booster Station are inspected each shift as a part of the shift inspection performed by Mill Operations staff or Site Services which also inspects the discharge line. The mechanical systems are constantly monitored by instrumentation, which reports to the Mill Operations Control Room.

Typical areas to inspect during visual surveillance of the reclaim pipeline include:

- Locations of excessive wear of the pipeline (filed with Mill Maintenance Department); and,
- Evidence indicating leakage from the pipeline.
- Evidence of leakage or improper operation of a pump, header, or distribution tank.

Additional inspections are required after any unusual event. The Unusual Event or Observation document outlines additional observations that will need to be documented. Repairs to the reclaim pipeline, reclaim barge and/or Booster Station may be required after any such unusual event.

9.8 Instrumentation

All instrumentation components must be read regularly by the Instrumentation Technician. The monitoring frequency for the geotechnical instrumentation is determined by the EoR and specifies the schedule by which data must be collected, plotted and reported. The readings are to be collected, reviewed and forwarded to the EoR according to his prescribed schedule. Within the QPO's (Appendix I), all instruments have trigger levels indicating the various response actions based upon the reading or change in reading. MPMC is responsible for implementing the QPO actions based upon the recorded data or through direction of the EoR. The EoR must be notified of any anomalous trends. Additional readings and inspections may also be required after any *Unusual Event or Observation*, at the direction of the EoR or at the direction of the Water and TSF Superintendent.

9.8.1 Geotechnical Instrumentation

MPMC personnel in accordance with the frequencies determined by the EoR gather Geotechnical instrumentation data.

Existing instrumentation locations are presented in Figure 9.2 and Figure 9.3 and a summary is provided in the sections below.

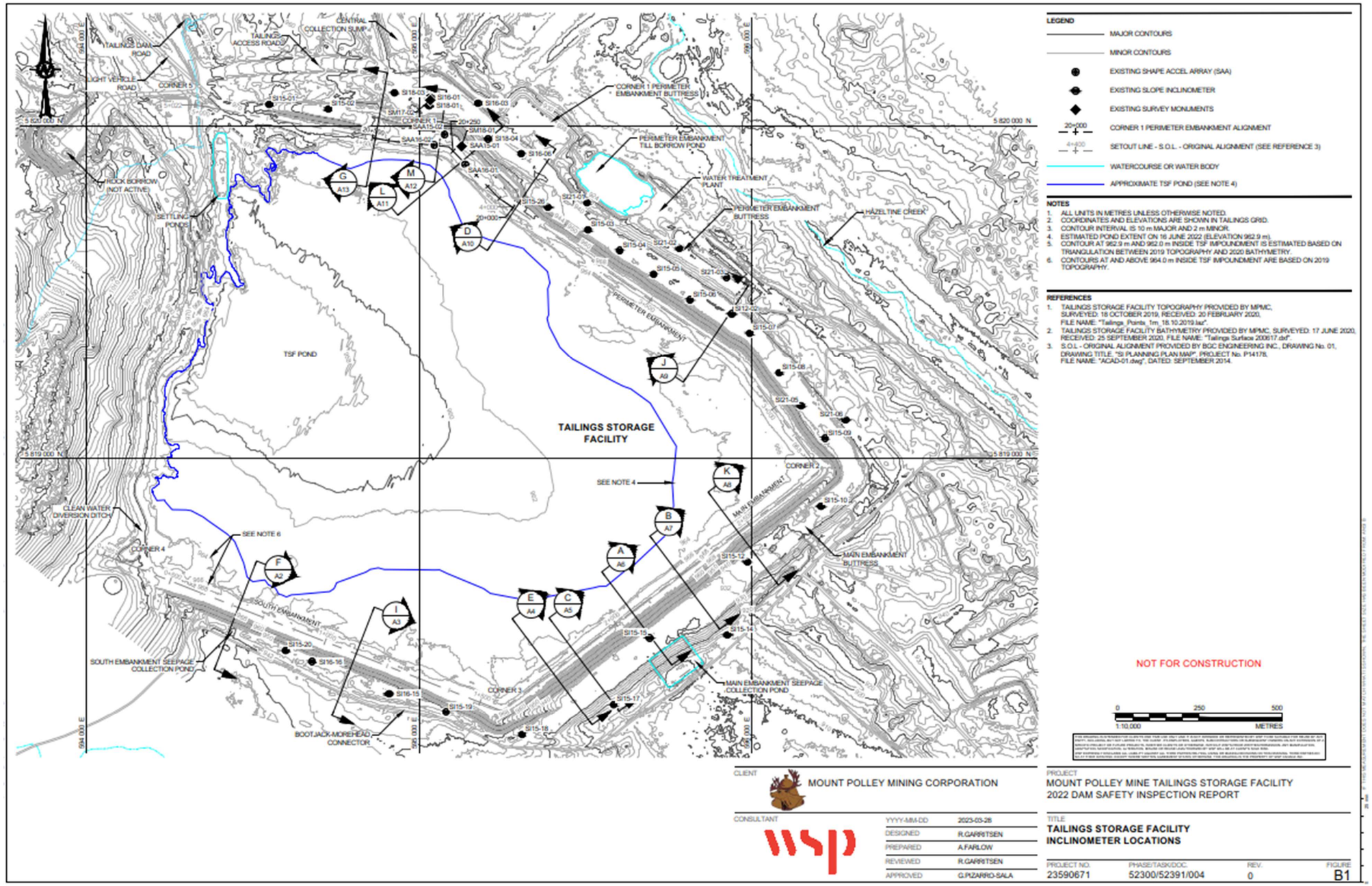

Figure 9.2 Slope Inclinometer and SAA locations

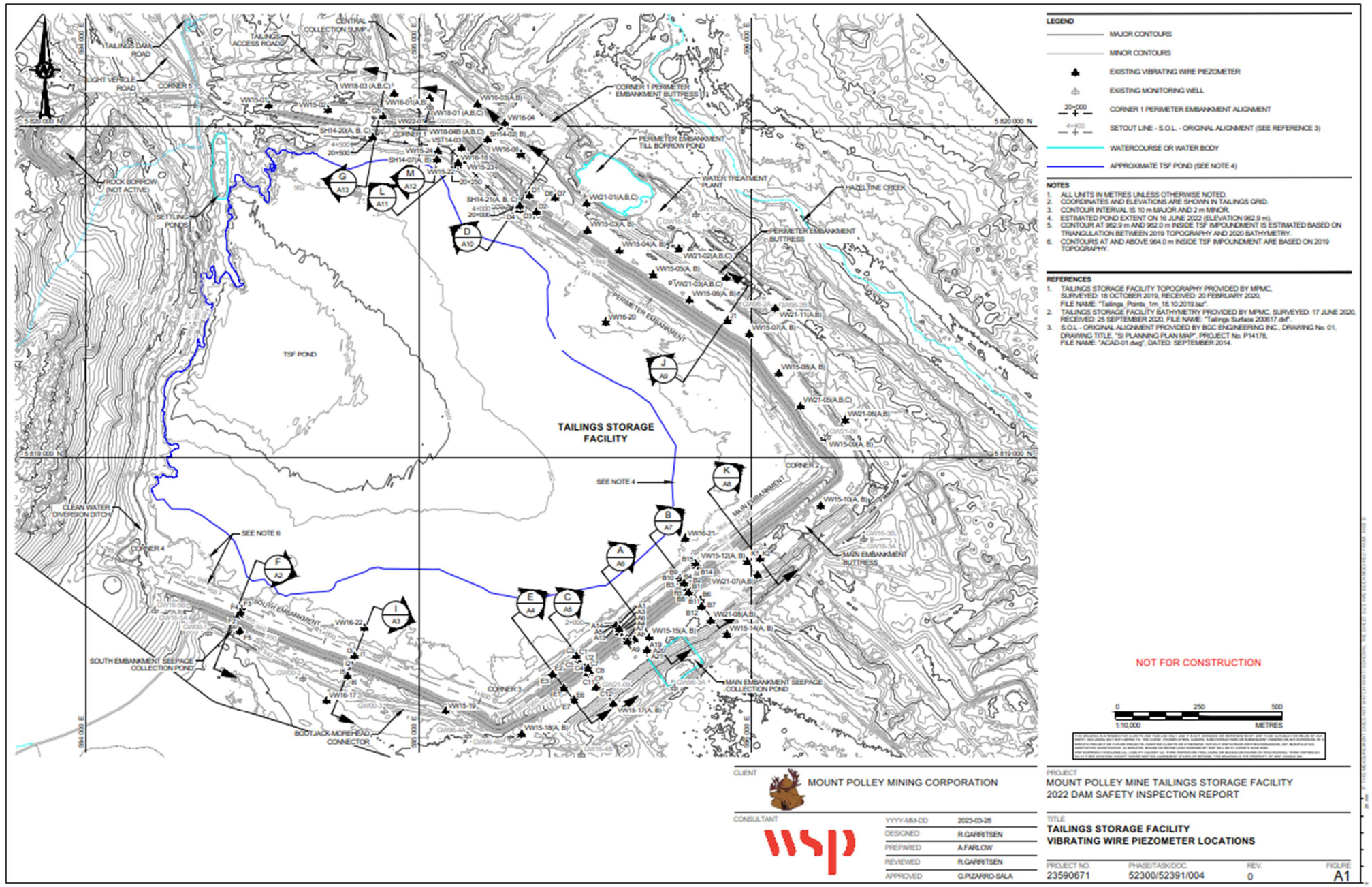

Figure 9.3Vibrating Wire Piezometer Locations

See the QPO (Appendix I) for specific triggers and response actions for geotechnical instrumentation, beach width and freeboard. The trigger values define four (4) operating zones: Normal Operating Zone, Concern Zone, Buffer Zone, and Unsafe or Out of Compliance Operating Zone. If the trigger levels are exceeded, the instruments are to be re-read immediately. If the initial readings are proven accurate, the EoR is to be contacted. If a change below the trigger level is recorded in multiple instruments in a similar location, the EoR is to be notified immediately. Interpretation of the instrumentation data is performed by the EoR, so the EoR will initiate communication with site related to interpretation of dam performance issues based on the instrumentation data. Communication related to any other issues related to dam performance that are identified on site will be initiated by site personnel to the EoR. If the instrumentation readings are within the Buffer Zone, the EoR and Water and TSF Superintendent are to be contacted immediately.

If the instrumentation readings are within the Unsafe or Out of Compliance Zone, the EoR, Water and TSF Superintendent, and onsite General Manager are to be contacted immediately, and the emergency response actions and notification under the EPRP (and section 11.0 of this document) are to be followed.

9.8.2 Inclinometers

A list of active inclinometers installed is included in Appendix B.

The slope inclinometers are to be read, and the data downloaded, reviewed and submitted to the EoR, once every two weeks. The tops of the inclinometer casings are to be surveyed quarterly, and the survey data supplied to the EoR with the inclinometer readings. The Water and TSF Superintendent is responsible for checking the readings against the QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased and installation of the in-place inclinometer may be required at the sole discretion of the EoR.

See the QPO table (Appendix I) for specific triggers and response actions for inclinometers. Inclinometer instrumentation is operated in accordance with the *Inclinometer Operation Manual* (attached in Appendix C.2).

Inclinometer instrumentation is operated in accordance with the *In-Place Inclinometer Manual* (attached in Appendix C.3).

9.8.3 Vibrating Wire Piezometers

The list of vibrating wire piezometers installed in the foundation can be found in Appendix B.

The piezometers are to be read, recorded, reviewed and submitted to the EoR once every two weeks. The Water and TSF Superintendent is responsible for checking the readings against the

QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased at the sole discretion of the EoR.

Trigger levels and the required follow-up actions for vibrating wire piezometers are listed in the QPO's (Appendix I). The embankment piezometers will fluctuate based on the pond level within the TSF, and will be interpreted by the EoR once every two weeks. Piezometer instrumentation is operated in accordance with the *Piezometer Operation Manual* (attached in Appendix C.4).

9.8.4 Shape Acceleration Arrays (SAA)

The four (4) SAAs installed in the 2015 Freshet Embankment are listed in Appendix B.

The SAAs are to be read by the data-logger daily and the data downloaded, reviewed and submitted to the EoR once every two weeks. The Water and TSF Superintendent is responsible for checking the readings against the QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased at the sole discretion of the EoR.

SAA instrumentation is operated in accordance with the *SAA Operation Manual* (attached in Appendix C.5).

9.8.5 Groundwater Wells

MPMC has a *QA/QC Manual* (Appendix H), which is required under *EMA* Permit 11678. This manual was last updated in November 2020 for the annual review. This manual includes a Groundwater Well Standard Operating Procedure and Groundwater Well Work Method for the operation of groundwater wells at Mount Polley Mine; both are included for reference in Appendix H.

Wells are used to collect information for both environmental and embankment performance monitoring. Any wells sampled for environmental reasons shall do so under their respective requirements and procedures. Information gathered for the purposes of embankment performance monitoring will be sent to the EoR for analysis.

10.0 DOCUMENTATION

10.1 Annual Dam Safety Inspection (DSI)

Annual inspections of the TSF and associated facilities are required to evaluate the current performance of the TSF and to observe potential deficiencies in its condition, performance and/or operation. The Water and TSF Superintendent is responsible for arranging the inspections. This

level of dam safety evaluation should be based on detailed observations made by the EoR on site and the relevant information on the TSF operations collected by site personnel. Additional reviews may be required also as a follow up to the report of an unusual event or observation.

The EoR will evaluate the safety of the TSF and incorporate a routine review of the following:

- The consequence classification of the dam;
- The OMS Manual;
- The availability of all documents pertaining to dam safety on site;
- The site surveillance practice; and
- Changes in relevant regulatory requirements since the last inspection.

The EoR will issue an annual inspection report after completing the review. The report will be prepared in accordance with the EMLI *Guidelines for Annual Dam Safety Inspection Reports*. The report will include the following:

- Conclusions on the status of the TSF;
- Statements indicating completion of recommendations from previous inspections and reviews; and

Recommendations, setting priorities and a timeline for completion, if necessary.The Mount Polley General Manager and the EMLI should review each annual inspection report. The report shall be submitted to the EMLI Chief Inspector by March 31 of the following year. Copies of the reports should be made available on site and are available in the office of the EoR. The Mount Polley General Manager will ensure that an appropriate action plan is prepared and executed to ensure that all recommendations made in the annual inspection report are followed. This action plan shall be documented within the General Managers Summary Report which is submitted to EMLI before March 31 annually.

10.2 Independent Engineering Review Panel (IERP)

An independent engineering review panel (IERP) has been established to provide expert technical guidance related to all aspects of the design, construction, operation and closure planning for the TSF.

The IERP comprises at least three (3) qualified experts, and shall meet at a minimum annually. The objectives of the IERP are to confirm that the design and operation of the TSF is consistent with industry standards of best practice, to identify areas where risk reduction measures may be required and to provide advice that may add value to the safe operation, closure and long-term maintenance of the TSF.

A report prepared by the IERP shall be submitted to the Mount Polley General Manager within one (1) month of completion of a review meeting. The Mount Polley General Manager shall

provide a summary of IERP activities and recommendations to the EMLI Chief Inspector on an annual basis.

10.3 Dam Safety Review

The principle objective of a Dam Safety Review (DSR) is to ascertain that a dam has an adequate margin of safety, based on the current engineering practice and updated design input data. A DSR may also be carried out to address a specific problem. The 2022 DSR was finalized and recommendations and action plans are tracked.

A qualified engineer will be responsible for conducting each DSR at the TSF. The engineer conducting the DSR must be qualified to conduct safety evaluations and be familiar with the designs and other site-specific conditions and requirements pertaining to operations of the impoundment and associated facilities; but ideally should not have been involved in the design, construction or operation of the TSF.

Routine DSRs at the TSF will be scheduled, confirmed or revised at the time of each annual inspection. As required under the *Mines Act* Permit M-200; a DSR for the TSF was completed in April, 2017 and 2022.

A detailed scope of work for each DSR will be defined by the engineer prior to conducting the review and will be consistent with current engineering practice at the time it is conducted. Each DSR will evaluate the safety of the TSF and incorporate a detailed review of the following:

- The consequences classification of the dam;
- The adequacy of past annual inspection practice, the annual inspection recommendations, and their implementation;
- The OMS Manual; and
- Timing for the next regular DSR.

Each DSR report should include conclusions and, if necessary, recommendations pertaining to the safety of the TSF. Copies of the DSR will be sent to the Mount Polley Mine General Manager and the EMLI for review. Similar to the annual inspection report, an action plan should be prepared by the Mount Polley General Manager to address any DSR recommendations. A copy of each DSR will be sent to the EMLI and will also be available at the site and at the office of the EoR.

10.4 Construction Records (As-built) Report

At the end of each year's construction activities, the EoR shall prepare a construction record report of the activities. The report will document the extent of the construction activities, QA/QC results, and modifications to the design, which have occurred. It will also comment on whether construction was completed to the nature of the design, and, if not, detail all required works to

ensure that embankment safety shall be maintained. The report is due by March 31 of the year following construction.

11.0 EMERGENCY PROCEDURES

All operation of water management structures as outlined in this OMS Manual, including that relating to emergency procedures, is completed in accordance with regulatory requirements, company policies and sound operating practices, encompassing all significant aspects of, and activities for, the economical, safe and environmentally responsible storage of tailings and management of water. Additionally, there are two (2) documents, independent to the OMS Manual that specifically address emergency response: the TSF-specific *Emergency Preparedness and Response Plan* (EPRP) and the Mount Polley Mine Site *Emergency Response Plan* (ERP). The TSF *EPRP* is included in Appendix E for reference.

The *EPRP* enables MPMC to identify emergency and hazardous conditions threatening the TSF, expedite effective response actions to prevent failure, and reduce loss of life and property damage should failure occur. The *EPRP* provides TSF-specific guidance to complement the Mount Polley Mine Site *ERP*.

EMLI has outlined the definition of a Reportable Incident shown below in **Error! Reference source not found.**. Section 1.7.1 (2)(c) of the HSRC is specific to the Tailings Dam Facilities.

Reportable Incidents

Reportable Incidents

1.7.1 (1) The following incidents are classified as dangerous occurrences and must be reported in accordance with section 1.7.2:
- (a) an incident that causes serious injury or loss of life;
- (b) an incident that had the potential to cause serious injury or loss of life.

(2) In addition to an incident referred to in subsection (1), the following incidents are classified as dangerous occurrences and must be reported in accordance with section 1.7.2:
- (a) unexpected major groundfall, slope failure or subsidence;
- (b) unexpected structural failure or collapse of any part of the mine;
- (c) for dams or dikes:
  - (i) unexpected cracking, subsidence, seepage, springs;
  - (ii) loss of freeboard;
  - (iii) washout, structural erosion, or any other deficiency that may adversely affect the integrity of the structure.

Figure 11.1 – 2022 HSRC Reportable Incidents

In the event of a Reportable Incident, the TSF QP or designate will notify EMLI. HSRC Section 1.7.2 outlines the requirements of this notification

Notification of a Reportable Incident

1.7.2 (1) In the event of a reportable incident, the manager must

(a) in the case of a reportable incident referred to in section 1.7.1. (1) (a), within 4 hours of the reportable incident, provide a verbal notification of the incident to an inspector, the management co-chair and the worker co-chair of the OHS committee or their designates and the local union,

(b) within 16 hours of a reportable incident, provide a written notice of the incident to an inspector, the management co-chair and the worker co-chair of the OHS committee or their designates and the local union, and

(c) within 60 days of a reportable incident, or within any longer time that may be specified by the chief inspector, submit the investigation report required under section 1.7.4 (2) to the chief inspector.

(2) The manager must engage with First Nations that may be affected by reportable incidents to determine which reportable incidents must be reported to the First Nations.

Figure 11.2 2022 HSRC Reportable Incident Notification

In the event that MPMC is unable to comply with any of the terms and conditions of the *Mines Act* Permit M-200 regarding the TSF, due to any cause, MPMC will:

- Immediately notify the EMLI of the failure to comply;
- Immediately take action to stop, contain, and/or clean up unauthorized discharges or otherwise stop the non-compliance, correct the problem, and if applicable, repeat sampling and analysis of any non-compliance immediately; and,
- The report will contain a description of the non-compliance, including dates and times, if the non-compliance has not been corrected, the anticipated time it is expected to continue, and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the non-compliance.

11.1 Warning Signs

There are three status levels (or warning signs) which can be assigned to observations or conditions noted with respect to the TSF and other water management facilities. Certain triggers for the TSF, as listed within the QPO tables, (Appendix I), already contain stated actions, which shall be the

default reaction to such an occurrence since they refer to very specific criteria. However, the responses listed in the QPO's are very specific, and these and other observations and conditions should also be incorporated into the site EPRP, which defines and describes the general response to varying degrees of emergency condition, as follows:

Level 1 - Condition

Unusual conditions that do not yet represent a potential emergency, but do require prompt investigation and resolution.

The action in the event of a Level 1 Condition will typically involve an investigation, intensified monitoring, inspecting and/or testing, and defining and implementing possible corrective measures. The trigger levels, which elicit a description of "Concern Zone" within the QPO table, would be described as Level 1 within the EPRP guidelines.

Construction equipment will be available at the Mount Polley Mine Site and include, but not be limited to: excavator(s), grader(s), haul truck(s) and bulldozer(s). Construction materials will be available at the TSF and around the Mine Site for use in repairing or remediation of any damaged areas.

The notification procedures are as follows:

- The person first noticing a Level 1 Condition shall notify the Mine Operations Superintendent and the Water and TSF Superintendent and initiate corrective actions and intensified monitoring.
- The Water and TSF Superintendent shall notify the General Manager and the EoR as appropriate.

Level 2 – Condition

Conditions that represent a potential emergency, if sustained or allowed to progress, but no emergency is imminent.

The first action in the event of a Level 2 Condition is to discuss and define an action plan, at the site, under the direction of the Water and TSF Superintendent. The trigger levels which elicit a description of "Buffer Zone" or "Unsafe or Out of Compliance Operating Zone" within the QPO table would be described as Level 2 within the EPRP guidelines. A more complete understanding of the full condition and consultation with the EoR may upgrade any of these triggers to Level 3.

In many cases, this will also involve contacting, and discussing the event with the EoR. After such a plan is prepared, it must be presented to the Mount Polley General Manager for approval. Construction equipment should be made available, if required, at short notice.

The notification procedures are as follows:

- The person first noticing a Level 2 Condition shall notify the Mine Operations Superintendent and the Water and TSF Superintendent. Initiate corrective actions and/or intensified monitoring as appropriate.
- The Water and TSF Superintendent shall notify the Mount Polley General Manager and the EoR as appropriate.
- Buffer Zone and Unsafe or Out of Compliance Operating Zone will trigger a Reportable Incident Notification to EMLI

Level 3 - Condition

An emergency defined by either failure of a significant component of the TSF and/or associated facility or a significant failure of the performance of a component of the TSF. Such failure may have already occurred, or be imminent.

The first actions in the event of any Level 3 (Emergency) Condition are:

- Check that all persons who could possibly be affected are safe; and
- Initiate the appropriate chain of communications.
- If not done so already, a Reportable Incident Notification must be submitted to EMLI

The person who initiated the communication should then stand by at a safe location near the problem area and await further instructions or decisions. All those involved in emergency response, after first having communicated with the appropriate parties, should consider two (2) types of actions as first steps in the emergency response, with respect to the protection of human life and health, environment and property:

- What can be done to prevent the situation from worsening?
- What can be done to reduce the consequences of the impending or actual failure?

Any such action must be presented to the Water and TSF Superintendent, who will refer the action to the Mount Polley General Manager and the EoR, who collectively will decide on its implementation in consultation with the EMLI.

The notification procedure for a Level 3 (Emergency) Condition is as follows:

- The person noticing a Level 3 (Emergency) Condition shall notify the Mine Operations Superintendent, who will inform the Water and TSF Superintendent and the Mount Polley

General Manager. Corrective actions and/or intensified monitoring are to be initiated, as appropriate.

- The Water and TSF Superintendent will contact the EoR.
- The Mount Polley General Manager shall notify the Corporate (Vancouver) office and the EMLI.

In the event of an emergency that will result in an actual or potentially imminent embankment failure, or unplanned release of water to the environment, the Mount Polley Mine General Manager shall also notify the BC-ENV, and Emergency Management BC.

Names and telephone numbers for the key contacts are given in Table 2-1..

Certification of This Manual

This manual was produced onsite and is intended to provide full guidance with respect to the Operation, Maintenance, and Surveillance of the TSF as well as the Site Water Management Infrastructure. It is a live document in the sense that it shall be kept up to date to reflect the most current conditions and shall be re-distributed in part or whole if it deemed necessary to maintain a safe, operable site.

The Master Hardcopy shall be kept onsite in the Water and TSF Superintendent's Office. Digital Copies of this Manual, in its entirety, shall be kept in the Environmental partition of the Mount Polley Server. Digital copies of the reference documents listed in Table 6.1 shall also be kept in the same folder.

The Water and TSF Superintendent as well as the General Manager shall sign the Master Hardcopy. All other copies are reproductions only.

The Manual is valid until March, 2022

APPENDIX 4-1B: Geochemistry of tailings from the Mount Polley Mine, British Columbia

Geochemistry of tailings from the Mount Polley Mine, British Columbia

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To support remedial decisions for the Tailings Storage Facility breach at the Mount Polley Mine (MPM), a geochemical characterization program assessing the metal leaching and acid rock drainage potential of the tailings and other materials released into Polley Lake, Hazeltine Creek, and Quesnel Lake was performed. Because the tailings and other materials settled under subaerial conditions along the banks of Hazeltine Creek and in subaqueous conditions in Polley and Quesnel Lakes, the geochemical characterization assessed reactivity in both terrestrial and aquatic environments. Tailings and other materials deposited in these areas were found to be consistently non-acid generating indicating that weathering conditions are expected to be pH-basic under all depositional conditions. Leaching potential of tailings in subaerial environments was low and the potential for oxidative and reductive dissolution under deep water conditions was found to be negligible. Sub-aerial copper leaching is likely controlled by mineral solubility, which will limit loadings to the environment and can be used to inform remedial decisions.

1 INTRODUCTION

A failure of a glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility at the Mount Polley Mine (MPM), British Columbia caused a breach of the embankment tailings dam on August 4, 2014 (IEEIRP, 2015). The dam breach resulted in a release of tailings and other materials into Polley Lake, Hazeltine Creek, and Quesnel Lake. As part of remediation planning, a geochemical characterization program assessed the metal leaching and acid rock drainage (ML/ARD) potential of the spilled tailings and other materials and this paper presents the key findings from the investigation.

2 BACKGROUND

2.1 *Geological Setting*

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008). The host rocks for porphyry mineralization are intrusions into the Nicola Volcanics varying in composition from diorite to syenite. Alteration is potassic (secondary biotite and pink orthoclase) and propylitic (calcite-epidote-chlorite-pyrite). Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5). Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$); iron carbonates have not been reported.

A significant portion of the copper at the MPM is not associated with sulphides (upwards of

50% in the upper portions of each pit) and has been historically been termed copper-oxide, although this includes both silicate hosted copper (e.g., chlorite) and copper carbonates like malachite (Taplin 2002).

2.2 *Ore Processing and Tailings Deposition*

Processing of ore mined from the Mount Polley yields a copper sulphide concentrate. In general terms, the concentrate is produced by blasting the ore and then hauling it to the processing plant, where it undergoes three stages of crushing, and three stages of grinding, followed by rougher and cleaner flotation to produce a copper concentrate. The flotation circuit concentrates sulphide minerals as they are hydrophobic. Following the removal of the copper sulphide minerals by flotation, the remainder of the slurry is disposed of as tailings. The tailings are lower in sulphide mineral content compared to the ore as majority of the copper sulphides have been removed.

Mill process reagents, with the exception of lime, are not expected to be present with the tailings and other materials deposited as they would either have remained with the concentrate (chemically bound to mineral surfaces) or degraded quickly in the environment. Life-of-mine processing changes were minimal and not expected to affect the geochemical reactivity of the tailings. As a result, the tailings geochemistry can be considered in aggregate.

Tailings slurry produced in the mill is gravity-fed to the TSF with deposition by single-point discharge. The single point discharge was often directed to cells, where bulldozers and weirs were used to separate the coarser fraction of the tailing from the finer fractions and build up sand adjacent to the embankments. The discharge point was sequentially rotated along the entire length of the three embankments (i.e. the Perimeter, Main, and South Embankments). The tailings produced during operations would have been well mixed and there appears to have been limited potential to create anomalous geochemistry zones that could have spilled after the dam breach.

3 CONCEPTUAL MODEL AND STUDY DESIGN

An initial geochemical conceptual model (IGCM) was formulated to guide the design of the characterization approach for the tailings and other materials deposited, which effectively represents hypotheses about tailings characteristics and reactivity that are subsequently evaluated through observations, sampling, testwork, and interpretation.

Complete details of the IGCM are provided in SRK (2015) and indicated that two main configurations of the tailings and other materials deposited needed to be evaluated. First, subaerial tailings along the banks of Hazeltine Creek would be susceptible to oxidation of sulphides due to exposure to atmospheric oxygen. Second, subaqueous tailings on the bottom of Polley Lake and Quesnel Lake would be much less reactive in terms of sulphide oxidation due low or oxygen free water but could facilitate dissolution of secondary minerals (i.e. iron hydroxides).

4 CHARACTERIZATION METHODS

4.1 *Overview*

Geochemical characterization of the tailings and other materials deposited consisted of field sampling along Hazeltine Creek and a series of geochemical tests to understand the composition, mineralogy and leaching characteristics under various storage configurations. SRK focused on the tailings and other materials deposited along Hazeltine Creek because weathering under sub-aerial conditions should represent the most likely scenario for leaching based on the IGCM. In addition, sampling by another consulting group (Minnow Environmental) included tailings and other materials deposited that settled in Polley and Quesnel Lakes. Between the historical data for the site, and two independent sampling campaigns, the assumption was that geochemical variability would be characterized. Complete details of field sampling and analytical

methods are provided in SRK (2015) and the following section provides key aspects of the methods used as part of the ML/ARD characterization program.

4.2 *Hazeltine Creek Sampling*

Samples of exposed tailings and other materials deposited in Hazeltine Creek were collected along 18 parallel transects, oriented roughly perpendicular to the course of Hazeltine Creek. The transects were spaced approximately 500 m apart beginning with transect ST17/18 in the area of the dam breach and ending with transect ST01 near the mouth of Hazeltine Creek at Quesnel Lake (Figure 4-1).

At each transect, major physical/depositional features were sampled, with up to five samples per transect. Physical/depositional features were determined in the field based on particle size (fine grained versus coarse), colour, or depositional area (e.g. high on a bank or shoulder versus adjacent to the creek). In total, 68 samples containing tailings and other materials deposited were collected. Approximately 10% of samples were collected as field duplicates and silica sand samples were included as field blanks.

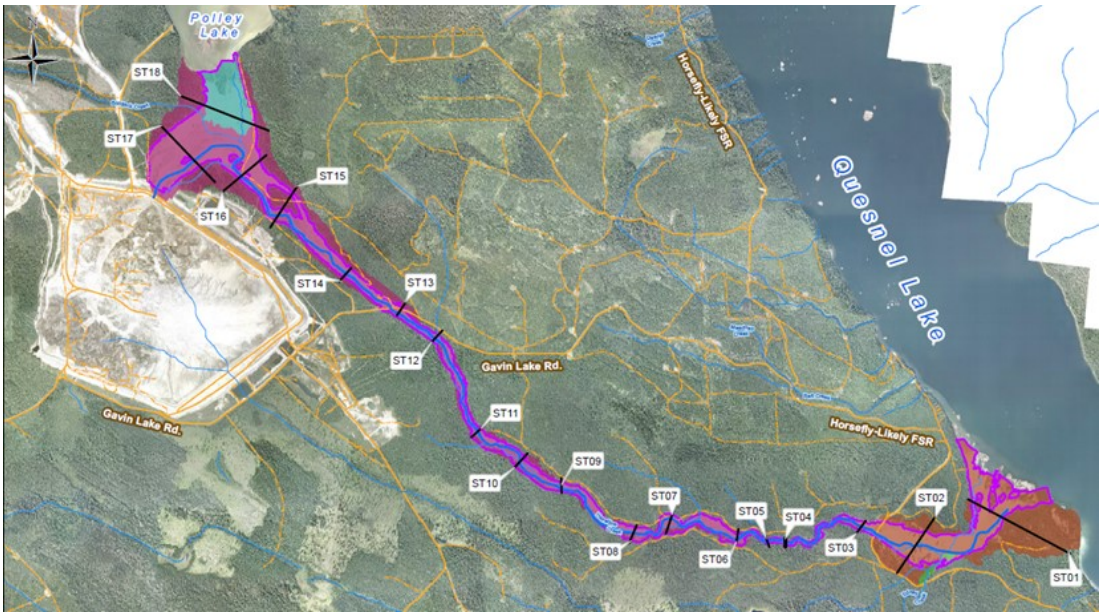

Figure 4-1: Location of Hazeltine Creek Sampling Locations (SNC-Lavalin, 2015).

A total of 78 additional samples were collected from the study area for sequential extraction analyses by Minnow Environmental between August 13 and October 24, 2014. Specific details of the sample collection procedures and locations are provided in Minnow (2015). Of the samples collected, 18 were from the profundal zone in Quesnel Lake (6 lake sediment samples and 12 tailings and other materials deposited), 18 were from the littoral zone in Quesnel Lake (2 lake sediment samples and 16 tailings and other materials deposited), and 15 were tailings and other materials deposited from along Hazeltine Creek. Fifteen samples from the bottom of Polley Lake were also collected.

4.3 *Laboratory Analyses*

4.3.1 *Acid-Base Accounting and Trace Element Composition*

A two-phase testing approach was used for geochemical characterization in order to constrain composition variability and understand specific acid-base accounting (ABA) and mineralogical characteristics of the Hazeltine Creek samples.

Phase one testing included moisture content, multi-element analysis, including sulphur content by aqua regia digestion with an inductively coupled plasma mass spectrometry (ICP-MS) finish, total inorganic carbon (TIC), and particle size distribution by sieving.

Phase two testing was conducted on 25% of the samples, which were selected to capture the range of sulphur, TIC, copper, and selenium content in the Hazeltine Creek samples based on the results of the phase 1 analyses. Testing included paste pH and conductivity, modified Sobek Neutralization Potential determination (MEND 1991), total sulphur (by LECO furnace) and sulphate sulphur (by hydrochloric acid (HCl) leach). A non-sulphide copper analysis was also conducted by leaching sampled using 2.5% sulphuric acid with the filtered leachate submitted for ICP-MS multi-element scans.

4.3.2 *Mineralogical Characterization*

Mineralogical characterization using Quantitative Evaluation of Minerals by Scanning Electron Microscopy (QEMSCAN) was conducted on splits from all of the kinetic test program samples (see Section 4.3.4). Rietveld X-ray diffraction (XRD) and electron microprobe were selectively used to refine and confirm modal abundances, mineral form (e.g. the different iron oxides present) and element deportment for low concentrations that could not be resolved by QEMSCAN.

4.3.3 *Sequential Extractions*

Sequential extractions involve a progressive series of chemical extractions applied to the same sample in order to partition the total element content into geochemical 'fractions'. The sequential extractions conducted for the tailings were designed and directed by Minnow Environmental (Minnow 2015) and based on Tessier et al.'s (1979) procedure with modifications. However, the procedure is designed for soils, and as a result, some of the reagents used would likely target different mineral fractions in tailings than they would in soils. The most significant deviation included the 'organically bound' elements as there are expected to be limited amounts of organic materials in the tailings and the reagents (nitric acid, hydrogen peroxide) and temperatures (85°C) used likely oxidized some of the sulphide and may also leach more resistant oxide minerals. Tessier et al. (1979) also noted some alteration of the minerals smectite, chlorite and mica in this digestion step and these minerals are present in the MPM tailings.

4.3.4 *Kinetic Testing*

The kinetic testing program consists of six standard laboratory humidity cells (MEND, 1991) (labelled HCs 1 - 6), three column leach tests (COLS 1 – 3), two blanks (a HC and a column), and one HC duplicate. The intent of the kinetic testing program was to establish weathering rates under oxygen unlimited conditions using humidity cell testing and then use column tests to evaluate the effect of longer flow paths and lower water to solids ratios that were more similar to the field than dilute HC tests.

A range of tailings samples containing mean and upper 95th percentile materials for copper, selenium and sulphur were selected. Columns tests consisted of between 1.5 and 4.5 kg of material that were splits from the humidity cells (i.e. HC-1 = COL-1) and were leached with between 150 and 500 mL of water in a week, respectively. All kinetic tests were flushed weekly with leachate analysed for anions, major cations and trace elements needed for the province of British Columbia water quality assessments.

5 RESULTS

5.1 *Hazeltine Creek Field Sampling*

Two types of tailings-bearing samples were observed along Hazeltine Creek. They were classified in the field as 'grey tailings' and 'magnetite sands' based on physical and mineralogical characteristics. The grey tailings were silty-sand sized particles, and reacted strongly to HCl fizz test in the field. The magnetite sands samples were pinkish-orange, had a moderate to weak fizz reaction and were strongly magnetic.

The grey tailings tended to be most abundant along the embankments and upper benches of the creek, whereas the magnetite sands were commonly present in low-lying areas near the creek. With the exception of the area near the tailings dam breach and Polley Lake, the tailings were deposited in relatively thin 'skiffs' (e.g. 10 to 20 cm deep). The thickest observed subaerial tailings deposits (e.g. 1 to 1.5 m deep) were in the immediate vicinity of the tailings dam breach and Polley Lake (SNC-Lavalin 2015).

5.2 *Laboratory Analyses*

5.2.1 *Acid Base Accounting*

The form of sulphur was found to be sulphide, with sulphate typically below detection. Sulphide sulphur from ICP-MS was used for calculating acid-potential (AP). Neutralization potential (NP) by titration was found to be overestimated and carbonate by TIC was used to estimated NP for acid-base account calculations (SRK 2015). Iron carbonates, which can also overestimate carbonate NP, have not been identified at MPM.

Consistent with expectations from operational sampling (data provided by MPMC to BC Ministry of Environment (MoE) http://www.env.gov.bc.ca/eemp/incidents/ 2014/mount-polley.htm), the tailings and other materials deposited were found to all be non-ARD generating (Figure 5-1).

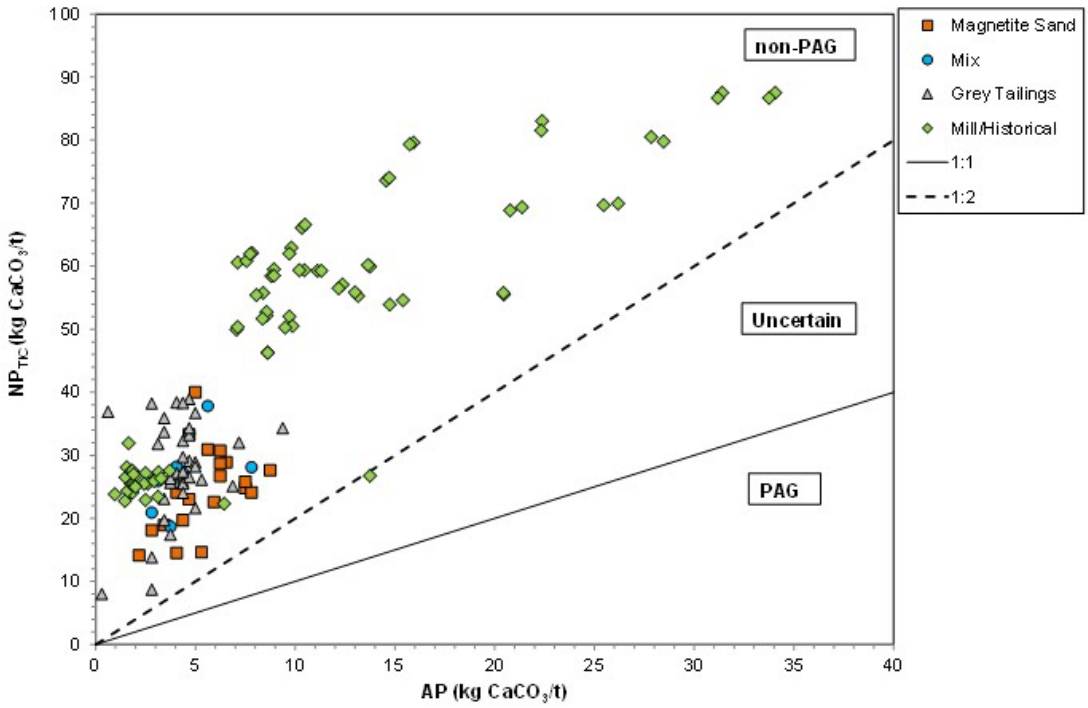

Figure 5-1: Comparison of tailings and other materials deposited and MPM mill/historical tailings.

5.2.2 *Trace Element Occurrence*

Complete analytical composition results for all samples from a 35 element scan are provided in SRK (2015). A statistical summary and shortened list of element concentrations that have guidelines for the protection of freshwater aquatic life in British Columbia is provided in (Table 5-1).

Table 5-1: Statistical summary of selected trace elements in MP tailings and other materials deposited.

Statistic	As mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Se mg/kg	V mg/kg	Zn mg/kg
Min	7.2	29	4.0	0.03	0.57	0.3	86	40
P5	8.7	360	4.4	0.06	1.9	0.74	120	45
P25	10	800	4.9	0.08	3.9	1.2	160	52
Mean	11	880	5.7	0.091	4.3	1.4	180	57
Median	11	910	5.4	0.08	4.6	1.5	180	56
P75	12	990	6.0	0.10	5.0	1.6	200	61
P95	13	1300	8.5	0.13	5.5	1.8	250	74
Max	13	1500	12	0.28	6.5	1.9	300	82

To provide an indication of trace element enrichment in the tailings and other materials deposited samples, concentrations were compared to typical global average concentrations for basalt (Price 1997). This comparison approach is a standard element leaching screening practice as outlined by MEND (2009). Concentrations present at more than an order-of-magnitude above global average values were considered enriched for the purpose of screening and enrichment ratios are shown in Figure 5-2. The ratios were calculated by dividing the concentration of copper (for example) in the sample by the typical concentration of copper in basalt. Ratios greater than 10 are considered enriched. Ratios less than one indicate lower concentrations in the Hazeltine Creek samples than in average basalt. 'Box and whisker' plots were used to illustrate the results, with the boxes representing the 25th to 75th percentile ranges. The solid horizontal line represents equivalence with typical basalt, whereas the dashed line represents ten times the concentration of basalt.

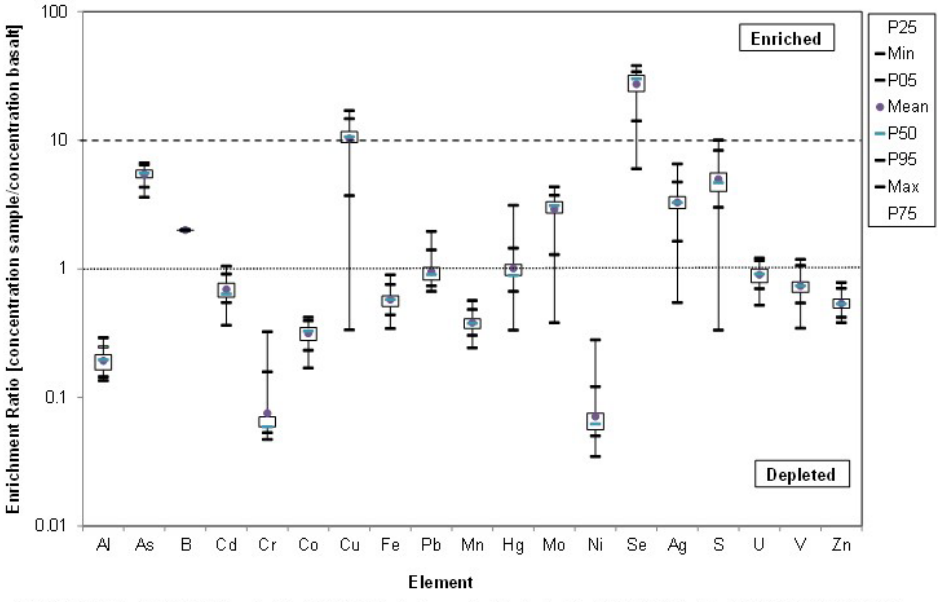

Figure 5-2: Element enrichment assessment for Hazeltine Creek tailings samples.

Based on the enrichment screening method of MEND (2009), copper and selenium are considered to be enriched in the tailings. However, the average concentration of selenium in operational tailings from within the TSF is lower (1.1 mg/kg) than the spilled materials and similar to the average of 137 regional stream sediment samples from the region surrounding Mount Polley (average 1.0 ppm, range 0.1 to 9.1 ppm)(GSC 1981; Jackman 2008)(Figure 5-3).

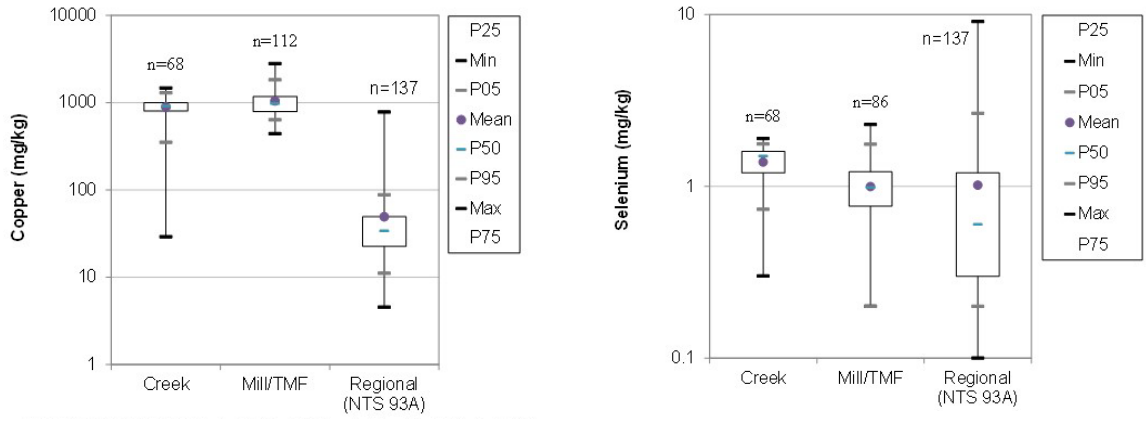

(A) (B)

Figure 5-3: Comparison of copper (A) and selenium (B) concentrations in Hazeltine Creek tailings and other materials deposited, operational mill tailings and regional sediments.

5.2.3 *Mineralogy*

The samples are dominated by silicates, including feldspars, chlorite and quartz. Iron oxides (mainly magnetite) were frequently the next most abundant minerals after the silicates, followed by carbonates and the minor amounts of sulphides. The presence of quartz at concentrations greater than 1% is a good indication that the tailings are intermixed with native sediments as the deposit is syenitic to monzonitic and the tailings should contain very little to no quartz (BC MINFILE No. 093A 008).

Sulphide mineralogy is consistent with the ore mineralogy previously described for the project, including pyrite and chalcopyrite as the two main sulphide minerals in approximately equal proportions (approximately 0.2% for each mineral), followed by bornite (less than 0.1%) and other copper sulphides (likely covellite).

The main carbonate present was calcite, ranging from 0.7% to 4.5%. Dolomite was also present, although typically less than 0.1% with the exception of one sample (HC-4) at 0.4%. Malachite was also present, although at near detection levels.

Copper and selenium deportment was investigated, however, the concentration of selenium was too low to be detected by QEMSCAN or electron microprobe and only copper results are available. Chalcopyrite contained approximately half of the copper when total copper concentrations were above 0.05%. Chlorite was the next most abundant mineral to host copper, followed by bornite and covellite/chalcocite.

The deportment in chlorite was unexpected as previous investigations have indicated that chrysocolla was the non-sulphide mineral phase hosting copper. However, other studies have also noted the same finding (Chanquıa et al, 2010) and the overall implication is likely insignificant in terms of reactivity as previous work by MPMC has shown copper in the non-sulphide phase extremely resistant to leaching by acidic solutions (Taplin 2002; Henry 2009). Results from the non-sulphide copper leach also support these findings with an average of 50% of the copper in a non-sulphide phase. Given the recalcitrant nature of this copper mineral phase, it is also considered a much less reactive phase compared to copper sulphides.

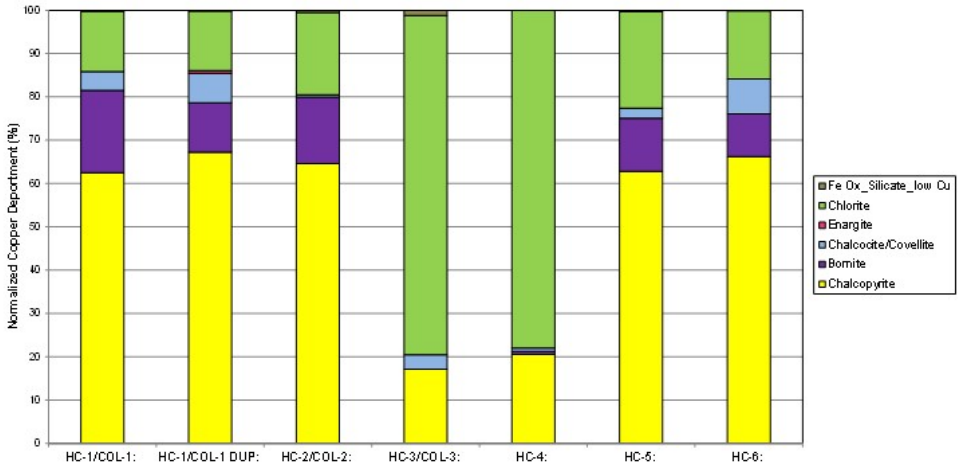

Figure 5-4: Mineral deportment of copper in Hazeltine Creek tailings and other materials deposited samples.

5.2.4 *Sequential Extraction Results*

Results from the extractions were grouped together to represent tailings and other materials deposited from Hazeltine Creek, from the bottom of Quesnel and Polley Lake, and also lake sediments that were not impacted by the tailings discharge (i.e. a background lake reference). Iron and copper are shown in

Figure 5-5. Iron is not considered enriched the tailings, but is often associated with minerals that are susceptible to dissolution under sub-oxic conditions.

Iron was predominantly associated with the 'residual metals' fraction (e.g. 85% of total iron extracted in lake tailings) in all samples tested, which is likely comprised of mainly sulphides due to the use of an aqua regia digest as the final step. Magnetite was not likely dissolved in any of the sequential extraction steps. Only a small portion of the iron was present in the reducible fraction (~ 12%) and at lower concentrations than the background lake reference samples.

Copper was mainly associated with the 'organic bound' fraction, although as previously discussed in Section 4.3.3, this is likely partially associated with sulphide minerals and also chlorite due to the reagents and temperatures used in the extraction step (Tessier 1979). Mineralogy results also support this with the deportment of copper partially in chlorite. The 'residual' fraction contained the next highest amount, but also notable for copper was the presence of 4% in the 'carbonate metal', likely reflecting the presence of malachite.

Selenium results (not shown) were predominantly below detection (0.2 mg/kg based on aqueous concentrations in the extractions), with only the 'organic bound' and residual fraction slightly above detection limits.

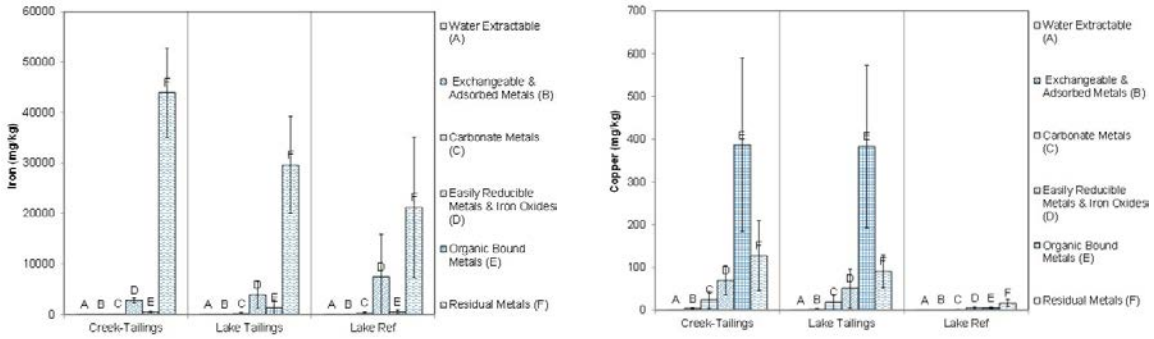

(A) (B)

Figure 5-5: Sequential extraction results for iron (A) and copper (B).

5.2.5 *Kinetic Testing*

Complete results for all elements regulated by the province of British Columbia are provided in SRK (2015) for both humidity cells and columns. Approximately one year of testing has been completed for this investigation, with testing on-going.

Copper is the focus of results presented below as copper is one of the two elements identified as enriched in the tailings. Sampling by the British Columbia Ministry of Environment (BC MOE) at the Mount Polley Mine has also identified copper as the main element of concern. Copper leaching is strongly pH dependent and therefore pH is also included for discussing long term copper behavior.

Humidity cell results (data not shown) have shown steadily declining rates of copper leaching under pH neutral conditions (pH of 8). Copper is leaching at a rate of 0.002 mg/kg/week, with concentrations around 0.005 mg/L. The columns (which are splits from HC composites) are also pH slightly basic (pH of 8) with a copper leaching rate slightly lower than the humidity cells at 0.001 mg/kg/week with concentrations now around 0.01 mg/L (Figure 5-6). The higher concentrations and lower leaching rate in the columns are interpreted here to reflect a solubility limit being reached, which is discussed in Section 6.1.1.

The lower pH and higher copper concentrations during the start of the kinetic tests are likely a result of the samples being stored in the laboratory for several months before testing began. During this time, the sulphide minerals would still have been oxidizing but the acidity formed could not be neutralized by the available carbonate minerals as there was no flow of water through the sample. As the column test started and water was passed through the tailings, pH increased and copper concentrations decreased.

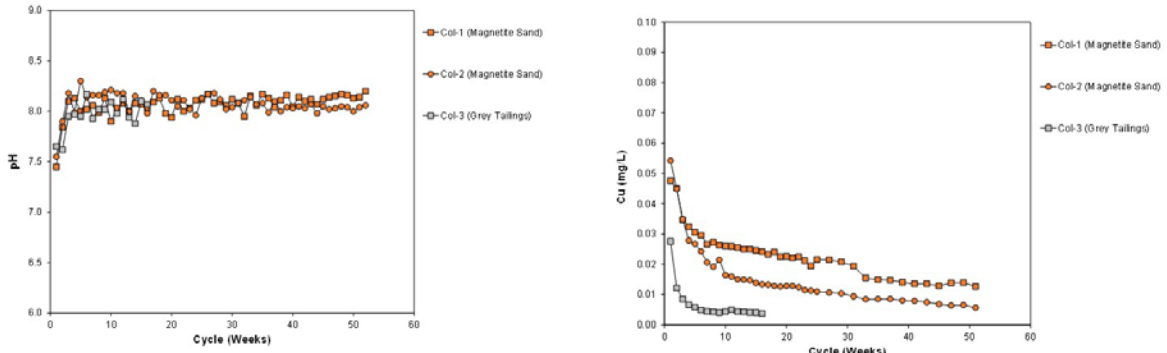

(A) (B)

Figure 5-6: Column testing results of pH (A) and copper (B).

6 DISCUSSION

6.1 *Leaching Mechanisms*

6.1.1 *Subaerial Weathering of Tailings*

Tailings and other materials deposited are expected to weather under neutral pH conditions. ARD has not been identified as a concern for Mount Polley tailings historically and the results of this program confirm the previous findings that weathering and trace element release will be under neutral pH.

The tailings and other materials deposited and mixed-in sediment materials deposited along the banks of Hazeltine Creek and any other subaerial setting will weather in the presence of oxygen. However, leaching is expected to be slow because sulphides leach at relatively slow rates under neutral to basic pH conditions when compared to acidic conditions, which is typically orders-of-magnitude faster. On-going geochemical testing is supporting this assessment and showing slowly declining copper release rates. Silicates will also weather, but at even slower rates that are dependent on mildly acidic rainwater (the dissolved carbon dioxide equilibrium pH of rainwater is ~5.5). Given the carbonates present in the MPM tailings, mildly acidic rainwater will be neutralized upon contact and leaching of silicates would be slower than could occur by rainwater.

Thermodynamic first principles and the equilibrium modelling software package PHREEQC (version 2.17.4137) (Parkhurst and Appelo, 1999) predicts low solubility of copper at neutral pH as compared to concentrations that are associated with copper porphyry deposits under acidic pH (Day and Rees, 2006). This is because secondary copper oxide minerals (i.e. malachite, tenorite) that would form after oxidative dissolution from a copper sulphide are only sparingly soluble. The prediction of contact water (i.e. tailings seepage) by PHREEQC under aerobic conditions and pH 8 carbonate buffered rainwater is an upper limit of 0.02 mg/L due to copper oxide solubility limits. This is consistent with other copper concentrations measured under neutral pH at the MPM and other copper porphyry sites (Day and Rees, 2006).

Copper concentrations were used to evaluate copper solubility control in water samples from the laboratory and field. The sites included a sampling site in upper Hazeltine Creek downstream of a one kilometre stretch of deposited sub-aerial tailings (referred to as HAC-13), from the column test containing tailings with 95th percentile copper content, and from a ditch collecting seepage from subaerial tailings and other materials deposited after two years since the tailings spill (provided by the BC MOE and MPM). The ditch water is from an area referred to as the Polley Flats, which is just below Polley Lake and one kilometer downstream of where the width of the area of tailings and other materials deposited is narrow (Figure 4-1). Results were plotted against solubility curves generated using PHREEQC for malachite ($Cu_2CO_3(OH)_2$), tenorite (CuO), and copper hydroxides ($Cu(OH)_2$). A saturation index of zero was used for all three secondary copper minerals, but a saturation index of 0.5 was also used for malachite as activation energy barriers often need to be overcome before a mineral can precipitate and this requires a higher degree of saturation. Malachite (as opposed to tenorite or copper hydroxides) was chosen to evaluate the saturation index range as it is the most likely secondary mineral control based on it being commonly identified on site and in the tailings.

The outcome of the comparison is shown in Figure 6-1. There is a good fit of the dissolved copper concentration results to the predicted concentrations based on pH and mineral solubility, especially to malachite with an SI of 0.5. Lower pH values were associated with spring freshet were similar to the initial flush of material in the laboratory kinetic testing program. During the winter (or prolonged dry periods), the majority of tailings are no longer receiving infiltration due to snow and ice cover allowing oxidation products and acidity to accumulate around the sulphide grains in tailings that do not freeze in the winter. Once freshet begins, these oxidation products and acidity will be neutralized and get flushed from the tailings, with pH increasing while copper concentrations decrease.

Selenium was shown to be correlated with copper (SRK 2015) and likely is present as an accessory element in the copper sulphides as this element often replaces sulphur owing to similar

geochemical properties (Ralston et al, 2008; MEND 2015). However, the methods used in this study could not detect selenium co-precipitated with silicate minerals and so selenium release should be conservatively assumed to be associated only with oxidative dissolution of sulphides.

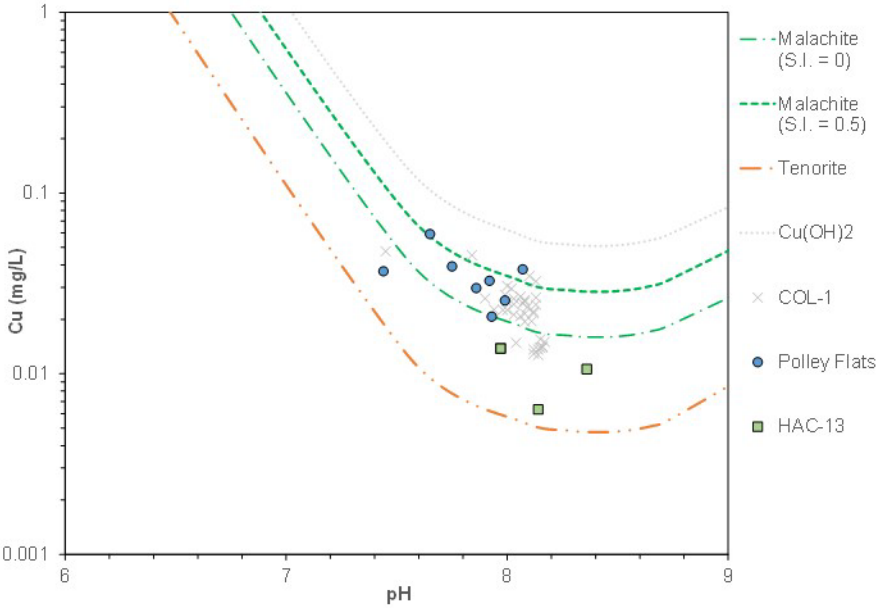

Figure 6-1: Secondary copper mineral solubility curves and monitoring results.

6.1.2 *Subaqueous Dissolution of Tailings*

For any of the tailings and other materials deposited that ended up in Quesnel or Polley Lake, water saturation is the best way to inhibit oxidation of sulphides (INAP 2010). Therefore, leaching of any elements hosted in sulphides (i.e. copper and selenium) that would be released by oxidation is effectively inhibited for tailings present in Quesnel and Polley Lakes.

Based on the results of the mineralogical characterization work and sequential extractions, the risk for mobilization of elements under reducing conditions was found to be low. Easily reducible iron oxides were minor components of the tailings samples tested and neither copper nor selenium were associated with a mineral phase that would be susceptible to reductive dissolution.

It should also be noted that selenium behaves quite differently under reducing conditions and will either sorb to mineral surfaces if it is present as selenite, or precipitate as elemental selenium (Ralston et al, 2008; MEND 2015). In either event, even if selenium was released from reductive dissolution processes, its geochemical behaviour under reducing conditions would result in it being removed from the water column and it is not considered a water quality risk under subaqueous reducing conditions.

6.2 *Reclamation Considerations*

The presence of a secondary mineral control on copper concentrations is an important finding for reclamation planning. This is because any efforts to encourage precipitation run-off and discourage infiltration into the tailings, through either grading or evapotranspiration through soil covers and vegetation growth, will likely result in a decreased loading of copper to the receiving environment. Mineral solubility control will maintain concentrations at a fixed level, so despite unchanging copper concentrations, with less water moving through the tailings, less copper can be transported. The establishment of vegetation on the top of the tailings may also help slow

down oxygen diffusion into the tailings and probably result in lower rates of sulphide oxidation and therefore primary copper leaching rates.

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APPENDIX 5-1: NPR Criterion Report

FINAL

Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones

Mount Polley Mine, British Columbia Canada

Mount Polley Mining Corporation



SRK Consulting (Canada) Inc. ▪ CAPR002434 ▪ October 2023

srk consulting

FINAL

Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones

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Cover Image(s):
Photo of the Springer Pit at the Mount Polley Mine

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Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid-Base Accounting
AP	Acid Potential; expressed in units of kg $CaCO_3$/t
ARD	Acid Rock Drainage
HCT	Humidity Cell Test
ML	Metal Leaching
MPM	Mount Polley Mine
MPMC	Mount Polley Mining Company
Non-PAG	Non-Potentially Acid-Generating
PAG	Potentially Acid-Generating
SERDS	Southeast Rock Disposal Site
TIC	Total inorganic carbon or carbonate. Expressed in units of %C.
TIC-NP	Neutralization Potential calculated from total inorganic carbon or carbonate; expressed in units of kg $CaCO_3$/t
TIC-NP/AP_{crit}	Critical ratio of TIC-NP to AP that is used to segregate waste rock at the mine for ARD potential.

1 Introduction

Mount Polley Mining Corporation (MPMC) operates the Mount Polley Mine (MPM) to produce gold and copper concentrates. Waste rock produced by mining has varying degrees of acid rock drainage (ARD) potential which is managed by MPMC to limit the potential for development of ARD in the future. The metric used to date to classify waste rock is the total inorganic carbon neutralization potential (TIC-NP) to acid potential (AP) ratio (TIC-NP/AP) with TIC-NP/AP≤2 defining potentially ARD generating (PAG) materials. SRK Consulting (SRK) has been working with MPMC to refine acid-base accounting procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has resulted in development of site-specific acid-base accounting procedures for these specific geological zones that will be mined consistent with theoretical considerations and similar approaches used at other mining operations in BC.

This report provides a summary of the methods and factors considered in the development of the site-specific acid-base accounting procedures and evaluation of a site-specific TIC-NP/AP criterion for waste rock from the Springer Deep and WX Zones at MPM.

2 Background

2.1 Geology

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008) and has been mined from several mineralized zones. With the exception of the distinctive small Pond Zone, common features of these zones are:

- The host rock for porphyry mineralization is the Mount Polley Intrusive Complex (MPIC) which intruded into Nicola Group Volcanics (Figure 2-1). The intrusion is primarily monzonite to monzo-diorite in composition. Smaller phases vary in composition from diorite to syenite.
- Mineralization is associated with magmatic-hydrothermal breccias. Alteration and mineralization occur in the matrix of the breccias, and in veins and swarms distributed around the breccias. BX1 is the main host for the bulk of the mineralization at MPM which is mined in the Cariboo and Springer Pits (Figure 2-1) and is planned to be mined from the Springer Deep and WX Zones. BX1 is characterized by alteration which resulted in the strongest destruction of both primary and breccia textures.
- Alteration at MPM is classified as potassic (sodic and calcic) with salmon-pink potassium feldspar as the main alteration mineral. Biotite is less common. Sodic alteration is defined by albite and calcic alteration is defined by actinolite, diopside, epidote, clinozoisite, and sporadic andraditic garnet. Calcite is pervasive. Alteration is zoned with the strongest calcic-potassic alteration in the core associated with BX1. Nicola Group rocks and fringing MPIC rocks have propylitic alteration.
- Like other alkalic porphyry deposits (e.g., Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g., Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPM geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit. Samples from Bell Pit blast holes collected in the early years of operations were identified as being from a Pyrite Zone but the location of this feature is not known.
- Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5).
- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$) formed as a natural weathering product of copper sulphides. Iron carbonates have not been reported.
- A significant portion of the copper at the MPM is not associated with sulphides (upwards of 50% in the upper portions of each pit). This fraction has been termed ‘copper oxide’ by MPM personnel and is associated primarily with chrysocolla ($(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$) and malachite ($Cu_2CO_3(OH)_2$) in equal proportions (Henry 2009). SRK (2015) showed that chlorite is a significant host for copper.

The WX and Springer Deep zones share these characteristics with copper-gold mineralization that is hosted by the BX1 magmatic-hydrothermal breccia that crosscuts monzonite and monzodiorite intrusive units of the MPIC.

Figure 2-1: Geological Map of the Mount Polley Mine

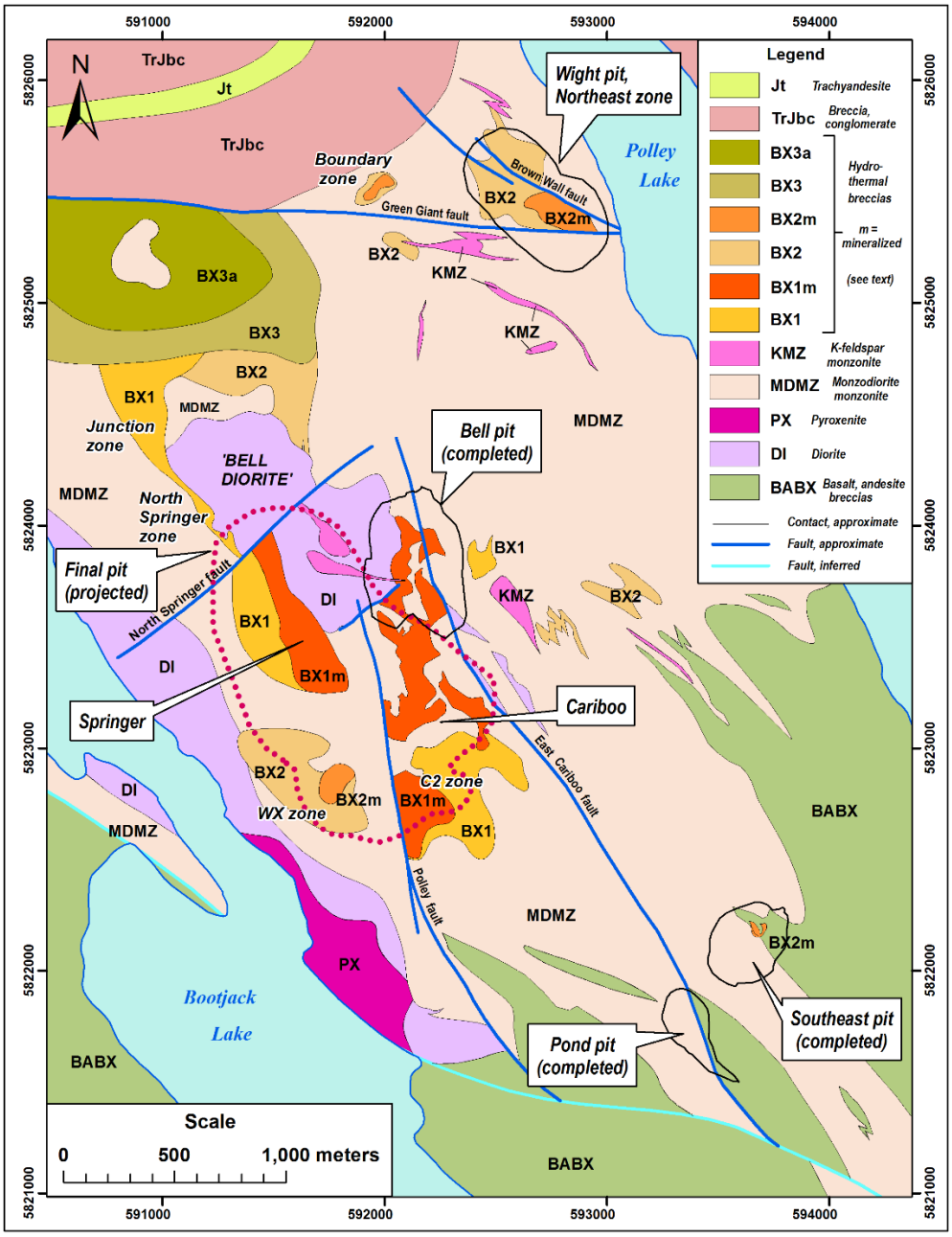

Sources: Rees (2013)

2.2 Site Location, Layout, and Mine Plan

MPMC has been operating MPM, located approximately 56 km northeast of Williams Lake and approximately 15 km southwest of the community of Likely in British Columbia, Canada, since 1996. MPMC recovers copper and gold from porphyry-style mineralization by open pit and underground mining. The plant is capable of processing 22,000 tonnes of ore per day using standard mineral flotation technology.

Full scale mining began in the Cariboo Pit by mining high grade oxide and gold parts of the ore body prior to transitioning to the Bell Pit in 1999. Mining was suspended in 2001 due to unfavorable market conditions. The mine re-opened in 2005 after a three- and half-year care-and-maintenance period. The following zones have been mined since 2005:

- Completed mining and backfilling of the Bell Pit.
- Completed mining and backfilling of the small Southeast Zone and Pond Zone Pits.
- Completed mining and flooding of the Wight Pit (Northeast Zone).
- Completed mining of the Boundary Pit.
- Completed mining and flooding of Northeast Zone underground (access from the Wight Pit).

In May 2019, mining was again suspended due to unfavourable market conditions. Mining operations restarted in November 2021 and milling operations resumed in June 2022.

The current approved mine plan includes mining from the Springer Pit until year 2025. Non-PAG waste rock is currently being placed in the southeast rock disposal site (SERDS) and used as construction material, with PAG waste rock placed in the temporary NW PAG stockpile until being re-handled to the Springer Pit at closure.

MPMC is in the process of preparing a joint Mines and Environmental Management Act (MEMA) permit amendment application package to cover the Springer Pit Expansion which would include mining of the Springer Deep and WX Zones from years 2024 to 2031. The mine plan within the amendment calls for non-PAG rock to similarly be placed in the SERDS and used as construction material, with PAG waste rock placed in the temporary NW PAG stockpile until being backfilled to the open pit at closure.

2.3 Regulatory Framework

The Mount Polley Mine development project received a BC Environmental Assessment certificate in 1992 and the Mines Act Permit *M-200* in 1995. Mining at the site has been carried out under the *M-200* permit since commercial production began in 1997.

The *M-200* permit governs how mine wastes are managed to minimize the impacts of metal leaching and acid rock drainage (ML/ARD). Within the *M-200* Permit, waste rock is required to be segregated for ARD potential and the ARD potential of waste rock is defined using an NP/AP (or NPR) criterion of 2, where NP is calculated using total inorganic carbon (termed TIC-NP) and AP is calculated using total sulfur.

The *M-200* Permit Section 3 (c) stipulates that:

- PAG waste rock can only be disposed in the Cariboo, combined Cariboo/Springer, Wight, and Southeast Zone pits, where it will be submerged permanently beneath a water cover.
- A maximum of 62 million tonnes of PAG waste rock can be stored in the Temporary NW PAG Stockpile until being re-handled to one of the approved pits at closure for permanent submergence.
- Isolated pockets of PAG materials (less than 1,000 tonnes) may be blended with non-PAG materials within the waste rock dumps, at a minimum non-PAG:PAG ratio of 20:1.

Within the framework of evaluating a site-specific TIC-NP/AP criterion for incorporation to the *M-200* Permit, Federal guidance (MEND 2009) outlines that materials with NP/AP within the range of 1 to 2 are considered to have uncertain potential for ARD. Site-specific NP/AP criteria can be developed provided that “acid potential generates acid identical to pyrite and neutralization potential reacts like calcite” (MEND 2009).

2.4 Waste Rock Segregation and Confirmatory Sampling

Waste rock is segregated during mining at MPM using procedures outlined in MPMC (2022). To summarize, waste rock and ore domains are modelled within an ore control and ABA block model prior to mining to support mine planning. Modelled ore control and ABA values are then confirmed by analysis of blasthole cuttings to confirm ore/waste boundaries and PAG/non-PAG boundaries on the pit bench prior to mining.

The success of operational segregation is confirmed through yearly collection of samples from segregated non-PAG rock, results of which are reported in annual ML/ARD reports (i.e. SRK, 2023).

Since 2009, 351 samples have been collected from non-PAG waste rock which has been segregated and placed in the SERDS, used as construction rock for various roads around the site, or used for tailings facility construction. The total dataset of confirmatory samples from 2009 to 2022 (n = 351) is plotted in Figure 2-2 as a function of TIC-NP/AP, which shows that operational segregation is effective with 9% of the samples collected to date thus far having been classified as PAG.

The samples identified as PAG had an average TIC-NP/AP of 1.3, relative to the average TIC-NP/AP of all non-PAG samples of 14. These results indicate successful operational waste rock segregation which results in a mass balance TIC-NP/AP that far exceeds 2 for NAG waste rock.

Figure 2-2: ARD Classification for NAG Waste Rock Confirmatory Samples

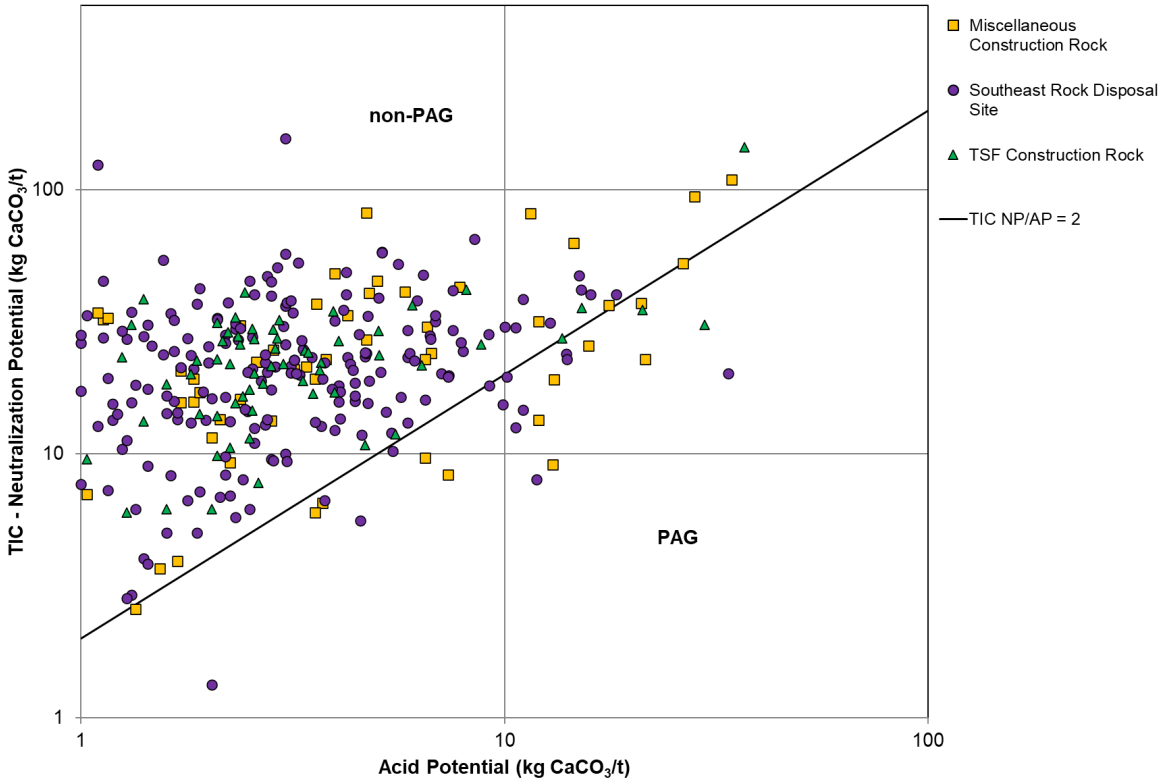

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task200_NPR Criterion Assess/[LOM_ConfirmatorySamples_CAPR002434_JED_Rev00.xlsx

3 Conceptual Geochemical Model for Site-Specific NP/AP Criterion

3.1 Mineralogical Considerations

Implementation of a site-specific or the generic TIC-NP/AP criterion stipulated by the Permit relies on analytical methods appropriately quantifying NP and AP within the bulk rock mass. At MPM, the mineralogical data have shown that calcite is the dominant carbonate mineral and that calcite abundance can accurately be quantified by total inorganic carbon or total carbon from the onsite laboratory (SRK 2023). Pyrite is the dominant sulfide mineral and other sulfur forms (including sulfate) are not common. Acid potential is therefore appropriately calculated from total sulfur.

Since waste segregation is based on analysis of drill core or blast hole cuttings which represent the bulk size fraction, an additional consideration is the degree to which carbonate and sulphur minerals partition during blasting. If the minerals segregate equivalently, the TIC-NP/AP criterion (TIC-NP/AP_{crit}) can be applied directly to the drill samples but if fractionation occurs it may be necessary to correct for the effect. Methods and results used to evaluate the effects of mineral partitioning are further outlined in Section 4.2 and Section 6.2 respectively.

3.2 Acid Neutralization Reactions

The TIC-NP/AP_{crit} reflects the ratio at which carbonate minerals are consumed relative to the rate of sulphide oxidation. For example, a TIC-NP/AP criterion of 2 assumes 2 moles of carbonate are needed to buffer the acid generated by oxidizing each mole of sulphide. The criterion is intended to ensure sufficient carbonates are available within the material to buffer acid produced by the total amount of sulphide to prevent formation of ARD.

The following processes affect the rate of carbonate utilization.

Pyrite oxidation and the generation of acidity (as H^+ equivalent) are summarized by reaction (1) below, where oxidation of one mole of pyritic sulphur generates two moles of H^+:

$$FeS_2 + 15/4O_2 + 7/2H_2O \rightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+ \quad (1)$$

Carbonate in solution at near neutral pH values is speciated between dissolved carbon dioxide ($H_2CO_3^0$) and bicarbonate (HCO_3^-) as follows:

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + H_2CO_3^0 \quad (2)$$

$$CaCO_3 + H^+ \rightarrow Ca^{2+} + HCO_3^- \quad (3)$$

If reaction (2), which is thermodynamically favored at lower pH, dominates the TIC-NP/AP_{crit} would be 1 given that the two protons produced per mole of sulphur (Equation 1) are neutralized by one mole of calcium carbonate equivalent. Reaction (3), which prevails at higher pHs, indicates a criterion of 2. Kinetic test data for samples from numerous other porphyry mines in BC show a similar outcome and yield the conclusion that the TIC-NP/AP_{crit} lies between 1 and 2.

A generic (not site-specific) TIC-NP/AP_{crit} assumes that reaction (3) is dominant and that a ratio of 2 would be required to prevent onset of acid generation. However, once the kinetics of the acid generation and neutralization reactions and the mineralogy of the materials are better understood (i.e., through static and kinetic laboratory geochemical testing), a site-specific TIC-NP/AP_{crit} can be evaluated.

4 Methods

4.1 Confirmation of Total Carbon and Total Sulfur as Analytical Proxies for Pyrite and Calcite

Previous work reported in SRK (2016) confirmed that total carbon can act as a proxy for calcium and magnesium carbonate content and that total sulfur can act as a proxy for pyrite. These conclusions were tested by mineralogical characterization of the drill core samples collected for humidity cell testing of representative samples from the Springer Deep and WX zones (Section 4.3.1) and of twenty of the bulk samples of blasted Springer Deep and WX zone waste rock collected to evaluate blast fractionation (Section 4.2) to confirm the existing ABA procedures apply to these new zones to be mined.

The blasted samples were shipped to the University of British Columbia Department of Earth, Ocean, and Atmospheric Sciences laboratory with the humidity cell samples tested at the SGS laboratory in Burnaby, BC. At both labs, the mineralogy was analyzed using quantitative x-ray diffraction (qXRD) by Rietveld refinement.

4.2 Blast Fractionation

Mineral partitioning during blasting can have an effect on the classification of waste rock ARD potential since fines tend to be more reactive. If carbonate minerals preferentially partition into the blast fines, the use of a bulk TIC-NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially partition to the fines. SRK (2016) showed that both carbonate and sulphide minerals partitioned into the fine fractions for samples from the Bell and Cariboo Pits, but that this effect was much stronger for carbonate resulting in ARD potential classifications based on the bulk fraction leading to misclassification of some of some non-PAG rock as PAG.

To confirm the blast fractionation behavior of Springer and WX Zone rock, MPMC environmental technicians collected forty-four samples of blasted Springer and WX Zone Waste rock. Sample collection involved:

- Identification of two locations where Springer waste rock was being blasted and two locations where WX zone waste rock was being blasted through liaison with site mine geologists (i.e. four locations total);
- Location of each site in the open pit using coordinates supplied from the mine geologists. At the active digging face which was being excavated following blasting at each location, 10 samples and 1 field duplicate were collected of the bulk blasted size fraction on a 5 x 2 m grid yielding 44 samples total. Samples were collected with a shovel and placed in new plastic buckets.

Buckets were labelled, sealed, and shipped to Global ARD Testing in Burnaby, BC. At Global ARD, all forty-four samples were sieved into coarse (+10 mm), medium (-10 mm +2 mm), and fine fractions (-2 mm). Each fraction was weighed and analyzed for total sulfur, sulphate sulphur by hydrochloric acid leach, Modified Sobek NP using the MEND (1991) method, and total inorganic carbon (TIC) by hydrochloric acid leach and measurement of the evolved gas by coulometer.

4.3 Determination of NP/AP_{crit} for Springer Deep and WX Zones

4.3.1 Kinetic Testing Program

Humidity Cell Tests Initiated from 2004 to 2009

Humidity cell tests were performed on fifteen samples in support of geochemical characterization for permitting of mining of the Wight Pit (Northeast Zone), Southeast Zone, Boundary Zone, Pond Zone, and expansion of the Springer Pit. Results have been reported annually as part of Permit M-200 requirements. The samples were selected to evaluate oxidation rates for typical and elevated sulphide concentrations within waste rock. Results from testing of nine samples of monzonite, breccia, and diorite samples were used as part of the assessment owing to having similar lithology to the Springer Deep and WX Zones. Two samples from the Pond Zone which has distinctive skarn type mineralization and four samples of unknown lithology from the Springer and SE Zones were not considered relevant and were not used (HC-8 to HC-13).

Humidity Cell Tests Initiated in 2022

In 2022, four humidity cells samples were specifically selected to represent future waste rock that would be generated by mining the Springer Deep and WX Zones, which represent the source of waste rock for the remaining mine life. Samples were selected by SRK from the drill hole database to represent upper range sulphur content for the dominant rock types in both zones.

All four humidity cell tests and a method blank test are in operation at the SGS Laboratory in Burnaby, BC and were initiated on August 5, 2022. HCT leachate analysis is as follows:

- Weekly pH and conductivity to 12 weeks, then bi-weekly.
- Anions (sulfate, acidity, alkalinity, fluoride, chloride) bi-weekly for week 0 to 8 and then every 4 weeks.
- Multi-element analysis (Al, Sb, As, Ba, Be, Bi, B, Cs, Cd, Ca, Cr, Co, Cu, La, Fe, Pb, Li, Mg, Mn, Hg, P, Mo, Ni, K, Rb, Se, Si, Ag, Na, Sr, S, Te, Tl, Th, Sn, Ti, W, U, V, Zn, Zr) bi-weekly for week 0 to 8 and then every 4 weeks

4.3.2 Interpretation of Kinetic Test Data

A site-specific TIC-NP/AP_{crit} can be developed by assessing relative rates of acid generation and carbonate mineral utilization under the high weathering conditions of the humidity cell tests. The method used has been used at several other porphyry mines and projects in BC for the same purpose (i.e., SRK 2014; 2020b) and is summarized here. The main inputs for determining a TIC-NP/AP_{crit} are stable sulphate release rates under non-acidic conditions, and the combined release rates of Ca, Mg, Na and K [$(Ca+Mg+0.5Na+0.5K)/SO_4$] expressed in moles. Sulphate release rates are proxy for acid generation, while the combined major cations are proxy for acid neutralization. The release of Ca, Mg, Na and K reflects the dissolution of carbonate minerals by the combined effects of sulphuric acid (from pyrite oxidation) and carbonic acid (formed by atmospheric CO_2 dissolved in the deionized water). The consideration of Na and K release reflects the potential for Ca and Mg liberated by carbonate

dissolution to exchange with Na and K on the surface of phyllosilicates due to their greater affinity for exchange sites. The release rate for Na and K are halved to account for their lower charge (univalent) compared to calcium and magnesium (divalent). Inclusion of Na and K assures that utilization of carbonate for acid neutralization is not underestimated due to cation exchange effects.

Only stable release rates calculated after the initial flush from each HCT are used to base the assessment on the release of ions resulting from both acid generation and neutralization reactions as opposed to flushing of small amounts of soluble minerals that will not reflect longer term effects. At low oxidation rates (lower sulphate release), the dominant process in the test is dissolution of carbonates by carbonic acid in deionized water under high water-to-solid ratios. As the influence of sulphide oxidation increases (shown by increase in sulphate release), the ratio better reflects the interaction of sulphuric acid with carbonates.

Under site conditions, buffering of infiltrating waters containing dissolved CO_2 by carbonate mineral dissolution occurs within a short distance within the waste rock pile and tailings profile so that the apparent flushing of carbonate minerals by carbonic acid observed in the HCT does not occur in a full-scale dump. A stabilizing [$(Ca+Mg+0.5Na+0.5K)/SO_4$] trend at higher sulphate release therefore shows how the waste rock responds to generation of sulphuric acid which is the dominant process controlling NP depletion under field conditions. This information can thus be used to determine the TIC-NP/AP_{crit} for the materials tested based on the ratio at which the materials being tested stabilize.

5 Quality Control

5.1 Quality Control Methods

QA/QC procedures for static testing programs conducted by MPM which involve analysis of total sulfur and total carbon at the onsite laboratory are reported in the annual ML/ARD reports for the mine (i.e., SRK 2023) and are not detailed herein.

QA/QC of humidity cells initiated from 2004 to 2009 has been conducted previously and is reported in several humidity cell assessments (i.e., SRK 2008, 2009, and 2010).

For static and kinetic testing programs initiated as part of this assessment, SRK followed internal QA/QC procedures as outlined in the SRK Expectations for Laboratory Geochemical Data Quality (2022) which have been agreed upon with the laboratories that SRK uses. The procedures included the following QA/QC components in addition to lab QA/QC procedures:

- Static characterization
  - A duplicate sample (split following sample pulverization) underwent static testing for every twenty samples.
  - SRK monitored static results from duplicates, in addition to checking lab-initiated QC samples (duplicates, blanks and certified reference materials) against expected values.
  - Internal consistency of the data set was checked by monitoring sulfur balance (i.e., four-acid sulfur vs total sulfur, sulfate sulfur less than total sulfur etc.), NP compared to fizz rating (based on the MEND (1991) method, paste pH (to ensure consistency with NP and TIC), and TIC (to ensure consistency with NP).
  - Results from samples that were outside of SRKs criteria were subject to further evaluation. A recheck request was issued to the lab where deemed necessary by the SRK geochemist. The lab may be asked to comment, to investigate further, or to re-run a sample to confirm a result.
- Humidity Cell Testing
  - A blank waste rock HCT was operated to test for contamination within the de-ionized water used or from the testing apparatus.
  - SRK monitored leachate data for indications of contamination, for ion balance, to ensure detection limits stay consistent, and for trend analysis to identify data spikes which could indicate analytical errors.
  - Results from blanks or samples that were outside SRK's criteria were subject to further evaluation. A re-check request was issued to the lab where deemed necessary. The lab would have been asked to comment, investigate further, or re-run a sample to confirm the result.

5.2 Quality Control Results

Results of SRK's QA/QC assessment are provided in Appendix A, with results summarized as follows:

- The static data reported herein passed SRK's QA/QC criteria and no re-check requests were issued.
- Re-check requests issued for the humidity cell data were limited to one-off data spikes, irregular detection limits resulting from dilution, and anomalously high concentrations in method blank tests. As of the time of reporting, there were no outstanding re-check requests, and the results were considered acceptable for the study.

6 Evaluation of Site-Specific ABA Procedures and NP/AP Criterion for Springer Deep and WX Zone Waste Rock

6.1 Confirmation of Total Carbon and Total Sulfur as Analytical Proxies for Pyrite and Calcite

Full results of mineralogical analysis of the HCT samples and bulk samples of blasted Springer Deep and WX zone waste rock are provided in Appendix B, with a summary of the sulfide and carbonate mineralogy results provided in Table 6-1.

The results show that calcite is the only detectable carbonate mineral, and that pyrite is the only sulfur mineral detected. This confirms that total carbon can act as a proxy for calcium and magnesium carbonate content and that sulfur can act as a proxy for pyrite for samples the WX and Springer Deep Zones.

Table 6-1: Summary of Springer Deep and WX Zone Sulfide and Carbonate Mineralogy Data

Zone	Statistic	Pyrite	Calcite
		wt%	wt%
WX	min	<DL	0.6
	median	0.5	1.7
	max	3.4	4.0
	count	12	12
SD	min	0.9	0.6
	median	1.9	1.4
	max	2.8	2.9
	count	12	12

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task100_C-S_Determination/[Compiled_MineralogyData_CAPR002434_JED_Rev00.xlsx

6.2 Blast Fractionation

Results of blasted WX and Springer Zone waste rock samples sieved to coarse (+10 mm), medium (-10 mm +2 mm), and fine fractions (-2 mm) are shown as box and whisker plots for total sulphur and total inorganic carbon in Figure 6-1 and Figure 6-2, which also include the bulk fraction results calculated as weighted averages using the fraction weights for each sample. Full analytical results by size fraction are provided in Appendix C. Review of the results showed:

- Total sulphur showed a higher mean in the fine fraction (mean = 0.41%) relative to the medium, coarse, and bulk size fractions which had means of 0.26%; however, all fractions had similar medians in the range of 0.15% and 0.17%. Using a t-test, there was not a statistically significant

difference between levels of total sulphur in the fine and bulk fractions using a 95% confidence level.

- TIC-NP was notably enriched in the fine fraction (median of 21 kg $CaCO_3$/t) relative to the coarse and bulk fractions which had medians of 5.4 and 7.3 kg $CaCO_3$/t respectively. Using a t-test, the fine fraction had statistically significant higher TIC-NP values compared to the coarse and bulk fractions fraction using a 95% confidence interval.

Figure 6-3 shows the size fraction relationship for the fine and bulk fractions for TIC-NP/AP. The relationship shows that TIC-NP/AP is higher in the fine fraction for the full range of measured TIC-NP/AP.

The regression line for the TIC-NP/AP relationship in (Figure 6-3) is:

Log (TIC-NP/AP, -2 mm) = 0.90 Log (TIC-NP/AP, bulk) + 0.29

Given that the reactivity of the fine fraction dominates the reactivity of the bulk material, the equation can also be used to calculate NPR thresholds in the fines equivalent to the bulk rock mass which is tested during mining for classification purposes. Table 6-2 compares the equivalent fine and bulk fraction equivalent TIC-NP/AP ratios calculated using the regression.

The approved TIC-NP/AP_{crit} of 2 has a fine fraction equivalent of 3.6 indicating that the effects of mineral partitioning during blast fractionation within Springer Deep and WX Zone rock will lead ARD classifications based on bulk TIC-NP/AP ratios to be overly conservative leading to misclassification of non-PAG waste rock as PAG. TIC-NP/AP_{crit} of 2.0 for the fine size fraction has a bulk size fraction equivalent of 0.9.

Table 6-2: Fine to Bulk Fraction Equivalents Calculated from Regression

TIC/AP Bulk Size Fraction	TIC/AP -2 mm Size Fraction
0.7	1.6
0.9	2.0
1.0	2.3
1.5	3.1
2.0	3.8
3.0	5.2

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task300_BlastFractionation/[BlastFractionationAssess_CAPR002434_JED_Rev00.xlsx

Figure 6-1: Box and Whisker Summary of Total Sulphur Size Fraction Analysis

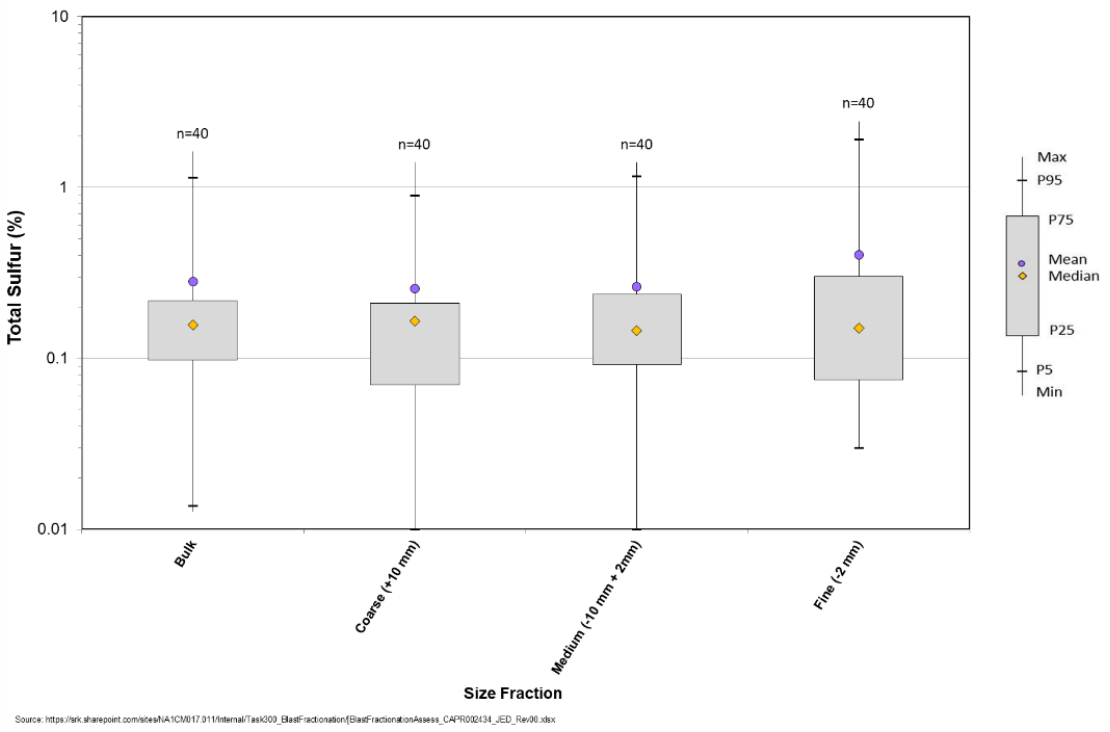

Figure 6-2: Box and Whisker Summary of Total Inorganic Carbon Size Fraction Analysis

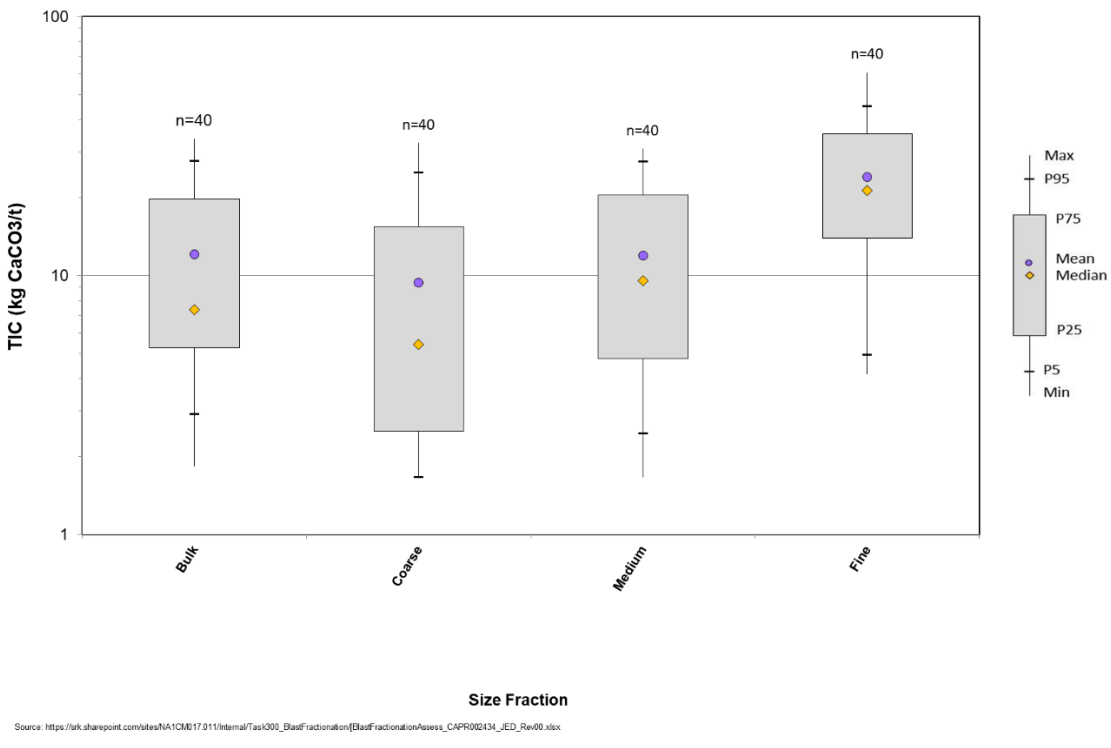

Figure 6-3: Measured TIC/AP for the -2mm versus calculated TIC/AP for the Bulk Fraction

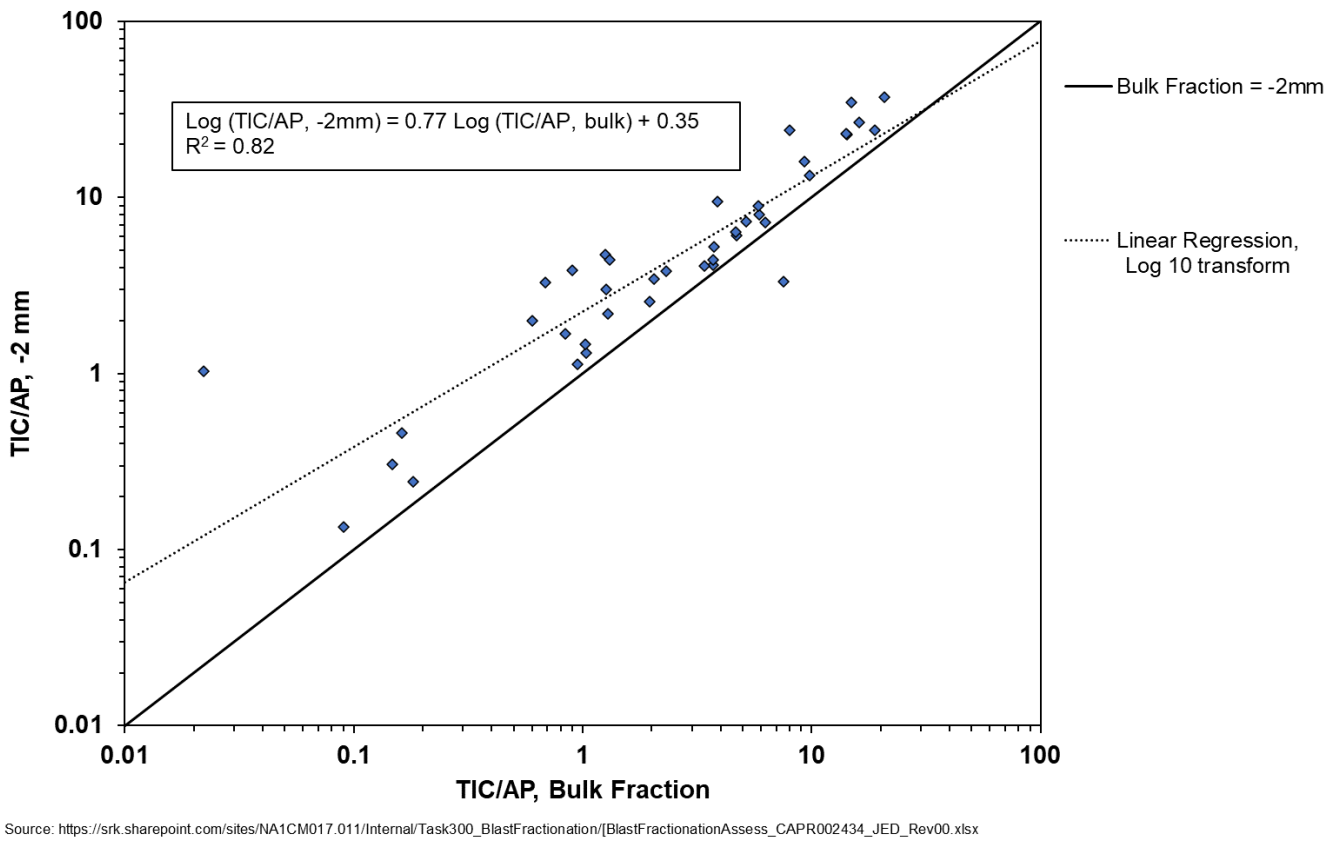

6.3 Kinetic Characteristics

6.3.1 Trend Description

Humidity cell leachate concentration timeseries charts for the 2022 HCTs up to September 2023 are provided in Appendix B, with kinetic stable rates summarized in Table 6-3. All four tests yielded non-acidic leachate (pH 7.1 to 8.3) from weeks 0 to 57 (Figure 6-4) and showed stabilizing weathering rates after 16 to 24 weeks for most major and trace elements following an initial flush of accumulated weathering products (Figure 6-4 and Appendix B). Based on the mineralogical results (Section 6.1 and Appendix B), leaching trends following the initial flush were interpreted to represent the primary oxidation of pyrite with acid neutralization by calcium and magnesium carbonate minerals.

Stable HCT concentrations for major cations (Ca, Mg, Na, and K) and sulphate, the major proxy for acid generation (Figure 6-4 and Appendix B), indicated release rates had stabilized for development of the site-specific TIC-NP/AP classification threshold. Figure 6-4F showed that the ratio of major ions to sulphate was showing slight variability but was varying within the expected range, further confirming release rates had sufficiently stabilized for development of the site-specific TIC-NP/AP for the Springer Deep and WX Zone samples.

Table 6-3: Summary of Waste Rock Humidity Cell Pre-Test and Kinetic Characteristics

			Pre-Test Static Data								Stable Rates									
HCT ID	**Zone**	**Lithology**	**Paste pH**	**Total S**	**SO_4 S**	**AP**	**Mod. Sobek NP**	**TIC-NP**	**TIC-NP/AP**	**Cu**	**Start Date**	**Last Date of Data**	**Start of Stable Period**	**SO_4**	**Dissolved Ca**	**Dissolved Mg**	**Dissolved K**	**Dissolved Na**	**Ca+Mg/SO_4**	**(Ca+Mg+0.5Na+0.5K)/SO_4**
				%S	%S	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t		mg/kg				mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mol/mol	mol/mol
HC3	NE	Breccia	8.3	0.45	<0.01	14	140	91	6.4	1700	7/21/2004	8/11/2008	63	2.2	4.5	0.14	0.083	0.041	5.2	5.2
HC4	NE	Breccia	8.4	0.99	<0.01	31	130	88	2.9	1300	7/21/2004	8/11/2008	75	2.1	5	0.08	0.076	0.038	5.8	5.8
HC5	NE	Plagioclase Porphyry Intrusive	8.6	0.54	<0.01	17	88	52	3.1	1700	7/21/2004	8/11/2008	75	2.1	4	0.19	0.073	0.036	4.9	4.9
HC2	NE	Plagioclase Porphyry Intrusive	8	1.4	<0.01	44	83	66	1.5	330	7/21/2004	1/7/2013	17	5.4	5.5	0.14	0.1	0.053	2.5	2.6
HC6	SE	Monzonite	8.4	0.72	<0.01	23	21	9.8	0.43	710	9/26/2005	1/7/2013	64	3	3.5	0.029	0.033	0.026	2.8	2.8
HC7	SE	Monzonite	8.7	0.37	<0.01	12	40	9.8	0.85	180	9/26/2005	1/7/2013	33	2.7	3.3	0.05	0.049	0.027	2.9	3
HC14	Springer	Breccia	8.1	0.39	-	12	96	40	3.3	720	10/12/2009	1/7/2013	39	3.2	7.2	1	0.27	0.062	6.6	6.7
HC15	Springer	Diorite	8.1	2.5	-	79	94	23	0.29	780	10/12/2009	1/7/2013	100	12	7.2	0.12	0.063	0.73	1.5	1.6
HC16	Springer	Monzonite	8.9	0.06	-	1.9	69	12	6.4	360	10/12/2009	1/7/2013	7	0.92	4	0.38	0.074	0.72	12	14
HC-17 SD MZ	Springer Deep	Monzonite	8.8	1.4	0.03	43	32	23	0.55	520	8/5/2022	9/8/2023	20	8.2	7.1	0.27	0.088	0.43	2.2	2.3
HC-18 SD FBXm	Springer Deep	Monzonite breccia	8.8	2	0.02	61	36	14	0.23	1400	8/5/2022	9/8/2023	16	17	9.3	0.27	0.13	1.7	1.4	1.6
HC-19 WX MZ	WX	Monzonite	8.6	2	0.03	63	23	12	0.19	580	8/5/2022	9/8/2023	20	9.9	6.2	0.19	0.038	2	1.6	2
HC-20 WX FBXm	WX	Monzonite breccia	8.5	2.5	0.02	78	40	31	0.39	830	8/5/2022	9/8/2023	24	14	9.5	0.24	0.039	1	1.7	1.9

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/!020_Project_Data/030_Lab Data/Kinetic Data/Calculations/[Mt_Polley_ HCT_WR_Outcomes_1CM017.011_rtc_rev00.xlsx

Figure 6-4: Summary of 2022 HCT Results for A) pH, B) Sulphate, C) Total Alkalinity, D) Dissolved Calcium, E) Dissolved Magnesium, F) Molar Ratio of Major Ions to Sulphate

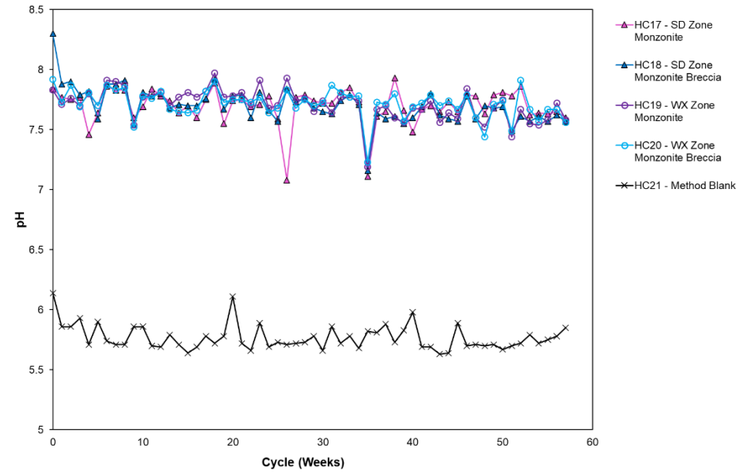

A)

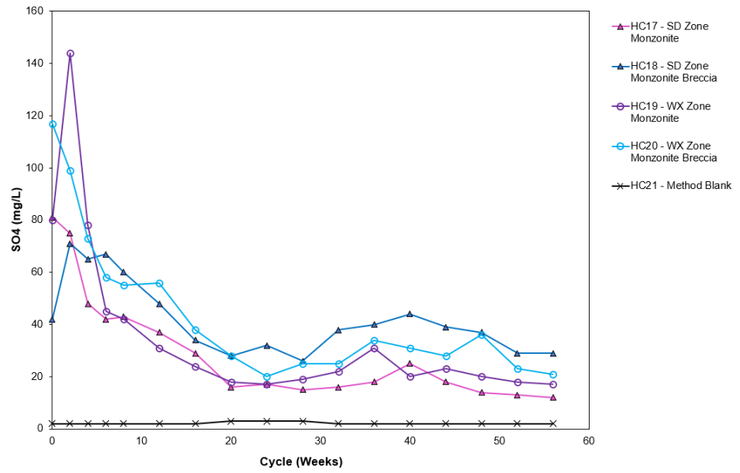

B)

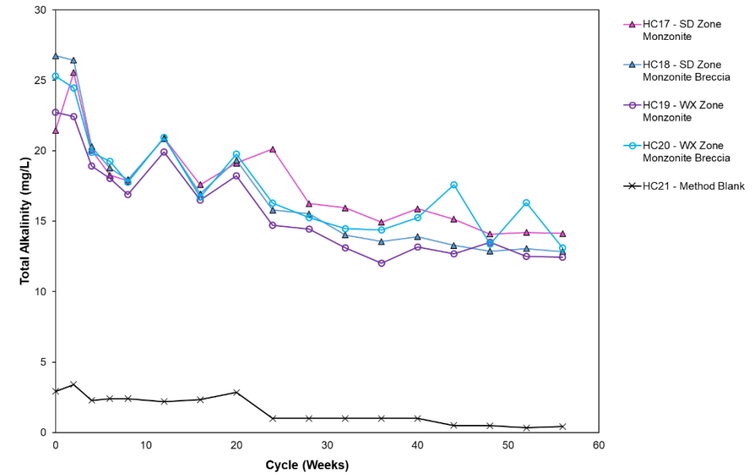

C)

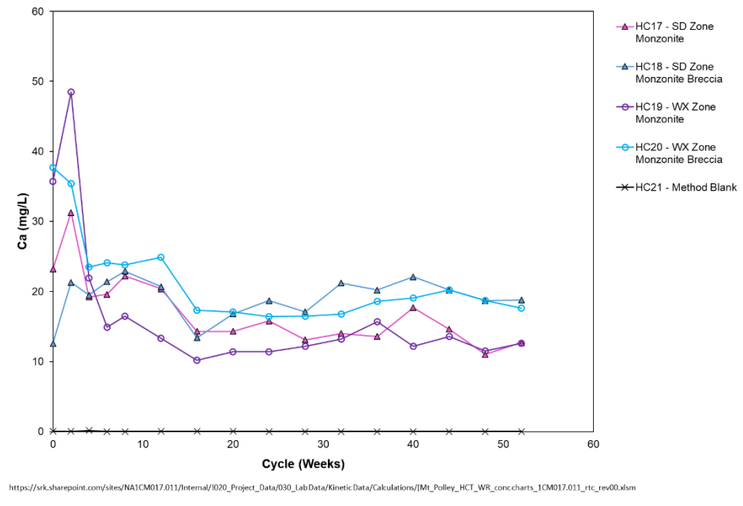

D)

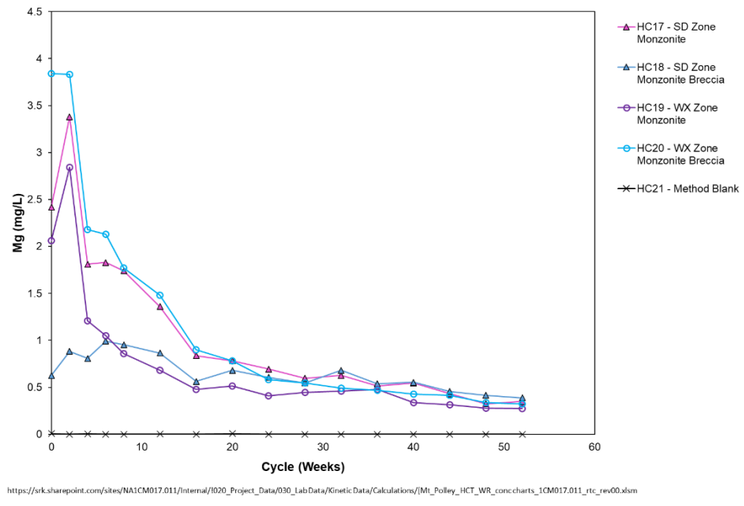

E)

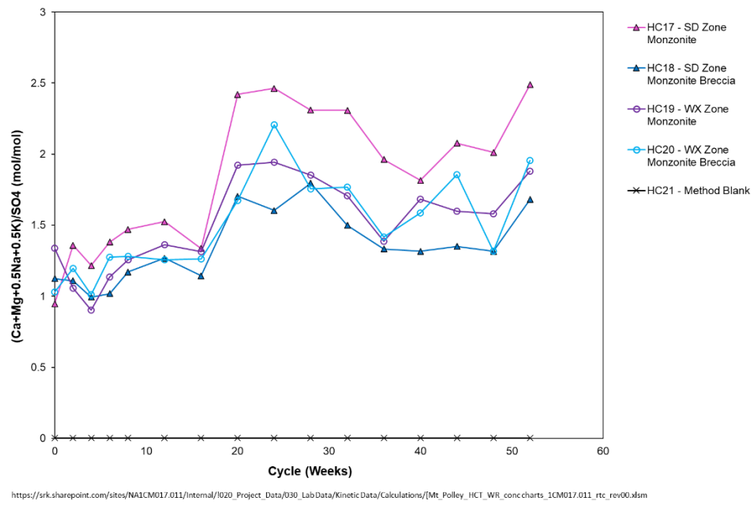

F)

6.3.2 Interpretation

Given the stability of major ion release rates, the data were evaluated to develop a site-specific TIC-NP*/AP_{crit}.

Figure 6-5 shows the rate of sulphate release (i.e., the approximate sulphide oxidation and acid generation rate) compared to the relative rate of acid neutralization by calcium and magnesium carbonate minerals in addition to sodium and potassium to account for cation exchange processes. As expected, the plot shows that at low sulphate release rates (e.g. <8 mg SO_4/kg/week), carbonate dissolution is primarily controlled by interaction with the de-ionized water used in the humidity cell test procedure which has a slightly acidic pH of 5.5 to 6.1 due to equilibration with atmospheric carbon dioxide (Figure 6-4).

At higher oxidation rates (e.g., >10 mg SO_4/kg/week) where release ratios are indicative of the material responding to sulphuric acid generated by sulphide oxidation, the data shows there is a tendency toward consumption of approximately 1.6 moles of calcium, magnesium, sodium, and potassium per mole of sulphate released. The data therefore indicate that a site-specific NP*/AP_{crit} of 1.6 is supported by the kinetic data.

Figure 6-5: Average Stable Molar Ratio of Calcium, Magnesium, Sodium and Potassium Relative to Sulphate, Compared to Average Stable Sulphate Release Rates for all Waste Rock HCTs Assessed

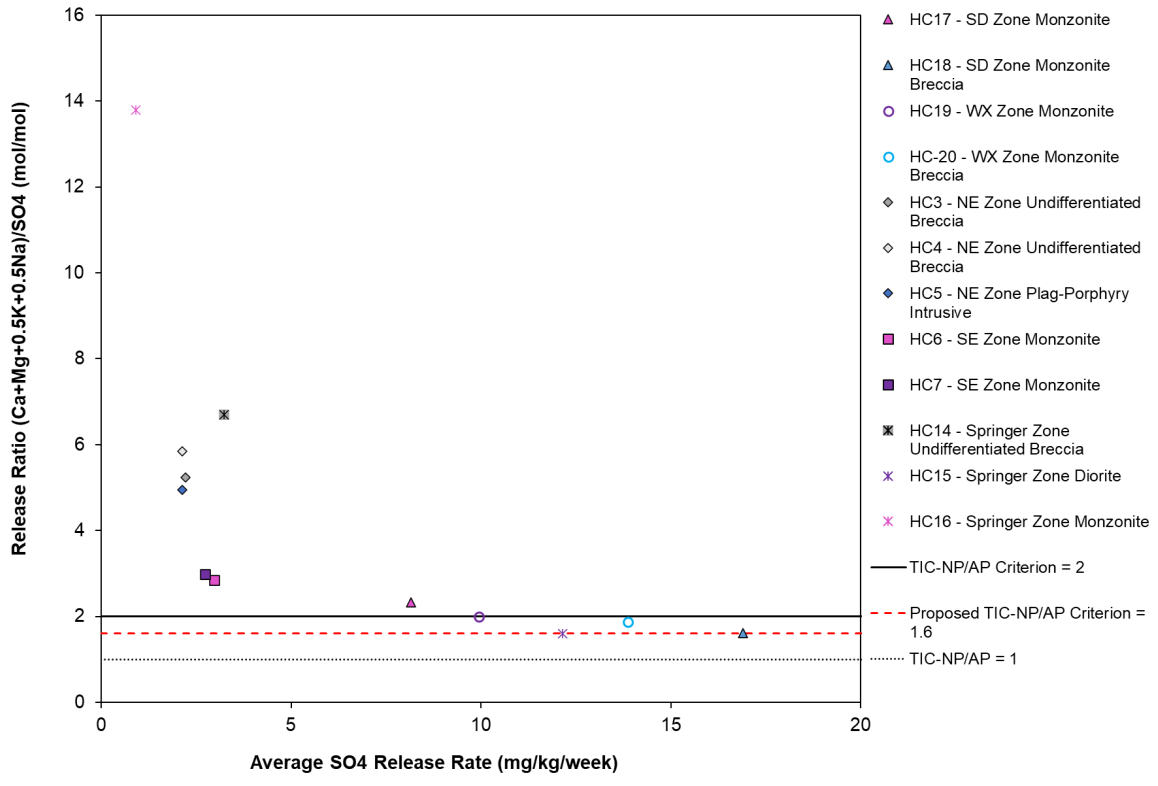

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/!020_Project_Data/030_Lab Data/Kinetic Data/Calculations/[Mt_Polley_ HCT_WR_Outcomes_1CM017.011_rtc_rev00.xlsx

6.4 Risk Assessment for Implementation of Site-Specific TIC-NP/AP_{crit}

In order to assess the risk of implementing the TIC-NP/APcrit as an operational criterion for classifying acid generation potential of waste rock, SRK has considered risk factors related to the potential for localized acidification due to PAG materials being incorporated with non-PAG waste rock and potential neutral pH leaching effects due to use of a lower NPR.

The main risk factors considered in this evaluation are:

- The effect of the PAG rock on overall mass balance TIC-NP/AP of the segregated non-PAG rock. As the proportion of PAG rock increases, the mass balance TIC-NP/AP will decrease, and the risk of acidification progressing beyond the PAG rock to the surrounding non-PAG rock increases.
- The degree to which changing the TIC-NP/AP_{crit} will change the neutral pH metal leaching potential of the segregated non-PAG rock.

6.4.1 Effect of PAG Rock Included with non-PAG Rock

Assuming the ML/ARD management plan continues to be properly implemented, the main reason for PAG rock to be used in construction or placed in the SERDS non-PAG rock are operational upsets whereby waste rock with TIC-NP/AP below the criterion is deposited.

Mass balance calculations were used to assess the effect of increasing the PAG content within construction rock or the SERDS using blast hole ABA data, which provides an indication of the range of TIC-NP and AP values observed in non-PAG and PAG material at the site. The calculations aimed to model mixing of non-PAG material that had median ABA characteristics (median TIC-NP and AP based on the total dataset of blast hole samples) with PAG material that had a range of TIC-NP and AP values. Non-PAG and PAG statistics were calculated separately using a TIC-AP/AP_{crit} of 2.0 and 1.6 to classify waste rock ARD potential to assess the influence of the TIC-NP/AP criteria on mass balance TIC-NP/AP.

The simulated PAG rock used in the mixing calculations consisted of: median TIC-NP and AP values (median TIC-NP/AP; solid lines in Figure 6-6) and 25th percentile TIC-NP and 75th percentile AP (upper case PAG; dashed lines in Figure 6-6).

Figure 6-6: Mass Balance Calculations Simulating the Effects of Mixing non-PAG and PAG Waste Rock

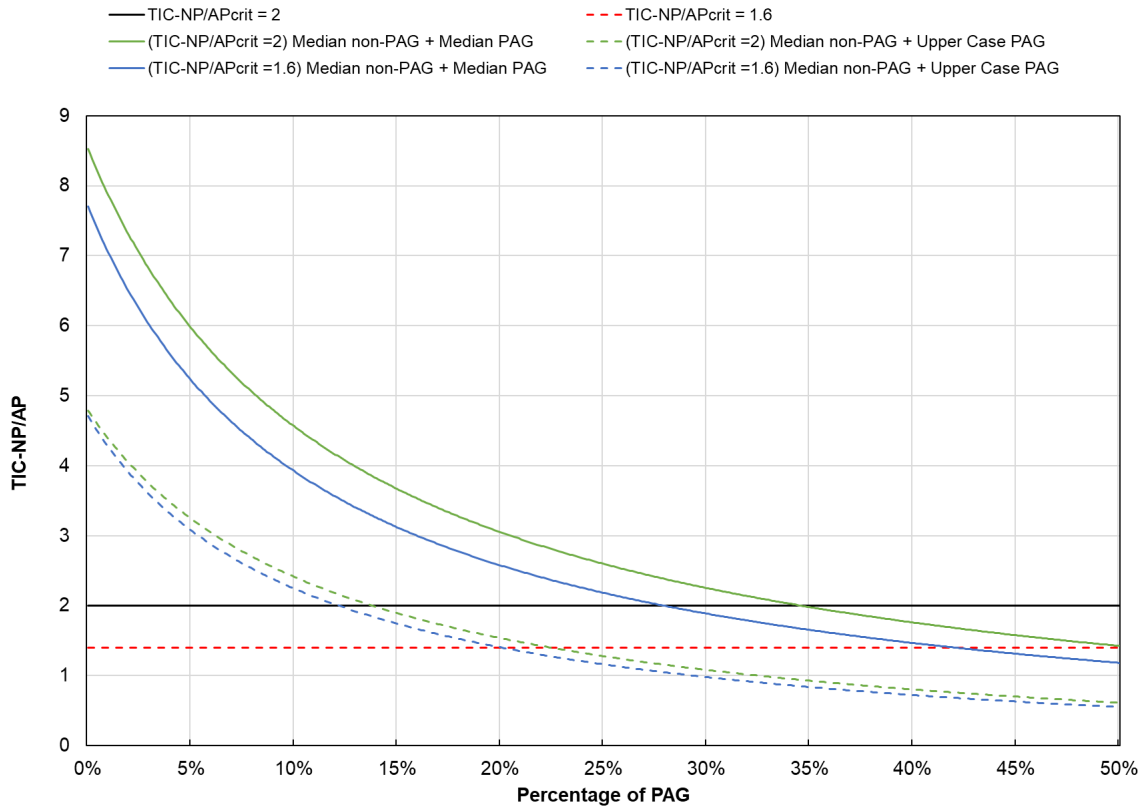

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task200_NPR_Criterion Assess/[NPRCriterion_RiskAnalysis_CAPR002434_JED_Rev00.xlsx

The results from the mass balance calculations shown in Figure 6-6 indicate that the change of the TIC-NP/AP_{crit} from 2.0 to 1.6 does not result in a large downward shift in mass balance ARD potential of non-PAG rock across a range of incorporated PAG content. Based on the observation that 9% of the confirmatory non-PAG samples collected to date were classified as PAG (defined as bulk TIC-NP/AP>2) (Section 2.4), these results indicate that lowering the TIC-NP/AP_{crit} does not pose a risk to mass balance TIC-NP/AP. The mix modelling indicates that a typical mix of segregated non-PAG which incorporates 9% PAG would have a TIC-NP/AP ratio of 4.1 in the bulk fraction which is in excess of 2 (Figure 6-6). This is equivalent to a TIC-NP/AP ratio of 6.7 in the blast rock fines.

6.4.2 Implications for Neutral pH Leaching in non-PAG Rock

The use of waste rock segregation addresses the potential for pH depression to levels at which sulphide oxidation accelerates and the solubility of metals increases exponentially. However, a lower TIC-NP/AP criterion could lead to higher sulphide content in segregated non-PAG which in turn could lead to higher sulphide oxidation rates and metal(oid) release rates.

For the Springer Deep and WX zones, decreasing the TIC-NP/AP criterion from 2.0 to 1.6 would increase the mean bulk size fraction sulphur content of non-PAG rock from 0.15 to 0.17 %S (medians of 0.091 and 0.099 %S respectively).

Given the negligible change in the sulphide sulphur content of non-PAG rock, the use of the site-specific TIC-NP/AP criterion is not expected to increase the neutral pH metal leaching potential of non-PAG rock for constituents released from oxidation of sulphide minerals including sulphate, copper, selenium, and zinc and the source term for non-PAG rock would remain unchanged.

7 Conclusion and Recommendations for TIC-NP/AP_{crit}

Based on the results of the assessment of site-specific ABA procedures and a TIC-NP/AP_{crit} for the Springer Deep and WX Zones, SRK recommends the following:

1. MPM can segregate waste rock for the Springer Deep and WX Zones according to the site-specific TIC-NP/AP criterion of 1.6 established herein.
2. MPM should account for blast fractionation prior to segregation of waste rock on the pit bench to ensure that non-PAG waste rock is not misclassified as PAG as follows:
    a. For the fine fraction (<2mm), PAG rock is defined as TIC-NP/AP ≤ 1.6;
    b. For the bulk fraction (i.e., samples of blast hole cuttings or drill core), PAG rock is defined as TIC-NP/AP ≤ 0.7. This accounts for preferential enrichment of carbonate minerals in blast fines.

SRK recommends that the regression to account for the effects of blast fractionation be tested and updated each year during mining of these zones to ensure that the samples collected are represented by the larger zones to be mined.

Closure

This report, Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones, was prepared by:

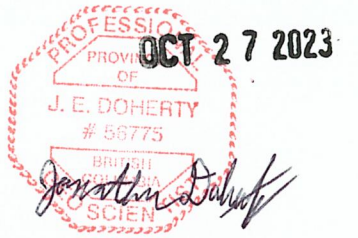

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and reviewed by


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Corporate Consultant (Geochemistry)

EGBC Permit to Practice: 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

References

MPMC. 2022. ML/ARD Management Procedure Manual. Mount Polley Mining Corporation. August 4, 2022.

SRK Consulting (Canada) Inc. 2023. Metal Leaching/Acid Rock Drainage Characterization and Monitoring Program – 2022 Annual Report. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434.

SRK Consulting (Canada) Inc. 2010. 2009 Review of Humidity Cell Data, Mount Polley Mine. Prepared for Mount Polley Mining Corporation. SRK Project Number 1CI008.000.

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SRK Consulting (Canada) Inc. 2008. 2007 Review of Humidity Cell Data for Northeast and Southeast Zones, Mount Polley Mine. Prepared for Mount Polley Mining Corporation. SRK Project Number 1CI008.000.

Appendix A. QA/QC Results

Appendix A: QA/QC Results

QC Test	SRK QC Criteria	Results
Paste pH		
Lab Duplicate (n=14)	For any samples, +/- 0.5 difference pH unit	All passed.
Split Duplicate (n=12)	For any samples, +/- 0.5 difference pH unit	All passed.
Standard Reference Material (n=1)	For any samples, +/- 0.5 difference pH unit	All passed.
TIC		
Method Blank (n=7)	<2X detection limit (DL)	All passed.
Lab Duplicate (n=8)	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Split Duplicate (n=12)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed.
Standard Reference Material (n=8)	Within specified tolerance ranges.	All passed.
Total S & Total Sulphate		
Method Blank (n=4) for Total S and (n=3) for SO4	<2X detection limit (DL)	All passed.
Sulphur balance (total S > sulphate S) (n=124)	For samples > 10X the detection limit (DL), Total Sulphur should be greater than Total Sulphate, if not the % difference should be within +/-20%	All passed.
Lab Duplicate (n=13) for Total Sulphate, (n=3) for Total S	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Split Duplicate (n=12) for Total S and SO4	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed except for the following samples: SP-1-1B and SP-1-1-DupB failed for Total S, both parent and dup samples >10X DL.
Standard Reference Material (n=5) for Total S, (n=4) for Total Sulphate	Within specified tolerance ranges.	All passed.
Modified NP		
NP consistent with paste pH (n=124)	Negative NP has paste pH <= 5	All passed.
Lab Duplicate (n=12) for NP and (n=14) for Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Split Duplicate (n=12) for NP and Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed except for the following samples that failed for Fizz Rating (parent and dup samples have different fizz rating): SP-1-1B and SP-1-1-DupB; WX-1-1A and WX-1-1-DupA; WX-1-1B and WX-1-1-DupB; WX-1-1C and WX-1-1-DupC; WX-2-1A and WX-2-1-DupA; WX-2-1B and WX-2-1-DupB.
Fizz test rating with NP (n=124)	Max NP does not exceed fizz test rating	All passed.
Standard Reference Material (n=4) for NP and (n=1) for Fizz Rating	Within specified tolerance ranges.	All passed.
Modified NP and TIC		
Comparison between Modified NP and TIC (n=124)	Check for trends/co-relation	NP generally higher than TIC

Appendix B. Mineralogy Results

QUANTITATIVE PHASE ANALYSIS OF TWENTY POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project #: 2221 (B1)
PO #: GL22-1707

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May 31, 2023 - Revised-

EXPERIMENTAL METHOD

The 20 samples of **Project #: 2221 (B1)** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone XRD Mill (Retsch GmbH, Germany) for 10 minutes. Continuous-scan X-ray powder-diffraction data were collected over a range of 3-80°2θ with CoKα radiation on a Bruker D8 Advance Bragg-Brentano diffractometer equipped with an Fe filter foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye-XE detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***Global ARD Testing Services Inc Revised Results May 31 2023 - Project 2221 (B1) PO GL22-1707 - 20 samples.xlsx***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1-20. Ideal formulae of the mineral phases present are shown in Table 2.

Note that the X-ray diffraction patterns in many of the samples are affected by the presence of some unknown clays which could not be analyzed (see hump fitted with calculated peak at ~7°2θ in Figures 1-15). Therefore, the results should be considered approximate.

Table 2. Ideal formulae for phases present; proj: 2221(B1)

Mineral	**Ideal Formula**
Actinolite	$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$
Analcime	$Na[AlSi_2O_6]\cdot H_2O$
Calcite	$CaCO_3$
Chabazite	$(Ca,K_2,Na_2)_2[Al_2Si_4O_{12}]_2\cdot 12H_2O$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Clinozoisite	$Ca_2Al_3(SiO_4)_3(OH)$
Diopside	$CaMgSi_2O_6$
Grossular	$Ca_3Al_2(SiO_4)_3$
Hematite	α-Fe_2O_3
Illite-Muscovite 1M & 2M	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$-$KAl_2AlSi_3O_{10}(OH)_2$
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-feldspar (microcline, orthoclase)	$KAlSi_3O_8$
Magnetite	$Fe^{2+}Fe^{3+}{}_2O_4$
Plagioclase (albite; albite, calcian)	$NaAlSi_3O_8$-$CaAl_2Si_2O_8$
Prehnite	$Ca_2Al_2Si_3O_{10}(OH)_2$
Pyrite	FeS_2
Quartz	SiO_2
Stilbite	$NaCa_4(Si_{27}Al_9)O_{72}\cdot 28H_2O$
Talc	$Mg_3Si_4O_{10}(OH)_2$
Titanite	$CaTiSiO_5$

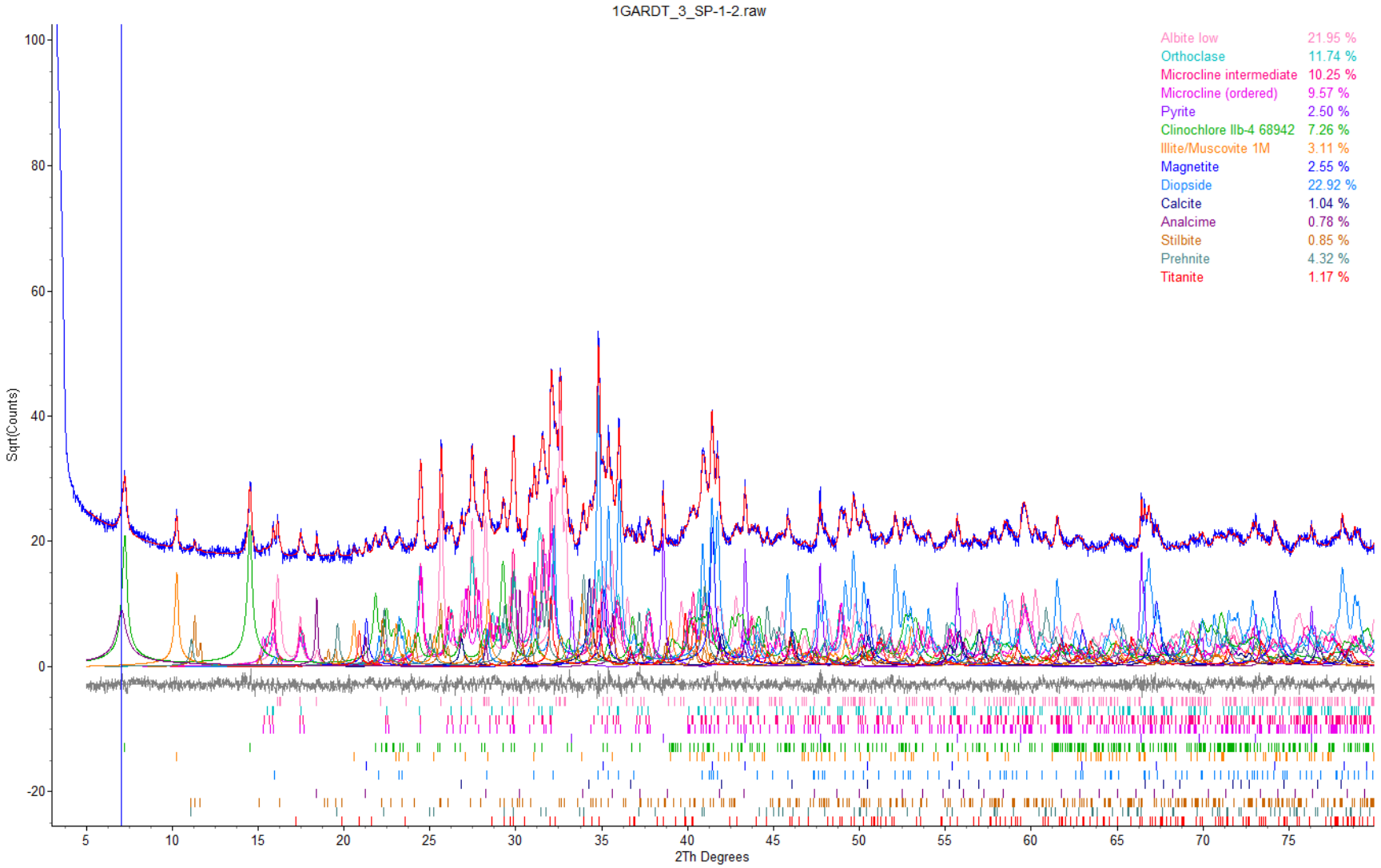

Figure 1. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 3_SP-1-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

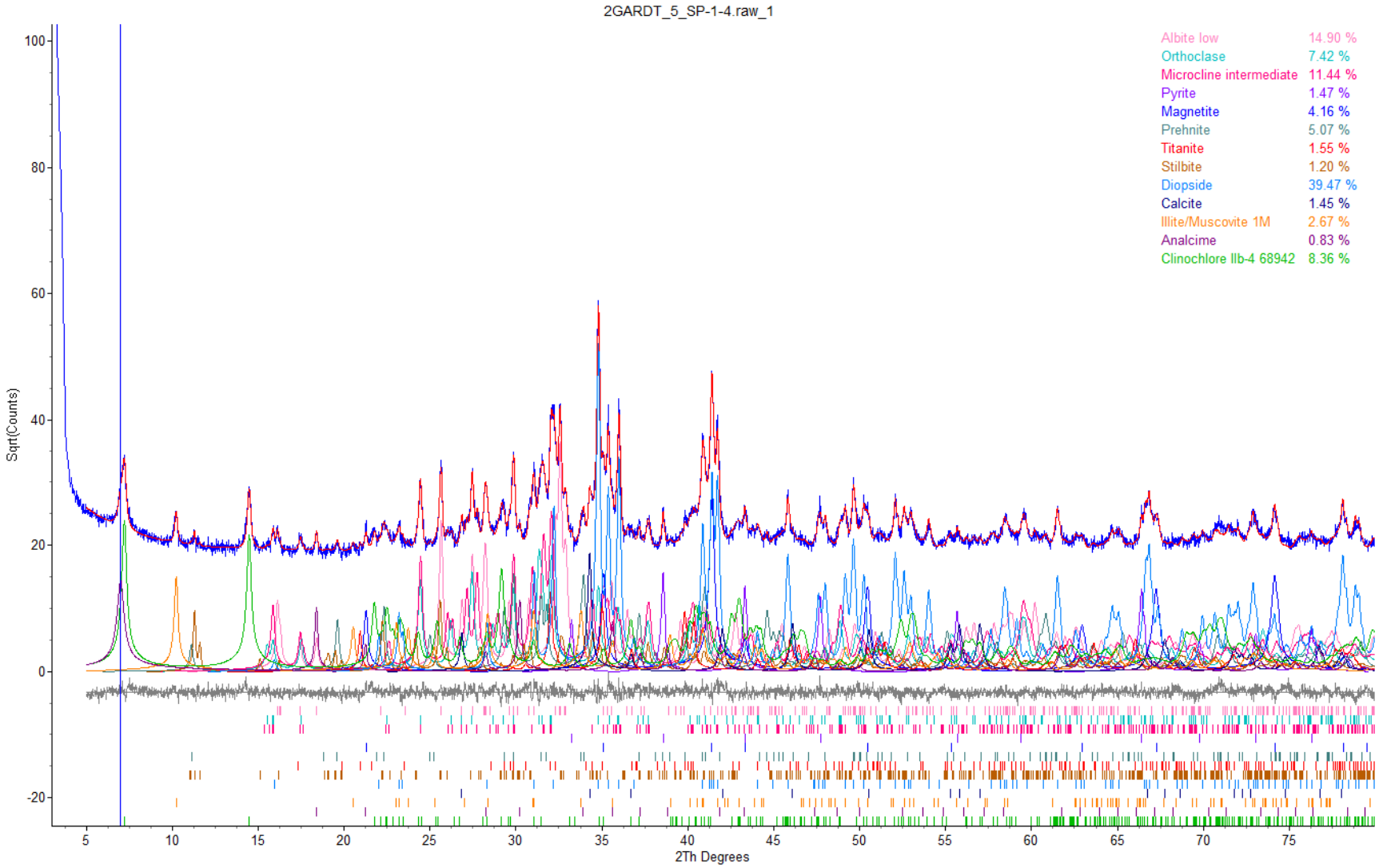

Figure 2. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 5_SP-1-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

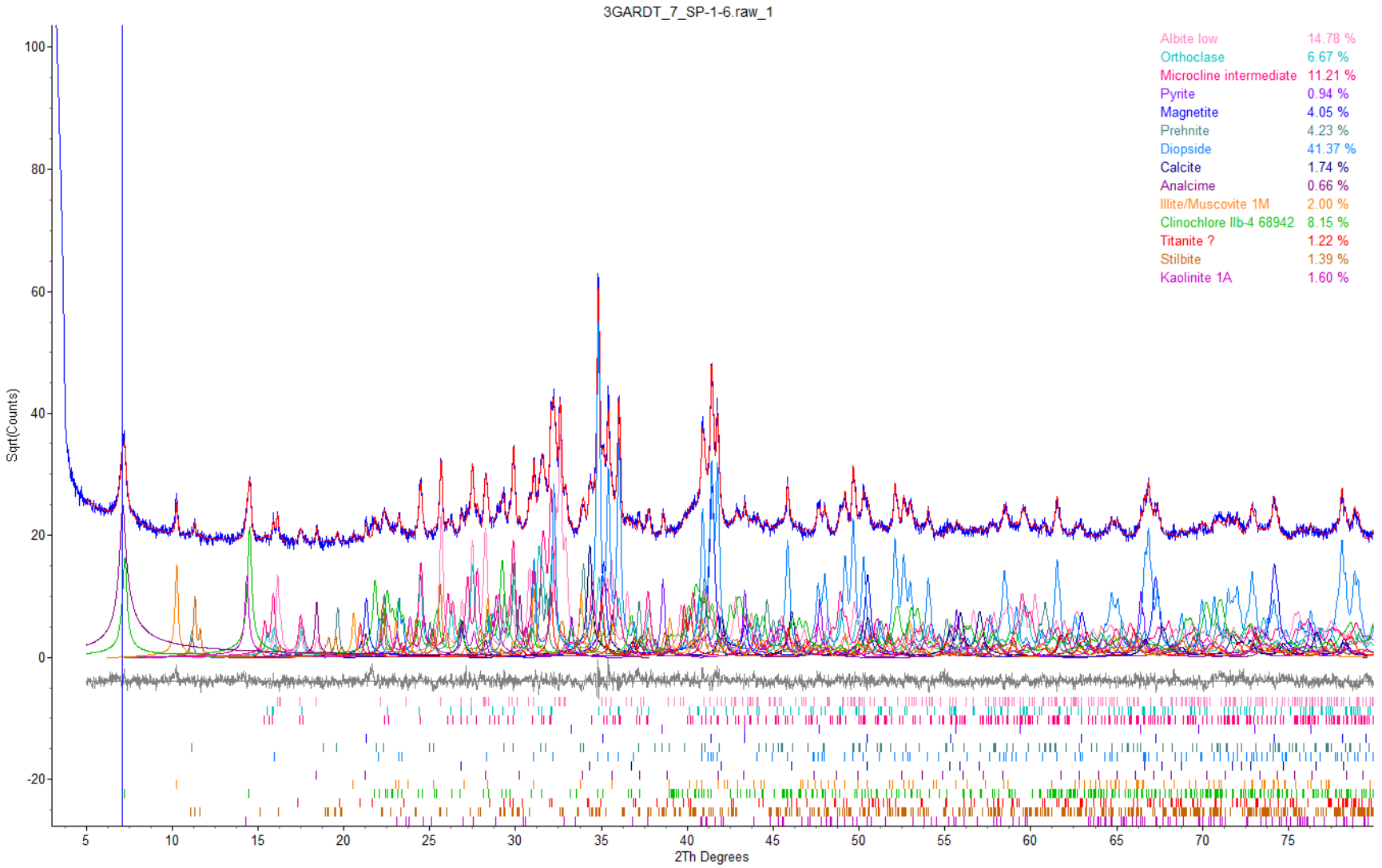

Figure 3. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 7_SP-1-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - positions of peaks phase). Coloured lines are individual diffraction patterns of all phases.

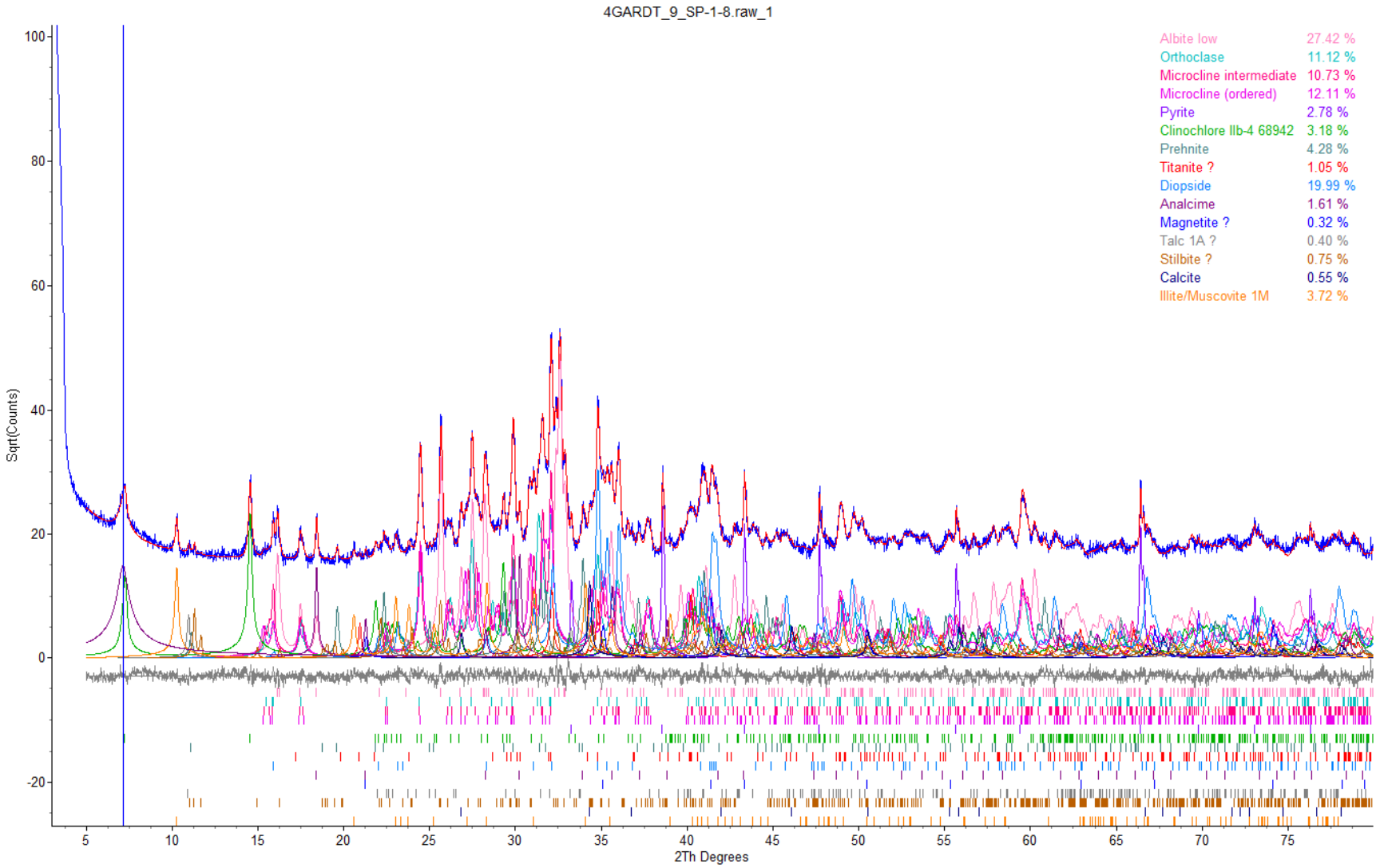

Figure 4. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 9_SP-1-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

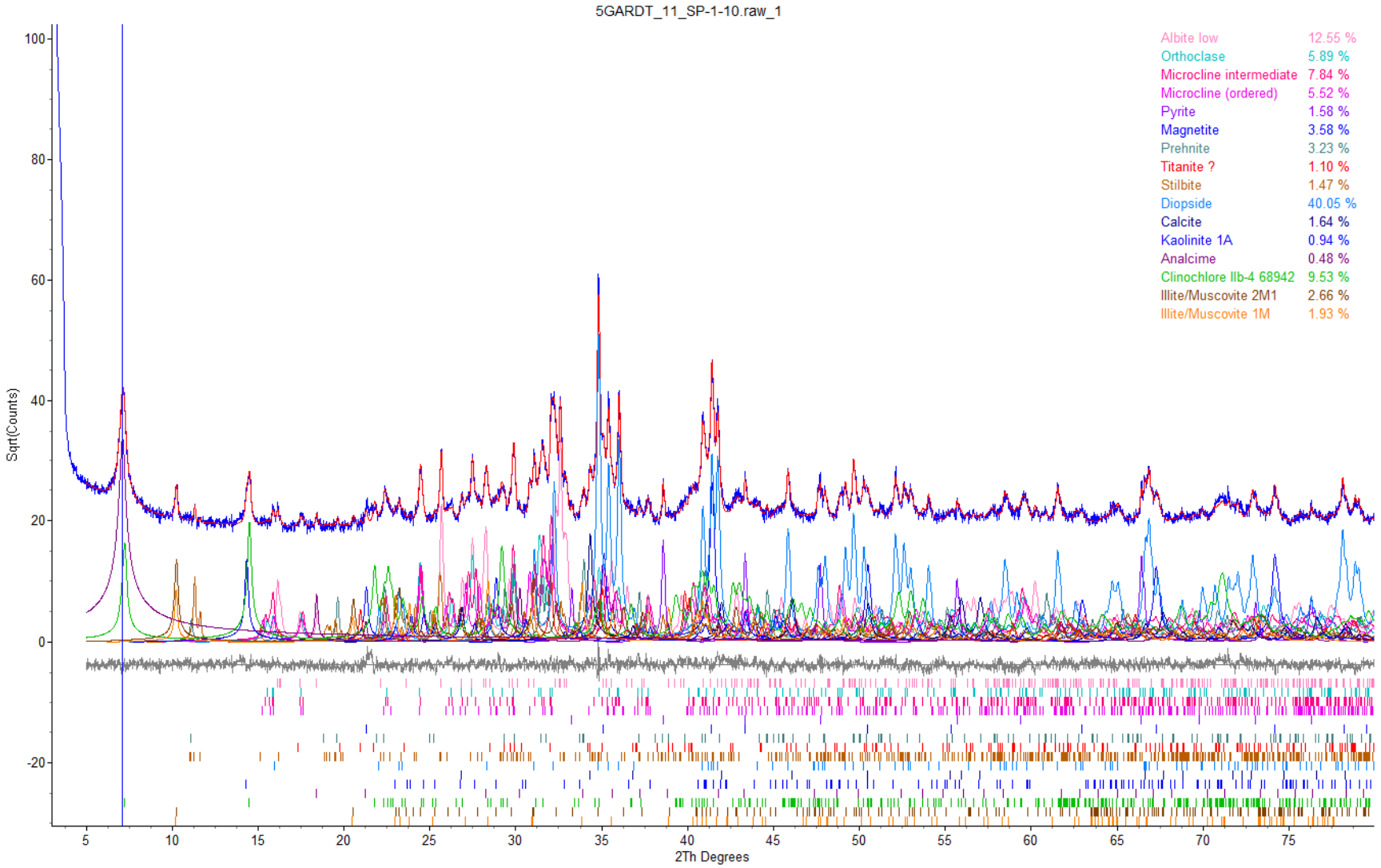

Figure 5. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 11_SP-1-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

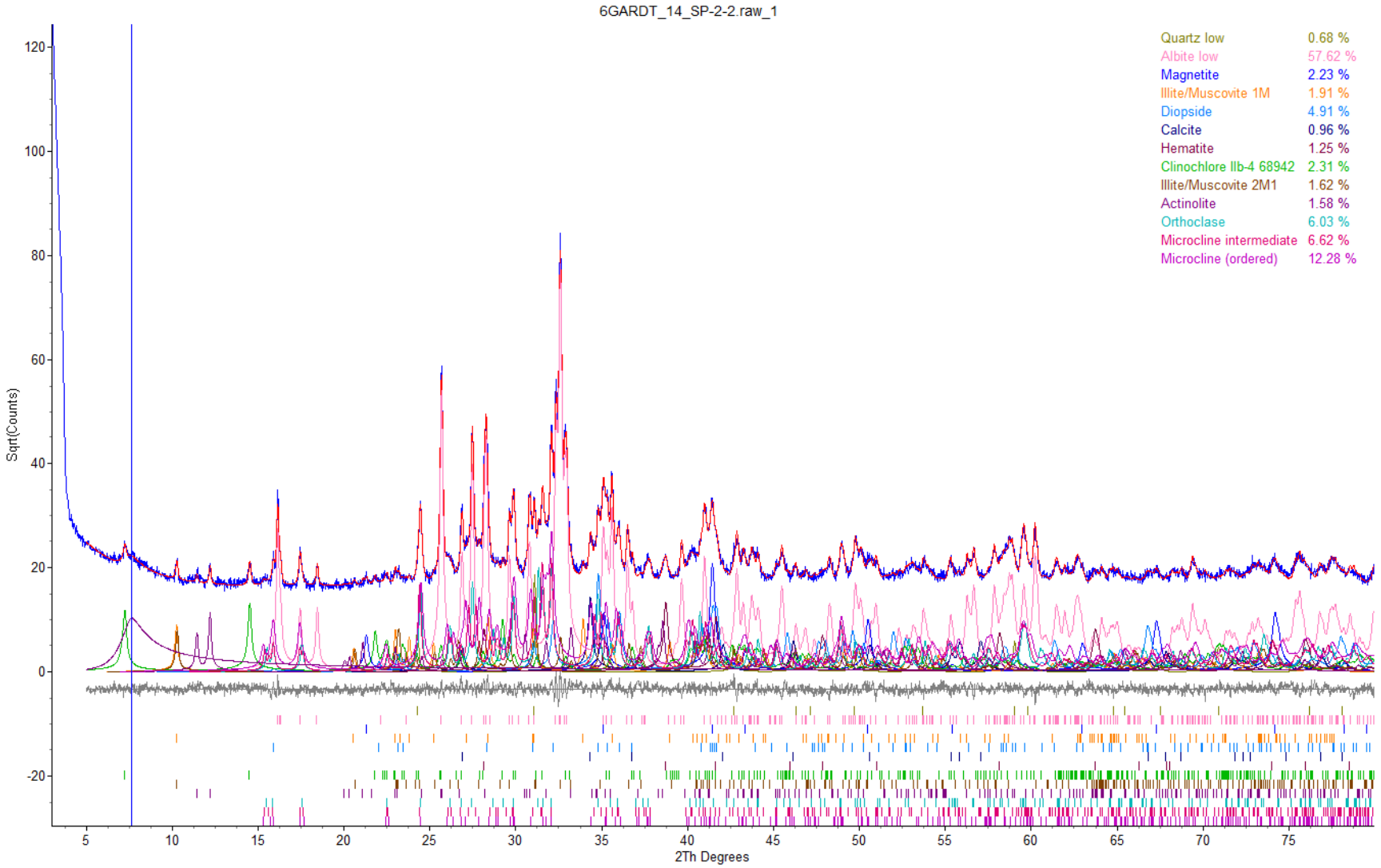

Figure 6. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 14_SP-2-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

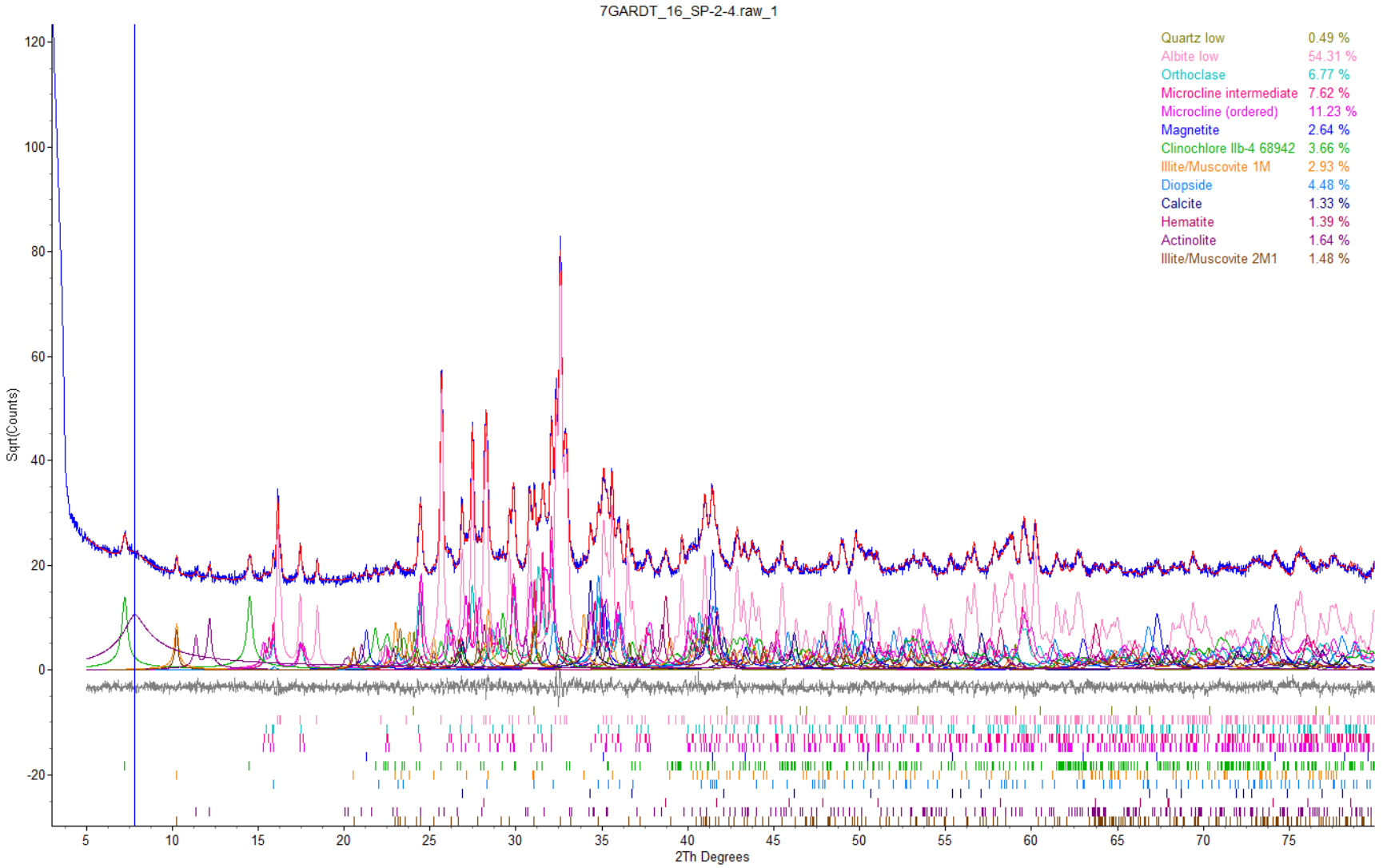

Figure 7. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 16_SP-2-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

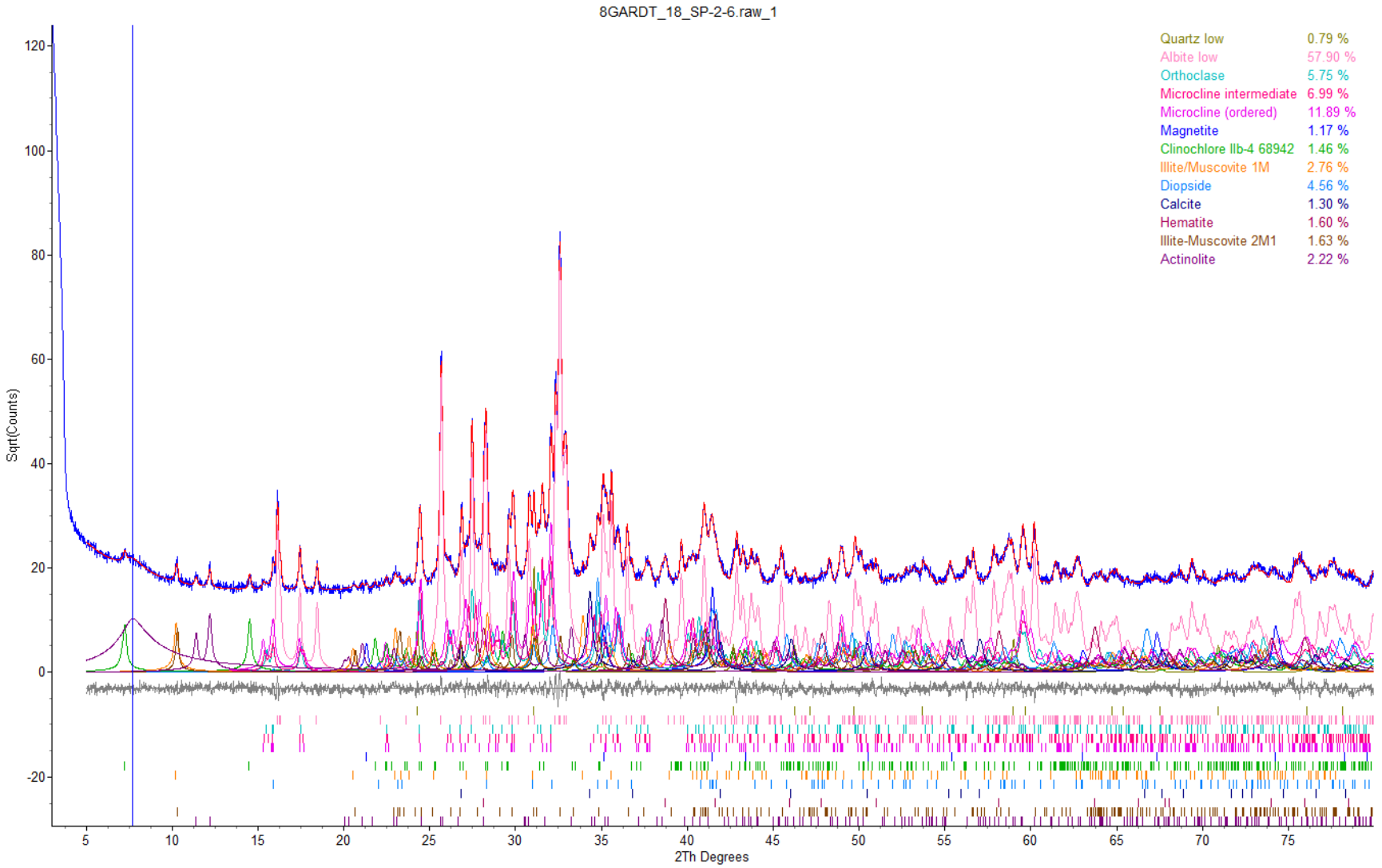

Figure 8. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 18_SP-2-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

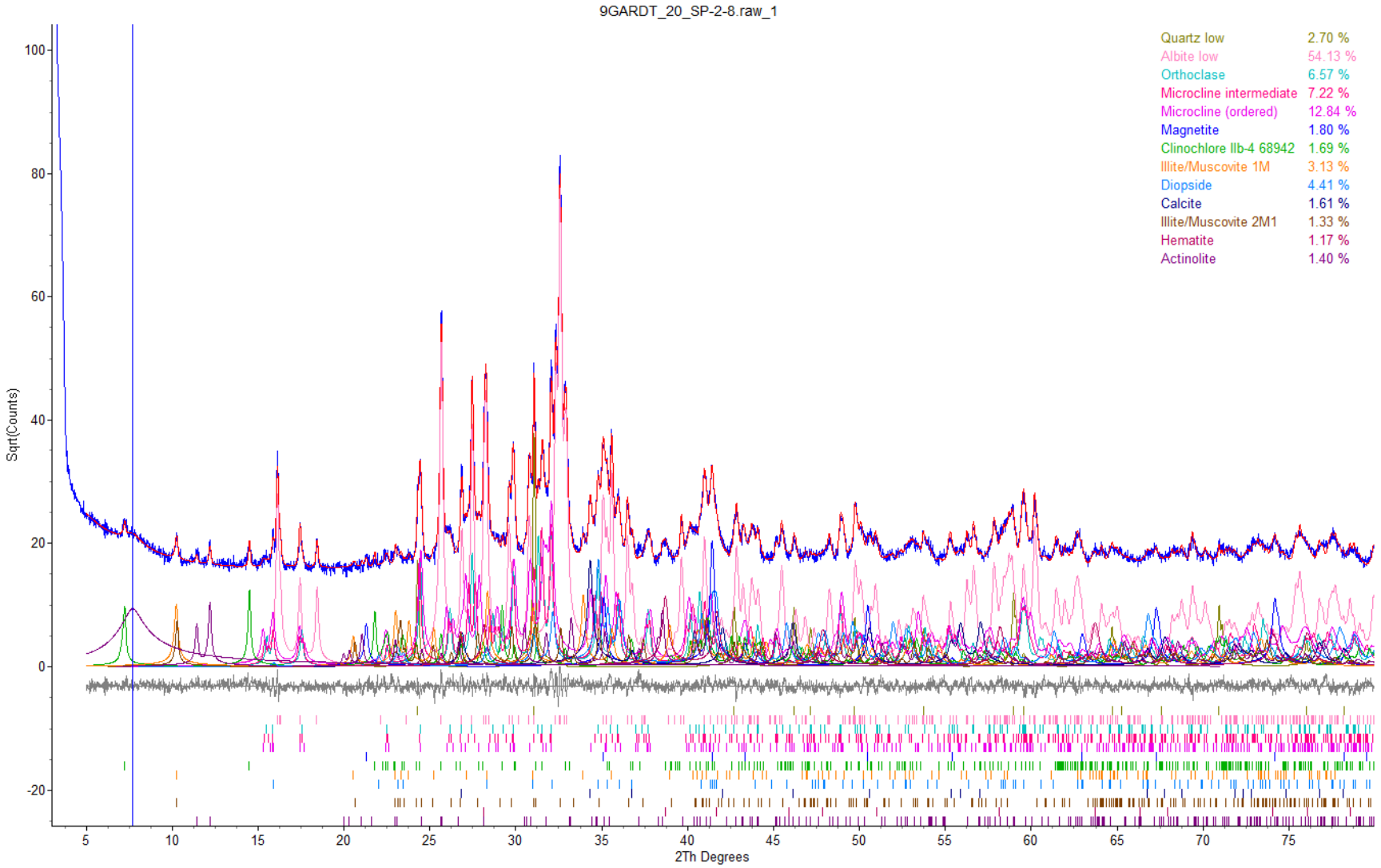

Figure 9. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 20_SP-2-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

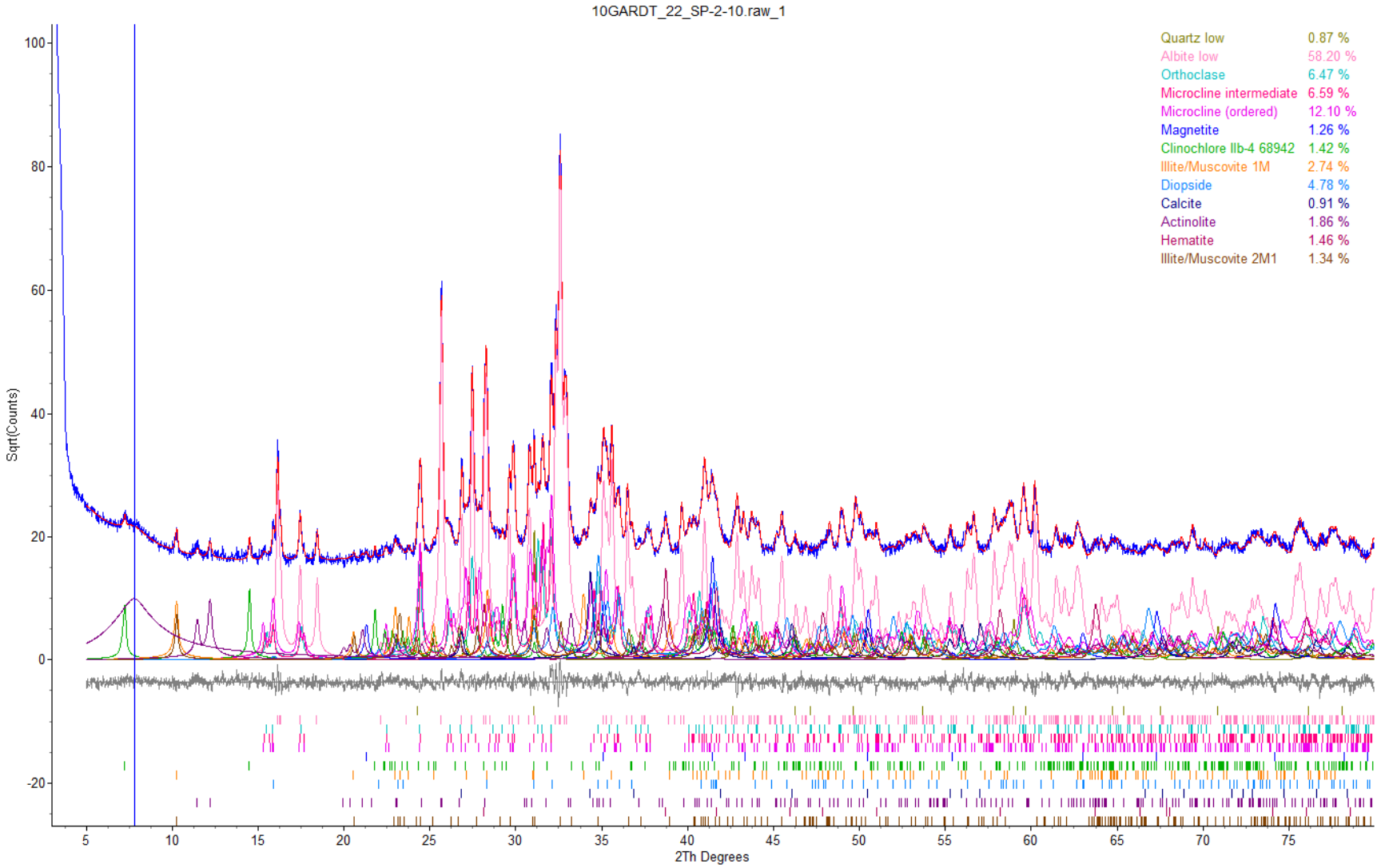

Figure 10. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 22_SP-2-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

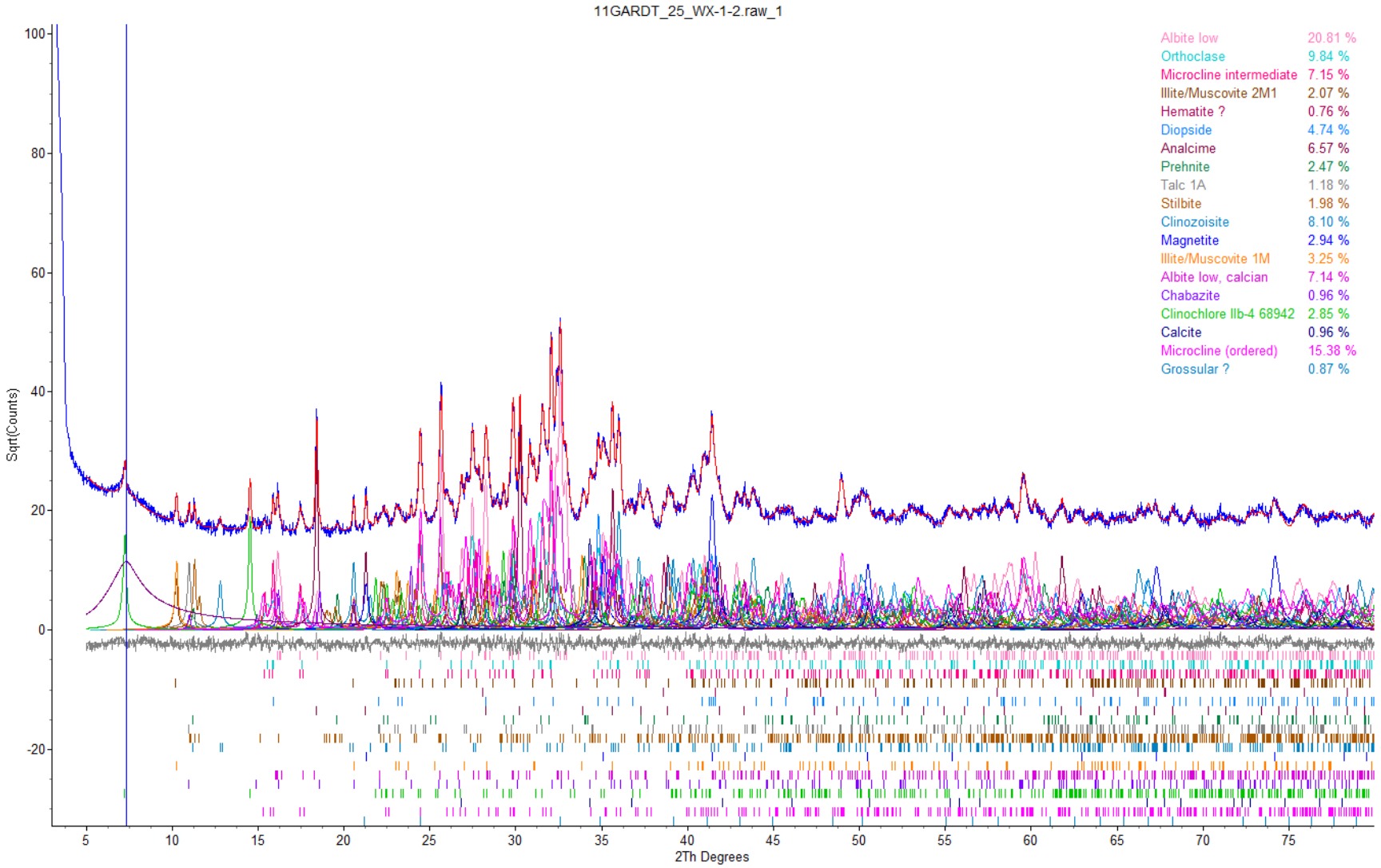

Figure 11. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 25_WX-1-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

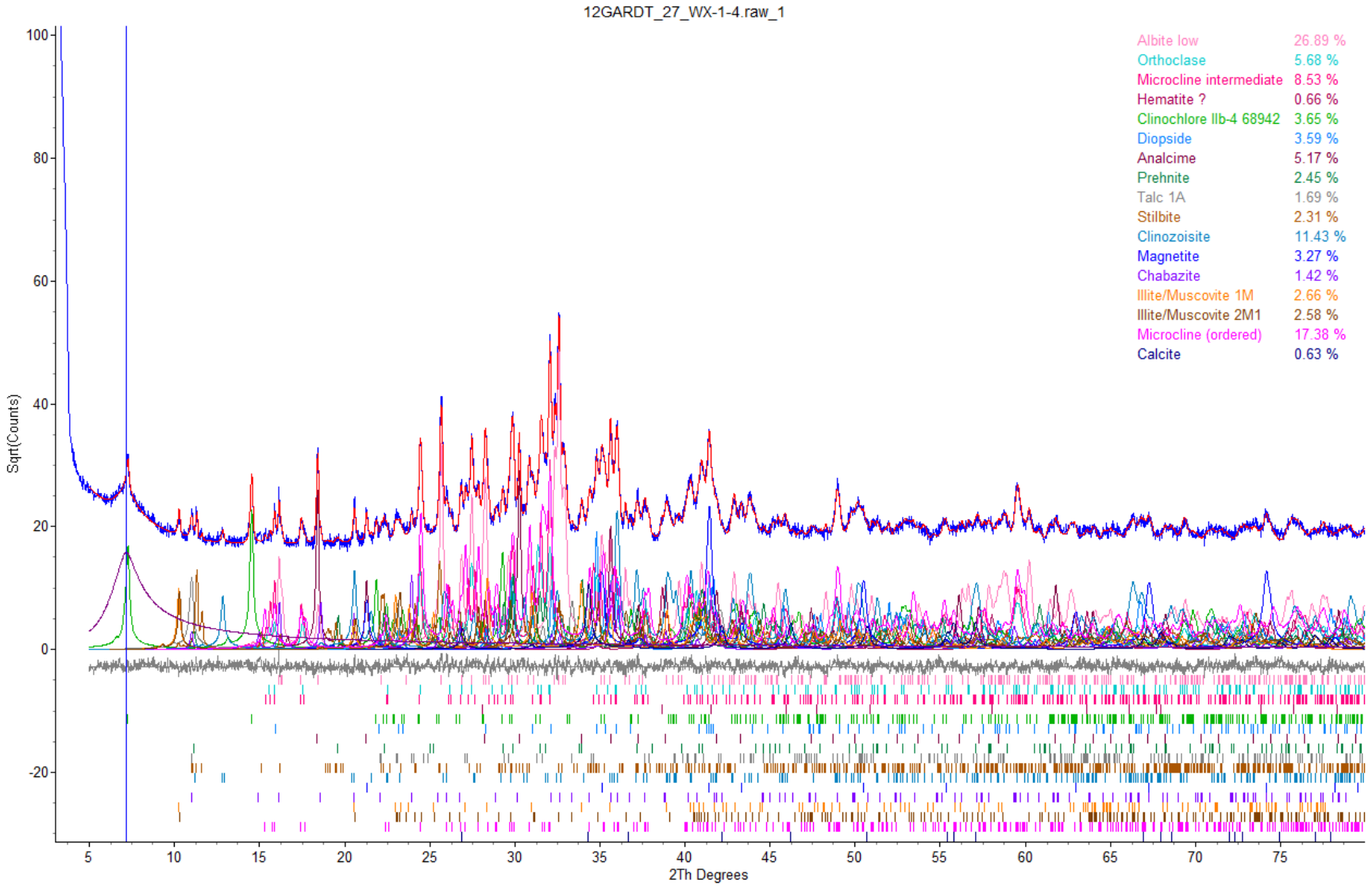

Figure 12. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 27-WX-1-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

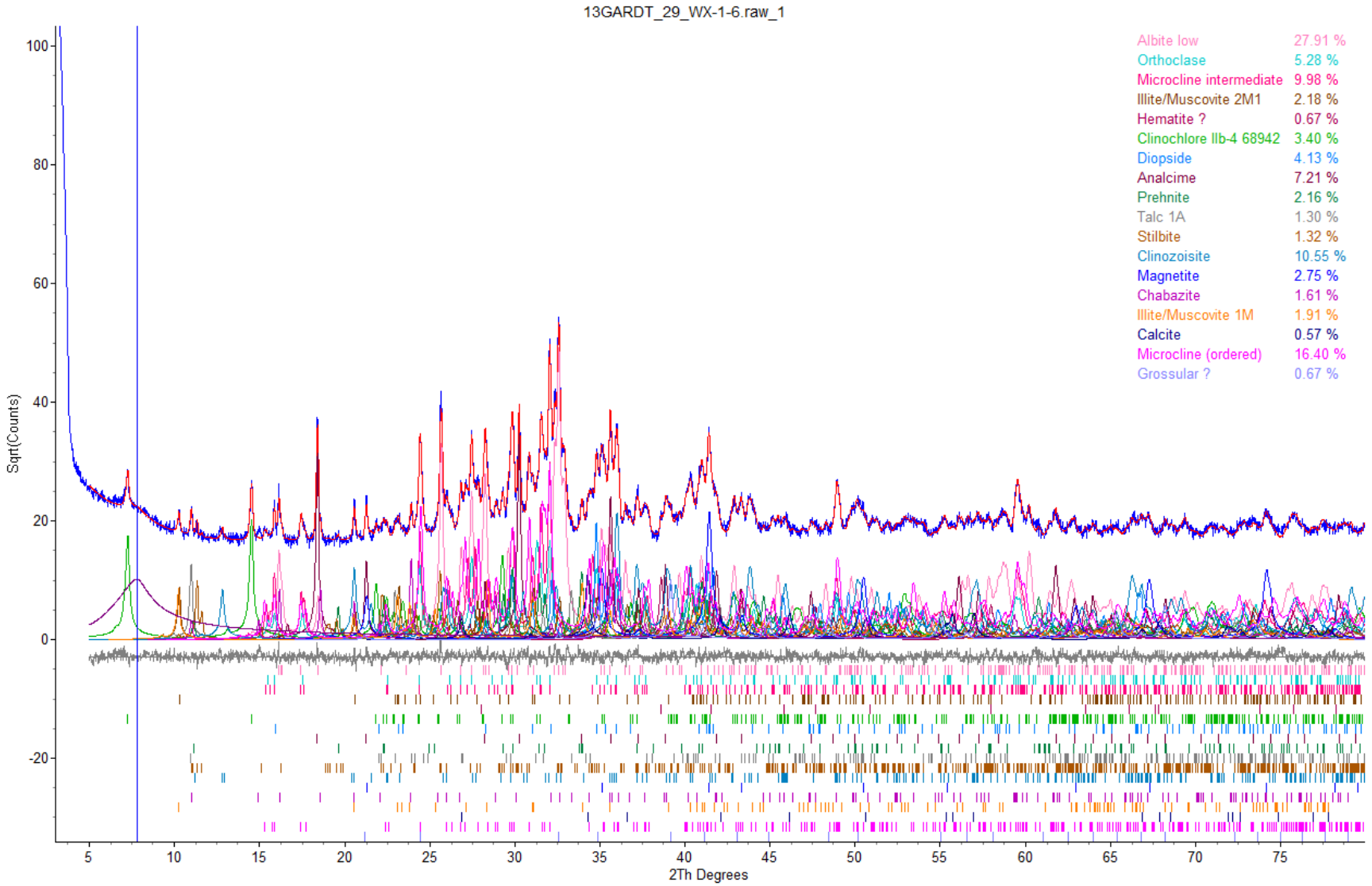

Figure 13. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 29_WX-1-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

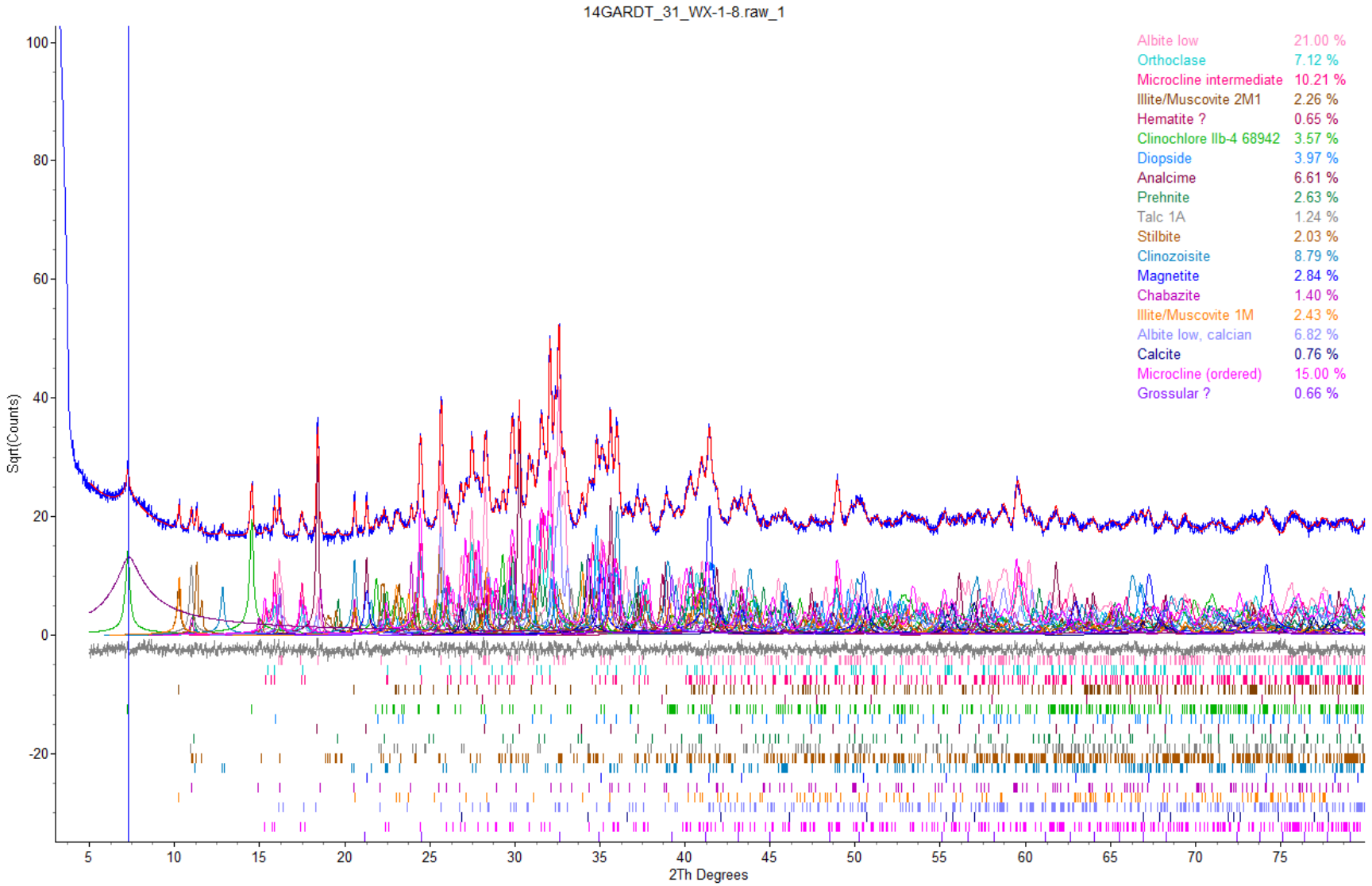

Figure 14. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 31_WX-1-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

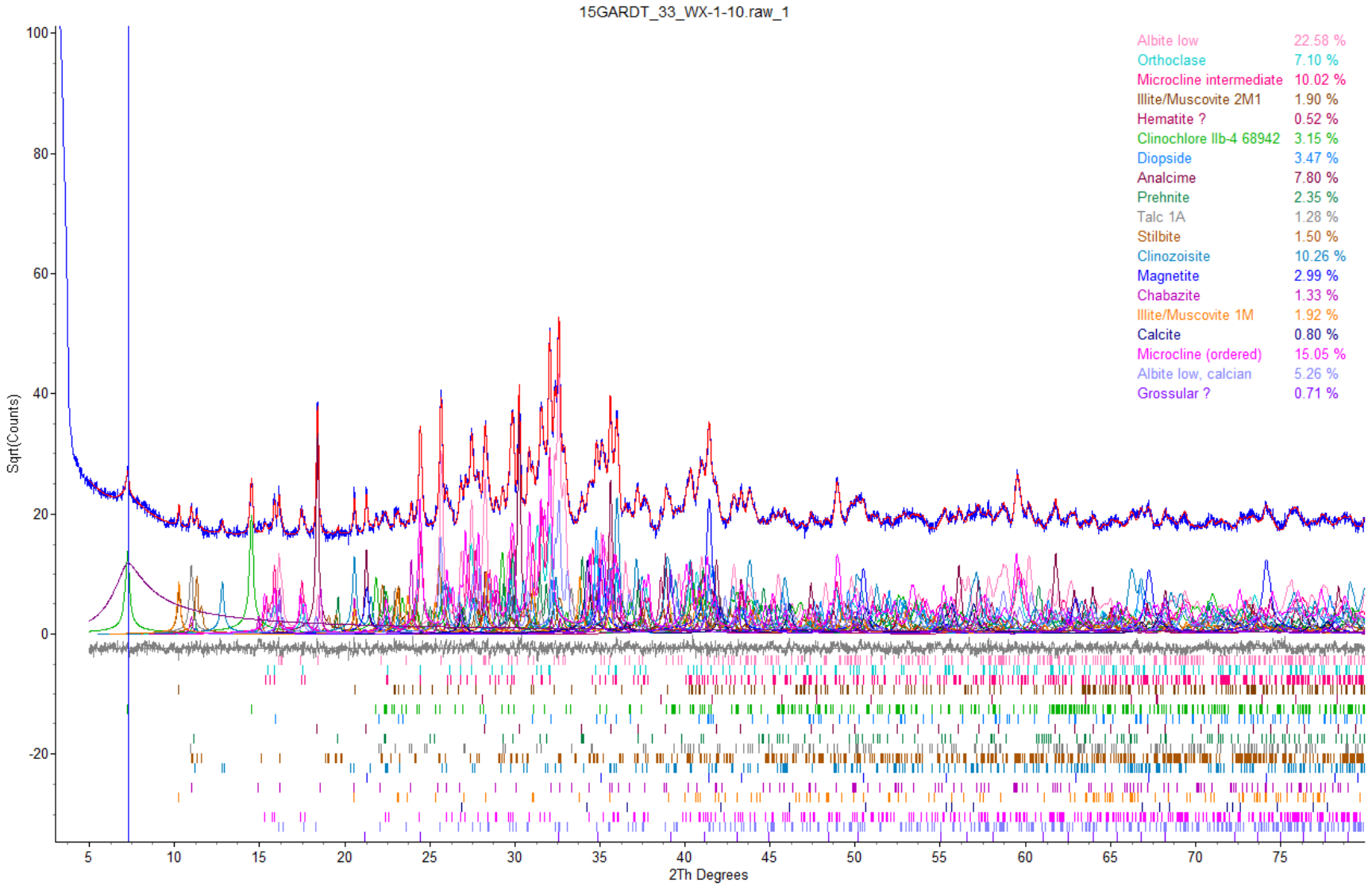

Figure 15. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 33_WX-1-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

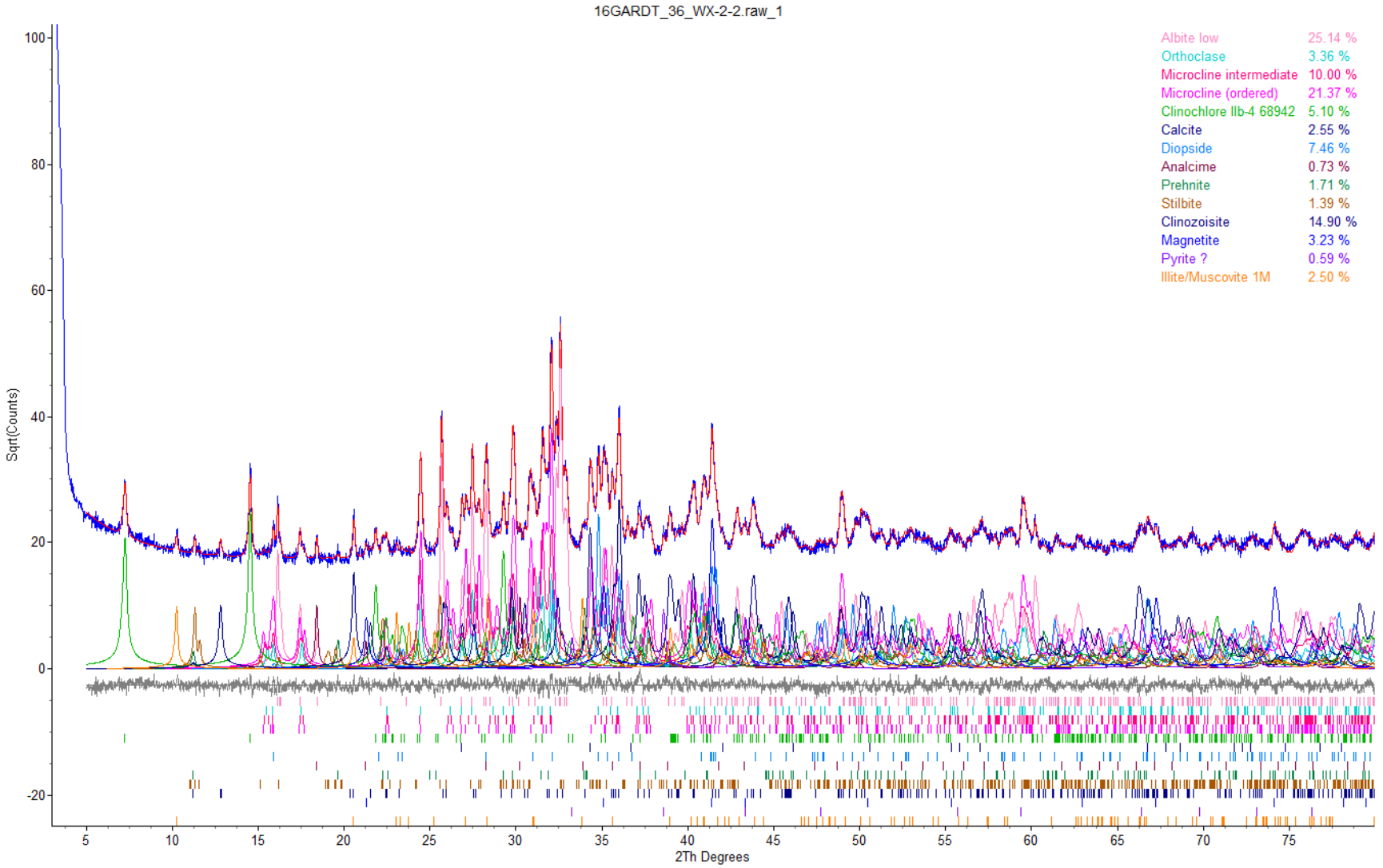

Figure 16. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 36_WX-2-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

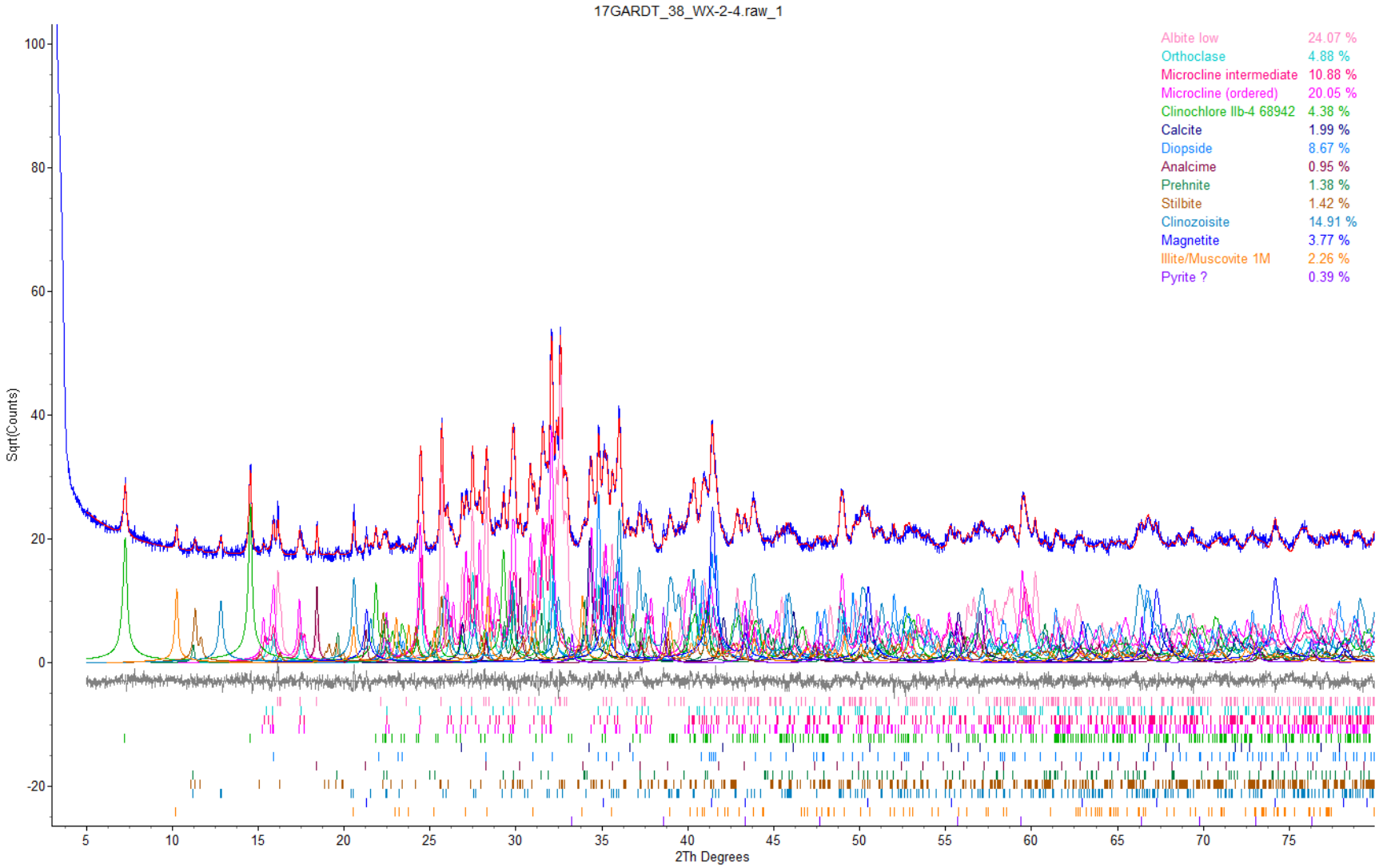

Figure 17. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 38_WX-2-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

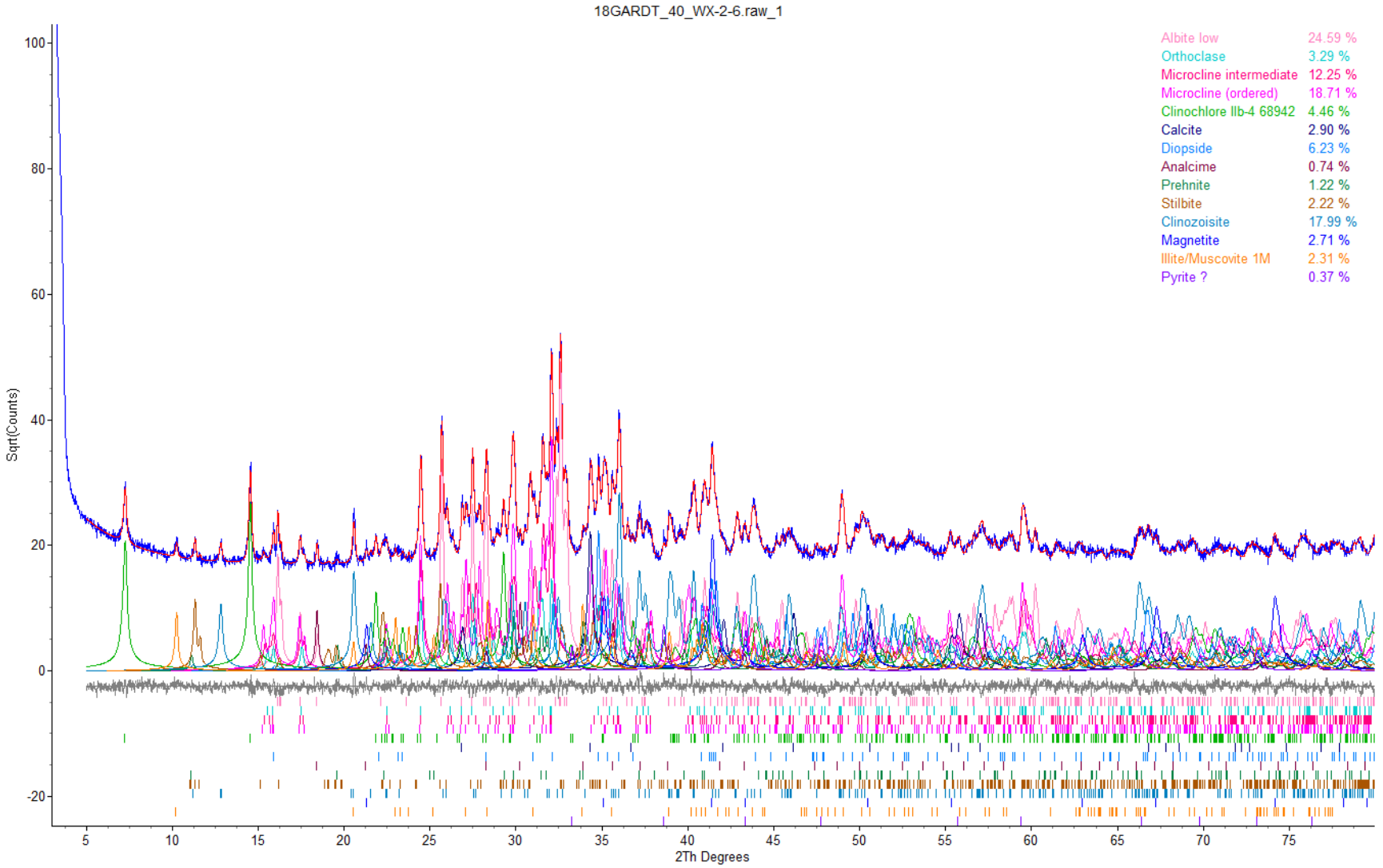

Figure 18. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 40_WX-2-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

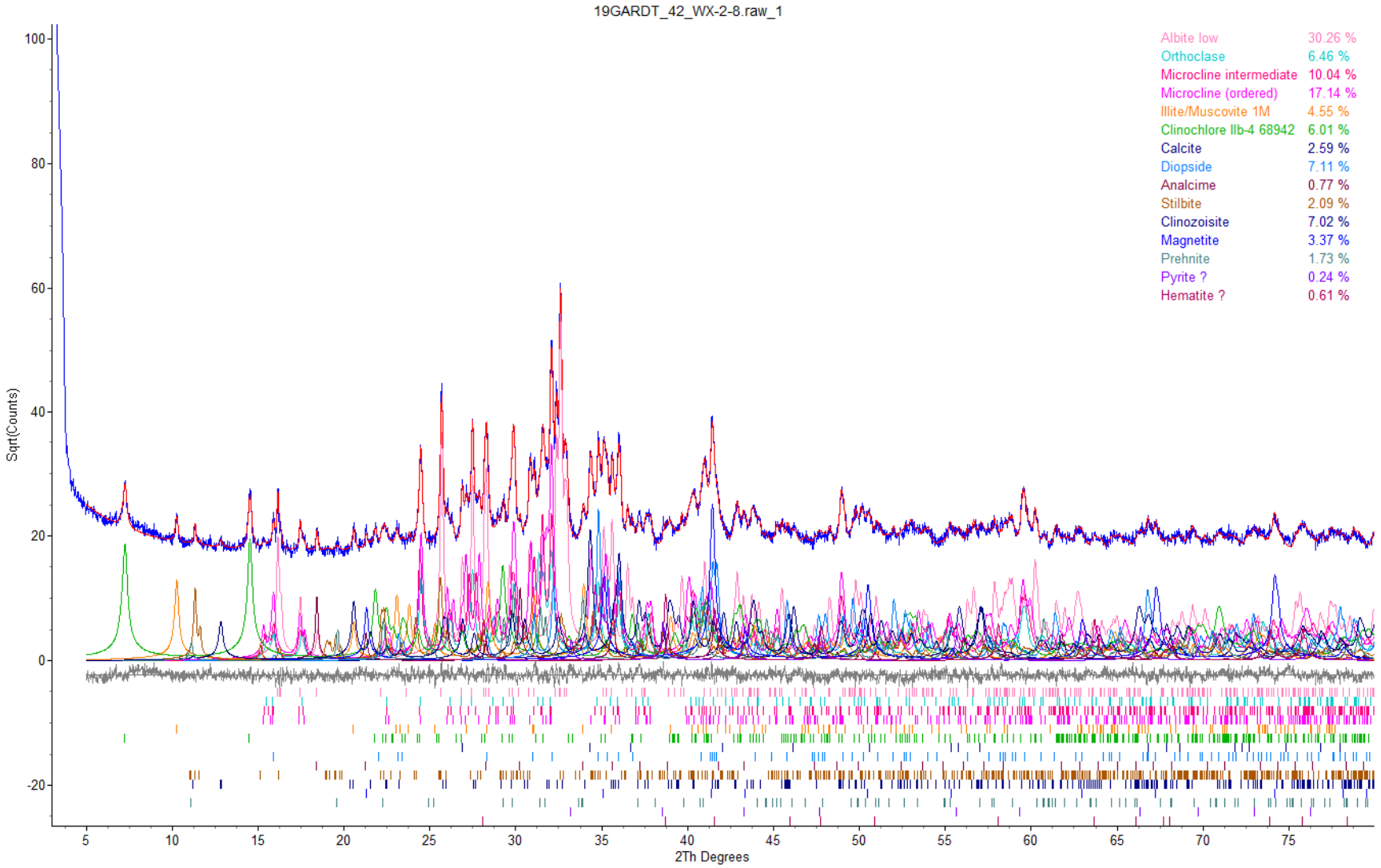

Figure 19. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 42_WX-2-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

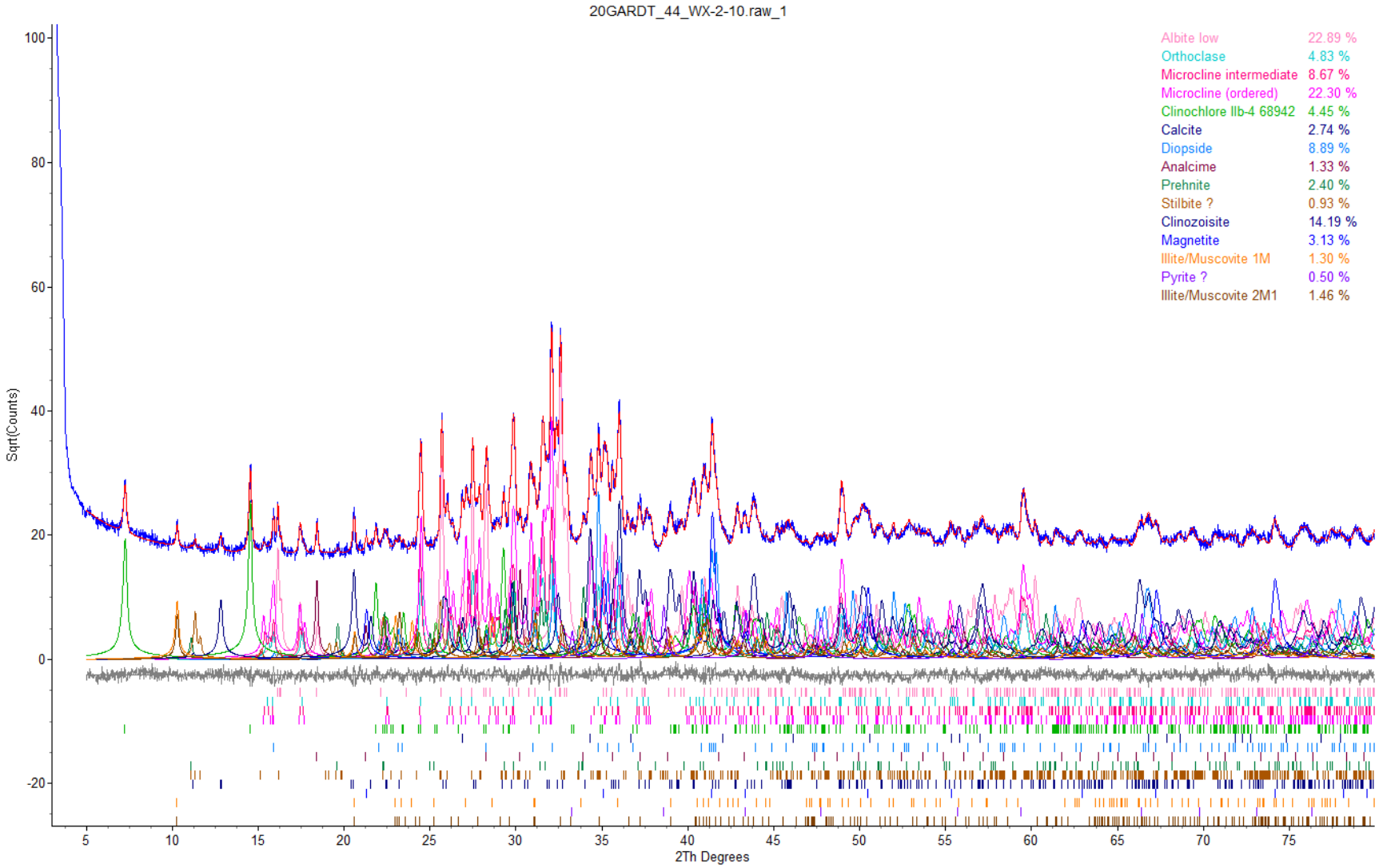

Figure 20. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 44_WX-2-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

Appendix C. Acid-Base Accounting Data for Springer Deep and WX Zones Samples Sieved to Various Size Fractions

CERTIFICATE OF ANALYSIS ▪ COVER PAGE

Global
ARD Testing Services Inc.

Company:		SRK Consulting (Canada) Inc.
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	2	Mathieu O'Leary
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Contact No:	Main: (604) 428-2730
	Alt: (604) 603-1359

PROJECT INFORMATION	
Project Name:	Mount Polley NPR Criterion
Project Number:	1CM017.011

RESULTS		
Reported To:	**1**	Shauna Litke (slitke@srk.com)
	2	Mathieu O'Leary (mathieu.oleary@mountpolley.com)
	3	
	4	
cc:		
	V1:	22-May-22
Date Reported:		

REPORT INFORMATION	
Global Project No:	2221
Report Version:	1
Pages (Including Cover):	4
Report Title:	COA x44 Samples Mount Polley (rec'd 25-Mar22)
Analysis Reviewed By:	Prab Bhatia (PBhatia@globalARDtesting.com)
Position:	Project Manager
Report Certified By:	Prab Bhatia
Signature:	

INVOICE		
Submitted To:		Mount Polley
cc:	**1**	Mathieu O'Leary (mathieu.oleary@mountpolley.com)
	2	
Mailing Address:		
Client PO No:		N/A
Global Invoice No:		ARD2221-0622A
Date Submitted:		May 30, 2022

NOTES
All samples are stored at no charge for 90 days past reporting date.
HCT, column, custom leach columns (Lysimeters) & SAD column samples
will be stored free for 90 days past kinetic testing program or Closedown.
Please contact the lab if you require additional sample storage time.

CERTIFICATE OF ANALYSIS ▪ SAMPLE DETAILS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Sample Description	Condition	Total Sample Wt Rec'd (kg)	Global Notes:
1	SP-1-1	Rock	Wet	29.50	
2	SP-1-1-Dup	Rock	Wet	29.15	
3	SP-1-2	Rock	Wet	29.55	
4	SP-1-3	Rock	Wet	27.00	
5	SP-1-4	Rock	Wet	28.60	
6	SP-1-5	Rock	Wet	25.20	
7	SP-1-6	Rock	Wet	26.65	
8	SP-1-7	Rock	Wet	30.05	
9	SP-1-8	Rock	Wet	25.00	
10	SP-1-9	Rock	Wet	29.00	
11	SP-1-10	Rock	Wet	28.50	
12	SP-2-1	Rock	Wet	24.40	
13	SP-2-1-Dup	Rock	Wet	25.30	
14	SP-2-2	Rock	Wet	24.80	
15	SP-2-3	Rock	Wet	25.00	
16	SP-2-4	Rock	Wet	27.55	
17	SP-2-5	Rock	Wet	25.00	
18	SP-2-6	Rock	Wet	24.20	
19	SP-2-7	Rock	Wet	25.05	
20	SP-2-8	Rock	Wet	23.50	
21	SP-2-9	Rock	Wet	23.00	
22	SP-2-10	Rock	Wet	27.05	
23	WX-1-1	Rock	Wet	19.80	
24	WX-1-1-Dup	Rock	Wet	19.65	
25	WX-1-2	Rock	Wet	23.30	
26	WX-1-3	Rock	Wet	20.80	
27	WX-1-4	Rock	Wet	21.50	

SAMPLE RECEIPT INFO:	
Date Samples Rec'd:	Friday, March 25, 2022
No. of Samples Rec'd:	44
Samples Rec'd By:	Mark

ANALYTICAL INSTRUCTIONS:	
From:	Shauna Litke
Date:	Friday, March 25, 2022

INSTRUCTIONS:

Sieve Samples as instructed and Analyze all fractions.
A (+10mm)
B(-10mm + 2mm)
C (-2mm)

CERTIFICATE OF ANALYSIS ▪ SAMPLE DETAILS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

28	WX-1-5	Rock	Wet	24.25	
29	WX-1-6	Rock	Wet	20.60	
30	WX-1-7	Rock	Wet	22.90	
31	WX-1-8	Rock	Wet	23.50	
32	WX-1-9	Rock	Wet	17.15	
33	WX-1-10	Rock	Wet	21.20	
34	WX-2-1	Rock	Wet	25.40	Overlying Water
35	WX-2-1-Dup	Rock	Wet	20.00	Overlying Water
36	WX-2-2	Rock	Wet	21.00	Overlying Water
37	WX-2-3	Rock	Wet	21.00	Overlying Water
38	WX-2-4	Rock	Wet	22.00	Overlying Water
39	WX-2-5	Rock	Wet	22.00	Overlying Water
40	WX-2-6	Rock	Wet	21.00	Overlying Water
41	WX-2-7	Rock	Wet	21.00	Overlying Water
42	WX-2-8	Tails	Wet	17.00	Overlying Water
43	WX-2-9	Rock	Wet	24.00	Overlying Water
44	WX-2-10	Rock	Wet	21.00	Overlying Water

Total wt of sample rec'd (kg): **1053.10**

CERTIFICATE OF ANALYSIS ▪ SIEVED FRACTION WEIGHTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consul
PROJECT NAME: Mount Polle
PROJECT NO: 1CM017.01
REPORT VERSION: 1

S.No.	Fraction	Weight	
1	+10 mm	19.25	kg
	-10+2mm	6.60	kg
	-2mm	3.65	kg
2	+10 mm	16.65	kg
	-10+2mm	7.10	kg
	-2mm	5.20	kg
3	+10 mm	16.60	kg
	-10+2mm	7.75	kg
	-2mm	5.15	kg
4	+10 mm	15.25	kg
	-10+2mm	7.40	kg
	-2mm	4.15	kg
5	+10 mm	17.95	kg
	-10+2mm	6.45	kg
	-2mm	4.15	kg
6	+10 mm	14.85	kg
	-10+2mm	6.35	kg
	-2mm	3.90	kg
7	+10 mm	16.80	kg
	-10+2mm	6.00	kg
	-2mm	3.75	kg
8	+10 mm	16.95	kg
	-10+2mm	7.65	kg
	-2mm	5.45	kg
9	+10 mm	13.05	kg
	-10+2mm	6.70	kg
	-2mm	5.30	kg
10	+10 mm	18.85	kg
	-10+2mm	6.60	kg
	-2mm	3.30	kg
11	+10 mm	14.75	kg
	-10+2mm	7.50	kg
	-2mm	5.70	kg
12	+10 mm	16.75	kg
	-10+2mm	4.55	kg
	-2mm	3.05	kg
13	+10 mm	14.60	kg
	-10+2mm	5.95	kg
	-2mm	4.20	kg
14	+10 mm	15.20	kg
	-10+2mm	5.55	kg
	-2mm	3.85	kg
15	+10 mm	16.90	kg
	-10+2mm	4.95	kg
	-2mm	3.30	kg
16	+10 mm	17.20	kg
	-10+2mm	6.10	kg
	-2mm	4.10	kg
	+10 mm	14.00	kg

S.No.	Fraction	Weight	
21	+10 mm	13.50	kg
	-10+2mm	5.25	kg
	-2mm	3.95	kg
22	+10 mm	17.55	kg
	-10+2mm	6.55	kg
	-2mm	3.60	kg
23	+10 mm	9.10	kg
	-10+2mm	6.25	kg
	-2mm	2.25	kg
24	+10 mm	11.90	kg
	-10+2mm	4.25	kg
	-2mm	1.25	kg
25	+10 mm	15.90	kg
	-10+2mm	4.05	kg
	-2mm	1.45	kg
26	+10 mm	9.80	kg
	-10+2mm	6.55	kg
	-2mm	2.30	kg
27	+10 mm	12.70	kg
	-10+2mm	5.40	kg
	-2mm	1.70	kg
28	+10 mm	15.40	kg
	-10+2mm	5.55	kg
	-2mm	1.90	kg
29	+10 mm	15.35	kg
	-10+2mm	3.25	kg
	-2mm	1.00	kg
30	+10 mm	14.35	kg
	-10+2mm	5.00	kg
	-2mm	1.80	kg
31	+10 mm	15.75	kg
	-10+2mm	4.35	kg
	-2mm	1.75	kg
32	+10 mm	10.90	kg
	-10+2mm	3.45	kg
	-2mm	1.05	kg
33	+10 mm	13.50	kg
	-10+2mm	4.80	kg
	-2mm	1.85	kg
34	+10 mm	13.35	kg
	-10+2mm	5.55	kg
	-2mm	3.80	kg
35	+10 mm	11.00	kg
	-10+2mm	9.35	kg
	-2mm	2.75	kg
36	+10 mm	11.40	kg
	-10+2mm	4.55	kg
	-2mm	2.90	kg
	+10 mm	11.70	kg

CERTIFICATE OF ANALYSIS ▪ SIEVED FRACTION WEIGHTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consul
PROJECT NAME: Mount Polle
PROJECT NO: 1CM017.01
REPORT VERSION: 1

S.No.	Fraction	Weight	
17	-10+2mm	6.05	kg
	-2mm	4.55	kg
18	+10 mm	14.50	kg
	-10+2mm	5.50	kg
	-2mm	3.95	kg
19	+10 mm	14.65	kg
	-10+2mm	5.50	kg
	-2mm	3.15	kg
20	+10 mm	14.90	kg
	-10+2mm	5.00	kg
	-2mm	3.35	kg

S.No.	Fraction	Weight	
37	-10+2mm	4.10	kg
	-2mm	2.30	kg
38	+10 mm	13.95	kg
	-10+2mm	4.25	kg
	-2mm	2.60	kg
39	+10 mm	12.00	kg
	-10+2mm	4.85	kg
	-2mm	3.05	kg
40	+10 mm	11.85	kg
	-10+2mm	4.15	kg
	-2mm	2.30	kg
41	+10 mm	10.90	kg
	-10+2mm	4.60	kg
	-2mm	3.35	kg
42	+10 mm	8.45	kg
	-10+2mm	4.35	kg
	-2mm	2.45	kg
43	+10 mm	14.45	kg
	-10+2mm	4.95	kg
	-2mm	3.45	kg
44	+10 mm	11.45	kg
	-10+2mm	4.75	kg
	-2mm	3.25	kg

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
1A	SP-1-1A	8.5	Slight	0.11	9.2	0.38	0.01	0.37	11.6	24.5	12.9	2.1
1B	SP-1-1B	8.6	Moderate	0.17	14.2	0.34	<0.01	0.34	10.6	25.0	14.4	2.4
1C	SP-1-1C	8.2	Strong	0.47	39.5	0.98	0.01	0.97	30.3	56.2	25.9	1.9
2A	SP-1-1-DupA	8.6	Slight	0.13	10.8	0.50	<0.01	0.50	15.6	21.5	5.9	1.4
2B	SP-1-1-DupB	8.5	Slight	0.16	13.3	0.53	<0.01	0.53	16.6	28.8	12.2	1.7
2C	SP-1-1-DupC	8.3	Strong	0.45	37.5	0.90	0.01	0.89	27.8	50.5	22.7	1.8
3A	SP-1-2A	8.6	None	<0.02	<1.7	0.88	<0.01	0.88	27.5	11.9	-15.6	0.4
3B	SP-1-2B	8.5	Slight	0.13	10.8	1.15	0.05	1.10	34.4	15.4	-19.0	0.4
3C	SP-1-2C	8.0	Moderate	0.17	14.2	1.90	0.03	1.87	58.4	26.8	-31.6	0.5
4A	SP-1-3A	8.7	Strong	0.18	15.0	0.30	0.02	0.28	8.8	23.7	15.0	2.7
4B	SP-1-3B	8.7	Strong	0.31	25.8	0.49	0.01	0.48	15.0	31.9	16.9	2.1
4C	SP-1-3C	8.2	Strong	0.73	60.8	0.77	<0.01	0.77	24.1	64.9	40.8	2.7
5A	SP-1-4A	8.6	Slight	0.16	13.3	0.49	<0.01	0.49	15.3	21.2	5.9	1.4
5B	SP-1-4B	8.6	Moderate	0.18	15.0	0.56	<0.01	0.56	17.5	23.6	6.1	1.3
5C	SP-1-4C	8.2	Strong	0.43	35.8	1.03	0.02	1.01	31.6	50.5	18.9	1.6
6A	SP-1-5A	8.6	Slight	0.03	2.5	1.24	<0.01	1.24	38.8	15.3	-23.5	0.4
6B	SP-1-5B	8.4	Slight	0.05	4.2	1.33	0.03	1.30	40.6	18.9	-21.7	0.5
6C	SP-1-5C	8.2	Strong	0.34	28.3	2.00	0.02	1.98	61.9	39.6	-22.3	0.6
7A	SP-1-6A	8.7	Slight	0.08	6.7	0.30	0.03	0.27	8.4	19.6	11.2	2.3
7B	SP-1-6B	8.7	Moderate	0.15	12.5	0.46	0.02	0.44	13.8	27.0	13.3	2.0
7C	SP-1-6C	8.0	Strong	0.46	38.3	0.85	0.01	0.84	26.3	57.4	31.2	2.2
8A	SP-1-7A	8.4	None	<0.02	<1.7	0.68	<0.01	0.68	21.3	15.7	-5.6	0.7
8B	SP-1-7B	8.4	Slight	0.02	1.7	0.61	<0.01	0.61	19.1	17.2	-1.9	0.9
8C	SP-1-7C	8.0	Moderate	0.14	11.7	1.26	0.03	1.23	38.4	26.6	-11.8	0.7
9A	SP-1-8A	8.3	None	0.04	3.3	1.40	<0.01	1.40	43.8	14.1	-29.7	0.3
9B	SP-1-8B	8.3	None	0.03	2.5	1.40	<0.01	1.40	43.8	15.3	-28.5	0.3
9C	SP-1-8C	7.9	Slight	0.12	10.0	2.44	0.06	2.38	74.4	24.6	-49.8	0.3
10A	SP-1-9A	8.8	Slight	0.03	2.5	0.08	<0.01	0.08	2.5	18.7	16.2	7.5
10B	SP-1-9B	8.6	Moderate	0.15	12.5	0.26	<0.01	0.26	8.1	24.2	16.1	3.0
10C	SP-1-9C	8.4	Strong	0.54	45.0	0.43	0.01	0.42	13.1	58.3	45.2	4.4
11A	SP-1-10A	8.5	Slight	0.14	11.7	0.85	<0.01	0.85	26.6	23.4	-3.2	0.9
11B	SP-1-10B	8.6	Slight	0.19	15.8	0.43	0.02	0.41	12.8	26.9	14.1	2.1
11C	SP-1-10C	8.3	Moderate	0.48	40.0	0.77	<0.01	0.77	24.1	53.8	29.7	2.2
12A	SP-2-1A	9.0	Slight	0.06	5.0	0.02	<0.01	0.02	0.6	12.6	12.0	20.2
12B	SP-2-1B	8.8	Slight	0.07	5.8	0.02	<0.01	0.02	0.6	13.1	12.5	21.0
12C	SP-2-1C	9.0	Moderate	0.27	22.5	0.04	<0.01	0.04	1.3	32.3	31.1	25.8
13A	SP-2-1-DupA	8.9	Slight	0.06	5.0	0.01	<0.01	0.01	0.3	13.2	12.9	42.2
13B	SP-2-1-DupB	9.0	Slight	0.09	7.5	0.02	<0.01	0.02	0.6	13.4	12.8	21.4
13C	SP-2-1-DupC	8.5	Moderate	0.26	21.7	0.03	0.02	0.01	0.3	30.7	30.4	98.2
14A	SP-2-2A	9.0	Slight	0.03	2.5	0.02	<0.01	0.02	0.6	13.2	12.6	21.1
14B	SP-2-2B	8.8	Slight	0.09	7.5	0.02	0.02	<0.01	<0.3	18.4	18.4	N/A
14C	SP-2-2C	8.5	Moderate	0.20	16.7	0.03	<0.01	0.03	0.9	27.3	26.4	29.1
15A	SP-2-3A	9.0	None	0.04	3.3	<0.01	<0.01	<0.01	<0.3	13.6	13.6	N/A
15B	SP-2-3B	8.9	Slight	0.06	5.0	0.01	<0.01	0.01	0.3	16.3	16.0	52.2
15C	SP-2-3C	8.5	Moderate	0.13	10.8	0.03	0.02	0.01	0.3	24.3	24.0	77.8
16A	SP-2-4A	9.1	None	0.04	3.3	<0.01	<0.01	<0.01	<0.3	8.6	8.6	N/A
16B	SP-2-4B	8.9	Slight	0.10	8.3	0.01	<0.01	0.01	0.3	13.2	12.9	42.2
16C	SP-2-4C	8.3	Moderate	0.28	23.3	0.03	<0.01	0.03	0.9	34.6	33.7	36.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
17A	SP-2-5A	8.7	Slight	0.03	2.5	<0.01	<0.01	<0.01	<0.3	10.5	10.5	N/A
17B	SP-2-5B	8.8	Slight	0.06	5.0	0.01	0.01	<0.01	<0.3	15.4	15.4	N/A
17C	SP-2-5C	8.5	Moderate	0.17	14.2	0.03	<0.01	0.03	0.9	24.3	23.4	25.9
18A	SP-2-6A	9.0	Slight	0.02	1.7	0.03	<0.01	0.03	0.9	8.9	8.0	9.5
18B	SP-2-6B	9.0	Slight	0.05	4.2	0.02	<0.01	0.02	0.6	15.2	14.6	24.3
18C	SP-2-6C	8.5	Slight	0.18	15.0	0.03	<0.01	0.03	0.9	23.9	23.0	25.5
19A	SP-2-7A	9.1	Slight	0.04	3.3	0.03	<0.01	0.03	0.9	10.5	9.6	11.2
19B	SP-2-7B	8.8	Moderate	0.09	7.5	0.03	<0.01	0.03	0.9	16.2	15.3	17.3
19C	SP-2-7C	8.6	Strong	0.24	20.0	0.05	<0.01	0.05	1.6	29.3	27.7	18.8
20A	SP-2-8A	9.0	Slight	0.08	6.7	0.04	<0.01	0.04	1.3	13.6	12.4	10.9
20B	SP-2-8B	9.0	Slight	0.14	11.7	0.04	<0.01	0.04	1.3	20.2	19.0	16.2
20C	SP-2-8C	8.5	Moderate	0.05	4.2	0.06	0.02	0.04	1.3	11.1	9.9	8.9
21A	SP-2-9A	8.9	Slight	0.03	2.5	0.01	<0.01	0.01	0.3	14.0	13.7	44.8
21B	SP-2-9B	8.8	Slight	0.05	4.2	0.03	<0.01	0.03	0.9	14.3	13.4	15.3
21C	SP-2-9C	8.5	Moderate	0.20	16.7	0.05	<0.01	0.05	1.6	29.5	27.9	18.9
22A	SP-2-10A	8.9	Slight	0.05	4.2	0.02	<0.01	0.02	0.6	11.4	10.8	18.2
22B	SP-2-10B	9.0	Slight	0.06	5.0	0.03	<0.01	0.03	0.9	13.6	12.7	14.5
22C	SP-2-10C	8.5	Moderate	0.26	21.7	0.04	<0.01	0.04	1.3	25.4	24.2	20.3
23A	WX-1-1A	8.3	Slight	0.06	5.0	0.16	<0.01	0.16	5.0	21.6	16.6	4.3
23B	WX-1-1B	8.2	Slight	0.03	2.5	0.13	<0.01	0.13	4.1	21.6	17.5	5.3
23C	WX-1-1C	8.3	Moderate	0.16	13.3	0.10	<0.01	0.10	3.1	38.1	35.0	12.2
24A	WX-1-1-DupA	8.3	None	0.04	3.3	0.19	<0.01	0.19	5.9	17.7	11.8	3.0
24B	WX-1-1-DupB	8.4	None	0.02	1.7	0.11	<0.01	0.11	3.4	17.6	14.2	5.1
24C	WX-1-1-DupC	8.1	Slight	0.10	8.3	0.06	<0.01	0.06	1.9	24.9	23.0	13.3
25A	WX-1-2A	8.3	None	0.07	5.8	0.11	<0.01	0.11	3.4	21.7	18.3	6.3
25B	WX-1-2B	8.3	None	0.15	12.5	0.14	<0.01	0.14	4.4	27.5	23.1	6.3
25C	WX-1-2C	8.2	Slight	0.20	16.7	0.15	<0.01	0.15	4.7	31.2	26.5	6.7
26A	WX-1-3A	8.3	Slight	0.13	10.8	0.13	<0.01	0.13	4.1	23.7	19.6	5.8
26B	WX-1-3B	8.4	Slight	0.16	13.3	0.11	<0.01	0.11	3.4	27.0	23.6	7.9
26C	WX-1-3C	8.1	Moderate	0.25	20.8	0.08	<0.01	0.08	2.5	34.8	32.3	13.9
27A	WX-1-4A	8.4	None	0.03	2.5	0.17	<0.01	0.17	5.3	17.7	12.4	3.3
27B	WX-1-4B	8.3	None	0.03	2.5	0.14	<0.01	0.14	4.4	17.7	13.3	4.0
27C	WX-1-4C	8.1	Slight	0.06	5.0	0.09	<0.01	0.09	2.8	22.7	19.9	8.1
28A	WX-1-5A	8.4	None	0.05	4.2	0.19	<0.01	0.19	5.9	18.8	12.9	3.2
28B	WX-1-5B	8.4	None	0.04	3.3	0.14	<0.01	0.14	4.4	16.2	11.8	3.7
28C	WX-1-5C	7.8	Slight	0.13	10.8	0.10	<0.01	0.10	3.1	22.2	19.1	7.1
29A	WX-1-6A	8.3	None	0.07	5.8	0.17	<0.01	0.17	5.3	21.6	16.3	4.1
29B	WX-1-6B	8.2	None	0.07	5.8	0.16	<0.01	0.16	5.0	19.9	14.9	4.0
29C	WX-1-6C	8.1	Slight	0.17	14.2	0.16	<0.01	0.16	5.0	27.4	22.4	5.5
30A	WX-1-7A	8.1	None	0.07	5.8	0.17	<0.01	0.17	5.3	23.0	17.7	4.3
30B	WX-1-7B	8.3	Slight	0.06	5.0	0.12	<0.01	0.12	3.8	20.5	16.8	5.5
30C	WX-1-7C	8.0	Slight	0.09	7.5	0.12	<0.01	0.12	3.8	22.5	18.8	6.0
31A	WX-1-8A	8.4	None	0.04	3.3	0.14	<0.01	0.14	4.4	21.8	17.4	5.0
31B	WX-1-8B	8.2	Slight	0.09	7.5	0.13	<0.01	0.13	4.1	24.0	19.9	5.9
31C	WX-1-8C	8.1	Slight	0.20	16.7	0.13	<0.01	0.13	4.1	30.7	26.6	7.6
32A	WX-1-9A	8.3	None	<0.02	<1.7	0.16	0.03	0.13	4.1	18.2	14.1	4.5
32B	WX-1-9B	8.5	None	<0.02	<1.7	0.16	<0.01	0.16	5.0	18.2	13.2	3.6
32C	WX-1-9C	8.1	Slight	0.05	4.2	0.14	<0.01	0.14	4.4	17.2	12.8	3.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
33A	WX-1-10A	8.4	None	<0.02	<1.7	0.15	<0.01	0.15	4.7	12.9	8.2	2.8
33B	WX-1-10B	8.4	None	0.03	2.5	0.14	<0.01	0.14	4.4	16.8	12.4	3.8
33C	WX-1-10C	8.2	Slight	0.16	13.3	0.14	<0.01	0.14	4.4	27.8	23.4	6.4
34A	WX-2-1A	8.7	Slight	0.25	20.8	0.21	<0.01	0.21	6.6	33.1	26.5	5.0
34B	WX-2-1B	8.8	Slight	0.26	21.7	0.21	<0.01	0.21	6.6	33.6	27.0	5.1
34C	WX-2-1C	8.3	Strong	0.47	39.2	0.25	<0.01	0.25	7.8	50.0	42.2	6.4
35A	WX-2-1-DupA	8.8	Moderate	0.23	19.2	0.21	<0.01	0.21	6.6	31.9	25.3	4.9
35B	WX-2-1-DupB	8.7	Moderate	0.25	20.8	0.20	<0.01	0.20	6.3	33.6	27.4	5.4
35C	WX-2-1-DupC	8.5	Strong	0.42	35.0	0.24	<0.01	0.24	7.5	48.2	40.7	6.4
36A	WX-2-2A	8.7	Moderate	0.28	23.3	0.15	<0.01	0.15	4.7	35.6	30.9	7.6
36B	WX-2-2B	8.7	Moderate	0.27	22.5	0.13	<0.01	0.13	4.1	34.6	30.5	8.5
36C	WX-2-2C	8.4	Strong	0.42	35.0	0.15	<0.01	0.15	4.7	46.3	41.6	9.9
37A	WX-2-3A	8.8	Moderate	0.27	22.5	0.14	<0.01	0.14	4.4	34.5	30.1	7.9
37B	WX-2-3B	8.5	Moderate	0.33	27.5	0.12	<0.01	0.12	3.8	39.4	35.7	10.5
37C	WX-2-3C	8.5	Strong	0.38	31.7	0.15	<0.01	0.15	4.7	44.4	39.7	9.5
38A	WX-2-4A	8.7	Moderate	0.31	25.8	0.19	<0.01	0.19	5.9	34.6	28.7	5.8
38B	WX-2-4B	8.7	Moderate	0.30	25.0	0.21	<0.01	0.21	6.6	33.5	26.9	5.1
38C	WX-2-4C	8.5	Strong	0.50	41.7	0.23	<0.01	0.23	7.2	48.2	41.0	6.7
39A	WX-2-5A	8.8	Moderate	0.30	25.0	0.20	<0.01	0.20	6.3	31.8	25.6	5.1
39B	WX-2-5B	8.6	Moderate	0.33	27.5	0.20	<0.01	0.20	6.3	36.0	29.8	5.8
39C	WX-2-5C	8.4	Strong	0.48	40.0	0.21	<0.01	0.21	6.6	43.9	37.3	6.7
40A	WX-2-6A	8.8	Moderate	0.39	32.5	0.20	<0.01	0.20	6.3	36.2	30.0	5.8
40B	WX-2-6B	8.6	Moderate	0.37	30.8	0.19	0.01	0.18	5.6	37.2	31.6	6.6
40C	WX-2-6C	8.7	Strong	0.54	45.0	0.20	0.04	0.16	5.0	46.3	41.3	9.3
41A	WX-2-7A	8.7	Moderate	0.25	20.8	0.21	<0.01	0.21	6.6	35.0	28.4	5.3
41B	WX-2-7B	8.7	Moderate	0.26	21.7	0.20	0.04	0.16	5.0	32.8	27.8	6.6
41C	WX-2-7C	8.5	Strong	0.37	30.8	0.25	0.01	0.24	7.5	45.3	37.8	6.0
42A	WX-2-8A	8.8	Slight	0.20	16.7	0.16	0.01	0.15	4.7	30.6	25.9	6.5
42B	WX-2-8B	8.6	Moderate	0.28	23.3	0.15	0.07	0.08	2.5	37.1	34.6	14.8
42C	WX-2-8C	8.3	Moderate	0.33	27.5	0.14	0.02	0.12	3.8	40.2	36.5	10.7
43A	WX-2-9A	8.7	Moderate	0.28	23.3	0.21	0.01	0.20	6.3	33.8	27.6	5.4
43B	WX-2-9B	8.7	Moderate	0.24	20.0	0.23	0.02	0.21	6.6	33.0	26.4	5.0
43C	WX-2-9C	8.6	Strong	0.40	33.3	0.26	0.02	0.24	7.5	47.5	40.0	6.3
44A	WX-2-10A	8.7	Moderate	0.20	16.7	0.20	0.03	0.17	5.3	32.1	26.8	6.0
44B	WX-2-10B	8.8	Moderate	0.26	21.7	0.22	0.02	0.20	6.3	33.1	26.9	5.3
44C	WX-2-10C	8.5	Strong	0.32	26.7	0.23	0.02	0.21	6.6	41.0	34.4	6.2
QUALITY ASSURANCE / QUALITY CONTROL												
Replicate Analysis:												
4A	SP-1-3A	8.7	Strong				0.02			23.7		
4A R	SP-1-3A (Rep)	8.7	Strong				0.02			23.4		
7A	SP-1-6A					0.30						
7A R	SP-1-6A (Rep)					0.30						
7B	SP-1-6B	8.7	Moderate				0.02			27.0		
7B R	SP-1-6B (Rep)	8.6	Moderate				0.02			26.5		
8B	SP-1-7B			0.02								
8B R	SP-1-7B (Rep)			0.02								
10C	SP-1-9C	8.4	Strong				0.01			58.3		
10C R	SP-1-9C (Rep)	8.4	Strong				0.01			57.7		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
13B	SP-2-1-DupB			0.09								
13B R	SP-2-1-DupB (Rep)			0.09								
14A	SP-2-2A	9.0	Slight				<0.01					
14A R	SP-2-2A (Rep)	9.0	Slight				<0.01					
14B	SP-2-2B					0.02						
14B R	SP-2-2B (Rep)					0.02						
17B	SP-2-5B	8.8	Slight				0.01					
17B R	SP-2-5B (Rep)	8.9	Slight				<0.01					
18B	SP-2-6B			0.05								
18B R	SP-2-6B (Rep)			0.04								
20C	SP-2-8C	8.5	Moderate				0.02			11.1		
20C R	SP-2-8C (Rep)	8.5	Moderate				0.02			11.6		
23B	WX-1-1B			0.03								
23B R	WX-1-1B (Rep)			0.04								
24A	WX-1-1-DupA	8.3	None				<0.01			17.7		
24A R	WX-1-1-DupA (Rep)	8.4	None				<0.01			18.3		
27B	WX-1-4B	8.3	None				<0.01			17.7		
27B R	WX-1-4B (Rep)	8.4	None				<0.01			17.6		
27C	WX-1-4C					0.09						
27C R	WX-1-4C (Rep)					0.11						
28B	WX-1-5B			0.04								
28B R	WX-1-5B (Rep)			0.04								
30C	WX-1-7C	8.0	Slight				<0.01			22.5		
30C R	WX-1-7C (Rep)	8.0	Slight				<0.01			23.2		
33B	WX-1-10B			0.03								
33B R	WX-1-10B (Rep)			0.03								
34A	WX-2-1A	8.7	Slight				<0.01			33.1		
34A R	WX-2-1A (Rep)	8.7	Slight				<0.01			32.7		
37B	WX-2-3B	8.5	Moderate				<0.01			39.4		
37B R	WX-2-3B (Rep)	8.6	Moderate				<0.01			38.6		
38B	WX-2-4B			0.30								
38B R	WX-2-4B (Rep)			0.31								
40C	WX-2-6C	8.7	Strong				0.04			46.3		
40C R	WX-2-6C	8.7	Strong				0.04			47.0		
43B	WX-2-9B			0.24								
43B R	WX-2-9B (Rep)			0.26								
44A	WX-2-10A	8.7	Moderate				0.03			32.1		
44A R	WX-2-10A (Rep)	8.7	Moderate				0.03			32.4		
Certified Reference Material (CRM) Analysis:												
Certified Reference Material		KZK-1		KZK-1		1) OREAS 24b 2) GS310-8 3) CDN-CM-38	RTS-3a			1) KZK-1 (Slight) 2) KZK-1 (Moderate)		
CRM True Value		**8.80**		**0.92**		**1) 0.19 2) 12.0 3) 5.30**	**1.10**			**1) 58.9 2) 61.6**		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**	***kg CaCO3/tonne***			
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
	Reference Material Results	8.82		0.90, 0.89, 0.85, 0.93, 0.87, 0.86		1) 0.18 2) 11.3 3) 5.47	1.18, 1.14			1) 59.1, 58.5 2) 60.1		
	Tolerance (+/-) or Acceptance Range	***0.09 (+/-)***		***80% - 120%***		***90% - 110%***	***90% - 110%***			***90% - 110%***		
	Method Blank Analysis:											
	Method Blank Results			<0.02, <0.02, <0.02, <0.02, <0.02, <0.02		<0.01, <0.01, <0.01	<0.01, <0.01					
	GLOBAL SOP No. / Method:	*ARD-004*	*ARD-005*	*HCl leach/ CO2-Coulometer*	*Calc.*	*LECO*	*ARD-013 (HCl Leach)*	*Calc.*	*Calc.*	*ARD-005*	*Calc.*	*Calc.*

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents*1	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur*2	AP*3	Mod. ABA NP	NNP*4	NPR*5
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**	***kg CaCO3/tonne***			
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		

NOTES:
Acceptance criteria at Global ARD Testing for all CRMs is ±10 % of certified value.
Job No: YVR2210450

Date of Analysis (24 h): May 3-5, 2022
pH of DI water (pH Units): 5.69
EC of DI water (µS/cm): 1.21

METHODS:
Total sulphur by Leco.
Total Inorganic Carbon (TIC): HCl leach, evolved CO_2 analysed by CO_2 Coulometer.

ABBREVIATIONS:
R = Rep = Replicate (is a sub-sample scooped from a single pulp sample bag produced per client sample)
D = Dup = Duplicate (is 2nd sub-pulp sample bag produced by processing a 2nd split of the head sample received. A duplicate pulp sample is prepared only at client request)
EC = Electric Conductivity
ORP = Oxidation Reduction Potential
NP = Neutralization Potential
Calc. = Calculation
IND = Indeterminate
NR = Not Requested

CALCULATIONS:
*1 CaCO3 Equivalents: based on TIC
*2 Sulphide-Sulphur: Total-sulphur - sulphate-sulphur
*3 AP (Acid Potential): Sulphide-Sulphur x 31.25
*4 NNP (Net Neutralization Potential): NP - AP
*5 NPR (Neutralization Potential Ratio): NP/AP

REFERENCES:
Sample Preparation: ASTM E877-08; MEND Report 1.20.1, Version 0 (2009)
ABA: Dried below 40°C (as requested by client), jaw-crushed if necessary, split by riffling and pulverized to 85% passing 200 mesh (75 µm).
Modified ABA (Sobek) NP: MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b (pages 6.2-11 to 17), March 1991.
Paste pH / Fizz Rating: Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M.; US EPA-600/2-78-054 (1978).
Sulphate Sulphur: Based on MEND method. The S extracted is determined by analysing the extract for SO4 using UV-Vis Spectrophotometer (STD Method 4500-SO42- E).

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S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
1A	SP-1-1A	8.5	Slight	0.11	9.2	0.38	0.01	0.37	11.6	24.5	12.9	2.1
1B	SP-1-1B	8.6	Moderate	0.17	14.2	0.34	<=0.01	0.34	10.6	25.0	14.4	2.4
1C	SP-1-1C	8.2	Strong	0.47	39.5	0.98	0.01	0.97	30.3	56.2	25.9	1.9
2A	SP-1-1-DupA	8.6	Slight	0.13	10.8	0.50	<=0.01	0.50	15.6	21.5	5.9	1.4
2B	SP-1-1-DupB	8.5	Slight	0.16	13.3	0.53	<=0.01	0.53	16.6	28.8	12.2	1.7
2C	SP-1-1-DupC	8.3	Strong	0.45	37.5	0.90	0.01	0.89	27.8	50.5	22.7	1.8
3A	SP-1-2A	8.6	None	<=0.02	<=1.7	0.88	<=0.01	0.88	27.5	11.9	-15.6	0.4
3B	SP-1-2B	8.5	Slight	0.13	10.8	1.15	0.05	1.10	34.4	15.4	-19.0	0.4
3C	SP-1-2C	8.0	Moderate	0.17	14.2	1.90	0.03	1.87	58.4	26.8	-31.6	0.5
4A	SP-1-3A	8.7	Strong	0.18	15.0	0.30	0.02	0.28	8.8	23.7	15.0	2.7
4B	SP-1-3B	8.7	Strong	0.31	25.8	0.49	0.01	0.48	15.0	31.9	16.9	2.1
4C	SP-1-3C	8.2	Strong	0.73	60.8	0.77	<=0.01	0.77	24.1	64.9	40.8	2.7
5A	SP-1-4A	8.6	Slight	0.16	13.3	0.49	<=0.01	0.49	15.3	21.2	5.9	1.4
5B	SP-1-4B	8.6	Moderate	0.18	15.0	0.56	<=0.01	0.56	17.5	23.6	6.1	1.3
5C	SP-1-4C	8.2	Strong	0.43	35.8	1.03	0.02	1.01	31.6	50.5	18.9	1.6
6A	SP-1-5A	8.6	Slight	0.03	2.5	1.24	<=0.01	1.24	38.8	15.3	-23.5	0.4
6B	SP-1-5B	8.4	Slight	0.05	4.2	1.33	0.03	1.30	40.6	18.9	-21.7	0.5
6C	SP-1-5C	8.2	Strong	0.34	28.3	2.00	0.02	1.98	61.9	39.6	-22.3	0.6
7A	SP-1-6A	8.7	Slight	0.08	6.7	0.30	0.03	0.27	8.4	19.6	11.2	2.3
7B	SP-1-6B	8.7	Moderate	0.15	12.5	0.46	0.02	0.44	13.8	27.0	13.3	2.0
7C	SP-1-6C	8.0	Strong	0.46	38.3	0.85	0.01	0.84	26.3	57.4	31.2	2.2
8A	SP-1-7A	8.4	None	<=0.02	<=1.7	0.68	<=0.01	0.68	21.3	15.7	-5.6	0.7
8B	SP-1-7B	8.4	Slight	0.02	1.7	0.61	<=0.01	0.61	19.1	17.2	-1.9	0.9
8C	SP-1-7C	8.0	Moderate	0.14	11.7	1.26	0.03	1.23	38.4	26.6	-11.8	0.7
9A	SP-1-8A	8.3	None	0.04	3.3	1.40	<=0.01	1.40	43.8	14.1	-29.7	0.3
9B	SP-1-8B	8.3	None	0.03	2.5	1.40	<=0.01	1.40	43.8	15.3	-28.5	0.3
9C	SP-1-8C	7.9	Slight	0.12	10.0	2.44	0.06	2.38	74.4	24.6	-49.8	0.3
10A	SP-1-9A	8.8	Slight	0.03	2.5	0.08	<=0.01	0.08	2.5	18.7	16.2	7.5
10B	SP-1-9B	8.6	Moderate	0.15	12.5	0.26	<=0.01	0.26	8.1	24.2	16.1	3.0
10C	SP-1-9C	8.4	Strong	0.54	45.0	0.43	0.01	0.42	13.1	58.3	45.2	4.4
11A	SP-1-10A	8.5	Slight	0.14	11.7	0.85	<=0.01	0.85	26.6	23.4	-3.2	0.9
11B	SP-1-10B	8.6	Slight	0.19	15.8	0.43	0.02	0.41	12.8	26.9	14.1	2.1
11C	SP-1-10C	8.3	Moderate	0.48	40.0	0.77	<=0.01	0.77	24.1	53.8	29.7	2.2
12A	SP-2-1A	9.0	Slight	0.06	5.0	0.02	<=0.01	0.02	0.6	12.6	12.0	20.2
12B	SP-2-1B	8.8	Slight	0.07	5.8	0.02	<=0.01	0.02	0.6	13.1	12.5	21.0
12C	SP-2-1C	9.0	Moderate	0.27	22.5	0.04	<=0.01	0.04	1.3	32.3	31.1	25.8
13A	SP-2-1-DupA	8.9	Slight	0.06	5.0	0.01	<=0.01	0.01	0.3	13.2	12.9	42.2
13B	SP-2-1-DupB	9.0	Slight	0.09	7.5	0.02	<=0.01	0.02	0.6	13.4	12.8	21.4
13C	SP-2-1-DupC	8.5	Moderate	0.26	21.7	0.03	0.02	0.01	0.3	30.7	30.4	98.2
14A	SP-2-2A	9.0	Slight	0.03	2.5	0.02	<=0.01	0.02	0.6	13.2	12.6	21.1
14B	SP-2-2B	8.8	Slight	0.09	7.5	0.02	0.02	<=0.01	<=0.3	18.4	18.4	N/A
14C	SP-2-2C	8.5	Moderate	0.20	16.7	0.03	<=0.01	0.03	0.9	27.3	26.4	29.1
15A	SP-2-3A	9.0	None	0.04	3.3	<=0.01	<=0.01	<=0.01	<=0.3	13.6	13.6	N/A
15B	SP-2-3B	8.9	Slight	0.06	5.0	0.01	<=0.01	0.01	0.3	16.3	16.0	52.2
15C	SP-2-3C	8.5	Moderate	0.13	10.8	0.03	0.02	0.01	0.3	24.3	24.0	77.8
16A	SP-2-4A	9.1	None	0.04	3.3	<=0.01	<=0.01	<=0.01	<=0.3	8.6	8.6	N/A
16B	SP-2-4B	8.9	Slight	0.10	8.3	0.01	<=0.01	0.01	0.3	13.2	12.9	42.2
16C	SP-2-4C	8.3	Moderate	0.28	23.3	0.03	<=0.01	0.03	0.9	34.6	33.7	36.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
17A	SP-2-5A	8.7	Slight	0.03	2.5	<=0.01	<=0.01	<=0.01	<=0.3	10.5	10.5	N/A
17B	SP-2-5B	8.8	Slight	0.06	5.0	0.01	0.01	<=0.01	<=0.3	15.4	15.4	N/A
17C	SP-2-5C	8.5	Moderate	0.17	14.2	0.03	<=0.01	0.03	0.9	24.3	23.4	25.9
18A	SP-2-6A	9.0	Slight	0.02	1.7	0.03	<=0.01	0.03	0.9	8.9	8.0	9.5
18B	SP-2-6B	9.0	Slight	0.05	4.2	0.02	<=0.01	0.02	0.6	15.2	14.6	24.3
18C	SP-2-6C	8.5	Slight	0.18	15.0	0.03	<=0.01	0.03	0.9	23.9	23.0	25.5
19A	SP-2-7A	9.1	Slight	0.04	3.3	0.03	<=0.01	0.03	0.9	10.5	9.6	11.2
19B	SP-2-7B	8.8	Moderate	0.09	7.5	0.03	<=0.01	0.03	0.9	16.2	15.3	17.3
19C	SP-2-7C	8.6	Strong	0.24	20.0	0.05	<=0.01	0.05	1.6	29.3	27.7	18.8
20A	SP-2-8A	9.0	Slight	0.08	6.7	0.04	<=0.01	0.04	1.3	13.6	12.4	10.9
20B	SP-2-8B	9.0	Slight	0.14	11.7	0.04	<=0.01	0.04	1.3	20.2	19.0	16.2
20C	SP-2-8C	8.5	Moderate	0.05	4.2	0.06	0.02	0.04	1.3	11.1	9.9	8.9
21A	SP-2-9A	8.9	Slight	0.03	2.5	0.01	<=0.01	0.01	0.3	14.0	13.7	44.8
21B	SP-2-9B	8.8	Slight	0.05	4.2	0.03	<=0.01	0.03	0.9	14.3	13.4	15.3
21C	SP-2-9C	8.5	Moderate	0.20	16.7	0.05	<=0.01	0.05	1.6	29.5	27.9	18.9
22A	SP-2-10A	8.9	Slight	0.05	4.2	0.02	<=0.01	0.02	0.6	11.4	10.8	18.2
22B	SP-2-10B	9.0	Slight	0.06	5.0	0.03	<=0.01	0.03	0.9	13.6	12.7	14.5
22C	SP-2-10C	8.5	Moderate	0.26	21.7	0.04	<=0.01	0.04	1.3	25.4	24.2	20.3
23A	WX-1-1A	8.3	Slight	0.06	5.0	0.16	<=0.01	0.16	5.0	21.6	16.6	4.3
23B	WX-1-1B	8.2	Slight	0.03	2.5	0.13	<=0.01	0.13	4.1	21.6	17.5	5.3
23C	WX-1-1C	8.3	Moderate	0.16	13.3	0.10	<=0.01	0.10	3.1	38.1	35.0	12.2
24A	WX-1-1-DupA	8.3	None	0.04	3.3	0.19	<=0.01	0.19	5.9	17.7	11.8	3.0
24B	WX-1-1-DupB	8.4	None	0.02	1.7	0.11	<=0.01	0.11	3.4	17.6	14.2	5.1
24C	WX-1-1-DupC	8.1	Slight	0.10	8.3	0.06	<=0.01	0.06	1.9	24.9	23.0	13.3
25A	WX-1-2A	8.3	None	0.07	5.8	0.11	<=0.01	0.11	3.4	21.7	18.3	6.3
25B	WX-1-2B	8.3	None	0.15	12.5	0.14	<=0.01	0.14	4.4	27.5	23.1	6.3
25C	WX-1-2C	8.2	Slight	0.20	16.7	0.15	<=0.01	0.15	4.7	31.2	26.5	6.7
26A	WX-1-3A	8.3	Slight	0.13	10.8	0.13	<=0.01	0.13	4.1	23.7	19.6	5.8
26B	WX-1-3B	8.4	Slight	0.16	13.3	0.11	<=0.01	0.11	3.4	27.0	23.6	7.9
26C	WX-1-3C	8.1	Moderate	0.25	20.8	0.08	<=0.01	0.08	2.5	34.8	32.3	13.9
27A	WX-1-4A	8.4	None	0.03	2.5	0.17	<=0.01	0.17	5.3	17.7	12.4	3.3
27B	WX-1-4B	8.3	None	0.03	2.5	0.14	<=0.01	0.14	4.4	17.7	13.3	4.0
27C	WX-1-4C	8.1	Slight	0.06	5.0	0.09	<=0.01	0.09	2.8	22.7	19.9	8.1
28A	WX-1-5A	8.4	None	0.05	4.2	0.19	<=0.01	0.19	5.9	18.8	12.9	3.2
28B	WX-1-5B	8.4	None	0.04	3.3	0.14	<=0.01	0.14	4.4	16.2	11.8	3.7
28C	WX-1-5C	7.8	Slight	0.13	10.8	0.10	<=0.01	0.10	3.1	22.2	19.1	7.1
29A	WX-1-6A	8.3	None	0.07	5.8	0.17	<=0.01	0.17	5.3	21.6	16.3	4.1
29B	WX-1-6B	8.2	None	0.07	5.8	0.16	<=0.01	0.16	5.0	19.9	14.9	4.0
29C	WX-1-6C	8.1	Slight	0.17	14.2	0.16	<=0.01	0.16	5.0	27.4	22.4	5.5
30A	WX-1-7A	8.1	None	0.07	5.8	0.17	<=0.01	0.17	5.3	23.0	17.7	4.3
30B	WX-1-7B	8.3	Slight	0.06	5.0	0.12	<=0.01	0.12	3.8	20.5	16.8	5.5
30C	WX-1-7C	8.0	Slight	0.09	7.5	0.12	<=0.01	0.12	3.8	22.5	18.8	6.0
31A	WX-1-8A	8.4	None	0.04	3.3	0.14	<=0.01	0.14	4.4	21.8	17.4	5.0
31B	WX-1-8B	8.2	Slight	0.09	7.5	0.13	<=0.01	0.13	4.1	24.0	19.9	5.9
31C	WX-1-8C	8.1	Slight	0.20	16.7	0.13	<=0.01	0.13	4.1	30.7	26.6	7.6
32A	WX-1-9A	8.3	None	<=0.02	<=1.7	0.16	0.03	0.13	4.1	18.2	14.1	4.5
32B	WX-1-9B	8.5	None	<=0.02	<=1.7	0.16	<=0.01	0.16	5.0	18.2	13.2	3.6
32C	WX-1-9C	8.1	Slight	0.05	4.2	0.14	<=0.01	0.14	4.4	17.2	12.8	3.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
33A	WX-1-10A	8.4	None	<=0.02	<=1.7	0.15	<=0.01	0.15	4.7	12.9	8.2	2.8
33B	WX-1-10B	8.4	None	0.03	2.5	0.14	<=0.01	0.14	4.4	16.8	12.4	3.8
33C	WX-1-10C	8.2	Slight	0.16	13.3	0.14	<=0.01	0.14	4.4	27.8	23.4	6.4
34A	WX-2-1A	8.7	Slight	0.25	20.8	0.21	<=0.01	0.21	6.6	33.1	26.5	5.0
34B	WX-2-1B	8.8	Slight	0.26	21.7	0.21	<=0.01	0.21	6.6	33.6	27.0	5.1
34C	WX-2-1C	8.3	Strong	0.47	39.2	0.25	<=0.01	0.25	7.8	50.0	42.2	6.4
35A	WX-2-1-DupA	8.8	Moderate	0.23	19.2	0.21	<=0.01	0.21	6.6	31.9	25.3	4.9
35B	WX-2-1-DupB	8.7	Moderate	0.25	20.8	0.20	<=0.01	0.20	6.3	33.6	27.4	5.4
35C	WX-2-1-DupC	8.5	Strong	0.42	35.0	0.24	<==0.01	0.24	7.5	48.2	40.7	6.4
36A	WX-2-2A	8.7	Moderate	0.28	23.3	0.15	<=0.01	0.15	4.7	35.6	30.9	7.6
36B	WX-2-2B	8.7	Moderate	0.27	22.5	0.13	<=0.01	0.13	4.1	34.6	30.5	8.5
36C	WX-2-2C	8.4	Strong	0.42	35.0	0.15	<=0.01	0.15	4.7	46.3	41.6	9.9
37A	WX-2-3A	8.8	Moderate	0.27	22.5	0.14	<=0.01	0.14	4.4	34.5	30.1	7.9
37B	WX-2-3B	8.5	Moderate	0.33	27.5	0.12	<=0.01	0.12	3.8	39.4	35.7	10.5
37C	WX-2-3C	8.5	Strong	0.38	31.7	0.15	<=0.01	0.15	4.7	44.4	39.7	9.5
38A	WX-2-4A	8.7	Moderate	0.31	25.8	0.19	<=0.01	0.19	5.9	34.6	28.7	5.8
38B	WX-2-4B	8.7	Moderate	0.30	25.0	0.21	<=0.01	0.21	6.6	33.5	26.9	5.1
38C	WX-2-4C	8.5	Strong	0.50	41.7	0.23	<=0.01	0.23	7.2	48.2	41.0	6.7
39A	WX-2-5A	8.8	Moderate	0.30	25.0	0.20	<=0.01	0.20	6.3	31.8	25.6	5.1
39B	WX-2-5B	8.6	Moderate	0.33	27.5	0.20	<=0.01	0.20	6.3	36.0	29.8	5.8
39C	WX-2-5C	8.4	Strong	0.48	40.0	0.21	<=0.01	0.21	6.6	43.9	37.3	6.7
40A	WX-2-6A	8.8	Moderate	0.39	32.5	0.20	<=0.01	0.20	6.3	36.2	30.0	5.8
40B	WX-2-6B	8.6	Moderate	0.37	30.8	0.19	0.01	0.18	5.6	37.2	31.6	6.6
40C	WX-2-6C	8.7	Strong	0.54	45.0	0.20	0.04	0.16	5.0	46.3	41.3	9.3
41A	WX-2-7A	8.7	Moderate	0.25	20.8	0.21	<=0.01	0.21	6.6	35.0	28.4	5.3
41B	WX-2-7B	8.7	Moderate	0.26	21.7	0.20	0.04	0.16	5.0	32.8	27.8	6.6
41C	WX-2-7C	8.5	Strong	0.37	30.8	0.25	0.01	0.24	7.5	45.3	37.8	6.0
42A	WX-2-8A	8.8	Slight	0.20	16.7	0.16	0.01	0.15	4.7	30.6	25.9	6.5
42B	WX-2-8B	8.6	Moderate	0.28	23.3	0.15	0.07	0.08	2.5	37.1	34.6	14.8
42C	WX-2-8C	8.3	Moderate	0.33	27.5	0.14	0.02	0.12	3.8	40.2	36.5	10.7
43A	WX-2-9A	8.7	Moderate	0.28	23.3	0.21	0.01	0.20	6.3	33.8	27.6	5.4
43B	WX-2-9B	8.7	Moderate	0.24	20.0	0.23	0.02	0.21	6.6	33.0	26.4	5.0
43C	WX-2-9C	8.6	Strong	0.40	33.3	0.26	0.02	0.24	7.5	47.5	40.0	6.3
44A	WX-2-10A	8.7	Moderate	0.20	16.7	0.20	0.03	0.17	5.3	32.1	26.8	6.0
44B	WX-2-10B	8.8	Moderate	0.26	21.7	0.22	0.02	0.20	6.3	33.1	26.9	5.3
44C	WX-2-10C	8.5	Strong	0.32	26.7	0.23	0.02	0.21	6.6	41.0	34.4	6.2
QUALITY ASSURANCE / QUALITY CONTROL												
Replicate Analysis:												
4A	SP-1-3A	8.7	Strong				0.02			23.7		
4A R	SP-1-3A (Rep)	8.7	Strong				0.02			23.4		
7A	SP-1-6A					0.30						
7A R	SP-1-6A (Rep)					0.30						
7B	SP-1-6B	8.7	Moderate				0.02			27.0		
7B R	SP-1-6B (Rep)	8.6	Moderate				0.02			26.5		
8B	SP-1-7B			0.02								
8B R	SP-1-7B (Rep)			0.02								
10C	SP-1-9C	8.4	Strong				0.01			58.3		
10C R	SP-1-9C (Rep)	8.4	Strong				0.01			57.7		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
13B	SP-2-1-DupB			0.09								
13B R	SP-2-1-DupB (Rep)			0.09								
14A	SP-2-2A	9.0	Slight				<=0.01					
14A R	SP-2-2A (Rep)	9.0	Slight				<=0.01					
14B	SP-2-2B					0.02						
14B R	SP-2-2B (Rep)					0.02						
17B	SP-2-5B	8.8	Slight				0.01					
17B R	SP-2-5B (Rep)	8.9	Slight				<=0.01					
18B	SP-2-6B			0.05								
18B R	SP-2-6B (Rep)			0.04								
20C	SP-2-8C	8.5	Moderate				0.02			11.1		
20C R	SP-2-8C (Rep)	8.5	Moderate				0.02			11.6		
23B	WX-1-1B			0.03								
23B R	WX-1-1B (Rep)			0.04								
24A	WX-1-1-DupA	8.3	None				<=0.01			17.7		
24A R	WX-1-1-DupA (Rep)	8.4	None				<=0.01			18.3		
27B	WX-1-4B	8.3	None				<=0.01			17.7		
27B R	WX-1-4B (Rep)	8.4	None				<=0.01			17.6		
27C	WX-1-4C					0.09						
27C R	WX-1-4C (Rep)					0.11						
28B	WX-1-5B			0.04								
28B R	WX-1-5B (Rep)			0.04								
30C	WX-1-7C	8.0	Slight				<=0.01			22.5		
30C R	WX-1-7C (Rep)	8.0	Slight				<=0.01			23.2		
33B	WX-1-10B			0.03								
33B R	WX-1-10B (Rep)			0.03								
34A	WX-2-1A	8.7	Slight				<=0.01			33.1		
34A R	WX-2-1A (Rep)	8.7	Slight				<=0.01			32.7		
37B	WX-2-3B	8.5	Moderate				<=0.01			39.4		
37B R	WX-2-3B (Rep)	8.6	Moderate				<=0.01			38.6		
38B	WX-2-4B			0.30								
38B R	WX-2-4B (Rep)			0.31								
40C	WX-2-6C	8.7	Strong				0.04			46.3		
40C R	WX-2-6C	8.7	Strong				0.04			47.0		
43B	WX-2-9B			0.24								
43B R	WX-2-9B (Rep)			0.26								
44A	WX-2-10A	8.7	Moderate				0.03			32.1		
44A R	WX-2-10A (Rep)	8.7	Moderate				0.03			32.4		
Certified Reference Material (CRM) Analysis:												
Certified Reference Material		KZK-1		KZK-1		1) OREAS 24b 2) GS310-8 3) CDN-CM-38	RTS-3a			1) KZK-1 (Slight) 2) KZK-1 (Moderate)		
CRM True Value		**8.80**		**0.92**		**1) 0.19 2) 12.0 3) 5.30**	**1.10**			**1) 58.9 2) 61.6**		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
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REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
	Reference Material Results	8.82		0.90, 0.89, 0.85, 0.93, 0.87, 0.86		1) 0.18 2) 11.3 3) 5.47	1.18, 1.14			1) 59.1, 58.5 2) 60.1		
	Tolerance (+/-) or Acceptance Range	***0.09 (+/-)***		***80% - 120%***		***90% - 110%***	***90% - 110%***			***90% - 110%***		
	Method Blank Analysis:											
	Method Blank Results			<0.02, <0.02, <0.02, <0.02, <0.02, <0.02		<0.01, <0.01, <0.01	<0.01, <0.01					
	GLOBAL SOP No. / Method:	*ARD-004*	*ARD-005*	*HCl leach/ CO2-Coulometer*	*Calc.*	*LECO*	*ARD-013 (HCl Leach)*	*Calc.*	*Calc.*	*ARD-005*	*Calc.*	*Calc.*

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents*1	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur*2	AP*3	Mod. ABA NP	NNP*4	NPR*5
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**	***kg CaCO3/tonne***			
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		

NOTES:
Acceptance criteria at Global ARD Testing for all CRMs is ±10 % of certified value.
Job No: YVR2210450

Date of Analysis (24 h): May 3-5, 2022
pH of DI water (pH Units): 5.69
EC of DI water (µS/cm): 1.21

METHODS:
Total sulphur by Leco.
Total Inorganic Carbon (TIC): HCl leach, evolved CO_2 analysed by CO_2 Coulometer.

ABBREVIATIONS:
R = Rep = Replicate (is a sub-sample scooped from a single pulp sample bag produced per client sample)
D = Dup = Duplicate (is 2nd sub-pulp sample bag produced by processing a 2nd split of the head sample received. A duplicate pulp sample is prepared only at client request)
EC = Electric Conductivity
ORP = Oxidation Reduction Potential
NP = Neutralization Potential
Calc. = Calculation
IND = Indeterminate
NR = Not Requested

CALCULATIONS:
*1 CaCO3 Equivalents: based on TIC
*2 Sulphide-Sulphur: Total-sulphur - sulphate-sulphur
*3 AP (Acid Potential): Sulphide-Sulphur x 31.25
*4 NNP (Net Neutralization Potential): NP - AP
*5 NPR (Neutralization Potential Ratio): NP/AP

REFERENCES:
Sample Preparation: ASTM E877-08; MEND Report 1.20.1, Version 0 (2009)
ABA: Dried below 40°C (as requested by client), jaw-crushed if necessary, split by riffling and pulverized to 85% passing 200 mesh (75 µm).
Modified ABA (Sobek) NP: MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b (pages 6.2-11 to 17), March 1991.
Paste pH / Fizz Rating: Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M.; US EPA-600/2-78-054 (1978).
Sulphate Sulphur: Based on MEND method. The S extracted is determined by analysing the extract for SO4 using UV-Vis Spectrophotometer (STD Method 4500-SO42- E).

Appendix D. Humidity Cell Leachate Concentration Timeseries Charts

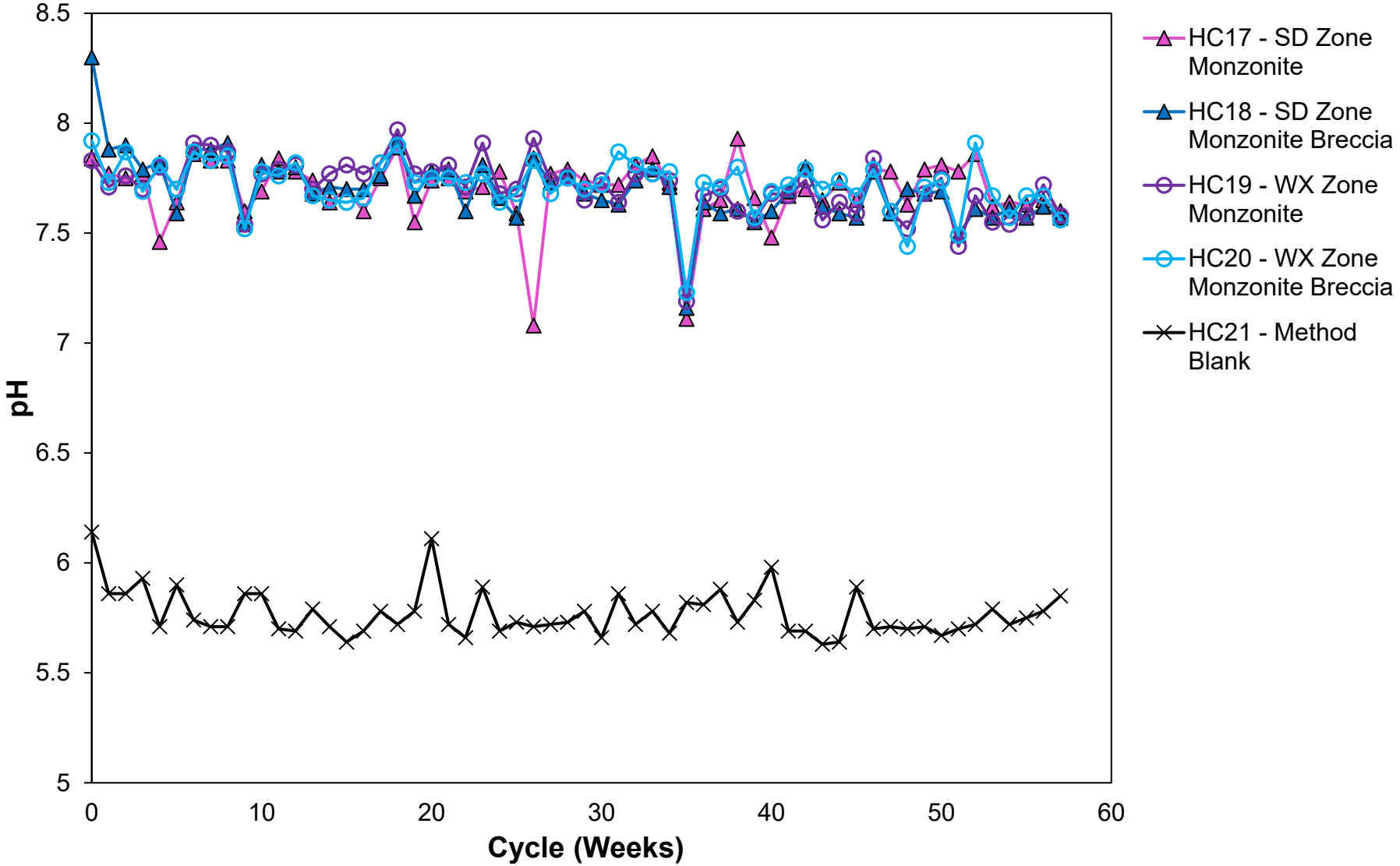

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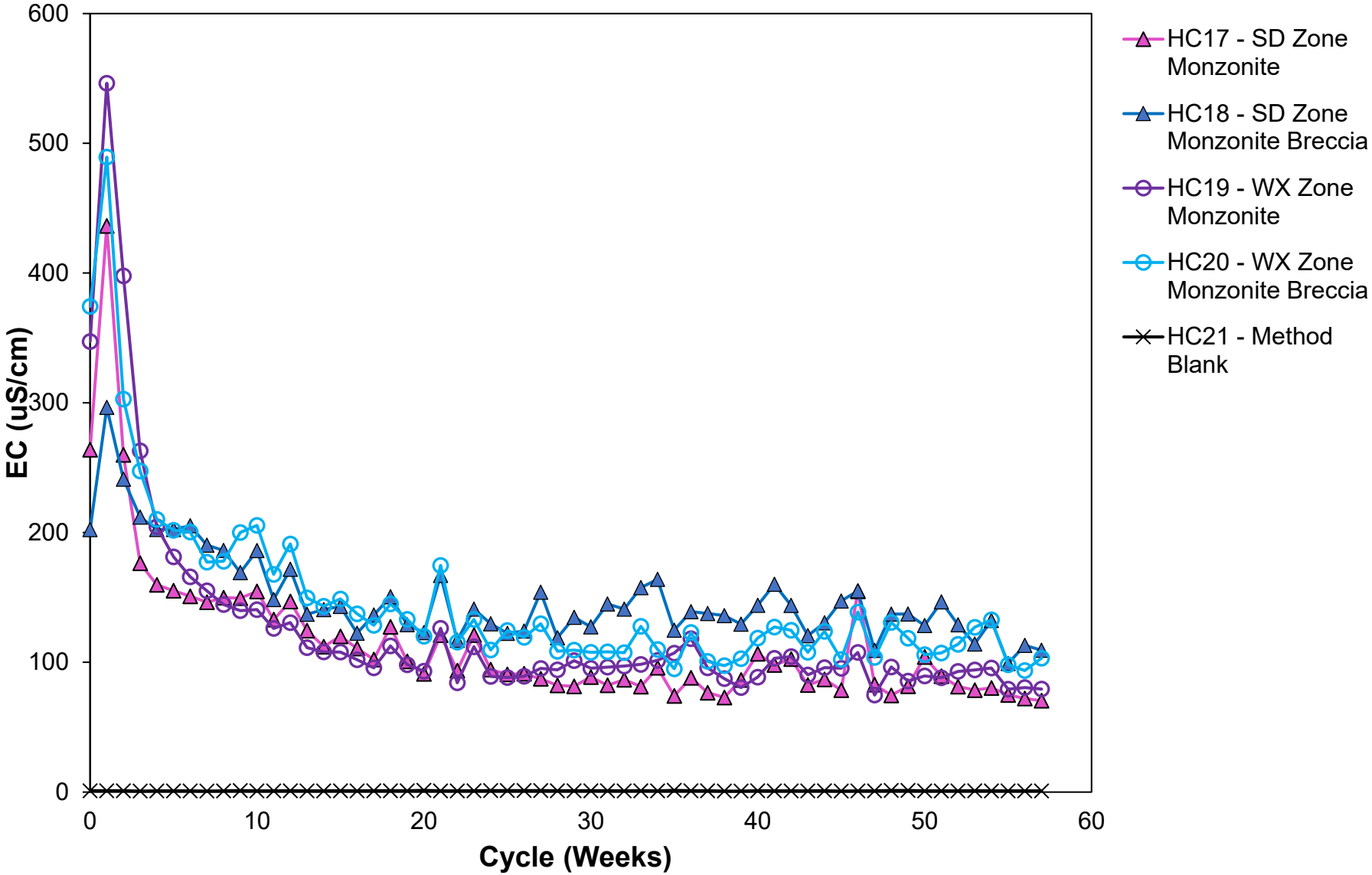

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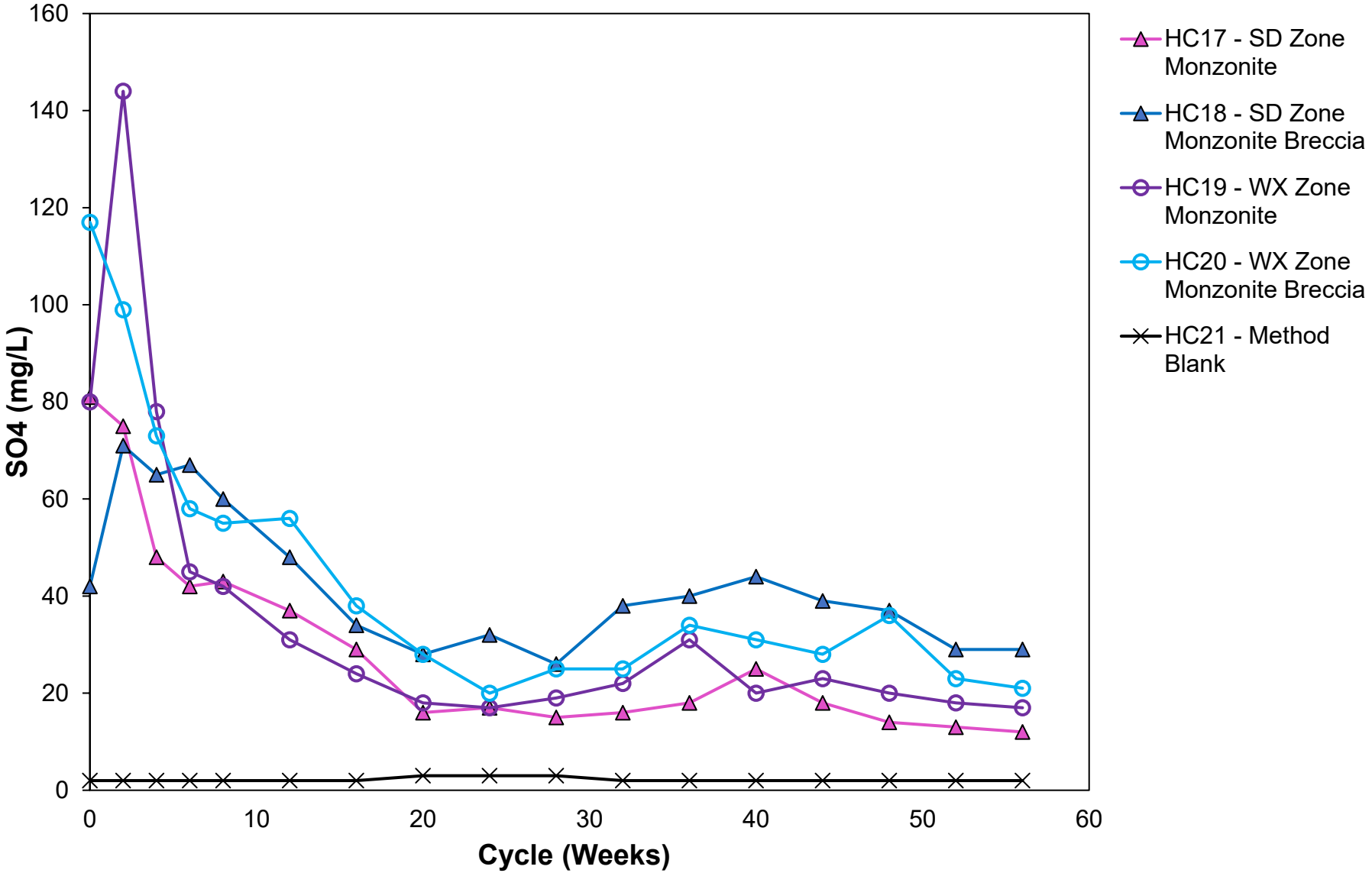

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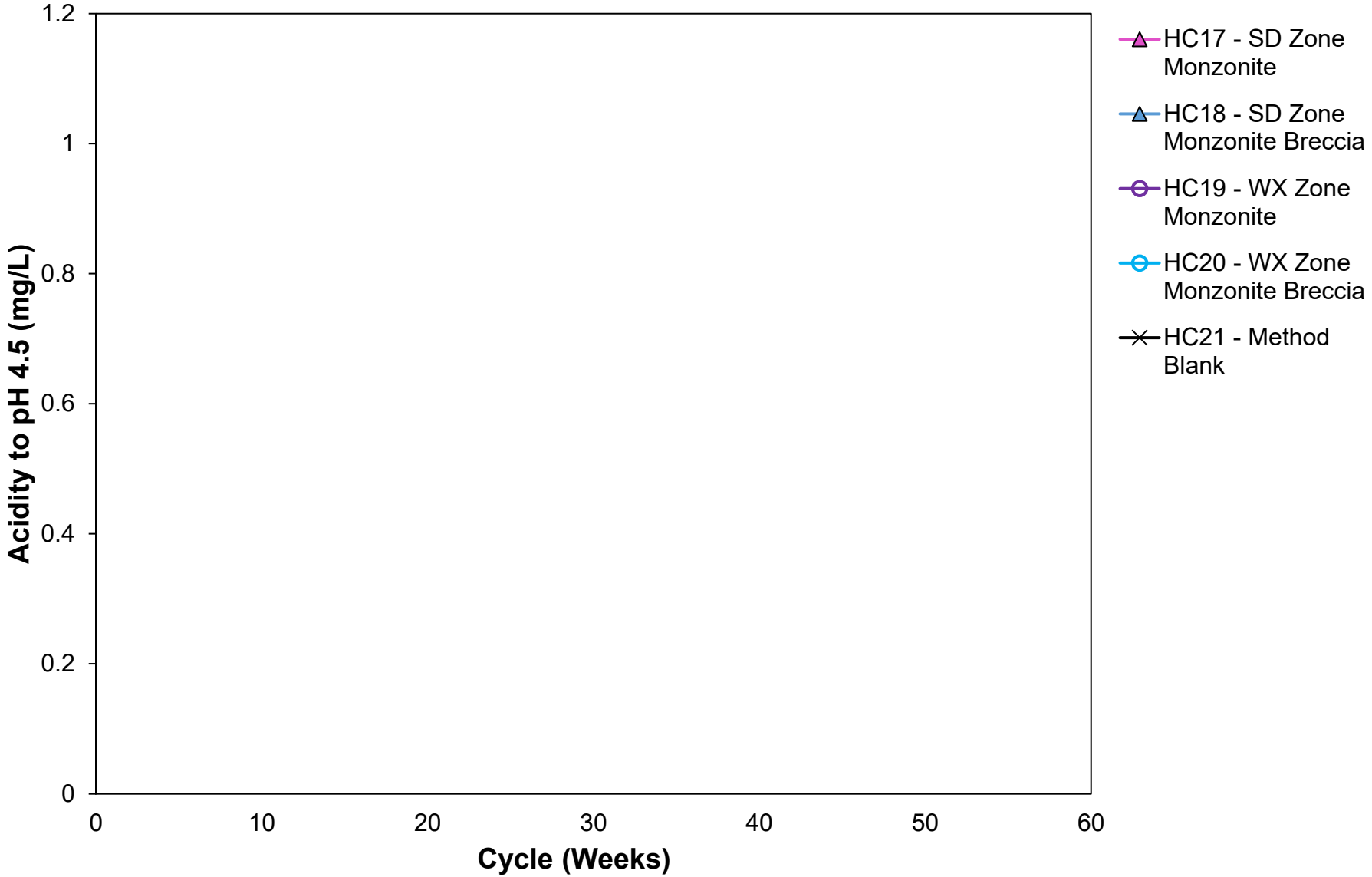

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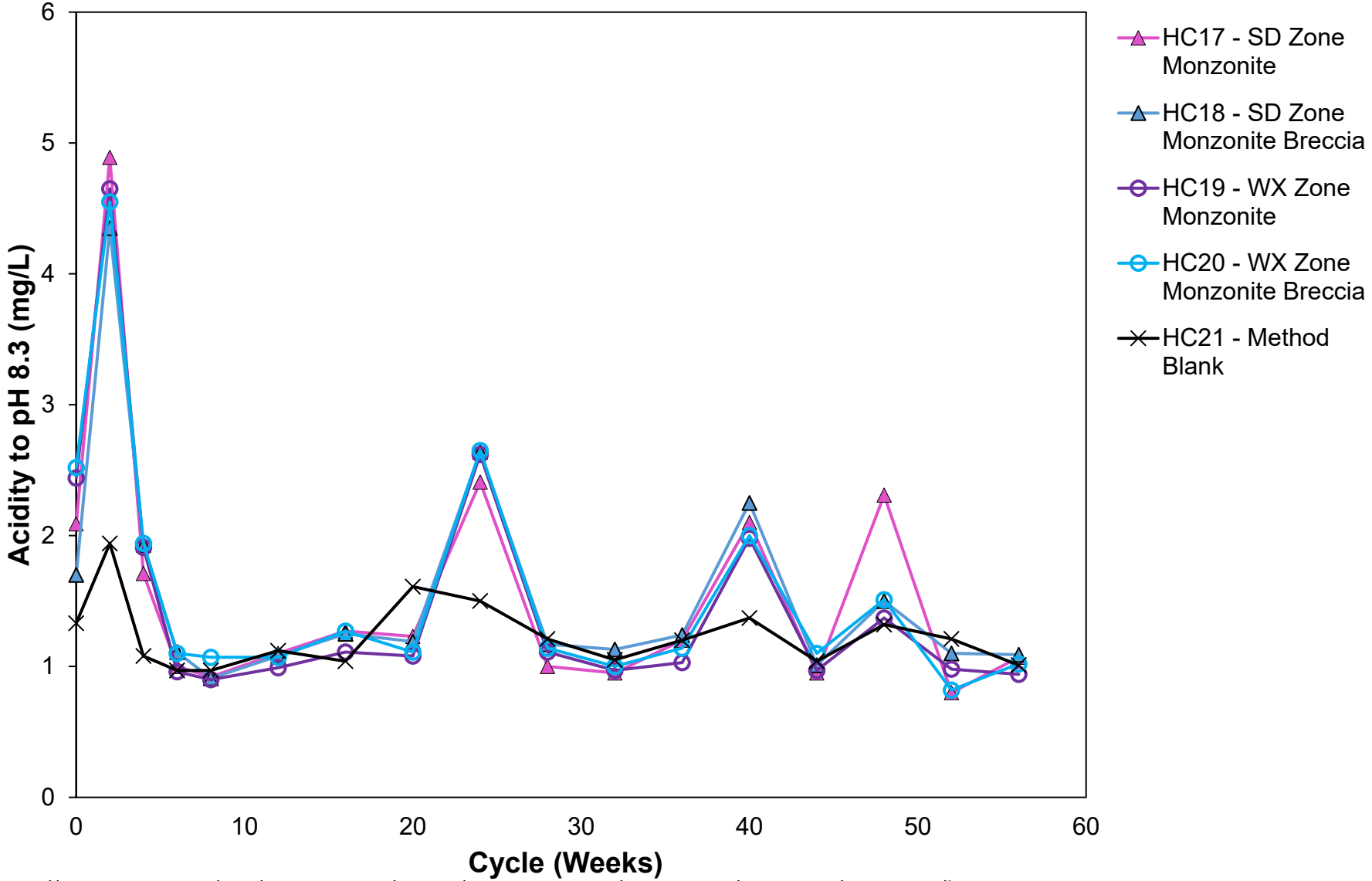

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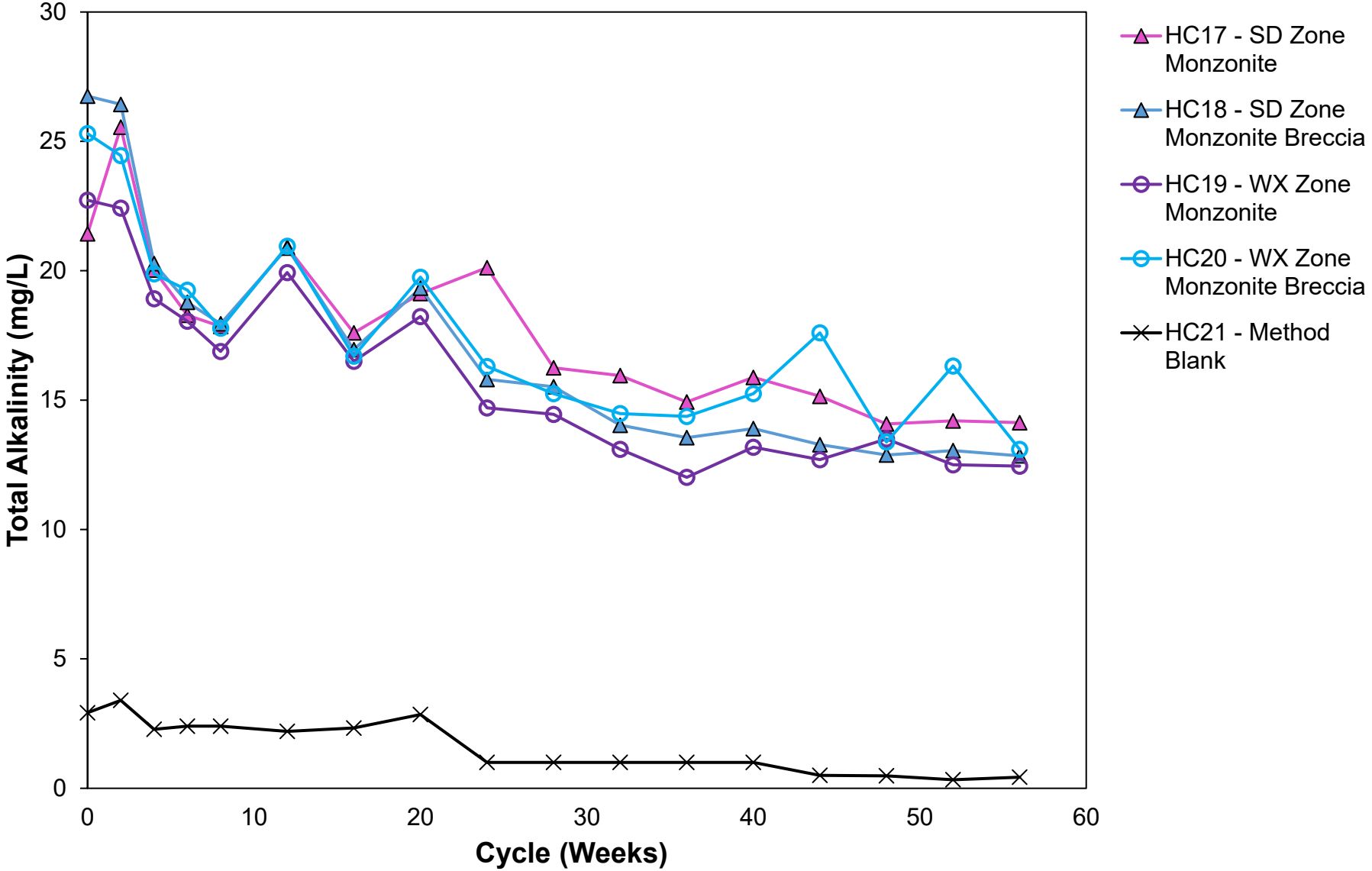

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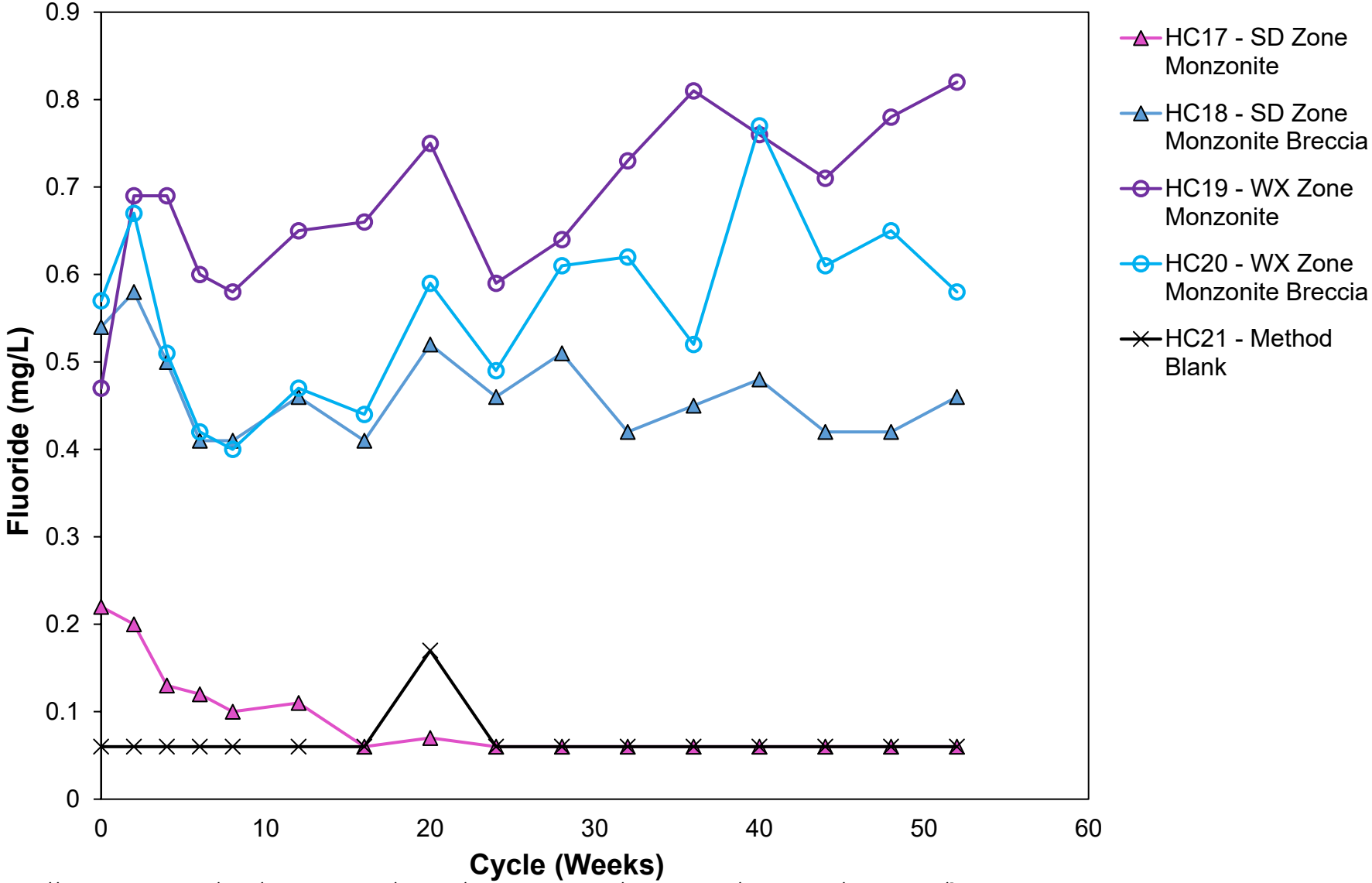

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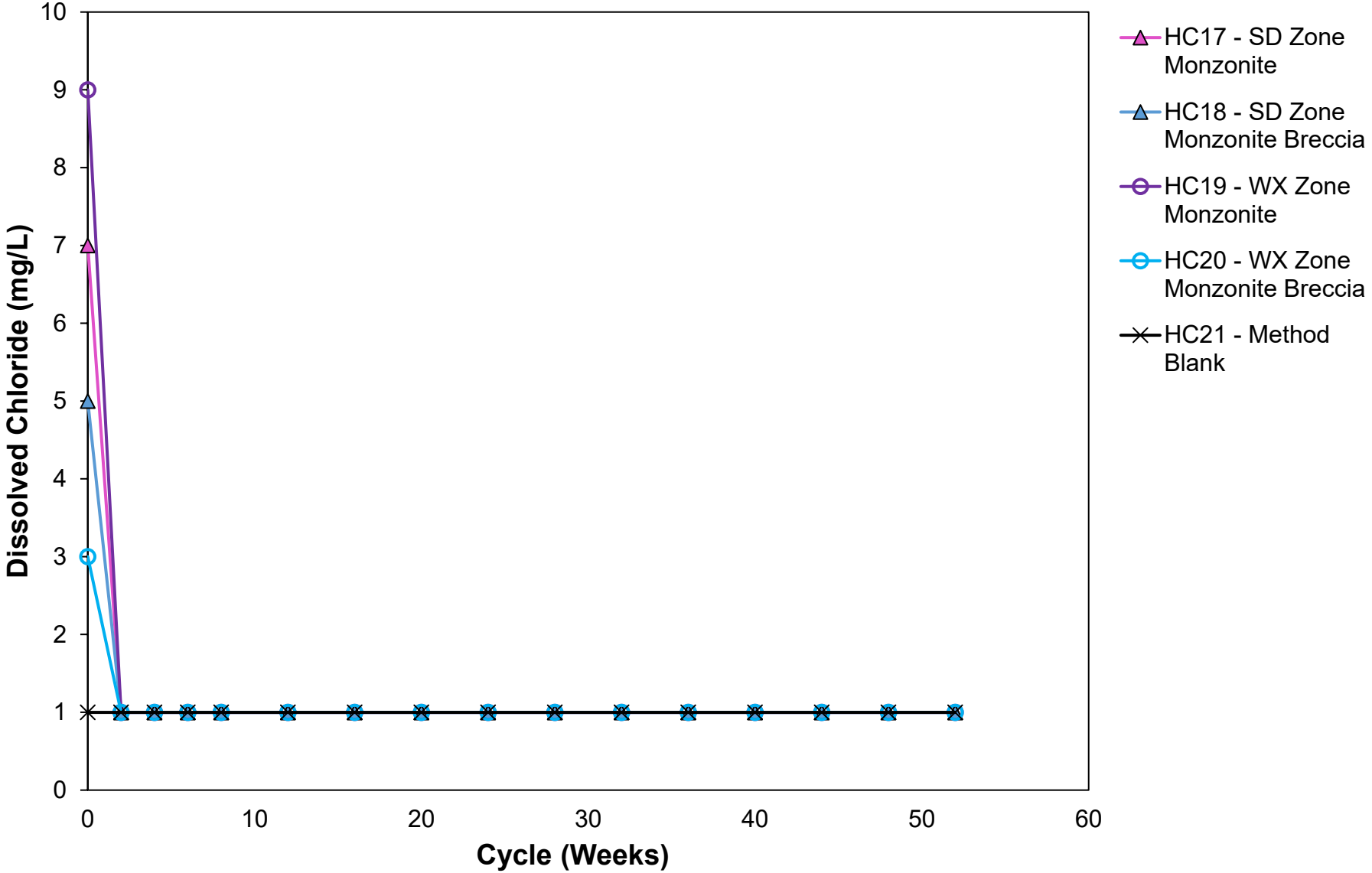

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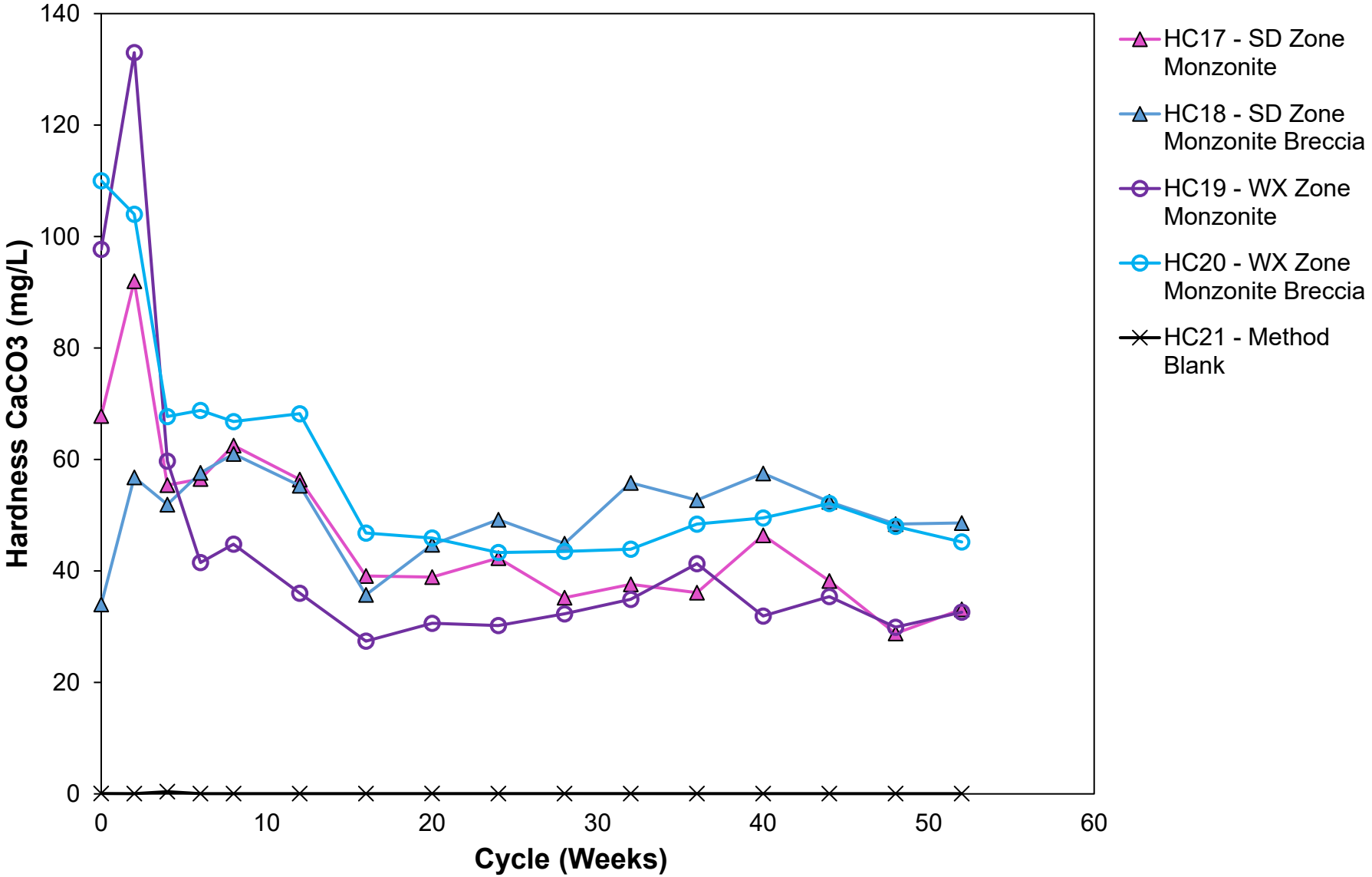

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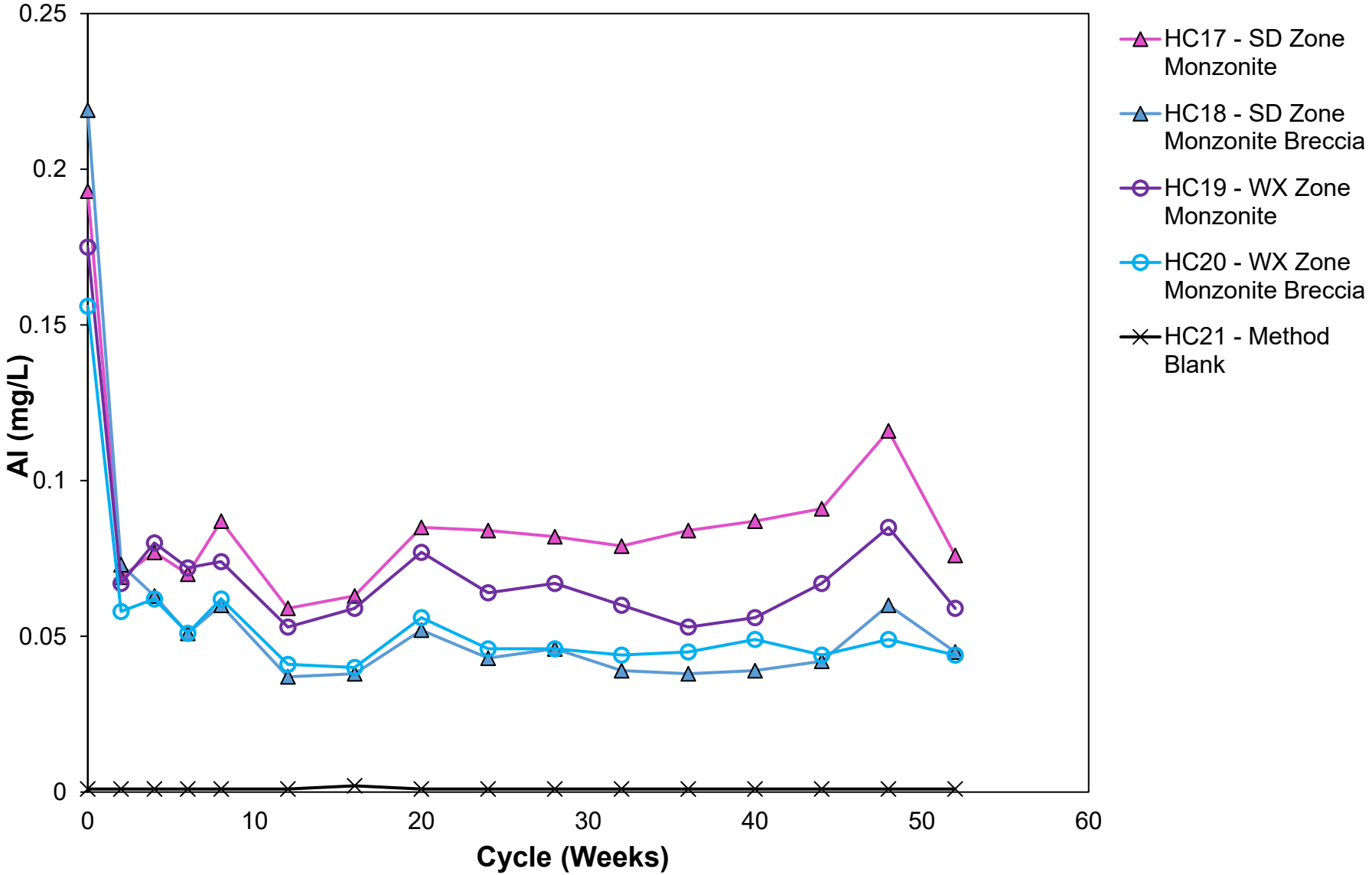

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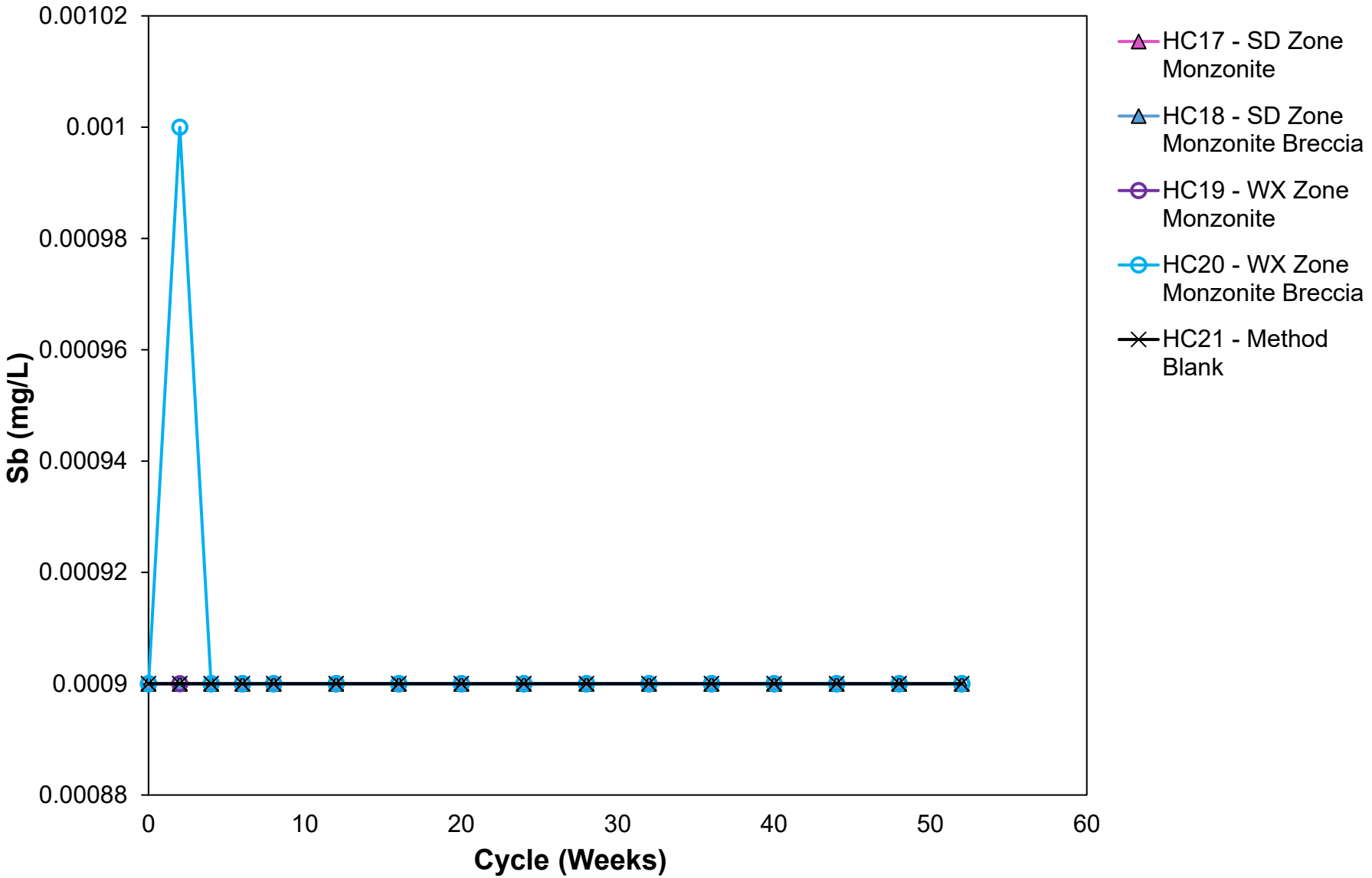

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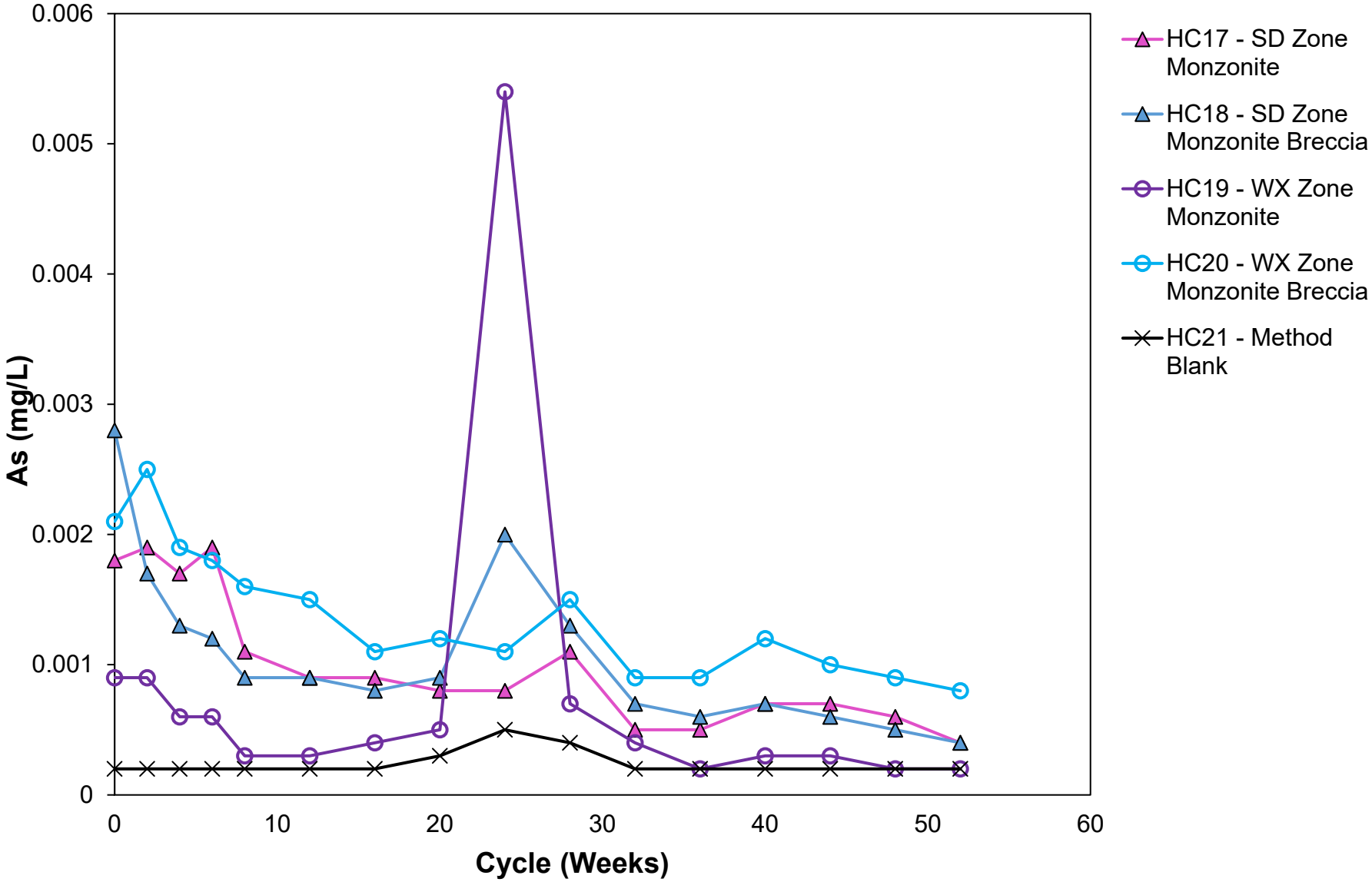

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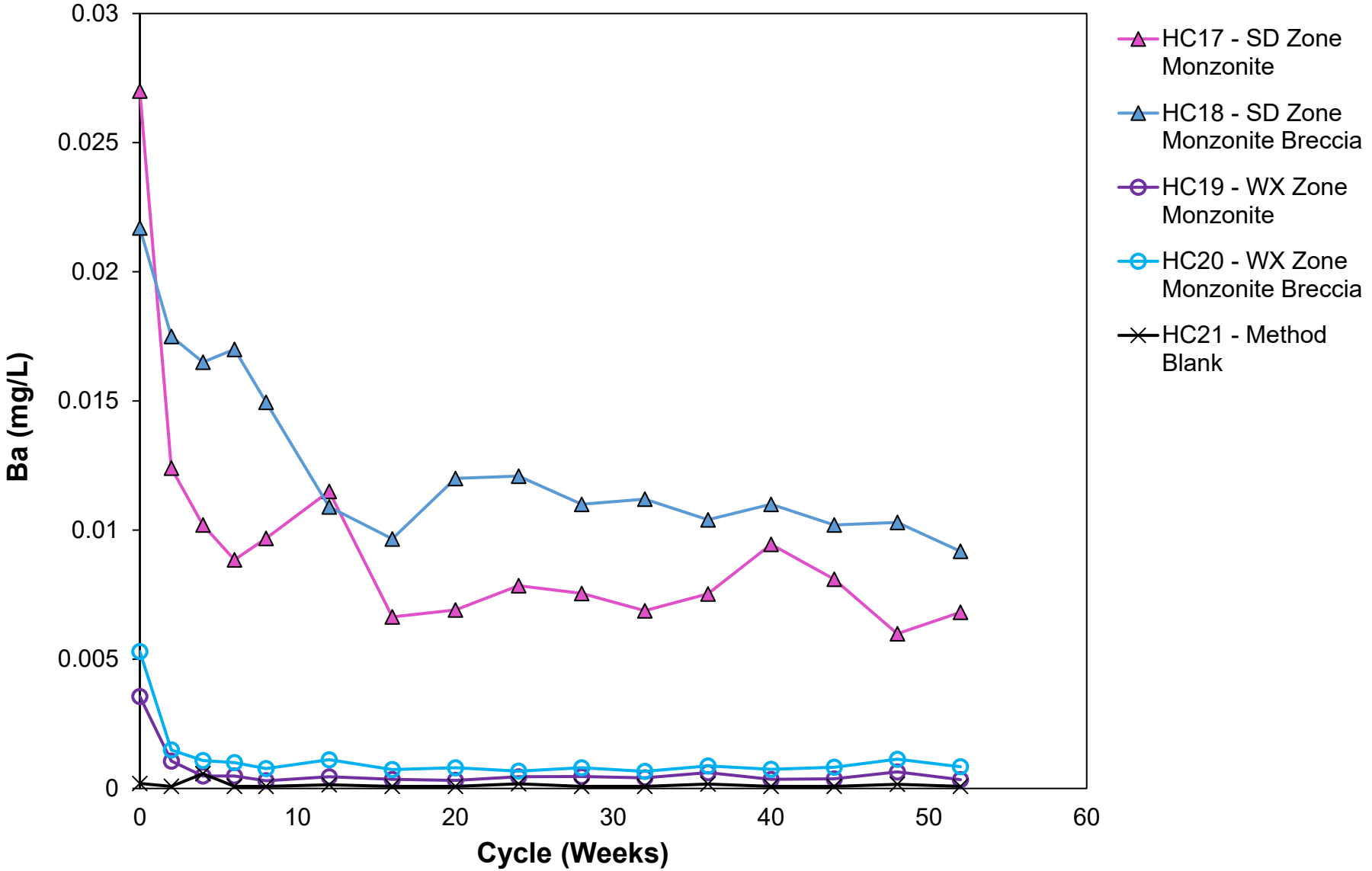

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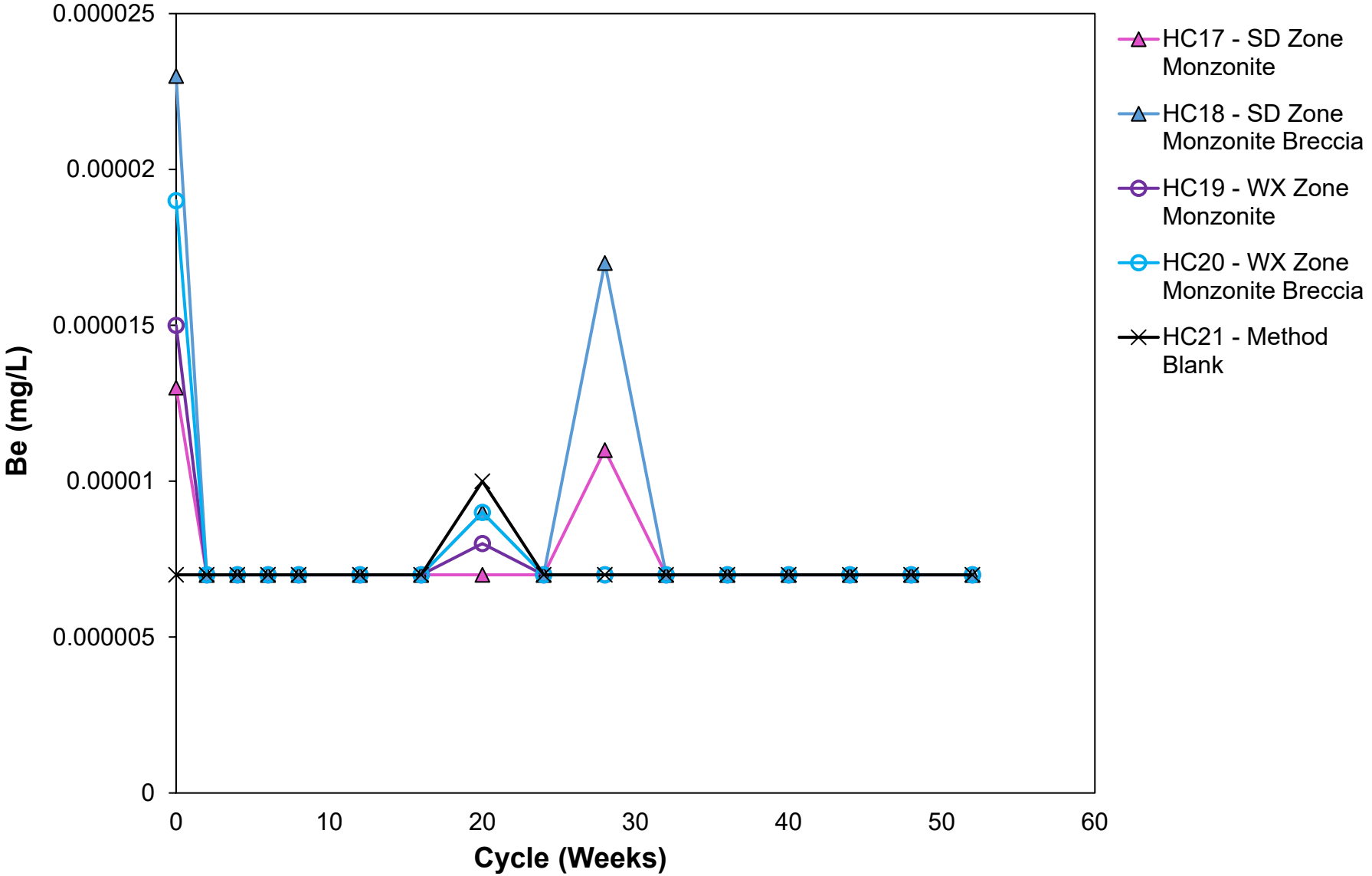

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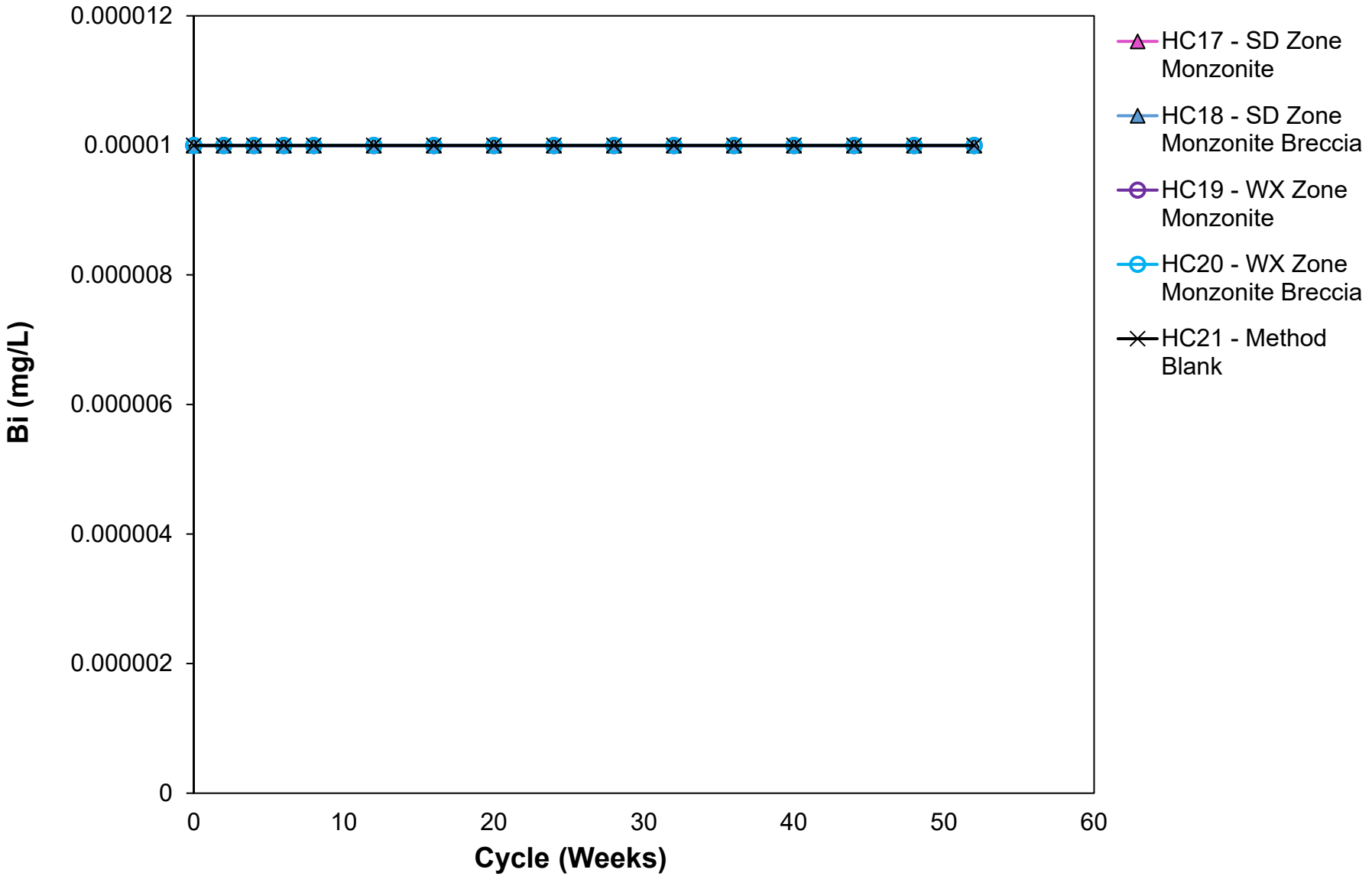

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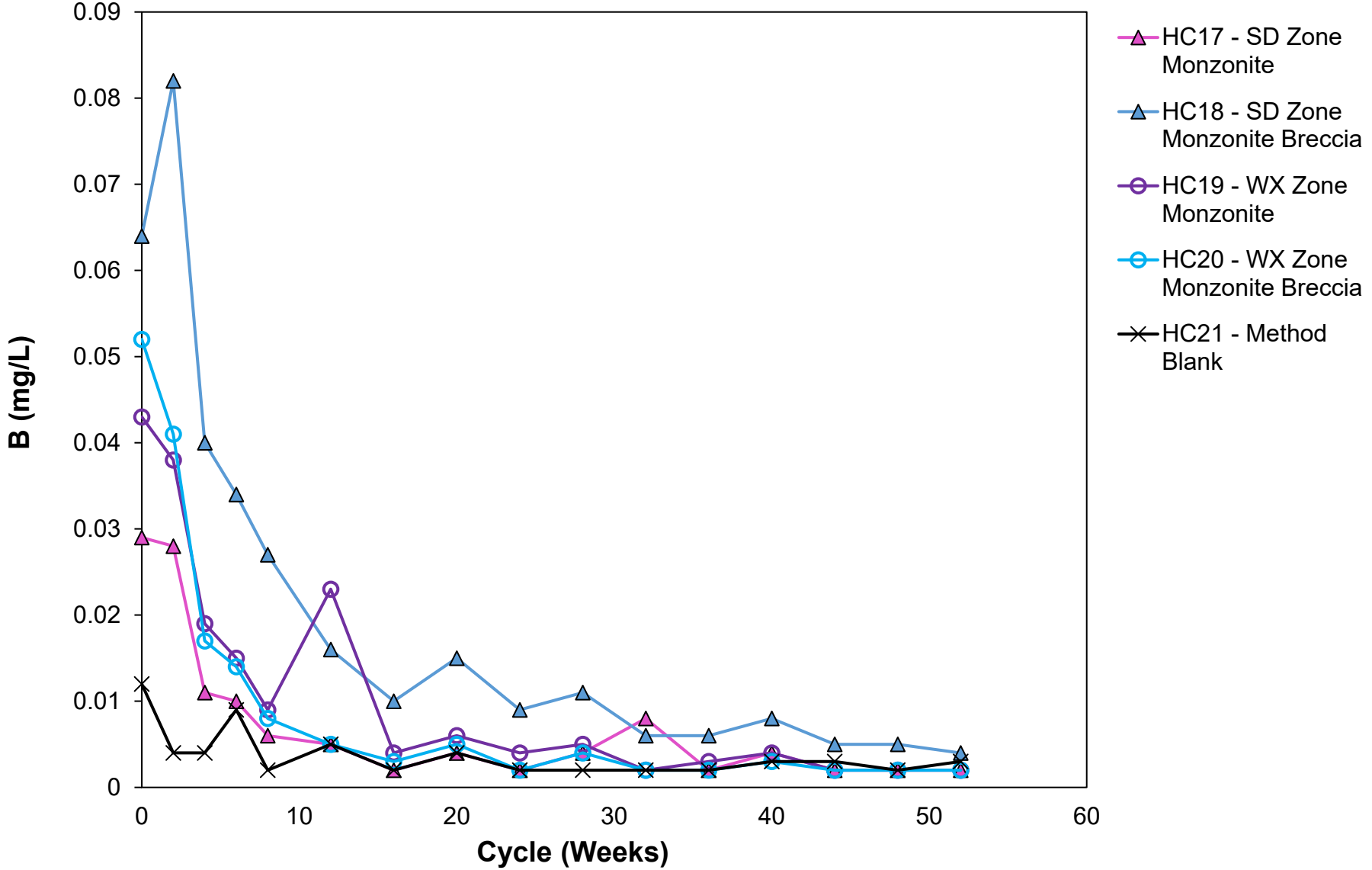

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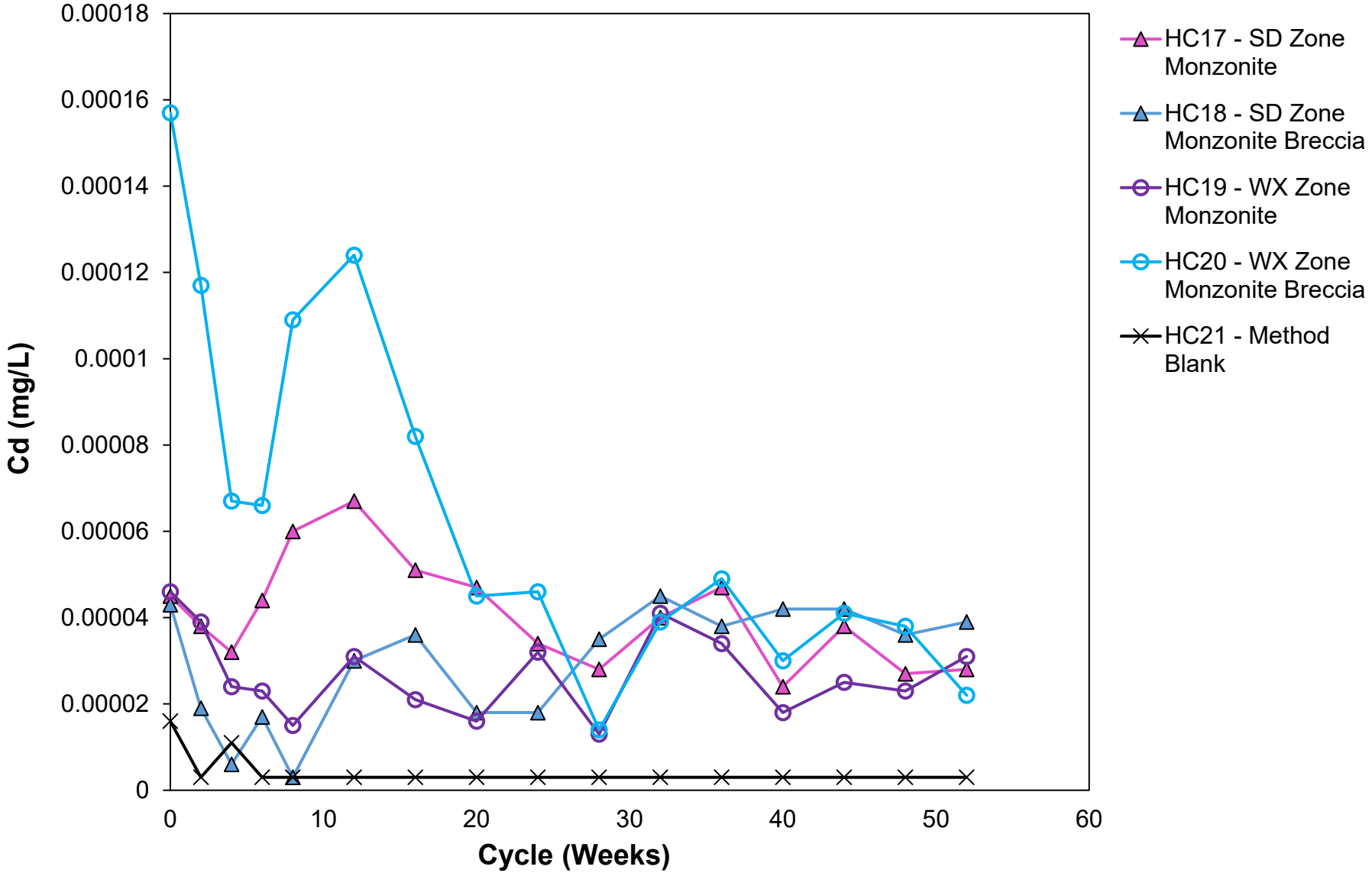

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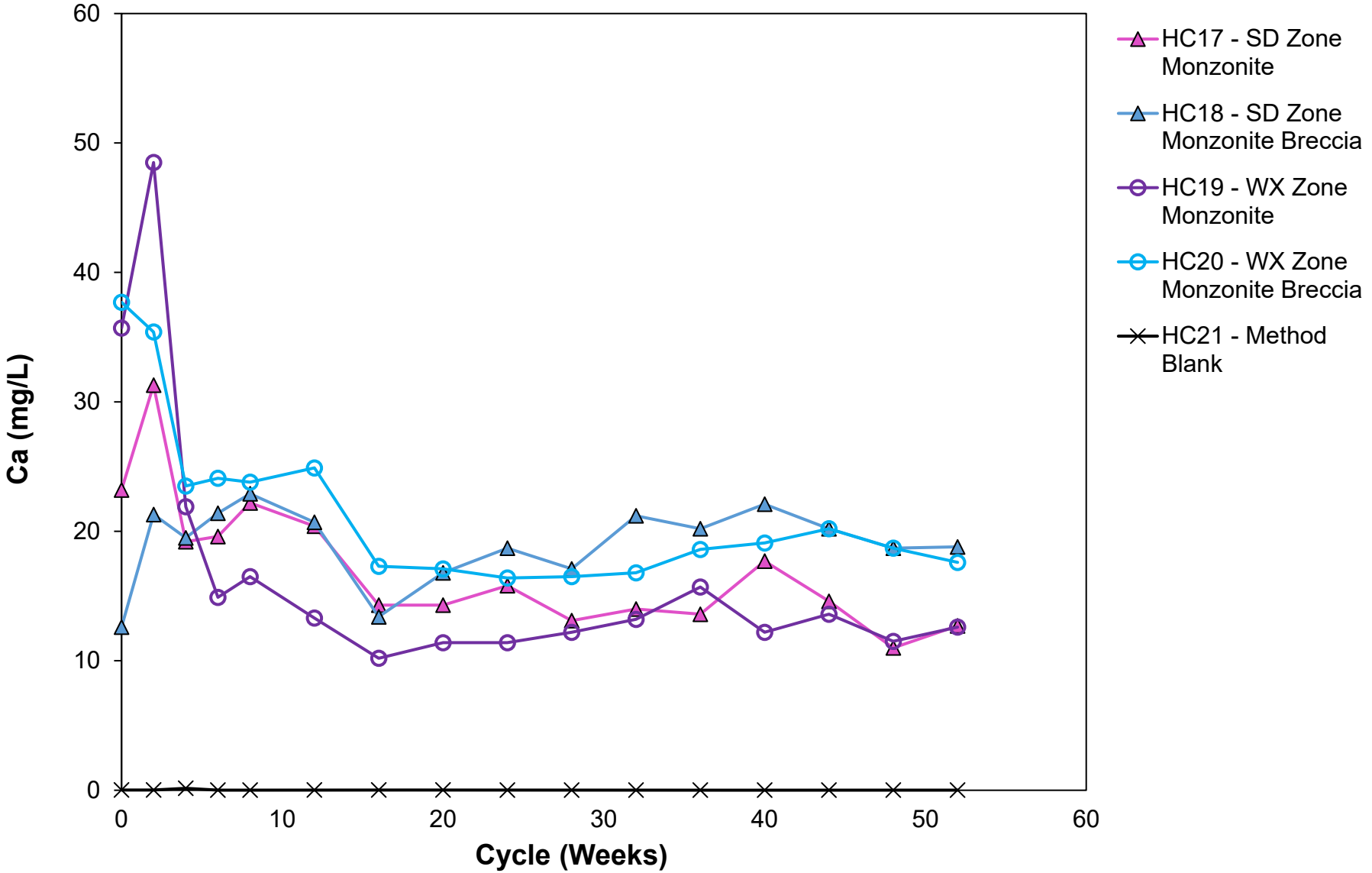

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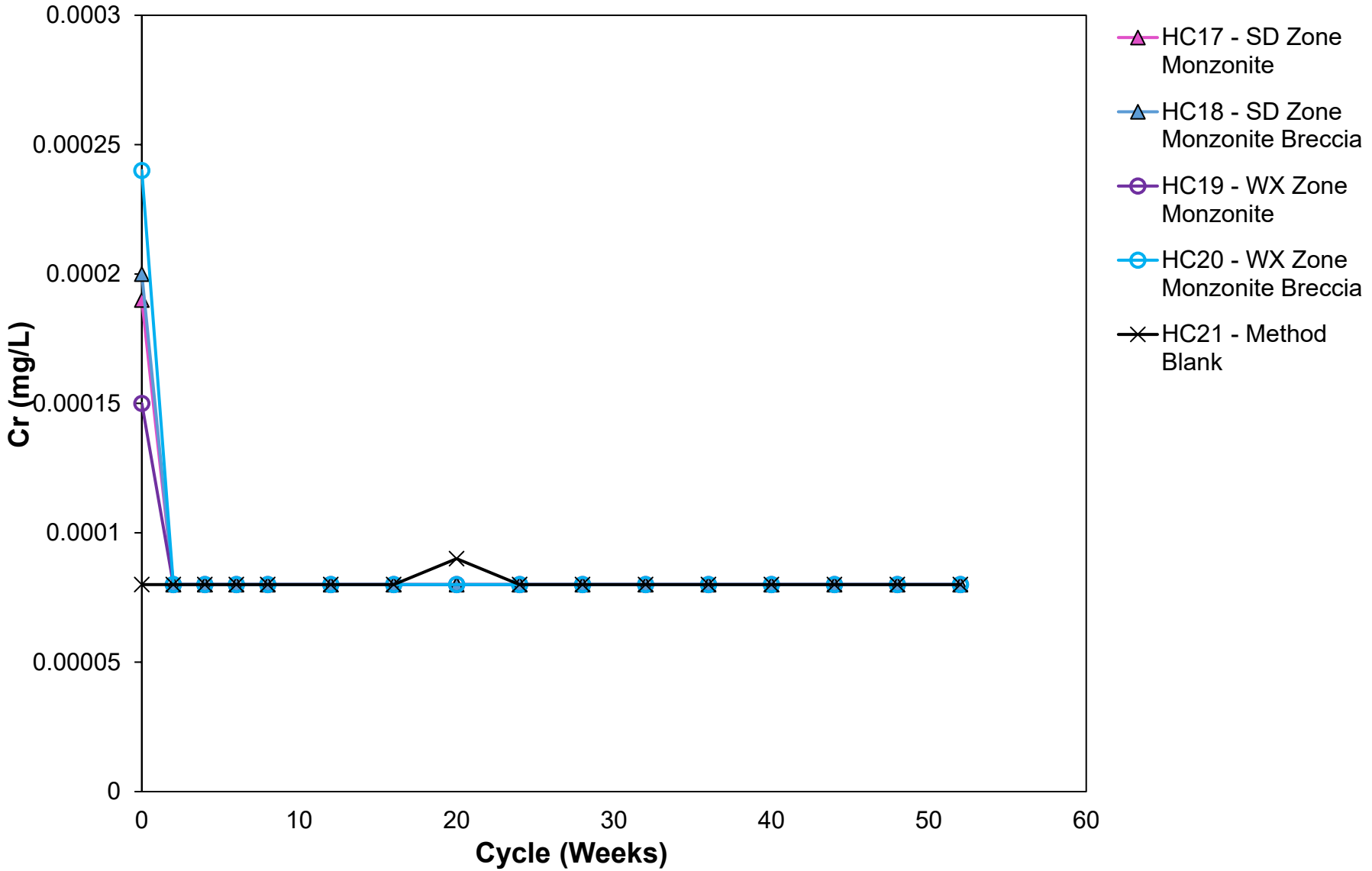

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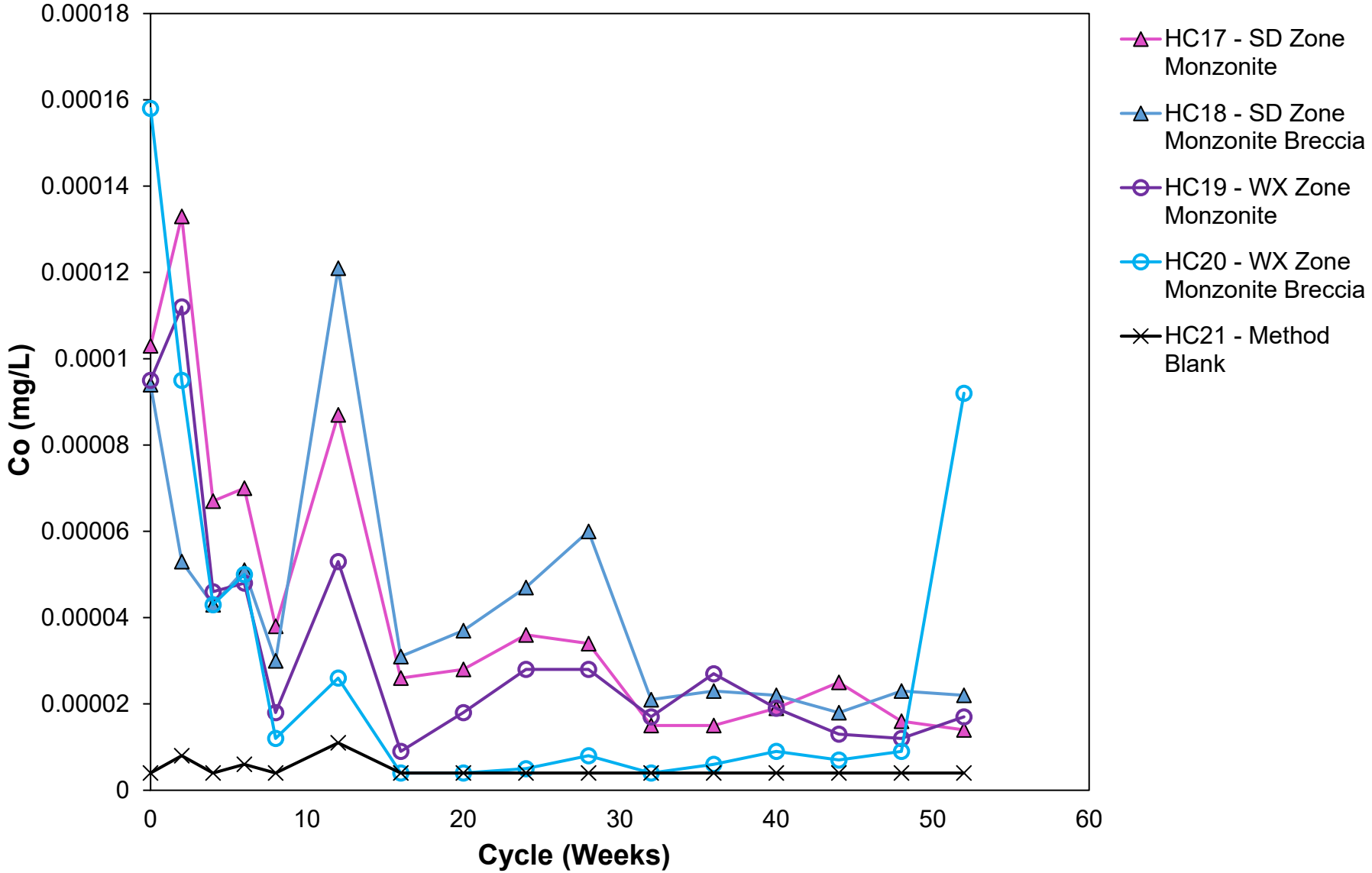

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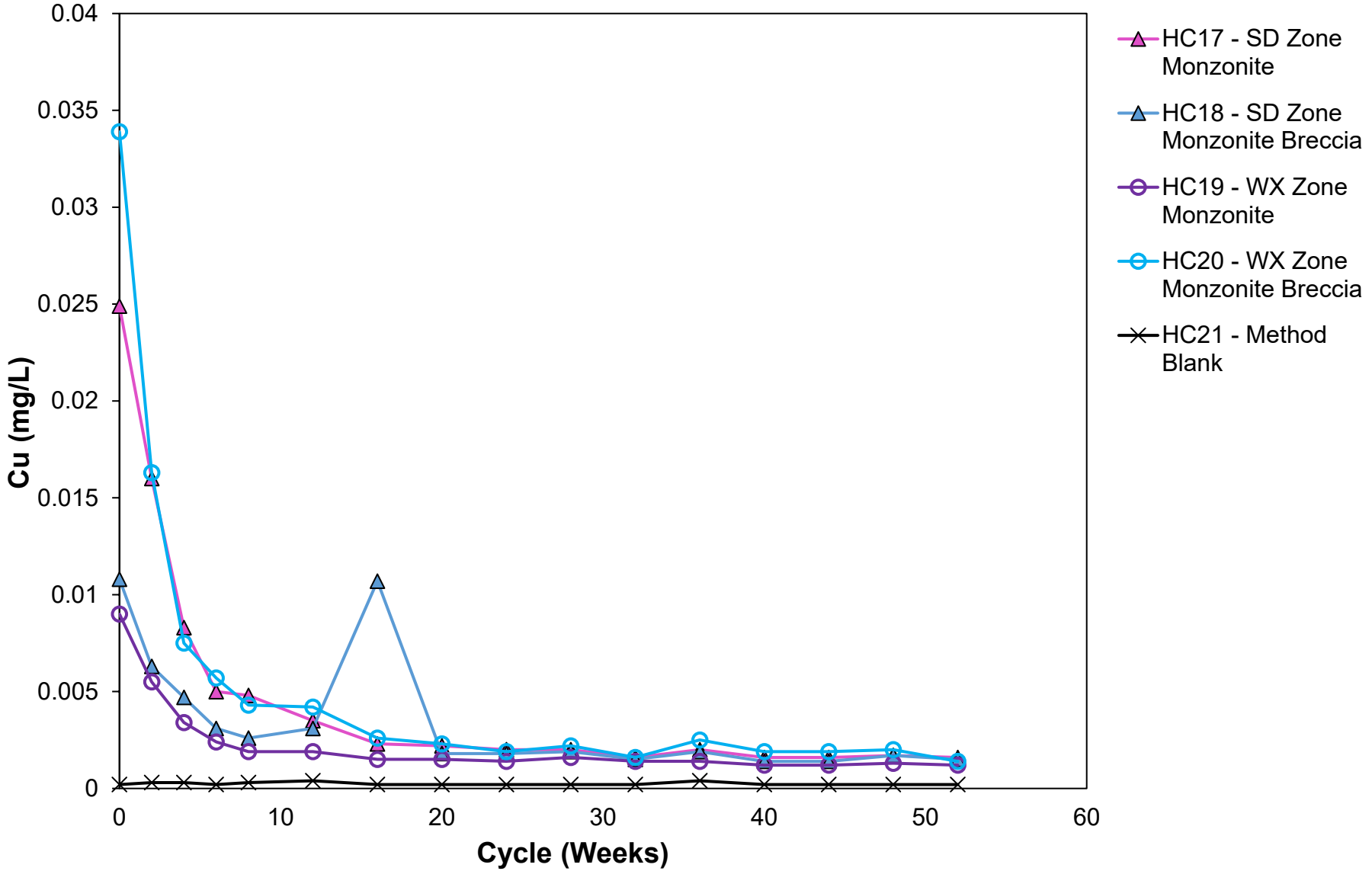

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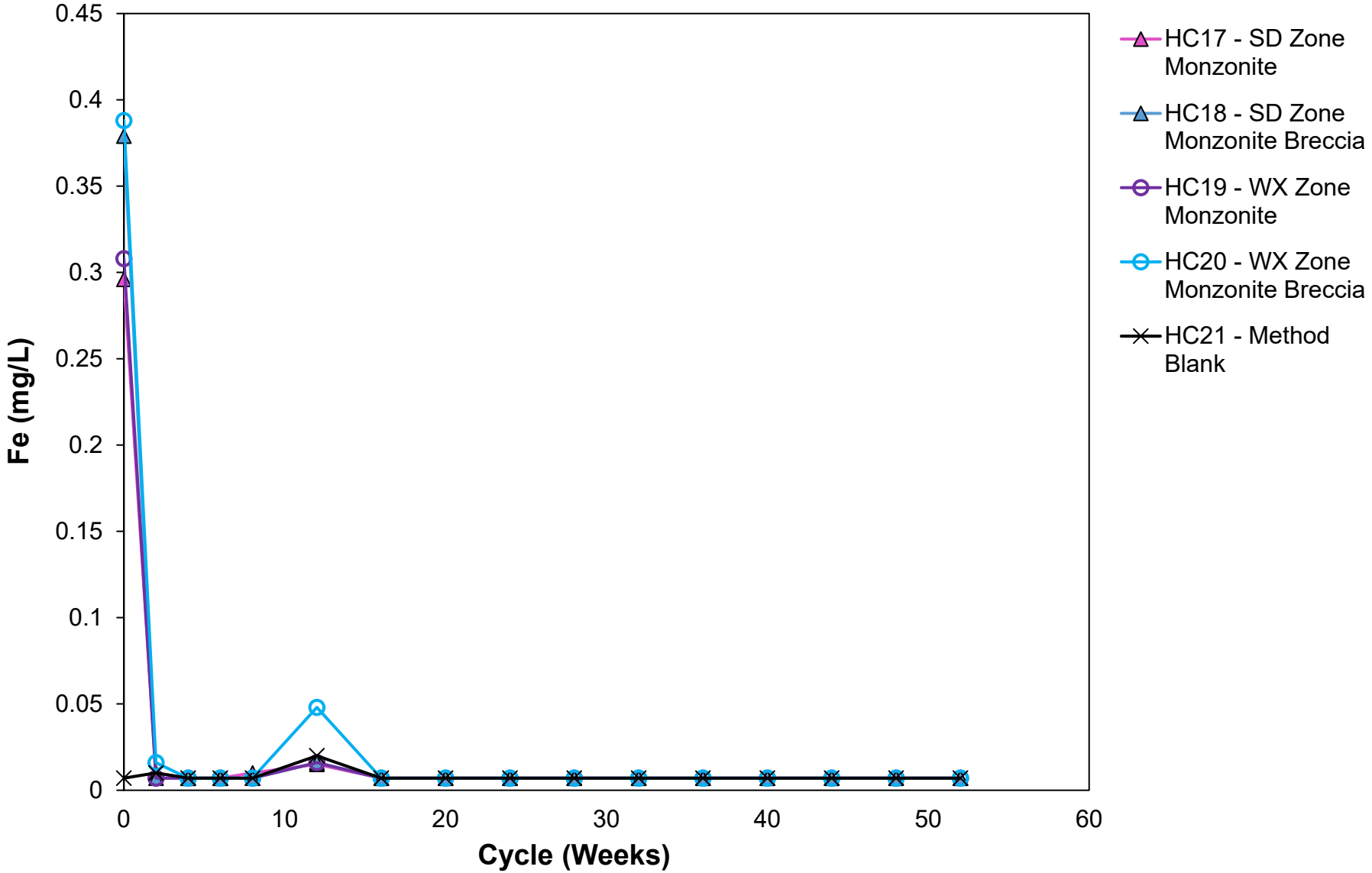

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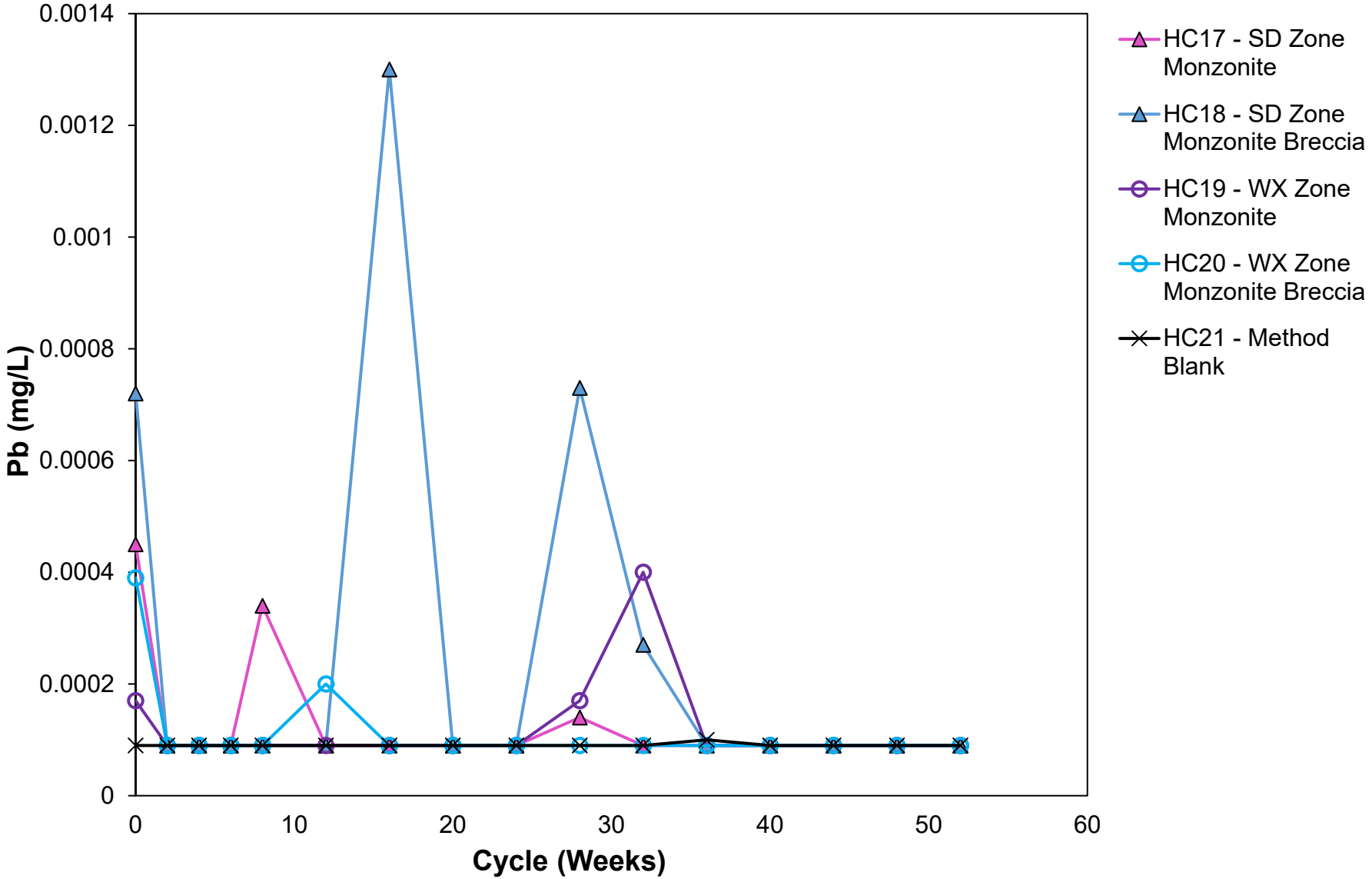

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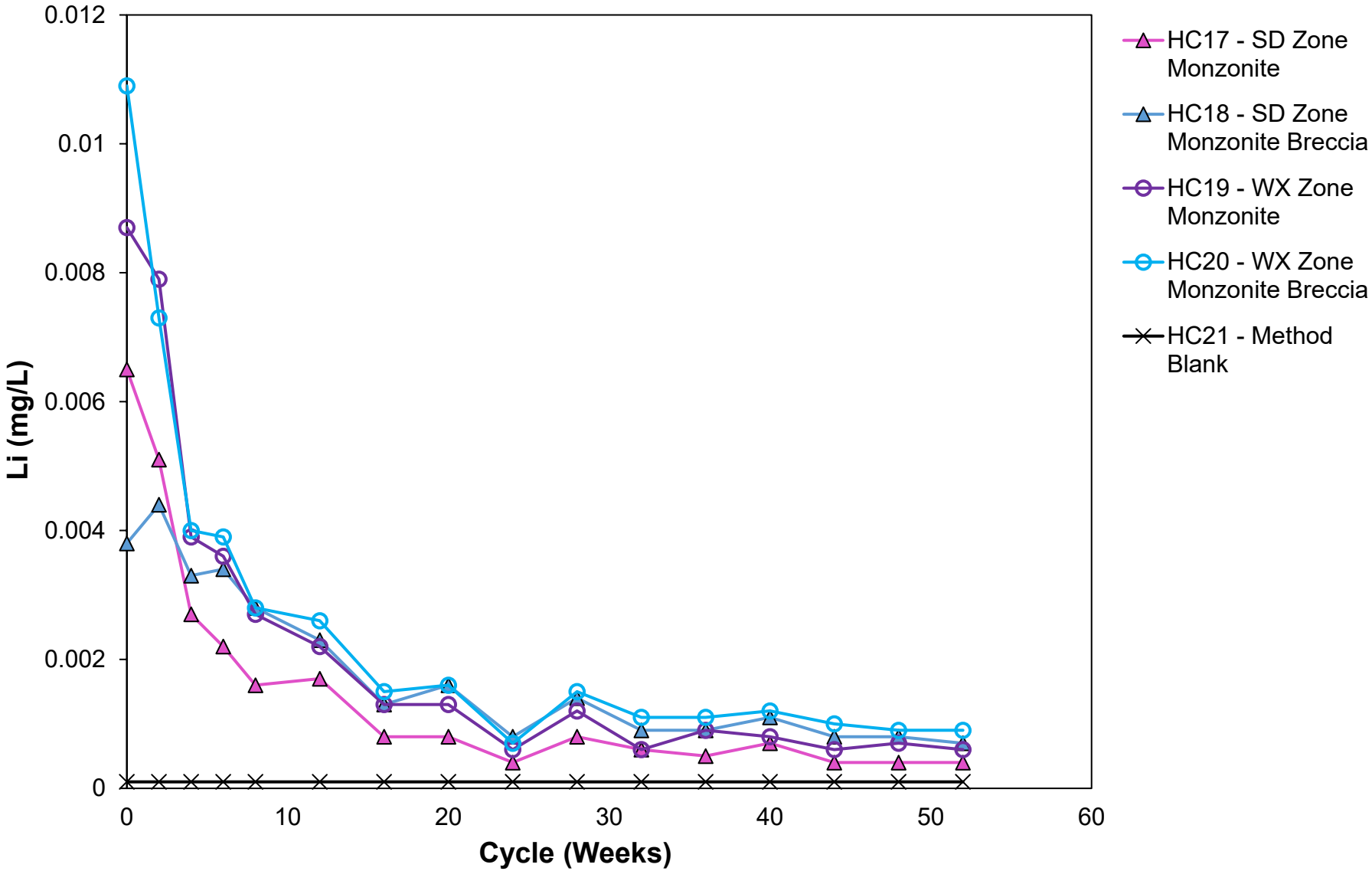

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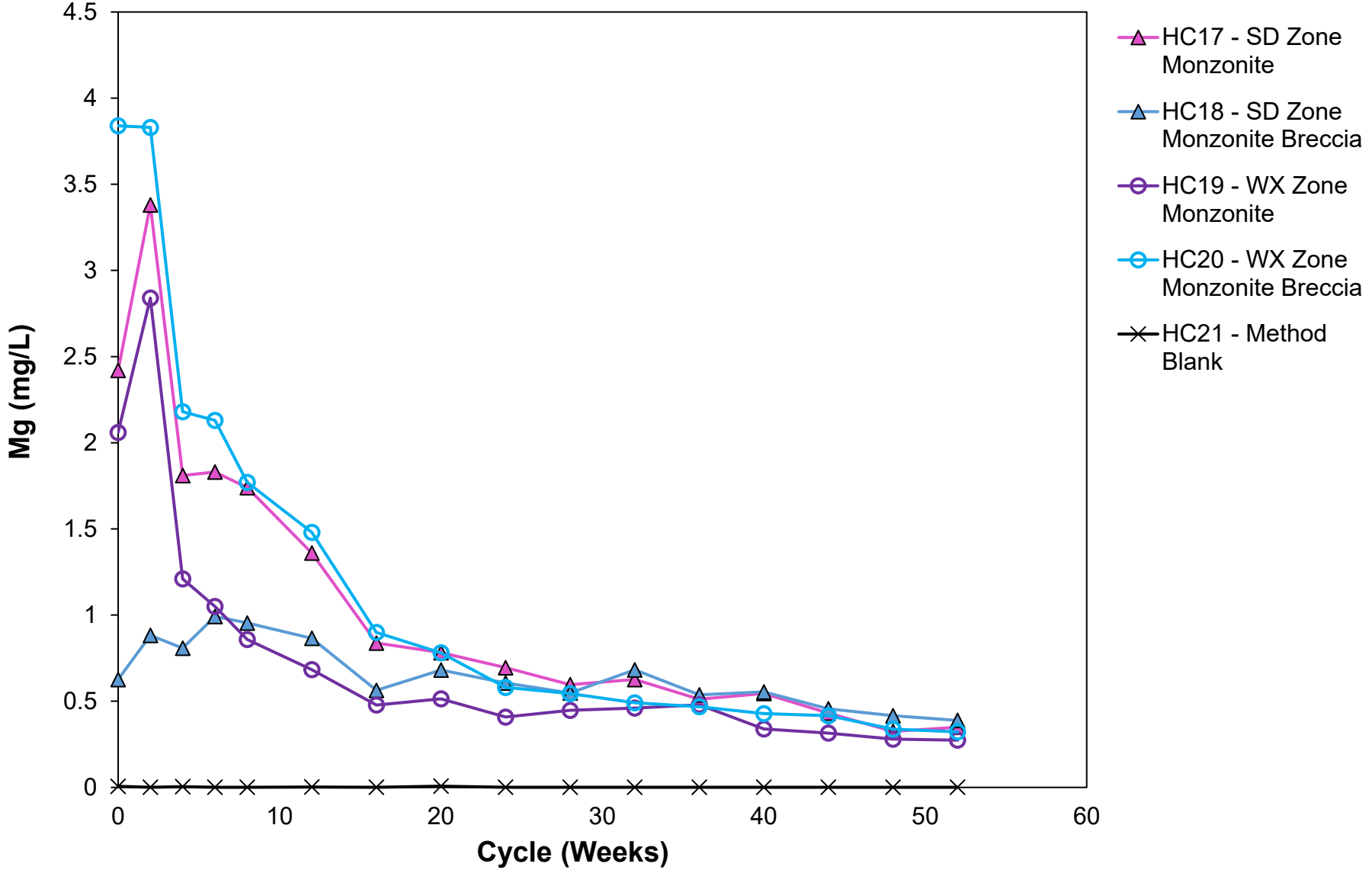

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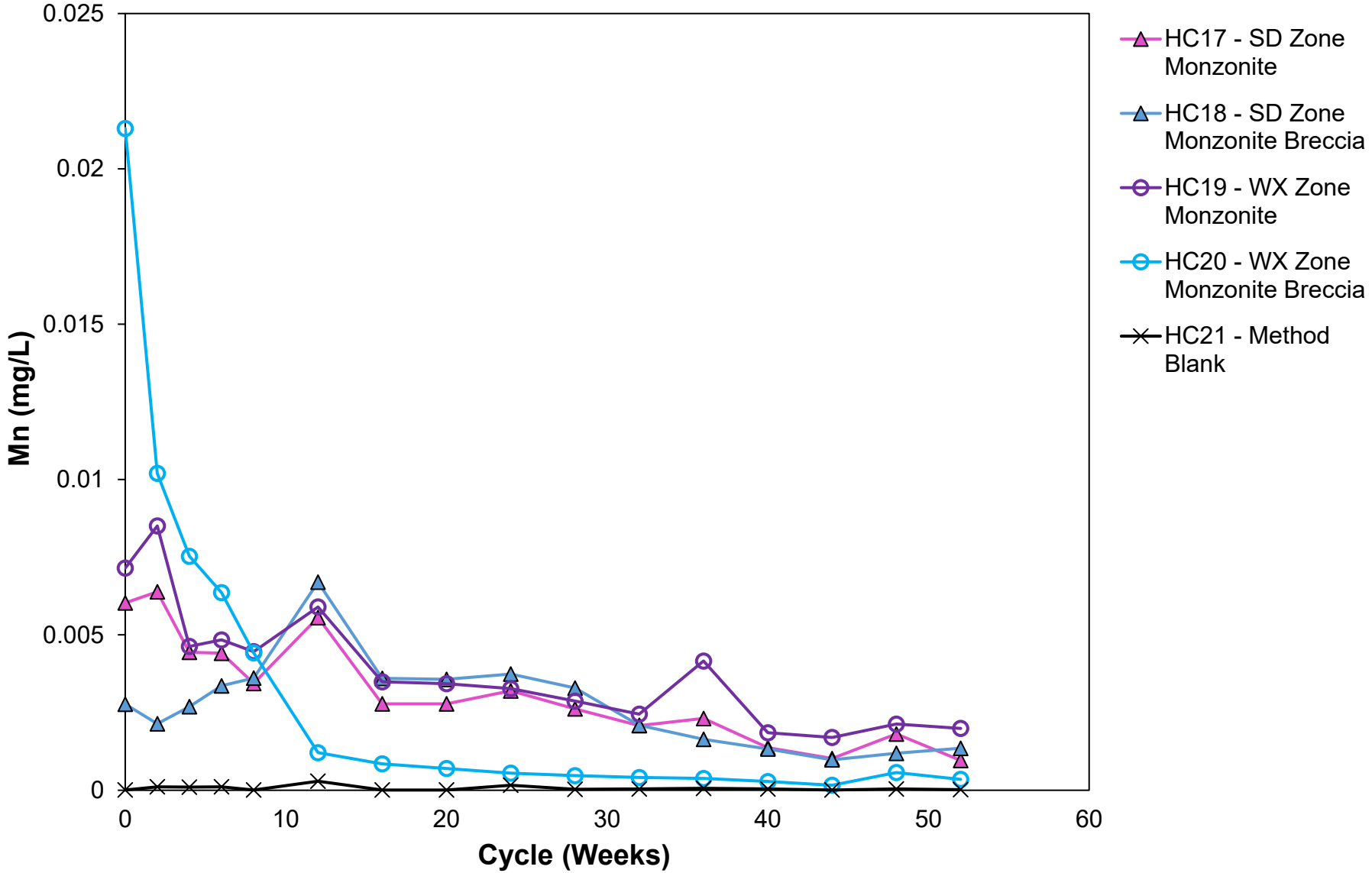

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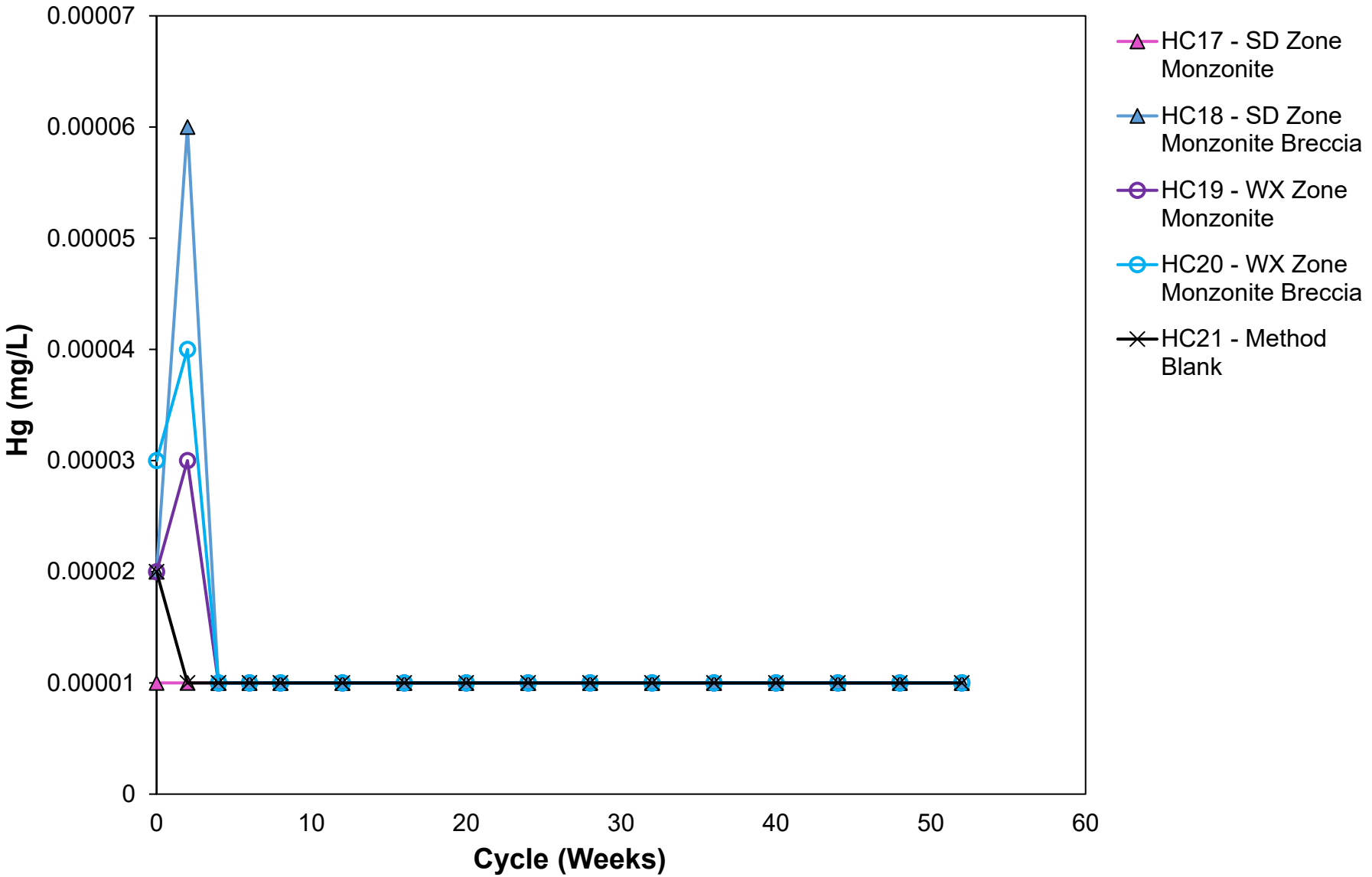

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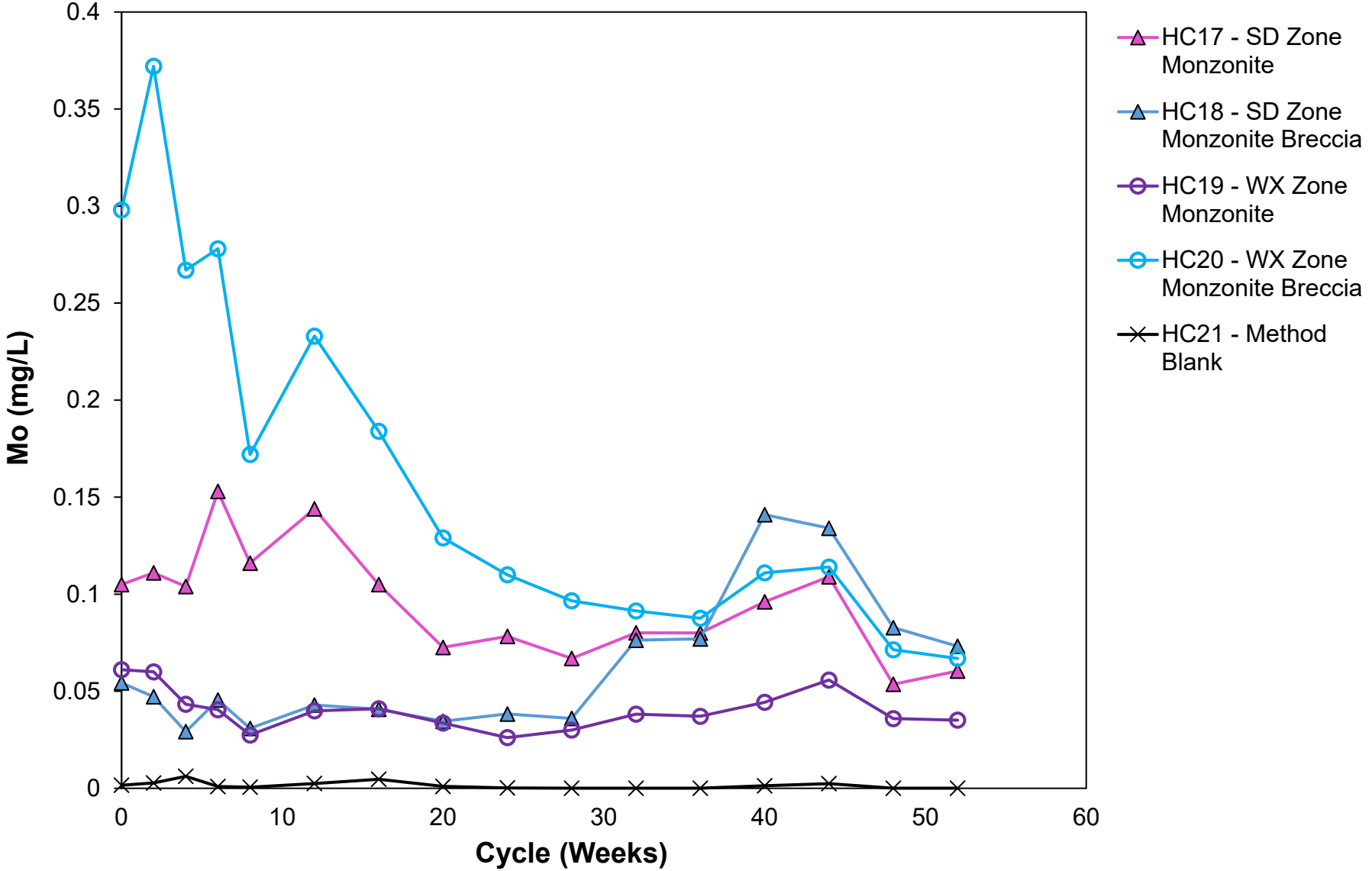

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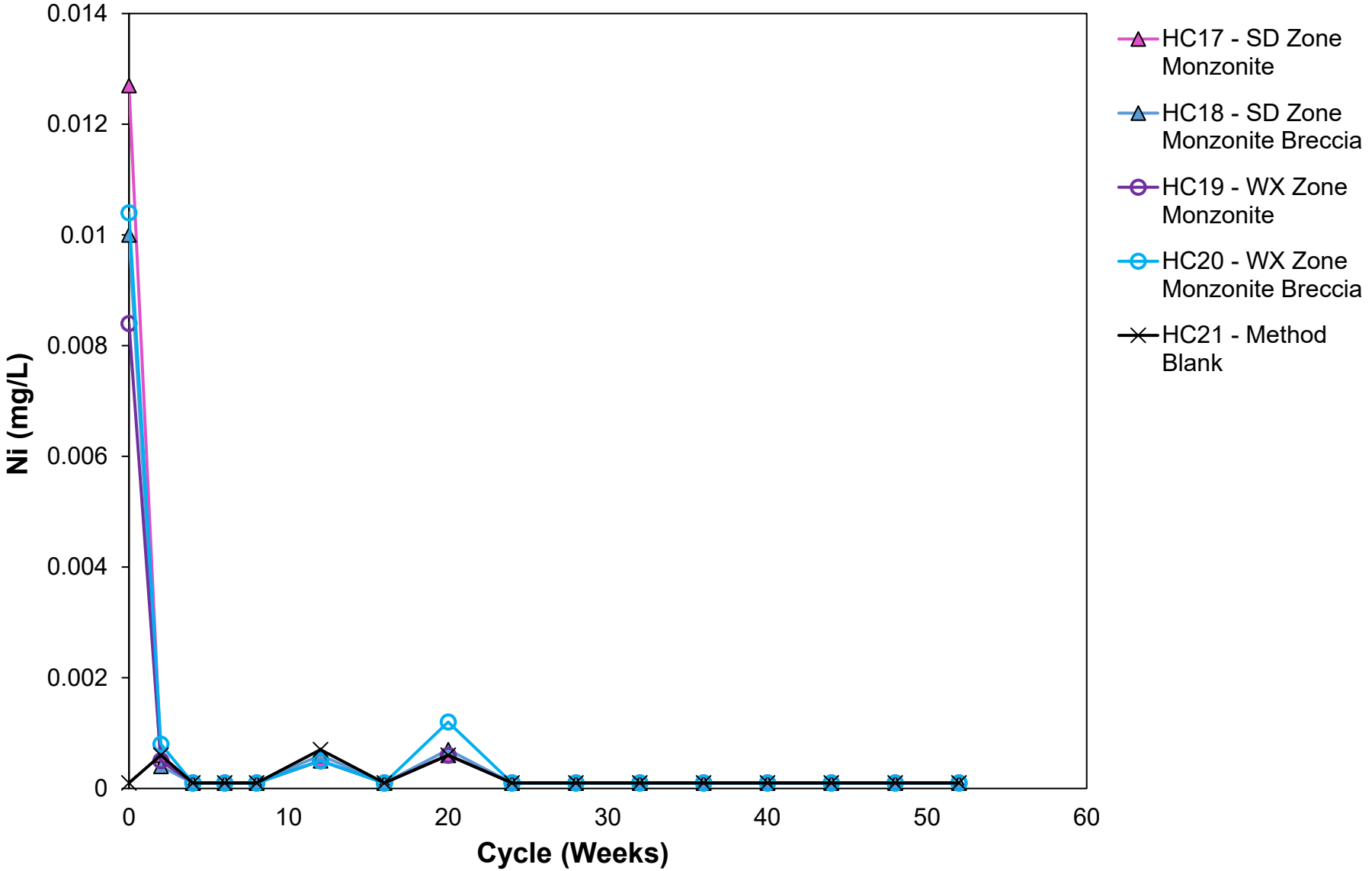

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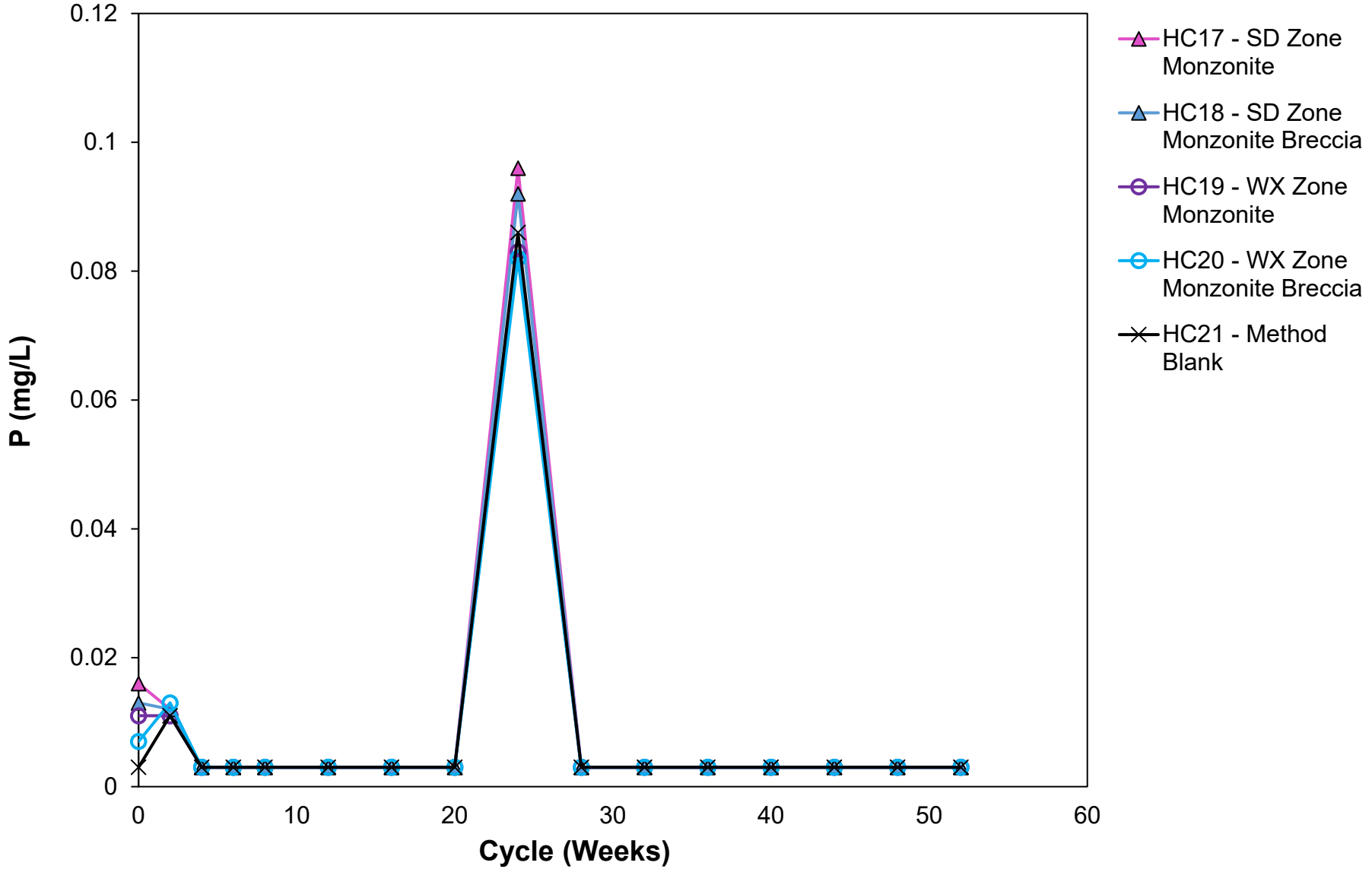

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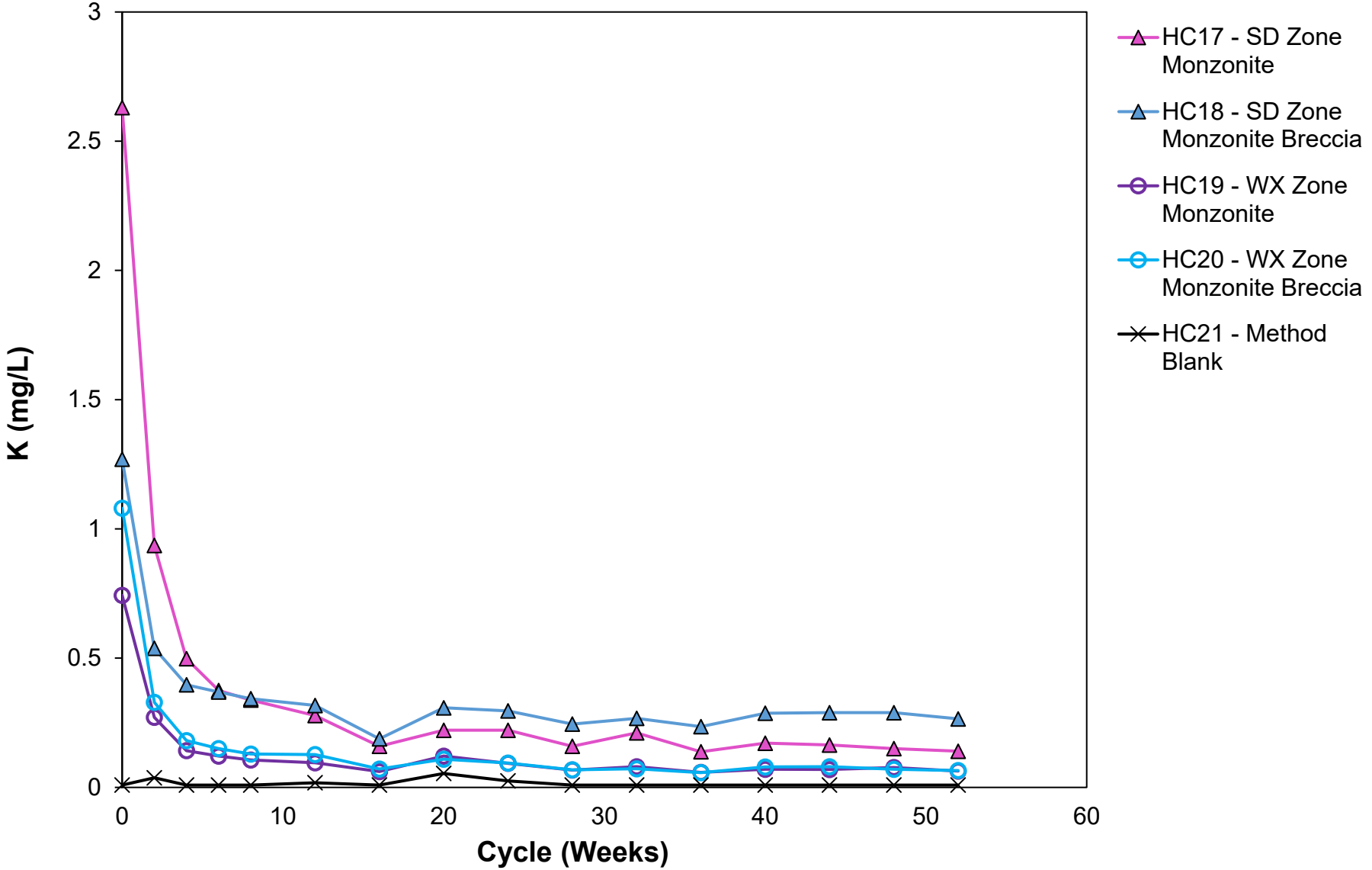

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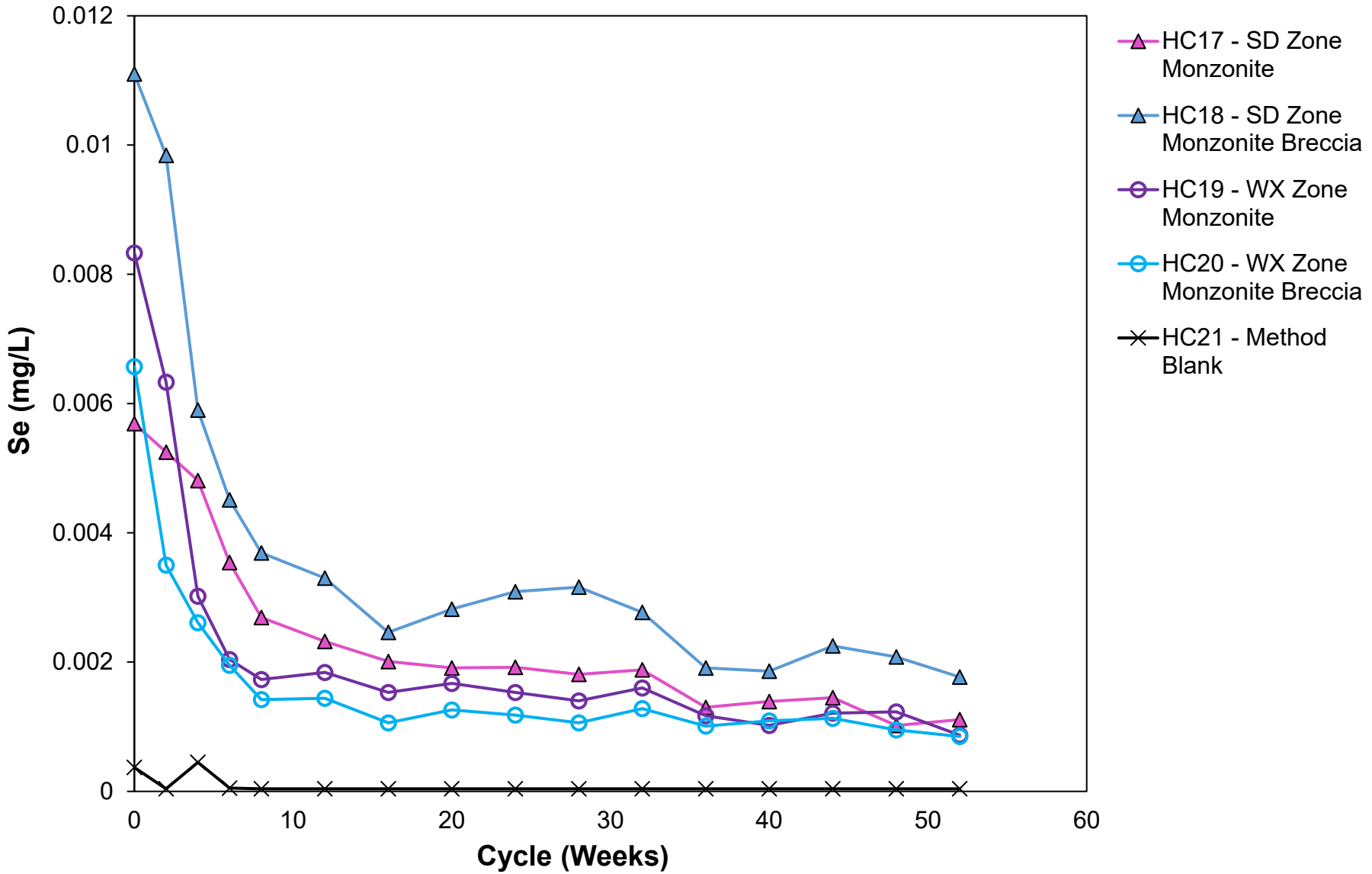

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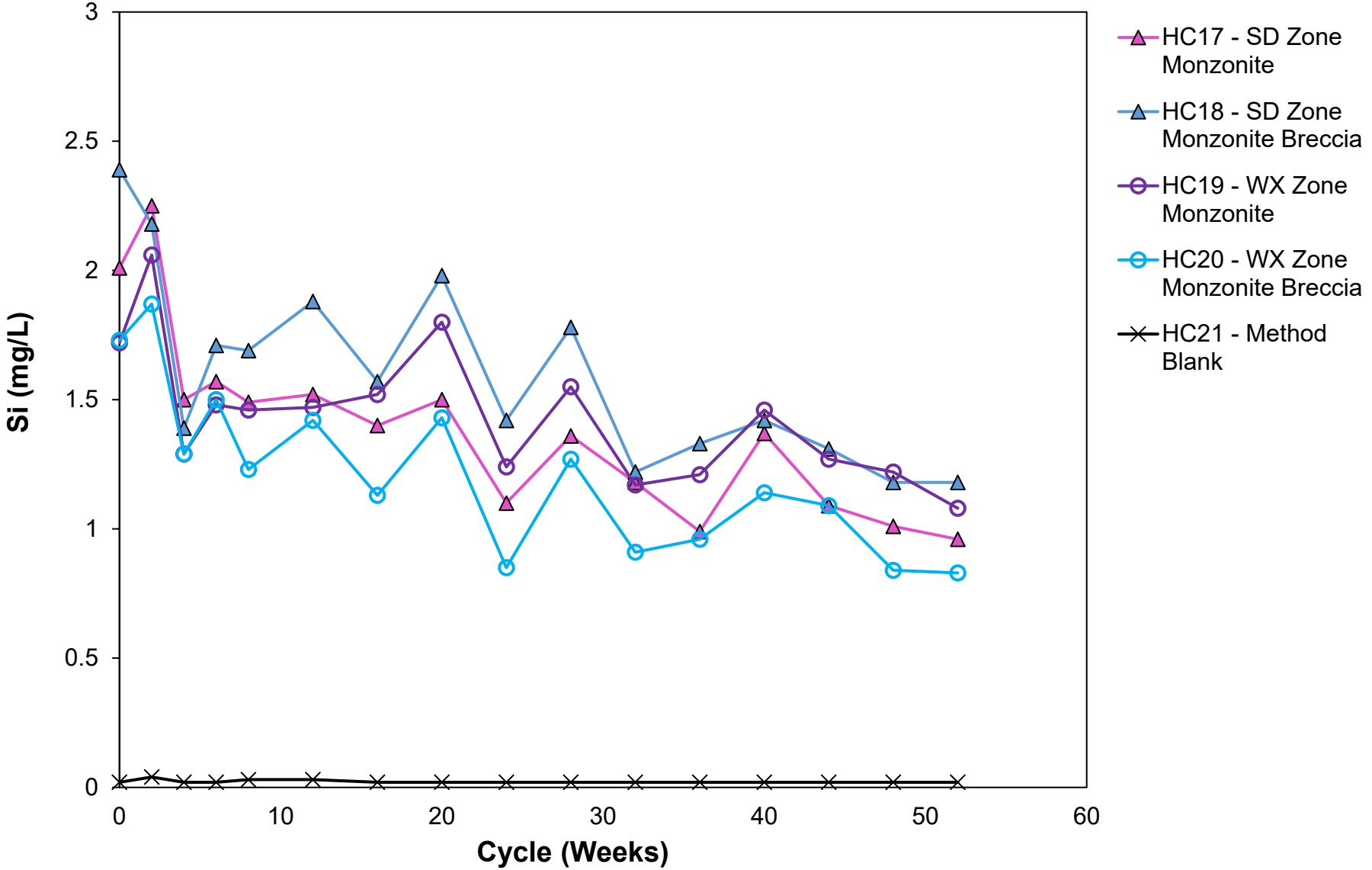

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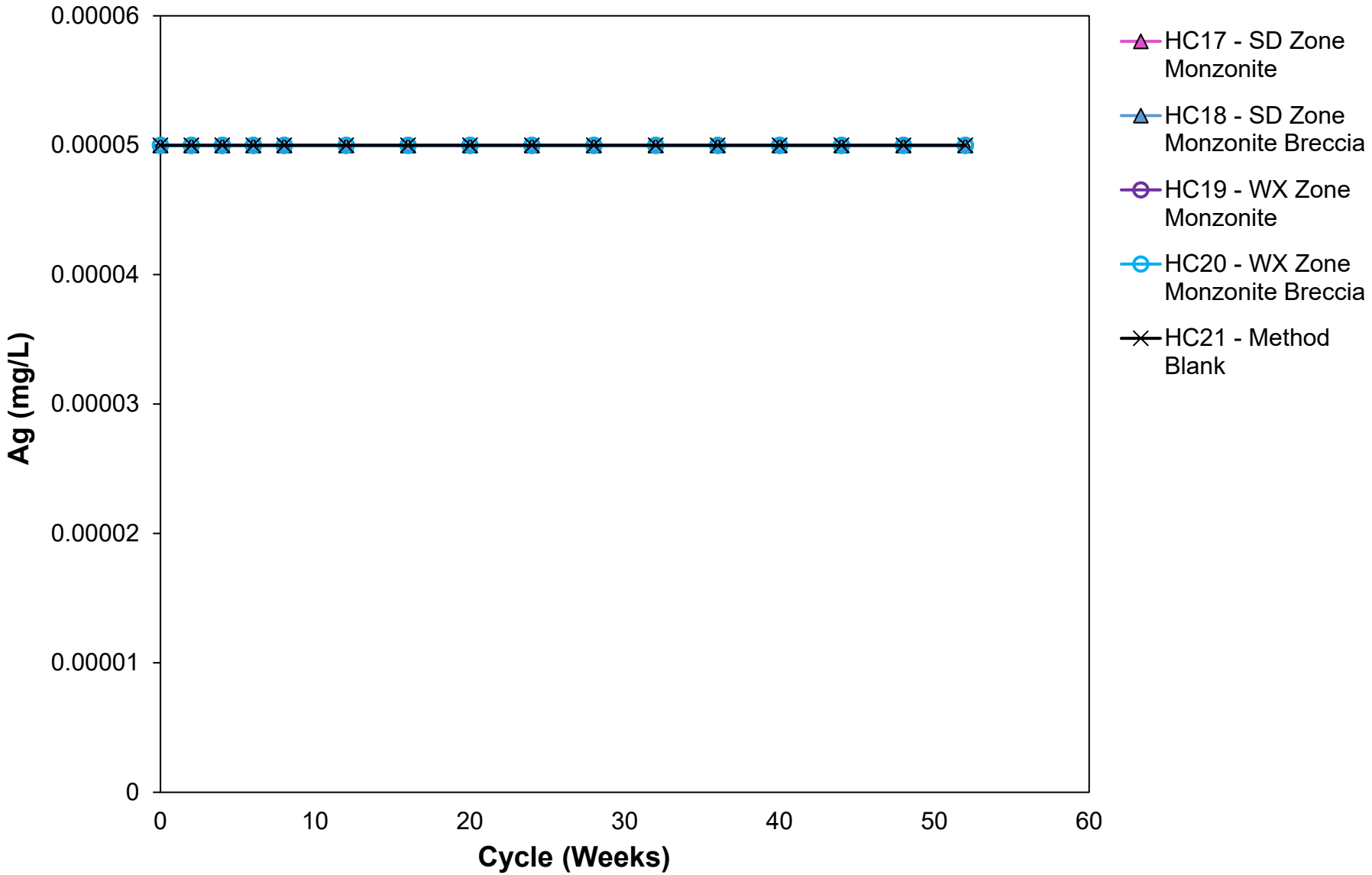

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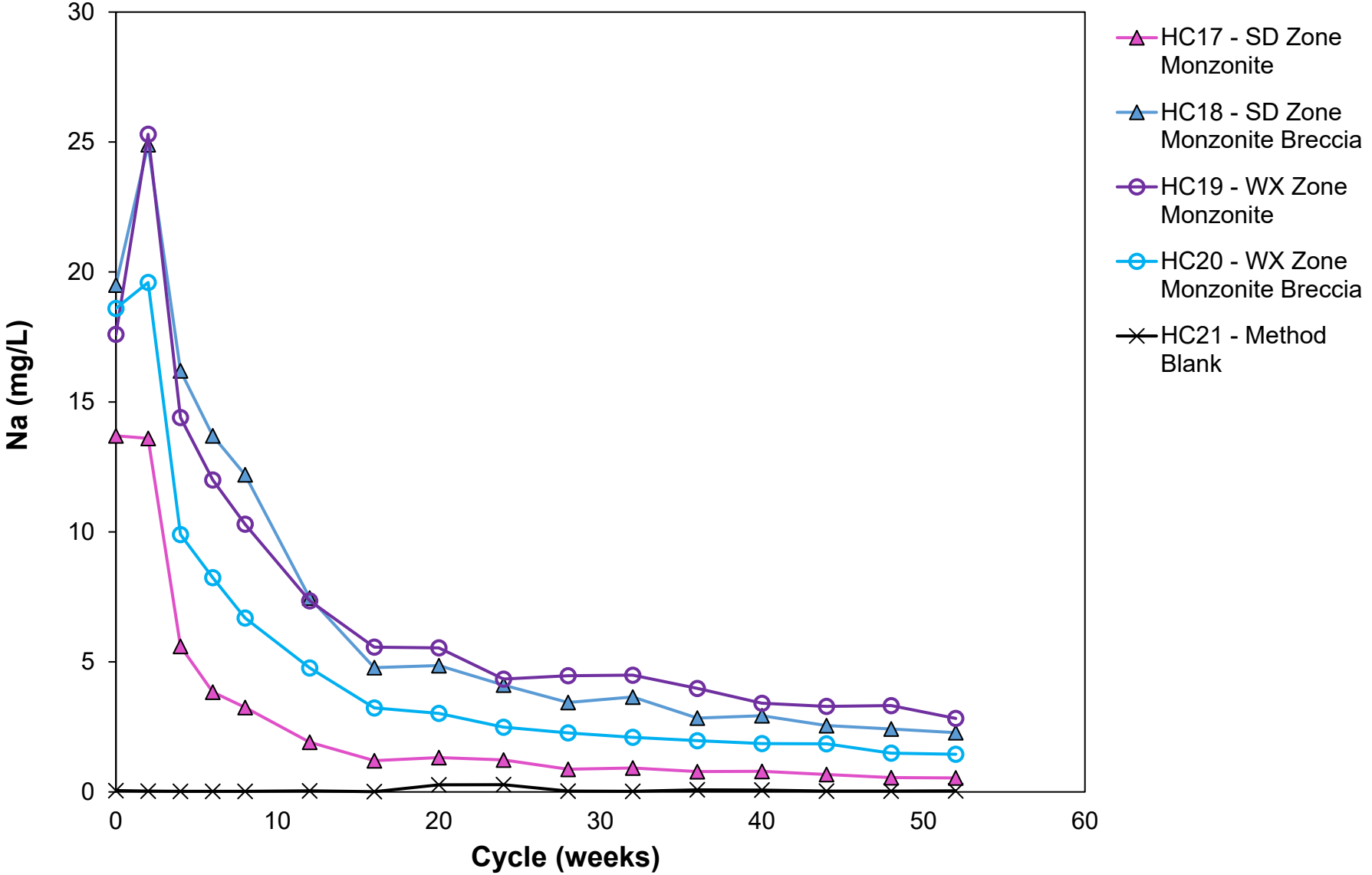

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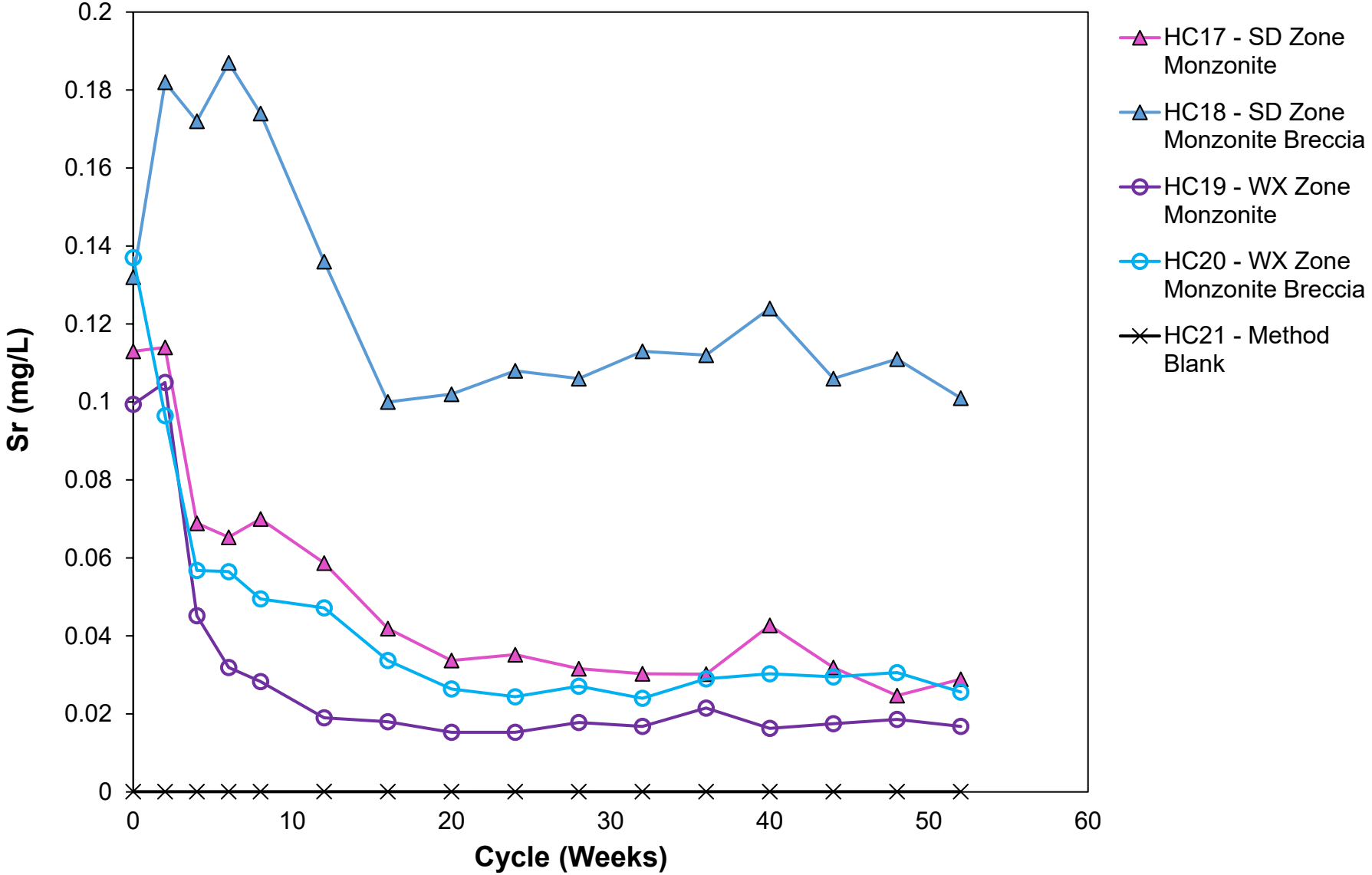

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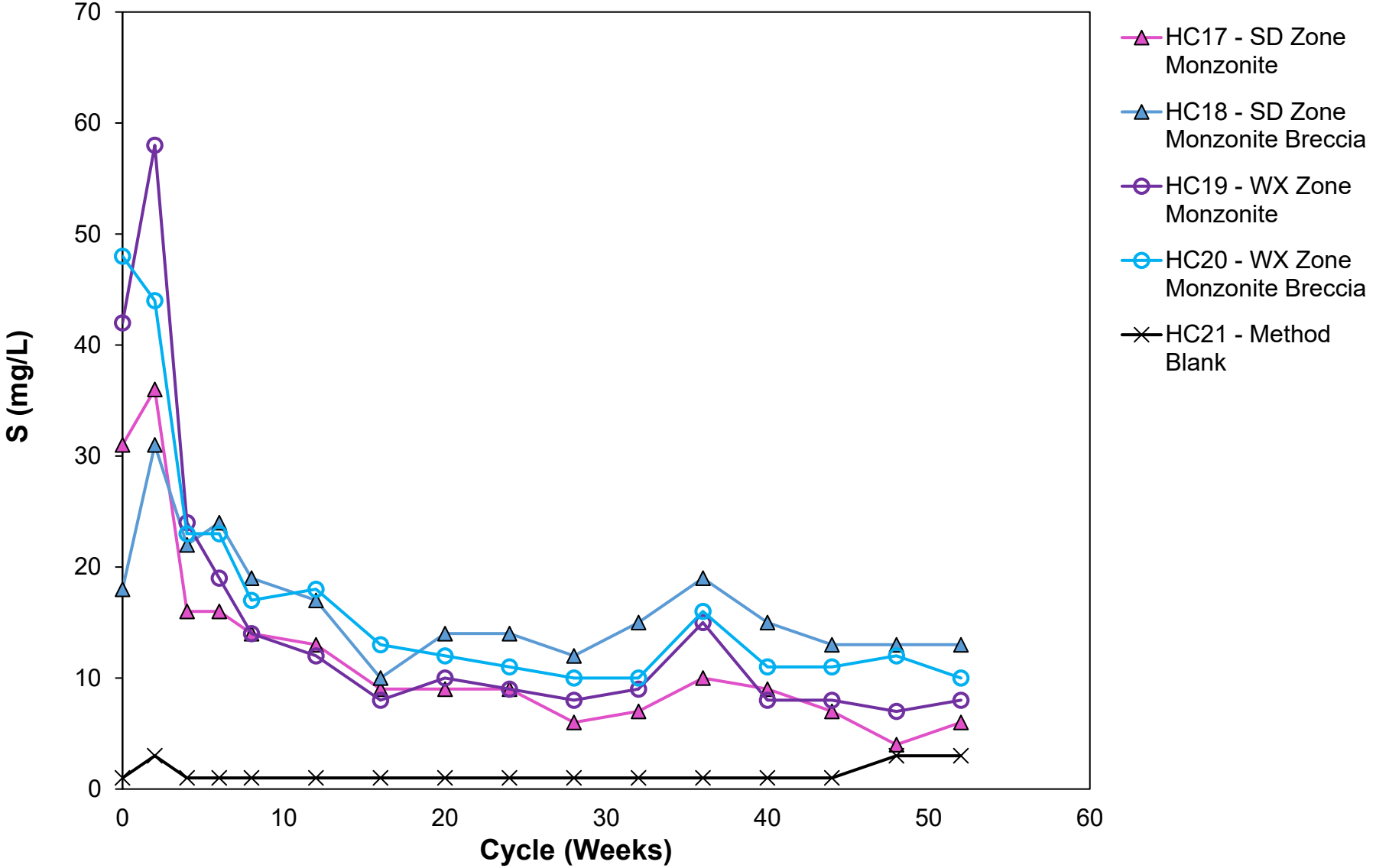

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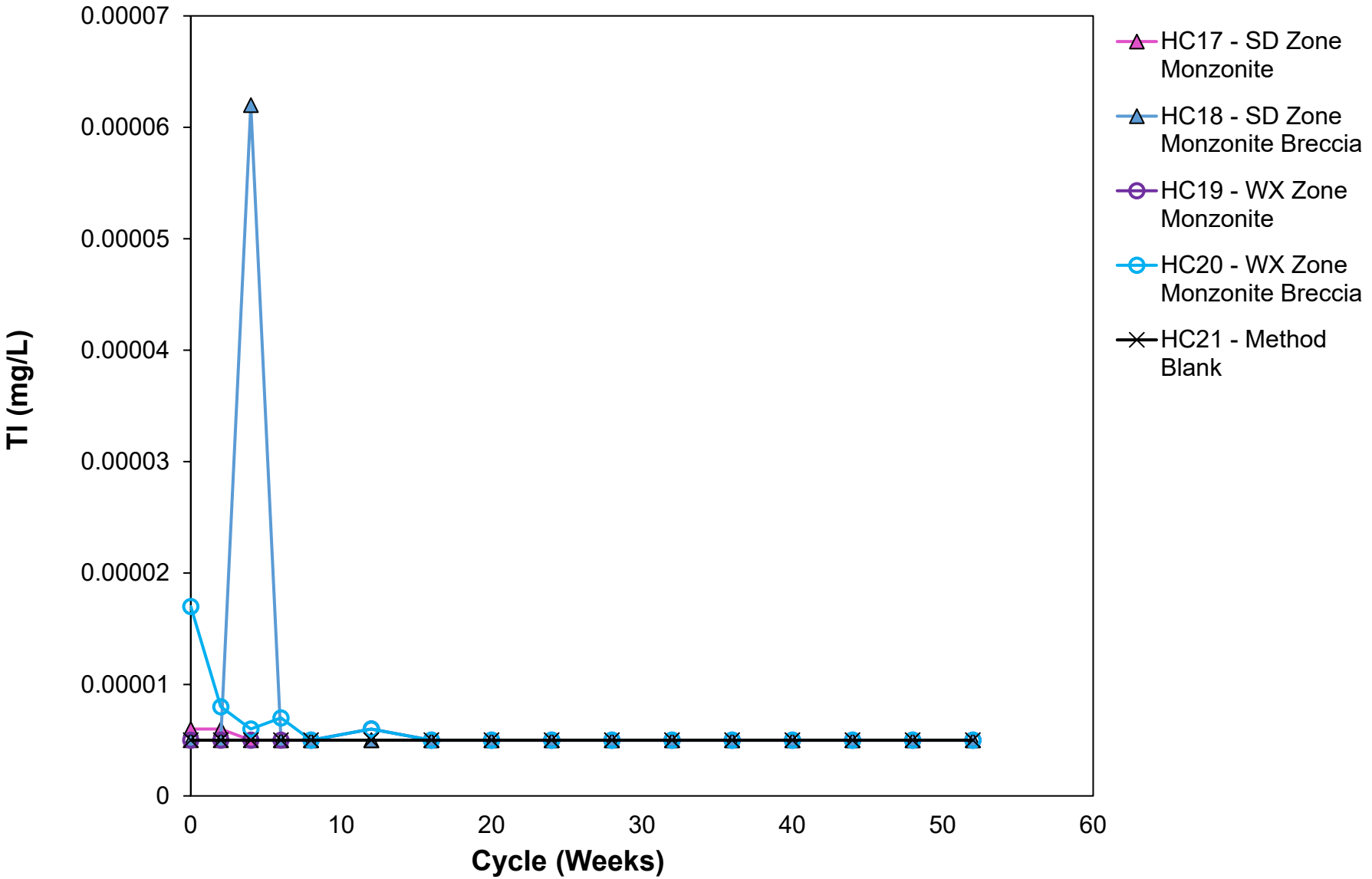

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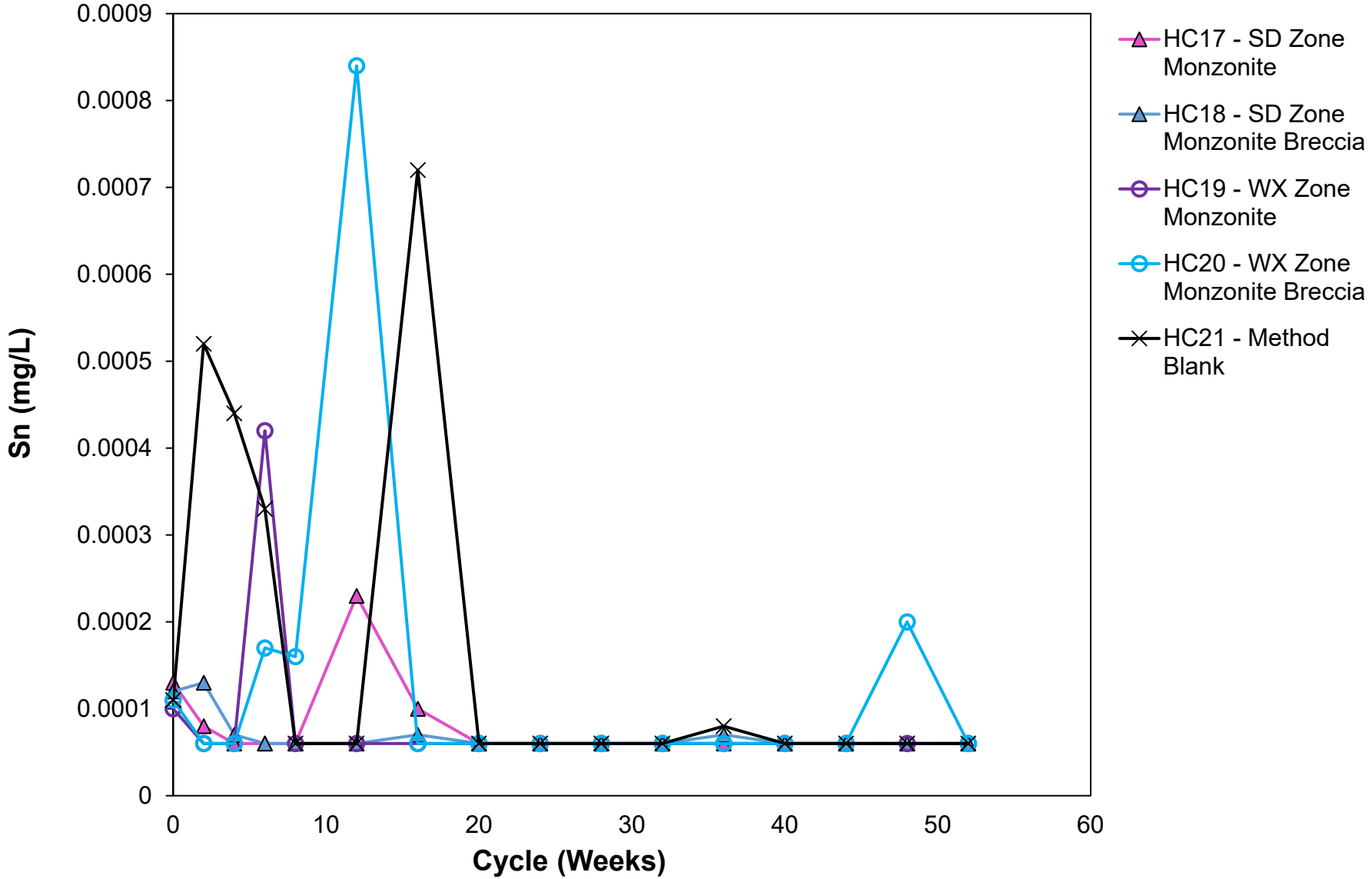

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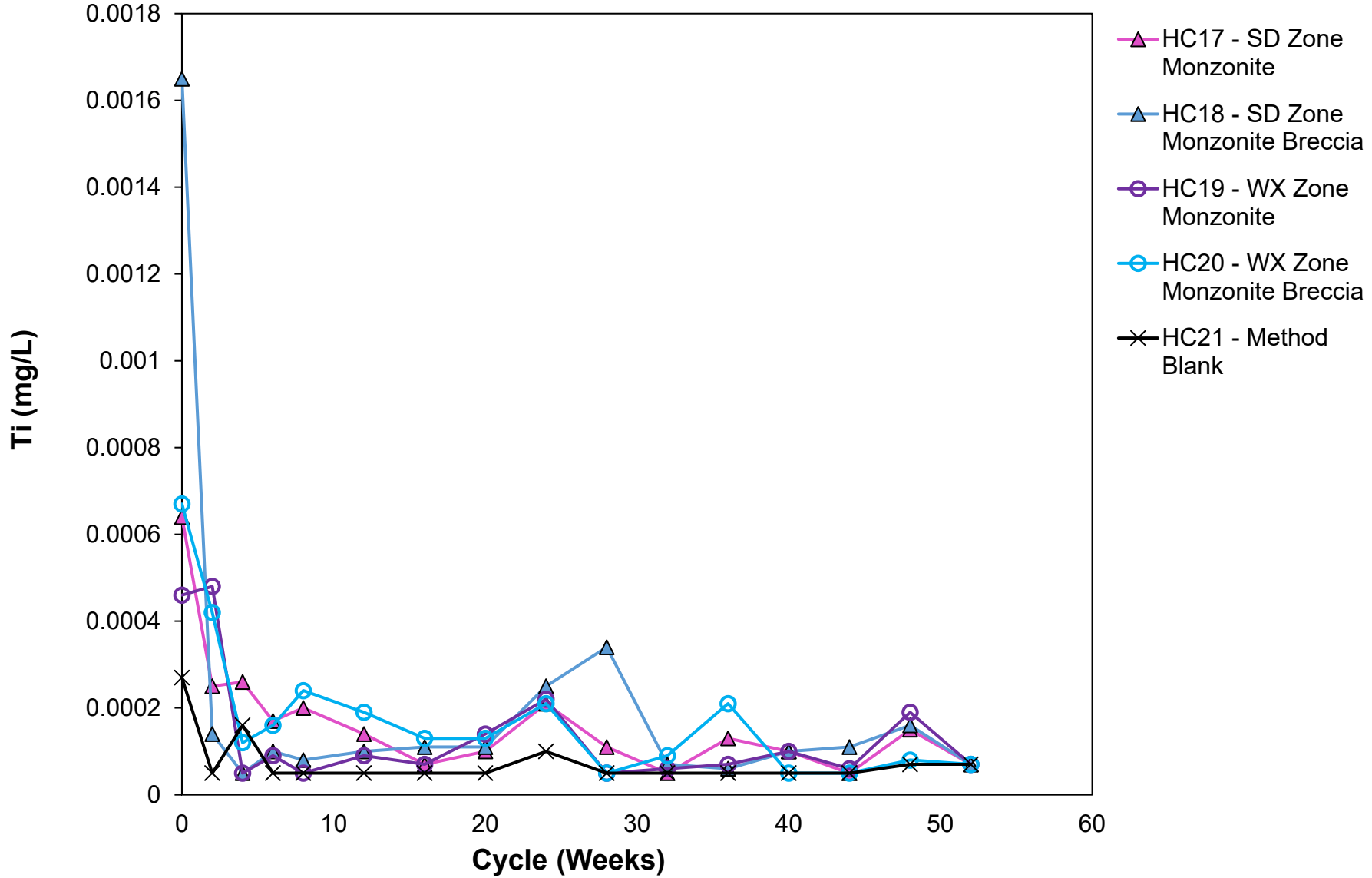

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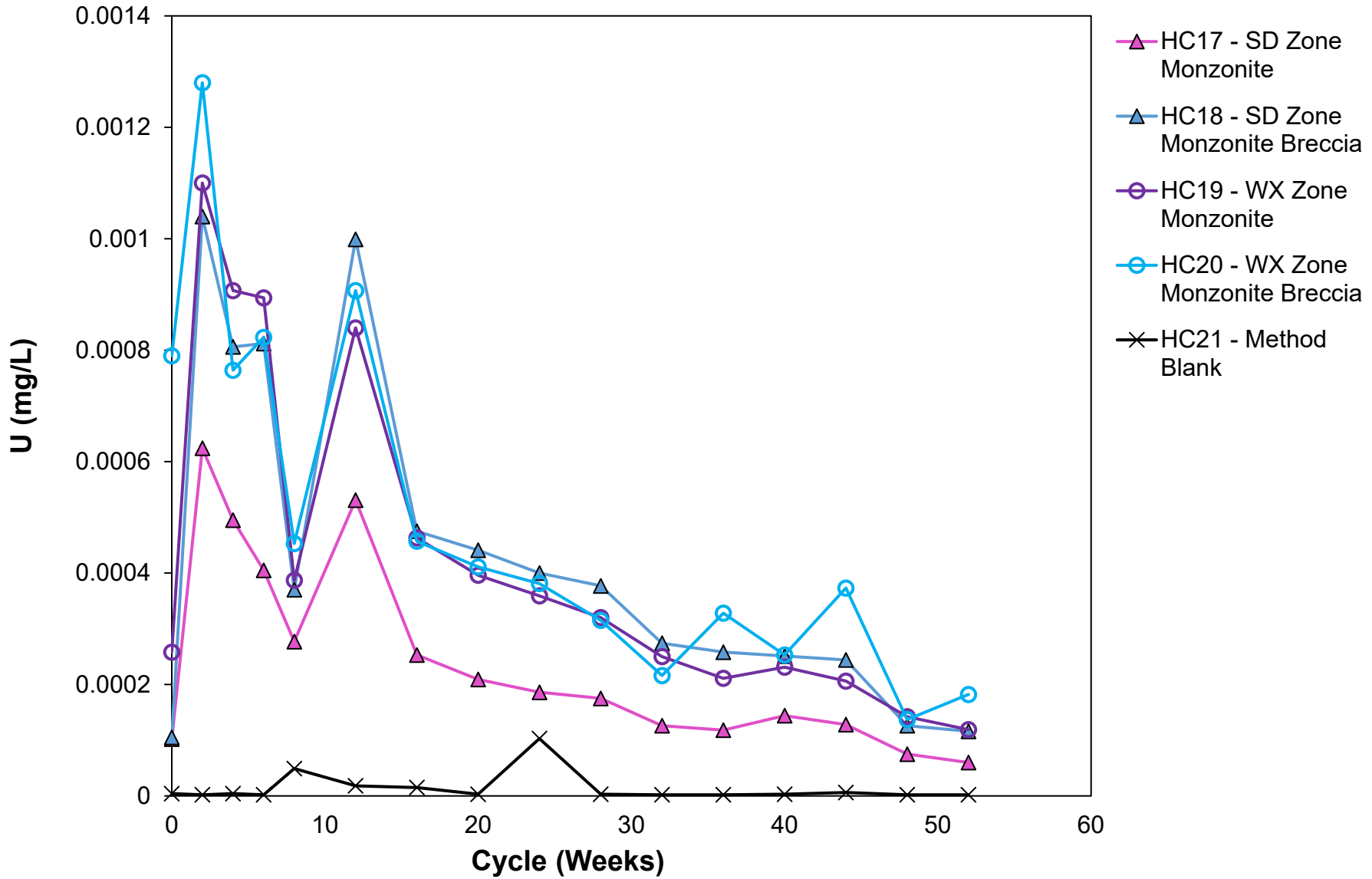

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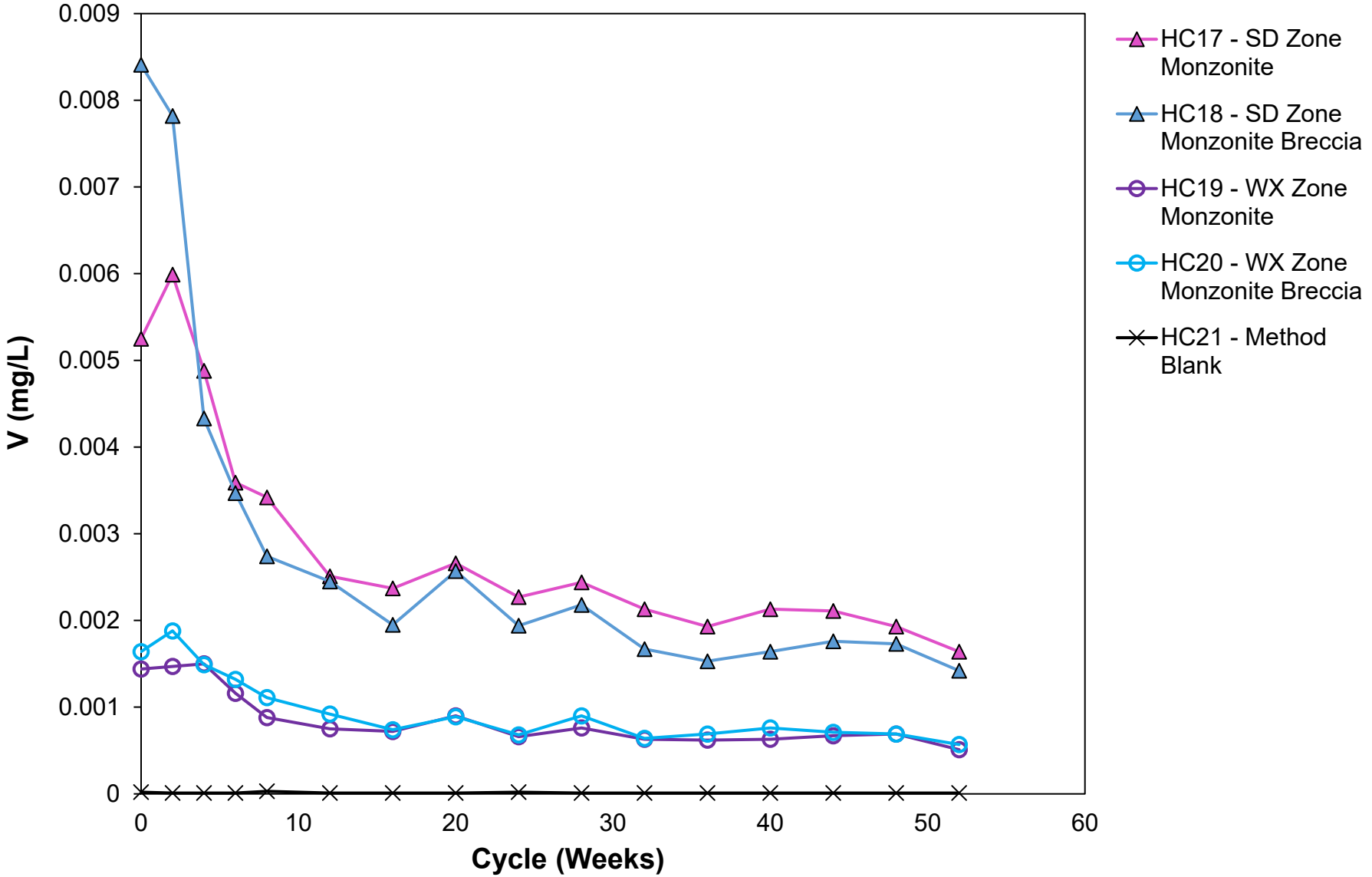

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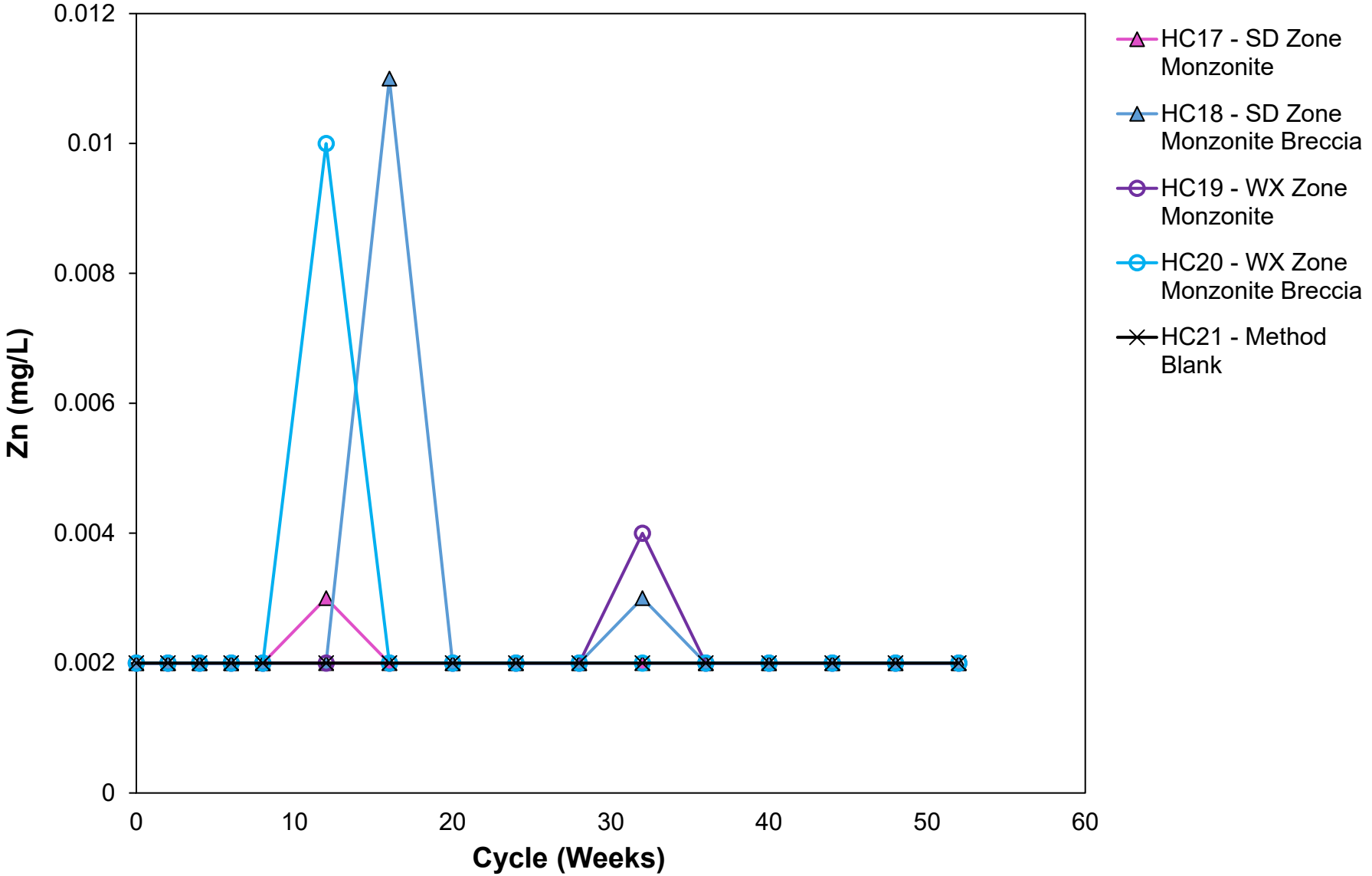

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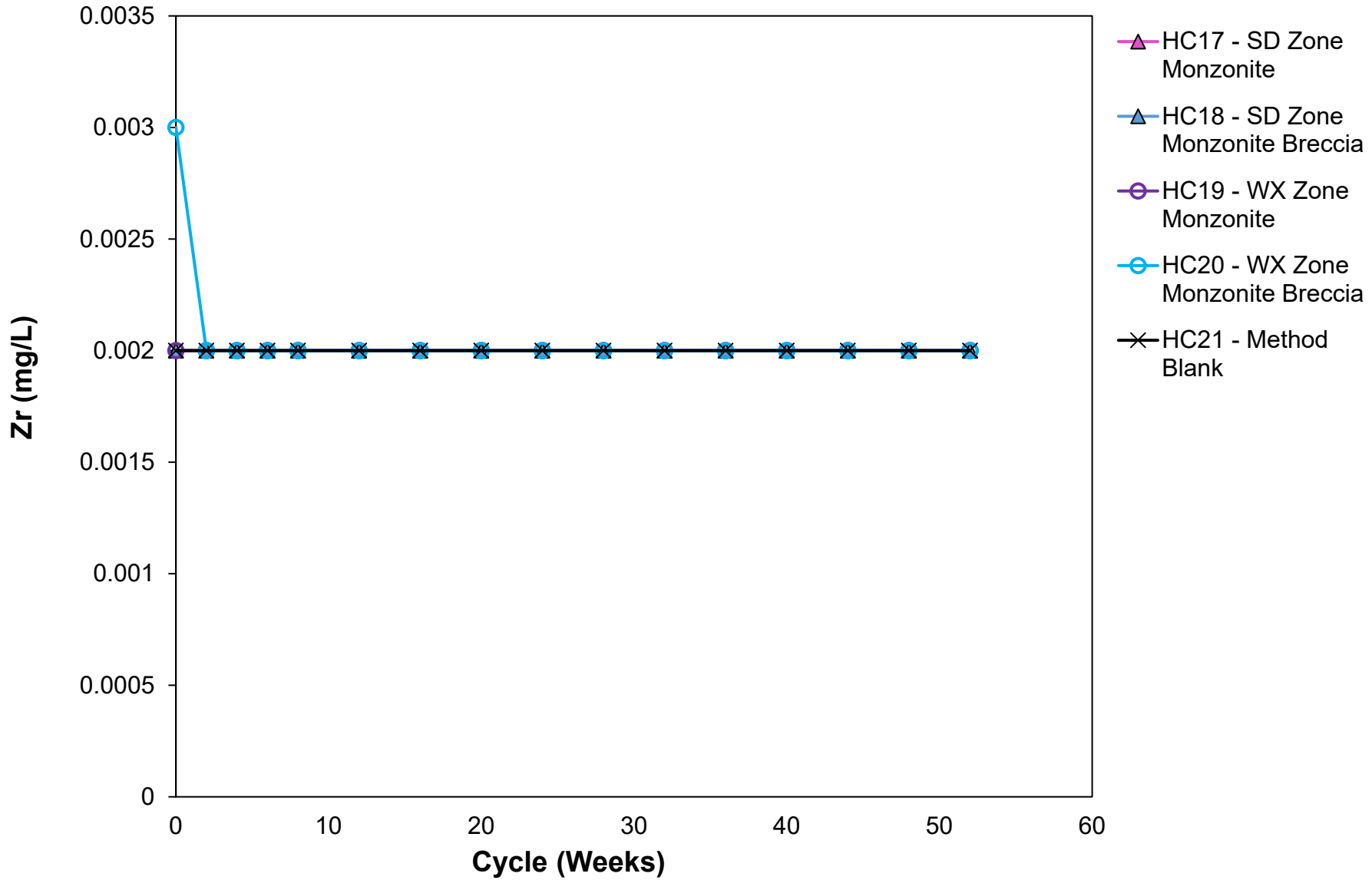

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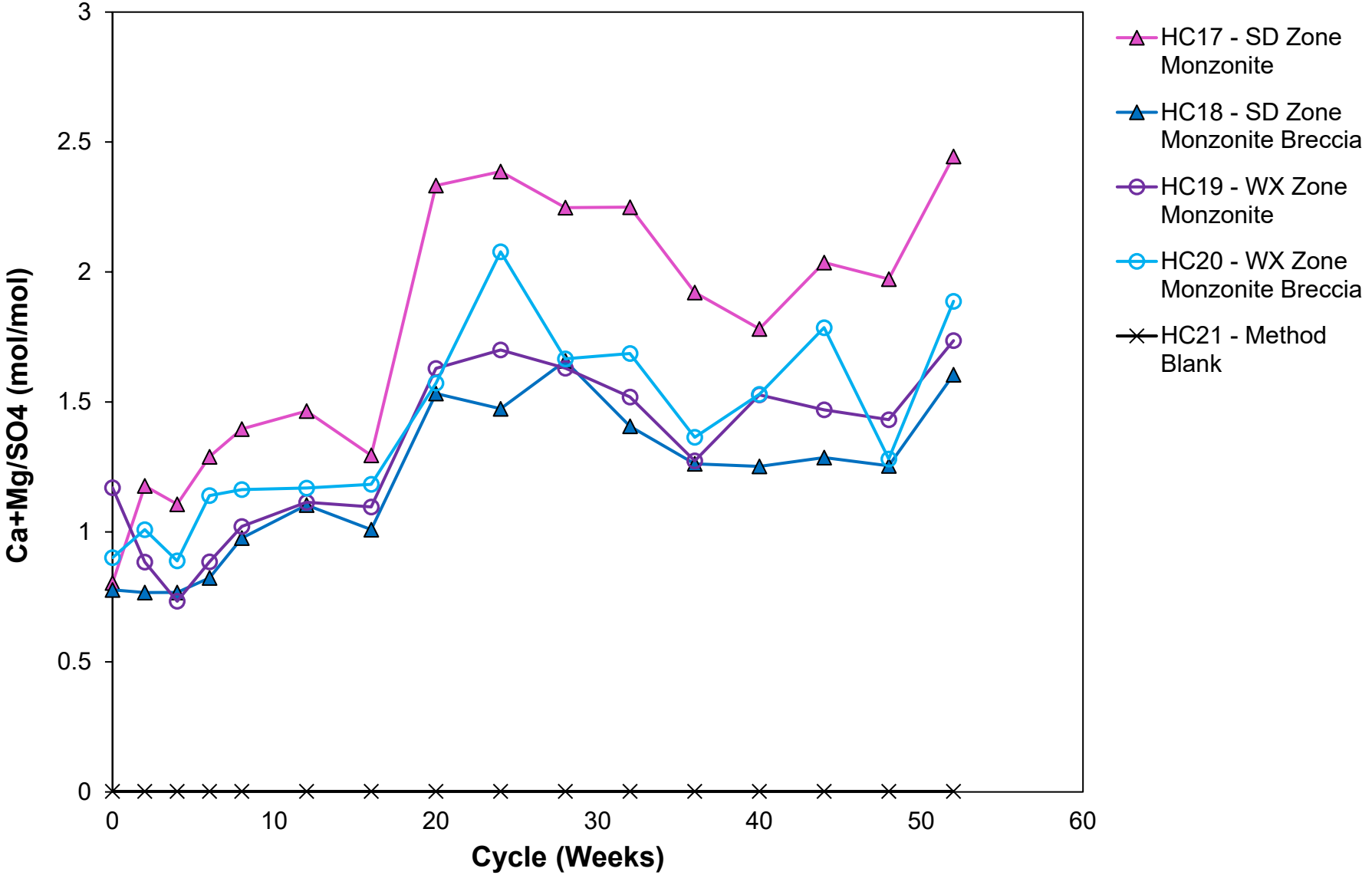

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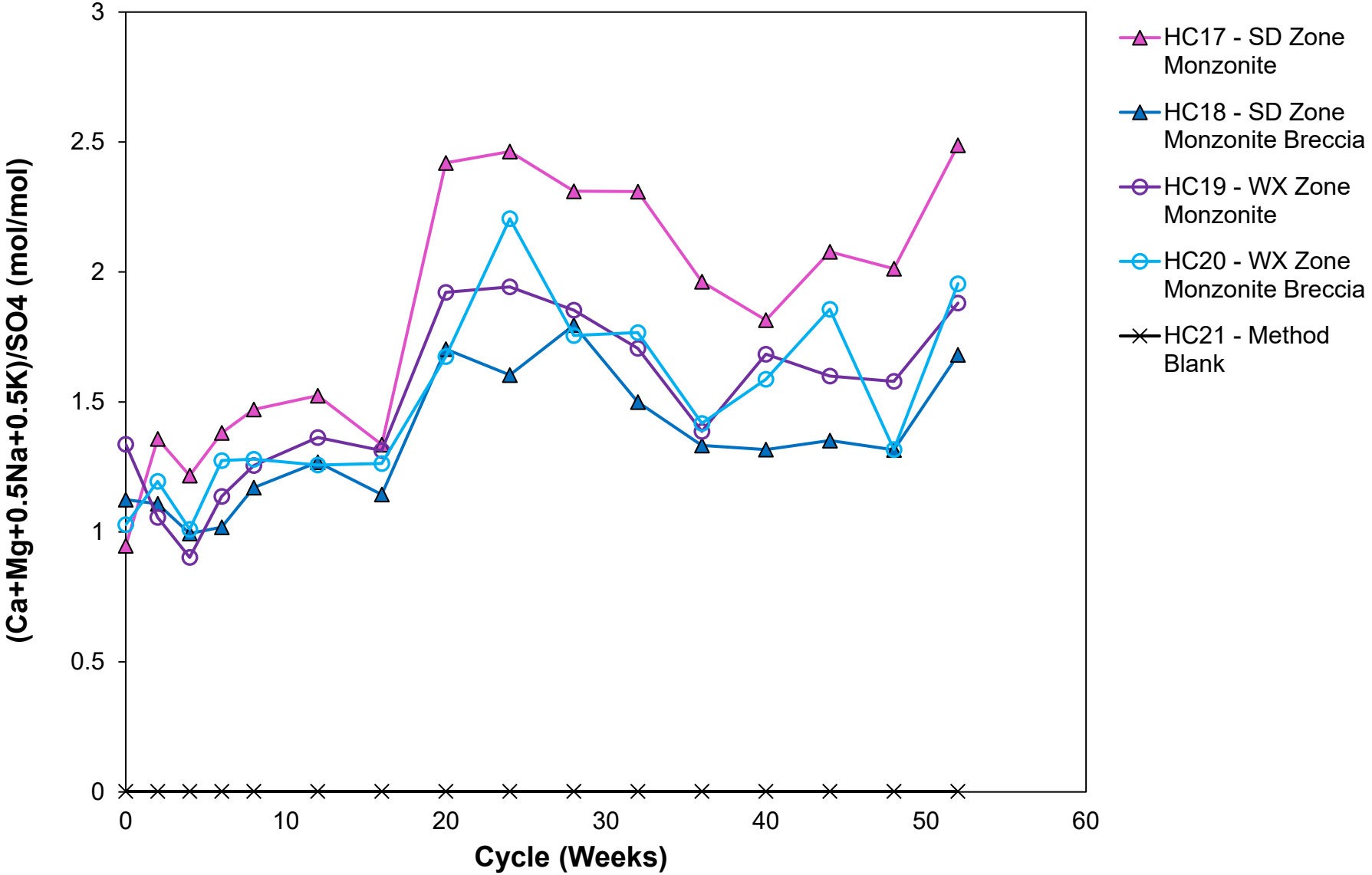

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APPENDIX 5-2: Water Infrastructure Design Report

TECHNICAL MEMORANDUM

DATE May 23, 2024 **Reference No.** 23590671-072-TM-Rev0-31152

TO Matt O'Leary
Mount Polley Mining Corporation

CC Lee Nikl, Jesse Maddaloni, German Pizarro-Sala, and Andrew McIntosh

FROM Nasim Hossein and Don Kidd **EMAIL nasim.hosseini@wsp.com; don.kidd@wsp.com**

TAILINGS STORAGE FACILITY SURFACE WATER MANAGEMENT INFRASTRUCTURE PERMITTING DESIGN MEMORANDUM (974 M RAISE)– MOUNT POLLEY MINE

1.0 INTRODUCTION

The Mount Polley Mine (the Mine) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. MPMC has retained WSP Canada Inc. (WSP) to complete the permit level design for the surface water management infrastructure of the tailings storage facility (TSF) to support raising the TSF to a crest elevation of 974 m at the Mount Polley Mine.

The Mine is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The Mount Polley Mine began production in 1997. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. The embankment is subdivided into three sections: the Main Embankment, Perimeter Embankment, and South Embankment. The TSF embankment for the Mount Polley Mine is planned to be raised for future operations from its currently permitted elevation of 970 m to 974 m (WSP 2024b).

This technical memorandum and attached design drawing package (Attachment 1) present the permit level design of the TSF surface water management infrastructure to support raising the TSF to a crest elevation of 974 m.

2.0 BACKGROUND

Diversion and collection channels are currently in place at the project site around the TSF (Attachment 1, Drawing 03). The TSF 974 m raise design will partially or fully cover some of the existing surface collection and diversion structures around the TSF by the embankment raise to the 974 m elevation. Therefore, water management infrastructure designs (Figure 1) are required to support the TSF embankment raise design and permit amendment.

Permit level design includes the following water management infrastructure:

- Design of TSF seepage management infrastructure, including seepage and surface runoff collection channels listed in Table 1.
- Relocation of the South Embankment Seepage Collection Pond (SESCP) (Attachment 1, Drawing 09) and the Main Embankment Seepage Collection Pond (MESCP) (Attachment 1, Drawing 14).
- Channel 7 is the connection channel between the Central Collection Sump (CCS) and Perimeter Embankment Till Borrow Pond (PETBP) (Attachment 1 – Drawing 21).
- Extension of the PETBP (Attachment 1, Drawing 23).
- Extension of the CCS (Attachment 1, Drawing 26).

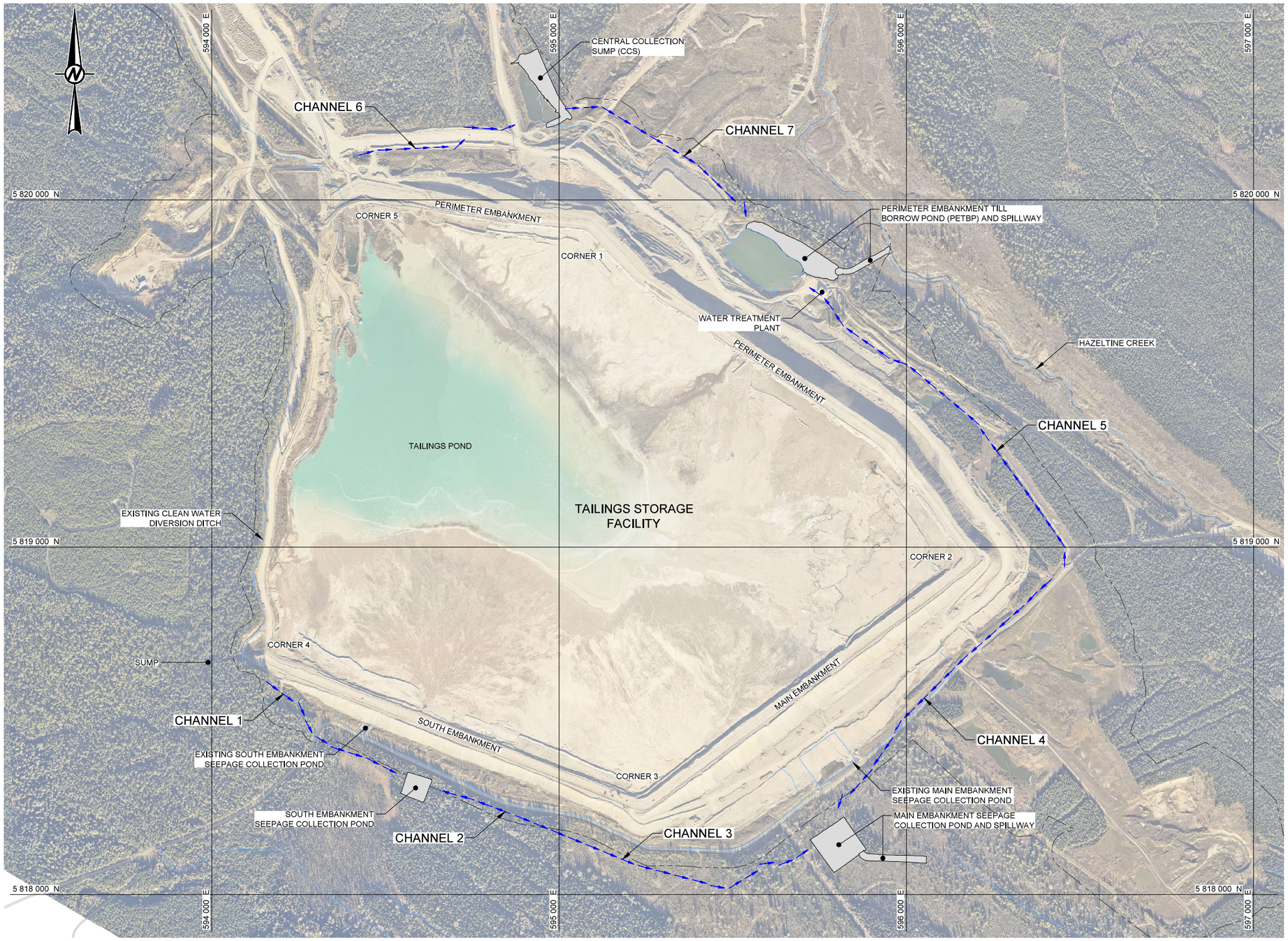

LEGEND

- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE SHOWN IN TAILINGS GRID.
3. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 AERIAL PHOTO PROVIDED BY MPMC, FILE NAME: "231030-Lidar Ortho Reduced.jpg", FLOWN: 30 OCTOBER 2023, RECEIVED: 29 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
DESIGNED	N.H.
PREPARED	A.F.
REVIEWED	N.H.
APPROVED	D.A.K.

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
APPROXIMATE LOCATION OF CHANNELS 1 TO 7

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
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Table 1: Tailings Storage Facility Collection Channels

Channel ID	Receiving Collection Pond/Sump	Drawing Reference Number (Attachment 1)
Channel 1	SESCP	Drawings 05 & 06
Channel 2	SESCP	Drawings 07 & 08
Channel 3	MESCP	Drawings 10 & 11
Channel 4	MESCP	Drawings 12 & 13
Channel 5	PETBP	Drawings 17 & 18
Channel 6	CCS	Drawings 19 & 20
Channel 7	PETBP	Drawings 21 & 22

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump.

2.1 Design Inputs

According to *Environmental Management Act* Permit 11678 (EMA 2022), surface water structures "must be designed to convey all flows up to 1:10-year 24-hour storm event and must be designed to withstand all flows up to the 1:200-year 24-hour storm event, without significant damage". The collection ponds will be designed to store the inflow volume reporting to the ponds during a 1:10-year 24-hour storm event with a spillway designed to convey the 1:200-year 24-hour storm event. The water management system will be designed to convey peak flow rates during events up to and including the 1:200-year 24-hour storm event.

The design basis for the TSF water management system is included in Attachment 2.

2.2 Climate

This section summarizes the climate characteristics (precipitation, air temperature, and humidity) in the area of the Mine; further details can be found in the climate baseline update report (WSP 2022).

Local climate characterization for the site was completed using climatic data recorded at the Mine and nearby Environment and Climate Change Canada (ECCC) climate stations. The local climate stations included Mill Site Weather Station, Weather Station #1 (near mill), and Weather Station #2 (TSF). The ECCC climate stations included Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, and were selected due to their proximity to the Site, length of record, elevation range, and concurrent time-period with local site records.

A long-term precipitation time series representative of the climate conditions at the Mine was derived using the long-term data from the ECCC Likely station (1974 to 1993) and data from the three on-site climate stations with data recorded from 1995 to 2021 (WSP 2022). The data set was infilled using historical data from additional regional climate stations and adjusted for orographic effect. The Mine experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the site is estimated to be 612 mm with a standard deviation of 118 mm.

The estimated mean annual air temperature at the site varies between 1.7°C to 6.3°C, with a long-term mean of 3.9°C. The mean monthly temperature ranges from -6.7°C in January to 15.1°C in July. The historical daily maximum and minimum air temperatures were recorded at 38.1°C in June 2021 and -39.8°C in December 1996, respectively. The mean monthly air temperature usually becomes positive in April and negative in November. The mean annual relative humidity is 68.1%, and the monthly mean relative humidity values range from 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity indicate little variation from the median, which suggests that the site experiences relatively consistent relative humidity on a monthly basis from year to year.

2.3 Design Storm Depths

A frequency analysis was completed on annual maximum 24-hour rainfall depths from the long-term derived precipitation record (WSP 2022) to estimate design storm rainfall depths. 24-hour rainfall depths for select return periods are presented in Table 2.

Table 2: 24-hour Precipitation Depths for the Mount Polley Mine (1974 to 2021)

Return Period (yr)	24-hour Rainfall Depth (mm)[(a)]
2	33
10	47
25	54
100	64
200	69
1000	80

Source: WSP 2022.

(a) Log Pearson III distribution.

The largest runoff volumes are anticipated to be associated with extreme rainfall events occurring during freshet. The snowmelt is expected to occur between March and May with a relatively greater portion melting in April. Snowmelt estimates induced by a corresponding rainfall event (rain plus snowmelt event) were calculated for spring conditions (April) using the equation below (Dunne and Leopold 1978).

$$M_R = 1.42T_a + 2.5 + \frac{RT_aC_W}{L} + 0.0059T_au_2 \quad \text{(Equation 1)}$$

Where:

M_R = snowmelt in mm/d snow water equivalent

R = rainfall depth in mm for return period event duration t, averaged over the duration of the storm

T_a = average air temperature over the duration in °C

C_W = specific heat of water (equal to 1 calorie per gram Celsius [cal/g°C])

L = latent heat of fusion of ice equal to 80 calorie per gram (cal/g)

u_2 = wind speed in km/d

The input parameter values for Equation 1 are summarized in Table 3. The estimated spring maximum 24-hour snowmelt rates are presented in Table 4.

Table 3: Snowmelt Parameter Values

Parameter	Value	Rationale
R_t	See Table 2	snowmelt generated by rainfall events
T_a	3.7°C	average April air temperature (assumed snowmelt period)[(a)]
u_2	225 km/d (2.6 m/s)	average April wind speed[(b)]
C_W	1 cal/g/°C	assumed
L	80 cal/g	assumed

Notes: cal/g°C = calorie per gram Celsius; cal/g = calorie per gram.
(a) WSP 2022.
(b) Golder 2017.

Table 4: 24-Hour Rainfall, Snowmelt, and Rain Plus Snowmelt Depths

Return Period (Years)	Mean Daily Temperature in April (°C)	24-Hour Rainfall (mm)	24-Hour Snowmelt (mm)	24-Hour Rain Plus Snowmelt (mm)
10	3.7	47	14.8	61.8
200	3.7	69	15.9	84.9

2.4 Catchment Characteristics

The catchment delineation was adopted from the previous water management plan study (refer to Golder 2020). The catchment areas were further refined using LiDAR provided by MPMC (Fullerton 2024), TSF embankment and buttress design contours for the 974 and 987[1] m raises, and the alignment of the new water management infrastructure.

The catchment areas for the overall the Mount Polley Mine site are shown in Figure 2. The relevant catchment areas around the TSF embankment raise to 974 m that were refined and used to model runoff for the collection channels are shown in Figure 3 and provided in Table 5. Note that for the design of the ponds, only sloping catchments that generated gravity flow were considered.

[1] The TSF embankment and buttress design for the 987 m raise is currently in progress as of the preparation of this document.

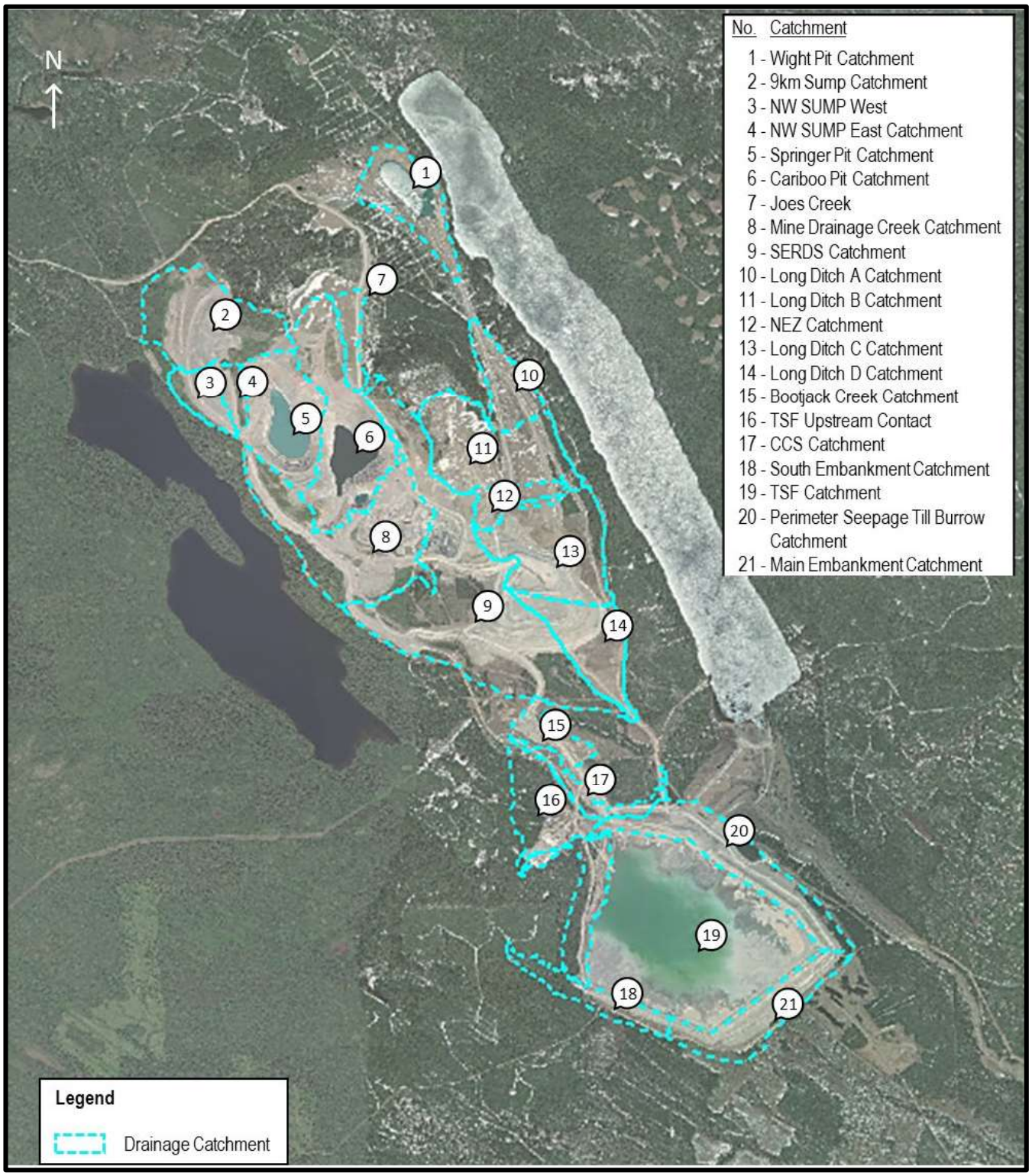

Figure 2: Catchment Areas

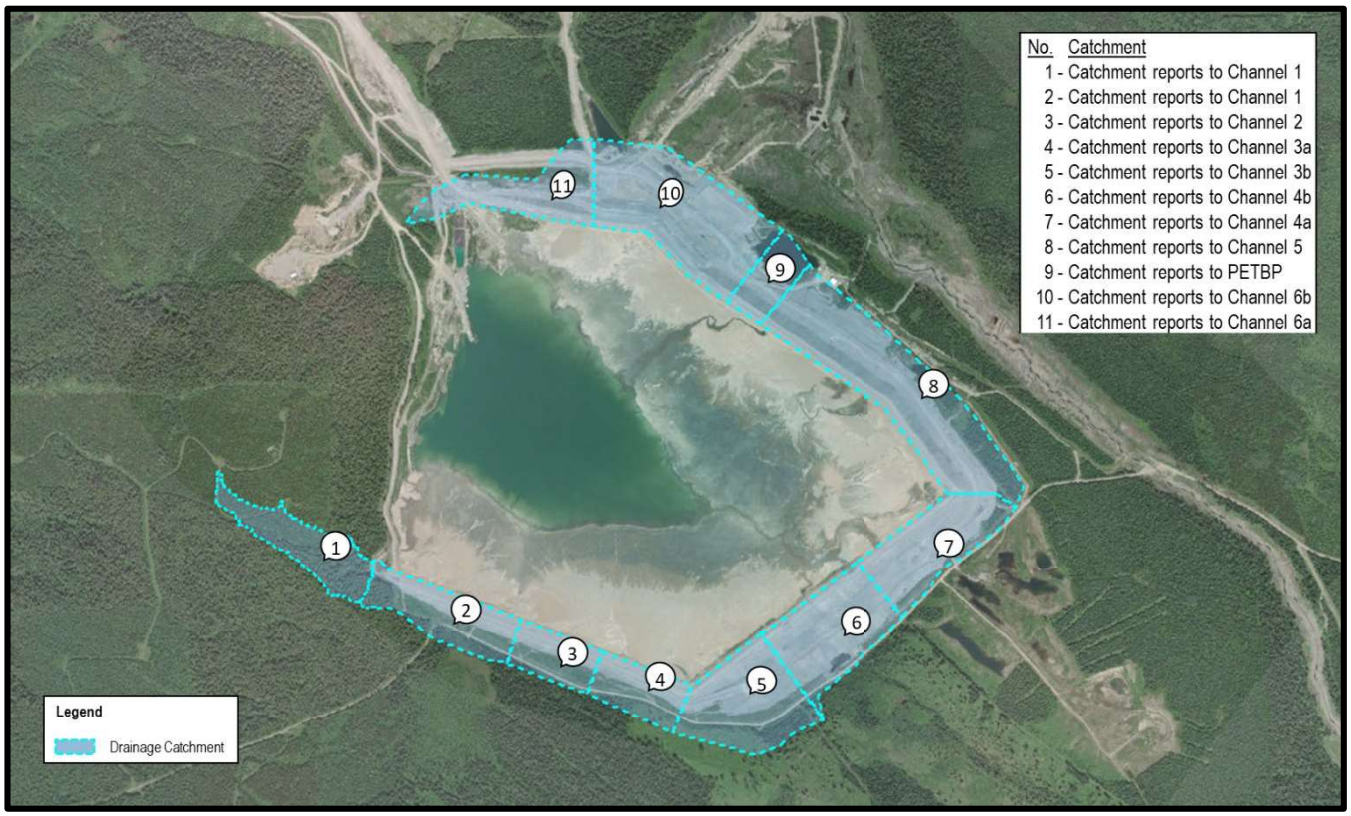

Figure 3: Catchment Areas Around the Tailings Storage Facility

Table 5: Catchment Areas

Collection Sump/Pond	Contributing Catchment[(a)]	Receiving Channel	Watershed Area (km^2)
SESCP	1, 2	Channels 1, 2	0.225
MESCP	3, 4, 5, 6, 7	Channels 3a, 3b, 4a, 4b	0.44
CCS	11, direct catchment area plus 2.4 km^2 from Long Ditch, 1.87 km^2 from SERDS ditch, and TSF upstream contact catchment	Channel 6	4.37
PETBP	8, 9, 10, direct catchment area plus catchment reporting to CCS	Channels 5, 6, 7	4.87

Notes: km^2 = square kilometres; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(a) As shown on Figure 3.

2.5 Seepage and Drain Flow Rate to Collection Channels

Seepage analyses were undertaken to estimate flows through the upstream drain and seepage rates through the embankment and foundation at elevation 974 m to inform the design of the downstream water management infrastructure. Potential groundwater inflow rates to seepage collection ponds, seepage flow through the upstream drain, and seepage through the embankment and foundation are summarized in Table 6 (WSP 2024b). The seepage and drain inflows were considered in the design of the collection channels in Section 4.1.

Table 6: Estimated Seepage Inflow to Collection Ponds

Embankment	Flow through the Embankment and Foundation (m^3/s)[(a)]	Flow Through Upstream Drains at TSF Elevation 974m (m^3/s)[(a)]
South Embankment	4.3×10^{-3}	3.7×10^{-2}
Main Embankment	8.1×10^{-3}	3.8×10^{-2}
Perimeter Embankment	1.5×10^{-2}	5.1×10^{-2}
Perimeter Embankment at Corner 1	9.1×10^{-3}	2.3×10^{-2}

Notes: m^3/s = cubic metres per second; TSF = tailings storage facility.

Source: WSP 2024b.

(a) Seepage rate listed assumes the TSF pond against the embankment.

3.0 HYDROLOGIC ANALYSIS

A rainfall runoff model was implemented using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) software, developed by the US Army Corps of Engineers (USACE 2022). This model was used to estimate the peak runoff flows from the catchments reporting to the surface water management infrastructure.

The rainfall component of the design event was distributed using the US Soil Conservation Service (SCS) Type II rainfall distribution (USDA 2009) (Attachment 2, Section 2.3). The time of concentration was estimated using the SCS TR-55 method (USDA 2009), which divides the longest flow path into sheet flow, shallow concentrated flow, natural channel flow, and constructed channel flow and considers a minimum time of concentration of 3.6 minutes. The lag time was estimated as 60% of the time of concentration. Catchment areas and corresponding time of concentration values are provided in Table 7.

The snowmelt depth was distributed evenly over a 12-hour period each day centred on the peak rainfall intensity of the events.

Catchment curve number (CN) values for different land types were provided in the design basis memorandum (Attachment 2). The weighted CN values to predict direct runoff are provided in Table 7. The wet antecedent moisture condition (AMC III) was considered in the modelling. A schematic flow diagram used for the design of the TSF collection channels and ponds is presented in Figure 4.

Table 7: Catchment Parameters

Catchment	Lag Time (min.)	Catchment Area Type	Weighted CN Value (AMC III)
Channel 1	8.7	TSF embankment and buttress	84
Channel 2	9.5	TSF embankment and buttress	84
Channel 3a[a]	8.9	TSF embankment and buttress	84
Channel 3b[a]	8.3	TSF embankment and buttress	84
Channel 4a[b]	8.6	TSF embankment and buttress	84
Channel 4b[b]	10.2	TSF embankment and buttress	84
Channel 5	15.2	TSF embankment and buttress	84
Channel 6	7.6	TSF embankment and buttress	84
Channel 7	3.6–5.6	TSF embankment and buttress	84
Long Ditch[c]	17.4–45.8	waste rock, disturbed, haul road, and undisturbed[d]	84
SERDS ditch[c]	35.3	waste rock, disturbed areas, haul road, mill site, and undisturbed areas[d]	84
TSF upstream contact[c]	11.4	undisturbed and disturbed areas	78
CCS direct catchment	9.7	disturbed areas, haul road, and undisturbed areas[d]	81
Perimeter Embankment	14.5	waste rock, disturbed areas, haul road, and undisturbed areas[d]	86
TSF upstream non-contact	15.2	undisturbed and disturbed areas	74

Notes: CN = curve number; AMC III = antecedent moisture condition III; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site; CCS = Central Collection Sump.

(a) Channel 3 includes channels 3a and 3b for design discharge analysis purposes.

(b) Channel 4 includes channels 4a and 4b for design discharge analysis purposes.

(c) These catchments report to CCS.

(d) Source: Golder 2016a.

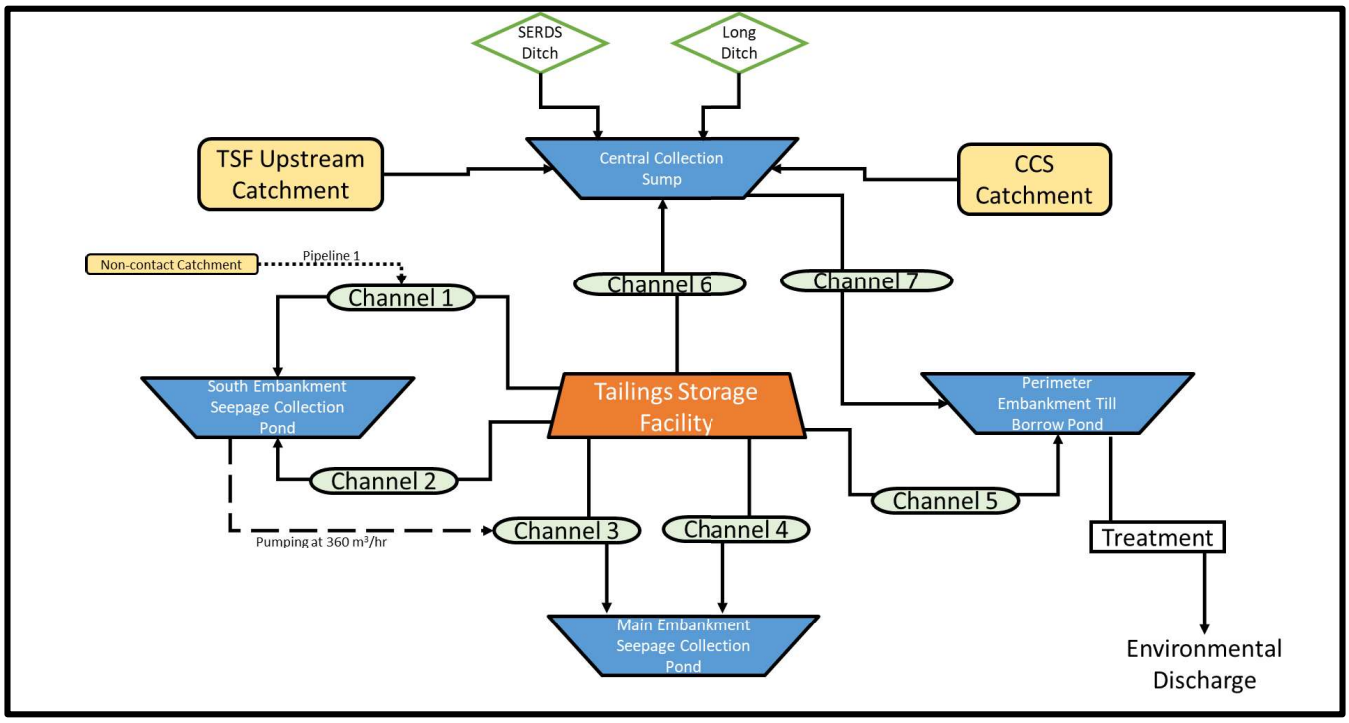

Notes: TSF = tailings storage facility; SERDS = Southeast Rock Disposal Site; CCS = Central Collection Sump.

Figure 4: Flow Diagram – Tailings Storage Facility Collection Channels

The estimated peak flows for the channels resulting from the 24-hour 1:200-year rain plus snowmelt event that includes seepage flow from the TSF and pumped flow from other ponds are provided in Table 8. The estimated peak runoff inflows and volumes, from the 24-hour 1:10-year and 1:200-year rain plus snowmelt events to the SESCP, MESCP, CCS, and PETBP are provided in Table 9. Discharge from the Long Ditch and the SERDS Ditch to the CCS is limited by their conveyance capacity (3.5 cubic metres per second [m^3/s] and 2.9 m^3/s, respectively [Golder 2016b and 2016c]). These peak flows were used in the design as peak discharges to the CCS during a 1:200-year event.

Table 8: Estimated Peak Flow in Channels

Channel	Peak Flow[a] (m^3/s) (1:200-year 24-hr rain plus snowmelt)
Channel 1	1.8
Channel 2	0.7
Channel 3a[b]	0.9
Channel 3b[b]	2.7
Channel 4a[c]	1.5
Channel 4b[c]	3.1
Channel 5	2.7
Channel 6	1.3
Channel 7	10.1

(a) Peak flows include runoff, seepage flow from the TSF and pumped flow from other ponds.
(b) Channel 3 includes channels 3a and 3b for design discharge analysis purposes.
(c) Channel 4 includes channels 4a and 4b for design discharge analysis purposes.

Table 9: Estimated Runoff Inflow Rate and Volume to South and Main Embankment Seepage Collection Ponds, Central Collection Sump, and Perimeter Embankment Till Borrow Pond

Pond/Sump	Runoff Inflow Volume (1000 m^3)		Peak Runoff Inflow Rate (m^3/s)[a]	
	1:10-year	1:200-year	1:10-year	1:200-year
SESCP	4.30	7.32	0.34	0.58
MESCP[b]	15.78	26.71	1.25	2.13
CCS	115.5	168.5	10.0	13.8
PETBP	128.3	188.8	8.4	12.6

Notes: m^3/s = cubic metres per second; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(a)Peak flows include direct precipitation to ponds.

(b) Estimated runoff and volume include contingency for extension of catchment reporting to Channel 4 as per potential elevation 987 m tailing storage facility embankment raise.

4.0 HYDRAULIC AND CIVIL DESIGN

This section describes the TSF surface water management infrastructure design. The estimated peak design flows used in the design are described in Section 3.0.

4.1 Channels

The collection channels were sized to convey the peak flow generated from the 1:200-year 24-hour storm event, as well as any seepage/drain flow plus any pumped flow from other ponds if applicable. The seepage flow rates are presented in Section 2.5. The channels were designed to include a minimum 0.3 metre freeboard.

The channels were sized assuming uniform flow conditions using the Manning's equation and accounting for superelevation in the curves. The Manning's coefficient values used for the channels are presented in Table 10. Manning's values for capacity were used in Manning's equation to size the channel for conveyance capacity. Manning's values for stability were used to verify the stability of the channel lining during design flow conditions; the maximum channel longitudinal slope was used for stability verification. Superelevation for each curve along the channels was estimated using the US Army Corps of Engineers (USACE 1972) method and results from the Manning's equation. The estimated superelevation was minimal, eliminating the need for any local increase in channel depth. For erosion protection of the channels, the riprap class was selected considering the maximum permissible velocity of the riprap provided in Table 11.

Table 10: Manning's Values for Channel Materials

Material	D_{50}	Manning's Values for Capacity	Manning's Values for Stability
Plastic	-	0.012	0.010
Gravel, uniform section, clean[(a)]	-	0.030	0.022
Riprap class 10 kg	200	0.038	0.034
Riprap class 25 kg	270	0.039	0.035
Riprap class 50 kg	340	0.042	0.037
Riprap class 100 kg	425	0.044	0.039
Riprap class 280 kg	610	0.046	0.042
Riprap class 1 000 kg	915	0.049	0.044
Grouted riprap	380	0.040	0.028

Notes: - = not applicable; D_{50} = median particle size.
(a) Manning's n for channels (Chow 1959).

Table 11: Maximum Permissible Velocity for Riprap and Plastic

Riprap Class	Velocity (m/s)
Plastic	5.0
Gravel, uniform section, clean	1.0
10 kg	2.7
25 kg	3.1
50 kg	3.5
100 kg	3.9
280 kg	4.5
Riprap class 1 000 kg	5.0
Grouted riprap	refer to Figure 7

Notes: m/s = metres per second.
Source: BC MOTI (2020) – values rounded.

Each of the TSF surface water management infrastructure channels is described below. The channel dimensions, normal flow depth, and normal flow velocity for each channel are provided in Table 12.

Table 12: Collection Channels Design Summary

Channel (Approximate Station PVI [m])	Total Flow (m^3/s)[(b)]	Base Width (m)	Channel Depth) (m)	Side Slopes (xH:1V)	Channel Slope (%)	Flow Depth (m)	Flow Velocity (m/s)	Material
Channel 1 (0+080 to 0+370)	1.8	1.0	1.0	2.0	12.00	0.3	3.4	50 kg class riprap
Channel 1 (0+370 to 0+614)	1.8	3.0	0.8	2.0	0.40	0.5	1.0	10 kg class riprap
Channel 2 (0+000 to 0+190)	0.7	1.0	1.0	2.0	0.3	0.5	1.0	compacted earth
Channel 2 (0+190 to 0+263)	0.7	1.0	1.0	2.0	2.0	0.3	1.4	10 kg class riprap
Channel 3 (0+000 to 0+400)	0.9	1.0	1.0	2.0	0.5–2.3	0.5	1.6	10 kg class riprap
Channel 3 (0+400 to 0+860)	2.7	1.0	1.0	2.0	5.0	0.5	2.7	25 kg class riprap
Channel 3 (0+860 to 0+928)	2.7	1.0	1.2	2.0	0.5	0.9	1.2	10 kg class riprap
Channel 4 (0+000 to 0+510)	1.5	1.0	1.0	2.0	0.50–4.3	0.7	2.2	10 kg class riprap
Channel 4 (0+510 to 0+630)	3.1	1.0	1.0	2.0	7.40	0.5	3.3	50 kg class riprap
Channel 4 (0+670 to 0+957)	3.1	1.0	1.3	2.0	0.5–2.40	0.9	2.3	10 kg class riprap
Channel 5 (0+000 to 0+810 and 0+967 to 1+153)	2.7	1.0	1.2	2.0	0.5–2.0	0.9	2.1	10 kg class riprap
Channel 6 (0+000 to 0+230 and 0+375 to 0+458)	1.3	1.0	1.0	2.0	2.5-5.0%	0.4	2.4	10 kg Class Riprap
Channel 6 (0+230 to 0+310)	1.3	1.0	1.0	2.0	8.0%	0.3	2.8	25 kg Class Riprap
Channel 7 (0+018 to 0+060 and 0+190 to 0+230)	10.1	6.0	1.5	2.0	10.00	0.4	3.9	100 kg class riprap
Channel 7 (0+060 to 0+146 and 0+172 to 0+190)	10.1	6.0	1.9	2.0	0.50	0.9	1.6	10 kg class riprap
Channel 7 (0+230 to 0+689)	10.1	6.0	1.6	2.0	0.10	1.2	1.2[(c)]	compacted earth
Channel 7 (0+689 to 0+692)	10.1	10.0	0.6	2.0	17.00	0.3	4.0	100 kg class riprap

Notes: PVI = point of vertical intersection; m^3/s = cubic metres per second.

(a) Total flow is the peak flow from storm events (presented in Table 8) plus the seepage flows.

(b) This is a temporary channel and some extension of erosion will be acceptable.

Channel 1—Channel 1 collects runoff from the embankment and the natural catchment (catchment 1 in Figure 3) and drains to SESCP. A pipeline (pipeline 1) is required to convey flow from the depression area to Channel 1. Channel 1 has a base width that varies between 1.0 m to 3.0 m with 2H:1V side slopes and channel depth that varies between 0.8 to 1.0 m. The design for pipeline 1 is described in Section 4.2 and Table 15.

Channel 2—Channel 2 collects runoff from the embankment and drains to SESCP. Channel 2 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 m.

Channel 3—Channel 3 collects runoff from the embankment and drains to MESCP. In addition, pumping from the SESCP at a rate of 360 m^3/hr is to be conveyed to the MESCP by Channel 3 (Attachment 2). Channel 3 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 to 1.2 m.

Channel 4—Channel 4 collects runoff from the embankment and drains to MESCP. The existing Channel 4 is to be maintained until future phases of TMF development (or site development). Channel 4 has a base width of 1.0 m with 2H:1V side slopes and channel depth varies between 1.0 to 1.3 m.

Channel 5—Channel 5 collects runoff from the embankment and drains to PETBP. Channel 5 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.2 m.

Channel 6—Channel 6 collects runoff from the embankment and drains to CCS Pond. Channel 6 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 m.

Channel 7—Channel 7 conveys discharge from the CCS to the PETBP and collects runoff from the perimeter embankment. Culvert 7 will be located approximately 130 m downstream from the CCS discharge point to convey discharge from the pond. The channel is designed to convey discharge from a 1:200-year 24-hour storm event to PETBP through culvert 7 plus runoff from catchment 10 (Figure 3) generated from a 1:200-year 24-hour storm event with a minimum of 0.3 m freeboard. Channel 7 has a base width of 6.0 m with 2H:1V side slopes and channel depth of 0.7 to 1.9 m.

A HEC-RAS 2D model was developed to simulate discharge of the design flow and flow depth from a 1:10-year 24-hour storm event and to confirm overtopping does not occur during the storm event. The HEC-RAS 2D model was developed using terrain generated by incorporating the proposed channel 7 design to LiDAR provided by MPMC (February 2024) and covers downstream of the CCS discharge point extending to approximately 200 m downstream of culvert 7. Culvert 7 is represented by a 2D connection structure as indicated in Figure 5; its characteristics are described in Table 15. The analysis indicates that discharge from a 1:200-year 24-hour storm event (9.58 m^3/s) is sufficiently conveyed without overtopping. The maximum flow depth within the model boundary was 1.7 m and occurs immediately upstream of culvert 7 (Figure 6).



Figure 5: Extent of Simulated 1:200 Year 24-Hour Storm Event for Channel 7

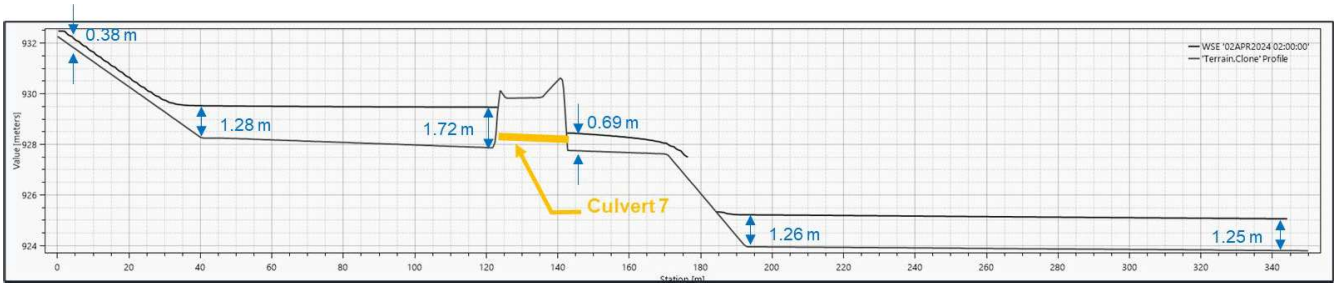

Figure 6: Channel 7 Simulated 1:200 Year 24-Hour Storm Event Water Surface Profile

4.1.1 Discharge Chute

Collection channels will require a steep (approximately 50% longitudinal slope) outfall structure for discharging to the collection ponds. Grouted riprap was selected for the lining material for erosion protection. The required riprap thicknesses were determined based on the peak flow velocity during a 1:200-year 24-hour storm event (Figure 7) and are summarized in Table 13.

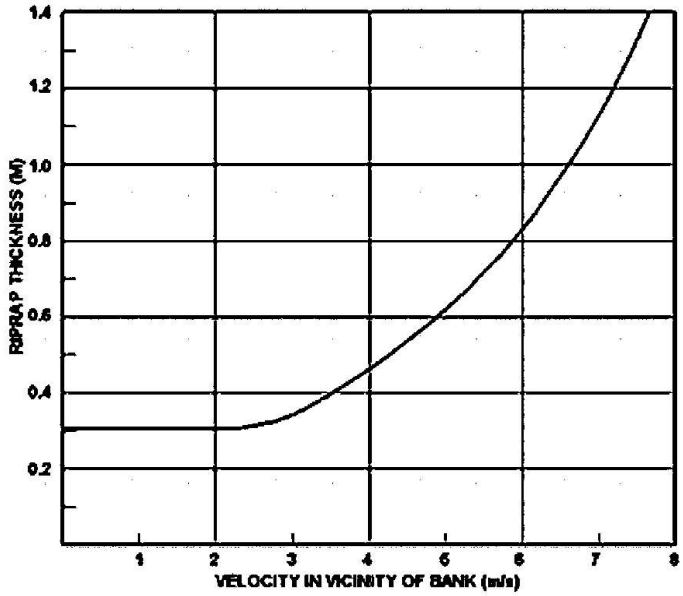

Source: HEC 11 2024.

Figure 7: Required Blanket Thickness as a Function of Flow Velocity

Table 13: Discharge Chute Design Summary

Chute	Base Width (m)	Channel Depth (m)	Longitudinal Slope (%)	Flow Velocity (m/s)	Grouted Riprap Thickness (mm)	Grout Penetration Thickness (mm)
1	3.0	0.5	50	5.2	700	200
2	1.0	0.5	50	5.0	600	200
3	2.0	0.5	50	6.2	900	200
4	3.0	0.5	50	6.5	1000	200
5	2.5	0.5	50	6.5	1000	200
6	1.0	0.6	20	4.5	600	200
7	11.0	0.5	50	6.9	1,100	200

4.1.2 Energy Dissipation Structure

Energy dissipation structures (stilling basin) will be required for channels 6 and 7 at the hydraulic jump. A hydraulic jump forms during the conversion of kinetic energy to potential energy where the channel slope decreases significantly and leads to a sudden change in flow depth and velocity.

The stilling basins were sized using results from the Manning's equation and three hydraulic design methods from the Department of the Interior Bureau of Reclamation (USBR 1984; USACE 1977) and the Prairie Farm Rehabilitation Administration (PFRA 1979).

The stilling basins will be constructed with a longitudinal slope of 0%. Consistent with the channel design inputs (Attachment 2), 0.3 m of freeboard was accounted for in defining the required depth of the energy dissipation structures. The design dimensions of the stilling basins are provided in Table 14.

Table 14: Stilling Basin Dimensions

Channel	Upstream Slope%	Downstream Slope%	Flow Velocity V_1 (m/s)	Basin Depth (m)	Basin Length (m)
Channel 6	16.7%	1%	3.5	1.1	1.0
Channel 7	10.0%	0.1%	3.9	1.0	6.0

As a result, channel depth is increased to 1.4 m at station 2+507 of channel 7 for a distance of 5.9 m to maintain a minimum freeboard of 0.3 m. The freeboard requirement at station 2+209 of channel 7 is already satisfied by the 1.8 m deep channel; thus, no additional channel depth is required.

4.2 Culverts/Pipelines

Culverts will be placed along the channels at road crossings and a pipeline will be placed to convey runoff from the western portion of catchment 18 (Figure 2) that collects in a natural depression to channel 1. Culverts and pipelines were sized using the HY-8 design software (USDOT 2022), which is a 1D steady-state hydraulic modelling program developed by the U.S. Department of Transportation, Federal Highway Administration. Culverts and pipelines were sized to convey the 1:200-year 24-hour storm event from the reporting catchment. A summary of the culvert designs is provided in Table 15 and a summary of the pipeline design is provided in Table 16. A typical cross-section and plan view of the culverts and the pipeline are provided in Attachment 1, Drawings 06, 13, 20, and 22.

Table 15. Culvert Design Summary

Culvert	Diameter (mm)	No. of Barrels	Material	Design Slope (%)	Design Flow (m^3/s)	Inlet Flow Depth (m)	Outlet Flow Velocity (m/s)
Channel 1 culvert	1000	2	corrugated steel	12.5	1.8	0.8	4.5[(a)]
Channel 4 culvert	1000	2	corrugated steel	5.8	1.5	0.8	3.2
Channel 6 culvert A (station 0+310 to 0+375)	800	2	corrugated steel	2.5	1.3	0.7	2.1
Channel 6 culvert B (station 0+470 to 0+501)	900	2	corrugated steel	0.5–33	1.32	0.7	1.8
Channel 7 culvert	1400	3	corrugated steel	0.5	9.6	1.8	2.9

Notes: m^3/s = cubic metres per second.

(a) Additional erosion protection measures required at the outlet to protect bedding.

Table 16: Pipeline Design Summary

Pipeline	Diameter (mm)	No. of Barrels	Material	Design Slope (%)	Design Flow (m^3/s)	Inlet Flow Depth (m)	Outlet Flow Velocity (m/s)
Pipeline 1	800	1	HDPE	1.0	0.61	0.7	2.9

Notes: m^3/s = cubic metres per second; HDPE = high-density poly ethylene.

Construction equipment on the site includes 789 (317,515 kg) and 785 (225,826 kg) mine haul trucks. A 2.0 metre cover depth is adopted for the culverts where conditions allow, based on experience with other mine sites with similar truck loading conditions. The minimum cover requirements were calculated using the methodology in the Corrugated Steel Pipe Institute handbook (CSPI 2007) and are summarized in Table 17. Pipeline 1 has a minimum cover of 0.3 metres as it will not be subjected to traffic loading.

Table 17: Culvert Cover

Culvert	Min. Cover Calculated (m)	Adopted Cover (m)
Channel 1 Culvert	0.6	2.0
Channel 4 Culvert	0.6	2.0
Channel 6 Culvert A	0.6	2.0
Channel 6 Culvert B	0.6	2.0
Channel 7 Culvert	0.9	2.0

4.3 Ponds

The SESCP and MESCP are required to be relocated, and the PETBP extended, to accommodate the TSF embankment 974 m raise footprint. The new ponds were designed to store the inflow generated from the 1:10-year 24-hour rain plus snowmelt event while allowing 0.5 m at the bottom for sediment storage. In addition, the design included 0.3 m of freeboard for the design storm event. The SESCP and MESCP locations were proposed outside the TSF 987 m extents as per MPMC request. The design inputs for collection ponds are provided in Attachment 2.

The inflow to the ponds includes the seepage and runoff that will be collected through the collection channels and the direct precipitation to the ponds. The water transfers between the collection channels and ponds are summarized below and a schematic flow diagram is provided in Figure 4 in Section 3.0.

SESCP—Surface water and seepage from the South Embankment will be directed to the pond through channels 1 and 2 (Attachment 1, Drawings 05 to 09). Currently, water from the pond is pumped to the MESCP at the pump capacity of 360 cubic metres per hour (m^3/h) and is conveyed by channel 3 (Donoso 2023). Dimensions for the SESCP are provided in Table 18.

MESCP—Seepage and runoff from the Main Embankment will be directed to the pond through channels 3a, 3b, 4a, and 4b (see Attachment 1, Drawings 10 to 16). Currently, water from the pond is being pumped to the TSF at the pump capacity of 360 m^3/h. Dimensions for the MESCP are provided in Table 18.

CCS and PETBP—Runoff and seepage from the Perimeter Embankment will be collected through channels 5, 6, and 7 (see Attachment 1, Drawings 17 to 26) in the PETBP. CCS receives contact water runoff from its direct catchment plus runoff from SERDS Ditch, Long Ditch, and TSF upstream catchment area via CCS (Attachment 1, Drawing 26; (Golder 2020)). The pond bottom elevation used in this study was taken from a previous Golder design study for the PETBP Spillway (Golder 2021). Dimensions for the PETBP are provided in Table 18

The SESCP and MESCP will be excavated in natural ground to a depth of 3 metres. It is noted that the ponds will receive groundwater flow underneath the embankments according to the *Tailing Storage Facility Site Characterization Report* (WSP 2023). WSP also estimated the potential groundwater inflow rate or seepage rate to seepage collection ponds (WSP 2024c). The results showed that seepage rate is predicted to be lower than 0.9 L/s for MESCP and 1.3 L/s for SESCP. The assessment was based on the design depth of 3 metres and a deepened design allowing for more water storage capacity or optimizing top surface area.

Table 18: Ponds Design Summary

Dimensions	SESCP	MESCP	CCS Pond	PETBP
Total Depth (m)(3)	3	3	2.0	8 (2)
Side Slopes	2H:1V(4)	2H:1V(4)	2H:1V(1)	2H:1V(1)
Dead Volume (0.5 m depth at bottom of pond) (1000 m^3)	1.25	6.82	7.63	5.6 (2)
Live Storage Below Spillway Invert (1000 m^3)	5.37	17.31	7.63	133.9
Spillway Crest Elevation (m)	936.3	908.3	933.0(5)	923.9
Crest Elevation (m)	937	909	934.5	925

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(1) Refers to extension of the Pond.

(2) Assumed PETBP pond bottom elevation of 917 m (Golder 2021).

(3) Between Pond Bottom Elevation and Minimum Crest Elevation.

(4) The stability analysis (WSP 2024a) indicates that the proposed cut slopes at a ratio of 2H:1V meets the desired safety standards across all loading conditions.

(5) Invert elevation of channel 7.

4.4 Spillways

4.4.1 Spillway Inlet

The spillway inlets for the MESCP, CCS Pond and PETBP were modelled in the HEC-HMS model (Section 3.0). The invert elevations of the spillways were estimated iteratively using the HEC-HMS model to provide the required 0.5 metre freeboard between the maximum water level design flow during 24-hr 1:200-year rain plus snowmelt event and the crest of the pond.

The spillways will be trapezoidal with side slopes of 2H:1V. The rectangular and triangular broad-crested weir equations were used to define the capacity of the weir. Rectangular weir coefficients of 1.4-1.7 and triangular weir coefficients of 1.0 to 1.3 were adopted depending on the hydraulic configuration of the spillway channel and crest (Smith 1995). Table 19 provides a summary of the spillway invert arrangements and resulting water level and discharge.

Due to the challenging topography in the vicinity of SESCP, implementing a spillway as a channel was not the most practical solution. Instead, alternative methods employing pumps to regulate and maintain specific elevation levels within the pond, will be employed. The details will be provided at the next stage of design.

Table 19: Summary of the Spillway Arrangements

Spillway	Pond Crest Elevation (m)	Spillway Invert Elevation (m)	Initial Pond Elevation (m)	Weir Bottom Width (m)	Weir Side Slope	Peak Discharge (m^3/s)	Peak Water Elevation (m)	Freeboard (m)
MESCP Spillway	909	908.3	908.3[(a)]	10.0	2H:1V	4.6	908.7	0.3
CCS Pond	934.5	933.0	933.0[(a)]	10.0	2H:1V	10.9	934.0	0.5
PETBP Spillway	925.0	923.9	922.7[(b)]	10.0	2H:1V	7.2	924.5	0.5

Notes: m^3/s = cubic metres per second.

(a) Initial water levels were assumed to be at the spillway invert elevation.

(b) Initial water level to be maintained to optimize the spillway outlet channel.

4.4.2 Spillway Outlet Channel

The MESCPand PETBP spillways and channels will be excavated in natural ground and discharge to the environment. The spillway channels will be lined with riprap along the reaches with flow velocity greater than 1 m/s. The results of the hydraulic sizing of the spillway channels are summarized in Table 20.

Table 20: Hydraulic Sizing of Spillway Channel Outlets

Spillways	Slope (%)	Channel Depth (m)	Side Slopes	Base Width (m)	Lining	Flow Depth (m)	Max Flow Velocity (m/s)
MESCP spillway outlet channel (Station 0+007to0+060)	0.54	1.8	2H:1V	2.0	10 kg class riprap	0.9	1.3
MESCP spillway outlet channel (Station 0+060 to0+201)	0.10	1.8	2H:1V	2.0	compacted earth	1.2	0.9
PETBP spillway outlet channel (Station 0+010 to 0+164)	8.0	0.7	2H:1V	5.0	50 kg class riprap	0.4	3.5
PETBP spillway outlet channel (Station 0+164 to 0+180)	1.0	1.2	2H:1V	3.0	10 kg class riprap	0.8	2

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond.

4.4.3 Spillway Discharge Structure

Discharge (dissipation) structures will be placed at the outlet of the spillway channels to dissipate energy, prevent erosion and to spread the discharge to the downstream environment. The width of the discharge structure is based on the top width of the respective spillway outlet channel and the length is based on the channel depth reduced to natural grade following a 2H:1V slope (Attachment 1). The dissipation structure of the PETBP spillway will be lined with 400 mm of 10 kg class riprap. Table 21 summarizes the discharge structures dimensions.

Table 21: Spillway Discharge Structure Dimensions

Spillway	Slope (%)	Width (m)	Length (m)
MESCP spillway discharge structure	0.1	2-20	20.0
PETBP spillway discharge structure	1.0	13-20	11.0

5.0 RECOMMENDATIONS FOR FUTURE STUDIES

The design of surface water management structures included in this document were based on information available at the time of design preparation. The following activities are recommended to refine or update the water management structure design presented in this document:

- Resolve the conflict between the existing roads and proposed channels alignment near Corner 3, Corner 2, and between these two corners.
- Confirmation of up-to-date as built information of all the existing mine infrastructure in proximity to the proposed water infrastructure alignments.
- Test pit investigation within the SESCP and MESCP footprints and along channels near high phreatic surface area as part of their geotechnical assessment. The estimated potential groundwater inflow rates should be reviewed after hydraulic testing of the subsurface soils and the lithologic information and observations from the test pit investigation are available.
- Assessment of rock riprap sources of supply, focusing on cost, quality of rock, and availability of the rock riprap.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust that the information presented herein meets the current MPMC requirements. Please do not hesitate to contact the undersigned with any questions or concerns.

WSP Canada Inc.





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PERMIT TO PRACTICE #1000200
Engineers & Geoscientists BC

Attachments: Attachment 1: Water Management Infrastructure Drawings
Attachment 2: TSF Surface Water Management Infrastructure – Design Basis Memorandum

https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/072-tm-31152-tsf wmi 974/rev0/23590671-072-tm-rev0-31152-tsf surface water management infrastructure design for tsf 974 m raise 23may_24.docx

STUDY LIMITATIONS

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ATTACHMENT 1

Water Management Infrastructure Drawings

MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

DRAWING LIST				
DRAWING NUMBER	DRAWING TITLE	REVISION NUMBER	PURPOSE OF ISSUE	DATE OF ISSUE
01	DRAWING LIST AND PROJECT LOCATION PLAN	0	ISSUED FOR PERMITTING	2024-05-23
02	SITE PLAN	0	ISSUED FOR PERMITTING	2024-05-23
03	GENERAL ARRANGEMENT - PLAN VIEW	0	ISSUED FOR PERMITTING	2024-05-23
04	GENERAL ARRANGEMENT - PLAN VIEW WITH AERIAL PHOTO	0	ISSUED FOR PERMITTING	2024-05-23
05	CHANNEL 1 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
06	CHANNEL 1 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
07	CHANNEL 2 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
08	CHANNEL 2 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
09	SOUTH EMBANKMENT SEEPAGE COLLECTION POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
10	CHANNEL 3 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
11	CHANNEL 3 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
12	CHANNEL 4 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
13	CHANNEL 4 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
14	MAIN EMBANKMENT SEEPAGE COLLECTION POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
15	MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
16	MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
17	CHANNEL 5 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
18	CHANNEL 5 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
19	CHANNEL 6 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
20	CHANNEL 6 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
21	CHANNEL 7 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
22	CHANNEL 7 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
23	PERIMETER EMBANKMENT TILL BORROW POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
24	PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
25	PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
26	CENTRAL COLLECTION SUMP - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23



PROJECT LOCATION PLAN
NOT TO SCALE

ISSUED FOR
PERMITTING

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

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PROFESSIONAL ENGINEER
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
DRAWING LIST AND PROJECT LOCATION PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	01 of 26	01

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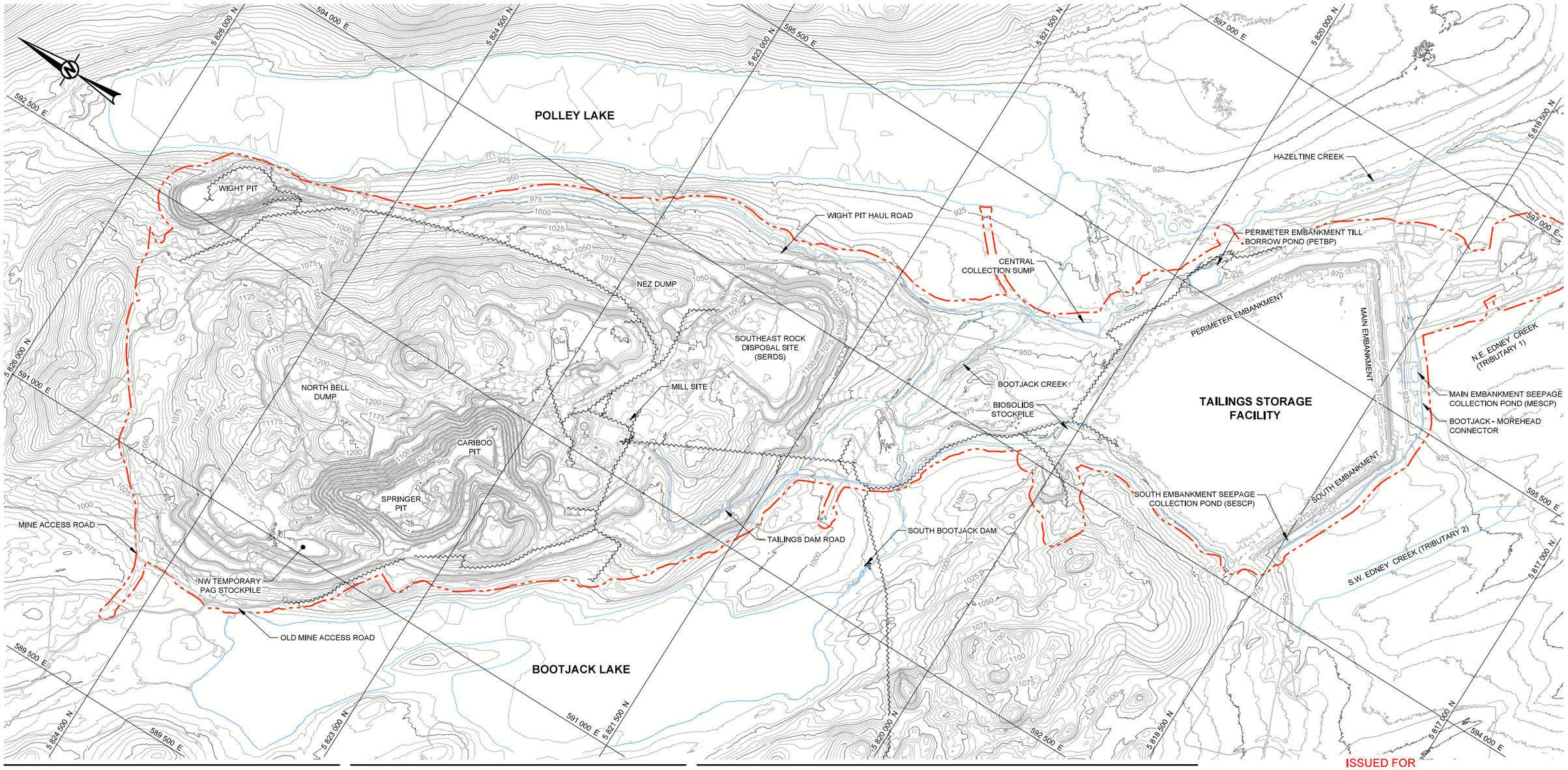

LEGEND

- GROUND CONTOURS (SEE NOTE 4)
- SHORELINE (SEE REFERENCE 4)
- WATERCOURSE (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 5)
- POWER LINE (SEE REFERENCE 6)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 25 m MAJOR AND 5 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2013-2023 (SEE REFERENCES 1-3).

REFERENCES

1. 2013 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MTPOLLEY2013-DTM.dwg", SURVEYED: 2013, RECEIVED: 1 OCTOBER 2014.
2. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: SEPTEMBER 3, 2014.
3. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-Mine Lidar Contour 0.25.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
4. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", SURVEYED: 2013, RECEIVED: 5 SEPTEMBER 2014.
5. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
6. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

SITE PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	02 of 26	02

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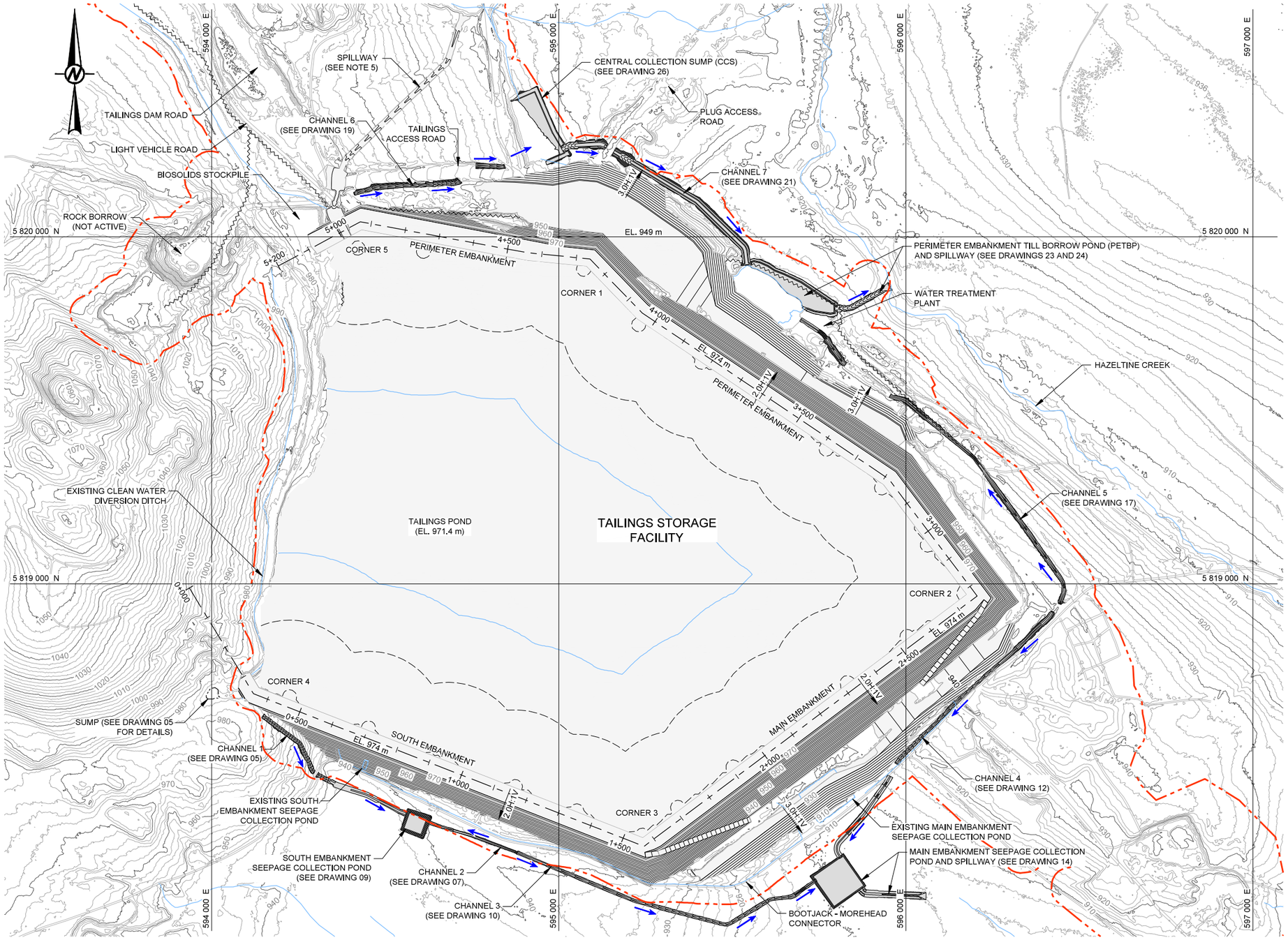

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE REFERENCE 1)
- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- TAILINGS DEPOSITION DESIGN CONTOURS
- TAILINGS POND (EL. 971.4 m)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR, TAILINGS DEPOSITION CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
5. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-Mine Lidar Contour 0.25.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

GENERAL ARRANGEMENT PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	03 of 26	03

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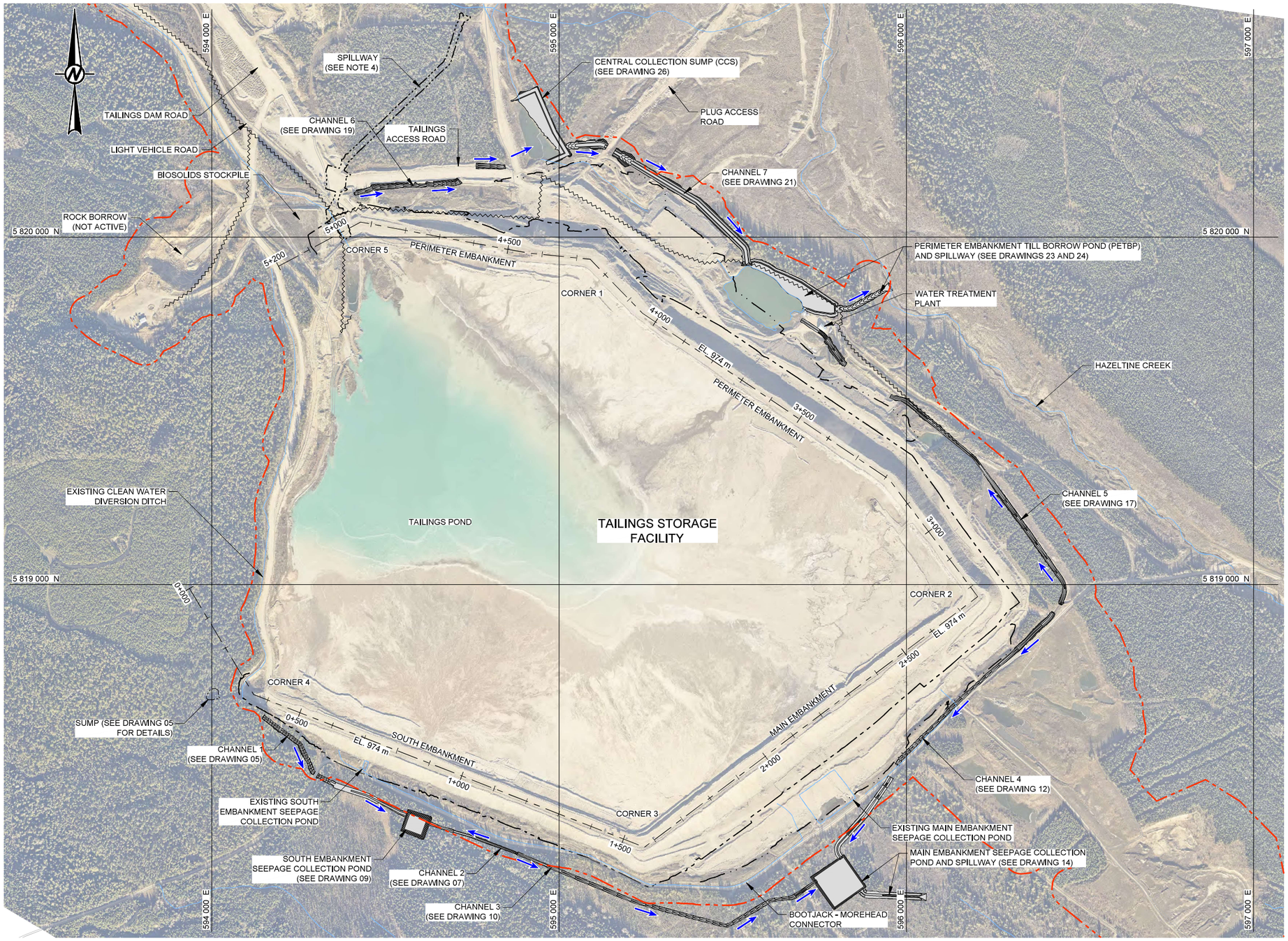

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- EL. 974 m TSF EMBANKMENT DOWNSTREAM TOE LIMIT
- EL. 974 m TSF BUTTRESS DOWNSTREAM TOE LIMIT
- TSF EL. 974 m SPILLWAY DESIGN FOOTPRINT
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- EXISTING POWER LINE - SEE NOTE 3 (SEE REFERENCE 4)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE SHOWN IN TAILINGS GRID.
3. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
4. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 AERIAL PHOTO PROVIDED BY MPMC, FILE NAME: "231030-Lidar Ortho Reduced.jpg", FLOWN: 30 OCTOBER 2023, RECEIVED: 29 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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0 200 400
1:6,000 METRES

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

GENERAL ARRANGEMENT
PLAN VIEW WITH AERIAL PHOTO

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	04 of 26	04

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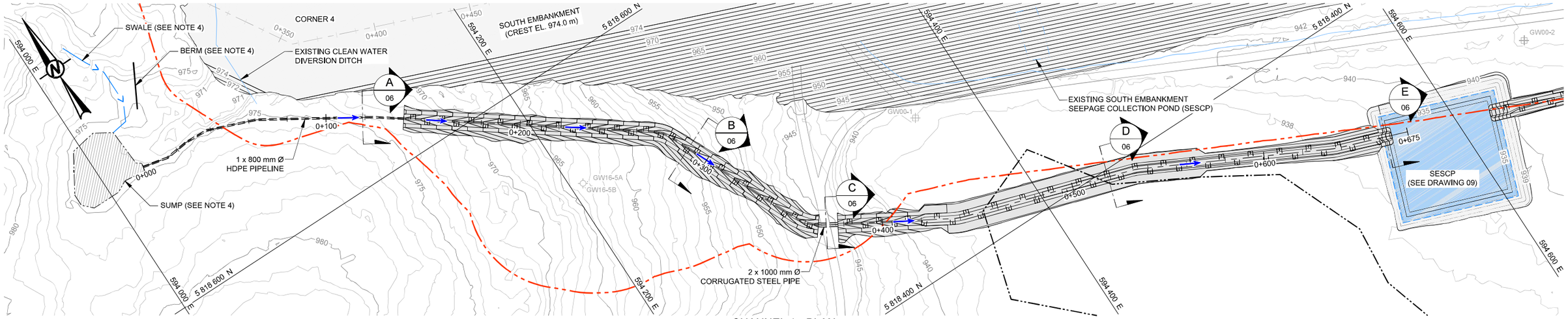

CHANNEL 1 - PLAN

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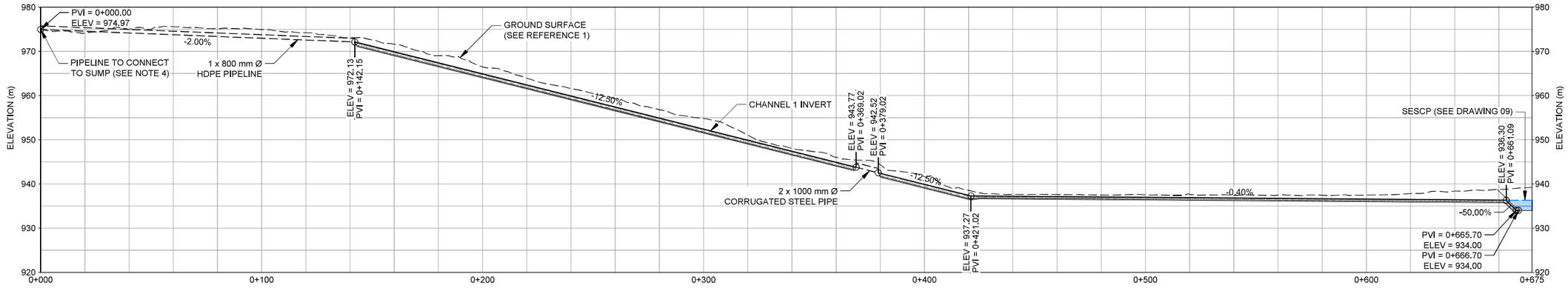

CHANNEL 1 - PROFILE

HORIZ. SCALE 1:1 000 m
VERT. SCALE 1:500 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- CHANNEL 1 DESIGN CENTRELINE (0+100)
- CHANNEL 1 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL GROUNDWATER INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SUMP, SWALE AND BERM AROUND CORNER 4 TO BE FIELD FIT AND APPROVED BY QA MANAGER.
5. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PERMITTING

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0 50 100
1:1,000 HORIZONTAL METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN # 53109

CLIENT

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CONSULTANT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 1
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	05 of 26	05

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\pwfiles.ds9\comp$\vdata\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\95_projects\23590671\31100\31152\Doc 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-02702-P05.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:9:19:55 AM | Printed By: TYKlassen Date: 2024-05-23 Time:2:18:11 PM

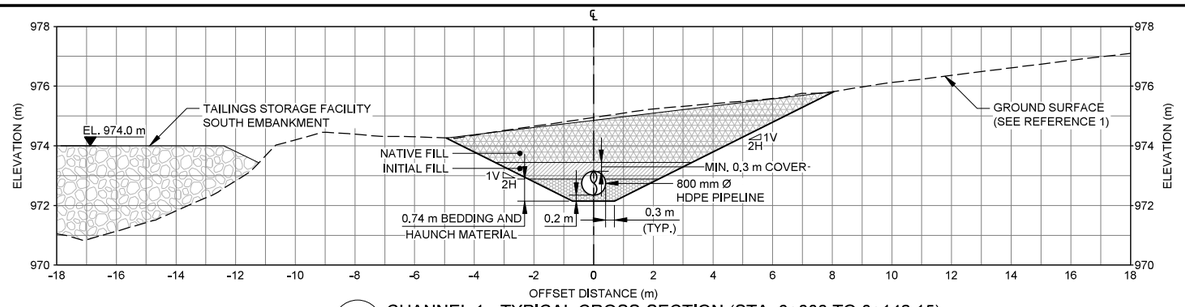

SCALE 1:100 m (A 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+142.15)

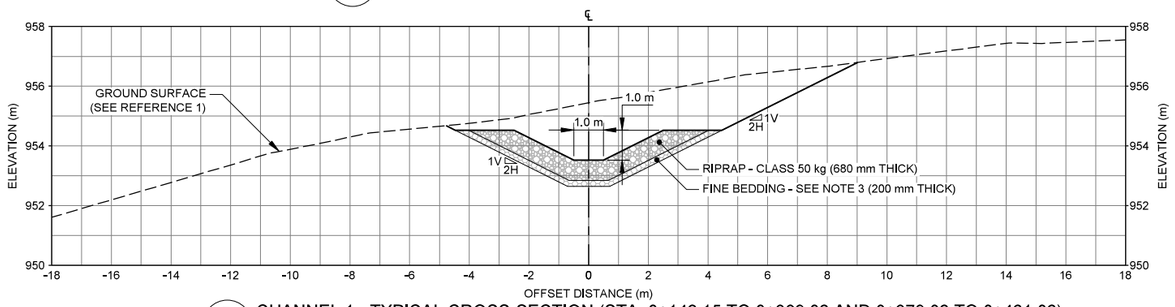

SCALE 1:100 m (B 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+142.15 TO 0+369.02 AND 0+379.02 TO 0+421.02)

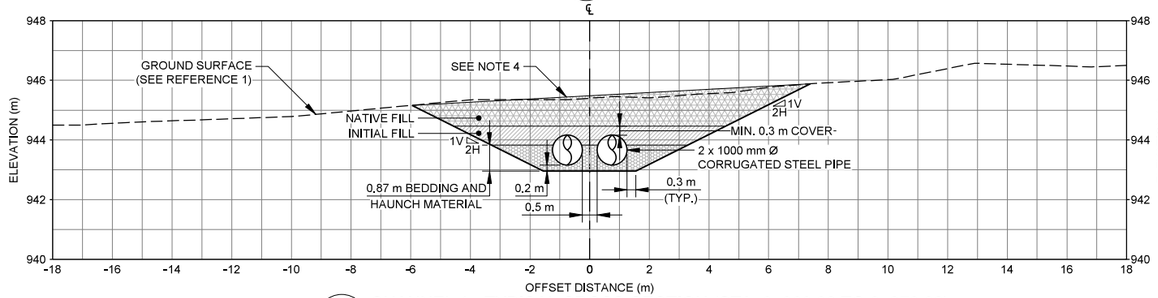

SCALE 1:100 m (C 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+369.02 TO 0+379.02)

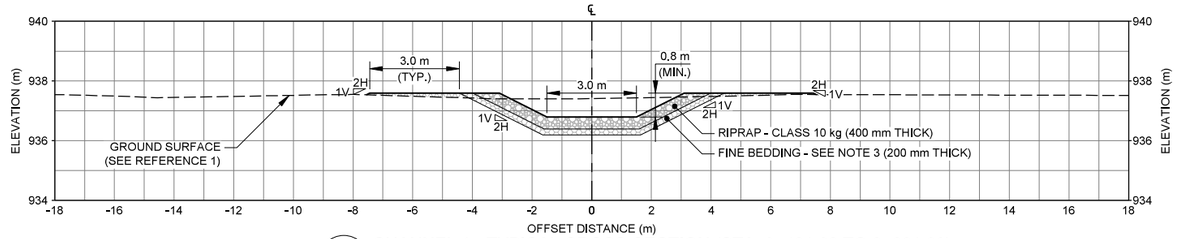

SCALE 1:100 m (D 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+421.02 TO 0+661.09)

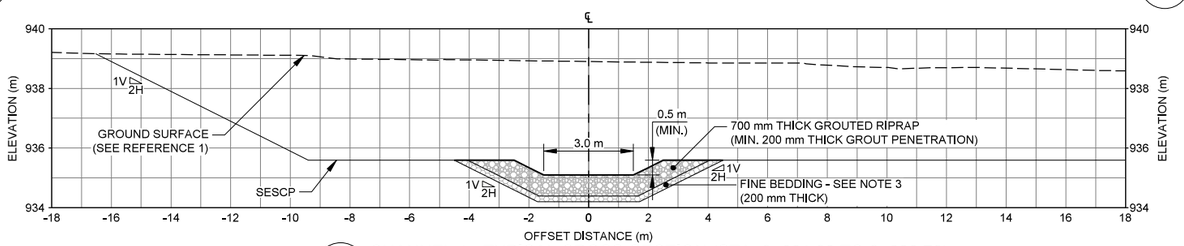

SCALE 1:100 m (E 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+661.09 TO 0+666.70)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 1 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL
- EMBANKMENT ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 5 10
1:100 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEINI # 9310

CLIENT

MOUNT POLLEY MINING CORPORATION

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 1
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	06 of 26	DRAWING
23590671	31100/31152/072	0		06

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 25 mm

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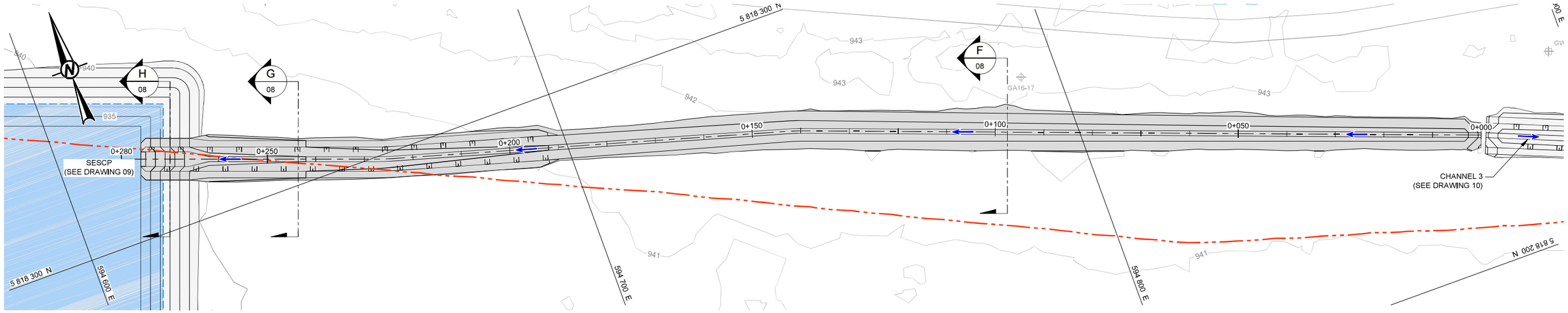

CHANNEL 2 - PLAN

SCALE 1:400 m

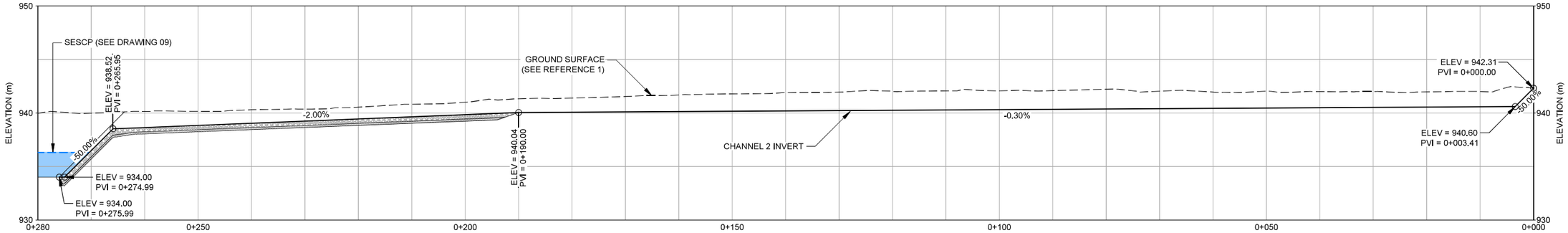

CHANNEL 2 - PROFILE

HORIZ. SCALE 1:400 m
VERT. SCALE 1:200 m

LEGEND

- CHANNEL 2 DESIGN CENTRELINE (0+100)
- CHANNEL 2 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PERMITTING

0 10 20
1:200 VERTICAL METRES

0 20 40
1:400 HORIZONTAL METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN # 53100

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 2
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	07 of 26	07

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\pw-ca-pdfs\corp\vancouver\data\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\072\07_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-07.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:10:08:29 AM | Printed By: TYKlassen Date: 2024-05-23 Time:2:16:31 PM

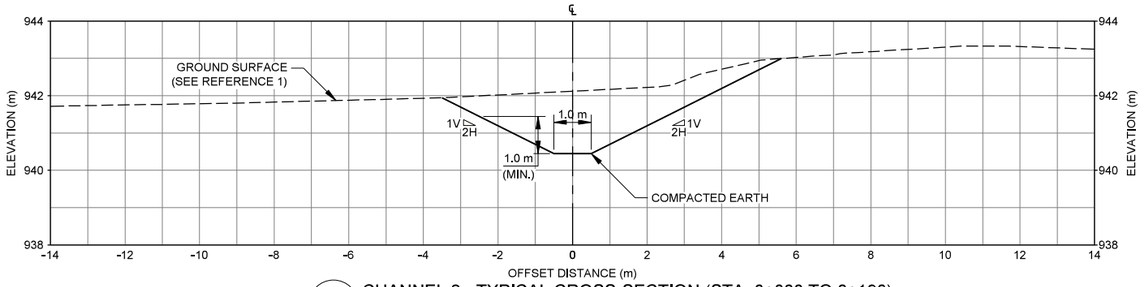

SCALE 1:80 m F 07 CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+190)

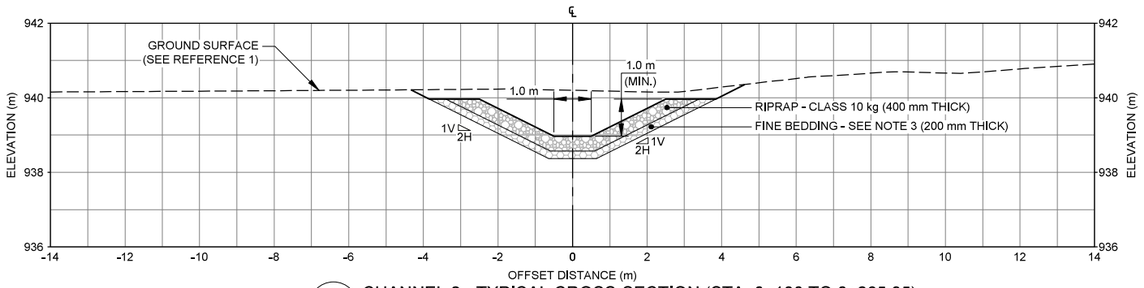

SCALE 1:80 m G 07 CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 0+190 TO 0+265.95)

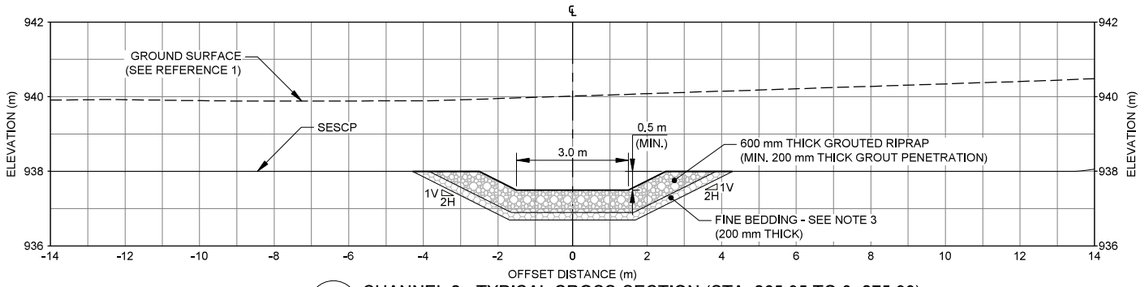

SCALE 1:80 m H 07 CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 265.95 TO 0+275.99)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 2 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

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0 4 8

1:80 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53103

CLIENT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 2
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	08 of 26	08

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm

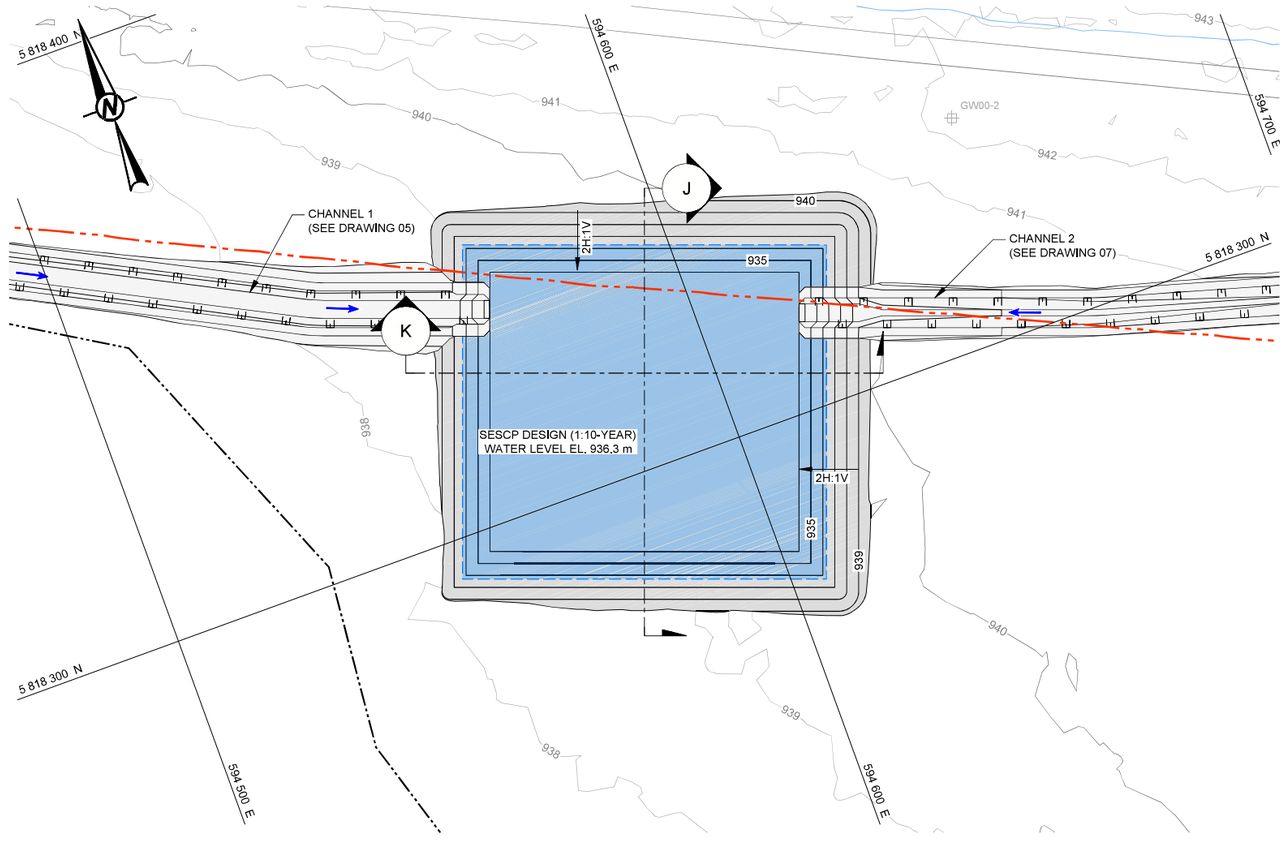

SESCP - PLAN
SCALE 1:500 m

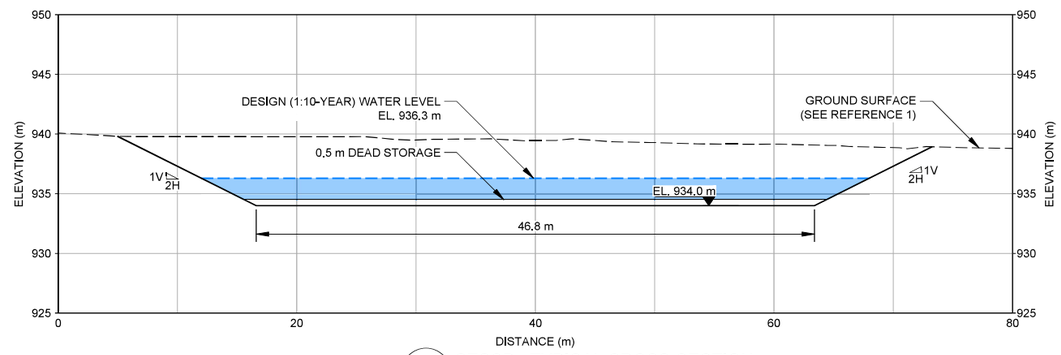

SCALE 1:250 m — J — SESCP - TYPICAL CROSS-SECTION

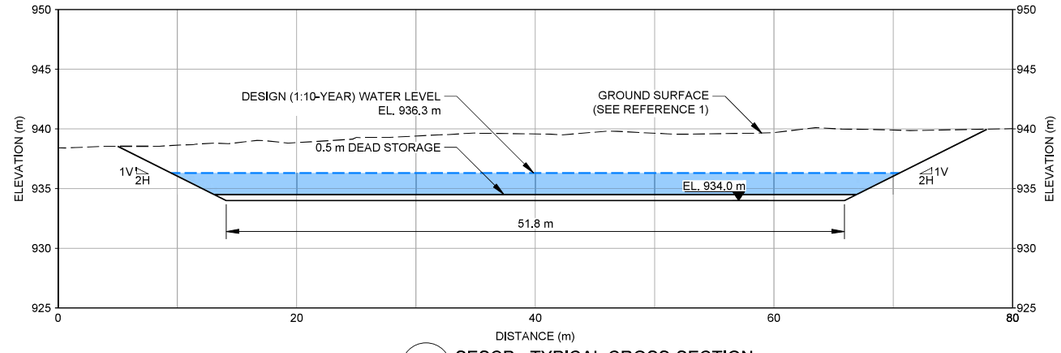

SCALE 1:250 m — K — SESCP - TYPICAL CROSS-SECTION

LEGEND

- SESCP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR
PERMITTING

0 10 20
1:250 METRES

0 20 40
1:500 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53100

CLIENT
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
SOUTH EMBANKMENT SEEPAGE COLLECTION POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	09 of 26	09

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

25 mm

Path: \\pwfiler.qdc\complextdata\data\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\072\Doc 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-D09.dwg | Last Edited By: jhopson Date: 2024-05-22 Time: 7:22:40 PM | Printed By: TYidiasen Date: 2024-05-23 Time: 2:14:55 PM

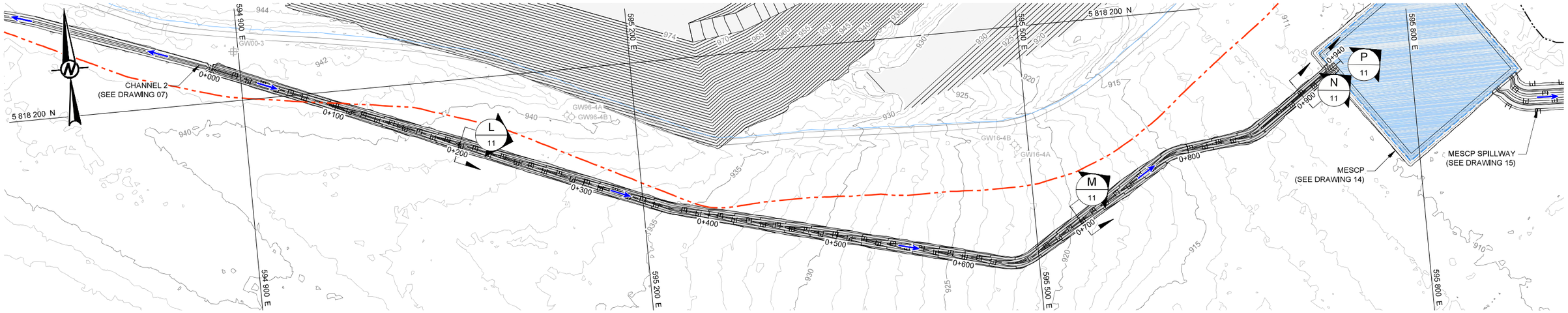

CHANNEL 3 - PLAN

SCALE 1:1 500 m

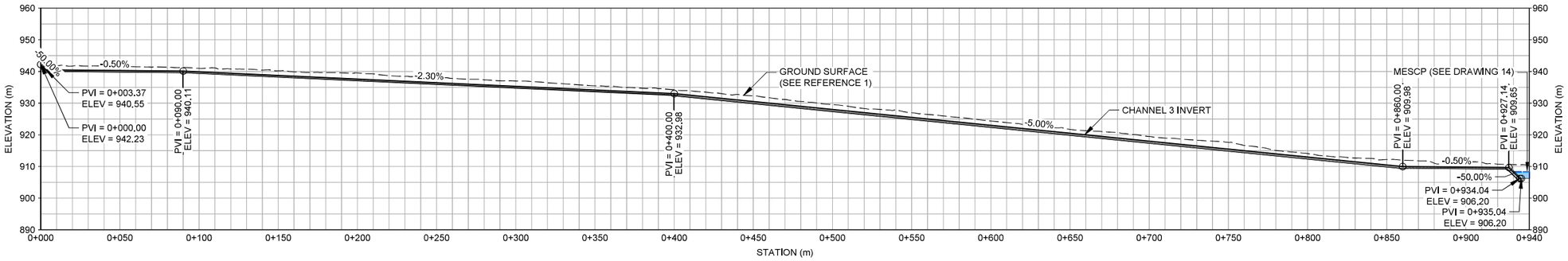

CHANNEL 3 - PROFILE

HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 3 DESIGN CENTRELINE (0+100)
- CHANNEL 3 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PERMITTING

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53109

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
VANCOUVER, BC
V6Z 2M1
+1 (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 3
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	10 of 26	10

Path: \\pwfileng.pdsi\comp\data\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100-31152-072-10.dwg | File Name: 23590671-31100-31152-072-10.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:10:28:21 AM | Printed By: TYKlassen Date: 2024-05-23 Time:2:30:42 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
0 25mm

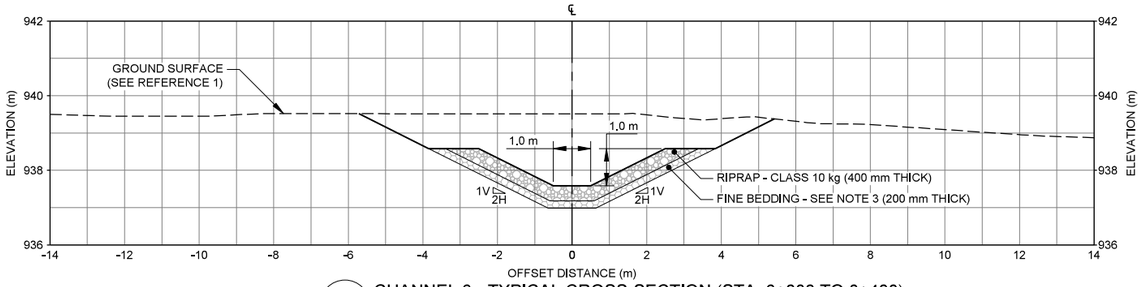

SCALE 1:80 m — L / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+400)

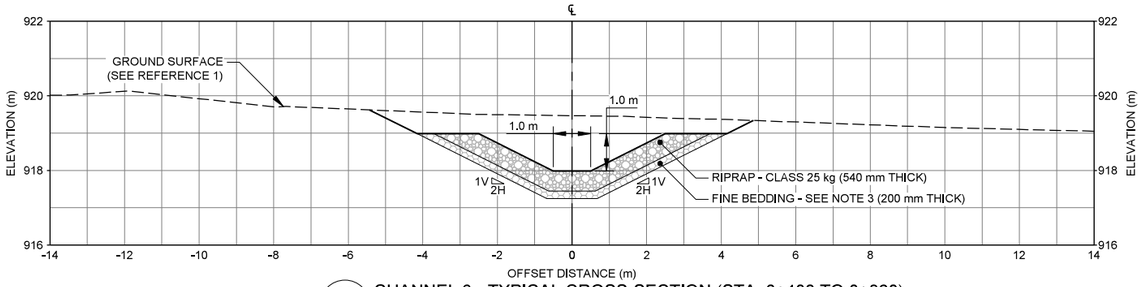

SCALE 1:80 m — M / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+400 TO 0+860)

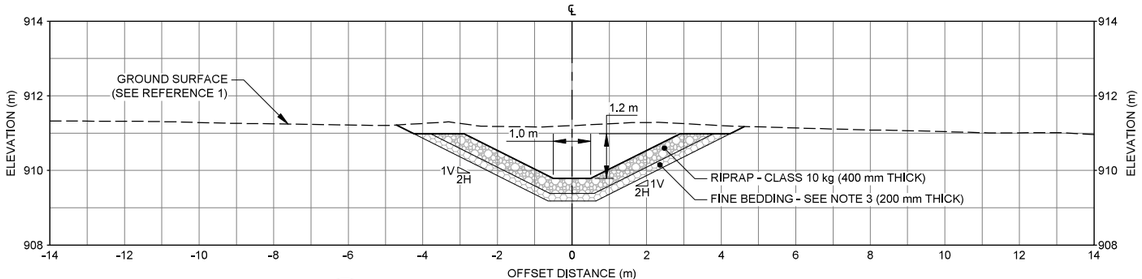

SCALE 1:80 m — N / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+860 TO 0+927.14)

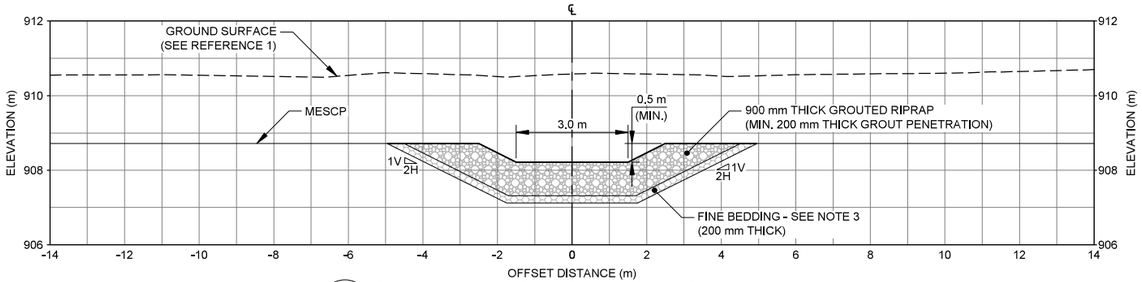

SCALE 1:80 m — P / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+927.14 TO 0+935.04)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 3 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

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0 4 8

1:80 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN # 53103

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
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V6Z 2M1
+1 (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 3
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	11 of 26	DRAWING
23590671	31100/31152/072	0		11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 25 mm

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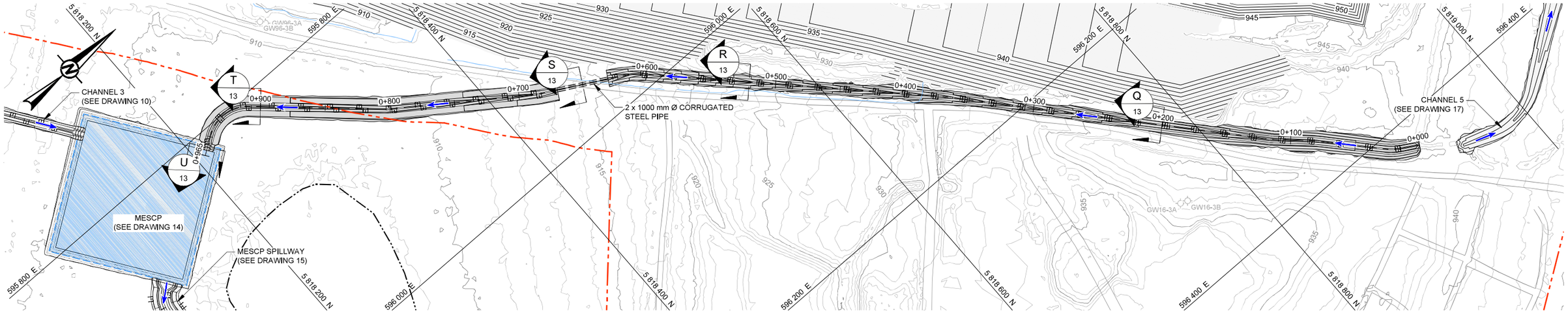

CHANNEL 4 - PLAN
SCALE 1:1 500 m

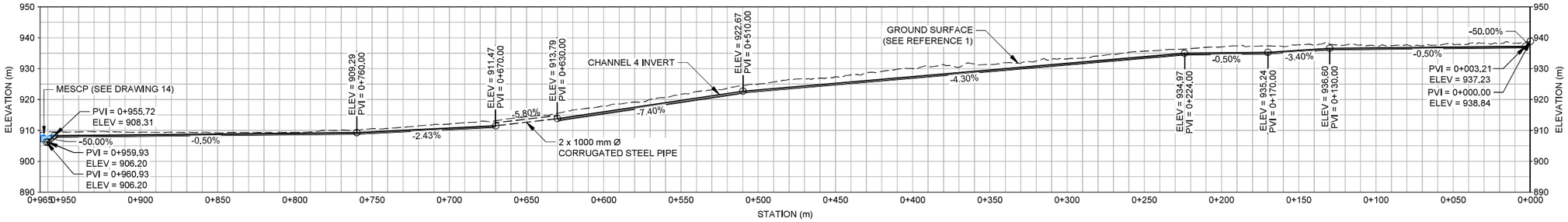

CHANNEL 4 - PROFILE
HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 4 DESIGN CENTRELINE (0+100)
- CHANNEL 4 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- HIGH PHREATIC SURFACE AREA
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PERMITTING

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN # 53100

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840 HOWE STREET, SUITE 1000
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PROJECT
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SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
CHANNEL 4
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	12 of 26	DRAWING
23590671	31100/31152/072	0		12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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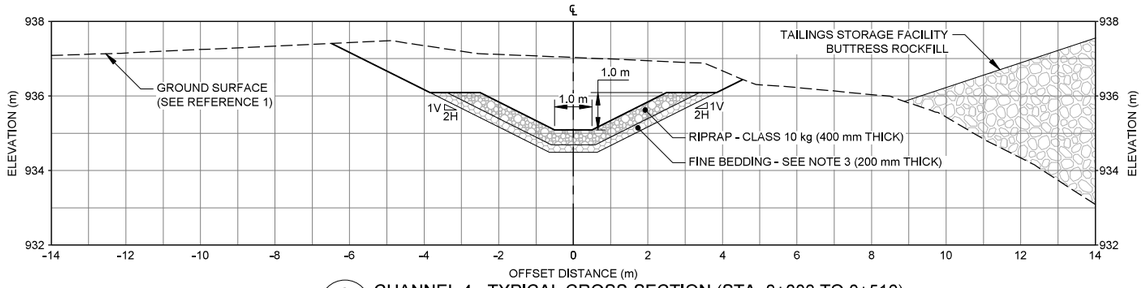

SCALE 1:80 m — Q/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+510)

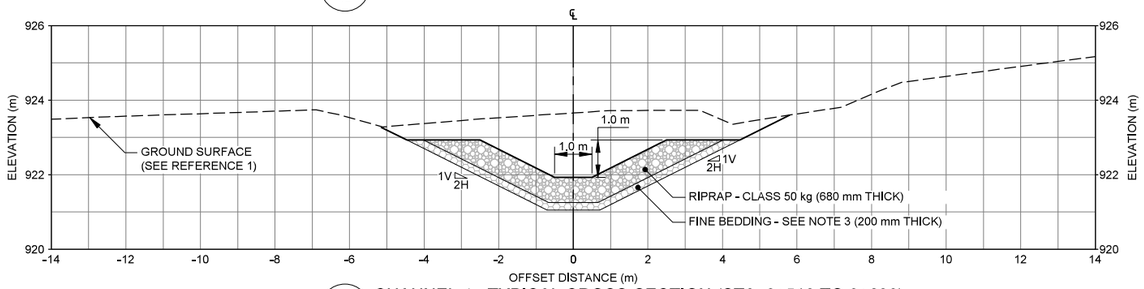

SCALE 1:80 m — R/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+510 TO 0+630)

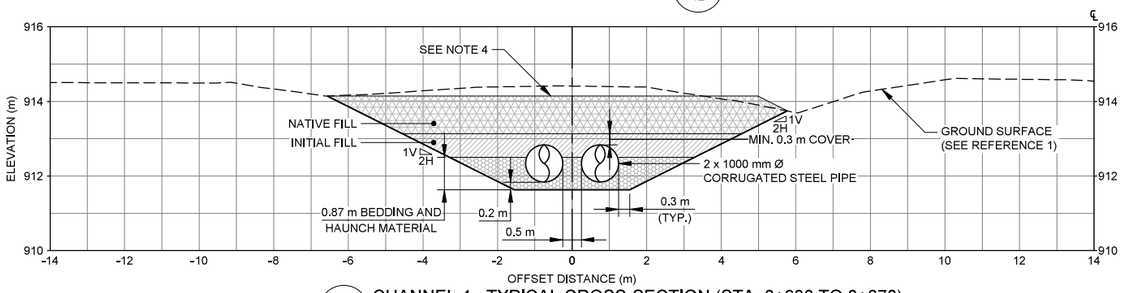

SCALE 1:80 m — S/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+630 TO 0+670)

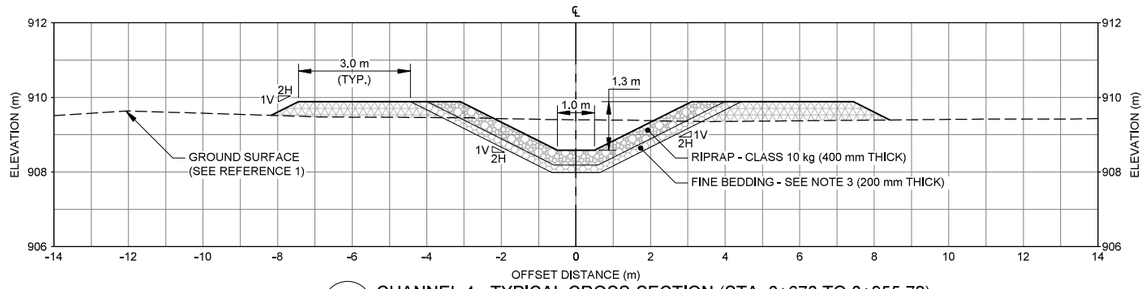

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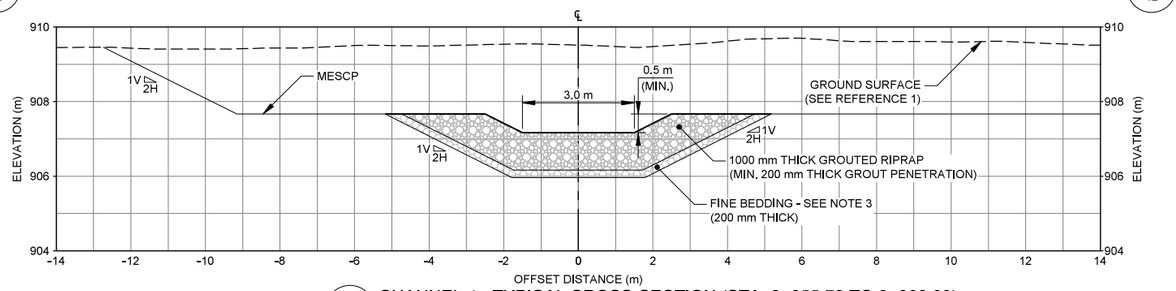

SCALE 1:80 m — U/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+955.72 TO 0+960.93)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 4 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL
- EMBANKMENT ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

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0 4 8
1:80 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI — # 43100

CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
840 HOWE STREET, SUITE 1000
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
CHANNEL 4
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	DRAWING
23590671	31100/31152/072	0	13 of 26 — 13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 — 25 mm

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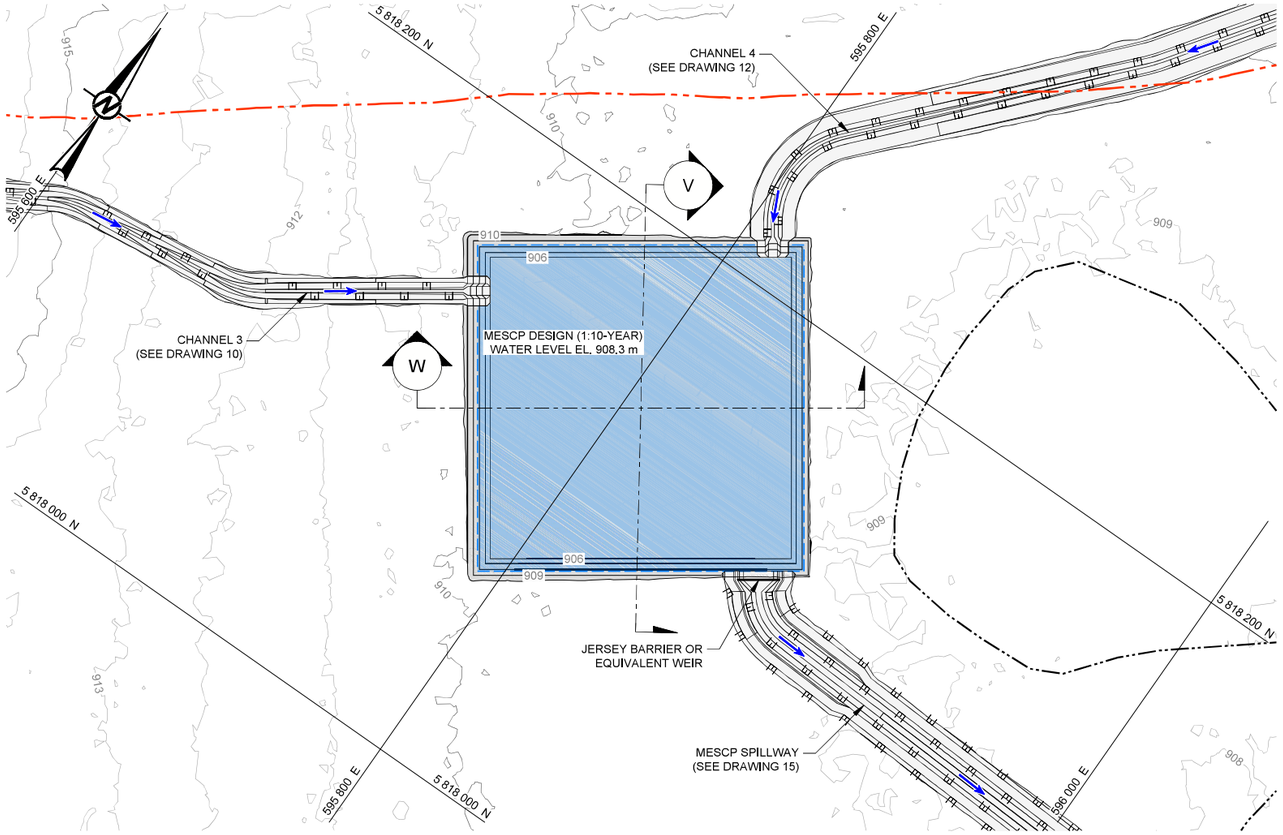

MAIN EMBANKMENT SEEPAGE COLLECTION POND - PLAN

SCALE 1:1 000 m

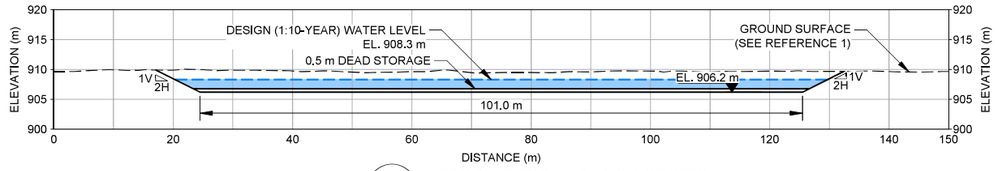

SCALE 1:500 m (V) MESCP - TYPICAL CROSS-SECTION

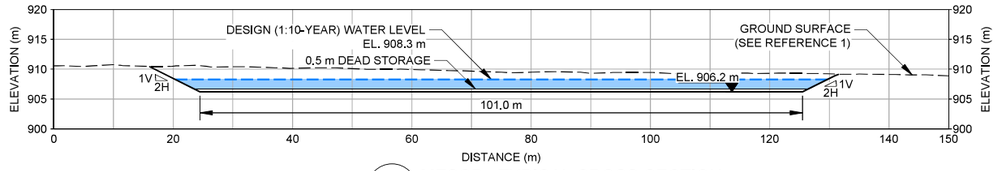

SCALE 1:500 m (W) MESCP - TYPICAL CROSS-SECTION

LEGEND

- MESCP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- M-200 PERMIT BOUNDARY (SEE REFERENCE 2)
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

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CLIENT

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PROJECT

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SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

MAIN EMBANKMENT SEEPAGE COLLECTION POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	14 of 26	14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

25 mm

Path: \\pdfile\.gdb\complexdata\data\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\072\14.dwg | File Name: 23590671-31100-31152-072-14.dwg | Last Edited By: jhopson Date: 2024-05-22 Time: 7:44:40 PM | Printed By: TYAlassen Date: 2024-05-23 Time: 2:28:21 PM

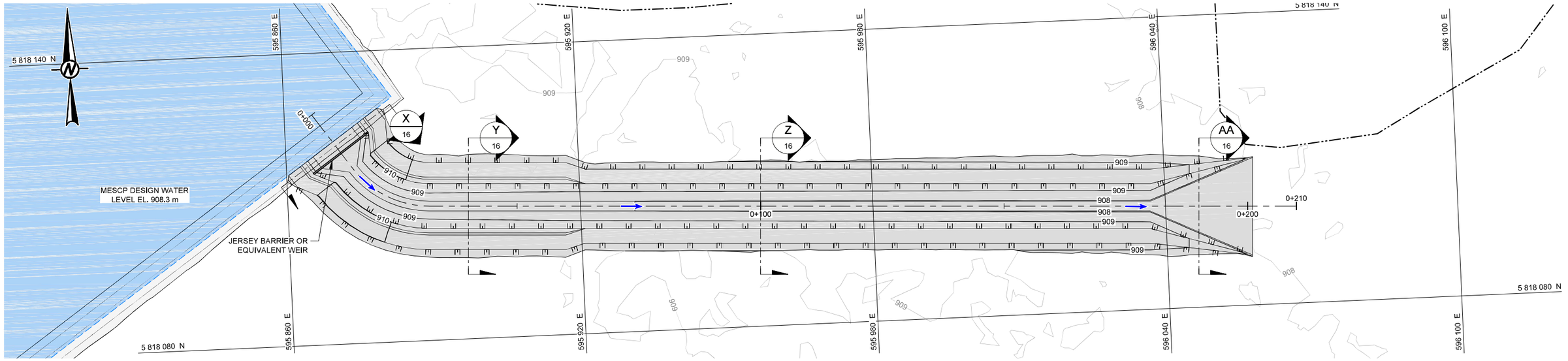

MESCP SPILLWAY - PLAN
SCALE 1:400 m

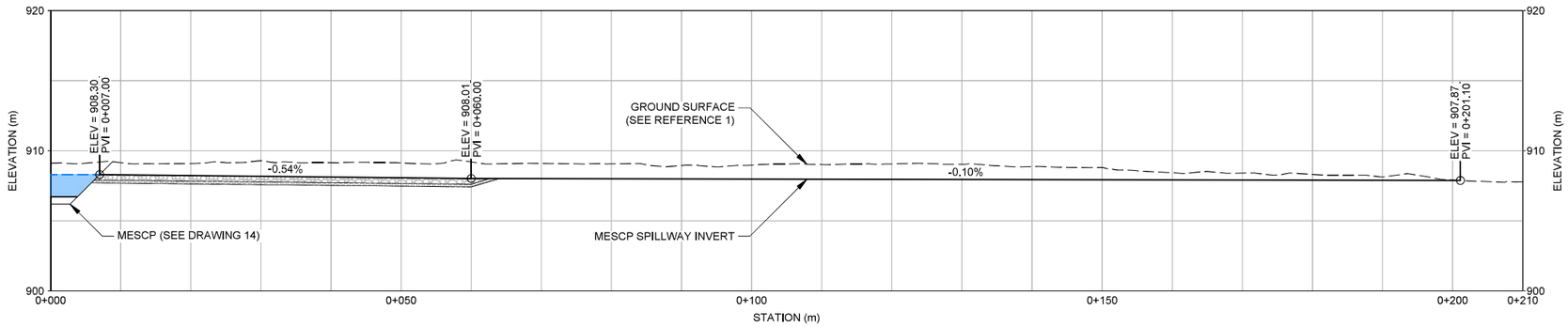

MESCP SPILLWAY - PROFILE
HORIZ. SCALE 1:400 m
VERT. SCALE 1:200 m

LEGEND

- MESCP SPILLWAY DESIGN CENTRELINE (0+100)
- MESCP SPILLWAY DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- M-200 PERMIT BOUNDARY (SEE REFERENCE 2)
- HIGH PHREATIC SURFACE AREA
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
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0 10 20
1:200 VERTICAL METRES

0 20 40
1:400 HORIZONTAL METRES

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CONSULTANT: WSP

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PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	15 of 26	DRAWING
23590671	31100/31152/072	0		15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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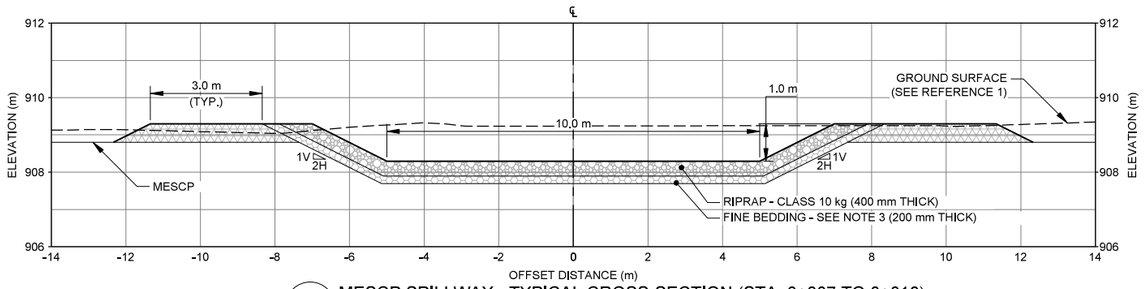

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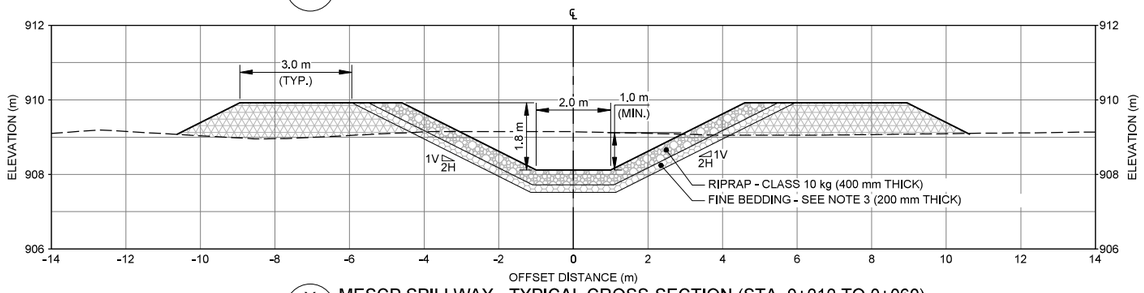

SCALE 1:80 m — Y / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+010 TO 0+060)

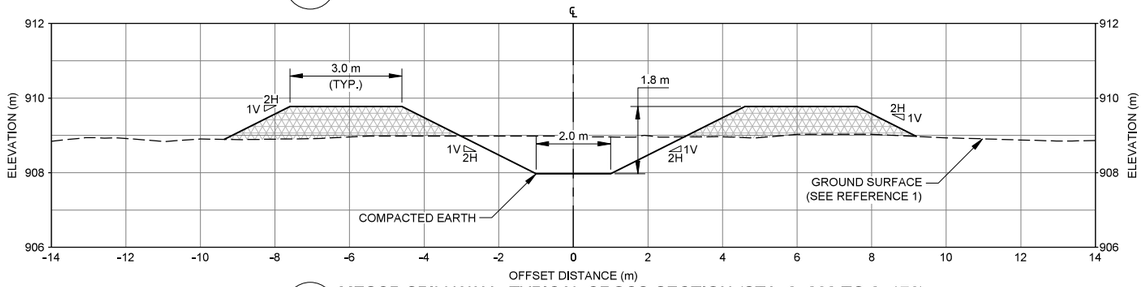

SCALE 1:80 m — Z / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+060 TO 0+176)

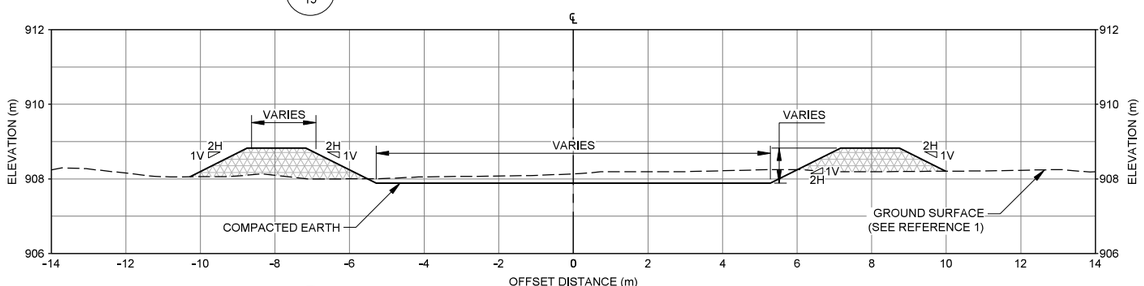

SCALE 1:80 m — AA / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+176 TO 0+201)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- MESCP SPILLWAY FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

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0 4 8

1:80 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 6310

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	16 of 26	DRAWING
23590671	31100/31152/072	0		16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 25 mm

Path: \\pdfile.gbl\comp\textdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\09_projects\23590671\31100\31152\Dec 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-16.dwg | Last Edited By: jhopson Date: 2024-05-22 Time: 7:47:03 PM | Printed By: TYHassen Date: 2024-05-23 Time: 2:25:58 PM

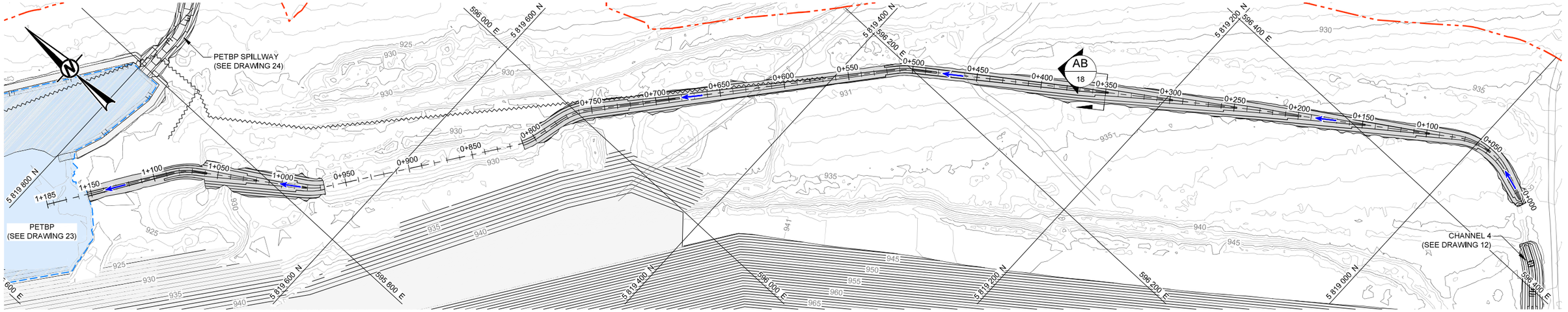

CHANNEL 5 - PLAN
SCALE 1:1 500 m

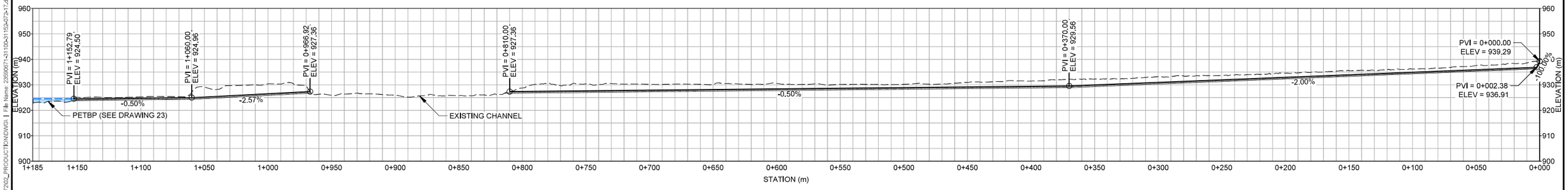

CHANNEL 5 - PROFILE
HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 5 DESIGN CENTRELINE (0+100)
- CHANNEL 5 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-Mine Lidar Contour 0.25.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR
PERMITTING

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53100

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
CHANNEL 5
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	17 of 26	17

Path: \\pdfiler.gds\complexdata\data\office\vancouver\CAD-GIS\client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\Doc 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-17.dwg | Last Edited By: jhopson Date: 2024-05-22 Time: 7:51:56 PM | Printed By: TYidiassen Date: 2024-05-23 Time: 2:43:16 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D
0 25 mm

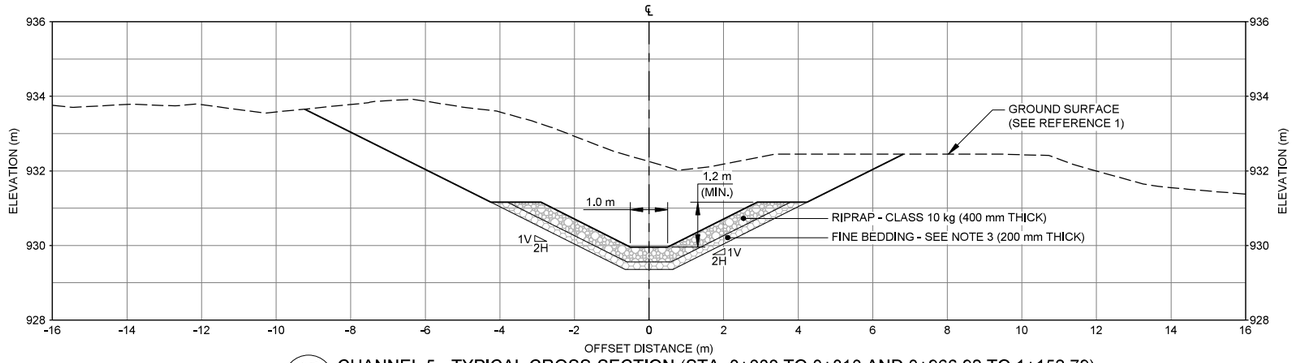

SCALE 1:80 m AB 17 CHANNEL 5 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+810 AND 0+966.92 TO 1+152.79)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 5 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEINI # 53103

CLIENT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 5
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	18 of 26	18

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\Doc 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-18.dwg | Last Edited By: jhopson Date: 2024-05-22 Time:7:52:32 PM | Printed By: TYKlassen Date: 2024-05-23 Time:2:41:44 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm

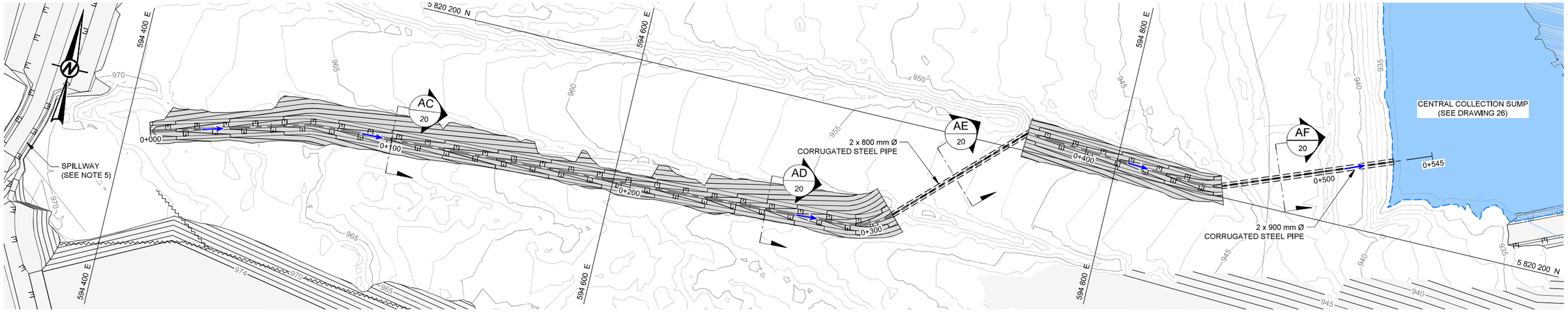

CHANNEL 6 - PLAN
SCALE 1:800 m

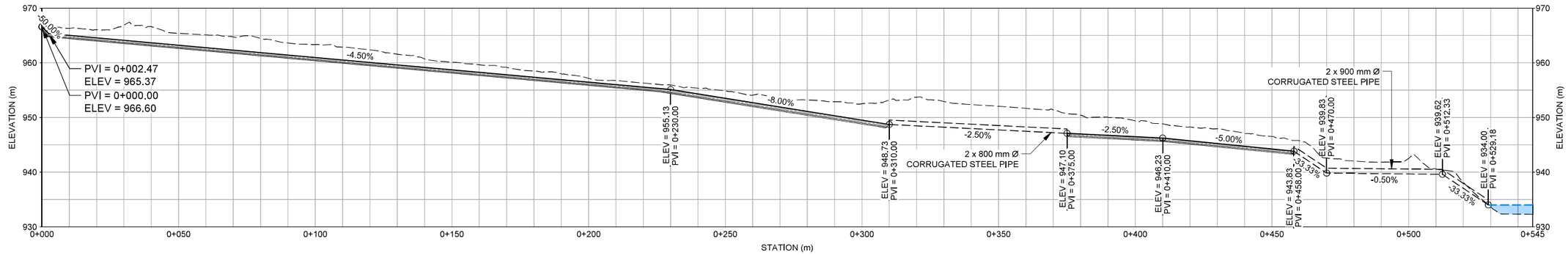

CHANNEL 6 - PROFILE
HORIZ. SCALE 1:800 m
VERT. SCALE 1:400 m

LEGEND

- CHANNEL 6 DESIGN CENTRELINE (0+100)
- CHANNEL 6 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
5. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR
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1:400 VERTICAL METRES (0 — 20 — 40)

1:800 HORIZONTAL METRES (0 — 40 — 80)

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53103

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CONSULTANT: WSP

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
CHANNEL 6
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	DRAWING
23590671	31100/31152/072	0	19 of 26 — 19

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

25mm

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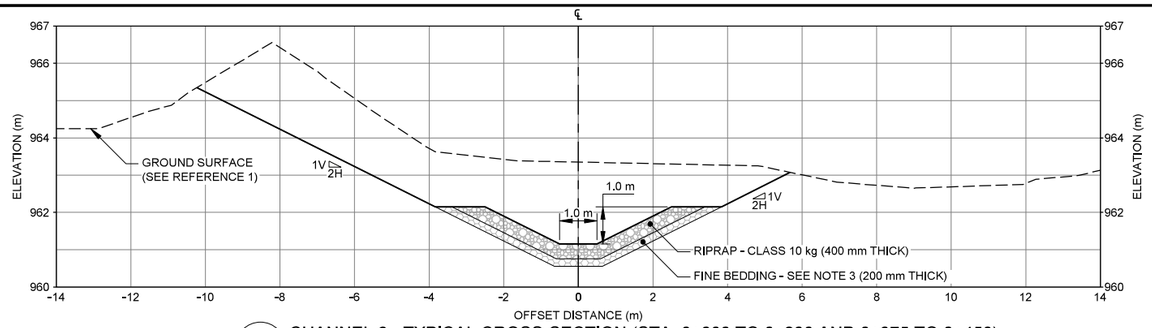

SCALE 1:80 m — AC 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+230 AND 0+375 TO 0+458)

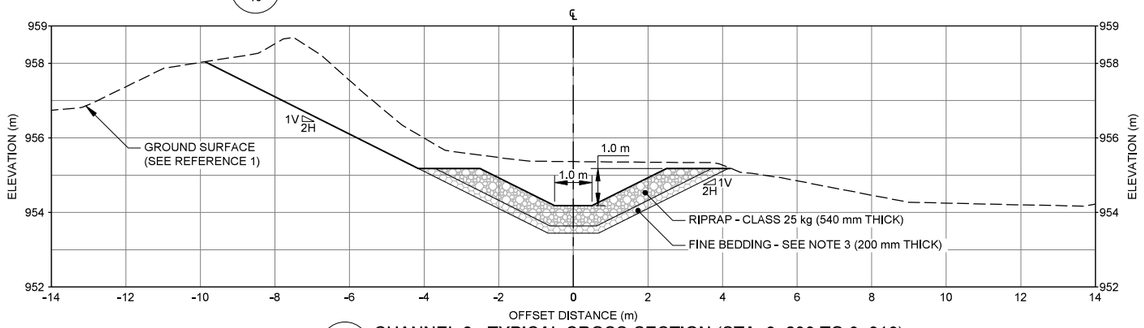

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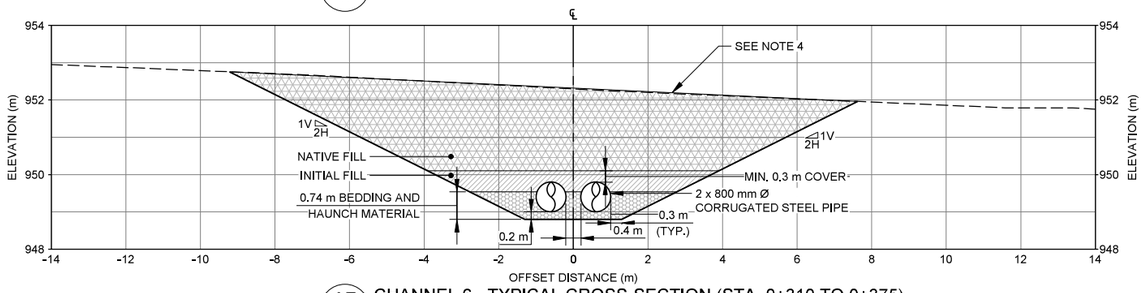

SCALE 1:80 m — AE 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+310 TO 0+375)

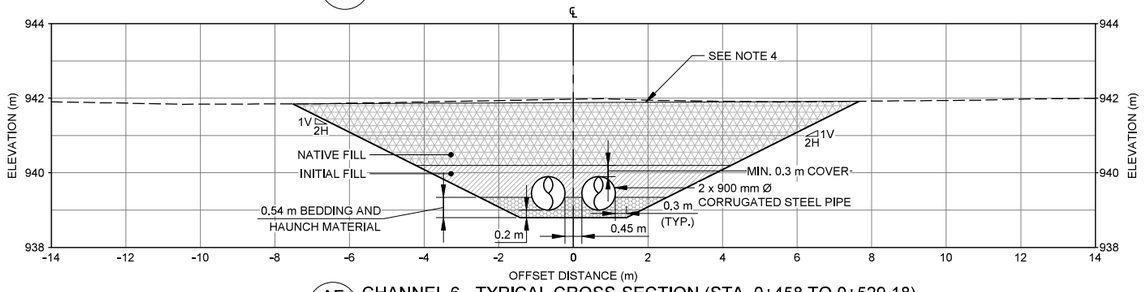

SCALE 1:80 m — AF 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+458 TO 0+529.18)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 6 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 8310

CLIENT

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CONSULTANT

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+1 (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 6
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	20 of 26	20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 25 mm

Path: \\pdfiler.ptld\comsllexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\Dwg\23590671-31100-31152-072-20.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:11:20:25 AM | Printed By: TYKlassen Date: 2024-05-23 Time:2:39:04 PM

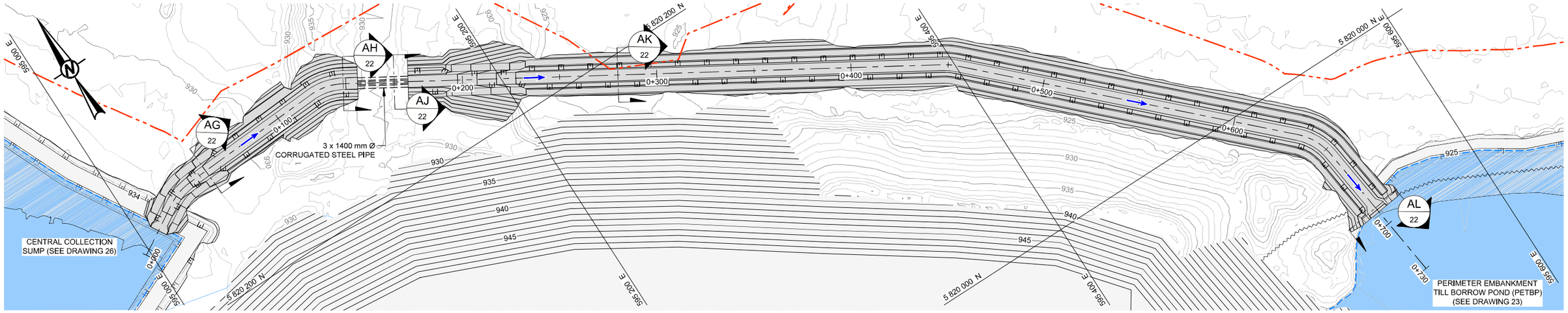

CHANNEL 7 - PLAN

SCALE 1:1 000 m

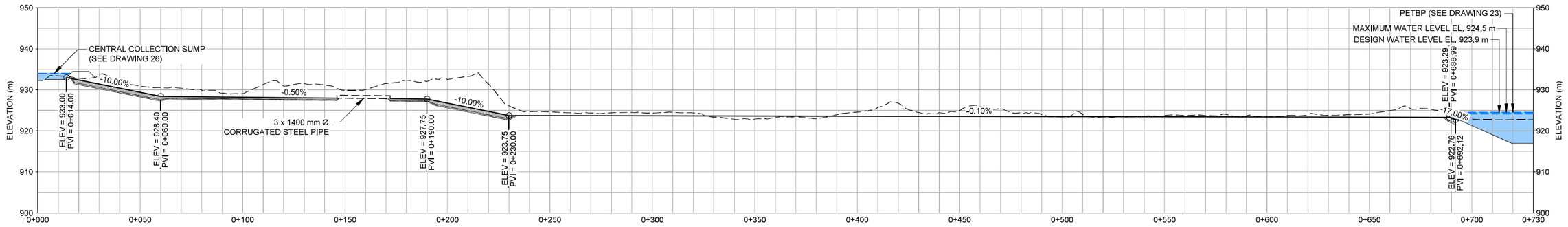

CHANNEL 7 - PROFILE

HORIZ. SCALE 1:1 000 m
VERT. SCALE 1:500 m

LEGEND

- CHANNEL 7 DESIGN CENTRELINE (0+100)
- CHANNEL 7 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR

PERMITTING

0 20 40
1:500 VERTICAL METRES

0 50 100
1:1,000 HORIZONTAL METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 31100

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 7
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	21 of 26	21

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

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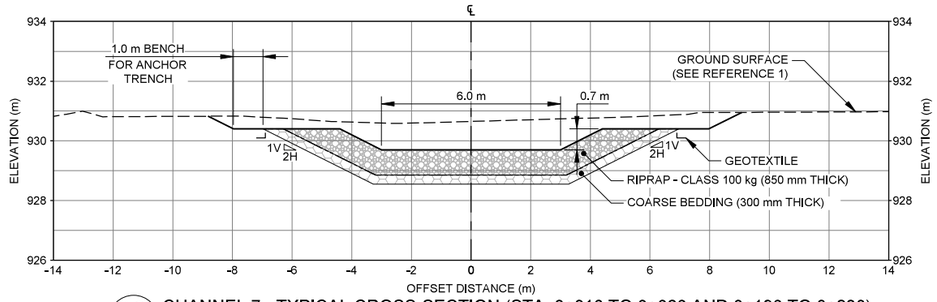

SCALE 1:100 m — AG / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+018 TO 0+060 AND 0+190 TO 0+230)

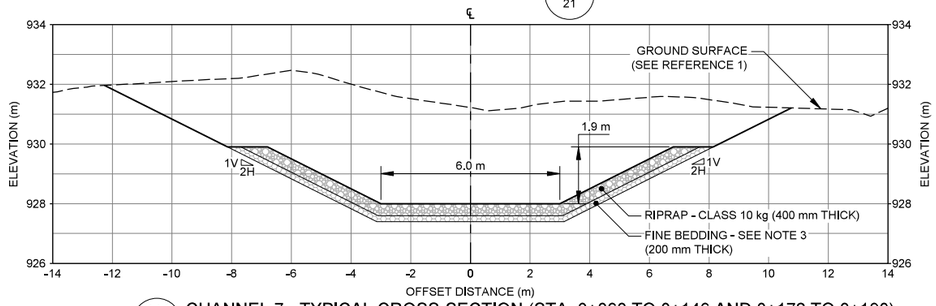

SCALE 1:100 m — AH / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+060 TO 0+146 AND 0+172 TO 0+190)

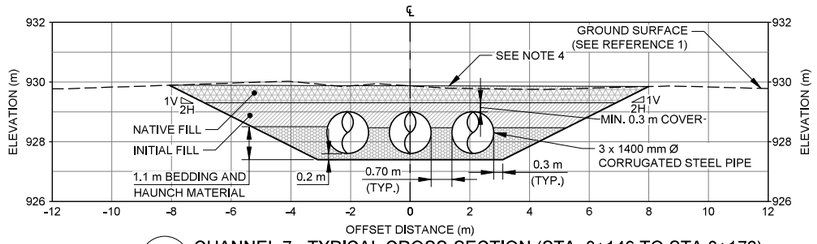

SCALE 1:100 m — AJ / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+146 TO STA 0+172)

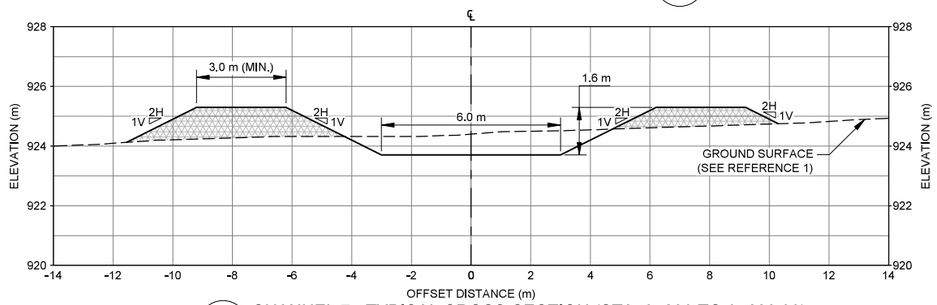

SCALE 1:100 m — AK / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+230 TO 0+688.99)

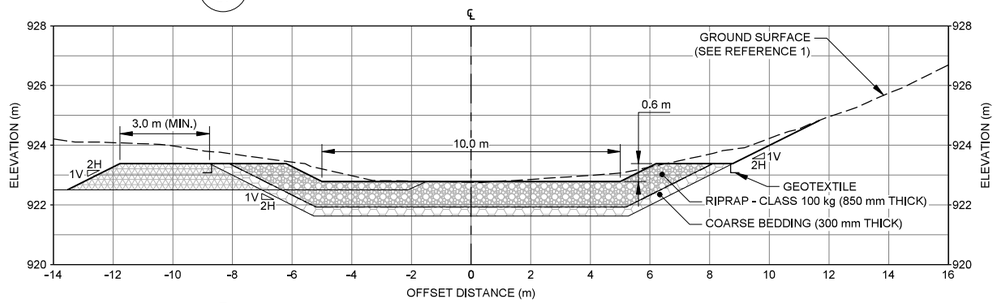

SCALE 1:100 m — AL / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+688.99 TO 0+692.11)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 7 FINISHED GRADE
- RIPRAP
- COARSE BEDDING
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 5 10
1:100 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN # 5109

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CHANNEL 7
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	22 of 26	22

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

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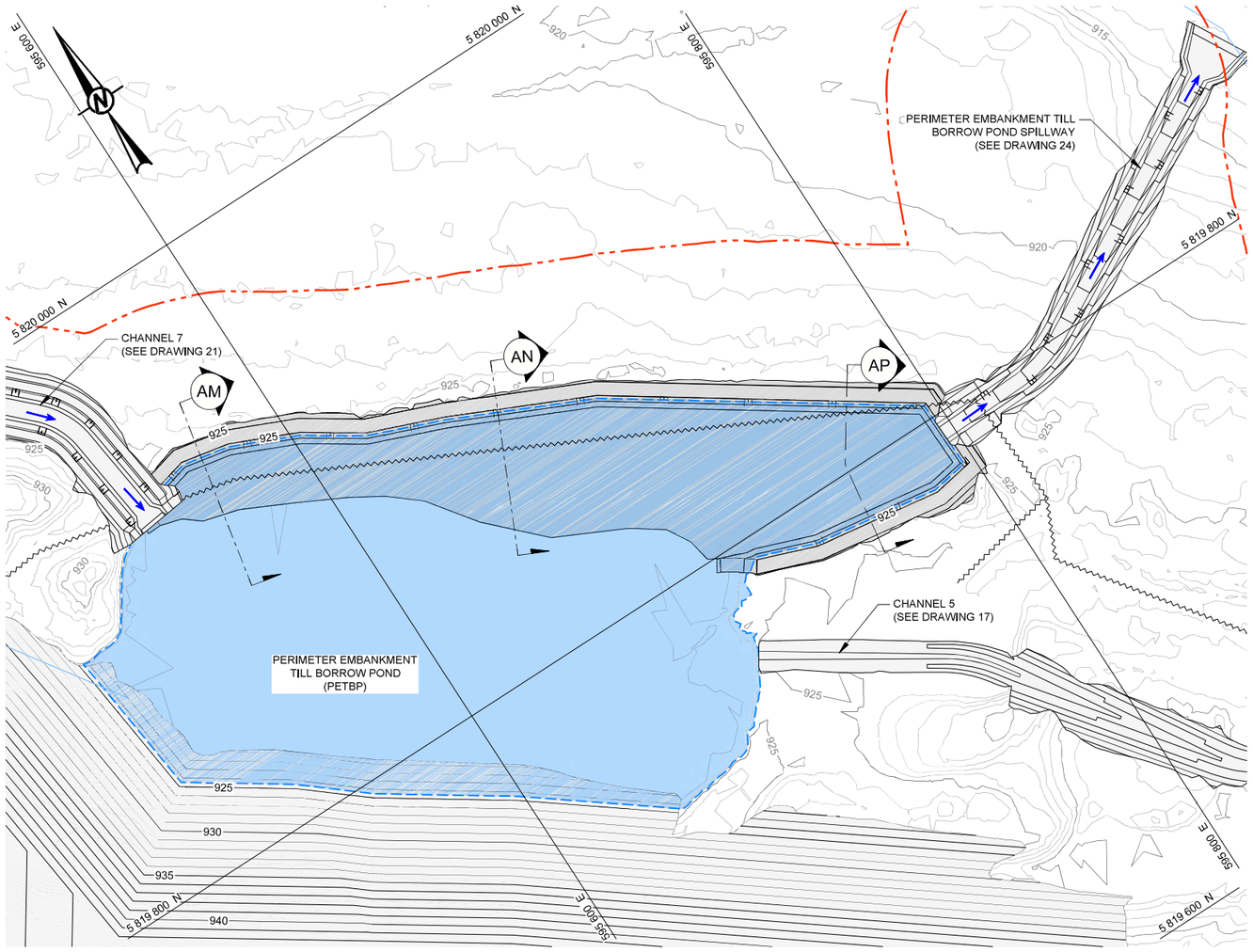

PERIMETER EMBANKMENT TILL BORROW POND - PLAN

SCALE 1:1 000 m

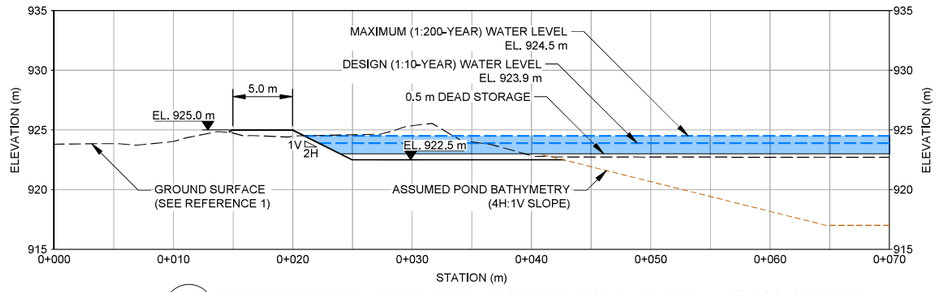

SCALE 1:250 m AM PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION

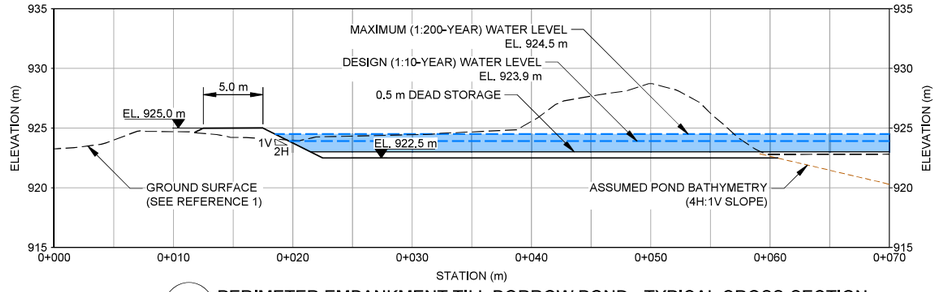

SCALE 1:250 m AN PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION

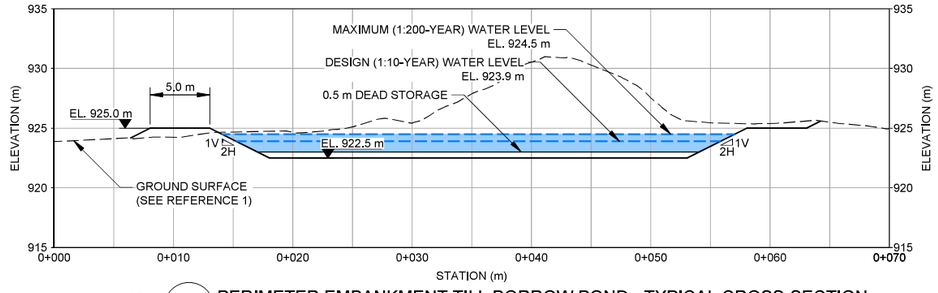

SCALE 1:250 m AP PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION

ISSUED FOR

PERMITTING

0 10 20
1:250 METRES

0 50 100
1:1,000 METRES

LEGEND

- PERIMETER EMBANKMENT TILL BORROW POND DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEINI # 39100

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

PERIMETER EMBANKMENT TILL BORROW POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	23 of 26	23

Path: \\pdfec-pbl\comsdkexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\Dec 07\2002_PRODUCTION\WG\ | File Name: 23590671-31100-31152-072423.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:11:24:02 AM | Printed By: TYklassen Date: 2024-05-23 Time:2:36:44 PM
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 mm

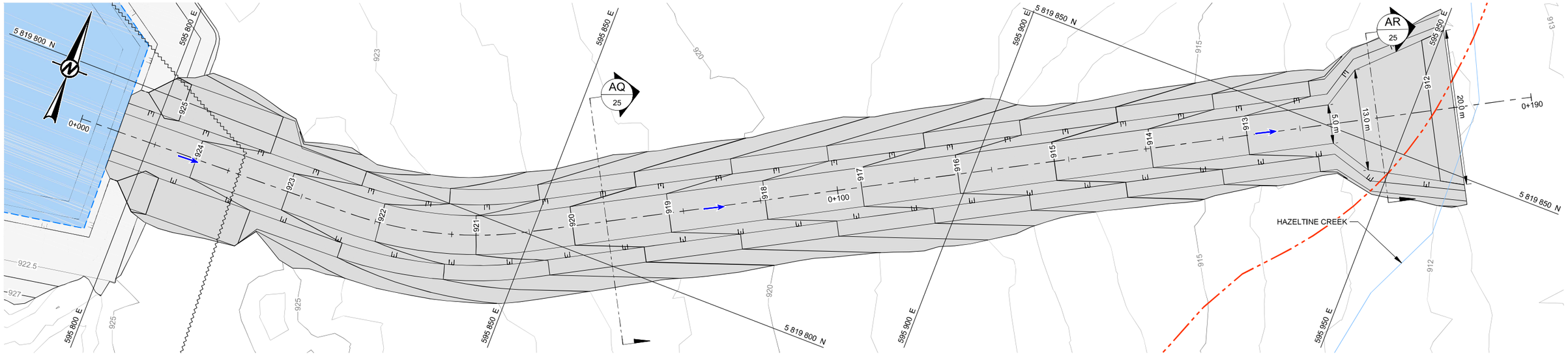

PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PLAN

SCALE 1:250 m

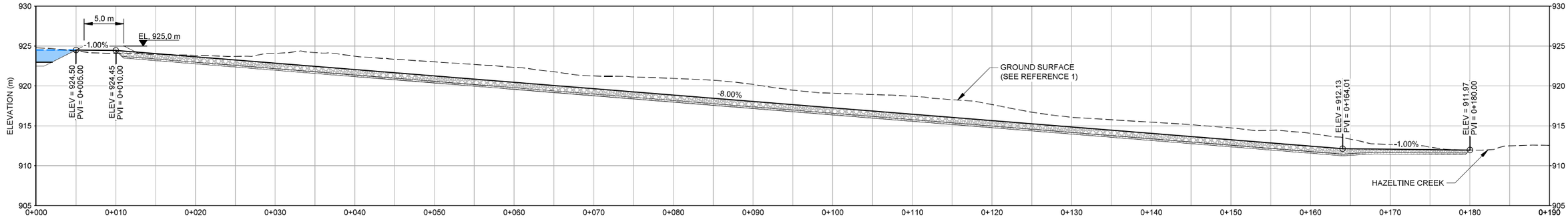

PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PROFILE

SCALE 1:250 m

LEGEND

- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY DESIGN CENTRELINE (0+100)
- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- PERIMETER EMBANKMENT TILL BORROW POND DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
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3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR

PERMITTING

0 10 20

1:250 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEINI # 43100

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	24 of 26	24

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 25 mm

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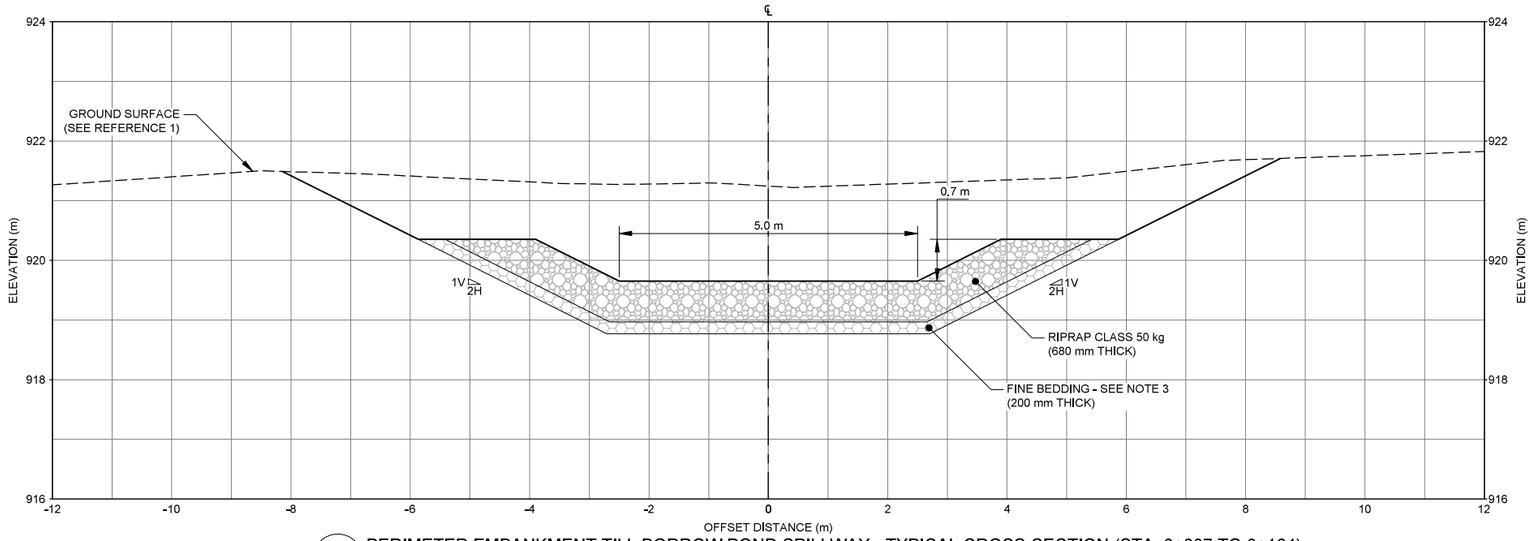

SCALE 1:50 m AQ 24 PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+007 TO 0+164)

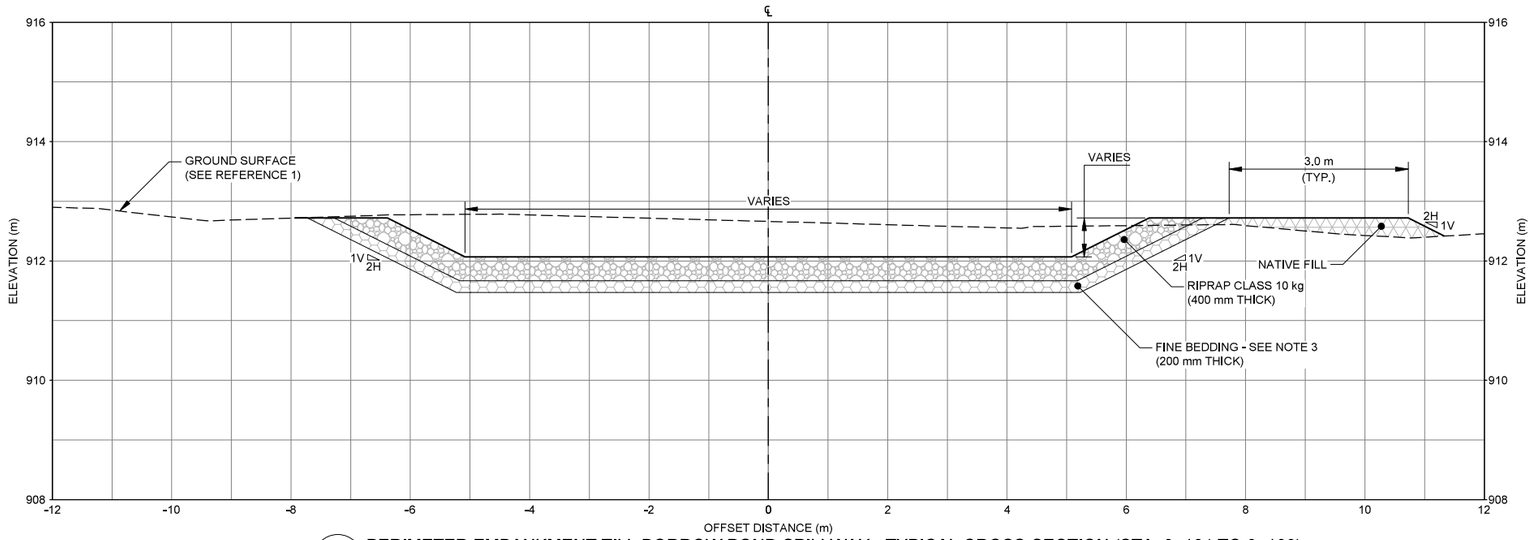

SCALE 1:50 m AR 24 PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+164 TO 0+180)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE ROCKFILL REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 2 4

1:50 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEINI # 53103

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	25 of 26	DRAWING
23590671	31100/31152/072	0		25

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm

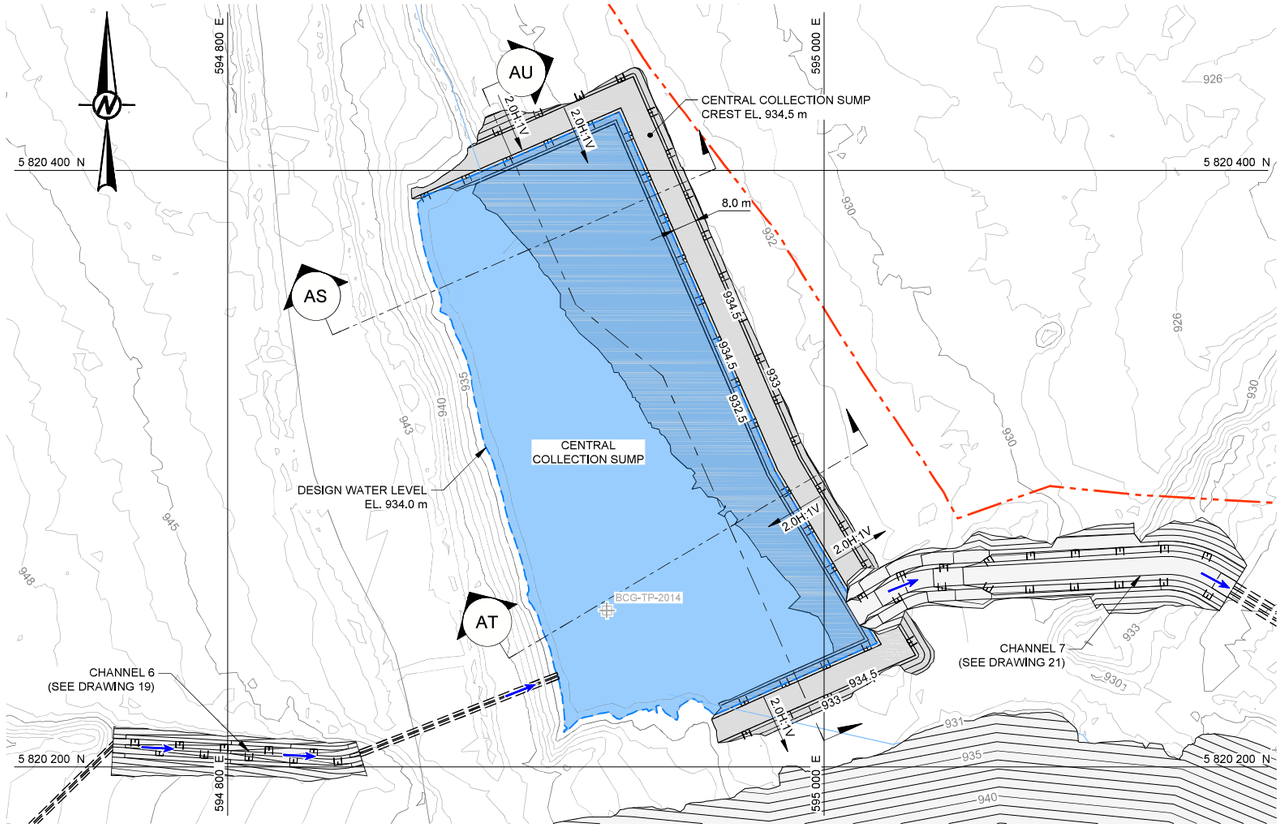

CENTRAL COLLECTION SUMP - PLAN

SCALE 1:1 000 m

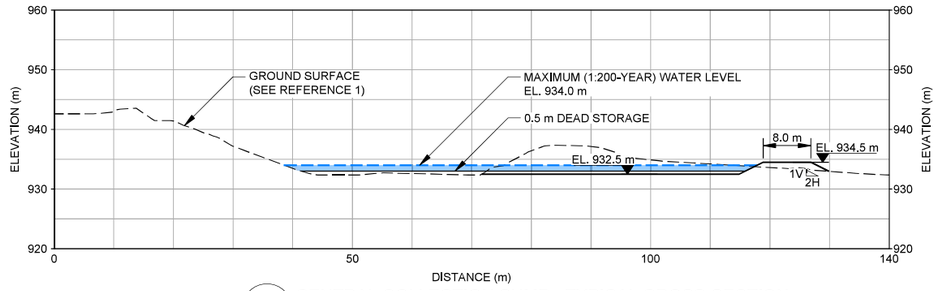

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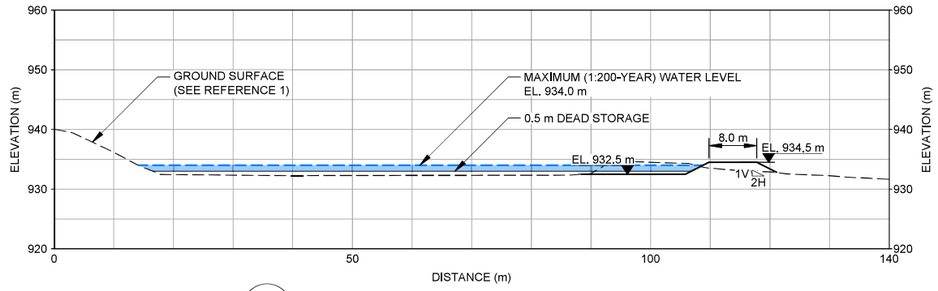

SCALE 1:500 m — AT — CENTRAL COLLECTION SUMP - TYPICAL CROSS-SECTION

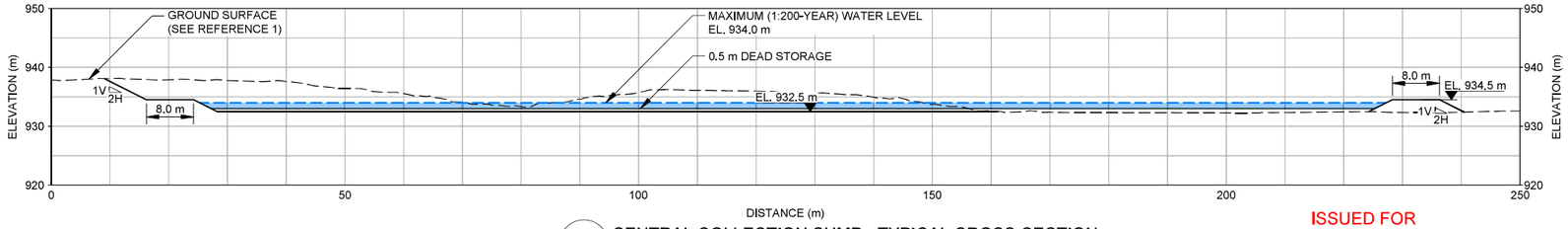

SCALE 1:500 m — AU — CENTRAL COLLECTION SUMP - TYPICAL CROSS-SECTION

LEGEND

- CENTRAL COLLECTION SUMP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- HISTORICAL INVESTIGATION LOCATION
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR

PERMITTING

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEINI # 53109

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CONSULTANT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CENTRAL COLLECTION SUMP
PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	26 of 26	DRAWING
23590671	31100/31152/072	0		26

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ATTACHMENT 2

TSF Surface Water Management Infrastructure – Design Basis Memorandum

TECHNICAL MEMORANDUM

DATE May 16, 2024 **Reference No.** 23590671-059-TM-Rev1-31151

TO Matt O'Leary
Mount Polley Mining Corporation

CC Lee Nikl and Germán Pizarro

FROM Nasim Hossein and Don Kidd **EMAIL nasim.hosseini@wsp.com; don.kidd@wsp.com**

TSF SURFACE WATER MANAGEMENT INFRASTRUCTURE – DESIGN BASIS MEMORANDUM – MOUNT POLLEY MINE

1.0 INTRODUCTION

The Mount Polley Mine is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The site is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The Mount Polley Mine began production in 1997.

The Tailings Storage Facility (TSF) for Mount Polly mine is being extended for future operations. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. This design basis memorandum (DBM) has been prepared by WSP to guide the design of TSF surface water management infrastructure, and to document the parameters and criteria to be used to develop the design inputs.

This memorandum provides the design basis of the TSF surface water management infrastructure to support raising the existing TSF from its currently permitted elevation of 970 m to about 974 m. This document is the updated version of Rev0 issued on 25 December 2023.

2.0 DESIGN BASIS

The design basis and criteria include hydraulic and hydrologic design assumptions for TSF water management at the Mount Polley Mine. This document does not include the design basis and criteria for the TSF spillway. The design basis and criteria for the TSF spillway, including the design event, freeboard, and catchments are provided in the design criteria technical memorandum for tailings storage facility raise to elevation 974 m (WSP 2024).

2.1 Hydrologic and Hydraulic Design Basis

The following tables summarize the criteria for design of the TSF surface water management infrastructure.

Table 1: Design Criteria – Water Diversion and Collection Channels

Parameter	Criteria	Reference/Comment
Design Storm	1:200-year, 24-hour rain plus snowmelt.	HSRC Part 10 guidance (2016), section 3.5.2 Sediment Ponds and Diversion Structures; BC Ministry of Environment-Section 5; Permit M-200
Pumped Flow	A pump capacity of 360 m^3/hr from South Embankment Pond to the collection channel near corner 3 flowing towards Main Embankment Pond.	Informed by MPMC, May 2023
Seepage Rate to the Collection Channels	Seepage rates will be based on the maximum seepage rate that will be estimated as part of the TSF design scope of work.	WSP2024b
Drain Flow Rate to Collection Channels	Drain flow rates will be based on the maximum drain flow capacity that will be designed as part of the TSF design scope of work.	WSP2024b
24-hr 1:200-year rainfall	69 mm	WSP 2022
24-hr 1:200-year snowmelt depth	15.9 mm (See section 2.2)	Estimated using Dunne & Leopold (1978) method for a corresponding rainfall event calculated for spring conditions (April).
Catchment Area	Delineated based on topography using 2023 contours with 0.1m resolution, 2023 LiDAR topography survey provided by MPMC, and embankment and buttress contours as part of the TSF design scope of work.	Channels 1-3 reporting to the South and Main Embankment Seepage Ponds will be designed considering the ultimate TSF embankment raise (987 m crest) . [(a)] other channels will be designed considering interim TSF raise (974 m crest).
24-hour storm distribution	Soil Conservation Service Storm Type II	Section 2.3
Side slopes	2H:1V	Adopted
Longitudinal slope	Minimum 0.1% slope, to optimize excavation volume	Adopted
Freeboard	Minimum 0.3 m	Permit M-200
Minimum channel base width	1.0 m	Adopted
Minimum channel depth	0.5 m	Adopted
Erosion Protection requirements and Permissible Flow Velocity	Erosion protection materials will be selected based on estimated peak velocities along the channel alignment using the hydraulic calculations.	BC MOTI 2019 Flows estimated using HEC-HMS model. Velocities estimated using Manning's equation.
Road Crossing Culverts	1:200-year, 24-hour rain plus snowmelt.	Match design flow inputs of adjacent conveyance structure.
Road Crossing Ford (as an alternative for culverts, if needed)	5H:1V maximum crossing side slopes.	BC Ministry of Forest Lands and Natural Resource Operations (2012).

MPMC = Mount Polley Mining Corporation; TSF = Tailings Storage Facility; BC MOTI = British Columbia Ministry of Transportation and Infrastructure.

(a) Design is in progress.

Table 2: Design Inputs– Collection Ponds

Parameter	Criteria	Comment/Reference
Storage Volume – Storm	Store 1:10-year, 24 hour rain plus snowmelt storm event	This design event is consistent with requirement in Environmental Management Act Permit 11678 (EMA 2022) Permit 11678 Paragraph 2.4.5, which states that "surface water control works must be designed to convey all flows up to a 1 in 10 year 24-hour storm event and must be designed to withstand all flows up to a 1 in 200 year 24-hour storm event, without significant damage".
Storage Volume – TSF Seepage	Excluded	Seepage inflow to the South and Main Embankment Ponds will be pumped out to the TSF or Perimeter Embankment Till Borrow Pit (PETBP). MPMC operates the ponds by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Seepage inflow to PETBP will be pumped out to the Treatment Plant or TSF. MPMC operates the pond by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Extra storage allowance may be an option to allow greater operational flexibility with pumping seepage flows. To be discussed and confirmed with MPMC.
Storage Volume – TSF Upstream drain flow	Excluded	Drain inflow to the South and Main Embankment Ponds will be pumped out to the TSF or PETBP. MPMC operates the ponds by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Drain inflow to PETBP will be pumped out to the Water Treatment Plant or TSF by the water level control system to leave enough storage capacity for storm events. Extra storage allowance may be an option to allow greater operational flexibility with pumping upstream drain flows.
24-hr 1:10-year rainfall	47 mm	WSP 2022
24-hr 1:10-year snowmelt depth	14.8 mm (See section 2.2)	Estimated using Dunne & Leopold (1978) method for a corresponding rainfall event calculated for spring conditions (April).
Dead Volume	0.5 m bottom of the pond	Adopted
Freeboard at Spillway Entrance	Minimum 0.3 m	Between the maximum water level design flow during 24-hr 1:200-year rain plus snowmelt event and the crest of the collection pond.
Pond geometry and side slope	Minimum 2H:1V	The stability analysis (WSP 2024a) indicates that the proposed cut slopes at a ratio of 2H:1V meets the desired safety standards across all loading conditions.
South and Main Embankment Ponds pumping capacity	The current pumping capacity is: South Embankment Pond to Main Embankment Pond = 360 m^3/hr. Main Embankment Pond to TSF = 360 m^3/hr.	Informed by MPMC, May 2023 The current pumping rates must be verified or updated according to the updates to the operational pumping rules and upstream drain and seepage flow rates. The opportunity of sending water from the South and Main Embankment Ponds to the PETBP to be evaluated.
Emergency Spillways	Convey the 1:200-year, 24-hour rain plus snowmelt storm event	EMA 2022 - Permit 11678

Table 2: Design Inputs– Collection Ponds

Parameter	Criteria	Comment/Reference
Freeboard at Spillway Outlet Channel	Minimum 0.3 m freeboard	Permit M-200
Pond Liners	Native material liner	Native material is anticipated to have sufficiently low permeability to act as pond lining.

2.2 Design Precipitation Depth

Extreme runoff volumes are anticipated to be associated with extreme rainfall events occurring during freshet. The snowmelt is expected to occur between March and May with a relatively greater portion melting in April. Snowmelt estimates induced by a corresponding rainfall event (rain plus snowmelt event) were calculated for spring conditions (April) using equation below (Dunne & Leopold, 1978).

$$M_R = 1.42T_a + 2.5 + \frac{RT_aC_W}{L} + 0.0059T_au_2$$

Where:

M_R = snowmelt in mm/day Snow Water Equivalent (SWE).
R = rainfall depth in mm/day averaged over the duration of the storm.
T_a = average air temperature over the duration in °C.
C_W = specific heat of water (equal to 1 cal/g/°C).
L = latent heat of fusion of ice equal to 80 cal/g.
u_2 = wind speed in km/day

The potential snowmelt during a rainfall event was estimated using the mean daily temperature in April of 3.7°C (WSP 2022). The spring average wind speed of 2.6 m/s (Golder 2017) was used for this equation. The estimated spring maximum 24-hour snowmelt rates are presented in Table 3.

Table 3: 24-Hour Rainfall, Snowmelt, and Rain Plus Snowmelt (mm)

Return Period (Years)	Mean Daily Temperature in April (°C)	24-Hour Rainfall (mm)	24-Hour Snowmelt (mm)	24-Hour Rain Plus Snowmelt (mm)
10	3.7	47	14.8	61.8
200	3.7	69	15.9	84.9

2.3 Design Storm Event Rainfall Distribution

Natural Resources Conservation Service (NRCS) (formerly known as Soil Conservation Service (SCS)) defines three storm distributions: Types I, Type IA, and Type II. The SCS storm type distribution over 24 hours at the Site was estimated based on the 1:100-year depth-duration-frequency (DDF) values at the Williams Lake (Station ID 1098940) and Quesnel (Station ID 1096631) climate stations operated by ECCC. The rainfall distribution at the Williams Lake and Quesnel climate stations for 5-minute to 12-hour durations were estimated as a percentage of the 24-hour rainfall and the results were compared to the representative percentages of each of the SCS curves. The DDF values were plotted and compared to the representative percentages of each of the SCS curves (Table 4 and Figure 1).

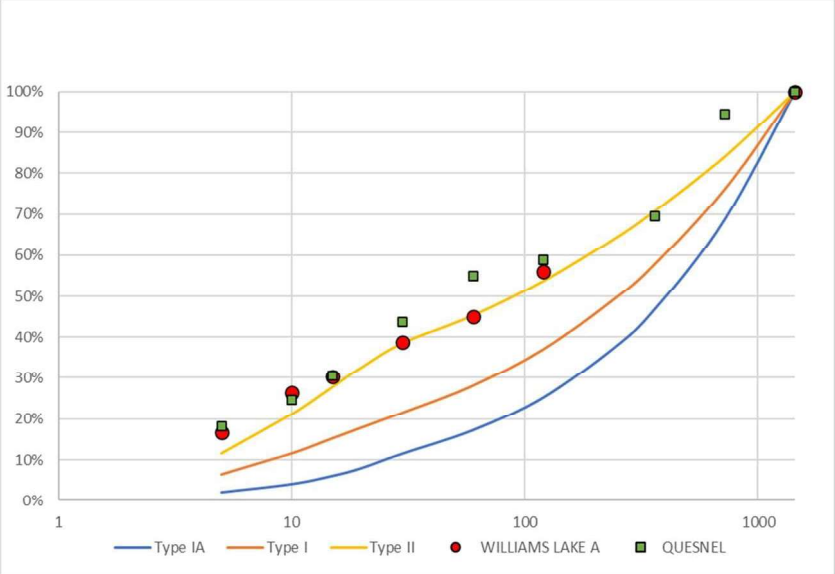

Figure 1: 1:100-year depth-duration values at the Williams Lake and Quesnel

Table 4: 1:100-year Depth-Duration-Frequency Values in mm for the Williams Lake and Quesnel Climate Stations

Duration	Williams Lake	Quesnel
5 min	7.8	8.8
10 min	12.4	11.9
15 min	14.2	14.7
30 min	18.2	21.1
1 hr	21.1	26.5
2 hr	26.3	28.4
6 hr	Not Available	33.5
12 hr	Not Available	45.6

Table 5: Comparison of DDF to NRCS Storm Distributions

Durations	DDF At Williams Lake	DDF At Quesnel	SCS Type IA	SCS Type I	SCS Type II
5 min	17%	18%	2%	6%	12%
10 min	26%	25%	4%	12%	21%
15 min	30%	30%	6%	15%	28%
30 min	39%	44%	12%	22%	39%
1 hr	45%	55%	17%	28%	45%
2 hr	56%	59%	25%	37%	54%
6 hr	Not Available	70%	47%	58%	71%
12 hr	Not Available	95%	69%	76%	84%

Table 5 indicates that the short-duration rainfall distribution at the Mt Polley mine site follows Type II distribution. Millar (2017) presented similar results and indicated that the SCS Type II distribution is considered representative of the 24-hour storm distribution for the Williams Lake climate station. For the design purpose, the SCS Type II storm was identified as the best representation of the typical rainstorm intensities at the site and was used to derive the design 24-hour rainfall distribution.

2.4 Hydrologic and Hydraulic Methods

The design of the TSF water management infrastructure will be based on design peak flows and volumes estimated using the Hydrologic Engineering Center hydrologic modelling system software (HEC-HMS) version 4.10 (USACE 2022). The US Department of Agriculture, Soil Conservation Service (SCS) Type IA rainfall distribution curve (USDA 1986) will be used to derive the design of storm hyetographs.

The SCS curve number (CN) method (USDA, 1986) will be used to estimate general catchment area losses. These losses are considered when determining the amount of rainfall during a storm that becomes direct runoff.

Time of concentration is estimated using SCS TR-55 method (USDA 2009), which divides the longest flow path into sheet flow, shallow concentrated flow, and open channel flow, and considers a minimum time of concentration of 6 minutes. The lag time was estimated as 60% of the time of concentration.

Catchment Curve Number (CN) values, to predict direct runoff, are provided in Table 4.

Table 6: Soil Conservation Services Curve Numbers Used for the Project

Land Type	CN (AMC II)	CN (AMC III)
Undisturbed catchment	55	73.8
TSF Embankment and Buttress	70	84.3
Disturbed catchment	79	89.6
Open Water	No loss	

CN = Curve number; AMC II = Average antecedent moisture conditions, AMC III = Wet antecedent moisture condition.

Channels will be sized for uniform flow conditions using Manning's equation for open channel flow. Manning's n values for different riprap sizes and plastic liner are shown in Table 5. For erosion protection of the channels, the riprap class was selected considering the maximum permissible velocity of the riprap provided in Table 8.

Table 7: Manning's n Values for Channels

Material Type	Manning's n for Capacity	Manning's n for Stability
Plastic	0.012	0.010
gravel, uniform section, clean(1)	0.03	0.022
Riprap class 10 KG	0.038	0.034
Riprap class 25 KG	0.039	0.035
Riprap class 50 KG	0.042	0.037
Riprap class 100 KG	0.044	0.039
Riprap class 250 KG	0.046	0.042

(1) Manning's n for Channels (Chow, 1959).

Table 8: Maximum Permissible Velocity for Riprap and Plastic (MOTI 2019)

Riprap Class	Velocity (m/s)
Plastic	5.0
Gravel, uniform section, clean	1.0
10 kg	2.7
25 kg	3.1
50 kg	3.5
100 kg	3.9
280 kg	4.5
Riprap class 1 000 KG	5.0
Grouted riprap	Refer to Figure 2

(2) Source: BC MOTI (2019) - values rounded

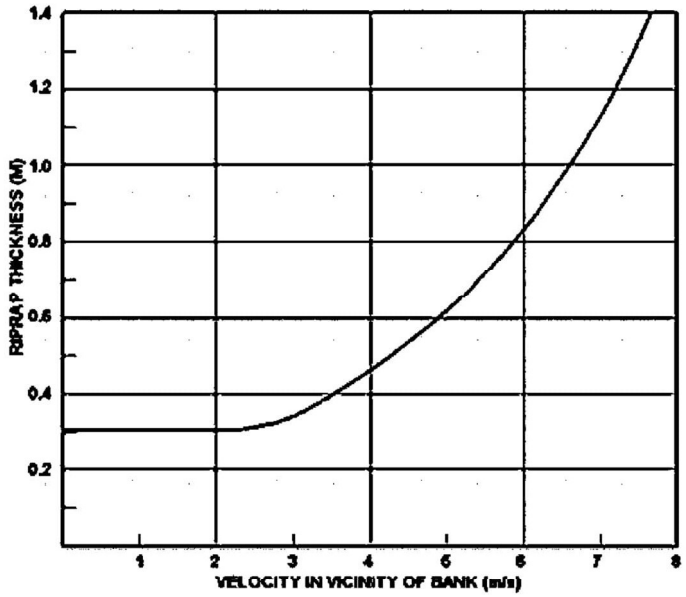

Figure 2: Required Blanket Thickness as a Function of Flow Velocity (HEC 11, 2024)

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

WSP Canada Inc.





Nasim Hosseini, M.Sc., P.Eng.
Water Resources Engineer

Don Kidd, P.Eng.
Principal, Senior Water Resources Engineer

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Engineers & Geoscientists BC

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STUDY LIMITATIONS

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APPENDIX 5-3: Site-Wide Water Balance Model

TECHNICAL MEMORANDUM

DATE March 21, 2024 **Reference No.** CA0020527.4505-026-TM-Rev0-31141

TO Matt O'Leary
Mount Polley Mining Corporation

FROM Stella Cheng, Gonzalo Donoso, and Peter Morgan **EMAIL stella.cheng@wsp.com; gonzalo.donoso@wsp.com; peter.morgan@wsp.com**

2023 SITE WIDE WATER BALANCE MODEL UPDATE AND CALIBRATION – MOUNT POLLEY MINE

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to provide water balance modelling services to update and calibrate the Site Wide Water Balance Model (SWWBM) in support of MPMC's 2023 Annual Report. This exercise is a requirement of Section 4.2.1 (f) of MPMC's Discharge Permit 11678, issued under the *Environmental Management Act* and most recently amended through a Consent Order on December 31, 2020 (BC ENV 2020).

The SWWBM was developed using GoldSim™, a highly graphical software package for carrying out dynamic, probabilistic simulations to support decision-making (GoldSim 2018). GoldSim™ is frequently used to evaluate water management alternatives, perform sensitivity analyses, and conduct mass balance simulations.

The SWWBM was developed as part of the Mount Polley Mine Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water management across the site (e.g., runoff, water transfers, and storage). The details of the SWWBM were first presented in the Mount Polley Mine Water Balance report (Golder 2016b).

On May 26, 2019, Mount Polley Mine (the Mine) entered a care and maintenance phase. On June 1, 2022, the Mine resumed operations under the current EMA Permit 11678. Mining and tailings deposition occurred throughout 2023.

WSP updated the SWWBM in March 2023 to calibrate water volumes, water levels and discharges in the Tailings Storage Facility (TSF) for the period from January 1, 2022 to December 31, 2022 (WSP 2023a). An updated Water Balance Report was presented in 2023 (WSP 2023b) as part of the Water Management Plan for the Springer Expansion Life-of-Mine update (WSP 2023c).

This technical memorandum describes updates to the SWWBM to reflect site conditions in 2023, and calibration to measured water levels in the TSF for the period from January 1, 2023 to December 31, 2023. A summary of the model updates, the assumptions made in the calibration process, a discussion of the calibration results, and the end-of-year water balance for the Mine, is included in this document.

2.0 MODEL UPDATE

2.1 Data Received

MPMC provided WSP with measured data from site (MPMC 2024a). The following data were received from MPMC (2024a):

- "Snow Pack 2023.xlsx" Periodic snowpack measurements (snow water equivalent [SWE] in cm).
- "TSF Water Balance Jan 24, 2023 v3.xlsx" Periodic Springer Pit, Cariboo Pit and Wight Pit water level measurements in 2023 (m, mine grid).
- "2023 all weather station data.xlsx" Q1 to Q4 2023 climate data from site – including rainfall (mm), daily temperature (ºC) and evaporation (mm).
- "HMI WTP 2023 Total.xlsx" Monthly discharge of treated water (m^3) through the water treatment plant (WTP).
- "Weekly TSF Reports.pdf" TSF reclaim pond water level measurements (m, tailings grid) and Springer Pit remaining tailings (M-m^3) throughout 2023
- "2023 DSI Report Data Request.msg" Tailings deposited in the TSF throughout 2023 (tonnes).

2.2 Summary of Model Updates

Through discussions with MPMC, the SWWBM was updated to reflect site water management operations for the period of January 1, 2023 to December 31, 2023. The model updates were as follows:

- Tailings discharge from the ore processing plant to the TSF throughout 2023.
- Discharge to the environment through the WTP was updated. The volume of WTP discharge saw a significant decline beginning in September 2023. This decrease occurred because the WTP has been offline since September 13, 2023, as water has been redirected from Wight Pit to TSF (MPMC 2024a). Monthly discharge volumes through the WTP are shown on Figure 1.
- Water from Wight Pit was transferred to the WTP via Long Ditch for treatment and discharge in 2023. A time series plot of the modelled total water volume in Wight Pit is shown in Figure 1.
- Water from Springer Pit was transferred to the WTP via West Ditch for treatment and discharge throughout 2023. A time series plot of the modeled total water volume in Springer Pit is shown in Figure 1.
- Water from Cariboo Pit was transferred to the WTP via West Ditch for treatment and discharge throughout 2023. A time series plot of the modeled total water volume in Cariboo Pit is shown in Figure 1.

Additional details related to use of available surveys are provided in the following section.

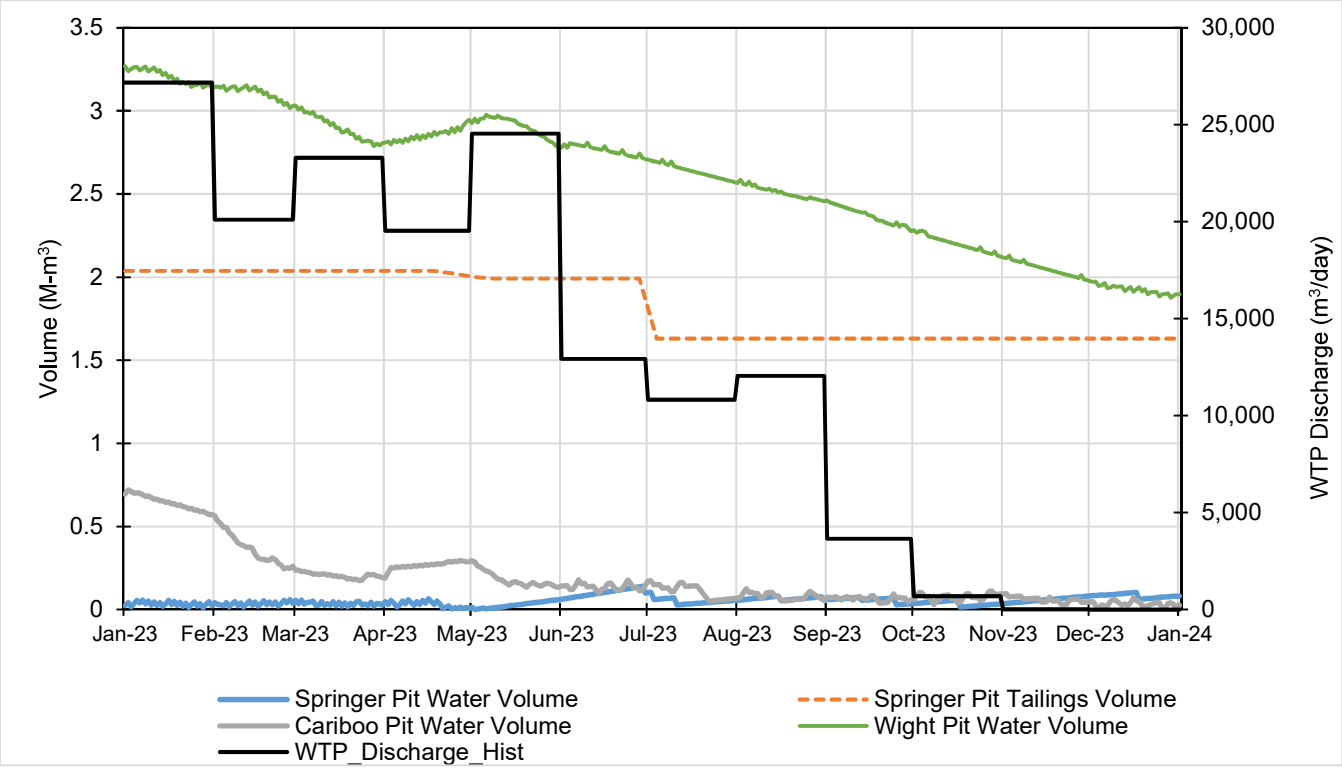

Note: The primary y-axis unit (M-m3) denotes millions of cubic meters.

Stored water volume = surface water volume + voids water volume

Figure 1: Springer, Cariboo, Wight Pits Volumes and WTP Discharge Flow Rate

2.3 Site Surveys

2.3.1 TSF

Topographic surveys of the TSF were conducted by MPMC on October 30, 2023. A bathymetric survey within the TSF was conducted on August 25, 2023. The storage-elevation curve was developed using the combined bathymetry and topography, and it is used in the SWWBM to infer the TSF free water volume from measured water level data, recognizing that the surfaces described are a triangulation of a bathymetry survey (tailings surface under water) and a topographic survey (tailings surface above water). The triangulation of survey points near the transition between water and land, as well as the use of different dates for the Topographic and Bathymetric Surveys, introduce uncertainty into the resulting storage-elevation curves. However, the accuracy is considered acceptable for the required resolution of the model results.

Storage-elevation curves for the TSF up to a dam crest elevation of 974 m developed from the August 25, 2023 TSF survey were used in support of the free water volumes projection affected by tailings deposition after the survey date of October 30, 2023. Storage-elevation curves were used to model the facilities with linear interpolation throughout 2023.

2.3.2 Springer-Cariboo

A bathymetric and topographic survey of Springer-Cariboo Pit was conducted by MPMC on January 25, 2024, indicating that the Springer and Cariboo pits were divided up to the saddle level (approximate elevation of 964 m), and then combined from that level upward. Based on the recorded pit elevation data from MPMC (MPMC 2024a) and the fact that the Springer Pit was completely dewatered as of April 18, 2023 (MPMC 2024b), the Springer Pit and Cariboo Pit should be considered as separate reservoirs for modeling purposes in 2023. Storage-elevation curves for Springer Pit and Cariboo Pit were generated individually to infer the free water volumes within the pits from measured water level data in the SWWBM.

Springer Pit storage-elevation curves based on the bathymetric and topographic survey on November 7, 2019 were utilized in the model until April 18, 2023. These were then projected to the Springer Pit storage-elevation curve based on the January 25, 2024 survey. Projected storage-elevation curves were used to model the facilities with linear interpolation. Tailings were excavated during the calibration period, it is assumed that the excavation is reflected in the survey data. Figure 1 shows a time series plot of Springer Pit tailings volume.

Cariboo Pit storage-elevation curves (dated January 30, 2023, refer to MPMC 2023) were utilized until the end of 2022. These were then projected to the Cariboo Pit storage-elevation curve based on the January 25, 2024 survey. Projected storage-elevation curves were used to model the facilities with a daily linear interpolation between dates, throughout 2023.

2.3.3 Wight Pit

Wight Pit storage-elevation curves (dated March 1, 2022; MPMC 2022) were provided by MPMC. The curves include underground workings and pore space assumptions. Measured water level data from MPMC were used to infer the water volumes in the pit based on the storage-elevation curves provided.

3.0 MODEL CALIBRATION

3.1 Overview

The SWWBM was calibrated by adjusting outflows of the reservoirs and comparing modelled water levels to measured water levels recorded at the TSF. The TSF temporarily retains high runoff inflows experienced during freshet and storm events. The resulting modelled water levels in the TSF are the balance of site-wide inflows and outflows, including pumping to and from the pits and the booster station, which are temporary storage locations for surplus water on site.

An input climate dataset was generated (Section 3.2) and seasonal runoff coefficients were used during freshet (Section 3.3) to better represent measured site runoff conditions (i.e., reduction in measured snowpack depth) in 2023 and to facilitate the calibration.

3.2 Climate Data

A climate dataset at the Mine for 2023 was generated and used to represent site climatic conditions for the calibration.

The dataset consisted of the following:

- January through December rainfall data from MPMC.

- Freshet (March through April) snowmelt as determined from decreases in snowpack SWE depth recorded at the Mine.

3.3 Runoff Coefficients

Runoff coefficients in the SWWMB are adjustable loss parameters that translate measured climate trends and ground conditions into estimates of modelled runoff. Model performance from historical climate data for the year 2023 supported the delineation of runoff coefficients into two distinct seasonal climate periods:

- Freshet (March to June; inclusive) – Highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.
- General (January to February; inclusive and July to December; inclusive) – Mid range coefficients to represent soil moisture contents for intermittent runoff events. A 30% increase to the general coefficients is applied to the subsequent month if the previous month had a cumulative rainfall plus snowmelt depth greater than 50 mm.

The seasonal runoff coefficients defined for the catchment types remained unchanged from those used in the 2022 SWWBM calibration and are listed in Table 1.

Table 1: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020

4.0 CALIBRATION RESULTS

Figure 2 shows the modelled and measured water levels within the TSF for the 2023 calibration period. The modeled water levels were estimated from the modeled volume estimated using the storage-elevation storage curves. The average difference between modelled and measured water levels is approximately 0.14 m, which is considered acceptable for the purposes of the calibration exercise.

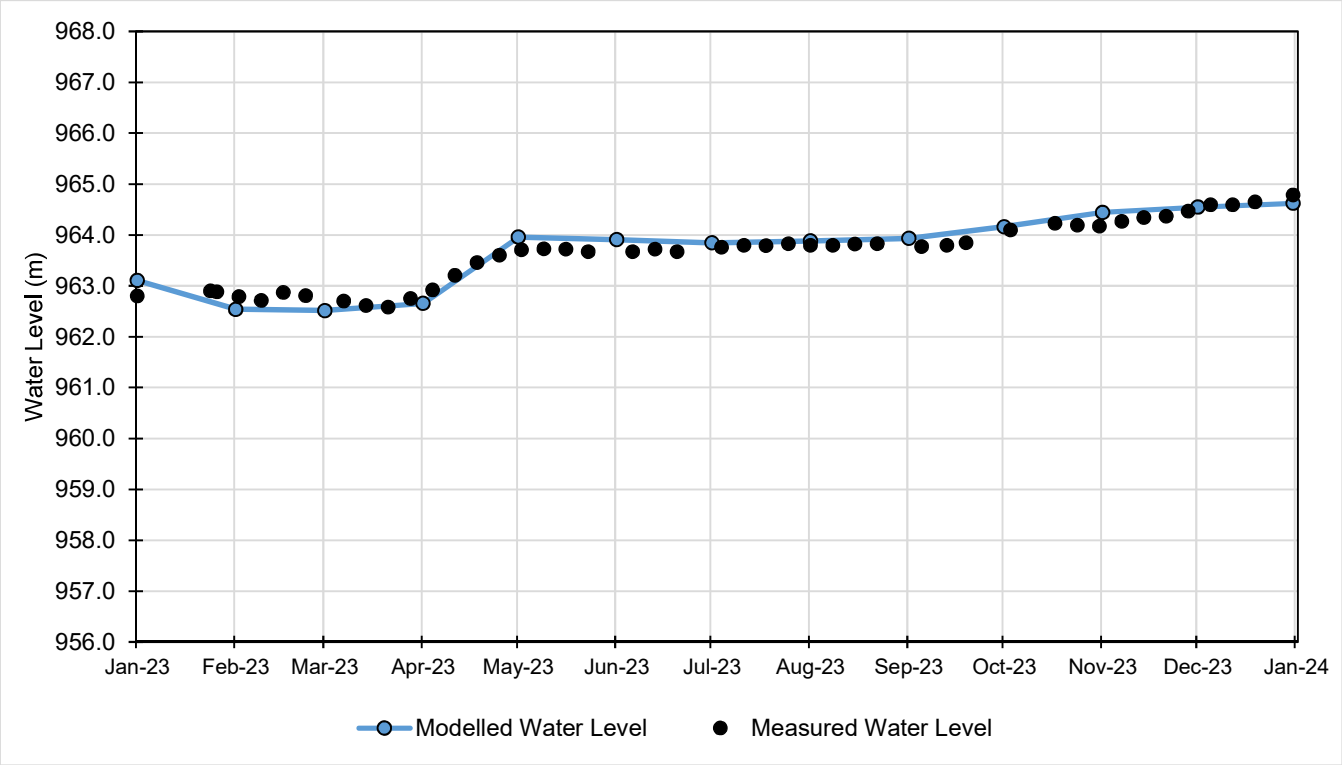

Note: Last measured water level occurred on 31 December 2023.

Figure 2: Water Levels in the TSF

Figure 3 shows the modelled free water volume in the TSF along with the inferred free water volume from measured water levels. The measured water levels were converted to an inferred water volume using the storage-elevation curves described in Section 2.3.

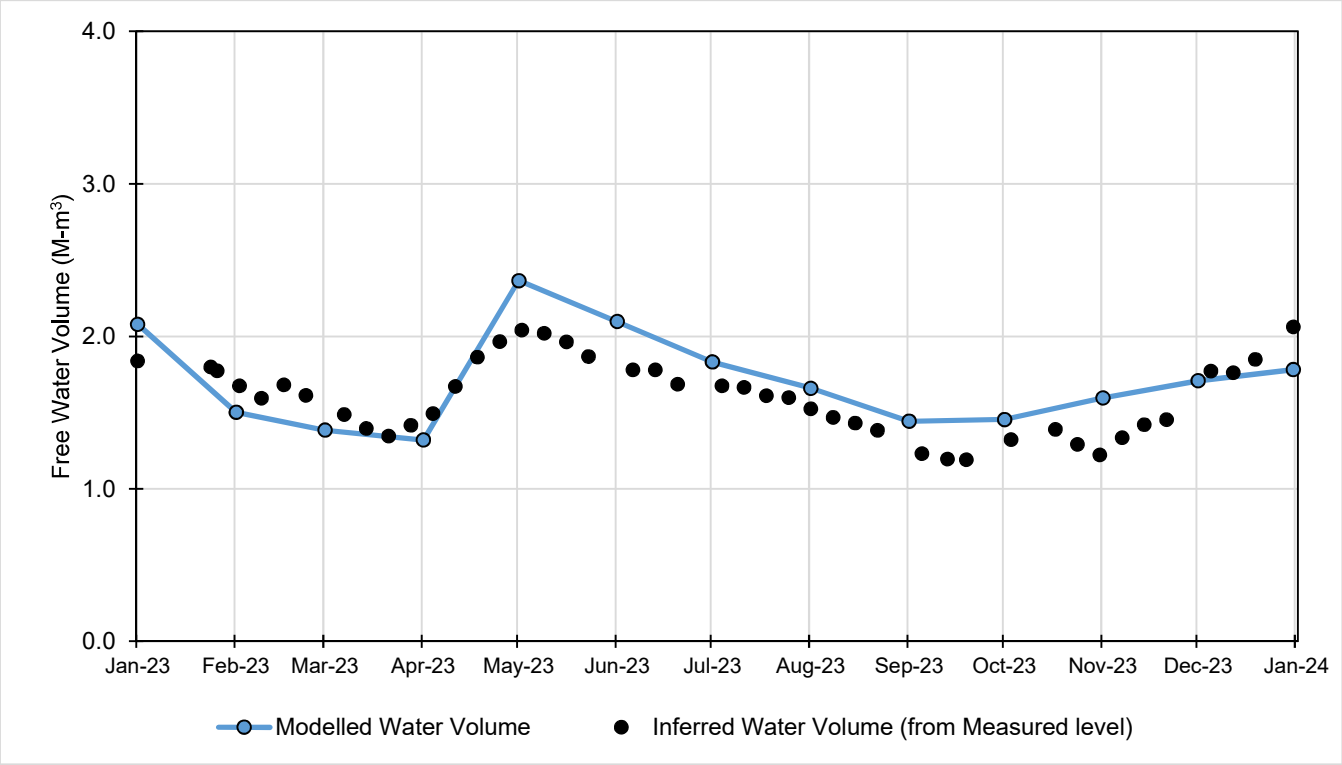

Note: Last measured water level occurred on December 31, 2023. The y-axis unit (M-m^3) denotes million cubic meters.

Figure 3: Free Water Volume in the TSF

Figure 2 and Figure 3 indicate that the model is reasonably calibrated and there is general alignment between measured free water levels and the inferred free water volume in the TSF. Differences between modelled and measured values may have several explanations:

- Variability in runoff coefficient throughout the year.
- Uncertainties in the climate data (e.g., snowpack surveys can miss intermittent snowmelt if conducted infrequently and the use of composite datasets may over or under-estimate actual conditions).
- Uncertainties in the TSF bathymetric survey (e.g., the transition between exposed tailings surface [i.e., beach] and free water can be complex).
- Uncertainties associated with the tie-in of the October 30, 2023 TSF storage curve with those utilized in the 2022 calibration, specifically referring to the projected storage curves from the 2020 TSF survey to the 987 m dam crest elevation.
- Uncertainties related to the projection of the Cariboo Pit storage curve from 2022 Calibration to the January 25, 2024 survey could lead to a situation where less storage capacity is modeled for the Cariboo Pit. Consequently, the volumes for the TSF and other pits may over estimated.
- Potential inaccuracies in water level measurements.

- Potential inaccuracies and/or missing WTP discharge data. The TSF weekly report noted that WTP ceased operations after September 13, 2023. However, there were still low volumes of WTP discharge recorded in October and November 2023. Additionally, the WTP discharge data are available for only 6 days in December 2023 (MPMC 2024a).
- Potential differences between modeled water transfer rates and actual transfers on site.
- There were minor discrepancies in the tailings deposition data between TSF Water Balance Spreadsheet and 2023 DSI Report data request (MPMC 2024a). WSP proceeded with tailings production umbers from the 2023 DSI Report data request to ensure consistency with the data used in the DSI.

The modelled results for the 2023 SWWBM calibration provide a reasonable approximation of site conditions and are considered suitable for water management planning.

5.0 END-OF-YEAR WATER BALANCE

Table 1 presents End of Year (EoY) modelled site water balance from 2017 through 2023. The modelled balance is the net storage of free water volume (total water) on site and net annual inflow. Storage locations include the TSF, pits, sumps, and ponds.

Table 2: EoY Modelled Site Water Balance Volume

Date	Total Water on Site[(a)(b)] (M-m^3)	Annual Water Net Inflow[(c)] (M-m^3)
December 31, 2017	6.0	4.6
December 31, 2018	3.9	5.3
December 31, 2019	3.8	6.4
December 31, 2020	8.2	9.5
December 31, 2021	7.5	6.1
December 31, 2022	6.0	6.4
December 31 ,2023	4.0	5.6

(a) End of year sum of water in TSF, pits, sumps, and ponds.
(b) Includes Wight Pit stored water volume.
(c) Net Inflows = Direct Precipitation + Runoff + Baseflows + Groundwater Inflow - Evaporation - Groundwater Outflow (for calendar year).

6.0 RECOMMENDATIONS

Based on the results of the 2023 SWWBM calibration, the following recommendations are provided to enable more robust water balance modelling:

- Increase the frequency of periodic snowpack measurements in the spring and fall seasons to generate more representative snowmelt data (e.g., in case mid-season snowmelt occurs outside of the freshet period).
- Record both snowfall and rainfall data measurements in the winter to produce more representative climate data (only rainfall and snowpack is recorded currently).

- Conduct both topographic and bathymetric surveys in spring and fall annually to achieve a more precise TSF storage curve progression.
- Review and validate available flow data on site to supplement the calibration of the SWWBM.
- Refine the runoff coefficients as part of future model updates.
- Refine the catchment areas to confirm various land types annually, thereby enhancing the precision of runoff estimations in the model through future updates.

7.0 CLOSURE

This technical memorandum summarizes the SWWBM calibration and end-of-year water balance for the model run period January 1, 2023 to December 31, 2023 (inclusive). The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust that this technical memorandum satisfies your current requirements. Please contact the undersigned should you have any questions.

WSP Canada Inc.



Stella Cheng, B.Sc., P.Eng.
Water Resources Engineer



2024-03-21

Gonzalo Donoso, M.Sc., P.Eng.
Senior Water Resources Engineer



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https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/026-tm-31141-2023 site wide water balance model update and calibration/rev0/ca0020527.4505-026-tm-rev0-31141-2023 wb calibration 21mar_24.docx

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STUDY LIMITATIONS

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APPENDIX 5-4: Responses to Comments from the Ministry of Environment and Climate Change Strategy – Technical Assessment Report for the Quesnel Lake Interim Discharge Extension

TECHNICAL MEMORANDUM

DATE 25 July 2022 **Reference No.** 22514095-052-TM-Rev0-81100

TO Mathieu O'Leary
Mount Polley Mining Corporation

CC Don Parsons

FROM Jesse Maddaloni, Lee Nikl and Tom Rutkowski **EMAIL Jesse.Maddaloni@wsp.com; Lee.Nikl@wsp.com; Tom.Rutkowski@wsp.com**

RESPONSES TO COMMENTS FROM THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY – TECHNICAL ASSESSMENT REPORT FOR THE QUESNEL LAKE INTERIM DISCHARGE EXTENSION

1.0 INTRODUCTION

This technical memorandum (memo) supports assumptions made in Golder Associate Ltd. (Golder)'s memo 22514095-051-TM-Rev0-81112 (Golder 2022a) which addressed water quality information requests received 21 June 2022 from the British Columbia Ministry and Environment and Climate Change Strategy (BC ENV) resulting from the Screening Phase review of the Technical Assessment Report for the Quesnel Lake Interim Discharge Extension. This memo specifically discusses the performance and operation of the Water Treatment Plant (WTP) upstream of the Quesnel Lake discharge.

The water quality memo (Golder 2022a) provided concentrations of parameters at the edge of the initial dilution zone in Quesnel Lake assuming that Environmental Management Act (EMA) Permit 11678 limits for parameters are met at the WTP outlet. This memo describes the performance and operation of the WTP from 2016 through 2021 and provides justification that parameter permit limits are achieved at the WTP outlet. This memo only discusses parameters of interest (Total Suspended Solids, Copper, and Selenium); information regarding other permitted parameters can be found in Golder 2022a.

2.0 WATER TREATMENT PLANT PERFORMANCE

The WTP receives influent from the Perimeter Embankment Till Borrow Pond (PETBP) and discharges effluent to a pipeline directed to the Quesnel Lake diffuser. Water quality is measured upstream of the WTP at point E19 and measured downstream of the WTP at point HAD-3. Figures in this memo show and compare parameter data recorded between these two monitoring points.

The WTP itself is a patented high-rate ballasted coagulation and flocculation process under the tradename Actiflo supplied by Veolia. The WTP is primarily designed for removal of Total Suspended Solids (TSS), but also removes metals mainly through TSS reduction.

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2.1 Total Suspended Solids

WTP influent, effluent, and permit limit concentrations for TSS are shown in Figure 1 over a six-year period between 2016 and 2021. Influent TSS is mainly below the permit limit (excluding one single sample) and effluent TSS is consistently below permit limit.

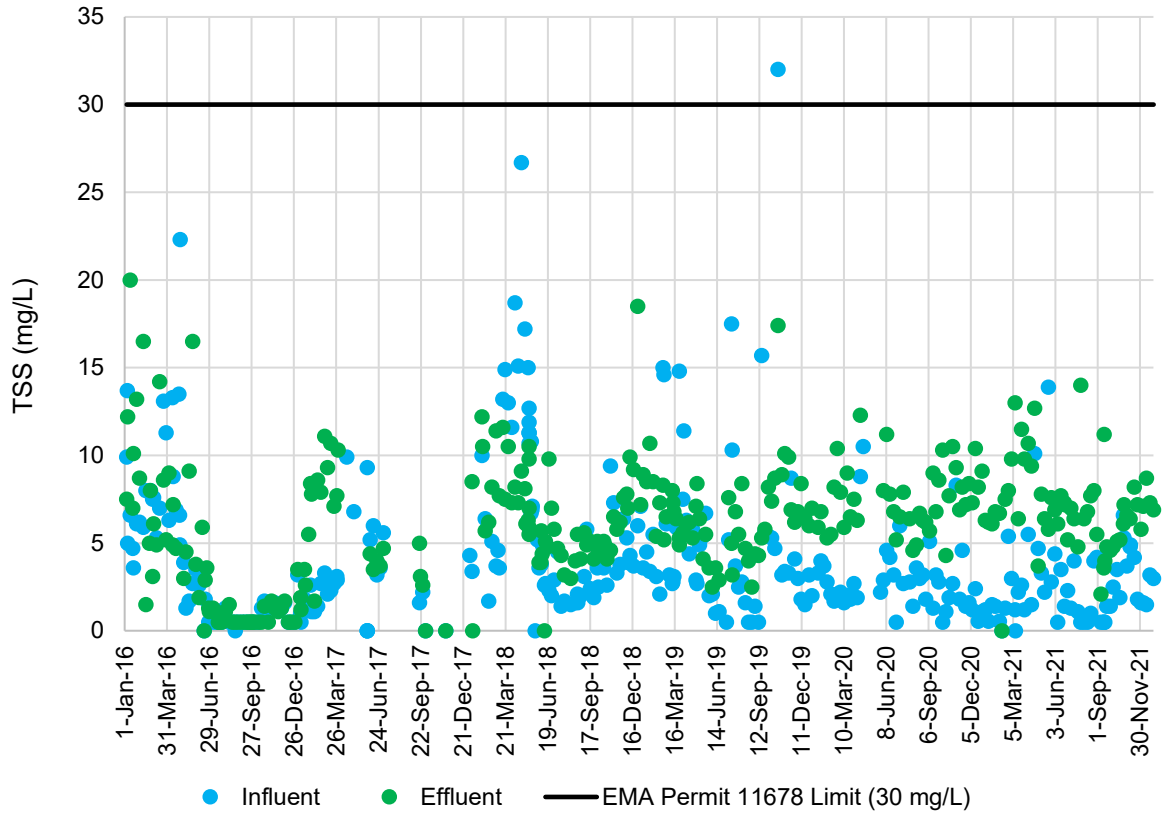

Figure 1: WTP Influent and Effluent TSS Measured at E19 and HAD-3 from 2016 to 2021

TSS treatment performance for the WTP is plotted in Figure 2, where influent TSS concentration is shown on the horizontal axis and TSS treatment efficiency (percent of influent TSS removed) is shown on the vertical axis. Figure 2 shows data points for samples collected over 2019 and 2021. It can be seen that TSS treatment performance ranges from approximately 0% to 70%, with the trend of growing treatment efficiency as influent TSS increases. At low influent TSS concentrations (approximately 5 mg/L and below), the WTP is not able to further reduce TSS and treatment efficiencies are low (and sometimes negative due to added TSS from treatment process). As influent TSS increases to the 10-20 mg/L range, the WTP is able to reduce effluent TSS and treatment efficiencies increase. Irrespective of the TSS treatment efficiency, Figure 1 shows that effluent TSS is consistently below the permit limit.

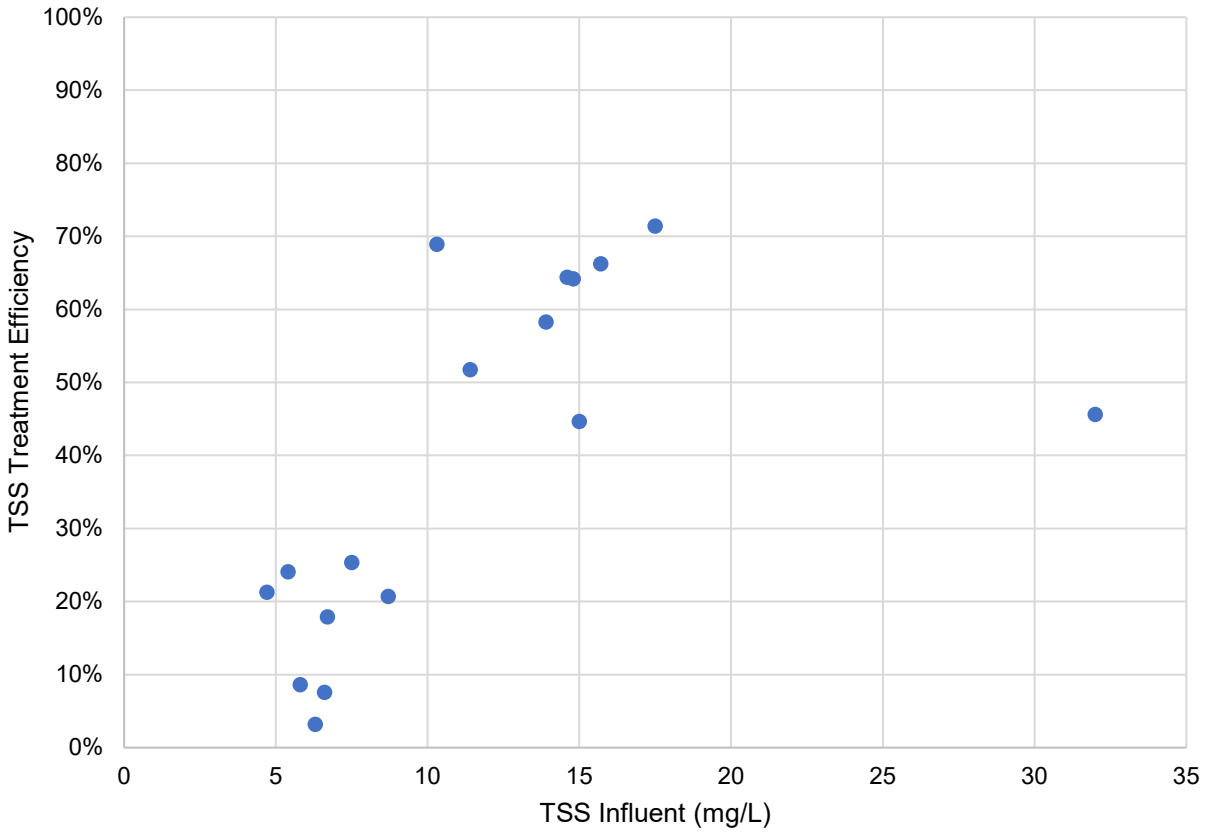

Figure 2: WTP TSS Treatment Efficiency vs. TSS Influent Concentration for Samples over 2019 and 2021

2.2 Copper

WTP influent, effluent, and permit limit concentrations for total copper are shown in Figure 3 over a six-year period between 2016 and 2021. Influent and effluent total copper concentrations are mainly below the permit limit, though there were some short infrequent periods where influent and effluent total copper levels were above the permit limit. Some data has been cropped from Figure 3 to allow a better zoomed view of data points near the permit limit. There is one copper occurrence that was cropped from the figure, occurring over 9 days in May 2018, where influent total copper had a maximum of 0.93 mg/L and effluent total copper had a maximum of 0.28 mg/L.

If total copper in the effluent exceeds the permit limit, the WTP is shut-down (or put into recirculation mode) and a Trigger Response Plan is activated, with WTP operation resumed once copper levels in the WTP effluent are confirmed below permit level. A summary of permit limit exceedances is provided in Table 7 of the Technical Assessment Report (Golder 2022b).

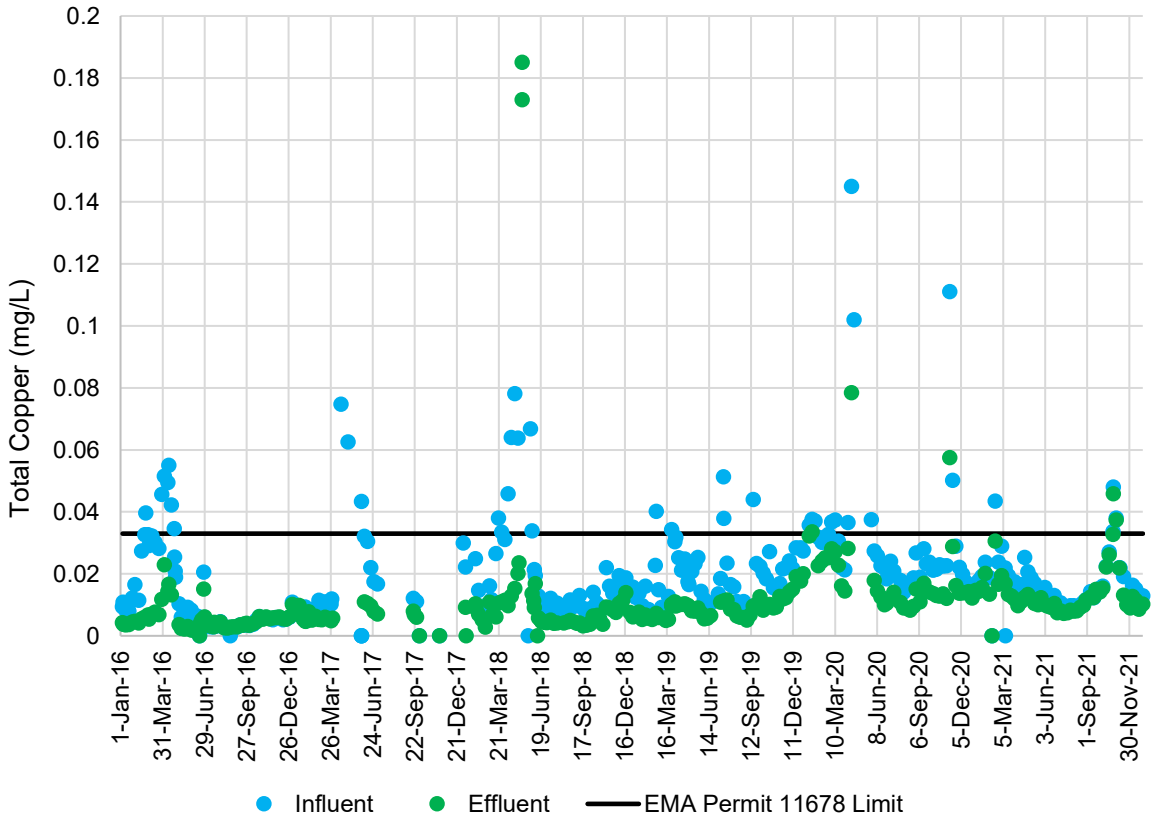

Figure 3: WTP Influent and Effluent Total Copper Measured at E19 and HAD-3 from 2016 to 2021

The water quality estimates provided in Golder 2022a show predicted WTP influent total copper concentrations from January 2023 through June 2025. The 95th percentile estimated concentration for total copper had a maximum of 0.061 mg/L. There are multiple instances in Figure 3 where influent total copper was near or above 0.061 mg/L and the WTP achieved an effluent total copper concentration below the permit limit, confirming that the WTP is able to treat that level of influent total copper. In the few instances where the WTP is not able to meet the permit limit for copper, the plant is shut-down or placed into re-circulation mode until the circumstances leading to that exceedance are remedied.

Total copper is the sum of dissolved copper and particulate copper. The WTP is primarily designed for TSS removal, and particulate copper is expected to be removed with TSS which is settled out during the treatment process. Dissolved copper also shows a reduction through the WTP, which may be attributable to co-precipitation with the Polyaluminum Chloride that is added at the start of the treatment process.

2.3 Selenium

WTP influent, effluent, and permit limit concentrations for total selenium are shown in Figure 4 over a six-year period between 2016 and 2021. Influent and effluent total selenium concentrations are consistently below the permit limit.

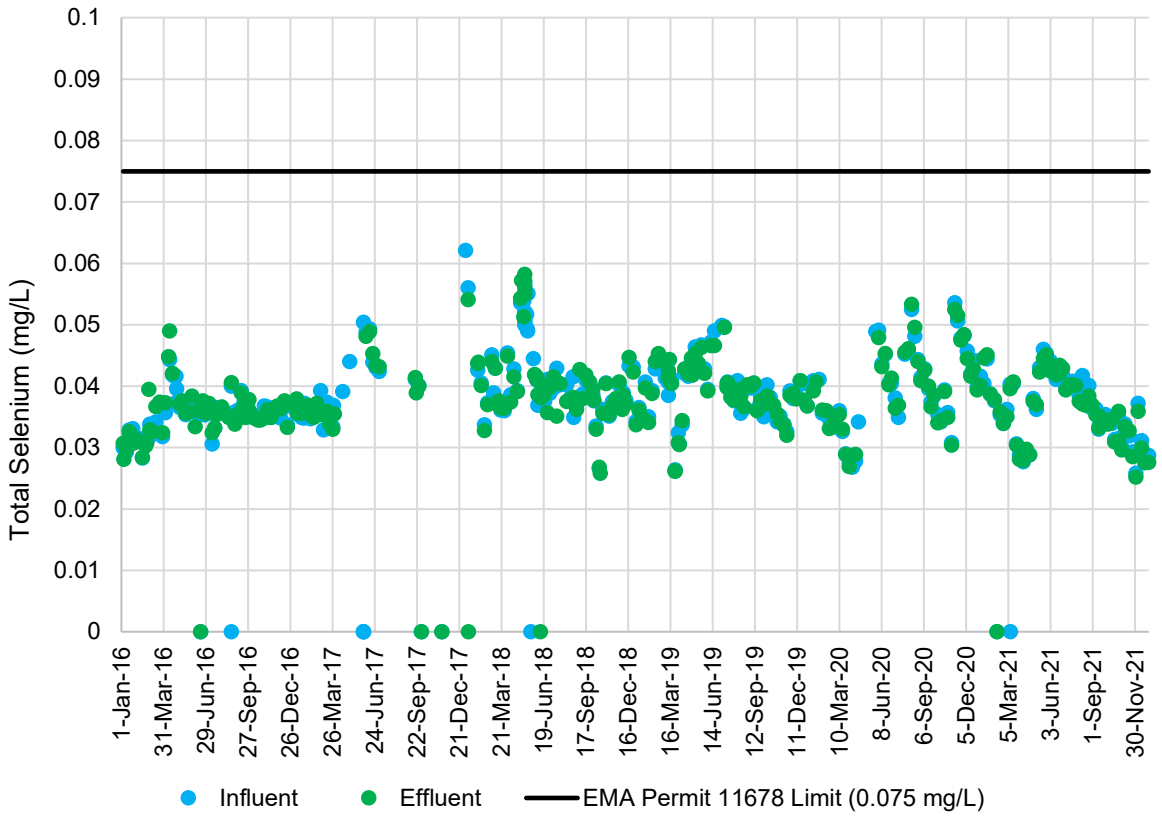

Figure 4: WTP Influent and Effluent Total Selenium Measured at E19 and HAD-3 from 2016 to 2021

The water quality estimates provided in Golder 2022a show predicted WTP influent total selenium concentrations from January 2023 through June 2025. The 95th percentile estimated concentration for total selenium had a maximum of 0.1 mg/L (with the maximum median value of 0.025 mg/L). The WTP is primarily designed for the removal of TSS and total selenium reduction through the plant is generally less than 10%. If WTP influent total selenium concentrations increase to 0.1 mg/L, then the WTP is not expected to meet the effluent permit limit; however, the historic data in Figure 4 demonstrates that influent selenium has not reached this level and that the maximum 95th percentile concentration of selenium is a conservatively high estimate. Current impacted water from mining activities at the site have not resulted in influent selenium concentrations beyond the permit limit.

Selenium concentrations may become an issue during mine post closure and development of passive treatment technologies targeting selenium reduction are currently being assessed and developed to address that possibility.

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Golder Associates Ltd.

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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/052-tm-81112-technical assessment report/22514095-052-tm-rev0-81100-quesnel lake tar trmt plant performance 25jul_22.docx

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APPENDIX 5-5: Recalibration of the Groundwater Flow Model for the Springer/Cariboo Open Pit and Predictions of Hydrogeological Conditions Near the Pits at Closure – Mount Polley Mine, BC

TECHNICAL MEMORANDUM

DATE May 22, 2024 **Reference No.** CA0020527.4505-040-TM-Rev0-31441

TO Mount Polley Mining Corporation

CC Jacqueline Foley and Jesse Maddaloni

FROM Arianna Piazza and Don Chorley **EMAIL arianna.piazza@wsp.com; don.chorley@wsp.com**

RECALIBRATION OF THE GROUNDWATER FLOW MODEL FOR THE SPRINGER/CARIBOO OPEN PIT AND PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE PITS AT CLOSURE – MOUNT POLLEY MINE, BC

1.0 INTRODUCTION

This technical memorandum presents the results of the groundwater model recalibration for the Springer/Cariboo Pit Lake at the Mount Polley Mine that is operated by the Mount Polley Mining Corporation (MPMC). This review was made in support of the Springer Expansion Permit Amendment Application that is currently being prepared for the site. The objective of the assessment is to update the model calibration (i.e., recalibration). The recalibration will improve model predicted groundwater conditions in the vicinity of the pit crest and south of the Spinger Pit in response to pit dewatering and seasonal changes in recharge after 2016, the last time the model was calibrated. Following model recalibration, the model was then used to predict groundwater conditions near the pits during closure.

The analysis presented in this memorandum builds on that which was completed by Golder Associates Ltd. (Golder; now WSP Canada Inc. [WSP]) in 2010 for the ultimate configuration of the Springer Pit that assumed no tailings/waste rock deposition in the pit (Golder 2010). It also builds on the analysis completed between 2014 and 2016 as part of mine water management that assumed the presence of tailings/waste rock in the pit (Golder 2014, 2015a, 2016) and on the model calibration check that was conducted in 2023 (WSP, 2024a). These analyses used a numerical groundwater model that considered hydrogeological data available at the time, and in particular the hydrogeological investigations that were conducted along the southwest wall of the Springer Pit in the spring of 2015 (Golder 2015b). The updated analysis presented in this memorandum considers hydrogeological and hydrologic data collected at the site, specifically groundwater elevations through 2023 (WSP, 2023, 2024b) and mine as-builts information from 2016 to 2023 provided by MPMC.

2.0 REVIEW OF MPMC HYDROGEOLOGICAL AND MINE DATA SINCE 2016

2.1 Water Levels

Water level monitoring data for the period 2016 to 2023 were collected as part of the groundwater monitoring program for the Mount Polley mine and were compiled and summarized in the annual monitoring reports by WSP (WSP 2023, 2024b). Groundwater monitoring has been ongoing at the mine site since 1995 with the objective of monitoring the direction, quantity, and quality of groundwater seepage near mine facilities (MPMC, 2019).

Groundwater levels were measured, at a minimum, semi-annually on approximately the same day of the year, and sometimes more frequently, in monitoring wells to detect changes in groundwater flow directions. Pressure transducers were also installed at GW12-2a and GW12-2b to record changes in pressures every hour. A barologger installed at GW12-2a records barometric pressure at the same frequency, allowing for correction of pressure transducer data for barometric changes. Water levels in Springer and Cariboo Pits were also reported usually once a month from 2016 to 2022, with a few short periods of increased frequency of measurements for the Springer Pit Lake. Figure 1 shows the location of the monitoring wells considered in this assessment. Figure 2 presents the water level data collected from 2015 to 2023 in monitoring wells located in the vicinity of the Springer Pit Lake and water level in the Springer Pit Lake and Cariboo Pit Lake. Key observations for select locations are summarized below.

Wells GW15-1a/b and GW15-2a/b

The available data indicate that hydraulic heads in wells GW15-1a/b and GW15-2a/b, immediately southwest of the Springer Pit crest, have been rising in response to the increases in the pit lake level between December 2015 and June 2016. The Springer pit lake reached an elevation of approximately 1037 metres above seal level (masl) in June 2016. Between January and June 2016, the water level elevation in the Springer Pit Lake was above the hydraulic heads in these four wells. These hydraulic head measurements indicate that, during this period, exfiltration of Springer Pit Lake water had likely occurred while the pit lake elevation was above 1025 masl. Following the aggressive drawdown of the Springer Pit Lake starting in June 2016, hydraulic heads in these four monitoring wells also declined, limiting the time period when the exfiltration of the pit lake occurred. As the Springer pit lake level progressively declined starting in 2017, water levels in these four wells remained above the elevation of the Springer Pit Lake. However, nested wells GW15-1a/b, the closest to the pit crest, appear to have a strong connection with the pit lake as the water level in both wells mimics the elevation of the pit lake until it drops below 1005 masl in February 2018. As the pit lake level continues to decline, the shallow well GW15-1b becomes dry (bottom of the well screen is at 1002 masl) and the water level in the deep well GW15-1a continues to drop and remains approximately 5 m above the pit lake level. Water level in wells GW15-2a/b remained at approximately 1020 masl, and they did not appear to be influenced by changes in the Springer Pit Lake water level after it dropped below 1010 masl.

Wells GW12-2a/b and GW16-6a/b

The hydraulic head measured in monitoring wells GW12-2a/b located approximately half-way between the crest of the Springer Pit and Bootjack Lake to the west was observed to gradually rise between December 2015 and June 2016 as the water level in the pit lake rose; in June 2016, when the pit lake reached its maximum elevation of 1037 masl, the hydraulic head in the shallow well GW12-2b was approximately 19 m below the elevation of the pit lake. Water levels in these two wells remained relatively constant and above the Springer Pit Lake elevation, when it dropped below 1010 masl in January 2017. Water levels in these two wells also remained above the water level elevation of the Bootjack Lake (987 masl) indicating that a groundwater divide between the Springer Pit and Bootjack Lake remains in the area of GW12-2(a,b) and GW15-2(a,b). This groundwater divide results in groundwater flow both towards the east and west from the groundwater divide. This is also confirmed by available monitoring data from wells GW16-6a/b, located south of the Springer Pit crest and approximately 120 m from Bootjack Lake that showed that water levels in these two wells remained constant and above the water levels in the Springer Pit and Bootjack Lake for the monitoring period (2017-2023).

Overall, the available data indicate that exfiltration from the Springer Pit might have occurred for a short period between January and June 2016, when the Springer Pit Lake elevation was above 1025 masl. From June 2016 to December 2023, following drawdown of the pit lake, the hydraulic heads in wells close to the Springer Pit crest have remained above the pit lake level, indicating that no exfiltration has likely occurred after this period. The hydraulic head at wells GW12-2a/b has remained below the pit lake level until January 2017, when the lake level dropped below 1010 masl, indicating the presence of a groundwater divide between the Springer Pit and Bootjack Lake.



Legend

Monitoring Well

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
SITE PLAN

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
0 25mm

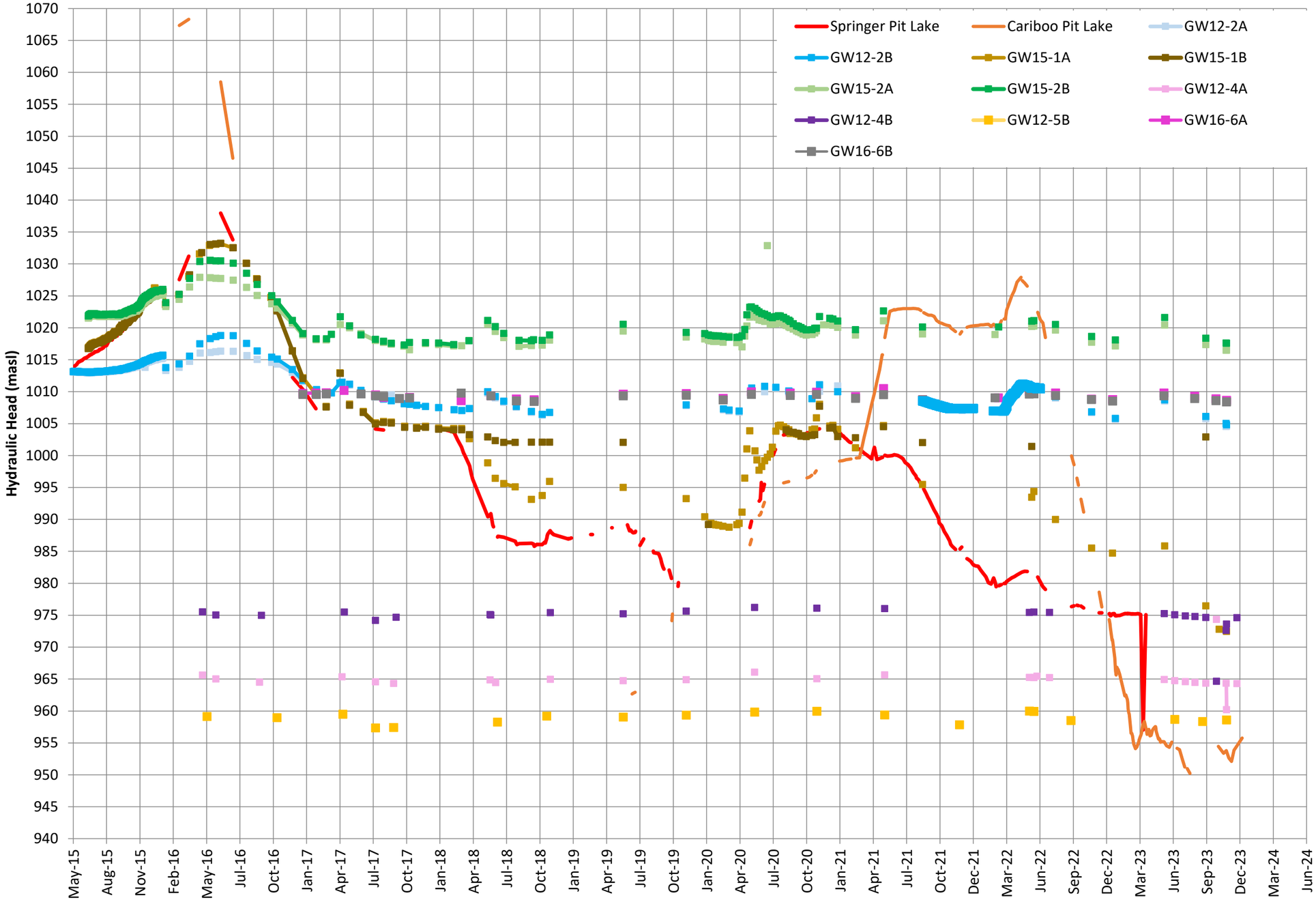

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
SPRINGER PIT LAKE LEVEL AND HYDRAULIC HEADS IN MONITORING WELLS (2015-2023)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
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2.2 Climate and Recharge to Groundwater

Climate information for the mine site was obtained from the Climate Baseline Update Report (WSP, 2022). MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and directions (1997 to 2003). In 2012, this station was replaced with two stations: one near the Mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall. Details of these stations are provided in Table 1.

Table 1: Local Climate Stations for the Mount Polley Mine

Station Name	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)[2]	Data Type	Period of Record
Mill Site Weather Station	5822420	592495	1,118	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	R, T, RH, SR, E, WS	2012-2021[3]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	R, T, RH, SR, E, WS	2012-2021[3]

1) UTM Coordinate system – Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

3) Station still in operation.

TSF = tailings storage facility; masl = metres above sea level.

R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation; E = Evaporation; WS = Wind Speed; WD = Wind Direction.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically taken during the melt phase. The details of these snow course stations are provided in Table 2.

Table 2: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[1]	Easting (m E)[1]	Approximate Elevation (masl)[2]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

1) UTM Coordinate system - Zone 10U.

Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

The site experiences high summer precipitation due to storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and achieves its maximum in March, reducing to 0 mm in April. Average annual precipitation at the site is estimated to be 612 mm.

Groundwater recharge due to the infiltration of precipitation at ground surface was estimated as a percentage of total precipitation recorded at the MPMC climate stations. In 2018, researchers from the University of Victoria and Simon Fraser University modeled recharge over British Columbia using both the HELP (Hydrologic Evaluation of Landfill Performance) and a global hydrologic model (PCR-GLOBWB). These studies projected that, for current climate conditions over much of British Columbia, recharge is about 30% of precipitation under natural watershed conditions (Forstner et al. 2018). Based on the type of land cover and recharge estimates included in a previous assessment (Golder, 2016), groundwater recharge was estimated to be approximately 30% of total precipitation, or 183 mm/y, in the site area. An increase in recharge to groundwater is anticipated to occur during the freshet period (April-June) following melting of the snowpack accumulated during the winter months. Water levels in the monitoring wells show an increase of up to 2–3 m starting in April.

2.3 Springer and Cariboo Pit Mine Progression 2016-2023

On September 20, 2023, MPMC provided the mine as-builts for the Springer Pit and Cariboo Pit for the following stages:

- January 2016 (file "*1601-Contour.dxf*"): at this stage the bottom of the Springer Pit is at 935 masl and the bottom of the Cariboo Pit is at 1050 masl.
- January 2017 (file "*1701-Contour.dxf*"): at this stage the bottom of the Springer Pit is at 935 masl and the bottom of the Cariboo Pit deepens at 1023 masl, expanding toward north and west.
- January 2018 (file "*1801-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl.
- January 2019 (file "*1901-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl.
- December 2021 (file "*2112-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl. No changes from previous stage.
- January 2023 (file "*2301-Contour.dxf*"): at this stage the separation between the two pits is a small ridge between the two pits at 1003 masl and the pit bottom 923 masl in the area of the Cariboo Pit.
- September 2023 (file "*230920-Pit.dxf*"): at this stage the separation between the two pits is a small ridge between the two pits at 965 masl and the pit bottom 923 masl in the area of the Cariboo Pit.

The as-built information outlined above was used to update the existing groundwater model to represent groundwater conditions between 2016 and 2023. In addition to the information above, MPMC provided the mine development plan from 2023 to 2031 to the end of mine life. The final configuration of the Springer and Cariboo pit (file "*Sp-6 v4 topomerge.dxf*") was also reviewed as part of this assessment to ensure that the current extent of the groundwater model was still adequate to simulate groundwater conditions to the end of mine life for model predictions during operations and closure.

3.0 GROUNDWATER MODEL RE-CALIBRATION

The details of the numerical hydrogeological model that was developed for the area adjacent to the Springer Pit have been documented in Golder Associates Ltd. (2010, 2014, 2015abc, 2016 and 2024a). These details are not repeated in this memorandum, except for the description of additional model modifications that were implemented to include changes in mine settings since the end of 2022 (model calibration check, WSP, 2024a). The numerical hydrogeological model was re-calibrated to groundwater conditions that existed immediately prior to the formation of the Springer Pit Lake (2014) and during mining operations between 2015 and 2023, described in Section 2.3. The calibration process involved refining the numerical model parameters to achieve the desired degree of correspondence between the model simulation results and the observations of the groundwater flow system (BC ENV, 2012), while reasonably representing the conceptual understanding of groundwater conditions described in previous assessments. The following section presents the calibration approach and metrics, calibration targets, and results of calibration.

3.1 Groundwater Model Update

Based on the review of the information described in Sections 2.0 and 2.3, the existing groundwater model was modified as follows:

- The Springer and Cariboo pit mine progression was implemented in the updated model based on the pit as-builts provided by MPMC (see Section 2.3) to simulate effects on groundwater conditions up to September 2023.
- Water levels in the pit lakes were assigned to the model based on the available monitoring data up to September 2023, as presented in Figure 2.

The remaining model settings and hydrogeological parameters that resulted from previous model calibration in 2016 were not modified and were used as initial parameters for model recalibration, which is the purposes of the current assessment.

3.2 Approach and Calibration Targets

Previous model calibration considered calibration targets and hydrogeological data collected in the existing monitoring wells, as follows:

- **Dewatered Conditions:** steady state calibration to hydraulic heads measured in mid-2014 in the pre-2015 monitoring wells installed near the Springer Pit and corresponding estimates of groundwater inflow to this pit, prior to the formation of the pit lake.
- **July 2015 Pit Lake Conditions:** steady state calibration to hydraulic heads measured in July 2015 in the pre-2015 monitoring wells and new monitoring wells installed in 2015 (i.e., the conditions when the Springer Pit Lake level was approximately 1017.2 masl).
- **Transient Pit Lake Conditions:** the hydraulic head data collected following the installation of the 2015 series wells until late January 2016 was used to conduct additional model calibration that simulated transient groundwater conditions over that period.

Previous model calibration stages were re-evaluated for model re-calibration purposes. The transient pit lake simulations were extended to September 2023.

During calibration, the model was run repeatedly and the model input parameters (hydraulic conductivity, storage properties, recharge) were iteratively adjusted until there was reasonable agreement between predicted and observed hydraulic heads, groundwater flow directions and groundwater flow rates to the slope seepage collection system. Parameter adjustments considered the conceptual understanding of groundwater conditions and were limited to the range of measured data, or, where no site-specific data were available, were limited to the published range of values for similar lithologies.

Quantitative and qualitative evaluation of model predictions against measured observations was conducted during calibration. Qualitative metrics included an evaluation of the patterns of groundwater flow based on predicted hydraulic head contours. Quantitative metrics included comparisons of measured to predicted hydraulic heads (spatial distribution differences), seepage rates and the calculation of the following calibration statistics for hydraulic head:

- Root Mean Squared Error (RMSE) and normalized RMSE (nRMSE): RMSE is a statistical measure of the mean difference between the predicted and measured hydraulic head (h) (i.e., residual head). The nRMSE is the RMSE divided by the range of observed hydraulic head values and is commonly expressed as a percentage. Normalized errors are typically more appropriate to use in areas of high relief and gradients, to account for significant variation in hydraulic head elevations (BC ENV, 2012). Generally, nRMSE under 10% is considered acceptable for model calibration, and a value of less than 5% is considered very good (BC ENV, 2012).

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n} h_{predicted} - h_{measured}}$$

$$nRMSE = \frac{RMSE}{max\ h_{measured} - min\ h_{measured}}$$

- Calculation of the mean absolute error (MAE) and normalized mean absolute error (nMAE) to get an estimate of the average difference between measured and predicted hydraulic heads.

$$MAE = \frac{1}{n}\left|\sum_{i=1}^{n} h_{predicted} - h_{measured}\right|$$

$$nMAE = \frac{MAE}{max\ h_{measured} - min\ h_{measured}}$$

The following sets of information were used as calibration targets to assess the overall steady-state and transient model calibration, as follows:

- Hydraulic heads measured between 2014 and 2023 at 15 observation points located within the model domain. The locations of the monitoring wells and hydraulic head values are presented on Figure 1.
- Observed groundwater inflow into the Springer Pit in 2014, as described in previous assessment (Golder, 2016).

- Visual inspection of the predicted hydraulic head contours and groundwater flow patterns compared to observations and the conceptual understanding of the groundwater regime in the model domain.

The following time steps were selected for these simulations if predicted conditions still reasonably matched observed conditions, based on available water level data:

- **May 2014**: groundwater conditions observed in the pre-2015 monitoring wells installed near the Springer Pit and corresponding estimates of groundwater inflow to this pit, prior to the formation of the pit lake (dewatered conditions).
- **July 2015**: groundwater conditions observed in July 2015 in the pre-2015 monitoring wells and new monitoring wells installed in 2015, when the Springer Pit Lake level was approximately 1017.2 masl.
- **June 2016**: groundwater conditions when the Springer Pit Lake reaches its maximum elevation (1037.9 masl).
- **November 2018**: groundwater conditions when the Springer Pit Lake is dewatered to 986 masl.
- **November 2019**: groundwater conditions when the Springer Pit Lake reaches its lowest elevation (980 masl) and Cariboo Pit Lake is at 995 masl.
- **May 2021**: groundwater conditions when the Springer Pit Lake is at 999 masl and the Cariboo pit lake is at 1015.8 masl.
- **June 2022**: groundwater conditions when the Springer Pit Lake is at 982 masl and the Cariboo pit lake is at 1025.4 masl.
- **September 2023**: groundwater conditions when the Springer Pit Lake is at 952 masl and the Cariboo has been mined to 923 masl (no pit lake present).

3.3 Results of Model Re-Calibration

The following section presents the results of the hydrogeological model re-calibration, including a comparison of measured to predicted static hydraulic head, transient changes in groundwater levels and groundwater inflow to the Springer Pit. As described in this section, the model is reasonably well calibrated to groundwater conditions between 2014 and 2023 with a good reproduction of hydraulic heads and gradients across the model domain. Therefore, the calibrated model is considered suitable to support prediction of future conditions (groundwater inflow/seepage rates into and out of the ultimate pit lake at closure).

The applied hydraulic conductivity values and recharge rates outlined in the following section provided a reasonable approximation of the flow regime based on the available data for the model domain. Although additional localized adjustments in recharge and hydraulic properties could be made to improve the match between measured and predicted values used as calibration targets, such localized improvements are not considered warranted at the model scale needed to assess future groundwater conditions in the vicinity of the ultimate pit lake at closure.

3.3.1.1 Calibrated Hydraulic Parameters

The calibrated hydraulic conductivity (K) values for each of the hydro stratigraphic units and the calibrated recharge values from precipitation are presented in Table 3. The spatial distribution of hydraulic conductivity is shown in Figure 3.

Table 3: Calibrated Hydraulic Properties Assigned to the Hydrogeological Model

Hydro Stratigraphic Unit	Depth	Horizontal Hydraulic Conductivity (m/s)	Anisotropy Ratio* (-)	Specific Storage (1/m)	Specific Yield (-)
Bedrock	0-40 m (Layers 1-2)	1×10^{-6}	1	1×10^{-7}	0.001
	40-100 m (Layers 3–5)	$\underline{1 \times 10^{-7}}$	1	1×10^{-7}	0.0001
	100-150 m (Layers 6–7)	8×10^{-8}	1	1×10^{-7}	0.0001
	150–350 m (Layers 8–10)	1×10^{-8}	1	1×10^{-7}	0.0001
	Below 350 m (Layers 11–13)	5×10^{-9}	1	1×10^{-7}	0.0001
Bedrock Along Bootjack Lake	0–40 m (Layers 1–2)	$\underline{3 \times 10^{-7}}$	$\underline{5}$	1×10^{-7}	0.001
	40-150m (Layers 3–7)	$\underline{3 \times 10^{-8}}$	$\underline{5}$	1×10^{-7}	0.0001
Brecciated Bedrock	0–40 m (Layers 1–2)	$\underline{5 \times 10^{-6}}$	1	1×10^{-7}	0.001
Springer Pit South Weathered Zone (GW15-01)	0–60 m Layers 1–4)	$\underline{5 \times 10^{-6}}$	1	1×10^{-7}	0.001

Time period	Recharge (mm/y)
July to March	180
<u>April to June</u>	220

m/s = metres per second; m = metres; mbgs = metres below ground surface; mm/y = millimetres per year.

*Anisotropy Ratio is defined as the ratio between Vertical and Horizontal Hydraulic Conductivity.

Underlined values were modified from previous calibration (Golder, 2016).

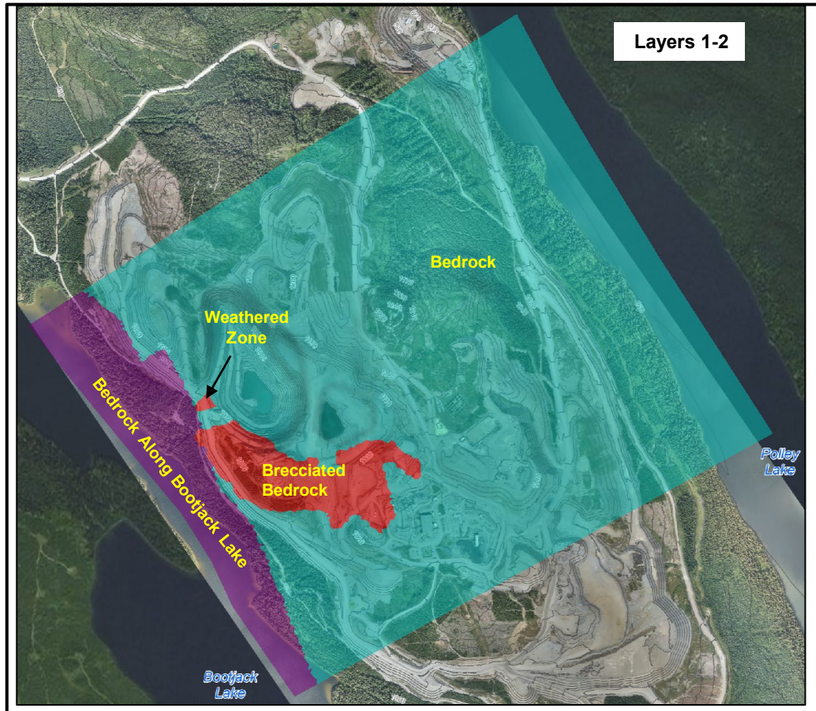

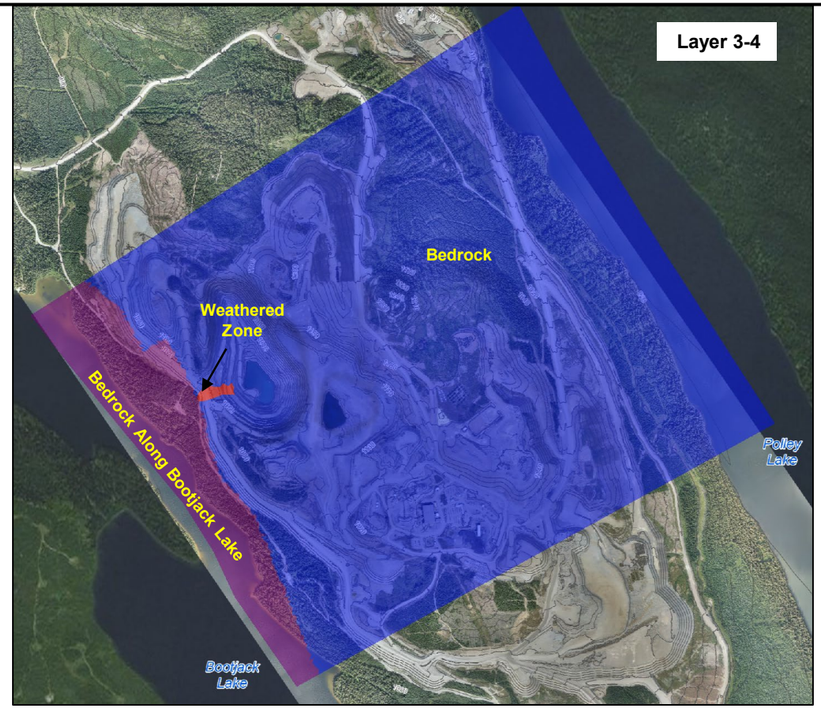

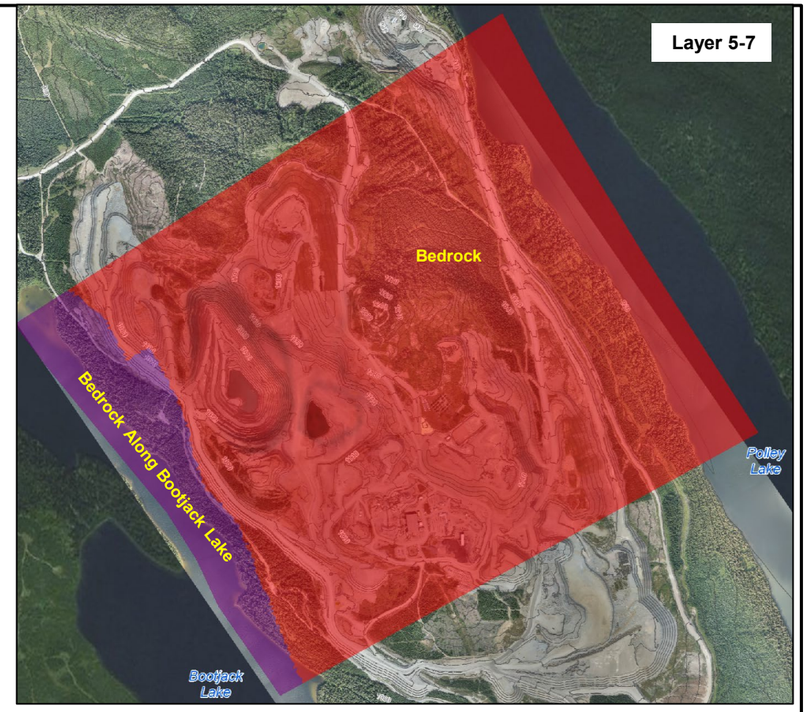

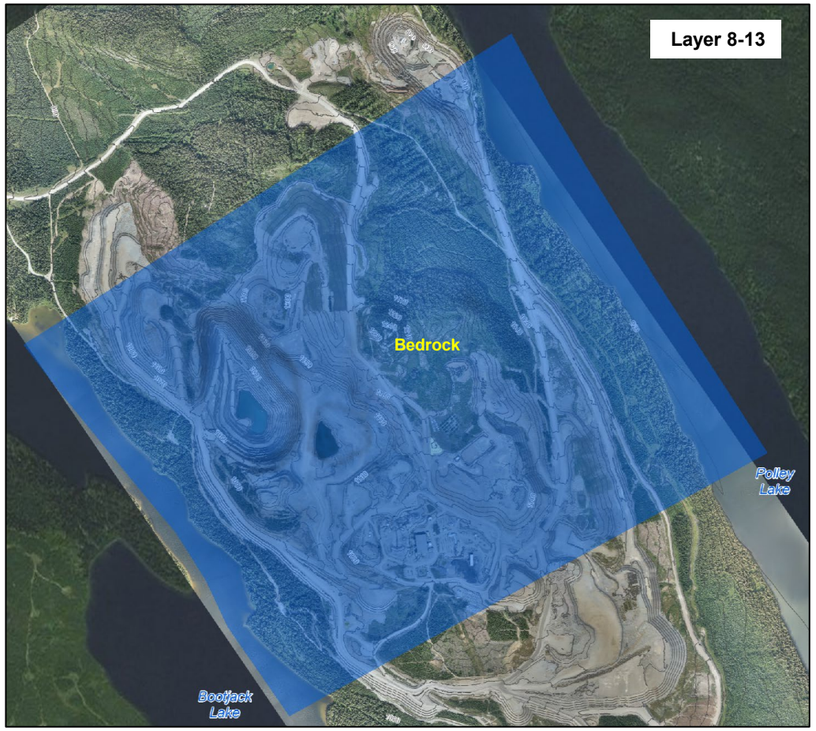

Hydrostratigraphic Units and their Hydraulic Conductivity Values

- Bedrock 0-40 m (1×10^{-6} m/s)
- Bedrock 40-100 m (1×10^{-7} m/s)
- Bedrock 100-150 m (8×10^{-8} m/s)
- Bedrock below 150 m (5×10^{-9} m/s to 1×10^{-8} m/s)
- Bedrock Along BJ Lake (3×10^{-7} m/s to 3×10^{-8} m/s)
- Breccia/Weathered Zone (5×10^{-6} m/s)

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
CALIBRATED HYDRAULIC CONDUCTIVITY

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**3**

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Modifications made to the hydrogeological model during the calibration process are presented in the bullets below and summarized in Table 4. Hydraulic parameter values were changed within the measured range in test data to improve the ability of the model to match measured hydraulic head and hydraulic gradients across the model domain; to match inflow observed in the dewatered Springer Pit; and to match the water level response to the dewatering and refilling of the Springer Pit Lake.

- Based on transient model simulations, the previous hydraulic conductivity distribution in the vicinity of the Springer Pit Lake did not correctly reproduce changes in hydraulic gradients to the refilling and dewatering of the Springer Pit Lake in near-pit wells. Therefore, the hydraulic conductivity of the bedrock unit was varied in the vicinity of the Springer and Cariboo pit in consideration of the observed groundwater levels and geology information as follows:
  - The shallow, more permeable bedrock between the pit crest and monitoring well GW15-01A/B that was considered more weathered was reduced in width and extended at depth up to Layer 4 (60 m depth) and its hydraulic conductivity was increased to 5×10^{-6} m/s, based on testing. This modification helped improve the match between observed and simulated response to the refilling and dewatering of the Springer Pit and the hydraulic gradient in this area.
  - The zone of the brecciated bedrock extending along the southwest portion of the Springer pit and south of the Cariboo Pit was modified based on geological mapping (Wafforn, 2013), to reduce the connection between the area of GW15-02 and the Cariboo Pit Lake. With the previous configuration, the dewatering of this lake and subsequent mining of the pit was influencing the water levels in this well too strongly. The hydraulic conductivity of this zone was increased to 5×10^{-6} m/s to improve the ability of the model to reproduce the response of water levels to refilling and dewatering of the Springer Pir Lake in GW15- 02A/B.
- The hydraulic conductivity of the bedrock at depth between 40 m and 100 m was decreased to 1×10^{-7} m/s. This change generally provided a better reproduction of hydraulic heads in deeper monitoring wells and the hydraulic gradients in the north and central portion of the model domain.
- The zone characterized with lower hydraulic conductivity around monitoring well GW12-2 was extended along the Bootjack Lake based on geological mapping (Wafforn, 2013) to improve the match between observed and simulated hydraulic heads in monitoring well GW16-6A/B and to better reproduce the hydraulic gradient and the groundwater divide observed between the Springer Pit and the Bootjack Lake. For the same purpose, an anisotropy of 5 (horizontal K 5 times greater than vertical K) was implemented in this zone.
- Recharge from precipitation was increased by approximately 20% from average value only for the period from April to June to better represent the increase in recharge following melting of the snowpack during the Freshet period. This change in recharge better represented the observed response of water levels in monitoring wells across the model domain during this period.

These model changes are summarized in the table below. All the other parameters were not modified from previous assessment.

Table 4: Hydrogeological Model Parameter Value Comparison and 2024 Modifications

Item	2016 Model Value	2024 Model Value
K value - Shallow bedrock between the pit crest and GW15-01A/B	3×10^{-6} m/s	5×10^{-6} m/s
K value - Zone of the brecciated bedrock extending along the southwest portion of the Springer pit and south of the Cariboo Pit	2×10^{-6} m/s	5×10^{-6} m/s
K value - Bedrock at depth between 40 m and 100 m	2×10^{-7} m/s	1×10^{-7} m/s
Anisotropy - Zone characterized with lower hydraulic conductivity around monitoring well GW12-2	Anisotropy – 1	Anisotropy – 5
Recharge from precipitation was increased by approximately 20% from average value based on climate data	October to April	April to June

3.3.1.1 Measured Versus Predicted Hydraulic Head and Inflow

Figures 4, 5, 7, 8, 9 and 10 show a comparison of measured versus predicted hydraulic heads for the different stages considered for model calibration along with a 1:1 reference line for comparison (points which fall on this 1:1 line would indicate that the predicted hydraulic head exactly matches the measured hydraulic head). Figure 6 shows observed and predicted hydraulic heads in representative monitoring wells for transient pit lake conditions between 2015 and 2023.

Overall, a reasonable match between measured and predicted hydraulic heads was obtained for all the stages considered. For dewatered conditions (Figure 4) and Pit Lake conditions up to June 2016 (Figure 5), when the pit lake reaches its maximum elevation of 1037 masl, the model-predicted hydraulic heads matched the hydraulic heads measured in the monitoring wells reasonably well. The normalized root-mean-square (nRMSE) error, which considers the scale of head variation across the model domain, was less than 6% for the dewatered conditions and less than 5% and 8% for the Pit Lake conditions for July 2015 and June 2016, respectively. The model can reproduce the water level response to the refilling of the pit lake in the near-pit monitoring wells and in the ones locates between the Springer Pit and the Bootjack Lake, as shown in Figure 6. Following the dewatering of the Springer Pit Lake starting in June 2016, the model still reasonably reproduces the response to this change in the monitoring wells located immediately south near the pit crest, as shown in Figure 6. The model underestimates the drawdown in the vicinity of the pit crest, immediately west of the pit in the area of monitoring wells GW15- 01a/b, and slightly overestimates it farther south of the pit crest, in the area of wells GW15-2a/b. In the area between the Springer Pit and the Bootjack Lake the model is therefore conservative in that it predicts a higher seepage from the pit lake than observed under these conditions. Predicted hydraulic heads in monitoring wells GW16-6a/b located further south of the Springer Pit are accurately represented by the model. Therefore, calibration stages selected to verify model calibration following June 2016 showed that predicted hydraulic heads are in agreement with observed hydraulic heads, as shown in Figures 6 through 9. For snapshots in time between November 2018 and September 2023, the weighted RMS error is between 8% and 10%, which is below or equal to the 10% limit considered acceptable by the BC Guidelines for Groundwater Modelling (BC ENV, 2012).
The mean error ME and mean absolute error MAE between measured and predicted hydraulic heads were approximately 0.06 m and 4.6 m, respectively, over all the stages considered. This indicates that model-predicted hydraulic heads were on average slightly higher than measured data (by approximately 0.06 m), and overall, data was on average within 4.6 m of the measured values.

Groundwater conditions between the Springer Pit Lake and Bootjack Lake both when the pit lake level is high or very low are reasonably represented by the model in the area of monitoring wells GW12-2a/b and GW16-6a/b and the model is predicting the presence of the observed groundwater divide in this area. The model also predicts similar seasonal fluctuations in monitoring wells due to changes in recharge during the freshet period, due to snowmelt.

Maps showing the calibration residuals in hydraulic head (i.e., difference between the model calculated hydraulic head and observed hydraulic head for all well data used for model calibration) for each calibration stage are presented in Attachment 1. The largest residuals are mostly in nested wells GW15-01a/b and GW15-2a/b when the pit lake is dewatered or the water level is low, with predicted hydraulic heads mostly 5 m to 20 m lower than observed heads, depending on the calibration stage. These discrepancies could be related to localized variations in hydraulic properties of the bedrock close to the pit crest which could be highly weathered or anisotropic and these conditions are difficult to reproduce with the groundwater model. However, as discussed in this section, the model tends to overpredict the influence of the pit lake on groundwater levels southwest of the pit crest, providing conservative estimates of seepage from the pit lake for future conditions.

The model-predicted groundwater inflow to the Springer Pit in the Dewatered Conditions scenario (May 2014) was approximately 900 m^3/day (165 USgpm), which is within the range of inflows estimated for this pit by MPMC (600 to 1600 m^3/day, Golder, 2014 and 2016).

A. Oblique View Looking Northeast

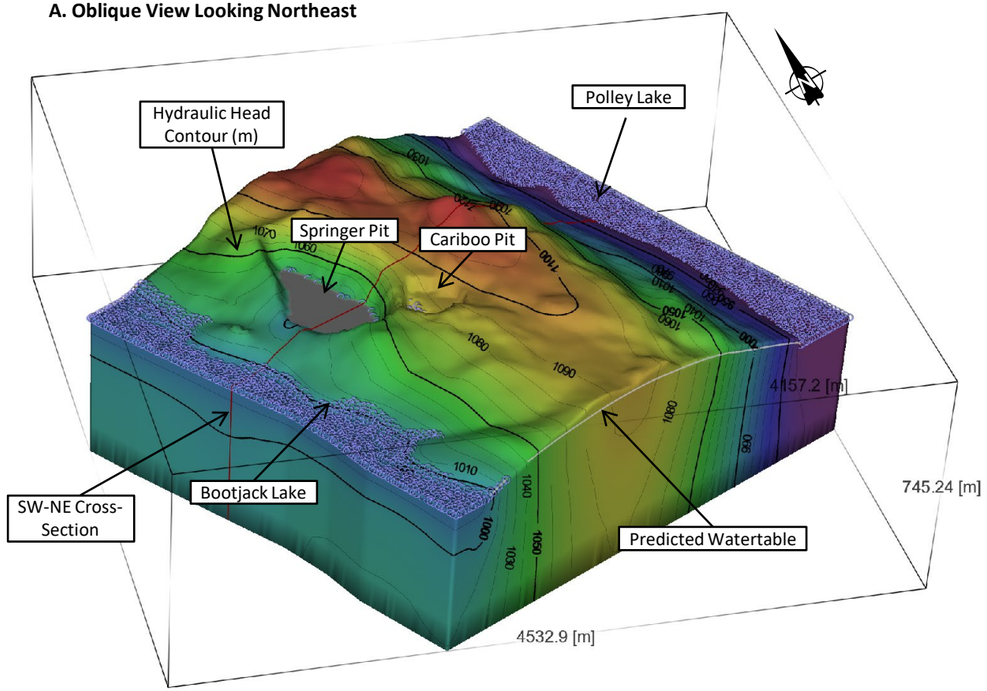

C. Comparison of Predicted vs. Observed Hydraulic Heads

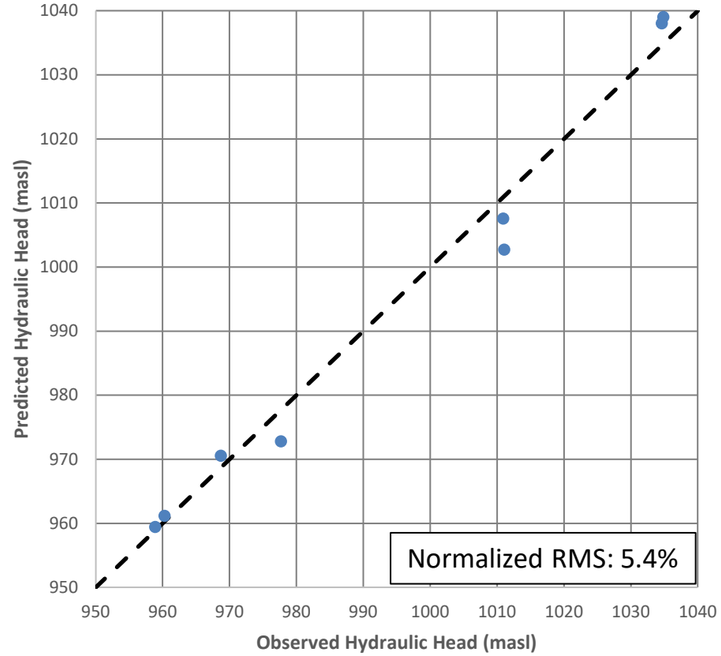

B. SW-NE Cross-section

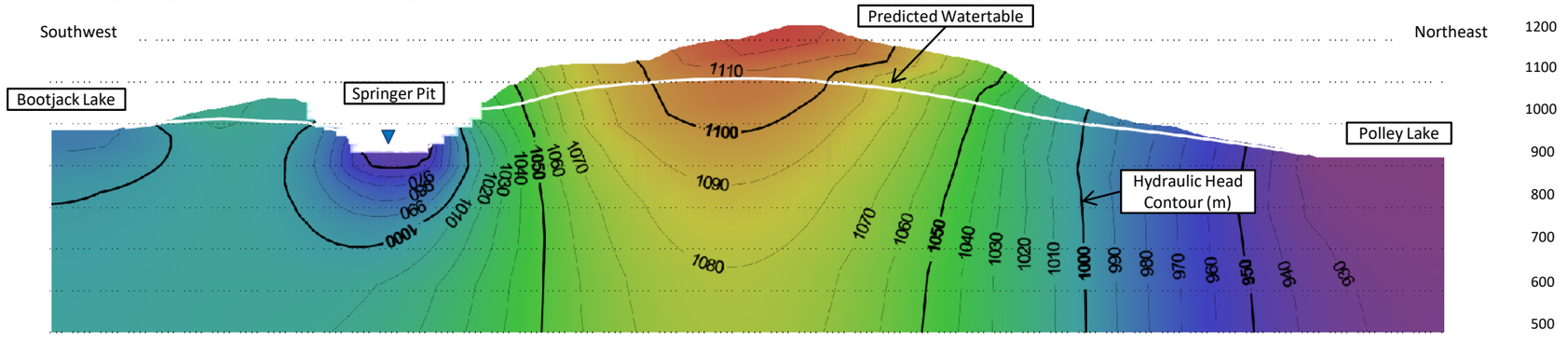

0 150 300

[m]

Notes:
Distances are in meters

CLIENT	MOUNT POLLEY MINING CORPORATION
PROJECT	SPRINGER PIT GROUNDWATER MODEL UPDATE
CONSULTANT	wsp
YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF
TITLE	GROUNDWATER MODEL CALIBRATION DEWATERED CONDITIONS (2014)
PROJECT NO.	CA0020527.4505 31400
REV.	0
FIGURE	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

A. Pit Lake Conditions July 2015 (SW-NE Cross-section) – Pit Lake at 1017.2 masl

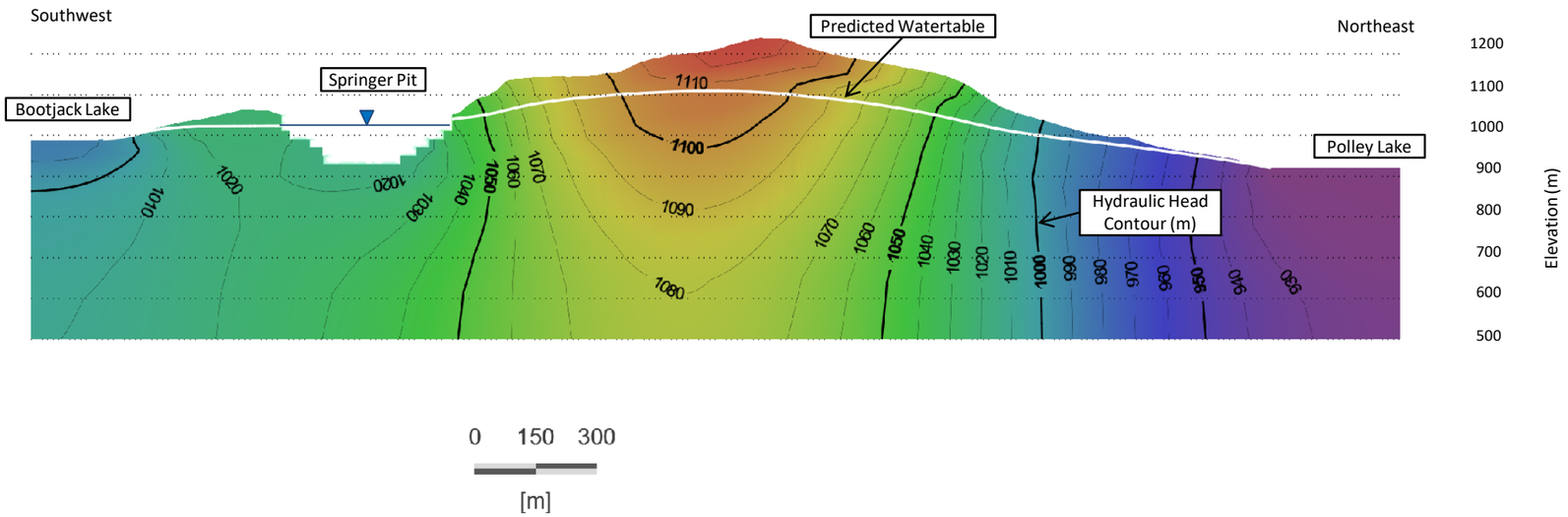

B. Comparison of Predicted vs. Observed Hydraulic Heads (July 2015)

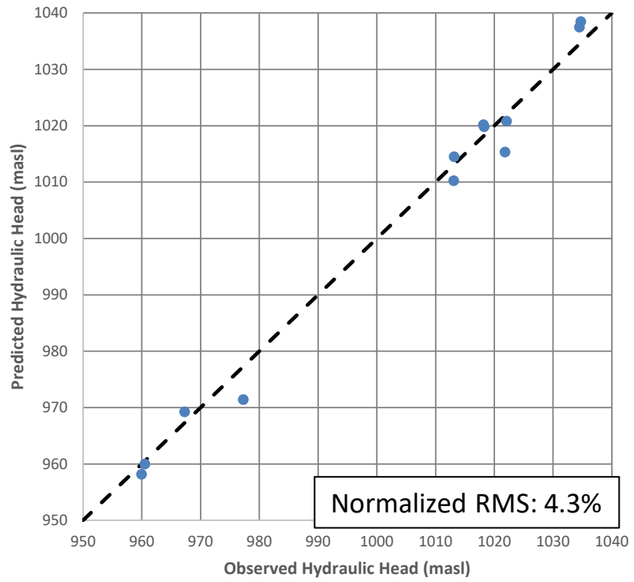

C. Pit Lake Conditions June 2016 (SW-NE Cross-section) – Pit Lake at 1037.97 masl

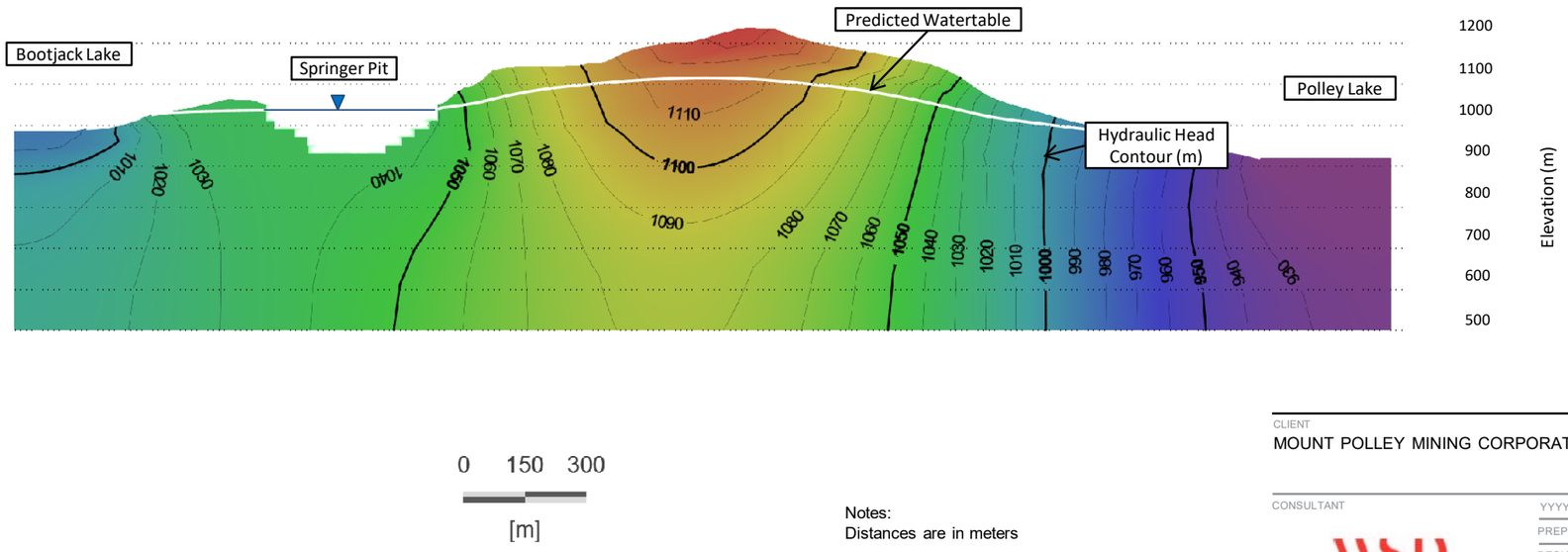

D. Comparison of Predicted vs. Observed Hydraulic Heads (June 2016)

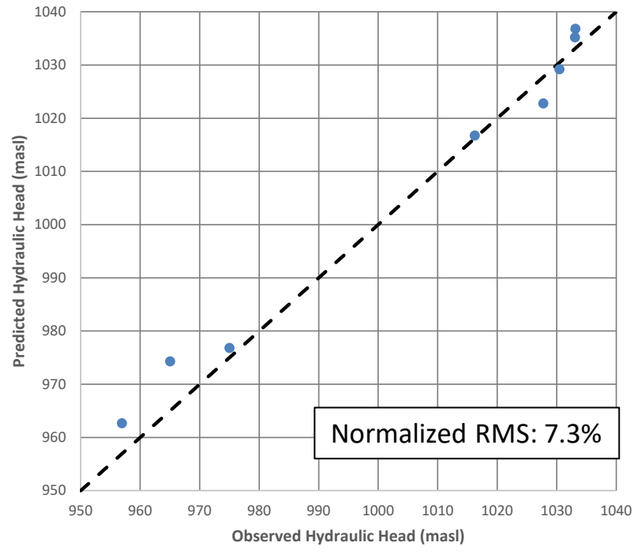

Notes:
Distances are in meters

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

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TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (JULY 2015 AND JUNE 2016)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**5**

IF THIS MEASUREMENT DOESN'T MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
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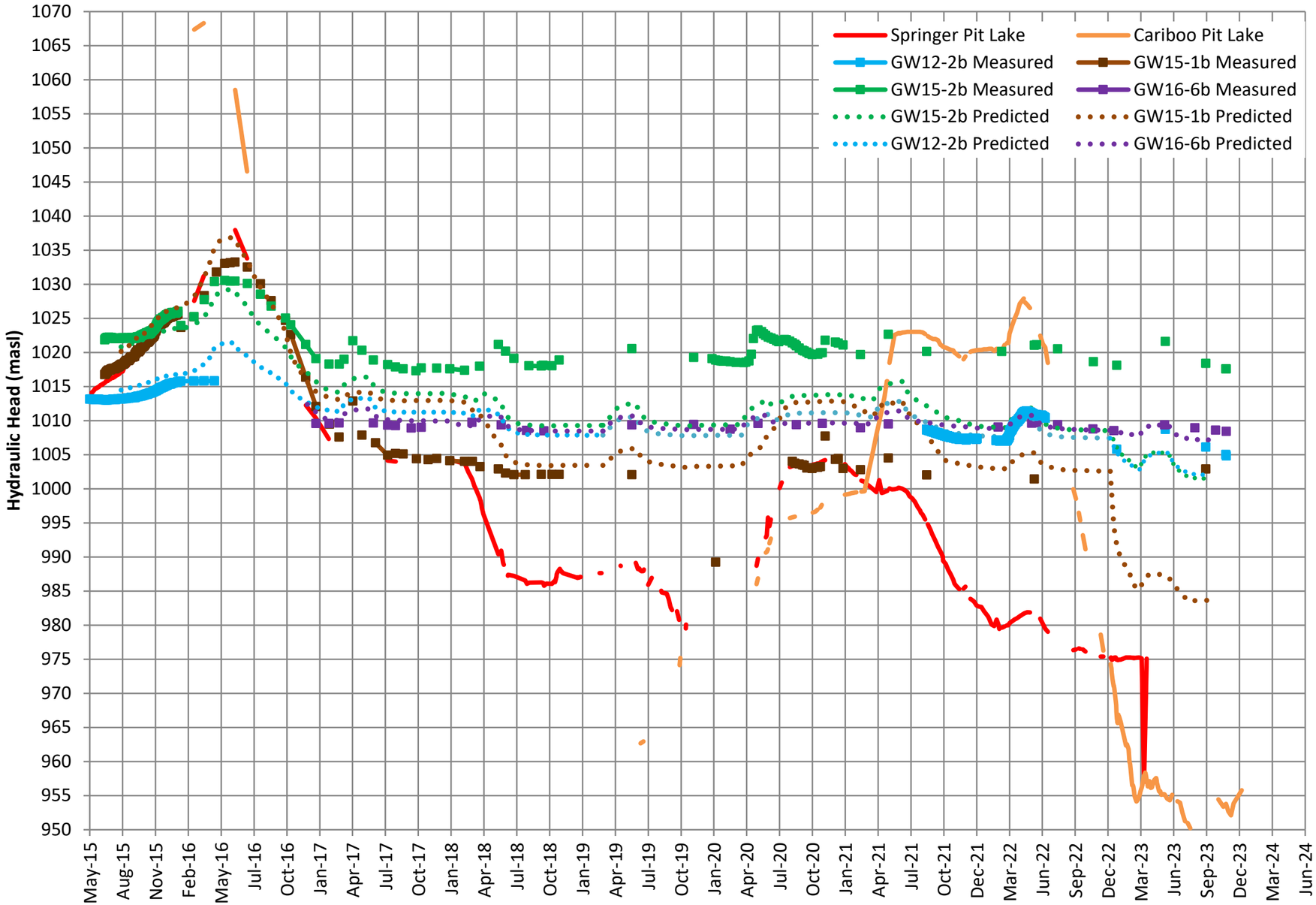

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SPRINGER PIT GROUNDWATER MODEL UPDATE

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TITLE
GROUNDWATER MODEL CALIBRATION
TRANSIENT PIT LAKE CONDITIONS (2015-2023)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

A. Pit Lake Conditions November 2018 (SW-NE Cross-section) – Pit Lake at 988 masl

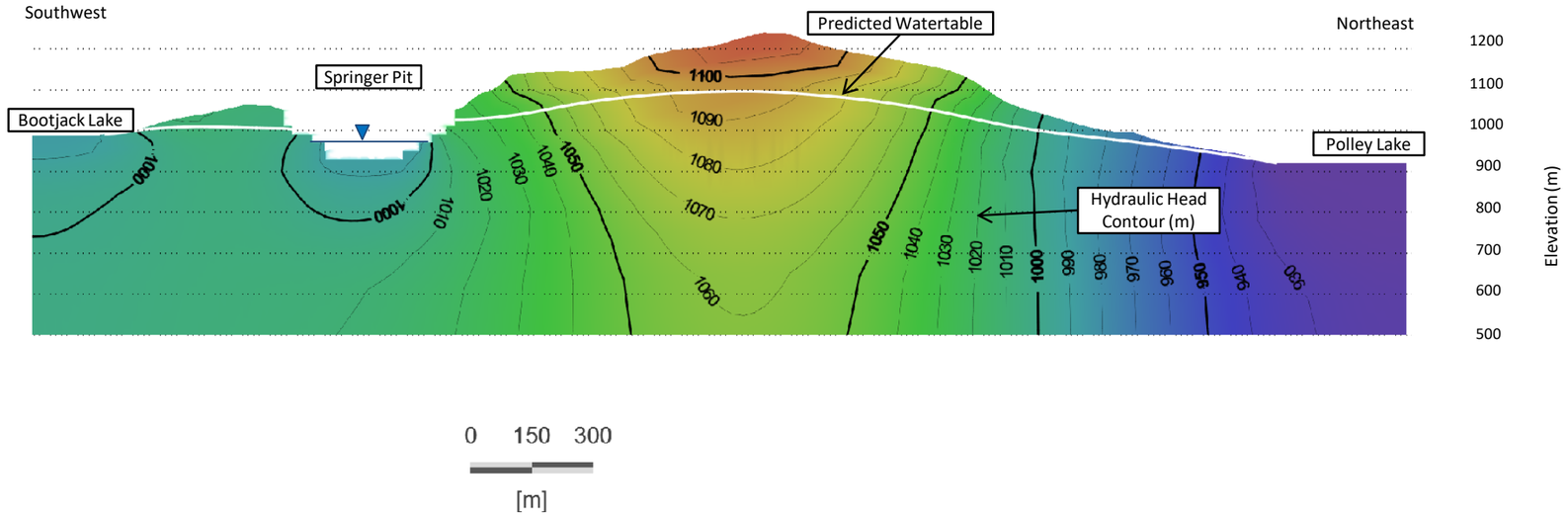

B. Comparison of Predicted vs. Observed Hydraulic Heads (November 2018)

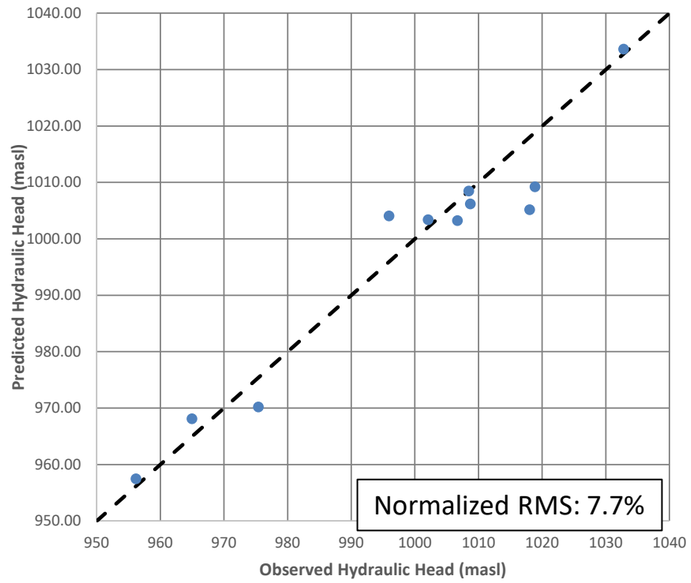

C. Pit Lake Conditions November 2019 (SW-NECross-section) – Pit Lake at 983 masl

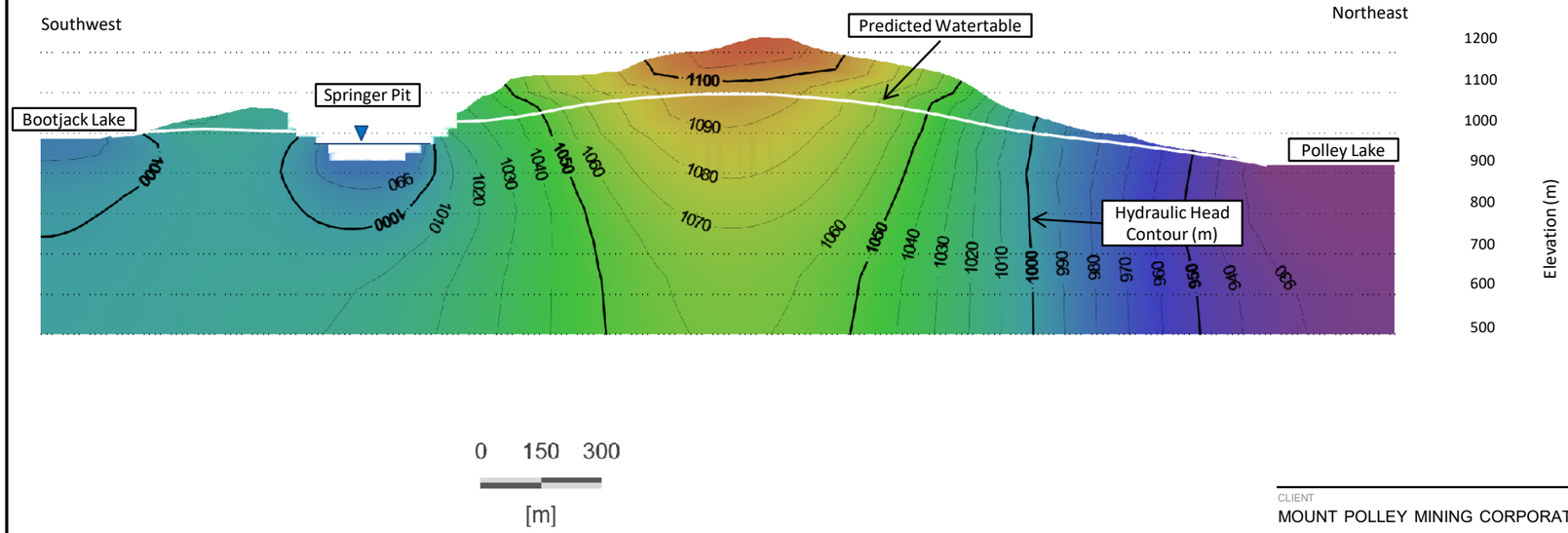

D. Comparison of Predicted vs. Observed Hydraulic Heads (November 2019)

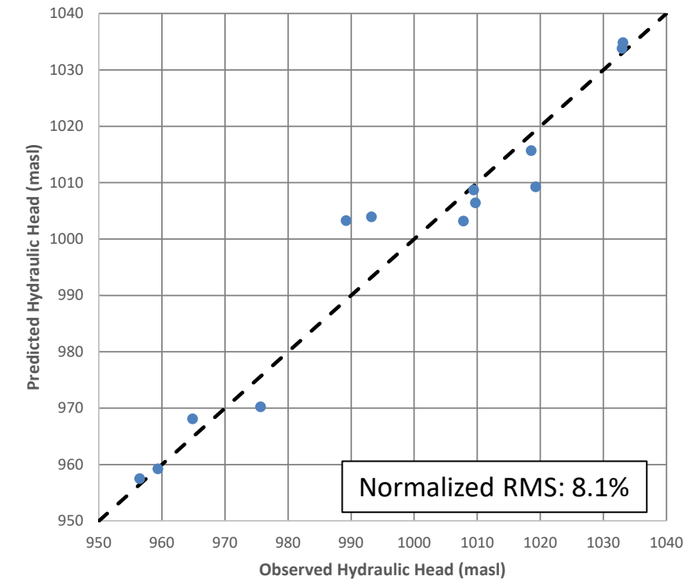

Notes:
Distances are in meters

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CONSULTANT
wsp

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APPROVED	JF

TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (NOVEMBER 2018 AND NOVEMBER 2019)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

A. Pit Lake Conditions May 2021 (SW-NE Cross-section) – Pit Lake at 999.7 masl

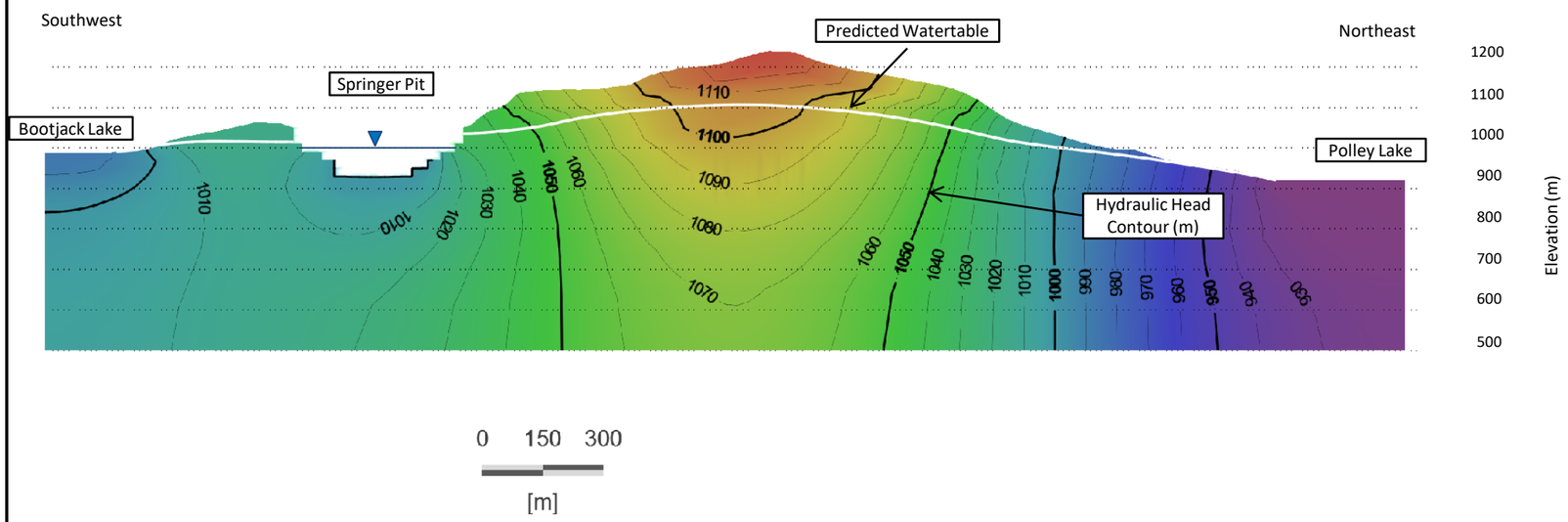

B. Comparison of Predicted vs. Observed Hydraulic Heads (May 2021)

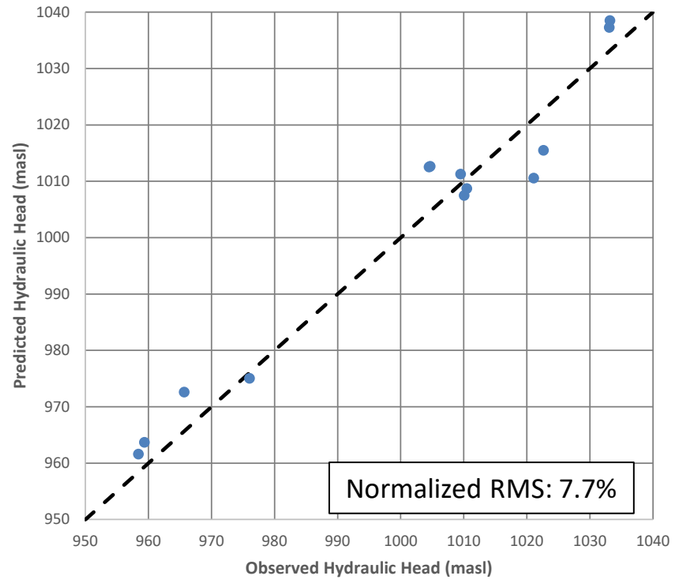

C. Pit Lake Conditions June 2022 (Cross-section) – Pit Lake at 981 masl

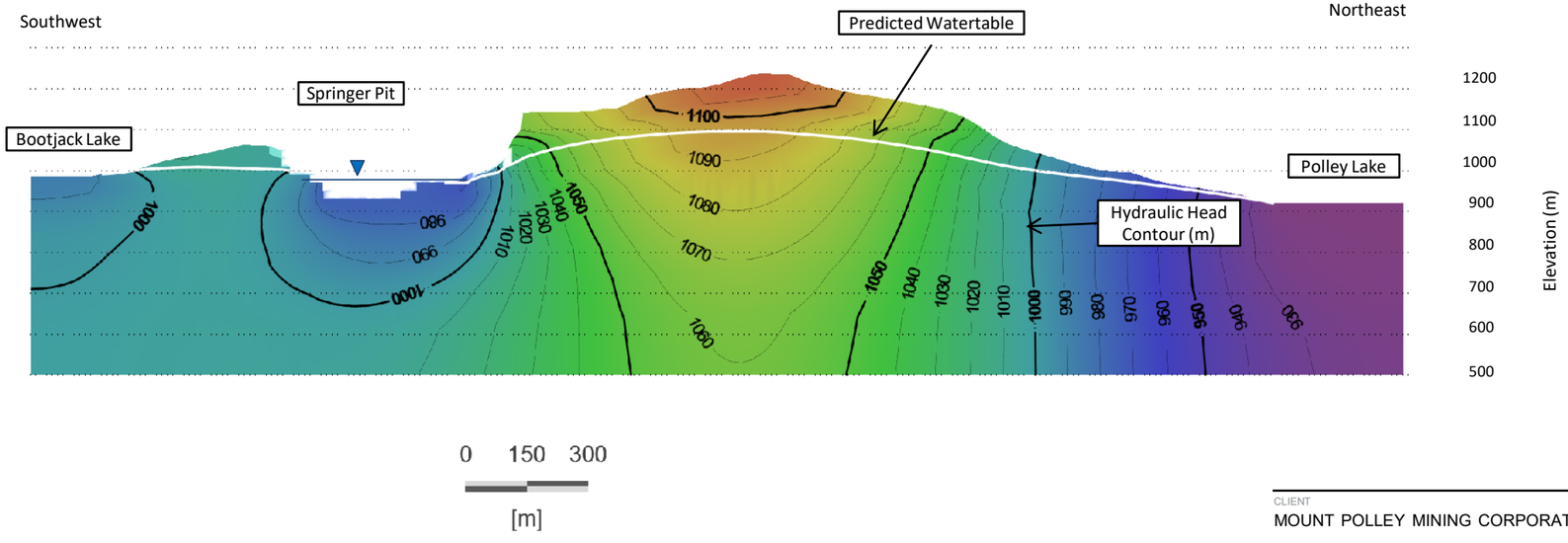

D. Comparison of Predicted vs. Observed Hydraulic Heads (June 2022)

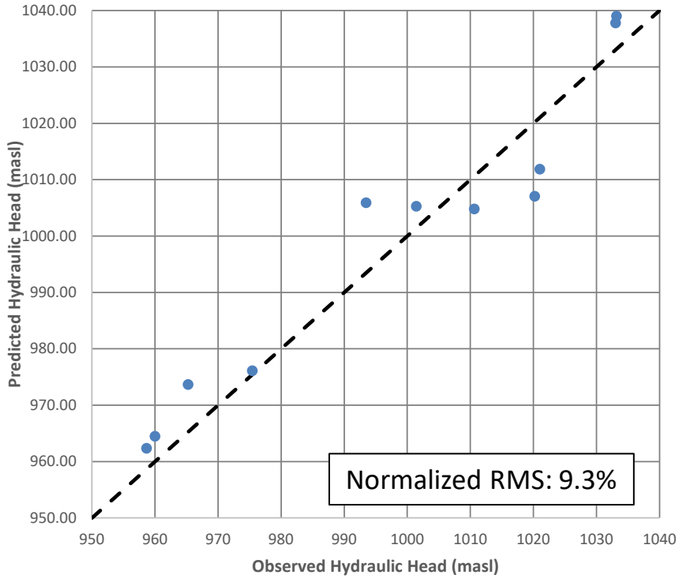

Notes:
Distances are in meters

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

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TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (MAY 2021 AND JUNE 2022)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

A. September 2023 (SW-NE Cross-section) – Dewatered Pit

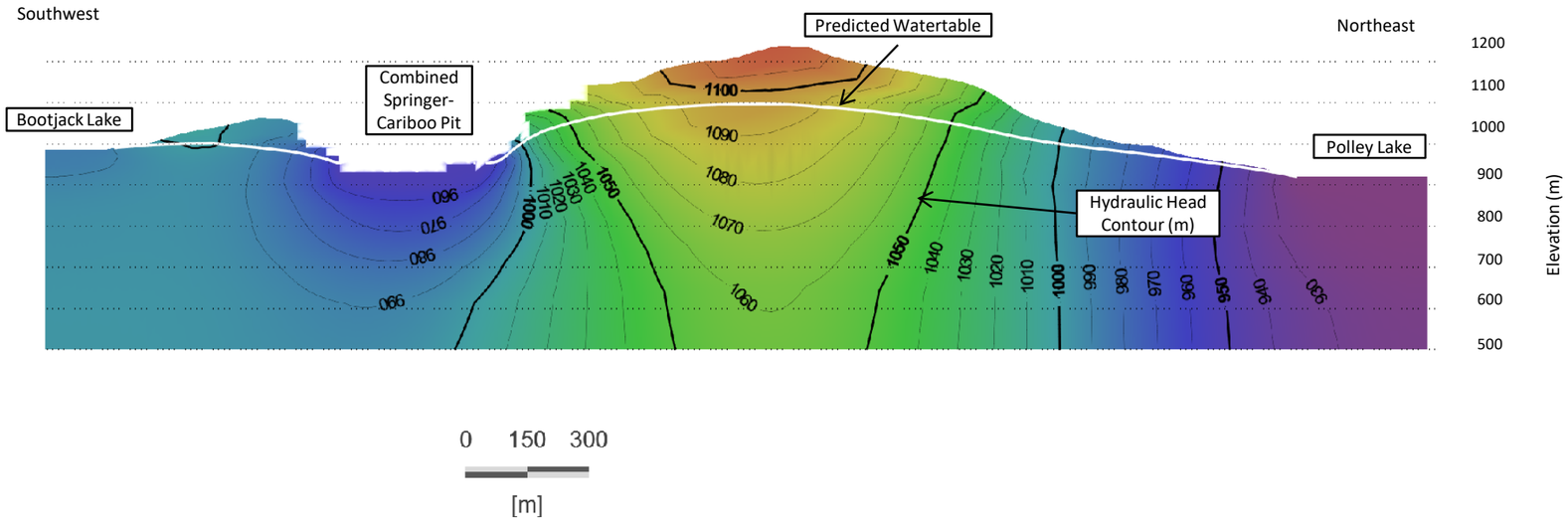

B. Comparison of Predicted vs. Observed Hydraulic Heads (September 2023)

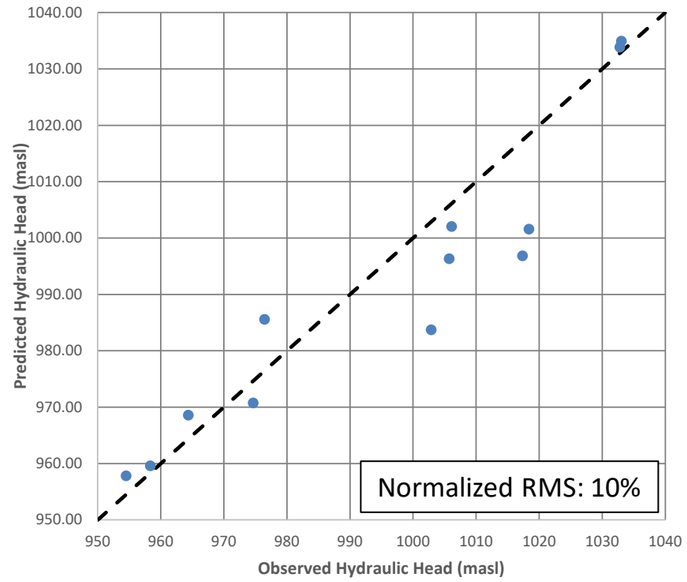

Notes:
Distances are in meters

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

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APPROVED	JF

TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (SEPTEMBER 2023)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

3.4 Limited Sensitivity Analysis

The calibrated model is considered to provide representative estimates of current groundwater conditions in the model domain, and these estimates are herein referred to as the Base Case scenario. However, as input parameters to the model are subject to some uncertainty, actual current groundwater conditions (groundwater levels and flow) might differ from what is computed by the model for the Base Case scenario. Following model calibration, the sensitivity of the predicted groundwater flow conditions to reasonable variations in model input parameters was assessed by conducting a limited sensitivity analysis, based on results of previous assessment (Golder, 2016). The results of this analysis provide the input parameter ranges that will reasonably bracket potential future effects on groundwater conditions within the model domain during closure.

The sensitivity analysis was conducted by means of additional steady-state and transient model simulations. In these simulations, selected model input parameters were varied over ranges that reflected their potential range of uncertainty, based on the previous assessment. The estimated hydraulic conductivity of the bedrock and recharge from precipitation were considered to have the highest degree of uncertainty, primarily because of the high variability that these parameters might have within the model domain and the expected high sensitivity of the model results on these parameters.

The model sensitivity simulations were run with the following changes to simulate two uncertainty scenarios:

- Upper Bound scenario: hydraulic conductivity of bedrock increased by a factor of 2 relative to Base Case values and recharge increased to 50% of total annual precipitation.
- Lower Bound scenario: hydraulic conductivity of bedrock decreased by a factor of 2 relative to Base Case values and recharge decreased to 20% of total annual precipitation.

The upper and lower bound range for hydraulic conductivity of the bedrock and recharge were considered reasonable based on the available data.

Table 5 summarizes the results of the uncertainty scenarios, presenting the computed groundwater inflow to the Springer Pit when dewatered and the nRMS for hydraulic head through all the calibration stages relative to the Base Case scenario. Both Lower Bound and Upper Bound scenarios resulted in a poorer calibration in terms of hydraulic head. However, the computed groundwater inflow to the Springer Pit was at both extremes of the observed range, therefore still reasonable. Based on these results, the parameter ranges utilized in the two sensitivity scenarios are considered reasonable for bracketing the range in potential effects on groundwater conditions within the model domain during closure.

Table 5: Results of Sensitivity Analysis

Alternate Scenario	Parameter	Groundwater Inflow to Springer Pit (May 2014) (m^3/d)	nRMS (%)
Base Case	Calibrated Model	900	4.3 to 10
Upper Bound	K of bedrock x 2, recharge 50% of total annual precipitation	1,600	4.6 to 12.3
Lower Bound	K of Vashon Drift / 2, recharge decreased by 20%	550	10.8 to 16.8

4.0 SEEPAGE PREDICTIONS DURING CLOSURE

The calibrated hydrogeological model was used to simulate groundwater conditions near the Springer/Cariboo Pit during closure. These predictions are herein referred to as the Base Case predictions. The following sections describe the model modifications and assumptions used for model predictions. Uncertainty in the predicted groundwater inflows resulting from the uncertainty in model input parameters is based on the limited sensitivity analysis discussed in Section 3.4.

4.1 Method

For the closure predictions, the following assumptions were made, based on information currently available on the closure plan:

- The combined Springer/Cariboo Pit will be mined to the ultimate depth of approximately 763 masl, based on the ultimate pit shape provided by MPMC (file “Sp-6 v4 topomerge.dxf”). Topographic contours representing the ultimate configuration of the Springer/Cariboo Pit are shown in Figure 10.
- The Springer/Cariboo Pit will be allowed to flood. The spillway elevation for this pit lake is approximately 1050 masl (Figure 10).
- Potentially Acid Generating (PAG) materials will be placed in the Springer/Cariboo Pit up to an elevation of approximately 1028 m. Similarly to the previous assessment, in these model simulations, it was assumed that the PAG materials that will be placed in the Springer/Cariboo Pit will have a hydraulic conductivity significantly higher than the surrounding rock mass, and thus offer no resistance to seepage entering or exiting the pit lake.
- Tailings will not be deposited in the Springer Pit/Cariboo Pit.

The model mesh and boundary conditions were modified to incorporate the extent of the ultimate Springer/Cariboo Pit and a sequence of steady-state simulations was completed to predict groundwater inflow/outflow to the Springer/Cariboo Pit Lake for different stages of pit flooding during closure. The stages ranged from a fully dewatered pit to progressively higher lake levels at approximate 20 to 50 m intervals, up to the expected maximum lake (spillover point) elevation of 1050 masl. For each simulation, the specified head boundaries were modified in the hydrogeological model to reflect the specified stage of flooding. This involved removing the constraints restricting the inflow of water and applying a specified head equivalent to the pit lake level to the pit nodes only where they occur below the simulated lake level elevation. This allows water to both enter or exit the pit lake based on the predicted hydraulic heads surrounding the Springer/Cariboo Pit.

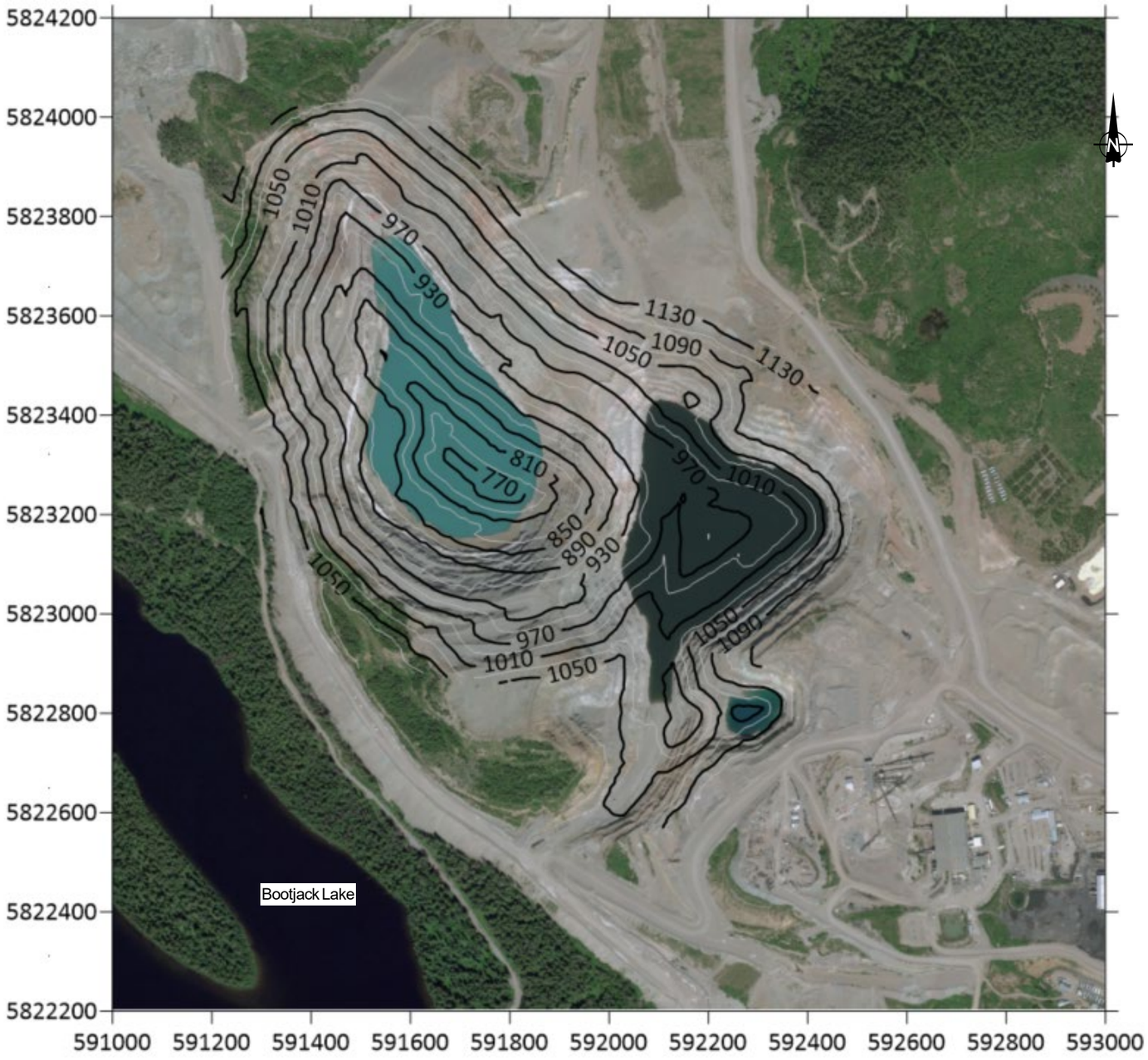

Legend

Topographic Contour (masl)

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC
AutoCad drawing was provided by MPMC in file Sp-6 v4 topomerge.dxf.dxf

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APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
ULTIMATE CONFIGURATION OF SPRINGER AND CARIBOO PIT

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

4.2 Results

Table 6 presents the predicted groundwater inflow and outflow rates during flooding of the Springer/Cariboo Pit for the Base Case predictions and for the two sensitivity scenarios. These predictions consider only groundwater flow to the open pit for the simulated pit lake elevation, and do not include potential inputs from direct precipitation within the footprint of the pit and/or surface water run-off (if not diverted) from the pit walls and from the surrounding areas. These surface water inputs are usually incorporated outside of the hydrogeological model in the Water Balance Model (WSP, 2023). Figure 11 and Figure 12 present hydrogeological conditions predicted by the calibrated model (Base Case) for the ultimate configuration of the Springer/Cariboo Pit when fully dewatered and at increased pit lake levels up to the spillway elevation of 1,050 m.

Table 6: Predicted Seepage Quantities for the Ultimate Configuration of the Springer/Cariboo Pit Lake

Springer-Cariboo Pit Lake Elevation (m)	Base Case		Upper Bound		Lower Bound	
	Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake
760	640	-	1120	-	420	-
800	640	-	1120	-	420	-
850	640	-	1110	-	420	-
900	630	-	1090	-	410	-
940	620	-	1080	-	410	-
960	610	-	1040	-	400	-
980	580	-	980	-	390	-
1000	520	-	850	-	360	-
1020	430	20	690	60	320	<10
1030	390	90	620	200	300	30
1040	360	200	560	440	280	80
1050	330	360	510	780	270	150

Model results indicated that when the Springer/Cariboo Pit is at the ultimate configuration and is fully dewatered, the groundwater inflow to the pit is between approximately 420 m^3/day and 1,120 m^3/d. When fully dewatered, the combined pit would act as strong groundwater sink that would reverse groundwater flow between Bootjack Lake and the pit such that the seepage from Bootjack Lake to the underlying bedrock would occur. As the pit lake level is raised, the groundwater seepage into the pit lake was predicted to gradually decrease to between approximately 270 m^3/day to 510 m^3/d once the spillway elevation of 1,050 m is reached.

In addition, as the pit lake level increases between 1,020 m and 1,030 m elevation, seepage in the range of 20 m^3/d to 200 m^3/d from the Springer/Cariboo Pit Lake into the subsurface was predicted to occur. This seepage was found to gradually increase when the pit lake reaches the spillover elevation of 1,050 m (between 150 m^3/day and 780 m^3/d). At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from the pit and recharge to groundwater occurring towards the southwest.

When compared to previous model predictions (Golder, 2016), updated average predicted inflow and outflow into and out of the pit lake are generally lower than previous estimates (between 10% and 45%), These differences are mainly due to the changes in hydraulic properties in the vicinity of the pit following model recalibration (i.e. reduction in hydraulic conductivity of the bedrock between 40 and 100 mbgs and changes to the brecciated bedrock) and to a lesser degree to the changes between the two simulated ultimate pits. While the updated ultimate pit is deeper and wider than the pit simulated in 2016, predicted flows are lower because of the reduced hydraulic conductivity of the units that are intersected by the ultimate pit.

The hydrogeological model was also used to estimate seepage pathways from the pit lake predicted for the conditions representing the pit lake at the spillway elevation (1050 masl) for the Base Case scenario, as presented in Figure 13. Particle tracking analyses indicate that seepage from the combined Springer/Cariboo Pit Lake when it reaches the spillover elevation is predicted to report to the northern portion of Bootjack Lake over an area of approximately 290 m by 1,200 m, approximately 1 km upstream of the outlet of Bootjack Lake. The advective travel times from the pit lake to the Bootjack Lake are estimated to be between approximately 3 months to less than one year, because of the relatively low transport porosity for bedrock (0.01 to 0.001 based on literature values presented in Guimera and Carrera, 2000), moderate permeability of shallow bedrock, and short travel distance (approximately 200 m from pit crest to Bootjack Lake). Updated seepage pathways when the pit lake reaches spillover elevation are very similar to previous estimates (Golder, 2016).

A. Pit Lake at 760 m Elevation (Dewatered Pit) – SW-NE Cross-Section

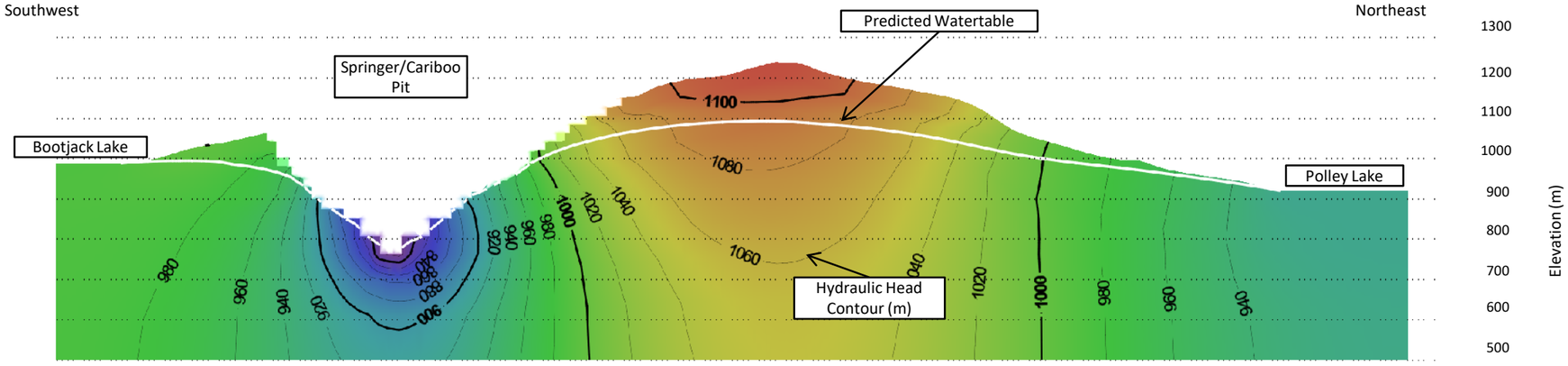

B. Pit Lake at 850 m Elevation – SW-NE Cross-Section

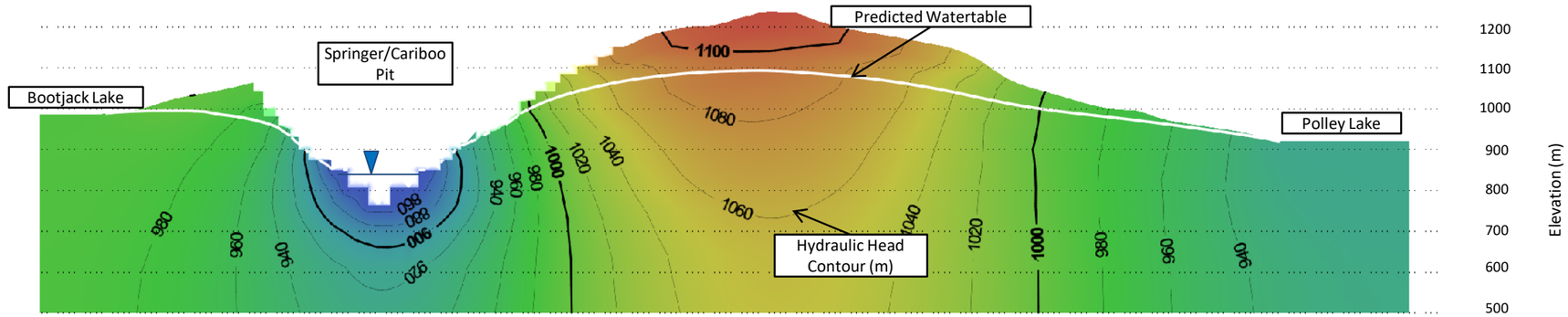

C. Pit Lake at 960 m Elevation – SW-NE Cross-Section

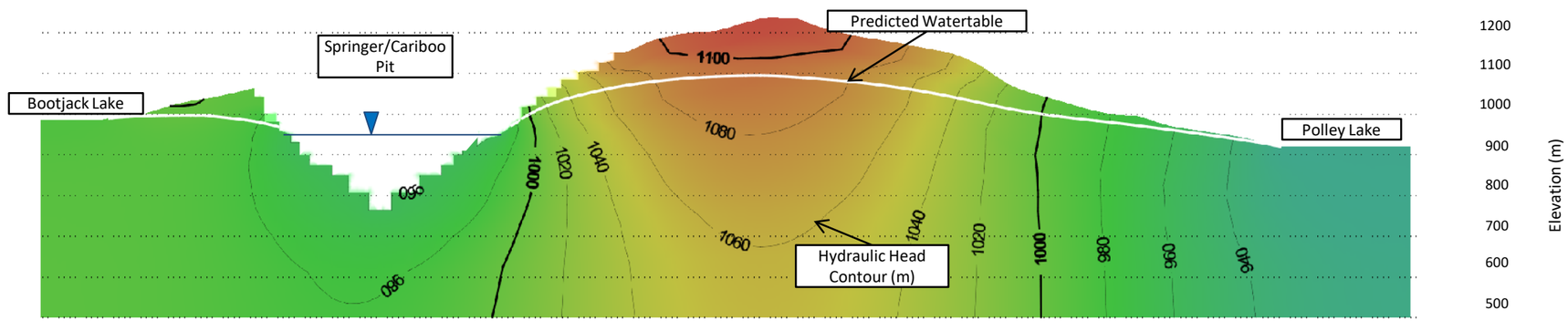

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APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
PREDICTED HYDROGEOLOGICAL CONDITIONS DEWATERED PIT TO PIT LAKE ELEVATION 960 M BASE CASE

PROJECT NO. CA0020527.4505 | 31400 | REV. 0

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25mm
0

A. Pit Lake at 1000 m Elevation – SW-NE Cross-Section

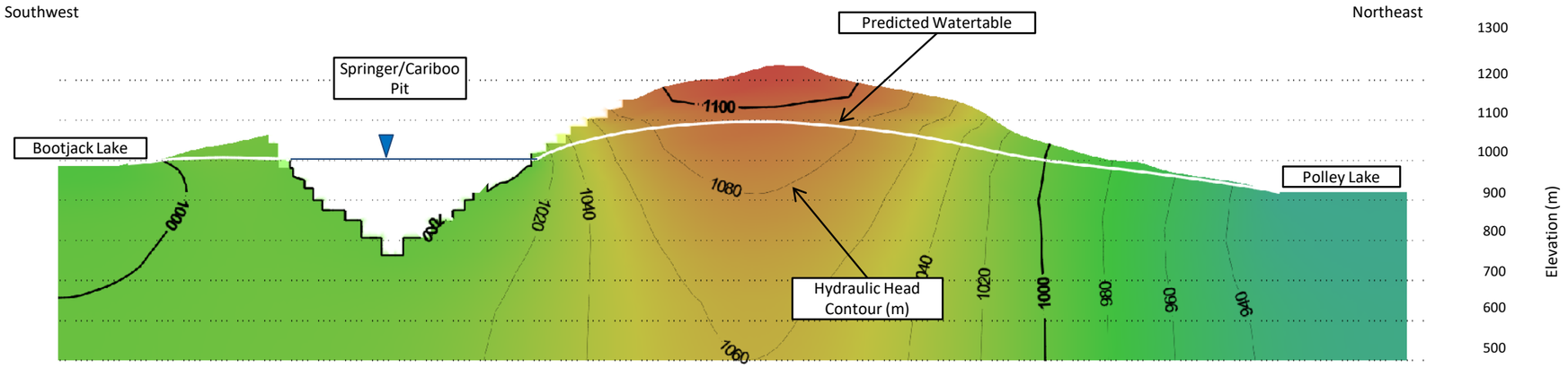

B. Pit Lake at 1030 m Elevation – SW-NE Cross-Section

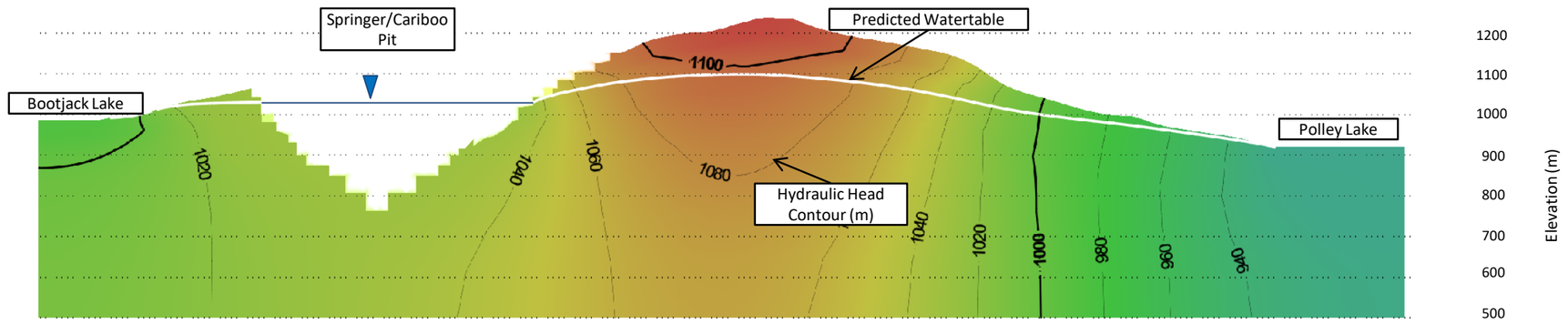

C. Pit Lake at 1050 m Elevation (Spillover) – SW-NE Cross-Section

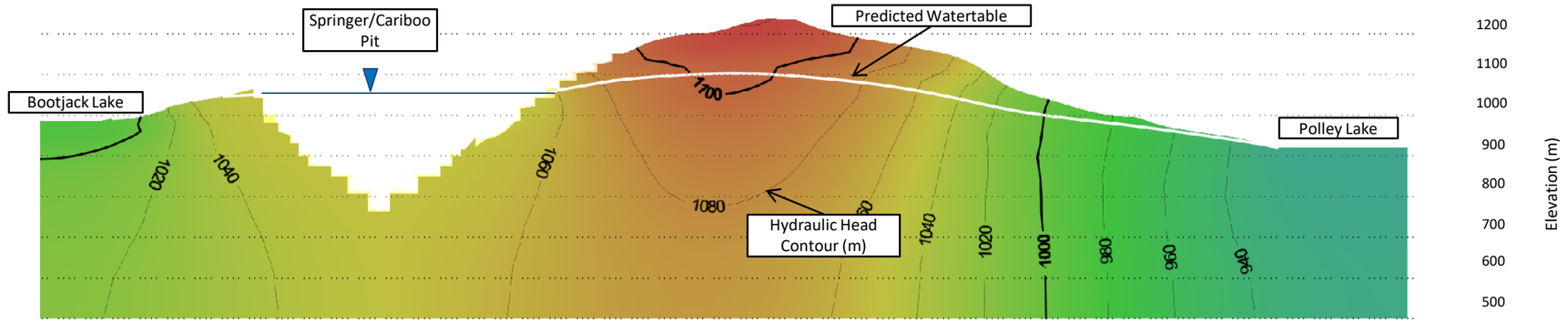

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
PREDICTED HYDROGEOLOGICAL CONDITIONS PIT LAKE FROM 1000 M TO 1050 M (SPILLOVER) BASE CASE

PROJECT NO. CA0020527.4505 | 31400 | REV. 0

A. Map View

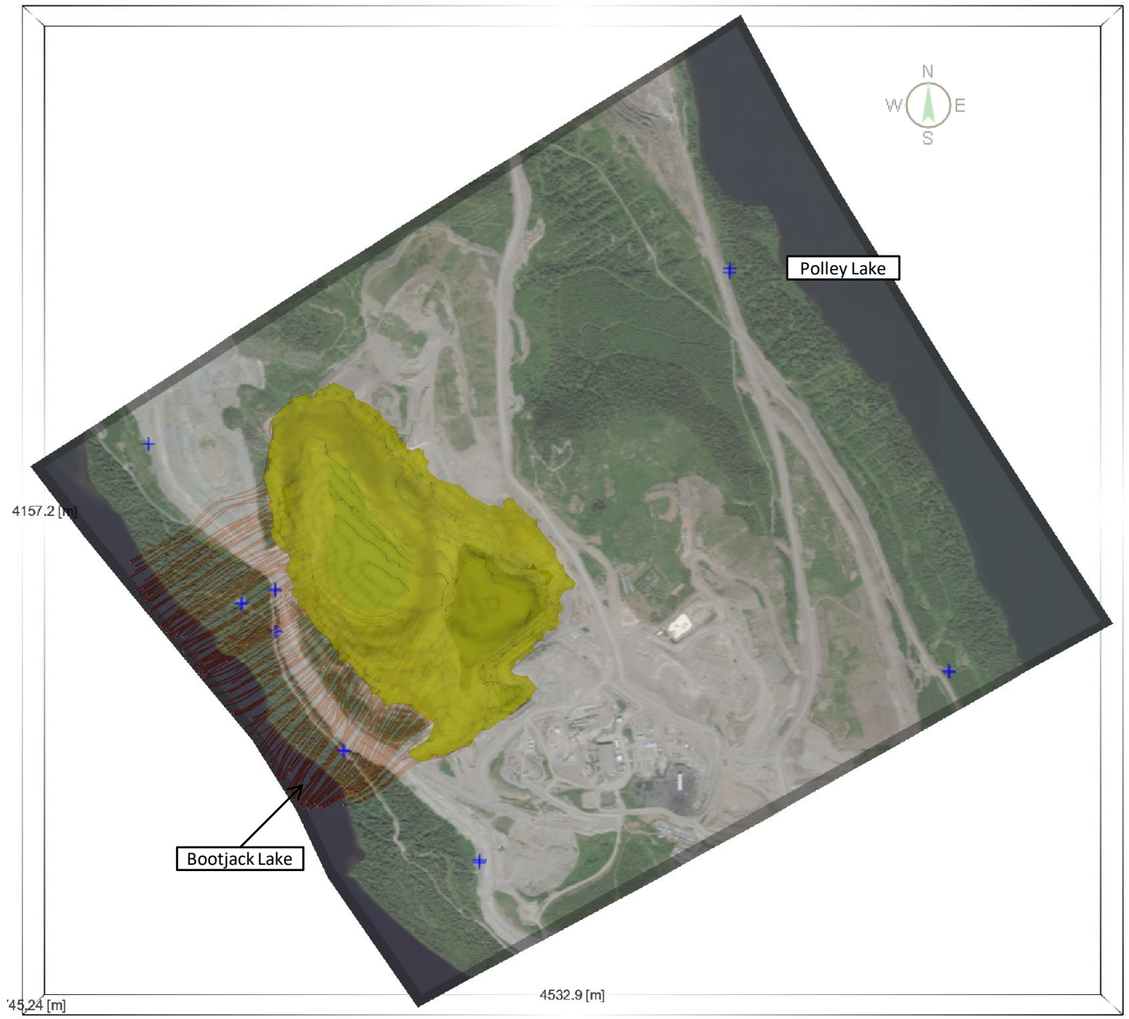

B. Oblique View Looking Northeast

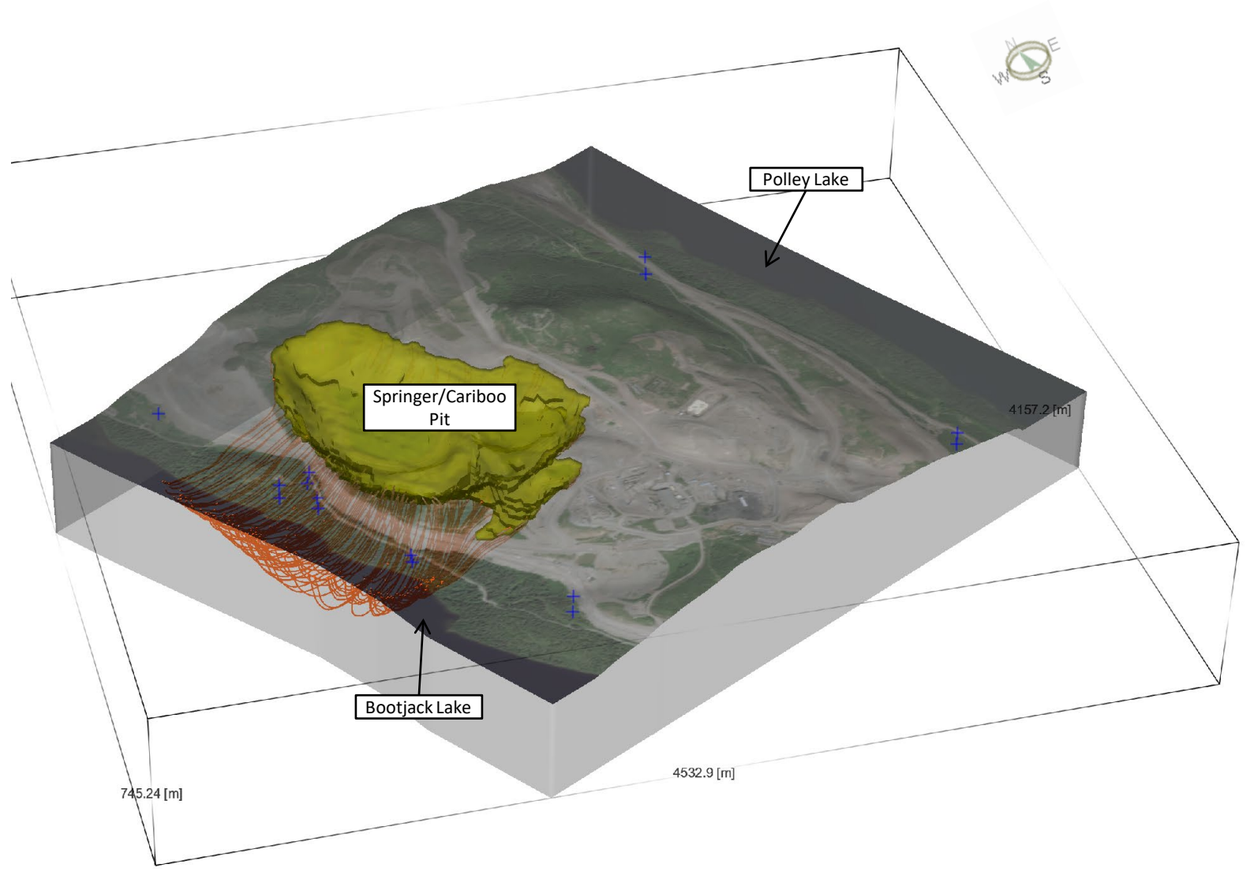

Legend

- Predicted Pathlines from Pit Lake
- Monitoring Well

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
PREEDICTED SEEPAGE PATHWAYS SPILLOVER ELEVATION (1050 MASL) BASE CASE

PROJECT NO. CA0020527.4505 | 31400 | REV. 0

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

5.0 SUMMARY AND CONCLUSIONS

The existing groundwater model built for closure conditions at the Springer/Cariboo Pit Lake (Golder, 2016) was updated to reflect changes in mine settings since 2016 including the pit configuration and water levels in pit lakes up to 2023. Model calibration was refined based on hydrogeological data collected since 2016 in the mine monitoring wells within the groundwater model domain. Results of this assessment are presented as follows:

- Available water level data indicate that exfiltration from the Springer Pit may have occurred in the period between January and June 2016, when the Springer Pit Lake elevation was above 1025 masl. From June 2016 to December 2022, following drawdown of the pit lake, the hydraulic heads in wells close to the Springer Pit crest have remained above the pit lake level, indicating that exfiltration has not likely occurred after this period. The hydraulic head at wells GW12-2a/b and GW16-6a/b has remained below the pit lake level until January 2017, when the lake level dropped below 1010 masl, inferring the presence of a groundwater divide between the Springer Pit and Bootjack Lake.
- The model was successfully recalibrated for different stages in time between 2014 and 2023. The recalibrated model can adequately reproduce groundwater conditions for each of the stages considered and capture observed increases and decreases in the hydraulic heads in near-pit monitoring wells following refilling and dewatering of the Springer Pit Lake (Figures 4 to 9). Groundwater conditions between the Springer Pit Lake and Bootjack Lake both when the pit lake level is high or very low are reasonably represented by the model in the area of monitoring wells GW12-2a/b and GW16-6a/b and the model is predicting the presence of an observed groundwater divide in this area. The model also predicts similar seasonal fluctuations in monitoring wells due to changes in recharge during the freshet period, following snowmelt.
- The recalibrated model was used to simulate groundwater conditions near the Springer/Cariboo Pit during closure, based on the ultimate configuration of the combined Springer/Cariboo Pit. The model mesh and boundary conditions were modified to incorporate the extent of the ultimate Springer/Cariboo Pit and a sequence of steady-state simulations was completed to predict groundwater inflow/outflow to the Springer/Cariboo Pit Lake for different stages of pit flooding during closure (from dewatered pit to spillover elevation). When fully dewatered (Figure 11), the combined pit would act as strong groundwater sink that would reverse groundwater flow between Bootjack Lake and the pit such that the seepage from Bootjack Lake to the underlying bedrock would occur (groundwater inflow to the pit would between approximately 420 m^3/day and 1,120 m^3/d). As the pit lake level is raised (Figures 11 to 13), the groundwater seepage into the pit lake was predicted to gradually decrease to between approximately 270 m^3/day to 510 m^3/d once the spillway elevation of 1,050 m is reached. As the pit lake level increases between 1,020 m and 1,030 m elevation, seepage in the range of 20 m^3/d to 200 m^3/d from the Springer/Cariboo Pit Lake into the subsurface was predicted to occur, increasing between 150 m^3/day and 270 m^3/d when the pit lake reaches the spillover elevation of 1,050 m. At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from the pit and recharge to groundwater occurring towards the southwest. When compared to previous model predictions (Golder, 2016), updated average predicted inflow and outflow into and out of the pit lake are generally lower than previous estimates (between 10% and 45%), These differences are mainly due to the changes in hydraulic properties in the vicinity of the pit following model recalibration.
- Particle tracking analyses (Figure 13) indicate that seepage from the combined Springer/Cariboo Pit Lake when it reaches the spillover elevation would report to the northern portion of Bootjack Lake over an area of approximately 290 m by 1,200 m, approximately 1 km upstream of the outlet of Bootjack Lake. The advective travel times from the pit lake to the Bootjack Lake are estimated to be between approximately 3 months to less than one year.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum. We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please contact the undersigned at 604-296-4200.

WSP Canada Inc.

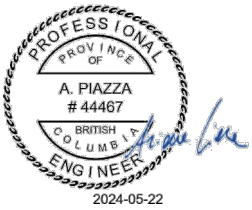

Arianna Piazza, P.Eng.
Principal Hydrogeologist



Don Chorley, P.Geo.
Senior Hydrogeology Specialist

AP/DWC/ar/ah

Attachment 1: Model Residuals

https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/040-tm-31441-gw model springer recalibration memo/rev0/ca0020527.4505-040-tm-rev0-31441-gw model springer recalibration memo 22may_24.docx

Engineers & Geoscientists BC Permit #1000200

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STUDY LIMITATIONS

This technical memorandum was prepared for the exclusive use of Mount Polley Mining Corporation (MPMC). The assessment was performed according to current professional standards and practices in the groundwater field and has been made using historical and technical data obtained from the sources noted within this technical memorandum. Except where specifically stated to the contrary, the information contained in this memorandum (including reports, information and data) was provided to WSP by others and has not been independently verified or otherwise examined by WSP to determine its accuracy or completeness. WSP has relied in good faith on this information and does not accept responsibility for any deficiency, misstatements or inaccuracies contained in the report as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The services performed as described in this technical memorandum were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. Hydrogeological investigations and the development of conceptual and numerical site models are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time, and in the sense that the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that subsurface conditions are not known between the specific investigation locations, and there is invariably a lack of complete information both spatially and temporally about the geological and hydrogeological conditions. The validity and accuracy of the conceptual model depends on the amount of data available relative to the degree of complexity of the geologic formations, the site area hydrogeology, and on the quality and degree of accuracy of the data utilized it in its development. Therefore, every conceptual model is a simplification of reality and the model described in this technical memorandum is not an exception.

The content of this report is based on information collected during the study, our present understanding of the site area conditions, the assumptions stated in this report, and our professional judgement in light of such information at the time of this report. This technical memorandum provides a professional opinion and, therefore, no warranty is expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This technical memorandum does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this technical memorandum are valid only as of the date of the report. If new information is discovered in future work, or if the assumptions stated in this technical memorandum are not met, WSP should be requested to re-evaluate the conclusions of this technical memorandum, and to provide amendments as required.

The information, recommendations and opinions expressed in this technical memorandum are for the sole benefit of MPMC. No other party may use or rely on this technical memorandum or any portion thereof without WSP's express written consent. The technical memorandum, all plans, data, drawings and other documents as well as all electronic media prepared by WSP are considered its professional work product and shall remain the copyright property of WSP, who authorizes only MPMC to make copies of the report, and only in such quantities as are reasonably necessary for the use of the technical memorandum by those parties. MPMC may not give, lend, sell, or otherwise make available the technical memorandum or any portion thereof to any other party without the express written permission of WSP, except as required by law. MPMC acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore MPMC cannot rely upon the electronic media versions of WSP's technical memorandum or other work products.

ATTACHMENT 1

Model Residuals

A. May 2014 – Dewatered Pit

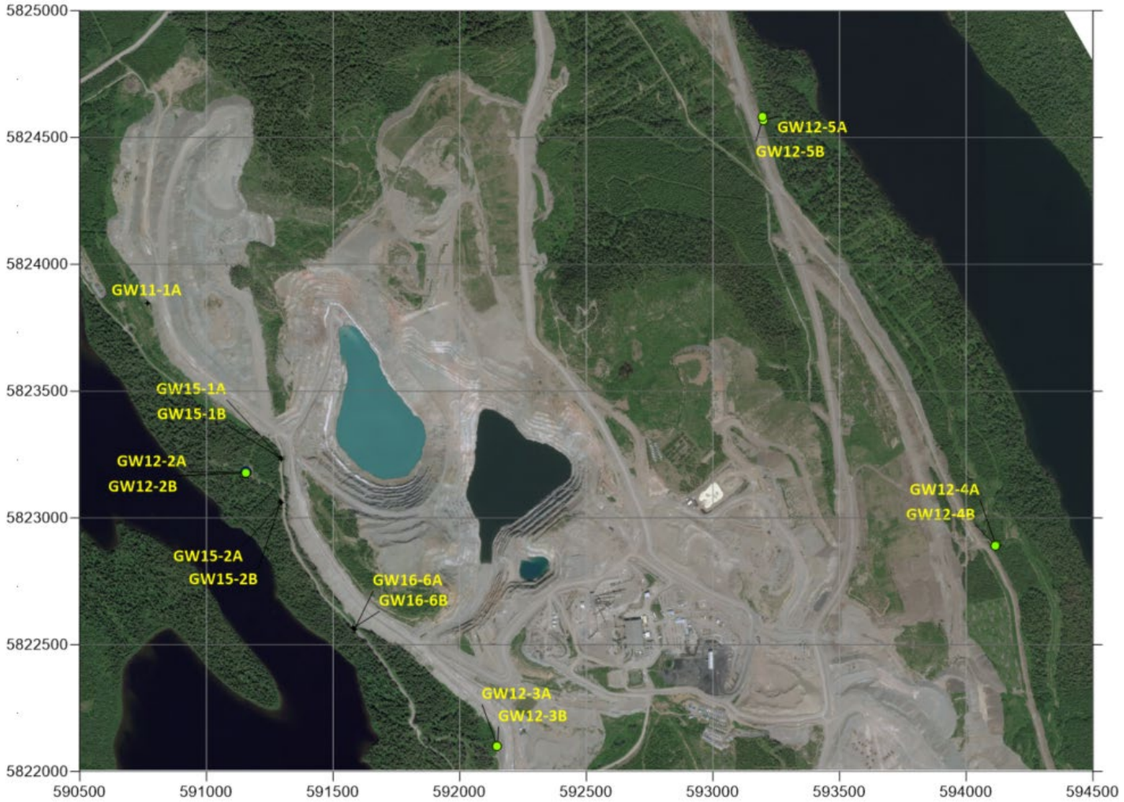

B. July 2015 – Pit Lake at 1017.2 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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CONSULTANT
wsp

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REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
MAY 2014 AND JULY 2015

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-1**

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0 25mm

A. June 2016 – Pit Lake at 1037.97 masl



B. November 2018 – Pit Lake at 983 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
JUNE 2016 AND NOVEMBER 2018

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

A. November 2019 – Pit Lake at 983 masl



B. May 2021 – Pit Lake at 999.7 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
NOVEMBER 2019 AND MAY 2021

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

A. June 2022 – Pit Lake at 981 masl



B. September 2023 – No Pit Lake

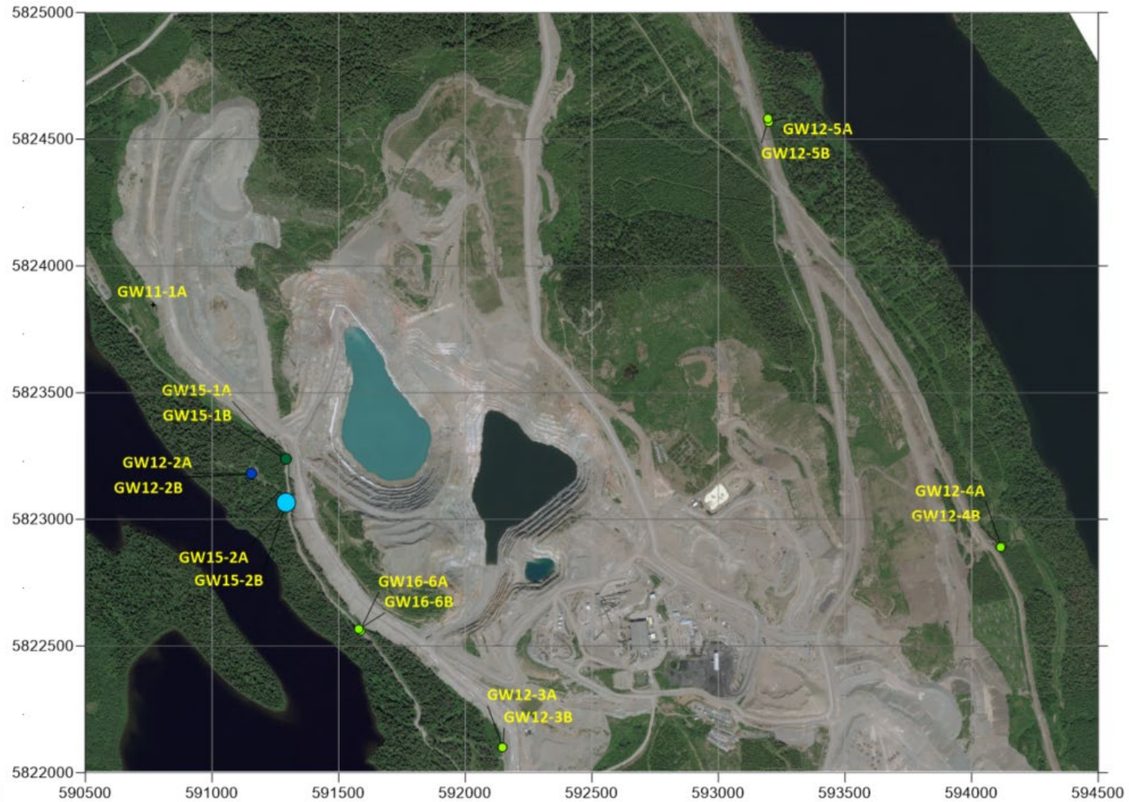

Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
JUNE 2022 AND SEPTEMBER 2023

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
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APPENDIX 5-6: Near Field Dispersial Model Verification

TECHNICAL MEMORANDUM

DATE 27 March 2023 **Reference No.** 23590671-017-TM-Rev0-31242

TO Mathieu O'Leary
Mount Polley Mining Corporation

CC Don Parsons

FROM Steve Mitchell, Alison Snow and Lee Nikl **EMAIL** **Steve.Mitchell@wsp.com; Alison.Snow@wsp.com; Lee.Nikl@wsp.com**

2022 VERIFICATION OF NEAR-FIELD MODELLING IN QUESNEL LAKE FOR MOUNT POLLEY MINE

1.0 INTRODUCTION

This memorandum provides an update to the previous near-field model validation that was presented in the memorandum entitled "2021 Verification of Near-Field Modelling in Quesnel Lake – Mount Polley Mine" (WSP Golder 2022). For brevity, only the results of the updated model validation are presented, because the methods are the same as those described in the previous memoranda (Golder 2016, 2018, 2019, 2020, 2021, and WSP Golder 2022).

In brief, near-field dilution was calculated using measured water quality data at "end-of-pipe", in ambient Quesnel Lake water, and at the boundary of the initial dilution zone (IDZ) in Quesnel Lake. While this method can lead to large variations in calculated dilution factors on a parameter-by-parameter basis, it is the only validation method available that does not entail adding a tracer chemical to the effluent. Adding a tracer, especially one that might introduce colour to the lake, was not considered for this study because local stakeholders have expressed a strong desire to avoid adding chemicals to Quesnel Lake.

Dilution factors were calculated using Equation 1:

$$DF = \frac{[C_{eff}]-[C_{amb}]}{[C_{IDZ}]-[C_{amb}]} \quad \text{[Equation 1]}$$

where:

C_{eff} = concentration in the effluent from the water treatment discharge (HAD-3)

C_{amb} = concentration in ambient lake water (QUL-2a)

C_{IDZ} = concentration in lake water at the boundary of the IDZ (QUL-5)

2.0 DILUTION FACTORS AT THE INITIAL DILUTION ZONE OF QUESNEL LAKE

The updated model validation includes all applicable data collected in 2022. During this time, discharge was started and ceased on the dates listed in Table 2-1. All treated water during the period of discharge was directed from the water treatment plant (WTP) to Quesnel Lake directly through the pipeline and diffusers.

Table 2-1: Start and Cease Dates of Discharge from the Water Treatment Plant

Start Dates	Cease Dates
1 January	10 June
22 June	31 December

Water quality was measured at locations that enabled dilution factors to be calculated on 10 occasions during the present validation period (Figure 1 and Table 2-1). The calculated median dilution factors were at least 81 on days when discharge was active (Table 2-2). These values confirm the model prediction that the minimum dilution factor at the boundary of the IDZ would range from approximately 40 to well above 100. The calculated dilution factors based on the 2022 monitoring data (Table 2-3 to Table 2-8) are consistent with the model prediction and indicate that the model prediction was conservative (cautionary).

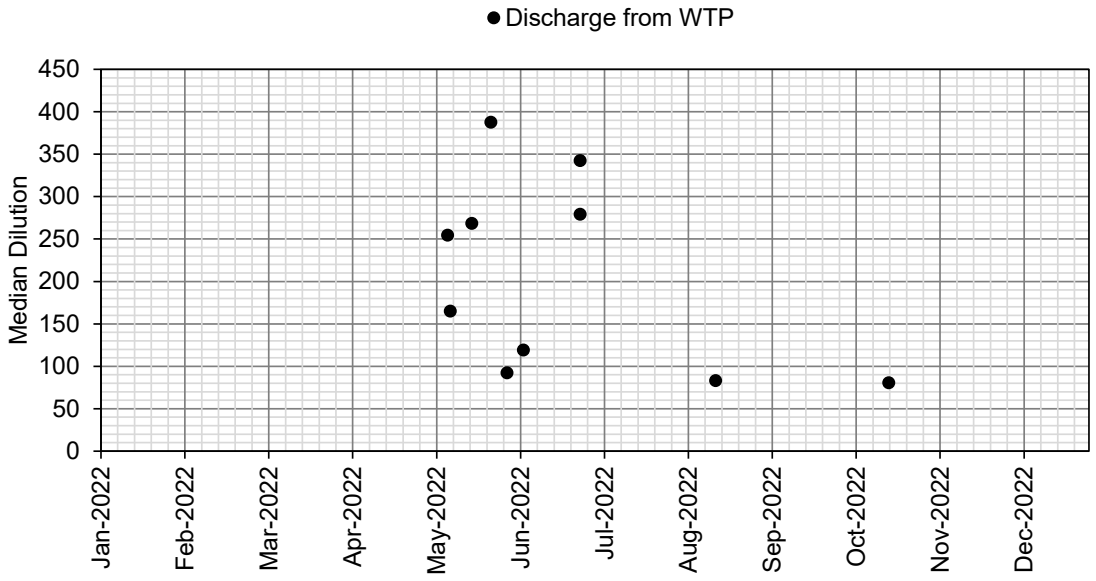

Figure 1: Calculated Dilution Factors at the Initial Dilution Zone Based on 2022 Monitoring Data

Table 2-2 : Calculated Dilution Factors at the Initial Dilution Zone

Discharge Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Dilution Factor						
			Total Dissolved Solids	Nitrate	Sulphate	Total Manganese	Total Molybdenum	Total Selenium	Median Dilution
HAD-3 – Hazeltine Discharge	Maximum at QUL-57, QUL-58 or QUL-59, near water surface, mid-depth or near lakebed[a]	2022-05-09	88	40	255	-[b]	408	372	255
HAD-3 – Hazeltine Discharge		2022-05-10	71	40	259	18	362	347	165
HAD-3 – Hazeltine Discharge		2022-05-18	1,504	41	241	155	296	356	268
HAD-3 – Hazeltine Discharge		2022-05-25	-[b]	40	230	3,036	388	497	388
HAD-3 – Hazeltine Discharge		2022-05-31	19	36	136	49	229	157	92
HAD-3 – Hazeltine Discharge		2022-06-06	137	32	96	120	139	119	119
HAD-3 – Hazeltine Discharge		2022-06-27	-[a]	41	279	85	510	531	279
HAD-3 – Hazeltine Discharge		2022-08-16	46	28	83	-[b]	98	93	83
HAD-3 – Hazeltine Discharge		2022-10-19	67	30	81	-[b]	106	106	81
HAD-3 – Hazeltine Discharge	Maximum at QUL-57, QUL-58 or QUL-59, above or below thermocline or above, below, or within plume[a]	2022-06-27	-[a]	42	342	168	658	581	342

(a) See Table 2-2 to Table 2-8 for specific station names.

(b) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the edge of the initial dilution zone was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

Table 2-3 : Calculated Dilution Factors for Total Dissolved Solids at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	824	82	88
HAD-3 – Hazeltine Discharge	QUL-57-S	2022-05-10	824	84	71
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	825	74	1504
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	826	64	-[c]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-31	827	114	19
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	828	79	137
HAD-3 – Hazeltine Discharge	QUL-57-B	2022-06-27	831	72	-[c]
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-08-16	838	90	46
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-10-19	848	85	67
HAD-3 – Hazeltine Discharge	QUL-58-AP	2022-06-27	831	73	-[c]

(a) Dilution factors were calculated using the maximum initial dilution zone total dissolved solids concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (73.5 mg/L) from the QUL-2a station.

(c) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the sampling location was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-4 : Calculated Dilution Factors for Nitrate at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-09	3.6	0.13	40
HAD-3 – Hazeltine Discharge	QUL-59-MID	2022-05-10	3.7	0.13	40
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-18	3.7	0.13	41
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	3.8	0.13	40
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	3.8	0.14	36
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	3.8	0.16	32
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	4.0	0.14	41
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	4.4	0.19	28
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	4.8	0.2	30
HAD-3 – Hazeltine Discharge	QUL-58-AP	2022-06-27	4.0	0.13	42

(a) Dilution factors were calculated using the maximum initial dilution zone nitrate concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient nitrate concentration (0.040 mg-N/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

N = nitrogen; IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-5 : Calculated Dilution Factors for Sulphate at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	483	7.7	255
HAD-3 – Hazeltine Discharge	QUL-57-S	2022-05-10	483	7.6	259
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-18	485	7.8	241
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	486	7.9	230
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	486	9.3	136
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	487	10.8	96
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	490	7.5	279
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	498	11.7	83
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	507	12	81
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	490	7.2	342

(a) Dilution factors were calculated using the maximum initial dilution zone sulphate concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient sulphate concentration (5.8 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; MP = Middle of Plume.

Table 2-6 : Calculated Dilution Factors for Total Manganese at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.11	0.0015	-[c]
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-05-10	0.11	0.0076	18
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.11	0.0024	155
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	0.11	0.0017	3,036
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-31	0.11	0.0039	49
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.11	0.0026	120
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-06-27	0.11	0.0029	85
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.11	0.0016	-[c]
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.1	0.0017	-[c]
HAD-3 – Hazeltine Discharge	QUL-59-AP	2022-06-27	0.11	0.0023	168

(a) Dilution factors were calculated using the maximum initial dilution zone total manganese concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.0017 mg/L) from the QUL-2a station.

(c) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the sampling location was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-7 : Calculated Dilution Factors for Total Molybdenum at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.16	0.00075	408
HAD-3 – Hazeltine Discharge	QUL-59-S	2022-05-10	0.16	0.00079	362
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.16	0.0009	296
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	0.16	0.00077	388
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	0.16	0.0011	229
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.16	0.0015	139
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	0.16	0.00069	510
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.17	0.0021	98
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.19	0.0021	106
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	0.16	0.0006	658

(a) Dilution factors were calculated using the maximum initial dilution zone total molybdenum concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.00036 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MP = Middle of Plume.

Table 2-8 : Calculated Dilution Factors for Total Selenium at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.041	0.00023	372
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-05-10	0.041	0.00024	347
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.041	0.00024	356
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	0.042	0.0002	497
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	0.042	0.00039	157
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.042	0.00048	119
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	0.043	0.0002	531
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.046	0.00062	93
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.049	0.00059	106
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	0.043	0.0002	581

(a) Dilution factors were calculated using the maximum initial dilution zone total selenium concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.00012 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; MP = Middle of Plume.

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions, please contact the undersigned.

WSP Canada Inc.



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STUDY LIMITATIONS

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APPENDIX 5-7: Long Term Far Field Diffuser Modelling

TETRA TECH EBA

TECHNICAL MEMO

ISSUED FOR USE

To:	Lyn Anglin, Imperial Metals Colleen Hughes, Mount Polley Mining Corporation	**Date:**	June 27, 2016
c:	Mike Herrell, Golder Associates	**Memo No.:**	001
From:	Daniel Potts, Tetra Tech EBA	**File:**	704-WTR.WTRM03015-01
Subject:	Mt. Polley Long Term Far Field Diffuser Modelling		

1.0 INTRODUCTION

Following the August 4, 2014 failure of its Tailings Storage Facility (TSF), Mount Polley Mine (the Mine) suspended operations. The failure of the TSF necessitated a new water management strategy, and in December 2015 the Mine was approved for short-term discharge of treated effluent into Quesnel Lake through two diffusers at a depth of approximately 50 m. For the present work, Tetra Tech EBA was retained to assess the potential long-term effects of continued discharge through these diffusers, currently installed.

1.1 Previous Related Work

Tetra Tech EBA previously completed several field and modelling studies related to water quality in Quesnel Lake.

- **Quesnel Lake Water Column Observations and Modelling** (Tetra Tech EBA, 2015a): Tetra Tech EBA was retained to perform both field measurements and numerical analyses to develop a predictive model that evaluated the fate of the suspended particulate material in Quesnel Lake and the turbidity resulting from that material.
- **Bathymetry Analysis and Volume Balance** (Tetra Tech EBA, 2015b): Tetra Tech EBA assessed the overall volume balance of the TSF failure event, giving consideration to all available sources of data, both on land and within Quesnel Lake.
- **Dilution Modelling at Potential Outfalls in Quesnel Lake** (Tetra Tech EBA, 2015c): Tetra Tech EBA was retained to assess the performance of proposed outfall designs in Quesnel Lake, particularly the long-term far field performance.

Golder Associates (Golder) conducted near-field modelling using CORMIX and conceptual outfall design (Golder, 2015a).

1.2 Objectives

The present work was undertaken in support of Mount Polley Mining Corporation (MPMC) in its application for a long-term permit for discharge into Quesnel Lake. This memorandum will be incorporated into a long-term Technical Assessment Report (TAR) as an appendix. The objectives of the present work were as follows:

- Assess the potential for dilution in Quesnel Lake under two preliminary “bookend” discharge scenarios, with consideration of long-term buildup over a decade.

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- Assess the potential for dilution in Quesnel Lake under three "detailed" discharge scenarios, with consideration of long-term buildup during the period of resumed mining operations.

1.3 Limnology Background Discussion

Quesnel Lake is a long, narrow fjord lake reaching from the Cariboo Mountains into the Interior Plateau of BC. Its average and maximum depths are 157 and 511 m, respectively, making it the deepest fjord-type lake in the world (Laval et al, 2008). It has a surface area of about 266 km^2 and a volume of 42 km^3. With a mean annual outflow of 128 m^3/s through the Quesnel River, the lake has an average hydraulic residence time of 10 years. At the west end of the lake, a contraction and sill at Cariboo Island partially separates the main body of the lake from the so-called "West Basin," which represents 8.6% and 2.3% of Quesnel Lake's surface area and volume, respectively. The West Basin's average and maximum depths are 43 and 107 m, respectively.

In temperate lakes, the temperature of the surface water passes through 4°C, the temperature of maximum density, twice annually in a well-understood cycle. Summer warming produces a layer of warm, buoyant water at the surface of a lake. The temperature difference, and thus density difference, between this layer and the cooler water beneath creates a resistance to mixing which stabilizes or stratifies the lake. In the fall, the surface layer cools, reducing the density difference between surface and deeper waters, until the stratification is overcome by wind-induced mixing. This mixing typically involves the entire water column and is commonly referred to as "fall overturn." Under winter conditions, cooling of the entire lake continues until the surface is less than 4°C, at which point a reverse winter stratification appears: a cold, buoyant surface layer overlies a warmer (closer to 4°C) deep layer. In the spring, warming of the surface layer leads up to "spring overturn" when, again, the stratification is overcome by wind-induced mixing. Continued warming of the surface layer re-forms the summer stratification and completes the annual cycle. These mixing episodes have previously been observed in Quesnel Lake in December and April. See, for example, thermistor data presented in Potts (2004) and in Laval et al (2012).

In temperate lakes deeper than about 100-200 m, the seasonal overturn cycle is complicated by high-pressure effects. The temperature of maximum density decreases with pressure, to approximately 3°C at a depth of 500 m. This means that seasonal overturn events can only involve the upper 100-200 m of the water column and deeper water is only renewed or displaced by subtle three-dimensional dynamics. For more discussion and numerous references, refer to Potts (2004) and Laval et al (2012). The main body of Quesnel Lake is subject to these effects. The West Basin of Quesnel Lake, however, with a maximum depth of just over 100 m, follows the normal seasonal overturn cycle for temperate lakes.

The three largest inflows to the lake are east of the sill, whereas Quesnel River flows out of the western tip of the West Basin, meaning that nearly all of the hydraulic throughput of the lake must pass through the West Basin. Based on an average annual outflow of 128 m^3/s, the West Basin's average residence time is about 90 days.

The sill separating the West Basin and the main body of the lake has a maximum depth of 35 m and forks around Cariboo Island. Wind setup and internal waves, or seiches, between the upper and lower layers in the water column cause two-layer exchange flow over the sill following strong wind events. Using temperature measurements, Potts (2004) estimated the rate of exchange flow to be on the order of 1500 m^3/s, which dwarfs the river outflow by an order of magnitude. This exchange is frequent enough and large enough to fully replace the water in the cool, deeper layer in 6-8 weeks (Laval et al, 2008), although the duration of individual exchange events is on the order of hours to a few days.

The key physical drivers of the lake are meteorological fluxes, wind, and rivers. Meteorological fluxes create the seasonal stratification and are dominated by shortwave and longwave radiation and evaporative heat transfer (Potts, 2004; Laval et al, 2012). Wind events are responsible for the seiche activity which can result in upwelling of cold water at the western tip of the lake and exchange flows across the sill (Laval et al, 2008) as well as episodic

deep water renewal (Laval et al, 2012). Rivers also influence circulation and deep water renewal, but to a lesser degree (Laval et al, 2012).

2.0 METHODS

2.1 Model Overview

Tetra Tech EBA used the EPA Visual Plumes UM3 model, embedded in the three-dimensional hydrodynamic model H3D, to evaluate the behaviour of an outfall plume in Quesnel Lake. UM3 is a numerical dilution model for outfall discharge into marine and freshwater environments, and is one of the models included in the Visual Plumes software. The model, developed and distributed by the US Environmental Protection Agency, is an accepted standard for determining environmental impacts from effluent discharge through an outfall. Tetra Tech EBA previously developed a three-dimensional hydrodynamic model of Quesnel Lake in order to describe the behaviour of the suspended material introduced to the lake after the August 4, 2014 TSF failure event. H3D is a three-dimensional hydrodynamic model that has been shown to accurately simulate the effects of tide, wind, river flow, density and time variability in receiving water bodies (Stronach et al., 1993). The Quesnel Lake implementation of the model was developed to simulate the temperature, turbidity, and total dissolved solids regime of the lake. The model is described in the report “Quesnel Lake Water Column Observations and Modelling” (Tetra Tech EBA, 2015a) including validation to historical data and simulation of the lake after the 2014 TSF failure event. The model grid for Quesnel Lake is shown in **Figure 2.1**, with diffuser locations and river inflow and outflow points labelled.

The existing hydrodynamic model of Quesnel Lake does not take into account pressure effects on water’s equation of state. Therefore, it does not reproduce the deep-water renewal processes of the main body of the lake. These processes are, however, inconsequential to the objectives of the present work focused in the West Basin, and generally only affect circulation in water bodies deeper than about 100-200 m.

For outfall assessments, the PLUMES UM3 code was integrated into H3D such that all of the simulated time-varying properties of velocity and density could have the appropriate influence on near-field plume behaviour, and the far-field behaviour could be simulated in a realistic manner. The UM3 model is valid in the near-field when boundary effects do not occur within the near-field, and when the plume dynamics do not cause significant recirculation in the receiving environment. The existing Quesnel Lake model resolution is relatively large (75 x 75 m at the diffuser location) in order to simulate the entire lake. As the point of interest for dilution modelling is 100 m from the outfall, the grid resolution is not suitable for near-field modelling. Near-field dilution is discussed in Golder (2015a) as well as Appendix H of the TAR; Golder used the CORMIX suite of near-field models to design and evaluate diffuser options. The salient difference between the long-term three dimensional approach (H3D-PLUMES) and the near-field approach (CORMIX) is the possibility of building up a background concentration of effluent in the three-dimensional model of the lake, reducing diffuser effectiveness regardless of near-field hydraulic performance.

Warm water is less dense than cool water, so a warm plume encountering the cool bottom waters of a lake is typically buoyant. On the other hand, given similar temperatures, a plume with higher suspended and dissolved solids than the receiving water will sink. The total dissolved solids (TDS) concentrations in the effluent (on the order of 1000 mg/L) are sufficient to overcome approximately 10°C worth of buoyancy. Therefore, the plume may tend either to sink or to rise, depending on its temperature and TDS concentration as well as those of the ambient water. The modelling method chosen is able to respond to these competing processes, including the background buildup of TDS and seasonal changes in effluent and lake temperature.

2.2 Representation of Effluent Characteristics

For modelling purposes, the diffuser effluent and receiving water were represented with the following properties: temperature, total suspended solids (TSS), TDS, and a dye tracer. Density was derived from temperature and TDS

by Chen and Millero's lake-specific equation of state (1986) at zero pressure, and modified for TSS using an assumed solids density of 2650 kg/m^3.

To enable a determination of the degree of effluent dilution achieved at a given point in the lake, the effluent was assigned a dye tracer concentration of 1.0, while the lake's other inflows were assigned a dye concentration of 0.0. The units of measurement for the dye can be interpreted as "m^3 of effluent per m^3 of sample." The dye was modelled as an inert, massless, soluble component. The dilution ratio can be calculated from the dye concentration at a given point; for example, a dye concentration of 0.01 represents 1 part effluent mixed with 99 parts ambient water – a dilution of 99:1.

In the "detailed" scenarios, selenium was added to the list of scalar constituents simulated.

2.3 Initial Conditions

The water temperature profile in the hydrodynamic model was initialized using the 26 November 2015 observation made by the Mine at QUL-66a (see **Figure 2.1**). This conductivity-temperature-depth (CTD) profile showed a nearly-homogeneous water column with temperature ranging from 5.7°C at the surface to 5.0°C at the maximum depth of the cast (90 m). Below 90 m, the initial temperature throughout the lake was assumed as 4.0°C.

For the "bookend" scenarios, the initial concentrations of TSS and TDS were taken as 1.5 and 78 mg/L, respectively, throughout the lake. These values were average measurements from sites near Hazeltine Creek mouth (Golder, 2015a). For the "detailed" scenarios, initial TSS was kept at 1.5 mg/L; however, initial TDS was adjusted to 69 mg/L and the initial selenium concentration was set to 0.00014 mg/L to match measurements east of Cariboo Island (values provided by Golder).

In all scenarios, the initial dye concentration was zero, to represent the absence of effluent.

2.4 Diffuser Discharge Hydrographs and Properties

The purpose of modelling the "bookend" scenarios was to provide preliminary estimates of dilution in Quesnel Lake before input data were available for a more detailed analysis. The defining characteristic of each of the two scenarios is the assumed hydrograph and properties of the discharge through the diffusers. The two "bookend" scenarios, Option 1 and Option 2, are described below.

The purpose of modelling the "detailed" scenarios was to provide best estimates of the resulting water quality in Quesnel Lake under a statistical range of predicted water quality in the discharge, from 5th to 95th percentile concentrations. The discharge characteristics for the "detailed" scenarios are described below.

2.4.1 Option 1 "Bookend" Discharge

Option 1 used a steady simulated flow rate of 0.33 m^3/s (10.4 Mm^3/yr). The steady flow represents discharge through a pipeline, bypassing the sedimentation ponds, and thus excluding any flow contribution from the lower reaches of Hazeltine Creek. Discharge was simulated beginning on 1 December 2005, to match the season that the Mine's discharge began under their short term discharge permit (1 December 2015). **Section 2.6.1** justifies the selection of 2005-2015 as the simulation period. The total simulated volume of effluent discharged from 1 December 2005 to 31 December 2015 was 105 Mm^3.

The temperature of the effluent was based on estimated monthly average temperatures at end of pipe, provided by Golder and consistent with the 2015 TAR (Golder, 2015a), and varied between 0.0 and 17.5°C. The TDS concentration in the effluent was assumed to be 1000 mg/L, based on the 75th percentile concentration in Springer Pit predicted by the Updated TAR Model (Golder, 2015b). Consistent with the Environmental Management Act

permit, the TSS concentration in the effluent was assumed to be 15 mg/L. As there was no mixing with Hazeltine Creek, the dye concentration was a constant 1.0. **Figure 2.2** illustrates the diffuser discharge hydrograph and properties for Options 1 and 2.

2.4.2 Option 2 "Bookend" Discharge

For the Option 2 scenario, the discharge is assumed to pass through the sedimentation ponds, thus mixing with water from Hazeltine Creek. Since the capacity of the diffuser system is 0.60 m^3/s, the treatment plant was assumed to shut down whenever the Hazeltine Creek flow exceeded 0.27 m^3/s. The discharge through the diffusers was therefore defined as indicated in **Table 2.1**, below. The total simulated volume of effluent discharged from 1 December 2005 to 31 December 2015 was 80 Mm^3, which is 76% of the total discharge in Option 1.

Table 2.1: Discharge Definition for Option 2

When Hazeltine Creek Base Flow Was	The Discharge Was
Less than 0.27 m^3/s,	Hazeltine Creek base flow plus 0.33 m^3/s of effluent.
Between 0.27 and 0.60 m^3/s,	Hazeltine Creek base flow only.
Greater than 0.60 m^3/s,	Exactly 0.60 m^3/s of Hazeltine Creek base flow.

The temperature and other properties of the effluent were assumed to be the same as in Option 1. Properties of the combined effluent and Hazeltine Creek discharge were calculated according to the proportion of flow from each source (**see Figure 2.2**). The properties of the Hazeltine Creek base flow are described in **Section 2.7**, below.

2.4.3 "Detailed" Scenario Discharges

The three "detailed" scenarios used discharge flow rates representing average-year hydrology at the mine site. The discharge was a mixture comprised of up to three streams at any given time, coming from the Perimeter Embankment Till Borrow Pond, Springer Pit, and Hazeltine Creek. The flow rates and concentrations of TDS and selenium for each of these streams were provided digitally to Tetra Tech EBA by Golder. Effluent flows are mingled with Hazeltine Creek flows from the simulation start until the end of November 2017, at which time a pipeline is assumed to be commissioned. A bypass conveying flows from Springer Pit is active from May 2016 to May 2017, inclusive, at which time the dewatering of Springer Pit is projected to be completed. For the concentrations of TDS and selenium, three time series were provided, corresponding to 5th-percentile, median, and 95th-percentile predictions of Golder's probabilistic water quality model (see Appendix D of the TAR). In this context, the 95th-percentile water quality predictions are relatively high values which are exceeded in only 5% of the model cases.

The discharge temperatures were estimated from the monthly temperatures of Hazeltine Creek and the effluent, discussed above, and combined in proportion to the respective flow rates. The TSS concentrations in Hazeltine Creek and the effluent were both assumed to be a constant 5.0 mg/L, matching the average concentration observed in Hazeltine Creek (sample location HAC-12) after the water treatment plant became operational (data provided by MPMC). The simulated dye concentration was 1.0 in the effluent streams, and was diluted appropriately when the discharge included water from Hazeltine Creek.

Figure 2.3 shows the discharge characteristics for the 5th-percentile, median, and 95th-percentile water quality "detailed" scenarios. Flow rates are presented as a total for the two diffusers.

2.5 Diffuser Physical Characteristics

The physical characteristics of the diffusers were modelled based on the information shown in drawings 101 through 105 in "HDPE PIPELINE - TEMPORARY DISCHARGE TO QUESNEL LAKE," issued for record and sealed 13 November 2015. There are two diffusers, installed at depths of 45 and 50 m below the water surface. Each diffusers has two ports spaced 15 m apart, each 0.20 m (8 inches) in diameter, which angle up at 45° above the bed slope. The diffuser ports are approximately 1 m above the lake bed.

Although changes to the existing diffuser configuration may be considered for future operations, only the existing configuration was assessed by the modelling described in this memo.

2.6 Meteorological Inputs

One advantage of running a continuous simulation over a decade is the opportunity to see the effects of variable hydrologic and meteorological inputs year by year. Rather than constructing an artificial set of inputs by means of statistics, Tetra Tech EBA chose to use surrogate historical periods to represent the potential future conditions. This approach preserves the linkages between winds, temperatures, and precipitation that would be lost under a stochastic approach.

Meteorological inputs were chosen differently for the "bookend" scenarios than for the "detailed" scenario. The "bookend" runs aimed to make basic assumptions about effluent flow and assess long term buildup under a range of environmental conditions. By contrast, the "detailed" run aimed to make a best estimate of the discharge and assess long term buildup under unfavourable environmental conditions.

2.6.1 Inputs for "Bookend" Scenarios

For the "bookend" scenarios, a surrogate historical decade of hydrologic and meteorological inputs was used to simulate the natural range of environmental conditions, while the effluent flow was held constant. Selection of the most appropriate historical decade was based primarily on winds, which are the strongest driver of mixing in Quesnel Lake, and are therefore the dominant influence over long term buildup. Wind energy is most effective at mixing the lake during the spring and fall overturn processes, which typically happen during the April-May-June and October-November-December periods, respectively.

In keeping with the modelling completed for the short-term discharge permit, wind and other meteorological inputs to the model were derived from the Williams Lake Airport (YWL) records. The period of record at YWL runs from 1961 to present. This period was screened for wind mixing energy by evaluating the root-mean-square (RMS) wind speeds during the two sensitive periods for overturn: April-May-June and October-November-December. The decade with the greatest variation in wind mixing energy was 2006-2015. This decade was therefore selected for the "bookend" models.

Other meteorological parameters of interest are temperature and precipitation, which influence stratification and flow through the lake, respectively. Temperatures were characterized by calculating the average temperature during the expected summer stratification period – May through October. Precipitation was characterized using an annual total. Since river flows are significantly influenced by snow pack, the precipitation for a given year was totaled between September 1st of the preceding year and August 31st to account for winter accumulation.

Table 2.2 below summarizes the variability of wind mixing energy, summer temperatures, and annual precipitation in the decade chosen for the "bookend" simulations. Each parameter is described in terms of its variation from the mean over the period of record at YWL. For example, in 2013 the RMS wind speed in the sensitive periods was 13% lower than average, summer temperatures were 1.1°C warmer than average, and precipitation was 2% less than average.

Table 2.2: Variability in Meteorological Conditions during "Bookend" Decade

Yearly Variation In			
Year	**Windiness**	**Summer T (°C)**	**Precipitation**
2005	0%	-0.2	24%
2006	-1%	0.7	-16%
2007	-7%	-0.1	0%
2008	-6%	-0.1	15%
2009	-2%	0.7	-1%
2010	9%	0.2	-15%
2011	0%	-0.6	24%
2012	1%	0.2	-7%
2013	-13%	1.1	-2%
2014	4%	1.2	18%
2015	2%	1.3	-5%

2.6.2 Inputs for "Detailed" Scenarios

For the "detailed" scenarios, the buildup of effluent in the lake was assessed in relatively unfavourable environmental conditions. Maximum buildup of effluent in the lake would be expected when the least amount of wind energy is available for mixing. The year with the lowest wind energy was 2013, so this year was selected for the "detailed" scenarios. Since the simulations require multi-year duration, the hydrologic and meteorological inputs from 2013 were repeated, or looped, to extend the input period.

Results from the Option 1 "bookend" scenario confirmed that, as expected, the greatest increase in background effluent concentrations in the lake occurred in 2013 (see **Section 3.2**).

2.7 Hydrologic Inputs

The West Basin of Quesnel Lake, into which the diffusers discharge, is at the "downstream" end of the Lake, meaning that the hydraulic throughput of the Lake must all pass through the West Basin. Quesnel River, which flows out of the West Basin, has an annual average flow rate of 128 m^3/s. Based on this flow rate, the average hydraulic residence time of the West Basin is about 90 days.

The major rivers flowing into Quesnel Lake are Horsefly River, Mitchell River, and Niagara Creek. Numerous smaller streams enter the lake as well, including Hazeltine Creek. Inflows to the Quesnel Lake model were represented using the three major rivers, with flows from the lesser streams lumped together with the most appropriate major rivers, following the methods of Potts (2004). Potts's methods predict average monthly inflows to Quesnel Lake, based on historically gauged catchments within and surrounding the Quesnel Lake watershed. To account for yearly differences in precipitation, the average monthly inflows in each year were scaled up or down according to the year's variance in precipitation, as shown in **Table 2.2** above. For example, monthly inflows for 2006 were scaled down from the average by 16%.

For the major rivers, temperatures were taken as the average monthly temperatures measured by Potts (2004). TSS in the Horsefly and Mitchell Rivers was assumed to be 1.5 mg/L, matching the initial condition in the Lake, while TSS in Niagara Creek was taken as 81 mg/L, a value derived from the observations of James (2004). All three major rivers were assumed to have TDS and selenium concentrations matching the initial concentrations in the Lake for the respective runs.

Despite its very small annual average flow rate of approximately 0.24 m^3/s, Hazeltine Creek was included in the "bookend" scenarios as a distinct inflow since estimated flows were available. The flow rate for Hazeltine Creek was derived from synthetic data created by SNC-Lavalin, extrapolated from the gauge location to the creek mouth by a ratio of catchment areas. For simulation years in which the synthetic data had gaps, the gaps were filled by inserting data from other years with similar annual precipitation; for example, gaps in 2014 data were filled with values from the same dates in 1991 (precipitation year totals 516.8 and 518.1 mm, respectively, at YWL). For the "detailed" scenarios, Hazeltine Creek was not included as a distinct inflow to avoid conflict with the monthly flows provided by Golder.

Average monthly temperatures for Hazeltine Creek were taken from MPMC (2009). For the "bookend" scenarios, TSS and TDS were assumed to be 3.3 and 81 mg/L, respectively (Golder, 2015a). For the "detailed" scenarios, TSS was assumed to be 5.0 mg/L, matching the average concentration observed in Hazeltine Creek (sample location HAC-12) after the water treatment plant became operational (data provided by MPMC). TDS and selenium concentrations were assumed to be 247 and 0.001 mg/L, respectively, matching baseline water quality values provided by Golder.

The outflow from the Quesnel Lake model was managed using a weir-type condition to represent Quesnel River's stage-discharge relationship.

Tetra Tech EBA validated the model's hydrology by comparing the simulated lake level against observed lake level at the Water Survey of Canada gauge near Likely from 2006 to 2014. The observed lake level varies 2.4 m in an average year, with a mean lake level of 0.8 m gauge; the simulated lake level varies 2.0 m in an average year with a mean level of 0.9 m gauge. This validation demonstrates that the weir-type outflow condition and the estimated inflows reasonably reproduce the natural rise and fall of the lake level. This degree of agreement is adequate for the present purpose, considering the scarcity of input data and the relatively small influence of hydrology on the model's predictions of long term effluent buildup.

2.8 Sources of Uncertainty

Table 2.3 lists sources of uncertainty in the predictions of water quality in Quesnel Lake stemming from the modelling approach and assumptions described above. Comments are provided describing how the uncertainty is addressed and what bias may be expected in the model's predictions.

Table 2.3: Uncertainty Analysis for Long Term Water Quality Predictions in Quesnel Lake

Source of Uncertainty	How Uncertainty is Addressed in Modelling	Expected Bias to Predicted Water Quality in Quesnel Lake
Future meteorological conditions.	Conditions from past years are used as surrogate data to represent future conditions.	No bias expected; however, random extremes or a changing climate could influence future outcomes.
Wind speed and direction over Quesnel Lake.	Wind speeds are assumed to match those measured at YWL; wind direction is rotated locally so that the dominant wind direction aligns with the lake's axis.	No bias expected; validations done in previous work support these assumptions as making the best use of the available data.
Hydrology in Quesnel Lake catchment area.	Average monthly inflows to the lake are modified by a factor for each year, based on precipitation at YWL.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Coarseness of hydrodynamic model's horizontal resolution.	Complete mixing implicitly assumed in the model cell where EPA Plumes places the plume; results are reported only outside a 1-cell radius around the diffusers.	Dilution may be overestimated in the few cells closest to the diffusers; no bias expected in the far field.
Effluent flow rates in "bookend" scenarios.	High flow rates assumed, subject to simple rules.	Predictions biased toward worse water quality.
Effluent flow rates in "detailed" scenarios.	Monthly flow rates were provided by Golder as best estimates of average future conditions.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Effluent temperatures and Hazeltine Creek temperatures, which strongly influence plume density.	Average monthly temperatures were applied in the model.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Effluent quality in "bookend" scenarios.	Constant concentrations were assumed.	Variability due to effluent quality is not reflected.
Effluent quality in "detailed" scenarios.	Model included daily variation in concentrations, predicted at three probabilistic levels (5th, 50th and 95th percentiles).	The 5th and 95th percentile predictions are expected to bias the predicted lake water quality downwards and upwards, respectively.

In general, the uncertainties described above were addressed in ways that resulted in the best estimate of long-term far field water quality. This was the primary objective of the modelling effort.

The corollary of this approach is that short-term variability and near-field dilution were lower priorities for modelling. For example, short-term variability due to effluent temperatures and flow rates is not reflected in the model due to the use of monthly averages for these parameters. Furthermore, near-field dilution (within a few cells of the diffuser) may be overestimated due to the coarseness of the model's horizontal resolution.

3.0 RESULTS

This section presents the results of the modelling introduced above. First, some example maps and sections are presented to orient the reader to the model's capabilities. Next, the results of the "bookend" scenarios are presented and discussed; and finally the results of the "detailed" scenarios are presented and discussed.

3.1 Example Model Outputs

Figures 3.1 and 3.2 show some examples of model output from the "bookend" scenarios. These examples facilitate discussion of some important model dynamics and set the background for further results presentation.

Figure 3.1 shows a snapshot of the West Basin condition on 12 August 2010 in the Option 1 scenario simulation. The main panel is a plan view or map showing most of the West Basin, with black line contours showing depth at 25-m intervals. The colour scheme represents dilution of the effluent as computed from the dye concentration in the model. The colour shown in each model cell represents the worst (lowest) dilution in the water column at that location and at the snapshot time.

For regulatory purposes, an initial dilution zone (IDZ) is commonly defined as a 100-m radius around the point of discharge. The horizontal resolution of the model is approximately 75 m at the diffuser location. To represent the IDZ, therefore, a 1-cell buffer has been applied around diffuser cells. The buffer was applied as a post-processing step and did not affect model dynamics. In the plan view, dilution within this IDZ has been blanked (light grey). In **Figure 3.1**, the worst dilution outside the IDZ is in the yellow cells southeast of the diffusers, in the range of 20:1 to 30:1.

The inset in **Figure 3.1** shows a cross-section of the West Basin at the diffuser location (see dashed red line on the map), viewed as if looking northwest. The diffusers are marked on the left slope of the lake bottom. The black line contours are temperature, at varying intervals chosen for visual effect. Colours represent dilution again, on the same colour scale as on the map. This section illustrates a strong temperature stratification in the West Basin, typical of summer conditions. The warm effluent discharging into the cool, deep ambient water is buoyant despite its TDS concentration, and the plume rises to approximately 20 m depth (yellow band above diffusers). The IDZ is not blanked on the inset.

Figure 3.2 shows a snapshot of the West Basin condition on 5 November 2014 in the Option 2 scenario simulation. The main panel is identical to **Figure 3.1** in its layout. The worst dilution outside the IDZ is in the yellow cells northeast of the diffusers, again in the range of 20:1 to 30:1.

The inset in **Figure 3.2** shows a longitudinal cross-section of the West Basin along its thalweg (path of greatest depth – see dashed red line on the map), viewed as if looking northeast. The diffusers are marked with dashed circles where the section passes them. At this point in the simulation, the summer temperature stratification has weakened significantly, and wind events can cause internal waves with vertical amplitudes in the tens of metres. These seiches draw the plume back and forth along the long axis of the basin, and can result in "re-dosing," where water carrying moderately-diluted effluent is drawn back past the diffusers to receive a second "dose" of effluent. The highest concentrations of effluent are off the section line and therefore do not appear in the inset.

3.2 Results from "Bookend" Scenarios

The objective of the "bookend" scenarios was to evaluate the capacity for dilution in Quesnel Lake, under a long-term discharge through a range of hydrologic and meteorological conditions. **Figure 3.3** provides time series of dilution for Option 1 (red; steady effluent flows) and Option 2 (black; effluent mixing with Hazeltine Creek). The vertical axis is dilution ratio on a log scale, with smaller numbers (worse water quality) towards the top. The dots

mark the lowest dilution in the model domain, outside the IDZ, from data archived at 24-hour intervals. The bold solid lines are 30-day moving averages of the worst dilution (dots). The fine dotted lines are 30-day moving averages of the worst dilution *at the water surface*. The 30-day moving averages were computed because some constituents, such as selenium, are subject to guidelines defined in those terms.

In Option 1, the worst predicted dilution was 23:1, occurring in summer while the plume was buoyant and subject to trapping under the thermocline. The example model output shown in **Figure 3.1** corresponds to this point in the Option 1 simulation: that is, the red dot at 12 August 2010 in **Figure 3.3** represents the 23:1 dilution in the worst yellow cell in **Figure 3.1**.

In Option 2, the worst predicted dilution was 27:1, occurring in fall with stratification weakening and significant seiche activity leading to local re-dosing. The example model output shown in **Figure 3.2** corresponds to this point in the Option 2 simulation: that is, the black dot at 5 November 2014 in **Figure 3.3** represents the 27:1 dilution in the worst yellow cell in **Figure 3.2**.

Simulated dilution in Option 2 is generally better than in Option 1 for two reasons. First, the Option 2 discharge was only 76% of the Option 1 volume, so there is less total buildup of effluent in the basin. Second, Option 2 involved mixing the effluent with Hazeltine Creek base flow, pre-diluting the effluent as well as affecting density.

To aid understanding of the circulation dynamics, Tetra Tech EBA computed a mass balance of the effluent in the West Basin for the Option 1 simulation. **Figure 3.4** presents a time series of the terms of the mass balance: cumulative effluent discharge, cumulative effluent exited via Quesnel River, cumulative effluent exited over the sill into the main body of the lake, and instantaneous effluent content of the West Basin. At any time, the cumulative effluent discharge must equal the sum of the other three terms. The Option 1 discharge was 0.33 m^3/s, or about 10.4 Mm^3/year. The buildup of effluent in the West Basin reached a quasi-steady state within 2 years. After this time, the West Basin generally contained about 3.5 to 6 Mm^3 of effluent (thick black line), or roughly half a year's worth of discharge. Of the remaining effluent, about 80% was transported out the Quesnel River, and 20% was exchanged over the sill into the main body of the lake. Exchange over the sill was episodic and occurred most often in late fall, whereas transport out Quesnel River was continuous and had its maximum rate during spring overturn (May and June). After steady state was reached, the only differences year-to-year were due to environmental conditions. The year with the greatest buildup of effluent was 2013, measured as the change in West Basin effluent content from 31 December to 31 December. Therefore, 2013 was deemed the worst year of the simulated decade in terms of effluent buildup.

3.3 Results from "Detailed" Scenarios

The objective of the "detailed" scenarios was to evaluate the capacity for dilution in Quesnel Lake, under a long-term discharge of varying properties estimated to represent discharge from the resumed operations of the Mine. **Figure 3.5** provides time series of dilution for discharges with 5th percentile (black), median (blue), and 95th percentile (red) estimated water quality. The layout of the figure is very similar to that of **Figure 3.3**, with dots representing instantaneous values at 24-hour intervals, and lines representing 30-day moving averages. The worst predicted dilutions occur in early summer, when the plume is buoyant, in the years 2018 through 2020. In these years the pipeline is in use, meaning that the effluent is not pre-diluted by Hazeltine Creek.

Examination of model outputs at hourly intervals (not shown) revealed that variations can occur at time scales as short as 3-6 hours. These variations could be due to changes in wind, solar heating, and internal waves in the lake. Instantaneous worst dilutions appearing in the simulations may not reflect daily averages, which are generally used for effects assessment. Therefore, data archived at hourly intervals were combined to produce daily-average worst dilutions during the critical periods of the "detailed" scenarios. **Table 3.1** lists the worst instantaneous dilutions found

at 24-hour intervals (midnights) beside the corresponding worst daily averages and worst 30-day averages, for the three water quality scenarios.

The "detailed" scenarios included selenium as a specific water quality parameter. **Figure 3.6** presents time series of the predicted selenium concentrations. The baseline Quesnel Lake concentration, 0.00014 mg/L, is indicated with a faint grid line, as is the British Columbia Ministry of Environment (MoE) 30-day average guideline of 0.002 mg/L (MoE, 2014). Similar to dilution, the worst selenium concentrations outside the IDZ were archived at 24-hour intervals. The thick lines plotted in **Figure 3.6** represent 30-day moving averages of these concentrations. The fine dotted lines represent 30-day moving averages of worst selenium concentrations *at the water surface*. **Table 3.1** also lists the worst 30-day average selenium concentrations for each scenario.

Table 3.1: Worst Conditions Predicted in "Detailed" Scenarios

Water Quality Scenario	Worst Instantaneous Dilution at Midnight	Worst Daily-Average Dilution	Worst 30-Day Average Dilution	Worst 30-Day Average Selenium Concentration (mg/L)
5th Percentile	24:1	23:1	38:1	0.0009
Median	26:1	28:1	39:1	0.0010
95th Percentile	27:1	28:1	40:1	0.0015

The worst predicted dilutions occur in the 5th-percentile water quality scenario. Worst dilutions generally occurred in summer when the plume was buoyant and was trapped below the thermocline. The 5th-percentile scenario had lesser TDS concentrations, and was therefore more buoyant in summer and more affected by the trapping dynamic, leading to worse predicted dilutions during the summer period. However, the worst predicted selenium concentrations occurred in the 95th-percentile scenario. The higher selenium concentrations in the effluent outweighed the slightly better dilutions generally achieved.

4.0 CONCLUSIONS

Tetra Tech EBA used a hydrodynamic model of Quesnel Lake in combination with the EPA Visual Plumes UM3 model to simulate water quality in Quesnel Lake with long-term discharge of mine water from the existing diffusers near the mouth of Hazeltine Creek.

Two "bookend" scenarios were simulated, with constant discharge characteristics and variable environmental conditions. Results from these scenarios indicated that:

- The worst water quality outside the IDZ typically occurs in summer when the effluent plume is buoyant and gets trapped below the thermocline;
- Buildup of background effluent concentration in the West Basin of Quesnel Lake reaches a quasi-steady state within 2 years, and this state represents approximately half a year's worth of discharge; and
- The strength of the wind during spring and fall overturn periods is the most significant environmental factor for long-term buildup.

Three "detailed" scenarios were simulated, with relatively unfavourable environmental conditions and varying discharge characteristics representative of resumed operations at the Mine. Results from these scenarios indicated that:

- The worst predicted daily-average dilution outside the IDZ would range from 23:1 to 28:1, depending on the concentration of TDS in the effluent;
- The worst predicted 30-day average dilution outside the IDZ would range from 38:1 to 40:1, depending on the concentration of TDS in the effluent;
- The worst predicted selenium concentration outside the IDZ would range from 0.0009 to 0.0015 mg/L, depending on the concentrations of selenium and TDS in the effluent; and
- Higher TDS and selenium concentrations in the effluent led to higher selenium concentrations outside the IDZ, despite an improvement in summer dilution due to reduced buoyancy of the effluent plume.

5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Mount Polley Mining Corporation and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Mount Polley Mining Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are attached to this memo.

6.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

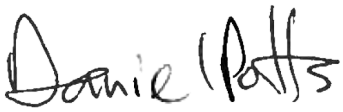

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FIGURES

Figure 2.1 Quesnel Lake Hydrodynamic Model Bathymetry
Figure 2.2 Diffuser Discharge Properties for Bookend Scenarios
Figure 2.3 Diffuser Discharge Properties for Detailed Scenarios
Figure 3.1 Option 1 “Bookend” Scenario Example Model Output: Dilution – Plan and Section
Figure 3.2 Option 2 “Bookend” Scenario Example Model Output: Dilution – Plan and Section
Figure 3.3 Simulated Dilution in Quesnel Lake “Bookend” Decadal Runs Options 1 and 2
Figure 3.4 Option 1 “Bookend’ Scenario Effluent Volume Balance
Figure 3.5 Simulated Dilution in Quesnel Lake “Detailed” Scenario Runs
Figure 3.6 Simulated Selenium in Quesnel Lake “Detailed” Scenario Runs

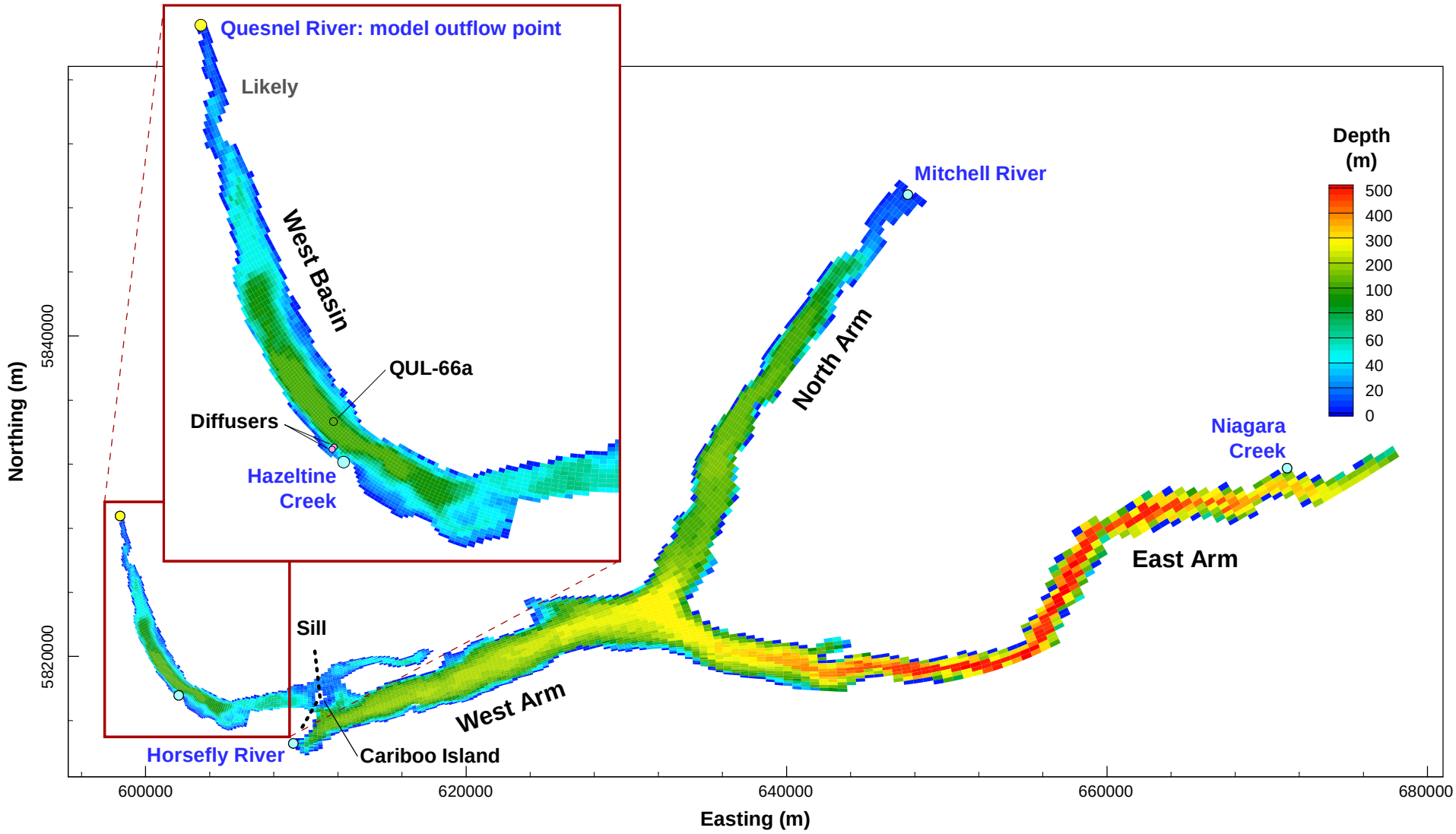

NOTES

Horizontal model resolution varies as shown, with higher resolution in the West Basin and West Arm, and lower resolution in the North and East Arms.

Modelled inflowing and outflowing rivers are labelled. The inset of the West Basin shows the diffuser locations.

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Quesnel Lake Hydrodynamic Model Bathymetry

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE: Tetra Tech EBA - VANC
DATE: May 16, 2016

Figure 2.1

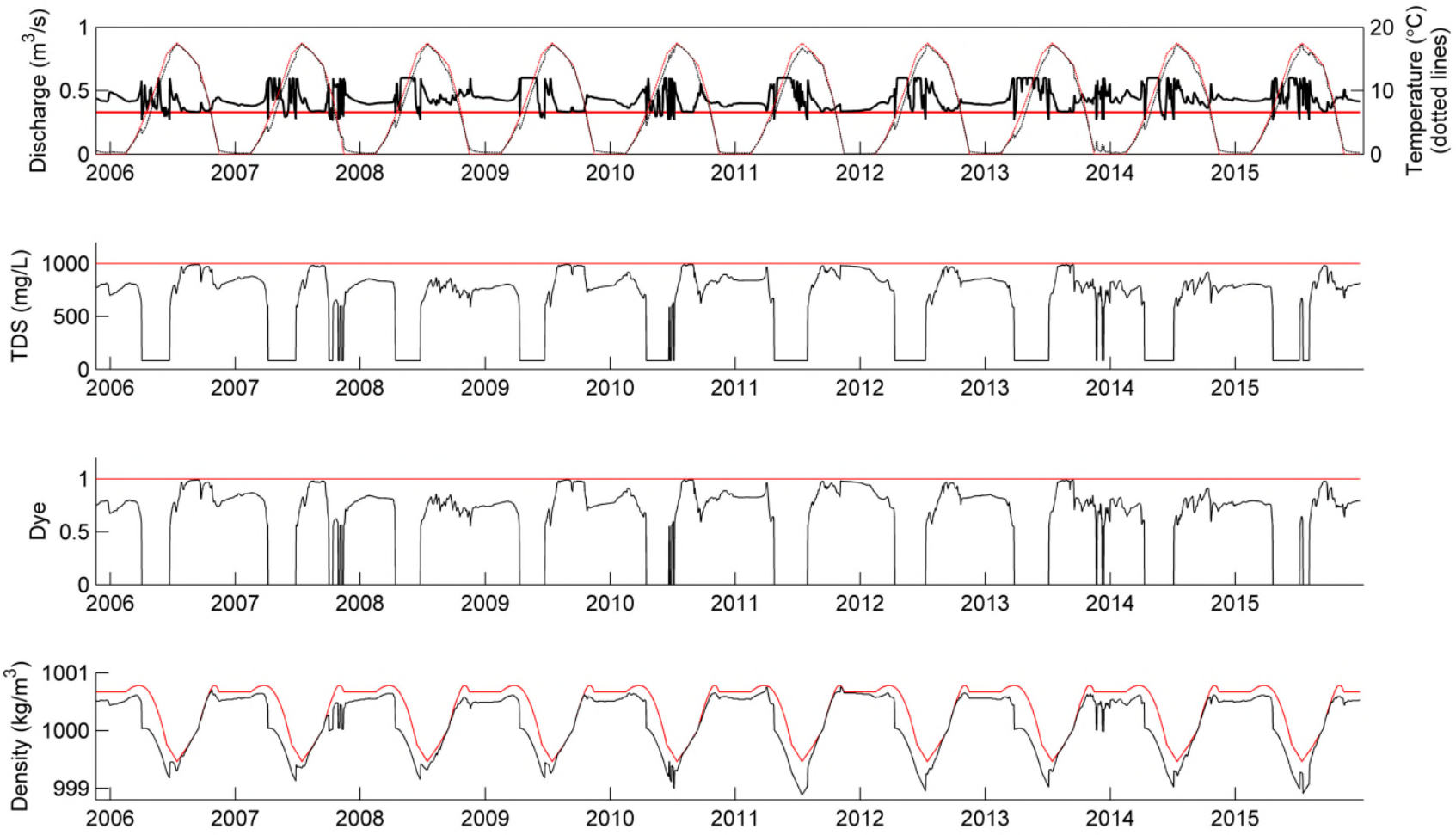

NOTES

Legend:

Option 1
Option 2

STATUS
ISSUED FOR USE

CLIENT

MPMC

QUESNEL LAKE DIFFUSER MODELLING

Diffuser Discharge Properties for "Bookend" Scenarios

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 13, 2016

Figure 2.2

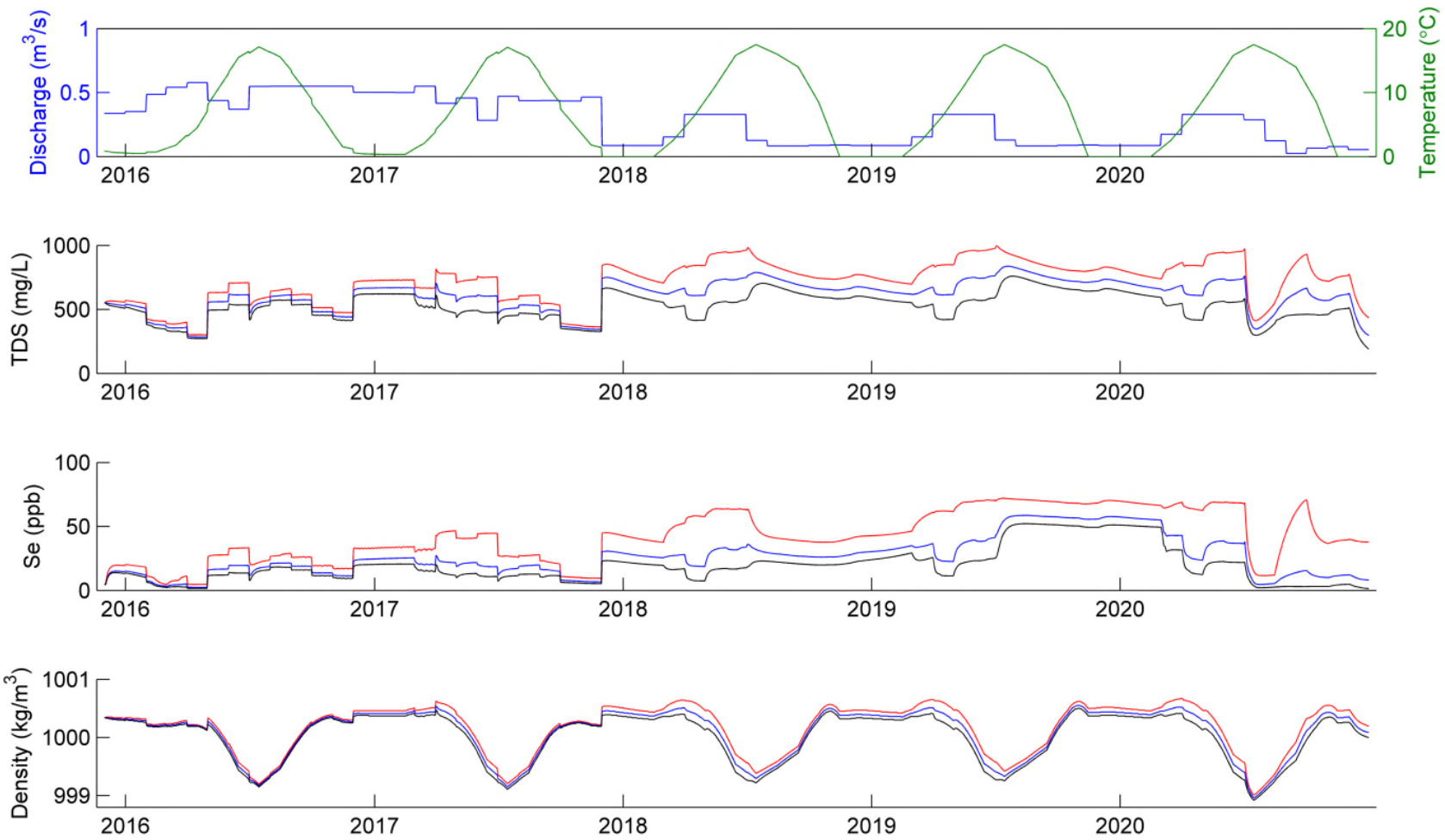

NOTES

Legend:

- 95th Percentile WQ
- Median WQ
- 5th Percentile WQ

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Diffuser Discharge Properties for "Detailed" Scenarios

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE: Tetra Tech EBA - VANC
DATE: June 9, 2016

Figure 2.3

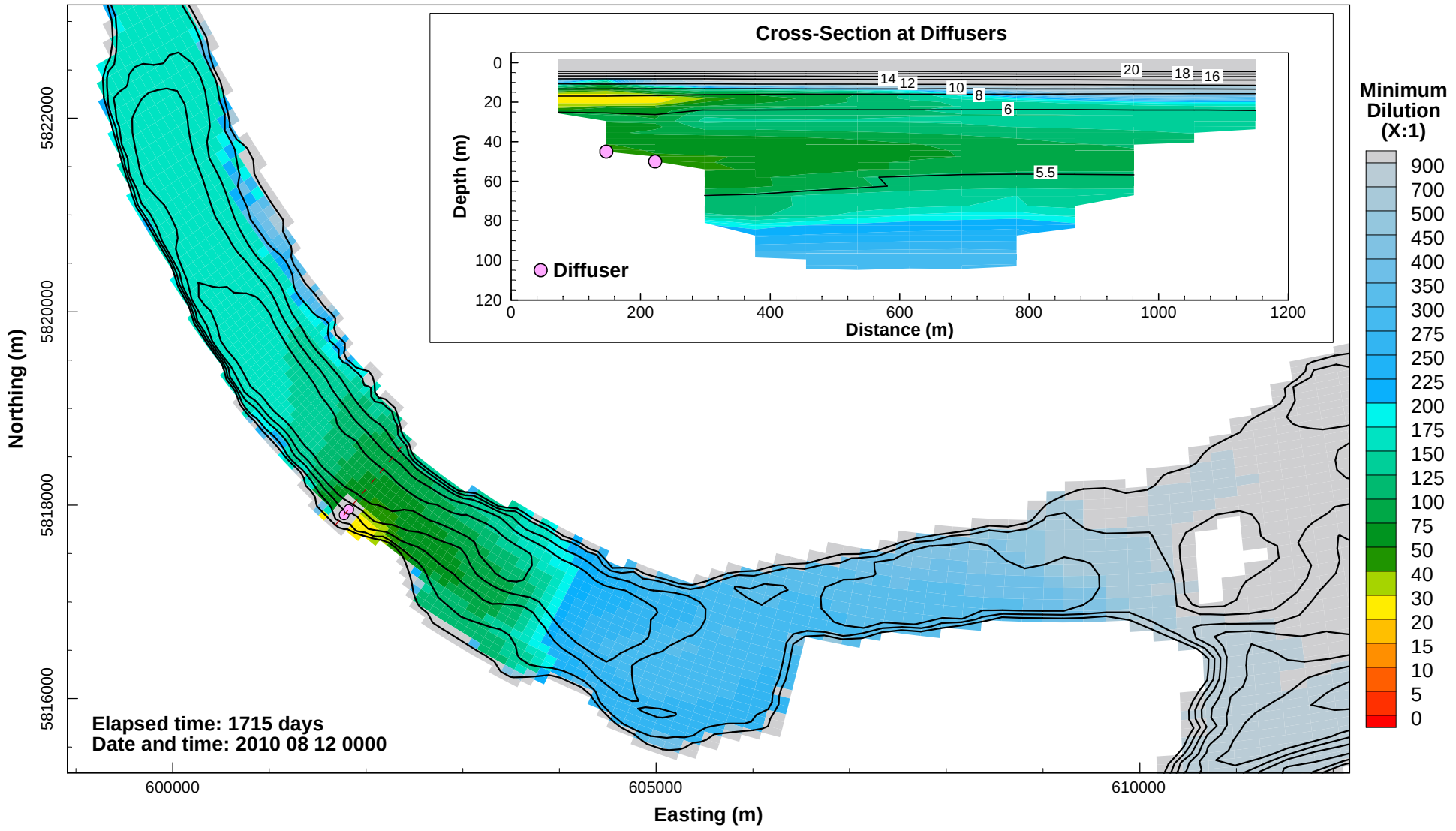

NOTES

Effluent flow rate: 0.33 m^3/s.

Plan view shows minimum dilution at any depth, with bathymetric line contours @ 25 m.
Section view shows dilution across West Basin, with temperature line contours.

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Option 1 "Bookend" Scenario Example Model Output: Dilution - Plan and Section

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.1

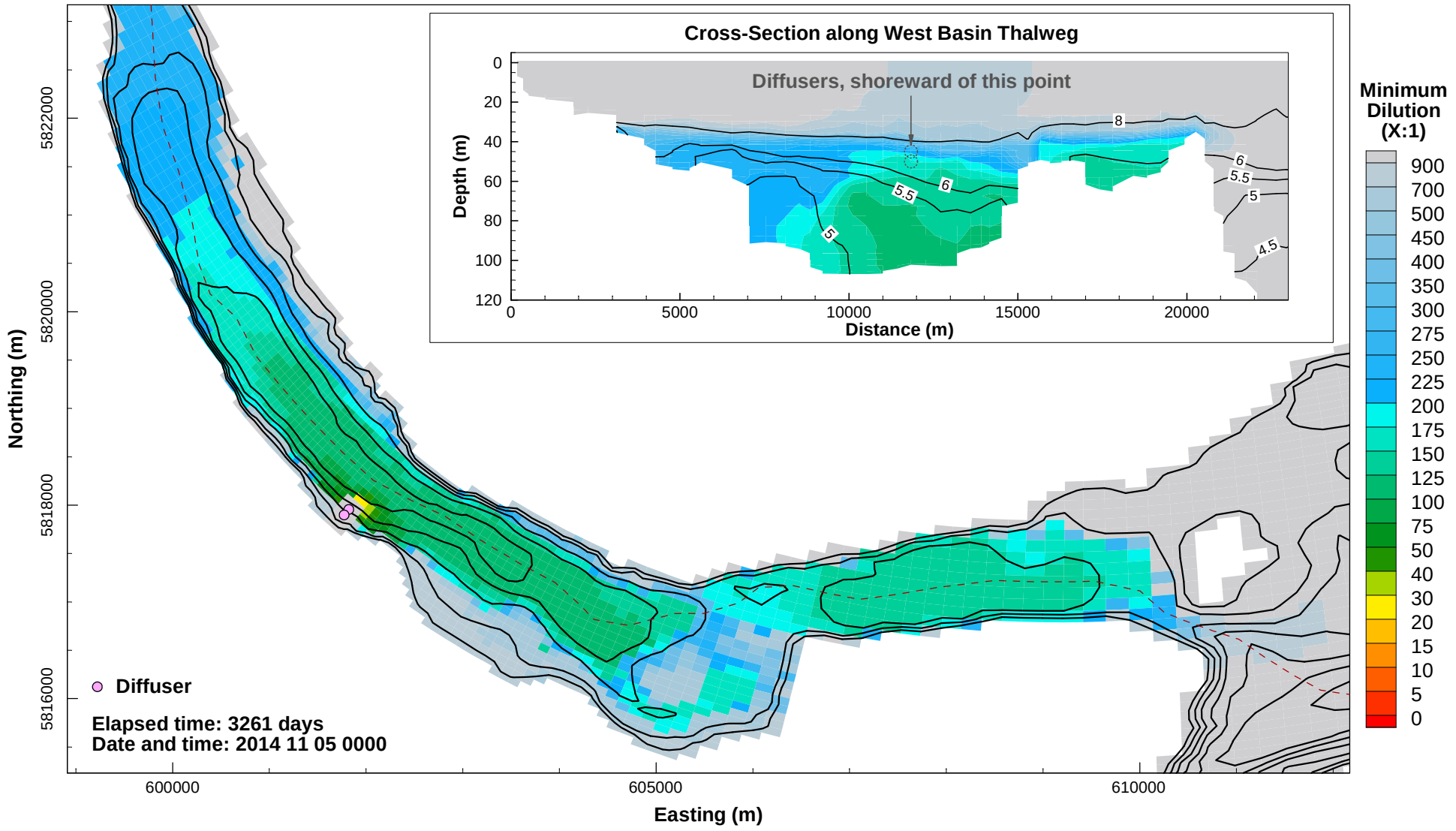

NOTES

Effluent flow rate: max 0.33 m^3/s, details per Option 2.

Plan view shows minimum dilution at any depth, with bathymetric line contours @ 25 m.
Section view shows dilution across West Basin, with temperature line contours.

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Option 2 "Bookend" Scenario
Example Model Output:
Dilution - Plan and Section

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.2

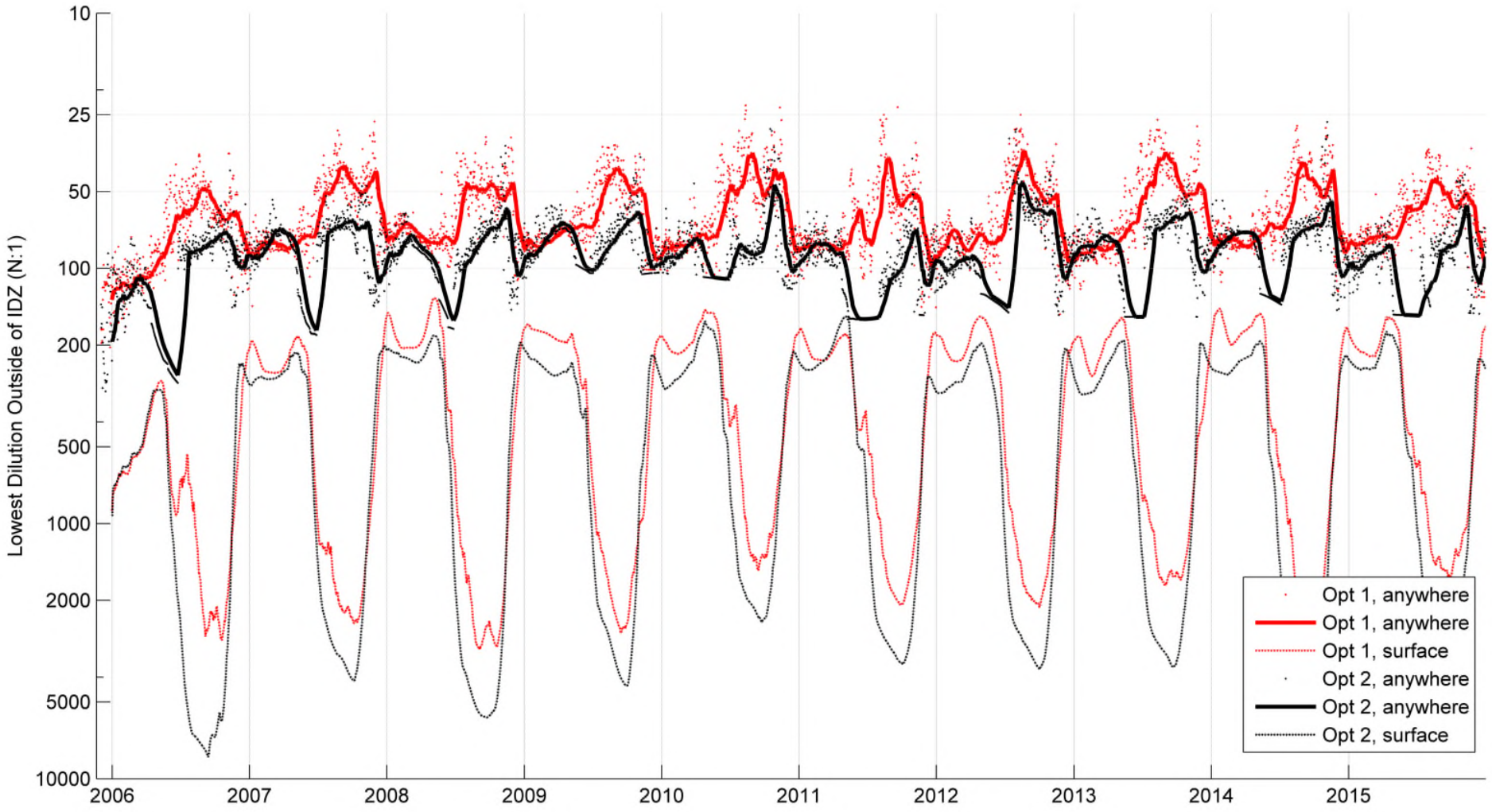

NOTES

Dots represent daily snapshot values.
Lines represent 30-day moving average.

Effluent flow rate: 0.33 m^3/s, details per Option.

STATUS
ISSUED FOR USE

CLIENT
MPMC

TETRA TECH EBA

QUESNEL LAKE DIFFUSER MODELLING

Simulated Dilution in Quesnel Lake "Bookend" Decadal Runs Options 1 and 2

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.3

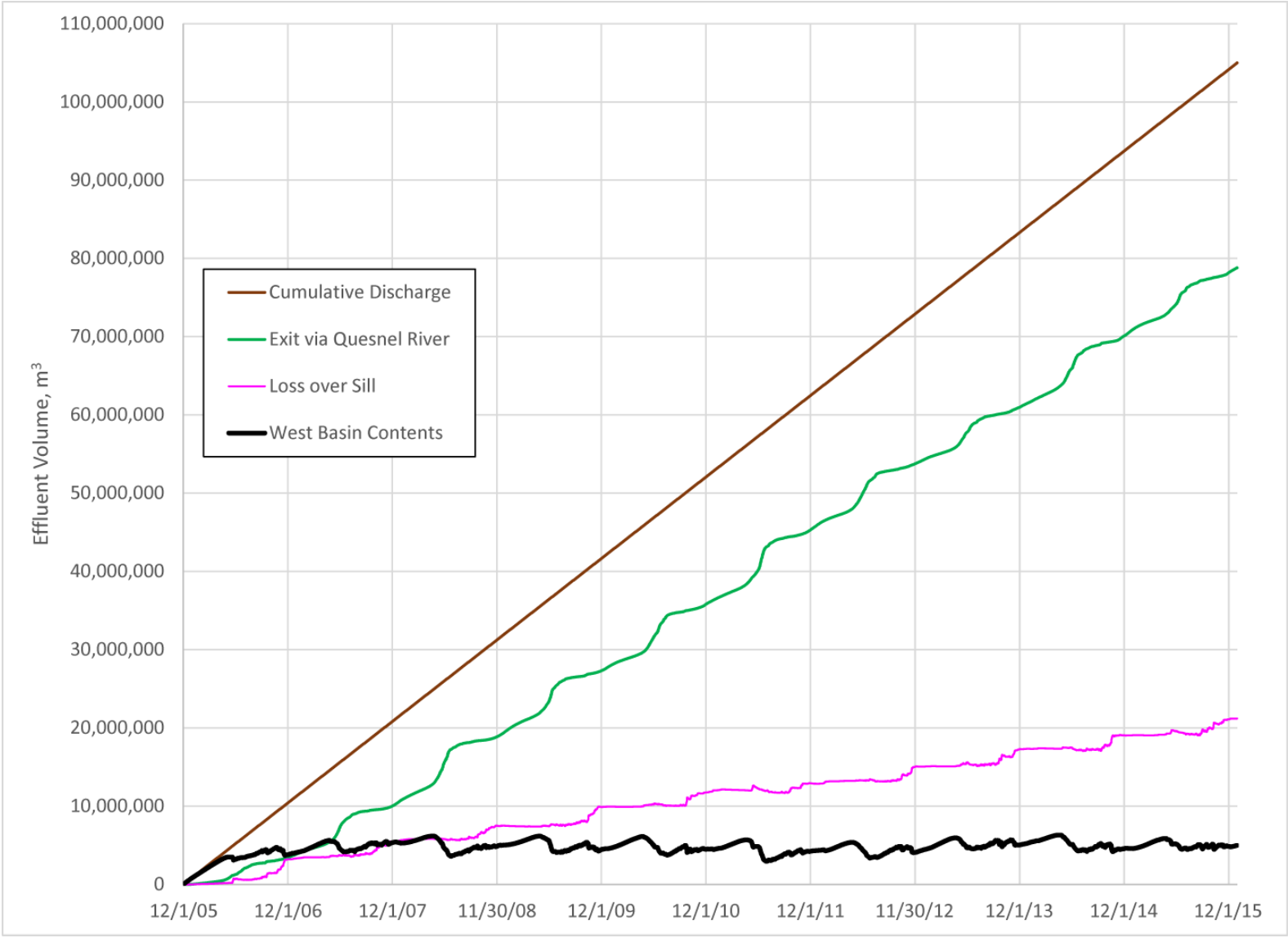

NOTES

Effluent flow rate: 0.33 m^3/s.
Effluent TDS: assumed 1000 mg/L, constant.

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Option 1 "Bookend" Scenario Effluent Volume Balance

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE: Tetra Tech EBA - VANC
DATE: June 8, 2016

Figure 3.4

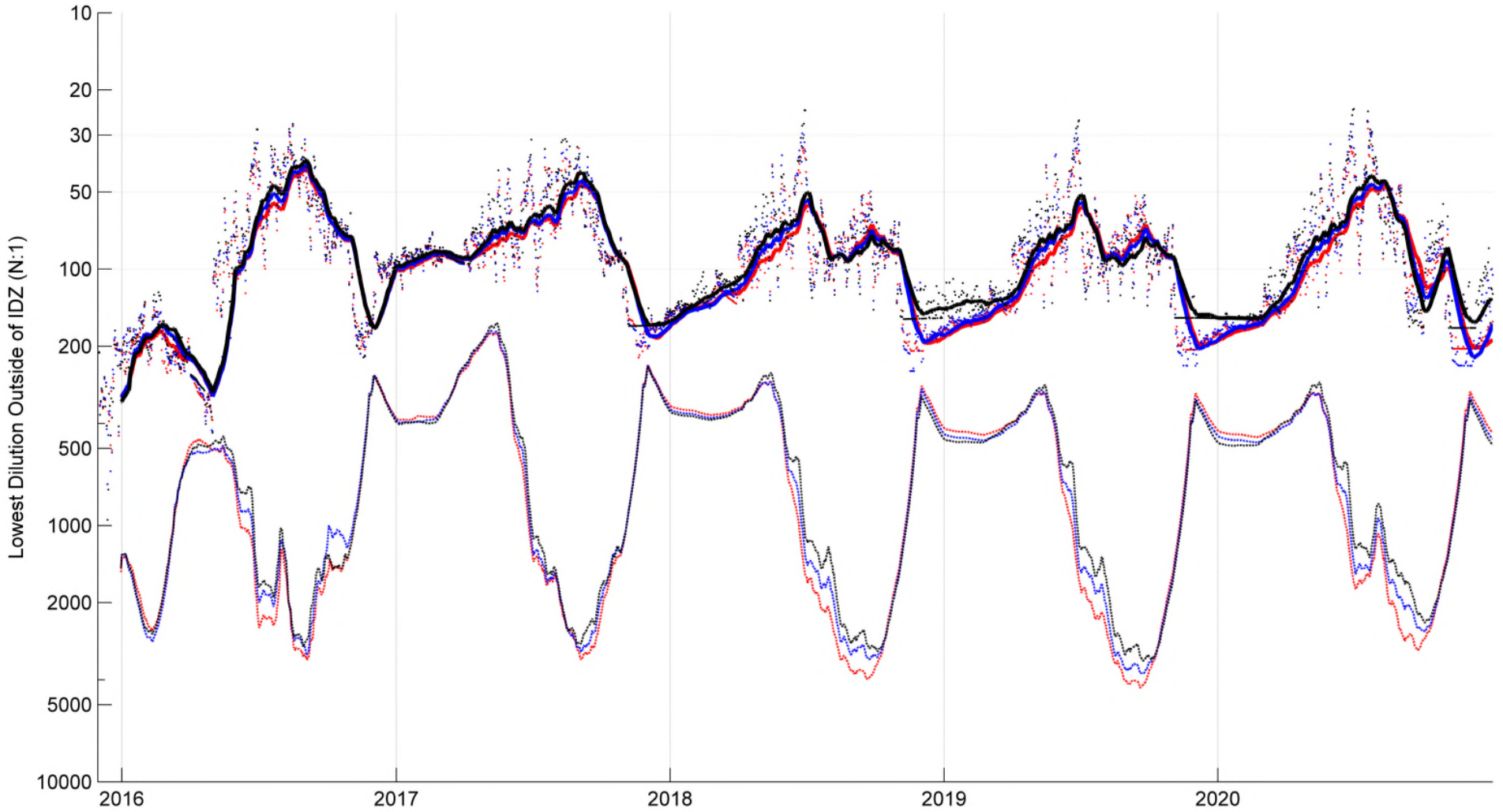

NOTES

Dots represent daily snapshot values.
Lines represent 30-day moving average.

95th Percentile WQ
surface
worst pt
Median WQ
surface
worst pt
5th Percentile WQ
surface
worst pt

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Simulated Dilution in Quesnel Lake "Detailed" Scenario Runs

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.5

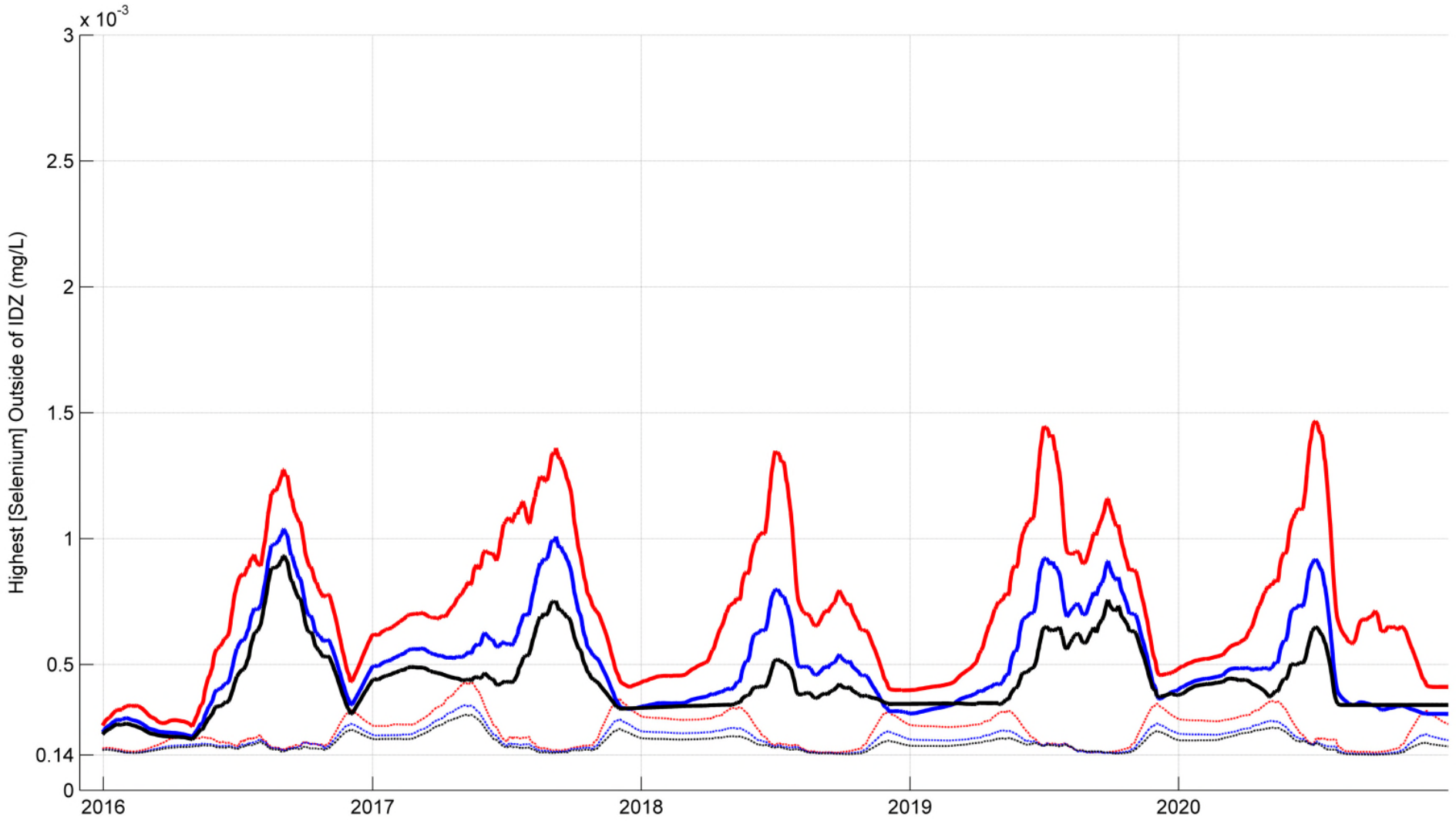

NOTES

Lines represent 30-day moving average.

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Simulated Selenium in Quesnel Lake "Detailed" Scenario Runs

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 15, 2016

Figure 3.6

APPENDIX A
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

HYDROTECHNICAL

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORTS AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. The report may include plans, drawings, profiles and other supporting documents that collectively constitute the report (the "Report").

The Report is intended for the sole use of Tetra Tech EBA's Client (the "Client") as specifically identified in the Tetra Tech EBA Services Agreement or other Contract entered into with the Client (either of which is termed the "Services Agreement" herein). Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Report when it is used or relied upon by any party other than the Client, unless authorized in writing by Tetra Tech EBA.

Any unauthorized use of the Report is at the sole risk of the user. Tetra Tech EBA accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Report.

Where Tetra Tech EBA has expressly authorized the use of the Report by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these General Conditions as well as any limitations on liability contained in the Services Agreement with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these General Conditions and the Services Agreement prior to making any use of the Report. Any use made of the Report by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Report and any other form or type of data or documents generated by Tetra Tech EBA during the performance of the work are Tetra Tech EBA's professional work product and shall remain the copyright property of Tetra Tech EBA.

The Report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the Report, if required, may be obtained upon request.

2.0 ALTERNATIVE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of the Report or any drawings or other project-related documents and deliverables (collectively termed Tetra Tech EBA's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original. Tetra Tech EBA will archive the original signed and/or sealed version for a maximum period of 10 years.

Both electronic file and hard copy versions of Tetra Tech EBA's Instruments of Professional Service shall not, under any circumstances, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's Instruments of Professional Service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 STANDARD OF CARE

Services performed by Tetra Tech EBA for the Report have been conducted in accordance with the Services Agreement, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Report.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of Tetra Tech EBA.

4.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless expressly agreed to in the Services Agreement, Tetra Tech EBA was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with Tetra Tech EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for Tetra Tech EBA to properly provide the services contracted for in the Services Agreement, Tetra Tech EBA has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

6.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of this Report, Tetra Tech EBA may have relied on information provided by persons other than the Client.

While Tetra Tech EBA endeavours to verify the accuracy of such information, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

7.0 GENERAL LIMITATIONS OF REPORT

This Report is based solely on the conditions present and the data available to Tetra Tech EBA at the time the Report was prepared.

The Client, and any Authorized Party, acknowledges that the Report is based on limited data and that the conclusions, opinions, and recommendations contained in the Report are the result of the application of professional judgment to such limited data.

The Report is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present at or the development proposed as of the date of the Report requires a supplementary investigation and assessment.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the hydrotechnical information that was reasonably acquired to facilitate completion of the design.

The Client acknowledges that Tetra Tech EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

8.0 JOB SITE SAFETY

Tetra Tech EBA is only responsible for the activities of its employees on the job site and was not and will not be responsible for the supervision of any other persons whatsoever. The presence of Tetra Tech EBA personnel on site shall not be construed in any way to relieve the Client or any other persons on site from their responsibility for job site safety.

APPENDIX 6-1: Effluent Quality Screening Table

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2015-12-01	2016-06-18	2018-01-10	2018-06-12	2021-02-09	2015-12-03	2015-12-07	2015-12-15	2015-12-22	2015-12-29	2016-01-05	2016-01-07	2016-01-12	2016-01-18	2016-01-19	2016-01-26	2016-02-01	2016-02-09	2016-02-15	2016-02-22	2016-02-24	2016-02-29
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	-	1179	1378	1308	1248.4	-	1294	1154.9	1226.4	1175	1206.3	1185.6	1257.2	1188.6	1181.3	1162.2	1170.6	1168.2	1067.7	1159.6	1186	1183.4
pH	pH units	-	6.37	8.158	7.42	7.39	6.77	6.93	6.9	7.74	7.6	8.1	7.7	7.61	7.56	7.73	7.78	7.79	7.72	7.23	6.94	7.56	7.6	7.74
Turbidity	NTU	-	2.00	0.53	2.76	0.45	1.6	2.34	2.22	1.27	1.08	1.13	1.34	1.65	1.65	1.34	1.02	2.27	1.25	1.51	1.33	1.76	0.83	1.92
Temperature	C	-	2.5	17.8	1.886	13.7	3.466	2.6	3.5	3.156	2.288	2.4	1.622	1.878	2.081	2.028	1.861	2.303	2.366	2.024	3.126	2.63	4.4	2.815
Dissolved oxygen	%	-	-	-	-	101.9	-	-	-	-	-	-	92.9	-	-	-	-	-	93.4	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	9.42	-	-	-	-	-	-	12.91	-	-	-	-	-	12.74	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	72.6	70.7	75.6	76.4	75.1	67	64.9	66	61.2	62.8	62.2	64.3	63.2	64.9	63.9	64.2	65.2
Specific conductivity	uS/cm	-	-	-	-	-	-	1260	1200	1200	1230	1200	1220	1200	1200	1200	1200	1180	1150	1200	1160	1180	1200	1200
pH	pH units	-	-	-	-	-	-	7.38	7.28	7.6	7.63	7.52	7.58	7.52	7.56	7.34	7.6	7.52	7.26	7.5	7.48	7.41	7.53	7.41
Total suspended solids	mg/L	30	-	-	-	-	-	13.9	8.2	7.6	6.4	11.9	7.5	12.2	20	7	10.1	13.2	8.7	16.5	<3.0	5	8	3.1
Turbidity	NTU	-	-	-	-	-	-	2.55	1.78	0.64	0.58	0.99	0.89	0.85	1.46	1.15	1.03	0.86	1.29	1.64	1.36	1.55	1.04	1.23
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	599	566	546	561	550	544	559	543	547	556	555	529	560	521	542	543	558
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	-	-	-	928	872	929	872	872	819	842	840	894	885	866	859	832	821	885	886	876
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.68	2.19	2.54	2.81	2.51	2.1	2.26	2.3	2.47	2.52	2.43	2.86	2.73	3.13	2.92	2.83	2.67
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	-	-	-	-	-	7.13	7.33	7.78	7.34	7.25	7.43	7.92	7.6	8.38	8.31	7.69	8.13	8.17	7.92	7.92	7.92	8.18
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	7.17	7.37	7.82	7.38	7.29	7.47	7.96	7.63	8.42	8.34	7.72	8.16	8.2	7.95	7.95	7.96	8.22
Nitrite	mg-N/L	0.78	-	-	-	-	-	0.0349	0.0393	0.0417	0.0369	0.0397	0.039	0.0384	0.0333	0.0319	0.0322	0.0314	0.029	0.0326	0.0322	0.0357	0.0407	0.0362
Total ammonia	mg-N/L	1.3	-	-	-	-	-	0.0521	0.0481	0.072	0.0885	0.0829	0.0568	0.0447	0.0668	0.0466	0.052	0.0492	0.0654	0.0788	0.155	0.115	0.116	0.0802
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.003	0.0027	0.003	0.003	<0.0020	0.0026	0.0023	0.0029	0.0025	0.0027	0.0026	0.0038	0.0028	0.0033	0.0035	0.0045	<0.0020
Total phosphorus	mg-P/L	0.09	-	-	-	-	-	0.0053	0.0038	0.0036	0.005	0.0052	0.0064	0.0061	0.0067	0.0063	0.008	0.0103	0.0056	0.0054	0.0062	0.0064	0.0058	0.0044
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	7.09	7.29	8.05	7.31	7.48	7.35	7.76	7.44	7.94	8.23	8.32	8.1	7.8	8.12	8.09	8.18	8.04
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	-	-	-	186	175	168	173	169	166	172	165	166	170	170	161	171	158	167	166	172
Chloride	mg/L	-	-	-	-	-	-	33	25.9	19.3	20.8	18.8	21.9	18.5	22.9	19.3	16.8	16.4	17.1	19.5	19.6	20.7	20.6	21.4
Fluoride	mg/L	17	-	-	-	-	-	0.24	0.31	0.37	0.39	0.4	0.33	0.42	0.38	0.39	0.43	0.34	0.35	0.39	0.34	0.33	0.32	0.33
Magnesium	mg/L	-	-	-	-	-	-	32.7	31.3	30.5	31.6	31.2	31.6	31.4	31.6	32	31.7	31.9	31	32.2	30.6	30.7	31.1	31
Potassium	mg/L	-	-	-	-	-	-	8.37	8.55	9.33	10.3	10	9.57	9.43	10.3	10.7	10.5	9.47	9.65	10.6	9.52	8.8	9.27	9.16
Sodium	mg/L	-	-	-	-	-	-	48.8	44.4	43.6	50.7	50.1	43.9	42.6	45.7	47.7	47	42.3	43.4	47.9	43.6	41.4	45.9	46.3
Sulphate	mg/L	1100	-	-	-	-	-	535	526	525	533	516	527	544	527	531	528	493	512	544	503	514	517	535
Total Metals																							
Aluminum	mg/L	-	-	-	-	-	-	1.15	1.12	0.775	0.463	0.683	0.787	0.623	0.774	0.74	0.485	0.866	0.669	0.728	0.573	0.81	0.651	0.739
Antimony	mg/L	-	-	-	-	-	-	0.00086	0.00101	0.00112	0.00108	0.00133	0.00133	0.00128	0.00123	0.00137	0.00131	0.00117	0.00121	0.00128	0.00113	0.00109	0.00111	0.00114
Arsenic	mg/L	0.028	-	-	-	-	-	0.00063	0.00054	0.00056	0.00056	0.00069	0.00064	0.00056	0.00055	0.0006	0.00056	0.00051	0.00047	0.00052	0.00047	0.00046	0.00046	0.00055
Barium	mg/L	-	-	-	-	-	-	0.0644	0.0635	0.0624	0.0532	0.0539	0.0713	0.0546	0.0576	0.0593	0.0607	0.0564	0.0548	0.0551	0.0615	0.0568	0.0542	0.0661
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	0.17	0.163	0.172	0.171	0.173	0.168	0.168	0.171	0.168	0.157	0.152	0.155	0.159	0.131	0.139	0.134	0.161
Cadmium	mg/L	-	-	-	-	-	-	0.0000694	<0.000050	0.0000177	<0.000050	<0.000040	0.0000268	<0.000040	0.000027	0.0000322	0.0000312	0.0000254	0.0000229	0.0000325	0.0000241	<0.000045	0.0000454	0.0000681
Calcium	mg/L	-	-	-	-	-	-	185	178	164	170	170	162	169	164	166	168	166	158	168	154	167	161	202
Chromium	mg/L	0.004	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	0.00021	0.00022	0.00019	0.00019	0.00019	0.00019	0.00017	0.0002	0.00019	0.00018	0.00016	0.00016	0.00016	0.0002	0.00022	0.00021	0.00025
Copper	mg/L	0.033	-	-	-	-	-	0.00461	0.00412	0.00403	0.00326	0.0038	0.00425	0.00374	0.0035	0.00385	0.00365	0.00442	0.00466	0.00419	0.00536	0.00597	0.00564	0.00668
Iron	mg/L	1	-	-	-	-	-	0.047	0.059	<0.030	<0.030	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	0.05	<0.030	<0.030	<0.030	0.054	<0.030	0.032
Lead	mg/L	-	-	-	-	-	-	0.00013	0.000073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0089	0.009	0.0101	0.0095	0.0104	0.0102	0.0111	0.0124	0.0129	0.0126	0.0123	0.0118	0.0121	0.0118	0.0117	0.0109	0.0117
Magnesium	mg/L	-	-	-	-	-	-	32.4	32.1	31.1	32	31.8	31.4	31.5	31.6	33.2	31.6	32	31.4	32.2	31	32	31.3	37.9
Manganese	mg/L	3.4	-	-	-	-	-	0.18	0.139	0.12	0.209	0.242	0.165	0.106	0.155	0.128	0.112	0.078	0.0883	0.135	0.139	0.116	0.115	0.153
Mercury	mg/L	-	-	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050
Molybdenum	mg/L	0.36	-	-	-	-	-	0.155	0.147	0.141	0.152	0.154	0.155	0.148	0.147	0.157	0.15	0.134	0.139	0.149	0.134	0.14	0.147	0.166
Nickel	mg/L	-	-	-	-	-	-	0.00073	0.00076	0.00063	0.00063	0.00063	0.00081	0.00056	0.0007	0.00066	0.00069	0.00065	0.00063	0.00059	0.00071	0.00073	0.0007	0.00082
Potassium	mg/L	-	-	-	-	-	-	8.49	8.96	9.7	9.15	10.6	12	9.4	10.6	11	10.7	9.41	9.84	10.8	9.62	9.62	9.53	11
Selenium	mg/L	0.075	-	-	-	-	-	0.0274	0.029	0.0302	0.0295	0.0309	0.0307	0.0281	0.0297	0.0326	0.0321	0.0307	0.0314	0.031	0.0284	0.0303	0.0307	0.0395
Silicon	mg/L	-	-	-	-	-	-	4.85	4.89	4.85	4.82	4.74	4.66	4.64	4.55	4.42	4.22	4.25	4.25	4.25	4.24	4.49	4.37	5.23
Silver	mg/L	0.00024	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	50.5	47.2	46	45.2	53.1	56	42.8	47.4	49.3	46.3	42.9	44.5	49.6	44.1	45.2	47.7	56.1
Strontium	mg/L	-	-	-	-	-	-	3.1	3.21	2.9	3.06	2.81	2.88	2.77	2.49	2.65	2.47	2.34	2.37	2.49	2.16	2.34	2.48	2.78
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	0.011	<0.010	<0.010	0.012	0.011	0.02	0.013	0.012	<0.010	<0.010	<0.010	0.013	<0.010	0.015	0.014	0.013	0.012
Uranium	mg/L	-	-	-	-	-	-	0.000896	0.00112	0.00136	0.00137	0.00153	0.000925	0.00128	0.000865	0.00118	0.0014	0.00121	0.00117	0.00111	0.000969	0.00093	0.000896	0.000999
Vanadium	mg/L	-	-	-	-	-	-	0.00073	0.00075	0.00087	0.00077	0.00092	0.00084	0.00072	0.00066	0.00071	0.00072	0.00074	0.00074	0.00072	0.00074	0.00084	0.00072	0.00091
Zinc	mg/L	0.059	-	-	-	-	-	0.0076	0.0057	0.0046	0.0043	0.0044	0.0083	0.0077	0.0084	0.0051	0.005	0.0056	0.0058	0.0062	0.0062	0.0066	0.0067	0.0081

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2015-12-01	2016-06-18	2018-01-10	2018-06-12	2021-02-09	2015-12-03	2015-12-07	2015-12-15	2015-12-22	2015-12-29	2016-01-05	2016-01-07	2016-01-12	2016-01-18	2016-01-19	2016-01-26	2016-02-01	2016-02-09	2016-02-15	2016-02-22	2016-02-24	2016-02-29
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	-	-	-	-	-	0.0937	0.0666	0.0746	0.0986	0.109	0.0799	0.0751	0.0849	0.0968	0.0647	0.0741	0.0811	0.0889	0.0683	0.0724	0.0773	0.0675
Antimony	mg/L	-	-	-	-	-	-	0.00076	0.00098	0.00108	0.00106	0.00119	0.00129	0.00127	0.00123	0.00132	0.00129	0.00122	0.0012	0.00127	0.00112	0.00107	0.00109	0.00103
Arsenic	mg/L	-	-	-	-	-	-	0.00051	0.00045	0.0004	0.00055	0.00048	0.00043	0.00041	0.00045	0.00043	0.00041	0.00037	0.00037	0.00044	0.00042	0.00037	0.00034	0.00037
Barium	mg/L	-	-	-	-	-	-	0.0644	0.063	0.0614	0.0601	0.0515	0.0571	0.0546	0.0573	0.0599	0.0582	0.059	0.0542	0.0548	0.062	0.0561	0.0543	0.0569
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	0.151	0.143	0.156	0.152	0.153	0.161	0.147	0.146	0.149	0.145	0.148	0.139	0.144	0.119	0.121	0.122	0.133
Cadmium	mg/L	0.00034	-	-	-	-	-	0.0000481	<0.000060	0.0000271	<0.000050	<0.000030	0.0000303	<0.000040	0.0000318	0.0000262	0.0000329	0.0000304	0.0000208	0.0000203	0.0000294	<0.000045	0.0000445	0.000045
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	0.00019	0.00018	0.00017	0.0002	0.00016	0.00014	0.00016	0.00019	0.00018	0.00017	0.00015	0.00016	0.00016	0.0002	0.00019	0.00019	0.0002
Copper	mg/L	-	-	-	-	-	-	0.00348	0.00297	0.00309	0.00327	0.00299	0.00271	0.00288	0.00278	0.00306	0.00296	0.00281	0.0032	0.00303	0.00386	0.00353	0.00379	0.00396
Iron	mg/L	0.35	-	-	-	-	-	<0.030	0.078	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.089	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0087	0.0092	0.01	0.0095	0.0102	0.0101	0.01	0.0118	0.0127	0.0123	0.0129	0.0116	0.0126	0.0116	0.011	0.011	0.0104
Manganese	mg/L	-	-	-	-	-	-	0.17	0.132	0.114	0.235	0.227	0.13	0.104	0.148	0.118	0.109	0.0772	0.0848	0.131	0.136	0.107	0.115	0.126
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.147	0.14	0.138	0.139	0.149	0.143	0.136	0.139	0.145	0.14	0.138	0.132	0.14	0.128	0.132	0.14	0.142
Nickel	mg/L	-	-	-	-	-	-	0.00065	0.00073	0.00053	0.00072	0.00059	0.00063	<0.00050	0.00051	0.00063	0.00067	0.00056	0.00056	0.00059	0.00063	0.00063	0.00057	0.00064
Selenium	mg/L	-	-	-	-	-	-	0.0269	0.0285	0.0299	0.0304	0.0298	0.0298	0.0299	0.0294	0.0336	0.0313	0.0306	0.0295	0.0308	0.0278	0.029	0.0307	0.0325
Silicon	mg/L	-	-	-	-	-	-	4.8	4.71	4.81	4.84	4.64	4.63	4.68	4.54	4.27	4.22	4.23	4.19	4.25	4.23	4.36	4.35	4.32
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	3	3.08	2.84	2.98	2.73	2.81	2.67	2.46	2.54	2.4	2.47	2.3	2.42	2.12	2.24	2.41	2.47
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	0.011	<0.010	<0.010	0.012	0.011	0.021	0.012	0.012	<0.010	<0.010	<0.010	0.013	<0.010	0.015	0.013	0.012	0.011
Uranium	mg/L	-	-	-	-	-	-	0.000635	0.000827	0.00112	0.00121	0.0013	0.000734	0.00101	0.000658	0.000943	0.00123	0.00101	0.000953	0.000904	0.00084	0.000739	0.000745	0.000749
Vanadium	mg/L	-	-	-	-	-	-	0.00052	0.0006	0.00066	0.00073	0.00067	0.00057	0.00059	0.00053	0.00054	0.00057	0.00063	0.00059	0.00057	0.00065	0.00052	0.00061	0.00063
Zinc	mg/L	-	-	-	-	-	-	0.0072	0.005	0.0043	0.0041	0.0042	0.0059	0.0062	0.0064	0.0044	0.005	0.0055	0.005	0.0058	0.0054	0.0059	0.0058	0.0061

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-03-02	2016-03-08	2016-03-15	2016-03-23	2016-03-29	2016-04-04	2016-04-11	2016-04-13	2016-04-19	2016-05-05	2016-05-10	2016-05-17	2016-05-24	2016-05-31	2016-06-07	2016-06-14	2016-06-20	2016-06-23	2016-06-27	2016-06-29	2016-07-06	2016-07-13
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1149.4	1107.1	1128.6	1254	1127	1161	1211	1215	1252	1175	1211	1172	1213	1228	1216	1228	1215	1228	1215	-	1217	1215
pH	pH units	-	7.8	7.89	7.46	7.434	7.459	7.433	7.639	7.565	7.457	7.274	7.277	7.414	7.384	7.331	7.397	7.346	8.297	8.345	8.248	-	8.244	8.236
Turbidity	NTU	-	1.1	5.35	1.9	1.35	3.02	0.76	0.72	1.09	1.37	1.96	0.5	0.5	0.21	0.7	0.36	0.39	1.05	2.61	1.82	-	0.77	0.41
Temperature	C	-	2.591	3.336	3.264	4.6	6.1	8.6	8.8	7.8	10.5	10	9.9	12.6	12.2	13.3	14.9	12.3	14.4	13	15.6	-	16.3	16.7
Dissolved oxygen	%	-	75.3	-	-	-	-	-	-	-	-	-	-	-	-	-	112.3	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	9.85	-	-	-	-	-	-	-	-	10.1	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	64	64.8	70.7	62.6	78.5	80.8	82.4	80.1	81.5	37.5	41.2	40.9	41.3	42.2	42.5	42.6	50.9	49.6	47.9	49.1	47.7	48.4
Specific conductivity	uS/cm	-	1220	1190	1220	1260	1150	1180	1230	1210	1250	1200	1190	1170	1170	1210	1180	1210	1200	1190	1200	1180	1200	1170
pH	pH units	-	7.38	7.47	7.62	7.57	7.44	7.71	7.85	7.67	7.52	7.22	7.48	7.4	7.4	7.64	7.45	7.61	8.05	8	7.98	7.98	7.89	8.01
Total suspended solids	mg/L	30	6.1	4.9	14.2	8.6	5.2	9	4.9	7.2	4.7	3	4.5	9.1	16.5	3.8	1.9	5.9	2.9	3.6	1.3	1.1	1.3	1.1
Turbidity	NTU	-	1.13	1.84	1.13	0.78	1.59	1.33	1.11	1.01	1.19	0.79	0.61	0.88	1.59	0.55	0.73	0.82	1.36	1.98	0.94	1.63	0.73	0.67
Hardness, as CaCO3	mg/L	-	567	577	584	598	604	590	640	670	655	505	527	490	508	530	504	517	514	509	534	518	531	499
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	911	879	906	939	897	856	692	949	978	910	891	903	920	880	826	909	925	930	946	928	904	874
Dissolved organic carbon	mg/L	-	2.84	3.21	3.15	3	3.75	4	4.43	4.21	3.65	2.63	2.27	2.36	2.38	2.29	2.48	2.24	2.74	2.25	2.32	2.59	2.26	2.37
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	8.53	8.72	8.78	9.47	7.77	7.7	8.71	9.51	8.43	8.79	8.66	8.51	8.75	8.55	8.8	9.01	8.73	8.57	8.84	9.03	8.15	8.51
Nitrate + nitrite	mg-N/L	-	8.56	8.76	8.81	9.49	7.78	7.72	8.72	9.53	8.46	8.85	8.73	8.57	8.82	8.61	8.87	9.08	8.82	8.66	8.93	9.13	8.23	8.59
Nitrite	mg-N/L	0.78	0.0341	0.0305	0.0212	0.0238	0.0155	0.0123	0.0166	0.0198	0.0247	0.0615	0.0629	0.0621	0.0618	0.0649	0.0712	0.0715	0.0891	0.0944	0.0958	0.0974	0.0829	0.0797
Total ammonia	mg-N/L	1.3	0.0739	0.0624	0.0576	0.0351	0.0755	0.0522	0.022	0.0606	0.0985	0.144	0.146	0.111	0.132	0.126	0.105	0.168	0.169	0.188	0.171	0.177	0.122	0.119
Dissolved phosphorus	mg-P/L	-	0.003	0.0024	<0.0020	0.0025	<0.0020	0.0023	<0.0020	0.0024	0.003	0.0035	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	0.0026	0.0074	0.0061	0.0057	0.0039	0.0025	0.0028
Total phosphorus	mg-P/L	0.09	0.0076	0.007	0.0092	0.005	0.0123	0.0081	0.0129	0.0161	0.0089	0.0058	0.003	0.007	0.0063	0.0053	0.005	0.0041	0.0135	0.0165	0.0121	0.0151	0.01	0.0056
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0039	0.0042	0.0016	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	8.35	8.6	8.67	10.2	8.15	8.06	8.66	9	8.83	8.95	8.97	8.81	9.21	9.07	9.02	8.96	9.04	9.24	9.1	8.91	9.27	9.19
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	175	175	181	184	190	185	199	208	205	152	161	147	154	162	153	156	157	154	163	158	161	153
Chloride	mg/L	-	24.4	23	17.9	19.3	15.8	15.6	14.1	14.4	14.8	21.2	19	18.2	19.5	20.3	19	19.7	12.5	12	12.3	12.8	11.5	11.9
Fluoride	mg/L	17	0.32	0.27	0.3	0.28	0.25	0.24	0.27	0.31	0.31	0.41	0.452	0.42	0.46	0.49	0.5	0.51	0.65	0.63	0.65	0.67	0.6	0.63
Magnesium	mg/L	-	31.7	33.9	32.3	33.5	31.2	31.4	35	36.8	34.5	30.4	30.5	29.6	29.9	30.2	29.9	31	29.9	30.1	30.9	30.3	31.1	28.5
Potassium	mg/L	-	9.27	7.77	7.26	8.21	4.57	4.56	3.46	3.28	3.95	14.2	14.7	13.5	14.8	14.9	15.5	15.6	17.4	16.7	16.7	16.7	17	15.5
Sodium	mg/L	-	45.5	41.4	39	40.7	31.4	30.6	24.5	22.9	30.9	58.6	57.5	56.3	56.1	55.3	56	55.4	60.1	59	58.2	59.5	57.8	53.9
Sulphate	mg/L	1100	541	512	530	545	506	504	553	595	559	542	524	528	545	539	551	566	550	537	551	559	507	533
Total Metals																							
Aluminum	mg/L	-	0.629	0.858	0.638	0.586	0.572	0.517	0.407	0.445	0.487	0.573	0.549	0.624	1.16	0.551	0.501	0.61	0.118	0.191	0.102	0.117	0.0476	0.0504
Antimony	mg/L	-	0.00108	0.00078	0.00085	0.00092	0.00051	0.00049	0.00042	0.00044	0.0005	0.00172	0.00173	0.00149	0.00171	0.00173	0.00168	0.00169	0.00159	0.00178	0.00162	0.00181	0.00169	0.00153
Arsenic	mg/L	0.028	0.00044	0.00045	0.00049	0.00058	0.00041	0.00043	0.00045	0.00049	0.00053	0.00043	0.00049	0.00044	0.0006	0.00047	0.00049	0.00052	0.00096	0.00096	0.00089	0.00085	0.00085	0.00072
Barium	mg/L	-	0.0598	0.0569	0.0494	0.0523	0.0437	0.0438	0.046	0.0466	0.0453	0.0594	0.0571	0.0589	0.0645	0.0648	0.0588	0.0662	0.0666	0.0621	0.0626	0.0635	0.0643	0.0589
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000078	<0.000050	<0.000050
Boron	mg/L	-	0.151	0.106	0.126	0.109	0.108	0.094	0.088	0.102	0.112	0.147	0.159	0.136	0.156	0.148	0.136	0.153	0.134	0.141	0.146	0.148	0.146	0.138
Cadmium	mg/L	-	0.0000517	0.000047	0.0000578	0.000051	0.0000788	0.0000753	<0.00010	0.0000883	0.0000755	<0.000020	<0.000010	<0.000020	0.0000085	0.0000061	0.0000088	<0.000015	<0.000010	<0.000015	<0.000010	0.000007	0.0000227	0.0000054
Calcium	mg/L	-	172	174	179	184	191	186	190	201	193	151	161	155	152	165	152	157	156	152	167	156	160	157
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00022	0.00024	0.00022	0.00019	0.00032	0.00034	0.00042	0.00047	0.00037	0.00015	0.00015	0.00012	0.00013	0.00011	<0.00010	0.00011	0.00013	0.0002	0.00014	0.00015	0.0001	<0.00010
Copper	mg/L	0.033	0.00533	0.00706	0.00763	0.00683	0.0118	0.0229	0.0144	0.0166	0.0132	0.00362	0.0024	0.00217	0.00305	0.0019	0.00168	0.00205	0.00421	0.00519	0.0151	0.00612	0.00338	0.00308
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.038	0.045	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	0.056	0.112	0.066	0.074	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000516	<0.000050	<0.000050	<0.000050	0.000069	<0.000050	0.000069	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0113	0.0091	0.0094	0.0106	0.0057	0.0048	0.0046	0.0052	0.0057	0.0172	0.0188	0.0154	0.0181	0.0184	0.0161	0.017	0.0146	0.0151	0.0174	0.017	0.0177	0.0165
Magnesium	mg/L	-	31.9	34	32.3	34.5	31.9	32.5	33.8	38.5	32.7	30.8	31.6	30.5	30.2	30.8	30.1	30.7	30.1	29.8	32.3	29.7	31.3	29.4
Manganese	mg/L	3.4	0.142	0.137	0.116	0.0959	0.117	0.12	0.102	0.109	0.123	0.0387	0.0461	0.0389	0.0427	0.0407	0.0301	0.0386	0.0432	0.0495	0.0422	0.0414	0.0281	0.0262
Mercury	mg/L	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.155	0.138	0.152	0.164	0.139	0.136	0.138	0.134	0.139	0.171	0.178	0.168	0.177	0.171	0.172	0.186	0.157	0.181	0.174	0.174	0.165	0.172
Nickel	mg/L	-	0.00075	0.00061	0.00068	0.00066	0.00091	0.00158	0.00097	0.00113	0.001	0.00066	0.00059	0.00065	0.00067	0.00063	0.00056	0.00065	0.00075	0.00074	0.00072	0.00071	0.00085	<0.00050
Potassium	mg/L	-	9.46	7.95	7.35	8.5	4.62	4.49	3.36	3.27	3.98	13.7	15	13.9	15.2	15.4	15.7	16.6	18.1	16.7	16.9	16.9	17.6	16.3
Selenium	mg/L	0.075	0.0329	0.0326	0.0367	0.0374	0.0324	0.0373	0.0448	0.049	0.0421	0.0371	0.0376	0.0356	0.0358	0.0384	0.0334	0.036	0.0368	0.0376	0.0359	0.0356	0.0372	0.0324
Silicon	mg/L	-	4.25	4.41	4.37	4.22	4.9	4.89	4.8	5.29	4.84	3.48	3.81	3.58	3.61	3.66	3.65	3.64	3.88	4.04	4.13	3.81	3.75	3.6
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	46.8	43.2	39.7	41.8	32.1	31.4	23.9	23.4	31.3	57.3	58.8	57.6	58.4	57.2	57.7	60.4	62.5	60.4	63	60.1	61.2	57.1
Strontium	mg/L	-	2.59	2.1	2.56	2.72	2.42	2.33	2.46	2.61	2.64	2.68	2.75	2.45	2.56	2.52	2.56	2.69	2.31	2.64	2.68	2.58	2.45	2.47
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	<0.000010	<0.000010	0.000014	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00026	<0.00010
Titanium	mg/L	-	0.012	0.018	0.017	0.016	0.016	0.017	0.018	0.015	0.017	0.012	0.019	0.012	<0.010	<0.010	0.024	<0.010	0.01	0.017	<0.010	<0.010	<0.010	0.01
Uranium	mg/L	-	0.000764	0.000685	0.00127	0.000981	0.00138	0.00144	0.00163	0.00153	0.00166	0.000566	0.00074	0.000717	0.000808	0.000601	0.000742	0.0007	0.00113	0.00127	0.00117	0.00123	0.00117	0.00118
Vanadium	mg/L	-	0.00082	0.00072	0.00075	0.00088	0.00083	0.00087	0.00081	0.00086	0.00097	0.00174	0.0007	0.00059	0.00085	0.0008	0.00075	0.00104	0.00125	0.00133	0.00117	0.00105	0.00103	0.00101
Zinc	mg/L	0.059	0.0064	0.0065	0.0067	0.0069	0.0074	0.0125	0.0047	0.0064	0.0061	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-03-02	2016-03-08	2016-03-15	2016-03-23	2016-03-29	2016-04-04	2016-04-11	2016-04-13	2016-04-19	2016-05-05	2016-05-10	2016-05-17	2016-05-24	2016-05-31	2016-06-07	2016-06-14	2016-06-20	2016-06-23	2016-06-27	2016-06-29	2016-07-06	2016-07-13
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.085	0.0679	0.0683	0.0629	0.0739	0.0826	0.091	0.0792	0.0723	0.0945	0.0481	0.0744	0.0809	0.0651	0.0773	0.24	0.0306	0.0271	0.0276	0.0264	0.0259	0.0253
Antimony	mg/L	-	0.00104	0.00075	0.00079	0.00091	0.0005	0.00044	0.00041	0.00043	0.00051	0.00165	0.00167	0.00147	0.00162	0.0017	0.00165	0.00166	0.00172	0.0017	0.00159	0.0017	0.00172	0.00151
Arsenic	mg/L	-	0.00037	0.00035	0.00038	0.00042	0.00032	0.00032	0.00041	0.00036	0.00041	0.00046	0.00034	0.00034	0.00037	0.00035	0.00043	0.00041	0.00087	0.00087	0.00088	0.00078	0.00081	0.00073
Barium	mg/L	-	0.0595	0.0563	0.0492	0.0506	0.0441	0.0434	0.0461	0.0455	0.0452	0.0591	0.0578	0.0576	0.0634	0.0618	0.0599	0.064	0.0644	0.0601	0.0622	0.062	0.0651	0.0594
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.134	0.1	0.107	0.099	0.101	0.085	0.083	0.091	0.107	0.142	0.143	0.128	0.14	0.134	0.126	0.138	0.139	0.137	0.14	0.137	0.137	0.124
Cadmium	mg/L	0.00034	0.0000513	0.0000464	0.0000563	0.0000498	0.0000905	0.0000708	<0.00010	0.0000851	0.0000802	<0.000020	<0.000010	<0.000010	0.0000085	<0.0000050	0.0000053	<0.000010	<0.000015	<0.000010	<0.000010	0.0000061	0.0000081	0.000009
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00019	0.00019	0.00022	0.00018	0.00028	0.00032	0.00041	0.00045	0.00035	0.00014	0.00014	0.0001	0.00012	0.00011	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00391	0.0042	0.00527	0.00459	0.00803	0.00939	0.0109	0.0117	0.00925	0.00166	0.00181	0.00121	0.00141	0.00129	0.00122	0.00107	0.00157	0.00146	0.00154	0.00187	0.00165	0.00174
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.06	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0109	0.0098	0.0089	0.0107	0.0058	0.0048	0.0048	0.0051	0.0056	0.0174	0.0186	0.0154	0.0177	0.0175	0.0153	0.0164	0.0159	0.0153	0.0168	0.016	0.0175	0.0163
Manganese	mg/L	-	0.138	0.128	0.113	0.0943	0.112	0.118	0.102	0.106	0.12	0.0393	0.0448	0.0372	0.0403	0.0395	0.0296	0.0347	0.0371	0.0438	0.0341	0.0323	0.0165	0.0173
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.148	0.132	0.137	0.165	0.133	0.131	0.132	0.127	0.138	0.169	0.164	0.166	0.173	0.169	0.169	0.182	0.164	0.175	0.162	0.164	0.163	0.16
Nickel	mg/L	-	0.00059	0.00052	0.00062	0.00057	0.00083	0.00096	0.00086	0.001	0.00093	0.00064	0.00051	0.00076	0.00072	0.00069	0.00069	0.00051	0.00059	0.00065	0.0006	0.00066	0.00063	<0.00050
Selenium	mg/L	-	0.0334	0.0335	0.0365	0.0368	0.0316	0.0348	0.0459	0.0489	0.0448	0.0368	0.0384	0.0341	0.0362	0.0371	0.0339	0.0349	0.0384	0.0383	0.0335	0.0357	0.0361	0.032
Silicon	mg/L	-	4.2	4.3	4.31	4.12	4.75	4.8	4.9	5.23	4.98	3.41	3.7	3.33	3.36	3.51	3.55	3.61	3.67	3.67	3.8	3.64	3.77	3.5
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.53	2.03	2.39	2.77	2.43	2.25	2.46	2.56	2.67	2.66	2.65	2.43	2.51	2.51	2.53	2.64	2.51	2.6	2.54	2.5	2.48	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	0.012	0.018	0.016	0.015	0.014	0.016	0.018	0.015	0.016	0.012	0.019	0.011	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.000616	0.000534	0.00107	0.000885	0.00127	0.00134	0.00157	0.00143	0.00162	0.000469	0.000583	0.000632	0.000615	0.000518	0.000696	0.000627	0.00118	0.00123	0.00111	0.00118	0.00117	0.00113
Vanadium	mg/L	-	0.00058	0.0006	0.00063	0.00053	0.00064	0.00072	0.00065	0.00069	0.00081	0.00075	0.00057	<0.00050	0.00053	0.00061	0.00067	0.00073	0.00088	0.00088	0.00086	0.00089	0.00084	0.00084
Zinc	mg/L	-	0.0061	0.0051	0.0058	0.006	0.0063	0.0068	0.0037	0.0051	0.0056	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-07-18	2016-07-20	2016-07-25	2016-08-02	2016-08-10	2016-08-17	2016-08-23	2016-08-30	2016-09-06	2016-09-13	2016-09-19	2016-09-22	2016-09-27	2016-09-29	2016-10-03	2016-10-11	2016-10-18	2016-10-24	2016-11-01	2016-11-08	2016-11-15	2016-11-22
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	-	1176	1208	-	1228	1238	1232	1218	1196	1225	-	-	1233	1217	1194.1	1222	1247	1227	1221	1224	1227	1224
pH	pH units	-	-	8.366	8.151	-	8.109	8.077	8.169	8.12	8.073	8.052	-	-	7.961	7.93	7.89	7.997	7.882	7.965	7.963	8.064	8.016	8.065
Turbidity	NTU	-	-	0.84	0.77	-	0.2	0.27	0.4	0.49	0.25	0.31	-	-	0.51	1.16	0.86	0.52	1.23	1.31	1.02	1.69	0.81	1.14
Temperature	C	-	-	17.1	18	-	18.9	19.2	17.4	16.5	14.9	14.8	-	-	13.5	12.8	13.178	11.5	11.7	10.9	9.9	9.8	8.7	7.8
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	104.9	-	-	-	-	-	93	-	-	-	-	-	-	107.8
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	9.72	-	-	-	-	-	-	11.39
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	51.4	49.4	51.2	51.7	50	54.2	52.2	51.9	51.3	52.2	50.9	51.7	50	70.4	51	52.4	52.1	51.9	52.5	52.5	52.3	52.6
Specific conductivity	uS/cm	-	1200	1200	1200	1190	1200	1200	1200	1200	1170	1180	1180	1170	1160	1200	1120	1130	1150	1130	1180	1160	1160	1170
pH	pH units	-	7.91	7.85	7.81	7.53	7.88	7.85	7.85	7.9	7.89	7.85	7.78	7.79	7.8	7.79	7.79	7.84	7.87	7.84	7.77	7.83	7.88	7.87
Total suspended solids	mg/L	30	<1.0	<1.0	<1.0	1.1	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	1.7	1.3	1.1
Turbidity	NTU	-	0.51	0.68	0.46	0.88	0.29	0.25	0.27	0.26	0.29	0.33	0.63	0.43	0.44	0.48	0.46	0.53	1.04	1.09	0.87	0.84	0.82	0.63
Hardness, as CaCO3	mg/L	-	504	513	518	528	529	513	505	482	489	484	500	484	505	507	478	481	500	481	494	494	510	490
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	900	902	919	899	948	895	962	956	942	931	925	942	898	902	944	925	932	882	888	925	910	896
Dissolved organic carbon	mg/L	-	2.37	2.26	2.64	2.5	2.34	2.36	2.34	2.19	2.18	1.76	2.05	1.93	1.93	1.97	1.92	2.16	1.97	2.11	2.01	1.98	2.11	2
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	8.92	8.72	8.6	8.87	9.04	8.73	8.78	9.2	9.51	8.99	9.34	9.1	8.72	8.74	9.16	8.83	8.96	8.82	8.72	8.94	8.72	8.7
Nitrate + nitrite	mg-N/L	-	9	8.79	8.68	8.93	9.1	8.8	8.85	9.27	9.58	9.08	9.43	9.18	8.77	8.8	9.21	8.88	9.01	8.87	8.77	8.98	8.76	8.73
Nitrite	mg-N/L	0.78	0.0842	0.0734	0.0756	0.0628	0.0633	0.0639	0.064	0.0673	0.0706	0.0874	0.0953	0.0821	0.0583	0.0608	0.0534	0.0577	0.0492	0.0521	0.0501	0.045	0.0348	0.0354
Total ammonia	mg-N/L	1.3	0.117	0.111	0.11	0.115	0.112	0.109	0.117	0.141	0.136	0.108	0.0955	0.0795	0.0639	0.0489	0.0376	0.0275	0.0294	0.0311	0.0269	0.0198	0.0149	0.0125
Dissolved phosphorus	mg-P/L	-	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	0.0036	0.0028	0.0031	0.0034	0.0052	0.0057	0.0046	0.0062	0.0041	0.0048
Total phosphorus	mg-P/L	0.09	0.0044	0.0049	0.0049	0.0032	<0.0020	<0.0020	<0.0020	0.0036	0.0056	0.0025	0.0031	0.0037	0.0046	0.0051	0.0056	0.0064	0.0058	0.0086	0.0168	<0.010	0.0067	0.0046
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	0.0025	0.0028	0.0022	0.0017	0.001	0.002
Total nitrogen	mg/L	-	9.12	8.58	9.02	9.08	8.96	9.03	8.93	8.68	8.82	9.15	8.96	9.35	8.77	9.13	8.81	8.88	8.57	8.93	8.61	9.01	8.86	8.61
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	152	157	158	159	163	154	151	149	148	149	147	149	145	152	147	146	151	145	150	151	154	151
Chloride	mg/L	-	12.4	12.1	12.1	12.4	12.8	12	12.4	13	13.4	12.7	13	12.5	11.9	12.3	12.6	12.7	12.7	12.3	12.5	12.4	12.2	12.4
Fluoride	mg/L	17	0.66	0.64	0.64	0.64	0.67	0.62	0.7	0.69	0.69	0.7	0.65	0.64	0.58	0.65	0.63	0.7	0.68	0.62	0.64	0.64	0.61	0.64
Magnesium	mg/L	-	30.1	29.6	29.8	31.7	29.7	30.9	31.1	26.8	29.1	27.3	32.3	27.1	28	31.1	27.1	28	29.5	29.1	28.8	28.7	30.3	27.4
Potassium	mg/L	-	17	16.7	16.6	17.2	16.6	18.3	18.3	16.6	16.8	16.7	17.3	16.3	15.6	18	15.5	17	16.7	16.8	16.7	16.7	16.7	16.1
Sodium	mg/L	-	57.3	59.7	57.7	60.4	58	63	62.2	58	59.2	59	65.2	53.8	56.4	60.7	54.2	60.2	60.6	58.6	58.7	58.2	57.9	58.2
Sulphate	mg/L	1100	558	544	536	552	558	540	544	568	589	555	575	559	533	540	568	553	559	548	544	557	542	545
Total Metals																								
Aluminum	mg/L	-	0.043	0.0602	0.0424	0.0699	0.0347	0.036	0.034	0.0333	0.0359	0.0447	0.0431	0.0416	0.0374	0.0444	0.0388	0.0456	0.0565	0.0942	0.0635	0.0739	0.0646	0.0525
Antimony	mg/L	-	0.00169	0.00186	0.00177	0.00176	0.00176	0.00167	0.00191	0.00188	0.00174	0.00181	0.00178	0.00178	0.00168	0.00173	0.0018	0.0018	0.00184	0.00182	0.00178	0.00182	0.00208	0.00178
Arsenic	mg/L	0.028	0.0009	0.00092	0.00085	0.00096	0.00084	0.00094	0.00098	0.00094	0.00089	0.00089	0.00102	0.00098	0.00094	0.00103	0.00097	0.00104	0.00095	0.00111	0.00111	0.00117	0.0011	0.00106
Barium	mg/L	-	0.0648	0.0672	0.0645	0.0695	0.066	0.063	0.0737	0.066	0.0646	0.0659	0.0668	0.0656	0.0663	0.0675	0.0641	0.0635	0.0576	0.0615	0.064	0.0673	0.0639	0.0644
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.146	0.136	0.142	0.142	0.146	0.141	0.146	0.151	0.141	0.152	0.153	0.147	0.14	0.138	0.161	0.134	0.157	0.147	0.144	0.15	0.154	0.149
Cadmium	mg/L	-	<0.000015	0.0000096	0.0000107	<0.000015	<0.000020	<0.000020	<0.000015	0.0000124	<0.000025	0.00001	<0.000015	<0.000020	<0.000015	0.0000177	<0.000015	<0.000020	<0.000015	<0.000020	<0.000020	0.000011	<0.000020	<0.000045
Calcium	mg/L	-	156	159	155	158	164	151	158	146	148	154	153	157	154	155	149	151	151	147	155	153	155	154
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	0.00012	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.00289	0.00437	0.00332	0.00446	0.00262	0.0025	0.00283	0.00291	0.00294	0.00348	0.00338	0.00378	0.004	0.00351	0.00338	0.00395	0.00452	0.00621	0.00536	0.00608	0.00544	0.00583
Iron	mg/L	1	<0.030	0.037	0.033	0.041	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	0.061	0.039	0.039	0.035	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000072	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0169	0.0155	0.0171	0.0163	0.0174	0.0167	0.0152	0.0173	0.0161	0.017	0.0179	0.0167	0.0162	0.0173	0.0169	0.0169	0.0153	0.016	0.0173	0.0167	0.0176	0.0172
Magnesium	mg/L	-	30.5	30.3	29.4	31	30.8	29.8	32.5	26.7	29.5	29.2	30.1	30.3	30	31.1	28.5	29.4	27.6	29.1	29.9	30	30.7	29.2
Manganese	mg/L	3.4	0.0214	0.0226	0.0188	0.021	0.0138	0.013	0.015	0.0173	0.0217	0.0283	0.0191	0.0178	0.0164	0.0171	0.0179	0.0171	0.0129	0.0159	0.0139	0.0117	0.00995	0.0103
Mercury	mg/L	-	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.175	0.178	0.175	0.171	0.184	0.167	0.18	0.17	0.172	0.181	0.175	0.18	0.19	0.187	0.176	0.172	0.171	0.174	0.173	0.179	0.184	0.176
Nickel	mg/L	-	0.00056	0.00058	0.00072	0.00066	0.00099	0.00069	0.00063	0.00057	0.00059	0.00061	0.00066	0.00061	0.00089	0.00112	0.00069	0.00061	0.00061	0.00055	0.00061	0.00055	0.00052	0.00057
Potassium	mg/L	-	17.4	17	16.7	18.1	17	17.9	19	17.1	17	17.8	18.3	17.6	17.1	17.7	16.3	17.1	15.9	16.5	16.9	17.6	17.3	16.7
Selenium	mg/L	0.075	0.0332	0.0353	0.0355	0.036	0.0355	0.0349	0.0406	0.0338	0.0355	0.0389	0.037	0.0349	0.0365	0.0378	0.0356	0.0348	0.0345	0.0345	0.0348	0.0362	0.0349	0.0361
Silicon	mg/L	-	3.68	3.77	3.63	3.77	3.67	3.75	3.87	3.75	3.85	4.12	3.96	3.9	3.99	4.09	3.74	4.15	3.99	4.11	4	4.27	4.11	4.16
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	59.3	61.7	58.8	64.4	59.6	61.3	64.3	59.7	59.5	63.1	63	58.9	60.7	60.8	57.8	63.3	57.9	59.8	60.8	61.7	62.7	61.9
Strontium	mg/L	-	2.64	2.58	2.56	2.57	2.61	2.45	2.62	2.45	2.49	2.54	2.52	2.64	2.63	2.64	2.6	2.53	2.52	2.44	2.52	2.51	2.6	2.47
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00037	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0002	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	0.01	0.011	0.011	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00118	0.0013	0.00121	0.00117	0.00125	0.00119	0.00122	0.00123	0.00125	0.00124	0.00123	0.00125	0.00115	0.00119	0.00131	0.00128	0.00127	0.00129	0.0013	0.00127	0.00132	0.00129
Vanadium	mg/L	-	0.00104	0.00108	0.00101	0.0011	0.00097	0.00108	0.00117	0.00106	0.00102	0.00109	0.00128	0.00121	0.00111	0.00132	0.00115	0.0012	0.00109	0.00119	0.00119	0.0012	0.00122	0.00117
Zinc	mg/L	0.059	<0.0030	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	0.0056	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-07-18	2016-07-20	2016-07-25	2016-08-02	2016-08-10	2016-08-17	2016-08-23	2016-08-30	2016-09-06	2016-09-13	2016-09-19	2016-09-22	2016-09-27	2016-09-29	2016-10-03	2016-10-11	2016-10-18	2016-10-24	2016-11-01	2016-11-08	2016-11-15	2016-11-22
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0258	0.0266	0.0249	0.0246	0.0291	0.0267	0.0223	0.0262	0.0233	0.0228	0.0257	0.0207	0.0197	0.0221	0.0178	0.0191	0.0182	0.0177	0.0174	0.0174	0.0157	0.0155
Antimony	mg/L	-	0.00164	0.00178	0.00176	0.00168	0.00174	0.00171	0.00173	0.00177	0.00172	0.00174	0.00164	0.00169	0.00166	0.0016	0.00175	0.00168	0.00179	0.00182	0.00174	0.00178	0.00166	0.00174
Arsenic	mg/L	-	0.00082	0.00084	0.00082	0.00082	0.00087	0.00094	0.00095	0.00087	0.00089	0.00083	0.00092	0.00078	0.00081	0.00088	0.00087	0.00094	0.00097	0.00104	0.00099	0.00106	0.00093	0.00101
Barium	mg/L	-	0.0639	0.0644	0.0639	0.0641	0.0645	0.0661	0.07	0.0664	0.0636	0.0646	0.0642	0.063	0.0624	0.0659	0.0612	0.062	0.0607	0.0595	0.0629	0.0662	0.0604	0.0645
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.137	0.132	0.133	0.132	0.138	0.137	0.136	0.139	0.134	0.138	0.138	0.133	0.151	0.129	0.157	0.124	0.149	0.14	0.132	0.147	0.14	0.136
Cadmium	mg/L	0.00034	<0.000015	0.000014	0.0000139	<0.000010	<0.000030	<0.000020	<0.000015	0.0000126	<0.000025	0.0000139	<0.000015	<0.000010	0.0000133	0.0000177	<0.000015	<0.000020	<0.000015	<0.000020	<0.000020	<0.0000050	<0.000025	<0.000045
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00183	0.00199	0.00196	0.00203	0.00176	0.00193	0.00138	0.0017	0.0018	0.00216	0.00233	0.00216	0.00197	0.00212	0.00207	0.00229	0.00266	0.00276	0.00303	0.00286	0.00285	0.00326
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0163	0.0152	0.0167	0.0156	0.017	0.0173	0.0151	0.0169	0.0159	0.0162	0.0169	0.0175	0.0148	0.0169	0.0166	0.017	0.0152	0.0155	0.0161	0.0166	0.0159	0.0169
Manganese	mg/L	-	0.0141	0.0145	0.0144	0.0145	0.00887	0.00909	<0.00010	0.00428	0.0093	0.0153	0.0153	0.00807	0.00406	0.0106	0.0116	0.011	0.0103	0.00943	0.00927	0.00654	0.00507	0.00546
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.164	0.167	0.164	0.16	0.182	0.162	0.171	0.169	0.17	0.169	0.182	0.175	0.175	0.181	0.171	0.164	0.171	0.165	0.163	0.167	0.174	0.165
Nickel	mg/L	-	0.00055	0.00052	0.00063	0.0006	0.0006	0.0006	0.00053	<0.00050	0.00053	0.00054	0.00059	<0.00050	<0.00050	0.00112	0.00055	0.00059	0.0006	<0.00050	0.00054	0.00052	<0.00050	0.00051
Selenium	mg/L	-	0.0325	0.0334	0.0377	0.0361	0.0355	0.0373	0.039	0.0327	0.035	0.0375	0.0371	0.033	0.0311	0.0346	0.0335	0.0341	0.0342	0.0351	0.0343	0.0329	0.0334	0.0355
Silicon	mg/L	-	3.57	3.64	3.65	3.65	3.59	3.84	3.67	3.67	3.78	3.78	3.88	3.53	3.73	3.8	3.62	3.92	3.81	3.86	3.72	3.91	3.75	3.9
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.49	2.53	2.54	2.51	2.62	2.5	2.53	2.5	2.49	2.44	2.63	2.55	2.45	2.61	2.52	2.47	2.55	2.43	2.45	2.43	2.54	2.41
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	0.011	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00113	0.00126	0.00117	0.00114	0.00124	0.00117	0.00117	0.00122	0.00123	0.00116	0.00114	0.00122	0.00125	0.00117	0.0013	0.00123	0.00127	0.00126	0.00121	0.00122	0.00124	0.00122
Vanadium	mg/L	-	0.00081	0.00091	0.00086	0.00093	0.00088	0.00096	0.00093	0.00089	0.00092	0.00097	0.001	0.00081	0.00072	0.00085	0.00079	0.00087	0.00096	0.00097	0.00097	0.00094	0.00093	0.00101
Zinc	mg/L	-	<0.0030	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0042	0.0065	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-11-29	2016-12-06	2016-12-14	2016-12-20	2016-12-28	2017-01-03	2017-01-09	2017-01-10	2017-01-17	2017-01-19	2017-01-26	2017-01-30	2017-02-01	2017-02-07	2017-02-14	2017-02-21	2017-03-01	2017-03-07	2017-03-14	2017-03-21	2017-03-27	2017-03-30
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1224	1224	-	1229	1247	1210	1205	1214	1222	1216	1223	1241	1234	1220	1242	1217	1221	1232	1214	1207	1223	1167
pH	pH units	-	8.013	8.035	-	8.023	7.976	8.063	8.089	7.819	8.131	8.088	7.74	7.291	7.391	8.031	7.616	7.501	7.414	7.339	7.445	7.466	7.458	7.471
Turbidity	NTU	-	1.52	6.74	-	0.52	1.09	2.52	1.88	1.18	2.38	2.79	0.63	1.29	1.18	1.21	0.99	3.8	1.91	3.28	1.94	1.63	4.35	1.33
Temperature	C	-	7.6	4.9	-	3.6	3.8	2.8	2.6	2.6	3	2.5	3.3	4.2	2.5	2.7	3.9	3.3	2.6	3.5	3.2	2.8	4.1	3.6
Dissolved oxygen	%	-	-	123.5	-	-	-	112.1	-	-	-	-	-	-	106.1	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	14.06	-	-	-	13.81	-	-	-	-	-	-	13.31	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	52.2	53.2	53.7	53.2	53.4	53.1	50.6	52	53.1	53	50.5	45.4	45.5	51.7	49	48.3	46.3	46.8	46.7	47.3	46.2	45.8
Specific conductivity	uS/cm	-	1200	1200	1200	1200	1170	1180	1170	1170	1150	1180	1170	1180	1160	1200	1180	1140	1060	1150	1180	1150	1150	1120
pH	pH units	-	7.88	7.92	7.85	7.88	7.86	7.87	7.89	7.83	7.87	7.83	7.58	7.45	7.38	7.85	7.52	7.62	7.42	7.39	7.49	7.61	7.42	7.38
Total suspended solids	mg/L	30	1.3	1.7	<1.0	<1.0	<1.0	3.5	1.9	1.2	3.5	2.6	5.5	8.4	7.8	1.7	8.6	7.9	11.1	9.3	10.7	7.1	7.7	10.3
Turbidity	NTU	-	0.83	1.16	0.46	0.43	0.55	2.16	2.43	1.27	2.61	2.05	0.61	0.81	1.23	0.9	1.14	1.59	1.97	2.01	1.43	1.22	1.69	1.44
Hardness, as CaCO3	mg/L	-	481	527	450	472	477	490	512	508	465	485	526	478	481	506	474	534	473	491	492	454	461	464
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	896	874	918	900	909	882	868	887	869	845	891	876	860	932	902	904	876	870	881	844	878	886
Dissolved organic carbon	mg/L	-	2.05	2.07	2.02	1.86	1.78	1.92	2.15	1.9	1.94	1.93	1.86	2.16	1.82	2.54	1.85	1.78	2.16	1.76	1.92	1.84	1.63	1.59
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	8.67	8.76	8.7	8.84	8.59	8.57	8.9	9.02	8.61	8.49	8.76	8.92	8.72	8.88	8.45	8.48	8.74	8.32	8.4	8.54	8.52	7.85
Nitrate + nitrite	mg-N/L	-	8.7	8.8	8.74	8.87	8.62	8.6	8.94	9.04	8.64	8.51	8.79	8.94	8.75	8.9	8.48	8.51	8.76	8.34	8.42	8.57	8.53	7.87
Nitrite	mg-N/L	0.78	0.0341	0.0325	0.0379	0.0311	0.0291	0.0349	0.0351	0.0258	0.0276	0.0223	0.0305	0.0253	0.0281	0.0238	0.0283	0.0299	0.021	0.0217	0.02	0.0224	0.0162	0.015
Total ammonia	mg-N/L	1.3	0.0143	0.0144	0.0152	0.0337	0.0162	0.0205	0.0157	0.0125	0.0148	0.0128	0.0213	0.0214	0.0215	0.0248	0.0236	<0.0050	0.0197	0.0197	0.0219	0.0129	0.0096	0.0106
Dissolved phosphorus	mg-P/L	-	0.0058	0.0044	0.0046	0.0049	0.0041	0.0066	0.0041	0.0055	0.0052	0.0061	0.004	0.0038	0.0029	0.0052	0.0029	0.0031	0.0023	0.0029	0.003	0.0031	0.0023	<0.0020
Total phosphorus	mg-P/L	0.09	0.0051	0.0074	0.0041	0.0057	0.0051	0.0102	0.0066	0.0057	0.01	0.0089	0.0048	0.011	0.0039	0.0078	0.0049	0.003	0.004	<0.0020	0.0024	0.0036	0.0039	0.0023
Orthophosphate	mg-P/L	-	0.0022	0.0015	0.0021	0.0023	0.0019	0.0032	0.0026	0.0026	0.0027	0.0032	<0.0010	<0.0010	<0.0010	0.0029	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	8.81	8.67	8.8	8.82	8.51	8.72	8.88	8.52	8.65	8.48	8.84	8.68	8.71	8.8	9.01	9.01	8.75	8.73	8.45	8.42	8.61	8.31
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	149	164	136	146	147	150	159	155	141	151	158	148	150	154	143	162	143	149	149	135	144	142
Chloride	mg/L	-	12.3	12.5	12	12.6	11.8	11.8	12.3	12.4	12.1	11.9	14.3	18.7	18.2	12.3	15.5	15.9	18.2	17.5	17.4	17.1	17.3	16.6
Fluoride	mg/L	17	0.63	0.65	0.63	0.65	0.64	0.65	0.62	0.63	0.65	0.64	0.62	0.51	0.52	0.64	0.56	0.54	0.51	0.5	0.51	0.55	0.5	0.49
Magnesium	mg/L	-	26.6	28.8	26.5	25.9	26.6	27.8	28.1	29.7	27.7	26.6	32	26.4	25.5	29.8	28.6	31.6	28.5	28.9	29.1	28.5	24.4	26.4
Potassium	mg/L	-	15.2	17	15.3	15.5	15.2	16.4	16.1	16.5	13.8	15.7	16.9	15.5	15.8	16	15.3	17.1	15.5	15.1	15.2	15.2	14.8	14.7
Sodium	mg/L	-	54.6	59.6	55.7	53.4	56.4	59.2	59.8	61	58	58	64.5	56.6	55.7	60.3	57.9	63	57.8	58.2	59	59.6	55.4	56.2
Sulphate	mg/L	1100	540	546	539	550	536	537	554	563	537	528	548	558	540	550	526	530	540	528	524	534	537	493
Total Metals																							
Aluminum	mg/L	-	0.0725	0.0575	0.0614	0.036	0.039	0.139	0.11	0.0855	0.144	0.103	0.531	0.887	1.07	0.0832	0.797	1.27	1.33	1.36	1.38	1.11	0.966	1.08
Antimony	mg/L	-	0.00165	0.00178	0.00179	0.00178	0.0017	0.00178	0.00183	0.00179	0.00187	0.00176	0.00173	0.00169	0.00193	0.00181	0.00166	0.00175	0.00167	0.00177	0.00175	0.00173	0.00162	0.00159
Arsenic	mg/L	0.028	0.00124	0.00117	0.00113	0.00116	0.00119	0.00127	0.00117	0.00124	0.00118	0.00128	0.00093	0.00064	0.0007	0.00121	0.00075	0.0009	0.00077	0.00082	0.00081	0.00077	0.00066	0.00071
Barium	mg/L	-	0.0637	0.061	0.0638	0.0624	0.0618	0.0612	0.0644	0.0629	0.0589	0.0666	0.0611	0.0577	0.0613	0.0601	0.0554	0.0609	0.0536	0.0592	0.061	0.0571	0.0576	0.0566
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.145	0.15	0.144	0.144	0.144	0.145	0.169	0.165	0.154	0.131	0.163	0.159	0.167	0.15	0.157	0.171	0.161	0.152	0.162	0.162	0.171	0.157
Cadmium	mg/L	-	<0.000035	<0.000030	0.0000198	<0.000030	<0.000040	<0.000030	<0.000040	<0.000040	<0.000035	<0.000030	<0.000040	<0.000040	<0.000030	<0.000030	0.0000215	<0.000050	<0.000055	<0.000060	<0.000050	<0.000080	<0.000060	<0.000060
Calcium	mg/L	-	149	162	161	159	154	154	168	166	156	155	163	152	164	159	148	165	144	144	152	149	151	147
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00015	0.0001	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.00591	0.00605	0.00551	0.00535	0.00613	0.0101	0.00864	0.00738	0.00982	0.00881	0.0054	0.00473	0.0046	0.00773	0.00506	0.00632	0.0053	0.0052	0.00604	0.0056	0.00487	0.00568
Iron	mg/L	1	0.039	0.033	<0.030	<0.030	<0.030	0.092	0.067	0.047	0.087	0.058	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000092	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0167	0.0175	0.017	0.0154	0.0157	0.0152	0.0161	0.0163	0.0156	0.0137	0.0167	0.0156	0.0182	0.0161	0.0149	0.0169	0.0152	0.0153	0.0152	0.0161	0.02	0.0151
Magnesium	mg/L	-	31.3	30.2	29	30.2	28.1	28.6	30.1	30.6	30.6	27.8	31	28.3	29.2	30.9	29.6	31.8	29.3	28.8	30	28.4	27.3	28.3
Manganese	mg/L	3.4	0.00797	0.00748	0.0115	0.00699	0.00721	0.0241	0.00902	0.00767	0.00907	0.00778	0.00847	0.00971	0.00768	0.00789	0.00622	0.0074	0.00645	0.00691	0.00824	0.00778	0.00801	0.0112
Mercury	mg/L	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	-	-	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.169	0.184	0.179	0.176	0.176	0.179	0.186	0.184	0.178	0.174	0.178	0.175	0.19	0.179	0.171	0.185	0.168	0.172	0.167	0.174	0.162	0.169
Nickel	mg/L	-	0.00058	0.00051	0.00058	0.00051	<0.00050	0.00056	0.0006	0.00055	0.00051	0.00057	0.00053	0.00055	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	17.6	16.6	17.6	16.2	16.9	16.5	16.2	16.8	16.2	15.7	16.6	16	16	16.5	15.5	16.8	15.5	15	15.9	15.1	15.3	15.3
Selenium	mg/L	0.075	0.0368	0.0363	0.0376	0.0333	0.0371	0.037	0.0379	0.0356	0.0362	0.0356	0.0366	0.036	0.0369	0.0353	0.0349	0.0372	0.0354	0.0357	0.0359	0.0337	0.033	0.0355
Silicon	mg/L	-	4.31	4.29	4.22	3.93	4.05	4.26	4.6	4.34	4.37	4.1	4.32	4.31	4.34	4.3	4.02	4.35	4.11	4.2	4.43	4.11	4.33	4.28
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	63.9	60	66.2	61.7	62.4	61.1	64.7	63.6	62.7	56.7	62.3	60	60.1	63.7	60.4	63.8	59.8	60	61.5	59.2	55.7	59
Strontium	mg/L	-	2.33	2.59	2.5	2.46	2.38	2.44	2.58	2.51	2.46	2.41	2.44	2.38	2.58	2.49	2.36	2.55	2.38	2.4	2.34	2.32	2.25	2.27
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00119	0.00139	0.00136	0.00129	0.00131	0.00141	0.0014	0.00134	0.00139	0.00127	0.00127	0.000852	0.001	0.00141	0.00106	0.00123	0.00108	0.00102	0.00118	0.00102	0.000928	0.000914
Vanadium	mg/L	-	0.00149	0.00112	0.00126	0.00116	0.00121	0.0015	0.00142	0.00132	0.00145	0.00136	0.00129	0.00108	0.00112	0.00136	0.00113	0.00127	0.00106	0.00108	0.00119	0.00116	0.00105	0.00114
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-11-29	2016-12-06	2016-12-14	2016-12-20	2016-12-28	2017-01-03	2017-01-09	2017-01-10	2017-01-17	2017-01-19	2017-01-26	2017-01-30	2017-02-01	2017-02-07	2017-02-14	2017-02-21	2017-03-01	2017-03-07	2017-03-14	2017-03-21	2017-03-27	2017-03-30
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0158	0.0139	0.0132	0.0135	0.012	0.0132	0.0123	0.0128	0.0115	0.0106	0.141	0.0719	0.0406	0.0173	0.113	0.112	0.0962	0.128	0.136	0.031	0.0748	0.0765
Antimony	mg/L	-	0.00163	0.00179	0.00163	0.00169	0.00171	0.00173	0.00174	0.00165	0.00146	0.00164	0.0017	0.00165	0.0017	0.00171	0.00157	0.00166	0.00161	0.00159	0.0017	0.00161	0.0016	0.00152
Arsenic	mg/L	-	0.001	0.00097	0.00109	0.00097	0.00109	0.00109	0.00111	0.00112	0.00091	0.00104	0.00067	0.00038	0.00041	0.00112	0.00046	0.00046	0.00042	0.00044	0.00042	0.00039	0.00038	0.00038
Barium	mg/L	-	0.0565	0.0616	0.0611	0.0552	0.0621	0.0606	0.0601	0.0603	0.0575	0.0582	0.0626	0.0548	0.0598	0.0563	0.0564	0.0597	0.053	0.0556	0.0574	0.0559	0.0559	0.054
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.138	0.148	0.135	0.136	0.139	0.151	0.146	0.147	0.139	0.136	0.15	0.143	0.151	0.146	0.143	0.152	0.149	0.164	0.15	0.13	0.14	0.138
Cadmium	mg/L	0.00034	<0.000035	<0.000025	<0.000030	<0.000030	0.0000198	<0.000015	<0.000040	<0.000030	<0.000015	<0.000020	<0.000040	<0.000040	<0.000040	<0.000030	0.0000233	<0.000025	0.0000466	<0.000065	<0.000050	<0.000050	0.0000562	<0.000060
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00293	0.00338	0.00377	0.00355	0.00403	0.0038	0.00453	0.00441	0.004	0.00401	0.00276	0.00208	0.00205	0.00471	0.0023	0.00263	0.00201	0.00235	0.00229	0.00234	0.00305	0.00233
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000089	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0161	0.0169	0.0159	0.0158	0.0148	0.0168	0.0153	0.0154	0.016	0.0148	0.0158	0.0151	0.0156	0.0153	0.0153	0.0164	0.0155	0.0165	0.0148	0.0142	0.0153	0.0144
Manganese	mg/L	-	0.00457	0.0051	0.00508	0.00493	0.00518	0.00475	0.00533	0.00508	0.00456	0.00485	0.00537	0.00543	0.00571	0.00554	0.00553	0.00615	0.00557	0.00634	0.00731	0.0072	0.00719	0.00832
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.167	0.181	0.159	0.155	0.157	0.175	0.17	0.165	0.16	0.171	0.177	0.17	0.167	0.171	0.161	0.18	0.162	0.169	0.159	0.173	0.161	0.163
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0352	0.0229	0.0327	0.034	0.0342	0.0377	0.0304	0.0341	0.0348	0.0334	0.038	0.0351	0.0343	0.0332	0.0334	0.0346	0.034	0.0362	0.0345	0.0354	0.0336	0.0333
Silicon	mg/L	-	3.95	3.89	3.75	3.73	3.71	3.96	3.45	3.99	3.88	3.8	4.14	4.05	3.94	4.08	3.78	3.92	3.75	3.97	3.95	3.91	3.86	3.9
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.34	2.58	2.31	2.37	2.27	2.44	2.4	2.33	2.25	2.38	2.45	2.3	2.32	2.4	2.27	2.5	2.28	2.33	2.28	2.37	2.2	2.21
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00118	0.00134	0.00122	0.00122	0.00138	0.00136	0.00129	0.00122	0.00121	0.00128	0.00123	0.000684	0.000613	0.00136	0.000869	0.000935	0.000808	0.00077	0.000856	0.000761	0.000634	0.000693
Vanadium	mg/L	-	0.00087	0.00091	0.00092	0.00094	0.001	0.001	0.00106	0.00108	0.00097	0.00093	0.00105	0.00084	0.00082	0.00106	0.00096	0.00098	0.00087	0.00084	0.00089	0.00088	0.00095	0.00089
Zinc	mg/L	-	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2017-06-06	2017-06-13	2017-06-20	2017-06-27	2017-07-04	2017-09-19	2017-09-21	2017-09-26	2018-01-09	2018-01-30	2018-01-31	2018-02-06	2018-02-13	2018-02-20	2018-03-01	2018-03-08	2018-03-15	2018-03-20	2018-03-27	2018-04-03	2018-04-10	2018-04-17
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1338	1347	1359	1344	1363	1444	1434	1450	1365.6	1280.8	1295.4	1408.6	1432.6	1397.2	1359.1	1495	1398	1111.1	1100	1181.1	1183.4	905.7
pH	pH units	-	7.652	7.612	7.61	7.59	7.538	7.6	7.9	7.4	7.09	7.35	7.46	7.48	7.54	7.69	7.39	7.312	7.42	7.21	7.5	7.55	7.39	7.4
Turbidity	NTU	-	0.5	0.53	1.49	0.86	0.71	0.54	0.52	0.64	0.33	3.19	2.23	0.04	2.94	1.91	1.77	1.67	2.33	2.97	2.67	3.18	3.34	4.16
Temperature	C	-	15.2	15.1	15.5	17.1	16.9	11.9	12.1	12	4.055	2.179	2.085	1.616	1.513	1.327	2.072	2.7	2.1	3.064	1.5	3.311	3.939	3.382
Dissolved oxygen	%	-	104.7	-	-	-	-	-	-	-	89	-	-	-	94.5	103.2	92.8	105	-	92.9	-	-	93.1	95.9
Dissolved oxygen	mg/L	-	9.28	-	-	-	-	-	-	-	11.59	-	-	-	13.13	14.48	12.74	12.28	-	12.44	-	-	12.17	12.74
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	99.7	86.5	83.2	76.1	77.8	104	105	88.4	107	73	67.6	69.3	73.9	54.4	62.4	63.8	60.9	91.5	85.6	75.7	78.6	78.5
Specific conductivity	uS/cm	-	1320	1290	1330	1280	1290	1410	1380	1390	1340	1260	1220	1370	1400	1440	1400	1420	1340	1090	974	1120	1150	899
pH	pH units	-	7.9	7.96	7.99	7.77	7.87	7.94	7.97	7.93	7.7	7.77	7.86	7.85	7.54	7.72	7.52	7.72	7.91	7.94	8	7.95	8.06	8.02
Total suspended solids	mg/L	30	4.4	3.5	4	3.7	4.7	4.9	3.1	2.6	8	12.2	10.5	5.7	6.2	8.2	11.4	7.7	11.6	7.5	10.5	7.3	8.2	7.3
Turbidity	NTU	-	0.62	0.59	0.82	0.64	1.13	0.59	0.56	0.65	1.19	1.62	2.19	1.55	1.69	1.81	2.02	1.6	2.51	3.55	3.24	2.63	3.13	3.06
Hardness, as CaCO3	mg/L	-	695	642	617	617	621	758	768	675	685	582	612	612	583	547	540	572	551	536	474	559	536	394
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1120	1020	1040	1070	1100	1210	1170	1130	1070	975	964	1030	1080	1120	1060	1080	1010	821	784	867	903	674
Dissolved organic carbon	mg/L	-	3.86	3.6	3.28	3.31	2.74	2.77	3.08	2.75	2.23	2.45	2.56	3.63	4.56	5.15	5.03	4.71	5.42	4.14	4.08	4.37	4.89	3.97
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	10.1	10.4	10	9.89	9.3	8.76	8.32	8.37	10.9	9.94	9.9	9.82	7.83	9.4	12.5	10.8	9.54	7.54	6.96	8.65	7.28	6.23
Nitrate + nitrite	mg-N/L	-	10.1	10.5	10.1	9.98	9.35	8.84	8.38	8.46	11	10	9.99	9.97	7.94	9.55	12.9	11	9.74	7.68	7.06	8.82	7.4	6.31
Nitrite	mg-N/L	0.78	0.065	0.0836	0.0898	0.0907	0.0454	0.0757	0.0658	0.0873	0.0821	0.0939	0.0952	0.15	0.117	0.156	0.331	0.268	0.192	0.137	0.103	0.173	0.116	0.0807
Total ammonia	mg-N/L	1.3	0.123	0.131	0.104	0.128	0.0609	0.113	0.1	0.07	0.176	0.336	0.324	0.398	0.26	0.333	1.01	0.794	0.46	0.32	0.344	0.604	0.414	0.339
Dissolved phosphorus	mg-P/L	-	0.0023	0.0029	<0.0020	0.0022	<0.0020	<0.0020	0.0021	<0.0020	0.0027	0.0023	0.002	0.0023	0.0027	0.0027	0.0024	0.0022	0.0036	0.004	0.0031	0.0028	0.0024	0.0038
Total phosphorus	mg-P/L	0.09	0.0027	0.0034	0.0037	<0.0020	<0.0020	0.0031	<0.0020	0.0036	0.0045	0.0043	0.0046	0.0044	0.0043	0.0069	0.0087	0.0063	0.0084	0.0099	0.0083	0.0061	0.0086	0.0087
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	10.2	10.9	10.7	10.1	9.48	8.8	8.51	8.78	11.5	10.9	11.3	10.2	8.47	10.1	13.7	11.6	10.3	7.93	7.54	9.61	8.58	6.73
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	216	194	191	190	195	239	245	215	216	180	189	193	184	165	166	175	168	170	144	173	164	116
Chloride	mg/L	-	13.5	15.8	17.4	19	18.6	16.2	16.3	20.6	15	17.8	21	26.3	26.6	33.4	31.7	33.6	31.3	17.6	15.9	22.7	22.2	14.9
Fluoride	mg/L	17	0.44	0.46	0.54	0.6	0.5	0.59	0.55	0.66	0.57	0.51	0.53	0.6	0.74	0.77	0.71	0.64	0.63	0.42	0.29	0.42	0.43	0.21
Magnesium	mg/L	-	38	38.4	33.8	34.5	32.4	39.4	38.1	33.4	35.2	32.1	34	31.7	29.9	32.8	30.4	32.8	31.8	26.8	27.8	31.2	30.5	25.5
Potassium	mg/L	-	3	7.23	9.52	12	7.84	3.94	3.99	10.8	2.67	8.08	10.9	12.8	14.2	20.5	18.9	17.7	17.1	5.9	3.57	9.52	9.49	2.59
Sodium	mg/L	-	33.7	41.4	48	55	43.8	48.8	47.9	60	36.5	51.6	62.1	69.8	76.8	107	85.9	88.9	81.6	37.3	30	53.3	52.8	19.6
Sulphate	mg/L	1100	604	586	603	604	619	718	683	644	620	562	570	611	634	651	613	633	593	469	421	484	476	364
Total Metals																								
Aluminum	mg/L	-	0.443	0.462	0.697	0.69	0.761	0.656	0.606	0.679	0.812	1.08	1.16	1.08	1.29	0.0982	1.28	1.29	1.08	0.967	1.13	1.16	1.18	0.899
Antimony	mg/L	-	0.00135	0.00139	0.00154	0.00166	0.00134	0.00107	0.001	0.00115	0.00191	0.0017	0.00175	0.00179	0.00156	0.00169	0.00221	0.00209	0.00204	0.0018	0.00112	0.00174	0.00153	0.0015
Arsenic	mg/L	0.028	0.00082	0.00098	0.00104	0.00114	0.001	0.00102	0.00093	0.00086	0.00072	0.00099	0.00094	0.0008	0.00079	0.00054	0.00145	0.00138	0.00084	0.0009	0.00082	0.0008	0.00072	0.00063
Barium	mg/L	-	0.0452	0.0568	0.0542	0.0541	0.0511	0.0405	0.0418	0.0526	0.0433	0.05	0.051	0.0628	0.0597	0.0675	0.0712	0.065	0.089	0.0548	0.051	0.0605	0.068	0.0461
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.184	0.191	0.207	0.242	0.187	0.252	0.246	0.251	0.343	0.225	0.224	0.23	0.277	0.171	0.292	0.277	0.217	0.233	0.137	0.166	0.191	0.118
Cadmium	mg/L	-	0.0000924	<0.00011	<0.000085	<0.000080	<0.000085	<0.00010	<0.000075	<0.000060	<0.00015	<0.00012	<0.00015	<0.00012	<0.00015	<0.000070	<0.000070	<0.000090	<0.000070	<0.00020	<0.000085	<0.00020	<0.000065	<0.00011
Calcium	mg/L	-	202	213	188	197	199	225	239	219	225	183	184	192	209	152	189	202	178	177	145	162	157	140
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00028	0.00024	0.00017	0.00015	0.00013	0.00012	0.00012	0.00012	0.00026	0.00021	0.00019	0.00016	0.00011	0.0001	0.00024	0.0002	0.0002	0.00024	0.00026	0.00026	0.00029	0.00037
Copper	mg/L	0.033	0.0109	0.0104	0.00962	0.00788	0.00701	0.00794	0.00685	0.00595	0.00916	0.0103	0.00881	0.0069	0.00522	0.00284	0.0108	0.00688	0.00612	0.0105	0.0109	0.0115	0.00971	0.0128
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.034	0.032	<0.030	0.041	0.04
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.006	0.0092	0.0094	0.012	0.01	0.0075	0.0083	0.012	0.008	0.0114	0.0127	0.0133	0.0122	0.0133	0.0151	0.0143	0.0122	0.0069	0.0053	0.0083	0.009	0.0032
Magnesium	mg/L	-	34.3	38	33.1	34.6	33.4	39.1	37	34.5	36.5	33.1	31.2	32.9	31.5	28.7	33.9	36.2	30.9	28.7	26.5	28.9	28.5	26.4
Manganese	mg/L	3.4	0.0945	0.0796	0.057	0.0498	0.0474	0.0566	0.0492	0.0569	0.0912	0.0719	0.0629	0.0722	0.0444	0.0409	0.0656	0.0771	0.0707	0.0729	0.093	0.0809	0.0783	0.08
Mercury	mg/L	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.14	0.164	0.154	0.171	0.164	0.17	0.176	0.178	0.169	0.182	0.188	0.196	0.233	0.21	0.205	0.221	0.203	0.126	0.103	0.151	0.155	0.106
Nickel	mg/L	-	0.00063	0.00071	0.00061	0.00065	0.00054	0.00052	0.00052	0.00058	0.0007	0.00057	0.00057	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	0.0007	0.00085	0.00166	0.00066
Potassium	mg/L	-	2.92	6.95	9.23	11.4	7.93	3.87	3.7	10.9	2.8	8.46	9.83	13.2	15.2	21.2	18	17.1	18.5	5.57	3.33	8.64	8.77	2.54
Selenium	mg/L	0.075	0.0481	0.0489	0.0453	0.0434	0.0432	0.0414	0.0389	0.04	0.0534	0.0437	0.0439	0.0401	0.0328	0.037	0.044	0.0429	0.0376	0.0364	0.0364	0.0448	0.0374	0.0415
Silicon	mg/L	-	5.92	5.82	5.38	5.6	5.38	6.77	6.74	6.52	7.9	6.14	5.37	5.79	5.91	4.64	5.32	5.37	5.16	5.53	5.73	5.07	5.38	5.18
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	31.6	43	46.7	55.7	45.1	49.1	46	61.4	38.4	53.9	60.9	75.7	81.4	96	91.4	92.6	86.5	41	29.1	50.6	53.3	21.3
Strontium	mg/L	-	2.76	2.77	2.7	2.79	3.12	4.2	4.37	3.66	3.9	2.37	2.24	2.56	4.09	2.13	2.05	2.35	2.11	2.24	1.48	1.56	2.41	1.44
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000022	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00035	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.0023	0.00194	0.00206	0.00183	0.00174	0.00264	0.00259	0.00197	0.00287	0.0021	0.00178	0.00163	0.00146	0.000814	0.00161	0.00148	0.00133	0.00208	0.00179	0.00165	0.00139	0.00122
Vanadium	mg/L	-	0.00112	0.00124	0.00121	0.00138	0.00119	0.00119	0.00107	0.00113	0.00154	0.00152	0.00149	0.00143	0.00117	0.00136	0.00143	0.00138	0.00151	0.00145	0.00146	0.00163	0.00121	0.00145
Zinc	mg/L	0.059	0.0034	0.0044	0.0059	0.0038	0.0037	0.0049	0.0056	0.0053	0.008	0.0057	0.0058	0.005	0.0054	0.0049	0.0052	0.005	0.0042	0.0046	0.0035	0.0045	<0.0030	0.0045

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2017-06-06	2017-06-13	2017-06-20	2017-06-27	2017-07-04	2017-09-19	2017-09-21	2017-09-26	2018-01-09	2018-01-30	2018-01-31	2018-02-06	2018-02-13	2018-02-20	2018-03-01	2018-03-08	2018-03-15	2018-03-20	2018-03-27	2018-04-03	2018-04-10	2018-04-17
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.349	0.238	0.121	0.103	0.115	0.117	0.103	0.104	0.132	0.101	0.14	0.0604	0.098	-	0.139	0.0837	0.0977	0.0976	0.102	0.106	0.0925	0.971
Antimony	mg/L	-	0.00145	0.00151	0.00156	0.00157	0.00128	0.00099	0.00095	0.00116	0.00192	0.00166	0.00182	0.0018	0.00147	0.00196	0.0019	0.00187	0.00188	0.00166	0.00113	0.00165	0.00149	0.00126
Arsenic	mg/L	-	0.00097	0.001	0.001	0.00111	0.00091	0.00096	0.00091	0.00072	0.00056	0.0008	0.00073	0.00054	0.00056	0.00078	0.00133	0.00116	0.00052	0.00083	0.00063	0.00054	0.00073	0.00057
Barium	mg/L	-	0.0498	0.0572	0.0555	0.0579	0.0494	0.0433	0.0435	0.0528	0.0394	0.0489	0.0545	0.0564	0.0514	0.0642	0.063	0.0674	0.0783	0.0594	0.0552	0.063	0.0702	0.0457
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.203	0.175	0.201	0.199	0.174	0.242	0.22	0.22	0.315	0.207	0.216	0.217	0.236	0.192	0.226	0.219	0.196	0.175	0.117	0.149	0.183	0.107
Cadmium	mg/L	0.00034	0.000111	<0.00012	<0.00010	0.0000745	<0.000080	<0.00010	<0.000085	<0.000060	0.000123	<0.00012	<0.00011	<0.00025	<0.00010	<0.00010	<0.000070	<0.000080	<0.000080	<0.000080	<0.000070	<0.000080	<0.000070	<0.000070
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00029	0.00024	0.00017	0.00016	0.0001	0.00011	0.00011	0.00012	0.00022	0.00018	0.00017	0.00014	<0.00010	<0.00010	0.00021	0.00019	0.00016	0.00019	0.00024	0.00023	0.00024	0.00038
Copper	mg/L	-	0.00929	0.00738	0.00559	0.00478	0.00416	0.0054	0.00487	0.0044	0.00523	0.00399	0.00545	0.00274	0.00199	0.00422	0.00503	0.00374	0.00315	0.00442	0.00518	0.0052	0.00326	0.0135
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.078
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000106	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0069	0.0082	0.0103	0.0115	0.0097	0.0077	0.0086	0.0115	0.0072	0.0109	0.0117	0.0134	0.0121	0.0162	0.0146	0.0123	0.0128	0.0062	0.0041	0.0091	0.0076	0.0034
Manganese	mg/L	-	0.102	0.0752	0.0557	0.0504	0.0411	0.0535	0.0489	0.0542	0.0826	0.0683	0.0614	0.0617	0.0414	0.0393	0.0625	0.0749	0.0679	0.0716	0.0938	0.0806	0.0781	0.0797
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.154	0.159	0.152	0.159	0.156	0.171	0.172	0.167	0.144	0.183	0.182	0.207	0.199	0.25	0.198	0.198	0.179	0.127	0.108	0.146	0.149	0.0937
Nickel	mg/L	-	0.0007	0.00065	0.00058	0.00056	0.00052	0.00051	0.0005	0.00055	0.0006	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	0.00058	<0.00050	0.00064
Selenium	mg/L	-	0.0475	0.0511	0.0441	0.0422	0.0422	0.0408	0.0383	0.04	0.0593	0.0426	0.0477	0.0373	0.031	0.0389	0.0402	0.0396	0.0371	0.032	0.0364	0.0397	0.0399	0.0397
Silicon	mg/L	-	5.68	5.54	5.61	5.45	5.05	6.32	6.11	6.22	7.85	5.76	5.79	5.09	5.13	4.79	4.71	5.07	4.87	5.17	5.37	5.18	5.17	5.02
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.97	2.87	2.73	2.65	3.04	4.45	4.48	3.62	3.92	2.34	2.45	2.71	3.67	2.63	1.92	2.14	2.03	2.27	1.57	1.69	2.22	1.23
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00153	0.0021	0.00199	0.00191	0.00163	0.00267	0.00257	0.00183	0.00249	0.00189	0.00137	0.00133	0.00132	0.000967	0.0012	0.00128	0.00108	0.00198	0.0015	0.00154	0.00125	0.00117
Vanadium	mg/L	-	0.0011	0.00117	0.00113	0.00121	0.001	0.00114	0.00104	0.00094	0.00127	0.00125	0.0013	0.00098	0.00094	0.00133	0.00111	0.00111	0.00123	0.00126	0.00122	0.00126	0.00096	0.00131
Zinc	mg/L	-	0.003	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	0.003	0.0037	<0.0080	0.0037	0.0056	0.0031	<0.0030	0.0044	<0.0030	0.0034	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	0.0048

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-04-24	2018-05-01	2018-05-03	2018-05-08	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-31	2018-06-04	2018-06-05	2018-06-07	2018-06-14	2018-06-18	2018-06-21	2018-06-27	2018-07-02	2018-07-10	2018-07-17	2018-07-24	2018-08-07
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	929.1	1001.1	1132.4	1249.3	1284	1284.3	1282.5	1286.5	1283.4	-	1386.6	1303.5	1339	1301	1257.9	1301	1305.9	1238	1241.2	1213	1276	1298.3
pH	pH units	-	7.37	7.19	7.1	7.52	7.36	7.24	7.27	7.27	7.38	-	7.52	7.48	7.987	7.374	7.29	7.29	7.62	7.29	7.72	7.51	7.7	7.88
Turbidity	NTU	-	2.94	2.64	3.63	0.53	1.02	2.18	1.4	5.45	1.96	-	0.1	0.13	1.69	0.93	0	0.02	1.27	1.6	0.63	0.71	0.26	0.39
Temperature	C	-	5.428	8.001	9.459	11.526	10.191	10.164	10.294	10.344	10.209	-	14.729	14.45	14	14.5	15.35	18.8	16.651	15.625	18.759	20.9	18.7	20.343
Dissolved oxygen	%	-	93.8	-	-	93.9	-	-	-	-	-	-	-	92.2	-	-	-	-	98.5	100.8	101.1	-	-	-
Dissolved oxygen	mg/L	-	11.81	-	-	10.17	-	-	-	-	-	-	-	9.37	-	-	-	-	9.57	9.99	9.39	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	72.7	71.8	69.6	64.4	69.5	68.1	67.5	67.1	70.3	66.6	62.6	59.2	64.7	51.9	47.1	48	49.7	48.9	47.1	51	52.3	55.4
Specific conductivity	uS/cm	-	918	1060	1100	1230	1270	1280	1290	1290	1260	1360	1370	1340	1240	1310	1280	1250	1260	1260	1260	1290	1310	1290
pH	pH units	-	7.99	8.01	7.83	7.6	7.84	7.82	7.77	7.74	7.79	7.71	7.54	7.95	7.9	7.9	7.77	7.56	7.74	7.84	7.57	7.54	7.6	7.75
Total suspended solids	mg/L	30	9.1	8.1	6.1	6.3	5.9	5.5	7	9.8	10.5	3.9	3.9	5.7	4.4	5.1	4.8	9.8	7	5.8	4.7	4.3	3.2	3
Turbidity	NTU	-	3.47	2.44	2.32	1.93	1.46	1.52	1.91	2.48	2.4	0.8	1.25	0.84	1.6	1.04	1.05	0.64	0.95	1.1	0.64	0.75	0.69	0.54
Hardness, as CaCO3	mg/L	-	490	538	596	647	647	643	653	649	643	589	584	570	599	508	494	492	502	486	473	489	476	554
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	697	840	878	1010	1040	1070	1080	922	1030	1070	984	997	1120	977	988	958	934	966	976	988	943	1030
Dissolved organic carbon	mg/L	-	3.67	3.61	3.4	3.11	3.47	3.15	3.14	3.07	3.05	2.96	3.26	3.58	3.53	3.77	3.27	3.87	2.92	2.6	2.62	2.46	2.33	2.22
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.68	5.45	5.67	6.14	6.32	6.31	6.32	6.3	6.22	7.02	7.27	7.14	6.77	6.97	7.01	6.97	6.85	6.81	6.72	6.56	6.7	6.46
Nitrate + nitrite	mg-N/L	-	5.71	5.47	5.7	6.17	6.35	6.34	6.35	6.32	6.25	7.11	7.37	7.24	6.87	7.08	7.11	7.07	6.94	6.89	6.8	6.64	6.79	6.56
Nitrite	mg-N/L	0.78	0.0306	0.0219	0.0231	0.0297	0.0307	0.0284	0.0297	0.0272	0.0282	0.0877	0.0984	0.104	0.105	0.107	0.105	0.0979	0.0913	0.0845	0.0776	0.0827	0.0847	0.0929
Total ammonia	mg-N/L	1.3	0.187	0.0803	0.061	0.0675	0.0397	0.0402	0.038	0.0393	0.0393	0.0157	0.0184	0.0161	0.0183	0.0127	0.0102	0.0162	0.0278	0.0215	0.0204	0.0332	0.0222	0.0308
Dissolved phosphorus	mg-P/L	-	0.0025	0.0029	0.0026	<0.0020	0.0031	0.0031	0.0033	0.0036	0.0032	0.0028	0.0031	0.003	0.0038	0.0023	<0.0020	0.0021	<0.0020	<0.0020	0.0037	0.0023	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.09	0.0068	0.0072	0.0094	0.0056	0.0067	0.0058	0.0064	0.0048	0.0053	0.0071	0.0084	0.0061	0.01	0.0068	0.0046	0.0051	0.0046	0.0048	0.0024	0.0086	0.0051	0.0049
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	0.0011	0.0012	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.57	6	6.21	6.91	6.82	7.47	5.58	6.82	6.87	6.52	7.03	7.33	7.29	7.38	6.6	7.37	6.9	7.19	6.68	6.53	6.93	6.9
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	153	166	184	201	198	198	203	201	199	186	183	178	188	158	154	154	157	150	149	156	150	180
Chloride	mg/L	-	15.8	13.6	13.5	14.7	13.8	15.1	15.6	15.8	13.8	22.5	24.9	25.5	19	26.1	26.7	26.1	27.2	25.7	25.4	23.7	25.4	25.5
Fluoride	mg/L	17	0.2	0.26	0.29	0.39	0.49	0.46	0.46	0.45	0.49	0.62	0.68	0.67	0.78	0.68	0.69	0.7	0.68	0.69	0.65	0.73	0.76	0.75
Magnesium	mg/L	-	26	29.9	33	35.1	36.8	36.1	35.6	35.6	35.3	30.1	30.7	30.3	31.4	27.3	26.5	25.9	26.8	26.9	24.5	24.2	24.8	25.2
Potassium	mg/L	-	2.03	2.22	2.63	3.38	4.05	4.01	4.28	4.31	3.92	10	12.3	13.4	14.2	16.7	16.5	16.5	17.1	18.5	16.6	17.3	17.5	17
Sodium	mg/L	-	18.2	20.5	24.2	28.2	33.2	32.5	31.3	32	31	65.5	72.1	73.1	77.3	79.4	78.6	79.3	79	81.4	75.5	74.2	78.9	84.2
Sulphate	mg/L	1100	382	462	517	599	621	621	623	623	617	630	633	606	587	564	568	551	579	547	555	538	580	584
Total Metals																								
Aluminum	mg/L	-	1.07	1.07	1.11	1.09	0.759	0.796	1.03	1.14	1.34	0.643	0.775	0.758	0.338	0.872	0.922	0.775	0.938	0.972	0.796	0.783	0.598	0.648
Antimony	mg/L	-	0.00085	0.00076	0.00079	0.00082	0.0008	0.00082	0.0008	0.00081	0.00089	0.00129	0.00129	0.00142	0.00142	0.0016	0.0016	0.00166	0.00169	0.00165	0.00174	0.00172	0.00181	0.00165
Arsenic	mg/L	0.028	0.00045	0.00034	0.00048	0.0004	0.00049	0.00046	0.00052	0.0005	0.00054	0.00097	0.00106	0.00108	0.00153	0.00162	0.00145	0.00151	0.00147	0.00143	0.00159	0.00136	0.00135	0.00156
Barium	mg/L	-	0.0369	0.037	0.0353	0.0416	0.0433	0.0433	0.0447	0.0435	0.0454	0.0513	0.0557	0.052	0.057	0.0598	0.0572	0.0567	0.057	0.0561	0.0654	0.0576	0.0596	0.0726
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.092	0.098	0.104	0.136	0.131	0.129	0.132	0.131	0.134	0.179	0.164	0.175	0.163	0.175	0.177	0.174	0.172	0.176	0.175	0.166	0.19	0.198
Cadmium	mg/L	-	<0.00010	0.000129	<0.00015	<0.00030	0.00037	0.000356	0.000385	0.000375	0.000384	<0.00017	<0.00031	<0.00014	0.000157	<0.00018	<0.000080	<0.000090	<0.00010	<0.000090	<0.000090	<0.00011	<0.000065	<0.00010
Calcium	mg/L	-	138	169	182	204	225	222	221	222	224	198	181	177	184	164	159	162	168	155	158	160	169	176
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00041	0.00068	0.00066	0.00335	0.00383	0.00372	0.00393	0.00383	0.00404	0.00045	0.00036	0.00029	0.00032	0.00016	0.00011	0.00011	0.00012	0.00012	0.00013	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.0153	0.0201	0.0235	0.209	0.185	0.173	0.204	0.216	0.282	0.0136	0.0114	0.00912	0.0168	0.00579	0.00515	0.00459	0.00439	0.00426	0.00502	0.00403	0.0041	0.00412
Iron	mg/L	1	0.038	0.031	0.036	<0.030	<0.030	<0.030	0.056	<0.030	0.033	<0.030	<0.030	<0.030	0.065	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0034	0.0046	0.0048	0.0077	0.0091	0.0087	0.009	0.009	0.0093	0.0111	0.0105	0.0113	0.0113	0.0121	0.0114	0.0116	0.0126	0.0116	0.0128	0.0138	0.0134	0.0129
Magnesium	mg/L	-	24.1	30.2	33.8	34.3	38.3	37.1	39	38	39.7	32	31.4	29.1	30.6	29.1	27.5	27.3	28.3	27.4	28.4	25.7	27	25.8
Manganese	mg/L	3.4	0.0823	0.111	0.111	0.255	0.299	0.291	0.301	0.295	0.306	0.151	0.132	0.109	0.128	0.0782	0.0624	0.0597	0.0681	0.0678	0.0719	0.0611	0.061	0.0595
Mercury	mg/L	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.106	0.141	0.145	0.145	0.145	0.143	0.145	0.146	0.148	0.211	0.206	0.204	0.218	0.219	0.202	0.212	0.216	0.206	0.207	0.21	0.219	0.208
Nickel	mg/L	-	0.00077	0.00107	0.00116	0.00348	0.00394	0.00409	0.00415	0.00401	0.00425	0.00096	0.00098	0.00088	0.001	0.00072	0.00057	0.00064	0.00055	0.00052	0.00065	0.00052	0.00055	<0.00050
Potassium	mg/L	-	2.11	2.31	2.53	3.58	4.24	4.15	4.24	4.18	4.32	10.6	12.2	12.8	13.4	17.6	16.8	17.8	17.2	17.6	18.7	18.2	17.6	16.9
Selenium	mg/L	0.075	0.0391	0.0543	0.0572	0.0513	0.0562	0.0571	0.0549	0.0553	0.0582	0.0419	0.0415	0.0411	0.0386	0.0381	0.0402	0.0386	0.0357	0.0398	0.0415	0.0351	0.0404	0.0375
Silicon	mg/L	-	5.19	5.53	5.1	5.38	5.68	5.75	5.73	5.74	5.94	5.27	5.33	4.96	5.38	4.68	4.68	4.52	4.64	4.45	4.96	4.65	4.77	5.1
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	19.2	21.7	24	27.9	33	32.3	33.4	32.9	34.5	67.9	71.9	70.8	77.8	83.3	81.5	81.6	79.4	81.8	84.2	74.2	81.9	83.5
Strontium	mg/L	-	1.81	2.42	2.45	2.9	3.34	3.36	3.34	3.39	3.34	2.59	2.34	2.23	2.17	1.94	1.87	1.91	1.93	1.86	1.86	1.91	2.02	1.71
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000021	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00092	0.00125	0.00135	0.00121	0.0013	0.00123	0.0012	0.00122	0.00142	0.00207	0.00167	0.00153	0.00204	0.00117	0.00115	0.00107	0.00112	0.00112	0.00114	0.00115	0.00124	0.0013
Vanadium	mg/L	-	0.001	0.00097	0.00096	0.0007	0.00064	0.0006	0.00066	0.00063	0.00077	0.0014	0.00145	0.00133	0.00159	0.00161	0.0014	0.00145	0.00151	0.00139	0.00144	0.00148	0.00142	0.00191
Zinc	mg/L	0.059	0.0059	0.0068	0.007	0.0232	0.0254	0.0249	0.0308	0.0262	0.0274	0.007	0.0054	0.0044	0.006	0.0031	0.0031	<0.0030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-04-24	2018-05-01	2018-05-03	2018-05-08	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-31	2018-06-04	2018-06-05	2018-06-07	2018-06-14	2018-06-18	2018-06-21	2018-06-27	2018-07-02	2018-07-10	2018-07-17	2018-07-24	2018-08-07
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0944	0.116	0.0876	0.101	0.0645	0.0539	0.0568	0.0667	0.063	0.0824	0.0693	0.0795	0.141	0.0975	0.0901	0.0613	0.1	0.0891	0.71	0.0867	0.103	0.116
Antimony	mg/L	-	0.00091	0.00075	0.00073	0.0008	0.00075	0.00078	0.00078	0.0008	0.00076	0.0012	0.00128	0.00134	0.00137	0.0015	0.0016	0.0016	0.00151	0.00156	0.0016	0.00148	0.00168	0.00154
Arsenic	mg/L	-	0.00034	0.00022	0.00028	0.00029	<0.00070	<0.00060	<0.00050	<0.00060	<0.00050	0.00079	0.00091	0.00109	0.00136	0.00135	0.00132	0.00134	0.0014	0.00133	0.00131	0.00113	0.0013	0.00143
Barium	mg/L	-	0.0389	0.0357	0.0363	0.04	0.0409	0.0409	0.0385	0.0384	0.0399	0.0494	0.0551	0.0549	0.0579	0.0577	0.0571	0.0563	0.0562	0.0579	0.0549	0.0578	0.0658	0.072
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.098	0.092	0.098	0.117	0.121	0.122	0.122	0.123	0.121	0.161	0.159	0.153	0.152	0.165	0.147	0.169	0.155	0.141	0.156	0.175	0.163	0.179
Cadmium	mg/L	0.00034	<0.000085	<0.00015	<0.00014	0.000299	0.000376	0.000387	0.00037	0.000366	0.000377	<0.00020	<0.00031	<0.00014	<0.00015	<0.00014	<0.000085	<0.00010	<0.000090	<0.00016	<0.00010	<0.00011	<0.000070	0.000086
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00036	0.00062	0.00064	0.00332	0.00388	0.00383	0.00378	0.00382	0.00381	0.00041	0.00036	0.00028	0.00025	0.00014	0.00011	0.0001	0.00011	0.0001	0.0001	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00604	0.00854	0.00929	0.0884	0.0855	0.0832	0.0822	0.083	0.088	0.00702	0.00602	0.00498	0.00942	0.00301	0.00346	0.00278	0.00312	0.00289	0.0039	0.00236	0.00237	0.00528
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.004	0.0046	0.0049	0.0081	0.009	0.009	0.0089	0.0089	0.009	0.0103	0.0107	0.0107	0.0114	0.0114	0.0113	0.0118	0.0115	0.0109	0.0118	0.0128	0.0109	0.0124
Manganese	mg/L	-	0.0791	0.106	0.113	0.244	0.277	0.271	0.308	0.284	0.271	0.14	0.13	0.11	0.121	0.0713	0.0617	0.0578	0.0647	0.0667	0.0603	0.0558	0.0575	0.0573
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.103	0.128	0.148	0.141	0.142	0.143	0.15	0.149	0.147	0.201	0.204	0.202	0.221	0.202	0.196	0.196	0.198	0.2	0.194	0.189	0.204	0.197
Nickel	mg/L	-	0.00056	0.0009	0.00102	0.00336	0.00404	0.004	0.004	0.00393	0.00397	0.00096	0.00087	0.00078	0.0008	0.00062	0.00061	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0456	0.0522	0.0554	0.0553	0.0532	0.0525	0.0515	0.0522	0.0525	0.044	0.0395	0.0401	0.0383	0.0362	0.0366	0.0383	0.0355	0.038	0.0361	0.0342	0.0374	0.0365
Silicon	mg/L	-	5.03	4.85	4.76	5.26	5.63	5.46	5.42	5.46	5.44	5.18	4.93	4.63	5.05	4.41	4.42	4.38	4.47	4.16	4.38	3.98	4.56	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.71	2.24	2.52	3.03	2.99	3.04	3.12	3.25	3.04	2.5	2.38	2.28	2.22	1.93	1.81	1.8	1.84	1.84	1.74	1.79	2	1.8
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.000855	0.00111	0.00124	0.00101	0.00119	0.00106	0.00104	0.00101	0.00119	0.00183	0.00157	0.00133	0.00197	0.00102	0.000928	0.000964	0.000905	0.000888	0.00106	0.00106	0.00111	0.00122
Vanadium	mg/L	-	0.00074	0.00073	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00107	0.00113	0.00115	0.00135	0.00114	0.00126	0.00117	0.00126	0.0012	0.00122	0.00099	0.0012	0.00161
Zinc	mg/L	-	<0.0030	0.004	0.0044	0.0186	0.0218	0.0222	0.0217	0.0218	0.0217	0.0051	0.0043	0.0035	0.0034	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-08-16	2018-08-21	2018-08-28	2018-09-04	2018-09-10	2018-09-17	2018-09-25	2018-10-02	2018-10-04	2018-10-09	2018-10-16	2018-10-18	2018-10-23	2018-10-30	2018-11-06	2018-11-13	2018-11-20	2018-11-27	2018-12-04	2018-12-06	2018-12-11	2018-12-18
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1525	1272	1318.4	1280	1292.8	1305.5	1332	1349.5	1385.3	1353.1	1407.4	1407.5	1367.5	1345.7	1132.5	1226.4	1346	1189.5	1242.8	1269	1385.3	1385.3
pH	pH units	-	7.46	7.51	7.43	7.34	7.49	7.14	7.338	7.34	6.92	7.13	7.1	7.32	7.33	7.69	7.21	7.39	7.635	7.09	7.52	7.66	7.4	7.32
Turbidity	NTU	-	0.35	0.22	0.61	0.25	1.63	0.93	1.25	1.27	1.34	1.42	0.2	0.62	1.07	1.78	2.01	3.53	1.04	0.6	2.34	1.46	3.14	2.02
Temperature	C	-	18.4	17.4	15.64	14.803	13.877	13.106	11.9	8.231	7.827	7.002	6.886	7.221	6.503	6.268	4.673	4.034	3.5	3.414	2.583	4.1	3.834	3.368
Dissolved oxygen	%	-	-	-	95	95.9	-	90.8	-	-	-	93.4	96.4	92.5	-	-	-	94.7	-	-	95.1	-	92	96.3
Dissolved oxygen	mg/L	-	-	-	9.41	9.67	-	9.5	-	-	-	11.29	11.67	11.12	-	-	-	12.35	-	-	12.89	-	12.05	12.78
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	51	49.9	49.9	47.1	43.4	43.3	45.2	48.8	55.7	75.3	83.8	86.2	69	54.2	64.7	81.3	80.6	73.2	71	75.9	73.8	62.2
Specific conductivity	uS/cm	-	1310	1340	1360	1330	1340	1310	1290	1300	1280	1350	1330	1350	1360	1330	1110	1300	1320	1240	1220	1300	1330	1360
pH	pH units	-	7.66	7.68	7.74	7.59	7.58	7.33	7.51	7.33	7.48	7.96	7.77	7.76	7.73	7.59	7.35	7.46	7.9	7.8	7.68	7.52	7.54	7.58
Total suspended solids	mg/L	30	4	5.5	4.1	5.6	4.9	5.1	4.1	5.1	4.6	4.8	5.1	4.9	4.1	4.6	6.5	5.8	6.2	7.6	7.8	7	9.9	9.2
Turbidity	NTU	-	0.74	0.68	0.8	0.75	1.07	1.32	0.87	0.88	1.32	0.85	0.96	0.91	1.18	1.61	2.41	1.56	1.45	2.24	3.33	2.07	2.37	2.64
Hardness, as CaCO3	mg/L	-	514	487	519	521	482	507	476	482	505	594	655	633	568	550	498	584	588	565	566	575	616	565
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1020	1040	796	1020	958	909	1030	1040	982	1070	1030	1080	1100	993	865	1010	1020	998	954	993	884	1000
Dissolved organic carbon	mg/L	-	1.97	2	2.11	3.56	2.27	1.75	2.13	2.57	1.79	2.15	2.2	2.54	7.54	3.39	3.86	3.78	4.33	3.52	4.05	4.55	3.98	4.01
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	6.43	6.6	6.28	6.5	6.52	6.11	6.43	6.6	6.1	5.24	4.9	4.56	5.68	6.52	5.92	5.61	5.93	5.9	5.34	5.51	5.6	6.75
Nitrate + nitrite	mg-N/L	-	6.51	6.69	6.37	6.6	6.63	6.22	6.53	6.69	6.17	5.3	4.94	4.59	5.73	6.58	5.95	5.64	5.97	5.94	5.38	5.55	5.64	6.81
Nitrite	mg-N/L	0.78	0.0852	0.0974	0.0968	0.106	0.111	0.107	0.103	0.0859	0.0737	0.0536	0.0411	0.0329	0.0489	0.06	0.0349	0.0311	0.0381	0.0425	0.041	0.0336	0.0401	0.0608
Total ammonia	mg-N/L	1.3	0.0352	0.0212	0.034	0.0227	0.0498	0.0545	0.0419	0.0568	0.0504	0.035	0.0234	0.0196	0.0289	0.0481	0.0324	0.0252	0.0279	0.0444	0.0401	0.0482	0.0436	0.0477
Dissolved phosphorus	mg-P/L	-	0.0023	<0.0020	0.0032	0.0029	<0.0020	<0.0020	0.0031	0.0034	0.003	0.004	0.0026	0.0034	0.0026	0.0025	0.0022	0.0025	0.0036	0.0027	0.0023	0.0031	0.0025	0.0037
Total phosphorus	mg-P/L	0.09	0.0044	0.0051	0.009	0.0096	0.0068	0.003	0.0067	0.0053	0.006	0.0067	0.0041	0.0052	0.007	0.0049	0.0056	0.0078	0.0111	0.0103	0.0097	0.0082	0.0094	0.0118
Orthophosphate	mg-P/L	-	0.0012	<0.0010	0.0017	0.0021	<0.0010	<0.0010	0.0014	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	0.0014	0.0013	<0.0010	0.0016	0.0021	<0.0010	<0.0010
Total nitrogen	mg/L	-	6.72	6.69	6.66	6.58	6.51	6.57	6.63	6.69	6.54	5.7	4.99	5.02	5.97	6.77	6.28	5.98	6.33	6.44	5.96	5.87	5.67	7.29
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	166	159	175	174	161	170	159	160	164	192	214	204	182	177	157	184	189	180	184	182	200	183
Chloride	mg/L	-	25.6	26.4	26.7	27.4	28.8	27.4	27.5	28.2	25.7	20.5	18.5	17.1	21.9	28.3	20.8	17.6	17.8	19.9	17.9	19	19.5	24.2
Fluoride	mg/L	17	0.76	0.77	0.73	0.73	0.69	0.7	0.72	0.72	0.65	0.64	0.71	0.67	0.69	0.6	0.37	0.5	0.6	0.49	0.51	0.5	0.67	0.63
Magnesium	mg/L	-	24.5	21.7	20	21.1	19.7	20	19.3	20.1	23.4	27.6	29.4	29.8	27.6	26.4	26	30.4	28.2	28.1	26.1	29.2	28.3	26
Potassium	mg/L	-	18.3	17.8	17.3	20.5	18.8	18.9	18	18.3	16.7	13.4	10.5	11	14.9	18.2	10.9	8	9.48	10.4	8.06	9.22	10.4	12
Sodium	mg/L	-	87.5	84.2	81.6	90.1	87.7	85	82.2	81	82.5	69	58.1	61.9	72	87.6	54.6	51.6	56.9	59	48.7	55.3	64	71.7
Sulphate	mg/L	1100	582	589	597	593	606	569	595	608	594	595	670	608	605	617	499	596	580	571	534	568	630	610
Total Metals																							
Aluminum	mg/L	-	0.79	0.978	0.832	0.765	0.897	0.852	0.889	1.01	0.971	1.01	0.8	0.868	0.889	1.01	1.15	1.07	0.993	1.11	1.25	1.29	1.25	1.52
Antimony	mg/L	-	0.00164	0.0016	0.00148	0.00158	0.00161	0.00172	0.00159	0.00159	0.00137	0.00117	0.00095	0.00105	0.00121	0.00138	0.00092	0.00078	0.00086	0.00088	0.00081	0.00084	0.00096	0.00101
Arsenic	mg/L	0.028	0.00173	0.00177	0.0017	0.00139	0.00171	0.00173	0.00172	0.00185	0.00171	0.00148	0.00095	0.00102	0.00145	0.00154	0.00091	0.00075	0.00103	0.00107	0.00085	0.00087	0.00119	0.0013
Barium	mg/L	-	0.0893	0.0873	0.0878	0.0885	0.0859	0.0672	0.0615	0.062	0.0567	0.0556	0.0436	0.0478	0.0523	0.0594	0.053	0.047	0.0521	0.0495	0.0462	0.0451	0.0486	0.0548
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.176	0.181	0.175	0.177	0.164	0.156	0.157	0.19	0.184	0.208	0.214	0.215	0.206	0.206	0.134	0.174	0.175	0.167	0.158	0.184	0.213	0.161
Cadmium	mg/L	-	<0.00010	<0.000085	0.000105	<0.000080	<0.000055	<0.000080	<0.000095	<0.000080	<0.00015	<0.00013	<0.000095	<0.00015	<0.00012	<0.00011	<0.00012	<0.00015	<0.00011	<0.00012	<0.00015	<0.00015	<0.00014	<0.00010
Calcium	mg/L	-	164	158	163	159	171	144	158	164	165	200	207	204	185	183	154	193	194	183	187	188	207	182
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	0.00011	0.00013	0.00012	0.00012	0.00012	0.00012	0.00014	0.00016	0.00016
Copper	mg/L	0.033	0.00455	0.00496	0.00453	0.00403	0.00417	0.00321	0.00341	0.00373	0.00437	0.00638	0.00605	0.0066	0.0056	0.00371	0.0093	0.00897	0.0084	0.00757	0.0104	0.00949	0.0114	0.0139
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.047	0.032
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00013	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0114	0.0108	0.0092	0.0093	0.01	0.0079	0.0089	0.0096	0.0091	0.0089	0.0079	0.0088	0.0092	0.011	0.007	0.0071	0.0077	0.0071	0.0064	0.0073	0.0083	0.0072
Magnesium	mg/L	-	24.8	21.9	20.7	18.6	21.5	18	20.2	20.9	22.5	29.8	27.6	29.2	27.3	27.3	24.6	30.2	29.6	30.2	25.5	28.7	27.8	25.7
Manganese	mg/L	3.4	0.072	0.055	0.0634	0.0551	0.0544	0.0477	0.0543	0.054	0.0701	0.0667	0.055	0.0591	0.0596	0.0632	0.0684	0.0564	0.0705	0.0667	0.0599	0.0863	0.0767	0.0808
Mercury	mg/L	-	-	-	<0.0000050	<0.0000050	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	<0.0000050
Molybdenum	mg/L	0.36	0.23	0.205	0.215	0.213	0.244	0.22	0.212	0.219	0.203	0.205	0.179	0.175	0.209	0.222	0.161	0.157	0.17	0.171	0.148	0.165	0.205	0.199
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	0.00056	<0.00050	0.00052	0.00052	0.00053	<0.00050	0.00056	0.0006	0.00059	0.00054
Potassium	mg/L	-	17.3	17.8	16.4	17.6	21.1	17.7	18.2	19.2	16.3	14.3	9.66	9.91	14.4	18.7	10.1	8.37	9.73	10.7	7.64	8.32	10.2	12.2
Selenium	mg/L	0.075	0.0376	0.0382	0.0362	0.0427	0.038	0.0418	0.0407	0.0389	0.0377	0.033	0.0268	0.0258	0.0356	0.0404	0.0354	0.0368	0.038	0.0407	0.0362	0.0385	0.0371	0.0447
Silicon	mg/L	-	5.13	5.35	5.59	5.97	6.01	5.9	5.77	5.78	5.78	6.02	6.14	6.34	5.84	5.78	5.22	6.01	5.95	5.73	5.52	6.3	6.46	5.68
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	0.000018	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	84	81.4	83	86.6	93.7	84.1	87.9	86.1	77.6	74.6	57.2	60.2	72.2	88.7	52.8	48.6	57.8	63.1	50.1	58.3	64.6	74.2
Strontium	mg/L	-	1.8	1.64	1.56	1.58	1.64	1.64	1.63	1.93	2.09	3.84	4.98	5	3.44	2.49	1.69	3.74	3.3	2.8	2.6	2.97	3.68	2.18
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.0013	0.00116	0.00121	0.00103	0.000904	0.000962	0.00103	0.00103	0.00118	0.00147	0.00165	0.00159	0.00142	0.00111	0.0011	0.00141	0.00157	0.00124	0.00126	0.00135	0.00148	0.00121
Vanadium	mg/L	-	0.00268	0.00318	0.0029	0.00331	0.00337	0.00299	0.00277	0.00243	0.00222	0.00185	0.00114	0.0011	0.00154	0.00169	0.00128	0.00105	0.0012	0.00154	0.00131	0.00134	0.00171	0.00189
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0037	0.0047	0.0062	0.0048	<0.0030	0.0034	0.0058	0.0153	0.0044	0.0042	0.0045	0.0043	0.0036

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-08-16	2018-08-21	2018-08-28	2018-09-04	2018-09-10	2018-09-17	2018-09-25	2018-10-02	2018-10-04	2018-10-09	2018-10-16	2018-10-18	2018-10-23	2018-10-30	2018-11-06	2018-11-13	2018-11-20	2018-11-27	2018-12-04	2018-12-06	2018-12-11	2018-12-18
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.101	0.105	0.0797	0.0873	0.0652	0.0836	0.11	0.0753	0.0828	0.0897	0.105	0.118	0.0968	0.0892	0.136	0.178	0.119	0.138	0.128	0.168	0.142	0.148
Antimony	mg/L	-	0.00167	0.00161	0.00157	0.00161	0.00156	0.00155	0.0015	0.0015	0.00144	0.00107	0.00095	0.00099	0.00123	0.00131	0.00093	0.0009	0.00096	0.00095	0.00082	0.0008	0.00095	0.00108
Arsenic	mg/L	-	0.00155	0.0015	0.00154	0.00112	0.0015	0.00153	0.00155	0.00166	0.00149	0.00121	0.00087	0.00099	0.00128	0.00136	0.00071	0.00058	0.0009	0.00069	0.00058	0.00062	0.00076	0.00076
Barium	mg/L	-	0.0904	0.0911	0.0893	0.0988	0.0785	0.0716	0.0619	0.0581	0.0562	0.0555	0.046	0.0479	0.0534	0.0577	0.0548	0.0464	0.0526	0.0527	0.0457	0.0471	0.0466	0.0574
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.163	0.16	0.158	0.154	0.16	0.148	0.158	0.155	0.177	0.186	0.21	0.199	0.182	0.197	0.124	0.161	0.155	0.153	0.145	0.147	0.182	0.152
Cadmium	mg/L	0.00034	<0.000070	<0.000060	<0.00020	<0.000080	0.0000392	<0.000060	<0.00010	<0.000080	<0.000080	<0.000085	<0.00011	<0.00015	0.000106	<0.00012	<0.00011	0.0000998	<0.000095	<0.00010	<0.000090	<0.00012	<0.00015	<0.00010
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.0001	<0.00010	0.0001	0.0001	0.00012	<0.00010	0.00014
Copper	mg/L	-	0.00181	0.00201	0.00216	0.00198	0.00176	0.00154	0.00174	0.00167	0.00153	0.00244	0.00332	0.00339	0.00282	0.00214	0.00464	0.00504	0.004	0.00352	0.00429	0.00432	0.00403	0.00441
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0112	0.0098	0.01	0.0098	0.0096	0.009	0.0089	0.0094	0.0093	0.0081	0.0081	0.0085	0.0091	0.0105	0.007	0.0072	0.0071	0.0071	0.0066	0.0069	0.0077	0.0072
Manganese	mg/L	-	0.0554	0.0496	0.0609	0.0572	0.0501	0.0491	0.0519	0.0497	0.0036	0.04	0.0537	0.0569	0.0554	0.0619	0.0669	0.0543	0.0507	0.0615	0.0618	0.0811	0.0699	0.0773
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.222	0.214	0.228	0.223	0.223	0.231	0.205	0.217	0.226	0.19	0.18	0.185	0.219	0.22	0.164	0.176	0.179	0.17	0.168	0.161	0.191	0.205
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0384	0.0363	0.036	0.0398	0.0394	0.0392	0.0402	0.0393	0.037	0.0325	0.0263	0.0268	0.0368	0.04	0.0357	0.0344	0.036	0.0374	0.035	0.0357	0.0366	0.0411
Silicon	mg/L	-	4.79	4.93	5.34	5.64	5.53	5.54	5.32	5.36	5.3	5.6	5.97	5.98	5.56	5.52	4.87	5.46	5.22	5.17	5.4	5.57	5.43	5.12
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.8	1.71	1.77	1.64	1.52	1.62	1.62	1.93	2.39	3.59	5.33	5.25	3.55	2.35	1.74	3.87	3.43	2.8	2.84	2.94	3.69	2.34
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00123	0.000963	0.00107	0.000841	0.000792	0.000733	0.000915	0.00083	0.00112	0.00146	0.00164	0.0017	0.00131	0.000918	0.000983	0.00145	0.00151	0.00122	0.00128	0.00142	0.00136	0.00123
Vanadium	mg/L	-	0.00209	0.00248	0.0025	0.003	0.00288	0.00265	0.00237	0.00201	0.00153	0.00127	0.00104	0.00103	0.00124	0.00133	0.0008	0.00087	0.00101	0.00114	0.00106	0.00111	0.00126	0.00157
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-12-27	2019-01-02	2019-01-08	2019-01-15	2019-01-22	2019-01-29	2019-02-05	2019-02-12	2019-02-19	2019-02-21	2019-02-26	2019-03-11	2019-03-12	2019-03-14	2019-03-19	2019-03-26	2019-03-26	2019-04-02	2019-04-04	2019-04-10	2019-04-16	2019-04-23
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1351.4	1429.8	1395.2	1415.1	1410.9	1475.5	1359.4	1364	1414.7	1430.1	1404.2	1426.5	1437	1386	1379	919.5	918.3	817.5	848	965.9	1058.1	1097
pH	pH units	-	7.58	7.4	7.44	6.97	7.21	7.16	7.25	7.23	6.75	7.17	7.16	7.05	6.9	7.15	6.88	7.13	7.32	7.3	7.35	7.4	6.78	7.4
Turbidity	NTU	-	1.94	1.76	1.87	2.41	2.18	2.46	2.26	1.08	2.17	2.26	4.3	3.4	1.96	4.51	1.71	4.11	2.53	4.14	0.97	5.15	1.54	1.76
Temperature	C	-	2.338	2.751	2.342	4.6	3.721	4.577	0.972	7.6	3.43	4.329	1.591	3.266	2.894	4.345	4.267	4.141	3.606	4.361	4.4	5.626	7.447	8.274
Dissolved oxygen	%	-	94.1	-	-	94.8	90.6	91.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	12.84	-	-	12.16	11.9	11.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	58.5	69.5	73.5	72.4	52.8	71.2	54.8	42.6	45.7	43	43.8	44.3	42.8	38.5	35.5	81.2	81.5	79.4	74.8	83.1	86.6	77.1
Specific conductivity	uS/cm	-	1320	1370	1380	1360	1390	1370	1430	1300	1360	1320	1360	1420	1400	1340	1320	931	917	806	811	983	1080	1010
pH	pH units	-	7.68	7.8	7.5	7.76	7.49	7.75	7.54	7.55	7.44	7.57	7.5	7.27	7.31	7.63	7.42	7.73	7.73	7.52	7.81	7.57	7.74	7.74
Total suspended solids	mg/L	30	18.5	7.2	8.9	8.5	10.7	8.5	5.4	7.3	8.3	5.2	6.5	8	7.3	6.8	6.4	5.3	4.9	5.6	5.5	6.1	6.2	5.3
Turbidity	NTU	-	1.02	1.75	2.14	1.24	1.41	1.51	1.65	1.09	4.39	2.16	1.64	2.11	2.01	2.05	1.6	2.01	2.06	1.84	1.27	1.89	2.03	1.53
Hardness, as CaCO3	mg/L	-	575	617	615	592	533	626	559	513	565	490	515	543	539	478	532	398	430	390	433	479	557	564
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1040	1100	1050	1060	1020	1100	1030	1060	1100	1050	1100	1070	1070	1030	1050	676	673	518	632	725	785	805
Dissolved organic carbon	mg/L	-	4.7	3.65	3.71	4.06	5.79	4.18	5.12	5.26	5.46	5.68	6.47	5.71	5.89	6.2	6.42	4.56	4.52	4.73	4.93	4.34	1.3	4.76
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	6.16	5.43	6.01	5.44	6.2	5.43	6.13	6.5	6.28	6.51	6.35	6.66	6.41	6.21	6.22	4.34	4.15	4.34	4.49	4.48	5.67	5.91
Nitrate + nitrite	mg-N/L	-	6.22	5.48	6.05	5.5	6.28	5.49	6.24	6.63	6.45	6.67	6.53	6.81	6.56	6.39	6.38	4.35	4.16	4.34	4.49	4.48	5.67	5.91
Nitrite	mg-N/L	0.78	0.063	0.0531	0.0399	0.0594	0.0833	0.061	0.113	0.136	0.165	0.16	0.173	0.147	0.148	0.173	0.162	0.0159	0.0124	<0.0050	<0.0050	<0.0050	<0.0050	0.0075
Total ammonia	mg-N/L	1.3	0.0362	0.0613	0.0525	0.0386	0.0335	0.0373	0.036	0.0386	0.0466	0.048	0.0507	0.0437	0.0431	0.0379	0.0288	0.0194	0.0217	0.019	0.0273	0.015	0.0157	0.0131
Dissolved phosphorus	mg-P/L	-	0.0035	0.003	0.0023	0.0022	0.003	0.0029	0.0027	0.0041	0.0038	0.0031	0.0027	0.0024	0.0025	0.0026	0.0029	0.0021	<0.0020	0.0034	0.0028	<0.0020	0.0058	0.0025
Total phosphorus	mg-P/L	0.09	0.0086	0.0079	0.0171	0.0138	0.0109	0.011	0.0134	0.0121	0.012	0.0183	0.0125	0.0195	0.017	0.007	0.0073	0.0083	0.0074	0.0082	0.0039	0.0046	0.0081	0.0058
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	6.62	5.75	5.66	5.53	6.82	5.68	6.5	6.77	6.87	7.1	6.75	6.74	6.6	6.52	6.43	4.39	4.51	4.6	4.67	4.52	6.07	6.19
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	187	202	201	195	177	209	185	170	186	163	170	180	178	159	175	121	132	120	133	148	177	173
Chloride	mg/L	-	24.6	24.5	23.9	21.2	25.1	22.8	27.3	29.7	30.2	31.4	31.8	34.8	34.2	35	36.5	13.8	12.8	10	10.2	10.2	10.7	11.1
Fluoride	mg/L	17	0.66	0.59	0.61	0.68	0.67	0.69	0.74	0.74	0.72	0.76	0.78	0.67	0.67	0.8	0.74	0.26	0.25	0.17	0.16	0.28	0.26	0.24
Magnesium	mg/L	-	26	27.3	27.3	25.8	21.9	25.3	23.4	21.3	24.5	20.2	21.9	22.8	22.9	19.8	23	23.6	24.1	22.1	24.3	26.3	27.9	32.2
Potassium	mg/L	-	11.6	10.2	8.71	9.29	11.2	9.36	12.3	14.9	16.5	15	14.1	15.6	16.1	14.6	18.5	3.52	3.25	2.02	2.11	2.09	2.48	2.56
Sodium	mg/L	-	74.2	75.2	63.2	73.7	79.3	70.6	85.9	93.4	97.5	88	93	96.3	97.4	94	107	27	25.4	14.5	16.2	18.5	19.2	21
Sulphate	mg/L	1100	631	631	684	620	602	652	634	640	619	642	625	640	619	621	626	375	367	324	335	436	467	443
Total Metals																								
Aluminum	mg/L	-	1.2	1.12	1.42	1.13	0.934	1.13	1.19	1.09	1.19	0.838	1.12	1.51	1.47	1.43	1.2	0.652	0.709	0.804	0.662	1	1.07	0.898
Antimony	mg/L	-	0.00106	0.00087	0.00089	0.00082	0.00096	0.00093	0.00105	0.00123	0.00111	0.00112	0.00109	0.00109	0.00118	0.00113	0.00132	0.00038	0.0004	0.00029	0.00032	0.00037	0.00038	0.00037
Arsenic	mg/L	0.028	0.00122	0.00092	0.00085	0.00119	0.00113	0.00111	0.00143	0.00166	0.00144	0.00128	0.00138	0.00142	0.00134	0.00186	0.00131	0.00039	0.0004	0.00027	0.0004	0.0004	0.0004	0.00047
Barium	mg/L	-	0.0512	0.0527	0.0485	0.0514	0.0542	0.0498	0.0484	0.0549	0.0483	0.0499	0.051	0.0469	0.0531	0.0496	0.0496	0.0326	0.032	0.0285	0.0303	0.0306	0.0315	0.0306
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.173	0.199	0.209	0.191	0.162	0.207	0.171	0.144	0.149	0.146	0.155	0.144	0.142	0.159	0.128	0.088	0.089	0.06	0.058	0.112	0.106	0.084
Cadmium	mg/L	-	<0.00015	<0.00011	0.0000823	<0.00020	<0.00011	<0.00013	<0.00011	<0.000090	<0.00015	<0.000095	<0.00020	<0.00011	<0.00010	<0.00020	<0.000075	<0.00010	<0.00011	0.0000786	<0.000080	<0.00015	<0.00010	<0.000080
Calcium	mg/L	-	187	197	206	180	189	207	177	171	173	177	174	164	180	170	168	129	129	121	133	152	175	166
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00017	0.00014	0.00011	0.00011	0.00015	0.00011	0.0001	0.00015	0.00014	0.00015	0.00012	0.00012	0.00013	0.00012	0.00023	0.00023	0.00013	0.00015	0.00013	0.00012	0.00013
Copper	mg/L	0.033	0.0075	0.00608	0.00685	0.00766	0.00531	0.00677	0.00568	0.00525	0.006	0.00722	0.00591	0.00547	0.00579	0.00495	0.00527	0.00956	0.0101	0.0109	0.00963	0.00999	0.0101	0.0103
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000068	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0077	0.008	0.0075	0.006	0.0062	0.0063	0.0055	0.0057	0.0057	0.0055	0.0056	0.0057	0.0059	0.0061	0.006	0.003	0.0029	0.0025	0.0026	0.0035	0.0035	0.0036
Magnesium	mg/L	-	24.5	26.8	28.4	24.5	22.6	26.8	22.9	21.4	21.7	21.3	22.1	20.4	24.1	21.6	20.5	21.7	20.7	21.4	24	26.7	29.4	31.2
Manganese	mg/L	3.4	0.0739	0.136	0.109	0.0776	0.0753	0.107	0.0826	0.0862	0.0932	0.089	0.1	0.0894	0.0979	0.0815	0.0753	0.105	0.103	0.0518	0.0533	0.0528	0.0561	0.0563
Mercury	mg/L	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.213	0.205	0.188	0.178	0.21	0.218	0.234	0.269	0.25	0.25	0.244	0.249	0.266	0.264	0.281	0.0869	0.0836	0.0694	0.0773	0.0943	0.107	0.108
Nickel	mg/L	-	0.00052	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061
Potassium	mg/L	-	11	9.56	8.47	8.75	11.2	9.95	11.7	15.1	13.2	15	14.3	13	17.1	15.8	16.1	3.58	3.31	2.02	2.05	2.13	2.54	2.6
Selenium	mg/L	0.075	0.0423	0.0337	0.0361	0.0349	0.0397	0.0341	0.0388	0.044	0.0453	0.0443	0.0442	0.0414	0.0425	0.0443	0.0404	0.0262	0.0261	0.0308	0.0305	0.0344	0.0428	0.042
Silicon	mg/L	-	6.03	6.01	6.45	5.96	5.82	6.37	5.67	5.35	5.29	5.38	5.09	5.04	5.37	5.15	4.78	5.73	5.72	5.09	5.22	5.55	5.25	5
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	75.5	72.3	66	68.5	79	72.2	84.3	99.7	89.9	99.4	96	83	101	106	97.4	26	24.1	15.2	16	19.1	20.9	21.5
Strontium	mg/L	-	3.06	2.98	3.79	3.26	2.2	3.91	2.55	1.75	1.58	1.64	1.56	1.54	1.65	1.56	1.53	1.46	1.56	1	1.27	2.14	2.21	1.83
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00131	0.00147	0.00163	0.00132	0.000964	0.00141	0.00103	0.000763	0.000765	0.000715	0.000759	0.000785	0.000751	0.000647	0.000644	0.000861	0.000884	0.000818	0.000765	0.00112	0.00126	0.0011
Vanadium	mg/L	-	0.00236	0.00171	0.00159	<0.0030	0.00236	0.00204	0.00229	0.0028	0.00242	0.00231	0.00228	0.00224	0.00249	0.00315	0.00257	0.00096	0.00091	0.00067	0.00074	0.00068	0.00068	0.00066
Zinc	mg/L	0.059	0.0041	0.0044	0.0057	0.0051	0.0061	0.0052	<0.0030	0.0074	<0.0030	<0.0030	<0.0030	0.0038	0.0041	<0.0030	0.0034	0.004	0.0044	0.0037	0.0037	0.005	0.0046	0.0036

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-12-27	2019-01-02	2019-01-08	2019-01-15	2019-01-22	2019-01-29	2019-02-05	2019-02-12	2019-02-19	2019-02-21	2019-02-26	2019-03-11	2019-03-12	2019-03-14	2019-03-19	2019-03-26	2019-03-26	2019-04-02	2019-04-04	2019-04-10	2019-04-16	2019-04-23
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.147	0.142	0.146	0.133	0.138	0.135	0.0741	0.0819	0.0871	0.0684	0.107	0.0939	0.0915	0.121	0.0996	0.0763	0.089	0.114	0.123	0.125	0.177	0.0967
Antimony	mg/L	-	0.00103	0.00091	0.00081	0.00083	0.00084	0.00089	0.00101	0.00114	0.00111	0.00113	0.00108	0.00108	0.00112	0.00124	0.00129	0.00036	0.00037	0.0003	0.00038	0.00034	0.00039	0.00035
Arsenic	mg/L	-	0.00084	0.00068	0.00059	0.00072	0.00076	0.00081	0.00087	0.00097	0.00089	0.00078	0.00079	0.00073	0.00072	0.00092	0.00085	0.00029	0.00027	0.00023	0.00054	0.00025	0.00029	0.0005
Barium	mg/L	-	0.054	0.0535	0.047	0.0529	0.0512	0.0502	0.0485	0.0514	0.0537	0.051	0.049	0.0508	0.0502	0.0461	0.0511	0.0341	0.034	0.0276	0.0313	0.0309	0.0339	0.0308
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.175	0.18	0.173	0.186	0.142	0.195	0.151	0.141	0.14	0.137	0.138	0.128	0.127	0.129	0.116	0.076	0.084	0.052	0.051	0.097	0.096	0.074
Cadmium	mg/L	0.00034	<0.00011	<0.00015	0.0000956	<0.00020	<0.00016	<0.00015	<0.00014	<0.00010	<0.000095	<0.00011	<0.00013	<0.000095	<0.00010	0.000177	<0.000090	<0.000090	<0.000095	<0.000065	<0.000070	<0.00015	<0.00010	<0.00010
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00018	0.00013	0.0001	<0.00010	0.00014	0.0001	<0.00010	0.00014	0.00012	0.00013	0.00011	0.00011	<0.00010	<0.00010	0.0002	0.00021	0.00012	0.00012	0.00012	0.00011	0.00012
Copper	mg/L	-	0.00319	0.00298	0.00307	0.0031	0.00273	0.00265	0.00248	0.00237	0.00221	0.0025	0.00251	0.00251	0.00238	0.00196	0.00258	0.00572	0.00609	0.00645	0.00613	0.00546	0.00589	0.00597
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0073	0.008	0.0069	0.0063	0.0055	0.0064	0.0055	0.0057	0.0051	0.0051	0.0054	0.0058	0.0057	0.0055	0.006	0.003	0.0032	0.0024	0.0026	0.0034	0.0037	0.0034
Manganese	mg/L	-	0.0715	0.14	0.106	0.0781	0.0682	0.103	0.0798	0.0803	0.099	0.0879	0.0969	0.0944	0.0887	0.0671	0.0819	0.105	0.104	0.0492	0.0521	0.0512	0.055	0.0541
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.206	0.218	0.184	0.184	0.178	0.209	0.236	0.243	0.254	0.234	0.242	0.256	0.254	0.248	0.292	0.0855	0.0913	0.0714	0.0771	0.0905	0.104	0.0979
Nickel	mg/L	-	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0383	0.0353	0.0408	0.0335	0.0359	0.035	0.0421	0.043	0.0433	0.0408	0.0445	0.041	0.0397	0.0434	0.0405	0.0304	0.0312	0.0295	0.031	0.037	0.0429	0.0455
Silicon	mg/L	-	5.39	5.9	6.03	5.93	4.99	5.75	5.33	5.02	5.09	5	4.84	4.74	4.69	4.48	4.79	5.06	5.34	4.78	5.01	5.29	4.91	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.95	3.25	3.71	3.49	1.84	3.73	2.57	1.68	1.73	1.57	1.56	1.55	1.5	1.57	1.62	1.46	1.62	1.07	1.26	2.03	2.14	1.68
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00115	0.00142	0.0015	0.00124	0.000799	0.00128	0.000904	0.000747	0.000615	0.000612	0.000639	0.000581	0.000519	0.00054	0.000482	0.000793	0.000876	0.000788	0.000771	0.00108	0.00127	0.00104
Vanadium	mg/L	-	0.00203	0.0016	0.00136	0.00169	0.00192	0.00167	0.002	0.00231	0.00204	0.00197	0.00191	0.00199	0.00202	0.00212	0.00233	0.00072	0.00072	0.00055	0.00057	0.00053	0.00054	0.0006
Zinc	mg/L	-	<0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-04-30	2019-05-02	2019-05-08	2019-05-15	2019-05-21	2019-05-28	2019-06-04	2019-06-11	2019-06-18	2019-07-09	2019-07-15	2019-07-16	2019-07-23	2019-07-30	2019-08-06	2019-08-13	2019-08-20	2019-08-27	2019-09-03	2019-09-10	2019-09-17	2019-09-24
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1183.3	1220	1250.6	1241.8	1243	1298.1	1354.4	1403.9	1445.4	1354.3	1194.3	1355.6	1163.2	1286.5	1281.6	1334.2	1331.1	1298	1344.2	-	1155	1115
pH	pH units	-	7.26	7.2	7.23	6.9	7.37	7.1	7.43	7.51	7.29	7.12	7.4	7.44	7.13	7.42	7.18	7.2	6.97	7.12	7.15	-	7.09	7.46
Turbidity	NTU	-	1.63	1.11	1.51	1.55	0.72	1.39	0.89	0.75	0.86	2.22	2.97	0.08	1.94	2.56	2.12	0.78	0.84	0.62	1.71	-	2.99	0.99
Temperature	C	-	8.264	8.2	10.612	14.28	15	15.972	16.58	15.304	18.411	16.45	16.431	16.821	16.509	16.481	17.361	17.606	16.263	15.7	16.961	-	12.398	11.6
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	86.6	93.6	70	57	72.1	80.6	79.4	86	88.4	97.4	97.6	96.5	97.6	104	106	87.8	91.3	72.5	72	65.6	74.9	88.6
Specific conductivity	uS/cm	-	1170	1190	1180	1240	1270	1300	1340	1410	1350	1320	1170	1190	1150	1230	1240	1340	1320	1290	1290	1320	1120	1080
pH	pH units	-	7.86	7.58	7.71	7.77	7.95	7.93	7.9	7.96	8.07	8.1	7.97	8.06	7.76	7.99	8.14	8.06	8.15	7.9	8.03	7.63	7.67	7.94
Total suspended solids	mg/L	30	7.1	8.4	6.4	4.1	5.5	3.6	2.5	3.6	2.9	7.6	5	3.2	6.8	5.5	8.4	4.7	4	2.5	4.4	3.1	5.3	5.8
Turbidity	NTU	-	1.51	1.57	1.58	1.32	1.43	1.06	0.55	0.57	0.41	1.14	1.47	1.24	1.53	1.11	1.11	0.79	0.74	0.51	0.64	0.57	1.55	1.27
Hardness, as CaCO3	mg/L	-	660	611	531	526	595	607	642	660	746	720	641	573	554	601	657	592	631	614	559	617	530	563
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	942	971	925	924	956	1030	1080	1060	1150	1060	947	912	926	1090	999	1050	1090	918	1070	1100	908	919
Dissolved organic carbon	mg/L	-	4.03	4.42	4.47	5	4.34	3.7	3.65	3.18	3.34	4.16	4.37	4.67	5.17	3.67	3.68	3.19	2.67	2.49	2.38	2.39	4.6	4.23
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	6.06	6.37	6.45	6.11	6.54	6.09	5.8	6.99	8.08	8.2	6.72	6.46	6.09	5.76	5.57	5.16	5.44	5.56	5.31	5.83	5.48	6.15
Nitrate + nitrite	mg-N/L	-	6.07	6.38	6.5	6.18	6.58	6.14	5.84	7.03	8.11	8.22	6.74	6.48	6.11	5.77	5.58	5.18	5.46	5.58	5.33	5.86	5.49	6.16
Nitrite	mg-N/L	0.78	0.0124	0.0061	0.0509	0.0733	0.0452	0.0528	0.0388	0.0324	0.0306	0.0235	0.0183	0.0172	0.013	0.0131	0.0129	0.018	0.0185	0.013	0.0206	0.0274	0.0133	0.0112
Total ammonia	mg-N/L	1.3	0.0146	0.018	0.0088	0.0189	0.0399	0.0388	0.0189	0.0314	0.0379	0.0198	0.0184	0.0221	0.0221	0.0166	0.0143	0.0251	0.0273	0.0351	0.0348	0.0452	0.04	0.0261
Dissolved phosphorus	mg-P/L	-	0.0022	0.0024	0.0027	0.0021	<0.0020	0.0043	0.0028	0.0031	<0.0020	0.0037	0.0025	<0.0020	0.0024	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	0.0027
Total phosphorus	mg-P/L	0.09	0.0081	0.0256	0.0067	<0.0020	0.0047	0.0044	0.0049	0.0092	0.0072	0.0081	0.0067	0.0094	0.0065	0.0056	0.0032	0.0079	0.0032	0.0082	0.0091	0.0053	0.0059	0.0048
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0023
Total nitrogen	mg/L	-	6.1	6.6	6.53	6.79	7.28	6.25	6.28	7.16	40.1	8.6	6.98	33.7	6.73	6.14	5.9	5.54	5.79	5.9	27.7	5.77	5.53	6.22
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	211	191	164	167	187	191	207	207	238	224	203	180	169	188	211	189	199	195	176	192	164	169
Chloride	mg/L	-	11.6	11.5	18.4	21.6	17.5	19.3	19.2	18	16.7	12.5	13.6	13.6	12.9	13.8	13.1	16.4	16.5	20.6	21	22.9	18.2	16.5
Fluoride	mg/L	17	0.35	0.36	0.46	0.46	0.39	0.54	0.54	0.55	0.59	0.39	0.37	0.33	0.3	0.4	0.47	0.54	0.57	0.59	0.57	0.7	0.45	0.37
Magnesium	mg/L	-	32.6	32.4	29.3	26.8	31	31.3	30.2	34.5	36.7	39.1	32.5	30.2	32.3	32.2	31.3	29.1	32.4	30.8	29	33.7	29	34
Potassium	mg/L	-	2.64	2.73	6.57	10.2	8.11	8.01	8.07	7.34	7.15	5.31	3.7	3.47	3.34	3.9	4.1	6.29	7.19	9.69	10.2	11.6	6.62	5.39
Sodium	mg/L	-	26.3	24	46.2	59.9	48.3	53.7	53.5	54.1	52.7	41	29.8	28.7	26.8	32.5	30.8	44.6	50.5	66.5	65	76.3	43.6	41.5
Sulphate	mg/L	1100	535	546	550	521	520	598	614	653	676	603	537	516	488	565	567	600	614	595	558	600	500	536
Total Metals																							
Aluminum	mg/L	-	1.07	1.01	0.917	0.866	0.868	0.855	0.575	0.642	0.543	0.845	0.762	0.631	0.836	0.853	0.868	0.686	0.786	0.673	0.709	0.718	0.652	0.896
Antimony	mg/L	-	0.00044	0.00049	0.00058	0.0008	0.00072	0.00071	0.00071	0.00063	0.00065	0.00058	0.00048	0.00052	0.00049	0.00057	0.00059	0.00077	0.00079	0.001	0.00098	0.00105	0.0007	0.00066
Arsenic	mg/L	0.028	0.00058	0.00064	0.00079	0.00105	0.00088	0.00091	0.00088	0.00098	0.00085	0.001	0.00073	0.00082	0.00073	0.00091	0.00074	0.00114	0.00112	0.00168	0.00177	0.00187	0.0009	0.00086
Barium	mg/L	-	0.0347	0.0338	0.0416	0.0504	0.0517	0.0496	0.0451	0.0436	0.0441	0.0425	0.0437	0.0441	0.0418	0.0401	0.0406	0.0383	0.0344	0.0404	0.0366	0.0368	0.0423	0.0394
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.138	0.127	0.109	0.112	0.113	0.147	0.168	0.19	0.167	0.138	0.117	0.101	0.092	0.157	0.153	0.162	0.176	0.149	0.156	0.158	0.11	0.108
Cadmium	mg/L	-	<0.00015	<0.00020	<0.000085	<0.000090	<0.00011	<0.00010	<0.00013	<0.00020	<0.00010	<0.00011	<0.000090	<0.00018	<0.000080	<0.00020	<0.00015	<0.00013	<0.00010	<0.00015	<0.000055	<0.000080	<0.000090	<0.00010
Calcium	mg/L	-	198	212	165	165	199	194	202	227	224	198	189	191	173	210	202	194	194	188	174	191	167	171
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00013	0.00012	0.00011	0.00012	0.00012	0.00024	0.00013	0.00016	0.00013	0.00013	0.00014	0.00011	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00013
Copper	mg/L	0.033	0.00981	0.00942	0.00805	0.00791	0.00887	0.00732	0.00547	0.00568	0.00651	0.0108	0.011	0.0113	0.0116	0.00855	0.00846	0.00636	0.00598	0.00592	0.00511	0.00523	0.00958	0.0101
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0045	0.0041	0.0053	0.0063	0.0056	0.0068	0.007	0.0074	0.0066	0.0051	0.0044	0.0034	0.0046	0.0057	0.0053	0.0064	0.0067	0.008	0.0079	0.0091	0.0061	0.005
Magnesium	mg/L	-	31.4	33.6	29.9	24.5	30.7	31.6	28.8	33.9	34.4	37.7	33.5	32.9	28.3	32.1	32.1	30.1	30.4	27.2	26	29.6	29	30.3
Manganese	mg/L	3.4	0.0623	0.0628	0.0596	0.0561	0.0551	0.0696	0.0701	0.0937	0.0898	0.0807	0.0645	0.0667	0.054	0.0492	0.0422	0.0515	0.0599	0.0575	0.0556	0.0772	0.0581	0.0656
Mercury	mg/L	-	-	-	<0.0000050	-	-	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.115	0.122	0.147	0.187	0.175	0.177	0.17	0.167	0.174	0.156	0.124	0.132	0.117	0.137	0.149	0.175	0.172	0.23	0.21	0.221	0.154	0.167
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	0.00053	<0.00050	0.00061	0.00058	<0.00050	<0.00050
Potassium	mg/L	-	2.67	2.49	6.6	9.48	7.68	7.92	7.5	6.93	6.29	4.96	3.51	3.54	3.22	4.07	3.95	6.21	6.67	10.2	9.45	11.2	6.4	5.06
Selenium	mg/L	0.075	0.0446	0.0418	0.0453	0.0437	0.0459	0.0421	0.0392	0.0466	0.0466	0.0496	0.0398	0.0406	0.0382	0.0377	0.0394	0.0383	0.0366	0.0402	0.04	0.0393	0.036	0.0376
Silicon	mg/L	-	5.4	5.03	4.77	4.28	5.43	5.48	5.09	5.63	4.84	5.62	5.32	5.49	5.09	5.71	5.55	5.52	5.41	5.45	5.63	5.38	5.53	5.64
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	23.9	24.8	46.5	58.9	48.3	51.4	50.4	54.8	47.6	42.9	30.6	28.2	25.6	34.7	33	44.8	47.7	65.3	65.3	72.2	42.9	36.9
Strontium	mg/L	-	2.72	3.01	2.01	1.69	2.2	2.71	2.99	2.89	2.99	2.28	2.24	2.22	1.72	2.67	2.85	2.91	2.91	2.77	2.34	2.19	1.9	2.35
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00155	0.00152	0.00111	0.000802	0.00121	0.00151	0.00158	0.00166	0.00205	0.00194	0.00147	0.00154	0.0013	0.00166	0.00179	0.00189	0.00196	0.00148	0.00157	0.0017	0.00129	0.0014
Vanadium	mg/L	-	0.00065	0.00077	0.00091	0.00118	0.00107	0.00092	0.00094	0.00092	0.00088	0.00115	0.00094	0.00118	0.00102	0.0013	0.0009	0.00138	0.00137	0.00226	0.00235	0.00235	0.00163	0.00146
Zinc	mg/L	0.059	0.0047	0.0051	0.0031	0.0031	<0.0030	0.0033	0.0037	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-04-30	2019-05-02	2019-05-08	2019-05-15	2019-05-21	2019-05-28	2019-06-04	2019-06-11	2019-06-18	2019-07-09	2019-07-15	2019-07-16	2019-07-23	2019-07-30	2019-08-06	2019-08-13	2019-08-20	2019-08-27	2019-09-03	2019-09-10	2019-09-17	2019-09-24
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.127	0.126	0.12	0.106	0.127	0.13	0.0834	0.121	0.13	0.151	0.13	0.0976	0.131	0.126	0.126	0.166	0.139	0.134	0.117	0.137	0.127	0.141
Antimony	mg/L	-	0.00045	0.00044	0.00061	0.00077	0.00067	0.00062	0.00074	0.00064	0.00069	0.00054	0.00048	0.00049	0.00048	0.00054	0.00057	0.00074	0.00077	0.00098	0.00102	0.00104	0.0007	0.00056
Arsenic	mg/L	-	0.00052	0.00053	0.00079	0.00103	0.00085	0.00093	0.00086	0.00093	0.00094	0.00095	0.00061	0.00065	0.00066	0.00078	0.00072	0.00109	0.00117	0.0015	0.00174	0.00172	0.00085	0.00077
Barium	mg/L	-	0.0362	0.0347	0.0428	0.0553	0.0547	0.0439	0.0483	0.0474	0.0489	0.0469	0.047	0.0475	0.0399	0.0423	0.0401	0.0375	0.0376	0.0402	0.0376	0.0391	0.043	0.0392
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.126	0.115	0.105	0.098	0.105	0.148	0.167	0.168	0.158	0.12	0.111	0.106	0.087	0.134	0.144	0.151	0.156	0.15	0.15	0.13	0.107	0.112
Cadmium	mg/L	0.00034	<0.00011	<0.00012	<0.000085	<0.00010	<0.00016	<0.00011	<0.00014	<0.00013	<0.00020	<0.00022	<0.000090	<0.000080	<0.000070	<0.00012	<0.00010	<0.00013	0.000102	<0.00015	<0.000070	<0.00011	<0.000080	<0.000050
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00012	0.00011	0.00012	0.0001	0.00011	<0.00010	0.00014	0.00012	0.00013	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
Copper	mg/L	-	0.00554	0.00548	0.0045	0.00466	0.00471	0.00449	0.00366	0.0043	0.00527	0.00706	0.00684	0.00707	0.00735	0.00557	0.00554	0.00432	0.00409	0.00336	0.00314	0.00343	0.00592	0.00682
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0043	0.0045	0.0055	0.0062	0.0057	0.0063	0.007	0.0071	0.0069	0.0051	0.0043	0.0043	0.0038	0.005	0.0056	0.0063	0.007	0.0081	0.0081	0.0082	0.0057	0.0052
Manganese	mg/L	-	0.0646	0.0673	0.0485	0.0533	0.0433	0.0582	0.0477	0.0872	0.0953	0.0705	0.0564	0.0552	0.0457	0.037	0.0362	0.0455	0.0561	0.0515	0.0466	0.0762	0.0547	0.0623
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.113	0.111	0.151	0.177	0.16	0.16	0.168	0.171	0.184	0.155	0.12	0.125	0.13	0.138	0.143	0.175	0.182	0.225	0.221	0.222	0.155	0.146
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00075	0.00056	<0.00050	0.00057
Selenium	mg/L	-	0.0437	0.046	0.0495	0.0435	0.0438	0.0447	0.0368	0.0466	0.0493	0.0516	0.038	0.0413	0.0407	0.0391	0.0358	0.0373	0.0362	0.0386	0.0389	0.0411	0.04	0.0394
Silicon	mg/L	-	5.33	5.04	4.57	4.17	4.8	5.09	5.08	5.47	5.09	5.22	5.05	5.23	5.09	5.43	5.5	5.18	5.49	5.13	5.13	5.42	5.45	5.67
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	3.02	2.98	2.13	1.62	2.17	2.54	2.88	3.02	3.12	2.38	2.15	2.15	1.91	2.46	2.87	2.84	3.12	2.67	2.46	2.26	1.86	2.05
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00151	0.00152	0.0011	0.000762	0.00109	0.00131	0.00145	0.00182	0.00204	0.00194	0.00145	0.00152	0.00138	0.00173	0.00177	0.00184	0.00165	0.00142	0.00154	0.00164	0.00133	0.00132
Vanadium	mg/L	-	0.00057	0.00054	0.00075	0.001	0.00087	0.00077	0.00087	0.00083	0.00095	0.00093	0.00082	0.00087	0.00073	0.00078	0.00074	0.00135	0.00129	0.00195	0.00213	0.00224	0.00152	0.00128
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-10-01	2019-10-08	2019-10-15	2019-10-22	2019-10-30	2019-11-05	2019-11-13	2019-11-19	2019-11-26	2019-12-03	2019-12-10	2019-12-18	2019-12-27	2020-01-02	2020-01-15	2020-01-21	2020-02-03	2020-02-11	2020-02-18	2020-02-25	2020-03-03	2020-03-10
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1227.7	1265.8	1183	1348.3	1239.8	1285.5	1242.7	1000.2	1181.7	1268	-	1278.5	1249	1230	1224	1268	1306.5	1279.1	1294.1	1287.2	1278.5	1225
pH	pH units	-	7.53	6.78	7.52	6.79	7.08	6.72	7.09	7.47	7.08	7.41	-	7.11	7.51	7.72	7.86	7.67	7.13	7.24	7.12	6.83	7.08	7.69
Turbidity	NTU	-	2.07	1.78	1.78	2.67	3.25	1.87	2.99	4.96	2.97	1.8	-	1.73	1.85	1.44	2.27	3.47	1.94	2.07	2.1	1.7	1.62	1.39
Temperature	C	-	8.949	8.932	9.6	6.486	6.965	6.652	7.91	3.277	4.144	7.5	-	3.339	3.9	3.8	3.5	4.1	2.957	3.085	3.156	3.781	3.448	3.9
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	85.3	88.5	86.6	85.2	89.2	86.9	92.8	82.8	87.7	89.6	91.6	88.8	89.5	87.8	77.9	76.9	88.5	88	92.2	90.9	86.1	78.4
Specific conductivity	uS/cm	-	1220	1160	1220	1250	1190	1190	1190	971	1130	1220	1260	1290	1300	1260	1290	1280	1250	1230	1250	1240	1280	1270
pH	pH units	-	8.04	7.84	7.86	7.83	7.84	7.71	7.96	7.91	7.82	7.81	7.86	7.93	8	7.92	7.85	7.79	7.72	7.92	7.75	7.72	7.63	7.69
Total suspended solids	mg/L	30	8.2	7.4	8.7	17.4	8.9	10.1	9.9	6.9	6.2	6.8	8.4	6.4	6	7	5.9	6.8	5.2	5.5	8.2	10.4	7.9	5.9
Turbidity	NTU	-	1.42	1.14	1.95	2.7	1.79	1.69	2.25	2.13	1.79	1.48	1.78	1.09	1.48	1.48	2.2	2.38	1.77	1.62	1.68	1.71	1.37	0.97
Hardness, as CaCO3	mg/L	-	605	613	588	581	614	547	568	433	531	624	649	607	679	627	611	578	546	631	550	563	591	522
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	597	546	586	-	-	-	-	-	-
Total dissolved solids	mg/L	-	899	937	965	947	925	783	963	742	848	987	1000	951	1000	969	966	967	985	952	976	1010	962	975
Dissolved organic carbon	mg/L	-	3.54	3.21	2.84	3.29	3.18	3.44	3.29	5.41	4.4	3.25	2.63	2.69	2.47	2.87	3.15	3.19	2.88	2.75	2.62	3.75	3.12	4.7
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.67	6.01	5.67	5.54	5.38	5.19	5.09	5.17	5.48	5.24	5.41	5.29	5.18	5.33	6.03	5.7	5.51	4.7	4.61	4.35	4.88	5.11
Nitrate + nitrite	mg-N/L	-	5.68	6.04	5.68	5.55	5.39	5.2	5.1	5.18	5.48	5.25	5.42	5.31	5.19	5.34	6.04	5.72	5.52	4.71	4.61	4.35	4.88	5.11
Nitrite	mg-N/L	0.78	0.0101	0.023	0.0103	0.016	0.0108	0.0118	0.0138	0.0059	0.0088	0.0102	0.0131	0.0137	0.0121	0.0152	0.016	0.0186	0.0101	0.0055	0.0062	<0.0050	<0.0050	<0.0050
Total ammonia	mg-N/L	1.3	0.0175	0.0139	0.0177	0.0256	0.0218	0.0228	0.0313	0.0304	0.0321	0.0263	0.0328	0.0393	0.0411	0.051	0.0993	0.0691	0.0449	0.0454	0.0394	0.0455	0.0361	0.0361
Dissolved phosphorus	mg-P/L	-	0.0023	<0.0020	<0.0020	0.0022	0.0031	0.0026	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	0.0029	0.0022	0.0029	0.0042	0.0038	0.0026	0.0034	0.003	0.0022	0.0038	0.0032
Total phosphorus	mg-P/L	0.09	0.0046	0.0049	0.0048	0.0205	0.0051	0.0046	0.0141	0.0161	0.0168	0.0095	0.0155	0.0105	0.0058	0.0204	0.0209	0.0205	0.0157	0.0184	0.0145	0.0167	0.0114	0.008
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.003
Total nitrogen	mg/L	-	6.25	6.45	6.04	6.06	5.38	5.49	5.23	5.64	5.91	5.11	5.46	5.91	5.76	5.87	6.29	6.36	5.94	5.19	5.04	4.65	5.26	5.48
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	189	192	183	181	193	171	176	132	161	195	205	190	218	201	193	178	170	201	176	176	184	160
Chloride	mg/L	-	17.1	19	17.9	18.5	16.9	15.9	21	16	14.2	15.8	15.8	16.2	16.5	16.5	17.5	17.8	16.9	16.8	16.6	17.2	18.9	18.5
Fluoride	mg/L	17	0.33	0.42	0.45	0.5	0.46	0.5	0.5	0.29	0.36	0.51	0.59	0.59	0.59	0.57	0.566	0.586	0.559	0.566	0.623	0.591	0.583	0.552
Magnesium	mg/L	-	32.2	32.2	31.8	31.3	31.9	29.3	31.1	25.3	31.4	33.1	33.5	32.5	32.6	30.6	31.3	32	29.4	31.1	27.2	29.7	31.8	30.1
Potassium	mg/L	-	6.2	5.93	6.61	5.91	5.28	5.45	5.2	3.42	4.45	5.92	6.32	6.36	7.3	6.93	8.37	9.49	7.13	8.43	7.16	7.97	9.74	8.16
Sodium	mg/L	-	43.8	42	48.2	45	39.8	43	44	25.4	38.4	46.3	49.7	51.5	55.7	58.6	58.9	64.5	56.7	61.9	55.1	58.9	68.3	62.6
Sulphate	mg/L	1100	514	578	546	564	553	534	548	410	495	568	591	584	578	603	600	580	580	566	577	570	577	562
Total Metals																								
Aluminum	mg/L	-	1.29	0.889	1.14	1.52	1.18	1.06	1.17	1.03	0.984	1.11	1.18	1.26	1.17	1.02	0.826	0.96	0.963	1.21	1.16	1.23	1.1	0.961
Antimony	mg/L	-	0.0007	0.00067	0.00081	0.00072	0.00063	0.00067	0.00068	0.00043	0.00059	0.00075	0.00078	0.00084	0.00083	0.00082	0.00088	0.00089	0.00081	0.0008	0.00087	0.00088	0.00089	0.00084
Arsenic	mg/L	0.028	0.00103	0.001	0.0014	0.00105	0.00081	0.00091	0.00098	0.0006	0.00073	0.00104	0.00108	0.00129	0.00114	0.00142	0.00182	0.00185	0.0013	0.00146	0.00154	0.00153	0.00158	0.00146
Barium	mg/L	-	0.0378	0.035	0.0365	0.0354	0.0351	0.0307	0.0331	0.0295	0.0324	0.034	0.033	0.0343	0.0321	0.0332	0.0349	0.033	0.0341	0.0325	0.0316	0.0323	0.0324	0.0355
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.112	0.128	0.123	0.127	0.125	0.123	0.14	0.073	0.101	0.144	0.158	0.151	0.164	0.164	0.133	0.126	0.136	0.154	0.161	0.158	0.133	0.137
Cadmium	mg/L	-	<0.000085	<0.000090	<0.00023	<0.000060	<0.00010	<0.000090	<0.00010	<0.000060	<0.000085	<0.00013	<0.00013	<0.00020	<0.00015	<0.000120	<0.000130	<0.000200	<0.000100	<0.000115	<0.000175	0.000178	<0.0000750	<0.0000950
Calcium	mg/L	-	176	189	196	184	184	176	175	153	169	190	189	198	202	188	169	185	176	175	189	182	166	177
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00016	0.00015	0.0002	0.00019	0.00016	0.00018	0.0002	0.00016	0.00019	0.00025	0.00025	0.00032	0.00032	0.00034	0.00045	0.00045	0.00039	0.0004	0.00039	0.0004	0.00045	0.00046
Copper	mg/L	0.033	0.0126	0.00823	0.00933	0.0101	0.00903	0.00929	0.0127	0.0119	0.0123	0.0142	0.0151	0.0191	0.0177	0.02	0.0322	0.0336	0.022	0.0242	0.0252	0.0252	0.0281	0.0272
Iron	mg/L	1	<0.030	<0.030	<0.030	0.052	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.067	0.042	0.033	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0056	0.006	0.0066	0.0064	0.0057	0.0057	0.0062	0.0039	0.0053	0.0069	0.0076	0.008	0.0082	0.0083	0.0082	0.0076	0.0071	0.0078	0.0078	0.0074	0.0084	0.0091
Magnesium	mg/L	-	31.4	30.5	33.5	31.1	28.2	28.2	29.9	24.8	30.6	32.5	32.7	34.9	31.4	30.8	29.8	30	29.8	30	30.4	31	30.1	30
Manganese	mg/L	3.4	0.0772	0.0746	0.0854	0.0958	0.0835	0.086	0.106	0.0702	0.0887	0.108	0.11	0.123	0.122	0.146	0.165	0.145	0.121	0.124	0.123	0.124	0.139	0.153
Mercury	mg/L	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-
Molybdenum	mg/L	0.36	0.161	0.162	0.182	0.158	0.161	0.157	0.167	0.108	0.143	0.176	0.173	0.203	0.194	0.205	0.212	0.21	0.198	0.199	0.209	0.205	0.212	0.21
Nickel	mg/L	-	0.00065	0.00071	0.00096	0.00088	0.00083	0.00088	0.00087	0.0006	0.00077	0.00096	0.00101	0.00109	0.00115	0.00116	0.0014	0.00144	0.00125	0.00126	0.00118	0.00127	0.00133	0.00137
Potassium	mg/L	-	5.89	5.38	7.29	5.98	5	4.9	5.26	3.45	4.6	5.62	6.23	6.76	6.96	7.11	7.96	8.27	7.2	7.23	8.03	7.82	8.65	8.66
Selenium	mg/L	0.075	0.037	0.0384	0.0372	0.0369	0.0355	0.0343	0.0336	0.032	0.0385	0.0388	0.0379	0.0409	0.0377	0.0368	0.0392	0.0407	0.0337	0.036	0.0331	0.0337	0.0349	0.0354
Silicon	mg/L	-	5.86	6.07	5.45	5.79	5.76	6.02	5.52	6.14	6.22	5.94	6.61	6.43	6.18	5.94	5.74	5.78	5.64	5.75	5.6	5.58	5.32	5.38
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	43.2	38.2	50.7	47.3	38.8	42.9	44.8	26.5	37.1	45.8	49.6	55.1	52.6	55.5	60.8	64.5	54.8	56.2	57.2	60.3	67.7	63.2
Strontium	mg/L	-	1.99	2.23	2.36	2.34	2.34	2.2	2.44	1.4	1.89	2.62	2.69	2.94	2.89	2.72	2.06	2.09	2.43	2.56	2.7	2.66	2.27	2.1
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010
Tin	mg/L	-	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00154	0.00148	0.00167	0.00165	0.00159	0.00156	0.00183	0.0011	0.00147	0.00192	0.00211	0.00204	0.00218	0.00204	0.00203	0.0019	0.00202	0.00206	0.00215	0.00211	0.00202	0.00196
Vanadium	mg/L	-	0.00152	0.0014	0.00205	0.00155	0.00114	0.00134	0.00134	0.00097	0.00113	0.00136	0.00131	0.00156	0.00155	0.00153	0.00186	0.002	0.00161	0.00158	0.0016	0.00162	0.00169	0.00159
Zinc	mg/L	0.059	0.0038	<0.0030	0.0033	<0.0030	0.0038	0.0031	0.0061	<0.0030	0.0031	0.0044	0.0173	0.0042	0.0039	0.0045	0.0045	0.0046	0.0042	0.0069	0.0039	0.004	0.0039	0.0042

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-10-01	2019-10-08	2019-10-15	2019-10-22	2019-10-30	2019-11-05	2019-11-13	2019-11-19	2019-11-26	2019-12-03	2019-12-10	2019-12-18	2019-12-27	2020-01-02	2020-01-15	2020-01-21	2020-02-03	2020-02-11	2020-02-18	2020-02-25	2020-03-03	2020-03-10
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.13	0.164	0.139	0.165	0.165	0.151	0.185	0.17	0.168	0.142	0.145	0.182	0.16	0.13	0.131	0.186	0.153	0.233	0.176	0.154	0.136	0.121
Antimony	mg/L	-	0.00067	0.00067	0.00076	0.00077	0.00059	0.00069	0.00067	0.00046	0.00054	0.00075	0.00079	0.00077	0.00082	0.00084	0.00086	0.00088	0.00076	0.00078	0.00083	0.00081	0.00081	0.00083
Arsenic	mg/L	-	0.00086	0.0009	0.00106	0.00087	0.00063	0.00075	0.00077	0.00049	0.00058	0.00073	0.0008	0.00081	0.0009	0.00097	0.00128	0.00137	0.00091	0.00102	0.00102	0.00096	0.00123	0.00103
Barium	mg/L	-	0.0389	0.0402	0.0358	0.0374	0.0355	0.0327	0.0316	0.0339	0.0325	0.0362	0.0339	0.0332	0.0367	0.0328	0.0345	0.0364	0.0342	0.0328	0.0298	0.0312	0.0325	0.0336
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.101	0.121	0.102	0.13	0.132	0.132	0.136	0.064	0.094	0.135	0.161	0.144	0.155	0.143	0.124	0.105	0.137	0.166	0.154	0.151	0.145	0.11
Cadmium	mg/L	0.00034	<0.00015	<0.000085	<0.00011	<0.000090	0.0000759	<0.000095	<0.00020	<0.000070	<0.00010	<0.00012	<0.00011	0.0000663	<0.00015	0.00011	<0.000160	<0.0000950	<0.000100	<0.000120	<0.000100	0.000127	<0.0000450	<0.000110
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00136	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00013	0.00015	0.00016	0.00016	0.00016	0.0002	0.00013	0.00019	0.00024	0.00025	0.00027	0.00032	0.00037	0.00038	0.00043	0.00034	0.00038	0.00034	0.00037	0.00043	0.00044
Copper	mg/L	-	0.00604	0.00499	0.00444	0.00433	0.00475	0.00474	0.00576	0.0071	0.00671	0.00615	0.00643	0.0068	0.0075	0.00761	0.0111	0.0115	0.00836	0.00912	0.00818	0.00789	0.00969	0.0103
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0056	0.0057	0.007	0.0061	0.0059	0.006	0.0063	0.0035	0.0052	0.0071	0.0073	0.0068	0.0075	0.0072	0.0076	0.0076	0.0073	0.009	0.0081	0.0078	0.0082	0.0071
Manganese	mg/L	-	0.071	0.0722	0.0745	0.0911	0.0925	0.0897	0.101	0.0637	0.088	0.108	0.113	0.118	0.122	0.14	0.137	0.141	0.119	0.127	0.116	0.119	0.145	0.147
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.159	0.153	0.167	0.176	0.14	0.153	0.16	0.11	0.147	0.174	0.181	0.177	0.187	0.22	0.226	0.222	0.18	0.189	0.198	0.193	0.208	0.198
Nickel	mg/L	-	0.00064	0.00063	0.00071	0.00072	0.00074	0.00086	0.00084	0.00059	0.00071	0.00092	0.00095	0.00102	0.00118	0.001	0.00124	0.00135	0.00111	0.00113	0.00108	0.00121	0.00135	0.00126
Selenium	mg/L	-	0.0345	0.0376	0.0398	0.0394	0.033	0.0375	0.033	0.0301	0.0422	0.0395	0.0433	0.0407	0.0358	0.0362	0.0432	0.0401	0.0349	0.03	0.0308	0.031	0.0366	0.0344
Silicon	mg/L	-	4.98	5.41	5.35	5.33	5.24	5.73	5.27	5.12	5.42	5.78	6.09	5.61	5.4	5.05	5.26	5.1	5.22	5.72	5.3	4.95	5.2	4.89
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2	2.43	2.24	2.55	2.26	2.2	2.33	1.32	1.85	2.65	2.73	2.69	2.92	2.87	2.2	2.09	2.43	2.64	2.63	2.6	2.2	2.05
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00148	0.0016	0.00161	0.00164	0.00161	0.00162	0.0017	0.00104	0.00133	0.00188	0.00211	0.0021	0.00207	0.00209	0.00175	0.00196	0.00214	0.00226	0.00212	0.00205	0.00189	0.00189
Vanadium	mg/L	-	0.00136	0.00126	0.00142	0.00124	0.00111	0.00117	0.00118	0.00078	0.00101	0.00118	0.00118	0.00127	0.00143	0.00134	0.00154	0.00168	0.00136	0.00148	0.0013	0.00137	0.00158	0.00142
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-03-17	2020-03-24	2020-03-31	2020-04-07	2020-04-14	2020-06-02	2020-06-09	2020-06-16	2020-06-24	2020-06-29	2020-07-07	2020-07-14	2020-07-28	2020-08-04	2020-08-11	2020-08-18	2020-08-25	2020-08-31	2020-09-08	2020-09-16	2020-09-22	2020-09-28
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1313	1250	1298	1226	1112	1329	1212	1286	1382	1466	1235	1098	1188	1229	1209	1452	1083.7	1176	1330.2	1196.1	1224.5	1212.6
pH	pH units	-	7.29	7.67	7.31	7.65	7.42	7.59	7.49	7.32	7.51	7.58	7.15	7.56	7.41	7.39	7.35	7.28	7.32	7.23	7.3	7.25	7.15	7.15
Turbidity	NTU	-	2.01	0.086	2.14	2	2.59	1.46	1.76	1.05	0.94	0.96	1.76	1.69	1.01	0.88	1.53	1.16	1.59	0.88	1.92	0.82	2.2	1.2
Temperature	C	-	4.614	6.4	4.289	3.1	4.1	12.4	16.7	12	14.8	13.8	14	14.4	17	17.06	16.1	16.579	15.281	14.3	15.825	13.999	16.662	11.852
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	104	111	107	94.8	91.3	106	105	107	112	112	107	104	105	104	95.8	104	91.9	78.3	90.8	74	72.8	79.5
Specific conductivity	uS/cm	-	1260	1290	1240	1210	1110	1410	1260	1340	1370	1460	1280	1120	1260	1350	1340	1390	1330	1220	1300	1180	1210	1190
pH	pH units	-	7.95	7.89	7.76	7.7	7.58	7.75	7.97	7.86	7.89	7.96	7.93	7.84	7.89	8	7.95	7.94	7.81	7.59	7.64	7.74	7.88	7.7
Total suspended solids	mg/L	30	9	6.5	7.5	6.3	12.3	8	11.2	7.8	6.8	5.2	6.5	7.9	6.4	4.6	4.9	6.7	6.3	6.2	5.7	9	6.8	8.6
Turbidity	NTU	-	1.24	1.11	1.08	1.19	2.06	1.4	1.32	1.31	0.94	1.2	1.69	2	0.82	0.79	0.75	0.82	1.17	1.03	0.92	1.02	1.34	0.79
Hardness, as CaCO3	mg/L	-	617	585	564	544	558	774	667	702	746	798	676	594	668	682	686	760	768	655	648	538	532	574
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	568	613	-	568	-	-	-	760	739	760	635	570	647	680	684	730	645	586	638	684	551	572
Total dissolved solids	mg/L	-	980	988	934	921	853	1050	1040	1080	1190	1200	1040	966	1520	1010	1130	1170	1090	1070	1070	961	976	955
Dissolved organic carbon	mg/L	-	3.32	2.67	2.83	2.86	3.32	3.74	3.53	3.43	3.6	3.01	3.77	4.5	4.2	3.42	3	2.96	3.27	3.38	3.34	3.42	3.89	3.4
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	4.69	4.68	4.76	3.58	4.42	6.55	5.26	5.12	5.07	5.03	4.43	4.39	5.04	5.5	5.35	5.84	5.31	5	5.42	4.4	4.46	4.3
Nitrate + nitrite	mg-N/L	-	4.7	4.69	4.77	3.58	4.42	6.56	5.26	5.12	5.08	5.05	4.43	4.4	5.05	5.51	5.36	5.84	5.32	5.02	5.44	4.42	4.47	4.31
Nitrite	mg-N/L	0.78	0.0064	<0.0050	<0.0050	0.0051	<0.0050	0.008	0.0055	0.0075	0.0162	0.0181	0.0074	0.0054	0.0099	0.0094	0.0153	0.0097	0.0128	0.0146	0.0143	0.0152	0.0066	0.0101
Total ammonia	mg-N/L	1.3	0.0293	0.0346	0.04	0.0328	0.0283	0.0343	0.0313	0.0309	0.0362	0.0392	0.0301	0.0152	0.051	0.032	0.0325	0.0313	0.035	0.0522	0.0376	0.0368	0.0472	0.0366
Dissolved phosphorus	mg-P/L	-	0.0044	0.0024	0.0023	0.0034	0.0025	<0.0020	0.0023	0.0024	0.0029	<0.0020	<0.0020	0.0022	0.0029	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	0.0031	0.0033	0.0025
Total phosphorus	mg-P/L	0.09	0.0083	0.0104	0.0207	0.0086	0.0083	0.005	0.0085	0.0034	0.0044	0.0106	0.0093	0.0059	0.0039	0.0098	0.0047	0.0038	0.003	0.0142	0.003	0.0036	0.005	0.0034
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4.8	4.96	5.16	4.02	4.89	7.47	6.09	5.73	5.44	5.43	4.77	4.83	5.29	5.61	5.95	6.42	5.7	5.54	5.62	4.96	4.77	4.65
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	197	184	177	174	177	248	212	223	240	260	218	188	216	218	220	246	252	208	204	170	163	181
Chloride	mg/L	-	15.8	12.8	13.2	15.8	18	10.6	10.1	10.9	11.4	11.9	10.8	10.4	11.4	12.8	12.5	12.4	12.4	12.9	13.8	14.3	14.8	13.5
Fluoride	mg/L	17	0.575	0.591	0.566	0.53	0.472	0.47	0.353	0.396	0.515	0.556	0.449	0.376	0.408	0.51	0.525	0.582	0.545	0.465	0.512	0.452	0.442	0.435
Magnesium	mg/L	-	30.6	30.6	29.5	26.5	28	37.4	33.4	35.3	35.5	36.6	32.2	30.2	31.4	33.4	33.4	35.6	33.5	32.7	33.7	27.8	30.4	29.9
Potassium	mg/L	-	7.48	5.61	5.23	7.33	7.12	3.81	3.26	3.12	3.48	3.64	3.04	2.76	3.24	3.89	3.79	4.17	4.61	5.29	4.89	5.9	6.42	5.27
Sodium	mg/L	-	57.1	48.9	42.9	54.5	51.4	36.4	30.9	30.2	35.2	37.7	31.7	28	30.1	34.6	34.9	34.9	35.6	38	38	34.7	43	36.8
Sulphate	mg/L	1100	574	569	542	525	518	661	564	633	683	715	601	504	562	659	640	659	625	562	631	545	546	560
Total Metals																								
Aluminum	mg/L	-	0.898	0.859	0.956	0.976	1.16	1.1	1.08	1.1	0.815	0.93	1.08	1.16	0.931	0.919	1.08	0.93	0.891	0.95	0.957	1.01	1.02	1.04
Antimony	mg/L	-	0.00075	0.00066	0.00056	0.00071	0.00062	0.0006	0.00054	0.00055	0.00055	0.00063	0.00053	0.00044	0.00053	0.00053	0.00056	0.00055	0.00053	0.00054	0.00052	0.0005	0.00051	0.0005
Arsenic	mg/L	0.028	0.0013	0.00114	0.00087	0.00132	0.00102	0.00069	0.00064	0.00062	0.00061	0.00068	0.00068	0.00072	0.00075	0.0007	0.00085	0.00081	0.0008	0.00098	0.00083	0.00103	0.00108	0.00096
Barium	mg/L	-	0.0336	0.0321	0.0331	0.0321	0.0326	0.0366	0.0307	0.0328	0.0319	0.033	0.0323	0.0343	0.0347	0.0366	0.0353	0.034	0.0382	0.0423	0.0406	0.0411	0.0399	0.0413
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.16	0.186	0.175	0.139	0.123	0.145	0.139	0.165	0.167	0.176	0.143	0.1	0.124	0.131	0.164	0.17	0.142	0.11	0.139	0.124	0.116	0.13
Cadmium	mg/L	-	<0.000115	<0.000110	<0.000110	0.000109	<0.000100	0.000211	<0.000210	<0.000220	<0.000205	0.000229	<0.000220	<0.000150	<0.000125	<0.000150	<0.000150	<0.000115	<0.000120	<0.000120	<0.000100	<0.0000350	<0.0000850	<0.0000800
Calcium	mg/L	-	177	195	187	180	166	253	226	245	240	245	202	178	205	216	218	235	203	182	200	218	171	180
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00038	0.00028	0.00026	0.00045	0.00058	0.0004	0.00032	0.00035	0.00033	0.00033	0.00031	0.00025	0.00021	0.00018	0.00015	0.00014	0.00013	0.00014	0.00012	0.00012	0.00015	0.0001
Copper	mg/L	0.033	0.0228	0.0161	0.0145	0.0282	0.0784	0.0179	0.0145	0.0125	0.00995	0.0105	0.0118	0.014	0.0107	0.00894	0.00891	0.00831	0.00949	0.0151	0.011	0.0169	0.0146	0.0141
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	0.125	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0074	0.0074	0.0068	0.0072	0.008	0.008	0.0065	0.0073	0.0076	0.008	0.0066	0.0049	0.0062	0.0079	0.0076	0.0082	0.0068	0.0072	0.0069	0.0076	0.0075	0.0076
Magnesium	mg/L	-	30.7	30.5	29.3	29.1	28.6	37.8	32.9	36.1	33.8	36.1	31.9	30.2	32.6	34	34.1	34.7	33.7	32.3	33.5	34	30.2	29.9
Manganese	mg/L	3.4	0.133	0.144	0.124	0.128	0.141	0.206	0.16	0.183	0.19	0.198	0.166	0.15	0.143	0.122	0.0947	0.0972	0.0892	0.0772	0.084	0.0675	0.102	0.0556
Mercury	mg/L	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	<0.0000050	-	-	-	-	<0.0000050	-	-
Molybdenum	mg/L	0.36	0.194	0.168	0.158	0.181	0.17	0.16	0.158	0.17	0.169	0.172	0.149	0.122	0.153	0.169	0.171	0.168	0.161	0.163	0.16	0.207	0.167	0.154
Nickel	mg/L	-	0.00105	0.00088	0.00075	0.00131	0.00132	0.0009	0.00079	0.00079	0.00077	0.00087	0.00074	0.00064	0.00059	0.00088	0.00058	<0.00050	0.00062	0.00064	0.00054	0.00063	0.00061	0.00061
Potassium	mg/L	-	7.42	5.7	5.25	7.71	7.05	3.41	2.99	3.24	3.23	3.5	2.98	2.93	3.6	3.63	4.11	3.71	4.35	5.44	5.11	6.05	6.2	5.39
Selenium	mg/L	0.075	0.033	0.0289	0.0269	0.0287	0.0289	0.0479	0.0432	0.0453	0.0402	0.0413	0.0364	0.0369	0.0455	0.0461	0.0533	0.0496	0.044	0.0409	0.0426	0.04	0.0366	0.0385
Silicon	mg/L	-	6.11	6.35	5.82	5.58	5.41	5.46	5.59	5.81	5.9	6.16	5.8	5.68	5.59	5.4	6.08	6.03	5.36	5.08	6.04	5.2	4.82	5.23
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	59.9	48.8	41.7	57.4	52.3	34.8	28.8	32.7	33.7	37.5	32	27.1	32.5	34.1	36.7	38.2	35.2	38	38.7	41.1	44.6	37.3
Strontium	mg/L	-	2.69	3.09	2.81	2.3	2	3.29	2.9	3.26	3.5	3.54	3.08	2.2	2.5	3.21	3.22	3.4	3.15	2.45	2.95	2.72	2.12	2.57
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00209	0.00222	0.002	0.00185	0.00165	0.00279	0.00233	0.00265	0.00288	0.00294	0.00242	0.00165	0.0019	0.0021	0.00216	0.00237	0.00216	0.00183	0.00204	0.00155	0.00182	0.0018
Vanadium	mg/L	-	0.00137	0.00107	0.001	0.00144	0.00116	0.00088	0.00085	0.00088	0.00093	0.00075	0.00079	0.00087	0.00088	0.00088	0.00088	0.00076	0.00079	0.00099	0.0009	0.00109	0.00097	0.00088
Zinc	mg/L	0.059	0.0049	0.0046	0.0049	0.0051	0.0056	0.007	0.0058	0.0057	0.0053	0.0079	0.0042	0.0039	<0.0030	0.0034	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-03-17	2020-03-24	2020-03-31	2020-04-07	2020-04-14	2020-06-02	2020-06-09	2020-06-16	2020-06-24	2020-06-29	2020-07-07	2020-07-14	2020-07-28	2020-08-04	2020-08-11	2020-08-18	2020-08-25	2020-08-31	2020-09-08	2020-09-16	2020-09-22	2020-09-28
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.144	0.149	0.163	0.142	0.137	0.178	0.14	0.12	0.115	0.0974	0.133	0.149	0.0869	0.103	0.0916	0.141	0.137	0.118	0.125	0.101	0.111	0.107
Antimony	mg/L	-	0.00074	0.00061	0.00061	0.00073	0.00065	0.00056	0.00056	0.00056	0.00057	0.00059	0.00051	0.00049	0.00052	0.00058	0.0005	0.0006	0.00046	0.00052	0.00053	0.00049	0.00048	0.0005
Arsenic	mg/L	-	0.00093	0.00085	0.00064	0.00092	0.00066	0.00065	0.0005	0.00049	0.00055	0.00058	0.00058	0.00058	0.00062	0.00087	0.00073	0.0007	0.00072	0.00085	0.00076	0.0009	0.00092	0.00082
Barium	mg/L	-	0.0339	0.0316	0.0331	0.0329	0.0315	0.0366	0.0327	0.0326	0.0344	0.0356	0.0312	0.0312	0.0321	0.036	0.0359	0.0353	0.0414	0.042	0.0414	0.0402	0.0426	0.0418
Beryllium	mg/L	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.154	0.171	0.154	0.135	0.115	0.146	0.125	0.135	0.171	0.166	0.138	0.104	0.113	0.147	0.144	0.171	0.161	0.112	0.143	0.095	0.097	0.13
Cadmium	mg/L	0.00034	<0.0000650	<0.0000900	<0.000105	<0.0000650	<0.000180	<0.000135	<0.000220	<0.000210	0.000205	<0.000230	<0.000240	<0.000185	<0.000130	<0.000205	<0.000110	<0.000130	<0.000110	0.0000889	<0.000100	<0.0000550	<0.000150	<0.0000900
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00034	0.00027	0.00024	0.00039	0.00056	0.00037	0.00029	0.00029	0.0003	0.00029	0.00027	0.00025	0.00017	0.00017	0.00012	0.00014	0.00012	0.00012	0.0001	0.0001	0.00013	<0.00010
Copper	mg/L	-	0.0094	0.00799	0.00623	0.00988	0.0256	0.00831	0.00748	0.00609	0.00538	0.00509	0.00632	0.00798	0.00589	0.00477	0.00489	0.00663	0.00703	0.0103	0.00792	0.0125	0.0106	0.00999
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0076	0.0071	0.0067	0.0085	0.0067	0.0075	0.006	0.0066	0.0081	0.0078	0.006	0.0049	0.006	0.0071	0.0068	0.0085	0.0076	0.0071	0.0069	0.0065	0.0064	0.0075
Manganese	mg/L	-	0.135	0.137	0.121	0.124	0.127	0.204	0.15	0.167	0.182	0.179	0.155	0.142	0.107	0.0924	0.0718	0.0943	0.0834	0.0703	0.0766	0.0612	0.101	0.0521
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.203	0.169	0.147	0.186	0.174	0.169	0.146	0.155	0.171	0.177	0.149	0.136	0.16	0.173	0.169	0.171	0.146	0.162	0.174	0.147	0.162	0.152
Nickel	mg/L	-	0.00109	0.00081	0.00073	0.00119	0.00138	0.00084	0.00072	<0.00050	0.00064	0.00059	0.00063	0.00057	<0.00050	0.00083	0.00058	0.00053	0.00075	0.00056	0.00054	0.00061	0.00062	0.0006
Selenium	mg/L	-	0.0291	0.0295	0.0277	0.0313	0.0287	0.0542	0.0401	0.0415	0.0453	0.0422	0.0379	0.0365	0.0436	0.055	0.0464	0.0504	0.0412	0.0397	0.0402	0.0402	0.0362	0.0382
Silicon	mg/L	-	5.15	5.72	5.22	5.28	4.91	5.24	5.05	4.94	5.74	5.42	5.48	4.87	5.14	5.35	5.09	5.88	5.38	4.98	5.57	4.37	4.84	5.01
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.88	3	2.71	2.37	2.06	3.58	2.99	3.14	3.54	3.83	3.15	2.37	2.65	3.2	3.22	3.6	3.06	2.58	2.89	2.13	2.08	2.48
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00207	0.00227	0.002	0.0019	0.00164	0.00267	0.00228	0.00258	0.0028	0.00288	0.00214	0.00178	0.00174	0.00214	0.00192	0.00208	0.00198	0.0018	0.00181	0.00142	0.00168	0.00156
Vanadium	mg/L	-	0.00118	0.00096	0.00077	0.00117	0.001	0.00076	0.0007	0.0007	0.00072	0.00074	0.0007	0.00075	0.00057	0.00062	0.00067	0.00066	0.00061	0.00071	0.00069	0.00076	0.0008	0.00077
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-10-06	2020-10-13	2020-10-20	2020-10-27	2020-11-04	2020-11-11	2020-11-17	2020-11-24	2020-12-01	2020-12-08	2020-12-15	2020-12-21	2020-12-29	2021-01-05	2021-01-12	2021-01-19	2021-01-26	2021-02-04	2021-02-16	2021-02-23	2021-03-02	2021-03-09
Parameter																								
Field Parameters																								
Specific conductivity	uS/cm	-	1216	1264.5	1071.1	1328.9	895.6	1119	1319.1	1241	1349.4	1317.8	1175	1334.1	1373.3	1296.9	1176	1202.4	1221.9	1213.5	1206.3	1290.3	1149	1185.5
pH	pH units	-	7.26	7.11	7.58	7.19	7.27	7.58	7.1	7.64	7.56	7.28	7.43	7.46	7.65	7.31	7.62	7.25	7.26	7.52	7.07	6.81	7.51	7.15
Turbidity	NTU	-	2.56	1.94	3.08	3.17	4.63	1.94	2.84	1.05	2.43	1.3	0.93	1.69	1.17	0.86	0.94	1.3	1.96	1.69	2.12	1.38	0.8	1.54
Temperature	C	-	12.399	9.321	5.068	4.804	5.725	3.5	5.696	5	3.511	3.956	5.8	3.912	3.49	3.489	5.6	3.585	3.392	3.772	2.778	3.219	4.2	4.28
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	12.68	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	79.1	93.4	84.6	89.8	79.6	75.5	89.7	105	98.3	98	92.3	98	105	104	90.8	79.5	86.8	97.9	82.5	87.8	91.4	78.6
Specific conductivity	uS/cm	-	1170	1190	1070	1140	865	1150	1320	1280	1310	1240	1230	1230	1300	1240	1170	1120	1160	1230	1130	1190	1160	1140
pH	pH units	-	7.63	7.89	7.73	7.74	7.68	7.76	7.68	7.65	7.94	8.04	7.92	7.91	7.99	7.95	7.75	7.67	8	7.9	7.94	7.87	7.79	7.62
Total suspended solids	mg/L	30	10.3	4.3	7.7	10.5	9.3	6.9	8.2	7.2	8.4	7.3	10.4	8.2	9.1	6.3	6.2	6.1	6.8	6.7	7.5	8	9.8	11.8
Turbidity	NTU	-	0.81	0.69	1.46	1.4	1.75	1.92	1.41	1.03	1.2	1.14	2.16	1.22	1.16	1.43	1.33	1.31	1.22	1.07	1.82	1.91	1.26	1.7
Hardness, as CaCO3	mg/L	-	585	614	540	577	419	601	670	706	756	672	634	722	654	640	554	528	622	655	601	574	588	534
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	552	631	547	582	422	619	636	692	658	682	651	664	681	639	573	541	645	634	614	598	604	592
Total dissolved solids	mg/L	-	1020	878	834	944	642	874	997	1020	1080	1040	976	969	998	982	910	854	878	876	867	902	889	842
Dissolved organic carbon	mg/L	-	3.29	3.36	4.43	3.86	4.54	4.21	3.39	2.94	2.52	2.48	2.85	3.27	2.59	2.68	2.72	2.53	2.64	2.64	2.05	2.97	2.91	2.6
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	3.63	4.38	5.24	4.55	3.55	4.95	5.46	6.13	6.27	6.13	5.46	5.58	5.41	5.61	4.98	5.46	4.61	4.94	3.88	3.72	3.81	4.28
Nitrate + nitrite	mg-N/L	-	3.64	4.38	5.24	4.56	3.55	4.96	5.46	6.14	6.28	6.14	5.47	5.58	5.41	5.62	4.98	5.47	4.61	4.94	3.88	3.72	3.81	4.29
Nitrite	mg-N/L	0.78	0.0089	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	0.0059	<0.0050	0.0105	<0.0050	<0.0050	0.0084	<0.0050	0.0076	<0.0050	0.0056	0.0059	<0.0050	<0.0050	0.0104
Total ammonia	mg-N/L	1.3	0.0343	0.0227	0.016	0.0221	0.0136	0.0208	0.0178	0.0329	0.0334	0.0295	0.0354	0.0349	0.0412	0.0414	0.0385	0.0386	0.0381	0.0508	0.0432	0.0508	0.0436	0.0425
Dissolved phosphorus	mg-P/L	-	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.002	0.0031	<0.0020	0.0021	<0.0020	0.0023	<0.0020	0.0039	0.0039	0.0039	0.0028	0.002	0.0024	<0.0020	<0.0020	<0.0020	0.0021
Total phosphorus	mg-P/L	0.09	0.0033	0.0028	0.0037	0.0054	0.0059	0.0047	0.0039	0.0031	0.0032	0.0046	0.0048	0.0066	0.0064	0.0073	0.0042	0.0053	0.0048	0.0032	0.0053	0.0049	0.004	0.0057
Orthophosphate	mg-P/L	-	0.0021	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4	4.86	5.77	4.95	3.96	5.11	5.84	6.31	6.41	6.2	5.88	5.68	5.56	5.76	5.39	5.81	4.9	5.41	4.31	4.01	4.09	4.7
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	187	200	170	182	129	186	212	227	241	216	200	228	207	208	175	166	200	206	191	182	188	167
Chloride	mg/L	-	13.8	12.9	11.3	12.4	8.9	9.61	10.3	9.75	10.1	10.7	11.3	9.48	8.95	8.97	11.4	12.2	11.6	12.6	12.8	13.4	13.2	13.6
Fluoride	mg/L	17	0.493	0.443	0.286	0.342	0.239	0.292	0.409	0.397	0.422	0.448	0.389	0.481	0.515	0.522	0.452	0.439	0.455	0.455	0.475	0.473	0.532	0.42
Magnesium	mg/L	-	28.5	28.2	28.1	29.9	23.4	33.2	33.8	33.6	37.3	32.3	32.6	37	33.4	29.4	28.4	27.5	29.9	34.1	30.1	29	28.9	28.5
Potassium	mg/L	-	5.32	4.7	3.48	4.03	2.01	2.56	2.71	3	3.16	3.6	3.95	4.52	3.98	4.14	4.83	5.18	5.07	5.85	5.26	5.12	5.08	5.29
Sodium	mg/L	-	35.5	33.2	24.3	31	15.5	21.6	24.7	26.4	31.1	33.1	33.8	40.9	36.1	34.2	37.8	38.7	38.6	43.9	41.6	41.9	40.4	41.7
Sulphate	mg/L	1100	561	547	464	507	378	539	603	612	619	617	551	585	614	590	535	513	531	542	510	547	546	514
Total Metals																								
Aluminum	mg/L	-	1.07	0.985	1.13	1.18	1.22	1.18	1.23	0.963	1.08	1.34	1.68	1.22	1.04	1.08	1.2	1.31	1.51	1.2	1.45	1.46	1.35	1.63
Antimony	mg/L	-	0.00047	0.00046	0.00041	0.00041	0.00028	0.00036	0.0004	0.00045	0.0004	0.00052	0.00049	0.00049	0.00047	0.00056	0.0006	0.0006	0.00062	0.0006	0.00061	0.00059	0.00064	0.00058
Arsenic	mg/L	0.028	0.00084	0.00084	0.0005	0.00054	0.00039	0.00039	0.00042	0.00049	0.00057	0.0007	0.00077	0.00088	0.00077	0.001	0.00096	0.00102	0.001	0.00095	0.00099	0.0009	0.00088	0.00095
Barium	mg/L	-	0.0365	0.0387	0.0376	0.0382	0.0292	0.0354	0.0332	0.0364	0.035	0.0392	0.0363	0.0354	0.036	0.0373	0.0376	0.0379	0.0393	0.04	0.0399	0.0377	0.0378	0.0406
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.14	0.151	0.089	0.112	0.064	0.08	0.117	0.144	0.133	0.142	0.146	0.157	0.165	0.151	0.139	0.115	0.145	0.141	0.158	0.169	0.16	0.127
Cadmium	mg/L	-	0.0000814	<0.000110	<0.0000650	<0.0000700	<0.0000750	<0.000145	<0.000130	<0.000155	<0.000150	<0.000170	<0.000135	<0.000140	<0.000155	<0.000140	<0.000110	<0.000135	0.0000972	<0.000130	<0.000120	0.000128	<0.000140	<0.000100
Calcium	mg/L	-	177	200	173	183	130	192	199	218	208	216	207	210	219	202	180	169	204	202	197	192	193	185
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00011	0.00013	0.00016	0.00012	0.00076	0.00034	0.00021	0.0002	0.00022	0.00022	0.00023	0.00022	0.00023	0.00023	0.00024	0.00023	0.00025	0.00029	0.00026	0.00027	0.00025
Copper	mg/L	0.033	0.0136	0.013	0.0128	0.0135	0.0121	0.0575	0.0288	0.0162	0.0137	0.0138	0.0139	0.0143	0.0122	0.0147	0.0142	0.0156	0.0201	0.0134	0.0306	0.0166	0.0194	0.0166
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.044	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0072	0.0067	0.005	0.0054	0.0028	0.005	0.0052	0.0061	0.0056	0.0064	0.0066	0.0065	0.0072	0.0071	0.0068	0.0067	0.0074	0.0076	0.0074	0.0073	0.008	0.007
Magnesium	mg/L	-	26.6	32	27.7	30.4	23.4	33.9	33.7	36	33.9	34.7	32.6	33.8	32.6	32.8	30	29	32.9	31.4	29.7	28.7	29.6	31.7
Manganese	mg/L	3.4	0.0586	0.0681	0.0646	0.0859	0.042	0.116	0.103	0.111	0.115	0.123	0.139	0.157	0.152	0.152	0.14	0.146	0.137	0.178	0.138	0.17	0.147	0.168
Mercury	mg/L	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.143	0.15	0.128	0.144	0.0916	0.144	0.148	0.146	0.154	0.158	0.162	0.171	0.166	0.166	0.176	0.171	0.187	0.208	0.197	0.184	0.197	0.175
Nickel	mg/L	-	0.0005	<0.00050	<0.00050	0.00052	<0.00050	0.00143	0.00088	0.00068	0.00051	0.00054	0.00061	0.00058	<0.00050	0.00062	0.00068	0.00064	<0.00050	<0.00050	0.0008	0.00074	0.00082	0.00067
Potassium	mg/L	-	5.26	4.82	3.58	4.02	2.02	2.42	2.5	2.89	2.88	3.72	3.66	3.9	3.7	4.42	5.14	5.05	5.28	5.13	5.22	5.09	5.04	5.52
Selenium	mg/L	0.075	0.034	0.0344	0.0391	0.0349	0.0304	0.0525	0.0515	0.0471	0.0484	0.0445	0.0416	0.0428	0.0394	0.0401	0.0446	0.0451	0.0387	0.0378	0.0358	0.0339	0.035	0.0396
Silicon	mg/L	-	4.77	5.5	5.56	5.71	5.32	6.16	6.06	6.6	5.73	6.25	6.01	6.32	6.64	6.38	6.15	5.6	5.94	6.32	5.77	6.02	5.76	6.09
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	38.2	35	24.7	30.7	15	21	24.1	28.5	28.1	35.4	34.3	35.5	32.1	36.9	41.3	39.8	39.4	40.9	39.8	38.2	39.2	42.3
Strontium	mg/L	-	2.53	2.66	1.79	2.31	1.41	2.32	3.02	3.17	2.98	3.25	2.7	2.76	2.94	2.68	2.16	1.73	2.5	2.34	2.26	2.58	2.48	1.94
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.0018	0.00171	0.0013	0.00148	0.000859	0.00109	0.00154	0.00175	0.00179	0.00186	0.00187	0.0021	0.0021	0.00218	0.00196	0.00194	0.00211	0.00203	0.00194	0.00208	0.00226	0.00186
Vanadium	mg/L	-	0.00085	0.00088	0.00079	0.00065	0.00074	0.00062	0.00053	0.00062	0.00074	0.0009	0.00088	0.0009	0.00091	0.00102	0.0012	0.00119	0.00126	0.00122	0.00126	0.0011	0.0012	0.0012
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	0.0033	0.0033	0.0087	0.0077	0.0066	0.0065	0.0056	0.0054	0.0054	0.0056	0.0047	0.0034	0.0034	0.0037	0.0034	0.0043	0.0037	0.0044	0.0031

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-10-06	2020-10-13	2020-10-20	2020-10-27	2020-11-04	2020-11-11	2020-11-17	2020-11-24	2020-12-01	2020-12-08	2020-12-15	2020-12-21	2020-12-29	2021-01-05	2021-01-12	2021-01-19	2021-01-26	2021-02-04	2021-02-16	2021-02-23	2021-03-02	2021-03-09
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.106	0.114	0.11	0.122	0.102	0.116	0.136	0.132	0.132	0.13	0.142	0.201	0.166	0.169	0.139	0.135	0.14	0.138	0.142	0.146	0.127	0.123
Antimony	mg/L	-	0.00052	0.00046	0.00038	0.0004	0.0003	0.0004	0.00042	0.00044	0.00043	0.00051	0.00048	0.00053	0.00049	0.00054	0.00062	0.0006	0.00062	0.00057	0.00063	0.00058	0.00058	0.00055
Arsenic	mg/L	-	0.00075	0.00064	0.0004	0.00042	0.0002	0.00026	0.00027	0.00028	0.00037	0.00036	0.00039	0.00062	0.00052	0.00064	0.0006	0.00057	0.00053	0.00058	0.00054	0.00052	0.00051	0.00048
Barium	mg/L	-	0.037	0.0394	0.038	0.038	0.0284	0.035	0.0358	0.0345	0.0362	0.0363	0.0348	0.037	0.0356	0.035	0.0376	0.0406	0.0385	0.0425	0.0398	0.0389	0.0372	0.0385
Beryllium	mg/L	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.129	0.125	0.083	0.107	0.065	0.084	0.112	0.135	0.144	0.127	0.136	0.146	0.149	0.133	0.118	0.106	0.137	0.13	0.133	0.153	0.146	0.117
Cadmium	mg/L	0.00034	0.0000599	<0.0000750	<0.0000650	<0.0000700	<0.0000600	0.000139	<0.000130	<0.000140	<0.000230	<0.000135	<0.000150	<0.000215	<0.000160	<0.000135	<0.000110	<0.000130	0.0000517	<0.000200	<0.000125	<0.000145	<0.000140	<0.000115
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	0.00011	0.00014	<0.00010	0.00073	0.00033	0.00021	0.00022	0.00018	0.0002	0.00026	0.00021	0.00021	0.00022	0.00022	0.00021	0.00028	0.00029	0.00026	0.00025	0.00024
Copper	mg/L	-	0.0095	0.00946	0.00813	0.00837	0.00636	0.0225	0.0119	0.00825	0.00737	0.00674	0.00625	0.00772	0.00659	0.00727	0.00774	0.00818	0.00863	0.00784	0.0134	0.00748	0.00887	0.00789
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0072	0.0064	0.0047	0.0052	0.0029	0.0056	0.0057	0.0063	0.0064	0.0066	0.007	0.007	0.0072	0.0066	0.0069	0.007	0.0074	0.0076	0.0073	0.0076	0.0075	0.0069
Manganese	mg/L	-	0.0586	0.0615	0.0649	0.0848	0.04	0.12	0.106	0.103	0.117	0.123	0.135	0.164	0.153	0.141	0.138	0.141	0.133	0.191	0.142	0.169	0.151	0.157
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.151	0.145	0.123	0.135	0.09	0.131	0.139	0.137	0.138	0.163	0.15	0.168	0.156	0.158	0.18	0.177	0.176	0.204	0.182	0.183	0.182	0.176
Nickel	mg/L	-	0.00056	<0.00050	<0.00050	<0.00050	<0.00050	0.00133	0.00086	<0.00050	0.00072	0.00059	0.0006	0.00103	0.00062	0.00056	0.00062	0.00065	<0.00050	<0.00050	0.00064	0.00063	0.00066	0.00058
Selenium	mg/L	-	0.0292	0.0312	0.0364	0.0335	0.0297	0.0608	0.0591	0.048	0.0521	0.0431	0.042	0.043	0.0374	0.0403	0.0371	0.0381	0.0358	0.0349	0.0345	0.0331	0.0358	0.0368
Silicon	mg/L	-	4.75	4.67	5.12	5.3	4.89	6.53	5.98	6	6.14	5.82	6.07	6.25	5.85	5.84	5.44	5.23	5.52	5.98	5.6	5.79	5.54	5.41
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.56	2.63	1.81	2.27	1.5	2.24	2.94	3.11	3.11	3.11	2.7	2.88	2.97	2.66	2.1	1.78	2.35	2.48	2.32	2.45	2.38	1.79
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	0.00029	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00162	0.00159	0.00122	0.00138	0.000836	0.00105	0.00148	0.00174	0.00189	0.00196	0.00171	0.00208	0.00218	0.00212	0.00194	0.00172	0.00191	0.00184	0.00174	0.00183	0.00186	0.0017
Vanadium	mg/L	-	0.00068	0.00063	0.00059	0.00058	<0.00050	0.00051	<0.00050	0.00053	0.00061	0.00068	0.00078	0.00091	0.00075	0.00082	0.00107	0.00109	0.00101	0.00116	0.00102	0.00103	0.00097	0.00099
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0075	0.0061	0.0053	0.0055	0.0046	0.0034	0.0038	0.0035	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	0.0033	0.0031	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-03-16	2021-03-23	2021-03-29	2021-04-06	2021-04-13	2021-04-20	2021-04-27	2021-05-04	2021-05-11	2021-05-19	2021-05-25	2021-06-02	2021-06-08	2021-06-15	2021-06-22	2021-06-23	2021-06-29	2021-07-06	2021-07-13	2021-07-21	2021-07-27	2021-08-03
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1165.1	1158.8	1119.4	1130.4	1076.6	822	945	943.1	1063.1	1146.6	1180	1232	1233.6	-	1158	1187	1091	1166.9	1161	1312.7	1120.1	1297
pH	pH units	-	7.08	6.95	7.36	6.91	7.37	7.57	6.92	7.42	7.37	7.42	7.41	7.12	7.8	-	7.52	7.57	7.33	7.73	7.4	7.47	7.31	7.23
Turbidity	NTU	-	1.33	1.31	1.84	1.52	1.61	3.31	2.25	3.75	1.47	1.08	2.45	1.41	1.39	-	1.45	1.03	1.01	1.25	0.64	0.55	0.7	0.21
Temperature	C	-	3.635	4.743	5.314	5.421	5.183	5.815	6.91	8.414	9.967	10.935	12.675	13.643	12.951	-	17.037	17.282	21.279	20.095	19.814	18.87	17.907	19.193
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	78.6	90.6	91.7	101	96.1	78.9	90	78.8	89.1	94.5	104	104	107	112	91.7	90.9	82.1	89	89.6	84.5	83.3	85
Specific conductivity	uS/cm	-	1110	1110	1130	1150	1050	787	899	913	1040	1140	1180	1160	1210	1290	1180	1170	1110	1140	1160	1110	1110	1150
pH	pH units	-	7.76	7.62	8.05	8.01	7.9	7.65	7.76	7.88	8.01	8.04	8.09	8.14	8.11	8.04	7.9	7.91	7.96	8.11	7.85	7.99	7.94	8.03
Total suspended solids	mg/L	30	6.4	11.5	9.8	10.7	9.4	12.7	3.7	7.3	6.4	5.8	7.6	6.9	6.1	7.7	7.3	7.2	5.2	7	6.4	4.6	14	6.4
Turbidity	NTU	-	1.01	1.28	1.61	1.33	1.09	2.63	2.18	1.63	1.28	1.14	1.07	1.29	1.28	1.1	1.04	1.07	1.24	0.92	0.9	0.66	0.7	0.74
Hardness, as CaCO3	mg/L	-	567	559	586	514	503	389	463	524	496	597	591	598	603	704	565	553	545	585	541	502	508	550
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	532	545	550	519	507	388	464	465	499	587	663	575	624	686	572	576	530	541	562	521	528	520
Total dissolved solids	mg/L	-	833	825	846	817	733	564	659	689	784	876	910	957	994	1050	909	927	858	858	919	893	922	917
Dissolved organic carbon	mg/L	-	3.16	2.59	2.9	3.11	2.97	4.2	4.62	4.6	4.71	4.26	4.15	3.89	3.55	3.55	2.8	2.61	2.57	2.39	3.72	5.85	4.59	4.55
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	4.56	3.84	3.49	3.69	3.9	3.18	3.5	3.69	4.54	4.87	4.75	4.34	4.6	4.36	3.88	3.97	3.86	3.44	3.51	3.46	3.31	3.43
Nitrate + nitrite	mg-N/L	-	4.56	3.84	3.49	3.7	3.9	3.18	3.5	3.69	4.54	4.88	4.76	4.34	4.61	4.37	3.89	3.98	3.88	3.45	3.52	3.47	3.32	3.44
Nitrite	mg-N/L	0.78	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0158	0.0068	0.0059	0.0136	0.0103	0.0134	0.0138	0.0161	0.0147	0.014	0.0127	0.0142	0.0122
Total ammonia	mg-N/L	1.3	0.0357	0.0248	0.0213	0.018	0.019	0.0186	0.0175	0.0134	0.0152	0.021	0.0194	0.0195	0.0177	0.0231	0.0136	0.0166	0.0167	0.0144	0.0197	0.026	0.0226	0.0307
Dissolved phosphorus	mg-P/L	-	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0024	0.0041	0.0023	0.0023	<0.0020	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0025	0.0034
Total phosphorus	mg-P/L	0.09	0.0031	0.004	0.0036	0.0034	0.0039	0.0071	0.0042	0.0028	0.0044	0.004	0.0063	0.0046	0.0056	0.0043	0.0049	0.003	0.0032	0.006	0.0034	0.0032	0.0043	0.0033
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
Total nitrogen	mg/L	-	4.76	3.89	3.9	3.99	4.19	3.43	3.79	3.88	4.9	5.34	5.08	4.87	4.97	4.77	4.06	4.33	4.06	4.1	3.65	3.67	3.73	3.74
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	175	176	185	160	160	122	143	164	157	188	186	185	189	224	178	174	172	185	171	156	158	174
Chloride	mg/L	-	13.3	12	11.2	11.6	11.1	8.85	8.02	7.89	8.55	7.82	7.18	9.08	7.96	7.74	8.55	8.76	9.2	9.28	9.06	9.6	9.34	9.81
Fluoride	mg/L	17	0.397	0.441	0.444	0.455	0.378	0.239	0.267	0.238	0.363	0.343	0.438	0.425	0.429	0.466	0.392	0.418	0.455	0.489	0.495	0.48	0.433	0.489
Magnesium	mg/L	-	31.5	29	30.2	27.9	25.2	20.5	25.7	27.7	25.2	30.9	30.8	33.1	31.9	35.2	29.3	28.9	28.1	30	27.6	27.2	27.7	28
Potassium	mg/L	-	5.09	4.36	4.56	3.88	3.57	1.92	2.14	1.97	2.09	2.6	2.5	2.6	2.69	2.7	3.52	3.77	3.65	3.74	3.4	4.01	4.13	4.13
Sodium	mg/L	-	44.5	35.6	36.5	33.2	28.3	14.8	16.3	16.8	18.3	22.6	23.8	25.5	24.7	29.6	32.3	31.6	30.3	33.3	30.1	33.1	33.9	31.2
Sulphate	mg/L	1100	499	505	478	487	450	322	392	400	478	529	550	526	590	594	517	535	508	522	559	513	492	532
Total Metals																								
Aluminum	mg/L	-	1.25	1.26	1.29	1.23	1.37	1.25	1.21	1.19	1.1	1.06	1.24	1.15	1.09	1.1	1.06	1.12	0.882	1.12	1.17	0.994	1.06	1.02
Antimony	mg/L	-	0.0006	0.00052	0.0005	0.00046	0.00045	0.0003	0.00035	0.00037	0.00041	0.00043	0.00046	0.00042	0.00043	0.00045	0.00057	0.00059	0.00059	0.0006	0.00064	0.00069	0.0007	0.0007
Arsenic	mg/L	0.028	0.00097	0.00081	0.00073	0.00071	0.00077	0.00041	0.00045	0.00041	0.00054	0.00067	0.00068	0.0006	0.0006	0.00078	0.00092	0.00096	0.00097	0.00103	0.00103	0.00115	0.00113	0.00113
Barium	mg/L	-	0.0391	0.0336	0.0346	0.0314	0.0338	0.0269	0.0286	0.0285	0.0295	0.0325	0.0333	0.0332	0.0338	0.0344	0.0354	0.0362	0.0358	0.0357	0.0363	0.0357	0.0377	0.035
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.114	0.142	0.153	0.151	0.14	0.076	0.075	0.075	0.09	0.108	0.116	0.114	0.136	0.145	0.138	0.137	0.128	0.139	0.169	0.148	0.151	0.153
Cadmium	mg/L	-	<0.000135	<0.0000900	0.0000987	<0.000110	<0.000100	<0.0000700	<0.000140	0.0000403	<0.0000800	<0.000110	<0.000135	0.0000926	0.0000703	<0.000130	<0.0000950	0.0000706	<0.000115	<0.0000850	0.0000545	<0.0000900	<0.0000850	0.0000478
Calcium	mg/L	-	166	172	177	165	158	121	146	144	156	185	209	179	198	219	180	181	170	171	177	163	165	163
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00024	0.00017	0.00016	0.00017	0.00015	0.00015	0.00013	0.00012	0.00013	0.00012	0.00014	0.00014	0.00015	0.00016	0.00012	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.0133	0.0128	0.0119	0.00976	0.0112	0.0124	0.0133	0.0121	0.0104	0.00997	0.0123	0.00997	0.00963	0.00917	0.0101	0.0104	0.00746	0.00801	0.00723	0.00746	0.0083	0.00796
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	0.075	0.046	0.042	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0066	0.0061	0.0056	0.006	0.0059	0.0031	0.003	0.0035	0.0044	0.005	0.0056	0.0053	0.0059	0.0068	0.0059	0.006	0.006	0.0061	0.0068	0.0064	0.0071	0.0066
Magnesium	mg/L	-	28.6	28.1	26.3	26	27.4	20.8	24.1	25.7	26.7	30.3	34.3	31.1	31.4	33.7	29.8	30.1	25.7	27.7	29.2	27.7	28.1	27.4
Manganese	mg/L	3.4	0.165	0.111	0.0988	0.115	0.09	0.0483	0.052	0.0472	0.0567	0.0666	0.0806	0.0789	0.0888	0.0996	0.0757	0.0921	0.0419	0.0537	0.0326	0.0374	0.0434	0.0416
Mercury	mg/L	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.18	0.16	0.157	0.145	0.125	0.0987	0.105	0.107	0.122	0.126	0.129	0.122	0.137	0.139	0.162	0.162	0.163	0.164	0.165	0.175	0.175	0.176
Nickel	mg/L	-	0.00067	0.00067	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057
Potassium	mg/L	-	5.6	4.06	3.96	3.56	3.63	2.04	2.08	2.06	2.16	2.36	2.62	2.51	2.75	2.81	3.41	3.58	3.63	3.62	3.49	3.87	4.27	3.96
Selenium	mg/L	0.075	0.0407	0.0304	0.0281	0.0279	0.0297	0.0288	0.0375	0.037	0.0423	0.0445	0.0451	0.0425	0.0433	0.0418	0.0421	0.0434	0.0429	0.0394	0.0402	0.0402	0.0401	0.0375
Silicon	mg/L	-	5.9	5.61	5.4	5.72	5.78	5.5	5.41	5.27	5.15	4.81	4.87	4.4	4.38	4.97	4.89	4.91	4.96	5.32	5.56	5.41	5.63	5.5
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	42.1	35.5	31.8	30.6	30.7	15.5	15.9	16.5	19.4	22.2	25.5	23.4	24	28.4	30.6	31.3	30.5	33	30.8	32.9	35	33.7
Strontium	mg/L	-	1.71	2.37	2.25	2.4	1.86	1.34	1.62	1.68	2.39	2.73	2.98	2.82	3.13	3.05	2.46	2.41	2.12	2.44	2.65	2.18	2.13	2.28
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00176	0.00186	0.00176	0.00184	0.00166	0.000919	0.00112	0.00107	0.00135	0.00164	0.00174	0.00173	0.00193	0.00212	0.00193	0.00208	0.00185	0.00199	0.00222	0.00204	0.00198	0.00213
Vanadium	mg/L	-	0.00121	0.00102	0.001	0.00104	0.0011	0.0009	0.00073	0.00072	0.00062	0.00075	0.00074	0.00068	0.00063	0.00094	0.001	0.00101	0.00108	0.00111	0.00111	0.0013	0.0013	0.0012
Zinc	mg/L	0.059	0.0032	<0.0030	0.0038	<0.0030	<0.0030	<0.0030	<0.0030	0.0034	0.004	0.0048	0.0058	0.0042	0.0046	0.0045	0.0033	0.0037	<0.0030	<0.0030	0.0033	0.0031	<0.0030	<0.0030

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-03-16	2021-03-23	2021-03-29	2021-04-06	2021-04-13	2021-04-20	2021-04-27	2021-05-04	2021-05-11	2021-05-19	2021-05-25	2021-06-02	2021-06-08	2021-06-15	2021-06-22	2021-06-23	2021-06-29	2021-07-06	2021-07-13	2021-07-21	2021-07-27	2021-08-03
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.124	0.125	0.126	0.133	0.119	0.104	0.122	0.114	0.127	0.165	0.216	0.177	0.223	0.234	0.21	0.231	0.222	0.237	0.226	0.219	0.192	0.187
Antimony	mg/L	-	0.00058	0.00051	0.00052	0.00042	0.00045	0.00026	0.00031	0.00034	0.00038	0.00043	0.00041	0.00043	0.00044	0.00044	0.00057	0.00054	0.00057	0.00057	0.00058	0.00067	0.00067	0.00066
Arsenic	mg/L	-	0.00056	0.0005	0.00051	0.00046	0.00045	0.00024	0.0003	0.00034	0.00044	0.00055	0.00064	0.0006	0.00056	0.0006	0.00079	0.00083	0.00082	0.00095	0.00092	0.00107	0.00105	0.00096
Barium	mg/L	-	0.0357	0.035	0.0387	0.0306	0.0319	0.0251	0.0273	0.0311	0.0286	0.0327	0.0323	0.0329	0.0333	0.0337	0.0352	0.0352	0.0358	0.0363	0.035	0.0358	0.0375	0.0372
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.107	0.141	0.152	0.143	0.13	0.068	0.07	0.068	0.086	0.105	0.107	0.104	0.128	0.145	0.119	0.134	0.138	0.151	0.15	0.132	0.129	0.146
Cadmium	mg/L	0.00034	<0.0000950	0.0000737	<0.000105	0.0000535	0.0000535	0.0000341	<0.0000700	<0.000110	<0.0000700	<0.0000850	<0.0000850	<0.000150	<0.0000750	0.0000679	<0.0000850	<0.0000950	<0.0000850	<0.000125	<0.0000750	<0.0000900	<0.0000850	<0.000150
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00022	0.00016	0.0002	0.00017	0.00013	0.00011	0.00011	<0.00010	0.00011	0.00012	0.00012	0.00013	0.00013	0.00014	0.00011	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00711	0.00748	0.00685	0.00531	0.00612	0.00601	0.00692	0.00689	0.00596	0.00644	0.00707	0.0066	0.00614	0.00564	0.00579	0.00585	0.00528	0.00461	0.00432	0.00564	0.00539	0.00509
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0066	0.0064	0.0069	0.0057	0.0055	0.003	0.0032	0.0033	0.0042	0.0052	0.0051	0.0046	0.0058	0.0062	0.0057	0.0065	0.0062	0.0061	0.0064	0.0061	0.0062	0.0066
Manganese	mg/L	-	0.148	0.109	0.11	0.116	0.0872	0.0438	0.0506	0.0475	0.053	0.0616	0.0739	0.0769	0.0851	0.0916	0.0658	0.082	0.0432	0.0401	0.0264	0.0358	0.0391	0.0386
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.188	0.156	0.152	0.132	0.138	0.0854	0.0987	0.103	0.119	0.13	0.125	0.124	0.129	0.158	0.158	0.156	0.16	0.165	0.166	0.172	0.172	0.162
Nickel	mg/L	-	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.036	0.0311	0.0277	0.0278	0.0306	0.0303	0.0382	0.0376	0.0422	0.0441	0.0454	0.0406	0.0368	0.0449	0.0407	0.0396	0.0415	0.0374	0.0414	0.0411	0.0393	0.0386
Silicon	mg/L	-	5.35	5.71	5.57	5.41	5.59	5.06	5.33	4.82	5.12	4.59	4.2	3.98	3.94	4.74	4.67	5.07	5.04	5.17	5.2	5.12	5.23	5.09
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.78	2.13	2.42	2.28	2.03	1.25	1.62	1.76	2.34	2.86	2.74	2.94	3.03	3.24	2.35	2.38	2.11	2.6	2.62	2.17	2.11	2.29
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00154	0.00153	0.00186	0.00158	0.00144	0.00082	0.000936	0.0011	0.00125	0.00143	0.00152	0.00156	0.00176	0.0018	0.00193	0.00183	0.00178	0.00188	0.00195	0.00192	0.00185	0.00192
Vanadium	mg/L	-	0.00099	0.00094	0.00102	0.00075	0.00081	0.00064	0.00056	0.00052	0.00051	0.00055	0.00057	0.00056	0.00052	0.00058	0.0009	0.00082	0.00103	0.00099	0.00091	0.00117	0.00115	0.00108
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-08-10	2021-08-17	2021-08-24	2021-08-30	2021-09-08	2021-09-14	2021-09-15	2021-09-16	2021-09-20	2021-09-28	2021-10-04	2021-10-12	2021-10-18	2021-10-26	2021-10-27	2021-11-02	2021-11-09	2021-11-18	2021-11-25	2021-12-02	2021-12-07	2021-12-14
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1116	1128.1	1098.8	1029	1090.9	1118	1117.1	1090.1	1063	1021	1075.7	1030	1032	1029.7	1033.8	1076.7	1042	1165.9	1180.4	1152	1095	1118
pH	pH units	-	7.06	7.46	7.51	7.33	7.32	7.72	7.52	7.52	7.2	7.54	7.85	7.65	6.91	7.68	7.64	7.61	7.87	7.55	7.53	7.07	6.89	6.93
Turbidity	NTU	-	0.98	1.1	1.59	0.88	1.12	0.58	1.38	1.03	1.31	1.14	1.99	2.57	4.13	4.1	4.64	3.11	2.34	1.54	2.23	2.1	1.59	1.63
Temperature	C	-	17.928	16.761	15.646	16.1	14.647	13.678	12.624	11.429	10.752	11.6	9.778	6.9	7.118	6.345	6.542	5.257	5.9	5.873	4.121	3.978	2.537	3.279
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	81.8	83.4	79.4	83.8	86.5	85.7	98.6	97.4	81.7	94.6	93.5	81.4	91.8	86.2	84.3	87.9	95.6	98.9	106	107	85.6	94.6
Specific conductivity	uS/cm	-	1120	1080	1090	1100	1100	1080	1100	1090	1100	1080	1060	1020	1040	1080	1070	1050	1040	1060	1080	1050	1050	1110
pH	pH units	-	7.99	7.91	7.96	7.99	7.98	8.07	8.09	8.09	8.1	8.1	8.11	8.01	8.04	8.08	7.99	8.07	7.88	7.78	7.91	7.83	7.66	8.02
Total suspended solids	mg/L	30	6.8	7.7	8	5.5	2.1	3.6	11.2	4	4.8	4.6	4.8	5.1	5.2	6.1	7.2	6.6	6.4	8.2	7.2	5.8	7.1	8.7
Turbidity	NTU	-	0.64	0.7	0.71	0.65	0.64	0.71	0.65	0.79	1.43	1.11	2.17	1.93	3.65	2.78	2.55	2.81	2.12	2.09	1.41	3.22	1.65	1.13
Hardness, as CaCO3	mg/L	-	518	511	533	504	501	507	470	466	524	506	519	475	492	471	472	493	499	549	593	568	504	530
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	548	529	528	542	519	514	542	545	490	530	508	466	508	476	458	485	519	568	576	540	498	524
Total dissolved solids	mg/L	-	915	911	872	1050	858	937	929	993	818	873	794	794	815	784	772	832	780	703	800	620	785	830
Dissolved organic carbon	mg/L	-	4.47	4.36	4.63	2.79	3.47	2.87	2.32	2.34	2.49	2.58	3.23	3	3.08	3.09	3.46	3.24	4.5	4.99	4.71	4.13	5.62	4.98
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	3.39	3.05	3.18	3.2	3.08	3.06	3.06	3.16	3.05	3.21	2.96	3.29	2.56	3.1	2.86	2.74	2.88	3.74	3.19	2.86	3.51	3.08
Nitrate + nitrite	mg-N/L	-	3.4	3.06	3.19	3.21	3.09	3.07	3.07	3.17	3.06	3.22	2.96	3.29	2.56	3.1	2.86	2.74	2.88	3.74	3.19	2.86	3.52	3.09
Nitrite	mg-N/L	0.78	0.0141	0.015	0.0106	0.0088	0.0088	0.0146	0.0063	0.0063	0.0066	0.0064	0.0057	<0.0050	0.0025	<0.0050	<0.0050	<0.0050	<0.0050	0.0029	0.0031	0.0043	0.0078	0.0065
Total ammonia	mg-N/L	1.3	0.0208	0.0186	0.0176	0.0154	0.013	0.0116	0.0114	0.0129	0.0111	0.0127	0.0126	0.0157	0.0174	0.0156	0.0139	0.0107	0.0104	0.0248	0.0341	0.045	0.0176	0.0216
Dissolved phosphorus	mg-P/L	-	0.0062	0.0031	<0.0020	0.0059	0.0073	0.0023	0.0032	0.0031	<0.0020	<0.0020	0.0027	0.0032	0.0029	0.0036	<0.0020	0.0024	0.0022	<0.0020	0.0022	<0.0020	0.0022	0.0022
Total phosphorus	mg-P/L	0.09	0.0037	0.005	0.0024	0.0048	0.0042	0.0042	0.0078	0.0108	0.005	0.005	0.0054	0.0083	0.0103	0.0092	0.0088	0.0086	0.0082	0.0038	0.003	0.0034	0.0048	0.0048
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0017	0.0011
Total nitrogen	mg/L	-	3.56	3.42	3.54	3.56	3.29	3.24	3.23	3.27	3.27	3.3	3.23	3.52	2.82	3.47	3.03	3.09	3.11	4.36	3.76	3.37	3.84	3.1
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	161	161	166	159	160	158	146	146	163	159	164	151	156	146	147	157	160	171	190	184	158	168
Chloride	mg/L	-	9.69	9.58	9.17	8.84	8.02	7.88	8.06	8.22	7.83	8.27	7.95	8.7	7.48	8.26	8.53	8.3	7.13	10.4	9.12	8.94	10.5	10.1
Fluoride	mg/L	17	0.515	0.5	0.42	0.441	0.455	0.46	0.468	0.45	0.513	0.535	0.544	0.461	0.488	0.396	0.41	0.478	0.42	0.294	0.333	0.476	0.364	0.468
Magnesium	mg/L	-	28.2	26.5	28.8	25.9	24.7	27.3	25.7	24.7	28.4	26.5	26.7	23.8	24.9	25.9	25.4	24.6	24.2	29.7	28.8	26.4	26.5	26.9
Potassium	mg/L	-	4.26	4.09	4.57	4.22	4	4.28	4.15	4.14	4.1	3.74	4.38	4.24	4.41	4.61	4.67	4.37	3.91	3.84	3.57	3.11	3.97	3.75
Sodium	mg/L	-	35.3	32.7	36.2	34.4	33.3	36.2	32.5	32.3	34.5	31.6	34.8	32.8	33	34.9	32.7	32.5	28.8	32.7	34.9	34.4	33.6	35.6
Sulphate	mg/L	1100	525	515	486	492	503	489	494	490	476	498	465	461	441	459	468	488	478	473	494	490	470	498
Total Metals																								
Aluminum	mg/L	-	1.19	1.14	1.05	1.02	0.652	0.67	0.699	0.656	0.765	0.631	0.625	0.685	0.694	0.707	0.792	0.646	0.64	1.22	0.974	1.14	1.16	1.26
Antimony	mg/L	-	0.00065	0.0007	0.0007	0.0007	0.00065	0.00065	0.00067	0.0007	0.00064	0.00068	0.00066	0.0006	0.0006	0.00059	0.00058	0.00058	0.00059	0.0005	0.00047	0.00048	0.00058	0.00057
Arsenic	mg/L	0.028	0.00113	0.00118	0.0013	0.00134	0.00115	0.00113	0.00116	0.00116	0.00114	0.00116	0.00116	0.00132	0.00121	0.00123	0.00121	0.00138	0.0011	0.00083	0.00075	0.00073	0.00091	0.00085
Barium	mg/L	-	0.0377	0.0356	0.0384	0.0396	0.0363	0.0369	0.0362	0.0348	0.0376	0.0362	0.0368	0.0411	0.039	0.0387	0.0399	0.0375	0.0371	0.0353	0.0341	0.0308	0.0342	0.034
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.16	0.17	0.144	0.153	0.151	0.149	0.155	0.158	0.15	0.145	0.148	0.098	0.12	0.105	0.097	0.11	0.134	0.107	0.144	0.149	0.124	0.135
Cadmium	mg/L	-	<0.0000650	<0.0000800	<0.000140	<0.000145	<0.000125	<0.0000800	<0.000125	<0.000125	<0.0000850	<0.000145	<0.0000850	<0.0000900	<0.0000800	<0.000130	<0.000100	<0.000100	<0.000110	0.0000748	0.0000879	0.000089	<0.0000950	<0.0000750
Calcium	mg/L	-	172	167	166	169	165	164	172	174	153	167	161	146	161	146	142	152	164	174	184	170	159	167
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00014	0.0002	0.00021	0.00022	0.00028	0.00021	0.00016	0.00015	0.00013	0.00016	0.00014	0.00012
Copper	mg/L	0.033	0.00805	0.0092	0.00981	0.0116	0.0121	0.0123	0.0128	0.0126	0.015	0.0141	0.0154	0.0222	0.0261	0.0327	0.0458	0.0374	0.0219	0.0131	0.01	0.009	0.0127	0.0115
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	0.058	0.045	0.066	0.132	0.158	0.125	0.188	0.099	0.088	0.04	0.035	0.085	<0.030	0.037
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	0.000067	0.000058	0.000082	<0.000050	<0.000050	<0.000050	0.000096	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0073	0.0072	0.0071	0.0068	0.0068	0.0064	0.0068	0.0067	0.0063	0.0063	0.0065	0.006	0.0062	0.0059	0.0065	0.0066	0.0062	0.0053	0.0064	0.0061	0.0061	0.0065
Magnesium	mg/L	-	28.8	27.2	27.7	29.2	26.1	25.5	27.4	26.9	26.2	27.5	25.8	24.7	25.7	27.2	25	25.6	26.7	32.4	28.2	28	24.5	26
Manganese	mg/L	3.4	0.0417	0.0413	0.0471	0.0429	0.0423	0.0437	0.0458	0.0452	0.043	0.0431	0.0479	0.0574	0.0467	0.062	0.0559	0.0531	0.0513	0.0802	0.0616	0.0665	0.0642	0.0615
Mercury	mg/L	-	<0.0000050	-	-	-	<0.0000050	-	<0.0000050	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.181	0.171	0.17	0.16	0.166	0.173	0.176	0.16	0.156	0.175	0.174	0.176	0.154	0.166	0.165	0.156	0.137	0.166	0.159	0.173	0.195
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	0.00056	0.00051	0.00053	0.00054	0.00057	0.00055	0.00061	0.00062	0.0007	0.00072	0.00087	0.00093	0.00073	0.00069	0.00054	0.0006	0.00065	<0.00050	0.00053
Potassium	mg/L	-	4.36	4.12	4.4	4.47	4.19	4.21	4.33	4.18	4.19	3.97	3.96	4.49	4.28	4.77	4.85	4.67	3.87	3.86	3.35	3.06	3.91	3.69
Selenium	mg/L	0.075	0.0371	0.0369	0.0384	0.037	0.0348	0.0332	0.0351	0.0348	0.0346	0.0342	0.0338	0.0346	0.0309	0.0359	0.0311	0.0296	0.0334	0.0327	0.0285	0.0252	0.0359	0.0299
Silicon	mg/L	-	6.06	5.76	5.53	5.84	5.78	5.43	5.76	5.44	6.14	5.75	5.51	4.91	5.37	5.17	4.82	5.08	5.7	5.81	5.71	6	5.93	6.21
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	37	33.2	39.5	37.1	34.5	32.9	37.4	35.5	33	32.7	34.6	33.5	31.2	33.7	33.1	33.6	30.6	32.3	31	32.4	32.4	36.1
Strontium	mg/L	-	2.24	2.45	2.11	2.13	1.9	2.13	2.15	2.12	2.06	2.04	2.13	1.54	1.98	1.59	1.6	1.86	1.99	1.97	3.39	3.69	2.19	3.44
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00206	0.00215	0.00211	0.00211	0.00205	0.00205	0.00194	0.00195	0.00206	0.00211	0.00207	0.00172	0.00182	0.00187	0.00173	0.00172	0.0019	0.00158	0.00185	0.00185	0.00183	0.00205
Vanadium	mg/L	-	0.00134	0.00126	0.00142	0.0015	0.00132	0.0014	0.0013	0.00129	0.00132	0.00139	0.0014	0.00177	0.00143	0.00145	0.00169	0.0014	0.00135	0.00105	0.00095	0.00099	0.00126	0.00103
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	0.0031	0.0034	0.004	0.004	0.0037	0.0038	0.0042	0.0037	0.0039	0.004	0.0039	0.0034	0.0035	0.0097	0.0032	0.0062

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-08-10	2021-08-17	2021-08-24	2021-08-30	2021-09-08	2021-09-14	2021-09-15	2021-09-16	2021-09-20	2021-09-28	2021-10-04	2021-10-12	2021-10-18	2021-10-26	2021-10-27	2021-11-02	2021-11-09	2021-11-18	2021-11-25	2021-12-02	2021-12-07	2021-12-14
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.234	0.241	0.211	0.239	0.231	0.264	0.235	0.226	0.215	0.228	0.23	0.178	0.198	0.186	0.18	0.177	0.185	0.121	0.131	0.129	0.131	0.138
Antimony	mg/L	-	0.00071	0.00066	0.00069	0.00068	0.00066	0.00063	0.00065	0.00067	0.00063	0.00061	0.00066	0.00062	0.00054	0.00058	0.00054	0.00059	0.00055	0.0005	0.00049	0.00042	0.00056	0.00054
Arsenic	mg/L	-	0.00123	0.00108	0.00119	0.00105	0.00114	0.00109	0.00106	0.00106	0.00103	0.00095	0.00109	0.00106	0.00096	0.00104	0.00102	0.00094	0.00087	0.00057	0.0005	0.00048	0.00055	0.00046
Barium	mg/L	-	0.0366	0.0352	0.0385	0.036	0.035	0.04	0.0362	0.0348	0.0381	0.0345	0.0381	0.0353	0.0373	0.0371	0.0361	0.0353	0.035	0.0354	0.0354	0.0318	0.033	0.0321
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.148	0.157	0.141	0.148	0.151	0.147	0.138	0.138	0.149	0.137	0.133	0.096	0.122	0.092	0.095	0.118	0.126	0.114	0.137	0.13	0.117	0.129
Cadmium	mg/L	0.00034	<0.0000650	<0.0000800	<0.0000700	<0.0000700	<0.000100	<0.0000800	<0.0000550	<0.0000650	<0.0000650	<0.000120	<0.0000900	<0.0000650	<0.0000750	<0.0000650	<0.0000800	<0.0000950	<0.0000850	0.0000727	0.0000873	0.0000636	<0.000140	<0.0000800
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00014	0.00012	<0.00010	0.00014	0.00012	0.00012	0.00012	0.0001
Copper	mg/L	-	0.00506	0.00534	0.00598	0.00634	0.0072	0.00779	0.00691	0.00712	0.00797	0.00764	0.00806	0.0102	0.0127	0.0141	0.0174	0.0156	0.0113	0.00751	0.00624	0.00505	0.0074	0.00611
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0069	0.0066	0.0072	0.0064	0.007	0.0062	0.0062	0.0059	0.0062	0.0066	0.0056	0.0059	0.0062	0.006	0.0062	0.0058	0.0053	0.0062	0.0064	0.0058	0.0066
Manganese	mg/L	-	0.0369	0.0357	0.0437	0.0353	0.0357	0.041	0.0372	0.0374	0.0357	0.0381	0.0429	0.0477	0.0393	0.0506	0.0462	0.0462	0.0442	0.078	0.0612	0.0646	0.0652	0.0585
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.176	0.171	0.179	0.174	0.16	0.167	0.16	0.162	0.148	0.154	0.179	0.149	0.166	0.164	0.161	0.171	0.154	0.133	0.165	0.163	0.156	0.193
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	0.00055	<0.00050	<0.00050	0.00055	<0.00050	0.00069	0.00062	0.00055	0.00059	0.00065	0.00065	<0.00050	0.00059	0.00054	<0.00050	0.00056	<0.00050
Selenium	mg/L	-	0.0402	0.0359	0.0354	0.034	0.0374	0.0338	0.0318	0.0333	0.0332	0.0326	0.0342	0.0359	0.0326	0.0358	0.0311	0.0318	0.0319	0.0346	0.0297	0.0273	0.0358	0.0286
Silicon	mg/L	-	5.49	5.44	5.26	5.32	5.58	5.55	5.46	5.37	5.17	5.18	5.55	4.62	4.86	4.75	4.16	4.75	5.17	5.72	5.83	5.85	5.46	5.91
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.18	2.33	2.07	2.22	1.99	2.07	2.19	2.12	2.08	2.02	2.02	1.48	1.93	1.57	1.52	1.91	2	1.92	3.39	3.85	2.07	3.4
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00197	0.002	0.00199	0.0021	0.00207	0.002	0.00183	0.00183	0.00175	0.00189	0.00189	0.00178	0.00183	0.00167	0.00158	0.00176	0.00178	0.00151	0.00179	0.00179	0.00176	0.00185
Vanadium	mg/L	-	0.0012	0.00106	0.00125	0.0012	0.00118	0.00118	0.00114	0.00115	0.00112	0.00102	0.00118	0.00111	0.00098	0.00106	0.00109	0.00104	0.00096	0.00086	0.00075	0.0007	0.00097	0.00085
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-12-21	2021-12-29	2022-01-05	2022-01-11	2022-01-18	2022-01-25	2022-02-01	2022-02-08	2022-02-15	2022-02-22	2022-03-01	2022-03-08	2022-03-15	2022-03-22	2022-03-29	2022-04-05	2022-04-12	2022-04-20	2022-04-26	2022-05-03	2022-05-09	2022-05-10
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1161.7	1162	1073	1151.4	1100	1044	1051	1049	1101	1016	1101	1141	1194.9	1139.2	944	975	925	1027.6	873	906	899	948
pH	pH units	-	7.4	6.55	7.71	7.23	7.57	7.74	7.8	7.56	7.63	7.58	7.64	7.61	7.51	7.44	7.3	7.42	7.67	7.47	7.48	7.53	7.4	7.62
Turbidity	NTU	-	1.42	1.26	0.86	1.23	1.82	1.3	1.96	1.57	1.16	1.94	1.78	1.88	1.4	1.76	2.49	1.58	1.72	2.73	1.32	3.81	2.93	2.86
Temperature	C	-	3.721	1.125	3.7	2.617	2.445	4.2	4.4	3.184	6.2	5.2	2.569	4.334	5.004	6.71	4.736	5.48	6.4	7.276	6.436	8.117	6.945	7.8
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	106	112	89.2	99.2	94	89.2	87.8	97.1	106	98.6	107	112	112	107	93.7	91.6	90.3	92.1	84.1	88.6	77.4	86.2
Specific conductivity	uS/cm	-	1120	1150	1040	1140	1090	1070	1080	1070	1080	1020	1080	1150	1190	1100	907	975	949	1050	872	895	899	951
pH	pH units	-	8.13	7.66	7.7	7.79	7.8	7.68	7.75	7.86	7.68	8.07	7.98	7.97	7.94	7.87	7.61	7.95	8.02	8.05	7.93	8.17	8.04	7.98
Total suspended solids	mg/L	30	7.3	6.9	9.6	9.5	12.4	6.1	5.5	4.9	7	7.9	12.4	8.2	8.2	6.4	15.3	7.3	8.4	9.2	11.5	13.1	9.5	19.2
Turbidity	NTU	-	1	1.81	1.18	0.84	2.28	1.2	0.66	2.12	1.17	2.14	2	1.49	1.17	2.09	2.52	2.12	1.78	1.44	2.5	2.74	3.06	3.34
Hardness, as CaCO3	mg/L	-	544	589	565	548	508	493	495	493	531	511	550	561	569	603	433	512	462	504	443	423	474	528
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	509	548	590	519	519	491	492	552	527	539	558	631	584	541	420	471	479	518	432	437	473	524
Total dissolved solids	mg/L	-	826	896	852	926	850	784	830	806	806	773	818	904	890	820	669	683	732	753	678	596	718	775
Dissolved organic carbon	mg/L	-	2.68	2.63	3.48	2.59	2.54	4.16	3.84	3.34	4.55	4.6	5.01	4.63	3.26	8.01	5.08	5.31	4.47	4.33	6.34	8.81	5.78	7.61
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	2.97	2.83	2.57	3.42	2.76	3.41	3.05	2.74	2.7	2.58	2.71	2.26	2.15	2.22	2.11	2.12	2.08	2.36	2.08	2.56	2.84	3.44
Nitrate + nitrite	mg-N/L	-	2.97	2.84	2.57	3.42	2.76	3.41	3.05	2.74	2.7	2.58	2.71	2.26	2.15	2.22	2.11	2.12	2.08	2.36	2.08	2.56	2.84	3.44
Nitrite	mg-N/L	0.78	<0.0050	0.0056	<0.0050	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total ammonia	mg-N/L	1.3	0.0208	0.0233	0.0212	0.03	0.0206	0.0213	0.02	0.0199	0.0181	0.0151	0.0179	0.0209	0.0185	0.0124	0.0078	0.0111	0.0064	0.0067	<0.0050	0.005	0.0075	<0.0050
Dissolved phosphorus	mg-P/L	-	0.003	<0.0020	0.0021	<0.0020	<0.0020	0.0023	<0.0020	0.0032	0.0034	0.0032	0.0046	0.0028	0.0025	<0.0020	0.004	0.0022	0.0038	<0.0020	<0.0020	0.0026	0.0064	0.0021
Total phosphorus	mg-P/L	0.09	0.0047	0.0051	0.0044	0.0046	0.0054	0.0055	0.0048	0.0063	0.0044	0.0068	0.0054	0.0052	0.0042	0.0026	0.0061	<0.0020	0.0052	0.0034	0.0049	0.0109	0.0022	0.0061
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	0.0014	0.0023	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	3.12	2.91	2.96	3.65	3.11	3.42	3.04	3.12	2.89	2.85	2.83	2.58	2.39	2.31	2.62	2.58	2.46	2.84	2.54	3.15	3.31	4.17
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	174	194	181	174	163	154	156	157	171	163	177	179	185	195	138	161	148	162	139	132	147	166
Chloride	mg/L	-	9.68	9.59	8.96	10.8	9.95	10.6	10.1	10.1	9.7	10	10.5	8.77	11.2	12	9.79	10.2	7.94	9.29	7.58	3.04	7.18	5.31
Fluoride	mg/L	17	0.473	0.576	0.446	0.452	0.483	0.465	0.462	0.498	0.529	0.487	0.582	0.555	0.568	0.49	0.326	0.348	0.352	0.353	0.269	0.322	0.239	0.271
Magnesium	mg/L	-	26.5	25.4	27.5	27.5	24.6	26.3	25.7	24.6	25.3	25.2	26.2	27.6	26	28.1	21.5	26.7	22.5	24.1	23.2	22.8	25.9	27.6
Potassium	mg/L	-	3.43	3.46	3.71	4.3	3.51	3.96	3.61	3.63	2.93	2.99	2.77	2.36	2.02	2.15	1.81	1.75	1.73	1.98	1.66	1.93	1.79	1.79
Sodium	mg/L	-	36.1	38.3	38.2	38.3	32.8	33.9	34.2	34.1	30.8	31.3	31	31.6	28.7	27.4	17.4	20.8	17.8	19.5	16.6	14.9	14.1	14.7
Sulphate	mg/L	1100	532	526	464	508	492	481	474	496	512	477	503	520	545	510	402	415	412	442	372	387	381	426
Total Metals																							
Aluminum	mg/L	-	0.919	1.16	1.07	0.858	1.11	0.995	0.929	1.1	1	1.26	0.926	0.814	0.815	1.29	1.05	1.14	0.993	1.06	0.838	0.453	1.13	1.11
Antimony	mg/L	-	0.00051	0.00049	0.00054	0.00058	0.00054	0.00057	0.00061	0.00062	0.00047	0.00053	0.00043	<0.00100	<0.00050	0.00028	0.00025	0.00026	0.00029	0.00034	<0.00050	0.00038	0.00038	0.0004
Arsenic	mg/L	0.028	0.00077	0.00094	0.00094	0.00087	0.00089	0.00085	0.0008	0.00105	0.00078	0.00092	0.00079	<0.00100	<0.00050	0.00048	0.00038	0.00041	0.00043	0.00045	<0.00050	0.00057	0.00036	0.00051
Barium	mg/L	-	0.0301	0.0303	0.0322	0.0343	0.0318	0.0335	0.032	0.031	0.0279	0.0302	0.0307	0.0316	0.0251	0.0257	0.0252	0.0252	0.0258	0.0265	0.0224	0.027	0.0287	0.0292
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000200	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000500	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.159	0.186	0.198	0.159	0.161	0.131	0.158	0.18	0.19	0.186	0.176	0.204	0.246	0.201	0.137	0.129	0.122	0.142	0.098	0.07	0.054	0.059
Cadmium	mg/L	-	<0.0000650	<0.0000800	<0.0000900	<0.0000950	<0.000110	<0.0000850	<0.0000750	<0.000100	<0.000100	<0.0000900	0.000108	0.000116	0.000108	<0.000120	<0.0000850	<0.0000700	<0.0000800	<0.0000650	0.0000776	0.0000458	0.0000738	<0.0000800
Calcium	mg/L	-	163	179	190	162	165	152	156	177	170	172	180	202	193	176	133	148	153	165	141	136	150	167
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00100	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00014	0.00013	0.00018	0.00012	0.00016	0.00013	0.00014	0.00013	0.00014	0.00014	<0.00100	<0.00050	0.00031	0.0002	0.00022	0.0002	0.00022	<0.00050	0.00018	0.00016	0.00014
Copper	mg/L	0.033	0.00854	0.0102	0.00926	0.00914	0.0103	0.0114	0.011	0.0122	0.00969	0.0115	0.0087	0.00722	0.00524	0.0073	0.00848	0.00833	0.0097	0.00873	0.00904	0.0178	0.013	0.0151
Iron	mg/L	1	0.032	0.039	<0.030	<0.030	0.041	0.057	0.034	0.05	0.032	<0.030	0.034	<0.100	<0.050	<0.030	<0.030	<0.030	0.043	<0.030	0.071	0.118	0.069	0.062
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000500	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	0.000054	<0.000050	<0.000050
Lithium	mg/L	-	0.0061	0.007	0.0073	0.0066	0.0065	0.0055	0.0065	0.0068	0.0063	0.0065	0.0057	<0.0100	0.0058	0.0051	0.0035	0.0039	0.0039	0.0045	<0.0050	0.0033	0.003	0.0034
Magnesium	mg/L	-	24.7	24.5	28.2	27.8	25.9	27	24.9	26.6	24.9	26.7	26.3	30.8	24.9	24.7	21.3	24.6	23.6	25.8	19.4	23.6	23.9	26.1
Manganese	mg/L	3.4	0.0653	0.0732	0.0734	0.111	0.0692	0.0908	0.0696	0.0736	0.0749	0.0705	0.0778	0.146	0.148	0.128	0.0724	0.0825	0.0669	0.0772	0.0468	0.0533	0.0448	0.0461
Mercury	mg/L	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.19	0.201	0.186	0.169	0.166	0.179	0.184	0.161	0.172	0.149	0.14	0.123	0.12	0.0965	0.106	0.114	0.126	0.101	0.114	0.114	0.118
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	0.00055	<0.00050	0.00057	0.00054	0.00064	0.00054	0.00055	<0.00050	<0.00500	<0.00250	<0.00050	0.00061	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	3.4	3.35	3.66	4.3	3.44	3.86	3.59	3.57	2.88	3.22	2.73	2.49	1.96	2	1.74	1.88	1.76	2	1.37	1.96	1.77	1.76
Selenium	mg/L	0.075	0.0275	0.0276	0.0297	0.0343	0.0288	0.032	0.0311	0.0312	0.0254	0.0294	0.0275	0.0247	0.0207	0.0246	0.0308	0.0359	0.0361	0.0411	0.0308	0.0428	0.0432	0.0477
Silicon	mg/L	-	6.35	6.58	6.76	6.2	6.44	6	5.99	6.6	6.44	7.06	7.41	7.06	6.26	6.22	6.42	6.08	5.56	5.7	4.8	5.22	4.92	5.06
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000100	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	34	36.4	37	39.2	32.8	34.5	32.7	35.7	31.7	34.8	32.1	35	27.7	25.3	18.8	21.3	17.7	21.2	13.6	15.9	13.3	14.4
Strontium	mg/L	-	3.94	4.28	4.14	2.68	3.41	2.41	2.97	3.7	4.04	3.95	4.59	5.04	4.73	4.12	2.64	2.84	2.72	3.08	2.33	1.7	1.66	1.96
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000100	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00207	0.00232	0.00197	0.00207	0.00186	0.00176	0.00191	0.00196	0.00188	0.00185	0.00195	0.00185	0.00161	0.00148	0.00103	0.00108	0.00127	0.00132	0.000986	0.0012	0.00112	0.00126
Vanadium	mg/L	-	0.00086	0.00094	0.001	0.00113	0.00117	0.00122	0.00127	0.00118	0.00093	0.00105	0.00091	<0.00500	<0.00250	0.00054	0.00052	0.00054	0.00076	0.00058	<0.00250	0.00078	0.00072	0.00068
Zinc	mg/L	0.059	0.0035	0.0038	0.0038	0.0033	0.0036	<0.0030	0.0031	0.0038	0.0057	0.0048	<0.0030	<0.0300	<0.0150	0.0033	<0.0030	0.003	<0.0030	<0.0030	<0.0150	0.0032	0.0031	0.0037

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-12-21	2021-12-29	2022-01-05	2022-01-11	2022-01-18	2022-01-25	2022-02-01	2022-02-08	2022-02-15	2022-02-22	2022-03-01	2022-03-08	2022-03-15	2022-03-22	2022-03-29	2022-04-05	2022-04-12	2022-04-20	2022-04-26	2022-05-03	2022-05-09	2022-05-10
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.14	0.143	0.152	0.119	0.116	0.11	0.121	0.151	0.0254	0.146	0.16	0.136	0.12	0.128	0.126	0.116	0.126	0.115	0.118	0.167	0.103	0.161
Antimony	mg/L	-	0.00053	0.00051	0.00054	0.00058	0.0005	0.00056	0.00059	0.00063	0.00048	0.00045	0.00038	0.0003	<0.00050	0.00028	0.00023	0.0003	0.00027	0.00032	<0.00050	0.00036	0.00036	0.00038
Arsenic	mg/L	-	0.0005	0.00053	0.00053	0.00057	0.00048	0.00052	0.00054	0.00056	0.00104	0.00049	0.00048	0.00051	<0.00050	0.00031	0.00024	0.00024	0.00027	0.0003	<0.00050	0.0004	0.00027	0.00031
Barium	mg/L	-	0.0311	0.0303	0.033	0.0338	0.0302	0.0315	0.0313	0.0312	0.0284	0.0281	0.0286	0.0284	0.026	0.0272	0.0253	0.0263	0.0257	0.0255	0.0266	0.026	0.0272	0.0294
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.187	0.19	0.164	0.148	0.146	0.126	0.152	0.163	0.18	0.16	0.13	0.166	0.234	0.208	0.122	0.12	0.104	0.113	0.105	0.062	0.055	0.062
Cadmium	mg/L	0.00034	<0.0000900	<0.0000900	<0.000110	<0.0000850	<0.0000850	<0.0000800	0.000086	<0.0000800	<0.0000900	<0.0000800	0.000111	0.000125	0.00016	0.000101	<0.0000800	<0.0000750	<0.0000750	<0.0000850	0.0001	<0.0000700	<0.0000650	<0.0000650
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00011	0.00012	0.00016	0.00011	0.00014	0.00011	0.00011	0.00011	0.0001	0.00014	0.00019	<0.00050	0.0003	0.00019	0.0002	0.00018	0.00019	<0.00050	0.0001	0.00011	0.00011
Copper	mg/L	-	0.00534	0.005	0.00542	0.00555	0.00528	0.00609	0.00603	0.00591	0.0105	0.00572	0.00557	0.00396	0.00378	0.00431	0.00517	0.0048	0.00624	0.00518	0.00595	0.00962	0.00671	0.00769
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.050	<0.030	<0.030	<0.030	<0.030	<0.030	<0.050	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0074	0.007	0.0065	0.0061	0.0059	0.0062	0.0068	0.0063	0.0062	0.0063	0.0065	0.005	0.0053	0.0042	0.0037	0.0037	0.0041	<0.0050	0.0031	0.0029	0.0032
Manganese	mg/L	-	0.0695	0.0696	0.071	0.107	0.0652	0.0865	0.071	0.072	0.0735	0.0637	0.0835	0.136	0.161	0.135	0.0729	0.0785	0.0639	0.073	0.0531	0.0464	0.0407	0.0423
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.195	0.2	0.202	0.203	0.162	0.166	0.174	0.176	0.162	0.156	0.141	0.126	0.118	0.12	0.0952	0.122	0.108	0.122	0.102	0.108	0.109	0.113
Nickel	mg/L	-	0.00052	<0.00050	<0.00050	0.00052	<0.00050	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0284	0.0294	0.0303	0.0338	0.0284	0.032	0.0305	0.0281	0.0257	0.0265	0.0277	0.0299	0.0221	0.0272	0.029	0.0336	0.0357	0.0395	0.0335	0.0439	0.0442	0.0485
Silicon	mg/L	-	6.53	6.64	6.08	6.04	6.04	5.78	6.06	6.26	6.64	6.42	6.39	7.11	6.06	6.4	5.79	5.66	5.37	5.34	5.3	5.04	4.55	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	4.27	4.56	3.86	3.08	3.33	2.45	3	3.54	4.25	3.61	4.41	4.71	4.64	4.43	2.67	3.18	2.6	3.12	2.33	1.65	1.64	1.9
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00212	0.0019	0.0019	0.0019	0.00172	0.00172	0.00172	0.00173	0.00189	0.00156	0.00171	0.000978	0.00153	0.00136	0.000939	0.000937	0.00116	0.00126	0.000951	0.00114	0.00093	0.00111
Vanadium	mg/L	-	0.00082	0.00078	0.0009	0.0009	0.00083	0.00097	0.0011	0.001	0.0008	0.00083	0.00059	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00250	0.00051	0.0005	0.00051
Zinc	mg/L	-	<0.0030	<0.0030	0.0039	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030	<0.0050	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0050	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-05-17	2022-05-18	2022-05-25	2022-05-31	2022-06-06	2022-06-06	2022-06-07	2022-06-09	2022-06-23	2022-06-27	2022-07-06	2022-07-12	2022-07-19	2022-07-26	2022-08-03	2022-08-09	2022-08-15	2022-08-16	2022-08-28	2022-08-31	2022-09-06	2022-09-13
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1094	1095	1170	1209.3	-	1113.3	1019	1140	1021.7	1027.8	1082	1102	1203	1088.8	1095	1127.1	1141.2	1110.1	1242	1133	1108	1075.1
pH	pH units	-	7.67	7.57	8.09	7.65	-	7.47	7.41	7.46	7.42	7.5	7.44	7.73	7.33	7.82	7.98	7.47	7.61	7.63	7.68	7.66	7.77	7.8
Turbidity	NTU	-	1.56	1.58	1.86	3.42	-	4.06	3.94	3.09	2.55	6.6	1.86	3.39	4.16	0.64	1.53	3.64	2.26	2.79	3.28	2.2	1.74	1.06
Temperature	C	-	10.214	8.8	11.3	14.022	-	13.459	12.9	13.9	12.498	16.376	15.684	16.291	17.124	18.317	17.364	16.978	16.645	16.933	15.338	17.39	14.588	12.812
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	88.9	88.1	88.7	90.3	-	79	81	79.3	85.1	92.2	92.2	93.8	80	85.2	78.6	86.3	79.8	81.5	89.8	85.3	83.9	80.6
Specific conductivity	uS/cm	-	1090	1120	1250	1210	-	1100	1090	1010	1040	1030	1200	1100	1080	1070	1110	1100	1110	1110	1250	1170	1070	1080
pH	pH units	-	7.97	8.08	8.03	8.15	-	7.74	7.74	7.84	8.06	8.16	8.09	8.18	7.92	8.09	8.11	8.04	7.98	8.05	7.87	8.1	8.02	8.04
Total suspended solids	mg/L	30	9.9	11.5	3.2	25.8	16.5	56.9	16.5	10.8	9.3	9.1	9	12.4	7.7	3.6	1.3	8.5	4.5	9.4	9.1	5.4	3.6	2.4
Turbidity	NTU	-	2.07	1.69	0.89	4.39	-	5.38	6.51	7.1	2.4	3.56	2.12	3.66	1.12	1.04	0.77	3.58	2.5	0.92	1.89	1.17	1.16	0.74
Hardness, as CaCO3	mg/L	-	563	600	556	622	-	526	508	483	482	491	540	519	504	490	500	518	520	541	625	566	490	515
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	626	604	625	634	-	525	508	502	495	511	509	558	498	510	497	534	504	502	621	575	518	509
Total dissolved solids	mg/L	-	869	945	904	914	-	877	882	796	807	787	793	852	827	902	982	884	852	868	1020	946	914	803
Dissolved organic carbon	mg/L	-	6.07	7.89	5.1	8.98	-	4.75	5.04	5.79	6.79	7.32	5.8	6.97	4.46	4.37	3.37	5.65	5.32	4.62	3.8	4.61	3.2	3.66
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.05	5.13	5.56	5.42	-	4.57	4.38	4.17	4.59	4.17	5.07	4.62	4.82	5.01	5.06	4.68	5.03	4.82	5.83	5.44	4.92	5.02
Nitrate + nitrite	mg-N/L	-	5.05	5.13	5.57	5.44	-	4.6	4.4	4.18	4.61	4.17	5.09	4.64	4.83	5.03	5.08	4.7	5.05	4.84	5.85	5.45	4.93	5.03
Nitrite	mg-N/L	0.78	<0.0050	<0.0050	0.0097	0.0166	-	0.0278	0.0192	0.0109	0.02	<0.0100	0.0166	0.0168	0.0147	0.0233	0.0254	0.0191	0.0189	0.0158	0.018	0.013	0.0108	0.0122
Total ammonia	mg-N/L	1.3	0.0082	0.0106	0.0161	0.022	-	0.0292	0.0218	0.0157	0.0156	0.0131	0.0214	0.0306	0.0267	0.0401	0.0402	0.0456	0.0342	0.0334	0.0382	0.0378	0.0289	0.0333
Dissolved phosphorus	mg-P/L	-	0.0034	<0.0020	0.0023	<0.0020	-	<0.0020	<0.0020	0.0062	0.0034	0.003	0.0044	0.0037	<0.0020	0.0022	<0.0020	0.0023	<0.0020	<0.0020	0.0032	0.0064	0.0022	0.0026
Total phosphorus	mg-P/L	0.09	0.0071	0.0045	0.0072	0.011	-	0.0119	0.0141	0.0103	0.011	0.0072	0.0076	0.0116	0.0041	0.0064	0.0069	0.006	0.0077	0.0075	0.0112	0.0083	0.0083	0.0042
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.5	5.08	5.8	5.95	-	4.9	4.81	4.42	5.29	4.68	5.2	4.97	5.16	5.68	5.65	5.53	5.54	5.45	6.07	5.58	5.44	5.36
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	173	186	181	194	-	164	158	148	148	151	168	160	155	150	153	158	158	166	192	175	146	158
Chloride	mg/L	-	5.88	5.92	3.63	7.31	-	9.36	9.37	10.8	11.2	10	10.7	7.2	9.17	7.53	6.8	10.4	8.41	8.25	8.6	8.39	7.73	7.95
Fluoride	mg/L	17	0.296	0.354	0.397	0.467	-	0.366	0.362	0.314	0.334	0.222	0.352	0.37	0.38	0.404	0.424	0.398	0.484	0.416	0.418	0.439	0.361	0.403
Magnesium	mg/L	-	31.8	32.8	25.2	33.5	-	28.4	27.5	27.6	27.2	27.6	29.4	29.1	28.4	28.1	28.7	29.9	30.6	30.8	35.4	31.3	30.4	29.2
Potassium	mg/L	-	2.07	2.09	2.17	2.73	-	3.27	2.99	2.95	3.27	3.02	3.3	3.48	3.47	3.57	3.84	4.35	4.24	4.2	4.36	4.2	4	3.7
Sodium	mg/L	-	17.9	18.5	18.3	24.5	-	27.9	24.9	24.2	27.8	24.8	28.4	31	30	33	34.2	37.7	36	34.4	35.9	35.4	34.7	32.6
Sulphate	mg/L	1100	520	526	559	590	-	513	488	444	460	432	480	492	485	501	498	516	499	494	582	552	495	494
Total Metals																								
Aluminum	mg/L	-	1.09	1.14	0.108	1.14	-	1.73	1.49	1.34	1.22	1.22	1.2	0.954	0.894	0.65	0.179	1.22	0.734	0.617	0.876	0.558	0.525	0.271
Antimony	mg/L	-	0.00043	0.0004	0.00045	0.00058	-	0.0007	0.0006	0.0006	0.00066	0.00063	0.00065	0.00076	0.00093	0.00096	0.00108	0.00088	0.00097	0.00095	0.00076	0.00079	0.00102	0.00102
Arsenic	mg/L	0.028	0.00062	0.00059	0.00069	0.00078	-	0.00113	0.00098	0.00084	0.001	0.00094	0.00087	0.00121	0.0012	0.00118	0.00135	0.00118	0.00122	0.0012	0.00118	0.00113	0.00102	0.001
Barium	mg/L	-	0.0379	0.0339	0.0368	0.0458	-	0.0484	0.0447	0.0418	0.0416	0.0424	0.0433	0.0486	0.0507	0.0543	0.0626	0.0552	0.0593	0.0567	0.0549	0.057	0.063	0.0636
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.077	0.079	0.101	0.112	-	0.105	0.102	0.09	0.1	0.091	0.086	0.124	0.112	0.113	0.134	0.136	0.127	0.125	0.126	0.117	0.124	0.121
Cadmium	mg/L	-	<0.000135	0.000129	0.000218	0.000212	-	0.000176	0.000152	0.0000801	<0.000105	<0.0000950	<0.0000800	<0.0000950	0.000164	<0.0000800	<0.000150	<0.0000950	<0.0000950	<0.000100	<0.0000850	<0.0000750	<0.0000850	<0.0000550
Calcium	mg/L	-	198	189	193	199	-	163	158	155	153	155	153	171	150	155	151	163	152	151	192	175	157	156
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00134	0.00245	0.00636	0.00587	-	0.00359	0.00293	0.00172	0.00034	0.00028	0.00023	0.00032	0.0002	0.0002	0.00022	0.00029	0.00021	0.00022	0.00032	0.00024	0.00018	0.00014
Copper	mg/L	0.033	0.0129	0.0136	0.0325	0.0373	-	0.036	0.0292	0.018	0.0131	0.0131	0.0113	0.0177	0.00948	0.0101	0.0108	0.0119	0.012	0.0103	0.0116	0.0101	0.0102	0.00723
Iron	mg/L	1	0.07	0.062	0.09	0.132	-	0.323	0.135	0.07	0.053	0.035	0.039	0.096	<0.030	<0.030	0.037	0.086	0.062	0.039	0.121	0.06	0.049	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	0.000058	-	0.000122	0.000078	<0.000050	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000059	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0042	0.0053	0.0051	0.0063	-	0.0061	0.0056	0.0067	0.0056	0.0048	0.0052	0.0068	0.0059	0.0067	0.0067	0.0073	0.0068	0.0069	0.0079	0.0068	0.0072	0.007
Magnesium	mg/L	-	32	32.2	34.8	33.2	-	28.7	27.7	28	27.5	30.1	30.9	31.9	30.1	29.9	29.2	30.9	30.2	30.4	34.5	33.5	30.7	29
Manganese	mg/L	3.4	0.111	0.144	0.269	0.271	-	0.235	0.202	0.157	0.15	0.144	0.141	0.177	0.12	0.118	0.108	0.146	0.108	0.111	0.18	0.118	0.0805	0.0691
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.127	0.119	0.13	0.139	-	0.149	0.148	0.142	0.167	0.163	0.159	0.184	0.178	0.194	0.193	0.204	0.198	0.2	0.214	0.195	0.188	0.196
Nickel	mg/L	-	<0.00050	0.0008	0.00174	0.00198	-	0.00151	0.00118	0.00086	0.00054	0.00057	<0.00050	0.00058	0.00051	0.00053	0.00057	<0.00050	0.00054	0.00051	0.00062	0.0005	<0.00050	0.00051
Potassium	mg/L	-	2.05	1.99	2.47	2.89	-	3.29	2.96	2.68	3.16	3.22	3.31	3.78	3.62	3.8	3.92	4.33	4	4.01	5.02	4	3.86	3.82
Selenium	mg/L	0.075	0.0564	0.0561	0.0612	0.0629	-	0.0522	0.0519	0.0506	0.048	0.0469	0.0527	0.053	0.0505	0.0489	0.0508	0.0473	0.0504	0.0501	0.0599	0.0544	0.0529	0.0474
Silicon	mg/L	-	4.83	4.71	5.73	6.18	-	6.26	5.72	5.46	5.4	5.38	6.11	6.46	5.72	5.82	5.95	6.49	6.37	6.22	6.81	6.24	6.09	5.79
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	19.9	18	21.7	26	-	28.1	26.2	23.4	26.3	27.2	29.3	34.2	33.1	34.3	36.6	37.4	35.6	35.4	38.8	34	34.3	32.6
Strontium	mg/L	-	2.6	2.36	2.16	2.07	-	1.63	1.65	1.43	1.42	1.47	1.49	1.38	1.35	1.47	1.46	1.62	1.55	1.58	1.96	1.76	1.77	1.64
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	-	0.0181	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00131	0.0013	0.0014	0.00169	-	0.00177	0.00165	0.00136	0.00182	0.00173	0.00162	0.00221	0.00206	0.00223	0.00234	0.00214	0.00224	0.00219	0.0024	0.00222	0.00232	0.00239
Vanadium	mg/L	-	0.00091	0.00088	0.00084	0.00117	-	0.00185	0.00124	0.00095	0.00116	0.00106	0.00106	0.00184	0.00133	0.00143	0.00165	0.00162	0.00165	0.00154	0.0015	0.00138	0.00137	0.00124
Zinc	mg/L	0.059	0.0045	0.0064	0.0121	0.0119	-	0.0086	0.0064	0.0036	<0.0030	0.0051	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-05-17	2022-05-18	2022-05-25	2022-05-31	2022-06-06	2022-06-06	2022-06-07	2022-06-09	2022-06-23	2022-06-27	2022-07-06	2022-07-12	2022-07-19	2022-07-26	2022-08-03	2022-08-09	2022-08-15	2022-08-16	2022-08-28	2022-08-31	2022-09-06	2022-09-13
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.155	0.158	0.0284	0.194	-	0.153	0.132	0.106	0.162	0.143	0.145	0.222	0.171	0.195	0.108	0.19	0.224	0.234	0.222	0.216	0.231	0.152
Antimony	mg/L	-	0.00037	0.00038	0.00041	0.00055	-	0.00065	0.00061	0.00056	0.00066	0.00061	0.00063	0.00077	0.00086	0.00094	0.00099	0.00087	0.00092	0.0009	0.00074	0.00083	0.00095	0.001
Arsenic	mg/L	-	0.00045	0.00045	0.00061	0.00071	-	0.0009	0.00084	0.00081	0.00097	0.00074	0.00073	0.00093	0.00099	0.00103	0.00127	0.00096	0.00111	0.00106	0.00094	0.0011	0.00101	0.00101
Barium	mg/L	-	0.0328	0.033	0.0348	0.044	-	0.0446	0.0404	0.0405	0.0414	0.0393	0.0424	0.0431	0.0485	0.0529	0.0549	0.0528	0.0572	0.0543	0.0591	0.057	0.065	0.0651
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.076	0.075	0.086	0.092	-	0.103	0.097	0.08	0.1	0.08	0.091	0.12	0.114	0.114	0.138	0.127	0.125	0.13	0.123	0.111	0.117	0.122
Cadmium	mg/L	0.00034	<0.000110	0.000125	0.000184	<0.000245	-	0.000134	<0.000140	<0.000110	<0.0000950	<0.000100	<0.0000850	<0.0000800	<0.0000800	<0.0000850	<0.0000800	<0.0000900	<0.0000800	<0.0000800	<0.0000600	<0.0000750	0.0000502	<0.0000600
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00123	0.00245	0.00556	0.00552	-	0.00298	0.00263	0.00166	0.00033	0.00023	0.00022	0.00021	0.00016	0.00018	0.00016	0.00018	0.00015	0.00016	0.00022	0.00018	0.00013	0.00014
Copper	mg/L	-	0.0071	0.00779	0.0239	0.0146	-	0.00852	0.00887	0.00827	0.00687	0.00667	0.00662	0.00707	0.00534	0.00654	0.00695	0.00514	0.00602	0.00602	0.00517	0.00613	0.00713	0.0073
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.062	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0039	0.0044	0.0049	0.0054	-	0.0058	0.0056	0.0048	0.0052	0.0047	0.0052	0.0067	0.0065	0.0061	0.0067	0.0071	0.007	0.0071	0.0072	0.0067	0.0066	0.007
Manganese	mg/L	-	0.104	0.145	0.228	0.265	-	0.212	0.189	0.162	0.148	0.128	0.126	0.142	0.109	0.111	0.0847	0.128	0.0827	0.0958	0.149	0.103	0.069	0.0726
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.122	0.12	0.117	0.125	-	0.151	0.148	0.135	0.164	0.157	0.175	0.19	0.192	0.194	0.19	0.196	0.196	0.188	0.226	0.192	0.169	0.181
Nickel	mg/L	-	0.0006	0.0008	0.00143	0.00158	-	0.00102	0.00099	0.00073	0.00052	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	0.00051	0.00052
Selenium	mg/L	-	0.0542	0.0555	0.055	0.0609	-	0.0504	0.0507	0.0469	0.0491	0.0496	0.0521	0.0486	0.0493	0.0502	0.0506	0.0517	0.0522	0.0539	0.0555	0.0494	0.0504	0.0488
Silicon	mg/L	-	4.38	4.79	4.99	5.45	-	4.9	5.24	5.39	5.13	5.14	5.66	5.75	5.58	5.71	6.19	6.12	5.97	6.09	5.99	5.42	5.75	5.45
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.3	2.26	2.03	2.03	-	1.67	1.64	1.39	1.39	1.41	1.52	1.44	1.41	1.51	1.42	1.56	1.48	1.52	1.87	1.83	1.62	1.58
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00119	0.00116	0.00137	0.00166	-	0.0017	0.00154	0.00128	0.00177	0.00155	0.00157	0.00204	0.00198	0.00204	0.0022	0.0021	0.00204	0.0021	0.00238	0.0021	0.00208	0.00217
Vanadium	mg/L	-	0.00054	0.00053	0.0006	0.00069	-	0.00071	0.00073	0.0007	0.00088	0.00082	0.00088	0.00103	0.00104	0.00116	0.00137	0.00121	0.00129	0.00129	0.00113	0.0012	0.00121	0.00124
Zinc	mg/L	-	<0.0030	<0.0030	0.0094	0.0062	-	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-09-20	2022-09-27	2022-10-04	2022-10-11	2022-10-18	2022-10-19	2022-10-25	2022-11-01	2022-11-08	2022-11-15	2022-11-24	2022-11-30	2022-12-06	2022-12-13	2022-12-20	2022-12-28	2023-01-03	2023-01-10	2023-01-17	2023-01-25	2023-01-31	2023-02-07
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1103.3	1102.4	1102.8	1076	1059	1129.8	1074.5	1108	1341	1129.6	1088	1114	1101	1124	1196	1182	1152	1152	1124	1169	1135	1153
pH	pH units	-	7.5	7.38	7.69	7.41	7.75	7.05	7.75	7.65	7.2	7.62	7.64	7.37	7.81	7.8	7.58	7.73	7.45	7.39	7.68	7.85	7.33	7.5
Turbidity	NTU	-	1	2.12	2.26	1.31	1.23	2.03	1.73	3.67	4.46	3.5	2.91	3.77	3.46	1.5	3.38	8.5	4.61	3.06	3.58	4.73	4.41	3.91
Temperature	C	-	12.177	13.44	12.241	11.07	9.785	9.154	6.153	5.218	2.322	3.646	3.153	1.423	1.378	1.703	2.06	2.21	2.799	2.706	2.661	2.827	1.139	2.799
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	77.6	77	84.2	87	74.4	74.7	71.8	75.2	80.5	83	73.3	72.5	62.7	56.7	45	41.4	56.2	71.3	63.4	60.7	52.8	64.3
Specific conductivity	uS/cm	-	1090	1130	1100	1090	1080	1080	1120	1080	1130	1070	1020	1050	1090	1120	1170	1180	1100	1100	1120	1110	1160	1080
pH	pH units	-	8.03	8.09	7.96	8.06	8.05	8.05	8.04	7.95	7.89	7.76	8	7.8	7.86	7.73	7.77	7.65	7.77	7.95	7.86	7.99	7.87	7.78
Total suspended solids	mg/L	30	3.7	8.8	3.3	6.5	4	2.7	4	5	5.6	6.1	6.5	5	7.5	6.7	6.7	13.6	7	5.7	11.5	8.7	7.8	5.1
Turbidity	NTU	-	1.08	1.24	0.64	1.01	1.21	1.42	1.11	1.5	1.49	3.99	1.56	2.27	3.14	1.42	1.12	1.07	1.71	1.15	1.09	2.34	5.01	3.76
Hardness, as CaCO3	mg/L	-	509	502	545	536	527	531	530	494	505	528	506	473	434	436	428	448	431	479	443	452	431	473
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	551	594	519	529	545	507	537	510	535	542	510	477	490	480	421	470	482	492	448	465	458	478
Total dissolved solids	mg/L	-	798	852	893	773	810	855	868	870	820	814	772	832	797	851	868	858	805	848	851	829	880	803
Dissolved organic carbon	mg/L	-	3.64	3.64	2.88	3.46	4.11	3.59	2.93	2.4	4.47	4.76	4.15	3.28	4.7	4.58	4.83	6	7.26	5.08	4.8	4.67	4.8	4.86
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.05	5.28	4.92	4.91	5.88	4.93	5.38	5.26	5.09	5.5	4.81	4.76	4.03	3.41	2.67	2.8	3.44	4.19	3.61	3.48	3.61	3.62
Nitrate + nitrite	mg-N/L	-	5.06	5.29	4.94	4.92	5.88	4.94	5.38	5.26	5.09	5.51	4.82	4.78	4.06	3.45	2.73	2.88	3.5	4.22	3.67	3.56	3.72	3.68
Nitrite	mg-N/L	0.78	0.0107	0.0099	0.0161	0.01	0.0059	0.0064	0.0055	<0.0050	<0.0050	0.0097	0.0108	0.0163	0.0318	0.0394	0.0625	0.076	0.057	0.0315	0.0584	0.0811	0.112	0.0656
Total ammonia	mg-N/L	1.3	0.0292	0.0273	0.0313	0.0107	0.0129	0.0138	0.0117	0.0131	0.0169	0.0259	0.0297	0.0453	0.0956	0.127	0.214	0.226	0.158	0.0912	0.155	0.196	0.271	0.228
Dissolved phosphorus	mg-P/L	-	0.0036	<0.0020	<0.0020	<0.0020	0.0033	0.0021	0.0025	0.0026	0.0033	0.0024	0.0022	0.0028	0.0038	0.0029	0.0037	0.0038	0.0034	0.0033	0.0038	0.0029	0.0032	0.0033
Total phosphorus	mg-P/L	0.09	0.0061	0.0044	0.0031	0.0061	0.0064	0.0056	0.0088	0.0086	0.0091	0.0074	0.0091	0.0078	0.0119	0.01	0.0123	0.0126	0.0093	0.0098	0.0138	0.0121	0.0122	0.01
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.53	5.82	5.16	5.11	5.42	5.5	5.75	5.93	5.62	5.7	5.1	4.95	4.38	3.98	3.22	3.38	4.13	4.76	4.16	3.83	4.3	4.34
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	155	154	167	164	162	161	163	151	154	161	155	144	134	139	135	145	134	149	139	144	138	149
Chloride	mg/L	-	8.32	9.48	8.34	8.37	9.82	8.43	8.97	8.44	9.13	9.28	9.44	8.69	10.8	12.8	14.9	16.1	13.3	10	12	12.4	15	12.6
Fluoride	mg/L	17	0.415	0.361	0.385	0.446	0.357	0.36	0.414	0.323	0.373	0.391	0.372	0.408	0.488	0.552	0.577	0.653	0.463	0.409	0.51	0.601	0.57	0.517
Magnesium	mg/L	-	29.6	28.6	31	30.6	29.8	31.3	29.9	28.4	29.3	30.5	28.9	27.6	24.1	21.7	22	21	23.4	25.9	23.3	22.4	21.1	24.5
Potassium	mg/L	-	3.6	3.77	3.43	3.42	3.23	3.53	3.45	3.4	3.73	3.68	3.3	3.88	6.59	7.98	12	12.8	8.28	5.69	7.78	9.57	11	8.3
Sodium	mg/L	-	31.6	33.8	34	33.2	32.1	34.6	33.6	33	33.2	34.8	32	35.3	44.5	49.3	64.7	67.3	52.8	40.6	47.8	57.3	60.4	54.8
Sulphate	mg/L	1100	501	510	494	498	572	479	495	476	499	508	488	493	506	525	549	562	492	482	479	523	520	505
Total Metals																								
Aluminum	mg/L	-	0.533	0.946	0.635	0.599	0.626	0.585	0.635	0.109	0.704	0.82	0.725	0.54	0.722	0.649	0.723	0.855	0.543	0.594	0.835	0.308	0.666	0.576
Antimony	mg/L	-	0.00102	0.00106	0.001	0.00104	0.001	0.00099	0.00102	0.00097	0.00099	0.00099	0.001	0.00106	0.00116	0.00118	0.00126	0.00141	0.00115	0.00114	0.00127	0.00119	0.00122	0.00104
Arsenic	mg/L	0.028	0.00113	0.0011	0.0011	0.00106	0.00109	0.00106	0.00106	0.0012	0.00116	0.00118	0.00136	0.00131	0.00171	0.00188	0.00232	0.00205	0.00171	0.00149	0.00166	0.00181	0.00195	0.0016
Barium	mg/L	-	0.0714	0.0662	0.0627	0.0691	0.0644	0.0623	0.0644	0.0626	0.0614	0.0606	0.0646	0.0565	0.0588	0.061	0.0628	0.0647	0.0562	0.0518	0.052	0.0549	0.0545	0.0555
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.116	0.124	0.117	0.108	0.127	0.112	0.132	0.15	0.137	0.147	0.137	0.147	0.136	0.124	0.119	0.114	0.118	0.13	0.118	0.124	0.113	0.116
Cadmium	mg/L	-	<0.0000600	<0.000150	<0.0000650	<0.0000600	<0.0000650	0.0000319	<0.000130	<0.0000650	<0.0000800	<0.0000750	<0.000130	<0.0000650	<0.0000450	<0.0000450	<0.0000450	<0.0000600	<0.0000550	<0.0000650	<0.0000600	<0.0000500	<0.0000450	<0.0000550
Calcium	mg/L	-	170	181	157	161	164	156	165	155	163	165	153	145	153	150	131	152	153	153	139	147	149	154
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00018	0.0002	0.00016	0.00016	0.00017	0.00015	0.00019	0.00023	0.00025	0.00026	0.00023	0.00015	0.00021	0.00016	0.00018	0.00025	0.00018	0.00017	0.00016	0.00025	0.00017	0.0002
Copper	mg/L	0.033	0.01	0.00958	0.0098	0.00964	0.00986	0.00953	0.011	0.0123	0.0115	0.012	0.0138	0.00959	0.00916	0.00805	0.00673	0.00766	0.00819	0.00996	0.008	0.00813	0.00708	0.00779
Iron	mg/L	1	0.047	0.044	0.048	0.045	0.045	0.047	0.071	0.123	0.099	0.101	0.14	0.033	0.141	0.078	0.108	0.178	0.114	0.07	0.085	0.159	0.098	0.092
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	0.000054	0.000071	0.000071	0.000081	0.000058	0.000093	0.000096	0.000065	0.000053	<0.000050	0.000053	<0.000050	0.00007	<0.000050
Lithium	mg/L	-	0.0071	0.0074	0.0076	0.0066	0.0067	0.0074	0.0071	0.0074	0.0076	0.0076	0.0069	0.0072	0.009	0.0094	0.0096	0.0098	0.0083	0.0077	0.0075	0.0084	0.0082	0.0073
Magnesium	mg/L	-	30.8	34.5	30.9	30.9	32.9	28.6	30.3	30	31.2	31.5	31.2	28	26.1	25.5	22.9	22.1	24.2	26.7	24.5	23.7	20.8	22.7
Manganese	mg/L	3.4	0.0767	0.0913	0.0742	0.0749	0.0699	0.0714	0.084	0.0925	0.104	0.118	0.0833	0.0748	0.0644	0.0616	0.0822	0.0719	0.0591	0.0696	0.0718	0.0746	0.0533	0.0777
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.186	0.176	0.187	0.167	0.181	0.174	0.166	0.187	0.189	0.174	0.173	0.196	0.199	0.227	0.263	0.197	0.19	0.191	0.212	0.202	0.178
Nickel	mg/L	-	0.00052	0.0006	0.00068	0.00051	0.00056	0.00051	0.00058	0.00064	0.00062	0.00064	0.00062	<0.00050	0.00076	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	3.73	3.83	3.59	3.47	3.37	3.38	3.44	3.53	3.61	3.69	3.23	3.93	6.98	8.37	12.1	13.1	8.22	5.43	8.11	9.19	10.5	8.5
Selenium	mg/L	0.075	0.0514	0.0514	0.0487	0.0512	0.0528	0.0498	0.0476	0.0494	0.052	0.0513	0.0467	0.0467	0.0389	0.0356	0.0306	0.0331	0.0369	0.0422	0.0379	0.0346	0.035	0.035
Silicon	mg/L	-	5.77	5.84	6.25	5.87	6.02	5.82	6.08	6.22	6.17	7.06	6.74	6.17	6.19	5.37	5.29	5.88	5.58	5.95	5.86	5.68	5.37	5.11
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	34.2	38.2	34.5	32.9	39.2	30.8	35	33.5	33.4	36.2	35	36.5	45.1	51.1	67.3	74.7	55	42	49.4	55.1	62.4	54
Strontium	mg/L	-	2.02	1.87	2.04	2.23	1.87	1.79	1.58	1.5	1.86	1.58	1.79	1.96	1.75	1.88	1.45	1.71	1.79	2.08	2.05	2.3	2.03	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.0104	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.0023	0.00237	0.00227	0.00227	0.00226	0.00235	0.00237	0.00229	0.00237	0.00249	0.00268	0.00243	0.00214	0.0017	0.00117	0.00113	0.00181	0.00223	0.0019	0.00165	0.0012	0.00182
Vanadium	mg/L	-	0.00131	0.00151	0.00139	0.00142	0.00147	0.00136	0.00149	0.00154	0.00147	0.00149	0.00177	0.00132	0.00179	0.00182	0.00226	0.00274	0.00226	0.00177	0.00206	0.0023	0.00228	0.00188
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0093	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-09-20	2022-09-27	2022-10-04	2022-10-11	2022-10-18	2022-10-19	2022-10-25	2022-11-01	2022-11-08	2022-11-15	2022-11-24	2022-11-30	2022-12-06	2022-12-13	2022-12-20	2022-12-28	2023-01-03	2023-01-10	2023-01-17	2023-01-25	2023-01-31	2023-02-07
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.19	0.166	0.194	0.194	0.178	0.191	0.176	0.0063	0.163	0.154	0.155	0.137	0.146	0.148	0.152	0.123	0.108	0.132	0.215	0.0546	0.119	0.126
Antimony	mg/L	-	0.00093	0.001	0.00106	0.001	0.00105	0.00102	0.00098	0.00094	0.00092	0.00093	0.00102	0.001	0.00106	0.00121	0.0012	0.00131	0.00105	0.00108	0.00112	0.00113	0.00125	0.00109
Arsenic	mg/L	-	0.00098	0.00094	0.00096	0.001	0.00101	0.00106	0.00091	0.00102	0.00088	0.00089	0.0009	0.001	0.00122	0.00132	0.00155	0.00125	0.00136	0.0011	0.00105	0.00163	0.00147	0.00124
Barium	mg/L	-	0.0631	0.0639	0.0617	0.0647	0.0638	0.0649	0.0617	0.0587	0.0606	0.0561	0.0544	0.0516	0.056	0.0518	0.0587	0.0578	0.053	0.0488	0.0496	0.0496	0.0514	0.0506
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.122	0.122	0.119	0.128	0.121	0.117	0.13	0.12	0.132	0.13	0.143	0.136	0.122	0.128	0.121	0.105	0.1	0.121	0.106	0.11	0.111	0.117
Cadmium	mg/L	0.00034	<0.0000700	<0.0000650	<0.000125	<0.0000550	<0.000110	<0.0000700	<0.000135	<0.0000600	<0.0000600	<0.0000800	0.0000332	<0.0000650	<0.0000550	<0.0000500	<0.0000350	<0.0000400	<0.0000400	<0.0000550	<0.0000600	<0.0000400	<0.0000600	<0.0000650
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00014	0.00013	0.00011	0.00013	0.00013	0.00013	0.00014	0.00017	0.00017	0.00011	0.00012	0.0001	<0.00010	0.00012	0.0001	<0.00010	0.00012	0.00012	0.00011	<0.00010	0.00011
Copper	mg/L	-	0.00628	0.00557	0.00577	0.00564	0.00622	0.00612	0.00591	0.00661	0.0057	0.00488	0.00556	0.00528	0.00399	0.00356	0.00288	0.00221	0.00343	0.00453	0.0041	0.00283	0.00269	0.00258
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.007	0.0072	0.0064	0.007	0.007	0.0076	0.0073	0.0071	0.0069	0.0072	0.0074	0.008	0.0093	0.0106	0.01	0.0076	0.0072	0.0076	0.008	0.0089	0.0076
Manganese	mg/L	-	0.066	0.0781	0.0637	0.0608	0.0564	0.0596	0.073	0.0798	0.0963	0.108	0.0664	0.0673	0.0553	0.0541	0.0745	0.0623	0.0519	0.0646	0.0658	0.0676	0.0465	0.0696
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.166	0.18	0.178	0.178	0.18	0.178	0.172	0.16	0.178	0.183	0.176	0.167	0.165	0.188	0.22	0.222	0.179	0.185	0.187	0.186	0.2	0.178
Nickel	mg/L	-	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00092
Selenium	mg/L	-	0.0499	0.0476	0.0496	0.0514	0.0489	0.0512	0.045	0.0477	0.0491	0.0484	0.0436	0.045	0.0379	0.0371	0.0259	0.0312	0.0326	0.0423	0.0356	0.0297	0.0322	0.0346
Silicon	mg/L	-	5.37	5.44	5.58	5.55	5.37	5.64	5.9	5.94	5.83	6.53	5.96	5.81	5.4	5.28	4.78	5.11	5.18	5.48	5.32	5	4.73	4.85
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.74	1.75	2.17	2.21	1.88	1.8	1.55	1.47	1.82	1.56	1.73	1.83	1.56	1.78	1.39	1.52	1.71	2.01	2	2.07	1.96	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00224	0.0023	0.00215	0.00221	0.00218	0.00225	0.00225	0.00215	0.00227	0.0023	0.00238	0.00232	0.00191	0.00157	0.00111	0.000964	0.00144	0.0021	0.00161	0.0015	0.00125	0.00172
Vanadium	mg/L	-	0.00114	0.00113	0.00135	0.00124	0.00124	0.0013	0.00116	0.00117	0.00118	0.00115	0.00116	0.00116	0.00136	0.00153	0.00182	0.00206	0.00177	0.00148	0.00166	0.00171	0.00188	0.00158
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0067	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2023-02-14	2023-02-21	2023-02-28	2023-03-07	2023-03-14	2023-03-21	2023-03-23	2023-03-27
Parameter										
Field Parameters										
Specific conductivity	uS/cm	-	1119	1139	1117	-	1147	1103	1077	1015
pH	pH units	-	7.25	7.8	7.71	-	7.85	7.53	7.56	7.44
Turbidity	NTU	-	1.82	2.75	2.6	-	2.52	10.74	5.28	9.69
Temperature	C	-	3.804	1.203	1.383	-	1.774	3.508	3.902	2.748
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-
Conventional Parameters										
Total alkalinity, as CaCO3	mg/L	-	89.3	88.8	86.6	99.2	64.8	77.4	81.7	92.4
Specific conductivity	uS/cm	-	1230	1130	1100	1160	1120	1100	1050	1000
pH	pH units	-	8.02	8.06	7.88	8.1	7.69	7.86	7.81	7.9
Total suspended solids	mg/L	30	6.5	4.9	3.1	5	6.1	15.3	9.9	14.2
Turbidity	NTU	-	1.61	2.54	1.8	1.3	1.1	3.85	3.91	8.8
Hardness, as CaCO3	mg/L	-	516	555	511	532	430	466	451	458
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	516	561	531	480	444	471	460	492
Total dissolved solids	mg/L	-	884	876	826	848	903	920	797	770
Dissolved organic carbon	mg/L	-	2.38	2.9	4.22	6.37	4.33	8.09	5.33	8.79
Nutrients and Biological Indicators										
Nitrate	mg-N/L	34	3.92	3.97	4.39	3.6	3.44	3.18	3.15	3.3
Nitrate + nitrite	mg-N/L	-	3.94	3.97	4.39	3.65	3.53	3.25	3.2	3.33
Nitrite	mg-N/L	0.78	0.0186	<0.0050	<0.0050	0.0542	0.093	0.0686	0.0482	0.027
Total ammonia	mg-N/L	1.3	0.0366	0.0212	0.0636	0.104	0.169	0.104	0.0754	0.0346
Dissolved phosphorus	mg-P/L	-	0.002	0.0037	0.0037	<0.0020	0.0025	0.0028	0.003	0.0044
Total phosphorus	mg-P/L	0.09	0.0062	0.0094	0.0085	0.0112	0.0114	0.0304	0.0194	0.0252
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4.07	4.16	4.8	4.3	4.36	4.12	4.07	4.3
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	163	173	156	169	138	149	144	145
Chloride	mg/L	-	8.91	7.21	7.52	10.5	13.2	13.7	11.7	8.47
Fluoride	mg/L	17	0.466	0.414	0.416	0.499	0.549	0.467	0.498	0.435
Magnesium	mg/L	-	26.4	29.9	29.6	26.6	20.8	22.7	22.2	23.3
Potassium	mg/L	-	3.28	2.93	2.97	6	7.01	5.37	4.64	3.22
Sodium	mg/L	-	30.8	31.4	31.7	46.4	52.9	41.9	37.1	26.7
Sulphate	mg/L	1100	505	519	503	501	502	494	472	451
Total Metals										
Aluminum	mg/L	-	0.818	0.504	0.487	0.568	0.431	0.925	0.996	1
Antimony	mg/L	-	0.00091	0.00089	0.00104	0.00111	0.00119	0.00101	0.00087	0.00068
Arsenic	mg/L	0.028	0.00118	0.00116	0.00132	0.00155	0.00175	0.00134	0.00124	0.00105
Barium	mg/L	-	0.0462	0.0465	0.0461	0.0502	0.0516	0.0566	0.0518	0.051
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.139	0.148	0.148	0.128	0.116	0.121	0.11	0.098
Cadmium	mg/L	-	<0.0000500	<0.0000950	<0.0000700	0.0000412	<0.0000650	<0.0000700	<0.0000750	<0.0000750
Calcium	mg/L	-	161	178	165	152	142	150	146	156
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00016	0.00017	0.00019	0.00016	0.00017	0.00025	0.00029	0.0004
Copper	mg/L	0.033	0.00804	0.00952	0.0111	0.00795	0.00808	0.00846	0.00891	0.0182
Iron	mg/L	1	0.067	0.066	0.066	0.074	0.113	0.154	0.184	0.347
Lead	mg/L	-	<0.000050	<0.000050	0.000055	0.000052	0.000052	0.000066	0.000062	0.000112
Lithium	mg/L	-	0.0072	0.0075	0.007	0.0079	0.0079	0.0077	0.0068	0.0061
Magnesium	mg/L	-	27.8	28.4	29	24.5	21.8	23.4	23.3	25
Manganese	mg/L	3.4	0.0821	0.0714	0.0912	0.06	0.0538	0.0636	0.0697	0.0827
Mercury	mg/L	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.174	0.168	0.181	0.178	0.19	0.165	0.155	0.148
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	0.00063	0.00066
Potassium	mg/L	-	3.49	2.86	3.1	5.51	7.31	5.55	4.8	3.45
Selenium	mg/L	0.075	0.0394	0.04	0.0437	0.0351	0.0323	0.0328	0.0323	0.0328
Silicon	mg/L	-	6.22	5.64	6.28	5.58	5.16	5.33	5.56	6.13
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	33	30	31.4	43.1	56.7	42.9	38.7	28.4
Strontium	mg/L	-	3.23	3.42	2.86	3.12	2.77	2.98	2.91	2.81
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.0101	0.0164
Uranium	mg/L	-	0.00278	0.00274	0.00282	0.00225	0.00192	0.00179	0.00185	0.00172
Vanadium	mg/L	-	0.00138	0.00128	0.00148	0.00151	0.00185	0.00148	0.00151	0.00164
Zinc	mg/L	0.059	0.0031	0.0038	0.0063	0.003	0.0032	<0.0030	0.003	0.0035

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2023-02-14	2023-02-21	2023-02-28	2023-03-07	2023-03-14	2023-03-21	2023-03-23	2023-03-27
Parameter										
Dissolved Metals										
Aluminum	mg/L	0.75	0.135	0.14	0.129	0.139	0.114	0.108	0.125	0.134
Antimony	mg/L	-	0.00092	0.0009	0.00095	0.00096	0.0011	0.00099	0.00082	0.0006
Arsenic	mg/L	-	0.0007	0.00096	0.00101	0.00111	0.00136	0.00072	0.00078	0.00076
Barium	mg/L	-	0.0437	0.043	0.0436	0.0484	0.048	0.0485	0.0464	0.039
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.141	0.129	0.15	0.117	0.114	0.101	0.097	0.089
Cadmium	mg/L	0.00034	0.0000414	<0.0000800	0.0000482	<0.0000650	<0.0000700	<0.0000650	<0.0000700	<0.0000600
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.0001	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00351	0.0041	0.005	0.00308	0.00293	0.00286	0.00317	0.00516
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0066	0.0068	0.007	0.0076	0.0072	0.0067	0.0056
Manganese	mg/L	-	0.0758	0.0675	0.084	0.0553	0.0477	0.0553	0.0609	0.0673
Mercury	mg/L	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.172	0.162	0.171	0.179	0.176	0.162	0.146	0.132
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0392	0.0375	0.0435	0.0337	0.031	0.0317	0.0312	0.0308
Silicon	mg/L	-	5.45	5.61	5.88	5.2	4.74	4.91	4.83	5.2
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	3.29	3.48	2.73	3.35	2.59	3	2.75	2.54
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00255	0.00257	0.00262	0.0021	0.00174	0.00158	0.00176	0.00159
Vanadium	mg/L	-	0.00104	0.00101	0.00118	0.00116	0.00139	0.00103	0.0009	0.00074
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

APPENDIX 7-1: Comprehensive Environmental Monitoring Plan (CEMP)

Mount Polley Mining Corporation

an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

Comprehensive Environmental Monitoring Plan 2019

Submitted to:

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
V0L 1N0

(250) 790-2215

Date: October 31, 2019

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Appendix A – Approved CEMP Terms of Reference (April 28, 2017)
Appendix B – Detailed Study Designs for CEMP Components
Appendix C – Sample of Monthly Monitoring Schedule
Appendix D – Site Matrix
Appendix E – Declarations of Competency

ACRONYMS

°C	degrees Celsius
µm	micrometer
µS/cm	micro Siemens per centimetre
ADP	Annual Discharge Plan
AERR	Annual Environmental and Reclamation Report
ARD	acid rock drainage
BC	British Columbia
CALA	Canadian Association of Laboratory Accreditation
CCS	Central Collection Sump
CEMP	Comprehensive Environmental Monitoring Plan
cm	centimetre(s)
COPC	constituents of potential concern
CRM	certified reference material
CRP	Conceptual Remediation Plan
CSM	Conceptual Site Model
CSR	Contaminated Sites Regulation
DFO	Fisheries and Oceans Canada
DGT	diffusive gradients in thin-film
DQO	data quality objectives
EEM	Environmental Effects Monitoring
EMA	*Environmental Management Act*
EMP	Environmental Monitoring Plan
EMPR	Energy, Mines, and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy
ERA	Ecological Risk Assessment
Golder	Golder Associates Ltd.
ha	hectares
HHRA	Human Health Risk Assessment
IDZ	initial dilution zone
km	kilometre(s)
km^2	square kilometre(s)
LOR	limit of reporting
LTWM	long term water management
m^3/s	cubic metres per second
masl	metres above sea level
MDL	method detection limit
Minnow	Minnow Environmental Inc.
mL	millilitre(s)
ML	metal leaching
mm	millimetre(s)
MPMC	Mount Polley Mining Corporation
MDMER	Metal and Diamond Mining Effluent Regulations
PAG	potentially acid-generating

PAO	Pollution Abatement Order
PEEIAR	Post-event environmental impact assessment report
PETBP	Perimeter Embankment Till Borrow Pond
PLC	Public Liaison Committee
QA	quality assurance
QC	quality control
RCP	Reclamation and Closure Plan
RPD	relative percent difference
SCIB	Soda Creek Indian Band
SFS	Society for Freshwater Science
SOP	standard operating procedure
SWL	static water level
TAR	Technical Assessment Report
TOR	terms of reference
TSF	Tailings Storage Facility
TSS	total suspended solids
WaterSmith	WaterSmith Research Inc.
WLIB	Williams Lake Indian Band
WM	work method
WTP	water treatment plant

1 INTRODUCTION

The Mount Polley Mine is located eight kilometres (km) southwest of Likely and 56 km (100 km by road) northeast of Williams Lake, British Columbia (BC; Figure 1.1). On November 29, 2015, Mount Polley Mining Corporation (MPMC), which operates the mine, received an amendment to Permit 11678 (herein referred to as the Permit) issued by the BC Ministry of Environment and Climate Change Strategy (ENV; previously known as the Ministry of Environment) pursuant to the *Environmental Management Act* (EMA; SBC 2003, Chapter 53) for a short-term water management strategy to discharge treated mine effluent into Quesnel Lake via Hazeltine Creek. The most recent amendment of the Permit was granted April 7, 2017 for a long-term water management strategy to discharge treated mine effluent directly to Quesnel Lake. Section 3.2 of the amended Permit requires MPMC to develop and implement a Comprehensive Environmental Monitoring Plan (CEMP) for the Mount Polley Mine site and surrounding receiving environment that combines pre-existing monitoring programs into an integrated plan as follows:

> *"The Permittee must continue to develop, submit, and implement an ongoing Comprehensive Environmental Monitoring Plan (CEMP) to evaluate the effects of mining-related activities on the physical, chemical, and biological characteristics of Hazeltine Creek, Edney Creek, Bootjack Lake, Morehead Creek, Polley Lake, Quesnel Lake, Quesnel River, and associated riparian and upland areas.*
>
> *The CEMP will consolidate and integrate all of the pre-existing monitoring programs that are being conducted in the vicinity of the mine site and include, at minimum, surface water (quality and quantity), groundwater (characterization and interactions with surface water), sediments, soils, periphyton, phytoplankton, benthic invertebrates, zooplankton, fish, floodplain and upland vegetation, and wildlife.*
>
> *The CEMP must at minimum address a three year time span, as well as at a minimum include all sampling sites, frequency of sampling, variables to be analysed, method detection limits, sampling methods, sample analysis methods, and data analysis methods."*

The June 23, 2016 version of the CEMP was approved in the April 7, 2017 Permit amendment. Subsequently, in 2017, MPMC submitted several versions of a CEMP to ENV for review, however, a plan for 2017 was not approved. This CEMP covers the 2018 to 2020 time period and was developed based on the approved updated Terms of Reference (TOR) included as Appendix A. Based on the requirements of the permit, the next CEMP will be submitted in March 2020.

This CEMP is a unique and integrated monitoring plan that has been developed to capture a number of independent and interdependent monitoring programs, including; site monitoring, water discharge, *Metal and Diamond Mining Effluent Regulations* (MDMER) requirements, and Tailings Storage Facility (TSF) embankment breach response and remediation. Monitoring programs are normally developed by requirements of sector-specific regulations (e.g., MDMER of the federal *Fisheries Act* [Government of

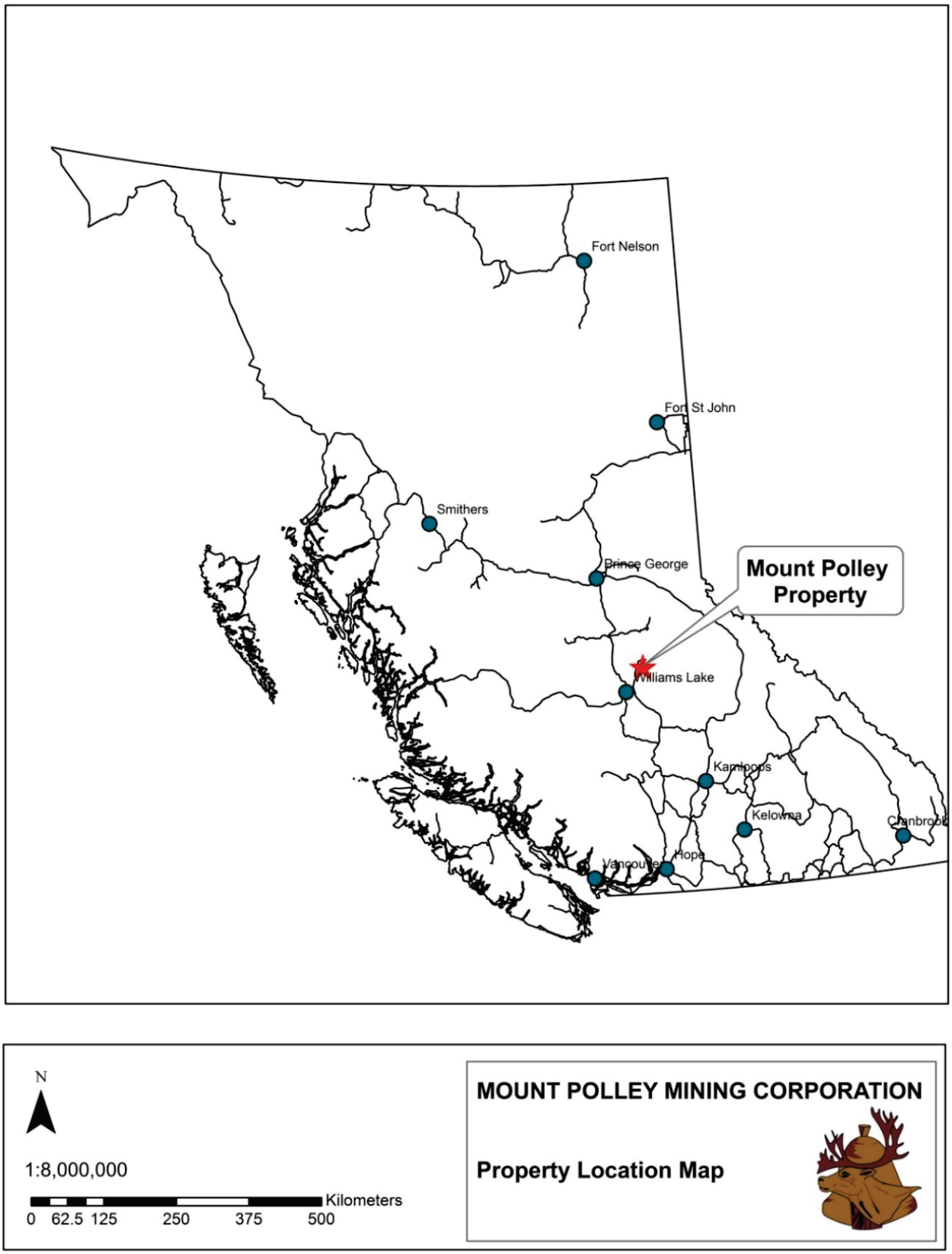

Figure 1.1 Mount Polley Mine property location

Canada 2018]) or by conditions in a permit with a specific monitoring plan that ties together permit-required and MDMER-required monitoring. As there is no ENV Technical Guidance document for this type of plan, this CEMP has been developed through an extensive consultative process that encompasses a number of permitting and other regulatory processes. Through these efforts, it has been suggested by various parties that all of the monitoring programs (e.g., water discharge monitoring, MDMER, TSF embankment breach response, etc.) be combined into one overarching program that takes advantage of the broader data set. This integrated monitoring plan offers the additional benefit of facilitating more efficient monitoring plan review by regulatory agencies, First Nations, and stakeholders. A constraint on this CEMP is where there are specific programs compelled by regulation such as the Environmental Effects Monitoring (EEM) Program that is required under the MDMER. In such instances, transparency of objectives and best efforts will be required to consolidate these different programs to the extent possible.

The CEMP is structured as follows:

- **Section 1:** Describes the CEMP objectives, a brief summary of the monitoring programs that have been integrated into the CEMP, and regulatory requirements.
- **Section 2:** Provides an overview of the integration of the various environmental monitoring programs being undertaken at the mine. Conceptual Site Models (CSMs) for the mine site and the TSF breach affected areas have also been provided, along with further details of the monitoring plans that have been integrated into the CEMP.
- **Section 3:** Provides an overview of First Nations and Stakeholders.
- **Section 4:** Provides a summary of the mine operations and the receiving environment.
- **Section 5:** Describes the environmental management practices in place, including water management.
- **Section 6:** Describes all monitoring components, including climate, surface water, hydrology, groundwater, contact water, seepage water, effluent, sediment quality, benthic invertebrate, plankton and chlorophyll *a*, periphyton, fish, wildlife, amphibian and reptile, soil, soil invertebrate, vegetation, and biosolids.
- **Section 7:** Describes the process for CEMP revisions and updates, along with a summary of changes made since the approved plan was submitted on June 23, 2016.
- **Section 8:** Summarizes relevant components of the post-TSF breach reclamation and remediation plans and interactions with CEMP components.
- **Section 9:** Provides an overview of the reporting of CEMP results.
- **Section 10:** Provides an overview of the future outlook.

The appendices attached to the CEMP are summarized below:

- **Appendix A:** Approved CEMP TOR (April 28, 2017).
- **Appendix B:** Contains the Detailed Study Designs for CEMP components, as referenced in document.
- **Appendix C:** Sample of Monthly Monitoring Schedule, which is a sample of the monthly environmental monitoring schedule provided to environmental department staff.

- **Appendix D:** Site Matrix, which describes all water sample locations in the CEMP, including site descriptions, site locations, access or safety concerns, and rationale for monitoring.
- **Appendix E** Declarations of Competency forms for Qualified Professionals contributing to the CEMP

1.1 OBJECTIVES

As specified in the Permit, the CEMP describes monitoring activities intended to support the evaluation of the potential for effects of mine-related activities on the physical, chemical, and biological characteristics of Bootjack Lake and Morehead Creek in the Springer Pit area, the Hazeltine and Edney Creek drainages, Polley Lake, Quesnel Lake, and Quesnel River, and associated riparian and upland areas. Specifically, the CEMP objectives are:

1. To evaluate if pollution[1] is occurring in the receiving environment as a result of the existing water discharge or mine-related activities;
2. To evaluate the environmental impacts of the August 2014 TSF embankment breach, to inform the rehabilitation plan, as well as to evaluate the effects of mitigation measures that are implemented as part of the rehabilitation strategy;
3. To integrate, to the extent feasible, the requirements of the MDMER; and
4. To inform reclamation and closure (*Mines Act* Permit M-200).

This CEMP includes monitoring of: effluent, surface water, groundwater, sediment, periphyton, plankton, benthic invertebrates, and fish in the aquatic environments; and soil, floodplain and upland vegetation, and wildlife in the terrestrial environments. Specific objectives for individual monitoring program components are stated in the subsequent sections. Supporting summary tables and maps are also provided.

Since the original integration of these plans and submission of the CEMP on March 31, 2016, many iterations of the CEMP have been reviewed, revised, and submitted in 2016 and 2017. Pre-existing monitoring plans that were integrated into the initial CEMP and have subsequently been revised within CEMP revisions (instead of individually) are:

- The *Monitoring Plan for Discharge of Treated Effluent to Quesnel Lake via Hazeltine Creek* (MPMC 2016a);
- The *Annual Monitoring Plan* for surface water and groundwater (MPMC 2015a);
- The *Biological Monitoring and Lake Sampling Plan* (MPMC 2015b); and
- The *Post-TSF Breach Monitoring Plan – 2015 Revision 1* (MPMC 2015c), which references the *Post Breach Fish Tissue Collection Plan – 2015* (MPMC 2015d) and the *Sampling and Analysis Plan: Detailed Site Investigation and Human Health and Ecological Risk Assessment* (Golder 2015a).

[1] Pollution as defined in the BC EMA (S.1(1)) means "*…the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment*".

Previous results were used to inform and structure this version of the CEMP and are summarized below in their respective sections or provided in Appendix B, as appropriate. A summary of results along with a discussion is provided in each relevant section. Throughout the CEMP, references are made to semi-x monitoring. This refers to monitoring that occurs twice per unit time, for example semi-annual monitoring indicates twice per year, and semi-monthly monitoring indicates twice per month.

It is expected that monitoring will be updated from time to time, consistent with an adaptive monitoring program (see Section 2.3). When changes are made to the monitoring, this amended plan (or relevant replacement pages) will be resubmitted to the Director and MPMC's Implementation Committee.

Work plans will be developed for all future monitoring programs and submitted to the ENV at least 30 days prior to commencing the program. These programs will be developed by a Qualified Professional (QP) and will consider linkages and dependencies with existing programs using previous data and review of the CSMs, which are presented in Section 2.2.

2 INTEGRATION OF MONITORING ACTIVITIES

The CEMP integrates environmental monitoring programs being carried out at the mine to meet multiple requirements which have different drivers and, therefore, objectives. Figure 2.1 shows the linkage between these drivers and associated monitoring objectives, as well as the resulting monitoring components that addresses those objectives. Further discussion is provided on these linkages in the sections following.

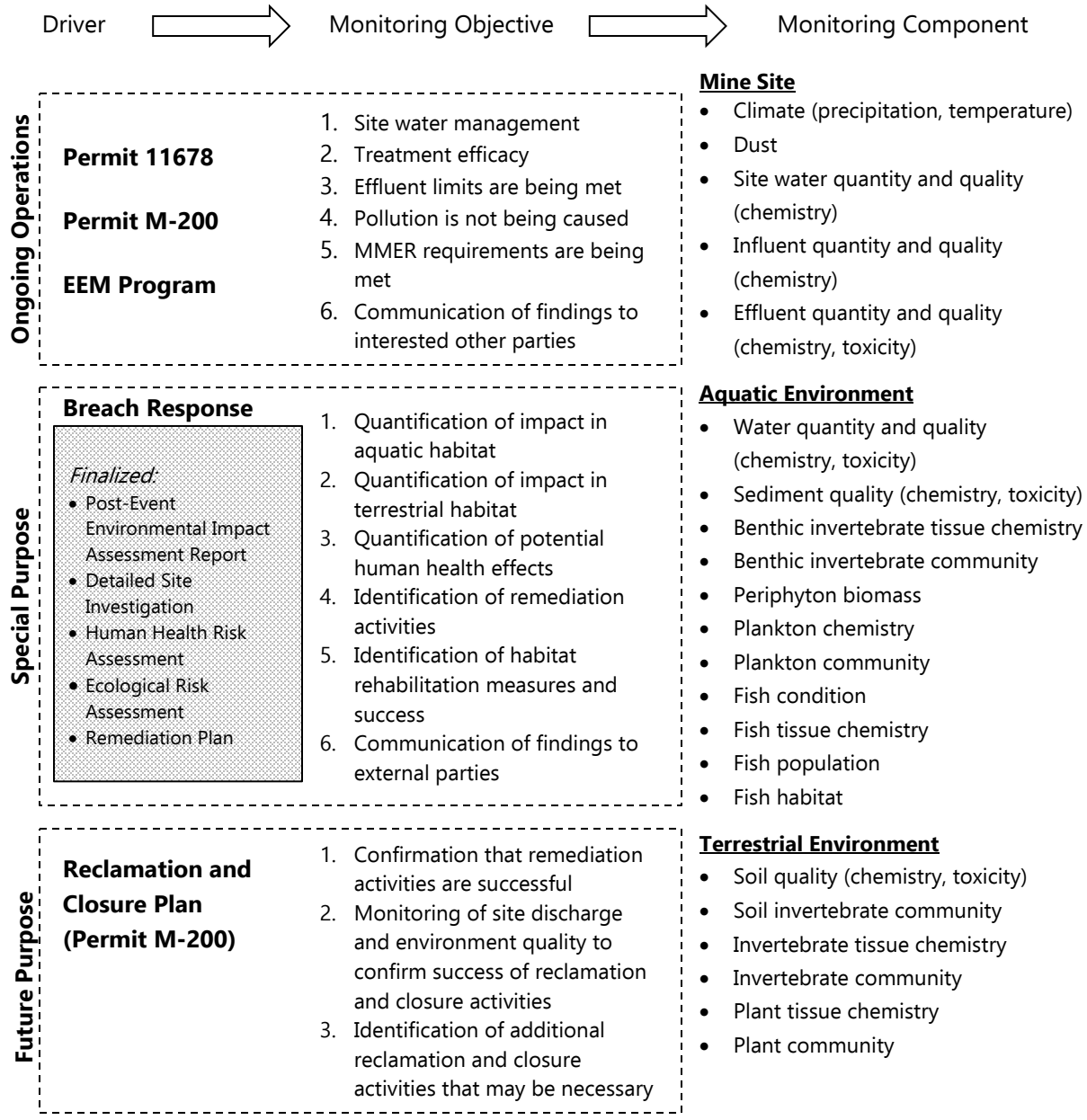

Figure 2.1 CEMP integration framework

2.1 MONITORING DRIVERS AND OBJECTIVES

There are three different drivers for current monitoring activities: ongoing operations, the TSF embankment breach response (special purpose program distinct from normal mine operations monitoring), and reclamation and closure planning (future purpose; note that some progressive reclamation has been done to date). These drivers and their associated monitoring objectives are described below. Previous monitoring results are continually reviewed to inform and structure the monitoring as well.

2.1.1 ONGOING OPERATIONS

Mount Polley Mine is an operational facility that is governed by provisions of the provincial EMA and *Mines Act* and the federal MDMER (a sector-specific regulation of the *Fisheries Act*). These permits and regulations contain specific requirements for on-going monitoring of site activities and downstream aquatic receiving environments. The objectives of ongoing operations monitoring are to:

1. Evaluate and plan for site water management.
2. Evaluate treatment efficacy to provide information for the ongoing management of the water treatment system installed at the time.
3. Verify that effluent limits are being met.
4. Verify that pollution is not being caused.
5. Verify that MDMER requirements are being met.
6. Communicate the findings to all interested parties.

Monitoring in accordance with conditions contained within BC *Mines Act* Permit M 200 is also summarized in the CEMP. This monitoring is only described in the CEMP for completeness purposes. Monitoring is summarized and future changes will be presented in CEMP revisions, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A). This permit requires monitoring for metal leaching and acid rock drainage (ML/ARD) characteristics, water quality of on-site contact water (Section 6.11), and water quality of seeps from open pits and waste rock piles (Section 6.10). Permit M-200 also contains conditions related to reclamation and closure planning and monitoring. Results of monitoring conducted under the M-200 permit will continue to be reported annually, along with the monitoring results directed under the CEMP, in a combined AERR (Annual Environmental and Reclamation Report) that is submitted to ENV and the BC Energy, Mines, and Petroleum Resources (EMPR; formerly Ministry of Energy and Mines). Refer to Section 9 for information on reporting associated with the CEMP.

MPMC is also subject to the conditions of the BC *Water Sustainability Act* (which replaced the *Water Act* in 2016) that includes provisions related to sediment and erosion control and working around water. MPMC holds conditional water licences and is subject to Order 76930-40 following the TSF embankment breach, both of which were issued under the former *Water Act*.

2.1.2 SPECIAL PURPOSE

On August 4, 2014, a foundation failure of the Mount Polley TSF perimeter embankment occurred. ENV issued a Pollution Abatement Order (PAO) that specified the need for specific impact studies and monitoring to address impacts of the breach event, inform remedial measures, and evaluate changes over time. These studies are referred to as "special purpose" studies (now primarily monitoring) because they relate to a unique event with program objectives that differ considerably from an operating mine. The objectives of the special purpose monitoring are to:

1. Monitor and assess impact to aquatic habitat.
2. Monitor and assess impact to terrestrial habitat.
3. Monitor and assess potential human health risks.
4. Identify remediation activities needed to address identified impacts.
5. Identify habitat rehabilitation measures and related works as well as the success of those works.
6. Communicate findings of the impact assessment and ongoing monitoring to external parties.

2.1.3 FUTURE PURPOSE

As an operating mine, MPMC is required to plan for eventual closure. Reclamation and closure monitoring takes place after the closure plan is implemented. Although progressive reclamation and reclamation research have already been initiated at the site, the Reclamation and Closure Plan (RCP) continues to be refined during operations in preparation for closure and is not yet finalized. However, in the context of a CEMP, future monitoring needs are appropriate to start considering. Because this CEMP is intended to be an adaptive plan, these will be updated as reclamation and closure planning progresses and greater certainty of locations, measurement endpoints, etc. are available.

The objectives of the future monitoring program are to:

1. Confirm that mine site reclamation activities are successful in achieving their stated objectives.
2. Monitor site discharge quality and receiving environment quality as appropriate to confirm that reclamation and closure works have been successful in preventing pollution and that discharges are compliant with applicable requirements.
3. Identify additional reclamation and closure activities that may be necessary.

Additional and more specific objectives will be developed as the reclamation and closure planning process progresses.

2.2 MONITORING COMPONENTS AND CONCEPTUAL SITE MODEL

Figure 2.2 provides an overview of the Mount Polley Mine, in particular the CEMP study areas along with their respective monitoring components. Figure 2.3 and Figure 2.4 show greater detail of the TSF area and the mine site, respectively, of the sources of mine-contact water to the surrounding aquatic receiving environment and areas of ground disturbance. The measurement endpoints are detailed in the applicable sections later in this plan.

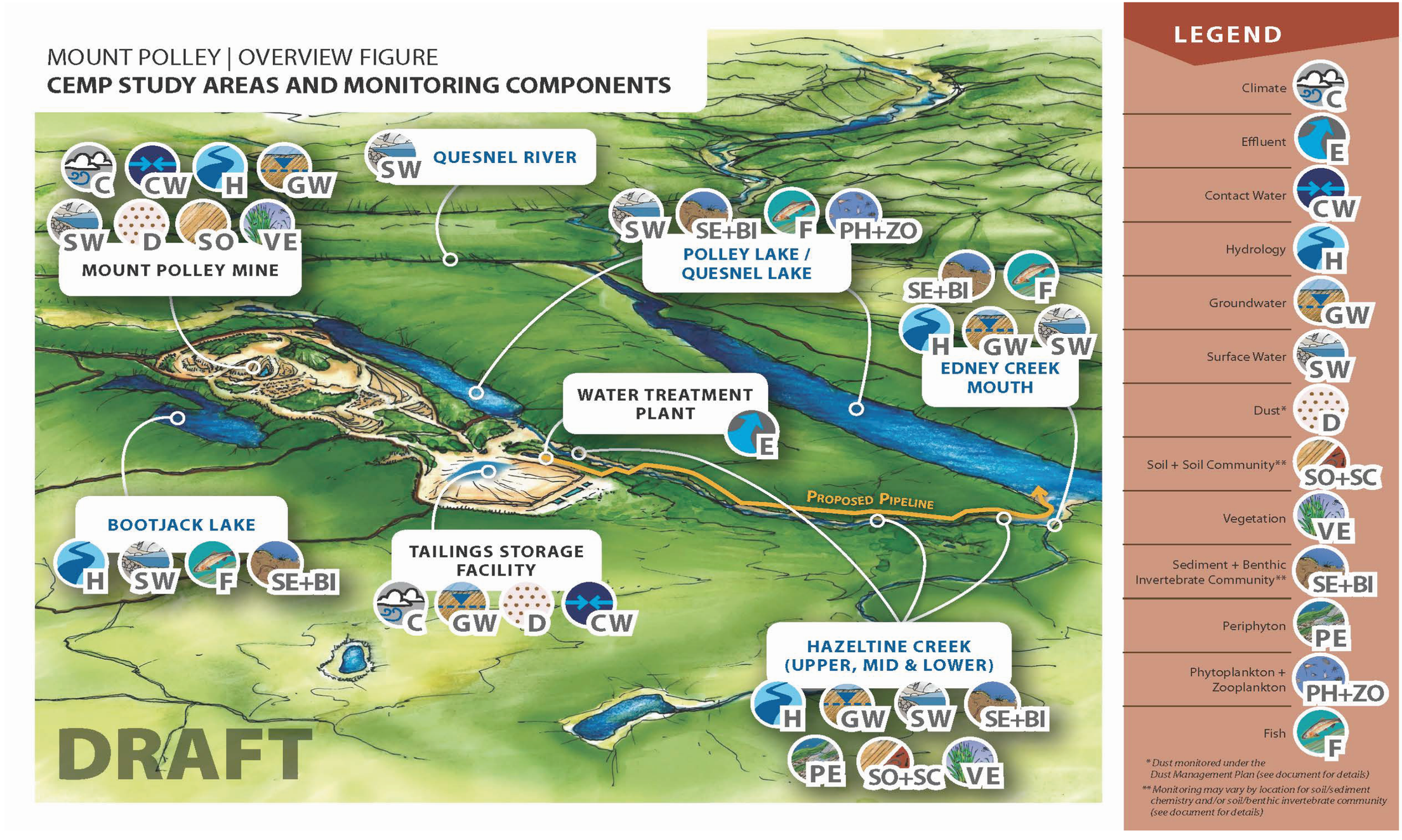

Figure 2.2 CEMP Study Areas and Monitoring Components

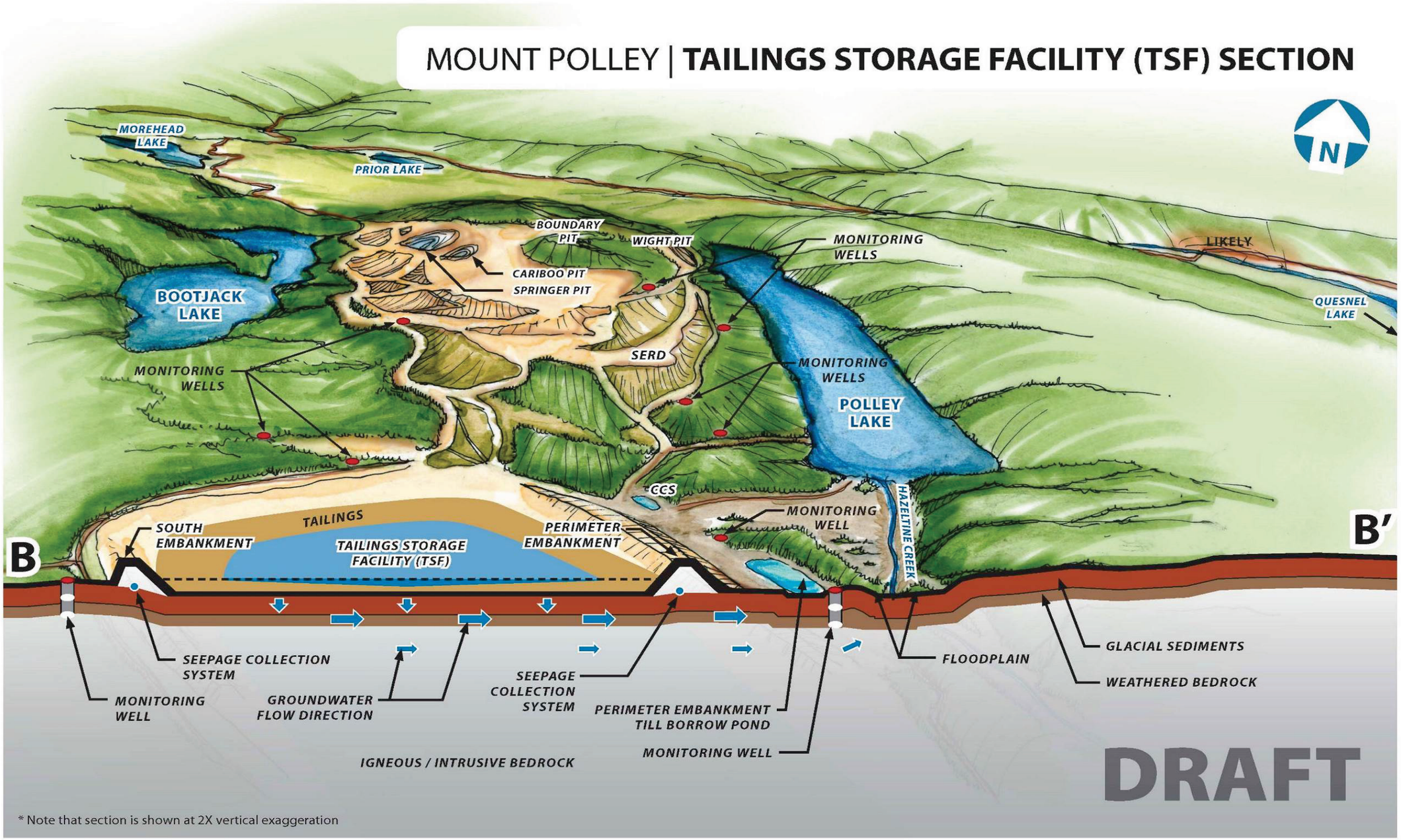

Figure 2.3 Tailings Storage Facility Section

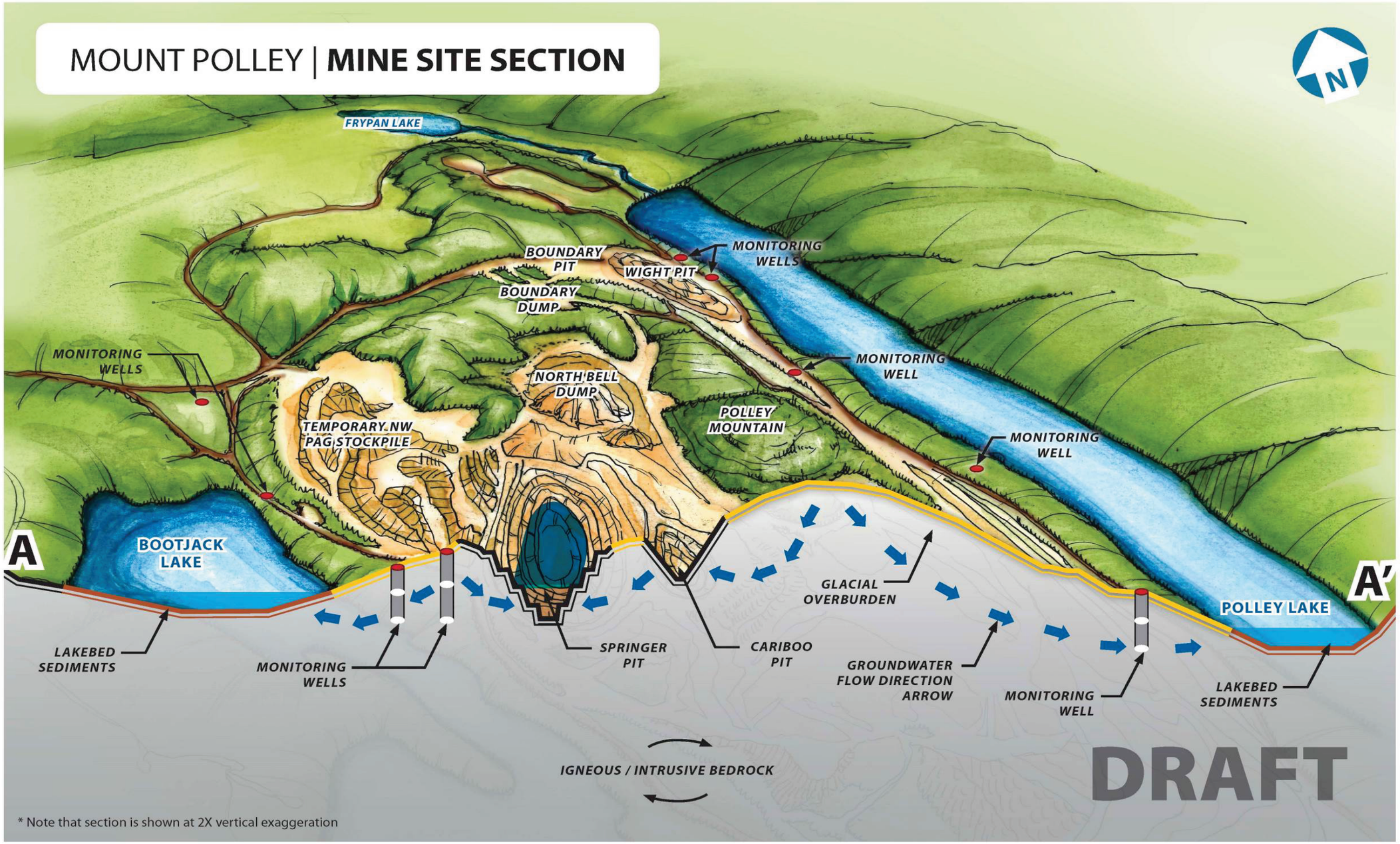

Figure 2.4 Mine Site Section

A CSM helps provide the basis for selecting appropriate monitoring components and suitable locations for those measurements. A CSM provides a graphical articulation of the understanding upon which the CEMP is based including movement of substances, pathways by which organisms (receptors) might become exposed to and interact with those substances in the environment. CSMs are often used in risk assessments to communicate similar concepts; however, in this CEMP, the focus of the study on specific constituents of potential concern (COPCs) has not been an objective because the monitoring program includes broader purposes and will include, for example, the full commercial analytical package for elemental analysis (frequently called "metals analysis"). Groups of substances that will be analyzed for, however, are those related to the potential sources. A CSM specific to the mine site was developed and is shown in Figure 2.5. A CSM for the TSF breach affected areas was developed for the Ecological Risk Assessment (ERA; Golder 2017) and is shown in Figure 2.6.

As discussed in Section 2.1.1, the mine has ongoing operational monitoring needs that centre on permit compliance that include management of site water and ultimately treated water discharges. The mine also needs to address disturbed ground through dust management in the short term. The measurable characteristics or components that contribute information to the stated monitoring objectives can then be identified as variables such as: precipitation and temperature (i.e., climate); dust; mine contact water, groundwater, and surface water quantity and quality; and influent and effluent quantity and quality. These are considered "Site" monitoring components (Figure 2.1). This information contributes to understanding the site water balance, function of site water collection systems, and management of the water treatment plant (WTP; e.g., capacity and treatment efficacy). This information is also useful in understanding the groundwater and seepage flow pathways to Bootjack and Polley lakes.

Ongoing operational activities at the site also have the potential to influence aquatic receiving environments related to effluent discharges. Under the long-term water management plan effluent is discharge from the WTP to Quesnel Lake. Relevant monitoring components for "Aquatic Habitat" include receiving water and sediment chemistry and toxicity, as well as biotic (e.g., plankton, benthos, fish) communities and tissue chemistry as summarized in Figure 2.1.

Following the TSF embankment failure in 2014, the environmental monitoring program was expanded to either incorporate additional monitoring components or increase the frequency of sampling. Many of the same existing operational monitoring components applied to this program and others were added. Additional measurements, related to physical impacts from the event, were collected to contribute to the Post-event Environmental Impact Assessment Report (PEEIAR) and to contribute to the Human Health Risk Assessment (HHRA) and the ERA. This "special purpose" monitoring information is relevant to the Remediation Plan for which an annotated table of contents has been submitted to ENV. As noted in the Risk Monitoring Considerations section of the ERA, further sample collection and evaluation of monitoring data will be done to further refine toxicity reference values for wildlife and confirm bioavailability of copper continues to be low and does not present a risk to wildlife.

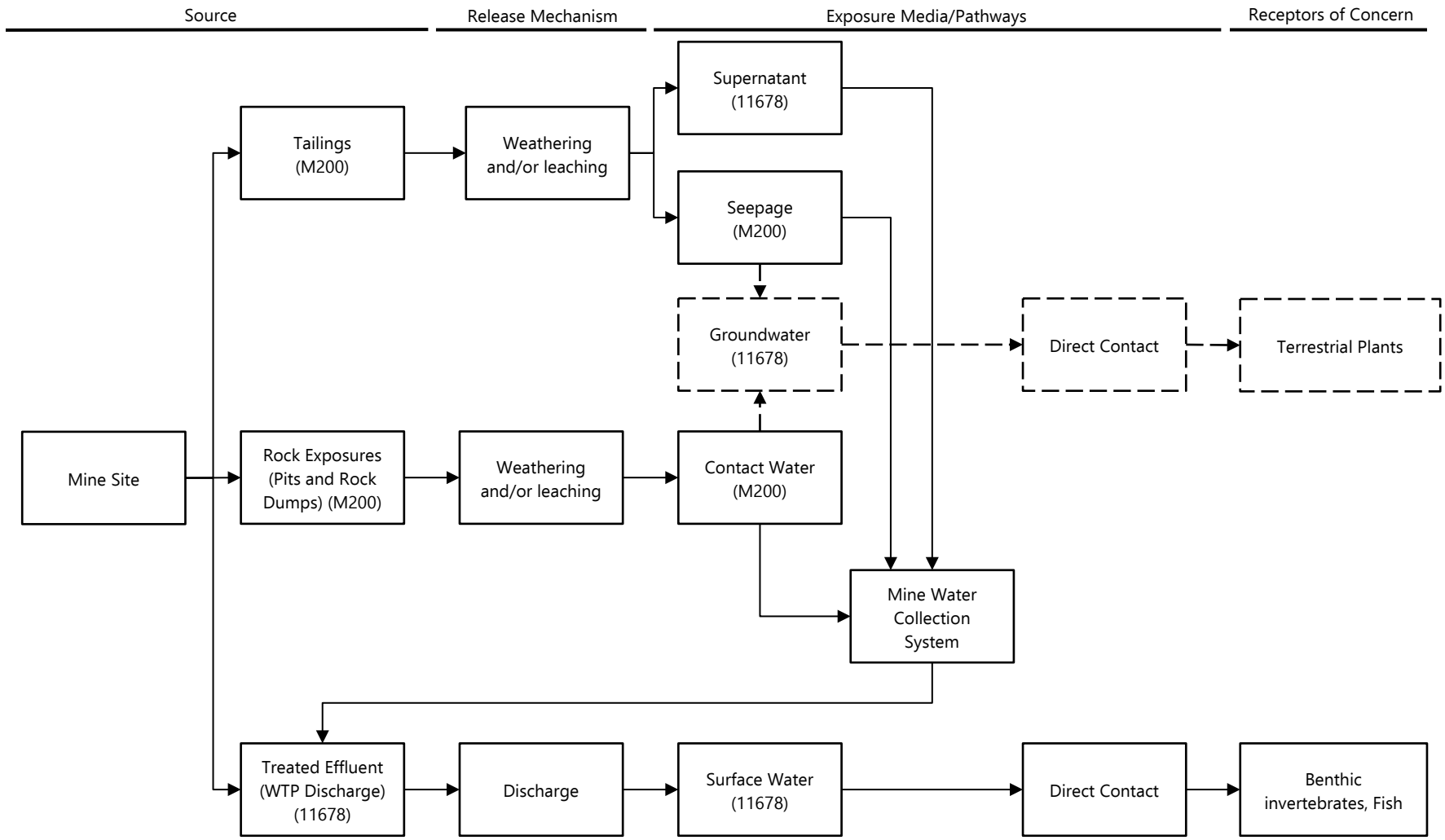

Notes:
Solid lines indicate pathways that are likely to be complete or operative.
Dotted lines indicate pathways that are likely to be incomplete or inoperative.

Figure 2.5 Conceptual Site Model for the mine site

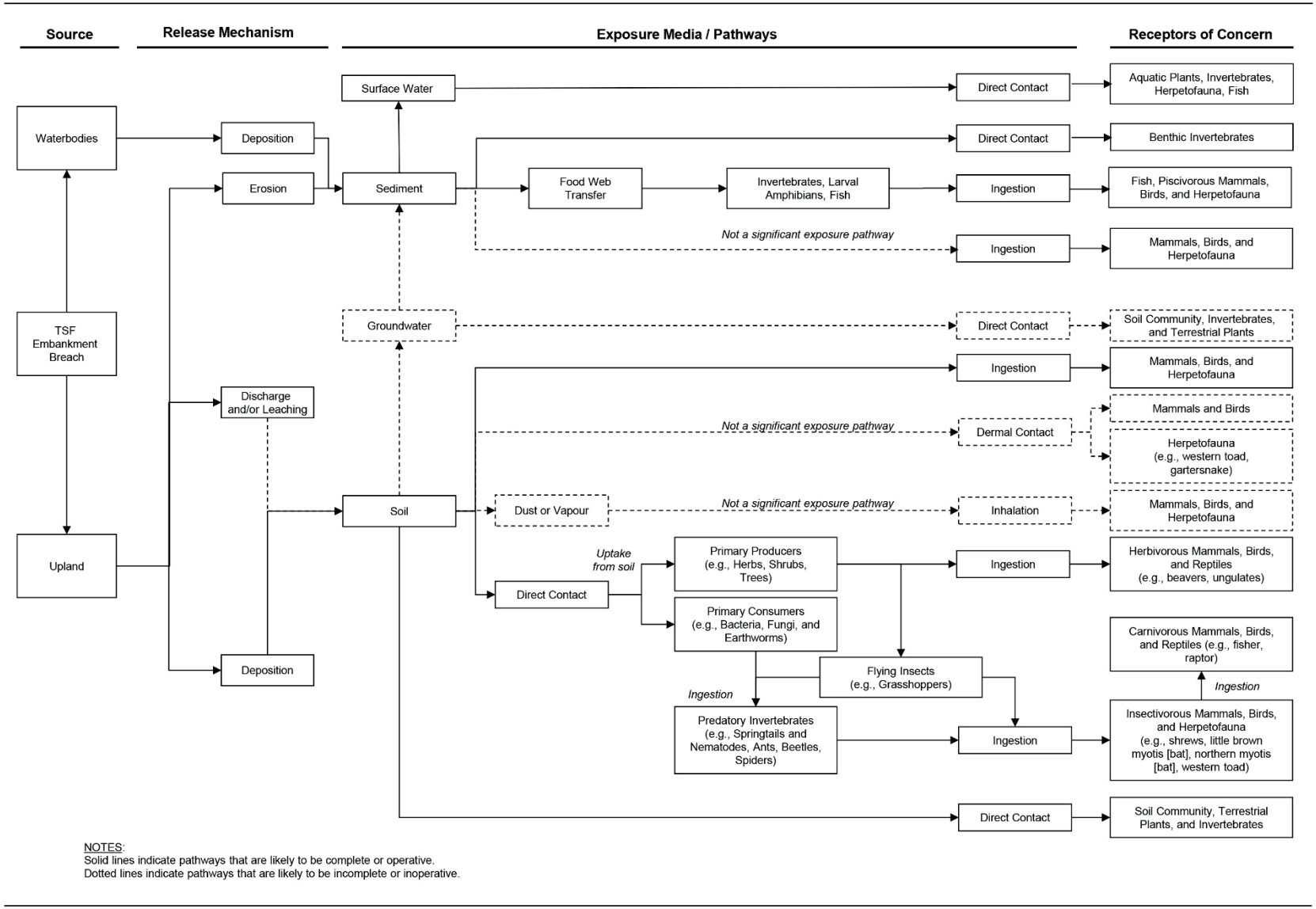

Figure 2.6 Conceptual Site Model for TSF breach affected areas, as developed for the ERA (from Golder 2017)

2.3 Adaptive Management Framework

The CEMP will be adaptive based on the results of ongoing operational and special purpose monitoring (illustrated in Figure 2.7) and based on the developing RCP. The adaptive framework recognizes that studies and monitoring can lead to new information that should be used to inform future monitoring. The framework provides feedback of this new information into the decision-making process that links monitoring and management actions that may need to be implemented to keep MPMC in compliance. For example, more immediate management actions may need to be undertaken in response to pre-defined triggers for unexpected changes in condition. The progressive implementation of the adaptive management framework will also include an annual review of the monitoring program to determine the potential need for revisions to planned sampling and analysis tasks. This review could include cessation of monitoring components that data show may no longer be necessary, or increase of monitoring based on changing conditions or monitoring results. Recommendations for monitoring related to the findings of post-breach-related studies have been included in this CEMP with the intention of forecasting monitoring that may be undertaken in the next three years. Monitoring for a specific year will be verified in monitoring program work plans following the adaptive management framework.



Figure 2.7 Adaptive Management Framework

3 First Nations and Stakeholders

3.1 First Nations Engagement

First Nations with recognized claimed traditional territory for the Mount Polley Mine are the T'exelc (Williams Lake Indian Band; WLIB) and the Xatśūll First Nation (Soda Creek Indian Band; SCIB). In 2011 and 2012, MPMC executed Participation Agreements with the WLIB and the SCIB, respectively. Through these respective Participation Agreements, Implementation Committees were formed to facilitate open dialogue between each of the First Nations and MPMC, providing a formalized and regular venue to discuss environmental, social, and economic matters related to mine development, operation, reclamation, and closure (e.g., mine updates, permitting, environmental protection, reclamation, employment opportunities, and potential joint ventures). Meetings with the WLIB have taken place since March 16, 2012 and since July 19, 2012 with the SCIB. Effective October 18, 2012, Joint Implementation Committee meetings have been held with representatives from MPMC, the WLIB, and the SCIB, replacing the previous MPMC/SCIB and MPMC/WLIB Implementation Committee meetings. Joint Implementation Committee meetings are held at minimum quarterly, but typically more frequently. These meetings and associated documentation (TOR, minutes, and action items) provide a well-defined, constructive forum in which issues, reviews, and comments relating to the current and anticipated future operations of the Mount Polley Mine may be discussed. This CEMP and the AERR will be provided in their current form to the SCIB and the WLIB for review, and discussion regarding any comments or concerns will be facilitated through the Joint Implementation Committee.

3.2 Public Liaison Committee

The Public Liaison Committee (PLC) for the Mount Polley Mine was formed in 1999, and meetings have been maintained through the operating years of the Mine. Meetings were historically scheduled in conjunction with updates on proposed developments and projects, with a minimum frequency of one meeting per year. An annual PLC meeting became a requirement of the Permit in 2013 and quarterly meetings became a requirement in 2015. The PLC is intended to provide an opportunity for MPMC to share information about mine activities and the results of monitoring programs with its members, and for members to share such information with their respective membership. The PLC does not replace or diminish the use of other communication procedures that MPMC will use regularly to inform the public, including but not limited to: public meetings, newsletters, emails, and internet websites. The PLC is seen as a medium to add value to parties with interest in the Mount Polley Mine, including, but not limited to: MPMC and its personnel, the public and public interest groups, local communities, First Nations, and regulators.

3.3 Communication Plan

The Permit requires a Communication Plan between MPMC and the WLIB, SCIB, Cariboo Regional District, and the Community of Likely to be in place. The original Communication Plan was submitted to the Director (ENV Statutory Decision Maker) on March 20, 2016 and was approved by the Director on May 11, 2016. The amended Permit required that an updated Communication Plan be submitted by June 30, 2017. The final Communication Plan was submitted to ENV on March 20, 2016.

4 MOUNT POLLEY MINE PROJECT OVERVIEW

4.1 PROJECT HISTORY

Mount Polley Mine, operated by MPMC (a wholly-owned subsidiary of Imperial Metals Corporation), is an open pit copper/gold mine with an underground component, and has the capacity to process 20,000 to 22,000 tonnes per day (tpd) of ore. The Mount Polley property covers 18,892 hectares (ha), which consist of seven mining leases totaling 2,007 ha, and 43 mineral claims encompassing 16,855 ha, as of March 2018.

Clearing of the site and construction of the entire facility began in 1995, with the mill being commissioned in June 1997. In May 1997, the Mine received an ENV (known as the Ministry of Water, Land and Air Protection at that time) Effluent Permit, issued under the provisions of the provincial EMA. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a tailings impoundment. Approval of the "Mount Polley Mine Reclamation and Closure Plan" by the EMPR resulted in the issuance of Permit M-200 in July 1997. The first full year of mining and milling at Mount Polley Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004 with mill production commencing again in March 2005. A summary of Permit 11678 amendments is provided in Table 4.1.

Table 4.1 Summary of Permit 11678 amendments

Date	Scope of Amendment
30-May-1997	Original permit
20-Oct-1997	Amended authorized tailings discharge rate (10,000 tpd increase)
12-Jun-1998	Amended reporting requirements
08-Sep-1999	Amended monitoring requirements
01-Feb-2000	Amended authorized tailings discharge rate (4,500 tpd increase)
07-Feb-2002	Approval to discharge effluent from the PESCP and MESCP; approval to store TSF supernatant and Mine Site contact water in the Cariboo and Bell Pits
04-May-2005	Amended authorized tailings discharge rate (5,000 tpd increase); discharge of groundwater to Polley Lake; updates to reference analytical procedures and monitoring program
17-Apr-2009	Amended monitoring, water level and supernatant characteristic requirements for the Cariboo and Bell Pits
07-Nov-2012	Approval to discharge to Hazeltine Creek
07-Jun-2013	Sulphate guidelines
09-Jul-2015	Tailings discharge to the Springer Pit
29-Nov-2015	Approval to discharge to Hazeltine Creek
04-Apr-2016	Discharge of additional tailings to the Springer Pit
09-Sep-2016	Hazeltine Creek discharge total suspended solids limit change
07-Apr-2017	Approval to discharge directly to Quesnel Lake

Notes: tdp: tonnes per day; PESCP: Perimeter Embankment Seepage Collection Pond; MESCP: Main Embankment Seepage Collection Pond; TSF: Tailings Storage Facility

As a result of a foundation failure of the perimeter embankment of the TSF on August 4, 2014 (see Section 2.1.2), the mine was placed in care and maintenance until August 5, 2015, when restricted operations under a short-term permit commenced. This restricted operations permit allowed processing of up to 4 million tonnes of ore over a one-year period, with tailings deposition into the Springer Pit.

The Mount Polley Mine became subject to the MDMER on April 10, 2014, following a planned discharge of mine effluent into Hazeltine Creek. The MDMER are also applicable to the long-term discharge approved for the Mount Polley Mine.

4.2 CURRENT OPERATIONS

MPMC was granted full restart permits on June 23, 2016 and has been operating at full capacity since June 27, 2016. The Mount Polley Mine site includes a crusher and mill (includes office spaces), a TSF, waste rock disposal sites, seepage collection ponds, haul roads, access roads, and various small buildings and storage areas (Figure 4.1). Concentrate is transported by truck from the site to the Port of Vancouver, where it is shipped to smelters overseas.

4.3 ENVIRONMENT

4.3.1 TOPOGRAPHY AND CLIMATE

The Mount Polley property is located on the eastern edge of the Fraser Plateau physiographic sub-division, characterized by rolling topography and moderate relief. Elevations range from 920 metres above sea level (masl) at Polley Lake to 1266 masl at the summit of Mount Polley. Volcanic rocks generally underlay this part of the plateau with inclusions of intrusive rocks. Most of the area is covered by a deposit of unconsolidated till which contains fluvial, lacustrine, and colluvial deposits. Some patches of organic soils are present in poorly drained areas (i.e., wetlands). The property is located in an alkali porphyry copper-gold deposit hosted in the Central Quesnel Belt along the Intermontaine Belt of BC.

The site is located within the Interior Cedar Hemlock biogeoclimatic zone. Local forests consist of Western red cedar, Douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch. Much of the area has been harvested in commercial logging operations and is also used for cattle grazing.

Average annual precipitation in the study area is 670 millimetres (mm). Precipitation typically occurs as snowfall from November through March, with an average maximum of snowpack of 178 mm snow water equivalent occurring at the end of March (Golder 2015b). Average monthly temperatures at the Mount Polley Mine range from -6.0 degrees Celsius (°C) in January to 15.3°C in July and August (MPMC 2016b). Prevailing winds are from the north-north-east and from the south-south-west near the TSF, and from the northwest (and to a lesser extent the southeast) near the mill, with a predominance of winds designated as calm (below 3 metres per second; Golder 2015b).

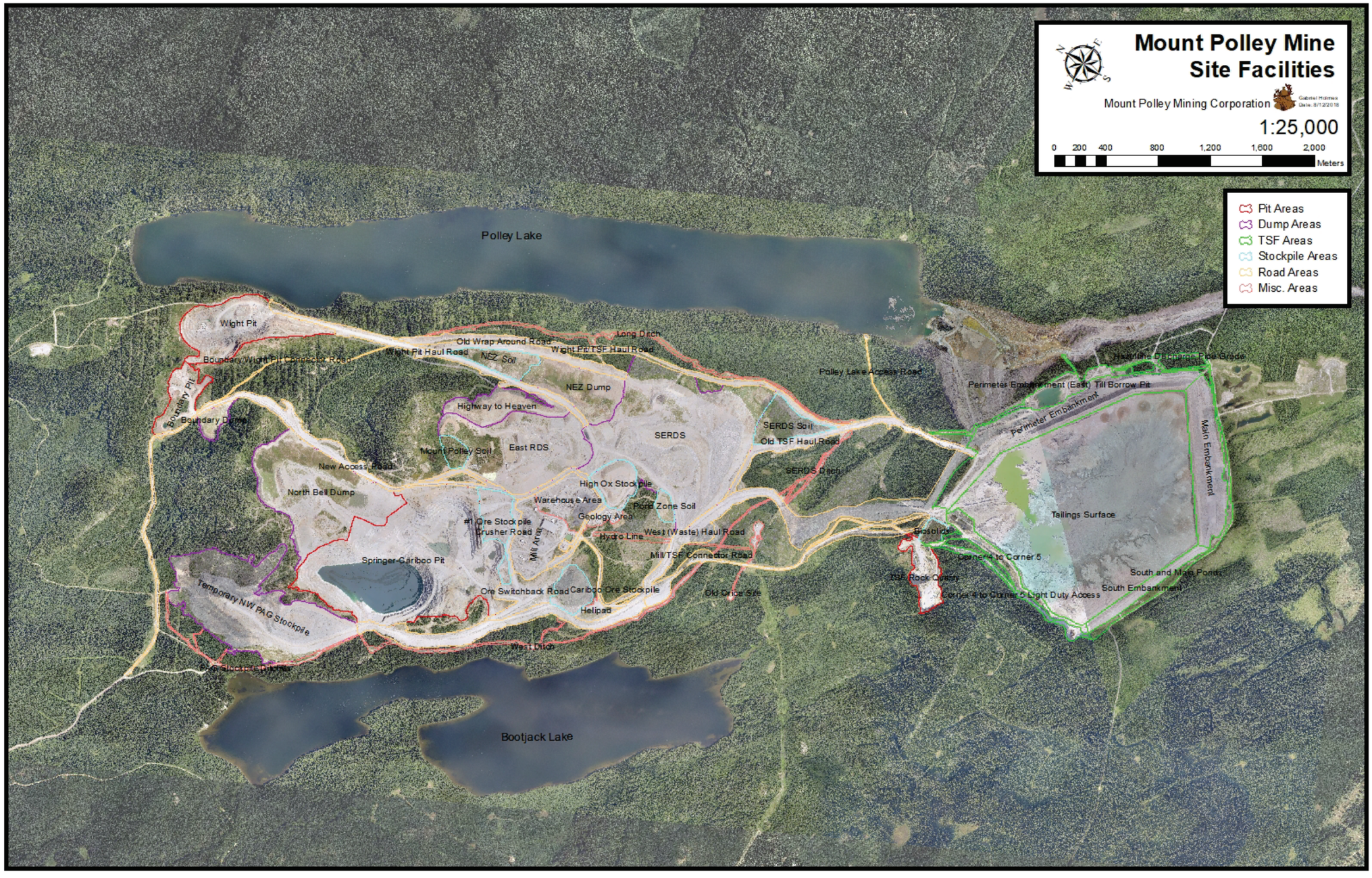

Figure 4.1 Mount Polley Mine site facilities

4.3.2 HYDROGEOLOGY

The groundwater flow at the site occurs primarily in the bedrock units in response to recharge from precipitation in the area between Polley Lake and Bootjack Lake. Flow in the overburden is less significant due to its limited thickness and discontinuous nature. Prior to mining, the water table at the site generally followed the surface topography, but the water table was deeper below the topographic heights and shallower in the low areas. At that time, the direction of groundwater flow was inferred to be from the top of the ridge between the Polley Lake and the Bootjack Lake towards the low lying areas associated with these lakes northeast and southwest from the ridge.

Mine dewatering has altered the groundwater flow pattern at the site, with the open pit and underground workings acting as sinks for groundwater flow. Mine dewatering lowered the water table elevation and created radial patterns of groundwater flow towards these facilities. Following the formation of the pit lake in the Cariboo Pit, seepage from this pit started to provide a contribution to groundwater inflow to the Springer Pit. At present, Springer Pit and Cariboo Pit continue to act as groundwater sinks. The currently available information suggests that some seepage from the Springer Pit lake towards Bootjack Lake occurred when the pit lake level exceeded 1030 m elevation in 2016 (Golder 2016b).

4.3.3 DRAINAGE AND HYDROLOGY

The mine is located on the divide of two sub-watersheds within the Quesnel Lake watershed. Quesnel is a large, deep fjord lake with a surface area of 255 square kilometres (km^2), and is composed of East, West, and North Arms. It is the deepest fjord-type lake in the world, with a maximum depth of more than 511 m in the East Arm (Laval et al. 2008). The West Basin is a shallower (113 m maximum depth) portion of the west arm that is demarcated in the east by a shallow sill near Cariboo Island that is approximately 35 m deep (Laval et al. 2008). The lake drains to the west via the Quesnel River to the Fraser River. The Horsefly River, Mitchell River, and Niagara Creek are the main tributaries to Quesnel Lake, entering from east of the sill.

The western watershed, which includes drainage from Bootjack Lake, Trio Lake, and Morehead Lake, discharges to Quesnel River via Morehead Creek and drained approximately 60% of the Mount Polley area prior to mine construction.

The eastern watershed includes Polley Lake (surface area of 3.8 km^2), which discharges to the east via Hazeltine Creek and then to the western arm of Quesnel Lake. The Hazeltine Creek and Edney Creek watershed areas at Quesnel Lake are currently approximately 30.2 km^2 and 87.4 km^2, respectively. Approximately 10.5 km^2 that historically reported to this watershed is now within the mine contact water runoff collection system catchment.

Bootjack Creek is a small tributary that previously flowed into Hazeltine Creek downstream of Polley Lake. Following the TSF embankment breach, Bootjack Creek was re-routed to Polley Lake; fish access is currently restricted. Historically, Bootjack Lake (surface area of 1.2 km^2) discharged into Hazeltine Creek via Bootjack Creek, but in 1913 a dam was constructed at the south end of Bootjack Lake and the flow direction was reversed in order to direct water into Morehead Lake for hydropower production. This resulted in 14 km^2

being diverted from the Hazeltine Creek catchment. The Morehead Creek watershed, including the Bootjack Lake catchment area, is approximately 11.2 km^2. Approximately 2.3 km^2 that historically reported to this watershed is now within the mine contact water runoff collection system catchment.

Pre-mining watersheds are shown in Figure 4.2. In general, the hydrology of the Mount Polley area is snowmelt driven, with the majority of annual runoff occurring in April and May during snowmelt (i.e., freshet; Knight-Piésold 2014).

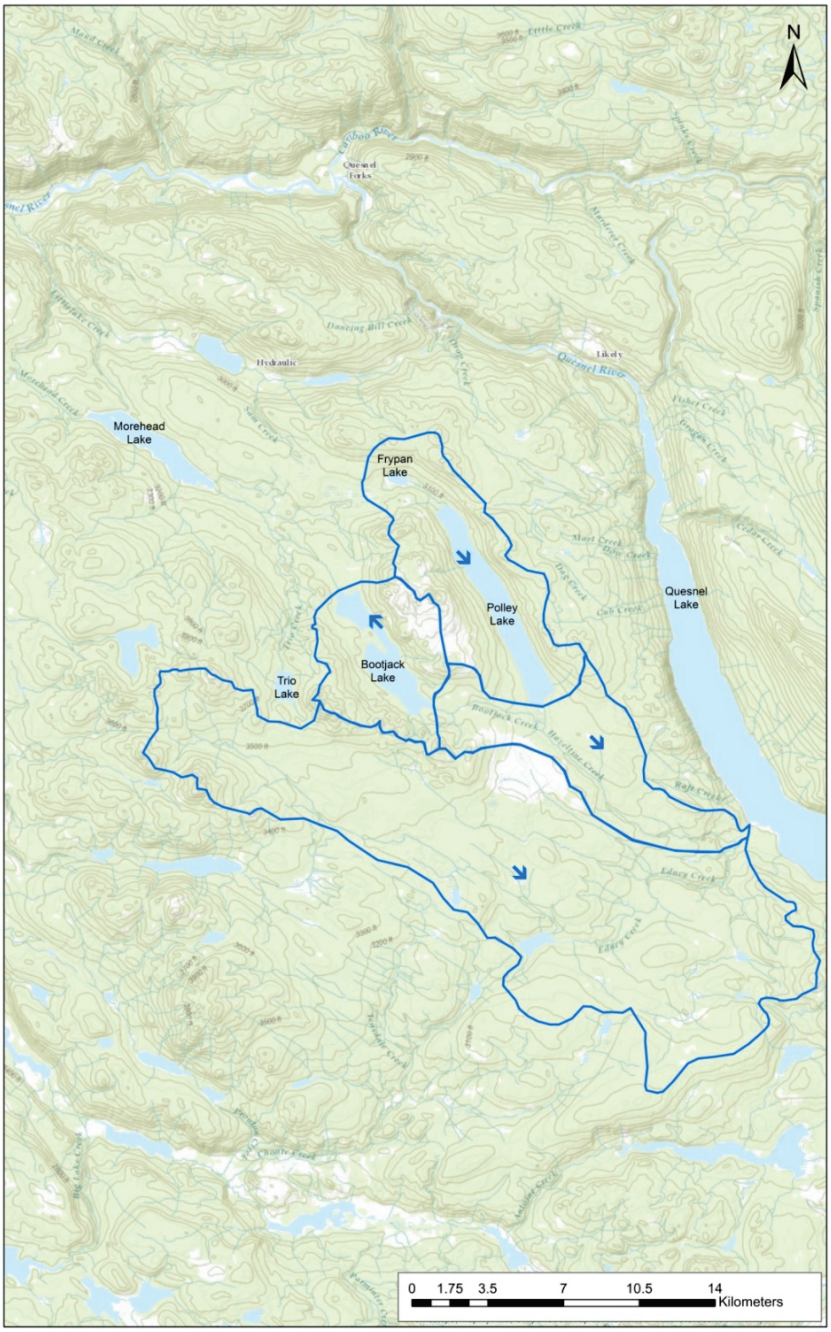

Figure 4.2 Mount Polley area pre-mining watersheds

5 ENVIRONMENTAL MANAGEMENT

5.1 WATER MANAGEMENT

To protect natural watercourses from mine-influenced contact water from roads, haul roads, waste rock piles, and other Mine areas, water is collected in a system of ditches and sumps located around the Mine site. Based on site water management objectives, site contact water is either pumped directly to the TSF or reports to the gravity-driven sections of the West Ditch or Long Ditch, the latter two of which both flow to the Central Collection Sump (CCS). Water in the CCS is currently allowed to overflow to the Perimeter Embankment Till Borrow Pond (PETBP) where it is pumped to the WTP or can be returned to the TSF. Pumping infrastructure also exists at the CCS such that it can be directed to the TSF. Water from the TSF is primarily pumped to the Mill via the Booster Station to meet process requirements, but can also be diverted to the CCS. A map of water collection infrastructure, including site collection ditches (including flow direction) and sumps, is shown in Figure 5.1. All water, primarily rain and snow melt, ultimately reports to the PETBP from which it is pumped to the WTP. At the time of writing, any contact water that requires temporary storage on site (i.e., when flows exceed those able to be treated and discharged) is pumped to the TSF. Tailings and process water from the Mill reports by gravity from the Mill to the TSF.

The Mount Polley site has a positive water balance, and a permit for a long-term water discharge system was received on April 7, 2017. Treatment is conducted for removal of suspended solids and associated metals using a Veolia ACTIFLO® system, which is described in detail in Section 5.1.2. Under the long-term water management strategy, treated mine effluent is discharged to Quesnel Lake via a direct pipeline to the submerged diffusers installed in the lake. A continuous discharge of up to 0.6 m^3/s, with an annual average of 0.33 m^3/s is currently permitted until December 31, 2022.

5.1.1 ANNUAL DISCHARGE PLAN

Permit 11678 requires the yearly submission of an Annual Discharge Plan (ADP). The intent of the plan is to identify the specific sources and quantities of water that will be discharged; however, the discharge system (which is described in Section 5.1.2) at Mount Polley is not designed to be able to solely discharge from specific sources and it is not realistic for MPMC to estimate the volumes of precipitation that will occur from year to year. The overall water management at the mine is described in detail in the Long-Term Water Discharge Technical Assessment Report (TAR) that was submitted to ENV October 17, 2016 (Golder 2016e).

5.1.2 DISCHARGE SYSTEM

The WTP sources water from the PETBP. During treatment, the feed water of the WTP undergoes suspended solids removal using Veolia ACTIFLO® water treatment technology. The WTP doses the raw water with coagulant to a tank where a polymer is injected to create floc particles. Microsand is added to ballast the flocculants, which move on to another tank that allows them to swell and mature. The water flows to the next stage, which uses lamella to clarify the water and promote fast settling of the microsand ballasted sludge. The clarified water is discharged and the sludge is separated from the microsand, which is reused.

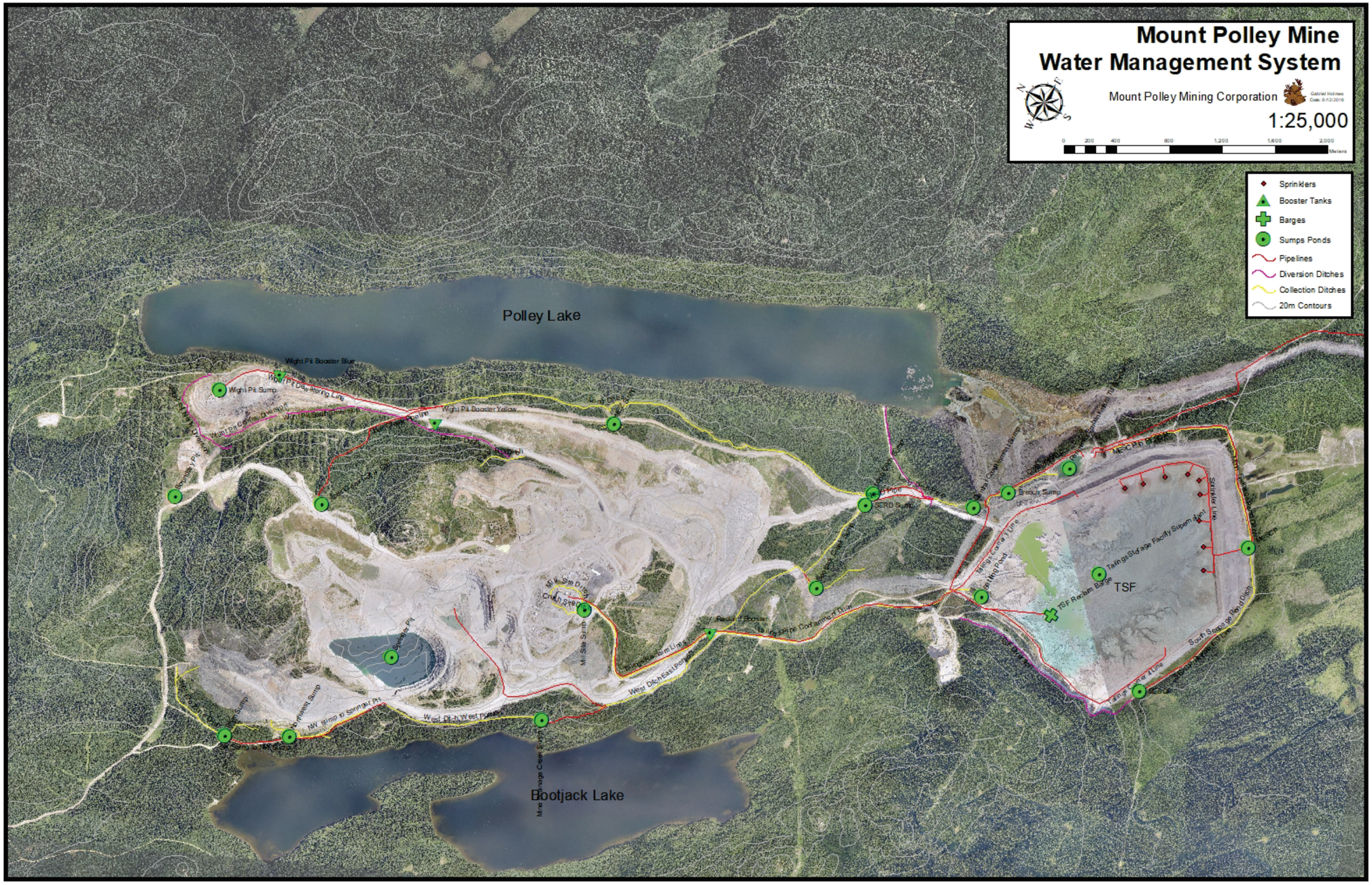

Figure 5.1 Mount Polley Mine water management system

An on-line turbidity meter measures the turbidity every ten seconds, where the WTP human-machine interface calculates the total suspended solids (TSS) using a calibrated factor based on a site-specific correlation between turbidity and TSS for the treated effluent. If the calculated on-line TSS is greater than 13 mg/L for 10 minutes, or greater than 14 mg/L instantaneously, an alarm sounds to alert the operator and the WTP automatically goes into recirculation mode and ceases discharge.

Treated water from the WTP is discharged, by gravity, to Quesnel Lake via a pipeline (installed as of November 2017) connected to two submerged diffusers. Effluent discharge to the Hazeltine Creek channel ceased as of September 30, 2017.

5.2 Sediment and Erosion Control Management Plan

MPMC has developed a RCP that has been submitted to EMPR under the *Mines Act* Permit M-200. This plan includes several Environmental Management Plans including a Sediment and Erosion Control Plan.

5.3 Invasive Plant Management Plan

MPMC developed an Invasive Plant Management Plan in 2010 and has regularly updated this plan to include newly disturbed areas and to follow the Cariboo Regional District Strategic Plan for Invasive Plant Management. This plan is included in the RCP.

5.4 Dust Management Plan

MPMC maintains a Dust Management Plan that is also included in the RCP.

5.5 Project Environmental Monitoring Plans

MPMC develops a project specific Environmental Monitoring Plans (EMPs) for any development project that has potential to impact the environment. The requirement for these EMPs is outlined in the Erosion and Sediment Control Plan (Section 5.2).

5.6 Waste Management

MPMC recognizes the value of responsible waste management and recycling. MPMC Recycling and Waste Management Awareness presentations are given to Mount Polley employees annually and MPMC promotes several recycling programs for used materials including waste oil, scrap steel, batteries, plastic pails, electronic waste, light bulbs and associated fixtures, paper, cardboard, and beverage containers. Waste management information is also presented to employees and contractors during site orientation. Each year, Mount Polley donates the funds generated by its beverage container recycling program to local charities.

In the course of its ongoing operations, Mount Polley utilizes potentially hazardous chemicals, reagents, and other products. Sumas Environmental Services Ltd. routinely removes and disposes of these waste products in an environmentally safe manner compliant with all relevant waste management legislation. Products removed include: aerosol cans; contaminated gasoline and diesel; waste oil (in drums); waste oil filters; waste grease fuel or oil soaked rags, debris, and floor dry; and leachable liquid toxic waste, such as

glycol/anti-freeze mix. The site waste oil tanks are emptied and the oil removed from site by a third party contractor. MPMC is registered (BCG-01559) with the ENV under the *Hazardous Waste Regulation* for generation and temporary storage of these materials.

5.7 INCIDENT REPORTING

All non-compliance incidents are reported to the Director or to Emergency Management BC. All incidents are recorded and tracked, and are included in the AERR. As outlined in the Communication Plan (see Section 3.3) and required by Section 2.5 of the permit, incidents or emergencies that have the potential to have adverse impacts on the environment will be reported to the SCIB, WLIB, Cariboo Regional District and community of Likely.

5.8 INSPECTIONS

MPMC Environmental Department staff conduct weekly inspections on the site with a focus toward regulatory compliance and waste management (Section 5.6). These inspections are documented and communicated regularly to the site management and their respective departments. Guidance is provided by the Environmental Department for proper internal reporting and follow-up. The goal of these inspections is to provide all departments the capability to engage in proper environmental management practices and open lines of communication with the Environmental Department.

6 MONITORING

The subsections below outline general procedures at MPMC for scheduling of environmental monitoring and data review and management. Field methods, laboratory analysis, data quality control and objectives, as well as data analysis methods are included in the following sections with their respective monitoring components. Note that frequencies may change due to weather conditions or construction work and will be dependent on accessibility and, most importantly, safety of the field crews. Declarations of Competency for relevant Qualified Professionals are provided in Appendix E.

6.1 SCHEDULING

To coordinate sampling and schedule all planned monitoring, as per the CEMP, MPMC prepares internal monthly sampling schedules. An example monthly sampling schedule has been included as Appendix C.

6.2 FIELD METHODS

Monitoring procedures that will be used in carrying out the CEMP are consistent with the *BC Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (2013 or most recent version, herein referred to as the "BC Field Sampling Manual"; MoE 2013a). As appropriate, monitoring procedures will also be consistent with the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Environment Canada 2012) and the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (MoE 2012). MPMC's procedures are also consistent with applicable sections of the *British Columbia Environmental Laboratory Manual* (MoE 2015), such as sample collection and preservation requirements.

Quality assurance/quality control (QA/QC) methods will follow procedures outlined in the *MPMC Environmental Department QA/QC Manual* (most recent version: MPMC 2016c, herein referred to as the "QA/QC Manual", developed for the Mount Polley Mine. This manual provides detailed Standard Operating Procedures (SOPs) and Work Methods (WMs) of the protocols for environmental monitoring at MPMC and is a requirement of the Permit (April 7, 2017: Section 3.8). Procedures described in the manual are consistent with the BC Field Sampling Manual (MoE 2013a). The QA/QC Manual is reviewed and updated as appropriate (at minimum annually) to reflect changes to the ENV procedures and recommendations, and industry best practices. Should the manual be updated, the ENV Environmental Protection Division will be notified within 30 days of implementation as required by the Permit.

The QA/QC Manual protocols include collection of samples by trained personnel using standardized procedures, and use of field notebooks and chain of custody forms for sample documentation and tracking. These protocols are summarized for the different CEMP monitoring components below, where appropriate.

6.3 LABORATORY ANALYSIS

Sample analysis will be conducted at a laboratory registered for the designated parameter under the *Environmental Data Quality Assurance Regulation*. MPMC will participate in QA audits as required by the regulation.

6.4 Data Quality Review and Data Management

A data quality review of results will be conducted, including screening of laboratory QA/QC data, sample integrity issues, detection limits achieved, and metadata accuracy, as well as potential outliers/extreme values. This information will be catalogued in the MPMC sample tracking spreadsheets and the laboratory is contacted if any problem is identified. Water, soil, sediment, and tissue chemistry data as well as weather station data will be uploaded into the MP-5 database using files generated by the analytical laboratory. Accompanying field data will be manually entered and uploaded into the MP-5 database. Original laboratory-produced results files are filed on the MPMC network by date, and are linked to the data stored in the MP-5 database. Field data undergo a QC screening prior to upload and parameter restrictions are in place to reduce the likelihood of a typographical or laboratory reporting error being uploaded.

Non-chemistry data, including toxicity testing results, benthic invertebrate and plankton taxonomy data, and hydrology data (logger downloads and FlowTracker exports) are filed according to year and site on the MPMC network.

6.5 Climate Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.5.1 Section Authors and Study Component Design Professionals

This section was written by MPMC and is guided by Section 3.6 of the Permit (April 7, 2017).

6.5.2 Monitoring Objectives

The objective of the climate monitoring program is to track site weather data to support maintenance of the site water balance, water flow and accumulation predictions, and the design of water management infrastructure. Climate data are also considered important basic site characterization information that inform a number of other activities, such as reclamation revegetation prescriptions or building snow load requirements. Climate monitoring is also required under the Permit Section 3.6 (April 7, 2017).

6.5.3 Monitoring Overview

MPMC maintains two automated HOBO weather stations. Both stations are connected via telemetry allowing real time viewing of weather conditions. Four snow course sites are located around the mine site to target different exposure conditions. Table 6.1 provides an overview of the climate monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.1 shows monitoring locations of the meteorological monitoring locations.

Table 6.1 Climate monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
Weather Station #1	N/A	Continuous monitoring weather station beside tree plots near Mill Site	Logged every 5 minutes	Temperature, wind speed and direction, solar radiation, relative humidity, rainfall	N/A
Weather Station #2	N/A	Continuous monitoring weather station adjacent to the TSF	Logged every 5 minutes	Temperature, wind speed and direction, solar radiation, relative humidity, rainfall	N/A
JCP	N/A	Snow course site located east of the start of the Long Ditch in a clearing	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
Weather Station #1	N/A	Snow course site located near Weather Station #1	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
PAG Stockpile	N/A	Snow course site located beside the NW sump	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
TSF	N/A	Snow course site located near Weather Station #2, near the TSF	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A

Notes: N/A: not applicable, TSF: tailings storage facility, JCP: Joe's Creek Pipe, PAG: potentially acid generating; NW: Northwest



Figure 6.1 CEMP monitoring locations: Climate monitoring

6.5.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Meteorological monitoring will occur as per the SOPs and WMs for Meteorological Data Collection and Snowpack Measurements in the QA/QC Manual. There are two automated HOBO weather stations located on the mine site that continuously record wind speed and direction, precipitation, solar radiation, relative humidity, and temperature. Evaporation is calculated based on data collected from these stations. The data are downloaded from the automated weather stations monthly or as required by remote radio telemetry. If necessary, data are also stored for 30 days on the weather logger and can be downloaded manually using a data shuttle.

The snowpack measurement method will change in 2018 to align with the *Snow Survey Sampling Guide* written by ENV (MoE 2016). A workshop will be given to the Environmental Staff at first snowfall in fall 2018. The SOP and WM for Snowpack Measurements will be updated at this time and submitted to ENV for review.

Table 6.2 is a summary of previous climate monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.2 Summary of climate monitoring

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Two weather stations collect temperature, wind speed and direction, solar radiation, and precipitation data. Snowpack data was collected at four representative snow course sites. The weather and snow course stations are situated to encompass the topographical and geographic range of the mine site.	N/A	N/A
Summary of findings	Weather data collected were compared to site averages. Evaporation was calculated using measured parameters.	N/A	N/A
Recommendations for 2018-2020 monitoring	The snowpack measurement method will be changed to align with the *Snow Survey Sampling Guide*. The program will otherwise continue unchanged because the two current weather stations and snow course sites provide adequate information for the conditions on site.	N/A	N/A

Notes: N/A – not applicable

6.5.5 Data Quality Control, Objectives, and Review

Data ranges are set in the MP-5 database to detect erroneous data collected during station malfunctions. Weather station data that are erroneous (e.g., sensor malfunctions) will be investigated.

6.5.6 Laboratory Analysis

No laboratory analysis is required for climate monitoring.

6.5.7 Data Analysis and Reporting

Climate statistics, including mean, minimum, and maximum temperature, will be calculated and reviewed monthly. Daily evaporation is calculated using the Penman-Monteith equation for open water in the WaSIM software (developed by Cranfield University), based on data collected from the weather stations and site-specific factors, such as weather station elevation. These data are reported annually in the AERR.

6.6 Surface Water Monitoring

Surface water monitoring is characterised below into the following locations: Hazeltine Creek, streams and creeks adjacent to the mine site (receiving environment of the mine site), Bootjack Lake, Polley Lake, Edney Creek, Quesnel Lake, and Quesnel River.

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.6.1 Section Authors and Study Design Professionals

The mine site environmental monitoring was developed during the Environmental Assessment process in 1995, which included input from several QPs. For the purpose of the CEMP, MPMC will continue to monitor with the understanding that this program is well-established to monitor any mine-related effects. The mine site monitoring described below was written by MPMC.

6.6.2 Monitoring Objectives

The objective of water chemistry monitoring in Hazeltine Creek is to evaluate the Hazeltine Creek aquatic environment following the TSF embankment breach and track changes to the aquatic environment over time and/or as a result of implementation of rehabilitation and sediment and erosion control work.

The objective of water chemistry monitoring in streams and creeks adjacent to the mine site, as well as Bootjack Lake and Polley Lake, is to identify water quality changes in waterbodies that run through or are adjacent to the mine site to assess efficacy of the mine water management systems and to stimulate applicable management actions.

The objective of water chemistry monitoring in Polley Lake, Quesnel Lake, and Quesnel River is to support ongoing evaluation of water chemistry following the TSF embankment breach in the downstream environments.

The objective of water chemistry monitoring in Quesnel Lake at the boundary of the initial dilution zone (IDZ) is to verify that the discharge of treated effluent is not causing an exceedance of the applicable ambient BC Water Quality Guidelines at the edge of the IDZ, as required by the Permit, and to verify the discharge model, as described in the ADP.

Monitoring of the far-field receiving environment in Quesnel Lake in the West Basin will be carried out downstream and upstream (for reference) of the mouth of Hazeltine Creek for the verification of the discharge model as described in the ADP.

6.6.3 MONITORING OVERVIEW

Table 6.3 summarizes the parameters analysed for surface water quality. The lake field parameters are measured at each sampling depth and for each limnological profile (excluding Secchi depth, which is taken from the surface of each lake sampling point). Table 6.4 provides an overview of the surface water monitoring. The location "Mine Site" refers to the streams and creeks adjacent to the mine site. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.2 shows monitoring locations of the surface water sampling locations.

Table 6.3 Surface water chemistry parameters

Parameter	LOR	Unit
Field Parameters - Lake		
pH	-	pH
Specific conductance	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Dissolved oxygen	-	%, mg/L
Secchi depth	-	m
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L
EEM Parameters		
Mercury (Hg)-Total	0.000005	mg/L

Notes: LOR: Limit of Reporting; EEM: Environmental Effects Monitoring

Table 6.4 Surface water monitoring overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Mine Site	W1	E225084	Morehead Creek	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W4a	E298551	North Dump Creek below Wight Pit Road	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W5	E208039	Bootjack Creek Above Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8	E216743	NE Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8Z	E223292	SW Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W10	E291209	Lower Edney Creek (upstream of breach impact)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W12	E216744	6 km Creek at Road	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W20	E297070	W20 Creek Tributary to Bootjack Lake	Semi-annually	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Edney Creek	EDC-01	E303014	Lower Edney Creek (remediated reach)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-10	E303010	Upper Hazeltine Creek at Polley Lake outlet	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-13	E304810	End of Reach 1 in Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-14	pending	Middle Hazeltine Creek upstream of the canyon	Monthly[2]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-05a	E304510	Upper Hazeltine Creek at Gavin Lake FSR Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-08	E303013	Lower Hazeltine Creek at Ditch Road Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Hazeltine Creek	HAC-01c	E303953	Lower Hazeltine Creek outflow to Quesnel Lake	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Bootjack Lake	B1	E207975	Bootjack Lake deepest area at north end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
Bootjack Lake	B2	E215897	Bootjack Lake deepest area at south end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
				Three times annually [10]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Bootjack Lake	B4	E216744	Bootjack Lake (potential zone of influence from seepage from Springer Pit)	For closure only[5]	For closure only[5]	For closure only[5]	-
Polley Lake	P1	E207974	Polley Lake deepest area at north end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
Polley Lake	P2	E207975	Polley Lake deepest area at south end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
				Three times annually [10]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-58	E304876	Quesnel Lake discharge IDZ	Four times annually[7, 11, 12]	Limnological profile, If plume detected: middle of plume (MP), 5 m above (AP), 5 m below plume (BP) If plume not detected: surface (S), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL
Quesnel Lake	QUL-57	E304874	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-59	E304875	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-18	E303019	Quesnel Lake far-field, downstream of Hazeltine Creek	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 50 m, 100 m[9]	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-2a	E303020	Quesnel Lake far-field, upstream of Hazeltine Creek (reference)	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 40 m, 60 m	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Quesnel Lake	QUL-ZOO-1	E306455	Quesnel Lake in centre of West Basin (zooplankton station)	Three times annually [10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-ZOO-7	E306456	Quesnel Lake near Cariboo Island (reference zooplankton station)	Three times annually [10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Notes: [1] In June and October due to access; [2] May to November only due to restricted access in winter; [3] At spring overturn and late summer; [4] Between spring and fall overturn; [5] Monitoring will depend on closure conditions; [6] if ice and weather conditions meet safety requirements; [7] Taken at evenly spaced time series plus or minus one month; [8] Total mercury will be collected at MID or BT for QUL-58 and at 40 m for QUL-2a as part of EEM four times per year (no less than 1 month apart). Parameter only reported to MDMER; [9] QUL-18 is approximately 110 m deep. 100 m sample depth is collected for historical consistency; [10] Taken in conjunction with plankton sampling (see Section 6.14); [11] When sampling is less frequent than monthly, sampling at Quesnel Lake operational surface water monitoring stations (as identified in Table 6.6) will be undertaken when effluent discharge to Quesnel Lake is discharging. In the event of an unexpected shutdown of the water treatment plant, reasonable efforts will be made to re-sample within the timeframe of the quarterly or other specified time period sampling upon restart of effluent discharge to Quesnel Lake; [12] Samples will be taken at HAD-3 on the same day as samples collected from QUL-57, -58, and -59.

DOC: dissolved organic carbon; BC WQG: British Columbia Water Quality Guidelines; AL: aquatic life; FSR: Forest Service Road; EEM: Environmental Effects Monitoring; IDZ: initial dilution zone

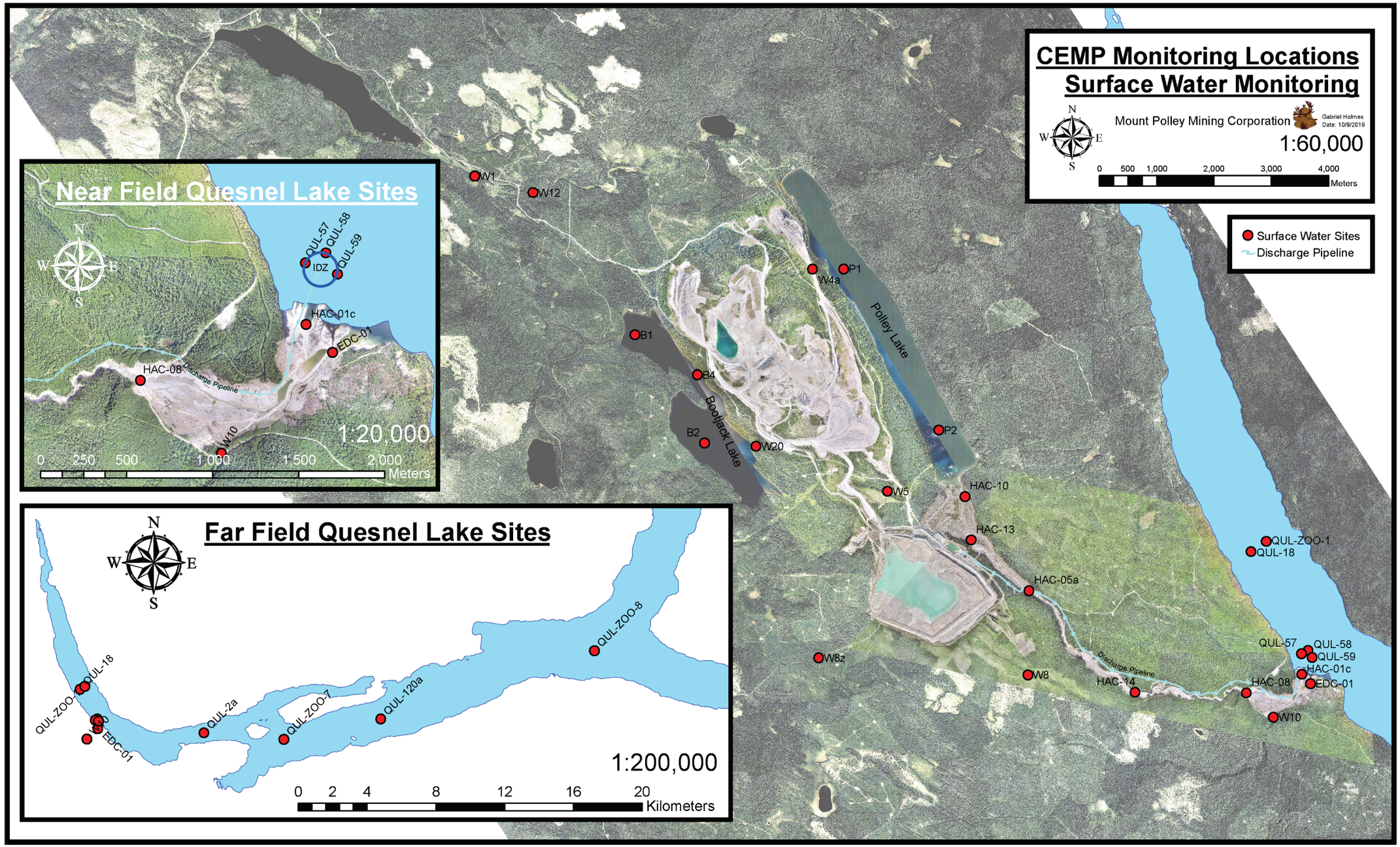

Figure 6.2 CEMP monitoring locations: Surface water monitoring

6.6.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Field parameter collection, sample collection, preparation, and shipping will be conducted following the SOPs and WMs for the associated field meters, Surface Water Quality Monitoring and Lake Water Monitoring, as appropriate as described in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.6.3. Limnological profiles of field parameters will be conducted where described in Table 6.4.

For the edge of the IDZ sampling, limnological profiles of field parameters (specific conductance, temperature, and turbidity) will be carried out in an attempt to identify the location of the plume from the outfall (i.e., direction of flow). MPMC is committed to spending a reasonable level of effort and time to detect the plume and direction of flow. The reasonable level of effort and time will vary depending on the health and safety risks associated with the weather conditions and season. Vertical profiles of field measurements and water chemistry samples will be taken at the inferred centerline of the plume at the edge of the IDZ (station QUL-58).

A plume dispersion model was developed by Golder for the nearfield (i.e., in the vicinity of the IDZ), and a hydrodynamic model of Quesnel Lake has been developed and calibrated by Tetra Tech EBA to predict effluent transfer throughout the West Basin of Quesnel Lake and potential for buildup (Golder 2015b). Monitoring at the near-field station, along with monitoring of other Quesnel Lake receiving environment stations, will be used to verify the near-field and lake-wide hydrodynamic models. It should be noted that the nearfield and the hydrodynamic models, as described in the Long Term Water Management Plan, serve as the basis for the Trigger Response Plan incorporated into the 2018 ADP.

Table 6.5 is a summary of previous surface water monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.5 Summary of surface water monitoring

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Monitoring included streams adjacent to the mine site to determine if there are any changes in water quality. Bootjack and Polley lakes were monitored as receiving environment of the mine. Bootjack Lake was monitored to evaluate potential for exfiltration from Springer Pit. The monitoring sites in Bootjack Lake were moved to two deeper monitoring locations in 2017, as described in the 2016 AERR. For the discharge receiving environment, Quesnel Lake and Quesnel River were monitored.	Post-breach monitoring overlapped with operational monitoring in Polley Lake, Quesnel Lake, and Quesnel River. Monitoring occurred at sites selected to capture major inputs and mixing of Hazeltine Creek. Supplemental sampling of 3 stations flowing into Hazeltine Creek in the Polley Flats area was undertaken to support a geochemical conceptual model in 2016 (SRK and Minnow 2016).	N/A
Summary of findings	The results for the creeks and lakes from 2016-2017 identified no significant trends. No indication of exfiltration from the Springer Pit was found in Bootjack Lake.	Results from Quesnel River show no indications of further effects post-breach since 2016. The 2016 and 2017 results showed that the lower sedimentation pond was effective at decreasing the TSS concentration of Hazeltine Creek. The modelling concluded that 93 to 99% of copper was organically complexed and generally not bioavailable.	N/A
Recommendations for 2018-2020 monitoring	A summary of all changes from the 2016 CEMP is provided in Section 6.6.4.1.	A summary of changes from the 2016 CEMP is provided in Sections 6.6.4.1 and 6.6.4.2.	N/A

Notes: AERR: Annual Environmental and Reclamation Report; N/A: not applicable; TSS: total suspended solids

6.6.4.1 OPERATIONAL MONITORING

Table 6.6 summarizes all changes in operational surface water monitoring form the 2016 CEMP.

Table 6.6 Operational monitoring changes since the 2016 CEMP

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
W1	Reduced frequency from monthly to quarterly	W1 monitors water quality in Morehead Creek, the outflow of Bootjack Lake. As of time of writing, Springer Pit water level is below 990 masl and no indication of exfiltration from the Springer Pit was found in Bootjack Lake. The monitoring frequency will be reviewed by a QP if Bootjack Lake shows any mine-related changes in the future.
W10	Reduced frequency from monthly to semi annually (in June and October)	The monitoring of this site overlaps with Post-Breach Monitoring as it acts as a reference location for the remediated section of Edney Creek. The reduced frequency aligns with frequency of EDC-01 (see Section 6.6.4.2).
W20	Reduced frequency from quarterly to semi-annually	This creek is not directly influenced by mine activities as mine-affected water is diverted away from this creek catchment. Less intense monitoring is required. The frequency will be reviewed by a QP if Bootjack Lake water quality shows any mine-related changes.
QUL-58	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	Monitoring As per the ADP, QUL-58 monitoring is for model verification.
QUL-57	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-57 monitoring is for model verification.
QUL-59	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-59 monitoring is for model verification.
QUL-18	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-18 monitoring is for model verification.
QUL-2a	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month) Considered Quesnel Lake reference site	As per the ADP, QUL-2a monitoring is for model verification and is now considered the Quesnel Lake reference site.

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
QUL-120a	Reduced from seasonally to semi-annually (taken at evenly spaced time series plus or minus one month) No longer considered Quesnel Lake reference site	As per the ADP, QUL-120a monitoring is for model verification.
QUR-1	Continuous monitoring removed	Continuous monitoring was conducted at this site from August 12, 2014 to May 30, 2016. In consultation with ENV, given the lack of variation in the results, continuous monitoring was deemed to be no longer necessary.
QUR-11	Removed	This site is regularly monitored by the provincial and federal government agencies with financial support from MPMC. An annual side-by-side sample will be collected by MPMC at the request of the regulator.
P1, P2	Reduced sampling from monthly to spring overturn, twice in summer, fall overturn, and once in winter under ice Change in sampling depths	The monitoring of these sites overlap with Post-Breach Monitoring. The reduction in monitoring frequency (both sampling and limnological profiles) is because the water quality in Polley Lake appears to be stable. If changes are observed in water quality reflecting breach- or mine-related impacts, frequency of monitoring will be reviewed by a QP. These sample depths align with pre-breach monitoring as agreed upon with ENV staff biologist.
B1, B2	Reduced monitoring of limnological profile from semi-monthly to monthly Change in sampling depths	The reduction in monitoring frequency is because the water quality in Bootjack Lake appears to be stable. If changes are observed in water quality reflecting mine-related impacts, frequency of monitoring will be reviewed by a QP. These sample depths align with pre-breach monitoring as agreed upon with ENV staff biologist.

Notes: CEMP: Comprehensive Environmental Monitoring Plan; masl: meters above sea level; QP: Qualified Professional; ADP: Annual Discharge Plan

6.6.4.2 POST-BREACH MONITORING

Table 6.7 summarizes all changes in operational surface water monitoring form the 2016 CEMP.

Table 6.7 Post-breach monitoring changes since the 2016 CEMP

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
HAC-13	Reduced from weekly to monthly	This site used to be upstream of the Hazeltine Creek Discharge and was monitored under the EEM. Currently, this site monitors water quality in Hazeltine Creek after Reach 1. Monitoring frequency has been reduced to align with other Hazeltine Creek samples.
HAC-14	Added	This site was added to monitor effects of remediation activities on Hazeltine Creek water quality. The frequency aligns with other Hazeltine Creek samples.
HAC-12	Removed	In consultation with ENV (C. Danyluk, personal communication, February 8, 2018), this site has been removed as it is no longer necessary with the connection of the pipeline from the WTP to the diffusers.
HAC-01c	Added	This site represents Hazeltine Creek water quality before entering Quesnel Lake. The frequency aligns with other Hazeltine Creek samples.
EDC-01	Reduced from monthly to semi-annually	No significant trends have been identified at EDC-01. Because of reduced site access in winter and stable water quality, sampling frequency has been reduced to semi-annually.

Notes: CEMP: Comprehensive Environmental Monitoring Plan; EEM: Environmental Effects Monitoring; ENV: BC Ministry of Environment and Climate Change Strategy; WTP: Water Treatment Plant

6.6.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all surface water monitoring (i.e., operational, post-breach, reclamation) is summarized in Table 6.8.

Table 6.8 Water chemistry QC sample frequencies for surface water monitoring

QC Samples	Frequency
Duplicate samples	10% of surface water samples
Equipment blanks	Monthly per piece of equipment (when used)
Trip blanks	Twice per month
Field blanks	Twice per month
Filter blanks	Quarterly
Deionized water blanks	Annually
Laboratory replicate[1]	Annually

Note: [1] Split sample

For results greater than five times the method detection limit (MDL), a relative percent difference (RPD) will be used to identify differences between original and duplicate samples. These data quality objectives (DQOs) are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.6.6 Laboratory Analysis

Samples will be submitted to and processed by a Canadian Association of Laboratory Accreditation (CALA) accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.6.7 Data Analysis and Reporting

In Hazeltine Creek, data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest) and evaluation of any spatial (e.g., down the creek) and temporal changes or trends. Results will also be compared to the BC aquatic life WQGs.

In the other surface water monitoring sites, statistical analysis will be carried out to compare data to reference sites and to assess trends over time. Results will also be compared to the BC aquatic life WQGs.

6.7 Hydrology Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.7.1 Section Authors and Study Design Professionals

This section was written by MPMC, and is guided by Section 3.4 of the Permit (April 7, 2017).

6.7.2 MONITORING OBJECTIVES

The objective of hydrological monitoring in Hazeltine Creek is to characterize the hydrology of the Hazeltine Creek system, assess fish habitat (only in reaches accessible to fish), interpret water quality and water balance, and evaluate changes over time as rehabilitation works are carried out and system recovery occurs (e.g., establishment of riparian vegetation).

The objective of hydrological monitoring in Edney Creek is to characterize the hydrology of Edney Creek in the remediated section, asses fish habitat, interpret water quality, and evaluate changes over time as rehabilitation works are carried out and system recovery occurs (e.g., establishment of riparian vegetation).

The objective of the hydrological monitoring of the streams and creeks that run through or adjacent to the mine site is to characterize the hydrology of the drainages, interpret water quality, and evaluate any changes over time.

6.7.3 MONITORING OVERVIEW

MPMC maintains eight hydrology stations as required by the Permit. Table 6.9 provides an overview of the hydrology monitoring. No large changes have been made from the 2016 CEMP, but wording has been changed to more align with the wording in Section 3.4 in the Permit. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.3 shows monitoring locations of the hydrology monitoring locations.

Staff gauges will be benchmarked (calibrated) once per year between June 15 and August 31, as defined by the Permit. Staff gauge readings will be recorded during water chemistry sampling events at the associated stations and each manual flow measurement. Note that there is currently no staff gauge installed at station W4a (North Dump Creek), as it is a very low flow creek; however, as recommended by WaterSmith Research Inc. (WaterSmith; Appendix K in MPMC 2016e), MPMC will endeavor to install a staff gauge at this location that provides adequate information. Continuous stage monitoring equipment (pressure transducers) will be installed at hydrometric locations specified in Table 6.9 during non-freezing conditions.

Manual flow gaugings will be conducted at all sites during high, moderate, and low flows in non-freezing conditions. These measurements will be conducted at minimum three times per year for validation of the stage-discharge rating curves. If stage-discharge stability is not demonstrated, the frequency of monitoring will be increased to five times per year during the non-freezing period (across the spectrum of high to low flows) to meet Resources Information Standards Committee Grade A standards for hydrometric monitoring (MoE 2009). Due to site characteristics and difficult operating conditions, often the sites meet Grade B/C standards. MPMC will continue to work with a QP to move toward meeting Grade A standards for all hydrological stations. A stage discharge curve that encompasses the non-freezing period flows will be maintained for all hydrological stations with staff gauges.

Table 6.9 Hydrology monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
H4	-	Upper Hazeltine Creek at Polley Lake outlet	Continuous[1]	Water head pressure, temperature	N/A
			Weekly (daily during high runoff periods)	Stage (staff gauge)	Permit 11678
			Monthly[1]	Manual flow gauging	
H1	-	Upper Hazeltine Creek hydrometric station (at Gavin Lake FSR Bridge)	Continuous[1]	Water head pressure, temperature	Permit 11678
			Monthly[1]	Stage (staff gauge)	
			Monthly[1]	Manual flow gauging	
H2	-	Lower Hazeltine Creek hydrometric station (downstream of the Ditch Road Bridge)	Continuous[1]	Water head pressure, temperature	Permit 11678
			Monthly[1]	Stage (staff gauge)	
			Monthly[1]	Manual flow gauging	
W1b	E291449	Morehead Creek	Water quality sample and when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	
W4a	E298551	North Dump Creek below Wight Pit Road	Monthly[1]	Manual flow gauging	Permit 11678
W5	E208039	Bootjack Creek Above Hazeltine Creek	Water quality sample and when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate, and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated); only when sufficient flow	

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
W12	E216744	6 km Creek at Road	Water quality sample; when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	
H3	-	Lower Edney Creek	Continuous[1]	Water head pressure, temperature	N/A
			When flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	

Notes: [1] In non-freezing conditions; N/A: not applicable

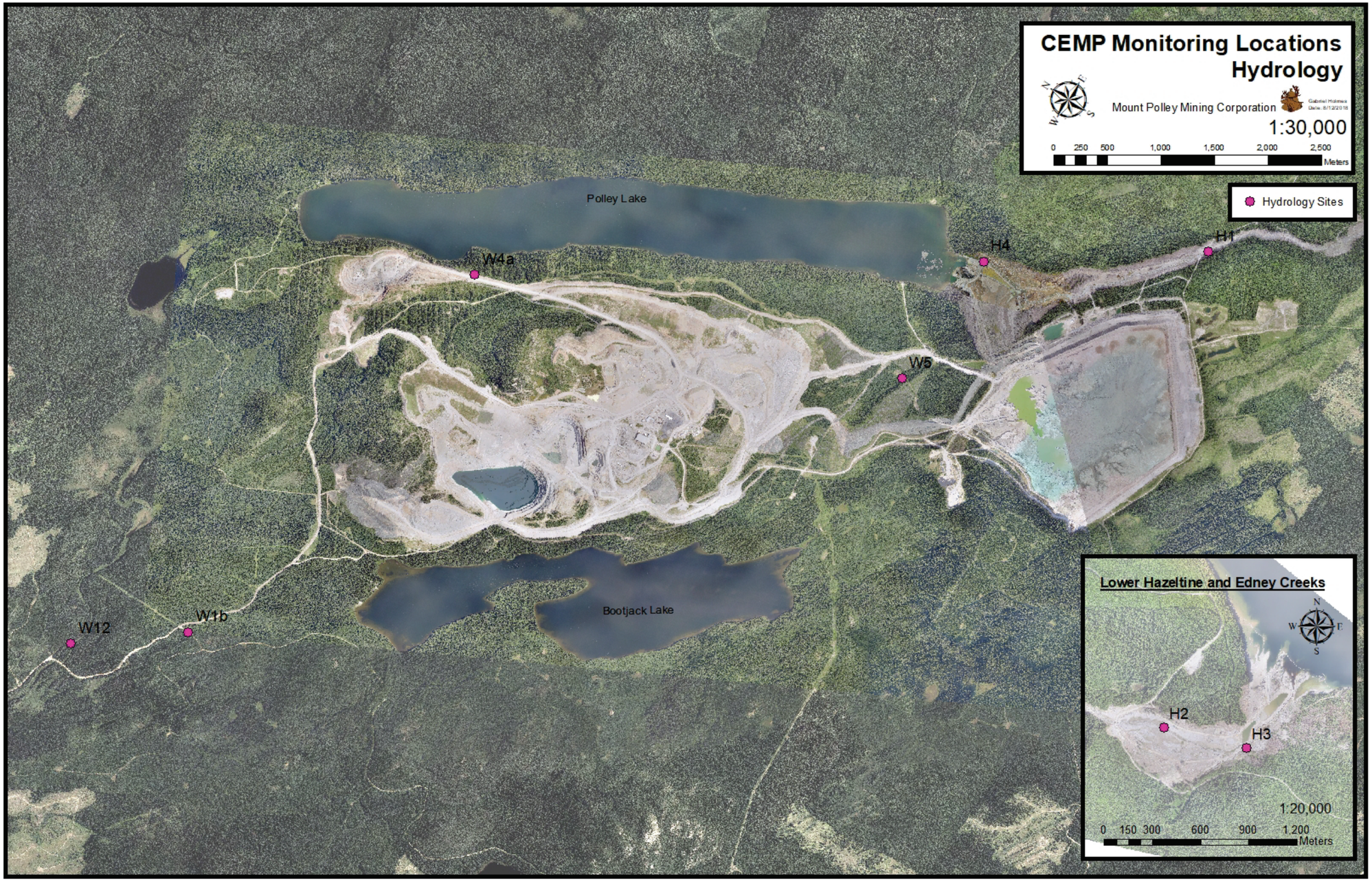

Figure 6.3 CEMP monitoring locations: Hydrology monitoring

6.7.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Hydrological monitoring will be conducted as per the SOPs and WMs for Hydrological Monitoring (which includes installing and downloading continuous loggers) and Benchmarking, as well as the specific WM for operating the FlowTracker acoustic Doppler velocity meter.

Note that some streams do not flow year-round; if there is no flow and a sample or measurement cannot be taken as scheduled, the attempt will be documented in the field notebook.

To verify the accuracy of established rating curves (i.e., confirm that the channel morphology at the station and outflow control point have not changed) and, where possible, extend the upper and lower bounds of the curves, manual flow gaugings will be taken according to Table 6.9 in non-freezing conditions. Manual flow monitoring requirements will be re-evaluated each year, following refinement of the stage-discharge rating curves.

Table 6.10 is a summary of previous hydrology monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.10 Summary of hydrology monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	W1b, W5, and W12 were established prior to 2014. W4a was established in 2014. More detail for each site is provided in Section 6.7.4.1.	H1 and H2 hydrology sites were established in 2015, when channeling of Hazeltine Creek was completed. H4 hydrology site was established in 2016 in the remediated section of upper Hazeltine Creek. H3 hydrology site in the remediated section of Edney Creek was established in 2015. More detail of each station is provided in Section 6.7.4.2.	N/A
Summary of findings	Manual measurements were used to confirm and refine rating curves.	Manual measurements confirmed the rating curves for H1, H2, and H3. Increased manual measurements for H4 will confirm the ratings curve.	N/A

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	Post-Breach	Reclamation
Recommendations for 2018-2020 monitoring	Manual measurements will be collected to confirm the rating curves. One hydrology station is not configured for staff gauge and its establishment will be explored.	Continuous monitoring of levels will continue using the established rating curve. Manual measurements will be collected to confirm the rating curves.	N/A

Notes: N/A: not applicable

6.7.4.1 Operational Monitoring

Table 6.11 summarizes the operational hydrology sites. Flows around the MPMC site are freshet driven; therefore, many hydrology stations are low flow during the rest of the year and cannot be measured. No continuous monitoring devices are installed at these sites due to the very low flow nature of the creeks.

Table 6.11 Summary of operational hydrology sites

Site	Comment
W1b	Site W1b was established in 2012. Benchmarking of this station has occurred annually. In 2016, WaterSmith made significant changes to the site and a new stage-discharge curve was developed. MPMC will continue to conducted manual measurements to confirm the rating curve.
W4a	Site W4a was established downstream, and replaced site W4 in 2014. Only manual bucket flow measurements are recorded from a constructed pipe weir at this site and will continue until recommendations for installation of a staff gauge are explored.
W5	Site W5 at Bootjack Creek was re-established in 2008. Benchmarking of this station has occurred annually. A new staff gauge was installed in 2016 by WaterSmith and a new stage-discharge curve was developed. MPMC will continue to conducted manual measurements to confirm the curve.
W12	Site W12 was established in 1990. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. MPMC will continue to conducted manual measurements to confirm the curve.

Notes: WaterSmith: WaterSmith Research Inc.; MPMC: Mount Polley Mining Corporation

6.7.4.2 Post-Breach Monitoring

Table 6.12 summarizes the post-breach hydrology sites.

Table 6.12 Summary of post-breach monitoring hydrology sites

Site	Comment
H1	Site H1 was established in upper Hazeltine Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the rating curve.
H2	Site H2 was established in upper Hazeltine Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the rating curve.
H3	Site H3 was established in the remediated area of lower Edney Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the curve.
H4	Site H4 was established in upper Hazeltine Creek at the Polley Lake Weir in 2016. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the curve.

Notes: MPMC: Mount Polley Mining Corporation

6.7.5 Data Quality Control, Objectives, and Review

The FlowTracker has built in error messages associated with measurements that are outside of set QC bounds, and reports an International Standard Calculation error and statistical (US Geological Survey calculation) error output following each discharge measurement as a QC measure.

Benchmarking, as described above and as per the protocol in the QA/QC Manual, will occur annually between June 15 and August 31 as per the Permit, or as described by the Permit.

Routine monitoring includes inspections of equipment, including stilling wells and loggers (e.g., to identify sedimentation inside the stilling well or debris build up in logger ports). Identification of potential station changes or issues also occurs through data analysis when data are inconsistent or unusual in comparison with previously collected data.

6.7.6 Laboratory Analysis

No laboratory analysis is required for hydrology monitoring.

6.7.7 Data Analysis and Reporting

Data analysis will include building and validating the stage-discharge rating curves, as well as production of annual hydrographs. These will be presented in the AERR.

6.8 GROUNDWATER MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.8.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC.

6.8.2 MONITORING OBJECTIVES

The primary objective of the groundwater monitoring program on the mine site is to determine the direction, volume, and quality of groundwater flow from the mine site and other disturbed areas to receiving environment.

6.8.3 MONITORING OVERVIEW

Groundwater monitoring wells around the mine site are installed in the area around the TSF, the Springer Pit, downstream of waste rock dumps and haul roads, and in other areas on or surrounding the mine. The monitoring program was developed on the recommendation of the groundwater program review by Golder conducted in March 2016. This review was submitted to ENV on March 31, 2016. An annual review of the groundwater monitoring program was also conducted by Golder in March 2017 and was submitted as Appendix F in the 2017 AERR (MPMC 2018). Recommendations from the 2017 review have been incorporated into the monitoring program outlined below. Sampling events at times of maximum and minimum hydrologic conditions to account for seasonal variability will be conducted when appropriate (i.e., spring and late summer/fall). Static water level (SWL) of all wells will be monitored on the same day at minimum once annually to allow for comparison across the site.

Groundwater monitoring wells were also installed along the Hazeltine Creek in 2015 and 2016. From Golder (2017), groundwater "was not screened for the terrestrial risk assessment because wildlife do not consume groundwater". Monitoring of surface water in Hazeltine Creek captures the potential effects of groundwater discharged to the Hazeltine Channel system (Golder 2017; see Section 6.6). No further monitoring is planned at these groundwater wells.

Table 6.13 summarizes the parameters analysed for groundwater quality. Table 6.14 provides an overview of the groundwater monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.4 shows monitoring locations of the groundwater sampling locations.

Table 6.13 Groundwater chemistry parameters

Parameter	LOR	Unit
Field Parameters		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L

Parameter	LOR	Unit
Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.14 Groundwater monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW96-2a	E229681	Tailings Impoundment East Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-2b	E229682	Tailings Impoundment East Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-3a	E229683	Tailings Impoundment SE Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4a	E229685	Tailings Impoundment SW Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4b	E229686	Tailings Impoundment SW Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-7	E229690	SE Sed Pond Well	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1a	E242385	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1b	E242384	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW00-2a	E242387	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3a	E242389	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3b	E242388	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
95-R-5	E229695	Lower SERDS Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW05-01	E258923	Wight Pit/Polley Lake Interface Well	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1a	E291210	Below Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1b	E291211	Below Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2a	E291212	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2b	E291213	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1a	E291969	NW of Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1b	E291970	NW of Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-2a	E291971	Springer Pit Well (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-2b	E291972	Springer Pit Well (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-3a	E291973	Below Waste Haul Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-3b	E291974	Below Waste Haul Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4a	E291976	Below NEZ Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4b	E291977	Below NEZ Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5a	E291978	Below Wight Pit Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5b	E291979	Below Wight Pit Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW14-1	E301973	Groundwater well at New Orica Site	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW15-1a	E303210	Springer Pit Well North (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-1b	E303211	Springer Pit Well North (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-2a	E303212	Springer Pit Well South (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW15-2b	E303213	Springer Pit Well South (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A
GW16-1a	E308529	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-1b	E308530	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-2a	E308531	Tailings Impoundment North Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-2b	E308532	Tailing Impoundment North Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-3a	E308533	Tailings Impoundment SE Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-3b	E308534	Tailings Impoundment SE Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-4a	E308535	Tailings Impoundment S Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-4b	E308536	Tailings Impoundment S Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-5a	E308537	Tailings Impoundment W Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-5b	E308538	Tailings Impoundment W Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6a	E308539	West of Cariboo Pit (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6b	E308540	West of Cariboo Pit (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-7	E308541	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-8	E308542	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG

Notes: [1] Wells show stable chemistry. If an unexpected change in SWL is observed, well water will be sampled; [2] Wells provide domestic water for personnel; BC WQG – British Columbia water quality guideline; SWL: static water level; CSR: Contaminated Sites Regulations; AL: aquatic life; [3] Leveloggers have been removed from GW15-1a and 1b as wells are dry. Leveloggers will be reinstalled once water is above well screen.

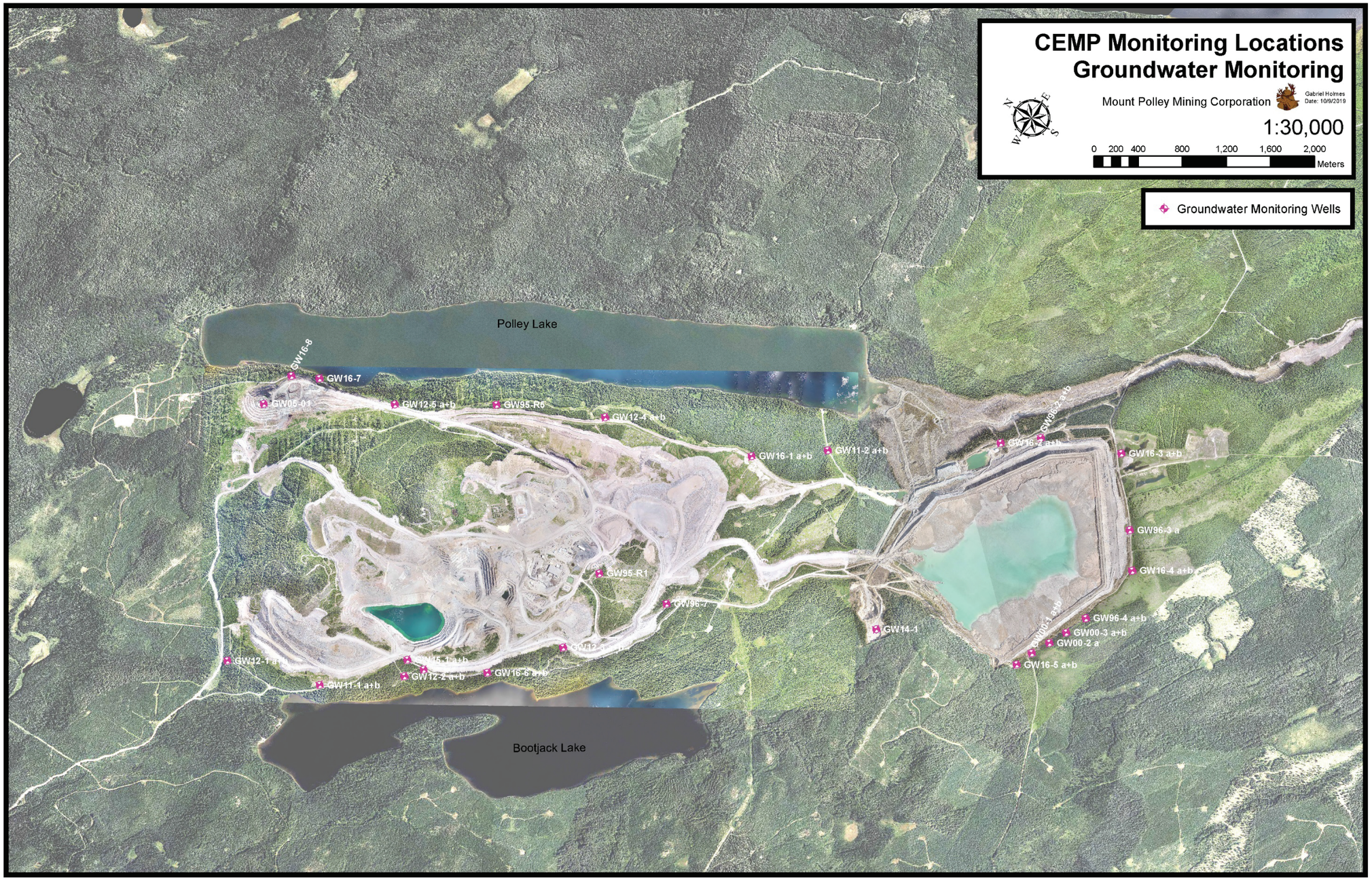

Figure 6.4 CEMP monitoring locations: Groundwater monitoring

6.8.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

As outlined in the SOPs, groundwater monitoring involves use of an automated depth to water meter to measure SWL and a submersible pump powered by a generator for sampling. These protocols also require routine inspections of the well housing.

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Groundwater Monitoring and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.8.3.

Table 6.15 is a summary of previous groundwater monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.15 Summary of groundwater monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Groundwater locations in both shallow and deep bedrock downstream of mine activities. Higher frequency monitoring occurred at wells near the Springer Pit in 2015, 2016, and 2017 because the pit water level was above 1025 masl. Dredging of the Springer Pit commenced in 2017, and the water level in the pit is less than 1000 masl at the time of writing.	An updated groundwater program was implemented for the ERA (Golder 2017). Wells installed in 2015 were resampled and additional wells were installed along the creek in 2016. Groundwater was analyzed for dissolved metals, TSS, pH, anions, nutrients, hardness and acidity.	N/A
Summary of findings	Monitoring of the groundwater wells near the Springer Pit showed exfiltration from the Springer Pit towards Bootjack Lake occurred during 2016. This exfiltration was reversed after the Springer Pit was dewatered, which was confirmed by continued monitoring of these wells. No groundwater leakage from Springer Pit to Bootjack Lake in 2107 was inferred based on the levels measured. No significant changes to groundwater quality were identified in the 2017 annual groundwater review (MPMC 2018).	Although copper was the primary metal of concern in the tailings outwash material deposited in Hazeltine Creek, groundwater copper concentrations were lower than the CSR standard. Other substances that exceeded CSR standards are believed to be associated with natural conditions and were not derived from the tailings.	N/A
Recommendations for 2018-2020 monitoring	New groundwater wells were drilled at the end of 2016 as per recommendations in the Groundwater Program Review. These wells were incorporated into the current program in 2017. One pair of wells was removed due to likely contamination and were replaced (see Golder 2016c). See Section 6.8.4.1 for more detail on the recommendations for future monitoring.	No further sampling is planned for groundwater in Hazeltine Creek. If the water quality declines in the creek, monitoring of these wells will be reviewed and considered.	N/A

Notes: masl: metres above sea level; CSR: Contaminated Sites Regulation; ERA: ecological risk assessment; TSS: total suspended solids

6.8.4.1 OPERATIONAL MONITORING

The monitoring frequencies of the Springer Pit wells were decreased from monthly to quarterly due to the ongoing dewatering at Springer Pit, which has resulted in a significant drop in water levels in some of these wells. For example, dataloggers have been removed from GW15-1a and b as these wells are now dry (J. Foley, personal communication, August 10, 2018). According to J. Foley, "due to the ongoing dewatering at Springer Pit, Golder would consider it acceptable to move to quarterly monitoring, if groundwater is present within the wells." Once dewatering stops and the pit is refilled, consideration to move back to monthly monitoring for a period of time will be given.

A further change to the recommendations put forth in Appendix F of MPMC (2018) is that "quarterly groundwater monitoring should continue at GW16-6 a and b, but semi-annual monitoring can be completed at the remaining GW16 well series. Note that some of the remaining 2016 well series (other than GW16-6 a/b) were monitored one to three times in the 2017 calendar year" (J. Foley, personal communication, August 10, 2018).

6.8.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all the groundwater monitoring is summarized in Table 6.16.

Table 6.16 Water chemistry QC sample frequencies for groundwater water monitoring

QC Samples	Frequency
Duplicate samples	10% of groundwater samples
Equipment blanks	Quarterly per piece of equipment (when used)
Trip blanks	Quarterly/semi-annually[1]
Field blanks	Quarterly/semi-annually[1]

Notes: [1] Quarterly for quarterly groundwater samples, semi-annually for semi-annual groundwater samples (i.e., six per year)

For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.8.6 LABORATORY ANALYSIS

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC for chemistry samples, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.8.7 Data Analysis and Reporting

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest) and evaluation of water chemistry or water level changes and/or trends. Groundwater chemistry will be compared to the Schedule 3.2, Column 3 (Aquatic Life) standards in the ENV Contaminated Sites Regulation (CSR) under the EMA, and BC WQGs per Technical Guidance 15 (MOE 2017a). These data will also be used by a third party qualified professional for the three-year groundwater monitoring program review, and updates to hydrogeological models, including the Springer Pit groundwater model. Hazeltine Creek groundwater data will be used to support the geochemical characterization of materials in the Hazeltine Creek corridor.

6.9 Contact Water Quality Monitoring

Monitoring in this subsection falls under BC *Mines Act* M-200 and is only described here for completeness. Monitoring is summarized and changes will be presented in the CEMP, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A).

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.9.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.9.2 Monitoring Objectives

The objective is to monitor trends in contact water quality on site, including runoff and mill process water, specifically at locations that represent the WTP source water. These data are applied to understand trends in site water chemistry and inform water management planning, including water discharge strategies.

6.9.3 Monitoring Overview

Table 6.17 summarizes the parameters analysed for contact water quality. Table 6.18 provides an overview of the contact water monitoring. Figure 6.5 shows monitoring locations of the contact water sampling locations.

Table 6.17 Contact water chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.18 Contact water monitoring overview

Station Name	EMS Code	Description	Drainage	Inspection Frequency	Sample Frequency	Parameters Measured	Guidelines	Permit[1]
E1a	E225309	TSF Supernatant	Tailings slurry, seepage collection ponds	Daily	Quarterly[2]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
Long Ditch	-	Long Ditch	East RDS, NEZ Dump, SERDS, Wight Pit dewatering	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
SERDS Ditch	-	SERDS Ditch	SERDS, West Ditch, MDC Sump	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E13	-	NW Sump	Temporary NW PAG Stockpile	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E14	-	Mine Drainage Creek Sump	Upper Mine Drainage Creek, West Ditch	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E15	-	Bootjack Creek Culvert Sump	TSF Haul Road, Upper Bootjack Creek	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E17	-	9km Sump	Temporary NW PAG Stockpile	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E4	-	Main Embankment Seepage Collection Pond	MTD, STD, Main Embankment foundation drains	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E18	-	Central Collection Sump	Long Ditch, SERDS Ditch	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
East MTD	-	East Main Toe Drain	East TSF Main Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
West MTD	-	West Main Toe Drain	West TSF Main Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
STD	-	South Toe Drain	TSF South Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
Gavin's Ditch	-	-	Undisturbed area east of Polley Mountain	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]
TSF Clean Water Diversion	-	-	Undisturbed area west of TSF	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]
Wight Pit Clean Water Diversion	-	-	Undisturbed area north of Wight Pit	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]

Notes: [1] Permit regulating the sample; [2] When reclaim water is sourced from TSF; [3] In spring and fall, coinciding with ditch inspections; [4] Under Section 2.4.1 of Permit 11678, surface runoff from undisturbed areas must be diverted away from mine workings. These clean water ditches are monitored to ensure water quality is maintained; N/A: not applicable; TSF: Tailings Storage Facility; PAG: potentially acid generating

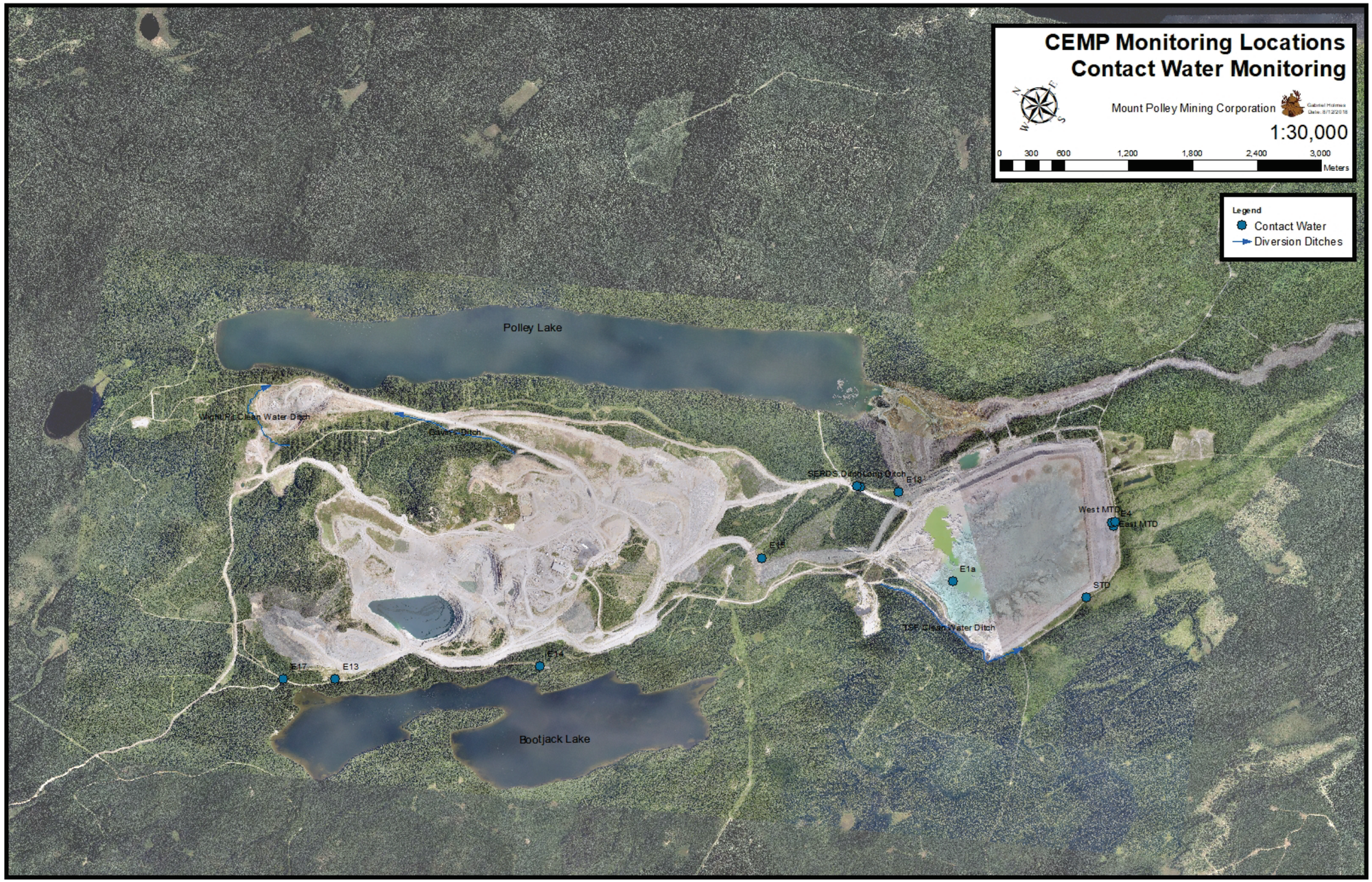

Figure 6.5 CEMP monitoring locations: Contact water monitoring

6.9.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.9.3.

Table 6.19 is a summary of previous contact water monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.19 Summary of contact water monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Sumps that collect and temporarily store water as well as ditches that convey water from many different sources were monitored.	N/A	N/A
Summary of findings	There were no notable trends in 2017 contact water monitoring that suggested the monitoring program needs to be changed.	N/A	N/A
Recommendations for 2018-2020 monitoring	The Springer Pit Sump (E11) is no longer representative of the pit lake water quality and has not been the source of influent for the WTP since 2016. Tailings supernatant (E1a) is also not the source for the WTP. Therefore, these sites has been removed from monitoring under the Permit; E11 continues to be monitored under the *Mines Act* Permit M-200 (see Section 6.10).	N/A	N/A

Notes: N/A: not applicable; WTP: Water Treatment Plant

6.9.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all contact water monitoring is summarized in Table 6.20. For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

Table 6.20 Water chemistry QC sample frequencies for contact water monitoring

QC Samples	Frequency
Duplicate samples	10% of contact water samples
Trip blanks	Combined with surface water QC schedule
Field blanks	Combined with surface water QC schedule

6.9.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.9.7 Data Management and Analysis

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest). These data, including spatial and temporal trends in relation to mine features and their geochemistry, will be used in long-term water management planning (Section 5.1).

6.10 Seep Monitoring

Monitoring included in this subsection fall under BC *Mines Act* Permit M-200 and is only described here for completeness. Monitoring is summarized and changes will be presented in the CEMP, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A).

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.10.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.10.2 Monitoring Objectives

An important component in determining and monitoring long-term chemical stability of drainage from the pits and waste rock dumps is water quality monitoring. The seep sampling is conducted under the BC *Mines Act* Permit M-200.

6.10.3 MONITORING OVERVIEW

Under the BC *Mines Act* Permit M-200 seepage monitoring program, monitoring of waste rock dump seepages is conducted under a bi-annual seep survey program of all waste rock dumps on site, with representative seeps being monitored more frequently when possible (numerous seeps stop flowing during dry periods). Table 6.21 summarizes the parameters analysed for seepage water quality. A list of dumps and pits that are sampled, along with the representative sample locations, is provided in Table 6.22 and Table 6.23, respectively. Figure 6.6 shows monitoring locations of the seepage sampling locations.

Table 6.21 Seepage water chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.22 Seep monitoring overview

Waste Rock Dump	Representative Sample	Representative Sample Frequency	Parameters Measured	Guidelines
North Bell Dump	Joe's Creek Pipe	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Dump	Boundary Seep 2	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
East RDS	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
NEZ Dump	NEZ Seep 1	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Waste Haul Road	Mine Drainage Creek Culvert	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Temporary NW PAG Dump	PAG Seep 15	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
TSF Haul Road	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
SERDS	SERD Seep 13	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

Table 6.23 Pit seepage monitoring overview

Pit	Station Name	Sample Frequency	Parameters Measured	Guidelines
Cariboo Pit	E8	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Wight Pit	E10	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Springer Pit	E11	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Pit	Boundary Pit	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

Notes: [1] When pit is not storing water from other sources on site

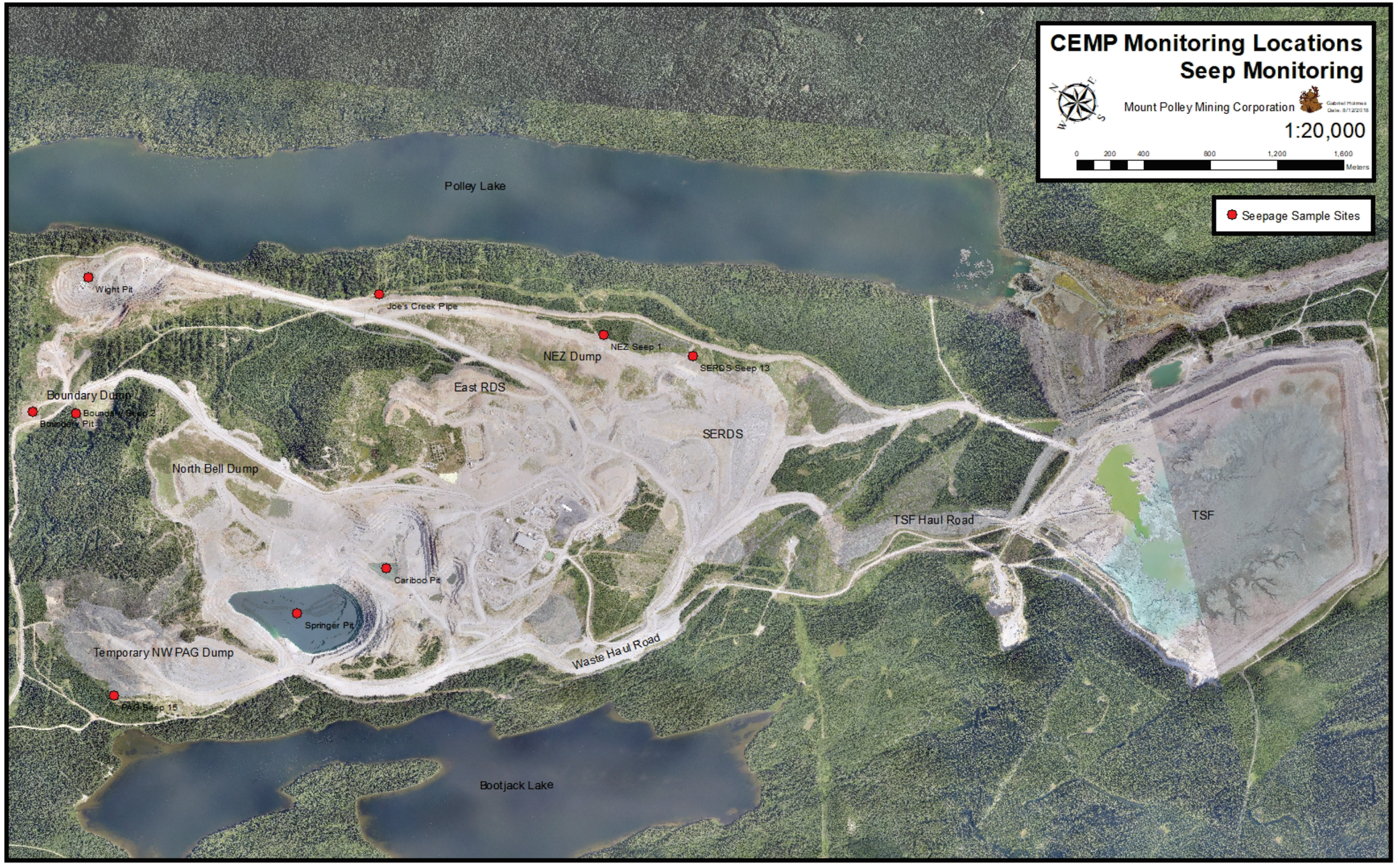

Figure 6.6 CEMP monitoring locations: Seep monitoring

6.10.4 High-Level Monitoring Design Description

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.10.3.

Table 6.24 is a summary of previous seep monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.24 Summary of seep monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	N/A	N/A	Seeps were sampled at the toe of waste rock piles and from pits that are not storing water from other locations.
Summary of findings	N/A	N/A	The results are used to inform long-term planning for reclamation and closure. It has been identified that two seeps from the NEZ Dump have elevated metal concentrations. See Section 6.10.4.1 for more detail.
Recommendations for 2018-2020 monitoring	N/A	N/A	The program will continue unchanged because bi-annual monitoring (i.e., in spring and fall) captures representative conditions.

Notes: N/A: not applicable; NEZ: North-East Zone

6.10.4.1 Reclamation and Closure Monitoring

NEZ Seep 1 and NEZ Seep 2 have elevated metal concentrations compared to other seeps on site. To address this, research into the source of the elevated metals has been launched, as well as possible treatment options. A new collection system for these two seeps has been constructed to isolate the water from the mine site collection infrastructure; this water will be pumped to the mill for the short-term while the research is conducted.

6.10.5 Data Quality Control, Objectives, and Review

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all seep monitoring is summarized in Table 6.25.

Table 6.25 Water chemistry QC sample frequencies for seep monitoring

QC Samples	Frequency
Duplicate samples	10% of seep monitoring samples
Trip blanks	Quarterly/Semi-annually[1]
Field blanks	Quarterly/Semi-annually[1]

Notes: [1] Quarterly for quarterly sampling events; semi-annually for semi-annual sampling events

For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.10.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.10.7 Data Analysis and Reporting

Collection of this data is used in long-term effluent water quality predictions. These results are presented in the AERR and are applied to understand long-term ML/ARD potential, develop site source terms, and inform water management planning.

6.11 Effluent Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.11.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.11.2 MONITORING OBJECTIVES

The objective of the effluent monitoring program is to verify the water chemistry complies with the applicable regulatory limits at the point of discharge (MDMER Schedule 4 and the Permit limits in Table 6.26; see Section 1.2.3 in the Permit), and that the discharge flow rate does not exceed the permitted rates of a maximum of 52,000 m^3/day and an annual average of 29,000 m^3/day (see Section 1.2.1 in the Permit). The influent is also sampled to allow for analysis of treatment efficacy.

6.11.3 MONITORING OVERVIEW

The flow rate, temperature, and TSS of the effluent will be continuously monitored and recorded in the Veolia WTP HMI. MPMC may consider less frequent sampling (MDMER minimum is quarterly) if the monthly mean concentrations of parameters are <10% of the MDMER guidelines for 12 months, as described Section 13 (1) of the MDMER. To make this change if these conditions are met, MPMC will follow the process outlined in Section 7. Table 6.27 summarizes the parameters analysed for effluent quality and Table 6.28 provides an overview of the effluent monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.7 shows monitoring locations of the effluent sampling locations. Reporting of the monitoring data is outlined in Section 9.

Table 6.26 Permit 11678 and MDMER Schedule 4 treated effluent compliance limits for direct discharge to Quesnel Lake

		Permit Limit		MDMER Schedule 4: Authorized Limits	
Constituent	**Units**	**Interim [1]**	**Final [2]**	**MAX Monthly Mean**	**MAX Grab Sample**
Non-Metal Constituents					
pH	pH	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5
Total Suspended Solids	mg/L	15 (mean)/30 (max)		15	30
Total Sulphate	mg/L	720	1,100	-	-
Total Ammonia	mg/L (as N)	0.41	1.21	-	-
Total Nitrate	mg/L (as N)	9.7	34	-	-
Total Nitrite	mg/L (as N)	0.78		-	-
Total Phosphorus	mg/L	0.09		-	-
Fluoride	mg/L	17			
Cyanide [3]	mg/L	-		1	2
Radium 226 [4]	Bq/L	-		0.37	1.11
Total Metals					
Arsenic	mg/L	0.0034	0.028	0.5	1
Chromium	mg/L	0.0011	0.004	-	-
Copper	mg/L	0.012	0.033	0.3	0.6
Iron	mg/L	1		-	-
Lead	mg/L	-		0.2	0.4
Manganese	mg/L	3.4		-	-
Molybdenum	mg/L	0.36		-	-
Selenium	mg/L	0.06	0.075	-	-
Silver	mg/L	0.00024		-	-
Zinc	mg/L	0.059		-	-
Dissolved Metals					
Aluminum	mg/L	0.75		-	-
Cadmium	mg/L	0.00034		-	-
Iron	mg/L	0.35		-	-
Acute Toxicity Testing Results					
96h LC50 Rainbow Trout	Mortality in 100% effluent	50%		-	LC50 >100%
48h LC50 *D. magna*		50%		-	LC50 >100%

Notes: [1] Maximum discharge limits until toxicity testing on final effluent concentrations is conducted; [2] Maximum discharge limits applicable after ENV is satisfied that toxicity testing demonstrates that the final effluent will not cause mixture toxicity. This requirement has been met; [3] MDMER requirement only; if cyanide is not used in the mining/milling process, then it does not have to be analysed. Since cyanide is not used in the mining/milling process at Mount Polley, the effluent is not analysed for cyanide; [4] MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied, and radium 226 analysis is currently conducted quarterly.

Table 6.27 Effluent chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Notes: LOR: Limit of Reporting

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Table 6.28 Effluent monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
E19	E305050	WTP influent	Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
HAD-3	E304230	WTP treated effluent	Continuous[1]	TSS (calculated), temperature, flow rate	Permit 11678
			Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals, radium 226[2], total mercury[3]	Permit 11678; MDMER; EEM
			Monthly	Acute toxicity tests: - Rainbow trout: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout* (Reference Method EPS1/RM/13) - Daphnia Magna: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna* (Reference Method EPS1/RM/14) - or most recent methods, as per MDMER	Permit 11678; MDMER[4]
			Semi-annually[5]	Chronic toxicity tests: - Biological Test Method: *Toxicity Tests Using Early Life Stages of Salmonid Fish* (Rainbow Trout) (Reference Method EPS 1/RM/28) - Invertebrate species: *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia* (Report EPS 1/RM/21) - Plant species: *Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, Lemna minor* (Reference Method EPS 1/RM/37) - Algal species: *Biological Test Method: Growth Inhibition Test Using Freshwater Alga Selenastrum capricornutum* (Report Method EPS 1/RM/25)	MDMER

Notes: [1] Only when discharging; [2] MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied and radium 226 analysis is currently conducted quarterly; [3] EEM requirement only; can be discontinued if concentration is less than 0.10 µg/L in 12 consecutive samples. This has been satisfied and mercury analysis has been discontinued; [4] MDMER June 2018 Part 2 Division 2 16 (1): frequency may be reduced to quarterly if discharge is determined not to be acutely lethal for 12 consecutive months; [5] Chronic/sub-lethal toxicity tests are conducted semi-annually for 3 years. MDMER June 2018 Schedule 5, 6 (1-3): after 3 years, frequency will be increased to once per calendar quarter on the sub lethal species whose results of sub lethal tests produce the lowest geometric mean, taking into account the inhibition concentration that produces a 25% effect or effective concentration of 25%; N/A: not applicable; TSS: total suspended solids; DOC: dissolved organic carbon; MDMER: Metal and Diamond Mining Effluent Regulations; EEM: Environmental Effects Monitoring



Figure 6.7 CEMP monitoring locations: Effluent monitoring

6.11.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed for the parameters described in Section 6.11.3.

Table 6.29 is a summary of previous effluent monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.29 Summary of effluent monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Discharge monitoring included the influent and treated effluent.	N/A	N/A
Summary of findings	All samples were at or below permit limits for the treated effluent in 2017; in 2016, the majority of samples were at or below the permit limits. When samples did not meet permit limits, ENV was notified and an investigation into the cause was undertaken. Comparing the influent concentrations to treated effluent concentrations verified reduction in parameters interest. See Section 6.11.4.1 for more details.	N/A	N/A
Recommendations for 2018-2020 monitoring	Monitoring of the influent (E19) will be increased from monthly to weekly to align with monitoring of HAD-03 for better efficiency analysis of the WTP.	N/A	N/A

Notes: N/A: not applicable; ENV: Ministry of Environment and Climate Change Strategy; WTP: water treatment plant

Should there be an extreme weather event or equipment failure in the WTP that could affect water quality in the effluent, MPMC has the ability to request rush analysis from the analytical lab (ALS). MPMC maintains an Emergency Response Plan for the effluent discharge as required by the MDMER and the Permit.

6.11.4.1 OPERATIONAL MONITORING

Figure 6.8 shows total copper concentrations and Figure 6.9 shows TSS in the influent (E19) and effluent (HAD-03) in 2017. No exceedances were recorded in 2017 in the effluent.

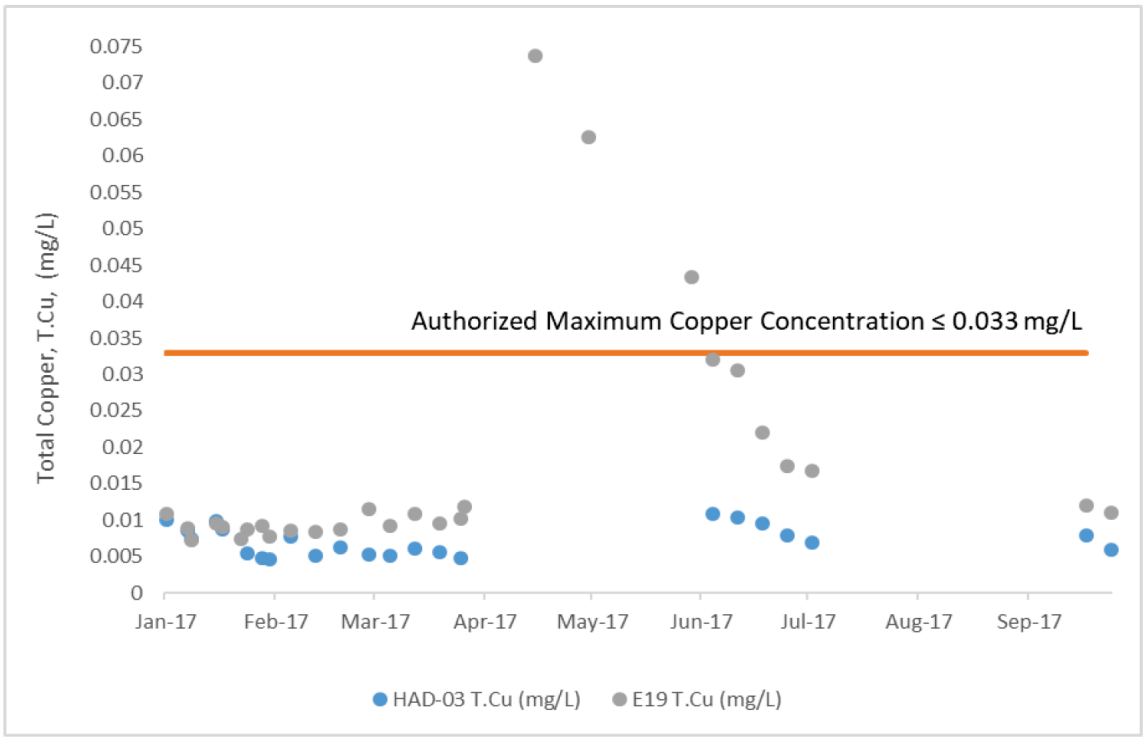

Figure 6.8 Total suspended solids concentrations in influent (E19) and effluent (HAD-03) in 2017

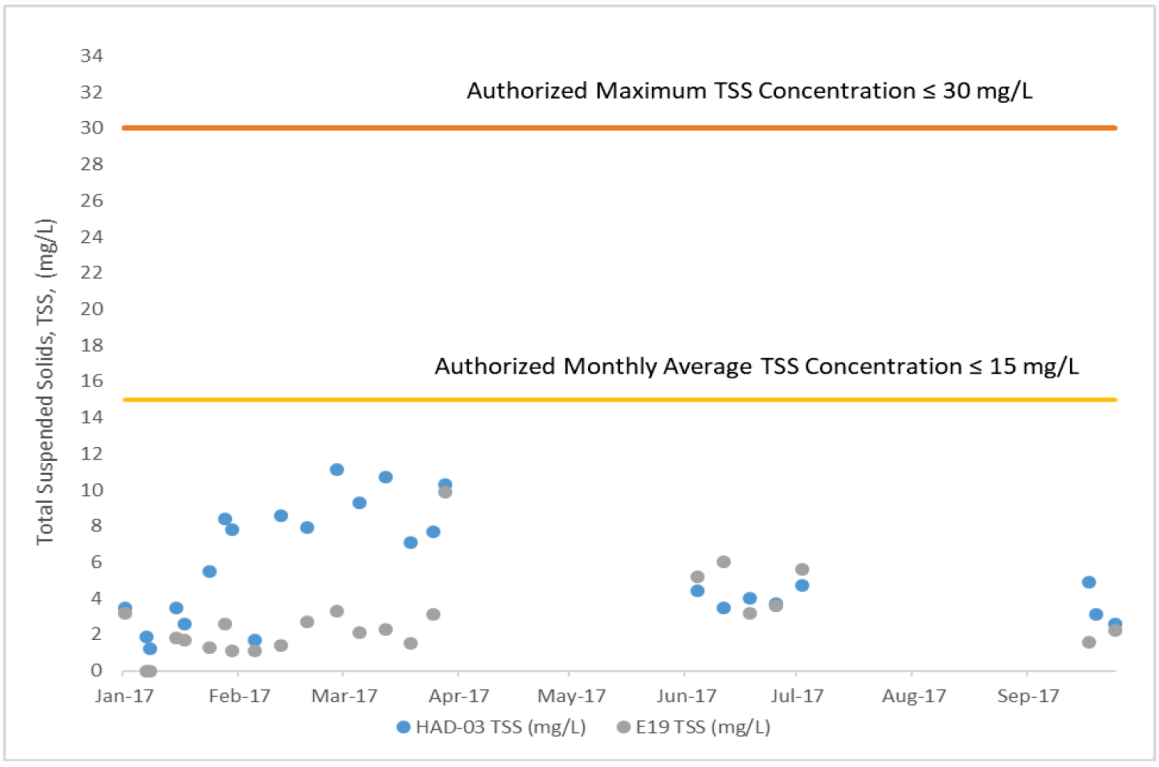

Figure 6.9 Total copper concentrations in influent (E19) and effluent (HAD-03) in 2017

MPMC conducts acute toxicity tests monthly for LC50 Rainbow trout and LC50 *Daphnia magna*. Under the new MDMER, *D. magna* is now a compliance parameter. MPMC will continue to conduct these acute lethality tests as required.

MDMER has changed the frequency of acute toxicity tests for effluent discharge. In accordance with Part 2, Division 2, paragraph 16 (1), acute lethality tests at the final discharge point (HAD-3) will become quarterly if the effluent is determined to be non-lethal for 12 consecutive months (Government of Canada 2018). Effluent at HAD-3 since discharge has started (December 2015) has been shown to be non-lethal.

MPMC has conducted chronic toxicity tests on the effluent discharge since December 7, 2015 on a quarterly and semi-annual basis. Under MDMER requirements, after three years (after December 2018 at HAD-3), the chronic toxicity tests results will be reviewed by a QP and will be streamlined to one test only. This test will be based on the most sensitive organism to the effluent according to historical geometric means and will be tested quarterly. The reduction of frequency from the 2016 CEMP for the chronic toxicity tests, as described in Table 6.28, aligns with the MDMER, as no actionable effects have been recorded at HAD-03 and the MDMER protocol is established to characterise the impacts on the most sensitive aquatic life.

6.11.5 Data Quality Control, Objectives, and Review

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. Effluent monitoring samples are combined in the surface water QC schedule (see Section 6.6.5), as laid out in Table 6.8.

6.11.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC for chemistry samples and Nautilus Environmental in Burnaby, BC for toxicity testing, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015) and the MDMER (where applicable; i.e., discharge water toxicity testing).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

QC monitoring for toxicity testing will be carried out at the laboratory, as per the test methods, with requirements to meet criteria such as test organism health history, and control acceptability. Uncertainty associated with test results will be described by the standard deviation around the mean and/or the confidence limits around the point estimate.

6.11.7 Data Analysis and Reporting

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, max, and 95th percentile values over the period of interest) and screening of results

against applicable regulatory benchmarks (see Table 6.26). Screening will include evaluation of results at the treated effluent discharge against MDMER and the Permit limits. Alerts are set up in the MP-5 database so that MPMC Environmental Department staff receives an email if specified benchmarks are exceeded.

6.12 SEDIMENT QUALITY MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.12.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow Environmental Inc. (Minnow). The detailed study design is provided in Appendix B.1. Golder prepared the study design for selecting an alternate reference lake for Polley Lake (Appendix B.7).

6.12.2 MONITORING OBJECTIVES

As outlined in Appendix B.1, the objectives of sediment quality monitoring are to:

- "Evaluate the influence of mine activities on the receiving environments (e.g., Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life by applying a variety of interpretive tools";
- "Provide data to support exposure assessment as part of the ERA and HHRA";
- "Provide supporting information for benthic invertebrate community monitoring"; and,
- "Advance technical understanding of the stability or mobility and potential bioavailability of metals and metalloids in lake sediments affected by the TSF Breach".

6.12.3 MONITORING OVERVIEW

Sediment quality monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 perimeter embankment failure; and
3) Monitoring of response to reclamation activity following the perimeter embankment failure.

An overview of the proposed sediment quality monitoring program is provided in Table 2 and Figures 5 and 6 of Appendix B.1. Sediment quality monitoring is focused on Polley Lake, Hazeltine Creek, and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake). Table 3 in Appendix B.1 summarizes the analytes and laboratory reporting limits for the sediment quality monitoring program.

The monitoring program is divided into lake monitoring and creek monitoring and will include physical and chemical characterisation of deposited sediments. Sediment quality sampling will be supported by

measurements of temperature, dissolved oxygen, pH, and specific conductance near the sediment-water interface at all sampling stations. Some additional monitoring of the stability and potential bioavailability of metals associated with sediments impacted by the TSF Breach may be undertaken (e.g., deployment of Diffusive Gradients in Thin Films [DGT] devices to monitor labile metal concentrations; toxicity testing using *Hyalella azteca*). More detail is provided in Appendix B.1.

6.12.4 High-Level Monitoring Design Description

Appendix B.1 provides a summary of sediment monitoring history previously conducted in the vicinity of the mine in the surrounding lakes and creeks, including baseline, and pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.1 for lake sediment sampling, creek sediment sampling, and DGT sampling. A study design for evaluating alternate reference lakes for Polley Lake is provided in Appendix B.7.

6.12.5 Data Quality Control, Objectives, and Review

Appendix B.1 summarizes the QAQC program for the sediment monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As described in Appendix B.1, "comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <40% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits." See Appendix B.1 for more details.

6.12.6 Laboratory Analysis

Chemical analyses will be completed at a CALA accredited analytical laboratory and will include moisture content, pH, particle size distribution, total organic carbon (TOC), total nitrogen, total sulphur, and total metal concentrations, as summarized in Table 3 in Appendix B.1.

Toxicity testing will be conducted at a CALA accredited testing laboratory using a 10 day test of the survival and growth of *Chironomus dilutus.* DGT analysis is described in detail in Appendix B.1 in Section 4.3.

6.12.7 Data Analysis and Reporting

As described in Appendix B.1, data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile for each analyte for all replicated data. Appendix B.1 describes how "sediment quality data will then be evaluated in comparison to British Columbia Working Sediment Quality Guidelines for the protection of aquatic life (WSQGs; MOE 2017b) and reference concentrations. Reference 95th percentile values will be used to screen exposed-area mean concentrations to efficiently identify analytes with concentrations that are beyond the range of reference.

"The overall interpretation of sediment quality data will include integration of a weight-of-evidence that includes other components of the MPMC CEMP (e.g., benthic invertebrate community data). Thus, within

the CEMP, sediment quality data interpretation will specifically include the integration of data on sediment quality, the results of specialized evaluations (e.g., DGT results), and the results of bio-assessment (e.g., sediment toxicity testing and benthic invertebrate communities).

"An interpretive report based on the sediment quality data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an Appendix and will include the data quality review, the results of the screening against BCWSQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.13 BENTHIC INVERTEBRATE MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.13.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.2. Golder prepared a study design for selecting an alternate reference lake for Polley Lake (Appendix B.7).

6.13.2 MONITORING OBJECTIVES

As outlined in Appendix B.2, the objectives of benthic invertebrate monitoring are to:

- "Evaluate the influence of Mount Polley Mine activities on benthic invertebrate communities, productivity, and tissue quality in receiving environments (e.g., Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines; MoE 2014) and to aquatic ecosystem health by providing supporting information for the assessment of potential effects to higher trophic levels (e.g., fish and fish habitat quality; Section 6.16)"; and,
- "Provide data to support exposure assessment as part of the ERA and HHRA."

Benthic invertebrate community monitoring is also required as part of EEM under the MDMER. The objective of the MDMER EEM benthic invertebrate monitoring identified in Appendix B.2 is to "evaluate whether there are effects to benthic invertebrate community characteristics between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)."

6.13.3 MONITORING OVERVIEW

Benthic invertebrate monitoring under the CEMP is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to reclamation activity following the TSF embankment breach.

An overview of the proposed benthic invertebrate monitoring program is provided in Table 3 of Appendix B.2, and includes benthic invertebrate community, productivity, and tissue quality. Benthic invertebrate monitoring is focused on Polley Lake, Hazeltine Creek, lower Edney Creek, Quesnel Lake, and associated reference areas (Figures 6 and 7 of Appendix B.2). Table 4 in Appendix B.2 summarizes the analytes and laboratory reporting limits for the benthic invertebrate monitoring program. The sampling frequency at this time is once every three years.

6.13.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Appendix B.2 provides a summary of benthic invertebrate monitoring history previously conducted in the vicinity of the mine in the surrounding lakes and creeks, including baseline, and pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.2 for community and productivity sampling, and tissue quality sampling. A study design for evaluating alternate reference lakes for Polley Lake is provided in Appendix B.7.

6.13.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Appendix B.2 summarizes the QAQC program for the benthic invertebrate monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As stated in Appendix B.2, "for benthic invertebrate tissue quality samples, comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <25% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits.

"For benthic invertebrate community samples, reanalysis for quality control endpoints (organism sorting efficiency, subsampling precision and accuracy error, and taxonomic identification error) will be performed on 10% of samples, and results of quality control measures will be evaluated relative to pre-established DQOs." See Appendix B.2 for more details.

6.13.6 LABORATORY ANALYSIS

As described in Appendix B.2, "taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory certified under the Taxonomic Certification Program of the Society for Freshwater Science (SFS). Benthic invertebrate tissue quality samples will remain frozen until overnight shipment on ice with completed COCs to ALS Environmental, Burnaby BC, which is an analytical laboratory accredited by the CALA."

6.13.7 Data Analysis and Reporting

As described in Appendix B.2, data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile for each endpoint for all replicated data. Data analysis will be completed for each monitoring component (community, productivity, and tissue quality). More detail for each monitoring component is provided in Section 4.5 of Appendix B.2.

As stated in Appendix B.2, "an interpretive report based on the benthic invertebrate data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the date quality review, the results of the screening against BCWQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.14 Plankton and Chlorophyll *a* Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.14.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.14.2 Monitoring Objectives

The objective of phytoplankton and zooplankton monitoring at lake stations is to assess potential changes in plankton community abundance and diversity, as well as temporal and special changes in zooplankton metal concentrations. Chlorophyll *a* sampling will be conducted and analyzed to provide support data that can be interpreted with other biological monitoring and water chemistry data in a broader analysis of lake productivity.

This monitoring will be conducted to aid in assessing lake productivity following the TSF embankment breach (Post-Breach Monitoring: Polley Lake and Quesnel Lake) and to identify any changes related to the chemistry of the discharged treated effluent (Operational Monitoring: Quesnel Lake).

6.14.3 Monitoring Overview

Table 6.30 summarizes the parameters analysed for plankton and chlorophyll *a* monitoring. Chlorophyll *a*, phytoplankton taxonomy and biomass, and zooplankton taxonomy and metal tissue samples will continue to be collected concurrently with water chemistry samples (including field parameters) three times per year to capture early and late growing seasons as outlined in Table 6.31. Growing seasons were determined after monthly sampling was conducted in 2015; data analysis of zooplankton community is presented in Golder (2016d). Further details of monitoring sites, including site access descriptions, access or safety concerns,

and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.10 shows monitoring locations of the plankton and chlorophyll *a* sampling locations.

Table 6.30 Plankton and chlorophyll *a* parameters

Parameter	LOR	Unit
Taxonomy		
Phytoplankton	-	-
Zooplankton	-	-
Total Metals in Tissue		
Aluminum (Al)	2	mg/kg
Antimony (Sb)	0.01	mg/kg
Arsenic (As)	0.02	mg/kg
Barium (Ba)	0.05	mg/kg
Beryllium (Be)	0.01	mg/kg
Bismuth (Bi)	0.01	mg/kg
Boron (B)	1	mg/kg
Cadmium (Cd)	0.005	mg/kg
Calcium (Ca)	20	mg/kg
Chromium (Cr)	0.005	mg/kg
Cobalt (Co)	0.05	mg/kg
Copper (Cu)	0.02	mg/kg
Iron (Fe)	0.1	mg/kg
Lead (Pb)	3	mg/kg
Lithium (Li)	0.02	mg/kg
Magnesium (Mg)	0.5	mg/kg
Manganese (Mn)	2	mg/kg
Molybdenum (Mo)	0.05	mg/kg
Nickel (Ni)	0.02	mg/kg
Potassium (K)	0.2	mg/kg
Selenium (Se)	10	mg/kg
Silicon (Si)	20	mg/kg
Silver (Ag)	0.05	mg/kg
Sodium (Na)	0.05	mg/kg
Strontium (Sr)	20	mg/kg
Thallium (Tl)	0.05	mg/kg
Tin (Sn)	0.02	mg/kg
Titanium (Ti)	0.002	mg/kg
Uranium (U)	0.1	mg/kg
Vanadium (V)	0.002	mg/kg
Zinc (Zn)	0.1	mg/kg
Plant Pigments (Water)		
Chlorophyll *a*	0.01	µg

Notes: LOR: Limit of Reporting

Table 6.31 Plankton and chlorophyll *a* monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
P2	E307975	Polley Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
B2	E215897	Bootjack Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-1	E306455	Quesnel Lake zooplankton station at Hazeltine	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-7	E306456	Quesnel Lake zooplankton station at Horsefly	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A

Notes: N/A: not applicable; IDZ: initial dilution zone

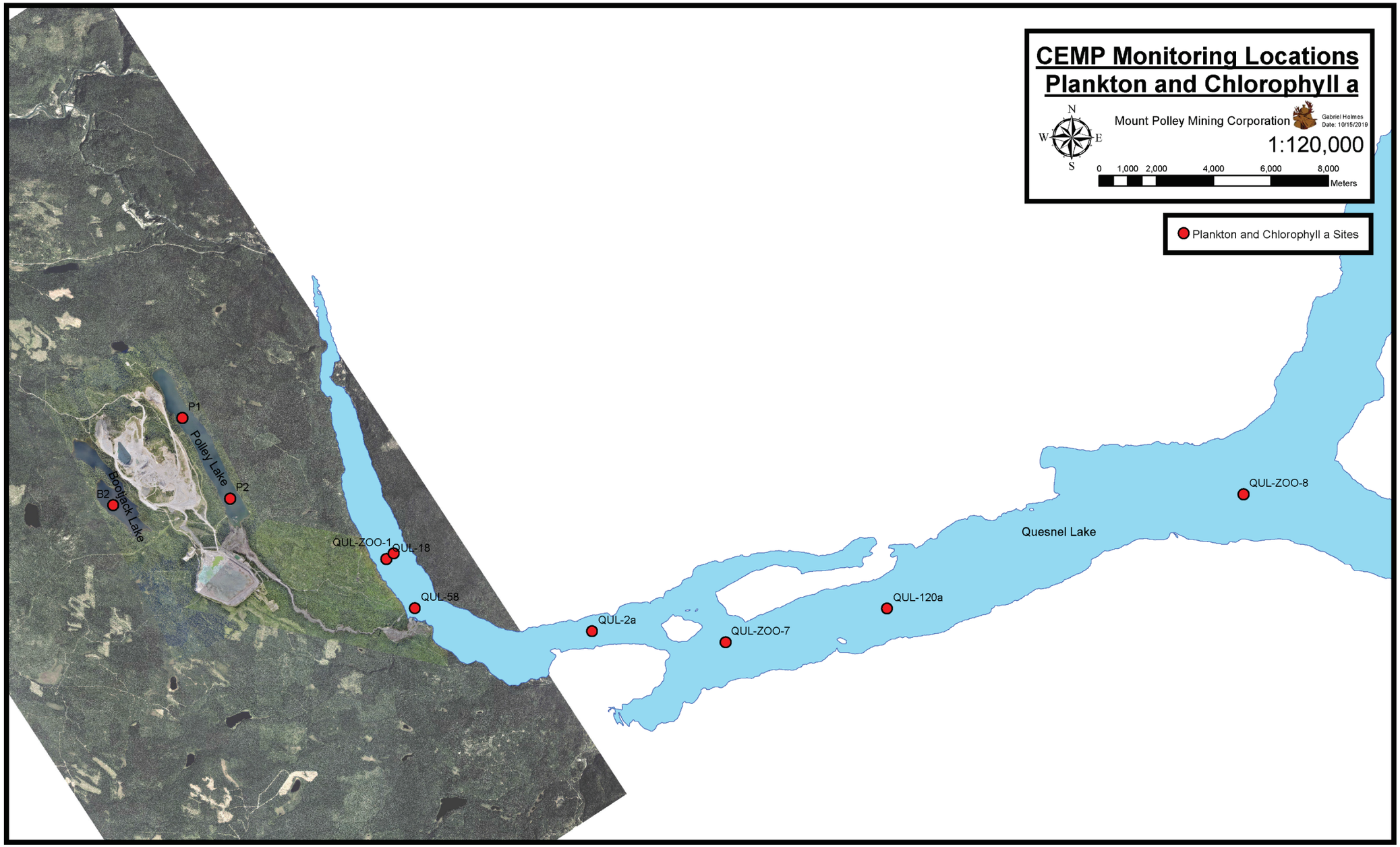

Figure 6.10 CEMP monitoring locations: Plankton and chlorophyll *a* monitoring

6.14.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following procedures outlined in the SOPs and WMs on Lake Water Monitoring and Zooplankton Sampling in the MPMC QA/QC Manual.

In brief, sampling at all stations will be conducted as follows:

- Zooplankton samples:
  - will be collected using 50 µm mesh nets with a mouth diameter ≥0.5 m, and equipped with a flow meter. In 2019, for stations previously sampled with a 150-µm mesh net, samples will be collected with both a 50- and a 150-µm mesh net to enable an assessment of the difference between the two net mesh sizes and to facilitate comparison with historical data.
  - will be collected using a modified horizontal tow.
  - for taxonomy/biomass will be transferred to a Nalgene container and preserved with buffered formalin.
  - for tissue chemistry will consist of a composite of multiple tows to achieve a minimum required tissue mass for analysis (i.e., 1.5 g).
- Phytoplankton samples
  - will be collected as a depth-integrated sample. Water will be collected from at least four discrete depths at each station (surface, one-third Secchi depth, two-thirds Secchi depth, total Secchi depth), with a grab sampler (e.g., Kemmerer, Van Dorn) or with a length of flexible tubing modified for this purpose, with or without a peristaltic pump.
  - will be collected as surface and depth-integrated samples in 2019 to allow for an assessment of the difference between the two methods and to facilitate comparison with historical data.
  - for Chlorophyll *a* analysis will be transferred to a container wrapped in aluminum foil.
  - for taxonomy/biomass will be preserved with Lugol's solution

One replicate will be collected in each of June and August, and five replicates will be collected during the July sampling event, and samples for zooplankton and phytoplankton will be collected on the same day for each lake. Secchi depth and *in situ* water-chemistry supporting data will be collected concurrently at each station.

Table 6.32 is a summary of previous plankton and chlorophyll *a* monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable. Monitoring for plankton and chlorophyll *a* overlaps with operational monitoring in Quesnel Lake, as described in Section 6.14.2.

Table 6.32 Summary of plankton and chlorophyll *a* monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Plankton (phyto and zoo) taxonomy and chlorophyll *a* sampling frequency was semi-annually in 2016 and 2017 (June/July and August) at two stations in Polley Lake and three stations in Quesnel Lake. Some sampling events were missed in 2017 due to safety concerns.		N/A
Summary of findings	Zooplankton and phytoplankton results will be analysed in the three-year interpretive report (see Section 9.4) and recommendations for changes may be made, if required, in this report. Some chlorophyll *a* data were collected prior to the TSF breach. Results from 2013 – 2017 are shown in Section 6.14.4.1.		N/A
Recommendations for 2017-2020 monitoring	The sampling program outlined in Table 6.31 will be repeated annually.		N/A

Notes: N/A: not applicable

6.14.4.1 POST-BREACH MONITORING

Figure 6.11 shows chlorophyll *a* data collected from Polley Lake from 2013 – 2017. Data from P2 will continue to be collected to analyse potential trends.

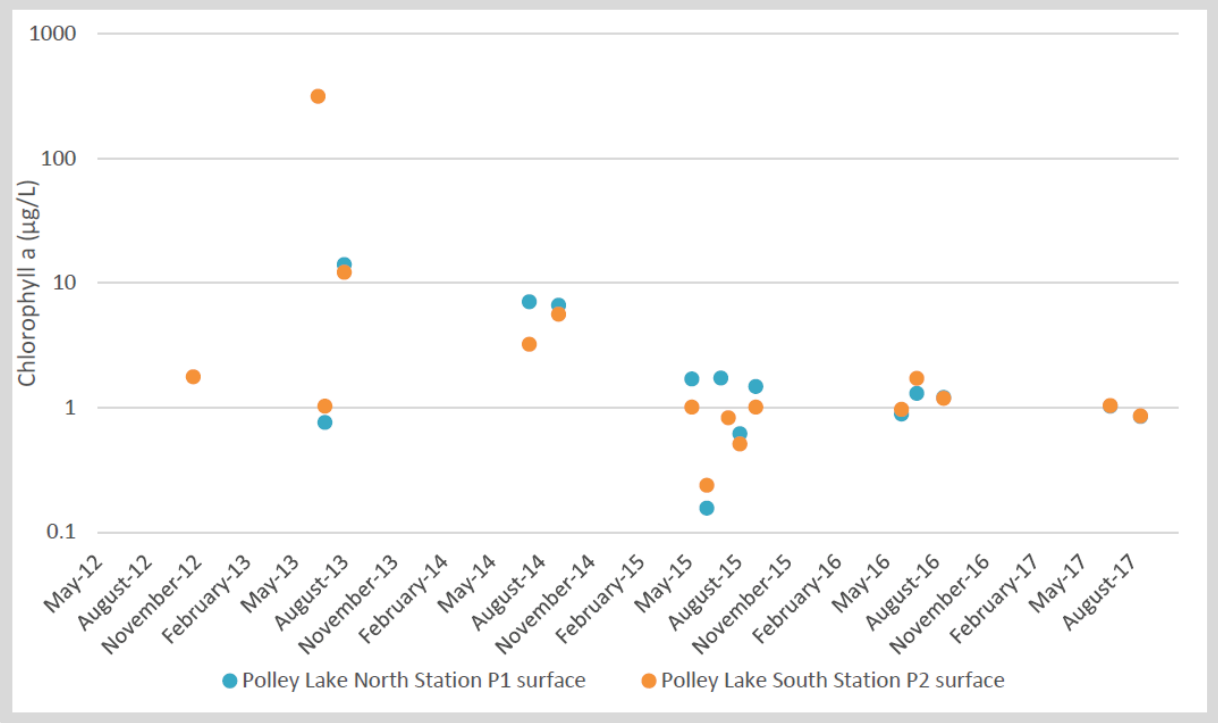

Figure 6.11 Chlorophyll *a* data collected from Polley Lake from 2013 - 2017

6.14.5 Data Quality Control, Objectives, and Review

QA/QC procedures will consist of re-analysis of 10% of phytoplankton and zooplankton taxonomy samples, and analysis of a duplicate metals sample for tissue chemistry once annually. For taxonomy, replicate counts should meet the DQO of within 20% of the original count. For metals, the RPD data quality of greater than 40% for concentrations greater than or equal to five times the MDL will be used to identify differences between original and duplicate samples for metals.

6.14.6 Laboratory Analysis

Plankton taxonomy samples will be shipped to the following laboratories for processing[2]:

- Biologica environmental Services Ltd., Victoria, BC: plankton taxonomy.
- ALS Environmental Inc., Burnaby, BC[3] – chlorophyll *a* and zooplankton tissue chemistry.

6.14.7 Data Analysis and Reporting

Statistical analysis will be carried out to evaluate trends over time by comparing results with data collected annually. In Quesnel Lake, near-field data will be compared with far-field and reference data to evaluate

[2] No accreditation program exists for plankton taxonomy

[3] Accredited by the Canadian Association of Laboratory Accreditation (CALA)

potential mine impact and spatial trends. These data will also be used to assess implications for lake productivity and fish populations.

6.15 PERIPHYTON MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.15.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.3.

6.15.2 MONITORING OBJECTIVES

As outlined in Appendix B.3, the objectives of periphyton monitoring are to:

- "Evaluate the influence of mine activities (related to mine operations, the TSF breach, and/or rehabilitation activities) on Hazeltine Creek (the creek receiving environment directly influenced by mine activity) and lower Edney Creek (a creek environment directly influenced by the TSF breach)";
- "Serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish; Sections 6.13 and 6.16, respectively)";
- "Provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity"; and,
- "Provide data to support exposure assessment as part of the ERA and HHRA".

Periphyton monitoring will include assessment of productivity, community composition, and tissue quality, with comparison to previous and/or reference conditions, to applicable guidelines (i.e., chlorophyll *a*; MoE 2018), and to literature-based criteria (or classification ranges) for productivity.

6.15.3 MONITORING OVERVIEW

Periphyton monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the previous discharge of treated effluent to Hazeltine Creek);
2) Monitoring of the impact of the 2014 TSF breach; and
3) Monitoring of the response to reclamation activity following the TSF breach.

An overview of the proposed periphyton monitoring program is provided in Table 1 and Figure 4 of Appendix B.3. Periphyton monitoring is focused on Hazeltine Creek and lower Edney Creek with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek

and lower Hazeltine Creek). Table 2 in Appendix B.3 summarizes the analytes and laboratory reporting limits or the periphyton monitoring program.

6.15.4 High-Level Monitoring Design Description

Appendix B.3 provides a summary of periphyton monitoring history previously conducted in the vicinity of the mine in the surrounding creeks, including pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.3 for biomass and chlorophyll *a* sampling, community sampling, and tissue quality sampling.

6.15.5 Data Quality Control, Objectives, and Review

Appendix B.3 summarizes the QAQC program for the periphyton monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As stated in Appendix B.3, "comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD < 25% for concentrations that are > 5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits. Specific QC sampling and associated reporting will for tissue quality and periphyton productivity endpoints be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). QC reporting will also be requested of the laboratory performing taxonomic analysis of the periphyton community samples, including organism enumeration checks for a minimum of 10% of samples." See Appendix B.3 for more details.

6.15.6 Laboratory Analysis

The laboratory responsible for the physical or chemical analyses will be accredited by the CALA for these analyses.

6.15.7 Data Analysis and Reporting

For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, minimum, and maximum for each analyte. Data analysis will be completed for each monitoring component (productivity, community, and tissue quality). More detail for each monitoring component is provided in Section 4.5 of Appendix B.3.

As outlined in Appendix B.3, "an interpretive report based on the periphyton monitoring data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the data quality review, the results of the screening against BCWSQG and other guidelines or classification schemes, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.16 FISH MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.16.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.4.

6.16.2 MONITORING OBJECTIVES

As outlined in Appendix B.4, the objectives of fish monitoring are to:

- "Evaluate the influence of Mount Polley Mine activities on fish communities, populations, and tissue quality in receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines [MoE 2014; CFIA 2015])";
- "Provide data to support exposure assessment as part of the ERA and HHRA"; and,
- "Document fish habitat utilization in creek and lake areas that were physically impacted by the TSF breach (most notably Hazeltine Creek and the lower segment of Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts".

From Appendix B.4, the objective of the MDMER EEM fish monitoring is to "evaluate whether there are differences in population endpoints (survival, growth, and reproduction) of sentinel fish species between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)." Evaluation of selenium in fish tissues is also triggered under the MDMER on the basis of current selenium concentrations in effluent.

6.16.3 MONITORING OVERVIEW

Fish monitoring under the CEMP is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to remediation following the TSF embankment breach.

As previously indicated, fish monitoring includes fish tissue quality monitoring, sentinel fish population monitoring, fish habitat characterization and fish usage monitoring, and fish community monitoring. An overview of the proposed fish monitoring program is provided in Table 8 and Figures 5 and 6 of Appendix B.4. Table 9 in Appendix B.4 summarizes the fish tissue analytes and laboratory reporting limits for the fish monitoring program.

6.16.4 High-Level Monitoring Design Description

Appendix B.4 provides a summary of fish monitoring history previously conducted in the vicinity of the mine in the surrounding creeks, including baseline monitoring, and pre- and post-breach monitoring. The sample collection methods and monitoring are also summarized in Appendix B.4 for tissue sampling, sentinel fish population monitoring, fish community monitoring, and fish habitat characterization and usage monitoring.

In addition to the monitoring outlined in Appendix B.4, visual spawning surveys of upper Hazeltine Creek to evaluate the success of re-introduction of spawning access by Polley Lake rainbow trout, and at the mouth of Hazeltine/Edney Creek to confirm access to that stream reach following a monitoring program developed in conjunction with the Habitat Remediation Working Group (HRWG). The surveys consisted of two field staff walking the bank of the creek channel and documenting visual observations of species, life stage, and behaviour of fish in the creek, and in lower Hazeltine/Edney, the presence of redds was noted. In upper Hazeltine Creek 25 surveys were conducted through the 2018 ice-free period and in the Hazeltine/Edney Creek mouth, 12 surveys were conducted. Spawning surveys were conducted in Hazeltine/Edney again in 2019.

6.16.5 Data Quality Control, Objectives, and Review

Appendix B.4 summarizes the QAQC program for the fish monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. For fish tissue samples, comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <25% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Specific QC samples will include laboratory blanks, laboratory replicates, and laboratory accuracy samples (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). The QC sample results will be assessed as part of the data quality review. See Appendix B.4 for more details.

6.16.6 Laboratory Analysis

All chemical analyses will be completed by a laboratory that is accredited by CALA, and will be required to include specific QC samples and report associated results.

6.16.7 Data Analysis and Reporting

Catch-per-unit-effort and summary statistics for meristic measurements taken in the field will be calculated. Although community and population data is collected during every phase or component of the fish monitoring program, the sample size will be defined by the study objectives and may be insufficient to address corollary questions. For example, the sample size required for tissue quality analyses (n = 8) is not large enough to support formal contrasts of population endpoints. To this end, evaluation of fish community data will rely on qualitative comparisons, and conclusions regarding fish populations will be supported by non-lethal measurements and sampling under the MDMER EEM (with larger sample size), as described in Appendix B.4. Analysis methods for the MDMER EEM fish population data, as described in Appendix B.4 will be "consistent with EEM technical guidance (Environment Canada 2012). Summary statistics, including mean, median, minimum, maximum, standard deviation, standard error, and sample

size, will be calculated for fish age, fork length, total length, body weight, condition, liver weight, gonad weight, and fecundity; calculations will be completed according to species and area. All data sets will be assessed for normality and equality of variance in order to determine the suitability of parametric statistical procedures. An effect on the fish population will be evaluated for each of these measures and is defined as a statistically significant difference between the effluent-exposed area and the reference area (Environment Canada 2012). For each endpoint, statistically significant differences between effluent-exposed and reference areas (by species and sex) will be assessed using ANOVA, Analysis of Covariance (ANCOVA), or non-parametric equivalents, as appropriate, following technical guidance (Environment Canada 2012).

"For the fish tissue data sets, statistical comparisons of age, length, weight, and concentrations of metals in fish tissues (n = 8) will be completed among years and locations. The sample size, mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile will be calculated for each analyte. Means will be calculated using the Kaplan-Meier (K-M) method. The standard deviation and the median for each analyte will also be calculated using the K-M method. When a standard deviation cannot be estimated (i.e., when an analyte has a high proportion of censored values), it will be reported as "not calculated".

"Results of the fish habitat characterizations for Upper Hazeltine, Lower Hazeltine, and Lower Edney creeks will be summarized, along with fish usage results, according to season (spring, summer, and fall) and year. Fish habitat characterization measures will be summarized by season, reach, and area (rehabilitated and reference), with summary statistics (mean and standard deviation) calculated for all numerical parameters."

More detail for each monitoring component is provided in Section 4.5 of Appendix B.4.

An interpretive report based on the fish monitoring data was prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the data quality review, the results of the screening against BCWQGs, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

With respect to the spawning surveys, rainbow trout were observed spawning in upper Hazeltine Creek, confirming that the fish were successfully re-introduced to the reconstructed channel. A majority of spawning activity occurring from May 10 to 25, 2018, when 488 rainbow trout redds were counted, and emergence of young-of-year trout began in late June (Minnow 2019). In 2018, rainbow trout, longnose sucker and redside shiner were observed lower Hazeltine/Edney (Minnow 2019) and in fall 2019, sockeye salmon were observed using the reconstructed habitat (data will be reported in 2020).

6.17 WILDLIFE MONITORING

Wildlife monitoring described below includes observational monitoring and monitoring using wildlife cameras. A study design for wildlife monitoring in the Hazeltine Creek corridor will be provided in 2020. This subsection will be updated accordingly.

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.17.1 Section Authors and Study Design Professionals

This section was written by MPMC (wildlife observations) and Golder (tissue collection and food chain model – related to follow up tasks for the ERA).

6.17.2 Monitoring Objectives

The current objective of the wildlife monitoring is to document the presence of mammals and birds using or migrating through the mine site and adjacent areas. This information is used for land use planning and to monitor the potential for effects of mine-related activities on animals in the area.

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017).

6.17.3 Monitoring Overview

Operational Monitoring - Wildlife occurrences will be recorded throughout the year by MPMC Environmental Department staff, and by other MPMC employees and contractors, when possible. Observations will include wildlife sightings and evidence of wildlife, such as tracks and droppings. Documentation will include the date, initials of the observer, location of the observation, wildlife observed, and comments (such as size of group, sex, or activity of an animal).

Data files from wildlife cameras installed in three locations (Hazeltine Creek, Mine Site, Reference site) are downloaded and reviewed monthly. Any changes to the location of the cameras are documented. Details including frequency of use by wildlife near each camera and variety of wildlife are documented. These details will be included in the AERR.

Supplemental Tasks - A tiered approach was been recommended, as outlined in Appendix B.5. Only Tasks 1A, 2A, 2B and 3 will be undertaken as part of the current CEMP. If risks are found to be unacceptable at the end of Step 2, further investigation following the proposed tiered approach described in Appendix B.5 will be conducted, which may include a development of a study design.

6.17.4 High-Level Monitoring Design Description

Table 6.33 is a summary of previous wildlife monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.33 Summary of wildlife monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	General wildlife observations (animals, scat, and tracks) documented.	N/A	N/A
Summary of findings	734 observations of wildlife were documented in 2017.	N/A	N/A
Recommendations for 2018-2020 monitoring	General wildlife observations will continue to be made per Permit requirements. A study design for wildlife monitoring in the Hazeltine Creek corridor will be provided in 2020.	Reconnaissance-level field surveys to support updated food chain modelling for potential bioaccumulation in wildlife.	N/A

Notes: N/A: not applicable

6.17.4.1 Operational Monitoring

This section will be updated when a study design is submitted in 2020.

6.17.4.2 Post-Breach Monitoring

In 2018, a reconnaissance-level survey was undertaken to support an update of the food chain model first presented in the ERA. Soil sampling is presented in Section 6.19, soil invertebrate sampling in Section 6.20, and vegetation monitoring in Section 6.21. An additional component considered in the food chain model was flying insects.

Samples of flying invertebrates (bees/wasps [order Hymenoptera], moths [order Lepidoptera], and crickets/grasshoppers [order Orthoptera]) were collected from the impacted area and background areas. Information about the tissue chemistry of this important food item for insectivorous birds and bats was not previously available in Golder (2017). The samples were collected through a combination of manual foraging and trapping. Manual foraging generally involved surveying flowering plants for bees or the ground surface for grasshoppers and using a sweep net to capture target invertebrates. Moths were predominantly collected using black light traps. Terrestrial invertebrate trapping was conducted using methods adapted from the RISC guidelines for terrestrial arthropod inventory (RIC 1998), guidance from the Biological Survey of Canada (Marshall et al. 1994; Danks 1996) and the US Department of Agriculture (Schauff 1998). Terrestrial invertebrate trapping methods employed on the Site included malaise traps, black light traps, pan/window traps and Berlese funnels.

Irrespective of the specific capture method, the following steps consistent with the *BC Field Sampling Manual* (BC ENV 2013) were followed to process the flying invertebrate samples:

- Samples were collected using nitrile gloves and transferred to clean Ziploc bags.
- Flying invertebrates of the same order from a single sample location (limited to 25 meters squared [m2]) were composited.
- Flying invertebrates were left in sample containers stored at ambient temperature overnight to allow samples to depurate.
- Flying invertebrate samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were transferred to a freezer to kill the invertebrates.
- Samples were kept frozen until they were submitted to the laboratory for analysis.

The invertebrate tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.7.

6.17.5 Data Quality Control, Objectives, and Review

Wildlife observations data will undergo a QC screening prior to upload to the network.

Twelve duplicate flying invertebrate samples were collected and laboratory QC samples consisted of duplicates, method and equipment blanks, and certified reference materials. RPDs exceeded DQOs for most metals in at least one duplicate sample. A higher variability in flying invertebrate samples is expected because the field duplicates are not splits of a composite—they are two composites of different individual organisms. In terms of copper, RPDs of 58 and 86% were noted in two of twelve duplicate pairs for wet weight concentrations and in one of twelve (RPD = 50%) of dry weight concentrations For vanadium, RPDs of 65 to 126% were noted in three of twelve duplicate sample pairs for wet weight concentrations and in zero of twelve duplicate sample pairs for dry weight. The data were considered reliable and suitable for there intended purpose

6.17.6 Laboratory Analysis

Laboratory analyses of the invertebrate tissue samples were undertaken by a CALA-accredited laboratory.

6.17.7 Data Analysis and Reporting

Number of wildlife observations will be tabulated and reported in the AERR.

The flying insect chemistry data (Golder 2019a) and updated food chain model (Golder 2019b) were submitted to ENV as an attachment to the 2018 Annual Report.

The wildlife food chain model presented in the ERA (Golder 2017) provided screening-level risk estimates for receptors exposed to copper and vanadium (the only contaminants of concern identified in the ERA),

which were based on calculated area-weighted hazard quotients (HQs) of <1 to 2.8, and a maximum HQ of 5.1 (for masked shrew in the Polley Flats area). Although the HQs were considered not to represent an unacceptable risk to wildlife, the food chain model was refined in 2018 by:

- Adding bats (*Myotis* sp.) as a receptor.
- Improving the quality of information with respect to tissue concentrations in invertebrates and plants by expanding the existing bioaccumulation sampling (as part of the reconnaissance-level survey conducted in 2018).
- Replacing the conservative assumption that flying insects have the same tissue concentrations as soil-dwelling insects by collecting site-specific data (as part of the reconnaissance-level survey conducted in 2018).
- Refining the toxicity reference values (i.e., the denominator in the HQ) to consider more than a highly conservative threshold

Revised screening-level risk estimates resulted in lower HQs. Screening-level HQs were <1 for all receptors except robin, shrew, and bat exposed to copper. The aggregate area-weighted HQs for those three receptors ranged from 1.0 to 1.7, and the maximum observed HQ for a sub-area was 2.1 for robin in the Polley Flats area. When a refined TRV was used to provide an additional level of protection to listed species, no HQs greater than 1 were identified and therefore, risks to wildlife associated with copper and vanadium in soils at the site are considered to be acceptable.

6.18 Amphibian and Reptile Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.18.1 Section Authors and Study Design Professionals

This section was written by Golder. The detailed study design concept is provided in Appendix B.6. Note that Appendix B.6 is a study design concept; a study design may be submitted at a later date depending on results of a preliminary review (Steps 1 and 2 as outlined in Figure 1 in Appendix B.6).

6.18.2 Monitoring Objectives

The study design concept in Appendix B.6 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.6, the objectives of amphibian monitoring will be to "continue the risk assessment process by proceeding through tiers to the point needed to support an informed risk management decision". More detail is provided in Appendix B.6.

6.18.3 Monitoring Overview

A tiered approach has been recommended, as outlined in Appendix B.6. Only Steps 1 and 2 will be completed as part of the current CEMP, with Step 1 undertaken in 2018. If risks are found to be unacceptable

at the end of Step 2, further investigation following the proposed tiered approach described in Appendix B.6 will be conducted, which may include a development of a study design.

6.18.4 High-Level Monitoring Design Description

In 2018, Step 1 of the study design concept was undertaken, specifically, a hazard evaluation. Existing soil, sediment and surface water chemistry data were screened for different habitat units against a conservative amphibian-specific screening value, as follows:

1. Review of existing guidelines: the purpose of the review was to determine if existing guidelines, criteria or standards contained sufficient amphibian-specific data to allow their use as a screening value for this assessment.
2. Derivation of screening values: the existing guidelines were determined to be unsuitable for the amphibian hazard assessment, and therefore screening values were developed through the review of scientific literature. Toxicity testing data were compiled, an uncertainty analysis was conducted on the compiled data, and safety factors were applied as applicable to mitigated identified uncertainties.
3. Application of derived screening values to site data: site monitoring data for water, sediment and soils were compared to the screening values for water and hydric soils/sediment.

6.18.5 Data Quality Control, Objectives, and Review

The study was a desktop review of guideline derivation documents and scientific literature.

6.18.6 Laboratory Analysis

No laboratory analysis were undertaken as part of the amphibian hazard assessment.

6.18.7 Data Analysis and Reporting

The amphibian hazard assessment (Golder 2019c) was submitted to ENV as an attachment to the 2018 Environmental and Reclamation Report (the "2018 Annual Report"), prepared in fulfillment of *Mines Act* permit M-200, and *Environmental Management Act* permit 11678. In summary, a toxicity reference value of 0.018 mg/L dissolved copper was derived for evaluating hazards associated with surface water, and 800 mg/kg copper for evaluating hazards associated with hydric soils or sediment. The available surface water and soil data for the Mount Polley site were compared to these conservative screening values, and overall, there was no evidence that environmental concentrations were routinely or notably higher than those screening value on a site-wide basis. Hazards to amphibians as a result of exposure to soil or surface water are considered to be low under these circumstances.

6.19 Soil Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description;

data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.19.1 Section Authors and Study Design Professionals

This section was written by Golder, and the detailed study design concept is provided in Appendix B.5.

6.19.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objective of soil monitoring will be to "refine site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate and plant tissues". More detail is provided in Appendix B.5.

6.19.3 Monitoring Overview

Monitoring of soil stockpiles on the mine site for reclamation and closure is outlined in the Soil Management Plan included in the RCP. It is covered under BC *Mines Act* Permit M-200.

In 2018, Task 1A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.19.4 High-Level Monitoring Design Description

Operational Sampling - Monitoring of soil stockpiles on the mine site for reclamation and closure is outlined in the Soil Management Plan included in the RCP. It is covered under BC *Mines Act* Permit M-200.

Supplemental Sampling - Soil samples were collected from 69 locations (co-located with tissue samples – described in Sections 6.20 and 6.21) to refine the exposure estimate for post-breach rehabilitated areas. The soil chemistry data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

Each sample was a composite of three aliquots of soil collected from within a 5 m radius of the tissue sample. The aliquots were collected from the top 20 cm of soil using a hand shovel, and then homogenized in a stainless-steel bowl prior to transfer to clean, laboratory-supplied 125-mL, glass sample jars with Teflon™ lined lids. Samples were kept on ice in a cooler after collection and kept cool until submitted to ALS for analysis of metals and pH.

6.19.5 Data Quality Control, Objectives, and Review

Supplemental soil sampling was undertaken using methods consistent with those used for the HHRA and ERA. Eight field duplicates were collected and laboratory QC consisted of duplicates, method blanks and matrix spike recovery. Copper and vanadium (the metals of interest for the food chain model) met the field DQOs. The soil sample results met the laboratory DQOs for precision, accuracy, method blanks, duplicate sample analysis and matrix spike recovery, with the exception of a method blank that had a detected

concentration of copper. This could be a potential bias in samples that are near the limit of reporting but was not an issue in the current samples because all copper results were substantially higher than detection limits. Overall, the data were considered representative and suitable for their intended use.

6.19.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.19.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. Data from the 2018 soil sampling were integrated with the relevant historical data to update the soil concentrations used in the food chain model. All samples were compared to the applicable CSR standards, and an overview of those findings is provided below for each of the different rehabilitated areas that were sampled in Tables 1 through 3. Overall, the results of the soil chemistry were consistent with results from previous sampling in those areas and no new contaminants of concern were identified. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.20 Soil Invertebrate Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.20.1 Section Authors and Study Design Professionals

This section was written by Golder, and the detailed study design concept is provided in Appendix B.5.

6.20.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objectives of soil invertebrate monitoring will be to:

- "Focus on establishing a long-term trend analysis of soil invertebrate community rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions";
- "Refine site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate tissues"; and,
- "Improve the quality of data with respect to tissue concentrations in invertebrates, particularly for flying insects."

6.20.3 Monitoring Overview

In 2018, Task 2A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.20.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Additional sampling was conducted to improve the spatial coverage of soil invertebrate samples, and to obtain sufficient samples of each main invertebrate type from the range of soil concentrations present at the site. Invertebrate (i.e., ants, beetles, spiders and worm) samples were collected through a combination of manual foraging and trapping. Manual foraging involved surveying the ground surface and searching below woody debris. Sampling was conducted if sufficient volume of soil invertebrates were noted or if a larger soil invertebrate (e.g., a large beetle) was found.

Terrestrial invertebrate trapping was conducted using methods adapted from the RISC guidelines for terrestrial arthropod inventory (RIC 1998), guidance from the Biological Survey of Canada (Marshall et al. 1994; Danks 1996) and the US Department of Agriculture (Schauff 1998). These documents guided the selection of the trapping method, locations of samples, sampling design and trapping protocols. Terrestrial invertebrate trapping methods employed on the Site included pitfall traps and Berlese funnels. Irrespective of the specific capture method, the following steps consistent with the *BC Field Sampling Manual* (BC ENV 2013) were followed to process the soil invertebrate samples:

- Samples were collected using nitrile gloves and transferred to either clean, laboratory supplied glass jars or clean Ziploc bags.
- Invertebrates of the same order from a single sample location (limited to 25 m^2) were composited.
- Soil invertebrates were left in partially open sample containers stored at ambient temperature overnight to allow samples to depurate.
- Invertebrate samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were transferred to a freezer to kill the invertebrates.
- Samples were kept frozen until they were submitted to the laboratory for analysis.

The soil invertebrate tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

6.20.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Soil invertebrate sampling were undertaken using methods consistent with those used for the HHRA and ERA. Eight field duplicates were collected and laboratory QC consisted of duplicates, method blanks and certified reference materials. RPDs were greater than 50% for most metals in at least one duplicate sample. A higher variability in soil invertebrate samples is expected because the field duplicates are not splits of a composite—they are two composites of different individual organisms. In terms of copper, an RPD of 65% was noted for the wet weight concentration in one duplicate pair, but the dry weight data had an acceptable RPD (48%). There was less variability in copper results than most other metals, and Golder concludes that the data are reliable and suitable for its intended purpose. RPDs of 55 to 106% were noted in four of eight duplicate sample pairs for wet weight concentrations and in two of eight duplicate sample pairs for dry

weight with respect to vanadium. However, this variability does not impact the overall conclusion that vanadium bioaccumulation is limited, nor does it change the conclusion that vanadium risks to wildlife from consumption of dietary items was low. The tissue samples met the laboratory DQOs with respect to copper and vanadium (the parameters of interest for the food chain model).

6.20.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.20.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.21 Vegetation Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.21.1 Section Authors and Study Design Professionals

This section was written by MPMC, and is a summary of the study design concept provided by Golder. The detailed study design concept is provided in Appendix B.5. Note that Appendix B.5 is a study design concept; a study design will be submitted in Q1 2019 after completion of tasks outlined in Figure 2 in Appendix B.5.

6.21.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objectives of vegetation monitoring will be to:

- "Focus on establishing a long-term trend analysis of plant community rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions"; and,
- "Refine site-specific relationships between copper concentrations in soil and copper concentrations in various plant tissues."

More detail is provided in Appendix B.5.

6.21.3 Monitoring Overview

In 2018, Task 2A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.21.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Samples of the edible portions of plants (were collected following the same approach used in 2015 and 2016. The focus of plant sampling was on rehabilitated areas to increase sample density in these areas and to provide more information about plants growing in soils that have lower copper concentrations than the non-reclaimed areas. The following plant tissue samples were collected in 2018:

- Berry—Berry samples were collected from raspberry [*Rubus occidentalis]*, high bush cranberry [*Viburnum trilobum*], and thimbleberry [*Rubus parviflorus*]) plants that were rooted in soil.
- Leaf—Willow (*Salix* sp.) and alder (*Alnus crispa*) leaf samples were collected from shrubs planted in the impacted area. Only shrubs planted in the floodplain before spring 2016 were sampled. Plants sampled included willow planted in lower Hazeltine Channel in early 2015, above the canyon in late 2015, and in upper Hazeltine Channel late 2015 (near Gavin Lake Bridge).
- Grass— Slender wheatgrass *(Elymus trachycaulus*) samples were collected from a variety of areas. The objective of the sampling was to reduce the uncertainty in the existing soil-to-grass bioaccumulation relationship, and therefore, sampling was limited to a single species which was commonly found across the entire site. Only the edible, above-ground portion of grass was collected.

Sampling methods were consistent with the *BC Field Sampling Manual* (MoE 2013) and consisted of the following steps:

- Plant tissue was hand-picked by field staff using nitrile gloves from an area of 25 m^2 or less. Plant tissue was composited from multiple plants within the area if sufficient volume could not be collected from one plant.
- Plant samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were placed in a cooler containing ice until they could be transferred to a freezer for storage prior to shipping to the laboratory for analysis.

The plant tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

6.21.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Vegetation sampling was undertaken using methods consistent with those used for the HHRA and ERA. Five replicate plant samples were collected and laboratory QC consisted of duplicates, method blanks and certified reference materials. Data quality objectives were met for copper and vanadium (the parameters of interest for the food chain model) in vegetation samples for both field and laboratory QC samples.

6.21.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.21.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.22 Biosolids Monitoring

MPMC is in possession of an EMA permit (15968) for the use of biosolids. This permit requires that MPMC retain the services of a qualified professional to develop a monitoring plan for the biosolids application program. MPMC will submit this plan to ENV and EMPR prior to receiving any additional shipments of biosolids to the mine site.

7 CEMP UPDATES AND REVISIONS

When possible, MPMC will provide written notice of planned changes to the CEMP to the ENV Director a minimum of 30 days prior to implementation to allow for review and feedback on the revision. Proposed changes will be shared with First Nations and stakeholders, as per MPMC's Communication Plan (MPMC 2016d). Additionally, changes that occur but are unplanned, such as the collection of additional samples, will be discussed with the ENV Director as soon as possible after the sampling occurs. When changes are made to the monitoring, this amended plan (or relevant replacement pages) will be resubmitted to the Director.

Given the dynamic nature of environmental investigation, rehabilitation, and water management plan development at Mount Polley Mine, it is anticipated that the CEMP will evolve in alignment with site activities and findings, as described in Section 2.3, and will be updated as required. It is anticipated that larger CEMP revisions in response to these activities and findings will be made with consideration of maintaining continuity in spatial and temporal coverage to meet the global objectives of the CEMP, as described in Section 1.1.

As required by the Permit, following the three-year detailed monitoring program interpretive report to the Director, MPMC will submit a summary of proposed changes to the CEMP to the Director by April 30 of that year (one month following the interpretive report deadline). In order to incorporate recommended changes in a timely fashion, MPMC would appreciate feedback on the proposed changes from the ENV by May 31 of that year.

8 RECLAMATION AND REMEDIATION

Rehabilitation of the aquatic and terrestrial receiving environments that were impacted by the TSF embankment breach and associated remediation activities is continuing as outlined in the Rehabilitation Strategy (November 2015 update; MPMC 2015f), as required by the PAO 107461. Under this broader Rehabilitation Strategy:

- Terrestrial rehabilitation works are being conducted as per the *Planning Concepts for Rehabilitation of Terrestrial Ecosystems at Mount Polley* technical memorandum prepared by Golder (2015e). The reclamation and monitoring steps described in this memorandum are based on the TSF embankment breach environmental impact assessment results to date.
- Rehabilitation of aquatic systems is being conducted under guidance of the Habitat Remediation Working Group, which includes representatives of DFO, ENV, the BC Ministry of Forest, Lands and Natural Resource Operations, the SCIB, and the WLIB. This group provides recommendations and feedback on aquatic ecosystem rehabilitation plans developed by MPMC's consultants.

Monitoring associated with the Hazeltine Creek channel rehabilitation construction activity is undertaken under the *Post-Breach Rehabilitation Work Environmental Management Plan* (Golder 2015f), which pertains to monitoring of any construction works and associated construction specifications. While the lower reaches of Hazeltine Creek remain non-fish bearing (with the exception of the lower sedimentation pond), the *MPMC Fish Exclusion and Response Plan* (MPMC 2015f) is in effect. MPMC will conduct monthly visual inspections for fish in the non-fish bearing areas of the creek when the creek is free of snow and ice (in case any fish have evaded the barriers), as well as weekly inspections of fish exclusion structures. The plan outlines response actions in the event that fish are observed.

As Hazeltine Creek is rehabilitated and returned to fish-bearing status, this environmental management plan will be phased out and be replaced by routine monitoring for evaluating performance of the works as a component of the CEMP.

The Habitat Remediation Working Group made up of provincial and federal regulators, qualified professionals and First Nations representatives, agreed upon a monitoring plan for the return of rainbow trout in Hazeltine Creek in 2018. This plan includes week fish surveys, detailed habitat usage surveys, benthic, sediment, water (quality and quantity), and fish tissue sampling. Reporting on these results will be included in the AERR.

The steps in the aforementioned terrestrial rehabilitation plan include establishment of permanent monitoring plots for ongoing assessment, feedback (to inform adaptive management) and demonstration. As terrestrial rehabilitation works progress, monitoring to this end will be implemented.

A Conceptual Remediation Plan (CRP) was submitted to ENV on January 31, 2018 (Golder 2018) and following receipt of comments on the CRP, a Remediation Plan submitted on March 29, 2019 (Golder 2019d). The Remediation Plan identifies remedial options for the sites impacted by the TSF breach, including creek habitats, lake habitats, and terrestrial habitats, as well as proposed monitoring components to verify the success of the planned remediation. The Remediation Plan was approved by ENV on July 3, 2019.

9 REPORTING

9.1 MONTHLY REPORTING

As required by Section 3.9 in the Permit (April 7, 2017) a monthly report will be submitted to the Director in each month that discharge occurs. The report will summarize the volume of treated effluent discharged, a summary of continuous turbidity readings of the treated effluent discharged, and the most recently available water quality results for the effluent discharged, including a summary of acute and/or chronic toxicity testing results.

9.2 QUARTERLY REPORTING

All data and information collected under the CEMP will be provided to the Director, in electronic format, on a quarterly basis or as required by the Permit.

Under the most recent version of PAO 107461 (June 9, 2017) Section 6.0, a quarterly report detailing the implementation status of requirements of the order, a summary of communications with stakeholders and public relating to the breach, and any remediation activities undertaken in Hazeltine Creek, Polley Lake and Quesnel Lake for the previous and upcoming three months must be submitted to the director.

9.3 ANNUAL REPORTING

As required by the Permit Section 3.9, MPMC will continue to submit an AERR on or before March 31 of each year. This report is combined with the Annual Reclamation Report prepared for the EMPR, with the combined document submitted to both agencies. These reports will include the details required by the permit, as well as an analysis of the linkages between program components, where appropriate. MPMC will refer to *Technical Guidance 4, Environmental Monitoring under the Environmental Management Act* such that the ENV's expectations for reporting are achieved.

The AERR will continue to be in a format suitable for public release and will be deposited at the Cariboo Regional District Library as well as submitted to the SCIB and WLIB within 30 days of being submitted to the ENV.

As required by the Permit (April 7, 2017) Section 2.5, MPMC will continue to submit an annual Environmental Emergency Response Plan and will include updated procedures and notification protocols. MPMC will also continue to submit an Annual Discharge Plan on or before April 15 of each year and include the details required by the Permit Section 2.7.

9.4 THREE-YEAR REPORTS

Under the Permit, a detailed monitoring program interpretive report is required every three years with the first report due on March 31, 2019 and every three years thereafter. The March 2019 interpretive report will include data collected in 2016, 2017, and 2018. This report will be completed by one or more qualified professionals and will be more comprehensive than the synoptic review of data presented in the annual reports. It will include recommendations for changes to the CEMP.

In addition, a groundwater monitoring program review including, but not limited to, sampling, well locations, site water balance, interpretation of data trends, and suitable recommendations is required every three years, with the first presented in March 2016. The next report will be submitted on March 31, 2019. Monitoring data and the analysis of those data presented in the report will be reviewed by a third party qualified professional.

10 FUTURE OUTLOOK

This CEMP represents a unique and specialized variation of a typical mine environmental monitoring plan. This plan seeks to integrate all environmental monitoring programs that are carried out on the Mount Polley mine site and in the local area related to:

(a) Ongoing mine operations (including EMA and *Mines Acts* permit requirements and MDMER requirements of the *Fisheries Act*);
(b) TSF embankment breach-related impacts and remediation; and,
(c) Reclamation and closure planning (*Mines Act* permit requirement).

The overall goals of this CEMP are to provide science-based evidence: for evaluation of environmental impacts of mine operations; for evaluation of the effects of any ongoing impacts of, and remediation measures undertaken in response to, the TSF embankment breach; and to inform ongoing reclamation and closure planning. These goals are guided by an intent to return the impacted areas of the mine site and its surroundings to viable and diverse ecosystems that reflect pre-breach land uses, or those identified by Communities of Interest as representing values of importance. These values of importance are identified through ongoing consultation with local Communities of Interest.

Mount Polley fosters a culture of research and innovation. In addition to the extensive monitoring and research work that was undertaken as part of the impact and risk assessments of the TSF embankment breach, there are a number of research projects underway (and several recently completed) that the mine has supported. The results of these projects may contribute directly to improving the mine's understanding of breach impacts (Cuervo et al, 2017; Garris et al, 2018; Byrne et al, 2018), new approaches to remediation, reclamation and closure (McMahen, PhD in progress, UBC; Litke MASc in progress, UBC), and to mitigating environmental impacts of ongoing operations.

With respect to mitigating environmental impacts of ongoing operations and planning for reclamation and closure, Mount Polley is embarking on passive water treatment research and pilot projects to test the suitability of constructed wetland water treatment systems for dispersed water treatment and discharge on the mine site. These research projects will include lab and site testing, monitoring of water quality, vegetation, and microbial communities, and will be reported annually in the AERR or in a technical memo.

As the results of monitoring programs and environmental research projects are generated, analyzed, and interpreted, this CEMP will be reviewed and updated where warranted. MPMC will aim to review the requirements of the CEMP on a quarterly basis and will submit a list of proposed changes based on the review to the Director within 45 days from the end of the quarter.

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Appendix A

CEMP Terms of Reference – 4 July 2017

Mount Polley Mining Corporation

Mount Polley Mining Corporation
an Imperial Metals company

Terms of Reference

Comprehensive Environmental Monitoring Plan – 4 July 2017

1 BACKGROUND AND CONTEXT

Mount Polley Mining Corporation (MPMC) is the owner and operator of the Mount Polley Mine, a property comprising, among other things, a copper-gold mine and mill complex located near Likely, British Columbia (BC).

MPMC is authorized by the BC Ministry of Environment (MoE) to discharge effluent to the land and to surface water from the Mount Polley Mine, subject to the terms and conditions of *Environmental Management Act* (*EMA*) Permit 11678. *EMA* Permit 11678 was originally issued to MPMC by the MoE on 30 May 1997, and has been the subject of numerous amendments since.

As is typical of owners of mines in BC, MPMC undertakes extensive environmental monitoring for a variety of purposes and objectives. In many instances, data collected as part of one monitoring program are beneficial to other programs, even though programs may have been established specifically for unique purposes.

Under Section 3.2 of *EMA* Permit 11678, MPMC is required to implement a Comprehensive Environmental Monitoring Plan (CEMP). In previous versions of *EMA* Permit 11678, MPMC was required to implement a number of individually defined monitoring plans for various aspects of Mount Polley Mine operations to which this MoE authorization was subject. As stated in Section 3.2 of *EMA* Permit 11678, the CEMP is intended to consolidate and integrate all such pre-existing monitoring programs.

2 OBJECTIVES AND DRIVERS

As described in Section 3.2 of *EMA* Permit 11678, the objective of the CEMP is to evaluate the effects of mining-related activities on the physical, chemical and biological characteristics of Hazeltine Creek, Edney Creek, Bootjack Lake, Morehead Creek, Polley Lake, Quesnel Lake, Quesnel River, and associated riparian and upland areas.

Environmental monitoring has the broad objective of verifying that environmental controls are in place that protect the environment and are sufficient to confirm compliance with applicable statutory requirements to which operations are subject. Environmental monitoring also has the broad objective of providing data to support evidence-based communication to parties who might be affected by the Mount Polley Mine.

For the Mount Polley Mine, the main drivers (which govern the objectives) are:

- Regulatory Drivers;
    - Federal (e.g., *Metal Mining Effluent Regulation* [MMER])
    - Provincial (e.g., *EMA, Mines Act*)
- MPMC Commitments:
    - The respective Participation Agreements (PAs) that MPMC have in place with the Soda Creek Indian Band (SCIB; Xatśūll First Nation) and the Williams Lake Indian Band (WLIB).

Subject to the requirements of the various drivers, the CEMP is intended to be an adaptive plan. This means that the CEMP is anticipated to change over time, as it is informed by findings obtained from preceding stages of work.

3 SCOPE AND CONTENT

The scope of the CEMP will be built around the Objectives and Drivers, will provide an appropriate level of scientific robustness, and will utilize provincially and federally acknowledged methodology. It is noted that failing to utilize methods common to the various objectives undermines the value of a comprehensive monitoring program. The scope of the CEMP will not include studies of general research (e.g., academic), nor will it include collection of regional data that are not directly linked to the Objectives and Drivers.

As per Section 3.2 of *EMA* Permit 11678, the scope of the CEMP must be such that it consolidates and integrates monitoring programs that are being conducted in the vicinity of the Mount Polley Mine site. At minimum, the CEMP must consider programs addressing surface water (quality and quantity), groundwater (characterization and interactions with surface water), sediments, soils, periphyton, phytoplankton, benthic invertebrates, zooplankton, fish, floodplain and upland vegetation, and wildlife.

As described in Section 3.2 of *EMA* Permit 11678, the CEMP must address, at minimum, a three-year time span, as well as, at minimum, include all sampling sites, frequency of sampling, variables to be analyzed, method detection limits, sampling methods, sample analysis methods, and data analysis methods.

As noted in the Background and Context of this Terms of Reference, environmental monitoring is a tool used by mining companies (and others) to inform them (and other parties), of the adequacy of their source control efforts. The content of the CEMP will be reflective of its use as such a monitoring tool. The CEMP will serve as the document that provides the context and linkages demonstrating how the monitoring program developed provides an appropriate mechanism by which to meet the Objectives and Drivers of the CEMP. In providing this purpose, the CEMP's content is anticipated to provide: a statement of its objectives; an overview of its subject (the Mount Polley Mine); a discussion of the various components that comprise environmental management in the context of the Mount Polley Mine; presentation of monitoring procedures and considerations (e.g., previous data) specific to each environmental monitoring component; and, an outline for control of the CEMP (e.g., updating and revising) and its reporting outputs.

A comprehensive monitoring plan requires a response framework as the monitoring program is the linkage between monitoring plan design, implementation, and effective use. The level and urgency

of response will have due regard to the level of potential risk to the environment (which includes people). The CEMP response framework will be updated in parallel with the CEMP, or as otherwise appropriate.

4 DEPENDENCIES AND ASSUMPTIONS

The CEMP is intended to support an interdependent program. The dependencies across the monitoring programs will be evaluated with the benefit of a conceptual site model (CSM). The CSM will aid in understanding and addressing the dependencies by allowing a visual representation of release and transport mechanisms (e.g., sources and water flow) and exposure by environmental receptors. The CEMP is predicated on the understanding that people (i.e., humans) are part of the environment. The CEMP response framework will have due regard to linkages and dependencies, and the CSM.

The CSM will be reviewed for dependencies in the context of:

- The Objectives and Drivers and Scope for the CEMP, as described in this Terms of Reference.
- The basal understanding of sources, pathways, contaminants of potential concern (COPC), and receptors.
- An analysis of the linkages between program components, in a tabular format.
    - Linkages will include a rationalization of methods used across program components to make the methodology as consistent as possible.
- Current and planned activities at the Mount Polley Mine site, especially how those activities might impact on the CSM.

The following assumptions guide the continued development and implementation of the CEMP required under Section 3.2 of *EMA* Permit 11678:

- The CEMP is developed, reviewed and revised by Qualified Professionals (QPs), QPs being as defined by the Province of BC (e.g., R.P.Bio.).
    - MPMC notes that there are certain aspects of CEMP scoping (particularly in defining the objectives and drivers), where a QP is not necessary. For example, the reasonable study questions from members of the public are outside of the domain of expertise for a QP who would develop a CEMP; however, the scientific approach by which those questions would be answered are within the QP's domain of expertise.
- The CEMP will be based on information that is available, verifiable and can be relied upon by a QP.
- With the exception of regulatory requirements, a pattern of decrease or stasis in environmental condition is a suitable basis for gradual decrease in monitoring locations, frequencies, or parameters.

5 REVISION

The Mount Polley Mine is an operating site, changes to which are anticipated to transpire as development and closure activities co-occur; thus, an adaptive approach is both necessary and appropriate for documents such as the CEMP. Review of the CEMP content is an integral aspect of its effectiveness. In this application, 'effectiveness' means that the CEMP delivers on the regulatory drivers, some of which have rigid statutory obligations (e.g., MMER), satisfies the Objectives and Drivers for the CEMP, and undertakes that work with due regard to financial impact (without limiting the ability to meet the Objectives and Drivers established) and the adaptive nature of the CEMP.

To fulfill the adaptive approach, the CEMP will be reviewed and revised considering data collected in previous years (as interpreted by QPs). Such data will include that collected and interpreted directly under the CEMP, or as may be available from other assessments, studies or reports commissioned by MPMC as relating to the Objectives and Drivers for the CEMP. In the case of the latter, the CEMP will be modified, as appropriate, in consideration of the results and recommendations of such assessments, studies or reports. Based on collected data (and subsequent interpretation by QPs), the CEMP will include rationale for existing monitoring as well as any changes to the monitoring plan. It is anticipated that larger CEMP revisions in response to these activities will be made with consideration of maintaining continuity in spatial and temporal coverage to meet the Objectives and Drivers of the CEMP.

When possible, MPMC will provide written notice of planned changes to the CEMP to the MoE Director a minimum of 30 days prior to implementation to allow for review and feedback on the revision. Such written notice shall describe the planned changes as well as the rationale for the changes, including a summary of relevant data considered.

Under Section 3.2 of *EMA* Permit 11678, MPMC must submit a three-year detailed monitoring program interpretive report and updated CEMP to the MoE Director, for approval, by 31 March 2019, and every three years thereafter. Following the three-year detailed monitoring program interpretive report to the Director, MPMC will submit a summary of proposed changes to the CEMP to the MoE Director by April 30 of that year (one month following the interpretive report deadline).

A key component of the CEMP will be the monitoring program itself. The monitoring program will be designed, reviewed and revised by QPs such that, in their professional opinion, it satisfies the Objectives of the Drivers for the CEMP and allows MPMC to be informed of the adequacy of their source control efforts. Changes to the monitoring program that occur but are unplanned, such as the collection of additional samples, will be formally submitted with the MoE Director as soon as possible after the sampling occurs. Such written notice shall describe the planned changes as well as the rationale for the changes.

Notification of any CEMP or CEMP monitoring program changes must be provided to the MoE Director in writing for approval.

Notwithstanding the above, as per Section 3.2 of *EMA* Permit 11678, the MoE Director may require revisions to the CEMP or monitoring program based on review of monitoring data and/or any other relevant information.

6 CONSTRAINTS AND PROJECT RISKS

In the context of the CEMP and the content of this Terms of Reference, the following constraints and project risks have been identified by MPMC:

- The Mount Polley Mine, and by it, MPMC as owner and operator of the mine, is constrained to comply with applicable laws and statutory requirements.
- The health and safety of persons engaged in the monitoring work is a paramount consideration. Samples that cannot be obtained safely, using practical methods, will not be obtained. Certain seasonal conditions may preclude safe sampling.
- MPMC has voluntarily entered into (respective) PAs with the SCIB and the WLIB. MPMC will honour the respective PAs in full, and expects the SCIB and WLIB to reciprocate. Certain aspects of the CEMP pertain to subjects that fall within the bounds of the PAs.

7 ROLES AND RESPONSIBILITIES

In the context of the CEMP and the content of this Terms of Reference, the following roles and responsibilities are established:

- The MPMC Environmental Superintendent (or designate) will be responsible for implementing the CEMP, and revising it as appropriate.
    - Deliverables will be prepared by, or under the direct supervision of, QPs.
- Monitoring that is part of the CEMP will be coordinated by MPMC.
- All parties' reviewers of technical elements of the CEMP are required to be QPs if they are providing recommendations on the content or implementation of its subject matter.
- Participants involved in the design and review of the CEMP acknowledge that study designs, monitoring methods, and interpretation will be carried out in accordance with federal and provincial laws, policy and guidance.

Appendix B

Detailed Study Designs for CEMP Components

Appendix B - Addendum

Subsequent to the Issuance of the August 2018 CEMP, the following changes were made to study programs described in Appendix B:

Study	Change
Appendix B.1: Diffusive Gradient in Thin Film (DGT) sampling and toxicity testing with *Hyalella azteca*.	Sampling was conducted in 2019 and laboratory results are pending. When received, the data will be reviewed and recommendations for additional sampling, if any, will be presented to ENV in 2020.
Appendix B.2: Replication of tissue samples at Edney Creek location E1	Eight replicates of periphyton and benthic invertebrate tissues for chemistry were collected from E1 in 2019. The results are pending from the analytical laboratory.
Appendix B.4: Monitoring frequency	Monitoring frequencies applicable from 2018 to 2019, will be reviewed following data interpretation and modifications may be made in response to QP recommendations, subject to approval by the Director.
Appendix B.4: Spawning surveys	Visual spawning surveys (counts of adults and redds) were conducted in Upper Hazeltine Creek (2018) and lower Hazeltine/Edney Creek (2018 and 2019) per a monitoring plan developed in conjunction with the Habitat Remediation Working Group.

Appendix B.1

Sediment Monitoring

Minnow Environmental Inc.

Sediment Quality Monitoring Plan

Prepared for:

Mount Polley Mining Corporation
Likely, British Columbia

Prepared by:

Minnow Environmental Inc.
Georgetown, Ontario

June 2018

minnow environmental inc.
A Trinity Consultants Company

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1 INTRODUCTION

1.1 Background

Sediment is an important sink and potential source of metals, metalloids, and nutrients[1] in aquatic environments (e.g., Horowitz 1991; Ingersoll et al. 1997; Simpson and Batley 2016). Sediment quality of receiving environments adjacent to mine sites can be influenced by the direct input of solids as well as by the introduction of dissolved constituents (e.g., metals) into water that subsequently associate with reactive materials on sediment surfaces (e.g., oxides, organic carbon) by surface complexation (Santschi et al. 1990; Stumm and Morgan 1996; Sposito 2004). Sediment also represents a pathway for the exposure of aquatic life to metals and other substances (e.g., nutrients, organic substances). Therefore, sediment quality is an important component of the CEMP.

The influence of the Mount Polley Mine on sediment quality can occur (or, at some locations, has occurred) by several key mechanisms: 1) general mine influence from physical impingement, dustfall, and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Sediment quality in waterbodies adjacent to the Mount Polley Mine has been monitored since baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996, 1997). Results of sediment quality monitoring are reviewed in Section 2 and provide context for a CEMP sediment quality monitoring program that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and temporal differences in addition to providing data to evaluate concentrations relative to effects-based guidelines (e.g., British Columbia Working Sediment Quality Guidelines [BCWSQG]; BCMOE 2017). In addition to sediment quality monitoring required as part of the Mount Polley CEMP, sediment quality monitoring is required to support benthic invertebrate community monitoring conducted as part of Environmental Effect Monitoring (EEM) under the Metal Mining Effluent Regulations (MDMER) of the federal *Fisheries Act*.

The following sections of the CEMP Sediment Quality Monitoring Plan provide the objectives of sediment quality monitoring, a summary of historical sediment quality findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication,

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication

frequency, and analytes), and detailed methodology for sediment quality monitoring (quality assurance/quality control [QA/QC], sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of sediment quality monitoring is to evaluate the influence of Mount Polley Mine activities on receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic life by applying a variety of interpretive tools (e.g., Working Sediment Quality Guidelines [BCMOE 2017], biological assessment). Sediment quality monitoring also provides supporting information for benthic invertebrate community monitoring, and to support exposure assessment as part of ecological risk assessment (ERA) and human health risk assessment (HHRA). An additional objective is to advance the technical understanding of the stability or mobility and the potential bioavailability of metals in lake sediments affected by the TSF embankment breach.

2 SUMMARY OF HISTORICAL FINDINGS

Sediment has been monitored in the vicinity of the Mount Polley Mine since 1989, with most of the sediment quality samples collected in Polley Lake, Bootjack Lake, Hazeltine Creek, and Edney Creek (Table 1). Hazeltine Creek and Edney Creek are primarily comprised of erosional habitat, with few locations of sediment deposition. This has made sediment sampling challenging relative to lake environments, and some unconventional methodologies were applied in baseline studies.

Sediment quality sampling in the vicinity of the Mount Polley Mine has spanned four distinct time periods:

1. Baseline monitoring (1989, 1995, 1996);
2. Pre-breach operational monitoring (1999, 2009, 2012);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge monitoring (2016).

Data collected prior to the breach were summarized in an Aquatic Environmental Description Report prepared concurrent with an application for water discharge to Polley Lake in 2014 (Minnow 2014), and general findings of the historical sampling, as well as sediment monitoring data collected from 2014 to present, are provided, by sampling area to support the design of the sediment quality monitoring plan.

2.1 Polley Lake

Baseline sediment quality of Polley Lake was characterized by concentrations of a number of metals that were naturally elevated above sediment quality guidelines, including arsenic, chromium, copper, iron, manganese, nickel, and selenium (Minnow 2014). Concentrations of copper, iron, and manganese were particularly elevated, with concentrations naturally exceeding upper sediment quality guidelines (also known as probable effect levels) in some samples (HKP 1996, 1997).

Sediment quality monitoring in Polley Lake during operations but before the TSF embankment breach in 2014 indicated that concentrations of most of the elevated analytes remained similar to baseline. One apparent exception was selenium, which increased from 1.7 – 2.6 mg/kg dry weight (dw) in baseline to 2.5 – 3.7 mg/kg dw in 2009, and 5.0 to 6.9 mg/kg dw in 2012 (Minnow 2014). This increase was considered to be due to uncontrolled surface runoff from a north waste rock dump which reported to Polley Lake via North Dump Creek. This runoff contained elevated concentrations of selenium from 2006 until control in 2009 with the construction of the Long Ditch.



Table 1: History of Sediment Quality Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
1989	Polley Lake, Bootjack Lake	Imperial Metals 1990
1995	Polley Lake, Bootjack Lake	HKP 1996
1996	Polley Lake, Bootjack Lake	HKP 1996
1999	Polley Lake, Bootjack Lake	Beak 2000
2009	Polley Lake	Minnow 2011
2012	Polley Lake	Minnow 2013a
2014	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2015a
2015	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2015b
2016	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2016

B) Creeks

Year	Locations	Report
1995	Upper Hazeltine, Lower Hazeltine, Edney	HKP 1996
1996	Upper Hazeltine, Lower Hazeltine, Edney	HKP 1997
1999	Upper Hazeltine, Lower Hazeltine, Edney	Beak 2000
2007	Upper Hazeltine, Lower Hazeltine	Minnow 2009
2009	Upper Hazeltine	Minnow 2011
2010	Upper Hazeltine, Lower Hazeltine	Minnow 2011
2011	Edney	Minnow 2012
2012	Upper Hazeltine, Lower Hazeltine, Edney	Minnow 2013a
2013	Upper Hazeltine	Minnow 2013b
2014	Upper Hazeltine, Lower Hazeltine	Minnow 2015a
2015	Sedimentation Pond	Minnow 2015b
2016	Sedimentation Pond	Minnow 2016

Following the TSF embankment breach, sediment quality monitoring in Polley Lake indicated that concentrations of arsenic, copper, and iron were elevated at one or more monitoring locations relative to guidelines and baseline concentrations (Minnow 2015a). Changes in sediment quality were greatest for copper, with concentrations increasing from a baseline range of 262 – 370 mg/kg dw to 630 – 722 mg/kg dw in September 2014 (Minnow 2015a). Due to very low organic content of the breach-derived materials, sediment organic carbon content was also lower following the breach (Minnow 2015a). Sediment quality monitoring completed in 2015 and 2016 indicated very similar sediment quality from 2014 to 2016 (Minnow 2015b; 2016a; Figures 1 and 2). Evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Polley Lake (average 0.66 mm/yr; 15 years for the accumulation of 1 cm of sediment; Minnow 2018). Sediment toxicity testing completed in 2014 and in 2016 indicated no effects to survival or growth of *Chironomus dilutus* and *Hyalella azteca* in standard tests completed on sediments from the Polley Lake basins (the deepest locations of the lake, known as P1 and P2), but a moderate reduction in growth of *H. azteca* at mid-depth areas (Minnow 2015a; Minnow 2017a). The benthic invertebrate community of the two deep basins in Polley Lake showed consistent recovery from 2014 to 2016 to a condition similar to the reference area in terms of density and richness in 2016 (Minnow 2017b). Lastly, a variety of sediment quality investigations conducted to characterize the potential mobility and bioavailability of sediment-associated metals (humidity cell tests, shake flask tests, selective extractions, ratios of simultaneously extracted metals to acid volatile sulphides [SEM/AVS], porewater chemistry, and Diffusive Gradients in Thin Films [DGT] devices) have all supported low mobility and bioavailability of sediment-associated metals (e.g., SRK 2015a,b; Minnow 2015a, 2016c, 2016d, 2017c, 2017d)

2.2 Hazeltine Creek

Baseline sediment quality of Hazeltine Creek was characterized in 1995 and 1996 (HKP 1996, 1997), but the latter included suspected errors (i.e., sampling in 1996 yielded unusually high concentrations of some metals [e.g., up to 2.2% copper] that were not observed in 1995 and have not been observed since). Based on the sampling conducted in 1995 (HKP 1996) and consistency with sampling conducted in 1999 (Beak 2000), concentrations of arsenic, copper, iron, and manganese (although reported as much lower than in 1996) were naturally elevated above lower sediment quality guidelines (Minnow 2014).

Sediment quality monitoring in Hazeltine Creek during operations but before the TSF embankment breach in 2014 indicated that concentrations of most of the elevated analytes remained similar to baseline. One possible exception was selenium, which, despite some uncertainty associated with different sampling methods and locations, had concentrations that were slightly greater than the sediment quality guideline of 2 mg/kg dw (i.e., up to 3.14 mg/kg dw

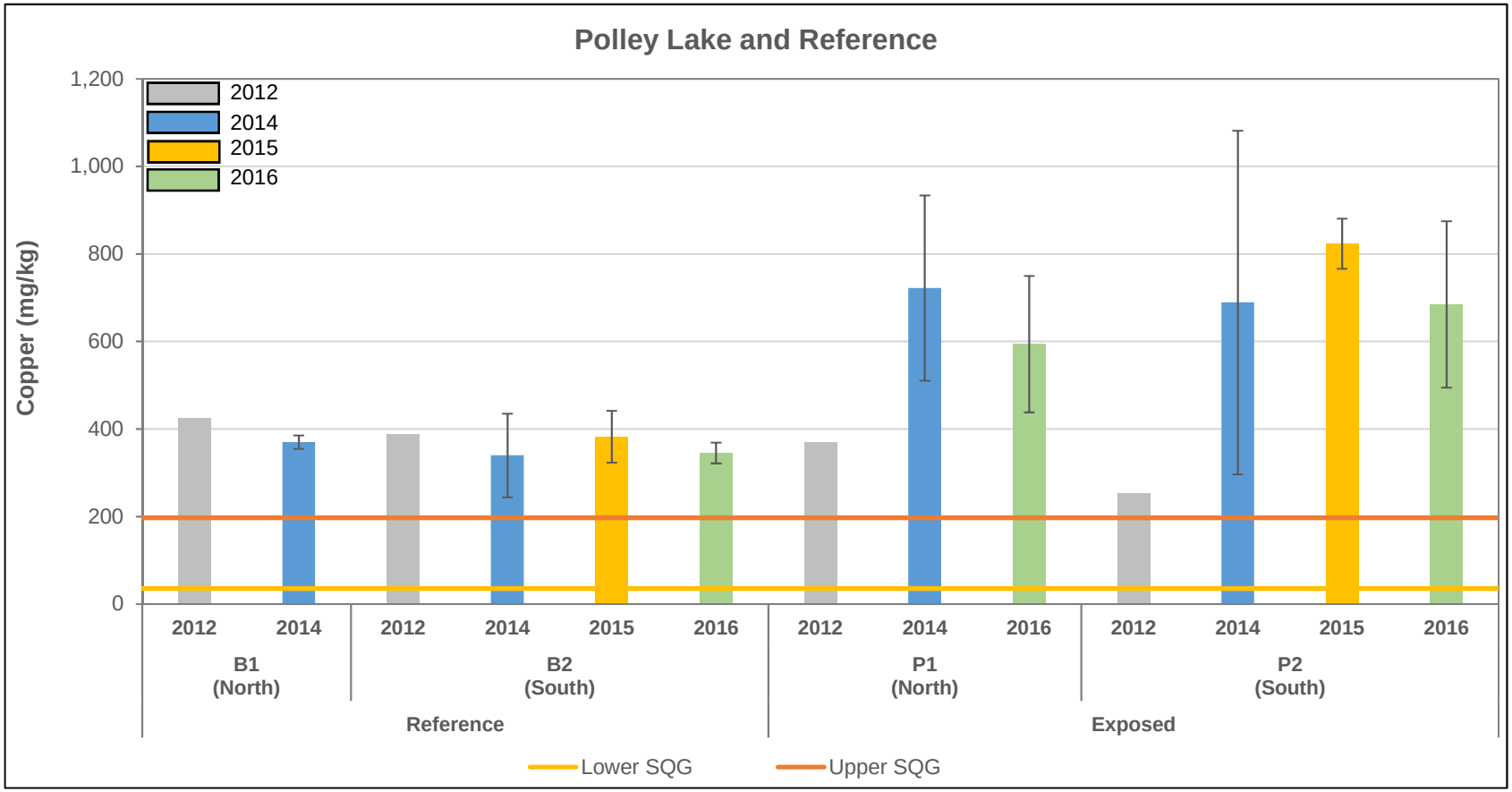

Figure 1: Concentrations of Copper in Polley Lake and Reference Sediment, 2012 to 2016

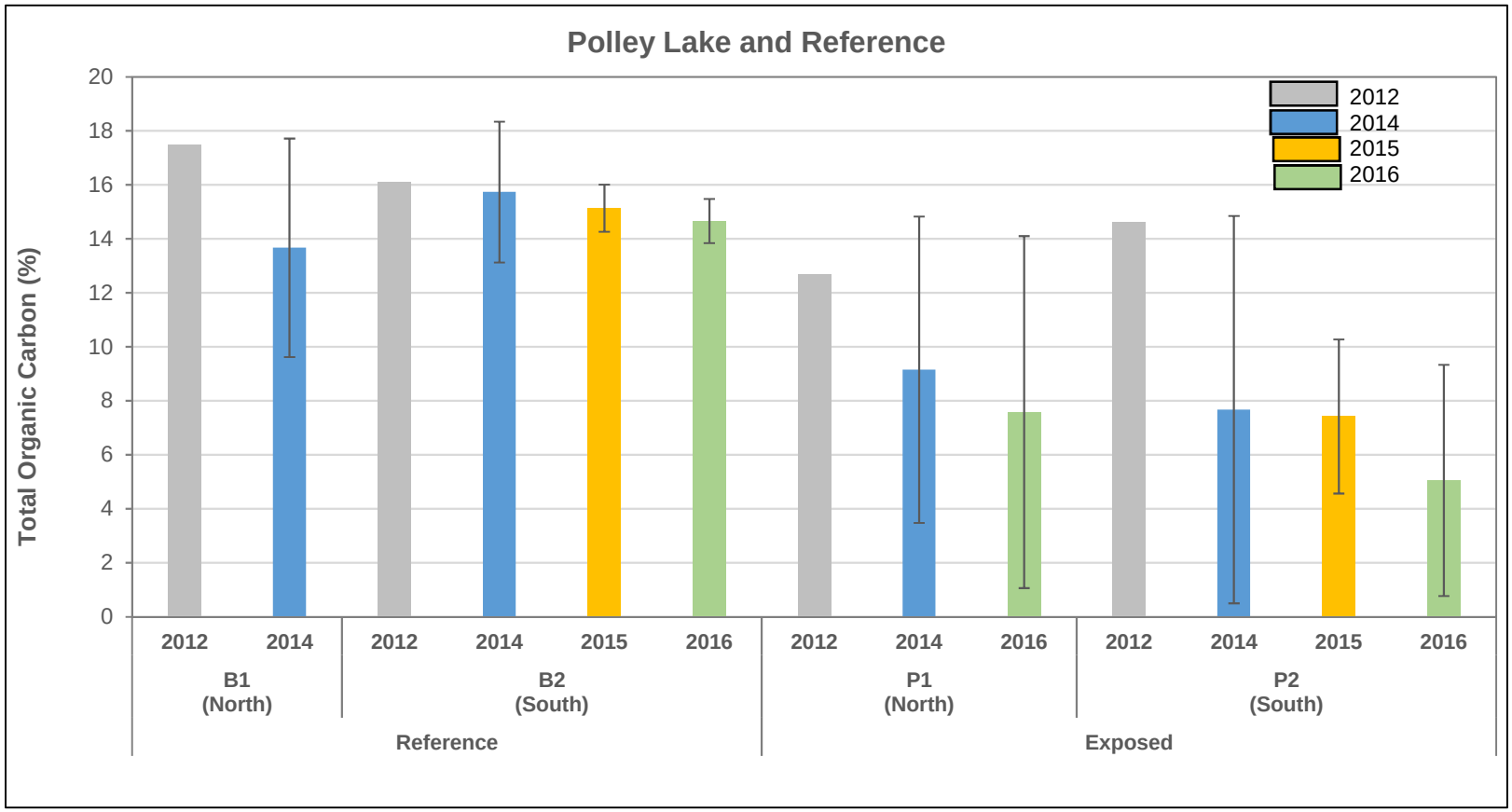

Figure 2: Concentrations of Total Organic Carbon in Polley Lake and Reference Sediment, 2012 to 2016

in a beaver pond in the fall of 2013; Minnow 2014). It is uncertain whether this difference was associated with the uncontrolled surface runoff that occurred from 2006 to 2009 (as described in Section 2.1) or if it was associated with the exclusive availability of fine sediment (that would naturally be expected to have higher metal concentrations) at a beaver pond sampled in 2013.

Following the TSF embankment breach, sediment quality monitoring was conducted in Hazeltine Creek in 2014. This sampling was prior to substantial rehabilitation from 2015 to 2017 and represented breach-material, believed to be mostly tailings. Accordingly, these "sediments" had very low organic carbon content, concentrations of copper and iron greater than upper sediment quality guidelines, and concentrations of arsenic and nickel greater than lower sediment quality guidelines (Minnow 2015a). Sediment quality monitoring of the Hazeltine Creek upper sedimentation pond completed in 2015 and 2016 indicated that concentrations of arsenic and nickel occurred at concentrations greater than reference and lower sediment quality guidelines, and concentrations of copper and iron occurred at concentrations greater than reference and upper sediment quality guidelines (Minnow 2015b; 2016).

2.3 Quesnel Lake

Sediment quality data for Quesnel Lake collected prior to the TSF embankment breach are limited to a few samples collected in the north arm near the mouth of the Mitchell River in 2012. These data documented a mean selenium concentration of 0.37 mg/kg dw (Minnow 2015a).

Following the TSF embankment breach, sediment quality monitoring in Quesnel Lake was completed at impacted areas and reference areas. A total of 121 sediment samples were collected from deep habitat of Quesnel Lake and 60 sediment samples were collected from shallow habitat of Quesnel Lake between 2014 and 2016 to characterize sediment quality (Minnow 2015a, 2015b, 2016). These sediment quality investigations indicated that the majority of breach-derived material was deposited to deep habitat. As with other habitats (i.e., Polley Lake and Hazeltine Creek), the chemical influence of the breach was most evident in copper concentrations greater than reference and upper sediment quality guidelines in impacted areas. Arsenic, iron, and manganese were elevated to concentrations greater than lower sediment quality guidelines, but concentrations of these metals were not elevated relative to reference or far-field concentrations. The influence of the breach was also evident in very low organic carbon content in impacted areas relative to reference. Sediment quality monitoring completed in 2015 and 2016 indicated very similar sediment quality from 2014 to 2016 (Figures 3 and 4; Minnow 2015b; 2016b), although the repositioning of two stations in area PNF in 2016 resulted in higher mean concentrations and lower variability. Some sediment consolidation (i.e., compaction) appears to be occurring in Quesnel Lake. Temporal change is expected to be primarily associated with deposition (i.e., covering of impacted sediment with non-impacted

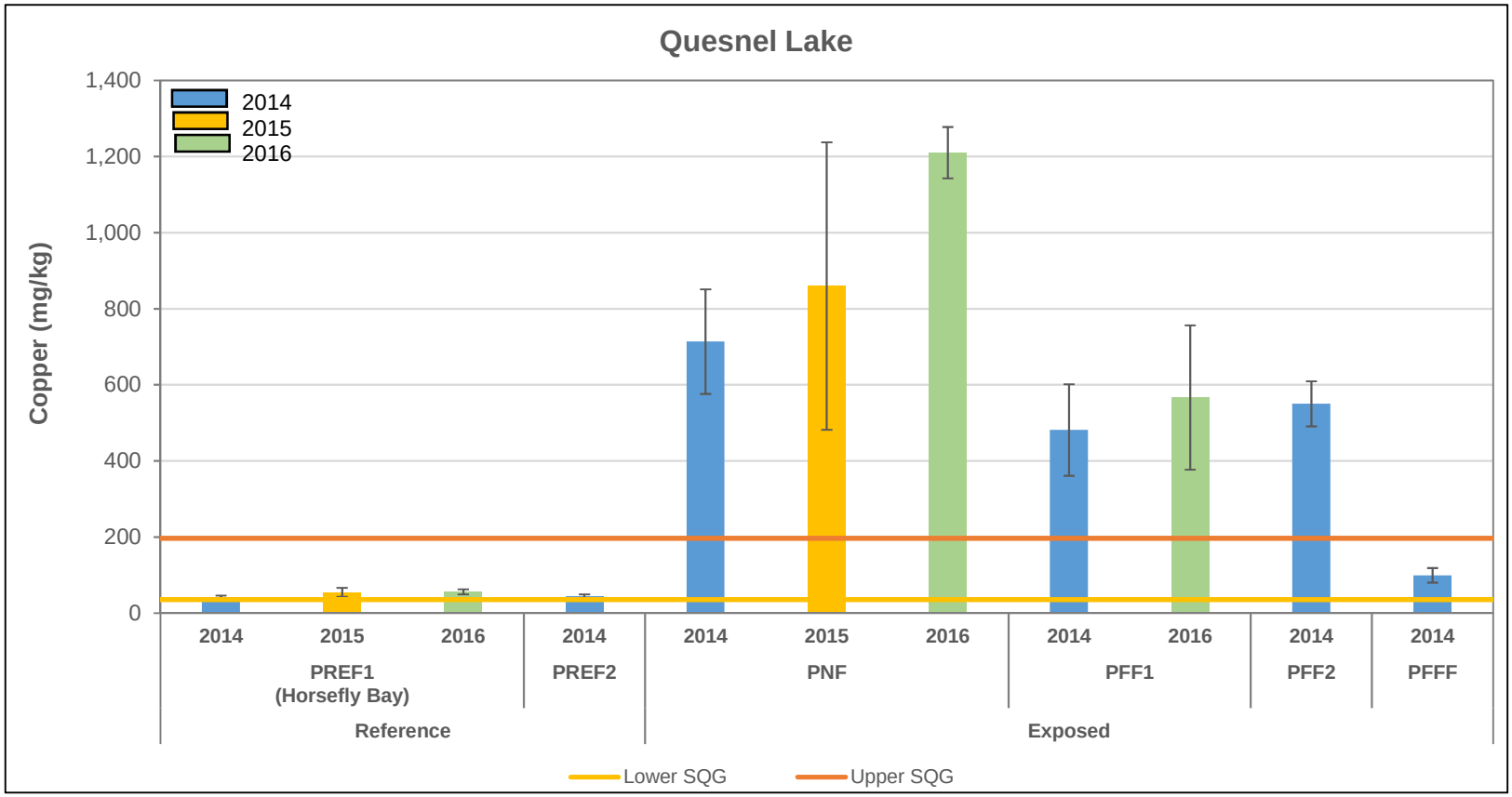

Figure 3: Concentrations of Copper in Quesnel Lake Sediment, 2014 to 2016

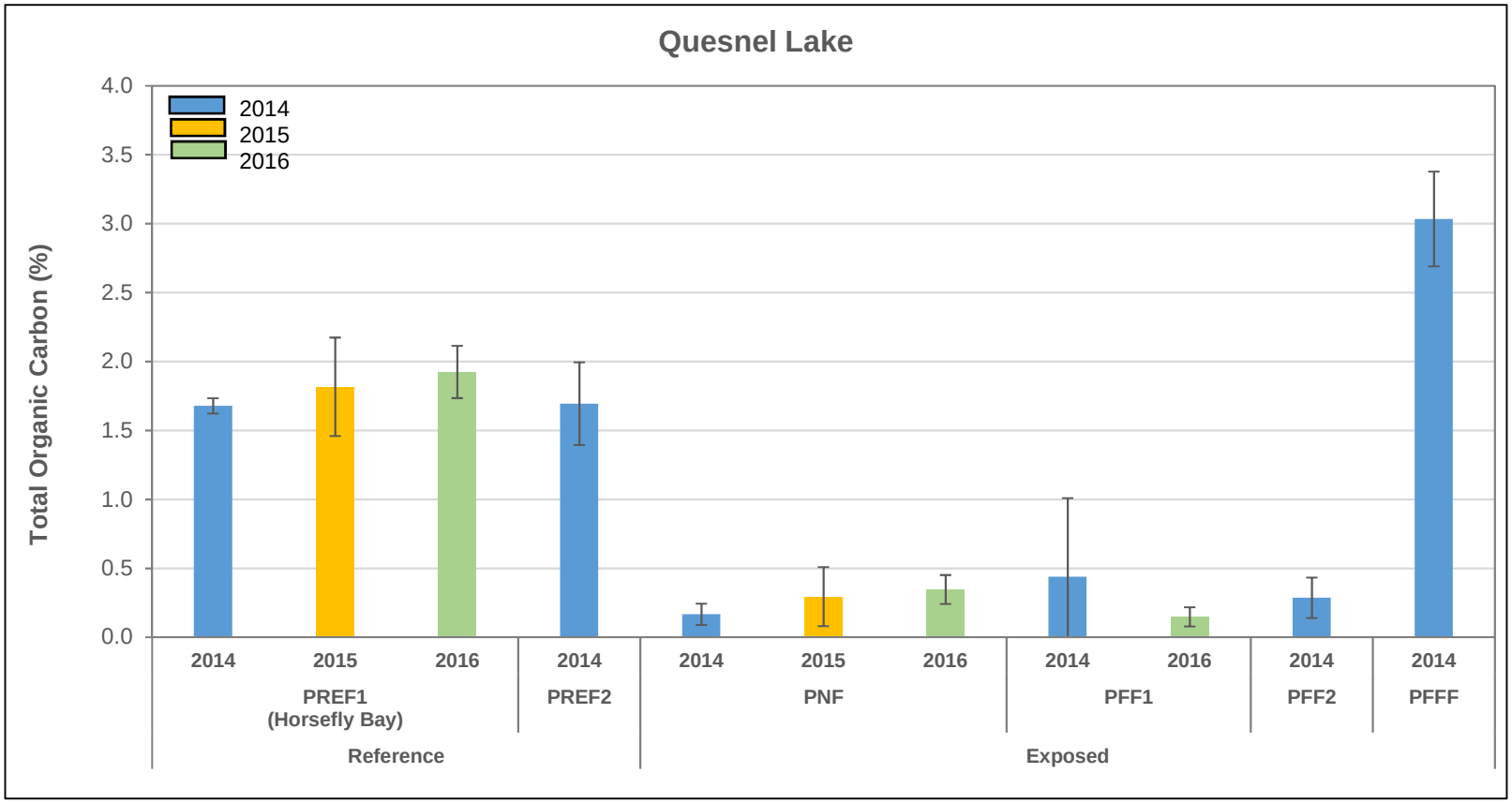

Figure 4: Concentrations of Total Organic Carbon in Quesnel Lake Sediment, 2014 to 2016

sediment), and evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Quesnel Lake (range 1.4 to 1.7 mm/yr; 6 to 7 years for the accumulation of 1 cm of sediment; Minnow 2018).

Sediment toxicity testing completed in 2014, 2015, and 2016 indicated no responses to *C. dilutus* survival, but clear reductions in growth (Minnow 2017a). Clear responses to *H. azteca* survival and growth were observed, but *H. azteca* has low site-relevance as it is not present in deep areas of local lakes. Evaluation of relationships between observed responses and sediment quality indicated that combinations of high copper concentrations and low sediment organic carbon content were the best determinants of the observed responses (Minnow 2017a). Despite the observed responses in sediment toxicity tests, benthic invertebrate community monitoring, which is considered to be a measure of greater ecological relevance than toxicity testing (due to the fact that it evaluates in-situ habitat use by site organisms), indicated consistent recovery of organism density and taxon richness from 2014 through 2016. Although these endpoints remain lower than reference and the exposed area communities are not identical to reference, the observed increases are indicative of continued recolonization of these impacted areas. Lastly, a variety of sediment quality investigations conducted to characterize the potential mobility and bioavailability of sediment associated metals (humidity cell tests, shake flask tests, selective extractions, ratios of simultaneously extracted metals to acid volatile sulphides [SEM/AVS], porewater chemistry, and DGT devices) have supported low mobility and bioavailability of sediment-associated metals (e.g., SRK 2015a,b; Minnow 2015a, 2016c, 2017c).

3 STUDY DESIGN OVERVIEW AND RATIONALE

Sediment quality monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed sediment quality monitoring program is provided in Table 2 and Figures 5 and 6. Sediment quality monitoring is focused on Polley Lake, Hazeltine Creek, and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake [and Jacobie Lake in 2018] for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake). In Polley Lake, sediment sampling will focus on the two basins (deepest locations in Polley Lake, representing locations of sediment accumulation/fate), with the deepest location in Bootjack Lake (and Jacobie Lake in 2018) serving as reference. In Quesnel Lake, sediment quality monitoring for MDMER EEM will focus on the area near the point of effluent discharge (per Minnow 2016b) with two reference areas serving as reference (one unaffected by the breach and one affected by the breach but outside of the influence of effluent discharge). Additional sediment sampling in Quesnel Lake will focus on the deep areas that were previously monitored as near-field areas, with concurrent sampling of suitable reference areas. Hazeltine Creek is an erosional creek, and sediment sampling will be opportunistic, focussed on the collection of fines deposited on the declining hydrograph. All sediment quality monitoring includes sediment physical condition and sediment chemistry at all proposed sampling locations, as well as supporting sediment toxicity testing at a subset of areas (Table 2). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to sediment quality guidelines for the protection of aquatic life (BCMOE). Accordingly, five stations per area are proposed for each to provide replication for the statistical contrasts.

Sediment quality monitoring will include physical and chemical characterization of deposited sediments, including particle size distribution, organic matter content, nutrients, and metals (see Section 4.2 below for greater detail). In accordance with BCMOE (2016) and in consideration that lake samples analyzed at the <63 µm fraction and <2.0 mm fraction yielded similar results (Minnow 2015a), sediment organic matter content, nutrients, and metals will be determined in the <63 µm fraction (silt and clay). Sediment toxicity testing (at Polley Lake, Quesnel Lake deep habitat, and associated references) will focus on larvae of the non-biting midge *Chironomus dilutus*. This organism is an ideal test organism for these sediments due to the ubiquitous presence of Chironomidae in these areas (Minnow 2015a) and the in-benthic habit of these organisms (in contrast to the epi-benthic habitat of other test organisms such as the amphipod

Table 2: Mount Polley CEMP Sediment Quality Monitoring Program Overview

A) Lakes

Water Body	Sampling Area	Type	Components [1]	Replication [2]	Rationale
Polley Lake	POL - P1 (Northwest Basin)	Exposed	C, T	5	immediately adjacent to mine and breach-influenced
	POL - P2 (Southeast Basin)	Exposed	C, T, D	5	immediately adjacent to mine and breach-influenced
Bootjack Lake	BOL - B2 (Southeast Basin)	Reference	C, T, D	5	reference for Polley Lake [3]
Quesnel Lake	QUL - EEMEXP	Exposed	C	5	adjacent to effluent discharge and breach-influenced
	QUL - EEMREF1	Reference	C	5	reference for EEMNF - breach-influenced reference
	QUL - EEMREF2	Reference	C	5	reference for EEMNF - non-breach-influenced reference
	QUL - PNF	Exposed	C, T, D	5	breach-influenced deep habitat
	QUL - PFF1	Exposed	C	5	breach influenced deep habitat
	QUL - PREF1	Reference	C, T, D	5	reference for exposed deep habitat areas of Quesnel Lake

[1] sediment monitoring components: C = chemistry (see Table 3 for analytes), T = toxicity (10-day test of *Chironomus dilutus*), and D = Diffusive Gradients in Thin Films

[2] number of replicate stations within the specified sampling area

[3] Bootjack Lake is retained as the reference for Polley Lake due to the fact that it has not been notably affected by the mine, there is a long-term dataset available for it, and its watershed includes similar geology to Polley lake. The latter is not true for other potential reference areas.

B) Creeks

Water Body	Sampling Area	Type	Components [1]	Replication [2]	Rationale
Hazeltine Creek	HAC - U	Exposed	C	5	immediately adjacent to mine and breach-influenced
	HAC - D	Exposed	C	5	immediately adjacent to mine and breach-influenced
Edney Creek	EDC - U	Reference	C	5	reference for HAC - U
	EDC - D	Reference	C	5	reference for HAC - D

[1] sediment monitoring components: C = chemistry (see Table 3 for analytes), T = toxicity (10-day test of *Chironomus dilutus*), and D = Diffusive Gradients in Thin Films

[2] number of replicate stations within the specified sampling area

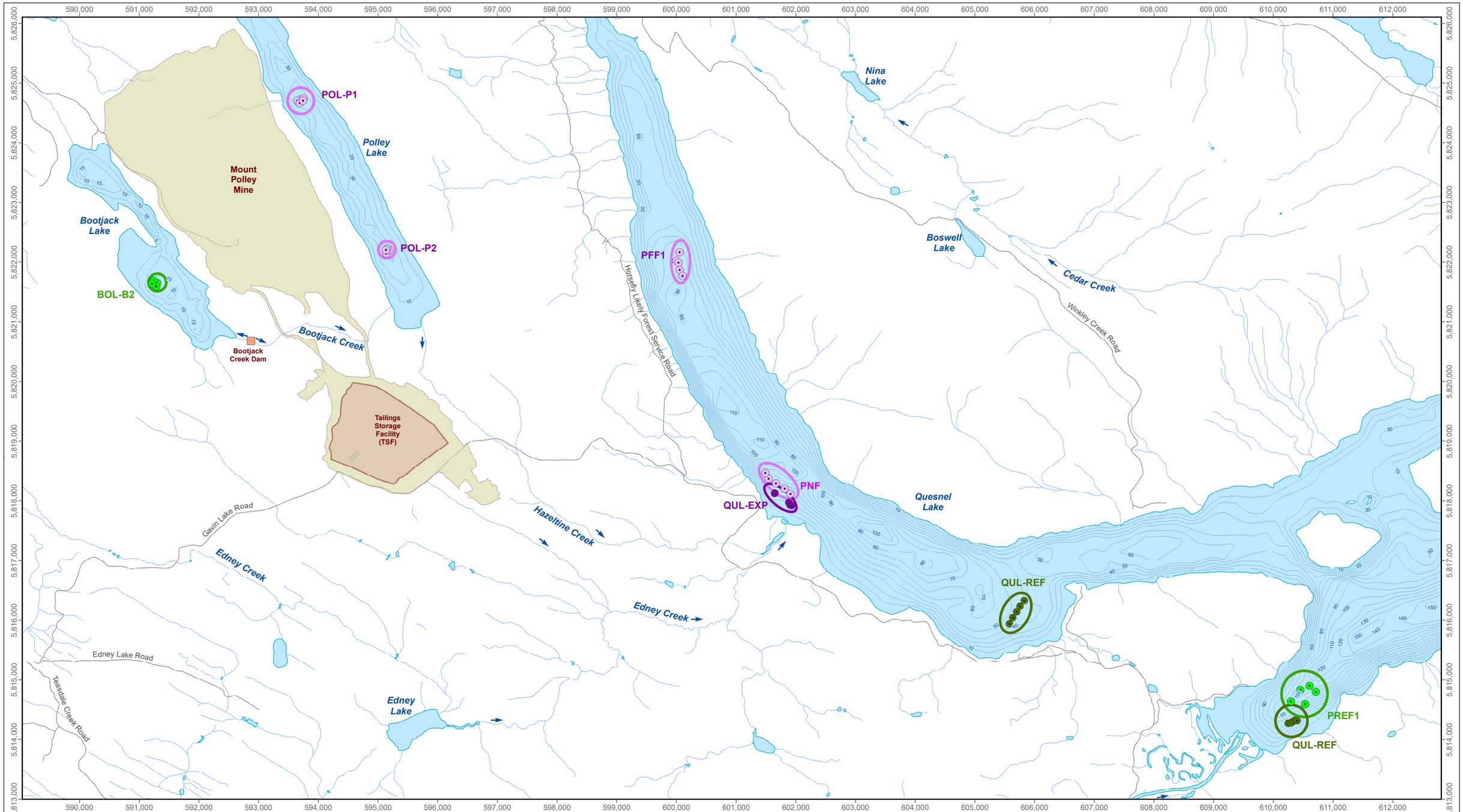

Sediment Quality Monitoring Station

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Sediment Quality Monitoring Area

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Please note: Quesnel Lake bathymetry lines are an approximate representation only and may not precisely delineate accurate depths at larger scales.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Sediment Monitoring Locations, Lakes

Date: June 2018
Project 177202.0042

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Figure 5

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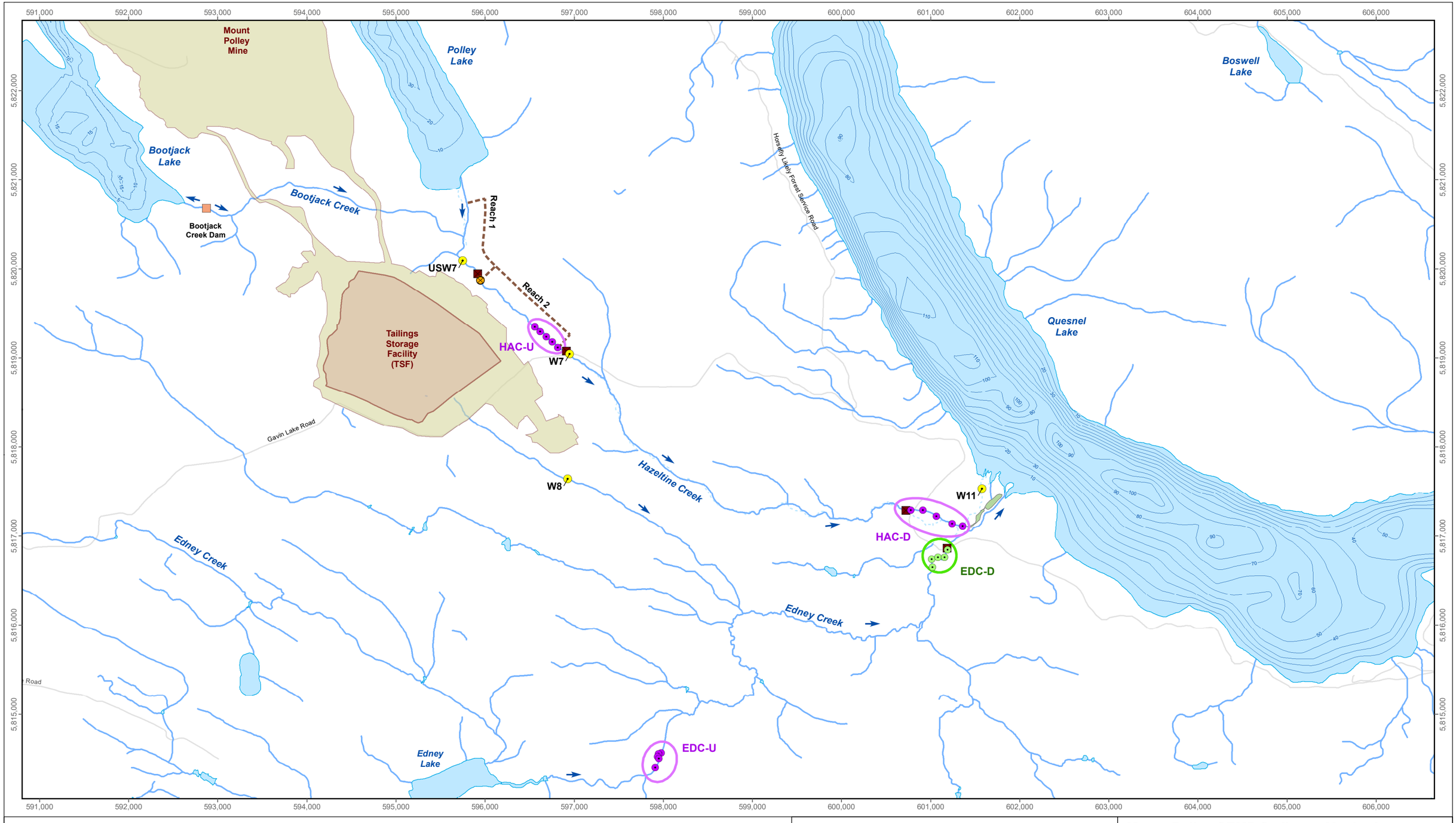

Sampling Locations
- Rehabilitated
- Reference
- Pre-Breach

- Routine Water Quality Station
- Effluent Discharge from 2014 to 2017
- Rehabilited Reaches (Golder 2017a,b)

- Tailings Storage Facility
- Active Mine Operation

- Bootjack Lake Bathymetry (5 m Intervals)
- Quesnel Lake Bathymetry (10 m Intervals)
- Polley Lake Bathymetry (10 m Intervals)
- Historic Watercourse

Note: Sampling Location in 2018 does not need to be exactly in the location identified on the map.

0 0.5 1 2 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U
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Mount Polley CEMP Sediment Monitoring Locations, Creeks

Date June 2018
Project 177202.0042

minnow environmental inc.

Figure 6

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\3-Sediment\17-42 Fig 6 CEMP Sediment Monitoring Locations, Creeks.mxd

Hyalella; Wang et al. 2004). Lastly, DGT devices will be deployed above the sediment water interface in areas most impacted by the TSF embankment breach (Polley Lake and Quesnel Lake deep areas) to provide annual feedback on whether there has been any change in the concentrations and/or proportion of labile metals above the sediment water interface (which would be suggestive of the potential instability or the temporal stability of sediment-associated metals).

Sediment quality and toxicity sampling will be supported by measurements of temperature, dissolved oxygen, pH, and specific conductance near the sediment-water interface at all sampling stations. Additional information to be collected includes GPS coordinates of each station and supporting photographs of the sampling location and samples. Some additional monitoring of the stability and potential bioavailability of metals associated with sediments impacted by the TSF embankment breach will be undertaken (e.g., deployment of Diffusive Gradients in Thin Films [DGT] devices to monitoring labile metal concentrations), as recommended by a QP and approved by ENV.

Sediment sampling will be completed in August or September consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2015a,b; 2016). The frequency of sediment quality monitoring at the federal EEM sampling areas (where sediment is collected to support a benthic invertebrate community survey to evaluate potential effects of effluent discharge) is initially at a prescribed frequency of every three years, subject to modification based on the findings of at least two EEM phases (Environment Canada 2012). The frequency of sediment sampling at the lake areas is also guided by the results of sediment quality monitoring undertaken from 2014 to 2017. Evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Polley Lake (average 0.66 mm/yr; 15 years for the accumulation of 1 cm of sediment) and Quesnel Lake (range 1.4 to 1.7 mm/yr; 6 to 7 years for the accumulation of 1 cm of sediment; Minnow 2018). This is consistent with limited change in sediment quality of these lakes which were sampled annually from 2014 to 2016 (e.g., Figures 1 to 4; Minnow 2016). Therefore, sediment sampling in lakes will be completed in 2018 and then every three years concurrent with EEM (2018, 2021, etc.). It is anticipated that a three-year frequency will be sufficient to track recovery associated with the deposition of approximately 2.0 mm of new sediment in Polley Lake and approximately 4.7 cm of new sediment in Quesnel Lake over the three-year period. As sediment samples are composed of the top 3 cm (30 mm) of deposited sediment (to represent exposure to benthic organisms and consistent with technical guidance; BCMOE 2016), this is equivalent to approximately 6.6% and 16% of the sample volume being comprised of new material. Water quality above the sediment water interface will be monitored in 2018-2020, including the deployment of Diffusive Gradients in Thin Films (DGTs). If monitoring of labile metal concentrations using DGT devices indicate increases above the sediment-water

interface, design modification (e.g., changes to monitoring frequency or locations) will be made in response to QP recommendations in future interpretive reports.

The initial frequency of sediment quality monitoring at the creek areas (Hazeltine and Edney Creeks) is annual. This is because post-breach / post-rehabilitation conditions have not been established. Frequency should be reviewed following interpretation of the data collected in 2020, with particular consideration of whether sediment, which is quantitatively rare in these erosional creeks, provides value as an independent monitor given the intensive monitoring of water, periphyton, and benthic invertebrates.

Sediments will be sampled, processed, analyzed, and associated data interpreted using methodology consistent with previous assessment at Mount Polley (e.g., Minnow 2015a,b; 2016), which is also consistent with technical guidance (e.g., Environment Canada 2012; BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of sediment quality monitoring programs. Quality assurance and quality control measures will be consistent with requirements outlined in the BC Field Sampling Manual (BCMOE 2013), and will include program review prior to implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the sediment quality monitoring program. Five replicate samples (samples from 5 separate stations to represent the sampling area) will be collected from each sampling area in order to capture within-area variability. Specific field QC samples will include duplicates (i.e., splits) collected at a frequency of 10% of the total number of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). Duplicate water samples will be collected at a frequency of 10% to assess field precision associated with the water samples that support DGT monitoring. In addition to field QA/QC, any laboratory conducting the physical or chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting will be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Lakes

Sampling of lake sediments will be consistent with previous monitoring (Minnow 2015a,b; 2016a). In Polley Lake (and the associated reference – Bootjack Lake [and Jacobie Lake in 2018]), sediments will be collected at five replicate stations per area, with sediments for the analysis of total organic carbon, total sulphur, total nitrogen, and metals collected using a Kajak-Brinkhurst corer or a Tech Ops corer in accordance with technical guidance for gravity coring outlined in the BC Field Sampling Manual (BCMOE 2013) and the Metal Mining Technical Guidance for EEM

(Environment Canada 2012). Sediment samples for particle size distribution will be collected using a Petite Ponar grab sampler. Briefly, the KB corer is a gravity corer that collects samples in 2" (5.08 cm) diameter core tubes. Core collection relies on a combination of surface tension within the core and suction supplied by a plunger that seals the top of the core tube after being deployed by a messenger. The Tech Ops corer is a gravity corer that collects samples in 4" (10.16 cm) diameter core tubes. Core collection relies on a combination of surface tension within the core and suction supplied by an automatic seal (plunger assembly) that shuts in response to sampler retrieval (upward pull). Success rates for each of the core devices tend to vary with sampling location in accordance with sediment characteristics and both devices may be used in the program.

Collection of sediment by coring requires careful application and experience to obtain good quality sediment samples (i.e., sediment samples that capture an undisturbed sediment-water interface). During coring, care will be taken to control the rate at which the coring device is lowered, to maintain the corer in a vertical position during descent, and to allow the corer to penetrate the sediment with minimal sediment disturbance. The corer will then be carefully retrieved to surface. At surface, an extruder head-piece will be inserted into the bottom of the core tube to prevent sediment slippage. Core samples will be rejected if there was evidence of slippage, that the core did not penetrate the substrate vertically, or that the sediment-water interface was disturbed within the core. Accepted samples will then be processed by removing the core tube from the corer and using the extruder to push the sediment upwards towards the top of the core tube in a controlled fashion with care taken to minimize suspension of fines. In the event of suspension, momentum will be stopped, allowing the suspended solids to re-settle. Once the sediment is extruded to near the top of the tube, an extrusion collar marked in 1-cm intervals will be carefully aligned on the top of the tube and the sediment will be extruded upwards into the extrusion collar to the 3-cm mark. A core slicer will then be carefully inserted between the tube and the collar to collect the top 3-cm of sediment, which will then be transferred into a 250 mL glass sampling jar labeled with the project number, sample location, and collection date. The procedure will then be repeated twice more (at minimum) in order to provide a composite sample of sufficient volume for the required analyses. All sampling equipment will be rinsed between stations using site water. As indicated above, duplicate (split) sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of grabs to support the split samples). In addition, supporting information will be collected at each sampling site as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will then be transferred to a refrigerator and held until shipment to the analytical laboratory.

Sediment samples for particle size analysis in Polley Lake, Bootjack Lake, and Jacobie Lake will be collected using a stainless steel Petite Ponar grab sampler in accordance with technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013) and the Metal Mining Technical Guidance for EEM (Environment Canada 2012). Briefly, the Petite Ponar is a 6" x 6" (15.24 cm x 15.24 cm) grab sampler with jaws that can be held open by shear-pressure on a spring-loaded pin. The grab sampler is lowered to the substrate at which point shear-pressure is eliminated and the pin springs out. Upon upward pull at the initiation of retrieval, the jaws of the ponar close to grab surficial sediment. As with coring, care must be taken to control the rate at which the ponar is lowered to allow appropriate sediment penetration and to minimize sediment disturbance. The ponar will then be carefully retrieved to surface and each grab will be placed into a plastic tote and observed for completeness and any unusual characteristics. If the sample is deemed acceptable (i.e., the sampler is full to each end and is representative of surface sediment), surficial material to a depth of 3 cm will be transferred to a second tote using a stainless steel spoon, and the remaining sediment discarded. At each station, composite samples of the top 3 cm of surficial sediment of three acceptable grabs will be collected. The sediment within the tote will then be homogenized using a stainless steel spoon and transferred into 250 mL glass sampling jars labeled with the project number, sample location, and collection date. Sampling equipment will be rinsed between stations using site water.

Sediment samples for toxicity testing of *Chironomus dilutus* will also be collected using a Petite Ponar grab sampler. The same methodology as above will be applied, with the exception that, at stations that require both sediment chemistry and toxicity testing, a composite sample will be composed of a minimum of five grabs and will be placed into a 250 mL glass sampling jar for chemical analysis (as above) and another 500 mL jar for toxicity testing. As noted above, all jars will be labelled with the project number, sample location, and collection date.

In Quesnel Lake, all sediment samples (for total organic carbon, total sulphur, total nitrogen, and metals) will be collected using a stainless steel Petite Ponar (15.24 cm x 15.24 cm; 0.023 m^2 sampling area) or a stainless steel standard ponar (22.86 cm x 22.86 cm; 0.052 m^2 sampling area) in accordance with federal and provincial technical guidance (Environment Canada 2012; BCMOE 2013). Attempts to collect sediment from Quesnel Lake by gravity coring have yielded poor success rates due to the substantial depth of sampling (approximately 100 meters) and the non-cohesive nature of the sediment. Samples will be retrieved with the assistance of a coMDMERcial line hauler (Ace Line Hauler - Brutus Plus 40) using methodology consistent with that described above for collection of the Polley Lake (and Bootjack Lake) sediment particle size samples. Composite samples of the top three centimeters of surficial sediment of a minimum of three acceptable grabs (i.e., full to each edge of the sampler) will be collected at stations where toxicity testing is not required, and composite samples of the top three centimeters of surficial

sediment of a minimum of five acceptable grabs (i.e., full to each edge of the sampler) will be collected at stations where toxicity testing is required (Table 2 and Figure 5). Sediment homogenization and transfer to sampling jars will be as described above. All sampling equipment will be rinsed between stations using site water. Duplicate (i.e., split) sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of grabs to support the split samples). In addition, supporting information will be collected at each sampling station as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will be placed in a refrigerator and held until shipment to the analytical laboratory.

Supporting information collected at each of the lake sediment monitoring stations will include GPS (Geographic Positioning System) coordinates, sampling depth, Secchi depth, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, photographs of sediment samples, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.). In addition, one full vertical profile of the field meter measurements will collected at one station per area.

4.2.2 Creeks

Hazeltine Creek and the associated reference creek (Edney Creek) are predominantly erosional (HKP 1996, 1997; Minnow 2007) and there are few locations of true sediment deposition. The limited sediment within these creeks tends to wash through during spring freshet and deposit as a thin layer of fines in quiescent areas on the lowering hydrograph. Thus, collection of true sediment (i.e., fines in the silt and clay size category) cannot be completed by conventional grab sampling as applied in lakes (as described above) and typically applied in depositional creeks (i.e., due to the dominant presence of sand, gravel, and cobble). An alternative method will therefore be applied – sampling by spoon. This sampling will target the fine sediment fraction (i.e., silt and clay). Sampling will be undertaken in late suMDMER when low flows support some sediment deposition, even if only as a thin layer over sand, gravel, or cobble. As with lake sampling, sediments will be collected at five replicate stations per area. However, due to the non-uniform nature of sediment deposition in erosional creeks, the actual sampling stations will be determined opportunistically with each field sampling campaign and may vary slightly over time (i.e., a priority will be placed on the quality of the five replicate sediment samples collected within each area rather than the precise location of each sample within each area).

Sediment samples from creeks will be collected using a clean stainless steel spoon. All samples will be collected from wetted sampling stations that support the accumulation of fine materials (i.e., small pools or backwaters). Sampling locations will be approached by foot in a manner that

does not disturb sediment prior to sampling. At locations of sediment deposition, surficial sediment will be carefully collected by slowly placing the spoon on the sediment surface in a manner that minimizes disturbance. The spoon will then be inserted into the sediment to capture sediment to a depth of no greater than 3 cm and moved horizontally to fill the spoon. In reality, the collection depth may be much less than 3 cm, as fines often settle in a thin layer over coarser material (and sampling seeks to avoid coarse material as indicated above). The spoon will then be slowly retrieved to surface to avoid sample washout. The content of the spoon will then be inspected to ensure that it represents fine sediment (i.e., is predominantly silt and clay) and, if accepted, will be placed into a 250 mL glass sampling jar labeled with the project number, sample location and collection date. This procedure will be repeated a minimum of four more times to form a composite sample representative of the sampling station. Sampling equipment will be rinsed between stations using site water. Duplicate sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of spoons to support the split samples). In addition, supporting information will be collected at each sampling site as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will then be transferred to refrigerator and held until shipment to the analytical laboratory.

Supporting information collected at each of the creek sediment monitoring stations will include GPS (Geographic Positioning System) coordinates, average water depth at the sample locations, average sediment depth collected, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, photographs of sediment samples, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.).

4.2.3 DGT Sampling

Diffusive Gradients in Thin Films (DGT) sampling devices (DGT model C-LSNX; DGT Research, Lancaster, UK) as described in Minnow (2017a) will be installed in the lower water column at one sediment sampling area in Polley Lake (POL-P2; with an area in Bootjack Lake [BOL-2] as reference) and at one sediment sampling area in Quesnel Lake (QUL-PNF; with an area in Quesnel Lake [QUL-PREF1] as reference; Table 2). Five replicate DGT devices will be placed in exposed areas and three replicates will be placed in reference areas. The purpose of the DGT device monitoring is to provide data on the concentrations of DGT-labile metals above of the sediment-water interface, and most importantly to monitor DGT-labile metals above the sediment-water interface to determine if those concentrations are changing over time. Low and unchanging concentrations of DGT-labile metals would be indicative of stability of metals and metalloids in

lake sediments affected by the TSF embankment breach. Conversely, increasing concentrations of DGT-labile metals would be indicative of instability of metals and metalloids in lake sediments.

The DGT devices will be installed in the lower water column approximately one meter above the sediment surface. This will be achieved by placing a line with anchor and float at each sample location. The DGT devices will be deployed with care (including not touching the DGT window) while wearing metal free disposable nitrile gloves and will be left in place for a total period of 35 to 50 days. Upon retrieval, DGT devices will be handled with care while wearing metal free disposable nitrile gloves. Upon retrieval, each DGT device will be gently rinsed with metal free water (provided by the laboratory) and placed into a labelled glass soil jar with a few drops of metal free water to prevent desiccation. Jars will then be placed into clean Ziploc™ bags and then into a dedicated cooler with ice packs, where they were maintained cool prior to transport.

Supporting information collected at each DGT deployment location will include GPS (Geographic Positioning System) coordinates, sampling depth, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, site photographs (including photographs of the DGT devices), and notes on the presence or absence of any fouling of the DGT devices. Supporting water samples will also be collected from each sampling area, including samples for total and dissolved constituents (including metals), the latter prepared by field filtration using a 0.45 µm syringe filter. Water samples will be placed into a dedicated cooler with frozen ice packs, and kept cool prior to transport to the field laboratory.

4.3 Sample Handling and Laboratory Analysis

At the termination of the field program or at intervals of no more than seven days, sediment samples will be shipped in coolers with ice packs to the analytical laboratory and/or toxicity testing laboratory. Shipment transit time will be less than one day.

Chemical analyses will be completed at an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA) using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015) and will include moisture content, pH, particle size distribution, total organic carbon (TOC), total nitrogen, total sulphur, and total metal concentrations (Table 3). All analyses except for particle size distribution will be completed on the silt/clay fraction (<63 µm diameter) in accordance with recent recommendations by BCMOE (2016) and because sediment quality characterization conducted in 2014 indicated similar results in <63 µm and <2 mm sediments (Minnow 2015a). Analysis of metals will be based on the BC Strong Acid Leachable Metals digestion (SALM; BCMOE 2016). Analyses of pH will be completed by electrode, particle size analysis will be completed by sieve and pipette, total organic carbon will be completed by combustion and titration (total carbon minus total inorganic carbon), total nitrogen and total sulphur will be completed by combustion, metals

Table 3: Analytes and Laboratory Reporting Limits for Mount Polley CEMP Sediment Quality Monitoring

Analyte	Units	Target LRLs	Concensus DLs [1]	British Columbia Sediment Quality Guidelines [2]	
				Lower	Upper
Physical Tests					
% Sand (2.0mm - 0.063mm)	%	0.1	1	-	-
% Silt (0.063mm - 4um)	%	0.1	1	-	-
% Clay (<4um)	%	0.1	1	-	-
Moisture	%	0.25	1		
pH (1:2 soil:water)	pH	0.1	-	-	-
Nitrogen and Carbon			-		
Total Nitrogen	%	0.02			
Total Organic Carbon	%	0.1	0.05	-	-
Sulphur					
Sulphur	%	200	200	-	-
Metals					
Aluminum	mg/kg	50	100	-	-
Antimony	mg/kg	0.1	0.1	-	-
Arsenic	mg/kg	0.05	0.2	5.9	17
Barium	mg/kg	0.5	1	-	-
Beryllium	mg/kg	0.1	0.1	-	-
Bismuth	mg/kg	0.1	0.1	-	-
Boron	mg/kg	10	5	-	-
Cadmium	mg/kg	0.05	0.05	0.6	3.5
Calcium	mg/kg	50	100	-	-
Chromium	mg/kg	0.5	1	37.3	90
Cobalt	mg/kg	0.1	0.3	-	-
Copper	mg/kg	0.5	0.5	35.7	197
Iron	mg/kg	50	100	21,200 [a]	43,776 [b]
Lead	mg/kg	0.1	0.1	35	91
Lithium	mg/kg	5	-	-	-
Magnesium	mg/kg	10	10	-	-
Manganese	mg/kg	0.2	0.2	460	1,100
Mercury	mg/kg	0.005	0.05	0.17	0.49
Molybdenum	mg/kg	0.1	0.1	-	-
Nickel	mg/kg	0.5	0.8	16	75
Phosphorus	mg/kg	50	10	-	-
Potassium	mg/kg	100	100	-	-
Selenium	mg/kg	0.1	0.1	2	-
Silver	mg/kg	0.05	0.1	0.5	-
Sodium	mg/kg	100	100	-	-
Strontium	mg/kg	0.1	0.1	-	-
Thallium	mg/kg	0.05	0.1	-	-
Tin	mg/kg	0.2	0.2	-	-
Titanium	mg/kg	1	1	-	-
Uranium	mg/kg	0.05	0.05	-	-
Vanadium	mg/kg	0.2	2	-	-
Zinc	mg/kg	1	2	123	315

[1] from Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016)

[2] British Columbia Sediment Quality Guidelines; from British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BCMOE 2017)

[a] approximately 2%

[b] approximately 4%

will be completed by collision reaction cell inductively coupled plasma – mass spectrometry (ICP-MS [USEPA Method 6020A; USEPA 1998]), and mercury will be completed by cold vapor atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (USEPA Method 245.7; USEPA 2005).

Toxicity testing will be completed at a testing laboratory accredited by CALA. Testing will be completed using a standard 10 day test of the survival and growth of *Chironomus dilutus* (a midge larva; Environment Canada 1997). In accordance with recent recommendations for toxicity testing, test replicates (n = 5) will be field-collected replicates. In addition to the exposed area field replicates and the reference area field replicates, a laboratory control (beach sand in accordance with the standard biological test methods) will also be included (also to be set up with five laboratory replicates).

At the termination of the DGT device collections or at intervals of no more than four days, DGT devices will be shipped in coolers with ice packs to the analytical laboratory. Laboratory analysis of the DGT devices will involve dismantling the devices followed by digestion of the resins to determine total metal concentrations in the resin by ICP-MS (USEPA Method 6020A; USEPA 1998). DGT-labile metal concentrations will subsequently be calculated by the analytical laboratory based on total metal in the resin, mean water temperature during deployment at each area, total deployment time, and manufacturer-supplied peer-reviewed diffusion coefficients, which, in turn, are based on Fick's first law of diffusion (Zhang and Davison 1995; Panther et al. 2014). Supporting water samples will be treated in a manner identical to the routine water quality samples collected as part of the CEMP (Section 6.6).

Each of the laboratories will provide a sample receipt confirmation when the samples are received and logged. These receipts will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Upon completion of the analyses, each laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

4.4 Data Quality Review

Upon receipt of sediment quality data and supporting water quality data from the analytical laboratory, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the sediment quality data will ensure timely communication with the laboratory should any issues be identified.

Comparisons between duplicate samples will be made by calculating the relative percent difference (RPD) between concentrations between paired duplicates. If the RPD is <40% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the completion of the DQR, all sediment quality data and supporting data will be managed in Microsoft (MS) Excel™. For all replicated data (typically based on a sample size of five stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile for each analyte. Sediment quality data will then be evaluated in comparison to British Columbia Working Sediment Quality Guidelines for the protection of aquatic life (WSQGs; BCMOE 2017) and reference concentrations. Reference 95th percentile values will be used to screen exposed-area mean concentrations to efficiently identify analytes with concentrations that are beyond the range of reference. Analytes with concentrations greater than guidelines and reference will be the focus of more detailed interpretation, which may include, as required for data interpretation: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations and/or over time.

WSQGs are numerical criteria that are protective of sediment-dwelling organisms based on long-term exposure. Most British Columbia WSQGs have been adopted from the CCME (CCME 1999) or from Ontario (OMOE 1993) and have two levels – a Lower WSQG (also known as a Threshold Effect Level [TEL] or a Lowest Effect Level [LEL]) and a Higher WSQG (also known as a Probable Effect Level [PEL] or a Severe Effect Level [SEL]). The Lower WSQG is intended to represent a concentration that will protect aquatic life from adverse effects of a toxic substance in most situations (BCMOE 2017). The Upper WSQG is intended to represent a concentration that, if exceeded, will likely cause severe effects on aquatic life (BCMOE 2017). However, WSQGs – even the Upper WSQGs - are often naturally exceeded in mineralized areas, as was the case for copper, iron, and manganese in Polley Lake (Section 2.1). In addition, SQGs were developed based on co-occurring bulk surficial sediment data and biological effect data (CCME 1995). Bulk

sediment chemistry can differ substantially from the <63 µm fraction, and this discrepancy between measurement (<63 µm fraction) and exposure (to bulk sediment to which SQGs are most applicable) should be considered in interpretation as "caution should be used in interpreting the biological significance of chemical concentrations in sediments for different types based on these guidelines" (CCME 1995).

Multivariate statistical tools may also be applied to assist with sediment quality data interpretation. Specifically, ordination techniques such as Principal Components Analysis (PCA), Correspondence Analysis (CA), or Nonmetric Multidimensional Scaling (NMDS) may be applied to assist in the identification of key spatial or temporal differences in sediment chemistry. Perhaps more importantly, these techniques will be used in the analysis of potential physical and/or chemical causes of differences in biological metrics (e.g., benthic invertebrate community condition) as a means of reducing data to focus on a small list of key components for correlation analysis (see Section 6.13 – Benthic Invertebrate Monitoring).

As indicated above, analytes with concentrations greater than guidelines and reference 95th percentile concentrations will be the focus of more detailed interpretation, which may include, as required for data interpretation: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations and/or over time. This will include the following: graphical plots in relation to all guidelines, reference values, and historical values and examination of relationships to physical variables. Plots of the analytes of interest (those greater than SQG and reference) will be prepared in MSExcel. At a sample size of 5, plots will include of each replicate by area. Available guidelines (BCWSQG), reference concentrations, and background concentrations (as available) will be added to the plots as lines to facilitate comparison of concentrations to these benchmarks.

Relationships between the analytes of interest and physical features (i.e., particle size) and other chemical variables (total organic carbon content) will be evaluated using correlation analysis. Spearman correlation (often referred to a Spearman Rank-Order correlation) will be completed. Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points).

Sediment toxicity test results (survival and growth of *C. dilutus*) will be interpreted based on a combination of effect size and statistical contrasts. Results associated with each exposed area will be contrasted against the matched reference area and against the laboratory control. Results will then be evaluated using a stepwise procedure similar to that of Southern California Coastal Water Research Project (SCCWRP) California Sediment Quality Objectives (CASQO; Bay et al. 2014):

1. mean responses (percent survival and growth [dry weight per surviving organism]) will be expressed as a percentage of the mean laboratory control result and the mean field reference result; and

2. results of the statistical contrasts of mean responses in tests of impacted sediment against the laboratory control and the field reference sediment will be compiled.

Results will then be categorized as follows:

1. no unacceptable response is a mean response within 20% of the mean field reference response (i.e., survival or growth were ≥80% of the field reference);

2. a low to moderate response is a mean response of between 20% and 50% of the mean field reference response (i.e., survival or growth were 50% to 80% of the field reference); and

3. a large response is a mean response of >50% of the mean field reference response (i.e., survival or growth were <50% of the field reference).

Low and moderate responses will be distinguished based on whether the results differ significantly from reference (moderate response) or not (low response). Application of a 20% reduction in survival relative to the field reference to define acceptability is consistent with thresholds used elsewhere (e.g., BCMELP 1998; Government of Canada 2010; Bay et al. 2014). If low, moderate, or high responses are observed in sediment toxicity testing, relationships between the effect endpoint (i.e., survival or growth) and sediment quality will be evaluated in consideration of WSQGs, effect thresholds, and the results of correlation analysis. Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., reduced survival or growth in sediment toxicity tests), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

The overall interpretation of sediment quality data will include integration of a weight-of-evidence that includes other components of the MPMC CEMP (e.g., water quality data, periphyton data for creeks, benthic invertebrate community data for lakes and creeks). Thus, within the CEMP, sediment quality data interpretation will specifically include the integration of data on sediment quality, the results of specialized evaluations (e.g., DGT results), and the results of bio-assessment (e.g., sediment toxicity testing and benthic invertebrate communities).

An interpretive report based on the sediment quality data will be prepared to be integrated into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWSQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.2

Benthic Invertebrate Monitoring

Minnow Environmental Inc.

Benthic Invertebrate Monitoring Plan

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June 2018

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1 INTRODUCTION

1.1 Background

Benthic invertebrates are excellent biomonitors for assessing potential effects of physical and/or chemical habitat changes in aquatic systems (Barbour et al. 1999; Feltmate and Fraser 1999; Beatty et al. 2006). Due to the complexity of benthic invertebrate community structure and known tolerances and sensitivities to sediment and water quality (e.g., Barbour et al. 1999; Mandaville 2002), benthic invertebrate community analysis is typically a highly sensitive bio-monitor. Benthic invertebrate are sessile, therefore evaluation of benthic invertebrate tissue quality can provide an important measure of localized chemical conditions and of spatial extent of an effect, as well as of potential direct or indirect exposure of fish and wildlife to metals, metalloids, and nutrients[1]. Therefore, benthic invertebrate community and tissue quality monitoring is an important component of the Mount Polley CEMP.

The influence of the Mount Polley Mine on benthic invertebrate communities, productivity, and/or tissue quality can occur by several key mechanisms: 1) general mine influence from dustfall and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Reclamation activities in Hazeltine Creek and lower Edney Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017a). Construction / rehabilitation in areas of upper Hazeltine Creek (Reaches 1 and 2) were completed between July and September of 2016 and 2017, respectively (Golder 2017b,c). Reach 2 of the rehabilitation works encompassed a sampling area established prior to the TSF embankment breach (UHC; Minnow 2009). In lower Hazeltine Creek, initial channel rehabilitation was completed in 2015, and further rehabilitation has yet to be completed in this area of creek. The geomorphology of Hazeltine Creek was drastically altered as a result of the TSF embankment breach such that Fisheries and Oceans Canada considered it not to be fish habitat (Golder 2015a), and the creek was inaccessible to fish from August 2014 (following the breach) until the spring of 2018 when it was reopened as fish habitat.

Benthic invertebrate communities in waterbodies adjacent to the Mount Polley Mine have been monitored since baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996, 1997). Benthic invertebrate tissue quality has been monitored since prior to the TSF

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication.

embankment breach (2009, 2010, 2012, and 2013; Minnow 2011, 2013a,b). Results of benthic invertebrate community and tissue quality monitoring are reviewed in Section 2 and provide context for a CEMP benthic invertebrate monitoring program that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and/or temporal differences in benthic invertebrate productivity, community, and/or tissue quality, in addition to providing data to evaluate tissue quality results (i.e., tissue selenium concentrations) relative to effects-based guidelines (e.g., British Columbia Water Quality Guidelines [BCWQG]; BCMOE 2014). In addition to monitoring required as part of the Mount Polley CEMP, benthic invertebrate community monitoring is required as part of Environmental Effect Monitoring (EEM) under the Metal Mining Effluent Regulations (MDMER) of the federal *Fisheries Act*.

The following sections of the CEMP Benthic Invertebrate Monitoring Plan provide the objectives of benthic invertebrate community and tissue quality monitoring, a summary of historical benthic invertebrate findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for benthic invertebrate community and tissue quality monitoring (quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of benthic invertebrate monitoring is to evaluate the influence of Mount Polley Mine activities on benthic invertebrate communities, productivity, and tissue quality in receiving environments (Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines; BCMOE 2014) and to aquatic ecosystem health by providing supporting information for the assessment of potential effects to higher trophic levels (e.g., fish and fish habitat quality; Section 6.16). Benthic invertebrate monitoring also provides data to support exposure assessment as part of the ecological risk assessment (ERA) and human health risk assessment (HHRA). Benthic invertebrate community monitoring is also required as part of Environmental Effect Monitoring (EEM) under the Metal and Diamond Mining Effluent Regulations (MDMER) of the federal *Fisheries Act* (Government of Canada 2018). The objective of the MDMER EEM benthic invertebrate monitoring is to evaluate whether there are effects to benthic invertebrate community characteristics between the area of



Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012a).

2 SUMMARY OF HISTORICAL FINDINGS

Benthic invertebrate community has been monitored in the vicinity of the Mount Polley Mine since 1989, and benthic invertebrate tissue quality has been monitored since 2009. The majority of benthic invertebrate community and tissue quality samples have been collected from Polley Lake, Bootjack Lake, Quesnel Lake, Hazeltine Creek, and Edney Creek (Tables 1 and 2).

Benthic invertebrate community sampling in the vicinity of the Mount Polley Mine has spanned the four distinct time periods listed below:

1. Baseline monitoring (1989, 1995, 1996);
2. Pre-breach operational monitoring (1999, 2007, 2009, 2010, 2012, 2013);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge monitoring (2016, 2017).

Benthic invertebrate tissue quality sampling in the vicinity of the Mount Polley has spanned operational time periods only (time periods 2 to 4). Data collected prior to the breach were summarized in a Technical Assessment Report (MPMC 2009) and an Aquatic Environmental Description Report (Minnow 2014a) prepared concurrently with applications for water discharge in 2009 and 2014, respectively. General findings associated with baseline, pre-breach, post-breach operational, and post-breach post-discharge monitoring are summarized, by sampling area, in the following sections.

2.1 Polley Lake

2.1.1 Community

The benthic invertebrate community of Polley Lake during baseline studies (Table 1; 1995 and 1996; HKP 1996, 1997) and pre-breach operational monitoring (1999; Beak 2000) was characterized by a dominance of Chironomidae (midges) and Oligochaeta (worms) in the two deep basins of the lake (P1 and P2). A temporal increase in density and richness at these stations was observed between baseline period and pre-breach operational monitoring, but due to unavailability of detailed sample collection and laboratory methods for baseline studies (e.g., HKP 1996, 1997) the reason for this difference is not clear (Minnow 2014a).

Following the TSF embankment breach, the benthic community in Polley Lake differed dramatically from conditions prior to the breach (1999; Beak 2000) and from reference in both deep basins of the lake (Figure 1). Specifically, no benthic organisms were present in the south basin (POL-P2) indicating an unequivocal impact, and organism density and taxon richness in the

Table 1: History of Benthic Invertebrate Community Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
1989	Polley Lake, Bootjack Lake	Imperial Metals 1990
1995	Polley Lake, Bootjack Lake	HKP 1996
1996	Polley Lake, Bootjack Lake	HKP 1997
1999	Polley Lake, Bootjack Lake, Jacobie Lake	Beak 2000
2007	Quesnel Lake	Minnow 2009
2014	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2015a
2015	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2016b
2016	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2016e, 2017a
2017	Quesnel Lake	Minnow 2018a

B) Creeks

Year	Locations	Report
1995	Bootjack Creek, Edney Creek, Edney Creek Tributaries, Hazeltine Creek	HKP 1996
1996	Bootjack Creek, Edney Creek, Edney Creek Tributary, Hazeltine Creek	HKP 1997
1999	Edney Creek, Edney Creek Tributary, Bootjack Creek, Jacobie Creek, Hazeltine Creek, Morehead Creek	Beak 2000
2002	Edney Creek	Morrow/Azimuth 2003
2007	Edney Creek, Edney Creek Tributary, Hazeltine Creek, Whiffle Creek, Bootjack Creek, Cedar Creek	Minnow 2009
2013	Bootjack Creek	Minnow 2014b
2014	Blackwater Creek, Clearwater River, Cariboo River, Quesnel River	Minnow 2015a
2015	Edney Creek, Hazeltine Creek, Cariboo River, Quesnel River	Minnow 2016b
2016	Edney Creek	Minnow 2017a
2017	Edney Creek, Hazeltine Creek, Frypan Creek	Minnow 2018a

Table 2: History of Benthic Invertebrate Tissue Chemistry Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
2009	Main Embankment Seepage Pond, Polley Lake	Minnow 2011
2012	Bootjack Lake, Frypan Lake, Main Embankment Seepage Pond, Polley Lake, Quesnel Lake, Trio Lake	Minnow 2013a
2015	Bootjack Lake, Polley Lake, Quesnel Lake	Minnow 2016a
2016	Bootjack Lake, Polley Lake, Quesnel Lake	Minnow 2017b

B) Creeks

Year	Locations	Report
2009	Hazeltine Creek	Minnow 2011
2010	Hazeltine Creek	Minnow 2011
2012	Hazeltine Creek, Edney Creek, North Dump Creek	Minnow 2013a
2013	Edney Creek, Hazeltine Creek, Jacobie Creek, Morehead Creek , Trio Creek	Minnow 2013b
2014	Cariboo River, Blackwater Creek, Clearwater River, Quesnel River	Minnow 2015a
2015	Edney Creek, Hazeltine Creek, Cariboo River, Quesnel River	Minnow 2016a
2016	Edney Creek, Hazeltine Creek	Minnow 2017b
2017	Edney Creek , Hazeltine Creek	Minnow 2018b

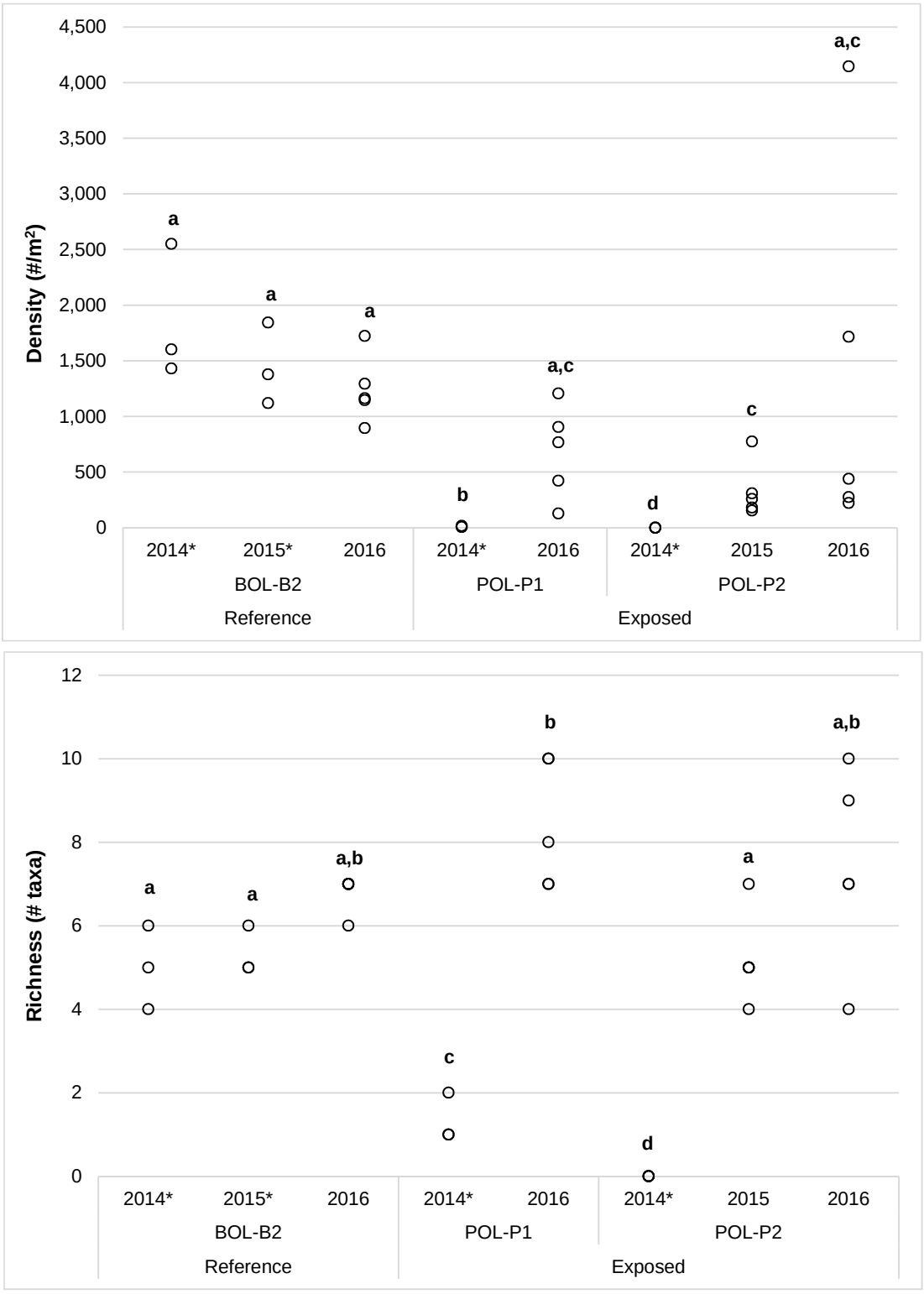

Figure 1: Benthic Invertebrate Community Endpoints in Polley Lake Deep Areas, Mount Polley Mine, 2014-2016 [a]

[a] Values shown beside data points indicate number of stations sharing a similar result. Areas not sharing a letter differed significantly ($p < 0.1$).

* Sample size = 3 indicated by an asterisk, all other sample sizes = 5.

north basin (POL-P1) was also substantially impacted (9 to 17 organisms/m^2; 1 to 2 taxa, respectively) relative to reference (1,431 to 2,551 organisms/m^2; 4 to 6 taxa, respectively) and pre-breach conditions (300 to 614 organisms/m^2; 10 to 15 taxa; Figure 1; Minnow 2015a). Benthic invertebrate community monitoring completed in 2015 and 2016 indicated substantial recovery of the benthic community in both deep basins of Polley Lake relative to 2014 conditions. Organism density (mean = 686 to 1,360 organisms/m^2) and taxon richness (mean = 7.4 to 8.4 taxa) at both areas in 2016 were similar to reference, and density was similar to pre-breach conditions as determined by Before-After/Control-Impact analysis (1999 and 2016; Minnow 2017a). Some differences in community composition relative to reference were observed in 2015 and 2016 (Minnow 2016b, 2017a); however, the primary difference (lower relative proportion of *Chaoborus* in Polley Lake in comparison to reference) was observed prior to the embankment breach (i.e., Beak 2000).

2.1.2 Tissue Quality

Benthic invertebrate tissue quality in Polley Lake was not assessed as part of baseline studies (1989-1996; Table 2). Selenium-specific aquatic environmental monitoring was initiated in 2009 after an uncontrolled surface runoff event from the north waste rock dump which reported to Polley Lake via North Dump Creek (Minnow 2011; see CEMP Sections 6.12 and 6.16). This runoff started in 2006, was controlled in 2009 with the construction of the Long Ditch, and was characterized by elevated concentrations of sulphate and selenium. Mean selenium concentrations observed during pre-breach operational monitoring (2009 and 2012; 6.0 to 7.8 mg/kg dw) were greater than reference and the interim BCWQG of 4 mg/kg dry weight, and were generally similar among sampling years (Figure 2; Minnow 2011, 2013a).

Following the TSF embankment breach, mean benthic invertebrate concentrations of selenium remained significantly higher than the BCWQG and reference, but were significantly lower in 2016 (5.4 mg/kg dw) relative to 2009 and 2012 indicating no breach-related increase (Figure 2; Minnow 2017b). Benthic invertebrate tissue quality investigations following the TSF embankment breach were also focussed on a suite of analytes identified as indicative of the chemical influence of the breach on sediment quality in the receiving environment (Minnow 2015a): Parameters of Interest (POIs: arsenic, copper, iron, manganese, nickel, and zinc), and Indicator Parameters (IPs: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium). Mean concentrations of a number these POIs and IPs were higher than reference in 2015 (manganese, tin, and titanium), in 2016 (arsenic, iron, and vanadium), and in both 2015 and 2016 (copper and molybdenum; Minnow 2016a, 2017a). In particular, mean benthic invertebrate copper concentrations were approximately 5.8 to 6.9 times higher than reference (Figure 3). These results are not unexpected, given that sediment copper concentrations were approximately

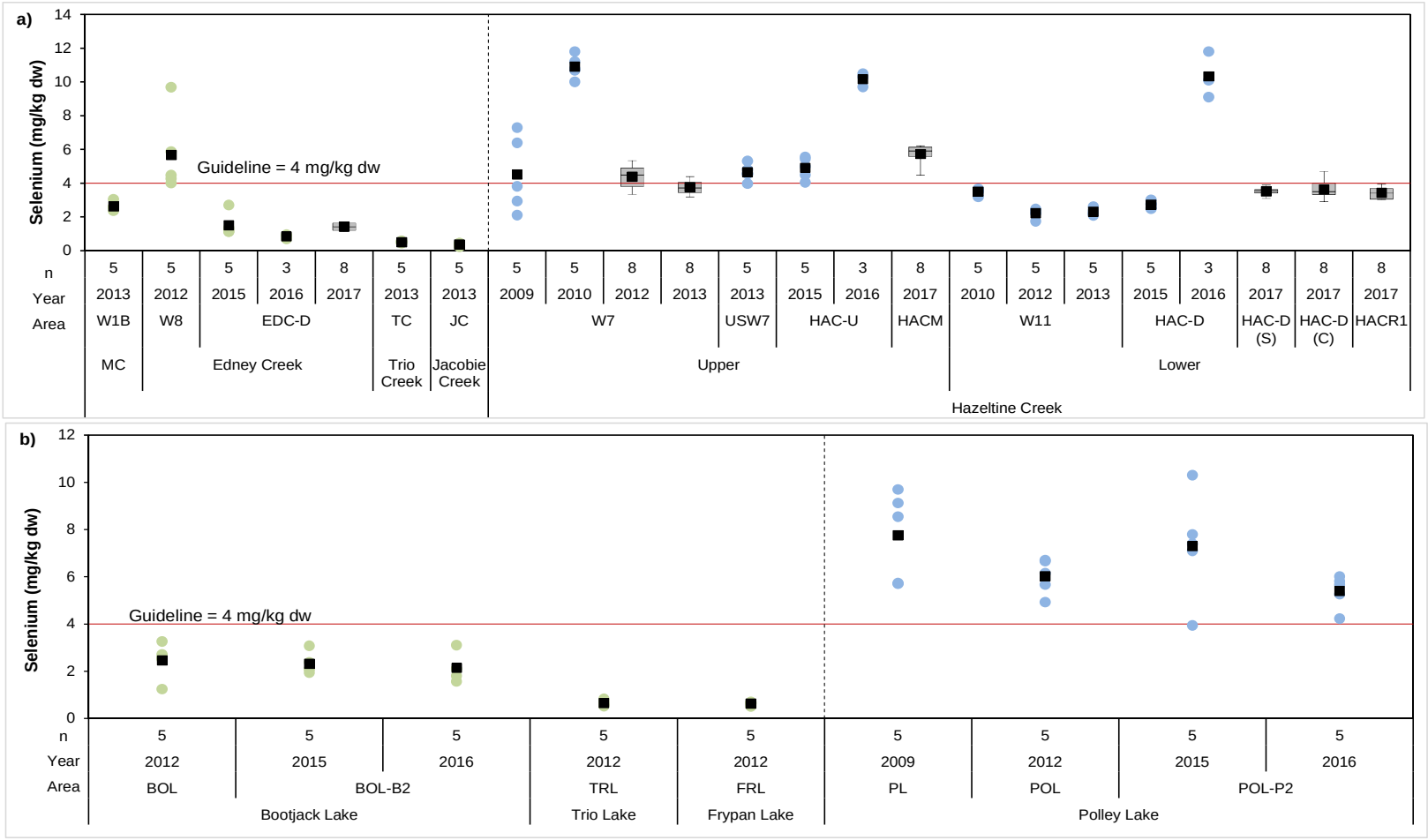

Figure 2: Selenium Concentrations in Benthic Invertebrate Tissue at a) Hazeltine Creek and b) Polley Lake with Associated Reference Areas, Mount Polley, 2009 to 2017

Notes: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.
MC = Morehead Creek.
S = Stonefly single taxon sample.
C = Caddisfly single taxon sample.

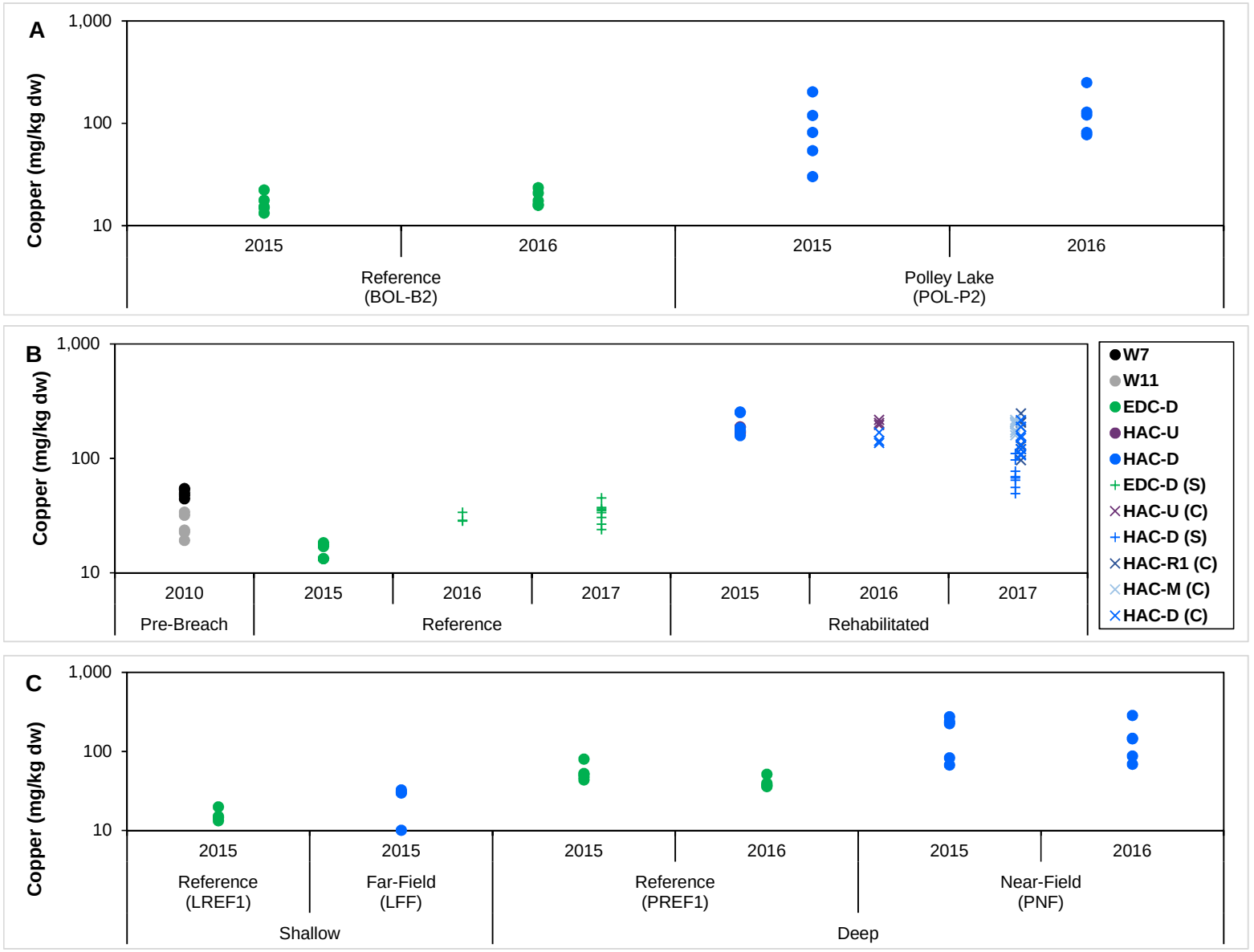

Figure 3: Benthic Invertebrate Tissue Copper Concentrations at A) Polley Lake, B) Hazeltine Creek, C) Quesnel Lake and Associated Reference Areas in the Vicinity of the Mount Polley Mine, 2009 to 2017

Notes: Dots indicate composite-taxa results, + symbols indicate stonefly samples, and × symbols indicate caddisfly observations. For lakes, non-depurated results are shown.

twice reference values (see CEMP Section 6.12). Although whole benthic invertebrate tissue concentrations accurately represent concentrations associated with food for higher trophic level organisms that consume benthic invertebrates, they may not accurately represent metal concentrations in the tissues of benthic organisms due to a known confounding influence of gut content on the determination of tissue metal concentrations in invertebrates, and therefore on the evaluation of potential biological effects associated with these metal concentrations (i.e., Chapman 1985, 2016). Metal concentrations were evaluated in both depurated and non-depurated benthic invertebrate samples in 2016 from Polley Lake in order to minimize the confounding influence of gut content. However, depuration made little difference to results (Minnow 2017a). Due to the uncertainties associated with depositional benthic invertebrate tissue monitoring, and similarities with results of other sampling methods (Diffusive Gradients in Thin Films [DGT] devices), DGTs will be used to monitor temporal changes in labile metal concentrations in Polley Lake (see CEMP Section 6.12).

Ratios of benthic invertebrate tissue metal concentrations to sediment concentration ([benthic invertebrate sample]/[sediment]) are referred to as Biota Sediment Accumulation Factors (BSAFs) and are often used to describe the accumulation of sediment-associated analytes in tissues of ecological receptors (i.e., Burkhard 2009). BSAFs for benthic invertebrate tissues from Polley Lake were generally higher than reference following the TSF embankment breach, however remained stable between 2015 and 2016, as did benthic invertebrate tissue chemistry results (Minnow 2016a, 2017a). The only exception was copper, with BSAF results indicative of greater bioavailability in 2016 versus 2015 (Minnow 2017a). Continued monitoring of potential temporal changes in labile metal concentrations in Polley Lake will be implemented using DGTs, which are not subject to the confounding influences (i.e., gut content) described for benthic invertebrate tissue quality monitoring.

2.2 Hazeltine and Edney Creeks

2.2.1 Community

The benthic invertebrate community of Hazeltine Creek was relatively stable between baseline studies in 1995, 1996 (HKP 1997, 1997), and operational monitoring in 1999 (Beak 2000) and 2007 (Minnow 2009), although unusual methodologies were applied to data collection in the 1996 baseline that appeared to affect results of certain endpoints such as density and the proportions of different taxon groups (MPMC 2009). Overall, benthic communities in both upper and lower Hazeltine Creek (with the exception of 1996 data) had high organism densities (25,000 to 43,000 and 6,000 to 33,000 organisms/m^2, respectively) and taxon richness (36 to 50 and 26 to 46 taxa, respectively) with a high proportion of metal sensitive taxa of the orders Ephemeroptera,

Plecoptera, and Trichoptera (EPT; mayflies, stoneflies, and caddisflies) indicating good ecosystem health (Minnow 2014a).

Monitoring in 2015 following the TSF embankment breach indicated that benthic invertebrate community recovery was incomplete and the community was dominated by pollution tolerant organisms (e.g., blackflies and oligochaete worms), particularly in the upper creek area (Minnow 2016b). In lower Hazeltine Creek, further recovery was documented in 2017, evidenced by taxon richness similar to reference (28 to 40 taxa) and a proportion of sensitive EPT taxa similar to reference and historic conditions despite significantly lower organism density (3,738 to 5,788 organisms/m^2; Figure 4). Productivity monitoring initiated in 2017 corroborated the low organism density, with biomass in lower Hazeltine Creek (0.70 to 2.5 g/m^2 dw) below that of upper Hazeltine Creek (2.9 to 20 g/m^2 dw) and reference (5.5 to 33 g/m^2 dw; Minnow 2018a). In upper Hazeltine Creek, the benthic community documented in 2017 (approximately one year following completion of final rehabilitation activities) was dominated primarily by Trichoptera (caddisflies), and to a lesser degree by Ephemeroptera (mayflies), and Chironomidae. The presence of these sensitive taxa suggests limited chemical effect on recolonization, and total organism abundances similar to reference in 2015 indicate a benthic community supportive of fish habitat productivity (Figure 4; Minnow 2018a).

Similar to Hazeltine Creek, the benthic invertebrate community of Edney Creek was evaluated during baseline studies in 1995, 1996 (HKP 1996, 1997), and during the pre-breach operational time period in 1999 (Beak 2000), 2002 (Morrow/Azimuth 2003), and again in 2007 (Minnow 2009). Benthic invertebrate communities appeared to be relatively stable over this time (with the exception of the 1996 data discussed above), with organism densities of 15,500 to 62,000 organisms/m^2 and taxon richness of 32 to 55 taxa, and a relatively high proportion of metal sensitive EPT taxa (MPMC 2009; Minnow 2014a).

Monitoring following the TSF embankment breach indicated recovery of the benthic invertebrate community between 2015 and 2017 in the rehabilitated area of lower Edney Creek. Specifically, although organism density was lower than reference in 2017 (due mainly to an increase in density at the reference area), taxon richness in 2016 and 2017 was similar to reference (Figure 4), and the relative proportion of Trichoptera increased significantly between 2016 and 2017 while the proportion of Chironomidae decreased, which is indicative of recovery (Minnow 2018a). Initial benthic invertebrate productivity sampling in 2017 indicated that total biomass in the rehabilitated area of lower Edney Creek (0.44 to 3.37 g/m^2 dw) was slightly lower than reference (0.79 to 3.44 g/m^2 dw; Minnow 2018a).

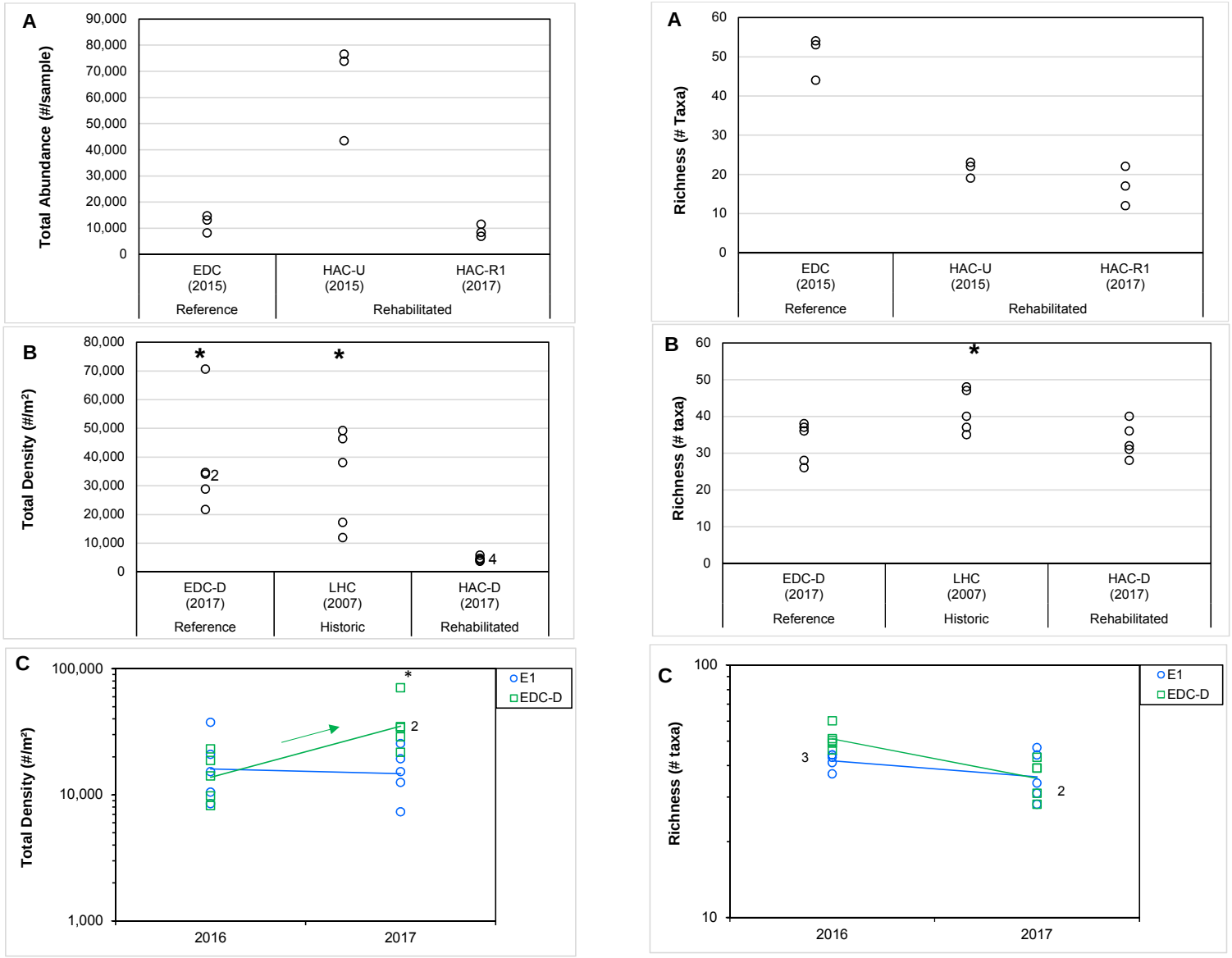

Figure 4: Benthic Invertebrate Community Endpoints for Rehabilitated Areas of A) Upper Hazeltine Creek (Kick-and-Sweep Sampling), B) Lower Hazeltine Creek (250 µm Surber Sampling), C) Lower Edney Creek (250 µm Surber Sampling), and Associated Reference Areas in the Vicinity of the Mount Polley Mine, 2007 to 2017[1]

Notes: For Lower Hazeltine Creek, areas displayed with an asterisk differed significantly from HAC-D (2017, $P < 0.1$). For Lower Edney Creek, statistical comparisons were conducted using a two-way ANOVA with factors Area and Year (* = significant difference ($\alpha = 0.1$) between areas for the given year; ** = significant difference ($\alpha = 0.1$) between areas in 2017 and magnitude of effect is different from ~~2016;~~ ► = significant ($\alpha = 0.1$) year effect ~~for E1~~► = significant ($\alpha = 0.1$) year effect for EDC-D).

[1] Values shown beside data points indicate number of stations sharing a similar result.

2.2.2 Tissue Quality

Benthic invertebrate tissue quality monitoring in Hazeltine Creek was initiated in 2009 as part of the ongoing characterization of selenium incorporation into the aquatic food chain in the vicinity of the Mount Polley Mine. Throughout the pre-breach operational period (2009 to 2013) mean benthic invertebrate tissue selenium concentrations at erosional habitats in upper Hazeltine Creek were higher than the interim BCWQG (4 mg/kg dw; BCMOE 2014) and generally higher than reference, while mean concentrations at erosional habitats in lower Hazeltine Creek were below the BCWQG (Figure 2; Minnow 2011, 2013a,b). In addition, selenium concentrations in benthic invertebrates from exposed erosional habitats were noted to be higher than those from nearby depositional areas (Minnow 2011, 2013b).

Following the TSF embankment breach, data interpretation focused on the POIs and IPs identified in Section 2.1.2 (which included selenium). In 2015 prior to initiation of effluent discharge to Hazeltine Creek, mean tissue concentrations of a number of these POIs and IPs were significantly higher in Hazeltine Creek than reference (arsenic, copper, iron, manganese, nickel, barium, calcium, cobalt, selenium, silver, sodium, strontium, titanium, and vanadium; Minnow 2016a). In addition, concentrations of copper and vanadium were higher in both upper and lower Hazeltine Creek areas relative to pre-breach conditions (3.5 and 8 times for copper, respectively; Figure 3; Minnow 2016a), whereas selenium concentrations were similar to pre-breach conditions (Figure 2). Examination of Bioconcentration Factors (BCFs; which are used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet; i.e, Arnot and Gobas 2006), indicated suggested that bioavailability did not differ from pre-breach conditions (Minnow 2016a).

Effluent was discharged directly to Hazeltine Creek between December 2015 and November 2017, however Hazeltine Creek was not considered to be fish habitat during this time by Fisheries and Oceans Canada (Golder 2015a) and was inaccessible to fish. Mean selenium concentrations in benthic invertebrates from Hazeltine Creek were higher than the majority of pre-breach results and the BCWQG in 2016 (10 mg/kg dw in both upper and lower Hazeltine Creek; Figure 2; Minnow 2017b), however these tissue concentrations corresponded with elevated mean dissolved selenium concentrations related to the conveyance of effluent that were 143-times higher than reference, and at least 46-times higher than at the same locations prior to the breach (Minnow 2013a, Minnow 2017b). Mean concentrations in 2017 were more similar to pre-breach results and were below the BCWQG in lower Hazeltine Creek (mean = 3.4 to 5.7 mg/kg dw; Figure 2; Minnow 2017b), presumably due to limited effluent discharge in 2017. Tissue concentrations of a number of POIs and IPs at effluent-exposed sampling areas were significantly

higher than reference in 2016[2] (barium, manganese, strontium, titanium), in 2017 (calcium), and in both years (arsenic, cobalt, copper, iron, molybdenum, nickel, selenium, vanadium; Minnow 2017b, 2018b). In particular, copper concentrations during this effluent discharge period (49 to 217 mg/kg dw) were elevated above reference and pre-breach concentrations but were generally similar to 2015 (prior to discharge; 158 to 254 mg/kg dw; Figure 3). Examination of BCFs indicated higher copper bioavailability relative to reference during the effluent discharge period (Minnow 2017b, 2018b), which was consistent with findings of higher labile copper concentration determined by DGTs (Minnow 2017c). Direct effluent discharge to Hazeltine Creek ceased in January 2018 prior to the reopening of upper Hazeltine Creek as fish habitat in spring 2018.

2.3 Quesnel Lake

2.3.1 Community

Benthic invertebrate community data for Quesnel Lake collected prior to the TSF embankment breach are limited to a few samples collected near the mouth of Hazeltine Creek in 2007 (Table 1). These data documented a mean density of approximately 31,100 organisms/m^2 and a mean taxonomic richness of 30 (Minnow 2009).

Benthic invertebrate community monitoring following the TSF embankment breach indicated that impacts to the community in shallow habitats were primarily limited to near-field areas and did not extend to far-field areas (Minnow 2015a). Impacts to the benthic community of the near-field area documented in 2014 included significantly lower mean organism density (159 to 294 organisms/m^2) and taxon richness (5.6 to 10 taxa) than reference (1,400 to 7,900 organisms/m^2 and 19 to 21 taxa, respectively; Minnow 2015a). Further monitoring in 2016 and 2017 confirmed these impacts, and indicated that limited recovery had occurred relative to: 1) a fine substrate reference with aquatic vegetation (2016; Minnow 2017a); and 2) two shallow sandy reference areas which more closely matching the habitat present in the near-field area in 2016 and 2017 (2017; Minnow 2018a). Benthic biomass sampling initiated in 2017 corroborated these results, with significantly lower biomass at the near-field area (mean = 0.28 g/m^2 ww) than reference (mean = 1.0 to 3.6 g/m^2 ww; Minnow 2018a).

Sediment investigations following the TSF embankment breach indicated that the majority of breach-derived material was deposited to deep habitat of Quesnel Lake (Minnow 2015a,b, 2016c). Immediately following the TSF embankment breach (2014), benthic invertebrate communities in deep exposed areas were characterized by particularly low mean organism

[2] Benthic invertebrate tissue quality results reflect single-taxon samples in 2016 and 2017 (caddisflies and/or stoneflies), and composite-taxa samples in 2015.

densities at the exposed near-field (PNF; 39.7 organisms/m^2) and far-field areas (3.4 to 22.6 organisms/m^2) relative to reference (5,840 organisms/m^2), and significantly lower mean taxon richness (0.2 to 2.6 taxa at near-field and far-field areas, 7.8 taxa at reference; Figure 5). Overall, results suggested that the biological effects were breach-related, but it was uncertain whether the effects were physical (due to smothering and/or low dissolved oxygen and low TOC content) or chemical (Minnow 2015a). Monitoring in 2015 and 2016 documented some recovery in mean organism density at the near-field (216 to 588 organisms/m^2 in 2015 and 2016, respectively), and far-field areas (266 organisms/m^2 in 2016; Figure 5), however density remained significantly lower than reference (Figure 5; Minnow 2016b, 2017a). Recovery of taxon richness was also documented (particularly at the near-field area; 4.6 to 6.2 taxa in 2015 and 2016, respectively), although differences in community composition remain (Minnow 2017a). Sediment transplant experiments indicated an increase in organism density and richness in exposed area sediment transplanted to the reference area, suggesting that sediment quality is not prohibitive of re-colonization (Minnow 2016b).

2.3.2 Tissue Quality

Benthic invertebrate tissue quality in Quesnel Lake was not assessed as part of baseline studies (1989-1996) for the Mount Polley mine (Table 2). Monitoring was initiated in 2012 as part of the ongoing characterization of selenium incorporation into the aquatic food chain in the vicinity of the Mount Polley Mine (see Sections 2.1.2 and 2.2.1). Sampling documented mean tissue selenium concentrations below the BCWQG in all areas of Quesnel Lake; 1.7 mg/kg dw near the Hazeltine Creek outlet, and 2.1 mg/kg dw at a reference area in the north arm of the lake (Minnow 2013a).

Following the TSF embankment breach, mean concentrations of all analytes identified as POIs and IPs in benthic invertebrate tissue (see Section 2.1.2) at the exposed shallow and deep areas of Quesnel Lake were similar to reference (including selenium), with the exception of copper which was significantly higher than reference at the deep exposed area in both 2015 and 2016 (147 to 178 mg/kg dw at exposed areas; 40 to 54.9 mg/kg dw at reference; Figure 3; Minnow 2016a, 2017b). As described previously (Section 2.1.2), these elevated benthic invertebrate concentrations could be attributed to higher sediment copper concentrations observed in this area and the confounding influence of gut contents (i.e., Chapman 1985; 2016). BSAFs for copper in the Quesnel Lake deep areas indicated relatively similar bioavailability between the exposed and reference areas (Minnow 2016a, 2017b), which is consistent with results of labile copper concentrations determined by DGTs (Minnow 2016d, Minnow 2017c).

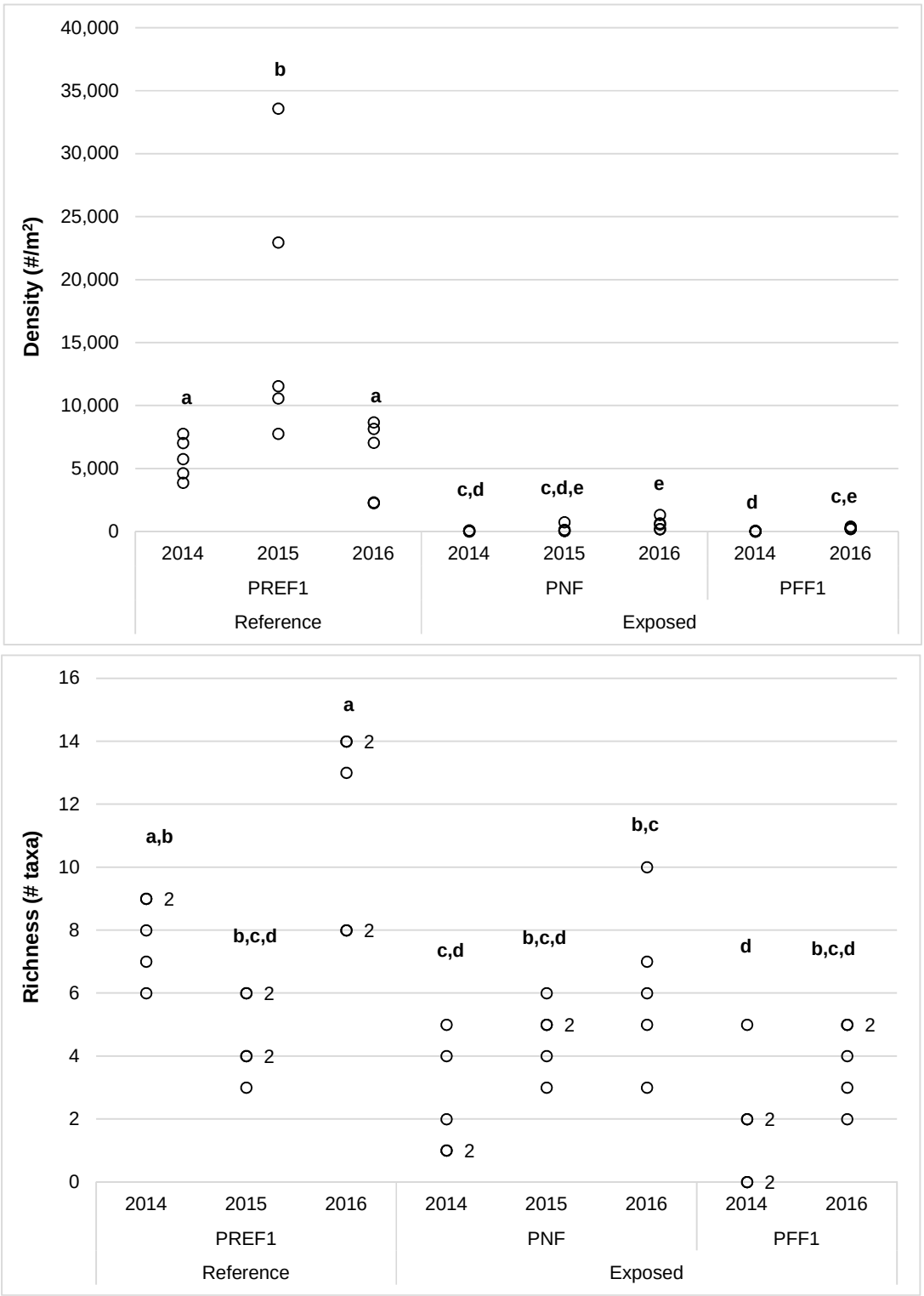

Figure 5: Benthic Invertebrate Community Endpoints in Quesnel Lake Deep Areas, Mount Polley Mine, 2014-2016 [a]

[a] Values shown beside data points indicate number of stations sharing a similar result. Areas not sharing a letter differed significantly ($p < 0.1$).

Note: Sample size = 5.

3 STUDY DESIGN OVERVIEW AND RATIONALE

Benthic invertebrate monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed benthic invertebrate monitoring program is provided in Table 3, and includes benthic invertebrate community, productivity, and tissue quality. Benthic invertebrate monitoring is focused on Polley Lake, Hazeltine Creek, lower Edney Creek, Quesnel Lake, and associated reference areas (Figures 6 and 7).

3.1 Community and Productivity

3.1.1 Lakes

Benthic invertebrate community monitoring in lakes is focused on Polley Lake and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake; Table 3; Figure 6). In Polley Lake, benthic invertebrate community sampling will focus on the two basins (deepest locations in Polley Lake, representing locations of sediment accumulation/fate, and long-term monitoring locations), with the deepest location in Bootjack Lake serving as reference. In Quesnel Lake, benthic invertebrate community sampling for MDMER EEM will focus on the area near the point of effluent discharge (per Minnow 2016e) with two areas serving as reference (one unaffected by the breach and one affected by the breach but outside of the influence of effluent discharge; Minnow 2018c). Sediment investigations following the TSF embankment breach indicated that the majority of breach-derived material was deposited to deep habitat of Quesnel Lake (Minnow 2015a,b, 2016c), therefore benthic invertebrate community sampling in Quesnel Lake will focus on the deep areas that were previously monitored as near-field and far-field areas, with concurrent sampling of suitable reference areas.

Benthic invertebrate community sampling will be completed in August or September using a petite-ponar, consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2015a, 2016b,e, 2017a), and with technical guidance (e.g., Environment Canada 2012a; BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting. Sampling will be supported by sediment quality sampling (see CEMP Section 6.12), measurements of *in situ* water quality near the sediment-water interface (temperature, dissolved oxygen, pH, and specific conductance), water depth, GPS coordinates, and supporting photographs at all sampling stations. Data

Table 3: Mount Polley CEMP Benthic Invertebrate Monitoring Program Overview

A) Lakes

Water Body	Sampling Area	Type	Components [a]	Replication [b]	Rationale
Polley Lake	POL - P1 (Northwest Basin)	Exposed	T	5	immediately adjacent to mine and breach-influenced
	POL - P2 (Southeast Basin)	Exposed	T	5	immediately adjacent to mine and breach-influenced
Bootjack Lake	BOL - B2 (Southeast Basin)	Reference	T	5	reference for Polley Lake
Quesnel Lake	QUL - EEMNF	Exposed	T	5	adjacent to effluent discharge and breach-influenced
	QUL - EEMREF1	Reference	T	5	reference for EEMNF - breach-influenced reference
	QUL - EEMREF2	Reference	T	5	reference for EEMNF - non-breach-influenced reference
	QUL - PNF	Exposed	T	5	breach-influenced deep habitat
	QUL - PFF1	Exposed	T	5	breach influenced deep habitat
	QUL - PREF1	Reference	T	5	reference for exposed deep habitat areas of Quesnel Lake

[a] Core benthic invertebrate monitoring components: T = community taxonomy (Lowest-Practicable-Level).
[b] Number of replicate stations within the specified sampling area.

B) Creeks

Water Body	Sampling Area	Type	Monitoring Frequency	Components [a]	Replication [b]			Rationale
					T	P	C	
Hazeltine Creek	HAC-R1 (Upper, Reach 1)	Exposed	Annual	T,P,C	5	5	8	adjacent to mine and breach-influenced
	HAC-U (Upper)	Exposed	Annual	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
	HAC-D (Lower)	Exposed	Bi-annual [c]	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
Frypan Creek	FPC-R3 (Reach 3)	Reference	2018 only	P, C	-	5	8	reference for upper Hazeltine Creek
Edney Creek	EDC-U (Upper)	Reference	Annual	T,P,C	5	5	8	reference for upper Hazeltine Creek
	E1 (Lower)	Exposed	Bi-annual [c]	T,P	5	5	-	adjacent to mine and breach-influenced
	EDC-D (Lower, unimpacted)	Reference	Bi-annual [c]	T,P,C	5	5	8	reference for lower Hazeltine Creek [d]

[a] Core benthic invertebrate monitoring components: T = community taxonomy (Lowest-Practicable-Level), P = productivity (wet and dry benthic biomass), and C = chemistry (see Table 4 for analytes).
[b] Number of replicate stations within the specified sampling area for a given program component.
[c] Bi-annual indicates sampling will occur every other year for all parameters indicated with the exception of tissue chemistry, which will be monitored annually. The next bi-annual sampling event will occur in 2019.
[d] Lower Edney Creek reference area will be located in an unimpacted area upstream of the breach influence (see Figure 7).

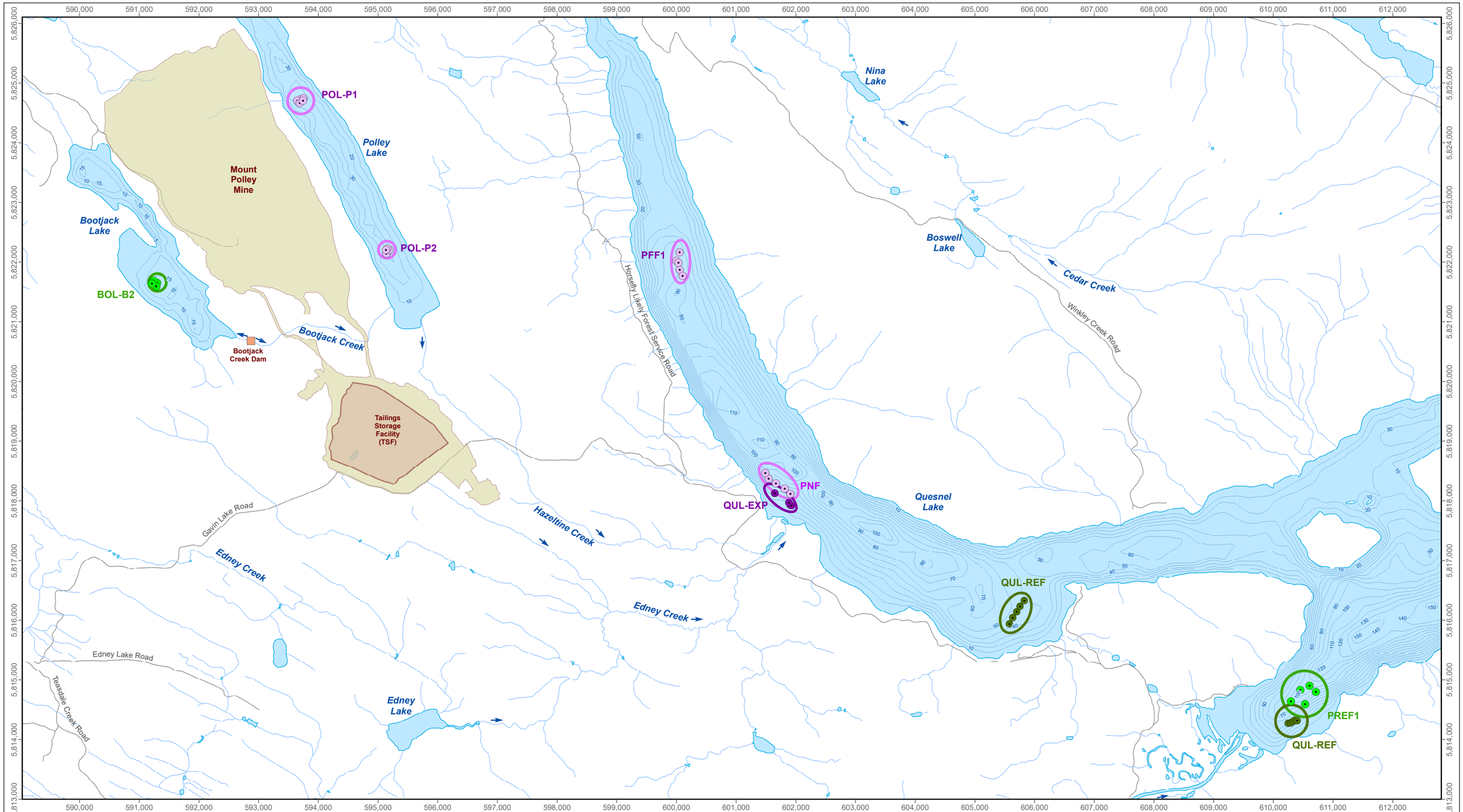

Benthic Invertebrate Monitoring Station

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Benthic Invertebrate Monitoring Area

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Please note: Quesnel Lake bathymetry lines are an approximate representation only and may not precisely delineate accurate depths at larger scales.

0 1 2 4
km

N
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Projection: North American Datum 1983 UTM Zone 10U
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Mount Polley CEMP Benthic Invertebrate Monitoring Location, Lakes

Date: June 2018
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minnow environmental inc. A Knight Consultants Company

Figure 6

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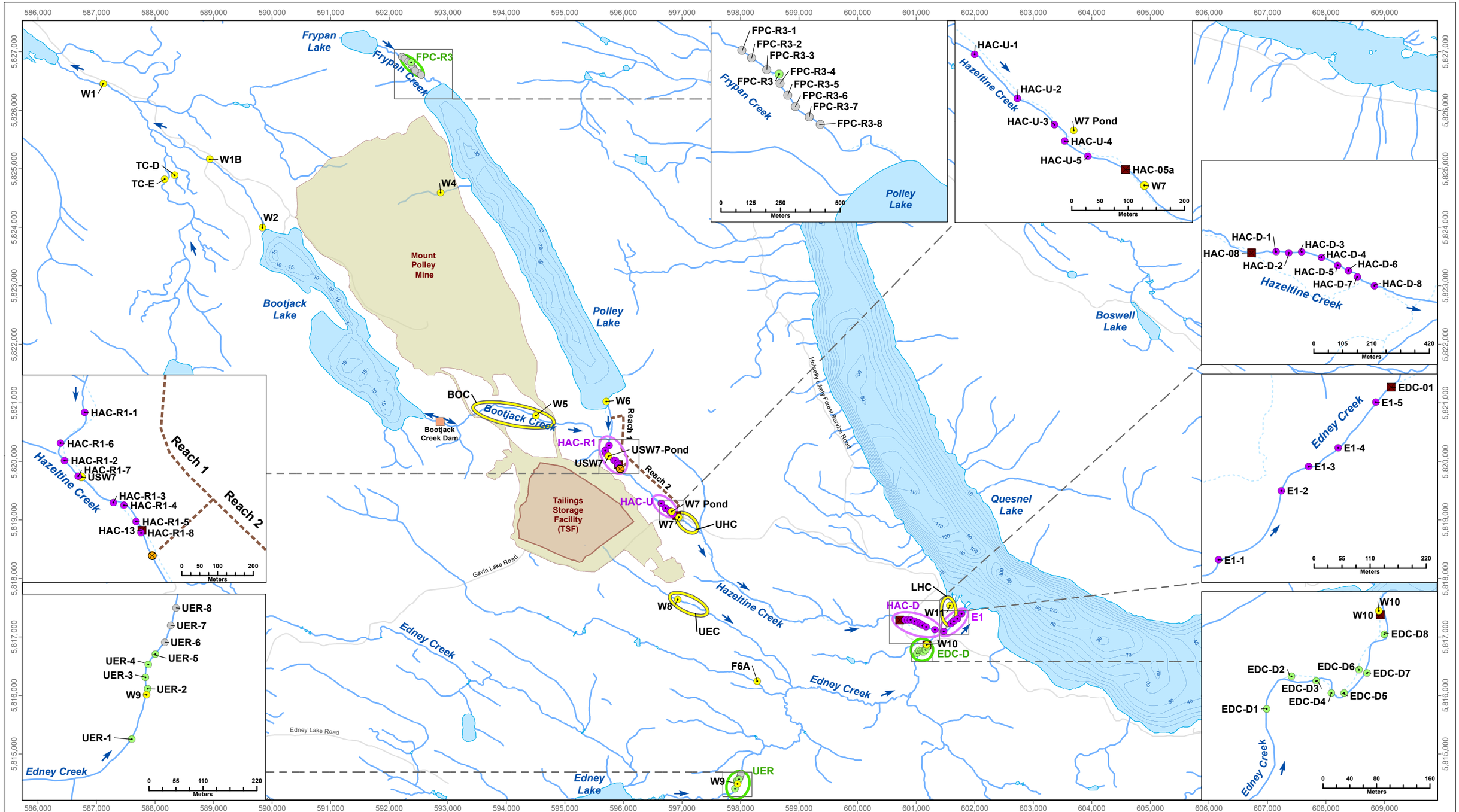

Benthic Invertebrate Monitoring Station
- Rehabilitated
- Reference
- Pre-Breach (n ≥ 5 at location)
- Conceptual

- Effluent Discharge from 2014 to 2017
- Routine Water Quality Station
- Rehabilited Reaches (Golder 2017a,b)
- Tailings Storage Facility
- Active Mine Operation

Benthic Invertebrate Monitoring Area
- Rehabilitated
- Reference
- Pre-Breach (n ≥ 5 within area)
- Historic Watercourse Pathway

Note: Sampling Location may be adjusted from those shown displayed based on field survey information.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Benthic Invertebrate Monitoring Locations, Creeks

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minnow environmental inc.

Figure 7

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\1-Benthos\17-42 Fig 7 MP PER and BI Creek.mxd

interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) statistical comparison to reference conditions. Accordingly, five stations per area are proposed for each sampling area to provide replication for the statistical contrasts.

The frequency of benthic invertebrate community monitoring at the federal EEM sampling areas in Quesnel Lake (to evaluate potential effects of effluent discharge) is initially at a prescribed frequency of every three years, subject to modification based on the findings of at least two EEM phases (Environment Canada 2012a). Additional benthic invertebrate community sampling in Quesnel Lake and Polley Lake (not associated with EEM) will also initially be completed in 2018 and then every three years concurrent with EEM (2018, 2021, etc.). Based on results of benthic invertebrate community monitoring undertaken from 2014 to 2017 which demonstrated some recovery following the TSF embankment breach (see Section 2 for details), and on low sediment deposition rates documented in Polley Lake and Quesnel Lake (see CEMP Section 6.12), it is anticipated that a three-year frequency will be sufficient to track benthic invertebrate recovery. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. These may include further reduction in monitoring frequency if continued recovery of benthic community results relative to reference is demonstrated.

3.1.2 Creeks

Benthic invertebrate community monitoring in creeks is focused on rehabilitated areas of Hazeltine Creek and lower Edney Creek, with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek and lower Hazeltine Creek; Table 3; Figure 7). Benthic invertebrate monitoring in Hazeltine Creek will focus on three areas (Figure 7)[3], including one area in Reach 1 (HAC-R1; where rehabilitation was completed in 2016), one area in Reach 2 (HAC-U; where rehabilitation was completed in 2017), and one area in lower Hazeltine Creek (HAC-D; where initial rehabilitation activities have been completed but additional rehabilitation will be conducted). The locations of sampling areas in upper and lower Hazeltine Creek (HAC-U and HAC-D) are generally consistent with those monitored prior to the TSF embankment breach, as is the location of the upper Edney Creek reference area (UER; Figure 7). Monitoring in lower Edney Creek will focus on one rehabilitated area (E1; where rehabilitation was completed in 2015). Suitable reference areas will be sampled concurrently. In Frypan Creek, the reference sampling area was selected to match habitat

[3] Note that previous creek sampling station locations are presented in Figure 7. These locations may change slightly depending on substrate, water depth, and water velocity. Similarly, conceptual station locations are displayed for Frypan Creek and Upper Edney reference areas, and will be established during the field campaign.

conditions in upper Hazeltine Creek as closely as possible, based on results of preliminary fish habitat assessment and benthic invertebrate monitoring (area selection was based primarily on substrate type and size; Minnow 2018d). The location of all benthic invertebrate community sampling stations will align with those proposed for periphyton monitoring (see CEMP Section 6.15).

Benthic invertebrate community sampling will be completed in August or September using a Hess or Surber sampler[4], consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2009, 2016b, 2017a, 2018a). Detailed methodology is provided in Section 4. All benthic invertebrate community samples collected from creeks will also be evaluated for benthic invertebrate productivity (biomass; through the documentation of benthic invertebrate community sample weight by the laboratory) for the purposes of relating productivity to the assessment of fish habitat. Sampling at each station will be supported by measures of sampling depth, water velocity, in situ water quality measurements (as outlined in Section 3.1.1), GPS coordinates, notes of the presence of aquatic vegetation/bryophytes on sampled substrate and other physical observations, and supporting photographs of the sampling location and samples. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (i.e., Frypan Creek and upper Edney reference). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) statistical comparison to reference conditions. Accordingly, five stations per area are proposed to provide replication for the statistical contrasts.

The initial frequency of benthic invertebrate community and productivity monitoring in Reaches 1 and 2 of upper Hazeltine Creek (and associated reference areas) is annual given the recent disturbance to these rehabilitated areas, and recent reopening of upper Hazeltine Creek as fish habitat to Polley Lake fish. The frequency in rehabilitated areas of lower Hazeltine Creek and lower Edney Creek (and associated reference areas) is every second year because these areas have been undisturbed since 2015 and the benthic community monitoring in these areas has demonstrated recovery (Minnow 2016b, 2017a, 2018a; see Section 2.2). Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. If results indicate stabilizing benthic communities and productivity during this period, then a reduction of monitoring frequency to every second year will be considered for upper Hazeltine Creek areas. The Frypan Creek reference area will only be sampled in 2018 (Table 3) to provide

[4] If sufficient sampling locations with habitat attributes suitable for Hess/Surber sampling cannot be located (particularly in the recently rehabilitated areas of upper Hazeltine Creek), kick and sweep sampling consistent with CABIN guidance (Environment Canada 2012a) may be implemented instead of Hess/Surber sampling.

comparison for benthic community data from upper Hazeltine Creek following the initial reopening of upper Hazeltine Creek as fish habitat (Minnow 2018e).

3.2 Tissue Quality

Benthic invertebrate tissue quality monitoring is focused on upper and lower areas of Hazeltine Creek, with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and lower Edney Creek for lower Hazeltine Creek; Table 3; Figure 7). Benthic invertebrate tissue quality monitoring in Hazeltine Creek is undertaken to monitor the combined influence of uncontrolled surface runoff from the north dump and downstream influence on Hazeltine Creek (which occurred from 2006 to 2009), the conveyance of mine effluent between December 2015 to December 2017, and the TSF embankment breach. Benthic invertebrate tissue quality monitoring will focus on three areas of Hazeltine Creek, including one area in Reach 1 (HAC-R1) and one in Reach 2 (HAC-U) of upper Hazeltine Creek, and one area in lower Hazeltine Creek (HAC-D). As described in Section 3.1.2, the locations of sampling areas in upper and lower Hazeltine Creek are generally consistent with those monitored prior to the TSF embankment breach (Figure 7). It should be noted that sampling areas HAC-U and HAC-D were previously exposed to the discharge of treated mine effluent (December 2015 to December 2017), whereas HAC-R1 is located upstream of the previous discharge point (Figure 7). As of November 2017, treated effluent is no longer discharged into Hazeltine Creek, and upper Hazeltine Creek has been reopened as fish habitat to Polley Lake fish as of spring 2018.

Benthic invertebrate tissue quality sampling will be completed in August or September concurrent with benthic invertebrate community sample collections described in Section 3.1.2, and will be consistent with previous data collections (Minnow 2011, 2013a,b, 2016a, 2017b, 2018b). Tissue samples collected from each station will include one composite-taxa sample that contains a mixture of taxa that is proportional to biomass at the station, and one single-taxon sample[5] (e.g., a sample of only one taxon). Composite-taxa benthic invertebrate tissue samples are reflective of dietary exposure for fish, and can therefore be used in assessment of fish habitat. Alternatively, single-taxon samples are beneficial for limiting variability associated with different benthic invertebrate taxon composition. The collection of both sample types will ensure temporal comparability with previous data collections which have included both composite-taxa and single-taxon tissue samples (e.g., Minnow 2011, 2013a,b, 2016a, 2017b, 2018b). Tissues will be collected for the analytical determination of moisture content, metals, and mercury (Section 4.3.2). Supporting measures at each station will include *in situ* water quality measurements as outlined

[5] Single-taxon sampling will be completed only if adequate sample material from any one taxon can be collected with a reasonable sampling effort.

above (Section 3.1.1), GPS coordinates, physical observations, and supporting photographs. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (i.e., Frypan Creek and upper Edney reference areas). Data interpretation for all parameters will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) comparison relative to BCWQG (i.e., tissue selenium concentrations; BCMOE 2014). A replication level of eight samples per area will be used to support the statistical contrasts.

The initial frequency of benthic invertebrate tissue quality monitoring at Hazeltine Creek (and associated reference areas) is annual given the recent disturbance of upper creek areas related to rehabilitation activities, and changes to the effluent exposure status. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. If results indicate stabilizing or decreasing benthic tissue concentrations during this period, then a reduction of monitoring frequency to every second year will be considered. The Frypan Creek reference area which is included for comparison with upper Hazeltine Creek will be sampled in 2018 only (see Table 3). Benthic invertebrate tissue quality sampling at this reference area will support rainbow trout tissue quality sampling in these areas only in 2018 following the initial reopening of upper Hazeltine Creek as fish habitat (Minnow 2018e).

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of benthic invertebrate community, productivity, and tissue chemistry monitoring programs. All sample collection, quality assurance and quality control, and laboratory analysis methods will be implemented in accordance with technical guidance (BCMOE 2013, 2015, 2016). Specifically, quality assurance and quality control measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the benthic invertebrate tissue quality monitoring program. To capture within-area variability, eight replicate composite-taxa and up to eight replicate single-taxa tissue quality samples will be collected from each sampling area. Field duplicate samples (i.e. splits samples of the benthic invertebrate tissue collected from one sampling station) will be collected for 10% of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). Duplicate water samples will be collected at a frequency of 10% to assess field precision associated with the water samples that support benthic invertebrate community and tissue quality monitoring. In addition to field QA/QC, the laboratory responsible for chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting for tissue quality results will be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). Laboratory Reporting Limits (LRLs) will also be evaluated in comparison to targets established by the analytical laboratory.

QC samples to assess field precision (field duplicates) will not be collected for benthic community or productivity monitoring endpoints due to the high inherent natural variability of these parameters. However, composite benthic invertebrate community samples will be collected at all sampling locations to ensure that each sample is representative of the station. Taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory certified under the Taxonomic Certification Program of the Society for Freshwater Science (SFS; formerly the North American Benthological Society). Quality control for benthic invertebrate taxonomic analyses will be consistent with federal requirements for metal mining EEM (Environment Canada 2012a). Specific QC sampling and associated reporting will be requested from the taxonomic laboratory, including an assessment of sub-sampling error, sorting

efficiency, and identification accuracy (Environment Canada 2012a, 2014). These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Community and Productivity

Benthic invertebrate sampling in lakes for community analysis will be collected using a stainless steel petite ponar grab sampler, consistent with previous monitoring (e.g., Minnow 2015a, 2016b,d, 2017a, 2018a) and in accordance with provincial and federal technical guidance (i.e., BCMOE 2013; Environment Canada 2012a). Briefly, the petite ponar is a 6" x 6" (15.24 cm x 15.24 cm) grab sampler with jaws that can be held open by shear-pressure on a spring-loaded pin. The grab sampler is lowered to the substrate at which point shear-pressure is eliminated and the pin springs out. Upon upward pull at the initiation of retrieval, the jaws of the ponar close to grab surficial sediment. Care must be taken to control the rate at which the petite ponar is lowered to allow appropriate sediment penetration and to minimize sediment disturbance. The petite ponar will be carefully retrieved to surface and each grab will be placed into a plastic tote and observed for completeness and any unusual characteristics. In Quesnel Lake, samples will be retrieved with the assistance of a commercial line hauler (Ace Line Hauler - Brutus Plus 40). Only high quality, comparable samples will be retained. If the sample is deemed acceptable, the sample will rinsed from the ponar into the tub to ensure the complete removal of all material The sample material will then be placed into a 250 µm mesh sieve bag and sieved free of all material less than 250 µm in diameter. At each station, a composite sample of five acceptable grabs will be collected (0.116 m^2 of bottom area in total) to ensure that each sample is representative of the station. After sieving, the retained material (sample) from the five composited grabs will then be carefully transferred to 1 or 2-L wide mouth plastic jars using a wash bottle while working over a plastic tub to avoid any potential loss of organisms. Any organisms that adhere to the inside of the sieve bag will be retrieved and added to the sample jar. Each jar will receive an internal and external label with the station number, area identifier, project number, date, and the initials of the field personnel. Each sample will be preserved with a 10% buffered formalin solution within six hours of collection to eliminate the potential effects of within-sample predation, which could affect abundance estimates. Sampling will be conducted at five replicate stations in each area (see Table 3).

Supporting information collected at all lake sampling stations will include sediment quality measures (see CEMP Section 6.12), GPS (Geographic Positioning System) coordinates; water depth; *in situ* water quality near the sediment-water interface (temperature, dissolved oxygen, pH, and specific conductance), site and sample photographs, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.). In addition, a full vertical profile of the field meter measurements will collected at one station per area. Supporting water samples will also be collected from each sampling area associated with EEM (see Table 3), including samples for total and dissolved constituents (including metals), the latter prepared by field filtration using a 0.45 µm syringe filter. Water samples will be placed into a dedicated cooler with frozen ice packs, and kept cool prior to transport to the field laboratory.

Sampling of benthic invertebrates in creeks for community and productivity analysis will be consistent with previous monitoring (e.g., Minnow 2009, 2016b, 2017a, 2018a), and with technical guidance (BCMOE 2013). A Hess sampler with a 0.1 m^2 diameter and upstream (incurrent) and downstream (excurrent) openings will be used if water depth allows. The incurrent opening will be covered with a mesh to prevent contamination of the sample with organisms from upstream. The excurrent opening will consist of a conical net equipped with 250 µm mesh attached to a removable collection cup that has mesh on the downstream end to allow water to exit. If creek environments are too shallow to accommodate Hess sampling, a Surber sampler (30.5 x 30.5 cm; 0.093 m^2) equipped with 250 µm mesh will be used. Each Hess/Surber sample will be collected by firmly and carefully placing the sampler on undisturbed substrate to a depth of 5 to 10 cm. All cobble and gravel within the sampler area (to a depth of approximately 10 cm) will be scrubbed and the current will be allowed to carry all dislodged organisms into the 250 µm net. The sampler net and collection cup will be rinsed and the contents will be carefully transferred to internally and externally labelled 1 or 2 L wide mouth plastic jars. Any remaining invertebrates found clinging to the sampling equipment will be removed and placed in the sample jar. At each station, one composite sample of three sub-samples (i.e., approximately 0.3 m^2 of creek surface area if a Hess sampler is used, 0.279 m^2 if a Surber sampler is used) will be collected to ensure that each sample is representative of the station. Each sample will be preserved with a 10% buffered formalin solution as described above. Sampling will be conducted at five replicate stations in each area (see Table 3), and each station will be established at a minimum distance of approximately three bankfull widths from adjacent stations, where habitat allows. A concerted effort will be made to

ensure that water velocity, water depth, and substrate characteristics are comparable among sub-samples and among respective stations to minimize natural influences on community variability[6].

Supporting information collected at each creek sampling station will include those parameters listed above for lakes, with the addition of substrate size measurements wherein 100 randomly selected substrate pebbles per station will be measured along their intermediate axis and the percent embeddedness 10% of the pebbles will be recorded, consistent with the CABIN protocol (Environment Canada 2012b). Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (e.g., in Frypan Creek and upper Edney Creek). Water samples will be collected as described above.

4.2.2 Tissue Quality

Benthic invertebrate tissue samples will be collected using a combination of hand picking and kick-and-sweep, consistent with previous monitoring (e.g., Minnow 2011, 2013a,b, 2016a, 2017b, 2018b) and with technical guidance (e.g., BCMOE 2016). Hand picking entails overturning rocks in the streambed and collecting any of benthic invertebrates observed. The kick-and-sweep method involves a field technician moving upstream and across the stream channel (in a zig-zag pattern) while holding a kick net (a net with a triangular opening and a 400 µm mesh bag) immediately downstream, and disturbing the substrate with his or her feet to dislodge benthic organisms into the net (a method modified from the Canadian Aquatic Biomonitoring Network [CABIN] 3-minute travelling kick-and-sweep; Environment Canada 2012b). The net will then be rinsed with water to move all debris and invertebrates to the collection cup at the bottom of the net. The collection cup will be removed and its contents (i.e., invertebrates and debris) will be placed into a plastic tote. Organisms will then be picked free of debris, and transferred into a labeled scintillation vial, without rinsing, to minimize the amount of water in each sample. One composite-taxa sample (containing a mixture of taxa that is proportional to biomass at the station), and one single-taxon sample (containing one taxon only) will be collected at each station. As possible, the taxa selected for the single-taxon samples will be consistent among sampling areas, and consistent with previous monitoring (Minnow 2017b, 2018b). However, single-taxon sampling will only be completed at each station if adequate sample material can be collected with a reasonable sampling effort[7]. Sampling will be conducted at eight replicate stations in each area

[6] If five stations with closely matching habitat attributes cannot be located (particularly in the recently rehabilitated areas of upper Hazeltine Creek), kick and sweep sampling consistent with CABIN guidance (Environment Canada 2012a) may be implemented instead of Hess/Surber sampling.

[7] A reasonable sampling effort will be considered approximately 1 hour per sample. If sample collection is nearly complete within this time frame, additional sampling effort will be applied to complete the sample collection.

(see Table 3). Samples will stored in a cooler containing ice packs for transport to the mine, where they will be frozen.

4.3 Sample Handling and Laboratory Analysis

4.3.1 Community and Productivity

Preserved benthic invertebrate community samples will be stored at room temperature until shipment to the laboratory for taxonomic identification and enumeration. Samples will be shipped with completed Chain-of-Custody (COC) forms immediately after the completion of the field campaign, however there are no recommended hold times for analysis.

Taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory using standard methods that incorporate QA/QC measures (e.g., Environment Canada 2012a; 2014). Upon sample receipt, the laboratory will provide a sample receipt confirmation which will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. All samples will be sieved and processed in the laboratory using the same mesh size as used in during field collections (250 µm), with the exception of those collected for MDMER EEM which will be identified and enumerated based on both the 250 µm and 500 µm fractions (Minnow 2018c). If the estimated number of invertebrates in a sample is greater than 600 individuals and the sample is fine and non-clumping, a subsample will be taken using a Marchant Box (Marchant 1989) as described by Environment Canada (2014). Samples (or sub-samples) will then be sorted using a gridded Petri dish under a low power stereo microscope into family/order while maintaining counts (but totals exclude Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera, and any terrestrial drop-ins). All samples will be processed to a minimum 300 organism count, and if 300 organisms have not been reached by the 50th cell of the Marchant Box, then the entire sample will be sorted (i.e., all 100 cells). All sorted organisms will be stored in 80% ethanol by family/order in separate labeled vials and debris will be preserved and labeled separately. Identifications of all insects to the lowest practicable level (LPL; typically genus or species) and non-insects to the genus/species level (where possible, but to a minimum of family level) will be conducted by experienced, certified taxonomists using up-to-date taxonomic keys, comparisons to an externally-verified reference collection, and effort lists compiled by CABIN, SAFIT (Southwest Association of Freshwater Invertebrate Taxonomists), and PNAMP (Pacific Northwest Aquatic Monitoring Partnership). Following identification, representative specimens may be preserved and retained for inclusion in a voucher collection for Mount Polley.

Following taxonomic identification, the wet and dry biomass of total organisms in each sample from creek environments (benthic invertebrate productivity) will be determined. For wet biomass,

samples will be poured through a piece of pre-weighed 212 µm Nitex mesh and dried gently between two pieces of absorbent paper. Each sample will then be weighed to the nearest 0.0001 g, and the weight of the mesh will be subtracted from the total weight to determine total sample wet weight. For dry biomass, wet samples will be then placed on a piece of pre-dried and pre-weighed glass fiber filter before being dried at 160^0F (71°C) for six hours. Following a short period of cooling, samples will be weighed as described above, and total sample dry weight will be calculated.

4.3.2 Tissue Quality

Benthic invertebrate tissue quality samples will remain frozen until overnight shipment on ice with completed COCs to ALS Environmental, Burnaby BC; an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA). Samples will be sent to the laboratory with sufficient time to complete analyses within the recommended sample hold times. Analyses will be completed using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015). Upon sample receipt, the laboratory will provide a sample receipt confirmation when the samples are received and logged. These receipts will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Tissue quality samples will be analysed for metals by CRC-ICP-MS (Collision Cell Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/6020A [USEPA 2004]) or HR-ICP-MS (High Resolution Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/ 200.8 [USEPA 1994]), mercury by CVAFS (Cold Vapour Atomic Fluorescence Spectrophotometry; USEPA Method 200.3 [USEPA 1991]/Method 245.7 [USEPA 2001]), and moisture content. The method selected for metals analysis will depend on sample weight, with HR-ICP-MS employed for smaller sample sizes. Tissue quality analytes are provided in Table 4, with the associated target LRLs, detection limit objectives outlined in technical guidance (“consensus detection limits”; BCMOE 2016), and available BCWQG (i.e., selenium; BCMOE 2014). Upon completion of the analyses, the laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

4.4 Data Quality Review

Upon receipt of all analytical data, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate (split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the benthic invertebrate monitoring data will ensure timely communication with the laboratory should any issues be identified

Table 4: Target Laboratory Reporting Limits (LRL) and Analytical Methods for Benthic Invertebrate Tissue Quality Analytes

Parameter	Metals in Tissue by HR-ICPMS Micro (USEPA 1991, 1994)		Metals in Tissue by CMC ICPMS (USEPA 1991, 2004)		Consensus DLs [a]	British Columbia Water Quality Guidelines [b]
Units	mg/kg wwt	mg/kg dw	mg/kg wwt	mg/kg dw	mg/kg wwt	mg/kg dw
Aluminum (Al)	1.0	5.0	0.40	2.0	0.40	-
Antimony (Sb)	0.0020	0.010	0.0020	0.010	0.0020	-
Arsenic (As)	0.0060	0.030	0.0040	0.020	0.0050	-
Barium (Ba)	0.010	0.050	0.010	0.050	0.010	-
Beryllium (Be)	0.0020	0.010	0.0020	0.010	0.0020	-
Bismuth (Bi)	0.0020	0.010	0.0020	0.010	0.0200	-
Boron (B)	0.20	1.0	0.20	1.0	-	-
Cadmium (Cd)	0.0020	0.010	0.0010	0.0050	0.0020	-
Calcium (Ca)	4.0	20	4.0	20	2.0	-
Cesium (Cs)	0.0010	0.0050	0.0010	0.0050	-	-
Chromium (Cr)	0.040	0.20	0.010	0.050	0.010	-
Cobalt (Co)	0.0040	0.020	0.0040	0.020	0.0040	-
Copper (Cu)	0.040	0.20	0.020	0.10	0.010	-
Iron (Fe)	1.0	5.0	0.60	3.0	1.0	-
Lead (Pb)	0.010	0.050	0.0040	0.020	0.0040	-
Lithium (Li)	0.10	0.50	0.10	0.50	-	-
Magnesium (Mg)	0.40	2.0	0.40	2.0	2.0	-
Manganese (Mn)	0.010	0.050	0.010	0.050	0.020	-
Mercury (Hg) [c]	0.0010	0.0050	-	-	0.002	-
Molybdenum (Mo)	0.0080	0.040	0.0040	0.020	0.010	-
Nickel (Ni)	0.040	0.20	0.040	0.20	0.010	-
Phosphorus (P)	2.0	10	2.0	10	5.0	-
Potassium (K)	4.0	20	4.0	20	10	-
Rubidium (Rb)	0.010	0.050	0.010	0.050	-	-
Selenium (Se)	0.020	0.10	0.010	0.050	0.020	4.0
Sodium (Na)	4.0	20	4.0	20	2.0	-
Strontium (Sr)	0.020	0.10	0.010	0.050	0.010	-
Tellurium (Te)	0.0040	0.020	0.0040	0.020	-	-
Thallium (Tl)	0.00040	0.0020	0.00040	0.0020	0.0010	-
Tin (Sn)	0.020	0.10	0.020	0.10	0.020	-
Uranium (U)	0.00040	0.0020	0.00040	0.0020	0.0010	-
Vanadium (V)	0.020	0.10	0.020	0.10	0.020	-
Zinc (Zn)	0.20	1.0	0.10	0.50	0.10	-
Zirconium (Zr)	0.040	0.20	0.040	0.20	-	-

[a] From Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[b] British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BCMOE 2018).

[c] Method for total mercury analysis will be according to USEPA (1991, 2001).

For benthic invertebrate tissue quality samples, LRLs will be evaluated relative to targets established for the analytes, to "consensus detection limits" (Table 4), and to relevant British Columbia guidelines (i.e., selenium; BCMOE 2014). Comparisons between duplicate samples will be made by calculating the relative percent difference (RPD) of metal concentrations between paired duplicates. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Results for laboratory blanks, precision, and accuracy will be evaluated relative to Data Quality Objectives (DQO) established by the analytical laboratory that performed the analyses. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping). For benthic invertebrate community samples, reanalysis for quality control endpoints (organism sorting efficiency, subsampling precision and accuracy error, and taxonomic identification error) will be performed on 10% of samples, and results of quality control measures will be evaluated relative to pre-established DQOs. Specifically, evaluation of organism sorting efficiency will involve reprocessing previously sorted material from randomly selected samples, and then determining the number of invertebrates that were not recovered during processing of the original sample, and an efficiency of < 10% missed organisms will be considered acceptable. Evaluation of subsampling error provides a measure of analytical accuracy by comparing the numbers of benthic invertebrates recovered between at least two sub-samples, and of analytical precision by comparing sub-sample derived benthic invertebrate community numbers with the densities determined for whole benthic invertebrate community samples. An error of < 20% will be considered acceptable for subsampling accuracy and precision. Evaluation of taxonomic identification error involves an internal quality control audit of taxonomic identification results whereby blind re-enumeration and re-identification of random samples will be performed by an analyst not involved in the original sample processing, and an error of < 5% for this endpoint will be considered acceptable.

4.5 Data Handling and Interpretation

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, chemical data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the data quality review described above (Section 4.4), all benthic invertebrate community, benthic invertebrate tissue chemistry data, and supporting data will be managed in Microsoft (MS) Excel™. For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP for analysis and summarized by calculating mean, median,

standard deviation, minimum, and maximum for each endpoint. Data analysis will be completed for each monitoring component (community, productivity, and tissue quality).

4.5.1 Community and Productivity

Benthic invertebrate communities will be evaluated using metrics of organism density (organisms per m²; grab samples, and Hess/Surber samples) or abundance[8] (organisms per sample; kick-and-sweep samples), taxonomic richness, Simpson's Index of Diversity, Simpson's Index of Evenness (calculated as in Smith and Wilson 1996; Environment Canada 2012a). The Bray-Curtis Index of Dissimilarity will also be used in the evaluation of samples collected for MDMER EEM as per technical guidance (Environment Canada 2012a). These primary indices will be calculated at the LPL of taxonomy for the 250 µm fraction of all samples, with the exception of samples collected for EEM which will be calculated using family-level data for the 500 µm sample fraction (Minnow 2018c). The densities and relative densities of the most abundant taxa will also be calculated (relative densities calculated as the abundance of each respective dominant/indicator taxon relative to the total number of organisms in the sample and expressed as a percentage). Dominant/indicator taxon groups will be defined as those groups representing more than 5% of total organism abundance within each set of areas being compared, or any taxon groups considered to be important indicators of environmental stress. In addition, benthic invertebrate productivity in creeks will also be evaluated using wet and dry total biomass converted to a standard area-based measurement (g/m^2). Summary statistics for all endpoints will be reported by area and year as described above (sample size, mean, median, minimum, maximum, and standard deviation).

Correspondence analysis (CA) or Nonmetric Multidimensional Scaling (NMDS) multivariate ordination methods will be used to further examine benthic invertebrate community structure. These are multivariate ordination methods used to reduce multivariate data into a manageable number of variables and will be applied to assist in the identification of key spatial or temporal differences in benthic invertebrate community (i.e., which stations have distinct benthic communities but also how these benthic communities differ among stations). The results of these multivariate analyses will be incorporated into the comparison of benthic invertebrate indices described below.

Benthic invertebrate community and productivity metrics from exposed areas will be compared to reference results in a control-impact study design, as well as compared temporally to previous monitoring results if data are available. Comparisons will be completed primarily using Analysis

[8] Abundance (as opposed to density) will be calculated only if kick-and-sweep sampling methods are used in creek due to lack of suitable Hess/Surber sampling habitat. See Section 3.1.2 for details.

of Variance (ANOVA) to test for statistically significant differences. For these analyses, the assumptions of normality and homogeneity of variances will be tested on the residuals of the ANOVA model using the Shapiro-Wilk test and Levene's test based on median values, respectively, using a significance level (α) of 0.1. Data will be transformed as necessary to satisfy assumptions of normality and homogeneity of variance. In instances where the residuals of the ANOVA model do not meet the assumptions of normality and homogeneity of variances, a non-parametric Kruskal-Wallis test will be conducted. When the overall results of an ANOVA or Kruskal-Wallis test are significant, differences between specific areas will be evaluated using post-hoc contrasts for ANOVA or Dunn's test for the Kruskal-Wallis test. A Bonferroni correction on the p-values will be used to conserve the overall Type I error rate. Statistical temporal contrasts may also be completed using Two-Way ANOVA (with factors *Area* and *Year*) if data are available for both the exposed and reference areas for all years being evaluated. For the Two-Way ANOVA model, assumptions of normality and homogeneity will be tested on the residuals of the model as described above using the Shapiro-Wilk test and Levene's test based on median values, respectively (α = 0.05). Data will be transformed as necessary to satisfy assumptions of normality and homogeneity of variance and if these assumptions are not met, the analysis will be conducted on ranks (equivalent to a non-parametric test). When the interaction between *Area* and *Year* is significant (α = 0.1) the following post-hoc contrasts will be conducted, and when the interaction between *Area* and *Year* is not significant, the effect of area and year will be assessed (α = 0.1) using the *Area* and *Year* terms in the ANOVA model. Further detailed analyses will be completed as required for data interpretation, and may include graphical comparisons to reference and historical data, and formal spatial statistical contrasts using methods similar to those described above.

If exposed versus reference or temporal differences in benthic invertebrate community and/or productivity results are noted, potential relationships between benthic invertebrate community metrics and physical and chemical conditions of the study areas will be explored using Spearman correlation (often referred to a Spearman Rank-Order correlation). For lake sampling areas, these physical/chemical endpoints may include results of multivariate statistical analyses used to identify key sediment quality parameters (e.g., CA or PCA axis scores; see CEMP Section 6.12). For most areas, correlation analyses will likely only include data from a single year of sampling in order to focus the analysis on differences between rehabilitated and exposed areas relative to reference, rather than on differences among years. Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the



Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points). Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., differences in benthic invertebrate community), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

4.5.2 Tissue Quality

Data analysis and interpretation of benthic invertebrate tissue quality results will focus on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015b, 2016, Minnow 2015a). Benthic invertebrate tissue quality results for these analytes will be compared to available pre-breach data (for selenium only in 2009, 2012 and 2013, and for all analytes in 2010; Minnow 2011, 2013a,b), contrasted between exposed and reference areas, and also compared temporally within exposed areas. In addition, tissue quality results for selenium will be compared to the relevant BCWQG (BCMOE 2014). Detailed analyses and interpretation related to these comparisons will be completed as required, and may include: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations tissue concentrations (control-impact study design using Analysis of Variance [ANOVA]) as described above. Formal statistical temporal and spatial contrasts may also be completed using ANOVA methods similar to those described for benthic invertebrate community data analysis to augment interpretation, where data allows.

Concentrations of the POIs and IPs in benthic invertebrate tissue will also be evaluated relative to concentrations in water. These ratios of concentrations will be calculated as: [tissue sample concentration]/[dissolved water concentration], and are referred to as Bioconcentration Factors (BCFs). BCFs are often used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet (i.e., Arnot and Gobas 2006), and are applicable to erosional areas where sediment is generally not present. BCFs will be calculated using tissue metal concentrations (dry weight) and mean dissolved metal concentrations in water from each sampling area. Calculated BCFs will then be qualitatively

compared among areas to identify differences in the uptake of metals by benthic invertebrate in areas impacted by effluent discharge and/or the TSF embankment breach.

Additionally, concentrations of POIs and IPs in benthic invertebrates will be evaluated relative to concentrations in periphyton, based on Trophic Transfer Factors (TTFs; the ratio of tissue concentrations in benthic invertebrates relative to concentrations in periphyton (i.e., TTF = [benthic invertebrate sample]/[periphyton sample]). TTFs can be used to generally describe the extent to which the concentration of an analyte increases between lower and higher trophic levels (e.g., Presser and Luoma 2010). TTFs greater than 1 indicate that the analyte is accumulating in benthic invertebrates to a greater extent than would be expected if ingestion of periphyton was the sole source of that analyte to the benthic invertebrates (assuming uptake and excretion of the analyte by the benthic invertebrates are equal). Co-located observations of benthic invertebrate and periphyton tissue chemistry will be used to calculate TTFs for each replicate station. Comparisons of TTFs will then be made between exposed and reference areas as well as with pre-breach results.

An interpretive report based on the benthic invertebrate monitoring data will be prepared for integration into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.



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Appendix B.3

Periphyton Monitoring

Minnow Environmental Inc.

Periphyton
Monitoring Plan

Prepared for:

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June 2018

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1 INTRODUCTION

1.1 Background

Periphyton represents an important component of aquatic food webs in creeks, and consists of a complex matrix of organisms. Periphyton generally includes algae, fungi, bacteria, and protozoa attached to submerged substrate (e.g., rocks, bedrock, woody debris). These organisms are representative of the lowest trophic level in running water and take up nutrients such as nitrogen (e.g., nitrate, nitrite) and phosphorus (e.g., ortho-phosphate), as well as other substances dissolved in water (e.g., major ions, metals) to serve physiological functions, which thereby become available via dietary pathways to consumer organisms at higher trophic levels. Periphyton productivity and community characteristics can be influenced by factors such as physical disturbance (i.e., changes to surface water hydrology) and water quality (relating to toxicity or changes in productivity due to nutrient chemistry), and periphyton tissue quality can be influenced by water and/or sediment quality (although the latter is primarily present in suspended form in erosional streams). Therefore, periphyton monitoring is an important tool for both the assessment of creek productivity (through measures of periphyton productivity and community) and the evaluation of the trophic transfer of substances (through measures of periphyton tissue quality), and these monitoring components have been incorporated into the CEMP.

The influence of the Mount Polley Mine on periphyton productivity, community, and tissue quality can occur by several key mechanisms: 1) general mine influence from dustfall and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Reclamation activities in lower Edney Creek and Hazeltine Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017b). Construction / rehabilitation in areas of upper Hazeltine Creek (Reaches 1 and 2) were completed between July and September of 2016 and 2017, respectively (Golder 2017a,c), with Reach 2 encompassing an upper Hazeltine Creek monitoring area established prior to the TSF embankment breach (W7; Minnow 2009). In lower Hazeltine Creek, initial channel rehabilitation was completed in 2015, and further rehabilitation has yet to be completed.

Periphyton tissue quality in creeks adjacent to the Mount Polley Mine has been monitored since prior to the TSF embankment breach (2010, 2012, and 2013; Minnow 2011, 2013a, 2013b). Periphyton productivity (chlorophyll-a and Ash-Free-Dry-Mass [AFDM]) has been monitored since 2013 (Minnow 2013c, 2018a,b), and periphyton community characteristics have not been

documented in these waterbodies. Results of previous periphyton productivity and tissue quality monitoring are reviewed in Section 2. These results provide context for a periphyton monitoring program that is guided by a combination of available historical findings, representative locations downstream of Mount Polley Mine operations (taking into consideration recent stream rehabilitation activities), representative reference locations, and considerations for a statistically-based design that will facilitate the detection of potential spatial and/or temporal differences in periphyton endpoints (productivity, community, and tissue quality), in addition to providing data to evaluate productivity endpoints (i.e., chlorophyll-a) against provincial water guidelines for the protection of aquatic life (e.g., BCWQG; BCMOE 2018) and literature-based productivity classification values (e.g., Biggs 1996).

The following sections of the CEMP Periphyton Monitoring Plan provide the objectives of periphyton productivity and tissue quality monitoring, a summary of historical periphyton monitoring results, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for periphyton productivity and tissue quality monitoring (sampling methods, analytical methods, quality control methods, data interpretation, and reporting).

1.1 Monitoring Objectives

The objective of periphyton monitoring in the Mount Polley receiving environment is to evaluate the influence of Mount Polley Mine activities (related to mine operations, the TSF embankment breach, and/or rehabilitation activities) on Hazeltine Creek (the creek receiving environment directly influenced by Mount Polley Mine activity) and lower Edney Creek (a creek environment directly influenced by the TSF embankment breach), and to serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish; Sections 6.13 and 6.16). Periphyton monitoring will include assessment of productivity, community composition, and tissue quality, with comparison to previous and/or reference conditions, to applicable guidelines (i.e., chlorophyll-a; BCMOE 2018), and to literature-based criteria (or classification ranges) for productivity. Periphyton monitoring results also provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity, as well as supporting the exposure assessment for the ecological risk assessment (ERA) and human health risk assessment (HHRA).

2 SUMMARY OF HISTORICAL FINDINGS

2.1 Productivity

Periphyton productivity monitoring completed during mine operations but before the TSF embankment breach indicated that productivity was low in a creek adjacent to the Mount Polley Mine (Bootjack Creek; 1.42 mg/m^2 of chlorophyll-a; Minnow 2013c) relative to the BCWQG of 100 mg/m^2 (BCMOE 2018). Following the TSF embankment breach, periphyton productivity in rehabilitated areas of upper and lower Hazeltine Creek and lower Edney Creek were also generally low (1.76 to 40.1 mg/m^2 of chlorophyll-a; Minnow 2018a; Figure 1), as evidenced by results well below the BCWQG and generally below chlorophyll-a levels associated with moderately enriched streams (21 mg/m^2; Biggs 1996) despite full sun exposure in these recently rehabilitated areas. Periphyton chlorophyll-a results from these rehabilitated areas following the TSF embankment breach were generally within the range documented in the associated reference areas (4.6 to 40.1 mg/m^2), as was periphyton biomass (AFDM; Figure 1; Minnow 2018a,b).

2.2 Tissue Quality

Periphyton tissue quality has been monitored since 2010 in the vicinity of the Mount Polley Mine (primarily within Hazeltine Creek), with a focus on selenium monitoring relative to reference (Minnow 2011, 2013a,b, 2018c), although additional analytes were included in analyses completed in 2010 (Minnow 2011). Mean periphyton selenium concentrations in upper and lower Hazeltine Creek have shown limited temporal change over the monitoring period, with the most recent results (2017) being similar to, or lower than, concentrations documented prior to the TSF embankment breach (Figure 2).

The inclusion of additional analytes in periphyton tissue quality monitoring continued in 2017 (Minnow 2018d), with tissue quality characterized in three rehabilitated areas of Hazeltine Creek (2 of which were effluent exposed during sample collection), relative to reference (an unimpacted area of lower Edney Creek). Data interpretation of these additional analytes focused on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015, 2016, Minnow 2015). Periphyton tissue quality from all rehabilitated Hazeltine Creek areas (both effluent exposed and not exposed) was characterized by copper concentrations that were significantly higher than reference (Figure 3), while concentrations of a number of additional analytes were higher than reference in at least one Hazeltine Creek area (two POIs: arsenic, iron;

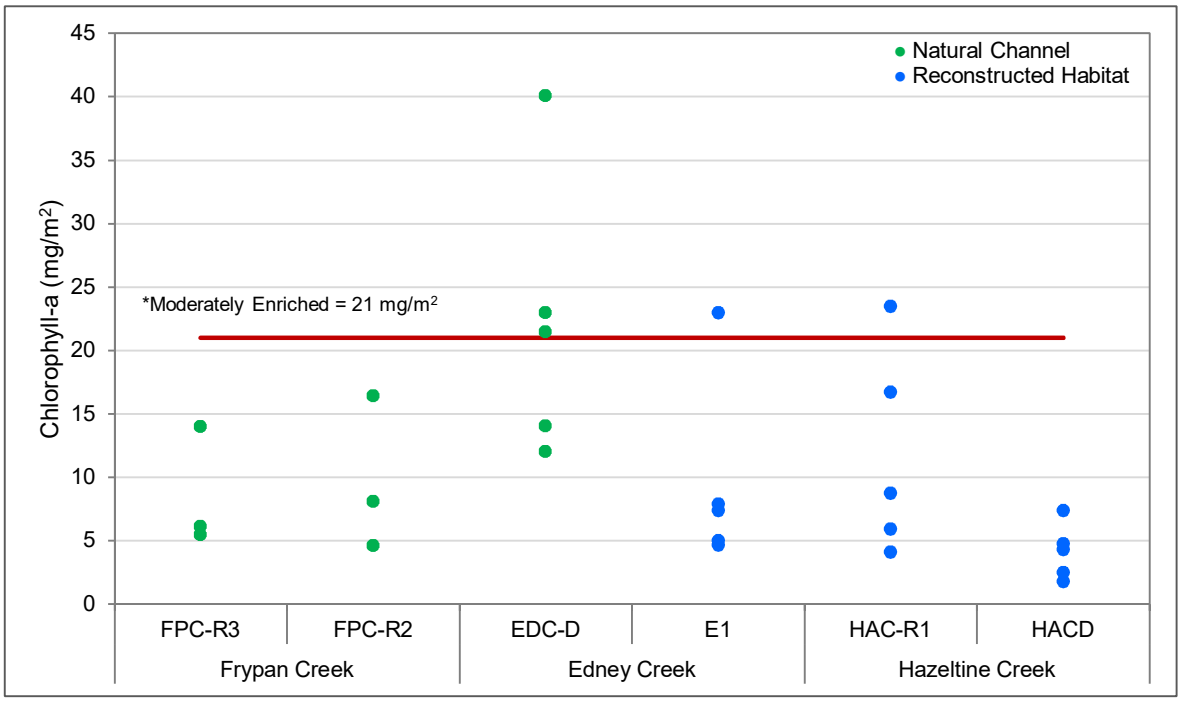

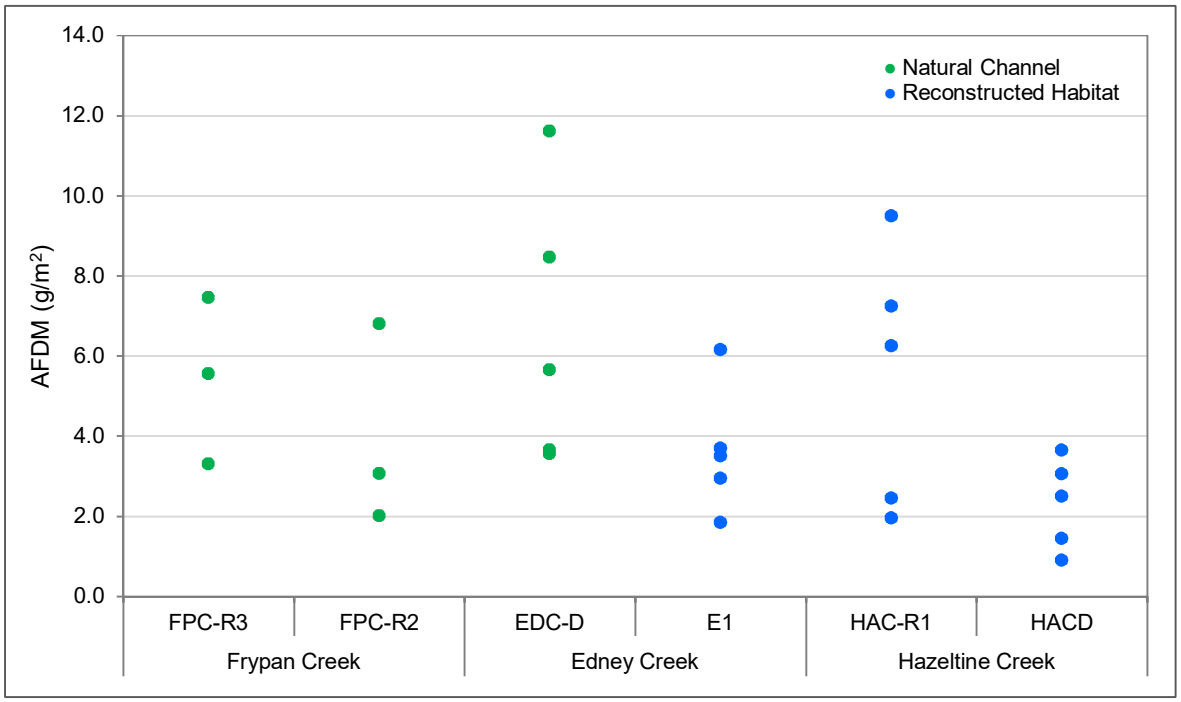

Figure 1: Chlorophyll-a and Ash-Free-Dry-Mass (AFDM) for Frypan, Edney and Hazeltine Creeks, 2017

* Value taken from Biggs 1996

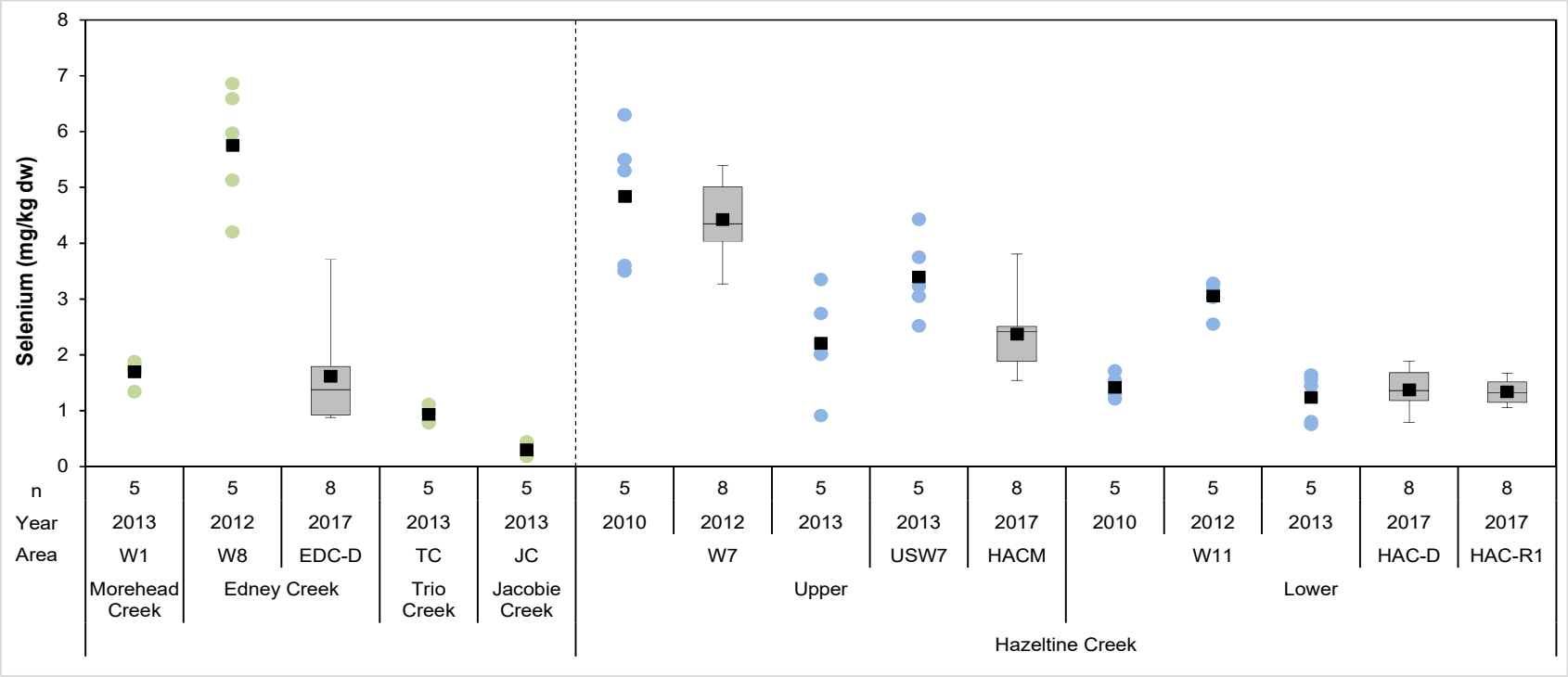

Figure 2: Selenium Concentrations in Periphyton Tissue at Hazeltine Creek with Associated Reference Areas, Mount Polley, 2010 to 2017

Note: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.

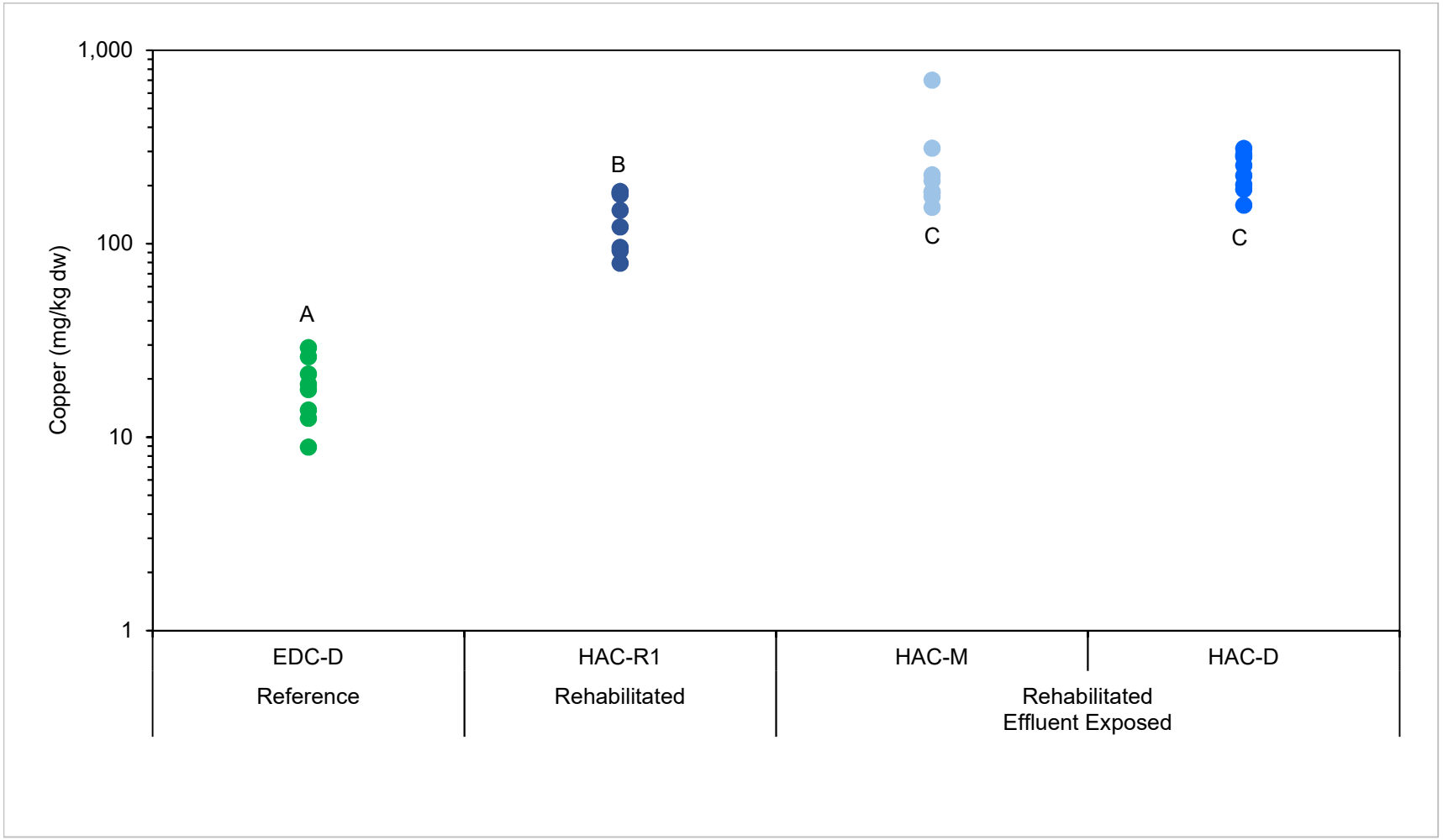

Note: Groups that share a letter (e.g., AB) are not significantly different from each other.

Figure 3: Periphyton Tissue Copper Concentrations at Rehabilitated and Effluent Exposed (HAC-M, HAC-D), Rehabilitated (HAC-R1), and Reference (EDC-D) Area, Mount Polley Mine, 2017

and six IPs: calcium, cobalt, molybdenum, phosphorus, sodium, and vanadium; Minnow 2018d) These results were consistent with the higher water concentrations of most of these analytes in Hazeltine Creek due to a combination of breach influence and effluent conveyance preceding and during sample collection.

3 STUDY DESIGN OVERVIEW AND RATIONALE

Periphyton monitoring under the CEMP is proposed to meet the combined needs of: 1) operational monitoring (including the previous discharge of treated effluent to Hazeltine Creek); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed periphyton monitoring program is provided in Table 1 and Figure 4. Periphyton monitoring is focused on Hazeltine Creek and lower Edney Creek with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek and lower Hazeltine Creek; Table 1; Figure 4). As described in Section 1.1, reclamation activities in Hazeltine Creek and lower Edney Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017b), and in 2016 and 2017 in sections of upper Hazeltine Creek in (Reaches 1 and 2, respectively; Golder 2017a,b). As such, periphyton monitoring in Hazeltine Creek will focus on three areas (Figure 4)[1], including one area in Reach 1 (HAC-R1; where rehabilitation was completed in 2016), one area in Reach 2 (HAC-U; where rehabilitation was completed in 2017), and one area in lower Hazeltine Creek (HAC-D, where initial rehabilitation activities have been completed but additional rehabilitation will be conducted). Monitoring in lower Edney Creek will focus on one rehabilitated area (E1; where rehabilitation was completed in 2015). These sampling areas also align with those proposed for benthic invertebrate community and tissue quality monitoring (see CEMP Section 6.13). It should be noted that sampling areas HAC-U and HAC-D were previously exposed to the discharge of treated mine effluent (December 2015 to December 2017), whereas HAC-R1 is located upstream of the previous discharge point (Figure 4). As of January 2018, treated effluent is no longer discharged into Hazeltine Creek. Concurrent sampling of suitable reference areas will be conducted in lower Edney Creek and Frypan Creek. In Frypan Creek, the reference sampling area was selected to match habitat conditions in upper Hazeltine Creek as closely as possible, based on results of preliminary fish habitat assessment and benthic invertebrate monitoring (area selection was based primarily on substrate type and size; Minnow 2018b).

Periphyton monitoring includes assessment of productivity (chlorophyll-a and AFDM) at all sampling locations. Periphyton community will also be monitored at all locations with the exception of Frypan Creek, which will be sampled in 2018 only for the purposes of comparison of

[1] Note that previous creek sampling station locations are presented in Figure 4. These locations may change slightly depending on substrate, water depth, and water velocity. Similarly, conceptual station locations are displayed for upper Edney Creek and Frypan Creek, and will be established during the field campaign.

Table 1: Mount Polley CEMP Periphyton Monitoring Program Overview

Water Body	Sampling Area	Type	Monitoring Frequency	Components [a]	Replication [b]			Rationale
					T	P	C	
Hazeltine Creek	HAC-R1 (Upper, Reach 1)	Rehabilitated	Annual	T,P,C	5	5	8	adjacent to mine and breach-influenced
	HAC-U (Upper)	Rehabilitated	Annual	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
	HAC-D (Lower)	Rehabilitated	Bi-annual [c]	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
Frypan Creek	FPC-R3 (Reach 3)	Reference	2018 only	P, C	-	5	8	reference for upper Hazeltine Creek
Edney Creek	UER (Upper)	Reference	Annual	T,P,C	5	5	8	reference for upper Hazeltine Creek
	E1 (Lower)	Exposed	Bi-annual [c]	T,P	5	5	-	adjacent to mine and breach-influenced
	EDC-D (Lower, unimpacted)	Reference	Bi-annual [c]	T,P,C	5	5	8	reference for lower Hazeltine Creek [d]

[a] core periphyton monitoring components: T = community taxonomic analysis, P = productivity (chlorophyll-a and Ash-Free-Dry-Mass, see Table 2), C = chemistry (see Table 2 for analytes).

[b] number of replicate stations within the specified sampling area for a given program component.

[c] Bi-annual indicates sampling will occur every other year for all parameters indicated with the exception of tissue chemistry, which will be monitored annually. The next bi-annual sampling event will occur in 2019.

[d] Lower Edney Creek reference area will be located in an unimpacted area upstream of the breach influence (see Figure 4).

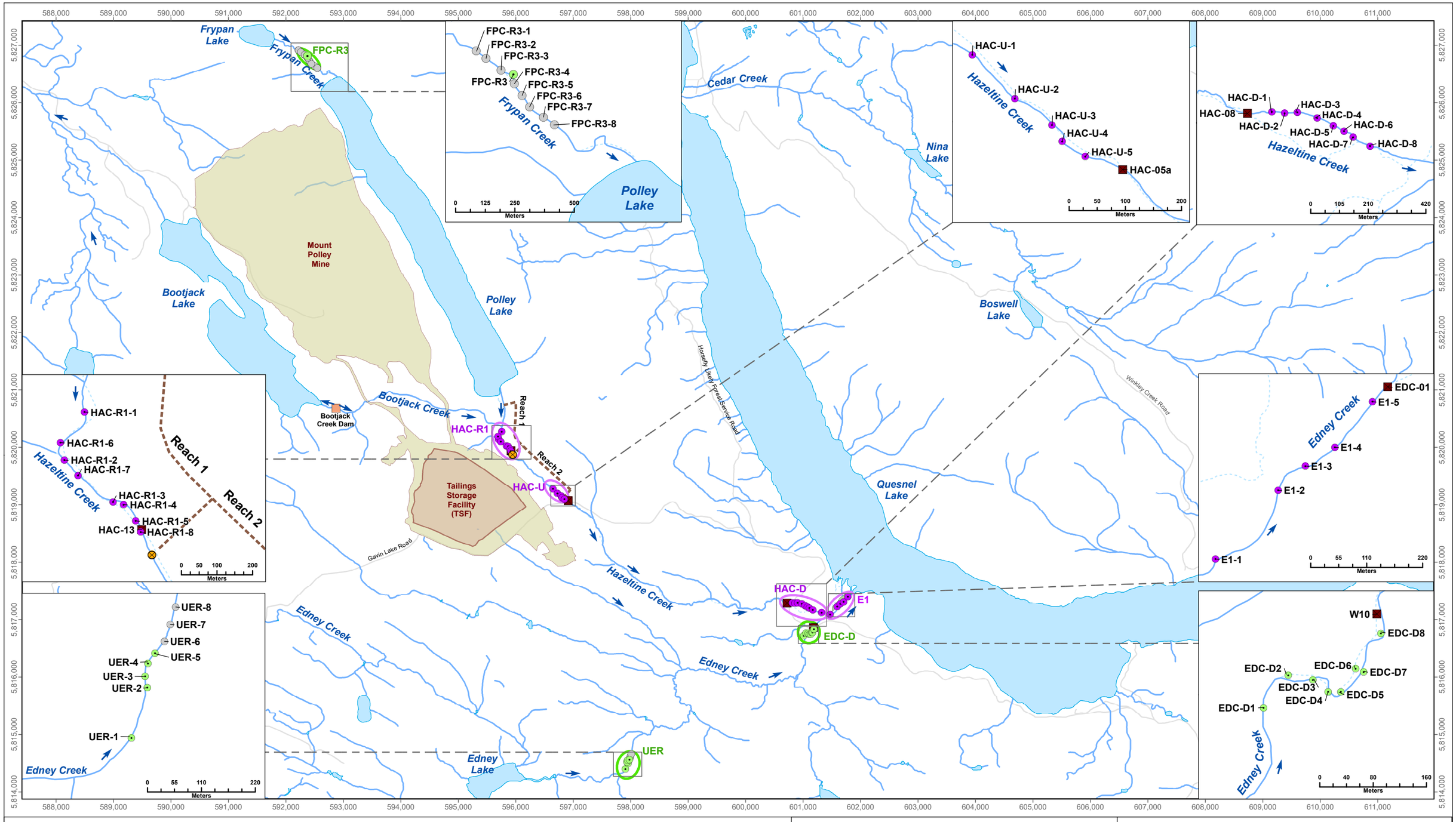

Periphyton Monitoring Station
- Rehabilitated
- Reference
- Conceptual

- Effluent Discharge from 2014 to 2017
- Routine Water Quality Station
- Rehabilited Reaches (Golder 2017 a,b)
- Tailings Storage Facility
- Active Mine Operation

Periphyton Monitoring Area
- Rehabilitated
- Reference
- Historic Watercourse Pathway

Note: Sampling locations may be adjusted from those shown displayed based on field survey information.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U
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Mount Polley CEMP Periphyton Monitoring Locations

Date June 2018
Project 177202.0042

minnow environmental inc.

Figure 4

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\2-Periphyton\17-42 Fig 4 MP PER and BI Creek.mxd

fish habitat productivity (Table 1). Periphyton community monitoring provides a means for evaluating re-establishment of the periphyton community in these recently disturbed areas, and is an additional line of evidence for assessing temporal changes in periphyton productivity. Periphyton tissue quality monitoring, which includes evaluation of concentrations of metals[2] and moisture content, will be included at all sampling locations with the exception of the rehabilitated area of lower Edney Creek (E1; Table 1). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; 3) comparison of productivity results relative to BCWQG and literature-based classification values. Accordingly, five stations per area for the assessment of productivity and community, and eight stations per area for the assessment of tissue quality are proposed to provide replication for the statistical contrasts.

Periphyton monitoring will be supported by measures of sampling depth, water velocity, and *in situ* water quality measurements (temperature, dissolved oxygen, pH, and specific conductance) at each sampling station. Additional information to be collected includes GPS coordinates of each station, notes of the presence of aquatic vegetation/bryophytes on sampled substrate and other physical observations, and supporting photographs of the sampling location and samples. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (e.g., in Frypan Creek and upper Edney Creek).

Periphyton sampling will be completed in August or September consistent with previous data collections (Minnow 2011, 2013a,b, 2018a,b,c,d). The initial frequency of periphyton community, productivity, and tissue quality monitoring at upper Hazeltine Creek (and associated reference areas) is annual given the recent disturbance to these rehabilitated areas, and changes to the effluent exposure status (Table 1). This frequency will enable tracking of recovery in these recently disturbed habitats. The frequency of periphyton community and productivity monitoring in rehabilitated areas of lower Hazeltine Creek and lower Edney Creek (and associated reference areas) is every second year because these areas have been undisturbed since 2015, however the frequency of tissue quality monitoring in lower Hazeltine Creek (and the associated reference area) is annual. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) will be made in response to QP recommendations. If results indicate stable periphyton productivity, community, and tissue quality during this period, then a reduction of monitoring frequency to every second year will be considered for upper Hazeltine Creek areas. The Frypan Creek reference area will only be sampled in 2018 (Table 1) to provide comparison for periphyton biomass and

[2] For simplicity, the term metals is used herein to include metalloids.

tissue quality data from upper Hazeltine Creek following the initial reopening of upper Hazeltine Creek as fish habitat (see CEMP Section 6.16).

Periphyton samples will be collected, processed, analyzed, and the associated data interpreted using methodology consistent with previous assessment at Mount Polley (e.g., Minnow 2011, 2013a,b, 2018a,b,c,d), which is also consistent with technical guidance (e.g., BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality assessment, and data handling and interpretation.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be led by qualified field staff experienced in the implementation of periphyton monitoring programs, and all sample collection methods, quality assurance and quality control measures, and laboratory analysis methods will be implemented in accordance with technical guidance (BCMOE 2013, 2015, 2016). Specifically, quality assurance and quality control measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability (and maintenance) of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the periphyton monitoring program. Replicate samples will be collected from each sampling area in order to capture within-area variability (samples from 5 and 8 separate stations will be collected to represent the sampling area for productivity/community and tissue quality endpoints, respectively). Specific field QC samples will include duplicates (i.e., splits) of periphyton tissue quality samples collected at a frequency of 10% of the total number of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). QC samples to assess field precision (field duplicates) will not be collected for periphyton productivity (chlorophyll-a and AFDM) or community monitoring endpoints due to high the inherent natural variability in these parameters. In addition to field QA/QC, the laboratory responsible for the physical or chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting will for tissue quality and periphyton productivity endpoints be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). QC reporting will also be requested of the laboratory performing taxonomic analysis of the periphyton community samples, including organism enumeration checks for a minimum of 10% of samples. These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Biomass and Chlorophyll-a

Periphyton samples for chlorophyll-a analysis and biomass (AFDM) will be collected by selecting five representative submerged rocks from each monitoring station. Representative rocks from each station will be selected from locations with similar habitat (depth, velocity, and substrate characteristics), while attempting to match depth and velocity among periphyton collection stations and areas as closely as possible. Selected rocks (excluding those that are too small, highly angular, or uncharacteristic in surface texture) will be taken to shore. For chlorophyll-a sample collection, a thin acetate template with a 2x2 cm opening in the middle will then be placed firmly on each rock, and the periphyton within this area will be scraped off using a stainless-steel razor blade or scalpel. Sample material from each of the five rocks will then be transferred from the razor blade or scalpel to a large (47 mm) 0.45 µm pore diameter Whatman mixed cellulose ester (MCE) filter paper until a single composite sample of approximately 200 mg to 1 g wet weight is obtained per station. If material collected from the five rocks sampled is insufficient, additional rocks will be sampled from the same area with similar habitat characteristics until the required sample volume is obtained. The filter paper will then be folded and placed into a labeled opaque centrifuge tube. The total surface area sampled at each station (0.002 m^2: 5 x 4 cm^2, or any deviations from this surface area), will be recorded to allow calculation of chlorophyll-a on a unit area basis for comparison to the British Columbia Water Quality Guideline (BCWQG; 100 mg/m^2; BCMOE 2018). The same five rocks sampled for chlorophyll-a analysis (and additional rocks if they were required) will be used to collect separate scrapings for analysis of AFDM. For AFDM sampling, sampling methods will follow those outlined above for chlorophyll-a, however material on the razor blade or scalpel from scraping of each rock will be rinsed into a small pre-labelled plastic jar with additional water added to cover the tissue (as necessary). Sampling will be conducted at five replicate stations in each area (see Table 1). Immediately after collection, all chlorophyll-a and AFDM samples will be placed in a cooler on ice for transport to the mine, where they will be frozen.

4.2.2 Community

Periphyton community samples will be collected from the same five rocks used for chlorohyll-a and biomass sampling whenever possible (and additional rocks if they were required), or from rocks of a similar size collected from the same general location and habitat (depth and velocity). Sample collection methods will be similar to those outlined for chlorophyll-a and AFDM. Briefly, a thin acetate template with a 2x2 cm opening in the middle will be placed firmly on each rock and all of the periphyton within this area will then be removed using a scalpel and/or brush and a squirt bottle filled with site water (BCMOE 2013, 2016; Stevenson and Bahls 2006). The collected

periphyton will then be transferred into a labelled sample jar, and this process will be repeated for the five rocks, resulting in a single composite sample from each station. The total surface area sampled at each station (0.002 m^2: 5 x 4 cm^2, or any deviations from this surface area if additional rocks are sampled) will be recorded. Immediately after collection, the sample will be preserved with Lugol's iodine solution until the sample is the colour of weak tea (approximately 1 mL of Lugol's per 250 mL of sample; BCMOE 2013), and will be mixed gently by inverting the sampling jar. All samples will be stored at room temperature. Sampling will be conducted at five replicate stations in each area (see Table 1).

4.2.3 Tissue Quality

Periphyton samples collected for tissue quality analysis will be collected by scraping periphyton from the surface of rocks using a scalpel until sufficient sample weight for analysis is attained (more than 500 mg wet weight). A minimum of five rocks will be sampled to ensure the sample is representative of the sampling station. Rocks sampled for productivity and community will be used preferentially, plus additional rocks (as necessary) to obtain the required sample weight. Periphyton scrapings will be transferred directly from the scalpel onto the wall of a labeled scintillation vial, without rinsing, to minimize the amount of water in each sample. Sampling will be conducted at eight replicate stations in each area (see Table 1). Samples will be placed in a cooler on ice for transport to the mine, where they will be frozen.

4.3 Sample Handling and Laboratory Analysis

Periphyton productivity (chlorophyll-a and AFDM) and tissue quality samples will remain frozen until overnight shipment on ice to the analytical laboratory. Samples will be sent to the laboratory with sufficient time to complete analyses within the recommended sample hold times (28 days for chlorophyll-a, 6 months for AFDM, 1 year for tissue quality [metals analysis]). Analyses will be completed at an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA) using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015). Upon sample receipt, the laboratory will provide a sample receipt confirmation which will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Analysis of chlorophyll-a will follow procedures adapted from USEPA Method 445.0 (USEPA 1997). Briefly, chlorophyll-a will be determined by routine acetone extraction followed by fluorescence detection using a non-acidification procedure (a method that is not subject to interferences from chlorophyll-b). Determination of total AFDM will follow procedures adapted from APHA Method 10300 C (APHA 2010). Total AFDM will be calculated as the difference between the dried sample weight and the ash weight, both of which will be determined gravimetrically. Dry weight will be determined by drying the sample at 105 °C, and the ash weight will be subsequently determined

by ashing the dried sample at 500 °C. Tissue quality samples will be analysed for metals by CRC-ICP-MS (Collision Cell Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/6020A [USEPA 2004]) or HR-ICP-MS (High Resolution Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/ 200.8 [USEPA 1994]), mercury by CVAFS (Cold Vapour Atomic Fluorescence Spectrophotometry; USEPA Method 200.3 [USEPA 1991]/Method 245.7 [USEPA 2001]), and moisture content. The method selected for metals analysis will depend on sample weight, with HR-ICP-MS employed for smaller sample sizes. Periphyton productivity and tissue quality parameters are provided in Table 2, with the associated target laboratory reporting limits (LRLs) and detection limit objectives outlined in technical guidance ("consensus detection limits"; BCMOE 2016). Upon completion of the analyses, the laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

Periphyton community samples will be stored at room temperature until shipment to the taxonomy laboratory for taxonomic identification and enumeration. Samples will be shipped immediately after the completion of the field campaign, however there are no recommended hold times for analysis. Sample analysis will be completed as follows. Briefly, samples will be homogenized, settled in Ütermohl chambers for 24 h, and all cells within randomly selected fields of view will be enumerated until a minimum count of 300 algal units (1 unit = >1 cell for colonial or filamentous taxa) is reached. Identification will be performed using an inverted phase contrast microscope, and algal taxa will be identified to minimum of genus-level according to the most up-to-date taxonomic references. Periphyton density will be determined using the area sampled, proportion subsampled, and the total area of the selected fields of view. Biomass estimates will be generated for each taxon using taxon-specific biovolume formulae (Hillebrand et al. 1999) for cell measurements, and taxon-specific densities.

4.4 Data Quality Review

Upon receipt of all analytical data, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate (split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the periphyton monitoring data will ensure timely communication with the laboratory should any issues be identified

Specifically, LRLs will be evaluated relative to targets established for the analytes and to "consensus detection limits" (Table 2), and to relevant British Columbia guidelines (i.e., chlorophyll-a for productivity samples; BCMOE 2018). Comparisons between duplicate samples

Table 2: Target Laboratory Reporting Limits (LRL) and Analytical Methods for Periphyton Productivity and Tissue Quality Analytes

A) Tissue Quality Parameters

Parameter	Metals in Tissue by HR-ICPMS Micro (USEPA 1991, 1994)		Metals in Tissue by CMC ICPMS (USEPA 1991, 2004)		Concensus DLs [a]
Units	**mg/kg wwt**	**mg/kg dw**	**mg/kg wwt**	**mg/kg dw**	**mg/kg wwt**
Aluminum (Al)	1.0	5.0	0.40	2.0	0.40
Antimony (Sb)	0.0020	0.010	0.0020	0.010	0.0020
Arsenic (As)	0.0060	0.030	0.0040	0.020	0.0050
Barium (Ba)	0.010	0.050	0.010	0.050	0.010
Beryllium (Be)	0.0020	0.010	0.0020	0.010	0.0020
Bismuth (Bi)	0.0020	0.010	0.0020	0.010	0.0200
Boron (B)	0.20	1.0	0.20	1.0	-
Cadmium (Cd)	0.0020	0.010	0.0010	0.0050	0.0020
Calcium (Ca)	4.0	20	4.0	20	2.0
Cesium (Cs)	0.0010	0.0050	0.0010	0.0050	-
Chromium (Cr)	0.040	0.20	0.010	0.050	0.010
Cobalt (Co)	0.0040	0.020	0.0040	0.020	0.0040
Copper (Cu)	0.040	0.20	0.020	0.10	0.010
Iron (Fe)	1.0	5.0	0.60	3.0	1.0
Lead (Pb)	0.010	0.050	0.0040	0.020	0.0040
Lithium (Li)	0.10	0.50	0.10	0.50	-
Magnesium (Mg)	0.40	2.0	0.40	2.0	2.0
Manganese (Mn)	0.010	0.050	0.010	0.050	0.020
Mercury (Hg) [b]	0.0010	0.0050	-	-	0.002
Molybdenum (Mo)	0.0080	0.040	0.0040	0.020	0.010
Nickel (Ni)	0.040	0.20	0.040	0.20	0.010
Phosphorus (P)	2.0	10	2.0	10	5.0
Potassium (K)	4.0	20	4.0	20	10
Rubidium (Rb)	0.010	0.050	0.010	0.050	-
Selenium (Se)	0.020	0.10	0.010	0.050	0.020
Sodium (Na)	4.0	20	4.0	20	2.0
Strontium (Sr)	0.020	0.10	0.010	0.050	0.010
Tellurium (Te)	0.0040	0.020	0.0040	0.020	-
Thallium (Tl)	0.00040	0.0020	0.00040	0.0020	0.0010
Tin (Sn)	0.020	0.10	0.020	0.10	0.020
Uranium (U)	0.00040	0.0020	0.00040	0.0020	0.0010
Vanadium (V)	0.020	0.10	0.020	0.10	0.020
Zinc (Zn)	0.20	1.0	0.10	0.50	0.10
Zirconium (Zr)	0.040	0.20	0.040	0.20	-

[a] from Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[b] Method for total mercury analysis will be according to USEPA (1991, 2001).

B) Productivity Parameters

Parameter	Units	Method	LRL
Chlorophyll-a	µg	USEPA 1997	0.02
Ash Free Dry Weight	g	APHA 2010	0.001

will be made by calculating the relative percent difference (RPD) between concentrations between paired duplicates. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Results for laboratory blanks, precision, and accuracy will be evaluated relative to Data Quality Objectives (DQO) established by the analytical laboratory that performed the analyses. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the DQR, all periphyton data and supporting data will be managed in MS Excel. For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, minimum, and maximum for each analyte. Data analysis will be completed for each monitoring component (productivity, community, and tissue quality).

Periphyton productivity (chlorophyll-a and AFDM) results will be converted to a standard area-based measurement (mg/m^2 and g/m^2 for chlorophyll-a and AFDM, respectively), and chlorophyll-a results will be compared to water quality guidelines for the protection of aquatic life (BCWQG = 100 mg/m^2; BCMOE 2018) and to literature-based criteria for moderately enriched streams (21 mg/m^2; Biggs 1996). Periphyton productivity results will also be compared to previous data (where possible), and to reference results. For periphyton community, endpoints including density, taxon richness, diversity indices, and dominant community composition endpoints will be calculated, and compared to reference results. Temporal comparisons of periphyton community results will be made once data are available (2018 represents the first year of periphyton community sample collection). More detailed evaluation of periphyton productivity and community results will include analyses using a control-impact study design. Specifically, Analysis of Variance (ANOVA) will be used to test for differences in periphyton productivity and community endpoints between rehabilitated areas of Hazeltine Creek and lower Edney Creek, and associated reference areas. For these analyses, the assumptions of normality and homogeneity of variances will be tested on the residuals of the ANOVA model using the Shapiro-Wilk test and Levene's test based on median values, respectively, using a significance level (α) of 0.05. Data will be transformed as necessary to satisfy assumptions of normality and

homogeneity of variance as required. In instances where the residuals of the ANOVA model do not meet the assumptions of normality and homogeneity of variances, a non-parametric Kruskal-Wallis test will be conducted. When the overall results of an ANOVA or Kruskal-Wallis test are significant, differences between specific areas will be evaluated using post-hoc contrasts for ANOVA or Dunn's test for the Kruskal-Wallis test. A Bonferroni correction on the p-values will be used to conserve the overall Type I error rate. Further detailed analyses will be completed as required for data interpretation, and may include: graphical comparisons to reference and historical data (if available), graphical plots in relation to guidelines and criteria, and formal statistical temporal and spatial contrasts using methods similar to those described above.

If exposed versus reference or temporal differences in periphyton productivity and community results are noted, relationships between periphyton productivity and community endpoints and supporting water quality will be evaluated using Spearman correlation (often referred to a Spearman Rank-Order correlation). Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points). Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., changes in periphyton productivity or community), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

Data analysis and interpretation of periphyton tissue quality results will focus on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015, 2016, Minnow 2015). Periphyton tissue quality results for these analytes will be compared to available pre-breach data (for selenium only [2010, 2012, and 2013]; Minnow 2011, 2013a, 2013b), contrasted between exposed and reference areas, and also compared temporally within exposed areas. Detailed analyses and interpretation related to these comparisons will be completed as required, and may

include: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations tissue concentrations as described above

Concentrations of the POIs and IPs in periphyton tissue will also be evaluated relative to concentrations in water. These ratios of concentrations will be calculated as: [tissue sample concentration]/[dissolved water concentration], and are referred to as Bioconcentration Factors (BCFs). BCFs are often used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet (i.e., Arnot and Gobas 2006), and are applicable to erosional areas where sediment is generally not present. BCFs will be calculated using tissue metal concentrations (dry weight) and mean dissolved metal concentrations in water from each sampling area. Calculated BCFs will then be qualitatively compared among areas to identify differences in the uptake of metals by periphyton in areas impacted by effluent discharge and/or the TSF embankment breach. Mean BCFs will also be qualitatively compared between or among years to examine any broad temporal changes in metal accumulation in periphyton tissue at exposed sites. In addition, concentrations of POIs and IPs in periphyton tissue will be used in the evaluation of Trophic Transfer Factors (TTFs) to benthic invertebrates; the ratio of tissue concentrations in benthic invertebrates relative to concentrations in periphyton (i.e., TTF = [benthic invertebrate sample]/[periphyton sample]). TTFs can be used generally to describe the extent to which the concentration of an analyte increases between lower and higher trophic levels (e.g., Presser and Luoma 2010; see CEMP Benthic Invertebrate Section 6.13 for details).

An interpretive report based on the periphyton monitoring data will be prepared for integration into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQG and other guidelines or classification schemes, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.4

Fish Monitoring

Minnow Environmental Inc.

Fish
Monitoring Plan

Prepared for:

Mount Polley Mining Corporation
Likely, British Columbia

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June 2018

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A Trinity Consultants Company

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1 INTRODUCTION

1.1 Background

Fish are important and highly valued aquatic ecosystem components. Fish community composition, fish population characteristics (e.g., survival, growth, and reproduction), and fish tissue quality can be effective monitors of potential biological effects associated with water quality, sediment quality, and/or physical disturbance. Fish tissue quality is also an important measure of potential exposure to metals, metalloids, nutrients[1], and other substances to humans and wildlife that consume fish. Lastly, the use of fish habitat by fish is an important monitor of the physical and chemical quality of aquatic habitat.

The influence of the Mount Polley Mine on fish communities, populations, and/or tissue quality can occur by several key mechanisms: 1) general mine influence on creeks and lakes from physical impingement, dustfall, and/or uncontained surface or groundwater flows; 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to November 2017, and directly since January 2018]); 3) the Tailings Storage Facility (TSF) embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Potential effects associated with effluent discharge are chemical, while those associated with general mine influence, the TSF embankment breach, and subsequent remediation can be both physical and chemical.

Fish in waterbodies adjacent to the Mount Polley Mine have been monitored historically by the provincial government (Burns and Klein 1973; Lirette and Tredger 1991; Bruce and Slaney 1991) and by the Mount Polley Mine starting with baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996a,b,c, 1997a). Results of fish monitoring are reviewed in Section 2 and provide context for a CEMP fish monitoring program (community, population, and tissue quality) that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and temporal differences. Fish tissue quality monitoring data will also be evaluated relative to guidelines for the protection of aquatic life and/or human health (e.g., the British Columbia Water Quality Guideline for selenium [BCMOE 2014] and the Health Canada guideline for mercury [CFIA 2015]). In addition, fish population monitoring is required as part of Environmental Effects Monitoring (EEM) under the Metal and Diamond Mining Effluent Regulations (MDMER) of the

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication.

federal *Fisheries Act* (Government of Canada 2018). The focus of the federal EEM fish survey is to determine if there are effects to sentinel fish population characteristics (e.g., survival, growth, and/or reproduction) associated with the discharge of mine effluent (currently to Quesnel Lake). Lastly, fish habitat characterization and fish usage monitoring serves to document and track the effectiveness of fish habitat that has been reconstructed/rehabilitated following the TSF embankment breach.

The following sections of the CEMP Fish Monitoring Plan provide the objectives of fish monitoring, a summary of historical fish community, population, and tissue quality findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for fish monitoring (quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of fish monitoring is to evaluate the influence of Mount Polley Mine activities on fish communities, populations, and tissue quality in receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines [BCMOE 2014; CFIA 2015]). Fish monitoring also provides data to support exposure assessment as part of post-breach ecological risk assessment (ERA) and human health risk assessment (HHRA). Lastly, fish monitoring documents fish habitat utilization in creek and lake areas that were physically impacted by the TSF embankment breach (most notably Hazeltine Creek and the lower segment of Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts. The objective of the MDMER EEM fish monitoring is to evaluate whether there are differences in population endpoints (survival, growth, and reproduction) of sentinel fish species between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012). As prescribed by the MDMER, there is no requirement to monitor fish tissue quality under the MDMER because the concentration of mercury in Mount Polley Mine effluent is less than 0.1 µg/L (0.0001 mg/L; Government of Canada 2018).

2 SUMMARY OF HISTORICAL FINDINGS

Fish monitoring in the vicinity of the Mount Polley Mine has been undertaken since 1989, with most of the monitoring conducted in Polley Lake, Bootjack Lake, Hazeltine Creek, and Edney Creek (Table 1). Fish in Quesnel Lake have also been intensively monitored since the TSF embankment breach in August 2014 and following the initiation of effluent discharge to Quesnel Lake in December 2015. Fish monitoring in the vicinity of the Mount Polley Mine has spanned four distinct time periods:

1. Baseline monitoring (1989, 1991, 1995, 1996);
2. Pre-breach operational monitoring (1997, 1998, 1999, 2007, 2009, 2010, 2012, 2013, 2014);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge operational monitoring (2016, 2017).

For Polley Lake and Hazeltine Creek, the second time period can be sub-divided into periods of: 1) prior to; 2) during; and 3) after, an uncontrolled surface runoff event from the north waste rock dump which reported to Polley Lake via North Dump Creek. This runoff started in 2006, was controlled in 2009 with the construction of the Long Ditch, and was characterized by elevated concentrations of sulphate and selenium. In addition to the construction of the Long Ditch, Mount Polley initiated selenium-specific aquatic environmental monitoring in 2009.

Fish community, population, and/or tissue quality data collected prior to the breach were summarized in an Aquatic Environmental Description Report prepared concurrent with an application for water discharge to Polley Lake in 2014 (Minnow 2014a). General findings of the historical monitoring, as well as fish monitoring data collected from 2014 to present, are provided in the following sections, by sampling area, to support the design of the CEMP Fish Monitoring Plan.

2.1 Polley Lake

2.1.1 Fish Community / Population

Baseline monitoring in Polley Lake and reference lakes (Bootjack, Trio, Morehead, and Frypan lakes) was conducted in 1989, 1995, and 1996 and documented the presence of rainbow trout, longnose sucker, and redside shiner. Peamouth chub and largescale sucker have also been reported in Bootjack Lake (in 2014 and 2016, respectively). The fish species composition of Polley and Bootjack lakes has remained the same through operational monitoring and following the perimeter embankment breach. Catchability of rainbow trout and longnose sucker in Polley

Table 1: History of Fish Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Endpoints[1]	Report
1989	Bootjack, Morehead	C, P, T[2]	Imperial Metals 1990
1995	Polley, Bootjack	C, P, T	HKP 1996a
1996	Polley, Bootjack	C[3]	HKP 1997a
1999	Polley, Bootjack	C, P, T	Beak 2000
2009	Polley, Bootjack, Trio, Frypan, Quesnel (near Hazeltine Creek)	C, P, T	Minnow 2011
2010	Polley, Quesnel (near Hazeltine Creek and North Arm)	C, P, T	Minnow 2011
2012	Polley, Bootjack, Trio, Frypan, Quesnel (near Hazeltine Creek and North Arm)	C, P, T[4]	Minnow 2013a
2014	Polley, Bootjack, Quesnel (multiple locations)	C, P[5], T	Lirette 2015; Golder 2016
2015	Poley[6], Bootjack, Quesnel (multiple locations), Trio	C, P, T	Golder 2016; Zirnhelt 2016; Zirnhelt and Dolighan 2015
2016	Polley, Quesnel (multiple locations)	C, P, T	Minnow 2016, 2017a,b; Lirette 2017
2017	Polley, Bootjack, Quesnel	C, P, T	Minnow 2018a

[1] C = Community, P = Population, and T = Tissue.

[2] Rainbow trout in Bootjack Lake only.

[3] Recreational angling use survey only.

[4] Selenium concentrations only.

[5] Population estimates only taken at Polley Lake (Lirette 2015).

[6] Rainbow trout collected from Frypan Creek and pooled with samples from Polley Lake.

Table 1: History of Fish Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

B) Creeks and Rivers

Year	Locations	Endpoints[1]	Report
1989	Upper Hazeltine, Lower Hazeltine, Upper Edney, Lower Edney, Bootjack, Morehead, Lower Morehead, 4K, 6K	C	Imperial Metals 1990
1990	Hazeltine, Bootjack	C, P	Bruce and Slaney 1991
1995	Upper Edney (multiple tributaries)	C, P	HKP 1996b,c
1996	Upper Edney (multiple tributaries)	C, P	HKP 1997a
1997	Upper Edney (multiple tributaries)	C, P	HKP 1997b
1998	Upper Edney (multiple tributaries)	C, P	Beak 1999
2007	Upper Hazeltine, Lower Hazeltine, Upper Edney (NE trib), Reference (Upper Edney [SW trib], Upper Cedar, Lower Whiffle)	C, P	Cariboo Envirotech 2008; Minnow 2009
2009	Upper Hazeltine	C, P, T[2]	Minnow 2011
2010	Upper Hazeltine	T[2]	Minnow 2011
2012	Upper Hazeltine	C, P, T[2]	Minnow 2013a
2013	Upper Hazeltine	T[2]	Minnow 2013b
	Bootjack	C, P	Minnow 2014b
2014	Upper Hazeltine, Horsefly, Quesnel, Soda, Edney	C, T[2]	DWB 2014; Golder 2016
2015	Frypan[3], Quesnel, Edney	C, P, T	DWB 2015; Golder 2016
2016	Edney	C, P	Minnow 2018b
2017	Edney, Quesnel	C, P, T	Minnow 2018a,b

[1] C = Community, P = Population, and T = Tissue.

[2] Selenium concentrations only.

[3] Rainbow trout collected from Frypan Creek and pooled with samples from Polley Lake.

Lake and Bootjack Lake by gill netting has remained reasonably consistent from baseline to the most recent gill netting effort in 2016 (Table 2). More recent hoop netting efforts (adopted as a preferred method as captures are non-lethal) document good catchability of both large-bodied species (Table 2).

After the perimeter embankment breach (August 2014), a barrier was installed at the outlet of Polley Lake preventing Polley Lake fish from accessing Hazeltine Creek. There was a noticeable decline in rainbow trout recruitment post-breach as evident in the smaller relative sizes of the age 1 and 2 cohorts in 2016, and the age 1 to 3 cohorts in 2017 (Figures 1 and 2; Minnow 2017a). The barrier preventing fish from entering Hazeltine Creek from Polley Lake was removed in the early spring of 2018 and recruitment is expected to increase accordingly.

2.1.2 Fish Tissue Quality

Tissue quality of Polley Lake (and Bootjack Lake) fish was evaluated in 1989, 1995, 1996, and 1999[2], providing baseline metal concentrations in muscle and liver tissue of rainbow trout and longnose sucker (Imperial Metals 1990; HKP 1996a, 1997a; Beak 2000). Fish tissue quality monitoring was subsequently undertaken in 2009 in response to the uncontrolled surface runoff event from a north waste rock dump which reported to Polley Lake via North Dump Creek (Minnow 2011). Results of the post-runoff but pre-breach monitoring (2009 to 2012) indicated that selenium concentrations in rainbow trout muscle and ovary tissue[3] were stable, that concentrations in muscle tissue were near the British Columbia water quality guideline (BCWQG; BCMOE 2014), and that concentrations in ovary tissue were below the BCWQG (Figure 3). A decrease in selenium concentrations in rainbow trout muscle and ovary concentrations appeared to occur from 2012 to 2014 (pre-breach; Figure 3). Ovary tissue is the best tissue for evaluating the potential adverse effects of selenium to fish (which are considered the most selenium sensitive organisms; Presser and Luoma 2009; Janz et al. 2010; DeForest et al. 2012; Janz 2012). Concentrations in selenium were also well below the effect threshold of 20 mg/kg dw developed by DeForest et al. (2012). Following the TSF embankment breach, an increase in concentrations of selenium in rainbow trout muscle (to above BCWQG) and ovary (below BCWQG) were observed (Figure 3), but the latter remained below the effect threshold.

Following the TSF embankment breach, fish tissue quality investigations were expanded to focus on a suite of analytes that included selenium and also included metals that: 1) were identified as

[2] Although the 1999 collections occurred after mine startup, the results of the collections were verified against previous data and, based on similar results, were used to augment the baseline database to a sample size of ten fish.

[3] Adult rainbow trout were collected either from Polley Lake or from upper Hazeltine Creek. The latter were adult fish from Polley Lake that had moved into Hazeltine Creek to spawn and are considered indistinct from Polley Lake fish for tissue quality monitoring purposes.

Table 2: Catch-Per-Unit-Effort (CPUE) Data for Rainbow Trout and Longnose Sucker in Polley Lake, 1995 - 2017

Year	Data source	Fishing Method	Effort (h)	Rainbow Trout		Longnose Sucker	
				Catch	CPUE	Catch	CPUE
1995	**HKP (1996a)**	Experimental gill net [a] (0.5" - 4" mesh)	15.72	16	0.0006	37	0.0014
2012	**Minnow (2013a)**	Multiple gill nets [b]	48.42	30	0.0006	68	0.0013
2014	**Lirette (2015)**	Four panel sinking net	15.17	75	0.0031	107	0.0044
		Four panel floating net	15.92	69	0.0027	33	0.0013
		All nets combined	15.50	144	0.0029	140	0.0028
2016	**Lirette (2017)**	Four panel sinking net	15.80	45	0.0018	154	0.0061
		Four panel floating net	15.77	79	0.0032	26	0.0010
		All nets combined	15.79	124	0.0025	180	0.0036
2016	**Minnow (2017b)**	Hoop Net [c]	804	1,737	51.9	2,422	72.4
2017	**Minnow (2018a)**	Hoop Net [c]	20.88	8	9.2	247	285
		Seine Net [d]	-	31	3.1	-	-

[a] CPUE values calculated using reported fishing effort time (15h 43min), and gillnet dimensions (67.5m x 2.35m) (HKP 1996a).
[b] CPUE values calculated as (caught / [ft^2 * h]).
[c] CPUE values calculated as number of fish per trap-day.
[d] CPUE values calculated as number of fish captured per m^2 (Area = 10 m^2).

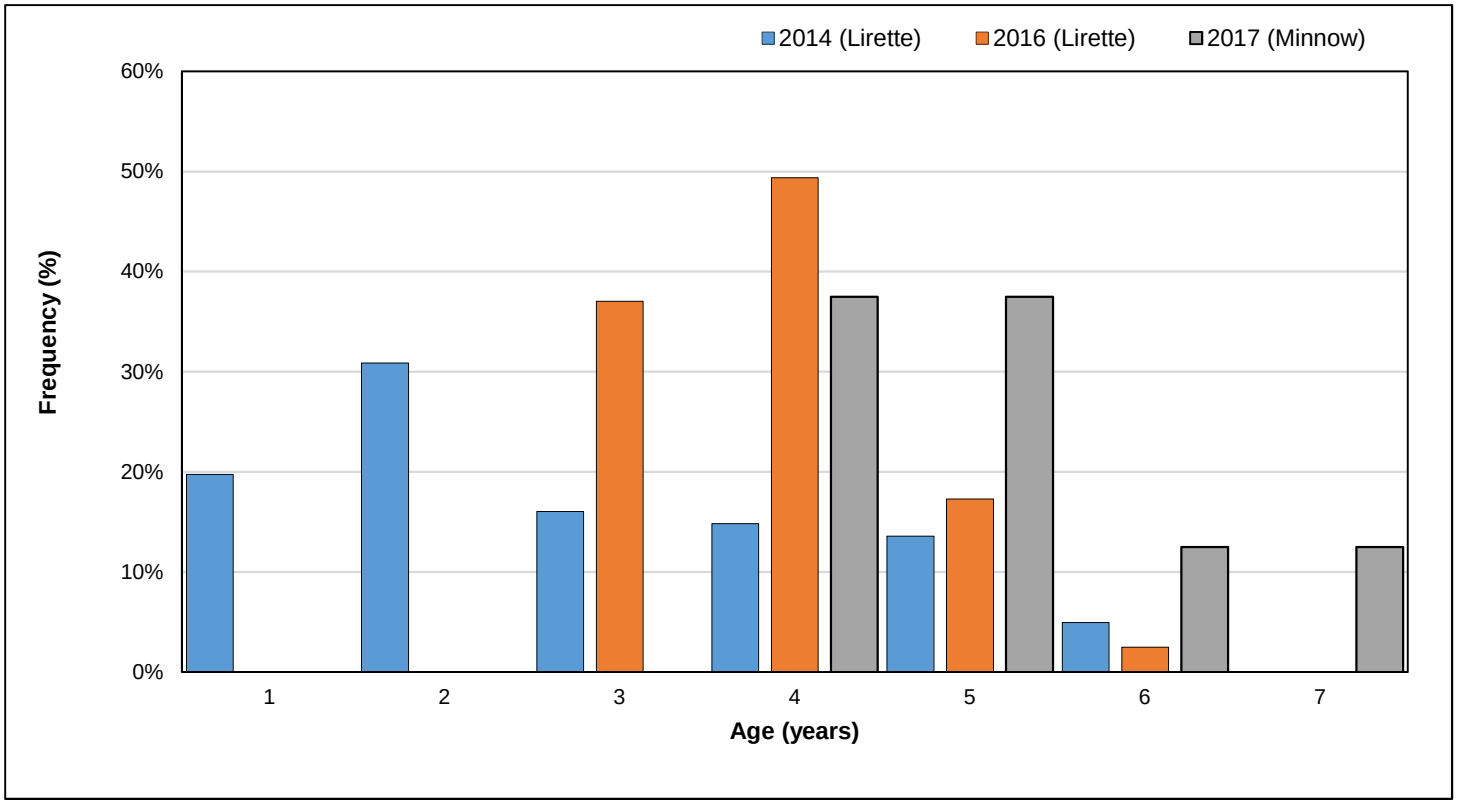

Figure 1: **Rainbow trout age frequency distribution in Polley Lake (data from Lirette 2014 and 2016, and Minnow 2017a)**

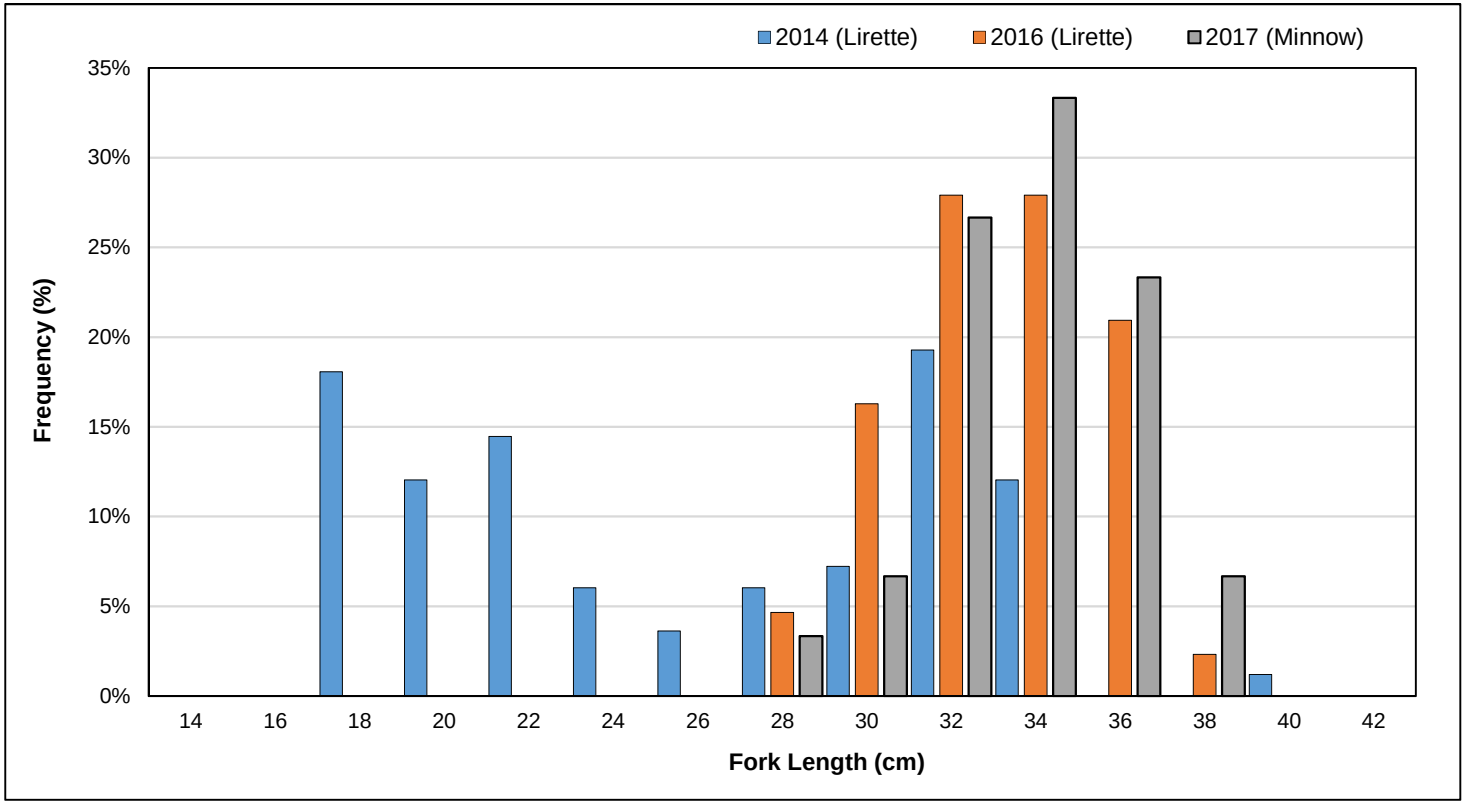

Figure 2: Rainbow trout fork length frequency distribution in Polley Lake (data from Lirette 2014 and 2016, and Minnow 2017a)

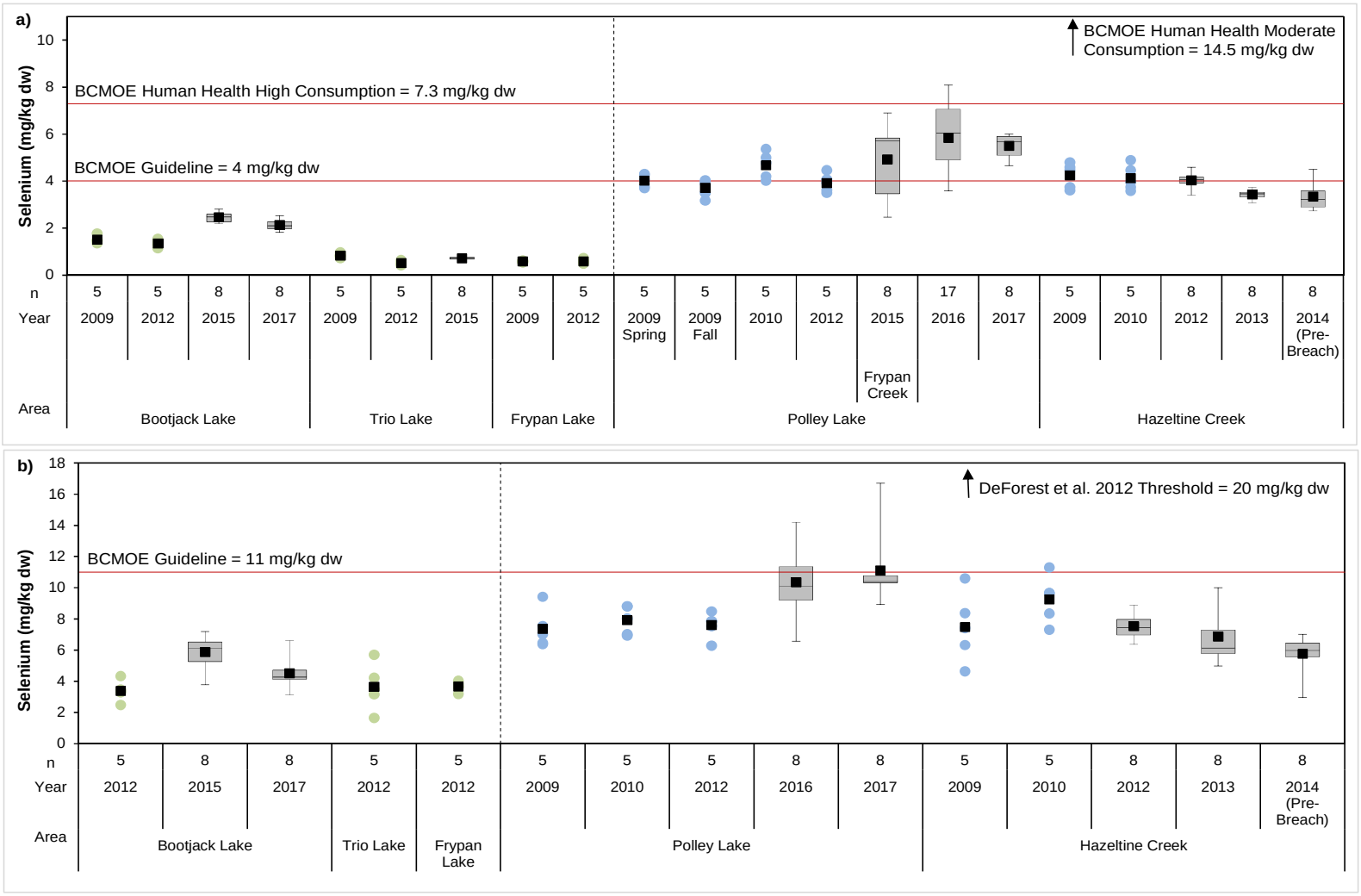

Figure 3: Selenium Concentrations in Rainbow Trout a) Muscle and b) Ovaries from Polley Lake, Hazeltine Creek, and Associated Reference Areas, Mount Polley, 2009 to 2017

Notes: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.

indicative of the influence of the TSF embankment breach on the receiving environment (arsenic, copper, iron [Minnow 2015], molybdenum, phosphorus, selenium [Golder 2015, 2016a]; and/or 2) had tissue quality guidelines (mercury and selenium). Concentrations of mercury and selenium in tissues of rainbow trout and longnose sucker collected in Polley Lake in 2015 to 2017 were lower than guidelines for the protection of human health (Figures 3 and 4), indicating that the fish can be safely consumed at consumption levels typical of the general population (Minnow 2017b, 2018a). Statistical contrasts of concentrations of the expanded suite of analytes in the tissues of Polley Lake fish relative to Bootjack Lake fish showed little agreement in terms of significant differences among species and/or tissues for almost all analytes, nor in the direction of differences when they were observed. This pattern indicates that, if there was any breach-related influence on Polley Lake fish tissue quality, it was minor. In Polley Lake, the only corroborated (reasonably unequivocal) differences were in selenium concentrations in the ovaries of Polley Lake rainbow trout, which were higher than reference and pre-breach in 2016 and 2017, potentially indicative of a breach-related influence (Minnow 2017b, 2018a). The same was not observed in longnose sucker; concentrations in longnose sucker tissues from Polley Lake (2017) were elevated relative to Bootjack Lake (2017), but were significantly lower than selenium concentrations in Polley Lake in 2010. For both species (rainbow trout and longnose sucker), selenium concentrations in ovary tissue were not at levels where adverse effects to fish would be expected (i.e., were not above the effect threshold).

2.2 Hazeltine Creek

2.2.1 Fish Community / Population

The fish community of Upper Hazeltine Creek has been dominated by juvenile rainbow trout during every sampling effort (Table 3). The fish community of Lower Hazeltine Creek (and Lower Edney Creek; both of which flow into Quesnel Lake) included bridgelip sucker, burbot, chinook salmon, coho salmon, kokanee, largescale sucker, longnose dace, longnose sucker, mountain whitefish, northern pikeminnow, peamouth chub, rainbow trout, and redside shiner (Table 3). Most of the fish species documented in Lower Hazeltine Creek or Lower Edney Creek in baseline (1989; Imperial Metals 1990) and in 2007 (Minnow 2009) were also observed in the rehabilitated section of Lower Edney Creek in 2016 and 2017 (Minnow 2018b).

The majority of rainbow trout collected in upper Hazeltine Creek and Edney Creek (79%; SNC-Lavalin 2015) have been young-of-the-year (YOY). In baseline, the density of rearing rainbow trout was 710 fish/100 m^2 and in lower Hazeltine Creek was 325 fish/100 m^2 (Imperial Metals 1990). By comparison, density in Bootjack Creek was 1,500 fish/100 m^2 (Imperial Metals 1990). Sampling in 1991 documented rainbow trout YOY density of 287 to 444 fish/100 m^2 in Hazeltine Creek compared to Bootjack Creek which had a density of 465 fish/100 m^2 (Bruce

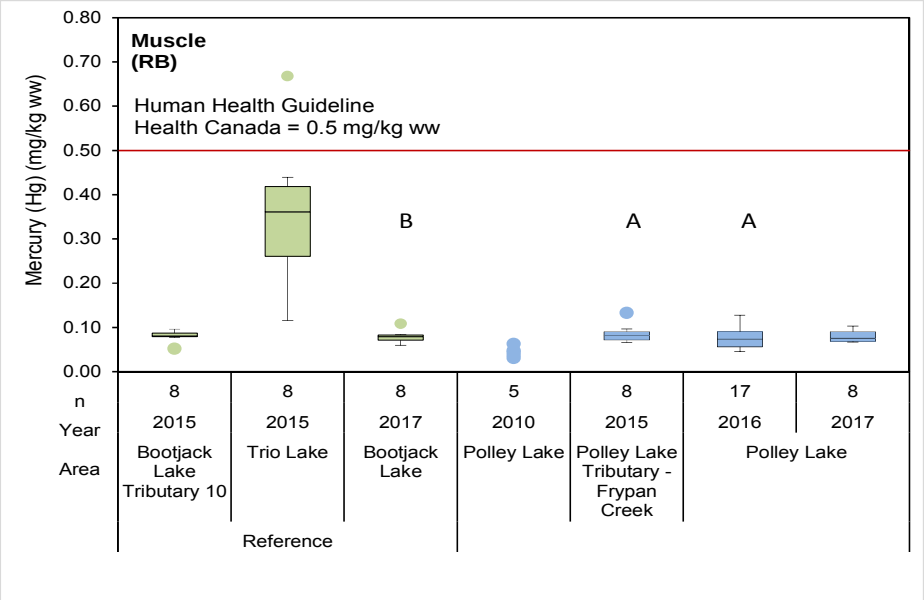

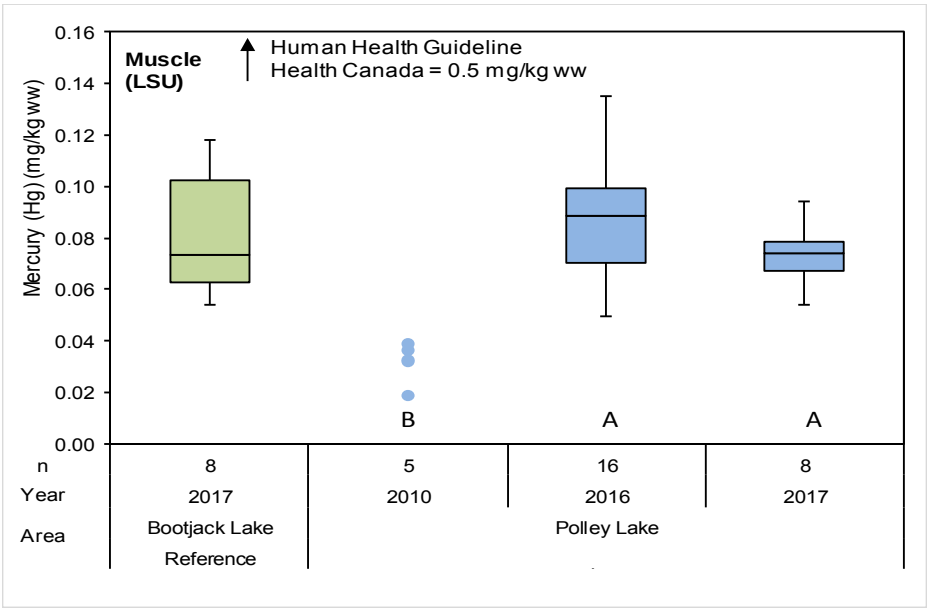

Figure 4: Mercury Concentrations (mg/kg ww) in Muscle Tissue of Fish from Polley Lake (2015 to 2017) Relative to Reference Areas (Bootjack Lake and Trio Lake; 2015 to 2017) and Pre-Breach (Polley Lake; 2010) [a,b,c]

[a] Concentrations in rainbow trout (RB) and longnose sucker (LSU) tissues from Polley Lake (2017) that differed significantly ($p<0.05$) from Bootjack Lake (2017) are denoted by an asterisk (*).

[b] Among-year comparisons were completed for Polley Lake only (2010, 2016 and 2017). The absence of letters (A,B,C) for 2010, 2016, and 2017 indicates no significant difference exists among years. Where significant differences were identified (family-wise $\alpha=0.05$), the years that were not significantly different from each other were assigned a common letter (A,B,C). The year with the greatest mean is assigned "A".

[c] Data summarized as boxplots when sample size was 8 or more; dot plots when sample size was 8 or fewer, or fewer than 8 results were detectable.

Table 3: Summary of Fish Collected in Hazeltine Creek and Associated Reference Areas, Mount Polley, 1989 to 2017

Area	Year	Report	Fishing Method	Bridgelip Sucker	Burbot	Chinook Salmon	Coho Salmon	Kokanee	Largescale Sucker	Longnose Dace	Longnose Sucker	Mountain Whitefish	Northern Pikeminnow	Peamouth Chub	Rainbow Trout	Redside Shiner	Sockeye Salmon	Salmon fry [c]	Juvenile Sucker sp.
Upper Hazeltine Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-
	1990	Bruce and Slaney 1991	electrofishing	-	-	-	-	-	-	-	-	-	-	-	616	-	-	-	-
	2007	Minnow 2009	electrofishing	-	-	-	-	-	-	-	-	-	-	-	198	-	-	-	-
	2012	Minnow 2013a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-
	2013	Minnow 2013b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-
	2014 [a]	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-
Lower Hazeltine Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	2	-	-	142	-	8	-	-
	2007	Minnow 2009, Cariboo Envirotech 2008	electrofishing	6	158	38	9	-	9	24	-	-	-	18	96	6	-	-	-
Upper Edney Creek [b]	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-
	1995	HKP 1996b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	295	-	-	-	-
	1996	HKP 1997a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	435	-	-	-	-
	1997	HKP 1997b	minnow trap, electrofishing	-	-	-	-	-	-	-	1	-	-	-	200	-	-	-	-
	1998	Beak 1999	electrofishing	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-
	2007	Minnow 2009, Cariboo Envirotech 2008	electrofishing	-	-	-	-	-	-	-	-	-	-	-	155	-	-	-	-
Lower Edney Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	12	16	-	-	-	-	7	3	-	-	24	-	869	-	-
	1995	HKP 1996b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-
	1996	HKP 1996b, 1997a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	158	-	-	-	-
	1997	HKP 1996b, 1997b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	111	-	-	-	-
	1998	Beak 1999	electrofishing	-	-	-	-	-	-	-	-	-	-	-	111	-	-	-	-
	2007	Cariboo Envirotech 2008	unknown	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-
	2014	DWB 2014	electrofishing	-	-	-	-	-	-	-	-	-	-	-	52	-	-	-	-
	2015	DWB 2015	electrofishing	-	16	-	-	-	-	11	27	-	18	-	125	4	-	39	-
Lower Edney Creek (Rehabilitated)	2016	Minnow 2018b	minnow trap, electrofishing, hoop net	-	17	6	11	-	4	58	2	8	9	-	245	33	-	-	10
	2017	Minnow 2018b	minnow trap	-	2	-	181	-	-	35	19	-	32	4	66	56	-	-	17
Lower Edney Creek (Reference)	2016	Minnow 2018b	minnow trap, electrofishing	-	4	3	21	-	-	12	-	1	1	-	93	1	-	-	-
	2017	Minnow 2018b	minnow trap	-	-	1	96	3	-	6	-	-	-	-	76	-	-	-	-
Horsefly River	2014 [a]	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
Lower Whiffle Creek	2007	Minnow 2009	unknown	-	27	-	-	-	-	-	-	-	-	-	118	-	-	-	-
Soda Creek	2014 [a]	Golder 2016	electrofishing	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-

[a] Catch numbers are amount of fish retained for tissue analysis, more fish may have been collected.
[b] Upper Edney Creek includes all stations on Upper Edney as well as two tributaries of Edney Creek
[c] Fry could not be identified to species level but suspected to include Coho, Chinook, and Sockeye

and Slaney 1991). In 2007, Upper Hazeltine Creek had a higher density of rainbow trout (400 to 700 fish/100 m^2) compared to the reference area, upper Edney Creek in 2007 (200 to 640 fish/100 m^2; Minnow 2009). Rainbow trout densities in Edney Creek varied considerably over time, with baseline densities of 169 fish/100 m^2 in 1996 and 17 fish/100 m^2 in 1997 (Minnow 2014b).

2.2.2 Fish Tissue Quality

Fish tissue quality evaluations have focussed on lake fish (see above). Adult rainbow trout have been collected from Hazeltine Creek for tissue quality characterization, and the associated data interpretation is integrated with the data for Polley Lake (above) as adult rainbow trout captured in Hazeltine Creek migrate into the creek to spawn.

2.3 Quesnel Lake

2.3.1 Fish Community / Population

The fish community of Quesnel Lake has been well characterized and includes a total of 20 species (Table 4). Prior to the TSF embankment breach, fish monitoring in Quesnel Lake was limited to collections for tissue quality analysis (2009, 2012, and 2014). These collections resulted in the capture of burbot, lake trout, largescale sucker, longnose sucker, mountain whitefish, peamouth chub, and rainbow trout (Table 5). Fish collections, primarily for tissue quality, have been undertaken annually since the TSF embankment breach in 2014, with community composition similar to that documented previously (Table 5). Additional collections for federal Environmental Effects Monitoring (EEM) were undertaken in 2016 (Minnow 2016).

The Mount Polley Phase 1 EEM included a population study of two sentinel species – northern pikeminnow and largescale sucker (with a supporting evaluation of peamouth chub; Minnow 2016). The objective of this monitoring was to determine if exposure to Mount Polley mine effluent (discharged to Quesnel Lake starting in December 2015) has an effect on the survival, growth, or reproduction of sentinel fish populations as compared to reference populations. Some differences in fish population endpoints (i.e., survival and energy use) were observed for northern pikeminnow, largescale sucker, and peamouth chub captured from effluent-exposed versus reference areas (Minnow 2016). However, there was no concordance between the results of comparisons of effluent-exposed populations to the two reference area populations (i.e., the metrics for effluent-exposed populations were often intermediate between the two references) nor among the three species. Overall, it was concluded that fish communities in the effluent-exposed and reference areas were similar and that effluent discharges from the mine were not affecting fish populations or fish health (Minnow 2016).

Table 4: Fish Species Documented in Quesnel Lake

Common Name	Latin Name
Sockeye Salmon	*Oncorhynchus nerka*
Coho Salmon	*Oncorhynchus kisutch*
Chinook Salmon	*Oncorhynchus tshawytscha*
Kokanee	*Oncorhynchus nerka*
Rainbow Trout	*Oncorhynchus mykiss*
Bull Trout	*Salvelinus confluentus*
Lake Trout	*Salvelinus namaycush*
Pygmy Whitefish	*Prosopium coulteri*
Mountain Whitefish	*Prosopium williamsoni*
Lake Whitefish	*Coregonus clupeaformis*
Burbot	*Lota lota*
Largescale Sucker	*Catostomus macrocheilus*
Longnose Sucker	*Catostomus catostomus*
Slimy Sculpin	*Cottus cognatus*
Northern Pikeminnow	*Ptychocheilus oregonensis*
Peamouth Chub	*Mylocheilus caurinus*
Leopard Dace	*Rhinichthys falcatus*
Longnose Dace	*Rhinichthys cataractae*
Redside Shiner	*Richardsonius balteatus*
Lake Chub	*Couesius plumbeus*

Table 5: Summary of Fish Collected in Quesnel Lake, Mount Polley, 2009 to 2017

Area		Year	Report	Fishing Method	Bull Trout	Burbot	Chinook Salmon	Coho Salmon	Kokanee	Lake Trout	Largescale Sucker	Longnose Dace	Longnose Sucker	Mountain Whitefish	Northern Pikeminnow	Peamouth Chub	Rainbow Trout	Redside Shiner	Sockeye Salmon	Juvenile Sucker sp.
Exposed	Quesnel Lake (near Hazeltine Creek)	2009	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
		2010	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	5 [b]	-	-	-	5	-	-	-
		2012	Minnow 2013a	gill net	-	1	-	-	-	7	28	-	9	15	-	41	13	-	-	-
		2014 [a]	Golder 2016	unknown	-	12	-	-	-	51	-	1	1	4	36	1	-	2	-	-
		2015	Zirnhelt and Dolighan 2015, Zirnhelt 2016	gill net, trap net	-	4	-	-	-	10	72	-	-	-	53	18	-	18	-	-
		2016	Minnow 2017b	hoop net	-	16	2	-	-	-	65	20	-	21	123	444	18	33	-	-
		2017	Minnow 2018a	gill net, minnow trap	1	3	-	-	2	-	-	-	-	-	27	-	2	-	1	2
	Quesnel Lake (near Likely) [a]	2014	Golder 2016	unknown	-	1	-	-	10	-	-	-	-	1	7	12	1	-	-	-
		2015	Golder 2016	unknown	-	-	-	-	8	-	-	-	-	-	-	-	8	-	-	-
	Quesnel Lake (Middle) [a,c]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-
		2015	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-
	Quesnel Lake (West) [a]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-
		2015	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-
Reference	Quesnel Lake (North Arm)	2010	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	5 [b]	-	-	-	5	-	-	-
		2012	Minnow 2013a	gill net	-	-	-	-	-	-	3	-	-	6	-	-	7	-	-	-
		2014 [a]	Golder 2016	unknown	-	-	-	-	10	-	-	-	-	-	31	2	-	-	13	-
		2015	Zirnhelt and Dolighan 2015, Zirnhelt 2016, Golder 2016	gill net, trap net	-	7	-	-	-	10	39	-	-	-	12	8	-	70	10 [a]	-
		2016	Minnow 2017b	hoop net	-	14	-	-	-	-	23	-	2	2	53	5	-	130	-	-
		2017	Minnow 2018a	gill net	2	-	-	-	1	-	-	-	-	5	-	-	-	-	2	-
	Quesnel Lake (East Arm) [a]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
		2015	Golder 2016	unknown	-	7	-	-	-	10	-	-	-	-	-	-	-	-	10	-
	Quesnel Lake (near Horsefly)	2014 [a]	Golder 2016	unknown	-	1	-	-	-	-	-	2	-	-	10	6	-	-	-	-
	Quesnel Lake (Peninsula Bay)	2016	Minnow 2017b	hoop net	2	25	-	1	-	-	100	7	4	63	67	24	1	189	-	-
		2017	Minnow 2018a	gill net	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-

[a] Catch numbers are amount of fish retained for tissue analysis, more fish may have been collected, Golder 2016 Summary Report.
[b] Sample presented as longnose sucker but could possibly be largescale sucker.
[c] Potentially exposed.

2.3.2 Fish Tissue Quality

Tissue quality of Quesnel Lake fish was evaluated following the TSF embankment breach in 2014. This monitoring has included 12 fish species and variously included whole body, muscle tissue, liver tissue, Kidney tissue, and ovary tissue samples (Golder 2016; Minnow 2017b, 2018a). Fish tissue quality investigations were focussed on a suite of analytes that included metals that: 1) were identified as potentially indicative of the influence of the TSF embankment breach on the receiving environment (arsenic, cadmium, copper, iron, mercury, molybdenum, phosphorus, selenium, vanadium, and zinc; and/or or 2) had tissue quality guidelines (mercury and selenium).

Concentrations of mercury and selenium in tissues of fish collected in Quesnel Lake from 2015 to 2017 (burbot, kokanee, lake trout, largescale sucker, northern pikeminnow, peamouth chub, redside shiner) were lower than guidelines for the protection of human health in all cases except for mercury in large burbot and lake trout (Table 6; Minnow 2017b, 2018a). Large burbot and large lake trout (greater than approximately 66 cm in length [fork length and total length, respectively]) had mercury concentrations at levels where consumption limitation should be considered in accordance with provincial and federal guidance (e.g., BCMOE 2014; CFIA 2015). Smaller burbot and lake trout, as well as all other species can be safely consumed at consumption levels typical of the general population. There was no evidence that the Mount Polley Mine had any influence on mercury concentrations in burbot or lake trout. Rather, these species are piscivores (eat other fish) and are expected to have naturally higher concentrations of mercury (which is known to biomagnify). Concentrations of selenium in all fish species and tissues collected in Quesnel Lake were below BCWQGs for the protection of aquatic life.

In Quesnel Lake, uncertainty over fish movement between the exposed and reference areas and the absence of pre-breach datasets (of similar species) made interpretation of fish tissue quality results challenging. In Quesnel Lake, the only corroborated (reasonably unequivocal) differences in tissue metal concentrations of fish collected from exposed versus reference areas were higher concentrations of arsenic, cadmium, mercury, and selenium in tissues or whole bodies of northern pikeminnow and/or peamouth chub collected from exposed areas relative to reference areas. However, results of Environmental Effects Monitoring (EEM) undertaken in 2016 indicated that populations of northern pikeminnow and peamouth chub collected at the exposed area had very slightly (but not biologically meaningful) lower condition than reference fish (3.6% lower; Minnow 2016). Accordingly, the few corroborated differences in tissue metal concentrations were not associated with any adverse effect on the health of peamouth chub or northern pikeminnow. In 2017, no corroborated (reasonably unequivocal) temporal changes were identified for northern pikeminnow (whole bodies) collected from Quesnel Lake (relative to 2016; Minnow 2018a). This

Table 6: Comparison of Muscle and Whole Body Samples Collected in Quesnel Lake to Consumption Guidelines for Protection of Human Health or Guidelines for the Protection of Aquatic Life, MPMC, 2015 to 2017

Sample Collection Timing	Area	Species (Species Code)	Tissue	Sample Size	Mercury (Hg) mg/kg ww		Selenium (Se) mg/kg dw				
					Health Canada Human Health (0.5 mg/kg ww)		BCMOE Human Health (Moderate = 14.5 mg/kg dw) (High = 7.3 mg/kg dw)			BCMOE Guideline (4 mg/kg dw)	
					Mean	Frequency > guideline	Mean	Frequency > moderate	Frequency > high	Mean	Frequency > guideline
Fall 2015	near Hazeltine Creek	Burbot (BB)	Muscle	4	0.35	0%	2.8	0%	0%	2.8	0%
		Lake Trout (LT)	Muscle	10	0.22	10%	1.9	0%	0%	1.9	0%
		Largescale Sucker (CSU)	Muscle	8	0.12	0%	3.1	0%	0%	3.1	13%
		Northern Pikeminnow (NSC)	Muscle	7	0.24	0%	2.0	0%	0%	2.0	0%
		Peamouth Chub (PCC)	Whole Body	8	-	-	-	-	-	3.1	13%
		Redside Shiner (RSC)	Whole Body	8	-	-	-	-	-	2.7	0%
	near Likely	Kokanee (KO)	Muscle	8	0.092	0%	2.4	0%	0%	2.4	0%
	East Arm (Reference)	Burbot (BB)	Muscle	7	0.26	14%	2.4	0%	0%	2.4	0%
		Lake Trout (LT)	Muscle	10	0.26	10%	1.6	0%	0%	1.6	0%
	Near Grain Creek (North Arm, Reference)	Largescale Sucker (CSU)	Muscle	8	0.11	0%	1.6	0%	0%	1.6	0%
		Peamouth Chub (PCC)	Whole Body	8	-	-	-	-	-	2.2	0%
		Redside Shiner (RSC)	Whole Body	8	-	-	-	-	-	2.0	0%
Spring 2016	near Hazeltine Creek	Largescale Sucker (CSU)	Muscle	8	0.11	0%	2.8	0%	0%	2.8	0%
		Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	3.1	0%
		Peamouth Chub (PCC)	Muscle	8	0.24	0%	2.8	0%	0%	2.8	0%
	Near Grain Creek (North Arm, Reference)	Largescale Sucker (CSU)	Muscle	8	0.11	0%	1.6	0%	0%	1.6	0%
		Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	2.1	0%
		Peamouth Chub (PCC)	Muscle	8	0.15	0%	1.6	0%	0%	1.6	0%
Fall 2017	near Hazeltine Creek	Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	2.3	0%

Note: ww = wet weight; dw = dry weight.

Indicates mean mercury concentration greater than Health Canada's Human Health concentration for muscle tissue in fish (0.5 mg/kg ww; CFIA 2015).

Indicates mean selenium concentration greater than the BCMOE Human Health guideline for moderate fish consumption (14.5 mg/kg dw; BCMOE 2014).

Indicates mean selenium concentration greater than the BCMOE guideline for muscle tissue or whole body in fish (4 mg/kg dw; BCMOE 2014).

pattern indicates that, if there was any breach-related influence on Quesnel Lake fish tissue quality, it was minor.

2.4 Quesnel River

2.4.1 Fish Community / Population

Fish were sampled in the Quesnel River in 2014, 2015, and 2017, targeting rainbow trout, primarily by angling (Table 7). Other species were captured, including burbot, mountain whitefish, and peamouth chub (Table 7). Rainbow trout that were collected in the Quesnel River in 2017 were of similar age and size to those collected in 2015 (Minnow 2018a).

2.4.2 Fish Tissue Quality

Tissue quality of rainbow trout collected from the Quesnel River in 2015 and 2017 did not exceeded Health Canada's Human Health guideline for mercury (Minnow 2018a). In 2015, selenium concentrations in rainbow trout were below the BCMOE guideline for human health and for the protection of aquatic life, but in 2017, one sample exceeded these guidelines (Minnow 2018a). As observed in Quesnel Lake, no corroborated (reasonably unequivocal) temporal changes were identified for rainbow trout (muscle, liver, and kidney tissue) collected from the Quesnel River in 2017 (relative to 2015; Minnow 2018a).

Table 7: Summary of Fish Collected in Quesnel River, Mount Polley, 2014 to 2017

Area	Year	Report	Fishing Method	Burbot	Mountain Whitefish	Peamouth Chub	Rainbow Trout
Quesnel River	2014	Golder 2016	unknown	-	-	3	12
	2015	Zirnhelt and Dolighan 2015	angling	-	-	-	8
	2017	Minnow 2018a	angling	1	2	-	8

3 STUDY DESIGN OVERVIEW AND RATIONALE

Fish monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to remediation following the TSF embankment breach. As previously indicated, fish monitoring includes fish tissue quality monitoring, sentinel fish population monitoring, fish habitat characterization and fish usage monitoring, and fish community monitoring. An overview of the proposed fish monitoring program is provided in Table 8 and Figures 5 and 6.

3.1 Fish Tissue Quality

Fish tissue quality monitoring is focused on Polley Lake and Quesnel Lake, with un-impacted reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for exposed areas of Quesnel Lake; Table 8; Figures 5 and 6). In Polley Lake, fish tissue quality monitoring is undertaken to monitor the combined influence of general mine proximity, uncontrolled surface runoff from the north dump (2006 to 2009), and influence of the TSF embankment breach. In Quesnel Lake and Quesnel River, fish tissue quality monitoring is undertaken to monitor the combined influence of the TSF embankment breach and the discharge of Mount Polley mine effluent (December 2015 to present). In Polley Lake (and reference), fish tissue quality monitoring will focus on rainbow trout and longnose sucker. Because selenium was elevated in the 2006 to 2009 surface runoff, this monitoring will be focussed on the collection of females in the spring so that ripe ovaries can be collected. The full complement of tissues to be collected will include muscle, liver, kidney, and ovary (Table 8). Scientific consensus is that the best tissues for evaluating the potential adverse effects of selenium to fish (which are considered to be the most selenium sensitive organisms) are ripe ovaries or eggs (Presser and Luoma 2009; Janz et al. 2010; DeForest et al. 2012; Janz 2012). Tissues will be collected for the analytical determination of moisture content, metals, and mercury (Section 4.3). Supporting data will include catch per unit effort, length, weight, and age (see below). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (BCMOE 2014; CFIA 2015). A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in Polley and Bootjack lakes will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Table 8: Mount Polley CEMP Fish Monitoring Plan Overview

A) Fish Tissue Quality Monitoring [1]

Water Body	Type	Fish Species	Tissues [2,3]	Replication	Frequency [4]	Rationale
Polley Lake	Exposed	RB, LSU	M,L,K,O	8	annual	immediately adjacent to mine and breach-influenced
Bootjack Lake	Reference	RB, LSU	M,L,K,O	8	annual	reference for Polley Lake [5]
Quesnel Lake	Exposed	RB, LT, KO, NSC, PCC	M,L,K,O	8	annual	adjacent to effluent discharge and breach-influenced
	Reference	RB, LT, KO, NSC, PCC	M,L,K,O	8	annual	reference for Quesnel Lake exposed
Quesnel River	Far-Field Exposed	RB	M,L,K,O	8	annual	far-field exposed area near Quesnel Lake outlet

[1] All fish tissues will be evaluated for the following analytes: percent moisture, metals by ICP-MS scan, and total mercury (Table 9).

[2] Fish tissues: M = muscle, L = liver, K = kidney, O = ovary (as available/developed; note that females will only be specifically targeted in Polley and Bootjack lakes).

[3] Except for small bodied fish (PCC and juvenile NSC), which will be submitted whole.

[4] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

[5] Bootjack Lake is retained as the reference for Polley Lake due to the fact that it has not been notably affected by the mine, there is a long-term dataset available for it, and its watershed includes similar geology to Polley lake. The latter is not true for other potential reference areas.

B) Fish Population Monitoring

Water Body	Type	Fish Species	Endpoints	Replication	Frequency [3]	Rationale
Polley Lake	Exposed	RB, LSU	L,W,C [1]	100	annual	immediately adjacent to mine and breach-influenced
Quesnel Lake	Exposed	NSC, RSC	Federal EEM [2]	20 / sex	every 3 years [4]	adjacent to effluent discharge and breach-influenced
	Reference	NSC, RSC	Federal EEM [2]	20 / sex		reference for Quesnel Lake exposed

[1] L = length-frequency distribution (indicative of recruitment and survival), W = weight, C = condition (indicative of overall health / energy storage).

[2] Fish population endpoints prescribed for federal EEM will be applied. These differ for lethal and non-lethal designs as described in Section 4.2.

[3] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

[4] Frequency prescribed for federal EEM.

C) Fish Habitat Characterization and Usage Monitoring

Water Body	Type	Fish Species	Measures	Frequency [5]	Rationale
Upper Hazeltine Creek	Impacted [1]	RB, LSU	Fish habitat characterization [3], fish occupancy and meristics [4]	annual	immediately adjacent to mine and breach-impacted
Lower Hazeltine Creek	Impacted [1]	all / any [2]		every 2 years	breach-impacted
Lower Edney Creek	Impacted [1]	all / any [2]		every 2 years	breach impacted

[1] Impacted by the TSF embankment breach.

[2] A total of 20 fish species have been documented in Quesnel Lake (SNC-Lavalin 2015) and would have access to Lower Hazeltine and Lower Edney creeks.

[3] Fish habitat characterization using methodology applied in 2016 and 2017 (Minnow 2018b), as adapted from Johnston and Slaney 1996.

[4] Fish occupancy as determined by observation (including spawning, and general presence) and by fishing with record of catch/effort and meristic measures (length and weight).

[5] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

D) Fish Community Monitoring

** qualitative fish community data will be collected to support all fish tissue, fish population, and fish habitat usage collections

Water Body	Collection Methods [1,2,3]	Endpoint	Frequency [6]	Rationale
Polley Lake	HN, MT, FT, SN, EF, GN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Bootjack Lake	HN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Quesnel Lake	HN, MT, FT, SN, GN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Upper Hazeltine Creek	MT, FT, SN, EF [4]	CPUE [5]	annual	to support fish population and habitat usage monitoring
Lower Hazeltine Creek	MT, FT, SN, EF [4]	CPUE [5]	every 2 years	to support fish habitat usage monitoring
Lower Edney Creek	MT, FT, SN, EF [4]	CPUE [5]	every 2 years	to support fish habitat usage monitoring
Quesnel River	AG	CPUE [5]		to support fish tissue quality monitoring

[1] In order of preference for non-lethal fish collection methods whenever possible (e.g., hoop netting, minnow trapping, electrofishing).

[2] HN = hoop netting, MT = minnow trapping, FT = fry trapping, SN = seining, EF = electrofishing, GN = gill netting, AG = angling.

[3] Prohibited in waters over twenty degrees Celsius.

[4] Subject to electrofishing prohibition during spawning and incubation periods and in waters below five degrees Celsius.

[5] CPUE = catch per unit effort. For HN, MT, and FT, CPUE will be expressed as catch per unit deployment time; for SN, CPUE will be expressed as catch per unit area; for EF, CPUE will be expressed as catch per unit electroshocking time and per unit area; for GN, CPUE will be expressed as catch per unit net surface area-time; and for AG, CPUE will be expressed as catch per unit of angling effort.

[6] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

590,000 595,000 600,000 605,000 610,000 615,000 620,000

5,830,000 5,825,000 5,820,000 5,815,000

Likely

Frypan Lake

Cedar Creek

Horsefly Likely Forest Service Road

Nina Lake

Polley Lake

Mount Polley Mine

Bootjack Lake

Bootjack Creek Dam

Tailings Storage Facility (TSF)

Boswell Lake

Winkley Creek Road

Quesnel Lake

Gavin Lake Road

Hazeltine Creek

Edney Creek

Edney Lake Road

Near Hazeltine Creek

Near Grain Creek

Quesnel Lake

Peninsula Bay

Near Hazeltine Creek

0 2.5 5 10
km

Fort Nelson
BRITISH COLUMBIA
ALBERTA
Fort St. John
Prince George
Mount Polley 592,000 mE 5,822,000 mN
Williams Lake
Vancouver
United States

LEGEND

- Rainbow Trout from Quesnel River for Tissue
- Small Bodied Fish for Tissue and EEM- Reference
- Small Bodied Fish for Tissue and EEM - Exposed
- Exposed Lake
- Reference Lake
- Tailings Storage Facility
- Active Mine Operation

0 1.25 2.5 5
km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Fish Monitoring Areas, Lakes and Quesnel River

Date June 2018
Project 177202.0042

minnow environmental inc. A Ecofy Consultants Company

Figure 5

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LEGEND

- Stream Segments Subject to Habitat Characterization and Fish Habitat Use Assessment
- Rehabilited Reaches (Golder 2017a,b)
- Historic Watercourse

0 0.5 1 2
km

N
W E
S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Fish Monitoring Areas, Creeks

Date June 2018
Project 177202.0042

minnow environmental inc.

Figure 6

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\4-Fish\17-42 - Fig 6 Fish Monitoring in Creeks.mxd

In Quesnel Lake (exposed and reference), fish tissue quality monitoring will focus on sentinel species. Sentinel species were selected on the basis of their trophic position, their status as sportfish or non-sportfish, their typical home range sizes, and the availability of historical tissue quality data. Rainbow trout (to be collected in the Quesnel River near the lake outlet; see below) and lake trout were selected as the sentinel sportfish species to monitor potential changes in tissue quality over time relative to human consumption of sportfish. In 2018, kokanee will also be monitored for this purpose (as there is a dataset from 2014 to which they can be compared). Northern pikeminnow and peamouth chub were selected as sentinel species with small home ranges to monitor potential changes in fish tissue quality associated with the TSF embankment breach and effluent discharge from the perspective of aquatic ecosystem health. Redside shiner may be used as an alternate sentinel species for this purpose depending upon future capture success. Fish species with small home ranges are better monitors of the potential effects of defined point sources (due to the fact that they are more continuously exposed) than fish with larger home ranges (e.g., Environment Canada 2012). The larger bodied fish will be subject to sampling the full complement of tissues, including muscle, liver, kidney, and ovary (Table 8). Ovary will only be sampled when available (i.e., when fully developed in mature females); additional fish will not be targeted and sacrificed to achieve the target sample size for ovary tissues (i.e., it is expected that ovary sample sizes will be less than eight). The small bodied fish (i.e., small northern pikeminnow, peamouth, and/or redside shiner) will be submitted as headless carcasses (as the heads will be submitted for otolith extraction and age determination). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (for selenium and mercury; BCMOE 2014; CFIA 2015). It is noted that comparison to reference conditions has previously proven to be challenging due to uncertainty over exposure given the large home ranges of the sportfish species and the apparent absence of a strong mine influence (Golder 2016; Minnow 2017b, 2018a). Thus, the greatest utility of fish tissue monitoring is as a temporal monitor and for comparison to available guidelines. A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in Quesnel Lake will be undertaken at an annual monitoring frequency from 2018 to 2020 (although, as previously noted, kokanee will only be collected in 2018), and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

In the Quesnel River, rainbow trout were selected as a sentinel sportfish species to monitor potential changes in tissue quality over time. Rainbow trout will be collected in the late summer and will be subject to sampling the full complement of tissues, including muscle, liver, kidney, and ovary (Table 8). As noted above, ovary will only be sampled when available (i.e., when fully

developed in mature females); additional fish will not be targeted and sacrificed to achieve the target sample size for ovary tissues (i.e., it is expected that ovary sample sizes will be less than eight). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (BCMOE 2014; CFIA 2015). A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in the Quesnel River will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Fish community and population data will be collected to support all fish tissue quality monitoring (as discussed in greater detail below). All collections will be supported by capture records for all species and documentation of effort that will be used to calculate Catch-Per-Unit-Effort (CPUE). All fish selected for tissue quality will be subject to measurement of length, weight (total and fork), and the collection of structures for age determination. Detailed methodology for fish collection, measurement, tissue sample collection, tissue sample processing, sample handling and laboratory analysis, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

3.2 Sentinel Fish Populations

Fish population monitoring is focused on Polley Lake and Quesnel Lake (Table 8; Figures 5 and 6). In Polley Lake, population monitoring is focused on tracking the population structure of rainbow trout. Specifically, with the inaccessibility of Hazeltine Creek (the major spawning and juvenile rearing location for Polley Lake Fish) between August 2014 and spring 2018, recruitment of Polley Lake rainbow trout was substantially diminished for four years (i.e., juvenile fish in Hazeltine were eliminated with the breach in August 2014 and recruitment from Hazeltine was unavailable in 2015, 2016, and 2017). Following the re-opening of Upper Hazeltine Creek in spring 2018, Polley Lake rainbow trout will again have access to the major spawning and rearing habitat and fish population monitoring will document changes in population structure over time (i.e., recovery of age-class balance). Polley Lake fish population monitoring will be conducted by hoop netting in the spring and fall. This non-lethal technique has previously proven effective for the collection of adult rainbow trout, adult longnose sucker, and larger redside shiner. All captured fish will be identified and counted, and all captured rainbow trout will be measured (total length, fork length, and weight) to provide data that can be used to characterize size-frequency distributions indicative of recruitment and survival. In 2018 only, an additional gill netting effort will be completed in the fall using methodology identical to that applied in 2014 and 2016 (Lirette 2015, 2017). This effort will apply experimental gill nets to achieve a high level of comparability to the previous work. The same measurements as noted above will be collected.

As this technique is destructive (lethal), age structures will also be collected and will allow age-frequency distributions to be determined in addition to the size frequency distributions noted above. Summary rainbow trout population metrics (mean age, mean size, size-at-age, and condition [weight-at-length]) as well as community metrics (CPUE, relative species proportions, as discussed in greater detail below) will be calculated and compared between areas (Polley Lake and Bootjack Lake), and over time. A target sample size of 50 (100 preferred) will provide replication for statistical contrasts. Data collected by the two different techniques in 2018 (hoop netting and gill netting) will be compared to determine if the non-destructive technique adequately addresses key questions, in which case future destructive sampling will be considered unnecessary. Fish population monitoring in Polley Lake will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Additional fishing efforts in Polley Lake shoreline areas will be undertaken to monitor the presence and abundance of juvenile rainbow trout. This will serve to monitor the recovery of rainbow trout in Polley Lake and to specifically augment the monitoring of juvenile trout recruitment determined for Upper Hazeltine Creek (as discussed in more detail in Section 3.3 below). Juvenile rainbow trout will be collected from shoreline areas in Polley Lake by minnow trapping, fry trapping, and backpack electrofishing. All captured fish will be identified, recorded, measured (fork length, total length, and weight) and released. Endpoints of CPUE, mean length, mean weight, size-frequency distributions, and condition will be calculated and monitored for comparison over time. Monitoring of juvenile rainbow trout in Polley Lake will be undertaken annually in the fall from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

In Quesnel Lake, populations of sentinel fish species (northern pikeminnow and redside shiner) will be monitored to evaluate potential effects associated with Mount Polley mine effluent discharge in accordance with requirements for EEM under the MDMER of the federal *Fisheries Act* (Environment Canada 2012; Government of Canada 2018). The fish population survey will be undertaken using prescribed methodology (Environment Canada 2012) and as described in detail in the Study Design report for the Phase 2 EEM (Minnow 2018c). Briefly, sentinel fish population monitoring in Quesnel Lake will evaluate population health (survival, growth, reproduction, and condition) of the two sentinel species. The study will be completed as a conventional (lethal) design (Environment Canada 2012) and will target 20 mature males and 20 mature females of each of the two sentinel species at the exposed area (near the Mount Polley effluent discharge) and at a reference area (Table 8; Figure 5). Fish collections will be completed by hoop netting and gill netting, and all fish measurements will be completed as prescribed by Environment Canada (2012) and as described in detail in Section 4.2. Quesnel Lake fish population monitoring will be completed in early spring when the sentinel species are fully

developed prior to spawning (McPhail 2007; Barrett and Munkittrick 2010). Northern pikeminnow typically spawn in the spring at a threshold temperature of 12 °C and redside shiner typically spawn in the spring at a threshold temperature of 10 °C (McPhail 2007). Both species typically spawn in flowing water over clean gravel substrates, but can also spawn in lakes. Sentinel fish species (up to the target sample size) will be subject to sacrifice and collection of the following measures prescribed for EEM: fork length, total length, weight, liver weight, gonad weight, and fecundity (Environment Canada 2012). Sentinel fish population endpoints (survival, growth, and reproduction) will be calculated for each species-area combination and statistically contrasted between effluent-exposed and reference areas as prescribed under EEM (Environment Canada 2012) and described in Section 4. Fish population monitoring in Quesnel Lake will be undertaken at the prescribed frequency of once every three years, with next collection in the spring of 2019. As outlined in EEM technical guidance, future frequency can change is response to findings. Detailed methodology for fish collection, measurement, tissue sample measurement, sample handling and laboratory analysis, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

3.3 Fish Habitat Characterization and Usage

Fish habitat characterization and usage monitoring is focused on Hazeltine Creek and lower Edney Creek, both of which were physically impacted by the TSF embankment breach (Table 8; Figure 6). Fish habitat characterization will monitor key characteristics of rehabilitated Hazeltine and Edney creek habitat in order to document recovery. Fish habitat usage monitoring will document the use of these rehabilitated creek habitats by all fish species and life stages, including the specific documentation of spawning and rearing in spring, summer, and fall months (May to October). Fish habitat characterization methods will be similar to those previously applied (Minnow 2018b) which are adapted from Johnston and Slaney (1996) and described in detail in Section 4.2. Fish habitat will be characterized in spring, summer, and fall in relation to the needs of fish that could potentially use the habitat (i.e., Polley Lake fish in the case of Upper Hazeltine Creek and Quesnel Lake fish in the case of Lower Hazeltine creek and Lower Edney Creek), and will include documentation of in-stream barriers and cover, spawning and overwintering habitat, riparian features, channel hydrology, bank condition, and water quality parameters. Fish habitat usage will be determined by a combination of visual observation and fish collection with measurement. Fish habitat usage monitoring will commence in the spring (May) once fish have begun to aggregate for spawning, and will be conducted again in the summer (August), and in the fall (September / October, including when fish are spawning). Fish collections will be completed using hoop netting, minnow trapping, fry trapping, seining, and backpack electrofishing (the latter only when appropriate based on non-spawning/egg incubation periods and when juvenile salmonids are not present). All captured fish will be identified and enumerated, and

fishing efforts will be documented for CPUE or density calculations (see following section). Up to 100 individuals from each collected species will be temporarily retained for length and weight measurements, which will be used to calculate summary statistics of length, weight, condition, and size-frequency distributions that will be monitored over time to document recovery. Fish habitat characterization and fish usage monitoring in lower Hazeltine Creek and lower Edney Creek will be undertaken at frequency of every two years starting in 2019[4], and the frequency will re-evaluated prior to 2021 based on QP recommendations. Detailed methodology for fish collection, fish measurement, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

For Upper Hazeltine Creek, fish collection will also include closed-station electrofishing that will provide the best possible estimate of the density of rearing rainbow trout (using removal calculators as outlined in Section 4). Fish capture data will be utilized to document the production of rainbow trout and any temporal changes therein including comparison to historical estimates (e.g., Minnow 2009). Fish meristic data will be used to calculate summary statistics of length, weight, condition, and size-frequency distributions that will also be compared to historical results (e.g., Minnow 2009). Fish habitat characterization and fish usage monitoring in upper Hazeltine Creek will be undertaken at an annual frequency from 2018 to 2020, and the frequency will re-evaluated prior to 2021 based on QP recommendations. Detailed methodology is provided in Section 4.

3.4 Fish Community

Fish community monitoring is a supporting measure to be determined in association with all fish collections (i.e., fish tissue quality monitoring, fish population monitoring, and fish habitat usage monitoring). Fish community monitoring effort will only be as required to collect the fish needed for these other purposes. Thus, the locations, timing, and frequency of fish community monitoring will be as outlined above (Sections 3.1 to 3.3, inclusive). In association with each fishing effort, all captured fish will be identified and counted. Details of each fishing effort (GPS coordinates, gear type and dimensions, and actual fishing time) will be recorded to provide the most quantitative record of fish community results possible. Specifically, the effort details will be collected to support the expression of CPUE on the basis of time (catch per time), area (catch per area), or the combination of gear-dimension and time (e.g., catch per 100 m net-hour). Interpretation of CPUE data will be based on a combination of: 1) comparison to previous conditions; 2) comparison to reference conditions; and 3) comparison of species proportions temporally and spatially (e.g., has the relative abundance rainbow trout versus longnose sucker

[4] Note that fish habitat characterization and usage monitoring in lower Hazeltine Creek will only be initiated after lower Hazeltine Creek is opened up as fish habitat (i.e., ponds and/or fish fences are removed).

changed over time and/or relative to the reference lake). Detailed methodology for fish collection, quality control/quality assurance, data quality review, data handling, data interpretation, and reporting is provided in Section 4.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of fish and fish habitat monitoring programs. Quality Assurance/Quality Control (QA/QC) measures will be consistent with requirements outlined in the BC Field Sampling Manual (BCMOE 2013) and the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016). Specific QA/QC measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of appropriate sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination (i.e., for tissue quality samples).

To capture within-area variability and support the tissue quality component of the fish monitoring program, eight replicate tissue chemistry samples will be collected from each sampling area. Fish tissue samples will include muscle, liver, kidney, and ovary tissues (or whole body analysis for smaller fish). Field duplicates (i.e., split samples collected from the same fish tissue) will be collected at a frequency of 10% of the total number of tissue samples to assess field precision, and will be evenly distributed among species and tissue types, to the extent possible. A Data Quality Objective (DQO) of <25% RPD will be applied to the duplicate (i.e., split) QC samples.

All chemical analyses will be completed by a laboratory that is accredited by the Canadian Association for Laboratory Accreditation (CALA), and will be required to include specific QC samples and report associated results. Specific QC samples will include laboratory blanks, laboratory replicates, and laboratory accuracy samples (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). The QC sample results will be assessed as part of the Data Quality Review (DQR; Section 4.4). Laboratory reporting Limits (LRLs) will also be evaluated in comparison to targets established by the analytical laboratory.

Raw field data recorded on field sheets will be transcribed into an electronic spreadsheet and data collected using digital data collection devices will be exported from a geodatabase to electronic spreadsheets. Electronic spreadsheets will be checked by a separate individual for entry errors as part of routine QA/QC procedures.

4.2 Sample Collection Methods

4.2.1 Fish Collection

All fish monitoring will be undertaken under fish collection permits from the British Columbia Ministry of Forests, Lands and Natural Resource Operations (FNLNRO) and all fish monitoring in

waters frequented by salmon (e.g., Quesnel Lake and Quesnel River) will also be undertaken under fish collection permits from Fisheries and Oceans Canada (DFO). All conditions associated with the fish collection permits will be strictly adhered to (including the general prohibition of fishing in waters with temperatures >20°C).

Fish collections will be completed in accordance with applicable technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013), the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016), and/or the Technical Guidance Document for EEM (Environment Canada 2012). A variety of fish collection techniques will be applied to collecting the fish required for the monitoring of fish tissue quality, fish populations, and habitat usage. To the extent possible, preference will be for non-destructive fish collection methods (e.g., hoop nets, minnow traps, fry traps, backpack electrofishing) in order to minimize the potential impact of fish monitoring on fish populations and/or communities. The following fish collection techniques will be used to support the CEMP fish monitoring plan:

- hoop netting;
- gill netting;
- minnow trapping;
- fry trapping;
- seining; and
- backpack electrofishing.

Hoop netting will be applied to the collection of large-bodied fish in lakes as the preferred collection method due to the fact that it is a non-lethal method. Hoop nets ranging in size from 0.6 m diameter, 2 cm stretched mesh to 0.75 m diameter, 3.8 cm stretched mesh with four to eight hoops and leads of approximately 30.5 m in length will be set as appropriate to target the fish required for tissue quality monitoring and fish population monitoring, and will be checked at a minimum frequency of every other day (although daily checks will be most common). The location of each net set will be recorded using a handheld GPS accompanied by notes on the set configuration (depth, lead to shore, trap to shore, etc.) and the time of deployment. Upon collection, the time of collection will be recorded and fish will be identified and counted as they are removed from the trap. Target species will be identified, counted, and then retained or measured (depending on the objective of the monitoring component). Non-target species will be identified, counted, and released at the location of capture. Individuals of the target fish species will be measured as outlined in Sections 4.2.2 and 4.2.3, per requirements of the particular monitoring component of the CEMP Fish Monitoring Plan.

Gill nets will be used as required to support hoop netting for fish tissue collection in lakes, as required, with application minimized and short deployment duration. Gill netting will also be applied in Polley Lake in late summer 2018 as a repeat of previous efforts (Lirette 2015, 2017). As required, gill nets will be set in lakes to collect large-bodied fish, consistent with historical sampling (e.g., Minnow 2018a) and recommendations from the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016). Net size and deployment configuration will be as required to most effectively capture target fish. For example, lake trout will be targeted in Quesnel Lake using a Profundal Index Netting methodology similar to the Summer Profundal Index Netting (SPIN) method (e.g., Jessup and Millar 2011). Fall 2018 gill netting in Polley Lake will employ experimental gill nets (two multi-panel gill nets of mesh size 38, 64, 38, and 89 mm), which will be set overnight. The nets will be set perpendicular to shore, with the smallest mesh orientated closest to shore. Set locations and configurations will be similar to those used in 2014 and 2016 (Lirette 2015, 2017). The location of each gill net set will be recorded using a handheld GPS accompanied by notes on the set configuration and the time of deployment. Check and retrieval times will be recorded and fish will be identified and counted as they are removed from the net. For experimental nets, fish counts will be recorded for each gill net panel. Non-target species will be identified, counted, and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Minnow traps (galvanized mesh – 42 cm length, 0.6 cm mesh, 2.5 cm diameter opening) will be set in lakes and creeks to capture small-bodied fish and juveniles. Juvenile rainbow trout (1+ or 2+ rainbow trout) will be targeted in Polley Lake. Minnow traps will be baited and will be tied off on shore or set on the substrate and marked with a float. Minnow traps set in creeks will be set so that the openings will be oriented upstream and downstream. Minnow traps will be checked at a minimum frequency of every other day (although daily checks will be most common). The location of each trap will be recorded using a handheld GPS accompanied by notes on the set configuration and the time of deployment. The retrieval time will be recorded and fish will be identified and counted as they are removed from the trap. Non-target species will be enumerated by species and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Fry traps will be set in selected lakes and creeks (Polley Lake, Hazeltine Creek, Edney Creek, and Frypan Creek) to augment minnow trap catches. Traps will be placed in habitat deemed suitable for juveniles (e.g., in slow flowing water near undercut banks, behind woody debris) and oriented with the closed end angled upstream. Traps will be weighed down on the streambed using small stones and will be checked daily. The location of each trap will be recorded using a

handheld GPS accompanied by notes on the set configuration and the time of deployment. Fry traps will be checked at a minimum frequency of every other day (although daily checks will be most common). The retrieval time will be recorded and fish will be identified and counted as they are removed from the trap. Non-target species will be enumerated by species and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Seining may also be completed in lakes and creeks to augment catches by other techniques. A 15 m long seine with a 0.3 mm mesh size will be used. The seine net will be pulled through shallow habitats by wading through the sampling area; in deeper areas, a boat may be used to pull one end of the seine (BCMOE 2013). Care will be taken to ensure that the lead line remains in contact with the substrate and the float-line remains at the surface to prevent fish from escaping. The contents of the seine will be brought to shore, and depending catch numbers, may be emptied into a water-filled tote and the seine will be inspected to confirm that all fish are removed. The location of each effort will be recorded using a handheld GPS accompanied by notes regarding habitat features and the area and maximum depth sampled. The date and time will be recorded and fish will be enumerated by species. Non-target species will be released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Open-station and/or closed-station backpack electrofishing will be completed in Polley Lake (along the shoreline) and in creeks. All electrofishing will be completed by an experienced and certified electrofishing team, consisting of a backpack electrofisher operator and one or more netters using electrofisher settings appropriate for the target species (i.e., frequencies and pulse width) and starting with lowest possible power output (voltage and duty cycle). Open stations will be fished by single electrofishing pass in an upstream direction. During open-station electrofishing, the operator will create a series of smooth, zig-zagging sweeps with the anode. Fish will follow the anode; therefore, the operator will move the anode towards the netter, who will net the stunned fish. Closed stations will be created using 3/8” mesh stop nets and care will be taken to ensure that the enclosed habitat is suitable for the potential presence of target fish. The dimensions (length and wetted and bankfull widths) and water depth (average of three measures) of each open and closed station will be measured at equally-spaced transects using a measuring tape and meter stick, respectively. During each closed station electrofishing effort, the electrofisher operator and netter will employ a multiple pass removal method at each station whereby one upstream pass (or “sweep”) of the enclosed reach is repeated three or more times to yield a fish removal pattern (i.e., diminishing catches) that can be used to determine fish density

using removal method equations. Fish captured during each open electrofishing pass or closed station sweep will be placed in separate buckets of aerated water. The location of each effort will be recorded using a handheld GPS accompanied by the start and end times and active electrofishing seconds. The total sampling area will be documented, along with a habitat descriptions that include observations of stream morphology and substrate characteristics, riparian vegetation and relative stream shading, as well as any potential confounding influences or other observations deemed relevant to interpretation of the fish survey data. The fish in each bucket will be enumerated by species. Non-target species will then be released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Fish will be captured from the Quesnel River by angling (targeting rainbow trout for fish tissue quality monitoring). Angling will be conducted using barbless, single hook lures, and/or flies. The general location of each effort will be recorded using a handheld GPS accompanied by notes on the hooks/lures/flies used, effort duration, and habitat. Captured fish will be identified and counted. Non-target species will be released at the location of capture and target species will be retained or measured. Retained rainbow trout will be measured as outlined in Sections 4.2.2 and 4.2.3, per requirements of the particular monitoring.

All fishing effort data will be recorded on field sheets or digital data collection devices. *In situ* water quality measurements (i.e., temperature, pH, dissolved oxygen, conductivity, and specific conductance) will also be recorded to support fishing efforts.

4.2.2 Fish meristic data

Meristic measurements on fish that will not be retained for lethal sampling will be recorded prior to releasing the fish at their point of capture. Fish retained for lethal sampling will be anesthetized using a clove oil solution or will be euthanized with a decisive blow to the head and spinal severance. Fish will be subjected to measurement of fork length, total length, and body weight (BCMOE 2013). Fork and total length of large-bodied fish will be measured to the nearest millimeter using a measuring board and fork and total length of small-bodied fish will be measured to the nearest 0.1 mm using digital calipers. Fresh body weight will be measured using an analytical balance or a set of Pesola™ spring scales (depending on fish weight). The Pesola™ scales are demarcated at intervals of 1 to 2% of the total scale range, providing an accuracy of plus or minus (±) 0.3% of the fish mass. The Pesola™ spring scale for individual weight measurement will be selected so that the fish weight is near the top of the scale's range to ensure that measurements achieve a resolution near 1%. Northern pikeminnow and redside shiner that will be lethally sampled as part of MDMER/EEM will also undergo an external health assessment

(Environment Canada 2012). Following external health assessment, each fish will be cut open and sex will be recorded. Gonads and liver will be removed for weighing and sampling as required. Tissues will be weighed to the nearest milligram using a portable analytical balance (capable of measurement to 0.001 g). For EEM, whole ovaries from sexually mature females will be placed in individually labelled sample vials and preserved with a 10% buffered formalin solution for determination of fecundity.

Age structures will be retained for all fish collected for fish tissue quality monitoring using available guidance for the best age structure for each species (e.g., Environment Canada 2012). Otoliths will be removed and used as the primary aging structure for all fish species except for sucker. Pectoral fin rays will be removed and used as the primary aging structure for sucker. Scales will also be collected for use as backup structures for age determination. Aging structures will be wrapped in waxed paper, and placed in labelled coin envelopes, which will then be frozen prior to submission to a qualified fish aging laboratory.

4.2.3 Fish Tissue Quality

For large-bodied fish targeted for tissue quality monitoring, tissue quality samples will be collected after meristic measures are collected and will include muscle, liver, kidney, and ovary (the latter as available). For small-bodied fish targeted for tissue quality monitoring (i.e., juvenile northern pikeminnow and peamouth chub), whole body samples will be analyzed for tissue chemistry. Tissue samples (muscle, liver, kidney, and/or ovary) will be removed, weighed to the nearest 0.001 g (±1% precision) using an analytical balance, placed in labelled Whirl-Pak™ bags, and frozen until analysis. All tissue samples will be collected using clean implements (cutting boards, filet knives, and tweezers; BCMOE 2016). Livers and kidneys will be collected whole, whereas approximately 10 to 50 g of boneless, skinless muscle will be collected, and a similar sized ovary sub-sample will be collected when available (or will be collected whole if smaller than this). Duplicate QC samples (i.e., split samples collected from the same fish tissue) will be collected for 10% of tissue samples to assess field precision, and will be evenly distributed among species and collected tissue types, to the extent possible. A DQO of <25% RPD will be applied to the duplicate (i.e., split) QC samples.

4.2.4 Fish Habitat Characterization and Usage

Habitat characterization methods will include those applied in 2016 and 2017 (Minnow 2018b; adapted from Johnston and Slaney 1996). Data will be recorded on field data sheets or using digital data collection devices. The following characteristics will be documented:

- stream dimensions (i.e., wetted and bankfull width, length, and depth) within each habitat unit;

- channel gradient;
- substrate type;
- in-stream barriers and cover;
- the presence/absence of spawning and overwintering habitat;
- riparian features (e.g., vegetation types and canopy cover);
- channel hydrology;
- bank condition; and
- *in situ* water quality.

Habitat characterization methods will be a composite of two standard methods: 1) Reconnaissance Fish Habitat Inventory (RIC 2001); and 2) Level 1 Field Fish Habitat Assessment ("Habitat Unit Assessment"; Johnston and Slaney 1996). Habitat characterization using methods adapted from RIC (2001) will be completed at replicate stations (three per area) and will include include measures of channel dimensions, water velocity, and in situ water quality at each station. Channel dimensions (bankfull width, wetted width, and a minimum of 5 incremental wetted depth measures), will be measured using a tape measure and metre stick. Water velocity will be measured using a portable velocity meter. At each velocity transect, water velocity, wetted depth, and bankfull-wetted depth will be measured at a minimum of five incremental distances (points) along one wetted channel cross-sectional width. Water velocity measurements will be obtained at 60 percent of depth as an estimate of the mean vertical velocity at each measurement point. In situ water quality measures will include temperature, specific conductance, dissolved oxygen, and pH using a calibrated handheld portable field meter. Additional habitat characteristics to be assessed at each station will include description of channel bed features (substrate type, relative proportion of each substrate type, etc.), channel and bank gradient, substrate size, bank stability, riparian vegetation (vegetation types, overhead shading), and in-stream cover (as the relative proportion that each contributed to total creek surface area at each station). Substrate size will be assessed (100 randomly selected rocks per station) for the purpose of monitoring temporal changes in substrate size distribution. Photographs of representative habitat will be taken at each station in each season to further support the habitat descriptions. During each seasonal survey, any unique or significant physical or biological features (e.g., tributaries, groundwater seeps, partial or seasonal fish barriers to fish migration) will be documented, including a brief description of the feature, together with its GPS coordinates. In addition, the GPS coordinates of pools present in the rehabilitated and reference reaches, and physical dimensions of the pools (length, width, and maximum depth) will be recorded.

Habitat assessment using Level 1 Field Fish Habitat Assessment methods ("Habitat Unit Assessment"; Johnston and Slaney 1996) will also be undertaken. At least seven consecutive habitat units (i.e., pool, glide, or riffle) will be identified towards the center of each reach and the dimensions of each habitat unit will be recorded. Specifically, the length, mean width (wetted and bankfull; mean of at least 3 measures), and mean depth (wetted and bankfull; mean of at least 5 measures) will be determined for each habitat unit using a tape measure and meter stick. For pools, the maximum and residual (maximum minus crest depth) wetted depth will also be measured, as well as pool type. A minimum residual depth of 0.2 m is required for classification of a habitat unit as a pool (Johnston and Slaney 1996). Additional habitat characteristics assessed at each habitat unit will include included channel gradient, substrate type, riparian vegetation (vegetation types, growth stage, and canopy cover), in-stream cover, access to off-channel habitat, the number of pieces of large woody debris (LWD) present, and indicators of disturbance.

Fish habitat usage monitoring will document the use of these rehabilitated creek habitats by all fish species and life stages, including the specific documentation of spawning and rearing in spring, summer, and fall months (May to October). Fish habitat usage will be determined by a combination of visual observation and fish collection using techniques described above (hoop netting, minnow trapping, fry trapping, seining, and backpack electrofishing; the latter only when appropriate based on non-spawning/egg incubation periods and when juvenile salmonids are not present). All captured fish will be identified and enumerated, and fishing efforts will be documented for CPUE or density calculations (as described above). Any observations of specific behaviours (e.g., spawning) will be noted.

4.3 Sample Handling and Laboratory analysis

To the extent possible, sample handling and laboratory analyses will be completed in accordance with technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013), the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016), the Technical Guidance Document for EEM (Environment Canada 2012), and the BC Environmental Laboratory Manual (BCMOE 2015).

At the termination of each field program or at intervals of no more than seven days, fish tissue samples will be shipped in coolers with ice packs and chain-of-custody forms (COCs) to the analytical laboratory. Shipment transit time will be less than one day. Chemical analyses will be completed by a CALA-accredited analytical laboratory and will include moisture content and total metal concentrations (Table 9). Concentrations of mercury and other metals will be analyzed using Cold Vapour Atomic Fluorescence Spectrophotometry (CVAFS; USEPA [United States Environmental Protection Agency] Method 200.3/245.7) and Collision Cell Inductively Coupled

Table 9: Analytes and Laboratory Reporting Limits for Mount Polley CEMP Fish Tissue Quality Monitoring

Analyte	Target LRLs	Units	Consensus DLs [1]	Units	Consensus DLs [1] as dw [2]	Units	Tissue Quality Guidelines
Physical Tests							
Moisture		% ww	1	% ww	-	% ww	-
Metals							
Aluminum	2	mg/kg dw	0.4	mg/kg ww	1.6	mg/kg dw	-
Antimony	0.01	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Arsenic	0.02	mg/kg dw	0.005	mg/kg ww	0.02	mg/kg dw	-
Barium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Beryllium	0.01	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Bismuth	0.01	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Boron	1	mg/kg dw	-	mg/kg ww	-	mg/kg dw	-
Cadmium	0.005	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Calcium	5	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Chromium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Cobalt	0.02	mg/kg dw	0.004	mg/kg ww	0.016	mg/kg dw	-
Copper	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Iron	3	mg/kg dw	1	mg/kg ww	4	mg/kg dw	-
Lead	0.02	mg/kg dw	0.004	mg/kg ww	0.016	mg/kg dw	-
Lithium	0.5	mg/kg dw	-	mg/kg ww	-	mg/kg dw	-
Magnesium	2	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Manganese	0.05	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Mercury	0.005	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	0.5 mg/kg ww [3]
Molybdenum	0.02	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Nickel	0.2	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Phosphorus	10	mg/kg dw	5	mg/kg ww	20	mg/kg dw	-
Potassium	20	mg/kg dw	10	mg/kg ww	40	mg/kg dw	-
Selenium	0.05	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	11 mg/kg dw [4]
Silver	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Sodium	20	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Strontium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Thallium	0.002	mg/kg dw	0.001	mg/kg ww	0.004	mg/kg dw	-
Tin	0.1	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Titanium	0.2	mg/kg dw	0.06	mg/kg ww	0.24	mg/kg dw	-
Uranium	0.002	mg/kg dw	0.001	mg/kg ww	0.004	mg/kg dw	-
Vanadium	0.1	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Zinc	0.5	mg/kg dw	0.1	mg/kg ww	0.4	mg/kg dw	-

[1] From Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[2] Calculated based on a 75% moisture content.

[3] Health Canada guideline for mercury (CFIA 2015).

[4] British Columbia Water Quality Guideline for aquatic life for selenium in fish ovary tissue (BCMOE 2014). Additional guidelines for the protection of aquatic life of 4 mg/dw in fish muscle or whole fish and for the protection of human health at moderate consumption levels (14.5 mg/kg dw for the general population) will also be applied.

Plasma-Mass Spectrometry (CRC-ICP-MS; USEPA Method 200.3/6020A) or High Resolution Inductively Coupled Plasma-Mass Spectrometry (HR-ICP-MS; USEPA Method 200.3/200.8), respectively (USEPA 1991, 1994, 2001, 2004). All samples will be submitted to the laboratory with a chain-of-custody (COC) record, a list of expected Laboratory Reporting Limits (LRLs), and laboratory QA/QC requirements.

Aging structures will be shipped to a qualified fish ageing laboratory, along with a chain-of-custody form (COC), for determination of fish ages. At the fish aging laboratory, samples will be thawed, otoliths extracted from heads if required, and the otoliths and fin rays will be sectioned, mounted on a glass slide using a mounting medium, and then read under a compound microscope using transmitted light. For each structure, age and edge condition will be recorded along with a confidence rating for the age determination. Scales collected as backup structures will only be used as required. Similarly, preserved egg samples will be shipped to a qualified laboratory, along with a chain-of-custody form (COC), for determination of fecundity. Methods for determining fish age and fecundity will be fully consistent with the technical guidance (Environment Canada 2012).

4.4 Data Quality Review

Upon receipt of fish tissue quality data from the analytical laboratory, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs are achieved. The DQR will also include an evaluation of differences between duplicate (i.e., split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the tissue quality data will ensure timely communication with the laboratory should any issues be identified.

Comparisons between duplicate samples will be made by calculating the RPD for concentrations measured in paired samples. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Catch-per-unit-effort (CPUE) and summary statistics for meristic measurements taken in the field will be calculated. CPUE will be calculated for each fish species by fishing method and sampling area. For hoop netting, minnow trapping, and fry trapping efforts, CPUE will be expressed as number of fish per day. For seining, CPUE will be calculated as the number of fish per square metre. CPUE will be calculated as the number of fish per 100 electrofishing seconds for open-

station electrofishing efforts. For closed station electrofishing, density will be determined using removal calculators (i.e., number of fish per unit area determined using Moran-Zippin estimators; Ricker 1971). CPUE for gill netting and angling will be calculated as the number of fish captured per square metre-hour and the number of fish per angler day, respectively.

Although community and population data is collected during every phase or component of the fish monitoring program, the sample size will be defined by the study objectives and may be insufficient to address corollary questions. For example, the sample size required for tissue quality analyses (n = 8) is not large enough to support formal contrasts of population endpoints. To this end, evaluation of fish community data will rely on qualitative comparisons, and conclusions regarding fish populations will be supported by non-lethal measurements and sampling under the MDMER/EEM (with larger sample size), as described in Section 4.2.2 and below. Analysis methods for the MDMER/EEM fish population data will be consistent with EEM technical guidance (Environment Canada 2012). Summary statistics, including mean, median, minimum, maximum, standard deviation, standard error, and sample size, will be calculated for fish age, fork length, total length, body weight, condition, liver weight, gonad weight, and fecundity; calculations will be completed according to species and area. In a lethal design EEM fish survey, detailed statistical analyses will focus on indicators of survival, energy use, and energy storage and will be completed based on guidance from Environment Canada (2012). These indicators include fish age, size-at-age, gonad size relative to body weight, condition, liver size relative to body weight, and fecundity, and egg size relative to body weight (Table 10). In a non-lethal design, histograms will be used to examine length-frequency distributions by species and area, and indicators include fish size and condition. All data sets will be assessed for normality and equality of variance in order to determine the suitability of parametric statistical procedures. An effect on the fish population will be evaluated for each of these measures and is defined as a statistically significant difference between the effluent-exposed area and the reference area (Environment Canada 2012). For each endpoint, statistically significant differences between effluent-exposed and reference areas (by species and sex) will be assessed using ANOVA, Analysis of Covariance (ANCOVA), or non-parametric equivalents, as appropriate, following technical guidance (Environment Canada 2012).

For the fish tissue data sets, statistical comparisons of age, length, weight, and concentrations of metals in fish tissues (n = 8) will be completed among years and locations. Following completion of the DQR, fish tissue quality data will be provided to the QP and summarized according to species, tissue type, and area. The LRL for each analyte and the number of samples below the LRL will be determined. Censored data will be managed using methods described in Helsel (2012), and those used in the R package NADA: Non-detects and Data Analysis for Environmental Data (Lee 2017). Any value below a LRL (i.e., a <LRL result) that exceeds the

Table 10: Survival, Energy Storage, and Energy Use Endpoints for Mount Polley EEM Fish Population Evaluation

Response		Measurement Endpoints [a]	Statistical Procedure
Effects on Fish [a]	Survival	Age	ANOVA[c]
	Energy Use	Size-at-age (body weight against age)	ANCOVA[c,d]
		Relative gonad size (gonad weight against body weight)	ANCOVA[c,d]
	Energy Storage	Condition (body weight against length)	ANCOVA[c,d]
		Relative liver size (liver weight against body weight)	ANCOVA[c,d]
Supporting Response Variables [b]	Energy Use	Relative fecundity (# of eggs/female against body weight)	ANCOVA[c,d]
		Relative egg size (mean egg weight against body weight)	ANCOVA[c,d]

Notes: ANOVA = Analysis of Variance; ANCOVA = Analysis of Covariance; # = number.

[a] Endpoints to be used for determining "effects" as designated by statistically significant differences between effluent-exposed and reference areas.

[b] These analyses are for informational purposes and significant differences between exposure and reference areas are not necessarily used to designate an effect (Environment Canada 2012).

[c] Or appropriate non-parametric equivalent, as required.

[d] For the ANCOVA analyses, the first term in parentheses is the endpoint (dependent variable Y) that is analyzed for an effluent effect. The second term in parentheses is the covariate, X (age, weight, or length).

maximum detected value for that parameter at the given station will be removed. The removal of the poor LRLs does not influence the estimation of the mean or standard deviation, but does influence the overall sample size. The sample size, mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile will be calculated for each analyte. Means will be calculated using the Kaplan-Meier (K-M) method. The standard deviation and the median for each analyte will also be calculated using the K-M method. When a standard deviation cannot be estimated (i.e., when an analyte has a high proportion of censored values), it will be reported as "not calculated".

Statistical comparisons of age, length, weight, and concentrations of metals in fish tissues will be completed among years and locations. Statistical comparisons among groups will completed using an analysis of variance (ANOVA) if assumptions of normality and homogeneity of variances are met. These assumptions will tested using the Shapiro Wilk's test and Levene's test (α=0.05), respectively. Data will be transformed, as required, to meet these assumptions. If the assumptions cannot be met, the Kruskal-Wallis test will be used. Response variables with censored observations will be compared among groups using the Wilcoxon score test. Specific contrasts will be conducted after an overall significant difference among groups. Bonferroni adjustments to the p-values will be made to maintain the family-wise Type I error rate at α=0.05. A magnitude of difference (MOD) will be calculated for each contrast. For metals for which information is available on accumulation in specific organs (e.g., copper accumulation in fish liver; Grosell 2012), interpretation will focus on the results associated with that organ.

Statistical comparisons of concentrations of mercury in fish tissue will be compared using analysis of covariance (ANCOVA) with fork length as a covariate (as mercury is known to bioaccumulate in fish tissue; e.g., Kidd and Batchelar 2012). The response variable and covariate will be $\log_{10}$-transformed, as required, for analysis. The significance of the interaction term of the ANOVA model will be assessed to compare regression slopes between groups. If the interaction term is not significant (α=0.05) it will be removed and the parallel slope ANCOVA model will be fit. If the fork length is not a significant predictor of mercury concentration in the parallel slope ANCOVA model, it will be removed from the model and comparisons of mercury concentrations between groups will be conducted using a t-test. If the fork length is a significant predictor of mercury concentration in the parallel slope ANCOVA model, comparisons of mercury concentrations between groups will be assessed using the group term of the model. Adjusted means will be reported for the average (geometric mean) fork length from the parallel slope ANCOVA model. A MOD will be calculated for each contrast.

Fish tissue quality data will also be evaluated in comparison to tissue quality guidelines for human health and/or for aquatic ecosystem health (available for mercury and selenium). Tissue quality

guidelines will include the Canadian Food Inspection Agency/Health Canada mercury guideline for the protection of human health (0.5 milligrams per kilogram wet weight [mg/kg ww]; CFIA 2015) and the BC selenium guidelines (BCMOE 2014). Selenium guidelines for BC include guidelines for the protection of human health, which are based on fish consumption levels (7.3 milligrams per kilogram dry weight [mg/kg dw] for subsistence consumers, 14.5 mg/kg dw for the general population, and 75 mg/kg dw for the recommended two servings of fish per week). Selenium guidelines for BC also include guidelines for the protection of aquatic life, which are 4 mg/kg dw in muscle tissue and whole body samples, and 11 mg/kg dw in egg/ovary tissues. Selenium concentrations in fish ovaries will also be compared to the threshold for reproductive effects in eggs and ovaries (20 mg/kg dw; DeForest et al. 2012).

Results of the fish habitat characterizations for Upper Hazeltine, Lower Hazeltine, and Lower Edney creeks will be summarized, along with fish usage results, according to season (spring, summer, and fall) and year. Fish habitat characterization measures will be summarized by season, reach, and area (rehabilitated and reference), with summary statistics (mean and standard deviation) calculated for all numerical parameters. These summarized variables will then be compared to general habitat preferences for relevant fish species. Additionally, recorded habitat measures will also be compared to "optimal" ranges of habitat parameters indicated in Habitat Suitability Index (HSI) models (i.e., suitability index value = 1) or in the literature (where available) for those fish species identified in rehabilitation design criteria and objectives. Specifically, mean results for habitat measures collected in each season at each reach will be compared to the tabulated optimal "habitat suitability criteria" ranges and identified as either meeting or not meeting these criteria. The proportions of habitat measures meeting the habitat suitability criteria in the rehabilitated and reference areas, respectively, will also be compared.

Habitat unit assessment measures will be summarized by habitat unit type within each reach, with mean values calculated for all numerical parameters. Measures will be used to calculate endpoints such as bankfull width to depth ratio, channel complexity, % pool, pool frequency, and LWD pieces per bankfull channel width. These endpoints and other observational measures (presence of off-channel habitat) will then be evaluated relative to diagnostics of salmonid habitat condition modified from Johnston and Slaney (1996), rated as poor, fair, or good. Lastly, quantitative (closed station) data will be used to determine fish density (number of fish per unit area determined using Moran-Zippin estimations; Ricker 1971). The presence and abundance of juvenile rainbow trout in these creeks will be compared to densities previously observed in Edney and Bootjack creeks (Minnow 2014a).

An interpretive report based on the fish monitoring data will be prepared to be integrated into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared

annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQGs, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.5

Wildlife, Soil, Soil Invertebrate, and Vegetation Monitoring

Golder Associates Ltd.

TECHNICAL MEMORANDUM

DATE 9 August 2018 **Reference No.** 1894924-025-TM-Rev1-23182

TO Stephen Monninger
Mount Polley Mining Corporation

CC Colleen Hughes

FROM Blair McDonald and Barbara Wernick **EMAIL Blair_McDonald@golder.com; Barbara_Wernick@golder.com**

STUDY DESIGN CONCEPT: TERRESTRIAL COMPONENT FOR THE MOUNT POLLEY MINE COMPREHENSIVE ENVIRONMENTAL MONITORING PLAN – MOUNT POLLEY MINE

1.0 INTRODUCTION

1.1 Purpose of the Study Design Concept

Mount Polley Mining Corporation (MPMC) is preparing a Comprehensive Environmental Monitoring Plan (CEMP) to integrate the environmental monitoring components from a variety of regulatory processes applicable to the Mount Polley Mine into a single document. An Ecological Risk Assessment (the ERA; Golder 2017) was prepared that integrated the available chemical and biological information to provide an overall conclusion about the magnitude and extent of ecological risks associated with the deposit of tailings. The ERA was accepted by the Ministry of Environment & Climate Change Strategy (ENV) on 31 January 2018, contingent on the implementation of additional monitoring in relation to specific areas of uncertainty identified in the ERA. There were several points of uncertainty in the terrestrial ERA with respect to plants, soil invertebrates and wildlife and these are outlined in Table 53 of the ERA. The purpose of this memorandum is to outline the monitoring concept proposed to MPMC to address those terrestrial ERA uncertainties in the CEMP. Contingent on acceptance by ENV, a detailed study design document and specific work instructions will be prepared by Golder as the basis for executing of the CEMP process.

1.2 Scope and Approach of the Risk Assessment

The ERA evaluated the site conditions as they existed in the first few years after the failure of the glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility. The terrestrial ERA included the “floodplain” area where the forest and native soils were removed by the debris flow, and the “halo” area where the forest floor was relatively undisturbed but buried to varying depths by scoured material and tailings. Tailings can limit the successful re-establishment of ecological communities because of a variety of chemical and/or physical limitations in the soil (Hossner and Hons 1992). The ERA used a “triad” style approach to evaluate the relative influence of physical issues versus chemical issues for a given receptor group using three different types of information:

- What is the magnitude of the exposure associated with tailings?
- What is the magnitude of effects associated with tailings under controlled experimental conditions?
- What is the magnitude of effects associated with tailings under field conditions?

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Copper was identified as the primary contaminant of concern. The ERA also found that the bioavailability of copper in tailings at the site was low. A low bioavailability does not mean that bioaccumulation was zero as copper has bioaccumulated in different parts of the ecosystem at concentrations that are greater than reference areas. However, the overall conclusion, based on a weight-of-evidence integration of the available information collected over several years, was that risks associated with copper were low, and that the effects associated with nutrient deficiencies and soil structural limitations were likely to be a larger influence on the long-term management goal of reintroducing a biologically diverse, functional and self-sustaining ecosystem. As with any complex risk assessment, there was uncertainty associated with the risk conclusions which were described in the risk assessment.

1.3 Summary of Main Areas of Uncertainty

The study design concept focuses on reducing the main sources of uncertainty described in Table 53 of the ERA. In brief, the main sources of uncertainty in the terrestrial ERA were:

1) Field-based monitoring of the diversity or abundance of plants, soil invertebrates or other parts of the soil ecosystem is valuable in an ecological risk assessment but was not practical in the current application because of the expected variability related to natural successional changes.

2) The ability to quantify the relative influence of copper versus the physical limitations of the soil is important from a theoretical perspective. This would typically be evaluated using controlled experiments. However, further experiment-based studies are not warranted unless there is evidence (from field monitoring) that natural succession is not progressing. It is reasonable to continue refining the site-specific understanding of copper bioaccumulation in plants and soil invertebrates in lieu of further experimental studies while the long-term field monitoring is executed.

3) Risks to wildlife are assessed with a single technique (a food chain model). Conservative assumptions were used in the model. Hazard quotients were less than 1 for eleven of the 15 receptor species evaluated in the model. Further refinement of the wildlife food chain model was requested with respect to the four receptor species that had a hazard quotient greater than 1.

Each of these main sources of uncertainty are addressed in further detail in Section 3.

2.0 BASIS OF DESIGN

Golder understands that MPMC is structuring the CEMP to be a stand-alone document that does not require reviewers to have a detailed understanding of the ERA. A summary of the available data and how those data were evaluated in the ERA (Golder 2017) is provided in this section as context for the specific recommendations in Section 4.

2.1 Plants

Information relevant to plants that was evaluated in the ERA included:

- Concentrations of metals in tailings were lower than numerical standards for the protection of soil invertebrates and plants, except for copper (and marginally, vanadium).
  - For copper, the numerical standard is 150 mg/kg. The 95% upper confidence limit of the mean (UCLM) concentration in untreated tailings was 737 mg/kg. Treatment (scarification, intermixing or transplanting soils) resulted in 95% UCLMs ranging from 197 to 538 mg/kg.
  - For vanadium, the numerical standard is 200 mg/kg. The 95% UCLM vanadium concentration in untreated tailings and the three treatment types were less than the numerical standard. Vanadium was retained as a contaminant of potential concern because the 90th percentile concentration in untreated tailings was marginally greater than the standard (213 mg/kg versus 200 mg/kg).
- A 42-d lodgepole pine (*Pinus contorta*) and bluebunch wheatgrass (*Pseudorogneria spicata*) germination and growth toxicity test was conducted on two representative samples of tailings (Section 3.3.3 of the ERA). Seedling emergence or survival was not impacted, but greater than 20% reductions in growth were observed for both species compared to the performance of a negative control consisting of clean silica sand of a similar grain size. All plants demonstrated some degree of growth over the 42-day exposure, despite copper concentrations ranging from approximately 800 to 1100 mg/kg.
- Multiple lines of evidence in the ERA demonstrated that copper had low bioavailability. The lines of evidence included geochemical modeling and three different chemical surrogate measurements in tailings samples (water soluble fraction; humidity cell and leach tests; physiological-based extraction tests – see Section 3.2.2 of the ERA). The toxicity testing (see above) also included a side-by-side trial where an equivalent concentration of copper was added to clean silica sand (in the form of copper sulphate). The bioavailability of copper from tailings was much lower than copper added to the tailings.
- There were physical effects of tailings on plant growth. The toxicity testing (see above) found that tailings tended to form hard crusts and germination was highest in the surface cracks. The measured bulk densities of tailings, till and lacustrine deposits at the site were greater than values from the literature that correspond to reductions in plant growth. Nutrient levels in the tailings were also limited and in a range that could limit plant growth (see Section 3.2.3.2 of the ERA).
- Plants appeared to bioaccumulate copper, but bioaccumulation factors were less than 1 and the bioaccumulation was concentration-dependent. There were no obvious differences in copper bioaccumulation during the 42-d toxicity testing (see above) between tailings and copper added to soils. There was no consistent pattern where copper concentrations in field-collected plant samples were greater in the impacted areas than in background and/or baseline samples (see Section 3.3.2.2 of the ERA). Copper concentrations were within the range of concentration considered to be adequate for plant growth (see Section 3.3.2.4 of the ERA) despite being collected over a wide range of soil concentrations. Overall, these lines of evidence demonstrate that many plants can control the uptake of copper.

2.2 Soil Invertebrates

The ERA involved fewer lines of evidence for soil invertebrates because: a) the findings of low copper bioavailability from plants would be expected to be consistent for soil invertebrates, and b) the physical alterations to the soil and habitat would be expected to have a more significant effect on soil invertebrates. Further discussion about the overall ecological succession expected at the site is provided below in Section 3.1. Additional information specific to soil invertebrates that was considered in the ERA included:

- There were relatively few soil invertebrates collected in 2015 and 2016. Composite samples were collected for beetles/ants (n = 15), spiders (n = 4), and worms/slugs (n = 8). Between two and four tissue samples of each soil invertebrate type were collected from background areas and the data used in a control chart (i.e., the average ± 2 standard deviations [SD]). There was a high degree of variability between individual samples in a given tissue composite type, but the average concentration of copper in beetle/ant composite samples was higher than the average (+ 2SD) upper limit of the control chart.
- The limited number of worm/slug samples had an average copper concentration that was within the range of copper tissue concentrations from laboratory studies that had the potential for reduced survival, growth or reproduction of soil invertebrates. There was not sufficient data to determine the relationship between soil concentrations and the tissue concentration of specific types of soil invertebrates, and many of the papers that evaluated the critical body residue of copper in soil invertebrates acknowledge that there are many factors that can limit site-specific bioavailability. The available data were thus not definitive that a risk to soil invertebrates is present but did provide a qualitative indicator that monitoring was appropriate.

2.3 Wildlife

Risks to wildlife were evaluated using a food chain model. In brief:

- A total of 15 surrogate species were selected from different feeding guilds (e.g., herbivores, carnivores; Table 1). Species-specific variables such as body weight, ingestion rates, and dietary preferences were adopted from federal risk assessment guidance or other reputable sources.
- Realistic worst-case exposure concentrations were determined for soil, water and the various dietary items, typically based on the 95% upper confidence limit of the mean. Site-specific bioaccumulation models were developed and used to predict tissue concentrations from soil concentrations. Bioaccumulation factors for small mammal tissue concentrations (needed to evaluate risk to carnivores) were taken from the literature.
- Relative bioavailability was used to calculate the dose for the wildlife receptors. Relative bioavailability of copper in water was assumed to be 100%. Relative bioavailability of copper in soil was based on site-specific physiologically-based extraction test (PBET) data. Relative bioavailability of copper in dietary items was assumed to be 40% based on information from the literature.
- The total amount of copper ingested per day was compared to conservative toxicity reference values. The food chain model was run separately for different areas and different soil rehabilitation approaches (i.e., transplanted, scarified or intermixed). A risk estimate for each surrogate species was calculated for the entire study area using area weighting. Risks were also calculated for background areas for context.

- Hazard quotients (HQ) were less than 1 for all receptors exposed to vanadium, and most receptors exposed to copper. HQs were greater than 1 for robin, common nighthawk, olive-sided flycatcher and masked shrew. The aggregate HQs (i.e., the area-weighted HQ for the site as a whole) for those four receptors ranged from 1.7 to 2.8. The maximum observed HQ for an individual subarea was 5.1 for masked shrew in the Polley Flats area.
- A hazard quotient greater than 1 does not mean that there are risks to wildlife. The food chain model used many conservative assumptions which were identified in the terrestrial ERA. HQs were also greater than 1 for olive-sided flycatcher and masked shrew exposed to background copper concentrations.

Table 1: Wildlife receptors evaluated with the food chain model

Receptor Group	Feeding Guild	Surrogate Species
Birds	Herbivore	Dark-eyed junco
	Insectivore	Robin; olive-sided flycatcher; common nighthawk
	Omnivore	Raven
	Carnivore	Northern pygmy owl
	Piscivore	Osprey, great blue heron
Mammals	Herbivore	Meadow vole; mule deer
	Insectivore	Masked shrew
	Omnivore	Deer mouse
	Carnivore	Ermine, fisher
	Piscivore	River otter

3.0 FURTHER CONSIDERATION OF UNCERTAINTY

3.1 Uncertainty Related to Ecological Succession

A “triad” style approach (exposure, experimental effects, field effects) is common in weight-of-evidence because the three different types of information are complementary. A well-designed field study provides a meaningful evaluation of risks because it provides direct information about what is being protected under realistic conditions. However, field studies are not always able to determine the cause of effects (if any are observed) and can be confounded by many different variables. Many of those variables (e.g., weather) are unrelated to the management question being evaluated.

A “triad” approach was used in the terrestrial ERA but it was not possible to assess every terrestrial receptor with a field study. In areas of the site that were subjected to extensive scouring, there was a near-complete loss of natural soils and their related ecological communities (i.e., soil microbes, fungi, invertebrates and plants). Quantitative assessment to establish the magnitude of that physical impact was unnecessary. Field measurement of the structure of the plant or soil invertebrate community was not possible because recolonization and ecological succession had only just started. Nevertheless, field studies are expected to be an important aspect of long-term monitoring because they will help to determine if the soil ecosystem is recovering as expected over time.

3.1.1 Summary of Expected Ecological Succession

An example of ecological succession in a hypothetical plant community is provided in Figure 1. Succession progresses through several distinct phases:

- Early succession is dominated by opportunistic species that have high growth or reproductive output, or some specialized ability to occupy a niche that other species cannot. An example would be an invasive, weedy species with a high output of wind-carried seeds. Species that can grow in nutrient-poor soil because they can convert nitrogen to a useable form (“nitrogen fixation”) would also have an advantage. Mites are an example of a primary colonizer from the soil invertebrate community because they have a high dispersal capacity, can tolerate low nutrient levels, and reproduce quickly (Hagvar et al. 2009).
- Middle succession involves increasing competition for resources (i.e., the limited nutrients that are introduced by the decay of leaf litter from the early stages). An example of the middle stages of succession would be the proliferation of alder which have a similar capacity for nitrogen fixation as grasses, but also the ability to outcompete grasses for moisture and light through root and shoot growth. Examples of invertebrates at this stage include ground-dwelling beetles or ants.
- Late succession continues competition in an increasingly diverse number of niches. At a late succession stage, the humic layer has regenerated through the decay and processing of organic material, and there is an ongoing cycle of nutrients in soils from the activity of microbes, fungi and soil invertebrates. Earthworms and other invertebrates that process organic material would be common. The overall ecological function (e.g., production of biomass, respiration, diversity) in the ecosystem has reached its maximum capacity, and the ecosystem has settled into a dynamic equilibrium.

Golder has identified several examples of natural ecological succession from the literature in Table 2, including recolonization of a landscape after a landslide or retreat of a glacier, or reclamation from non-metal mining such as quarrying.

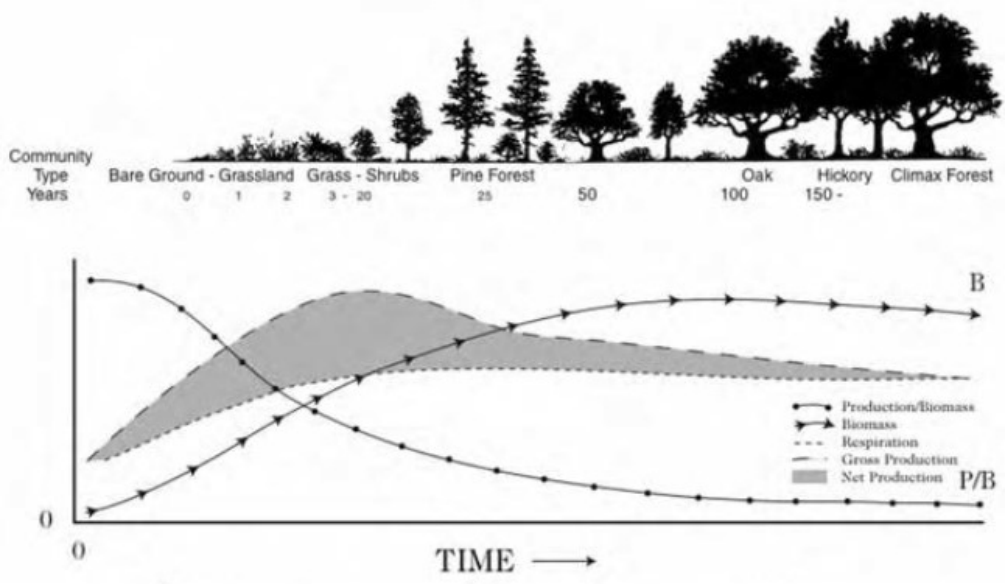

Figure 1: General schematic of vegetative succession over time (from Schneider 2008)

Table 2: Examples of Ecological Succession

Authors	Site Context	Observations
Russell and La Roi (1986)	34-hectare spoil heap of overburden generated from coal mining activities in Rocky Mountain foothills, Alberta.	Vegetative cover limited by coarseness of material and low nutrient levels. Total plant cover is less than 10% despite relatively long length of time since formation of the spoil heap (34 years). Perennial grass and forbs are the dominant species.
Frouz et al. (2008)	Chronosequence of 27 sites on four different coal mine spoil heaps (100+ km^2) in Europe. Total length of time since disturbance was 40 years.	Plant and soil invertebrate communities were assessed. Statistical analysis found that succession was driven by the formation of the humic layer. Sites tended to switch from “no humus” to “humus forming” at roughly 15 years, and from “humus forming” to “humus present” at roughly 25 years.
Miles and Swanson (1986)	Chronosequence of 25 landslides in Oregon. Total length of time since disturbance was 30 years.	Total vegetation cover ranged from 51% (in the primary scar) to 78% (in the primary deposition area). Cover consisted of trees (approximately 50% of the total), shrubs (25% of total) and herbs (25% of total), suggesting that succession had progressed to a mature state.

Authors	Site Context	Observations
Smith et al (1986)	Chronosequence of 49 landslides in Haida Gwaii. Total length of time since disturbance was 150 years. Logged and non-logged areas included for comparison.	Humic layer reformed relatively quickly but had decreased nutrient levels until Year 30. There was a relatively thick cover of red alder (an early colonizing tree species) within 20 years, but the total vegetative cover in the slide areas did not reach the undisturbed areas for 50 years. (For context, a logged area returned to a total cover like the undisturbed area within 20 years).
Gobbi et al. (2006).	Chronosequence of soil invertebrates colonizing a receding terminal glacier moraine. Total length of time was 150 years.	Species richness increased from 2 to 26 genera. Spiders and beetles were the primary colonizers, while ants and centipedes are only present in the older sites. The pattern of succession was consistent with the available information about the habitat preference and life history strategies of each species.

Note: A chronosequence is an ecological study that investigates a set of similar sites that share similar attributes and a similar disturbance but have different ages in order to understand the time-dependent aspects of succession.

3.1.2 Influence of Natural Succession on the Design of the CEMP

Although MPMC has conducted a variety of actions over the last two years to facilitate natural ecological succession, the plant and soil invertebrate community in the area impacted by tailing deposition is likely still in the early, opportunistic stages of recolonization. Further information about the following activities conducted to date can be found in the Conceptual Remediation Plan (Golder 2018):

- Soil manipulation (e.g., scarification to create a “rough and loose” soil material with better physical structure)
- Blending and placement of native topsoils to improve moisture retention and nutrient levels, and to reintroduce native microbes, fungi, seeds and soil invertebrates
- Mounding and placement of coarse woody debris to create preferential microsites where plant recolonization can be accelerated
- Placement of wood chip mulch to increase organic carbon and nutrient levels as the mulch decays
- Riparian planting of native shrubs and conifers
- Seeding of upland areas with a mix of native grasses

The net effect of the original impact and the subsequent rehabilitation effort is that a high degree of variability between areas is still expected because the treated and untreated areas are still in the first few years of succession. The total length of time to reach a mature, dynamic equilibrium is unknown, but likely on the order of 20 to 30 years based on the examples from Table 2. The rehabilitation activities described above would be expected to accelerate and enhance that process. A field study to measure the difference between "control" and "impact" that could separate the relative influence of copper versus physical limitations would be challenging in this early phase. Specifically:

- Comparison to reference is not expected to be practical in the near-term (i.e., one can reasonably conclude that there will be substantive changes between the impacted areas and areas that have not covered with tailings). No suitable reference areas (i.e., an area that has been logged and all vegetation and humic material removed) are currently known.
- Comparison between individual years may not add significant value because differences in weather (e.g., rainfall, snowpack, temperature) would also introduce significant year-to-year variability.

Instead, monitoring of the plant and soil invertebrate community should focus on establishing a long-term trend analysis rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions. This would involve:

- **Selecting representative, permanent monitoring plots.** The number of plots will depend on the number of different habitat units to be monitored. These units could be based on copper concentrations, remedial areas, the types of rehabilitation already applied, or other attributes that will influence succession (e.g., slope, moisture content, distance from undisturbed edge).
- **Monitoring each plot in a consistent manner to support analysis of trends over time.** No consensus exists at this time about which specific metrics are needed to monitor progress towards a biologically diverse, functional and self-sustaining ecosystem. Input from other subject matter experts (e.g., mine reclamation specialists) is likely required given that the timelines for monitoring will extend into the mine closure process.
- **Sufficient sampling effort to make informed management decisions.** A defensible trend analysis needs to consider statistical power. Statistical power is influenced by the minimum measurable change and the variability amongst replicates of a given habitat unit. Even if a formal power analysis is not needed, the study design needs a common understanding about how the trend analysis would be used to make future decisions. For example, trend analysis may benefit more from measuring 5 metrics at 50 plots for three years followed by a 5-year hiatus than measuring 10 metrics at 20 plots every year. The 750 measurements in the first option may be more meaningful than the 1,600 measurements in the second option because option 1 provides more spatial coverage and measures inter-year variability.

3.2 Uncertainty about the Relative Influence of Copper on Soil Invertebrates and Plants

The ERA concluded that risks from copper were low, and therefore, further focused investigations to determine the relative influence of copper on soil invertebrates and plants versus physical variables (such as through toxicity testing or greenhouse experiments) were not warranted until there was information from the field monitoring that succession was not progressing towards the long-term management goal of reintroducing a biologically diverse, functional and self-sustaining ecosystem (Table 53 of the ERA). A trend analysis will not provide a definitive check on progress towards this management goal for several years. In the meantime, continued refinement of the site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate and plant tissues is recommended because:

- The presence of sufficient plants or invertebrates for sampling across the range of copper concentrations in soil provides important qualitative evidence (pending confirmation from the trend analysis) that copper is not exerting a significant effect on the survival of soil invertebrates or plants. If areas with the upper range of copper concentrations in soil lack soil invertebrates, or show visual evidence of copper toxicity to plants, it would be a trigger for the more focused investigation (or, could lead directly to supplemental remediation as part of the overall adaptive management strategy).
- Refining the soil-to-tissue relationships provides direct evidence about copper bioavailability and bioaccumulation. This helps to clarify potential differences in copper bioaccumulation between different species or taxonomic groups, and the site-specific relationships can be compared to similar relationships from the scientific literature or other copper-contaminated sites to provide further support to the ERA conclusion that copper bioavailability is relatively low.
- The site-specific bioaccumulation relationships are also used as part of the wildlife food chain model. Some of the existing relationships are based on limited data sets, which have added uncertainty to the results of the food chain model. A more robust relationship between soil and tissue concentrations increases the overall sophistication and future application of the food chain model as part of the CEMP.

3.2.1 Uncertainty in Risk Estimates for Wildlife Species

The food chain model used appropriately conservative assumptions and model parameters consistent with common practices for a screening-level risk assessment.

In terms of risk management decisions, some qualified professionals default to a prescriptive interpretation that any HQ than 1 represents a potential risk that requires further assessment or remediation. Realistically, marginal HQs (e.g., less than 2 or 3) are unlikely to present an unacceptable risk but there is no consensus on a specific threshold between acceptable or unacceptable risk beyond the prescriptive guidance about HQ = 1. The existing HQs are not considered to represent an unacceptable risk but are sufficiently higher than 1 to warrant further refinement of the model to reduce uncertainty. The uncertainty in the HQs generated from the food chain model is the product of the uncertainty in each of the variables used. Not all variables need to be refined. The variables that would benefit most from refinement are:

- Improving the quality of data with respect to tissue concentrations in invertebrates. This can be accomplished by expanding on the bioaccumulation sampling as described in Section 3.2. The food chain model has also conservatively assumed that flying insects have the same tissue concentrations as soil-dwelling insects, which is a data gap that should be addressed by further sampling.

- Refining the toxicity reference values (i.e., the denominator in the HQ). The current toxicity reference value was taken from the ECO-SSL guidance (USEPA 2018) and is based on a conservative “no-observed adverse effect level” from the available literature. This toxicity reference value may be substantially lower than a true “acceptable” concentration that corresponds to low (i.e., not statistically significant) effects on growth or reproduction. A common area for refinement in a wildlife risk assessment is to update the toxicity reference value to reflect an effects-based threshold in lieu of a highly conservative screening threshold.
- Reviewers of the ERA identified the use of relative bioavailability as an uncertainty in the food chain model but did not reach a consensus about whether this issue was significant in terms of the final risk conclusion. There are unresolved differences in professional opinion on this topic which would ideally be addressed as part of the food chain model refinement. Golder notes that ENV has previously accepted the approach used in the current ERA at other sites and believes that further dialogue on this point prior to initiating additional investigation is warranted.

Refinement (or resolution) on these three topics is expected to reduce the overall uncertainty in the food chain model. Golder understands that the refined model would be run for the same subareas and HQs presented for both individual subareas and for the aggregate of the entire study area. Golder also understand that ENV desires that bats (*Myotis* sp.) be added as an additional receptor.

4.0 CONCEPTUAL STUDY DESIGN

4.1 General Approach

A proposed approach to address the remaining areas of uncertainty in the terrestrial ERA is provided in Figure 2. In brief, the following activities are proposed for the remainder of 2018 and the first quarter of 2019:

- Conduct a reconnaissance-level assessment and conduct limited pilot-scale investigation for candidate metrics for inclusion in the long-term trend analysis monitoring of ecological succession.
- Engage stakeholders and subject matter experts in a workshop to review the findings from the reconnaissance-level assessment and to obtain consensus about how a “biologically diverse, functional and self-sustaining ecosystem” will be measured.
- Conduct a one-time supplemental sampling program to refine the current information regarding copper bioaccumulation and relative bioavailability. Refine the toxicity reference values and use all three outputs from the one-time supplemental sampling program to update the food chain model.
- Develop the preliminary design for the trend monitoring in terms of specific metrics, sampling effort, frequency and interpretative approaches and submit for regulatory approval.

At the completion of these four activities, the CEMP will be updated to incorporate the specific design for long-term monitoring of the ecological succession expected to occur over time. The long-term monitoring will need triggers for when ecological succession will be deemed to be insufficient (even if such triggers are narrative). Additional rehabilitation or additional investigation regarding the cause of the insufficient progress would occur if those triggers are exceeded.

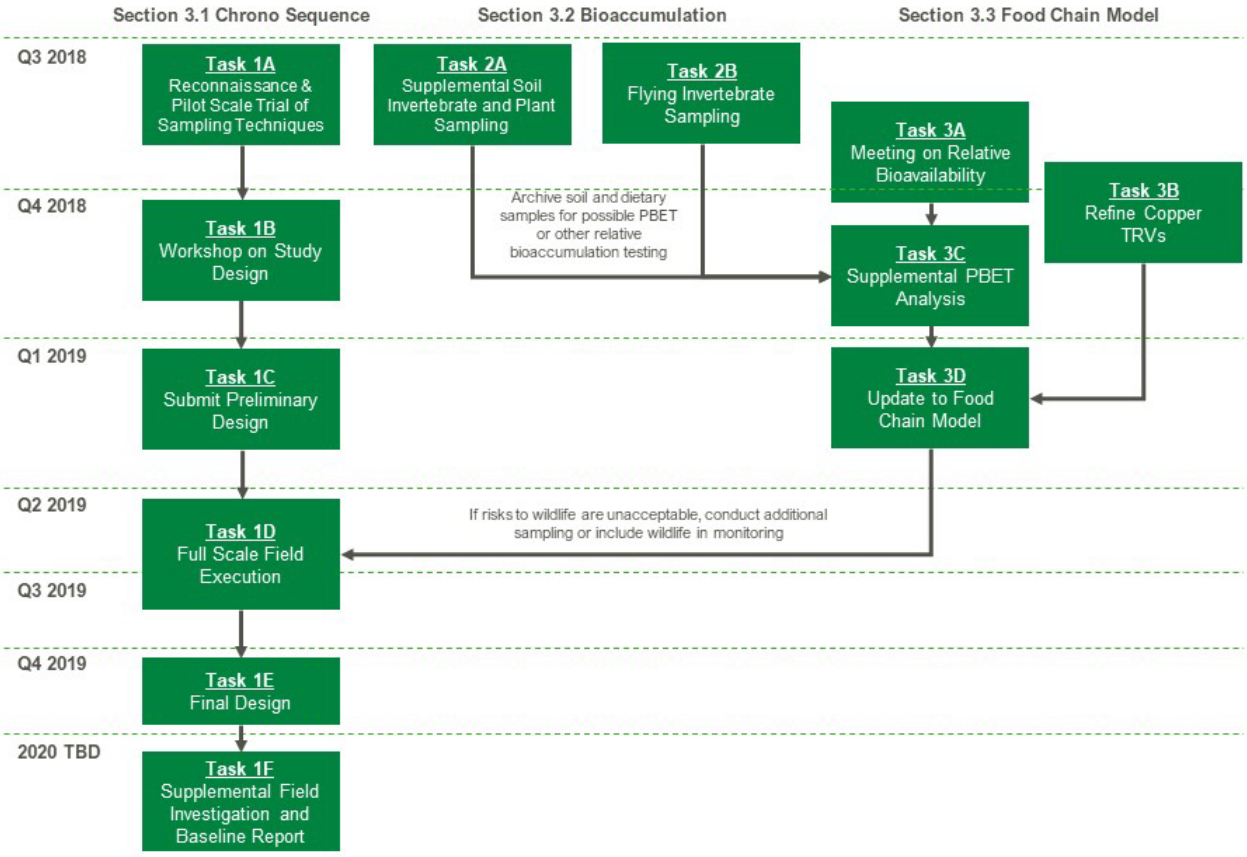

Figure 2: Proposed Approach for the Terrestrial CEMP Component

4.2 Additional Information

4.2.1 Task 1A – Reconnaissance and Pilot-Scale Sampling

There is value in conducting a reconnaissance-level sampling program in the summer of 2018 to provide at least a narrative description (supported by field measurement) of the current state of ecological succession. The reconnaissance-level sampling will focus on:

- Determining the diversity and percent cover of plants in three plots in each of the seven major terrestrial units (Halo; Untreated – Polley Flats; Untreated – Upper Hazeltine; Untreated – Lower Hazeltine; Transplanted; Intermixed; Scarified) for a total of 21 plots.
- Making detailed observations about plant succession in selected locations where additional rehabilitation was conducted (e.g., placement of large woody debris, mounding, placement of mulch).
- Conduct an overall site inspection to identify if there are areas that were subject to additional rehabilitation where no ecological succession appears to be occurring.

- Conducting a standardized bird survey at five locations (for spatial coverage) to document which species are using the available habitat. (Birds are selected for the survey because of the potential that listed species would use the habitat). Habitat monitoring for other wildlife species is not included in the scope of this reconnaissance-level sampling.

Data from the reconnaissance sampling will help to inform the design of the long-term trend analysis. Golder will also use the opportunity to conduct a pilot-scale trial of sampling techniques that could be used to measure other aspects of ecological succession. For example, the future trend analysis (see tasks below) may involve a metric related to soil invertebrate diversity, density or function. The literature describes a wide array of possible sampling techniques (e.g., a soil core to measure the diversity and abundance of mites; a bait-trap to measure the biomass of ants; a pit-fall trap to measure the diversity of ground-dwelling beetles). Golder is using malaise traps, pit-fall traps and Berlese funnels as part of the tissue sampling, any one of which could add value to the design of the long-term monitoring.

4.2.2 Task 1B – Workshop on Design of Trend Analysis

Golder expects that reviewers and stakeholders would comment extensively on the design of the trend analysis, and a variety of technical opinions are expected. There is a wide diversity of possible technical approaches, compounded by an absence of risk assessment guidance on how ecological succession should be monitored.

Golder expects that it will be necessary to draw on regulatory guidance from other relevant Ministries (e.g., Mines, Forestry) where landscape level changes in plant communities are more commonly assessed. For example, BCMOFR/BCMOE (2010) provides guidance on how to assess terrestrial ecosystems, but guidance on measuring successional state is limited to a semi-quantitative assessment that tracks the proportion of early colonizers (‘seral’ species) to later colonizers (‘climax’ species). No specific thresholds for the different states are described and therefore, the site could conceivably remain in a “pioneer” state for 60 or more years. This type of narrative assessment, although described in regulatory guidance, would not add value for site management decisions. Conversely, there are examples of how plant succession is being monitored for mine closure purposes in a quantitative manner (e.g., Highland Valley Copper focuses on plant diversity and functional contribution as a surrogate for the broader ecological succession; Smyth et al. 2016) but no specific thresholds are described beyond “continued progress”.

Golder proposes a one-day workshop where a focused overview of the findings from the reconnaissance-level sampling and tissue sampling can be presented, followed by discussion of relevant examples of risk-based mine closure and monitoring elsewhere in British Columbia. Potential examples where publicly-available information is likely available include the Britannia Mine, the Sullivan Mine, and Highland Valley Copper. It is important to establish at least a preliminary consensus with the regulators about the intended application of this part of the CEMP before effort is expended on the design and costing of specific methods. This workshop is intended to be similar to the Problem Formulation Workshop that helped to build consensus on how the ERA was ultimately executed.

4.2.3 Task 1C – Preliminary Design of Trend Analysis

Golder will develop a preliminary design for the long-term trend analysis based on the reconnaissance sampling, further consideration of relevant examples at other BC mine sites, and input from the reviewers.

4.2.4 Task 1D – Full Scale Field Execution

Golder proposes that the preliminary sampling design would be implemented in the spring and summer of 2019. The scope of this program is currently unknown, pending the outcome of the preliminary design.

4.2.5 Task 1E – Refinement to Design

Conceptually, Golder envisions that the preliminary design might specify a larger number of potential metrics which would be reduced to a final subset based on the data collected in 2019. The intent of the refinement step is to provide a formal check that the preliminary design has been fully optimized in terms of effectiveness and efficiency. A key aspect of optimization is that it is not necessary to continually monitor all aspects of the ecosystem as a conservative, precautionary approach. Instead, the goal is that the CEMP component provides a science-based framework for adaptive management. Adaptive management focuses on monitoring a smaller number of metrics (but monitoring them well) so that there is a clear baseline with pre-defined triggers for when one-time supplemental investigations might become necessary.

4.2.6 Task 1F – Baseline Report

Conceptually, the terrestrial monitoring component will focus on monitoring succession at pre-defined intervals rather than annually. The ERA and its supporting appendices contain information about conditions up to approximately D+3 (disturbance + 3 years). The reconnaissance sampling is effectively an interim snapshot about D+4, and the full field execution would provide the formal baseline that reflects conditions at D+6 (and possibly D+7, if year-to-year variability is included in the study design). Subsequent cycles of the terrestrial monitoring program would then document the ongoing ecological succession at defined intervals post-baseline (e.g., baseline + 2 years, B+5, B+10, B+20).

4.2.7 Task 2A – Soil Invertebrate and Plant Sampling

This task is a standalone activity intended to reduce the uncertainty in the existing site-specific bioaccumulation models (Figure 3) for soil invertebrates and plants. Both models could be improved by obtaining additional co-located soil and tissue samples so that the relationships are not based on composite samples (e.g., separate ‘surface insects’ into ‘ants’, ‘spiders’ and ‘beetles’; separate ‘grass’ into the main species that have been seeded on the site). Conceptually, Golder would target different specific taxa or species emphasizing areas that have not yet been sampled (i.e., the three reclamation treatments). These areas tended to have copper concentrations in the middle of the range bounded by the background and untreated areas. All data (i.e., data from Golder 2017 and data collected in August 2018) will be used to refine the existing bioaccumulation relationships (see Figure 3, below). Note that the total number of tissue samples submitted for analysis will be dependent on the trap effectiveness. A decision on whether the supplemental data are sufficient will be made in light of the uncertainty in the regression equation.

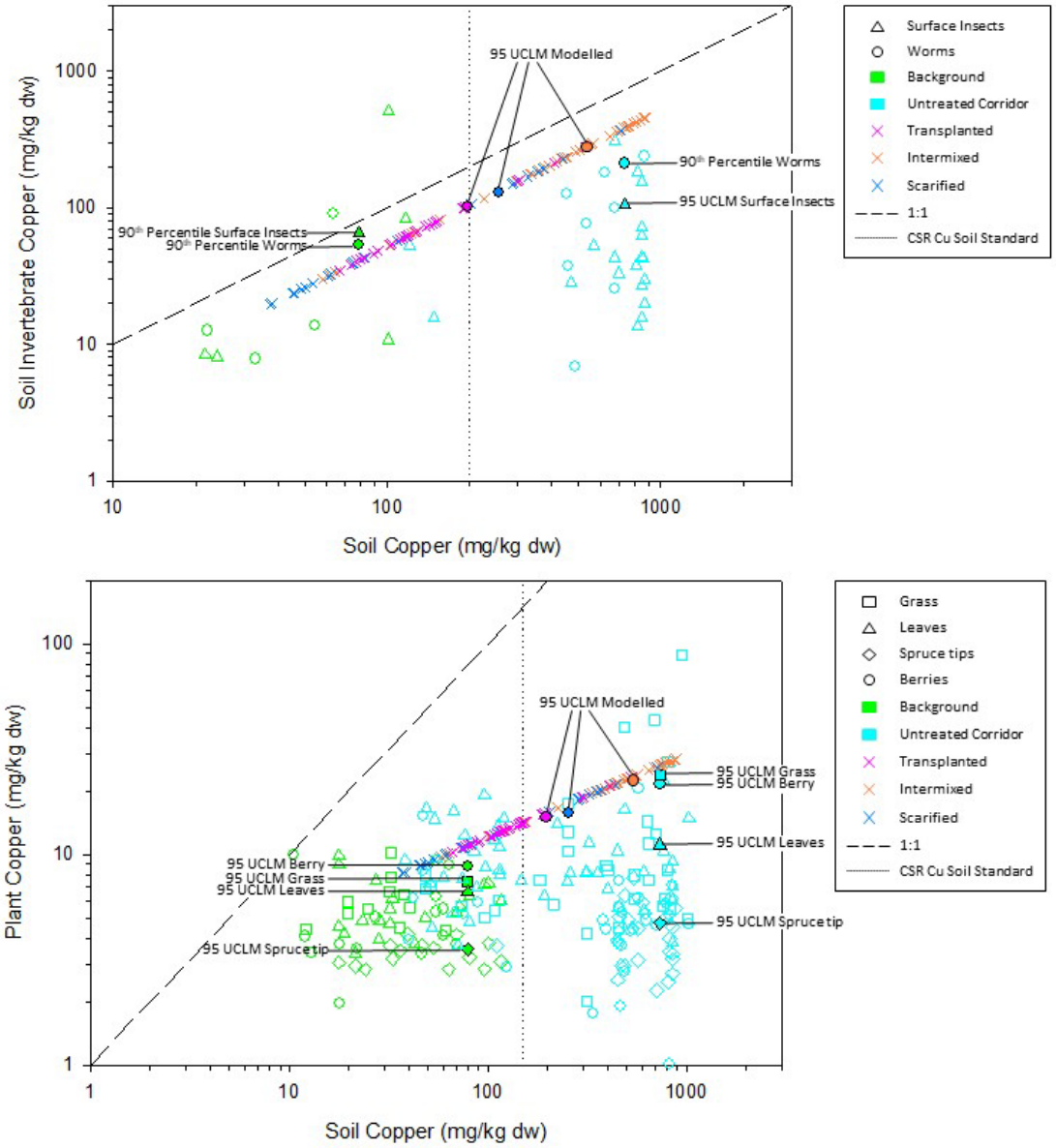

Figure 3: Existing bioaccumulation models for soil invertebrates and plants (from Golder 2017, Appendix F)

4.2.8 Task 2B – Flying Insect Sampling

This task is a standalone activity to address a data gap in the food chain model. Golder will collect flying insects (e.g., moths, flies, flying ants, grasshoppers) using malaise traps with lights. These taxonomic groups reflect the likely dietary items for insectivorous birds and bats. Hand collection with butterfly nets will also be employed. Ideally, sufficient biomass will be collected from a single location to allow for submission of taxa-specific composites (not a composite of all flying insects). Tissue concentrations are not expected to be directly related to local soil concentrations because flying insects are mobile, and therefore, the goal would be to focus on sampling from five broad zones (e.g., Polley Flats, Upper Hazeltine, Lower Hazeltine, Halo, and Background. The goal is to obtain at least seven tissue samples per taxonomic group per area (to allow for the calculation of a 95% upper confidence limit of the mean). The total number of tissue samples submitted for analysis will be dependent on the trap effectiveness.

4.2.9 Task 3A – Meeting on Relative Bioavailability

There was conflicting feedback from technical reviewers about how the food chain model incorporated the relative bioavailability of copper in water, food and dietary items once ingested by different ecological receptors. Golder assumed that copper in water would have a 100% bioavailability relative to the form of copper added to the food used in the original mammalian or avian toxicity test. Site-specific PBET data was used as a surrogate for the relative bioavailability of soil, and information from the literature was used to provide a conservative estimate of the relative bioavailability of copper once incorporated into biological tissues. Similar approaches have been approved by ENV at other sites, including the risk-based management of elevated copper in soils at the Britannia Mine. Relative bioavailability for soil and dietary items has also been evaluated in the risk assessment literature with specific consideration of the potential for differences in gastrointestinal bioavailability between mammals and birds (e.g., Sample et al., 2014; Kaufman et al., 2007).

Golder recommends holding a focused meeting on this specific technical topic with the subject matter experts and ENV. Eliminating relative bioavailability from the food chain model would be demonstrably over-conservative and inconsistent with the scientific principles that influence how an ingested dose is ultimately absorbed by birds and mammals. If the consensus from that meeting is that further quantitative assessment is needed to support the existing approach, it would be completed this fall in Task 3C. Golder proposes to collect archive tissue and soil samples in the summer sampling program (Task 2A) as a precaution (subject to the availability of sufficient tissue mass).

4.2.10 Task 3B – Refinement of Copper TRV

Golder will update the existing toxicity reference values for copper to use a multi-study concentration profile in lieu of the existing point-estimate based TRVs adopted from ECO-SSL. A similar approach has been proposed in the amphibian monitoring component of the CEMP. The development and application of ECx-based toxicity reference values in wildlife food chain model is well-established in the scientific literature (e.g., Allard et al. 2010) and has been adopted by provincial and federal risk assessment guidance manuals (e.g., Environment Canada 2010) as an accepted practice to refine screening-level ERAs.

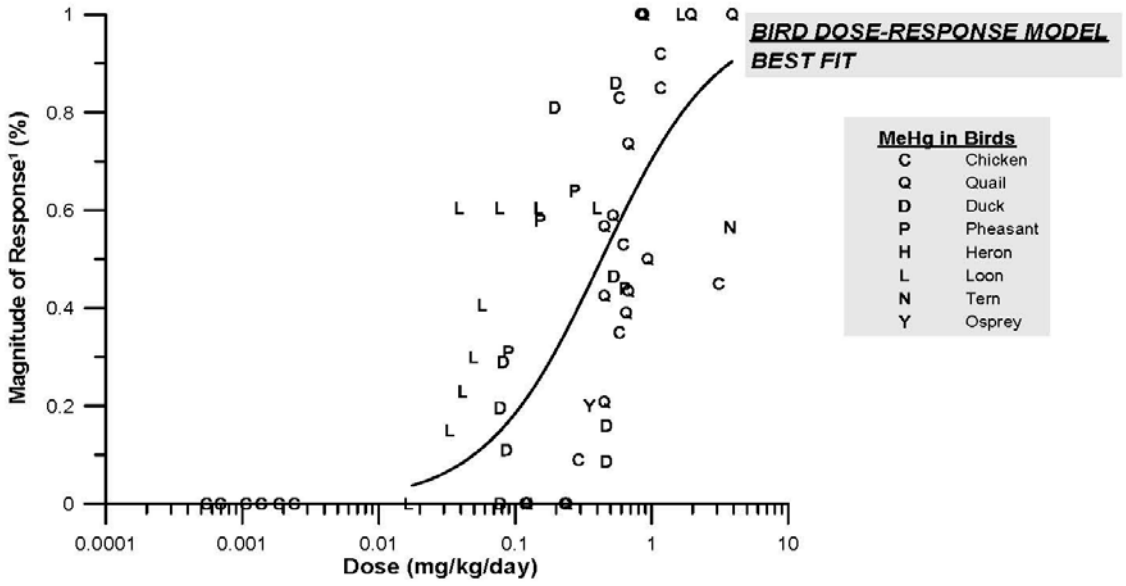

[1] *The magnitude of response y-axis scale extends from 0 to 1 (e.g., 0.5 corresponds to a 50% effect size such as reduction in reproductive output relative to control).*

Figure 4: Example of a multi-study concentration response profile (from Environment Canada 2010, courtesy of Azimuth Consulting Group)

4.2.11 Task 3C – Supplemental Bioavailability Analysis

Golder believes that there is sufficient technical support and past precedents for the current use of relative bioavailability in the wildlife food chain model. However, if necessary based on Task 3A, Golder would conduct additional analysis on archived soil, plant and invertebrate tissue samples to provide further information about how bioavailability can be incorporated into the food chain model. Conceptually, relative bioavailability is about establishing a common modifying factor to interpret the total copper concentrations that are established by the chemical analytical laboratory. A focused assessment that involves the same bioavailability analysis on water, soil, food and representative “spiked-food” samples made to duplicate the original approach used in the key toxicology studies from the literature would create a common basis for relative bioavailability in the food chain model.

4.2.12 Task 3D – Update to Food Chain Model

This task is a standalone activity to update the food chain model with the information obtained in Tasks 2A, 2B, 3B, and 3C. Depending on the quantity of information from 2A and 2B, it may be possible to add additional refinement in terms of dietary preferences to more closely reflect how different receptors would be expected to use the site. A bat will also be added as an additional surrogate receptor per ENV’s request. The deliverable for this task would be an update to the existing food chain model report (Appendix F of the ERA).

5.0 SUMMARY

This memorandum describes a proposed approach for the terrestrial component of the CEMP. Not all tiers are recommended for immediate implementation, and there are significant technical and regulatory issues that would need to be resolved as part of the design and execution. Golder recommends that the current CEMP focus on executing the proposed tasks up to the end of Q1 2019. This includes progressing the proposed chrono sequence approach for the long-term CEMP up to the point of submitting a preliminary design for formal ENV approval. The proposed tasks also include activities to reduce the uncertainty in risk estimates to soil invertebrates and wildlife that addresses the content of Table 53 of the ERA.

6.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this technical memorandum.

Please do not hesitate to contact the undersigned if there are questions regarding this memorandum.

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Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10023g/documents_1894924/2. issued/025-tm-23182-terrestrialconcept/rev1/1894924-025-tm-rev1-23182-terrestrialdesignconcept_09aug_18.docx

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STUDY LIMITATIONS

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Appendix B.6

Amphibian and Reptile Monitoring

Golder Associates Ltd.

TECHNICAL MEMORANDUM

DATE 9 August 2018 **Reference No.** 1894924-018-TM-Rev1-23182

TO Stephen Monninger
Mount Polley Mining Corporation

CC Colleen Hughes

FROM Blair McDonald and Barbara Wernick **EMAIL Blair_McDonald@golder.com; Barbara_Wernick@golder.com**

STUDY DESIGN CONCEPT: AMPHIBIAN COMPONENT FOR THE MOUNT POLLEY MINE COMPREHENSIVE ENVIRONMENTAL MONITORING PLAN

Introduction

Golder Associates Ltd. (Golder) understands that Mount Polley Mine is preparing a Comprehensive Environmental Monitoring Plan (CEMP) to integrate the monitoring components from a variety of regulatory processes applicable to the mine into a single document. One element of the regulatory process involved the submission of an Ecological Risk Assessment (the ERA; Golder 2017) which integrated the available chemical and biological information to provide an overall conclusion about the magnitude and extent of ecological risks associated with the deposit of tailings. The ERA was accepted by Ministry of Environment & Climate Change Strategy (ENV) on 31 January 2018, contingent on the implementation of additional monitoring in relation to specific areas of uncertainty identified in the ERA. One of the identified areas of uncertainty at the conclusion of the ecological risk assessment (Table 53 of the ERA) was that amphibians were not formally assessed. The ERA identified amphibians and reptiles as a relevant receptor group (Section 2.3.3.4 of Golder 2017) with western toad and common gartersnake identified as possible receptors. Western toad was selected as the receptor of potential concern for the broader amphibian and reptile community because it is also a listed species.

This purpose of this memorandum is to outline the monitoring concept proposed to address the uncertainty associated with the amphibian component for the Mount Polley CEMP. If this concept meets ENV expectations, a detailed study design document and specific work instructions will be prepared by Golder as the basis for executing this component as part of the Mount Polley-led CEMP process.

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Basis of Design

The basis of design consists of a summary of the available data and how those data were evaluated in the ERA, provided for the convenience of the reviewers. Copper and vanadium were retained as the contaminants of potential concern in the terrestrial ERA, and copper was retained as the contaminant of potential concern in the aquatic risk assessment. Although no amphibian-specific toxicity reference values were available, these contaminants of potential concern were selected by comparing the maximum observed concentrations conservative, regulatory-approved standards and guidelines. The maximum observed vanadium concentration was only marginally greater than the generic soil standard, and therefore, copper is expected to be the primary contaminant of potential concern for amphibians. Other data relevant to amphibians were described in Section 3.4 of Golder (2017) and consisted of:

- Substantial numbers of tadpoles were observed in 2015 in pooled water that formed throughout the Hazeltine Creek corridor. These tadpoles were confirmed to be western toad (*Anaxyrus boreas*) which is listed on Schedule 1 of the federal *Species at Risk Act*. More than 75,000 individual western toads (approximately 66,000 tadpoles, 9,000 juveniles, 300 sub-adults and 50 non-breeding adults) were subsequently salvaged from 40 different standing water depressions over a two-month period in 2016 prior to the start of rehabilitation. Long-toed salamanders (*Ambystoma macrodactyllium*) and Columbia spotted frogs (*Rana luteiventris*) were also salvaged (at lower numbers). Golder (2017) concluded that the salvage provided qualitative information that amphibians were able to successfully survive, grow and reproduce despite direct contact with tailings and surface water.

- Tissue samples were collected from three amphibians (species not identified) were collected by ENV in August 2016. Golder was not able to confirm the methods used for sampling, processing or analysis and did not review the certificate of analysis with respect to quality assurance/quality control measures. Tissue concentrations in two samples collected from impacted areas ranged from 56.4 to 871 mg/kg Cu dry weight. A tissue sample collected from Gavin Lake (considered by ENV to be a background area) was 12.4 mg/kg Cu dry weight. Data were compared to literature that indicated that copper tissue concentrations corresponding to a lowest-observed effect concentration (LOEC) or no-observed effect concentration (NOEC) ranged from 60 to 325 mg/kg dw (Attachment F, Appendix J of Golder 2017). The average concentration of the two impacted samples was also considered in the uncertainty analysis for the wildlife food chain model (i.e., would the risk conclusion be different if piscivorous birds and mammals had a diet consisting entirely of amphibians). Beyond these qualitative observations, data were not formally evaluated because methods and quality assurance/quality control practices could not be verified.

- Multiple lines of evidence in the ERA demonstrated that copper had low bioavailability. The lines of evidence included geochemical modeling and three different chemical surrogate measurements in tailings samples (water soluble fraction; humidity cell and leach tests; physiological-based extraction tests – see Section 3.2.2 of Golder 2017). Speciation modelling of copper in water showed most of the dissolved copper in Quesnel Lake water would be bound to carbonates which have lower bioavailability than copper ions (see Section 4.2.1.3 of Golder 2017). Golder concluded that the bioavailability of copper would be unlikely to be high for amphibians if there were multiple lines of evidence showing that copper bioavailability to other receptors was low.

Further Consideration of Uncertainty

The purpose of this section is to expand on the specific uncertainties identified in the ERA to be evaluated by focussed monitoring as outlined in this conceptual design document. Golder (2017; Table 53) provided an overview of the uncertainties to assist with future risk management decisions, but a one or two sentence summary does not necessarily convey sufficient detail to show how the design of the amphibian monitoring is linked to the findings of the ERA.

For amphibians, uncertainty is because of the absence of quantitative risk assessment for amphibians. Notwithstanding the value of the inferences and qualitative observations described above, there was only a limited amount of direct measurement of exposure or effects relevant to amphibians at the time the ERA was undertaken. From a practical perspective, rehabilitation of the riparian areas, and restoration of Hazeltine Creek was ongoing throughout the risk assessment process and therefore the habitat suitability for amphibians was considered low. Moreover, completion of the ERA for other major groups of receptors (e.g., mammals, plants) was needed to determine if further remediation activities, which would further disrupt habitat suitability, was needed to address the residual concentrations of copper in the deposited material. Therefore, Golder (2017) determined that it would be inappropriate to arrive at a risk conclusion at that time without further evaluation.

The ERA found that risks for the major groups of receptors were generally low to moderate (reflecting the low bioavailability of copper in tailings) and therefore, extensive additional intrusive works are less likely. Thus, it is appropriate to now consider a monitoring plan that will contribute to confirming that the risk conclusions for other major groups of receptors are also applicable to amphibians.

Conceptual Approach

The amphibian component is essentially a continuation from the problem formulation already completed (Golder 2017) (which identified amphibians as a relevant receptor). In brief, the proposed approach is to continue the risk assessment process by proceeding through the following tiers to the point needed to support an informed risk management decision. The tiering is described in Figure 1, and consists of the following main tasks:

1) Conduct a hazard evaluation – Screen existing soil, sediment and surface water chemistry data for different habitat units against a conservative amphibian-specific screening value. Eliminate habitat units from consideration if copper concentrations are sufficiently low (i.e., the 90th percentile and 95% upper confidence limit of the mean) that risks are not expected.

2) Conduct an exposure assessment – For those areas that are not screened out in Step 1, compare the distribution of soil (or sediment, or water) concentrations for that area to a multi-study concentration response profile for copper. Areas where the average concentrations (e.g., 95% UCLM) are less than the toxicity reference value (TRV) (e.g., geometric mean of chronic, relevant no-observed effect levels) will be excluded from evaluation. Areas that cannot be excluded will be prioritized according to their potential risks (e.g., based on the degree of overlap between the distribution of concentration data and the response profile).

3) Conduct a laboratory-based effects assessment – The exposure assessment above assumes that copper in tailings is equally bioavailable as the original toxicity test. This is unlikely to be true because the ERA had multiple lines of evidence that showed bioavailability of tailings were low. If Step 2 demonstrates the potential for unacceptable risks, then laboratory-based toxicity testing will be used to establish a site-specific copper TRV and the representative soil, sediment and surface water data will be re-screened. Laboratory testing will likely need to include the physical nature tailings as a variable.

4) Refine the application of the toxicity reference values – The evaluation in Steps 2 and 3 assume that all soils, sediment and surface water are representative of a potential amphibian exposure. There may be portions of the terrestrial zone that are unlikely to be suitable amphibian habitat because of their distance from water, substrates or other factors. Refinement of the screening process from Step 3 to focus on the potential areas of habitat may be considered.

5) Conduct a field-based effects assessment – A field-based effects assessment is not contemplated unless concentrations in relevant amphibian habitats exceed both the literature-based and site-specific TRVs. Field-based measurements focus on comparison of population-level or organism-level endpoints between impacted and reference amphibian habitats. A mesocosm study could also be considered (e.g., transplant amphibian larvae between enclosures established in reference and impacted habitats and measure survival and growth at end of chronic exposure)

6) Integrate toxicity and habitat data in a population model – If a copper concentration response relationship has been established, it could be used in a population model to determine the relative influence of copper and physical stressors in the context of natural stressors (e.g., low precipitation) and habitat quality. This assumes that there is adequate information about the population dynamics of the western toad.

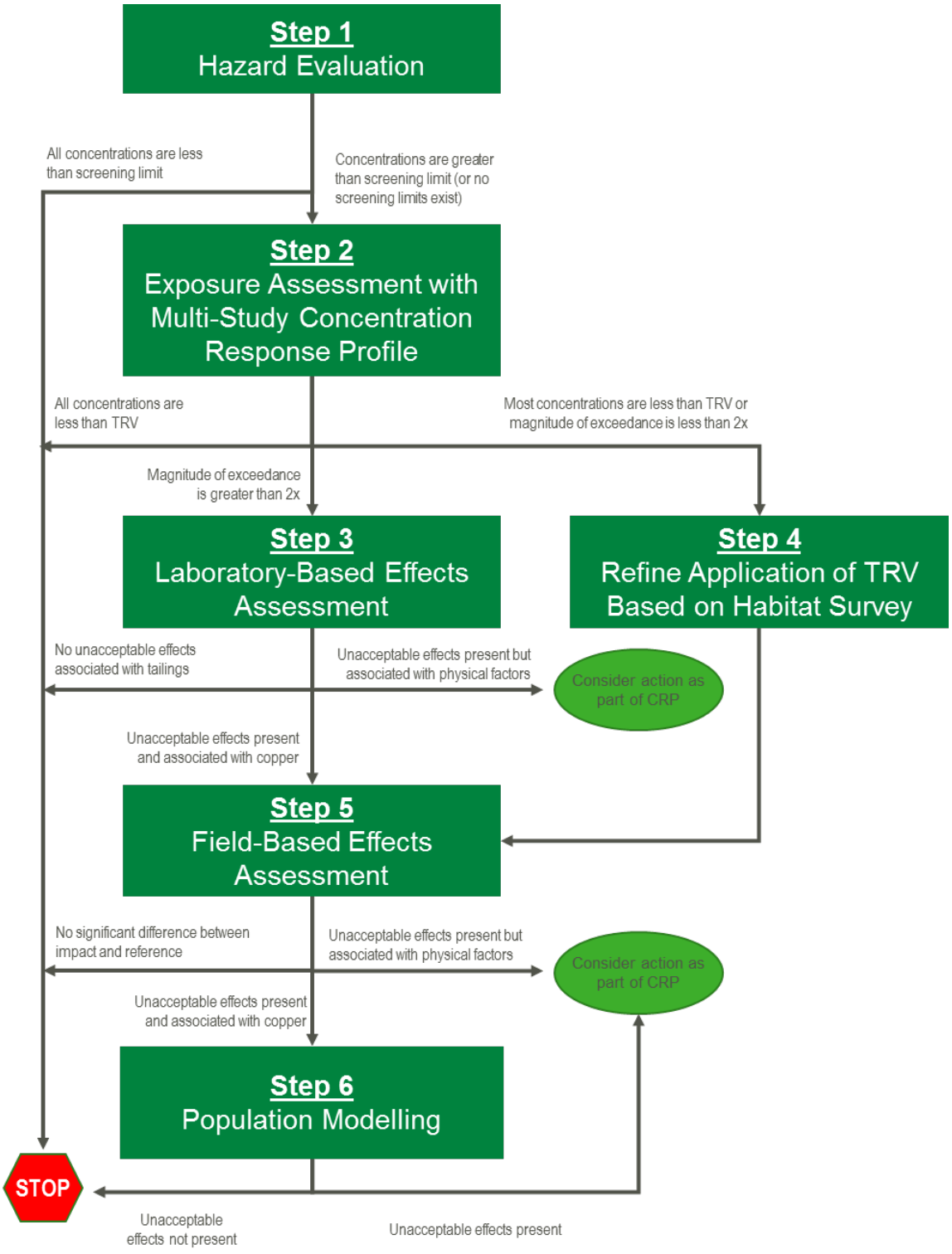

Figure 1: Proposed Tiering for Amphibian CEMP Component

Additional Information

This section expands on each tier in terms of potential sampling activities, levels of effort, and decision criteria. Further expansion of the rationale in the detailed study design is expected based on ENV feedback regarding the approach. The following guidance documents were reviewed as part of the development of this conceptual approach:

- FSCAP. 2016. Module 6: Ecological Risk Assessment for Amphibians on Federal Contaminated Sites. Draft (Not Approved as Guidance).
- Navfac (US Navy, Naval Facilities Engineering Command). 2004. Development of a standardized approach for assessing potential risks to amphibians exposed to sediment and hydric soils. TR-2245-ENV.

These documents provide amphibian-specific risk assessment information that was considered in the context of provincial guidance on conducted detailed ecological risk assessments at contaminated sites.

Step 1: Hazard Evaluation

FSCAP (2016) comment that there are relatively few summaries of amphibian toxicity data that provide generic screening limits. Golder will conduct a brief literature search to seek out amphibian-specific screening limits and review the available environmental quality guidelines to determine the degree to which they are protective of amphibians. The screening limits (if available) will be used to provide an initial evaluation of the soil, sediment and surface water data that is representative of the current-day exposure scenario for amphibians. The purpose of this initial hazard evaluation is to determine if portions of the site can be excluded from the amphibian assessment. An area will be excluded if: a) there is sufficient data to characterize the defined unit; and b) if the 90th percentile and 95% upper confidence limit of the mean concentrations in the unit are less than screening limit. If multiple screening limits are identified, an area will be excluded only if it has concentrations that are less than all limits. If no defensible screening limits are identified, we will proceed directly to Step 2.

Step 2: Multi-study Concentration Response Profile

FSCAP (2016) describe a process for integrating all available literature toxicity data into an overall concentration response profile for each media This “response profile” is then used to derive point-estimate screening limit (i.e., a single “safe” concentration) or effects-based TRVs (e.g., the range of values that correspond to a ECx effect). An example for zinc from FSCAP (2016) is provided in Figure 1.

Golder will develop multi-study concentration response profiles for copper in water and sediment/hydric soils consistent with FSCAP (2016). The overall process involves a literature review (with quality assurance procedures to eliminate unreliable data) consistent with ECO-SSL procedures. The general approach to integrating the literature data into a concentration-effect relationship is like that described by Allard et al. (2010) for wildlife TRVs. The ECO-SSL process is endorsed as a preferred approach in BC risk assessment by Technical Guidance 6 (guidance under the Contaminated Sites Regulation) and wildlife TRVs that consider the entirety of the available literature (instead of a single point estimate) are increasingly common in contaminated sites risk assessments.

Not all data have the same value in the derivation process:

1) Data that fail to meet basic test acceptability criteria (e.g., negative control are not present) will be rejected.

2) More weight will be given to North American species. Many toxicity studies use the African clawed toad (*Xenopus*) as a surrogate, but this species is not native to North America. Removing species that cannot be present at the site is consistent with provincial guidance about establishing site-specific water quality objectives (BCMOE 2013) and is also discussed by FSCAP (2016).

3) More weight will be given to studies that involved measured (instead of nominal) concentrations and/or involved field-collected samples instead of laboratory-spiked samples.

The specific derivation of a screening limit or a TRV is ultimately dependent on the quality and quantity of toxicity data available. It is likely that there will be a wide range of effects associated with a given concentration (e.g., Figure 2, which is for lead), and therefore, a specific derivation rule cannot be proposed at this time. FSCAP (2016) recommends that the data set should be explored to determine if there are significant differences in toxicity profiles for different species, exposure duration, endpoints and life stage. A specific decision about what constitutes an acceptable effect was not proposed by FSCAP (2016), but realistically, screening limits or toxicity reference values that are meant to be protective of western toads would need to reflect a low risk (e.g., EC10 or EC20). Moderate-to-high risk limits (e.g., an EC50-based TRV) may also be derived to help provide further context. Golder will need to consider the totality of the available data and provide a rationale for the TRV proposed. The available soil data will be compared to the TRVs using the same approach as described in Step 1.

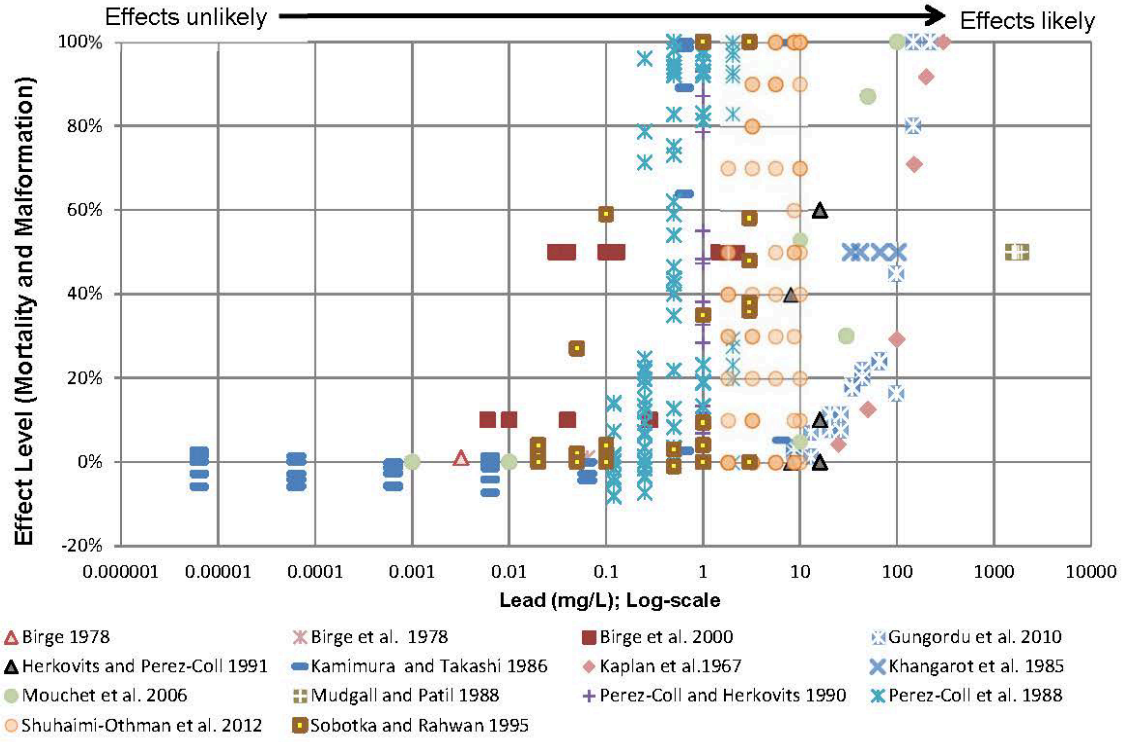

Figure 2: Example of a concentration-response profile (from FSCAP 2016)

Detailed reviewer comments were provided by ENV on May 29, 2018 and a teleconference was held on 9 July 2018 to discuss the conceptual approach and the reviewer comments. Golder understood from the teleconference that a topic of concern relates to how the results from the comparison of soil, sediment and surface water data to the amphibian-specific TRVs would account for amphibian habitat requirements.

Golder notes that there have been many soil samples collected from the site which were considered in the terrestrial risk assessment, and that additional soil sampling is being conducted in August 2018 as part of the supplemental terrestrial monitoring described under separate cover. Nevertheless, it would be a potential gap in the assessment if there were no data available regarding concentrations of copper in soil in areas that are important rearing or feeding habitat for amphibian species. Golder intends to present the data screening from Steps 1 and 2 in a manner that provides context for how the available data helps to inform hazards to amphibians. Specifically, a qualified biologist will provide a summary of habitat requirements for each of the individual amphibian species found in the area and will determine the extent of “high-quality” and “low-quality” habitat using existing information. This desktop-level review will help to place the hazard evaluation from Steps 1 and 2 in context. Further refinement of the hazard assessment based on a detailed habitat survey (Step 4) or a field-based assessment of effects (Step 5) will be considered based on the outcome of Steps 2 and 3.

Step 3: Site-specific Concentration-Response Relationship

A site-specific concentration response could be developed using amphibian toxicity testing in a manner similar to the approaches used for benthic organisms and plants in the ERA. Conceptually, the testing would include:

- Between 5 and 10 field-collected samples with varying copper concentrations that capture the range at which copper would be expected to exert a negative effect (based on Step 2).
- Additional negative controls to evaluate the physical nature of the tailings (e.g., low organic carbon; grain size and shape).
- Inclusion of spiked-copper samples (e.g., silica sand and natural soils spiked with a range of copper concentrations) to evaluate the difference in bioavailability between tailings and the typical literature values.

A detailed design for a laboratory-based toxicity test has not yet been developed, and there would need to be clarification from ENV about how the amphibian toxicity data would be used to make site management decisions before a suitable detailed design could be prepared. Amphibian toxicity testing is not a common approach and there are multiple laboratory-, organism- or sample-related factors that could lead to an unacceptable level of uncertainty in the results. For example:

- Nearly all available standardized protocols (ASTM, USEPA) use *Xenopus* which is not native to North America and it is not clear that this species is appropriate for the current application. Environment and Climate Change Canada (ECCC) is in the process of developing a standardized protocol with a relevant, Canadian species, but Golder understands that there are methodological challenges and organism supply issues yet to be resolved. The status of the draft method is unknown.

- Most standardized protocols are designed for spiked-water applications which would not necessarily provide value to the current application. One exception is NavFac (2004) which describes a method for exposing North American frog and toad tadpoles to field-collected sediment samples for a 10 to 14-day exposure. An ASTM test method is also available for sediment (but it uses *Xenopus*).
- It may be necessary to field-collect test organisms which would not be possible without applicable provincial scientific collection permits and/or federal permits under the Species at Risk Act.

Step 3 could provide value for site management decisions, but there are technical and regulatory issues to be resolved. Further development of a detailed study design for amphibian toxicity testing is not recommended until Step 2 has been completed, and only if there is consensus about how risk management decisions would factor in the possibility of high uncertainty associated with the use of a non-standard toxicity testing method. Ideally, an approved ECCC test method would be available at the time this step would be undertaken.

Step 4: Refinement of the TRV Application

A specific design for this step has not yet been developed. As a default, all soil, surface water and near-shore sediment data will be evaluated in Steps 2 and 3. The general concept for Step 4 is to refine how those TRVs are applied to different areas of the site based on whether the area provides (or will in the future) meaningful habitat for amphibians. The nearshore of the various waterbodies and their immediate riparian zones are likely amphibian habitat and would be included. Conversely, although western toads forage over relatively large areas and can use a range of different habitats (ECCC 2016), portions of the study area that are not suitable habitat for amphibians would then be excluded from the exposure estimates. Step 4 would involve a survey of the impacted area by biologists with specialized amphibian expertise. Areas of the site would be classified according to their suitability as amphibian breeding, hibernation, and foraging habitat (both at present, and in the future). This information would be used to refine how the TRVs are applied (e.g., exclude areas with minimal value to amphibians, and focus on understanding the risks in areas that are key to sustaining the amphibian population).

Step 5: Field-based Effects Assessment

From a risk assessment perspective, field programs provide valuable information because they provide a direct measurement of effects under field conditions. However, in the current application, direct measurement of effects does not necessarily help to differentiate the effects of the residual concentrations of metals associated with tailings from the physical effect of the tailings themselves. The physical alteration of habitat in the impacted areas was substantial, and as a result, a control-impact study design needs to account for the fact that risk management decisions will be different depending on whether the main stressor is physical or chemical.

FSCAP (2016) comments that amphibian risk assessment can incorporate field-based assessments and lists a number of standard methods for conducting field surveys for amphibians. Field assessment would involve a control-impact comparison (similar to the approach used for the benthic taxonomy studies in Quesnel and Polley Lake) and each type of area would preferably involve multiple locations to minimize the effect of natural variability of the risk management outcome. A variety of endpoints could be measured in a control-impact study design (e.g., number of egg masses per unit area; frequency of lesions or malformations per adult; abundance of amphibian larvae per unit catch effort).

Further development of a detailed study design for an amphibian field assessment is not recommended until Step 2 has been completed, and only if there is consensus about how risk management decisions would factor in the possibility of high uncertainty in its outcome. A key question is to determine the number of amphibian breeding sites within the impacted area, and to conduct a baseline survey to confirm that there is an adequate number of potential control sites available in the area. This baseline survey could be conducted as part of Step 4.

Step 6: Population Model

An additional line of evidence in an amphibian risk assessment is to combine the available toxicity and habitat data into a population model. A population model, in this context, simulates the stability of a given local population under a range of future conditions. The model is used to determine if reductions in survival, growth or reproduction from the physical or chemical stressors associated with tailings will impact the population as a whole. An example of a contaminant-habitat population model is provided for context.

Willson et al. (2012) used a population model (at a site unrelated to Mount Polley) to evaluate the impact of mercury on individual toads on the overall viability of population of American toads (*Bufo americanus*). The model simulated the population dynamics of toads to establish a baseline discrete-time model (e.g., how many toads will survive to each successive life-stage based on habitat quality; how big are the toads at reproductive age as a function of food availability; how many eggs will be produced as a function of adult toad size). The effect of mercury on the population was then added to the model as a reduction in the survival, growth and reproduction baseline as a function of mercury concentration. The net effect was a model that simulated how different concentrations of mercury would contribute to the stability of the toad population over time, and to determine which type (and how much) habitat enhancement was needed to off-set the influence of mercury.

In the current application, a model similar to Willson et al. (2012) would provide value by integrating the information from Steps 3, 4 and 5. However, a model like this would only be appropriate if there was evidence that copper was exerting an unacceptable effect which could not be readily remediated. Golder recognizes that habitat compensation to address residual contamination is a policy question that would need to be resolved, particularly for a listed species where the intent is to protect the individuals of the population, not just the population itself. There are also technical limitations to this type of model in terms of the quality and quantity of data available for parameterization. Golder assumes that there would be sufficient species-specific information for western toads because the species is listed and would be a priority for researchers (at least relative to other Canadian amphibians). It may also be reasonable to assume the population variables for western toads are similar to American toads.

Further development of a detailed study design for an amphibian population model is not recommended until Step 2 has been completed, and only if there is compelling evidence that there is a chemical-related impact that would be likely to cause an unacceptable outcome to amphibian populations. In the absence of a chemical-related impact, a model would not necessarily add any value (i.e., a decision to conduct habitat improvement to mitigate a physical stressor does not need to be based on a model).

Summary

This memorandum describes a proposed tiered approach for the amphibian component of the CEMP. Not all tiers are recommended for implementation, and there are significant technical and regulatory issues that would need to be resolved as part of the design and execution of Steps 3 onwards. However, Steps 1 and 2 provide a framework that is similar to a screening-level risk assessment for amphibians, and the process for accomplishing those steps has already been described by draft regulatory guidance (i.e., there is a basis for developing a clear process for those steps).

Golder recommends that Steps 1 and 2 should be completed as part of the current CEMP. No further action would be necessary if risks to amphibians can be shown to be low based on comparison of the relevant soil, surface water and chemistry data to toxicity reference values derived from the available literature. A preliminary review indicates that there will be sufficient data in the literature of suitable quality to support Step 2. If risks are found to be unacceptable at the conclusion of Step 2, further investigation following the tiered approach described in this memorandum may be necessary.

Closure

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

Please do not hesitate to contact the undersigned if there are questions regarding this memorandum.

Golder Associates Ltd.

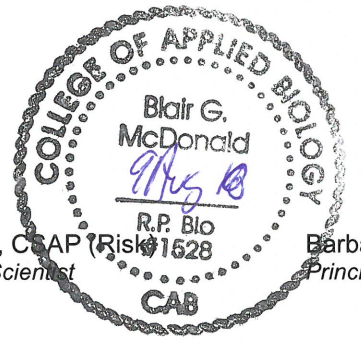

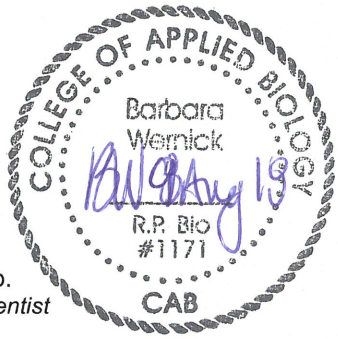

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BM/BW/cr

Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10023g/documents_1894924/2. issued/018-tm-23182-amphibiandesignconcept/rev1/1894924-018-tm-rev1-23182-amphibiandesignconcept_09aug_18.docx

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Study Limitations

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Appendix B.7

Study Design for Developing Reference Conditions for Polley Lake

Golder Associates Ltd.

31 October 2019 Reference No. 1894924-111-L-Rev0-23185

Mr. Don Parsons
Mount Polley Mining Corporation
Box 12
Likely, BC V0L 1N0

STUDY DESIGN FOR DEVELOPING REFERENCE CONDITIONS FOR POLLEY LAKE – MOUNT POLLEY MINE

Dear Mr. Parsons,

Golder Associates Ltd. (Golder) is pleased to provide Mount Polley Mining Corporation (MPMC) with this study design for characterizing reference conditions for Polley Lake. This study design was prepared in response to a condition set by the Ministry of Environment and Climate Change Strategy (ENV) for approval of the Comprehensive Environmental Monitoring Plan (CEMP), specifically:

> *An updated study design must be provided, which includes the monitoring location, frequency, and methods for assessing reference conditions for Polley Lake, and which includes a description of the process for characterizing the relative differences between Bootjack Lake, Polley Lake, and the newly identified reference location.*[1]

1.0 OBJECTIVES

Polley Lake is adjacent to the Mount Polley Mine, and environmental monitoring is undertaken to assess the potential for mining activities to affect biological communities in the lake. At the present time, the reference lake for Polley Lake is Bootjack Lake, on the opposite side of the mine site from Polley Lake. Because there is potential for mine-contact water to enter Bootjack Lake in the future, ENV requested that MPMC identify one or more alternate lakes to function as references and to begin data collection early on to provide temporal and spatial continuity to the program. The purpose of this letter is to provide a decision framework and methods for selecting candidate alternate reference lakes for Polley Lake.

[1] 9 November 2018 letter from D. Hill, ENV, to D. Reimer, MPMC, "Approval of the August 15, 2018 Comprehensive Environmental Management Plan (CEMP) – Mount Polley Mine Permit PE-11678".

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2.0 IDENTIFICATION OF CANDIDATE LAKES

The decision framework for identifying potential candidate reference lakes is illustrated in Figure 1. The primary variables expected to have an influence on hydrodynamics and biological communities in a given lake, and which can be characterized at a desktop level, are: biogeoclimatic zone, size, depth, surrounding land use, and underlying geology. Ideally, reference areas will have as similar characteristics to the exposed area as is reasonably practicable. Once a subset of lakes is identified, collection of sediment and water samples will be needed to select the final candidate reference lake(s).

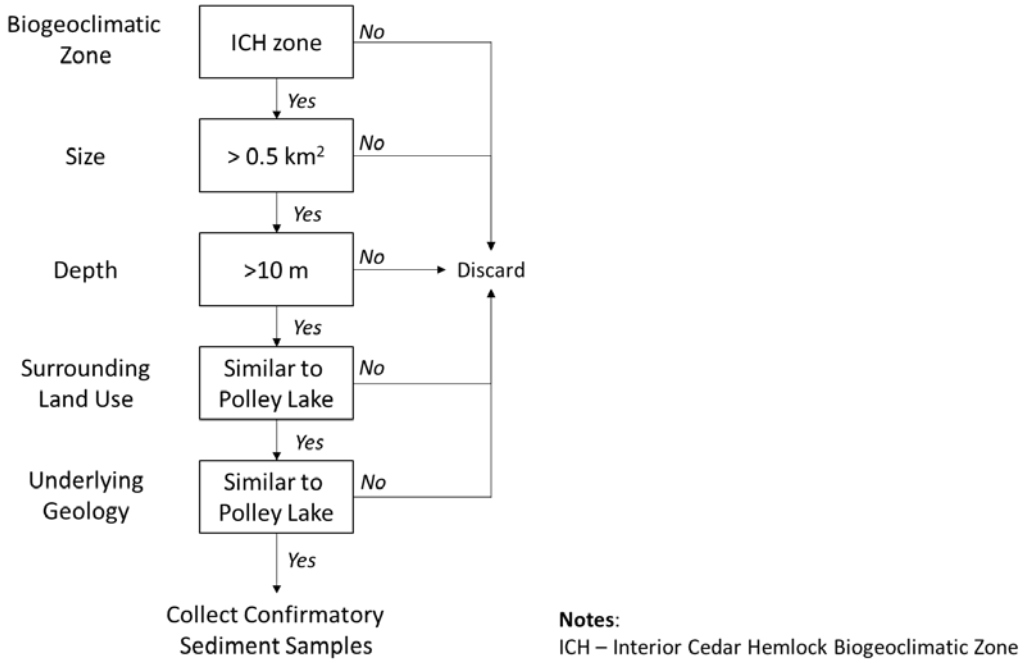

Figure 1: Decision Framework for Selection of Candidate Reference Lakes

Following this approach, Table 1 provides a summary of an initial subset of candidate reference lakes. Jacobie Lake was sampled in 2018 and the results confirm that the underlying geology is likely too dissimilar to Polley Lake to provide a suitable reference. It is also expected that Spanish Lake is unsuitable because it is in a wet subzone (wk2) of the Interior Cedar Hemlock (ICH) zone, has notably different underlying geology (arsenic and selenium is enriched in rocks on the opposite shore of Quesnel Lake), and is subject to mineral exploration and planned mine development (and therefore potential future mine-related activities).

Morehead and Gavin Lakes are both in the moist cool subzone (mk3) of the ICH zone, and Morehead coincides with at least one geological unit (LT_{Nvl}) that is similar to Polley Lake. Geological mapping will be further reviewed to evaluate similarity in the composition of the underlying geology vis-à-vis similarity to be a source of primary metals/metalloids of concern (e.g., copper, selenium, arsenic). However, Morehead Lake receives drainage from Bootjack Lake.

Table 1: Characteristics of Polley Lake and Candidate Reference Lakes

Lake	Elevation (m) [(a)]	Area (km^2) [(a)]	Depth: max (mean) (m) [(a)]	Underlying Geology [(b)]	Biogeoclimatic Zone [(c)]	Activities
Polley Lake	920	3.9	35 (18)	LT_{Nvl}, LT_{MPic}, LT_{Nav}	■ ICHmk3	■ Adjacent to Mount Polley Mine ■ Recreation (camping, fishing)
Bootjack Lake	983	2.6	15	LT_{Nvl}, LT_{Npt}	■ ICHmk3	■ Adjacent to Mount Polley Mine ■ Recreation (camping, fishing)
Jacobie Lake	1,122	0.86	20 (7)	LT_{Npv}, LT_{Nvb}	■ ICHmk3	■ Recreation (camping, fishing)
Morehead Lake	916	2	17	$LT_{Nvl,}$ Qal	■ ICHmk3	■ Recreation (camping, fishing)
Gavin Lake	963	0.94	24	MJ_{Qm}, LT_{Ns}	■ ICHmk3	■ Recreation (camping, fishing)
Spanish Lake	919	4.6	72.5 (29.6)	MLT_{Ns}	■ ICHwk2	■ Mineral exploration ■ Recreation (camping, fishing)

Notes:

(a) Activities, elevation and area identified from various angler and recreational use information websites.

(b) BC Forest Service Biogeoclimatic Ecosystem Classification System (ftp://ftp.for.gov.bc.ca/HRE/external/!publish/becmaps/PaperMaps/field/DHO_HorseflySubunit_Cariboo-ChilcotinResourceDistrict_CaribooRegion__field.pdf).

(c) BC EMPR Geoscience Map 2007-1 Regional Geology of the Mount Polley Area, central British Columbia (http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/GeoscienceMap/BCGS_GM2007-01.pdf).

ICH: Interior Cedar Hemlock.

LT_{MPic}: Hydrothermal altered intrusive carapace holocrystalline monzonitic intrusions and volcaniclastic wall rock.

LT_{Nav}: Pink-white analcime pyroxene+/-olivine basalt breccia, flows and tuffs.

LT_{Npt}: Plagioclase phyric, pyroxene lapilli tuff, breccia and minor flows.

LT_{Npv}: Green and maroon pyroxene porphyry breccias, pyroxene-olivine basalt flows, and crystal-rich sediments.

LTNs: Grey siltstone, normal graded sandstone and cherty shale with pyroxene and plagioclase-rich crystal sandstones.

LTNvb: Massive, coarse polymictic volcanic breccias, graded sandstones, siltstone and rare limestone breccia horizons.

LTNvl: Red-brown, massive, polymictic breccia, feldspar, and hornblende crystal tuff.

MLTNs: Graphitic and quartzose phyllite, shale, siltstone and sandstone.

MJQm: Hornblende-biotite quartz monzonite.

mk3: moist cool zone.

wk2: wet cool zone.

3.0 VERIFICATION OF SUITABLE REFERENCE LAKE

Prior to the 2021 benthic invertebrate sampling program for Polley Lake, five sediment samples will be collected from lakes with similar geology to Polley Lake and analyzed for metals and grainsize distribution. Water samples will be collected from two locations and two depths (surface and depth) and analyzed for metals, hardness, total and dissolved organic carbon, and nutrients. At each of the two sampling locations, field measurements of pH, temperature, dissolved oxygen and conductivity will be recorded at 1 m intervals. Sampling methods (including quality assurance/quality control procedures) as outlined in the CEMP will be followed.

The resulting physico-chemical data will be compared to data from Polley Lake and Bootjack Lake. The comparisons may be made visually using graphs; through screening against sediment quality guidelines; and/or using statistical tests such as principle components analysis (PCA) or non-metric multidimensional scaling NMDS). The specific tests will be determined at the time of analysis, as factors such as variance and distribution (normal/non-normal) of the data and proportion of detectable versus non-detectable concentrations will need to be taken into account.

Sampling of the benthic invertebrate community of the selected lake will be conducted in 2021, along with sampling in Polley Lake.

4.0 CLOSURE

We trust that this letter provides sufficient information for your present needs. If you have any questions, please do not hesitate to contact the undersigned at 604-296-4200.

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

Yours very truly,

Golder Associates Ltd.

ORIGINAL SIGNED

Barbara Wernick, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

ORIGINAL SIGNED

Lee Nikl, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

BW/LN/lmi/et

Attachment: Study Limitations

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Appendix C

Combined Monitoring Schedule 2019

Mount Polley Mining Corporation

Monitoring Schedule

Task	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	31	1	2	3	4	5	6
					No staff on weekend		
Lakes							
Surface Water		Discharge: E19, HAD-3 Surface water sampling: W1, WA (W1 dup), W4a, W5, W8, W8z, W20, W21, Gavin's Ditch, WL (W12 dup), East 12204 (East MTD dup), West MTD, LD, SERD, E1a, ED (E4 dup), **2 ppl; 8**	Surface water sampling: E13, E14, E15, E17, E18, E19a, E20, E21, E22, E23, STD, TB + FB ; JCP, Boundary Seep 2, MDC, SERD Seep 13 **2 ppl; 8 hours**	SERD Seep Survey **2 ppl; 5 hours**			
Reclamation		Seeding/Monitoring as necessary					
Groundwater				GW15-1A/B & GW15-2A/B SWLs			
Hydrology							
Weather		Snowpack/Manual Rain Gauge		Manual Rain Gauge			
Inspections		Mill Potable Water Meter **2 per; 5 hours (winter)**	HAC Fish Spawning Survey **1 per; 6 hours** **2 ppl; 4 hours**	EDC Fish Spawning Survey; Waste Inspection			
Soil/Sediment		ABA (if dumping NAG waste)					
	7	8	9	10	11	12	13
Lakes	P1 (S+P)[1] + PA-B + P2 (S+P)[1] B1 IS+P) + B2 (S+P) + BB-S **2 ppl; 8 hours**						
Surface Water		**DO all locations:** HAC-01c, HAC-13 + HAC-08, HAC-05a, HAC-10 + HAC-J + HAC-10-FB, POF-1, POF-5, CSD Bridge photos Discharge:E19, HAD-3 + HAD-C BAC-01 (Ladies Dry) **2 ppl; 8**	PAG Seep Survey **2 ppl; 5 hours**	East RDS Seep Survey **2 ppl; 5 hours**			
Dustfalls				Dustfalls **2 ppl; 7 hours in winter** **1 per: 4 hours in summer**			
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs						
Hydrology	W1b, W5, W12, SERD, H6 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Spring/Fall Ditch Inspections	HAC Fish Spawning Survey	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	14	15	16	17	18	19	20
Lakes	QUL-ZOO-8 (S+C)[3] + QUL-ZOO-8-FB QUL-ZOO-7 (S+C)[3] QUL-ZOO-1 (S+C)[3]	QUL-58 (S+C)[1] + T.Hg + Ra-226 QUL-57 (C) + QUL-59 (C) QUL-2a (S+C)[1] + T.Hg + Ra-226	QUL-18 (S+C)[1] + QUL-R-50m QUL-120a (S+C[1] + QUL-ATa-190m				
Surface Water		Discharge: E19, HAD-3 + T.Hg + Ra-226+ toxicity[e, g, h] (100L) BAC-02 (Pit shop sink)		NEZ Seep Survey + DO at all locations: NEZ Samples + 2119 NEZ Seep LD (US NEZ Seep LD dup)+ Martel Sump + NEZ Seep -TB			
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs						
Hydrology	H1, H2, H3, H4 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Trailer Inventory	HAC Fish Inspection (if ice free)/Fish Spawning	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	21	22	23	24	25	26	27
Lakes							
Surface Water		Discharge:E19, HAD-3 BAC-03 (3rd floor mill lunchroom)					
Reclamation	Seeding/Monitoring as necessary						
Groundwater	Quarterly GW: GW 15-1a & 1b GW 15-2a & 2b GW 12-2a + GWL-Ba & GW 12-2b GW96-7 95-R5 **2 ppl; 8 hours**	Quarterly GW: GW95R-1 + Ecoli + GWIER-A GW05-01 + Ecoli GW04-1 + Ecoli GW-Low Flow + GW-Grundfos GW16-6a & 6b **2 ppl; 8 hours**	Bi-annual GW: GW00-1a & 1b GW00-2a GW00-3a & 3b GW96-3a GW96-4a & 4b **2 ppl; 8 hours**	Bi-annual GW: GW96-2a & 2b GW16-4a & 4b GW16-3a & 3b GW16-5a & 5b GW16-2a & 2b **2 ppl; 8**			
Hydrology	W4a, JCP, NW Ditch, H5 (Junction Zone Ditch), STD, MTD, NEZ Seep 1, SERD Seep 13 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast	Check HOBO Link online	Manual Rain Gauge			
Inspections	Waste inspection	HAC Fish Spawning Survey	Pipeline Inspection	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	28	29	30	31			
Lakes							
Surface Water		Discharge:E19, HAD-3 BAC-04 (Assay Lab Eyewash)					
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs Bi-annual GW: GW11-1a & 1b GW11-2a & 2b GW12-1a & 1b GW12-3a & 3b GW12-4a & 4b **2 ppl; 8 hours**	Bi-annual GW: GW12-5a & 5b GW16-7 & 8 GW16-1a & 1b **2 ppl; 8 hours**	HAC Creek GW	HAC Creek GW			
Hydrology							
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Spring/Fall Ditch Inspections	HAC Fish Spawning Survey	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						

C = cast + secchi
P = profile + secchi
S = sample

Special Sampling:
1) Chlorophyll a, phytoplankton, [zooplankton - POL only] (Jun/Aug)
3) Zooplankton, chlorophyll *a* , phytoplankton, surface sample

QA/QC Sampling:
Field Blank - 2x monthly minimum
Trip Blank - 2x monthly minimum
Equipment Blank KEM2 - monthly; GW - quarterly
Duplicates - 2x monthly minimum

Quarterly Wells (SWL): Complete Q1

~~GW96-1a~~	GW96-2a
GW96-4a	GW16-2a,3a,4a,5a
GW00-1a	GW96-3a
GW00-2a	GW00-3a

Flows:
Purple:Bucket Black: Tracker

Ongoing/When Time:
Crew Training
Battery recycling
Trailer Clean Up/Safety -test PFDs
Wash trucks (in and out)

Seep Sampling:

SERD	WHR
PAG	TSF
BOUNDARY	NBD
EAST RDS	NEZ

Reclamation Activities:
Grass Seeding

QUL Sample Depths (m):

QUL-18	0, 20, 50, 100
QUL-2a	0, 20, 40, 60
QUL-58	If detect plume: Middle of plume (MP) + 5m above (AP) + 5m below (BP) (all sites) If can't detect plume: S, 1m above thermo , 1m below thermo [or MID if no thermo], bottom * write sample depths in field book **4x per year: T.Hg taken at QUL-58 (depth at which plume expected), QUL-2a (close to same depth as QUL-58), & HAD-3 *** write field parameters for each sample taken and indicate if discharging in field book
QUL-55	: 0, 15, 30
QUL- 42:	0, 10, 20
QUL-120a:	0, 40, 80, 120, 140 well-mixed: 0, 80, 190

BJ + POL Sample Depths (m):
S, 1m above thermo , 1m below thermo [or MID if no thermo], bottom
* write sample depths in field book
** monthly profiles between spring and fall overturns

Toxicity:
a) 96h LC50 RBT, 48h LC50 *D. magna*
b) 7 day ELS RBT
c) 7d C. dubia S&R
d) 7d RBT S&G
e) 30d ELS RBT
f) 30d ELS top-up (100L)
g) 72h algal (MMER)
h) 7 day duckweed (MMER)

Chorophyll *a* :
250ml polyethylene bottle wrapped in aluminum foil

Phytoplanton:
polyethylene bottle, preserved with Lugol solution

Zooplankton taxonomy (1 haul):
Quesnel Lake --> 150µm mesh net to 30m depth (1 tow), preserved with buffered sucrose
Polley Lake --> 50µm mesh net to 28m depth (1 tow), preserved with 85% ethanol

Zooplankton metals:
minimum amount of water, kept frozen, multiple hauls (depending on biomass)
QUL --> 50 µm mesh net minimum amount of water, kept frozen, multiple hauls (depending on biomass)
POL --> 50 µm mesh net minimum amount of water, kept frozen, multiple hauls (depending on biomass)

Special Analyses:
T.Hg - 40ml glass vial with 1x HCl
Ra-226 - 1L plastic with 6x HNO3

Appendix D

Site Matrix

Mount Polley Mining Corporation

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
W1 Morehead Creek	E 587262 N 5826275	1990	Meandering creek with lots of willows and grass, no distinct trail. Large marsh to the North.	Drive to km 4.5 on Bootjack Road to a small opening in the trees, and walk down the bank on the south side for 50 m. Trail and site marked with orange flagging tape.	Radio communication must be used on the Bootjack Road (Channel RR-25). Ensure that vehicle is parked to the side of the road out of the way of traffic. Watch for wildlife. Watch for rotten logs while approaching site. Follow working in/near water procedures.	Downstream of mine impacted area. Provides opportunity to monitor potential changes in POI's in Bootjack Lake.
W1b Morehead Creek	E 588920 N 5825173	2003	Meandering creek that flows under a bridge.	Drive to approx. km 7 on Bootjack Road and turn south onto side road for approx. 90 m until you reach a bridge. Walk down an embankment on the upstream side of the bridge to the creek.	Radio communication must be used on Bootjack Rd (Channel RR-25). Watch for wildlife. Watch your footing when walking down embankment. Follow working in/near water procedures.	Monitoring flow out of Bootjack Lake.
W4a North Dump Creek	E 593152 N 5824689	2014	Small stream that flows under the Wight Pit road through a culvert.	Drive towards the Wight Pit, before entering pit there will be one last runaway lane on the left hand side, park vehicle on right side of the road. The sample site is located over the berm and down an embankment; there is a large log on the hillside to indicate the sample location.	Watch for wildlife. Watch your step while descending the embankment to monitoring location; there are loose rocks. Follow working in/near water procedures.	Downstream of mine impacted areas. Provides opportunity to monitor for non-contained seeps or run-off collection ditches.
W5 Bootjack Creek	E 594481 N 5820782	1990	Small stream runs through culvert	Drive down the TSF haul road towards Polley lake weir, turn left at the central collection sump. Turn left onto deactivated logging road across from SERD outlet pipe. At top of hill, turn right and at the valley in the road park truck. Trail down to the creek is on the upstream side of creek. Site trail is indicated by fallen tree across path.	Contact Pit Shifter prior to entering haul roads. Drive with caution on haul roads and give heavy equipment the right-of-way. Use 2-way radio communication (Channel 5 – Pit Ops 1). Watch for wildlife. Slippery slopes with quite a few willows and one fallen tree. Old logging road can be very rough and muddy, recommend 4X4 or walk in during snowy conditions. Follow working in/near water procedures.	Downstream of mine impacted areas. Provides an opportunity to monitor for seepage from the SERD.
W8 Edney Creek Tributary	E 597005 N 5817606	1995	Small stream with easy access from the road.	Turn S at the old ABR onto a narrow road. Drive for roughly 2 km, until you come to a small stream flowing under road through a culvert. Monitoring site is located on the downstream side of the road.	This road can be very muddy, recommend 4X4 or walk in during snowy conditions. Look for old orange ribbon. Watch for wildlife. Follow working in/near water procedures.	Downstream of mine impacted area. Provides opportunity to monitor for potential seepage from TSF.
W8z Edney Creek Tributary (control)	E 593290 N 5817920	1997	Small creek flows under road through a culvert. Many trees down over stream and many willows.	Drive to Gavin Lake Rd and turn right. Drive a few kms to about km 15 board, just before a junction with a deactivated logging road. The monitoring location is on the right hand side of the road (upstream side of the road) just before the second landing.	Look for pink ribbon. Park to the side of the road. Short steep incline to access the monitoring site. Watch your step; there is not much room near the creek. Watch for wildlife. Follow working in/near water procedures.	Upstream of mine. Allows for monitoring of seasonal variability of surface water.
W10 Edney Creek	E 601183 N 5816862	1995	Lower Edney Creek underneath a bridge.	Turn left onto Gavin Lake Rd. Continue on and turn right on Ditch Rd towards Horsefly. Travel to the second bridge crossing. On the right hand side of the road past the bridge (upstream side of the creek), there is a path down to the creek.	Watch for public traffic on the road and ensure vehicle is parked out of the way. Flows may be high during freshet. Ice can build up on edges of creek in winter conditions. Watch for wildlife. Follow working in/near water procedures.	Outside of mine impacted area. Allows the opportunity to monitor for changes in newly constructed creek downstream and to monitor for seasonal variability.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
W12 6K Creek (Tributary to Morehead Creek)	E 588360 N 5825961	1990	Small stream that enters a marsh at the end of an old overgrown road. Small fish present in the stream.	Drive to km 5.5 on Bootjack Rd., to the chain-up pullout. Walk down old road on the NE side of Bootjack for roughly 150 m.	Radio communication must be used on the Bootjack Rd (Channel RR-25). Ensure that vehicle is parked to the side of the road out of the way of traffic. Watch for wildlife. Follow working in/near water procedures.	Upstream of mine. Allows for monitoring of seasonal variability of surface water.
W20 Un-named Tributary to Bootjack Lake	E 592161 N 5821586	2013	Small creek on the NE side of Bootjack Lake, lots of grass, willow, alder and fallen trees. Creek flows roughly parallel to the West Ditch.	Walk in or boat access only. Drive midway on the West Ditch Rd. between the Booster Station and Mine Drainage Creek Sump. Park and walk W to the creek. Follow creek to the lakeshore. Monitoring location is in the creek channel approx. 15 m from the lakeshore. Look for orange ribbon at monitoring location.	If accessing by boat, follow safe boating SOP. If walking, watch for wildlife. Watch for Devil's Club. Walk with caution, as there are lots of blowdown. Ensure vehicles are parked out of the way. Follow working in/near water procedures.	Downstream of mine impacted area. Provides the opportunity to monitor for any seepage from the west ditch.
E1a Tailings Storage Facility	E 594495 N5819187	1997	TSF Supernatant	Drive along the TAR to the TSF. Enter the TSF near corner 5 and follow road to the barge.	Use radio communication when travelling on haul roads and contact Pit Shifter prior to entering haul roads and TSF area (switch from Channel 5 to Channel 1 (Tailings) when entering TSF area). Give right-of-way to heavy equipment. Follow working in/near water procedures. Watch for slippery surfaces in freezing conditions.	Monitoring supernatant WQ in the TSF.
E11 Springer Pit	E 591701 N 5823327	2011	At bottom of the Springer Pit.	Travel down into the bottom of the Springer pit ramp and the monitoring location is near the pipes coming out of the springer pit.	Contact the Pit Shifter prior to entering and leaving the Springer Pit. Use caution when walking under highwalls.	When not storing water from other sources on site: source terms. When storing water from other sources on site: monitoring for potential discharge.
E19	E 595760 N 5819760	2015	Water Treatment Plant Influent	Travel down the TSF haul road towards corner 2 of the TSF. Approx. half way to corner 2 there is a road on the left that goes to the WTP. Monitoring site is located inside facility at the influent pipe at the main entrance to plant.	Use caution when driving on haul roads; contact the Pit Shifter prior to traveling to and from WTP. Watch for haul trucks on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication.	Provides ability to monitor efficacy of treatment.
HAD-3	E 595772 N 5823583	2015	Water Treatment Plant Effluent	Travel down the TSF haul road towards corner 2 of the TSF. Approx. half way to corner 2 there is a road on the left that goes to the WTP. Monitoring site is located inside facility at the effluent pipe located by the door that leads to the WTP office.	Use caution when driving on haul roads; contact the Pit Shifter prior to traveling to and from WTP. Watch for haul trucks on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication.	Compliance point for discharge to environment.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
H1 Hazeltine Creek	E 597030 N 5818978	2015	Mid Hazeltine Creek hydrology station approximately 100 m downstream of Gavin Lake Bridge.	Travel to Gavin Lake Rd and turn left. Cross the Gavin lake bridge and park off to the side. Walk approx. 100 m downstream of the bridge to hydrological monitoring station and is marked with staff gage and metal pipes.	Used caution when driving on TSF haul road. Contact the Pit Shifter prior to traveling on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch your footing on loose rocks. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. May need hip waders.	To monitor hydrology of mid Hazeltine Creek.
H2 Hazeltine Creek	E 601024 N 5817253	2015	Lower Hazeltine Creek hydrology station.	Travel to the Gavin Lake Rd and turn left. Continue on road until you reach the Ditch Rd, and turn right towards Horsefly. Before the Ditch Road bridge, turn left through the gate. The station is approx. 200m from the gate. Hydrology station is marked with staff gage and metal pipes.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. May need hip waders.	To monitor hydrology of lower Hazeltine Creek.
H3 Edney Creek	E 601538 N 5817123	2015	Edney Creek Hydrology station.	Travel to the Gavin lake Rd and turn left. Continue on road until you reach the Ditch Rd, and turn right towards Horsefly. Drive past the Ditch Road bridge and turn left through the gate. Drive approx. 300 m and the hydrology station is marked with staff gage and metal pipes on the right hand side of the road.	Park vehicle to the side of road. Watch footing when walking to hydrology station – some loose rocks. Use caution in high flow times – do not complete task if flow is too strong. Follow working in/near water procedures. Watch for wildlife. May need hip waders.	To monitor hydrology of Edney Creek.
H4 Hazeltine Creek	E 595892 N 5819997	2015	Upper Hazeltine Creek hydrology station at Polley lake weir..	Drive down the TSF haul road to Polley lake weir. Hydrology station is marked by staff gauge approx. 50 m downstream, of the weir.	Use caution when driving on haul roads, radio contact the Pit Shifter prior to entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. Watch footing on loose rocks down to the creek. May need hip waders.	To monitor hydrology in upper Hazeltine Creek and out of Polley Lake.
HAC-05a Hazeltine Creek	E 596916 N 5819074	2015	Upper Hazeltine Creek just upstream of Gavin Lake bridge.	Travel as described above to H1. Monitoring location is the upstream side of Gavin Lake bridge.	Used caution when driving on TSF haul road. Radio contact the Pit Shifter prior to entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch your footing on loose rocks. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor WQ downstream of the effluent discharge - when discharging. To monitor WQ post creek reconstruction - when not discharging.
HAC-08 Hazeltine Creek	E 600723 N5817290	2015	Lower Hazeltine Creek just upstream of Ditch road bridge.	Travel as described above to H2, but instead of turning left before the bridge, drive to the bridge and park to the side. Monitoring location is just upstream of the Ditch road Bridge.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times. Use caution in freezing conditions as ice can build up – may need swing sampler in these conditions. Follow working in/near water procedures.	This site was established to monitor WQ below the canyon. As Hazeltine Creek remediation continues there are opportunities to monitor the effect of remediation on the creek.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
HAC-10 Hazeltine Creek	E 595793 N 5820738	2015	Upper Hazeltine Creek monitoring site just downstream of Polley Lake weir.	Travel as described above to H4. Sample location is just downstream of Polley lake weir, from a large rock on the west side bank.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor the surface WQ of Polley Lake as the water flows out of the lake and into Hazeltine Creek. The data from this site provides quick feedback on important parameters for fish habitat in the creek (pH, DO, and temperature).
HAC-12 Hazeltine Creek upper settling pond	E 601577 N 5817292	2015	Lower Hazeltine Creek monitoring site at diffuser pipes in upper settling pond.	Travel as described above to H2, but drive approx. 500 m past it towards Quesnel Lake. Site is marked with two curved pipes sticking out of the ground.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times and icy conditions as ice can build up on edges. Follow working in/near water procedures.	This site currently monitors the quality of the mixture of effluent discharge and Hazeltine Creek water prior to the outflow to Quesnel Lake – when discharging. Site will be removed from the sampling program once discharge pipeline is complete.
HAC-01c Hazeltine Creek outflow	E 601661 N 5817598	2015	Hazeltine Creek outflow to Quesnel Lake.	Travel as described to HAC-12, and then drive towards Quesnel Lake. Monitoring Site is located at the outflow of Hazeltine Creek into Quesnel Lake.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times and icy conditions as ice can build up on edges. Follow working in/near water procedures.	Monitor WQ at the mouth Hazeltine creek at Quesnel lake once the discharge pipeline is complete. It will replace HAC-12 as the outflow site when it is removed from the sampling program.
HAC-14 Hazeltine Creek	E 598742 N 5817299	2017	Mid Hazeltine Creek monitoring site above the canyon.	Drive as described to H1, but continue down Gavin Lake road to approx. km 5.5 and turn right on the creek access road. Continue on road for approx. 2 km and turn right at the second road on the right hand side. Monitoring site is located at the bottom of the ramp marked by a red and white stripped flagging tape.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions as ice can build up on edges of creek. May need snowshoes in winter. Follow working in/near water procedures.	Monitor WQ of Hazeltine creek above the canyon.
POF-5 Polley Flats	E 595682 N 5820174	2017	Drainage from Polley Flats into Hazeltine Creek	Drive as described to HAC-10. Just before the weir, turn right and follow road to the end. Site is on the left hand side towards Hazeltine Creek and is marked with an orange stake at the outflow to Hazeltine Creek.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor WQ of the drainage from the Polley Flats.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
EDC-01 Edney Creek	E 601811 N 5817445	2015	Lower Edney Creek Sample site approx. 20 m upstream of the flood channel.	Follow travel instructions as described above to H3. Follow Edney Creek downstream towards Quesnel Lake and the monitoring location is approx. 20 m upstream from the flood channel.	Park vehicle to the side of road. Watch footing over loose rocks to the creek. Use caution in high flow times and freezing conditions as ice can build up on edges of creek. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ of Edney Creek post reclamation of the lower section and its input to Quesnel Lake.
B1 Bootjack Lake	E 590049 N 5823528	2001/2007	Bootjack lake north WQ monitoring site	Drive on the Bootjack Forest service road to the Bootjack lake campsite at km 8 on the access road.	Follow Safe Boating SOP. Contact Pit Shifter and Front Gate person when leaving mine site. Call kms on Channel RR-25 on the Bootjack FSR. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ for potential mine influence in Bootjack Lake.
B2 Bootjack Lake	E 591263 N 5821647	2001/2007	Bootjack Lake south WQ monitoring site	Drive on the Bootjack Forest service road to the Bootjack lake campsite at km 8 on the access road.	Follow Safe Boating SOP. Contact Pit Shifter and Front Gate person when leaving mine site. Call kms on Channel RR-25 on the Bootjack FSR. Watch for wildlife. Follow working in/near water procedures.	Monitor water WQ for potential mine influence in Bootjack Lake
P1 Polley Lake	E 593708 N 5824693	2001/2007	Polley Lake north WQ monitoring site	Drive down the TSF haul road to Central collection sump near corner 1. Turn left as if going to the central collection sump but then drive approx. 500 m and then turn right onto Polley lake boat launch.	Follow Safe Boating SOP. Contact the Pit Shifter prior to traveling on Haul roads. Use caution on Haul roads, give the right-of-way to heavy equipment and use 2-way radio communication. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ water quality for potential mine influence in Polley Lake
P2 Polley Lake	E 595348 N 5821863	2001/2007	Polley Lake south WQ monitoring site	Drive down the TSF haul road to Central collection sump near corner 1. Turn left as if going to the central collection sump but then drive approx. 500 m and then turn right onto Polley lake boat launch.	Follow Safe Boating SOP. Contact the Pit Shifter prior to traveling on Haul roads. Use caution on Haul roads, give the right-of-way to heavy equipment and use 2-way radio communication. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ for potential mine influence in Polley Lake
QUR-11 Quesnel River	E 596625 N 5830438	2016	Quesnel River WQ monitoring site at Likely Bridge	Drive on the Likely Highway towards the town of Likely, approx. 30 km from the Bootjack Forest service road. Park in the pullout just before the bridge. Collect water from the bridge using the Kemmerer sampler. Monitoring site is indicated by darker brown coloured post in the middle of the bridge.	Wear reflective PPE, watch for traffic. Use caution in the winter as bridge can get slippery.	This site was established to mirror the Federal Provincial Monitoring site for the outlet of Quesnel Lake that is funded by MPMC. Monitor WQ in Quesnel River.
QUL-2a Quesnel Lake	E 607988 N 5817214	2014	Quesnel Lake post-breach and effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ upstream of diffuser ports in Quesnel Lake.
QUL-120a Quesnel Lake	E 618271 N 5818030	2014	Quesnel Lake background WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor Quesnel Lake WQ at background site.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
QUL-18 Quesnel Lake	E 600795 N 5819749	2014	Quesnel Lake post-breach and effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ downstream of diffuser ports in Quesnel Lake
QUL-58 Quesnel Lake	E 601791 N 5818025	2015	Quesnel Lake effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor the initial dilution zone of the effluent plume in Quesnel Lake. Default WQ monitoring site when not discharging.
QUL-ZOO-1 Quesnel Lake	E 601058 N 5819925	2015	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue in the West Basin of Quesnel Lake.
QUL-ZOO-7 Quesnel Lake	E 612469 N 5816656	2015	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue near Horsefly River in Quesnel Lake.
QUL-ZOO-8 Quesnel Lake	E 630691 N 5821991	2014	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue background in Quesnel Lake.
Weather Station #1	E 592792 N 5823182	2012	HOBO weather monitoring station.	Drive along the Wight Pit Haul road and turn left onto the road to the Leach Pad. Park beside the leach pad and walk up the grassy hill between the sulphur pile and the research tree plots. Weather station is located at the top of the hill.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Watch for wildlife. Use caution near sulphur pile and watch footing walking up hill. Snowshoes may be required in winter.	Monitor wind speed/gust/direction, rain, solar radiation, and min/mean/max temperature continuously for water balance monitoring on site.
Weather Station #2	E 591092 N 5819976	2012	HOBO weather monitoring station.	Drive along light duty road towards the Orica site. Drive up the Orica site road (approx. 30 m) and park slightly off the road as to not block access. The Weather Station is located on top of a small hill on the right hand side of the road.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Watch for wildlife. Watch footing walking up hill.	Monitor wind speed/gust/direction, rain, solar radiation, and min/mean/max temperature continuously for water balance monitoring on site.
Snow Course Site: Weather Stn #1	E 592792 N 5823182	1997	Snow course monitoring site.	Follow instructions as described above for Weather Station #1.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Use caution when driving in winter conditions. Watch for wildlife. Use caution near sulphur pile and watch footing walking up hill. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.
Snow Course Site: JCP	E 593632 N 5823895	2012	Snow course monitoring site.	Drive along Wight Pit haul road towards the Wight Pit. Turn right at the third road on the right hand side. Drive up to stream crossing. May need to walk in snowy conditions approx. 100 m to clearing on the left hand side. Snowpack course site is in that clearing.	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.
Snow Course Site: TSF	E 594092	1997	Snow course monitoring site.	Drive as described above to Weather Station #2, but instead of turning at the Orica site, drive past it	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used	Monitor snowpack-water equivalent for water balance monitoring on site.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
	N 5819976			approx. 100 m. Pull over to side of road when a small clearing in the trees is reached on the right hand side. A ditch indicates the site.	Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	
Snow Course Site: PAG	E 590835 N 5823537	2015	Snow course monitoring site.	Drive along haul road towards the PAG dump. Take the small ramp on the left hand side towards the 9k sump. Drive to the NW sump. Site is located up ramp beside the sump.	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.

Notes:
POI – Parameters of Interest
TSF – Tailings Storage Facility
TAR – Tailings Access Road
WQ – Water Quality

Appendix E

Declaration of Competency Forms

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

This declaration of competency is collected for the purposes of increasing government transparency and ensuring professional ethics and accountability. It will be disclosed to the public.

1. Name of Qualified Professional BARBARA WERNICK

   Title SENIOR ENVIRONMENTAL SCIENTIST

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: COLLEGE OF APPLIED BIOLOGY (#1171)

3. Brief description of professional services:

   DEVELOPMENT OF APPROACH TO SELECTION OF REFERENCE LAKES, SUMMARIES OF AMPHIBIAN & TERRESTRIAL STUDY COMPONENTS

Declaration

I declare that I am a qualified professional with the required knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X BWernick

Print Name: BARBARA WERNICK

Witnessed by:

X L. Nikl

Print Name: Lee Nikl

Date signed: 30 OCTOBER 2019

[1]*Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably by relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Blair McDonald

   Title Associate, Senior Environmental Scientist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: College of Applied Biology Registration # 1528

3. Brief description of professional services:

   Environmental toxicology and ecological risk assessment

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x _____

Print Name: Blair McDonald

Witnessed by:

x _____

Print Name: NEIL McQUITTY

Date signed: 29 Oct 19

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Pierre Stecko

   Title Senior Aquatic Scientist

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biology Registration # 1709

3. Brief description of professional services:

   Aquatic environmental assessment, water quality, sediment quality, aquatic ecotoxicology

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X 

Print Name: Pierre Stecko

Witnessed by:

X K Batchelar

Print Name: Katharina Batchelar

Date signed: October 24 '19

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

- *a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*
- b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA

Ministry of Environment and Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Katharina Batchelar

   Title Aquatic Scientist

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biology Registration # 3103

3. Brief description of professional services:

   Aquatic ecotoxicology, aquatic environmental monitoring, sediment quality, metal toxicology

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x K Batchelar

Print Name: Katharina Batchelar

Date signed: October 24, 2019

Witnessed by:

x

Print Name: Pierre Stecko

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APPENDIX 9-1: Surface Erosion Prevention and Sediment Control Plan

Mount Polley Mine
Environmental Management Plan:

Sediment and Erosion Control Management Plan

Last Update: 31 July 2023

Document Revision Control

Rev. No.	Revision	Date	Approved
0	Original	2010	RM
1	Incorporation of available best practices	7 July 2014	CH
2	Minor update	12 February 2015	KM
3	Inclusion of site-specific components	30 April 2015	KM
4	Update of site-specific components	March 2016	CH
5	Update of site-specific components	2 December 2016	KM
5	Annual Review	4 December 2019	GH
5	Annual Review	23 November 2020	GH
5	Annual Review	7 December 2021	GH
5	Annual Review	15 December 2022	GH
6	Annual Review	8 May 2023	
6	Update of document layout	20 July 2023	

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1 INTRODUCTION

This “Sediment and Erosion Control Management Plan” (the Plan) provides direction for the management of surface erosion at Mount Polley Mine (the Mine). The Plan addresses existing and potential surface erosion impacts associated with mine expansion (construction activities), operation, and decommissioning phases, and applies to all Mount Polley personnel and contractors. The main objective of this Plan is to minimize erosion of surficial sediments and intercept and manage sediment laden water as close to the source as possible. Erosion and sediment control measures and best management practices (BMPs) are incorporated in the Plan as approaches to prevent erosion and the introduction of sediment into natural water bodies and watercourses. Guidelines for monitoring the efficacy of measures in this Plan are also presented.

2 DESCRIPTION OF THE PROJECT

2.1 Project Location

The Mine, operated by Mount Polley Mining Corporation (MPMC, a wholly owned subsidiary of Imperial Metals Corporation), is an open pit copper/gold mine with an underground component located in south-central British Columbia. It is located 8 kilometres (km) southwest of Likely and 56 km northeast of Williams Lake, British Columbia (BC) (refer to Figure 1). The Mount Polley Mine has the capacity to process 20,000 to 22,000 tonnes per day (tpd) of ore when in normal operations. The mine property covers 24,077 hectares (ha), consisting of 7 mining leases totalling 2,007 ha, and 51 mineral claims encompassing 22,070 ha. Mine concentrates are trucked to facilities at the Port of Vancouver, then shipped to overseas smelters or transported by rail to smelters in North America.

The Mine property is located on the eastern edge of the Fraser Plateau physiographic sub-division, characterized by rolling topography and moderate relief. Elevations range from 920 metres above sea level (masl) at Polley Lake to 1266 masl at the summit of Mount Polley.

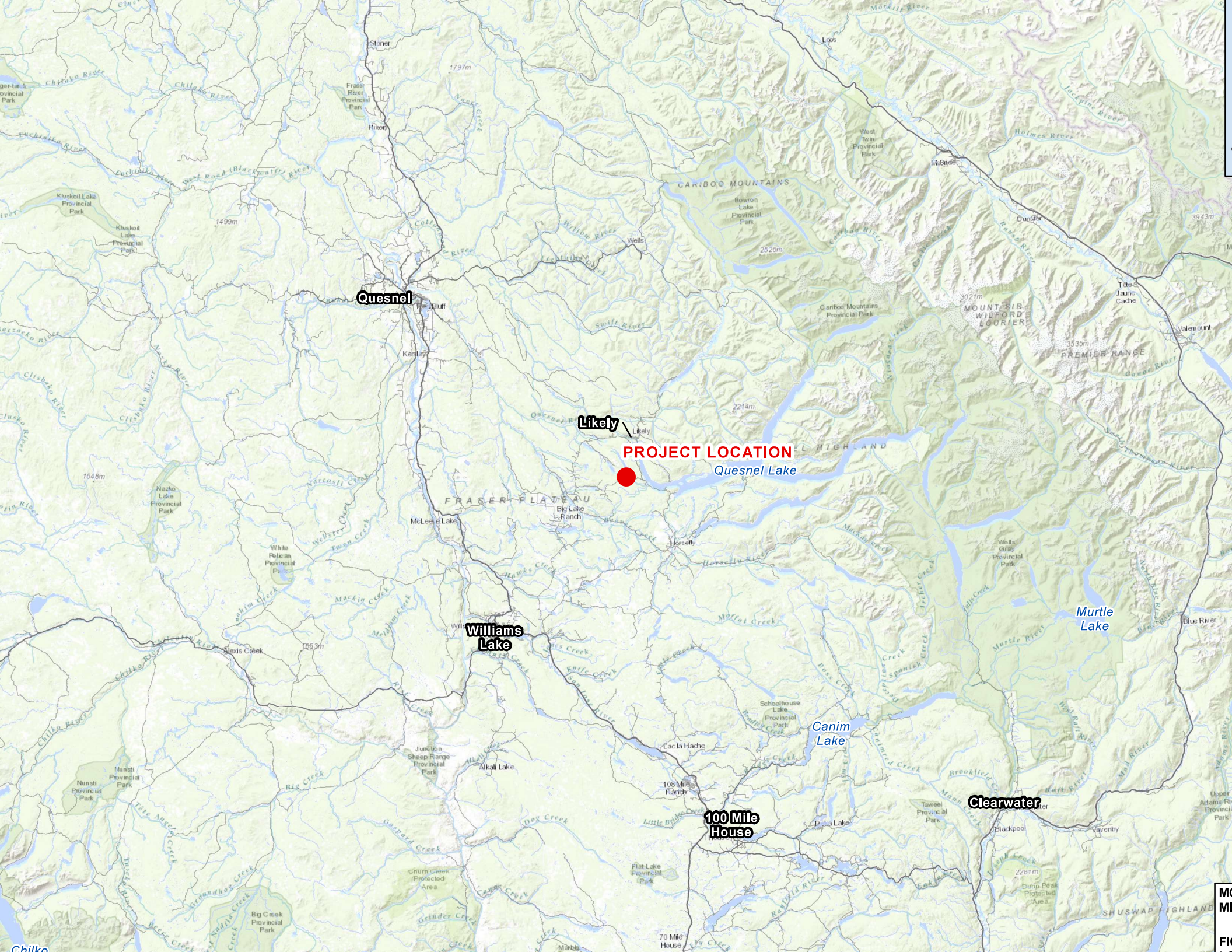
PROJECT LOCATION
Quesnel
Likely
Quesnel Lake
Williams Lake
100 Mile House
Clearwater
Murtle Lake
Canim Lake
Stoner
Hixon
Wells
Kersley
Big Lake Ranch
McLeese Lake
Horsefly
Alexis Creek
Lac la Hache
Alkali Lake
Deka Lake
Blackpool
Vavenby
Blue River
Valemount
Dunster
McBride
Loos
Fraser River Provincial Park
Kluskoil Lake Provincial Park
Nazko Lake Provincial Park
White Pelican Provincial Park
Junction Sheep Range Provincial Park
Nunsti Provincial Park
Big Creek Provincial Park
Churn Creek Protected Area
Flat Lake Provincial Park
Schoolhouse Lake Provincial Park
Taweel Provincial Park
Dunn Peak Protected Area
Wells Gray Provincial Park
Bowron Lake Provincial Park
Cariboo Mountains Provincial Park
West Twin Provincial Park
Tête Jaune Cache
CARIBOO MOUNTAINS
MOUNT SIR WILFORD LOURIER
PREMIER RANGE
FRASER PLATEAU
SHUSWAP HIGHLAND
Chilko
Chilako River
Euchiniko River
Nazko River
Clisbako River
Cottonwood River
Willow River
Swift River
Quesnel River
Horsefly River
Moffat Creek
Murtle River
Blue River
Mackin Creek
Big Creek
Dog Creek
Gaspard Creek
Little Bridge Creek
Raft River
Mad River
Upper Adams River Provincial Park
1797m
1499m
1648m
1653m
2526m
2214m
3021m
3535m
3943m
2281m

2.2 Project History

Clearing of the site and construction of the entire facility began in 1995, with the mill commissioned in June 1997. In May 1997, the Mine received a BC Ministry of Environment and Climate Change Strategy (BC ENV) (previously the Ministry of Water, Land and Air) Effluent Permit, *Environmental Management Act* (EMA) Permit 11678 (PE11678)', issued under the provisions of the provincial EMA. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a tailings storage facility (TSF). Approval of the original Mount Polley Mine Reclamation and Closure Plan by the BC Ministry of Energy, Mines and Low Carbon Innovation (BC EMLI) (previously Ministry of Energy, Mines and Petroleum Resources) resulted in the issuance of *Mines Act* Permit M–200 in July 1997.

The first full year of mining and milling at the Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004, with mill production commencing in March 2005.

The Mine is currently coming out of care and maintenance and entering full operations, having been in care and maintenance since 31 May 2019. The operational period of the mine is planned to extend beyond 30 June 2025, which is the last day of approved discharge under the current version of EMA Permit 11678 (amended 1 December 2022).

2.3 Plan Objectives

The intent of this plan is to provide site-specific sediment and erosion control measures for the activities at the Mount Polley Mine site, including protective measures and guidance to be implemented during all phases of the mine activities, concentrating on construction activities. The sediment and erosion mitigation strategies will follow applicable Best Management Practices (BMPs) along with site-specific measures for water management, and sediment and erosion control during construction. The mitigation measures and strategies outlined in the Plan will assist MPMC in meeting or exceeding the Projects regulatory conditions during mining and construction activities. More specifically, the Plan is intended to prevent or minimize the transport, and deposition of sediments and soil particulates from the mine site into environmentally sensitive areas such as nearby watercourses and affect downstream water quality.

The general approach applied in this document is to reduce sediment sources and minimize contact between sediment sources and water. Where avoidance is not possible, mitigation measures are adopted to reduce erosion. The BC Ministry of Transportation and Infrastructure (MOTI) describes erosion and sediment controls as: (i) erosion control – prevent or minimize the dislodgement of soil particles, and (ii) sediment control – to capture water-borne particles in a controlled manner before undesirable damage is caused (MOTI 2022). Sediment and erosion control measures are, and will continue to be, used during construction, operation, and decommissioning activities at the Mine. Activities that may result in erosion include clearing vegetation and stripping topsoil, stockpiling topsoil, and constructing roads, infrastructure, and tailings and water management structures. Potential hazards from these activities, in the absence of planned mitigation measures, include increased surface erosion from disturbed areas, increased sediment load to downstream receiving environments, and siltation or erosion of downstream watercourses or water bodies.

The main objectives of the Sediment Control and Erosion management plan are:

- Minimize the quantity of contact water by intercepting and/or diverting surface water before it enters a disturbed area with exposed soils or co-mingles with contact water.
- Collect and manage all contact water for treatment before discharge to the environment.
- Allow discharge to the environment if regulatory discharge criteria are met (PE11678).

The following are guidelines applicable to surface erosion prevention and sediment control. These documents may be used as a resource when developing project specific environmental management plans (EMPs) for the Mine.

- "Erosion and Sediment Control Manual", (MOTI 2022).
- "Developing a Mining Erosion and Sediment Control Plan Version 1.0" (BC Ministry of Environment [MoE] 2015).
- "Environmental Best Management Practices for Urban and Rural Land Development in British Columbia" (Draft) (MWLAP 2004).
- "Standards and Best Practices for Instream Works" (MWLAP 2004).
- "Best Management Practices Guide for Storm water: Appendix H Construction Site Erosion and Sediment Control Guide" (Dayton and Knight 1999).
- "Land Development Guidelines for the Protection of Aquatic Habitat" (DFO 1993).

2.4 Roles and Responsibilities

Mine Manager: The Mine Manager will be aware of the Plan and how the proposed or ongoing mining activities could affect soil erosion potential and sediment delivery to adjacent watercourses and water bodies. The Mine Manager is accountable for allocating resources for implementing the measures outlined in the Plan to comply with relevant water quality guidelines and applicable water quality objectives.

Environmental Superintendent: The Environmental Superintendent will be accountable for implementing the requirements of the Plan, including monitoring and reporting activities. The Environmental Superintendent will be aware of and familiar with the relevant legislation and permit requirements listed in Section 2.2 to ensure compliance with the regulatory requirements. Responsibilities of the Environmental Manager include:

- Implementation of the Plan.
- Tracking compliance with provincial and federal legislation and applicable permit conditions.
- Communicating environmental requirements and performance to the Mine Manager.
- Investigating and reporting environmental incidents.
- Developing and implementing strategies to address environmental risks, incidents, and non-compliance situations.

The Environmental Superintendent will use external Qualified Professionals (QP) who have specific expertise in erosion protection and sediment control, as necessary, for implementation or improvement of the Plan.

Employees and Contractors: All employees and contractors involved in the planning, design, and carrying out of site preparation and earthworks at the Mine site will be required to undergo basic training and orientation to become familiar with the contents of the Plan.

3 LEGISLATION AND REGULATIONS

3.1 Legislation

The following lists the federal and provincial regulatory requirements with regards to surface erosion prevention and sediment control. The guidance in the subsequent sections is designed to help works proceed in accordance with these regulations:

- BC *Water Sustainability Act*
- BC *Environmental Management Act*
- BC *Mines Act*
    - Health, Safety and Reclamation Code for Mines in British Columbia (EMLI 2021)
- Canada Fisheries Act
    - Metal and Diamond Mine Effluent Regulation
- Canada *Environmental Protection Act*

3.2 Existing Permits

MPMC has received and is currently operating under the following two permits:

- BC Mines Act Permit M200 (5 May 2023)
- BC Environmental Management Act (EMA) PE11678 (1 December 2022)

Permit M200 contains sections that address sediment and erosion control management for the site and are included in Appendix A.

4 EXISTING SITE CONDITIONS

4.1 Topography

Terrain and geomorphology of the region comprise flat and gently rolling topography with hummock bedrock exposures, dissected by a network of streams and lakes. Surface drainage patterns are influenced by bedrock topography. In the Tailings Storage Facility (TSF) area, the gentle topography and surface expression of the lowland area at the head of the west arm of Quesnel Lake is the result of glacial advance followed by glacial retreat and inundation by meltwater, creating a glacial lake (glaciolacustrine) environment. The regional surficial geology is predominantly the result of erosion and deposition associated with the most recent glaciation.

4.2 Geologic Setting

Volcanic rocks generally underlay this part of the plateau with inclusions of intrusive rocks. Most of the area is covered by a deposit of unconsolidated till which contains fluvial, lacustrine, and colluvial deposits. Some patches of organic soils are present in poorly drained areas (i.e., wetlands). The property is in an alkali porphyry copper-gold deposit hosted in the Central Quesnel Belt along the Intermountain Belt of BC.

4.3 Vegetation

The site is located within the Interior Cedar Hemlock bio geoclimatic zone. Local forests consist of western red cedar, douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch. Much of the area was historically harvested in commercial logging operations and was also used for cattle grazing.

4.4 Soils

The regional surficial geology is predominantly the result of erosion and deposition associated with the late Pleistocene (Wisconsinan) glacial episode referred to as the Fraser Glaciation. The stratigraphic sequence identified in the area of the TSF can be generalized in order of increasing depth as follows:

- Fill and anthropogenic materials.
- Till, interpreted as till derived from sediment entrained within the glacial ice and deposited by melting water and ice (ablation till).
- Glaciolacustrine sediments.
- Glaciofluvial sediments.
- Basal till.
- Bedrock.

4.5 Watercourses

The Mine is drained by three main watersheds: Hazeltine Creek (30.2 km^2) at Quesnel Lake, Edney Creek (87.4 km^2) at Quesnel Lake, and Morehead Lake (62.7 km^2) (Figure 2). The Hazeltine Creek watershed includes Polley Lake and conveys all water from Polley Lake, the east side of Mount Polley, and the area surrounding the TSF. The Morehead Creek watershed includes the Bootjack Lake catchment area (11.2 km^2). The regional topography, water bodies, and watersheds are shown in Figure 2.


Morehead Lake
Morehead Creek
Frypan Lake
Grogan Creek
Cedar Creek
WB1
(MOREHEAD CREEK)
MOREHEAD LAKE CATCHMENT AREA
Dow Creek
Nina Lake
Dag Creek
Polley Lake
Bootjack Lake
Mount Polley Mine Site
HAZELTINE CREEK CATCHMENT AREA
Jacobie Lake
Trio Creek
Trio Lake
BOOTJACK LAKE CATCHMENT AREA
Bootjack Creek
Quesnel Lake
H1
(UPPER HAZELTINE)
Raft Creek
H2
(LOWER HAZELTINE)
H3
(LOWER EDNEY)
Hazeltine Creek
EDNEY CREEK CATCHMENT AREA
Gavin Lake
Gavin Creek
Moorhouse Creek
Edney Creek
Fire Lake
Edney Lake
Moorhouse Lake

4.6 Climate

The average annual precipitation in the area is 612 millimetres (mm). Precipitation typically occurs as snowfall from November through March, with an average maximum of snowpack of 185 mm snow water equivalent occurring at the end of March. Average monthly temperatures at the Mine range from -13.1 degrees Celsius (°C) in December to 18.9 °C in July. Prevailing winds are from the northwest near the TSF, and from the southwest (and to a lesser extent from the northwest) near the mill.

4.7 Climate Baseline

The climate baseline for the Mine was updated in 2022 (Golder 2022). A summary of the baseline climate parameters is provided in Table 1 and is described in Golder 2022.

Table 1: Summary of Key Climate Parameters

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050's (%)	+5
Projected annual total precipitation anomaly from baseline for 2080's (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Projected annual air temperature anomaly from baseline for 2050's (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080's (°C)	+2.7
Mean annual relative humidity (%)	68.1
Mean annual solar radiation (W/m^2)	135
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863
Mean snow water equivalent for the month of March (mm)	185

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).

mm = millimetre; °C = degrees Celsius; W/m^2 = watts per square metre.

4.8 Land Use

Infrastructure at the Mount Polley Mine site includes open pits, an underground mine, a crusher, a mill, and office spaces, a TSF, a water treatment plant (WTP), waste rock disposal areas, collection and settling ponds, a surface water collection system, haul roads, access roads, and storage facilities. The total lease area associated with the Mine is 18,892 hectares (ha).

5 RISK ASSESSMENT

The sediment and erosion controls required are based on associated risk to the environment. Table 2 relates potential sediment sources to the sensitive areas on and surrounding the Mine site and assigns a level of risk based on sensitivity of the receiving environment (receiver size, fish bearing status, etc.) and erosion potential.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
6 km Creek	- Not fish bearing in upper reaches. - Variable forest buffer.	- Access road. - Junction Zone Ditch or 9 km Sump.	- NW PAG Stockpile soil stockpiles - NW PAG Stockpile/Junction Zone Ditch access roads. - NW Sump.	- Established gravel ditch bottom. - Upstream area mostly covered with waste rock. - Soil stockpiles revegetation. - Two high traffic road crossings.	Medium.
Mine Drainage Creek	- Not fish bearing. - Connected to Bootjack Lake.	- Mine Drainage Creek Sump. - West Ditch.	- Waste Haul Road. - Helipad reclamation parcel. - Crusher Access Road. - Ore Switchback Road. - Cariboo .Stockpile and soil stockpiles. - Pipeline from Springer Pit to water treatment plant.	- Some unarmoured ditch sections. - Some till placed on outer slope of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Caribou Stockpile soil stockpiles new. - Helipad reclamation parcel revegetating. - Majority of runoff into ditch (including from reclamation and soil stockpile areas) filters through rock haul road. - Water in pipeline to treatment plant contains low total suspended solids.	Medium.
W20 Creek	- Fish bearing (very low productivity). - Variable forest buffer.	- West Ditch. - West Ditch Access Road.	- Light Vehicle Tailings Road. - Waste Haul Road. - Above Waste Haul Road reclamation parcel. - Pipeline from Springer Pit to water treatment plant.	- Ditch armoured - Reclamation parcel revegetating; upstream of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Water in pipeline to treatment plant contains low suspended solids. - Majority of runoff into ditch filters though rock haul road.	Medium.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Bootjack Lake	- Fish bearing. - Medium sized receiver. - Variable forest buffer.	- NW Sump. - NW Ditch. - Mine Drainage Creek Sump. - West Ditch. - West Ditch Access Road. - Mine Drainage Creek. - W20 Creek.	- Waste Haul Road. - Helipad reclamation parcel. - Crusher Access Road. - Ore Switchback Road. - Caribou Stockpile and soil stockpiles. - Light Vehicle Tailings Road. - Waste Haul Road. - Above Waste Haul Road reclamation parcel. - Pipeline from Springer Pit to water treatment plant.	- Some unarmoured ditch sections. - Some till placed on outer slope of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Caribou Stockpile soil stockpiles new. - Reclamation parcels revegetating. - Water in pipeline to treatment plant contains low total suspended solids. - Majority of runoff into ditch filters through rock dumps and rock haul roads.	Medium.
North Dump Creek	- Not fish bearing in upper reaches. - Variable forest buffer.	- Joe's Creek Coffer Dam. - Joe's Creek Pipeline. - Gavin's Ditch (clean water diversion). - Wight Pit Ditch (clean water diversion). - Wight Pit Haul Road.	- North Bell Dump reclamation areas and soil stockpiles. - Access Road. - East Dump reclamation areas and soil stockpiles.	- Joe's Creek Coffer Dam/Pipeline water very low turbidity/suspended solids. - Ditches armoured or have established of have low-erodibility substrates except some potentially erodible sections in Wight Pit Ditch. - East Dump reclamation area in early stages of revegetation. - Varying levels of soil stockpile revegetation (some new). - Two moderate use road crossings.	Medium.
Bootjack Creek	Not fish bearing Connected to Polley Lake.	- Bootjack Creek Sump. - Tailings Access Road Ditch. - SERDS Ditch.	- Tailings Access Road. - Tailings Access Road soil stockpiles. - SERDS access roads. - Southeast Zone soil stockpiles.	- Some erodible ditch sections. - Portion of runoff into ditches filters through waste rock roads/dumps. - Three high use road crossings.	Medium.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Polley Lake	- Fish bearing. - Undergoing rehabilitation. - Sedimentation ponds constructed at outflow.	- Wight Pit Ditch (clean water diversion). - Long Ditch. - North Dump Creek.	- North Bell Dump reclamation areas and soil stockpiles. - Access Road. - NEZ Dump reclamation area and soil stockpile. - East Dump reclamation areas and soil stockpiles. - Tailings Access Road. - Tailings Access Road soil stockpiles. - SERDS access roads. - Southeast Zone/SERDS soils stockpiles.	- Varying levels of revegetation of upstream reclamation areas and soil stockpiles. - Ditches armoured or have established low-erodibility substrates except some potentially erodible sections of Wight Pit Ditch.	Low.
Hazeltine Creek[d]	- Fish bearing. - Undergoing rehabilitation. - Sedimentation ponds constructed at outflow.	- Polley Lake. - Long/SERDS Ditch (combined). - Central Collection Sump. - Perimeter Till Borrow Pit and ditch from Central Collection Sump. - Pipeline from Springer Pit to water treatment plant. - Edney Creek.	- TSF and associated infrastructure. - TSF Perimeter Embankment and PAR soil stockpiles. - TSF Ditch (clean water diversion). - TSF South Toe Drain Ditch. - TSF Main Seepage Pond. - ABR/Main Seepage Pond Ditch.	- High volume water transfers. - Water has time to settle in the TSF and Perimeter Embankment Till Borrow Pit. - Water in pipeline to treatment plant contains low total suspended solids. - Soil stockpiles varying levels of revegetation. - South Till Borrow area revegetation is advanced. - Active TSF construction upstream.	Medium (Risk will increase when the creek returns to fish-bearing status).

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Edney Creek	- Fish bearing. - Forest/wetland buffer.	- TSF Ditch (clean water diversion). - TSF South Seepage Pond. - TSF South Toe Drain Ditch. - TSF Main Seepage Pond. - ABR/Main Seepage Pond Ditch. - South Till Borrow reclamation area.	- TSF and associated infrastructure. - South and Main Embankment soil stockpiles.	- Few erodible ditch sections. - Low water volumes managed. - Water seepage ponds contain low turbidity/suspended solids. - New soil stockpiles (early stages of revegetation). - Active TSF construction upstream. - South Till Borrow area revegetation is progressing.	Low.

(a) Secondary sources are potential sources of sediment that are upstream of (i.e., potentially contribute to) primary erosion.

(b) Historic turbidity and total suspended data in relevant water collection infrastructure were considered when assessing erosion potential; water management contingency measures in place across water management system.

(c) Based on combination of area sensitivity and erosion potential.

(d) Sediment and erosion control in Hazeltine Creek beyond the mine footprint related to the Tailings Storage Facility embankment breach is managed under a separate program.

Based on the risk matrix and site conditions, water management works appear to be the largest risk to receiving environment systems, because:

- Reclamation areas and soil stockpiles on site (with the exception of localized active stripping and stockpile locations) have been seeded or inspected to confirm natural revegetation is underway (Appendix B). Site-specific observations from routine reclamation inspections and annual soil stockpile surveys indicate that minimal erosion occurs at these sites.
- Mine site hydrology is snowmelt dominated, and periods of high flow are experienced annually during freshet, meaning that:
    - There is higher potential for in-ditch erosion.
    - There is higher potential for erosion by surface runoff that reports to collection ditches.
    - Risk of an emergency release of water is elevated.
- Collection ditches are located downstream of disturbed areas on site and collect and convey any turbid water that is generated from disturbed areas on site.

6 BEST MANAGEMENT PRACTICES (BMPS)

Best management practices for water and sediment management will be implemented within and around the various construction areas (e.g., roads, tailings embankments, process plant platform, ponds) with the main objective of controlling runoff and seepage from the construction areas at the source, to the extent practicable. BMPs will include:

- Engagement of Qualified Professionals to support the development of specific management plans and update the Plan every 5 years.
- Strive to divert non-contact water around work areas, wherever possible, and convey contact water to the existing contact water system for treatment prior to release.
- Limiting work activities as much as possible to dry weather conditions and covering/ revegetating disturbed areas as quickly as possible after completing work in an area.
- Ensuring that no construction activities take place in, or construction equipment passes through existing watercourses.
- Stockpiling any materials on site as far as possible from watercourses.
- Ensuring that all stockpiles on site with the potential for erosion to a watercourse be covered and/or revegetated to reduce sediment generation.
- Inspecting and maintaining covers and diversion/conveyance ditches on a regular basis.
- Grading the site such that the potential for ponding is minimized.
- Ensuring that extra covers and clean granular materials are available onsite for channel and stockpile maintenance.

The following sections provides general sediment and erosion control guidelines to be followed for future construction projects and/or new surface development on the mine site through the different project phases.

6.1 Pre-project Planning

The BMP guidance documents referenced in Section 3.3 and, when necessary, QPs, are to be consulted to support planning of a specific project. Prior to starting any new construction work, the following should be considered:

- Design of projects to minimize the amount of ground cleared and disturbed.
- Design of projects to minimize disturbance adjacent to receiving environment watercourses and water bodies.
- Planning of works such that areas adjacent to waterways and drainage lines remain undisturbed or protected from erosion for as long as practicable.
- Planning of work to minimize the use of heavy equipment and have equipment conduct work as efficiently as possible.
- Planning of interim water and runoff management strategies to reduce erosion and identify available mitigation techniques if sediment is mobilized.
- Planning of long-term erosion control measures to be implemented after project completion.

- Identification of monitoring and inspection requirements for, during and after the project.
- Design of project criteria, construction plans, and mitigation for stream and other watercourse crossings to meet or exceed all standards and codes established by relevant authorities for the project.

Permitting, notification, and reporting requirements for projects will vary based on their location and proximity to natural water bodies and water. If the project has potential to impact natural watercourses or water bodies (i.e., if the work is outside site contact water collection systems and/or is adjacent to natural waterways), a site-specific environmental management plan (EMP) for project work should be developed. The EMP should include, at minimum:

- A summary of how information requirements, as detailed above, are being implemented.
- Details of drainage patterns over the area, both clean water and potential construction runoff.
- Locations of adjacent environmentally sensitive areas that could be impacted.
- A general outline of the planned work.
- Details of existing or planned erosion and sedimentation control methods to manage construction runoff.
- The location of any existing or planned drainage diversions.
- An inspection and monitoring schedule.
- A revision number and date.

For projects requiring an EMP, appropriate training and awareness to supervisors, workers (employees and contractors) regarding their responsibilities to comply with environmental laws and applicable codes. Workers are to be made aware of the required mitigation measures for a task, in addition to any requirements contained in any public or private approvals and agreement documents.

The following subsections outline additional sediment and erosion control techniques that may be incorporated into planning.

6.1.1 Stabilization and Treatment Methods

Erosion control measures are to be planned and, if required, installed prior to any clearing or earthwork activities. Stabilization measures are put in place to prevent or reduce the mobilization of sediment by stabilizing the source (e.g., exposed soils). Typical erosion control measures that may be used to stabilize areas that have the potential to be sources of sediment to water bodies or watercourses include:

- Seeding or mulching.
- Non-vegetative cover (e.g., gravel or straw).
- Riprap placement.
- Slope modification to reduce erosive energy (e.g., flattening or benching).
- Surface ripping and roughening to promote infiltration.
- Slope drains/chute construction.
- Erosion blankets.

While pro-active stabilization measures are used to minimize the presence of sediment laden water, treatment measures may be necessary when it is not possible to completely prevent the mobilization of sediment. Typical sediment control measures that may be used to manage sediment in contact water include the following:

- Check dams or weir structures.
- Outlet protection.
- Sediment retention ponds, sediment traps and sediment basins.
- Silt fence or similar barrier, such as straw bales.
- Swales.
- Vegetated buffer zones.

6.1.2 Runoff Collection Ditches

Runoff collection ditches may be either temporary or permanent structures. Permanent surface runoff control works should be sized to convey runoff from a 1 in 10 year 24-hour flood flow and to withstand a 1:200-year, 24-hour event without significant damage as per BC ENV Permit 11678.

The design of sections of ditch may depend on topography, excavation material (till or bedrock) and design discharge. Different material gradations or design approaches may be used for armouring depending on site-specific conditions and material availability. Any convergences with other ditches or streams should be armoured.

It is expected, in observance of Permit 11678, that new runoff collection ditches will direct flow to the contact water system and result in treatment at the water treatment plant.

6.2 Construction

Construction should comply with the plans developed in the pre-construction phase (Section 7.1) so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment, or other deleterious substances into any watercourse. Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control management plans to be revised accordingly. Monitoring is to be carried out as per Section 7 of this document.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.
- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.
- Follow the project EMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

6.2.1 Soil Salvage

Under MPMC's Mines Act Permit M-200, surficial soils are required to be stripped from the areas to be disturbed in advance of construction of works including waste rock dumps, waste or ore stockpiles, and roads. Stockpiles are often required to store salvaged soils for later use in reclamation, and further erosion control considerations apply, in addition to the earthworks project considerations discussed above. Stockpiles should be promptly seeded with an appropriate native seed mixture. If stockpiles have the potential to impact natural watercourses or water bodies, temporary erosion and sediment control measures should be installed and maintained until a vegetative cover is established.

6.3 Post-Construction

When a project is completed, long-term sediment retention and erosion control measures may need to be considered. These measures may include elements of the stabilization and treatment options in Section 6.1.1, as well as:

- Restricting access to areas being rehabilitated.
- Establishing a vegetative cover.
- Armouring areas receiving surface runoff.
- Slope modification to reduce erosive energy, such as flattening or benching.
- Surface ripping and roughening to promote infiltration.
- Diversion berms and drains (to intercept upstream runoff).

Any interim measures should remain in place until long-term controls are established. When monitoring and inspections (as described in Section 7) find long-term measures are sufficient, interim, or temporary erosion and sediment control features may be reclaimed.

6.4 Decommissioning and Reclamation

At closure, MPMC is responsible for leaving the mine site in compliance with all regulations, including site runoff water quality and revegetation to meet end land use and land capability objectives.

Detailed soil application and revegetation plans that include methods for reducing erosion are included in the site Reclamation and Closure Plan.

6.5 Mine Operations

Sediment and erosion control practices for new disturbances at the mine site are to follow the procedures outlined in the previous sections, but measures are also to be implemented and maintained on a site-wide scale.

6.5.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Water from these collection systems is conveyed to the PETBP and sent to a treatment plant prior to discharge from the site and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels.

The overall operating premise at the Mine is that contact water is captured and conveyed via channels, ditches, and pipelines to a centralized location and treated through the water treatment plant (WTP) prior to discharge to Quesnel Lake via submerged diffuser. The WTP outlet is the primary monitoring point for compliance with PE11678 (location HAD-3). There is a secondary PE11678 monitoring point near the diffuser discharge within Quesnel Lake (Location QUL-58).

6.5.2 Emergency Release of Water

If emergency release of water from the site water collection system should occur, sediment and erosion control materials are to be installed, as required, to avoid the displacement of sediment as water moves over land. These materials are stored in the Environmental C-Can located beside the Leach Pad, and the Environmental Department staff is available to guide proper installation. The Mount Polley Emergency Response Plan and Water Management Inspection Manual outline in more detail response protocol for such events, and Section 7.2 outlines event-based monitoring procedures.

7 ENVIRONMENTAL MONITORING AND REPORTING

Water quality is monitored on-site per the Comprehensive Environmental Monitoring Plan (CEMP) (MPMC 2019) to ensure that the water quality conforms to the EMA permit requirements. Monitoring frequency and location of various water quality parameters are outlined in the CEMP. If water quality exceeds trigger levels for any parameter as listed in Section 7.2 of the EMA permit, MPMC will immediately complete Trigger Response Plan actions as outlined in their Annual Discharge Plan (MPMC 2018).

7.1 Routine Inspections

Daily inspections of site water containment infrastructure are completed (refer to the Water Management Inspection Manual, MPMC, 2019 to verify the collection system is working as designed). As per this document, inspections are completed at least once on day shift and night shift during high-risk periods (i.e., freshet). The inspection form template is included as Appendix C. Completed forms are provided to the Environmental Department for review and filing at the end of each seven (7) day set. Note that protocol and triggers are in place for immediate notifications to occur if deficiencies are observed. Daily inspections are the responsibility of Mill Maintenance, and the Environmental and Engineering Departments are responsible for updating the Water Management Inspection Manual, which is a component of the site Operation Maintenance and Surveillance (OMS) Manual.

Inspections of all site water management infrastructure (sumps, ditches, culverts, pipelines, etc.) are completed in spring after freshet and in fall prior to freeze up, as per EMA Permit 11678. This is the responsibility of the Environmental Department. Results are documented in the inspection form (refer to the template provided as Appendix D) and filed internally. Inspection results are used to inform upgrades of water management structures. Noted deficiencies, including areas of erosion or sedimentation, are compiled, and prioritized in a project list which is provided to the Engineering Department to address, based on the identified levels of urgency.

7.1.1 Contact Water Monitoring

Routine monitoring of mine site contact water conveyed through various infrastructure components is conducted as per Mines Act Permit M-200. This sampling program, including sample locations, frequencies, and QA/QC procedures, is detailed in the CEMP, which is regularly updated to account for operational changes at the mine site. All routine samples collected on site are analysed for physical parameters (including total suspended solids and turbidity), anions, nutrients, and total and dissolved metals. Monitoring locations and frequencies (at the time of this update) are shown in Figure 3.

These sample results are included in the annual reporting to BC ENV and BC EMLI. Results from these samples are used, along with inspection results, to identify potential upgrade opportunities for site water conveyance.

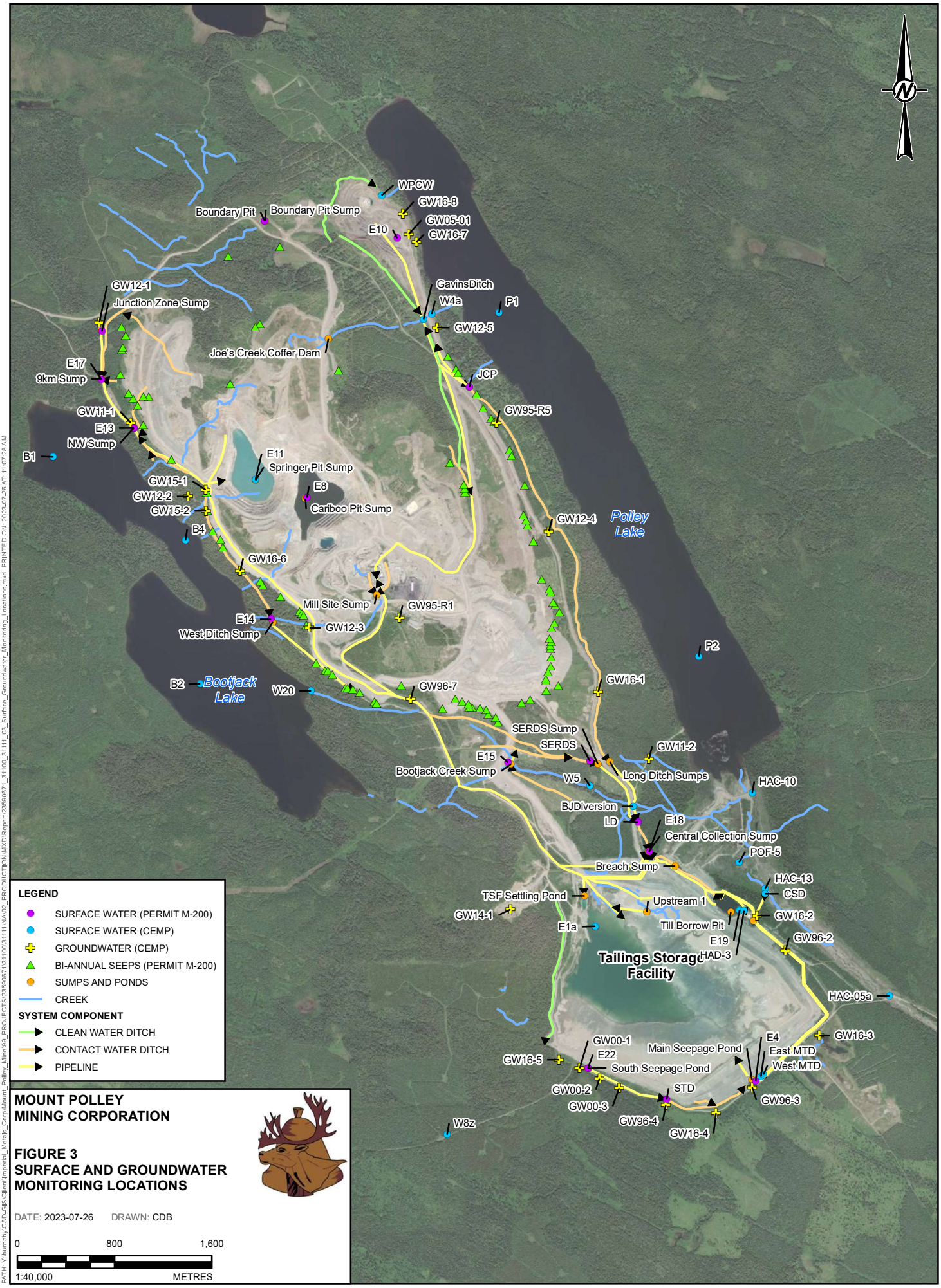

LEGEND

- SURFACE WATER (PERMIT M-200)
- SURFACE WATER (CEMP)
- GROUNDWATER (CEMP)
- BI-ANNUAL SEEPS (PERMIT M-200)
- SUMPS AND PONDS
- CREEK

SYSTEM COMPONENT

- CLEAN WATER DITCH
- CONTACT WATER DITCH
- PIPELINE

MOUNT POLLEY MINING CORPORATION

FIGURE 3
SURFACE AND GROUNDWATER MONITORING LOCATIONS

DATE: 2023-07-26 DRAWN: CDB

0 800 1,600

1:40,000 METRES

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7.1.2 Receiving Environment Monitoring

The Environmental Department conducts water quality monitoring in receiving environment water bodies and watercourses as per MPMC's CEMP, which is required under EMA Permit 11678. Note that chemistry and flow monitoring at a few contact water sites is included under this program, including monitoring related to the permitted effluent discharge. In addition to regular sampling (e.g., monthly, quarterly), a five (5)-week intensive turbidity and total suspended solids monitoring program is conducted in spring and fall in receiving environment streams that could potentially be impacted by erosion from the mine. This includes the following creeks downstream of inflows from runoff diversion ditches:

- North Dump Creek
- Bootjack Creek
- Edney Creek

7.2 Event/Incident Based Monitoring

Results from routine or freshet/fall rainy period monitoring of receiving environment or general observations from carrying out other work at the mine site may indicate increased sedimentation from mine-related sources. Table 3 outlines the triggers for additional monitoring and required follow up actions if elevated suspended sediment levels are observed or measured.

Table 3: Event-based Monitoring Protocol for Receiving Environment Waterways

Trigger	Actions and Responsibilities
Receiving environment waterway or waterbody is observed to have a “cloudy” appearance.	- Observer to report observation to the Environmental Coordinator (or member of the Environmental Department if Environmental Coordinator cannot be reached). - Environmental Coordinator, or their delegate from the Environmental Department, is to carry out in situ monitoring at this site, following the turbidity triggers and associated protocol below.
80-100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed.	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to mine activities: - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed.	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to a mine activity: - Stop any construction or mine activities that may contribute to or exacerbate erosion and sedimentation. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.

A detailed event-based monitoring program for the receiving environment should be included in project EMPs. Table 4 provides recommended protocol to incorporate.

Table 4: Recommended Event-based Monitoring Protocol for a Construction Project

Trigger	Actions and Responsibilities
80-100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring.	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all erosion and sediment control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring.
100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring.	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. - Construction supervisor to stop all local construction work. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all sediment and erosion control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. Work is not to recommence until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
Rainfall (or snowmelt) ≤ 10 mm/h or 25 mm/d.	During minor rainfall or snowmelt runoff events, the Environmental Monitor is to: - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of potential sediment sources (soil stockpiles, sediment ponds, etc.).
Rainfall (or snowmelt) /10 mm/h or 25 mm/d.	During major rainfall or snowmelt runoff events, the Environmental Monitor is to: - Notify the Environmental Coordinator and construction supervisor. - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of high-risk areas (soil stockpiles, sediment ponds, etc.). Environmental Coordinator and/or construction supervisor are to consider full work stop in the area based on conditions.

Note: Upstream monitoring site may be used as “background” reference.

7.3 Reporting and Performance

Water management at the Mount Polley site involves the collection of all mine contact water (see Environmental Management Act Permit PE11678 for this requirement). Contact water is conveyed through a series of ditches and collection sumps to the Perimeter Embankment Till Borrow Pond (PETBP) which is an influent source to the Water Treatment Plant (WTP). This WTP is designed for the removal of suspended solids from contact water and treated effluent is discharged to a pipe that conveys treated water to Quesnel Lake for discharge through submerged diffuser. This discharge is regulated by PE11678 and has a primary compliance monitoring location at the WTP outlet (HAD-3) and has a secondary compliance monitoring location in Quesnel Lake near the diffuser discharge (QUL-58).

Given the water management in place and the single, monitored discharge point, and given that this point is regulated by permit, this location and the permit limits provide the best point at which measurement of the ESCP performance, in aggregate, be evaluated.

The effluent permit provides a site- and discharge-specific regulatory discharge standard with which MPMC must comply.

8 REPORTING AND RECORD KEEPING

8.1 Annual Reporting

Site inspections and monitoring activities associated with surface erosion prevention and sediment control during construction, operations, and closure activities will be documented and reported in accordance with the requirements of MPMC's EMA Permit 11678 and Mines Act Permit M-200.

8.2 Incident Reporting

Significant releases of sediment-laden water from onsite disturbed areas will be appropriately characterized concerning extent and loading and reported to Emergency Management BC, with follow up reporting to provincial regulatory agencies as required by regulations and permits. The Environmental Superintendent will review the reports internally to identify necessary improvements in water management procedures.

8.3 Emergency Reporting

In the event that an emergency release of water from the site collection system occurs, the protocol in the Water Management Inspection Manual (MPMC, 2019) outlining responsibilities, notification requirements, documentation (refer to the form in Appendix E), and actions to carry out would apply. One key action is the installation of sediment and erosion control materials and/or structures.

Monitoring associated with an emergency release of water is the responsibility of the Environmental Department, and should include the following:

- Assessment of the spatial extent of the release and if the release reached receiving environment waterways or water bodies.
- Monitoring of water released (visual observations, flow measurements/estimates, field parameters including turbidity, and/or sampling, based on the observed location, conditions and size of the release).
- Monitoring (visual observations, field parameters including turbidity, and sampling) of downstream waterways or waterbodies into which water was released.

Reporting to Emergency Management BC and follow up reporting to provincial regulatory agencies will likely require this information, in addition to the information required to be collected as per the Water Management Inspection Manual (refer to the form in Appendix E).

8.4 Record Keeping

Monitoring data will be entered into an electronic database and have quality control checks completed upon receipt of results. Data will be entered into a standard format that allows for data reporting and analyses. Data and data comparisons will be stored in a single file format for each type or monitoring activity.

9 EVALUATION AND ADAPTIVE MANAGEMENT

9.1 Sampling and Monitoring Data

The CEMP is, at minimum, updated every three years, based on the results of detailed three-year monitoring program interpretive reports. More frequent changes are, however, anticipated to reflect changing site conditions and, as per the mechanisms described in the CEMP, written notice of proposed changes will be provided to the BC ENV. First Nations and stakeholders will also be updated, as per MPMC's Communication Plan. The CEMP is also referenced in the site OMS Manual, which is regularly updated to account for operational changes at the mine site.

Results from monitoring completed as per the CEMP are submitted to the BC ENV quarterly and are also included in the Annual Environmental and Reclamation Report, which is submitted to the BC ENV and BC EMLI annually. The Environmental Superintendent or their designate (the Environmental Coordinator) is responsible for ensuring this reporting is carried out.

9.2 Maintenance and Inspection Reports

As per the Water Management Inspection Manual, supplemental inspections are to be completed by Mill Maintenance, Mine Operations, and the Environmental Department during high-risk periods (i.e., during precipitation and/or snowmelt runoff events), with support from the Engineering Department. Inspection reports from high flow periods provide feedback on the functioning of site water collection systems under conditions when erosion potential is high. Noted deficiencies are incorporated into project planning for continuous improvements along with findings from routine inspections as described above.

An annual inspection was completed in June 2023 to review the existing sediment and erosion control measures that are in place at the mine site. A summary of the 2023 inspection is included in Appendix F.

9.2.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Thus, runoff from disturbed areas that potentially contains sediments is not directly released to the environment. Water from these collection systems is stored on site and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels, necessitating removal of suspended sediments through active or passive treatment prior to discharge.

To minimize the volume of contact water collected and stored at the site, upstream ditches to divert non-site contact water may be constructed. As water from these works enters the receiving environment, for construction of new diversion ditches, an EMP should be developed and followed for construction, and the guidelines in Sections 6.1 to 6.3 followed.

Inspection and monitoring requirements for site water collection systems and diversion ditches are outlined in Section 7.

9.3 Onsite Plan Review

Construction should comply with the plans developed in the pre-construction phase (Section 6.1) so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment, or other deleterious substances into any watercourse. Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control management plans to be revised accordingly. Monitoring is to be carried out as per Section 6 of this document. Actions and maintenance that may be required based on monitoring observations include:

- Correcting deficiencies of the erosion and sediment control measures as soon as they are observed.
- Removal of any sediment and debris accumulation that compromises the effectiveness of the erosion and sediment control measures.
- Implementation of additional stabilization and treatment measures listed in Section 6.1.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.
- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.
- Follow the project EMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

9.3.1 Adaptive Management

This Plan is designed to be updated as sediment and erosion control science and BMPs develop over time. It is also designed to be adapted for operational changes and water management needs at the mine site. Continuous improvements that may be carried out include:

- Changes to the design of works to eliminate deficiencies that are noted during inspections and require regular maintenance.
- Implementation of mitigation measures in response to water quality trends noted in the receiving environment.
- Implementation of measures that reduce treatment needs prior to discharging water.
- Implementation of measures to reduce maintenance costs.
- Implementation of measures to reduce environmental risk.

10 QUALIFIED PROFESSIONALS

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

This Erosion and Sediment and Control Management Plan was revised and reviewed by the following qualified professionals:

Andrew McIntosh, M.Eng., CESCL.
Project Manager

Peter W. Morgan, P.Eng.
Engineering Manager-Mine Water

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P. W. MORGAN

July 31, 2023

Engineers & Geoscientists BC Permit #1000200

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APPENDIX A

Permit M-200 (2020) – Erosion and Control Section

Permit No. M-200
Mine No. 1101163
Permit Approving Mine Plan and Reclamation Program
Mount Polley Mining Corporation, Mount Polley Mine
Date: 10 December 2020

8. Sediment and Erosion Control

(a) The Permittee shall implement the Erosion and Sediment Control Plan (Document 42.1).
(b) The Permittee shall ensure that the Erosion and Sediment Control Plan is reviewed annually, and updates reported in the Annual Reclamation Report. Substantive changes shall be provided to the Chief Inspector prior to implementation.
(c) The Permittee shall appropriately characterize any significant releases of sediment-laden water, defined as an unauthorized discharge to the receiving environment, with respect to extent and loading, and report it to the Chief Inspector.
(d) The Permittee shall ensure that the characterization of unauthorized discharges of sediment-laden run-off include, at a minimum, flow, total suspended solids, turbidity, pH, conductivity, temperature, dissolved oxygen, and total and dissolved metals, of both the effluent and the receiving water.

APPENDIX B

Reclamation Revegetation Assessment Form

MOUNT POLLEY RECLAMATION RE-VEGETATION ASSESSMENT FORM

Date: _____ Transect: _____
Assessor(s): _____ Plot: _____
Reclamation Site: _____ Plot Size: _____
Site Conditions (slope position, slope angle, aspect): _____

Ground Surface

Surface Roughening (present, description):	
Coarse Woody Debris (% cover, types):	

Understorey Vegetation

General

% Cover (all species)	
% Cover (invasive species)	
Average Height (m)	
Vigor (0 - 5)	

Species Specific

Species	# Species	% Cover	Height (m)	Vigor (0 - 5)	Planted/Ingress/Invasive

Trees/Shrubs

Species	# Present	Average Height (m)		Vigour (0 - 5)	Planted/Ingress

Wildlife Value

Wildlife Observations:	
Habitat Types Present:	

Comments

(ex. erosion, variation across plot)

APPENDIX C

Daily Water Management Inspection Checklist

Bi-Annual Water Management Infrastructure Inspection Checklist (September 2016)

Location	Initials	Date	OK	Not OK	Photo (Y/N)	Comments/Actions Required
Junction Zone Ditch						
9km Sump						
Junction Zone Seepage Collection Sump						
Northwest Ditch						
Northwest Sump						
West Ditch						
Mine Drainage Creek Sump						
Waste Haul Road Culvert (at MDC)						
Orica Site Settling Pond						
Orica Ditch						
Bootjack Lake Dam						
Bootjack Cr Culverts at TAR						
Bootjack Cr Culverts under Light Vehicle TSF Road						
Bootjack Creek Sump (Upstream)						
Bootjack Creek Sump						
TAR Ditch						
SERDS Ditch						
SERDS Culverts at TSF Road						
SERDS Culverts at TAR						
SERDS Sump						
SERDS Ditch Pipeline						
Wight Pit Clean Water Ditch (N)						
Wight Pit Clean Water Ditch (SW)						
SEZ Ditch						
Gavin's Ditch						
Access Road Culverts						
Joe's Creek Coffer Dam						
Joe's Creek Pipeline						
Long Ditch						
Long Ditch Sump (Upper)						
Long Ditch Pipeline						
Long Ditch Sump (Lower)						
Bootjack Creek Bridge Crossing						
Bootjack Creek Channel						
Mill Site Ditch						
Mill Site Sump						
Crusher Site Ditch						
Tailings Ditch (Mill to Booster Station)						
Tailings Ditch (Booster Station to 5 Corner)						
Tailings Ditch (5 corner to TSF)						
Central Collection Sump						
Breach Sump Ditch						
Perimeter Embankment Till Borrow Pit						
Hazeltine Discharge Pipeline						
Main Seepage Pond						
Ditch below 3 Corner						
South Toe Drain Ditch						
South Seepage Pond						
South Seepage Pond Pipeline						
Borrow Pit Ditch & Settling Pond across from Horsefly-Gavin FSR						
Horsefly-Gavin FSR under permit obligation with MOF (Gavin Lake Road Bridge to W8z)						
TSF Clean Water Ditch						

APPENDIX D

Bi-annual Water Management Infrastructure Inspection Checklist

Daily Water Management Inspection Checklist

Inspector: _____ Date: _____

Shift (Crew, D or N):_____ Weather Conditions (ex. hot, windy): _____

Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes/ Comments
WTP Well		(m)	
WTP Slurry Line		GOOD / ISSUE	
Perimeter Embankment Till Borrow		RED YELLOW BLACK	
CCS		GOOD / ISSUE	
Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
Breach Sump		GOOD / ISSUE	
Weir		GOOD / ISSUE	
Polley Fish Fence (Day Shift)		GOOD / ISSUE	Cleaned? Y / N
SERDS Sump		RED YELLOW BLACK	
Long Ditch Sump (Upper)		RED YELLOW BLACK	
Long Ditch Sump (Lower)		RED YELLOW BLACK	
Long Ditch/SERDS Outflow Pipes		GOOD / ISSUE	
South Seepage Collection Pond		RED YELLOW BLACK	
Main Seepage Collection Pond		RED YELLOW BLACK	
Sprinklers		GOOD / ISSUE	
Lower Hazeltine Pond Water Level		(m)	
TSF Settling Pond		GOOD / ISSUE	
Tailings outflow pipe		GOOD / ISSUE	
TSF Upstream		GOOD / ISSUE	
Cariboo Pit Sump		GOOD / ISSUE	
Springer Pit Lake		GOOD / ISSUE	
Junction Zone Seepage Sump		GOOD / ISSUE	
9K Sump **# Starts** _____		RED YELLOW BLACK	
NW PAG Sump **# Starts** _____		RED YELLOW BLACK	
Mine Drainage Creek Sump		RED YELLOW BLACK	
West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
Springer Pit Dewatering Outflow		GOOD / ISSUE	
Bootjack Creek Sump - Upstream Side		GOOD / ISSUE	
Bootjack Creek Sump		RED YELLOW BLACK	
Wight Pit Water Level		(m)	
Joe's Creek Pipe		GOOD / ISSUE	

Updated November 2, 2016

Is the TSF Generating Dust?

No Minor Moderate Major

Is the Polley Lake Plug Generating Dust?

No Minor Moderate Major

REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING IN FREEZING CONDITIONS

ADDITIONAL COMMENTS/OBSERVATIONS (ex. erosion):

WILDLIFE OBSERVATIONS (include locations):

Daily Water Management Inspection Checklist

*(Controlled Document – **DO NOT COPY**: please ask Environment Department for print out)*

Inspector: _____ Date: _____

Shift: (Crew, D or N) _____ Weather Conditions: (ex. hot, windy, sunny): _____

	Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes / Comments
1	Junction Zone Seepage Sump		GOOD / ISSUE	
2	9K Sump # Starts _____		RED YELLOW BLACK	
3	CWTS (Wetland)		GOOD / ISSUE	
4	NW PAG Sump # Starts _____		RED YELLOW BLACK	
5	Mine Drainage Creek Sump		RED YELLOW BLACK	
6	West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
7	Booster Station		GOOD / ISSUE	
8	Bootjack Creek Sump – Upstream side		GOOD / ISSUE	
9	Corner 1 Buttress Culverts/Ditch		GOOD / ISSUE	
10	TSF Barge		GOOD / ISSUE	
11	Dredge Outflow Pipe		GOOD / ISSUE	Location:
12	South Seepage Collection Pond		RED YELLOW BLACK	
13	Main Seepage Collection Pond		RED YELLOW BLACK	Percent Full ____%
14	Fish fence at outlet to Quesnel Lake		GOOD / ISSUE	
15	Fish Fences above Gavin Lake Bridge		GOOD / ISSUE	Cleaned? Y / N
16	WTP Well		(m)	
17	WTP Slurry Line		GOOD / ISSUE	
18	Perimeter Embankment Till Borrow Pond		RED YELLOW BLACK	
19	Breach Sump/COW Drain/Upstream Drain		GOOD / ISSUE	
20	CCS		GOOD / ISSUE	
21	Long Ditch Outflow Pipes		GOOD / ISSUE	
22	Long Ditch Sump (Lower)		RED YELLOW BLACK	
23	Long Ditch Sump (Upper)		RED YELLOW BLACK	
24	SERDS Sump		RED YELLOW BLACK	
25	Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
26	**NEZ Seep Sump**		GOOD / ISSUE	
27	Wight Pit Water Level		(m)	
28	Joe's Creek Pipe		GOOD / ISSUE	
29	**Leachpad LCRS**		(m)	Pumped? Y / N
30	West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
31	Bootjack Creek Sump		RED YELLOW BLACK	
32	Mill Site Sump		Pump Hours	

Updated May 25, 2019

Is the TSF Generating Dust? *(Circle one)* No Minor Moderate Major

**REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING FREEZING CONDITIONS **

ADDITIONAL COMMENTS/OBSERVATIONS (EX. EROSION):

NOTE* - Please clean up and report all spills of hydrocarbons or chemicals

WILDLIFE OBSERVATIONS (include locations):

APPENDIX E

Water Release Report Form

Water Management Incident Report Form

Please complete and forward to the Environmental Department.

DATE OF REPORT	
DATE AND TIME INCIDENT DISCOVERED	
NAME(S) OF PERSON/PEOPLE REPORTING INCIDENT	
LOCATION OF INCIDENT	
IS WATER RELEASING TO THE ENVIRONMENT?	
If yes, what time did it start releasing, and at what rate is the water flowing?	
If no, at what rate is it approaching release?	
DESCRIPTION OF HOW/WHY INCIDENT OCCURRED	
HAS THE PROBLEM BEING FIXED? HOW?	
If yes, what time did the water stop releasing to the environment (if released)?	
If no, describe actions being taken to fix problem (record timeline of events).	

DESCRIPTION OF MEASURES TAKEN TO PROTECT ENVIRONMENT (ex. sediment and erosion control materials)	
PREVENTATIVE MEASURES TAKEN TO ENSURE INCIDENT DOES NOT OCCUR AGAIN	
SUPERVISOR NAME	
SUPERVISOR SIGNATURE	
FOLLOW UP REQUIRED?	
Environmental Department: Name: _____ Sign: _____	Comments:

APPENDIX F

Sediment and Erosion Site Inspection – June 2023

Sediment and Erosion Site Inspection – June 2023

WSP was retained by MPMC to undertake a visual inspection of the Long Ditch and West Ditch drainage systems at the Mount Polley mine on 7 June and 8 June 2023. Don Kidd, Senior Engineer, Q.P. P.Eng. undertook the visual inspection of both drainage systems. The visual inspection confirmed that both drainage systems were in good condition, with no ditch erosion evident in the mostly vegetated riprap lined ditches.

Based on the visual inspection the following action items are recommended.

- Undertake bathymetry surveys of SFRD and Central Collection Sumps to confirm that adequate storage is available for the design storm events, and if not undertake dredging works to provide the storage required.
- Provide written documentation of pump capacity required at each sump, based on previous hydraulic modelling work undertaken by WSP (formerly Golder) and confirm that the correct pump and backup capacity is available.
- Where the system has sections of ditch replaced by culverts/pipes, confirm the pipe is sized correctly to convey the design storm event.

Monitoring should be carried out in accordance with project specific EMPs developed as per Section 2.2.3 and regulatory permits and legislation requirements. If the project has the potential to impact natural water courses, and requires an EMP, a designated environmental monitor should oversee the project. The environmental monitor's daily tasks are to be defined in the EMP, and should include:

- Visual inspections of erosion and sedimentation controls.
- Visual inspections of equipment for leaks.
- Visual inspections of spill kits to confirm appropriate supplies are available.
- Visual inspections of potential sedimentation sources, such as soil stockpiles, new disturbances, and active construction areas.
- Monitoring of the weather forecast and current conditions.
- Documentation of the above.

If a project does not have the potential to impact natural water courses, and EMP is not developed, monitoring is still expected and BMPs for sediment and erosion control should still be applied. Inspections should be conducted by a designated qualified member of the Mount Polley Environmental or Engineering Department for the tasks outlined above.

In active construction areas where activities could impact receiving environment water quality, additional monitoring may be required beyond routine sampling described in Section 5.1. Monitoring may include in situ turbidity testing and/or partial or full suite water quality sampling (full suite = parameters listed for routine samples in Section 5.1). Results should be compared against pre-construction data and the BC Water Quality Guidelines for Freshwater Aquatic Life. Downstream monitoring site(s) should be located at a sufficient distance to ensure mixing of construction runoff and ambient stream water. An upstream control site of sufficient distance to be isolated from any construction-related impacts may be monitored simultaneously and compared to downstream monitoring results. Monitoring requirements and sampling frequency depend on the specific project and a monitoring plan should be included in the project EMP.

APPENDIX 9-2: Soil Management Plan

Mount Polley Mining Corporation

an Imperial Metals company
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Environmental Management Plan:

Soil Management Plan

Last Update: January 8, 2016

Document Revision Control

Rev. No.	Revision	Date	Author
0	Original Soil Salvage and Stockpile Protocol	1997	RM
1	Update to reflect site changes	2012	KM
2	Update to reflect site changes and results of site soil stockpile assessment; addressed *Mines Act P*ermit M-200 conditions	March 2014	KM
3	Update of site specific components; added document tracking and formatting to be consistent with other MPMC EMPs	January 2017	KM

1 Introduction

All surficial soil at the Mount Polley Mine (the Mine) identified through soil surveys as being appropriate for plant growth are salvaged and either used immediately in the reclamation program or stored in a suitable manner for future use. This is a requirement of the British Columbia (BC) *Mines Act* and associated BC Health Safety Reclamation Code. In addition, Mount Polley Mining Corporation's (MPMC's) *Mines Act* Permit M-200 contains specific conditions related to soil management that are addressed in this Soil Management Plan (the Plan).

The purpose of this Plan is to outline the procedures to characterize, salvage, store, and apply all suitable growth material in accordance with regulatory requirements and to support reclamation of the Mine site to the desired land capability and end land uses.

2 Soil Handling and Management

The following subsections outline procedures for soil handling and management through the different stages of the mine life at the Mount Polley Mine.

2.1 Soil Characterization

Site-specific soil surveys must be completed for areas scheduled for disturbance by a qualified individual and submitted to the BC Ministry of Energy and Mine (MEM) Chief Inspector for approval. The following survey procedure is recommended and is consistent with soil surveys previously conducted at Mount Polley Mine; however, this methodology may be modified by a qualified individual based on site conditions, existing information, and their experience.

1. Pre-stratify the area according to terrain using aerial photographs. Confirm the stratification is appropriate with a site inspection.

2. Select soil pit locations at representative sites or using a predetermined systematic grid or transect. Soil pit density may range from one pit per half hectare to one pit per two hectares, depending on site variability.

3. Expose the soil profile by machine excavation or hand-dug holes. Existing road cuts and excavations can also be cleaned for use.

4. Describe the soil and site characteristics at each soil profile location as per the BC Ministry of Environment standards and guidance in the "Field Manual for Describing Terrestrial Ecosystems" (MoE, 2010).

5. Sample soils at select, representative sites to provide local soil quality data. Sampling intensity may be adapted based on the level of preexisting soil quality data for the area.

6. Present and interpret the soil survey data in a report and recommend salvage depths for (1) soil appropriate for reclamation, and (2) subsoil which could be used in reclamation with soil amendments or as a subsoil.

For reference, soil and landform inventories completed to date for the Mount Polley Mine include:

- Southeast Dump, Boundary Pit and West PAG Projects (2010)
- Wight Pit Rock Waste Dump Extension Project (2006)

- Southeast Pit Project, Wight Pit to Tailings Pond Road, and Southeast Pit to Tailings Pond Road (2005)
- Northeast Extension Project (2004)
- Springer Pit (2001)
- Baseline Soil Survey and Agricultural Assessment of proposed Tailings Storage Facility, Open Pit, and Waste Rock Dumps (1995).

2.2 Soil Salvage

2.2.1 Salvage Materials and Depths

Material to be salvaged is grouped into four types as described below, which should be stripped and stockpiled separately. Delineation of these materials in the field is to be supported by a qualified individual, as described in Section 2.2, however, some general field guidance is as follows.

1. Non-merchantable woody debris is to be salvaged prior to removing soil and stockpiled for use in reclamation (or immediately used in reclamation, if possible). Small woody debris may be stripped with soil and incorporated into soil stockpiles.

2. Soil appropriate for reclamation should be salvaged to the depth pre-determined in the site-specific survey described in Section 2.1; however, as a general guide, soils are to be salvaged to the effective rooting depth.

3. Underlying subsoil is classified as the material between the soil horizons appropriate for reclamation and the soil parent material.

4. Organic soils from wetlands are recognizable by their black colour and “mucky” texture.

2.2.2 Procedure

A qualified individual representing the Environmental Department should train and oversee equipment operators to ensure salvage operations are completed to the specifications described in this Plan.

Non-merchantable coarse woody debris is to be salvaged first and stockpiled (small woody debris can be mixed in with topsoil piles). Organic matter (grass, plants, chipped woody material, etc.) is to be incorporated into the topsoil piles by salvaging plant materials on the surface with the topsoil. To minimize compaction caused by equipment, use single lift operations rather than repeatedly driving over the surface scraping off thin layers. With a single pass, a bulldozer or backhoe can push the soil into a pile or windrow for storage or for loading into a truck by an excavator or backhoe for transport. If suitable soil is still visible after the initial scraping (this can generally be identified by the presence of roots), another pass will be required to salvage all soil materials appropriate for use in reclamation. Soil inventory and strata delineation information collected prior to salvaging will guide the stripping depths and are to be verified in the field by the Environmental Department representative overseeing salvage operations. Desired volumes of subsoil material are to be stripped in a second lift and stored in separate stockpiles from the topsoil.

Soil should ideally be handled when it is in a loose friable state; operations are to be ceased if the soil is too wet or dry to prevent degradation of its physical structure. If wet soil is sticking to the equipment, wait until the soil has dried. Conversely, if the soil is dry and hard to handle resembling flour, wait until the soil is wetted through precipitation (or active methods, such as sprinkling). In addition, stripping should be ceased in high wind events, if the wind is mobilizing soil as it is being handled. Scheduling stripping work to avoid wet and dry months (e.g., freshet and late summer, respectively) can reduce the risk of having to temporarily stop operations. It is possible to strip in winter months and freezing conditions decrease

compaction of the soil being handled, however, snow should be removed prior to stripping and should not be incorporated into soil stockpiles.

2.3 Soil Stockpiling

When possible, it is preferable for soil to be directly applied for reclamation, allowing microbes and viable seeds to remain in the soil. If this is not possible:

1. Carefully select the storage location because once stockpiled, the soil should not be disturbed again until it is used in final reclamation. Minimize exposure to wind, southwest sun, and water/flooding. To minimize risk of sedimentation of natural water courses, stockpiles should, where possible, be located upstream of site water collection ditches.

2. Stockpile the soil in a manner that maximizes surface area and minimizes soil depth. When possible, the maximum depth should be the height of a pile dumped from a haul truck (~2.5m).

3. Promptly seed stockpiles with the custom MPMC native grasses and forbes blend or, in areas where invasive plant establishment is a concern (i.e., seed sources are present nearby), the custom MPMC aggressive seed mix. Both seed mixes are certified weed free. Revegetation will help to mitigate wind and water erosion, reduce risk of weedy species ingress, and maintain microbial activity.

4. Take a representative sample of the stockpile to assess soil quality, as per the procedure in Appendix A.

5. Place signage on the stockpiles to avoid accidental disturbance.

6. Enter stockpile construction date, soil type, location, and soil volume into the Soil Stockpile Inventory spreadsheet and associated GIS map file. Document seeding in the Environmental Department Reclamation Field Book.

7. Add stockpile locations to site maps and plans for Mine Operations to avoid disturbance or loss of stockpiles.

2.4 Soil Stockpile Inspections

Inspection of soil stockpiles is to be completed annually. For each soil stockpile, the following information should be documented: date; photo number (if a photo is taken); percent vegetation coverage; percent invasive plant coverage; species present; signs of erosion and/or sedimentation; any erosion prevention works; and any additional comments or observations. Where possible, inspections should be completed in the summer months when vegetation is actively growing and easiest to identify.

Results are to be reviewed and any stockpiles exhibiting erosion and/or poor vegetation coverage are to be added to MPMC's bi-annual seeding list for re-seeding in spring or fall when weather conditions are most appropriate for seeding. Alternative options for more significant erosion may be implemented, as per the MPMC Sediment and Erosion Control Plan, such as berms or silt fences. Occurrences of invasive species are to be managed as per MPMC's Invasive Plant Management Plan. If a stockpile has been seeded twice, and still exhibits low vegetation cover, alternative vegetation options can be investigated, including:

- Amending the soil with compost tea or compost;

- Hydroseeding with a mulch/tackifier mixture designed for poor soil and/or steep slopes;

- Installation of horizontally placed logs to act as catch berms and retain moisture;
- Development of a seed mixture specifically designed for poor quality soils;
- Planting with primary successional shrubs. Willow and cottonwood can be planted using bioengineering techniques, such as live stakes and wattles, for additional erosion control.

2.5 Soil Amendment

Recommendations for amendment of soils to be used in reclamation are based on results from a site soil stockpile quality assessment conducted in September 2013, as well as results from ongoing reclamation research and progressive reclamation. Soil amendments may include biosolids and fertilizer, and recommendations for use are detailed in the site Reclamation and Closure Plan. Results from the September 2013 assessment are presented in Appendix B.

If biosolids are used as a soil amendment, they can be mixed with the soil prior to application to ensure thorough mixing and to reduce compaction caused by the dual application of soil followed by biosolids.

2.6 Soil Application

Soil should be replaced to the depths specified for that Mine site unit in the site Reclamation and Closure Plan or research trial design.

To reduce compaction, soil placement should only occur under appropriate moisture conditions. Work should be stopped under wet conditions (i.e., if the soil is sticking to the equipment) and very dry conditions (i.e., if the soil resembles flour). In addition, equipment traffic on the reclamation area should be minimized. This can be done by working systematically and planning access routes so equipment do not have to pass over completed areas, and, if applicable, equipment can do multiple tasks at a time (e.g., site preparation and placing of coarse woody debris).

Site preparation of placed soil should be conducted to create increased microtopography, which reduces erosion and provides more diverse plant microsites, including microsites with improved moisture retention. Site preparation methods are described in detail in Appendix C.

If woody debris is not already incorporated into the soil being placed, it should be applied onto the soil surface concurrently with or following site preparation. Even if woody debris is already in the soil, it may be desirable to place additional coarse woody debris as habitat features or for erosion control. Woody debris can help create more diverse microsites and habitats, retain moisture, contribute to long-term soil organic matter, and improve catch of native seeds. Recommendations for coarse woody debris application are:

- Create occasional pyramids or stacks of multiple pieces of woody debris to create more complex habitat structures and vertical structure.
- Lay logs horizontally across the slope, so they’re more likely to stop the flow of water and erosion. This is especially helpful if logs are placed downslope of depressions to help them retain soil and organic matter.
- Mix tree species of the debris, where possible, as different species decompose at different rates, staggering the release of nutrients for vegetation.

If coarse woody debris is not available or only in small amounts, boulders or rock fragments can be placed in piles and individually. Although rocks are not a source of nutrients over time, similar to woody debris they can increase moisture retention, promote plant microsite diversity, provide habitat, and reduce soil erosion.

Following soil application, the site should be inspected and test pits dug to verify that the target soil depth was achieved across the site (accounting for the variability associated with site preparation).

3 Reporting

The following information will be submitted to the MEM, as well as the BC Ministry of Environment, each year in the MPMC Annual Environmental and Reclamation Report:

- An update of soil management and handling activities, including erosion and sediment control measures, and soil replacement depths on reclamation sites;
- An updated soil stockpile inventory, including stockpile volumes and locations;

MPMC also is required to submit an updated Reclamation and Closure Plan to MEM every five years (at minimum), as well as with all major permit amendment applications for changes to the mine plan. The Reclamation and Closure Plan is to include an updated material balance to verify that sufficient quantities of suitable soil are present to reclaim existing and planned disturbed areas to the recommended prescriptions (i.e., soil depths) for meeting land capability objectives. Contingency options are to be assessed if sufficient volumes of suitable soil may not be available.

4 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Coordinator):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan.
- Be aware of high level mine planning, to ensure that soil characterization and stripping supervision are incorporated into plans.
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including soil baseline characterizations, overseeing stripping operations, annual inspections, seeding, and reporting.
- Ensure that individuals conducting soil characterization surveys, overseeing soil stripping, and inspecting soil stockpiles have appropriate training.
- Ensure that this Plan is routinely updated to reflect changes in site conditions and procedures, and that the revised plan is submitted to MEM in the Annual Environmental and Reclamation Report and/or a Reclamation and Closure Plan update.

Qualified individual overseeing salvage operations (likely an Environmental Technician/Technologist):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Coordinate with and supervise Mine Operations to ensure soil handling and management procedures are followed during stripping operations.

- Maintain an up to date soil stockpile inventory and provide a soil management update in the Annual Environmental and Reclamation Report, as directed by the Environmental Superintendent.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances that will require soil salvaging. Work with that individual to ensure that the soil is characterized prior to stripping and a qualified individual is present to oversee salvage operations.
- Assign appropriate equipment for handling soil.
- Work with the Environmental Superintendent or designate to assign areas for soil to be stockpiled or directly placed.
- Ensure that all material suitable for reclamation is stripped prior to expansion of mine works.

Mine Operations Supervisors:

- Coordinate with the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist).
- Only allow operations to proceed when weather and soil moisture conditions are appropriate.
- Notify the General Foreman and qualified individual overseeing the salvage operation of any concerns that arise and address these concerns prior to proceeding with the work.

Mine Operations Operators:

- Follow instructions from the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist) and Mine Operations Supervisors.
- Clarify uncertainties or address any concerns that arise with the Mine Operations Supervisor and/or qualified individual overseeing the salvage operation prior to proceeding with work.

References

Meister, R. 2001. Springer Pit Soil Survey. Prepared for Mount Polley Mining Corporation. April 2002.

Meister, R. 2004. Northeast Extension Project Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. July 13, 2004.

Meister, R. 2005 Southeast Pit Project Wight Pit to Tailings Road Southeast Pit to Tailings Pond Road Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. June 6, 2005.

Meister, R. 2006. Wight Pit Rock Waste Dump Extension Project Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. September 25, 2006.

Meister, R. 2010. Southeast Dump, Boundary Pit and West PAG Projects Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. October 24, 2010.

MoE (BC Ministry of Environment). 2010. Field Manual for Describing Terrestrial Ecosystems in the Field – 2nd Ed. Land Management Handbook 25. Victoria, British Columbia: Crown Publications Inc.

Appendix A: Soil Stockpile Sampling Procedure

When taking soil chemistry samples from stockpiles, the following procedure is recommended:

1. Take a photo of the stockpile to document characteristics, including size and vegetative cover.

2. For each sample, use a new (clean), plastic sample bag.

3. Collect a composite sample from a minimum of three locations that are representative of the different sections of the stockpile. Record the GPS coordinates for each location.

4. If the stockpile has recently been created (within one year), samples can be collected from the surface. If stockpiles are older, at each sample location dig a profile using a shovel or mini back-hoe to greater than 1m (from all surfaces of the stockpile). Take a sample from 0.1 to 0.2m and 1.0m depths (this encompasses the more biologically active surface soils, as well as less active soils at depth). Ensure that equal volumes are sampled at every location and depth so that the composite is representative. The minimum total sample volume is approximately 500ml.Label each sample with a unique sample ID and the date.

5. Document sample collection in the MPMC Environmental Department Reclamation Field Book, including date, sample ID and description, collector, and any additional relevant observations or details.

6. Store samples in the refrigerator until ready for shipment to the lab (typically ALS Environmental in Burnaby, BC). Ship in coolers with ice packs within the time frame required to meet lab hold times.

7. Request lab analysis for parameters including, but not limited to:

    - Moisture content
    - Texture
    - pH
    - Electrical conductivity
    - Total nitrogen
    - Available phosphorus
    - Organic matter
    - Micronutrients including sulphur and potassium

Appendix B Soil Stockpile Sample Results

Methods

Soil samples were collected on September 3, 2013 from 23 soil stockpiles across the Mount Polley Mine site. At each stockpile three profiles representing variability across the stockpile were dug to greater than 1m with a mini backhoe. Equal volume samples were collected from 0.3m and 1m depths at each of the three locations and all samples from each stockpile were composited in a clean, labeled plastic sampling bag. Samples were stored in a cooler with ice upon collection, and then transferred to a refrigerator for storage until shipping. Samples were shipped in coolers on ice to ALS Environmental in Burnaby, BC, then were subsequently transported to the ALS Environmental Saskatoon laboratory for analysis. Fertilizer recommendations were generated by ALS, using wheat growing at 36 bushels per acre as a proxy.

Results

Results are presented in Tables B. 1 – B.3. General findings based on analytical results are:

- pH has increased from a baseline average of approximately 5.5 to between 6 and 8.
- Soil is deficient in nitrogen.
- Soil has marginal to deficient phosphorus and organic matter levels.
- Soil is marginal to deficient for potassium levels; however, concentrations are similar to levels in baseline soil samples.
- Micronutrients levels are sufficient for copper, iron, manganese, and zinc.
- Micronutrient levels are marginal to deficient for boron and chloride.
- Nutrient loss increases with stockpile storage time.

Soil Amendments

Direct application of stripped soil helps maintain soil microbial communities, native seed viability, and nutrient levels. When using stockpiled soil, incorporation of woody debris and other organic matter and including nitrogen fixing species in revegetation prescriptions are methods for rebuilding deficient nutrient pools. Soil amendments can also be used for improving levels of nutrients in which soil is deficient. Based on laboratory agricultural recommendations for grass cover:

- Average nutrient requirements to meet target nutrient levels of stockpiled soil are: 52 mg/kg of nitrogen, 13 mg/kg of phosphorus, and 19 mg/kg of potassium, which corresponds to a need for 61.9-15.7-22.5 (nitrogen-phosphorus-potassium) fertilizer at 187 kg/ha.
- Average micronutrient requirements to meet target nutrient levels are 0.2 mg/kg of boron and 7 mg/kg of chloride.

MPMC has historically accepted biosolids from Metro Vancouver for use in reclamation. Typical biosolids (Attachment 1) contain sufficient levels of potassium and phosphorus to ameliorate deficiencies identified in the 2013 soil sampling results. Routine biosolids assessment does not test for boron or chloride; however, these results show that in general, metal and anion levels are elevated. Biosolids also contain

an average of 11 mg/kg of Nitrate-N, which provides more than a six-fold increase over the average soil stockpile concentration of 1.7 mg/kg.

These results are to be incorporated into reclamation prescriptions in the MPMC Reclamation and Closure Plan, which include recommendations for use of soil amendments. Recommendations should be supported by site research and mine reclamation best practices, which will provide guidance on when soil amendments are necessary, and what types and quantities to use. This should include long-term considerations, as soil amendments may only provide a short-term nutrient source.

Table B.1 Soil stockpile sample soil characteristic results

Location	Soil Climatic Zone	Texture	pH (1S:2W)	EC (1S:2W - mS/cm)	EC (Calc. Sat Extr - mS/cm)	Salinity Rating	Organic Matter (%)
Mill Site	Dark Gray	Clay Loam	6.8	0.1	0.2	Non Saline	2.2
SERDS	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	4.4
SEZ 2	Dark Gray	Loam	6.5	0.3	0.7	Non Saline	6.4
Perimeter Embankment 1	Dark Gray	Clay Loam	6.4	0.2	0.4	Non Saline	4.4
PAG Dump	Dark Gray	Clay Loam	7.1	0.3	0.7	Non Saline	3.2
NW Sump Road	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	1.7
North Bell Dump Till	Dark Gray	Clay Loam	8.3	0.2	0.4	Non Saline	0.9
Springer North	Dark Gray	Clay Loam	7.9	0.1	0.2	Non Saline	1.0
North Bell Dump Top	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.6
Access Road km 12	Dark Gray	Clay Loam	7.6	0.1	0.2	Non Saline	1.5
EAST RDS	Dark Gray	Clay Loam	8.0	0.1	0.2	Non Saline	1.3
Ore Switchback	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	3.6
NEZ Dump	Dark Gray	Clay Loam	7.0	0.2	0.4	Non Saline	2.5
Highway to Heaven	Dark Gray	Clay Loam	6.9	0.2	0.4	Non Saline	2.6
Wight Pit Till	Dark Gray	Clay Loam	7.7	0.3	0.7	Non Saline	0.9
Wrap Around Road	Dark Gray	Clay Loam	7.4	0.2	0.4	Non Saline	1.9
Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	3.3
Perimeter Embankment 2	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	3.8
South Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	5.2
Main Embankment	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.2
TSF Corner 1	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	1.6
TRR	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	3.1
Cariboo Stockpile		Sandy Loam	7.5				2.1
AVERAGE			7.0	0.2	0.3		2.7
1995 Test Pits (Average)			5.7		0.2		2.5
1997 Test Pits (Average)			5.3		0.4		4.4
2006 Test Pits (Average)			6.0		0.2		2.8

Table B.2 Soil stockpile sample soil nutrient results

	Soil Test Nutrient Levels (mg/kg)															
Location	**NO_3-N**		**P**		**K**		**SO_4-S**		**Cu**		**Mn**		**Zn**		**B**	
Mill Site	1	Deficient	2	Deficient	79.5	Marginal	12	Sufficient	70	Excess	5.1	Sufficient	0.75	Sufficient	0.2	Deficient
SERDS	1.5	Deficient	>27	Marginal	70.5	Deficient	4	Marginal	1.25	Sufficient	24.7	Excess	1.05	Sufficient	0.2	Deficient
SEZ 2	1.5	Deficient	26.5	Marginal	109.5	Sufficient	>24	Sufficient	82.5	Excess	21.75	Excess	1.6	Sufficient	0.4	Marginal
Perimeter Embankment 1	4.5	Deficient	4	Deficient	53.5	Deficient	19	Sufficient	3.85	Sufficient	55	Excess	0.85	Sufficient	0.2	Deficient
PAG Dump	1	Deficient	13	Marginal	96	Marginal	>21.5	Sufficient	144	Excess	7.4	Sufficient	1.2	Sufficient	0.6	Sufficient
NW Sump Road	1	Deficient	>27	Marginal	91.5	Marginal	5	Marginal	9.8	Sufficient	20.3	Excess	0.85	Sufficient	0.15	Deficient
North Bell Dump Till	1	Deficient	8.5	Deficient	101	Marginal	>21.5	Sufficient	25.5	Excess	5.55	Sufficient	0.7	Sufficient	0.25	Deficient
Springer North	1	Deficient	13.5	Marginal	59	Deficient	3	Deficient	102.5	Excess	5.95	Sufficient	1.1	Sufficient	0.1	Deficient
North Bell Dump Top	2	Deficient	>27	Marginal	75.5	Deficient	>21.5	Sufficient	18.05	Excess	25.95	Excess	0.8	Sufficient	0.15	Deficient
Access Road km 12	1	Deficient	20	Marginal	63	Deficient	3	Deficient	33.35	Excess	6.05	Sufficient	0.6	Marginal	0.1	Deficient
EAST RDS	1	Deficient	3.5	Deficient	45.5	Deficient	4	Marginal	10.4	Sufficient	5.85	Sufficient	0.5	Marginal	0.15	Deficient
Ore Switchback	1.5	Deficient	>27	Marginal	86.5	Marginal	14.5	Sufficient	9.85	Sufficient	21.6	Excess	1.75	Sufficient	0.3	Marginal
NEZ Dump	2.5	Deficient	23.5	Marginal	69.5	Deficient	>21.5	Sufficient	156.5	Excess	7.35	Sufficient	1.7	Sufficient	0.15	Deficient
Highway to Heaven	1	Deficient	13	Marginal	79	Marginal	15.5	Sufficient	92.5	Excess	16.75	Sufficient	0.8	Sufficient	0.15	Deficient
Wight Pit Till	1	Deficient	10	Deficient	60.5	Deficient	>21.5	Sufficient	15.05	Sufficient	4.35	Sufficient	0.85	Sufficient	0.15	Deficient
Wrap Around Road	1	Deficient	8	Deficient	79.5	Marginal	17	Sufficient	60	Excess	6.45	Sufficient	0.85	Sufficient	0.1	Deficient
Till Borrow	1	Deficient	5	Deficient	78.5	Marginal	0.5	Deficient	2.1	Sufficient	16.3	Sufficient	1.1	Sufficient	0.15	Deficient
Perimeter Embankment 2	7.5	Deficient	6.5	Deficient	81.5	Marginal	5.5	Marginal	2.65	Sufficient	7.35	Sufficient	0.8	Sufficient	0.25	Deficient
South Till Borrow	1.5	Deficient	9.5	Deficient	85.5	Marginal	1	Deficient	2.4	Sufficient	65	Excess	0.55	Marginal	0.15	Deficient
Main Embankment	1	Deficient	1	Deficient	76.5	Deficient	12	Sufficient	3.25	Sufficient	12.3	Sufficient	0.4	Marginal	0.15	Deficient
TSF Corner 1	1.5	Deficient	2.5	Deficient	53.5	Deficient	5	Marginal	5.3	Sufficient	14.65	Sufficient	0.3	Marginal	0.1	Deficient
TRR	1	Deficient	9.5	Deficient	54	Deficient	3.5	Deficient	1.25	Sufficient	17.05	Sufficient	2.3	Sufficient	0.3	Marginal
Cariboo Stockpile	<1.0	Deficient	10.1	Marginal	92	Marginal	14.6	Sufficient	491	Excess	910	Excess	93.8	Excess		
AVERAGE	1.7		10.0		75.7		8.2		58.4		55.8		5.0		0.2	
1995 Test Pits (Average)			30.0		73.0				305		778		89		19	
1997 Test Pits (Average)			26.7		99.8											
2006 Test Pits (Average)			27.9		91.0											

Table B.3 Fertilizer recommendations based on soil stockpile sample soil characteristic results

	Fertilizer Recommendations (lbs/ac / kg/ha)											
Location	**N**		**P2O5**		**K2O**		**S**		**B**		**Cl**	
Mill Site	105	117.6	37.5	42	20	22.4	5	5.6	0.25	0.28	17.5	19.6
SERDS	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
SEZ 2	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
Perimeter Embankment 1	115	128.8	22.5	25.2	55	61.6	12.5	14	0.5	0.56	7.5	8.4
PAG Dump	90	100.8	37.5	42	85	95.2	0	0	0.5	0.56	7.5	8.4
NW Sump Road	105	117.6	22.5	25.2	20	22.4	0	0	0	0	7.5	8.4
North Bell Dump Till	105	117.6	17.5	19.6	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Springer North	105	117.6	27.5	30.8	20	22.4	0	0	0.5	0.56	17.5	19.6
North Bell Dump Top	105	117.6	22.5	25.2	85	95.2	12.5	14	0.5	0.56	17.5	19.6
Access Road km 12	100	112	17.5	19.6	20	22.4	0	0	0.5	0.56	7.5	8.4
EAST RDS	105	117.6	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Ore Switchback	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
NEZ Dump	105	117.6	17.5	19.6	20	22.4	0	0	0.25	0.28	7.5	8.4
Highway to Heaven	100	112	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Wight Pit Till	105	117.6	22.5	25.2	20	22.4	0	0	0.5	0.56	17.5	19.6
Wrap Around Road	105	117.6	27.5	30.8	55	61.6	0	0	0.5	0.56	17.5	19.6
Till Borrow	105	117.6	27.5	30.8	17.5	19.6	0	0	0.5	0.56	17.5	19.6
Perimeter Embankment 2	105	117.6	37.5	42	20	22.4	12.5	14	0.5	0.56	17.5	19.6
South Till Borrow	80	89.6	27.5	30.8	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Main Embankment	105	117.6	27.5	30.8	17.5	19.6	12.5	14	0.5	0.56	17.5	19.6
TSF Corner 1	105	117.6	37.5	42	20	22.4	5	5.6	0.5	0.56	17.5	19.6
TRR	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
Cariboo Stockpile						0						
AVERAGE	103	116	26	29	38	42	4	5	0	0.5	14	16

Appendix C: Site Preparation Methods

Surface roughening is a key element for reducing erosion, retaining moisture, and reducing compaction.

Some approaches that can be used are:

1. Ripping (Figure C.1) is used as a soil roughening technique in areas too large to economically roughen with a backhoe or excavator, and is typically best for dry soils. Ripping breaks up compacted layers of soil. Rip soils when they are dry to permit shattering beneath the surface. Ripping guidelines:
    a. Rip to a depth of ~0.5 to 1m (or as deep as possible given the soil texture and coarse fragments).
    b. Make rips contour to the slope.
    c. The distance between rippers should be equal to the depth ripped.
    d. Lift the ripper from the soil every 3 to 6m to allow for some downslope water drainage. Offset drainage breaks in the ripping rows.

2. Trenching can be used for medium moisture level soils. The easiest method is to use a bull dozer and angle the blade to make “horizontal windrows”. Lift the blade every 3 to 6m to allow for some downslope water drainage. Offset the drainage breaks in the trenches.

3. Mounding (Figure C.1) is typically best for wetter sites and can be carried out on slopes or on flat terrain. Mounding can be done with a backhoe or excavator with a digging bucket to create microbasins for extreme surface roughening as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Dig, poke, or push a basin that is ~0.5m deep and has the width of the equipment bucket. This allows the basin to be up to ~1 to 1.5m wide.
    c. Drop the excavated soil on the soil surface adjacent to the basin (on the upslope side if working on a slope).
    d. Create one mound every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope. The frequency can be increased or decreased depending on erosion risk associated with the terrain.

4. Mechanical Screefing (Figure C.2) can be applied on level ground or on slopes and can be utilized in snowy conditions, as this technique reduces the likelihood of incorporating snow into the soil. The results are similar to mounding, but shallower. Mechanical screefing can an be done with an excavator with a digging bucket as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Push bucket into snow and up to ~0.5m into the underlying soil.
    c. Rake bucket downslope ~1m creating a shallow depression with a shallow downslope berm.
    d. Create one screef every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope.



Figure C.1 Mounding (left) and ripping (right) site preparation methods

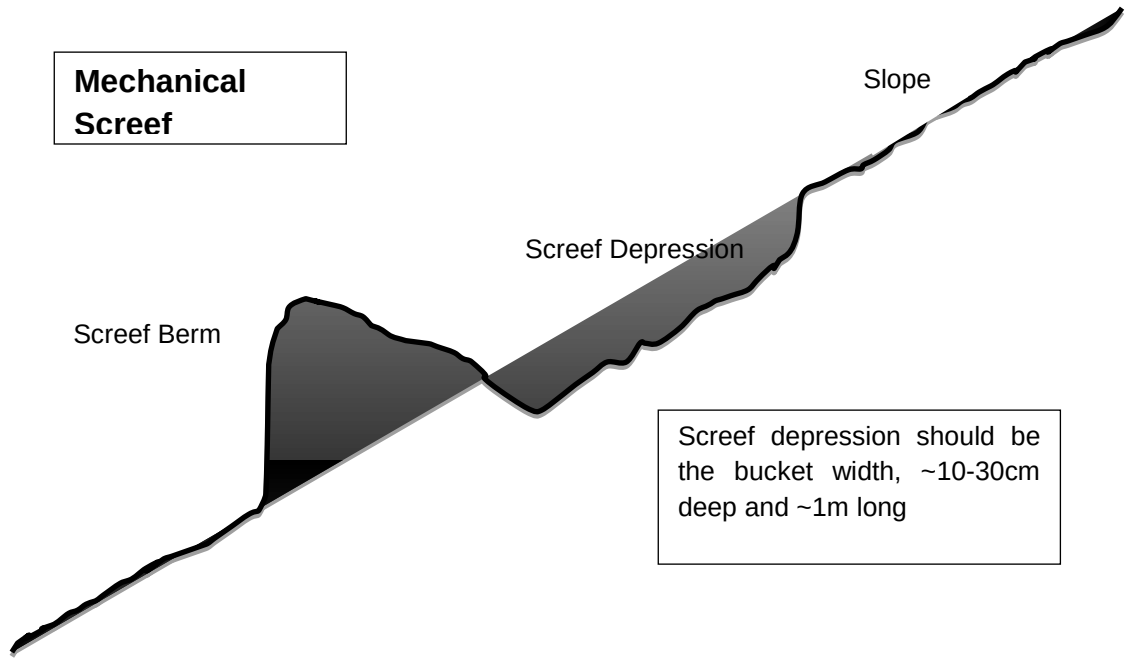

Figure C.2 Mechanical screefing schematic

Attachment 1:
Metro Vancouver Biosolids Composition (2013)

METRO VANCOUVER'S BIOSOLIDS COMPOSITION

	BC Organic Matter Recycling Regulation		Annacis I. WWTP (Routine QC Station)			
			Numbers of Samples Collected	Dewatered Biosolids (Class A)		
				Period:	15-Apr-13	- 15-Oct-13
	Class A Biosolids	Class B Biosolids		Mean	Min	Max
Physical Parameters						
Total Solids (%)			32	26.5	23.4	30.3
Volatile Solids (%)			6	70.3	69.1	72.1
Electrical Conductivity (ds/m)			6	6.07	5.50	6.60
Bulk Density						
pH			6	8.1	7.8	8.4
Macronutrients (mg/kg dw)						
Total Kjeldahl Nitrogen (TKN)			6	52,633	49,400	55,300
Ammonia distillation			6	9,560	9,040	10,100
Nitrate/Nitrite-N			0	0.0	0.0	0.0
Nitrate/Nitrite-N (Available)			5	11.0	11.0	11.0
Phosphorus (Total)			31	24,568	22,600	29,200
Phosphorus (Available)			5	2,680	1,900	3,500
Potassium (Total)			20	1,730	1,550	2,050
Potassium (Available)			5	1,282	1,110	1,470
Calcium (Total)			27	23,756	21,900	25,500
Magnesium (Total)			27	6,132	5,460	6,990
Total Trace Elements (mg/kg)						
Aluminum			27	7,701	6,650	8,730
Arsenic	**75**	**75**	27	5.2	4.0	7.0
Barium			14	318	294	343
Cadmium	**20**	**20**	27	2.4	2.0	3.4
Chromium		**1,060**	27	64	42	99
Cobalt	**150**	**150**	27	4.3	3.7	4.9
Copper		**2,200**	27	894	759	1,030
Iron			27	33,137	28,500	37,600
Lead	**500**	**500**	27	56	36	71
Manganese			27	349	315	395
Mercury	**5**	**15**	27	1.8	1.0	3.2
Molybdenum	**20**	**20**	27	13.9	10.7	19.5
Nickel	**180**	**180**	27	26	18	38
Selenium	**14**	**14**	27	7.0	6.1	9.0
Silver			27	6.8	4.6	9.7
Zinc	**1,850**	**1,850**	27	1312	1090	1550
Bacteriology (MPN/g)						
Fecal Coliform - discrete	**<1,000**		79	125	19	820

APPENDIX 9-3: ML/ARD Management Plan

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

ML/ARD MANAGEMENT PROCEDURE MANUAL

OBJECTIVE

The objective of this Metal Leaching/Acid Rock Drainage (ML/ARD) Management Procedure Manual is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). This document summarizes all the various procedures and considerations related to ML/ARD potential through mine life processes.

DOCUMENT REVISION HISTORY

This document replaces earlier versions of similar documents that directed ML/ARD Management at MPM in response to *Mines Act* Permit M-200 issued on August 3, 1995. This update reflects requirements outlined in the current M-200 Permit, amended May 3, 2023.

Document Update Summary

Revision Date	Author	Comment
June 30, 2016	Chad Cameron Ben Harding Katie McMahen Luke Moger Ryan Brown Stephen Day (SRK)	Original Document
August 04, 2022	Mathieu O'Leary Gabriel Holmes Aaron Zwiebel (DWB) Shauna Litke (SRK)	Added contacts, water treatment plant waste ML/ARD characterization, QA/QC sampling, and PAG misplacement action plan.
October 23, 2023	Mathieu O'Leary Gabriel Holmes	Updated NPR criterion for Springer Deep and WX Zones, and annual blast fractionation confirmatory sampling.

	Alicia Lalonde (DWB) Shauna Litke (SRK)	

KEY CONTACTS AND QUALIFIED PROFESSIONALS

Numerous personnel at Mount Polley are responsible for carrying out the procedures written in this plan. Key mine personnel and their contact information are as follows.

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Any update to this document is reviewed by a Qualified Professional (QP) in the area of practice of ML/ARD management, as required by *Mines Act* Permit M-200 Condition A.5. Qualified professionals reviewing this document are as follows:

Version	Qualified Professional	Phone	Email
June 30, 2016	Stephen Day, PGeo (SRK)	604-862-4097	sday@srk.com
August 04, 2022	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com
October 23, 2023	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com

BACKGROUND

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulfur (e.g., sulfide and elemental sulfur) are exposed

to the weathering effects of oxygen and water. In iron sulphide minerals (e.g., pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid. ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at MPM is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due to the potential consequences of acid generation for long term management of the site, Mount Polley Mining Corporation (MPMC) actively manages waste rock based on its ARD potential as described in the following sections.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for ML. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals, but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at MPM).

UNDERSTANDING OF THE DISTRIBUTION OF ARD POTENTIAL

Like other alkalic porphyry deposits (e.g., Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g., Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPMC geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit.

This ML/ARD Management Procedure Manual applies to waste rock and ore stockpiles. Tailings are consistently NAG due to removal of copper sulphides by ore processing.

MANAGEMENT OF PAG ROCK

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored subaqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit

- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo-Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

DETERMINATION OF ML/ARD POTENTIAL

Waste rock on site is separated into two categories, NAG and PAG, using Neutralizing Potential Ratio (NPR) defined as:

$$NPR = NP/AP.$$

Acid Potential (AP) (in kg $CaCO_3$/t) is measured from:

- Total sulfur (%) x 31.25

Neutralizing Potential (NP) (in kg $CaCO_3$/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate (SRK 2023a).

NPR CRITERION

A site-specific criterion (NPR) of 1.6 was developed by SRK for Springer Deep and WX Zones (SRK 2023b). To derive the NPR*, the stable rate of sulphate release was compared to the relative rate of acid neutralization by calcium and magnesium carbonate minerals, as well as potassium and sodium to account for cation exchange. The data showed a tendency toward consumption of approximately 1.6 moles of calcium, magnesium, sodium, and potassium per mole of sulphate released.

Rock sourced from other zones is defined as PAG when NPR $\leq$ 2.

BLAST FRACTIONATION

SRK was retained by MPMC to refine ABA procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has led to the

development of site-specific ABA procedures for these particular geological zones. An excerpt from the summary report provided by SRK (2023b) is included below.

"Mineral partitioning during blasting can have an effect on the classification of waste rock ARD potential since fines tend to be more reactive. If carbonate minerals preferentially partition into the blast fines, the use of a bulk TIC-NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially partition to the fines."

Review of SRK's results of blast fractionation for the Springer Deep and WX Zones showed:

- No difference in levels of total sulfur in the fine and bulk fraction.
- NP (calculated from TIC) was enriched in the fine fraction compared to the bulk fraction.

SRK (2023b) derived a regression for the NP/AP relationship between the fines and the bulk fraction.

An NPR* of 0.7 in the blast hole cuttings is used to determine dig limits for PAG rock because this is equivalent to an NPR* of 1.6 in the blast fines, which is the reactive component in the rock. For all other rock types, an NPR of 2 in the blast hole cuttings will be used to determine dig limits until a relationship is confirmed.

MATERIAL CHARACTERIZATION OVERVIEW

This section provides an overview of characterization procedures.

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument , allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries, and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Millfeed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

Water treatment wastes are quantified monthly and sampled quarterly, with material characterization performed to assess ML/ARD potential and contribute to a material inventory.

As a confirmatory sampling measure, the Environmental Department takes random weekly grab samples from the NAG waste dump when NAG is being dumped and/or used for construction, to verify that material is being appropriately characterized and handled.

In the event that a confirmatory sample or other activities result in the discovery of PAG material in a NAG-designated area, a QP is to be informed without delay, who will dictate the response actions in coordination with site contacts. Mount Polley is permitted to blend pockets of less than 1,000 t of PAG materials with non-PAG materials at a ratio of 20:1, as described in *Mines Act* Permit M-200 Section D.3.(c)(i)(d). If these conditions cannot be met, it may be necessary to remove PAG material from NAG areas.

Water chemistry monitoring of seepage from rock dumps, water treatment plant wastes, and contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third-party laboratory for metals analysis as an additional source of data for site geochemical models.

IN-PIT SEGREGATION

Blasthole Samples:

1. After the production drill has completed and moved away from the hole, the sample may be taken.
2. Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3. Samples are to be collected in a clean plastic sample bag.
4. The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5. The sample bag is to be tied off using ribbon.
6. In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7. Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1. Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2. The sample is to be dried at 105°C.
3. The sample is then to be crushed in the Primary Crusher.
4. The sample is then to be crushed in the Fine Crusher.
5. The sample is to be split until the sample size is approximately 200 g.

a. Reject from the sample is to be wasted.

6. The sample is then to be pulverized for 75 seconds.
7. The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.
8. If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1. The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the LIMS database.
2. The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3. The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1. Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.
2. Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is included as Figure 1.

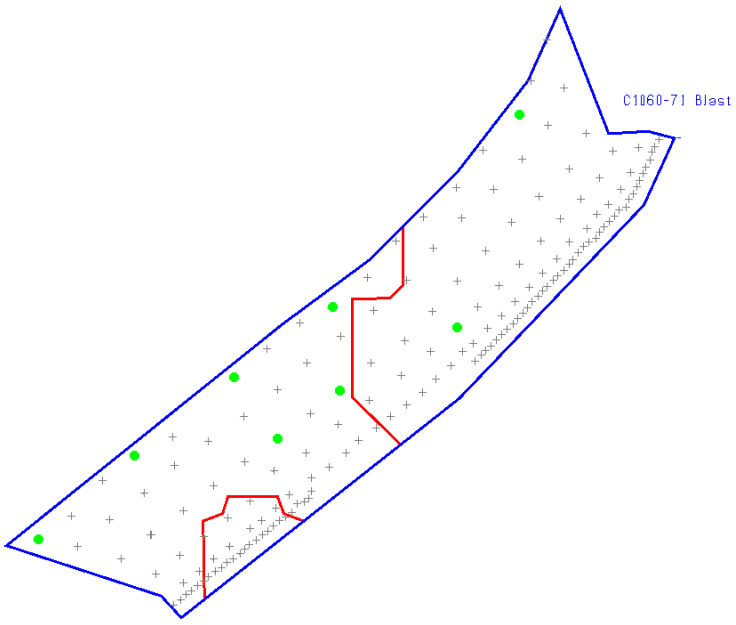

Figure 1: Location of ABA samples (green dots) within a blast. Red polygons denote mill feed ore, remainder is waste. The Ore Control Technician focuses sampling on areas which are designated waste and/or stockpile ore by the blasthole model. Reference blast = 149,173 t.

3. The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1. If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2. The Assay Lab will run the sample through the LECO CS230 Carbon Sulfur Analyzer.
3. Once analyzed, the machine transfers the carbon percentage (C%) and the sulfur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4. The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5. The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1. Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2. Modeling the blast
    a. The software used is MineSight.
    b. The model is based on a 5 metre (m) x 5 m x 12 m block system.
    c. The block closest to the ABA sample will closely match the sample.
    d. The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.
    e. Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
    f. Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.
3. The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor. An example of a sample layout is included as Figure 2.

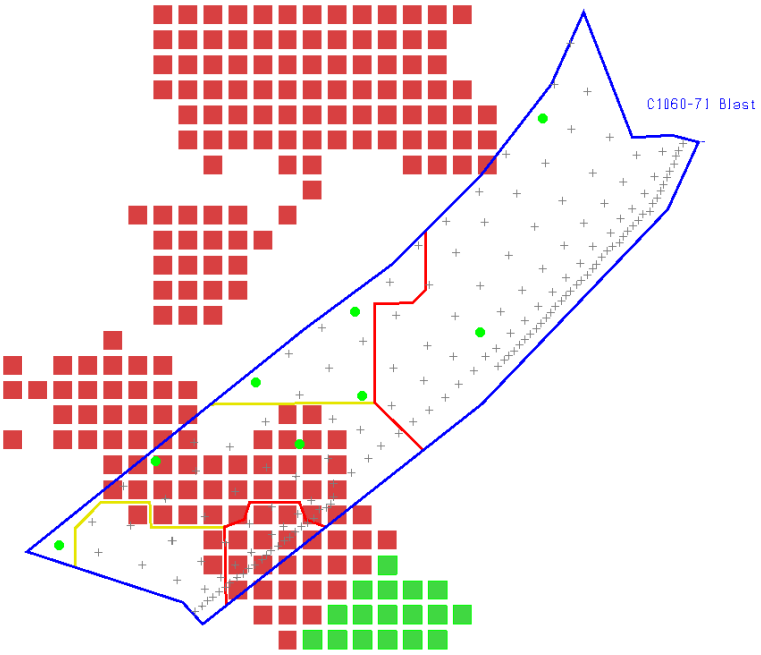

Figure 2. ABA results from samples shown in Figure 1 are used to update the blasthole PAG model item which identifies blocks which meet PAG criteria (red). The Ore Control Technician then marks up the PAG waste (yellow polygon) and the complete ore/waste markup is released to the Surveyor.

Surveyor:

1. The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.

2. Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.

    a. Red Placard = High Grade Ore
    b. White Placard = Super High Grade Ore
    c. Green Placard = Low Grade Ore
    d. Yellow Placard = PAG
    e. Blue Placard = NAG
    f. Pink Ribbon = High Grade Mill Feed Ore

3. Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

MATERIAL HANDLING

Shovel/Haul Truck Operators:

1. The Shovel Operator will mine the rock, following the contacts laid out by the Surveyor.

2. The Shovel Operator will ensure that all material contained within the contact stakes is routed as described by the markup and that any uncertainty in material classification is resolved by seeking the assistance of either the Pit Supervisor or the Engineering Department.
3. Upon loading a haul truck, the Shovel Operator shall direct the Haul Truck Driver as to the material type being hauled, and destination, using a horn sequence. The Haul Truck Driver will then take the material to the designated area.

IN-PIT MONITORING

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC analyzed for total sulfur and total carbon at the Assay Lab to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are summarized in the Comprehensive Environmental Management Plan.

TAILINGS MONITORING

Mill Metallurgy

1. The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    - Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    - The shift composite is then to be added to a monthly composite.
    - At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for ABA total sulfur and carbon analysis.
2. The Environmental Department is to send the monthly tailings composite sample to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion to provide data for site geochemical modelling.

WATER TREATMENT PLANT WASTE

Environmental Department:

1. Record the value on the waste line totalizer monthly when Water Treatment Plant (WTP) data are downloaded.
2. Collect samples of waste which has exited the WTP quarterly to characterize WTP wastes. Samples shall be taken of material that has exited the sludge line, to the West of the WTP and down-flow from where microsand is cycloned for re-use.
3. Sampling Method for liquid wastes (adapted from MPMC-WORK-002):
    - Record in-situ measures: pH, temperature, conductivity, and turbidity.
    - Take a water sample from the pipe outflow and send for lab analysis corresponding with other contact water samples as described in the Comprehensive Environmental Monitoring Plan, including but not limited to: physical parameters, pH, total and dissolved metals.
4. Sampling method for solid wastes (adapted from MPMC-WORK-016):
    - Take a composite sample of solids from the sludge pile adjacent to the WTP, with samples from at least 5 locations on the pile.
    - Send to an external laboratory for total sulfur, total inorganic carbon, elemental analysis by ICP-MS following aqua regia digestion and shake flask extraction testing to assess the ML/ARD potential of solids.
5. Review and archive lab data in a timely manner for use by personnel responsible for the Annual Reclamation Report.
6. The TSS concentration in wastewater will be used along with the waste line totalizer values to quantify the solids delivered to the TSF. The relationship between total and dissolved metals in the WTP waste line sample will be used to quantify the suspended (filterable) metals in this sample.
7. This information will be included in the MLARD materials inventory, and reported to EMLI in the Annual Reclamation Report as per Code Section 10.5.7 on water treatment wastes and by-products.

NAG Material Monitoring

Environment Department

1. As a confirmatory sampling measure, the Environmental Department is to take ABA grab samples from the NAG Dump and any area where NAG rock is used for construction on a weekly basis, while NAG dumping and/or NAG rock construction is occurring. Sampling will conform with MPMC-SOP-016: ABA and Soil Sampling. Two size fractions (+2 mm and -2 mm) will be analyzed for each sample collected. Sieving to be completed by lab once samples have been collected.
2. To assure data quality, as recommended in the BC Field Sampling Manual, a minimum of one in ten samples will be a duplicate sample, as written in MPMC-SOP-016.
3. Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site are summarized in the Comprehensive Environmental Management Plan.

Ore Control

1. As a blast fractionation confirmatory sampling measure, ten samples of blast muck will be collected each year. Blasts to sample will be selected based on mining activities and by targeting a range of sulfur contents.

Response to Finding PAG in NAG Areas

Environmental Department

1. Upon reviewing data indicating PAG material has been found in a NAG area, without delay contact one or more Qualified Professionals listed in this document, and the Pit Supervisor or designate to pass along the relevant data and sampling location.
2. Return to the location where PAG material was discovered and stake the sampling location. Note that material may have been dozed, buried or pushed down the dump face, in which case personnel are to mark as close as possible.
3. At the discretion of Qualified Professionals, undertake additional ABA sampling to assess the prevalence of PAG material.

Pit Supervisor:

1. Discuss NAG/PAG separation with shovel and haul truck operators and investigate the possibility of a loading or dumping mix-up. This is not a punitive activity but meant to identify potential causes and estimate material volume.
2. At the discretion of Qualified Professionals, organize the removal of PAG material from the non-PAG area.

ML/ARD Qualified Professional

1. Work with site contacts to develop an appropriate plan of action to address the situation.
2. If it is not possible to demonstrate that PAG material meets conditions outlined in M-200 Section D.3.(c)(i)(d), it may be necessary to remove recoverable PAG material.

REVIEW OF RESULTS AND PROGRAM EFFICACY

Data collected and corresponding interpretation regarding the ML/ARD program are included in the Annual Environmental and Reclamation Reports (AER and ARR, respectively), due annually to the British Columbia Ministry of Environment and Ministry of Energy and Mines on March 31 of each year, reflective of the previous calendar year. Personnel responsible for the AER/ARR may recommend updates to the ML/ARD program based on operational changes or findings of annual reporting. The AER/ARR include sections on: waste rock characterization and disposal; drainage water quality monitoring; and, updates to long-term predictions (kinetic testing).

REFERENCES

SRK Consulting (Canada) Inc. 2023a. Metal Leaching/Acid Rock Drainage Characterization and Monitoring Program – 2022 Annual Report. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434. March 2023.

SRK Consulting (Canada) Inc. 2023b. Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock - Springer Deep and XY Zones. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434. October 2023.

APPENDIX 9-4: Mine Site Water Management Plan

REPORT

Springer Expansion LOM Plan – Water Management Plan

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

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Reference No. 23590671-091-R-Rev3-31191

May 21, 2024

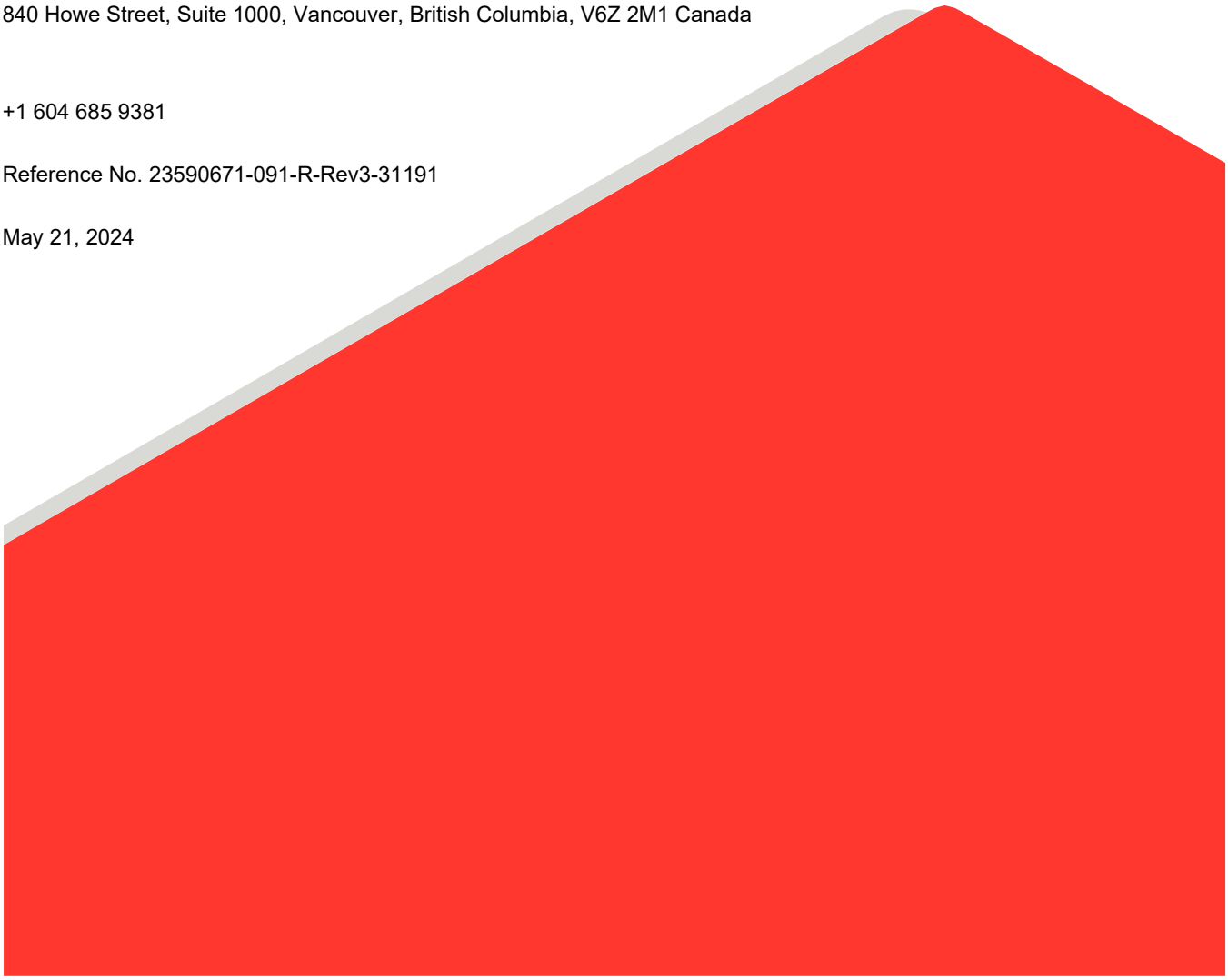

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Executive Summary

Background

The Mount Polley Mine (The Mine, or Site) is a copper-gold mine owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia. As a result of a foundation failure of the Tailings Storage Facility (TSF) in 2014, mining and milling operations were suspended and MPMC did not have a permitted water discharge. An interim restricted operations M-200 permit application was submitted to regulators on March 20, 2015, and approval to resume operations was received on July 9, 2015. Milling operations resumed on August 4, 2015. Tailings and mine contact water were conveyed to and temporarily stored in the Springer Pit until 2016 when the Tailings Storage Facility was repaired and authorized for use under Mines Act Permit M-200 and *Environmental Management Act* (EMA) Permit 11678.

Also in 2016, MPMC submitted a Technical Assessment Report (TAR) to the British Columbia Ministry of Environment and Climate Change Strategy. The TAR provided details of the proposed Long-term Water Management Plan for the Mine, including the discharge quantity and quality for the operations, closure, and post-closure phases of mine life. It included a technical assessment of the effluent discharge during operations to identify whether or not receiving water uses would be impaired, and recommended a preferred discharge approach using an active treatment system and a pipeline discharging treated mine water at depth in Quesnel Lake.

Under Section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley Mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life. If market conditions remain favourable and operations occur continuously, the mine would operate beyond June 30, 2025. Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation (EMLI) and the Ministry of Environment and Climate Change Strategy (BC ENV), with the request to BC ENV being an extension of the discharge period beyond 2025.

This Water Management Plan (WMP) addresses permit requirements for assumed future operations of the site, which at the time of writing are expected to run through March 31, 2031. This WMP also summarizes and discusses predicted water quantity, quality, and treatment during closure (April 1, 2031, through March 31, 2041) and post-closure (April 1, 2041, through March 31, 2131) phases. It should be noted that these dates are expected dates for mining operations; however, as with all mines, such schedules are subject to changes that result from commodity pricing and other factors.

Approach

The timeline for operations and closure has been assumed based on mine planning information available at the time of writing and is subject to change over time. The current Reclamation and Closure Plan (MPMC 2022a) describes the plan for closing the site.

This WMP describes the water management approach for the Site during both operations and closure. The regulatory framework for the Site is described in detail, including a table of concordance outlining how the WMP addresses the Joint Application information requirements. The proposed mine plan is described, including the assumed dates for operation, closure, and post-closure phases for modelling purposes.

Baseline information is summarized for the Site, including geology, climate, hydrology, and the receiving environment water quality (Quesnel Lake discharge via submerged diffuser). A major component of this WMP is a summary of the water balance and water quality models developed for the Mine, including a summary of inputs into these models and a summary of the results. These two models are described in detail in the appended reports (Appendix A and Appendix B). The results of the water balance and quality models provides critical information to define the design basis for water treatment for the site (summarized in this WMP), during operations and during closure/post-closure. An update of treatment technology development for closure/post-closure is also provided.

This WMP also provides discussion regarding remediation of landforms on mine sites during closure and post-closure activities.

Final Design and Technology Development

For the purposes of this revised WMP, the “final design” of the site is defined as the water management infrastructure design in place at closure of the site. During operations, the water management infrastructure (i.e., collection ditches, pipes, sumps, pumps, etc.) will remain in its current configuration. During the remainder of operations, plans will be put in place to develop the final design for water management and treatment into closure and post-closure.

A key component of developing the final design during operations is developing alternative treatment technologies that could be considered for closure of the site. This WMP provides an update on progress on a number of possible treatment technologies included in the water treatment technology inventory.

Study Limitations

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APPENDICES

APPENDIX A
Site-wide Water Balance Model (SWWBM)

APPENDIX B
Site-wide Water Quality Model (SWWQM)

1.0 INTRODUCTION

1.1 Background

The Mount Polley Mine (the Mine, or Site) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake. The Mine location is shown in Figure 1 and the Mine site layout is shown in Figure 5.

MPMC began production at the mine in 1997 and operated until October 2001 when operations were suspended temporarily for economic reasons. In March 2005, the Mine restarted production and it was in continuous operation until August 4, 2014, when a subsurface failure of the Tailings Storage Facility (TSF) foundation resulted in mining and milling operations being suspended. MPMC was subsequently issued with a Pollution Abatement Order (Order #107461) by the BC Ministry of Environment and Climate Change Strategy (BC ENV). Containment infrastructure for collection of drainage from the breached section of the TSF was constructed by September 4, 2014, and all contact water was subsequently directed to and contained within the Springer Pit. This measure was implemented as part of the emergency response and was considered a temporary Water Management Plan to deal with changed conditions arising from the breach.

On July 9, 2015, MPMC was provided approval by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to return to restricted operations for a one-year period using the Springer Pit for tailings deposition and subject to the conditions stated in the M-200 Permit (Mine No. 1101163). On June 23, 2015, MPMC was provided approval by MEMPR to return to normal operations using the TSF for tailings deposition under an approved four-year mine plan as stated in the M-200 Permit.

MPMC had been in care and maintenance since May 31, 2019, which resulted in an extension to the operational period needed to develop the permitted Phase 4 Cariboo-Springer Pit. In addition to this, the results of exploration and strong resource prices have provided the basis for an extended life of mine plan that will result in mining activity beyond Phase 4 Cariboo-Springer Pit, to include additional phases that will expand Springer Pit to consolidate Springer and Cariboo pits adding approximately 8 years to the life of the mine.

For the purposes of this WMP, WSP Canada Inc. (WSP) has assumed that the mine will be in operation until March 31, 2031, followed by a closure phase from April 1, 2031, to March 31, 2041, and a post-closure phase from April 1, 2041, to March 31, 2131. It should be recognized that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations. These are only assumed mine phase dates to allow completion of modelling and should not be considered by regulators as static dates.

MPMC has a permit to discharge treated effluent from the Mine under the *Environmental Management Act* (EMA; SBC 2003) as Permit 11678. The permit was issued on May 30, 1997, and most recently amended through a Consent Order on September 18, 2020. An interim extension to Section 1.2.3 of PE-11678 was granted by BC ENV in 2022, allowing the existing discharge to Quesnel Lake to continue until June 30, 2025. The (2022) TAR provided an update on, among other things, receiving environment data and, in aggregate, provided scientific rationale to support the view that the discharge is not causing pollution. Under Section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life.

Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation and the Ministry of Environment and Climate Change Strategy, with the request to BC ENV being an extension of the discharge period beyond 2025.

Section 2.10 of EMA Permit 11678 requires the development of a WMP that addresses future Water Management Plans beyond the end of 2022 and during mining operations. This WMP seeks to provide a practical plan for managing mine water for the proposed life of mine and to do so in a manner that reflects the requirements of Section 2.10 of the permit, based on information available at the time of writing. It also proposes an implementation schedule and revision process for the WMP.

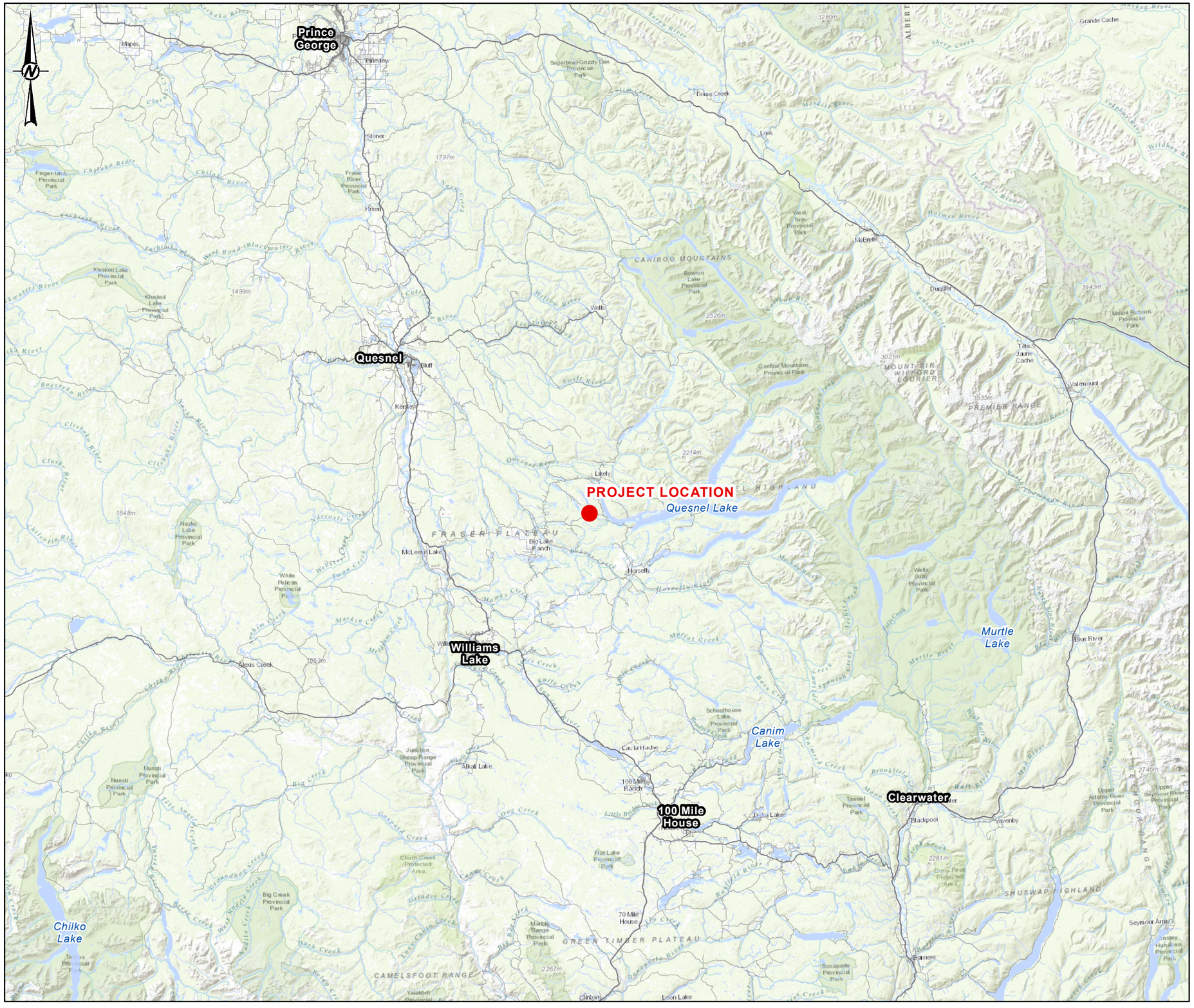

LEGEND

- SITE LOCATION
- ROAD
- WATERCOURSE
- WATERBODY



0 25 50

1:1,250,000 KILOMETRES

REFERENCES

1. INSET MAP DATA OBTAINED FROM GEOBASE®.
2. BASEMAP OBTAINED FROM ESRI. USED UNDER LICENCE, ALL RIGHTS RESERVED.
3. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM IHS INC.
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
LOCATION OF MOUNT POLLEY MINE

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
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1.2 Water Management Approach and Framework

1.2.1 Introduction

This document presents a WMP that addresses water management throughout the future operational, closure, and post-closure phases. This WMP mainly serves to provide support for the joint permit application associated with the proposed Springer Expansion Life of Mine (LOM) Plan.

A Table of Concordance outlining the Joint Application Information Requirements (JAIR) and how this WMP addresses those requirements can be found in Table 1. Sections 1.2 and 1.3 (this report) describe the water management framework, project development process, and the regulatory framework for this document.

A site-wide water balance model (SWWBM) and site-wide water quality model (SWWQM) were developed as part of this WMP (Appendix A and Appendix B) which describe proposed water management quantities and qualities for operations, closure, and post-closure phases of the Mine. A discussion of water treatment during operations and closure/post-closure is also provided, including treatment design bases for these LOM phases.

An additional objective of this WMP is to provide updates on treatment technology development and alternative water treatment strategies that are being explored by MPMC for implementation both in operations and upon closure of the site.

1.2.2 Water Management Approach

The primary approach to water management on site is to separate contact (mine affected) and non-contact (non-mine affected) sources of runoff and seepage. The distinction between the two water sources can be characterized as follows:

- **Contact water:** water that may have come into direct contact with mining or milling activities. This water generally requires management or treatment before release to the environment and is captured by the requirements of PE-11678.
- **Non-contact water:** non-contact water is understood as runoff originating from areas unaltered by mining activity that does not contact mining areas. Such water is not captured under the effluent permit (PE-11678). It is typically diverted to the extent practicable and allowed to discharge directly to the receiving environment.

In 2016, MPMC submitted a TAR (Golder 2016g) describing the water management strategy and configuration for the resumption of normal operations. The main objective of the TAR was to define the water management practices that will help prevent the year-over-year accumulation of contact water at the mine, and to mitigate the potential for unplanned and/or non-compliant releases to the environment. Managing water to prevent a year-over-year accumulation of stored water is also consistent with the advice from the TSF Engineer of Record and from the Independent Engineering Review Panel, both of whom act in roles created under the *Mines Act*. The following strategies were proposed to meet this objective:

- To the extent practicable, reduce the volume of non-contact water collected on site by diverting non-contact water away from mine-impacted areas and from site contact water collection systems.
- Treat and discharge surplus water so that minimal water accumulates from year to year, and infrastructure is in place to store and treat all flows up to a 1-in-10-year 24-hour storm event and withstand all flows up to the 1-in-200-year 24-hour storm event without significant damage.

- Maintain a minimum water volume of 1 million cubic metres (M-m^3) in the TSF for operation of reclaim pumps and a maximum water volume of 1.7 M-m^3, consistent with the Quantitative Performance Objectives for the TSF (Golder 2020b).
- Maintain a minimum of 100 m long tailings beaches at the TSF, consistent with the Quantitative Performance Objectives for the TSF (Golder 2020b).

These strategies assume that there will be minimal storage of contact water on site; however, during freshet (April through June) and storm events, the volume of mine water runoff will exceed the discharge and treatment capacity. Therefore, temporary detention of freshet and storm runoff volume will be necessary to equalize flows prior to discharge.

This WMP, to a large extent, builds on the strategies listed above by validating existing water management practices against applicable regulatory decisions and permit requirements that have come into effect since the TAR was submitted. This has been achieved through a review of the following information:

- Approved and assumed mine plans.
- Water management infrastructure works (e.g., pumps, sumps, channels, ditches).
- Current surface and groundwater monitoring practices.
- Water treatment configuration during operations and closure/post-closure.
- The review of the above information has been facilitated by revisions to the calibrated SWWBM and SWWQM, with appropriate sensitivity to a range of applicable water quality parameters. The water balance and water quality data outputs from the calibrated models have been used to address water management planning for mining operations through closure and post-closure.

1.2.3 Water Management Framework

Figure 2 provides a visual representation of the water management framework used in this WMP, and the subsections that follow the figure describe these concepts in more detail.

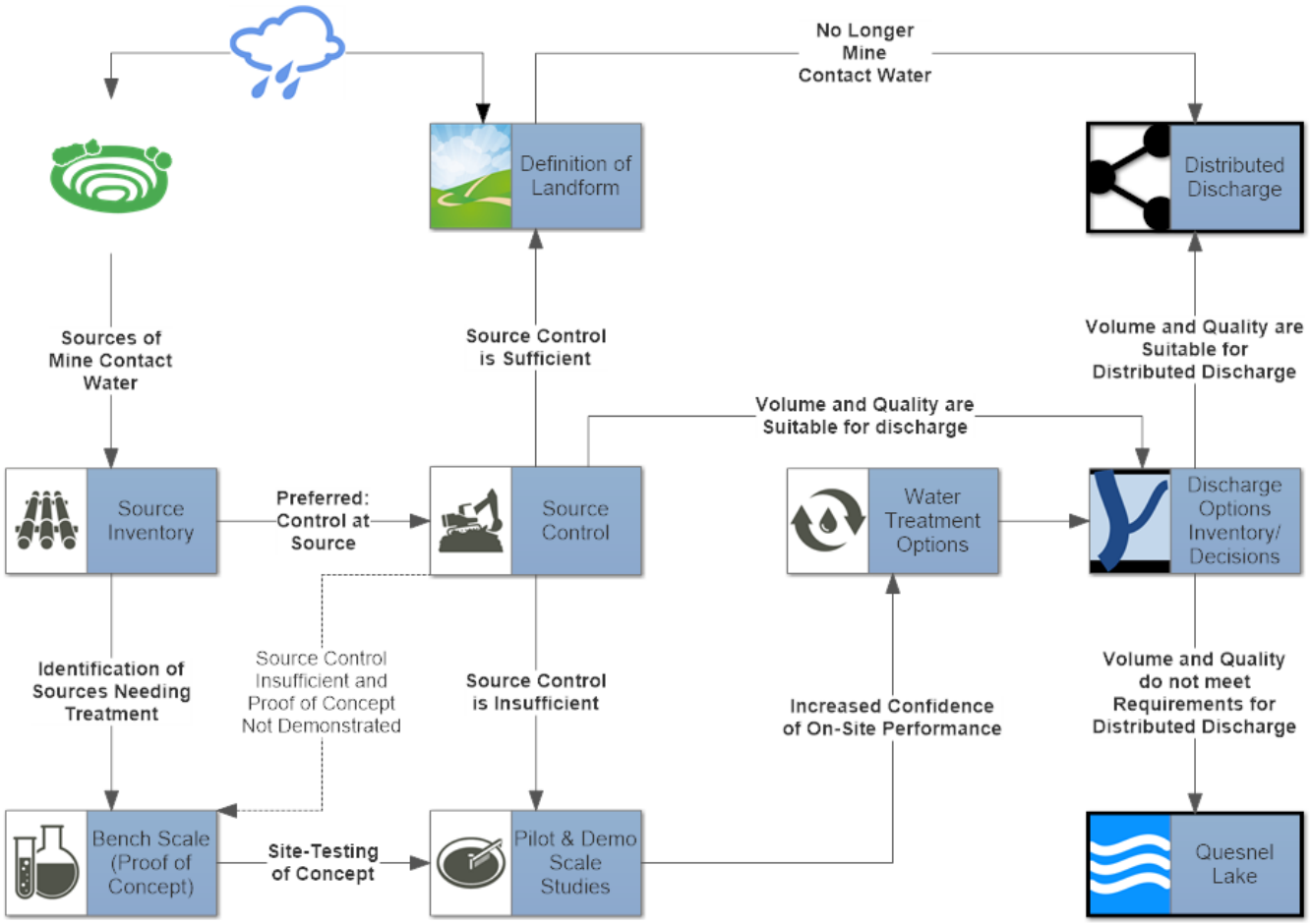

Figure 2: Water Management Plan Framework

Source Inventory

A source inventory has been developed to identify areas of the site that generate contact water. The source inventory includes information on location, modelled or measured flow, modelled or measured water quality, and current on-site collection or discharge locations. This inventory provides a list of sources where water management (i.e., diversion, source control, to other means) or water treatment is required. This has been developed to be a “living database” that will be updated as the Mine layout changes over time, or as the Mine transitions into closure and post-closure.

Source Control

Source control is the preferred approach to managing water quantity and quality. Source control is a preferred option in most waste management hierarchies because it controls risks at their source. Where source control measures are effective in reducing the volumes of mine contact water (i.e., runoff from a reclaimed landform without containing mining materials), then it would be suitable and prioritized for distributed discharge, subject to receiving waterbody or watercourse’s volume and flow capacity. Typically, this latter form of source control would be implemented as part of closure.

Water Treatment

Contact water would require management in accordance with the MPMC's effluent permit and may include treatment using active, passive, or semi-passive technologies. It may also include direct bypass where the water, treated through settling in situ and not through an active treatment system, is found to meet the permit limits.

This is a multi-phase process starting with identifying sources, modelling quantity and quality of water needing treatment, followed by bench-scale, pilot-scale, and demonstration-scale studies to systematically test and demonstrate the viability and feasibility of developed technologies for the Site. The length of time it takes for a specific technology or treatment process to advance from pre-conceptual to the execution stage is typically on the order of years.

Since the TAR was issued, one focus of the water treatment work has been to identify opportunities to treat waters at source through passive or semi-passive treatment options. Passive treatment is being pursued with the desire of it providing a low energy, low-reagent use and therefore low greenhouse gas footprint post-closure treatment method. To that end, several technologies and treatment options have been subject to conceptual level studies and testing trials and updates to this technology development process has been provided in this WMP.

Discharge Inventory

Discharge options for contact water would be decided based on the Best Achievable Technology (BAT; BC ENV 2015) selected, the modelled quantity and quality of treated water expected to be discharged, and the assimilative capacity of the receiving waterbodies. A decision gate would use this information to determine the best choice of discharge options, whether that is a local watercourse or waterbody.

Non-contact water and treated water suitable for distributed discharge would be discharged to site watercourses, subject to volume and quality decision gates and applicable regulatory requirements. The only current permitted treated water discharge under PE-11678 is discharge to Quesnel Lake via submerged diffuser and must show that the concentrations of the water quality parameters in Table 1 of the permit are met at the "Edge of Quesnel Lake Initial Dilution Zone (IDZ)" in Quesnel Lake. This WMP only provides update regarding the Quesnel Lake receiving environment (the assumed discharge location for the remainder of operations); details regarding alternative discharge locations distributed around the Site are discussed in Golder 2020e.

1.3 Regulatory Framework

1.3.1 Overview

This section provides an overview of the applicable regulatory documents and bodies that are relevant to the development of this WMP. The applicable legislation for effluent discharges to aquatic receiving environments in BC includes the provincial EMA, which contains a general prohibition against causing pollution, and the federal *Fisheries Act* (RSC 1985, c. F-14), which contains a general prohibition against the deposit of a deleterious substance into waters frequented by fish (Section 36). What constitutes a deleterious substance is a matter of expert opinion; however, for the purposes of discharges involving a metal mine, which applies to the current effluent discharge permit amendment application, what constitutes a deleterious substance is specifically defined in the Metal and Diamond Mining Effluent Regulations (MDMER; SOR/2002-222).

While this WMP has been prepared in support of MPMC's water management planning and a provincial permit requirement, federal requirements have also been addressed in the evaluations carried out, either through this plan, the 2020 WMP (Golder 2020e), or through the TAR submitted in 2016 (Golder 2016g), because MPMC must comply with both provincial and federal laws.

1.3.2 Environmental Management Act

The EMA is BC's principal pollution control statute with regulations made pursuant to that Act for more specific regulatory purposes. The EMA prohibits causing pollution, and (per subordinate regulation) requires specified dischargers to obtain an effluent discharge permit. Because federal legislation has no effluent permitting system, federal agencies (i.e., Environment and Climate Change Canada and Fisheries and Oceans Canada) utilize the provincial permit process to communicate their specific requirements to the proponent. However, the proponent remains responsible for compliance with the general prohibitions of those federal laws (described further below), notwithstanding the presence of a provincial permit. The amended permit for the effluent discharge falls under the Waste Discharge Regulation (B.C. Reg. 154/2019), pursuant to the EMA.

In the EMA, pollution is defined as "the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment." The common expectations under the EMA are two-fold:

- Acutely lethal conditions should not exist at the point of discharge or within the initial dilution zone (IDZ) of the effluent.
- Chronic sublethal effects should not occur outside of the IDZ. A lack of chronic sublethal effects is reliably predicted when the parameter of concern has a concentration lower than applicable BC ambient water quality guidelines (WQGs) (BC ENV 2016). However, while WQGs are a convenient "first pass" benchmark of pollution, they do not reliably predict the actual presence of pollution. BC ENV offers alternatives to the BC WQGs to provide evidence that pollution has not occurred.

The IDZ is the three-dimensional zone around the point of discharge where mixing of the effluent and the receiving water occurs. For a large waterbody, the IDZ is commonly defined as a cylindrical body of water around the outfall with a lateral radius the lesser of 100 m from the outfall or 25% of the width of the body of water and extending upwards to the surface of the water column. However, the process for delineation of an IDZ is described in BC ENV 2019a and any new discharges would be expected to follow this technical guidance.

1.3.3 Fisheries Act

With respect to the *Fisheries Act*, a deleterious substance is a substance that, if added to water, would degrade, or alter or form part of a process of degradation of that water such that it would likely be rendered deleterious to fish or fish habitat, or the use by humans or fish that frequent that water. The specific properties defining a substance as being deleterious under the parent Act are up to interpretation by experts, except where sector-specific regulations have been developed, such as the MDMER. If a water of a certain quality is determined to be suitable for discharge in accordance with EMA, it is expected (but is also confirmed) that the water is also not a deleterious substance.

Fisheries and Oceans Canada also regulates fish habitat under the *Fisheries Act*. This includes, among other things, provisions for minimum flows; a prohibition against harmful alteration, disruption, or destruction (e.g., such as could occur if a watercourse were overloaded and scoured with too much flow); or the placement of physical structures into fish habitat (e.g., outfall).

1.3.4 Metal and Diamond Mining Effluent Regulations

The MDMER is a sector-specific regulation written under the authority of the *Fisheries Act*. The MDMER includes specific definition of what constitutes a deleterious substance in effluent from a metal mine. The MDMER also contains a requirement to undertake an environmental effects monitoring program. Undertaking an environmental effects monitoring program provides assurances that the technology-based effluent limits specified in the MDMER are sufficient to protect the aquatic receiving environment.

1.3.5 Water Sustainability Act

In BC, legislation of matters relating to the use of surface water and groundwater, and protection of water resources, are governed by the *Water Sustainability Act* (WSA; SBC 2014). The WSA was brought into force on February 29, 2016, replacing the *Water Act*. Five new regulations were introduced under the WSA, consisting of the Water Sustainability Regulation (BC Reg. 32/2023), the Water Sustainability Fees, Rentals and Charges Tariff Regulation (BC Reg. 37/2019), the new Groundwater Protection Regulation (BC Reg. 253/2022), the new Dam Safety Regulation (BC Reg. 32/2023), and the Water Districts Regulation (BC Reg. 38/2016). The Water Sustainability Regulation includes requirements for the licensing, diversion, and use of groundwater and surface water to protect water resources and ecosystems, while the Groundwater Protection Regulation specifically addresses protection of the groundwater resource and identifies requirements for the construction of wells.

MPMC currently holds three surface water licences, specifically:

- 5002458, which authorizes the non-power storage of Hazeltine Creek (500,000 m^3/yr).
- C101763, which authorizes Polley Lake water to be stored (1,000,352 m^3/yr) and used for processing ore (455 m^3/d).
- C111741, which allows Polley Lake water to be used for dust suppression (818 m^3/d) and work camps (36 m^3/d).

With the introduction of the WSA, these licences continue to be valid under the WSA rather than the former *Water Act*.

Section 11 of the WSA requires an authorization for Changes In and About a Stream, which includes a broader definition of “stream” in law than what is commonly understood to be a stream in ordinary use. There are certain activities that are authorized by regulation; however, the need for a written authorization will depend on the specific effluent discharge infrastructure being constructed.

1.4 Table of Concordance

A Table of Concordance serves as the single list of joint information requirements for a *Mines Act* (MA) permit application, issued by the Ministry of Energy, Mines and Low Carbon Innovation, and an effluent discharge permit application under the *Environmental Management Act*, by the Ministry of Environment and Climate Change Strategy. These joint information requirements, and how this WMP addresses those requirements, are listed in Table 1. The WMP and supporting documents are all prepared and/or reviewed by the Qualified Professionals presented in Table 2.

Table 1: Table of Concordance

Joint Application Information Requirements	Requirement Description	Water Management Plan Section
2. Baseline Information		
2.2. Meteorology and Climate	A summary of relevant meteorological and climate information will be provided, based on existing monitoring data. The baseline information will include parameters relevant for the design and construction of the Project, such as precipitation, snowpack, temperature, and evapotranspiration.	Section 3.2.1
2.6. Water Quantity		
2.6.1. Surface Water Quantity	The hydrology baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place.	Section 3.2.2
2.6.2. Groundwater Quantity	The groundwater baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published groundwater datasets. The baseline information will be summarized from data collection programs already in place.	Sections 3.2.3 & 3.2.4
5. Modelling, Mitigation, and Discharges		
5.1. Summary	Qualitative hydrology and water quality assessments of the potential effects of the Project will be provided.	Sections 4.3, 4.4, & 4.6
5.3. Site-wide Water Balance Model	Quantitative model will be updated to reflect new LOM schedule. Updates include revisions to catchment boundaries, storage, and runoff impacted by mine development. Results will include facility level water volume and level projections and estimated discharge quantities from the site. Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.3 (SWWBM) & Section 4.6 (WTP-details)
5.4. Surface Water Quality Model	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.4 (SWWQM) & Section 4.6 (WTP-details)
5.6 Mitigation Methods		
5.6.4. Water Treatment	Information/discussions on the anticipated changes to water quantity and quality as informed by the Surface Water Balance and Surface Water Quality Models, and how these predictions relate to the water treatment effectiveness and capacities will be provided. An update on water treatment technology and research development will be provided in the updated Water Management Plan submitted with the Application. This will include an implementation plan and schedule for water treatment technology development.	Sections 4.3 (SWWBM), 4.4 (SWWQM), 4.6.1 (Treatment Design Bases), & 4.6.2 (Treatment Technology Update)

Table 1: Table of Concordance

Joint Application Information Requirements	Requirement Description	Water Management Plan Section
5.6.4.1. Description	A description of the existing water treatment system will be provided in the Application.	Section 4.1 & Section 4.6.1
5.6.4.2. Location	The location of the existing water treatment system will be provided in the Application.	Figure 5 – Mine Site Layout
5.6.4.4. Treatment Effectiveness	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.6.1
5.6.4.6. Influent and Effluent Quality	Predictions for changes to WTP influent volume and quality resulting from the Project will be provided. Additionally, this section will provide details on proposed mitigation, including WTP capacity, performance, and adequacy in mitigating the discharge.	Section 4.6.1 & Section 4.6.2

LOM = Life of Mine; WTP = Water Treatment Plant.

Table 2: Qualified Professionals List

Name	Accreditation and Number	Section of Water Management Plan Responsible For
Gonzalo Donoso	P.Eng., #211694	Sections 3.2, 4.2, 4.3
Lee Nikl	R.P.Bio., #601	Sections 1.3, 3.2, 4.2, 4.4, 4.5
Jesse Maddaloni	P.Eng., #36620	Sections 1.1, 1.2, 1.4, 2.0, 4.1, 4.6, 5.0
Jacqueline Foley	P.L.Geo., #130262	Section 3.2.3

2.0 PROJECT DESCRIPTION AND MINE PLAN

2.1 Approved Mine Plan

On November 6, 2015, MPMC submitted a *Mines Act* Permit M-200 amendment application (MPMC 2015) to mine the Phase 4 Cariboo-Springer Pit. On June 23, 2016, this application was approved by MEMPR, and an amendment to *Mines Act* Permit M-200 was received by MPMC, approving the return to full operations and use of the TSF. The required approval from BC ENV to resume deposition of tailings in the TSF, as required under EMA Permit 11678, was also received on June 23, 2016 (MEMPR 2016).

The approved mine plan included mining and processing (or stockpile) 27.8 Mt of ore from the Phase 4 Cariboo-Springer Pit over a four-year mine life. The approved mine plan also included transferring 5 Mt of tailings from the Springer Pit to the TSF. The TSF was planned to be constructed to a crest elevation of 970 metres (m; Tailings Coordinate Grid and Elevation Datum) to accommodate tailings transfer from the Springer Pit and new tailings.

MPMC has been in care and maintenance since May 31, 2019. One of the consequences of operational delays has been that planned tailings dam raises have not been constructed to schedule; and, at present, the TSF is only constructed to a crest elevation of 970 mm.

2.2 Mine Plan Beyond 2023

Beyond 2023 the majority of mining will occur in the Springer and Cariboo Pit which is also the focus of the Springer Expansion LOM plan. The current plan has the life of mine concluding in 2031 then rehandled Potentially Acid Generating (PAG) material is placed back into the pit until end of 2033. The open pit mining operation mines on average 6.1 million tonnes of ore and 7.7 million tonnes of waste per annum (peaking at 35.5 million tonnes in 2025). The Springer Expansion which includes Phase 5, Phase 6, C2, WX will supplement ore production into the year 2031. A Life of Mine planned total material moved is presented in the Table 3 below and shown in Figure 3.

Table 3: LoM Waste Mined (t)

Year	Total Wast Mining by Pit Phase (NAG)							Total Wast Mining by Pit Phase (PAG)					
	C2-B/ Car-RR-NAG	WX-NAG	Springer 4-NAG	Springer 5-NAG	Springer 6-NAG	Un-Prod Waste RH	Spr Talls Dump Fill	C2-B/ Car-RR-NAG	WX-NAG	Springer 4-NAG	Springer 5-NAG	Springer 6-NAG	PAG ReHandle
2024			1,090,714	17,263,779		735,262	1,671,460			233,148	921,548		
2025	2,223,438		278,717	21,627,577		843,869	374,554	340,301		35,350	803,264		
2026				22,028,147		725,000	11,627				386,955		
2027				14,094,795	2,385,013	689,769	18,825				398,216	407,957	
2028				1,476,896	11,813,839	827,026	41,901				732	13,015,868	
2029	840,294	1,999,546			8,114,673	756,210	1,912,244	38,380	12,173			11,060,273	
2030		5,817,474			7,383,626	700,000	9,326		2,869,174			6,503,661	
2031		2,391,839			191,651	841,868	4,110		2,346,898			38,382	22,500,000
2032													30,000,000
2033													21,429,209

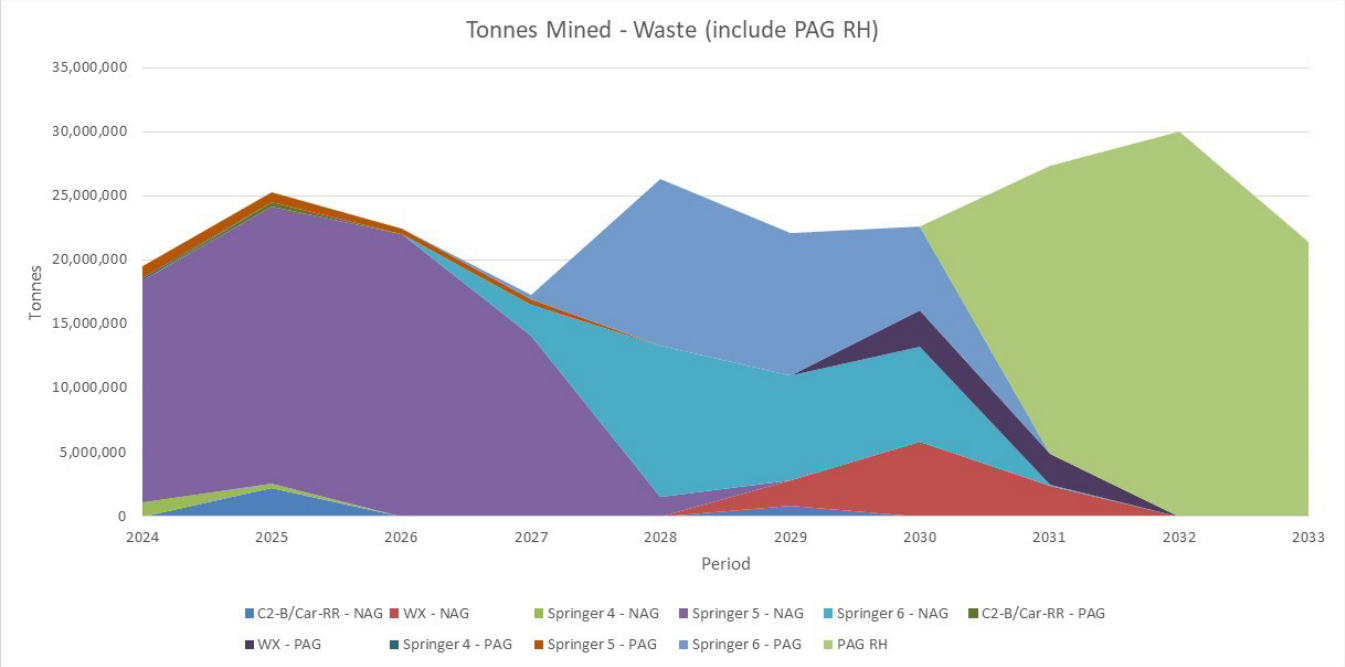

Figure 3: LoM Waste Mined (t)

The ore mined by Pit Phase is presented below in Table 4 and shown in Figure 4.

Table 4: LoM Ore Mined (t)

Year	ORE Above C/O by Pit Phase				
	C2-B/Car-RR	WX	Springer 4	Springer 5	Springer 6
2024			5,733,351	1,326,649	
2025	1,626,030		3,883,659	1,550,312	
2026				5,795,978	
2027				8,131,599	72,751
2028				4,013,289	1,258,489
2029	1,908,094	48,935			550,232
2030		802,009			6,083,558
2031		495,484			1,802,980
2032					
2033					

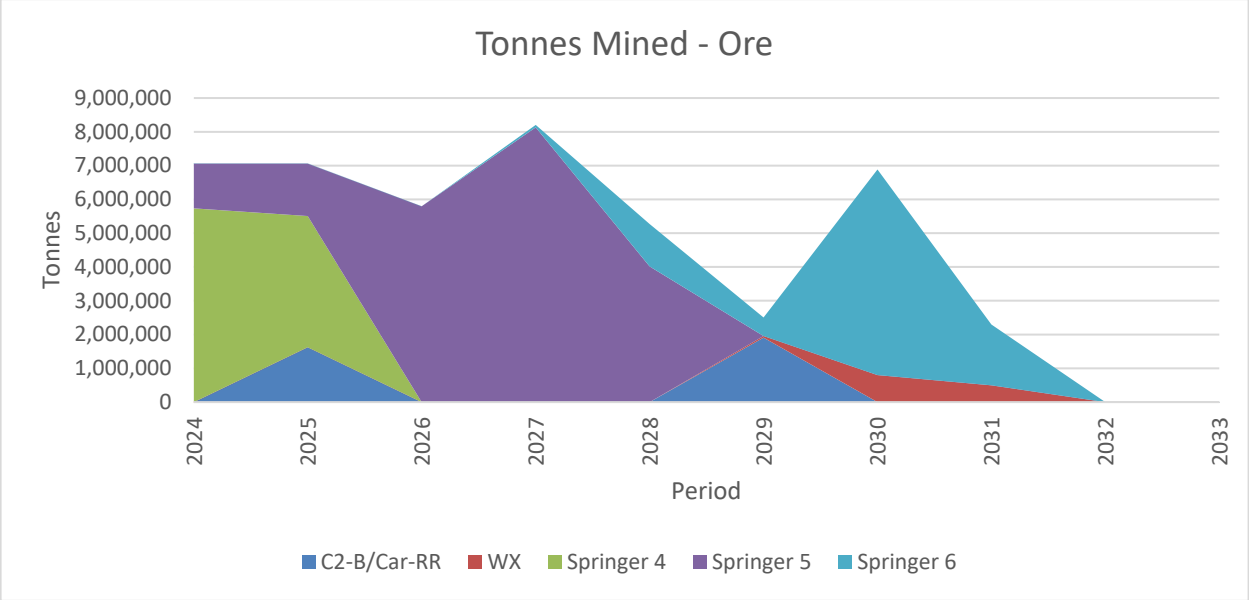

Figure 4: LoM Ore Mined (t)

A summary of the mine development dates for each phase of the LOM plan sub-components is shown in Table 5.

Table 5: Mine Development Schedule

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Springer 4										
Springer 5										
C2-B/Car-RR										
Springer 6										
WX										
PAG RH										

2.2.1 Surface Disturbances

The expansion of Springer Pit will require little stripping or preparation as the area has been previously disturbed mining the Bell, C2 and Cariboo pits. An inventory of areas disturbed to date, and projection of the land to be disturbed up to the projected end of mine life can be found in the Joint Application for the Springer Expansion application.

2.2.2 Pit Dewatering

The Springer Pit is currently mined to Phase 4 at a depth of 928m from surface. Dewatering from the Springer Pit will require establishing temporary sumps in the mine working usually at the lowest working bench. Electric or diesel pumps will convey water to a large sump located in the Cariboo pit. The Cariboo Pit will be pumped to the West collection ditch and then to the Perimeter Embankment Till Borrow Pond.

2.2.3 Assumptions

For the purposes of this WMP, WSP has assumed that the mine will be in operation for an additional mine life of approximately eight years (i.e., from May 2, 2023, to March 31, 2031). Ore will be processed at an average milling rate of 20,000 tonnes per day (tpd). Tailings from processing the ore will be pumped to the Tailing Storage Facility. Mining of the remainder of Phase 4 Cariboo-Springer Pit will require tailings (approximately 2.75 Mt) currently stored in the Springer Pit to be removed.

The TSF crest elevation is currently 970 m and additional TSF raises will continue beyond 2023 with an interim raise to 974 m planned to start in 2023 and then additional raises to the ultimate crest elevation of 987 m. The available tailings volume capacity for the 987 m crest elevation design is 62.8 Mt (based on a feasibility level design of the TSF to a dam crest elevation of 987 m) of which approximately 5.3 Mt has been used up since the resumption of operations in July 2022.

It has also been assumed that the waste rock generated during assumed future operations will be placed within the same footprint of the existing waste rock dumps and that the footprint of the pits will not significantly increase from the current configuration.

It should be recognized that the mine life duration, the production rate, the design of the mine facilities (e.g., TSF) have been assumed for the purposes of advancing this revised WMP and this will be confirmed or adjusted as part of the detailed mine plan being developed by MPMC. Details of the proposed amendments to the existing mine plan are anticipated to be presented in a *Mines Act* Permit M-200 amendment application.

2.3 Project Description

2.3.1 Project Development Phases

This section provides a description of the forecasted future mining phases associated with the Springer Expansion LOM Plan:

- **Future operational phase:** The Mine has resumed operation since June 2022 under the current EMA Permit 11678. The future operational phase is assumed for the period from May 2, 2023, through March 31, 2031, in line with the Springer Expansion LOM Plan. Future operations are anticipated to include the following:
  - Full mining and milling activities will resume, including deepening of the Cariboo and Springer pits (Phases 5, 6, C2, WX).
  - Tailings will be deposited into the TSF until March 2031 (subject to approvals for dam raises in the interim to 974 m and ultimately to 987 m).
- **Closure phase:** will begin when mining is finished and will include closure and reclamation activities as identified in the Reclamation and Closure Plan (RCP; MPMC 2022a) over the period of April 1, 2031, through March 31, 2041.
- **Post-closure phase:** will begin when the closure period is finished and will continue indefinitely. For the purposes of modelling and this WMP, post-closure has been assumed over the period of April 1, 2041, through March 31, 2131 (100 years including the closure phase). Pit lakes will develop in the combined Springer-Cariboo Pit and Wight Pit.

It should again be noted that these mine phase dates are assumed for the general purpose of modelling and that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations.

2.3.2 Future Operational Phase

Under the future operational phase, tailings from milling operations will be discharged to the TSF from May 2, 2023, through 2031.

Outside of the TSF, mine contact water will either flow or be pumped to the SERDS (via West Ditch) and Long ditches, which flow to the Central Collection System (CCS). Water from the CCS reports by gravity to the PETBP, where it will be treated using the Veolia Actiflo system and discharged through the Quesnel Lake pipeline. When the inflows to the CCS exceed the discharge rate (typically during the freshet period), excess contact water will be pumped to the TSF for temporary detention.

Mine water inflows into the TSF will consist of:

- Water pumped with the tailings slurry.
- Precipitation and runoff into the TSF.
- Excess water pumped from the water management structures for temporary storage in the TSF during freshet and storm events.

Stored water in the TSF is reclaimed to meet process requirements. A minimum water volume of 1 M-m^3 is required to accommodate operation of barge pumps during operations. Makeup water would typically be required during dry years and on occasion during the winter. During these discrete periods, makeup water will be sourced from water collection sumps located in pits or other contact water sites.

2.3.3 Closure Phase and Post-closure

The SWWBM includes projection of water management into the closure and post-closure phases based on the Reclamation and Closure configuration update (MPMC 2022a), with adjusted closure dates to match the Springer Expansion LOM plan. The following objectives of the closure and post-closure phases have been identified:

- Long-term preservation of water quality within and downstream of decommissioned operations.
- Long-term stability of the TSF.
- Removal of all access roads, ponds, ditches, pipelines, structures, and equipment not required following mine closure.
- Long-term stabilization of all exposed materials that are susceptible to erosion.
- Establishment of a self-sustaining vegetative cover consistent with existing forestry, grazing, and wildlife needs.
- Natural integration of disturbed lands into the surrounding landscape and restoration of the natural appearance of the area.

As the closure phase ends and the post-closure phase begins, it is assumed that some catchments will produce non-contact water as areas are successfully remediated, and some sump pumping systems are assumed to be decommissioned to allow overflow from sumps and or pits directly into the environment rather than being pumped into the contact-water system for treatment. More details regarding the closure and post-closure assumptions regarding operating or decommissioned water management components within the mine facilities may be found in the Water Balance Model Report (Appendix A, WSP 2023a).



LEGEND

WATER COLLECTION SYSTEMS

- CLEAN WATER DITCH
- CONTACT WATER DITCH
- PIPELINE

0 600 1,200

1:30,000 METRES

REFERENCES

1. PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. WATER MANAGEMENT INFRASTRUCTURE INFORMATION PROVIDED BY MOUNT POLLEY MINING CORPORATION (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

WATER MANAGEMENT PLAN

TITLE

MINE SITE LAYOUT

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31100/31191	0	**5**

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3.0 BASELINE INFORMATION

3.1 Geology

An understanding of the regional and local geology and the geochemical characteristics of the different mine materials (e.g., waste rock, ore) aids in developing an understanding of how these materials will weather, and to identify the processes that will control the release of constituents under ambient conditions. The following subsections (adapted from the TAR) provide a summary of the mine geology and geochemical characteristics that were subsequently used to derive the geochemical source terms (refer to Appendix C of the TAR, Golder 2016g; SRK 2015) for inclusion into the site-wide water quality model (refer to Appendix D of the TAR, Golder 2016g). The subsections of Section 3.1 were written by SRK Consulting (Canada) Inc. (SRK).

3.1.1 Regional Geology

The mine is in Quesnellia, an accreted terrane in the Intermontane Belt of the Canadian Cordillera. Quesnellia is characterized by Triassic to Jurassic volcanic, sedimentary, and mafic to intermediate intrusive rocks formed in a west-facing arc that developed west of the continental margin of ancestral North America. The mine is within the Mount Polley Intrusive Complex (MPIC), situated in the Central Quesnel Belt, a region of Quesnellia roughly between latitudes 51.5° and 53.5°N (Figure 6 and Figure 7). In this area, the arc and a marginal basin immediately to its east were obducted eastwards onto the then continental margin in the late Early Jurassic. Continued crustal shortening in the Middle Jurassic resulted in regional metamorphism and southwest-verging back-folding of the now coupled arc-marginal basin and continental margin assemblages. The mine lies in the core of a broad regional, northwest-trending upright syncline at the western limit of this Middle Jurassic folding. Regional metamorphic grade at the mine is no more than zeolite facies.

Stratified Triassic rocks surrounding the site are assigned to the Nicola Group, the type-area of which is in southern Quesnellia, where the Nicola hosts other porphyry copper deposits such as the Highland Valley, Copper Mountain, and New Afton mines. The arc stratigraphy in the Mount Polley district extends from the Middle and Late Triassic Nicola Group into the Early Jurassic. From the base, the Nicola Group consists of Middle to early Late Triassic sedimentary and minor volcanic rocks, overlain by a thick Late Triassic succession of submarine, trachybasaltic volcanics and related tuffaceous sediments and volcaniclastic breccias. The youngest assemblage, which extended into the Early Jurassic, consists of volcanic, plutonic, and sedimentary rocks representing a more mature stage of arc activity, and more differentiated magmatism, when the MPIC was formed. The youngest arc rocks are polymictic breccia and conglomerate that unconformably overlie the MPIC, and are products of late arc uplift and erosion. In the southern part of the Mount Polley property, Nicola Group country rocks are covered by post-accretion units, including outliers of unnamed Cretaceous sandstone and conglomerate, early Tertiary andesitic volcanic and sedimentary rocks of the Kamloops Group, and Miocene-Pliocene basaltic volcanics of the Chilcotin Group.

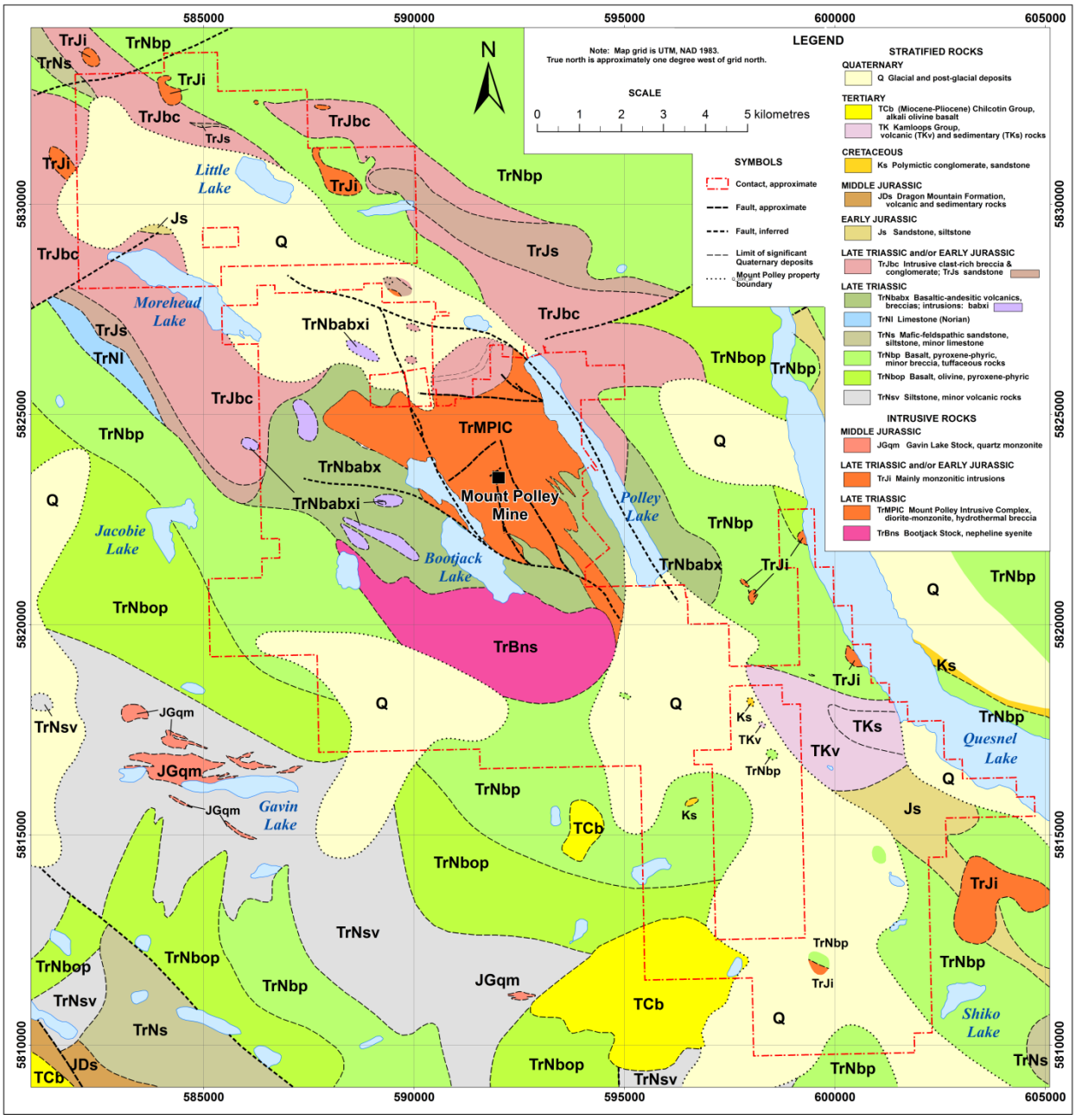

Source: Rees 2013.

Figure 6: Regional Geology of the Mount Polley Property

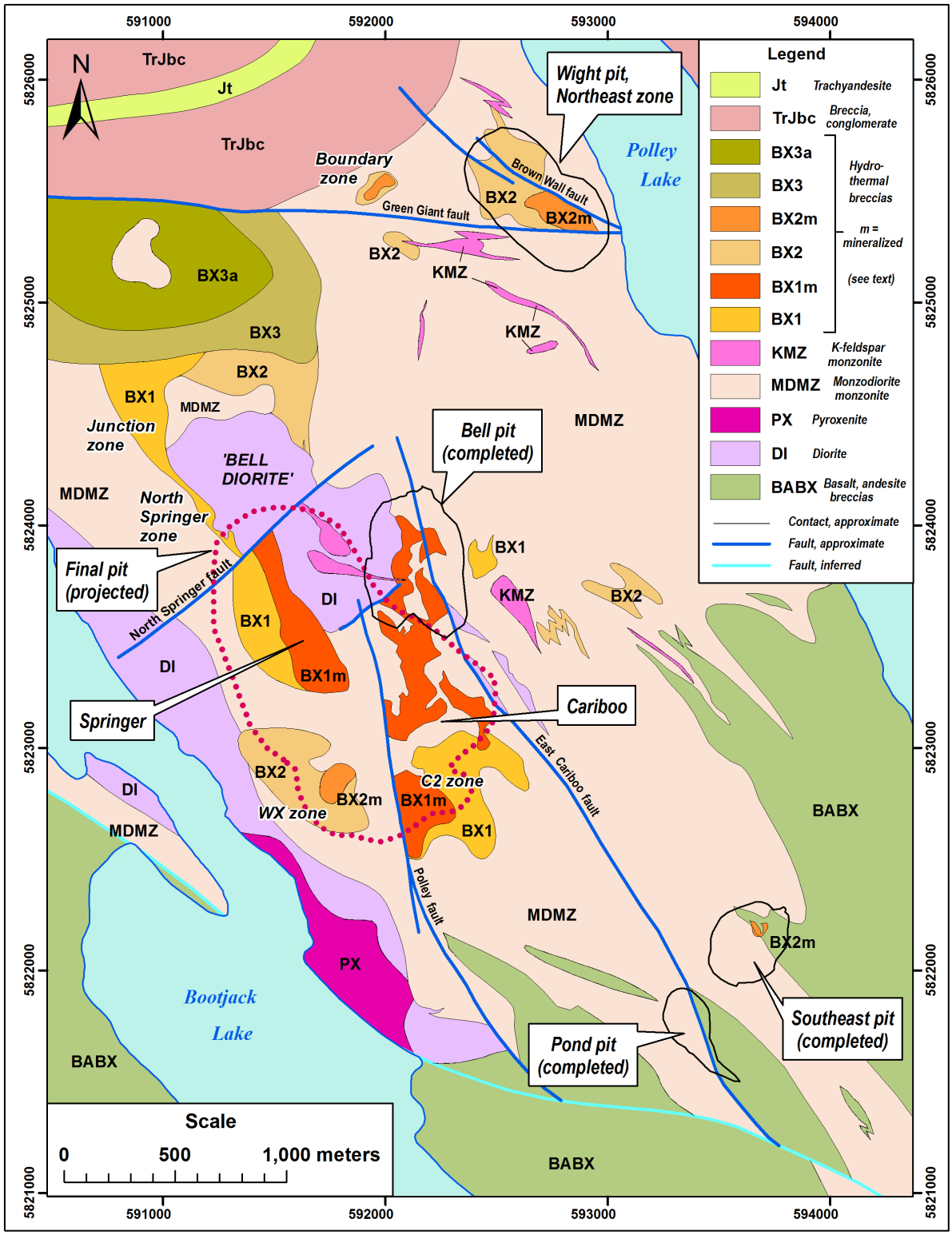

Source: Rees 2013.

Figure 7: Simplified Geology of the Mount Polley Intrusive Complex

3.1.2 Deposit Geology

Geological details of the Mount Polley deposit are found in Rees 2013 and the findings are summarized below.

The MPIC hosts the Mount Polley copper-gold porphyry deposit (Figure 6 and Figure 7). It is a Late Triassic magmatic centre approximately 6 km by 4 km, elongated in a north-northwest direction. It consists of alkalic, marginally silica-undersaturated intrusions and magmatic-hydrothermal breccias. The age of the deposit is approximately 205 million years based on uranium-lead isotopic dating; there is close agreement between age determinations from MPIC intrusions and minerals associated with sulphide mineralization. Mineralization occurs in almost all constituent rock types of the MPIC, and thus occurred late in its formation. Nearly all economic mineralization is in breccias, or in mineralized stockwork veins in adjacent wall rock intrusion. Country rocks of the Nicola Group closest to the MPIC are mafic to intermediate volcanic and subvolcanic coherent rocks, and related breccias, and may form components of mineralized hydrothermal breccias in the periphery of the MPIC.

3.1.3 Metal Leaching/Acid Rock Drainage Geochemistry

Details of the characterization of metal leaching/acid rock drainage potential at the mine are provided in Appendix C of the TAR (Golder 2016g). Findings are summarized below.

The Mount Polley deposit is classified as an alkalic porphyry copper-gold deposit. With the exception of the distinctive small Pond Zone skarn deposit, it has been mined from several mineralized zones (Springer, Cariboo, Bell, Southeast, Northeast, Boundary) with common geological features including mainly a monzonitic plutonic host rock, association with breccia bodies in the intrusion, dominantly potassic hydrothermal alteration, lack of pronounced pyrite haloes, enrichment in copper and selenium relative to global norms, pervasive calcite, and natural oxide alteration. As a result, geochemical characteristics are consistent between zones, allowing a site-wide approach to geochemical characterization.

Potentially acid generating (PAG) and non-acid generating (NAG) waste rock materials occur locally as pyrite zones, but NAG rock dominates. Acid rock drainage potential has been used to segregate waste rock, with NAG waste rock being placed in several waste rock disposal sites and PAG waste rock either deposited in completed pits that are projected to flood at the closure of the mine (in accordance with the management practice of subaqueous disposal), or placed in the Temporary NW PAG Stockpile for final subaqueous disposal in the Springer Pit.

Tailings are classified as NAG based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014 (Appendix C of SRK 2015).

The metal leaching/acid rock drainage assessment was used to inform the development of geochemical source terms for use in the SWWQM. Major geochemical source terms were identified as waste rock stockpiles and tailings. Other sources included backfilled waste rock, ore processing, pit walls, ore stockpiles, and the sulphur and magnetite stockpiles. Source terms were mainly developed from conceptual geochemical models, then interpretation of rock geochemical characteristics and seepage data, rather than scale-up of laboratory kinetic test data. The reader is referred to Appendix C of SRK 2015 for details on the derivation of geochemical source terms and to Appendix D of the TAR (Golder 2016g) and Section 4.4 for how these source terms are applied in the model.

3.2 Climate and Hydrology

3.2.1 Climate

The Site is located 56 km northwest of Williams Lake, British Columbia (BC) near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976).

Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

In 2022, WSP updated the climate baseline data for the Site to include the most recent climate data. The climate of the mine site was characterized in the Baseline Climate Update Report (Golder 2022a) using historical measurements recorded at local climate stations, supported by data collected from five nearby regional Environment and Climate Change Canada (ECCC) climate stations. The baseline climate update report is summarized below, and more details can be found in Golder 2022a.

MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and direction (1997 to 2003). In 2012, this station was replaced with two stations: one near the mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall.

Five ECCC climate stations: Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, were selected to support and extend the long-term climate dataset for the Site due to their proximity to the Site, length of record, elevation range, and concurrent period of record with the local climate stations at the Site. In addition, the ECCC Prince George climate station was added to include an additional station with solar radiation data. Historical records were retrieved from ECCC's Historical Climate Data web server (ECCC 2022a). More recent records were compiled through e-mail correspondence with ECCC staff (ECCC 2022b).

The details of these stations are shown in Table 6. The locations of the mine weather stations are shown in Figure 8.

Table 6: Local and Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[a]	Easting (m E)[a]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[b]
Mill Site Weather Station	5822420	592495	1,118	-	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	-	R, T, RH, SR, E, WS	2012-2021[d]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	-	R, T, RH, SR, E, WS	2012-2021[d]
Likely (1094616)	5828785	599332	724	9	P, R, S, T	1974-1993

Table 6: Local and Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[a]	Easting (m E)[a]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[b]
Williams Lake A (1098940)	5781820	564666	940	50	P, R, S, T, RH, SR	1961-2021[d]
Spokin Lake 4E (1097646)	5782274	589827	1,033	40	P, R, S, T	1983-2021[d]
Barkerville (1090660)	5880996	599515	1,283	59	P, R, S, T	1888-2021[c], [d]
Quesnel A[e] (1096630)	5873987	546720	545	80	P, R, S, T, RH	1946-2021[d]
Prince George A (1096450)	5971423	521103	691	163	P, R, S, T, RH, SR	1973-1995

(a) UTM Coordinate system – Zone 10U.

(b) Length of record from start year to end year may not reflect the number of complete years of data.

(c) Provisional data for the period January 2016 to December 2021 were provided by ECCC.

(d) Station still in operation.

(e) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

ID = Identification; masl = metres above sea level; km = kilometre; P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. The details of these stations are provided in Table 7, and their locations are shown in Figure 8.

Table 7: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[a]	Easting (m E)[a]	Approximate Elevation (m)[b]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

(a) UTM Coordinate system – Zone 10U.

(b) Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

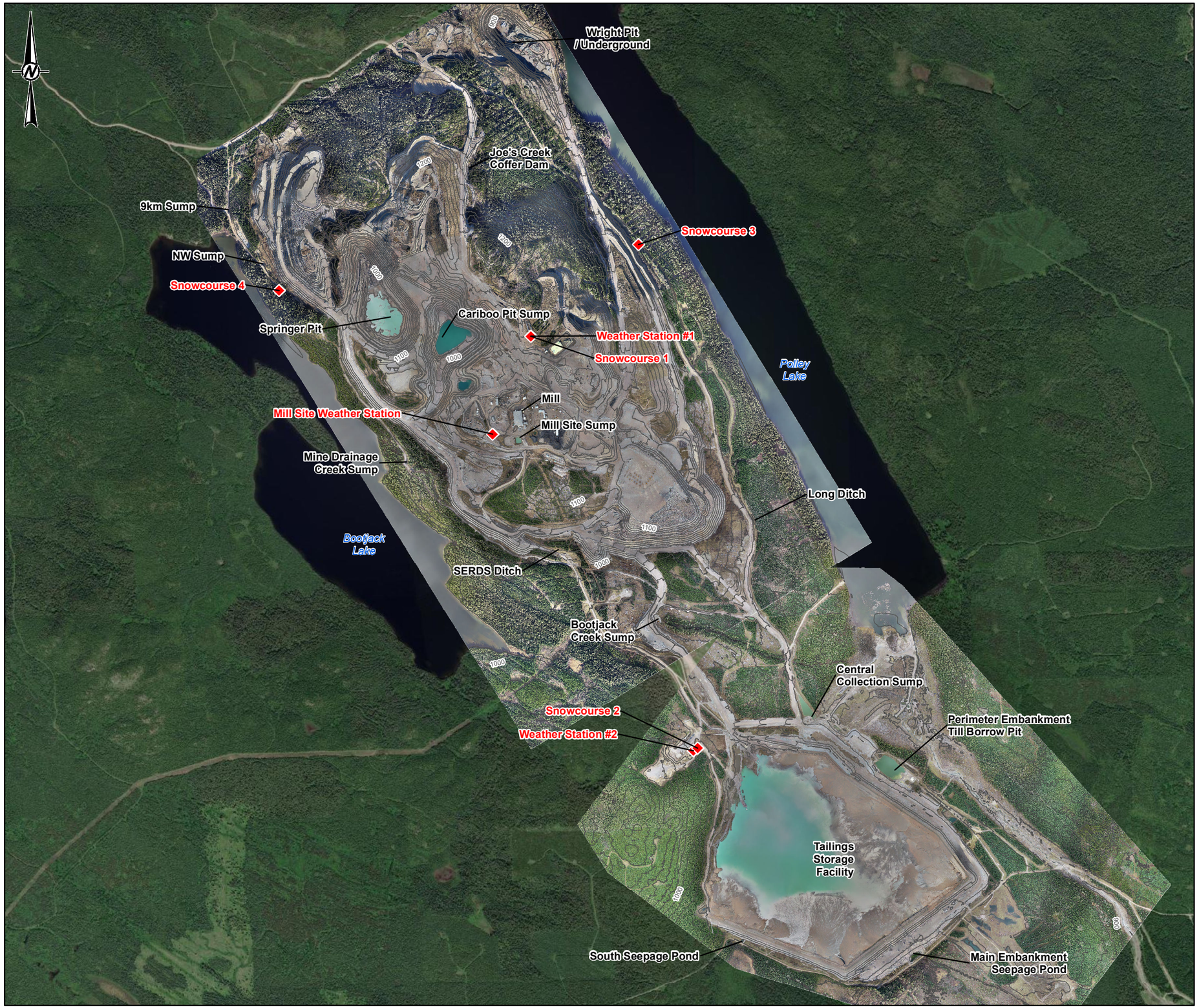

LEGEND

- CLIMATE STATION
- CONTOUR (10m)

0 600 1,200

1:30,000 METRES

REFERENCES

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. CLIMATE AND SNOWCOURSE STATION LOCATIONS OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
MOUNT POLLEY CLIMATE AND SNOWCOURSE STATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
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Air Temperature

Air temperature statistics for the Site were developed using historical data from the nearby ECCC climate station in Likely approximately 9 km northeast of the Site. The historical Likely data set was adjusted to the average elevation of the Mount Polley mine by applying the regional monthly lapse rate (Golder 2022a). Data gaps were infilled using data from the four regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

Monthly and annual air temperature statistics for the Site (1974-2021) are presented in Table 8. The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between -6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively.

Table 8: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**38.1**	**-39.8**

Precipitation

The MPMC precipitation dataset was extended and infilled using the available data record from the five regional stations as described below to derive a daily and 24-hour long-term synthetic precipitation dataset for the Site. The Likely ECCC Station data were used to extend the precipitation record for the Site given the station's length of record and proximity to the Site.

Precipitation data gap infilling was completed following a priority sequence determined by analyzing measured daily rainfall from April to November for all climate stations; it was assumed that precipitation occurring between December and March occurred as snowfall. The regional climate station priority sequence considered the best-fit measured concurrent daily rainfall correlation (Rainfall Correlation), rainfall ranking correlation (Rainfall Rank), and percentage of time rain was recorded on the same day (Concurrent Daily Rain) between the raw data collected at the MPMC climate stations and each ECCC climate station (Golder 2022a).

A precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the ECCC climate stations used to infill gaps. The adjustment was based on the April-to-November rainfall ranking factor of the raw ECCC climate station and Site rainfall records.

The Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Site is estimated to be 612 mm with a standard deviation of 118 mm. Frequency analyses of the derived long-term precipitation time series for the Site were undertaken to generate the variability in monthly and annual precipitation of the Site. Estimated annual wet and dry precipitation depths for a range of return periods are shown in Table 9.

Table 9: Long-Term Precipitation at the Mount Polley Mine Site

Month[a]	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	74.3	66.5	33.2	28.2
February	35.8	54.0	48.3	24.1	20.5
March	29.7	44.7	40.0	20.0	16.9
April	44.7	67.3	60.2	30.1	25.5
May	49.9	75.2	67.2	33.6	28.5
June	70.8	107	95.4	47.7	40.4
July	63.6	95.8	85.7	42.9	36.3
August	50.6	76.2	68.1	34.1	28.8
September	52.3	78.8	70.5	35.2	29.9
October	58.1	87.5	78.2	39.1	33.1
November	49.8	75.0	67.1	33.5	28.4
December	57.6	86.8	77.7	38.8	32.9
Annual Total[b]	**612**	**922**	**825**	**412**	**349**

(a) Wet and Dry Monthly values assumed to follow the same monthly distribution as the Average.

(b) Annual total precipitation depths were rounded to the nearest mm for presentation purposes; therefore, it may appear the sum of the monthly values do not equal the annual total.

Relative Humidity

Relative humidity data are available for the Site from 2019 to 2021 and for ECCC climate stations Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). The MPMC WS1 relative humidity record is more complete than WS2's record; therefore, WS1 data were used for the analysis and infilled with WS2 data where necessary and if available. However, relative humidity data for the Site are insufficient for characterizing long-term climatic conditions of the Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative relative humidity estimate for the Site. A long-term relative humidity time series for the Site was developed using ECCC Williams Lake A data infilled with ECCC Quesnel A data with an adjustment factor of 1.13 and 1.04 (Golder 2022a).

Statistics for relative humidity are presented in Table 10. Mean annual relative humidity is 68.1%. Monthly mean values vary between 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity show little variation from the median indicating the Site experiences relatively constant relative humidity on a monthly basis from year to year.

Table 10: Derived Monthly and Annual Relative Humidity Statistics for the Site (1974-2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

Solar Radiation

Solar radiation data are available for the Site from 2001 to 2003 and 2019 to 2021, and for ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data for the Site are insufficient for characterizing climatic conditions of the Site due to the short period of record, and as the data recorded in 2001 is incomplete and not concurrent with either ECCC climate station. Solar radiation statistics for the Site were determined from the ECCC Williams Lake data. Missing values were infilled by adjusting the Prince George records by a factor of 1.04 (Golder 2022a).

Statistics for solar radiation for the Site are presented in Table 11. Mean annual solar radiation is 135 W/m^2, with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July following the same seasonal pattern for monthly air temperature. The 25th and 75th percentiles show greatest variation in solar radiation occurs in the summer months when solar radiation is greatest during the year, and less variation in winter months when solar radiation is lowest.

Table 11: Estimated Solar Radiation Statistics for the Site (1974-2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

Evaporation

Evaporation monitoring data are available for the Site from 2019 to 2021; however, the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Site. Therefore, a mathematical model (Morton 1983) was used to calculate evaporation and evapotranspiration (actual and potential) for the Site based on the long-term synthetic records for air temperature, relative humidity, and solar radiation. Evaporation is defined as free water evaporation, or the amount of evaporation from open/free water surfaces (i.e., the water is returned to the atmosphere from lakes, ponds, and watercourses). Potential evapotranspiration (PET) is the water loss that occurs from a vegetated natural surface if there is no deficiency of water in the soil for use by vegetation (Thornthwaite 1948). Actual evapotranspiration (AET) is the water loss that occurs from a vegetated natural surface considering the availability of water in the soil for use by vegetation. Estimated monthly and annual shallow lake evaporation, PET, and AET values are provided in Table 12, Table 13, and Table 14 respectively.

The mean annual shallow lake evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates vary between 0 mm in December to 138 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly evaporation occurs in July when evaporation is greatest, and lowest variation occurs in January and December when evaporation is lowest.

Table 12: Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**663**	**699**

The mean annual PET rate is estimated to be 863 mm, varying between 744 mm and 1022 mm. Mean monthly PET rates vary between 1 mm in December and January to 171 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly PET occurs in July when PET is greatest, and lowest variation occurs in January and December when PET is lowest.

Table 13: Estimated Monthly and Annual PET Statistics for the Site (1974-2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

The mean annual AET rate is estimated to be 399 mm, varying between 319 mm and 449 mm. Mean monthly AET rates vary between 1 mm in December and January to 89 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly AET occurs in July when AET is greatest, and lowest variation occurs in January and December when AET is lowest. On an annual basis, AET at the Site is less than shallow lake evaporation and PET rates because AET is limited by the availability of water, particularly during the summer months when the air temperature is highest.

Table 14: Estimated Monthly and Annual AET Statistics for the Site (1974-2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

Wind Speed and Direction

Hourly wind speed and direction data are available for the Site from 1997 to 2003, and daily wind speed data are available from 2019 to 2021; however, the data are not continuous. The hourly wind speed and direction data available from 1997 to 2003 were used to develop wind rose plots. A wind rose depicts the relative frequency of wind from a given direction on a 16-point compass. Each ring on the wind rose represents a frequency of 2% of the data period. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a defined wind speed range. A wind rose is provided for the period of August 1997 to November 2003, and seasonal wind roses are presented to display seasonal variability in wind patterns, where the seasons have been defined as follows:

- Winter – December to February
- Spring – March to May
- Summer – June to August
- Autumn – September to November

Daily wind data recorded from 2019 to 2021 from WS1 and WS2 were wind speed only, no direction. The period of record for WS2 in 2020 are incomplete and are not included in the analysis. The relative frequency (%) of the magnitude of the daily wind speed data recorded at WS1 for 2019 and 2021 were compared to the relative frequency (%) of wind speed magnitude of the data from 1997 to 2003.

A wind rose plot for the Site depicting the relative frequency of mean hourly wind speed and direction, and the seasonal distribution, between August 29, 1997, and November 27, 2003, is shown in Figure 9.

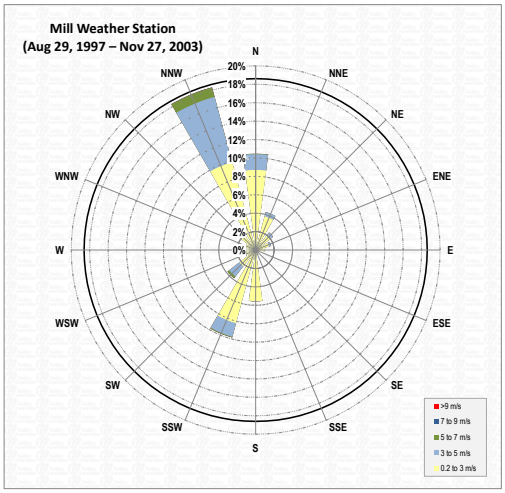

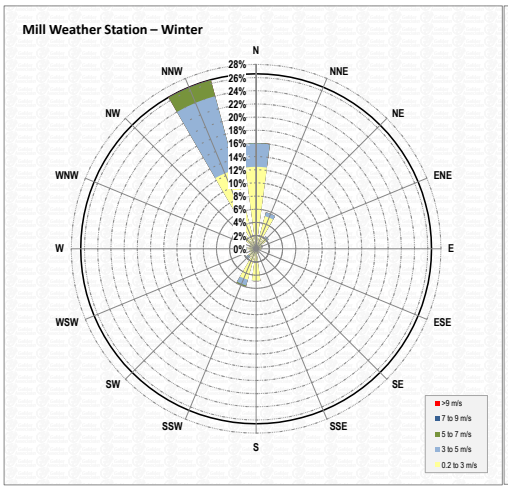

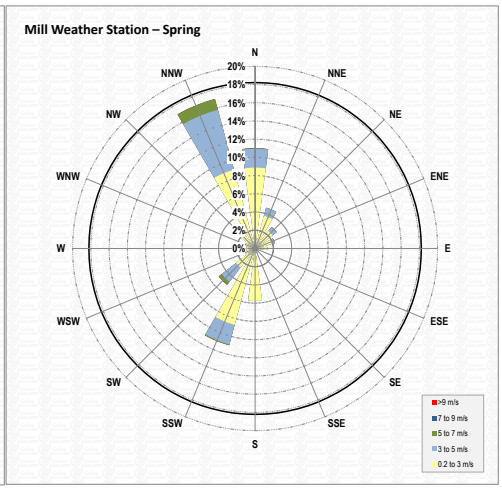

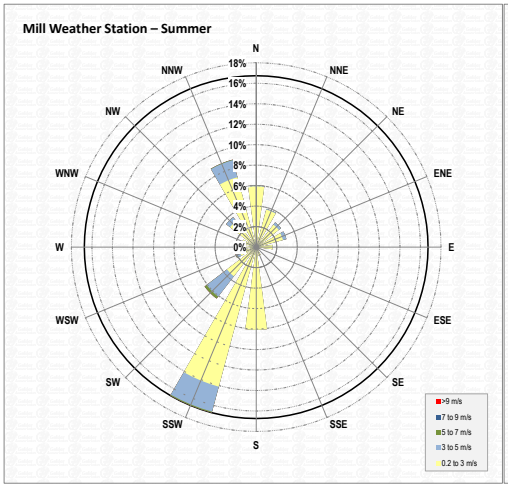

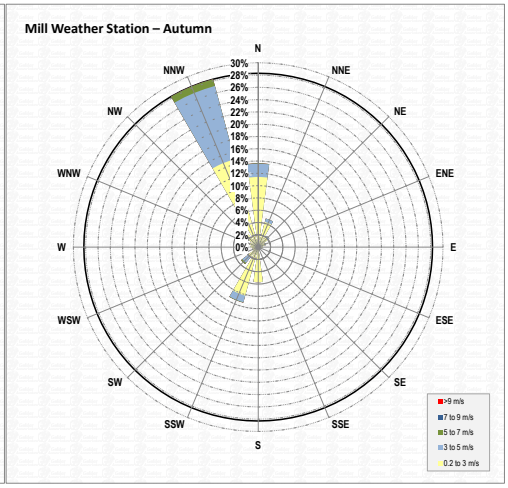

Spring = March, April, May; Summer = June, July, August; Autumn = September, October, November; Winter = December, January, February.

Figure 9: MPMC Station Monitoring Period and Seasonal Wind Roses – August 29, 1997, to November 27, 2003

Winds measured at the Site typically blew from the north-northwest, north, and south-southwest directions, with minimal winds from the east and the west. The spring, autumn, and winter seasonal wind roses were consistent with the wind rose pattern for the entire monitoring period; however, during the summer months, the majority of winds were from the south-southwest. Similarly, wind speeds in spring, autumn, and winter were generally consistent with the wind rose for the entire monitoring period, while wind speeds in summer were generally lower.

Wind speed measured and seasonal distributions at the Site from 2019 to 2021 were consistent with the relative frequency of wind speed magnitudes and the seasonal distributions recorded between August 29, 1997, and November 27, 2003 (Table 15). It is noted that the data from 2019 and 2021 are daily wind speed rather than hourly wind speed and only the relative frequency (%) of wind speed magnitude was compared.

Table 15: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station August 29, 1997, to November 27, 2003[(a)]	Weather Station 1 January 1, 2019, to December 31, 2021[(b)]
calm	35%	28%
0.2 to 3 m/s	50%	56%
3 to 5 m/s	14%	13%
5 to 7 m/s	2%	3%
7 to 9 m/s	0%	0%
>9 m/s	0%	0%

(a) Recorded as hourly wind speed.

(b) Recorded as daily wind speed.

Snow Cover Properties

Snow cover data at the Site are available monthly from manual measurements from 1997 to 2022, recorded as snow-water-equivalent (SWE). Measurements, although not continuous, are typically recorded at the beginning and end of a month, with the latter being representative of the monthly SWE. Snow cover monthly statistics, reported as SWE, are presented in Table 16. At 50% exceedance, snow begins accumulating in November and achieves its maximum in March, reducing to 0 mm in April. The 5th and 95th percentiles and standard deviation values demonstrate the variability in the amount of SWE at the Site, with March having the greatest variability from year to year.

Table 16: Snow Water Equivalent for the Site (1997-2021)

Month	Number of Measurements	Mean (mm)	Minimum (mm)	Percentile					Maximum (mm)	Standard Deviation (mm)
				5%	25%	50%	75%	95%		
January	22	147	76	88	120	139	164	327	339	56
February	22	182	99	104	131	193	222	338	344	61
March	22	185	0	6	97	198	257	403	411	108
April	21	33	0	0	0	0	81	177	177	58
November	22	17	0	0	0	9	37	72	72	25
December	22	102	32	50	77	101	122	193	196	44

3.2.2 Site Drainage and Surface Hydrology

The Mine is drained by three main watersheds: the Hazeltine Creek (30.2 km^2) at Quesnel Lake, the Edney Creek (87.4 km^2) at Quesnel Lake, and the Morehead Lake (62.7 km^2) watersheds (Figure 10). The Hazeltine Creek watershed includes Polley Lake and conveys all water from Polley Lake, the east side of the Mine, and the area surrounding the TSF. The Morehead Creek watershed includes the Bootjack Lake catchment area (11.2 km^2). The watershed areas listed here exclude the mine, which covers part of the original watersheds.

Both the Hazeltine Creek and the Morehead Creek watersheds were significantly altered by historical (i.e., pre-Mount Polley Mine) water diversions. Bootjack Creek, a small remnant of which now flows into Polley Lake via a constructed diversion channel, historically conveyed water from Bootjack Lake to Hazeltine Creek. In 1913, flow from Bootjack Lake was reversed by miners (not associated with MPMC) damming the east end of Bootjack Lake and digging a new outlet westward to Morehead Creek. Around the same time, a water control structure was also built at the outlet of Polley Lake (Hazeltine Creek), and Hazeltine Creek water was diverted to Bullion Pit to support hydraulic placer mining. Flow from Polley Lake to Hazeltine Creek was restored with the abandonment of mining at Bullion Pit during World War II. However, the flow from Bootjack Lake to Hazeltine Creek was never restored.

Prior to the breach of the TSF, Edney Creek and Hazeltine Creek converged just prior to discharging into Quesnel Lake. The mouths of the two creeks were separated following the breach and interim remediation works. As of late summer, 2020, Edney Creek and Hazeltine Creek have been reconnected, with in-stream habitat features installed, as part of the conclusion of habitat construction works in the lower Hazeltine Creek and Edney Creek area.

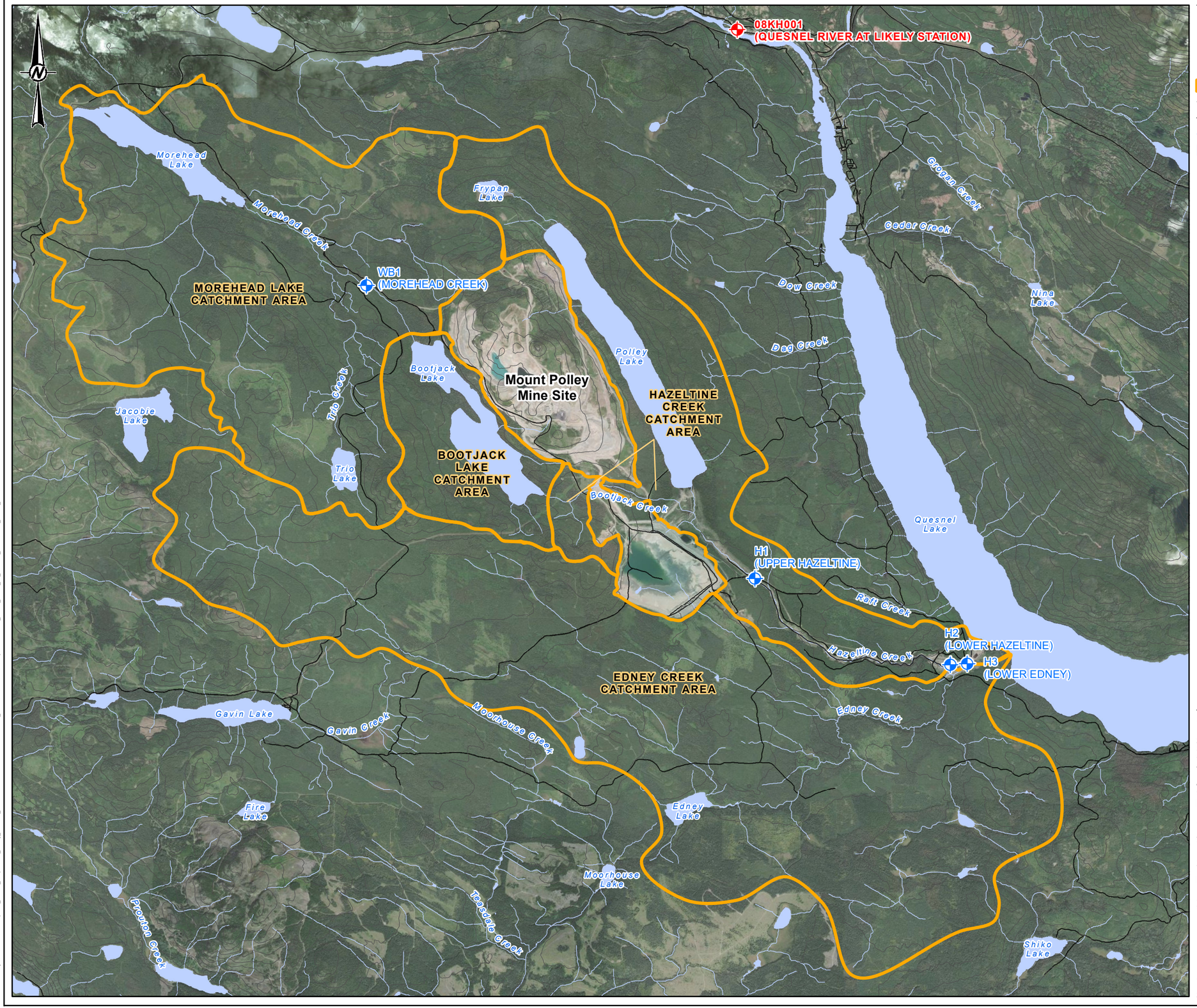

LEGEND

- MPMC HYDROMETRIC STATION
- ENVIRONMENT CANADA HYDROMETRIC STATIONS
- WATER CATCHMENT AREA
- CONTOUR (10m)
- ROAD
- WATERCOURSE
- WATERBODY

0 1.6 3.2

1:80,000 KILOMETRES

REFERENCES

1. CONTOURS, ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD.
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
MAJOR DRAINAGES AND FLOW MONITORING STATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31100/31191	0	**10**

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 1in

3.2.3 Pit Groundwater Hydrogeology

In 2016, Golder assessed groundwater flow for the following three open pits at the mine: Springer and Cariboo pits, Wight Pit, and Boundary Pit. The analysis for each pit was described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016g). Hydrogeological assessments for the pits were conducted as part of the TAR to provide estimates of seepage into and out of the pits. Similarly, estimates of seepage into and out of the TSF was also assessed using a three-dimensional model (Golder 2016j).

A provision to update this Water Management Plan and provide an updated seepage assessment is included as part of the revision trigger and frequency table under the implementation plan and schedule in Section 5.0. A review of the existing hydrogeological pit model calibration is ongoing to determine whether existing model parameters remain valid. Based on the results of the pit model review, and should any notable difference to parameter concentrations be identified, the hydrogeological parameters will be updated. Updated seepage parameters are not expected to alter the macro water balance results for the site or alter the water treatment quantity design basis; however, this will be confirmed once updated parameters are available. Should recalibration be required, an update to the hydrogeological parameters and associated seepage estimates will be completed in 2024.

The summary below is based on the previous (2016) hydrogeological assessments.

Springer and Cariboo Pits

During closure, the Springer Pit and the Cariboo Pit will be allowed to flood. Once the pit lake level is above approximately 1,028 m elevation, the pit lakes in these two pits will merge and form a single pit lake. The spillway elevation for this pit lake will be approximately 1,050 m elevation. PAG materials will be placed in the combined Cariboo-Springer Pit at closure and stored sub-aqueously to mitigate acid generation and metal leaching, in accordance with standard mine waste handling practices (MEND 2015).

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from both the Springer and Cariboo pits towards Bootjack Lake for the Phase 4 Cariboo-Springer Pit mine plan (Golder 2016g). The analysis considered placement of waste rock in the pit prior to the pit lake formation. As the pit lake level increases to between 1,020 and 1,030 m elevation, seepage in the range of 10 to 100 m^3/d from the Springer Pit Lake into the subsurface was predicted to occur (Table 17). Seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillway elevation of 1,050 m. In the Cariboo Pit, seepage towards the Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 m elevation. At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from both pits and recharge to groundwater occurring towards the southwest.

Table 17: Predicted Groundwater Flows for the Springer and Cariboo Pits

Pit Lake Elevation (masl)	Springer Pit		Cariboo Pit	
	Groundwater Flow (m^3/d)		Groundwater Flow (m^3/d)	
Base Case	**Into the Lake**	**Out of the Lake**	**Into the Lake**	**Out of the Lake**
880 (dewatered pit)	520	0	600[(a)]	0[(a)]
940	510	0	610	0
960	490	0	610	0
980	460	0	590	0
1,000	420	0	540	0
1,020	320	10	460	0
1,030	300	100	420	0
1,040	280	250	380	0
1,050	270	400	320	20
Upper Bound				
1,050	440	880	500	90
Lower Bound				
1,050	190	220	250	0

(a) These values represent conditions when the Cariboo Pit is fully dewatered (i.e., the base of the Cariboo Pit is at approximately 938 m elevation).

Source: Golder 2016g.

masl = metres above sea level.

Wight Pit

Hydrogeological modelling was carried out for the Wight Pit (Golder 2016g). The results from the hydrogeological model indicate that under steady-state conditions (Table 18), groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at an elevation of 880 m to 600 m^3/d at an elevation of 926 m (Golder 2016g).

Table 18: Predicted Groundwater Flows for the Wight Pit

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Lake	**Out of the Lake**
Base Case		
880	2,600	0
900	2,500	0
910	2,100	0
920	800	0
926	600	500
Lower Bound		
926	400	300
Upper Bound		
926	700	800

Source: Golder 2016g.

masl = metres above sea level.

Boundary Pit

At present, hydrogeological data specific to the Boundary Pit are not available. However, MPMC indicated that during mining seepage was not observed along the pit walls. This is considered reasonable due to the relatively shallow depth of this pit and depth to water table measured at monitoring wells that were installed near other mine facilities. It is thus considered likely that the water table was located near or below the floor of the Boundary Pit before mining at this location commenced.

Although seepage to the Boundary Pit from the surrounding rock mass is not expected, seepage out of this pit could occur due to water entering the pit via surface water runoff and direct precipitation. An estimate of these potential seepage rates out of the pit was made to provide input to the pit water balance and to characterize a potential seepage pathway originating from this pit (Golder 2016g).

Seepage rates out of the Boundary Pit have been estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake level is 5 m above its base (1,073 m) is approximately 59 m^3/d, with a potential range between 35 and 177 m^3/d due to uncertainty in bedrock permeability (Table 19). Seepage outflow is estimated to decrease as the height of water column above the pit bottom decreases as shown in Table 19.

Table 19: Estimated Seepage Outflows from the Boundary Pit

Water Level (masl)	Estimated Groundwater Outflow (m^3/d)		
	Lower Bound	Base Case	Upper Bound
1,068	2	3	10
1,069	6	10	29
1,070	12	20	61
1,071	16	26	79
1,072	32	53	159
1,073	35	59	177

Source: Golder 2016g.

masl = metres above sea level.

3.2.4 Seepage from the Tailings Storage Facility

WSP is currently designing a new upstream drainage system to accommodate the increase in the TSF water elevation (WSP 2023b). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width). Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipated seepage rates through the embankment and foundation. Seepage analyses were conducted for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 20 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 20: Seepage Flow Rates

Beach (m)	Seepage Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note(s): Includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The TSF contains both water and tailings. The term TSF water volume is used to describe the total amount of water within the TSF. The term TSF pond is also used, which describes the area of the TSF, mainly near the water surface elevation, where tailings are generally not placed and a water pond forms at the surface, typically with some water depth. The term TSF supernatant pond is also used and refers to the same pond. During operations, a pump barge is placed at the TSF pond to allow suction TSF water for process purposes and placing the pump intake at the pond allows drawing water without drawing tailings. The location of the TSF pond depends on how tailings are placed within the TSF and the pond can be shifted around the TSF through tailings placement. Nearing closure, the TSF pond will be shifted to a specific location within the TSF.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF water volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different TSF water volume amounts. The estimates are provided in Table 21, which outline a conservative scenario, in terms of seepage flow quantities.

Table 21: Tailings Beach Width

TSF Water Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 20 and Table 21 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF water volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (August 1, 2031), the TSF water volume reduces to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 22 will be in effect 6 months after the end of the operation phase and throughout the closure and post-closure phases.

Table 22: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	S2	S4	S5
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF water volume is limited to 250,000 m³.

3.3 Characterization of Existing Water Quality

The characterization of existing surface water quality in Quesnel Lake has been updated as part of this WMP and is described below. The characterization of other receiving environments (Bootjack Lake, Hazeltine Creek, and Polley Lake) have not been updated in this WMP but have been previously characterized in Golder 2016g and Golder 2020e. Only the Quesnel Lake characterization has been updated as part of this WMP, as it is the sole discharge location permitted in the existing EMA permit, expected to continue through operations. This single discharge location may continue through closure or may share discharge with other distributed locations. Data from March 2015 to September 2023 collected in the West Basin, east of the sill near Cariboo Island, were summarized. These data represent the background water quality of Quesnel Lake, generally flowing into the West Basin.

The following summary statistics were calculated for Quesnel Lake to represent existing conditions:

- Number of samples.
- Number and percentage of samples with values below the method detection limit (MDL).
- Minimum, median, arithmetic mean, 95th percentile, and maximum concentrations.

Minimum, maximum, and median values were calculated using absolute values; that is, when the summary statistic corresponded to a non-detect value in the dataset, the MDL was reported. For values reported as less than the MDL, the MDL was substituted for calculation of the mean and 95th percentile. A mean was not calculated for parameters with greater than 50% non-detect values. A median was only reported where a mean was not calculated. A 95th percentile was not calculated for parameters with less than 10 measurements or with greater than 95% non-detect values.

Existing conditions were defined as arithmetic mean concentrations or median where a mean was not calculated. Data were compared to applicable BC drinking water guidelines and BC 30-day WQGs (BC ENV 2019b) protective of aquatic life; the maximum WQG was substituted where a 30-day WQG did not exist, as indicated in summary tables provided in Sections 3.3.1 through 3.3.4 in BC ENV 2019b. WQGs calculated based on toxicity modifying factors (e.g., hardness, pH, chloride, dissolved organic carbon) were calculated based on corresponding toxicity modifying factor values (i.e., minimum and maximum statistics) described in the summary statistics for each waterbody.

BC WQGs protective of the most sensitive receiving environment use (generally aquatic life) were used for screening water quality.

The average residence time of Quesnel Lake is approximately 10 years but is estimated to be 90 days within the West Basin (Laval et al. 2008). Quesnel Lake is oligotrophic, with low primary productivity and total dissolved solids (TDS). The West Basin has vertical mixing typical of temperate lakes, with thermal stratification for most of the year, interrupted by brief turnover periods in the spring and the fall when vertical density gradients are lowest. The physical limnology of the West Basin is described more fully in Laval et al. 2008 and Tetra Tech EBA Inc. (Tetra Tech 2015).

Levels of total suspended solids (TSS), turbidity, and total metals previously elevated in the West Basin as a result of the TSF foundation failure remained below WQGs from 2015 to 2023 east of Cariboo Island (Golder 2016a,c). All mean constituent concentrations were below applicable BC WQGs in Quesnel Lake baseline water quality measured east of Cariboo Island from 2015 to 2023 (Table 23).

Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Physical Parameters													
pH (field)	pH units	-	-	6.5 – 9.0	A	123	0	0	6.4	7.7	7.4	8.4	8.9
Temperature (field)	°C	-	-	-	-	123	0	0	2.5	4.1	6.4	18	21
Conductivity (field)	µs/cm	-	-	-	-	123	0	0	21	112	115	143	202
Turbidity	NTU	+1 NTU from background	A	+2 NTU from background	A, (c)	124	0	0	0	0.29	0.7	1.8	48
Dissolved organic carbon	mg/L	-	-	-	-	156	0	0	1.2	1.8	2.1	2.5	13
Hardness (Dissolved)	mg/L	-	-	-	-	165	0	0	44	53	53	56	58
Total Dissolved Solids	mg/L	-	-	-	-	165	0	0	57	70	71	84	92
Total Suspended Solids	mg/L	-	-	+5 mg/L from background	A, (c)	226	186	82	<1	1.1	2.0	<3	12
Major Ions													
Alkalinity, Total (as CaCO3)	mg/L	-	-	-	-	226	0	0	39	50	49	52	54
Chloride	mg/L	250	A	150	A	226	201	89	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	1.5	A	1.00 – 1.11	A, Max, (d)	226	0	0	0.025	0.034	0.034	0.038	0.045
Sulphate	mg/L	-	-	218	A, (e)	226	0	0	4.5	6.3	6.3	6.8	6.9
Nutrients													
Ammonia	mg/L (as N)	-	-	0.175	A, (f)	226	190	84	<0.005	<0.005	0.0052	0.0052	0.013
Nitrate	mg/L (as N)	10	A	3	A	226	0	0	0.014	0.14	0.13	0.15	0.15
Nitrite	mg/L (as N)	1	A	0.02	A, (g)	226	201	89	<0.001	<0.001	<0.001	<0.001	<0.001
Total Phosphorus	mg/L	0.01	A, lakes	0.005 – 0.015 in Lakes	A	218	92	42	<0.002	<0.002	0.0039	0.0063	0.098
Total Metals													
Aluminum	mg/L	-	-	5	A, WW, Max	226	0	0	0.0063	0.013	0.017	0.036	0.22
Antimony	mg/L	0.006	A	0.009	W	226	189	84	<0.0001	<0.0001	NC	<0.0001	0.00013
Arsenic	mg/L	0.01	A	0.005	A, Max	226	43	19	<0.0001	0.00011	0.00012	0.00015	0.00022
Barium	mg/L	-	-	1	W	226	0	0	0.0043	0.0052	0.0053	0.006	0.0081
Beryllium	mg/L	-	-	0.00013	W	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Boron	mg/L	5	A	1.2	A	226	200	88	<0.01	<0.01	NC	<0.01	<0.01
Cadmium	mg/L	0.005	A	-	-	226	192	85	<0.000005	<0.000005	NC	NC	0.00001
Calcium	mg/L	-	-	See note	W, (h)	226	0	0	13	18	18	19	20
Chromium	mg/L	0.05	A	0.001	W, (i)	226	201	89	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Cobalt	mg/L	0.001	A	0.004	A	226	200	88	<0.0001	<0.0001	NC	<0.0001	0.00017
Copper	mg/L	2	A	-	-	226	14	6	<0.0005	0.00067	0.0008	0.0013	0.0073
Iron	mg/L	-	-	1	A, Max	226	179	79	<0.03	<0.03	0.032	0.039	0.17
Lead	mg/L	0.005	A	0.0044 – 0.0049	A, (j)	225	117	52	<0.00005	<0.00005	0.00012	0.0004	0.0031
Lithium	mg/L	-	-	-	-	226	140	62	<0.0005	<0.001	0.001	0.0011	0.0016
Magnesium	mg/L	-	-	-	-	226	0	0	1.8	2.0	2.0	2.2	2.3
Manganese	mg/L	0.12	A	0.84 – 0.86	A, (k)	226	0	0	0.00012	0.001	0.0012	0.0023	0.0089
Mercury	mg/L	0.001	A	0.00001	A, (l)	25	20	80	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.088	A	7.6	A	226	0	0	0.00026	0.00034	0.00034	0.00041	0.00051

Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Total Metals (cont'd)													
Nickel	mg/L	0.08	A	0.025	W, (m)	226	196	87	<0.0005	<0.0005	NC	<0.0005	0.00068
Selenium	mg/L	0.01	A	0.002	A	226	10	4	0.000057	0.000098	0.00012	0.00016	<0.0005
Silicon	mg/L	-	-	-	-	226	0	0	0.82	1.8	1.8	2.0	2.1
Silver	mg/L	-	-	0.00005	A, (n)	226	200	88	<0.00001	<0.00001	NC	<0.00001	0.000012
Sodium	mg/L	-	-	-	-	226	0	0	0.78	0.96	0.96	1.0	1.5
Strontium	mg/L	7	A	-	-	226	0	0	0.094	0.14	0.14	0.15	0.15
Thallium	mg/L	-	-	0.0008	W	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	226	199	88	<0.0001	<0.0001	NC	<0.0001	0.00023
Titanium	mg/L	-	-	-	-	226	200	88	<0.01	<0.01	NC	<0.01	0.011
Uranium	mg/L	0.02	A	0.0085	W	226	0	0	0.00012	0.00016	0.00016	0.00018	0.00018
Vanadium	mg/L	-	-	-	-	226	199	88	<0.0005	<0.0005	NC	NC	<0.001
Zinc	mg/L	3	A	-	-	226	198	88	<0.003	<0.003	NC	<0.003	0.0057
Dissolved Metals													
Aluminum	mg/L	-	-	0.05	A, (o)	226	0	0	0.004	0.0059	0.0066	0.011	0.02
Antimony	mg/L	0.006	A	-	-	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Arsenic	mg/L	0.01	A	-	-	226	139	62	<0.0001	<0.0001	0.0001	0.00013	0.00018
Barium	mg/L	-	-	-	-	226	0	0	0.0046	0.0051	0.0052	0.0056	0.0065
Beryllium	mg/L	-	-	-	-	226	201	89	<0.0001	<0.0001	NC	<0.001	<0.001
Boron	mg/L	5	A	-	-	226	201	89	<0.01	<0.01	NC	<0.01	<0.01
Cadmium	mg/L	0.005	A	0.00011 – 0.00014	A, (p)	226	198	88	<0.000005	<0.000005	NC	NC	<0.00001
Calcium	mg/L	-	-	-	-	226	0	0	15	18	18	19	20
Chromium	mg/L	0.05	A	-	-	226	201	89	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.001	A	-	-	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Copper	mg/L	2	A	0.20 – 2.05	A, (q)	226	45	20	<0.0005	0.0006	0.00064	0.00094	0.002
Iron	mg/L	-	-	0.35	A, Max	226	201	89	<0.03	<0.03	NC	<0.03	<0.03
Lead	mg/L	0.005	A	-	-	221	105	48	<0.00005	<0.00005	0.0001	0.0003	0.00071
Lithium	mg/L	-	-	-	-	226	172	76	0.00069	<0.001	0.0010	<0.001	0.0013
Magnesium	mg/L	-	-	-	-	226	0	0	1.8	2.0	2.0	2.1	2.3
Manganese	mg/L	0.12	A	-	-	226	14	6	0.000086	0.00021	0.00031	0.001	0.0028
Mercury	mg/L	0.001	A	-	-	10	10	100	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.088	A	-	-	226	0	0	0.00026	0.00033	0.00033	0.00038	0.00045
Nickel	mg/L	0.08	A	-	-	226	198	88	<0.0005	<0.0005	<0.0005	<0.0005	0.0012
Potassium	mg/L	-	-	-	-	226	0	0	0.43	0.49	0.49	0.53	0.62
Selenium	mg/L	0.01	A	-	-	226	10	4	0.00005	0.00009	0.00011	0.00016	<0.0005
Silicon	mg/L	-	-	-	-	226	0	0	0.76	1.7	1.7	1.9	2.0
Silver	mg/L	-	-	-	-	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	-	-	-	-	226	0	0	0.82	0.95	0.95	1.0	1.2

Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Dissolved Metals (cont'd)													
Strontium	mg/L	7	A	-	-	226	0	0	0.1	0.14	0.13	0.15	0.15
Thallium	mg/L	-	-	-	-	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	226	200	88	<0.0001	<0.0001	NC	<0.0001	0.00013
Titanium	mg/L	-	-	-	-	226	201	89	<0.01	<0.01	NC	<0.01	<0.01
Uranium	mg/L	0.02	A	-	-	226	0	0	0.00012	0.00016	0.00015	0.00017	0.00018
Vanadium	mg/L	-	-	-	-	226	201	89	<0.0005	<0.0005	NC	<0.0005	<0.001
Zinc	mg/L	3	A	0.008	A, (r)	225	195	87	<0.003	<0.003	0.0031	<0.003	0.0081

(a) BC WQ guideline for the protection of drinking water, available at https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines, accessed October 31, 2023.
(b) BC Water Quality Guidelines (BC WQG). Fresh Water Aquatic Life 30-day Guidelines used, except where noted (e.g., molybdenum, total aluminum). Maximum (Max) guidelines substituted where 30-d guidelines do not exist.
(c) For guideline comparison, Quesnel Lake background turbidity is assumed equal to 1 NTU and background TSS is equal to the MDL of 3.0 mg/L.
(d) Hardness dependent fluoride guideline: BC Max WQG (mg/L) = (-51.73+(92.57log10(hardness))*0.01), 0.4 at hardness 10 mg/L.
(e) Hardness dependent sulphate guideline: BC 30-d WQG (mg/L) = 128 at hardness <30 mg/L, 218 at hardness 31-75 mg/L, 309 at hardness 76-180 mg/L, 429 at hardness 181-250 mg/L, determined based on site water at hardness >250 mg/L.
(f) pH and temperature dependent ammonia guideline: values selected from Table 4 in BC WQG based on maximum temperature and pH.
(g) Chloride (Cl) dependent nitrite guideline: BC 30-d WQG (mg/L) = 0.02 at Cl <2 mg/L, 0.04 at Cl 2-4 mg/L, 0.06 at Cl 4-6 mg/L, 0.08 at Cl 6-8 mg/L, 0.10 at Cl 8-10 mg/L, 0.20 at Cl >10 mg/L.
(h) up to 4 – highly sensitive to acid inputs; 4 to 8 – moderately sensitive; over 8 – low sensitivity. Refer to alkalinity, the more restrictive of calcium or alkalinity applies.
(i) Max guideline is for hexavalent chromium.
(j) Hardness dependent lead guideline: BC 30-d WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness >8 mg/L.
(k) Hardness dependent manganese guideline: BC 30-d WQG (mg/L) = 0.0044*hardness+0.605.
(l) Mercury BC 30-d WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.
(m) Hardness dependent nickel guideline: BC 30-d WQG (mg/L) = 0.025 at hardness <60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.15 at hardness >180 mg/L.
(n) Hardness dependent silver guideline: BC 30-d WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, 0.0015 at hardness >100 mg/L.
(o) pH dependent dissolved aluminum guideline: BC 30-d WQG (mg/L) = 0.05 at pH ≥6.5, exp(1.6-3.327*(median pH)+0.402*(median pH2)) at pH <6.5.
(p) Hardness dependent dissolved cadmium guideline: BC 30-d WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.
(q) Hardness dependent copper guideline: BC 30-d WQG (mg/L) = 0.002 at hardness ≤50 mg/L, (0.04*hardness/1000) at hardness >50 mg/L.
(r) Hardness dependent zinc guideline: BC 30-d WQG (mg/L) = (7.5+0.75(hardness-90))/1000.
(s) Minimum, maximum, and median were calculated using absolute values; that is, when the summary statistic corresponded to a non-detect (ND) value in the dataset, the MDL was reported.
(t) Mean was not calculated for parameters with greater than 50% non-detect values. A median was reported where a mean was not calculated.
(u) 95th percentile was not calculated for parameters with less than 10 samples.
(v) 95th percentile was not calculated for parameters with greater than 95% non-detect values.

Underlined value = exceeds maximum BC Drinking Water Quality Guidelines.
Shaded value = exceeds 30-day average BC Water Quality Guidelines.

A = approved guideline; W = working guideline; Max = maximum guideline used; Min = Minimum concentration requirement based on life stage; WW = wildlife water supply guidelines; NC = not calculated; "<" = reported value is less than method detection limit (MDL).

4.0 WATER MANAGEMENT AND TREATMENT

4.1 Water Management Summary

A network of channels, ponds, and pumping systems is operated by MPMC for managing surface water at the mine. Contact (mine-affected) and non-contact water (non-mine-affected) systems are managed with the objective of avoiding the mixing of these waters.

The non-contact water system includes channels to divert runoff from undisturbed catchments away from mine infrastructure. Contact water from within the mine site is actively managed using on-site water management infrastructure and conveyed to the TSF or to the PETBP for re-use as part of mine operations or for treatment through the Water Treatment Plant (WTP) and subsequent discharge through a pipeline to Quesnel Lake.

The mine has a positive water balance, with discharge required during mine operations to prevent year-on-year accumulation of water. The only currently permitted discharge of treated contact water from site occurs through the existing WTP and the Quesnel Lake pipe and diffusers. Water management during operations will continue per the current water management infrastructure. The existing WTP (Actiflo patented high-rate ballasted coagulation and flocculation process) is considered the Best Achievable Technology (BAT, BC ENV 2015) for treatment and discharge through assumed future operations (Golder 2015g).

The treatment flow rate of the existing WTP varies between approximately 0.21 m^3/s and 0.31 m^3/s, pending operator control of the plant. The allowable maximum annual discharge volume from site is currently 10.59 M-m^3/year (average of 0.33 m^3/s), as per EMA Permit 11678. The design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate).

The mine's water management plan assumes minimal storage of contact water on site, although during freshet (April through June) and extreme storm events, the volume of mine water runoff will exceed the discharge and treatment capacity, and temporary retention will be necessary to store water prior to discharge. Temporary water accumulation will occur in the TSF or in available pit volume(s). Temporary stored water will be discharged to the environment through the WTP following the freshet period or the storm event.

As the mine moves into closure and post-closure, the objectives of water management are to return the impacted land to pre-mining land functions. As the mine is constructed across a watershed divide, it is desired that during the post-closure period, drainages will be distributed back to their natural watersheds (i.e., to Bootjack Lake, Polley Lake, and Hazeltine Creek), provided that this can be achieved in an environmentally appropriate and permittable manner. MPMC has been proceeding with a program of evaluating and developing passive, semi-passive, and active water treatment technologies for their possible use during mine closure to support the goal of distributing discharge back into the pre-mining configuration. Two treatment options are considered the BAT for treatment during closure and post-closure: Option A – distributed passive/semi-passive treatment systems (applied to select sources), and Option B – pit-lake treatment followed by the centralized Actiflo plant (Golder 2016h). Option B is the current assumption for water treatment during closure/post-closure, but MPMC has also been progressing technology evaluations to support Option A.

This water management plan provides an update on expected water quantity and quality required for treatment during both operations and closure/post-closure (treatment design basis) and provides an update on treatment technology development considered for closure/post-closure (Section 4.7).

4.1.1 Short-term Water Management Strategy

Current water management practices have the objective to minimize mixing of contact and non-contact surface water sources where practicable. The flows from these sources are driven by direct precipitation, runoff, and snowmelt from the associated catchments. The majority of the contact water at the Site is collected along two ditches that run north to south along the western and eastern edges of the Mine: West Ditch and Long Ditch respectively. During large runoff events, the water management infrastructure is subject to increased runoff volumes that require careful planning to mitigate potential risk for discharging contact water to the receiving environment.

To address BC ENV recommendations, WSP is developing a short-term water management strategy, scheduled for completion in 2024, through staged analysis and reporting of surface water infrastructure and flow assessment for runoff and pumps and pipeline conveyance. The aim of the short-term water management strategy is reducing uncertainty during operational scenarios, providing tools for identifying/characterizing real-time events, and providing a decision-making framework for Site personnel during large runoff events.

4.2 Description of Source Inventory

Flow and water quality parameter inputs to the site water management tools, specifically the SWWBM and the SWWQM, are derived from a combination of measured data sources and assumed values based on established modelling practices and site knowledge. The primary objective of these water management tools is to predict the chemistry of water; in particular, the concentrations of constituents that have been identified in PE-11678 and how the loading behaves as water flows through disturbed and undisturbed landforms and constructed conveyance structures (e.g., ditches, pipelines, channels). The amount of loading (constituent concentrations) in contact water is generally influenced by the geochemistry of the source material (i.e., waste rock, ore) and the quantity of water. Non-contact water is not influenced by mine operations.

For the purposes of advancing the development of these water management tools, contact water flows can be classified as follows:

- **Waste rock contact water**—sourced primarily from waste dumps and ore stockpiles distributed throughout the mine.
- **Pit wall runoff**—sourced from the containment walls of excavated voids (i.e., pit shells).
- **Tailings Storage Facility**—sourced from the seepage collection system of the TSF.
- **Other**—site-wide sources for disturbed and undisturbed runoff and groundwater inflows.

As part of this WMP and water management framework, a source inventory (Table 24) has been compiled that identifies areas of the mine that generate mine-contact water. The inventory is intended to be a living database and may need to be updated as the mine layout changes over time or as the mine transition into closure becomes more defined. The source inventory is composed of the following data:

- Modelled or measured water quality data (i.e., station names, station UTM co-ordinates, number of samples, date range of samples).
- Modelled or measured flow (i.e., availability of flow records and a qualitative measure of how well the source is modelled in the SWWBM).

The water quality data from the source inventory is further defined and expanded upon in Section 4.4, where the water quality data are used to calibrate the SWWQM and provide context to the key findings from the model simulation results.

Table 24: Source Inventory

	Description	Water Quality			Data Source Coordinates	Water Quantity			
		Data Source[a]	Number of WQ Samples[b]	Period of Record (inclusive)	UTM Zone 10 (X/Y)[c]	Measured Flow Data	Period of Record (inclusive)	Number of Flow Records	Modelled Flows Available (Y = YES, N = NO; P = PARTIAL)[d]
Waste Rock Contact Water	Boundary Pit Waste Rock Seepage and Runoff	Boundary Dump SEEPS	70	2013–2022	591906/5825223	No Data	-	-	P
	Wight Pit Waste Rock Seepage and Runoff	JCP	66	2014–2023	593634/5823889	Spot Flow Data	2013–2020	73	P
	NAG Waste Rock Seepage and Runoff (including ore stockpiles)	SERDS SEEPS	523	2013–2022	594170/5822279	Spot Flow Data (SERDS Ditch)	2014–2019	28	P
	Temporary NW PAG Stockpile Seepage and Runoff	PAG Dump SEEPS	140	2013–2023	590736/5823923	No Data	-	-	P
	Ore Stockpile Runoff	SERDS SEEPS	523	2013–2022	594456/5821005	Spot Flow Data (SERDS Ditch)	2014–2019	28	P
Pit Wall Runoff	Boundary Pit Wall Runoff	BP[e]	16	2016–2023	591784/5825446	No Data	-	-	Y
	Wight Pit Wall Runoff	E10[e]	71	2016–2023	592872/5825309	No Data	-	-	Y
	Cariboo Pit Wall Runoff	E8[e]	40	2016–2023	592128/5823173	No Data	-	-	Y
	Springer Pit Wall Runoff	E11[e]	53	2016–2022	591703/5823328	No Data	-	-	Y
Tailings Storage Facility	TSF Pumped Draindown	E5	144	2014–2023	NA	No Data	-	-	P
	TSF Process Water	E1/E1a[f]	157	2011–2023	594480/5819669	No Data	-	-	Y
	TSF Seepage – Saturated	E1/E1a[f]	157	2011–2023	594480/5819669	No Data	-	-	P
	TSF Seepage – Unsaturated	E1/E1a[f]	157	2011–2023	594480/5819669	No Data	-	-	P
	TSF Beach Runoff	E1/E1a[f]	157	2011–2023	594480/5819669	No Data	-	-	Y
Other	Disturbed Runoff	W5	256	2014–2023	593125/5822868	No Data	-	-	Y
	Undisturbed Runoff	W8	224	2006–2023	597020/5817600	No Data	-	-	Y
	Groundwater Inflow	GW12/GW15	53	2013–2023	594170/5822279	No Data	-	-	P

(a) Boundary Dump SEEPS, SERDS SEEPS, and PAG Dump SEEPS contain multiple sampling points in the vicinity of the prescribed area.

(b) Samples collected before the period of record are excluded.

(c) UTM Zone 10 X and Y coordinates are approximate and represent the general location of the sampling point. Certain areas have multiple sampling points in the vicinity of the prescribed area.

(d) “Partial” designation indicates that the SWWBM only captures selected elements of the source category. Flows are not calibrated due to a lack of adequate flow records at preferred calibration points.

(e) Water quality inputs assigned to pit wall runoff were based on SRK source terms for wall rock lithologies and proportions instead of source terms calculated from pit water monitoring data.

(f) Water quality assigned from model predictions of the TSF instead of source terms calculated from pit water monitoring data.

Source: Holmes 2020, pers. comms.; Ivens 2020, pers. comms.

WQ = Water Quality; SEEPS = Seepage; JCP = Joe’s Creek Pipe; NAG = Non-potentially Acid Generating; NW = Northwest; SERDS = Southeast Rock Disposal Site; PAG = Potentially Acid Generating; TSF = Tailings Storage Facility; NA = Not Available; MTD = Main Toe Drain; GW = Groundwater; SWWBM = site-wide water balance model.

4.3 Water Balance

This section describes the SWWBM, including discussion of calibration to observed data, implementation of updates to reflect the Springer Expansion LOM Plan, and simulation results. The SWWBM represents a key water management tool that is used to confirm whether existing and proposed site Water Management Plans are adequate for supporting the joint permit application associated with the proposed Springer Expansion LOM plan.

4.3.1 Water Balance Model

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). The SWWBM was originally developed for the TAR to support the effects predictions in the LTWMP for the mine and has since been calibrated on an annual basis (refer to WSP 2023e for 2022 annual calibration). WSP incorporated the Springer Expansion LOM Plan (MPMC 2023b) for the implementation of future operations scenario in the SWWBM.

The updated SWWBM simulates the site water circuitry (the logic driving water transfers, discharges, and flows on site) under the assumed future operations scenario. The model is built to project inflows and outflows to major storage locations and conveyance structures on-site. The SWWBM water quantity projections are then fed into the WQM to generate predictions on water quality parameter concentrations at selected locations of interest.

4.3.1.1 Model Software

GoldSim allows dynamic and complex water quantity interactions to be represented through a visual and highly modular framework. All input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. GoldSim is widely used for mine water quantity studies and provides the following capabilities:

- Deterministic and probabilistic simulations can be run within the model, which allows statistics and probabilities to be assigned to the model outputs.
- Simulation periods can be varied within the same model.
- The model framework can be easily adjusted to account for evolving conditions on a mine site, which allows the model to be used as an operational planning tool.
- Water quantity and water quality modules can be directly linked within the model, which allows both modules to be updated simultaneously; this is particularly useful when evaluating a range of scenarios (e.g., alternative water management strategies).

4.3.1.2 Model Objectives

This SWWBM has the following objectives:

- Include a future operational phase that will extend from May 2, 2023, to March 31,2031.
- Include a closure phase extending from April 1, 2031, to March 31,2041.
- Include a post-closure phase commencing on April 1, 2041, and extending to March 31, 2131 (100 years including closure).
- Estimate the quantity of contact water collected on-site per the climate conditions.
- Estimate water retention requirements in major storage locations at site such as the TSF and pits.

- Estimate the quantity of contact water requiring treatment.
- Provide support for the assessment of future operations water quality and associated water treatment and/or discharge options.
- Provide a model that can be linked to a water quality module that assesses site water quality during forecasted future operations.

4.3.1.3 General Assumptions and Key Input Parameters

General assumptions applied to this model update are as follows:

- Continuation of mining of the Springer Pit and Cariboo Pit will not significantly increase the footprint of the pits.
- There is no seepage from the ponds or sumps other than the TSF (i.e., all ponds and sumps are assumed to be lined, or seepage is assumed to be negligible).
- Direct precipitation, evaporation, and seepage loss from ditches are assumed to be negligible.
- Precipitation occurs as snow from December to February and as rain or a mixture of rain and snow in all other months.
- Snowpack is represented by the cumulative precipitation depths over the months of December, January, and February, spanning a period of three months.
- Snowmelt occurs in the months of March, April, and May as a percentage of the maximum snowpack at the end of February (5% in March, 90% in April, and 5% in May).
- The closure and post-closure phases are included in the SWWBM, and the flow logic and model wiring for these phases are based on 2022 Reclamation and Closure Plan (RCP) (MPMC 2022a).

Key input parameter values and assumptions for the operational phase simulations are presented in Table 25.

Table 25: Key Input Parameter Values and Assumptions

Parameter	Value	Reference
TSF emergency spillway invert elevation at 987 m dam crest elevation during operations	985.8 m	WSP 2023g
Initial TSF water volume	2.84 M-m^3	TSF Weekly Report (MPMC 2023a)
Initial Springer Pit water level	970.66 m	TSF Weekly Report (MPMC 2023a)
Initial Cariboo Pit water level	954.72 m	TSF Weekly Report (MPMC 2023a)
Initial Wight Pit water level	912.87 m	TSF Weekly Report (MPMC 2023a)
Tailings stored in Springer Pit	2.00 M-m^3	TSF Weekly Report (MPMC 2023a)
Water Treatment Plant (WTP) treatment capacity	25,000 m^3/d (0.29 m^3/s)	Provided by MPMC (MPMC 2023c)

4.3.1.4 Model Scope and Flow Diagram

The scope and structure of the SWWBM is outlined in the conceptual flow diagram for forecasted future operations in Figure 11. The flow diagram illustrates the water circuitry at the Mine, including operational storage, conveyance, and discharge of water. The water management infrastructure modelled within the SWWBM is summarized in Table 26. The flow types that are programmed into the SWWBM are outlined in Table 27.

From closure and progressively to post-closure, certain Site areas will be reclaimed, and run-off will become non-contact water. Pumping rates for the Site will be reduced at the end of the closure period, as certain areas are assumed reclaimed. Closure and post-closure flow diagrams are shown in Figure 12 and Figure 13, respectively.

Table 26: Water Management Infrastructure

Major Ditches	Sumps and Minor Ponds	Major Ponds and Storage Facilities
▪ Long Ditch ▪ SERDS Ditch (lower portion of West Ditch)	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ Central Collection Pond ▪ Bootjack Creek Sump ▪ Mill Site Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9K Sump ▪ Boundary Pit	▪ TSF ▪ Cariboo Pit ▪ Springer Pit ▪ Wight Pit ▪ Perimeter Embankment Till Borrow Pond

Source: WSP 2023e.

SERDS=Southeast Rock Disposal Site; T.SF = Tailings Storage Facility.

Table 27: Types of Flows Represented in the SWWBM

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows)	▪ Water consumption flows (turbo-misters, and water trucks) ▪ Water treatment discharge ▪ permanent, unrecoverable storage in tailings (interstitial water) ▪ Open water evaporation ▪ Pumped flows between facilities ▪ Transfer flows (gravity flows between facilities) ▪ Groundwater flows

Source: WSP 2023e.

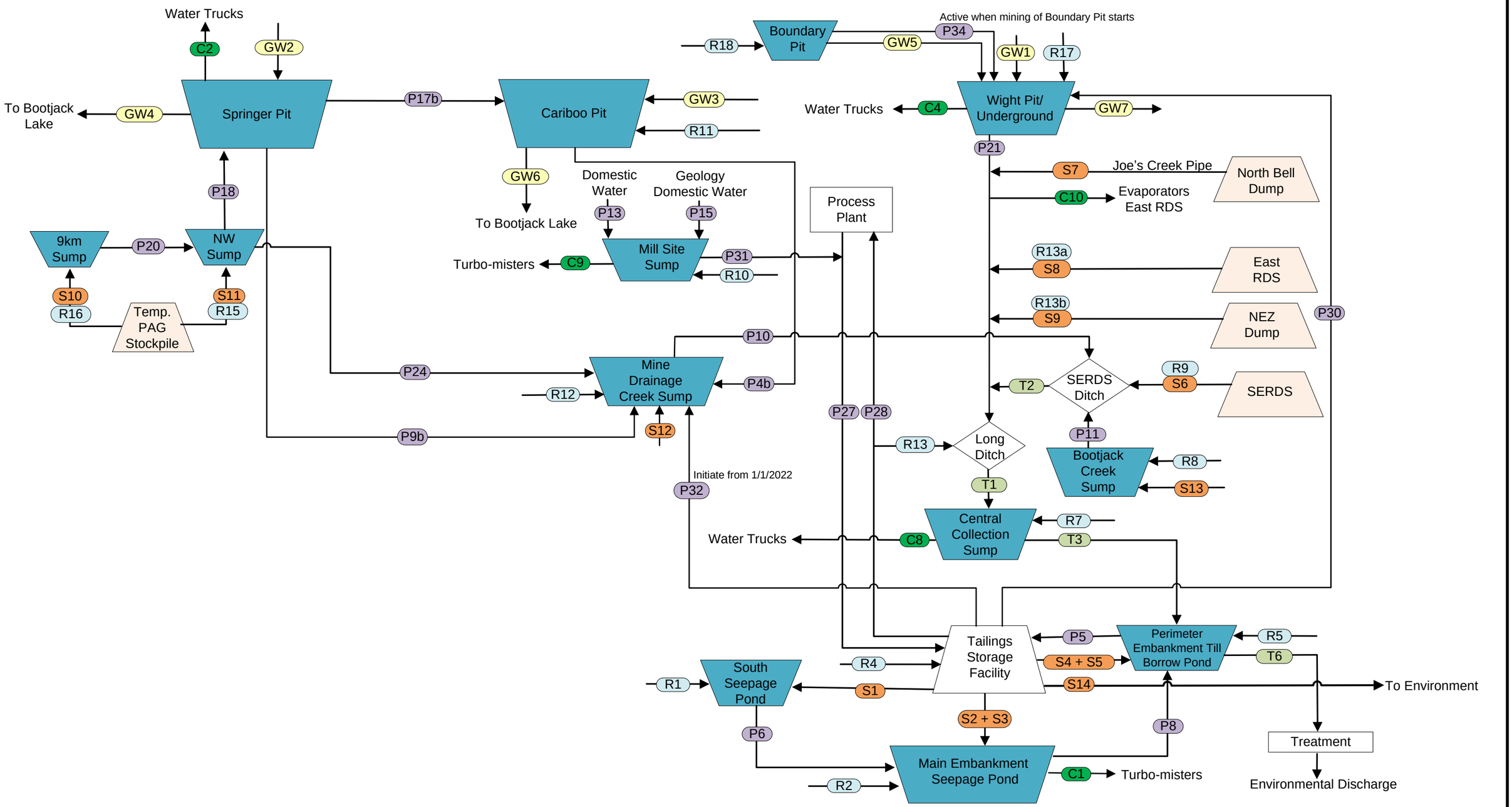

Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	4 December 2023
CHECKED	GD
DATE	4 December 2023
SCALE	Not to Scale
PROJECT No	23590671/31191
FIGURE No	11
REV No	0

TITLE

Springer Expansion LOM Site Wide Water Balance
Operational Phase Flow Diagram
2 May 2023 – 31 March 2031

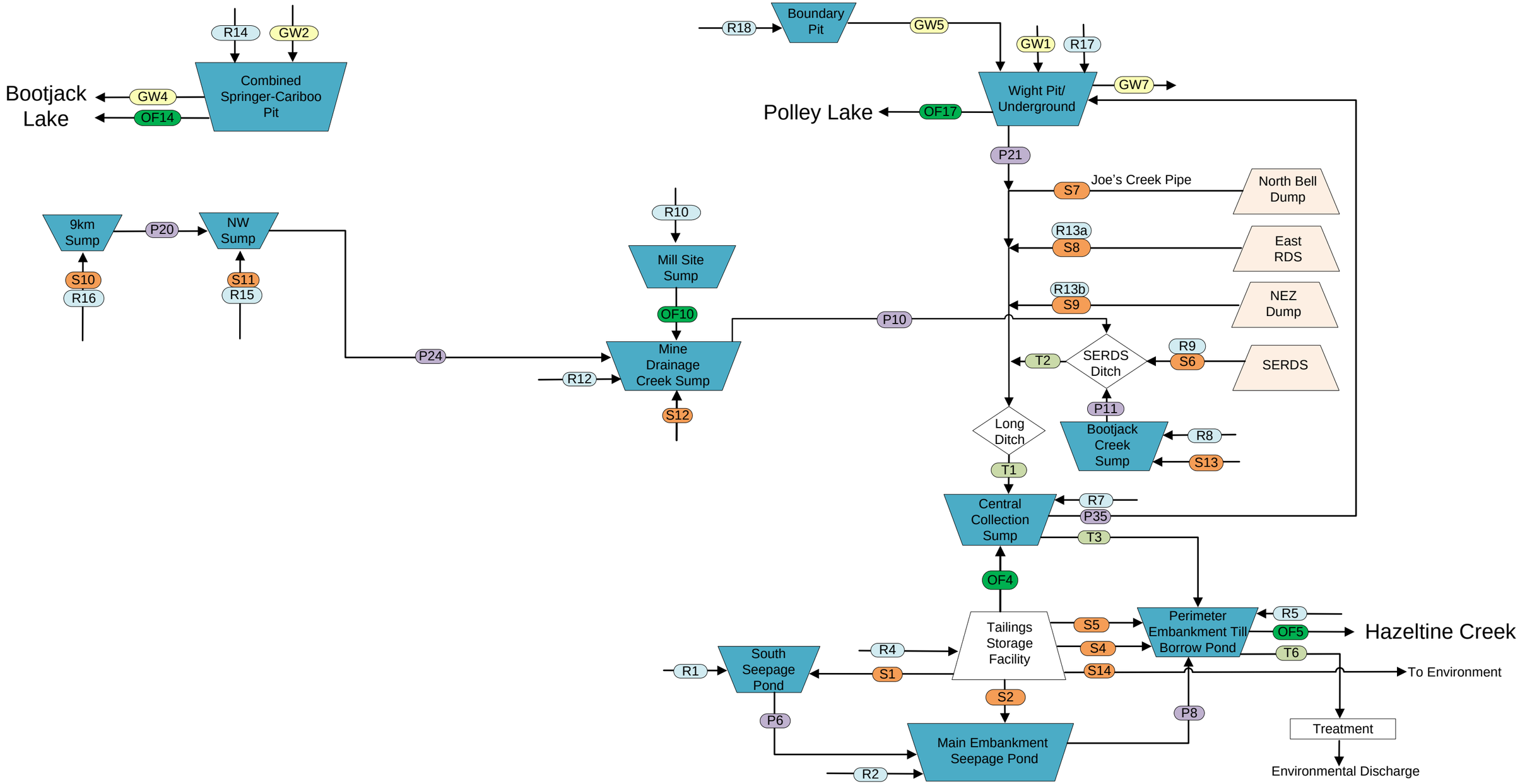

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 4 December 2023

CHECKED: GD
DATE: 4 December 2023

SCALE: Not to Scale
PROJECT No: 23590671/31191
FIGURE No: 12
REV No: 0

TITLE

Springer Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041

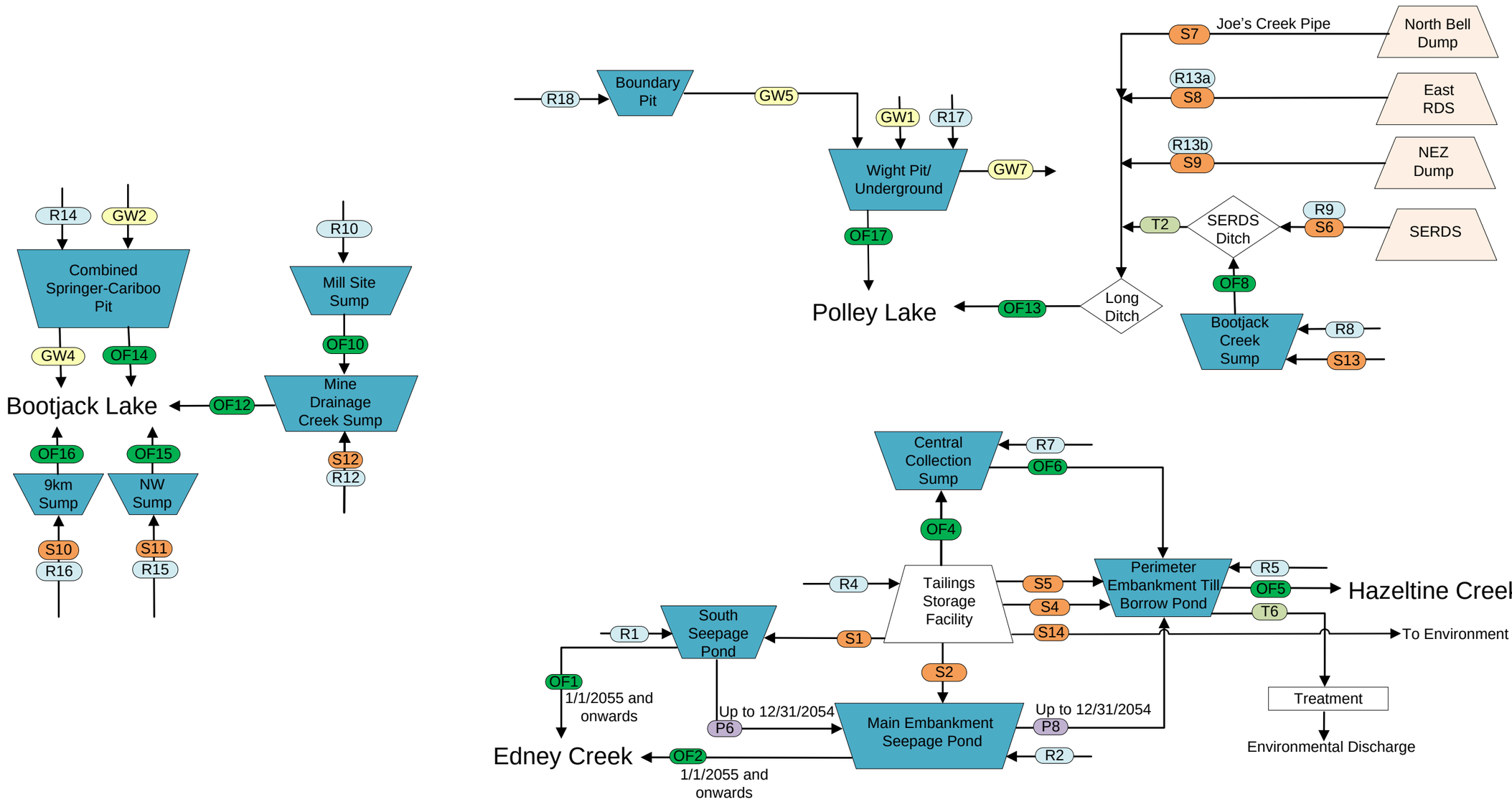

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 4 December 2023
CHECKED: GD
DATE: 4 December 2023
SCALE: Not to Scale
PROJECT No: 23590671/31191

TITLE

Springer Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 April 2041 Onwards

FIGURE No: 13
REV No: 0

4.3.1.5 Climate Inputs

The following sections describe the climate inputs used in the SWWBM. The climate datasets are derived from local and site-based climate stations as described in Section 3.2.1.

Deterministic Climate Inputs

The model features a deterministic simulation mode, which allows the user to select from three predefined climate scenarios based on long-term ECCC and local data (as described in Section 3.2.1):

- average annual precipitation data (Table 9)
- 1:10-year wet annual precipitation (Table 6)
- 1:200-year wet annual precipitation (Table 6)

For each selected scenario, the associated annual precipitation is repeated for each year of the simulation period. Annual median lake evaporation is used for the deterministic mode, and snowpack is accumulated within the model based on the assumption that snow accumulates from December to February, with a 5%, 90%, and 5% melting in March, April, and May, respectively.

Stochastic Climate Inputs

GoldSim has stochastic elements, allowing uncertainty to be represented in model input data. GoldSim uses the Monte Carlo method to sample stochastic elements for probabilistic simulations. A stochastic generator is included in the model to probabilistically simulate natural climatic variation at the mine. The stochastic generator operates on an annual basis and generates random sequences of annual precipitation over the simulation period (one such random sequence is called a “realization”). This method of climate input is used to model a wide range of precipitation inputs and acts as a sensitivity analysis that can be easily viewed as results in the form of percentile values.

To simulate stochastic conditions, monthly precipitation data were fitted to a normal distribution. A normal distribution is a type of probability distribution (a mathematical representation of the relative likelihood of an uncertain variable having specific values). All distribution types use a set of arguments to specify the relative likelihood for each possible value. The arguments for normal distribution are the dataset’s mean and standard deviation. The mean and standard deviation for the monthly precipitation values were determined. The standard deviations were adjusted using a standard z-table, so that the annual mean of the stochastically generated results agreed with the mean of the historical data. The monthly input arguments (mean and standard deviation) are shown in Table 28.

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the normal distribution of the dataset. The stochastic generator was set to perform 2000 realizations to create a sample size that was sufficiently large to account for a range of conceivable climatic scenarios for the study period.

Table 28: Stochastic Climate Generator Log-normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

Climate Change

An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 8 Global Climate Models (UBC 2022) and two emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the GoldSim model) was used to extend these projections from year 2100 to 2200 by resampling monthly data from 2071-2100 and relating projected changes in temperature and precipitation climate variables to a set of extended greenhouse gas concentration pathways beyond year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emissions scenarios using a range of values. The mean, and the upper bound, have been included in the SWWBM to analyze the effects of climate change. Lake evaporation, snow accumulation and snowmelt were calculated in the same way as for the average scenario.

4.3.1.6 Hydrology Inputs

The following sections describe the processes and inputs that define the SWWBM's hydrology.

Runoff Parameters

Runoff in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. Adjustment during the calibration process resulted in a 30% increase of the general runoff coefficients in cases where the monthly precipitation exceeds 50 mm. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)**—mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)**—highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 29.

Table 29: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Catchment Areas

To model runoff, direct precipitation, and evaporation, the catchment areas for each storage element were defined in the model. The catchment/reporting area for each storage element remains consistent with the TAR (Golder 2016g). However, there's one exception: the TSF impoundment catchment at the projected 987 m crest. Any alterations would mainly affect the infrastructure downstream of the TSF, but these changes are expected to have minimal impact on the model results. The catchments are shown in Table 30 and illustrated in Figure 14.

Table 30: Current Catchment Areas for SWWBM Storage/Conveyance Elements

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF Upstream Catchment (External)	622,800
TSF Impoundment Catchment (Internal – current)	2,269,700
TSF Impoundment Catchment (Internal – projected at 987m raise)[(a)]	2,860,000
Perimeter Embankment Till Borrow Pond (PETBP)	524,300
Central Collection Sump (CCS)	438,600
Bootjack Creek Sump	175,200
SERDS Ditch[(b)]	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Cariboo Pit	1,320,400
Springer Pit	651,900
NW Sump	330,200
9K Sump	698,700
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

(a) The raise of the TSF will affect the catchments producing runoff into the TSF. To consider the increase of the TSF impoundment catchment, the model interpolates the TSF impoundment catchments between the current state and the TSF raise to 987m. Changes in other catchments are minor.

(b) The current SERDS Tailings Co-disposal project does not affect the delineation of the catchment.

Source: Golder 2016g. Update on TSF impoundment based on TSF projections.

TSF = Tailings Storage Facility; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump; SERDS = Southeast Rock Disposal Site.



LEGEND

- WATER CATCHMENT AREA
- WATER COLLECTION DITCH
- CONTOUR (10m)

0 600 1,200

1:30,000 METRES

REFERENCES

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD. (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

WATER MANAGEMENT PLAN

TITLE

WATER CATCHMENT AREAS

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31100/31191	0	**14**

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4.3.1.7 Storage Capacities

Free water volumes in storage ponds, sumps, and tailings facilities depend on a balance between their inflows and outflows. The stage (elevation) can be directly correlated to a specific storage volume using site bathymetric (sub-aqueous surface) and topographic (land surface) data. These relationships can be referred to as stage-storage curves.

Dynamic storage facilities such as the TSF, where tailings deposition changes the available storage, require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. Stage-storage curves for the TSF up to a crest elevation of 987 m were developed from the 2020 TSF survey. These curves were obtained from preliminary tailings deposition modelling carried out in support of the design of the 987 m TSF.

The stage-storage curves projected up to a crest elevation of 987 m constitute a 2-D element that considers the tailings tonnage. These curves will interpolate according to the dry tailings volume across the Springer Expansion LOM schedule. Additionally, these curves are limited by the spillway invert stated in Table 25, serving as the upper boundary for the maximum TSF elevation.

- Springer Pit (November 7, 2019, bathymetry survey)
- Cariboo Pit (June 3, 2022, topographic survey)
- TSF (June 17, 2020, bathymetric survey tied-in with October 22, 2019, topographic survey)
- Wight Pit (January 13, 2022, bathymetric survey)

The estimated volume capacities for the facilities listed above and other storage locations are presented in Table 31.

Table 31: Maximum Capacities for Major Storage Facilities

Major Storage Facility	Estimated Capacity (M-m^3)
Springer Pit[(a)]	14.8
Cariboo Pit[(b)]	5.1
Combined Springer-Cariboo Pit final mine-out	30.3
TSF – 987 m crest elevation design	5.7[(b)]
Wight Pit	3.8
PETBP	0.17

(a) Represents current individual pit volumes (i.e., before pits are combined or further mined).

(b) Capacity at the final stage of the TSF, when tailings deposition ends.

Source: WSP 2023a.

4.3.1.8 Mine Plan

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage/volume of dry tailings during the project is provided in Table 32 (MPMC 2022b). It is assumed that 6.55 M-tons of dry tailings have been placed in the TSF between the mine plan start date of July 1, 2022, and the assumed SWWBM operations start date of May 2, 2023.

Table 32: Mine Plan (Annual Totals)

Year	Dry Tailings (tons)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on July 1, 2022.

(b) Mine plan ends on March 31, 2031.

4.3.1.9 TSF Water Volumes

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on-site year over year (including within the TSF) by treating and discharging water.

The minimum and maximum operational water volumes in the TSF under normal conditions are 1.5 M-m^3 and 1.7 M-m^3, respectively.

The water balance model activates and deactivates pumping flows. As a result, the TSF water volume is set at 1.5 M-m^3 prior to freshet and it returns to the specified normal operating range after freshet. TSF water volume conditions are presented in Table 33.

Table 33: TSF Water Volume Values

Condition	TSF Water Volume (M-m^3)
Minimum under normal conditions	1.5
Maximum prior to freshet (February-April)	1.5
Maximum after freshet and until freeze-up	1.7

4.3.1.10 Flow Derivation and Logic

This section describes the model logic for pumped flows, seepage (from the TSF), groundwater inflows and outflows, consumption, and transfer flows.

Pumped Flows

The most relevant transfer rates, including rates between TSF, Pits and PETBP; have been informed by MPMC (MPMC 2023c), while the remaining rates remain consistent with the TAR model and were based on engineering judgement (Golder 2016g). Maximum pumping rates for the operational, closure, and post-closure phases (2023 to 2131) are available in Appendix A.

It should be noted that the capacity set for transfer from TSF to Wight Pit (P30) was assumed at a capacity to avoid PETBP overflow during operations. Capacity set for transfer from CCS to Wight Pit (P35) during closure is a WSP assumption to allow suitable water transfer capacity between CCS and Wight Pit during the closure phase, and this future conveyance system will require design confirmation as the Site approaches closure.

PETBP Pumping Logic

The PETBP functions as attenuation pond for the WTP, with a storage capacity of 170,000 m^3. If this storage capacity is depleted, water is pumped to the TSF for temporary detention (P5).

Mill Process Flows

The mill process water requirements are based on 2.0 m^3/t of dry tailings. Interstitial water sequestered in the deposited tailings is based on 0.347 m^3/t of dry tailings deposited.

Tailings Storage Facility Seepage Flows

Seepage flows from the TSF (S1 to S5) were estimated using a two-dimensional numerical groundwater flow model to quantify anticipated seepage rates through the embankment and foundation. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. The TSF seepage rates are presented in Section 3.2.4.

Consumption Flows

Consumption flows are system losses attributed to the operation of dust suppression equipment. Consumption flows were estimated by MPMC staff for operations (MPMC 2023c) and are modelled according to the following logic:

- Turbo-misters operate from May to September.
- Water trucks withdraw water at variable rates from May to September.

Consumption flow rates are presented in Appendix A.

4.3.2 Water Balance Calibration

Models are representations of systems, and as a result, accuracy will vary. Models are used to provide an indication of a system and how the system behaves under certain conditions. Calibration and validation exercises are used as an indicator of how well the model replicates conditions during the calibration period and provide the basis for future projections assuming that past behavior is an indicator of future behavior. The level of accuracy in model calibrations is dependent on the availability and quality of historical data and whether the logic for transferring or storing water is representative of actual conditions. If there are significant changes to the system that is being modelled, then those assumptions should be validated through additional model calibration as more monitoring data become available. The following sections provide information on the calibration process and the associated results.

4.3.2.1 Calibration Period

The calibration period is from January 1, 2017, to December 31, 2022. A 6-year period was selected to capture variable climatic, operational, and hydrological conditions that have been experienced on site.

4.3.2.2 Tailings Storage Facility Water Volume

The TSF represents the largest designated water storage facility at the mine. The large volume capacity of the facility, coupled with the availability of water level and survey data, and the TSF's role in the production mill reclaim water system, means the structure is a key indicator of large water volume changes on site, and with that, a good location for conducting a calibration check that is representative of the entire mine. A calibration check was carried out for the TSF water volume. Measured TSF water levels and operational water transfer data formed the primary inputs (e.g., water transfers to the Springer or Cariboo pits, production mill process flows, and water transfer to and from the PETBP). In addition, a global water balance check was performed to check that the difference between total water inflows and total water outflows was equal to the change in site storage.

Initial model simulation runs during the calibration period, without any adjustments, revealed poor agreement for selected periods. To account for these differences, general seasonal runoff coefficients (July to February) were assigned a 30% increase (scalar factor applied to the runoff coefficients for the applicable period) to represent higher antecedent moisture conditions if the previous month accumulated more than 50 mm of precipitation depth. In addition, general runoff coefficients were applied to what was defined as dry period in the TAR. Climate records obtained from a nearby ECCC station (Spokin Lake 4E; 1097646) appeared to support the hypothesis that rain-on-snow events, occurring for short and discrete periods, would have contributed to higher runoff conditions. The model was run again, and the results are shown in Figure 15.

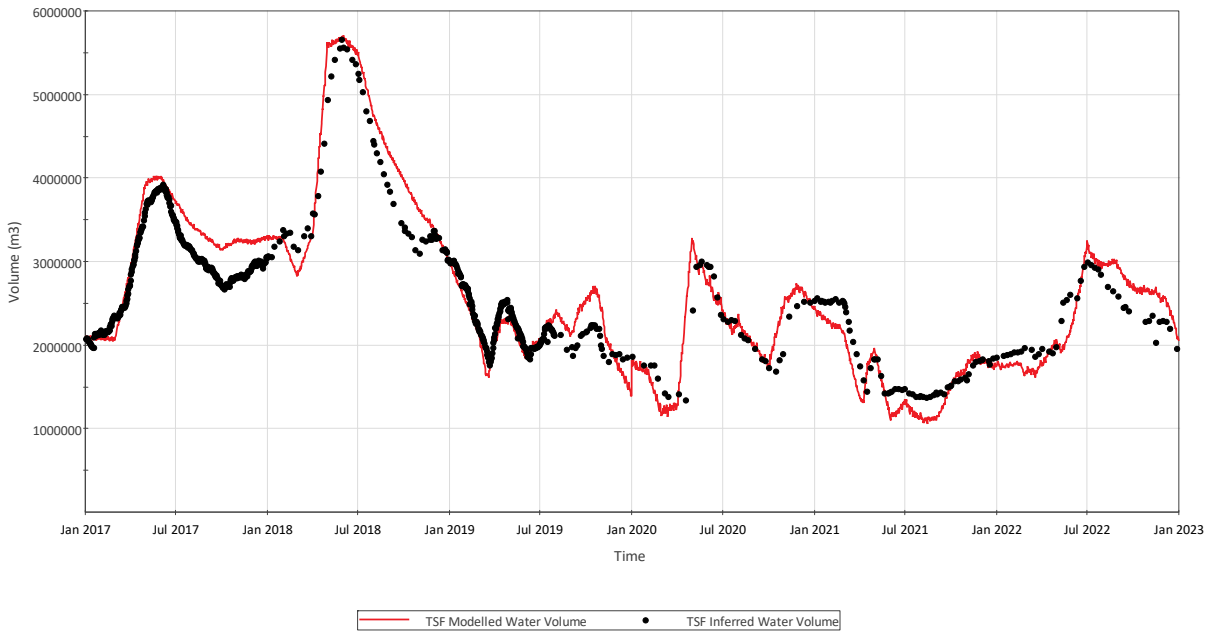

Figure 15: Tailings Storage Facility Water Volume Calibration from January 1, 2017, to December 31, 2022

As illustrated in Figure 15, the TSF modelled water volumes appear to demonstrate good agreement between modelled and inferred water volumes (water level measurements converted to a volume using interpolated stage-storage curves), with modelled volumes consistently tracking inflection points (change from accumulation to depletion or vice-versa). There are select periods where the calibrated model is slightly over-estimating or under-estimating the inferred volumes.

Remaining differences between modelled and inferred values may have several explanations:

- Variability in runoff coefficient throughout the year.
- Uncertainties in the climate data (e.g., snowpack surveys can miss intermittent snowmelt if conducted infrequently and the use of composite datasets may over or under-estimate actual conditions).
- Uncertainties in the TSF bathymetric survey (e.g., the transition between exposed tailings surface [i.e., beach] and free water can be complex).
- Uncertainties in the TSF storage curve after the start of tailings deposition.
- Potential inaccuracies in water level measurements.
- Gaps and/or inconsistent water level measurements.
- Potential inaccuracies and/or missing WTP discharge data.
- In general, the modelled results for the 2022 SWWBM calibration give a reasonable approximation of site conditions and are considered suitable for water management planning exercises.

4.3.3 Water Balance Results

The updated SWWBM results are intended to inform the water quality assessment for this WMP. The primary use of the water quantity and quality assessments are to predict whether the discharge water quality from the mine during operations will meet the parameter concentrations and discharge quantities and to anticipate water treatment requirements. This section provides an overview of the key results of the SWWBM. Full detailed SWWBM results can be found in Appendix A.

Quantity of Discharge

Throughout the entire planned future operations and closure periods to March 31, 2041, the maximum treatment capacity of the WTP in the model is assumed to be 25,000 m^3/day (0.29 m^3/s, 9.15 M-m^3/year). Excess water beyond this discharge rate is temporarily stored on-site until it can be treated and discharged.
Centralized collection and treatment of contact water is assumed during operations, closure, and post-closure. The Mine's current discharge permit authorizes an annual discharge volume of 10.59 M-m^3.

In year 2041, the assumed treatment capacity of the WTP in the model remains at 25,000 m^3/day (0.29 m^3/s). However, annual contact water requiring treatment is reduced over the post-closure phase as site areas are remediated and some runoff is considered non-contact water, as shown in Figure 13. The annual contact water treated discharge volume declines further in year 2051 when the South Seepage Pond and Main Embankment Seepage Pond catchments are considered remediated, commencing 10 years after the post-closure phase. At the end of the operations phase, contact water requiring treatment notably increases in 2031, as milling is assumed to terminate in 2031 and the demand for milling process water also terminates.

Estimated annual contact water volumes requiring treatment from operations to post-closure are presented in Table 34.

Table 34: WTP Annual Volume Requiring Treatment

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th Percentile	99.5th Percentile
2023[a]	3.90	4.57	5.72
2024	5.00	5.94	7.24
2025	3.50	4.97	6.79
2026	3.37	4.72	6.53
2027	3.35	4.79	6.60
2028	3.36	4.80	6.70
2029	3.39	4.78	6.46
2030	3.31	4.75	6.56
2031[b]	3.93	4.39	5.04
2032	5.56	6.68	7.82
2033	5.54	6.57	7.57
2034	5.50	6.54	7.49
2035	5.42	6.42	7.44
2036	5.43	6.44	7.36
2041[c]	2.36	2.88	4.04
2046	1.80	2.27	3.31
2051	0.46	0.83	1.39

Table 34: WTP Annual Volume Requiring Treatment

Year	Annual Volume Requiring Treatment at WTP (M-m³)		
	50th Percentile	90th Percentile	99.5th Percentile
2071	0.33	0.71	1.48
2091	0.32	0.69	1.60
2111	0.32	0.71	1.44
2131	0.02	0.03	0.05

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

Tailings Storage Facility

Temporary detention of water will be necessary to manage the large runoff volumes generated during freshet (typically April to June). The inflows during freshet will exceed treatment capacity, and detention volume is required to prevent uncontrolled release from the PETBP and to equalize the flow for treatment. The TSF is available to store excess freshet water until four months after the start of closure. At that time, the TSF water volume will decrease to a maximum of 0.25 M-m³, the maximum allowable water volume at closure. To create the reduced TSF water volume, a closure spillway will be constructed at the north abutment (Corner 5) of the TSF. Water will discharge from the TSF to the CCS, and then flow to the PETBP for treatment prior to discharge.

During closure and post-closure, the TSF is modelled to discharge annually via the spillway, and the TSF water volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m³. As from Figure 16, the water volume fluctuation follows a consistent pattern during both closure and post-closure periods, with minimum values occurring in winter and reaching maximum capacity during freshet (0.25 M-m³).

Figure 16 shows the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF water volume pattern shown for the 2041-2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131). Table 35 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 16.

Table 35: TSF Water Volume (m³)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,330,244	1,390,394	1,429,751
	Average	1,493,500	1,576,822	1,809,717
	Maximum	2,840,000	2,840,000	3,493,139
Closure	Minimum	0	0	0
	Average	119,248	188,149	265,076
	Maximum	1,756,506	2,012,120	2,479,271
Post-closure	Minimum	0	0	0
	Average	50,710	116,082	182,881
	Maximum	252,571	252,571	252,571

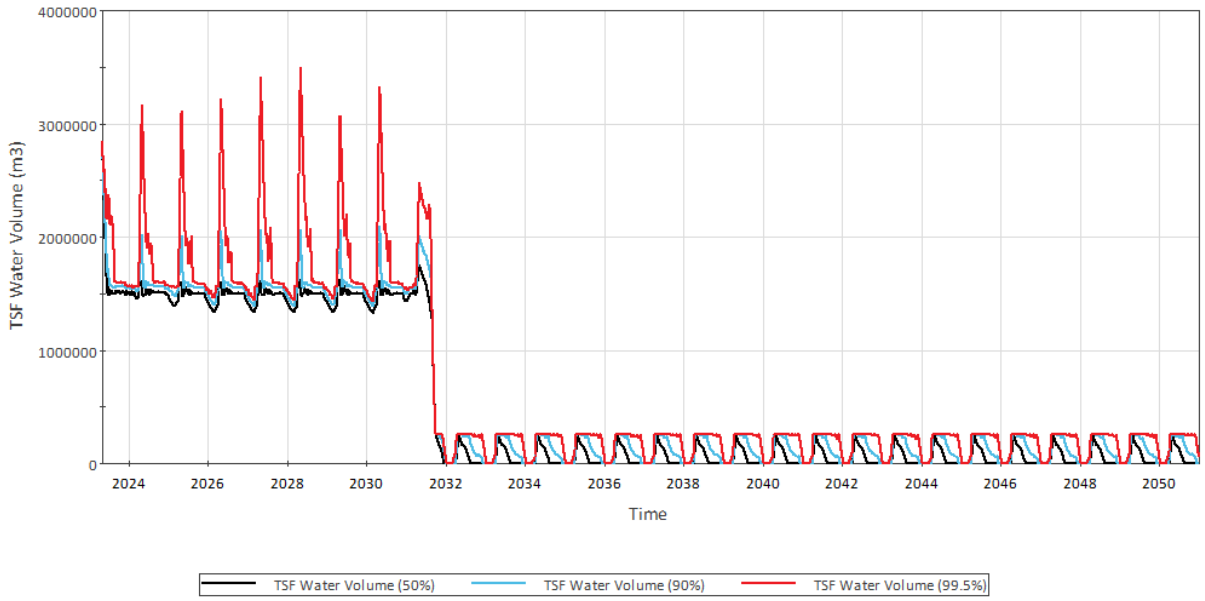

Figure 16: TSF Water Volume During Operations to 10 Years After Post-closure

Combined Springer-Cariboo Pit

Springer Pit and Cariboo Pit were modelled as a single pit for the closure and post-closure phases (starting April 1, 2031). A result comparison between different percentiles for Combined Springer-Cariboo Pit volume during closure and post-closure is provided in Figure 17 . Potentially Acid Generating (PAG) waste rock will be stacked uniformly to an elevation of 1,004 m in the base of the Combined Springer-Cariboo Pit at the end of the operations phase. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2033 under the 99.5th percentile condition, while under the rest of the climate conditions it is estimated to cover the PAG material placed in pit by 2034. Under the 50th percentile results, the combined Springer-Cariboo Pit lake is estimated to start overflowing in 2058, while under the 90th percentile it is estimated to start overflowing in 2056, and in 2055 under the 99.5th percentile. The Water Quality Report (WSP 2023c) discusses modelled water quality of the Springer-Cariboo pit lake at the estimated time of overflow.

Table 36: Combined Springer-Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Closure	Minimum	109,345	145,263	211,031
	Average	4,827,785	5,199,295	5,652,177
	Maximum	9,030,590	9,598,661	10,300,000
Post-closure	Minimum	9,032,744	9,600,627	10,300,000
	Average	20,033,811	20,167,573	20,287,305
	Maximum	21,100,000	21,100,000	21,100,000

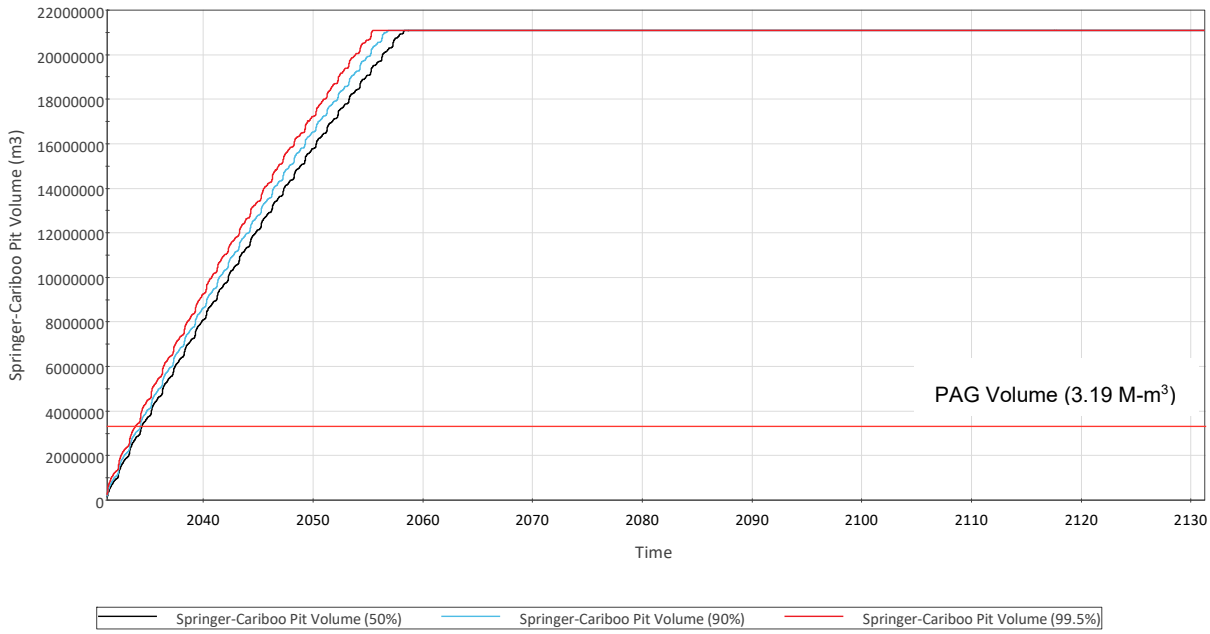

Figure 17: Combined Springer-Cariboo Pit Water Volume from Closure

The combined Springer-Cariboo Pit is modelled to fill to its maximum volume during post-closure. Following that time, additional volume collected in the combined pit will overflow from the pit's spillway and is assumed to direct discharge to the receiving environment in the SWWBM. Water quality and water treatment discussion is included under separate cover regarding this assumption of direct environmental discharge of pit lake overflow during post-closure.

Table 37 shows the modelled average annual overflow volume from the combined Springer-Cariboo Pit.

Table 37: Combined Springer-Cariboo Pit Annual Overflow (m^3)

Phase	Combined Springer-Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	469,711	1,051,048	2,249,910

Wight Pit

The water volume in Wight Pit is expected to increase during every freshet season. Four months into the closure phase, the TSF water volume will be reduced to a maximum of 0.25 M-m^3 within two months. Once the TSF can no longer provide freshet storage, Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for freshet storage and will be allowed to fill. Wight Pit is projected to start overflowing in 2049 under the 50th percentile results, and in 2047 under the 90th and 99.5th percentile results. Overflow from Wight Pit during post-closure is assumed as direct environmental discharge to Polley Lake and the water quality implications of this assumption are discussed in the water treatment section of this WMP. Estimated volumes stored in Wight Pit from operations to 10 years after post-closure are presented in Figure 18 and the average annual post-closure overflow volumes are shown in Table 39.

Table 38: Wight Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	459,747	650,947	1,128,389
	Maximum	3,427,576	3,483,974	3,495,141
Closure	Minimum	0	0	0
	Average	80,815	373,440	1,188,190
	Maximum	490,123	1,153,040	2,326,346
Post-Closure	Minimum	0	0	0
	Average	4,835,386	4,841,820	4,849,597
	Maximum	4,984,114	4,984,114	4,984,114

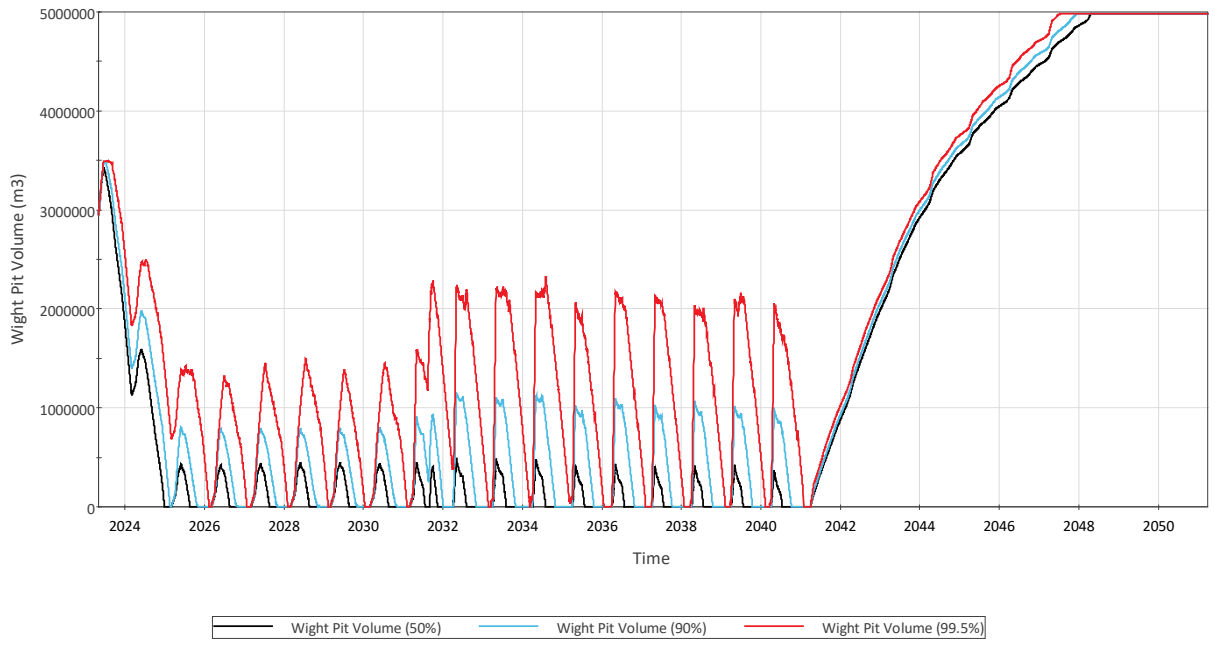

Figure 18: Wight Pit Water Volume During Operations to 10 Years After Post-closure

Table 39: Wight Pit Annual Average Overflow (m^3)

Phase	Wight Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-closure	466,741	617,692	993,214

4.3.4 Water Balance Model Summary

The SWWBM was updated to reflect the Springer Expansion LOM plan during the operational phase and incorporates closure and post-closure phases for the Mount Polley Mine. The SWWBM supports water management planning and the assessment of water quality and associated water treatment and discharge options.

The model was run from May 2, 2023, to March 31, 2131, and included the following LOM phases:

- Operational phase extending from May 2, 2023, to March 31, 2031.
- Closure phase extending from April 1, 2031, to March 31, 2041.
- Post-closure phase commencing on April 1, 2041, and extending, for the purposes of this analysis, to 2131.

The model was run stochastically for 2000 realizations to present 50th, 90th, and 99.5th percentile model results. The results for the modelling during the operational phase are presented as follows:

- The average annual treated discharge for the 50th percentile is approximately 3.65 M-m^3 between 2023 and 2031, while the milling process water demand exists.
- The maximum annual treated discharge for the 99.5th percentile is 7.21 M-m^3 in 2031.
- The maximum TSF water volume during the operational phase is approximately 3.49 M-m^3 for 99.5th percentile, and 1.62 M-m³ for the 50th percentile results (excluding 2023 when the TSF is initially set to 2.84 M-m^3 in the model).
- During the operational phase, the volume in Springer Pit and Cariboo Pit are both decreased to empty before each freshet, and temporary storage will occur during the freshet.
- There are no overflows from the PETBP under the simulated conditions during the operational phase.

The conclusions for the modelling during closure and post-closure phases are as follows:

- The average annual treated discharge for the 50th percentile result is approximately 0.95 M-m^3.
- The TSF water volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2055 and 2058, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake between 2033 and 2034.
- During closure, the volumes in PETBP are reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet under each of the climate conditions simulated. During closure and post-closure phases, the PETBP does not have sufficient storage capacity to prevent overflow during freshet for the 99.5th percentile condition; however, these overflow volumes are included with the annual treatment requirement volumes. System modifications will occur during closure to prevent overflow of contact water requiring treatment.
- The Wight Pit is expected to initiate spilling between 2047 and 2049, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.

4.4 Water Quality

The Site Wide Water Quality Model Report (SWWQM), developed in GoldSim for the TAR (Appendix D; Golder 2016g) and linked to the SWWBM, was updated as part of this WMP. The complete description of the model setup, inputs, assumptions, calibration and model results are presented in the Springer Expansion water quality model report (Appendix B, WSP 2023c). The objectives of the SWWQM are as follows:

- Hindcast concentrations of constituents in the influent to the WTP (i.e., water quality in the PETBP) and at other Mine facilities (i.e., CCS, Springer Pit, Cariboo Pit, 9K Sump, NW Sump, Mine Drainage Creek Sump, Bootjack Creek Sump, South Embankment Seepage Collection Pond, Main Embankment Seepage Collection Pond, TSF supernatant pond, and seepage from all ore stockpiles) for the calibration period.
- Forecast concentrations of constituents during operations, closure and post-closure as part of the permit application for the Springer Expansion LOM.

The model simulation included four time periods:

- **Calibration** (January 1, 2017, to December 31, 2022) – the calibration period includes care and maintenance of the Mine site (January 1, 2017, to May 31, 2022) and the beginning of resumed operations (June 1, 2022). During the calibration period, water in the Perimeter Embankment Till Borrow Pond (PETBP) is treated at the water treatment plant (WTP) and discharged to Quesnel Lake.
- **Resumed Operations** (January 1, 2023, to March 31, 2031) – the resumed operations period when, similar to the calibration period, water in the PETBP is treated at the WTP and discharged to Quesnel Lake.
- **Closure** (April 1,2031, to March 31, 2041) – a ten-year active closure period is assumed, during which potentially acid generating (PAG) stockpile material from the Temporary Northwest (NW) PAG stockpile is deposited into the Springer-Cariboo Pit and other facilities are reclaimed. The closure phase will include reclamation activities as identified in the RCP (MPMC 2022a). The WTP is assumed to be in operation through all of the closure period. Details on the closure and post-closure management of mine facilities are provided in the MPMC 2022a.
- **Post-closure** (April 1, 2041, to April 1, 2131) – this period includes filling of pits, discharge, and establishment of steady-state conditions for the drainage from mine facilities. Results are presented for two periods within post-closure:
  - Early post-closure (April 1, 2041, to March 31, 2051) – Represents the first ten years of post-closure during which drainage from Mine facilities is assumed to progressively return to undisturbed water quality. The WTP is assumed to be in operation during this period.
  - Long-term post-closure (April 1, 2051, to April 1, 2131) – this time period has been selected to represent steady-state conditions after all closure and post-closure changes have taken place. The need for treatment during long-term post-closure will be confirmed as MPMC approaches this phase and may be achieved through distributed passive or semi-passive treatment systems if required.

Uncertainty exists regarding the exact timing of these transitions. The time periods are intended to show, at a conceptual level, the difference in site drainage quality as the site progresses through the post-closure period; it is not intended to imply that the transitions will occur on precisely those dates.

4.4.1 Constituents in the Model

The constituents in the SWWQM include physical parameters, major ions, nutrients, and dissolved metals and metalloids (Table 40). The dissolved fractions of metals and metalloids are used in all mixing calculations in the model. The total concentrations of metals and metalloids are calculated by adding particulate fractions to the dissolved concentrations as described in the Particulate Addition and Total Metals section that follows the table.

Table 40: Constituents in the Site-wide Water Quality Model

Category	Constituent
Physical parameters	Total dissolved solids (calculated), hardness (calculated).
Major ions	Calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate.
Nutrients	Nitrate, nitrite, total ammonia, total phosphorus.
Dissolved metals and metalloids	Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc.

Particulate Addition and Total Metals

The process of calculating particulate fractions of constituents and total metals and metalloids concentrations was described in Appendix D of the TAR (Golder 2016g). Predictions of total metals and metalloids were calculated by adding empirical particulate fractions to the predicted dissolved metals and metalloids concentrations. Particulate fractions were calculated for two periods:

1) **Operations and Closure:** Monitoring data in the SERDS Ditch and Long Ditch between 2008 and 2023 were used to establish the empirical particulate metal concentrations during operations and closure because these facilities are expected to contribute the majority of particulate load to site flows. The model assumes that total suspended solids (TSS) will be settled to 15 mg/L during operations and closure (i.e., the maximum permitted discharge concentration) before being discharged.

2) **Post-closure:** Monitoring data from Edney Creek was used to establish the empirical particulate metal concentrations because data from this location is considered representative of undisturbed (i.e. reclaimed) surface runoff. The model assumes that TSS will be settled to 3 mg/L (i.e., the 95th percentile of TSS from monitoring data at Edney Creek from 2016 to 2022).

4.4.2 Model Set-up

The model simulated concentrations on a daily time step from January 2017 to December 2022 (calibration period), May 2023 to March 2031 (operations) and from April 2031 to March 2131 (closure and post-closure). Probabilistic climate and water quality inputs were used to run the model stochastically for 2000 simulations:

- **Climate Inputs:** The SWWQM was run with probabilistic monthly climate inputs during operations, closure and post-closure as described in Section 4.3.1.5. Monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022a) were fitted to a log-normal probability distribution. The calibration period used historical climate data for the climate inputs.

- **Water Quality Inputs:** For each realization, a unique concentration for each parameter was selected based on randomly sampled values from within a statistical probability distribution function that was derived from each input.

To interpret the results, median and 95th percentile concentrations were calculated for each Mine facility. To put the results in context, a 95th percentile prediction indicates the maximum concentration that is likely to be reached over the duration of the simulation, with a 95% likelihood that concentrations will be at or below that concentration (it does not suggest that concentrations will exceed this value 5% of the time).

4.4.3 Model Inputs

Water quality inputs in the SWWQM were derived from site monitoring data. A summary of the water quality inputs assigned to each flow in the SWWQM is presented in Table 41 and described below.

Site Water Quality Monitoring Data

Site water quality monitoring data from 2006 to 2023 (depending on the input) were used to develop water quality inputs in the SWWQM. For each constituent, water quality inputs were represented in the model by probability distribution functions. The same standardized process described in the TAR (Appendix D, Golder 2016g) was used to fit probability distribution functions to the monitoring data. A summary of the distributions selected, maximum, 95th percentile, and mean values used for each constituent, and number of samples for each water quality input are presented in in the Springer Expansion SWWQM Report (WSP 2023c).

Geochemical Source Terms

Water quality inputs derived from geochemical source terms developed by SRK Consulting Canada were applied to the SWWQM as an additional scenario in the 2016 Long Term Water Management Plan (Golder 2016). Updates to these geochemical source terms were completed by SRK consulting (SRK 2023). An alternative model scenario was completed using the geochemical source terms as water quality inputs in place of inputs calculated from monitoring data. The results of the two scenarios (using monitoring data or geochemical inputs) were compared. Consistent with the previous geochemical source terms provided by SRK for the 2016 TAR (Golder 2016g) and the 2020 WMP (Golder 2020e), the SRK inputs were considered more conservative than the monitoring data inputs and produced generally higher concentrations in the SWWQM. The results presented in this report are from the scenario that utilized the water quality inputs that were calculated from monitoring data (Section 2.6.3). The results from the geochemical source term scenario are not presented because the model predictions were considered overly conservative for most parameters and because the model was calibrated using the inputs calculated from monitoring data.

Table 41: Summary of Water Quality Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Rock Disposal Site Contact Water	RDS Runoff to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 – July 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 – July 2022)		
	RDS Runoff to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)		
	NAG Waste Rock Runoff	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	NAG Waste Rock Seepage	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)		
	Temporary NW PAG Stockpile Runoff	PAG Dump Seep water quality (n = 140, May 2013 – January 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Temporary NW PAG Stockpile Seepage	PAG Dump Seep water quality (n = 140, May 2013 – January 2023)	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)	
Pit Wall Runoff	Boundary Pit Wall Runoff	Boundary Pit water quality (n = 16, February 2016 – July 2023)		
	Wight Pit Wall Runoff	Wight Pit water quality (n = 71, January 2016 – February 2023)		
	Springer Pit Wall Runoff	Springer Pit water quality (n = 53, January 2016 – August 2022)		
	Cariboo Pit Wall Runoff	Cariboo Pit water quality (n = 40, January 2016 – February 2023)		
Tailings Storage Facility	TSF Beach, Impoundment, and Embankment Runoff	TSF supernatant water quality (n = 157, May 2011 to February 2023)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Unsaturated TSF Seepage	TSF Main Embankment Seepage Collection Pond (n = 144, January 2006 – February 2023)		
	Saturated TSF Seepage	Predicted concentration in the TSF		
Other	Haul Road Runoff	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Disturbed Runoff	W4 and W5 site monitored data (n = 256, January 2014 to February 2023)		
	Undisturbed Runoff	W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)		
	Groundwater Inflow to Springer-Cariboo Pit	GW12-1/2, GW15-1/2 site monitored data (n = 253, June 2013 to January 2023)		

NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site.

4.4.4 Model Assumptions

The key assumptions that have been made in the SWWQM are:

- The input water qualities used in the SWWQM are representative of their respective input sources and will continue to be representative over the modelled timeframe. Water quality data for model inputs were selected from available lab testing and field monitoring, augmented by professional judgement where necessary.
- Concentrations of parameters from monitoring data that were lower than the analytical detection limit were set equal to half the detection limit.
- Concentrations of parameters in direct precipitation onto the water surface of water management facilities were assumed to be zero. No mass was removed or added to modelled systems through evaporation or direct precipitation. These processes affected water quantity only and did not affect mass of modelled parameters in the system.
- All open pits, ponds, and sumps are fully mixed systems. No stratification is considered over the modelled timeframe. All inputs are mixed with existing water volumes to calculate concentrations of parameters.
- All parameters are assumed to behave conservatively. That is, they are assumed to not settle, precipitate, sorb, degrade, or undergo any other process that would reduce concentrations. This assumption is likely to have negligible effects on major ion predictions but may lead to over-estimation of some nutrients and metals.
- All PAG waste rock will be disposed sub-aqueously in the Springer-Cariboo Pit at closure to mitigate onset of acid generation. Acid generation is not expected to occur prior to subaqueous disposal, and disposal in the Springer-Cariboo Pit Lake will prevent acid onset in the future by limiting oxidation in the waste rock. Geochemical characterization studies estimate the time to the onset of acid generation varies between decades and 100 years (MPMC 2022a).
- The combined Springer-Cariboo Pit is assumed to be empty at the start of closure.
- Rock disposal sites (RDS) are assumed to be reclaimed in post-closure. Following revegetation, the runoff from these facilities is assumed to return to undisturbed runoff quality over the course of ten years.
- Diffusive flux from the submerged PAG waste rock into the Springer-Cariboo Pit Lake water cap was not modelled.
- Accumulation and flushing of oxidation products from weathered PAG material prior to subaqueous disposal was not modelled.
- Ice formation and melting were not considered in pits, ponds, and ditches that retain water.

4.4.5 Model Calibration

The SWWQM was set up to hindcast concentrations from January 1, 2017, to December 31, 2022, at seven locations:

- Springer Pit
- Cariboo Pit
- Wight Pit
- CCS
- PETBP
- TSF
- NW Sump

Where discrepancies between model results and monitoring data existed, the model was adjusted to better reflect monitoring data. The same adjustments, made during calibration of the SWWQM in the 2020 Water Management Plan (Golder 2020e) and during the calibration of the SWWQM in the 2022 Reclamation and Closure Plan (MPMC 2022a), were maintained in this update to achieve calibration with monitoring data:

- Adjusting the proportion of Wight Pit runoff and groundwater inflows that are assigned a waste rock contact water input based on storage of waste rock in the pit.
- Adjusting the proportion of runoff from waste rock that is assigned an undisturbed water quality input.
- In the TSF, applying calibration factors greater than 1.0 to improve the model calibration for chloride, fluoride, potassium, sodium, nitrite, dissolved antimony, dissolved arsenic, dissolved barium, dissolved lithium, dissolved molybdenum, and dissolved vanadium. These calibration factors are applied during periods when tailings are deposited to the TSF.

Calibration Results

Model calibration results are shown compared to monitoring data for total dissolved solids and dissolved copper in Figure 19 through Figure 25. Model calibration results for all parameters and locations are provided in the Springer Pit Expansion SWWQM Report (Appendix B, WSP 2023c). Monitoring data were generally between the projected 5th and 95th percentile model calibration results for all parameters. However, several parameters (e.g., dissolved copper) were underpredicted during periods in 2018, 2020, and 2021. The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility (Golder 2022f). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process.

Where monitoring data fell within the 5th and 95th percentile model calibration results, the model was considered to be in good agreement with monitoring data. The good agreement indicates that model inputs were well characterized and that these parameters had low sensitivity to assumptions or model conditions not matching site conditions.

Where monitoring data were consistently below the 5th percentile predictions, the model was considered to be over predicting concentrations. Possible reasons why the model may be over-predicting concentrations are:

- The model was developed to predict water quality conservatively; where uncertainty exists in model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected. For example, seepage from RDSs was assigned a NAG water quality for the entire model simulation period, which is a conservative assumption.
- Metal concentrations that are far below detection limits may be skewed upward by model inputs where half-detection limits were applied.
- Settling of particulate material is not accounted for in the model.
- Geochemical processes, such as precipitation and adsorption, are not accounted for in the model.

Although these factors may lead to over-prediction of concentrations, the model is considered valid for the purpose of predicting concentrations of parameters on the Mine and in the influent to the WTP because deviations in model predictions from monitoring data in this category tend toward additional environmental protection.

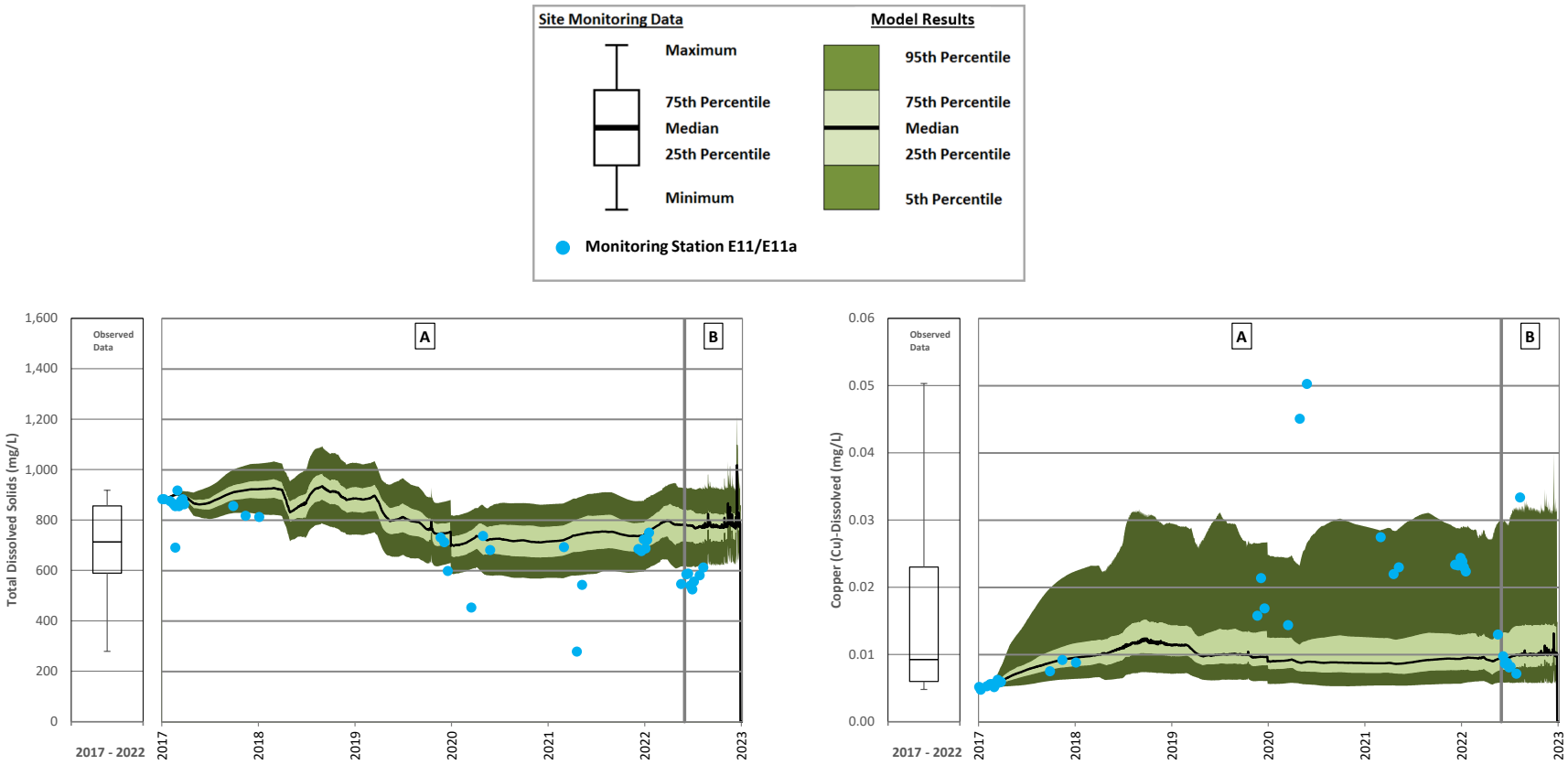

A = Care and Maintenance; B = Resumed Operations

Figure 19: Springer Pit Calibration – Total Dissolved Solids and Dissolved Copper

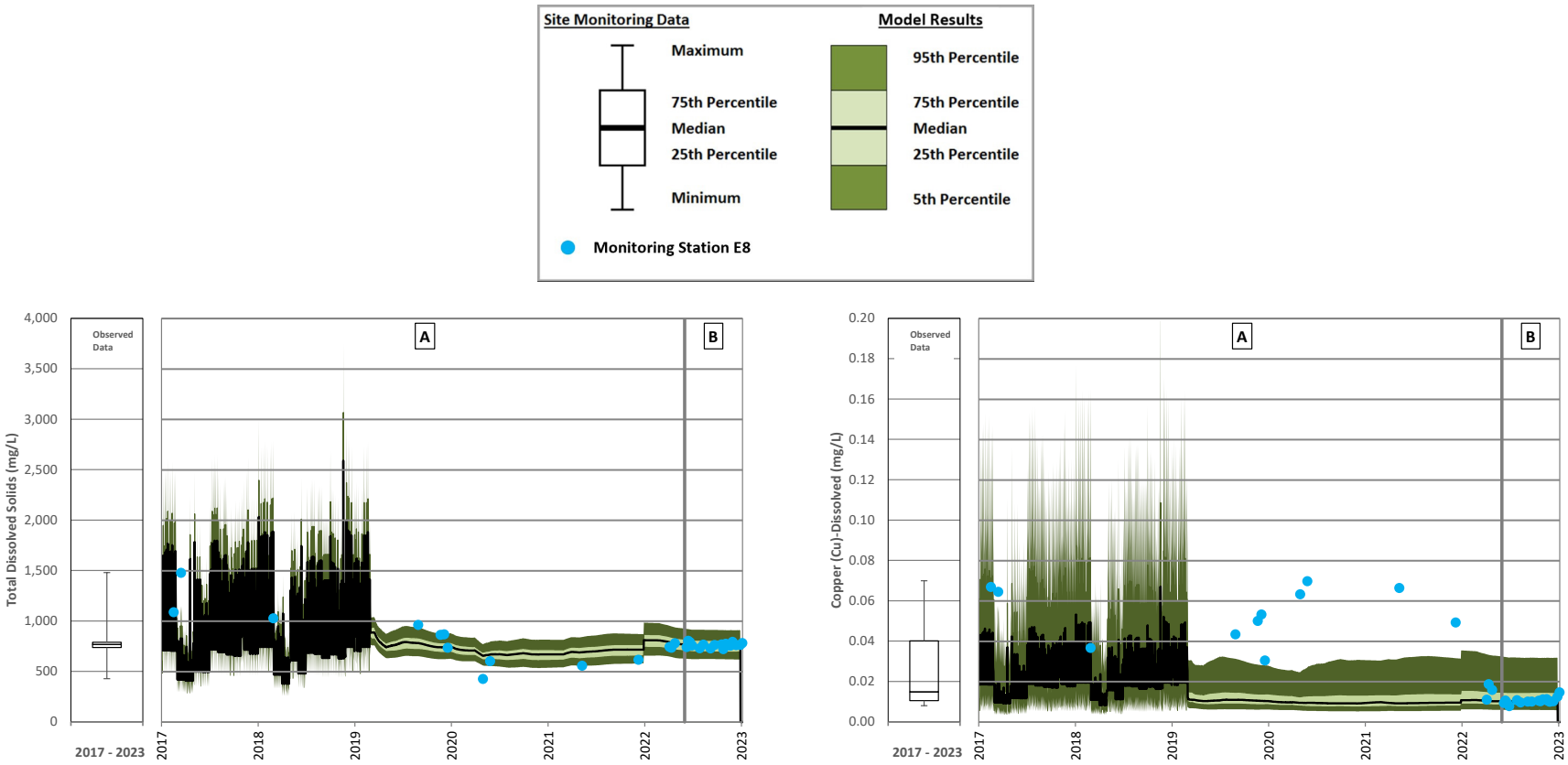

A = Care and Maintenance; B = Resumed Operations

Note(s): Cariboo Pit is a flow-through system from the beginning of the model simulation to March 2019, which results in a wide range in predicted concentrations. After March 2019, Cariboo Pit stores water, which reduces the range in predicted concentrations. The source of increased copper concentrations in 2019, 2020 and 2021 monitoring data is due to the discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to Cariboo Pit). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 20: Cariboo Pit Calibration – Total Dissolved Solids and Dissolved Copper

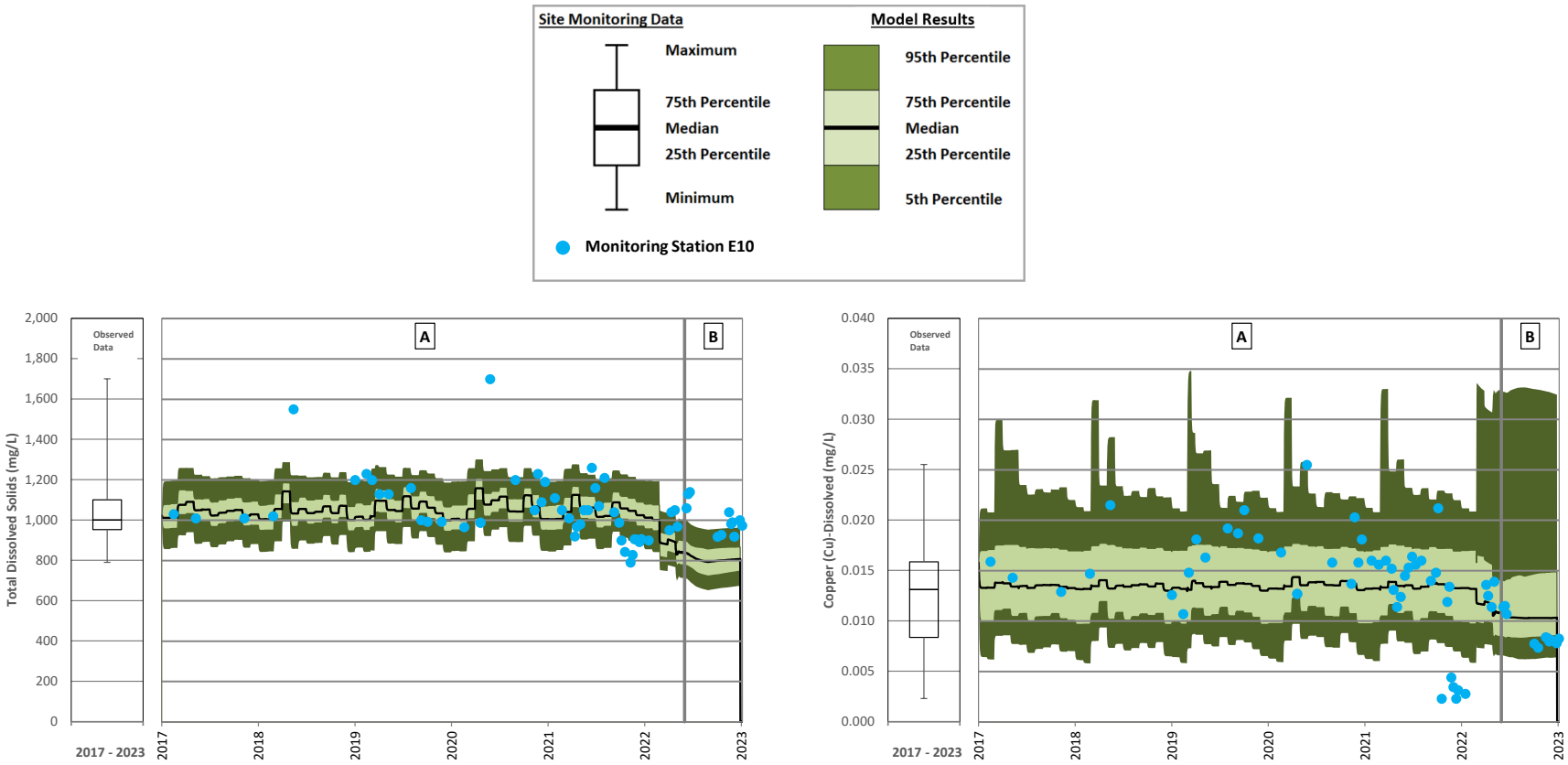

A = Care and Maintenance; B = Resumed Operations.

Figure 21: Wight Pit Calibration – Total Dissolved Solids and Dissolved Copper

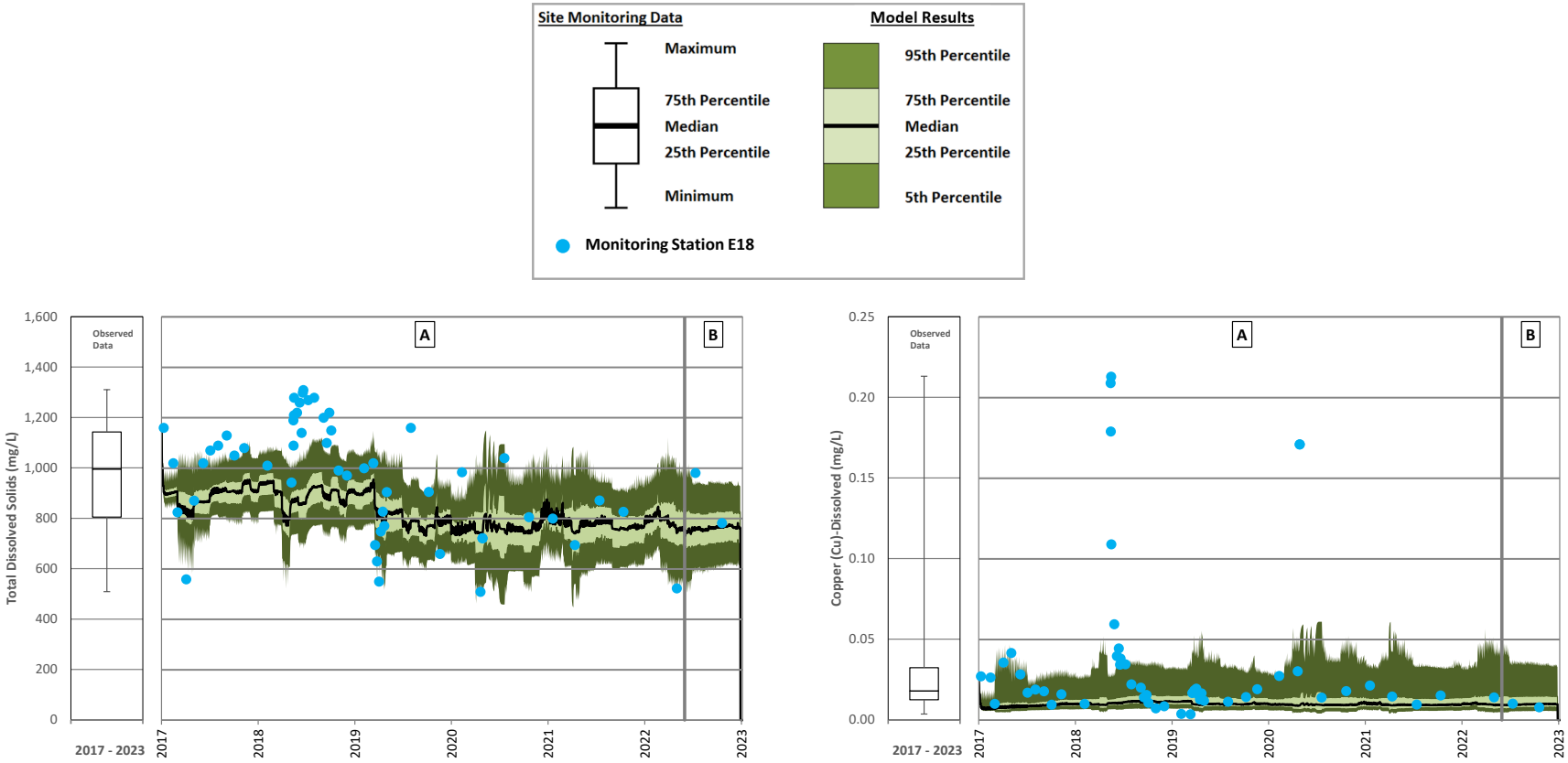

A = Care and Maintenance; B = Resumed Operations

Note(s): The source of increased dissolved copper concentrations in the Central Collection Sump 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the CCS. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 22: Central Collection Sump Calibration – Total Dissolved Solids and Dissolved Copper

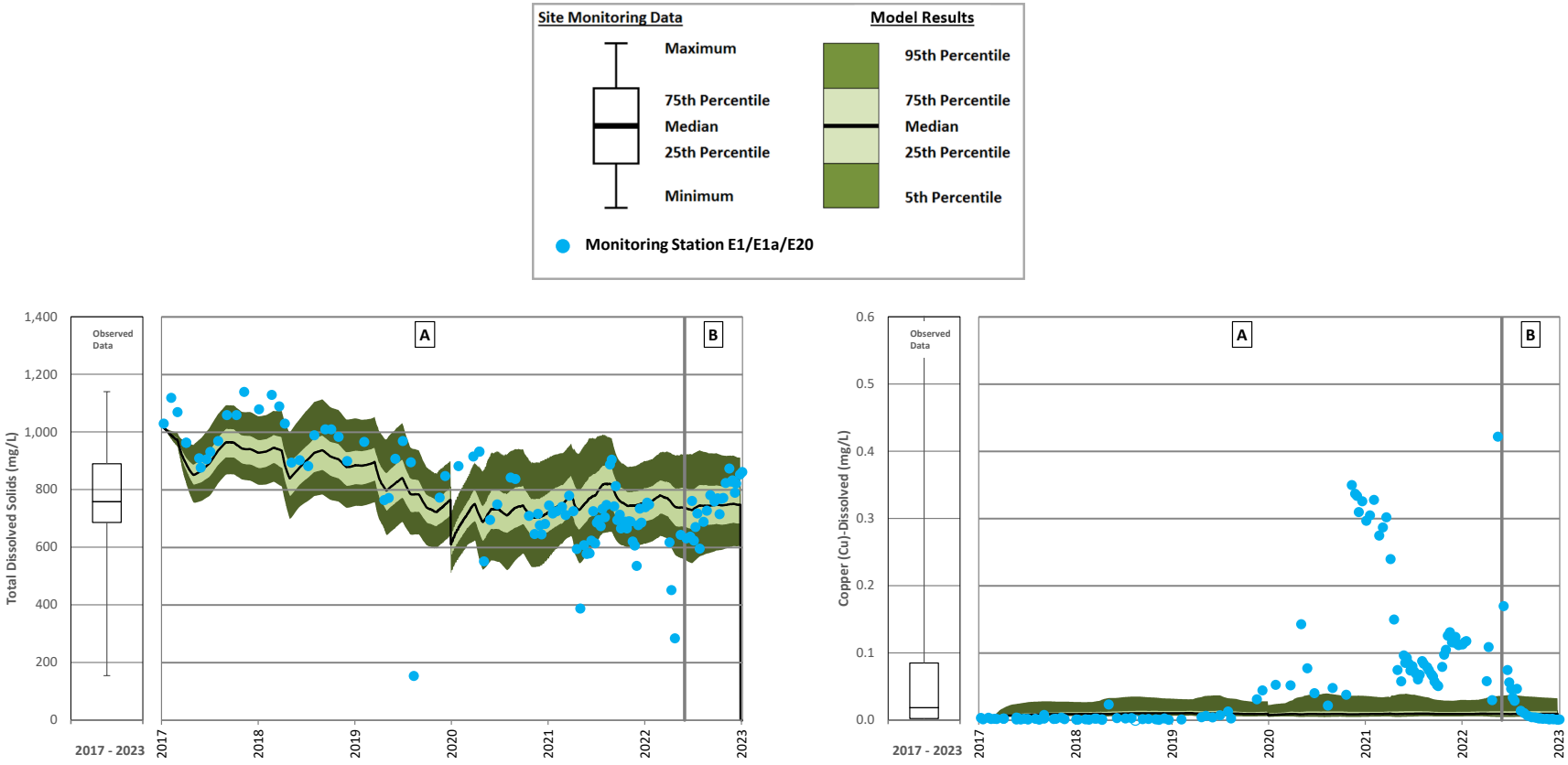

A = Care and Maintenance; B = Resumed Operations

Note(s): The source of increased copper concentrations in 2018 and from 2020 to 2022 in the monitoring data of the Tailings Storage Facility (TSF) is due to the discharge of leachate to the TSF from the onsite test heap leach facility. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 23: Tailings Storage Facility Supernatant Pond – Total Dissolved Solids and Dissolved Copper

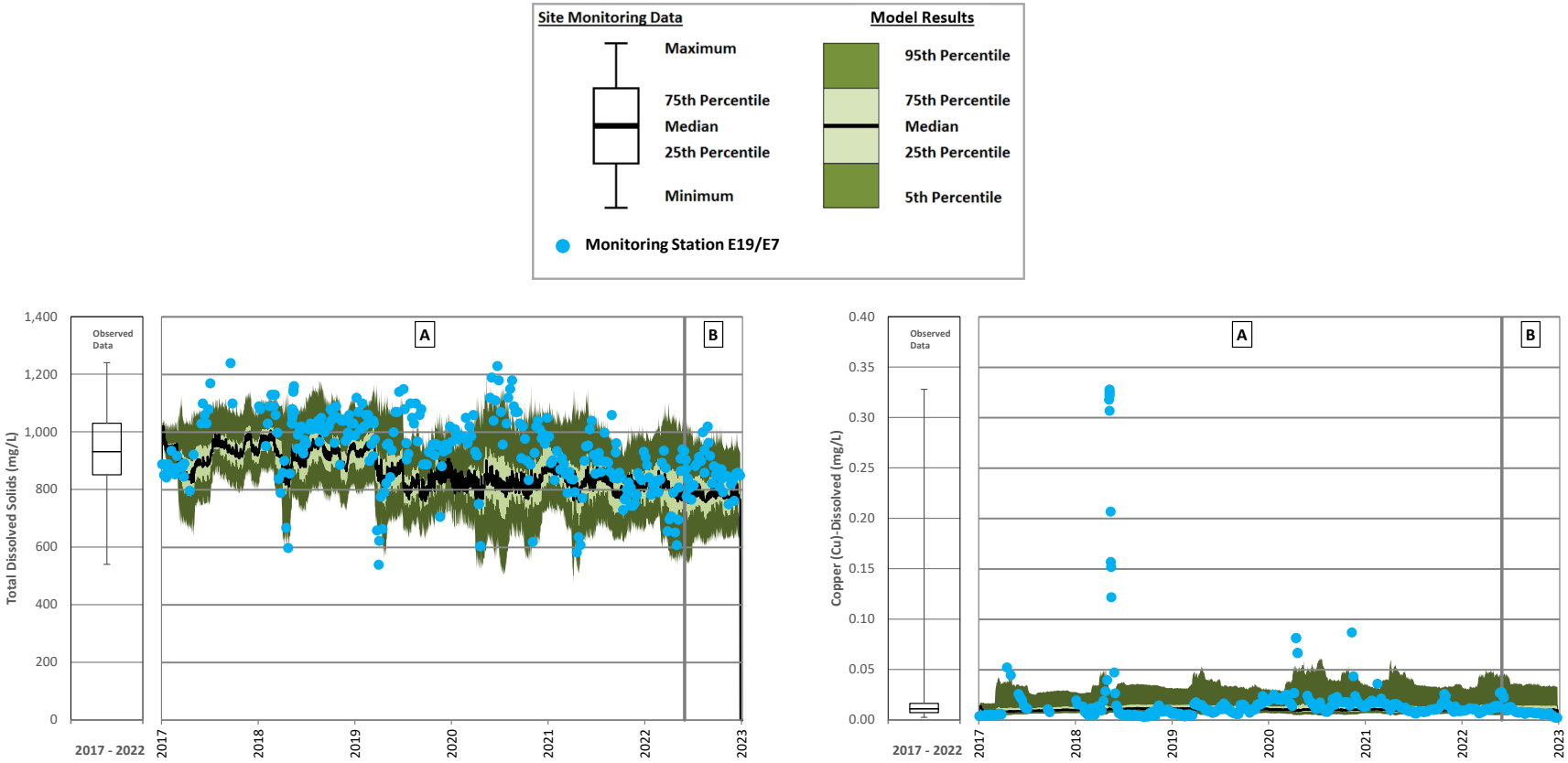

A = Care and Maintenance; B = Resumed Operations

Note(s): The source of increased dissolved copper concentrations in the Perimeter Embankment Till Borrow Pond 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the PETBP. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 24: Perimeter Embankment Till Borrow Pond – Total Dissolved Solids and Dissolved Copper

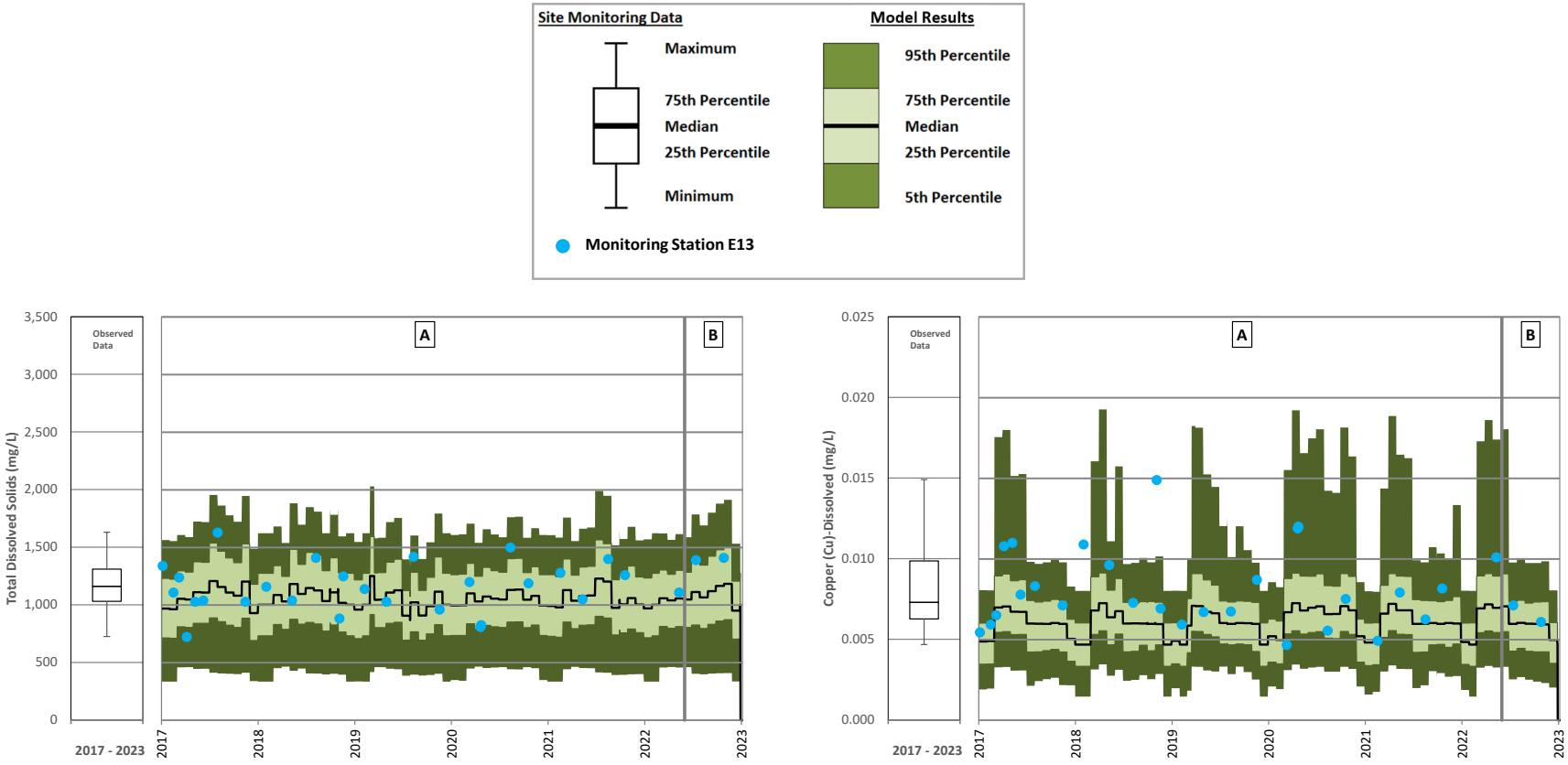

A = Care and Maintenance; B = Resumed Operations

Figure 25: Northwest Sump – Total Dissolved Solids and Dissolved Copper

4.4.6 Model Simulation

After the model calibration was completed, model simulations were performed for the following periods:

- Operations (January 1, 2024, to March 31, 2031)
- Closure (April 1, 2031, to March 31, 2041)
- Post-closure (April 1, 2041, to April 1, 2131)

For most parameters, peak concentrations of parameters occur in operations or closure. Concentrations decrease during closure and post closure as Site areas are reclaimed. Runoff inflows from reclaimed areas are assigned the undisturbed runoff water quality input. Some parameters (for example, dissolved aluminum and dissolved chromium) increase in concentration from operations to closure and post-closure because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the contact areas of the Site (disturbed runoff areas, TSF beach runoff areas, NAG waste rock areas and PAG waste rock areas).

The following sections present time series of predicted concentrations of several key parameters (copper and selenium) for the PETBP, the Springer-Cariboo Pit Sump, Wight Pit and Long Ditch (which receives contact water from the SERDS). Maximum of median and 95th percentile predicted concentrations are presented for all modelled parameters in these locations. Time series and maximum concentrations for all modelled parameters and locations are presented in the SWWQM report (Appendix B).

4.4.6.1 Perimeter Embankment Till Borrow Pond

During operations, closure and the first ten years of post-closure, the PETBP is the assumed influent water to the WTP, which discharges to Quesnel Lake. Maximum of the daily median and maximum of the daily 95th percentile concentrations in the PETBP are presented in Table 42. Time series for predicted copper and selenium concentrations in the PETBP are presented in Figure 26.

In general, concentrations in the PETBP are predicted to remain relatively consistent during operations until the end of pumping from the mill processing plant in 2031. This consistency is due to the assumption that the entire surface areas of the RDS are accounted for at the beginning of the model simulation. Therefore, the runoff and seepage volumes from the RDS do not change. Changes in predicted concentrations in the PETBP are due to:

- Variable pumping from the TSF to the Mine Drainage Creek Sump (MDCS) during operations. During periods when the TSF is pumped to the MDCS, concentrations of most parameters increase in the MDCS. Concentrations decrease in the MDCS when there is no pumping from the TSF. Changes in MDSC water quality reach the PETBP through the pathway connecting the MDCS to the PETBP:
  - TSF → MDCS → SERDS Ditch → Long Ditch → CCS → PETBP.
- Surface runoff at the mine site causes fluctuations in concentrations depending on the proportions of the catchment areas flowing into the facilities (e.g., RDS areas, disturbed areas, undisturbed areas). Parameter concentrations reach steady-state during the winter months because surface runoff is low.

Discharge from the PETBP may be directed to Hazeltine Creek in closure if distributed discharge can be achieved. This discharge may also include overflow and seepage from the TSF, as well as runoff from surrounding catchment areas of the PETBP, TSF, and CCS.

Predicted concentrations in the PETBP change from operations to closure and into early post-closure because of the staggered reclamation of the TSF beach and impoundment areas which are then assigned an undisturbed water quality once the areas are reclaimed. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the PETBP. In closure and post-closure, concentrations in the PETBP follow two patterns:

1) Decrease from operations because the statistical distributions assigned to undisturbed runoff water quality have lower concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., sulphate, nitrate and dissolved copper).

2) Increase from operations because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., total phosphorus, dissolved chromium and dissolved iron).

Predicted concentrations in the PETBP reach a steady state approximately 10 years after the start of post-closure when all mine site areas have been reclaimed.

Table 42: Summary of Predicted Water Quality in Perimeter Embankment Till Borrow Pond

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 - March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	649	809	340	483	220	314	153	233
Total Dissolved Solids	mg/L	948	1,117	500	710	359	496	239	313
Major Ions									
Calcium	mg/L	208	250	102	144	61	84	41	55
Chloride	mg/L	17	20	4.6	11	6.6	10	5.1	8.0
Fluoride	mg/L	0.74	1.0	0.28	0.39	0.24	0.35	0.17	0.24
Magnesium	mg/L	31	45	21	30	16	26	12	23
Potassium	mg/L	16	19	3.7	6.8	3.8	5.0	2.7	3.5
Sodium	mg/L	63	75	23	32	24	32	18	22
Sulphate	mg/L	576	681	268	401	138	189	104	144
Nutrients									
Ammonia	mg/L (as N)	0.021	0.058	0.032	0.074	0.012	0.051	0.0081	0.038
Nitrate	mg/L (as N)	3.4	23	2.1	6.4	0.61	2.5	0.45	1.9
Nitrite	mg/L (as N)	0.055	0.069	0.017	0.032	0.0054	0.06	0.0041	0.045
Total Phosphorus	mg/L	0.014	0.029	0.015	0.025	0.017	0.026	0.022	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.048	0.2	0.07	0.3
Antimony	mg/L	0.0012	0.0016	0.00048	0.00095	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0028	0.0033	0.002	0.0032	0.00085	0.0012	0.00086	0.0016
Barium	mg/L	0.054	0.073	0.028	0.056	0.022	0.031	0.015	0.022
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.37	0.19	0.36	0.046	0.061	0.031	0.042
Cadmium	mg/L	0.00022	0.00041	0.000029	0.00014	0.000019	0.000079	0.000013	0.00006
Chromium	mg/L	0.00065	0.0007	0.00072	0.00082	0.00055	0.0013	0.00084	0.0017
Cobalt	mg/L	0.00064	0.0014	0.00036	0.00062	0.000083	0.00029	0.000058	0.00023
Copper	mg/L	0.02	0.19	0.016	0.17	0.004	0.0079	0.0032	0.007
Iron	mg/L	0.48	0.58	0.48	0.54	0.087	0.33	0.13	0.44
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.000019	0.000072	0.000016	0.0001
Lithium	mg/L	0.0095	0.012	0.0052	0.011	0.0027	0.0041	0.0017	0.0027
Manganese	mg/L	0.14	0.26	0.058	0.14	0.075	0.16	0.057	0.13
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.28	0.089	0.16	0.045	0.071	0.034	0.054
Nickel	mg/L	0.0011	0.0021	0.001	0.0016	0.00058	0.0013	0.00087	0.0019
Selenium	mg/L	0.041	0.074	0.022	0.044	0.0034	0.011	0.0025	0.0083
Silver	mg/L	0.0000053	0.000013	0.0000053	0.000013	0.0000052	0.000015	0.0000062	0.000019
Strontium	mg/L	5.3	8.4	1.1	2.1	0.59	1.2	0.41	0.85
Thallium	mg/L	0.0000089	0.000014	0.0000049	0.0000058	0.0000051	0.0000052	0.000005	0.0000052

Table 42: Summary of Predicted Water Quality in Perimeter Embankment Till Borrow Pond

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 - March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Tin	mg/L	0.000049	0.00013	0.000051	0.00015	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0035	0.00087	0.0019	0.00084	0.0015	0.00055	0.0011
Vanadium	mg/L	0.0035	0.0039	0.0018	0.0027	0.00058	0.001	0.0007	0.0012
Zinc	mg/L	0.012	0.019	0.0069	0.011	0.002	0.0032	0.0017	0.0027
Dissolved Metals									
Aluminum	mg/L	0.017	0.047	0.019	0.067	0.02	0.084	0.042	0.18
Antimony	mg/L	0.0012	0.0014	0.00046	0.00081	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0025	0.003	0.0017	0.0029	0.00082	0.0011	0.00083	0.0015
Barium	mg/L	0.052	0.064	0.026	0.047	0.021	0.03	0.014	0.02
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.34	0.19	0.33	0.046	0.059	0.031	0.04
Cadmium	mg/L	0.00021	0.00036	0.000026	0.000091	0.000018	0.000071	0.000012	0.000053
Chromium	mg/L	0.00027	0.00031	0.00034	0.00044	0.00044	0.00077	0.00073	0.0011
Cobalt	mg/L	0.00036	0.0011	0.000078	0.00034	0.000083	0.00022	0.000058	0.00016
Copper	mg/L	0.012	0.03	0.0068	0.018	0.0036	0.0063	0.0029	0.0054
Iron	mg/L	0.036	0.14	0.04	0.097	0.043	0.14	0.089	0.26
Lead	mg/L	0.000025	0.00003	0.000024	0.000037	0.000019	0.000052	0.000016	0.000083
Lithium	mg/L	0.0093	0.011	0.005	0.0096	0.0027	0.004	0.0017	0.0026
Manganese	mg/L	0.12	0.24	0.037	0.12	0.071	0.14	0.054	0.11
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.27	0.089	0.15	0.045	0.07	0.034	0.054
Nickel	mg/L	0.00056	0.0016	0.00046	0.001	0.00051	0.001	0.0008	0.0016
Selenium	mg/L	0.041	0.068	0.022	0.038	0.0033	0.011	0.0025	0.0082
Silicon	mg/L	6.5	8.1	6.9	8.0	5.2	6.7	5.9	8.1
Silver	mg/L	0.0000053	0.0000076	0.0000053	0.0000069	0.0000052	0.0000084	0.0000062	0.000012
Strontium	mg/L	5.3	8.1	1.1	1.8	0.59	1.2	0.4	0.83
Thallium	mg/L	0.0000089	0.000013	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.000054	0.000051	0.000071	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.0066	0.0075	0.0056	0.0085	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0032	0.00085	0.0016	0.00084	0.0014	0.00055	0.0011
Vanadium	mg/L	0.0023	0.0028	0.00065	0.0015	0.00043	0.00062	0.00055	0.00085
Zinc	mg/L	0.0092	0.016	0.0043	0.0079	0.002	0.0032	0.0017	0.0027

(a) Calculated based on predicted calcium and magnesium concentrations.

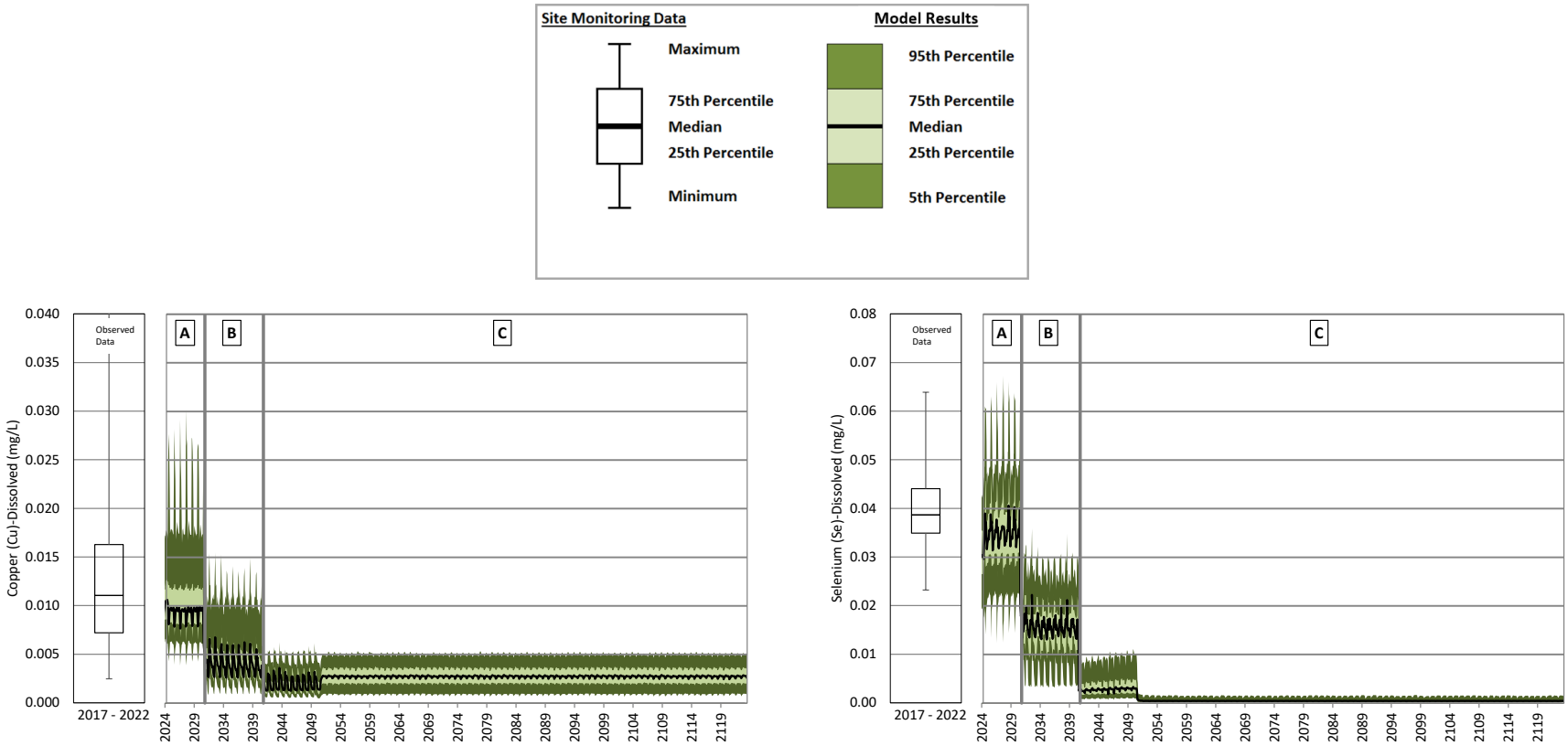

A = Operations; B = Closure; C = Post-closure

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 26: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

4.4.6.2 Springer-Cariboo Pit

At closure, the PAG material from the Temporary NW PAG Stockpile will be placed in the Springer-Cariboo Pit, and a pit lake will form. The pit will fill passively with groundwater and surface runoff from the pit catchment area. The groundwater inflow to the pit is assumed to flow into the stored PAG material in closure and post-closure. The surface runoff includes runoff and seepage from North Bell RDS, East RDS, and the haul roads. These facilities will be reclaimed during closure. The pit lake is predicted to completely fill between 2059 (99.5th percentile of the 2000 water balance model simulations) and 2063 (mean of the 2000 water balance model simulations), at which point, overflow from the pit will discharge to Bootjack Lake.

Maximum of the daily median and maximum of the daily 95th percentile concentrations in the Springer-Cariboo Pit are presented in Table 43. Time series for predicted copper and selenium concentrations in the Springer-Cariboo Pit are presented in Figure 27. Peak concentrations for most parameters are predicted to occur during the closure period because:

- The PAG material in the Springer-Cariboo Pit contains pore water with a NAG Seep water quality.
- The groundwater inflow to the pit, which has a groundwater water quality (Table 24), is assumed to flow into the PAG material and displace the pore water upwards into the forming pit lake.
- The displacement of pore water from the PAG material into the pit lake causes pit lake concentrations to peak in closure.

The only parameters with predicted maximum concentrations greater in post-closure than closure are aluminum, chromium, iron, and lead. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to a greater proportion of the total inflows to the Springer-Cariboo pit.

Table 43: Summary of Predicted Water Quality in Springer-Cariboo Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	539	781	580	822	533	739	448	629
Total Dissolved Solids	mg/L	798	1,177	858	1,238	796	1,139	659	954
Major Ions									
Calcium	mg/L	167	245	178	251	163	223	135	189
Chloride	mg/L	3.6	9.2	3.8	5.2	3.8	5.1	3.0	4.4
Fluoride	mg/L	0.21	0.29	0.29	0.41	0.28	0.39	0.21	0.31
Magnesium	mg/L	30	41	33	48	31	44	27	38
Potassium	mg/L	3.0	4.9	2.7	3.9	2.7	3.8	1.9	2.7
Sodium	mg/L	21	31	19	24	18	23	14	18
Sulphate	mg/L	417	686	475	687	432	628	343	510
Nutrients									
Ammonia	mg/L (as N)	0.023	0.053	0.024	0.04	0.024	0.039	0.015	0.023
Nitrate	mg/L (as N)	8.9	19	4.5	9.1	2.0	5.1	1.1	2.8
Nitrite	mg/L (as N)	0.011	0.022	0.011	0.022	0.010	0.02	0.0056	0.011
Total Phosphorus	mg/L	0.021	0.033	0.017	0.032	0.016	0.031	0.016	0.029
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.049	0.17	0.049	0.19
Antimony	mg/L	0.00035	0.00065	0.0005	0.00083	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0015	0.0025	0.0011	0.0014	0.00068	0.001	0.00062	0.00093
Barium	mg/L	0.044	0.078	0.038	0.057	0.034	0.046	0.027	0.038
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.3	0.097	0.17	0.069	0.093	0.051	0.072
Cadmium	mg/L	0.000029	0.00018	0.000046	0.00022	0.000041	0.00017	0.000034	0.00015
Chromium	mg/L	0.00065	0.00071	0.00063	0.00073	0.00042	0.00092	0.0005	0.0011
Cobalt	mg/L	0.00039	0.00073	0.00041	0.00092	0.00012	0.00067	0.000092	0.00059
Copper	mg/L	0.015	0.17	0.021	0.19	0.012	0.033	0.0095	0.028
Iron	mg/L	0.47	0.55	0.48	0.54	0.087	0.27	0.088	0.3
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000057	0.000023	0.000065
Lithium	mg/L	0.0038	0.0068	0.0042	0.0067	0.0039	0.0057	0.0028	0.0044
Manganese	mg/L	0.072	0.87	0.061	0.27	0.031	0.22	0.024	0.19
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.15	0.1	0.16	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00098	0.0012	0.001	0.0022	0.00059	0.0019	0.00061	0.0018
Selenium	mg/L	0.038	0.077	0.044	0.081	0.04	0.069	0.031	0.056
Silver	mg/L	0.000005	0.000012	0.0000061	0.000014	0.0000061	0.000015	0.000006	0.000015
Strontium	mg/L	0.98	1.7	1.9	3.4	1.8	2.9	1.4	2.4
Thallium	mg/L	0.0000048	0.0000056	0.0000051	0.0000059	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00014	0.000051	0.00013	0.000051	0.000052	0.00005	0.000051

Table 43: Summary of Predicted Water Quality in Springer-Cariboo Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.024	0.026	0.026	0.027	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00093	0.0017	0.0012	0.0035	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.0018	0.0024	0.002	0.0024	0.00097	0.0015	0.00082	0.0013
Zinc	mg/L	0.0059	0.0079	0.0072	0.013	0.0039	0.0092	0.003	0.0075
Dissolved Metals									
Aluminum	mg/L	0.013	0.042	0.017	0.07	0.021	0.057	0.021	0.077
Antimony	mg/L	0.00033	0.00051	0.00048	0.00069	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0012	0.0022	0.00084	0.0012	0.00065	0.00091	0.00059	0.00083
Barium	mg/L	0.042	0.069	0.036	0.048	0.034	0.045	0.027	0.036
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.27	0.093	0.14	0.069	0.091	0.051	0.07
Cadmium	mg/L	0.000027	0.00013	0.000044	0.00018	0.00004	0.00016	0.000032	0.00014
Chromium	mg/L	0.00027	0.00032	0.00024	0.00034	0.00031	0.0004	0.00039	0.00056
Cobalt	mg/L	0.00011	0.00045	0.00013	0.00064	0.00012	0.0006	0.000092	0.00051
Copper	mg/L	0.0063	0.011	0.012	0.035	0.012	0.032	0.0091	0.026
Iron	mg/L	0.027	0.11	0.033	0.095	0.043	0.087	0.044	0.11
Lead	mg/L	0.000024	0.000028	0.000026	0.000031	0.000025	0.000037	0.000023	0.000045
Lithium	mg/L	0.0036	0.0058	0.004	0.0057	0.0039	0.0056	0.0028	0.0043
Manganese	mg/L	0.051	0.85	0.04	0.25	0.027	0.2	0.02	0.18
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.14	0.1	0.15	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00043	0.0007	0.00049	0.0016	0.00052	0.0015	0.00054	0.0015
Selenium	mg/L	0.038	0.071	0.044	0.075	0.04	0.069	0.031	0.056
Silicon	mg/L	6.7	7.7	5.9	6.7	5.7	6.7	5.5	6.4
Silver	mg/L	0.000005	0.0000059	0.0000061	0.0000084	0.0000061	0.0000081	0.000006	0.0000079
Strontium	mg/L	0.96	1.3	1.9	3.1	1.8	2.8	1.4	2.3
Thallium	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00006	0.000051	0.000053	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.0055	0.0072	0.0074	0.0085	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00091	0.0014	0.0011	0.0032	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.00059	0.0012	0.00083	0.0012	0.00082	0.0011	0.00067	0.00091
Zinc	mg/L	0.0032	0.0053	0.0045	0.01	0.0039	0.0092	0.003	0.0075

(a) Calculated based on predicted calcium and magnesium concentrations.

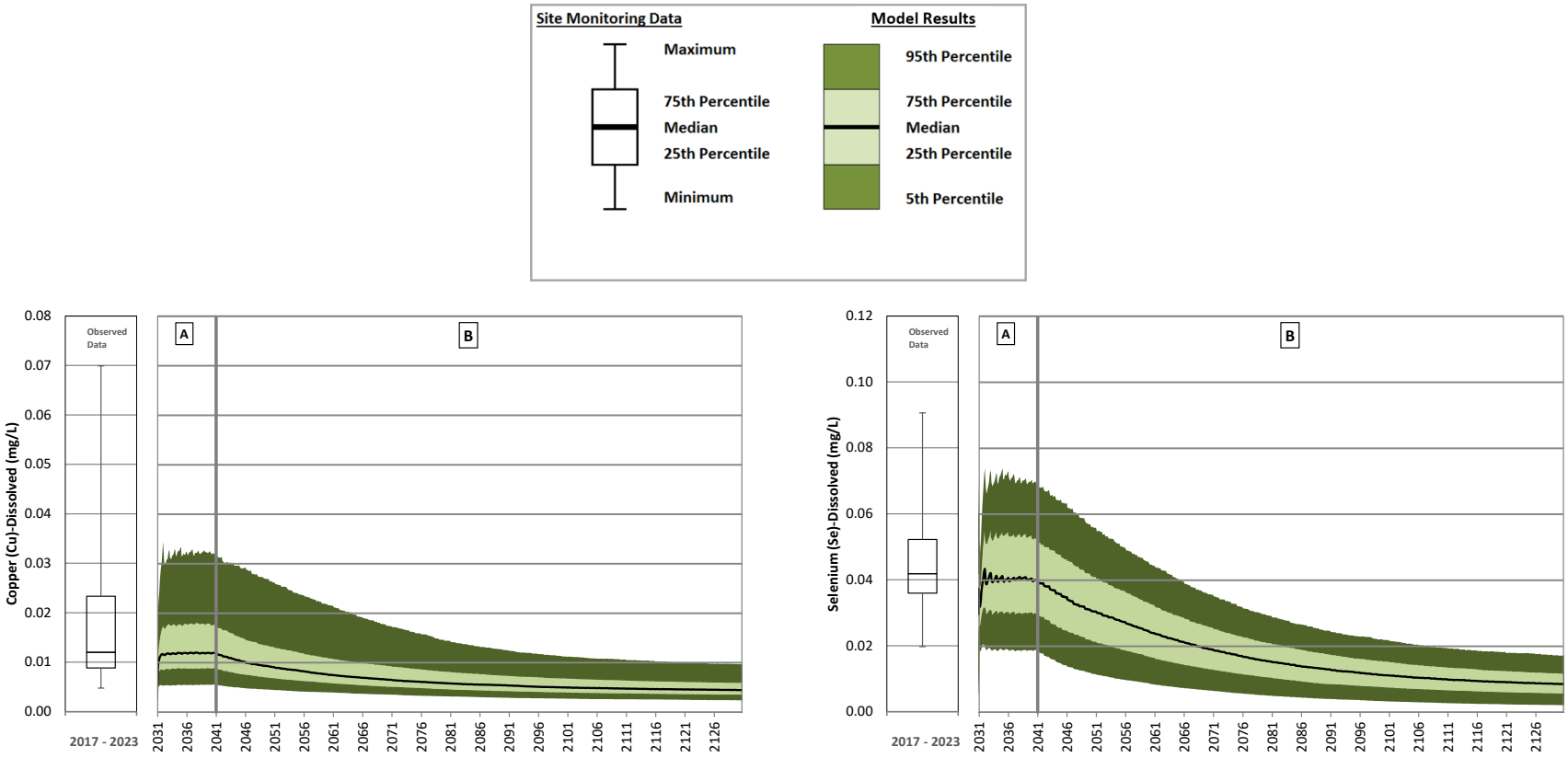

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 27: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Springer-Cariboo Pit – Operations, Closure and Post-closure

4.4.6.3 Wight Pit

Towards the last year of operation, the TSF water volume will be progressively reduced to a maximum of 0.25 M-m^3. During that time and continuing into closure, the Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for storage and will be allowed to fill. A pit lake will form in Wight Pit as the mined-out pit refills passively with groundwater, seepage from Boundary Pit, surface runoff from pit walls, disturbed areas, and haul roads in the Wight Pit catchment. Wight Pit is projected to start overflowing in 2048 under the mean results and in 2046 under 99.5th percentile, at which point overflow will be directed to Polley Lake. Reclamation of the disturbed areas and haul roads is assumed to occur during closure. Runoff water quality from these facilities is predicted to return to undisturbed water quality.

Maximum of the daily median and maximum of the daily 95th percentile concentrations in Wight Pit are presented in Table 44. Time series for predicted copper and selenium concentrations in the Wight Pit are presented in Figure 28.

Predicted concentrations of parameters in Wight Pit are generally stable 10 years after the start of post-closure. Concentrations of most parameters decrease slightly through early post-closure after the pit has filled and is flushed with runoff from reclaimed disturbed areas and haul roads in the Wight Pit catchment area.

Some parameters are predicted to have higher concentrations in post-closure than closure (for example, dissolved copper). The increase in concentration for these parameters is caused by either:

a) Higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Wight Pit.

b) Increased proportions of the total inflows to Wight Pit from pit wall runoff that is assigned the Wight Pit wall runoff during post-closure.

Table 44: Summary of Predicted Water Quality in Wight Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	730	896	182	379	159	323	159	323
Total Dissolved Solids	mg/L	1,080	1,242	251	570	216	439	215	440
Major Ions									
Calcium	mg/L	238	294	54	114	47	94	47	94
Chloride	mg/L	9.6	22	2.9	16	2.4	16	2.4	16
Fluoride	mg/L	0.76	1.1	0.28	0.49	0.28	0.49	0.28	0.49
Magnesium	mg/L	33	40	11	23	9.8	22	9.8	22
Potassium	mg/L	9.0	21	0.59	6.0	0.55	0.83	0.46	0.83
Sodium	mg/L	47	84	20	31	20	31	20	31
Sulphate	mg/L	646	743	101	302	93	187	93	188
Nutrients									
Ammonia	mg/L (as N)	0.016	0.07	0.0031	0.056	0.0024	0.014	0.0022	0.014
Nitrate	mg/L (as N)	1.6	5.4	0.23	3.8	0.08	1.6	0.072	1.6
Nitrite	mg/L (as N)	0.031	0.071	0.0011	0.029	0.0004	0.019	0.00038	0.019
Total Phosphorus	mg/L	0.013	0.018	0.014	0.027	0.014	0.027	0.013	0.027
Total Metals									
Aluminum	mg/L	0.46	0.47	0.46	0.5	0.036	0.15	0.036	0.15
Antimony	mg/L	0.0011	0.0018	0.000071	0.00084	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.002	0.0035	0.0027	0.0047	0.0024	0.0045	0.0024	0.0045
Barium	mg/L	0.05	0.074	0.021	0.07	0.017	0.063	0.017	0.063
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.45	0.28	0.53	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00052	0.000011	0.000089	0.0000079	0.000028	0.0000075	0.000028
Chromium	mg/L	0.00063	0.00065	0.00066	0.00076	0.00041	0.00089	0.00037	0.00085
Cobalt	mg/L	0.00072	0.0018	0.00034	0.00044	0.000055	0.00016	0.000052	0.00015
Copper	mg/L	0.022	0.18	0.012	0.17	0.0031	0.007	0.0031	0.0071
Iron	mg/L	0.46	0.62	0.46	0.53	0.065	0.24	0.065	0.24
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000052	0.000025	0.000048
Lithium	mg/L	0.009	0.013	0.0035	0.009	0.0033	0.0046	0.0033	0.0046
Manganese	mg/L	0.16	0.31	0.048	0.078	0.03	0.074	0.03	0.073
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.3	0.031	0.11	0.031	0.047	0.031	0.047
Nickel	mg/L	0.0012	0.0016	0.00085	0.0014	0.0004	0.0011	0.0004	0.0011
Selenium	mg/L	0.03	0.052	0.0019	0.03	0.00081	0.0077	0.00076	0.0077
Silver	mg/L	0.000005	0.000011	0.0000051	0.000012	0.000005	0.000012	0.000005	0.000012
Strontium	mg/L	6.6	11	0.25	1.6	0.18	0.61	0.15	0.61
Thallium	mg/L	0.00001	0.000017	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.000053	0.00017	0.000053	0.000085	0.000053	0.000086

Table 44: Summary of Predicted Water Quality in Wight Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.024	0.026	0.024	0.027	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0041	0.00036	0.0014	0.00027	0.001	0.00023	0.001
Vanadium	mg/L	0.0028	0.0041	0.0016	0.0034	0.00048	0.0026	0.00048	0.0026
Zinc	mg/L	0.014	0.024	0.0065	0.013	0.003	0.0099	0.0031	0.0099
Dissolved Metals									
Aluminum	mg/L	0.0048	0.017	0.0083	0.045	0.0079	0.033	0.0079	0.033
Antimony	mg/L	0.0011	0.0016	0.000051	0.0007	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.0017	0.0032	0.0024	0.0044	0.0024	0.0044	0.0024	0.0044
Barium	mg/L	0.048	0.065	0.019	0.061	0.017	0.061	0.017	0.061
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.42	0.28	0.5	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00048	0.0000086	0.000044	0.0000067	0.00002	0.0000063	0.00002
Chromium	mg/L	0.00025	0.00026	0.00028	0.00037	0.0003	0.00037	0.00026	0.00033
Cobalt	mg/L	0.00044	0.0015	0.000056	0.00016	0.000055	0.00008	0.000052	0.000078
Copper	mg/L	0.013	0.021	0.0032	0.011	0.0028	0.0054	0.0028	0.0055
Iron	mg/L	0.014	0.18	0.02	0.084	0.021	0.061	0.021	0.059
Lead	mg/L	0.000025	0.000025	0.000025	0.00003	0.000025	0.000032	0.000025	0.000028
Lithium	mg/L	0.0088	0.012	0.0033	0.008	0.0033	0.0044	0.0033	0.0044
Manganese	mg/L	0.14	0.29	0.027	0.057	0.027	0.057	0.027	0.057
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.28	0.031	0.098	0.031	0.046	0.03	0.047
Nickel	mg/L	0.00064	0.0011	0.0003	0.00081	0.00033	0.00081	0.00033	0.00081
Selenium	mg/L	0.03	0.046	0.0019	0.024	0.00079	0.0076	0.00074	0.0076
Silicon	mg/L	6.8	9.0	7.8	9.4	7.8	9.4	7.8	9.4
Silver	mg/L	0.000005	0.0000054	0.0000051	0.0000064	0.000005	0.0000059	0.000005	0.000005
Strontium	mg/L	6.6	10	0.24	1.3	0.17	0.59	0.15	0.59
Thallium	mg/L	0.00001	0.000016	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.000053	0.000086	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.0054	0.007	0.005	0.0078	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0038	0.00033	0.0012	0.00027	0.00096	0.00023	0.00096
Vanadium	mg/L	0.0016	0.003	0.00042	0.0022	0.00033	0.0022	0.00033	0.0022
Zinc	mg/L	0.012	0.021	0.0038	0.0099	0.003	0.0099	0.0031	0.0099

(a) Calculated based on predicted calcium and magnesium concentrations.

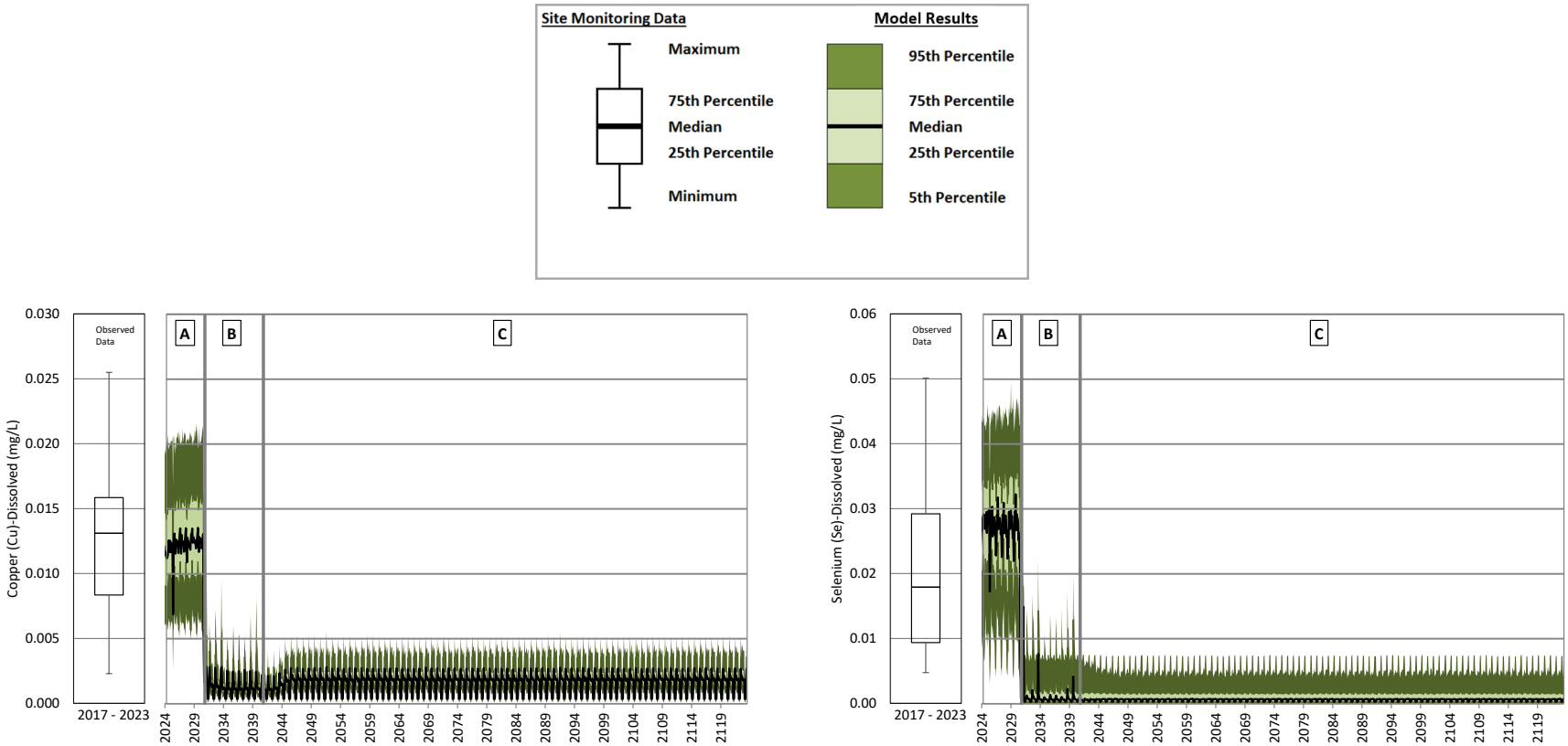

A = Operations; B = Closure; C = Post-closure

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 28: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Wight Pit – Operations, Closure and Post-closure

4.4.6.4 Long Ditch

In closure, the Long Ditch continues to receive flow from the SERDS Ditch and overflow from Bootjack Creek Sump (via SERDS Ditch). Discharge from the Long Ditch is assumed to be directed to Polley Lake during post-closure. The combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek includes the SERDS RDS, NEZ RDS, and East RDS along with haul roads, disturbed areas, and undisturbed catchment area. Tailings co-disposal to the SERDS location will include a soil cover during closure that will remediate runoff from the tailings deposition area to that runs off to SERDS Ditch. However, seepage water quality from the SERDS tailings are assumed to remain unchanged through closure and post-closure. The proportion of seepage assigned tailings water quality is calculated based on the total proportions of tailings relative to waste rock deposited (3.5% tailings and 96.5% waste rock; (MPMC 2022b).

Maximum of the daily median and maximum of the daily 95th percentile concentrations in Long Ditch are presented in Table 45. Time series for predicted copper and selenium concentrations in the Long Ditch are presented in Figure 29.

Peak concentrations in Long Ditch are predicted to occur during operations, representing runoff and seepage from un-reclaimed RDS areas within the combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek. These facilities are reclaimed throughout closure, at which point runoff is assigned undisturbed water quality. Most parameter concentrations in Long Ditch are predicted to decrease through closure, reaching steady state conditions 10 years after the start of post-closure.

Seasonal peak concentrations in winter are driven by seepage from the RDS area within the watershed which is assigned the NAG water quality in perpetuity. During winter months, when precipitation occurs as snowfall, RDS seepage represents a higher proportion of the total flow to the Long Ditch and causes concentrations to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Bootjack Creek Sump, SERDS Ditch, and Long Ditch which causes concentrations of some parameters, such as aluminum, to increase.

Table 45: Summary of Predicted Water Quality in Long Ditch

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	676	873	385	570	330	503	339	510
Total Dissolved Solids	mg/L	963	1,327	554	826	465	709	479	730
Major Ions									
Calcium	mg/L	216	263	116	173	92	137	95	139
Chloride	mg/L	17	25	2.7	12	3.0	8.9	3.1	9.0
Fluoride	mg/L	0.67	0.97	0.25	0.4	0.14	0.25	0.14	0.26
Magnesium	mg/L	33	52	23	34	24	39	25	39
Potassium	mg/L	16	23	1.0	4.8	1.4	1.9	1.4	1.9
Sodium	mg/L	65	88	18	27	10	15	10	15
Sulphate	mg/L	569	728	281	437	191	317	195	321
Nutrients									
Ammonia	mg/L (as N)	0.02	0.059	0.0044	0.044	0.0063	0.012	0.0063	0.012
Nitrate	mg/L (as N)	3.5	33	0.53	7.1	0.36	3.7	0.37	3.9
Nitrite	mg/L (as N)	0.056	0.081	0.0014	0.023	0.00084	0.0019	0.00085	0.0019
Total Phosphorus	mg/L	0.014	0.034	0.016	0.026	0.025	0.037	0.025	0.037
Total Metals									
Aluminum	mg/L	0.47	0.5	0.48	0.54	0.07	0.31	0.069	0.31
Antimony	mg/L	0.0012	0.0018	0.00012	0.00071	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0027	0.0037	0.002	0.0034	0.00095	0.0017	0.00096	0.0017
Barium	mg/L	0.052	0.076	0.023	0.056	0.017	0.025	0.017	0.026
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.4	0.2	0.41	0.03	0.047	0.03	0.048
Cadmium	mg/L	0.00024	0.00045	0.000028	0.00016	0.000024	0.0001	0.000025	0.00011
Chromium	mg/L	0.00064	0.00069	0.00075	0.00091	0.00088	0.0017	0.00088	0.0017
Cobalt	mg/L	0.00067	0.0015	0.00034	0.00072	0.000071	0.00044	0.000072	0.00046
Copper	mg/L	0.02	0.19	0.015	0.18	0.0056	0.019	0.0052	0.02
Iron	mg/L	0.48	0.6	0.5	0.56	0.14	0.45	0.14	0.46
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.00002	0.00011	0.000019	0.00011
Lithium	mg/L	0.0083	0.013	0.003	0.0074	0.0022	0.0037	0.0022	0.0037
Manganese	mg/L	0.15	0.3	0.049	0.18	0.02	0.14	0.02	0.15
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.3	0.05	0.1	0.032	0.061	0.032	0.062
Nickel	mg/L	0.0011	0.0025	0.0011	0.0019	0.00098	0.0021	0.00098	0.0021
Selenium	mg/L	0.039	0.089	0.023	0.053	0.016	0.034	0.017	0.037
Silver	mg/L	0.0000054	0.000014	0.0000056	0.000014	0.0000071	0.00002	0.0000072	0.00002
Strontium	mg/L	5.7	9.2	1.1	2.3	0.97	1.7	0.97	1.7
Thallium	mg/L	0.0000094	0.000015	0.0000049	0.0000058	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.00014	0.000051	0.00015	0.000057	0.000057	0.000057	0.000058

Table 45: Summary of Predicted Water Quality in Long Ditch

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.026	0.026	0.025	0.026	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0037	0.00064	0.0022	0.00088	0.002	0.00089	0.0022
Vanadium	mg/L	0.0035	0.0044	0.0017	0.0028	0.00075	0.0013	0.00075	0.0013
Zinc	mg/L	0.013	0.021	0.0073	0.012	0.0029	0.0056	0.0012	0.0049
Dissolved Metals									
Aluminum	mg/L	0.016	0.046	0.025	0.08	0.042	0.19	0.041	0.19
Antimony	mg/L	0.0012	0.0017	0.0001	0.00057	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0025	0.0034	0.0017	0.0032	0.00092	0.0016	0.00093	0.0016
Barium	mg/L	0.05	0.067	0.021	0.048	0.016	0.024	0.017	0.025
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.37	0.19	0.38	0.03	0.045	0.03	0.046
Cadmium	mg/L	0.00024	0.0004	0.000025	0.00012	0.000023	0.000096	0.000024	0.00011
Chromium	mg/L	0.00026	0.00031	0.00037	0.00053	0.00077	0.0012	0.00077	0.0012
Cobalt	mg/L	0.00039	0.0013	0.000061	0.00044	0.000071	0.00036	0.000072	0.00038
Copper	mg/L	0.012	0.038	0.0065	0.021	0.0053	0.017	0.0049	0.019
Iron	mg/L	0.037	0.15	0.051	0.12	0.095	0.27	0.095	0.27
Lead	mg/L	0.000024	0.000029	0.000024	0.000043	0.00002	0.00009	0.000019	0.00009
Lithium	mg/L	0.0081	0.012	0.0028	0.0064	0.0022	0.0035	0.0022	0.0036
Manganese	mg/L	0.13	0.27	0.028	0.16	0.016	0.12	0.016	0.13
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.29	0.049	0.091	0.032	0.061	0.032	0.061
Nickel	mg/L	0.00058	0.0019	0.00051	0.0013	0.00091	0.0018	0.00091	0.0018
Selenium	mg/L	0.039	0.083	0.023	0.047	0.016	0.034	0.017	0.037
Silicon	mg/L	6.7	8.5	7.0	8.2	6.7	9.1	6.7	9.1
Silver	mg/L	0.0000054	0.0000084	0.0000056	0.0000078	0.0000071	0.000014	0.0000072	0.000014
Strontium	mg/L	5.6	8.8	1.1	2.0	0.97	1.6	0.97	1.7
Thallium	mg/L	0.0000094	0.000014	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.000055	0.000051	0.000073	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.0068	0.0076	0.0059	0.0074	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0034	0.00061	0.0019	0.00088	0.0019	0.00089	0.0021
Vanadium	mg/L	0.0023	0.0032	0.00047	0.0016	0.0006	0.00092	0.0006	0.00092
Zinc	mg/L	0.01	0.018	0.0046	0.009	0.0029	0.0056	0.0012	0.0049

(a) Calculated based on predicted calcium and magnesium concentrations.

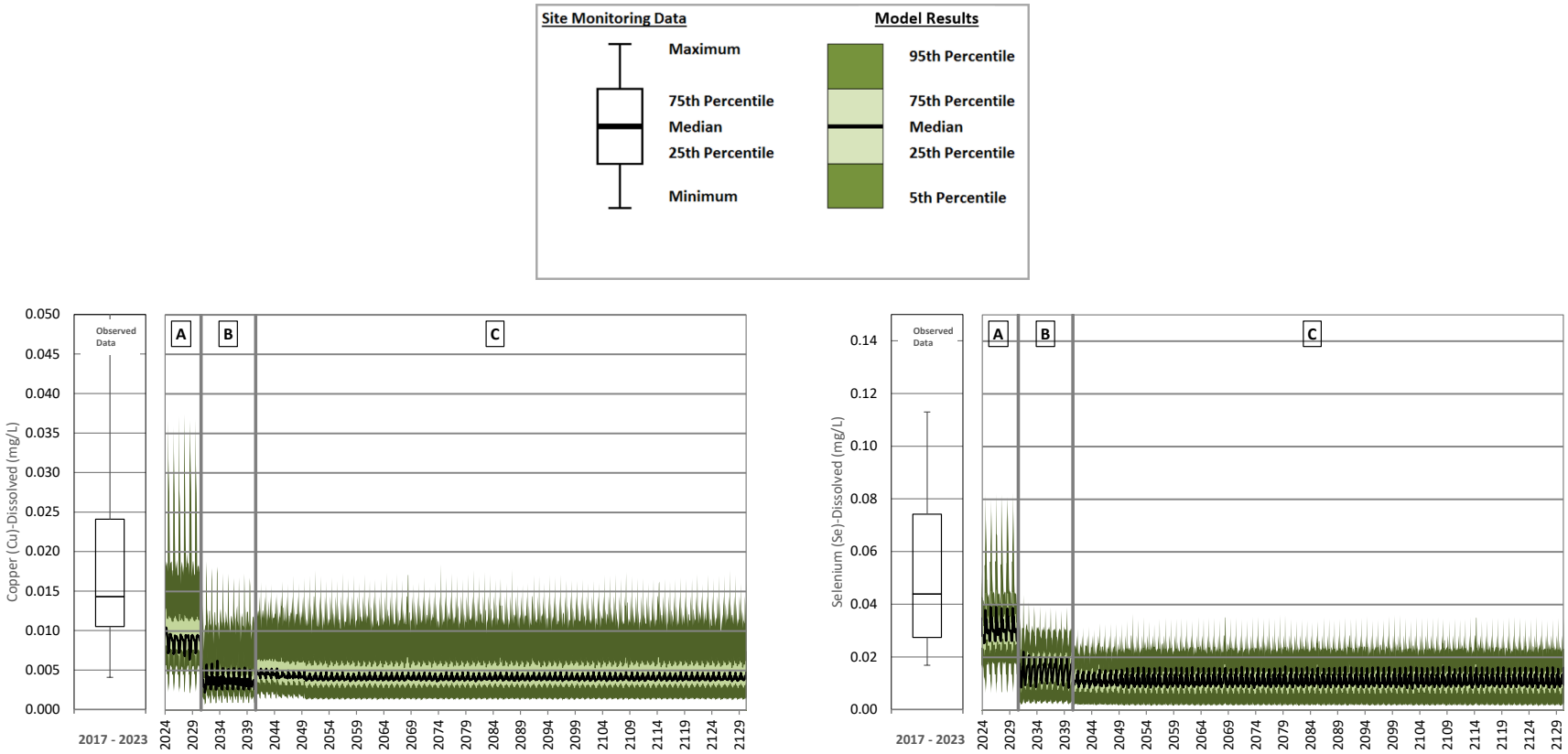

A = Operations; B = Closure; C = Post-closure.

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 29: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Long Ditch – Operations, Closure and Post-closure

4.5 Description of Discharge Options Inventory

4.5.1 Restoration of Watercourses

There are few ecologically productive watercourses that have been changed as a result of mining activity. Hazeltine Creek and a lower portion of Edney Creek were changed extensively as a result of the August 2014 foundational failure and resulting TSF breach. The restoration of those watercourses began to take place as soon as safe access was possible following that breach. Historical changes to the natural drainage patterns occurred well before the Mount Polley Mine was developed. Bootjack Creek drainage and Hazeltine Creek drainages were modified to support hydraulic placer mining.

The primary driver behind watercourse restoration at Mount Polley is aquatic productivity / productive capacity of aquatic habitats, rather than the use of a watercourse as a discharge conveyance system[1]. However, some amount of flows within Hazeltine Creek could potentially augment the amount of habitat available, particularly during seasonally dry periods (e.g., August). Currently, the weir at the confluence of Hazeltine Creek and Polley Lake is being used to mute the peak flows and to provide flow nourishment to Hazeltine Creek.

Other streams affected by mine development include Bootjack Creek and Mine Drainage Creek. MPMC has determined that Bootjack Creek cannot maintain its current alignment while still functioning as fish habitat. Impacts to Bootjack Creek will be addressed through the development of offset habitat in accordance with Fisheries and Oceans Canada's fish habitat policy. Mine Drainage Creek is currently captured as contact water in Mine Drainage Creek sump and pumped to the west ditch for management and treatment. However, rainbow trout spawning was recorded previously in the lower reach of the creek (~25 m upstream of Bootjack Lake), and restoration of this watercourse could be considered as part of future planning.

Should additional drainages need to be constructed at closure, they will be constructed with the objective of developing those watercourses as aquatic habitats where feasible. Feasibility evaluations will include the stream gradient, access and connectivity to other habitats, habitat enhancement objectives, stream bed characteristics (i.e., the stream bed must be capable of maintaining surface water) and the cost to construct as a habitat. Where it is not feasible to construct a drainage feature as an aquatic habitat, hydraulic engineering design principles (Chow 1959) will be used to provide drainage features that are built to sustain themselves without maintenance following closure. The details of such drainages will be identified as closure designs are developed in advance of the mine going into closure.

4.5.2 Watercourses Available to Receive Discharge

Over 2015 and 2016, Golder assessed the capacity of the following receiving environments around the Mine to receive treated effluent discharge (Golder 2015a, Golder 2016b, Appendix G of the TAR – Golder 2016g):

- Polly Lake outlet
- Hazeltine Creek at the mouth
- Bootjack Lake outlet
- Edney Creek at the mouth
- Quesnel River at Likely

[1] Note: Prior to Hazeltine Creek being made accessible to fish, it was temporarily used to convey treated water flows to Quesnel Lake while the current pipeline and diffuser were being constructed.

Based on the far-field volumetric dilution values for the mean seven-day low flow condition, concentrations of constituents in the treated effluent discharge were calculated such that concentrations at the potential effluent discharge locations would meet WQGs. The concentrations of constituents in the treated effluent discharge to meet WQGs were compared to monitoring data at station HAD-3 to determine if additional water treatment would be required.

Based on median concentrations from monitoring data, additional water treatment would be required to meet WQGs for several constituents (sulphate, nitrate, nitrite, dissolved aluminum, dissolved copper, and total selenium) if considering discharge to the receiving environments listed above.

In Golder (2016g), two potential discharge locations were presented for long-term discharge at the mine in operations:

- Pipeline to Quesnel River
- Pipeline to Quesnel Lake

Based on the hydrologic and chemical assimilative capacities of potential receiving environments, a pipeline to Quesnel Lake was ranked to provide the best assimilative capacity for discharge from the Mount Polley Mine during operations. A pipeline from the WTP to Quesnel Lake was constructed, including submerged diffuser at the pipeline terminus, to convey treated mine contact water to this selected receiving environment. This discharge location remains as the single permitted discharge location for the mine, which is anticipated to continue through operations and potentially into closure/post-closure.

A detailed description of this receiving environment assessment and results are provided in the 2020 Water Management Plan (Golder 2020e) and not duplicated in full here.

4.6 Water Treatment

This section provides details regarding water treatment for the Mine to identify the design basis for current (operations) and potential future (closure/post-closure) water treatment options. This section also provides updates on the progression of water treatment technology development.

4.6.1 Design Basis

The flows and associated water quality that require treatment during the operational and closure periods are described in this section and form the design basis for the current treatment system and the design basis for identification of water treatment technologies for closure.

Flow Rate

Operations

The treatment flow rate of the existing WTP varies between approximately 0.21 m^3/s and 0.31 m^3/s, pending operator control of the plant. The allowable maximum annual discharge volume from site is currently 10.59 M-m^3/year (average of 0.33 m^3/s), as per EMA Permit 11678. The design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate).

The SWWBM has assumed a maximum WTP treatment capacity of 0.29 m^3/s for modelling purposes and this flow rate results in sufficient treatment of all contact water required for discharge from Site for the predicted operations period (WSP 2023a). The SWWBM has predicted that the 50th percentile average annual treated water discharge from Site is 3.72 M-m^3 during operations (average of 0.12 m^3/s). Stochastic results from the SWWBM were also used to predict 90th percentile annual volume requirements for treated water discharge during operation, resulting in an annual average volume of 4.64 M-m^3 (average of 0.15 m^3/s) Given these volume predictions and the modelled WTP capacity, the treatment capacity of the existing WTP has been assumed sufficient for the remainder of the LOM operations period.

Closure and Post-closure

For closure and post-closure, the SWWBM was again used to predict annual treatment volumes for the period of 2031 to 2131. For the closure period of 2031 to 2041, results showed an annual average treatment volume of approximately 5.50 M-m^3 for 50th percentile climate conditions and 6.53 M-m^3 for the 90th percentile climate conditions, which results in an average treatment flow rate of 0.17 m^3/s and 0.21 m^3/s, respectively (WSP 2023a). For the post-closure period of 2041 to 2131, results showed an annual average treatment volume of approximately 0.80 M-m^3 for 50th percentile climate conditions and 1.16 M-m^3 for the 90th percentile climate conditions, which results in an average treatment flow rates of 0.03 m^3/s and 0.04 m^3/s, respectively.
The treatment flow rate design basis is selected as the 90th percentile average requirement of 0.21 m^3/s during closure and 0.04 m^3/s during post-closure.

The combined Springer-Cariboo Pit and Wight Pit are both modelled to become pit lakes during post-closure and are assumed to fill and overflow directly to the environment without treatment. Overflow is predicted to occur between 2047 and 2049 for Wight Pit and between 2055 and 2058 for Springer-Cariboo pit. Annual overflow volume from these pits is predicted to be 0.62 M-m^3 for Wight Pit and 1.05 M-m^3 for Springer-Cariboo Pit for the 90th percentile climate scenario. Water quality and treatment requirements for pit overflow water is discussed in the closure/post-closure water quality section. If overflow from both pits is included in the annual treatment volume, then the design basis for water treatment during post-closure would increase to 0.09 m^3/s.

Water Quality and Targets

Operations

The SWWBM was used to predict water quality at the PETBP during operations (the current influent source to the WTP). Table 46 provides a list of constituents of interest determined following review of modelled water quality predictions during operations (WSP 2023c). Table 46 compares the current EMA Permit 11678 WTP discharge limits with the predicted 95th percentile parameter concentrations in the PETBP.

Table 46: Predicted Water Quality Concentrations and Permit Limits for Treatment During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations
Major Ions			
Total Sulphate	mg/L	1,100	681
Nutrients			
Total Ammonia	mg/L (as N)	1.30	0.06
Total Nitrate	mg/L (as N)	34	23
Total Phosphorus	mg/L	0.09	0.03

Table 46: Predicted Water Quality Concentrations and Permit Limits for Treatment During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations
Total Metals			
Arsenic	mg/L	0.028	0.003
Chromium	mg/L	0.004	0.001
Copper	mg/L	0.033	**0.190**
Iron	mg/L	1.00	0.58
Manganese	mg/L	3.4	0.26
Molybdenum	mg/L	0.36	0.28
Selenium	mg/L	0.075	0.074
Zinc	mg/L	0.059	0.019
Dissolved Metals			
Cadmium	mg/L	0.00034	**0.00036**
Copper	mg/L	No EMA Permit Limit	0.030

Note(s): **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to the PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter. The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 46 shows that total copper and dissolved cadmium are predicted to require treatment during operations. Total Suspended Solids (TSS), not listed in Table 46, is also required for treatment during operations. The existing WTP has been shown to effectively treat TSS for historical operating conditions (discussed in more detail in Golder 2022b). WTP influent and effluent quality were assessed over six years between 2016 and 2021, showing effluent TSS consistently below permit limit (Golder 2022b).

The existing WTP has been able to effectively treat total copper for the majority of historic operating conditions, as demonstrated in Figure 30, which shows total copper concentration in the WTP influent and effluent over the period of 2016 through 2023. Also shown in the figure is the total copper EMA permit limit for the WTP effluent (0.033 mg/L). The SWWQM predicted maximum of the 95th percentile concentration for total copper of 0.190 mg/L in the WTP influent shown in Table 46 is a conservative prediction and the average WTP influent total copper illustrated in Figure 30 is significantly lower at a value of 0.025 mg/L (between 2016 and 2023). Figure 30 shows that the existing WTP is able to maintain WTP effluent total copper below the permit limit with only occasional occurrences of total copper above the permit limit. These occurrences are managed by halting WTP discharge and temporary WTP recirculation until copper concentration is below permit limit. This process is managed through MPMC's Trigger Response Plan, further discussed in Golder 2022b.

There is one instance of high historic total copper that is not seen on Figure 30 due to the axis limits in the figure. In May 2018, specific conditions occurred on-site to produce a WTP influent total copper concentration of 0.933 mg/L. The Trigger Response Plan was initiated for this occurrence to manage the high copper instance. This particular event is an outlier occurrence and is further discussed in Appendix B (Section 3.1) when discussing total copper model predictions.

The EMA Permit also includes a Numeric Performance Metric (NPM) for total copper at a value of 0.012 mg/L (annual average). The existing WTP is able to meet this NPM, and the annual average of total copper in the WTP effluent during 2022 and 2023 was 0.012 mg/L and 0.010 mg/L, respectively.

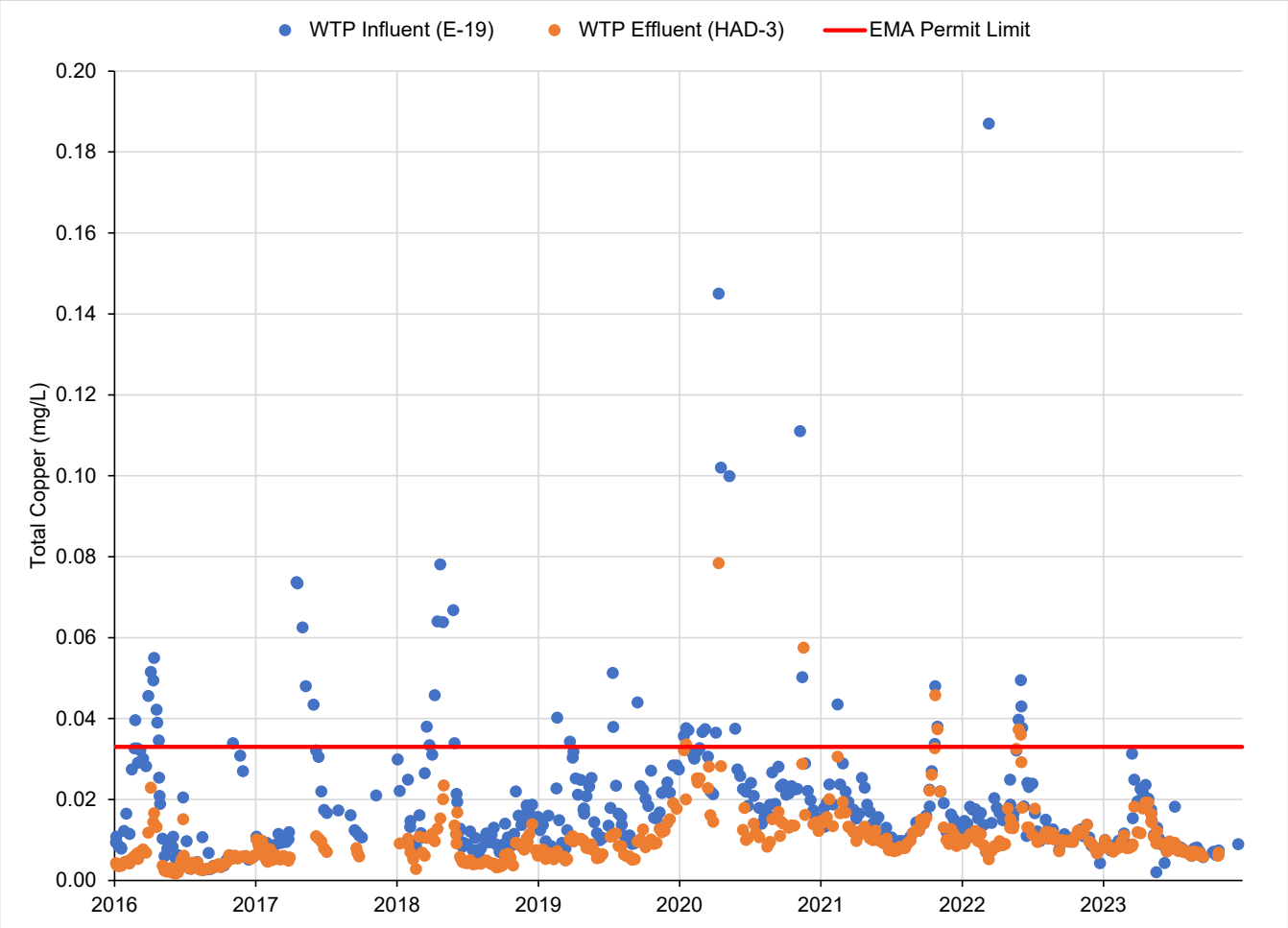

Figure 30: Historical Total Copper in WTP Influent and WTP Effluent from 2016 through 2023

Total selenium is not predicted to require treatment during operations, as shown by the 95th percentile PETBP concentration shown in Table 46. Even though predictions show that PETBP total selenium concentration is near the permit limit, monitoring data has shown actual total selenium in the PETBP consistently below the permit limit (Golder 2022b). The water treatment system during operations has not required selenium treatment and it is not anticipated to require selenium treatment for the remainder of operations. The Selenium Management Plan (SeMP, Golder 2016i) lists in-pit treatment along with biological treatment as two of the measures that may be employed to mitigate selenium if required.

Table 46 shows that dissolved cadmium is predicted to require treatment during operations. This modelled 0.36 µg/L concentration is a conservative estimate from the model, and monitoring data from existing operation does not show dissolved cadmium in concentrations requiring treatment. The existing WTP does not target dissolved cadmium as a constituent of concern (COC), but similar to copper and selenium, total cadmium is partially removed through TSS removal at the WTP.

Closure and Post-closure

The SWWBM was used to predict water quality at the PETBP during closure/post-closure. Central collection to the PETBP may not be the final post-closure water treatment configuration (particularly if distributed treatment and discharge can be permitted), but collection to this location has been assumed as the closure base case as it represents the currently permitted system configuration and is one of the two BAT options identified for closure. Table 47 provides a list of constituents of interest and the maximum of the 95th percentile predicted concentrations in the PETBP during closure and post-closure (WSP 2023c). Table 47 also compares predicted PETBP water quality to MPMC's current EMA Permit 11678 WTP discharge limits. These WTP discharge limits have been assumed for closure/post-closure as they represent the currently permitted treatment requirements. Distributed treatment during closure/post-closure may discharge to different receiving environments with different discharge limits than the existing EMA Permit, but the current limits have been assumed for closure/post-closure for the purposes of this Water Management Plan.

Table 47: Predicted Water Quality Concentrations at Perimeter Embankment Till Borrow Pond During Closure/Post-closure

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations – Closure	PETBP – Maximum of 95th Percentile Predicted Concentrations – Post-closure
Major Ions				
Total Sulphate	mg/L	1,100	401	144
Nutrients				
Total Ammonia	mg/L (as N)	1.30	0.07	0.04
Total Nitrate	mg/L (as N)	34	6	2
Total Phosphorus	mg/L	0.09	0.03	0.03
Total Metals				
Arsenic	mg/L	0.028	0.003	0.002
Chromium	mg/L	0.004	0.001	0.002
Copper	mg/L	0.033	**0.17**	**0.01**
Iron	mg/L	1.00	0.54	0.44
Manganese	mg/L	3.40	0.14	0.13
Molybdenum	mg/L	0.36	0.16	0.05
Selenium	mg/L	0.075	0.044	0.008
Zinc	mg/L	0.059	0.011	0.003
Dissolved Metals				
Cadmium	mg/L	0.00034	0.00009	0.00005

Note(s): **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to the PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter. The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 47 shows that total copper is predicted to require treatment during closure and post-closure. TSS, not listed in Table 47, is also required for treatment during closure/post-closure. Total selenium is not predicted to require treatment in closure/post-closure but is still considered as a potential COC for these phases.

The assumed BAT treatment system during closure/post-closure is pit-lake treatment (for selenium treatment if required) followed by the centralized Actiflo plant (existing WTP), with the possibility of distributed passive/semi-passive treatment if systems are environmentally appropriate and permittable. TSS treatment is assumed to be required through closure and post-closure and will be achieved with the Actiflo plant.

Total copper treatment is predicted to be required through closure and post-closure and will be achieved with a combination of the Actiflo plant (total copper removal through TSS removal), and future trimercapto-striazine trisodium salt (TMT) pre-treatment, if required (for dissolved copper precipitation).

Total selenium is considered a potential COC during closure and post-closure, though not predicted to require treatment. Existing monitoring data has consistently shown total selenium in Site contact water to be below discharge limits. If required, the assumed method of selenium treatment is semi-passive pit-lake pre-treatment for dissolved selenium (active dosing of carbon source to pit-lake), followed by treatment by the Actiflo plant for TSS and particulate selenium removal. MPMC has also been progressing the development of multiple passive and semi-passive closure treatment technologies that target selenium in order to potentially reduce the complexity and operating footprint of long-term treatment system during post-closure.

At mine closure, three major zones are in long-term contact with waste rock: the combined Springer-Cariboo Pit, Wight Pit, and the SERDS which drains into Long Ditch. Table 48 provides a list of constituents of interest and the maximum of the 95th percentile predicted concentrations in the Springer-Cariboo Pit, Wight Pit, and Long Ditch during closure and post-closure (WSP 2023c). Predicted parameters are shown post-2041 for Wight Pit and Long Ditch, the period in closure they have been assumed to discharge directly to environment in the SWWBM. Predicted parameters are shown post-2055 for Springer-Cariboo, the period in closure that the pit is assumed to overflow directly to the environment in the SWWBM.

Table 48: Predicted Water Quality Concentrations at Springer-Cariboo Pit, Wight Pit, and Long Ditch During Closure/Post-closure

Parameter	Unit	Springer-Cariboo Pit – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2055)	Wight Pit – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2041)	Long Ditch – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2041)
Major Ions				
Total Sulphate	mg/L	510	187	317
Nutrients				
Total Ammonia	mg/L (as N)	0.02	0.01	0.01
Total Nitrate	mg/L (as N)	3	2	4
Total Phosphorus	mg/L	0.03	0.03	0.04
Total Metals				
Arsenic	mg/L	0.001	0.005	0.002
Chromium	mg/L	0.001	0.001	0.002
Copper	mg/L	0.028	0.007	0.019
Iron	mg/L	0.30	0.24	0.45
Manganese	mg/L	0.19	0.07	0.14
Molybdenum	mg/L	0.11	0.05	0.06
Selenium	mg/L	0.056	0.008	0.034
Zinc	mg/L	0.008	0.010	0.006
Dissolved Metals				
Cadmium	mg/L	0.00014	0.00002	0.00010

Note: The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Direct discharge of the Table 48 catchments to the environment during post-closure is assumed in the SWWBM, but this will not occur until appropriate permit limits are established and when actual water quality near post-closure is confirmed. Copper and selenium concentrations in these drainages will be monitored through operations and closure. If copper treatment is required during post-closure for these drainage sources, then centralized or distributed TMT pre-treatment and/or TSS settling could be employed to reduce total copper to below established limits. Other technologies being considered for closure may also address copper reduction. If selenium treatment is required during post-closure, then centralized pit-lake or distributed passive/semi-passive treatment could be employed to reduce total selenium to below established limits.

Details on modelled water quality concentrations for all parameters and mine phases at various site locations (in addition to the locations discussed here) can be found in Appendix B.

4.6.2 Water Treatment Technology Development

Good engineering practice typically requires a project to follow a standardized engineering design process for the selection and progressive refinement of the final project concept. A project progresses from a pre-concept phase for the identification of multiple treatment options, through concept, pre-feasibility, and feasibility phases to project execution. Generally, the engineering studies performed for each of these project phases are supported by test work that progresses from proof-of-concept and detailed bench-scale testing to pilot-scale and demonstration-scale test work. Some of the treatment technologies tested may not progress to the next stage of development. For example, a treatment technology may be eliminated if its treatment capacity is insufficient to treat the forecast volumes. This framework takes a staged approach, such that input assumptions, design, and cost for the total system can be refined as each stage is completed and the information that the plan relies on becomes more certain. This allows input assumptions to be less conservative as they become more accurate with accumulated knowledge. Additional details regarding this project development framework and how it aligns with the BC Ministry of Environment and Climate Change Strategy's BAT policy is provided in Golder 2020e.

A generic model for such a project development framework is provided in Figure 31. This framework also approximates the sequence of steps outlined in BC ENV's BAT policy (BC ENV 2015).

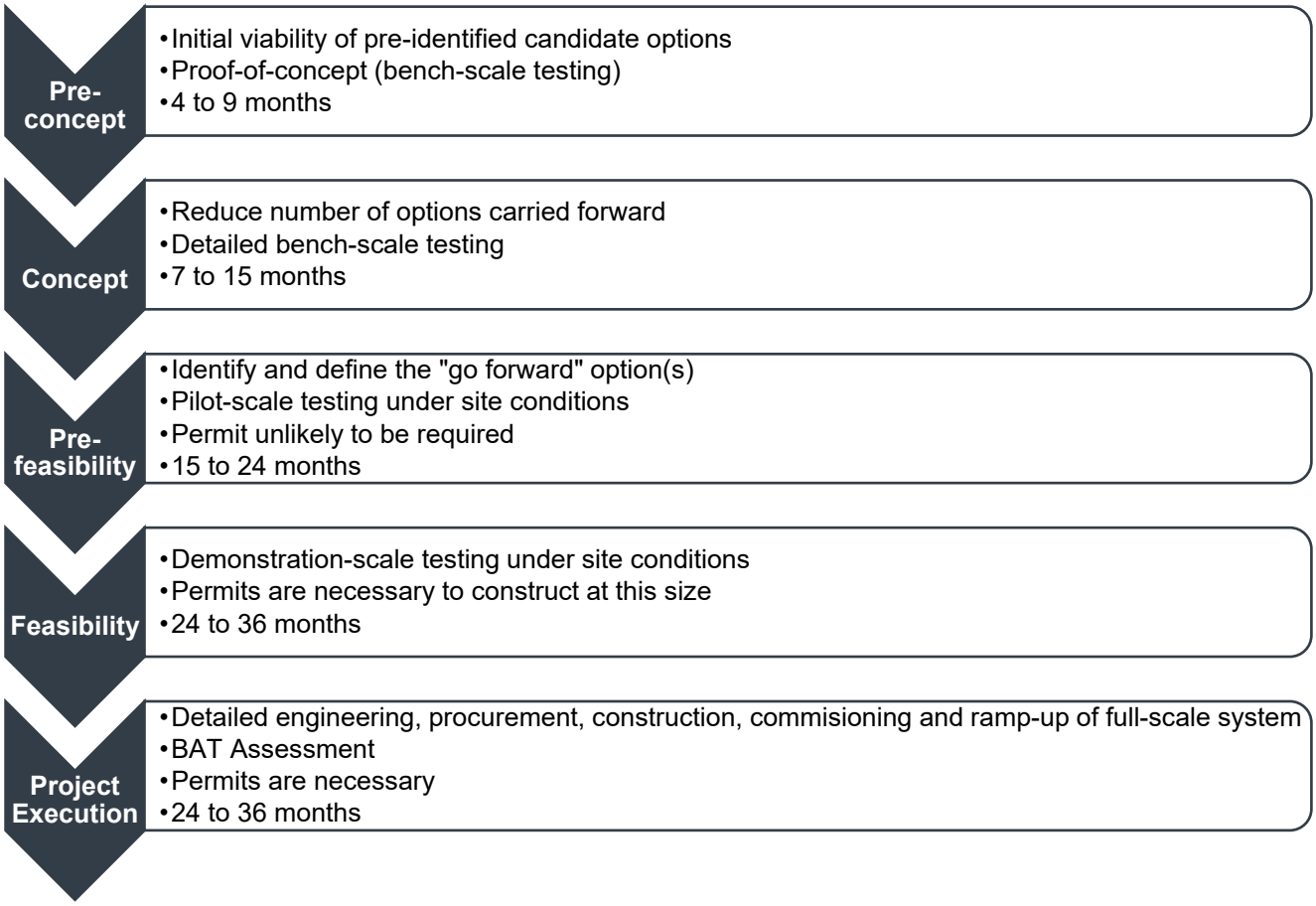

Figure 31: Project Development Framework

MPMC has been progressing and evaluating multiple technologies under this project development framework to support the treatment of identified COCs and to support potential decentralized treatment and discharge during closure/post-closure. Various studies and trials have been completed to support these efforts as an important component of water management planning and closure refinement. An inventory of treatment technologies and a summary of their development is presented in Table 49.

This Water Management Plan assumes that the reader is familiar with the technologies presented in Table 49; this document only provides updates on work completed by MPMC since circa 2017 to support the development of these technologies. Detailed descriptions of these technologies and associated process flow schematics can be found in Golder 2020e.

Table 49: Treatment Technology Inventory and Stage of Development

Technology/ Stage of Development	Targeted COCs	Proof-of-Concept Bench-Scale Testing	Detailed Bench-Scale Testing	Pilot-Scale Testing	Demo-Scale Testing	Full-Scale Execution	Work Completed
Actiflo	TSS, total copper					→	Bench and full-scale testing. Flocculant Management Plan.
Lime Treatment	Dissolved copper					→	N/A
TMT Treatment	Dissolved copper	→	→	→	→		Bench and full-scale testing. Toxicity evaluation.
Pit-Lake Treatment	Selenium, nitrate	→	→	→			Preliminary concept design and proof-of-concept bench-scale testing. Pilot-scale testing workplan.
Saturated Rock Fill (SRF)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, detailed bench-scale testing workplan, and long-term substrate leach testing. Wight Pit SRF assessments.
Packed Bed Reactor (PBR)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, and detailed bench scale testing workplan.
Biochemical Reactor (BCR)	Selenium, nitrate	→	→				Concept design and proof-of-concept bench-scale testing.
Submerged Sand Reactor (SSR)	Selenium, nitrate	→					Screening analysis.
Constructed Wetland Treatment (CWT)	Selenium, nitrate	→	→	→			Concept design, bench-scale testing, and on-site pilot scale testing (by others).

Implemented → Under Consideration → Eliminated/Paused →

Actiflo

Actiflo, the tradename of a technology supplied by Veolia, is the technology currently in use as the Site's WTP and is considered the BAT for TSS removal during operations and closure/post-closure. The main targeted COC of this technology is TSS, with total copper removal also occurring via TSS removal. Polyaluminum chloride (PAC) is dosed into the influent water in the Actiflo process, which produces aluminum hydroxide precipitates that adsorb to copper complexes, thus removing copper during the solids-liquids separation step of the process. The Actiflo technology is currently implemented at full-scale on-site, as indicated in Table 49.

Concept design, bench-scale, and full-scale testing have been completed for the Actiflo technology, including assessment and optimization of PAC and various chelating agent dosages (including TMT) to assist copper removal (Golder 2016k, Golder 2017a, Golder 2018a, Golder 2019a, Golder 2019b, Golder 2020f). A Flocculant Management Plan for the Actiflo WTP was also recently completed (WSP 2023d) to address recent EMA Permit requirements, which describes the Actiflo process and associated flocculant use in detail, including PAC, polymer, and microsand. Golder 2022b also provides a detailed summary of recent WTP performance regarding TSS, total copper, and total selenium removal.

Actiflo treatment is currently operating as the core component of the treatment system during operations and is currently assumed as the base case core component of treatment during closure/post-closure.

Lime Treatment

Active treatment with lime is currently in use at the site, where existing mill process plant infrastructure is used to dose lime, raise contact water pH, resulting in the precipitation of metal hydroxides, particularly dissolved copper. Precipitated copper is then removed via TSS removal in the Actiflo system. The main targeted COC of this technology is dissolved copper. Lime treatment is currently implemented on-site, as indicated in Table 49, and used as a pre-treatment step of the Actiflo water treatment system to target dissolved copper removal. Use of this technology is well known to industry and technology development to support this has not been required.

Lime treatment, when required, is currently a component of the water treatment system during operations.

TMT Treatment

TMT is a chelating agent that aids with dissolved copper precipitation that allows copper treatment through TSS removal. The main targeted COC of this technology is dissolved copper.

Bench-scale test work completed showed that TMT is able to effectively precipitate dissolved copper (Golder 2016k, Golder 2017a, Golder 2018a) and the full-scale trials completed showed that the existing Actiflo treatment system was able to remove the copper bound with TMT to below the permit limit (Golder 2019a, Golder 2019b, Golder 2020f). Full-scale trials also showed that copper removal to lower concentrations (total copper <0.012 mg/L) was challenging for Actiflo with TMT treatment, not due to limitations in dissolved copper precipitation but due to limitations in Actiflo TSS removal to low concentrations. TMT was effective in precipitating dissolved copper, but the Actiflo system was not effective in subsequently removing the precipitate to result in low effluent copper concentrations. The toxicity of TMT has also been evaluated and showed that its use would not result in an acutely lethal effluent (Golder 2018b).

TMT treatment is still being considered for full-scale implementation during closure/post-closure if required.

Pit-Lake Treatment

Pit-lake treatment targeting COCs of selenium and nitrate is an in-situ technology that requires nutrient and carbon source dosing to create conditions for biological treatment within the pit-lake.

A conceptual assessment of full-scale pit-lake selenium treatment was completed (Golder 2017b) and the technology was deemed a cost-effective approach to managing selenium and was recommended for further bench and pilot-scale testing. Proof-of-concept bench-scale testing for pit-lake selenium treatment was also completed and showed effective removal of selenium and nitrate, with further pilot-scale testing recommended (Golder 2019c). A pilot-scale study for pit-lake treatment was designed for Cariboo Pit (Golder 2020d), but the pit is being dewatered to support future mining activities and this work has not yet been completed. A pit-lake trial is also not currently available in Wight Pit, as the pit is providing required water storage during storm and freshet operations and will not remain at a steady volume required for the trial.

Pit-lake treatment targeting selenium and nitrate is still being considered for full-scale implementation and is currently assumed as part of the treatment system during closure/post-closure if required.

Saturated Rock Fill (SRF)

SRF treatment is a fixed-film anaerobic system targeting the treatment of selenium and nitrate and ideally utilizes a mined open pit as a bioreactor operated in a horizontal flow configuration.

A concept study for SRF treatment was completed (Golder 2020g) and SRF was recommended for further bench-scale and pilot-scale testing. Proof-of-concept bench-scale testing for SRF was also completed (Golder 2021), which showed effective removal of selenium and nitrate, but also indicated metal leaching. Detailed bench-scale testing and waste rock SRF substrate metal leach testing was recommended following completion of the proof-of-concept work. Bench-scale leach testing using anticipated SRF substrate waste rock from site was completed (Golder 2022c), which monitored leached metals over a long-term test period of 52 weeks. Results showed that metal leaching varies over time and differs between metals and must be considered during the start-up phase of SRF implementation (and may lead to additional required polishing treatment steps downstream of the SRF). Detailed bench-scale testing for SRF has been proposed and a test plan has been submitted to MPMC (Golder 2022d). Geotechnical and geochemical substrate characterization for SRF media waste rock is currently ongoing and anticipated for completion in 2023. It is anticipated that geochemical substrate characterization will be conducted by MPMC's geochemical consultant SRK.

SRF treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive treatment of selenium and nitrate during closure/post-closure if required.

Packed Bed Reactor (PBR)

PBR treatment is another fixed-film anaerobic system targeting the treatment of selenium and nitrate. PBR treatment differs from SRF treatment through the use of a vertical flow (top to bottom) reactor.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and PBR treatment was shown to be effective in reducing selenium and nitrate. Further detailed bench-scale and pilot-scale testing was recommended following completion of the initial testing. Detailed bench-scale testing for PBR has been proposed and a test plan has been submitted to MPMC (Golder 2022e).

PBR treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive distributed treatment of selenium and nitrate during closure/post-closure if required.

Biochemical Reactor (BCR)

BCR treatment is another fixed-film anaerobic treatment technology that consists of a lined pond filled with a submerged organic substrate media mix. The main targeted COCs of this technology are selenium and nitrate. BCR treatment is passive and does not involve continuous dosing of a carbon source to the media bed.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and BCR treatment was shown to be effective in reducing selenium and nitrate, but redox sensitive metals were present in the BCR effluent.

Upon review of the BCR technology in comparison to other passive and semi-passive technologies, MPMC decided to not proceed with further development of this technology (MPMC 2021) for the following reasons:

- Limited lifespan of BCR passive treatment systems based on the availability of a carbon source that is encapsulated in the system during construction – this needs to be replaced periodically at significant cost.
- Emission of elevated levels of biochemical oxygen demand (BOD) from the system during commissioning and start-up of operation that exceed standards for discharge to the environment.
- Persistent emission of phosphorus from the BCR during operation that will likely exceed plausible standards for discharge to the environment.

BCR treatment is no longer being developed as a passive treatment technology option during closure/post-closure.

Submerged Sand Reactor (SSR)

SSR is similar to other anaerobic reactor technologies, with the use of the existing tailings as media for the bioreactor. The main targeted COCs of this technology are selenium and nitrate.

A concept study was completed for SSR (Golder 2020g), as well as proof-of-concept bench-scale testing (Golder 2019d). Use of MPMC tailings as SSR bioreactor media or use of the site's TSF as an in-situ SSR was not recommended for further investigation. Bench-scale testing resulting in metal release in the reactor effluent when using site tailings as the reactor media. The concept study also concluded that further investigation of SSR was not warranted, based on a review of literature, an evaluation of historical water quality monitoring data, and an evaluation of the feasibility of utilizing the TSF from a hydrogeological and permitting perspective.

SSR treatment is no longer being developed as a treatment technology option during closure/post-closure.

Constructed Wetland Treatment (CWT)

MPMC retained Ensero Solutions Inc. (Ensero), formerly known as Contango Strategies Ltd., to conduct a detailed assessment and evaluation of the feasibility of a CWT system for passive/semi-passive treatment during closure/post-closure. The main targeted COCs of this technology are selenium and nitrate.

Pilot-scale design, sizing, and testing for CWT was completed by Ensero (Ensero 2020), and the technology demonstrated successful results for treatment of targeted COCs; however other passive/semi-passive technologies have indicated improved treatment capability in comparison. MPMC may choose to proceed with demonstration-scale on-site testing of CWT once the pilot-scale results have been fully understood and if the performance of competing technologies (SRF and others) indicates an advantage for CWT.

CWT is still being evaluated for full-scale implementation and is currently considered a technology option for passive/semi-passive and distributed treatment of selenium and nitrate during closure/post-closure if required.

5.0 WATER MANAGEMENT PLAN REVISION TRIGGERS

Operational events (i.e., triggers) that may result in updates to the WMP being required are listed in Table 50 as part of the revision process. These triggers cover changes to the mine plan or changes to site catchments or the TSF that would likely have a material impact on how water is conveyed, stored, and treated at the mine.
When one of the operational events occur, it is expected that an update will be required to the WMP to address changes to the water management approach. Triggers and proposed timelines for a WMP update are included in Table 50.

The need for changes to water treatment will be evaluated for each operational trigger. If it is determined that an operational trigger requires a change to the water treatment approach, the required engineering design process will be followed for the selection and progressive refinement of options as described in Figure 31.

Table 50: Water Management Plan: Revision Process for Potential Future Updates to Water Management Plan

Revision Trigger	Applicable Regulatory Body and Permit	WMP Update	Anticipated WMP Update Submission (revision trigger + X months)	Additional Notes
Mine plan update: a change to the permitted mine plan or implementation schedule that results in modifications to the water management systems.	MEMPR; M-200 EMA; PE-11678	Full update	10 months	Update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Tailings Storage Facility: a change to the permitted configuration (i.e., dam crest elevation, water storage volume, or tailings volumes) of the TSF that impacts water storage and discharge requirements.	MEMPR; M-200 EMA; PE-11678	Full update	6 months	Update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Catchment areas: change in the site footprint of more than 10% increase or decrease in runoff volume attributed to changes in the permitted and modified mine areas.	MEMPR; M-200 EMA; PE-11678	Partial update	3 months	Update will be composed of a calibration and sensitivity exercise on the existing water balance (including water quality model). Updates to groundwater/hydrogeological models may be required.
Requirement to update WMP by the Engineer of Record or the Independent Engineering Review Panel.	MEMPR; HSRC	Level of update depends on requirement of Engineer of Record or Independent Engineering Review Panel	6 months	To be determined; however, it may include an update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Requirement to update the WMP by the Statutory Decision Maker of MEMPR or BC ENV	MEMPR; M-200 EMA; PE-11678	Level of update depends on requirement of statutory decision maker	6-10 months	To be determined; however, it may include an update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.

WMP = Water Management Plan; TSF = Tailings Storage Facility; EMA = *Environmental Management Act*; MEMPR = Ministry of Energy, Mines, and Petroleum Resources; HSRC = Health, Safety and Reclamation Code for Mines in British Columbia; BC ENV = British Columbia Ministry of Environment and Climate Change Strategy.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

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APPENDIX A

Site-wide Water Balance Model (SWWBM)

REPORT

Mount Polley Mine Water Balance Model

Springer Expansion Life-of-Mine

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May 21, 2024

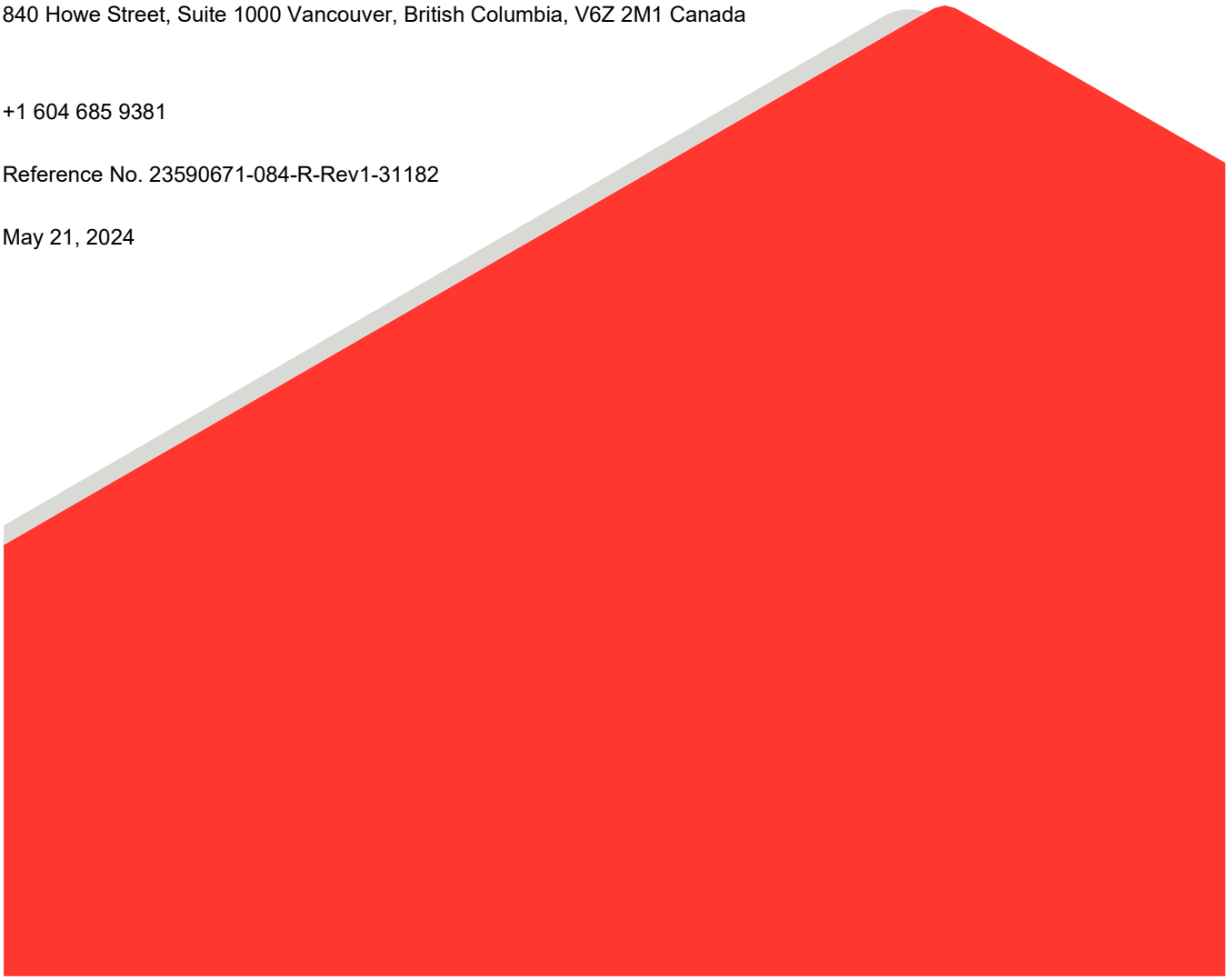

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APPENDICES

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Springer Expansion LOM SWWBM Inputs

APPENDIX B
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APPENDIX C
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1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) is currently submitting a permit application for the new Springer Expansion phase, extending assumed operations until March 31, 2031. The Site Wide Water Balance Model (SWWBM) presented in this report is a critical component, essential to support the Water Management Plan required for the Springer Expansion permit application. It should be noted that the specific operation, closure, and post-closure dates in this report have been assumed for the purpose of modelling. There are many factors that exist that can alter these dates, such as delays on the mine production as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan. Thus, these time frames should not be considered static.

The SWWBM was originally developed for the Technical Assessment Report (TAR) to support the effects predictions in the Mount Polley Mine Long Term Water Management Plan (Golder 2016a) for the Mount Polley Mine (the Mine) and has since been calibrated on an annual basis (refer to WSP 2023a for the latest 2022 annual calibration). This report presents the SWWBM based on the Springer Expansion Life-of-Mine (LOM) Plan informed by MPMC (MPMC 2022), to a crest elevation of 987 m of the TSF.

The work presented in this report is as follows:

- A summary of the physical setting at the Site (Section 2.0)
- An overview of the climate and hydrology at the Site (Section 3.0)
- A description of the SWWBM, including inputs and assumptions (Section 4.0)
- A presentation of SWWBM results, including operational, closure, post-closure phases (Section 5.0)
- Tabular inputs of the SWWBM (APPENDIX A)
- Flow Diagrams and 2022 Water Management Infrastructure Drawing (APPENDIX B)

This report has been prepared in accordance with the “Study Limitations,” which are presented at the beginning of the report. The reader’s attention is specifically drawn to this information for reference during use of this report.

2.0 BACKGROUND

2.1 General Information

Mount Polley Mine is a copper and gold mine operated by MPMC, a subsidiary of Imperial Metals Corporation. The Mine is located approximately 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake. Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

MPMC is applying for a permit for the new Springer Expansion phase, which extends operations until 2031. Updating the SWWBM to reflect the Springer Expansion LOM plan is required to support the Water Management Plan for this permit application. The updated SWWBM will generate results throughout the operational phase to a crest level of 987 m of the TSF (to be completed before the end of operations), extending into the closure and post-closure phases.

3.0 CLIMATE AND HYDROLOGY

3.1 Climate

In 2022, WSP Canada Inc. (WSP) updated the climate baseline data for the Mine. The climate of the Mine was characterized in the Baseline Climate Update Report (Golder 2022b) using historical measurements from local climate stations, supported by data obtained from five nearby regional Environment and Climate Change Canada (ECCC) climate stations. During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. Detailed climate information can be viewed in Golder 2022b. The climate inputs for the SWWBM are presented in Section 4.5.1.

3.2 Site Drainage and Surface Hydrology

A network of ditches, sumps, and pumping systems are operated by MPMC to manage surface water at the Mine. The current water management infrastructure of Mount Polley is presented in the MPMC 2022 Water Management Infrastructure Drawing provided in APPENDIX B. Surface water is separated between contact (mine affected) and non-contact (non mine affected) sources of runoff. The two water sources can be characterized as follows:

- Contact water: water that may have come into direct contact with mining and milling activities. This water generally requires treatment before release to the environment.
- Non-contact water: runoff originating from areas unaltered by mining activity that does not contact mining areas. It is typically diverted to the maximum extent practicable and allowed to discharge directly to the receiving environment.

The objective of current water management practices is to minimize the mingling of contact and non-contact surface water sources whenever possible. These flows originate from direct precipitation, runoff, and snowmelt from catchments. Contact water is mainly collected along two ditches running north to south along the Site: West Ditch and Long Ditch. A block flow diagram provides a conceptual overview of the sumps and their respective connections across the Mine area presented in Figure 1.

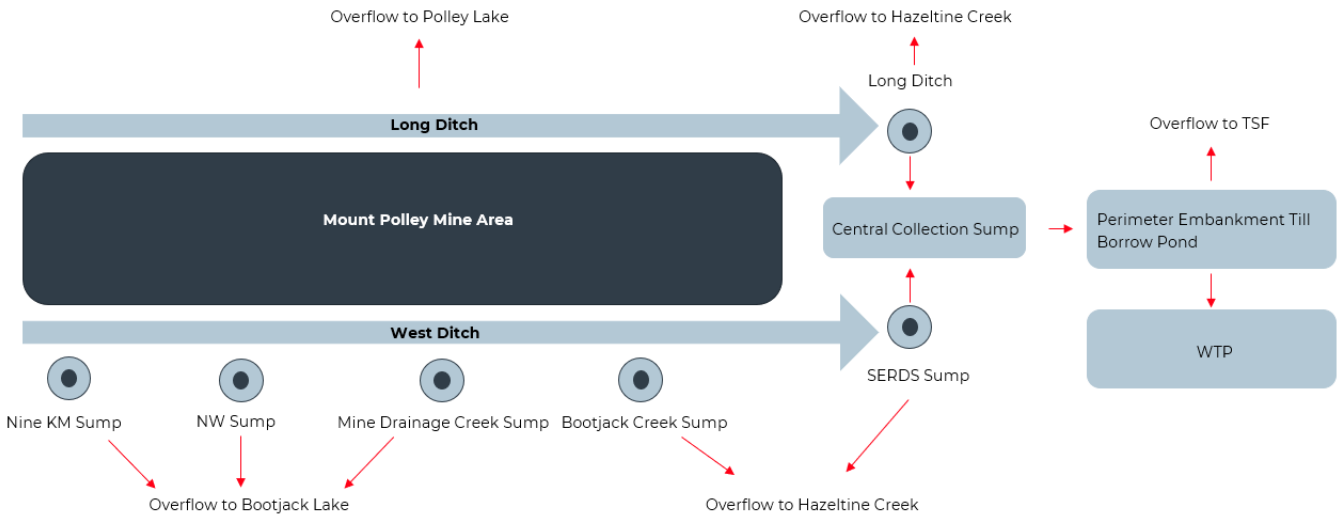

Figure 1: Conceptual Block Flow Diagram of Mount Polley Mine Contact Water Management Infrastructure

The West Ditch system collects contact water starting from the west side of the Site, progressing from the Nine KM Sump to the SERDS Sump. Components of the West Ditch system include various sumps, ditches, and pumping systems.

Similarly, the Long Ditch system manages contact water from the east side of the Site, extending from below the site access road to the Central Collection Sump. This system also comprises various sumps, ditches, and pumping systems.

3.3 Pit Groundwater Hydrogeology

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. The analysis for each pit is described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a).

Hydrogeological assessments for the pits were conducted as part of the TAR to estimate groundwater seepage into and out of the pits. Seepage estimates have not been updated for the WBM results presented in this document, which relies on the estimates completed in the 2016 TAR. WSP is currently updating these seepage estimates for the Mine pits, the seepage estimates will be updated in the SWWBM when available. Results will be assessed to identify any notable changes to the seepage estimate. Updated seepage parameters are not expected to alter the water balance results for the site or alter the water treatment quantity design basis; however, this will be confirmed once updated parameters are available. Groundwater inputs for the SWWBM are presented in Section 4.5.3.

3.4 Tailings Storage Facility

Flows from the TSF have been discussed in the TAR (Golder 2016a). WSP is currently designing a new upstream drainage system within the TSF to accommodate the increase in the TSF pond elevation (WSP 2023e). Updated estimations of seepage flow rates have been developed for each embankment as part of the TSF embankment crest at elevation 987 m design and are provided in Section 4.5.7.5.

4.0 SITE WIDE WATER BALANCE MODEL

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). This section presents SWWBM software, model objectives, general assumptions, processes, and inputs.

4.1 Model Software

GoldSim allows dynamic and complex water quantity interactions to be represented through a visual and highly modular framework. All input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. GoldSim is widely used for mine water quantity studies and provides the following capabilities:

- Deterministic and probabilistic simulations can be run within the model, which allows statistics and probabilities to be assigned to the model outputs.
- Simulation periods can be varied within the same model.
- The model framework can be easily adjusted to account for evolving conditions on a mine site, which allows the model to be used as an operational planning tool.
- Water quantity and water quality modules can be directly linked within the model, which allows both modules to be updated simultaneously; this is particularly useful when evaluating a range of scenarios (e.g., alternative water management strategies).

4.2 Model Objectives

This SWWBM was updated to include the future operational phase, in line with the assumed Springer Expansion LOM plan. Additionally, it has been updated to reflect changes in the closure and post-closure phases since the Reclamation and Closure Model update completed in 2022 (Golder 2022a).

This SWWBM has the following objectives:

- Include a future operational phase that will extend from May 2, 2023, to March 31, 2031.
- Include a closure phase extending from April 1, 2031, to March 31, 2041.
- Include a post-closure phase commencing on April 1, 2041, and extending to March 31, 2131 (100 years including closure).
- Estimate the quantity of contact water collected on-site per the climate conditions.
- Estimate water retention requirements in major storage locations at site such as the TSF and pits.
- Estimate the quantity of contact water requiring treatment.
- Enable assessment of future operations water quality and associated water treatment and/or discharge options.
- Provide a model that can be linked to a water quality module that assesses site water quality during forecasted future operations.

4.3 Assumptions and Key Input Parameter Values

General assumptions applied to this model are as follows:

- Continuation of mining of the Springer Pit and Cariboo Pit will not significantly increase the footprint of the pits.
- There is no seepage from the ponds or sumps other than the TSF (i.e., all ponds and sumps are assumed to be lined, or seepage is assumed to be negligible).
- Direct precipitation, evaporation, and seepage loss from ditches are assumed to be negligible.
- Precipitation occurs as snow from December to February and as rain or a mixture of rain and snow in all other months.
- Snowpack is represented by the cumulative precipitation depths over the months of December, January, and February, spanning a period of three months.
- Snowmelt occurs in the months of March, April, and May as a percentage of the maximum snowpack at the end of February (5% in March, 90% in April, and 5% in May).
- The closure and post-closure phases are included in the SWWBM, and the flow logic and model wiring for these phases are based on the 2022 Reclamation and Closure Plan (RCP) (Golder 2022a). Flow diagrams for closure and post-closure phases are also presented in Appendix B.

Key input parameter values and assumptions for the operational phase simulations are presented in Table 1.

Table 1: Key Input Parameter Values and Assumptions

Parameter	Value	Reference
TSF emergency spillway invert elevation at 987 m dam crest elevation during operations	985.8 m	WSP 2023c
Initial TSF water volume	2.84 M-m^3	TSF Weekly Report (MPMC 2023a)
Initial Springer Pit water level	970.66 m	TSF Weekly Report (MPMC 2023a)
Initial Cariboo Pit water level	954.72 m	TSF Weekly Report (MPMC 2023a)
Initial Wight Pit water level	912.87 m	TSF Weekly Report (MPMC 2023a)
Tailings stored in Springer Pit	2.00 M-m^3	TSF Weekly Report (MPMC 2023a)
Water Treatment Plant (WTP) treatment capacity	25,000 m^3/d	Provided by MPMC (MPMC 2023b)

4.4 Model Domain

A description of the model flows is provided in APPENDIX A. The domain and structure of the SWWBM is outlined in the conceptual flow diagrams for the forecasted operational, closure and post-closure phases in Appendix B. The flow diagrams illustrate the assumed water circuit system at the Site during operations, closure, and post-closure, including the storage and conveyance of water. The water management infrastructure within the SWWBM for the operational phase is summarized in Table 2 and flow types are outlined in Table 3.

From closure and progressively to post-closure, certain Site areas will be reclaimed, and run-off will become non-contact water and the volume of annual contact water will reduce. Pumping rates for the Site will be reduced at the end of the closure period, as certain areas are assumed reclaimed. The progression of flow routes and discharges to the environment are shown on the flow diagrams presented in Appendix B.

Table 2: Water Management Infrastructure during Operations

Major Ditches	Sumps and Minor Ponds	Major Ponds and Storage Facilities
▪ Long Ditch ▪ SERDS Ditch (lower portion of West Ditch)	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ Central Collection Pond ▪ Bootjack Creek Sump ▪ Mill Site Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9K Sump ▪ Boundary Pit	▪ TSF ▪ Cariboo Pit ▪ Springer Pit ▪ Wight Pit ▪ Perimeter Embankment Till Borrow Pond

SERDS=Southeast Rock Disposal Site; TSF = Tailings Storage Facility

Table 3: Types of Flows Represented in the SWWBM

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows)	▪ Water consumption flows (turbo-misters, and water trucks) ▪ Water treatment discharge ▪ permanent, unrecoverable storage in tailings (interstitial water) ▪ Open water evaporation ▪ Pumped flows between facilities ▪ Transfer flows (gravity flows between facilities) ▪ Groundwater flows

4.5 Model Inputs

4.5.1 Climate Inputs

The following sections describe the climate inputs used in the SWWBM.

4.5.1.1 Precipitation

The SWWBM was run with probabilistic monthly climate inputs for this assessment. To develop probabilistic inputs, monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022b) were fitted to a log-normal probability distribution. The mean and standard deviation for the monthly precipitation values are shown in Table 4.The model is run using a daily time step, which represents better variation between months such as the water volume in the TSF or the pits.

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the distribution of the dataset. The stochastic generator was set to perform 2000 realizations to create a sample size that was sufficiently large to account for a range of conceivable monthly climatic precipitation scenarios for the study period. The results of these 2000 realizations were compiled to generate probability distributions that yield percentile values. To represent average and extreme climate scenarios, results for the 50th, 90th and 99.5th percentiles are presented in Section 5.0.

Table 4: Stochastic Climate Generator Log-Normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

4.5.1.2 Evaporation

The median annual shallow lake evaporation rate is estimated to be 670 mm. Monthly evaporation rates vary between 0 mm in December to 136 mm in July. Estimated median monthly and annual shallow lake evaporation from 1974 to 2001 are presented in Table 5.

Table 5: Median Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Median Shallow Lake Evaporation (mm)
January	0
February	7
March	32
April	67
May	102
June	121
July	136
August	113
September	60
October	21
November	4
December	0
Annual	**663**

4.5.1.3 Climate Change

An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 8 Global Climate Models (UBC 2022) and two emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the GoldSim model) was used to extend these projections from year 2100 to 2200 by resampling monthly data from 2071-2100 and relating projected changes in temperature and precipitation climate variables to a set of extended greenhouse gas concentration pathways beyond year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emissions scenarios using a range of values. The mean, and the upper bound, have been included in the SWWBM to analyze the effects of climate change. Lake evaporation, snow accumulation and snowmelt were calculated in the same way as for the average scenario.

4.5.2 Hydrology Inputs

The following sections describe the hydrologic processes and inputs used in the SWWBM.

4.5.2.1 Runoff Parameters

Runoff in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. Adjustment during the calibration process resulted in a 30% increase of the general runoff coefficients in cases where the monthly precipitation exceeds 50 mm. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)** – mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)** – highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 6.Runoff coefficients are adjusted during the annual SWWBM calibration to align estimated runoff volumes with Site monitoring data.

Table 6: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020

4.5.2.2 Catchment Areas

To model runoff, direct precipitation, and evaporation, the catchment areas for each storage element were defined in the model. The catchment/reporting area for each storage element remains consistent with the TAR (Golder 2016a). However, there's one exception: the TSF impoundment catchment at the projected 987 m crest. Any alterations would mainly affect the infrastructure downstream of the TSF, but these changes are expected to have minimal impact on the model results. The catchments are shown in Table 7. Subdivision of catchments areas by land type are presented in Table A-1 in APPENDIX A.

Table 7: Current Catchment Areas for SWWBM Storage/Conveyance Elements

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF Upstream Catchment (External)	622,800
TSF Impoundment Catchment (Internal – current)	2,269,700
TSF Impoundment Catchment (Internal – projected at 987m raise) [(a)]	2,860,000
Perimeter Embankment Till Borrow Pond (PETBP)	524,300
Central Collection Sump (CCS)	438,600
Bootjack Creek Sump	175,200
SERDS Ditch[(b)]	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Cariboo Pit	1,320,400
Springer Pit	651,900
NW Sump	330,200
9K Sump	698,700
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

Source: Golder 2016a. Update on TSF impoundment based on TSF projections.

(a) The raise of the TSF will affect the catchments producing runoff into the TSF pond. To consider the increase of the TSF impoundment catchment, the model interpolates the TSF impoundment catchments between the current state and the TSF raise to 987m. Changes in other catchments are minor.

(b) The current SERDS Tailings Co-Disposal project does not affect the delineation of the catchment.

After finishing operations, some mining features become remediated during closure and become non-contact water during post-closure. This is modelled by changing the land types, from disturbed to not disturbed areas. The land types define the runoff coefficients (Table 6) and the water quality, which is analyzed in the Water Quality Report (WSP 2023d). The model logic to convert the land types it is as follows (all timeframes are from start of closure on April 1, 2031 – assumed for the purpose of modelling):

- Roads:
  - 14% of total road area switch to disturbed at year 3.
  - 21% of total road area (additional 7%) switch to disturbed at year 4.
  - Negligible amount of road surface is fully reclaimed (no undisturbed road area ever).
- Dump areas transition to disturbed at the following rate:
  - Closure + year 1 = 22%.
  - Closure + year 2 = 37%.
  - Closure + year 3 = 61%.
  - Closure + year 4 = 100%.
- Mill site
  - Areas switch to disturbed at year 2.
- All Disturbed areas, not including unreclaimed roads, will transition to undisturbed at the following schedule:
  - year 5 = 25%.
  - year 10 = 50%.
  - year 15 = 75%.
  - year 20 = 100%.

After this time all areas will be undisturbed except Pit areas and unreclaimed roads.

4.5.3 Groundwater Inputs

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. Groundwater flows with dependency on the water level of the pits are presented in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a) and repeated in Appendix A of this report.

4.5.4 Storage Capacities

Free water volumes in storage ponds, sumps, and the TSF depend on a balance between their inflows and outflows. The stage (elevation) can be directly correlated to a specific storage volume using bathymetric and topographic data. These relationships are referred to as stage-storage curves.

Dynamic storage facilities such as the TSF, where tailings deposition changes the available storage, require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. Stage-storage curves for the TSF up to a crest elevation of 987 m were developed from the 2020 TSF survey. These curves were obtained from preliminary tailings deposition modelling carried out in support of the design of the 987 m TSF.

The stage-storage curves projected up to a crest elevation of 987 m constitute a 2-D element that considers the tailings tonnage. These curves will interpolate according to the dry tailings volume across the Springer Expansion LOM schedule. Additionally, these curves are limited by the spillway invert stated in Table 1, serving as the upper boundary for the maximum TSF elevation. The stage-storage curves up to a crest elevation of 987 m crest in this report are provided in APPENDIX A.

Stage-storage curves were available for the following major storage elements and are provided in APPENDIX A:

- Springer Pit (November 7, 2019, bathymetry survey)
- Cariboo Pit (June 3, 2022, topographic survey)
- TSF (June 17, 2020, bathymetric survey tied-in with October 22, 2019, topographic survey)
- Wight Pit (January 13, 2022, bathymetric survey)

The estimated volume capacities for the facilities listed above and other storage locations are presented in Table 8.

Table 8: Maximum Capacities for Major Storage Facilities

Major Storage Facility	Estimated Capacity (M-m^3)
Springer Pit[(a)]	14.8
Cariboo Pit[(a)]	5.1
Combined Springer-Cariboo Pit final mine-out	30.3
TSF – 987 m crest elevation design	5.7[(b)]
Wight Pit	3.8
PETBP	0.17

(a) Represents current individual pit volumes (i.e., before pits are combined or further mined.)
(b) Capacity at the final stage of the TSF, when tailings deposition ends.

When the embankment reaches an elevation of 987 m, the TSF pond will be pushed towards the north abutment. The TSF will be available to store freshet water until four months after the start of the closure phase (July 31, 2031) in order to capture the last freshet period during the operations phase. Commencing August 1, 2031, TSF volume will be progressively reduced to 0.25 M-m^3 over the course of two months due to construction of the closure spillway.

4.5.5 Mine Plan

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage/volume of dry tailings during the project is provided in Table 9 (MPMC 2022). It is assumed that 6.55 M-tons of dry tailings have been placed in the TSF between the mine plan start date of July 1, 2022, and the assumed SWWBM operations start date of May 2, 2023.

Table 9: Mine Plan (Annual Totals)

Year	Dry Tailings (tons)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on July 1, 2022.

(b) Mine plan ends on March 31, 2031.

4.5.6 TSF Pond Volumes

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on-site year over year (including within the TSF) by treating and discharging water.

The minimum and maximum operational water volumes in the TSF under normal conditions are 1.5 M-m^3 and 1.7 M-m^3, respectively.

The water balance model activates and deactivates pumping flows. As a result, the TSF pond volume is set at 1.5 M-m^3 prior to freshet and it returns to the specified normal operating range after freshet. TSF volume conditions are presented in Table 10.

Table 10: TSF Pond Volume Values

Condition	TSF Pond Volume (M-m^3)
Minimum under normal conditions	1.5
Maximum prior to freshet (February-April)	1.5
Maximum after freshet and until freeze-up	1.7

Note: M-m^3 = 1 × 10^6 m^3

4.5.7 Flow Derivation and Logic

This section describes the model logic for pumped flows, seepage (from the TSF), groundwater inflows and outflows, consumption, and transfer flows.

In general, the model localizes the outflows of the TSF and pits and ponds; based on demand priorities using modeling elements known as "allocators." When water is present in storage, the allocator calculates evaporation as the first priority, followed by all pumping flows depending on the configured priorities. The maximum pumping capacity is utilized when water is available. If the total outflow is restricted, a lower or zero pumping rate is applied.

4.5.7.1 Pumped Flows

The most relevant transfer rates, including rates between TSF, Pits and PETBP; have been informed by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on engineering judgement (Golder 2016a). Maximum pumping rates for the operational, closure, and post-closure phases (2023 to 2131) are shown in APPENDIX A.

It should be noted that the capacity set for transfer from TSF to Wight Pit (P30) was assumed at a capacity to avoid PETBP overflow during operations. Capacity set for transfer from CCS to Wight Pit (P35) during closure is a WSP assumption to allow suitable water transfer capacity between CCS and Wight Pit during the closure phase, and this future conveyance system will require design confirmation as the Site approaches closure.

4.5.7.2 PETBP Pumping Logic

PETBP will begin pumping water to the TSF when the water elevation at the PETBP surpasses 923.25 m or when the TSF water volume drops below the minimum threshold by 50,000 m^3 or more.

4.5.7.3 Mill Process Flows

The mill process water requirements are based on 2.0 m^3/t of tailings. Interstitial water sequestered in the deposited tailings is based on 0.347 m^3/t of tailings deposited.

4.5.7.4 Consumption Flows

Consumption flows are system losses attributed to the operation of dust suppression equipment. Consumption flows were estimated by MPMC staff for operations (MPMC 2023b) and are modelled according to the following logic:

- Turbo-misters operate from May to September.
- Water trucks withdraw water at variable rates from May to September.

Consumption flow rates are presented in APPENDIX A.

4.5.7.5 Tailings Storage Facility Flows

WSP is currently designing a new upstream drain system to accommodate the increase in the TSF pond elevation (WSP 2023e). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width).

Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipate seepage rates through the embankment and foundation. Seepage analyses for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 11 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 11: Seepage Flow Rates

Beach (m)	Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note: includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF pond volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different pond sizes. The estimates are provided in Table 12, which outline a conservative scenario, in terms of seepage flow quantities.

Table 12: Tailings Beach Width

TSF Pond Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 11 and Table 12 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (August 1, 2031), the TSF pond reduces its volume to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase in the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 13 will be in effect 6 months after the end of the operation phase and throughout the post-closure phase.

Table 13: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	**S2**	**S4**	**S5**
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF pond is limited to 250,000 m³.

5.0 WATER BALANCE RESULTS

The following sections present major model results for the operational and closure phases, and partial results for post-closure phase. Full extension of post-closure results are presented in Appendix C.

5.1 WTP Treatment Capacity

Throughout the entire planned future operations and closure periods to March 31, 2041, the maximum treatment capacity of the WTP in the model is assumed to be 25,000 m^3/day (0.29 m^3/s, 9.15 M-m^3/year). Excess water beyond this discharge rate is temporarily stored within the TSF until it can be treated and discharged. Centralized collection and treatment of contact water is assumed during operations, closure, and post-closure. The Mine's current discharge permit authorizes an annual discharge volume of 10.59 M-m^3.

In year 2041, the assumed treatment capacity of the WTP in the model remains at 25,000 m^3/day (0.29 m^3/s). However, annual contact water requiring treatment is reduced over the post-closure phase as site areas are remediated and some runoff is considered non-contact water, as shown in the flow diagram Figure B-3 provided in Appendix B. The annual contact water treated discharge volume declines further in year 2051 when the South Seepage Pond and Main Embankment Seepage Pond catchments are considered remediated, commencing 10 years after the post-closure phase. At the end of the operations phase, contact water requiring treatment notably increases in 2031, as milling is assumed to terminate in 2031 and the demand for milling process water also terminates.

Estimated annual contact water volumes requiring treatment from operations to post-closure are presented in Table 14, and Figure 2 illustrates daily WTP discharge rates from operations to 10 years after post-closure.

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[a]	3.90	4.57	5.72
2024	5.00	5.94	7.24
2025	3.50	4.97	6.79
2026	3.37	4.72	6.53
2027	3.35	4.79	6.60
2028	3.36	4.80	6.70
2029	3.39	4.78	6.46
2030	3.31	4.75	6.56
2031[b]	3.93	4.39	5.04
2032	5.56	6.68	7.82
2033	5.54	6.57	7.57
2034	5.50	6.54	7.49
2035	5.42	6.42	7.44
2036	5.43	6.44	7.36

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2041[(c)]	2.36	2.88	4.04
2046	1.80	2.27	3.31
2051	0.46	0.83	1.39
2071	0.33	0.71	1.48
2091	0.32	0.69	1.60
2111	0.32	0.71	1.44
2131	0.02	0.03	0.05

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

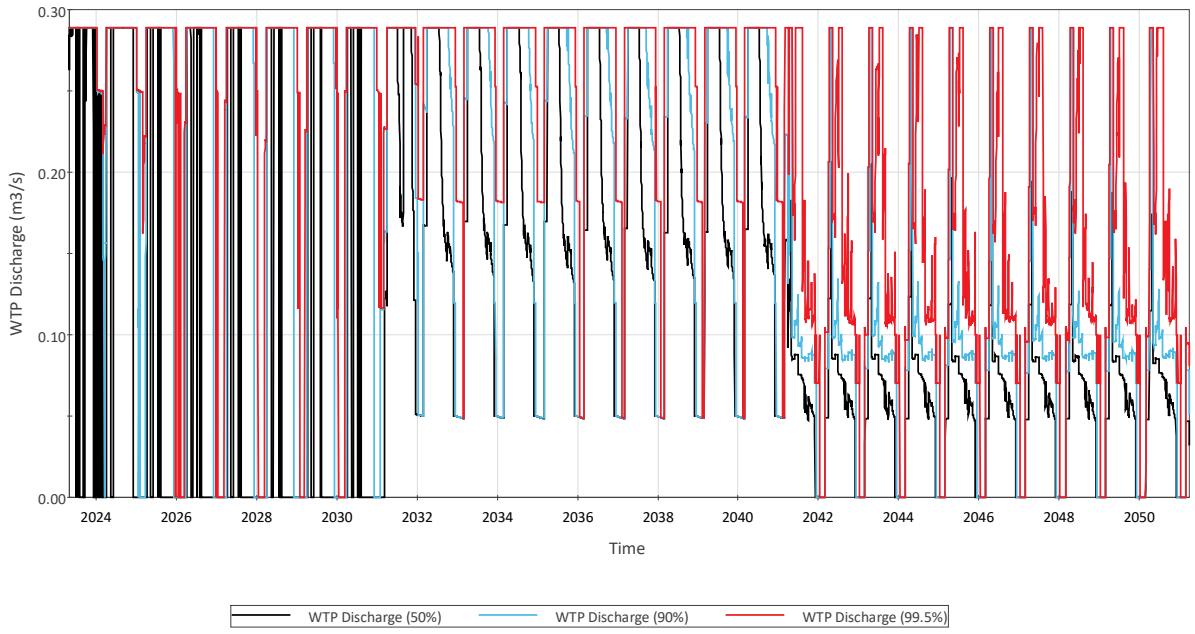

Figure 2: WTP Discharge Rate from Operations to 10 years after Post-Closure

5.2 Tailings Storage Facility

Temporary detention of water will be necessary to manage the large runoff volumes generated during freshet (typically April to June). The inflows during freshet will exceed treatment capacity, and detention volume is required to prevent uncontrolled release from the PETBP and to equalize the flow for treatment. The TSF is available to store excess freshet water until four months after the start of closure. At that time, the TSF pond will decrease its volume to 0.25 M-m³, the maximum allowable volume at closure.

To create the reduced TSF pond, a closure spillway will be constructed at the north abutment (Corner 5) of the TSF. Water will discharge from the TSF to the CCS, and then flow to the PETBP for treatment prior to discharge.

During closure and post-closure, the TSF pond is modelled to discharge annually via the spillway, and the TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3. As from Figure 3, the volume fluctuation follows a consistent pattern during both closure and post-closure periods, with minimum values occurring in winter and reaching maximum capacity during freshet (0.25 M-m^3).

Figure 3 shows the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF volume pattern shown for the 2041-2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131). Table 15 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 3.

Table 15: TSF Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,330,244	1,390,394	1,429,751
	Average	1,493,500	1,576,822	1,809,717
	Maximum	2,840,000	2,840,000	3,493,139
Closure	Minimum	0	0	0
	Average	119,248	188,149	265,076
	Maximum	1,756,506	2,012,120	2,479,271
Post-Closure	Minimum	0	0	0
	Average	50,710	116,082	182,881
	Maximum	252,571	252,571	252,571

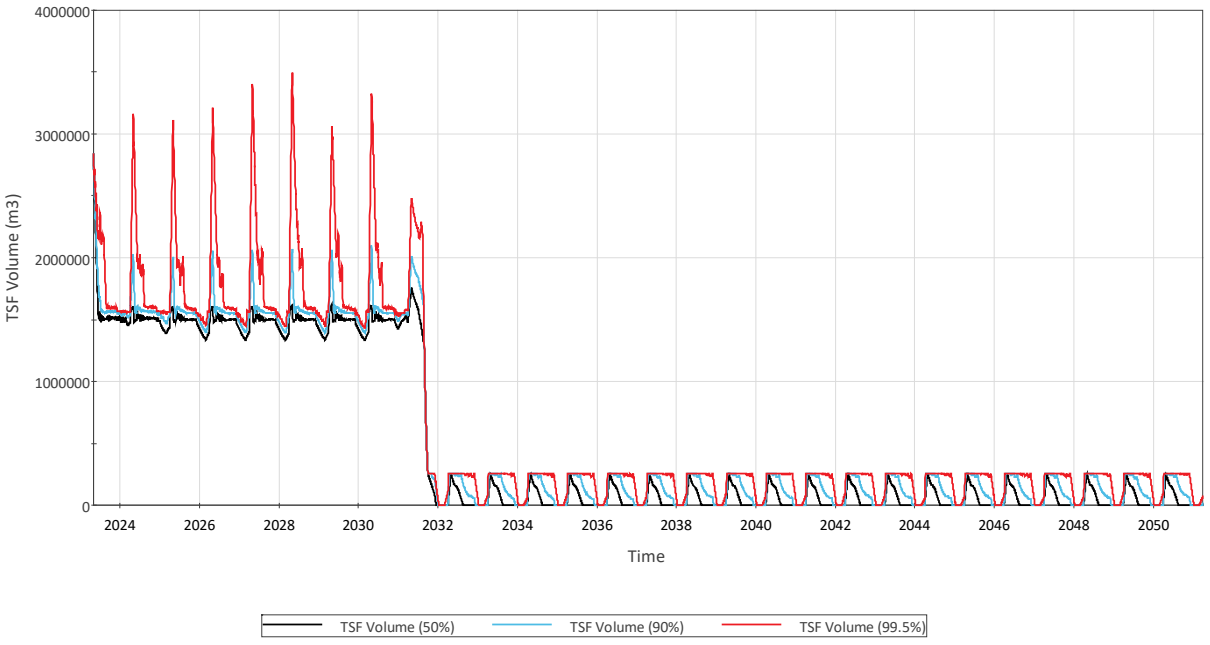

Figure 3: TSF Water Volume from Operations to 10 Years after Post-Closure

5.3 Springer Pit

The simulated Springer Pit water volume during the operational phase is shown in Figure 4 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Springer Pit storage volume of 0 m^3 on May 2, 2023. During the operational phase, the volume in Springer Pit is reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet, as freshet inflow exceeds pit dewatering pumping capacity.

Springer Pit and Cariboo Pit are modelled as a single pit in the closure phase, using the stage-storage curve based on the ultimate projected topography, as detailed in Section 5.5.

Table 16: Springer Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	8,620	35,720	117,745
	Maximum	74,124	169,623	361,074

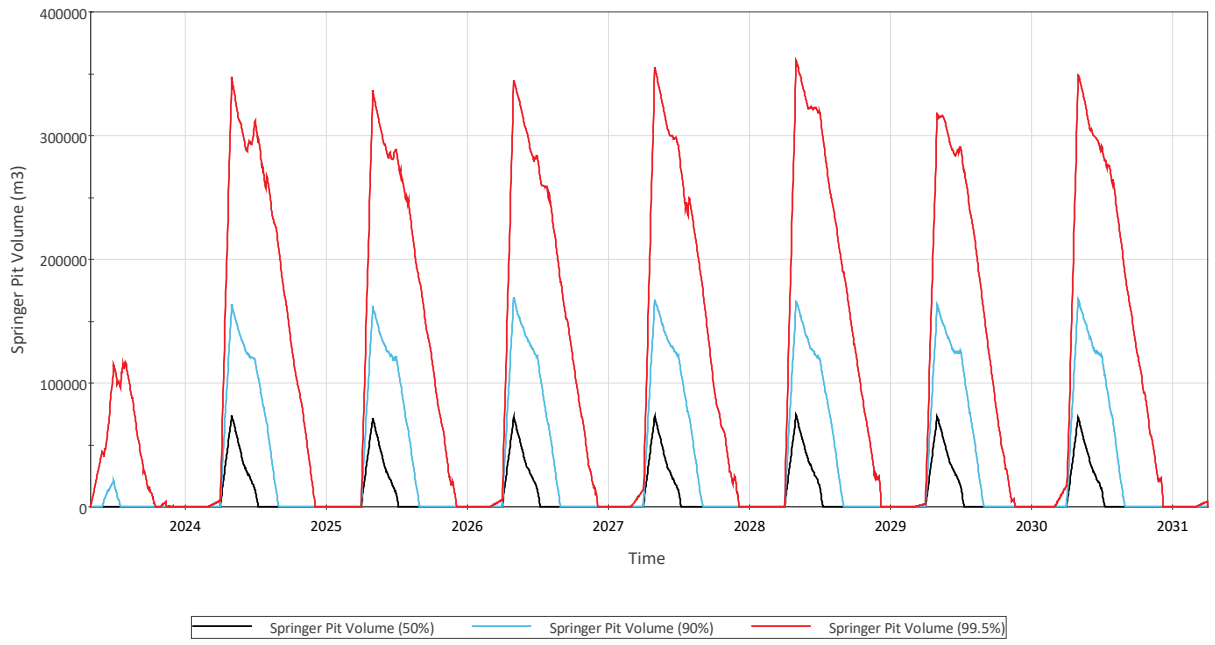

Figure 4: Springer Pit Water Volume during Operations

5.4 Cariboo Pit

Simulated Cariboo Pit water volumes during the operational phase are shown in Figure 5 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Cariboo Pit storage volume of 0.24 M-m^3 on May 2, 2023. During the operational phase, the volume in Cariboo Pit is reduced to the minimum volume before each freshet, and temporary storage will increase to its maximum volume of 0.26 M-m^3 during the freshet. Springer Pit and Cariboo Pit have been modelled as one combined pit in the closure phase as explained in Section 5.3.

Table 17: Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	81,256	112,813	169,463
	Maximum	259,249	259,249	259,249

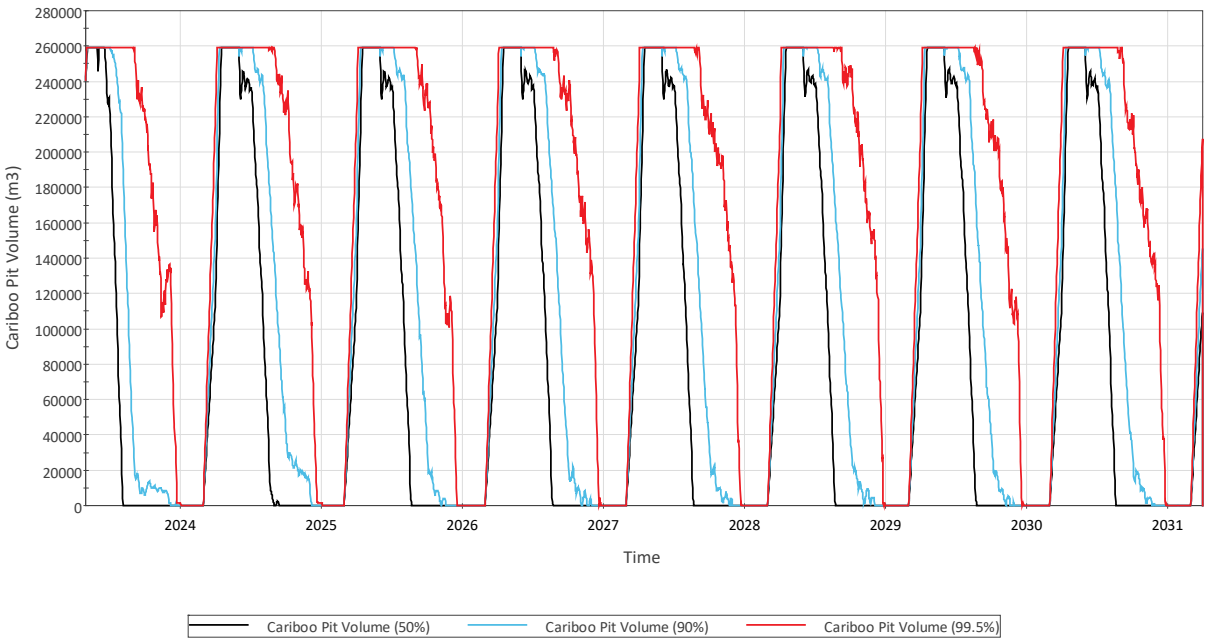

Figure 5: Cariboo Pit Water Volume during Operations

Table 18 shows the modelled average annual overflow volume from the Cariboo Pit during operations, and these overflow volumes are included in the total annual volumes required for treatment shown in Table 14.

Table 18: Cariboo Pit Annual Overflow (m^3)

Phase	Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Operations	283,897	574,260	1,221,920

5.5 Combined Springer-Cariboo Pit

Springer Pit and Cariboo Pit were modelled as a single pit for the closure phase (starting April 1, 2031). A result comparison between different percentiles for Combined Springer-Cariboo Pit volume during closure and post-closure is provided in Figure 6 . Potentially Acid Generating (PAG) waste rock will be stacked uniformly to an elevation of 1,004 m in the base of the Combined Springer-Cariboo Pit at the end of the operations phase. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2033 under the 99.5th percentile condition, while under the rest of the climate conditions it is estimated to cover the PAG material placed in pit by 2034. Under the 50th percentile results, the combined Springer-Cariboo Pit lake is estimated to start overflowing in 2058, while under the 90th percentile it is estimated to start overflowing in 2056, and in 2055 under the 99.5th percentile. The Water Quality Report (WSP 2023d) discusses modelled water quality of the Springer-Cariboo pit lake at the estimated time of overflow.

Table 19: Combined Springer-Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Closure	Minimum	109,345	145,263	211,031
	Average	4,827,785	5,199,295	5,652,177
	Maximum	9,030,590	9,598,661	10,300,000
Post-Closure	Minimum	9,032,744	9,600,627	10,300,000
	Average	20,033,811	20,167,573	20,287,305
	Maximum	21,100,000	21,100,000	21,100,000

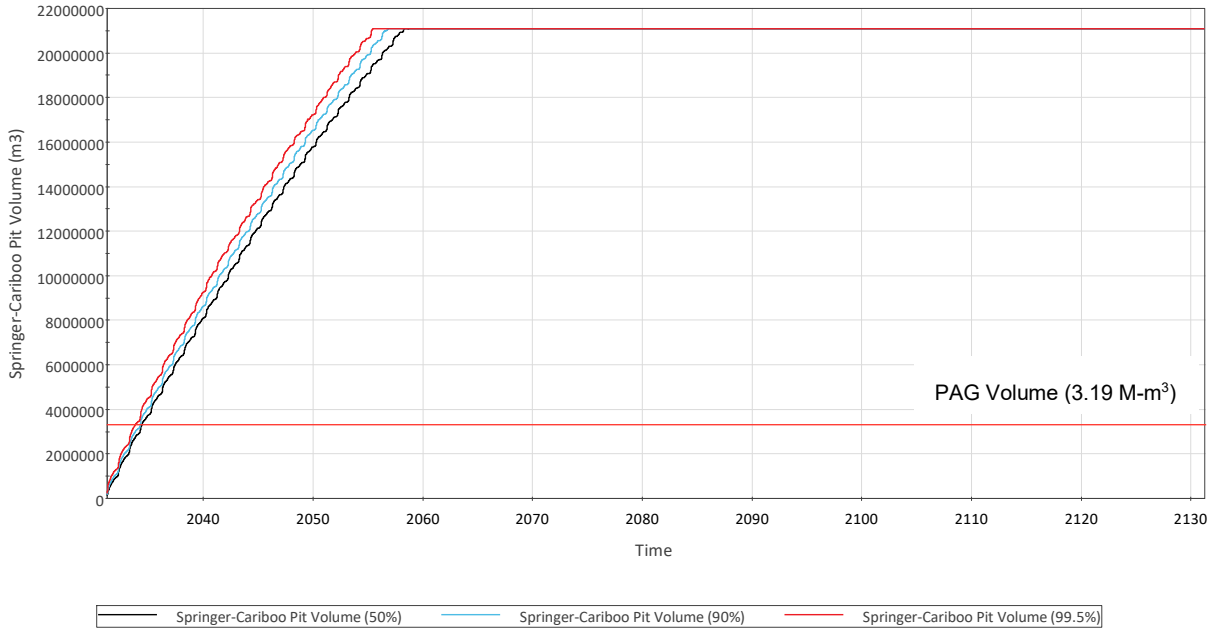

Figure 6: Combined Springer-Cariboo Pit Water Volume from Closure

The combined Springer-Cariboo Pit is modelled to fill to its maximum volume during post-closure. Following that time, additional volume collected in the combined pit will overflow from the pit's spillway and is assumed to direct discharge to the receiving environment in the SWWBM. Water quality and water treatment discussion is included under separate cover regarding this assumption of direct environmental discharge of pit lake overflow during post-closure.

Table 20 shows the modelled average annual overflow volume from the combined Springer-Cariboo Pit.

Table 20: Combined Springer-Cariboo Pit Annual Overflow (m^3)

Phase	Combined Springer-Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	469,711	1,051,048	2,249,910

5.6 Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP serves as the final component of the centralized water management infrastructure, collecting water from the entire site. From this point, the water is pumped back to the mine for reuse, storage, or treated and discharged through the adjacent WTP. The current maximum capacity of the PETBP is 170,000 m^3. When the water volume in the PETBP exceeds 121,700 m^3 during the operations phase, modelled pumps to the TSF are activated to prevent overflow.

The 50th percentile results show that the maximum volume in the pond approaches 125,000 m^3 during the freshet. There are no occurrences of overflow from the PETBP under the simulated conditions during the future operational phase. During closure and post-closure, less storage is available in the overall water management system, and the PETBP reaches higher maximum volumes during freshet periods and does not have the capacity to prevent overflow for the 99.5th percentile results (as shown in PETBP overflow volumes listed in Table 22). The SWWBM predicts that the PETBP will have sufficient capacity to prevent overflow for the 50th and 90th percentile climate conditions. It is assumed that sufficient storage will be implemented during closure to prevent any unwanted overflow of contact water requiring treatment during the closure phase. The volumes listed in Table 22 are included in the total annual volumes required for treatment shown in Table 14.

Estimated storage volumes in the Perimeter Embankment Till Borrow Pond (PETBP) from operations to 10 years after post-closure are presented in Figure 7, with minimum, average, and maximum bounds of those trends shown in Table 21.

Table 21: PETBP Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	57,800	57,800	57,800
	Average	70,564	86,981	108,041
	Maximum	122,966	148,674	170,000
Closure	Minimum	57,800	57,800	57,800
	Average	65,872	73,383	93,979
	Maximum	120,397	149,882	170,000
Post-Closure	Minimum	57,800	57,800	57,800
	Average	58,029	57,924	65,613
	Maximum	72,012	137,714	170,000

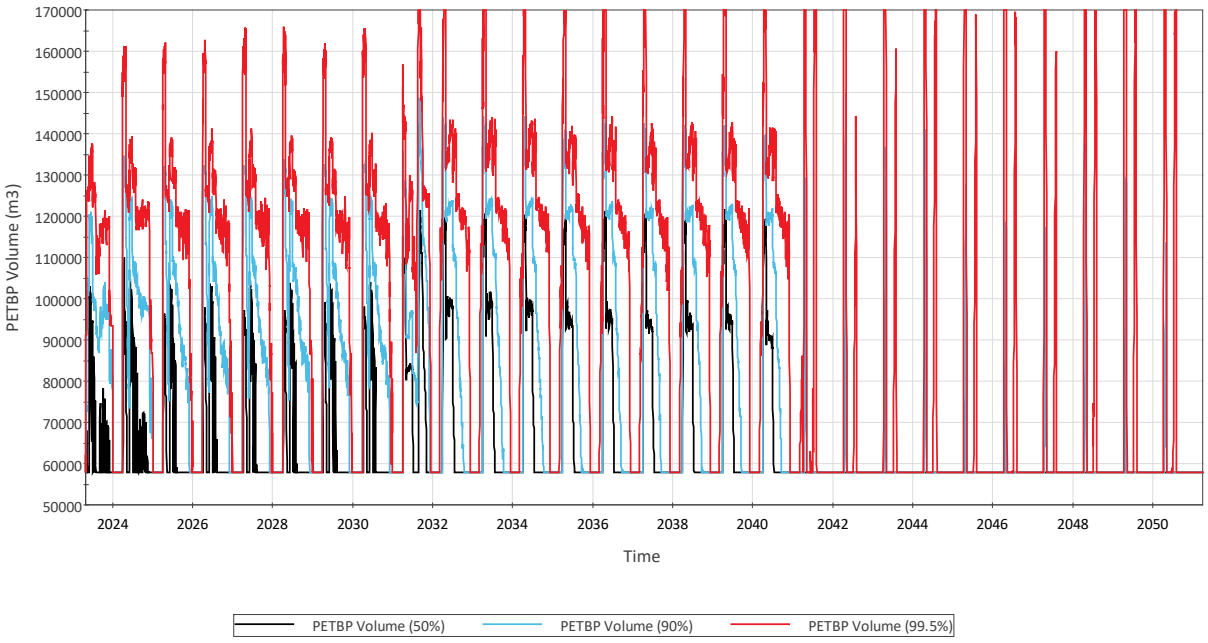

Figure 7: PETBP Water Volume in Pond during Operations to 10 years after Post-Closure

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[a]	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	227,098
2033	0	0	39,339
2034	0	0	9,640
2035	0	0	0
2041	0	0	498,988
2046	0	0	456,228

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2051	0	0	126,721
2056	0	0	334,984
2076	0	0	259,000
2096	0	0	269,515
2116	0	0	240,229
2131	0	0	0

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

5.7 Wight Pit

The water volume in Wight Pit is expected to increase during every freshet season. Four months into the closure phase, the TSF pond will be reduced to 0.25 M-m^3 within two months. Once the TSF can no longer provide freshet storage, Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for freshet storage and will be allowed to fill. Wight Pit is projected to start overflowing in 2049 under the 50th percentile results, and in 2047 under the 90th and 99.5th percentile results. Overflow from Wight Pit during post-closure is assumed as direct environmental discharge to Polley Lake and the water quality implications of this assumption are discussed under separate cover. Estimated volumes stored in Wight Pit from operations to 10 years after post-closure are presented in Figure 8 and the average annual post-closure overflow volumes are shown in Table 24.

Table 23: Wight Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	459,747	650,947	1,128,389
	Maximum	3,427,576	3,483,974	3,495,141
Closure	Minimum	0	0	0
	Average	80,815	373,440	1,188,190
	Maximum	490,123	1,153,040	2,326,346
Post-Closure	Minimum	0	0	0
	Average	4,835,386	4,841,820	4,849,597
	Maximum	4,984,114	4,984,114	4,984,114

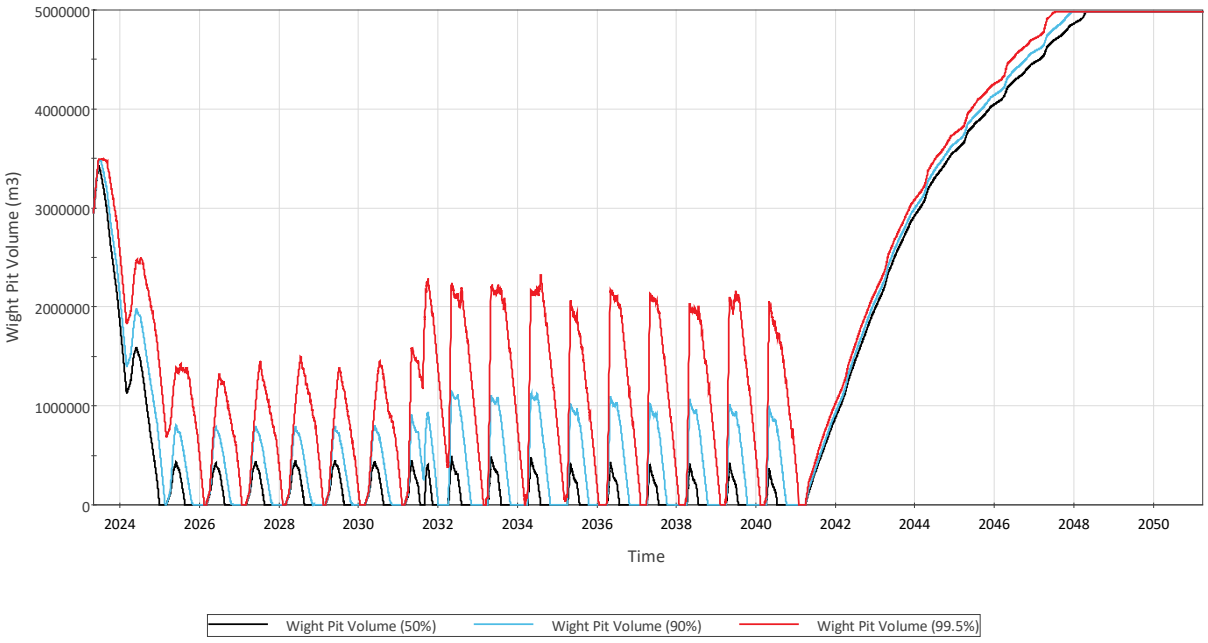

Figure 8: Wight Pit Water Volume from Operations to 10 years after Post-Closure

Table 24: Wight Pit Annual Average Overflow (m^3)

Phase	Wight Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	466,741	617,692	993,214

6.0 SUMMARY

The SWWBM was updated to reflect the Springer Expansion LOM plan during the operational phase and incorporates closure and post-closure phases for the Mount Polley Mine. The SWWBM supports water management planning and the assessment of water quality and associated water treatment and discharge options.

The model was run from May 2, 2023, to March 31, 2131, and included the following LOM phases:

- operational phase extending from May 2, 2023, to March 31, 2031.
- closure phase extending from April 1, 2031, to March 31, 2041.
- post-closure phase commencing on April 1, 2041, and extending, for the purposes of this analysis, to 2131.

The model was run stochastically for 2000 realizations to present 50th, 90th, and 99.5th percentile model results. The results for the modelling during the operational phase are presented as follows:

- The average annual treated discharge for the 50th percentile is approximately 3.65 M-m^3 between 2023 and 2031, while the milling process water demand exists.
- The maximum annual treated discharge for the 99.5th percentile 7.21 M-m^3 in 2031.
- The maximum TSF pond volume during the operational phase is approximately 3.49 M-m^3 for 99.5th percentile, and 1.62 M-m^3 for the 50th percentile results (excluding 2023 when the TSF is initially set to 2.84 M-m^3 in the model).
- During the operational phase, the volume in Springer Pit and Cariboo Pit are both decreased to empty before each freshet, and temporary storage will occur during the freshet.
- There are no overflows from the PETBP under the simulated conditions during the operational phase.

The conclusions for the modelling during closure and post-closure phases are as follows:

- The average annual treated discharge for the 50th percentile result is approximately 0.95 M-m^3.
- The TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2055 and 2058, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake between 2033 and 2034.
- During closure, the volumes in PETBP are reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet under each of the climate conditions simulated. During closure and post-closure phases, the PETBP does not have sufficient storage capacity to prevent overflow during freshet for the 99.5th percentile condition; however, these overflow volumes are included with the annual treatment requirement volumes.
- The Wight Pit is expected to initiate spilling between 2047 and 2049, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.

7.0 CLOSING

This report summarizes the SWWBM to support the water management information requirements for the Springer Expansion LOM plan.

We trust that this report satisfies your current requirements. Please contact the undersigned should you have any questions.

WSP Canada Inc.



Stella Cheng, B.Sc., EIT
Water Resources Engineer

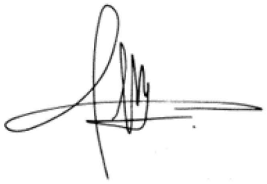

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APPENDIX A

Springer Expansion LOM SWWBM Inputs

A1.0 CATCHMENT AREAS BY LAND TYPE

Table A-1: Catchment Areas by Land Type

Catchment	Land Types (m^2)						
	Waste Rock	Haul Roads	Mill Site Area	Disturbed Area	Undisturbed Area	Maximum Pond Area	Total Catchment
South Seepage Pond	0	0	0	0	0	385	385
Main Embankment Seepage Pond	214,904	0	0	124,485	0	37,546	376,935
TSF Upstream (External)	0	238,423	0	63,800	320,559	0	622,782
PETBP	100,535	96,348	0	193,072	65,060	69,307	524,322
CCS	0	67,918	0	122,204	248,419	21,823	438,541
Bootjack Creek Sump	0	103,986	0	70,041	0	1,130	175,157
SERDS Ditch	401,235	165,456	273,919	313,059	383,918	0	1,537,587
Mill Site Sump	0	0	0	0	0	1,628	1,628
Cariboo Pit	922,698	0	129,436	0	0	268,208	1,320,342
Mine Drainage Creek Sump	437,190	137,335	314,166	114,972	111,134	1,125	1,115,922
Nez Dump	199,116	261,421	0	237,889	202,646	0	1,299,306
North Bell Dump	0	0	0	0	0	0	597,350
East RDS	693,392	0	0	899,543	0	0	597,350
Springer Pit	0	0	0	156,100	0	280,478	436,578
NW Sump	205,919	63,800	0	60,210	0	231	330,160
9K Sump	497,228	0	0	60,735	140,272	400	698,635
Wight Pit	162,022	0	0	0	0	251,888	413,910
Boundary Pit	3,511	0	0	0	10,286	9,616	23,413

Note: TSF-Tailing Storage Facility; PETBP-Perimeter Till Borrow Pond; CCS-Central Collection Sump.

A2.0 FLOW INVENTORY

A description of the model flows is provided in Table A-2. Direct precipitation, runoff and environmental discharge flows are numbered according to their associated elements and are therefore not described herein.

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Hydrology	Precipitation	N/A[(a)]
	Evaporation	N/A[(a)]
	Runoff	All flows labelled R[(b)]
Consumption	Turbo-misters	C1, C10
	Water Truck Usage	C4, C8
Seepage (from Tailings Storage Facility)	South Seepage Pond Inflow	S1
	Perimeter Embankment Till Borrow Pond (PETBP)	S4, S5
	Main Embankment Seepage Pond	S2, S3
	Seepage to Environment	S14
Seepage (from Other Facilities)	SERDS Dump to SERDS Ditch	S6
	North Bell Dump to Wight Pit	S7
	East RDS to Long Ditch	S8
	NEZ Dump to Long Ditch	S9
	To 9KM Sump	S10
	To NW Sump	S11
	To Mine Drainage Creek Sump	S12
	To Bootjack Creek Sump	S13
Groundwater Flows	Wight Pit Groundwater Inflow	GW1
	Springer Pit Groundwater Inflow	GW2
	Cariboo Pit Groundwater Inflow	GW3
	Springer Pit Groundwater Outflow	GW4
	Boundary Pit to Wight Pit	GW5
	Cariboo Pit Groundwater Outflow	GW6
	Wight Pit Groundwater Outflow	GW7
Transfers	Long Ditch to Central Collection Sump (CCS)	T1
	SERDS Ditch to Long Ditch	T2
	CCS to PETBP	T3
	PETBP to Water Treatment Plant (WTP)	T6
Pumped Flows – Wight Pit	TSF to Wight Pit	P30
	Boundary Pit to Wight Pit	P34
	Wight Pit to Long Ditch	P21
Pumped Flows – Springer Pit	NW Sump to Springer Pit	P18
	Springer Pit to Cariboo Pit	P17b
	Springer Pit to SERDS Ditch	P9b

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Pumped Flows – Process Plant	Process flow from TSF	P28
	Process return to TSF	P27
Pumped Flows – Sumps	Cariboo Pit to SERDS Ditch	P4b
	PETBP to TSF	P5
	South Seepage Pond to Main Embankment Seepage Pond	P6
	Main Embankment Seepage Pond to PETBP	P8
	Mine Drainage Creek Sump to SERDS Ditch	P10
	Bootjack Creek Sump to SERDS Ditch	P11
	Mill Domestic Water to Mill Site Sump	P13
	Geology Domestic Water Effluent to Mill Site Sump	P15
	9K Sump to NW Sump	P20
	NW Sump to Mine Drainage Creek Sump	P24
	Mill Site Sump to TSF	P31
	TSF to Mine Drainage Creek Sump	P32

(a) Evaporation and direct precipitation flows not shown on flow diagram.

(b) No flows were assigned specifically for snowmelt. Instead, snowpack was accumulated in the model and snowmelt was included in the runoff flows.

Source: Springer Pit Expansion LOM SWWBM Flow Diagram (Appendix B).

A3.0 FLOW RATES

A3.1 Pumped Flows

Except for P13 and P15, which were measured at 545 m^3/d and 2.5 m^3/d, respectively (Golder 2016a), all maximum pumping rates have been assumed. Among these rates, P4b, P5, T6, P9b, P17b, P21, P30, and P32 were provided by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on Golder's engineering judgement (Golder 2016a).

Maximum pumping rates for operational flows are shown in Table A-3, and maximum pumping rates for closure flows are shown in Table A-4. It should be noted that any pumped flows shown in Table A-3, but not shown in Table A-4, are assumed to be decommissioned with zero transfer capacity.

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P4b	Cariboo Pit	PETBP	13,000	MPMC 2023b
P5	PETBP	TSF	100,000	Golder 2016a
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P9b	Springer Pit	PETBP	0	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	N/A[a]	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P13[b]	Mill Domestic Water	Mill Site Sump	545	Golder 2016a
P15[b]	Geology Domestic Water	Mill Site Sump	2.5	Golder 2016a
P17b	Springer Pit	Cariboo Pit	4,000	MPMC 2023b
P18	NW Sump	Springer Pit	9,594	Golder 2016a
P20	9KM Sump	NW Sump	13,633	Golder 2016a
P21	Wight Pit	PETBP	8,712/14,088[c]	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P27	Mill	TSF	N/A[e]	Golder 2016a
P28	TSF	Mill	N/A[e]	Golder 2016a
P30[d]	TSF	Wight Pit	10,000	Determined in this SWWBM
P31	Mill Site Sump	TSF	8,640	Golder 2016a
P32	TSF	PETBP	13,000	MPMC 2023b

(a) No maximum pumping rate applied. This pumping demand is dynamic and depend on the required pumping rate to dewater the Mine Drainage Creek Sump.

(b) Based on measured flow rates (Golder 2016a).

(c) 14,088 m3/day effective starting September 2023.

(d) Capacity assumed to avoid PETBP overflow during operation. See Section 4.5.7.1 in the main report.

(e) No maximum pumping rate applied. These are defined based on the process flow requirements from the Mill, where P27 is defined as process water (including interstitial water) in addition to tailings solids, and P28 is defined as process water demand.

Table A-4: Maximum Pumping Rates for Closure Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	8,640	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P20	9KM Sump	NW Sump	8,640	Golder 2016a
P21	Wight Pit	PETBP	8,712	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P35[(a)]	CCS	Wight Pit	85,000	Determined in this SWWBM

(a) Active to use Wight Pit to store water when TSF is not available for storage during closure. See Section 4.5.7.1 in the main report.

A3.2 Consumption Flows

The flow parameters for the turbomisters are shown in Table A-5 and Table A-6.

Table A-5: Operational Hours per Day for Turbomisters

Flow ID	From	Hours per Day				
		May	June	July	August	September
C1	Main Embankment Seepage Collection Pond	10	10	10	10	10
C10	Wight Pit	10	10	10	10	10

Table A-6: Operational Flow Rates for Turbomisters

Flow ID	From	Evaporation Rates (m^3/hr)	
		May and June	July to September
C1	Main Embankment Seepage Collection Pond	5.5	12.7
C10	Wight Pit	5.5	12.7

The flow parameters for water trucks are shown in Table A-7 and Table A-8 below.

Table A-7: Operational Days per Month for Water Trucks

Flow ID	From	Days per Month				
		May	June	July	August	September
C4	Wight Pit	0	0	20	20	15
C8	CCS	4.5	19	12.6	21.5	10.6

Table A-8: Operational Flow Rates for Water Trucks

Flow ID	From	Flow Rates (m^3/day)
C4	Wight Pit	818
C8	CCS	818

A3.3 Transfer Flows

The flow rates for the transfer flows were defined in the model as described in Table A-9.

Table A-9: Transfer Flows

Flow ID	From	To	Flow Definition/Rates
T1	Long Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the Long Ditch catchment.
T2	SERDS Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the SERDS ditch catchment.
T3	Central Collection Sump	PETBP	Modelled as the overflow rate from the CCS.
T6[(a)]	PETBP	Water Treatment Plant	Maximum capacity 25,000 m^3/day during operations until post-closure.

(a) Provided by Maximum pumping rates provided by MPMC (MPMC 2023b).

A3.4 Groundwater inputs

Springer Pit

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from both the Springer and the Cariboo pits towards Bootjack Lake (Golder 2016b). The analysis considered placing waste rock in the ultimate pit prior to the pit lake formation. As the pit lake level increases between 1,020 masl and 1,030 masl, seepage in the range of 10 to 100 m^3/d from the Springer Pit Lake into the subsurface was predicted to occur (Table A-10). Seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillway at 1,050 masl.

Table A-10: Springer Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	520	0
940	510	0
960	490	0
980	460	0
1000	420	0
1020	320	10
1030	300	100
1040	280	250
1050	270	400

Cariboo Pit

Predicted groundwater flows of Cariboo Pit remain consistent from Golder 2016b. In the Cariboo Pit, seepage towards the Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 masl.

Table A-11: Cariboo Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	600	0
940	610	0
960	610	0
980	590	0
1000	540	0
1020	460	0
1030	420	0
1040	380	0
1050	320	20

Wight Pit

Groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at of 804 masl, to 600 m^3/d at 935 masl (Golder 2015). Table A-12 shows the predicted groundwater flows for Wight Pit.

Table A-12: Wight Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
804	2600	0
880	2600	0
900	2500	0
910	2100	0
920	800	0
926	600	500
930	600	500
935	600	500

Boundary Pit

MPMC reported that seepage was not observed along the pit walls during mining. However, seepage out of the pit could still occur due to water entering via surface water runoff and direct precipitation. Potential seepage rates out of the pit were estimated to incorporate them into the pit water balance and to characterize a possible seepage pathway originating from this pit (Golder 2016c).

Seepage rates out of the Boundary Pit were estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake surface level is 5m above its base (1,072 masl) is approximately 59 m^3/d, with a potential range between 35 m^3/d and 177 m^3/d due to uncertainty in bedrock permeability. Seepage outflow is estimated to decrease as the height of water column above the pit bottom decreases as shown in Table A-13.

Table A-13: Boundary Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Outflow (m^3/d)
1067	3
1068	10
1069	20
1070	26
1071	53
1072	59
1073	59

A4.0 STORAGE CHARACTERIZATION

Table A-14 to Table A-18 show the stage-storage curves for the following facilities:

- Springer Pit
- Cariboo Pit

- Combined Springer-Cariboo Pit
- Tailings Storage Facility
- Wight Pit

Table A-14: Springer Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
970.66	0
975	34,449
980	281,473
985	689,185
990	1,150,873
995	1,693,101
1000	2,297,269
1005	3,045,813
1010	3,869,395
1015	4,768,531
1020	5,738,839
1025	6,755,500
1030	7,834,556
1035	8,957,496
1040	10,176,962
1045	11,466,163
1050	12,809,134
1053	13,659,688

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
920	0
925	3,372
930	12,800
935	29,815
940	54,426
945	91,091

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
950	138,417
955	203,118
958.3	259,149

Table A-16: Combined Springer-Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
878	0
880	5,448
890	35,320
900	80,294
910	146,856
920	238,531
930	356,228
940	511,132
950	722,060
960	997,061
970	1,333,646
980	1,732,505
990	2,217,857
1,000	2,813,866
1,010	4,854,554
1,020	8,247,385
1,030	12,008,865
1,040	16,312,811
1,050	21,104,196

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
956.2	0	0	0	0
957	30,784	0	0	0
958	162,897	0	0	0
959	374,780	0	0	0
960	711,559	0	0	0
961	1,173,550	0	0	0
962	1,790,644	0	0	0
963	2,875,098	0	0	0
964	4,542,339	0	0	0
965	6,448,707	179,178	0	0
966	8,512,995	486,916	0	0
967	10,624,891	881,413	39,874	0
968	12,568,198	1,366,370	307,114	0
969	12,568,198	2,006,216	656,772	0
970	12,568,198	2,973,695	1,096,052	0
971	12,568,198	4,343,412	1,634,717	0
972	12,568,198	6,174,788	2,418,560	0
973	12,568,198	7,184,001	3,568,309	0
974	12,568,198	7,184,001	5,176,980	0
975	12,568,198	7,184,001	7,180,246	0
976	12,568,198	7,184,001	7,180,246	0
977	12,568,198	7,184,001	7,180,246	0
978	12,568,198	7,184,001	7,180,246	0
979	12,568,198	7,184,001	7,180,246	0
980	12,568,198	7,184,001	7,180,246	0
981	12,568,198	7,184,001	7,180,246	273
982	12,568,198	7,184,001	7,180,246	67,347
983	12,568,198	7,184,001	7,180,246	323,880
984	12,568,198	7,184,001	7,180,246	890,494
985	12,568,198	7,184,001	7,180,246	1,912,234

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
986	12,568,198	7,184,001	7,180,246	3,505,768
987	12,568,198	7,184,001	7,180,246	5,704,281

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
803.99	5
804.99	52
809.99	3,282
814.99	8,195
819.99	14,407
824.99	22,909
829.99	34,808
834.99	57,021
839.99	84,080
844.99	122,282
849.99	167,552
854.99	223,215
859.99	289,126
864.99	363,462
869.99	449,185
874.99	544,867
879.99	696,584
884.99	883,743
889.99	1,100,537
894.99	1,349,504
899.99	1,630,787
904.99	1,970,250
909.99	2,341,775
914.99	2,881,655

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
919.99[(a)]	3,546,163
924.99	4,266,921
927.99	4,752,523

(a) Upper bound during operations is 919.99 m

Table A-19: Maximum Capacities for All Storage Facilities

Storage Facility	Estimated Capacity (m^3)
South Seepage Pond	315
Main Embankment Seepage Pond	86,146
TSF Upstream (External)	2,300,000
PETBP	170,000
CCS	50,990
Bootjack Creek Sump	1,420
Mill Site Sump	2,106
Cariboo Pit	1,234,641
Mine Drainage Creek Sump	1,420
Springer Pit	14,806,107
NW Sump	200
9K Sump	330
Wight Pit	3,779,404
Boundary Pit	14,468

APPENDIX B

Flow Diagrams and 2022 Water Management Infrastructure

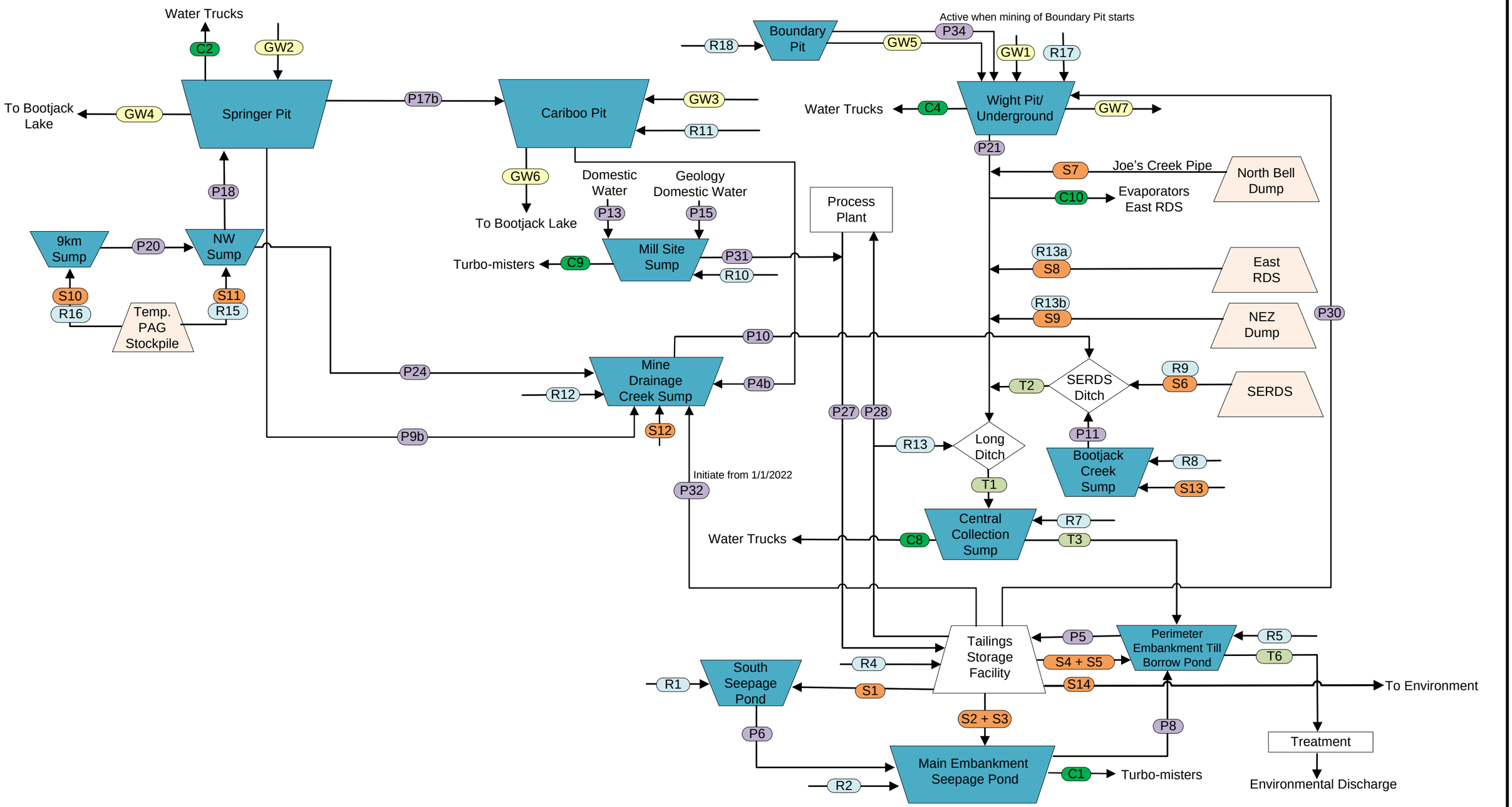

Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram 2 May 2023 – 31 April 2031

FIGURE No: B-1
REV No: 0

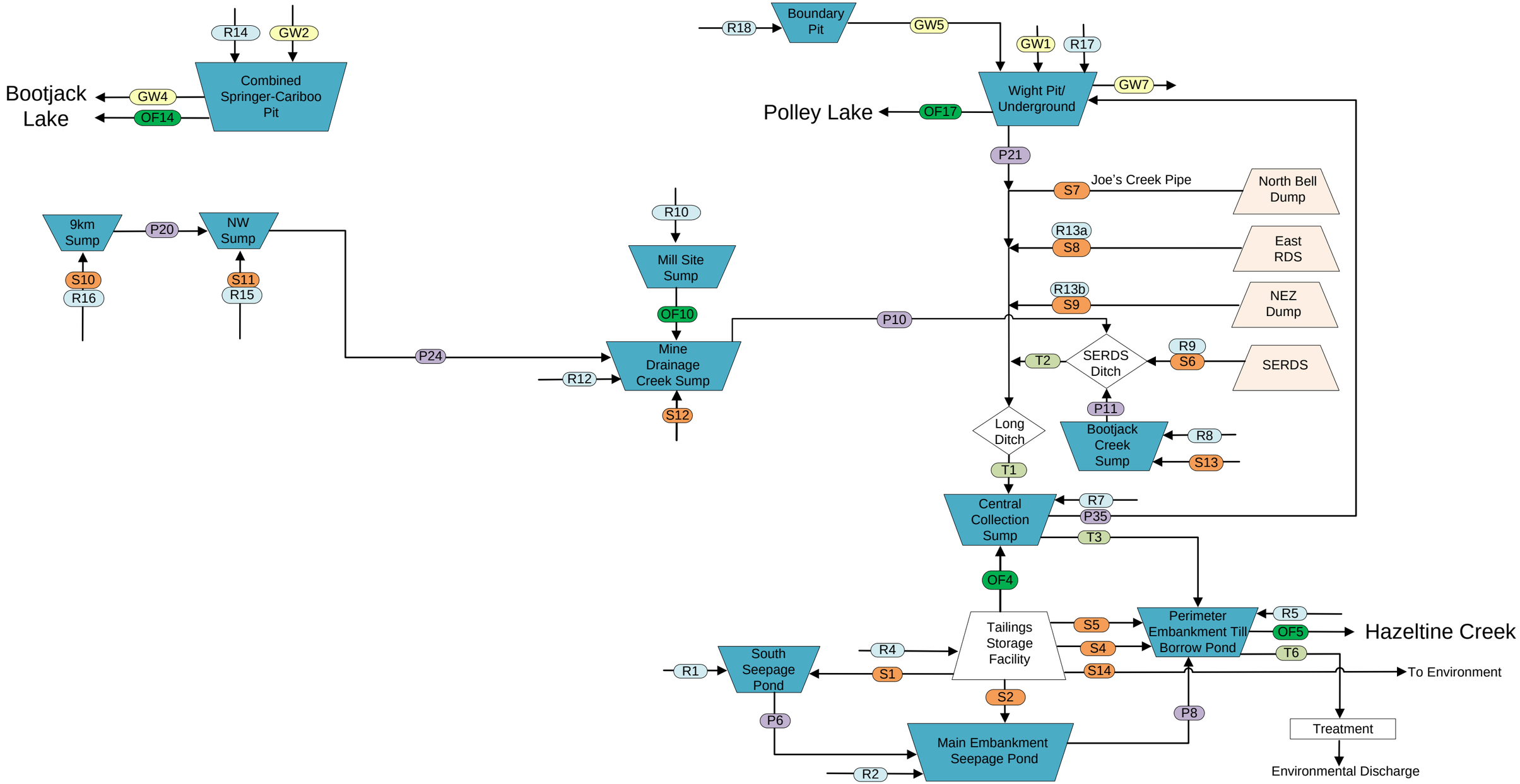

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182
FIGURE No: B-2
REV No: 0

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041

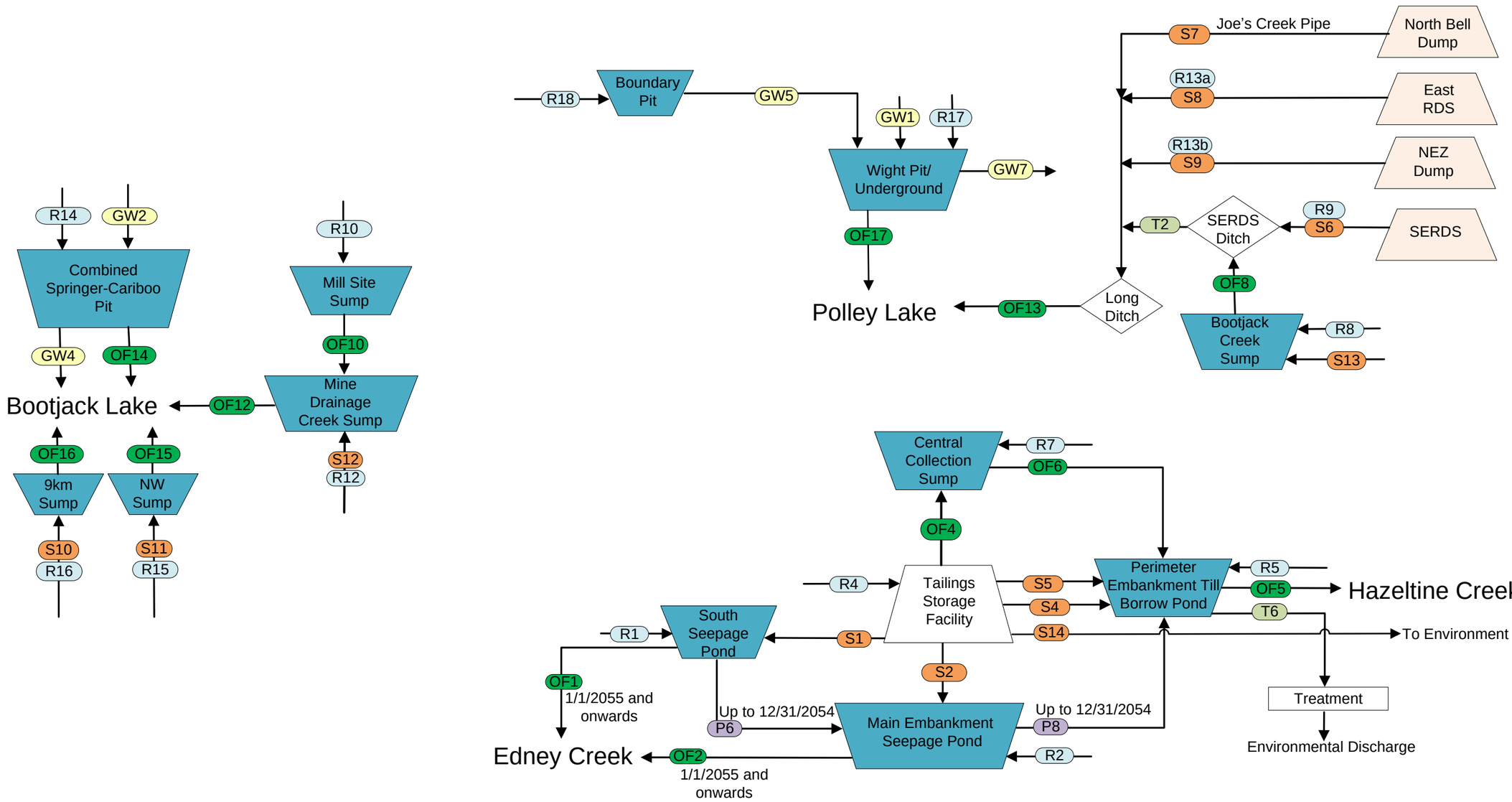

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023
CHECKED: GD
DATE: 31 October 2023
SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 April 2041 Onwards

FIGURE No: B-3
REV No: 0

Mount Polley Mining Corporation

2022 Water Management Infrastructure

1:25,000

Gabriel Holmes
Date: 3/20/2023
Photo Dates: 2013, 2021

0 200 400 800 1,200 1,600 Meters

- Sprinklers
- Booster Tanks
- Barges
- Sumps/Ponds
- Pipelines
- Diversion Ditches
- Collection Ditches
- 20m Contours

Polley Lake

Bootjack Lake

TSF

Wight Pit Sump
Wight Pit Booster Blue
Wight Pit Dewatering Line
NEZ Booster to Mill
NEZ to Wight Pit Gravity Feed
Wight Pit Booster To Mill
Wight Pit North Diversion
Wight Pit Central Diversion
Boundary Pit
Joes Creek Coffer Dam
Gavins Ditch
East RD Ditch
NEZ Sump
Long Ditch
Bootjack Creek Diversion
SERD Sump
Long Ditch Pipe
SERD Pipe
Central Collection Sump
Breach Sump
Perimeter Embankment Till Borrow Pit
WMP Sludge Pond
PEP to TSF
Corner 2 Ditch
WTP Discharge Line
Main Seepage Pond Ditch
Sprinkler Line
MESCP
MESCP Dewatering Line
Tailings Storage Facility Supernatant
Tailings Corner 1 Line
CCS to TSF
Settling Pond
TSF Reclaim Barge
Tailings/Reclaim Lines
TSF Diversion
Tailings Corner 4 Line
SESCP
SESCP Dewatering Line
South Seepage Pond Ditch
Upper and Lower Long Ditch Sumps
Bootjack Creek Sump
BJ Creek Upstream Sump
Reclaim Booster
Tailings Pipe Containment Ditch
SERD Ditch
Leach Pad to Mill
Mill Site Ditch
Mill Site Sump
Cariboo Pit
Cariboo Pit to West Ditch
Springer Pit
Springer Pit to SERD Ditch
West Ditch West Portion
Mine Drainage Creek Sump
Junction Zone Seepage Collection Sump
9 Km Sump
Northwest Sump
NW Sump to Springer Pit
9 Km Sump to NW Sump

APPENDIX C

SWWBM Results

C1.0 SWWBM RESULTS FOR THE ENTIRE MODELLED DURATION

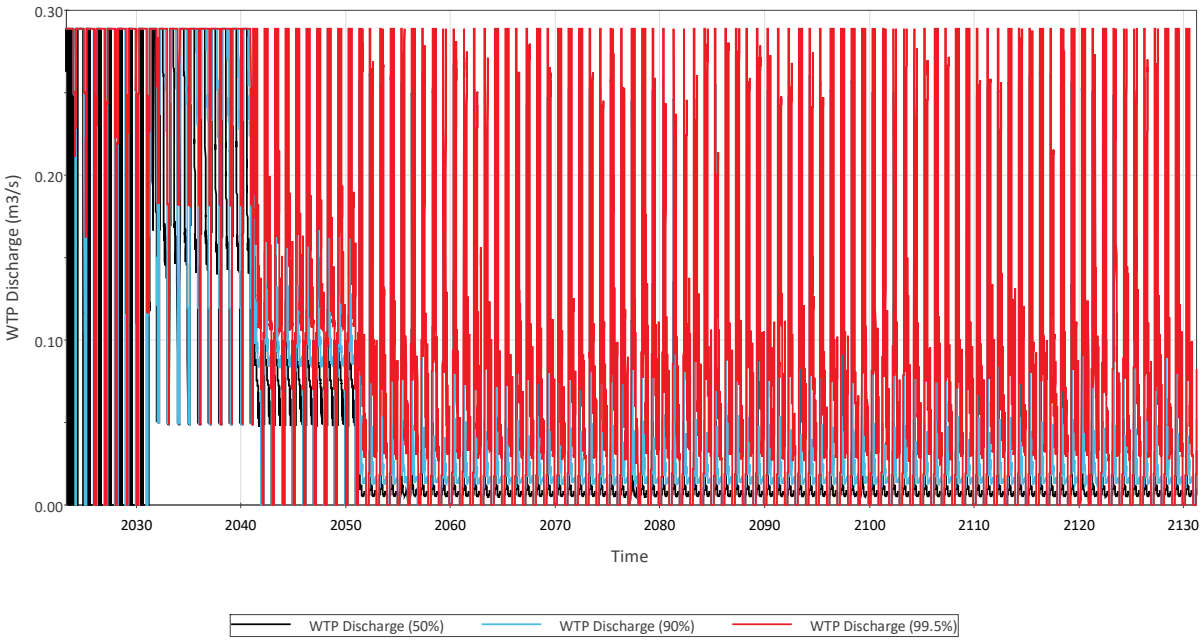

Figure C-1: WTP Discharge Rate

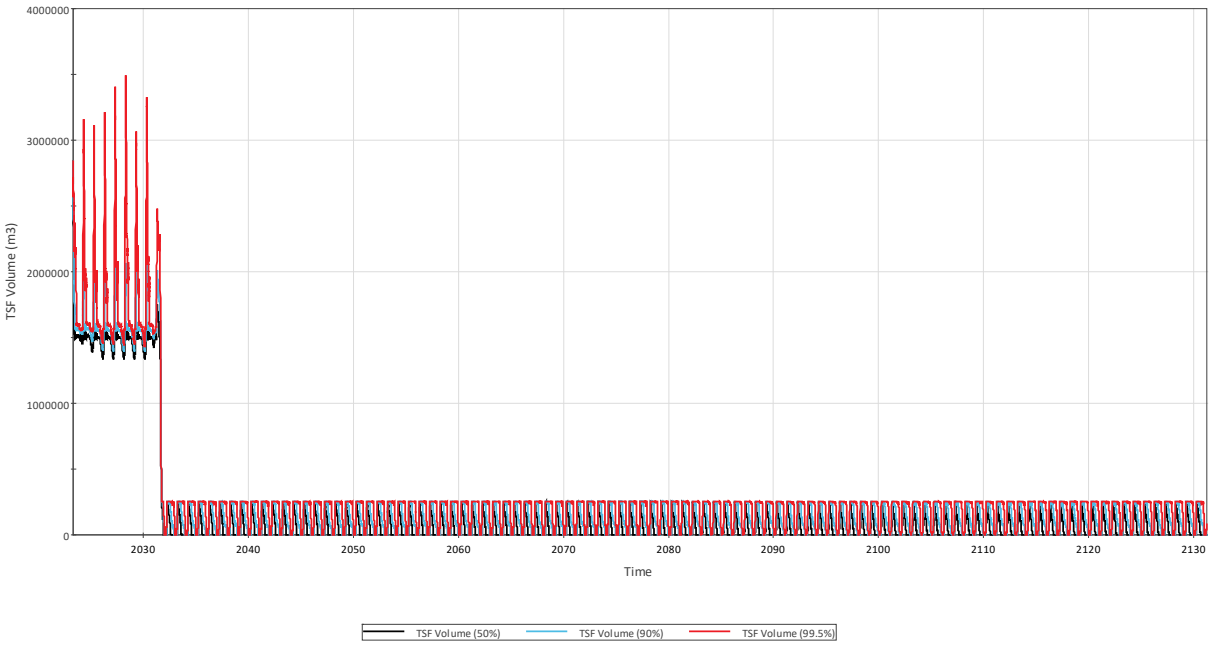

Figure C-2: TSF Water Volume

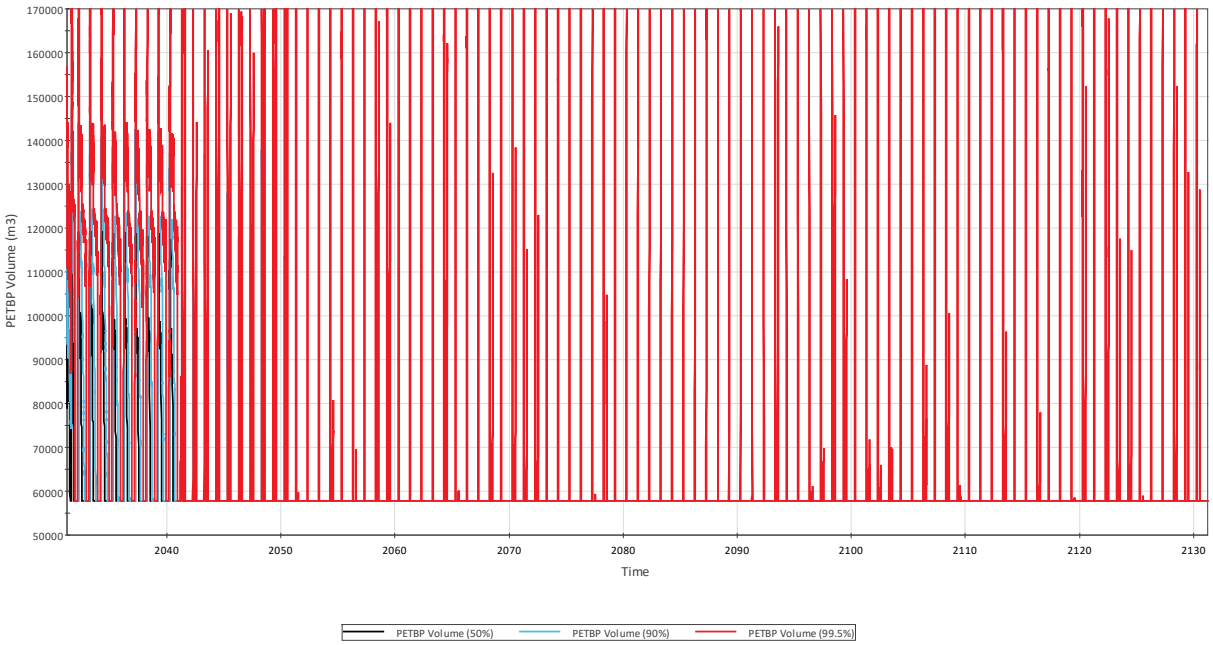

Figure C-3: PETBP Volume

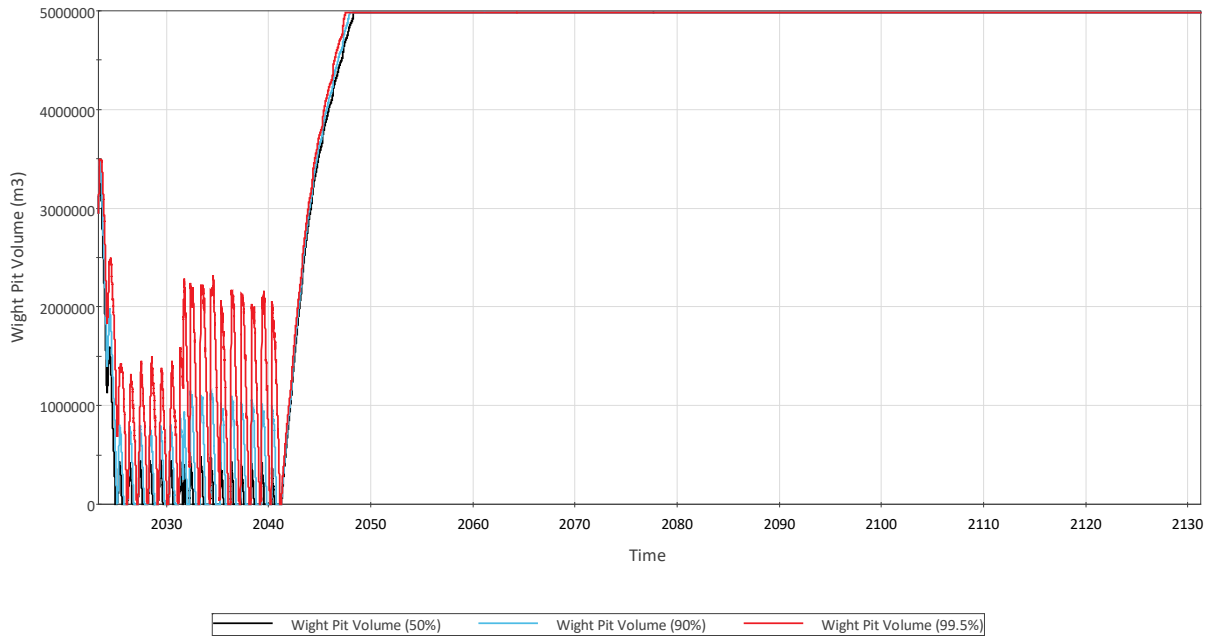

Figure C-4: Wight Pit Volume

C2.0 WTP MONTHLY VOLUME REQUIRING TREATMENT

This section is the monthly WTP volume requiring treatment corresponding to Table 14 in the main report. Results for the 50th, 90th, and 99.5th percentiles are shown in Table C-1,Table C-2, and Table C-3, respectively.

Table C-1: Monthly WTP Volume Requiring Treatment for the 50th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	816,200	714,510	466,465	298,682	393,832	463,508	445,012	301,332	3,899,541
2024	301,982	322,462	76,026	726,922	523,873	539,217	517,617	447,473	414,717	452,531	431,880	246,110	5,000,810
2025	0	0	53,142	720,473	591,207	534,104	514,400	382,392	201,214	243,282	229,247	27,300	3,496,761
2026	0	0	0	688,329	521,182	542,808	524,114	386,785	176,998	244,214	243,589	40,074	3,368,093
2027	0	0	0	688,776	534,057	536,783	519,699	387,212	196,149	226,169	214,556	42,347	3,345,748
2028	0	0	0	688,891	531,950	539,151	521,670	396,985	195,580	234,616	211,572	40,014	3,360,429
2029	0	0	0	688,784	544,074	541,812	528,879	381,832	204,143	238,037	220,087	42,961	3,390,609
2030	0	0	0	688,176	538,822	531,757	509,464	354,337	172,519	251,827	215,659	46,981	3,309,542
2031	0	0	237,630	731,590	765,112	731,759	662,575	497,020	747,088	751,567	580,182	269,013	5,973,536
2032	131,342	125,704	448,444	738,838	769,600	740,196	716,634	556,391	384,194	421,400	381,192	148,665	5,562,600
2033	127,587	117,879	445,027	738,690	768,837	739,082	713,725	575,883	385,994	414,549	366,935	147,325	5,541,513
2034	127,597	117,891	437,865	738,650	768,819	742,270	713,301	541,642	385,473	408,260	370,575	150,231	5,502,574
2035	127,586	117,878	444,939	738,787	766,046	735,339	695,924	494,783	377,100	398,504	366,789	158,514	5,422,189
2036	127,576	122,067	429,120	737,706	767,650	736,600	701,205	515,991	380,646	401,859	364,644	148,376	5,433,440
2041	127,587	117,877	413,048	362,220	249,322	241,876	208,531	165,735	151,247	157,910	143,254	22,615	2,361,222
2046	0	0	123,083	323,226	243,391	241,126	220,680	179,310	153,569	162,800	135,467	13,109	1,795,761
2051	0	0	119,167	121,927	44,866	45,020	32,832	21,846	20,830	24,124	24,756	648	456,016
2071	0	0	17,031	87,326	47,547	45,644	34,582	21,884	21,211	24,356	25,574	604	325,759
2091	0	0	16,622	86,552	42,145	52,098	36,589	17,207	19,486	30,153	21,007	501	322,360
2111	0	0	16,769	87,191	47,016	44,779	37,451	20,173	21,125	26,512	23,155	531	324,702
2131	0	0	16,786	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16,786

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-2: Monthly WTP Volume Requiring Treatment for the 90th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	885,614	958,697	578,613	446,170	447,714	481,672	462,761	309,174	4,570,415
2024	377,183	322,277	113,359	894,904	779,430	707,385	562,135	490,842	459,376	483,603	469,228	278,584	5,938,306
2025	323,561	171,779	98,804	780,798	646,909	707,544	569,266	473,066	423,510	388,419	316,149	65,368	4,965,173
2026	0	0	13,559	921,364	860,396	697,753	558,474	498,251	448,535	417,750	261,713	45,218	4,723,013
2027	0	0	0	909,318	883,083	690,653	567,414	494,660	461,943	440,356	286,990	54,549	4,788,966
2028	0	0	0	905,149	887,772	719,201	557,734	472,854	449,297	463,258	297,832	51,563	4,804,660
2029	0	0	31,781	908,298	851,264	743,112	563,432	469,271	458,404	424,635	285,248	48,768	4,784,213
2030	0	0	0	921,523	871,912	711,883	548,263	482,499	432,592	421,499	312,624	51,493	4,754,288
2031	0	139,919	257,819	737,112	766,533	738,071	713,096	711,970	749,089	768,000	724,613	524,247	6,830,469
2032	187,843	126,063	625,665	745,943	767,394	745,350	723,700	692,818	669,208	655,228	519,533	221,585	6,680,330
2033	127,805	118,150	644,497	745,302	770,615	740,246	731,736	697,401	661,853	636,522	498,198	198,112	6,570,437
2034	127,800	118,135	637,439	745,437	768,720	741,344	723,879	696,275	672,179	649,275	476,996	183,273	6,540,752
2035	127,802	118,141	645,117	745,232	763,488	736,645	727,405	695,144	649,488	628,630	419,917	163,355	6,420,364
2036	127,797	122,341	613,083	744,624	767,206	737,447	719,757	703,975	656,267	626,538	438,312	183,768	6,441,115
2041	127,799	118,132	580,468	469,180	331,660	250,918	239,674	194,673	184,385	183,246	175,373	25,134	2,880,642
2046	0	0	197,894	487,380	328,197	255,875	244,583	189,140	163,557	181,219	165,921	55,582	2,269,348
2051	0	0	197,677	329,334	74,348	62,290	63,306	27,312	25,911	26,119	20,689	578	827,564
2071	0	0	28,327	359,639	84,532	60,635	73,332	29,193	23,735	25,201	21,288	629	706,511
2091	0	0	27,250	340,424	87,555	69,665	69,251	29,607	16,467	27,933	23,053	439	691,644
2111	0	0	27,975	361,283	80,159	60,050	73,821	30,598	25,085	24,980	24,788	646	709,385
2131	0	0	27,475	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27,475

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-3: Monthly WTP Volume Requiring Treatment for the 99.5th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	940,831	1,017,066	1,014,689	840,704	540,347	540,241	486,389	343,028	5,723,295
2024	385,574	322,644	375,957	1,052,693	876,096	941,834	805,020	635,879	467,136	543,423	512,886	324,468	7,243,610
2025	380,429	308,546	172,950	1,041,321	857,806	918,684	799,156	649,819	510,215	471,458	466,990	210,118	6,787,492
2026	268,122	205,663	137,139	1,006,448	664,073	928,893	776,396	656,365	484,345	507,440	543,055	353,048	6,530,987
2027	248,025	987	174,709	1,079,656	779,401	899,129	839,908	631,130	532,026	571,311	506,640	339,650	6,602,572
2028	301,944	154,165	17,859	1,070,472	856,776	913,431	833,476	624,229	500,595	561,590	537,481	331,434	6,703,452
2029	323,617	171,421	36,359	1,004,402	813,070	885,392	783,514	584,930	486,866	548,893	479,899	342,520	6,460,883
2030	235,921	0	169,714	1,092,716	879,138	846,907	878,625	572,737	469,739	557,987	494,851	356,974	6,555,309
2031	366,468	232,600	99,485	735,675	764,489	744,587	754,595	713,896	749,088	774,058	691,134	580,977	7,207,052
2032	525,067	415,819	756,422	976,186	774,058	748,499	765,138	727,786	604,316	631,416	502,789	391,970	7,819,466
2033	471,811	382,127	429,403	777,737	774,058	749,088	593,182	679,723	736,429	727,938	679,985	572,660	7,574,141
2034	471,811	439,306	616,955	746,919	774,058	749,088	667,234	535,682	667,972	674,220	661,799	487,664	7,492,708
2035	471,811	439,306	571,375	741,446	774,058	749,088	669,320	543,308	604,006	754,476	637,604	481,521	7,437,319
2036	354,383	122,484	525,917	749,088	773,390	748,129	772,095	769,990	695,682	685,335	650,794	512,808	7,360,095
2041	471,811	174,423	458,123	1,005,000	408,139	247,481	375,939	247,970	235,638	162,452	169,983	82,562	4,039,521
2046	54,814	0	193,956	1,025,727	466,256	307,922	362,470	246,942	211,775	170,928	144,565	128,795	3,314,150
2051	54,672	0	191,316	611,260	216,955	112,875	61,647	51,906	31,348	38,903	11,959	11,056	1,393,897
2071	0	0	49,327	704,072	231,146	68,286	221,257	108,687	41,189	25,820	26,475	499	1,476,758
2091	0	0	48,392	869,063	209,395	89,442	113,091	149,427	51,126	17,419	53,586	989	1,601,930
2111	0	0	48,511	786,421	233,424	73,247	94,044	65,403	77,612	29,724	34,557	1,166	1,444,109
2131	0	0	48,429	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	48,429

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

C3.0 TOTAL ANNUAL RUNOFF VOLUME FROM STOCKPILES/DUMPS

C3.1 Temp PAG Stockpile

The total annual runoff volume during operations for Temp PAG Stockpile is shown in Table C-5. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-4 presents the distribution of these land types.

Table C-4: Temp PAG Stockpile Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	703,147
Disturbed Area	120,945
Undisturbed Area	140,272
Haul Road Area	63,800

Table C-5: Temp PAG Stockpile Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	122,711	226,570	445,588
2024	248,347	421,842	768,449
2025	247,456	422,850	766,070
2026	247,757	428,520	753,043
2027	247,936	425,785	793,090
2028	248,912	426,147	794,141
2029	249,343	422,660	755,345
2030	248,572	425,593	777,709
2031	26,050	41,089	68,748

C3.2 SERDS

The total annual runoff volume during operations for SERDS is shown in Table C-7. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, haul road, and mill site). This catchment area breakdown was inserted as input into SWWBM. Table C-6 presents the distribution of these land types.

Table C-6: SERDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	401,235
Disturbed Area	313,059
Undisturbed Area	383,918
Mill Site Area	273,919
Haul Road Area	165,456

Table C-7: SERDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	192,874	365,010	738,562
2024	360,384	625,704	1,163,887
2025	359,170	627,159	1,167,189
2026	359,541	635,520	1,138,079
2027	359,635	632,119	1,195,850
2028	360,975	631,021	1,198,955
2029	361,394	625,581	1,140,716
2030	360,604	629,622	1,172,763
2031	34,619	54,596	91,336

C3.3 NEZ Dump

The total annual runoff volume during operations for NEZ Dump is shown in Table C-9. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-8 presents the distribution of these land types.

Table C-8: NEZ Dump Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	199,116
Disturbed Area	237,889
Undisturbed Area	202,646
Haul Road Area	261,421

Table C-9: NEZ Dump Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	134,053	250,501	499,643
2024	261,170	448,211	824,647
2025	260,297	449,304	824,468
2026	260,554	455,313	807,290
2027	260,710	452,591	849,291
2028	261,692	452,458	850,911
2029	262,082	448,643	809,462
2030	261,399	451,677	832,800
2031	26,321	41,516	69,459

C3.4 East RDS

The total annual runoff volume during operations for East RDS is shown in Table C-11. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock and disturbed). This catchment area breakdown was inserted as input into SWWBM. Table C-10 presents the distribution of these land types.

Table C-10: East RDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	693,392
Disturbed Area	899,543

Table C-11: East RDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	235,819	436,431	860,762
2024	473,874	806,323	1,471,681
2025	472,115	808,296	1,467,921
2026	472,643	819,122	1,441,909
2027	472,982	813,946	1,518,218
2028	474,853	814,415	1,520,466
2029	475,642	807,784	1,446,191
2030	474,205	813,412	1,488,869
2031	49,338	77,807	130,151



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APPENDIX B

Site-wide Water Quality Model (SWWQM)

REPORT

Mount Polley Mine Water Quality Model

Springer Expansion – LOM Water Quality Model

Submitted

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Submitted by:

WSP Canada Inc.
840 Howe Street, Suite 1000 Vancouver, British Columbia, V6Z 2M1

Reference No. 23590671-053-R-Rev0-31282

4 December 2023

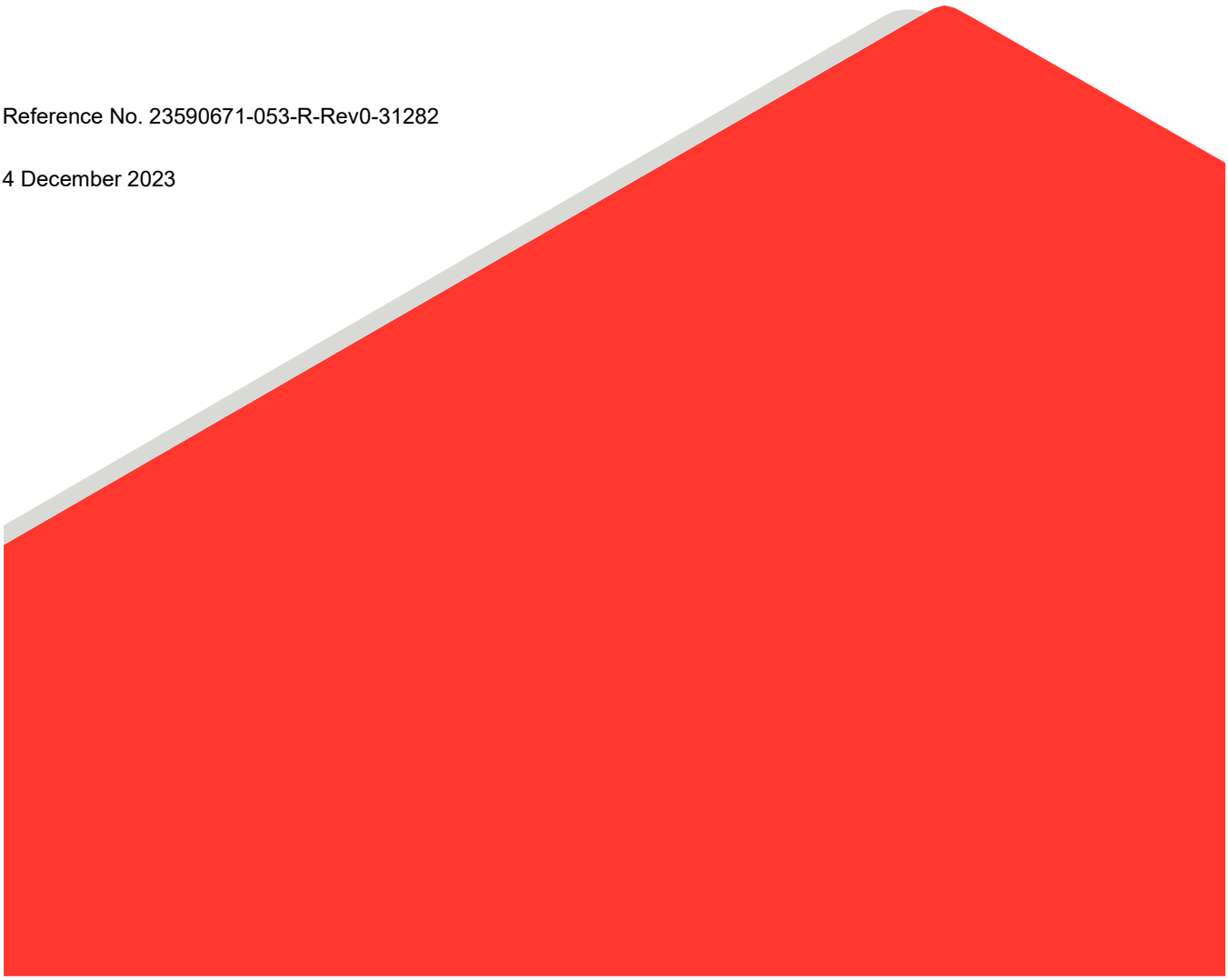

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EXECUTIVE SUMMARY

Background

The Mount Polley Mine (the Mine, or Site) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake.

MPMC began production at the mine in 1997 and operated until October 2001 when operations were suspended temporarily for economic reasons. In March 2005, the Mine restarted production and it was in continuous operation until 4 August 2014 when a subsurface failure of the Tailings Storage Facility (TSF) foundation resulted in mining and milling operations being suspended. MPMC was subsequently issued with a Pollution Abatement Order (Order #107461) by the BC Ministry of Environment and Climate Change Strategy (BC ENV). Containment infrastructure for collection of drainage from the breached section of the TSF was constructed by 4 September 2014, and all contact water was subsequently directed to and contained within the Springer Pit. This measure was implemented as part of the emergency response and was considered a temporary Water Management Plan to deal with changed conditions arising from the breach.

On 9 July 2015, MPMC was provided approval by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to return to restricted operations for a one-year period using the Springer Pit for tailings deposition and subject to the conditions stated in the M-200 Permit (Mine No. 1101163). On 23 June 2015, MPMC was provided approval by MEMPR to return to normal operations using the TSF for tailings deposition under an approved four-year mine plan as stated in the M-200 Permit.

MPMC has been in care and maintenance since May 31, 2019, which has resulted in an extension to the operational period needed to develop the permitted Phase 4 Cariboo-Springer Pit. In addition to this, the results of exploration and strong resource prices have provided the basis for an extended life of mine plan that will result in mining activity beyond Phase 4 Cariboo-Springer Pit, to include additional phases that will expand Springer Pit to consolidate Springer and Cariboo pits adding approximately 8 years to the life of the mine.

For the purposes of this report, WSP Canada Inc. (WSP) has assumed that the mine will be in operation until 31 March 2031, followed by a closure phase from 1 April 2031 to 31 March 2041, and a post-closure phase from 1 April 2041 to 31 March 2131. It should be recognized that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations. These are only assumed mine phase dates to allow completion of modelling and should not be considered by regulators as static dates.

MPMC has a permit to discharge treated effluent from the Mine under the *Environmental Management Act* (EMA; SBC 2003) as Permit 11678. The permit was issued on 30 May 1997 and most recently amended through a Consent Order on 18 September 2020. An interim extension to Section 1.2.3 of PE-11678 was granted by BC ENV in 2022, allowing the existing discharge to Quesnel Lake to continue until 30 June 2025. The (2022) TAR provided an update on, among other things, receiving environment data and, in aggregate, provided scientific rationale to support the view that the discharge is not causing pollution. Under section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life.

Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation and the Ministry of Environment and Climate Change Strategy, with the request to BC ENV being an extension of the discharge period beyond 2025.

Section 2.10 of EMA Permit 11678 requires the development of a water management plan (WMP) that addresses future Water Management Plans beyond the end of 2022 and during mining operations. The WMP seeks to provide a practical plan for managing mine water for the proposed life of mine and to do so in a manner that reflects the requirements of Section 2.10 of the permit, based on information available at the time of writing. It also proposes an implementation schedule and revision process for the WMP.

In support of the WMP, the site wide water quality model was updated to reflect predicted mine site conditions during operations, closure, and post-closure (this report). This included updates to the water balance inputs and water quality inputs based on monitoring data. Updated geochemical source terms were also modelled in an alternative scenario (in place of inputs calculated from monitoring data) and were compared to model results that used monitoring data to calculate the water quality inputs. The model results from the scenario that used the geochemical source terms were considered overly conservative and are not presented in this report.

The updated predicted concentrations during operations, closure and post-closure in the mine site are similar to those presented in previous iterations of the water quality model including the 2016 Long Term Water Management Plan (Golder 2016) and the 2020 Water Management Plan (Golder 2020). For some parameters, the maximum predicted concentrations of total metals are lower during post-closure in this update of the water quality model. This change in predicted total metal concentrations is due to an adjustment to the particulate addition calculation during post-closure that now assumes a total suspended solids concentration that is representative of a reclaimed water quality input. Changes in concentrations from operations to closure and post-closure are caused by reclamation of mine site areas that are complete during post-closure. Predicted concentrations reach a steady state during post-closure after reclamation of the mine site areas is complete and the Springer Expansion pit is filled. Treatment and mitigation strategies during operations, closure and post- closure are addressed in the treatment section of the WMP (WSP 2023a).

STUDY LIMITATIONS

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APPENDICES

APPENDIX A
Water Quality Model Calibration Results

APPENDIX B
Water Quality Model Results - Operations, Closure and Post-closure

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to update the Site Wide Water Quality Model (SWWQM) to support the joint permit amendment application for the new Springer Expansion life-of-mine (LOM) plan that will extend operations until 31 March 2031 (current estimates).

The SWWQM was developed as part of the Mount Polley Mine (Mine) Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water quality across the site. The SWWQM was updated in 2020 as part of the Water Management Plan that addressed water management through future operations (Golder 2020). The SWWQM was also updated as part of the Five Year Mine and Reclamation Plan (RCP) to include the closure and post-closure phases for the period of 1 September 2024 to 1 September 2124 (Golder 2022a).

This report presents the updates made to the SWWQM to predict parameter concentrations within the mine site during operations, closure and post-closure as part of the permit application for the Springer Expansion LOM plan. Included here is a summary of the model, assumptions, model inputs and results.

2.0 MODEL APPROACH

A site wide surface water balance model (SWWBM; WSP 2023a) was developed to predict flow quality at the Mine and potential discharges to the receiving environment during operations, closure and post-closure, and comprises the underlying framework for evaluating mass transfers in the SWWQM. The SWWQM is directly linked to the reclamation and closure SWWBM and includes mass transfers for each flow.

The SWWQM model does not include water treatment or mixing in the receiving environment. Rather, water quality was simulated in Mine facilities so that treatment technologies can be selected and applied, as described in the Water Management Plan that was prepared along with this report (WSP 2023b).

2.1 Model Platform

The model was developed using GoldSim Version 14.0 (GoldSim 2021). GoldSim is a graphical, object-oriented mathematical modelling program where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the program is designed to facilitate an understanding of the various factors that control an engineered or natural system and to predict potential changes in the system.

GoldSim was selected for the current assessment for the following reasons:

- It facilitates probabilistic simulations, allowing descriptive statistics and probabilities to be assigned to the model outputs.
- The model framework can be easily adjusted to account for changing/future conditions on a mine site, allowing the model to be used as a planning tool.
- Water quantity and water quality models can be directly linked, allowing both models to be updated simultaneously when conducting sensitivity scenarios for alternate water management strategies.

2.2 Model Simulation Period

The model simulations included four time periods:

- **Calibration** (1 January 2017 to 31 December 2022) – the calibration period includes care and maintenance of the Mine site (1 January 2017 to 31 May 2022) and the beginning of resumed operations (1 June 2022). During the calibration period, water in the Perimeter Embankment Till Borrow Pond (PETBP) is treated at the water treatment plant (WTP) and discharged to Quesnel Lake.
- **Resumed Operations** (1 May 2023 to 31 March 2031) – the resumed operations period when, similar to the calibration period, water in the PETBP is treated at the WTP and discharged to Quesnel Lake.
- **Closure** (1 April 2031 to 31 March 2041) – a ten-year active closure period is assumed, during which potentially acid generating (PAG) stockpile material from the Temporary Northwest (NW) PAG stockpile is deposited into the Springer-Cariboo Pit and other facilities are reclaimed. The closure phase will include reclamation activities as identified in the WMP. The WTP is assumed to be in operation through all of the closure period. Details on the closure and post-closure management of mine facilities are provided in the SWWBM Report (WSP 2023a).
- **Post-closure** (1 April 2041 to 1 April 2131) – this period includes filling of pits, discharge, and establishment of steady-state conditions for the drainage from mine facilities. Results are presented for two periods within post-closure:
  - Early post-closure (1 April 2041 to 31 March 2051) – Represents the first ten years of post-closure during which drainage from Mine facilities is assumed to progressively return to undisturbed water quality. The WTP is assumed to be in operation during this period.
  - Long-term post-closure (1 April 2051 to 1 April 2131) – this time period has been selected to represent steady-state conditions after all closure and post-closure changes have taken place. The need for treatment during long-term post-closure will be confirmed as MPMC approaches this phase and may be achieved through distributed passive or semi-passive treatment systems if required.

Uncertainty exists regarding the exact timing of these transitions. The time periods are intended to show, at a conceptual level, the difference in site drainage quality as the site progresses through the post-closure period; it is not intended to imply that the transitions will occur on precisely those dates.

2.3 Facilities

The SWWQM includes the following facilities (grouped into five categories):

- **Open Pits**: Springer-Cariboo Pit, Wight Pit, and Boundary Pit.
- **Sumps**: NW Sump, 9K Sump, Mine Drainage Creek Sump (MDCS), Bootjack Creek Sump (BCS), Central Collection Sump (CCS), Perimeter Embankment Till Borrow Pond (PETBP), South Embankment Seepage Collection Pond (SESCP), and Main Embankment Seepage Collection Pond (MESCP).
- **Ditches/Drains**: Long Ditch and Southeast Rock Disposal Site (SERDS) Ditch.

- **Rock Disposal Sites (RDSs)**: East RDS, SERDS, Northeast Zone (NEZ) RDS, North Bell RDS, and Boundary RDS.
- **Other Facilities**: Tailings Storage Facility (TSF), TSF Quarry, Temporary NW PAG Stockpile, and haul roads.

2.4 Mine Site Flows

The SWWBM accounts for mine waste and water management plans, which are described in detail in the Springer Expansion Model SWWBM Report (WSP 2023b). During the calibration and operations periods, the Mine facilities are used to manage water within the Mine site and the only Mine discharge to the receiving environment is from the WTP (Table 1 and Figure 1). During closure, water will continue to be managed within the Mine facilities and the combined Springer-Cariboo Pit will be allowed to fill before discharging to Bootjack Lake (Table 2 and Figures 2 and 3). To the extent possible, flows from the Mine site will be returned to pre-disturbance watershed flows as the facilities are reclaimed during closure (Table 3).

During post-closure, most site catchment areas are expected to drain directly to their pre-disturbance watersheds; this applies to 9K Sump, NW Sump, Springer-Cariboo Pit, Mine Drainage Creek, Wight Pit, Joe's Creek, SESCP, and the MESCP. Some sumps, ponds, and ditches are expected to flow together and to be discharged as a combined flow to their pre-disturbance watersheds; Long Ditch discharge will include flow from SERDS Ditch and Bootjack Creek Sump, and PETBP discharge will include overflows from the TSF and CCS (Table 3).

Figure 1: Springer Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram 2 May 2023 – 31 March 2031

Figure 2: Springer Expansion LOM Site Wide Water Balance Closure Phase Flow Diagram 1 April 2031– 31 March 2041

Figure 3: Springer Expansion LOM Site Wide Water Balance Post-closure Phase Flow Diagram 1 April 2041 Onwards

Table 1: Facility Flows during Calibration and Operations

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	MDCS
Springer Pit	Pumping from TSF, NW Sump and Cariboo Pit; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Cariboo Pit and TSF
Cariboo Pit	Pumping from TSF and Springer Pit; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Wight Pit and TSF
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	SERDS Ditch
Wight Pit Lake	Pumping from TSF and Cariboo Pit; Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed, and RDS areas.	Long Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 2: Facility Flows during Closure

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	Springer Pit
Springer-Cariboo Pit	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Bootjack Lake
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	SERDS Ditch
Wight Pit Lake	Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas.	SERDS Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 3: Facility Flows during Post-Closure.

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	Bootjack Lake
NW Sump	Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	
Springer-Cariboo Pit Lake	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	
MDCS	Runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	
Wight Pit Lake	Pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas.	Polley Lake
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	Edney Creek
MESCP	TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

2.5 Mine Plan

The SWWQM predicts concentrations based on water quality concentrations assigned to runoff from surface areas (Section 2.5.1), scheduled water management pumping and waste rock/tailings production from mine operations according to the mine plan presented in Section 2.5.2 (WSP 2023a).

2.5.1 Mine Site Surface Areas

The SWWQM and SWWBM assumes the entire surface area of the RDS, disturbed runoff areas and undisturbed runoff areas are accounted for at the beginning of operations. Therefore, the runoff and seepage volumes do not change until closure and post-closure when remediation of mine surface areas begin. The total surface areas are presented in the Springer Expansion Model Water Balance Report (WSP 2023a).

2.5.2 Waste Rock and Tailings Deposition

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage of dry tailings during the project is provided in Table 4 (MPMC 2023). Tailings are deposited into either the TSF or the SERDS Tailings Co-disposal site. The tailings beach area increases during operations until deposition is complete in 2031. The tailings and waste rock excavated from Springer Pit are to be deposited in the SERDS Tailings Co-disposal site according to the 3-year schedule presented in Table 5 (WSP 2022a).

Table 4: Annual Tonnes of Dry Tailings Deposited

Year	Dry Tailings (tonnes)
2022[a]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[b]	860,381

(a) Mine plan starts on 1 July 2022.

(b) Mine plan ends on 31 March 2031.

Table 5: Annual Tonnes of NAG Waste Rock and Tailings Deposited in the SERDS (MPMC 2022)

Year	Non-acid Generating Waste Rock (dry tonnes)	Tailings (dry tonnes)
May 2022	1,849,434	0
June 2022	1,533,187	0
July 2022	1,646,190	0
August 2022	1,876,485	0
September 2022	1,810,659	75,000
October 2022	1,503,095	75,000
November 2022	1,826,860	75,000
December 2022	1,472,950	350,000
January 2023	1,938,754	600,000
February 2023	1,472,298	600,000
March 2023	1,976,869	600,000
April 2023	1,714,812	600,000
May 2023	1,831,868	600,000
June 2023	1,804,423	60,000

Table 5: Annual Tonnes of NAG Waste Rock and Tailings Deposited in the SERDS (MPMC 2022)

Year	Non-acid Generating Waste Rock (dry tonnes)	Tailings (dry tonnes)
July 2023	1,930,151	0
August 2023	1,897,087	0
September 2023	1,902,815	0
October 2023	1,892,896	0
November 2023	1,841,006	0
December 2023	1,909,111	0
January 2024	1,966,900	0
February 2024	1,813,317	0
March 2024	1,975,000	0
April 2024	1,848,880	0
May 2024	1,758,513	0
June 2024	1,834,097	0
July 2024	1,875,487	0
August 2024	1,852,433	0
September 2024	2,151,911	0
October 2024	1,712,150	0
November 2024	1,911,993	0
December 2024	1,921,593	0
Total	58,253,223	3,635,000

2.6 Model Setup

The model simulated concentrations on a daily time step from January 2017 to December 2022 (calibration period), May 2023 to December 2034 (operations) and from January 2035 to January 2135 (closure and post-closure). Probabilistic climate and water quality inputs were used to run the model stochastically for 2000 simulations:

- **Climate Inputs:** The SWWQM was run with probabilistic monthly climate inputs during operations, closure and post-closure as described in Appendix H of the WMP. Monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022b) were fitted to a log-normal probability distribution. The calibration period used historical climate data for the climate inputs.
- **Water Quality Inputs:** For each realization, a unique concentration for each parameter was selected based on randomly sampled values from within a statistical probability distribution function that was derived from each input.

To interpret the results, median and 95th percentile concentrations were calculated for each Mine facility. To put the results in context, a 95th percentile prediction indicates the maximum concentration that is likely to be reached over the duration of the simulation, with a 95% likelihood that concentrations will be at or below that concentration (it does not suggest that concentrations will exceed this value 5% of the time).

2.6.1 Modelled Parameters and Particulate Addition

The parameters in the SWWQM include physical parameters, major ions, nutrients, and dissolved metals and metalloids (Table 6). The dissolved fractions of metals and metalloids are used in all mixing calculations in the model. The total concentrations of metals and metalloids are calculated by adding particulate fractions to the dissolved concentrations as described below.

Table 6: Parameters in the Site Wide Water Quality Model

Category	Parameters
Physical parameters	Total dissolved solids (calculated), hardness (calculated)
Major ions	Calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate
Nutrients	Nitrate, nitrite, total ammonia, total phosphorus
Dissolved metals and metalloids	Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc

Total metal predictions were calculated using dissolved metal predictions and empirical particulate metal concentrations for Operations and Closure (Section 2.6.1.1) and Post-closure (Section 2.6.1.2).

2.6.1.1 Particulate Addition – Operations and Closure

Monitoring data from the SERDS Ditch and Long Ditch were used to establish the empirical particulate metal concentrations because these facilities are expected to contribute the majority of particulate load to site discharges during operations and closure. The model assumes that TSS will be settled/removed to 15 mg/L (i.e., the current average authorized discharge concentrations) prior to discharge.

Monitored data for total and dissolved metals were used to calculate observed particulate metal concentrations in the SERDS Ditch and Long Ditch. The strength of correlation of measured particulate metal concentrations to TSS concentrations was calculated using linear regressions. An empirical particulate metal concentration for each parameter was established by grouping each parameter into the following categories:

- Correlated parameters ($R^2 \geq 0.75$)—a particulate concentration using 15 mg/L during operations/closure was calculated using the regression equation, and this concentration was added to both the maximum median and 95th percentile dissolved metal predictions to calculate a total metal concentration.
- Poorly-correlated parameters ($0.25 < R^2 < 0.75$)—median and 95th percentile particulate concentrations were calculated based on observed data for samples with a TSS below 15 mg/L, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.
- Non-correlated parameters ($R^2 \leq 0.25$)—median and 95th percentile particulate concentrations were calculated based on all observed data, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.

A summary of the correlated and non-correlated parameters and the particulate concentrations used for operations and closure in the model are presented in Table 7.

Table 7: Particulate Metal Concentrations – Operations and Closure

Parameter	Coefficient of Determination (R^2)	Category	Median Particulate Concentration (mg/L)	95th Percentile Particulate Concentration (mg/L)
Aluminum	0.82	Correlated	0.46	0.46
Antimony	0.021	Non-correlated	0.000020	0.00014
Arsenic	0.87	Correlated	0.00019	0.00019
Barium	0.74	Poorly-correlated	0.0015	0.0083
Beryllium	0.39	Poorly-correlated	-	-
Boron	0.001	Non-correlated	0.0040	0.031
Cadmium	0.37	Poorly-correlated	0.0000017	0.000073
Chromium	0.76	Correlated	0.00049	0.00049
Cobalt	0.84	Correlated	0.00032	0.00032
Copper	0.024	Non-correlated	0.0090	0.16
Iron	0.85	Correlated	0.49	0.49
Lead	0.86	Correlated	0.00013	0.00013
Lithium	0.51	Poorly-correlated	0.00020	0.0010
Manganese	0.79	Correlated	0.014	0.014
Mercury	0.016	Non-correlated	-	-
Molybdenum	0.0071	Non-correlated	-	0.011
Nickel	0.84	Correlated	0.00047	0.00047
Selenium	0.0087	Non-correlated	-	0.0056
Silver	0.63	Poorly-correlated	-	0.000005
Strontium	0.0029	Non-correlated	0.017	0.34
Thallium	0.41	Poorly-correlated	-	-
Tin	0.22	Non-correlated	-	0.000080
Titanium	0.81	Correlated	0.022	0.022
Uranium	0.008	Non-correlated	0.000023	0.00031
Vanadium	0.84	Correlated	0.0012	0.0012
Zinc	0.77	Correlated	0.0014	0.0014

2.6.1.2 Particulate Addition – Post-closure

Monitoring data from Edney Creek was used to establish the empirical particulate metal concentrations because data from this location is considered representative of undisturbed (i.e., reclaimed) surface runoff. The model assumes that TSS will be settled to 3 mg/L (i.e., the 95th percentile of TSS from monitoring data at Edney Creek from 2016 to 2022).

Monitored data for total and dissolved metals were used to calculate observed particulate metal concentrations in Edney Creek. The strength of correlation of measured particulate metal concentrations to TSS concentrations was calculated using linear regressions. Measured particulate metal concentrations were not correlated to TSS ($R^2 \leq 0.25$) for all parameters. Median and 95th percentile particulate concentrations were calculated based on all observed data, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively (Table 8).

Table 8: Particulate Metal Concentrations – Post-closure

Parameter	Coefficient of Determination (R^2)	Category	Median Particulate Concentration (mg/L)	95th Percentile Particulate Concentration (mg/L)
Aluminum	0.012	Non-correlated	0.028	0.12
Antimony	0.0048	Non-correlated	0	0
Arsenic	0.0083	Non-correlated	0.00003	0.00011
Barium	0.00008	Non-correlated	0.00038	0.0015
Beryllium	-[a]	Non-correlated	0	0
Boron	0.028	Non-correlated	0	0.002
Cadmium	0.02	Non-correlated	0.0000012	0.0000078
Chromium	0.0000024	Non-correlated	0.00011	0.00052
Cobalt	0.000022	Non-correlated	0	0.000076
Copper	0.0046	Non-correlated	0.00034	0.0016
Iron	0.0051	Non-correlated	0.044	0.18
Lead	0.0012	Non-correlated	0	0.00002
Lithium	0.0078	Non-correlated	0	0.00016
Manganese	0.0039	Non-correlated	0.0038	0.016
Mercury	-[a]	Non-correlated	0	0
Molybdenum	0.046	Non-correlated	0.00003	0.00045
Nickel	0.0055	Non-correlated	0.00007	0.00031
Selenium	0.006	Non-correlated	0.000022	0.00012
Silver	0.038	Non-correlated	0	0.0000066
Strontium	0.0015	Non-correlated	0.0029	0.023
Thallium	-[a]	Non-correlated	0	0
Tin	0.0077	Non-correlated	0	0
Titanium	-[a]	Non-correlated	0	0
Uranium	0.00018	Non-correlated	0.000001	0.00004
Vanadium	0.00047	Non-correlated	0.00015	0.00039
Zinc	0.0057	Non-correlated	0	0

a) Coefficients of determination could not be calculated for beryllium, mercury, thallium and titanium because concentrations in the Edney Creek monitoring data were all below detection limits.

2.6.2 Water Quality Calculations

In the SWWQM, Mine facilities were grouped into four categories: open pits, water management ponds sumps and ditches, RDSs, and TSF. The concentrations of parameters at each Mine facility were estimated as described below.

2.6.2.1 Pits, Ponds and Ditches

Conveyance facilities on site (Long Ditch and SERDS Ditch) that are flow-through systems (i.e., they do not retain water for more than a single timestep) were modelled by assigning a water quality to each inflow and calculating a mixed water quality based on the proportions of each inflow (Equation 1). For pits, sumps, and ponds where water can be stored (9K Sump, NW Sump, Springer-Cariboo Pit, MDCS, Wight Pit, SESCP, MESCP and the PETBP), the concentration and volume retained from the previous time step is included in the calculation (Equation 2).

$$C_{pond} = \frac{\sum C_i Q_i}{\sum Q_i}$$ Equation 1

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*

$$C_{pond} = \frac{C_x V_x + \sum C_i Q_i - \sum C_x Q_o}{V_x + \sum Q_i - \sum Q_o}$$ Equation 2

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*
C_x = concentration in facility in previous timestep *x*
V_x = volume of water in facility in previous timestep *x*
Q_o = flow rate of outflow *o*

Evaporation from water surfaces was included as a decrease in total volume (V_i); in other words, evaporation was a water quantity reduction only and did not remove mass of modelled parameters from the system.

2.6.2.2 Rock Disposal Sites and Tailings Storage Facility

Runoff and seepage volumes from RDSs and the TSF were predicted by the SWWBM and input water quality was assigned to these flows based on site monitoring data. Concentrations at these Mine facilities were calculated using Equation 1.

2.6.2.3 SERDS Tailings Co-Disposal

Water quality modelling of seepage from the SERDS Tailings Co-disposal Facility was consistent with the modelling presented in the 2022 Permit Amendment Application (MPMC 2022). Seepage from the SERDS Tailings Co-disposal Facility into SERDS Ditch is assigned a combination of unsaturated TSF seepage water quality and NAG waste rock seepage water quality (Equation 3; Table 8). Source terms for waste rock were not modified upwards to reflect co-disposal with tailings because concentrations in the waste rock are a function of solubility rather than oxygen penetration (MPMC 2022).

$$C_{SERDS} = \left(C_{Tailings} \times \frac{\sum M_{Tailings}}{\sum M_{Tailings} + \sum M_{NAG}}\right) + \left(C_{NAG} \times \frac{\sum M_{NAG}}{\sum M_{Tailings} + \sum M_{NAG}}\right)$$ Equation 3

Where:

C_{SERDS} = concentration of SERDS runoff or seepage during mine operations

$C_{Tailings}$ = unsaturated tailings water quality input (Table 8)

$\Sigma M_{Tailings}$ = cumulative mass of tailings deposited in the SERDS Tailings Co-disposal Facility

ΣM_{NAG} = cumulative mass of waste rock deposited in the SERDS Tailings Co-disposal Facility

$C_{Tailings}$ = NAG waste rock seepage water quality input (Table 8)

2.6.3 Model Inputs

Water quality inputs in the SWWQM were derived from site water quality monitoring data. A summary of the water quality inputs assigned to each flow in the SWWQM is presented in Table 6 and described below. Site water quality monitoring data from 2006 to 2023 (depending on the input) were used to develop water quality inputs in the SWWQM. For each parameter, water quality inputs were represented in the model by probability distribution functions. The development of the distribution inputs is described in Section 2.6.3.1. A summary of the distributions selected, the maximum, 95th percentile, and mean values used for each parameter, and the number of samples for each water quality input are presented in Table 9.

As areas in the mine site are reclaimed, the assigned water quality inputs are adjusted in the SWWQM (Table 6):

- Before reclamation of the RDS facilities, the water quality of runoff is assigned either PAG, non-potentially acid-generating (NAG), Boundary Dump (in the Boundary Pit RDS runoff), or Joe' s Creek Pipe (in the Wight Pit RDS runoff) water quality depending on the RDS location. The water quality of runoff is assumed to be equal to disturbed runoff while the facilities are being reclaimed, and then gradually return to undisturbed watershed runoff.
- Seepage from the RDS facilities is conservatively assumed to remain as contact water in perpetuity.
- For Wight Pit and Boundary Pit, the pit wall runoff is assigned the same water quality input during the calibration, operations, closure and post-closure periods. The water quality input assigned to runoff from each of the pit walls is calculated using monitoring data from the corresponding pit (e.g., the water quality distribution assigned to pit wall runoff into Wight Pit is calculated using monitoring data from Wight Pit).
- Pit wall runoff into the Springer-Cariboo Pit during calibration, operations, closure and post-closure is assigned water quality from two source terms:
  - For pit walls of the former Springer Pit, the source term is calculated based on observed data from Springer Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
  - For pit walls of the former Cariboo Pit, the source term is calculated based on observed data from Cariboo Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
- During the calibration, operations, closure and post-closure periods, disturbed areas are assigned a water quality input calculated using monitoring data from the North Dump Creek and Bootjack Creek (Stations W4 and W5).

- During the calibration, operations, closure and post-closure periods, undisturbed areas are assigned a water quality input calculated using monitoring data from undisturbed runoff (Stations W8 and W8z).
- During the calibration, operations and closure periods, runoff from the TSF beach, impoundment and embankment is assigned a water quality input calculated using monitoring data from the TSF supernatant (Stations E1 and E1a). The water quality of TSF beach, impoundment and embankment runoff is assumed to be equal to undisturbed runoff once the area has been reclaimed in post-closure.
- The proportion of seepage from saturated and unsaturated tailings in the TSF during closure and post-closure are based on hydrogeologic modelling of seepage from the facility (Appendix F). Seepage from unsaturated tailings is assigned the water quality input calculated using monitoring data from the MESCP (Stations E4 and E5). Seepage from the saturated tailings is assigned predicted water quality from the TSF.
- Runoff from the Haul Road is assigned NAG water quality until it is reclaimed in post-closure. Once the Haul Road is reclaimed, runoff from this area is assigned the undisturbed water quality input.
- During the calibration, operations, closure and post-closure periods, groundwater inflow into the combined Springer-Cariboo Pit is assigned a water quality input calculated using monitoring data from Springer Pit Wells (Stations GW12-1/2 and GW15-1/2).

Table 9: Site-Wide Water Quality Model Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Rock Disposal Site Contact Water	RDS Runoff to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 – July 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Boundary Pit	Boundary Dump Seep water quality data (n = 70, June 2013 – July 2022)		
	RDS Runoff to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Wight Pit	Joe's Creek Pipe (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)		
	NAG Waste Rock Runoff	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	NAG Waste Rock Seepage	East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)		
	Temporary NW PAG Stockpile Runoff	PAG Dump Seep water quality (n = 140, May 2013 - January 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Temporary NW PAG Stockpile Seepage	PAG Dump Seep water quality (n = 140, May 2013 - January 2023)	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)	

Table 9: Site-Wide Water Quality Model Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Pit Wall Runoff	Boundary Pit Wall Runoff	Boundary Pit water quality (n = 16, February 2016 - July 2023)		
	Wight Pit Wall Runoff	Wight Pit water quality (n = 71, January 2016 - February 2023)		
	Springer Pit Wall Runoff	Springer Pit water quality (n = 53, January 2016 - August 2022)		
	Cariboo Pit Wall Runoff	Cariboo Pit water quality (n = 40, January 2016 - February 2023)		
Tailings Storage Facility	TSF Beach, Impoundment, and Embankment Runoff	TSF supernatant water quality (n = 157, May 2011 to February 2023)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Unsaturated TSF Seepage	TSF Main Embankment Seepage Collection Pond (n = 144, January 2006 - February 2023)		
	Saturated TSF Seepage	Predicted concentration in the TSF		
Other	Haul Road Runoff	NAG Waste Rock: East Rock Disposal Site, Northeast Zone Dump, SERDS Seep water quality (n = 523, May 2013 to October 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Disturbed Runoff	W4 and W5 site monitored data (n = 256, January 2014 to February 2023)		
	Undisturbed Runoff	W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)		
	Groundwater Inflow to Springer-Cariboo Pit	GW12-1/2, GW15-1/2 site monitored data (n = 253, June 2013 to January 2023)		

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site.

Table 10: Summary of Stochastic Water Quality Inputs

Table 10. Summary of Stochastic Water Quality Inputs

Parameter	Units	Boundary Pit Waste Rock Contact Water					Wight Pit Waste Rock Contact Water/Joe's Creek Pipe				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	760	267	1,560	70	Lognormal	1,546	1.1	2,200	66
Major Ions											
Calcium	mg/L	Lognormal	167	1.7	1,500	70	Normal	322	34	423	66
Chloride	mg/L	Delta-lognormal	1.2	1.6	8.9	70	Lognormal	4.7	1.8	20	66
Fluoride	mg/L	Lognormal	0.19	2.0	1.5	70	Normal	0.17	0.069	0.38	66
Magnesium	mg/L	Normal	23	10	55	70	Lognormal	64	1.1	90	66
Potassium	mg/L	Normal	1.4	0.29	2.3	70	Normal	2.2	0.3	3.1	66
Sodium	mg/L	Normal	6.3	1.5	11	70	Lognormal	17	1.1	23	66
Sulphate	mg/L	Normal	402	173	920	70	Lognormal	911	1.1	1,240	58
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.026	3.9	2.0	68	Lognormal	0.0033	1.7	0.018	66
Nitrate	mg/L (as N)	Lognormal	0.25	5.1	12	70	Normal	25	11	59	66
Nitrite	mg/L (as N)	Lognormal	0.004	3.0	1.0	69	Constant	-	-	0.0025	12
Total Phosphorus	mg/L	Lognormal	0.032	3.3	0.8	62	Lognormal	0.044	1.2	0.071	66
Dissolved Metals											
Aluminum	mg/L	Normal	0.0033	0.002	0.031	70	Lognormal	0.0035	1.6	0.015	66
Antimony	mg/L	Normal	0.00013	0.000054	0.0017	70	Lognormal	0.00051	1.1	0.00066	66
Arsenic	mg/L	Lognormal	0.00075	1.6	0.0034	70	Lognormal	0.0014	1.1	0.0018	66
Barium	mg/L	Normal	0.038	0.0095	0.083	70	Normal	0.057	0.012	0.091	66
Beryllium	mg/L	Delta-lognormal	0.00016	1.7	0.0005	70	Constant	-	-	0.00005	35
Boron	mg/L	Normal	0.05	0.014	0.092	70	Normal	0.076	0.0098	0.1	66
Cadmium	mg/L	Lognormal	0.000029	2.3	0.0003	70	Lognormal	0.000043	1.3	0.000096	66
Chromium	mg/L	Constant	-	-	0	70	Constant	-	-	0.00025	64
Cobalt	mg/L	Lognormal	0.00015	2.6	0.0024	70	Lognormal	0.000078	1.5	0.00026	66
Copper	mg/L	Delta-lognormal	0.005	2.3	0.064	70	Lognormal	0.018	1.1	0.025	66
Iron	mg/L	Lognormal	0.035	2.7	0.69	70	Constant	-	-	0.015	64
Lead	mg/L	Delta-lognormal	0.000095	1.5	0.0003	70	Constant	-	-	0.000025	37
Lithium	mg/L	Lognormal	0.0023	2.2	0.023	70	Normal	0.0041	0.0005	0.0056	66
Manganese	mg/L	Lognormal	0.041	5.1	2.0	70	Lognormal	0.012	2.0	0.1	66
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0.0000025	1.0
Molybdenum	mg/L	Lognormal	0.03	2.4	0.6	70	Lognormal	0.075	1.2	0.13	66
Nickel	mg/L	Delta-lognormal	0.00051	1.7	0.05	70	Constant	-	-	0.00025	35

Table 10. Summary of Stochastic Water Quality Inputs

Parameter	Units	Boundary Pit Waste Rock Contact Water					Wight Pit Waste Rock Contact Water/Joe's Creek Pipe				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Selenium	mg/L	Lognormal	0.0038	2.8	0.2	70	Lognormal	0.067	1.3	0.13	66
Silicon	mg/L	Lognormal	5.4	1.5	60	70	Normal	6.0	0.33	7.0	66
Silver	mg/L	Lognormal	0.0000054	1.4	0.000032	70	Constant	-	-	0.000005	37
Strontium	mg/L	Normal	2.2	0.86	4.8	70	Lognormal	3.2	1.1	4.6	66
Thallium	mg/L	Lognormal	0.0000051	1.2	0.00002	70	Constant	-	-	0.000005	37
Tin	mg/L	Lognormal	0.000052	1.3	0.00034	70	Constant	-	-	0.00005	37
Titanium	mg/L	Normal	0.0082	0.0052	0.024	70	Lognormal	0.0064	1.6	0.028	66
Uranium	mg/L	Lognormal	0.001	2.4	0.05	70	Lognormal	0.0013	1.2	0.002	66
Vanadium	mg/L	Lognormal	0.00041	1.6	0.0018	70	Lognormal	0.00059	1.3	0.0012	66
Zinc	mg/L	Lognormal	0.0016	1.3	0.0058	70	Lognormal	0.0058	1.3	0.012	66

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Non-PAG Waste Rock Contact Water					PAG Waste Rock Contact Water				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	1,441	546	3,410	523	Normal	1,280	525	2,280	136
Major Ions											
Calcium	mg/L	Normal	300	100	626	523	Normal	271	112	485	136
Chloride	mg/L	Normal	3.1	1.8	9.9	508	Lognormal	2.3	2.2	15	136
Fluoride	mg/L	Normal	0.32	0.2	0.97	521	Lognormal	0.11	1.7	0.38	136
Magnesium	mg/L	Normal	57	21	124	523	Normal	47	17	79	136
Potassium	mg/L	Lognormal	2.0	1.4	5.0	501	Lognormal	2.7	1.6	10	136
Sodium	mg/L	Normal	19	6.3	44	523	Lognormal	20	1.7	72	136
Sulphate	mg/L	Normal	840	315	1,590	490	Normal	685	352	1,480	102
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0039	2.1	0.058	497	Lognormal	0.0092	3.6	0.2	125
Nitrate	mg/L (as N)	Delta-lognormal	3.6	5.5	160	523	Normal	14	12	60	140
Nitrite	mg/L (as N)	Lognormal	0.0045	2.3	0.11	499	Lognormal	0.0042	2.4	0.058	112
Total Phosphorus	mg/L	Lognormal	0.013	2.4	0.14	507	Normal	0.027	0.015	0.074	123

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Non-PAG Waste Rock Contact Water					PAG Waste Rock Contact Water				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0053	2.7	0.072	520	Lognormal	0.004	2.1	0.031	135
Antimony	mg/L	Lognormal	0.00024	2.1	0.0017	523	Normal	0.00023	0.00013	0.00062	140
Arsenic	mg/L	Lognormal	0.00032	2.0	0.0017	519	Normal	0.00039	0.00015	0.00084	125
Barium	mg/L	Lognormal	0.035	1.5	0.095	489	Normal	0.059	0.034	0.19	140
Beryllium	mg/L	Constant	-	-	0.00005	319	Constant	-	-	0.00005	94
Boron	mg/L	Lognormal	0.059	1.5	0.18	507	Lognormal	0.063	2.3	0.5	140
Cadmium	mg/L	Delta-lognormal	0.00008	3.4	0.00062	502	Lognormal	0.000034	3.6	0.00072	139
Chromium	mg/L	Constant	-	-	0.0001	2.0	Constant	-	-	0.00025	129
Cobalt	mg/L	Delta-lognormal	0.00064	2.6	0.0027	449	Lognormal	0.00014	3.2	0.0021	120
Copper	mg/L	Lognormal	0.011	3.1	0.2	468	Normal	0.0059	0.0026	0.014	133
Iron	mg/L	Constant	-	-	0	2.0	Delta-lognormal	0.083	2.3	0.45	135
Lead	mg/L	Constant	-	-	0	328	Constant	-	-	0	97
Lithium	mg/L	Delta-lognormal	0.0033	1.8	0.012	491	Lognormal	0.0016	2.3	0.012	140
Manganese	mg/L	Delta-lognormal	0.024	9.9	1.2	484	Delta-lognormal	0.088	10	4.0	129
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Normal	0.13	0.073	0.35	506	Normal	0.097	0.082	0.37	123
Nickel	mg/L	Delta-lognormal	0.0017	2.2	0.0059	476	Lognormal	0.00038	1.7	0.0021	139
Selenium	mg/L	Normal	0.065	0.053	0.23	490	Normal	0.061	0.044	0.19	136
Silicon	mg/L	Lognormal	5.7	1.2	9.5	523	Lognormal	7.1	1.1	10	136
Silver	mg/L	Lognormal	0.0000066	1.5	0.000044	523	Constant	-	-	0	95
Strontium	mg/L	Normal	3.4	1.8	9.3	523	Normal	1.1	0.37	1.8	139
Thallium	mg/L	Constant	-	-	0.000005	334	Constant	-	-	0.000005	102
Tin	mg/L	Constant	-	-	0.00005	331	Constant	-	-	0.00005	99
Titanium	mg/L	Constant	-	-	0	406	Constant	-	-	0	112
Uranium	mg/L	Lognormal	0.0013	2.7	0.016	523	Normal	0.0011	0.0007	0.0027	140
Vanadium	mg/L	Lognormal	0.00039	1.6	0.0014	517	Lognormal	0.00044	1.6	0.0013	128
Zinc	mg/L	Delta-lognormal	0.0086	2.0	0.028	467	Lognormal	0.0021	1.7	0.02	137

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Boundary Pit Wall Runoff					Wight Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	371	118	726	16	Lognormal	1,020	1.1	1,340	69
Major Ions											
Calcium	mg/L	Normal	92	30	182	16	Lognormal	231	1.2	367	70
Chloride	mg/L	Delta-lognormal	1.1	1.5	3.9	16	Delta-lognormal	4.1	1.5	10	71
Fluoride	mg/L	Normal	0.63	0.19	1.2	16	Lognormal	0.76	1.3	1.5	71
Magnesium	mg/L	Normal	8.6	3.0	18	16	Lognormal	28	1.1	41	70
Potassium	mg/L	Normal	1.4	0.32	2.4	16	Lognormal	1.7	1.3	3.3	71
Sodium	mg/L	Normal	5.2	1.6	10	16	Lognormal	27	1.2	44	71
Sulphate	mg/L	Normal	166	70	375	16	Lognormal	611	1.1	810	69
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0076	1.8	0.042	15	Delta-lognormal	0.022	3.2	0.2	71
Nitrate	mg/L (as N)	Delta-lognormal	0.51	6.2	10	16	Delta-lognormal	0.5	4.2	4.0	71
Nitrite	mg/L (as N)	Lognormal	0.0028	4.0	0.19	16	Lognormal	0.0044	2.2	0.031	71
Total Phosphorus	mg/L	Lognormal	0.0068	2.8	0.15	16	Lognormal	0.0051	1.6	0.018	69
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0034	2.5	0.051	16	Lognormal	0.0022	1.7	0.0098	71
Antimony	mg/L	Normal	0.00099	0.00048	0.0024	16	Lognormal	0.00065	1.4	0.0014	71
Arsenic	mg/L	Normal	0.00058	0.00019	0.0011	16	Lognormal	0.0007	1.3	0.0015	68
Barium	mg/L	Normal	0.035	0.016	0.084	16	Lognormal	0.029	1.5	0.08	71
Beryllium	mg/L	Constant	-	-	0	16	Constant	-	-	0.00005	47
Boron	mg/L	Delta-lognormal	0.028	1.3	0.064	16	Normal	0.27	0.097	0.48	71
Cadmium	mg/L	Normal	0.000073	0.000035	0.00018	16	Normal	0.00027	0.00013	0.00057	70
Chromium	mg/L	Constant	-	-	0	16	Constant	-	-	0.00025	54
Cobalt	mg/L	Delta-lognormal	0.0002	1.7	0.00084	16	Delta-lognormal	0.00058	2.0	0.0025	71
Copper	mg/L	Normal	0.023	0.01	0.054	16	Normal	0.013	0.005	0.028	71
Iron	mg/L	Constant	-	-	0	16	Delta-lognormal	0.17	1.7	0.42	71
Lead	mg/L	Constant	-	-	0	16	Constant	-	-	0	44
Lithium	mg/L	Delta-lognormal	0.0079	1.6	0.02	16	Delta-lognormal	0.0085	1.1	0.013	71
Manganese	mg/L	Lognormal	0.016	3.5	0.67	16	Normal	0.13	0.095	0.41	71
Mercury	mg/L	Constant	-	-	0	14	Constant	-	-	0	0
Molybdenum	mg/L	Normal	0.12	0.059	0.3	16	Lognormal	0.14	1.1	0.21	67
Nickel	mg/L	Constant	-	-	0	16	Normal	0.00064	0.00025	0.0014	66
Selenium	mg/L	Normal	0.02	0.011	0.053	16	Normal	0.021	0.014	0.05	71

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Boundary Pit Wall Runoff					Wight Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Silicon	mg/L	Normal	3.6	1.3	7.6	16	Normal	6.8	1.3	11	71
Silver	mg/L	Delta-lognormal	0.000021	1.7	0.000093	16	Constant	-	-	0.000005	41
Strontium	mg/L	Normal	2.7	1.0	5.7	16	Lognormal	6.6	1.3	14	71
Thallium	mg/L	Constant	-	-	0	16	Normal	0.00001	0.0000033	0.00002	67
Tin	mg/L	Constant	-	-	0	15	Constant	-	-	0.00005	42
Titanium	mg/L	Constant	-	-	0	15	Constant	-	-	0.005	54
Uranium	mg/L	Normal	0.0043	0.002	0.01	16	Lognormal	0.0029	1.2	0.0048	70
Vanadium	mg/L	Constant	-	-	0	16	Normal	0.00058	0.00036	0.0013	70
Zinc	mg/L	Constant	-	-	0	15	Delta-lognormal	0.012	1.5	0.027	65

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Springer Pit Wall Runoff					Cariboo Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	758	148	1,000	53	Lognormal	747	1.3	1,536	39
Major Ions											
Calcium	mg/L	Normal	136	27	180	53	Lognormal	137	1.3	289	39
Chloride	mg/L	Normal	8.8	3.3	14	53	Normal	7.0	2.6	15	40
Fluoride	mg/L	Normal	0.48	0.11	0.67	53	Lognormal	0.44	1.2	0.82	40
Magnesium	mg/L	Normal	26	4.7	33	52	Lognormal	27	1.3	61	39
Potassium	mg/L	Normal	9.4	5.2	20	53	Lognormal	2.8	1.5	9.2	40
Sodium	mg/L	Normal	44	13	64	53	Normal	30	8.6	58	40
Sulphate	mg/L	Normal	453	101	600	53	Normal	437	146	1,050	40
Nutrients											
Ammonia	mg/L (as N)	Normal	0.084	0.066	0.24	53	Normal	0.041	0.036	0.15	33
Nitrate	mg/L (as N)	Normal	6.1	2.8	10	53	Lognormal	6.6	2.3	65	40
Nitrite	mg/L (as N)	Normal	0.045	0.026	0.12	53	Lognormal	0.02	2.3	0.15	33
Total Phosphorus	mg/L	Lognormal	0.011	2.1	0.066	51	Lognormal	0.012	2.2	0.08	38

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Springer Pit Wall Runoff					Cariboo Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Normal	0.013	0.0069	0.034	53	Lognormal	0.0045	2.3	0.057	40
Antimony	mg/L	Normal	0.0013	0.00037	0.002	53	Lognormal	0.0012	1.3	0.0026	35
Arsenic	mg/L	Lognormal	0.0013	1.4	0.003	53	Lognormal	0.0012	1.3	0.0028	38
Barium	mg/L	Normal	0.048	0.014	0.091	53	Lognormal	0.058	1.2	0.11	40
Beryllium	mg/L	Constant	-	-	0.00005	50	Constant	-	-	0.00005	37
Boron	mg/L	Normal	0.14	0.023	0.21	52	Normal	0.13	0.029	0.22	34
Cadmium	mg/L	Normal	0.000026	0.000019	0.000065	51	Lognormal	0.000045	1.6	0.00019	39
Chromium	mg/L	Constant	-	-	0.00025	53	Constant	-	-	0.00025	40
Cobalt	mg/L	Normal	0.00012	0.000058	0.0003	50	Lognormal	0.00025	2.2	0.002	39
Copper	mg/L	Lognormal	0.0068	2.6	0.068	53	Lognormal	0.02	2.1	0.12	39
Iron	mg/L	Constant	-	-	0.015	53	Constant	-	-	0.015	39
Lead	mg/L	Constant	-	-	0.000025	53	Constant	-	-	0.000025	38
Lithium	mg/L	Normal	0.012	0.0048	0.02	53	Normal	0.0063	0.0012	0.011	36
Manganese	mg/L	Normal	0.032	0.018	0.086	53	Normal	0.06	0.017	0.11	35
Mercury	mg/L	Constant	-	-	0.0000025	26	Constant	-	-	0.0000025	16
Molybdenum	mg/L	Normal	0.17	0.028	0.25	52	Normal	0.15	0.042	0.28	39
Nickel	mg/L	Normal	0.00051	0.00024	0.0014	53	Normal	0.0007	0.00032	0.0017	39
Selenium	mg/L	Normal	0.036	0.0038	0.047	51	Lognormal	0.055	1.3	0.12	39
Silicon	mg/L	Lognormal	4.4	1.2	7.8	53	Lognormal	6.1	1.3	12	40
Silver	mg/L	Constant	-	-	0.000005	52	Constant	-	-	0.000005	38
Strontium	mg/L	Normal	1.9	0.76	3.3	53	Normal	1.3	0.33	2.3	40
Thallium	mg/L	Constant	-	-	0.000005	52	Constant	-	-	0.000005	39
Tin	mg/L	Constant	-	-	0.00005	53	Constant	-	-	0.00005	39
Titanium	mg/L	Normal	0.0083	0.0053	0.024	53	Constant	-	-	0.005	40
Uranium	mg/L	Normal	0.0017	0.00042	0.0029	53	Normal	0.0022	0.0004	0.0034	35
Vanadium	mg/L	Lognormal	0.0012	1.6	0.0038	53	Lognormal	0.0017	1.5	0.0061	40
Zinc	mg/L	Lognormal	0.0017	1.4	0.007	47	Lognormal	0.0018	1.5	0.0055	40

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Tailings Pumped Draindown					Tailings Supernatant				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	899	1.2	1,428	99	Normal	814	143	1,140	152
Major Ions											
Calcium	mg/L	Lognormal	149	1.2	245	88	Normal	135	22	200	151
Chloride	mg/L	Normal	21	4.1	33	105	Normal	14	8.2	34	157
Fluoride	mg/L	Lognormal	0.71	1.2	1.3	73	Normal	0.59	0.21	1.2	149
Magnesium	mg/L	Lognormal	24	1.3	48	88	Normal	22	4.9	36	151
Potassium	mg/L	Lognormal	12	1.2	20	131	Normal	13	8.4	36	151
Sodium	mg/L	Normal	77	11	111	88	Normal	59	28	123	151
Sulphate	mg/L	Lognormal	504	1.2	875	99	Normal	491	85	684	153
Nutrients											
Ammonia	mg/L (as N)	Normal	0.043	0.032	0.14	97	Delta-lognormal	0.049	4.3	0.7	150
Nitrate	mg/L (as N)	Normal	1.9	0.98	4.8	77	Normal	3.7	3.5	14	155
Nitrite	mg/L (as N)	Delta-lognormal	0.011	3.1	0.06	92	Normal	0.073	0.076	0.3	155
Total Phosphorus	mg/L	Normal	0.025	0.011	0.061	100	Lognormal	0.016	1.9	0.07	153
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0022	1.6	0.0083	130	Lognormal	0.027	1.6	0.09	150
Antimony	mg/L	Lognormal	0.00035	1.5	0.0011	133	Normal	0.001	0.00068	0.0026	149
Arsenic	mg/L	Lognormal	0.0017	1.2	0.0027	133	Normal	0.0014	0.00059	0.003	151
Barium	mg/L	Normal	0.055	0.017	0.11	88	Normal	0.052	0.018	0.094	150
Beryllium	mg/L	Constant	-	-	0.000025	4.0	Constant	-	-	0.00005	138
Boron	mg/L	Lognormal	0.13	1.2	0.19	133	Normal	0.1	0.037	0.2	151
Cadmium	mg/L	Lognormal	0.000039	2.3	0.0003	118	Lognormal	0.00003	2.1	0.00017	149
Chromium	mg/L	Lognormal	0.00029	1.4	0.002	132	Constant	-	-	0.00025	150
Cobalt	mg/L	Delta-lognormal	0.00029	1.4	0.00046	132	Lognormal	0.00021	3.8	0.0047	151
Copper	mg/L	Lognormal	0.0018	2.2	0.012	120	Lognormal	0.012	7.2	1.3	149
Iron	mg/L	Constant	-	-	0.0025	1.0	Constant	-	-	0.005	1.0
Lead	mg/L	Lognormal	0.000028	1.4	0.0001	131	Constant	-	-	0.000025	150
Lithium	mg/L	Normal	0.0059	0.0017	0.011	131	Lognormal	0.0084	1.6	0.03	149
Manganese	mg/L	Normal	0.11	0.089	0.38	49	Normal	0.05	0.041	0.16	146
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0.000025	8.0
Molybdenum	mg/L	Lognormal	0.17	1.3	0.4	133	Normal	0.17	0.044	0.27	151
Nickel	mg/L	Lognormal	0.00031	1.5	0.0011	132	Lognormal	0.00065	2.3	0.0045	151
Selenium	mg/L	Lognormal	0.011	2.1	0.06	84	Lognormal	0.026	1.3	0.05	149

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Tailings Pumped Draindown					Tailings Supernatant				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Silicon	mg/L	Lognormal	6.2	1.1	8.5	86	Lognormal	3.9	1.3	8.0	151
Silver	mg/L	Constant	-	-	0.0001	132	Constant	-	-	0.000005	146
Strontium	mg/L	Lognormal	1.6	1.6	6.0	133	Normal	1.6	0.28	2.4	146
Thallium	mg/L	Constant	-	-	0.000005	64	Constant	-	-	0.000005	146
Tin	mg/L	Constant	-	-	0.000025	4.0	Constant	-	-	0.00005	147
Titanium	mg/L	Constant	-	-	0	76	Constant	-	-	0.0003	1.0
Uranium	mg/L	Lognormal	0.0015	1.3	0.0031	87	Normal	0.001	0.00042	0.0023	151
Vanadium	mg/L	Lognormal	0.0006	1.6	0.002	88	Lognormal	0.0013	2.3	0.01	151
Zinc	mg/L	Lognormal	0.0012	1.9	0.01	133	Lognormal	0.0023	2.1	0.016	149

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Disturbed Runoff					Undisturbed Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	171	1.7	1,340	255	Normal	169	67	396	220
Major Ions											
Calcium	mg/L	Lognormal	35	2.0	281	245	Normal	29	14	60	206
Chloride	mg/L	Lognormal	0.51	2.2	6.9	255	Delta-lognormal	3.4	2.1	12	153
Fluoride	mg/L	Lognormal	0.067	1.3	0.15	246	Lognormal	0.071	1.7	0.25	99
Magnesium	mg/L	Lognormal	5.5	1.8	52	245	Normal	13	7.5	30	208
Potassium	mg/L	Lognormal	0.55	1.4	1.8	226	Normal	0.97	0.3	1.9	204
Sodium	mg/L	Lognormal	3.5	1.7	29	245	Normal	6.6	3.1	13	206
Sulphate	mg/L	Lognormal	21	3.4	463	253	Delta-lognormal	6.3	2.3	30	219
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0039	1.8	0.016	247	Normal	0.0055	0.0035	0.016	219
Nitrate	mg/L (as N)	Lognormal	0.033	5.4	2.6	244	Delta-lognormal	0.061	3.2	0.7	206
Nitrite	mg/L (as N)	Delta-lognormal	0.0026	2.3	0.0093	246	Lognormal	0.00075	2.1	0.01	211
Total Phosphorus	mg/L	Normal	0.017	0.0048	0.031	230	Normal	0.023	0.0069	0.043	217

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Disturbed Runoff					Undisturbed Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Delta-lognormal	0.026	4.0	0.31	243	Delta-lognormal	0.043	3.4	0.28	203
Antimony	mg/L	Lognormal	0.000053	1.3	0.00027	241	Lognormal	0.00005	1.2	0.00016	208
Arsenic	mg/L	Lognormal	0.0003	1.3	0.00056	241	Normal	0.00087	0.00044	0.0019	208
Barium	mg/L	Normal	0.016	0.0053	0.032	230	Normal	0.0093	0.0022	0.016	206
Beryllium	mg/L	Constant	-	-	0	213	Constant	-	-	0	14
Boron	mg/L	Normal	0.025	0.011	0.059	241	Normal	0.017	0.0073	0.041	208
Cadmium	mg/L	Lognormal	0.0000058	1.8	0.000028	240	Lognormal	0.0000078	1.9	0.000035	204
Chromium	mg/L	Lognormal	0.0003	1.5	0.00094	242	Normal	0.00077	0.00027	0.0015	206
Cobalt	mg/L	Lognormal	0.000059	1.6	0.00053	245	Lognormal	0.000056	1.4	0.00028	207
Copper	mg/L	Lognormal	0.0063	1.7	0.035	244	Normal	0.0022	0.0016	0.0071	208
Iron	mg/L	Delta-lognormal	0.10	1.9	0.33	243	Delta-lognormal	0.11	1.9	0.39	207
Lead	mg/L	Lognormal	0.000026	1.3	0.00011	243	Delta-lognormal	0.000071	1.4	0.00017	206
Lithium	mg/L	Lognormal	0.00051	1.6	0.0076	246	Normal	0.0016	0.0009	0.003	208
Manganese	mg/L	Lognormal	0.0046	3.3	0.08	241	Normal	0.0088	0.0064	0.037	205
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Lognormal	0.0035	3.2	0.18	246	Normal	0.0017	0.0012	0.0056	205
Nickel	mg/L	Normal	0.00046	0.00028	0.0013	244	Normal	0.00077	0.00053	0.0026	208
Selenium	mg/L	Lognormal	0.00091	4.7	0.082	245	Normal	0.00037	0.00015	0.0006	202
Silicon	mg/L	Normal	5.7	0.79	7.4	245	Normal	6.0	1.6	9.0	208
Silver	mg/L	Lognormal	0.0000056	1.4	0.000019	243	Lognormal	0.0000061	1.6	0.000039	208
Strontium	mg/L	Lognormal	0.19	1.6	0.74	236	Normal	0.24	0.11	0.45	206
Thallium	mg/L	Constant	-	-	0	244	Constant	-	-	0	93
Tin	mg/L	Constant	-	-	0	244	Constant	-	-	0	11
Titanium	mg/L	Constant	-	-	0	238	Lognormal	0.0047	1.4	0.015	208
Uranium	mg/L	Lognormal	0.00016	2.1	0.002	245	Normal	0.00054	0.00038	0.0017	208
Vanadium	mg/L	Normal	0.00056	0.00026	0.0014	244	Lognormal	0.00054	1.3	0.0018	208
Zinc	mg/L	Normal	0.0073	0.0048	0.022	235	Lognormal	0.0012	1.9	0.0066	207

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Groundwater Flow				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters						
Total Dissolved Solids	mg/L	Lognormal	217	1.6	639	222
Major Ions						
Calcium	mg/L	Normal	45	29	145	253
Chloride	mg/L	Delta-lognormal	2.6	3.1	15	239
Fluoride	mg/L	Normal	0.28	0.13	0.67	242
Magnesium	mg/L	Normal	8.5	8.0	28	252
Potassium	mg/L	Normal	0.43	0.24	1.2	247
Sodium	mg/L	Normal	20	6.4	39	243
Sulphate	mg/L	Normal	88	59	341	225
Nutrients						
Ammonia	mg/L (as N)	Delta-lognormal	0.010	1.7	0.037	249
Nitrate	mg/L (as N)	Delta-lognormal	0.38	4.1	3.1	248
Nitrite	mg/L (as N)	Delta-lognormal	0.011	3.0	0.036	253
Total Phosphorus	mg/L	Lognormal	0.014	1.5	0.038	225
Dissolved Metals						
Aluminum	mg/L	Lognormal	0.0022	1.7	0.0089	248
Antimony	mg/L	Delta-lognormal	0.00017	1.7	0.00052	251
Arsenic	mg/L	Normal	0.0024	0.0013	0.0052	251
Barium	mg/L	Lognormal	0.017	2.3	0.12	252
Beryllium	mg/L	Constant	-	-	0.00005	233
Boron	mg/L	Normal	0.27	0.16	0.57	243
Cadmium	mg/L	Lognormal	0.0000064	2.0	0.000054	249
Chromium	mg/L	Constant	-	-	0	240
Cobalt	mg/L	Lognormal	0.000053	1.3	0.0002	246
Copper	mg/L	Lognormal	0.00037	1.9	0.0027	247
Iron	mg/L	Delta-lognormal	0.093	1.8	0.2	249
Lead	mg/L	Constant	-	-	0.000025	246
Lithium	mg/L	Normal	0.0033	0.00067	0.0054	238
Manganese	mg/L	Normal	0.024	0.02	0.077	238
Mercury	mg/L	Constant	-	-	0.0000025	2.0
Molybdenum	mg/L	Normal	0.032	0.013	0.05	252
Nickel	mg/L	Delta-lognormal	0.00086	1.4	0.0015	247
Selenium	mg/L	Delta-lognormal	0.0009	5.7	0.018	251
Silicon	mg/L	Normal	7.9	1.0	10	252
Silver	mg/L	Constant	-	-	0.000005	245
Strontium	mg/L	Lognormal	0.14	2.5	1.3	252
Thallium	mg/L	Constant	-	-	0.000005	248
Tin	mg/L	Lognormal	0.000053	1.3	0.00034	251
Titanium	mg/L	Constant	-	-	0	244

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Groundwater Flow				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Uranium	mg/L	Delta-lognormal	0.00023	2.8	0.0015	251
Vanadium	mg/L	Delta-lognormal	0.0015	1.9	0.0029	251
Zinc	mg/L	Delta-lognormal	0.0076	1.8	0.027	251

2.6.3.1 Development of Water Quality Inputs

The following standardized process was used to develop a statistical distribution for each parameter (Table 7):

- Step 1: Determine if data are available and if values are less than the method detection limit (MDL). Except for special cases listed below under Step 5, values below the MDL were set equal to half of the MDL.
- Step 2: Examine time-series of available data to select the most representative range of data to use for input:
  - The following general rules were used to select the data used for input to the model:
    - Where no trend was apparent in the monitoring data over time, the whole data set was used as input to the model.
    - Where a decreasing trend was observed in the monitoring data, the whole data set was used, including the earlier, higher values, thereby adding conservatism and representing a potential return to conditions that led to higher concentrations (without specifying what those conditions were).
    - Where an increasing trend was observed in the monitoring data, input data were limited to the range of data most representative of current or recent conditions.
- Step 3: Remove outliers from selected data:
  - Three statistical tests were used to identify outliers. These included the three times standard deviation (3σ) rule, the Hampel identifier, and combined Rosner-Dixon test. A data point was considered an outlier only if it was flagged by all three tests. By using multiple tests, the possibility of misdiagnoses was reduced (Beckman and Cook 1983; Jain 1981; Kottegoda 1984; Pearson 2001).
- Step 4: Fit suitable statistical distributions to the resulting data:
  - The probability distributions considered for the water quality data were normal, lognormal, or delta-lognormal, as these are typical distributions for water quality data (AEP 1995; US EPA 1991). To identify which distribution best described a constituent, all three distributions were initially fitted to the available data. Statistical goodness of fit tests, consisting of the Chi-squared test, the Kolmogorov-Smirnov test and the squared correlation coefficient (Sokal and Rohlf 1981) were used to determine which distribution was most appropriate.
- Step 5: Process data with a single value:
  - Where all data were at a single value a constant input was used equal to this value.
  - Where all data were below the MDL, a constant input was used at half the MDL.
  - Where dissolved mercury data were not available for a location, a constant input was used equal to half the lowest detection limit measured on site, consistent with other locations.

- Step 6: Determine the minimum and maximum bounds to define a reasonable range for the selected distribution:
  - When possible, the maximum observed value was used as the maximum bound of all distributions. In cases where the maximum observed value was too low to result in a fitted distribution, the lowest maximum value acceptable for a fitted distribution was used as the maximum bound. The maximum is considered reasonable because there is a large dataset of mine water chemistry and parameter concentrations in drainage water are not expected to increase significantly from the period of observed data to closure.

The minimum value of a distribution was set to zero for the normal distribution, a value very close to zero (e.g., 0.00000001) for the lognormal distribution, or half the detection limit for the delta-lognormal distribution.

2.6.4 Geochemical Source Terms

Water quality inputs derived from geochemical source terms developed by SRK Consulting Canada were applied to the SWWQM as an additional scenario in the 2016 Long Term Water Management Plan (Golder 2016). Updates to these geochemical source terms were completed by SRK consulting (SRK 2023). An alternative model scenario was completed using the SRK geochemical source terms as water quality inputs in place of inputs calculated from monitoring data. The results of the two scenarios (using monitoring data or SRK geochemical inputs) were compared. Consistent with the previous geochemical source terms provided by SRK for the 2016 TAR (Golder 2016) and the 2020 WMP (Golder 2020), the SRK inputs were considered more conservative than the monitoring data inputs and produced generally higher concentrations in the SWWQM. The results presented in this report are from the scenario that utilized the water quality inputs that were calculated from monitoring data (Section 2.6.3). The results from the geochemical source term scenario are not presented because the model predictions were considered overly conservative for most parameters and because the model was calibrated using the inputs calculated from monitoring data.

2.6.5 Initial Water Quality

Concentrations in ponds, sumps, and pits at the beginning of the calibration period are based on monitoring data in January 2017. Concentrations in ponds, sumps, and pits at the beginning of the operations period are based on monitoring data in May 2023.

2.7 Model Assumptions

Assumptions that have been made in the SWWQM are:

- The input water qualities used in the SWWQM are representative of their respective input sources and will continue to be representative over the modelled timeframe. Water quality data for model inputs were selected from available lab testing and field monitoring, augmented by professional judgement where necessary.
- Concentrations of parameters from monitoring data that were lower than the analytical detection limit were set equal to half the detection limit.
- Concentrations of parameters in direct precipitation onto the water surface of water management facilities were assumed to be zero. No mass was removed or added to modelled systems through evaporation or direct precipitation. These processes affected water quantity only and did not affect mass of modelled parameters in the system.

- All open pits, ponds, and sumps are fully mixed systems. No stratification is considered over the modelled timeframe. All inputs are mixed with existing water volumes to calculate concentrations of parameters.
- All parameters are assumed to behave conservatively. That is, they are assumed to not settle, precipitate, sorb, degrade, or undergo any other process that would reduce concentrations. This assumption is likely to have negligible effects on major ion predictions but may lead to over-estimation of some nutrients and metals.
- All PAG waste rock will be disposed sub-aqueously in the Springer-Cariboo Pit at closure to mitigate onset of acid generation. Acid generation is not expected to occur prior to subaqueous disposal, and disposal in the Springer-Cariboo Pit Lake will prevent acid onset in the future by limiting oxidation in the waste rock. Geochemical characterization studies estimate the time to the onset of acid generation varies between decades and 100 years (MPMC 2022).
- The combined Springer-Cariboo Pit is assumed to be empty at the start of closure.
- Rock disposal sites are assumed to be reclaimed in post-closure. Following revegetation, the runoff from these facilities is assumed to return to undisturbed runoff quality over the course of ten years.
- Diffusive flux from the submerged PAG waste rock into the Springer-Cariboo Pit Lake water cap was not modelled.
- Accumulation and flushing of oxidation products from weathered PAG material prior to subaqueous disposal was not modelled.
- Ice formation and melting were not considered in pits, ponds, and ditches that retain water.

3.0 MODEL CALIBRATION

The SWWQM was set up to hindcast concentrations from 1 January 2017 to 31 December 2022 at seven locations:

- Springer Pit
- Cariboo Pit
- Wight Pit
- CCS
- PETBP
- TSF
- NW Sump

Where discrepancies between model results and monitoring data existed, the model was adjusted to better reflect monitoring data. The same adjustments, made during calibration of the SWWQM in the 2020 Water Management Plan (Golder 2020) and during the calibration of the SWWQM in the 2022 Reclamation and Closure Plan (WSP 2022), were maintained in this update to achieve calibration with monitoring data:

- Adjusting the proportion of Wight Pit runoff and groundwater inflows that are assigned a waste rock contact water input based on storage of waste rock in the pit.
- Adjusting the proportion of runoff from waste rock that is assigned an undisturbed water quality input.
- In the TSF, applying calibration factors greater than 1.0 to improve the model calibration for chloride, fluoride, potassium, sodium, nitrite, dissolved antimony, dissolved arsenic, dissolved barium, dissolved lithium, dissolved molybdenum, and dissolved vanadium. These calibration factors are applied during periods when tailings are deposited to the TSF.

3.1 Calibration Results

Model calibration results are shown compared to monitoring data in Figures 4 to 9 (model calibration results for all parameters and locations are provided in Appendix A). Monitoring data were generally between the projected 5th and 95th percentile model calibration results for all parameters. However, several parameters (e.g., dissolved copper) were underpredicted during periods in 2018, 2020, and 2021 (Figure 5, Figure 7, Figure 8 and Figure 9). The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility (Golder 2022c). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process.

Where monitoring data fell within the 5th and 95th percentile model calibration results, the model was considered to be in good agreement with monitoring data. The good agreement indicates that model inputs were well characterized and that these parameters had low sensitivity to assumptions or model conditions not matching site conditions.

Where monitoring data were consistently below the 5th percentile predictions, the model was considered to be over predicting concentrations. Possible reasons why the model may be over-predicting concentrations are:

- The model was developed to predict water quality conservatively; where uncertainty exists in model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected. For example, seepage from RDSs was assigned a NAG water quality for the entire model simulation period, which is a conservative assumption.
- Metal concentrations that are far below detection limits may be skewed upward by model inputs where half-detection limits were applied.
- Settling of particulate material is not accounted for in the model.
- Geochemical processes, such as precipitation and adsorption, are not accounted for in the model.

Although these factors may lead to over-prediction of concentrations, the model is considered valid for the purpose of predicting concentrations of parameters on the mine site and in the influent to the WTP because deviations in model predictions from monitoring data in this category tend toward additional environmental protection.

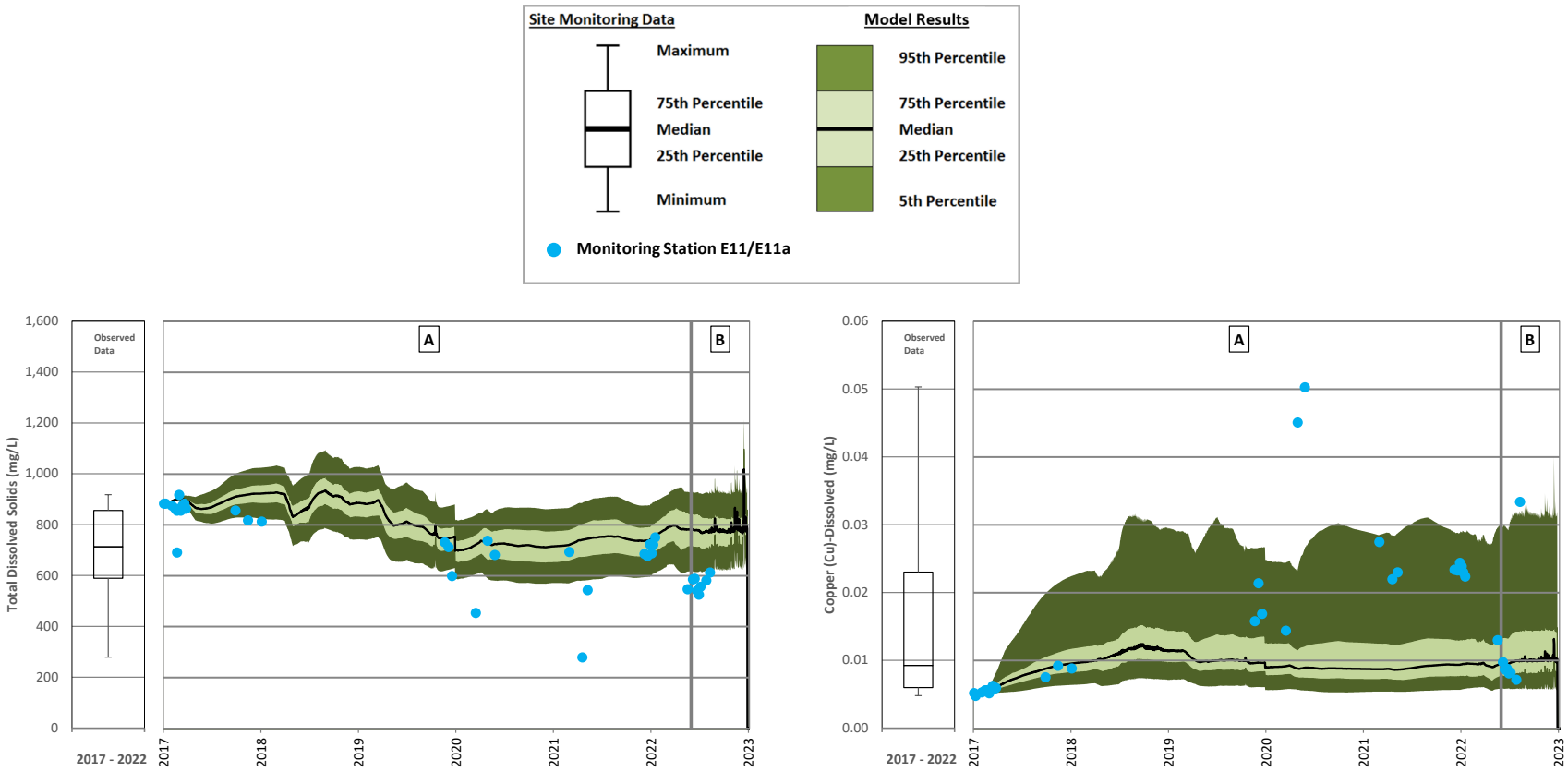

A = Care and Maintanence; B = Resumed Operations

Figure 4: Springer Pit Calibration – Total Dissolved Solids and Dissolved Copper

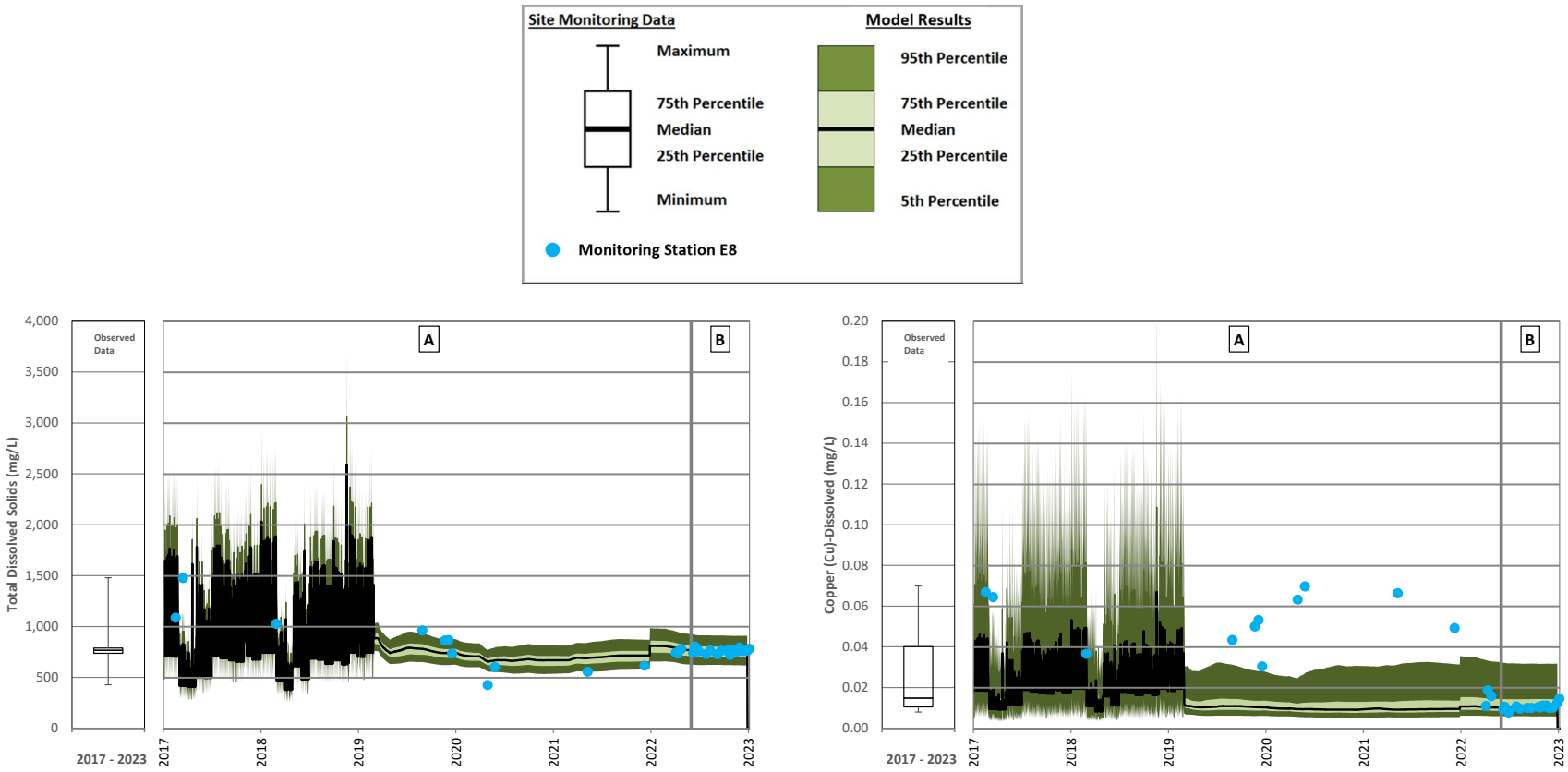

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system from the beginning of the model simulation to March 2019, which results in a wide range in predicted concentrations. After March 2019, Cariboo Pit stores water, which reduces the range in predicted concentrations. The source of increased copper concentrations in 2019, 2020 and 2021 monitoring data is due to the discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to Cariboo Pit). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 5: Cariboo Pit Calibration – Total Dissolved Solids and Dissolved Copper

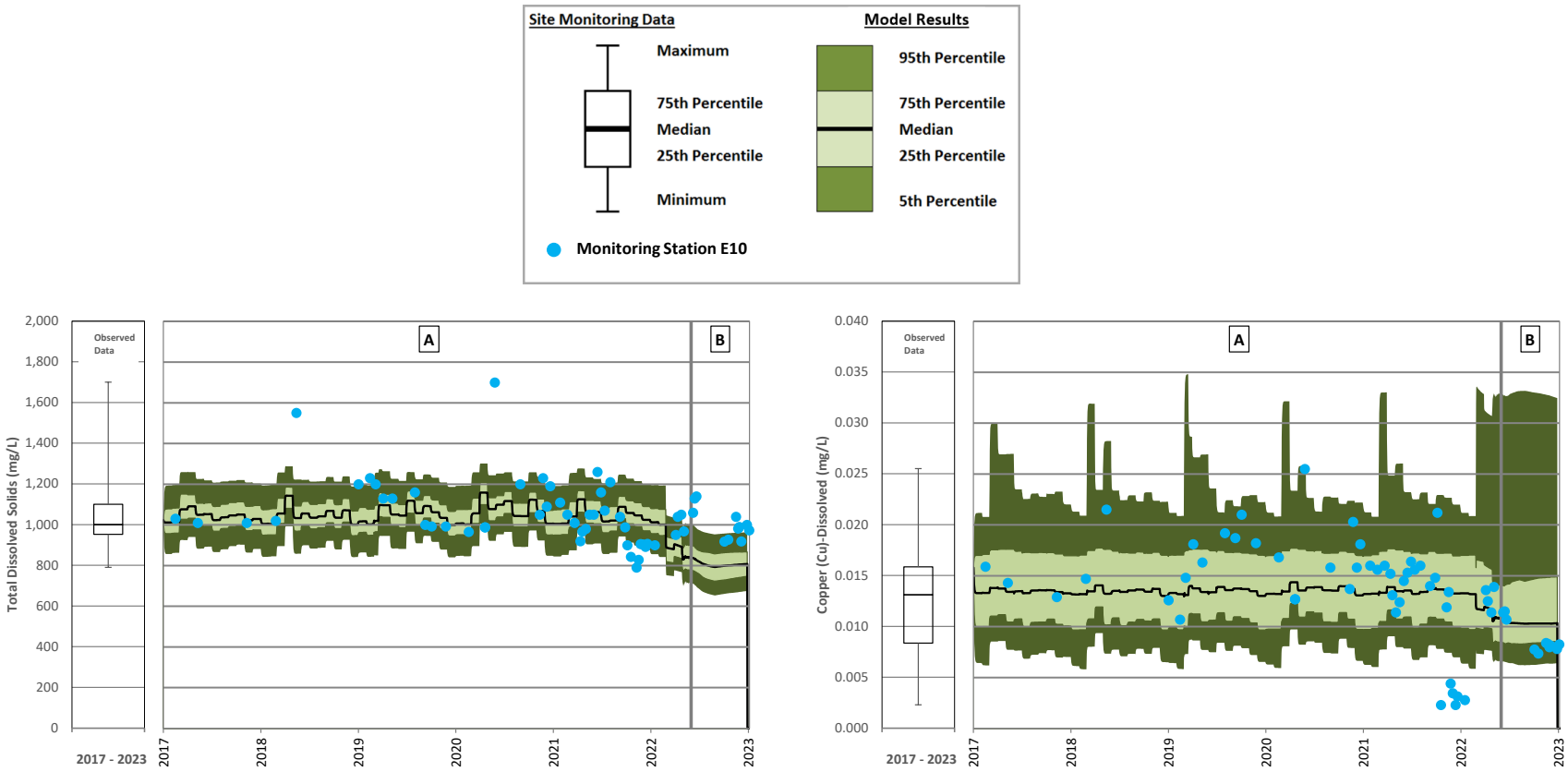

A = Care and Maintanence; B = Resumed Operations

Figure 6: Wight Pit Calibration – Total Dissolved Solids and Dissolved Copper

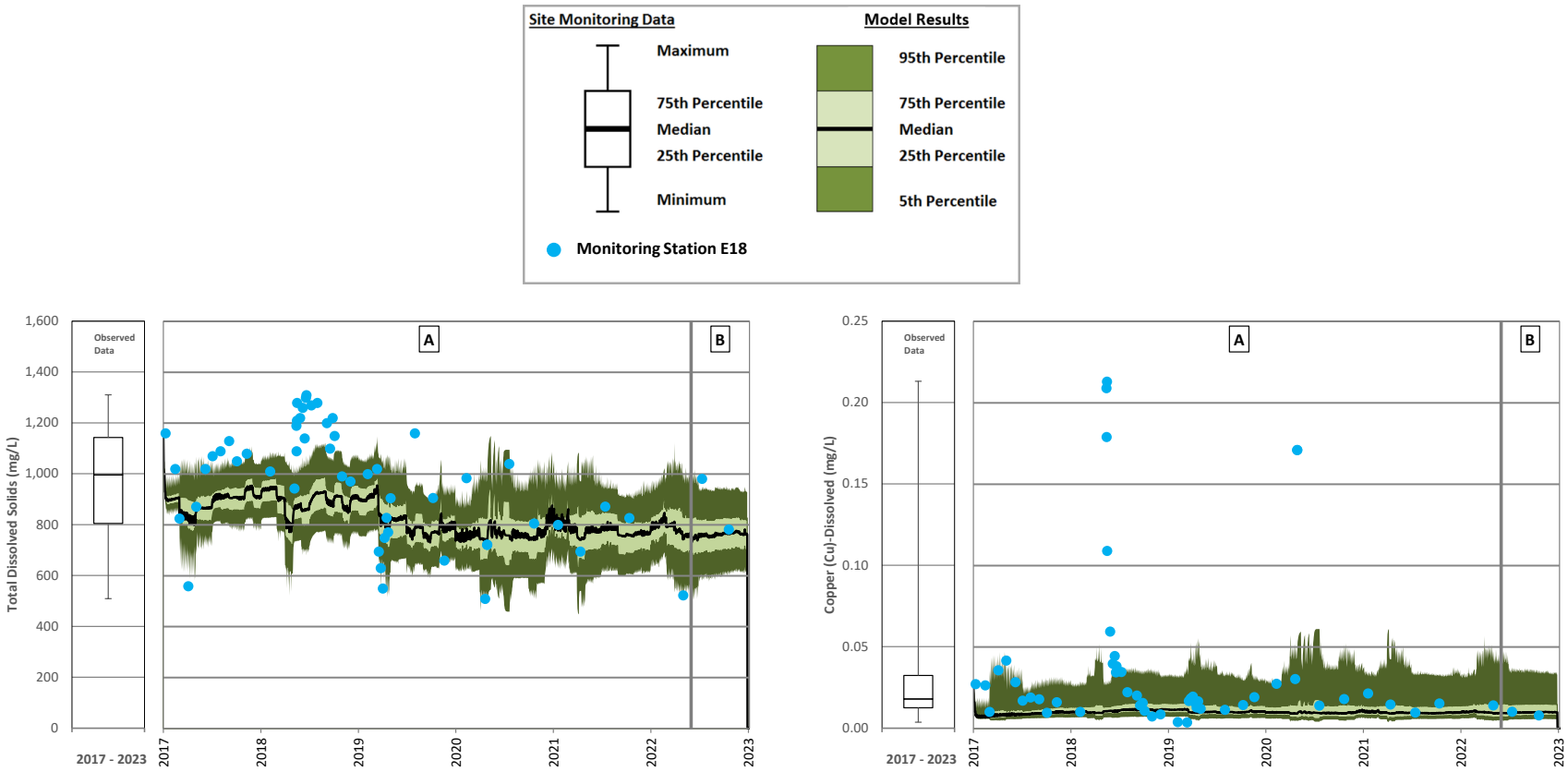

A = Care and Maintanence; B = Resumed Operations

Note: The source of increased dissolved copper concentrations in the Central Collection Sump 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the CCS. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 7: Central Collection Sump Calibration – Total Dissolved Solids and Dissolved Copper

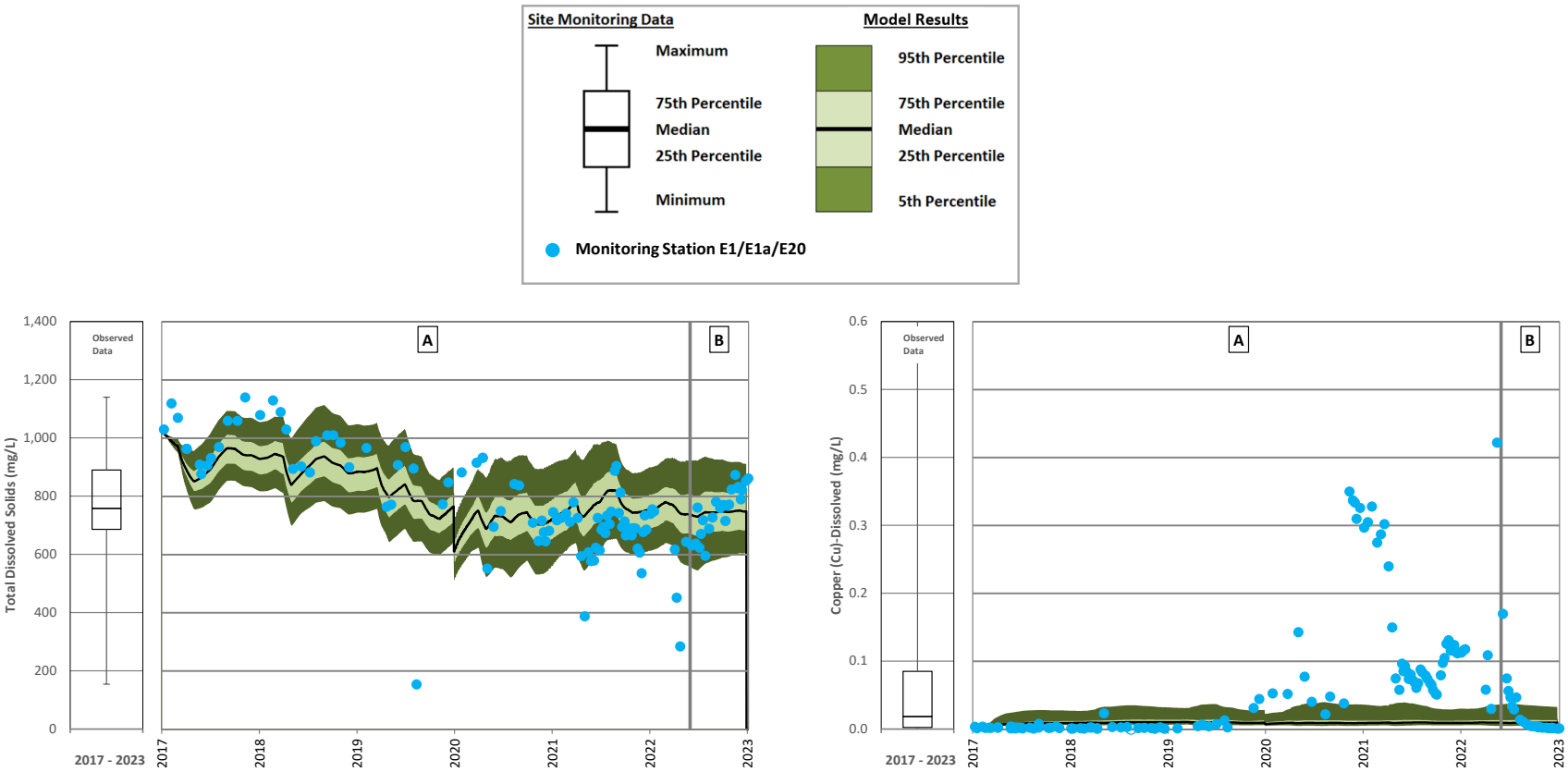

A = Care and Maintanence; B = Resumed Operations

Note: The source of increased copper concentrations in 2018 and from 2020 to 2022 in the monitoring data of the Tailings Storage Facility (TSF) is due to the discharge of leachate to the TSF from the onsite test heap leach facility. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 8: Tailings Storage Facility Supernatant Pond – Total Dissolved Solids and Dissolved Copper

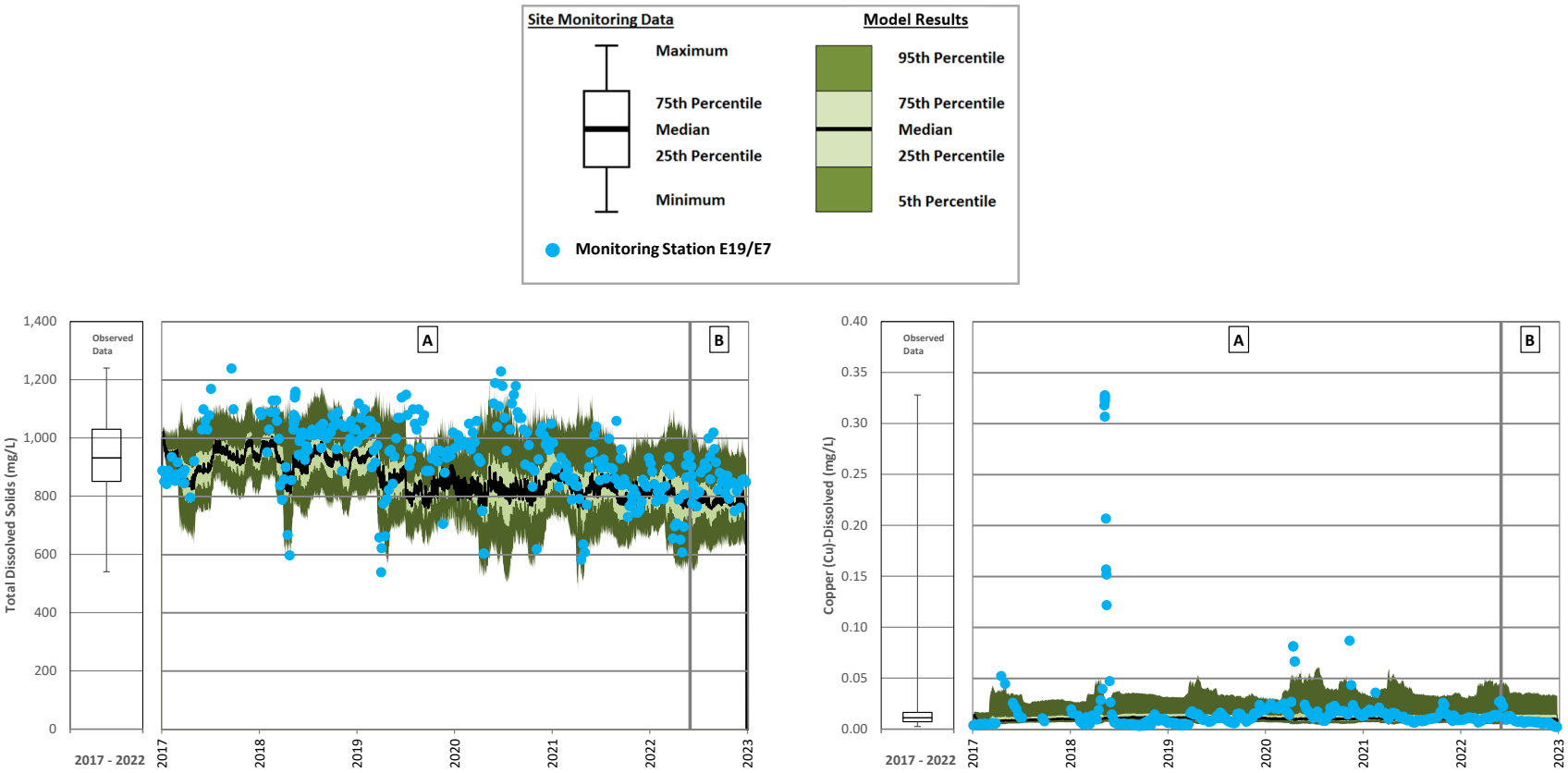

A = Care and Maintanence; B = Resumed Operations

Note: The source of increased dissolved copper concentrations in the Perimeter Embankment Till Borrow Pond 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the PETBP. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 9: Perimeter Embankment Till Borrow Pond – Total Dissolved Solids and Dissolved Copper

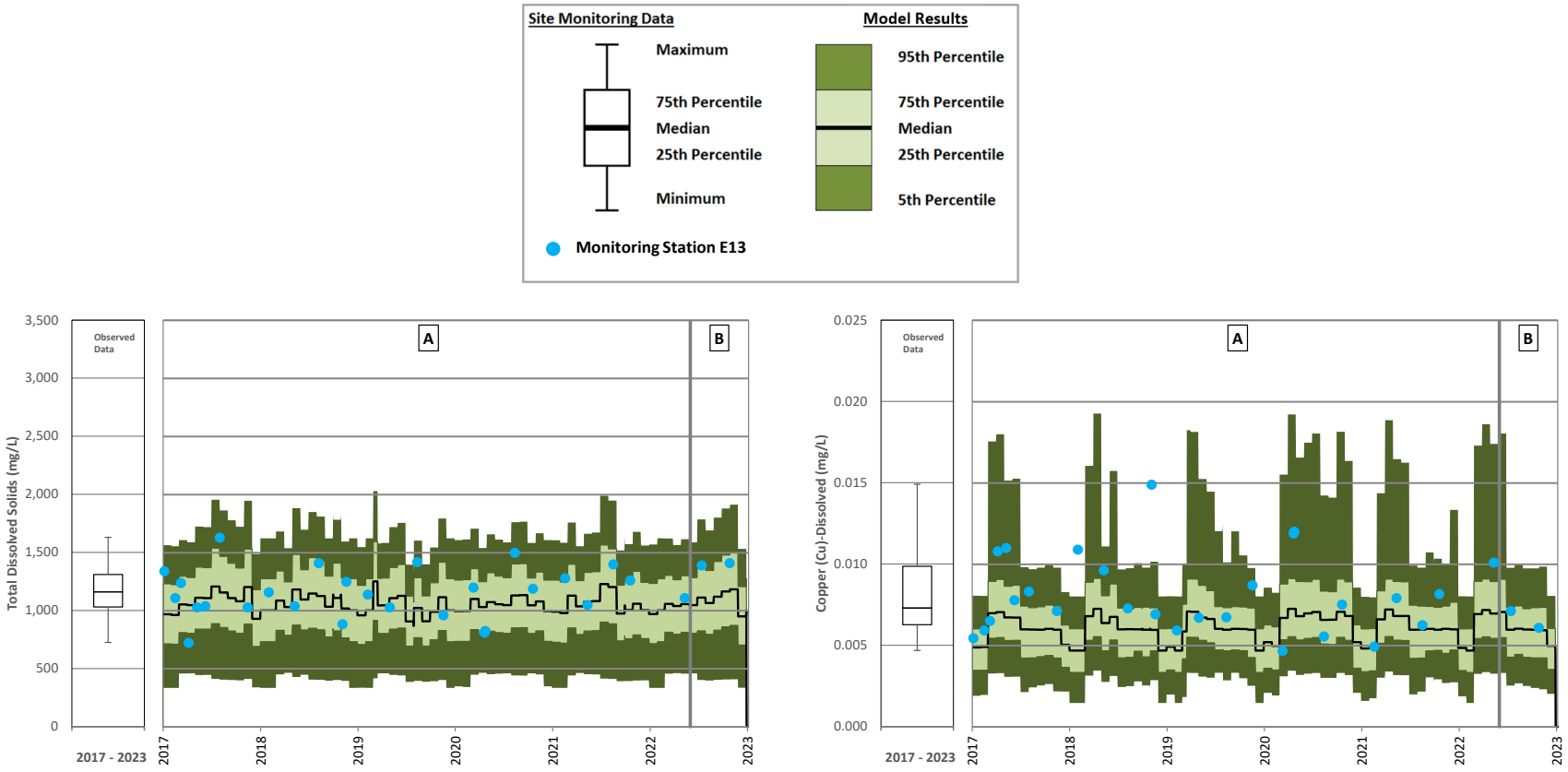

A = Care and Maintanence; B = Resumed Operations

Figure 10: Northwest Sump – Total Dissolved Solids and Dissolved Copper

4.0 MODEL RESULTS

After the model calibration was completed, model simulations were performed for the following periods:

- Operations (1 January 2024 to 31 March 2031)
- Closure (1 April 2031 to 31 March 2041)
- Post-closure (1 April 2041 to 31 March 2131)

The following sections present predicted discharge concentrations for the PETBP in operations, which represents predicted WTP influent concentrations, and each of the nine discharge locations in closure and post-closure that discharge to receiving environments (Section 2.4):

- PETBP
- 9 km Sump
- NW Sump
- Springer-Cariboo Pit Sump
- MDCS
- Wight Pit
- Long Ditch
- SESCP
- MESCP

Maximum of median and 95th percentile predicted concentrations are presented for all modelled parameters. Time series of predicted dissolved concentrations are presented for parameters with permit limits. Time series predictions are also compared to historical observed data for each facility in the model as a quality control check.

4.1 Perimeter Embankment Till Borrow Pond

During operations, closure and the first ten years of post-closure, the PETBP is the influent water to the WTP, which discharges to Quesnel Lake. Maximum of the daily median and maximum of the daily 95th percentile concentrations in the PETBP are presented in Table 11. Predicted total concentrations in the PEBTP are based on a TSS concentration of 15 mg/L. Time series for predicted concentrations in the PETBP are presented for parameters with permit limits in Figures 10 to 15.

In general, concentrations in the PETBP are predicted to remain relatively consistent during operations until the end of pumping from the mill processing plant in 2031. This consistency is due to the assumption that the entire surface areas of the RDS are accounted for at the beginning of the model simulation. Therefore, the runoff and seepage volumes from the RDS do not change. Changes in predicted concentrations in the PETBP are due to:

- Variable pumping from the TSF to the MDCS during operations. During periods when the TSF is pumped to the MDCS (P100 booster pumping in Figure 1), concentrations of most parameters increase in the MDCS. Concentrations decrease in the MDCS when there is no pumping from the TSF. Changes in MDSC water quality reach the PETBP through the pathway connecting the MDCS to the PETBP:
  - TSF → MDCS → SERDS Ditch → Long Ditch → CCS → PETBP
- Surface runoff at the mine site causes fluctuations in concentrations depending on the proportions of the catchment areas flowing into the facilities (e.g., RDS areas, disturbed areas, undisturbed areas). Parameter concentrations reach steady-state during the winter months because surface runoff is low.

Discharge from the PETBP will be directed to Hazeltine Creek in closure. This discharge includes overflow and seepage from the TSF, as well as runoff from catchment areas of the PETBP, TSF, and CCS.

Predicted concentrations in the PETBP change from operations to closure and into early post-closure because of the staggered reclamation of the TSF beach and impoundment areas which are then assigned an undisturbed water quality once the areas are reclaimed. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the PETBP. In closure and post-closure, concentrations in the PETBP follow two patterns:

1) Decrease from operations because the statistical distributions assigned to undisturbed runoff water quality have lower concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., sulphate, nitrate and dissolved copper).
2) Increase from operations because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., total phosphorus, dissolved chromium and dissolved iron).

Predicted concentrations in the PETBP reach a steady state approximately 10 years after the start of post-closure when all mine site areas have been reclaimed.

Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	649	809	340	483	220	314	153	233
Total Dissolved Solids	mg/L	948	1,117	500	710	359	496	239	313
Major Ions									
Calcium	mg/L	208	250	102	144	61	84	41	55
Chloride	mg/L	17	20	4.6	11	6.6	10	5.1	8.0
Fluoride	mg/L	0.74	1.0	0.28	0.39	0.24	0.35	0.17	0.24
Magnesium	mg/L	31	45	21	30	16	26	12	23
Potassium	mg/L	16	19	3.7	6.8	3.8	5.0	2.7	3.5
Sodium	mg/L	63	75	23	32	24	32	18	22
Sulphate	mg/L	576	681	268	401	138	189	104	144
Nutrients									
Ammonia	mg/L (as N)	0.021	0.058	0.032	0.074	0.012	0.051	0.0081	0.038
Nitrate	mg/L (as N)	3.4	23	2.1	6.4	0.61	2.5	0.45	1.9
Nitrite	mg/L (as N)	0.055	0.069	0.017	0.032	0.0054	0.06	0.0041	0.045
Total Phosphorus	mg/L	0.014	0.029	0.015	0.025	0.017	0.026	0.022	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.048	0.2	0.07	0.3
Antimony	mg/L	0.0012	0.0016	0.00048	0.00095	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0028	0.0033	0.002	0.0032	0.00085	0.0012	0.00086	0.0016
Barium	mg/L	0.054	0.073	0.028	0.056	0.022	0.031	0.015	0.022
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.37	0.19	0.36	0.046	0.061	0.031	0.042
Cadmium	mg/L	0.00022	0.00041	0.000029	0.00014	0.000019	0.000079	0.000013	0.00006
Chromium	mg/L	0.00065	0.0007	0.00072	0.00082	0.00055	0.0013	0.00084	0.0017
Cobalt	mg/L	0.00064	0.0014	0.00036	0.00062	0.000083	0.00029	0.000058	0.00023
Copper	mg/L	0.02	0.19	0.016	0.17	0.004	0.0079	0.0032	0.007
Iron	mg/L	0.48	0.58	0.48	0.54	0.087	0.33	0.13	0.44
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.000019	0.000072	0.000016	0.0001
Lithium	mg/L	0.0095	0.012	0.0052	0.011	0.0027	0.0041	0.0017	0.0027
Manganese	mg/L	0.14	0.26	0.058	0.14	0.075	0.16	0.057	0.13
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052

Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.24	0.28	0.089	0.16	0.045	0.071	0.034	0.054
Nickel	mg/L	0.0011	0.0021	0.001	0.0016	0.00058	0.0013	0.00087	0.0019
Selenium	mg/L	0.041	0.074	0.022	0.044	0.0034	0.011	0.0025	0.0083
Silver	mg/L	0.0000053	0.000013	0.0000053	0.000013	0.0000052	0.000015	0.0000062	0.000019
Strontium	mg/L	5.3	8.4	1.1	2.1	0.59	1.2	0.41	0.85
Thallium	mg/L	0.0000089	0.000014	0.0000049	0.0000058	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.00013	0.000051	0.00015	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0035	0.00087	0.0019	0.00084	0.0015	0.00055	0.0011
Vanadium	mg/L	0.0035	0.0039	0.0018	0.0027	0.00058	0.001	0.0007	0.0012
Zinc	mg/L	0.012	0.019	0.0069	0.011	0.002	0.0032	0.0017	0.0027
Dissolved Metals									
Aluminum	mg/L	0.017	0.047	0.019	0.067	0.02	0.084	0.042	0.18
Antimony	mg/L	0.0012	0.0014	0.00046	0.00081	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0025	0.003	0.0017	0.0029	0.00082	0.0011	0.00083	0.0015
Barium	mg/L	0.052	0.064	0.026	0.047	0.021	0.03	0.014	0.02
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.34	0.19	0.33	0.046	0.059	0.031	0.04
Cadmium	mg/L	0.00021	0.00036	0.000026	0.000091	0.000018	0.000071	0.000012	0.000053
Chromium	mg/L	0.00027	0.00031	0.00034	0.00044	0.00044	0.00077	0.00073	0.0011
Cobalt	mg/L	0.00036	0.0011	0.000078	0.00034	0.000083	0.00022	0.000058	0.00016
Copper	mg/L	0.012	0.03	0.0068	0.018	0.0036	0.0063	0.0029	0.0054
Iron	mg/L	0.036	0.14	0.04	0.097	0.043	0.14	0.089	0.26
Lead	mg/L	0.000025	0.00003	0.000024	0.000037	0.000019	0.000052	0.000016	0.000083
Lithium	mg/L	0.0093	0.011	0.005	0.0096	0.0027	0.004	0.0017	0.0026
Manganese	mg/L	0.12	0.24	0.037	0.12	0.071	0.14	0.054	0.11
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.27	0.089	0.15	0.045	0.07	0.034	0.054
Nickel	mg/L	0.00056	0.0016	0.00046	0.001	0.00051	0.001	0.0008	0.0016
Selenium	mg/L	0.041	0.068	0.022	0.038	0.0033	0.011	0.0025	0.0082
Silicon	mg/L	6.5	8.1	6.9	8.0	5.2	6.7	5.9	8.1
Silver	mg/L	0.0000053	0.0000076	0.0000053	0.0000069	0.0000052	0.0000084	0.0000062	0.000012
Strontium	mg/L	5.3	8.1	1.1	1.8	0.59	1.2	0.4	0.83

Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Thallium	mg/L	0.0000089	0.000013	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.000054	0.000051	0.000071	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.0066	0.0075	0.0056	0.0085	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0032	0.00085	0.0016	0.00084	0.0014	0.00055	0.0011
Vanadium	mg/L	0.0023	0.0028	0.00065	0.0015	0.00043	0.00062	0.00055	0.00085
Zinc	mg/L	0.0092	0.016	0.0043	0.0079	0.002	0.0032	0.0017	0.0027

a) Calculated based on predicted calcium and magnesium concentrations.

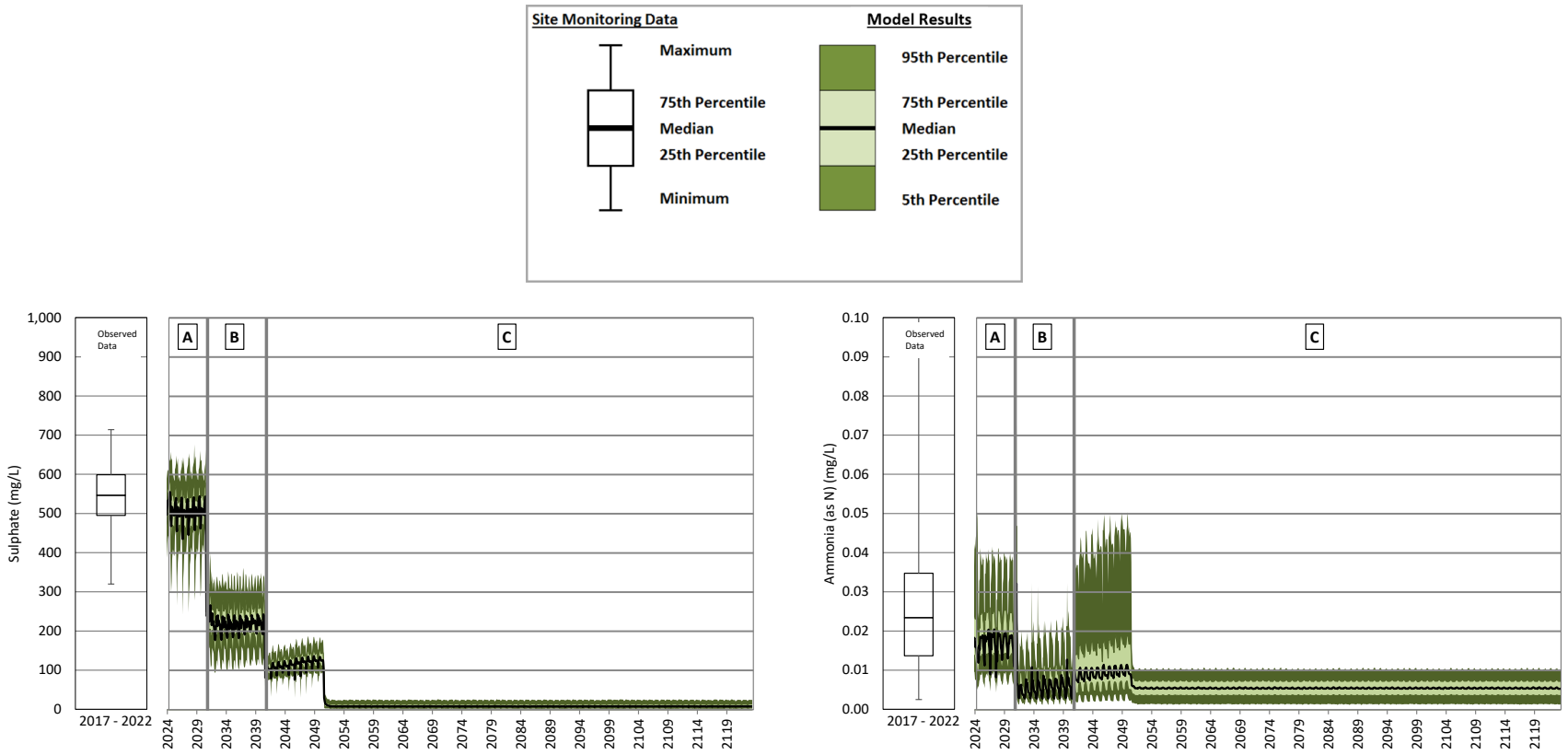

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. The increase in total ammonia concentrations during the first ten years of post-closure is caused by the pumping from the MESCP which ends in 2051. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 11: Predicted Sulphate and Total Ammonia Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

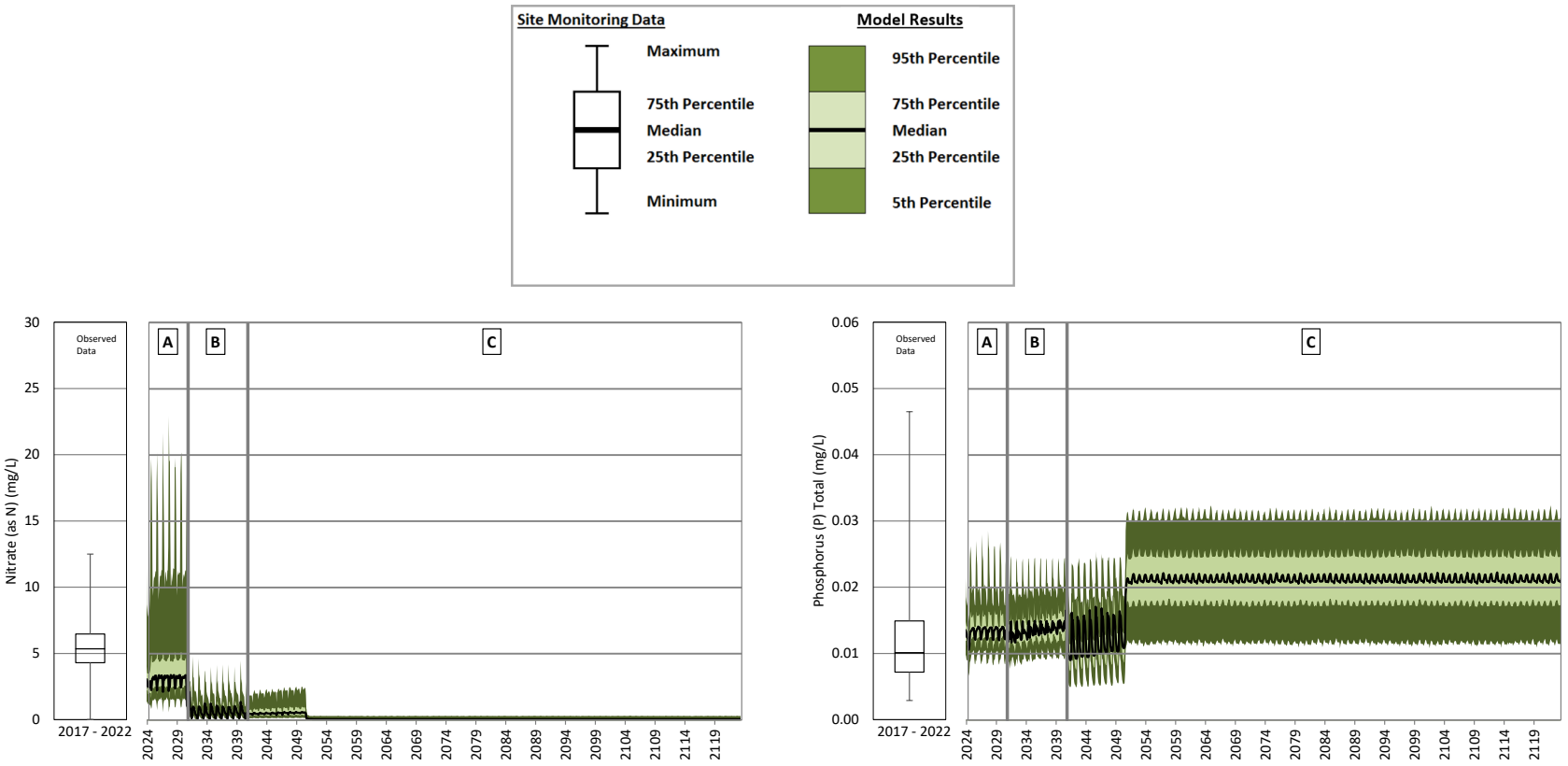

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 12: Predicted Nitrate and Total Phosphorus Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

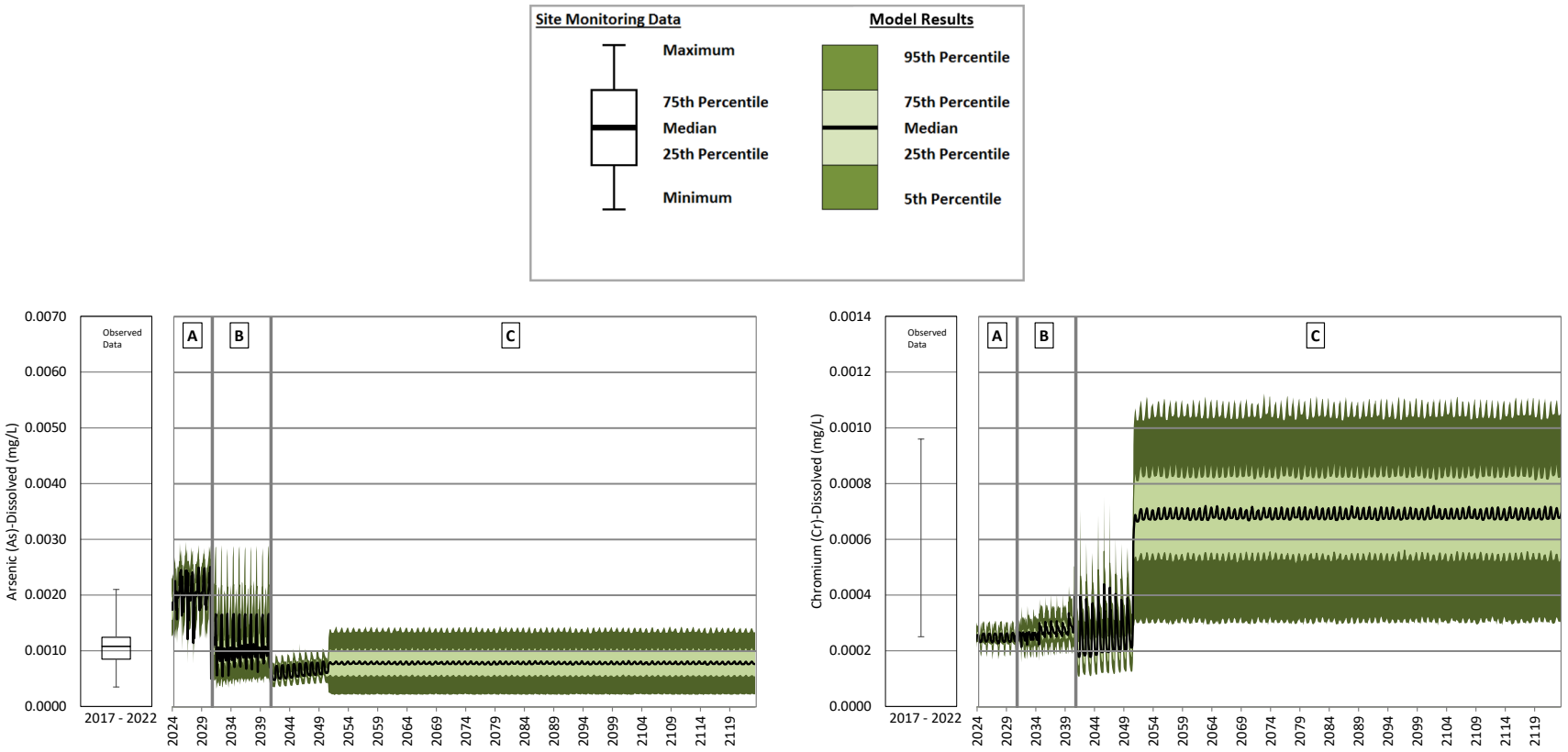

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 13: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

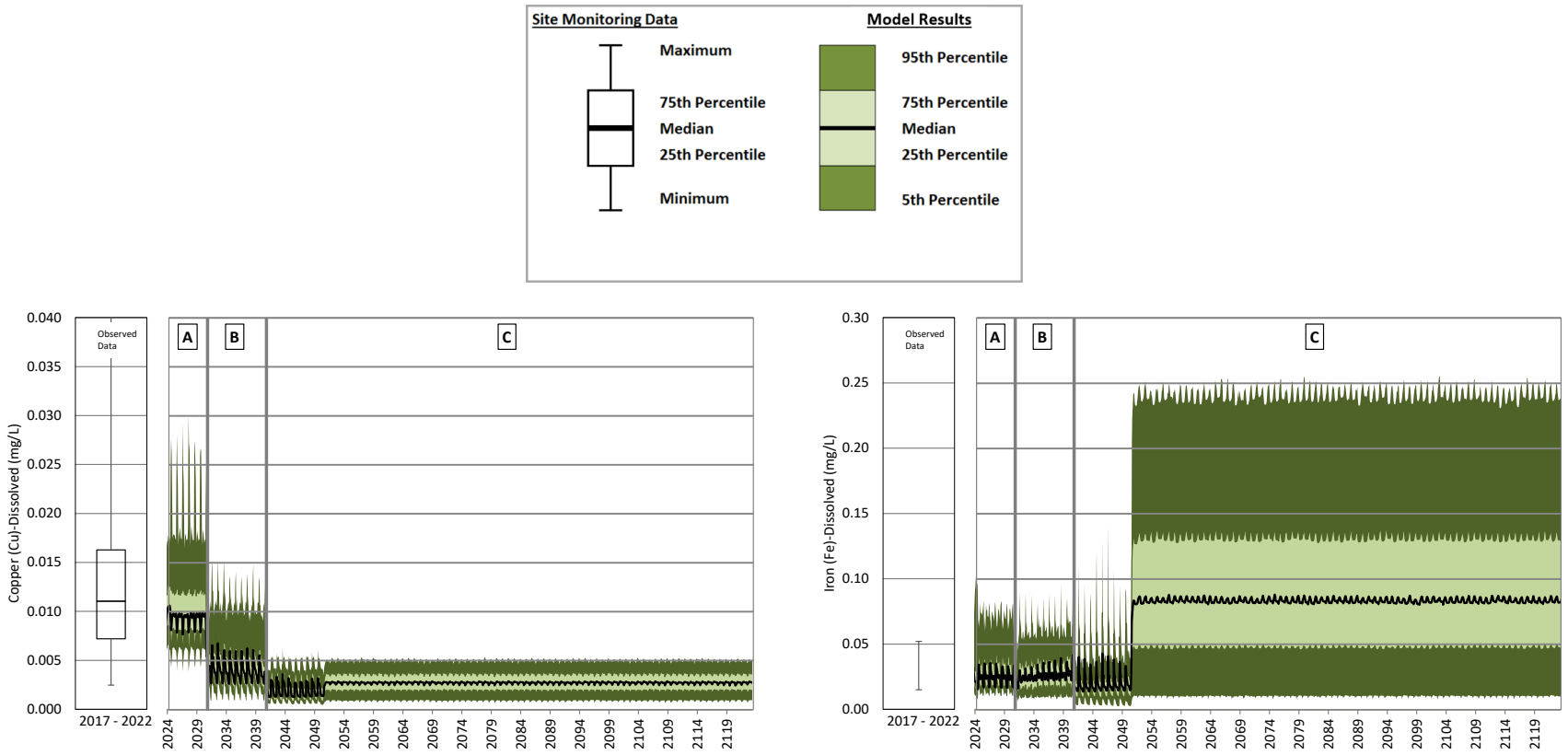

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 14: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

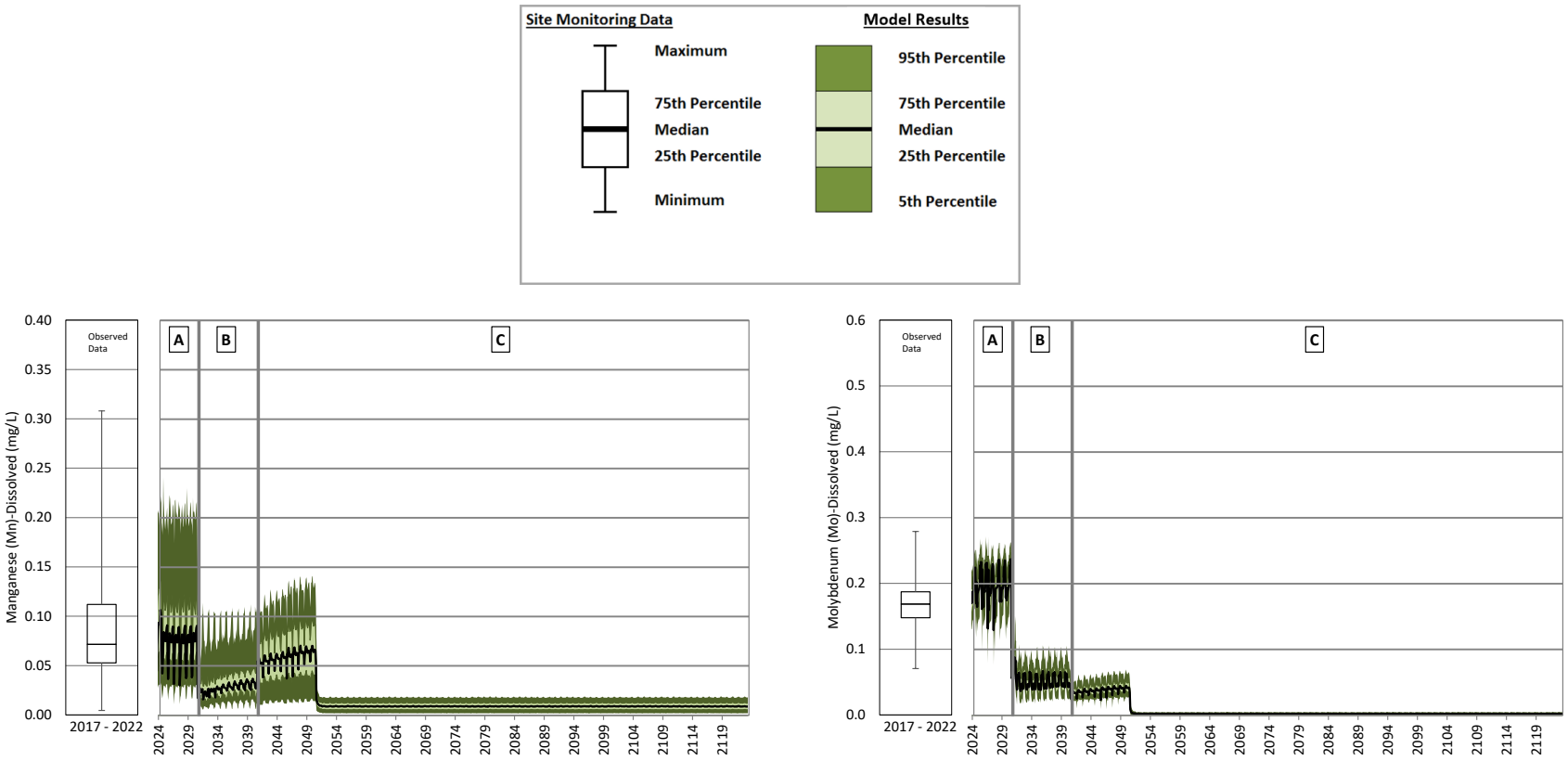

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. The increase in manganese concentrations during the first ten years of post-closure is caused by the pumping from the MESCP which ends in 2051. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 15: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

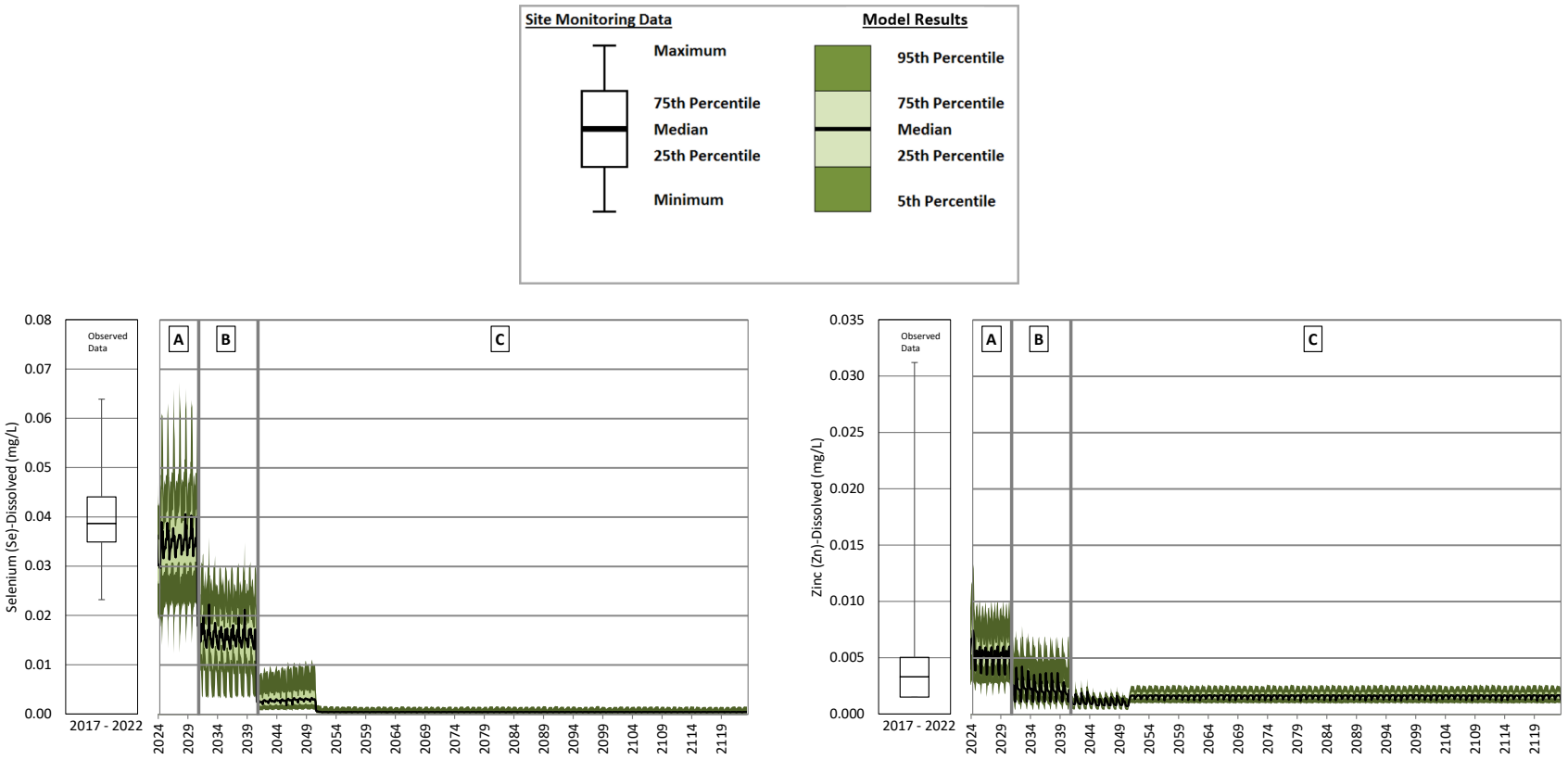

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 16: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

4.2 9 km Sump and Northwest Sump

The 9 km (9K) Sump and the NW Sump receive drainage from undisturbed and disturbed areas in their catchment areas, as well as runoff and seepage from the Temporary NW PAG Stockpile and East RDS. Discharge from the 9K Sump and NW Sump is assumed to be directed to Bootjack Lake during post-closure.

Time series plots for key parameters in the 9K Sump for operations, closure and post-closure are shown in Figures 17 to 22. Time series plots for key parameters in the Northwest Sump for closure and post-closure are shown in Figures 23 to 28. Maximum of median and 95th percentile predictions are presented in Tables 12 and 13 for the 9K Sump and NW Sump, respectively.

Changes in concentrations in the 9K and Northwest Sumps from operations to closure and post-closure are due to remediation of the catchment areas. Trends for all key parameters reach steady state conditions in the 9K Sump and NW Sump 10 years after the start of post-closure when the runoff areas are assumed to be reclaimed (Figures 16 to 21 for the 9K Sump; Figures 22 to 27 for the NW Sump). Concentrations of most parameters gradually decrease as runoff water qualities from all facilities reporting to the 9K Sump are predicted to return to undisturbed water quality (Table 9). After the PAG material has been removed from the 9K Sump catchment area, runoff from the Temporary NW PAG Stockpile is assigned the disturbed runoff water quality and returns to undisturbed after ten years, which causes concentrations of most parameters to decrease.

Seasonal concentration peaks during winter are associated with continued seepage through the reclaimed Temporary NW PAG Stockpile. During winter months, the relative flow contribution of seepage from the Temporary NW PAG Stockpile is high compared to runoff because snowfall is assumed to accumulate on the stockpile and not melt until spring. Seepage from the Temporary NW PAG Stockpile is assigned a PAG water quality input during reclamation and then a NAG water quality input in perpetuity once reclamation is complete. The NAG and PAG water quality in the seepage flows during the winter results in the seasonal winter peaks in concentrations.

The only parameters with predicted maximum concentrations greater in post-closure than closure are total phosphorus, aluminum, arsenic, chromium, iron, lead, silver and silicon. These parameters have higher concentrations in the statistical distributions assigned for undisturbed runoff water quality than the statistical distributions assigned for PAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more flows on the Mine site, which results in predicted concentrations of aluminum, arsenic, chromium, iron, lead, silver and silicon to be higher in post-closure than closure.

Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	759	1,206	592	958	518	887	515	904
Total Dissolved Solids	mg/L	1,124	1,770	852	1,425	741	1,317	738	1,337
Major Ions									
Calcium	mg/L	236	378	183	298	156	272	155	278
Chloride	mg/L	2.5	7.2	2.0	4.6	2.4	7.5	2.5	7.8
Fluoride	mg/L	0.1	0.23	0.093	0.19	0.094	0.19	0.094	0.19
Magnesium	mg/L	41	63	33	52	31	50	31	51
Potassium	mg/L	2.4	5.4	1.5	2.4	1.5	2.4	1.5	2.4
Sodium	mg/L	18	41	12	20	12	20	12	20
Sulphate	mg/L	596	1,068	464	796	376	737	375	735
Nutrients									
Ammonia	mg/L (as N)	0.0091	0.07	0.0052	0.0097	0.0058	0.011	0.0058	0.011
Nitrate	mg/L (as N)	16	35	0.055	0.5	0.046	0.32	0.043	0.32
Nitrite	mg/L (as N)	0.0042	0.018	0.0004	0.0032	0.0005	0.00066	0.0005	0.0005
Total Phosphorus	mg/L	0.027	0.048	0.019	0.03	0.021	0.031	0.022	0.031
Total Metals									
Aluminum	mg/L	0.47	0.5	0.49	0.59	0.063	0.27	0.063	0.28
Antimony	mg/L	0.00023	0.00053	0.00015	0.00043	0.00012	0.00027	0.00012	0.00027
Arsenic	mg/L	0.00075	0.0010	0.00084	0.0012	0.0008	0.0015	0.00082	0.0015
Barium	mg/L	0.056	0.11	0.027	0.053	0.024	0.045	0.024	0.045
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.06	0.24	0.042	0.1	0.036	0.07	0.036	0.072
Cadmium	mg/L	0.000032	0.00027	0.000021	0.00014	0.000019	0.000093	0.000019	0.000096
Chromium	mg/L	0.00072	0.00086	0.00088	0.0011	0.00077	0.0015	0.00078	0.0016
Cobalt	mg/L	0.0004	0.001	0.00034	0.00052	0.000058	0.00032	0.000058	0.00032
Copper	mg/L	0.014	0.16	0.014	0.17	0.0045	0.0088	0.0044	0.0089
Iron	mg/L	0.48	0.62	0.51	0.62	0.12	0.41	0.12	0.42
Lead	mg/L	0.00014	0.00015	0.00014	0.00017	0.000022	0.000097	0.000022	0.00010
Lithium	mg/L	0.0017	0.0062	0.0015	0.0041	0.0016	0.0034	0.0016	0.0034
Manganese	mg/L	0.087	1.5	0.032	0.19	0.016	0.17	0.016	0.17
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.095	0.22	0.067	0.16	0.053	0.13	0.053	0.13
Nickel	mg/L	0.001	0.0015	0.0012	0.0016	0.0008	0.0017	0.00081	0.0018

Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Selenium	mg/L	0.057	0.12	0.036	0.085	0.03	0.071	0.03	0.072
Silver	mg/L	0.0000052	0.000012	0.0000058	0.000015	0.0000059	0.000018	0.0000059	0.000018
Strontium	mg/L	0.96	1.8	0.84	1.6	0.75	1.2	0.76	1.3
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0049	0.0074	0.0049	0.0074
Uranium	mg/L	0.0011	0.0023	0.0007	0.0018	0.00073	0.0015	0.00074	0.0015
Vanadium	mg/L	0.0017	0.002	0.0017	0.002	0.00066	0.0012	0.00066	0.0012
Zinc	mg/L	0.0054	0.0079	0.0085	0.014	0.0014	0.003	0.0011	0.003
Dissolved Metals									
Aluminum	mg/L	0.014	0.047	0.036	0.13	0.035	0.16	0.035	0.17
Antimony	mg/L	0.00021	0.00039	0.00013	0.00029	0.00012	0.00027	0.00012	0.00027
Arsenic	mg/L	0.00047	0.00073	0.00057	0.00092	0.00077	0.0013	0.00079	0.0014
Barium	mg/L	0.053	0.1	0.025	0.044	0.024	0.044	0.024	0.044
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.056	0.21	0.038	0.072	0.036	0.068	0.036	0.07
Cadmium	mg/L	0.00003	0.00023	0.000018	0.000091	0.000017	0.000085	0.000018	0.000088
Chromium	mg/L	0.00034	0.00048	0.0005	0.00072	0.00066	0.001	0.00067	0.0011
Cobalt	mg/L	0.00012	0.00073	0.000061	0.00024	0.000058	0.00024	0.000058	0.00024
Copper	mg/L	0.0057	0.0094	0.0058	0.012	0.0041	0.0073	0.004	0.0073
Iron	mg/L	0.033	0.17	0.07	0.17	0.079	0.23	0.081	0.24
Lead	mg/L	0.000024	0.000037	0.000025	0.000057	0.000022	0.000077	0.000022	0.00008
Lithium	mg/L	0.0015	0.0052	0.0013	0.0031	0.0016	0.0032	0.0016	0.0033
Manganese	mg/L	0.065	1.5	0.01	0.17	0.012	0.16	0.012	0.15
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.095	0.21	0.066	0.15	0.053	0.13	0.053	0.13
Nickel	mg/L	0.00048	0.00098	0.00061	0.001	0.00073	0.0014	0.00074	0.0015
Selenium	mg/L	0.057	0.12	0.036	0.079	0.03	0.071	0.03	0.072
Silicon	mg/L	6.9	8.5	5.8	7.0	5.9	7.9	5.9	8.0
Silver	mg/L	0.0000052	0.0000066	0.0000058	0.000009	0.0000059	0.000011	0.0000059	0.000012
Strontium	mg/L	0.95	1.4	0.83	1.3	0.74	1.2	0.75	1.2
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.005	0.0056	0.005	0.0063	0.0049	0.0074	0.0049	0.0074
Uranium	mg/L	0.001	0.002	0.00068	0.0015	0.00073	0.0015	0.00074	0.0015

Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Vanadium	mg/L	0.00048	0.00085	0.00054	0.00086	0.00051	0.00079	0.00051	0.00081
Zinc	mg/L	0.0027	0.0052	0.0059	0.011	0.0014	0.003	0.0011	0.003

a) Calculated based on predicted calcium and magnesium concentrations.

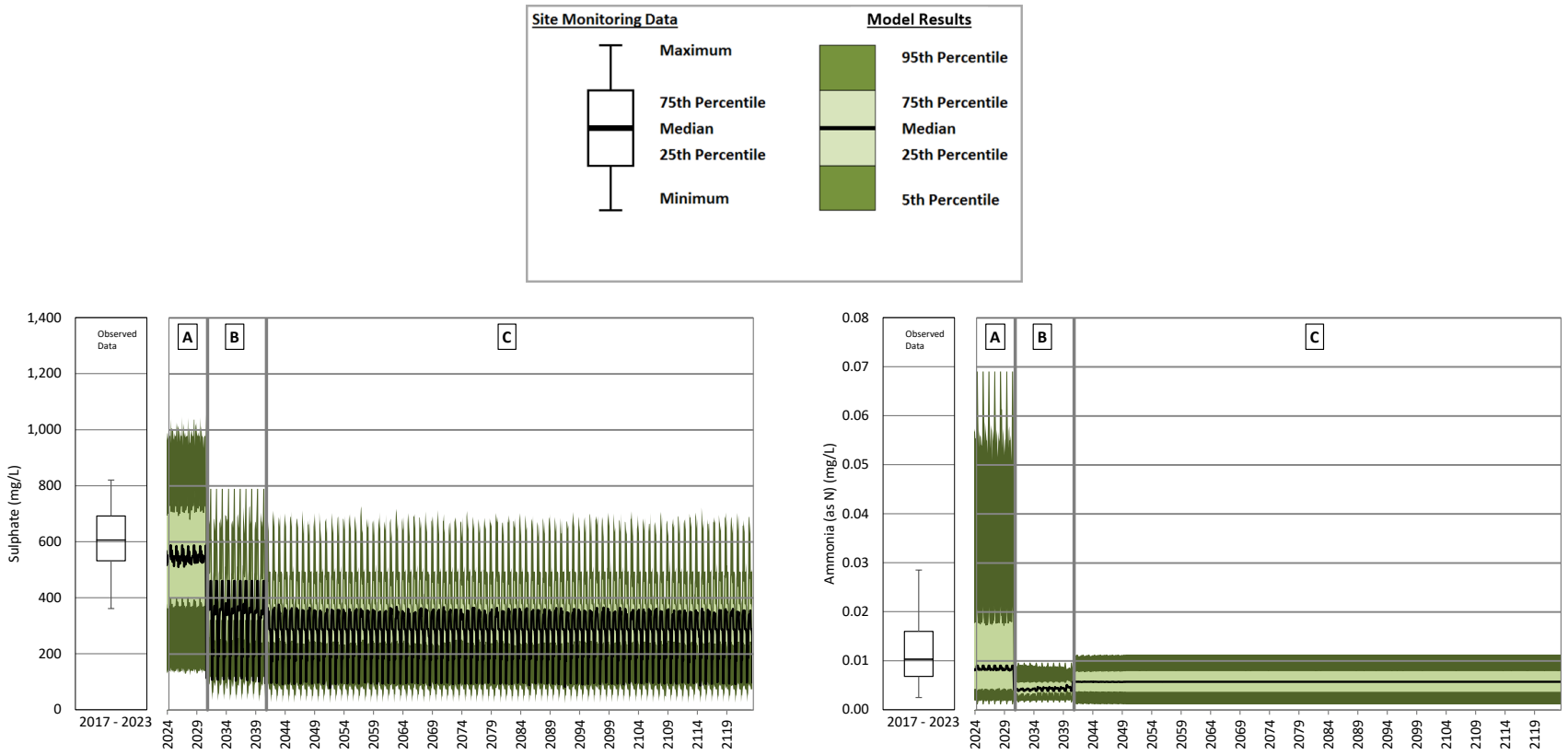

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 17: Predicted Sulphate and Total Ammonia Concentrations in the 9K Sump – Operations, Closure and Post-closure

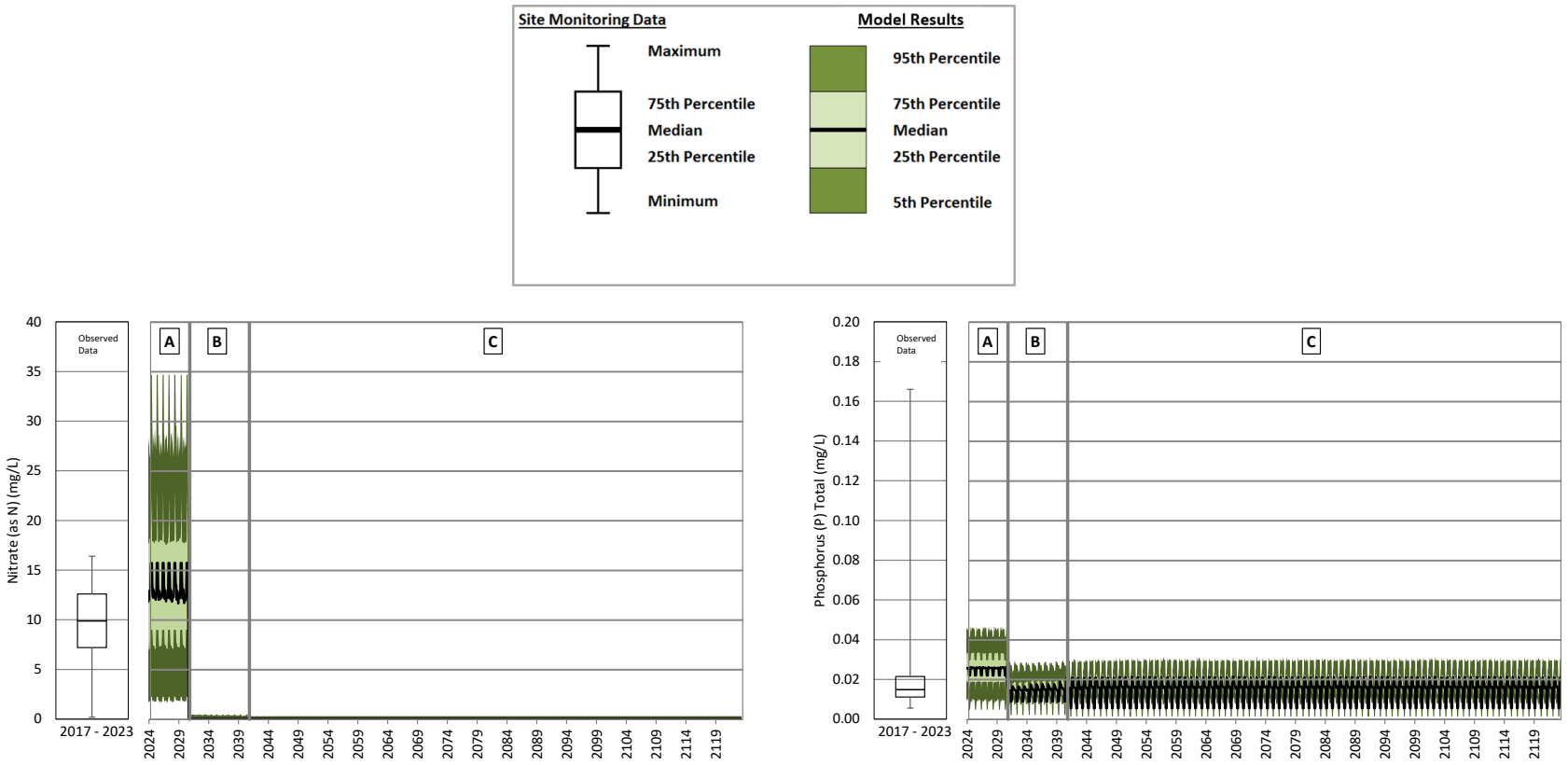

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 18: Predicted Nitrate and Total Phosphorus Concentrations in the 9K Sump – Operations, Closure and Post-closure

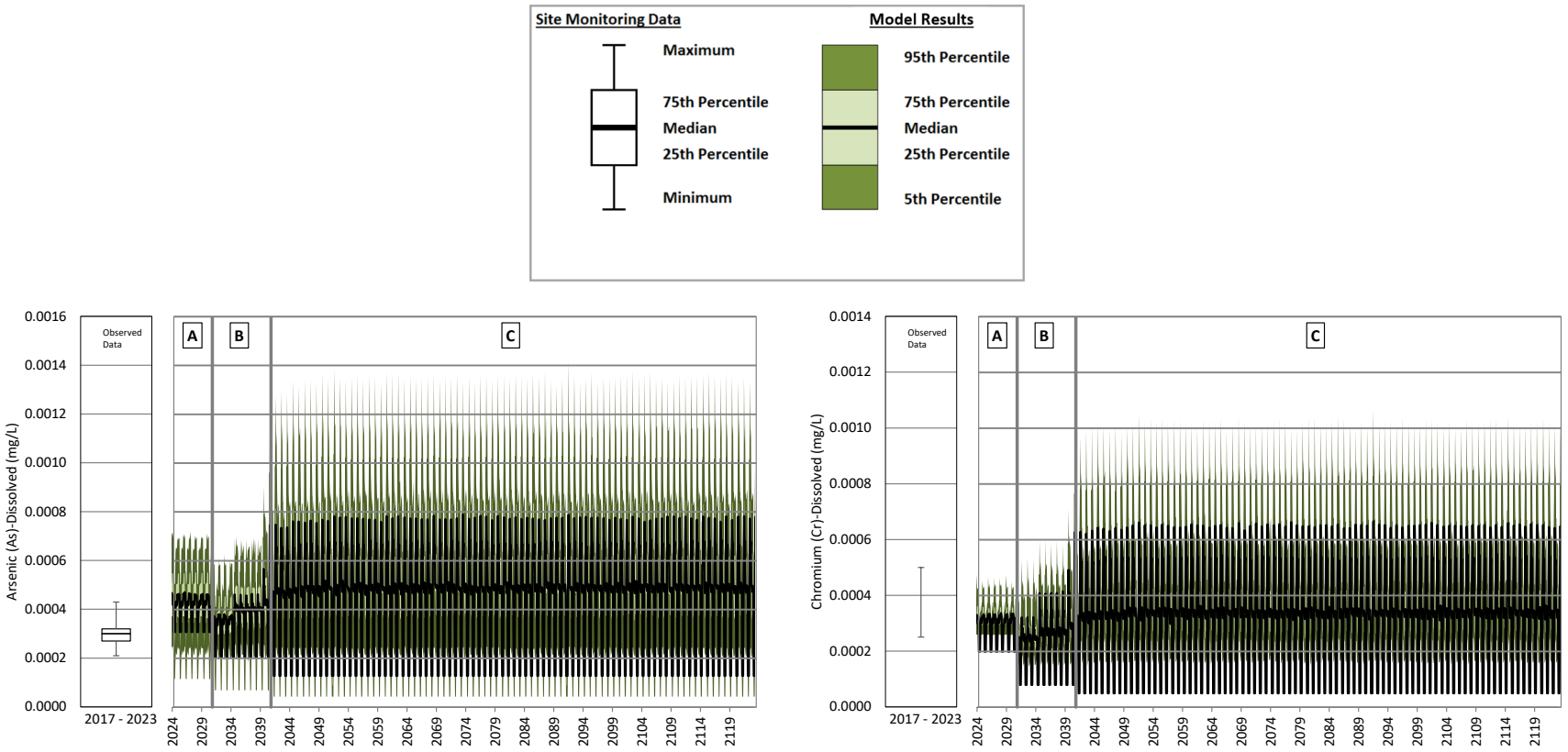

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 19: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the 9K Sump – Operations, Closure and Post-closure

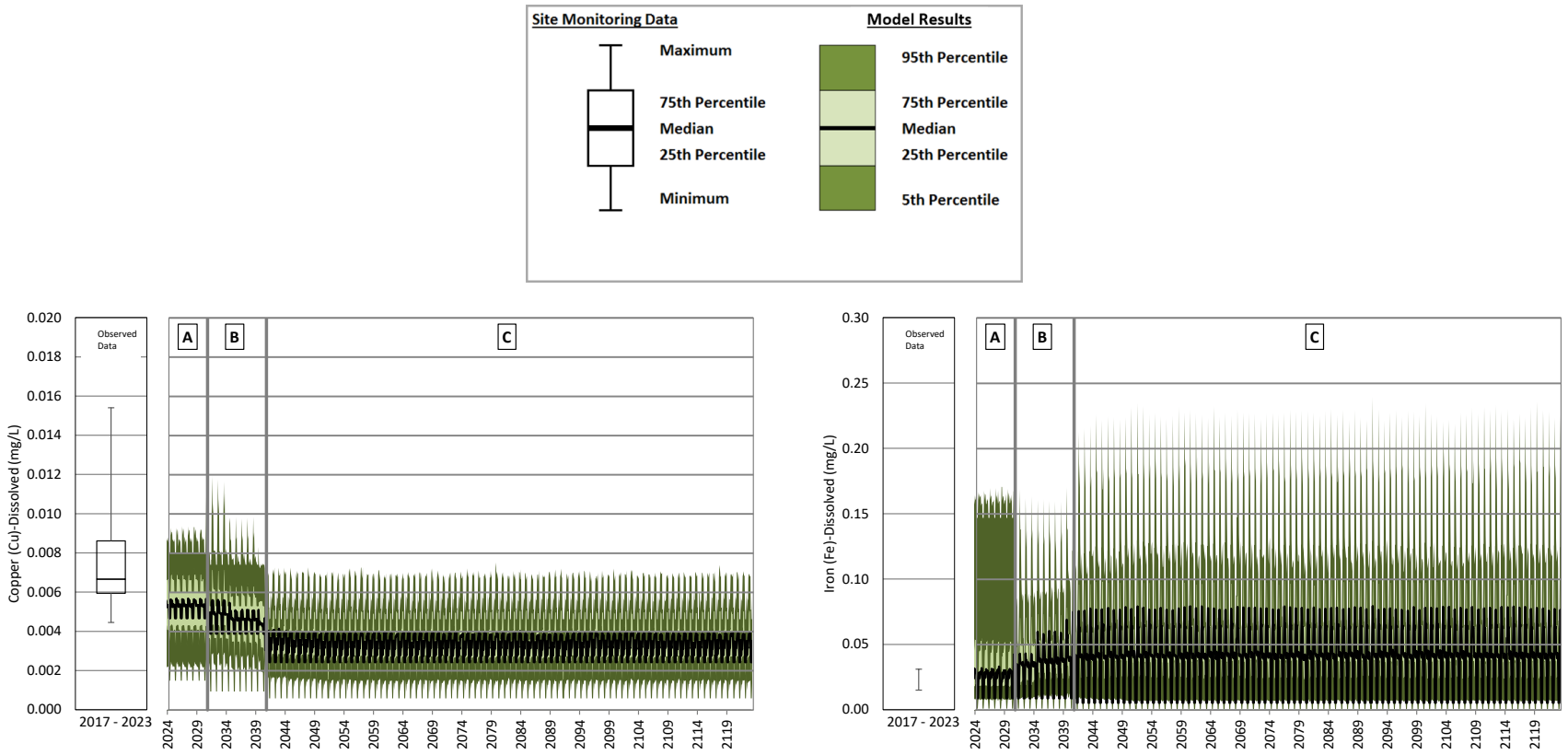

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 20: Predicted Dissolved Copper and Dissolved Iron Concentrations in the 9K Sump – Operations, Closure and Post-closure

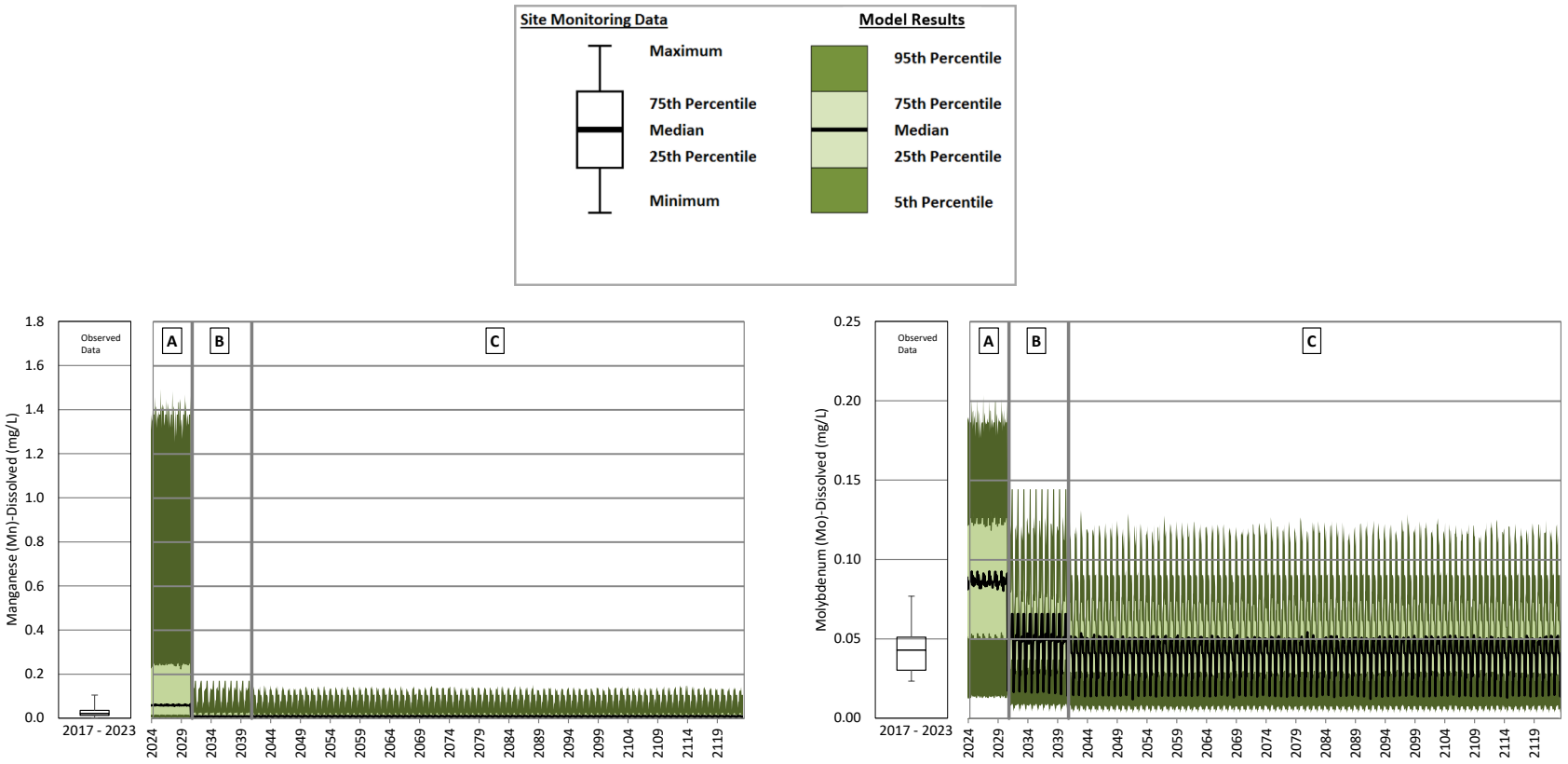

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 21: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the 9K Sump – Operations, Closure and Post-closure

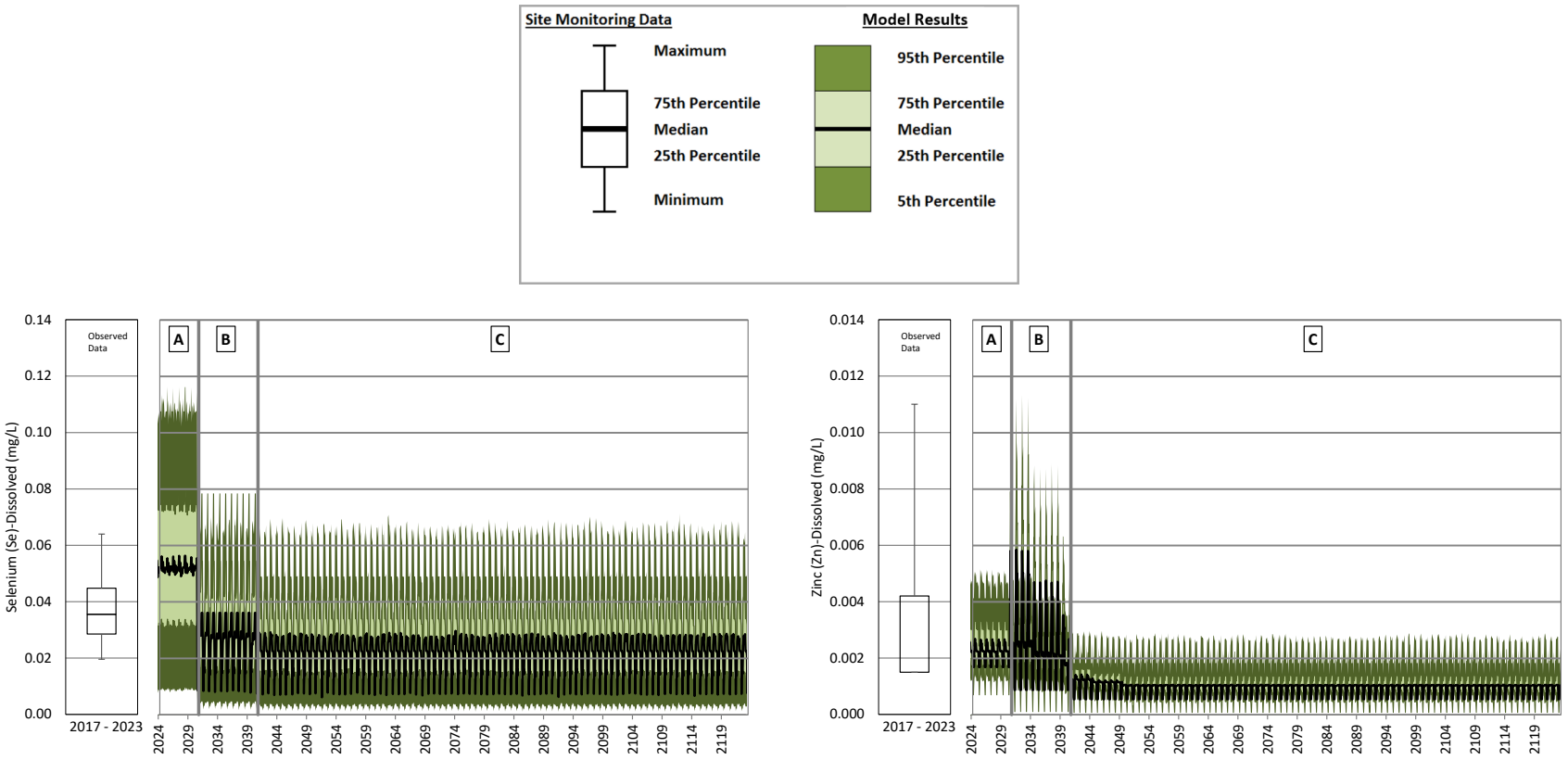

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 22: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the 9K Sump – Operations, Closure and Post-closure

Table 13: Predicted Maximum Concentrations in the Northwest Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	769	1,190	592	958	512	878	505	890
Total Dissolved Solids	mg/L	1,126	1,757	852	1,425	730	1,304	724	1,311
Major Ions									
Calcium	mg/L	240	374	183	298	155	270	152	273
Chloride	mg/L	2.4	7.1	2.0	4.4	2.4	7.7	2.5	8.0
Fluoride	mg/L	0.12	0.23	0.099	0.19	0.094	0.19	0.094	0.19
Magnesium	mg/L	42	62	33	52	30	50	30	51
Potassium	mg/L	2.4	5.2	1.5	2.4	1.5	2.4	1.5	2.4
Sodium	mg/L	18	40	12	20	12	20	12	20
Sulphate	mg/L	602	1,053	464	796	373	734	366	726
Nutrients									
Ammonia	mg/L (as N)	0.0091	0.07	0.005	0.0097	0.0058	0.011	0.0058	0.011
Nitrate	mg/L (as N)	16	35	0.37	3.8	0.051	0.32	0.043	0.32
Nitrite	mg/L (as N)	0.0042	0.018	0.00069	0.0033	0.0005	0.00086	0.0005	0.0005
Total Phosphorus	mg/L	0.026	0.047	0.019	0.03	0.022	0.032	0.022	0.032
Total Metals									
Aluminum	mg/L	0.47	0.49	0.49	0.58	0.066	0.27	0.064	0.29
Antimony	mg/L	0.00023	0.00053	0.00015	0.00043	0.00012	0.00027	0.00012	0.00026
Arsenic	mg/L	0.00072	0.00095	0.00082	0.0011	0.00082	0.0015	0.00084	0.0015
Barium	mg/L	0.055	0.11	0.028	0.053	0.024	0.045	0.024	0.045
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.061	0.23	0.043	0.1	0.036	0.07	0.036	0.071
Cadmium	mg/L	0.000038	0.00026	0.000022	0.00014	0.000018	0.000091	0.000019	0.000094
Chromium	mg/L	0.0007	0.00079	0.00084	0.001	0.0008	0.0016	0.00079	0.0016
Cobalt	mg/L	0.00042	0.0010	0.00035	0.00053	0.000059	0.00031	0.000058	0.00032
Copper	mg/L	0.015	0.17	0.015	0.17	0.0047	0.0091	0.0043	0.0088
Iron	mg/L	0.47	0.61	0.51	0.61	0.12	0.42	0.13	0.43
Lead	mg/L	0.00014	0.00014	0.00014	0.00016	0.000023	0.000098	0.000022	0.0001
Lithium	mg/L	0.0018	0.0061	0.0015	0.0041	0.0016	0.0033	0.0016	0.0034
Manganese	mg/L	0.089	1.5	0.034	0.19	0.015	0.17	0.016	0.17
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.096	0.21	0.067	0.16	0.053	0.13	0.052	0.13
Nickel	mg/L	0.001	0.0015	0.0012	0.0016	0.0008	0.0018	0.00082	0.0018
Selenium	mg/L	0.058	0.12	0.036	0.085	0.03	0.071	0.029	0.071
Silver	mg/L	0.0000054	0.000012	0.0000059	0.000014	0.000006	0.000018	0.000006	0.000019

Table 13: Predicted Maximum Concentrations in the Northwest Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	1.1	1.9	0.84	1.6	0.74	1.2	0.74	1.2
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0049	0.0074	0.0049	0.0075
Uranium	mg/L	0.0011	0.0022	0.00071	0.0018	0.00073	0.0015	0.00074	0.0015
Vanadium	mg/L	0.0017	0.002	0.0017	0.002	0.00067	0.0012	0.00067	0.0012
Zinc	mg/L	0.0058	0.0081	0.0088	0.014	0.002	0.0033	0.0011	0.0029
Dissolved Metals									
Aluminum	mg/L	0.013	0.038	0.034	0.13	0.038	0.16	0.036	0.17
Antimony	mg/L	0.00021	0.00039	0.00013	0.00029	0.00012	0.00027	0.00012	0.00026
Arsenic	mg/L	0.00044	0.00067	0.00055	0.00086	0.00079	0.0014	0.00081	0.0014
Barium	mg/L	0.053	0.099	0.026	0.044	0.024	0.043	0.024	0.043
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.057	0.2	0.039	0.073	0.036	0.068	0.036	0.069
Cadmium	mg/L	0.000036	0.00022	0.00002	0.000091	0.000017	0.000083	0.000018	0.000086
Chromium	mg/L	0.00031	0.00041	0.00046	0.00066	0.00069	0.001	0.00068	0.0011
Cobalt	mg/L	0.00014	0.00072	0.000068	0.00025	0.000059	0.00024	0.000058	0.00024
Copper	mg/L	0.0065	0.011	0.0067	0.015	0.0044	0.0075	0.004	0.0072
Iron	mg/L	0.028	0.17	0.068	0.16	0.081	0.23	0.083	0.24
Lead	mg/L	0.000025	0.000034	0.000026	0.000053	0.000023	0.000078	0.000022	0.000081
Lithium	mg/L	0.0016	0.0051	0.0013	0.0031	0.0016	0.0031	0.0016	0.0033
Manganese	mg/L	0.068	1.4	0.012	0.17	0.012	0.15	0.012	0.15
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.096	0.2	0.066	0.15	0.053	0.13	0.052	0.13
Nickel	mg/L	0.00047	0.00096	0.0006	0.001	0.00073	0.0015	0.00075	0.0015
Selenium	mg/L	0.058	0.12	0.036	0.079	0.029	0.071	0.029	0.07
Silicon	mg/L	6.9	8.4	5.8	7.0	5.9	8.0	5.9	8.0
Silver	mg/L	0.0000054	0.0000065	0.0000059	0.0000088	0.000006	0.000012	0.000006	0.000012
Strontium	mg/L	1.1	1.5	0.83	1.3	0.73	1.2	0.74	1.2
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0054	0.0056	0.0054	0.0065	0.0049	0.0074	0.0049	0.0075
Uranium	mg/L	0.0011	0.002	0.00069	0.0015	0.00073	0.0014	0.00074	0.0015
Vanadium	mg/L	0.00047	0.00084	0.00053	0.00085	0.00052	0.00081	0.00052	0.00082
Zinc	mg/L	0.0031	0.0055	0.0061	0.011	0.002	0.0033	0.0011	0.0029

a) Calculated based on predicted calcium and magnesium concentrations.

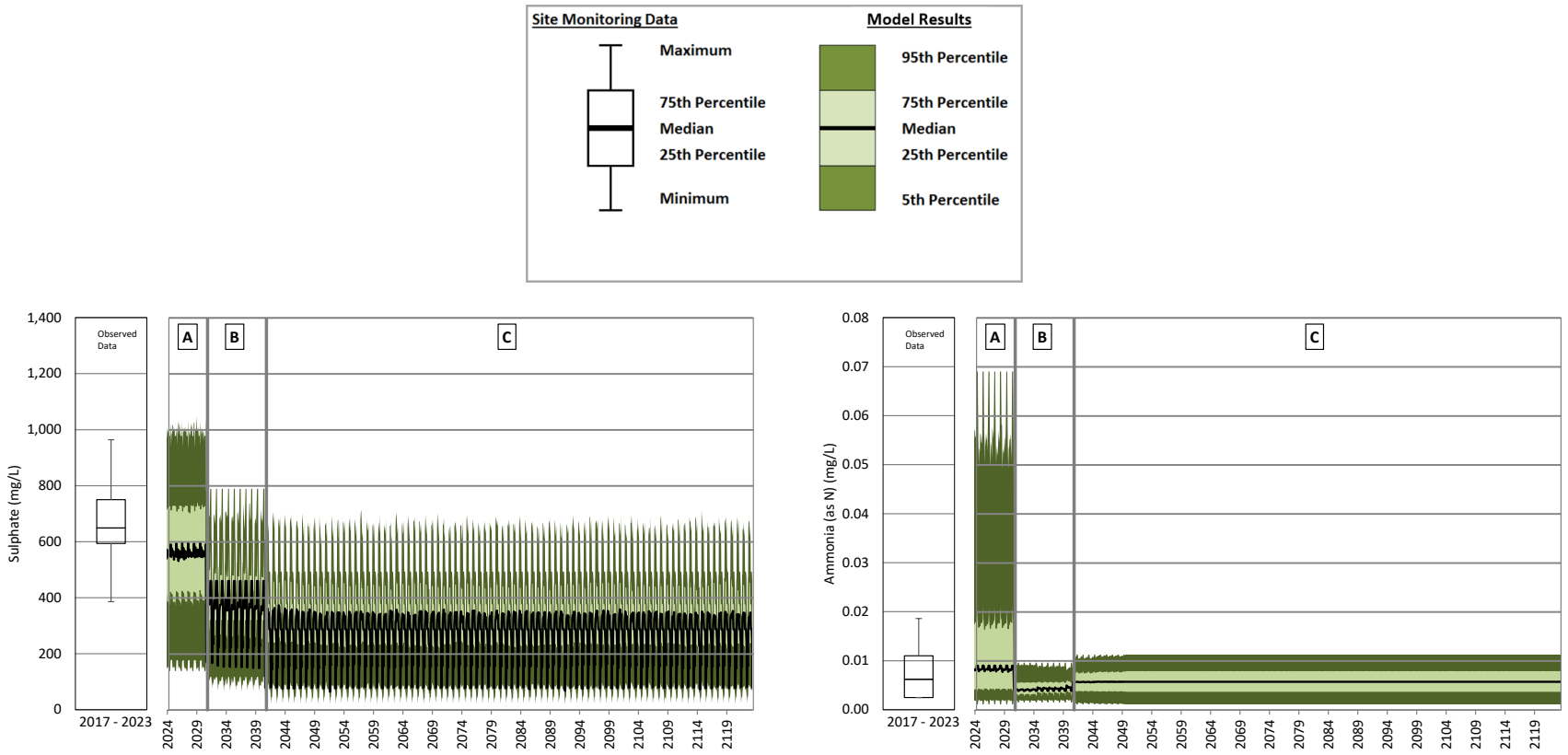

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 23: Predicted Sulphate and Total Ammonia Concentrations in the Northwest Sump – Operations, Closure and Post-closure

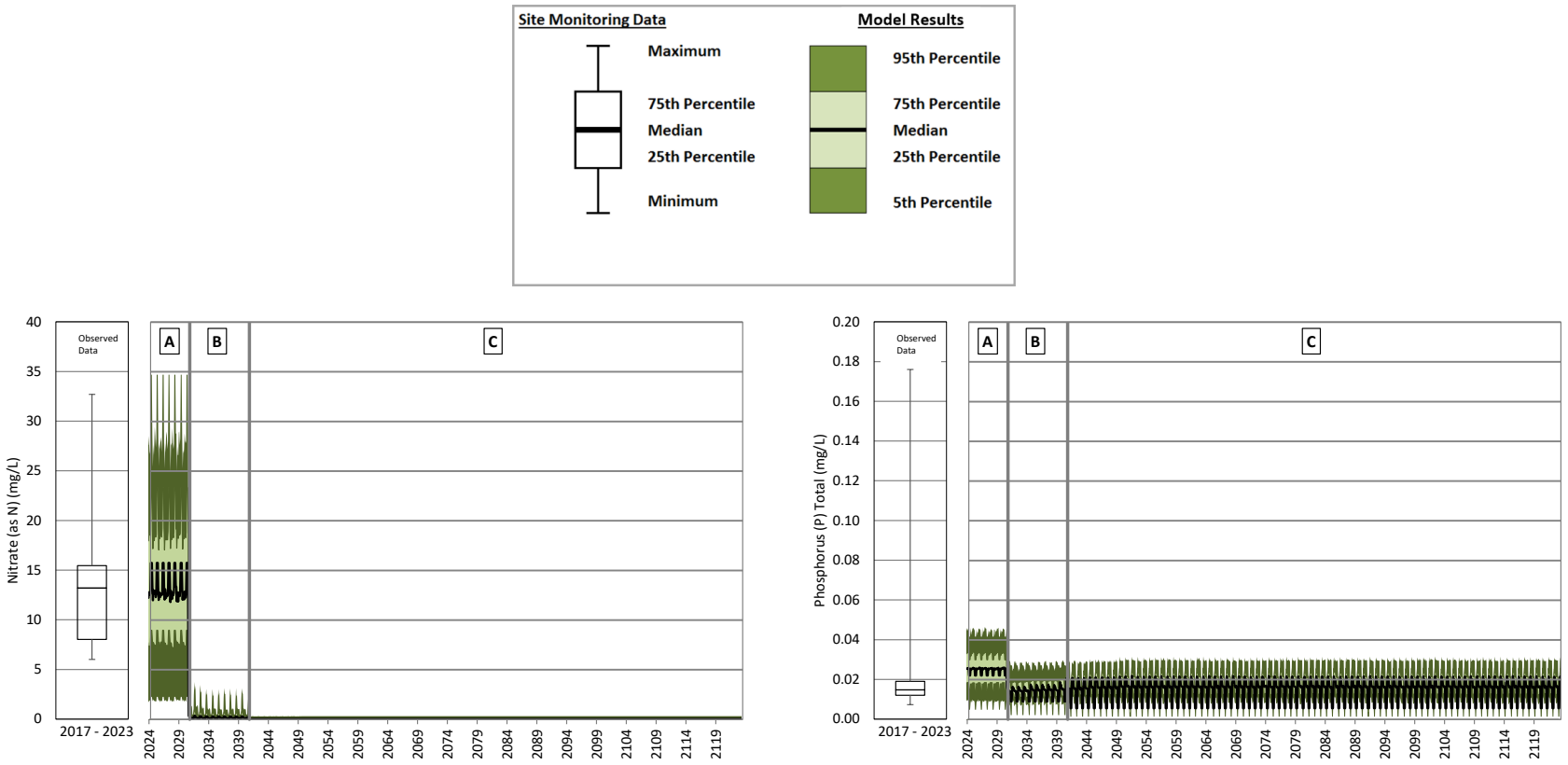

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 24: Predicted Nitrate and Total Phosphorus Concentrations in the Northwest Sump – Operations, Closure and Post-closure

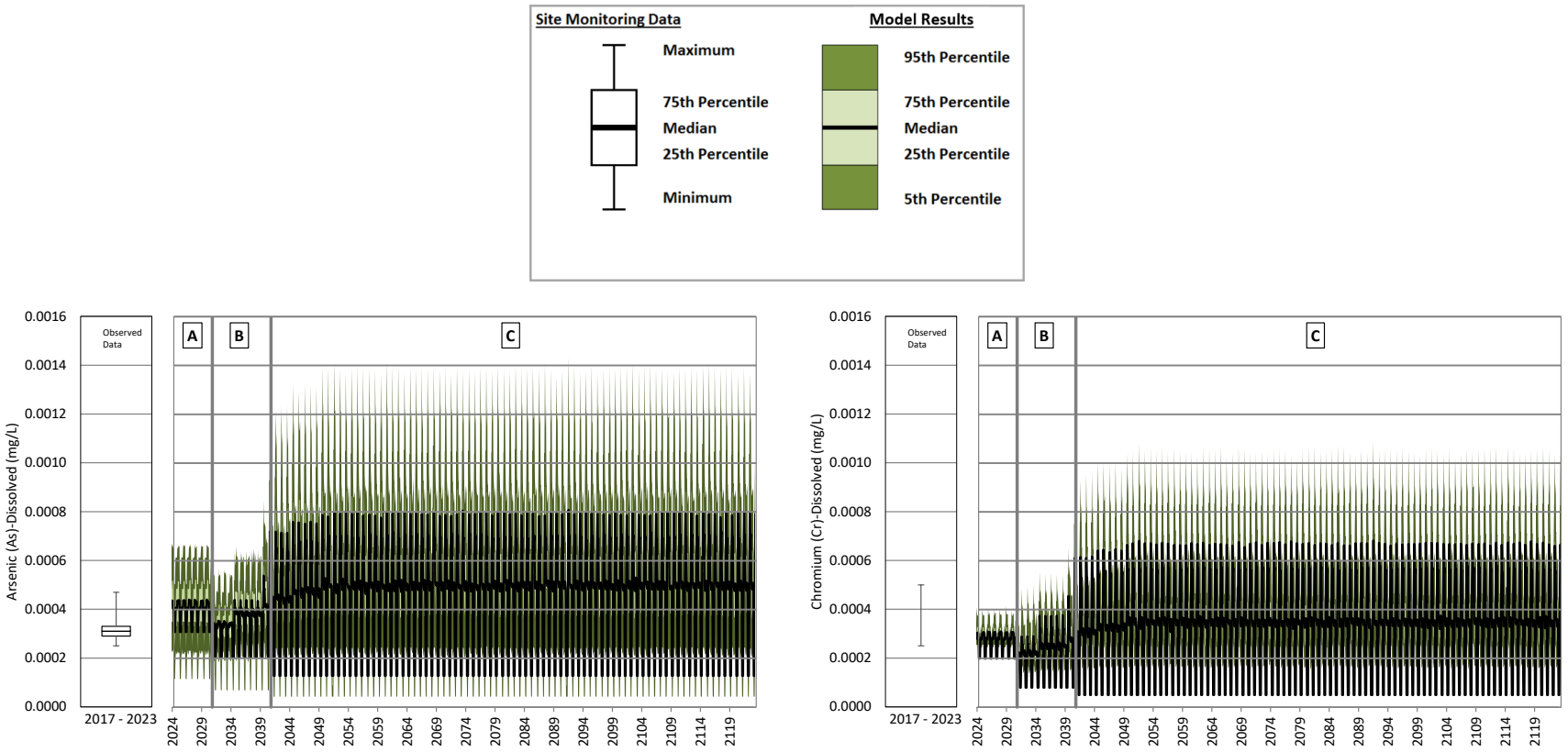

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 25: Predicted Total Arsenic and Total Chromium Concentrations in the Northwest Sump – Operations, Closure and Post-closure

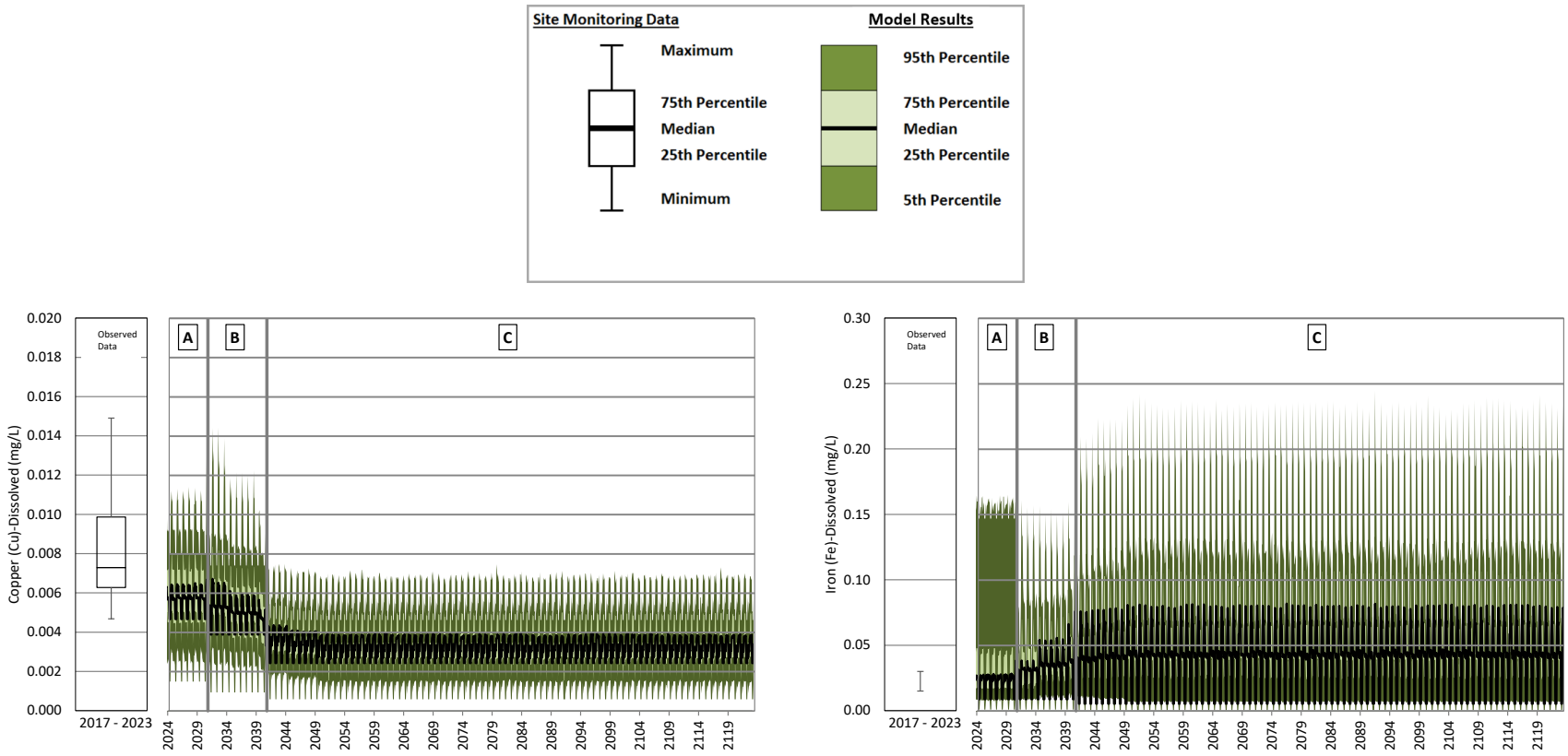

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 26: Predicted Total Copper and Total Iron Concentrations in the Northwest Sump – Operations, Closure and Post-closure

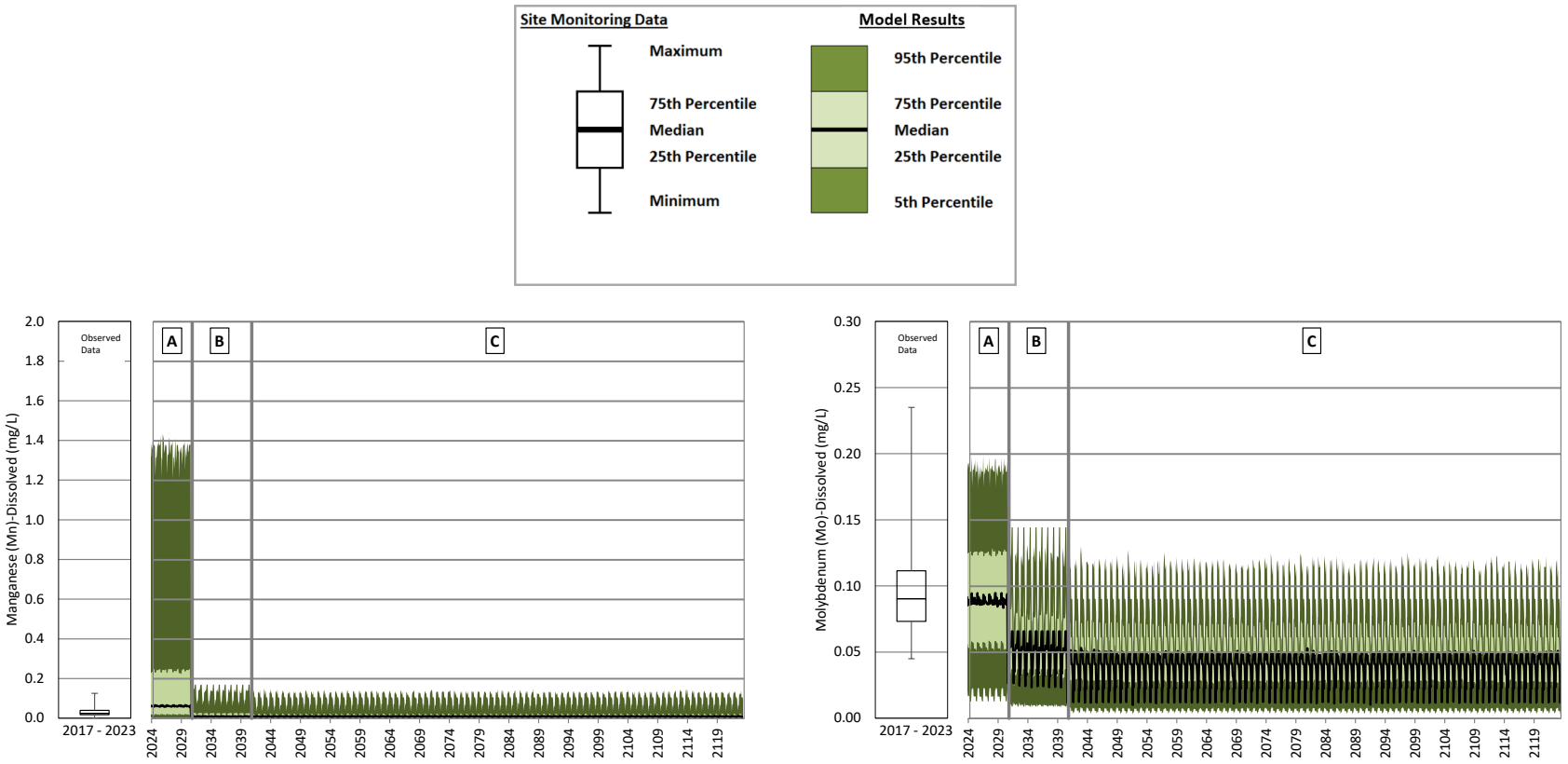

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 27: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Northwest Sump – Operations, Closure and Post-closure

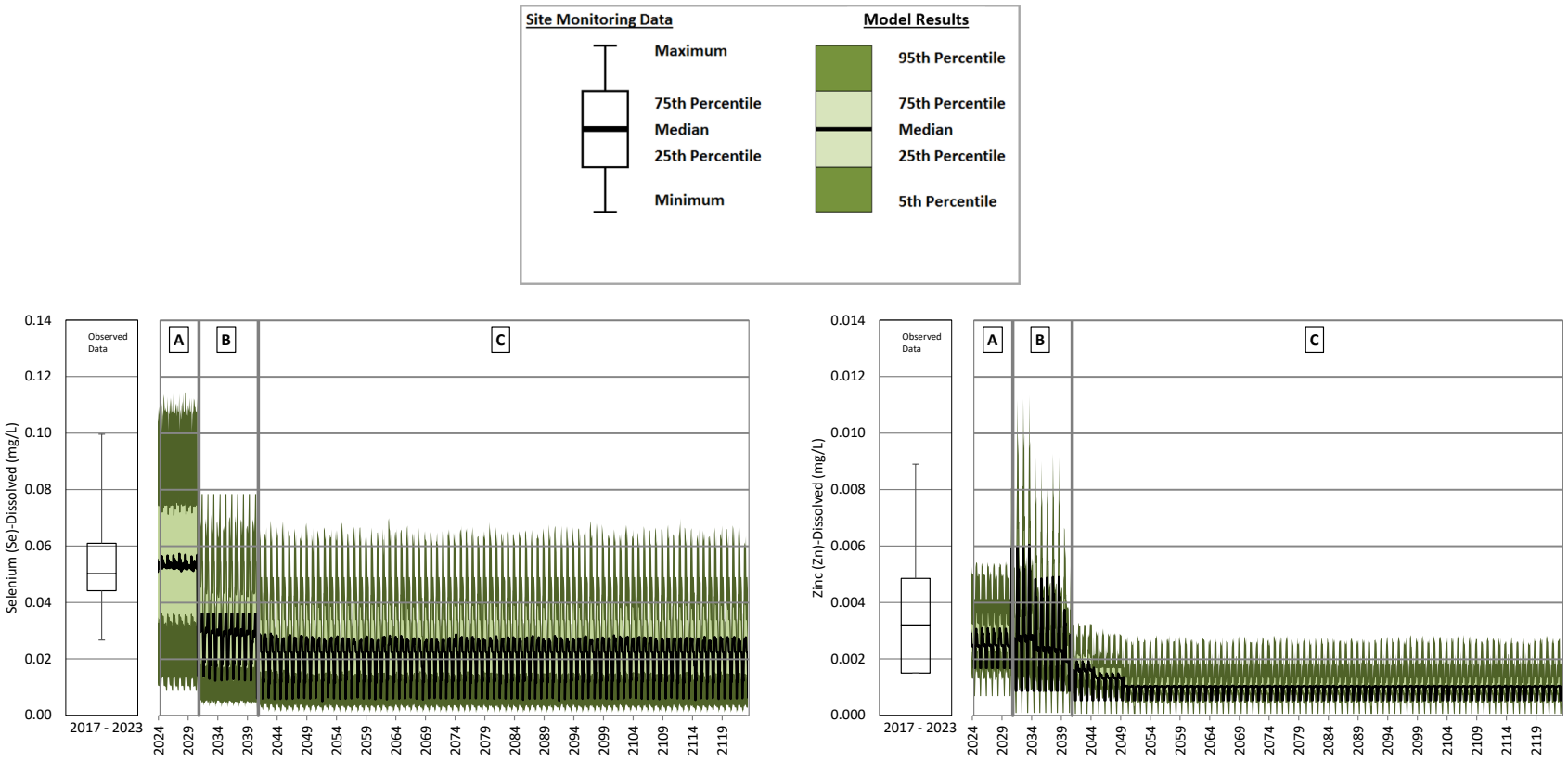

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 28: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Northwest Sump – Operations, Closure and Post-closure

4.3 Springer-Cariboo Pit

At closure, the PAG material from the Temporary NW PAG Stockpile will be placed in the Springer-Cariboo Pit, and a pit lake will form. The pit will fill passively with groundwater and surface runoff from the pit catchment area. The groundwater inflow to the pit is assumed to flow into the stored PAG material in closure and post-closure. The surface runoff includes runoff and seepage from North Bell RDS, East RDS, and the haul roads. These facilities will be reclaimed during closure. The pit lake is predicted to completely fill between 2059 (99.5th percentile of the 2000 water balance model simulations) and 2063 (mean of the 2000 water balance model simulations), at which point, overflow from the pit will discharge to Bootjack Lake.

Time series plots for key parameters in the Springer-Cariboo Pit for closure and post-closure are shown in Figures 29 to 34. Maximum of median and 95th percentile predictions are presented in Table 14. It is anticipated that particulate metals such as aluminum and copper will be lower in pit lake waters compared to model predictions, as has been observed in operational monitoring (Golder 2016b).

Peak concentrations for most parameters are predicted to occur during the closure period because:

- The PAG material in the Springer-Cariboo Pit contains pore water with a NAG Seep water quality (Table 9).
- The groundwater inflow to the pit, which has a groundwater water quality (Table 9), is assumed to flow into the PAG material and displace the pore water upwards into the forming pit lake.
- The displacement of pore water from the PAG material into the pit lake causes pit lake concentrations to peak in closure.

The only parameters with predicted maximum concentrations greater in post-closure than closure are aluminum, chromium, iron, and lead. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to a greater proportion of the total inflows to the Springer-Cariboo pit.

Table 14: Predicted Maximum Concentrations in the Springer-Caribou Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	539	781	580	822	533	739	448	629
Total Dissolved Solids	mg/L	798	1,177	858	1,238	796	1,139	659	954
Major Ions									
Calcium	mg/L	167	245	178	251	163	223	135	189
Chloride	mg/L	3.6	9.2	3.8	5.2	3.8	5.1	3.0	4.4
Fluoride	mg/L	0.21	0.29	0.29	0.41	0.28	0.39	0.21	0.31
Magnesium	mg/L	30	41	33	48	31	44	27	38
Potassium	mg/L	3.0	4.9	2.7	3.9	2.7	3.8	1.9	2.7
Sodium	mg/L	21	31	19	24	18	23	14	18
Sulphate	mg/L	417	686	475	687	432	628	343	510
Nutrients									
Ammonia	mg/L (as N)	0.023	0.053	0.024	0.04	0.024	0.039	0.015	0.023
Nitrate	mg/L (as N)	8.9	19	4.5	9.1	2.0	5.1	1.1	2.8
Nitrite	mg/L (as N)	0.011	0.022	0.011	0.022	0.010	0.02	0.0056	0.011
Total Phosphorus	mg/L	0.021	0.033	0.017	0.032	0.016	0.031	0.016	0.029
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.049	0.17	0.049	0.19
Antimony	mg/L	0.00035	0.00065	0.0005	0.00083	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0015	0.0025	0.0011	0.0014	0.00068	0.001	0.00062	0.00093
Barium	mg/L	0.044	0.078	0.038	0.057	0.034	0.046	0.027	0.038
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.3	0.097	0.17	0.069	0.093	0.051	0.072
Cadmium	mg/L	0.000029	0.00018	0.000046	0.00022	0.000041	0.00017	0.000034	0.00015
Chromium	mg/L	0.00065	0.00071	0.00063	0.00073	0.00042	0.00092	0.0005	0.0011
Cobalt	mg/L	0.00039	0.00073	0.00041	0.00092	0.00012	0.00067	0.000092	0.00059
Copper	mg/L	0.015	0.17	0.021	0.19	0.012	0.033	0.0095	0.028
Iron	mg/L	0.47	0.55	0.48	0.54	0.087	0.27	0.088	0.3
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000057	0.000023	0.000065
Lithium	mg/L	0.0038	0.0068	0.0042	0.0067	0.0039	0.0057	0.0028	0.0044
Manganese	mg/L	0.072	0.87	0.061	0.27	0.031	0.22	0.024	0.19
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051

Table 14: Predicted Maximum Concentrations in the Springer-Caribou Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.081	0.15	0.1	0.16	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00098	0.0012	0.001	0.0022	0.00059	0.0019	0.00061	0.0018
Selenium	mg/L	0.038	0.077	0.044	0.081	0.04	0.069	0.031	0.056
Silver	mg/L	0.000005	0.000012	0.0000061	0.000014	0.0000061	0.000015	0.000006	0.000015
Strontium	mg/L	0.98	1.7	1.9	3.4	1.8	2.9	1.4	2.4
Thallium	mg/L	0.0000048	0.0000056	0.0000051	0.0000059	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00014	0.000051	0.00013	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.024	0.026	0.026	0.027	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00093	0.0017	0.0012	0.0035	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.0018	0.0024	0.002	0.0024	0.00097	0.0015	0.00082	0.0013
Zinc	mg/L	0.0059	0.0079	0.0072	0.013	0.0039	0.0092	0.003	0.0075
Dissolved Metals									
Aluminum	mg/L	0.013	0.042	0.017	0.07	0.021	0.057	0.021	0.077
Antimony	mg/L	0.00033	0.00051	0.00048	0.00069	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0012	0.0022	0.00084	0.0012	0.00065	0.00091	0.00059	0.00083
Barium	mg/L	0.042	0.069	0.036	0.048	0.034	0.045	0.027	0.036
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.27	0.093	0.14	0.069	0.091	0.051	0.07
Cadmium	mg/L	0.000027	0.00013	0.000044	0.00018	0.00004	0.00016	0.000032	0.00014
Chromium	mg/L	0.00027	0.00032	0.00024	0.00034	0.00031	0.0004	0.00039	0.00056
Cobalt	mg/L	0.00011	0.00045	0.00013	0.00064	0.00012	0.0006	0.000092	0.00051
Copper	mg/L	0.0063	0.011	0.012	0.035	0.012	0.032	0.0091	0.026
Iron	mg/L	0.027	0.11	0.033	0.095	0.043	0.087	0.044	0.11
Lead	mg/L	0.000024	0.000028	0.000026	0.000031	0.000025	0.000037	0.000023	0.000045
Lithium	mg/L	0.0036	0.0058	0.004	0.0057	0.0039	0.0056	0.0028	0.0043
Manganese	mg/L	0.051	0.85	0.04	0.25	0.027	0.2	0.02	0.18
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.14	0.1	0.15	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00043	0.0007	0.00049	0.0016	0.00052	0.0015	0.00054	0.0015
Selenium	mg/L	0.038	0.071	0.044	0.075	0.04	0.069	0.031	0.056
Silicon	mg/L	6.7	7.7	5.9	6.7	5.7	6.7	5.5	6.4
Silver	mg/L	0.000005	0.0000059	0.0000061	0.0000084	0.0000061	0.0000081	0.000006	0.0000079
Strontium	mg/L	0.96	1.3	1.9	3.1	1.8	2.8	1.4	2.3
Thallium	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051

Table 14: Predicted Maximum Concentrations in the Springer-Caribou Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.000049	0.00006	0.000051	0.000053	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.0055	0.0072	0.0074	0.0085	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00091	0.0014	0.0011	0.0032	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.00059	0.0012	0.00083	0.0012	0.00082	0.0011	0.00067	0.00091
Zinc	mg/L	0.0032	0.0053	0.0045	0.01	0.0039	0.0092	0.003	0.0075

a) Calculated based on predicted calcium and magnesium concentrations

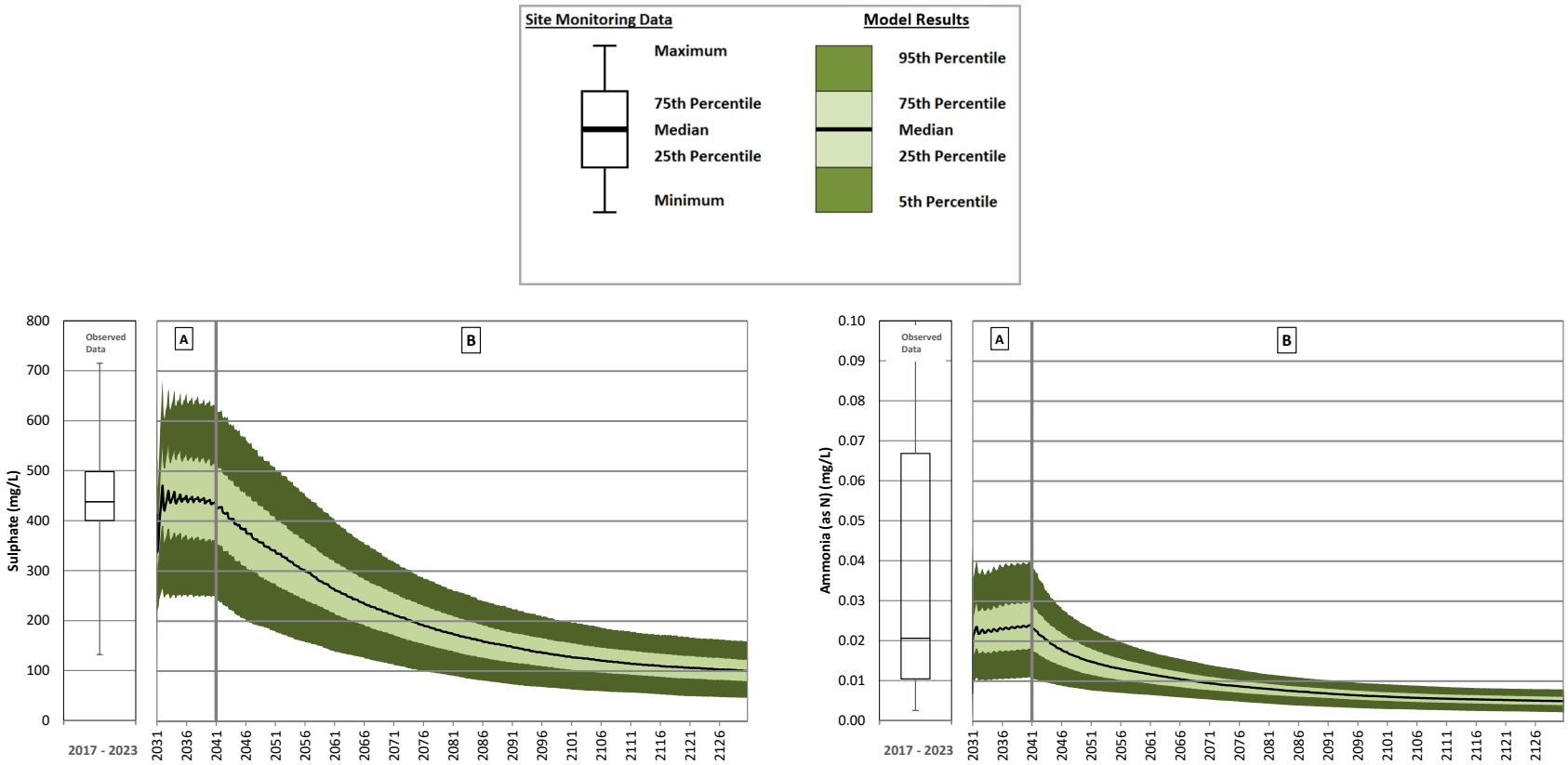

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 29: Predicted Sulphate and Total Ammonia Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

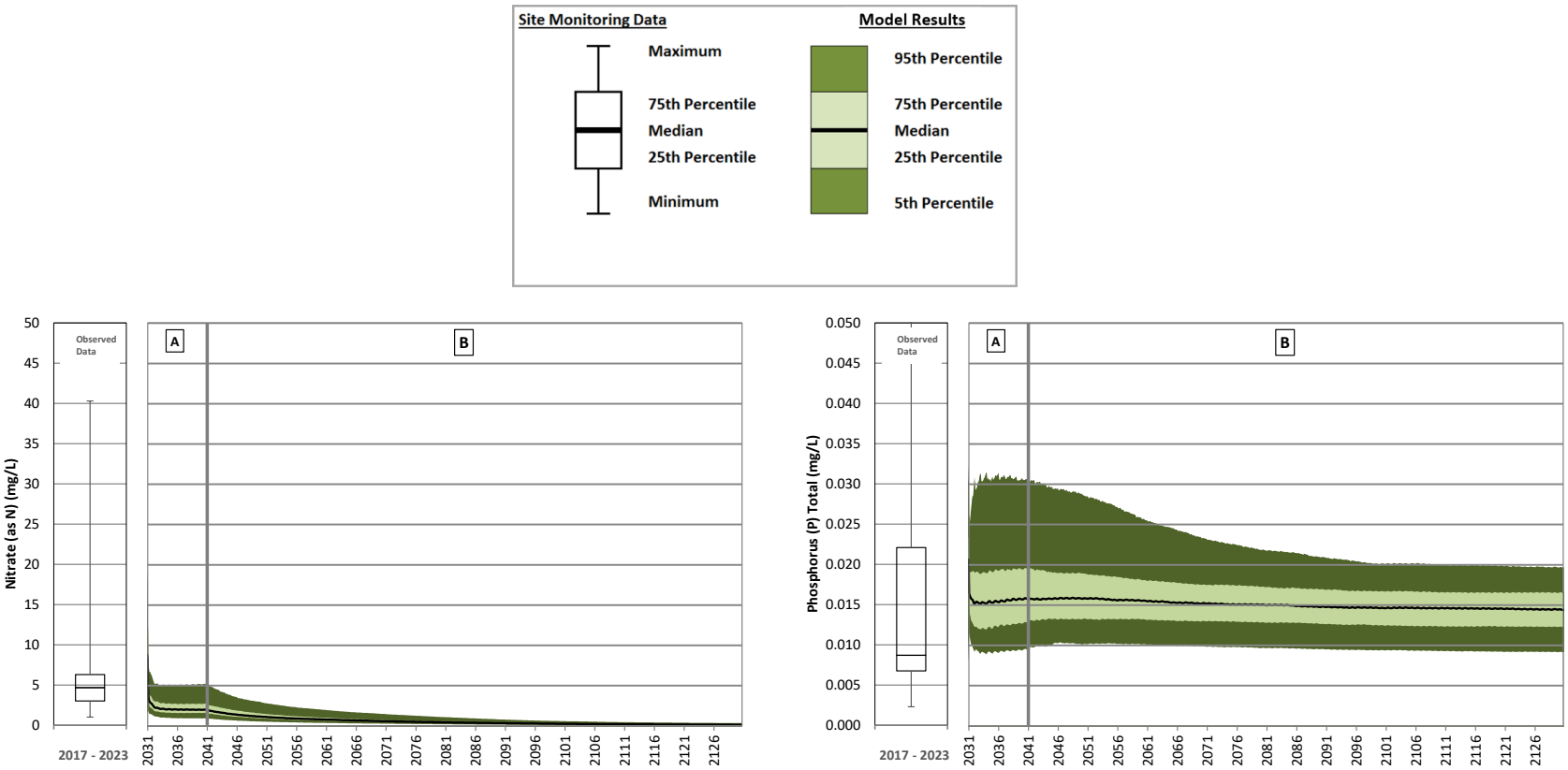

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 30: Predicted Nitrate and Total Phosphorus Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

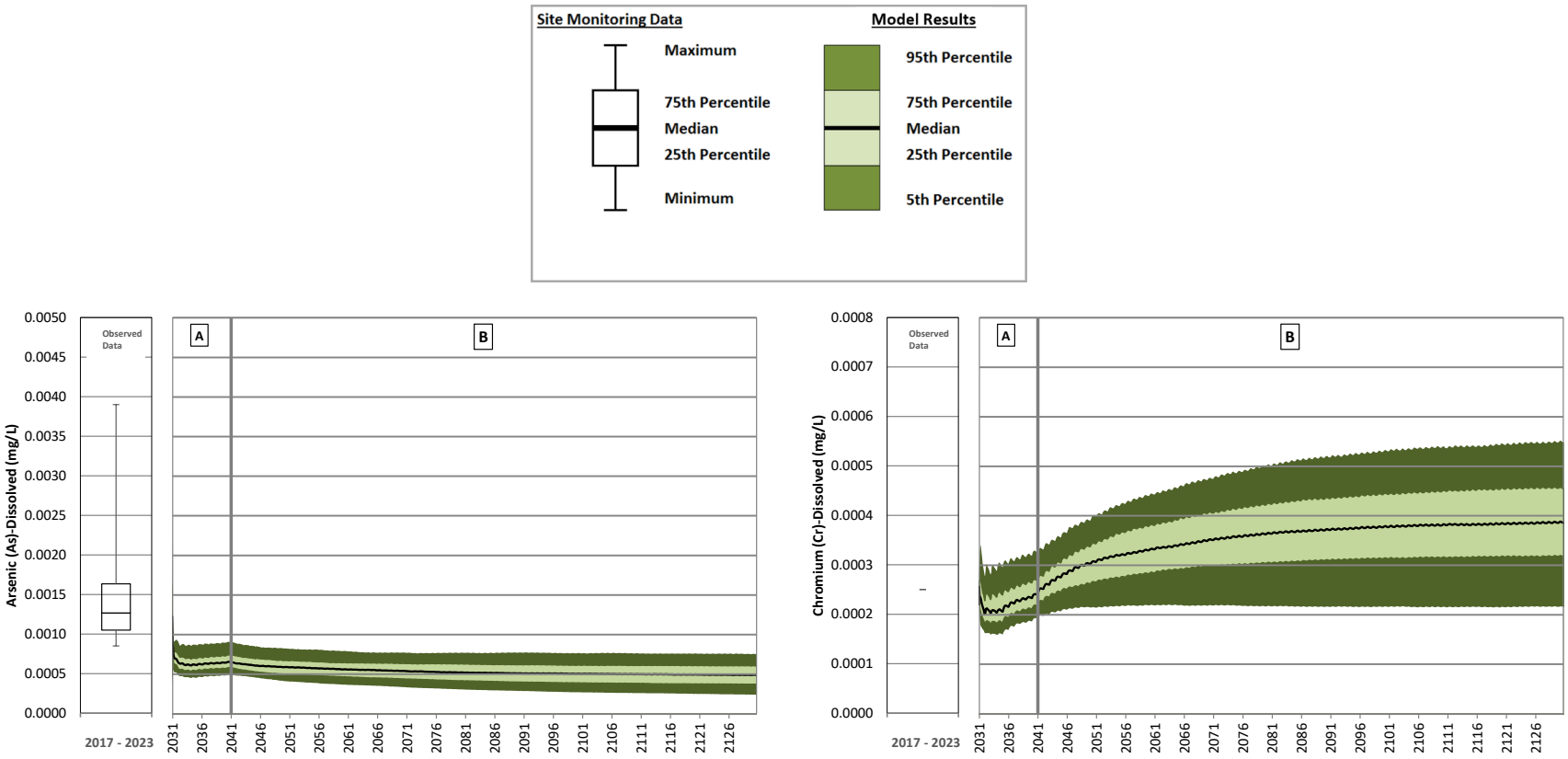

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 31: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

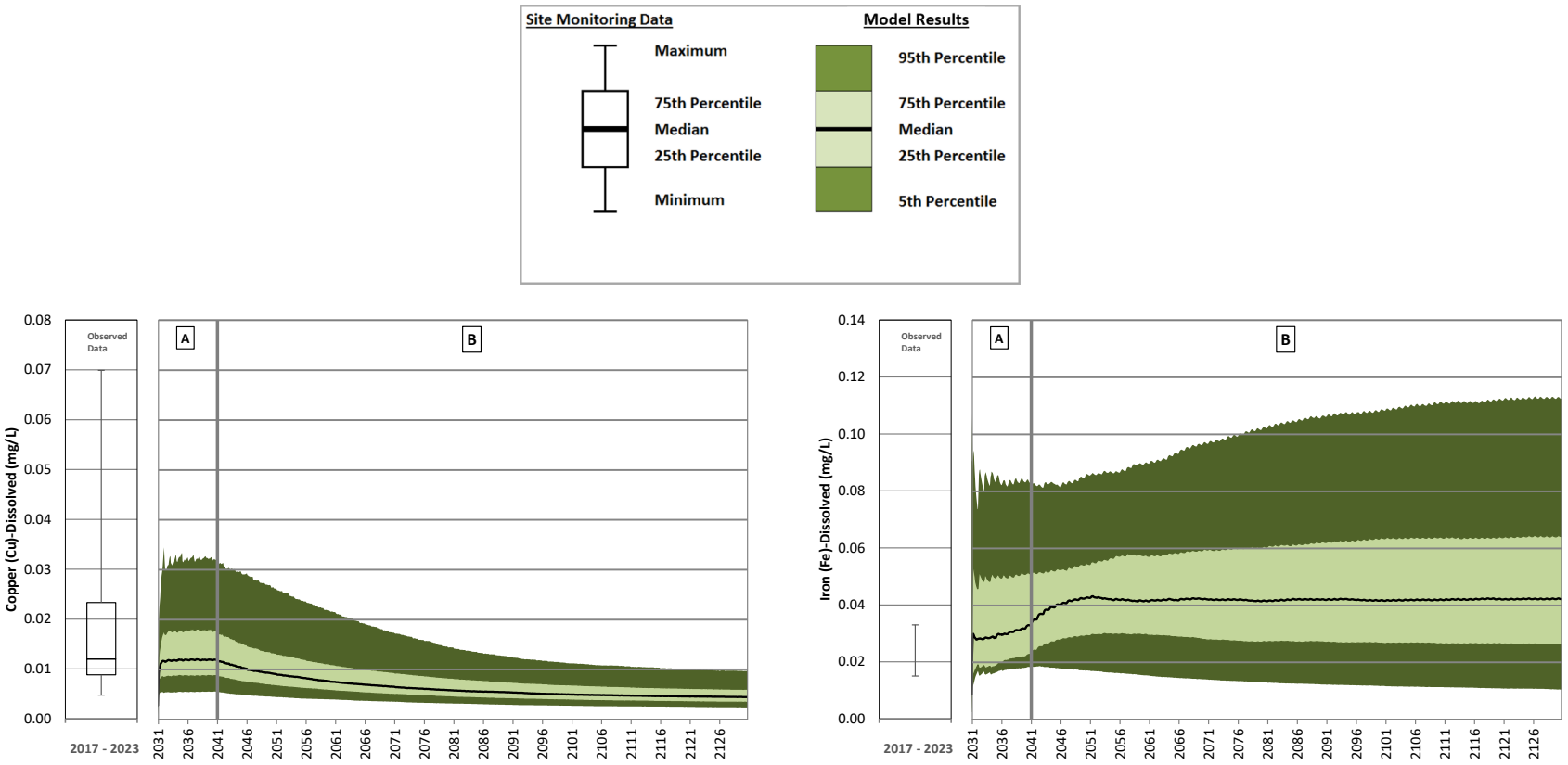

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 32: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

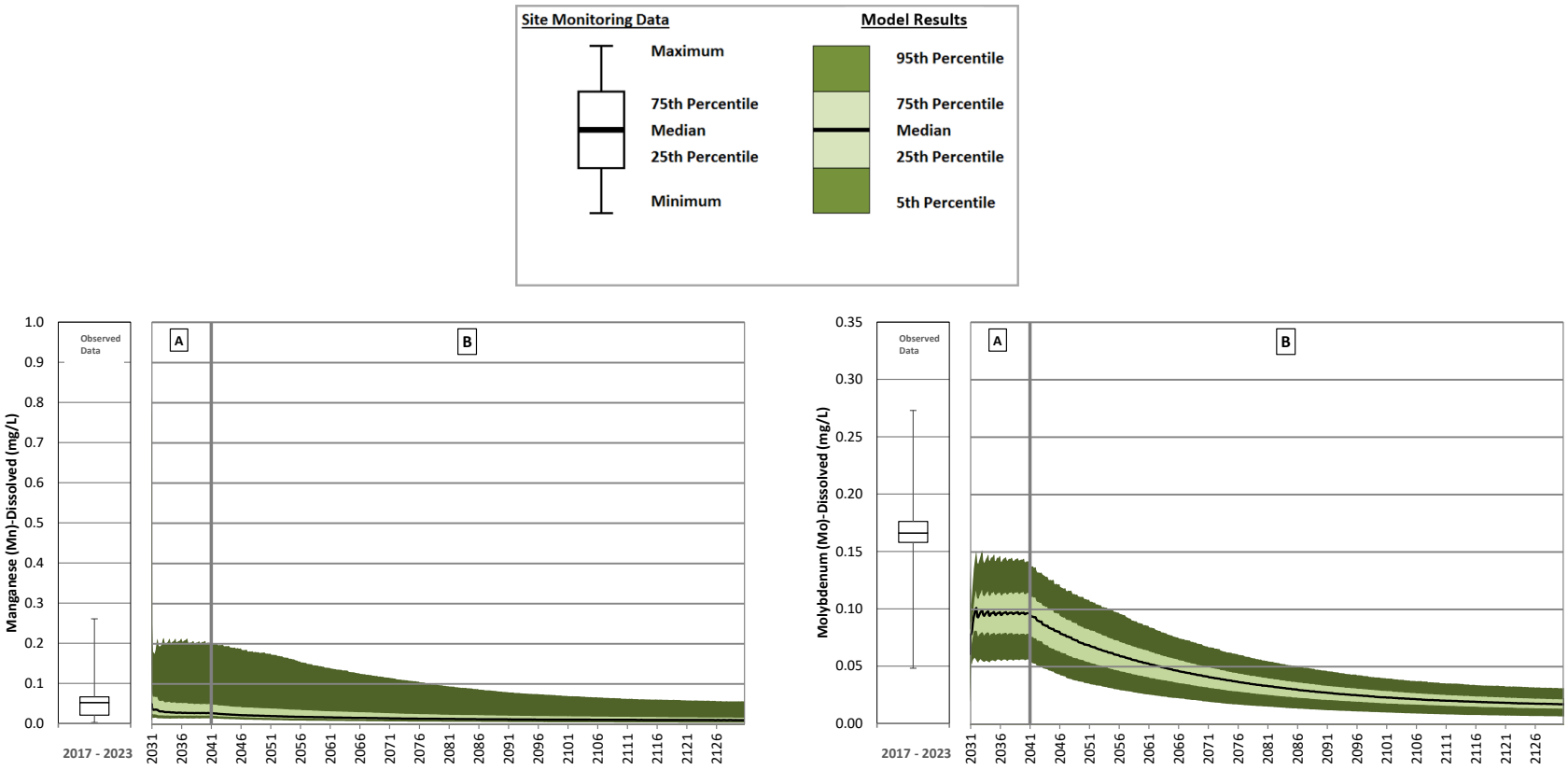

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 33: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

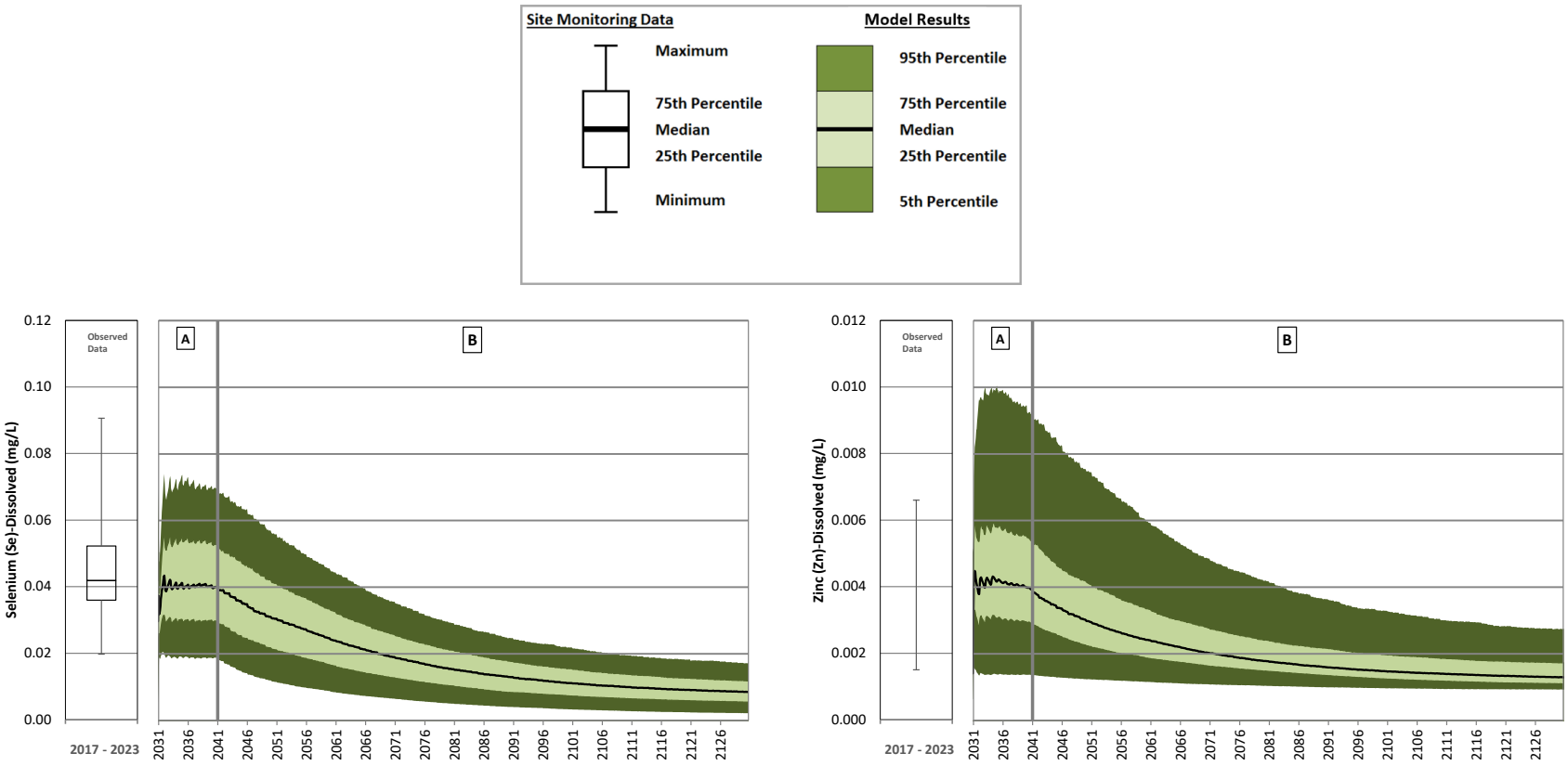

A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 34: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

4.4 Mine Drainage Creek Sump

The Mine Drainage Creek Sump receives drainage from undisturbed and disturbed areas, haul roads, and RDSs in its catchment area. Discharge from the Mine Drainage Creek Sump is planned to be directed to Bootjack Lake.

Time series plots for key parameters in the Mine Drainage Creek Sump for closure and post-closure are shown in Figures 35 to 40. Maximum of median and 95th percentile predictions are presented in Table 15.

For most parameters, predicted peak concentrations in the Mine Drainage Creek Sump occur during closure, and then decrease as disturbed areas, haul roads, and RDS areas are reclaimed (Figures 35 to 40). Concentrations are highest during operations for most parameters because RDS and haul road runoff is assigned the NAG water quality input until reclamation, which will occur throughout closure. Water qualities from these facilities are predicted to return to the undisturbed water quality (Table 9). Predicted water quality reaches steady state 10 years after the start of post-closure, after all watershed areas have been reclaimed.

Seasonal peak concentrations during winter are driven by seepage from the East RDS. During winter months, when precipitation occurs as snowfall, East RDS seepage represents a high proportion of the total flow to the Mine Drainage Creek Sump and causes concentrations of parameters to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the Mine Drainage Creek Sump, which causes concentrations of parameters, such as aluminum, to increase from closure to post-closure.

Table 15: Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	718	1,086	592	958	172	277	164	261
Total Dissolved Solids	mg/L	1,053	1,647	852	1,425	232	337	222	337
Major Ions									
Calcium	mg/L	220	329	183	298	45	69	41	62
Chloride	mg/L	26	31	2.0	4.5	2.5	8.5	2.5	8.5
Fluoride	mg/L	0.84	1.0	0.11	0.18	0.075	0.16	0.074	0.16
Magnesium	mg/L	41	64	33	52	15	26	15	26
Potassium	mg/L	25	30	1.4	2.3	1.0	1.5	1.0	1.5
Sodium	mg/L	94	113	12	20	7.1	12	7.2	12
Sulphate	mg/L	587	910	464	796	49	89	40	70
Nutrients									
Ammonia	mg/L (as N)	0.028	0.057	0.005	0.0097	0.0058	0.011	0.0059	0.012
Nitrate	mg/L (as N)	6.4	35	0.57	6.8	0.056	0.32	0.045	0.32
Nitrite	mg/L (as N)	0.085	0.11	0.00095	0.004	0.0005	0.0013	0.0005	0.00052
Total Phosphorus	mg/L	0.017	0.041	0.018	0.029	0.023	0.033	0.023	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.49	0.59	0.069	0.3	0.067	0.3
Antimony	mg/L	0.0017	0.0023	0.00015	0.00043	0.000059	0.000079	0.000058	0.00008
Arsenic	mg/L	0.0039	0.0046	0.00079	0.0011	0.00089	0.0016	0.0009	0.0016
Barium	mg/L	0.069	0.09	0.027	0.053	0.013	0.017	0.011	0.016
Beryllium	mg/L	0.00005	0.000051	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Boron	mg/L	0.21	0.38	0.04	0.1	0.021	0.033	0.019	0.033
Cadmium	mg/L	0.0001	0.00033	0.000024	0.00014	0.0000093	0.000028	0.0000094	0.000028
Chromium	mg/L	0.00065	0.00069	0.00081	0.001	0.00086	0.0017	0.00086	0.0017
Cobalt	mg/L	0.00046	0.0012	0.00035	0.00056	0.00006	0.00017	0.000057	0.00017
Copper	mg/L	0.018	0.2	0.016	0.17	0.0041	0.0079	0.0029	0.0065
Iron	mg/L	0.48	0.52	0.51	0.61	0.13	0.45	0.13	0.45
Lead	mg/L	0.00014	0.00014	0.00014	0.00016	0.000019	0.00011	0.000016	0.00011
Lithium	mg/L	0.011	0.015	0.0016	0.0041	0.0016	0.0029	0.0016	0.0029
Manganese	mg/L	0.096	0.52	0.034	0.19	0.015	0.041	0.015	0.04
Mercury	mg/L	0.000005	0.0000051	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Molybdenum	mg/L	0.3	0.38	0.067	0.16	0.008	0.016	0.0066	0.013
Nickel	mg/L	0.001	0.003	0.0011	0.0016	0.00087	0.0019	0.00087	0.0019
Selenium	mg/L	0.05	0.11	0.036	0.085	0.0037	0.0078	0.003	0.0066
Silver	mg/L	0.0000064	0.000016	0.000006	0.000014	0.0000061	0.000019	0.0000061	0.000019

Table 15: Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	2.9	4.6	0.84	1.6	0.28	0.47	0.29	0.47
Thallium	mg/L	0.0000058	0.0000083	0.000005	0.0000057	0.000005	0.0000051	0.000005	0.0000052
Tin	mg/L	0.00005	0.00015	0.00005	0.00013	0.00005	0.000051	0.00005	0.000052
Titanium	mg/L	0.027	0.027	0.024	0.025	0.0049	0.0077	0.0048	0.0078
Uranium	mg/L	0.0015	0.0045	0.00067	0.0018	0.00061	0.0012	0.00061	0.0012
Vanadium	mg/L	0.0046	0.0053	0.0017	0.0021	0.0007	0.0012	0.00069	0.0013
Zinc	mg/L	0.0074	0.016	0.0091	0.015	0.0029	0.005	0.001	0.0012
Dissolved Metals									
Aluminum	mg/L	0.017	0.05	0.033	0.13	0.041	0.18	0.039	0.19
Antimony	mg/L	0.0017	0.0021	0.00013	0.00029	0.000059	0.000079	0.000058	0.00008
Arsenic	mg/L	0.0036	0.0043	0.00051	0.00081	0.00086	0.0015	0.00087	0.0015
Barium	mg/L	0.067	0.081	0.025	0.044	0.012	0.016	0.011	0.014
Beryllium	mg/L	0.00005	0.000051	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Boron	mg/L	0.2	0.35	0.036	0.072	0.021	0.031	0.019	0.031
Cadmium	mg/L	0.000099	0.00028	0.000021	0.000091	0.0000081	0.00002	0.0000082	0.00002
Chromium	mg/L	0.00026	0.0003	0.00043	0.00064	0.00075	0.0012	0.00075	0.0012
Cobalt	mg/L	0.00018	0.00096	0.000068	0.00027	0.00006	0.000095	0.000057	0.000096
Copper	mg/L	0.0092	0.047	0.0074	0.017	0.0038	0.0063	0.0026	0.0049
Iron	mg/L	0.039	0.08	0.063	0.17	0.09	0.26	0.09	0.26
Lead	mg/L	0.000025	0.000031	0.000026	0.000049	0.000019	0.000086	0.000016	0.000086
Lithium	mg/L	0.011	0.014	0.0014	0.0031	0.0016	0.0027	0.0016	0.0027
Manganese	mg/L	0.074	0.5	0.013	0.17	0.011	0.025	0.011	0.024
Mercury	mg/L	0.000005	0.0000051	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Molybdenum	mg/L	0.3	0.37	0.066	0.15	0.0079	0.016	0.0066	0.013
Nickel	mg/L	0.00046	0.0024	0.00058	0.001	0.0008	0.0016	0.0008	0.0016
Selenium	mg/L	0.05	0.1	0.036	0.079	0.0037	0.0077	0.003	0.0065
Silicon	mg/L	7.1	8.2	5.8	7.0	6.0	8.2	6.0	8.3
Silver	mg/L	0.0000064	0.00001	0.000006	0.0000087	0.0000061	0.000013	0.0000061	0.000013
Strontium	mg/L	2.8	4.3	0.83	1.3	0.28	0.44	0.29	0.45
Thallium	mg/L	0.0000058	0.0000076	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Tin	mg/L	0.00005	0.00007	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Titanium	mg/L	0.0083	0.0086	0.0056	0.0065	0.0049	0.0077	0.0048	0.0078
Uranium	mg/L	0.0015	0.0042	0.00064	0.0015	0.00061	0.0012	0.00061	0.0012
Vanadium	mg/L	0.0034	0.0042	0.00054	0.00088	0.00055	0.00085	0.00054	0.00086
Zinc	mg/L	0.0048	0.013	0.0065	0.012	0.0029	0.005	0.001	0.0012

a) Calculated based on predicted calcium and magnesium concentrations.

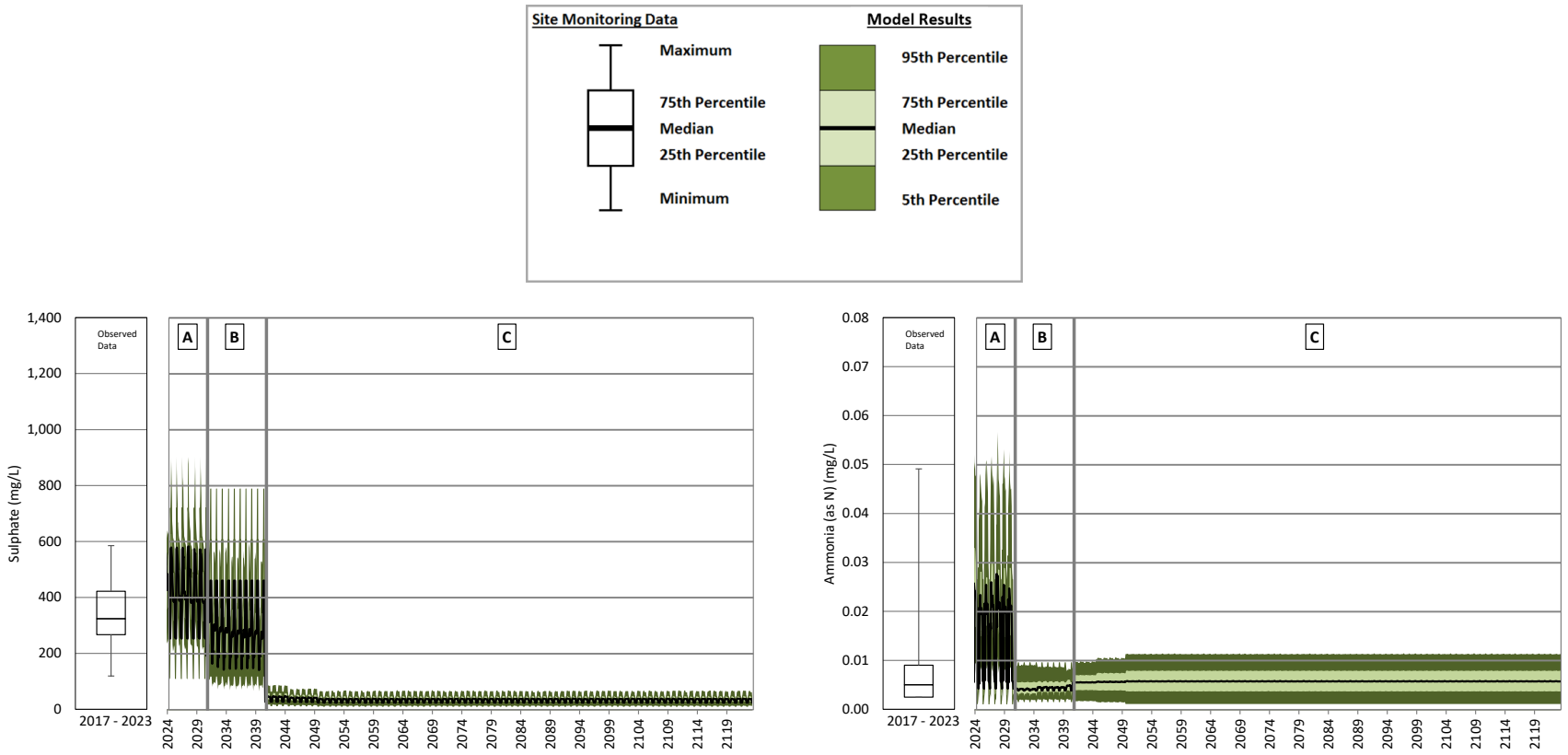

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 35: Predicted Sulphate and Total Ammonia Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

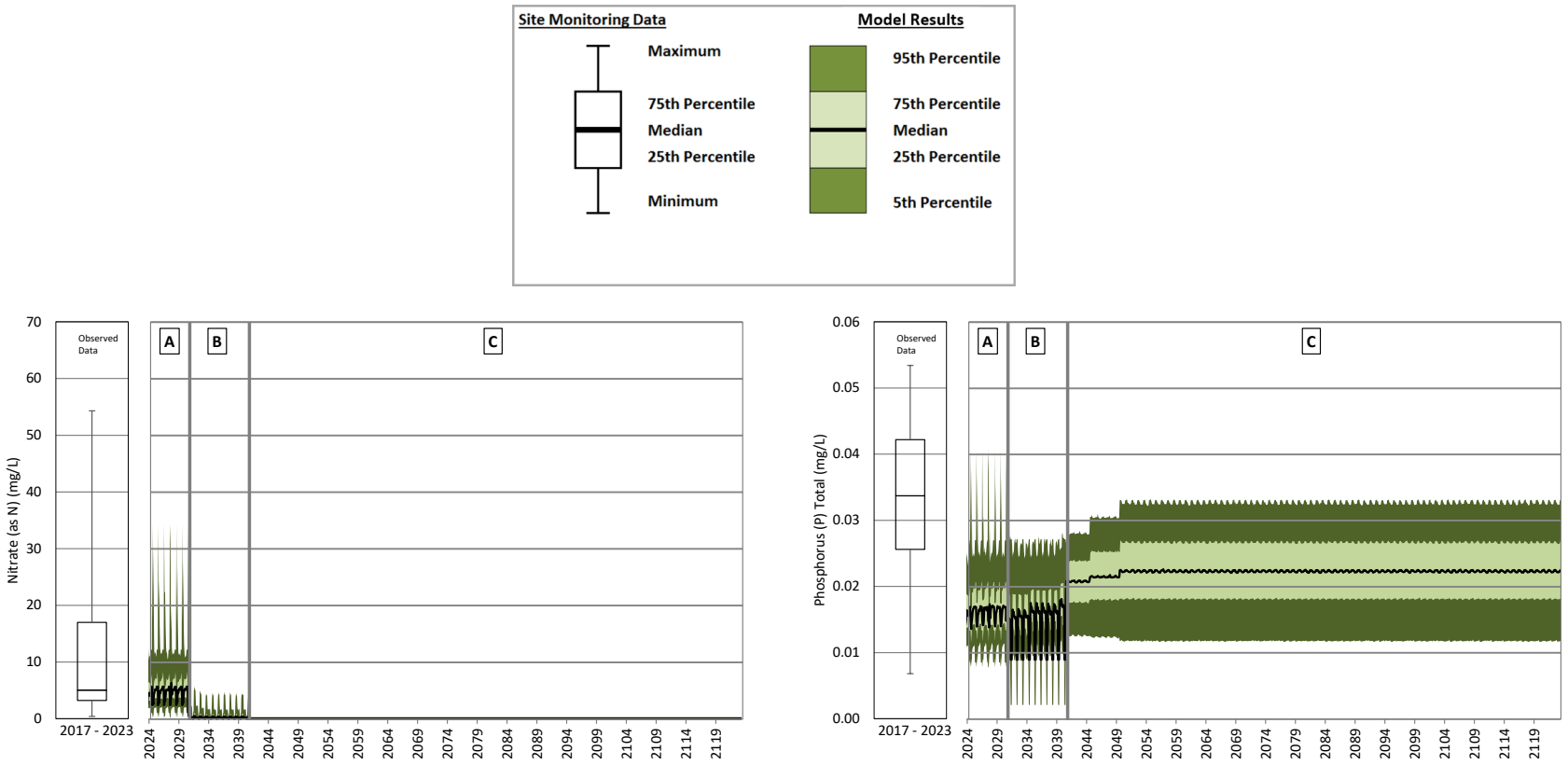

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 36: Predicted Nitrate and Total Phosphorus Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

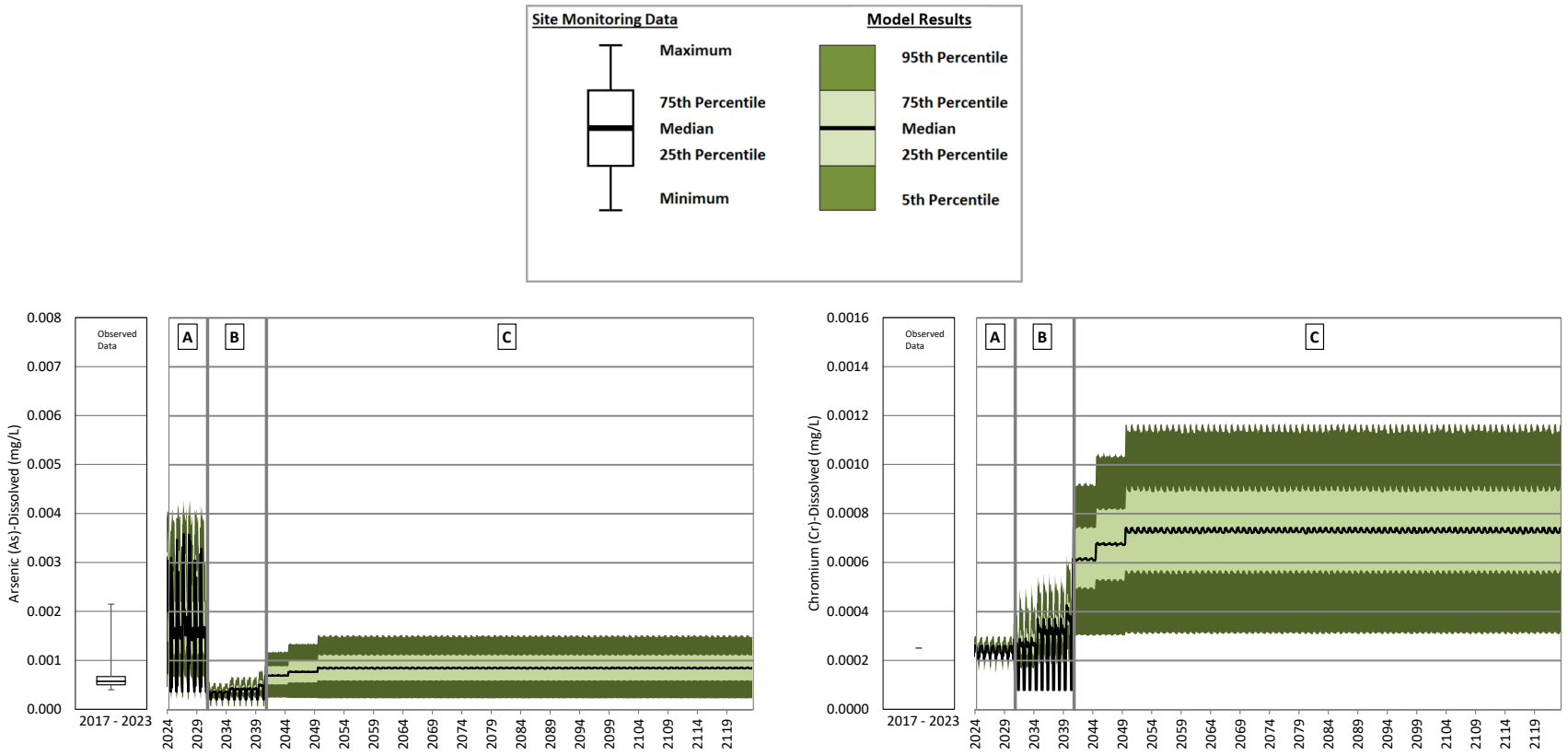

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 37: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

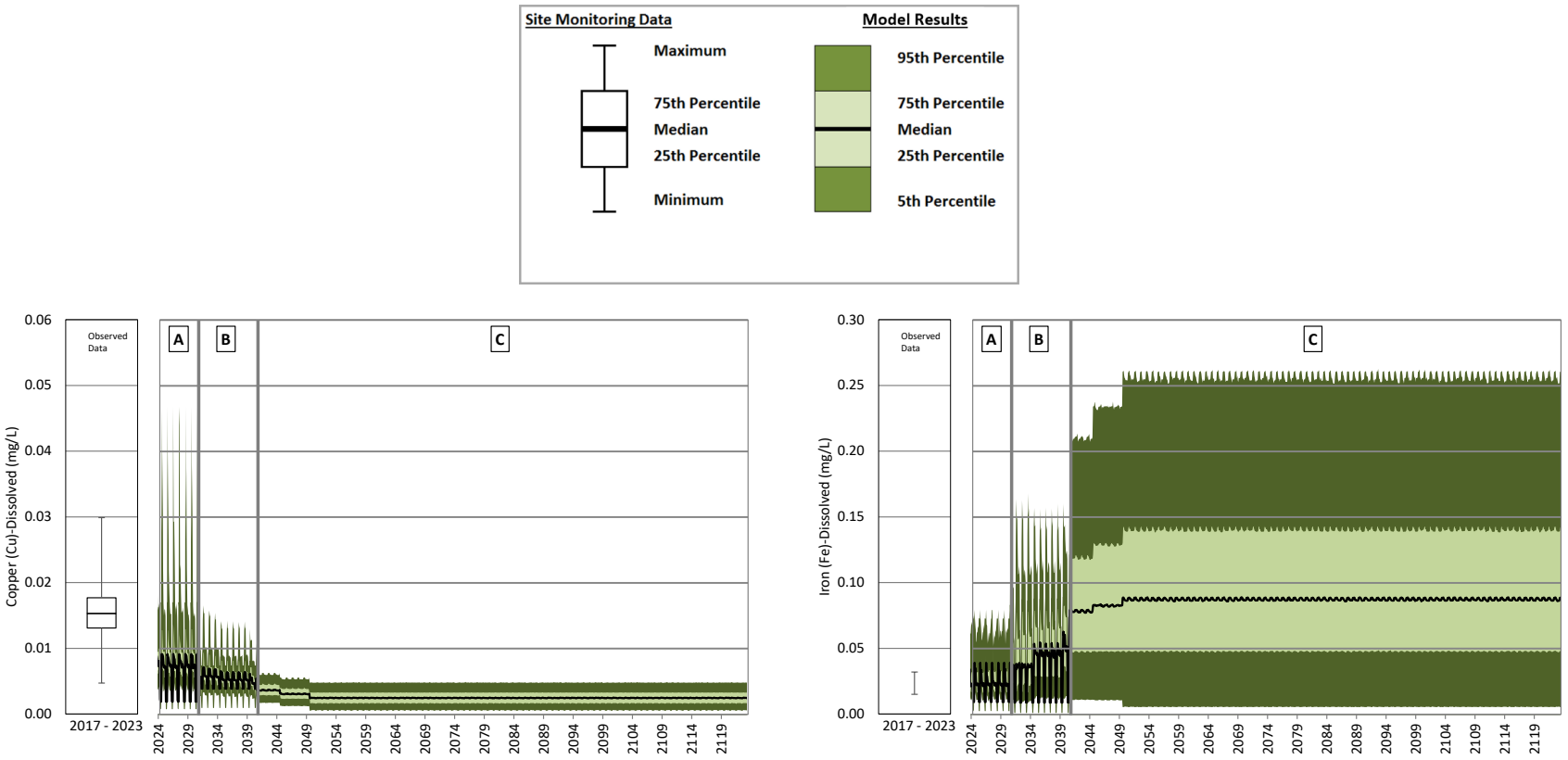

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 38: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

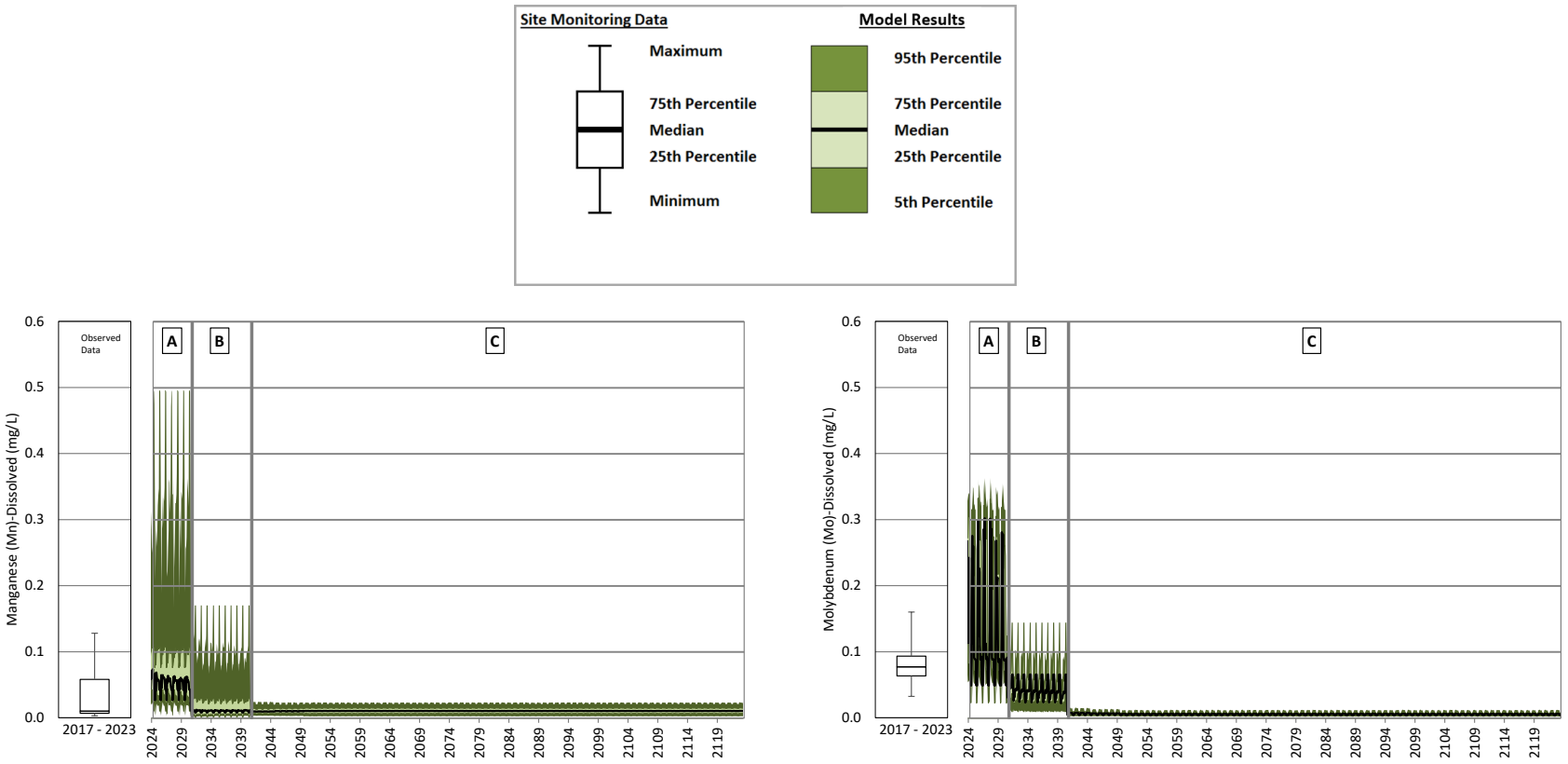

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 39: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

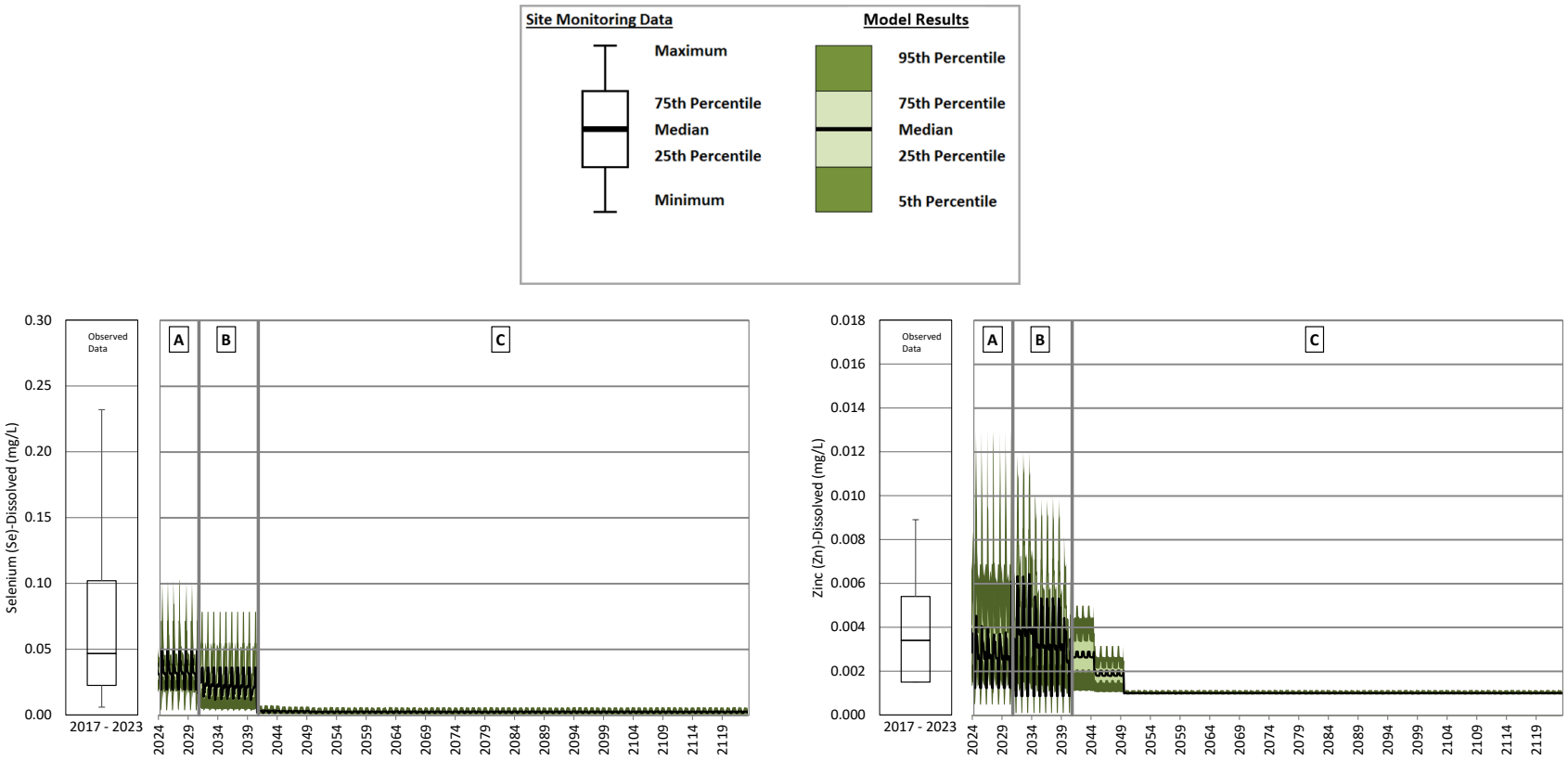

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 40: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

4.4.1 Wight Pit

Towards the last year of operation, the TSF pond will be progressively reduced to 0.25 M-m^3 of water. During that time and continuing into closure, the Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for storage and will be allowed to fill. A pit lake will form in Wight Pit as the mined-out pit refills passively with groundwater, seepage from Boundary Pit, surface runoff from pit walls, disturbed areas, and haul roads in the Wight Pit catchment. Wight Pit is projected to start overflowing in 2048 under the mean results and in 2046 under 99.5th percentile, at which point overflow will be directed to Polley Lake. Reclamation of the disturbed areas and haul roads is assumed to occur during closure (see Section 2.2). Runoff water quality from these facilities is predicted to return to undisturbed water quality as presented in Table 9.

Time series plots for key parameters in Wight Pit for operations, closure and post-closure are shown in Figures 41 to 46. Maximum of median and 95th percentile predictions are presented in Table 16.

Predicted concentrations of key parameters in Wight Pit are generally stable 10 years after the start of post-closure (Figures 41 to 46). Concentrations of key parameters decrease slightly through early post-closure after the pit has filled and is flushed with runoff from reclaimed disturbed areas and haul roads in the Wight Pit catchment area.

Some parameters are predicted to have higher concentrations in post-closure than closure (for example, dissolved copper). The increase in concentration for these parameters is caused by either:

a) Higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Wight Pit.

b) Increased proportions of the total inflows to Wight Pit from pit wall runoff that is assigned the Wight Pit wall runoff during post-closure.

Wight Pit has been the subject of some experimental work that looked at Wight Pit as a possible saturated rock fill reactor. Those trials are incomplete, and Wight Pit is currently being used for water storage. This use remains the intended use within the Reclamation and Closure Plan. Should MPMC advance the use of Wight Pit as a saturated rockfill reactor, there will need to be permitting (following a decision) and updates to the Reclamation and Closure Plan.

Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	730	896	182	379	159	323	159	323
Total Dissolved Solids	mg/L	1,080	1,242	251	570	216	439	215	440
Major Ions									
Calcium	mg/L	238	294	54	114	47	94	47	94
Chloride	mg/L	9.6	22	2.9	16	2.4	16	2.4	16
Fluoride	mg/L	0.76	1.1	0.28	0.49	0.28	0.49	0.28	0.49
Magnesium	mg/L	33	40	11	23	9.8	22	9.8	22
Potassium	mg/L	9.0	21	0.59	6.0	0.55	0.83	0.46	0.83
Sodium	mg/L	47	84	20	31	20	31	20	31
Sulphate	mg/L	646	743	101	302	93	187	93	188
Nutrients									
Ammonia	mg/L (as N)	0.016	0.07	0.0031	0.056	0.0024	0.014	0.0022	0.014
Nitrate	mg/L (as N)	1.6	5.4	0.23	3.8	0.08	1.6	0.072	1.6
Nitrite	mg/L (as N)	0.031	0.071	0.0011	0.029	0.0004	0.019	0.00038	0.019
Total Phosphorus	mg/L	0.013	0.018	0.014	0.027	0.014	0.027	0.013	0.027
Total Metals									
Aluminum	mg/L	0.46	0.47	0.46	0.5	0.036	0.15	0.036	0.15
Antimony	mg/L	0.0011	0.0018	0.000071	0.00084	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.002	0.0035	0.0027	0.0047	0.0024	0.0045	0.0024	0.0045
Barium	mg/L	0.05	0.074	0.021	0.07	0.017	0.063	0.017	0.063
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.45	0.28	0.53	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00052	0.000011	0.000089	0.0000079	0.000028	0.0000075	0.000028
Chromium	mg/L	0.00063	0.00065	0.00066	0.00076	0.00041	0.00089	0.00037	0.00085
Cobalt	mg/L	0.00072	0.0018	0.00034	0.00044	0.000055	0.00016	0.000052	0.00015
Copper	mg/L	0.022	0.18	0.012	0.17	0.0031	0.007	0.0031	0.0071
Iron	mg/L	0.46	0.62	0.46	0.53	0.065	0.24	0.065	0.24
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000052	0.000025	0.000048
Lithium	mg/L	0.009	0.013	0.0035	0.009	0.0033	0.0046	0.0033	0.0046
Manganese	mg/L	0.16	0.31	0.048	0.078	0.03	0.074	0.03	0.073
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005

Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.19	0.3	0.031	0.11	0.031	0.047	0.031	0.047
Nickel	mg/L	0.0012	0.0016	0.00085	0.0014	0.0004	0.0011	0.0004	0.0011
Selenium	mg/L	0.03	0.052	0.0019	0.03	0.00081	0.0077	0.00076	0.0077
Silver	mg/L	0.000005	0.000011	0.0000051	0.000012	0.000005	0.000012	0.000005	0.000012
Strontium	mg/L	6.6	11	0.25	1.6	0.18	0.61	0.15	0.61
Thallium	mg/L	0.00001	0.000017	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.000053	0.00017	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.024	0.026	0.024	0.027	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0041	0.00036	0.0014	0.00027	0.001	0.00023	0.001
Vanadium	mg/L	0.0028	0.0041	0.0016	0.0034	0.00048	0.0026	0.00048	0.0026
Zinc	mg/L	0.014	0.024	0.0065	0.013	0.003	0.0099	0.0031	0.0099
Dissolved Metals									
Aluminum	mg/L	0.0048	0.017	0.0083	0.045	0.0079	0.033	0.0079	0.033
Antimony	mg/L	0.0011	0.0016	0.000051	0.0007	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.0017	0.0032	0.0024	0.0044	0.0024	0.0044	0.0024	0.0044
Barium	mg/L	0.048	0.065	0.019	0.061	0.017	0.061	0.017	0.061
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.42	0.28	0.5	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00048	0.0000086	0.000044	0.0000067	0.00002	0.0000063	0.00002
Chromium	mg/L	0.00025	0.00026	0.00028	0.00037	0.0003	0.00037	0.00026	0.00033
Cobalt	mg/L	0.00044	0.0015	0.000056	0.00016	0.000055	0.00008	0.000052	0.000078
Copper	mg/L	0.013	0.021	0.0032	0.011	0.0028	0.0054	0.0028	0.0055
Iron	mg/L	0.014	0.18	0.02	0.084	0.021	0.061	0.021	0.059
Lead	mg/L	0.000025	0.000025	0.000025	0.00003	0.000025	0.000032	0.000025	0.000028
Lithium	mg/L	0.0088	0.012	0.0033	0.008	0.0033	0.0044	0.0033	0.0044
Manganese	mg/L	0.14	0.29	0.027	0.057	0.027	0.057	0.027	0.057
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.28	0.031	0.098	0.031	0.046	0.03	0.047
Nickel	mg/L	0.00064	0.0011	0.0003	0.00081	0.00033	0.00081	0.00033	0.00081
Selenium	mg/L	0.03	0.046	0.0019	0.024	0.00079	0.0076	0.00074	0.0076
Silicon	mg/L	6.8	9.0	7.8	9.4	7.8	9.4	7.8	9.4
Silver	mg/L	0.000005	0.0000054	0.0000051	0.0000064	0.000005	0.0000059	0.000005	0.000005
Strontium	mg/L	6.6	10	0.24	1.3	0.17	0.59	0.15	0.59
Thallium	mg/L	0.00001	0.000016	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005

Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.00005	0.00005	0.000053	0.000086	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.0054	0.007	0.005	0.0078	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0038	0.00033	0.0012	0.00027	0.00096	0.00023	0.00096
Vanadium	mg/L	0.0016	0.003	0.00042	0.0022	0.00033	0.0022	0.00033	0.0022
Zinc	mg/L	0.012	0.021	0.0038	0.0099	0.003	0.0099	0.0031	0.0099

a) Calculated based on predicted calcium and magnesium concentrations.

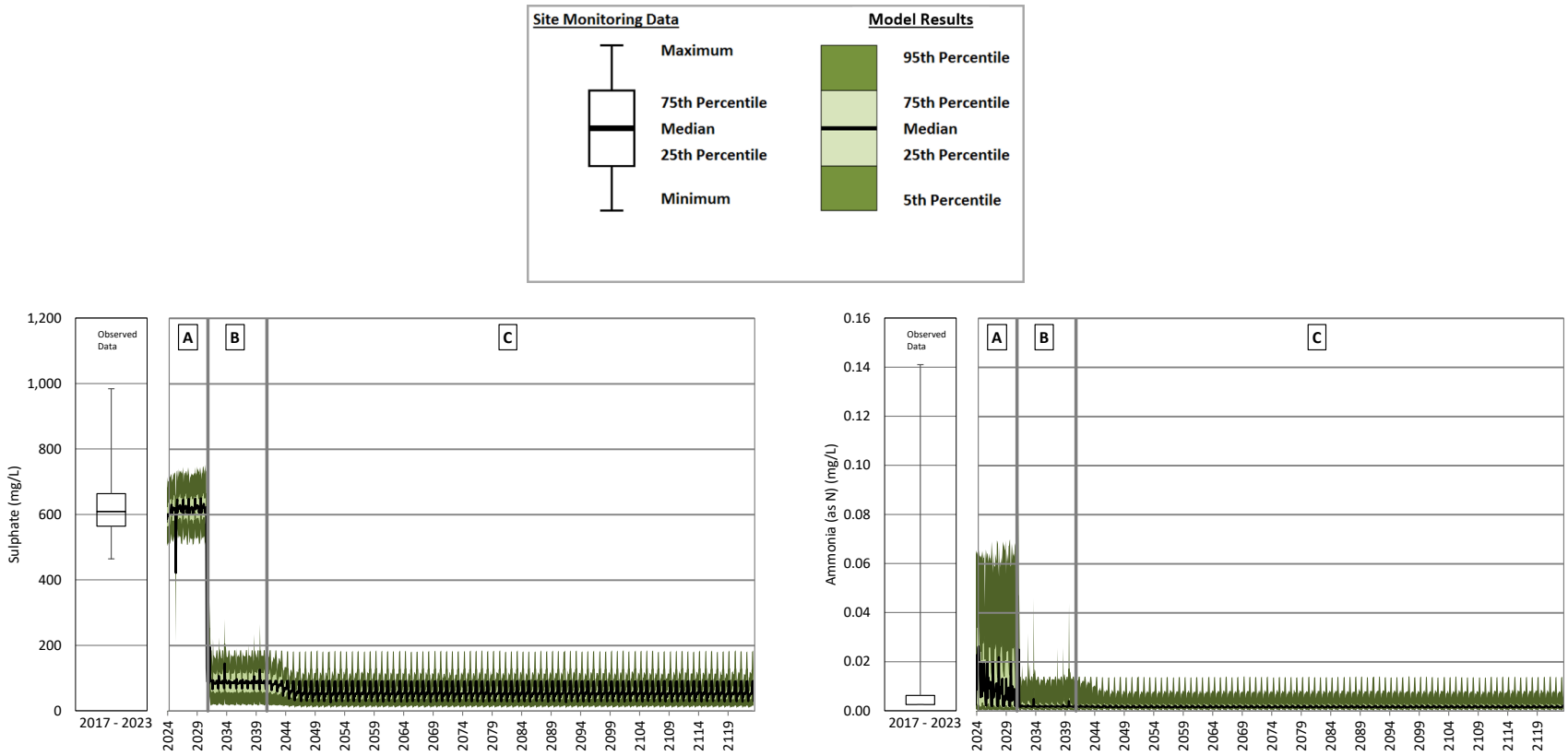

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 41: Predicted Sulphate and Total Ammonia Concentrations in Wight Pit – Operations, Closure and Post-closure

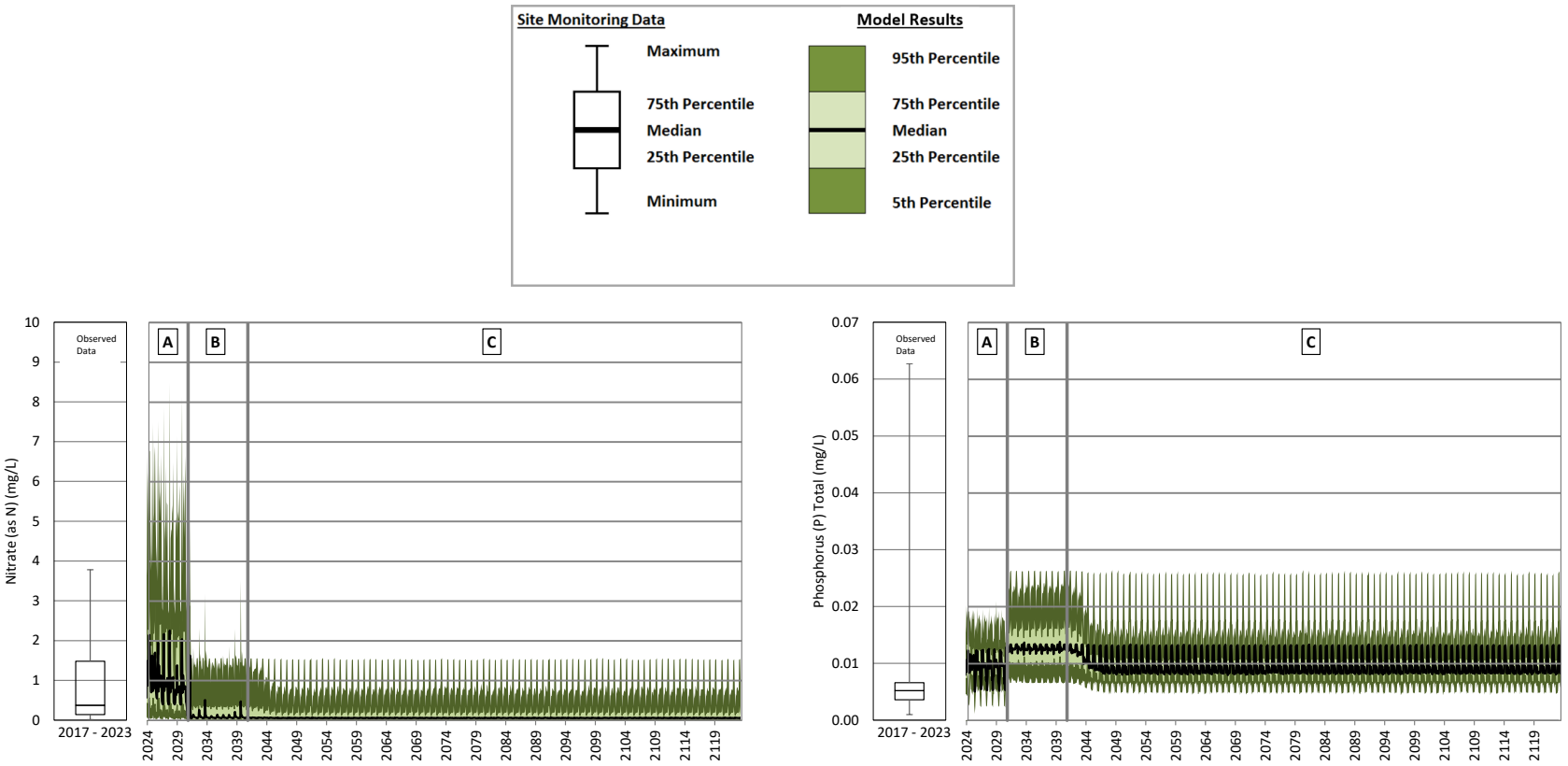

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 42: Predicted Nitrate and Total Phosphorus Concentrations in Wight Pit – Operations, Closure and Post-closure

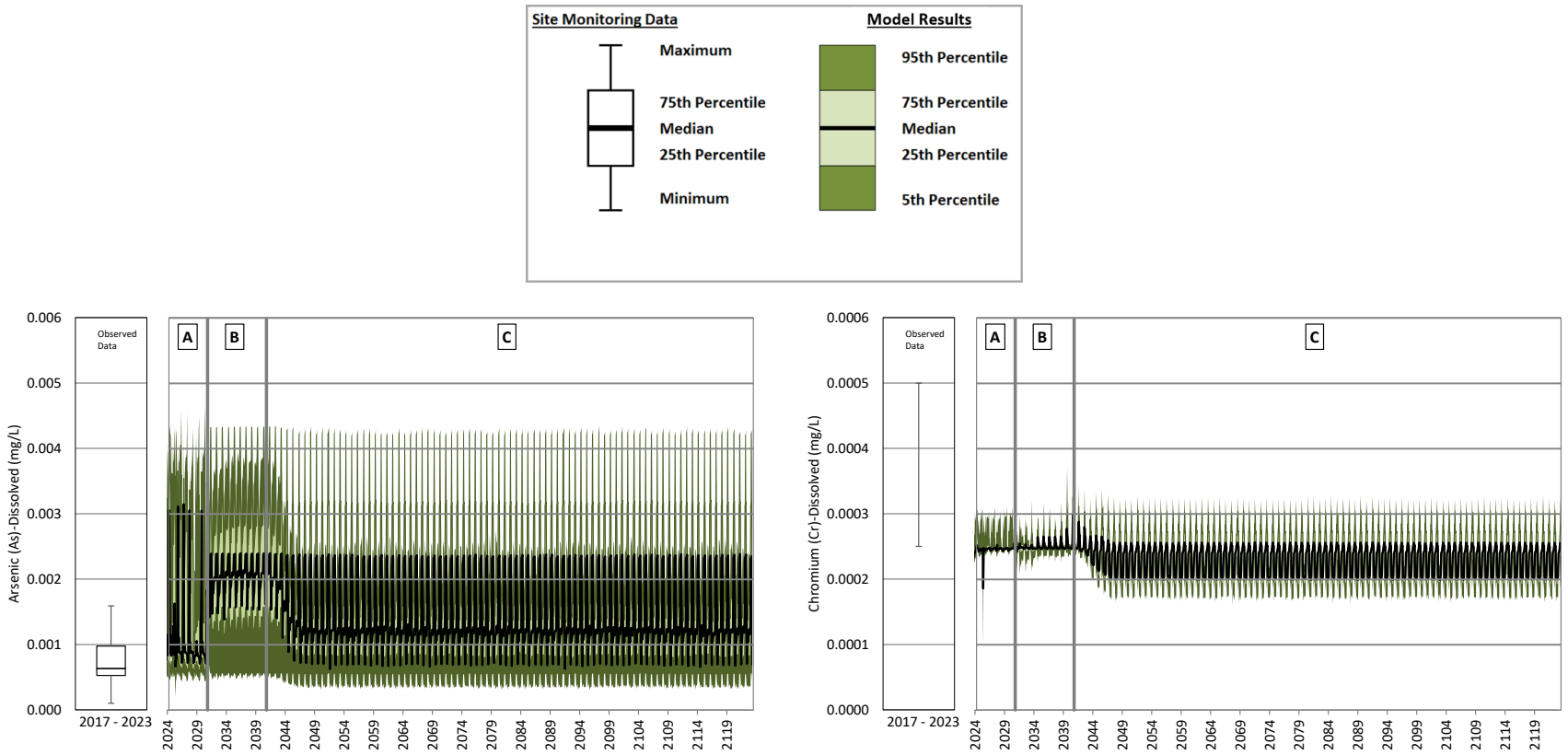

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 43: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in Wight Pit – Operations, Closure and Post-closure

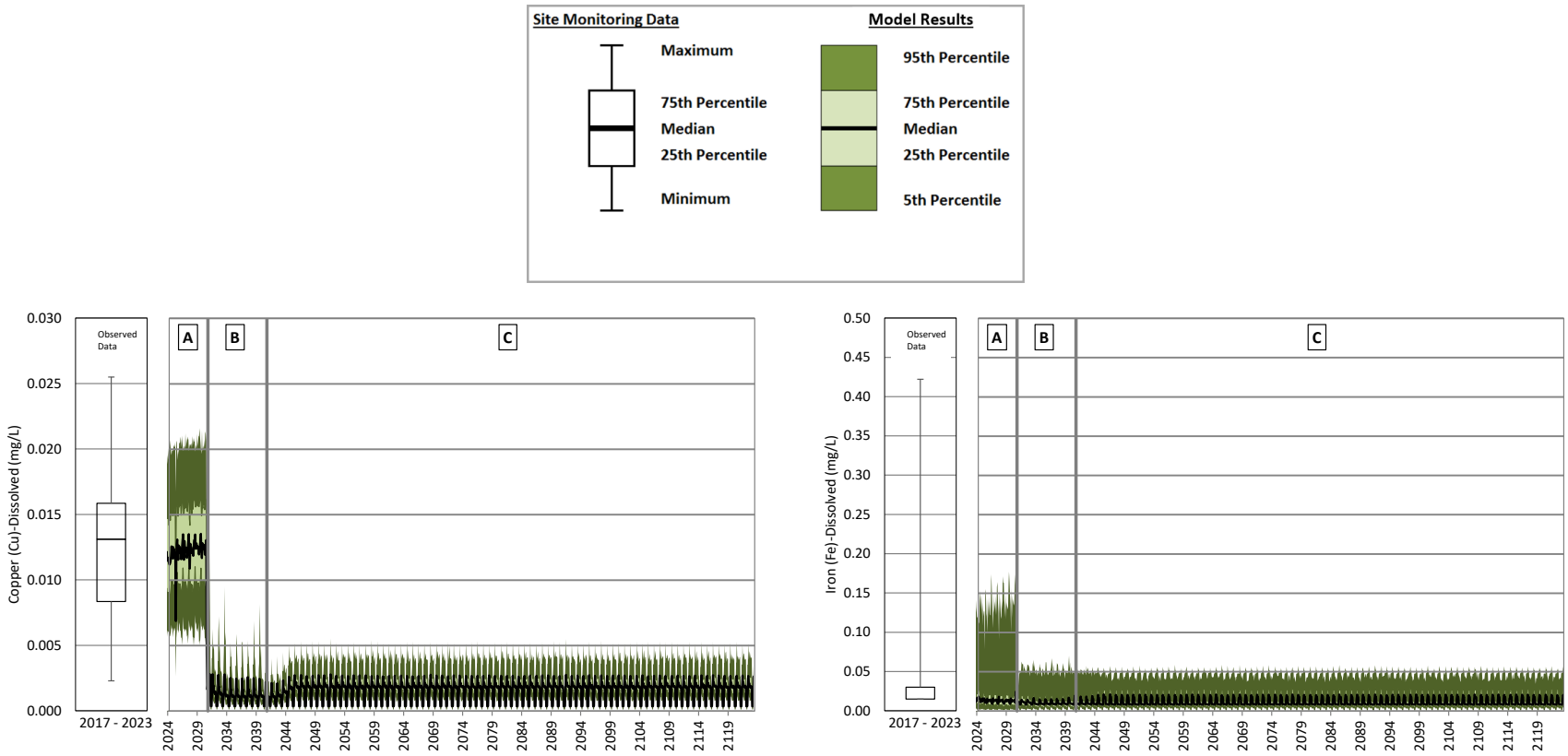

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 44: Predicted Dissolved Copper and Dissolved Iron Concentrations in Wight Pit – Operations, Closure and Post-closure

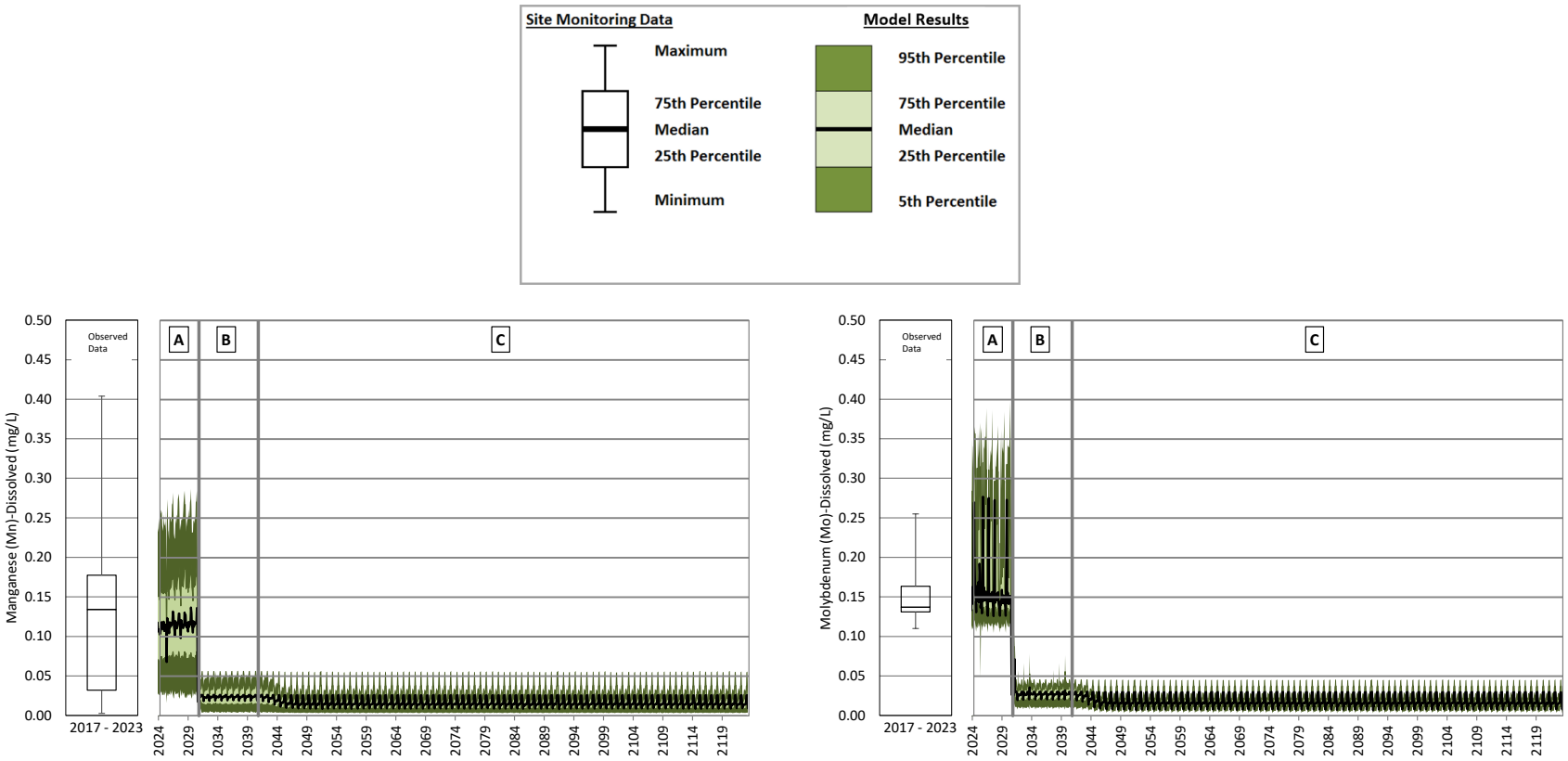

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 45: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in Wight Pit – Operations, Closure and Post-closure

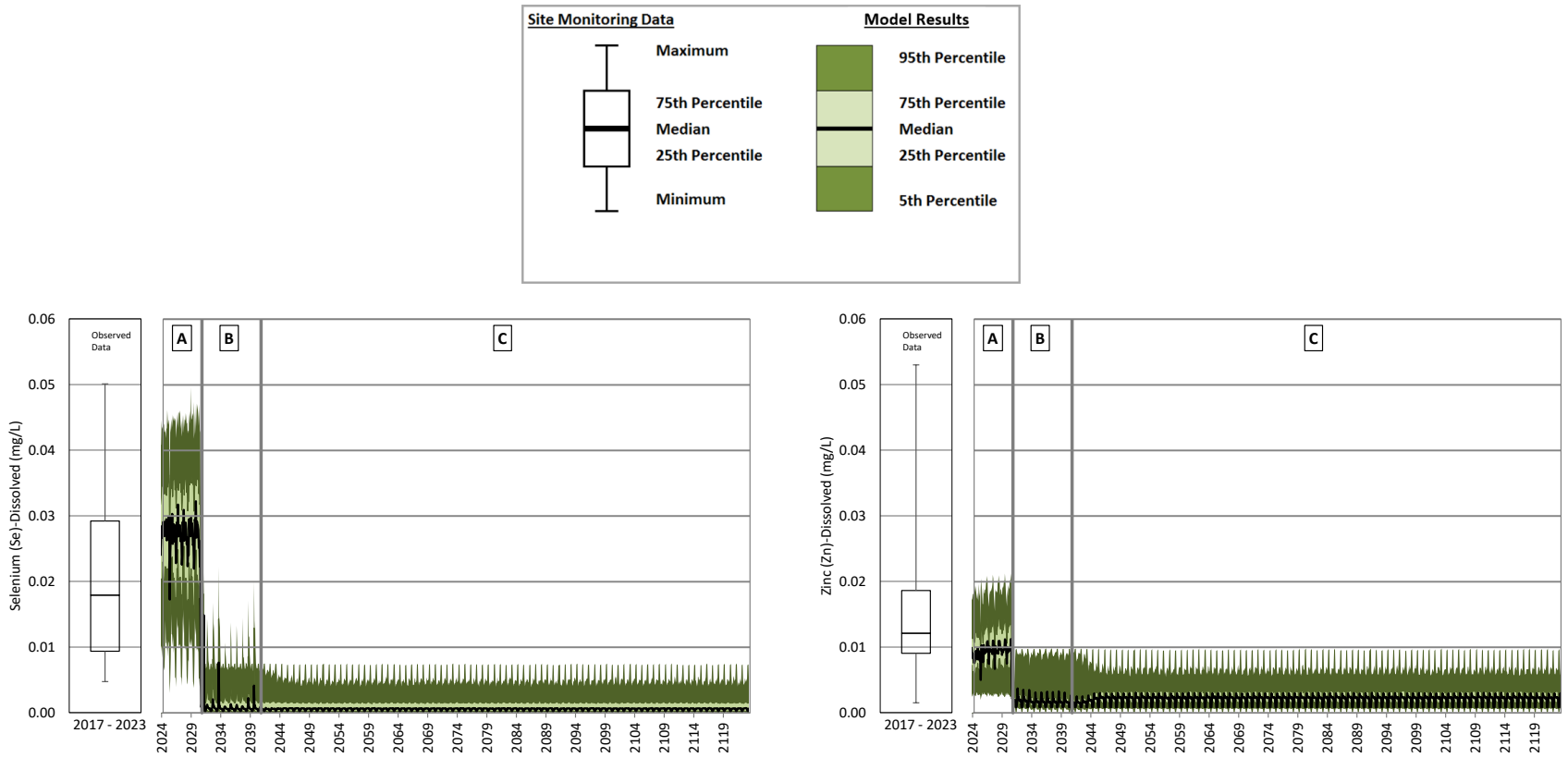

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 46: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in Wight Pit – Operations, Closure and Post-closure

4.5 Long Ditch

In closure, the Long Ditch continues to receive flow from the SERDS Ditch and overflow from Bootjack Creek Sump (via SERDS Ditch). Discharge from the Long Ditch will be directed to Polley Lake, subject to water quality meeting requirements. The combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek includes the SERDS RDS, NEZ RDS, and East RDS along with haul roads, disturbed areas, and undisturbed catchment area. Tailings co-disposal to the SERDS location will include a soil cover during closure that will remediate runoff from the tailings deposition area which runs off into SERDS Ditch. However, seepage water quality from the SERDS tailings is assumed to remain unchanged through closure and post-closure. The proportion of seepage assigned tailings water quality is calculated based on the total proportions of tailings relative to waste rock deposited (3.5% tailings and 96.5% waste rock; MPMC 2022).

Time series plots for key parameters in Long Ditch for closure and post-closure are shown in Figures 46 to 48 for the climate change module results and in Figures 47 to 52. Maximum of median and 95th percentile predictions are presented in Table 17.

Peak concentrations in the Long Ditch are predicted to occur during operations, representing runoff and seepage from un-reclaimed RDS areas within the combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek (Figures 47 to 52). These facilities are reclaimed throughout closure, at which point runoff is assigned undisturbed water quality (Table 9). Parameter concentrations in the Long Ditch are predicted to decrease through closure, reaching steady state conditions 10 years after the start of post-closure.

Seasonal peak concentrations in winter are driven by seepage from the RDS area within the watershed which is assigned the NAG water quality in perpetuity. During winter months, when precipitation occurs as snowfall, RDS seepage represents a higher proportion of the total flow to the Long Ditch and causes concentrations to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Bootjack Creek Sump, SERDS Ditch, and Long Ditch which causes concentrations of some parameters, such as aluminum, to increase.

Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	676	873	385	570	330	503	339	510
Total Dissolved Solids	mg/L	963	1,327	554	826	465	709	479	730
Major Ions									
Calcium	mg/L	216	263	116	173	92	137	95	139
Chloride	mg/L	17	25	2.7	12	3.0	8.9	3.1	9.0
Fluoride	mg/L	0.67	0.97	0.25	0.4	0.14	0.25	0.14	0.26
Magnesium	mg/L	33	52	23	34	24	39	25	39
Potassium	mg/L	16	23	1.0	4.8	1.4	1.9	1.4	1.9
Sodium	mg/L	65	88	18	27	10	15	10	15
Sulphate	mg/L	569	728	281	437	191	317	195	321
Nutrients									
Ammonia	mg/L (as N)	0.02	0.059	0.0044	0.044	0.0063	0.012	0.0063	0.012
Nitrate	mg/L (as N)	3.5	33	0.53	7.1	0.36	3.7	0.37	3.9
Nitrite	mg/L (as N)	0.056	0.081	0.0014	0.023	0.00084	0.0019	0.00085	0.0019
Total Phosphorus	mg/L	0.014	0.034	0.016	0.026	0.025	0.037	0.025	0.037
Total Metals									
Aluminum	mg/L	0.47	0.5	0.48	0.54	0.07	0.31	0.069	0.31
Antimony	mg/L	0.0012	0.0018	0.00012	0.00071	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0027	0.0037	0.002	0.0034	0.00095	0.0017	0.00096	0.0017
Barium	mg/L	0.052	0.076	0.023	0.056	0.017	0.025	0.017	0.026
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.4	0.2	0.41	0.03	0.047	0.03	0.048
Cadmium	mg/L	0.00024	0.00045	0.000028	0.00016	0.000024	0.0001	0.000025	0.00011
Chromium	mg/L	0.00064	0.00069	0.00075	0.00091	0.00088	0.0017	0.00088	0.0017
Cobalt	mg/L	0.00067	0.0015	0.00034	0.00072	0.000071	0.00044	0.000072	0.00046
Copper	mg/L	0.02	0.19	0.015	0.18	0.0056	0.019	0.0052	0.02
Iron	mg/L	0.48	0.6	0.5	0.56	0.14	0.45	0.14	0.46
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.00002	0.00011	0.000019	0.00011
Lithium	mg/L	0.0083	0.013	0.003	0.0074	0.0022	0.0037	0.0022	0.0037
Manganese	mg/L	0.15	0.3	0.049	0.18	0.02	0.14	0.02	0.15
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058

Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.22	0.3	0.05	0.1	0.032	0.061	0.032	0.062
Nickel	mg/L	0.0011	0.0025	0.0011	0.0019	0.00098	0.0021	0.00098	0.0021
Selenium	mg/L	0.039	0.089	0.023	0.053	0.016	0.034	0.017	0.037
Silver	mg/L	0.0000054	0.000014	0.0000056	0.000014	0.0000071	0.00002	0.0000072	0.00002
Strontium	mg/L	5.7	9.2	1.1	2.3	0.97	1.7	0.97	1.7
Thallium	mg/L	0.0000094	0.000015	0.0000049	0.0000058	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.00014	0.000051	0.00015	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.026	0.026	0.025	0.026	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0037	0.00064	0.0022	0.00088	0.002	0.00089	0.0022
Vanadium	mg/L	0.0035	0.0044	0.0017	0.0028	0.00075	0.0013	0.00075	0.0013
Zinc	mg/L	0.013	0.021	0.0073	0.012	0.0029	0.0056	0.0012	0.0049
Dissolved Metals									
Aluminum	mg/L	0.016	0.046	0.025	0.08	0.042	0.19	0.041	0.19
Antimony	mg/L	0.0012	0.0017	0.0001	0.00057	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0025	0.0034	0.0017	0.0032	0.00092	0.0016	0.00093	0.0016
Barium	mg/L	0.05	0.067	0.021	0.048	0.016	0.024	0.017	0.025
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.37	0.19	0.38	0.03	0.045	0.03	0.046
Cadmium	mg/L	0.00024	0.0004	0.000025	0.00012	0.000023	0.000096	0.000024	0.00011
Chromium	mg/L	0.00026	0.00031	0.00037	0.00053	0.00077	0.0012	0.00077	0.0012
Cobalt	mg/L	0.00039	0.0013	0.000061	0.00044	0.000071	0.00036	0.000072	0.00038
Copper	mg/L	0.012	0.038	0.0065	0.021	0.0053	0.017	0.0049	0.019
Iron	mg/L	0.037	0.15	0.051	0.12	0.095	0.27	0.095	0.27
Lead	mg/L	0.000024	0.000029	0.000024	0.000043	0.00002	0.00009	0.000019	0.00009
Lithium	mg/L	0.0081	0.012	0.0028	0.0064	0.0022	0.0035	0.0022	0.0036
Manganese	mg/L	0.13	0.27	0.028	0.16	0.016	0.12	0.016	0.13
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.29	0.049	0.091	0.032	0.061	0.032	0.061
Nickel	mg/L	0.00058	0.0019	0.00051	0.0013	0.00091	0.0018	0.00091	0.0018
Selenium	mg/L	0.039	0.083	0.023	0.047	0.016	0.034	0.017	0.037
Silicon	mg/L	6.7	8.5	7.0	8.2	6.7	9.1	6.7	9.1
Silver	mg/L	0.0000054	0.0000084	0.0000056	0.0000078	0.0000071	0.000014	0.0000072	0.000014
Strontium	mg/L	5.6	8.8	1.1	2.0	0.97	1.6	0.97	1.7
Thallium	mg/L	0.0000094	0.000014	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058

Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.000049	0.000055	0.000051	0.000073	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.0068	0.0076	0.0059	0.0074	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0034	0.00061	0.0019	0.00088	0.0019	0.00089	0.0021
Vanadium	mg/L	0.0023	0.0032	0.00047	0.0016	0.0006	0.00092	0.0006	0.00092
Zinc	mg/L	0.01	0.018	0.0046	0.009	0.0029	0.0056	0.0012	0.0049

a) Calculated based on predicted calcium and magnesium concentrations.

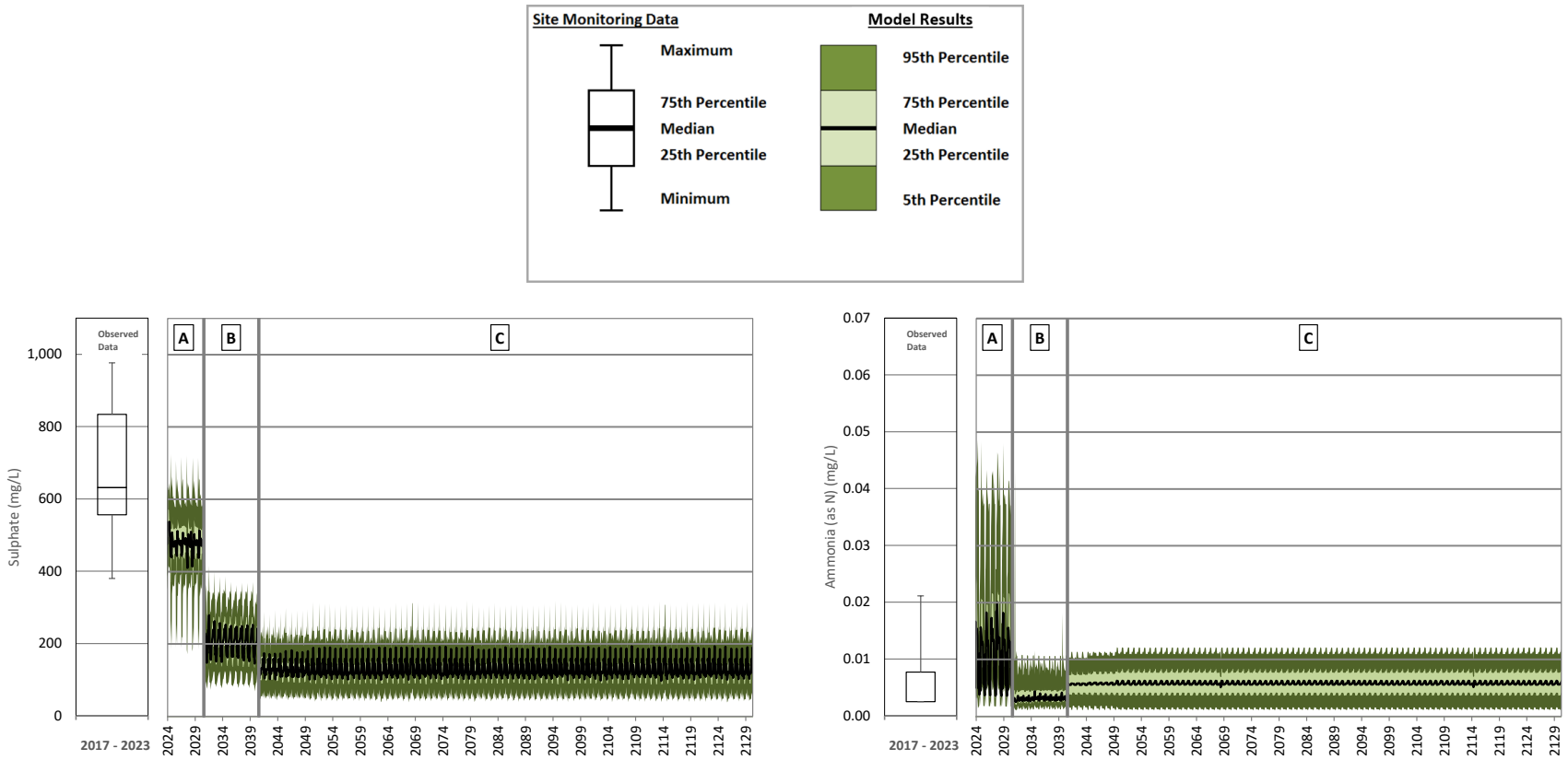

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 47: Predicted Sulphate and Total Ammonia Concentrations in Long Ditch – Operations, Closure and Post-closure

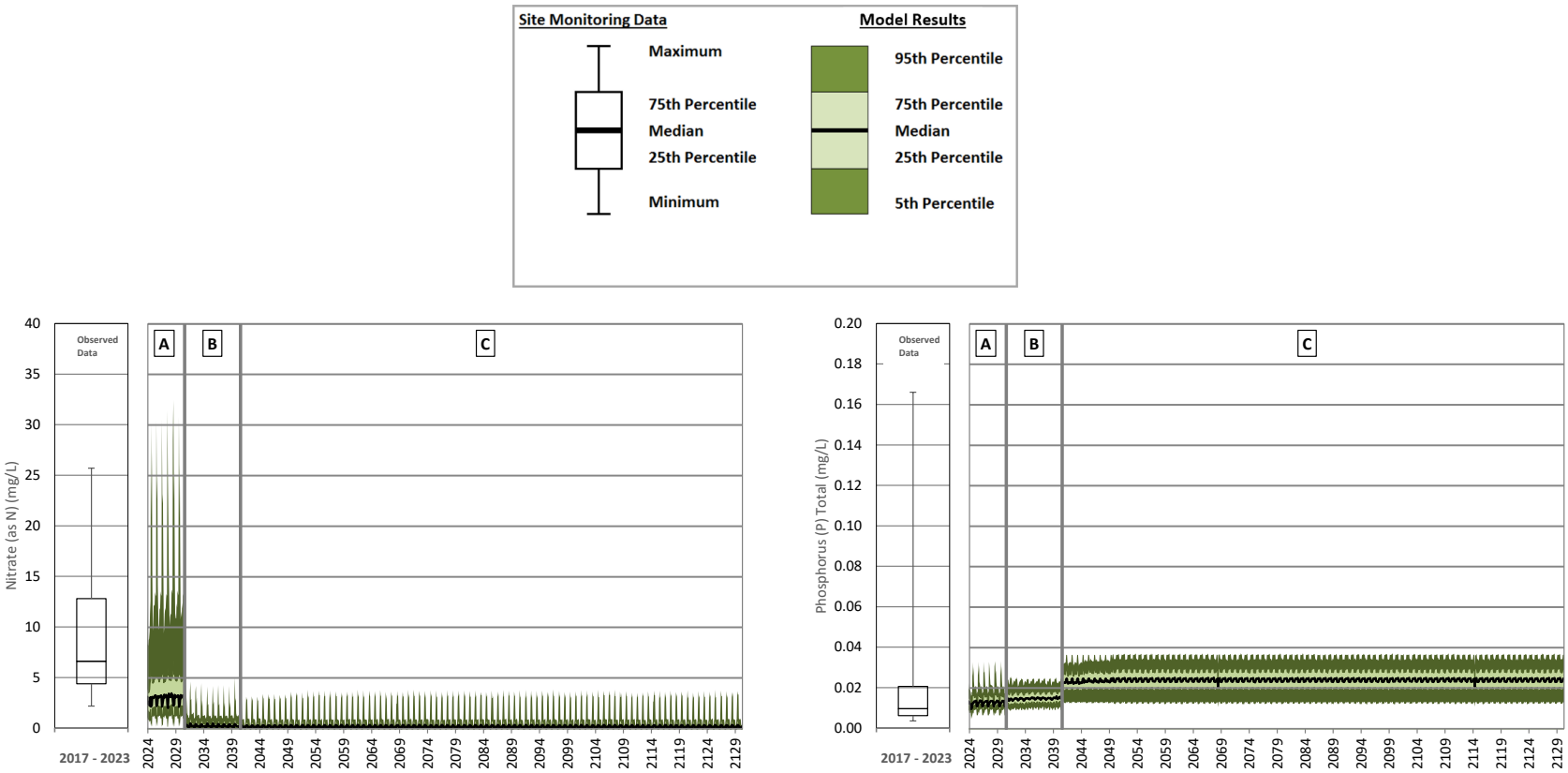

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 48: Predicted Nitrate and Total Phosphorus Concentrations in Long Ditch – Operations, Closure and Post-closure

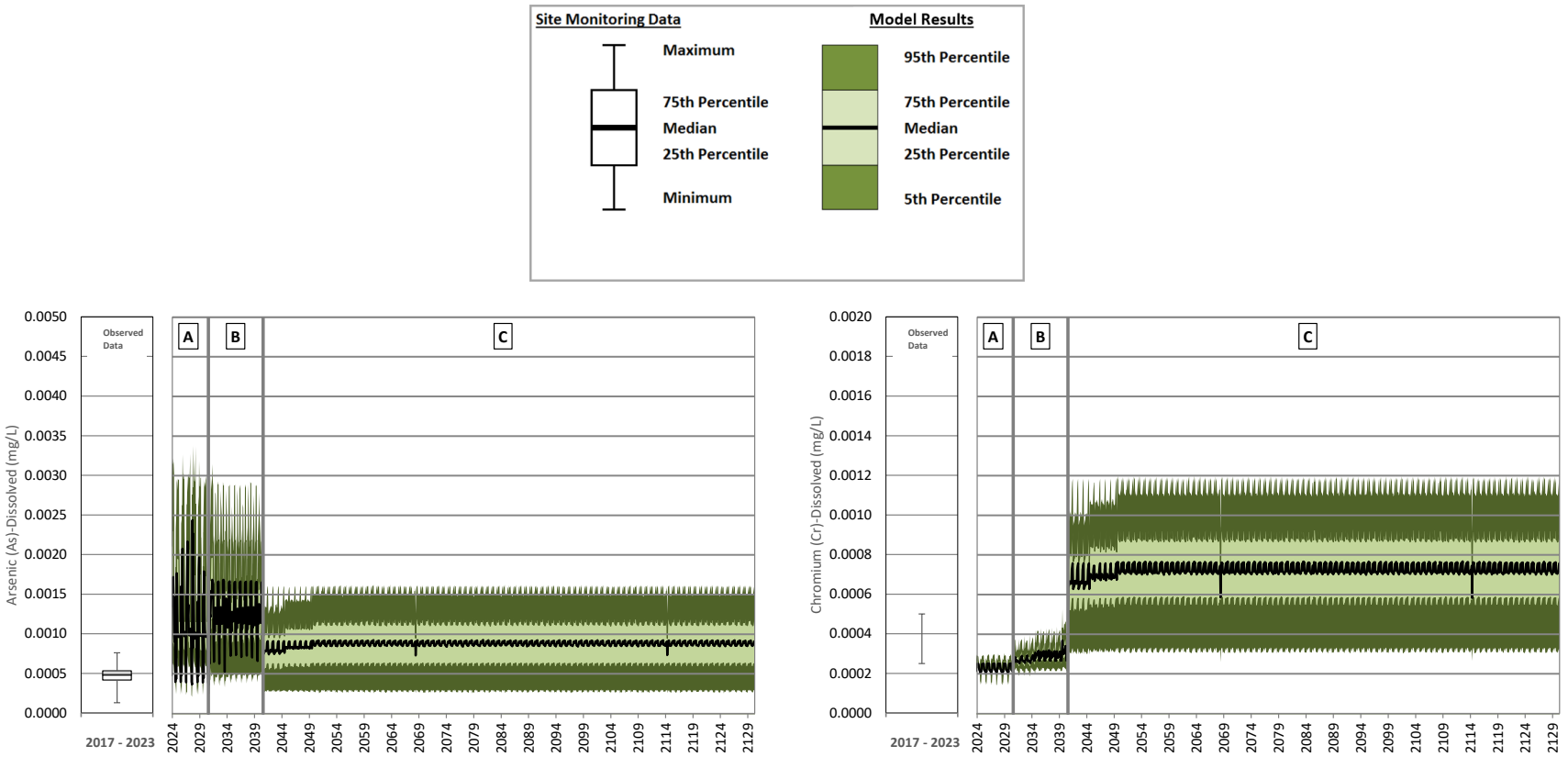

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 49: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in Long Ditch – Operations, Closure and Post-closure

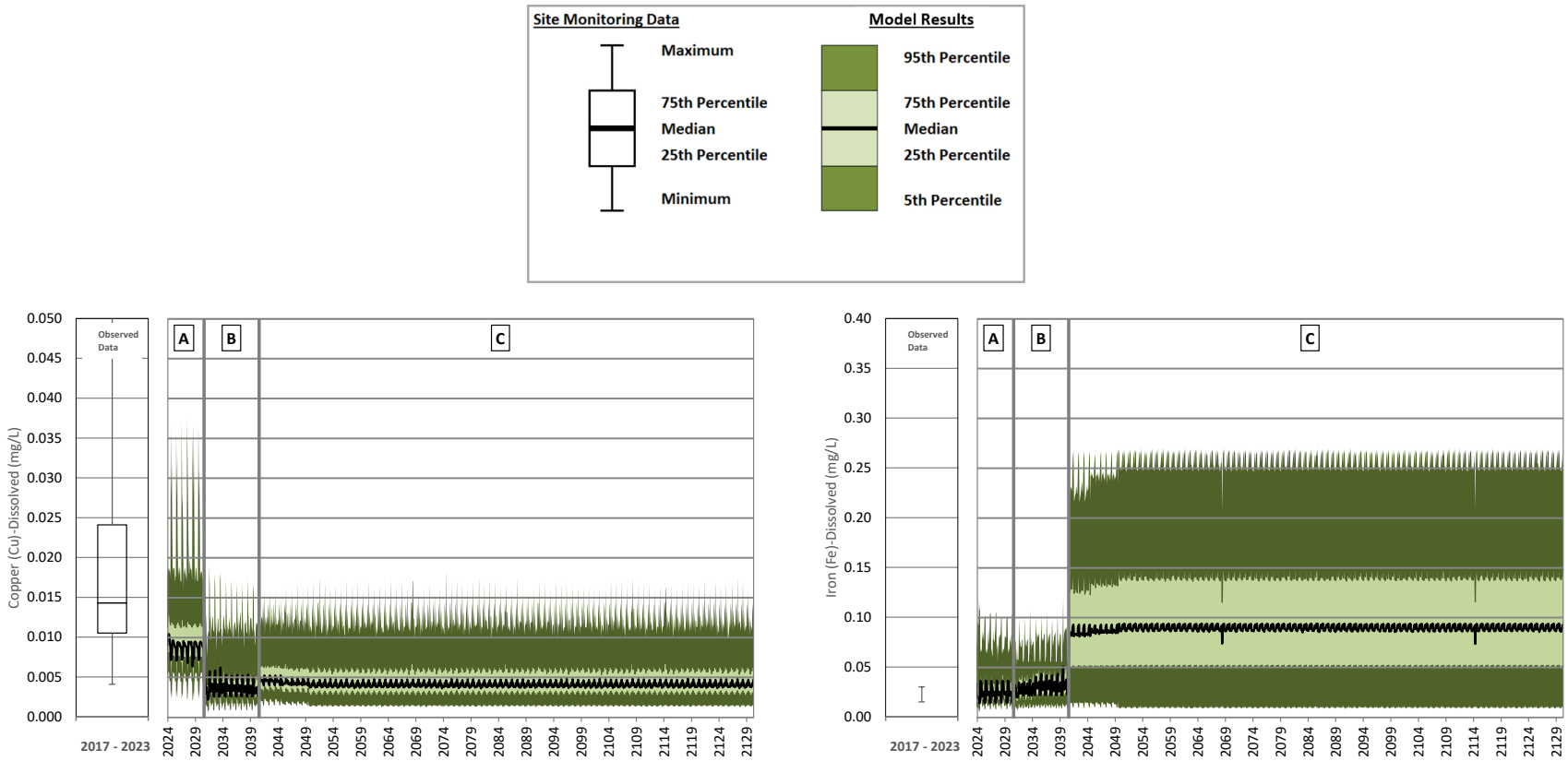

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 50: Predicted Dissolved Copper and Dissolved Iron Concentrations in Long Ditch – Operations, Closure and Post-closure

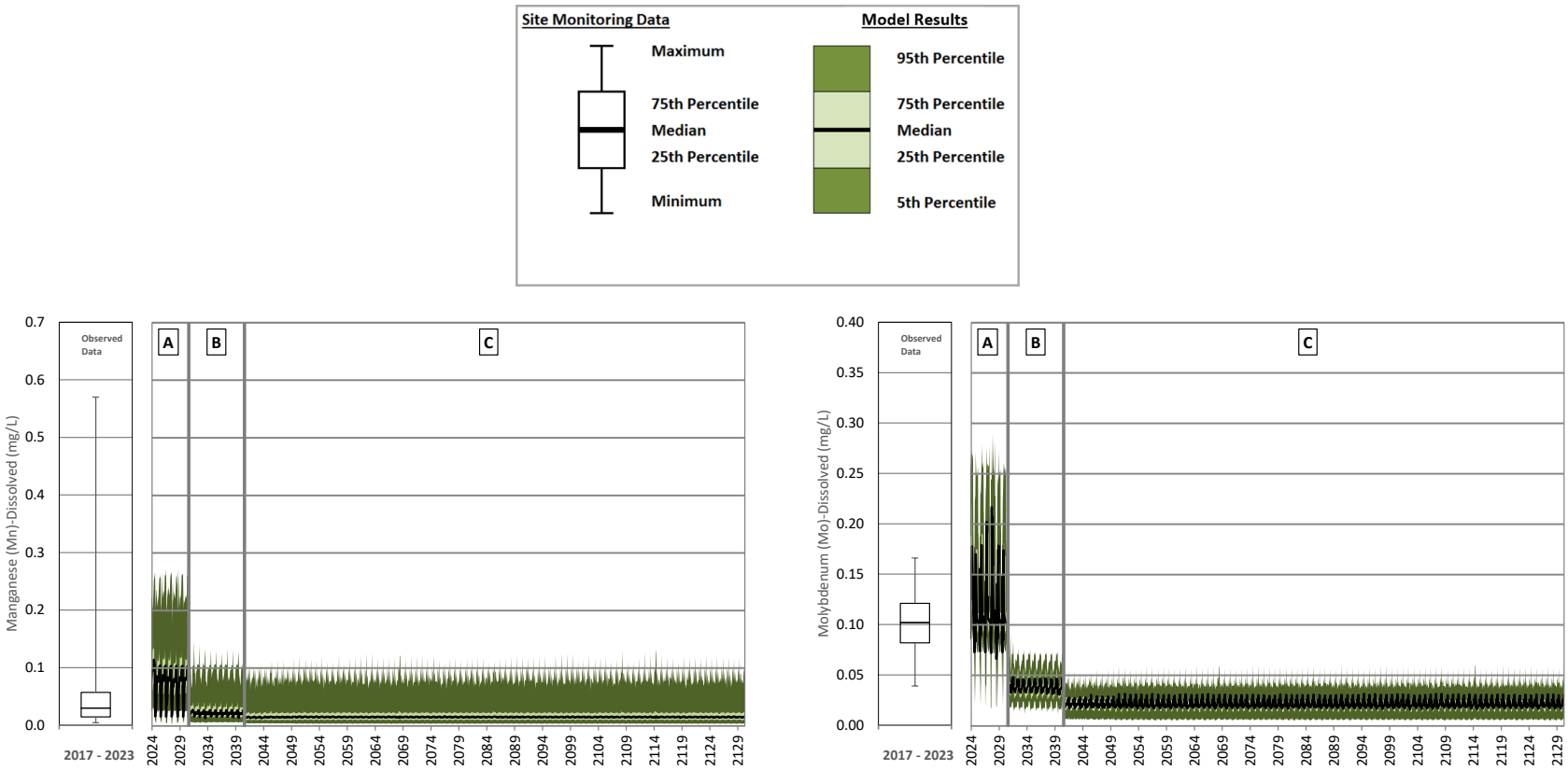

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 51: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in Long Ditch – Operations, Closure and Post-closure

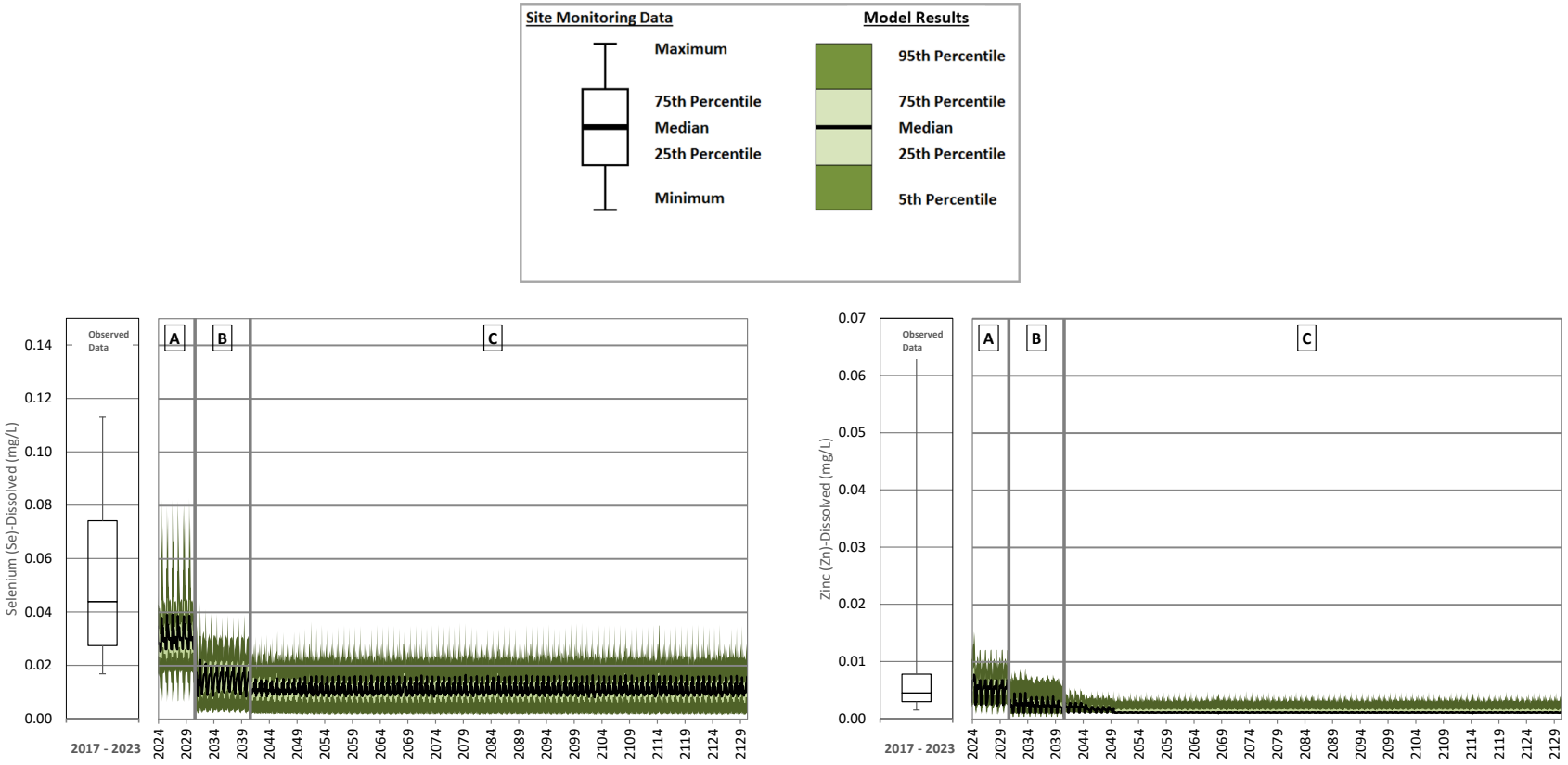

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 52: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in Long Ditch – Operations, Closure and Post-closure

4.5.1 South Embankment Seepage Collection Pond

The SWWBM assumes that the SESCP has a small catchment area and receives mostly TSF seepage in closure. Time series plots for key parameters in SESCP for operations, closure and post-closure are shown in Figures 53 to 58. Maximum of median and 95th percentile predictions are presented in Table 18.

For most parameters, the predicted peak concentrations in the SESCP occur during operations, and then decrease as TSF beach and impoundment areas are reclaimed during closure and post-closure. Water quality is predicted to reach steady-state conditions by 2074, after the TSF surface has been reclaimed. Because the saturated TSF seepage is assumed to be the same water quality as the TSF beach, impoundment, and embankment areas, the decrease in SESCP concentrations is coincident with the decrease in parameter concentrations in the TSF beach and impoundment.

The assigned TSF beach, impoundment and embankment water quality changes from the TSF supernatant input to undisturbed water quality during the closure period causing the decrease in concentration in the TSF. As TSF concentrations decrease, concentrations in the SESCP decrease due to saturated seepage from the TSF. The increase in concentrations until 2074 is due to a proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility. While the range in predicted concentrations is considered reasonable, the timing of this transition is uncertain because the amount of time it may take to flush process water from the tailings is unknown.

Table 18: Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	744	1,103	683	1,019	298	529	580	864
Total Dissolved Solids	mg/L	1,079	1,618	1,018	1,509	490	785	915	1,307
Major Ions									
Calcium	mg/L	221	321	206	300	81	139	172	254
Chloride	mg/L	2.3	13	6.5	13	7.3	12	9.1	15
Fluoride	mg/L	0.32	0.44	0.4	0.51	0.3	0.45	0.45	0.58
Magnesium	mg/L	46	73	41	65	23	44	36	56
Potassium	mg/L	1.7	2.6	4.0	4.9	4.4	5.6	5.3	6.7
Sodium	mg/L	16	25	29	38	29	37	37	46
Sulphate	mg/L	586	897	560	845	156	208	224	375
Nutrients									
Ammonia	mg/L (as N)	0.012	0.07	0.019	0.072	0.014	0.057	0.021	0.084
Nitrate	mg/L (as N)	2.2	10	2.4	8.4	0.71	2.9	1.2	4.1
Nitrite	mg/L (as N)	0.0051	0.026	0.011	0.059	0.0063	0.07	0.0097	0.084
Total Phosphorus	mg/L	0.0092	0.028	0.012	0.026	0.014	0.027	0.016	0.029
Total Metals									
Aluminum	mg/L	0.46	0.46	0.46	0.46	0.03	0.12	0.03	0.12
Antimony	mg/L	0.00026	0.00044	0.00029	0.00049	0.00018	0.00029	0.00028	0.0004
Arsenic	mg/L	0.0007	0.00084	0.00099	0.0012	0.00084	0.0011	0.00092	0.0012
Barium	mg/L	0.034	0.048	0.039	0.053	0.029	0.042	0.04	0.052
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.042	0.088	0.062	0.1	0.054	0.073	0.069	0.089
Cadmium	mg/L	0.00011	0.00027	0.00008	0.00019	0.000026	0.000093	0.000057	0.00016
Chromium	mg/L	0.00063	0.00063	0.00064	0.0007	0.00037	0.00085	0.00037	0.00087
Cobalt	mg/L	0.00033	0.00033	0.00036	0.00047	0.000088	0.00031	0.000097	0.00035
Copper	mg/L	0.027	0.18	0.023	0.18	0.0046	0.011	0.011	0.02
Iron	mg/L	0.46	0.46	0.46	0.46	0.056	0.2	0.055	0.2
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000024	0.00005	0.000026	0.000052
Lithium	mg/L	0.0099	0.016	0.0098	0.015	0.0038	0.007	0.0073	0.012
Manganese	mg/L	0.037	0.11	0.092	0.16	0.086	0.18	0.11	0.22
Mercury	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.31	0.46	0.31	0.42	0.051	0.079	0.074	0.11
Nickel	mg/L	0.00088	0.0011	0.00088	0.0011	0.0004	0.00081	0.0004	0.00081
Selenium	mg/L	0.11	0.19	0.076	0.15	0.0038	0.012	0.007	0.018
Silver	mg/L	0.000005	0.000011	0.000005	0.000011	0.000005	0.000012	0.000005	0.000012

Table 18: Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	4.6	7.2	3.8	6.2	0.82	1.5	2.1	4.1
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000058	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0051	0.0065	0.0053	0.0069
Uranium	mg/L	0.004	0.0068	0.0032	0.0059	0.0012	0.0027	0.0025	0.0043
Vanadium	mg/L	0.0014	0.0014	0.0015	0.0016	0.0005	0.00094	0.00052	0.00099
Zinc	mg/L	0.0066	0.015	0.0059	0.0096	0.0017	0.0029	0.0029	0.0071
Dissolved Metals									
Aluminum	mg/L	0.0023	0.0068	0.0024	0.0067	0.0023	0.0059	0.0023	0.0056
Antimony	mg/L	0.00024	0.0003	0.00027	0.00035	0.00018	0.00029	0.00028	0.0004
Arsenic	mg/L	0.00042	0.00057	0.00071	0.00089	0.00081	0.0010	0.00089	0.0011
Barium	mg/L	0.032	0.039	0.037	0.044	0.028	0.041	0.04	0.051
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.038	0.057	0.058	0.074	0.054	0.071	0.069	0.087
Cadmium	mg/L	0.0001	0.00022	0.000077	0.00015	0.000025	0.000085	0.000055	0.00015
Chromium	mg/L	0.00025	0.00025	0.00026	0.00031	0.00026	0.00033	0.00026	0.00035
Cobalt	mg/L	0.00005	0.00005	0.000078	0.00019	0.000088	0.00024	0.000097	0.00027
Copper	mg/L	0.018	0.027	0.014	0.023	0.0043	0.0098	0.011	0.019
Iron	mg/L	0.015	0.015	0.015	0.015	0.012	0.012	0.011	0.011
Lead	mg/L	0.000025	0.000025	0.000026	0.00003	0.000024	0.00003	0.000026	0.000032
Lithium	mg/L	0.0097	0.015	0.0096	0.014	0.0038	0.0068	0.0073	0.012
Manganese	mg/L	0.016	0.088	0.07	0.14	0.082	0.16	0.1	0.21
Mercury	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.31	0.45	0.3	0.41	0.051	0.078	0.074	0.11
Nickel	mg/L	0.00034	0.00056	0.00034	0.00053	0.00033	0.00049	0.00033	0.0005
Selenium	mg/L	0.11	0.19	0.076	0.14	0.0038	0.012	0.007	0.018
Silicon	mg/L	4.7	7.0	4.9	6.9	5.1	6.8	5.2	6.8
Silver	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Strontium	mg/L	4.6	6.8	3.8	5.9	0.82	1.5	2.1	4.0
Thallium	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.005	0.005	0.0051	0.0062	0.0051	0.0065	0.0053	0.0069
Uranium	mg/L	0.004	0.0066	0.0032	0.0056	0.0012	0.0026	0.0025	0.0043
Vanadium	mg/L	0.00025	0.00025	0.00033	0.00047	0.00035	0.00054	0.00037	0.0006
Zinc	mg/L	0.0039	0.012	0.0033	0.007	0.0017	0.0029	0.0029	0.0071

a) Calculated based on predicted calcium and magnesium concentrations.

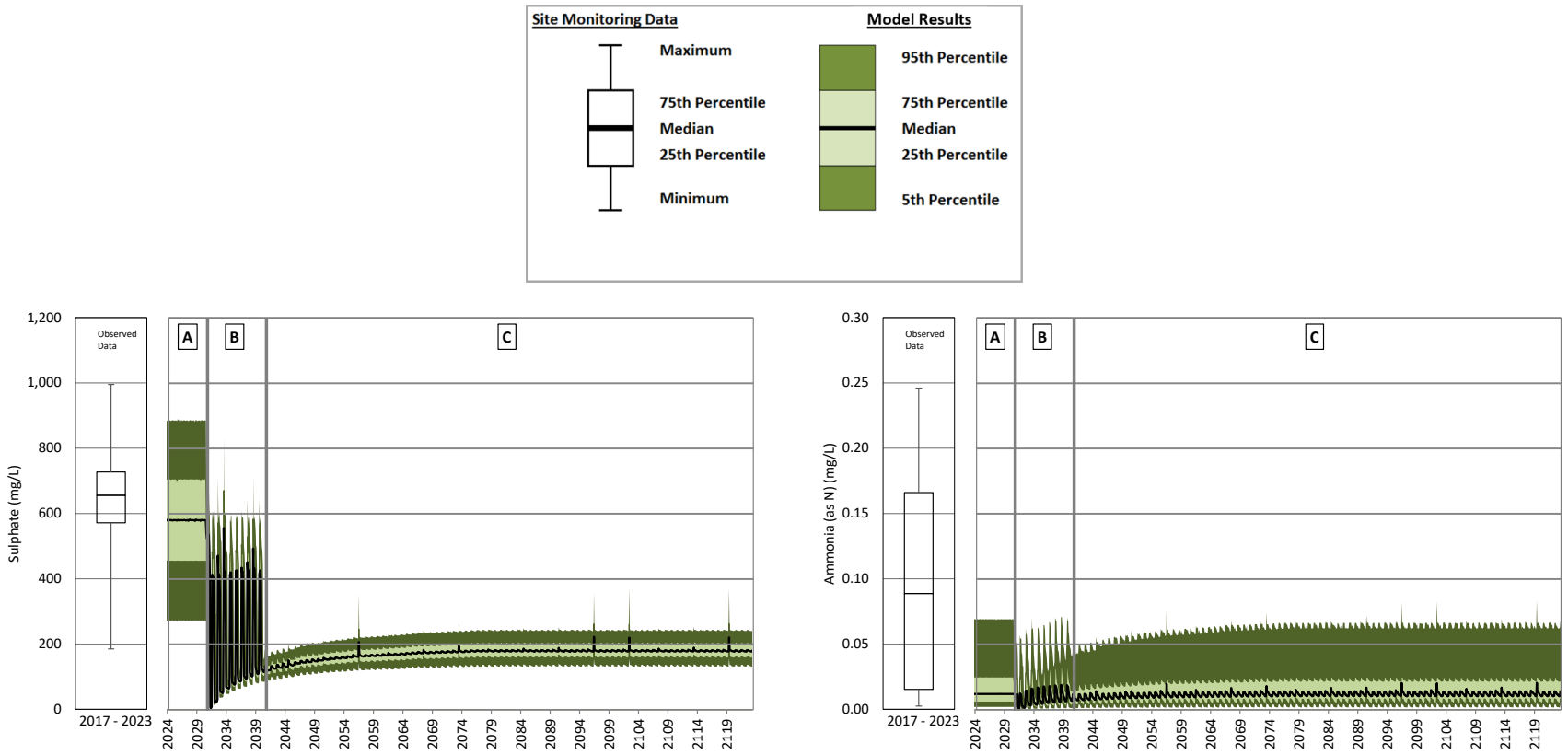

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 53: Predicted Sulphate and Total Ammonia Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

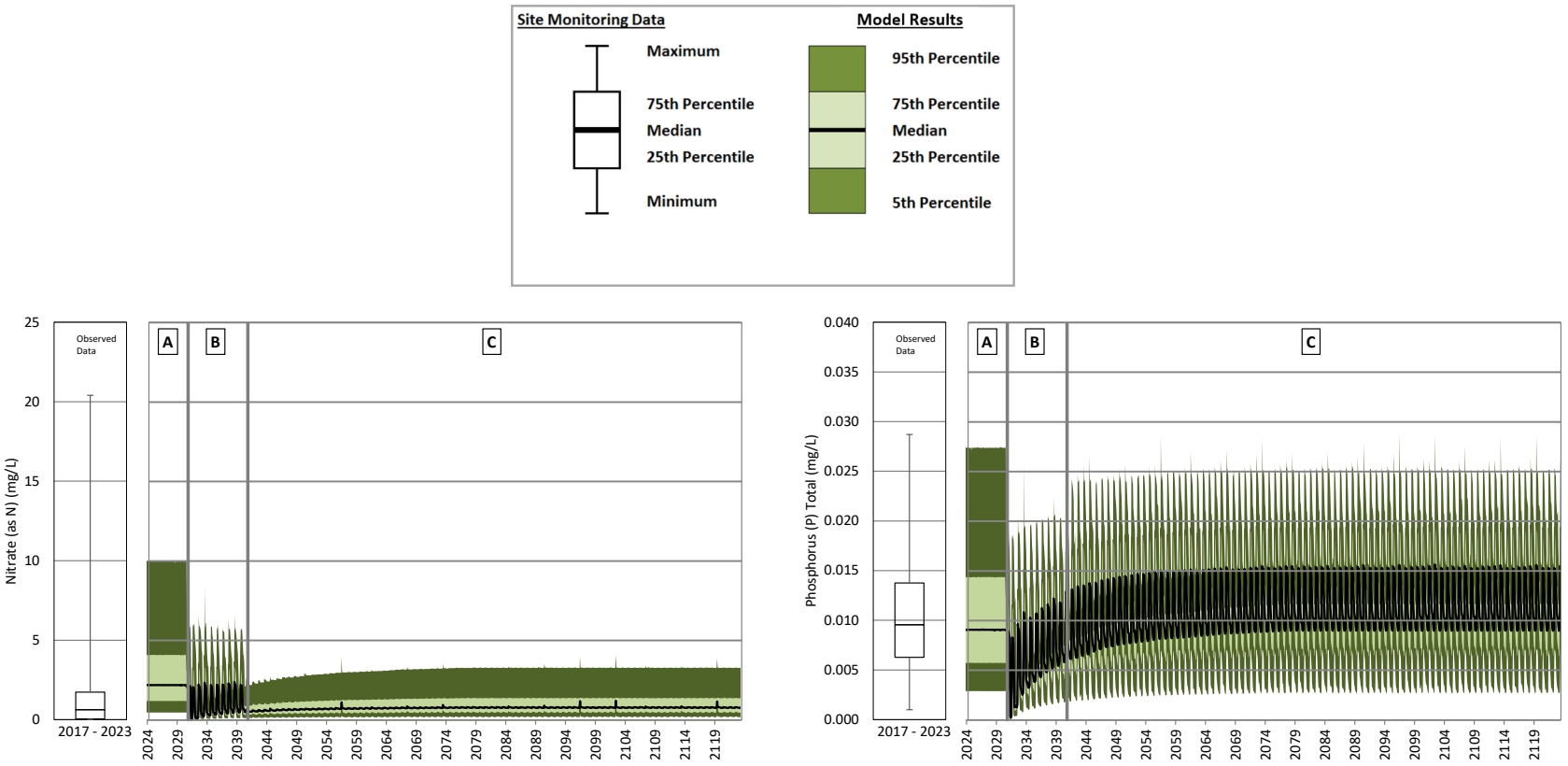

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 54: Predicted Nitrate and Total Phosphorus Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

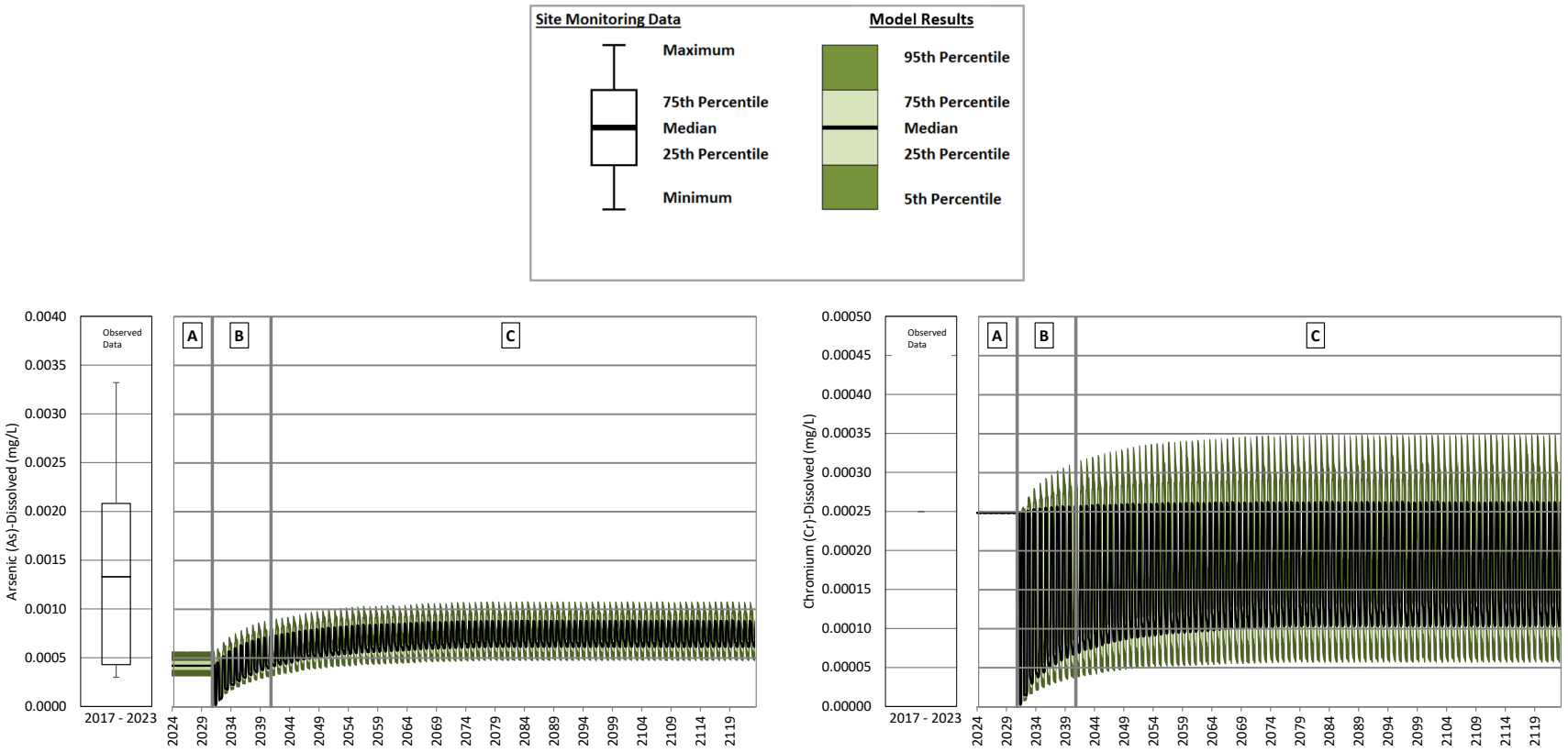

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 55: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

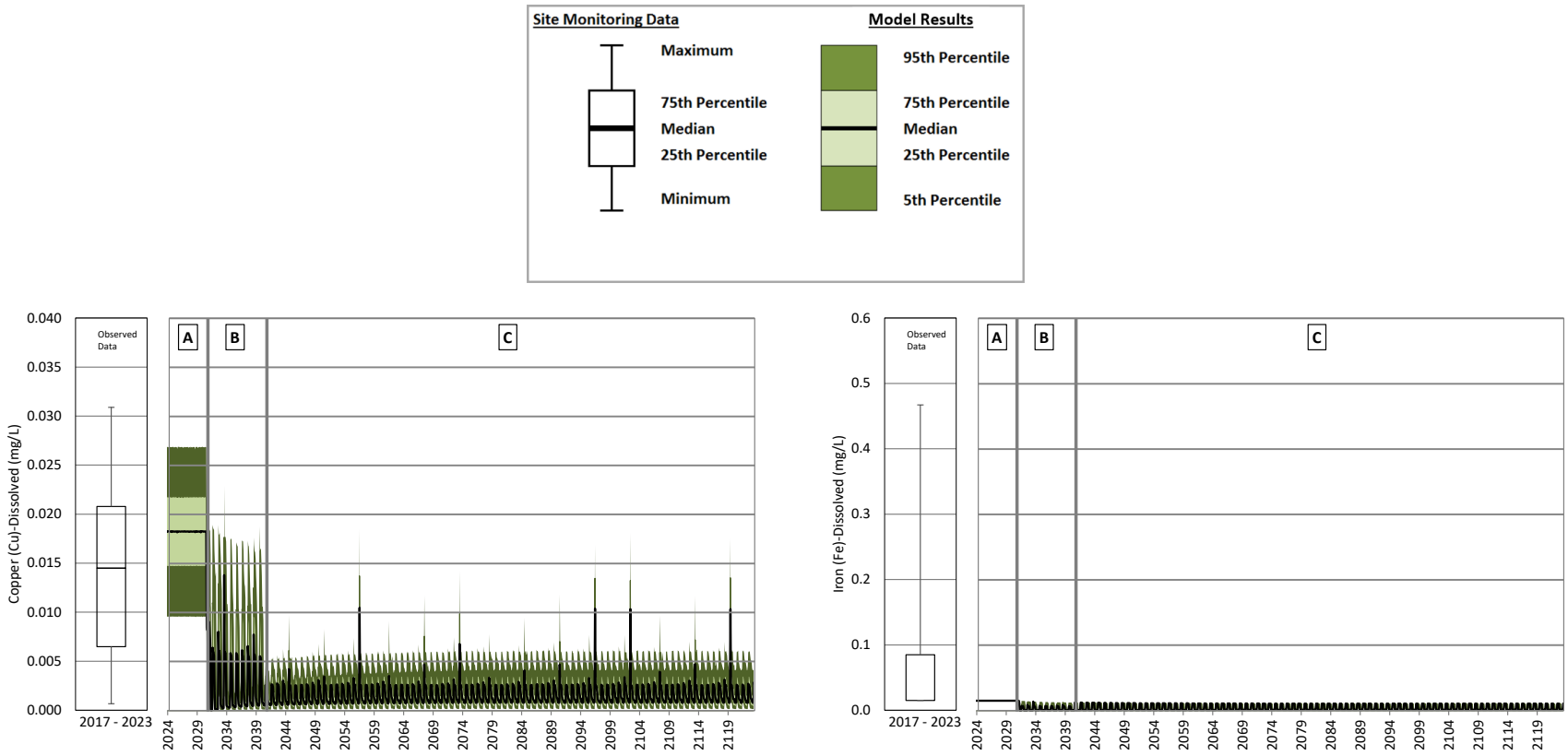

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 56: Predicted Dissolved Copper and Dissolved Iron Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

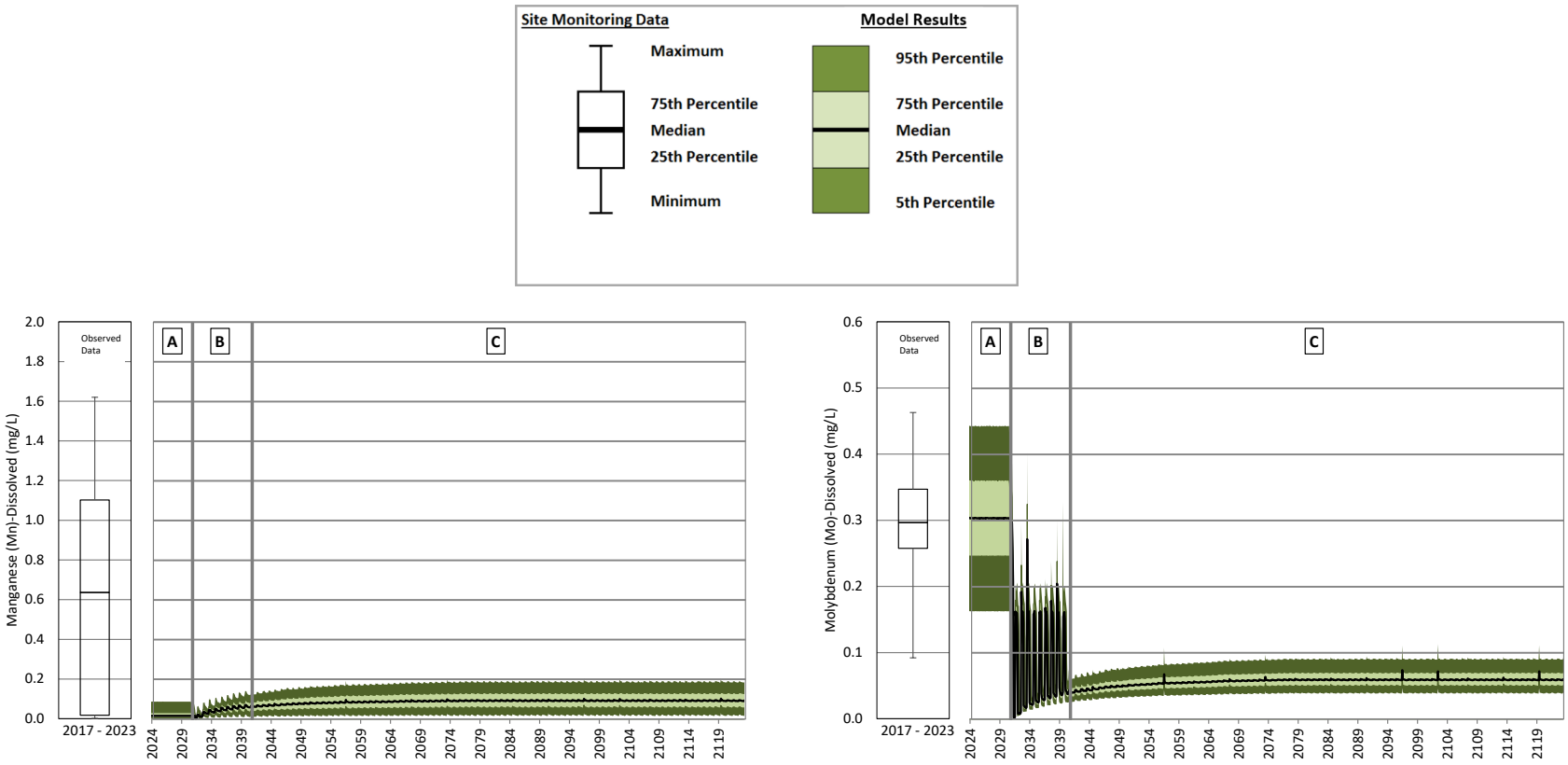

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 57: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

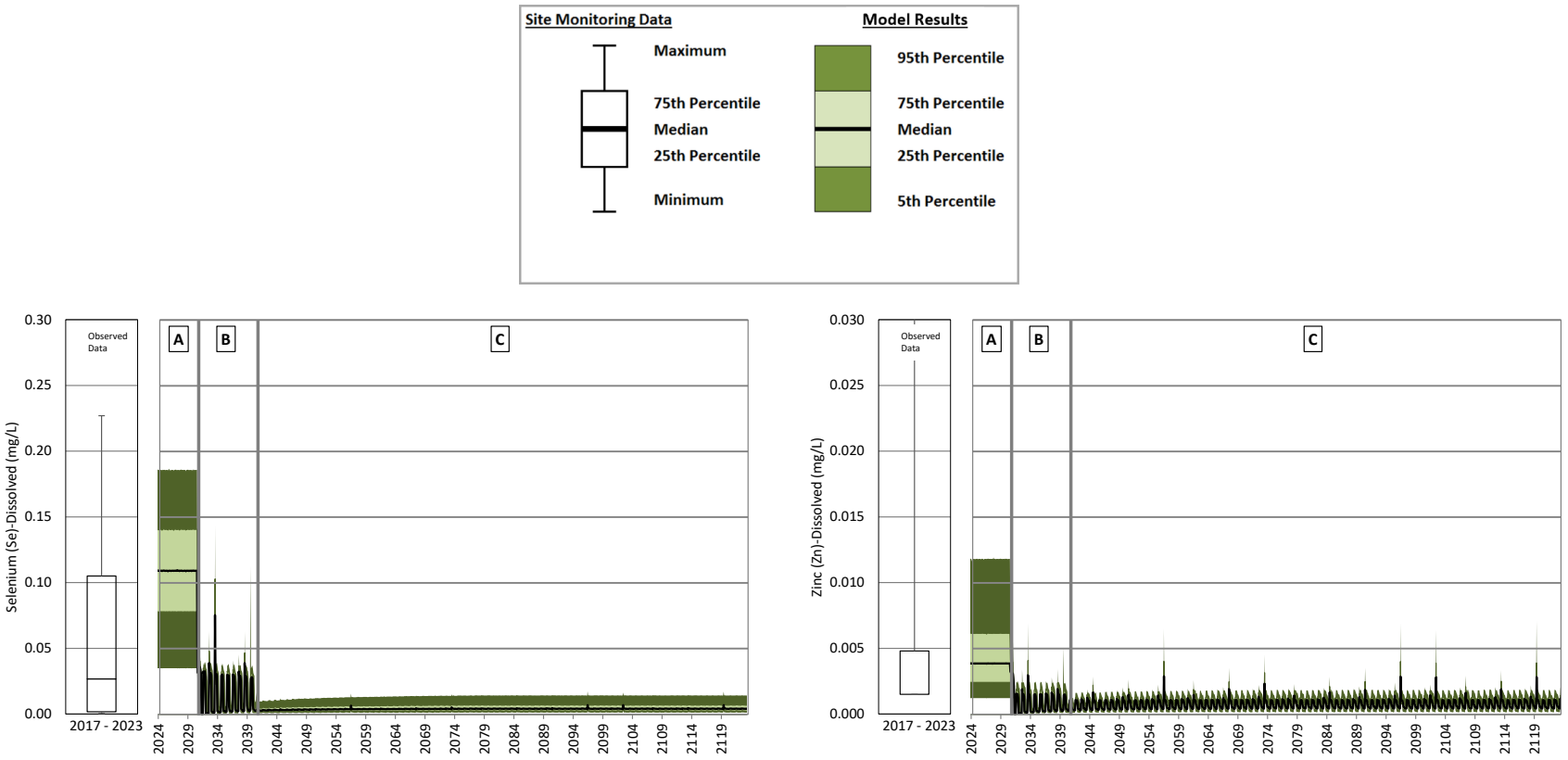

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 58: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

4.5.2 Main Embankment Seepage Collection Pond

The SWWBM assumes that the MESCP has minimal surface catchment area from TSF area and undisturbed catchment area and receives mostly TSF seepage in closure. Discharge from the MESCP will be directed to upper Edney Creek. Time series plots for key parameters in MESCP for operations, closure and post-closure are shown in Figures 59 to 64. Maximum of median and 95th percentile predictions are presented in Table 19.

For most parameters, peak concentrations in the MESCP occur during operations, and then are predicted to decrease once mine site areas are reclaimed (Figures 59 to 64). Reclaimed areas of the TSF beach and impoundment are assigned an undisturbed water quality. The increase in concentration until 2051 for most parameters in the MESCP is caused by pumping from the SESCP. Pumping from the SESCP to the MESCP ends in 2051. Similar to the SESCP, the range in predicted concentrations is considered reasonable. However, the timing is uncertain because the amount of time it might take to flush process water from the tailings is unknown.

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	641	800	469	681	331	562	153	254
Total Dissolved Solids	mg/L	950	1,216	753	1,046	516	819	215	314
Major Ions									
Calcium	mg/L	196	240	143	203	91	155	37	57
Chloride	mg/L	24	28	6.2	13	7.1	11	4.5	9.9
Fluoride	mg/L	0.86	0.97	0.39	0.51	0.3	0.41	0.15	0.21
Magnesium	mg/L	36	49	27	42	25	43	15	27
Potassium	mg/L	23	25	4.2	7.3	4.2	5.4	2.3	3.1
Sodium	mg/L	90	97	28	36	27	34	15	19
Sulphate	mg/L	614	757	469	626	153	205	82	119
Nutrients									
Ammonia	mg/L (as N)	0.031	0.057	0.04	0.08	0.013	0.057	0.0073	0.032
Nitrate	mg/L (as N)	3.6	15	2.9	6.3	0.68	2.8	0.37	1.5
Nitrite	mg/L (as N)	0.079	0.092	0.02	0.057	0.0061	0.067	0.0032	0.035
Total Phosphorus	mg/L	0.014	0.025	0.014	0.022	0.015	0.025	0.025	0.038
Total Metals									
Aluminum	mg/L	0.47	0.49	0.47	0.52	0.037	0.15	0.072	0.33
Antimony	mg/L	0.0016	0.0019	0.00056	0.001	0.00018	0.00026	0.000076	0.00013
Arsenic	mg/L	0.0037	0.004	0.00098	0.0013	0.00085	0.0011	0.001	0.0019
Barium	mg/L	0.069	0.083	0.038	0.053	0.029	0.038	0.013	0.02
Beryllium	mg/L	0.000052	0.000054	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Boron	mg/L	0.13	0.2	0.071	0.11	0.05	0.065	0.028	0.037
Cadmium	mg/L	0.00014	0.00025	0.000058	0.00015	0.000029	0.000091	0.000012	0.000052
Chromium	mg/L	0.00066	0.00069	0.00067	0.00073	0.00044	0.00094	0.00096	0.0019
Cobalt	mg/L	0.00047	0.00075	0.00036	0.00046	0.000086	0.00031	0.000063	0.00021
Copper	mg/L	0.022	0.18	0.02	0.17	0.0057	0.013	0.003	0.0071
Iron	mg/L	0.47	0.51	0.46	0.53	0.067	0.24	0.15	0.5
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000023	0.000054	0.000017	0.00012
Lithium	mg/L	0.013	0.016	0.0091	0.014	0.0041	0.0076	0.0018	0.0032
Manganese	mg/L	0.093	0.18	0.088	0.16	0.084	0.17	0.047	0.1
Mercury	mg/L	0.0000052	0.0000054	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Molybdenum	mg/L	0.38	0.45	0.26	0.35	0.05	0.077	0.027	0.043
Nickel	mg/L	0.001	0.0017	0.00092	0.0011	0.00047	0.00091	0.00099	0.0022
Selenium	mg/L	0.064	0.1	0.057	0.1	0.0038	0.012	0.002	0.0069
Silver	mg/L	0.0000056	0.000013	0.0000051	0.000012	0.0000051	0.000013	0.0000067	0.000021
Strontium	mg/L	4.1	5.8	2.6	4.1	0.89	1.6	0.35	0.73
Thallium	mg/L	0.0000064	0.0000086	0.0000051	0.000006	0.0000051	0.0000051	0.0000055	0.0000059
Tin	mg/L	0.000052	0.00013	0.000051	0.00013	0.000051	0.000051	0.000055	0.000059
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0052	0.0087
Uranium	mg/L	0.0027	0.0041	0.0022	0.0038	0.0014	0.0028	0.00065	0.0014
Vanadium	mg/L	0.0044	0.0046	0.0018	0.0023	0.00053	0.00095	0.00075	0.0014
Zinc	mg/L	0.0084	0.013	0.0068	0.01	0.0021	0.0036	0.0011	0.0014

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Dissolved Metals									
Aluminum	mg/L	0.012	0.039	0.013	0.069	0.009	0.031	0.044	0.21
Antimony	mg/L	0.0016	0.0018	0.00054	0.00089	0.00018	0.00026	0.000076	0.00013
Arsenic	mg/L	0.0035	0.0037	0.00071	0.0011	0.00082	0.0010	0.00098	0.0018
Barium	mg/L	0.067	0.074	0.036	0.044	0.028	0.037	0.013	0.018
Beryllium	mg/L	0.000052	0.000054	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059
Boron	mg/L	0.13	0.17	0.067	0.083	0.05	0.063	0.028	0.035
Cadmium	mg/L	0.00013	0.0002	0.000056	0.00011	0.000028	0.000083	0.000011	0.000044
Chromium	mg/L	0.00027	0.0003	0.00029	0.00035	0.00033	0.00042	0.00085	0.0013
Cobalt	mg/L	0.00018	0.00047	0.000077	0.00018	0.000086	0.00023	0.000063	0.00013
Copper	mg/L	0.013	0.026	0.011	0.019	0.0054	0.011	0.0026	0.0055
Iron	mg/L	0.025	0.065	0.02	0.083	0.023	0.052	0.1	0.31
Lead	mg/L	0.000026	0.000029	0.000026	0.00003	0.000023	0.000034	0.000017	0.000099
Lithium	mg/L	0.013	0.015	0.0089	0.013	0.0041	0.0075	0.0018	0.003
Manganese	mg/L	0.071	0.16	0.067	0.13	0.08	0.16	0.043	0.088
Mercury	mg/L	0.0000052	0.0000054	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Molybdenum	mg/L	0.38	0.44	0.25	0.33	0.05	0.077	0.027	0.043
Nickel	mg/L	0.00045	0.0011	0.00038	0.00057	0.0004	0.00059	0.00092	0.0019
Selenium	mg/L	0.064	0.096	0.057	0.096	0.0038	0.012	0.002	0.0068
Silicon	mg/L	5.6	6.8	5.0	6.4	5.2	6.6	6.5	9.3
Silver	mg/L	0.0000056	0.0000069	0.0000051	0.000006	0.0000051	0.000006	0.0000067	0.000015
Strontium	mg/L	4.1	5.5	2.5	3.7	0.89	1.6	0.35	0.71

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Thallium	mg/L	0.0000064	0.0000079	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Tin	mg/L	0.000052	0.000055	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059
Titanium	mg/L	0.0065	0.0077	0.0056	0.0087	0.005	0.0064	0.0052	0.0087
Uranium	mg/L	0.0027	0.0039	0.0022	0.0035	0.0014	0.0028	0.00064	0.0013
Vanadium	mg/L	0.0032	0.0034	0.0006	0.0011	0.00038	0.00056	0.0006	0.00099
Zinc	mg/L	0.0057	0.01	0.0041	0.0075	0.0021	0.0036	0.0011	0.0014

a) Calculated based on predicted calcium and magnesium concentrations.

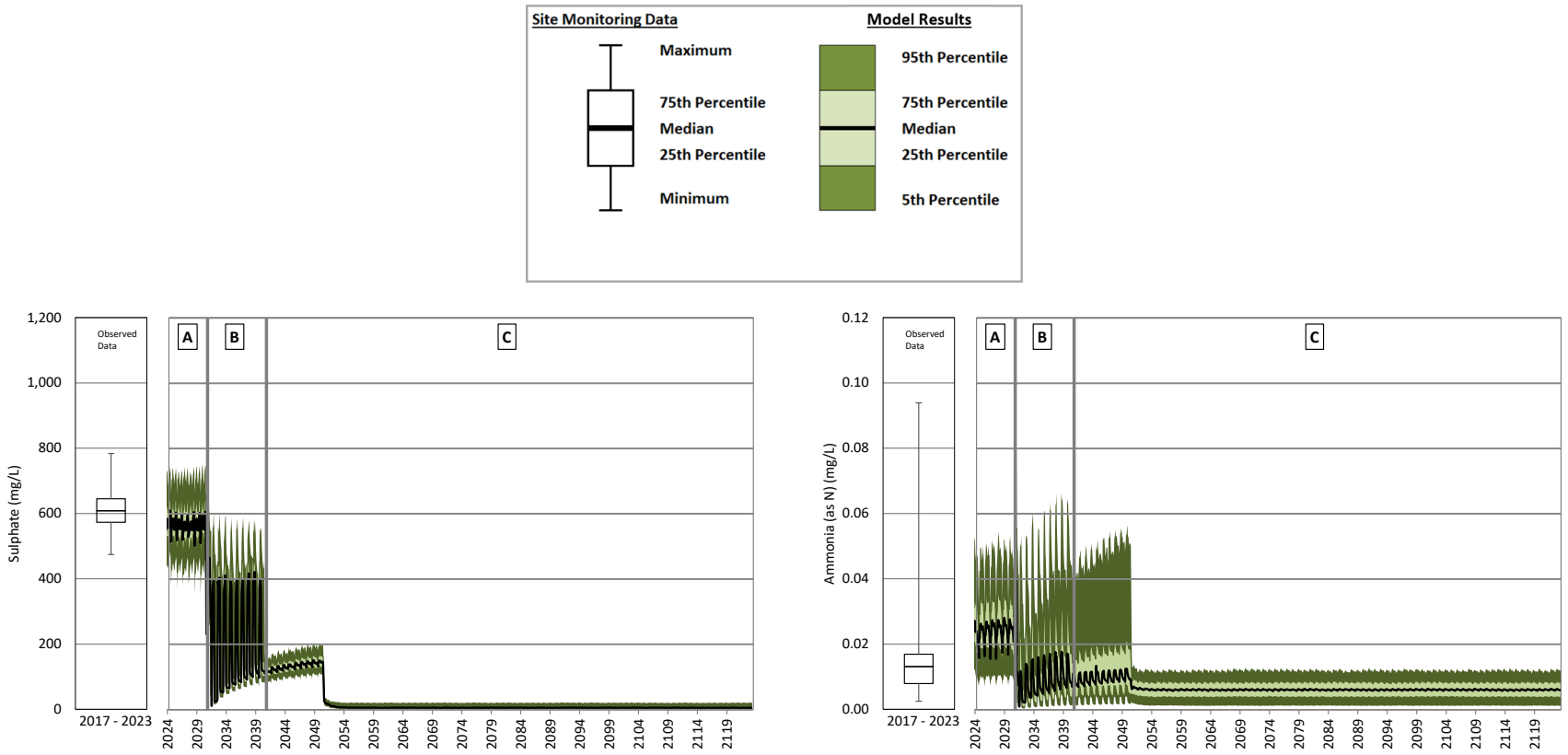

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 59: Predicted Sulphate and Total Ammonia Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

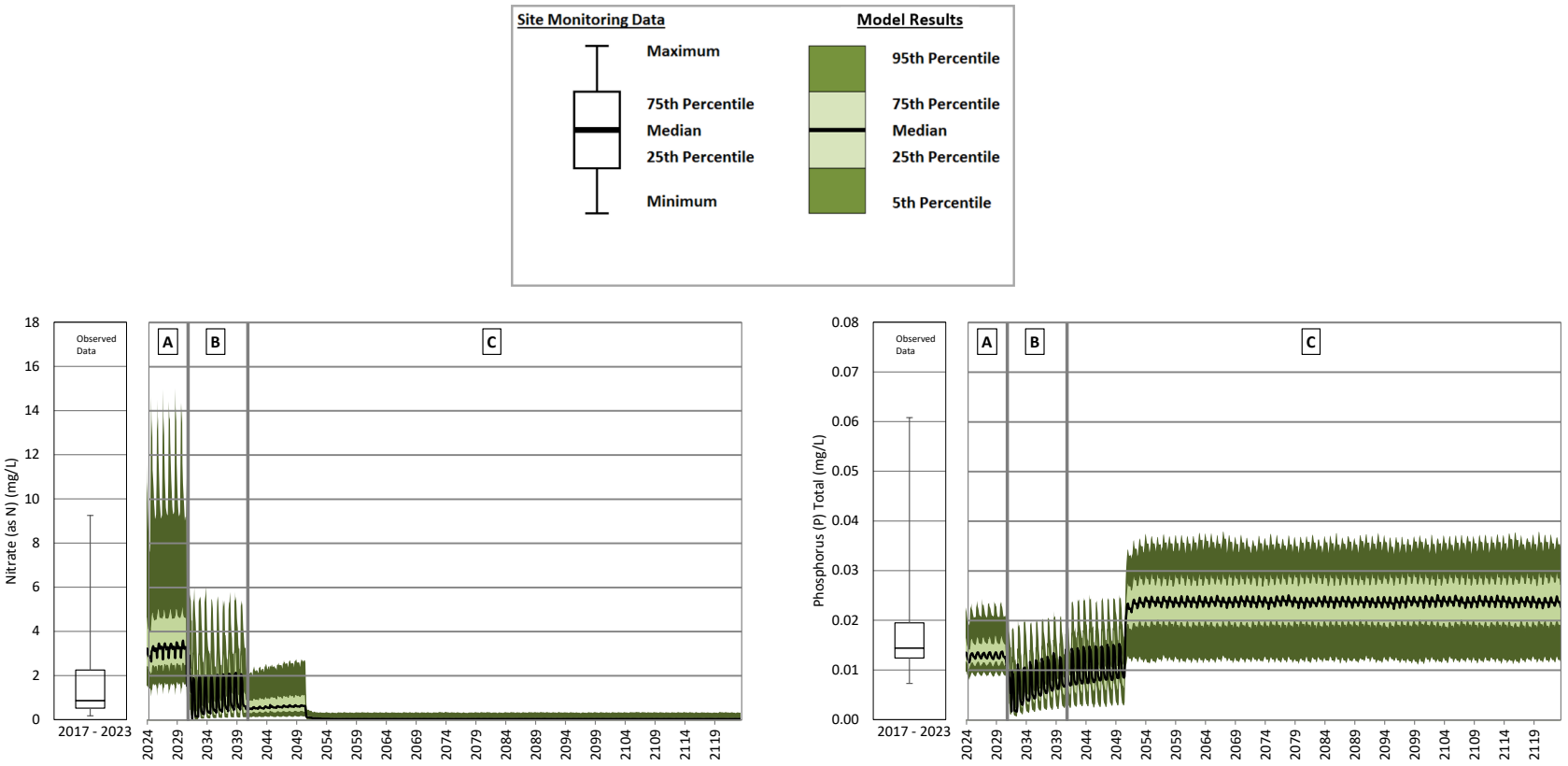

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 60: Predicted Nitrate and Total Phosphorus Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

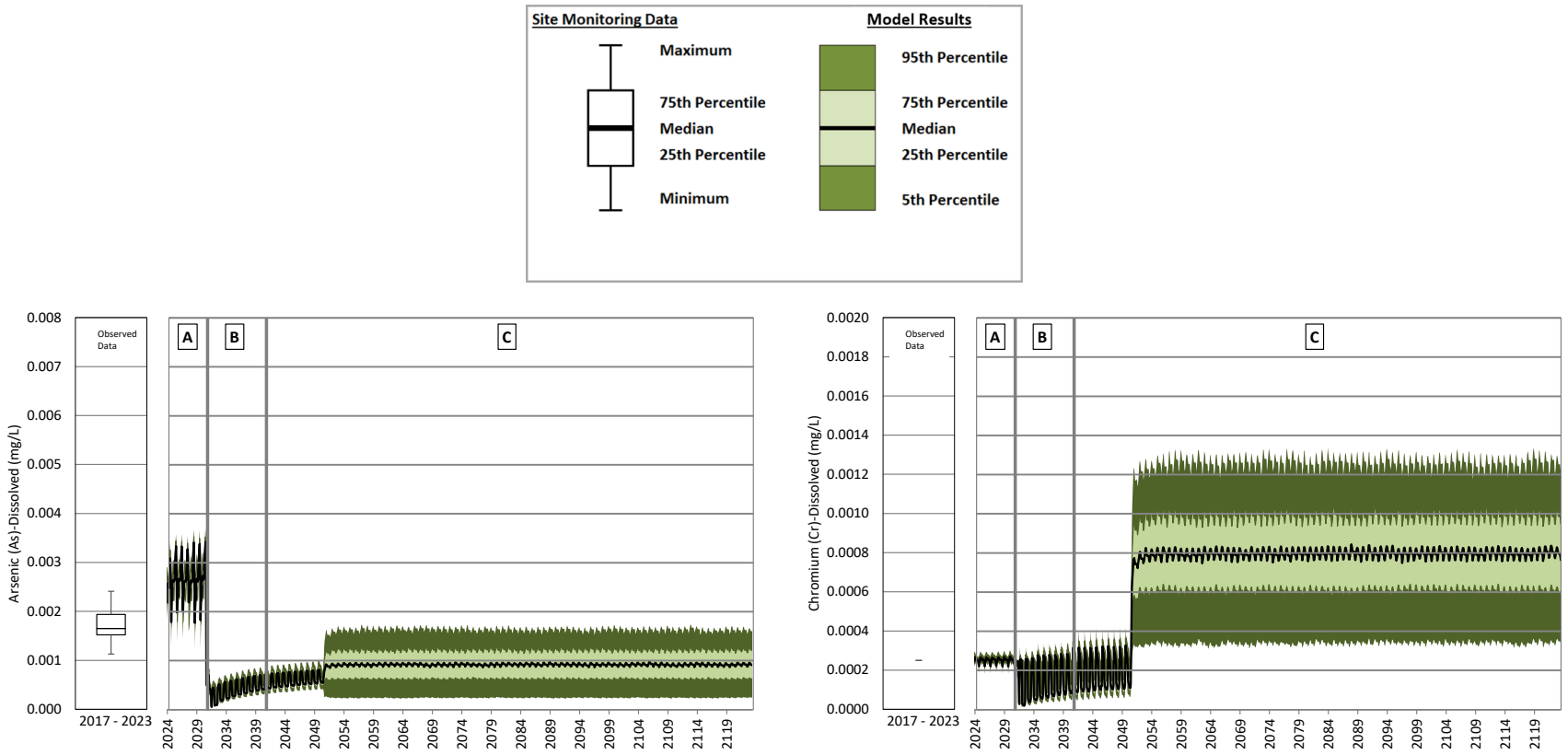

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 61: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

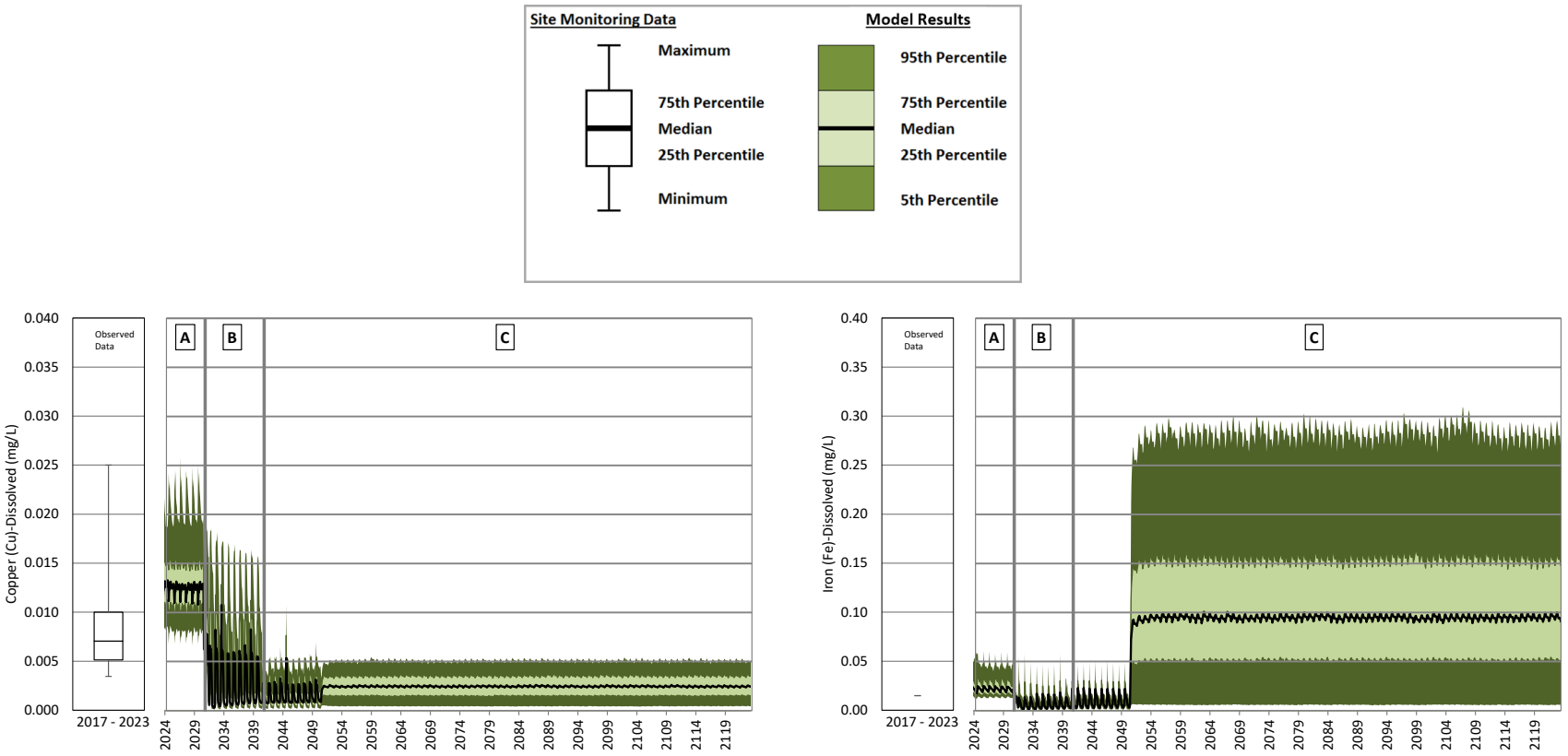

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 62: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

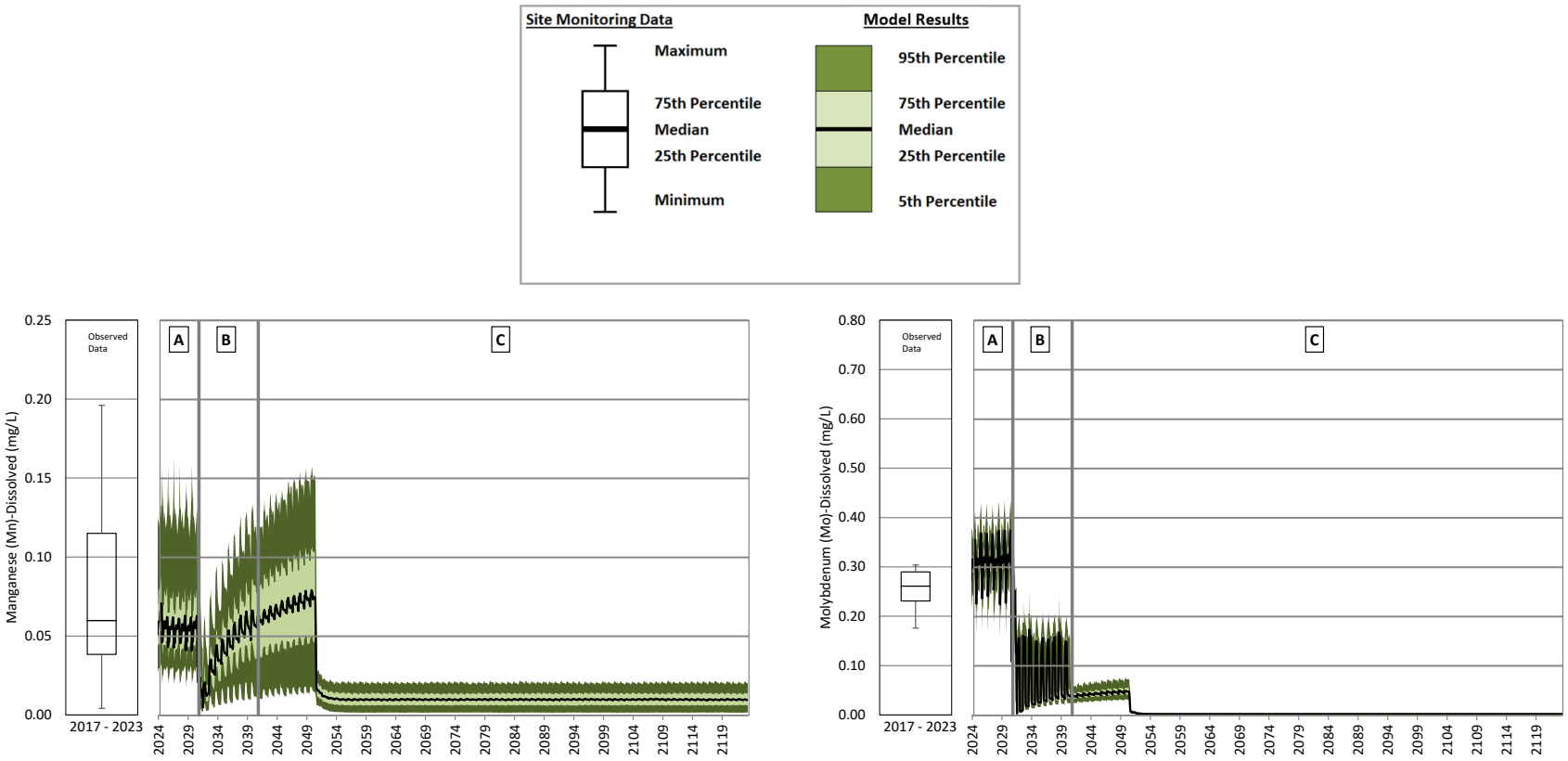

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 63: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

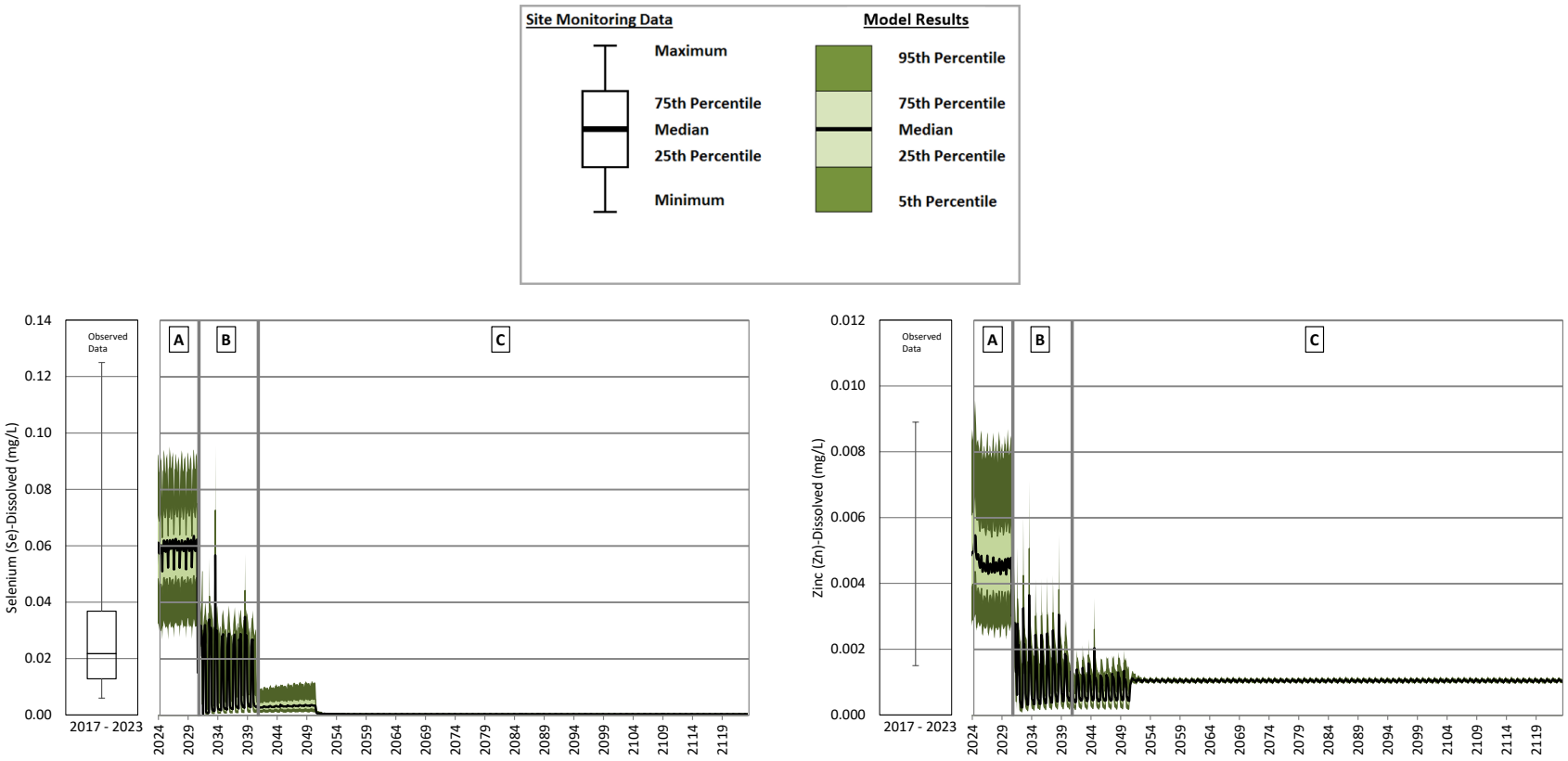

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 64: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

5.0 SUMMARY

The GoldSim model that was developed for the 2020 WMP to predict discharge water quality at the mine during operations was updated to predict concentrations during operations, closure and post-closure on the mine site under the Springer Expansion mine plan. The model was also updated with additional monitoring data for assigned water quality inputs to refine the distribution inputs into the model. Updated geochemical source terms were also modelled in an alternative scenario (in place of inputs calculated from monitoring data) and were compared to model results that used monitoring data to calculate the water quality inputs. The model results from the scenario that used the geochemical source terms were considered overly conservative and not presented in this report.

The updated model was calibrated against monitoring data from the mine site. During closure and post-closure, discharges from the mine will preferably be returned to their undisturbed watersheds, to the extent possible. Specifically, nine potential mine discharge locations are expected to drain to Polley Lake, Bootjack Lake, Edney Creek, and Hazeltine Creek.

The updated predicted concentrations during operations, closure and post-closure in the mine site are similar to those presented in previous iterations of the water quality model including the 2016 Long Term Water Management Plan (Golder 2016), the 2020 Water Management Plane (Golder 2020) and the 2022 Reclamation and Closure Plan (Golder 2022a). For some parameters, the maximum predicted concentrations of total metals are lower during post-closure in this update of the water quality model. This change in predicted total metal concentrations is due to an adjustment to the particulate addition calculation during post-closure that now assumes a total suspended solids concentration that is representative of a reclaimed water quality input. Changes in concentrations from operations to closure and post-closure are caused by reclamation of mine site areas that are complete during post-closure. Predicted concentrations reach a steady state during post-closure after reclamation of the mine site areas is complete and the Springer Expansion pit is filled. In general, the model predicted higher concentrations in the closure period, relative to the post- closure period for most parameters with the exception of parameters that are predicted to be higher in the assigned undisturbed runoff water quality than in the assigned disturbed, NAG or PAG waste rock water quality. Treatment and mitigation strategies during operations, closure and post-closure are addressed in the treatment section of the WMP (WSP 2023a).

6.0 CLOSURE

This report summarizes the reclamation and closure update of the SWWQM.

We trust this report satisfies your current requirements. Please contact the undersigned should you have any questions.

Signature Page

WSP Canada Inc.



Steve Mitchell, BSc
Water Quality Modeller

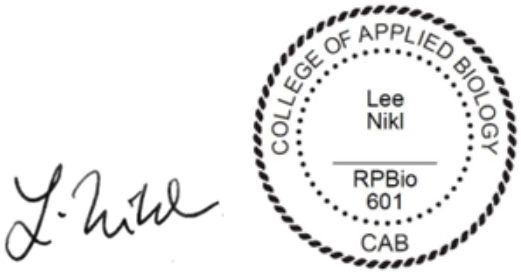

Lee Nikl, MSc, RPBio
Senior Environmental Scientist, Fellow

SM/LN/ar/ap

https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/053-r-31282-springer expansion water quality model report/rev0/23590671-053-r-rev0-31282-springer pit expansion wq model report 04dec_23.docx

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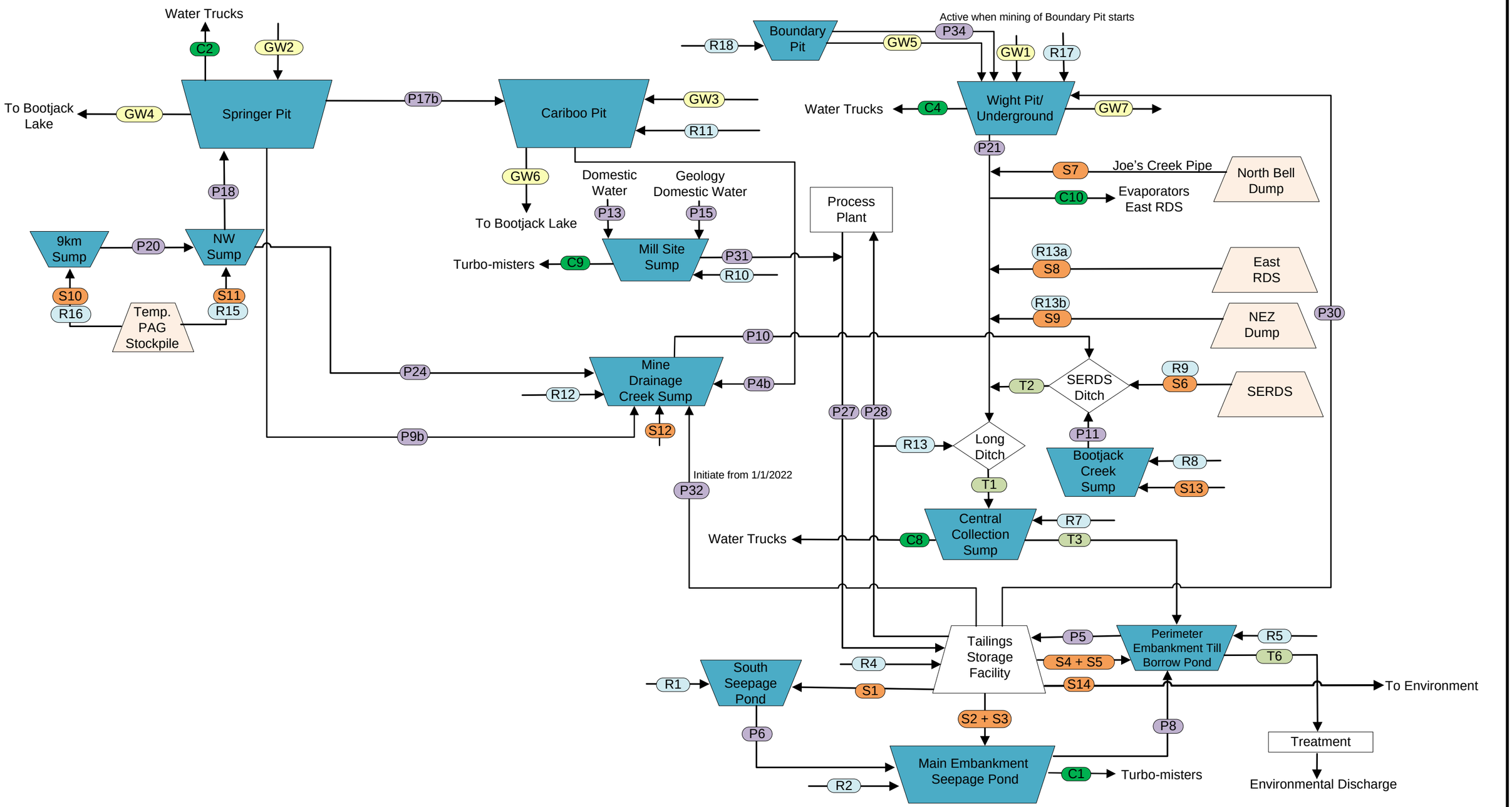

Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 2 October 2023

CHECKED: GD
DATE: 2 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram
2 May 2023 – 31 March 2031

FIGURE No: 1
REV No: 0

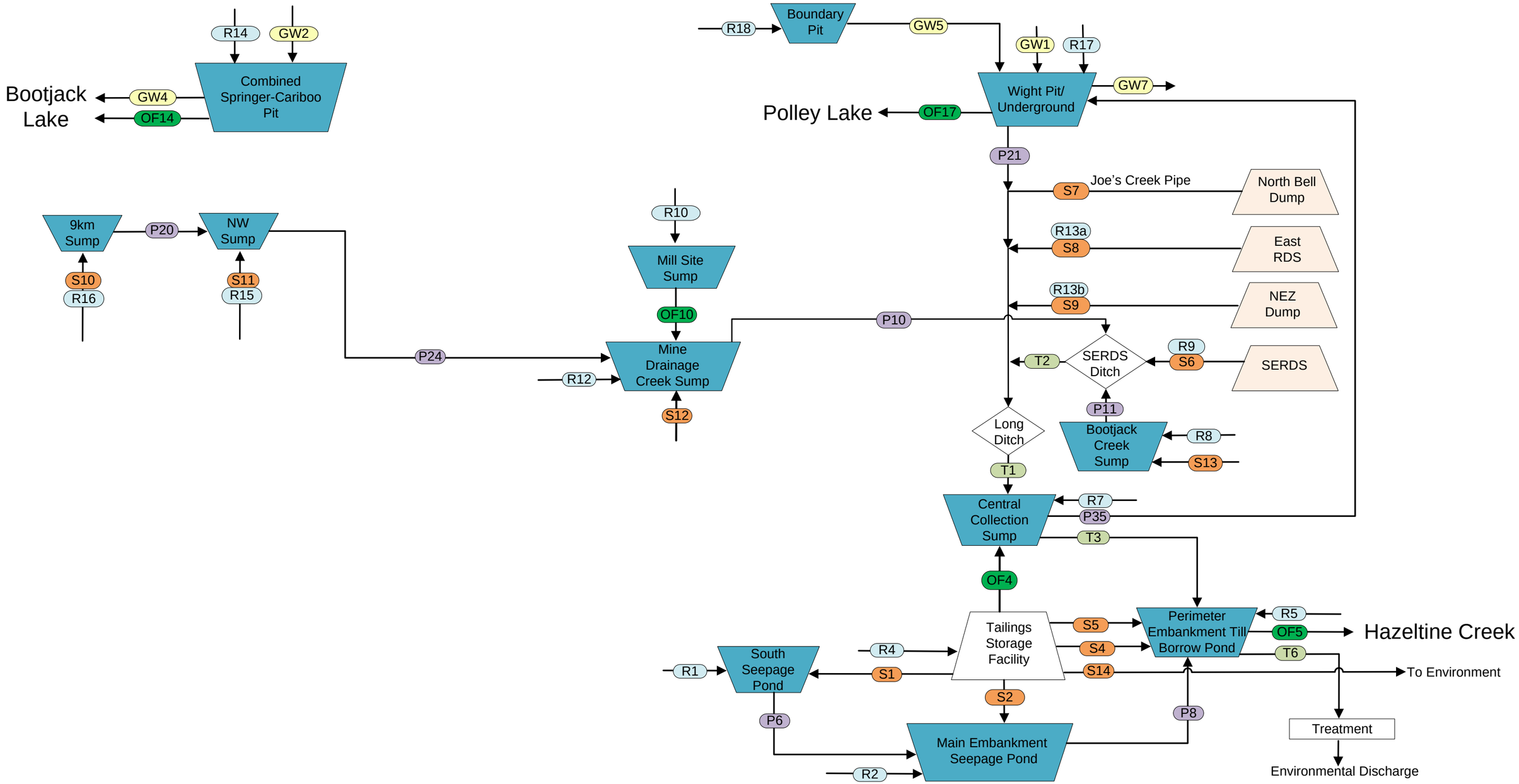

Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 2 October 2023

CHECKED: GD
DATE: 2 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182
FIGURE No: 2
REV No: 0

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041

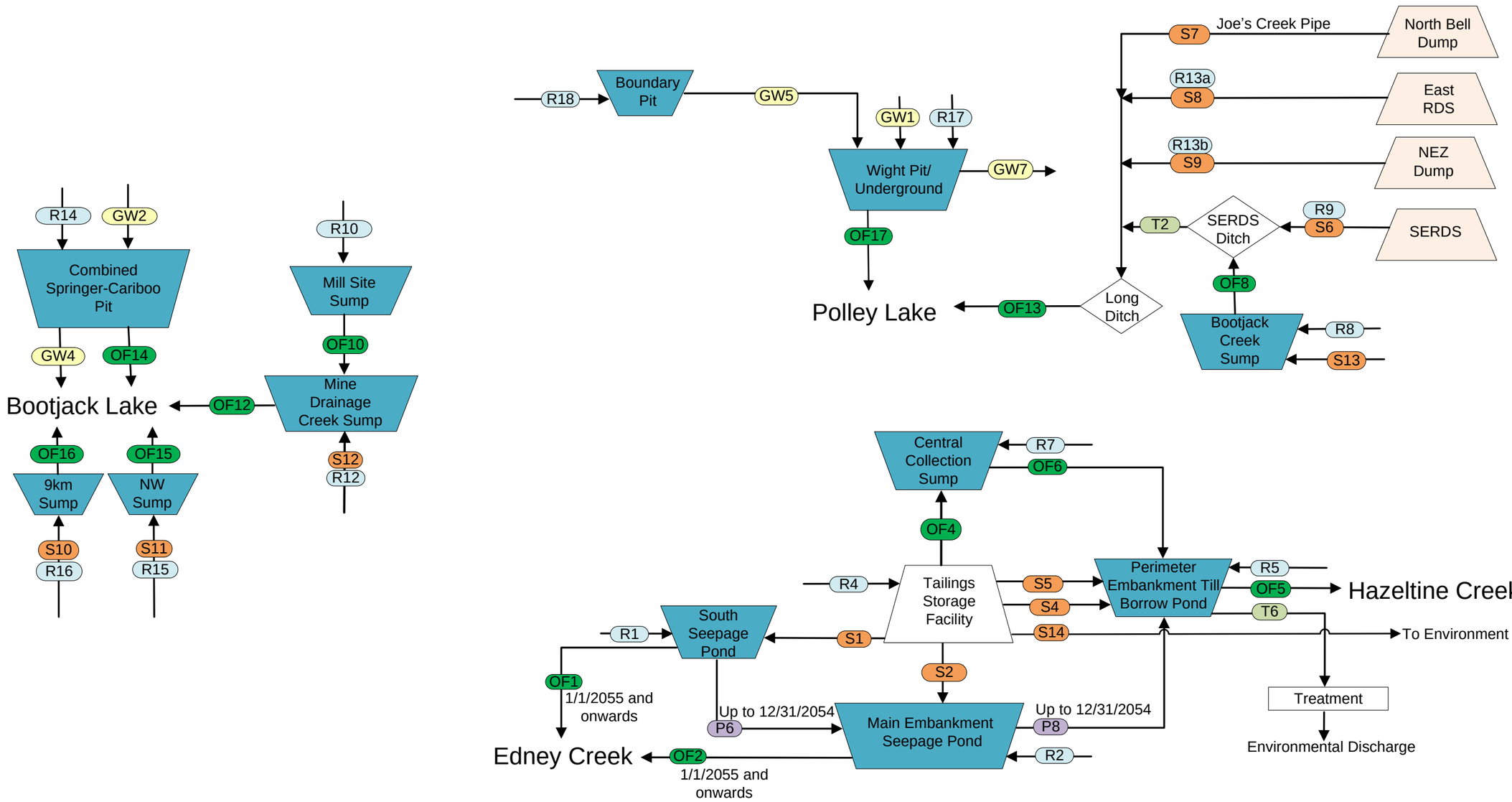

Springer Pit Expansion LOM Site Wide Water Balance

- Runoff (R)
- Seepage Flow (S)
- Overflow (OF)
- Pumped Flows (P)
- Groundwater Flows (GW)
- Transfer Flows (T)
- Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT	Mount Polley Mining Corporation	TITLE	**Post-closure Phase Flow Diagram**
DRAWN SC	DATE 2 October 2023		**1 April 2041 Onwards**
CHECKED GD	DATE 2 October 2023		
SCALE Not to Scale	PROJECT No 23590671/31182	FIGURE No 3	REV No 0

APPENDIX A

Water Quality Model Calibration Results

APPENDIX

Appendix A

Water Quality Model Calibration Results

Reference No. 23590671-053-R-Rev0-31282

December 2023

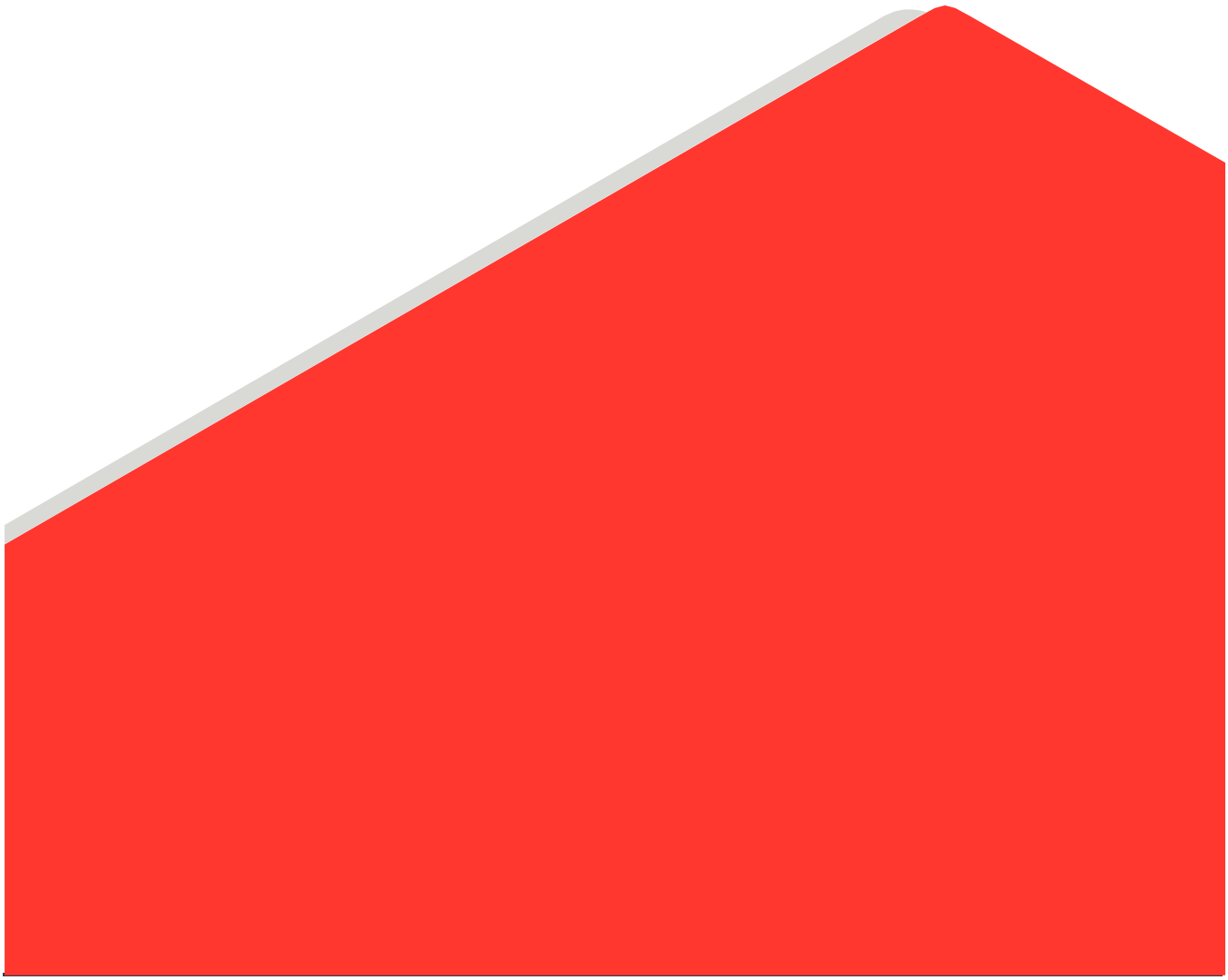

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Appendix A – Calibration Figures

This attachment presents the water quality calibration figures for Springer Pit, Cariboo Pit, Wight Pit, the Central Collection Sump, the Tailings Storage Facility, the Perimeter Embankment Till Borrow Pond and the Northwest Sump. The calibration period was from January 2017 to January 2023.

Springer Pit Calibration

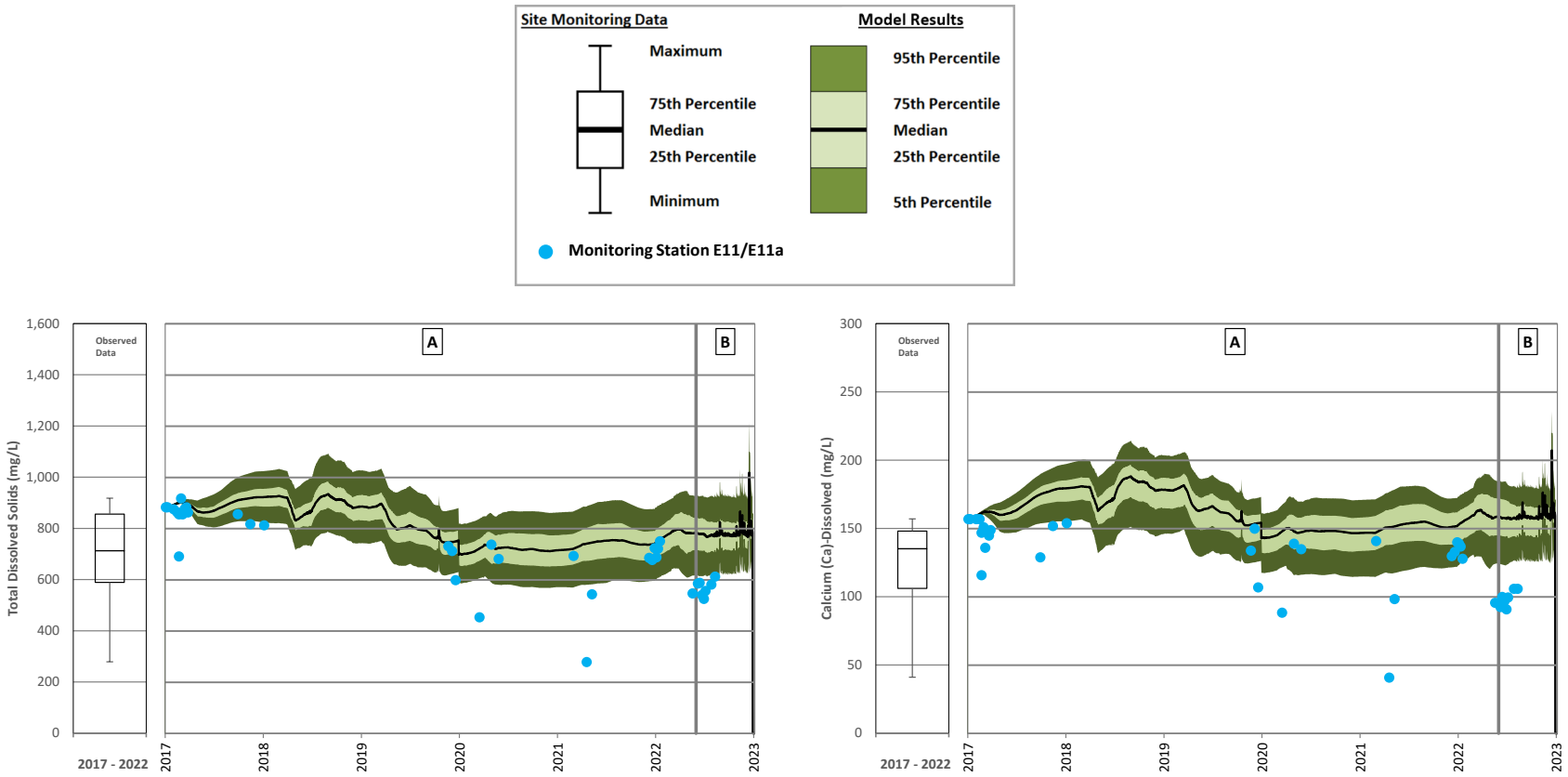

A = Care and Maintanence; B = Resumed Operations

Figure A 1: Springer Pit Calibration – Total Dissolved Solids and Calcium

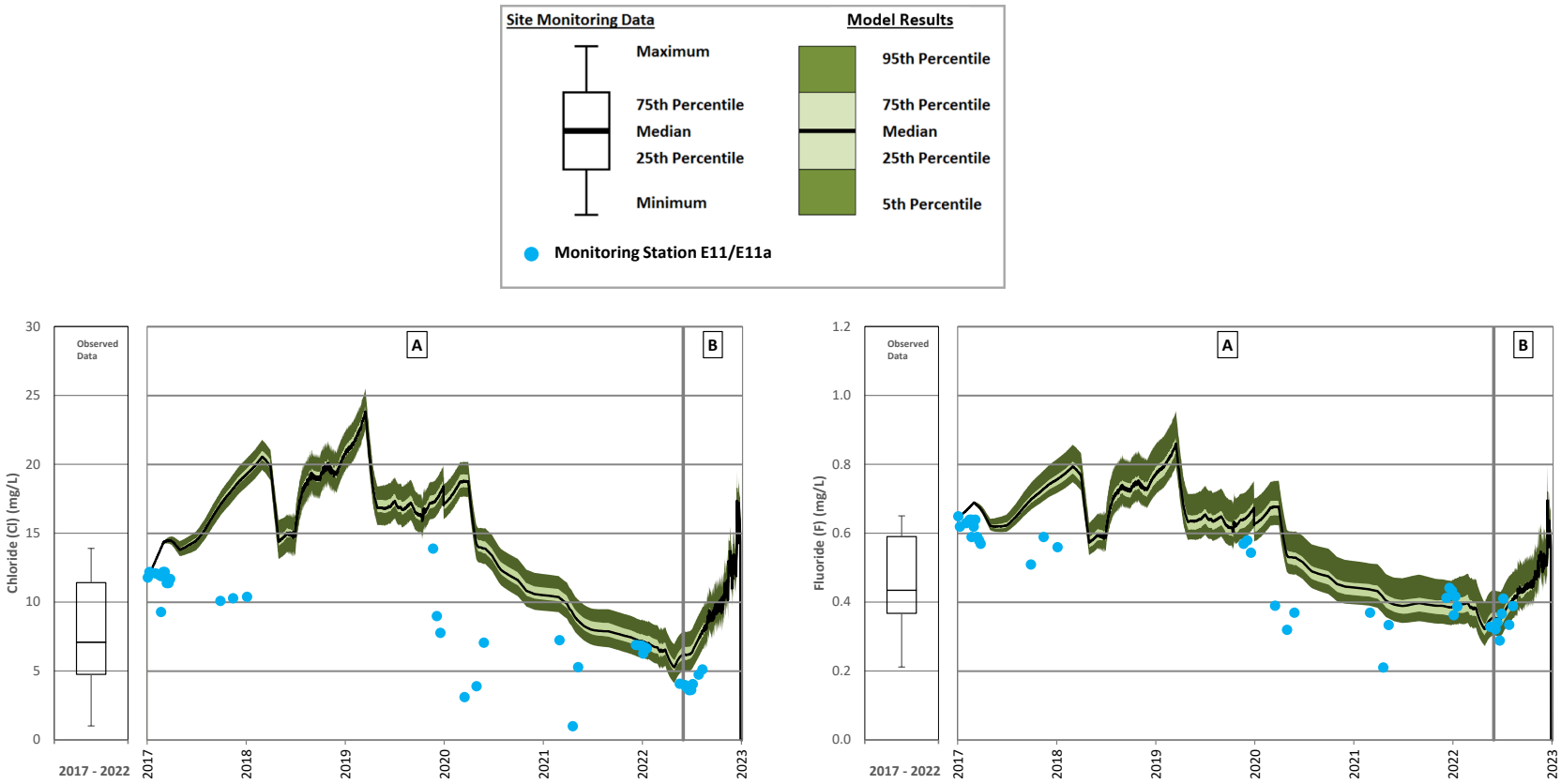

A = Care and Maintanence; B = Resumed Operations

Note: Chloride and fluoride concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 2: Springer Pit Calibration – Chloride and Fluoride

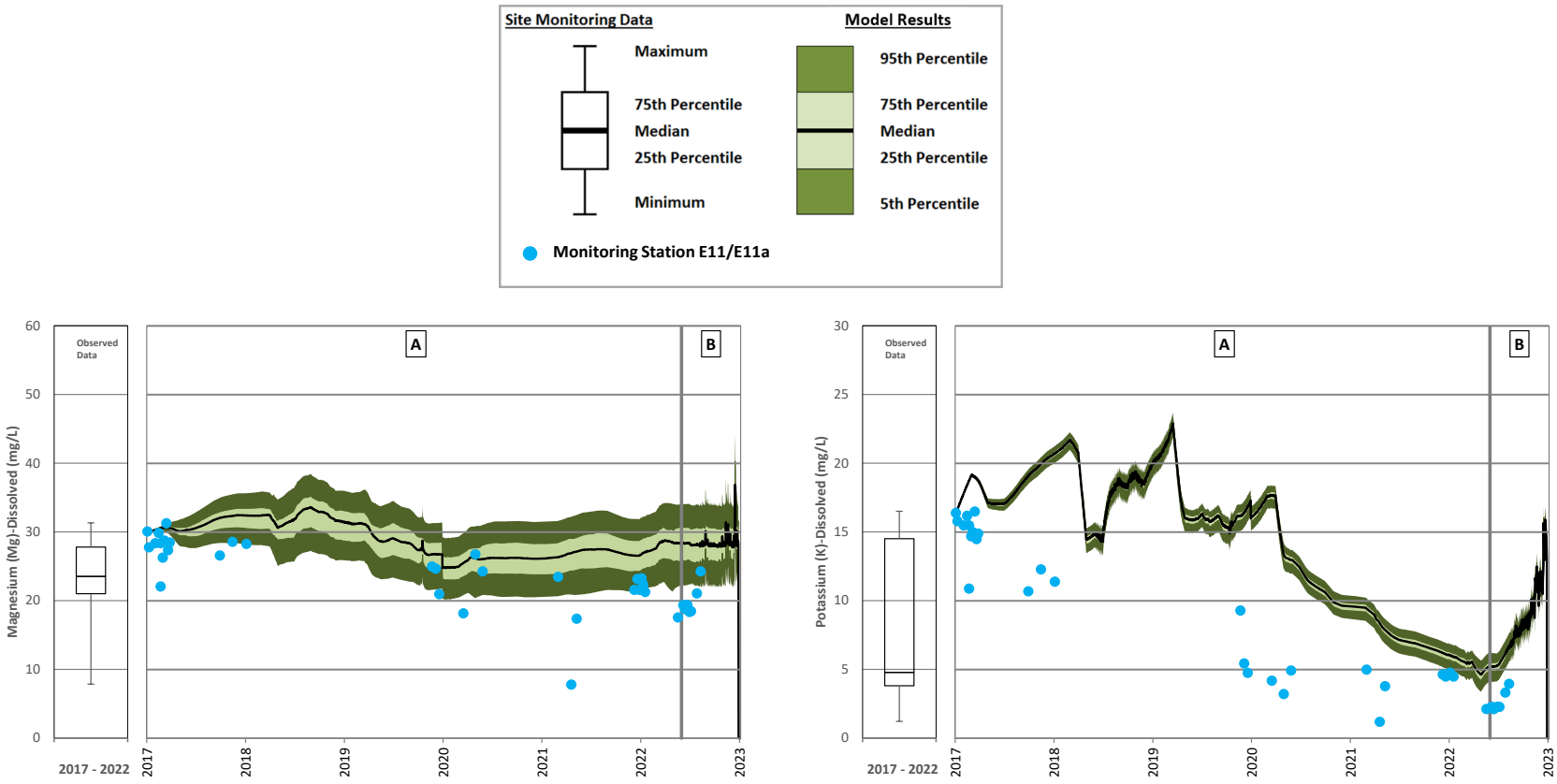

A = Care and Maintanence; B = Resumed Operations

Note: Potassium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 3: Springer Pit Calibration – Magnesium and Potassium

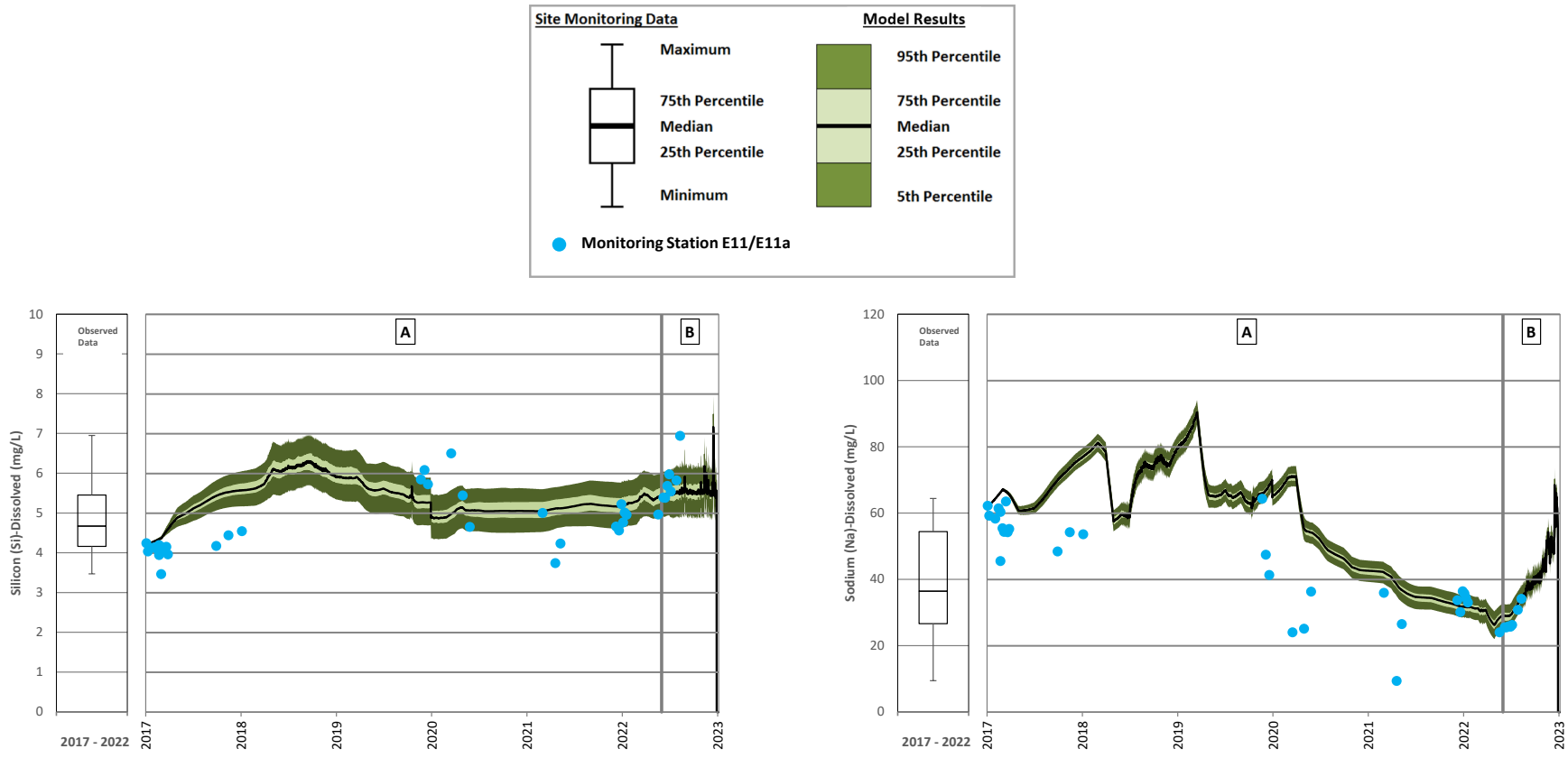

A = Care and Maintanence; B = Resumed Operations

Note: Sodium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in Tailings Storage Facility (TSF) that is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 4: Springer Pit Calibration – Silicon and Sodium

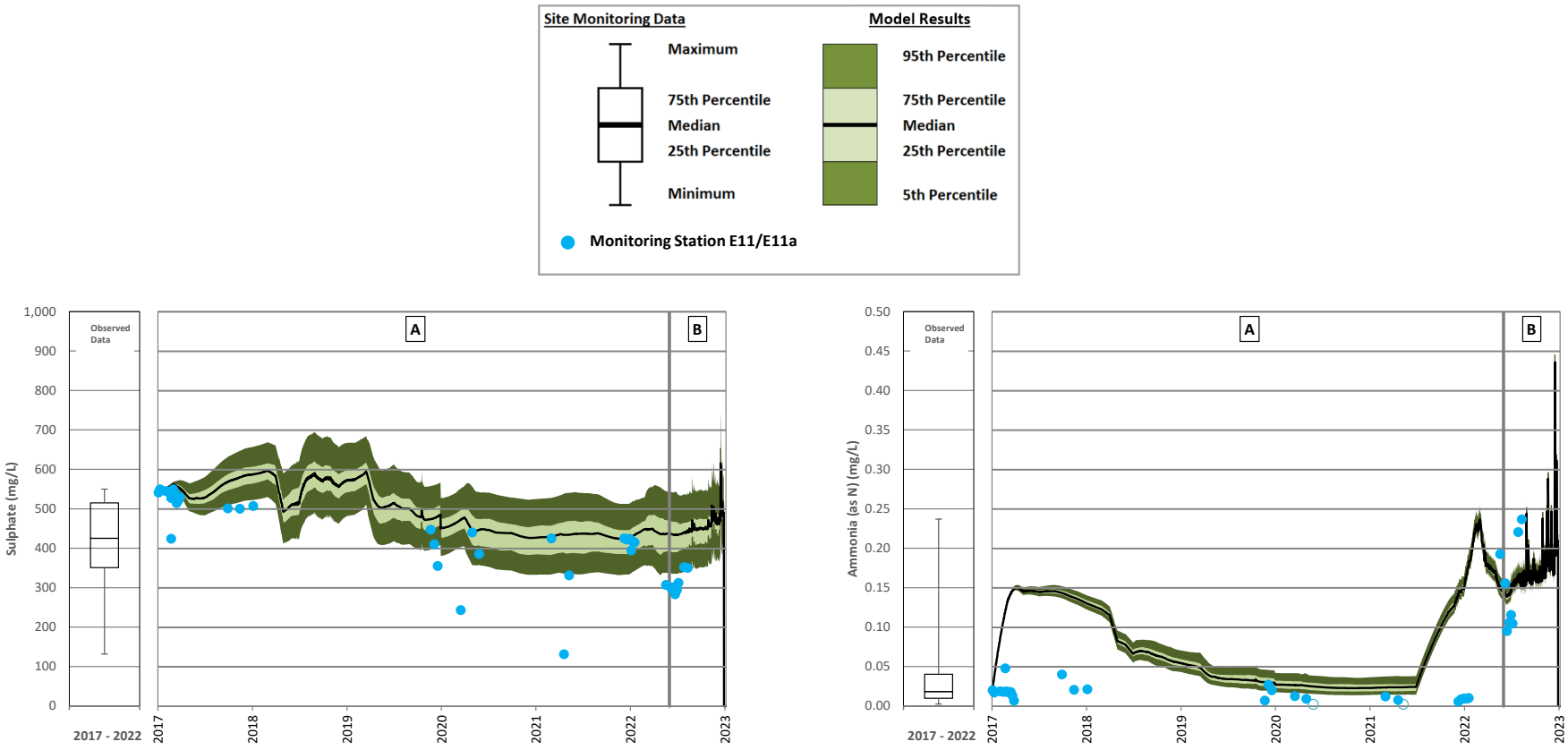

A = Care and Maintanence; B = Resumed Operations

Note: Total ammonia concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 5: Springer Pit Calibration – Sulphate and Total Ammonia

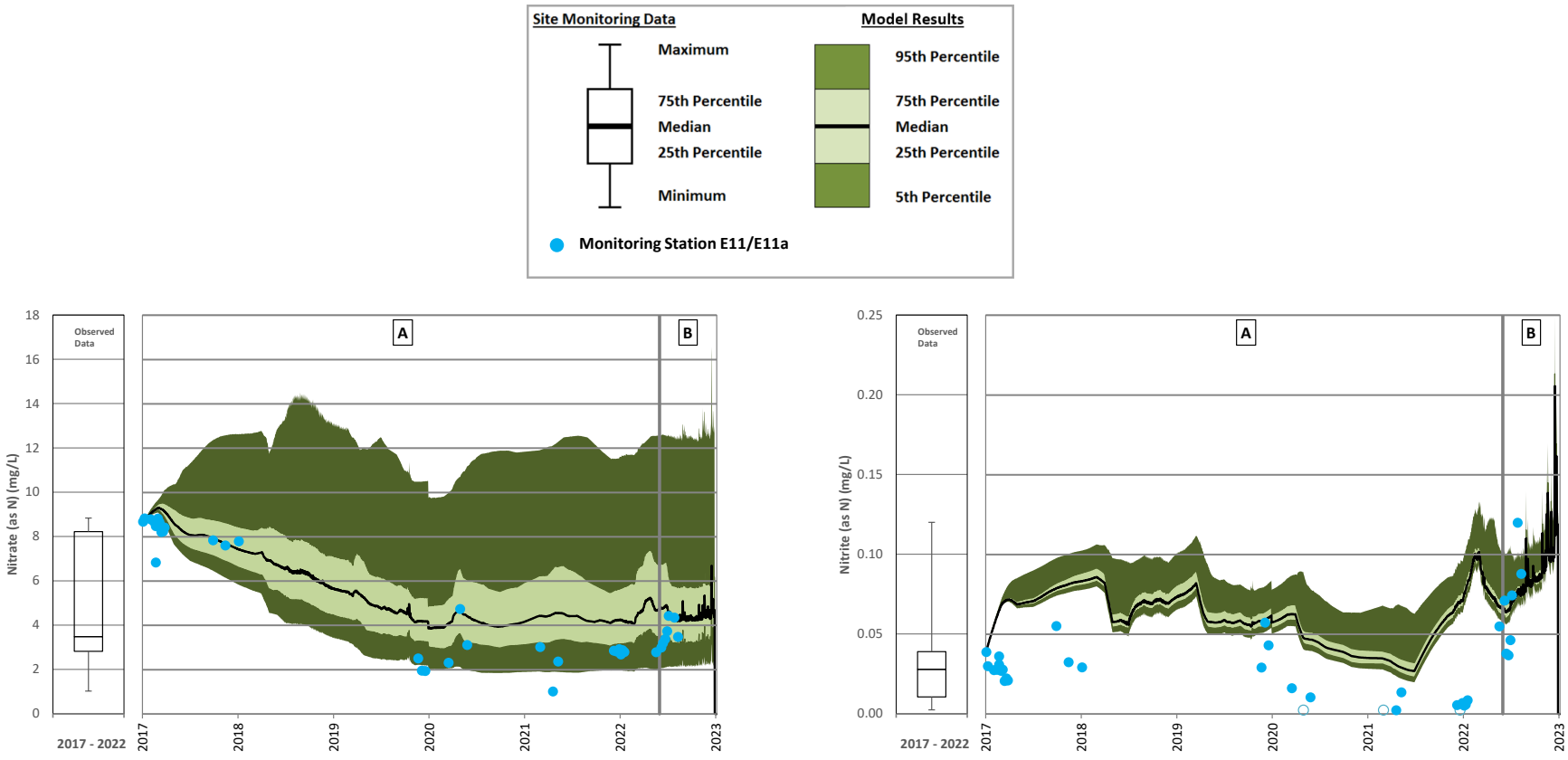

A = Care and Maintanence; B = Resumed Operations

Note: Nitrite concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 6: Springer Pit Calibration – Nitrate and Nitrite

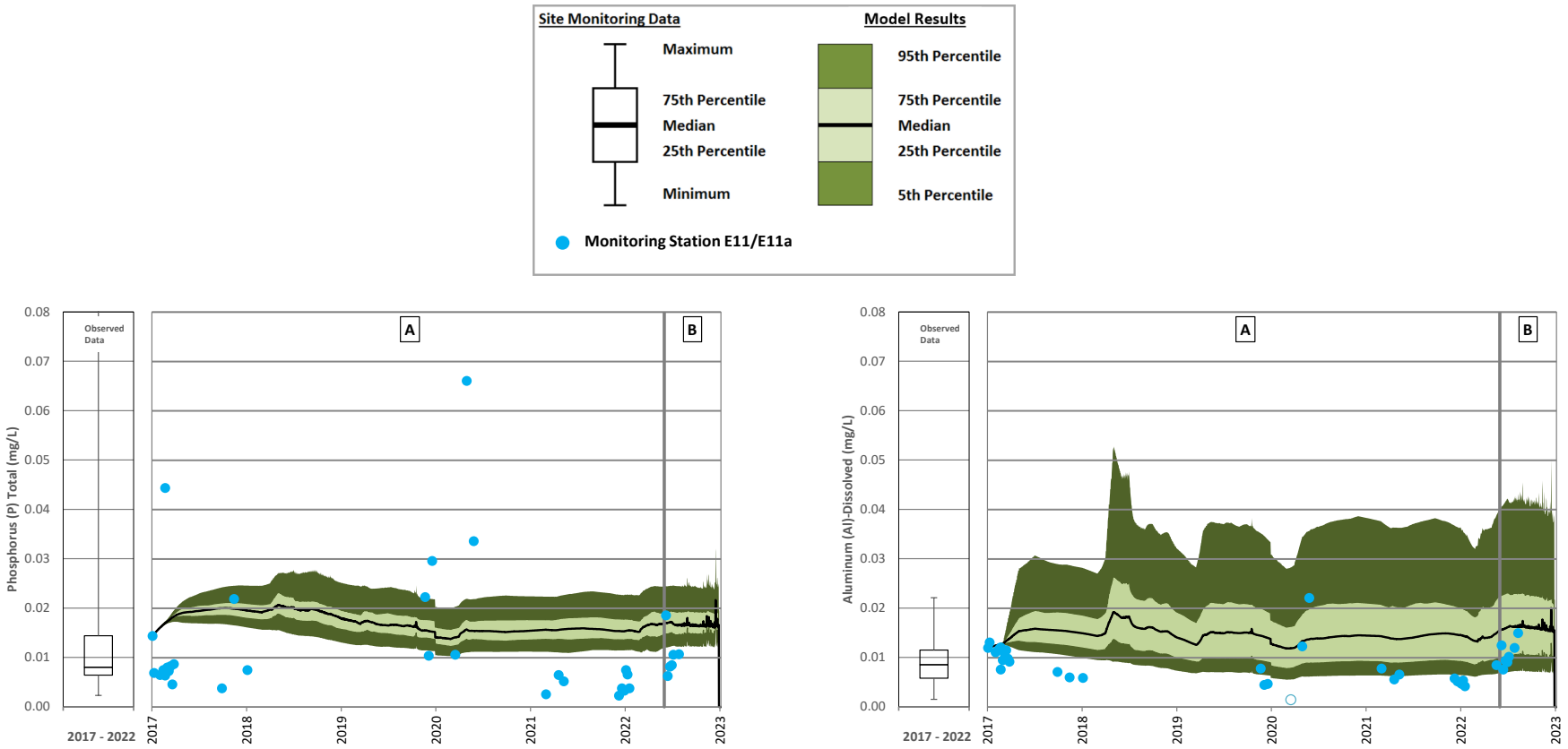

A = Care and Maintanence; B = Resumed Operations

Figure A 7: Springer Pit Calibration – Total Phosphorus and Dissolved Aluminum

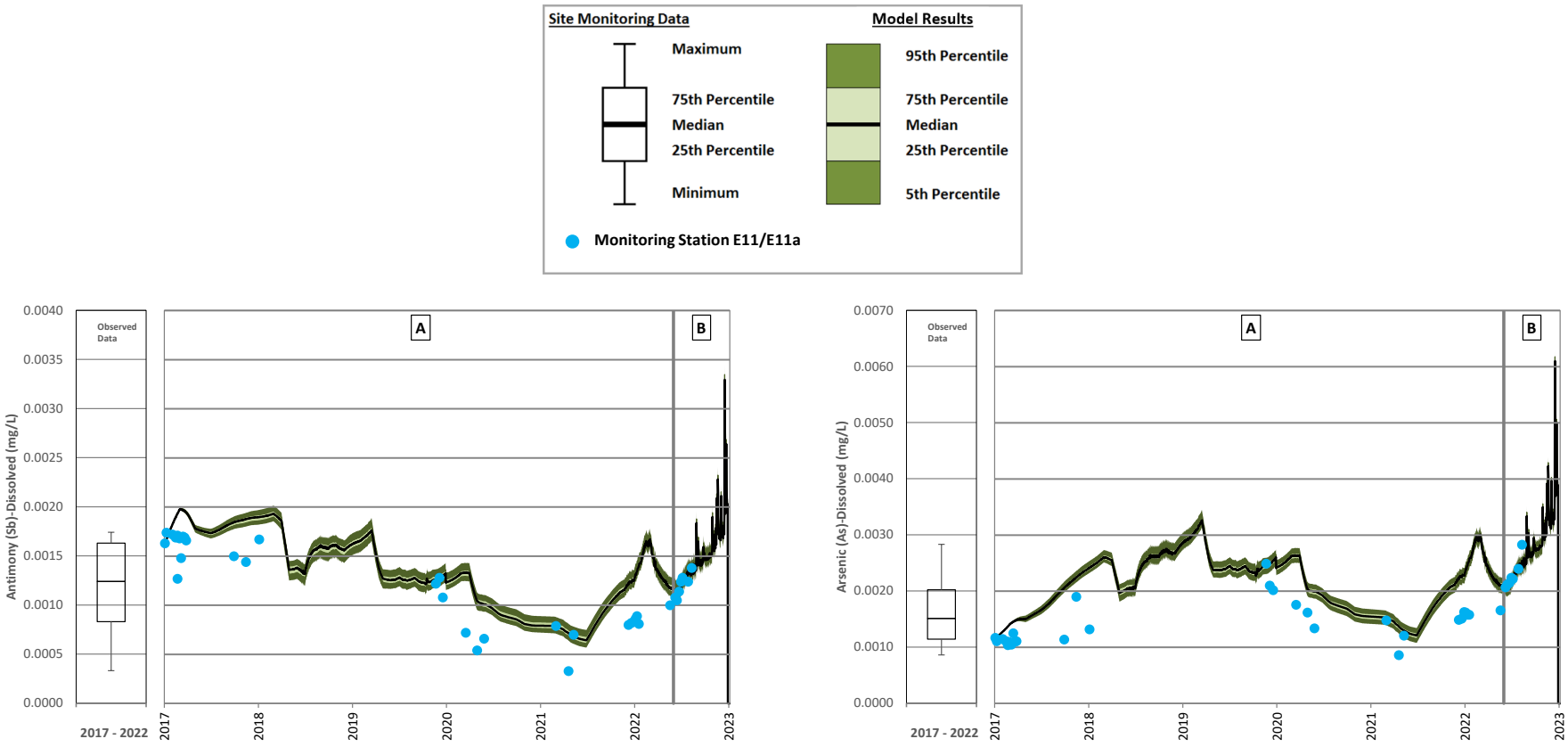

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 8: Springer Pit Calibration – Dissolved Antimony and Dissolved Arsenic

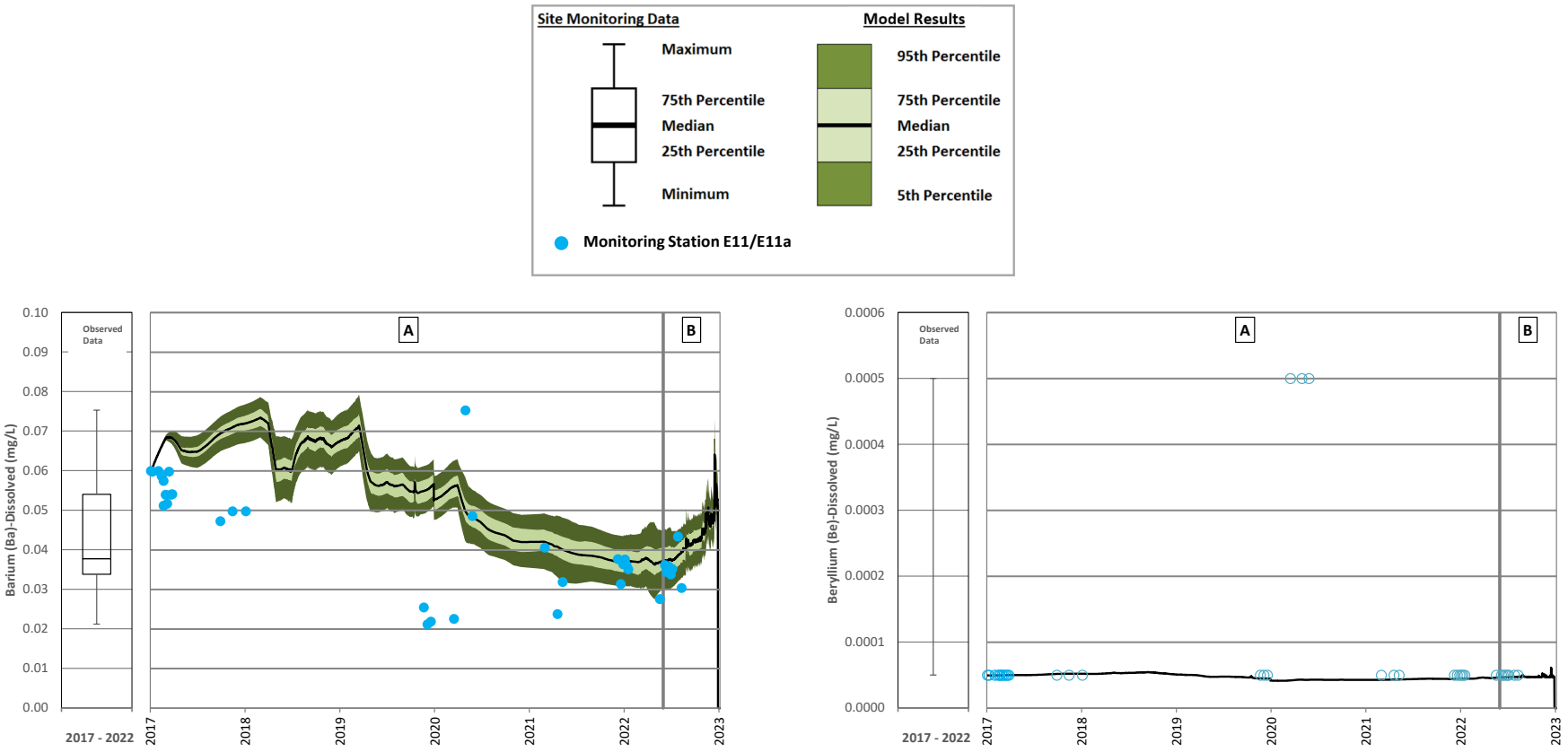

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved barium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 9: Springer Pit Calibration – Dissolved Barium and Dissolved Beryllium

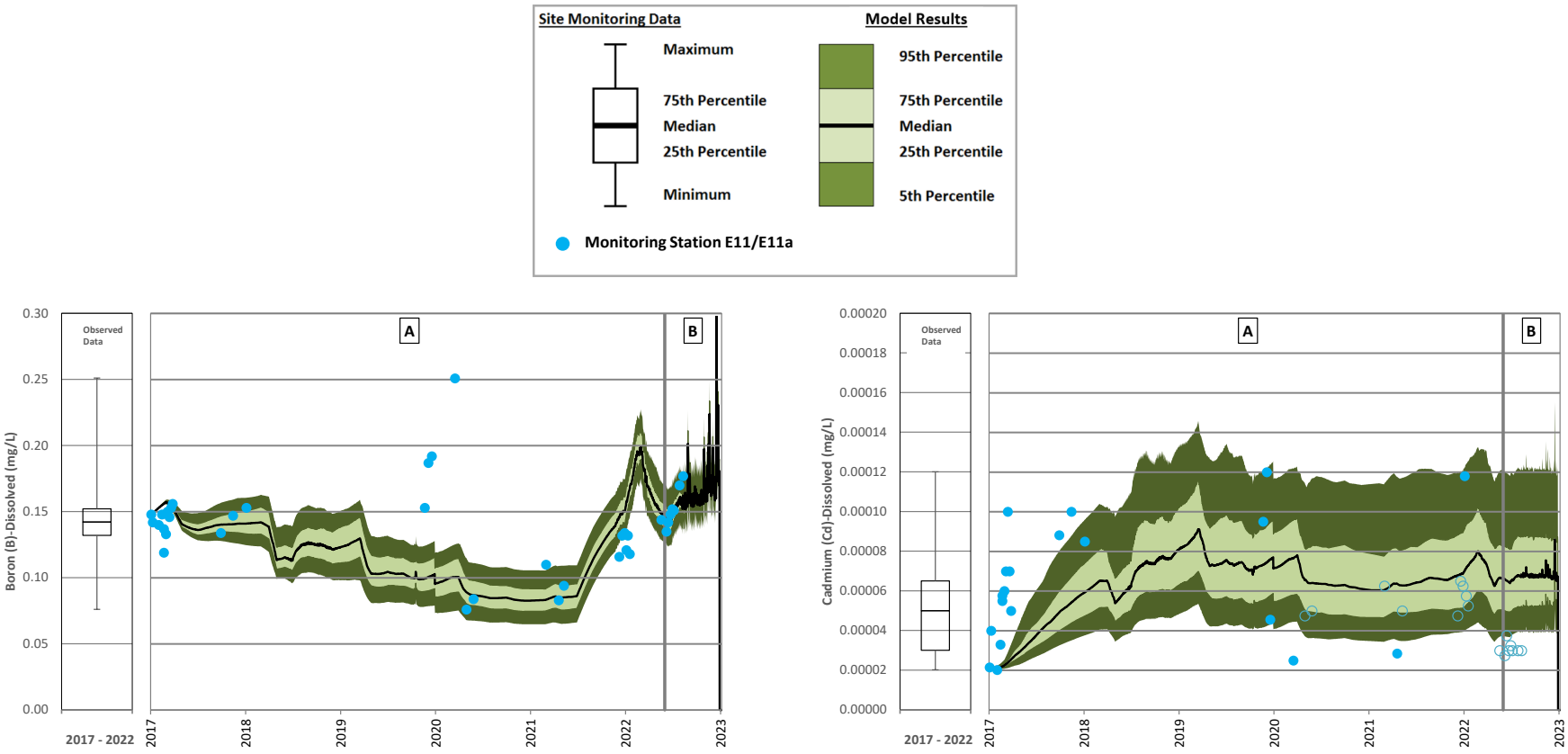

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved boron concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 10: Springer Pit Calibration – Dissolved Boron and Dissolved Cadmium

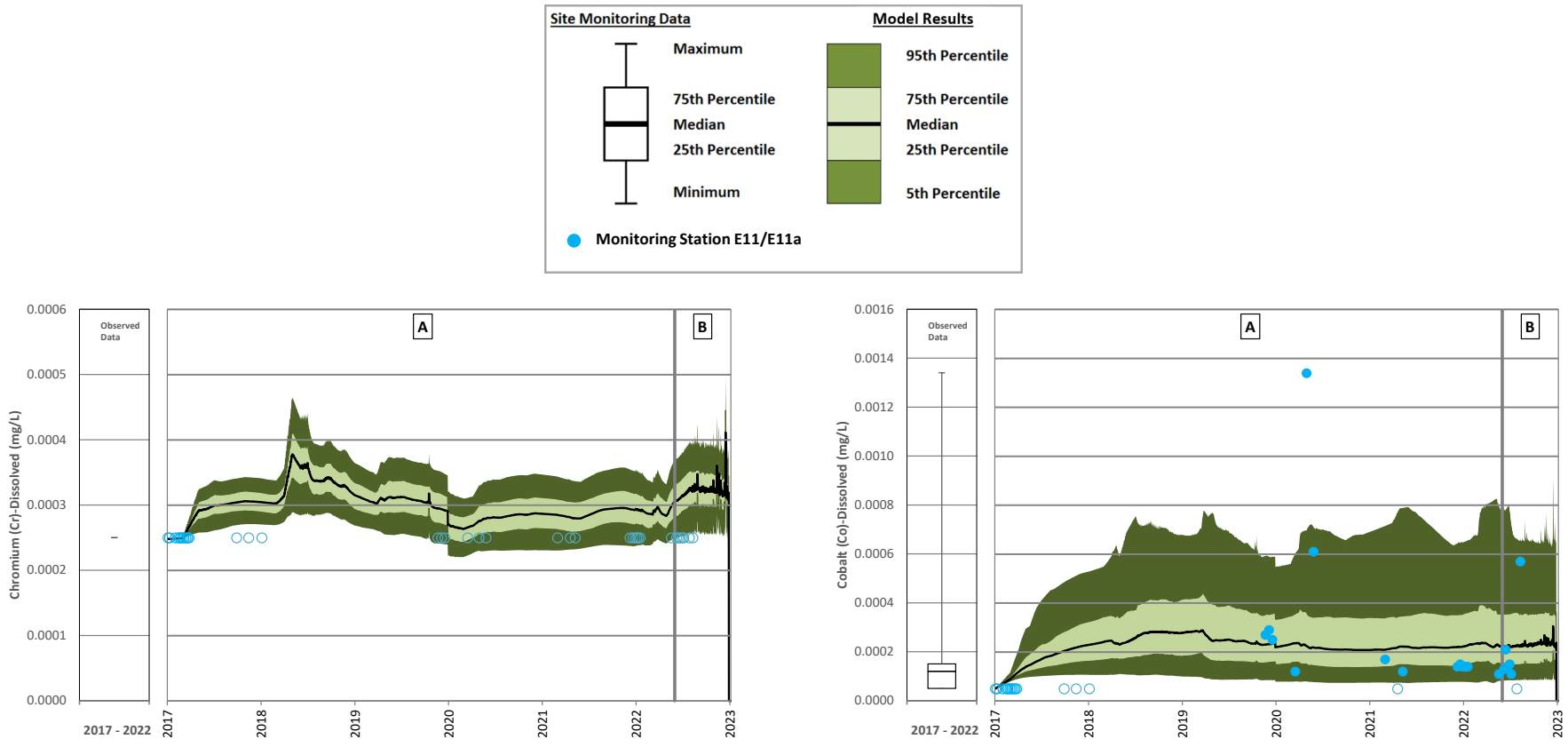

A = Care and Maintanence; B = Resumed Operations

Figure A 11: Springer Pit Calibration – Dissolved Chromium and Dissolved Cobalt

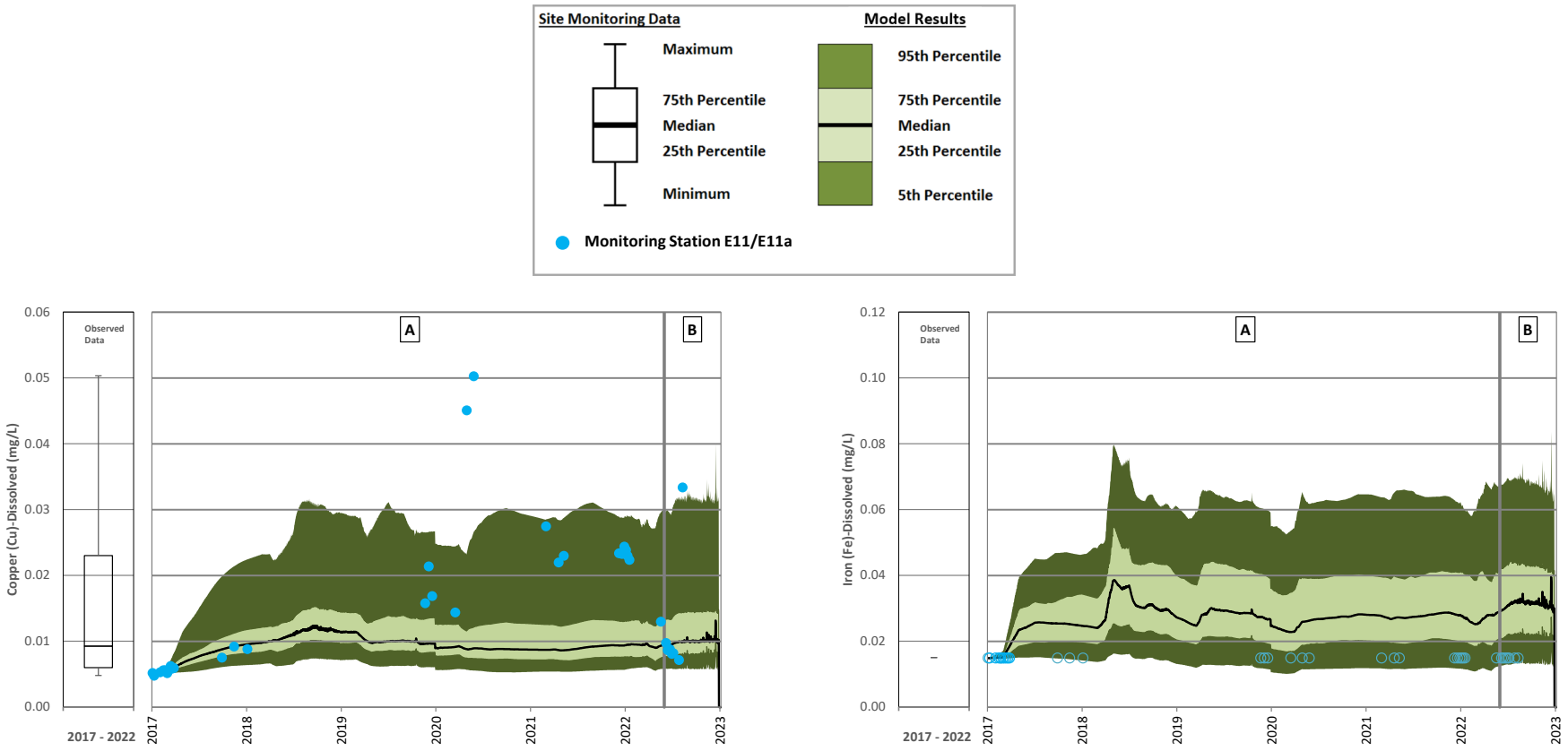

A = Care and Maintanence; B = Resumed Operations

Figure A 12: Springer Pit Calibration – Dissolved Copper and Dissolved Iron

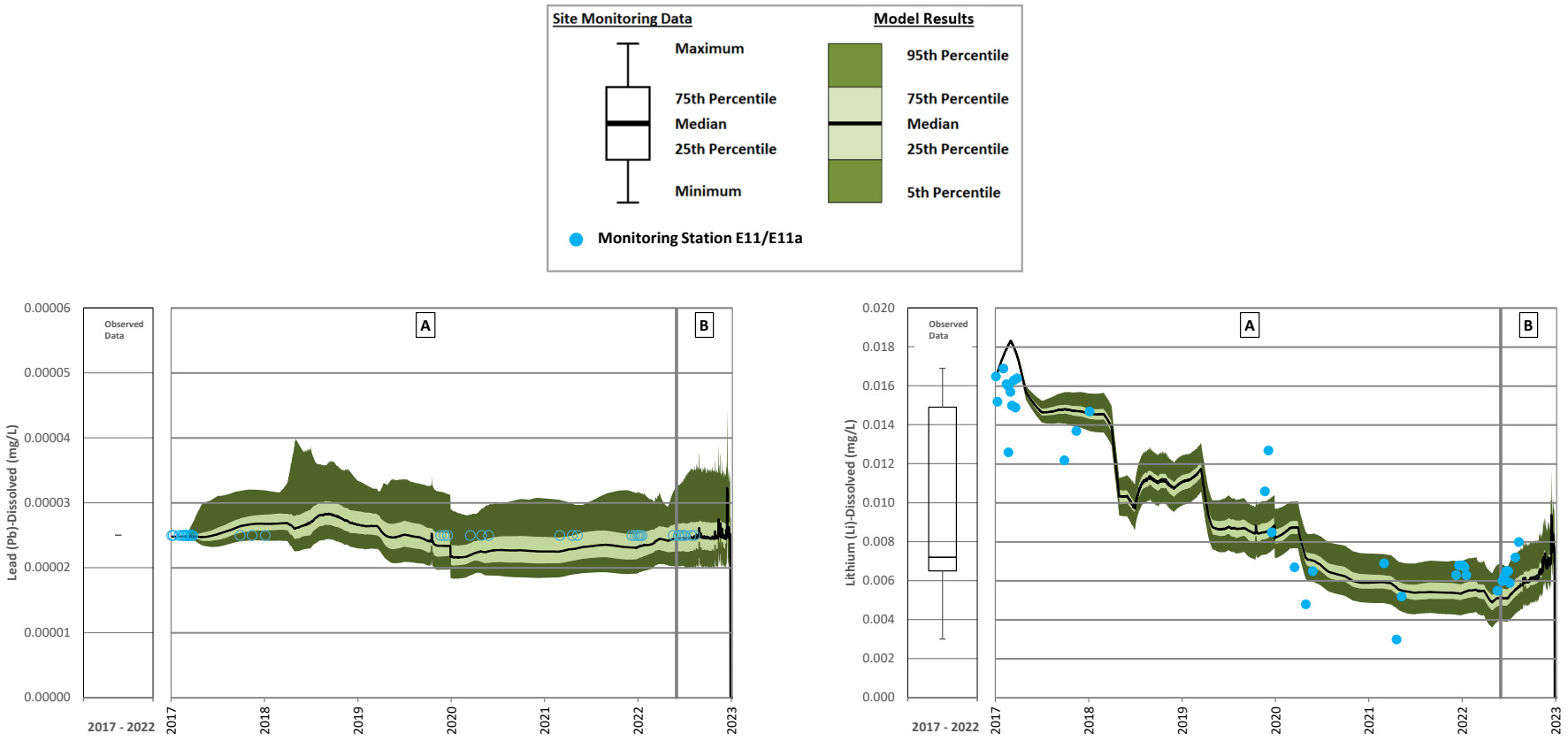

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved lithium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 13: Springer Pit Calibration – Dissolved Lead and Dissolved Lithium

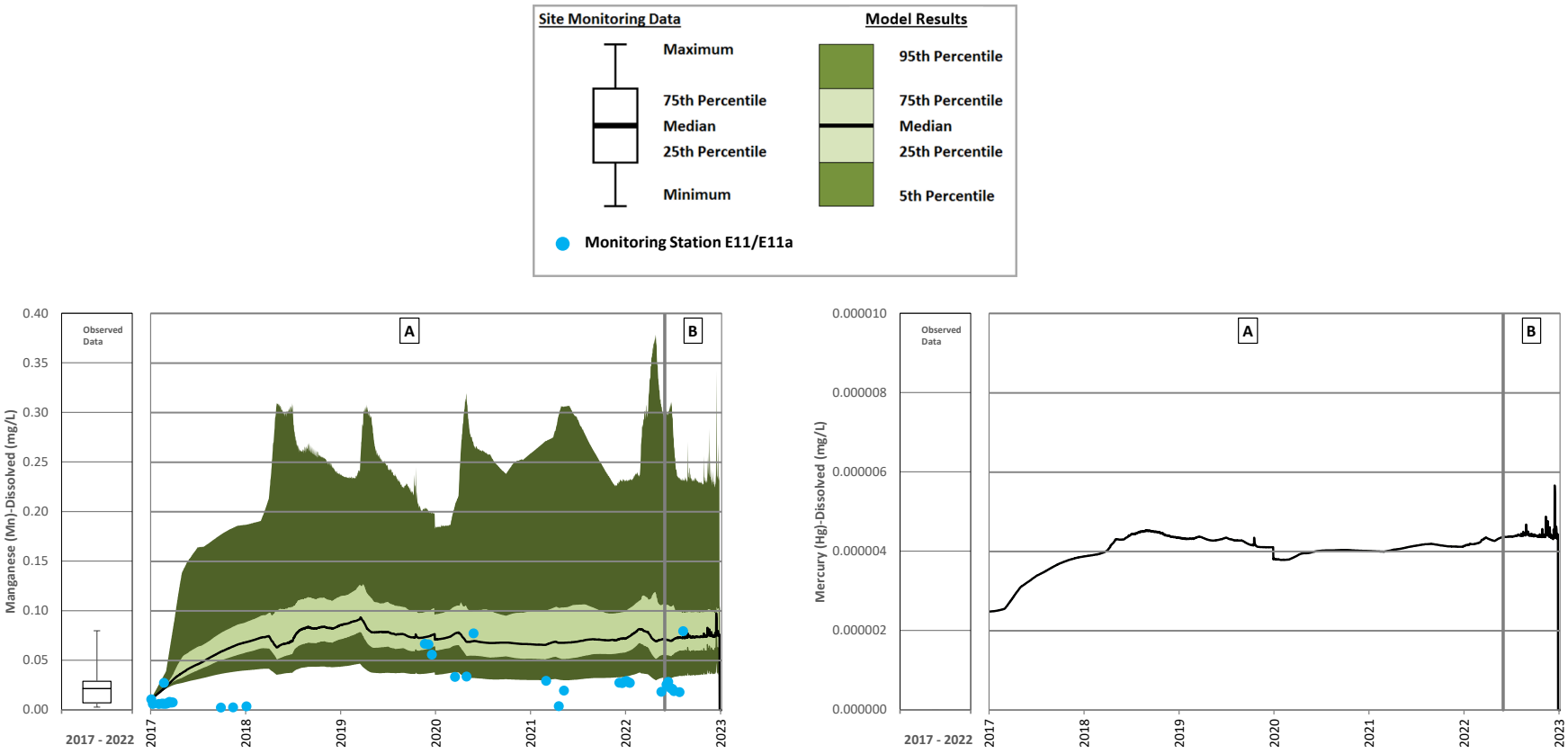

A = Care and Maintanence; B = Resumed Operations

Figure A 14: Springer Pit Calibration – Dissolved Manganese and Dissolved Mercury

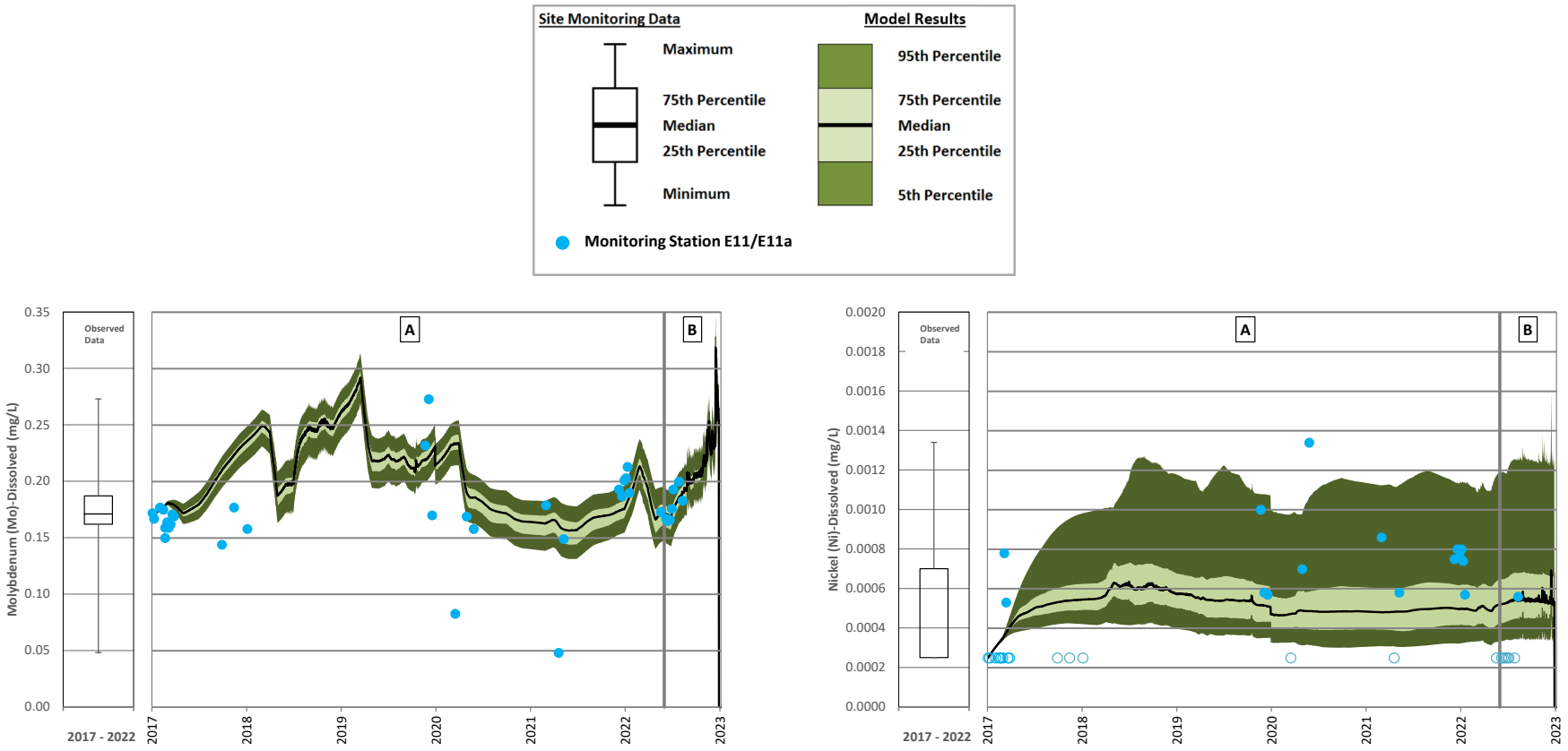

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved molybdenum concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 15: Springer Pit Calibration – Dissolved Molybdenum and Dissolved Nickel

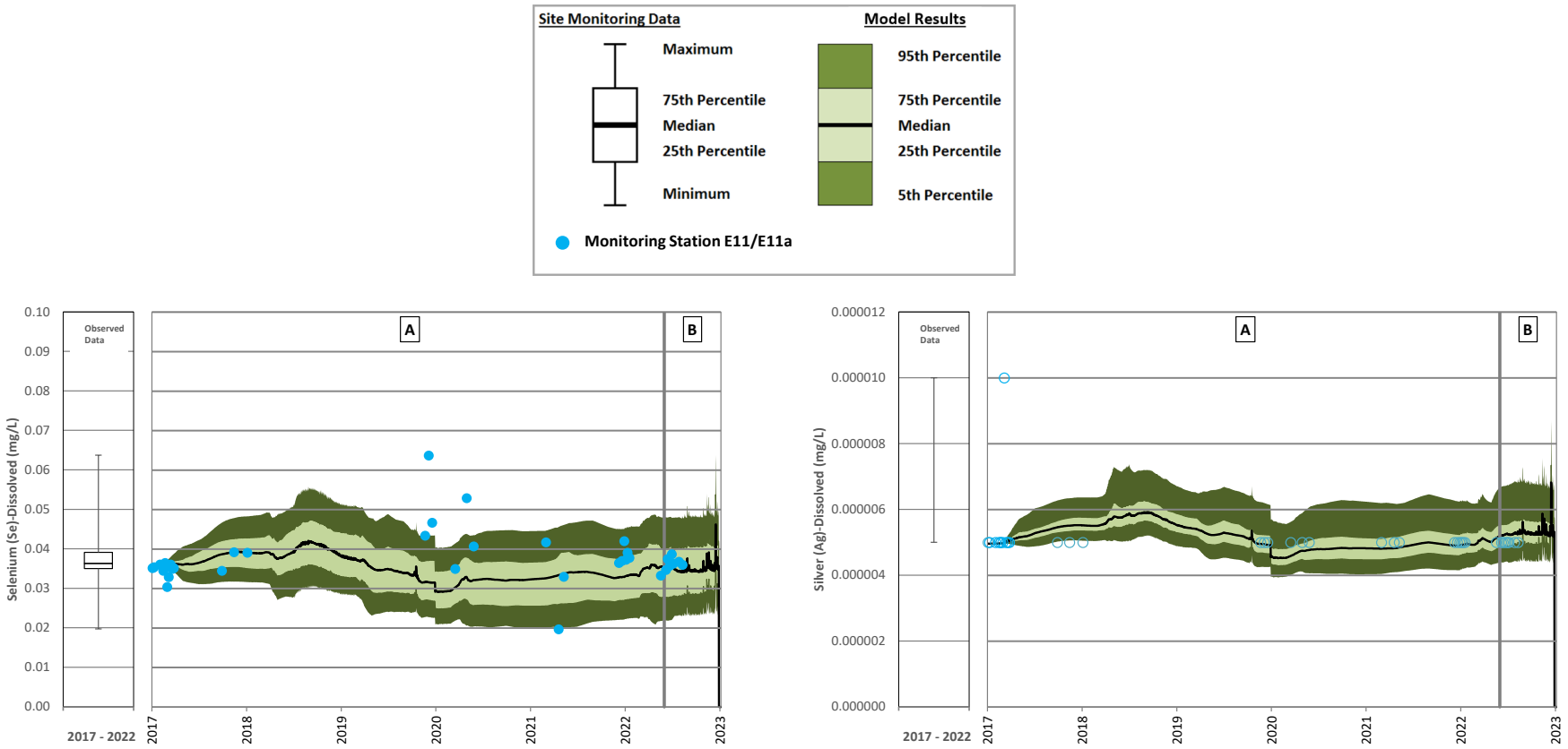

A = Care and Maintanence; B = Resumed Operations

Figure A 16: Springer Pit Calibration – Dissolved Selenium and Dissolved Silver

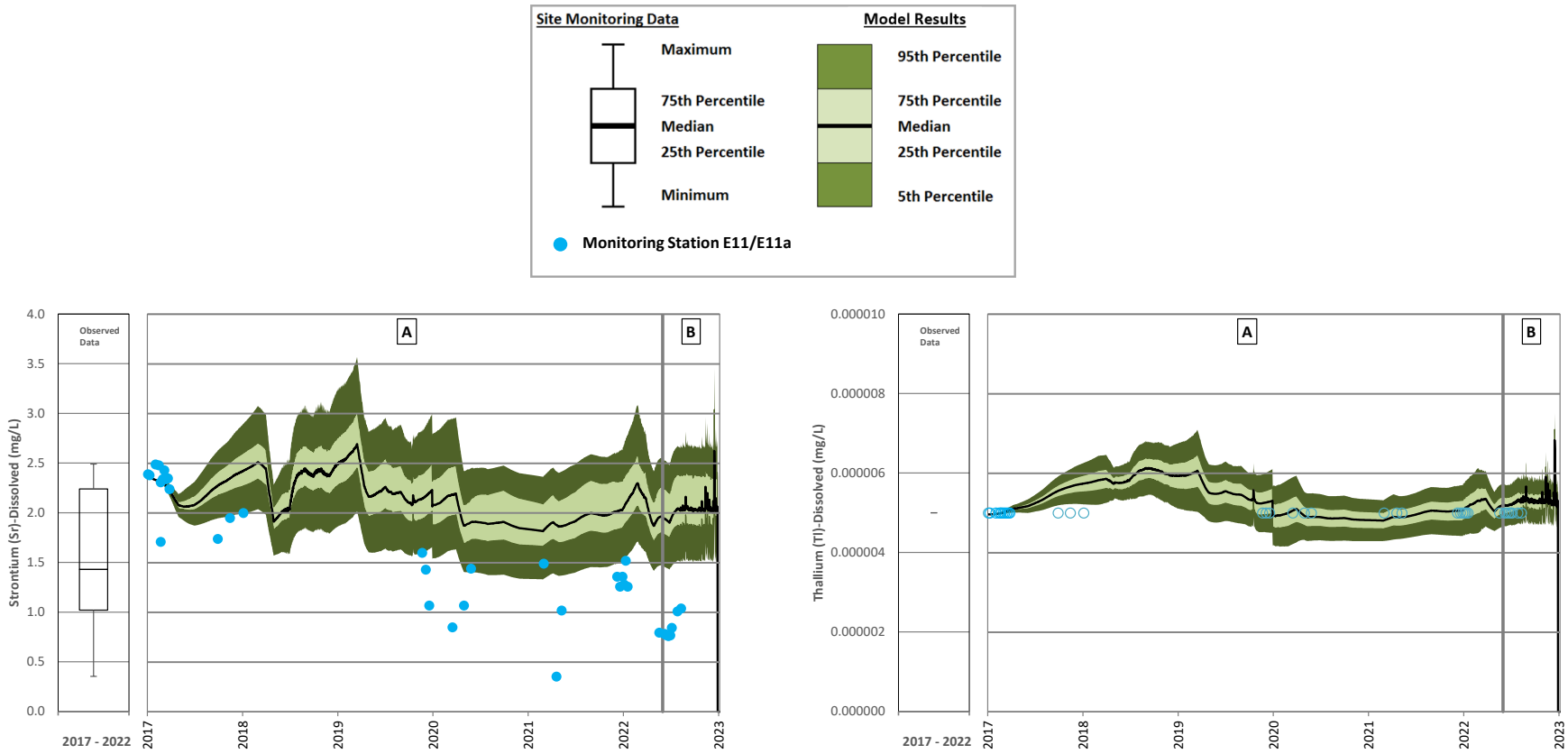

A = Care and Maintanence; B = Resumed Operations

Figure A 17: Springer Pit Calibration – Dissolved Strontium and Dissolved Thallium

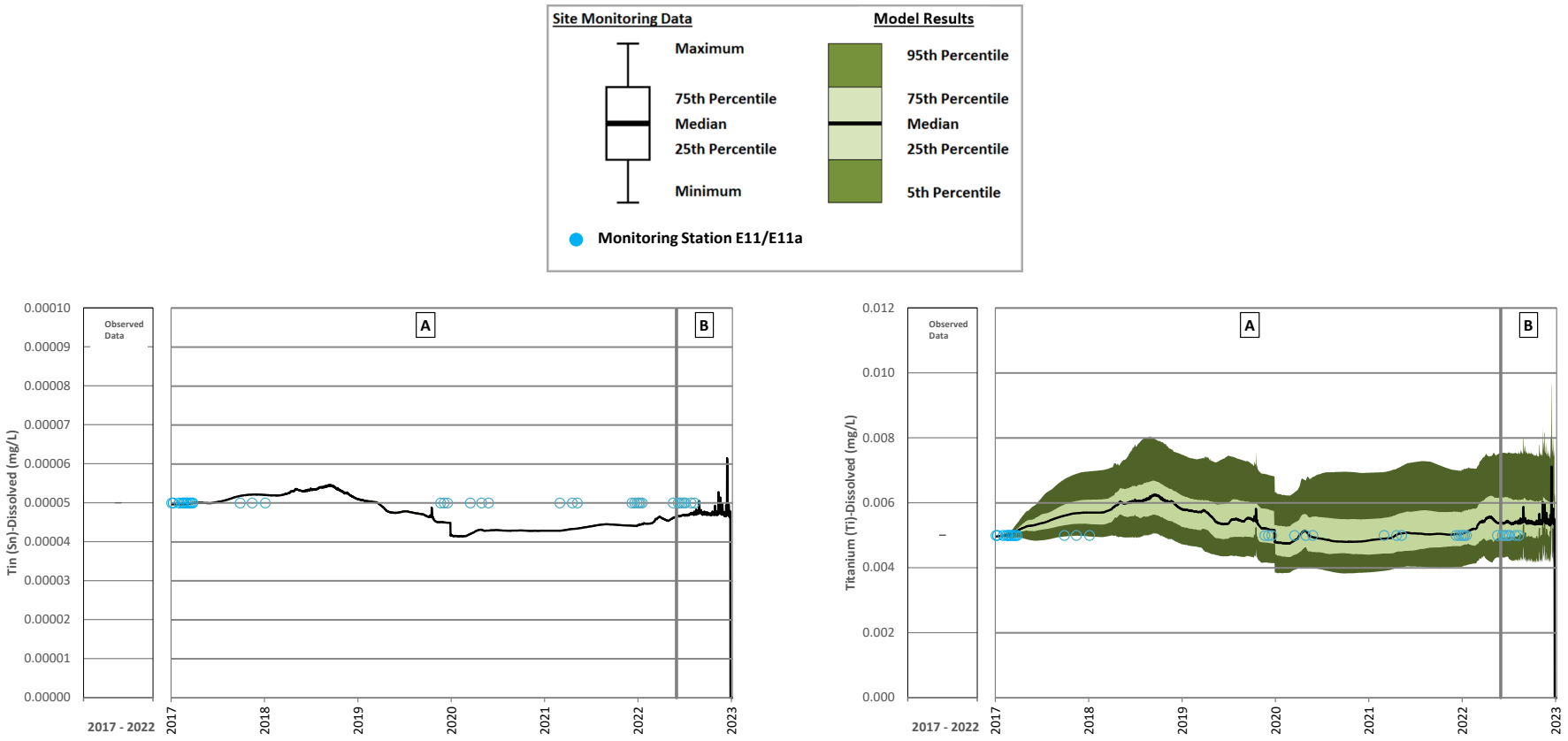

A = Care and Maintanence; B = Resumed Operations

Figure A 18: Springer Pit Calibration – Dissolved Tin and Dissolved Titanium

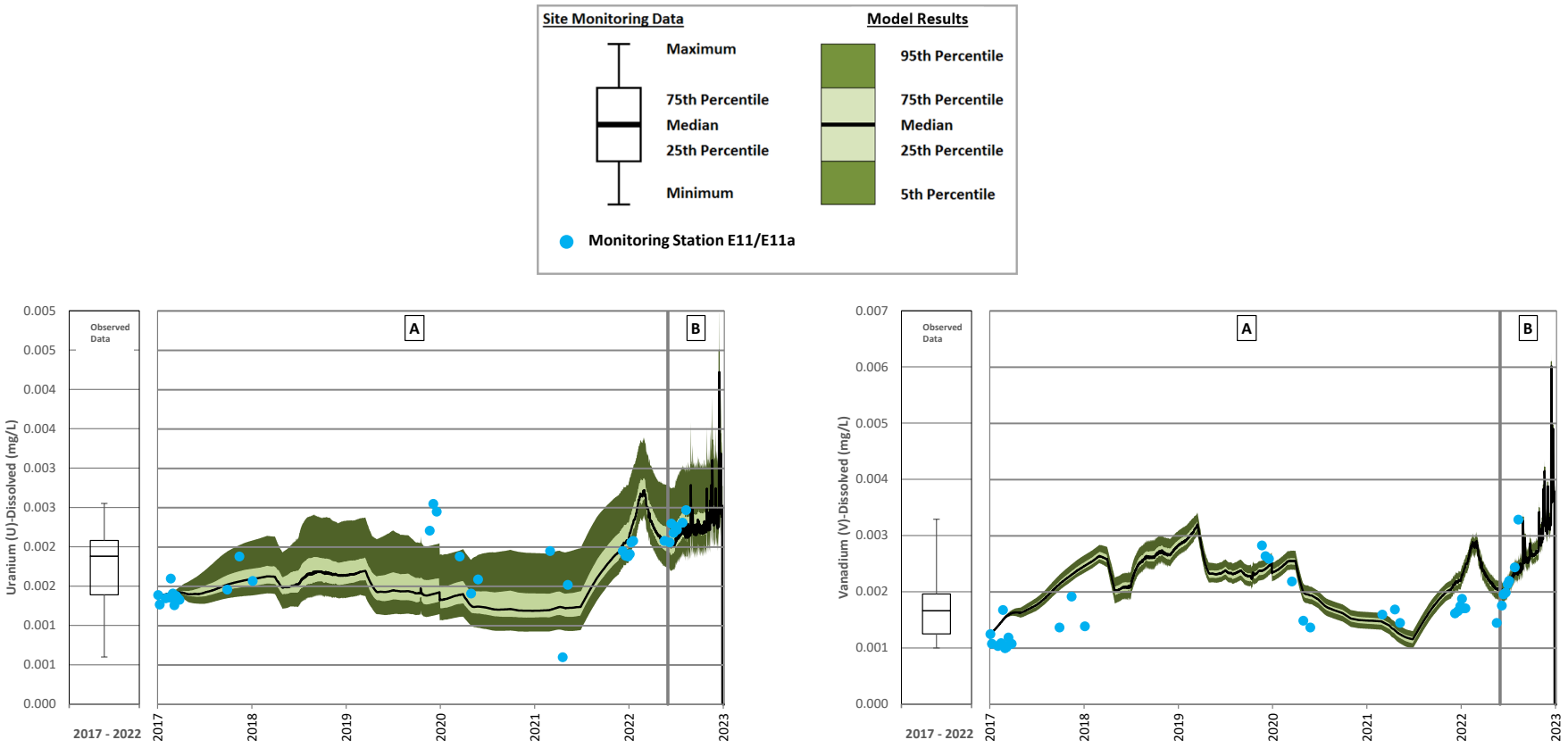

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved uranium and vanadium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 19: Springer Pit Calibration – Dissolved Uranium and Dissolved Vanadium

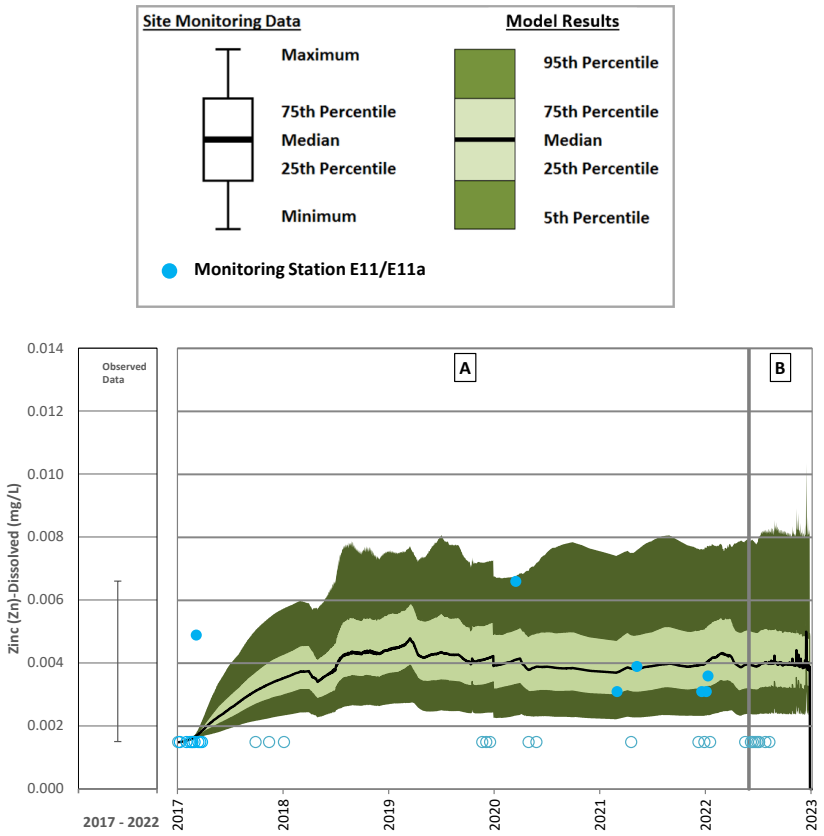

A = Care and Maintanence; B = Resumed Operations

Figure A 20: Springer Pit Calibration – Dissolved Zinc

Cariboo Pit Calibration

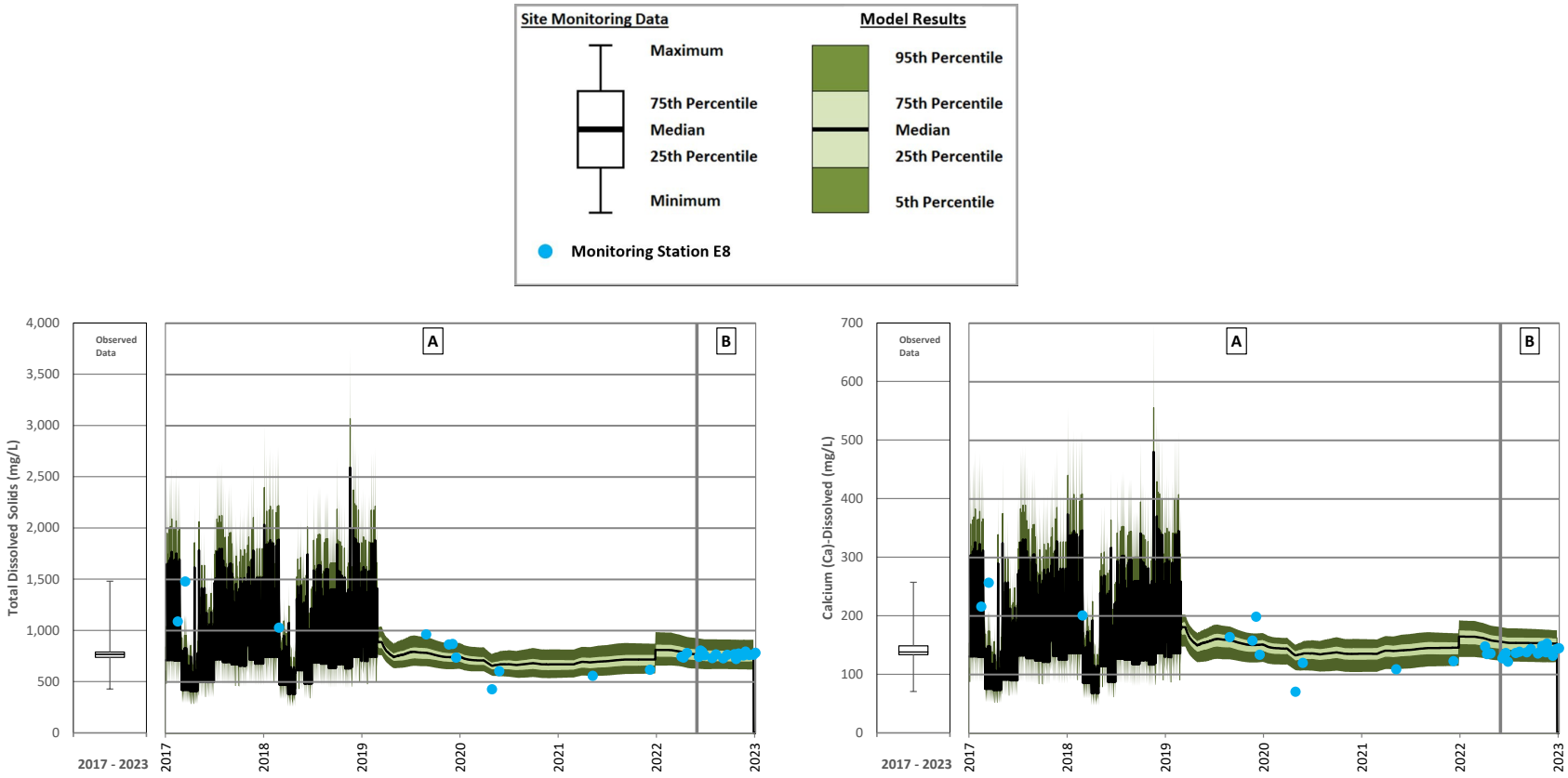

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Total dissolved solids and calcium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 21: Cariboo Pit Calibration – Total Dissolved Solids and Calcium

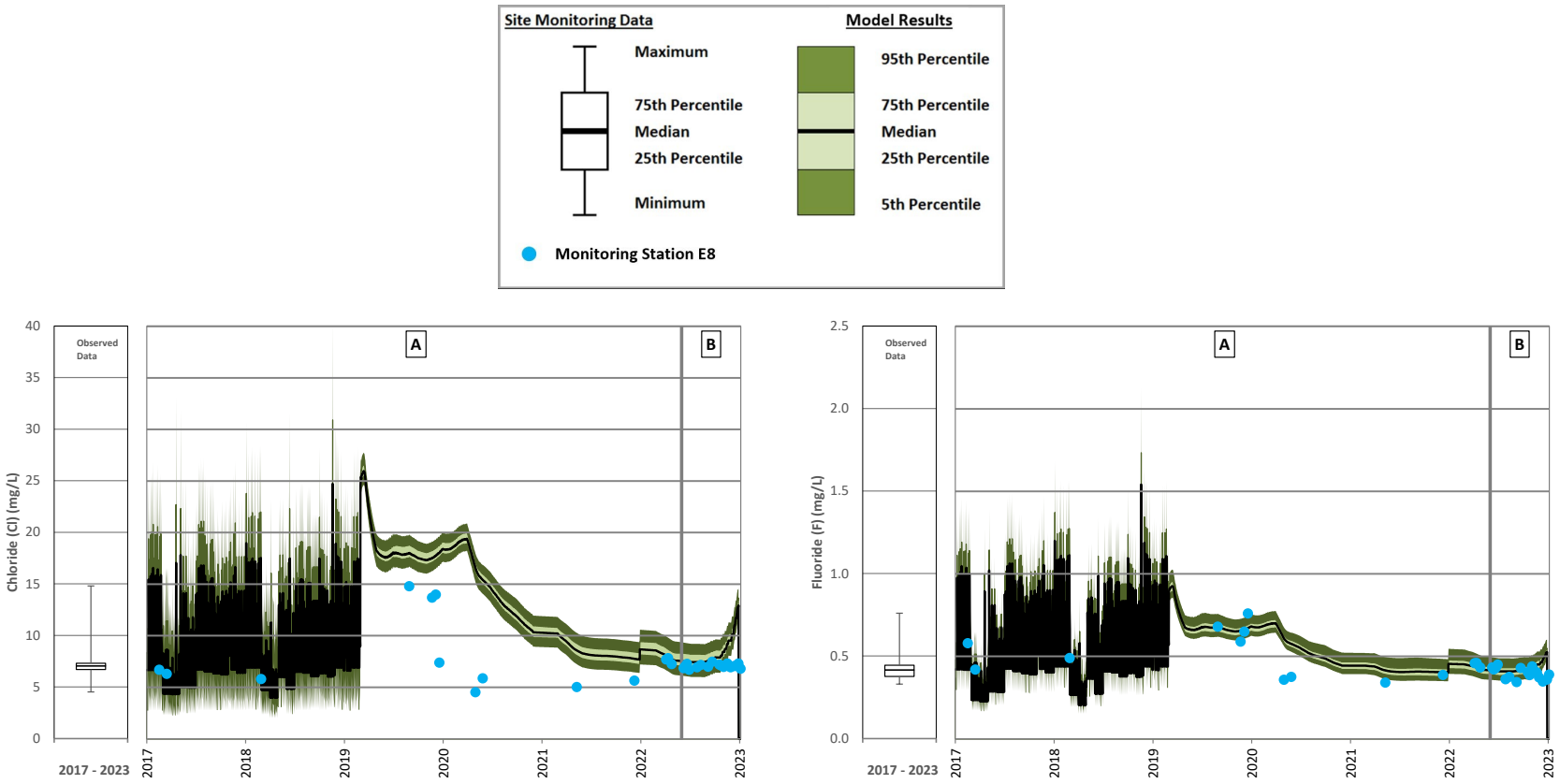

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Chloride and fluoride concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 22: Cariboo Pit Calibration – Chloride and Fluoride

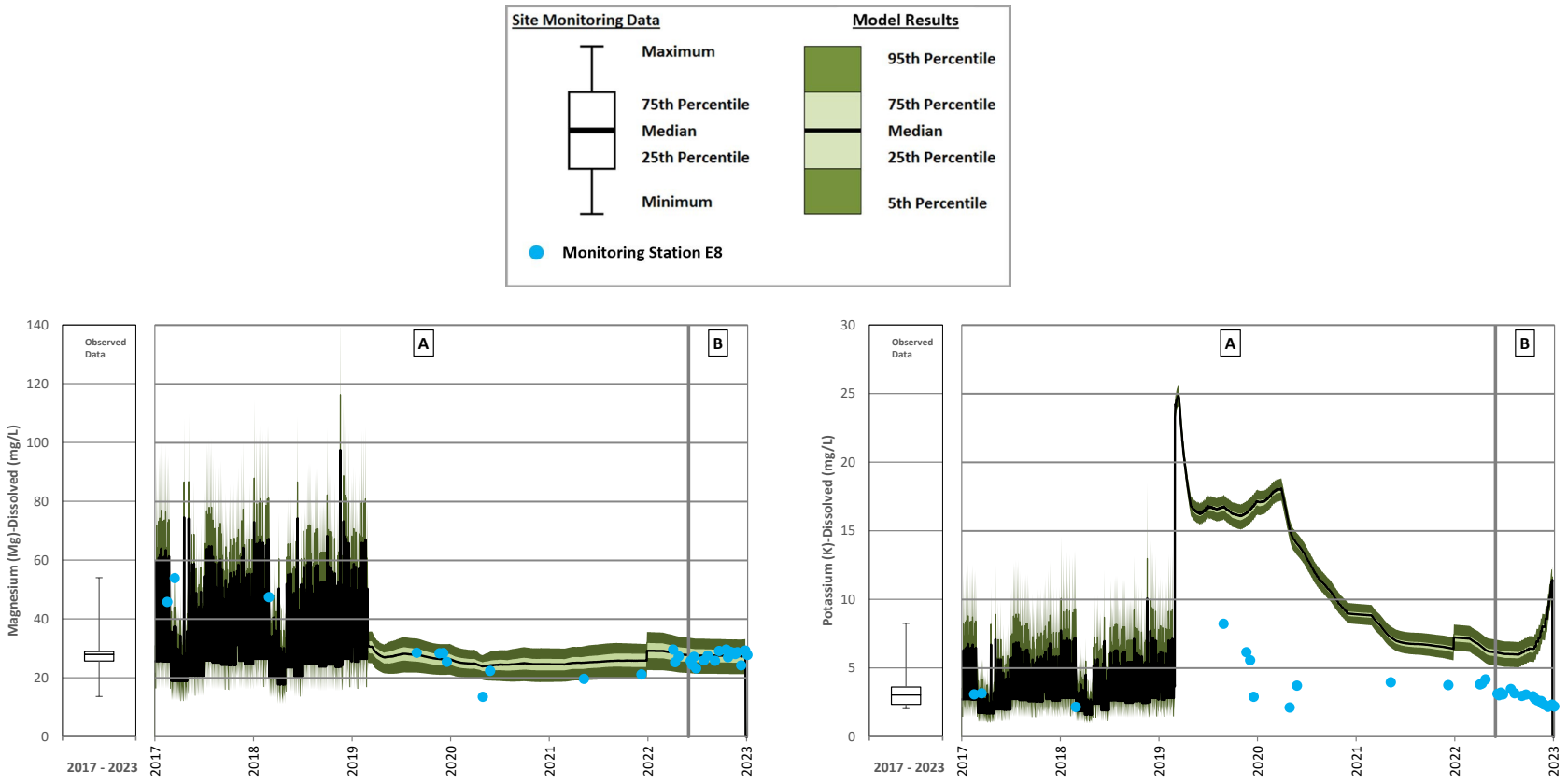

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Magnesium and potassium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit..

Figure A 23: Cariboo Pit Calibration – Magnesium and Potassium

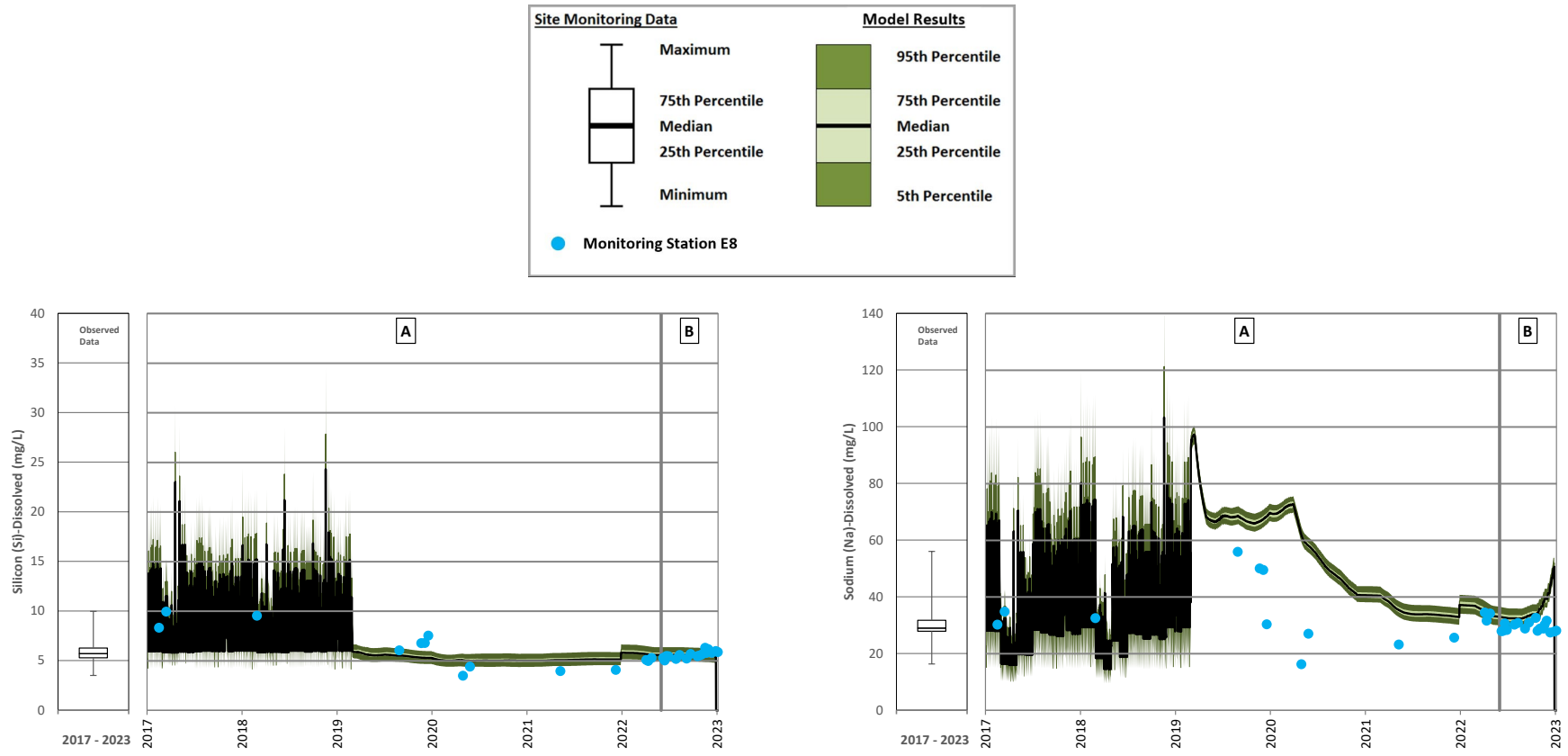

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Silicon and sodium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 24: Cariboo Pit Calibration – Silicon and Sodium

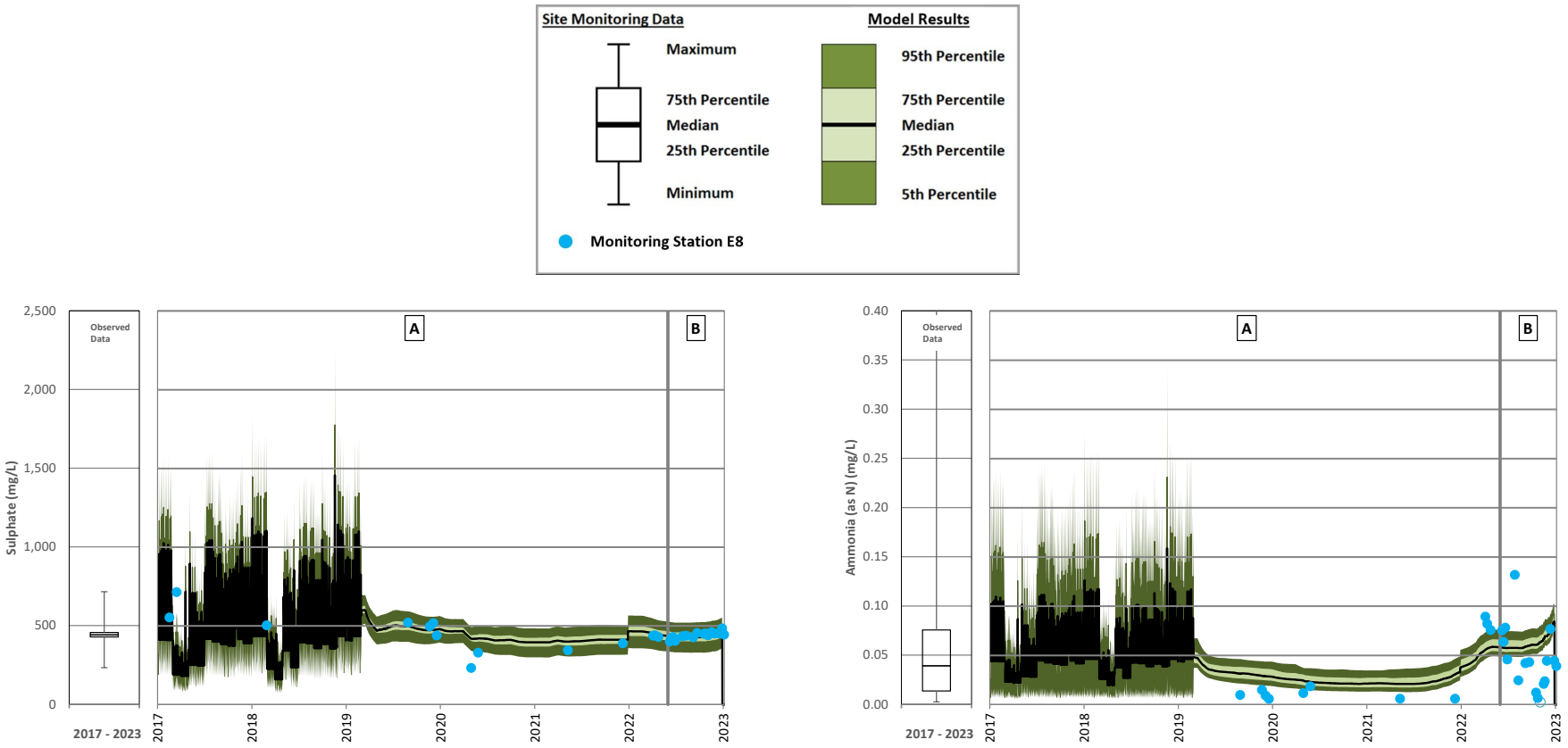

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Sulphate and total ammonia concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 25: Cariboo Pit Calibration – Sulphate and Total Ammonia

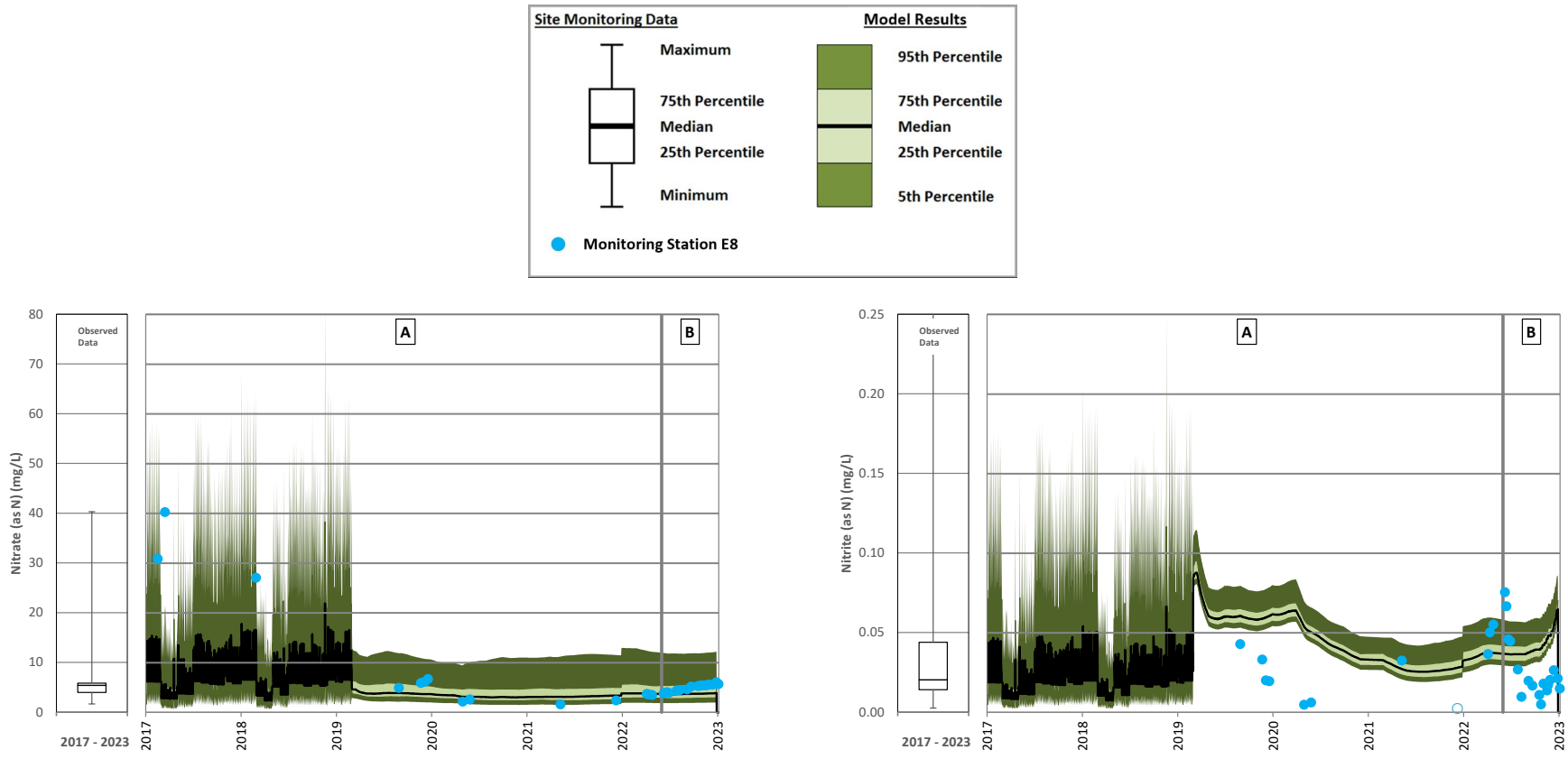

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Nitrate and nitrite concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 26: Cariboo Pit Calibration – Nitrate and Nitrite

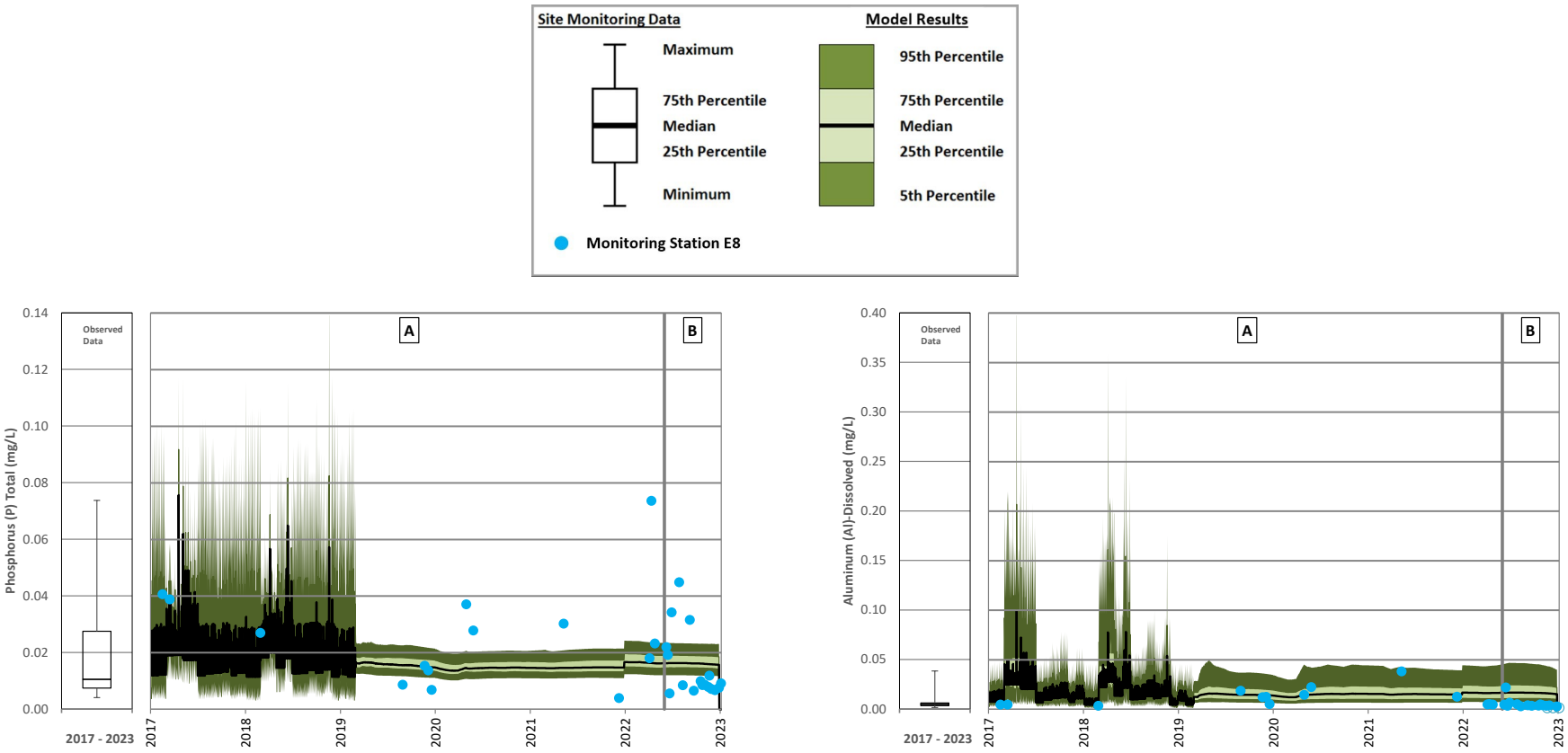

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Total phosphorus and dissolved aluminum concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 27: Cariboo Pit Calibration – Total Phosphorus and Dissolved Aluminum

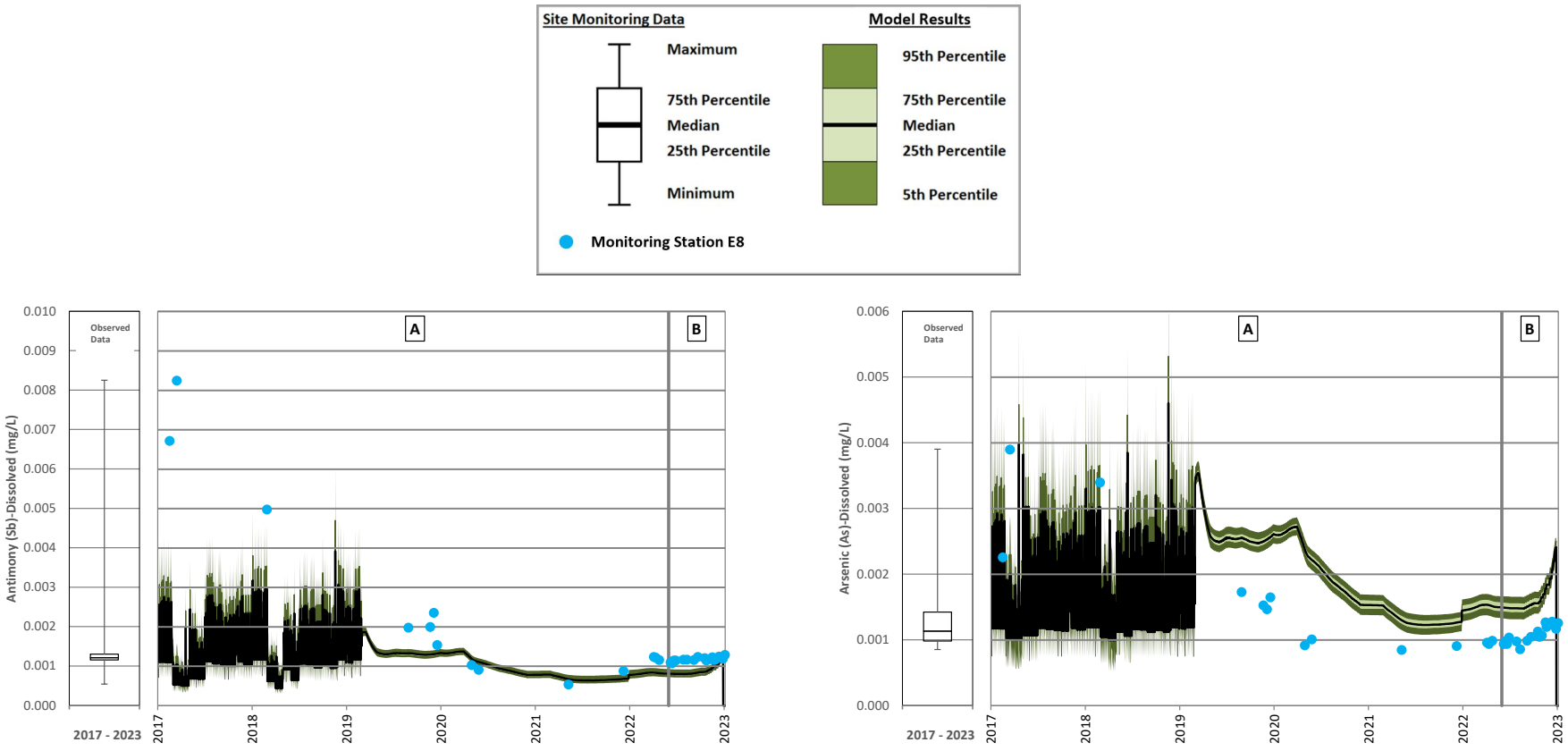

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 28: Cariboo Pit Calibration – Dissolved Antimony and Dissolved Arsenic

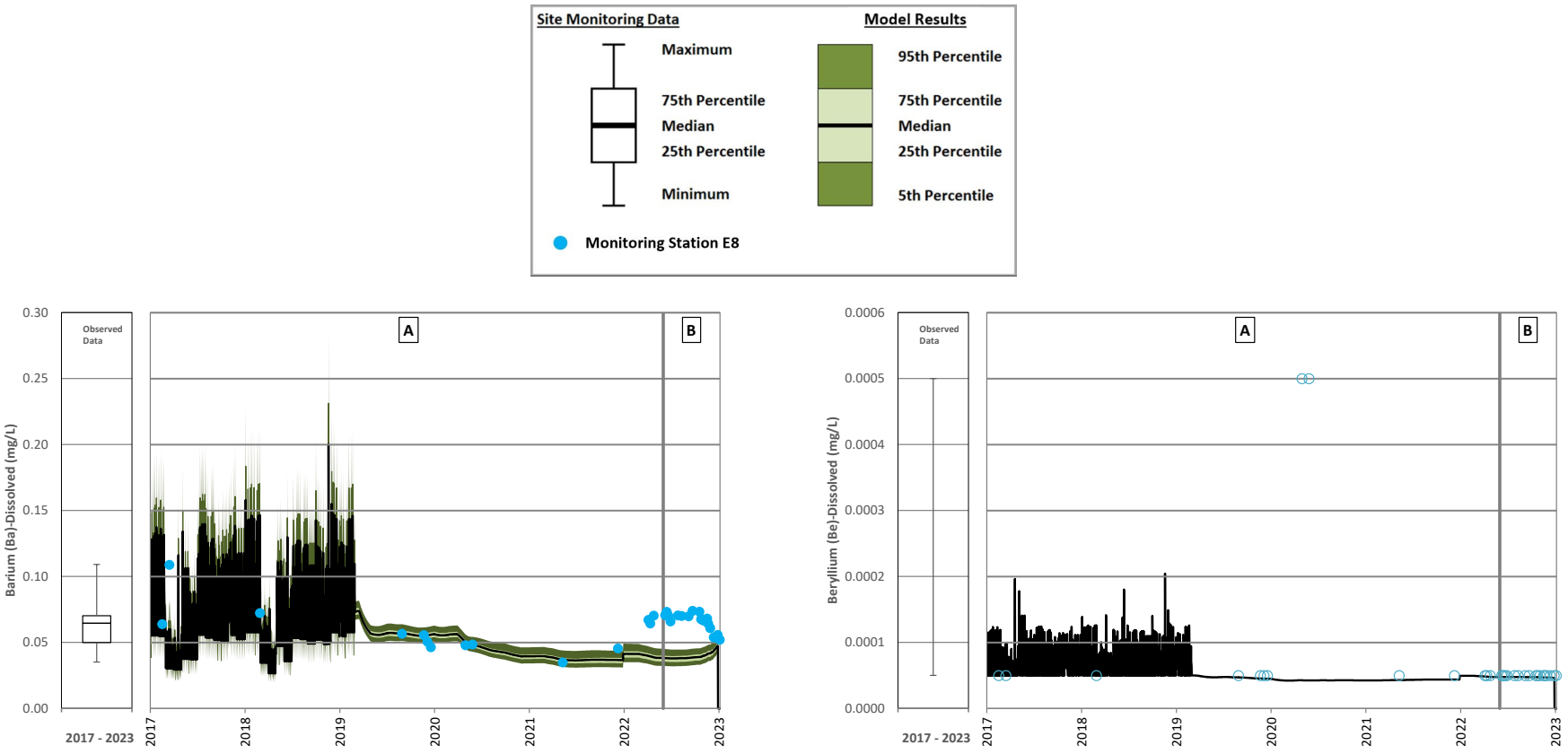

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved barium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 29: Cariboo Pit Calibration – Dissolved Barium and Dissolved Beryllium

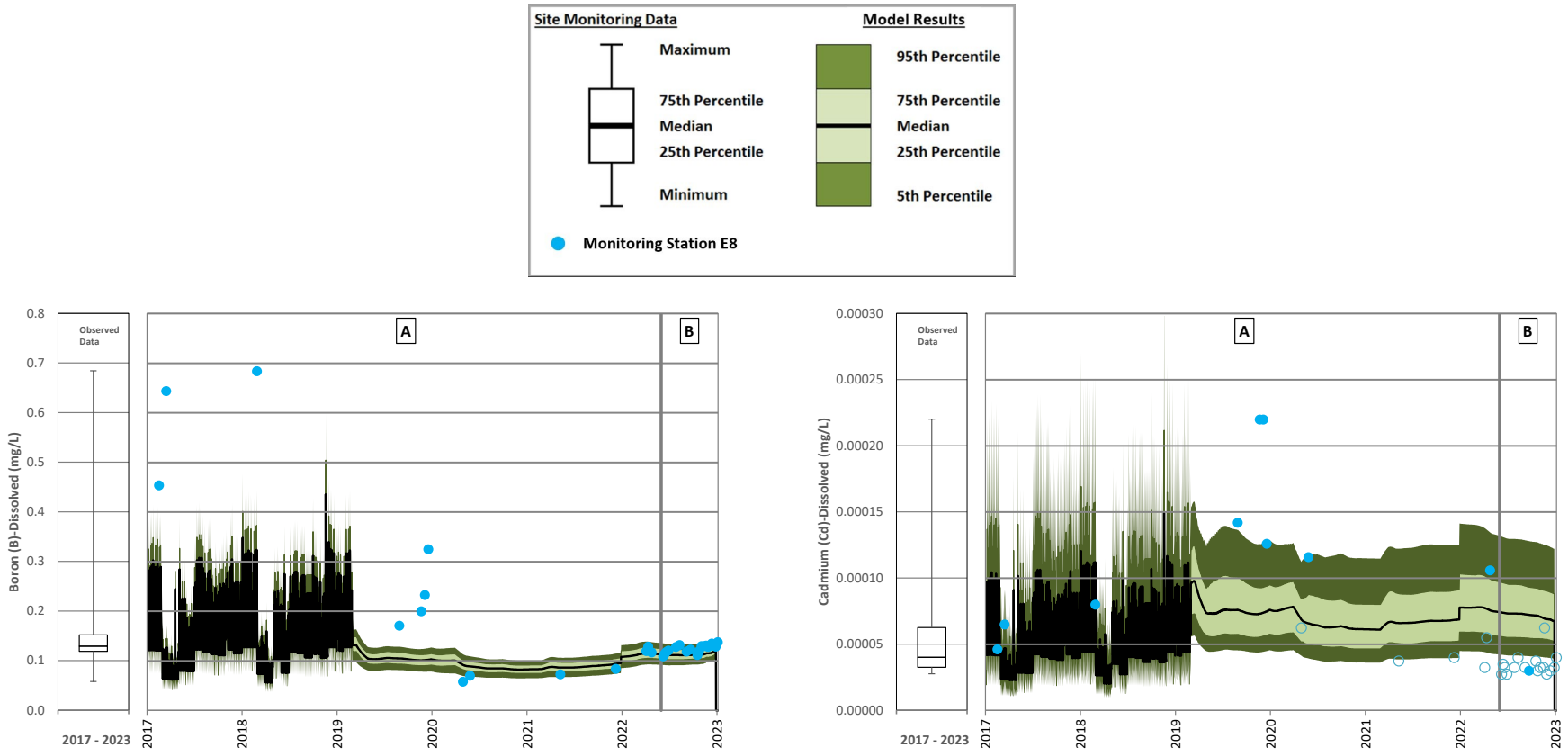

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved boron and dissolved cadmium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 30: Cariboo Pit Calibration – Dissolved Boron and Dissolved Cadmium

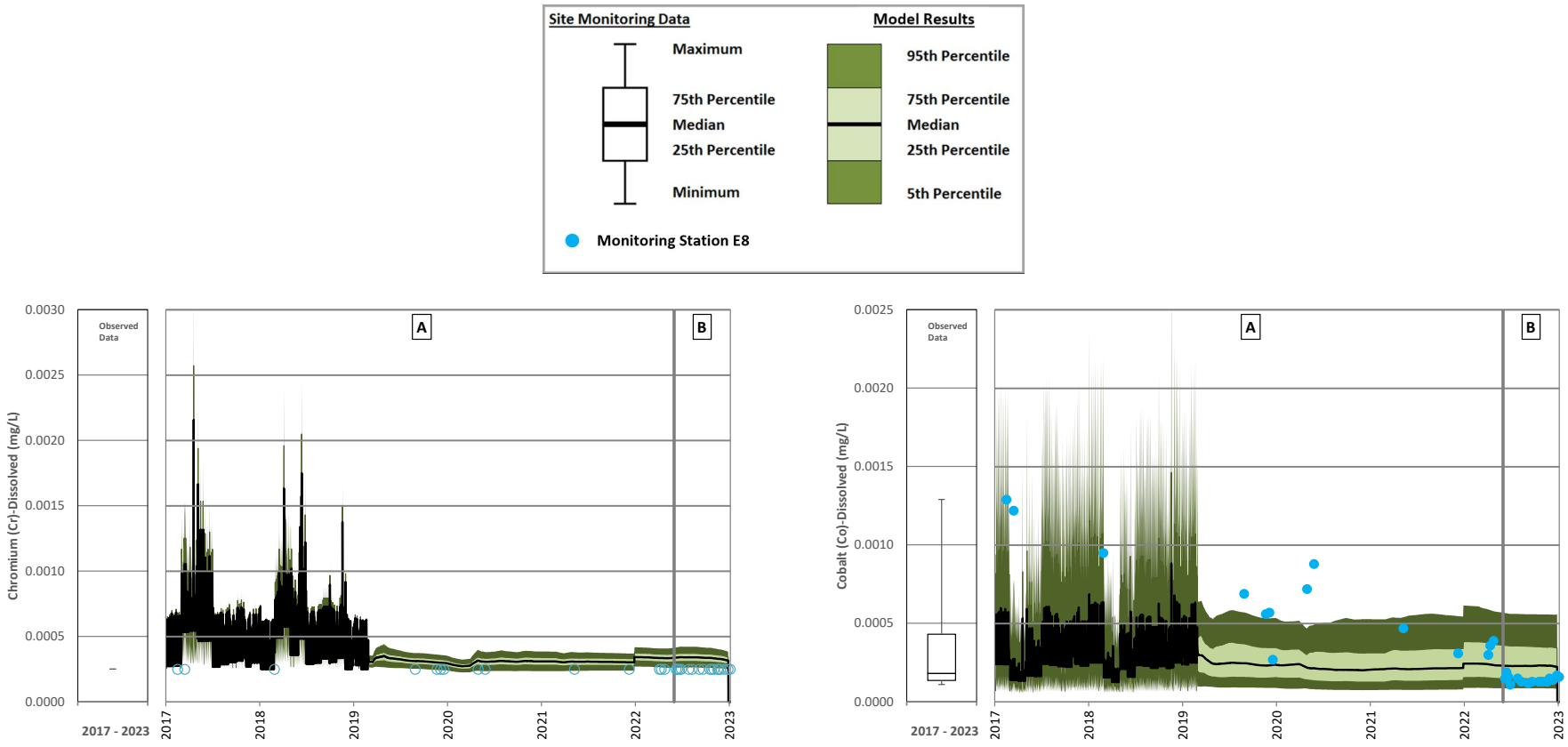

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved chromium and dissolved cobalt concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 31: Cariboo Pit Calibration – Dissolved Chromium and Dissolved Cobalt

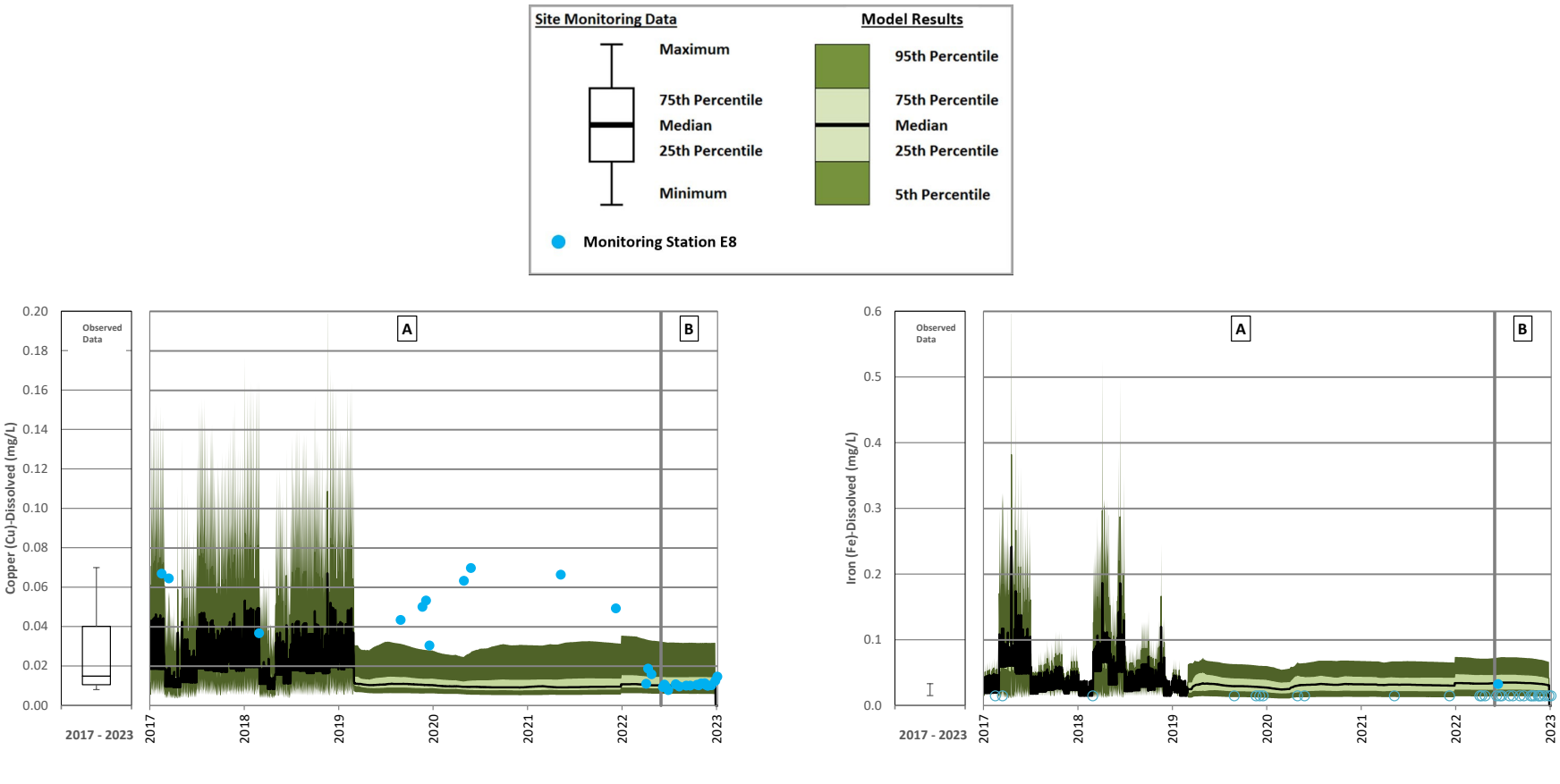

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved copper and dissolved iron concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 32: Cariboo Pit Calibration – Dissolved Copper and Dissolved Iron

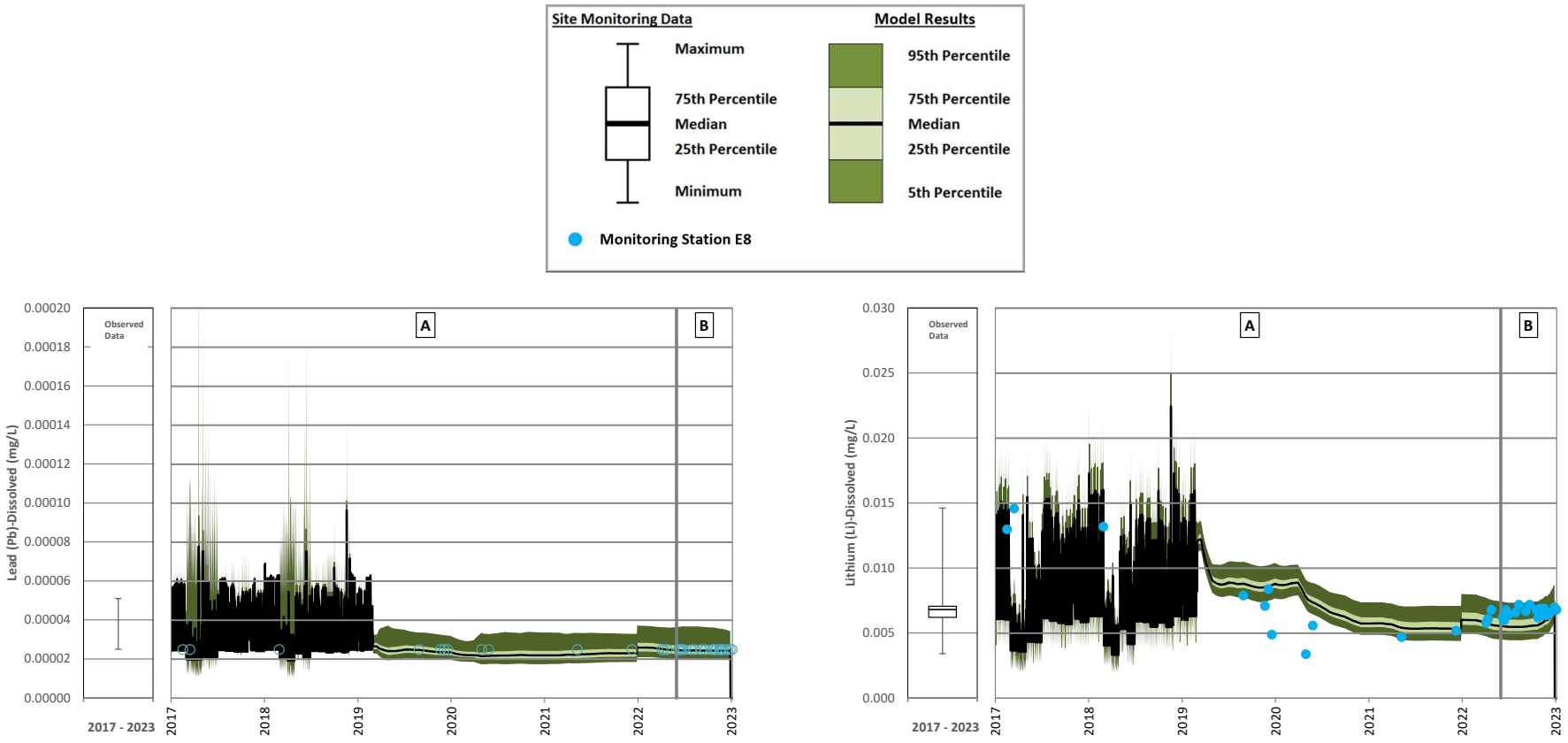

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved lead and dissolved lithium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 33: Cariboo Pit Calibration – Dissolved Lead and Dissolved Lithium

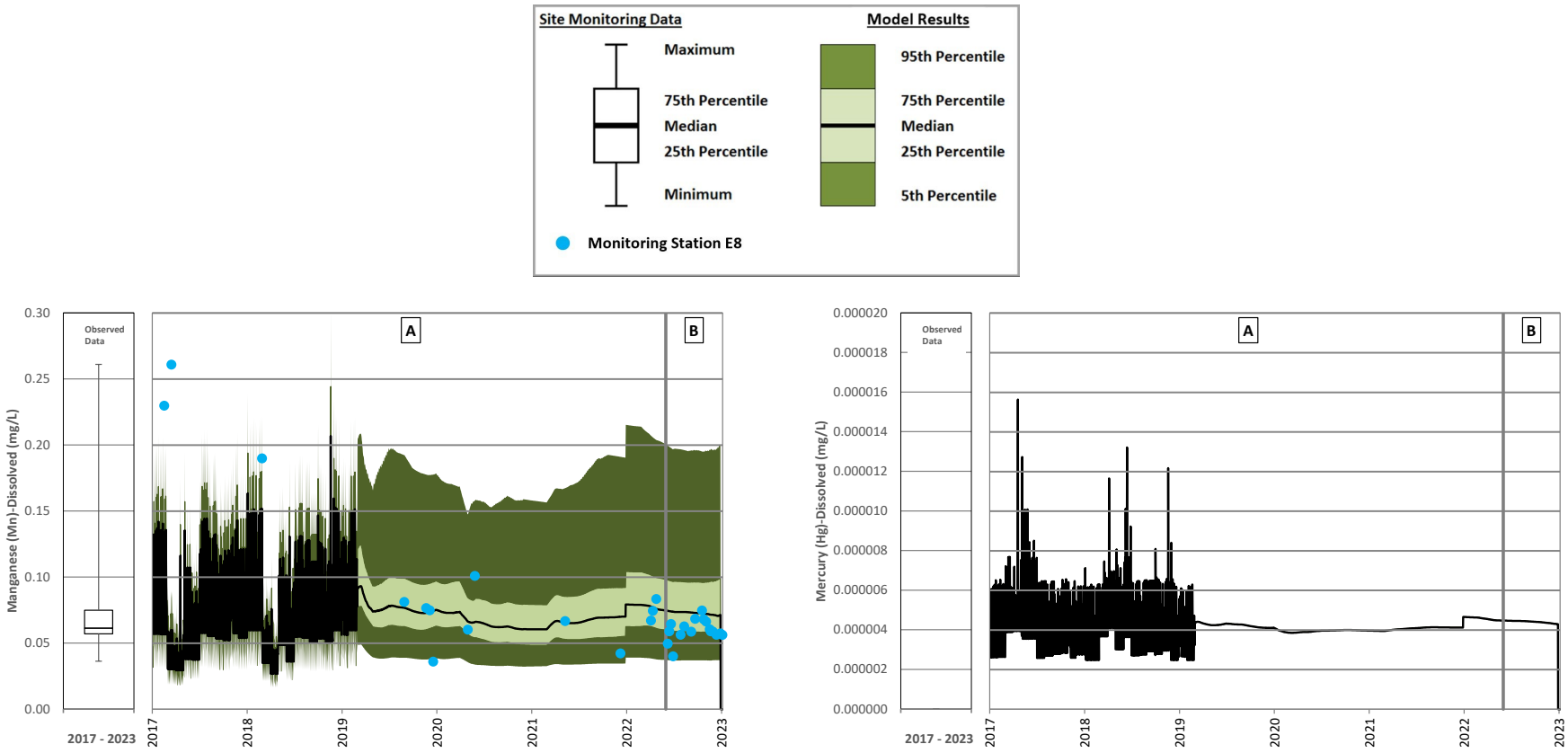

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved manganese concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 34: Cariboo Pit Calibration – Dissolved Manganese and Dissolved Mercury

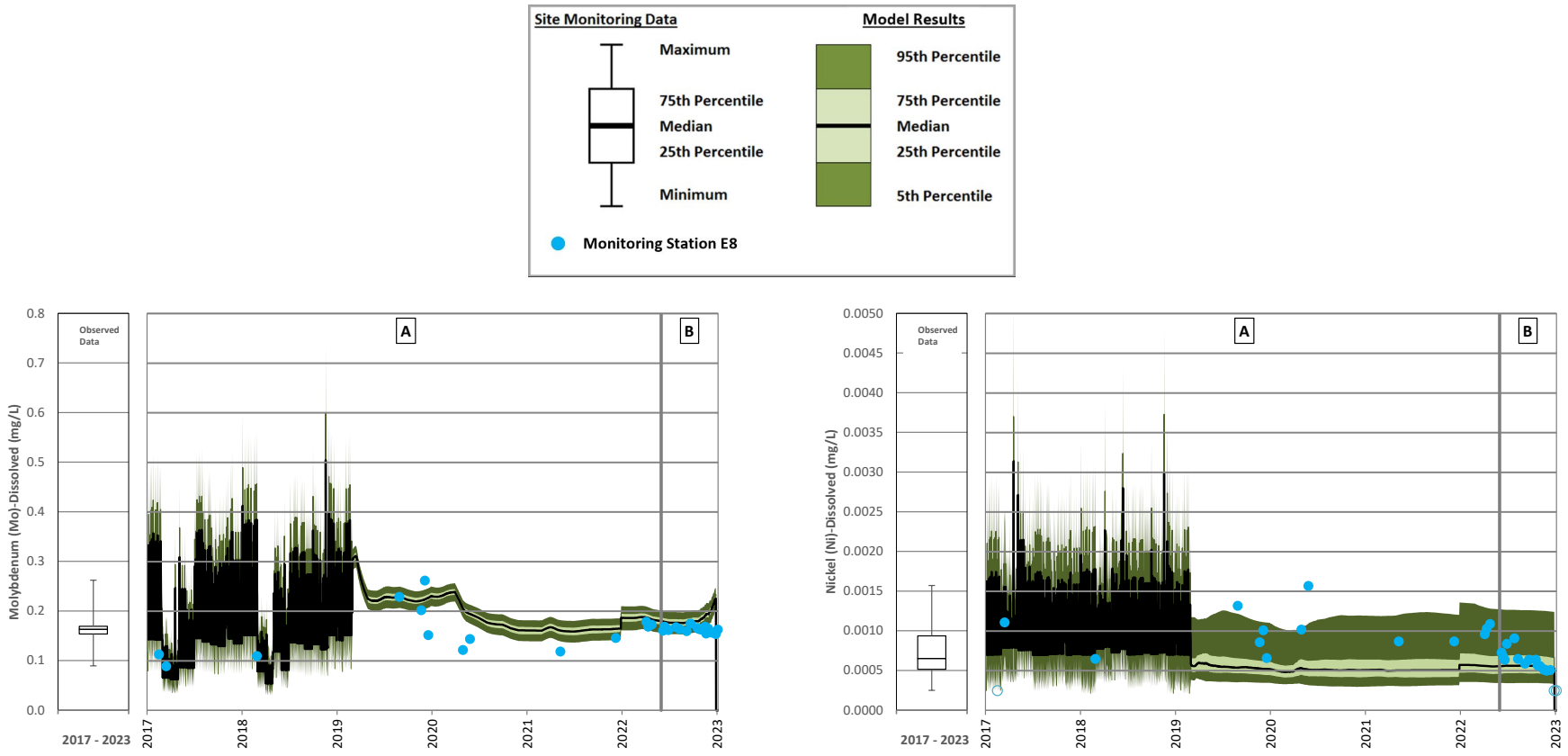

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved molybdenum and dissolved nickel concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 35: Cariboo Pit Calibration – Dissolved Molybdenum and Dissolved Nickel

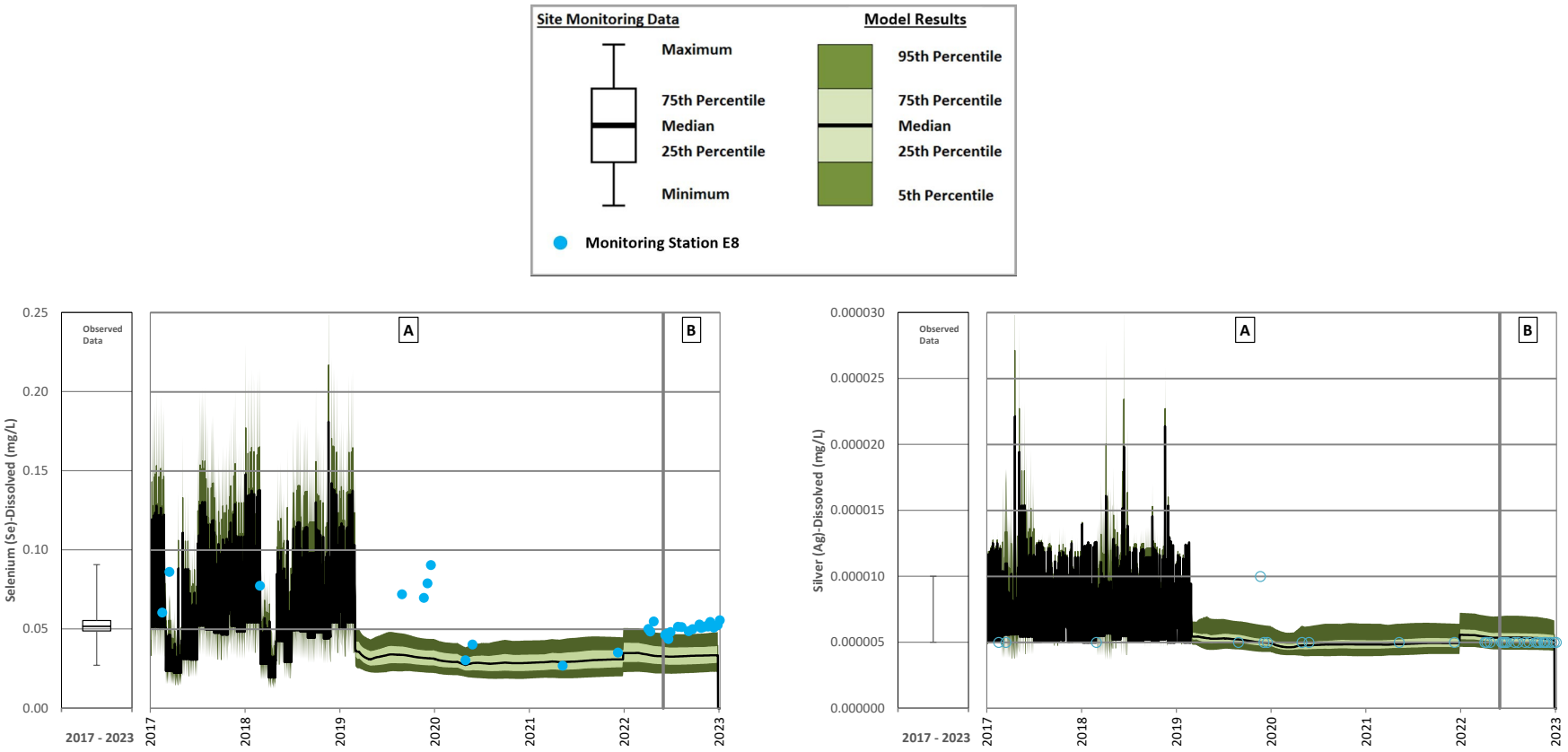

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved selenium and dissolved silver concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 36: Cariboo Pit Calibration – Dissolved Selenium and Dissolved Silver

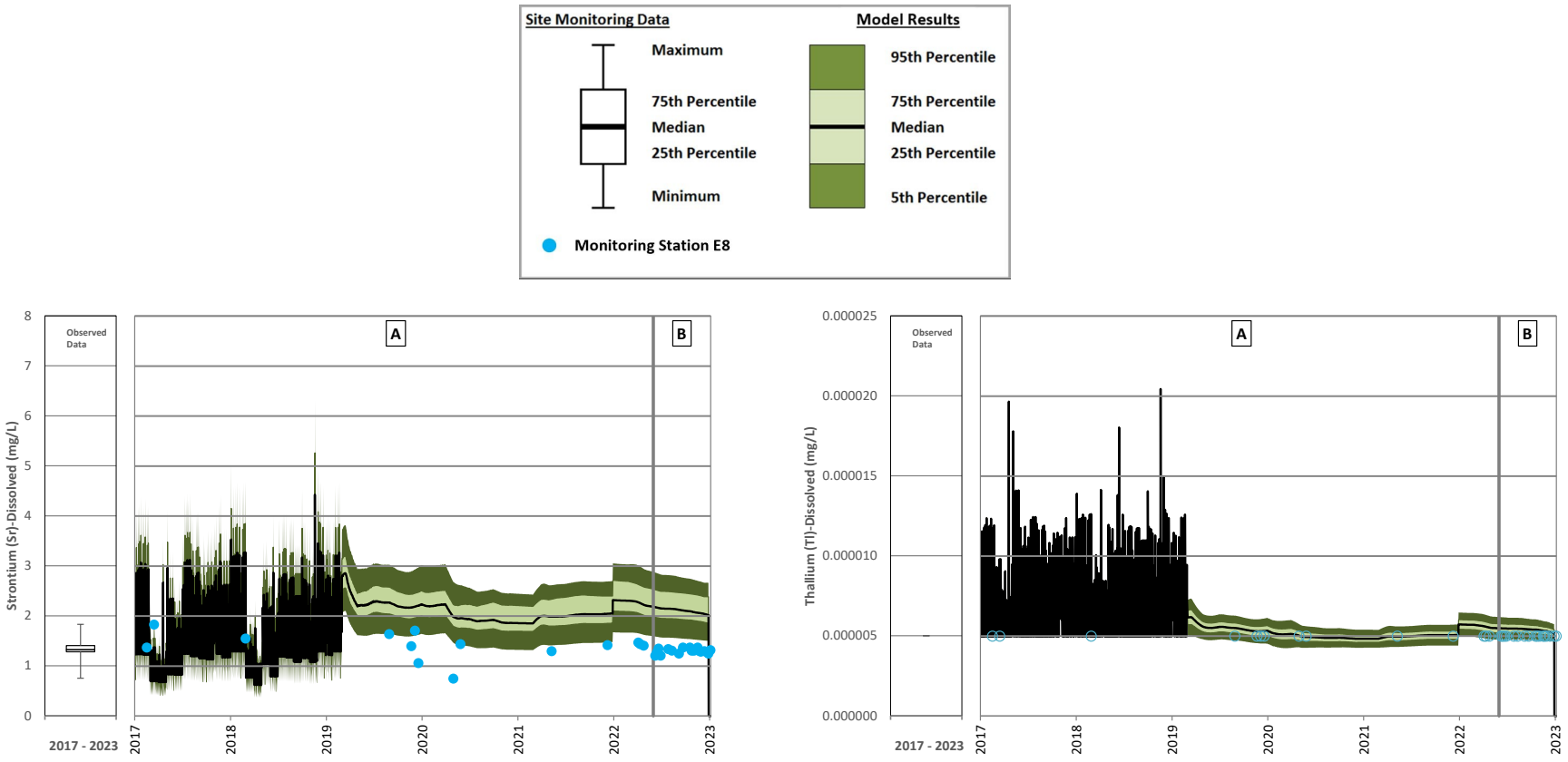

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved strontium and dissolved thallium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 37: Cariboo Pit Calibration – Dissolved Strontium and Dissolved Thallium

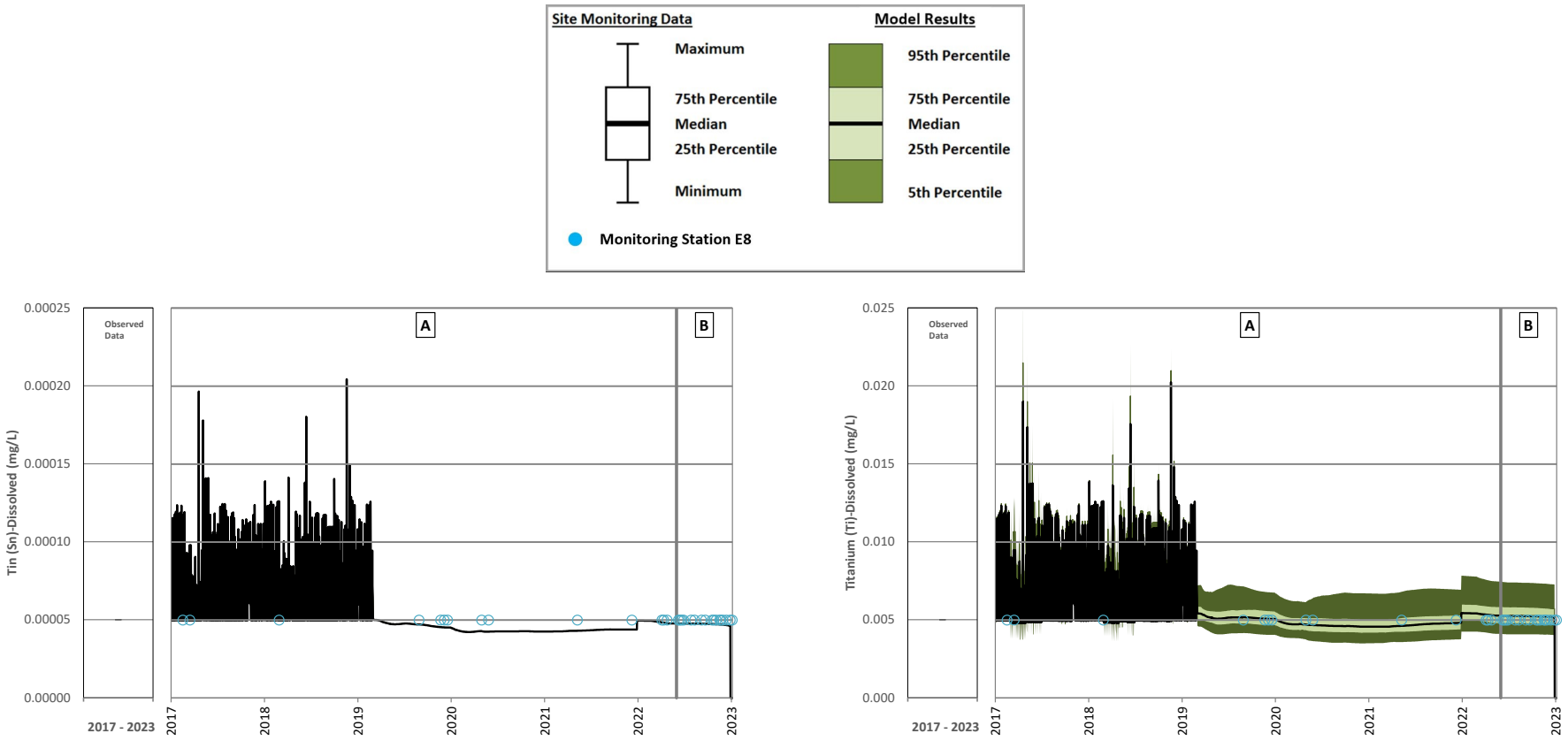

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved titanium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 38: Cariboo Pit Calibration – Dissolved Tin and Dissolved Titanium

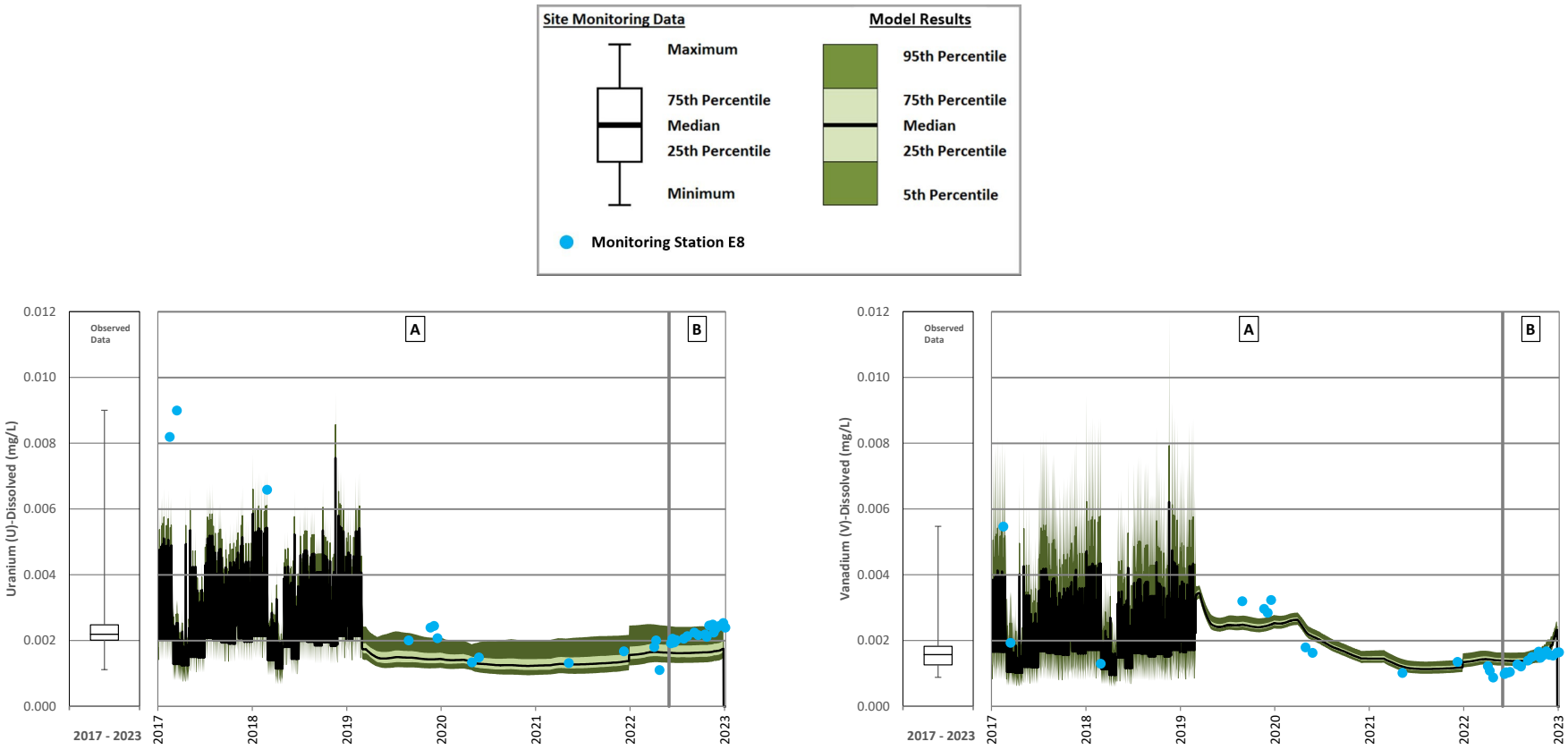

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved uranium and dissolved vanadium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 39: Cariboo Pit Calibration – Dissolved Uranium and Dissolved Vanadium

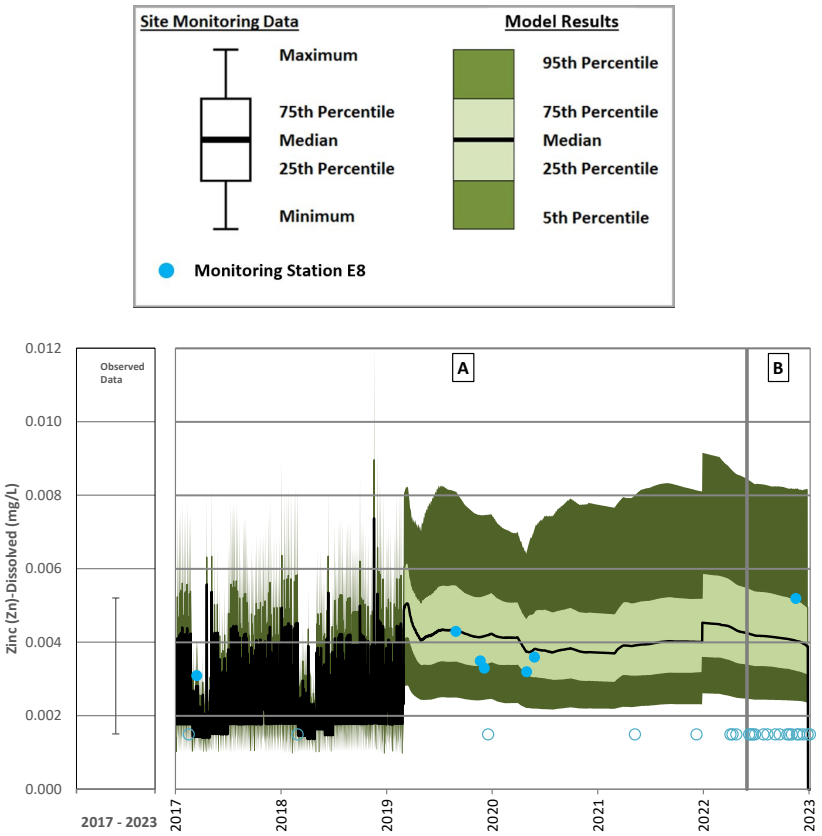

A = Care and Maintanence; B = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved zinc concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 40: Cariboo Pit Calibration – Dissolved Zinc

Wight Pit Calibration

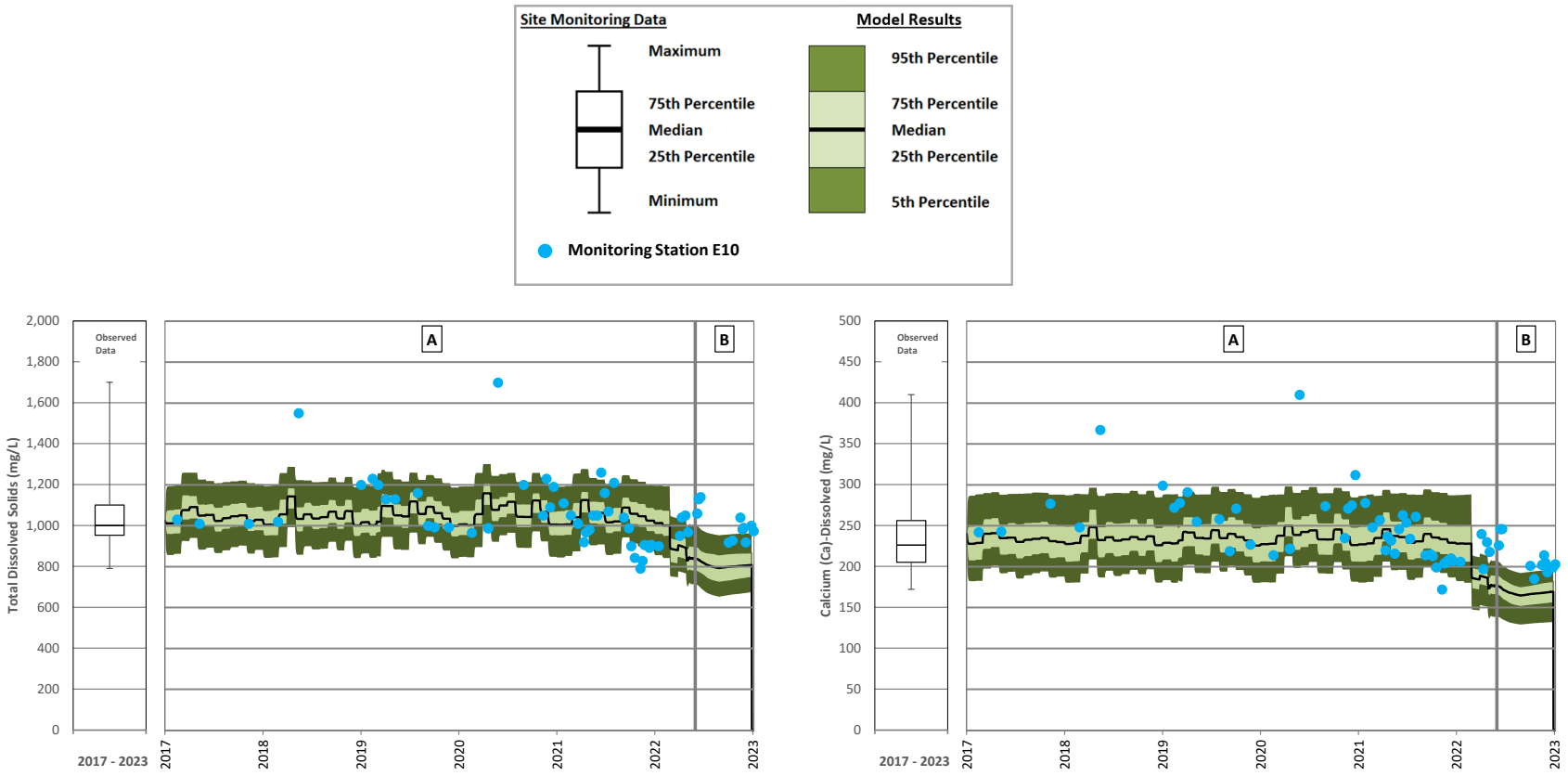

A = Care and Maintanence; B = Resumed Operations

Note: Total dissolved solids and calcium decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 41: Wight Pit Calibration – Total Dissolved Solids and Calcium

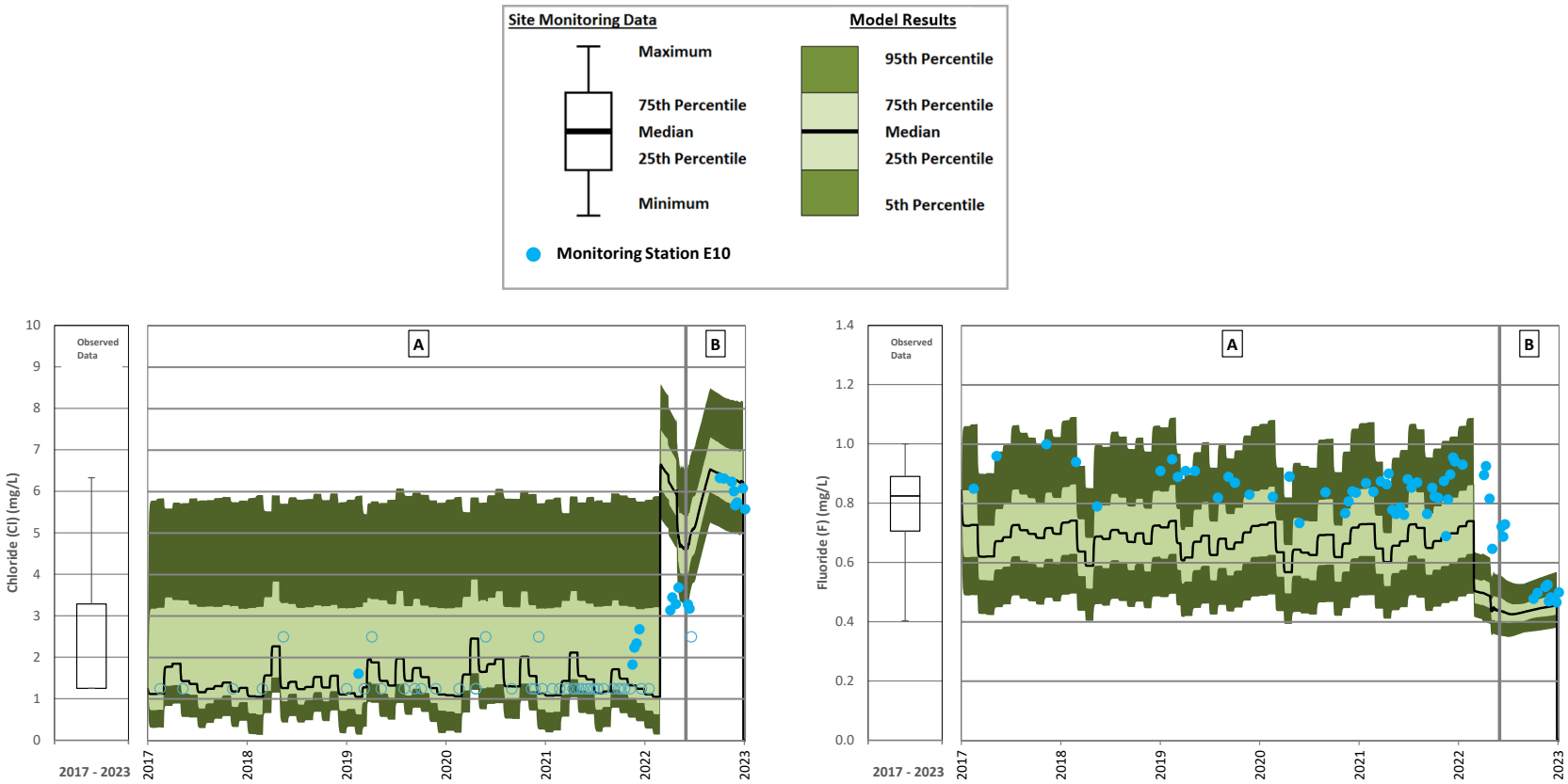

A = Care and Maintanence; B = Resumed Operations

Note: Chloride concentrations increase in Wight Pit and fluoride concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 42: Wight Pit Calibration – Chloride and Fluoride

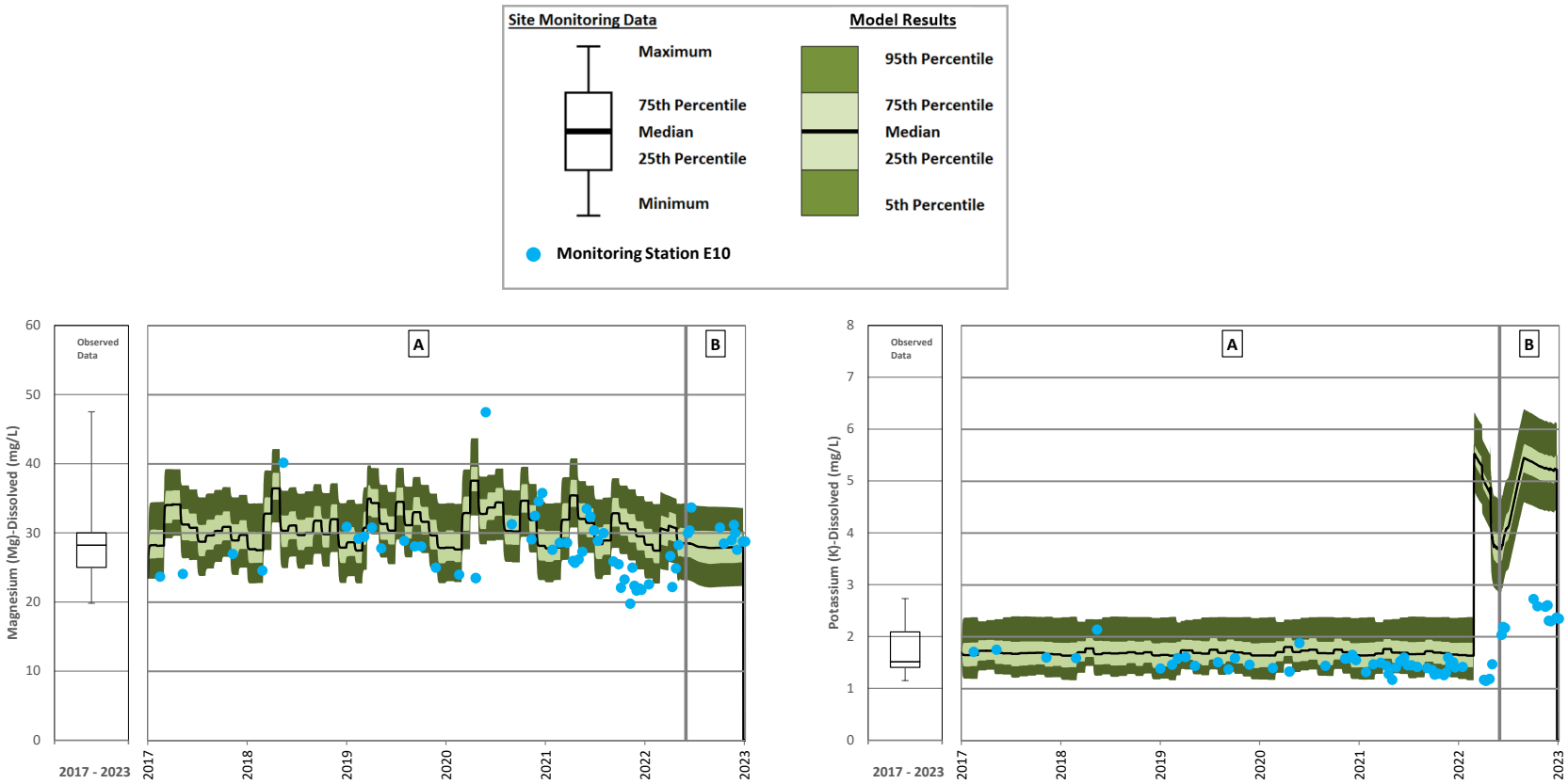

A = Care and Maintanence; B = Resumed Operations

Note: Potassium concentrations increase in Wight Pit decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 43: Wight Pit Calibration – Magnesium and Potassium

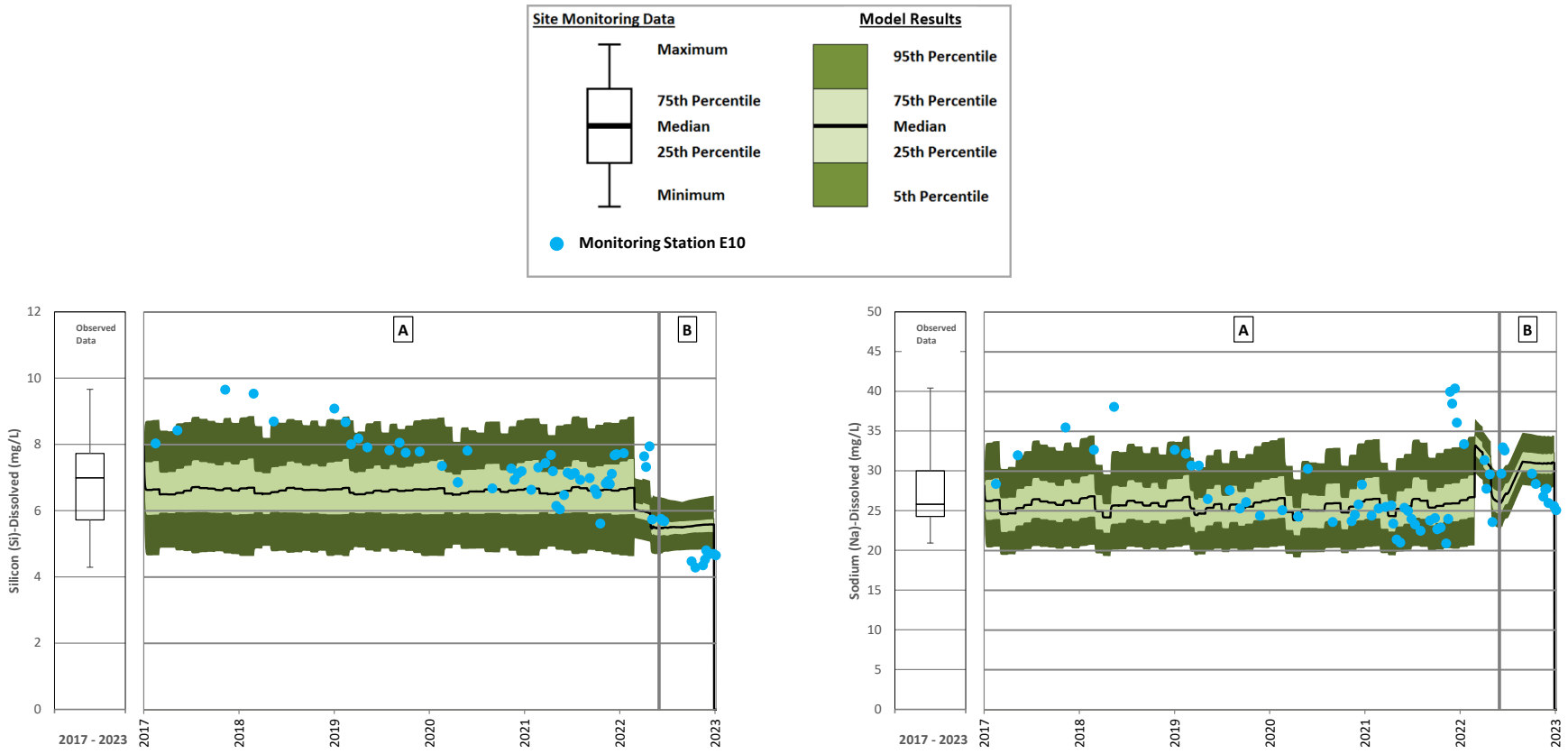

A = Care and Maintanence; B = Resumed Operations

Note: Silicon concentrations decrease in Wight Pit and sodium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 44: Wight Pit Calibration – Silicon and Sodium

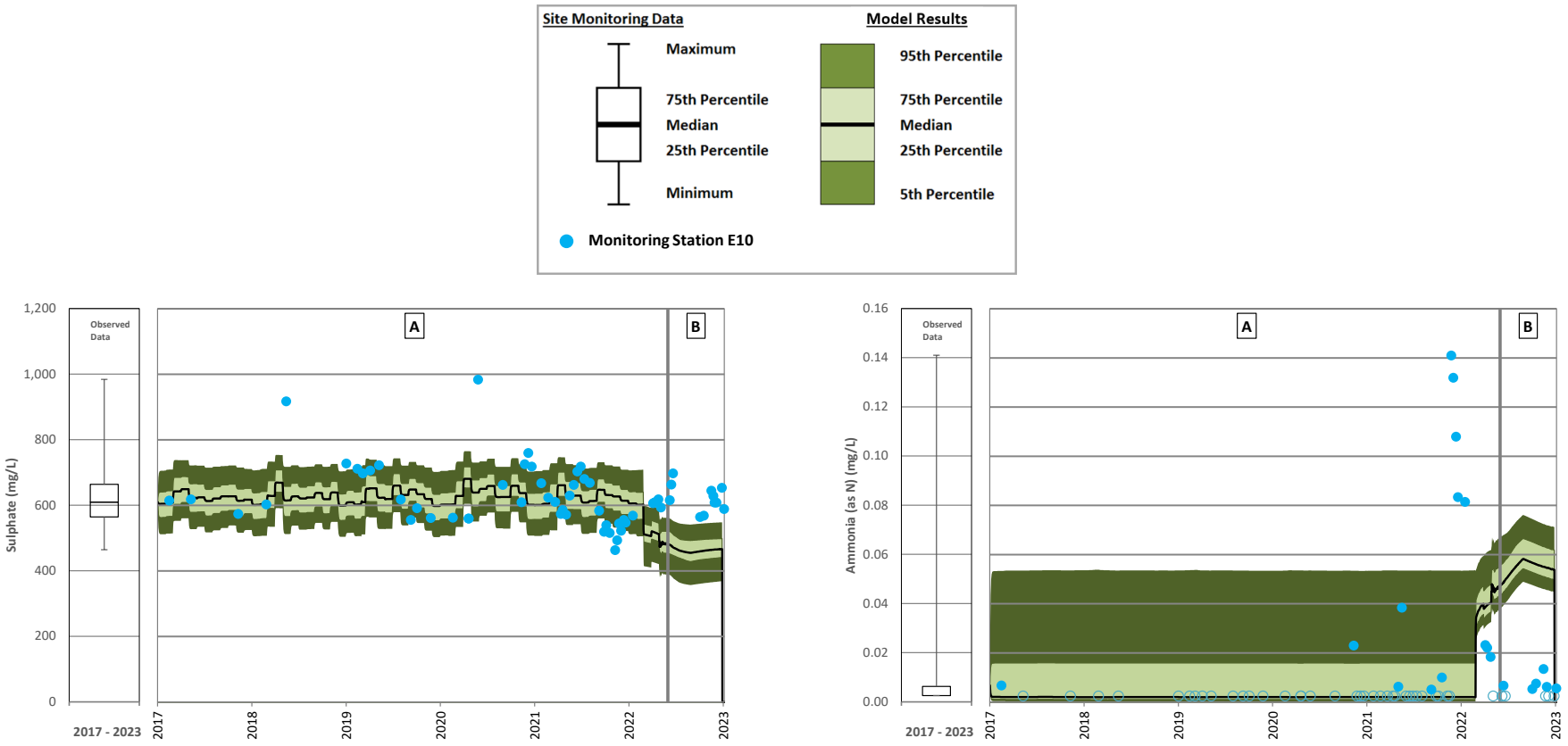

A = Care and Maintanence; B = Resumed Operations

Note: Sulphate concentrations decrease in Wight Pit and total ammonia concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 45: Wight Pit Calibration – Sulphate and Total Ammonia

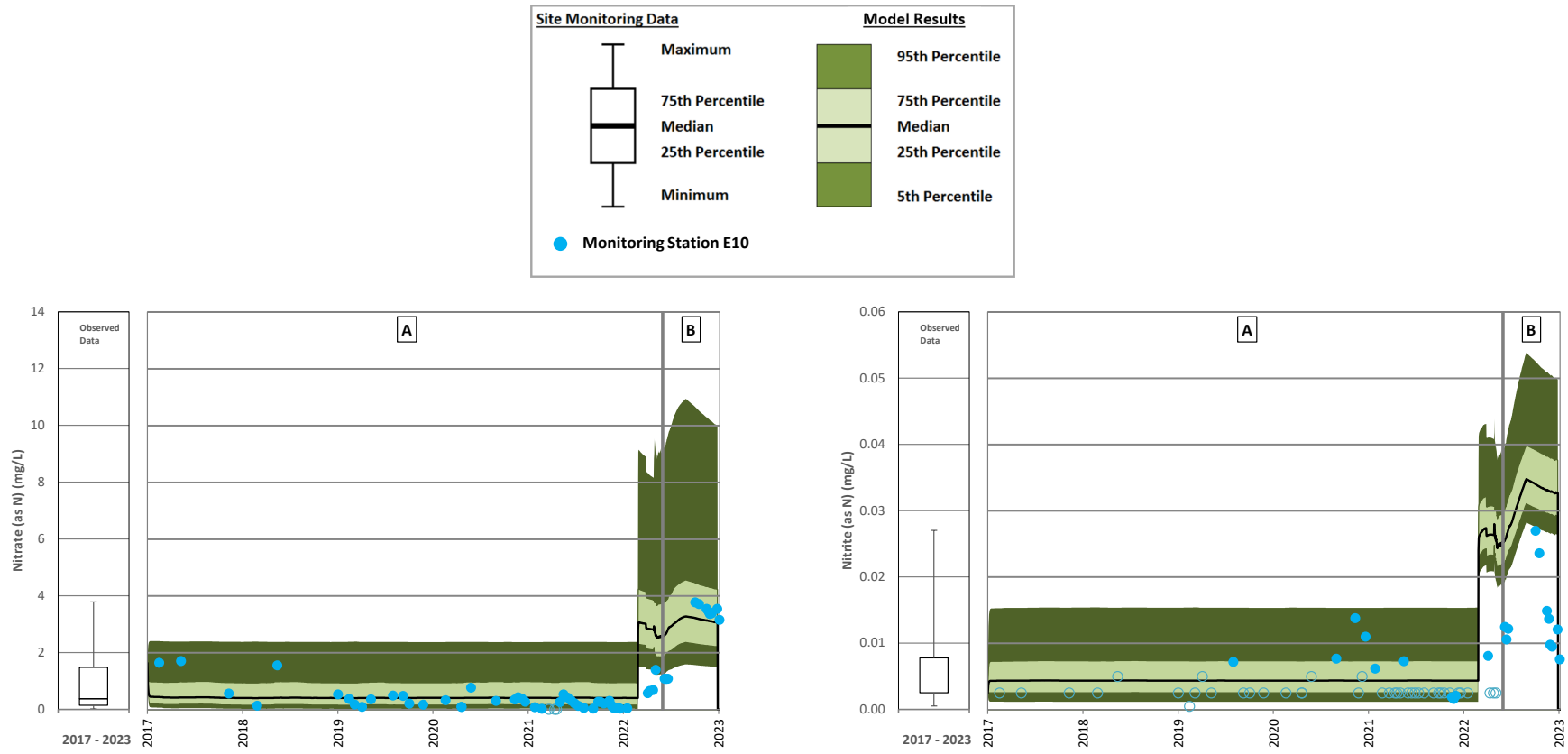

A = Care and Maintanence; B = Resumed Operations

Note: Nitrate and nitrite concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 46: Wight Pit Calibration – Nitrate and Nitrite

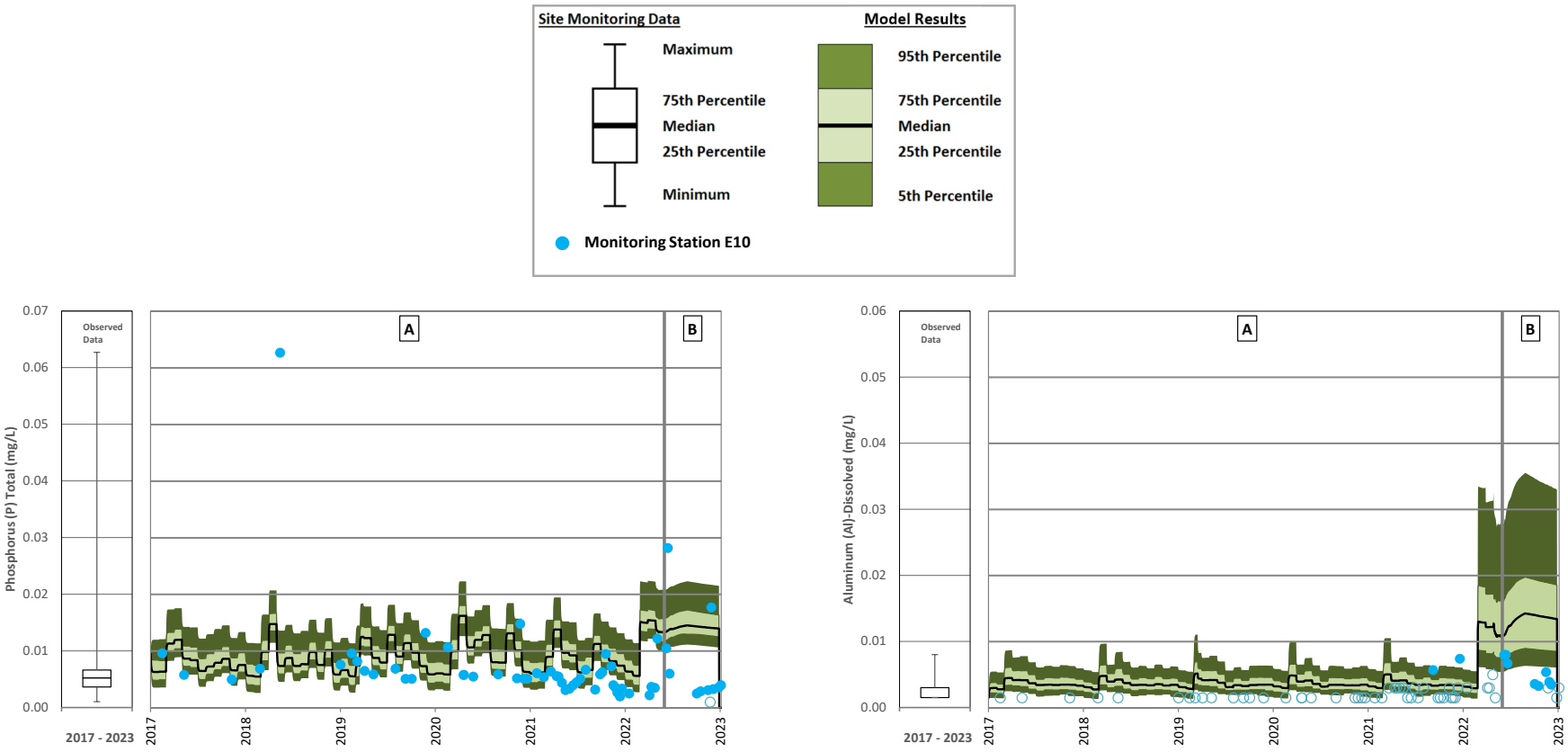

A = Care and Maintanence; B = Resumed Operations

Note: Total phosphorus and dissolved aluminum concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 47: Wight Pit Calibration – Total Phosphorus and Dissolved Aluminum

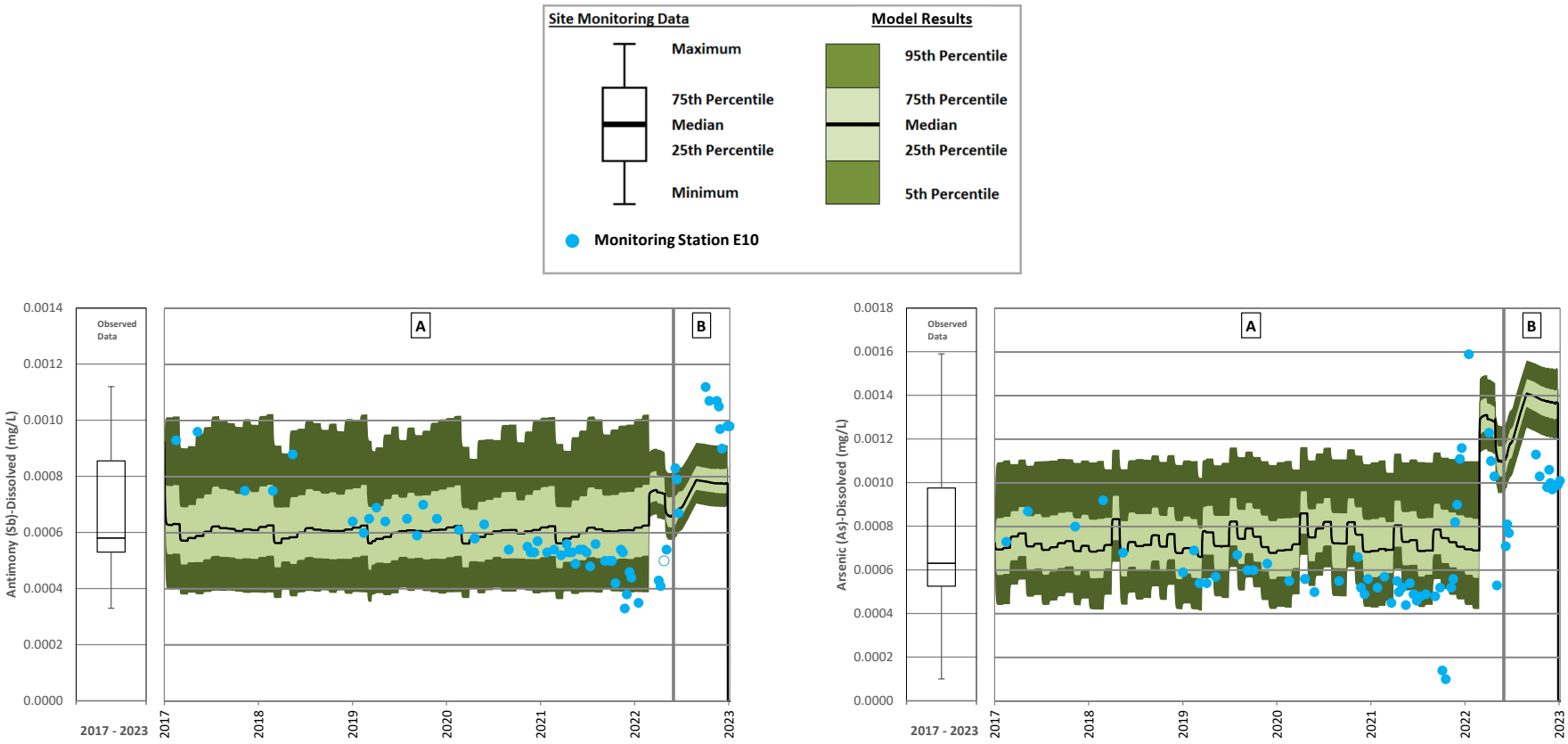

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 48: Wight Pit Calibration – Dissolved Antimony and Dissolved Arsenic

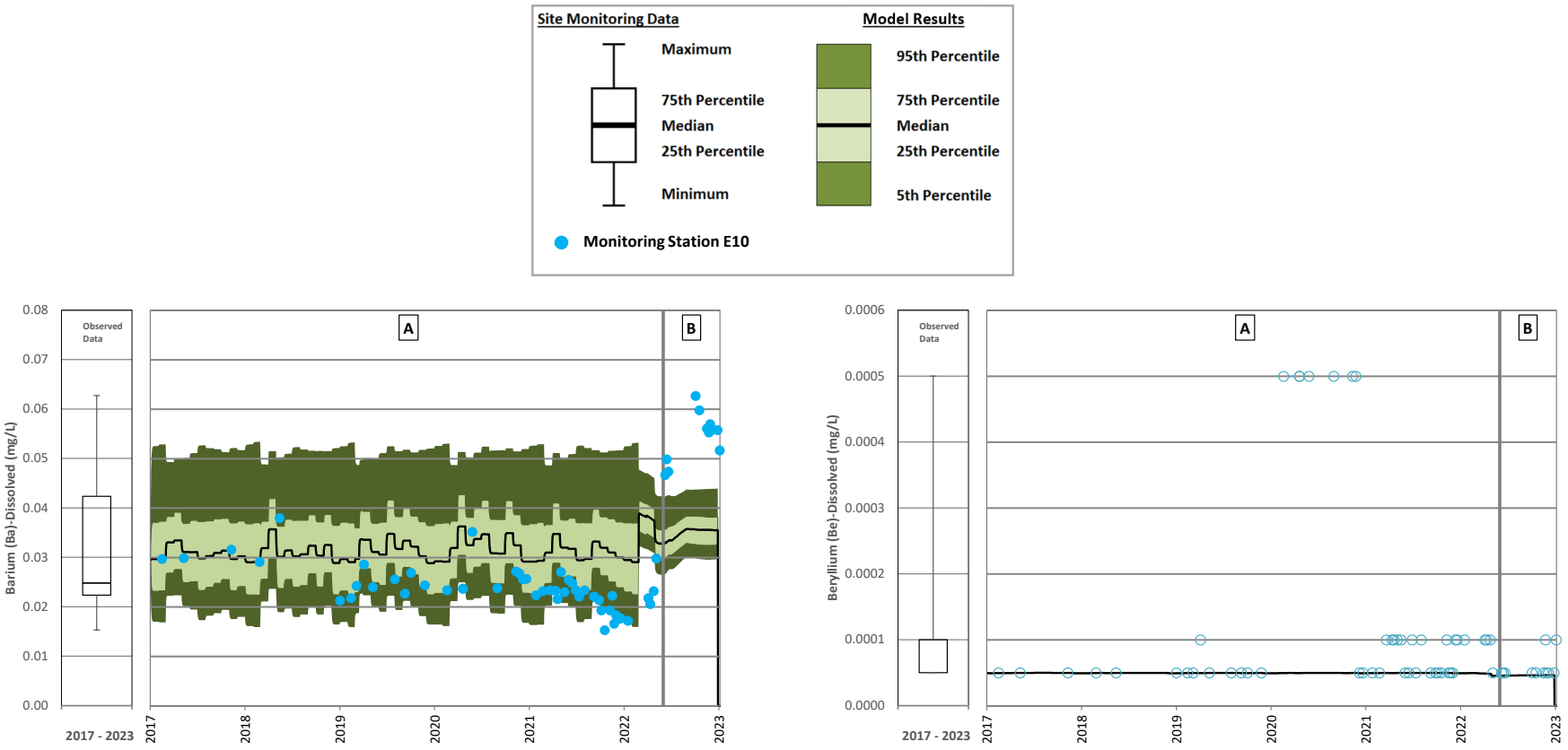

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved barium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 49: Wight Pit Calibration – Dissolved Barium and Dissolved Beryllium

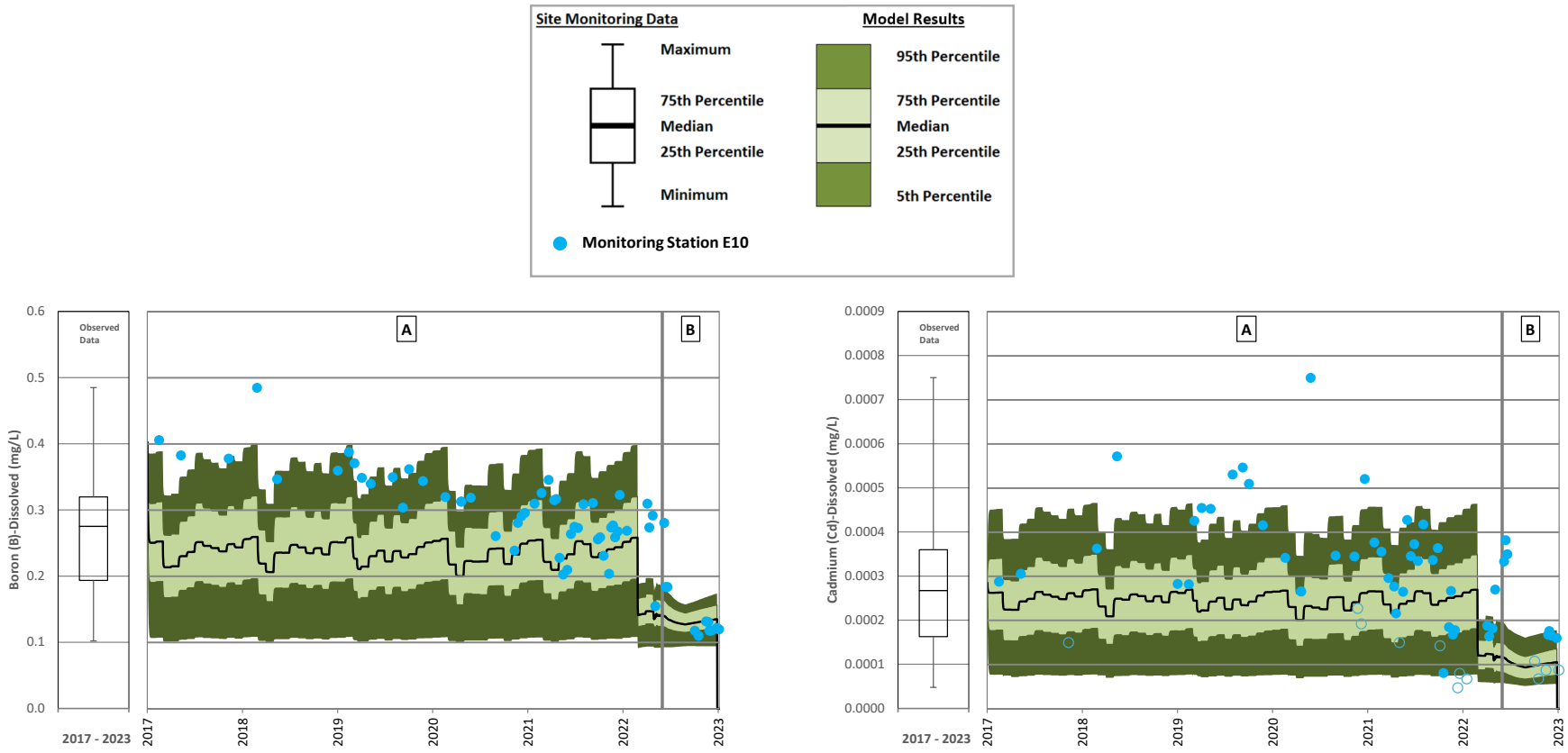

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved boron and dissolved cadmium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 50: Wight Pit Calibration – Dissolved Boron and Dissolved Cadmium

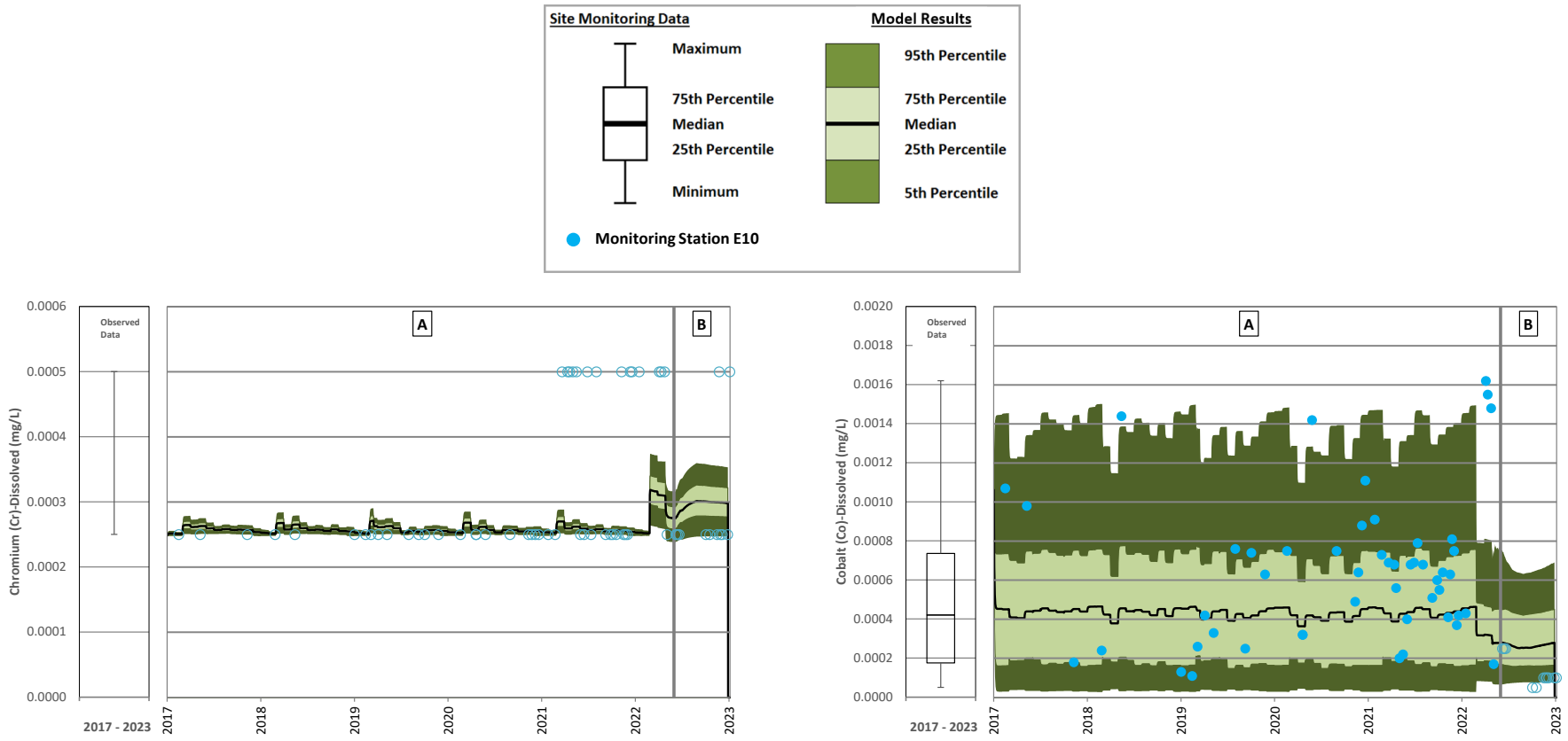

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved chromium concentrations increase in Wight Pit and dissolved cobalt concentrations decrease at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 51: Wight Pit Calibration – Dissolved Chromium and Dissolved Cobalt

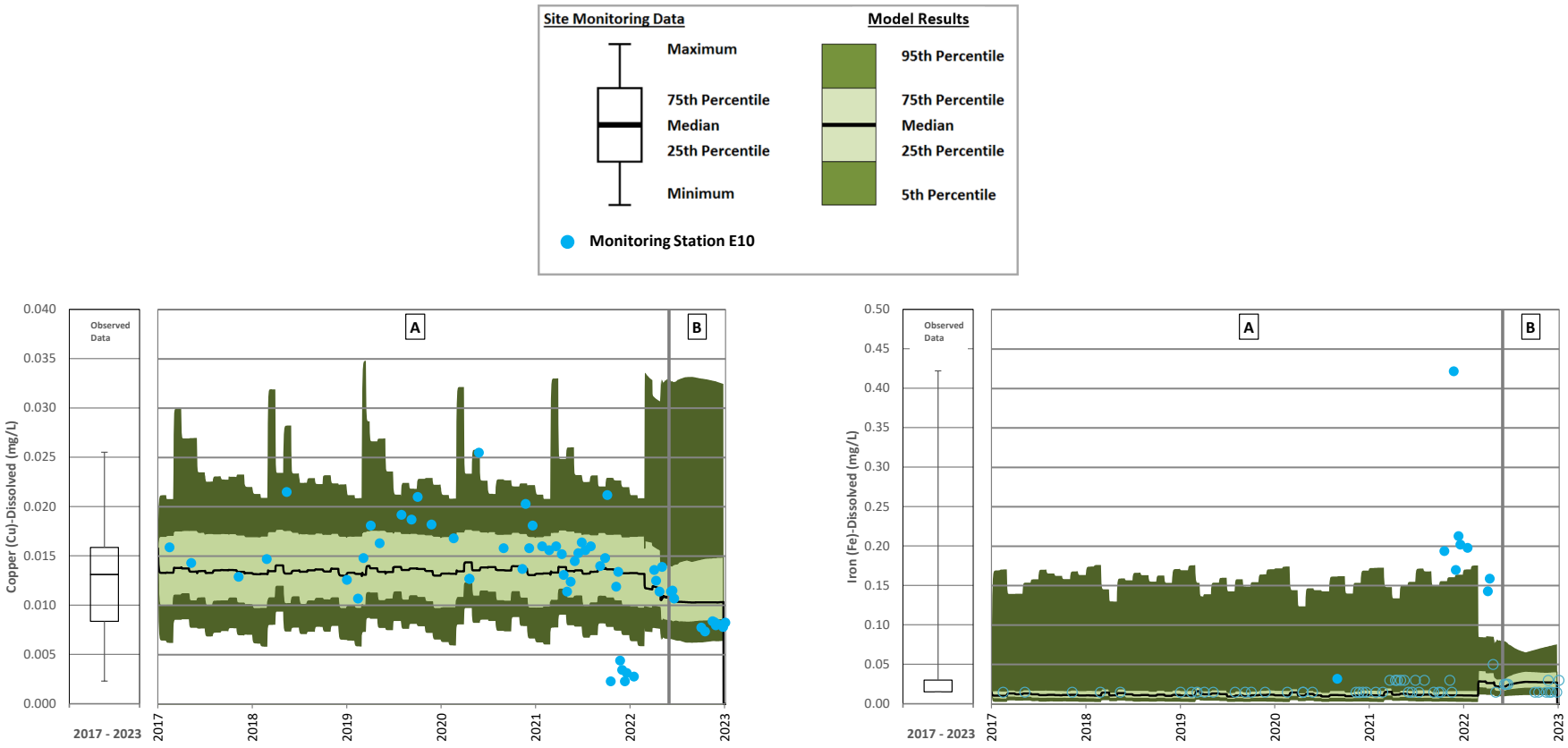

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved copper concentrations increase in Wight Pit and dissolved iron concentrations decrease at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 52: Wight Pit Calibration – Dissolved Copper and Dissolved Iron

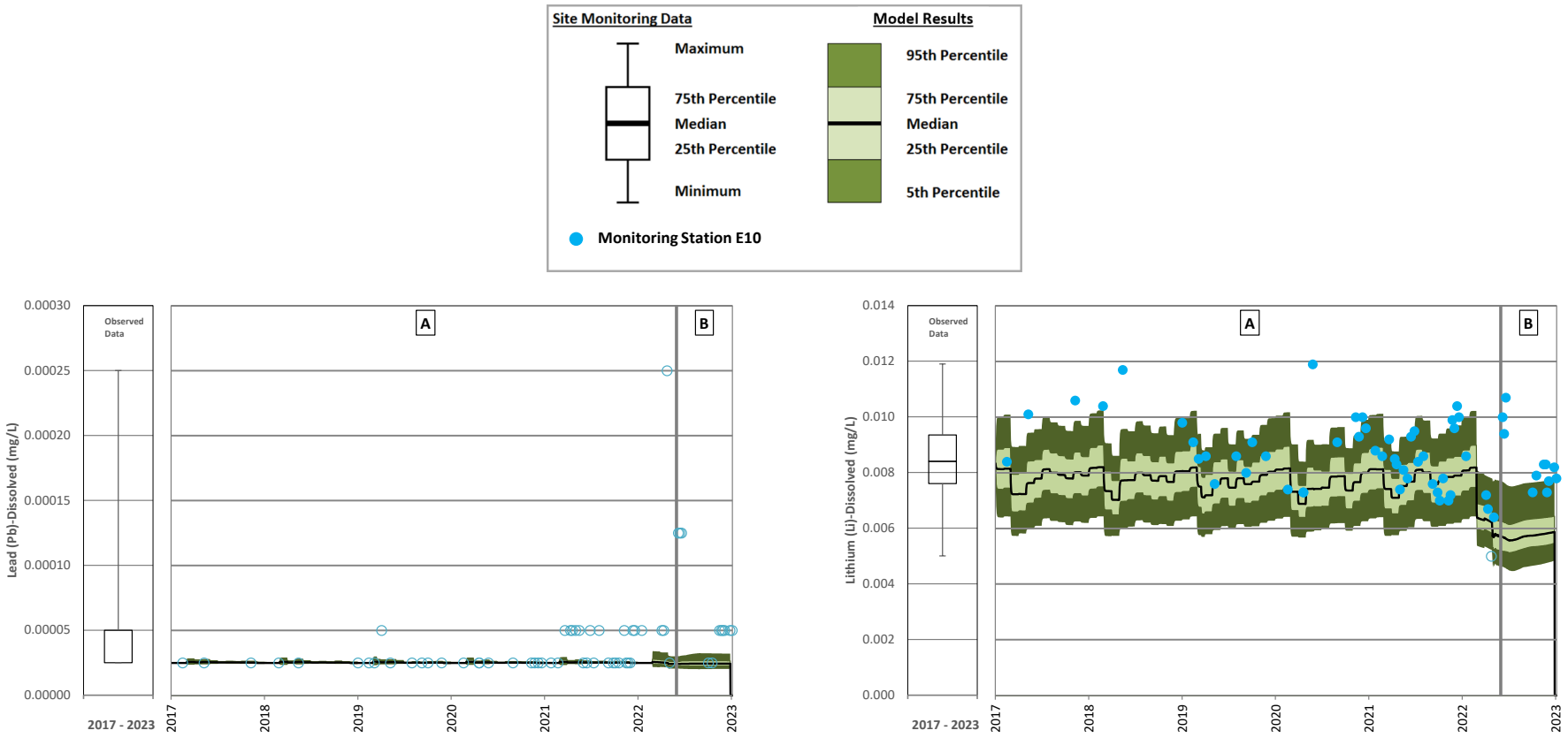

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved lithium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 53: Wight Pit Calibration – Dissolved Lead and Dissolved Lithium

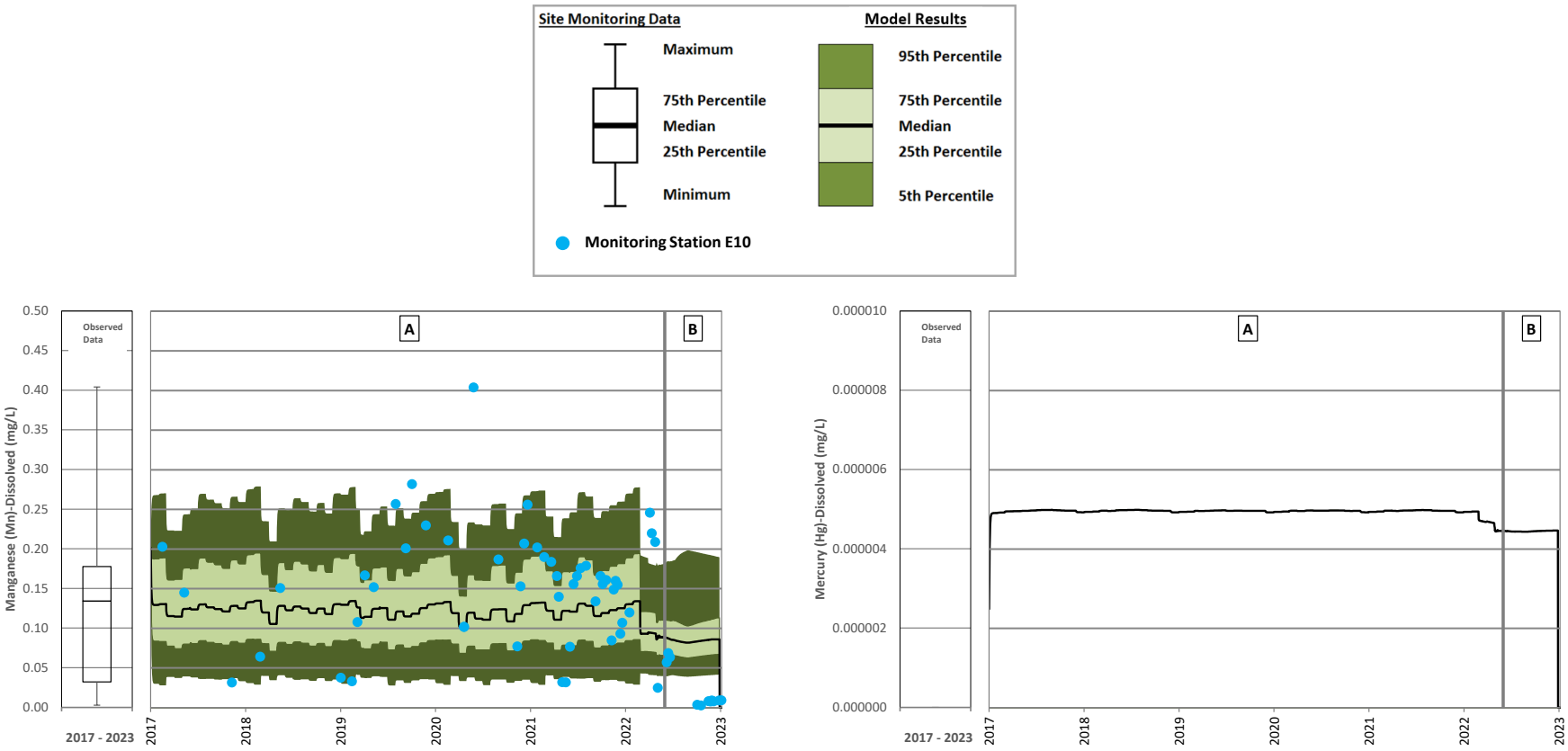

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved manganese concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 54: Wight Pit Calibration – Dissolved Manganese and Dissolved Mercury

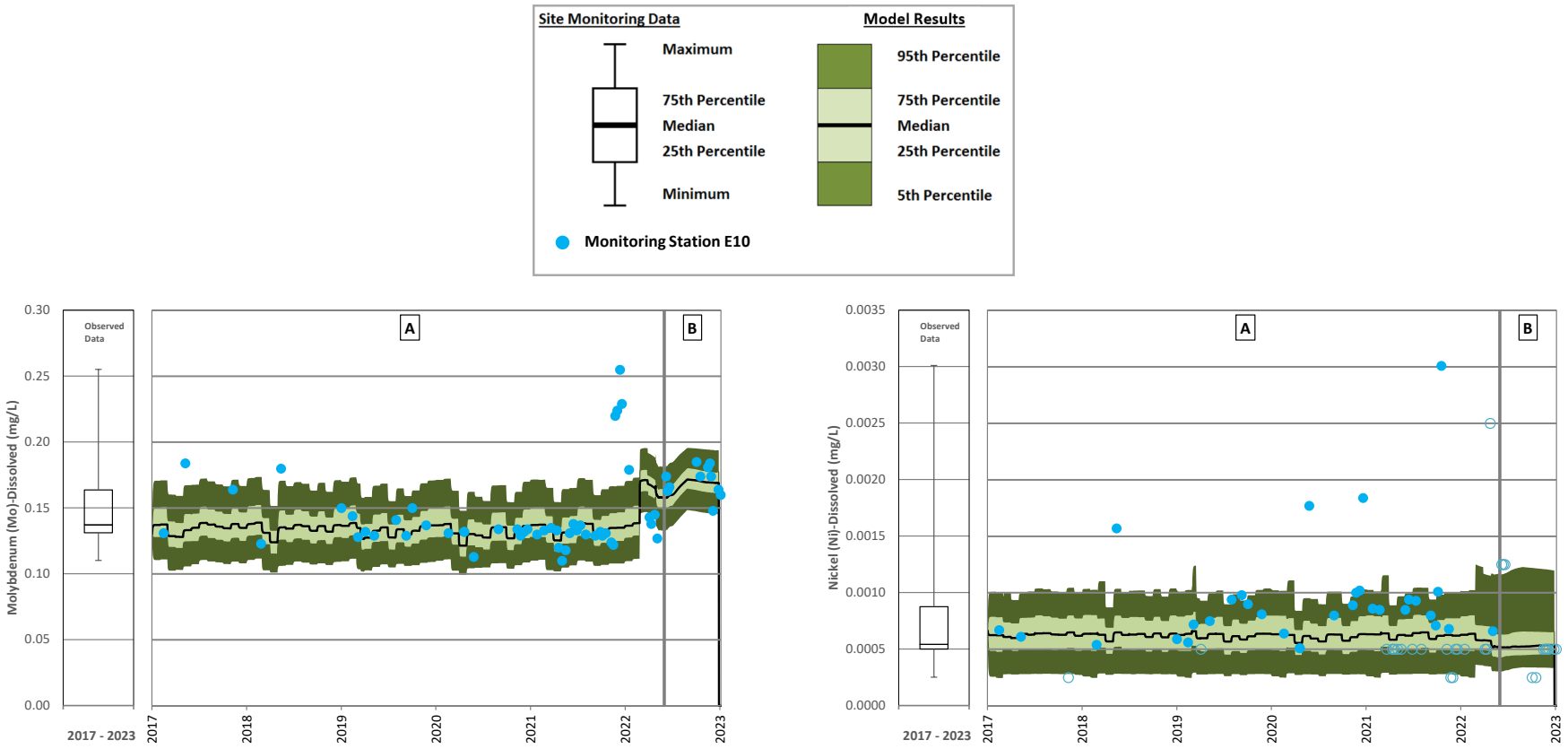

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved molybdenum concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 55: Wight Pit Calibration – Dissolved Molybdenum and Dissolved Nickel

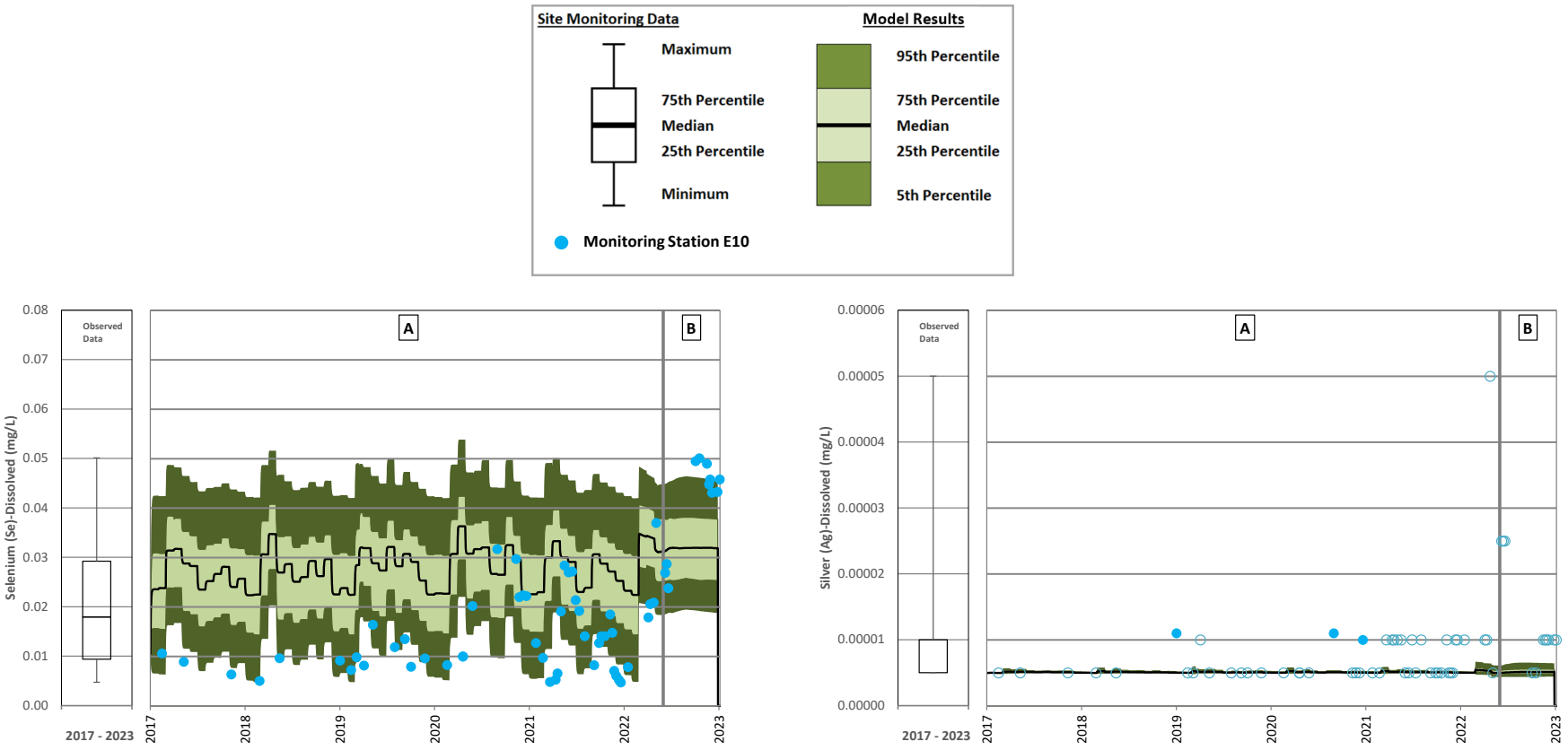

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved selenium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 56: Wight Pit Calibration – Dissolved Selenium and Dissolved Silver

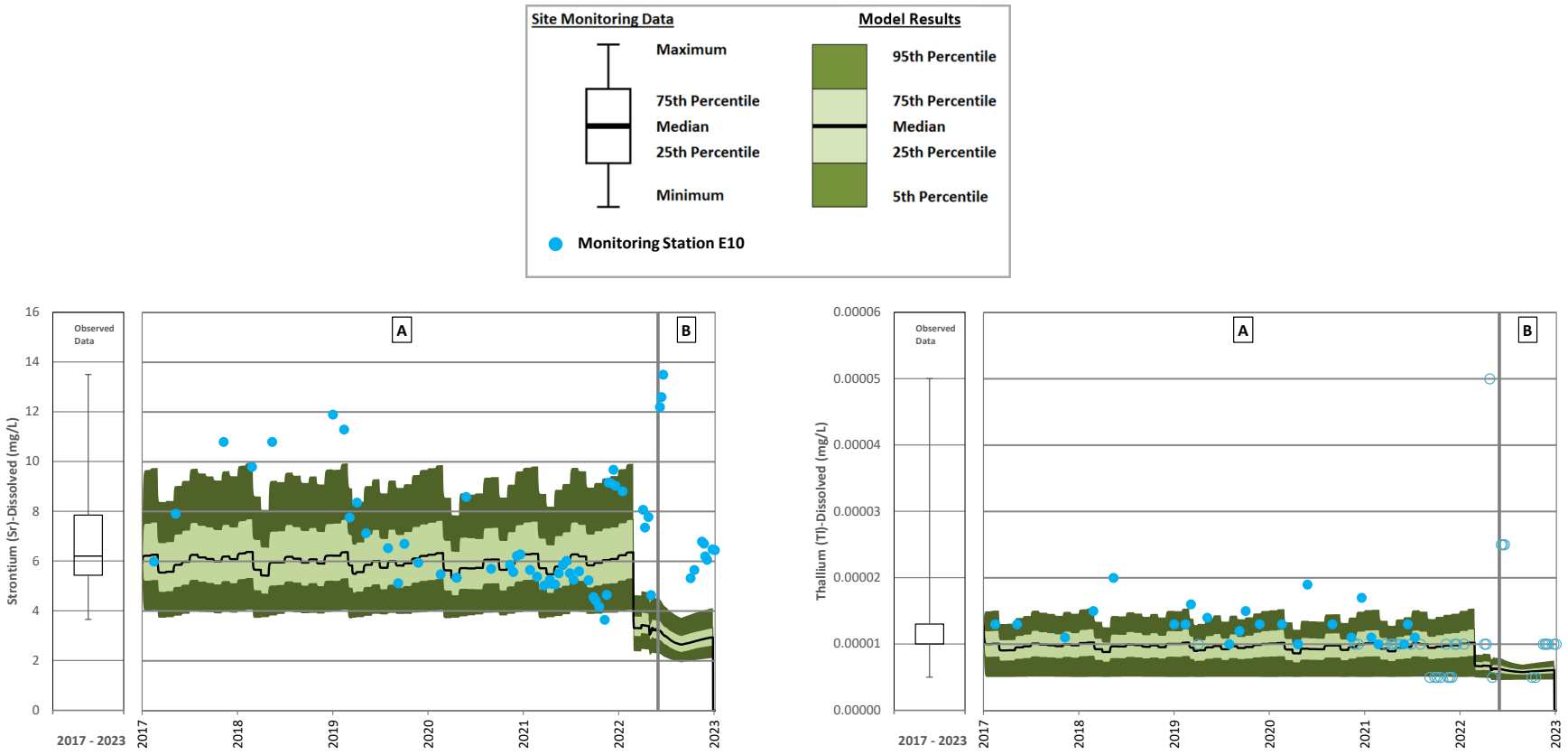

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved strontium and dissolved thallium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 57: Wight Pit Calibration – Dissolved Strontium and Dissolved Thallium

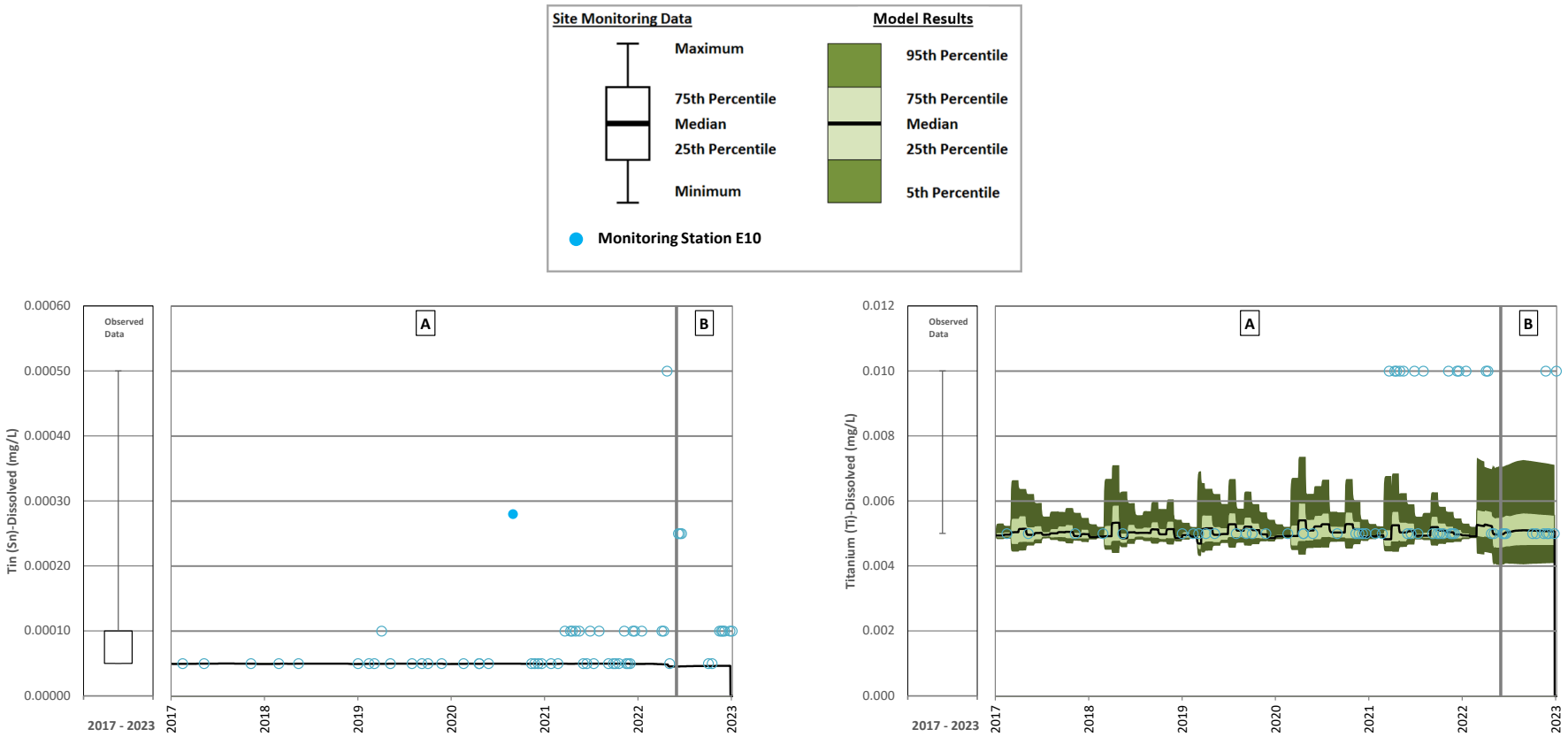

A = Care and Maintanence; B = Resumed Operations

Figure A 58: Wight Pit Calibration – Dissolved Tin and Dissolved Titanium

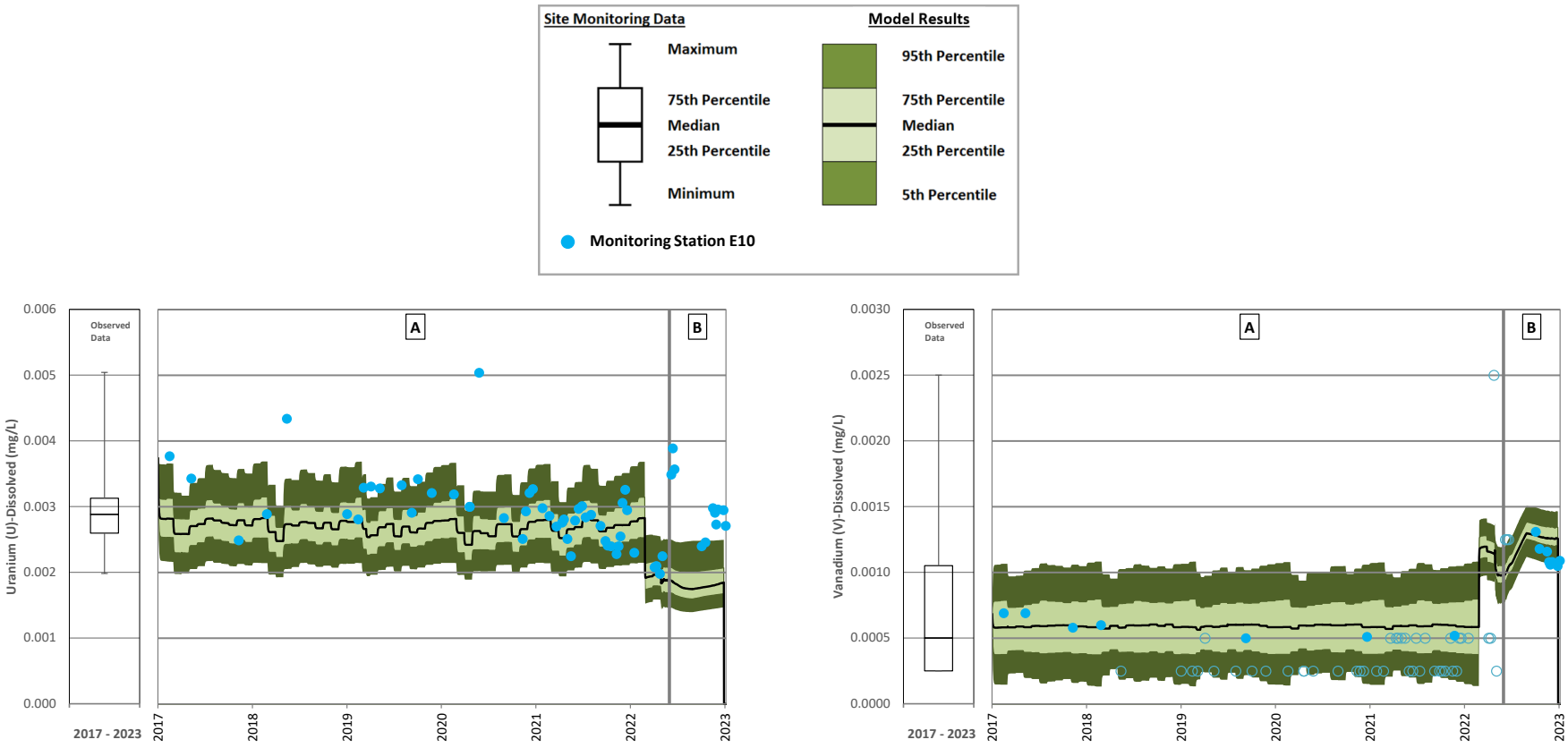

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved uranium concentrations decrease in Wight Pit and dissolved vanadium concentrations increase at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 59: Wight Pit Calibration – Dissolved Uranium and Dissolved Vanadium

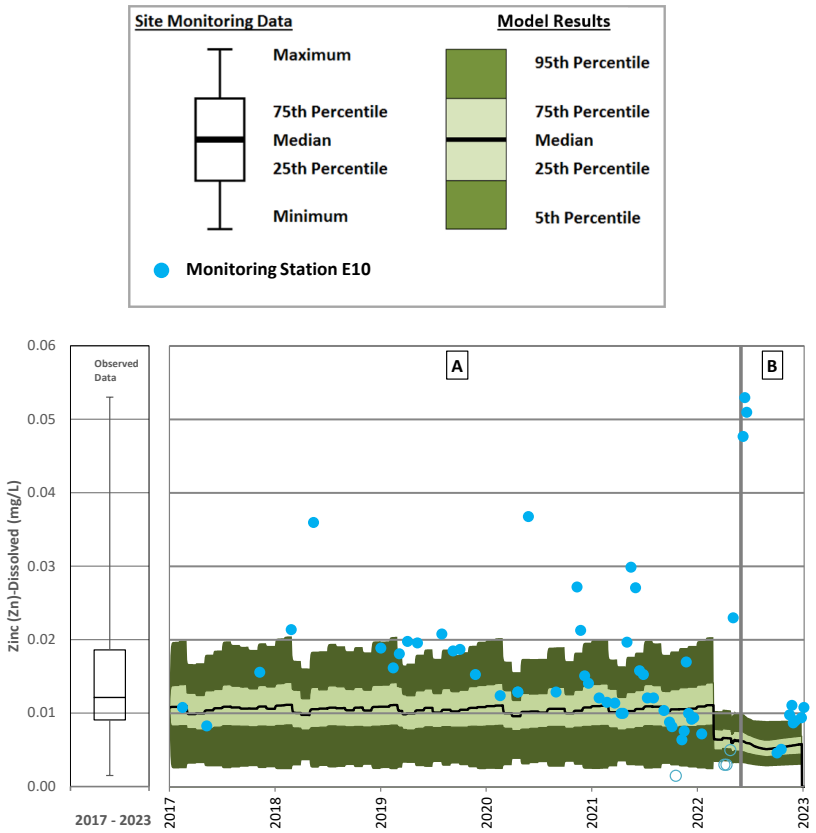

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved zinc concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 60: Wight Pit Calibration – Dissolved Zinc

Central Collection Sump Calibration

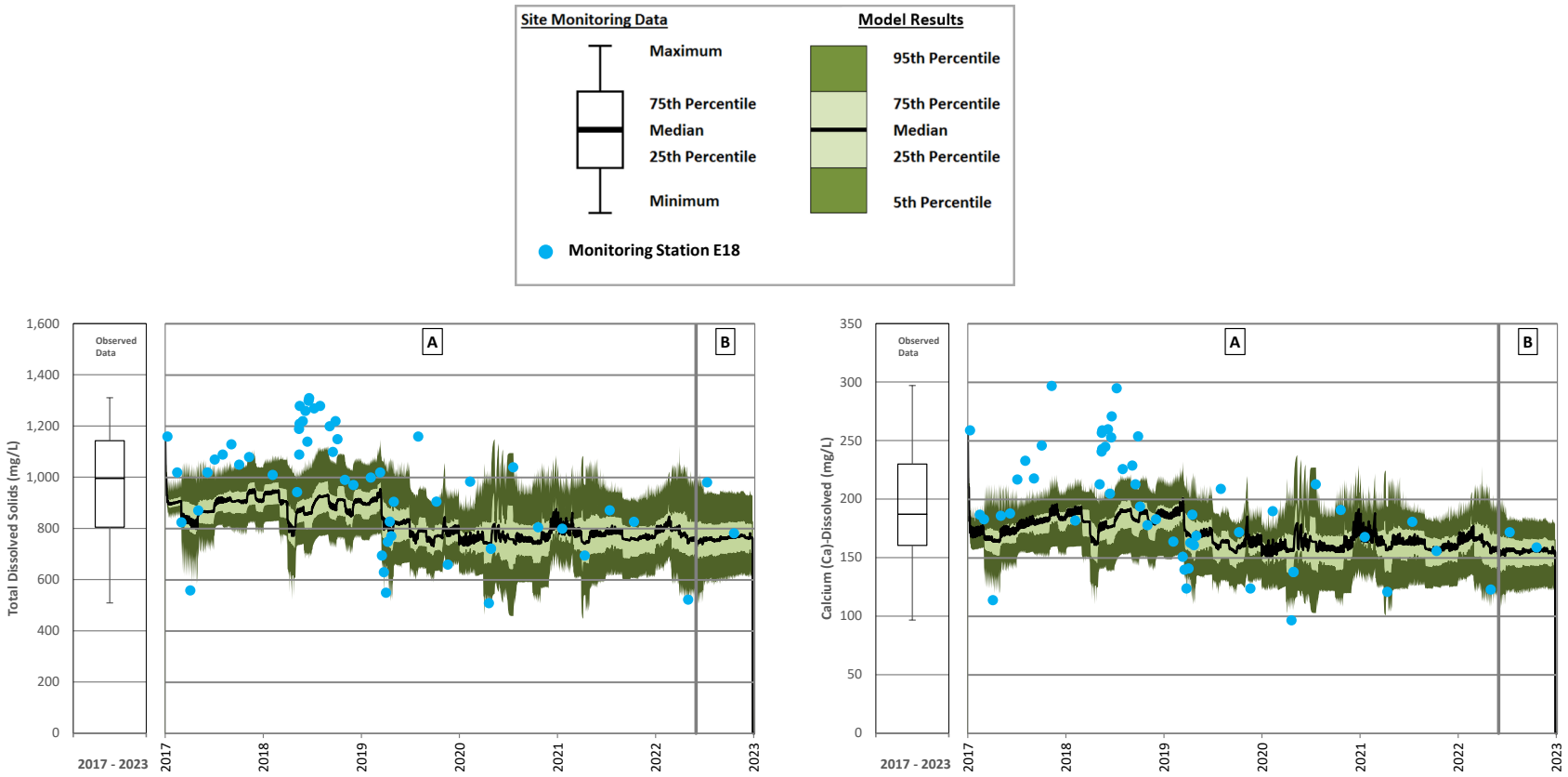

A = Care and Maintanence; B = Resumed Operations

Figure A 61: Central Collection Sump Calibration – Total Dissolved Solids and Calcium

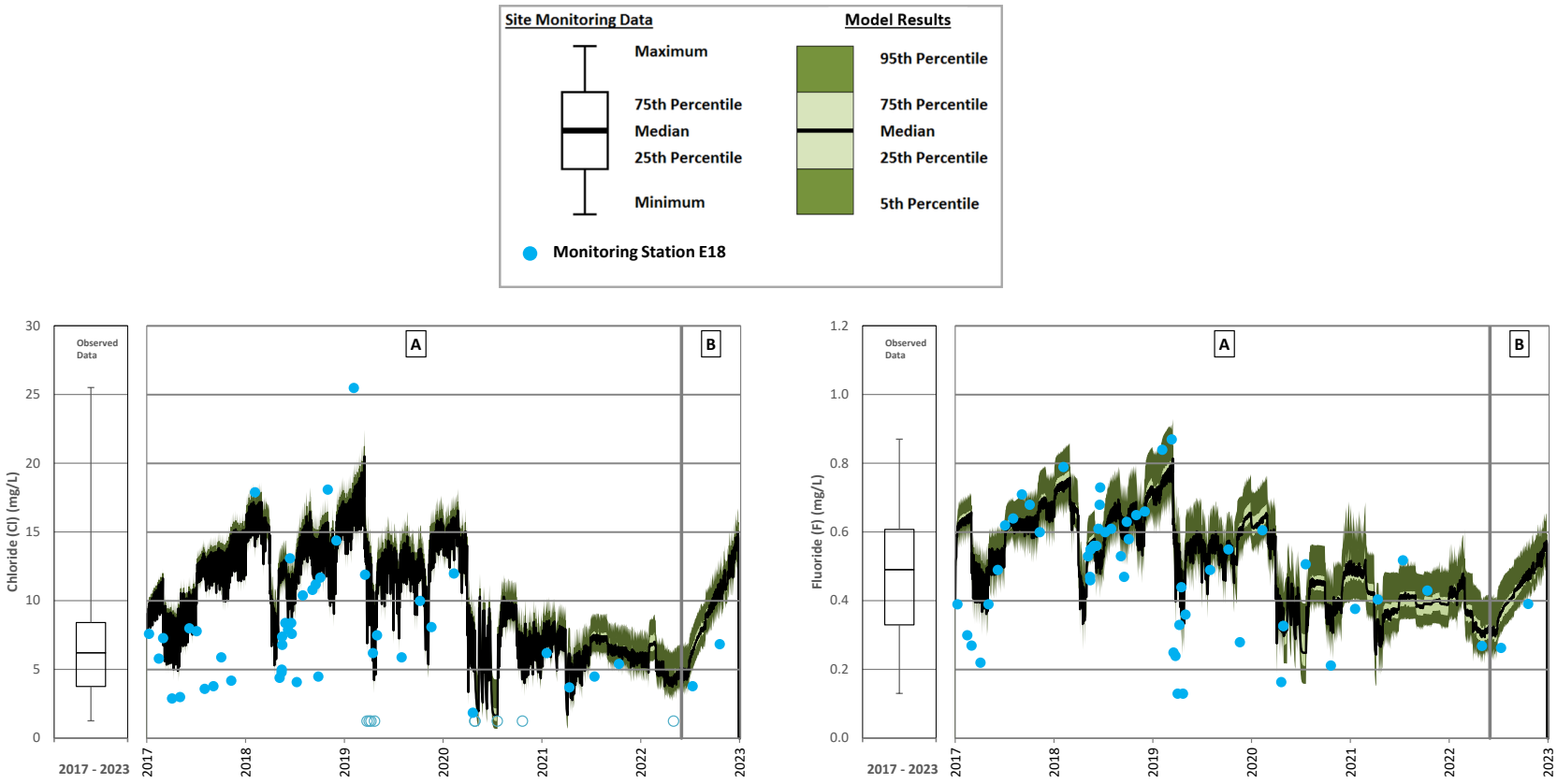

A = Care and Maintanence; B = Resumed Operations

Note: Chloride and fluoride concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 62: Central Collection Sump Calibration – Chloride and Fluoride

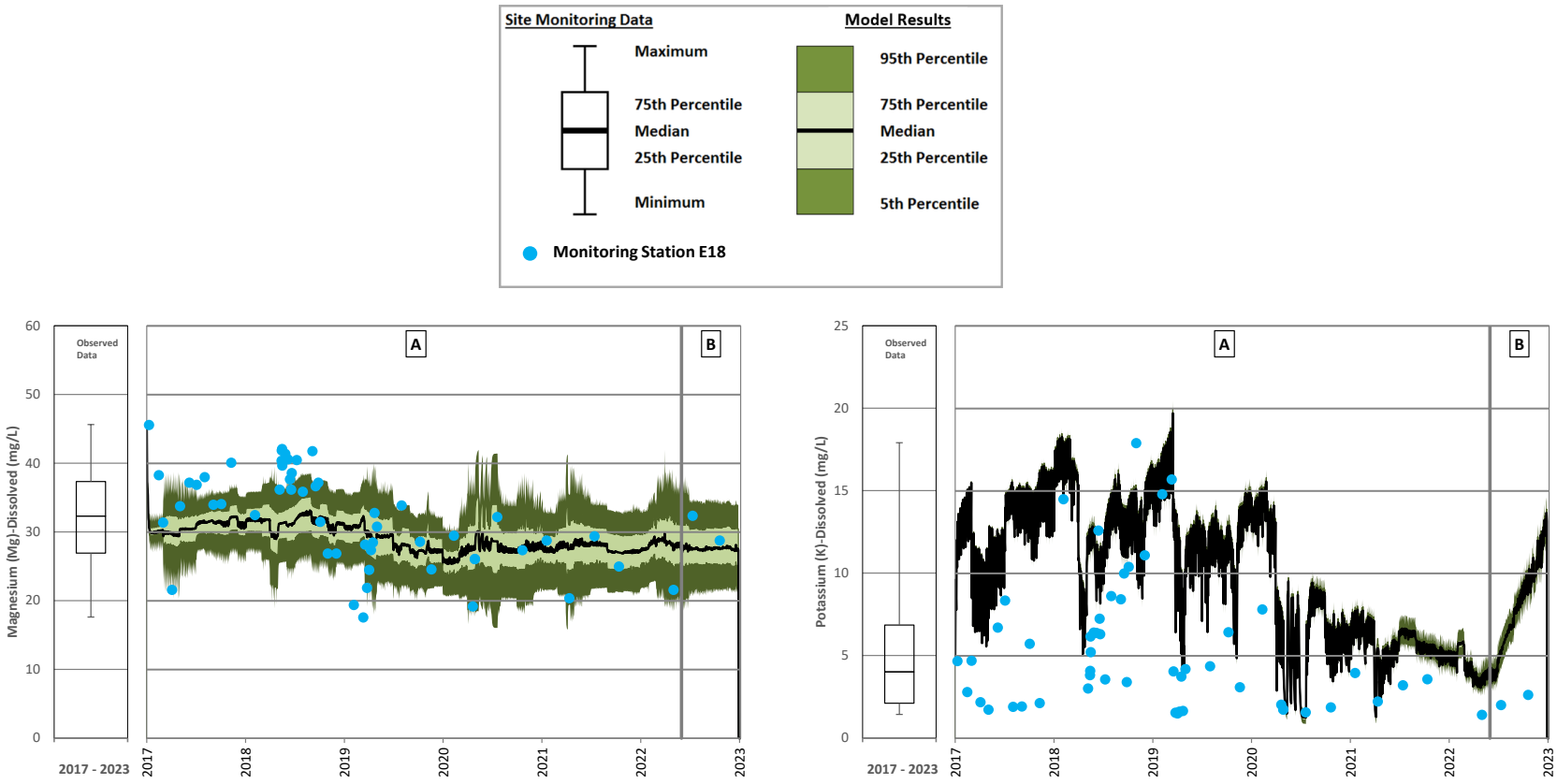

A = Care and Maintanence; B = Resumed Operations

Note: Potassium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 63: Central Collection Sump Calibration – Magnesium and Potassium

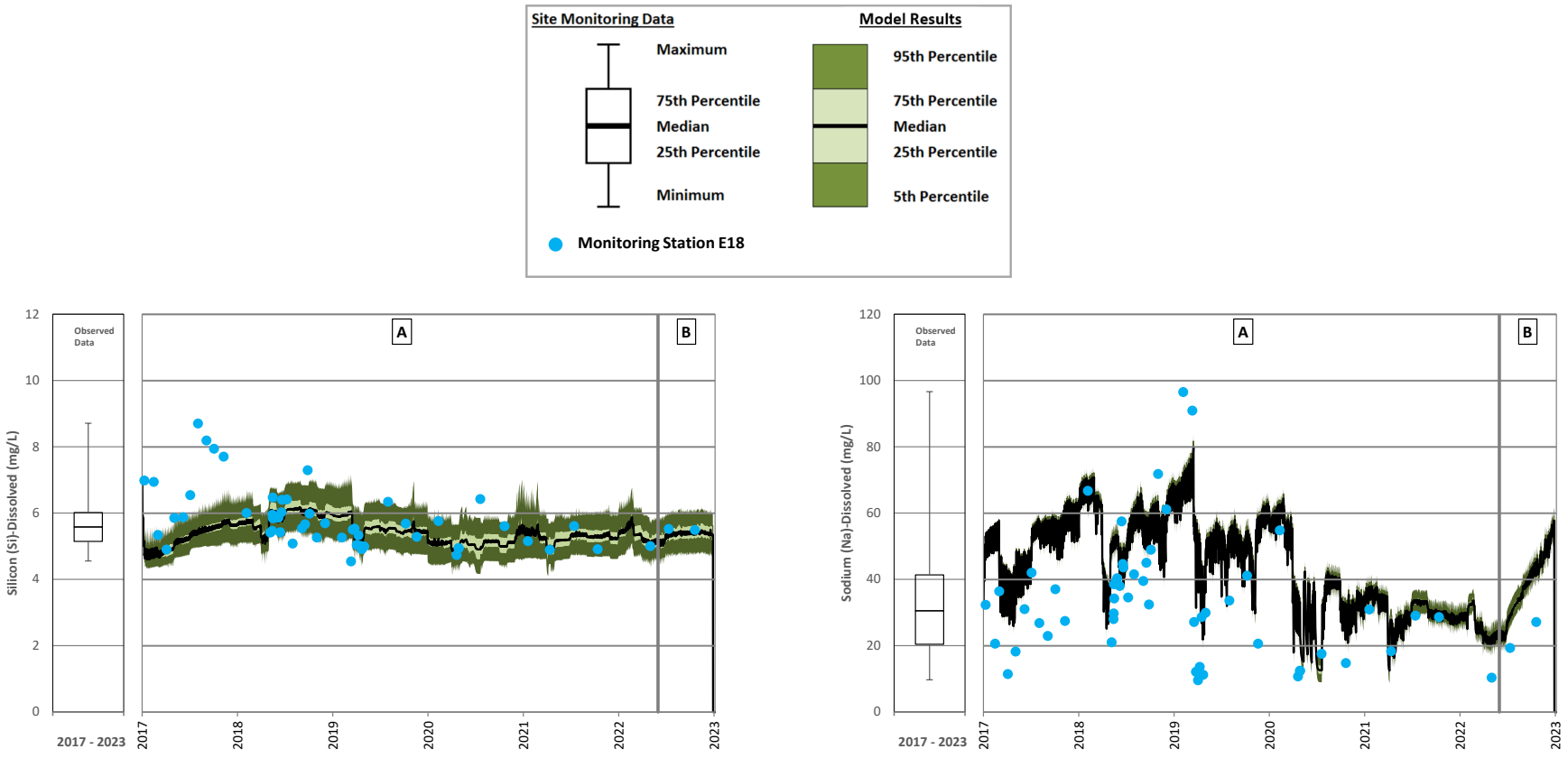

A = Care and Maintanence; B = Resumed Operations

Note: Sodium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 64: Central Collection Sump Calibration – Silicon and Sodium

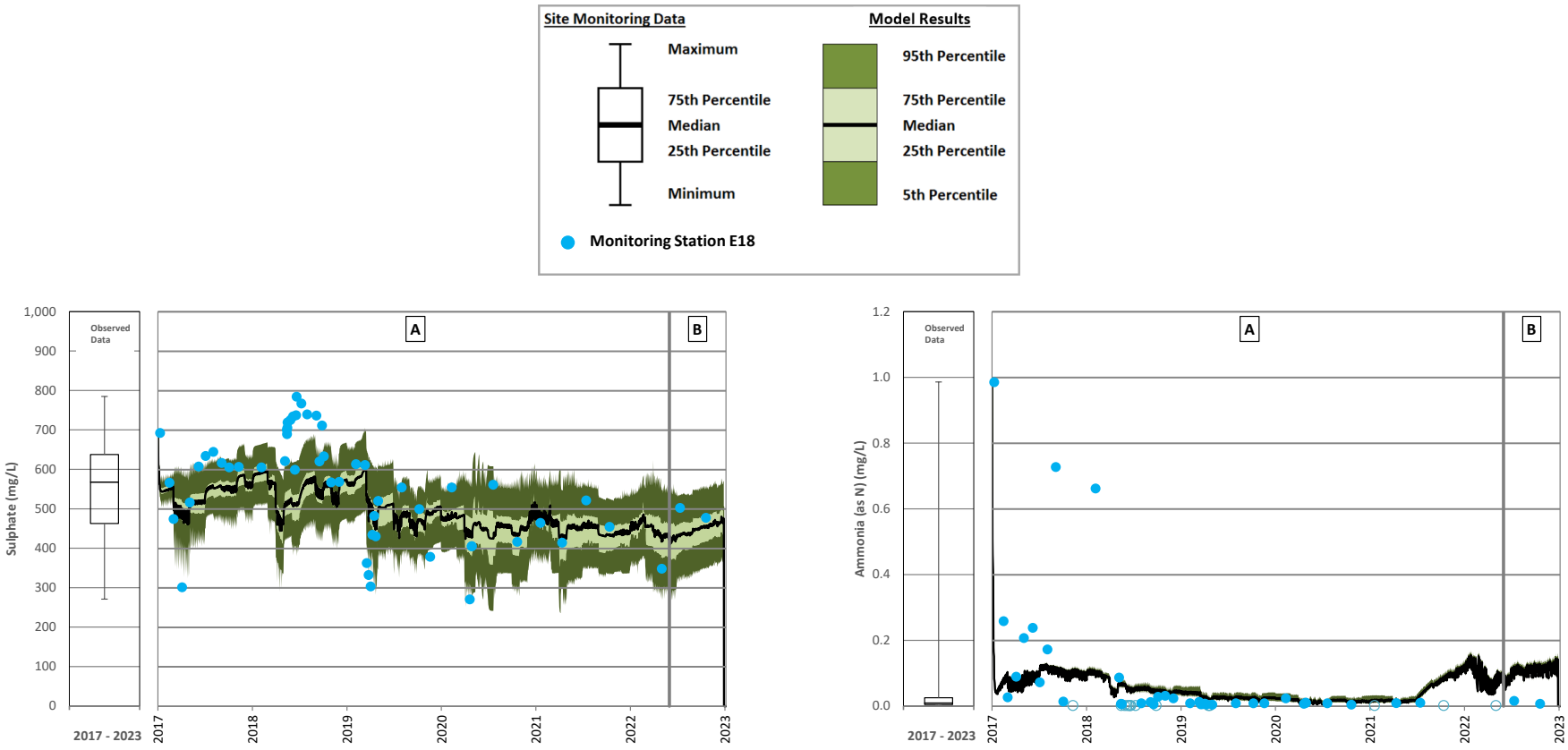

A = Care and Maintanence; B = Resumed Operations

Note: Sulphate and total ammonia concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 65: Central Collection Sump Calibration – Sulphate and Total Ammonia

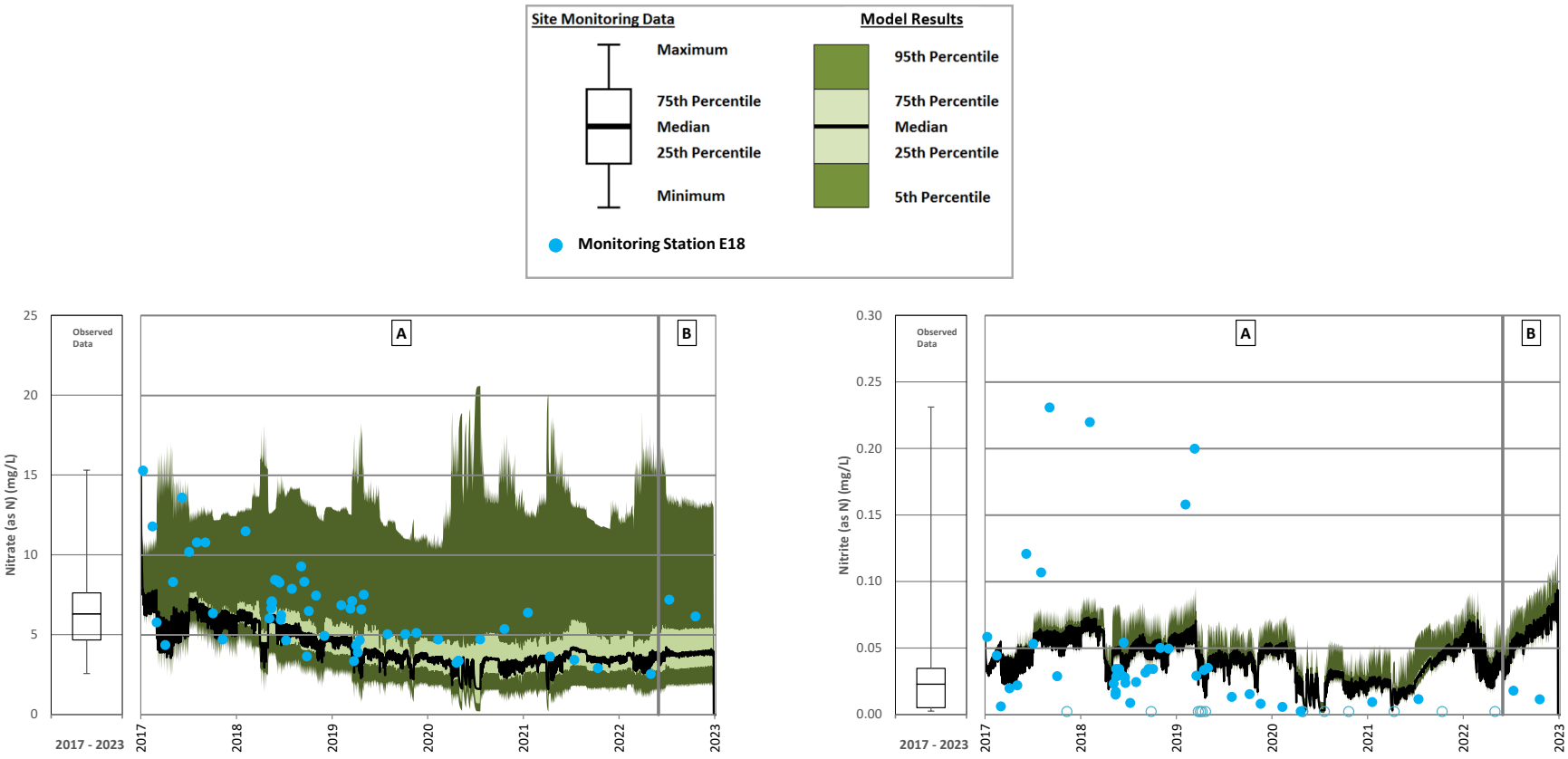

A = Care and Maintanence; B = Resumed Operations

Note: Nitrite concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 66: Central Collection Sump Calibration – Nitrate and Nitrite

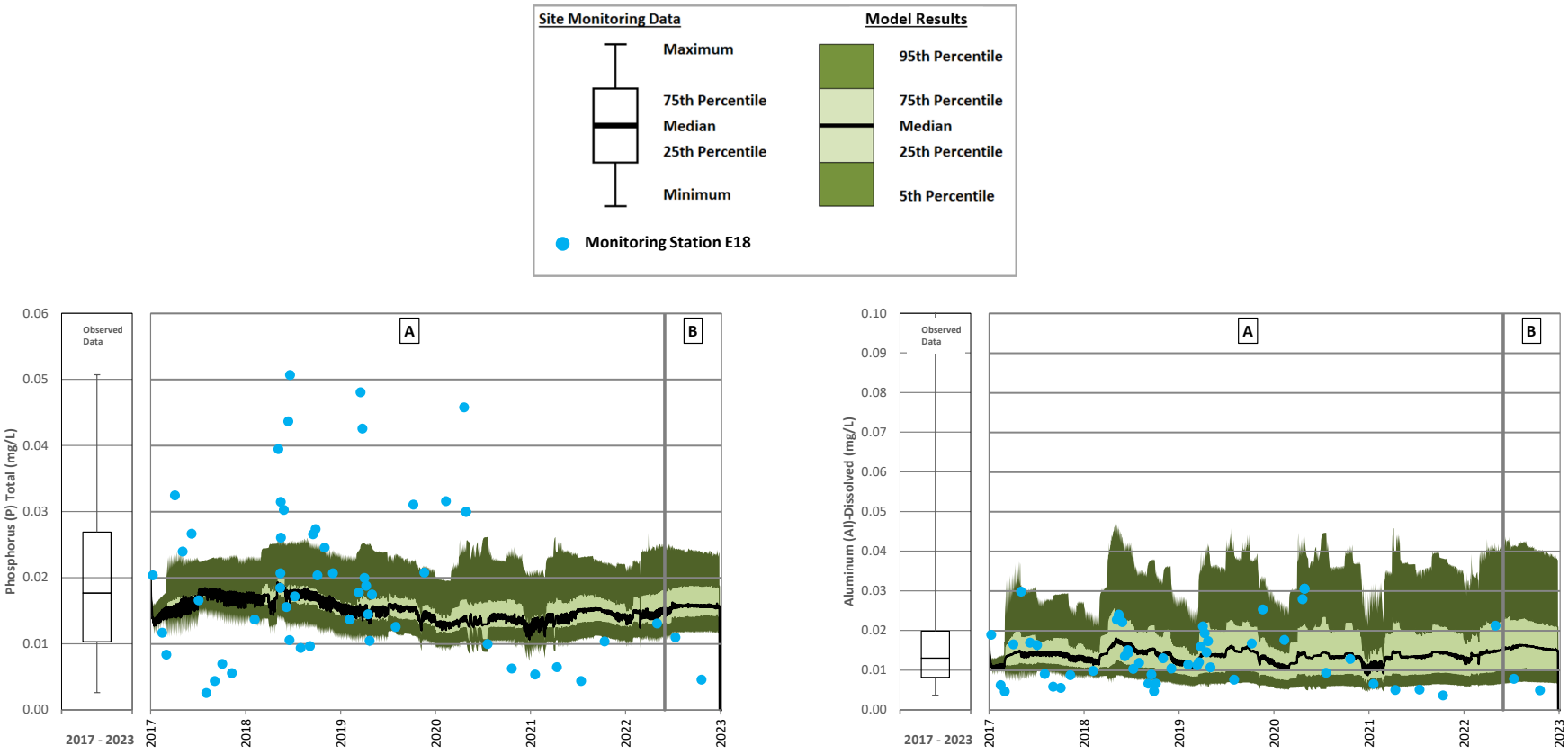

A = Care and Maintanence; B = Resumed Operations

Figure A 67: Central Collection Sump Calibration – Total Phosphorus and Dissolved Aluminum

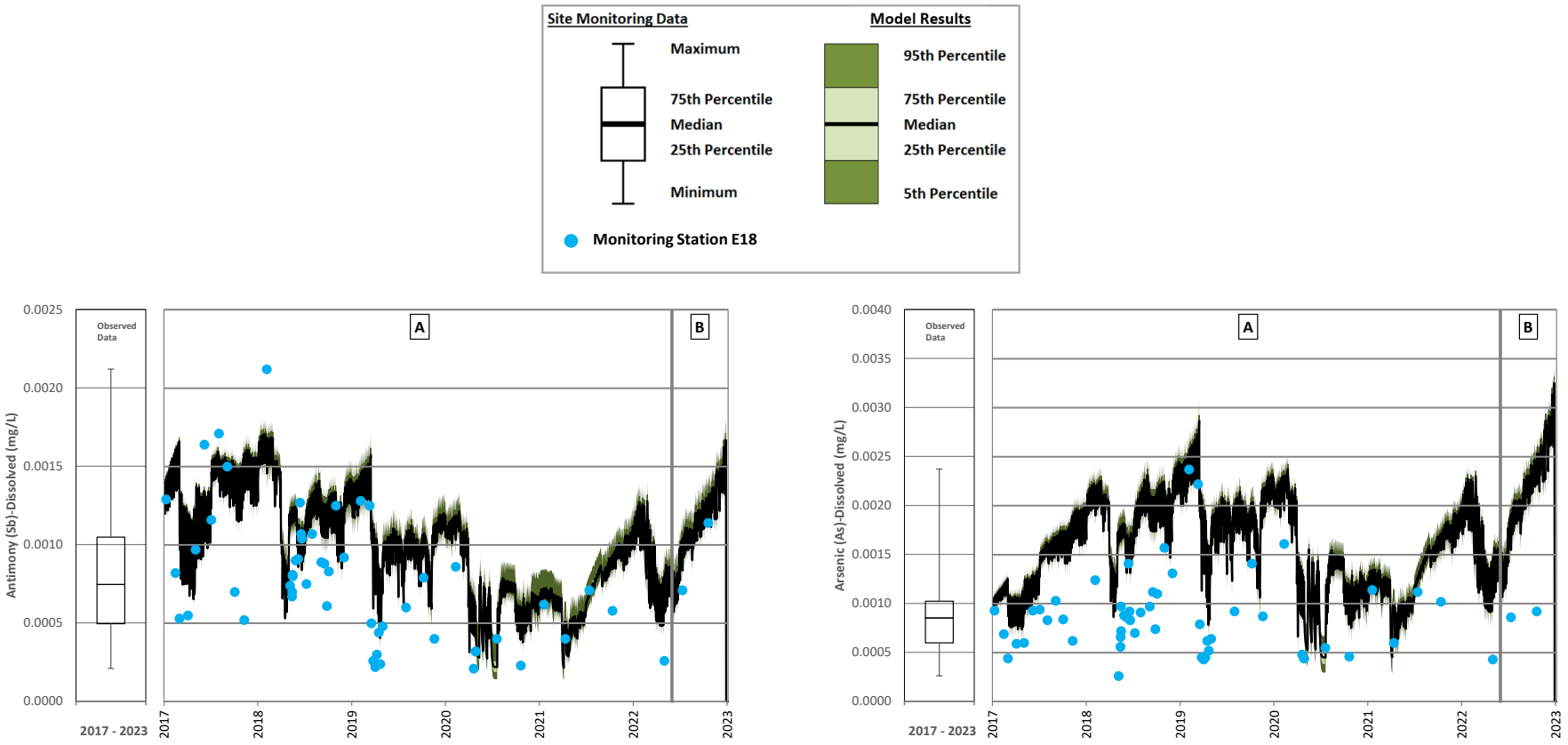

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 68: Central Collection Sump Calibration – Dissolved Antimony and Dissolved Arsenic

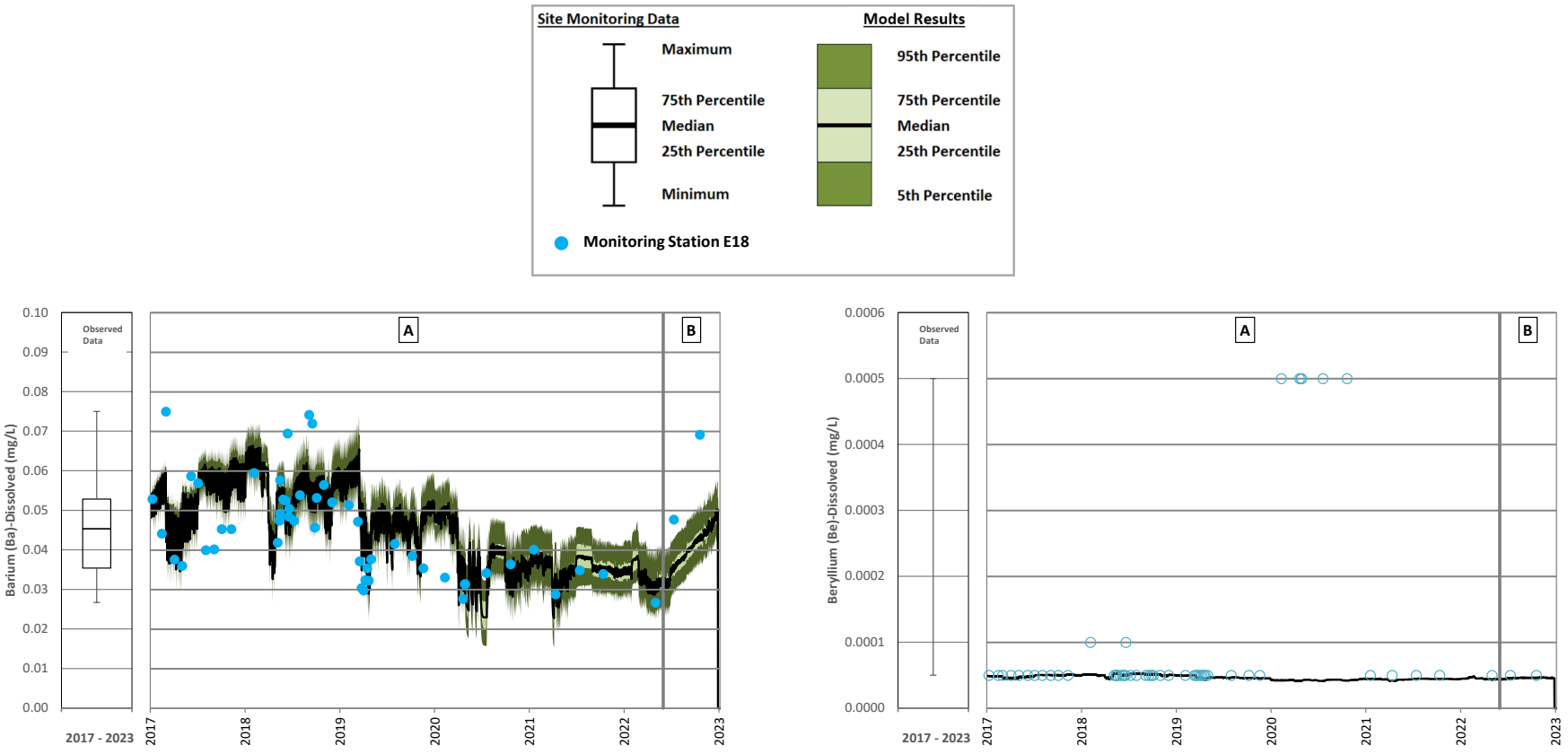

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved barium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 69: Central Collection Sump Calibration – Dissolved Barium and Dissolved Beryllium

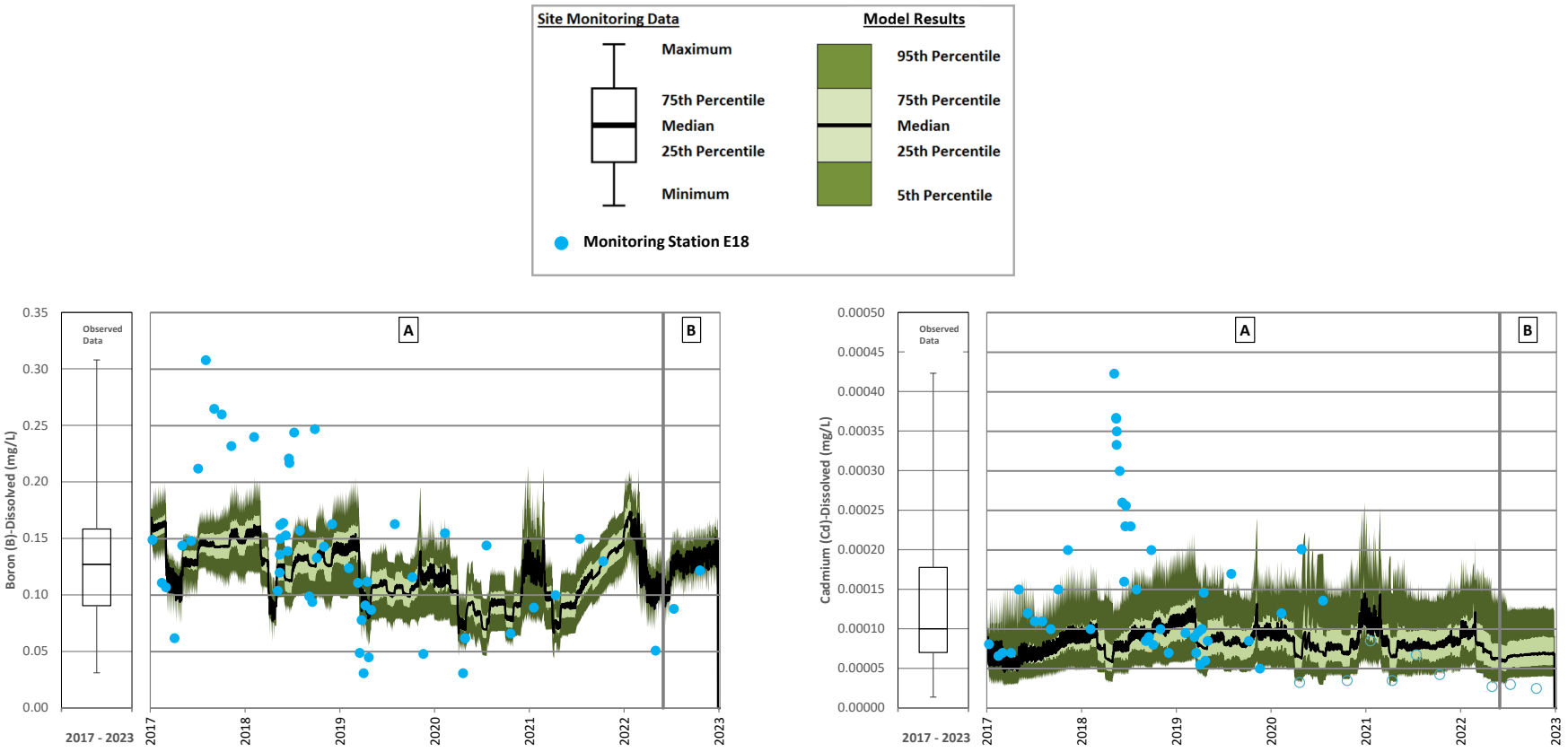

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved boron concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 70: Central Collection Sump Calibration – Dissolved Boron and Dissolved Cadmium

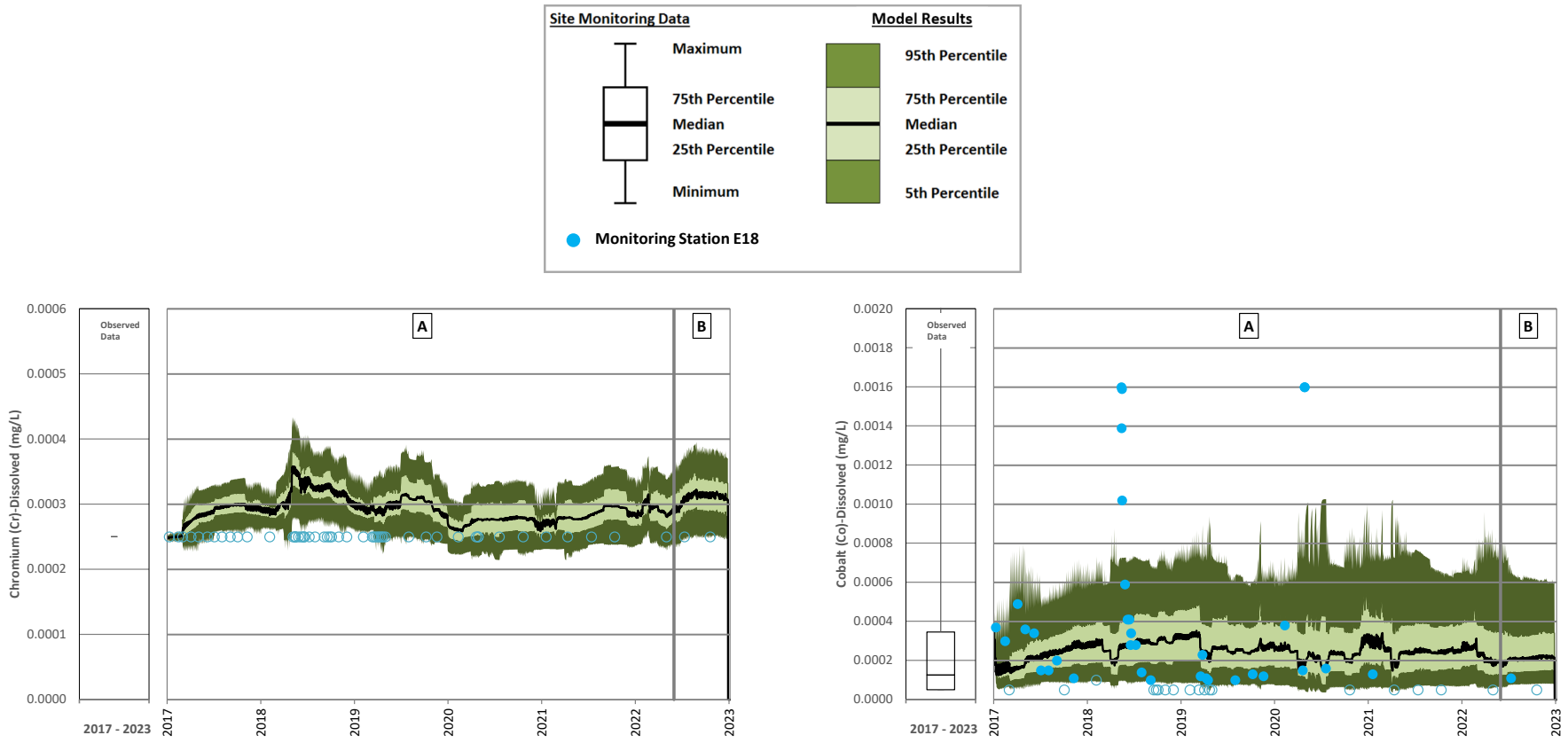

A = Care and Maintanence; B = Resumed Operations

Figure A 71: Central Collection Sump Calibration – Dissolved Chromium and Dissolved Cobalt

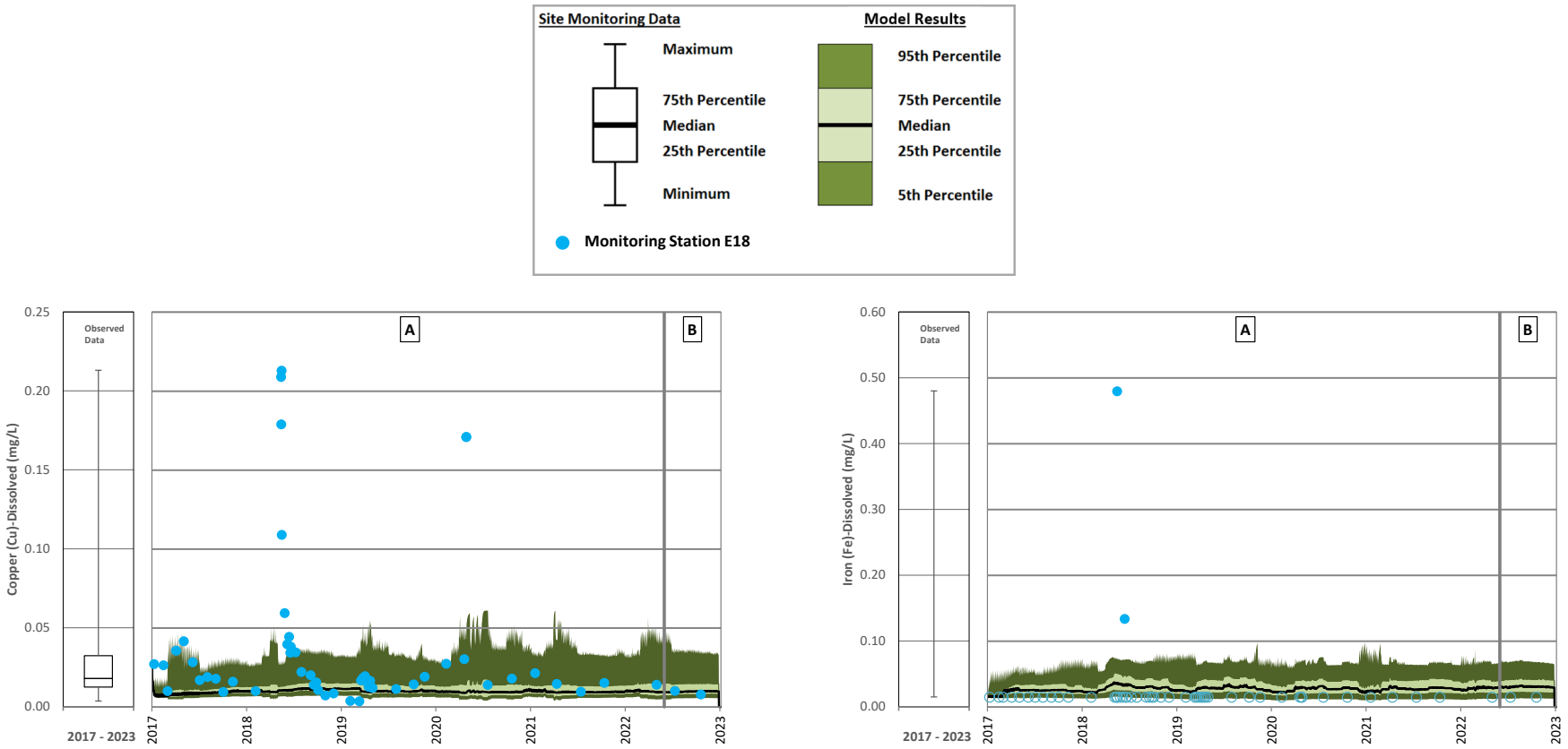

A = Care and Maintanence; B = Resumed Operations

Figure A 72: Central Collection Sump Calibration – Dissolved Copper and Dissolved Iron

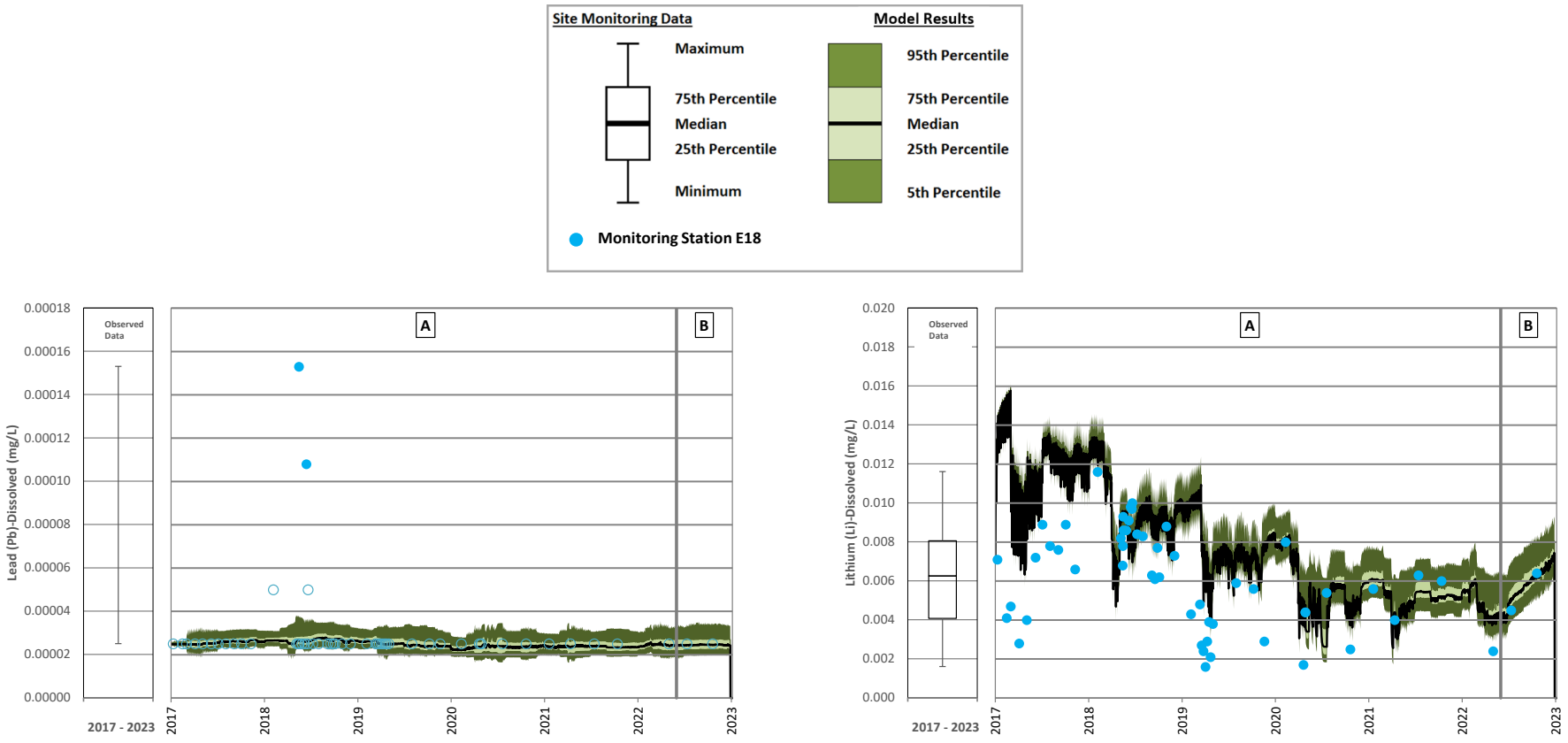

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved lithium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 73: Central Collection Sump Calibration – Dissolved Lead and Dissolved Lithium

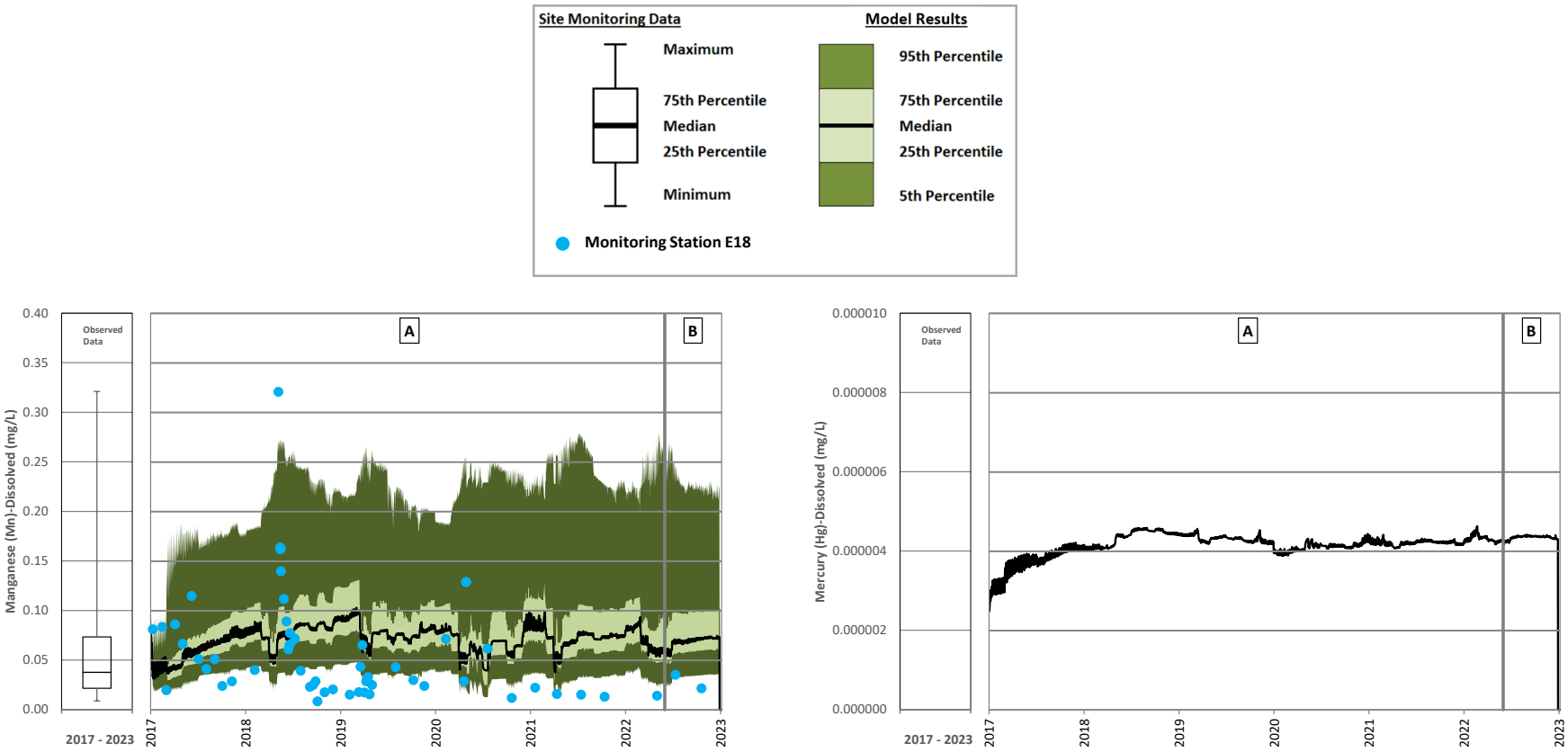

A = Care and Maintanence; B = Resumed Operations

Figure A 74: Central Collection Sump Calibration – Dissolved Manganese and Dissolved Mercury

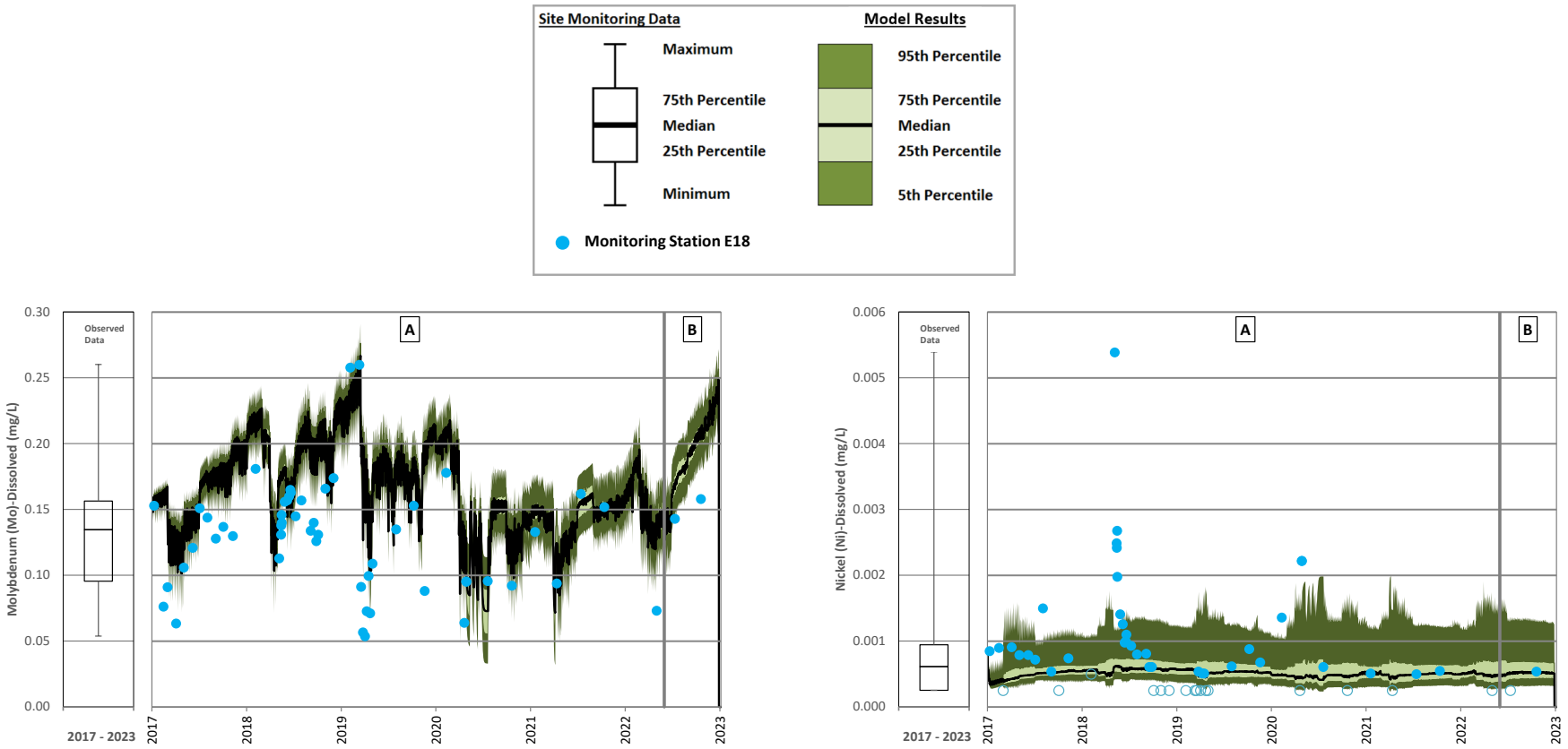

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved molybdenum concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 75: Central Collection Sump Calibration – Dissolved Molybdenum and Dissolved Nickel

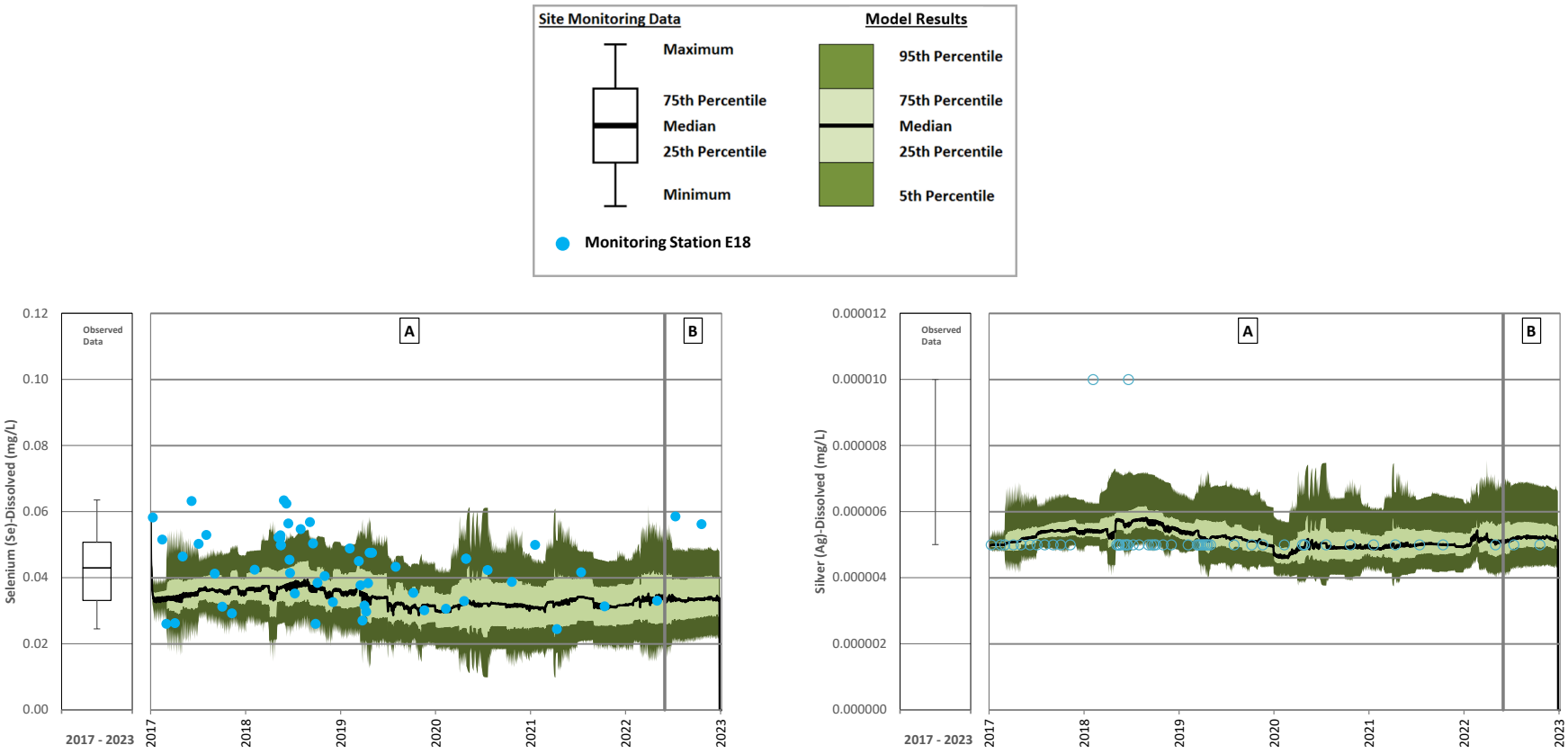

A = Care and Maintanence; B = Resumed Operations

Figure A 76: Central Collection Sump Calibration – Dissolved Selenium and Dissolved Silver

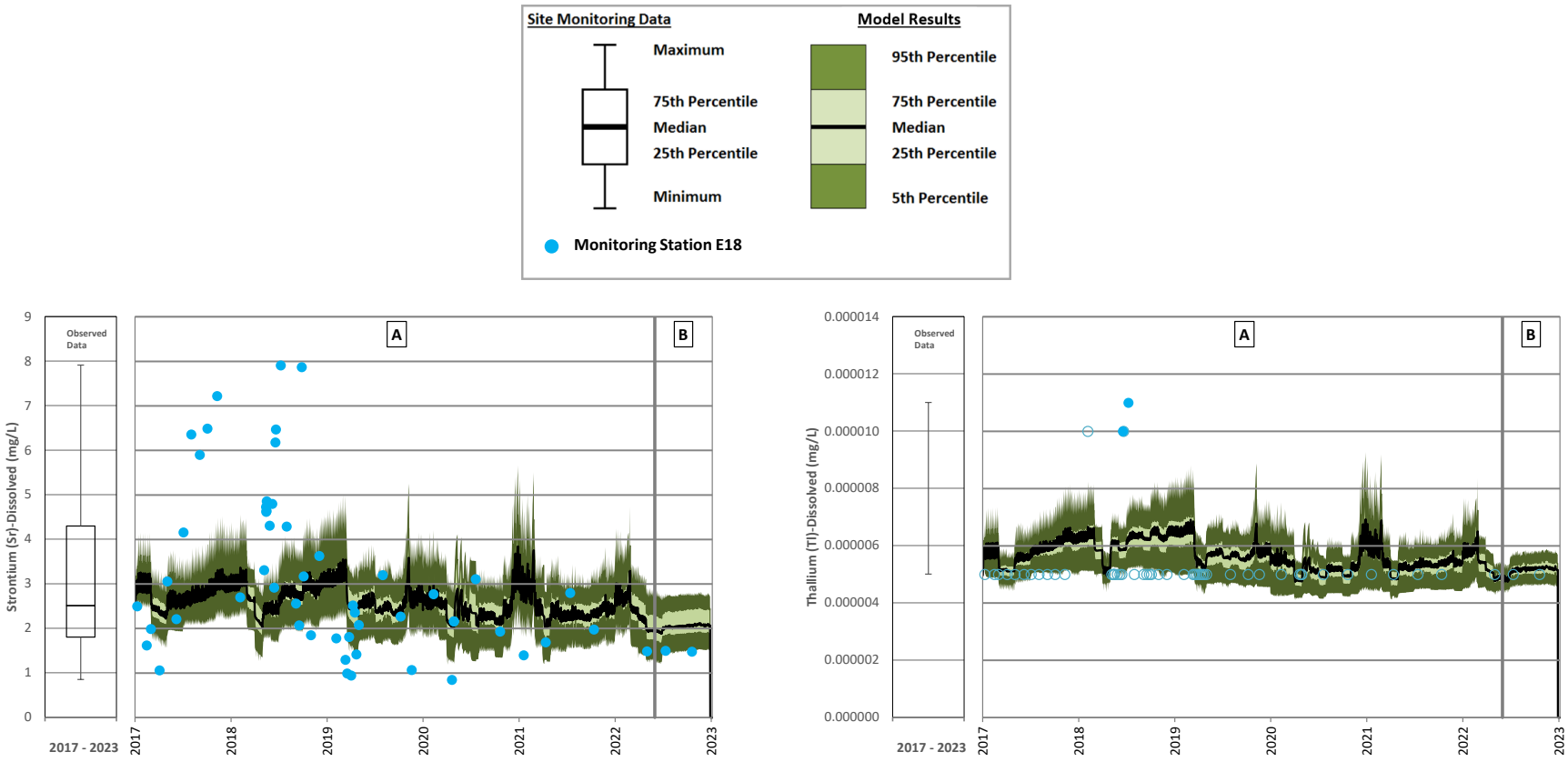

A = Care and Maintanence; B = Resumed Operations

Figure A 77: Central Collection Sump Calibration – Dissolved Strontium and Dissolved Thallium

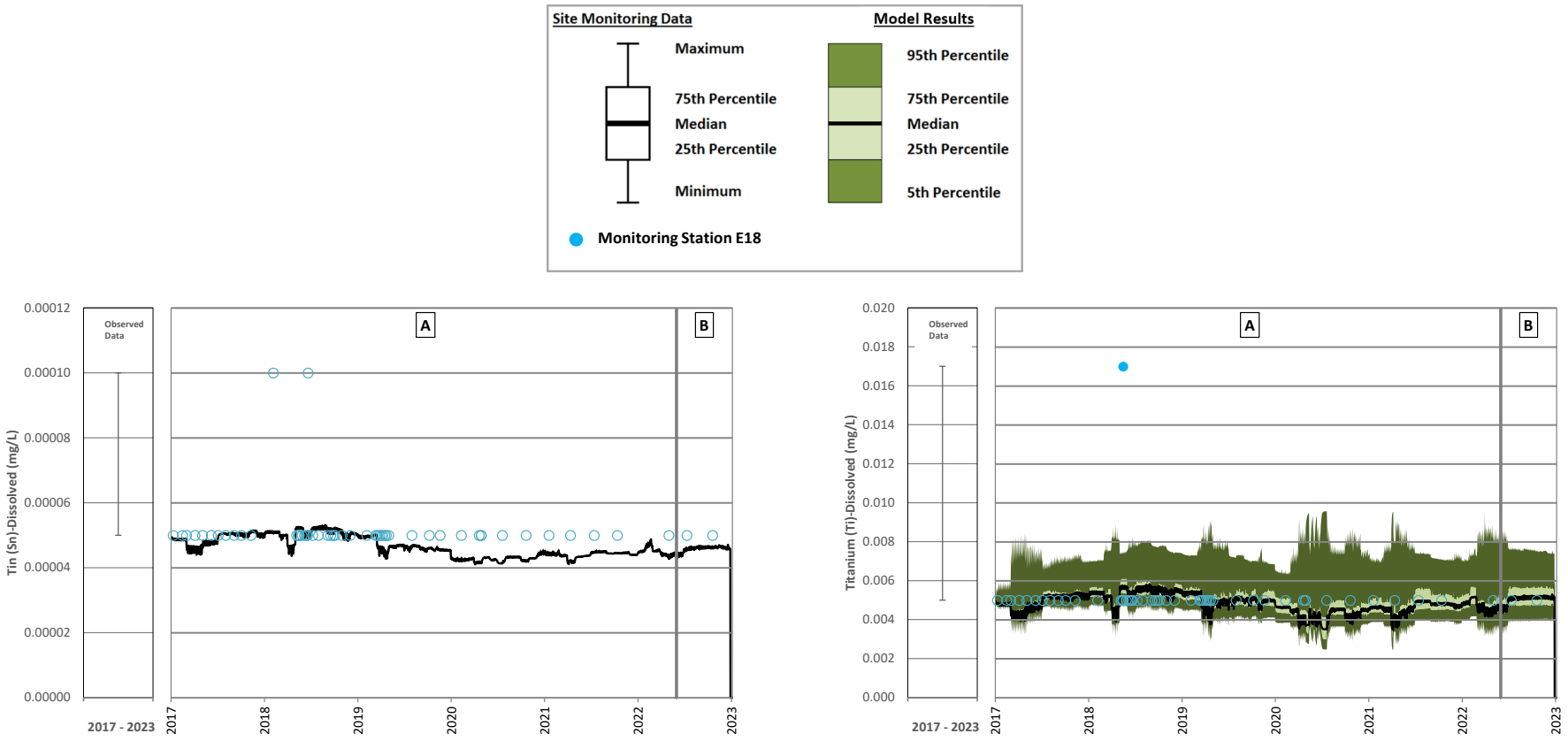

A = Care and Maintanence; B = Resumed Operations

Figure A 78: Central Collection Sump Calibration – Dissolved Tin and Dissolved Titanium

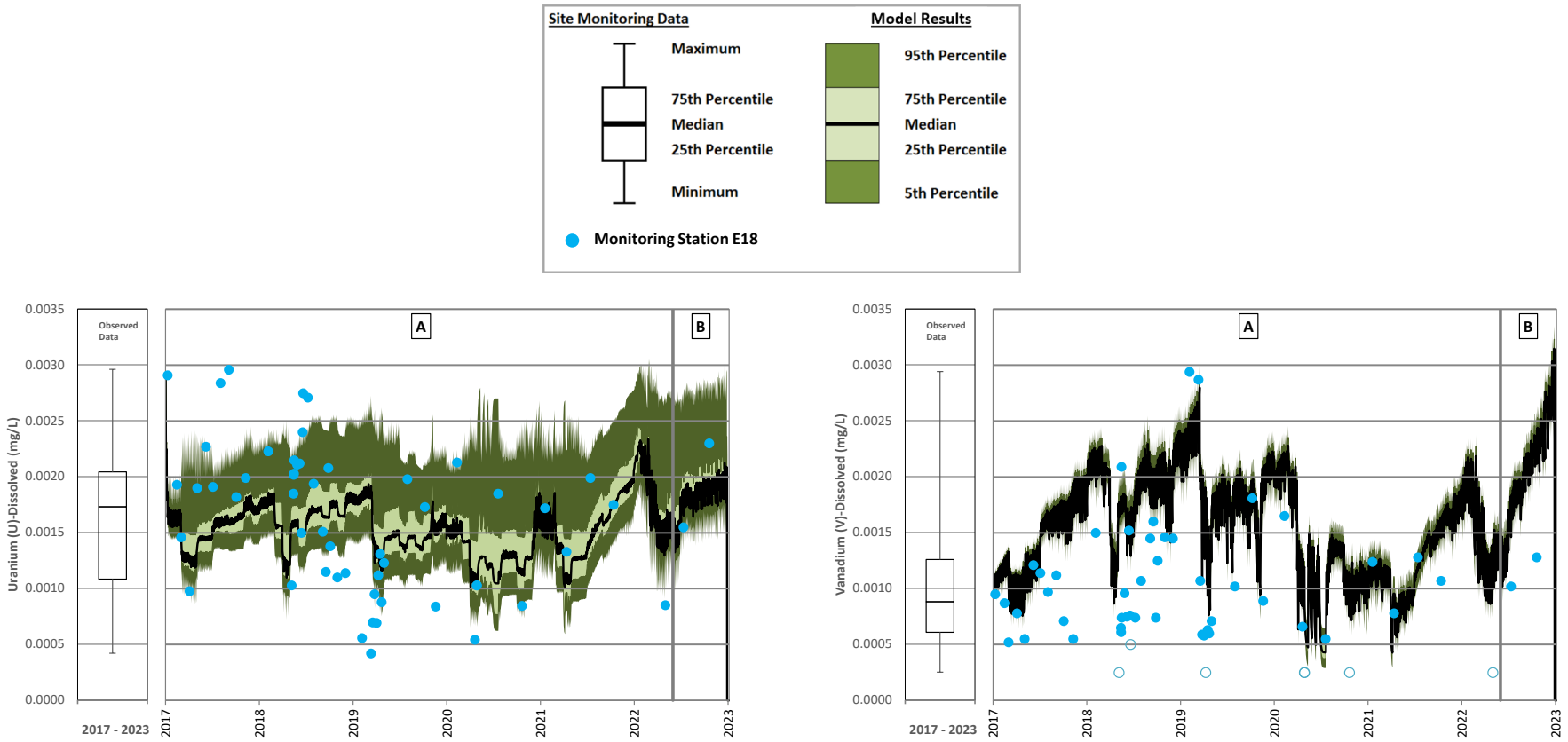

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved uranium and dissolved vanadium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 79: Central Collection Sump Calibration – Dissolved Uranium and Dissolved Vanadium

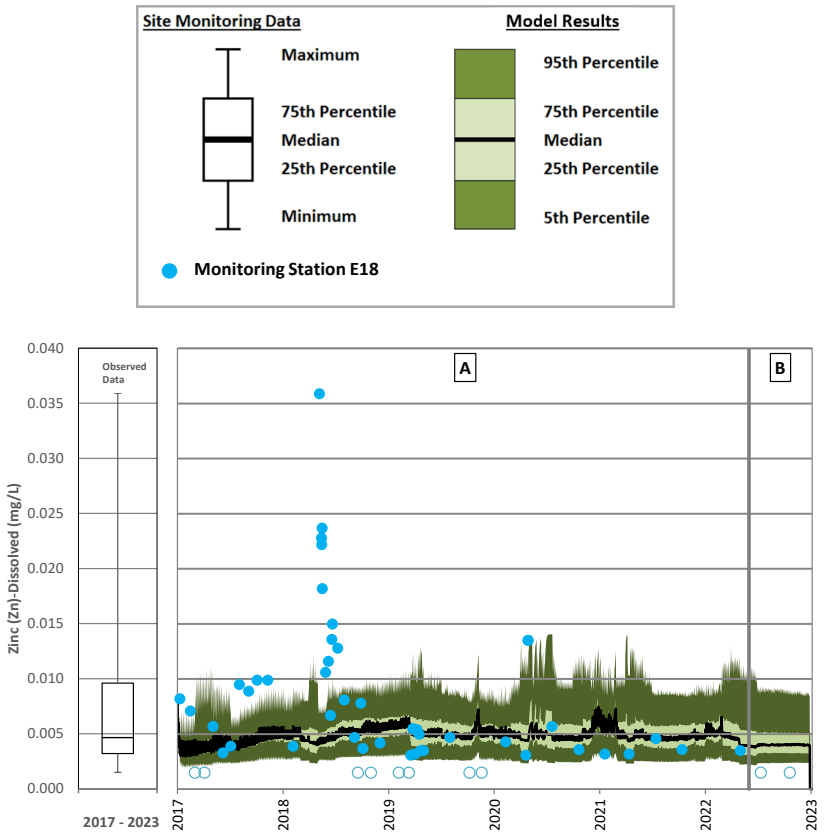

A = Care and Maintanence; B = Resumed Operations

Figure A 80: Central Collection Sump Calibration – Dissolved Zinc

Tailings Storage Facility Calibration

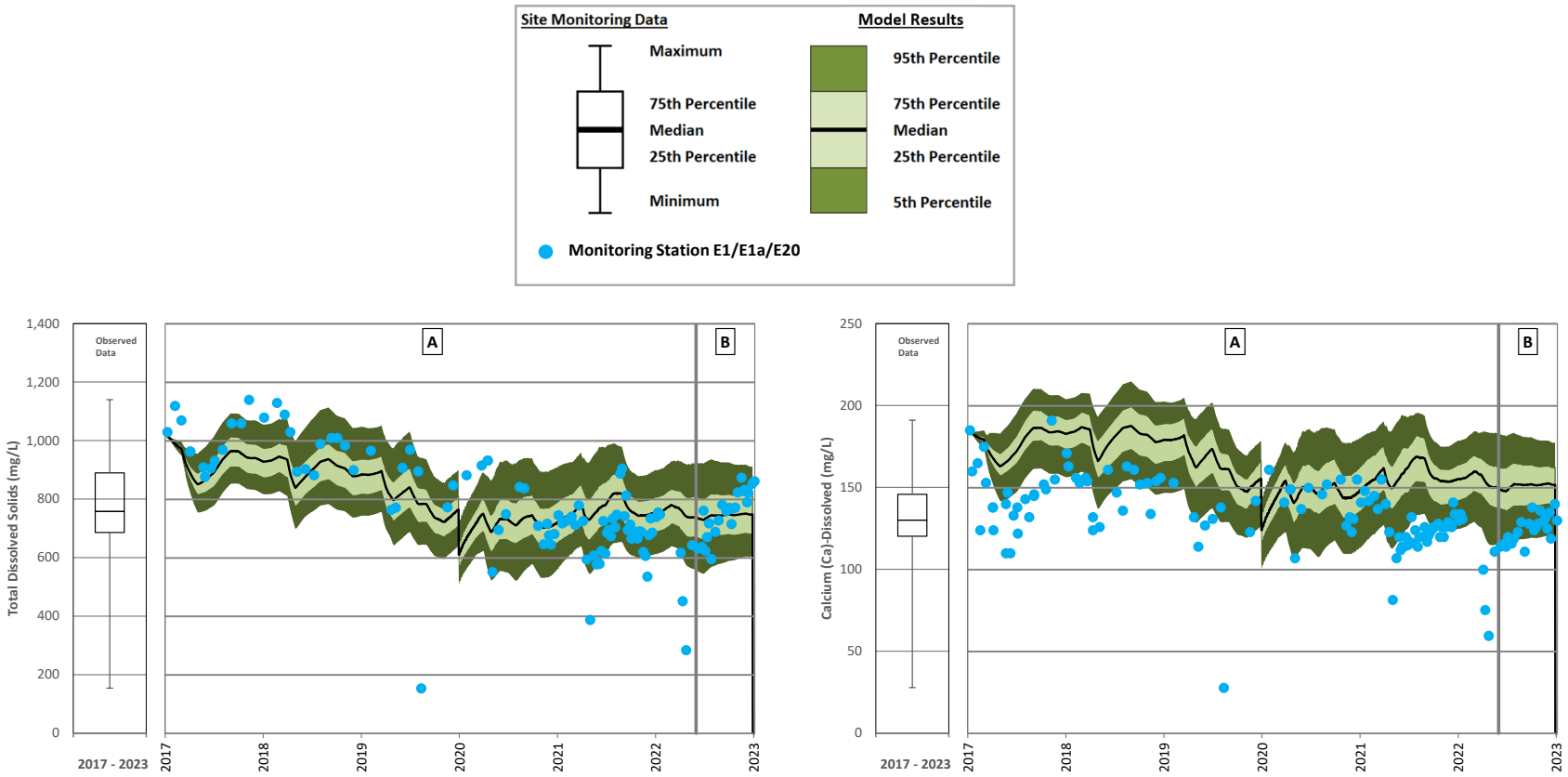

A = Care and Maintanence; B = Resumed Operations

Figure A 81: Tailings Storage Facility Calibration – Total Dissolved Solids and Calcium

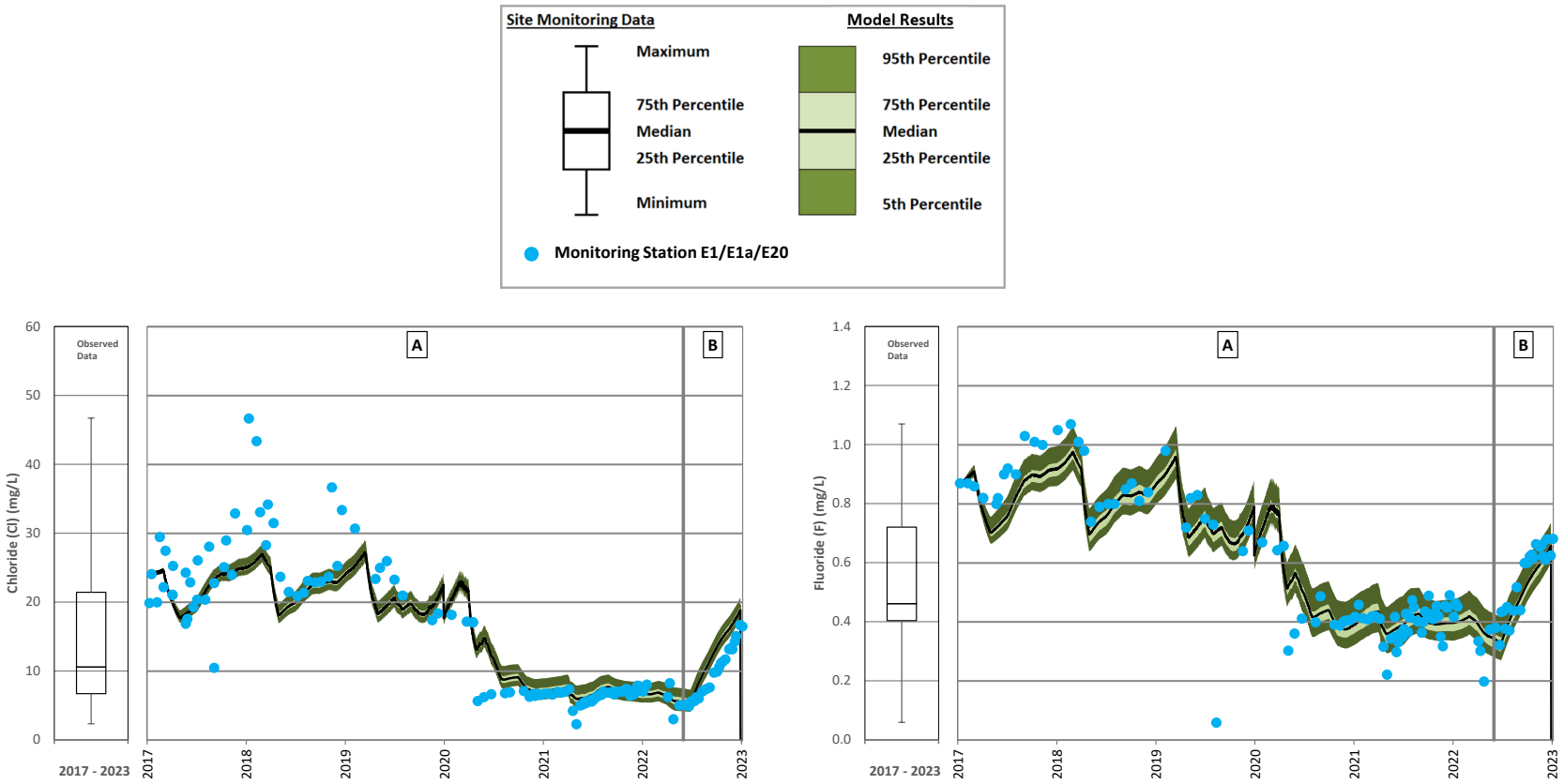

A = Care and Maintanence; B = Resumed Operations

Note: The increased chloride and fluoride concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 82: Tailings Storage Facility Calibration – Chloride and Fluoride

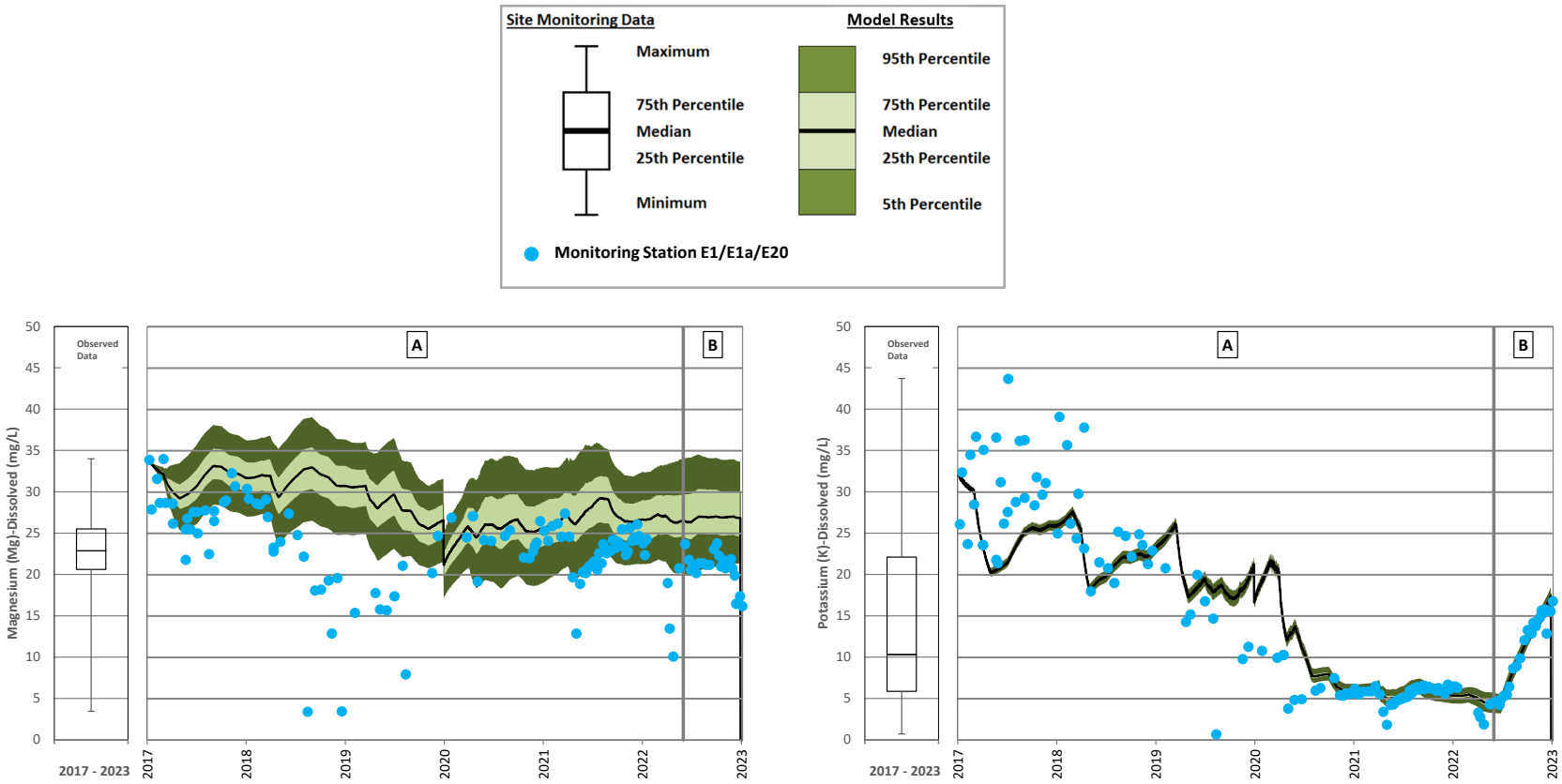

A = Care and Maintanence; B = Resumed Operations

Note: The increased potassium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 83: Tailings Storage Facility Calibration – Magnesium and Potassium

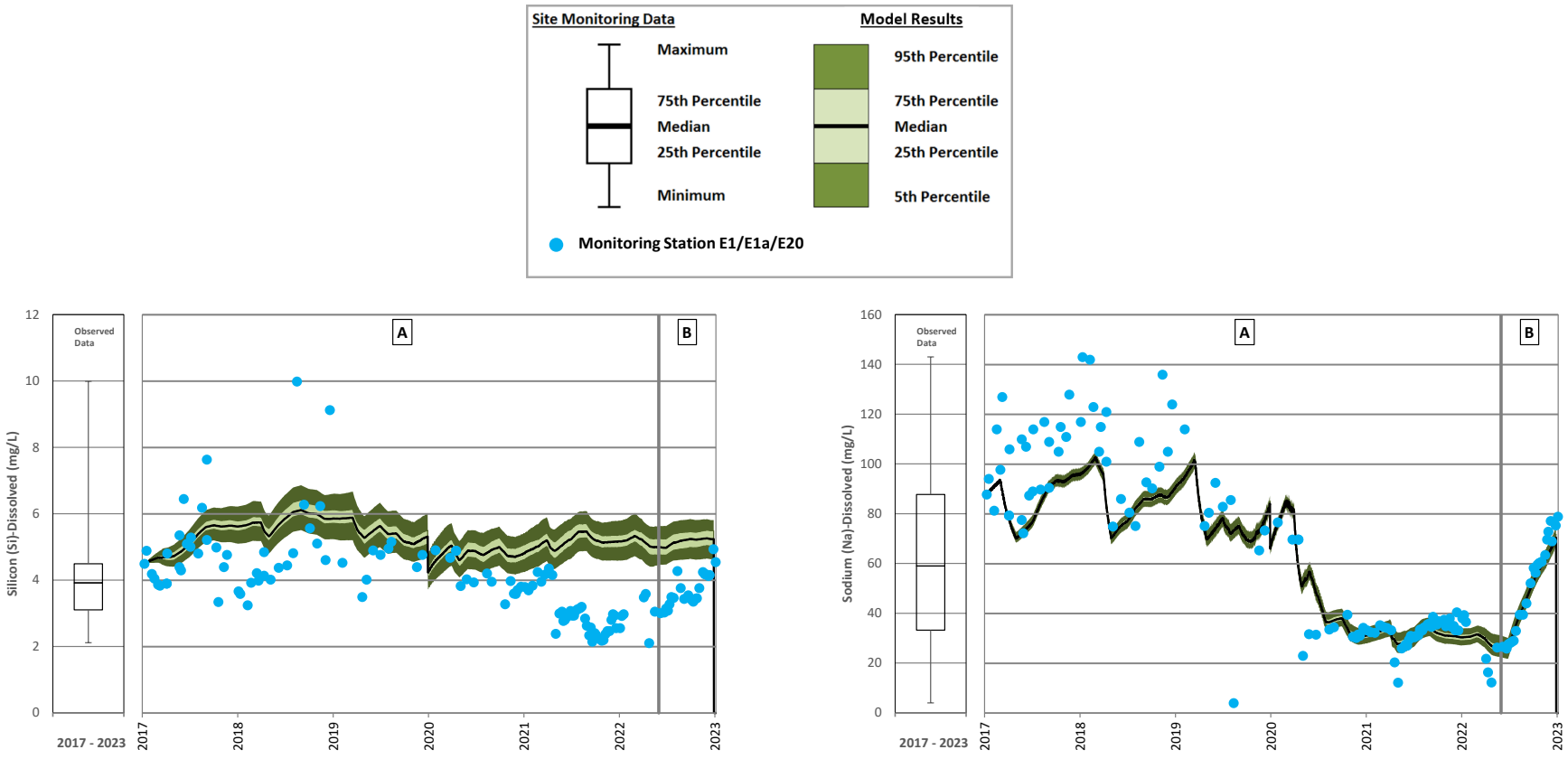

A = Care and Maintanence; B = Resumed Operations

Note: The increased sodium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 84: Tailings Storage Facility Calibration – Silicon and Sodium

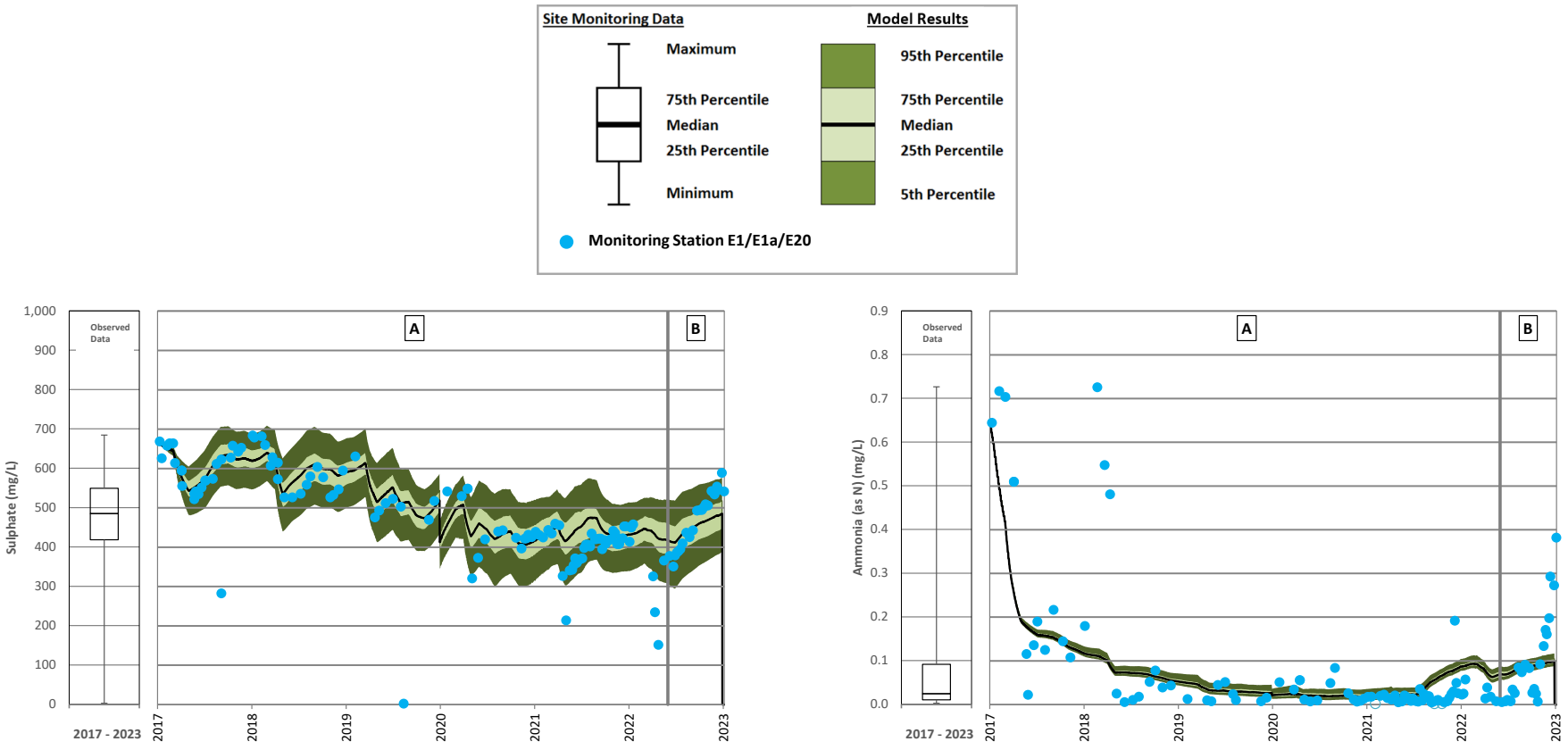

A = Care and Maintanence; B = Resumed Operations

Note: The increased sulphate and total ammonia concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 85: Tailings Storage Facility Calibration – Sulphate and Total Ammonia

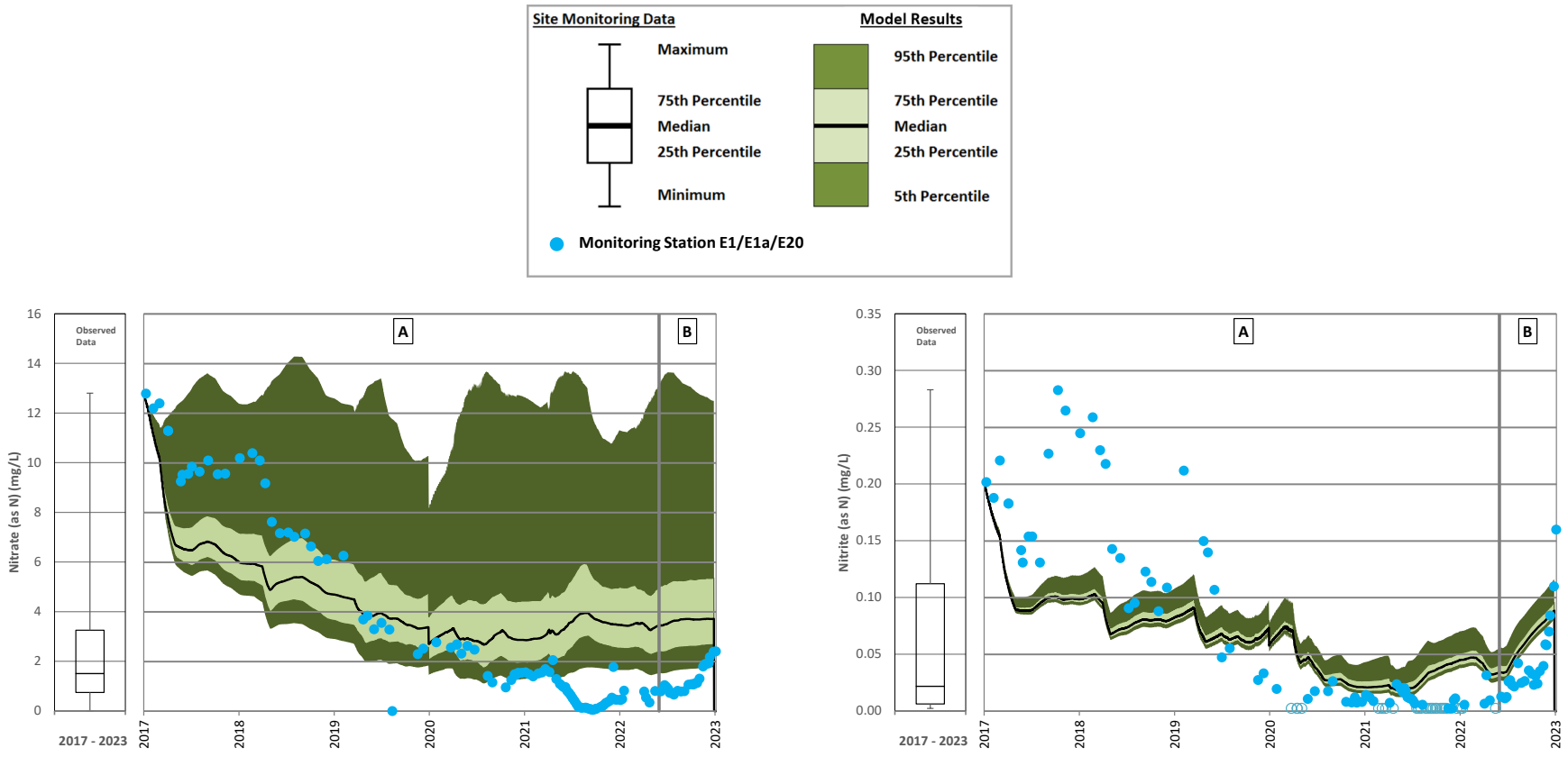

A = Care and Maintanence; B = Resumed Operations

Note: The increased nitrite concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 86: Tailings Storage Facility Calibration – Nitrate and Nitrite

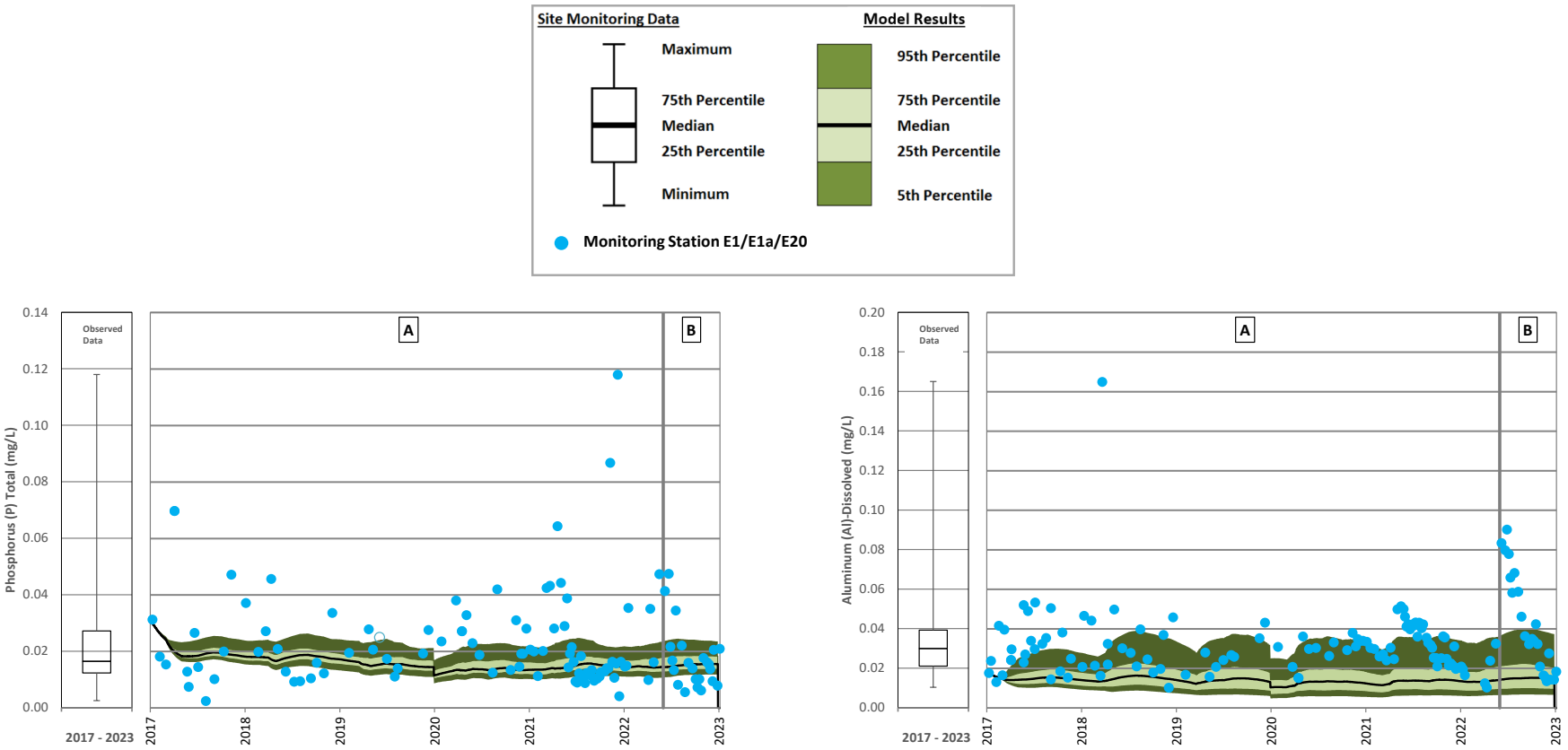

A = Care and Maintanence; B = Resumed Operations

Figure A 87: Tailings Storage Facility Calibration – Total Phosphorus and Dissolved Aluminum

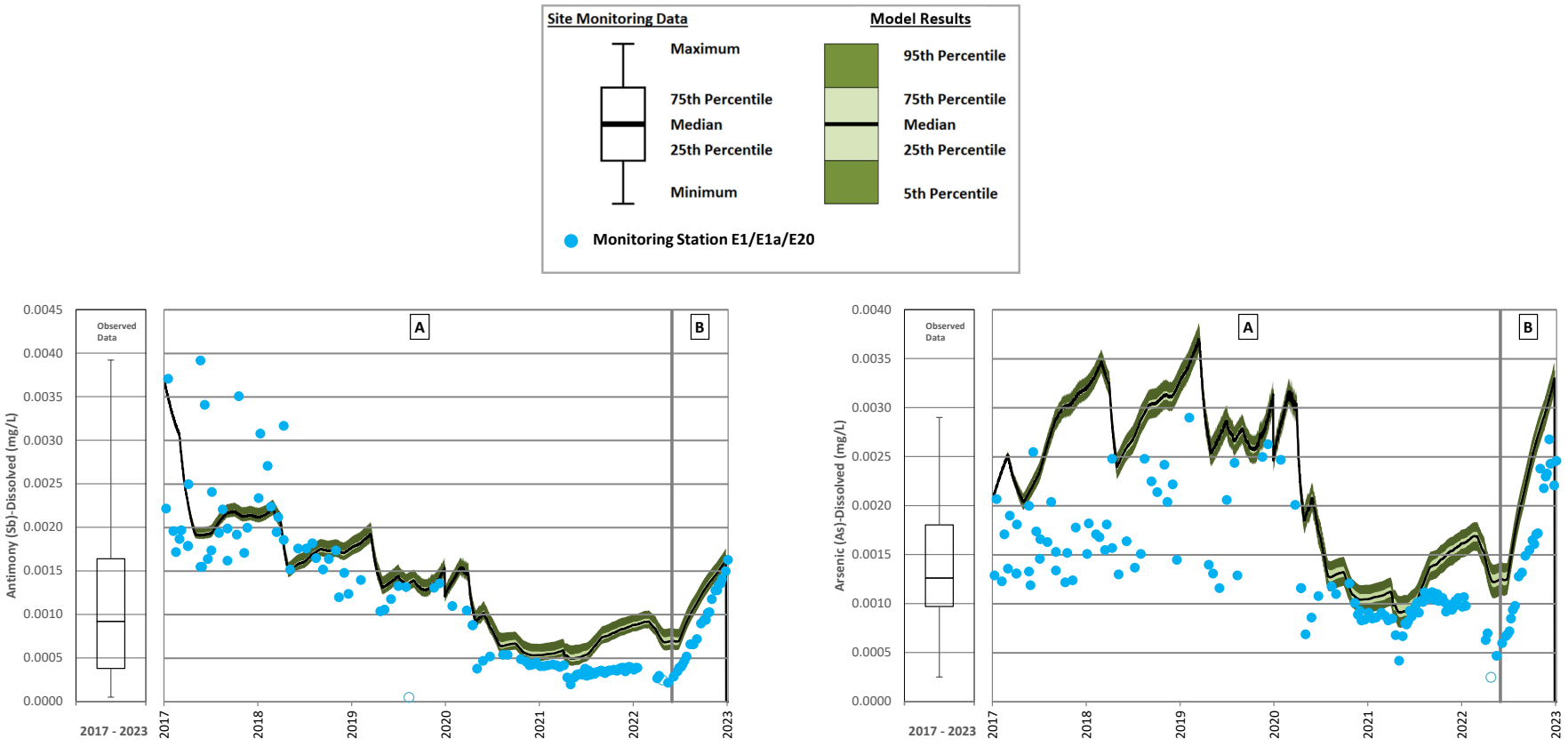

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved antimony and dissolved arsenic concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 88: Tailings Storage Facility Calibration – Dissolved Antimony and Dissolved Arsenic

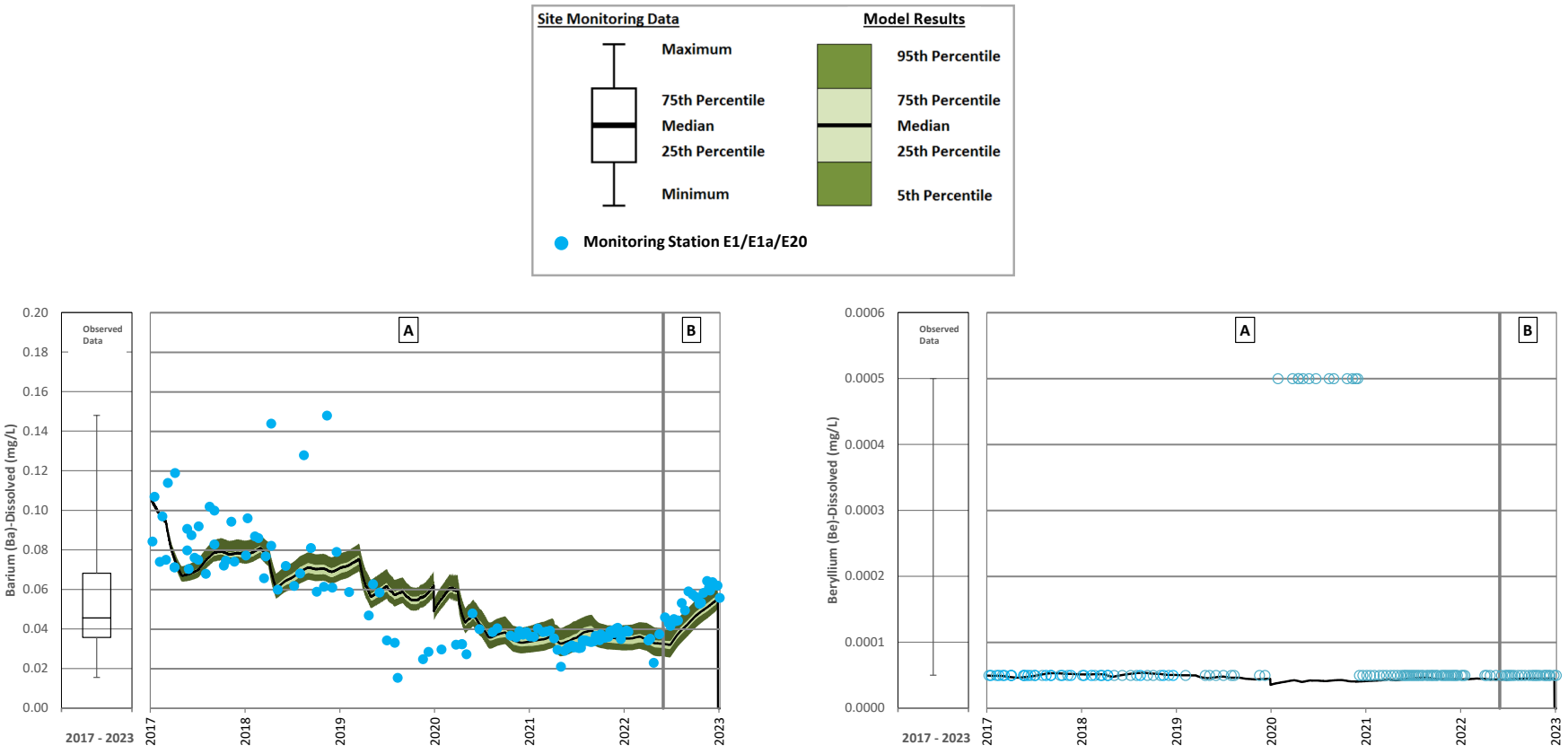

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved barium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 89: Tailings Storage Facility Calibration – Dissolved Barium and Dissolved Beryllium

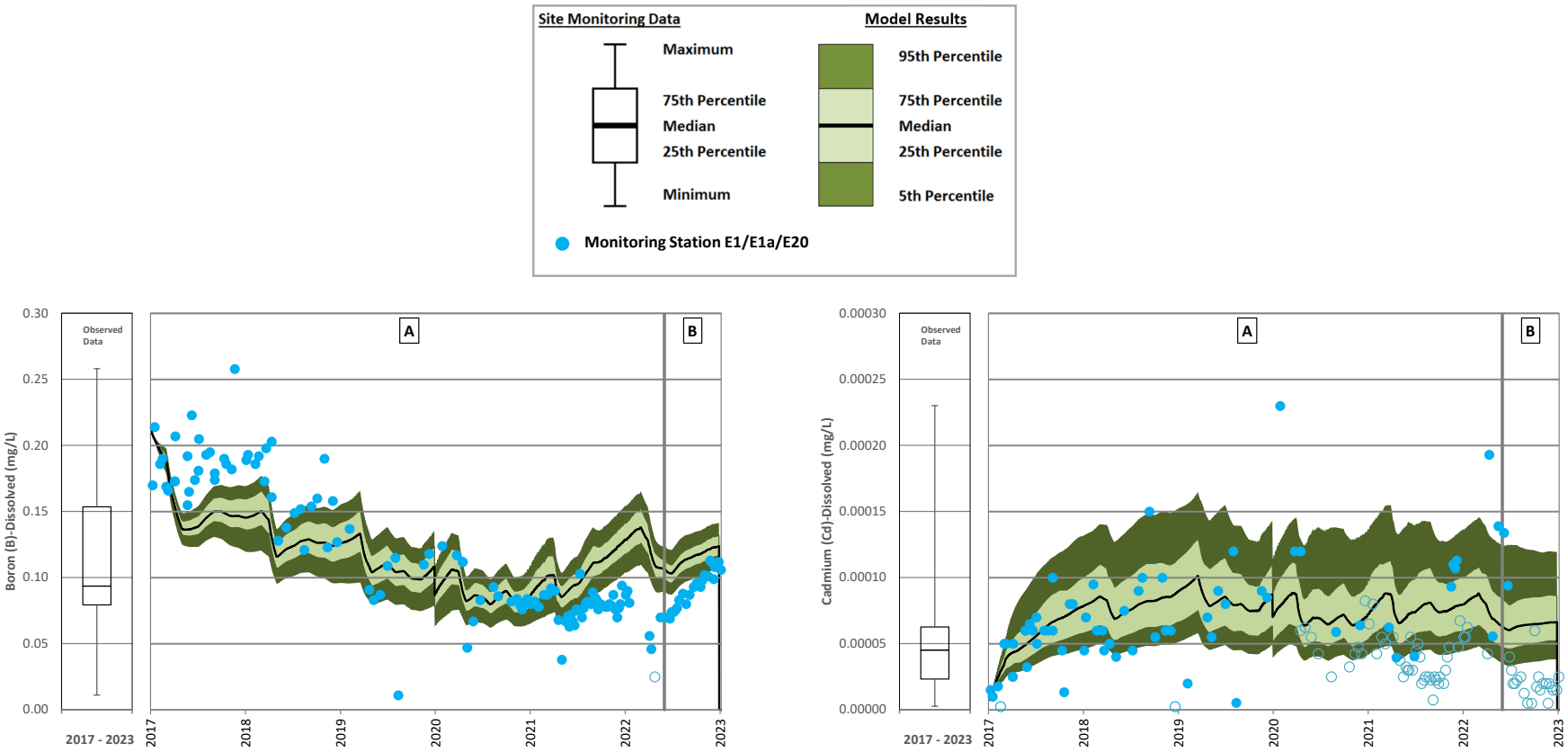

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved boron concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 90: Tailings Storage Facility Calibration – Dissolved Boron and Dissolved Cadmium

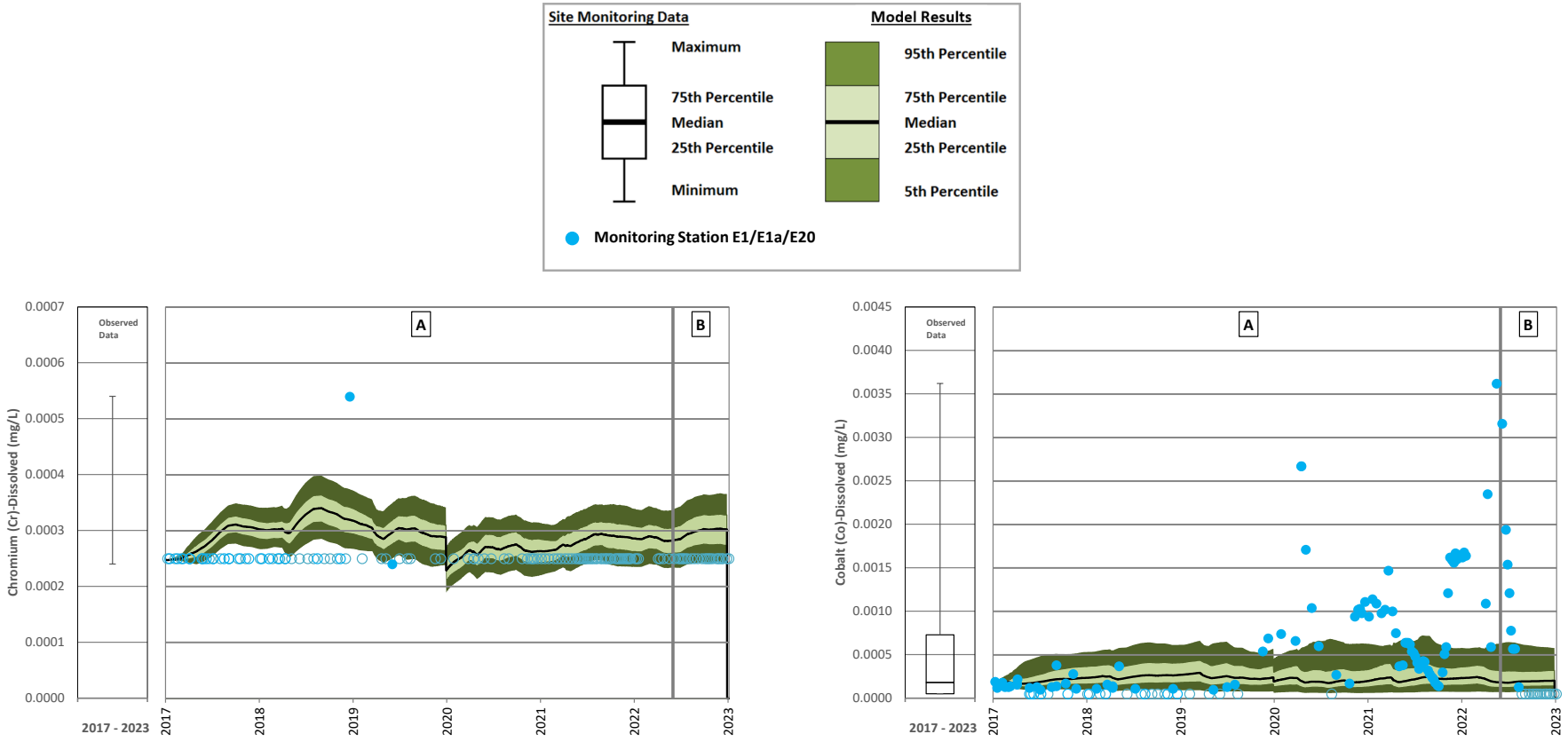

A = Care and Maintanence; B = Resumed Operations

Figure A 91: Tailings Storage Facility Calibration – Dissolved Chromium and Dissolved Cobalt

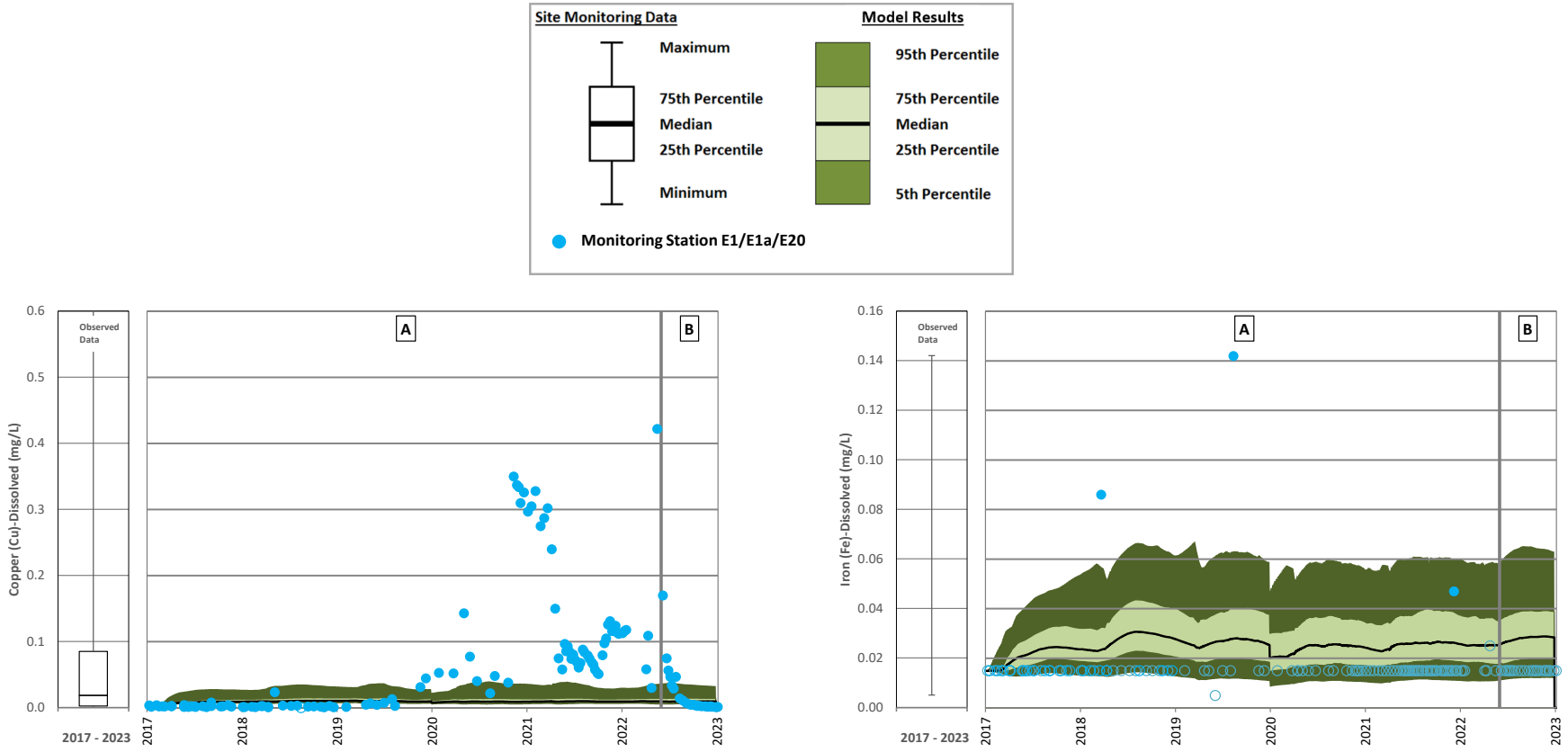

A = Care and Maintanence; B = Resumed Operations

Figure A 92: Tailings Storage Facility Calibration – Dissolved Copper and Dissolved Iron

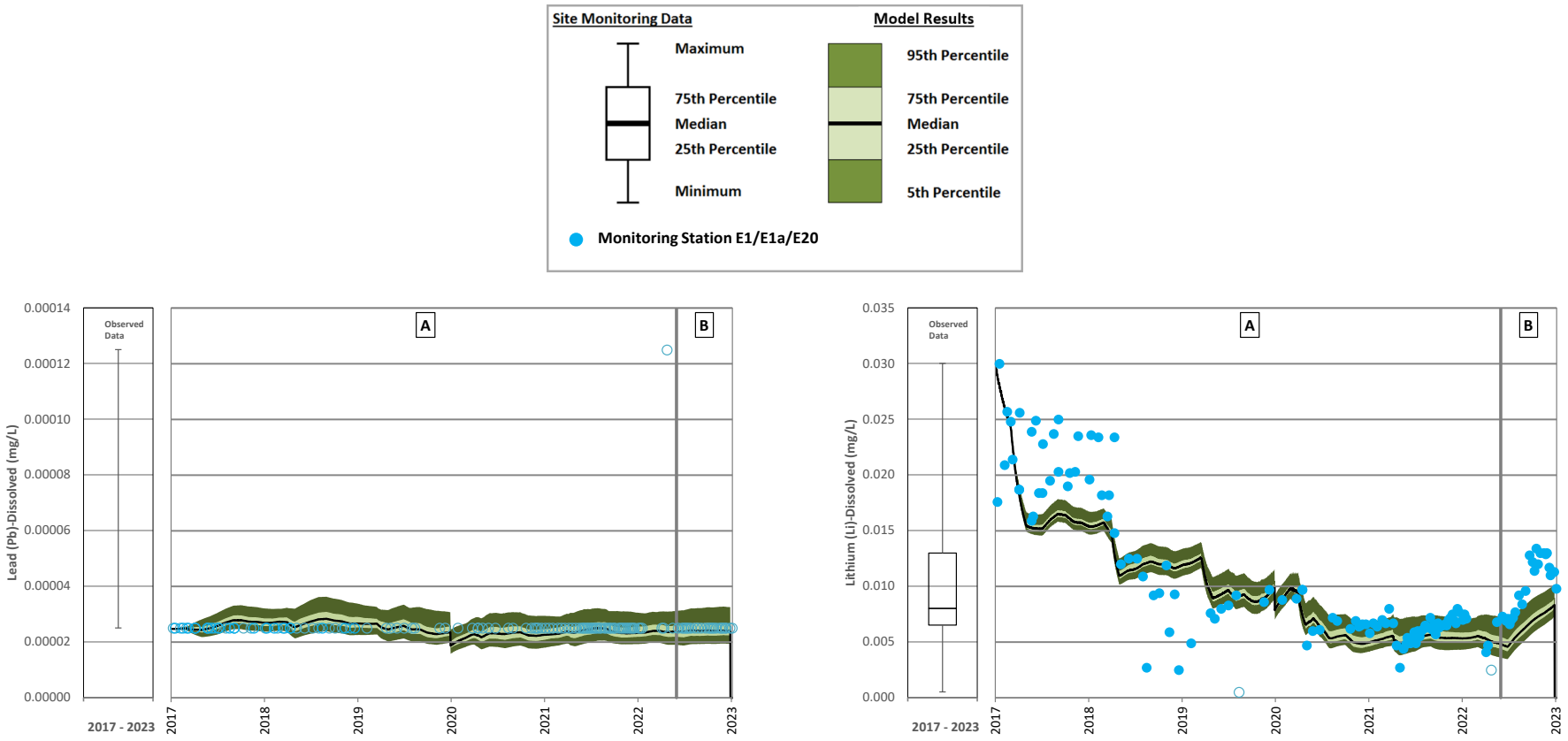

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved lithium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 93: Tailings Storage Facility Calibration – Dissolved Lead and Dissolved Lithium

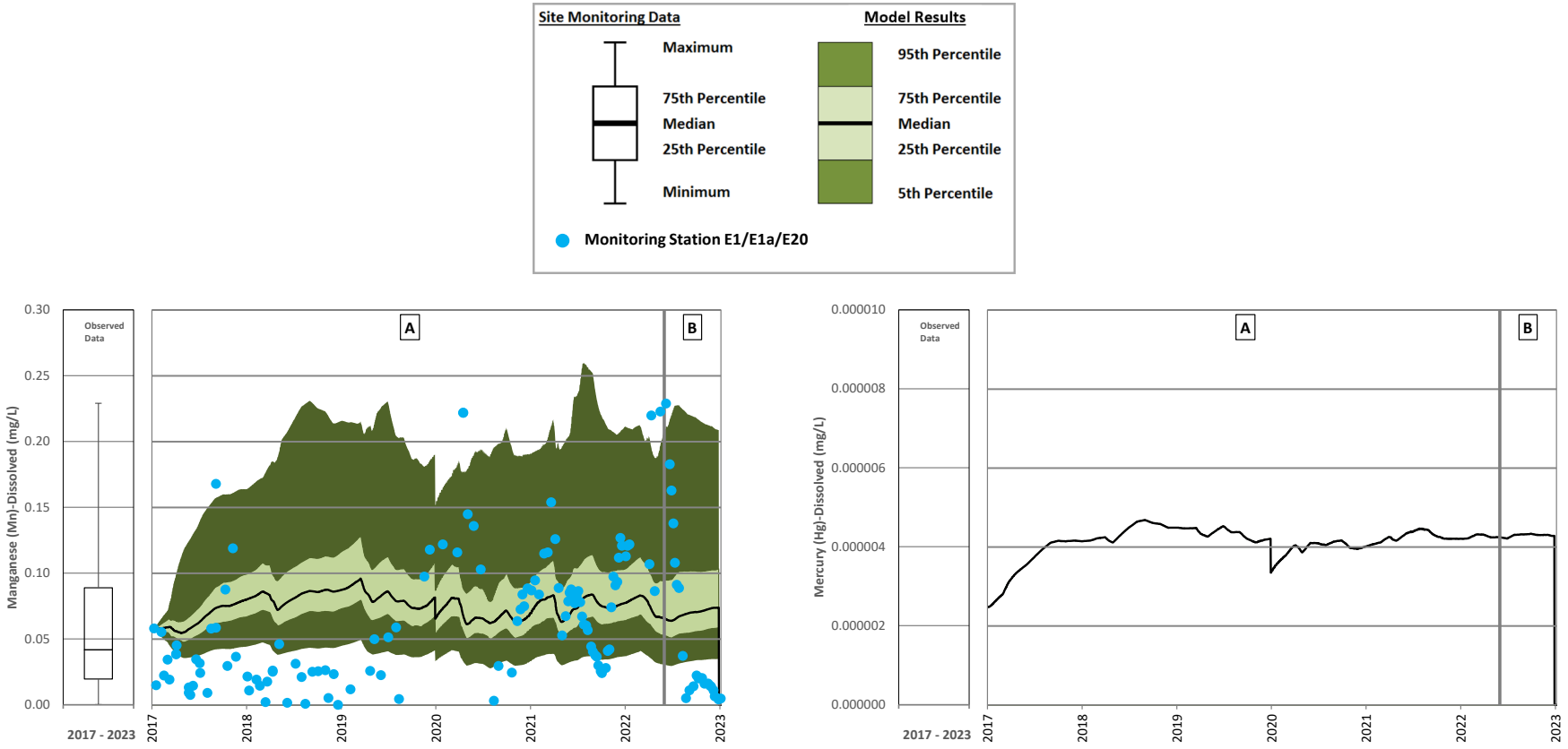

A = Care and Maintanence; B = Resumed Operations

Figure A 94: Tailings Storage Facility Calibration – Dissolved Manganese and Dissolved Mercury

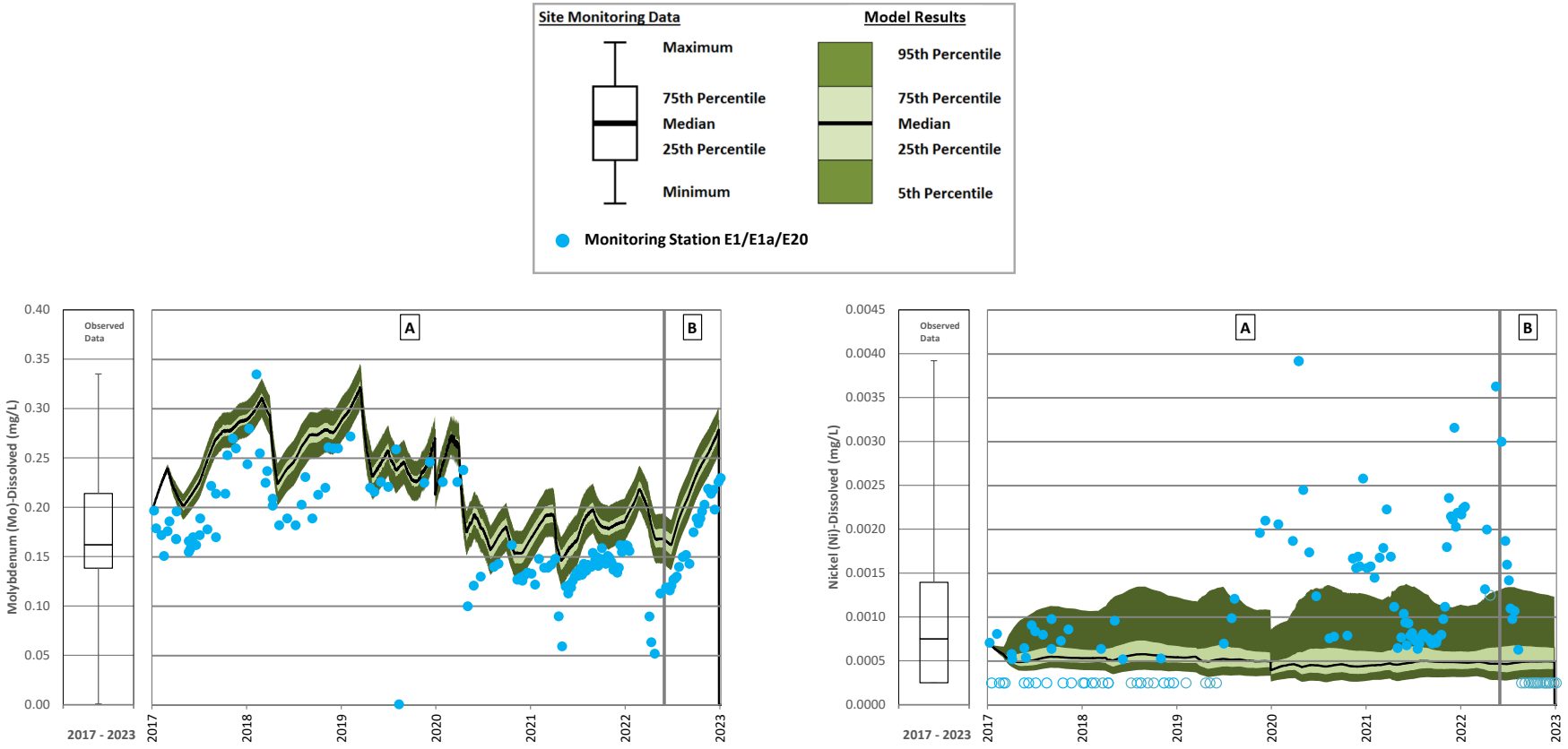

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved molybdenum concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 95: Tailings Storage Facility Calibration – Dissolved Molybdenum and Dissolved Nickel

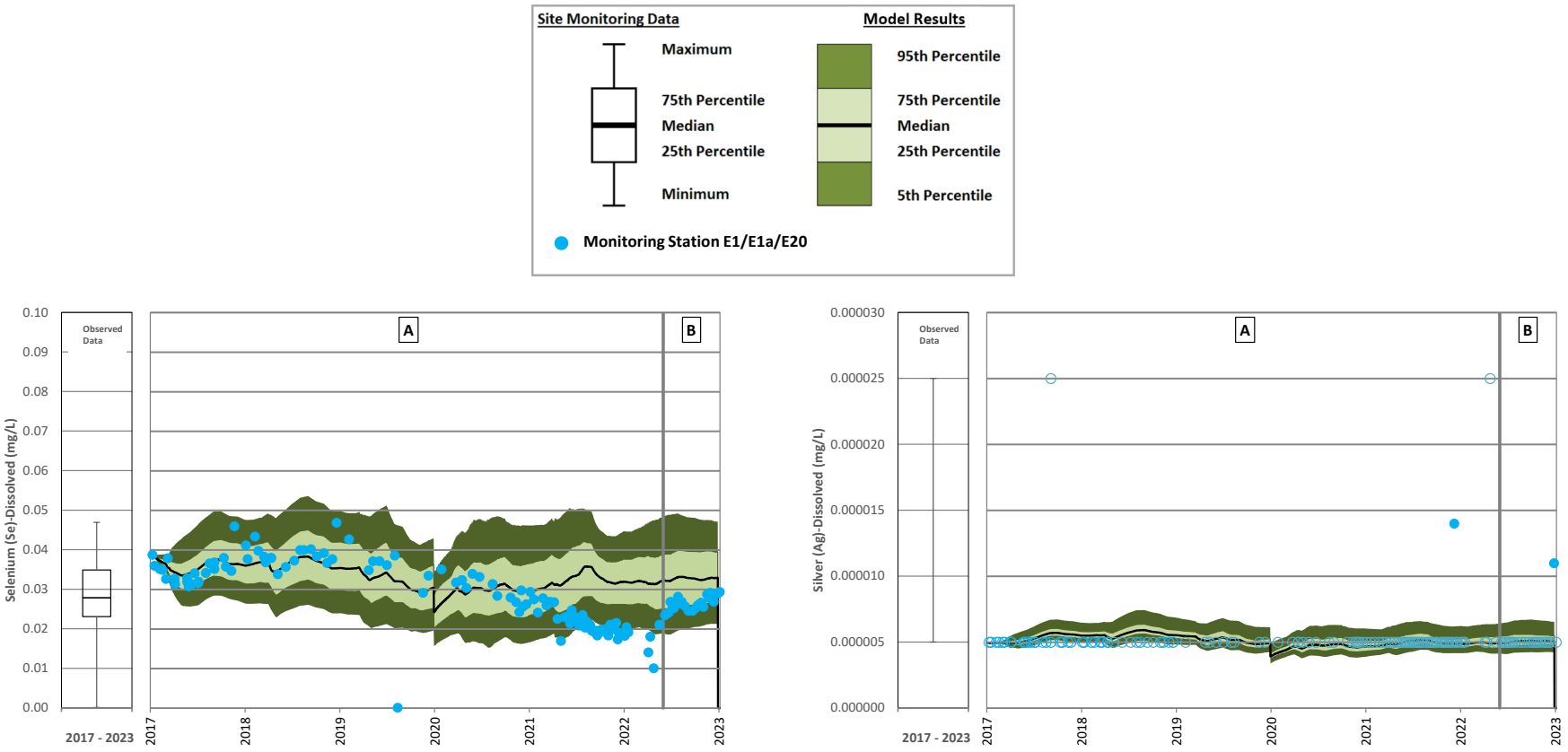

A = Care and Maintanence; B = Resumed Operations

Figure A 96: Tailings Storage Facility Calibration – Dissolved Selenium and Dissolved Silver

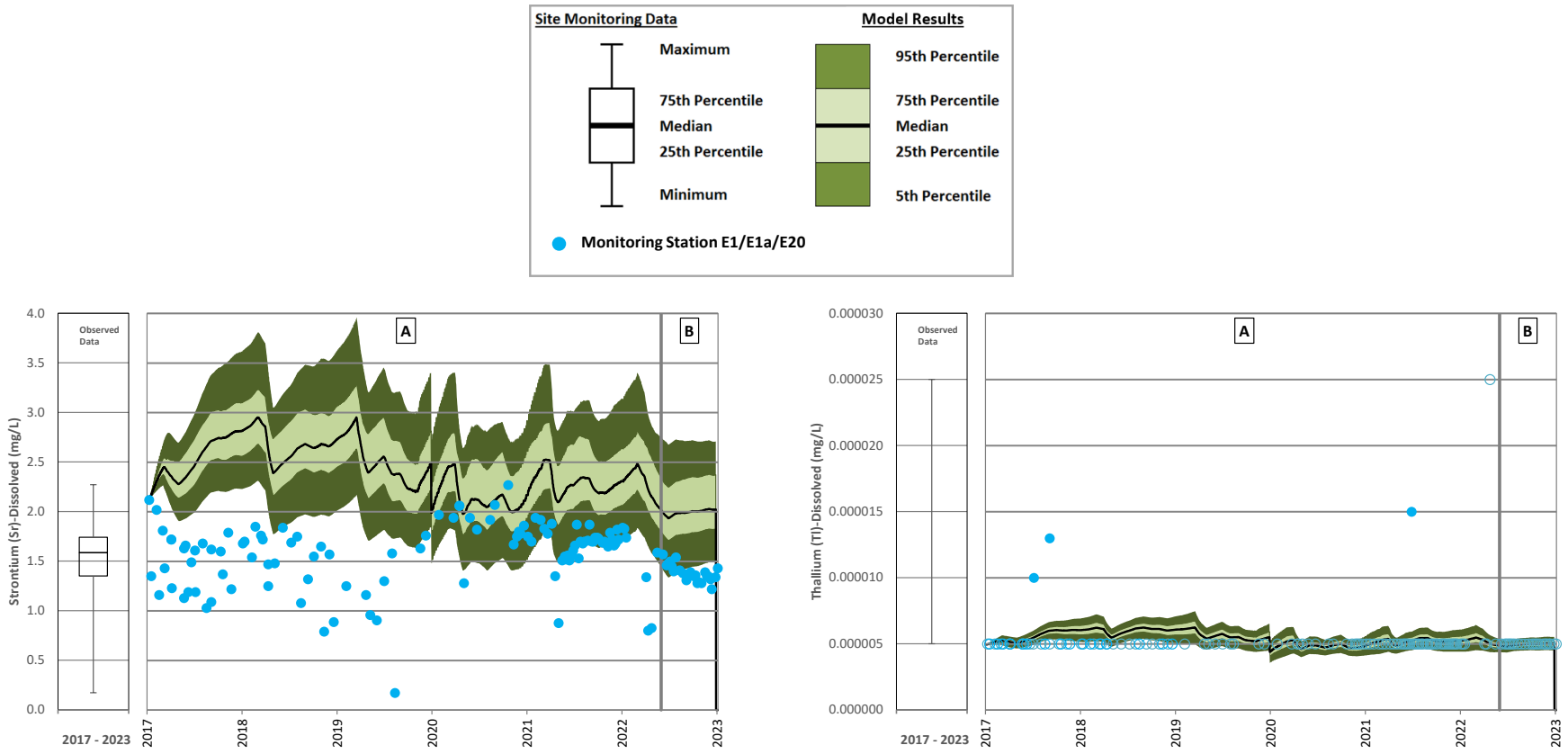

A = Care and Maintanence; B = Resumed Operations

Figure A 97: Tailings Storage Facility Calibration – Dissolved Strontium and Dissolved Thallium

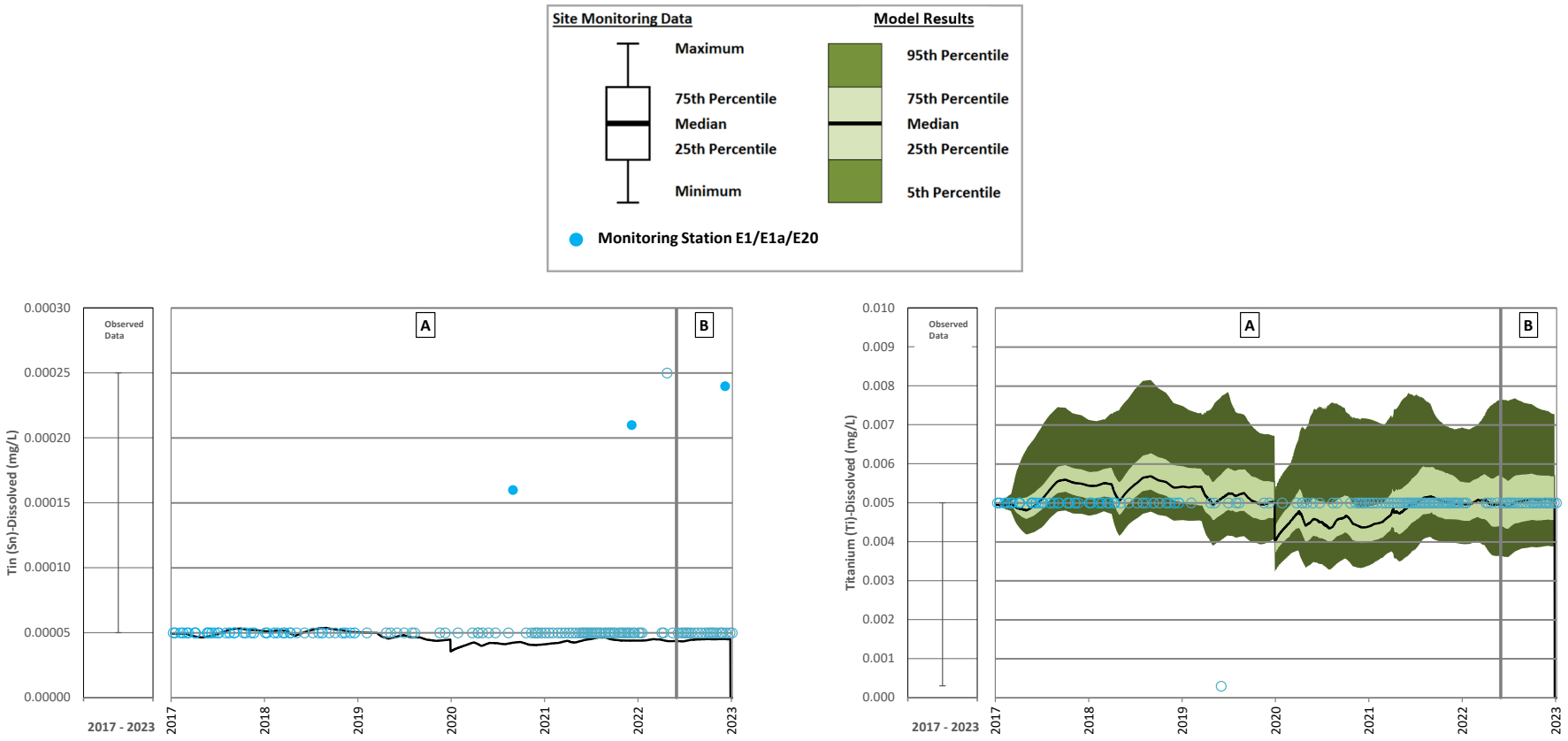

A = Care and Maintanence; B = Resumed Operations

Figure A 98: Tailings Storage Facility Calibration – Dissolved Tin and Dissolved Titanium

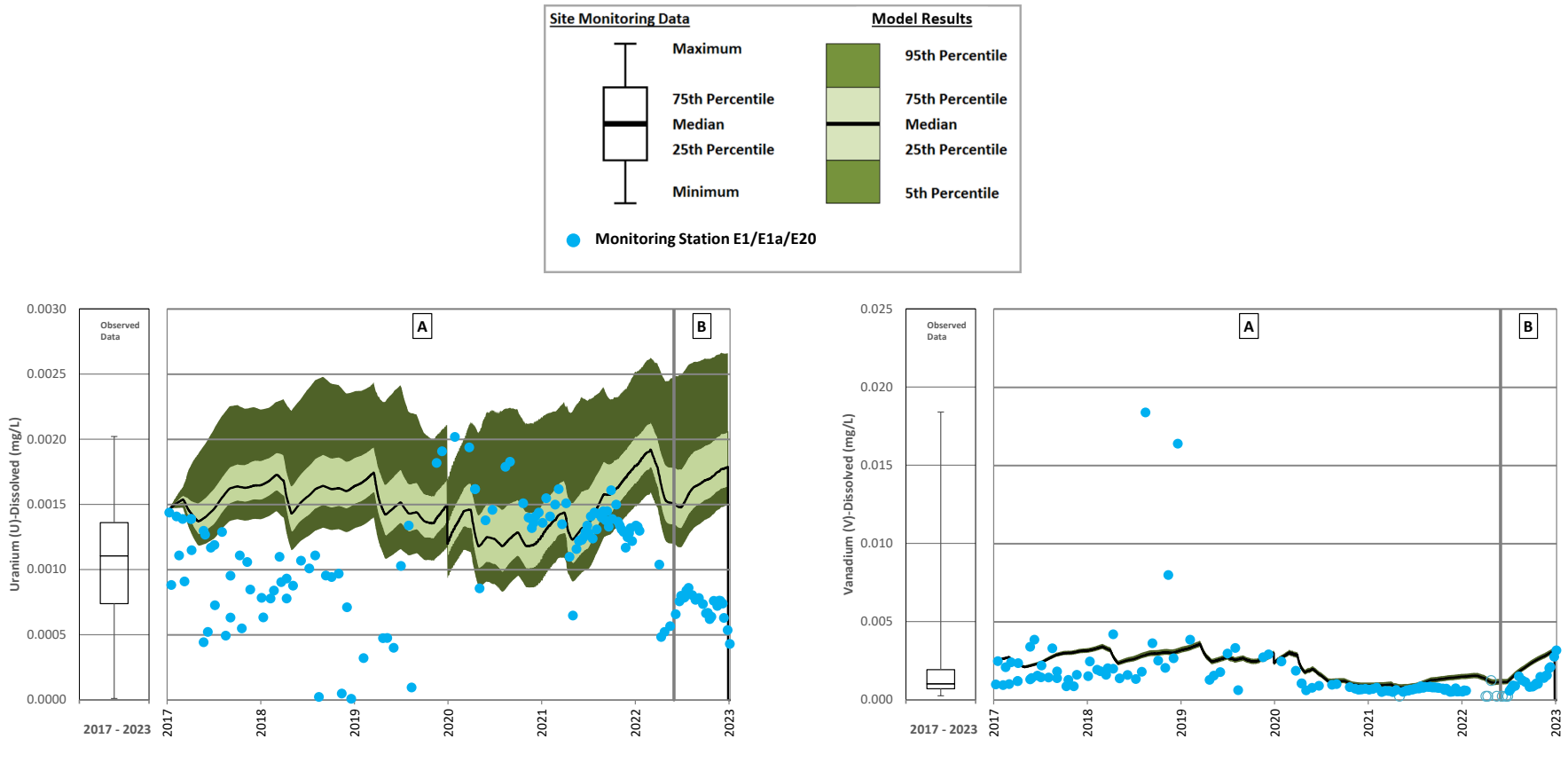

A = Care and Maintanence; B = Resumed Operations

Note: The increased dissolved uranium and dissolved vanadium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 99: Tailings Storage Facility Calibration – Dissolved Uranium and Dissolved Vanadium

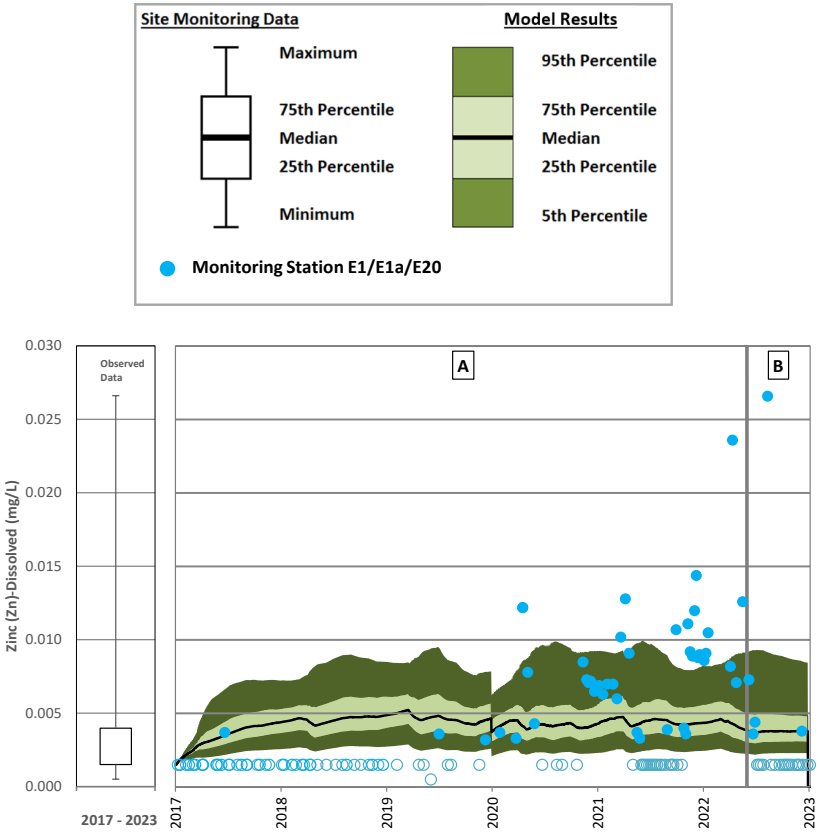

A = Care and Maintanence; B = Resumed Operations

Figure A 100: Tailings Storage Facility Calibration – Dissolved Zinc

Perimeter Embankment Till Borrow Pond Calibration

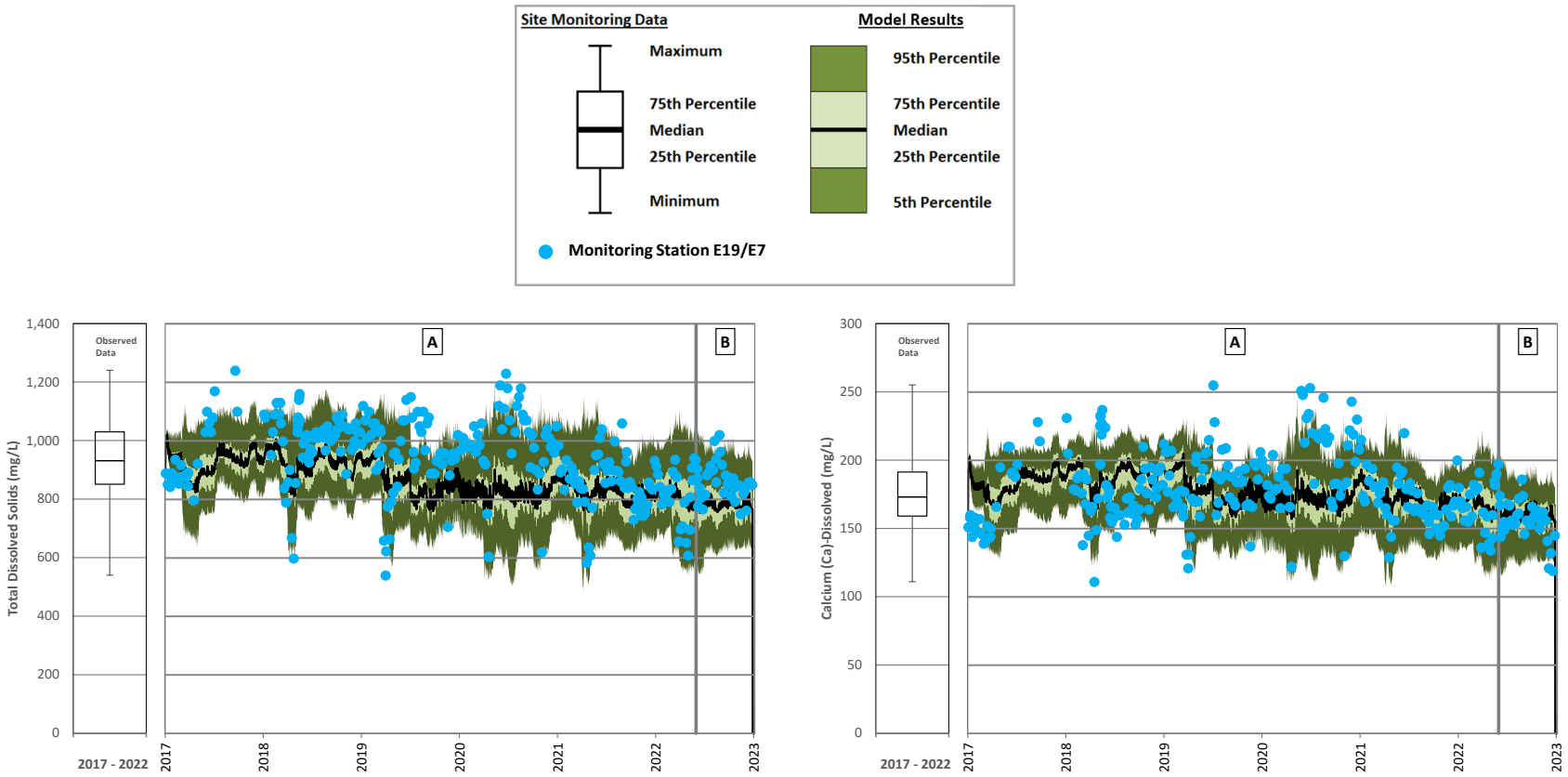

A = Care and Maintanence; B = Resumed Operations

Figure A 101: Perimeter Embankment Till Borrow Pond Calibration – Total Dissolved Solids and Calcium

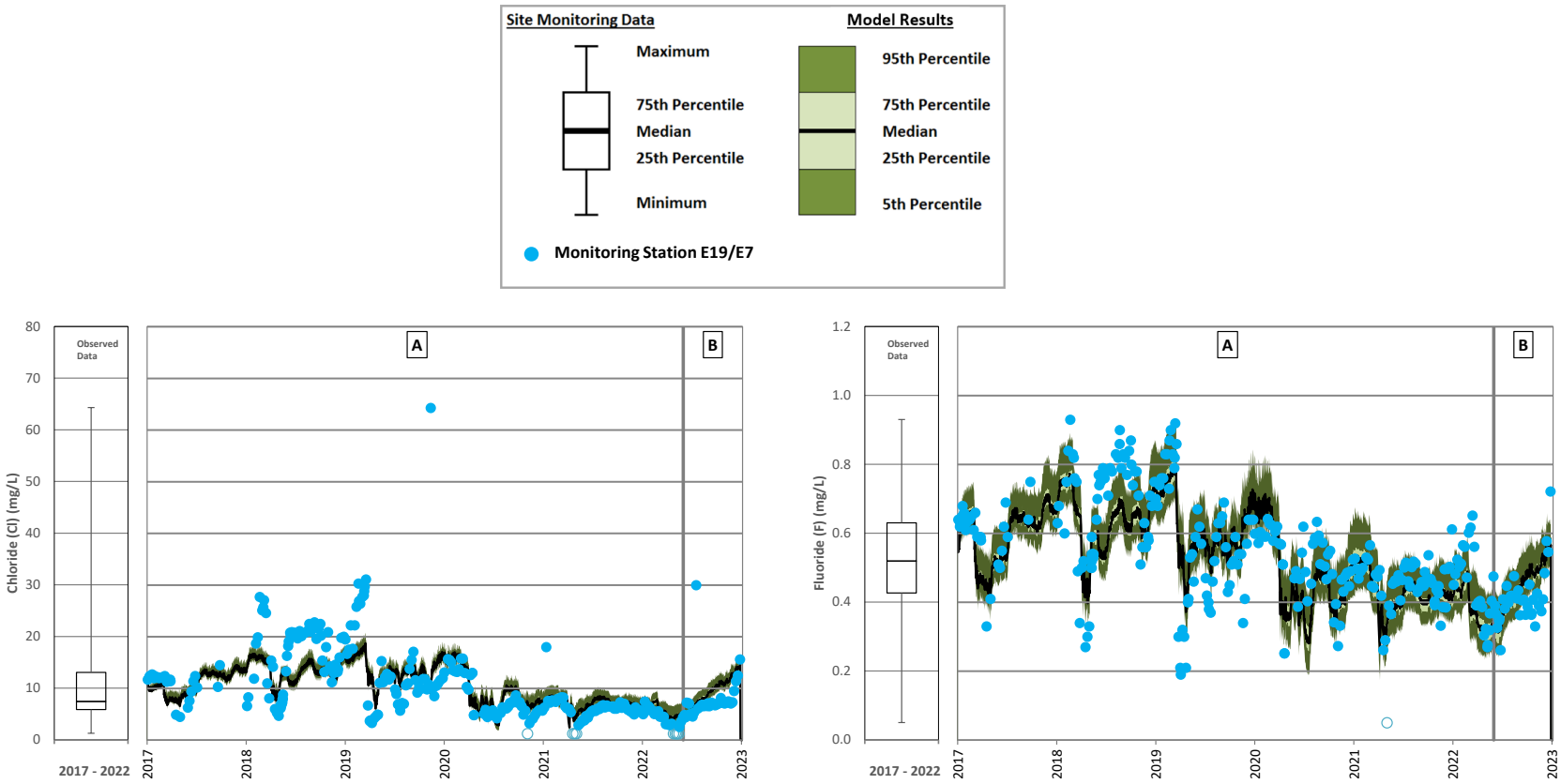

A = Care and Maintanence; B = Resumed Operations

Note: Chloride and fluoride concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 102: Perimeter Embankment Till Borrow Pond Calibration – Chloride and Fluoride

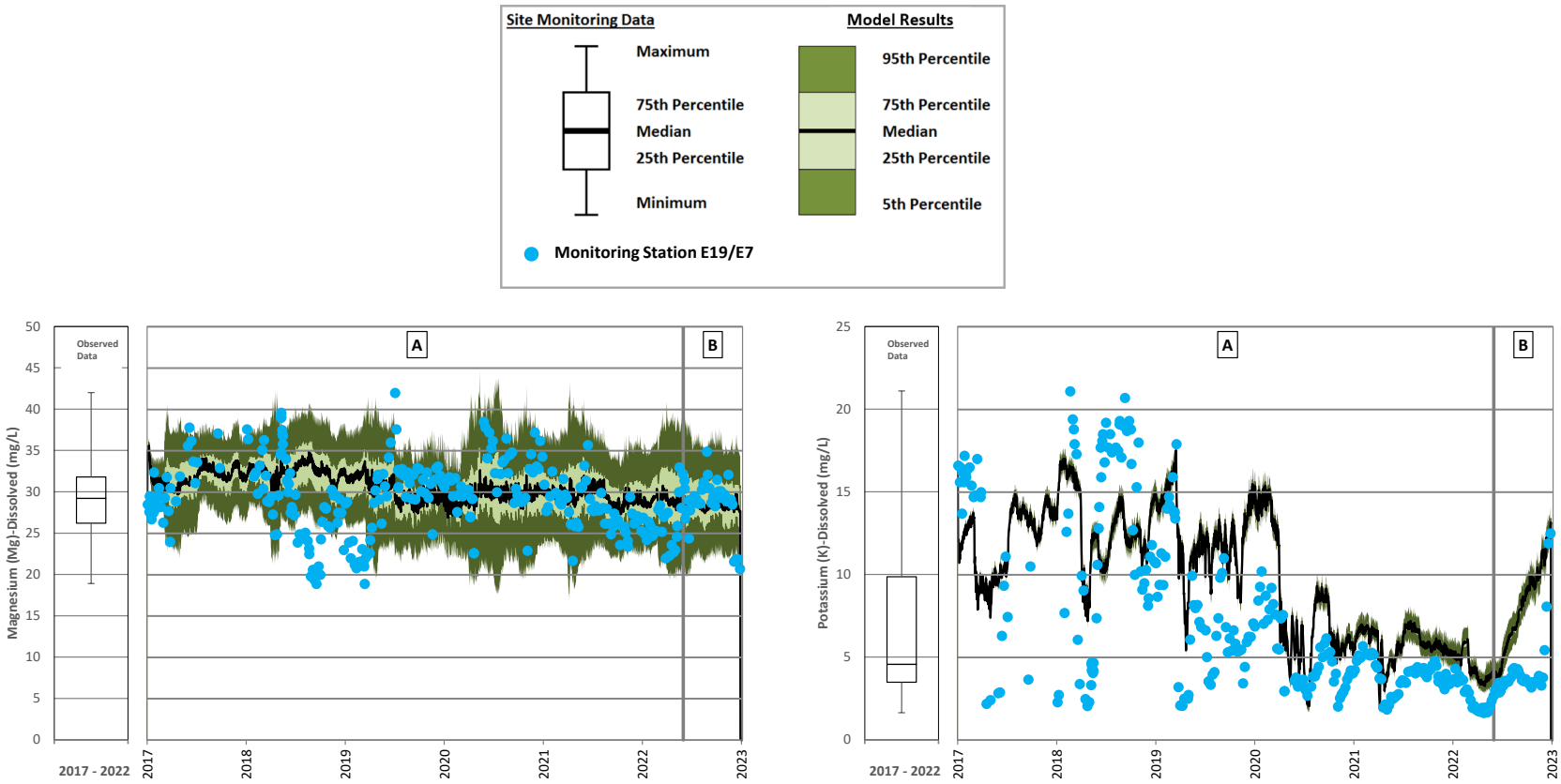

A = Care and Maintanence; B = Resumed Operations

Note: Potassium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 103: Perimeter Embankment Till Borrow Pond Calibration – Magnesium and Potassium

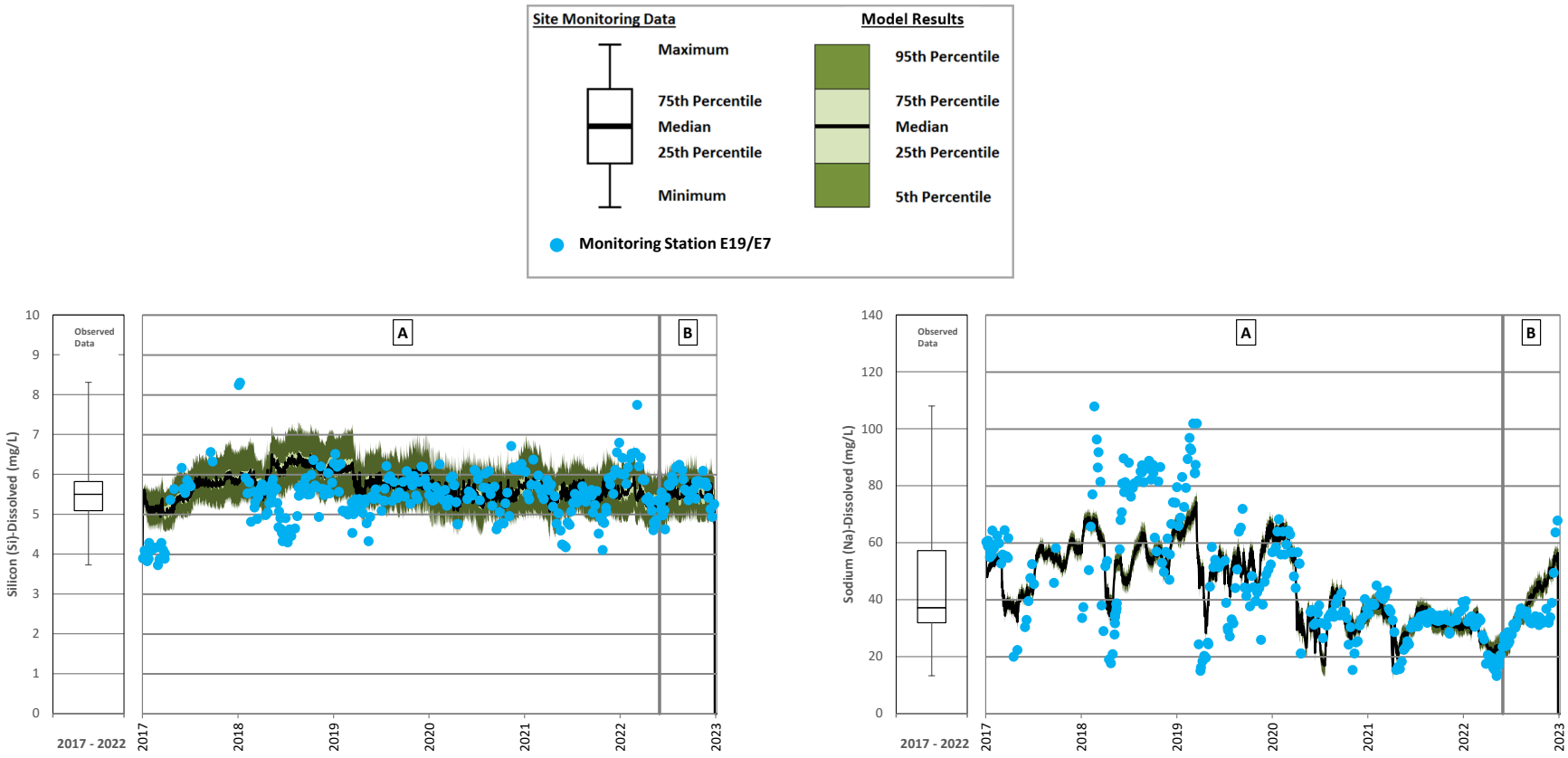

A = Care and Maintanence; B = Resumed Operations

Note: Sodium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 104: Perimeter Embankment Till Borrow Pond Calibration – Silicon and Sodium

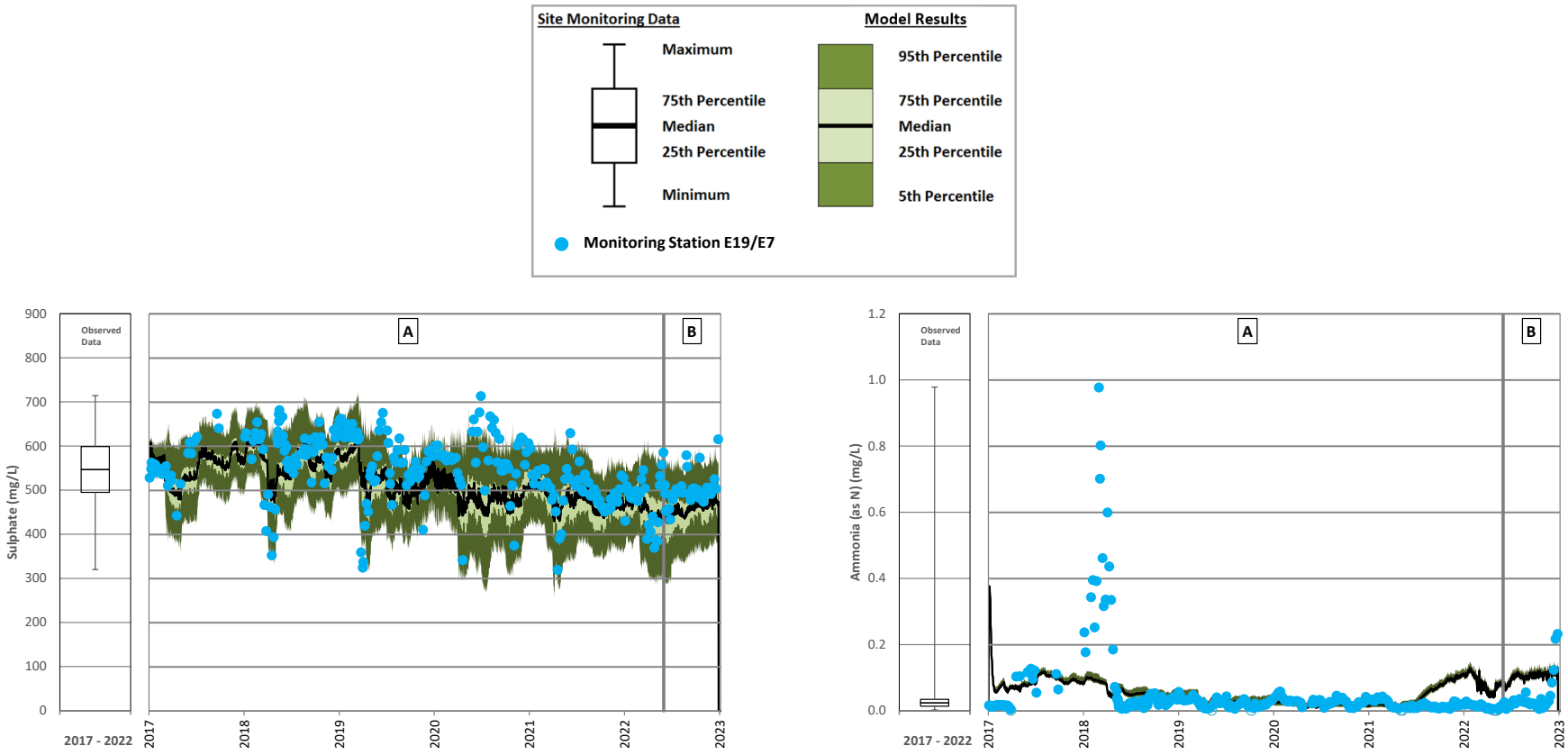

A = Care and Maintanence; B = Resumed Operations

Note: Total ammonia concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 105: Perimeter Embankment Till Borrow Pond Calibration – Sulphate and Total Ammonia

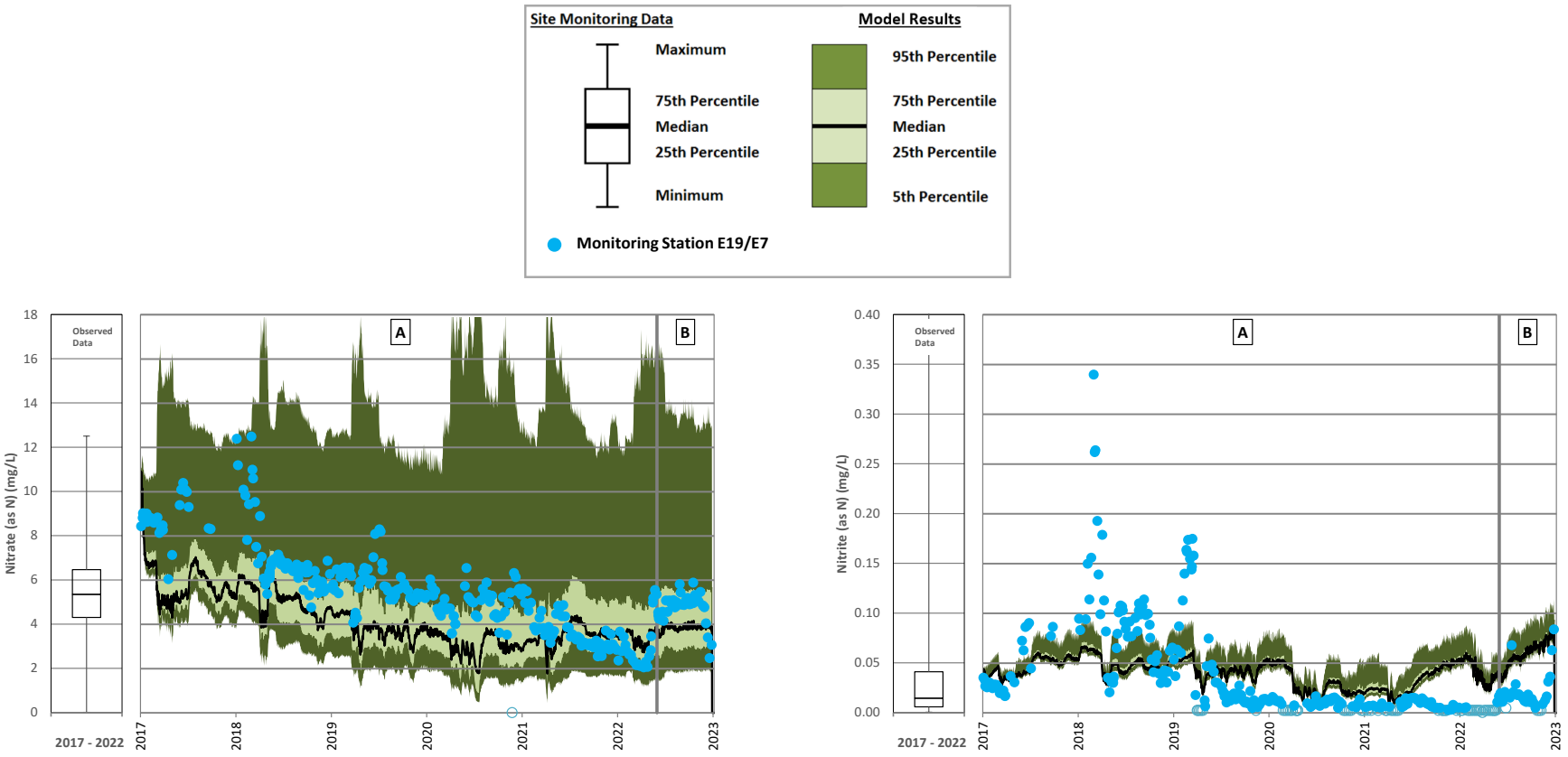

A = Care and Maintanence; B = Resumed Operations

Note: Nitrite concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 106: Perimeter Embankment Till Borrow Pond Calibration – Nitrate and Nitrite

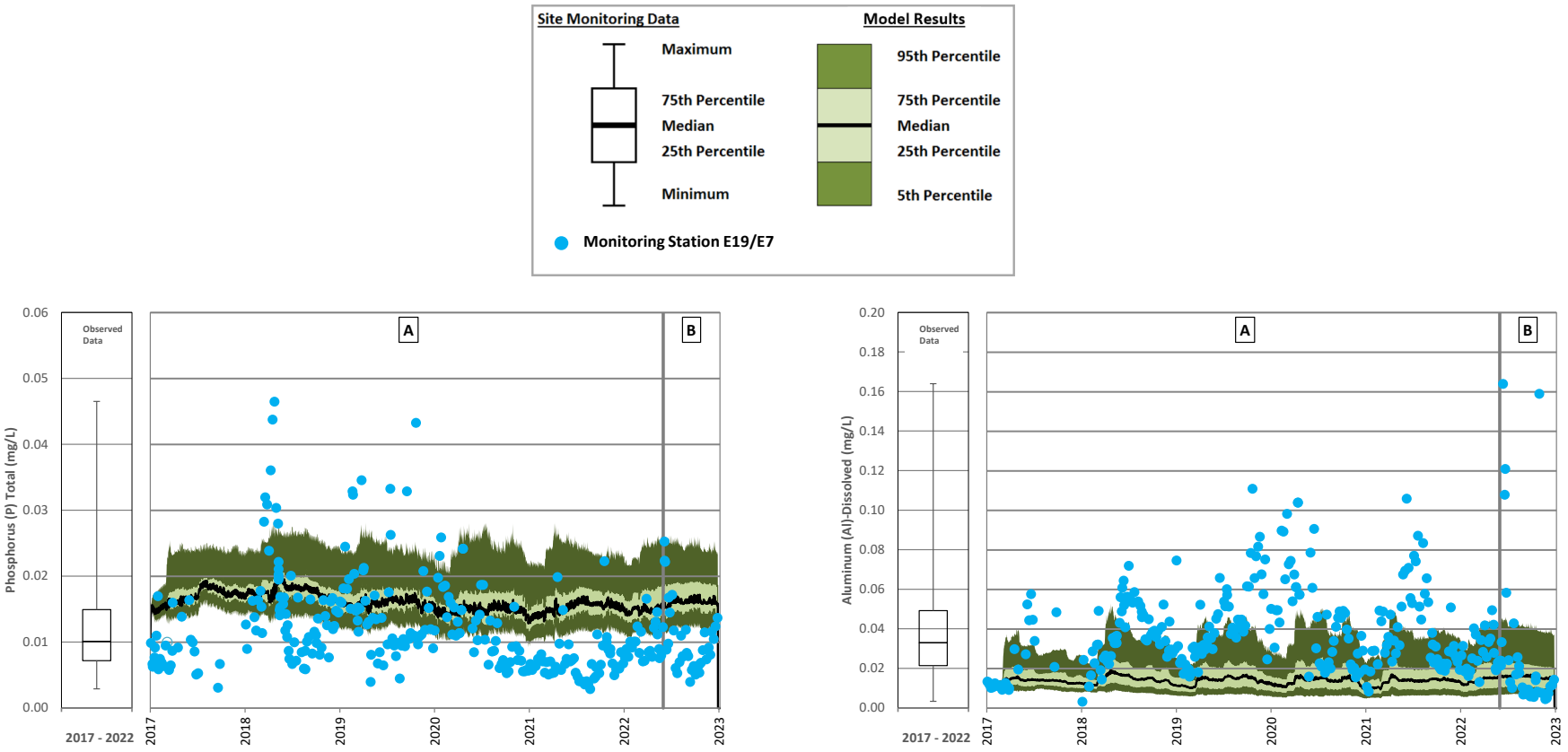

A = Care and Maintanence; B = Resumed Operations

Figure A 107: Perimeter Embankment Till Borrow Pond Calibration – Total Phosphorus and Dissolved Aluminum

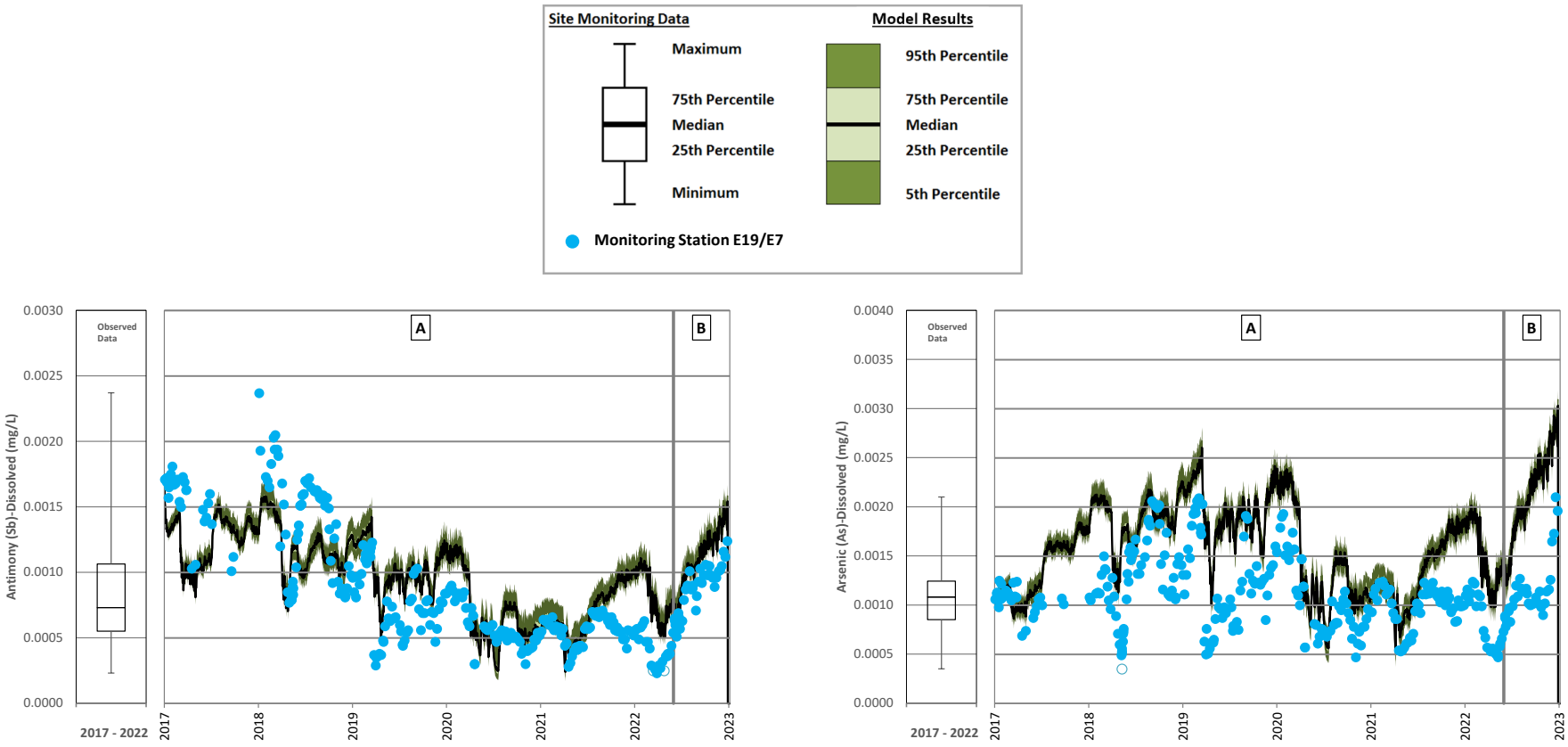

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 108: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Antimony and Dissolved Arsenic

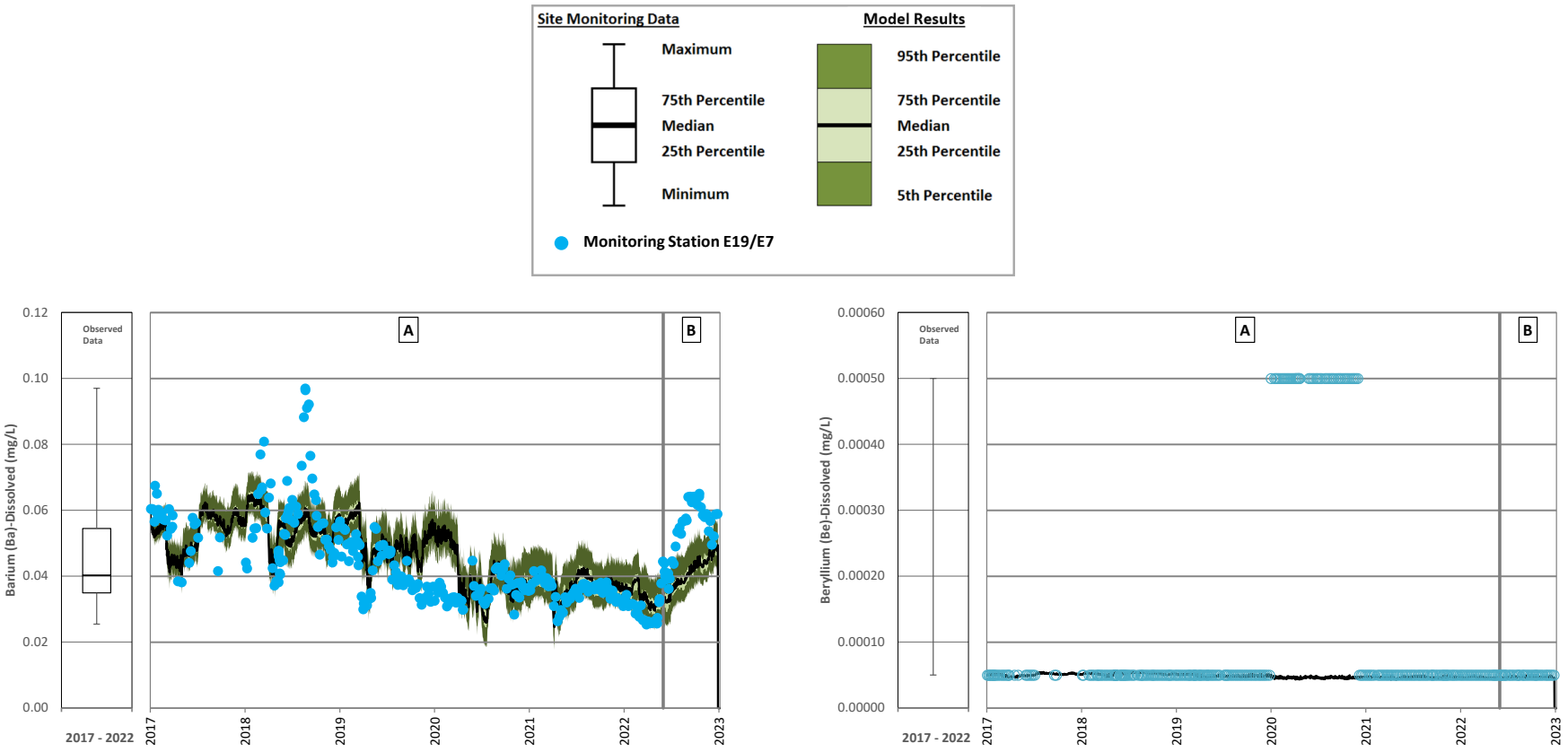

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved barium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 109: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Barium and Dissolved Beryllium

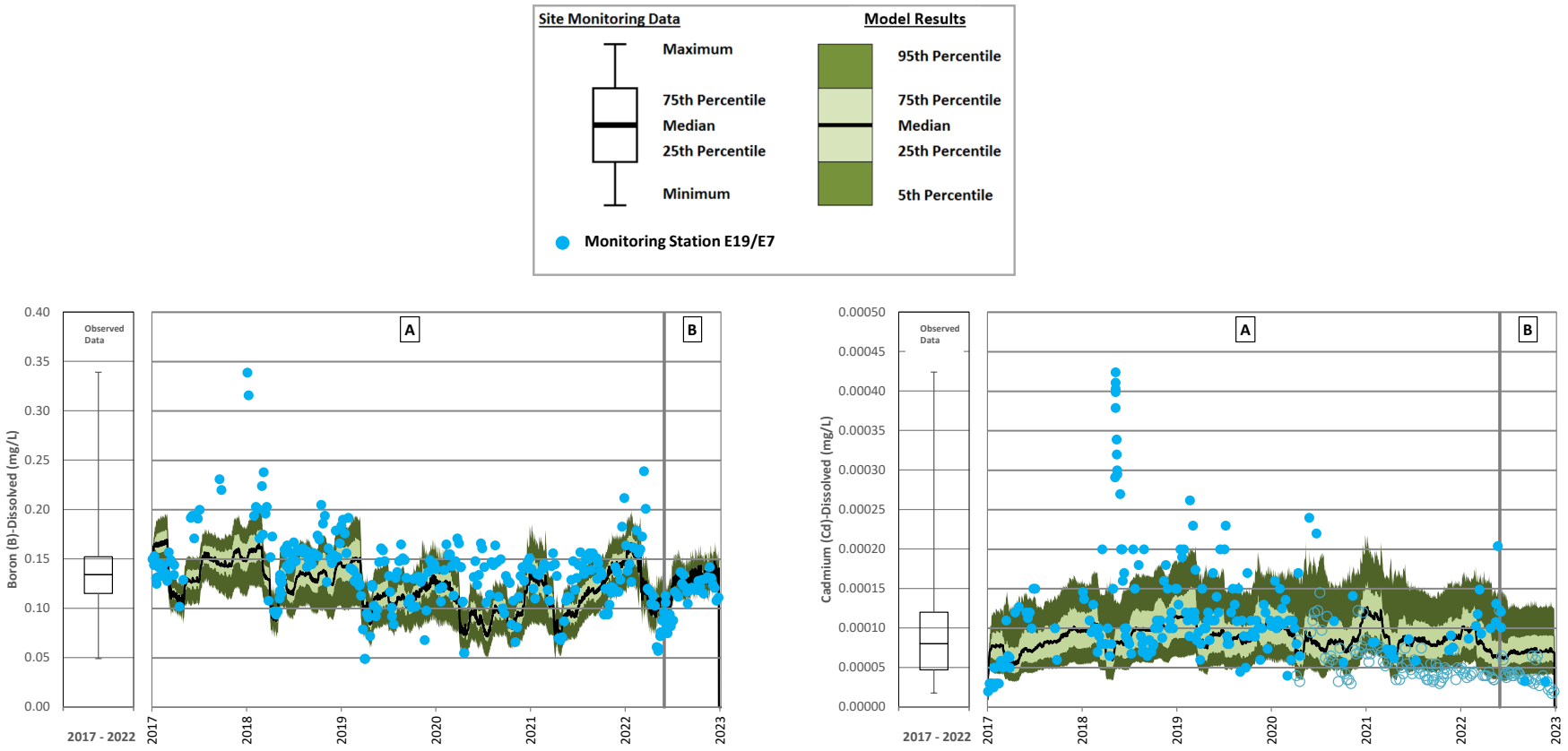

A = Care and Maintanence; B = Resumed Operations

Figure A 110: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Boron and Dissolved Cadmium

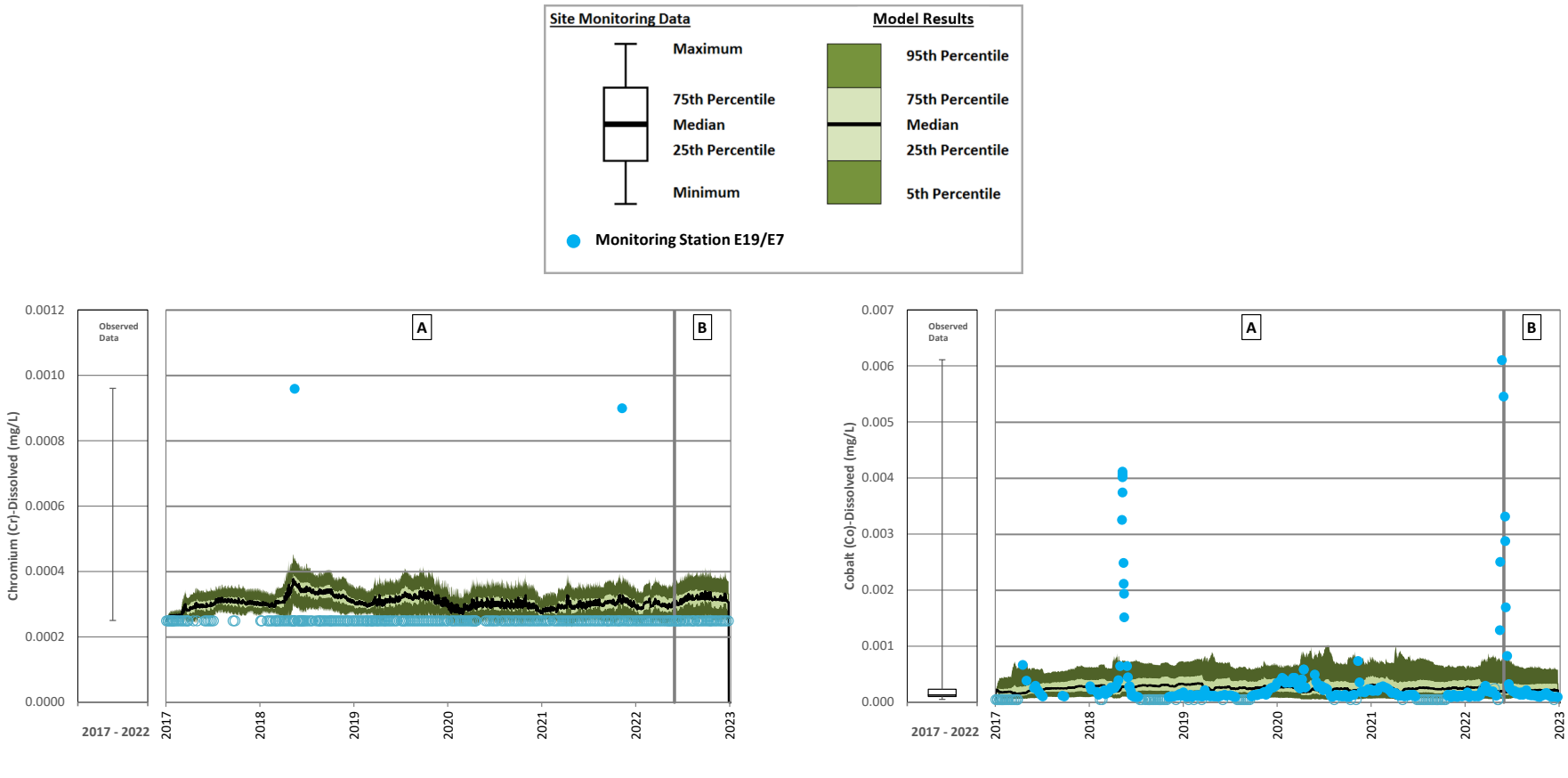

A = Care and Maintanence; B = Resumed Operations

Figure A 111: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Chromium and Dissolved Cobalt

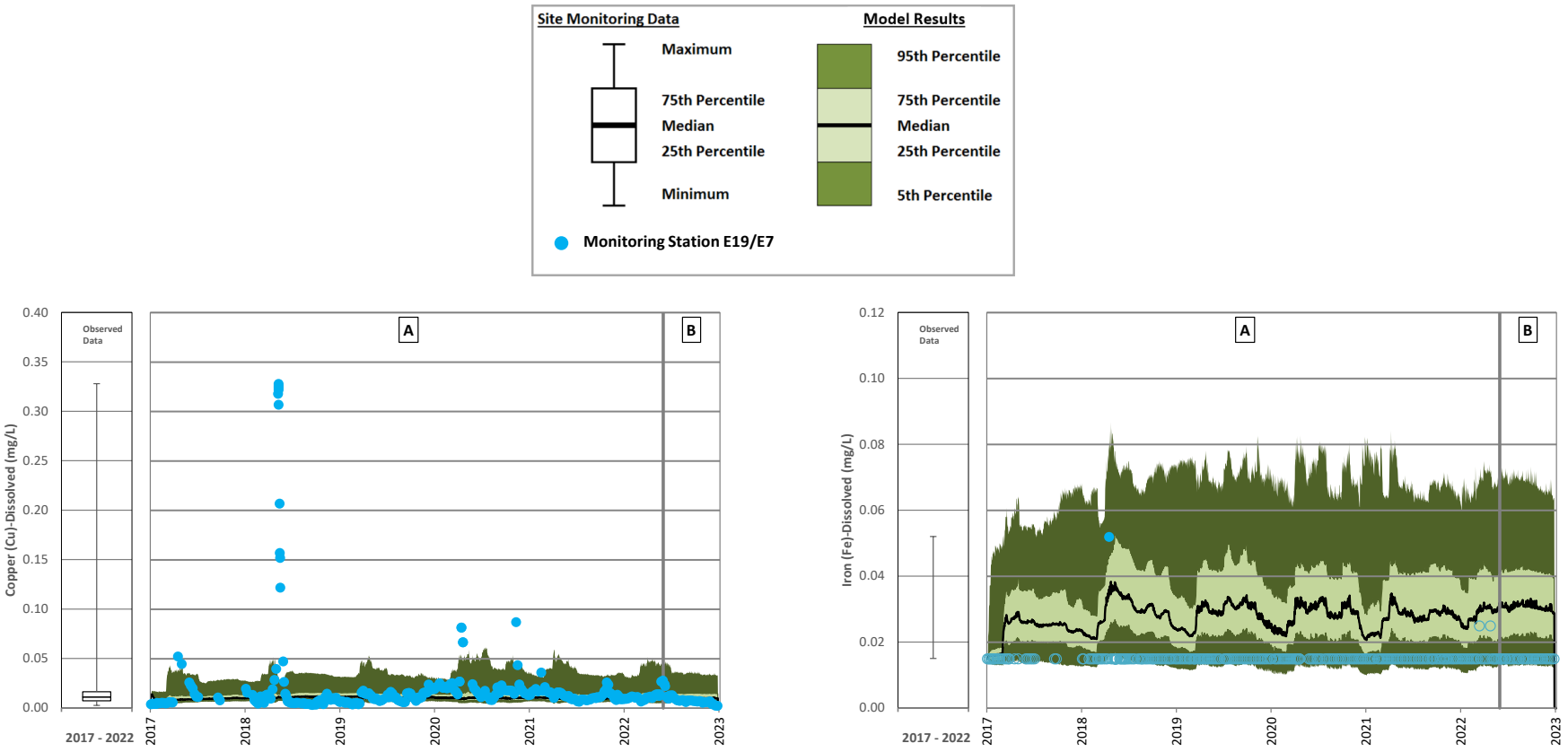

A = Care and Maintanence; B = Resumed Operations

Figure A 112: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Copper and Dissolved Iron

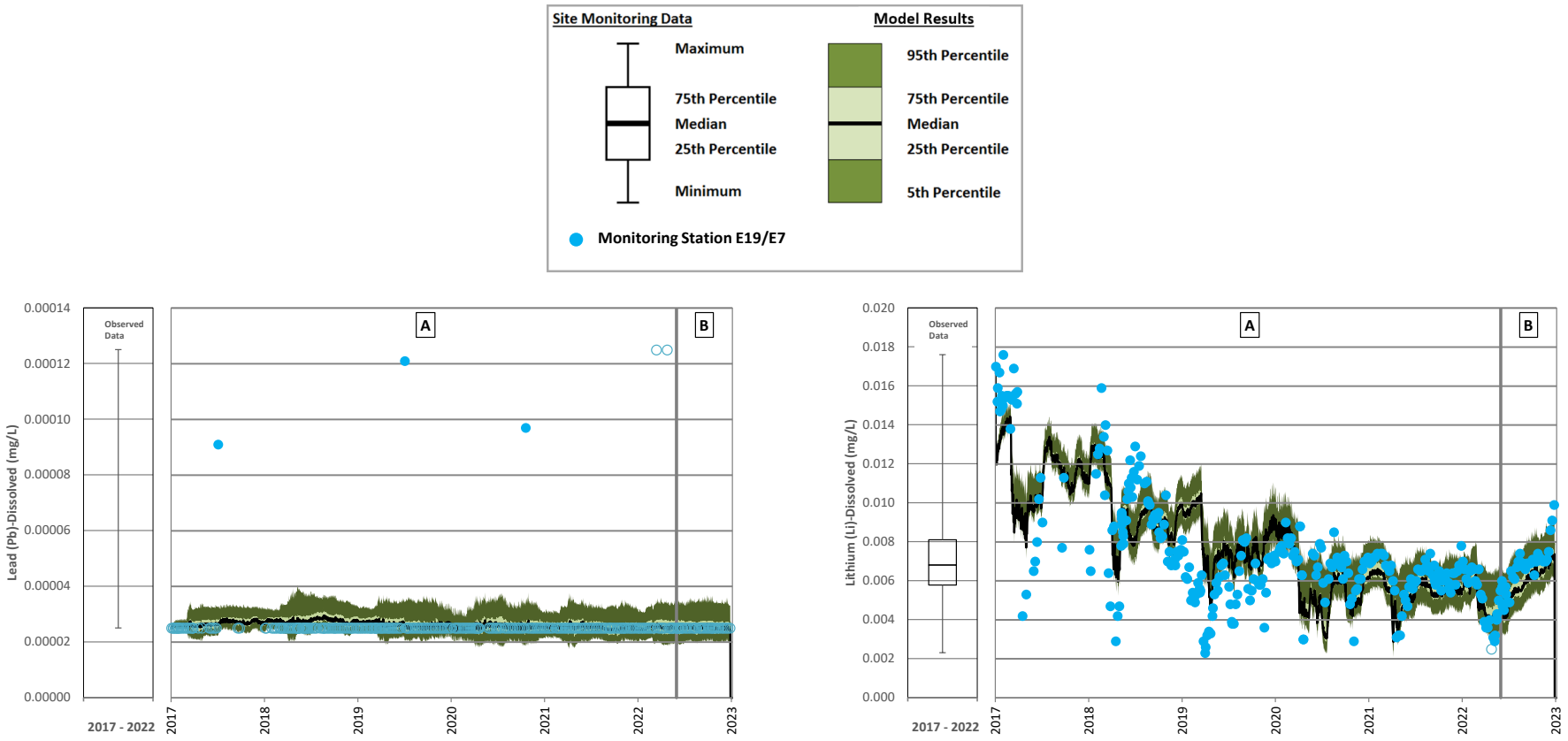

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved lithium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 113: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Lead and Dissolved Lithium

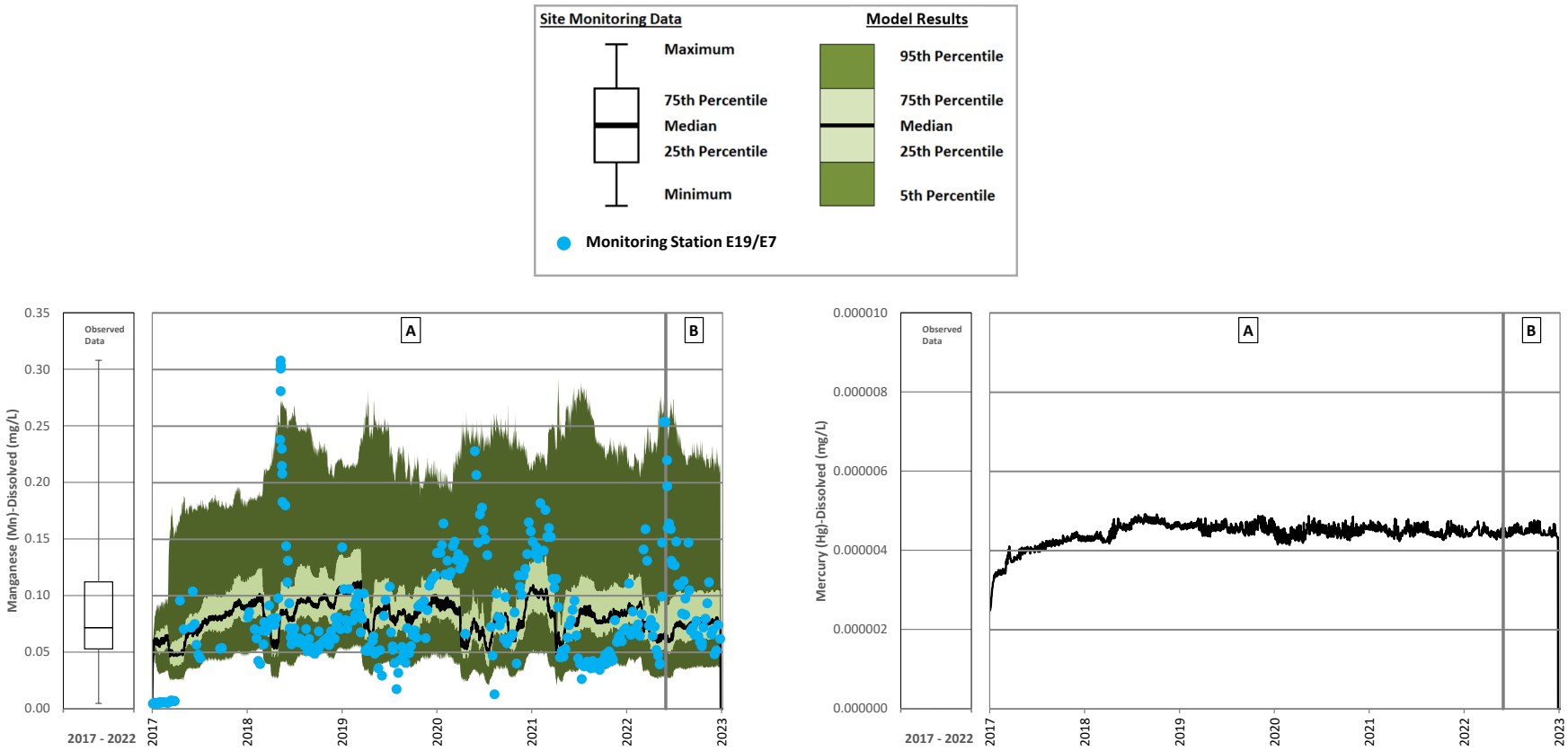

A = Care and Maintanence; B = Resumed Operations

Figure A 114: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Manganese and Dissolved Mercury

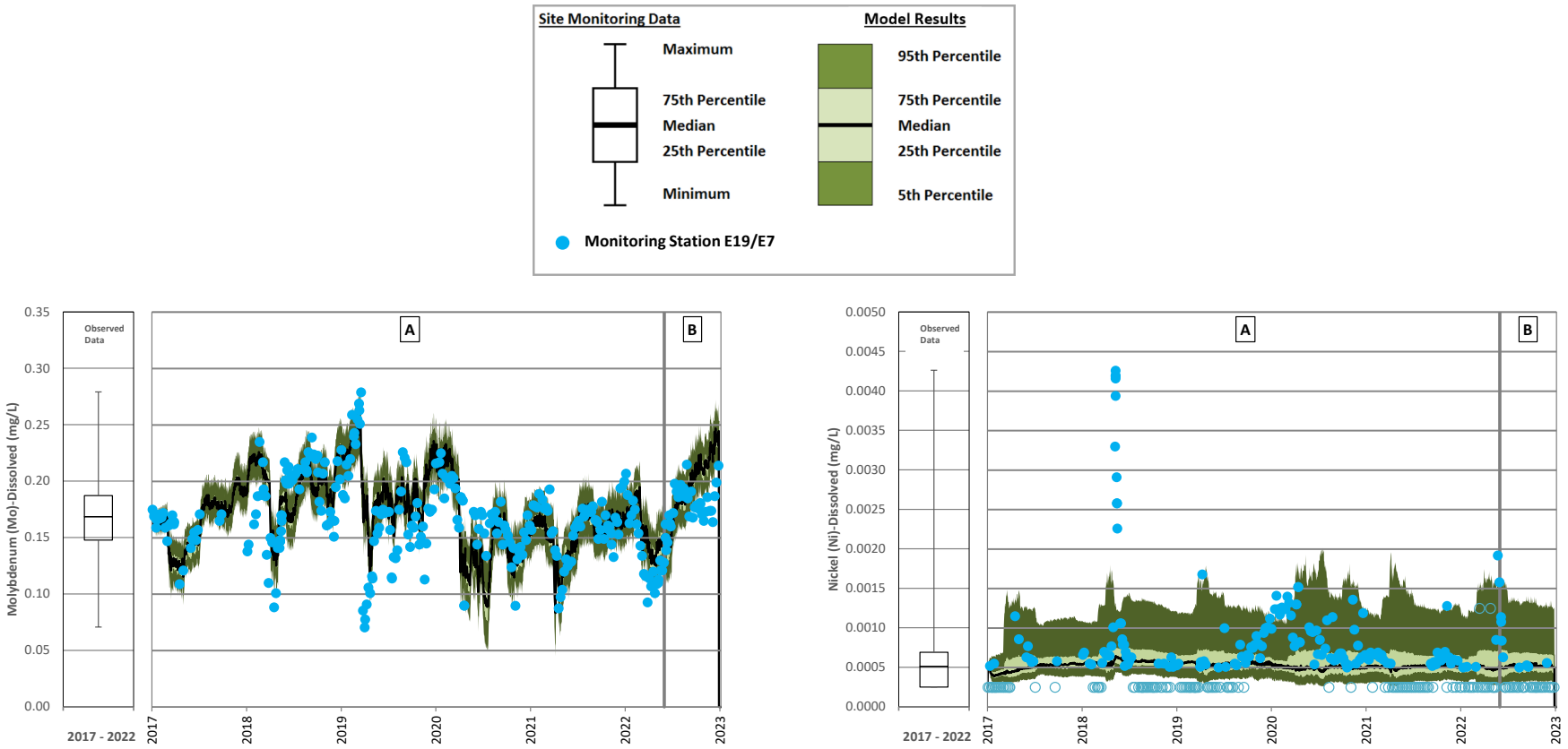

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved molybdenum concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 115: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Molybdenum and Dissolved Nickel

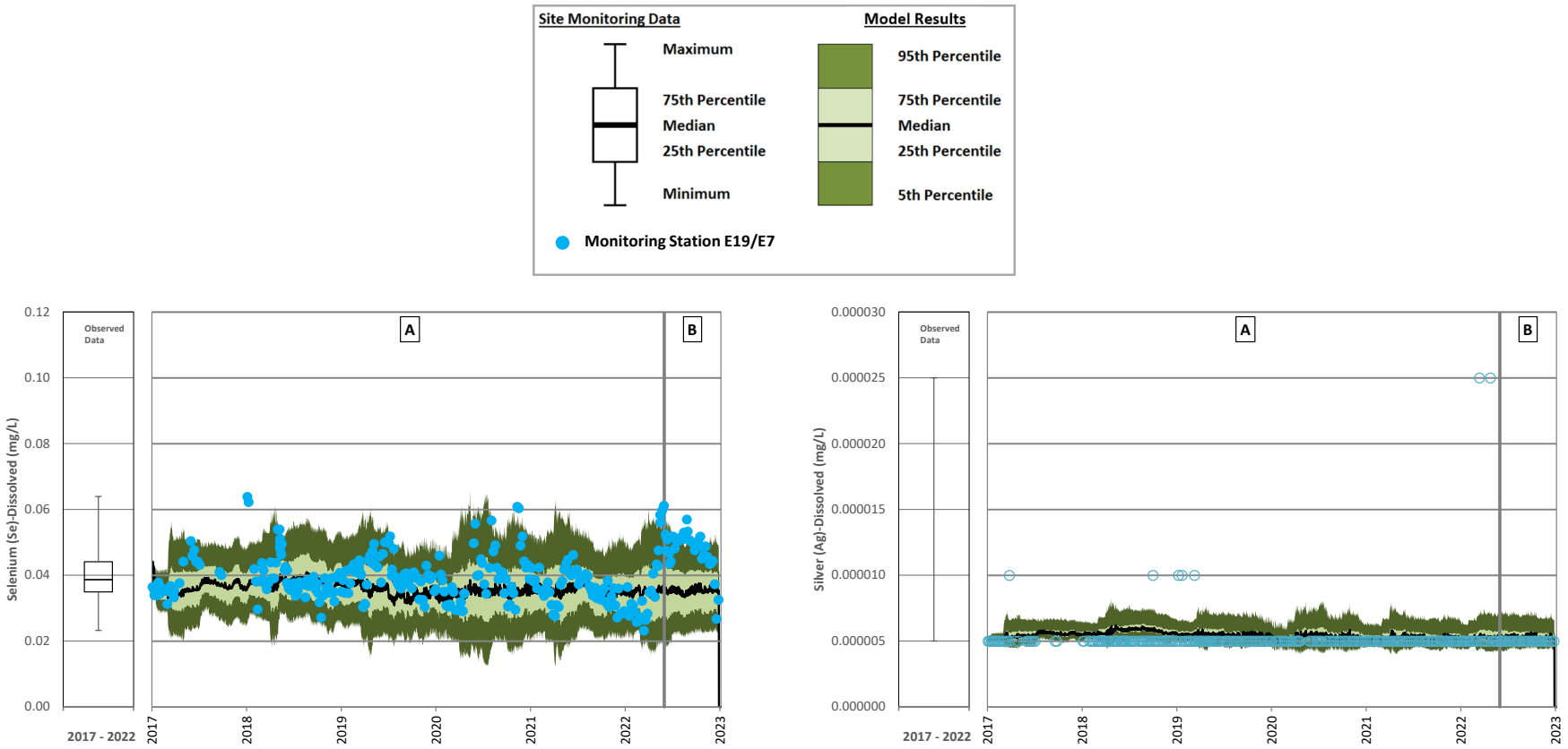

A = Care and Maintanence; B = Resumed Operations

Figure A 116: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Selenium and Dissolved Silver

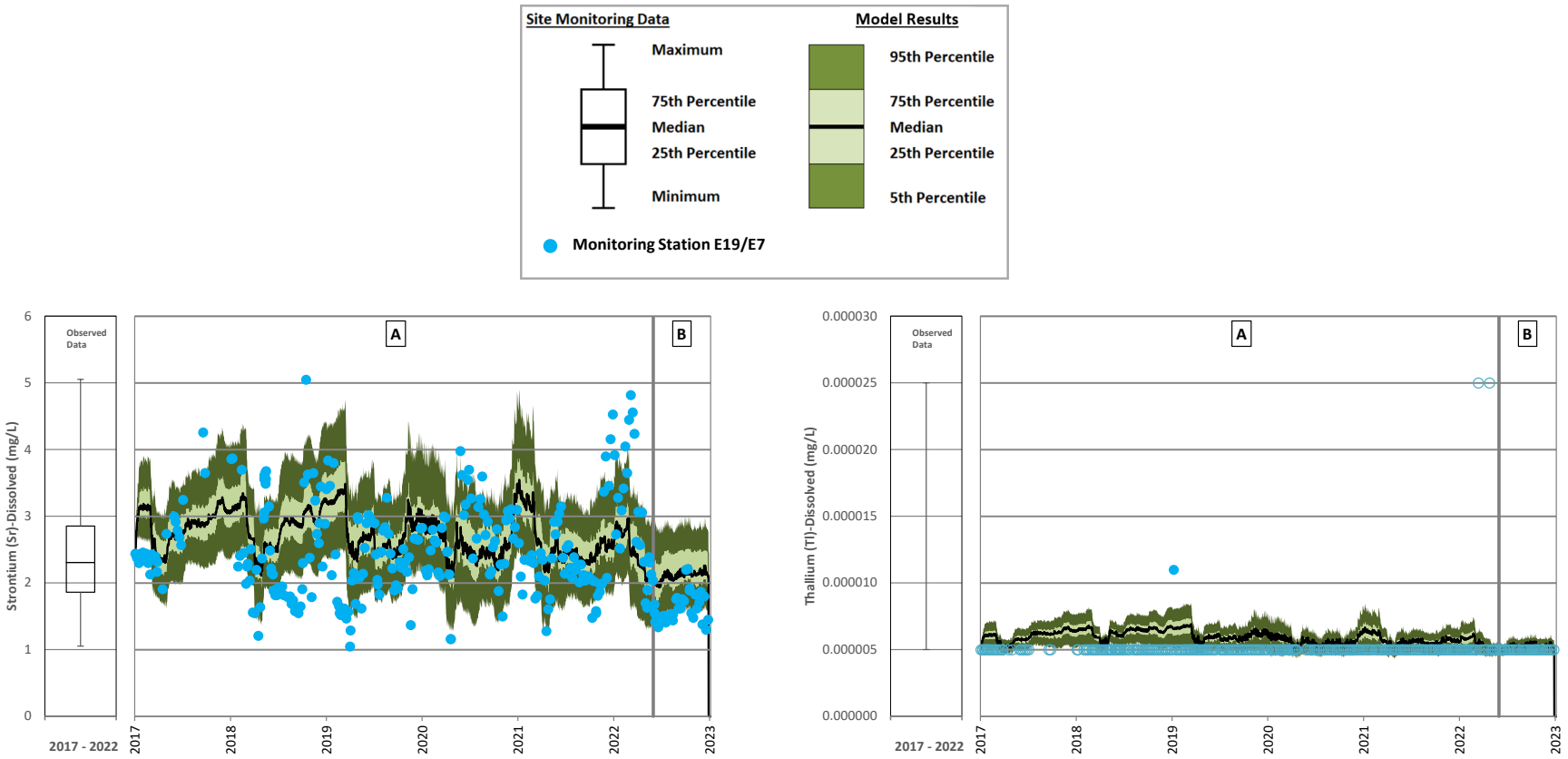

A = Care and Maintanence; B = Resumed Operations

Figure A 117: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Strontium and Dissolved Thallium

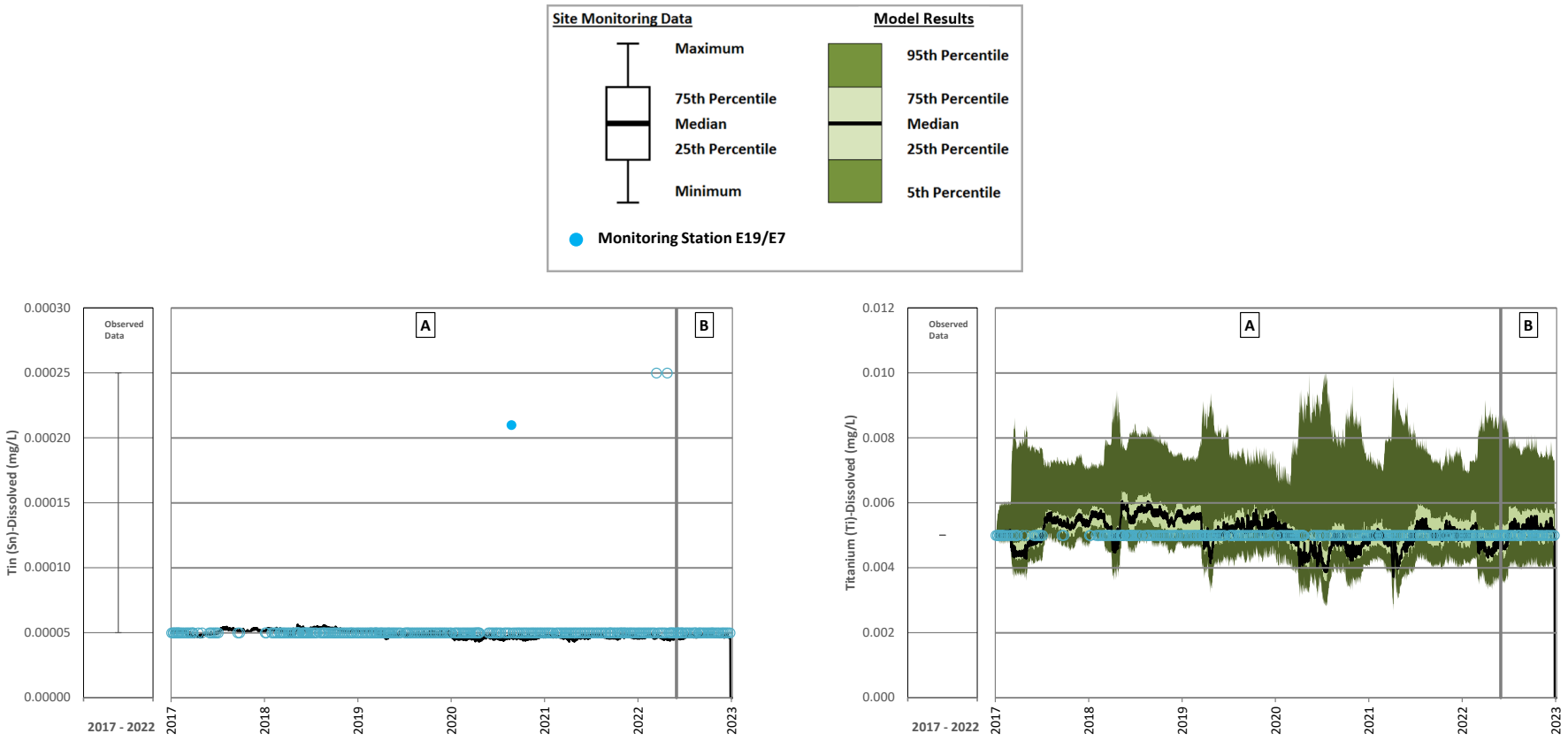

A = Care and Maintanence; B = Resumed Operations

Figure A 118: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Tin and Dissolved Titanium

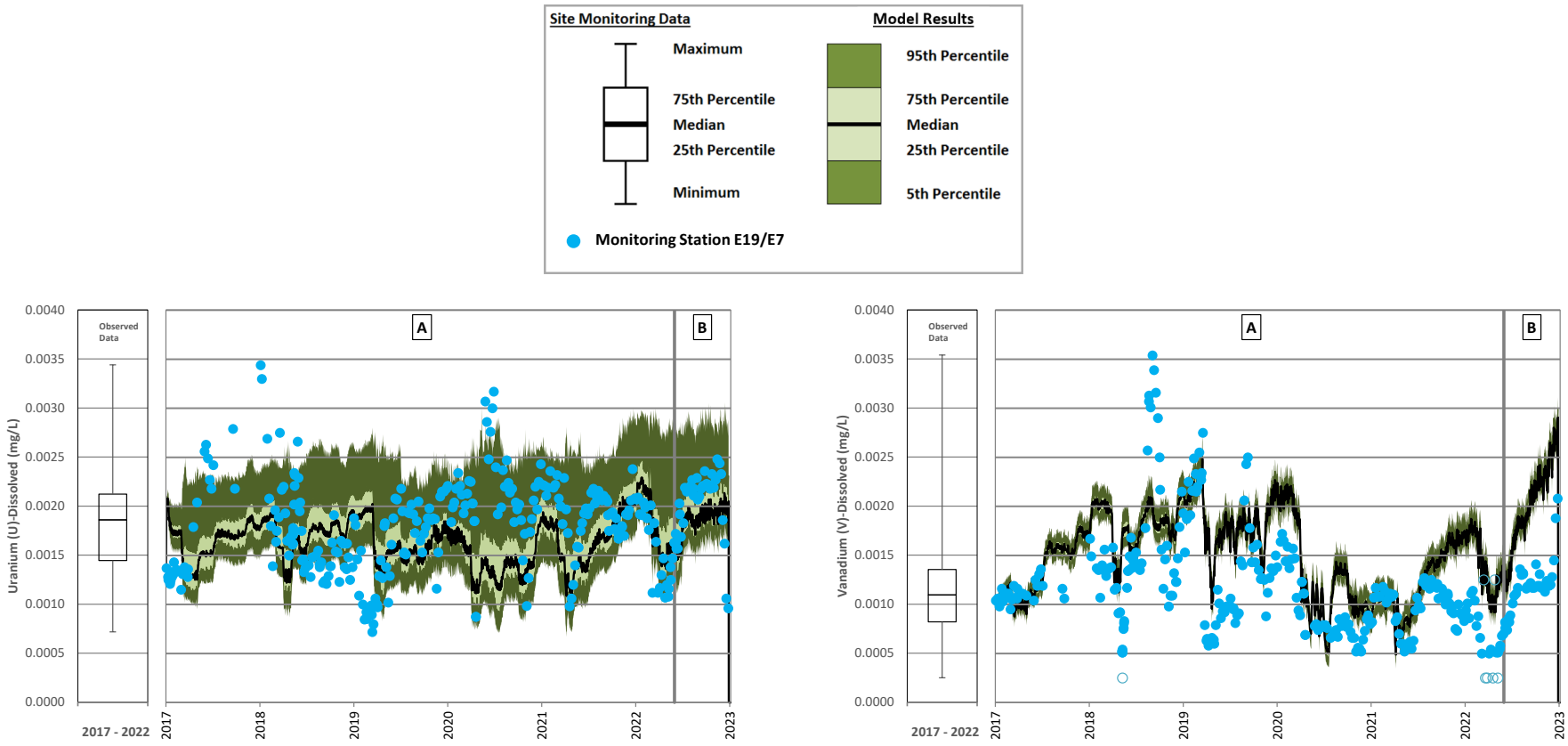

A = Care and Maintanence; B = Resumed Operations

Note: Dissolved Vanadium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 119: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Uranium and Dissolved Vanadium

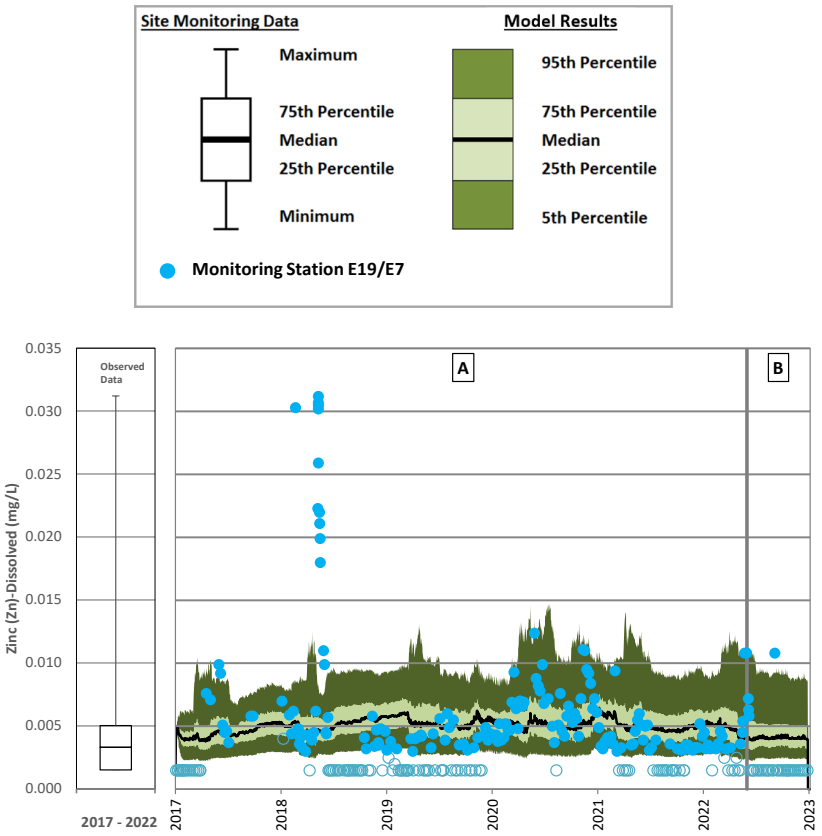

A = Care and Maintanence; B = Resumed Operations

Figure A 120: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Zinc

Northwest Sump Calibration

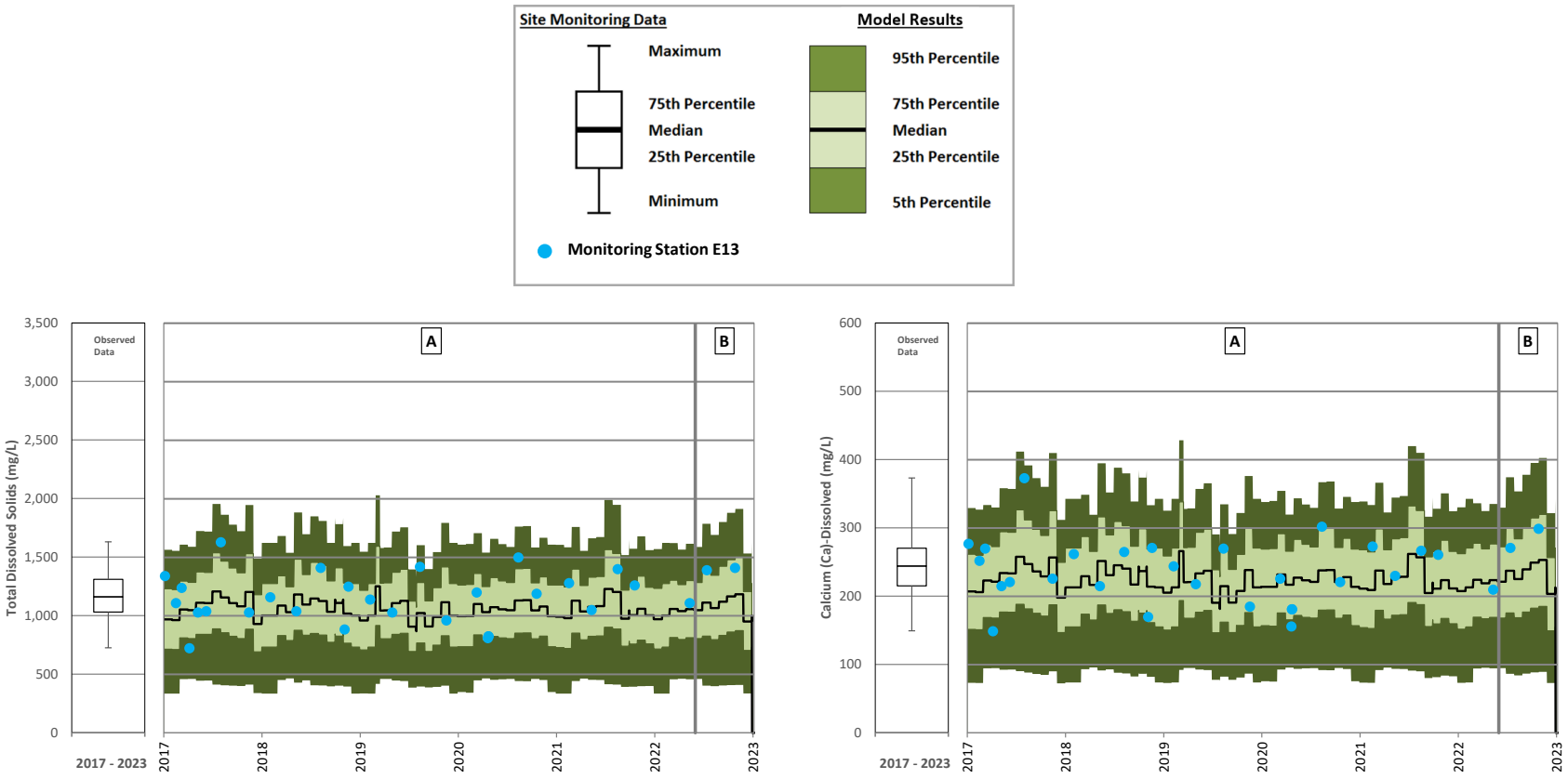

A = Care and Maintanence; B = Resumed Operations

Figure A 121: Northwest Sump Calibration – Total Dissolved Solids and Calcium

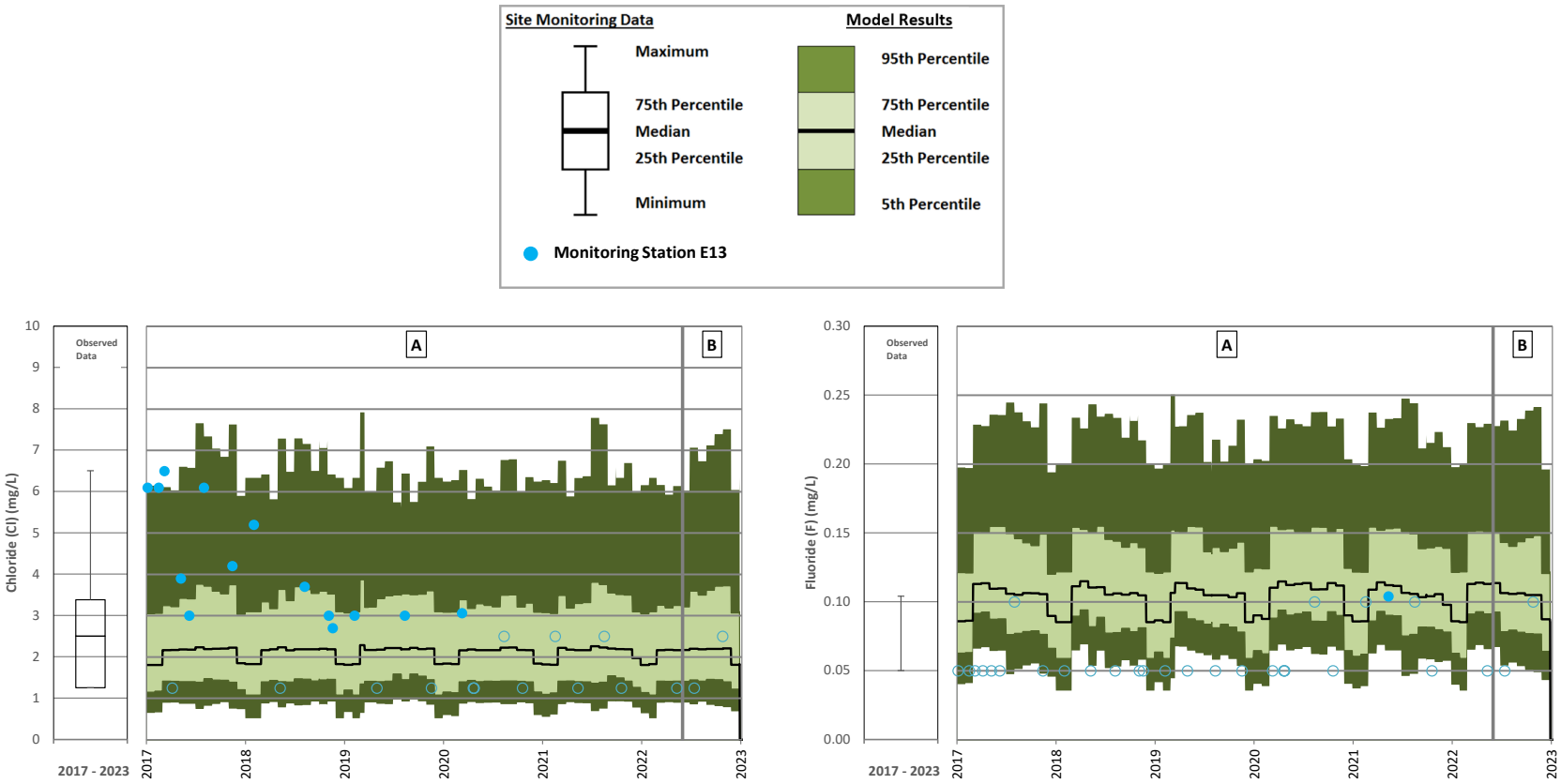

A = Care and Maintanence; B = Resumed Operations

Figure A 122: Northwest Sump Calibration – Chloride and Fluoride

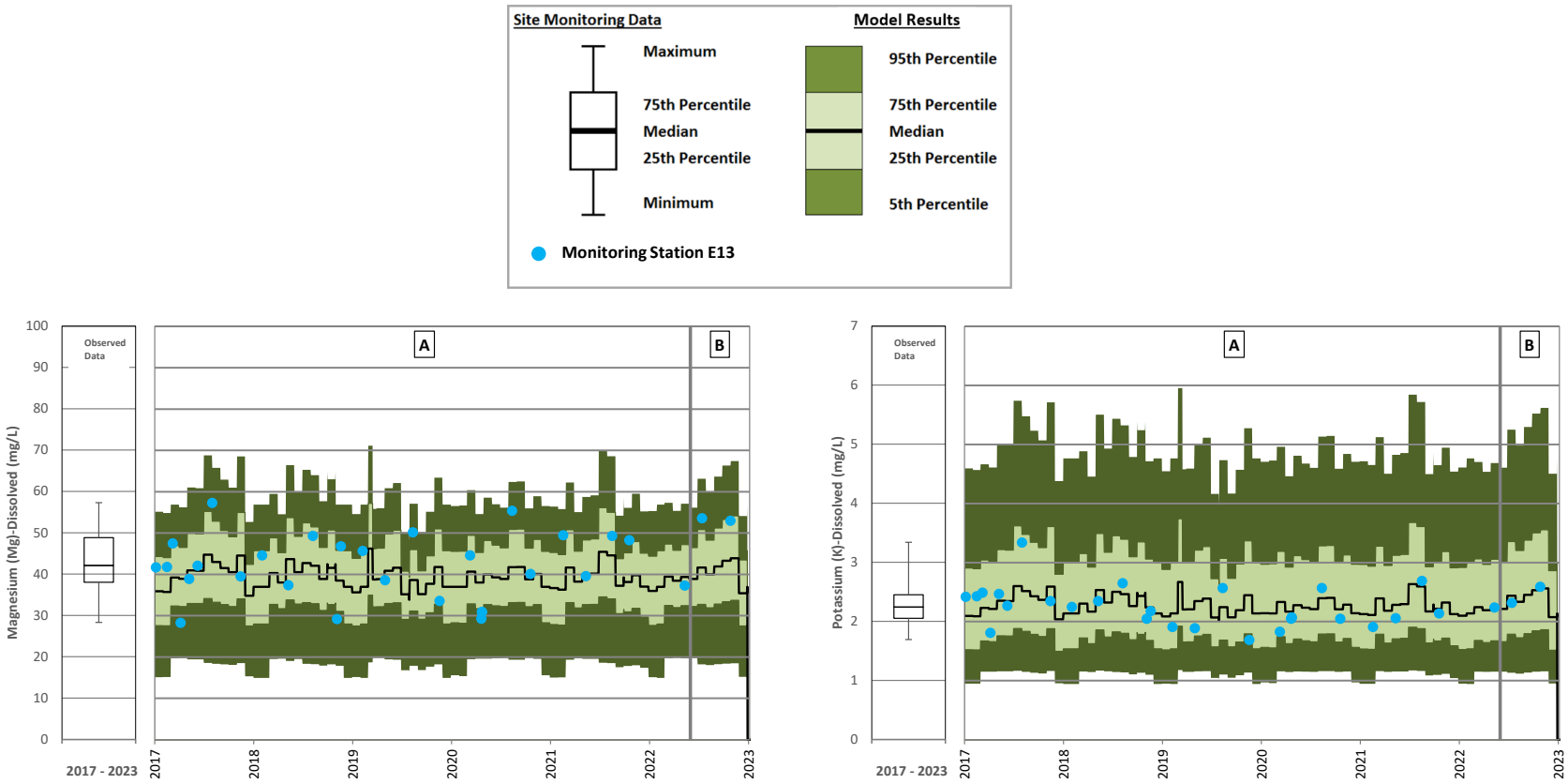

A = Care and Maintanence; B = Resumed Operations

Figure A 123: Northwest Sump Calibration – Magnesium and Potassium

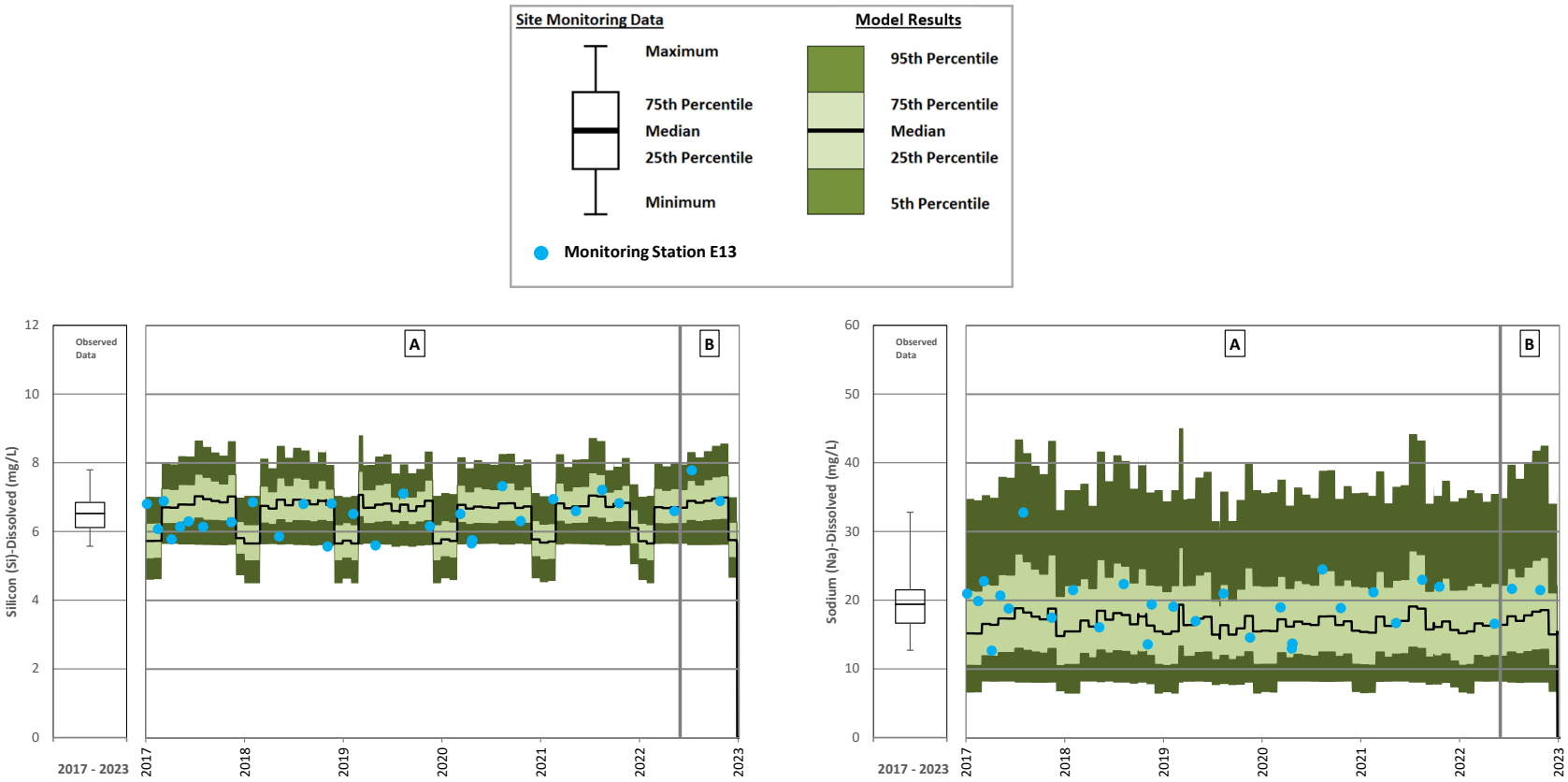

A = Care and Maintanence; B = Resumed Operations

Figure A 124: Northwest Sump Calibration – Silicon and Sodium

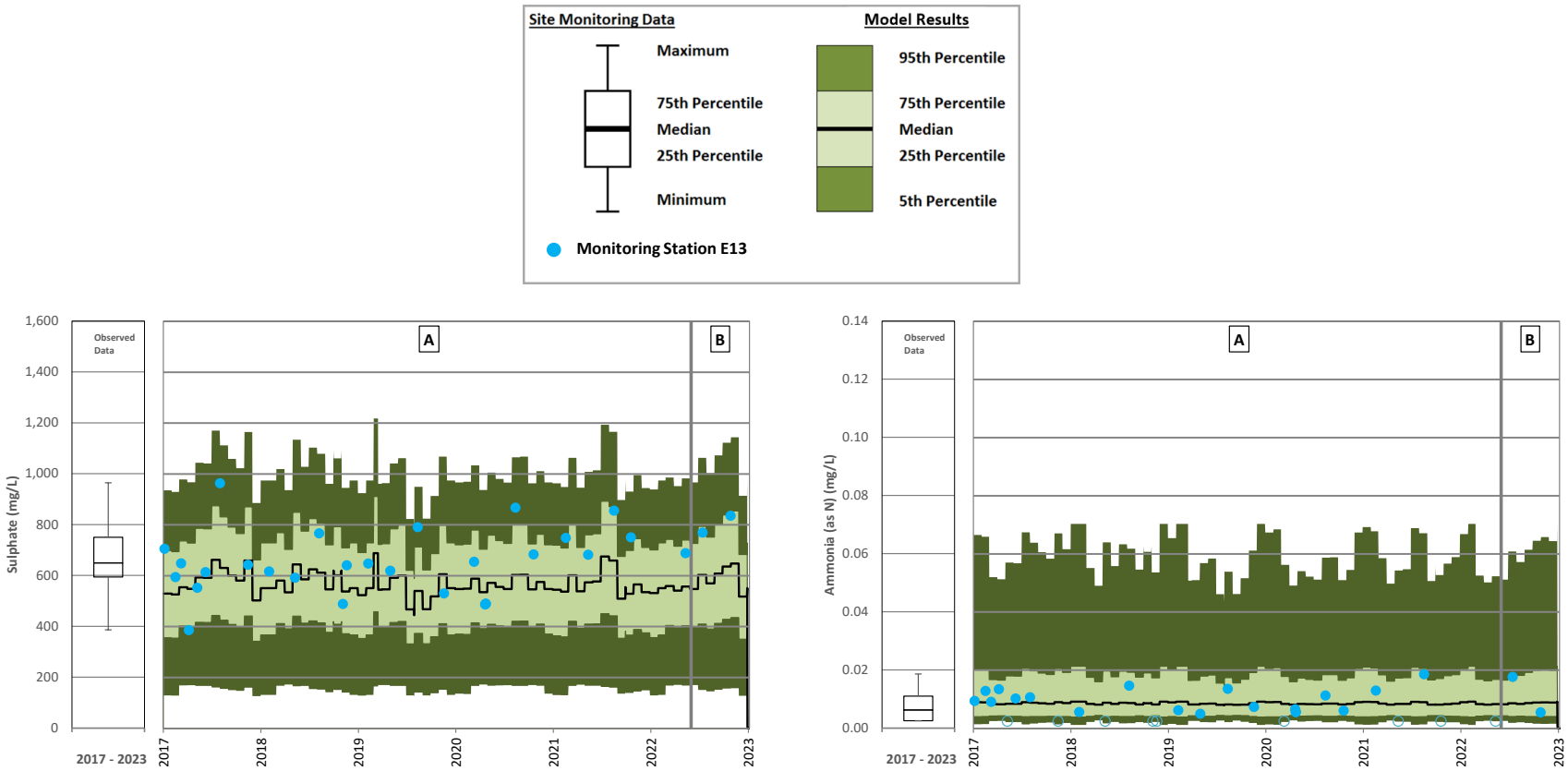

A = Care and Maintanence; B = Resumed Operations

Figure A 125: Northwest Sump Calibration – Sulphate and Total Ammonia

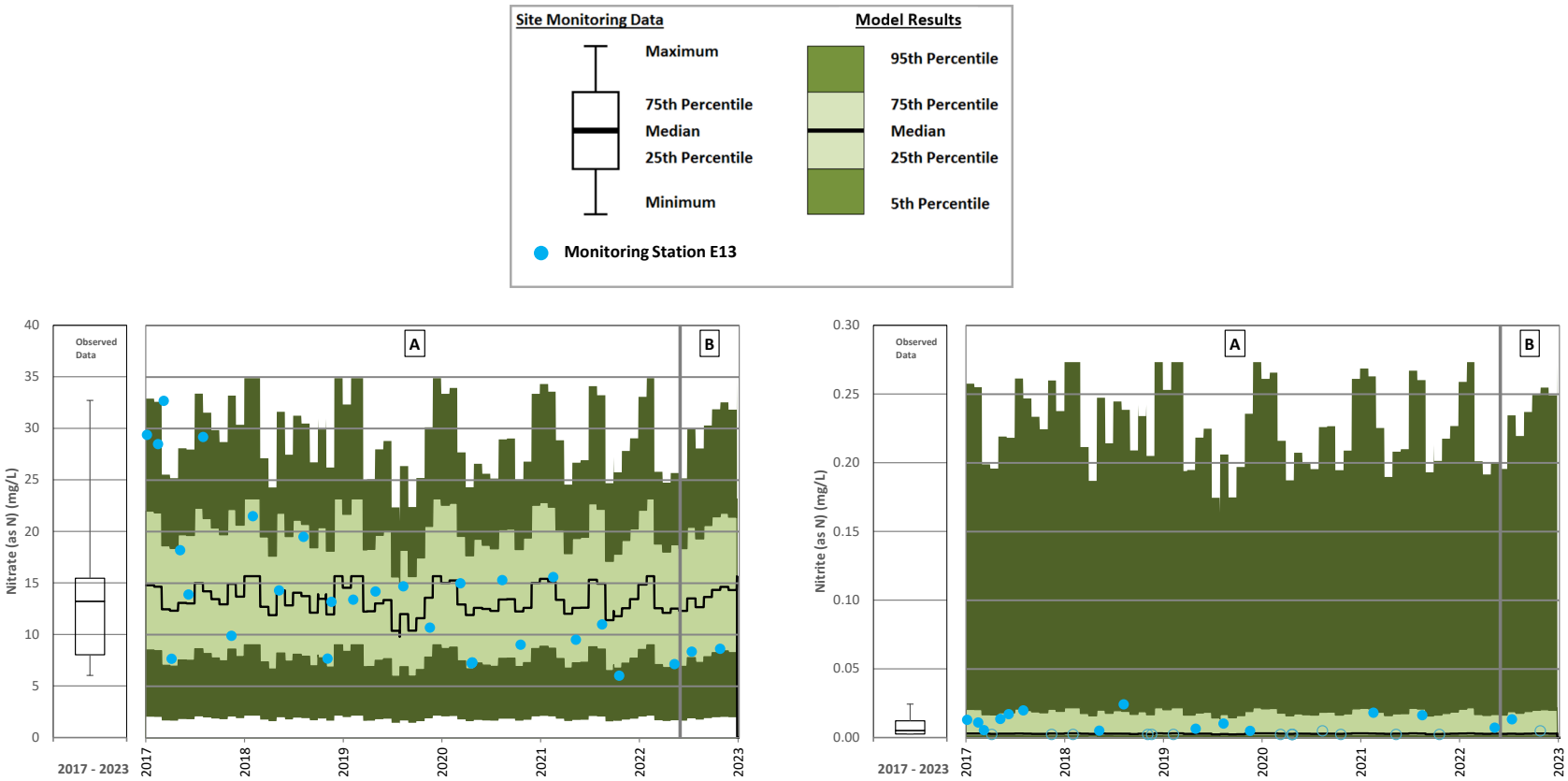

A = Care and Maintanence; B = Resumed Operations

Figure A 126: Northwest Sump Calibration – Nitrate and Nitrite

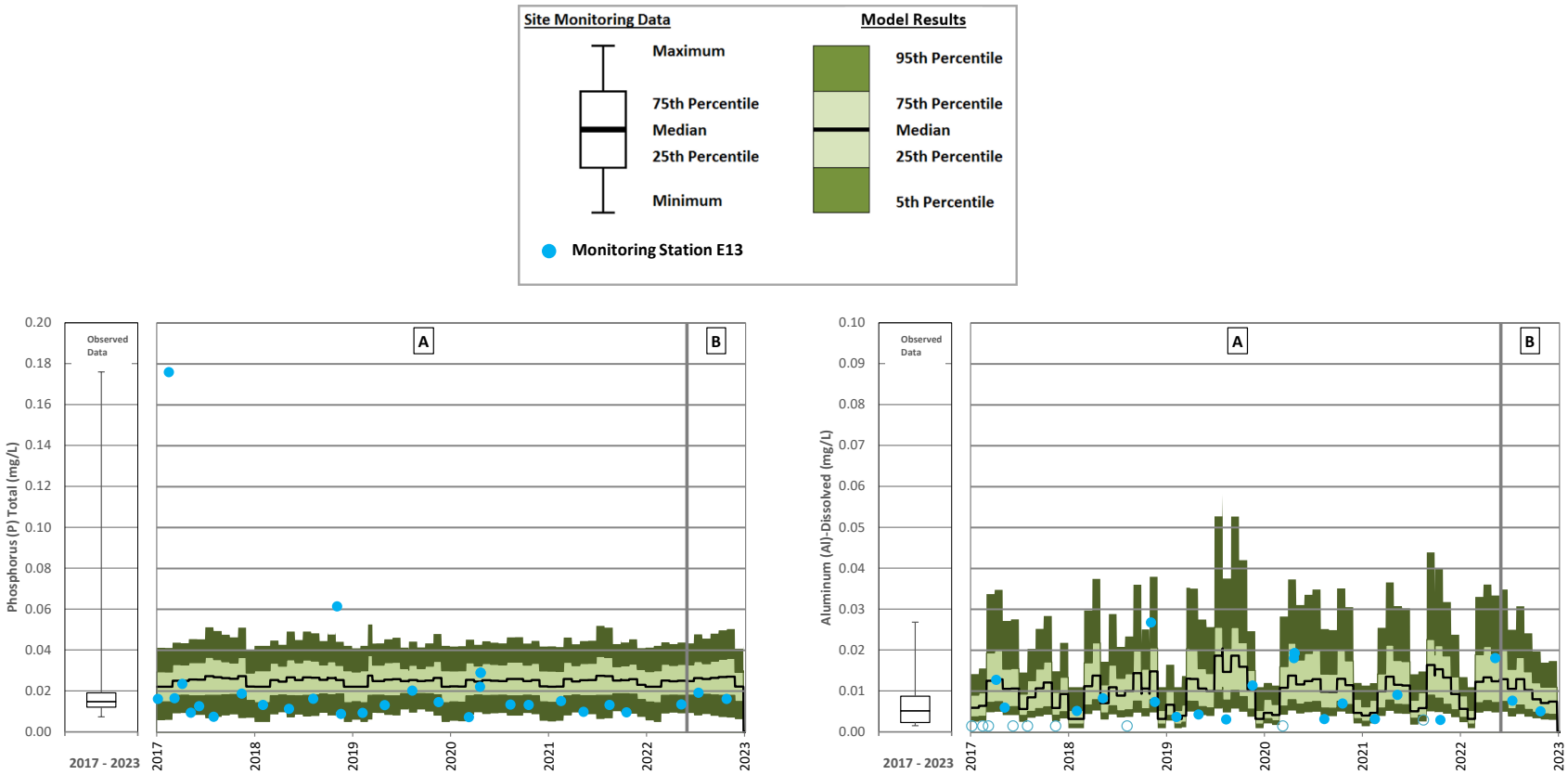

A = Care and Maintanence; B = Resumed Operations

Figure A 127: Northwest Sump Calibration – Total Phosphorus and Dissolved Aluminum

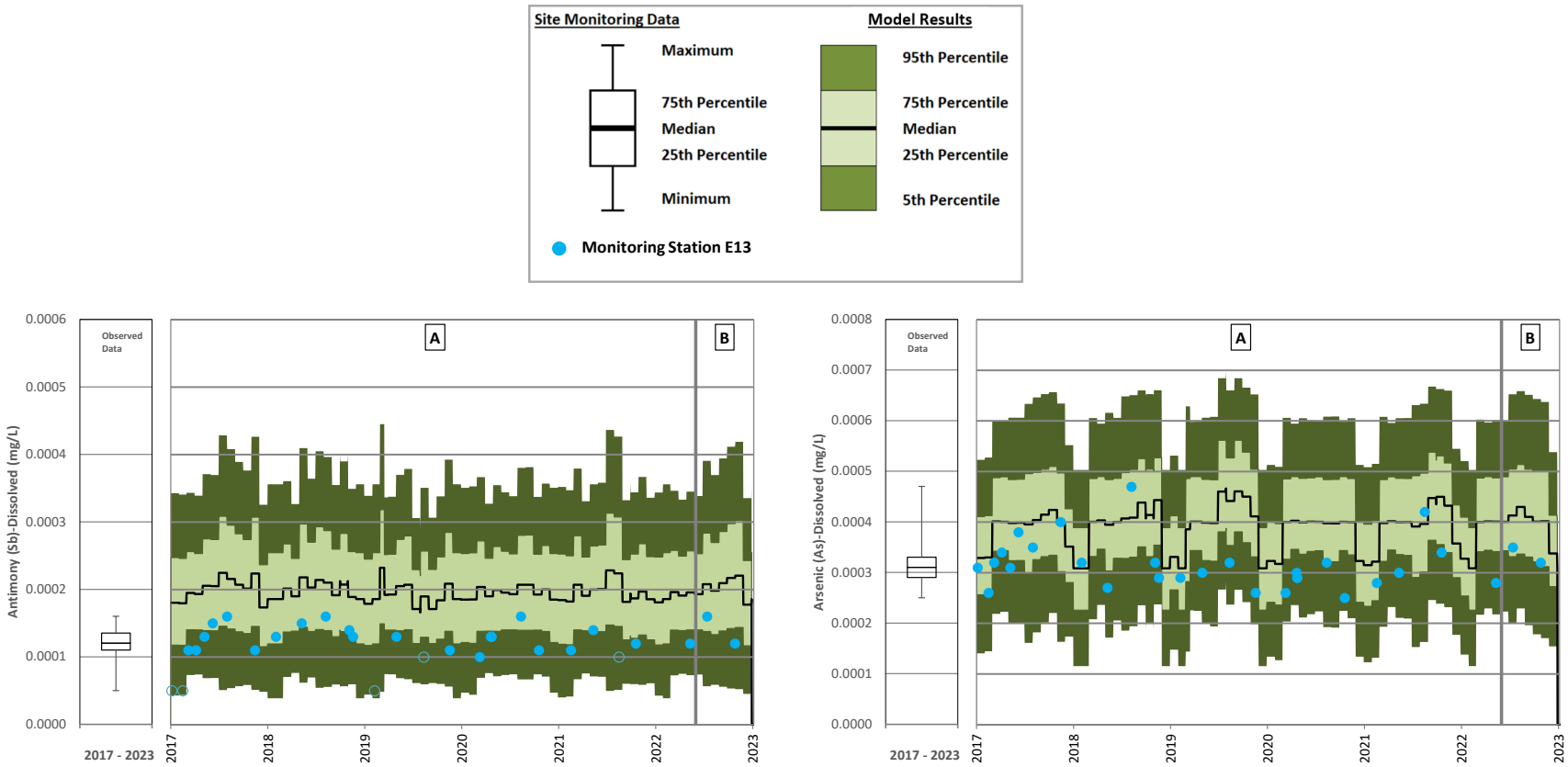

A = Care and Maintanence; B = Resumed Operations

Figure A 128: Northwest Sump Calibration – Dissolved Antimony and Dissolved Arsenic

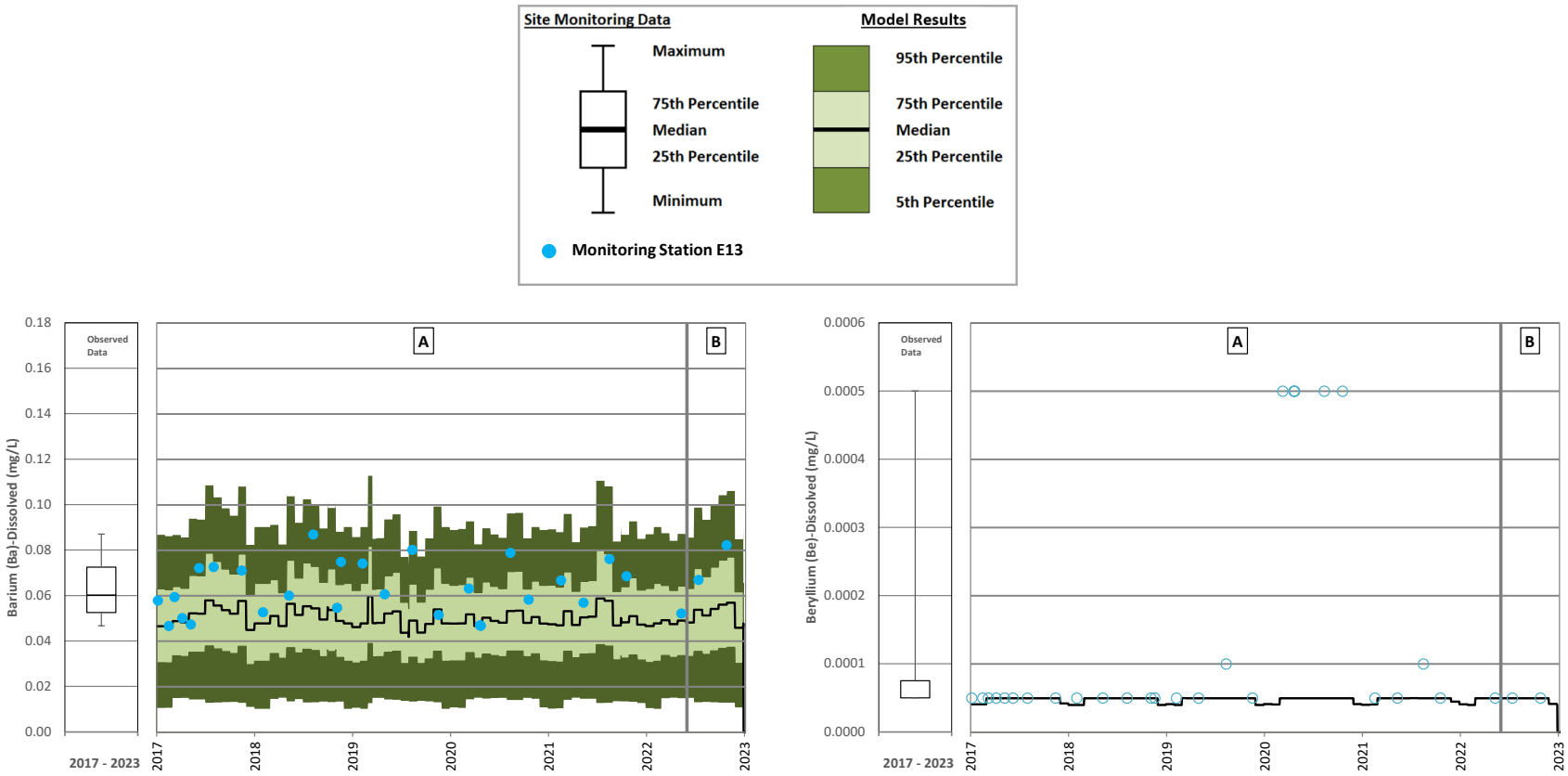

A = Care and Maintanence; B = Resumed Operations

Figure A 129: Northwest Sump Calibration – Dissolved Barium and Dissolved Beryllium

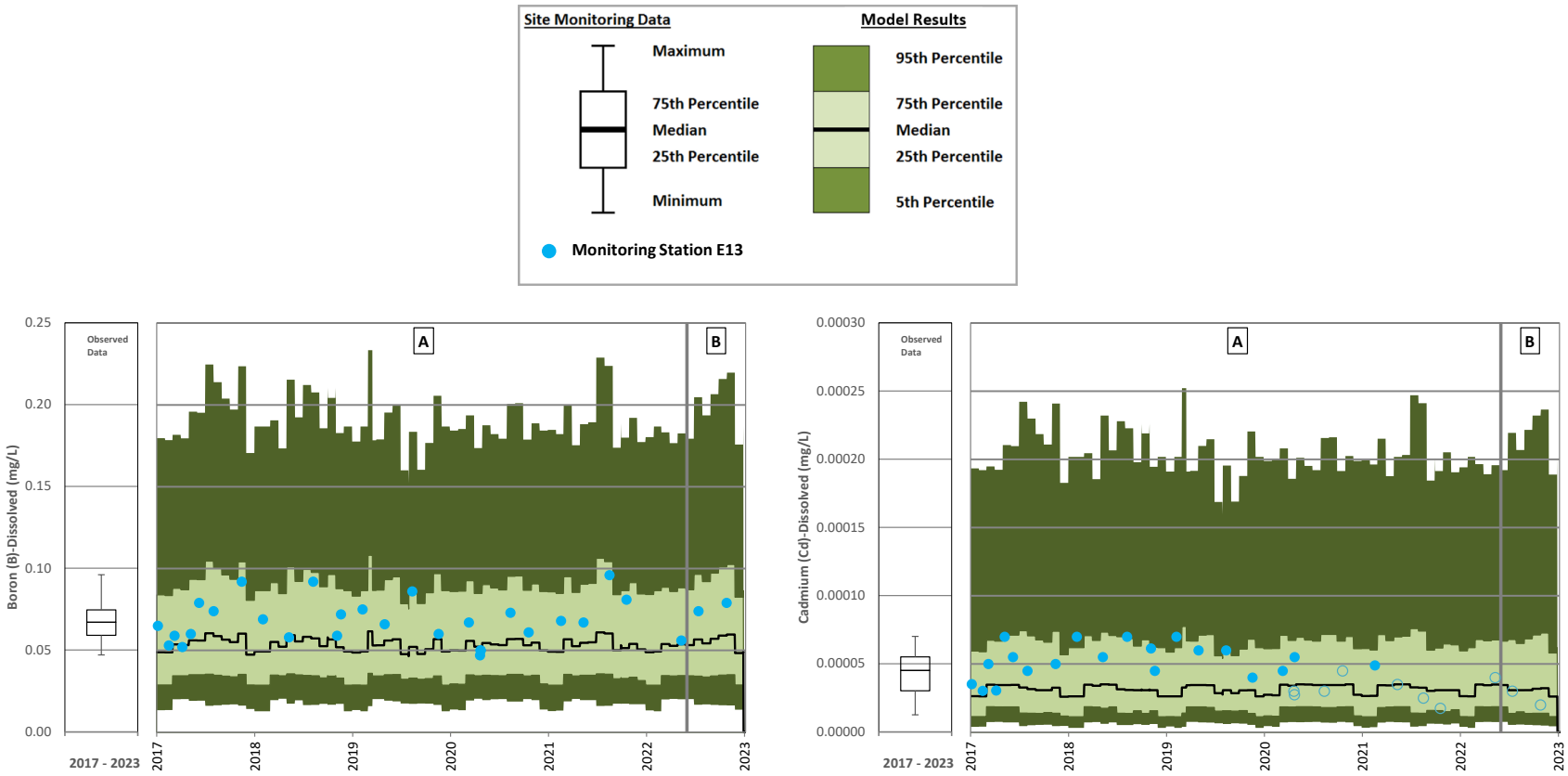

A = Care and Maintanence; B = Resumed Operations

Figure A 130: Northwest Sump Calibration – Dissolved Boron and Dissolved Cadmium

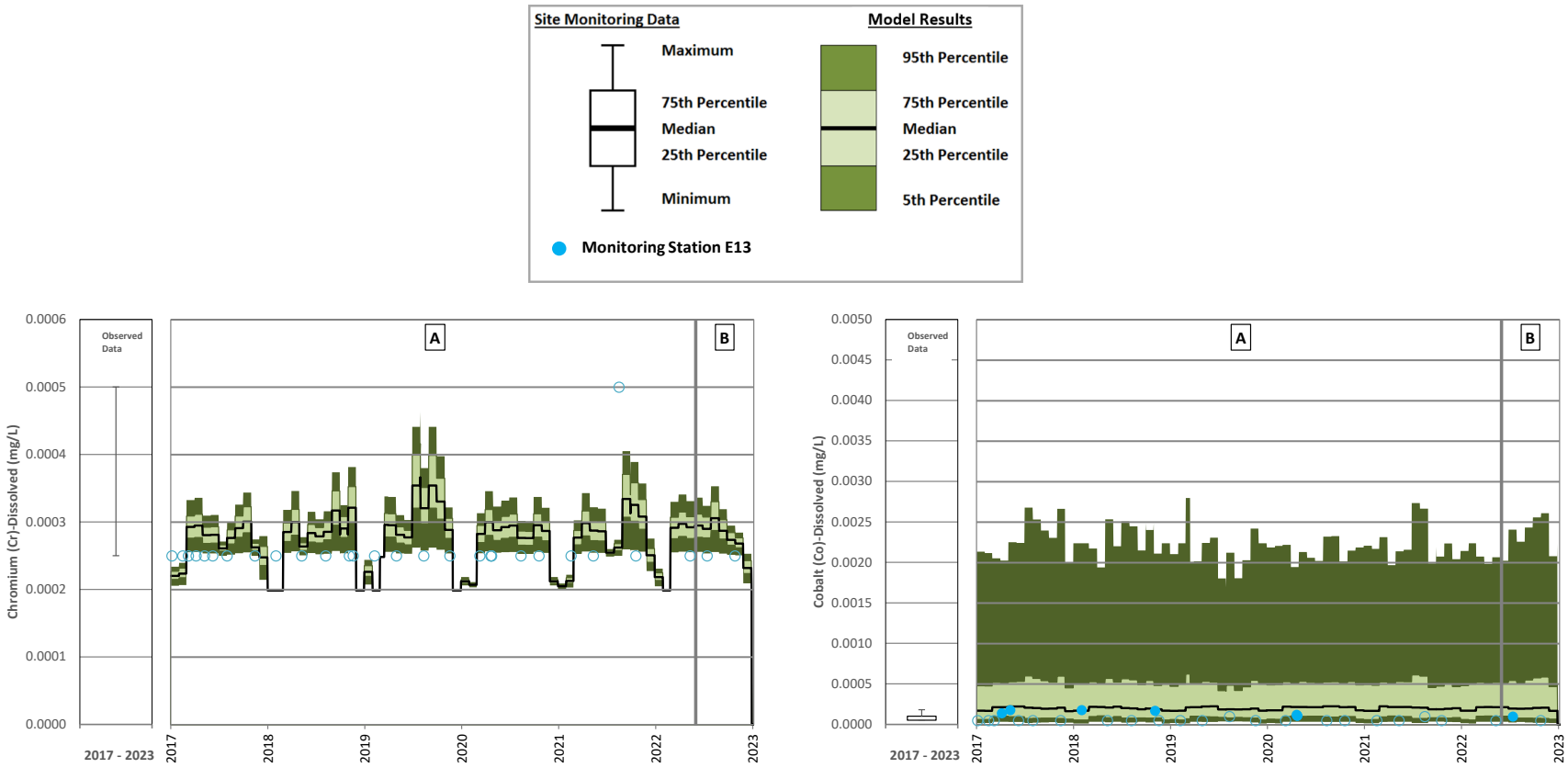

A = Care and Maintanence; B = Resumed Operations

Figure A 131: Northwest Sump Calibration – Dissolved Chromium and Dissolved Cobalt

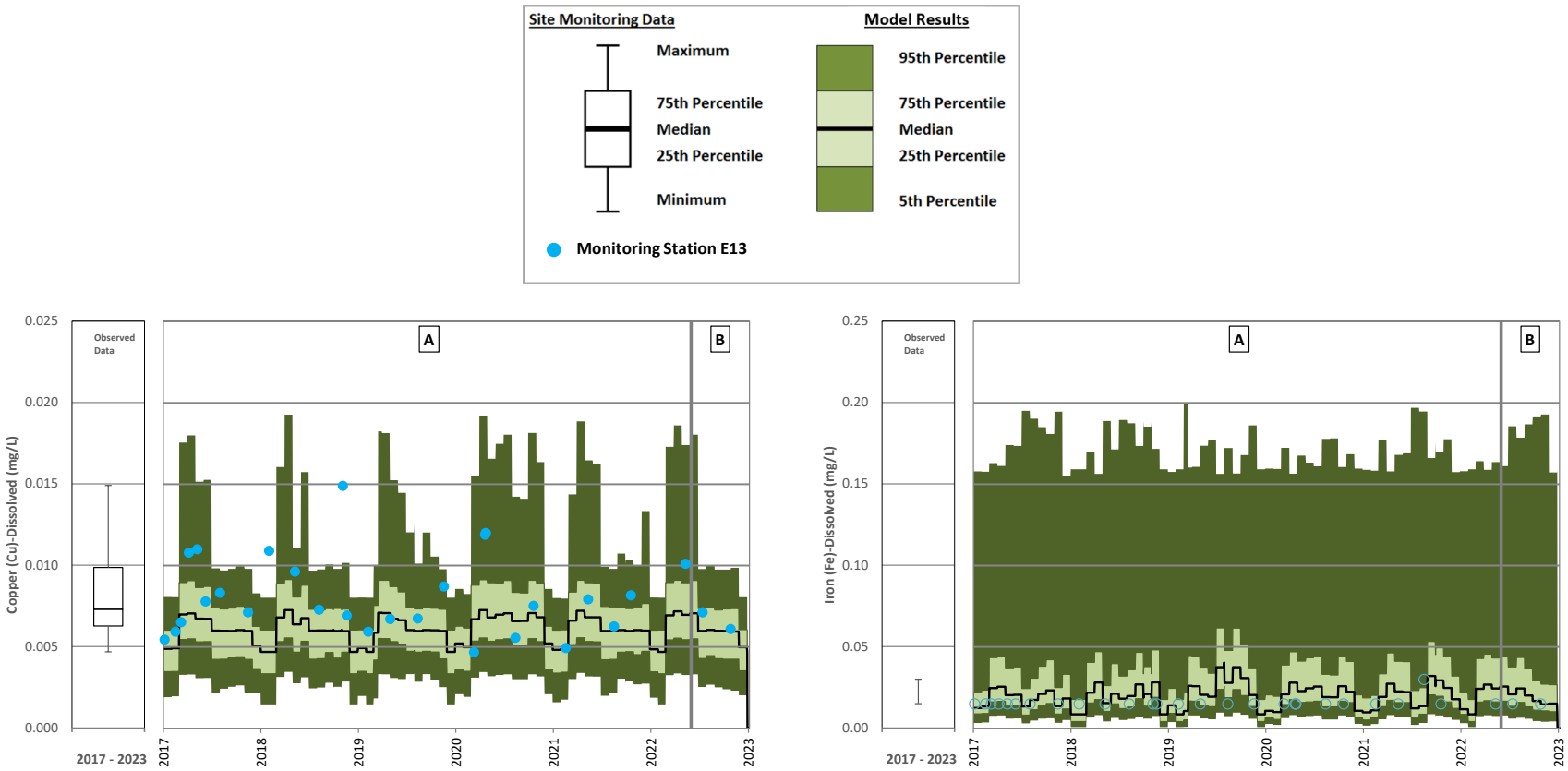

A = Care and Maintanence; B = Resumed Operations

Figure A 132: Northwest Sump Calibration – Dissolved Copper and Dissolved Iron

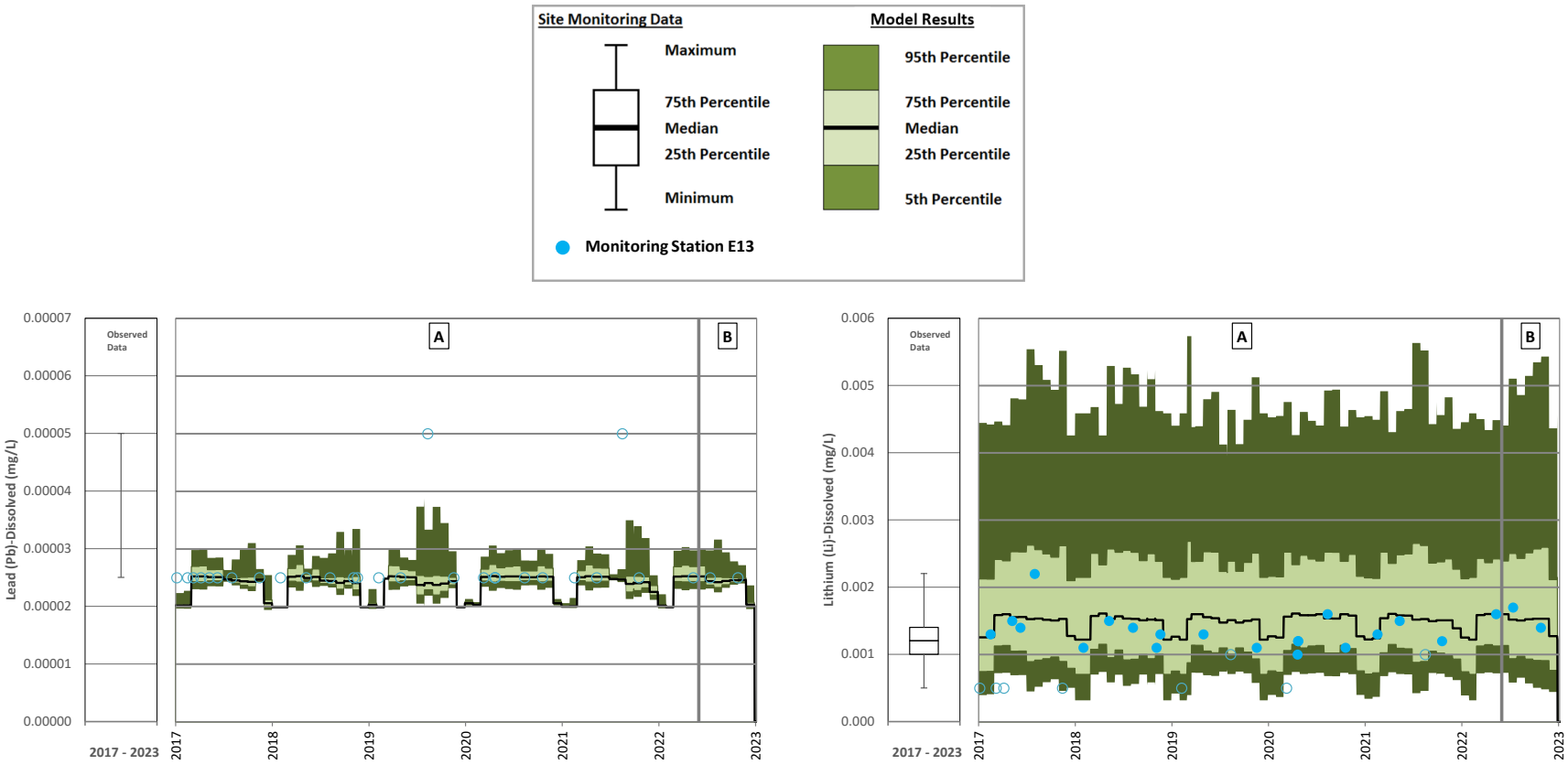

A = Care and Maintanence; B = Resumed Operations

Figure A 133: Northwest Sump Calibration – Dissolved Lead and Dissolved Lithium

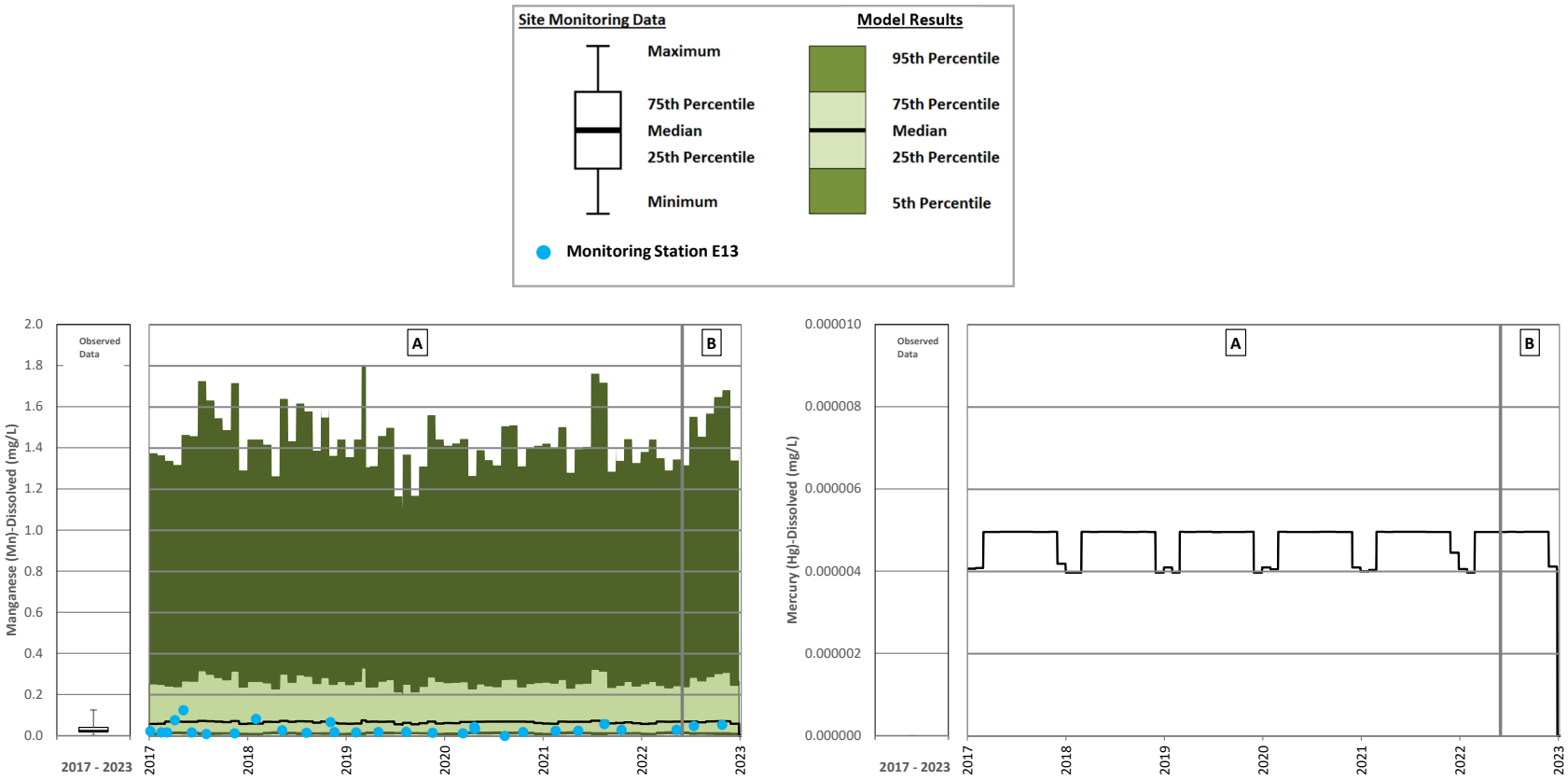

A = Care and Maintanence; B = Resumed Operations

Figure A 134: Northwest Sump Calibration – Dissolved Manganese and Dissolved Mercury

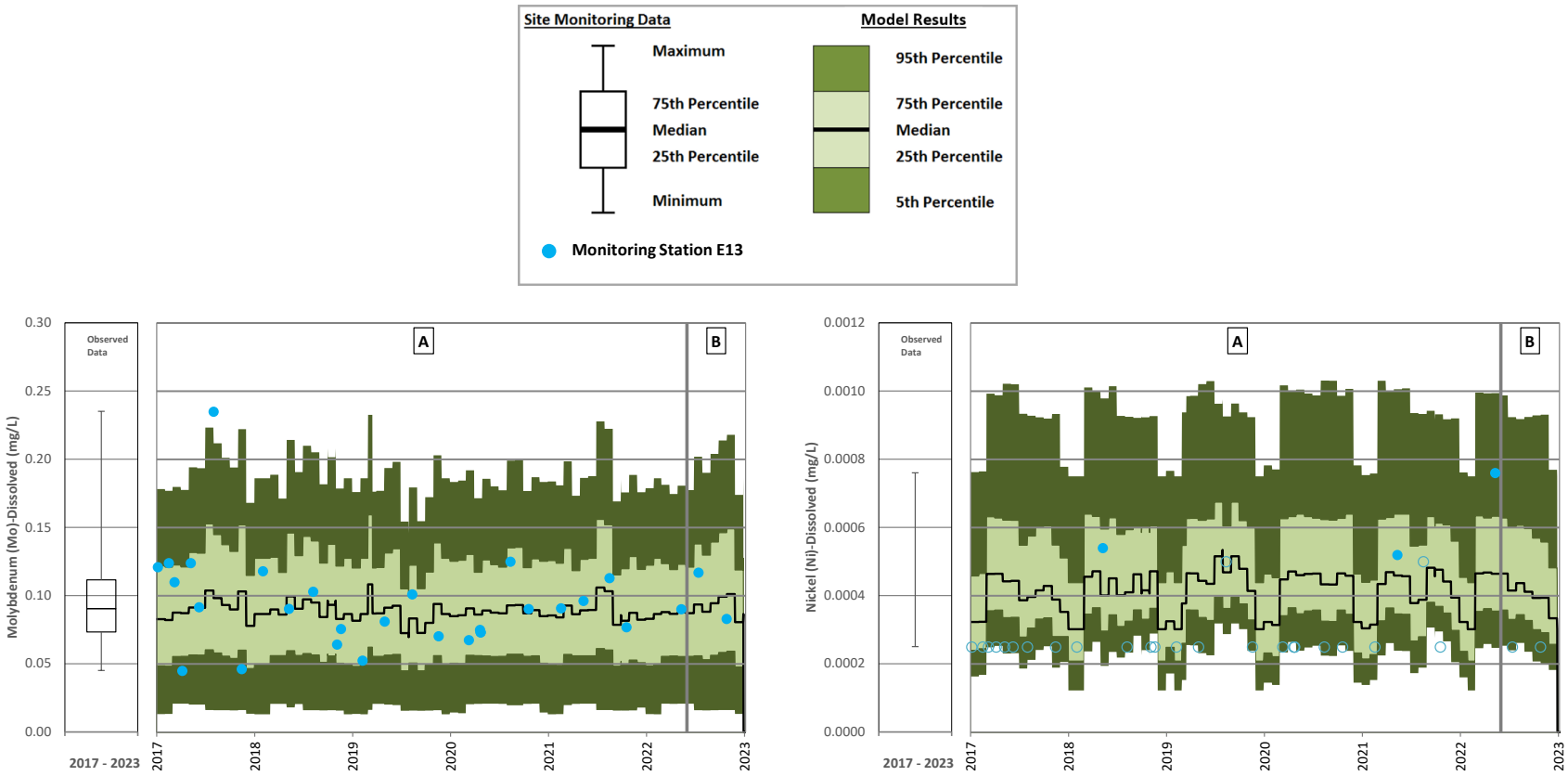

A = Care and Maintanence; B = Resumed Operations

Figure A 135: Northwest Sump Calibration – Dissolved Molybdenum and Dissolved Nickel

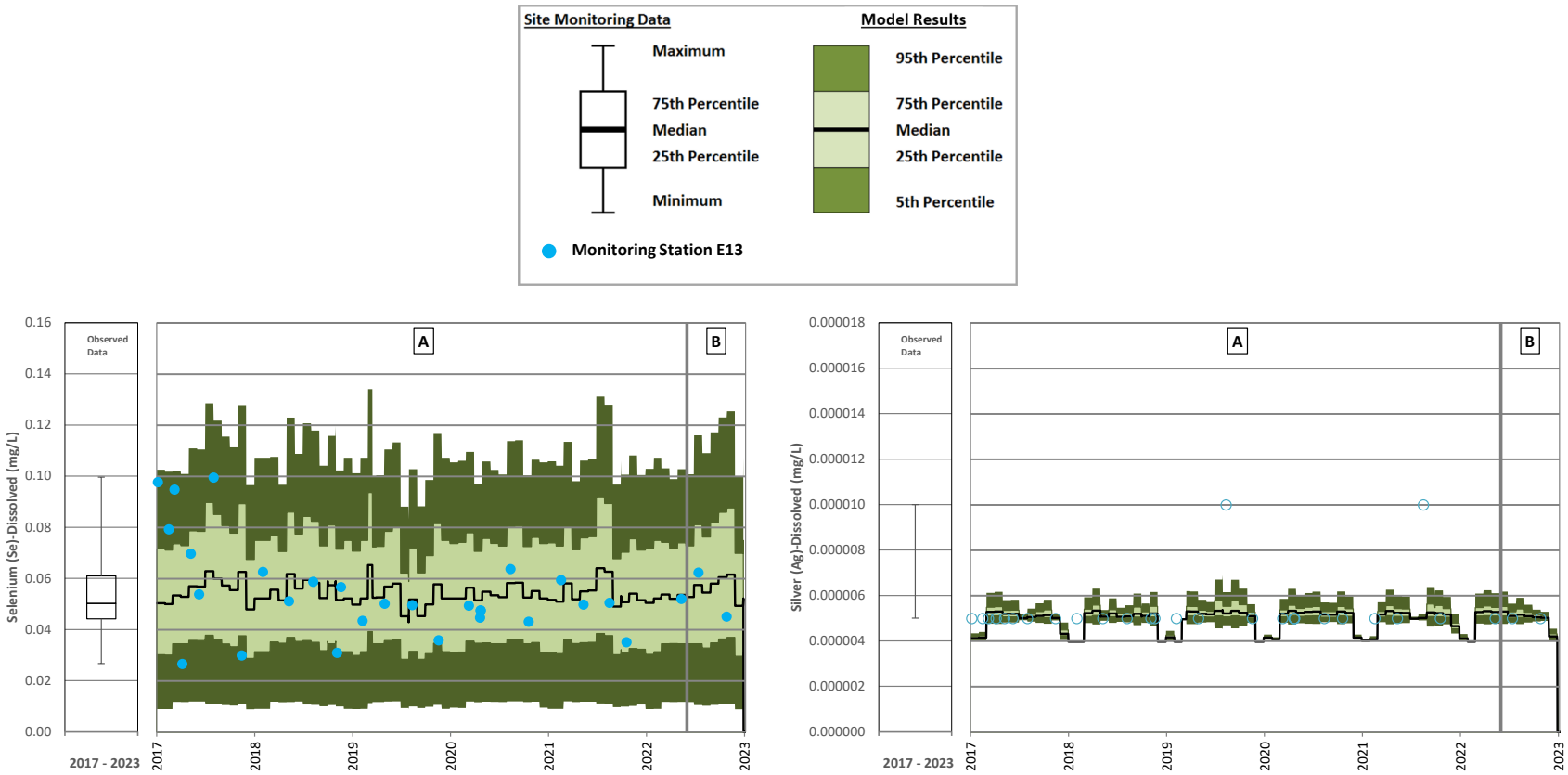

A = Care and Maintanence; B = Resumed Operations

Figure A 136: Northwest Sump Calibration – Dissolved Selenium and Dissolved Silver

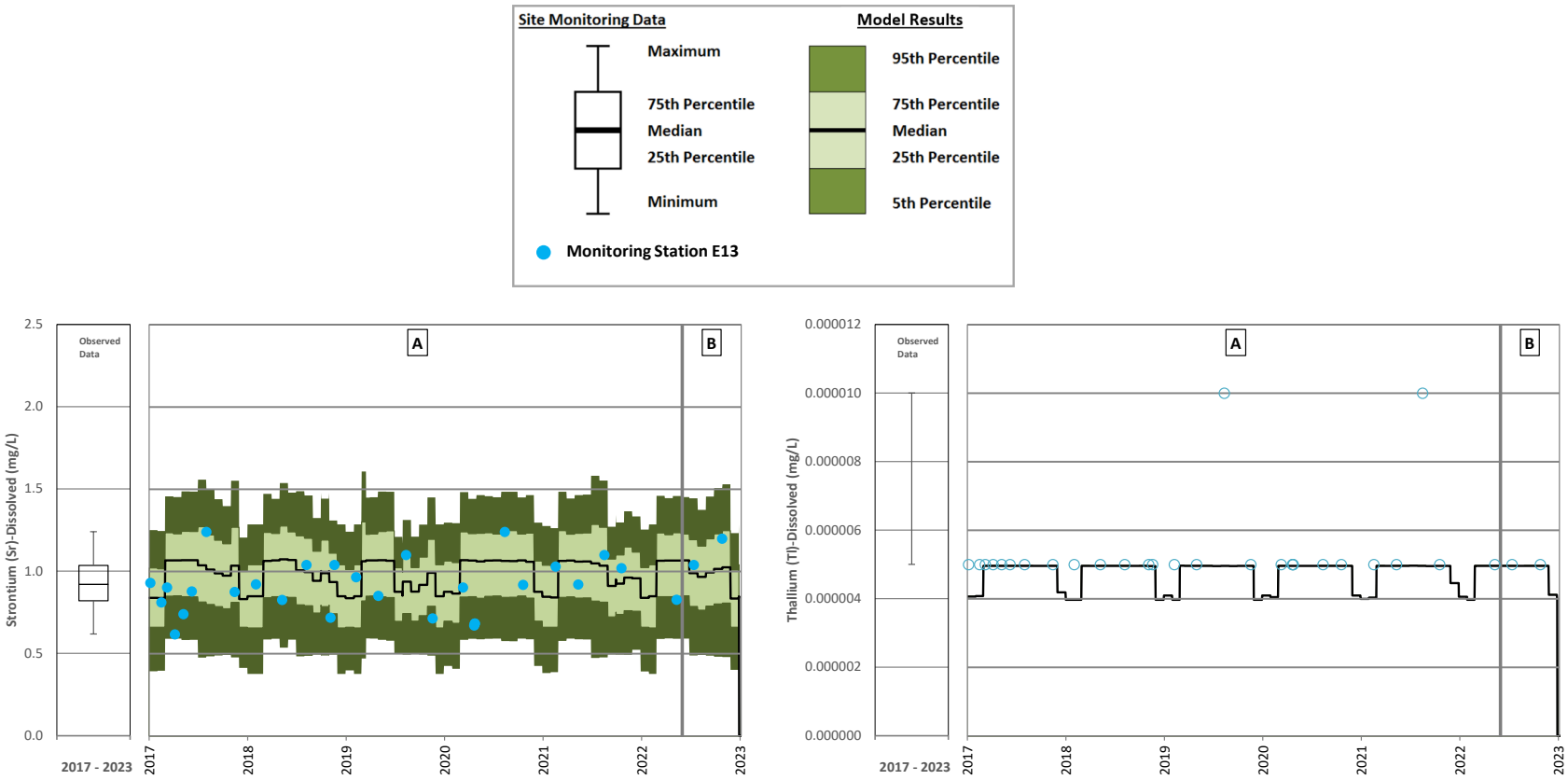

A = Care and Maintanence; B = Resumed Operations

Figure A 137: Northwest Sump Calibration – Dissolved Strontium and Dissolved Thallium

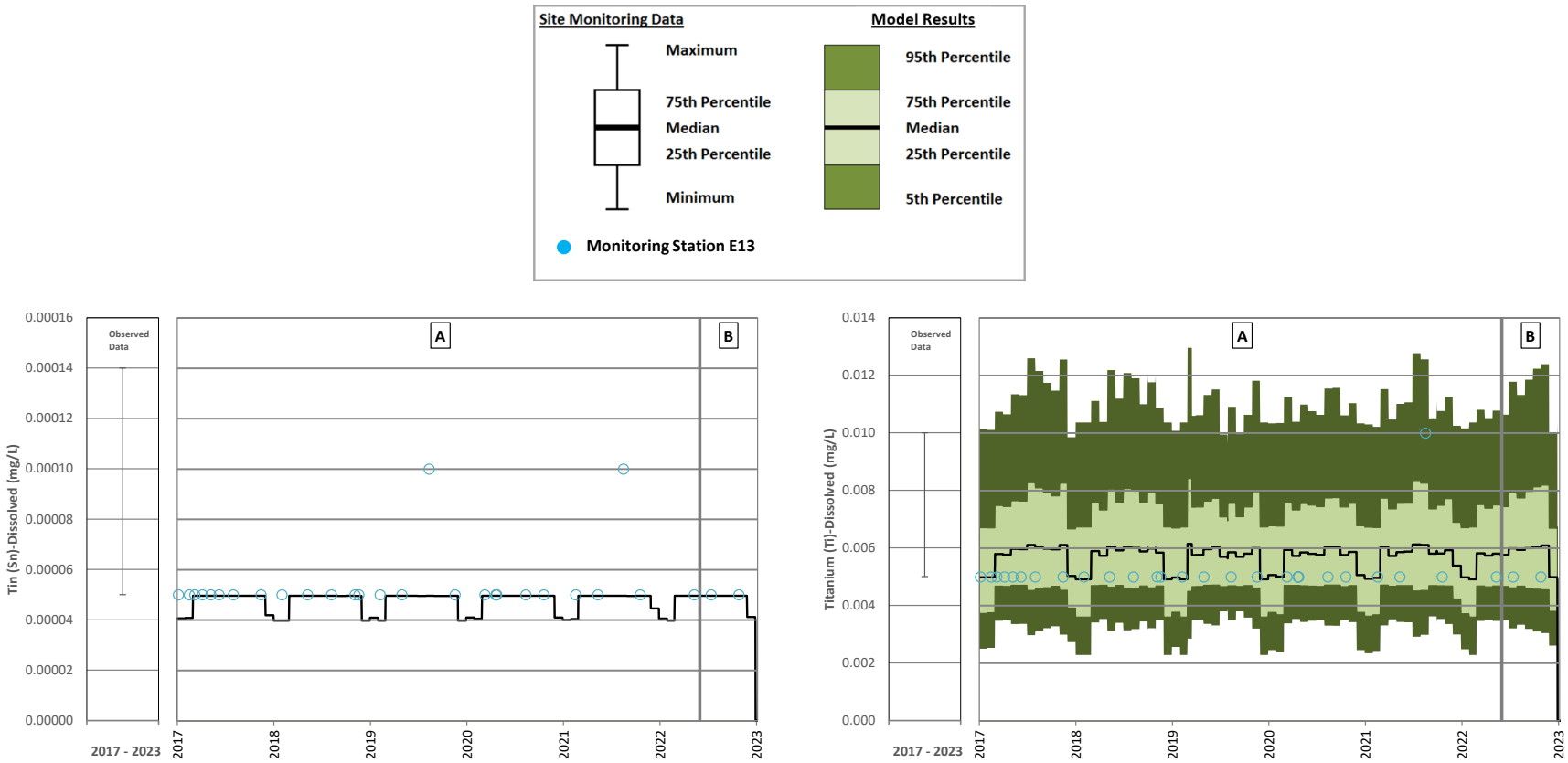

A = Care and Maintanence; B = Resumed Operations

Figure A 138: Northwest Sump Calibration – Dissolved Tin and Dissolved Titanium

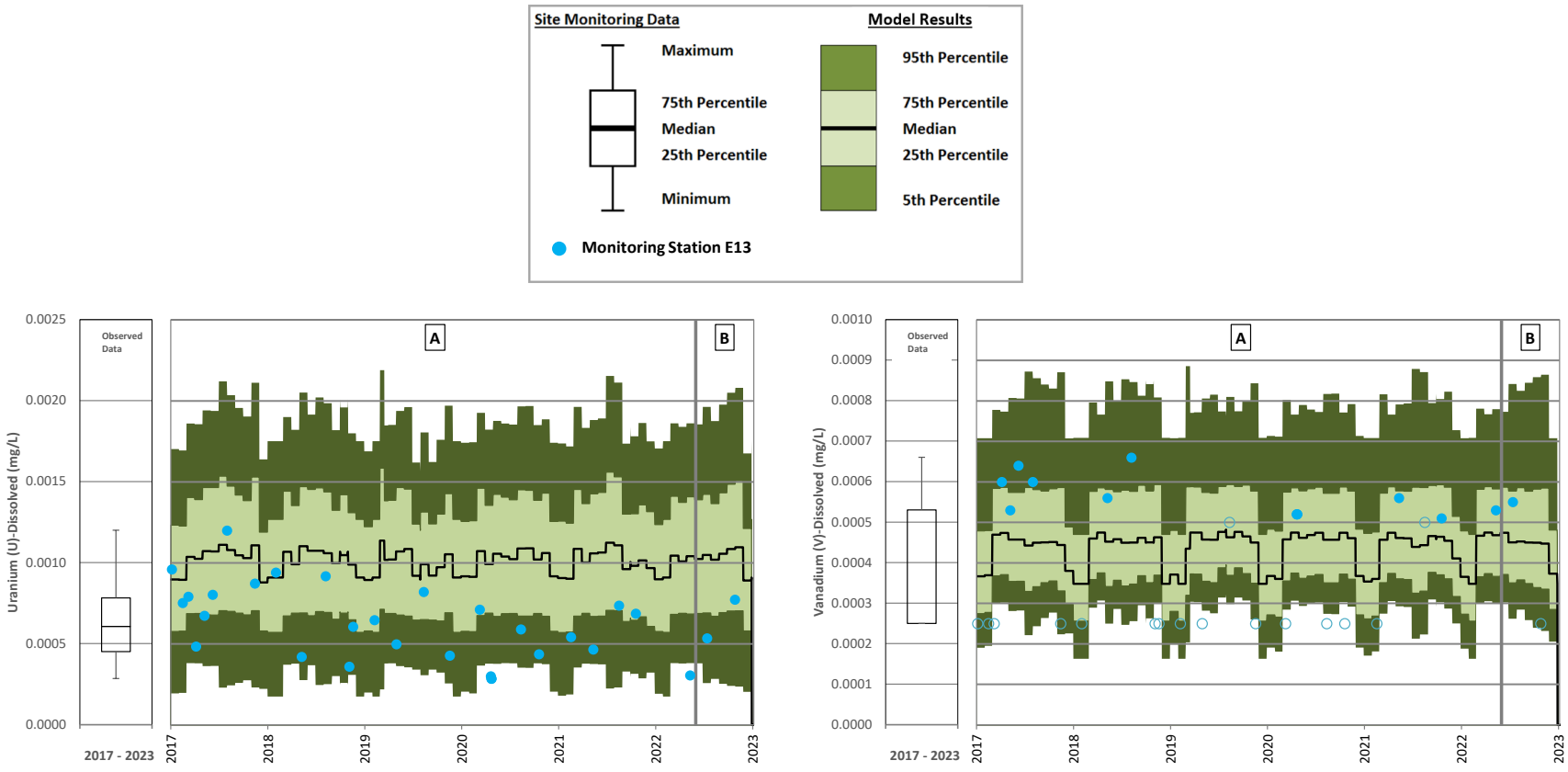

A = Care and Maintanence; B = Resumed Operations

Figure A 139: Northwest Sump Calibration – Dissolved Uranium and Dissolved Vanadium

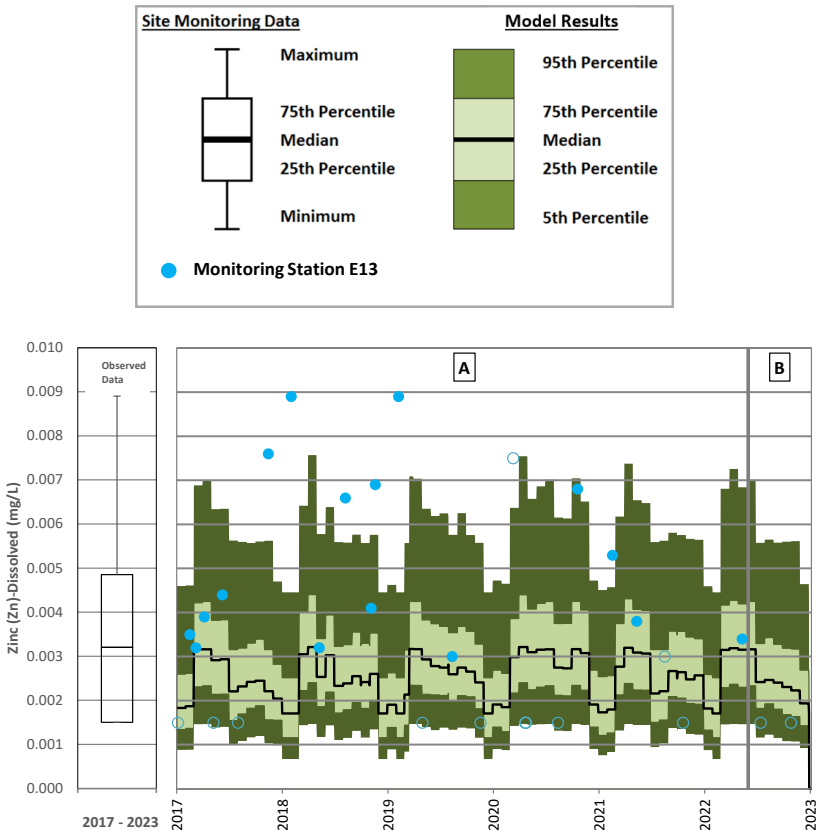

A = Care and Maintanence; B = Resumed Operations

Figure A 140: Northwest Sump Calibration – Dissolved Zinc

APPENDIX B

Water Quality Model Results - Operations, Closure and Post-closure

APPENDIX

Appendix B

Water Quality Model Results - Operations, Closure and Post-closure

Reference No. 23590671-053-R-Rev0-31282

December 2023

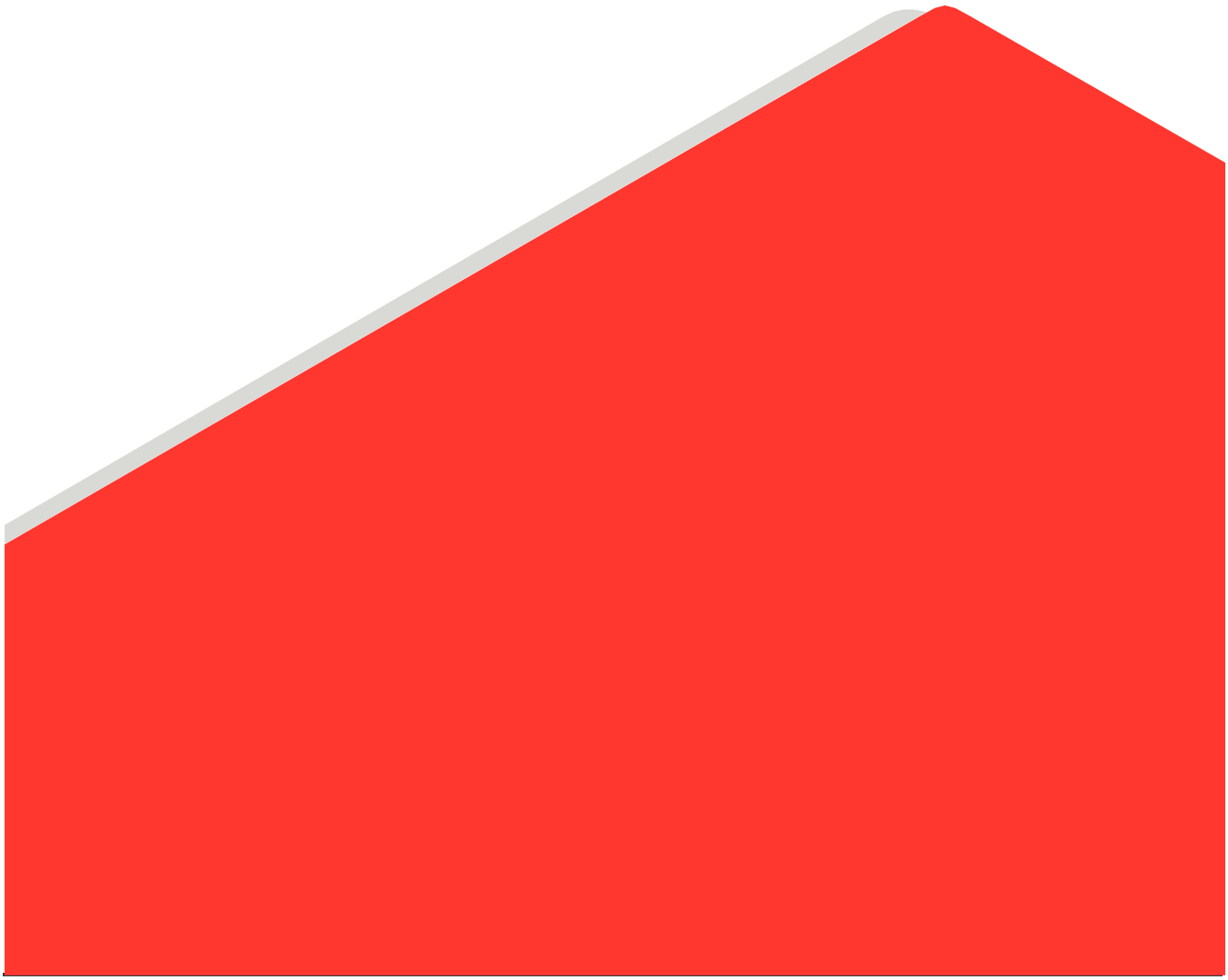

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Appendix B – Water Quality Figure B s

This attachment presents the water quality results Figure B s for Springer Pit, Cariboo Pit, Springer-Cariboo Pit, Wight Pit, the Central Collection Sump, the Tailings Storage Facility, the Perimeter Embankment Till Borrow Pond the 9K Sump, the Northwest Sump and Long Ditch. The operations period is from January 2024 to December 2024. The closure period is from January 2035 to December 2045. The post-closure period is from January 2045 to January 2135.

Model Results for Springer Pit and Cariboo Pit are only presented for the operations period. The model results for the combined Springer-Cariboo Pit are presented for closure and post-closure.

Springer Pit Operations

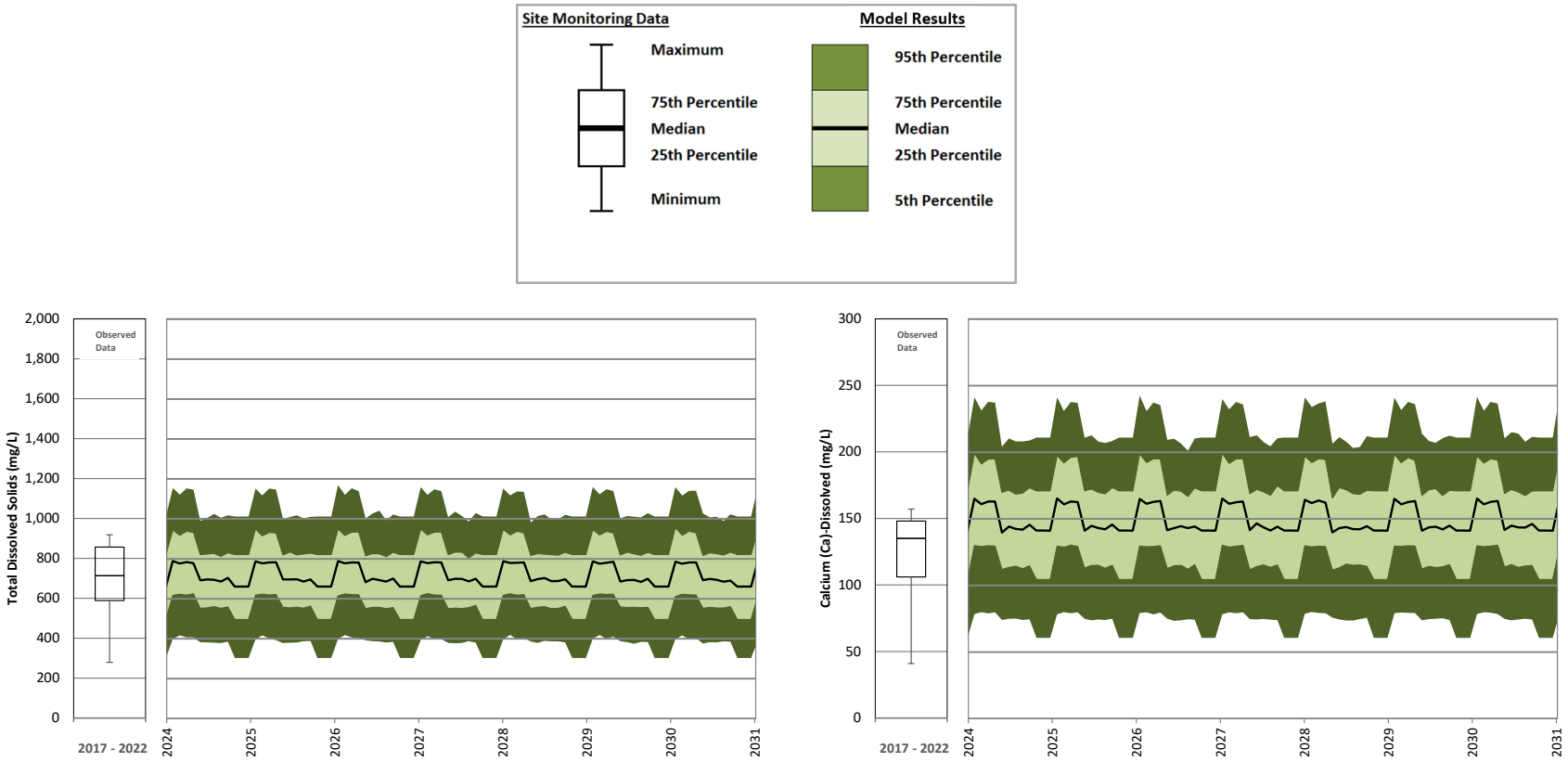

Figure B **1: Springer Pit Operations – Total Dissolved Solids and Calcium**

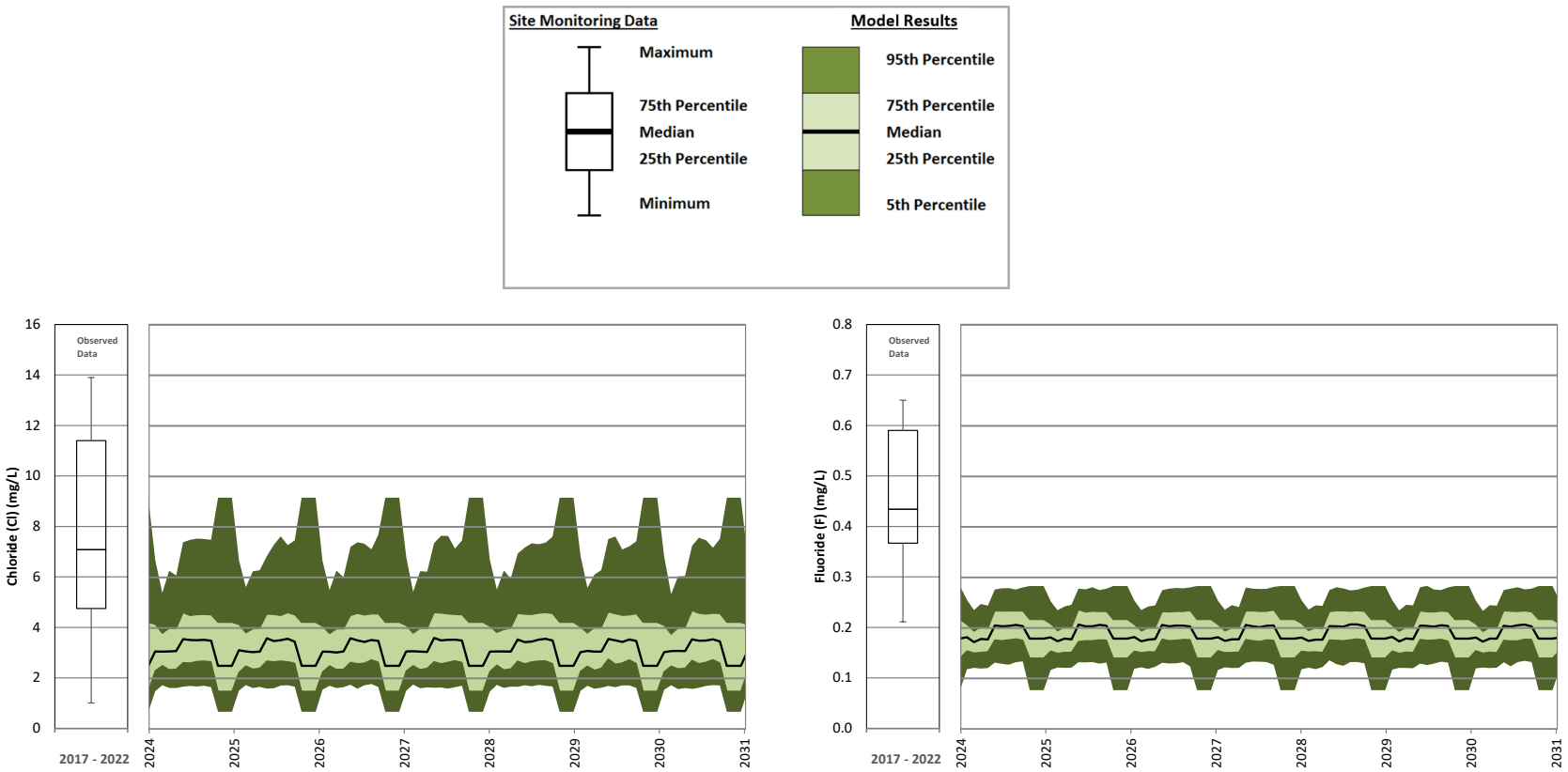

Figure B **2: Springer Pit Operations – Chloride and Fluoride**

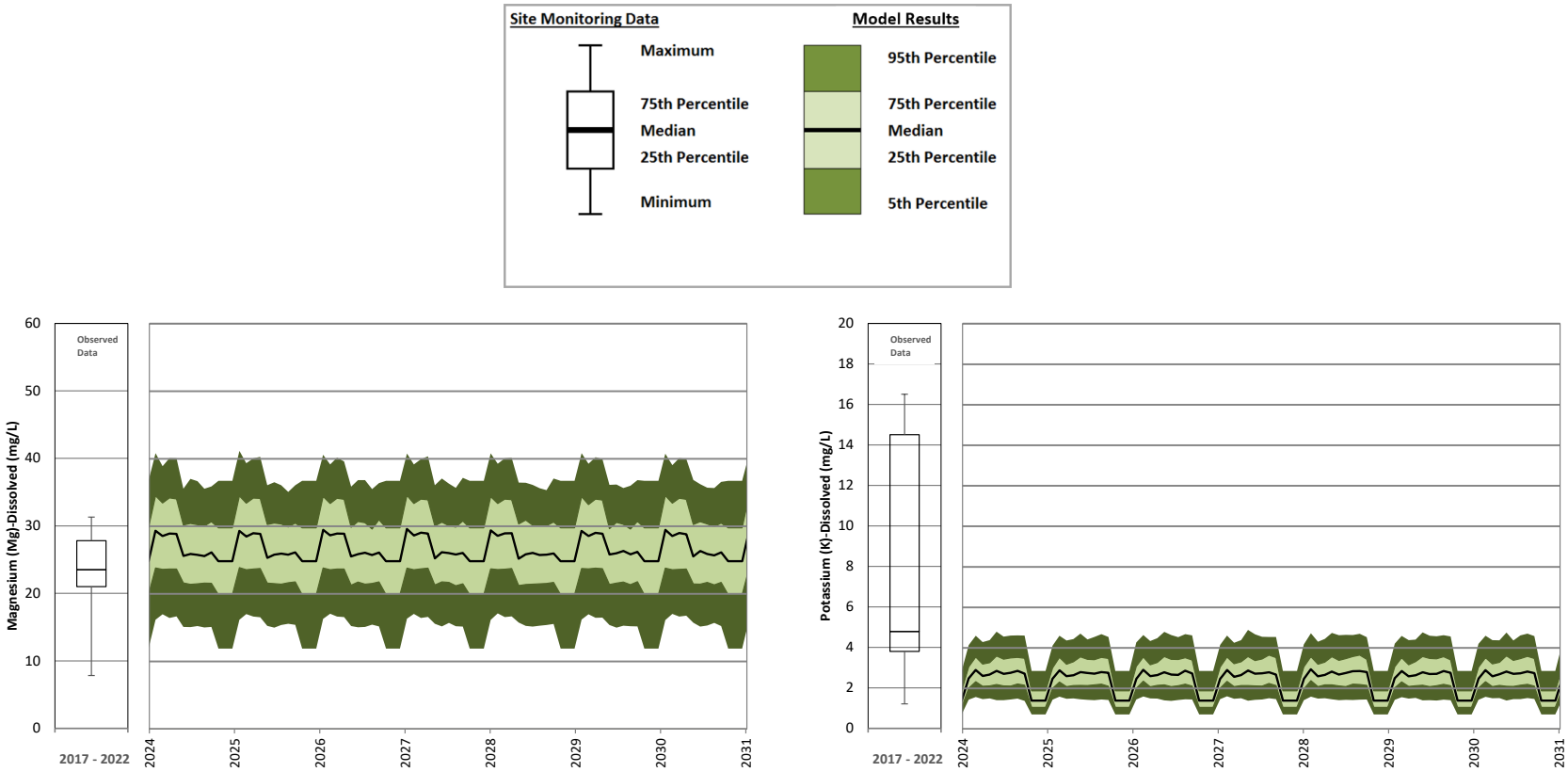

Figure B **3: Springer Pit Operations – Magnesium and Potassium**

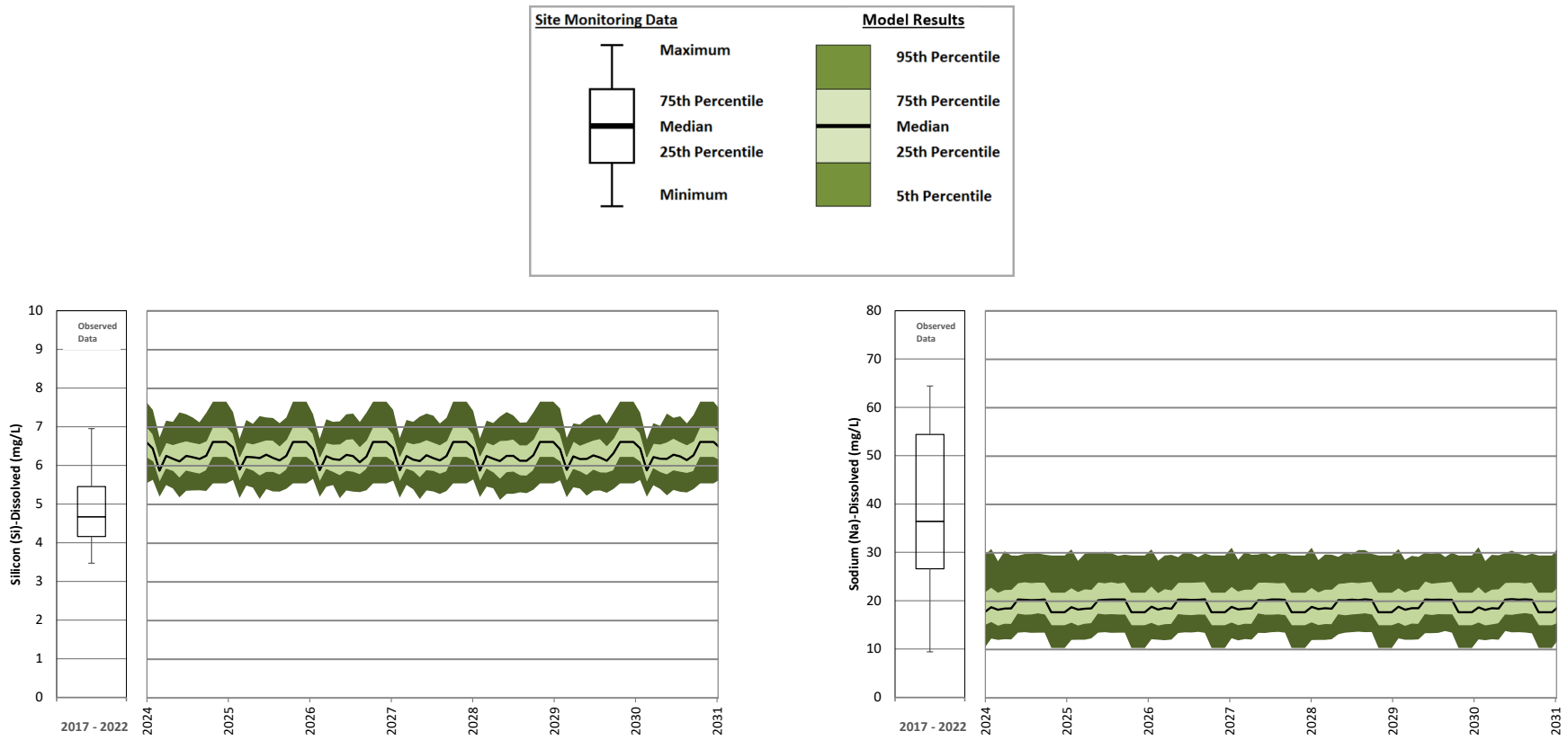

Figure B **4: Springer Pit Operations – Silicon and Sodium**

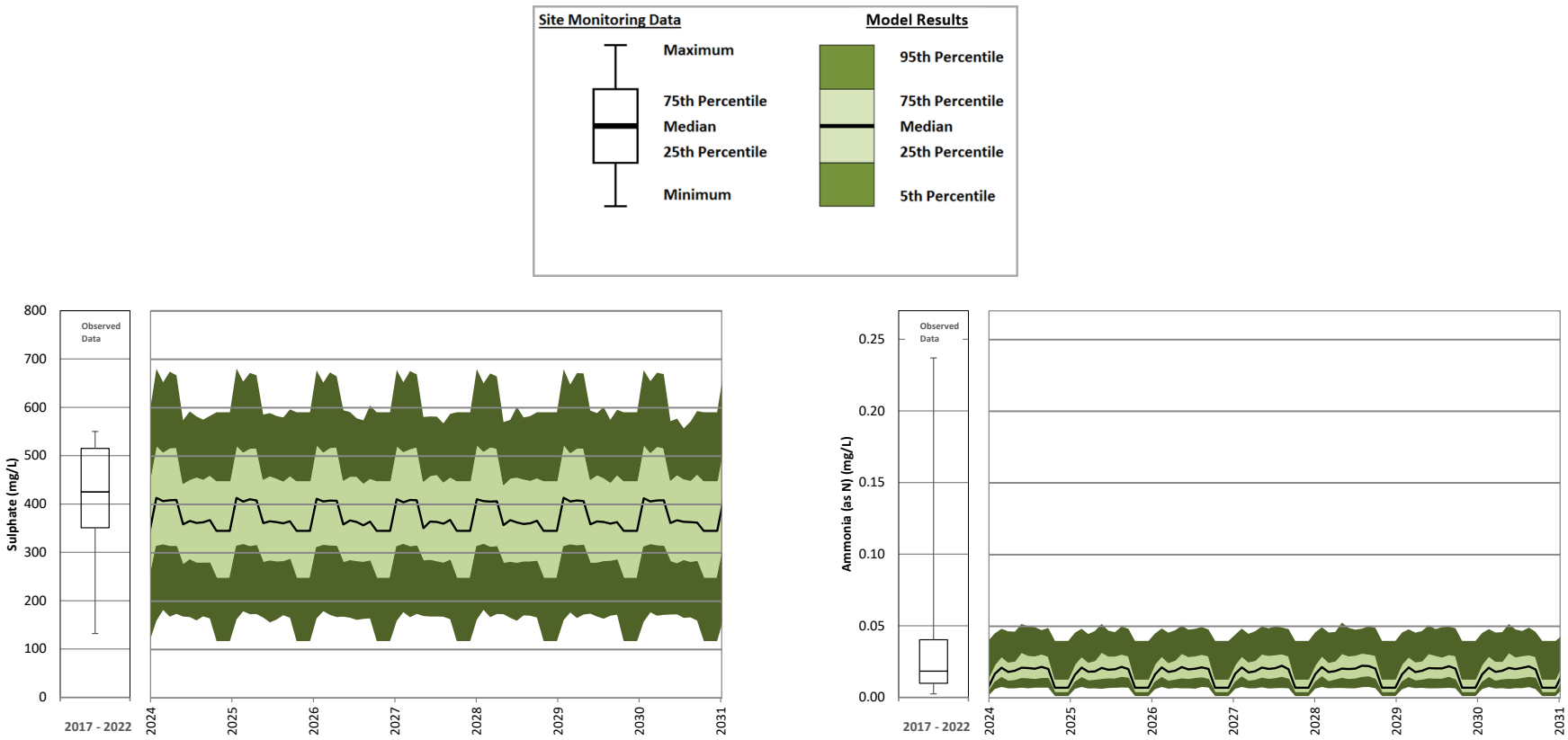

Figure B **5: Springer Pit Operations – Sulphate and Total Ammonia**

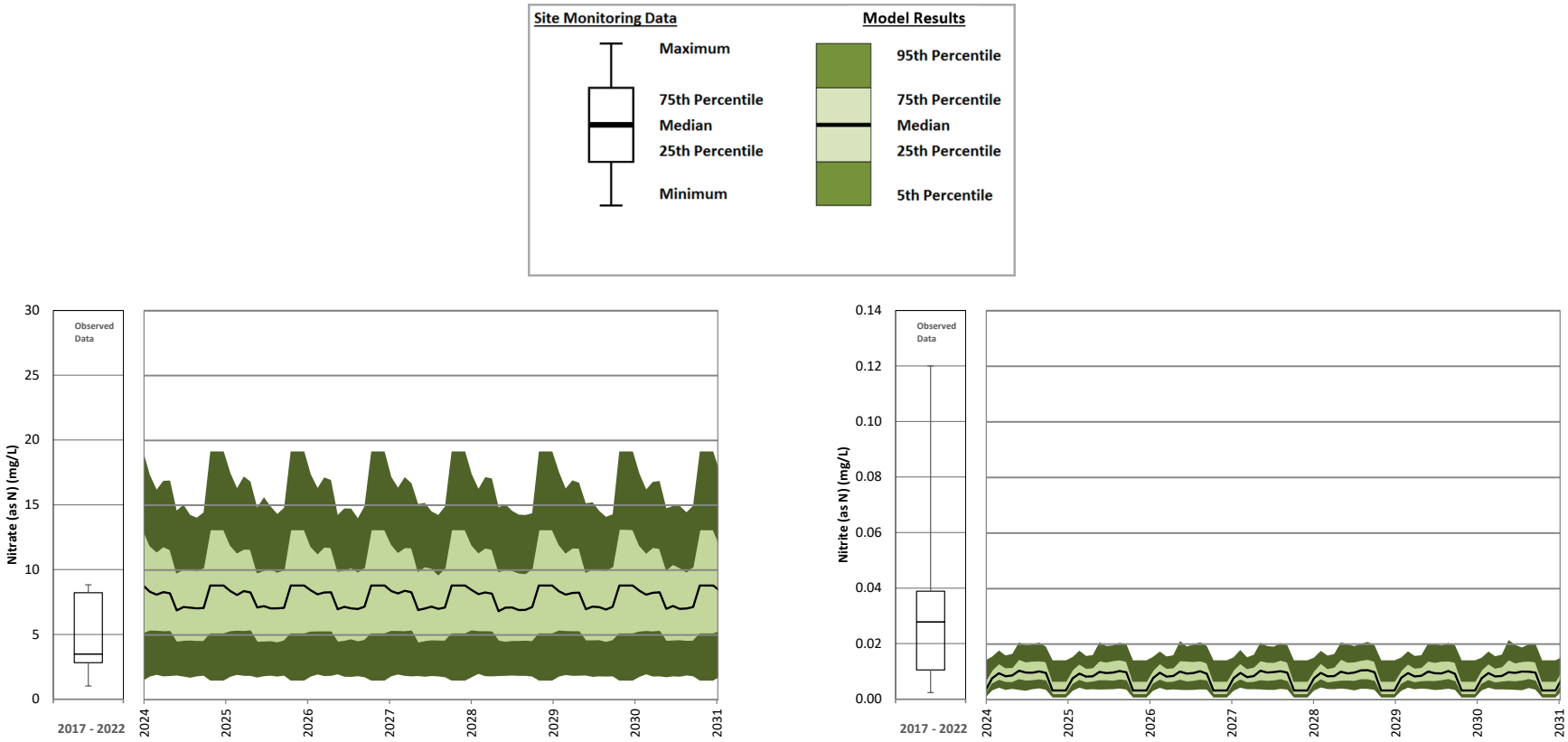

Figure B **6: Springer Pit Operations – Nitrate and Nitrite**

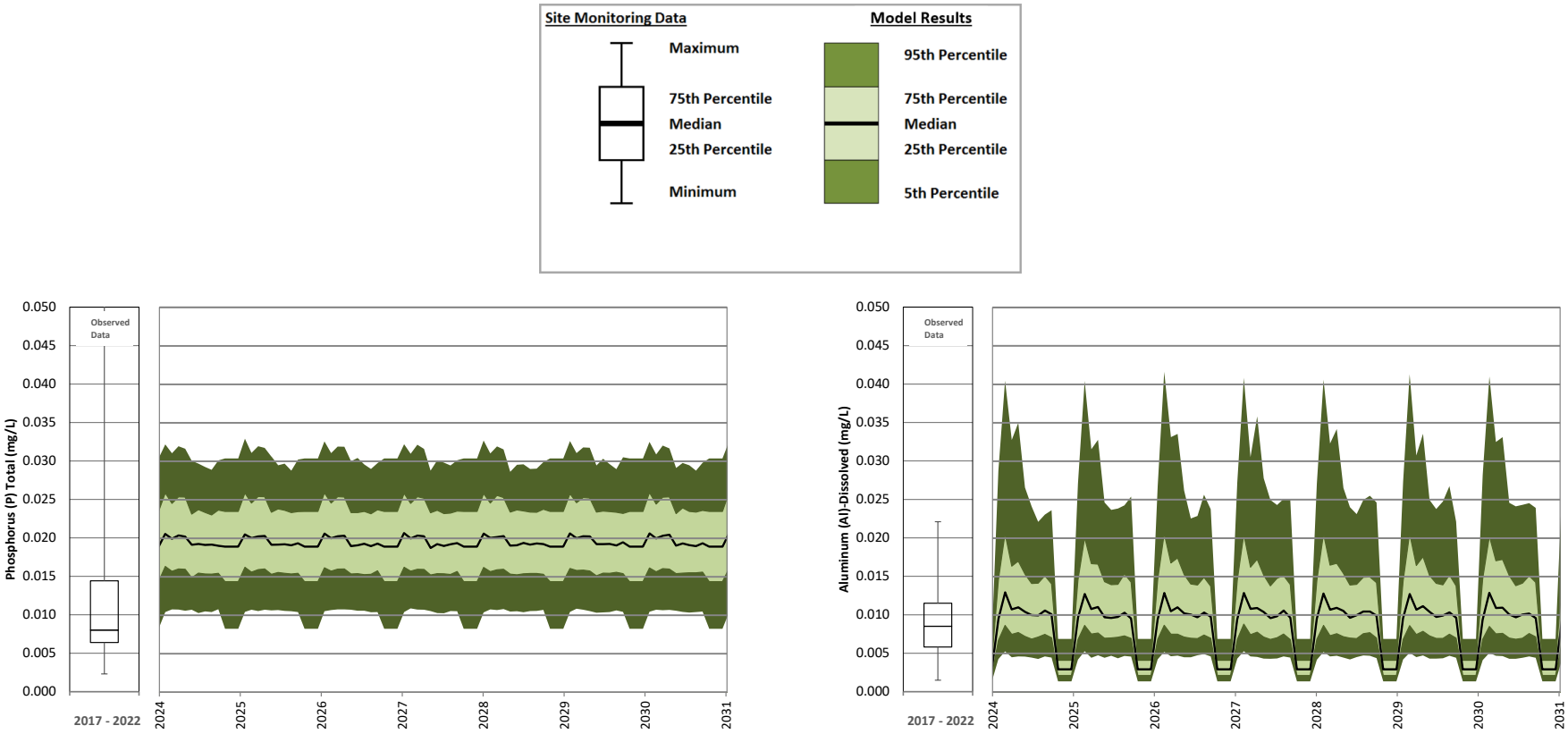

Figure B **7: Springer Pit Operations – Total Phosphorus and Dissolved Aluminum**

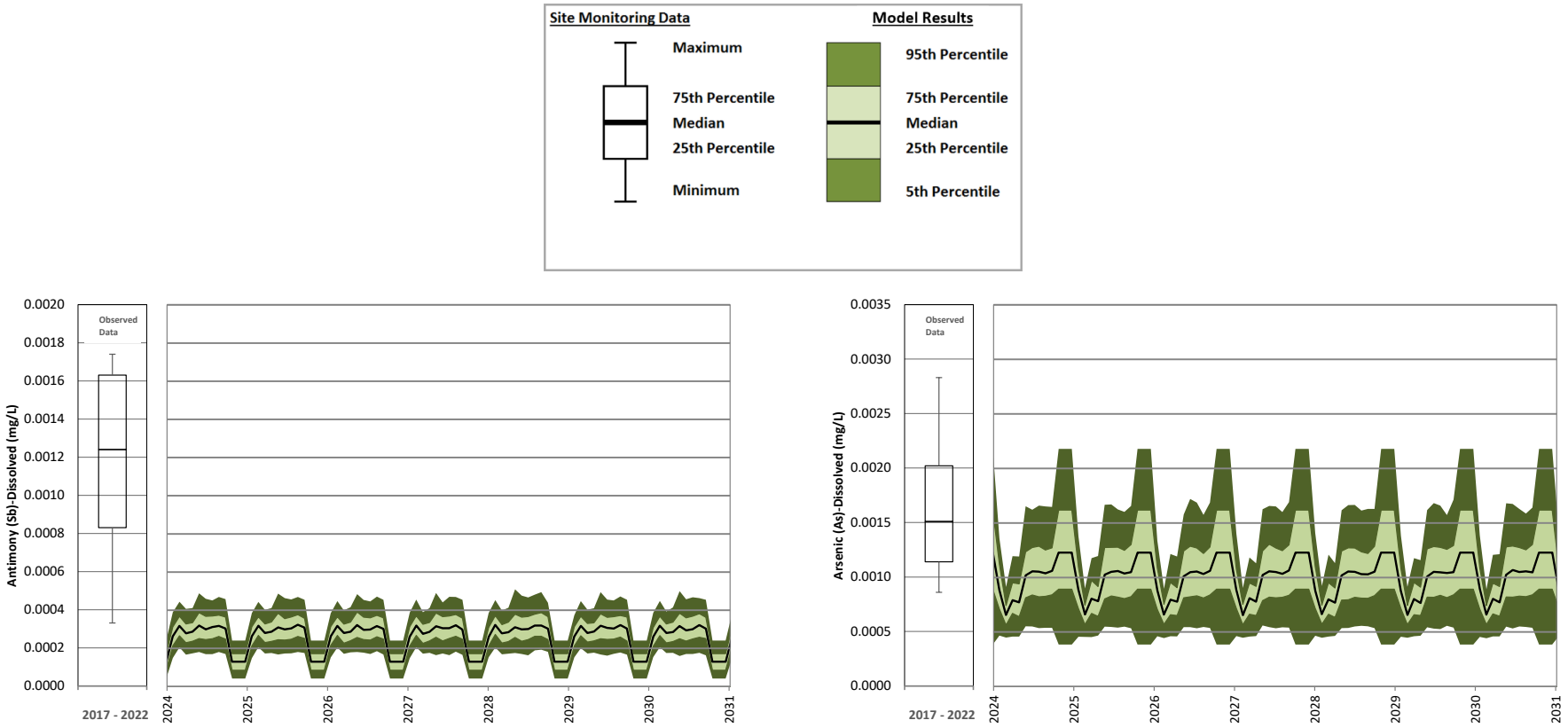

Figure B **8: Springer Pit Operations – Dissolved Antimony and Dissolved Arsenic**

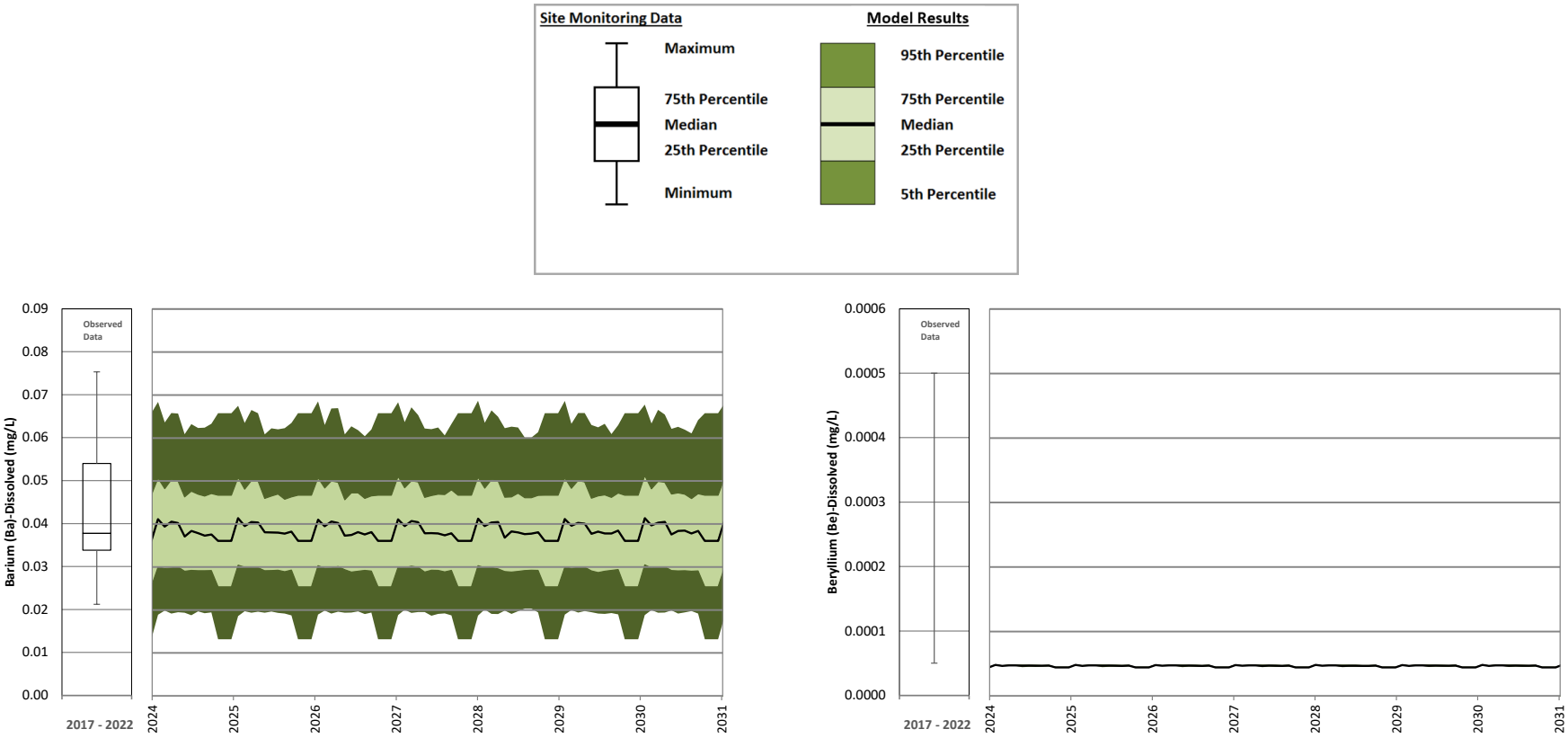

Figure B **9: Springer Pit Operations – Dissolved Barium and Dissolved Beryllium**

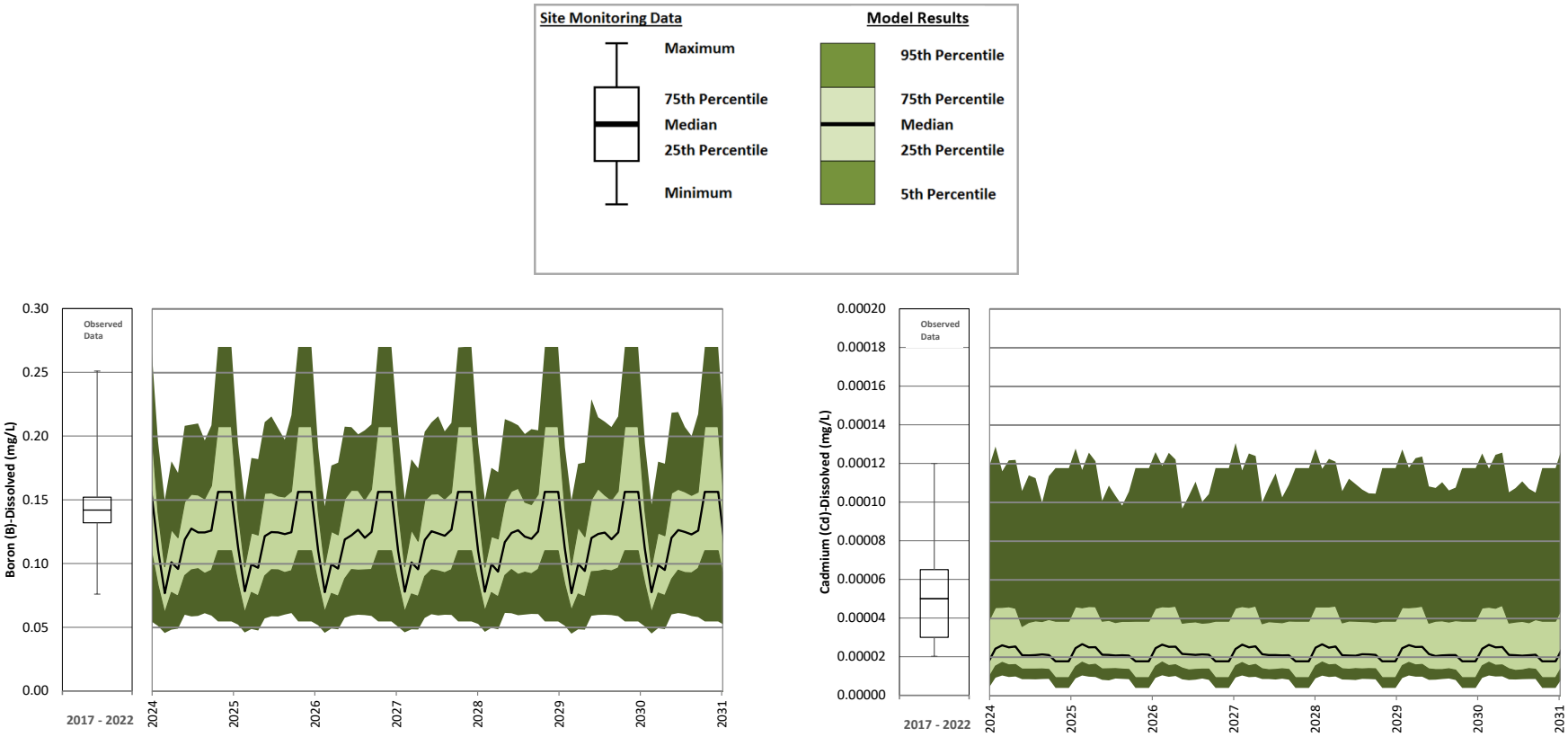

Figure B **10: Springer Pit Operations – Dissolved Boron and Dissolved Cadmium**

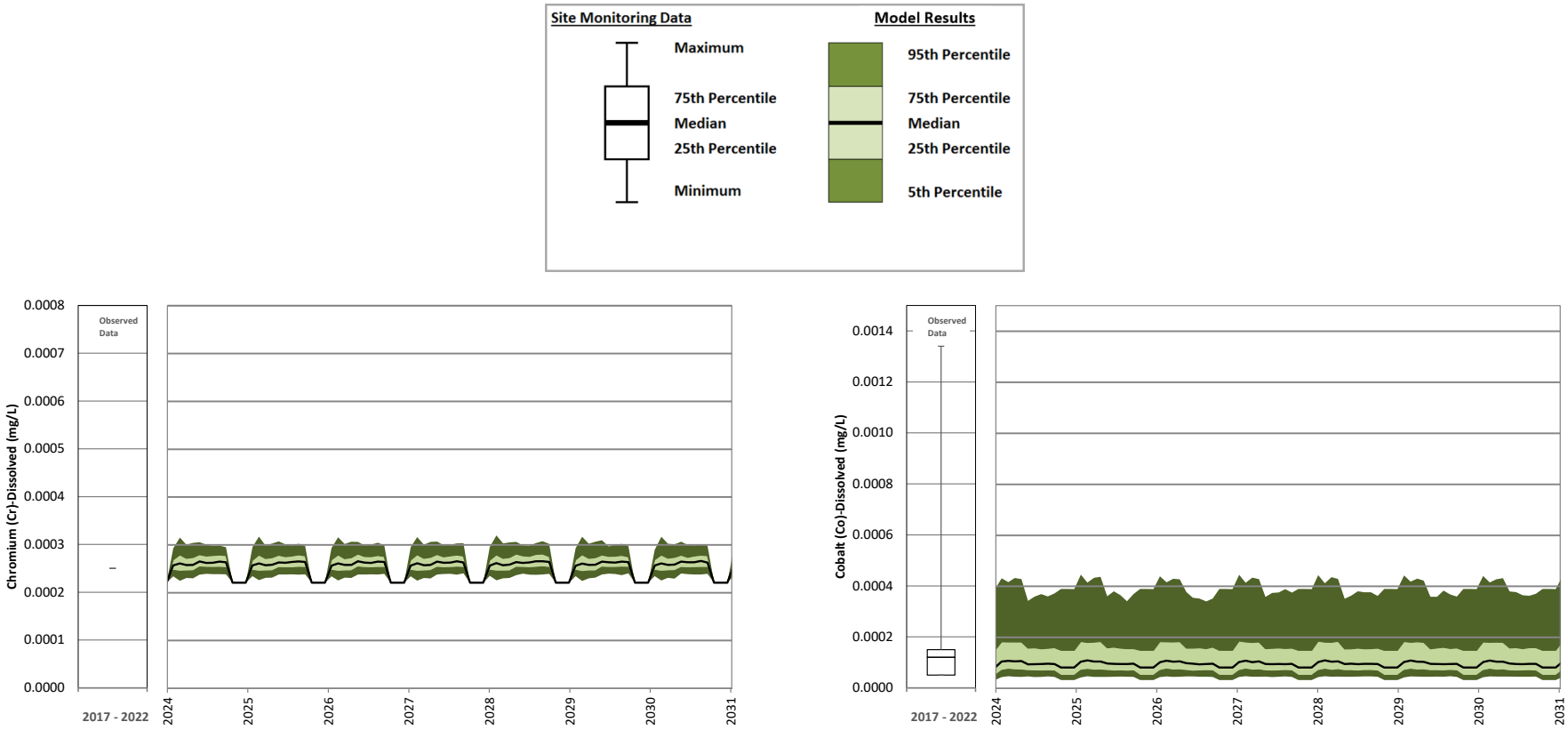

Figure B **11: Springer Pit Operations – Dissolved Chromium and Dissolved Cobalt**

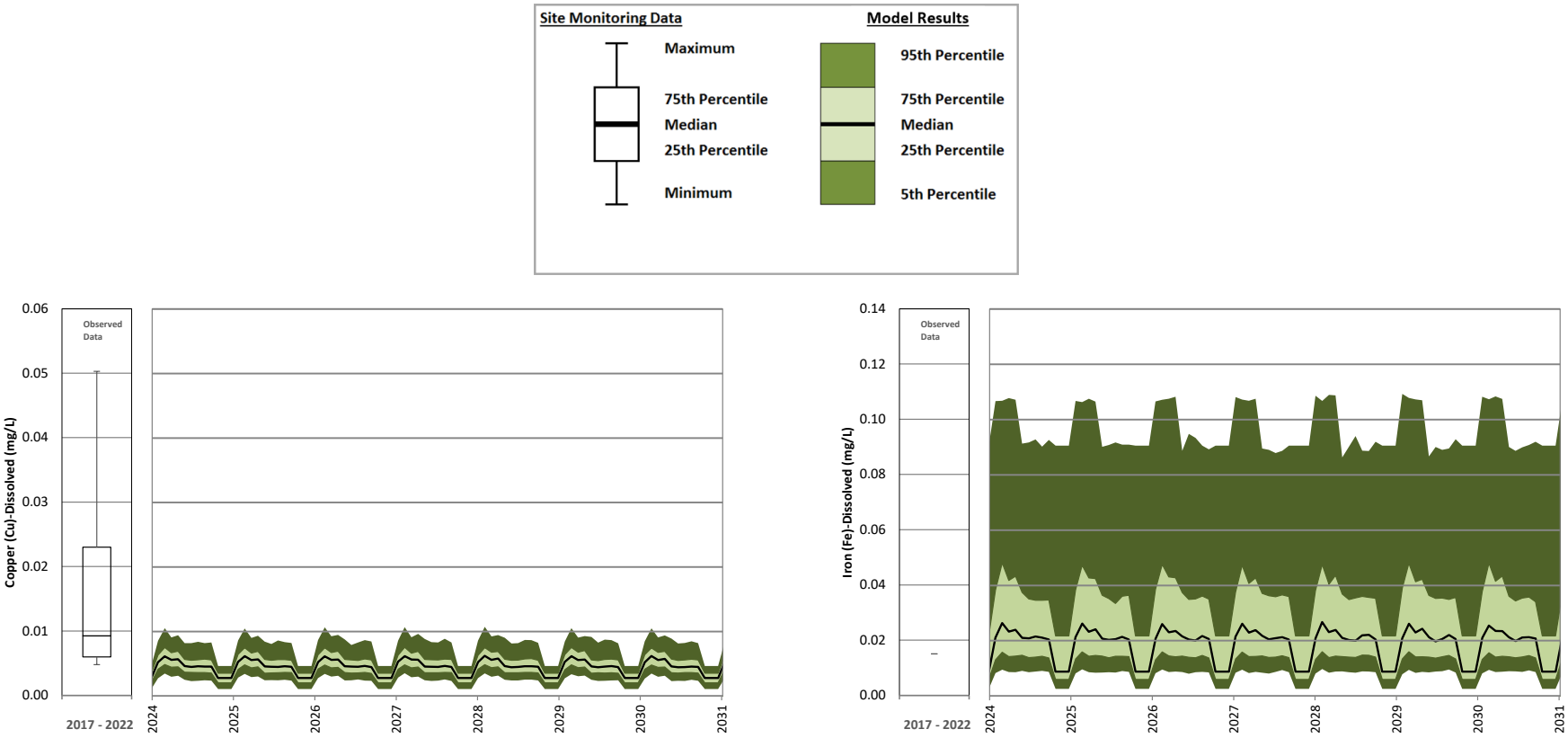

Figure B **12: Springer Pit Operations – Dissolved Copper and Dissolved Iron**

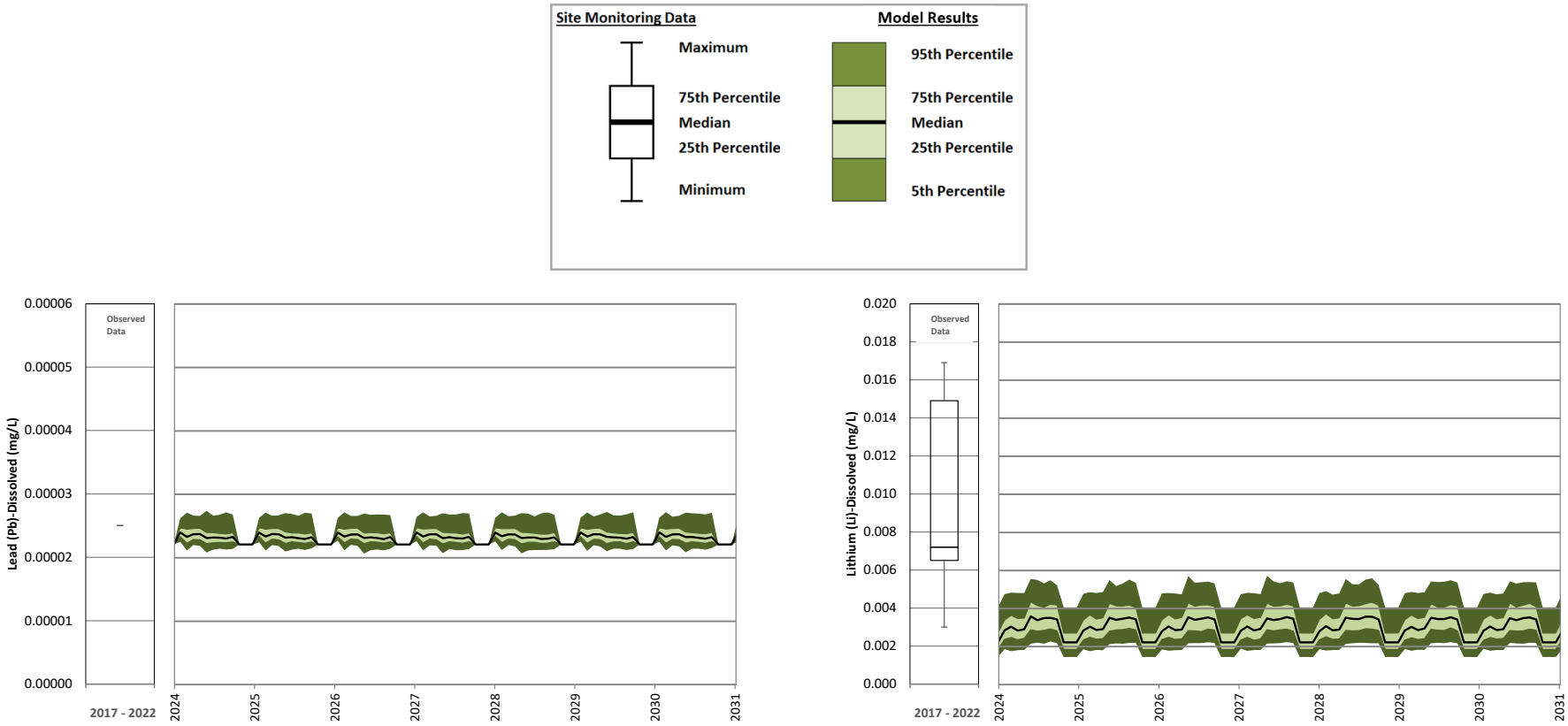

Figure B **13: Springer Pit Operations – Dissolved Lead and Dissolved Lithium**

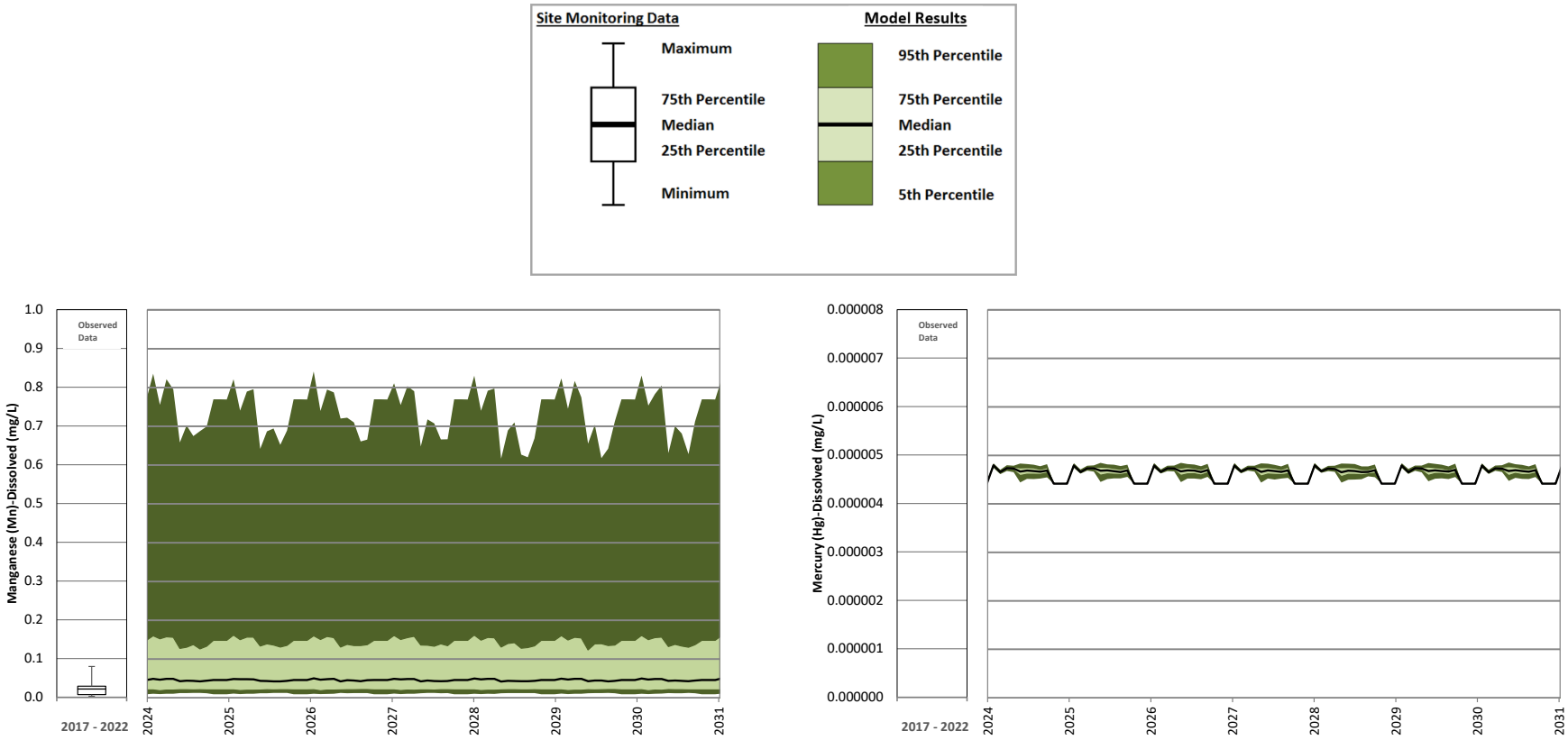

Figure B **14: Springer Pit Operations – Dissolved Manganese and Dissolved Mercury**

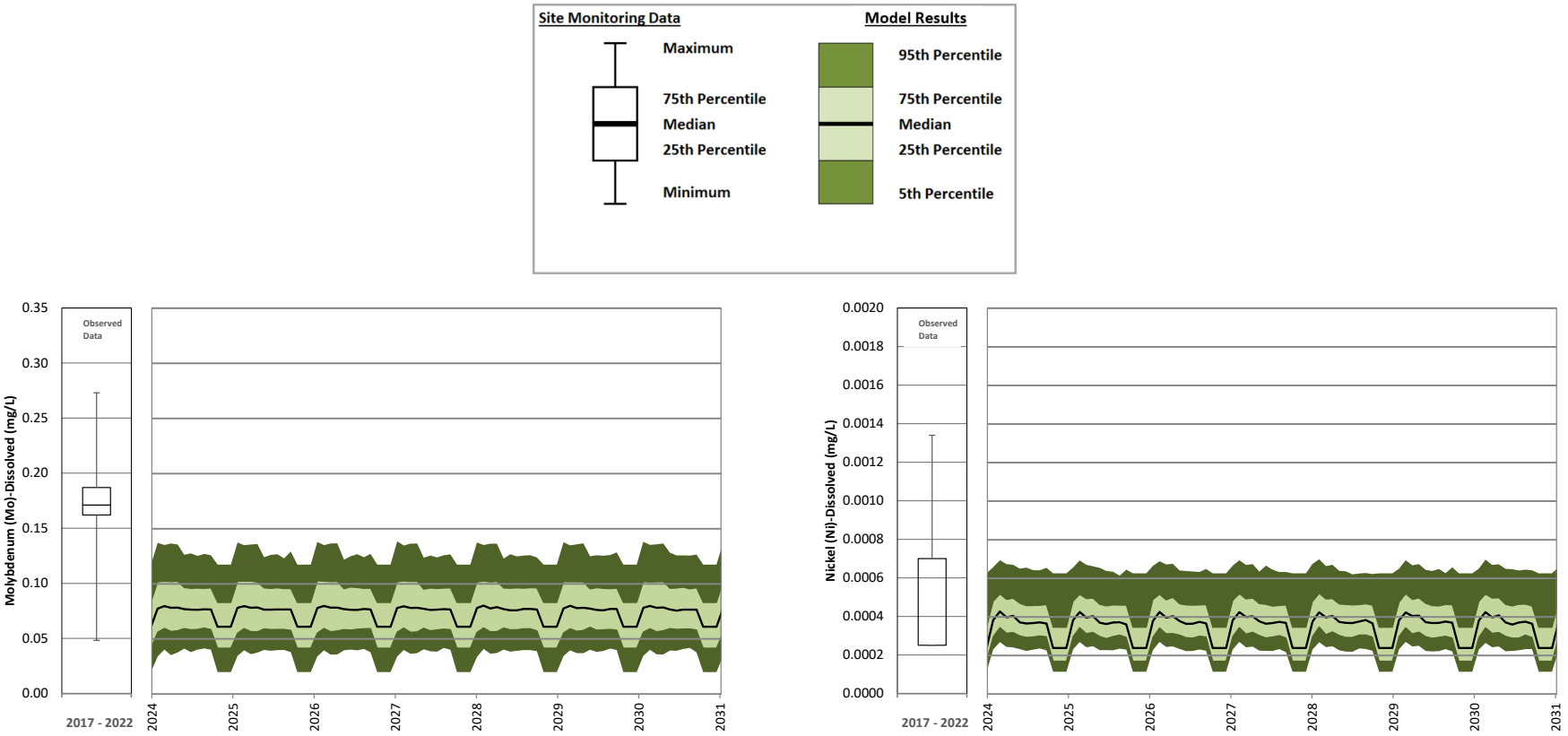

Figure B **15: Springer Pit Operations – Dissolved Molybdenum and Dissolved Nickel**

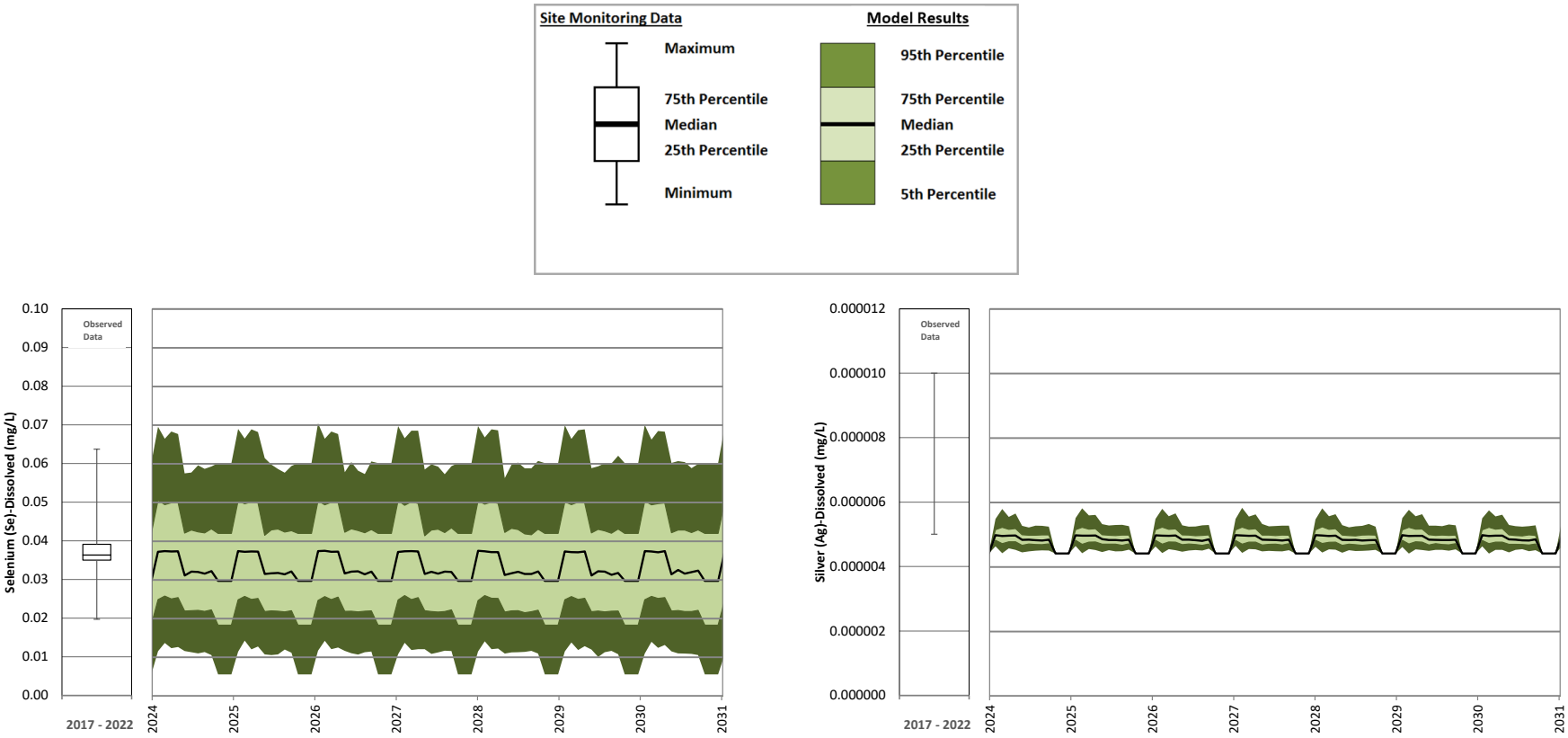

Figure B **16: Springer Pit Operations – Dissolved Selenium and Dissolved Silver**

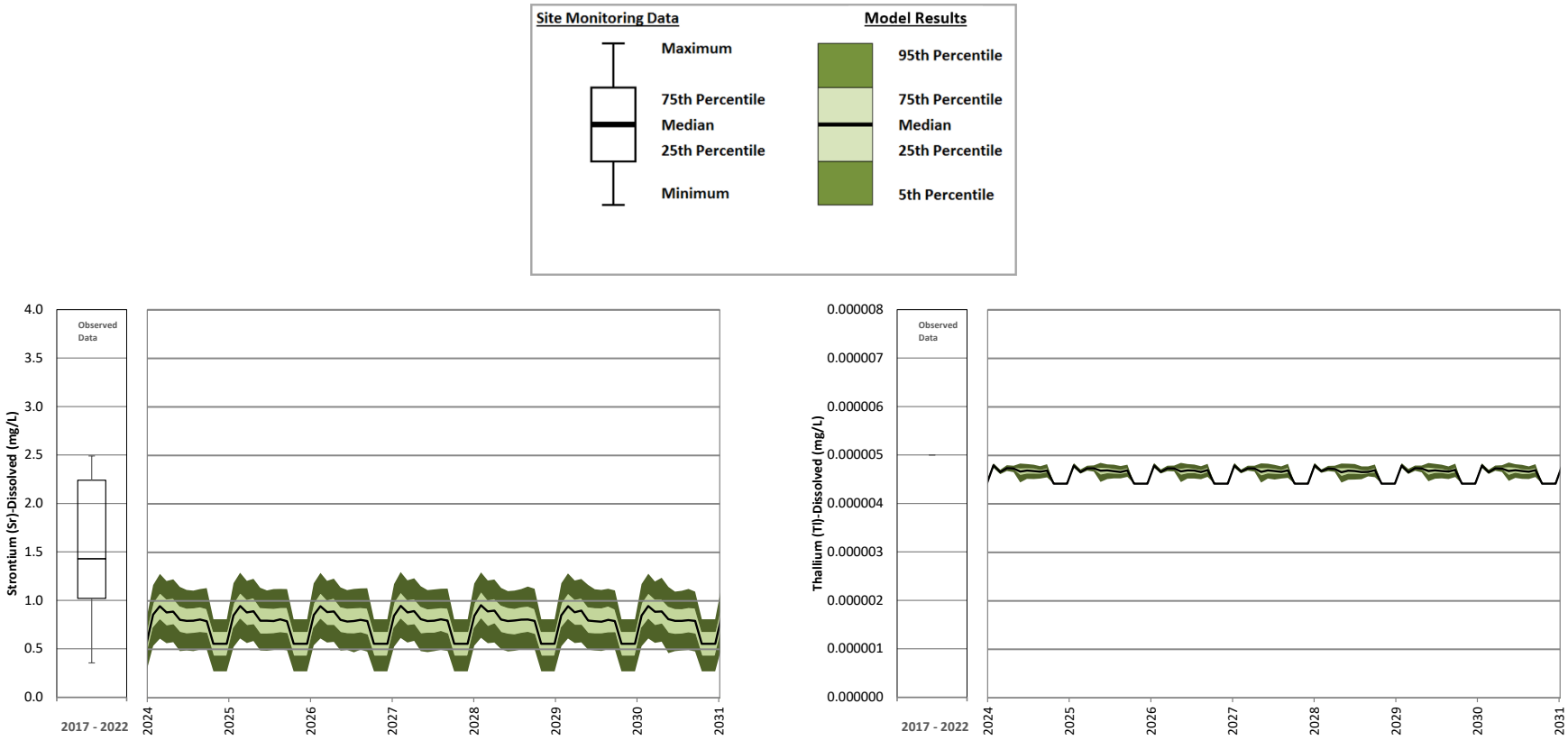

Figure B **17: Springer Pit Operations – Dissolved Strontium and Dissolved Thallium**

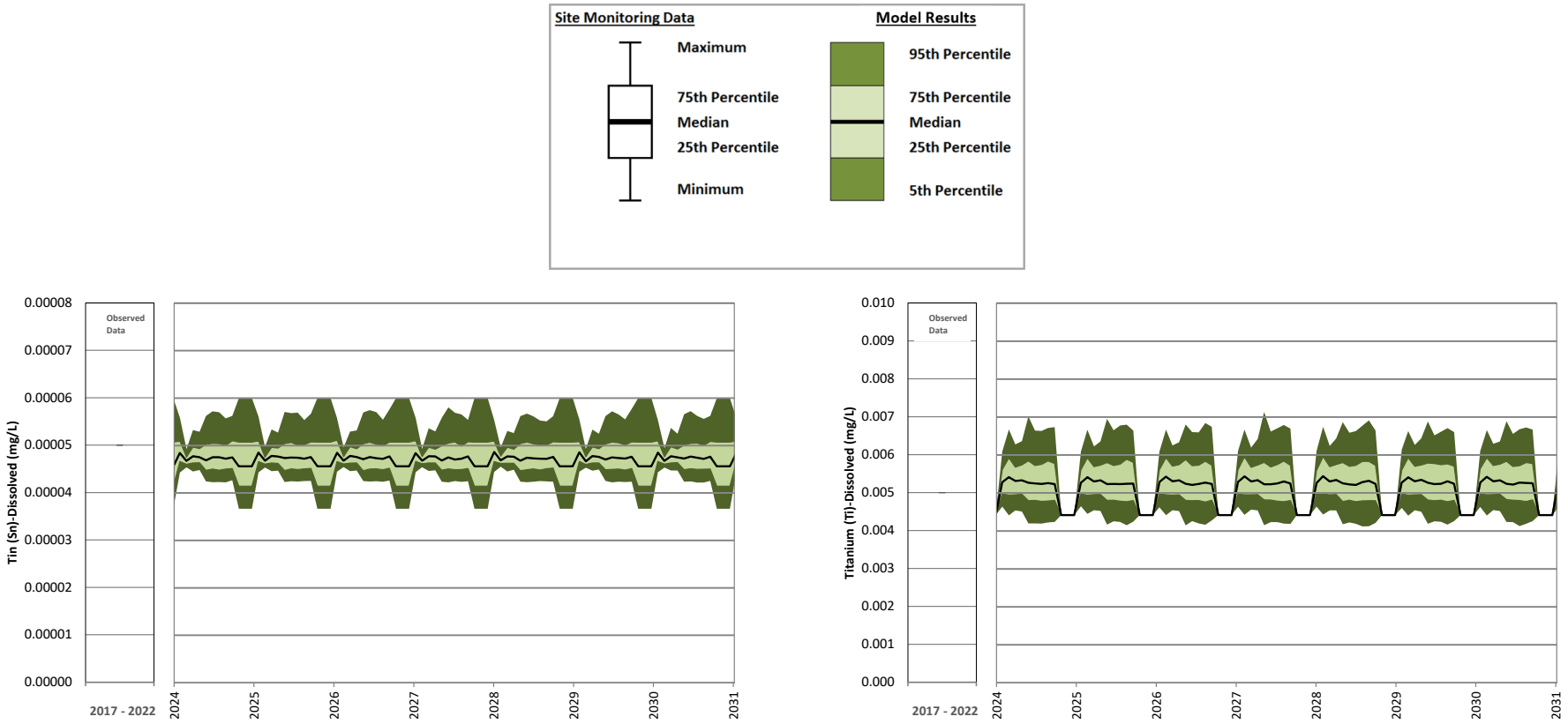

Figure B **18: Springer Pit Operations – Dissolved Tin and Dissolved Titanium**

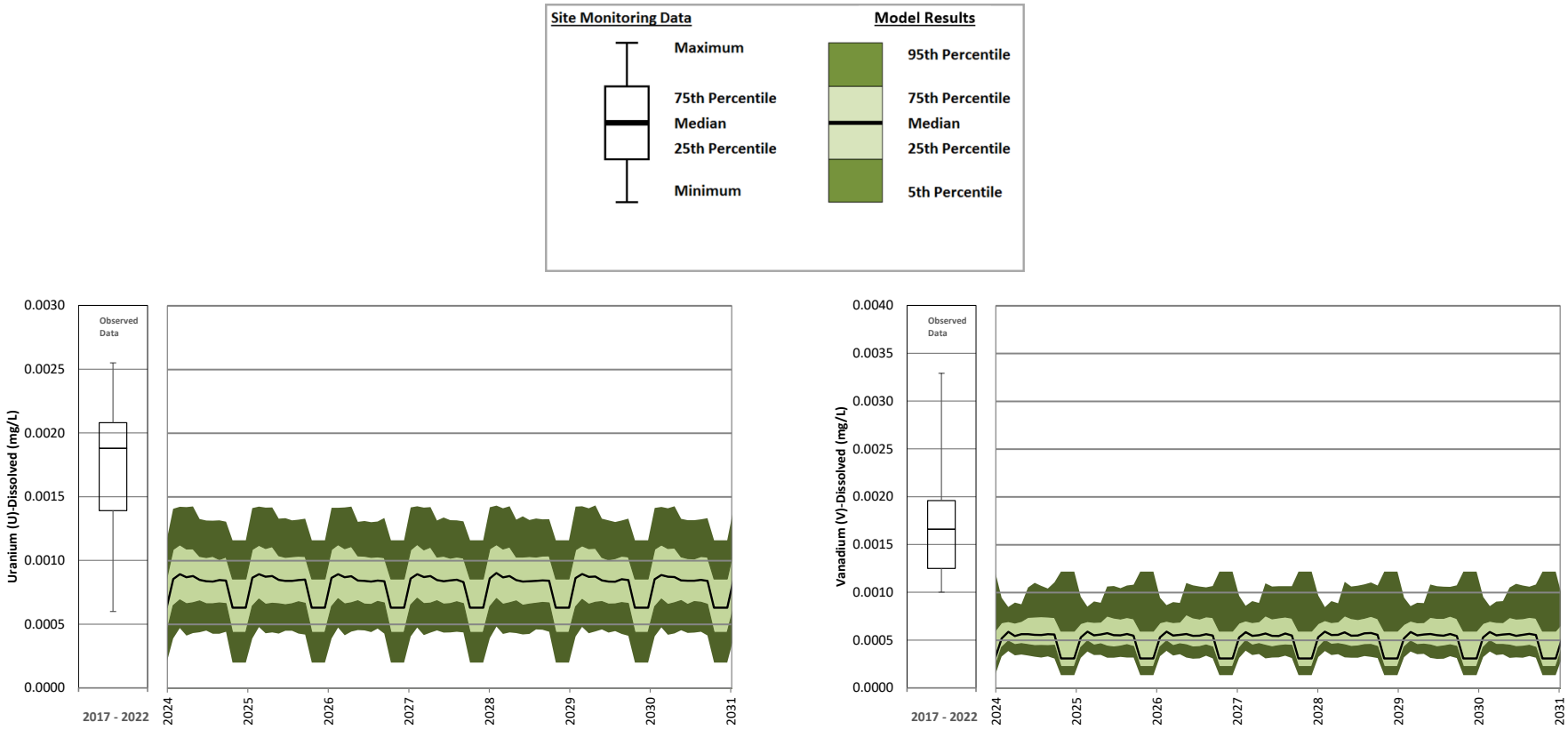

Figure B **19: Springer Pit Operations – Dissolved Uranium and Dissolved Vanadium**

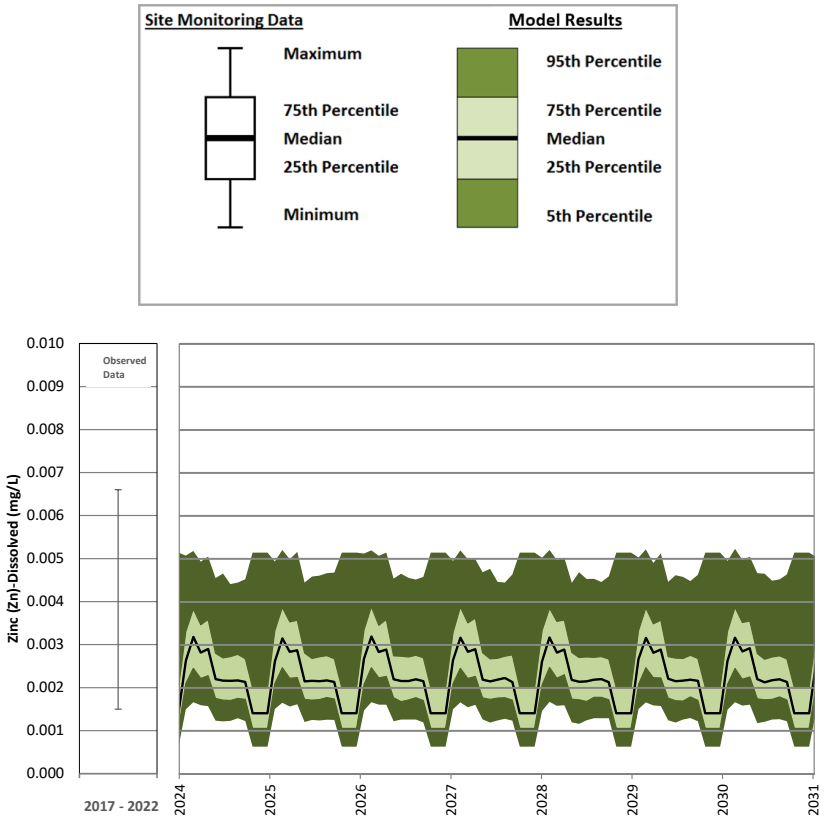

Figure B **20: Springer Pit Operations – Dissolved Zinc**

Cariboo Pit Operations

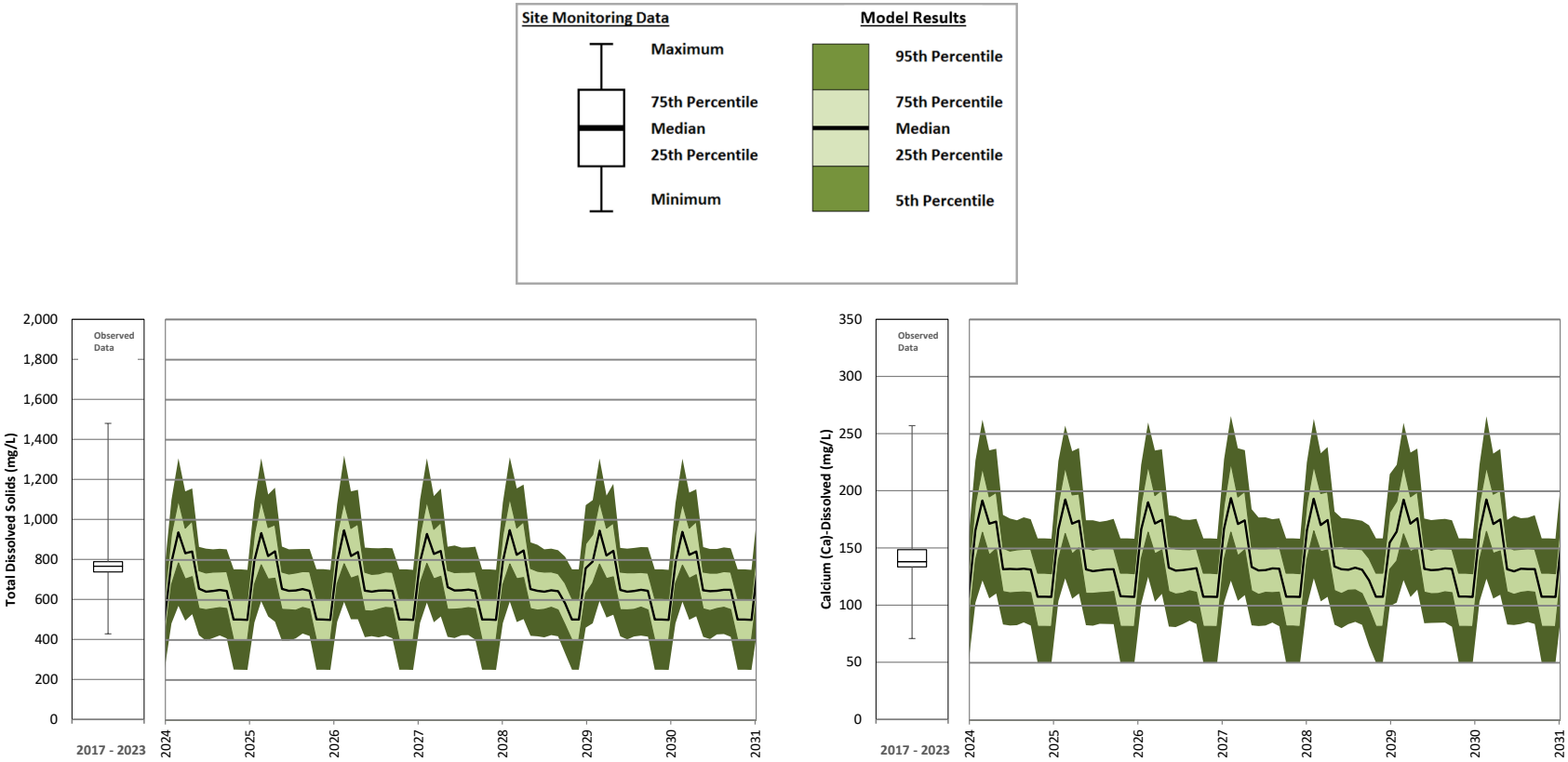

Figure B **21: Cariboo Pit Operations – Total Dissolved Solids and Calcium**

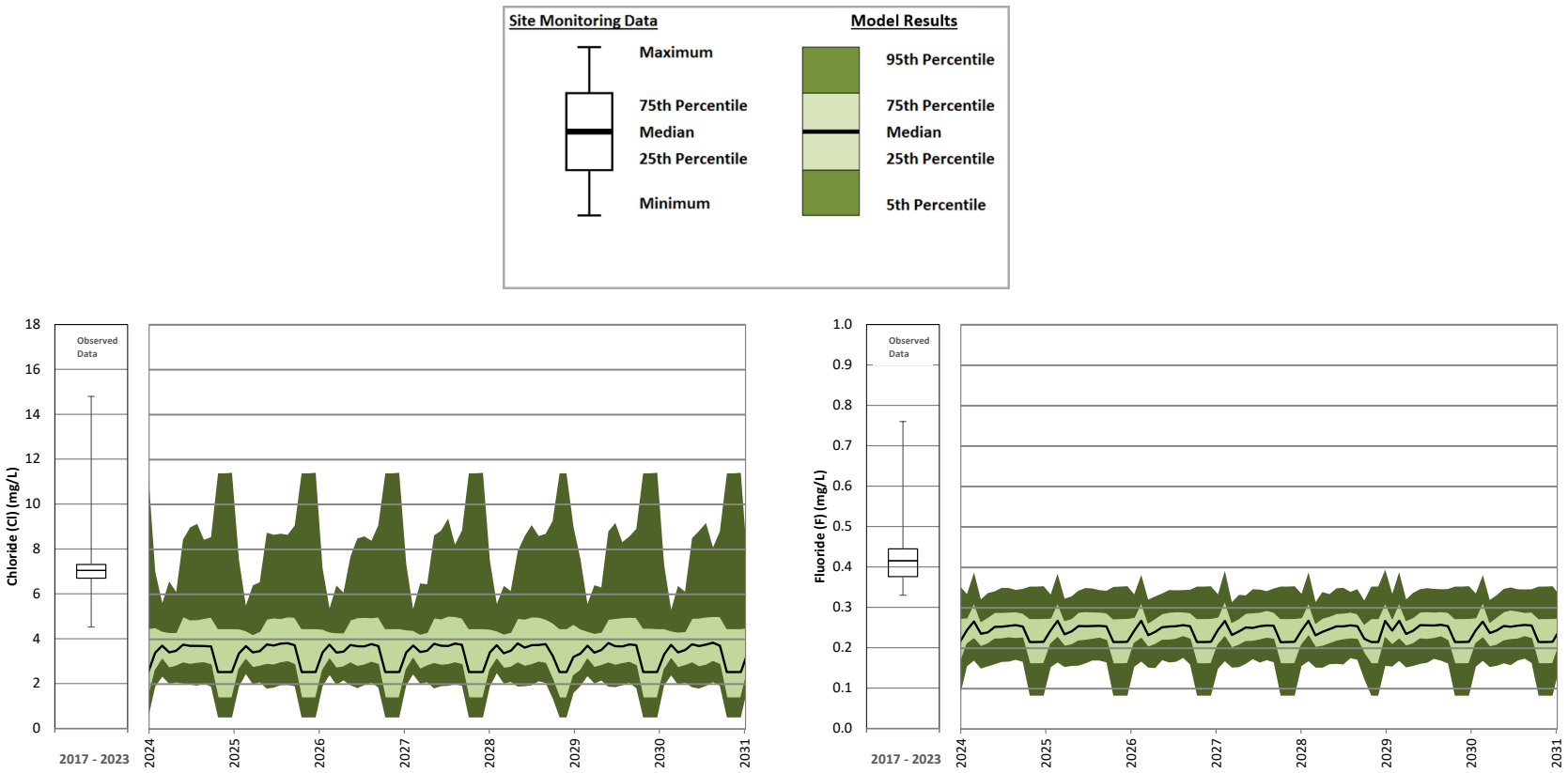

Figure B **22: Cariboo Pit Operations – Chloride and Fluoride**

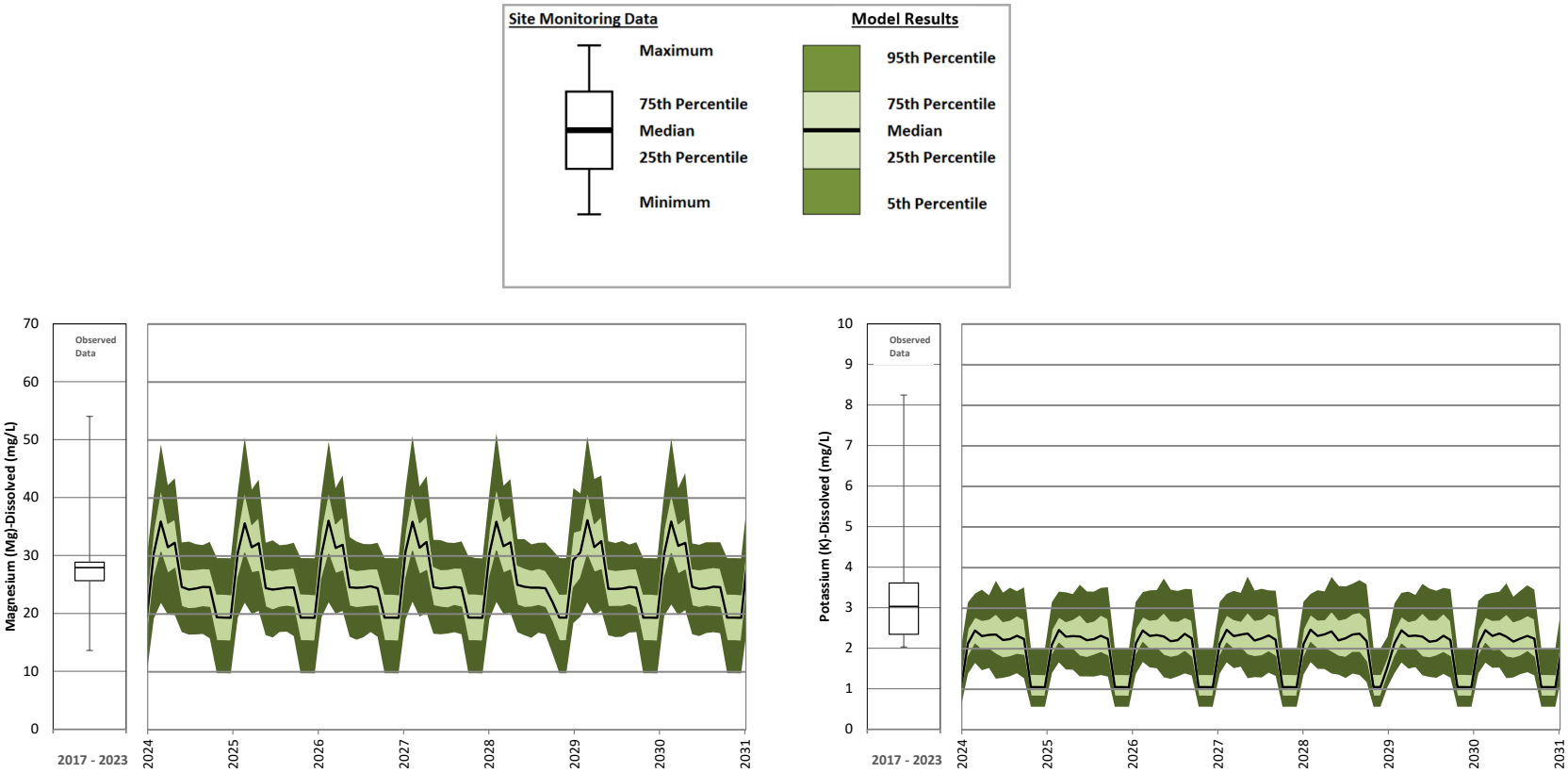

Figure B **23: Cariboo Pit Operations – Magnesium and Potassium**

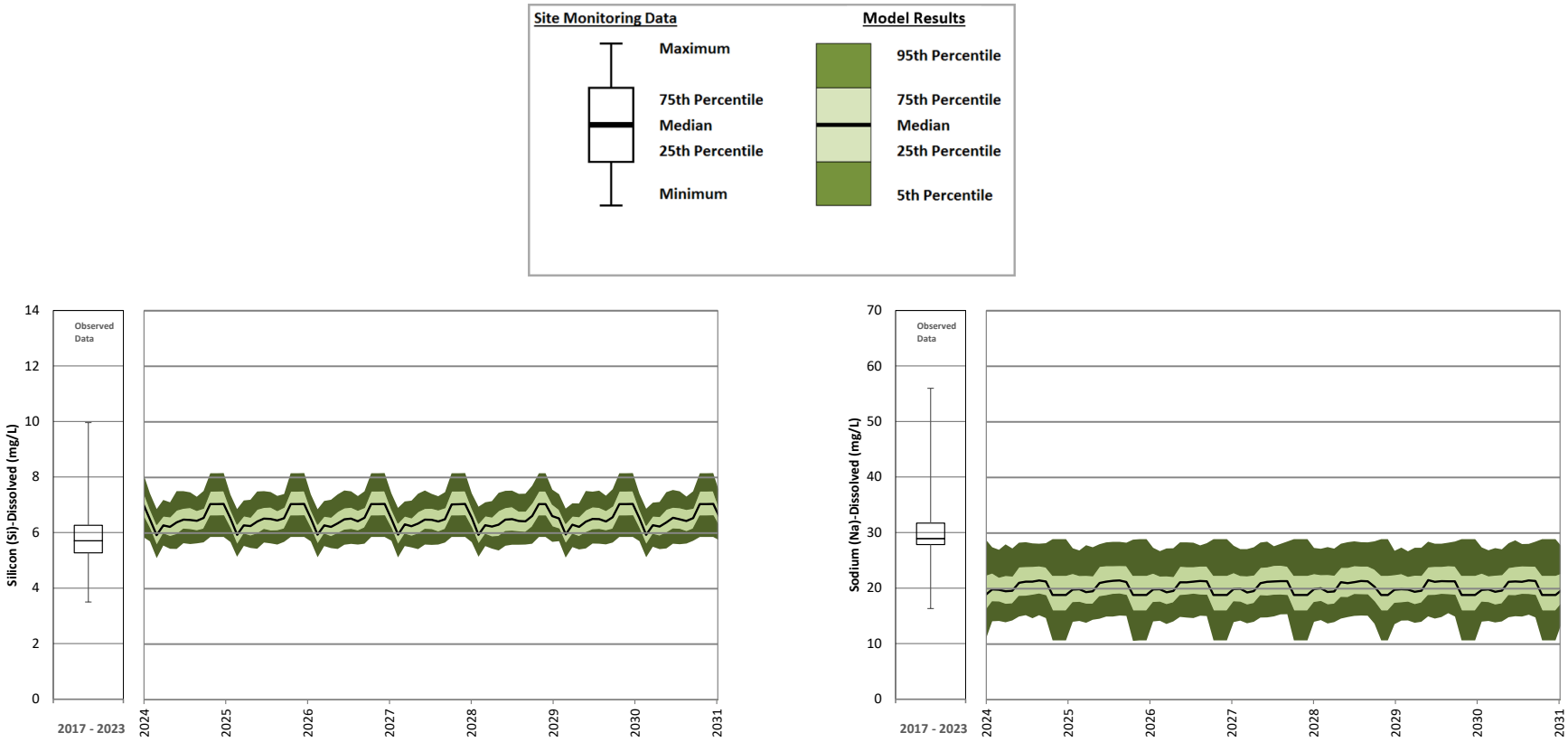

Figure B **24: Cariboo Pit Operations – Silicon and Sodium**

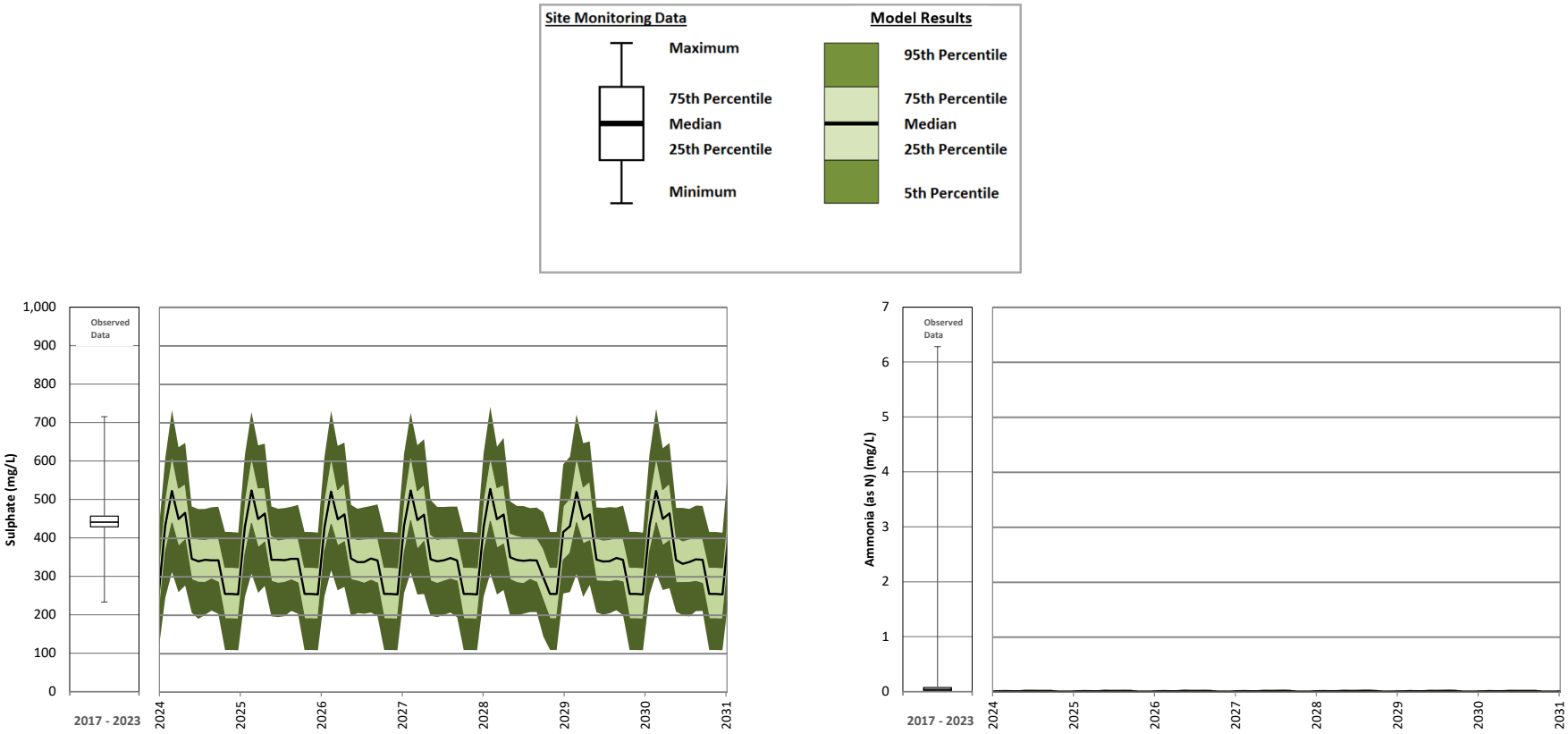

Figure B **25: Cariboo Pit Operations – Sulphate and Total Ammonia**

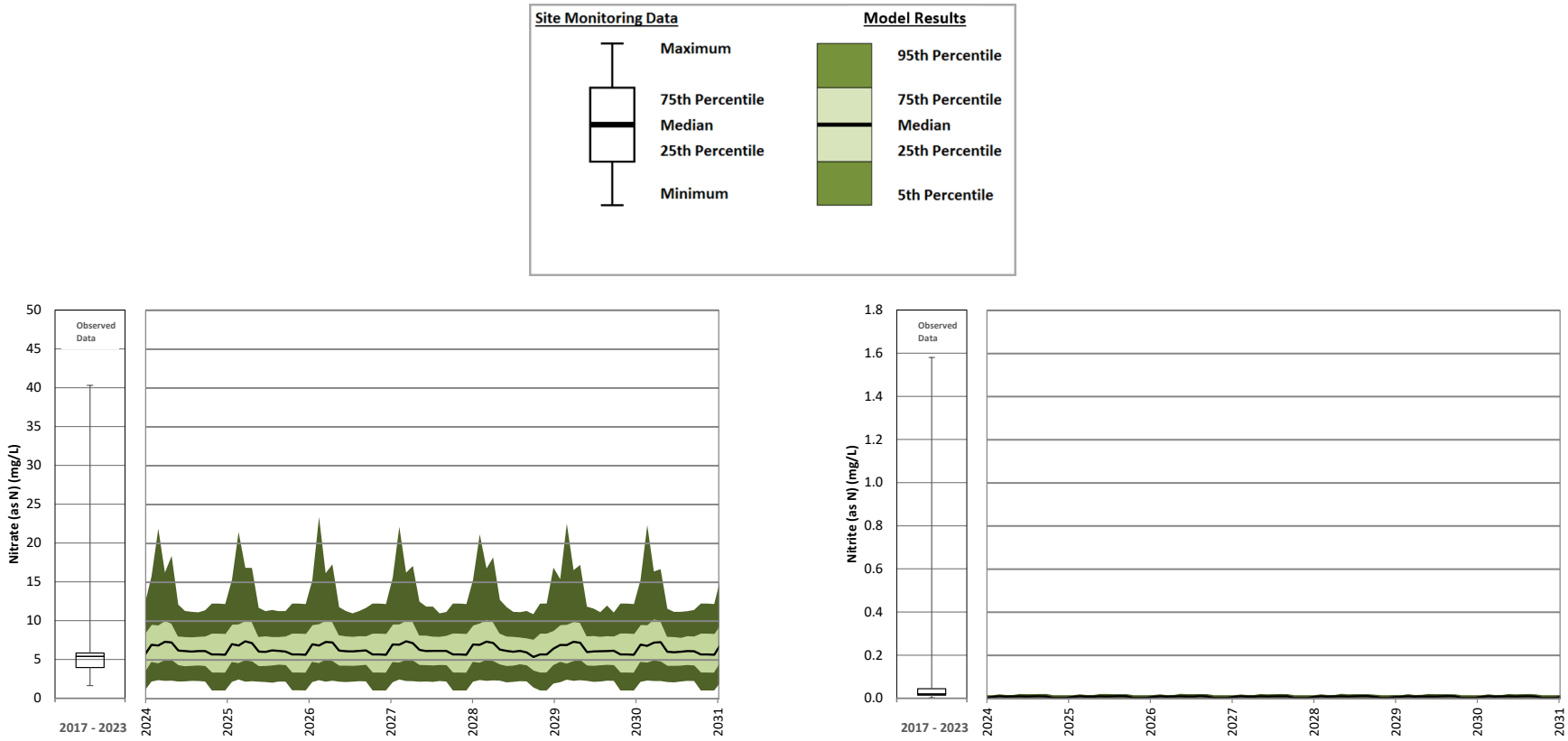

Figure B **26: Cariboo Pit Operations – Nitrate and Nitrite**

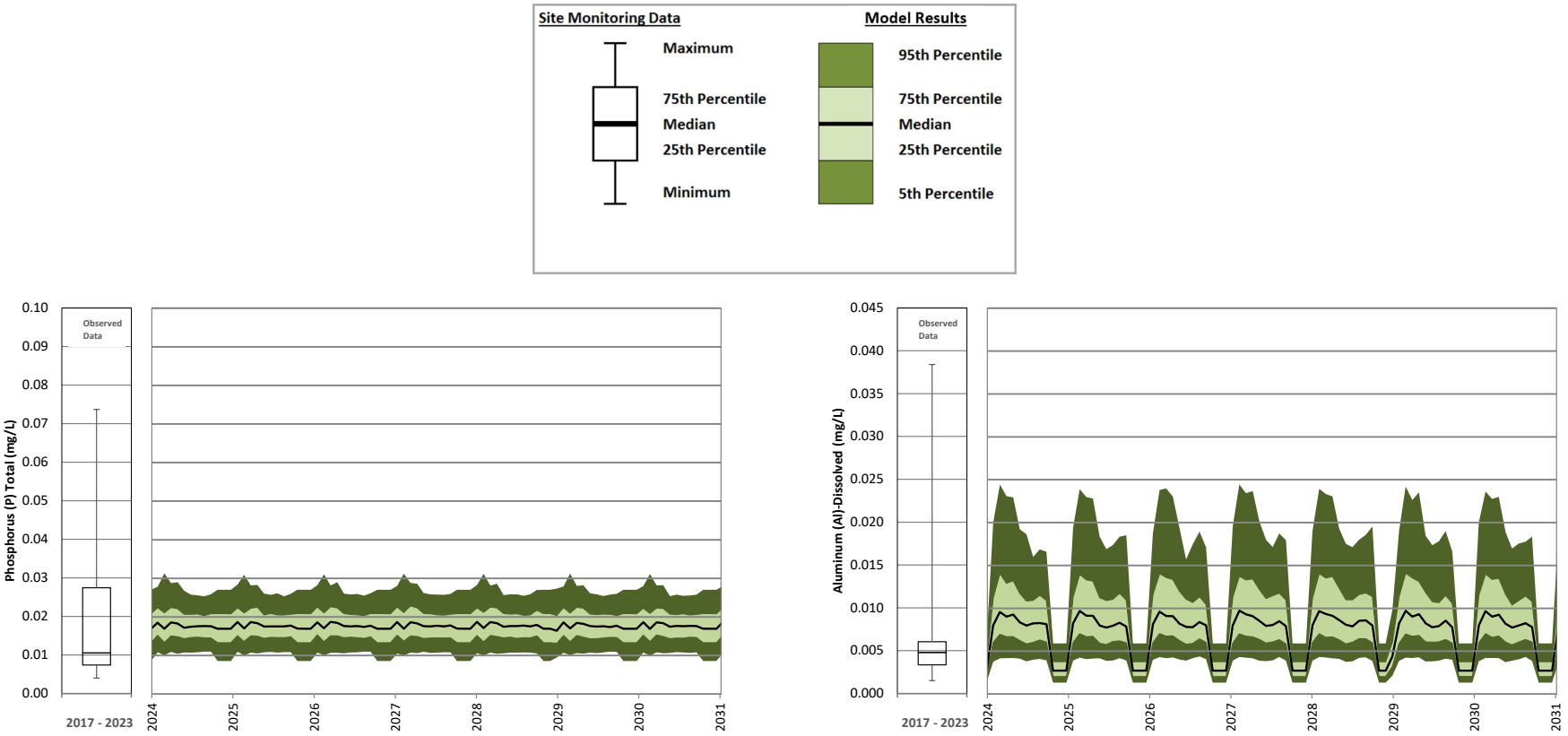

Figure B **27: Cariboo Pit Operations – Total Phosphorus and Dissolved Aluminum**

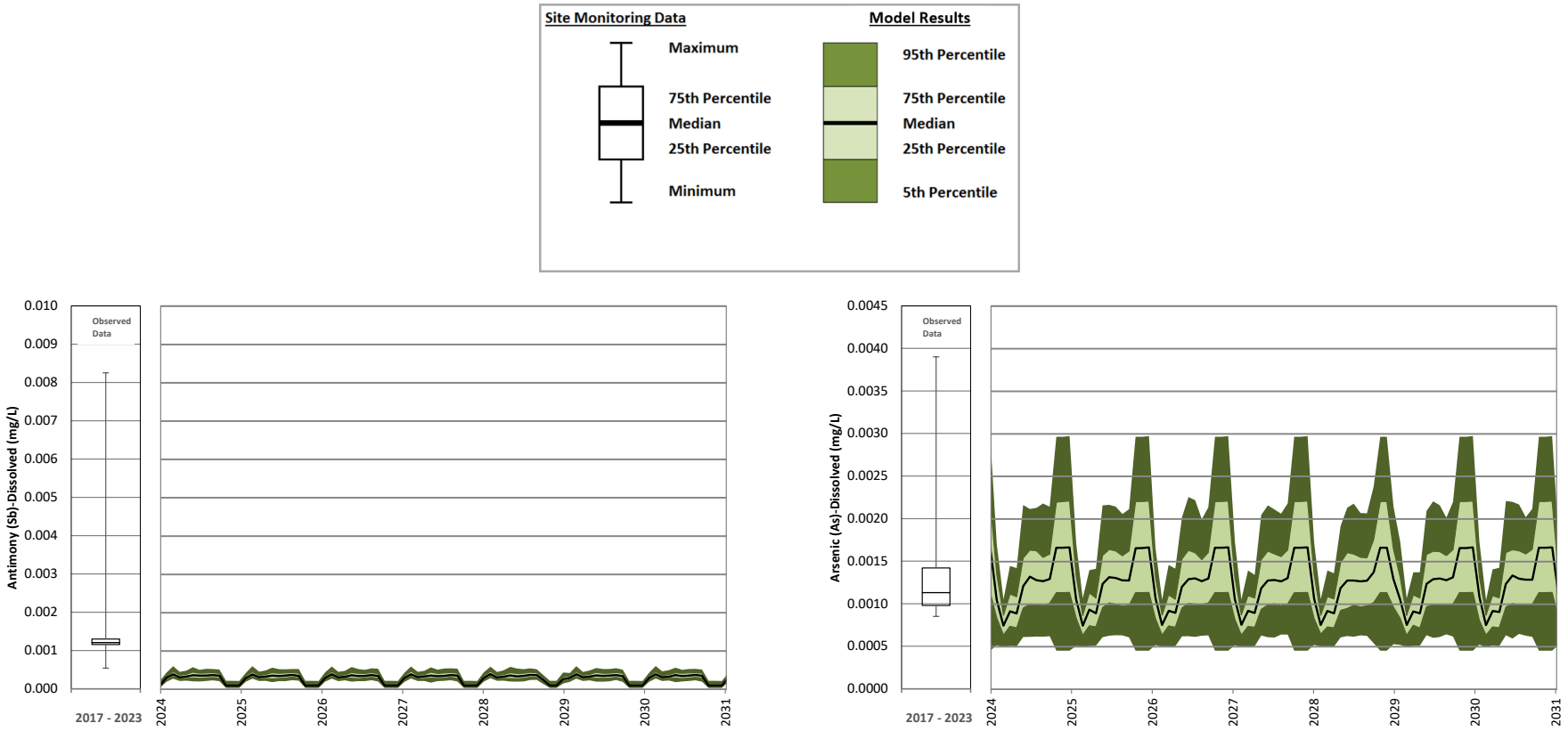

Figure B **28: Cariboo Pit Operations – Dissolved Antimony and Dissolved Arsenic**

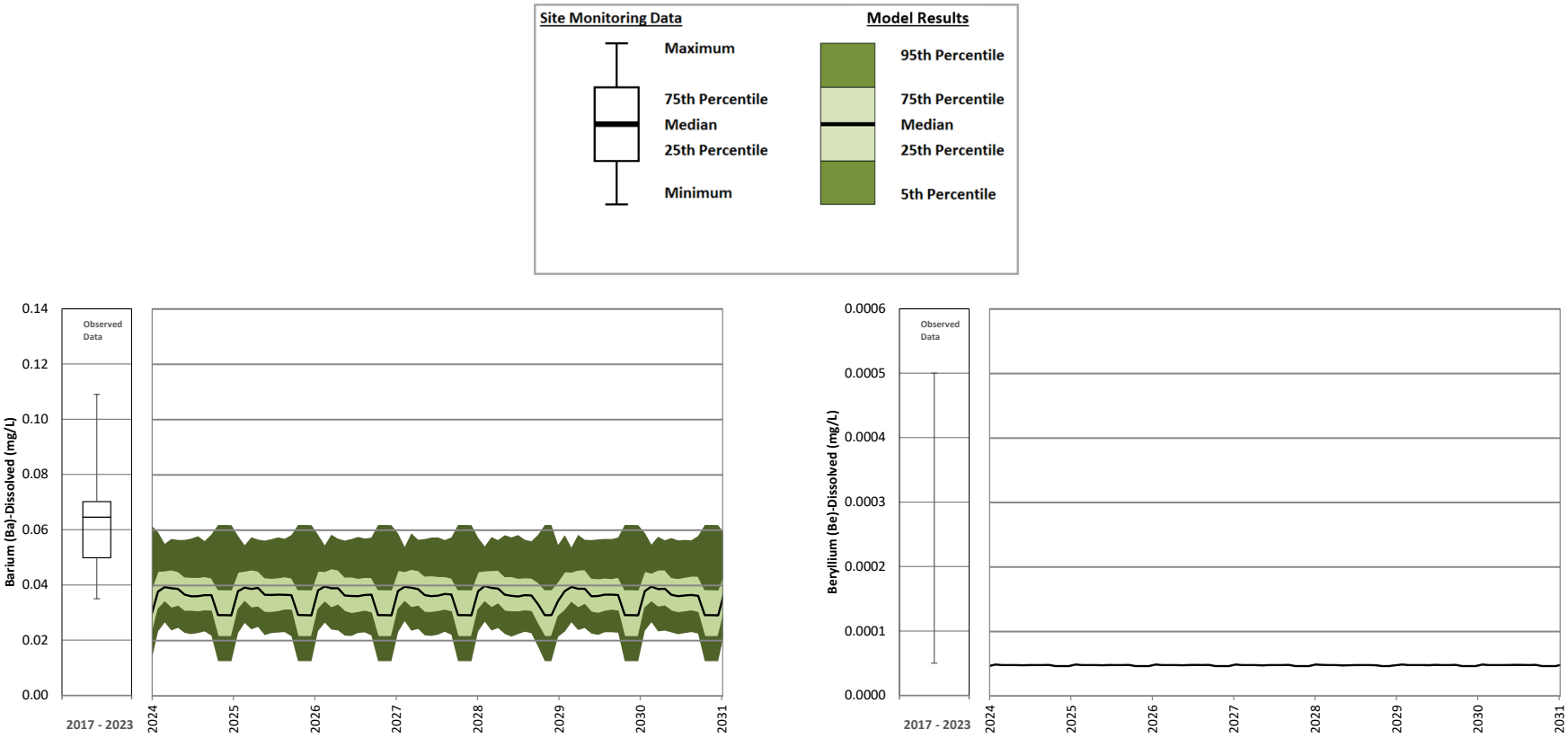

Figure B **29: Cariboo Pit Operations – Dissolved Barium and Dissolved Beryllium**

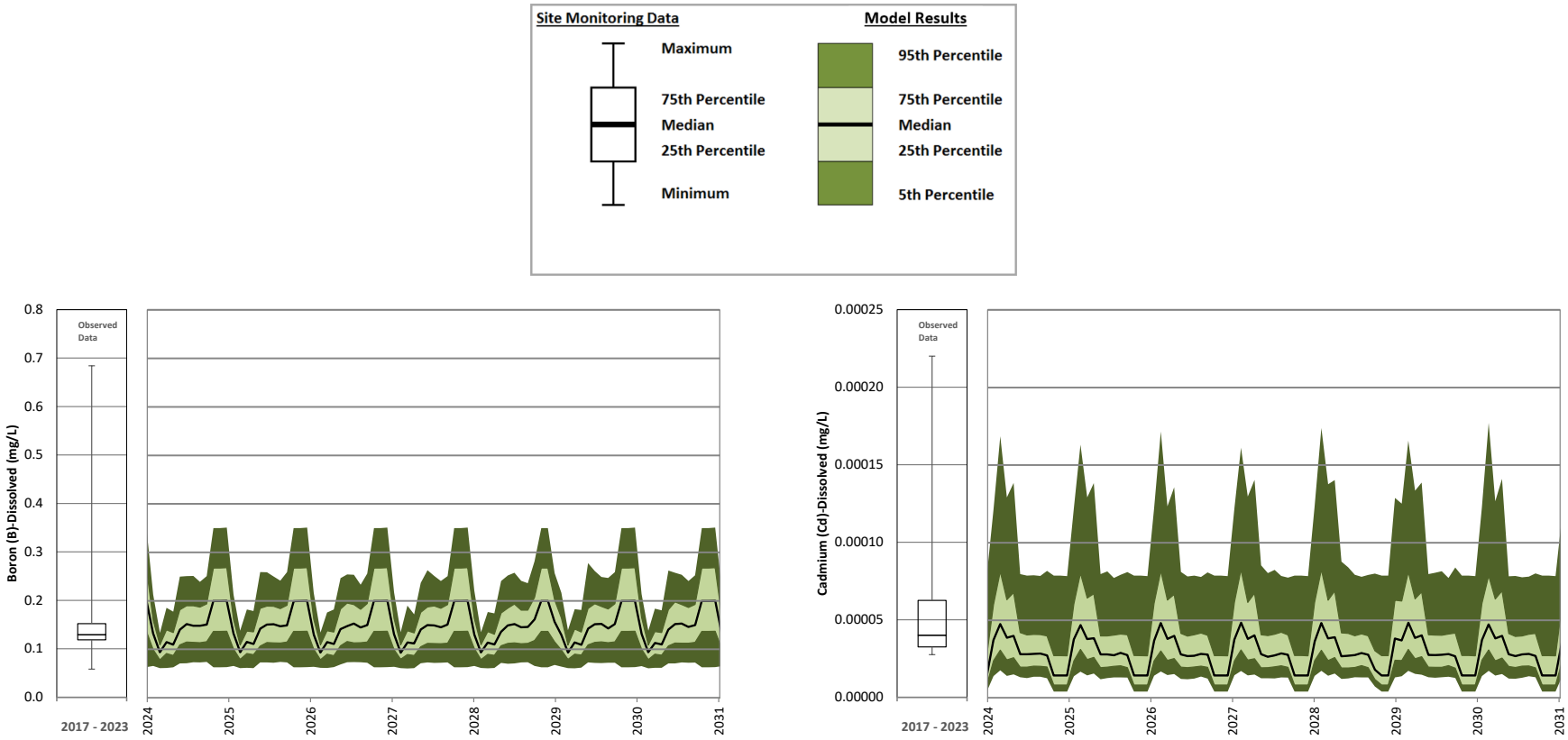

Figure B **30: Cariboo Pit Operations – Dissolved Boron and Dissolved Cadmium**

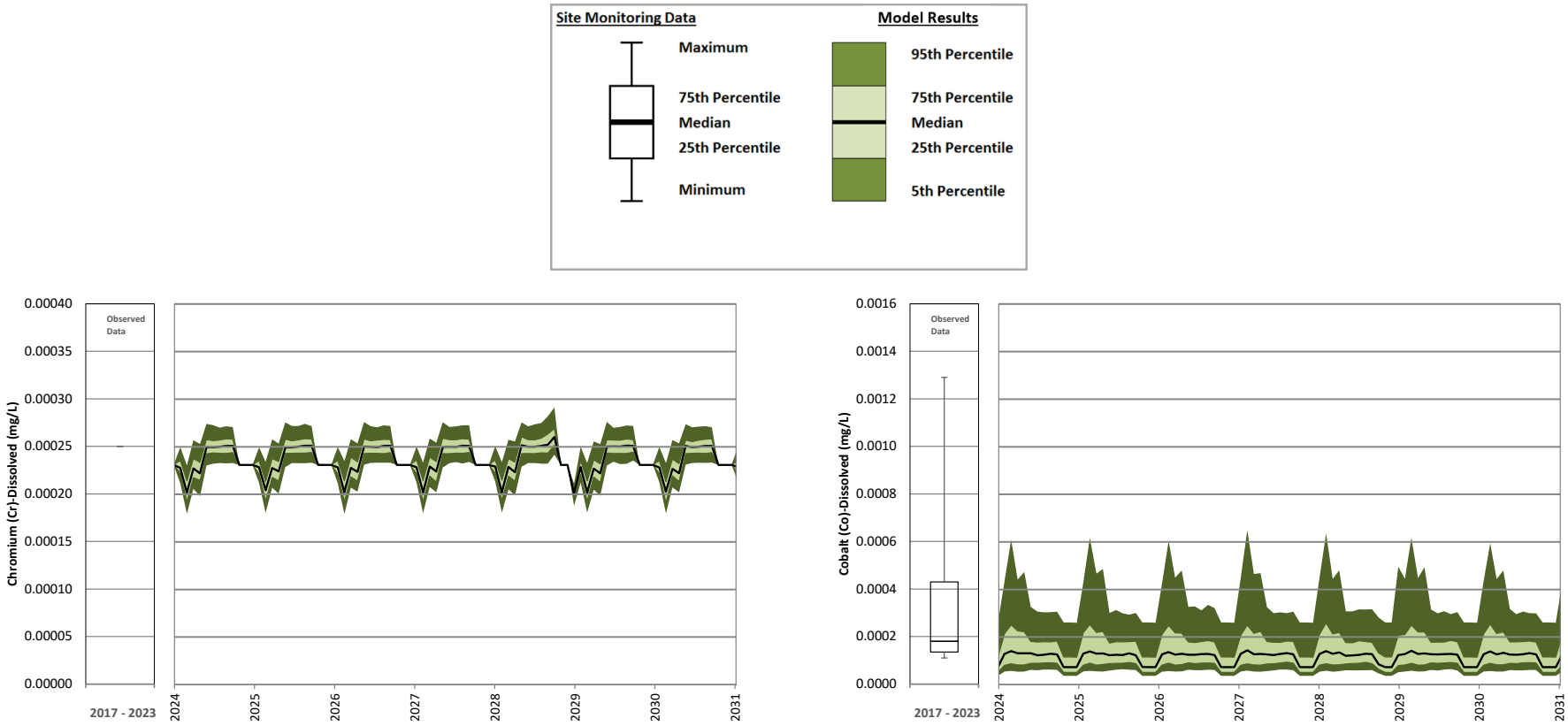

Figure B **31: Cariboo Pit Operations – Dissolved Chromium and Dissolved Cobalt**

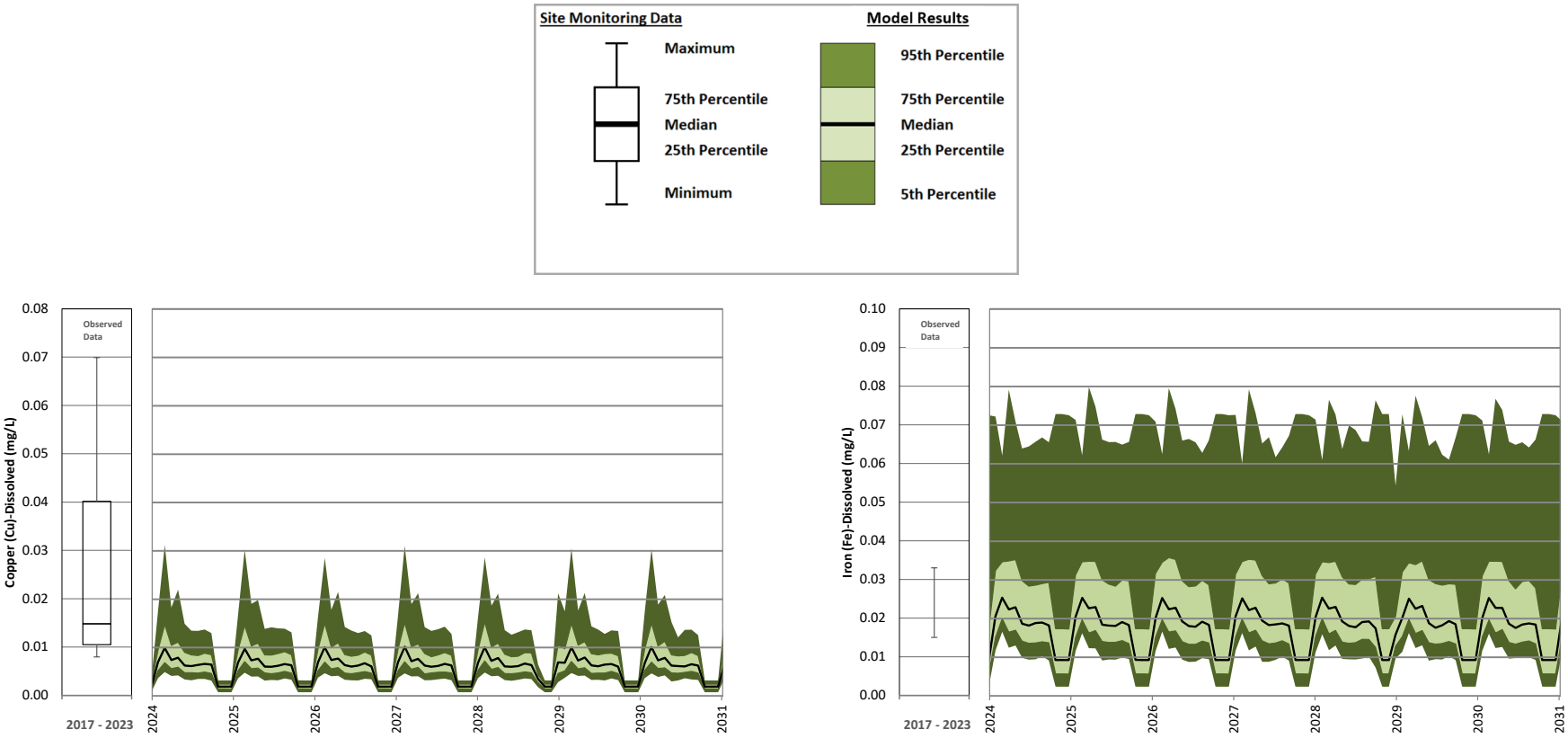

Figure B **32: Cariboo Pit Operations – Dissolved Copper and Dissolved Iron**

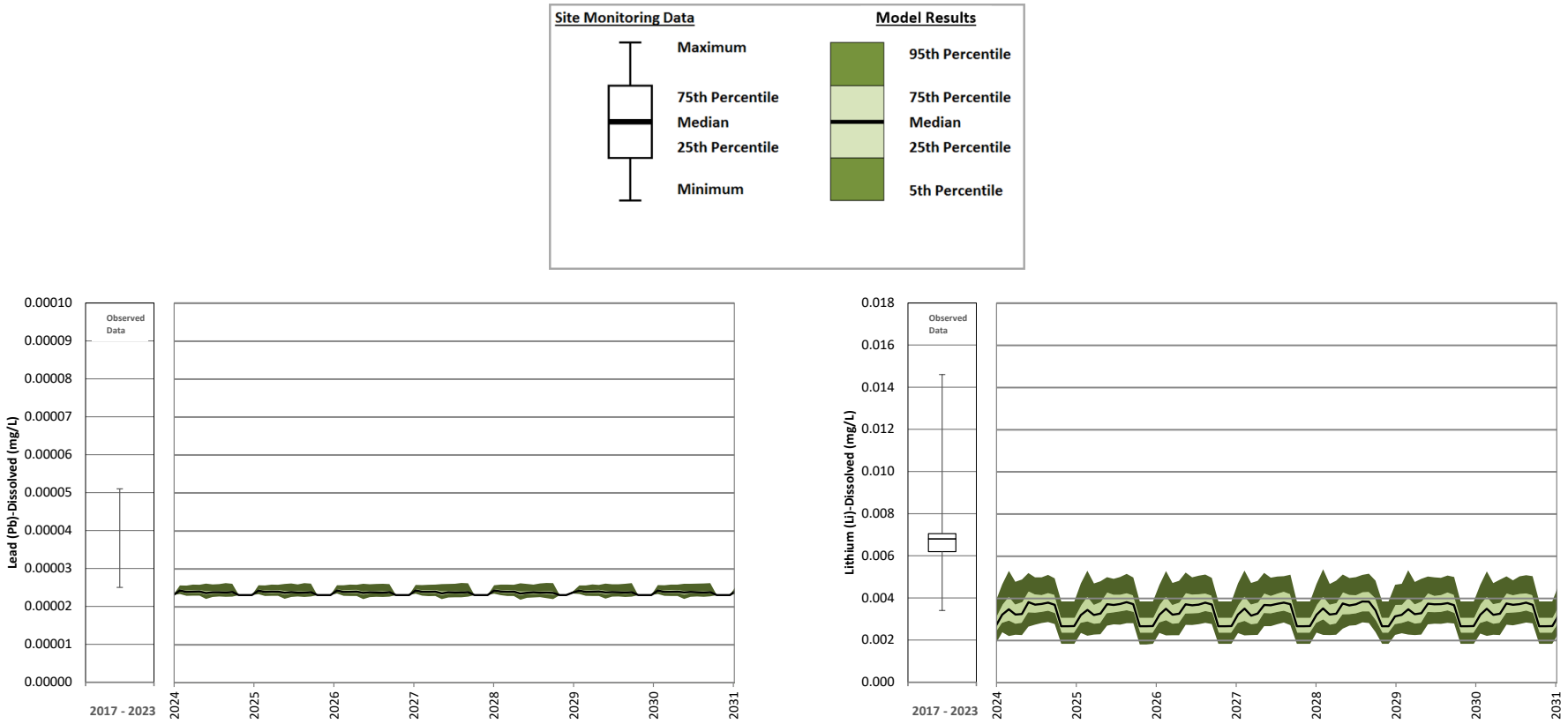

Figure B **33: Cariboo Pit Operations – Dissolved Lead and Dissolved Lithium**

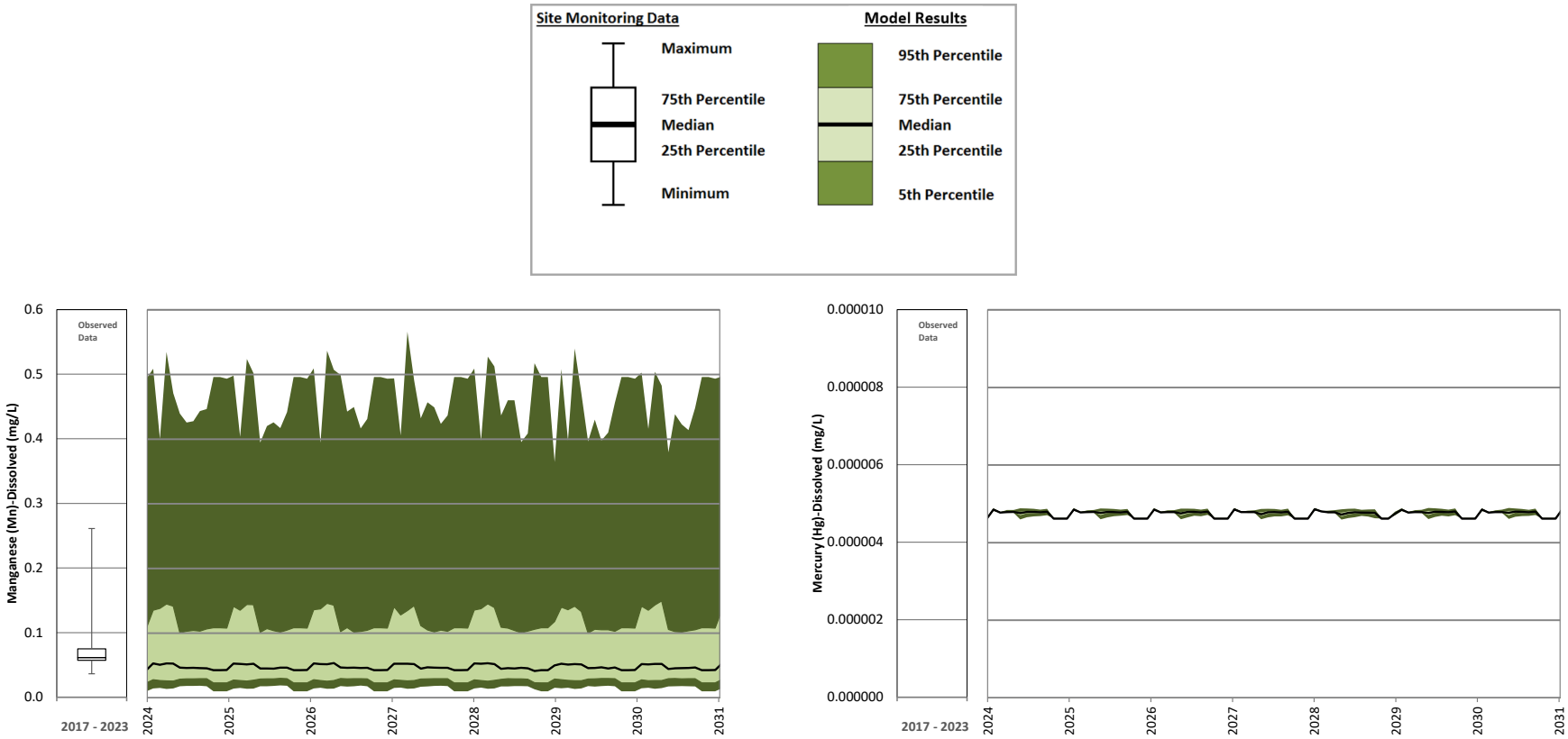

Figure B **34: Cariboo Pit Operations – Dissolved Manganese and Dissolved Mercury**

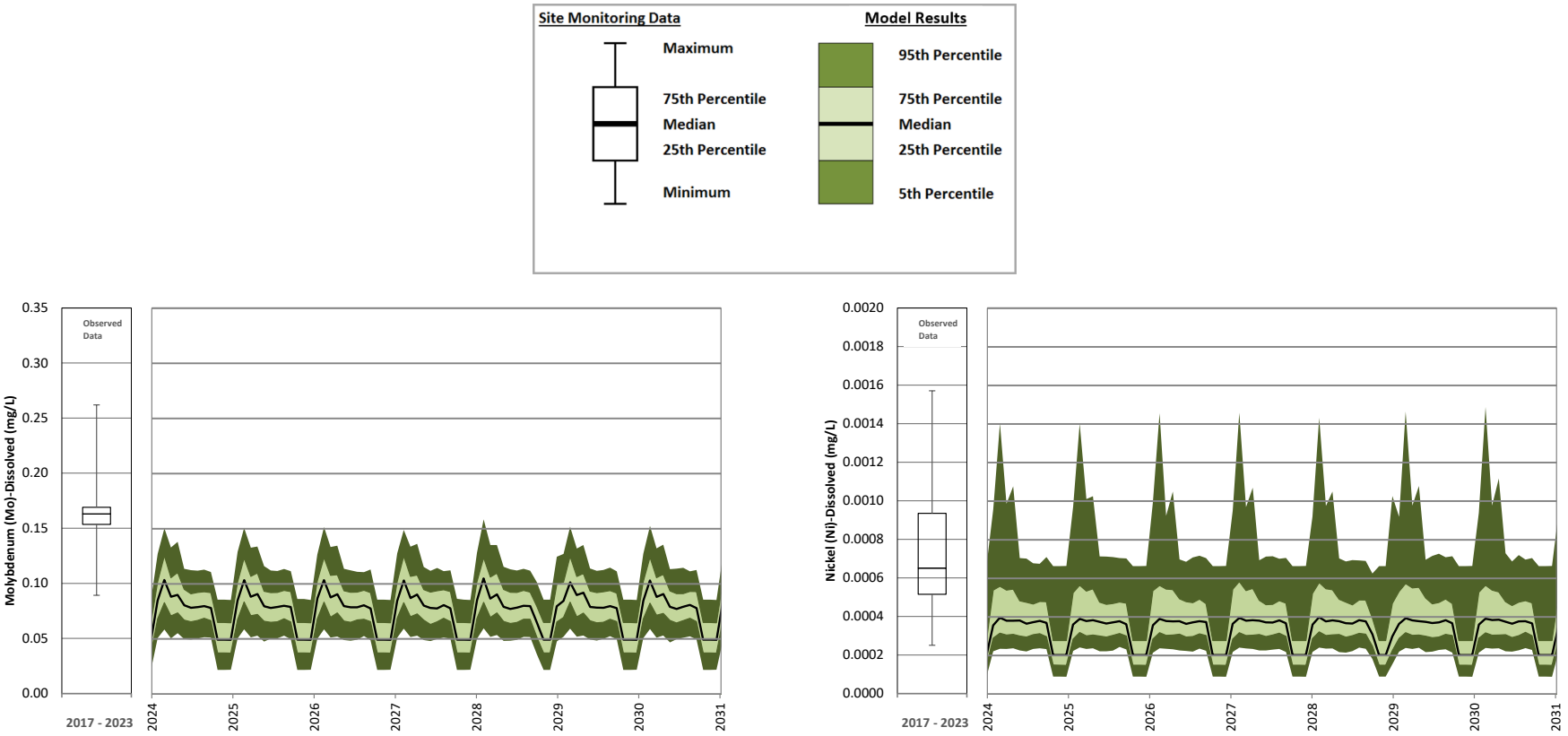

Figure B **35: Cariboo Pit Operations – Dissolved Molybdenum and Dissolved Nickel**

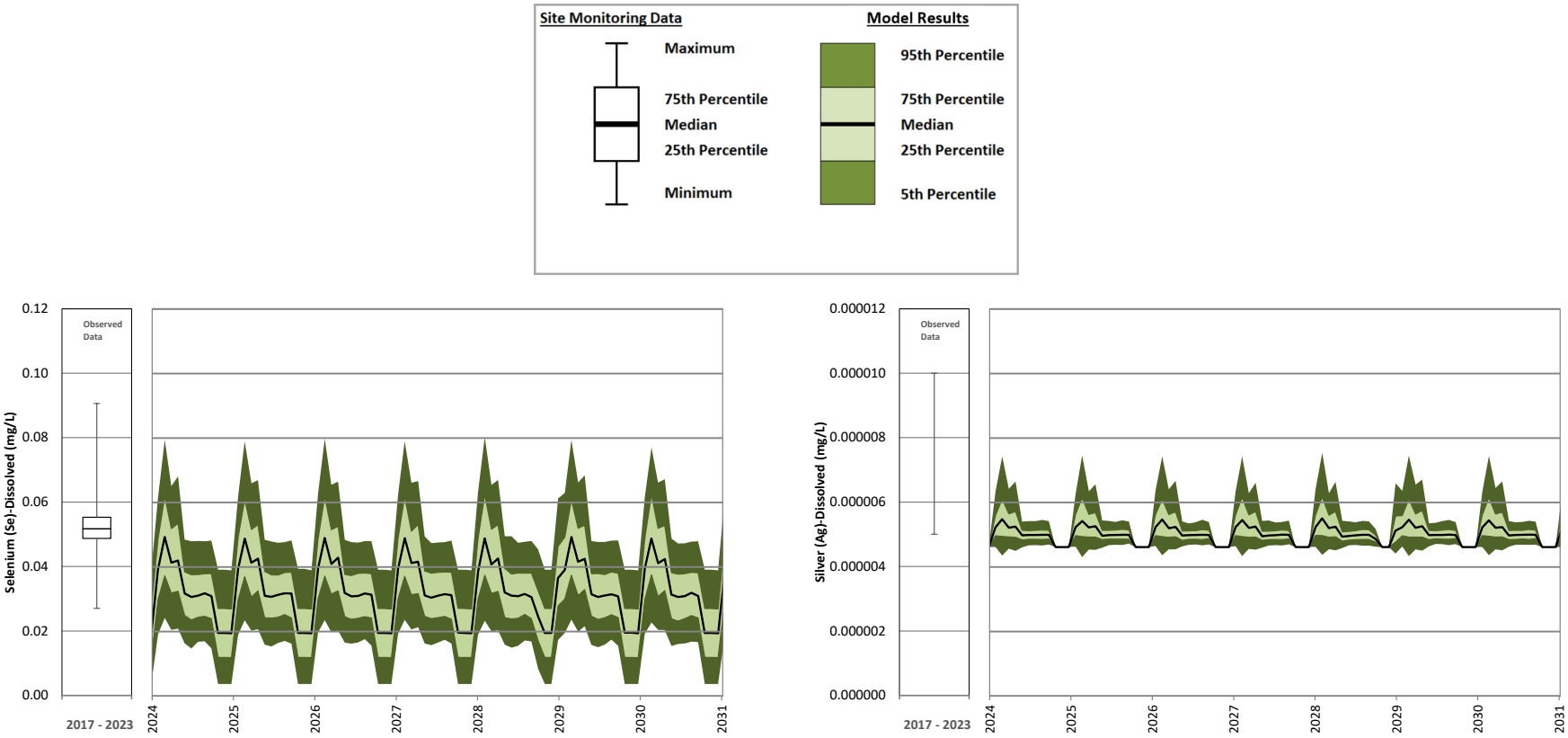

Figure B **36: Cariboo Pit Operations – Dissolved Selenium and Dissolved Silver**

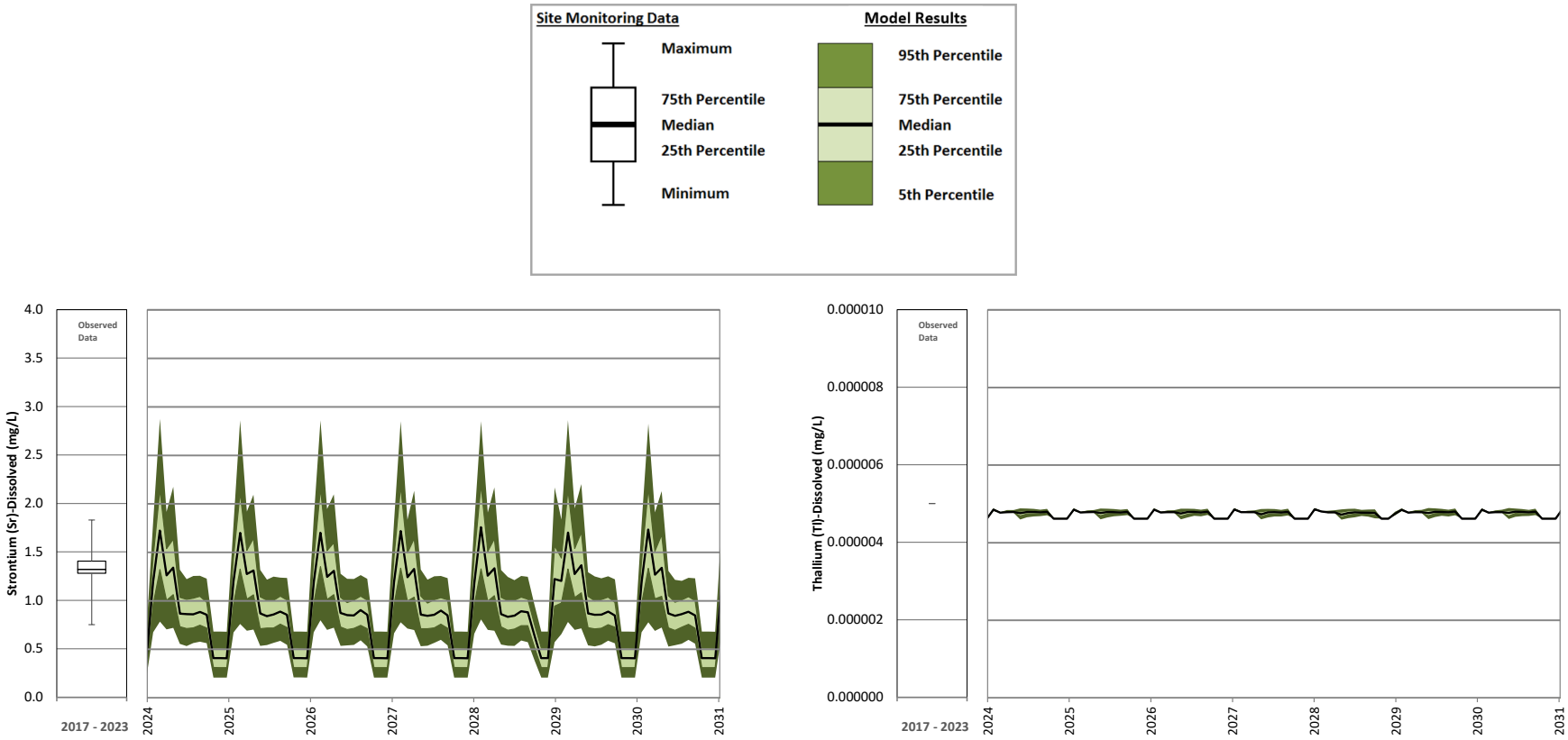

Figure B **37: Cariboo Pit Operations – Dissolved Strontium and Dissolved Thallium**

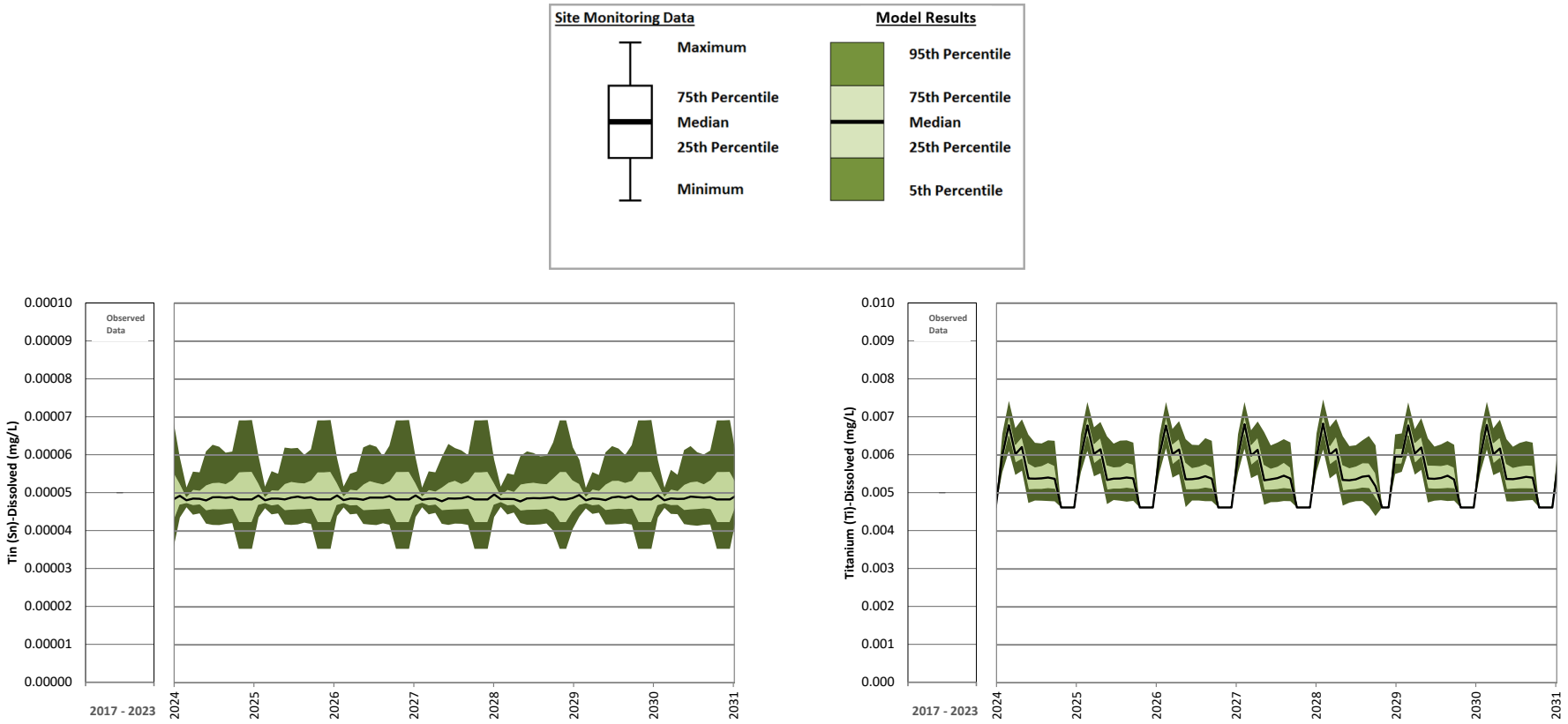

Figure B **38: Cariboo Pit Operations – Dissolved Tin and Dissolved Titanium**

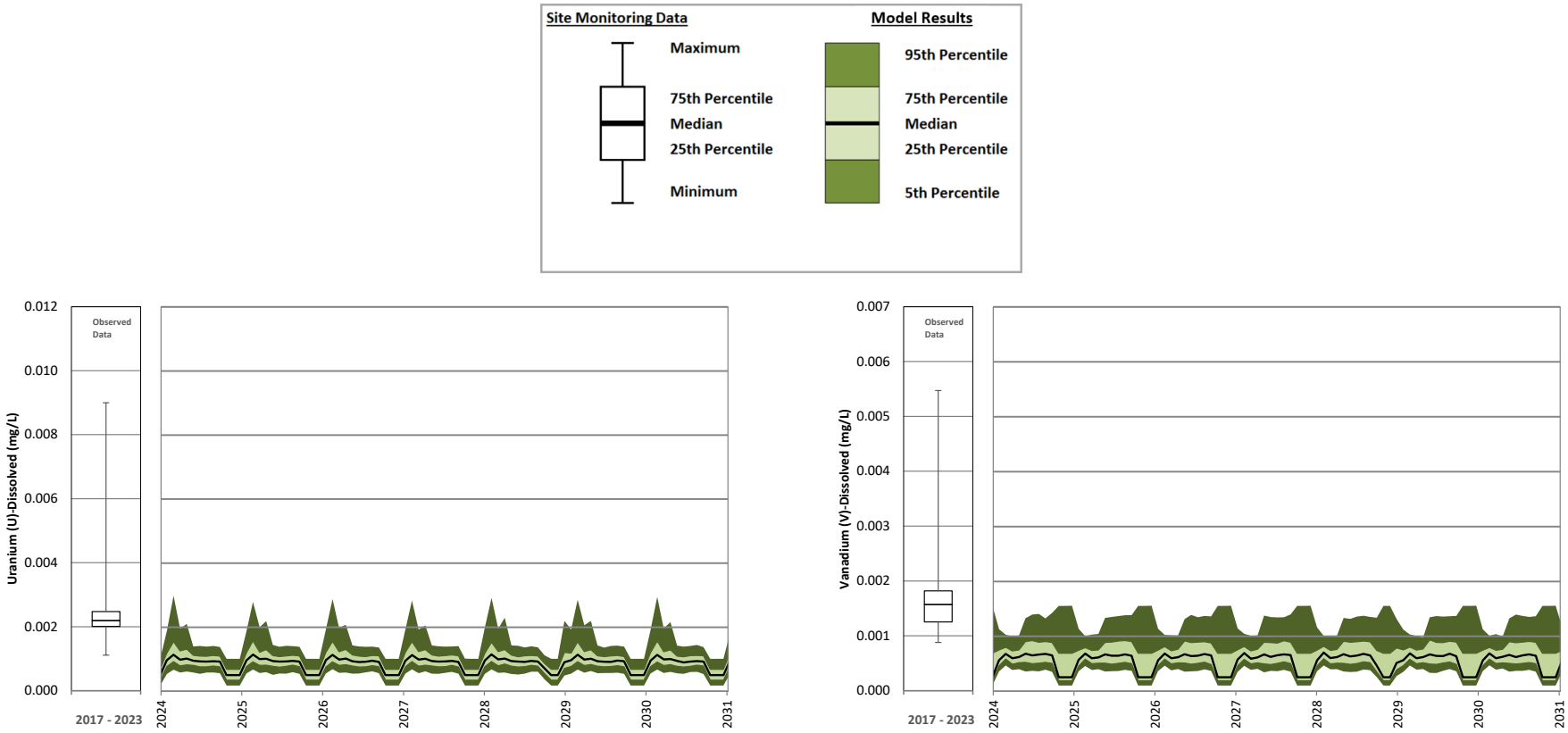

Figure B **39: Cariboo Pit Operations – Dissolved Uranium and Dissolved Vanadium**

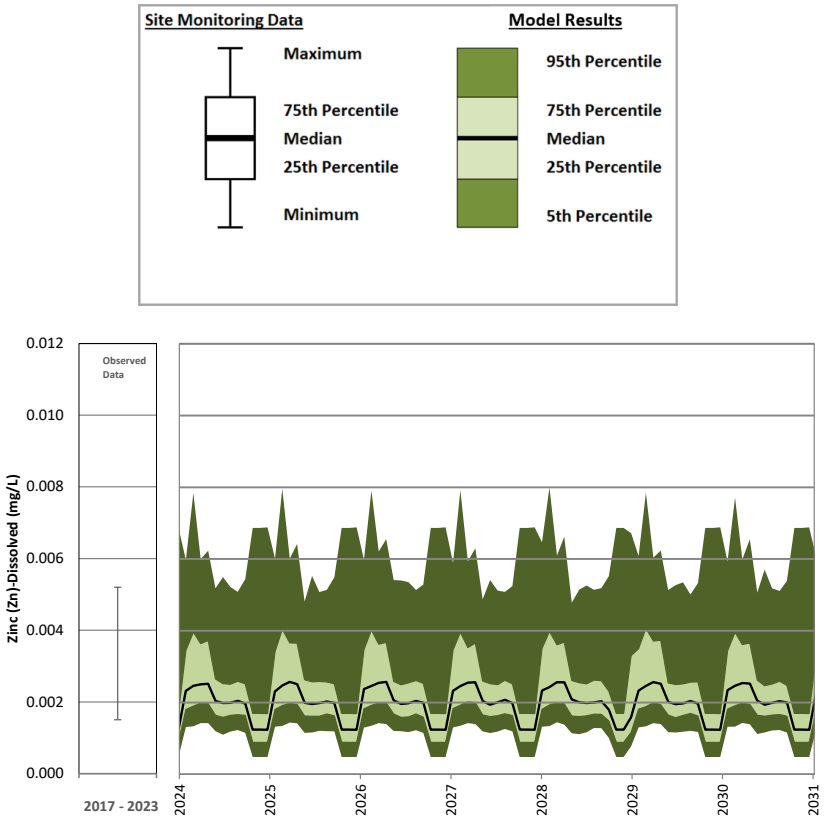

Figure B **40: Cariboo Pit Operations – Dissolved Zinc**

Springer-Cariboo Pit Operations

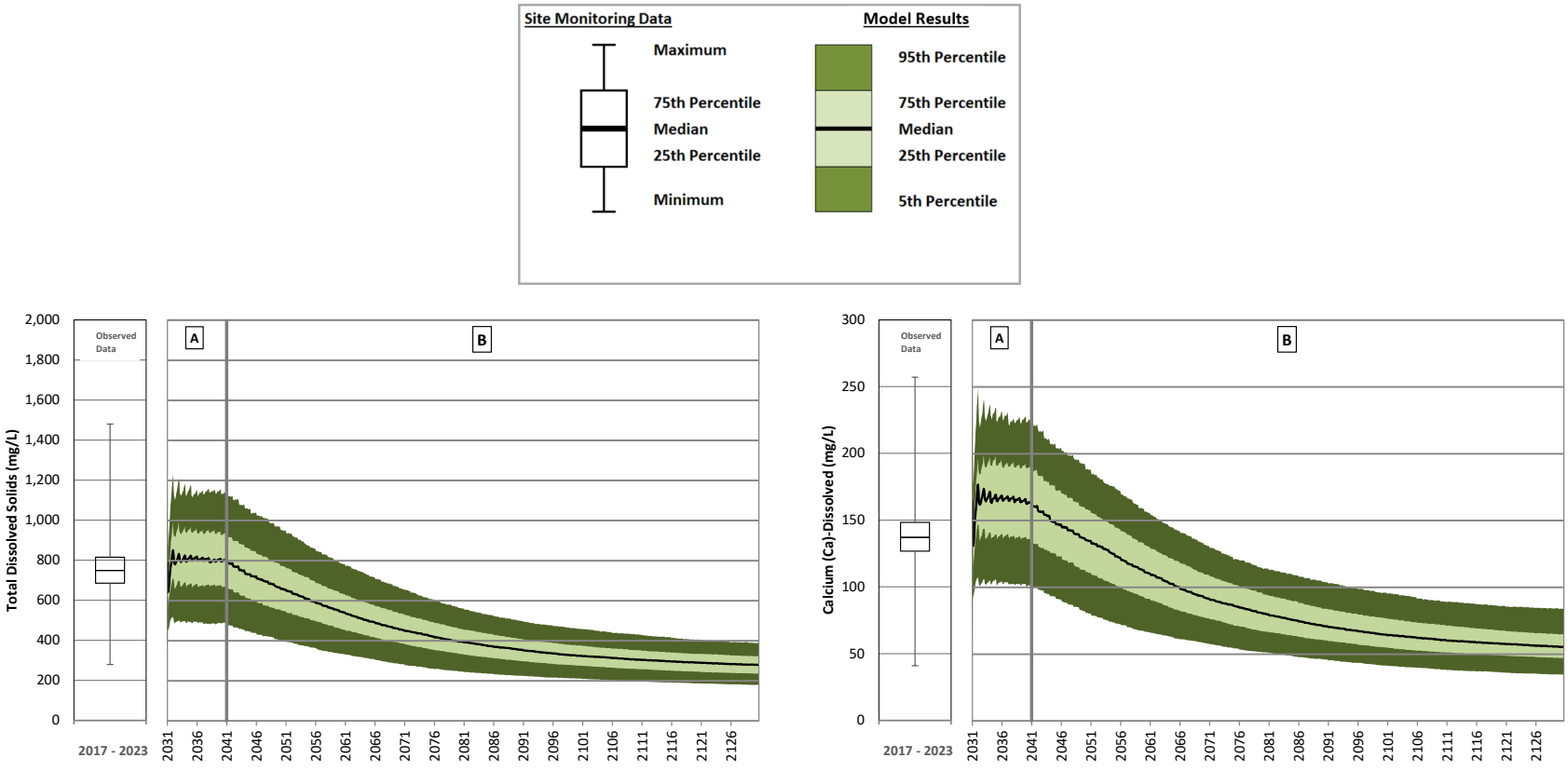

A = Closure; B = Post-closure

Figure B **41: Springer-Cariboo Pit Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

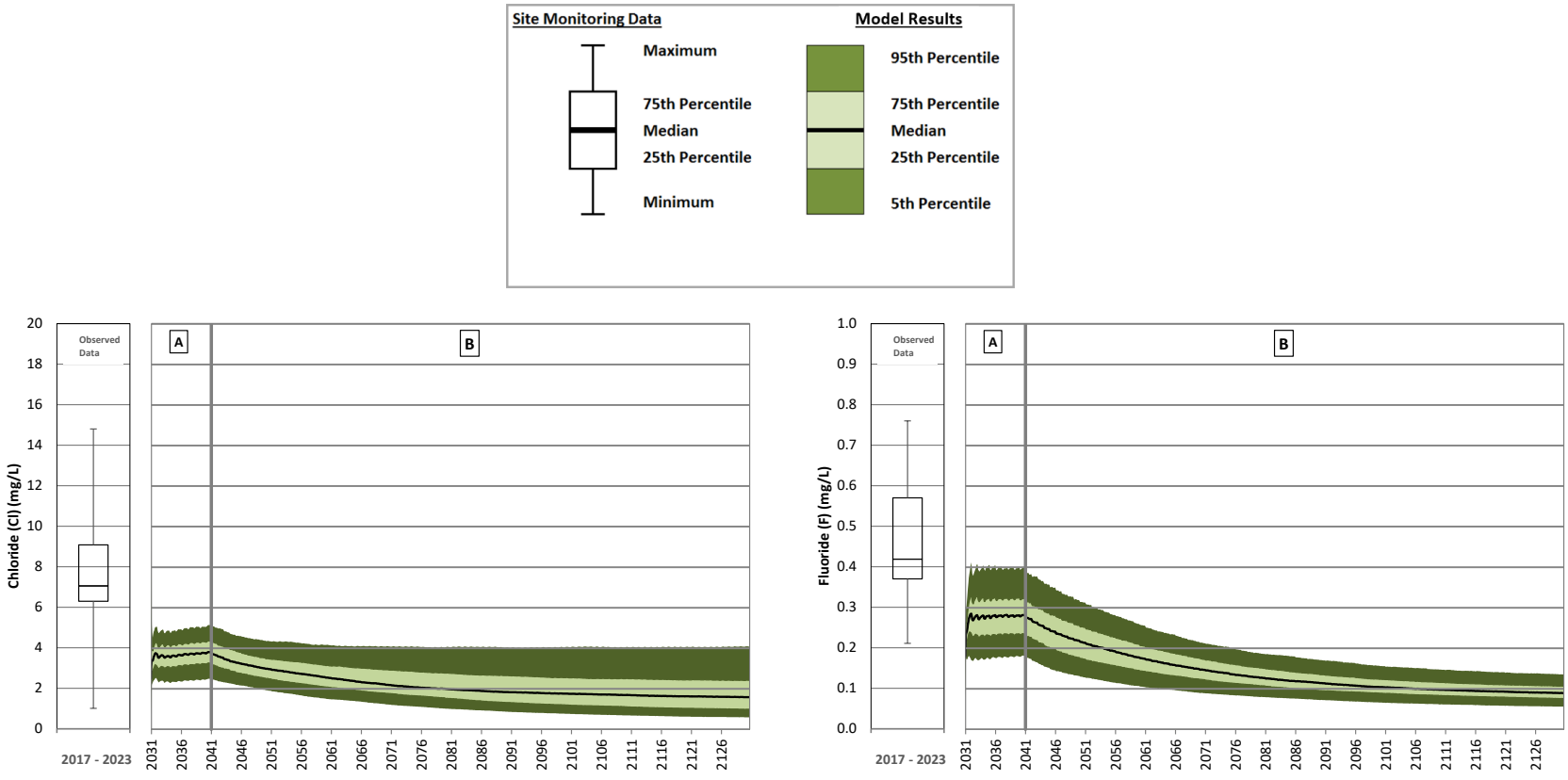

A = Closure; B = Post-closure

Figure B **42: Springer-Cariboo Pit Operations, Closure and Post-closure – Chloride and Fluoride**

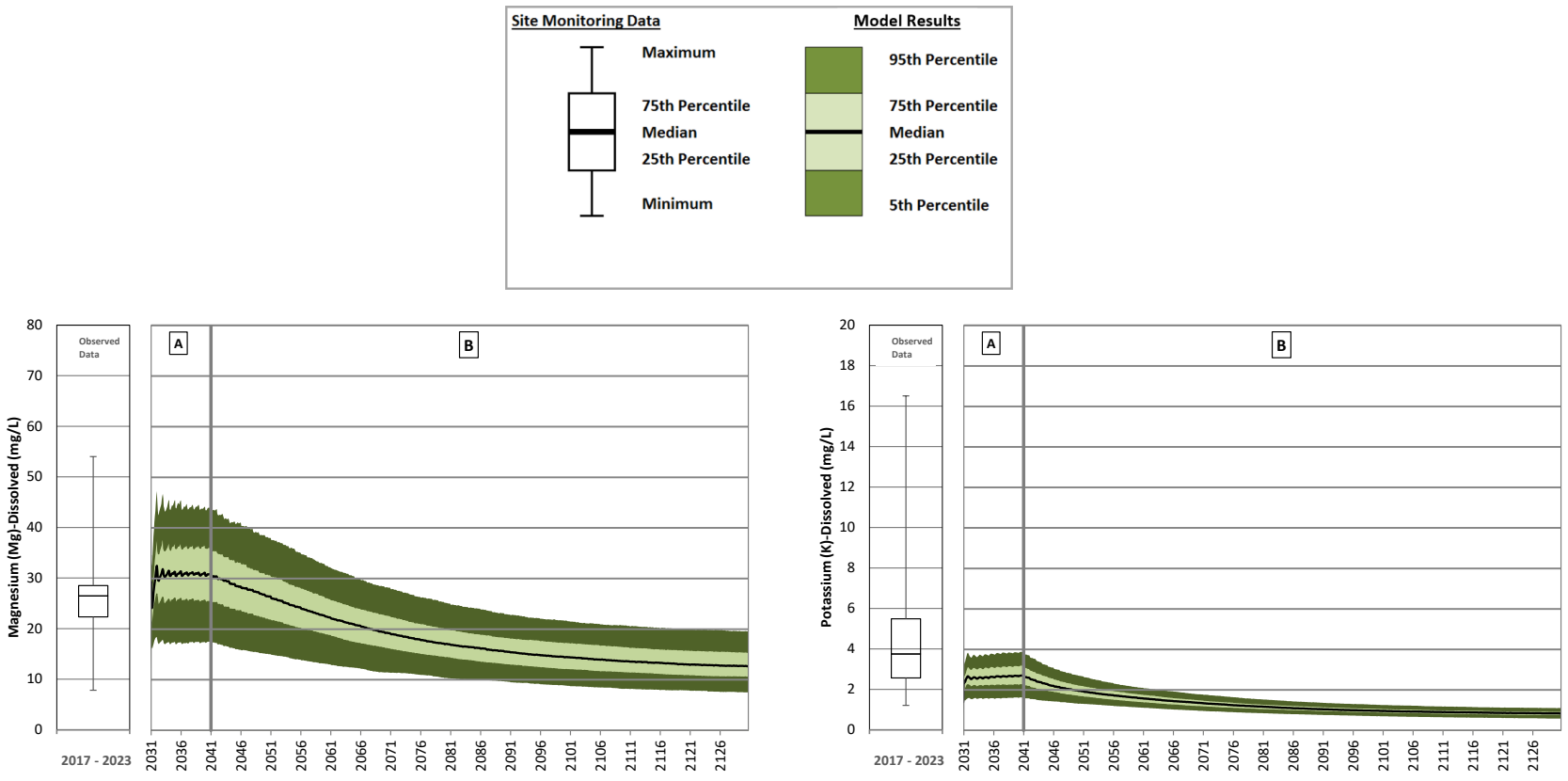

Figure B **43: Springer-Cariboo Pit Operations, Closure and Post-closure – Magnesium and Potassium**

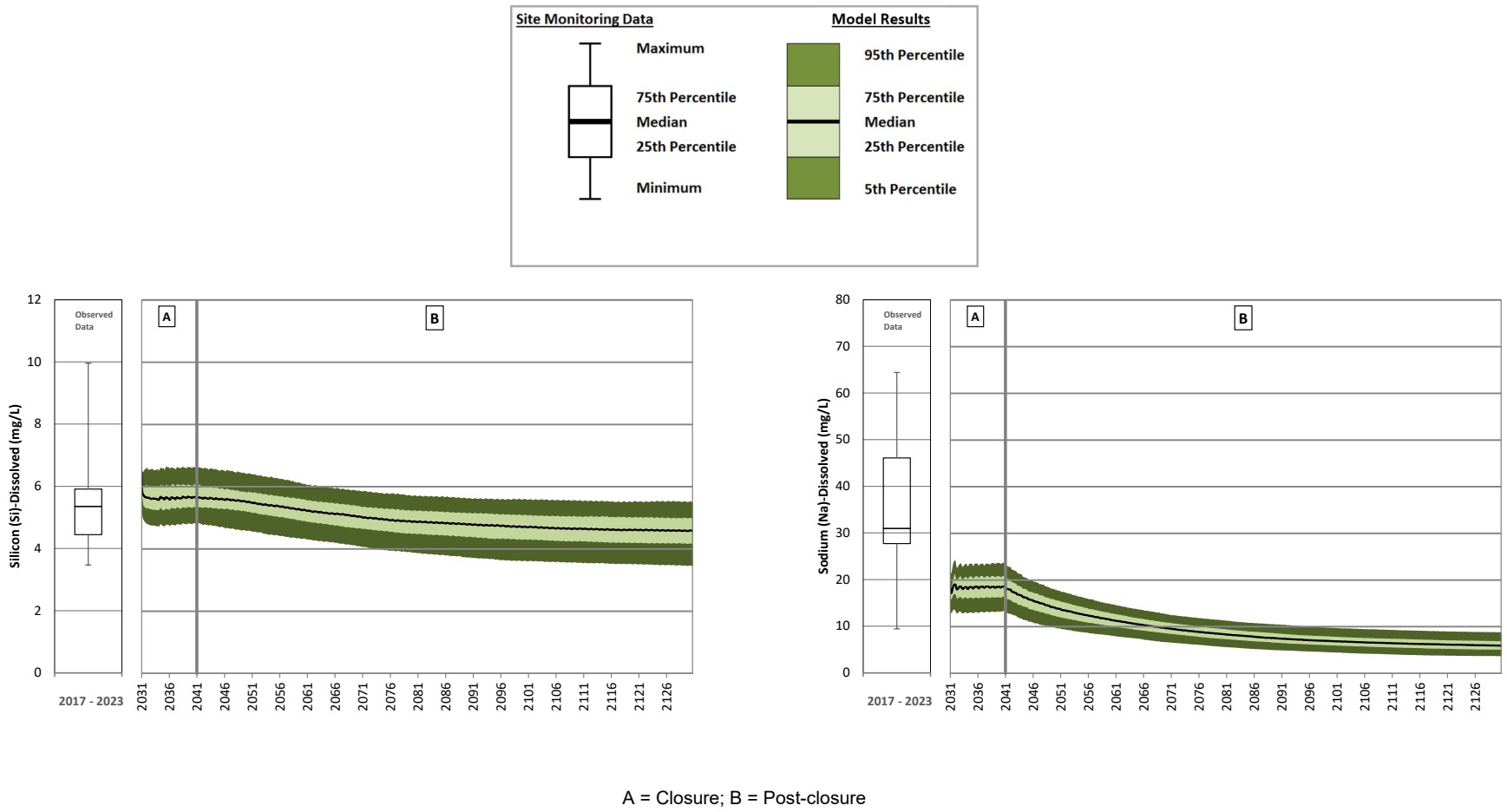

Figure B **44: Springer-Cariboo Pit Operations, Closure and Post-closure – Silicon and Sodium**

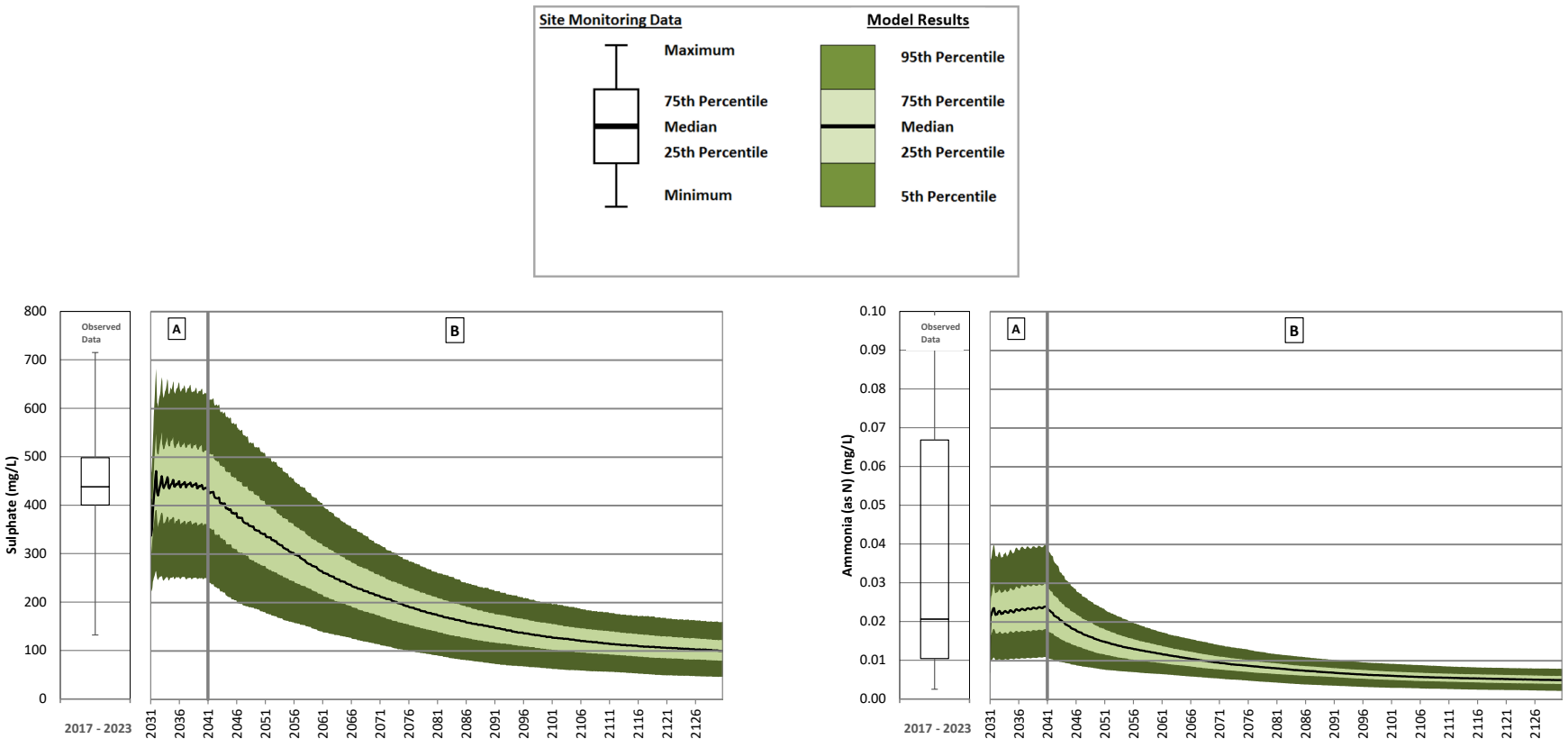

A = Closure; B = Post-closure

Figure B **45: Springer-Cariboo Pit Operations, Closure and Post-closure – Sulphate and Total Ammonia**

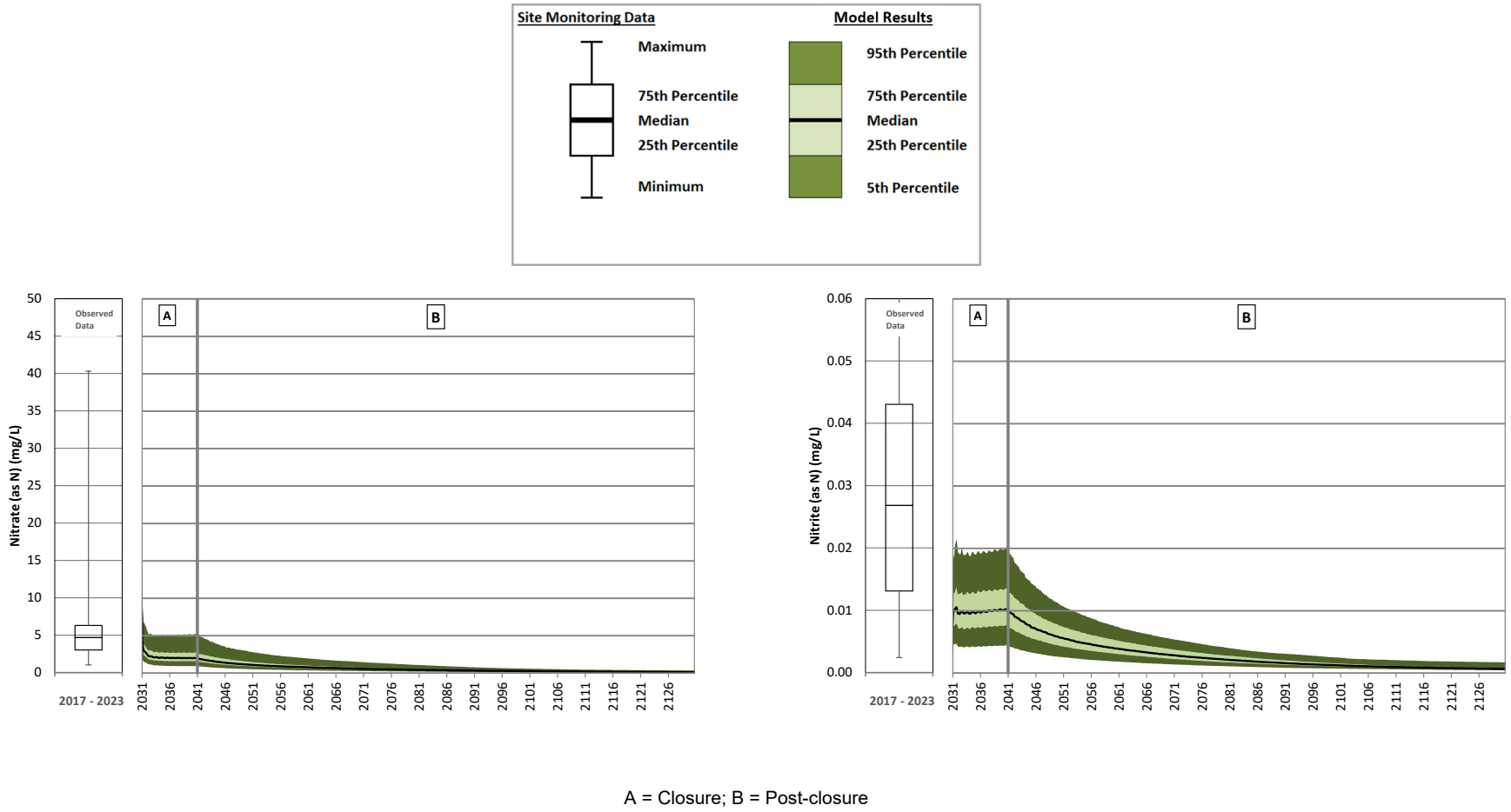

A = Closure; B = Post-closure

Figure B **46: Springer-Cariboo Pit Operations, Closure and Post-closure – Nitrate and Nitrite**

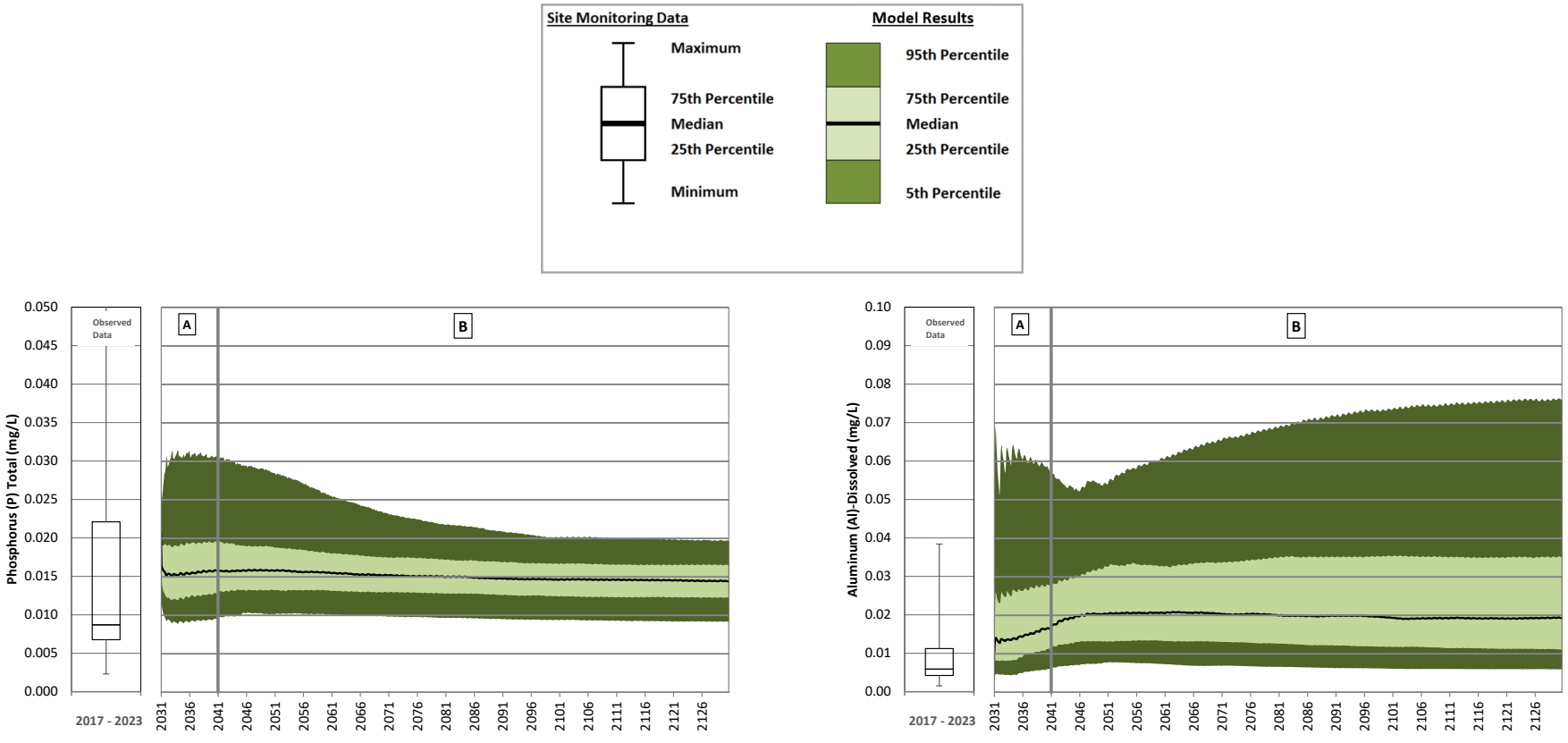

A = Closure; B = Post-closure

Note: The increases in dissolved aluminum concentrations are caused by higher concentrations in the undisturbed water quality inputs compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **47: Springer-Cariboo Pit Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

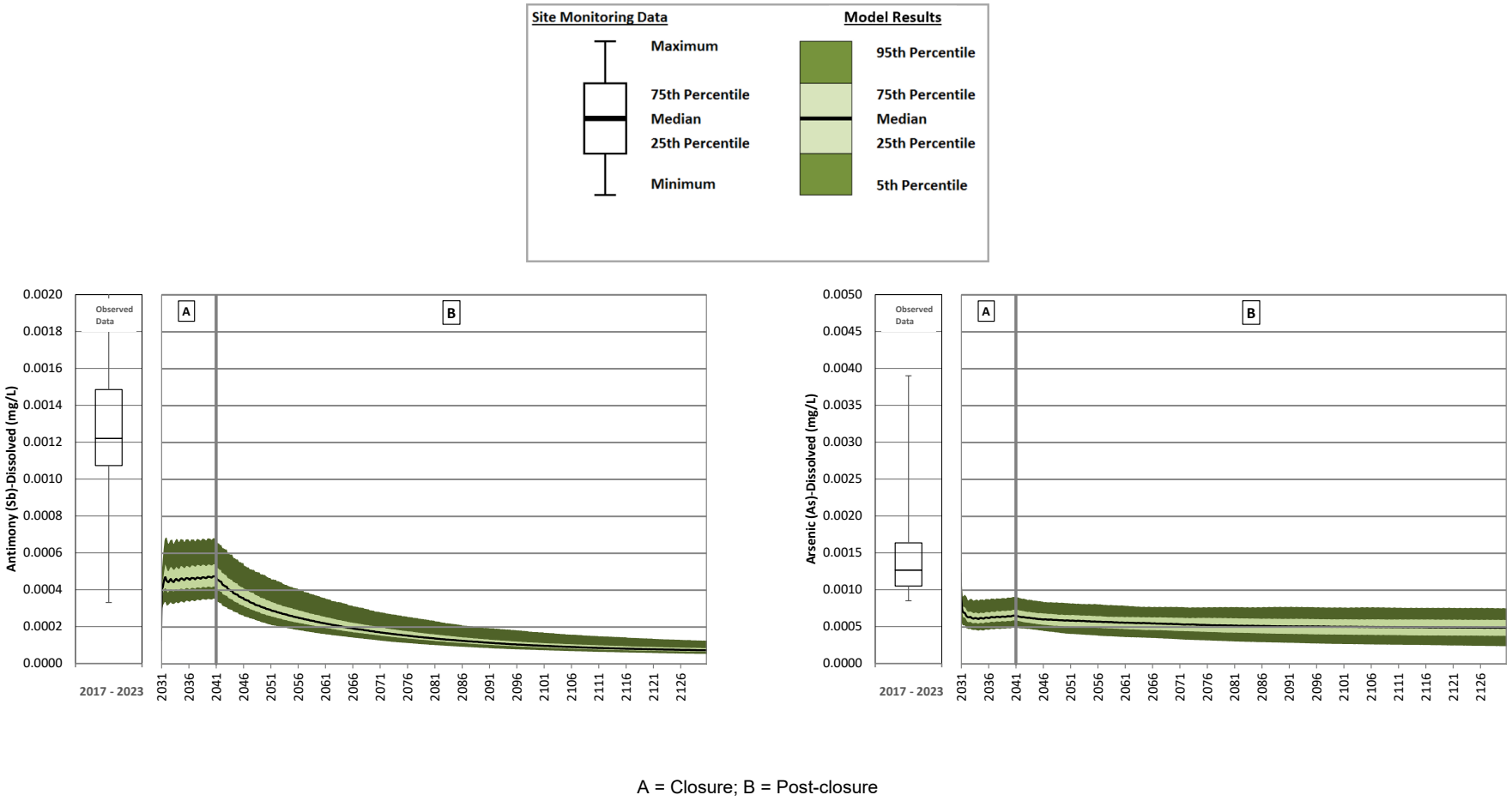

A = Closure; B = Post-closure

Figure B **48: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

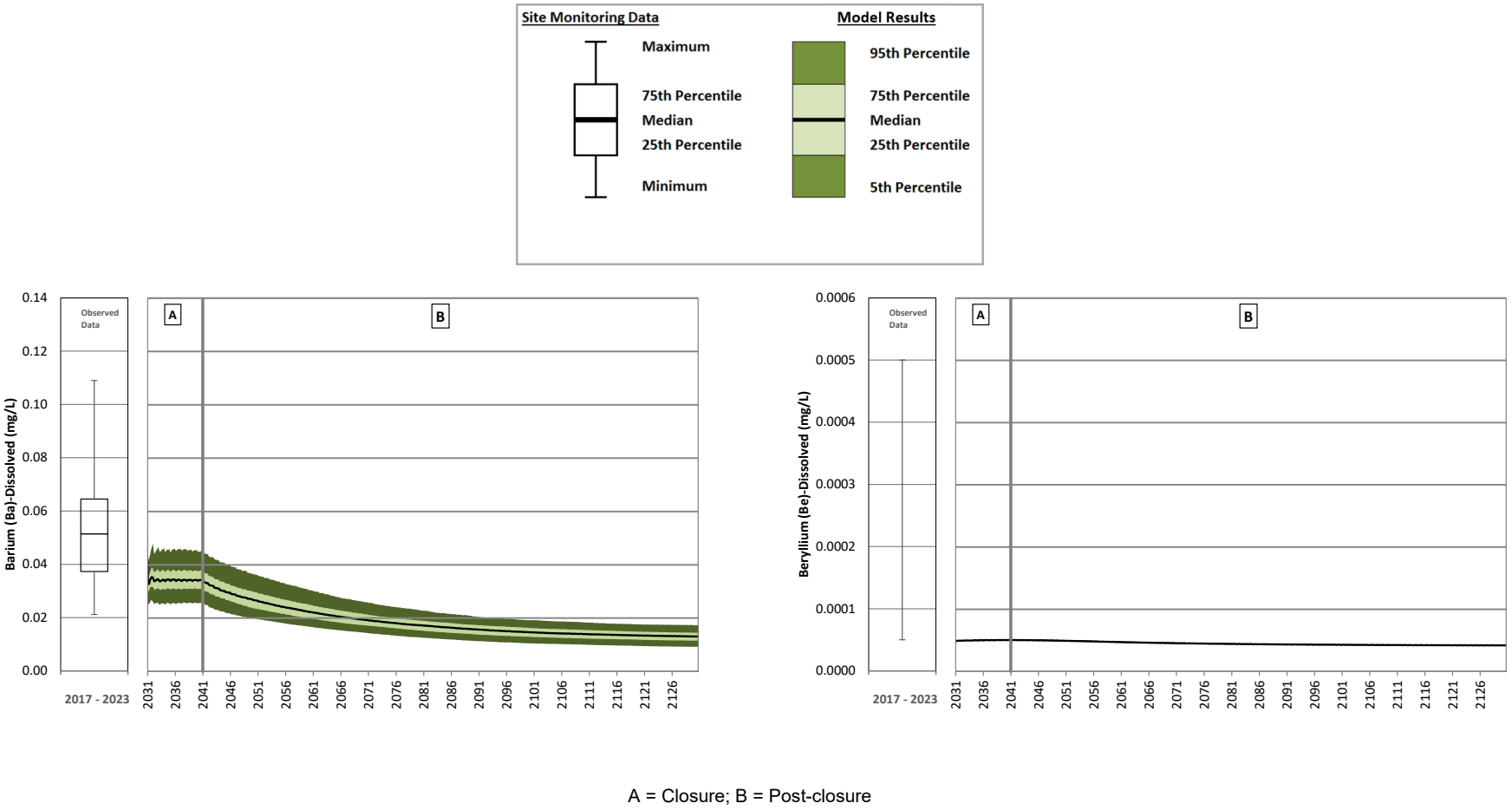

A = Closure; B = Post-closure

Figure B **49: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

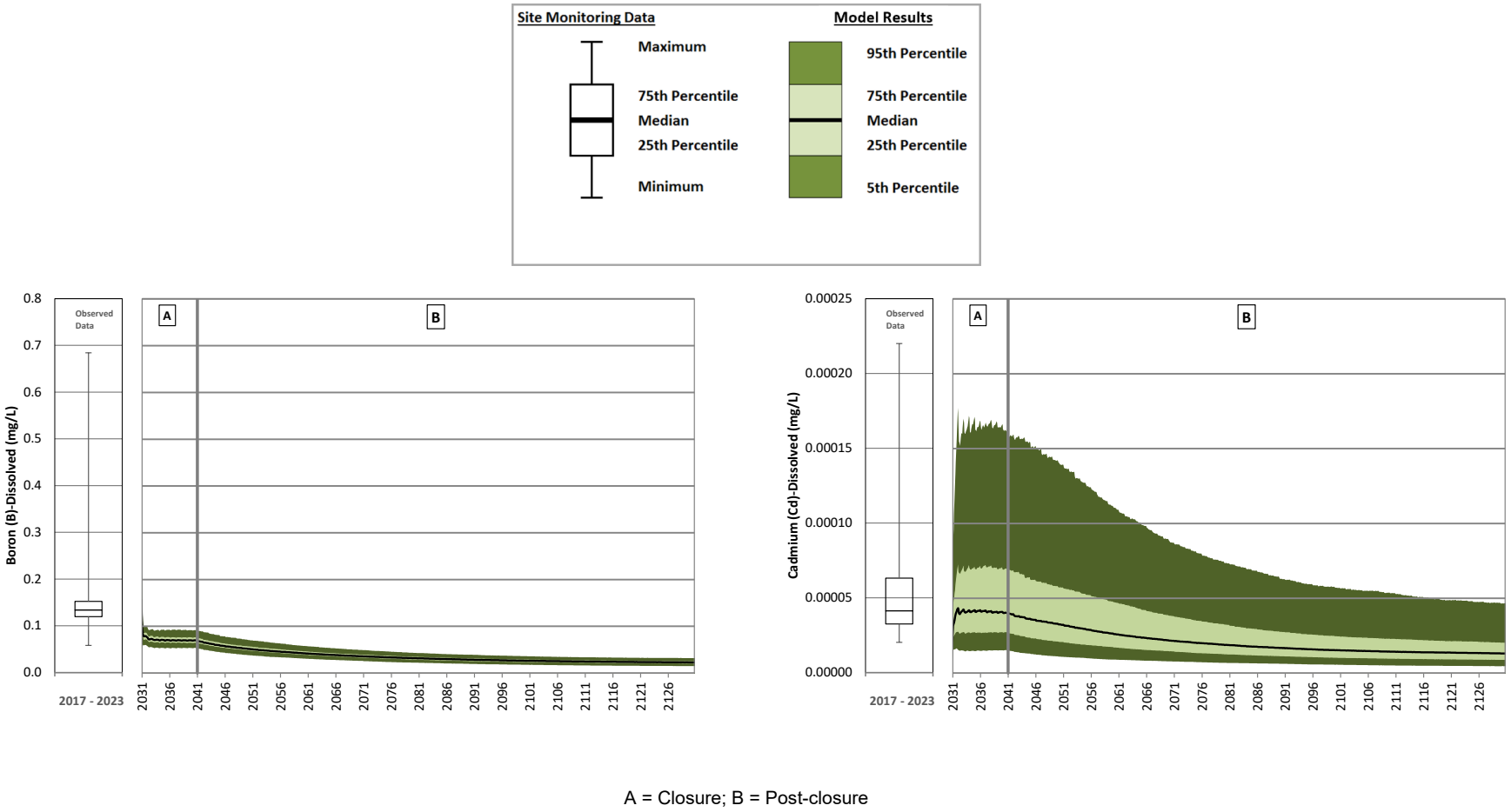

A = Closure; B = Post-closure

Figure B **50: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

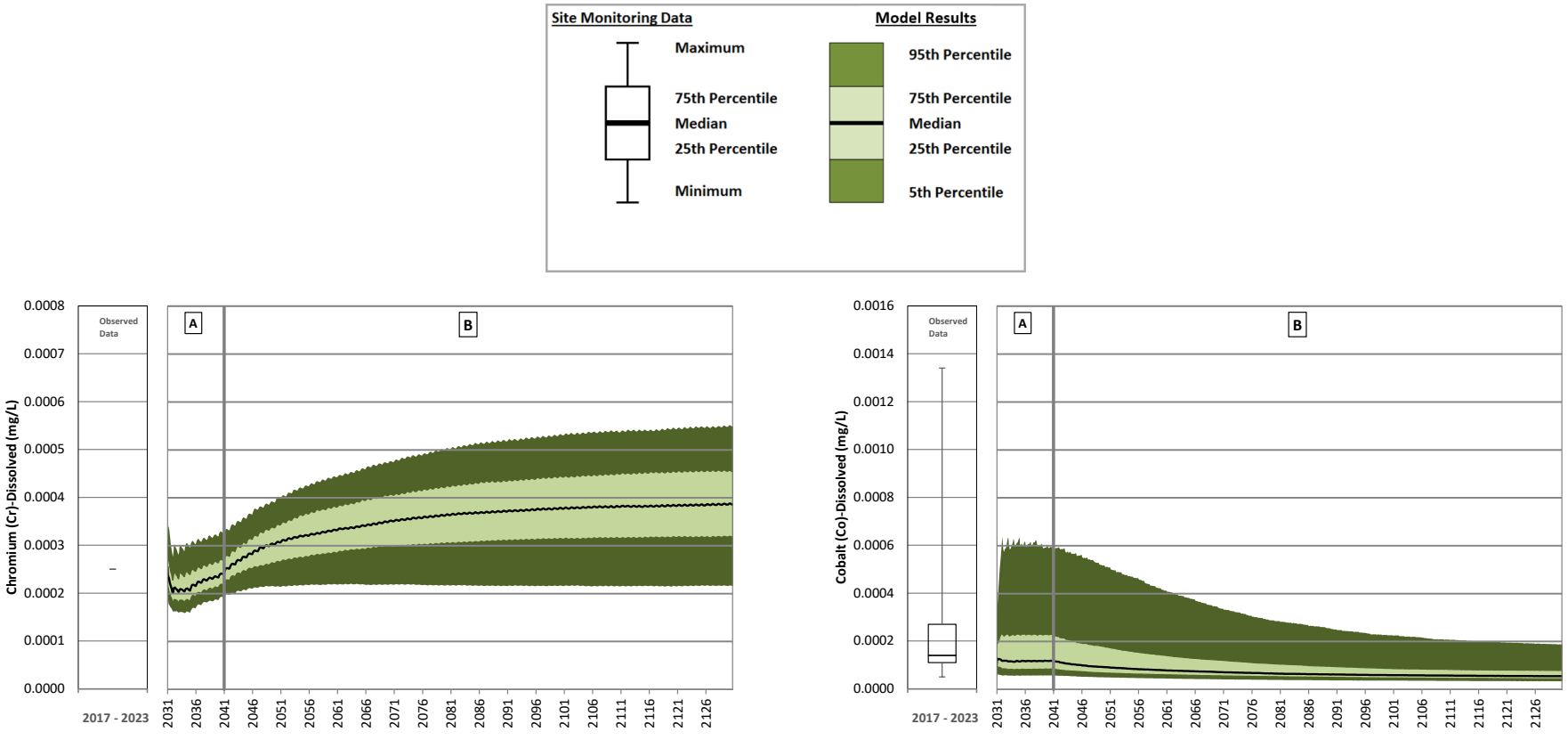

A = Closure; B = Post-closure

Note: The increase in dissolved chromium concentrations is caused by higher concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **51: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

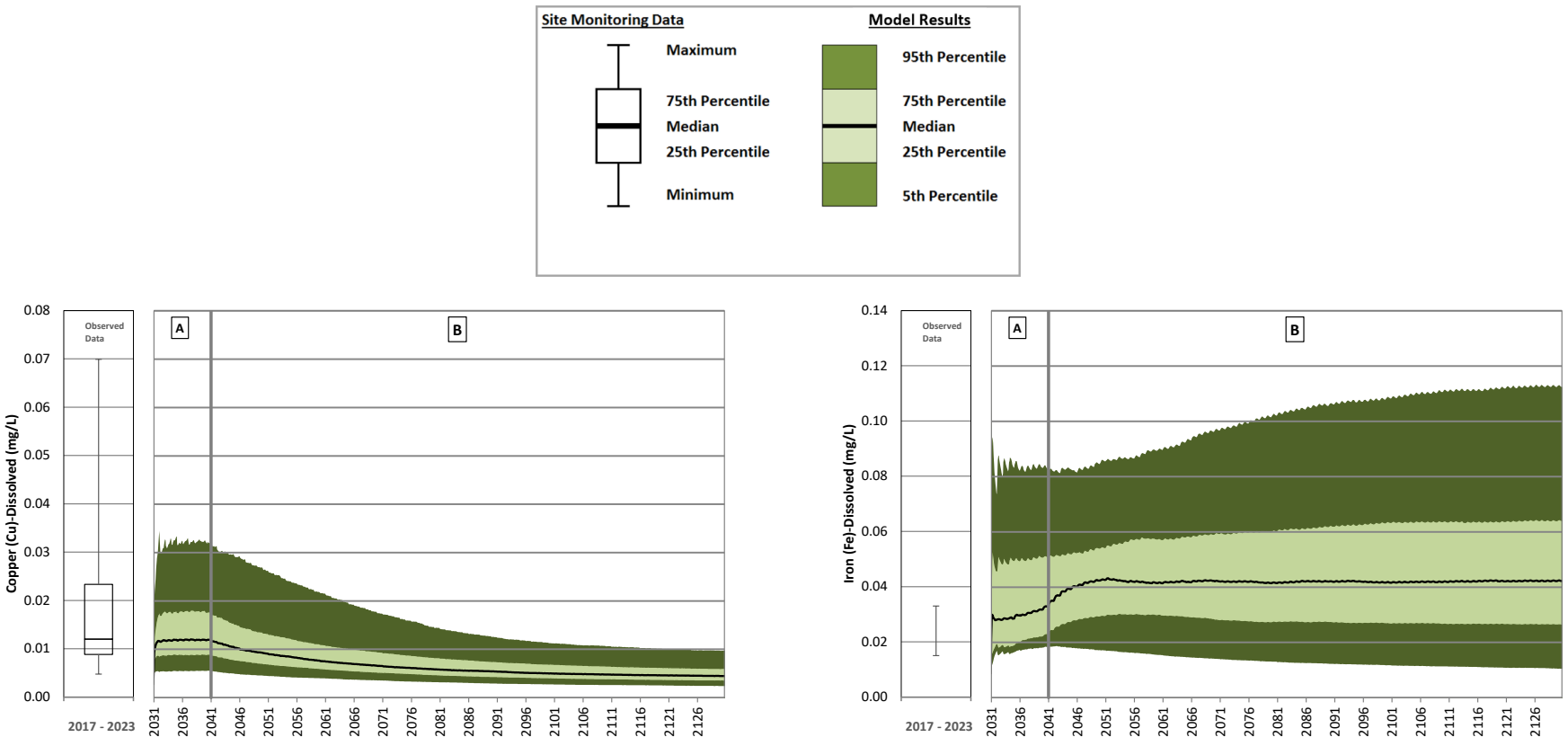

A = Closure; B = Post-closure

Note: The increase in dissolved iron concentrations is caused by higher concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **52: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

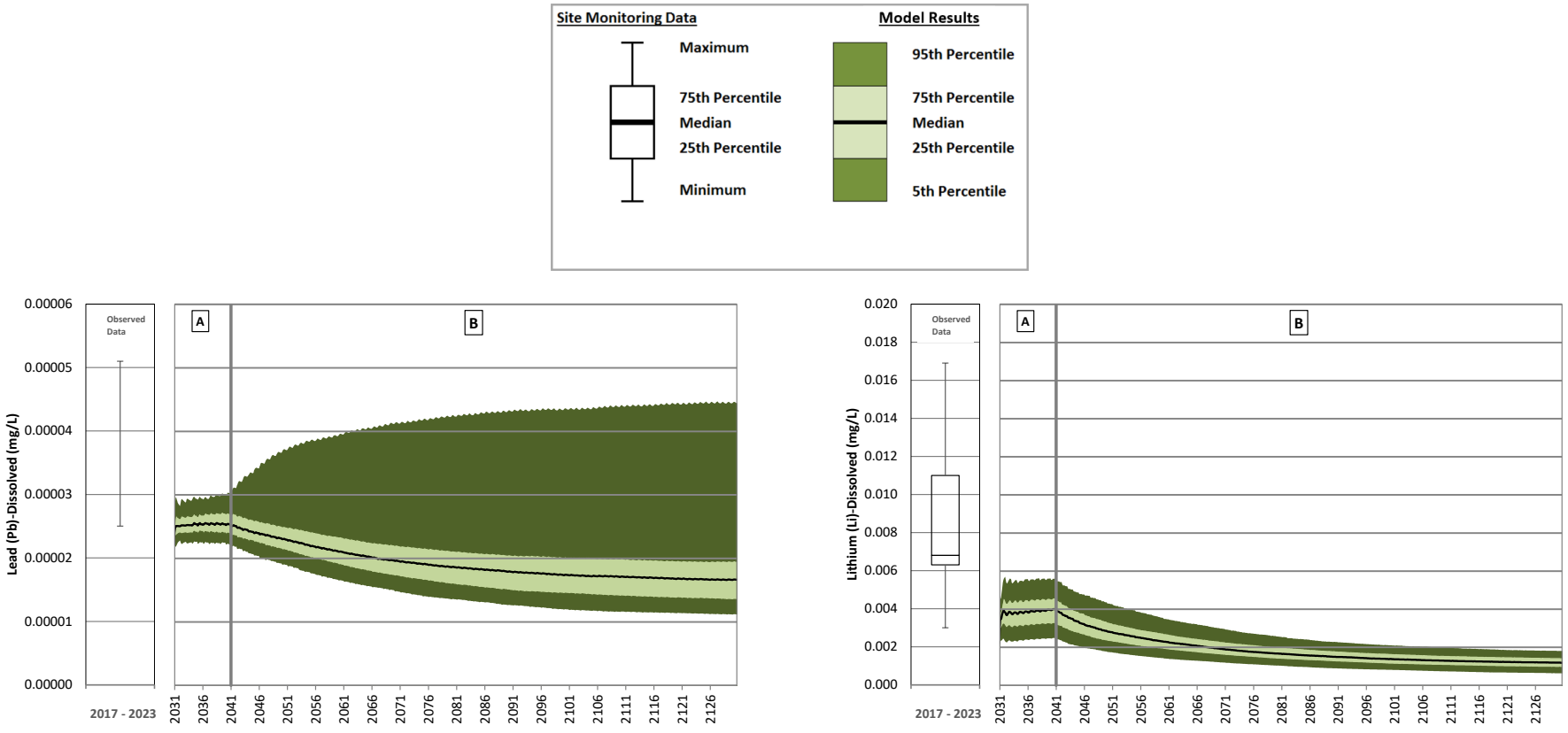

A = Closure; B = Post-closure

Note: The increase in the 95th percentile of dissolved lead concentrations is caused by higher maximum concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **53: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

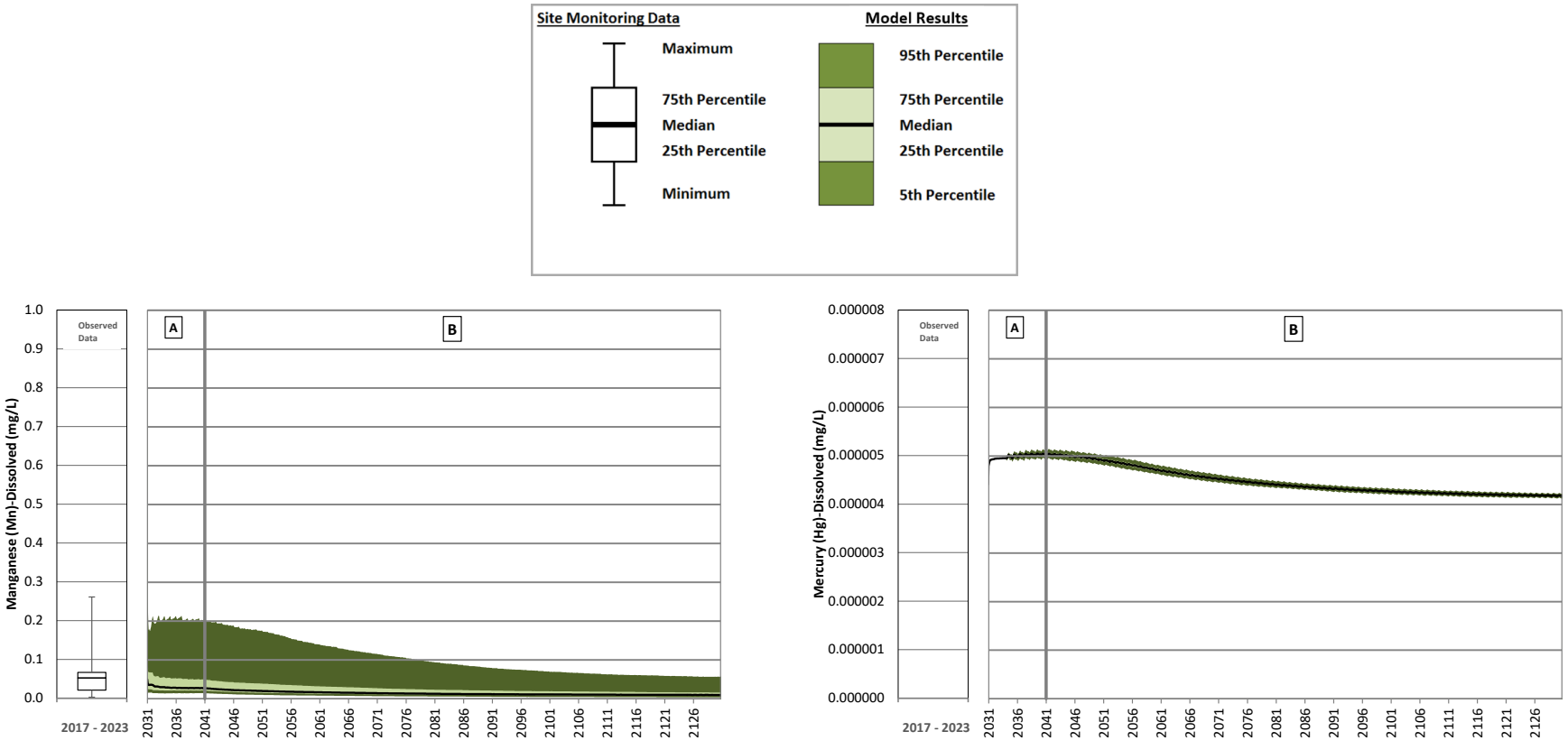

A = Closure; B = Post-closure

Figure B **54: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

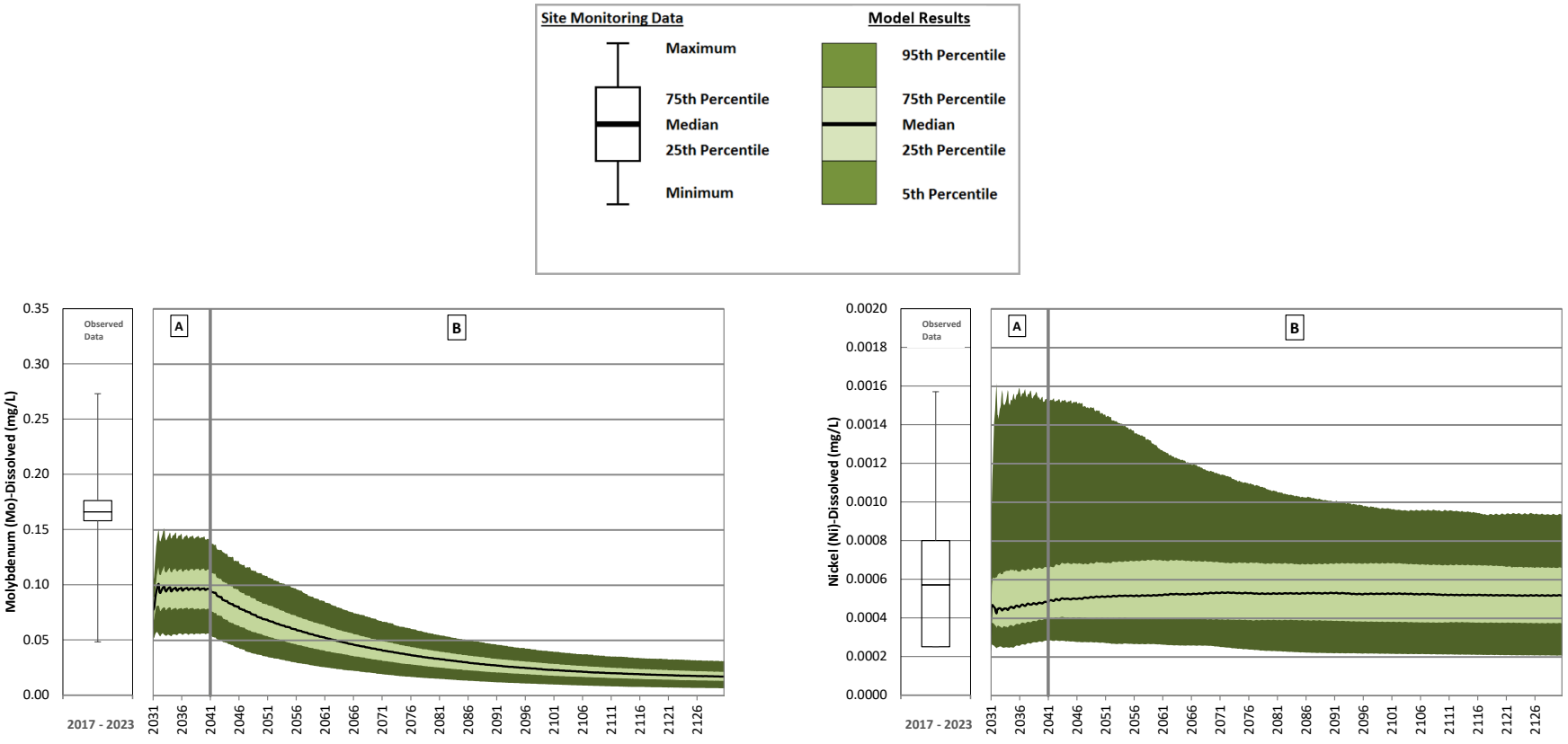

A = Closure; B = Post-closure

Figure B **55: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

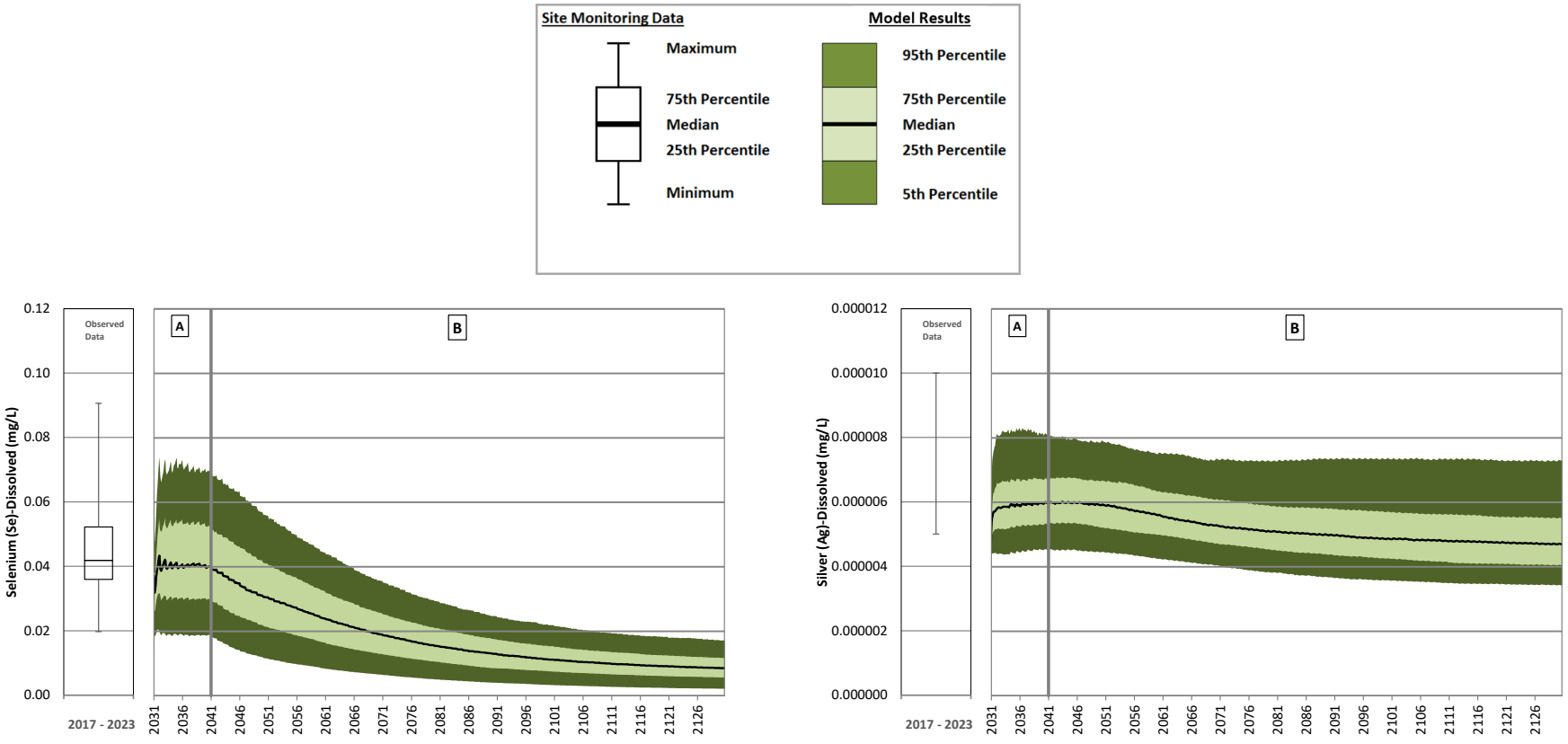

A = Closure; B = Post-closure

Figure B **56: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

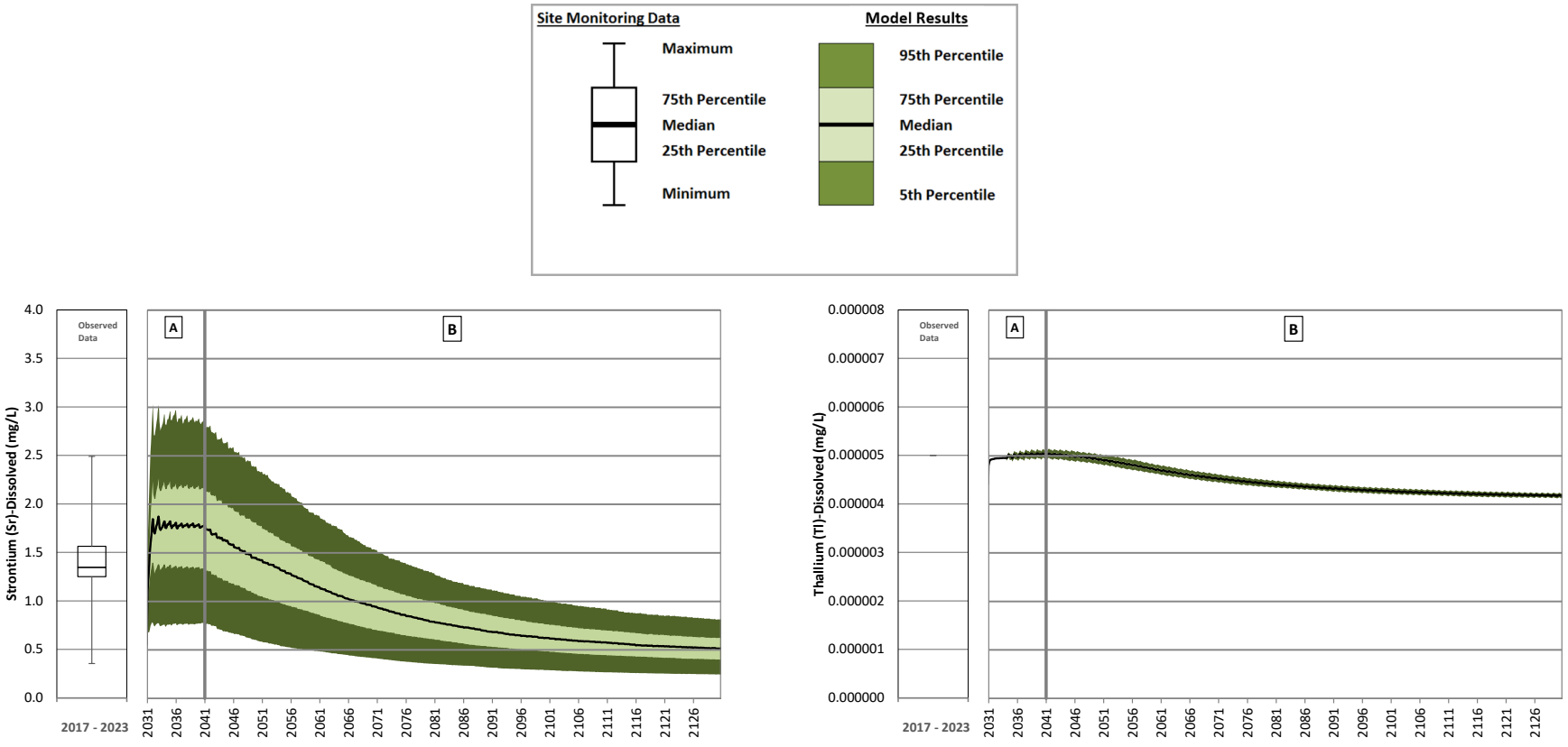

A = Closure; B = Post-closure

Figure B **57: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

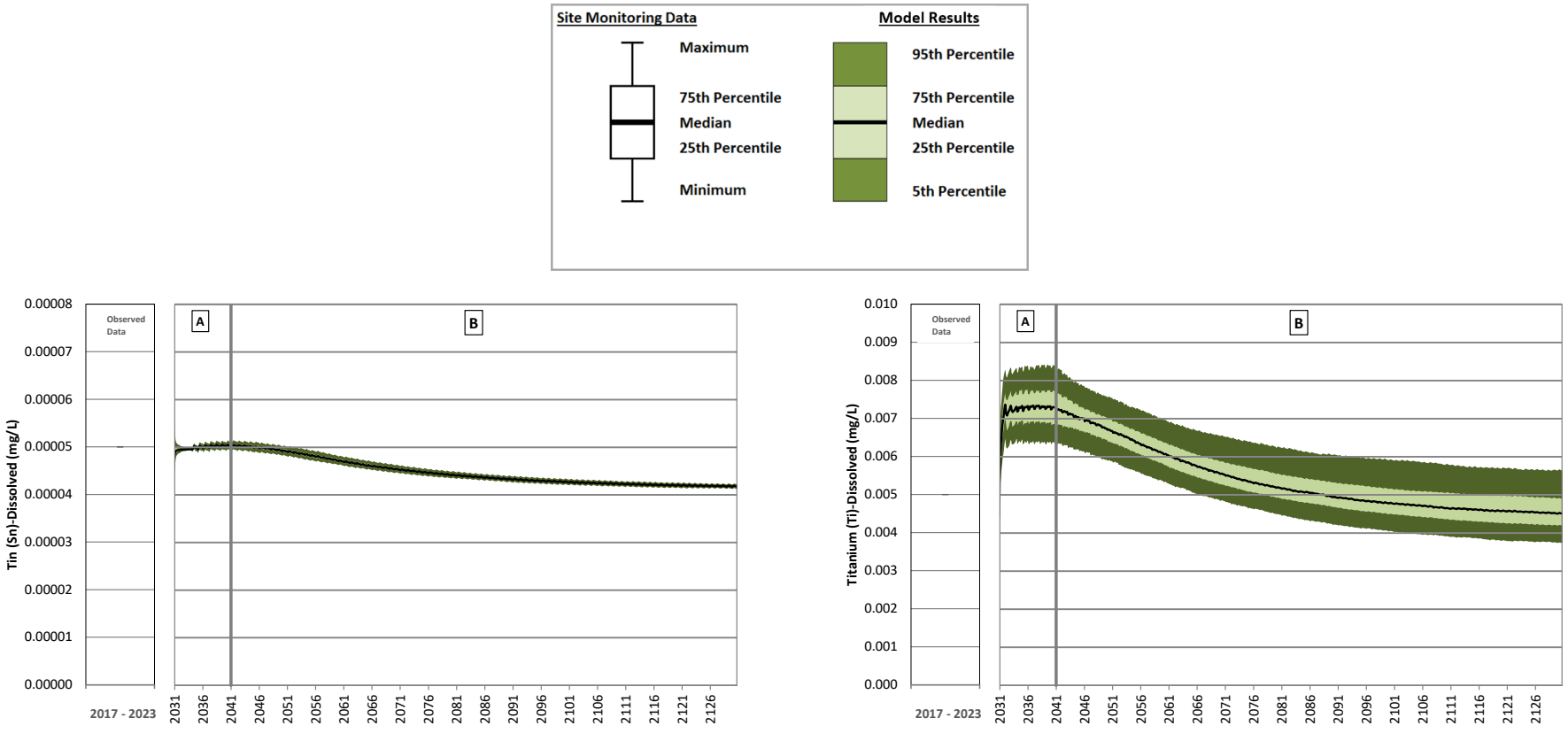

A = Closure; B = Post-closure

Figure B **58: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

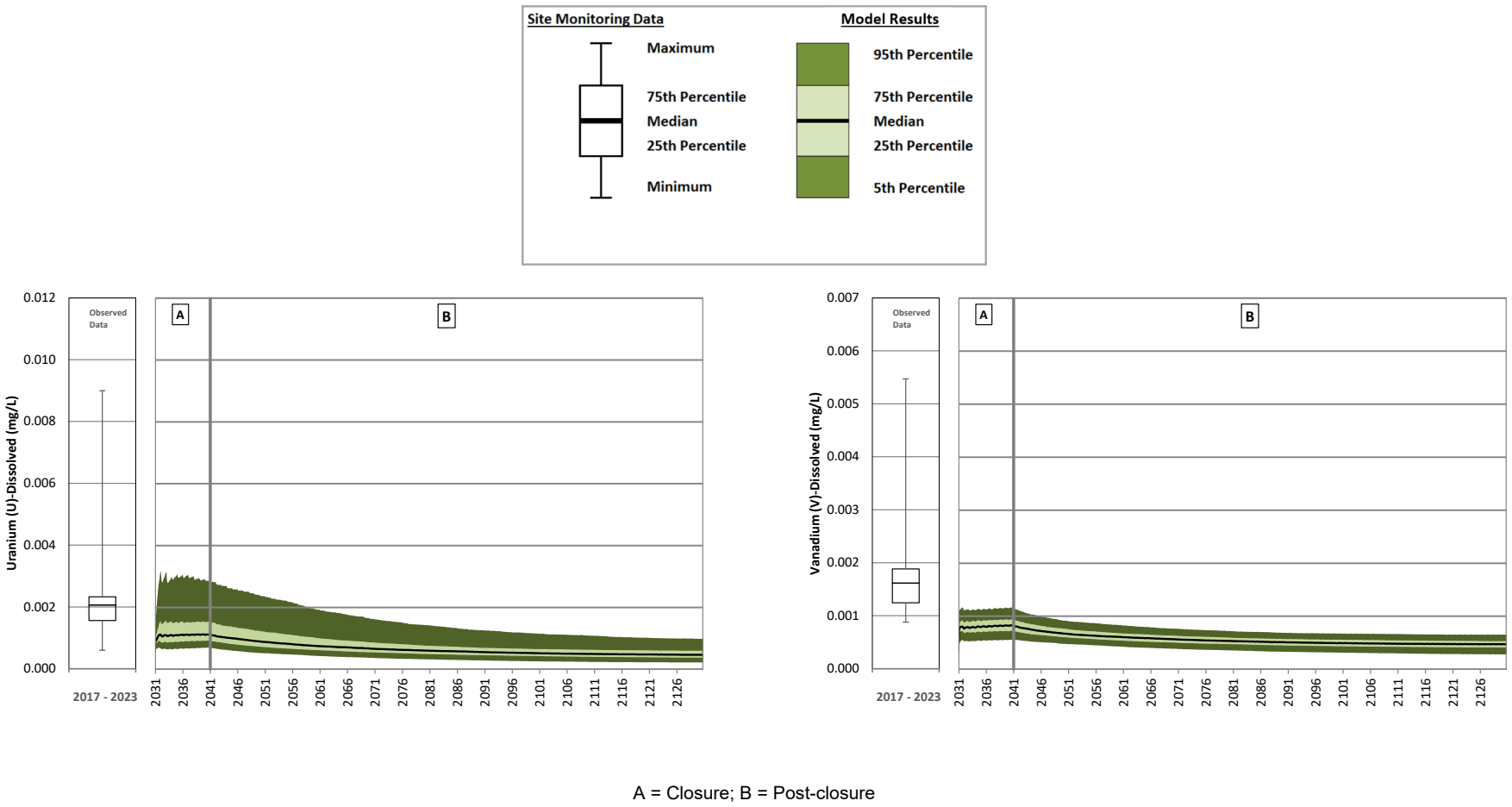

A = Closure; B = Post-closure

Figure B **59: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

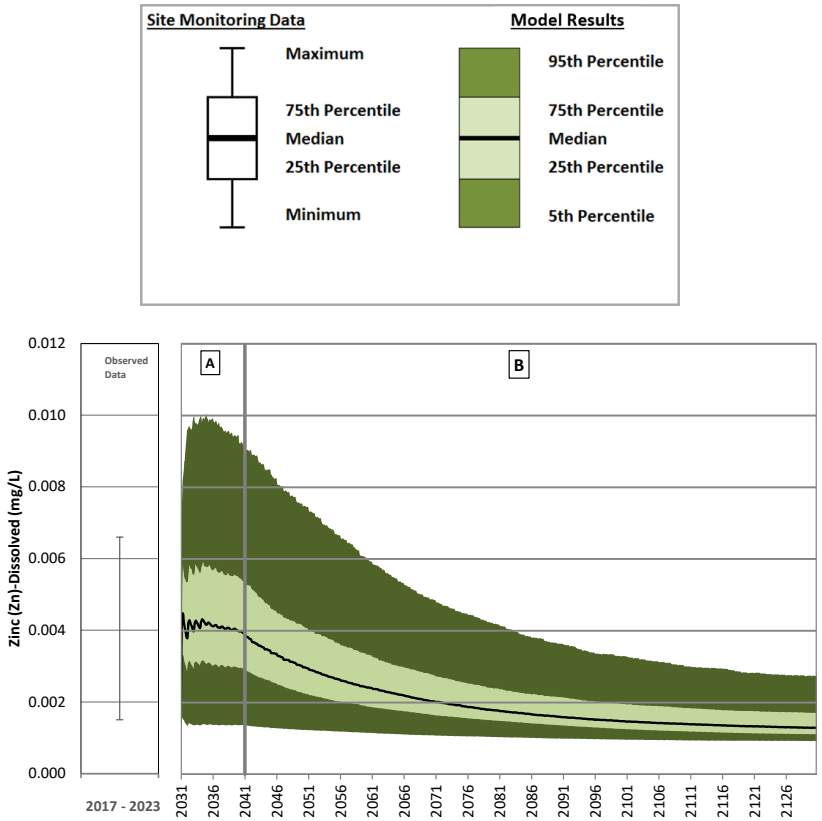

A = Closure; B = Post-closure

Figure B **60: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Zinc**

Wight Pit Calibration

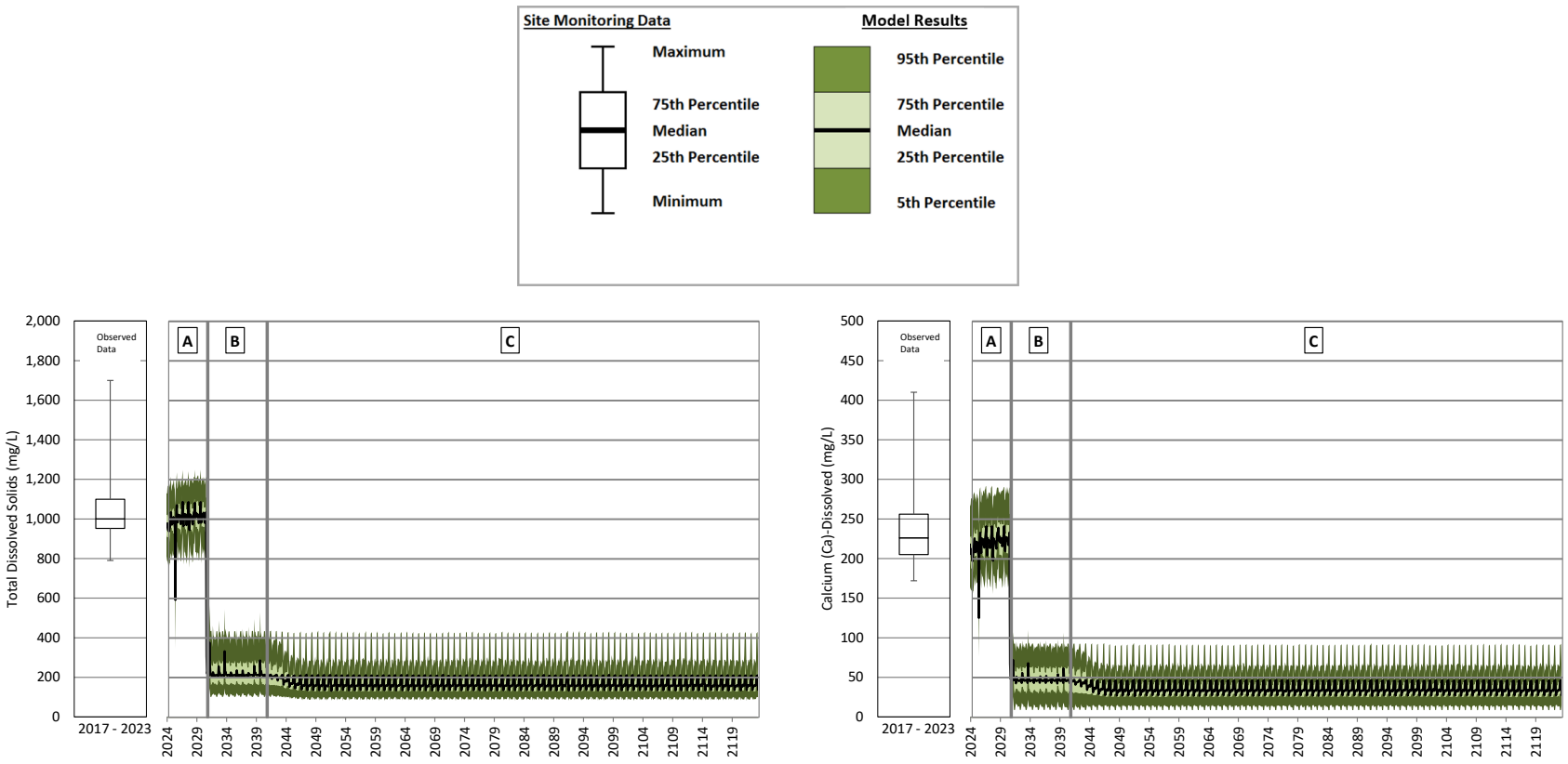

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **61: Wight Pit Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

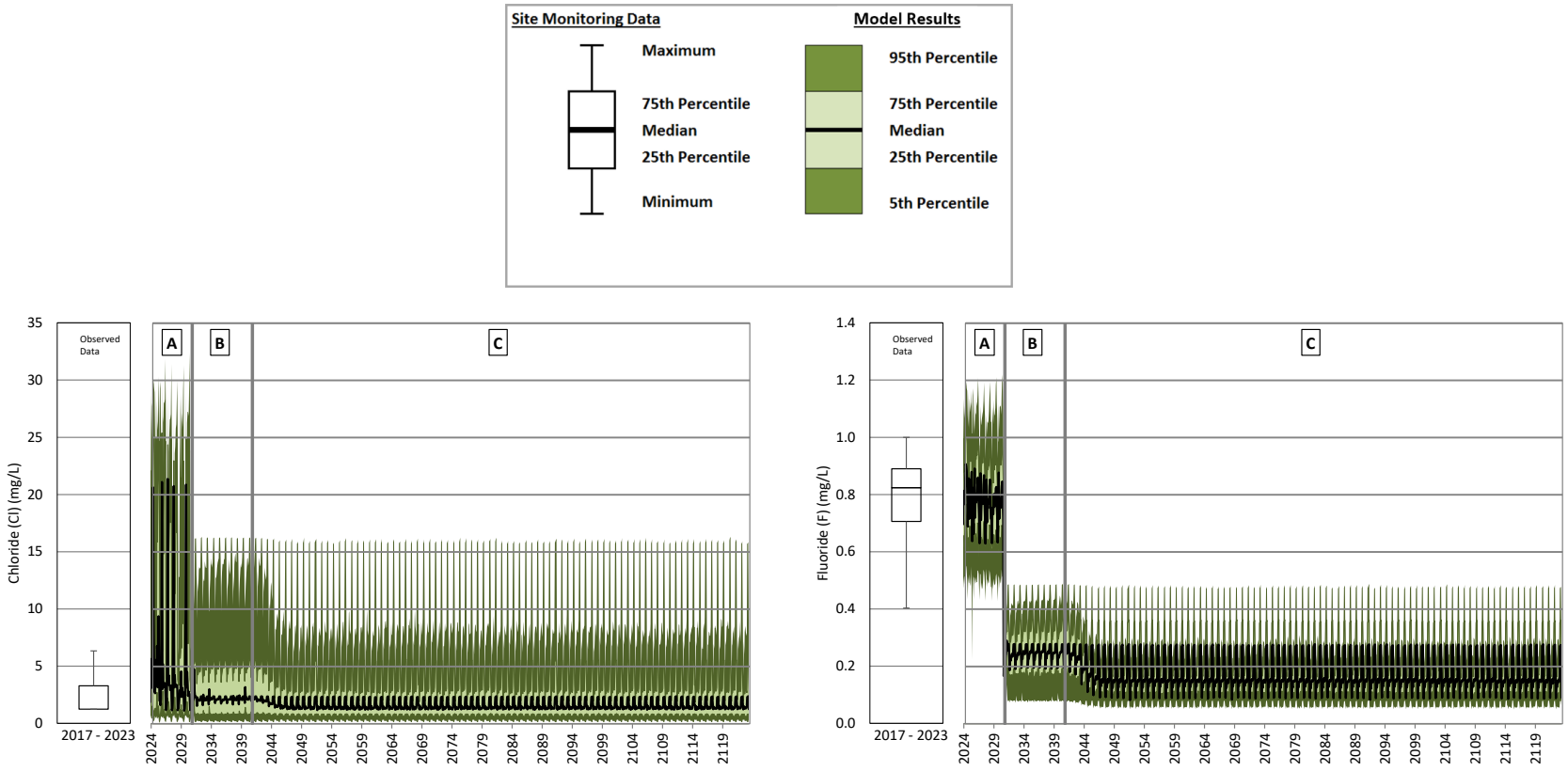

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-clsoure when reclamation of the mine site areas in complete.

Figure B **62: Wight Pit Operations, Closure and Post-closure – Chloride and Fluoride**

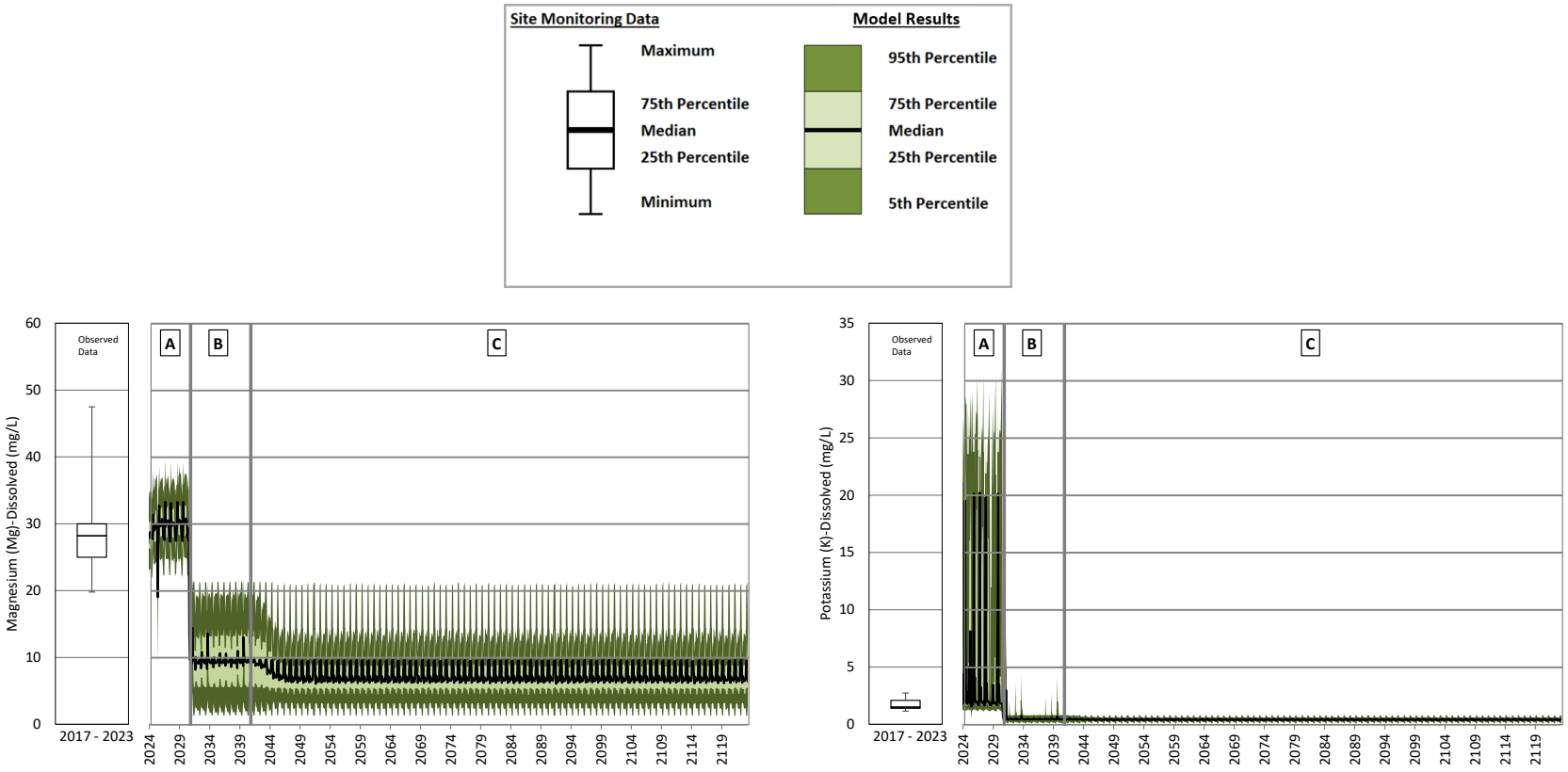

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **63: Wight Pit Operations, Closure and Post-closure – Magnesium and Potassium**

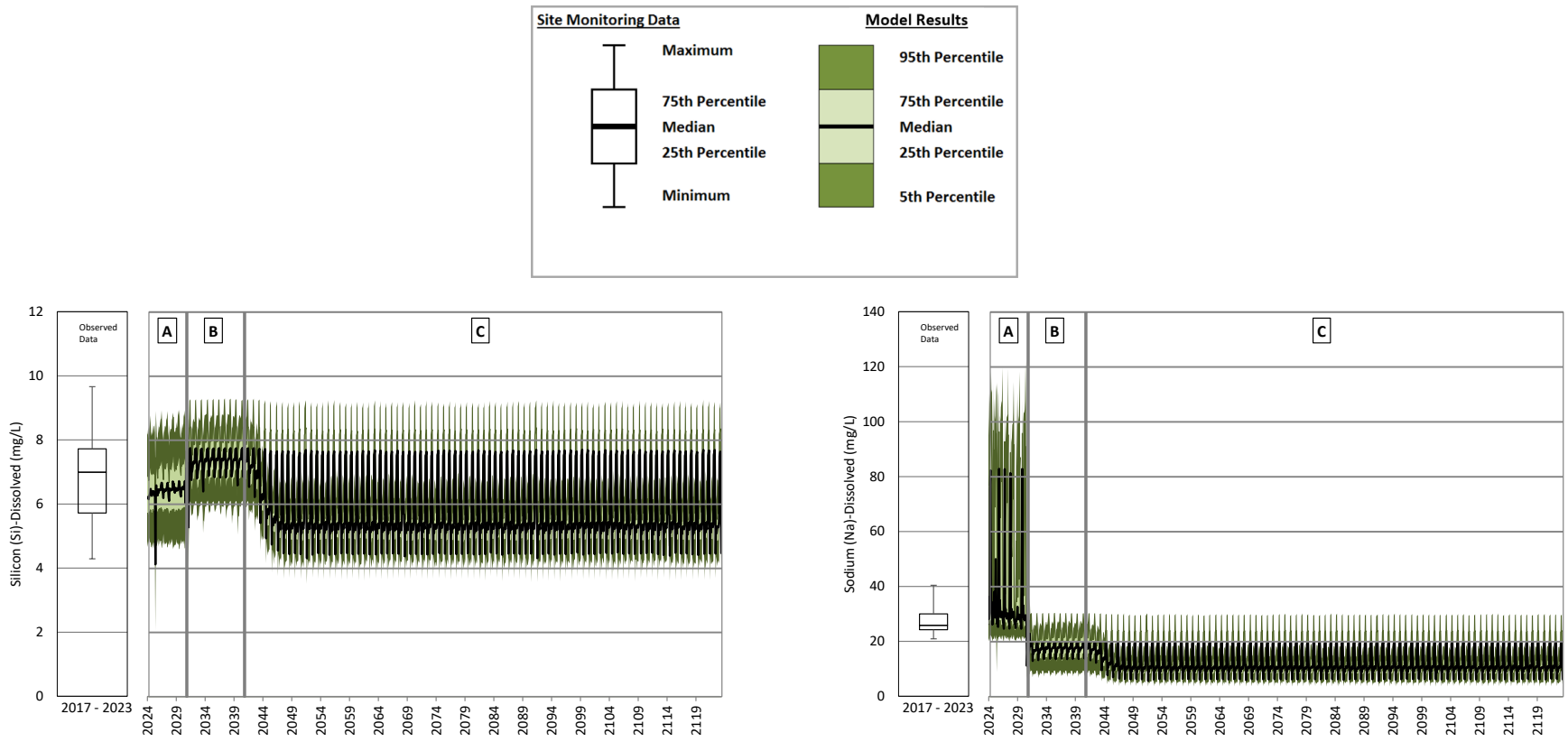

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **64: Wight Pit Operations, Closure and Post-closure – Silicon and Sodium**

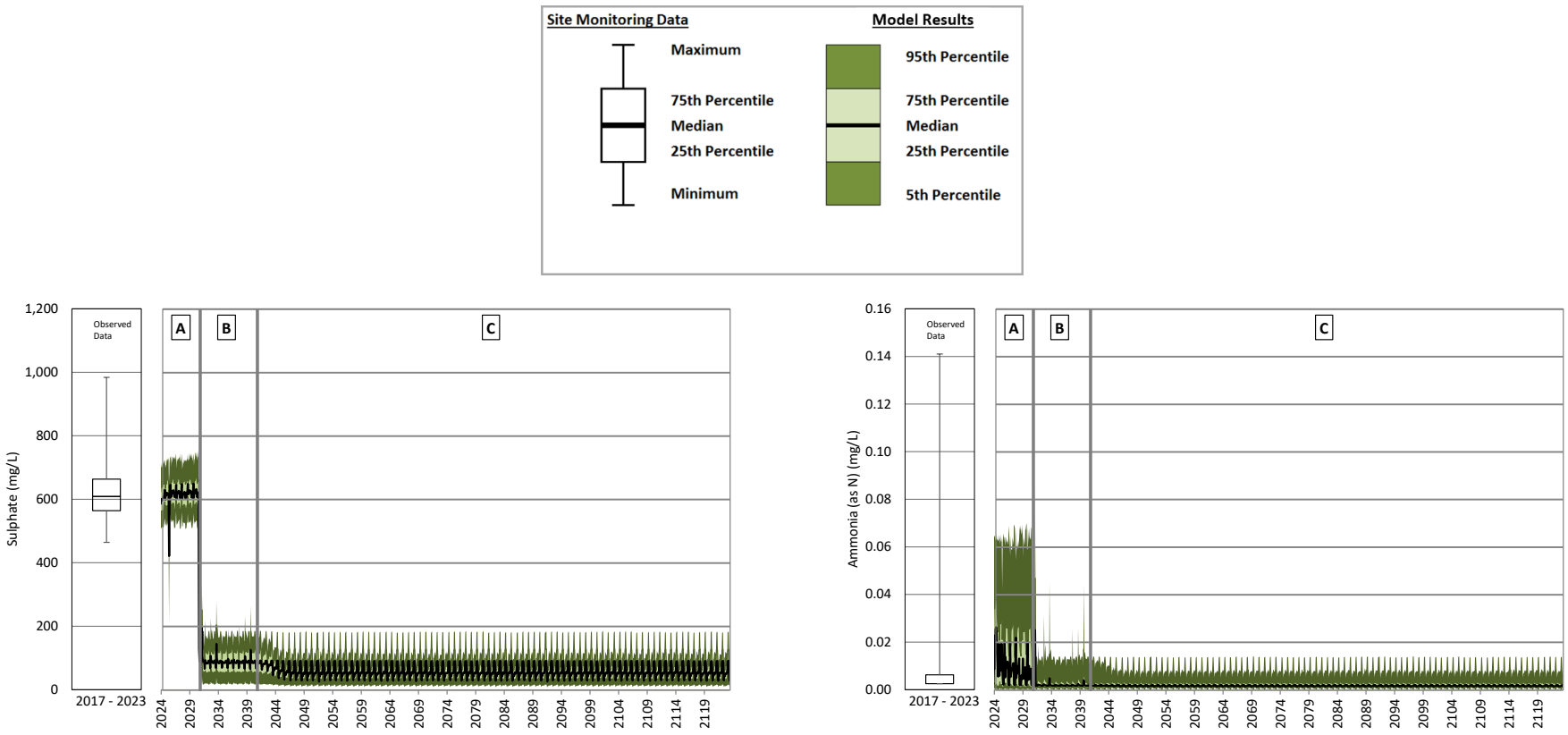

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **65: Wight Pit Operations, Closure and Post-closure – Sulphate and Total Ammonia**

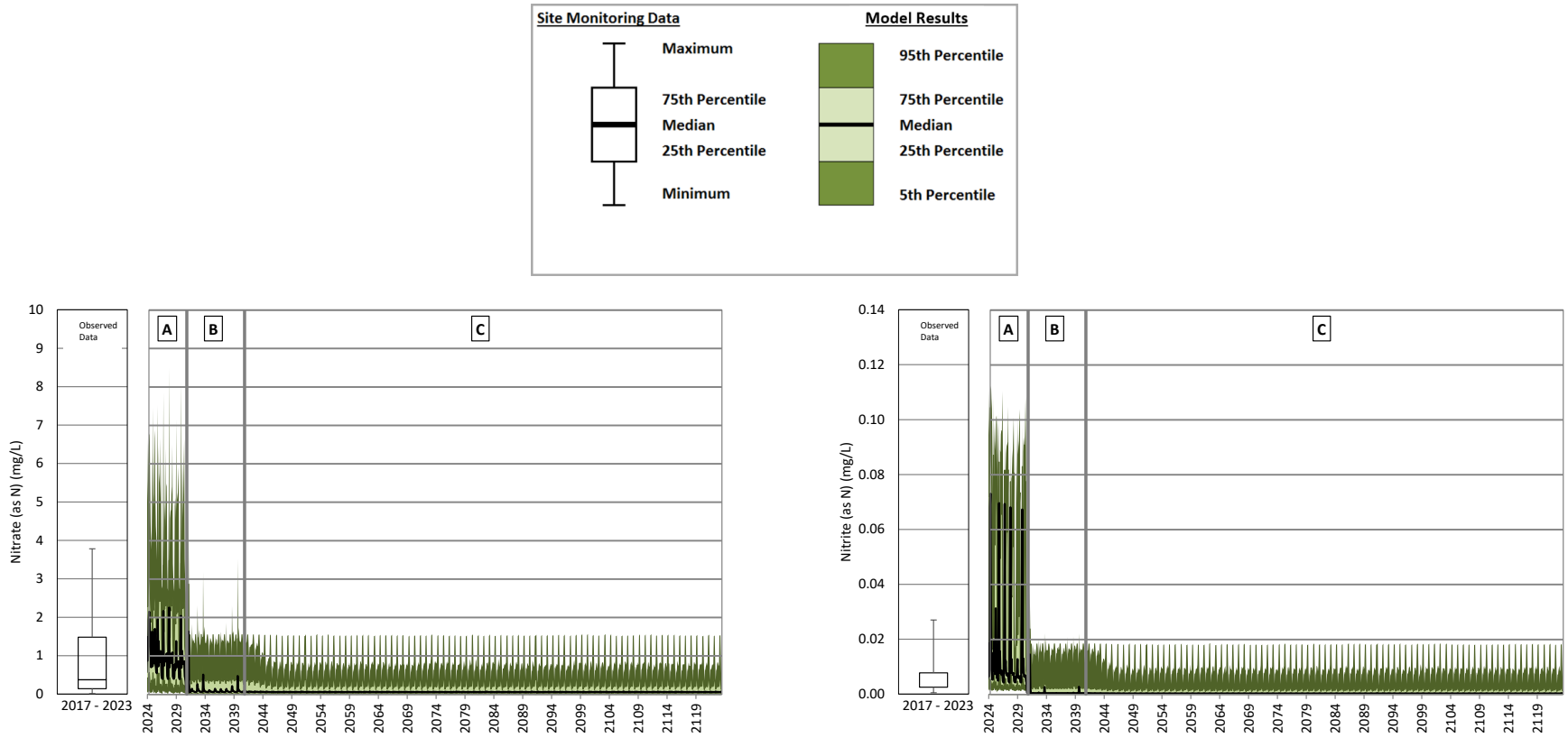

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **66: Wight Pit Operations, Closure and Post-closure – Nitrate and Nitrite**

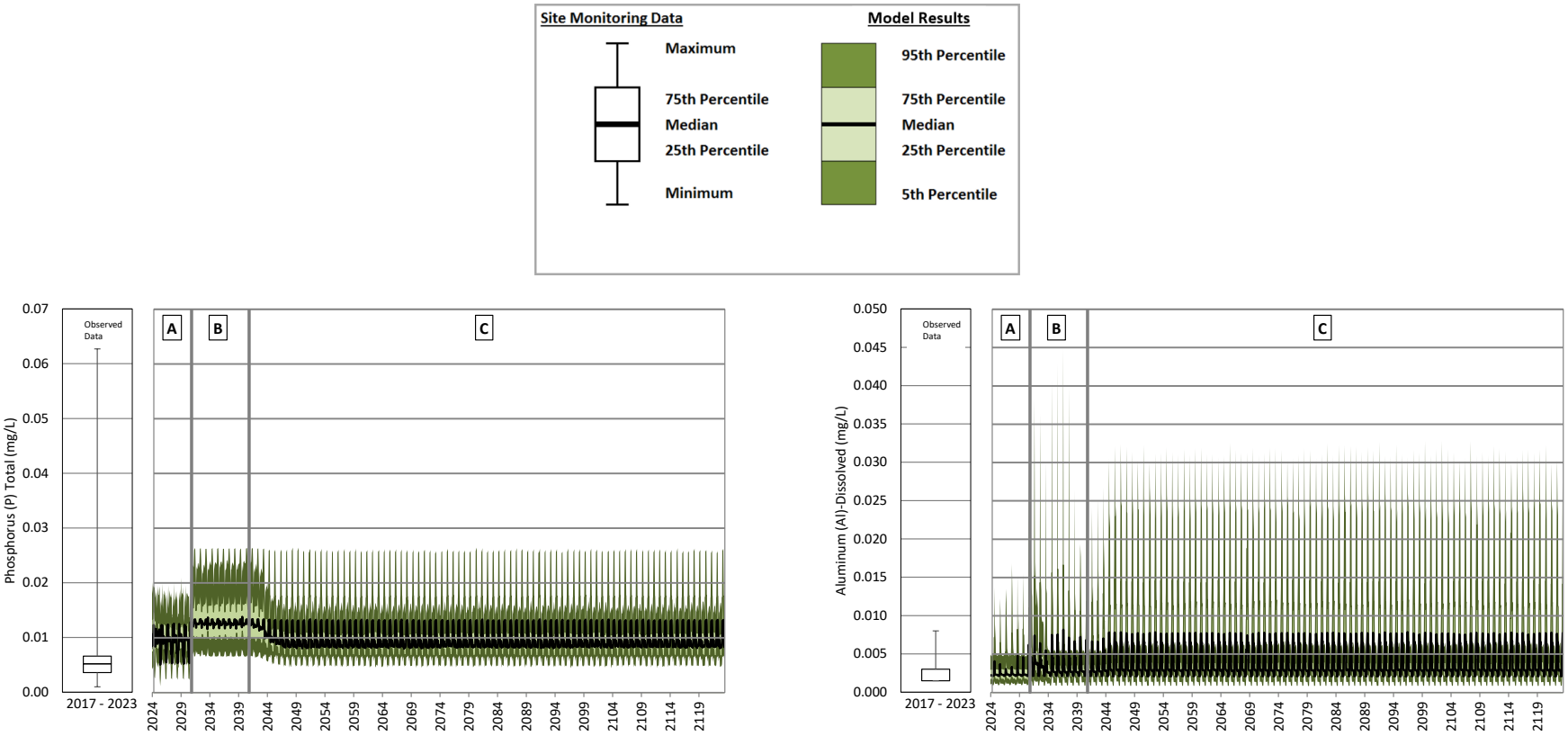

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus concentrations increase from operations to closure due to pumping from the Tailings Storage Facility. Total phosphorus concentrations then decrease during post-closure as runoff areas are remediated. The increase in dissolved aluminum concentrations from operations to closure and post-closure is caused by higher dissolved aluminum concentrations in the disturbed and undisturbed water quality inputs as well as pumping from the Central Collection Sump.

Figure B **67: Wight Pit Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

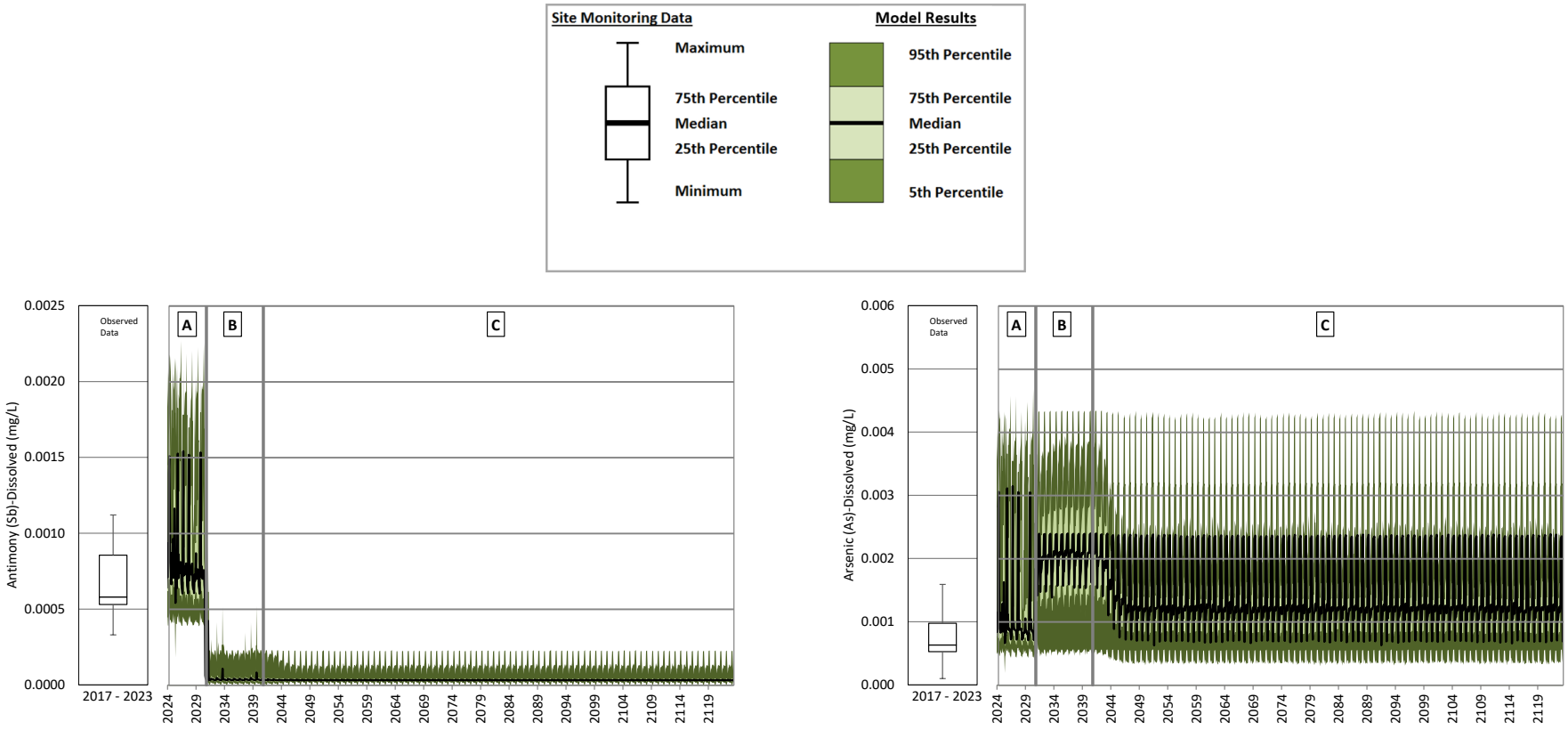

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **68: Wight Pit Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

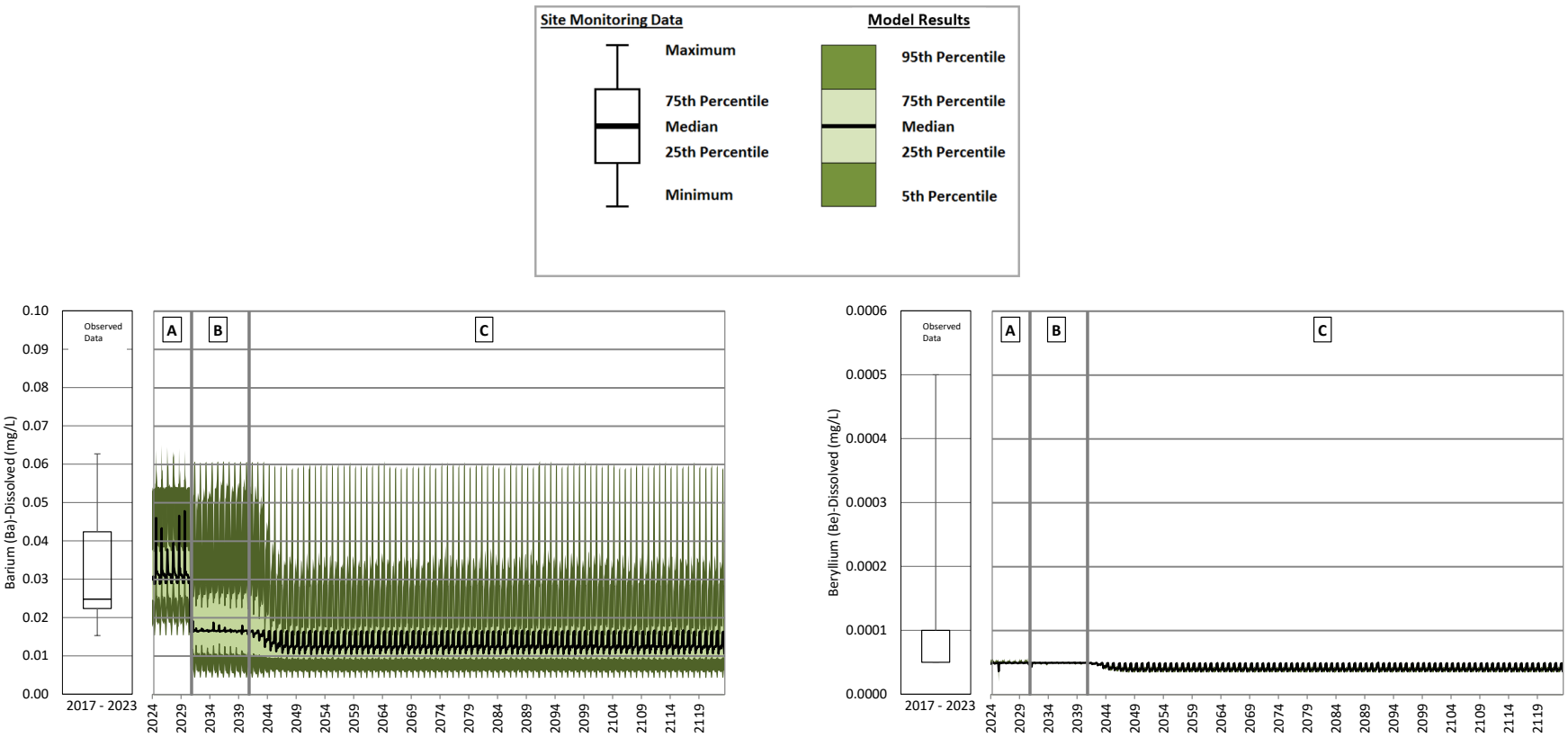

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **69: Wight Pit Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

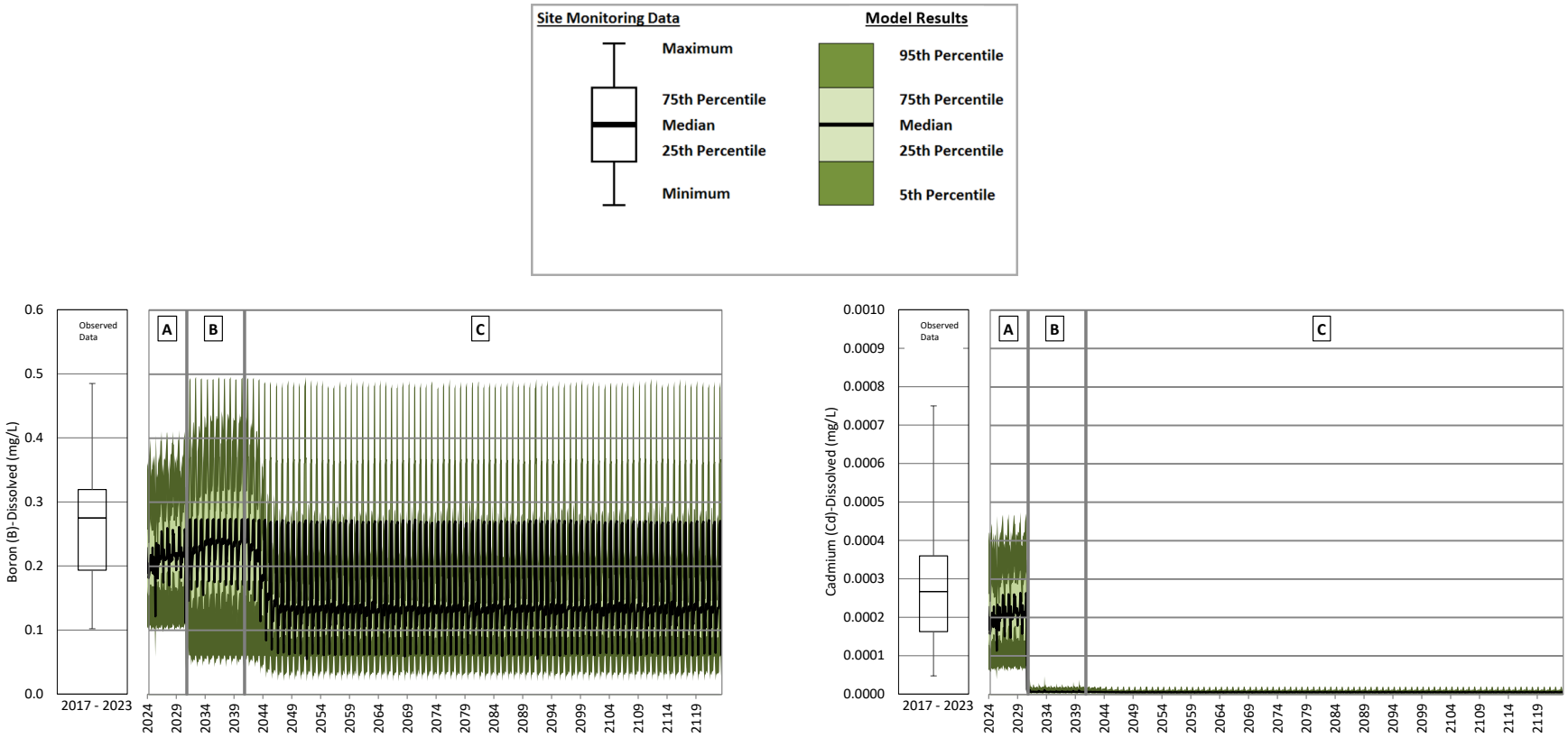

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **70: Wight Pit Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

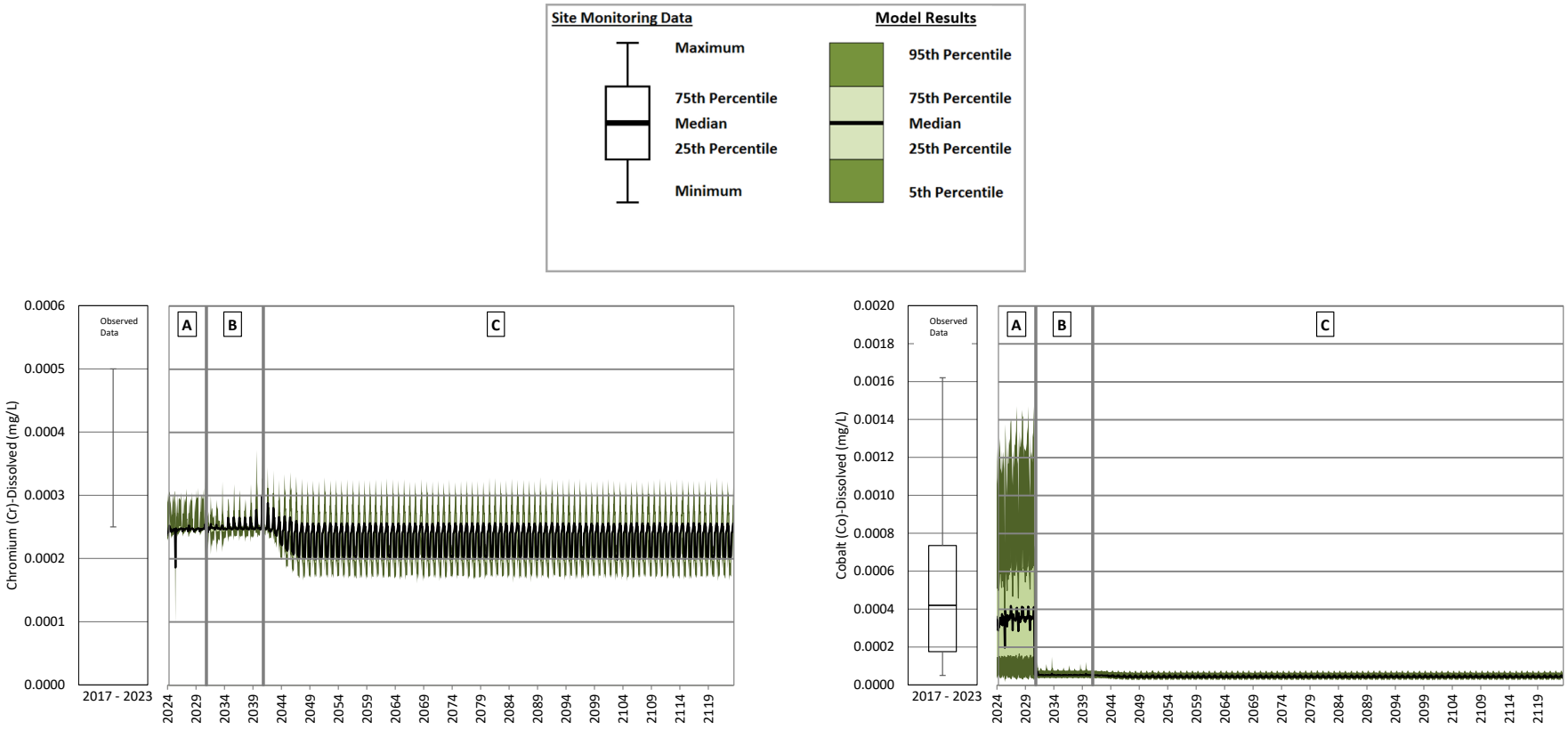

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **71: Wight Pit Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

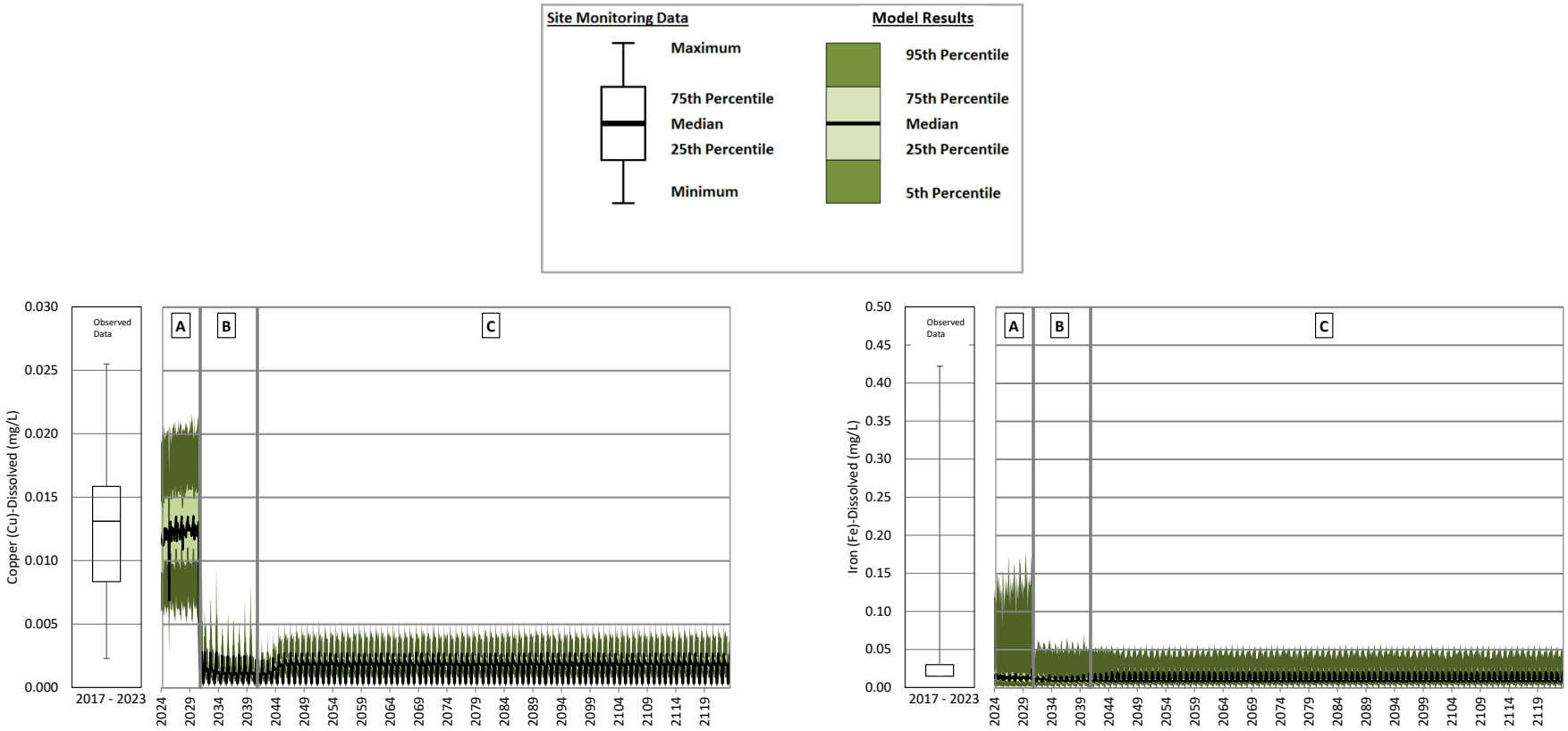

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **72: Wight Pit Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

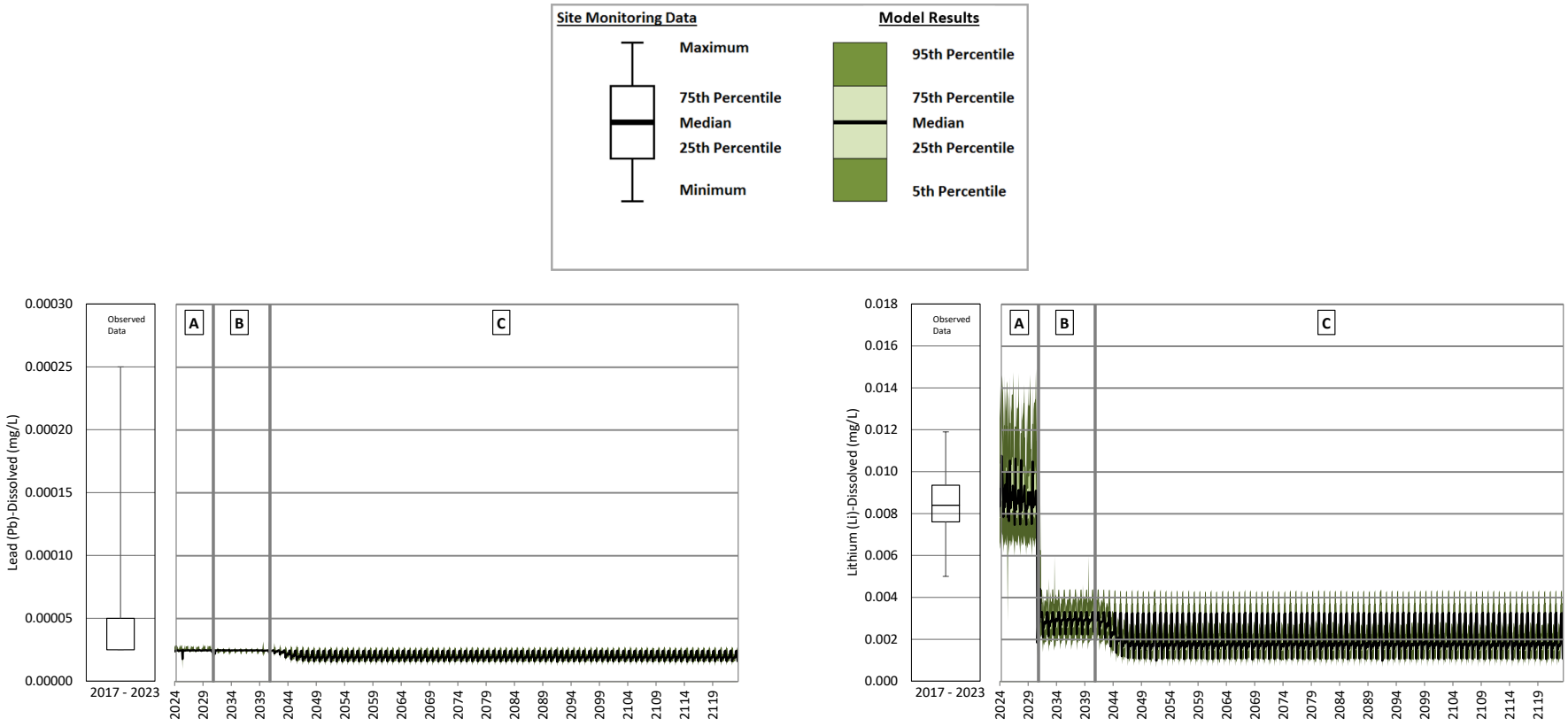

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **73: Wight Pit Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

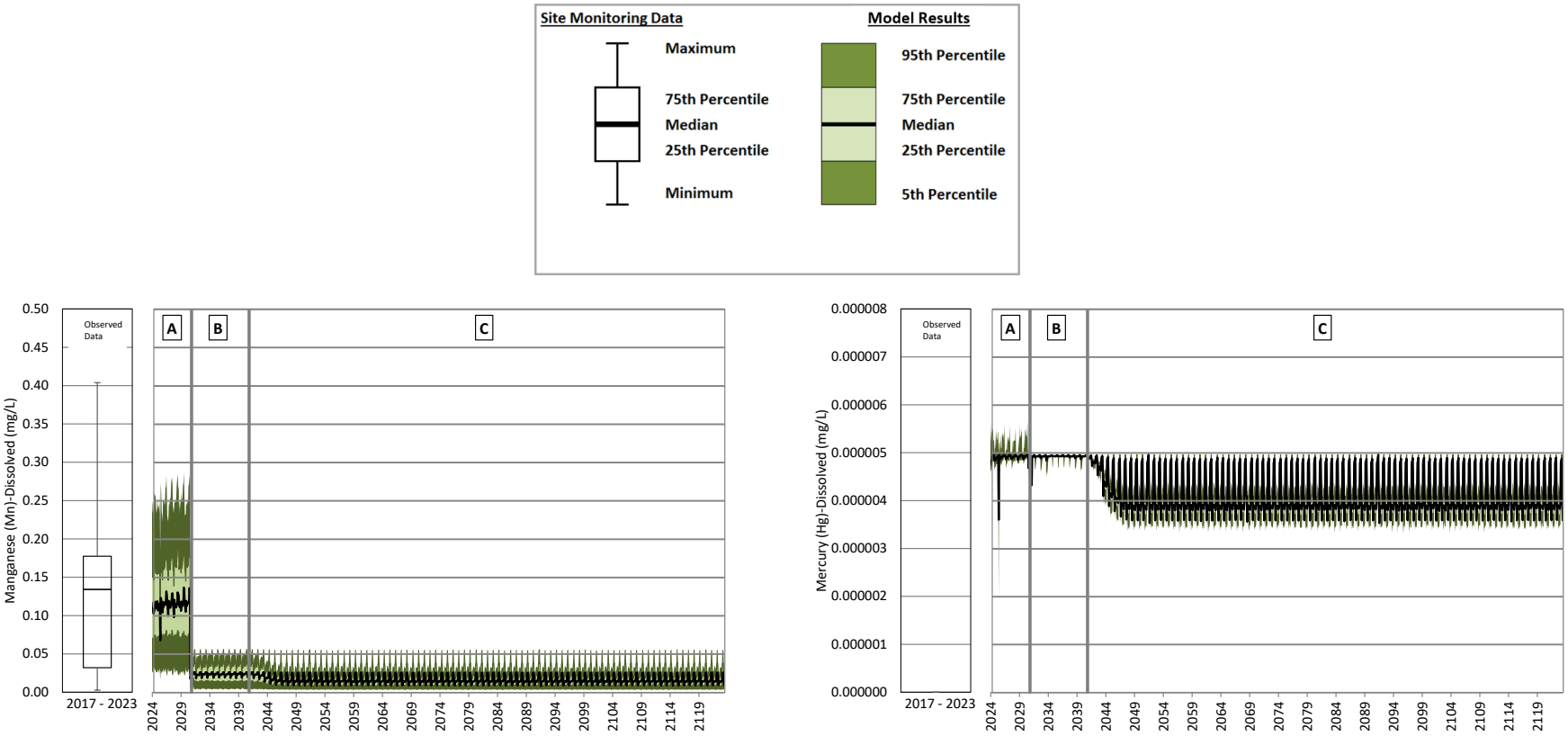

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **74: Wight Pit Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

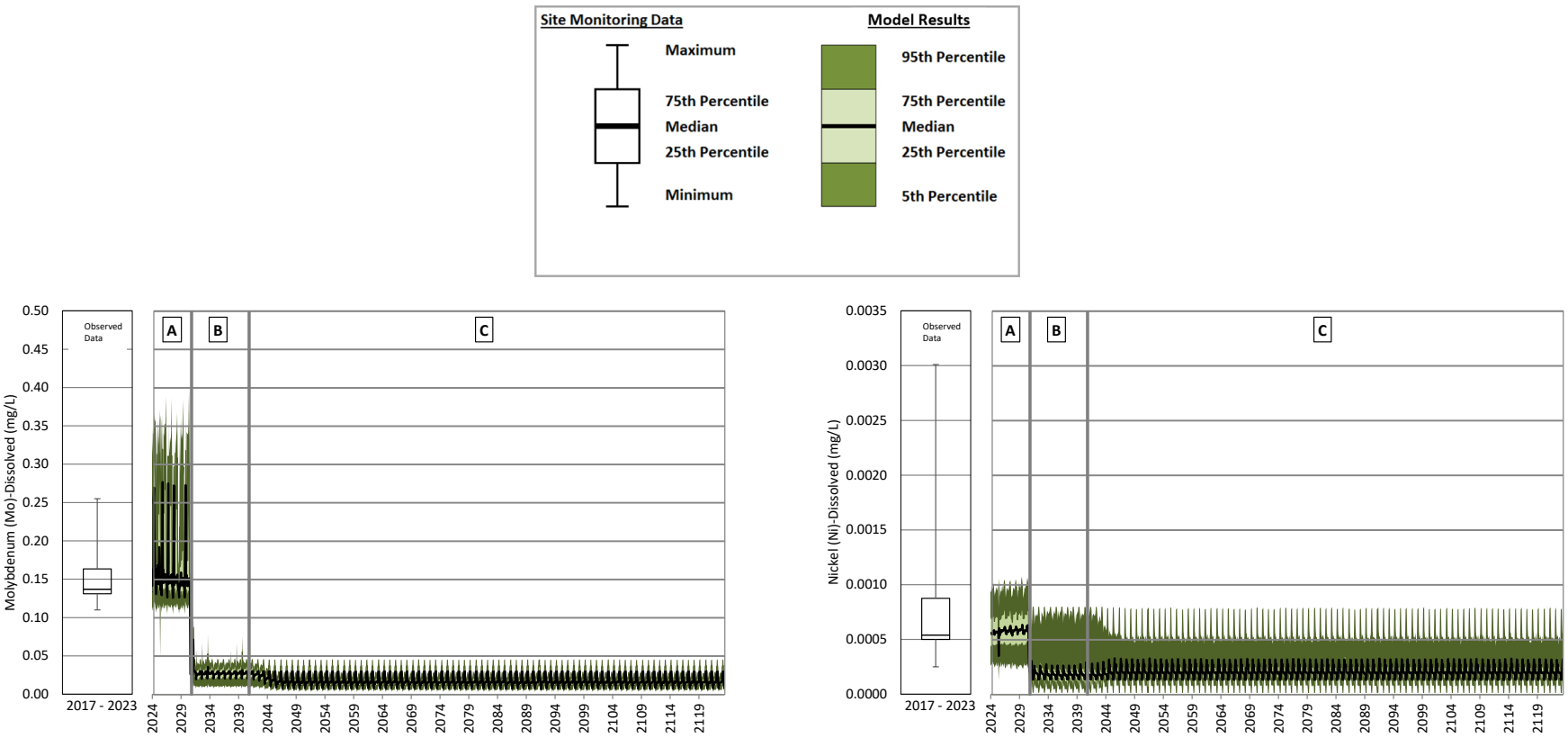

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **75: Wight Pit Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

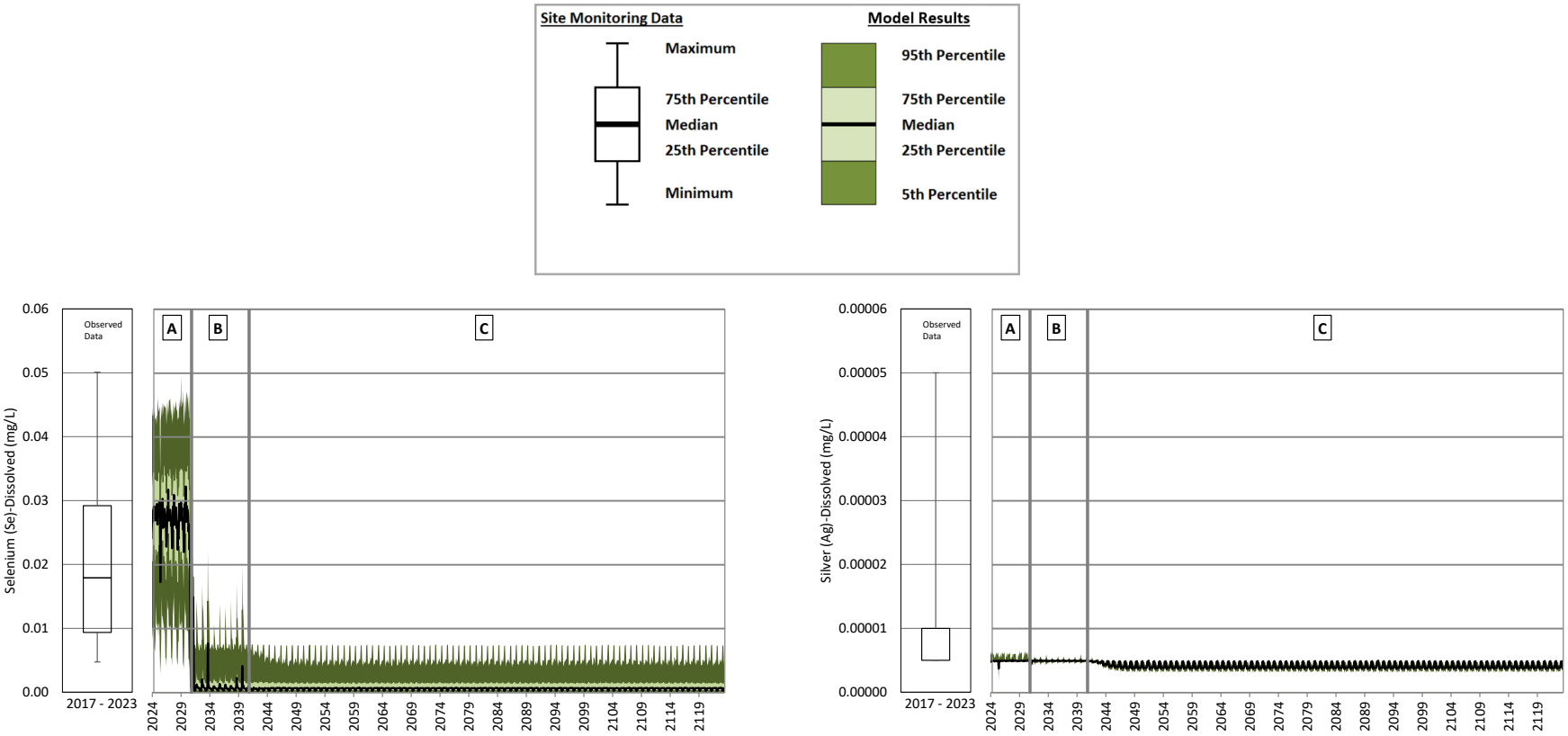

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **76: Wight Pit Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

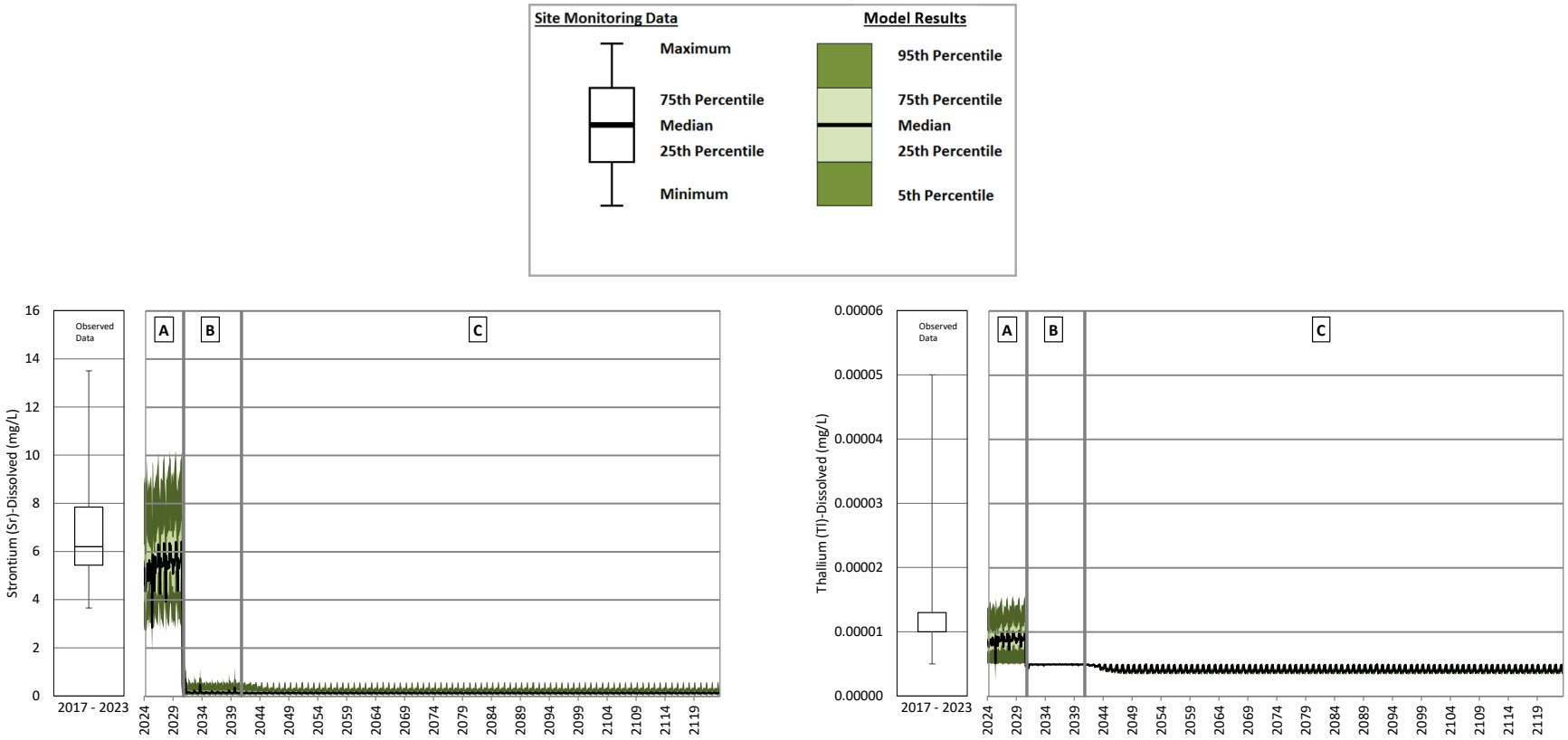

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **77: Wight Pit Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

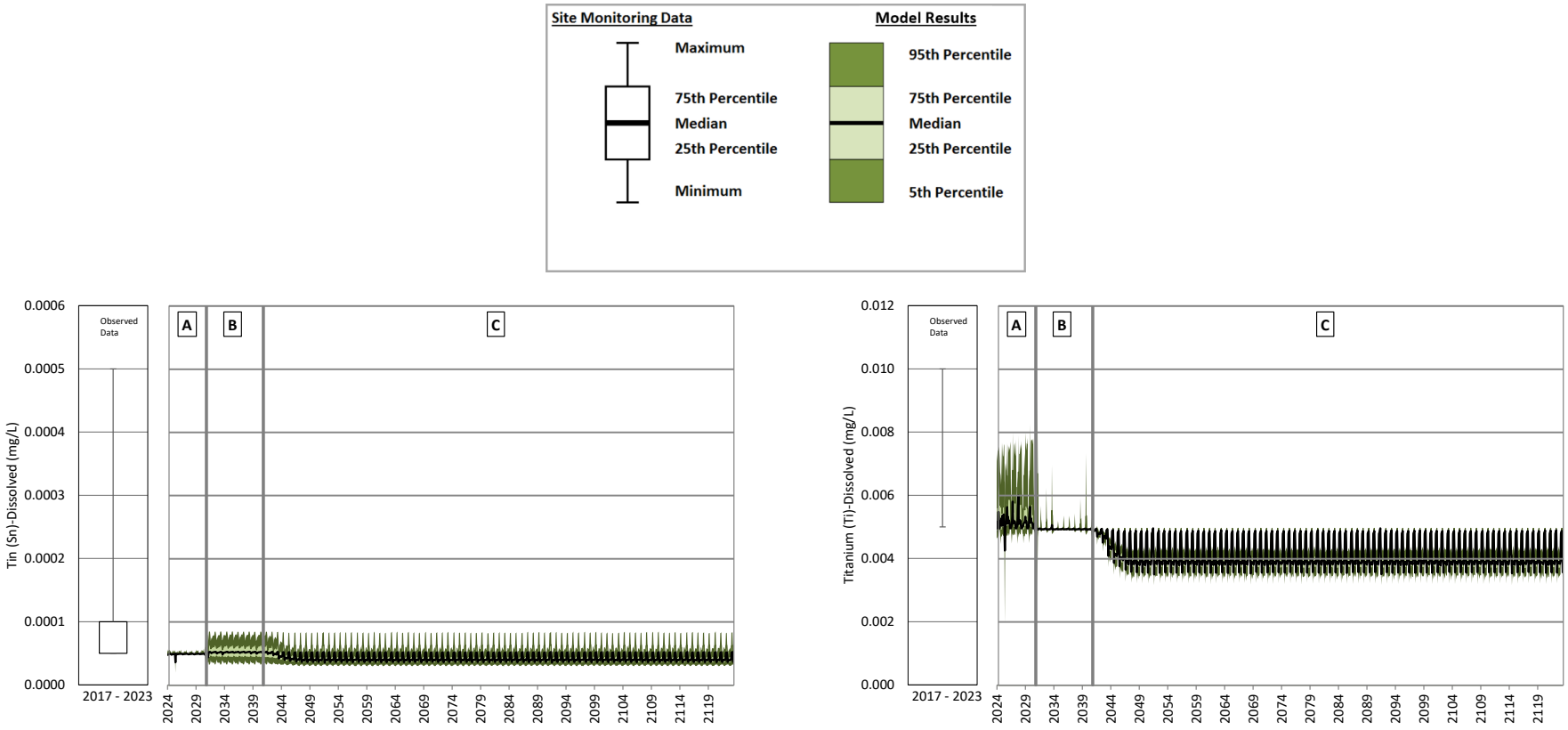

A = Operations; B = Closure; C = Post-closure

Note: Dissolved tin concentrations increase from operations to closure and post-closure due to a greater proportion of total inflows from groundwater. The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **78: Wight Pit Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

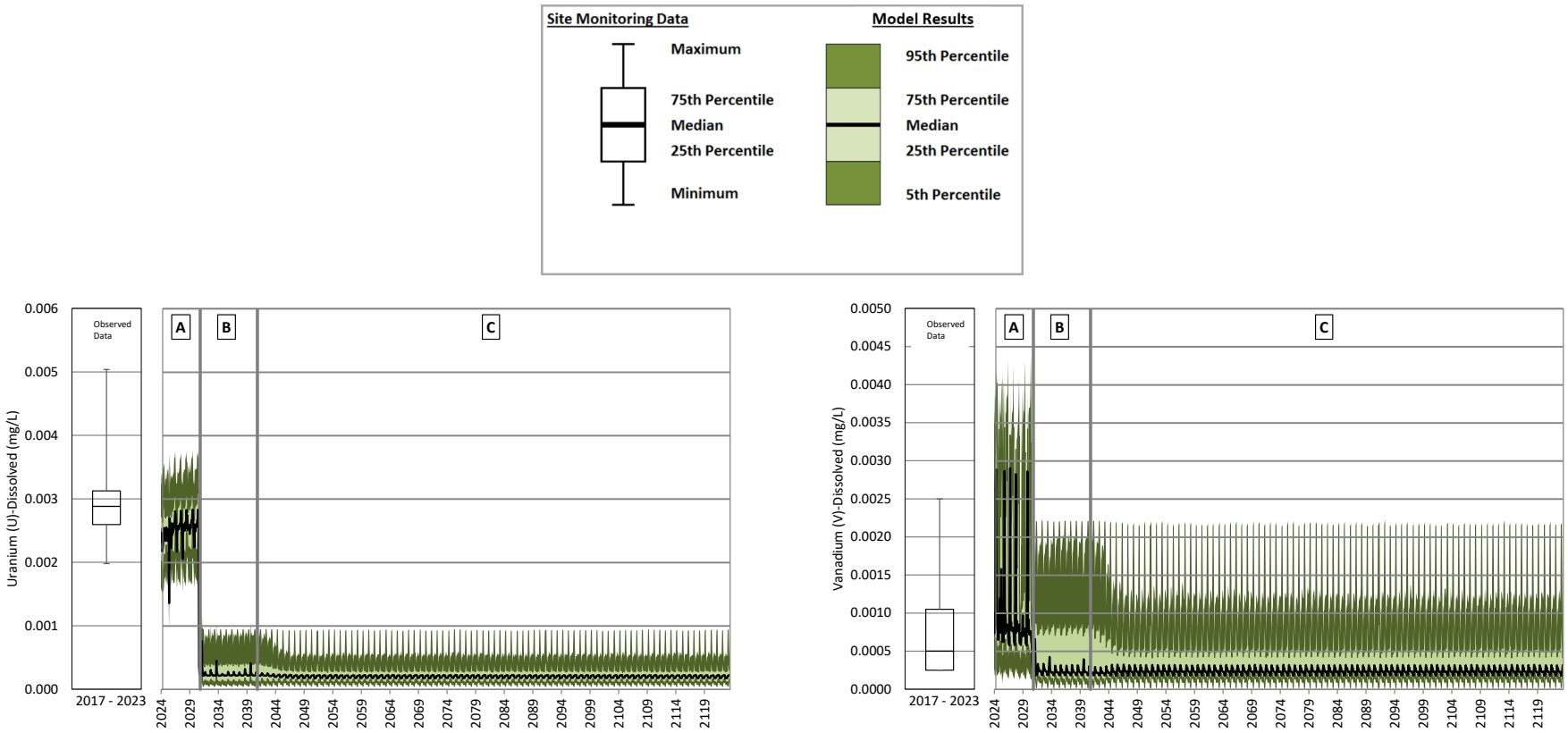

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **79: Wight Pit Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

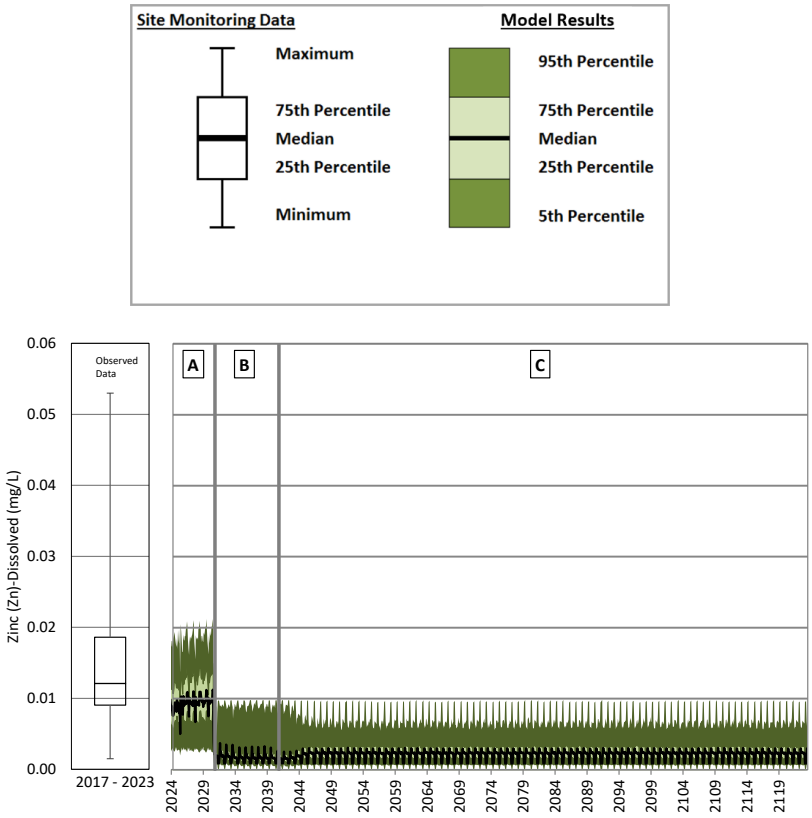

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **80: Wight Pit Operations, Closure and Post-closure – Dissolved Zinc**

Central Collection Sump Operations

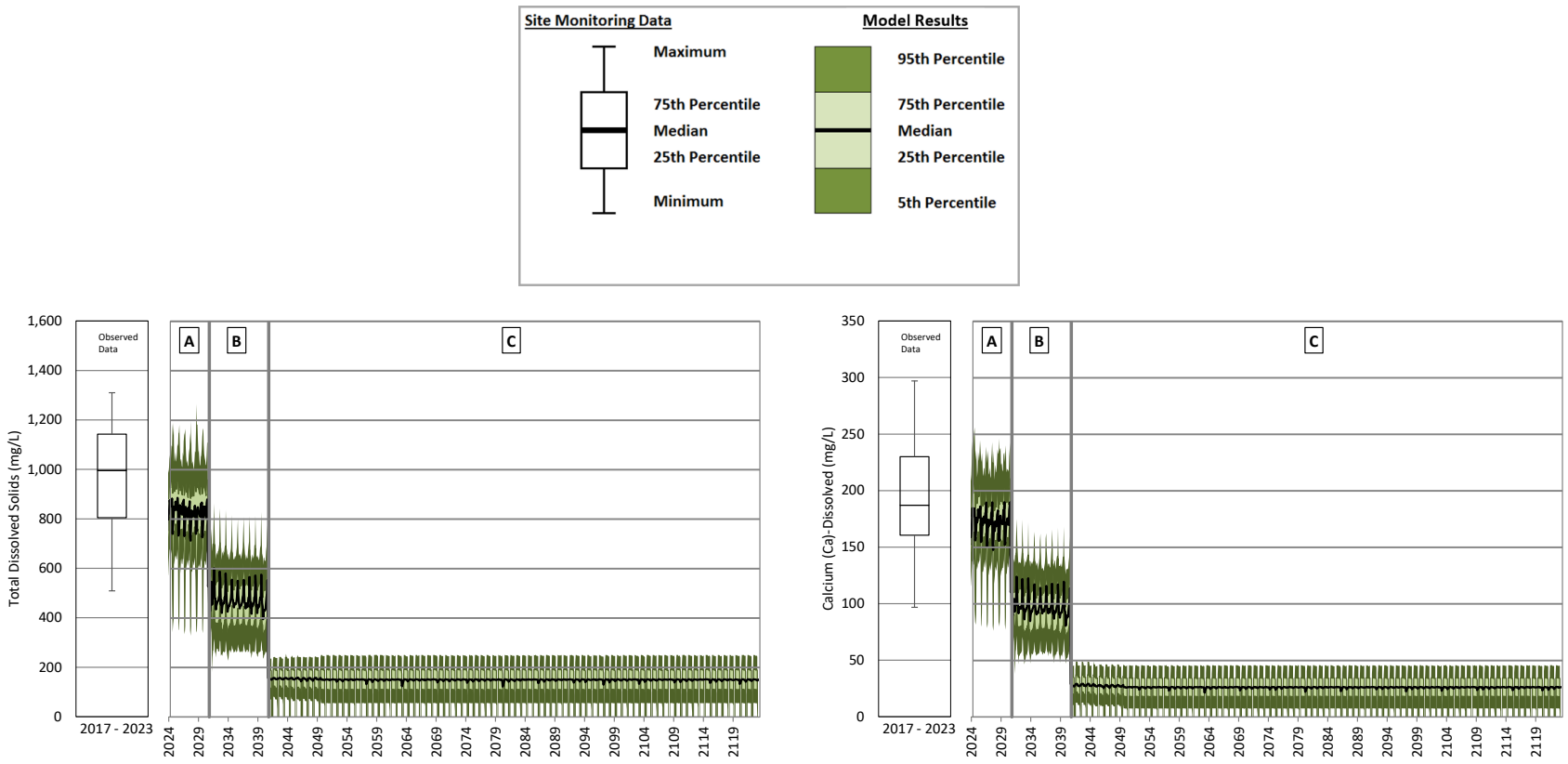

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **81: Central Collection Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

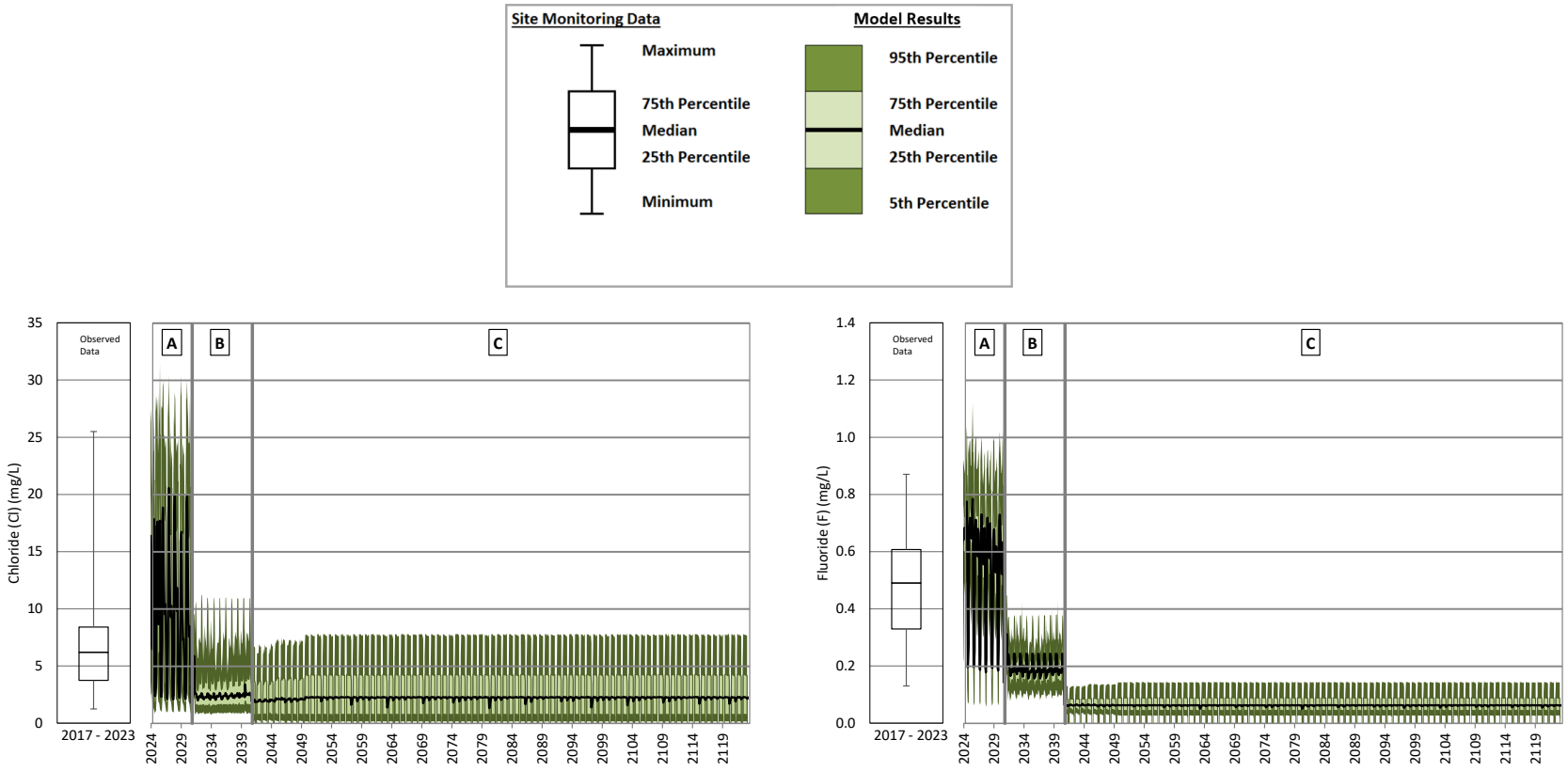

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **82: Central Collection Sump Operations, Closure and Post-closure – Chloride and Fluoride**

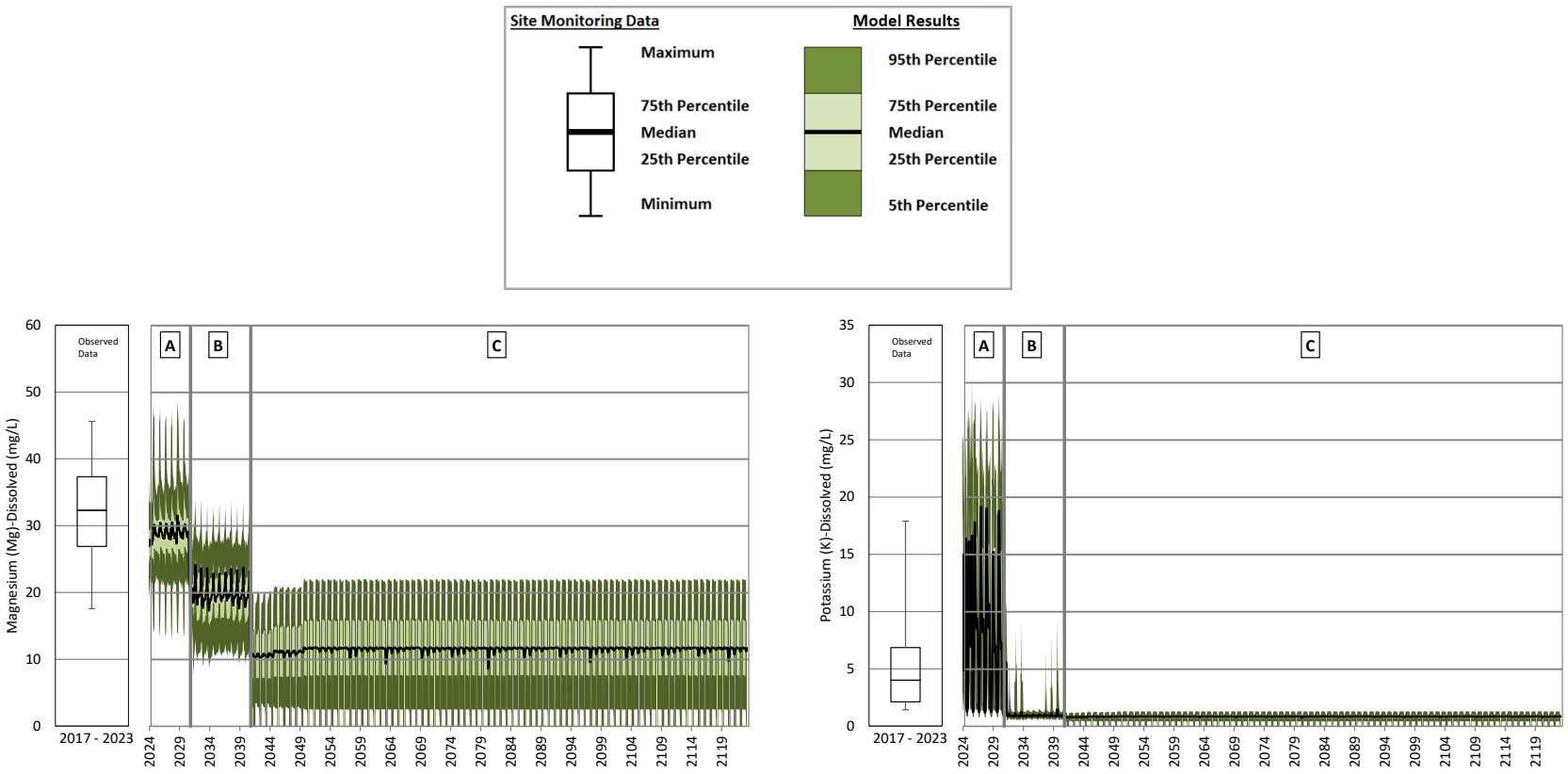

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **83: Central Collection Sump Operations, Closure and Post-closure – Magnesium and Potassium**

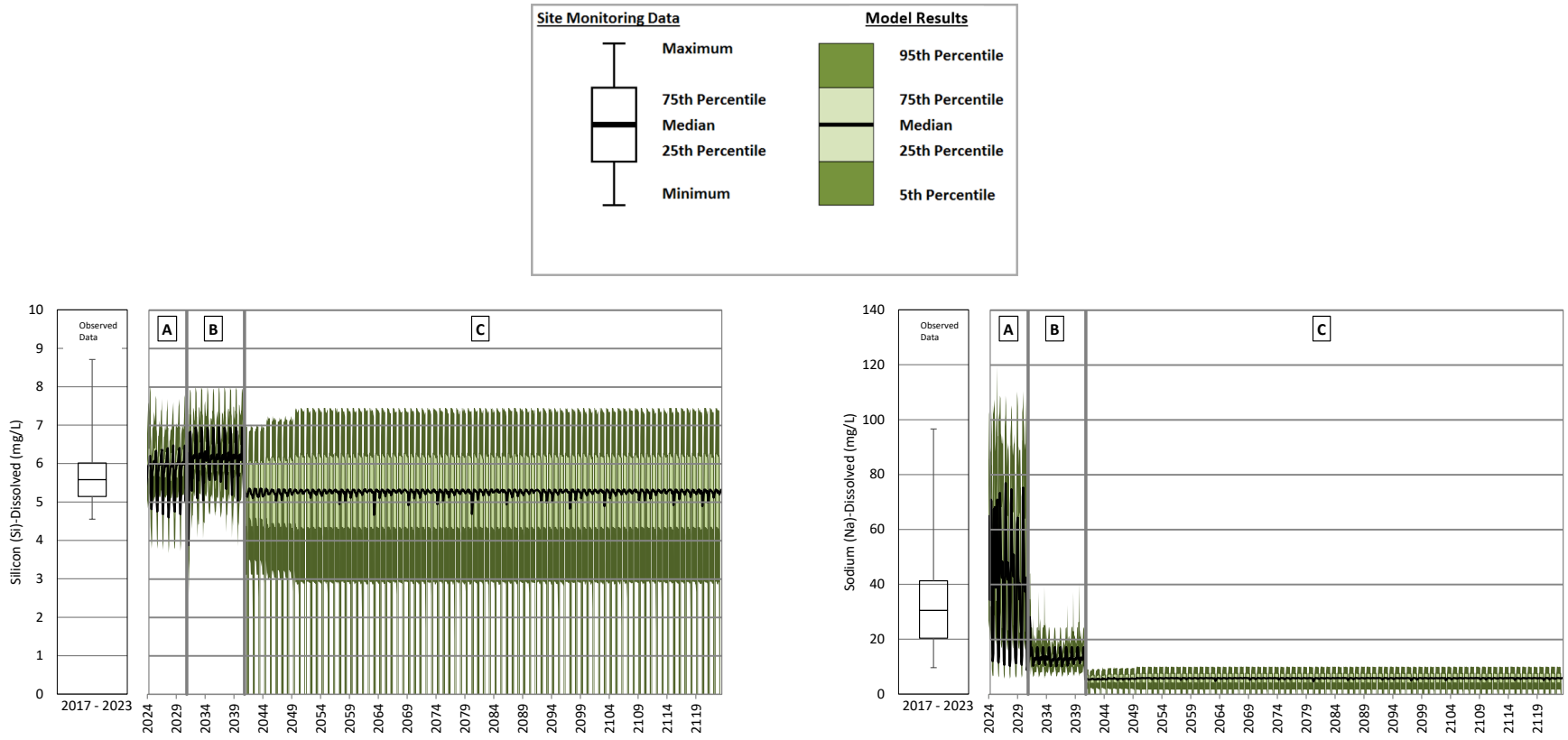

A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from operations to closure and post-closure is caused by runoff from areas that were assigned the disturbed water quality input being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **84: Central Collection Sump Operations, Closure and Post-closure – Silicon and Sodium**

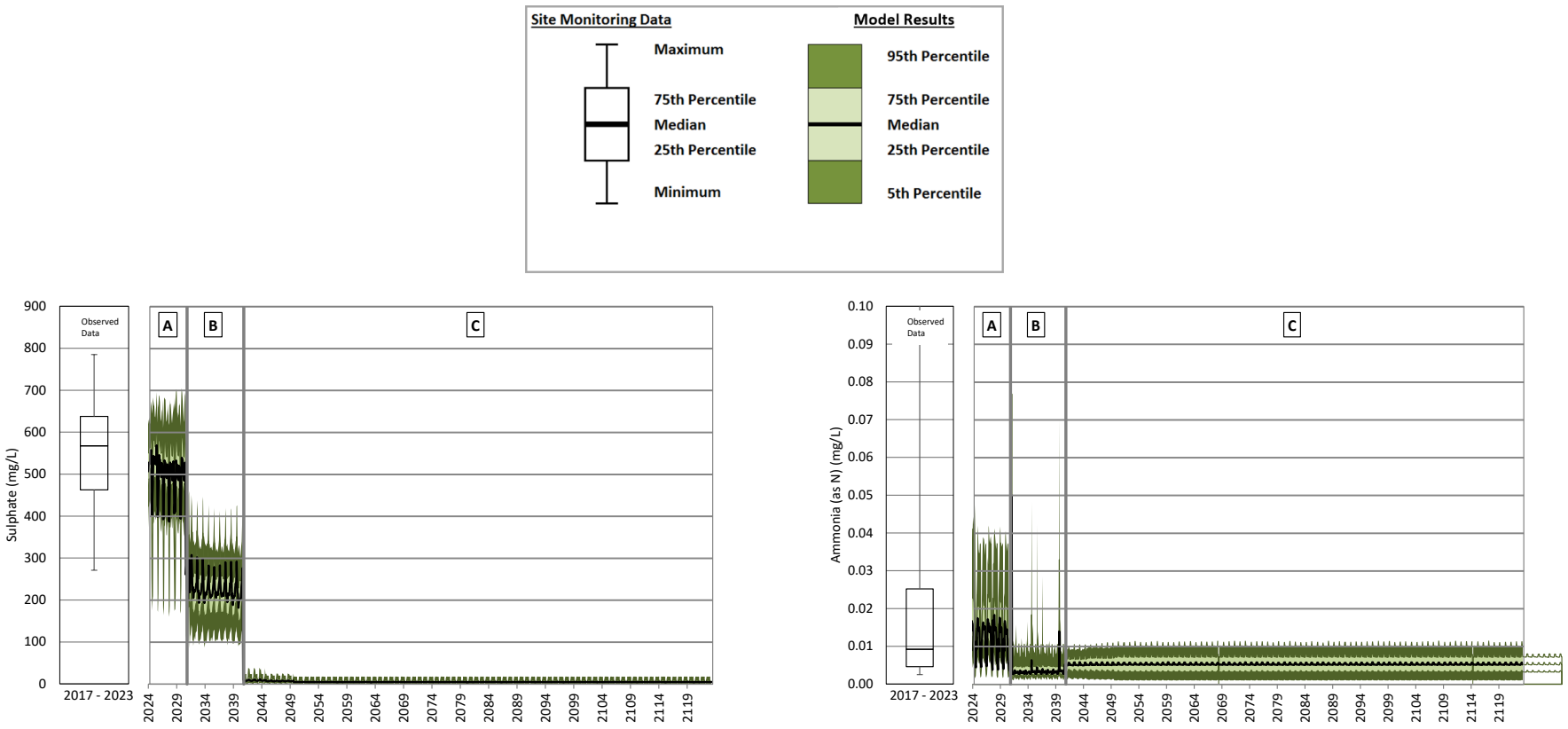

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **85: Central Collection Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**

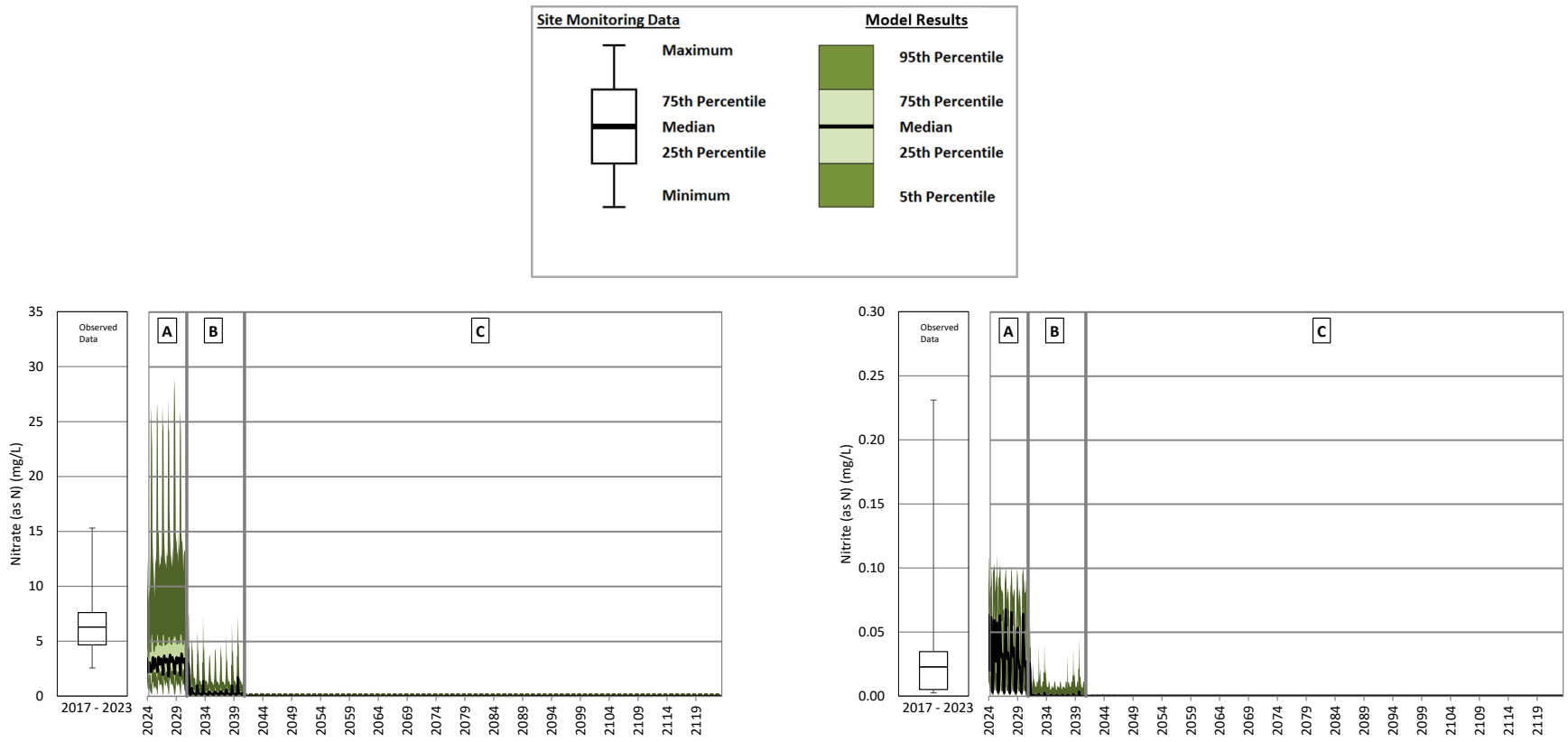

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **86: Central Collection Sump Operations, Closure and Post-closure – Nitrate and Nitrite**

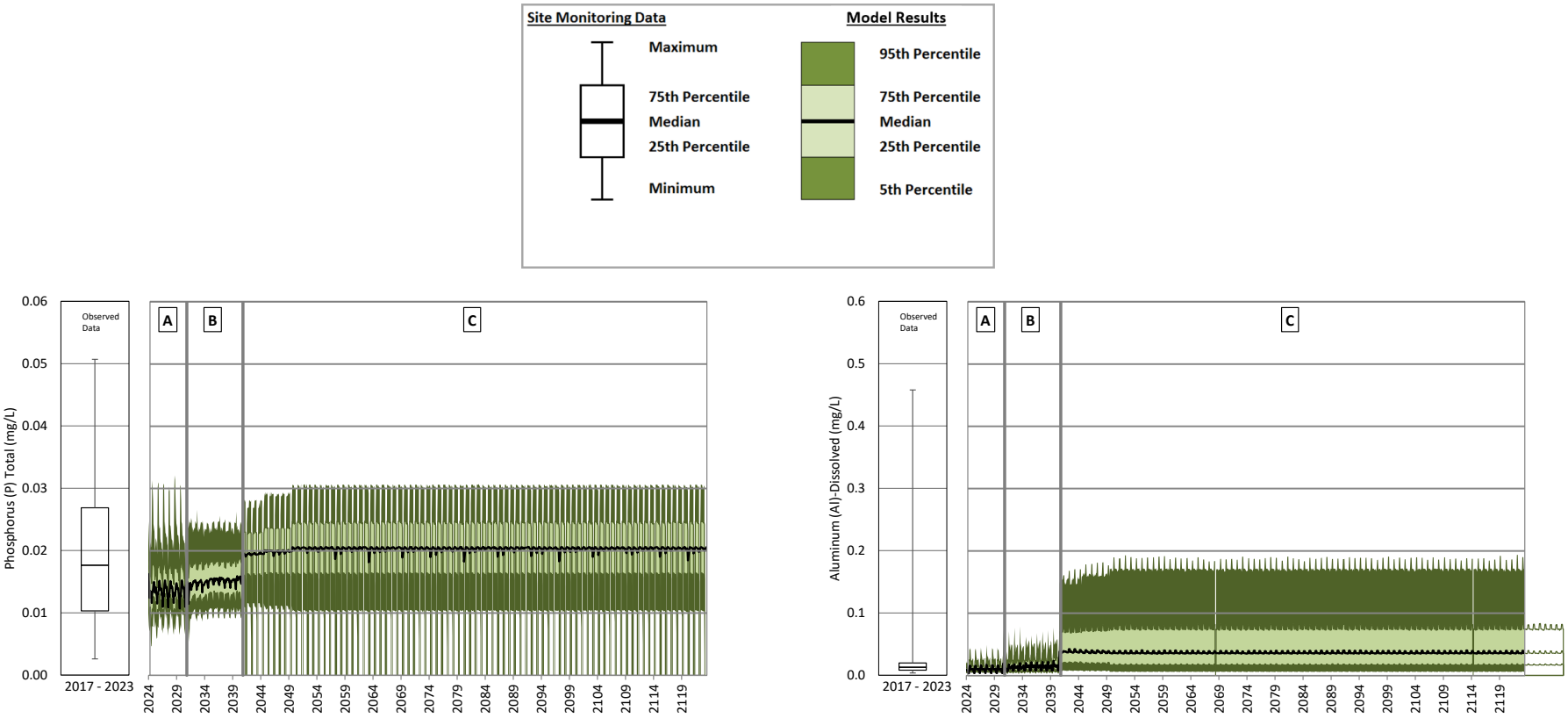

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **87: Central Collection Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

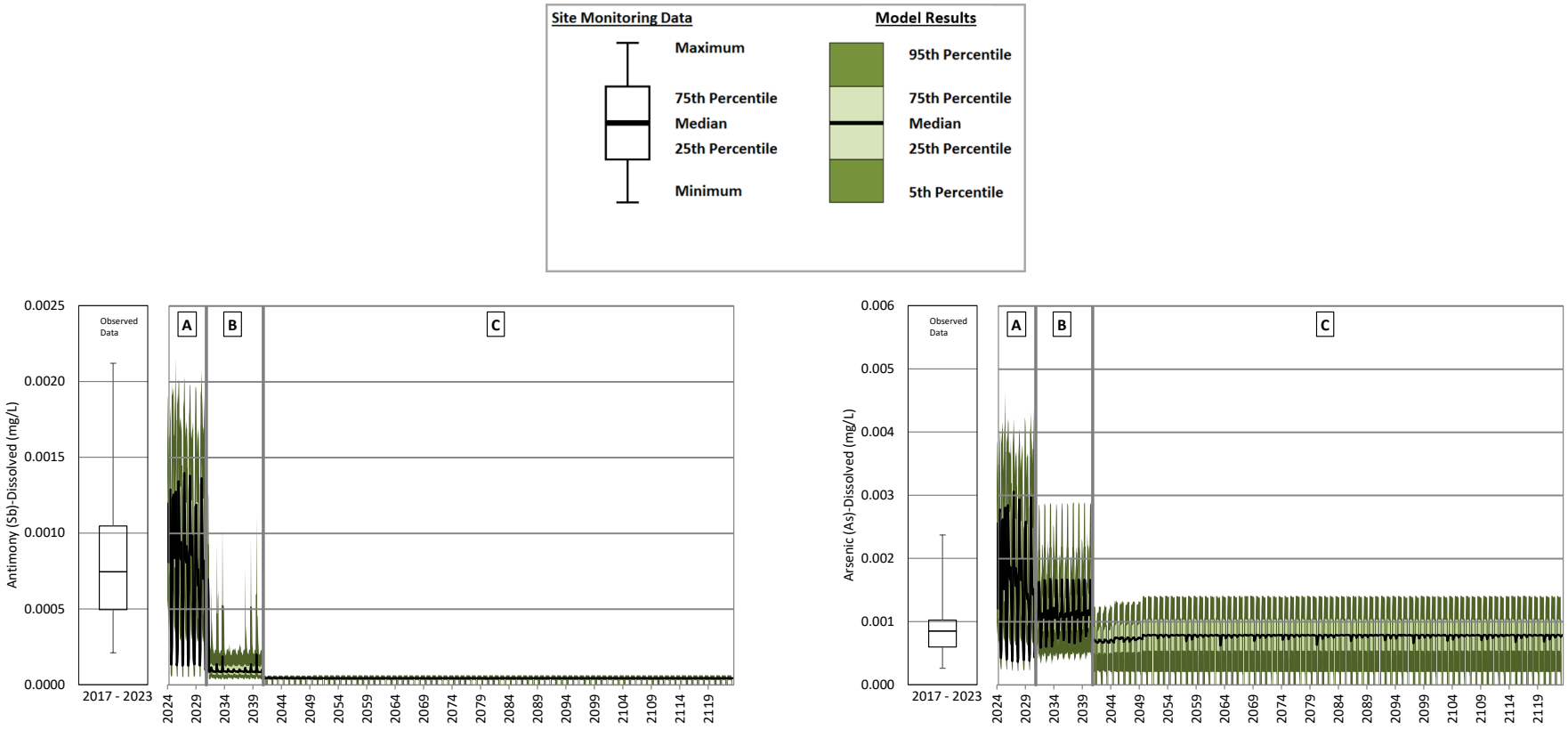

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **88: Central Collection Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

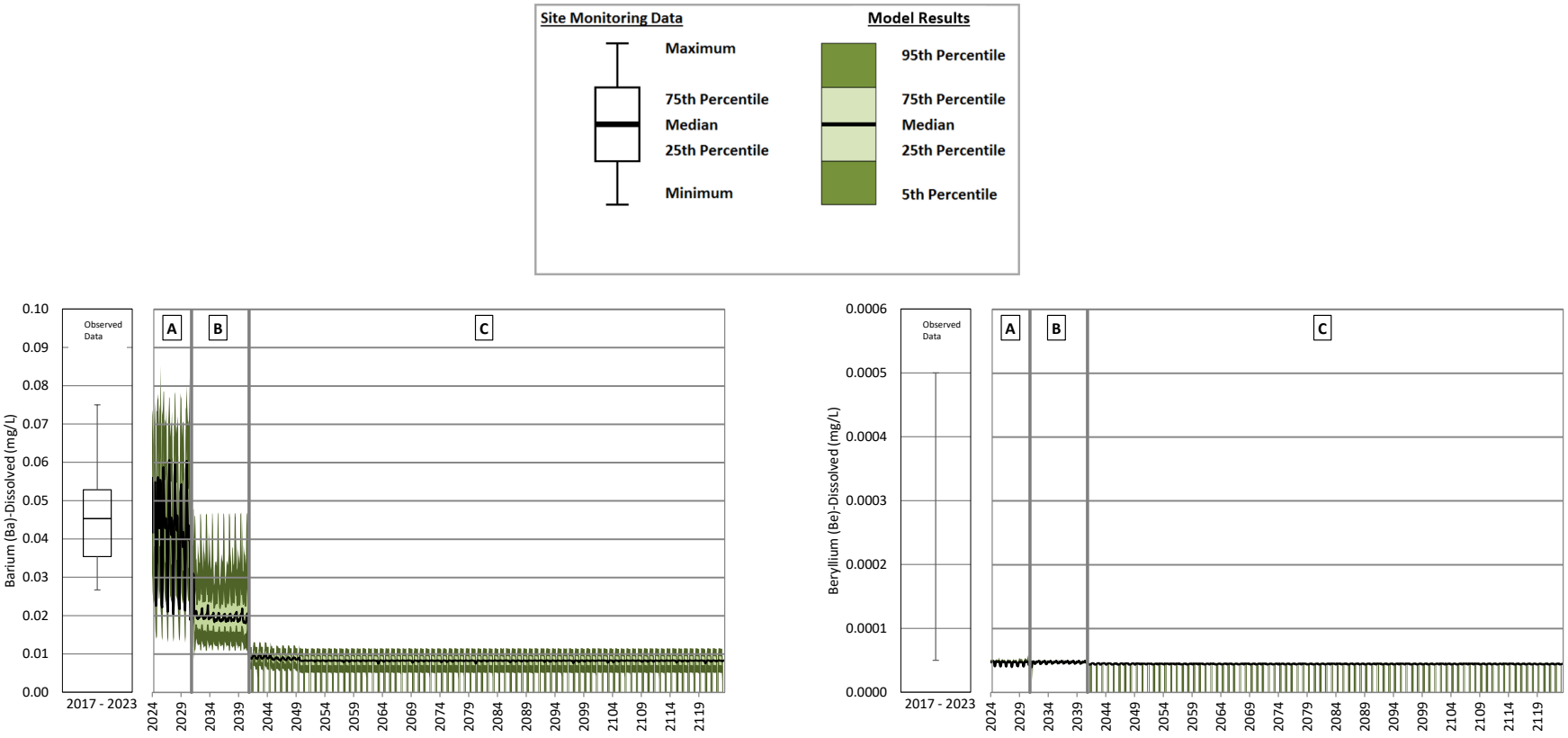

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **89: Central Collection Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

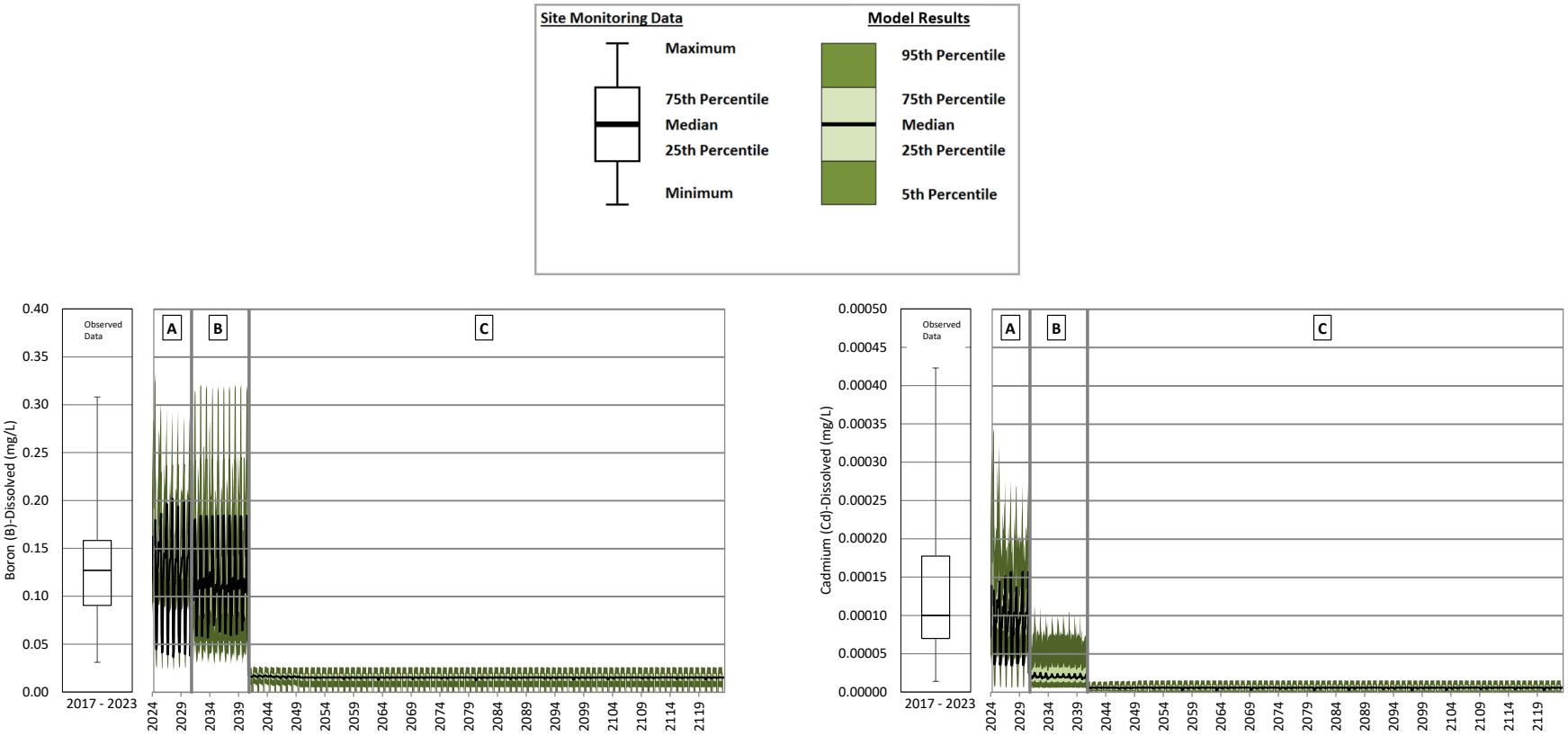

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **90: Central Collection Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

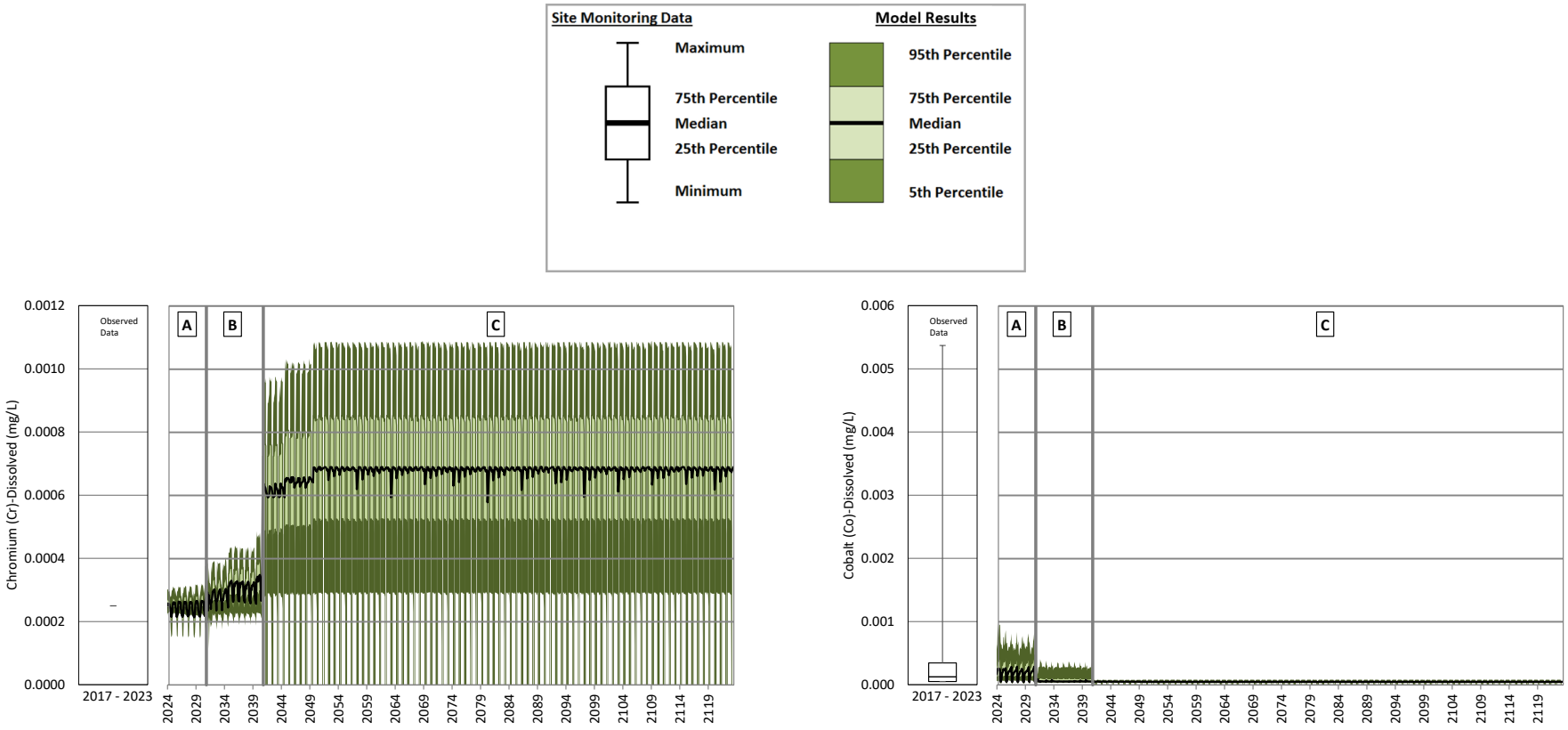

A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **91: Central Collection Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

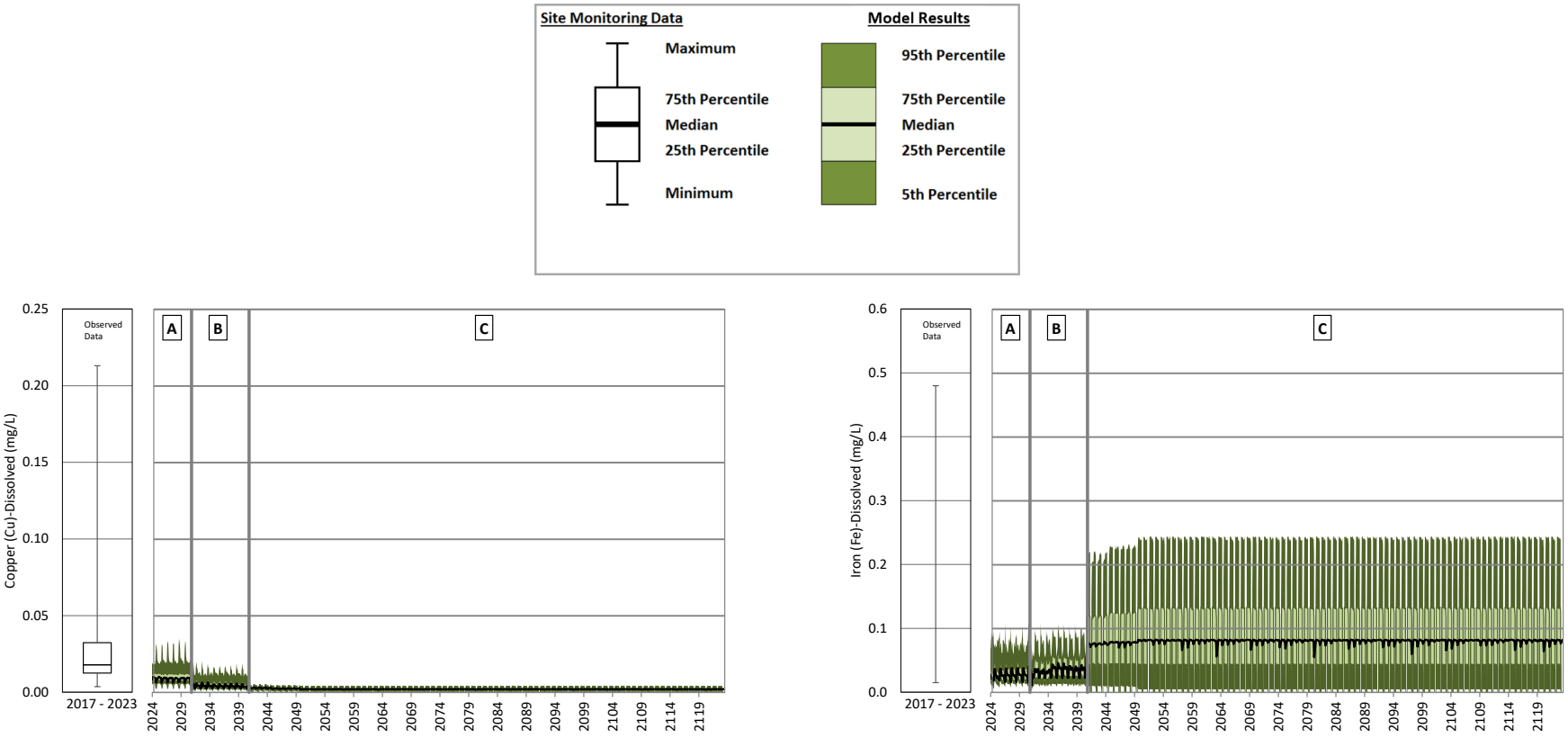

A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **92: Central Collection Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

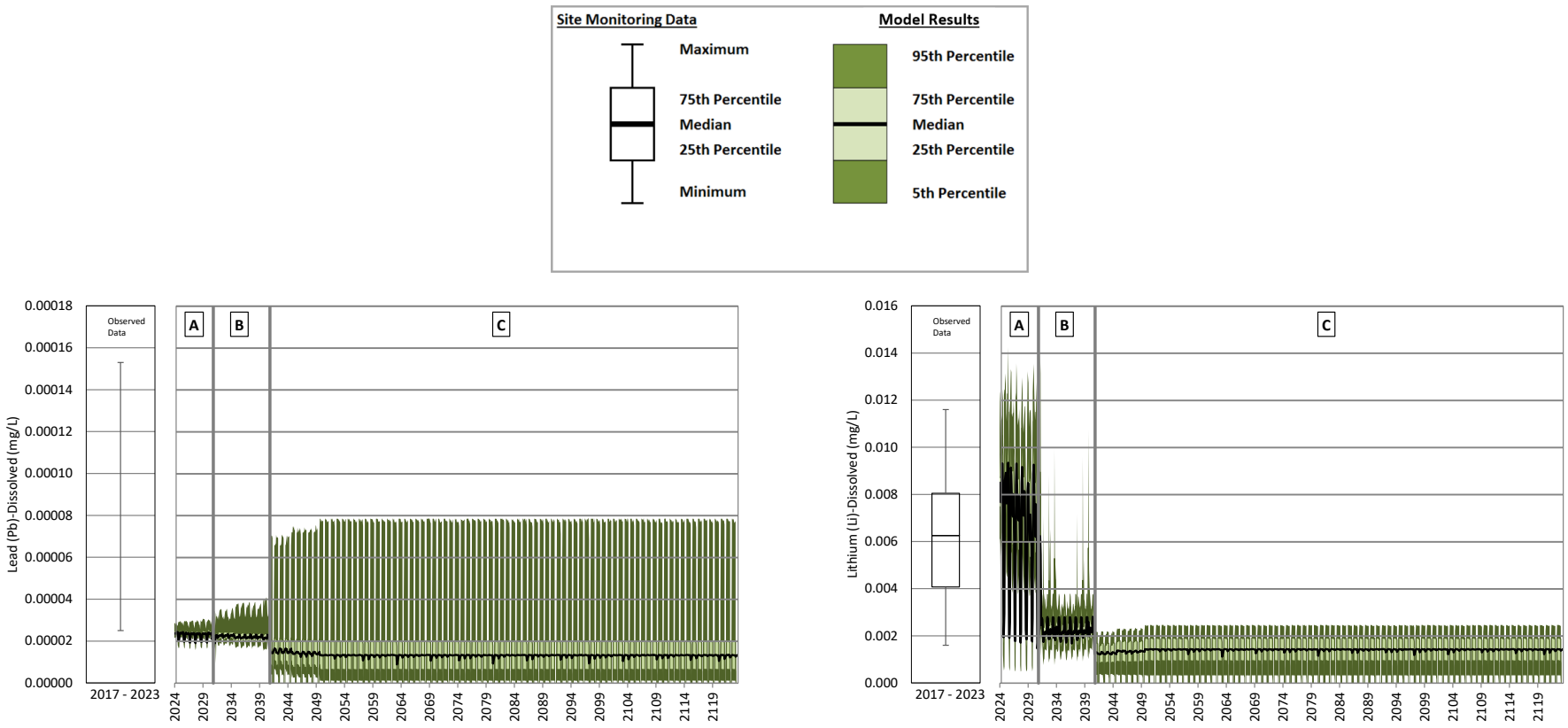

A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **93: Central Collection Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

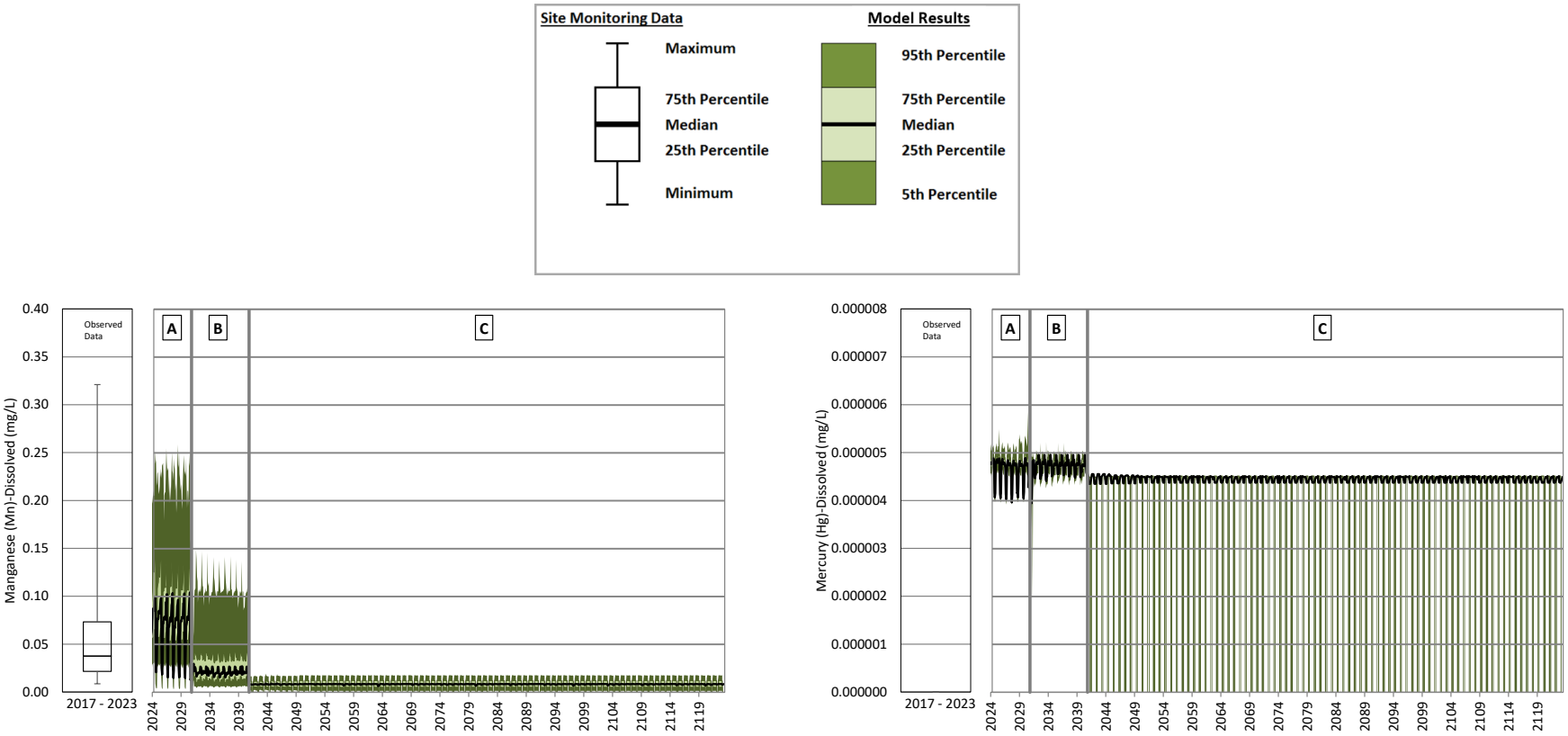

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **94: Central Collection Sump Operations, Closure and Post-closure – Dissolved Manganese and Dbootissolved Mercury**

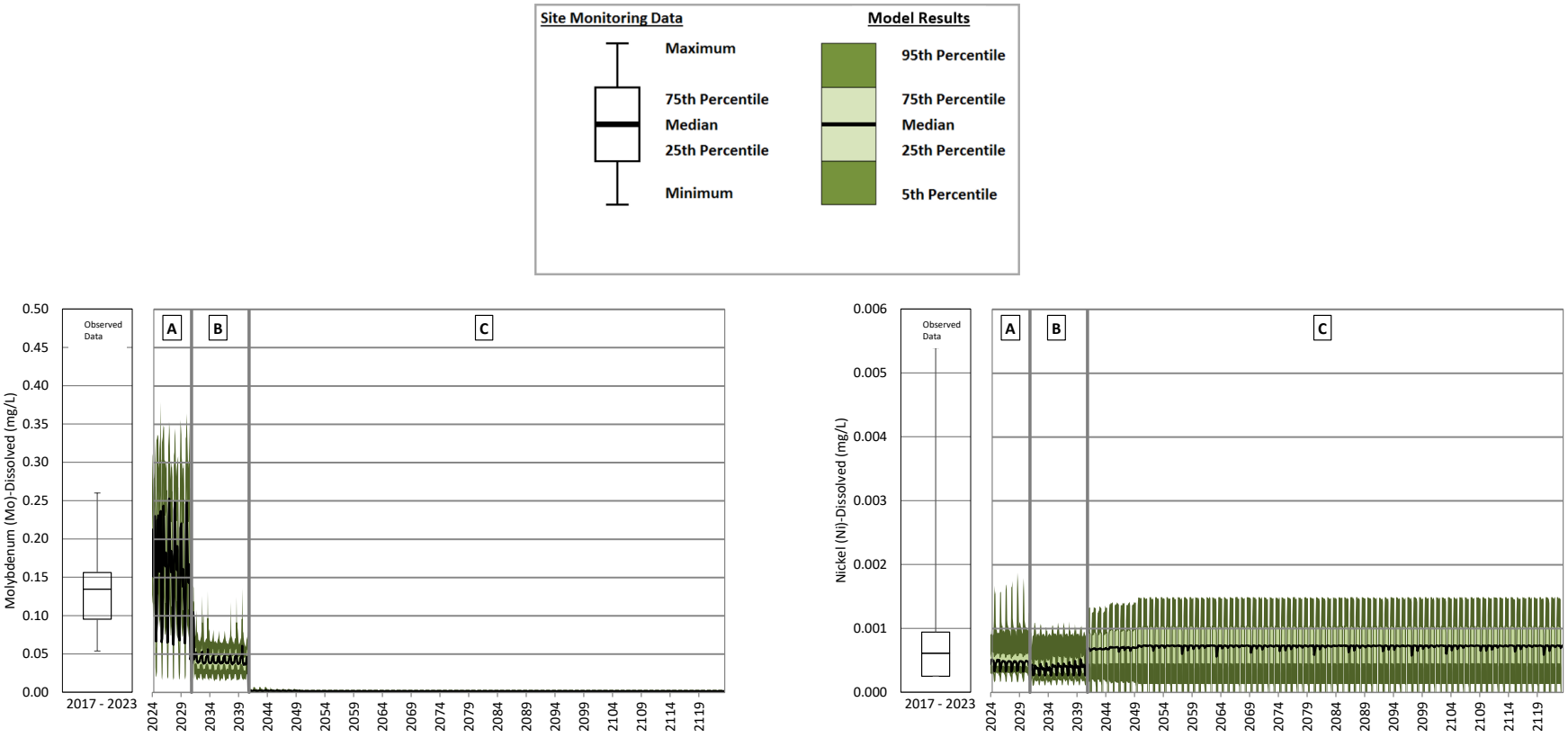

A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **95: Central Collection Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

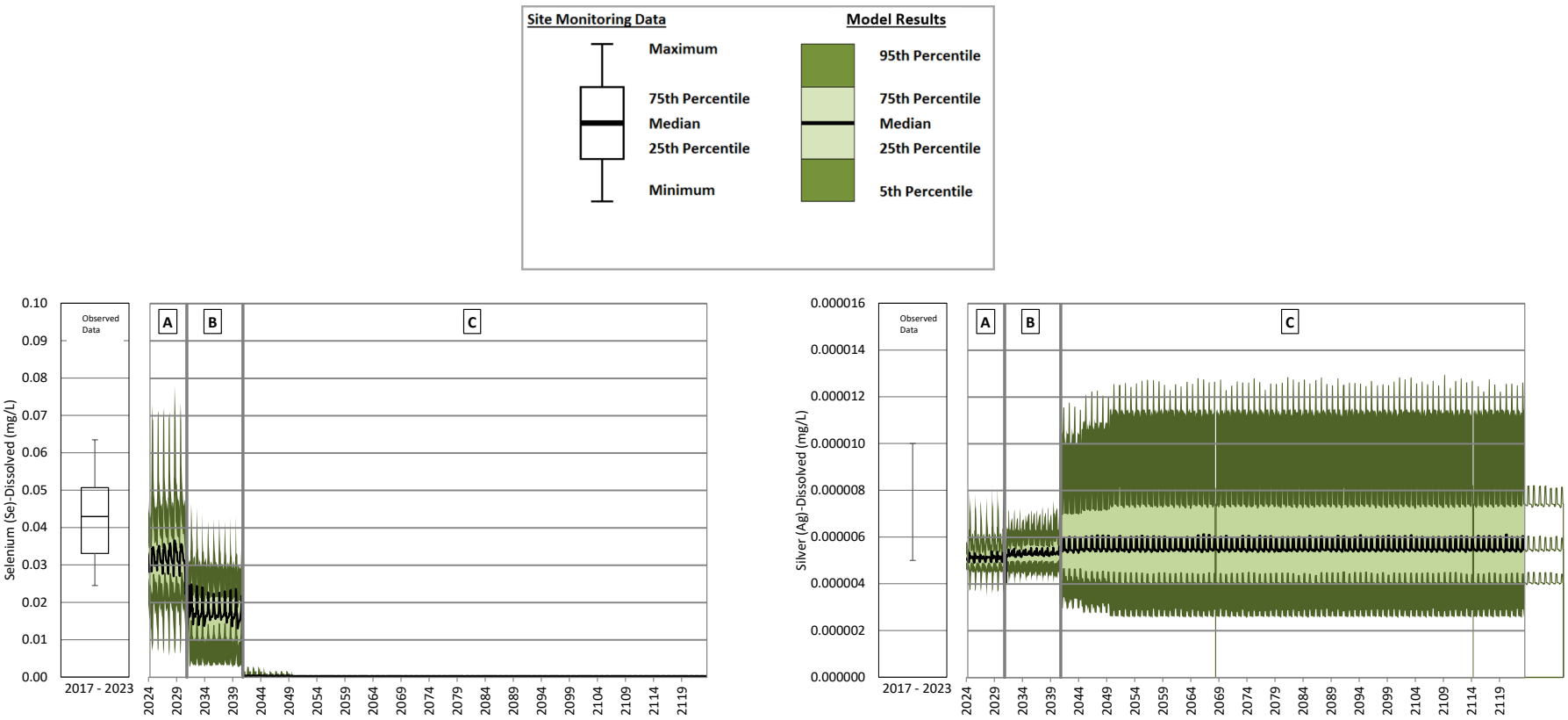

A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **96: Central Collection Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

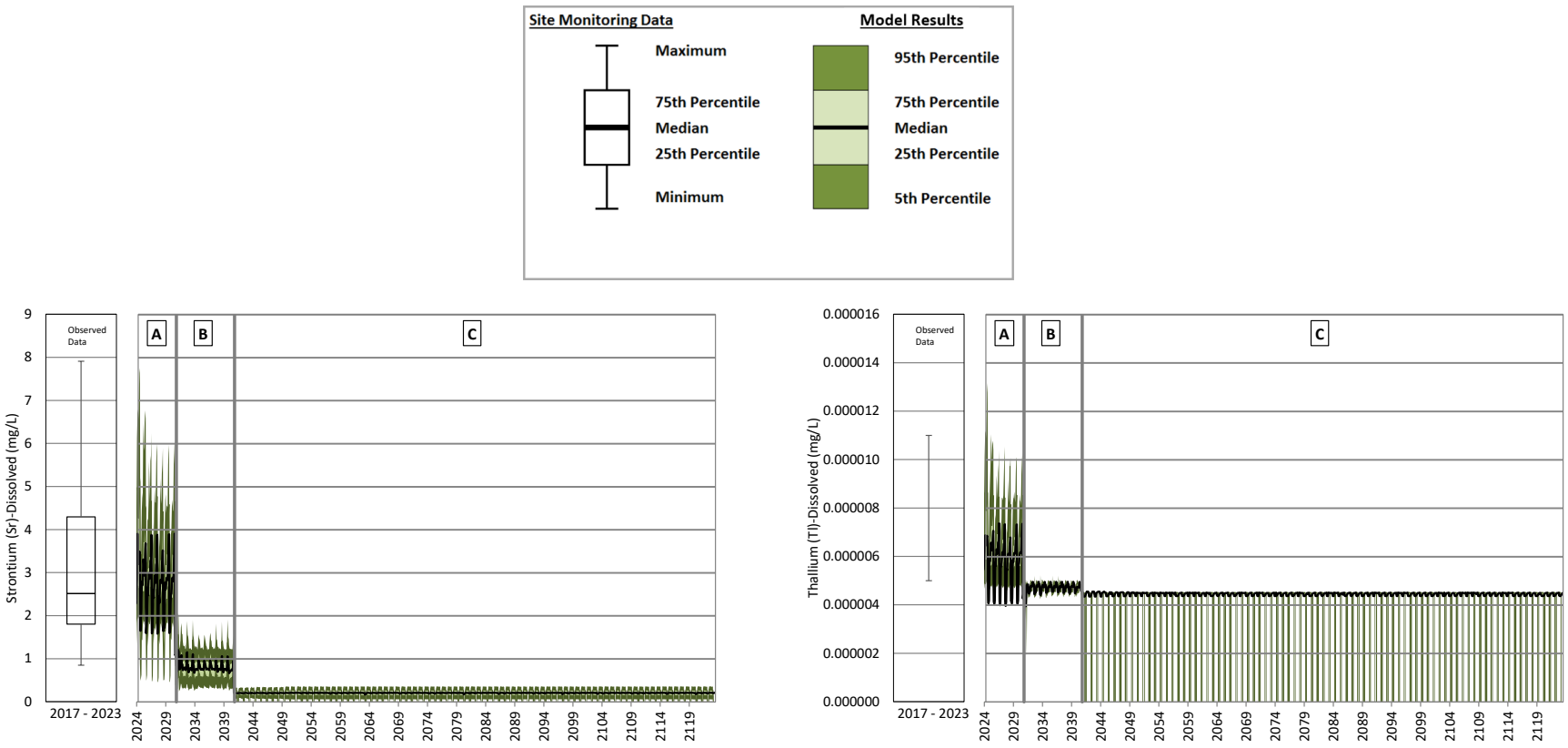

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **97: Central Collection Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

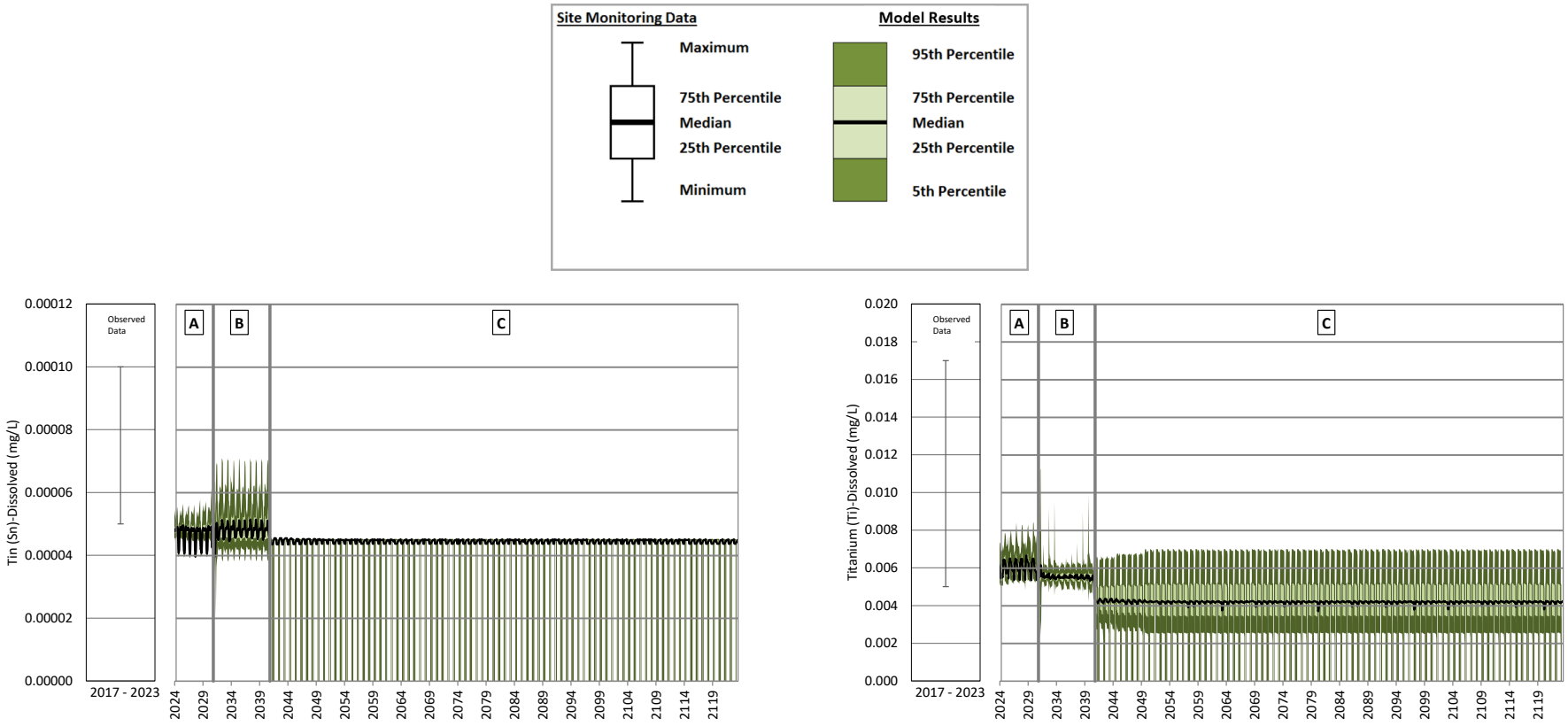

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **98: Central Collection Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

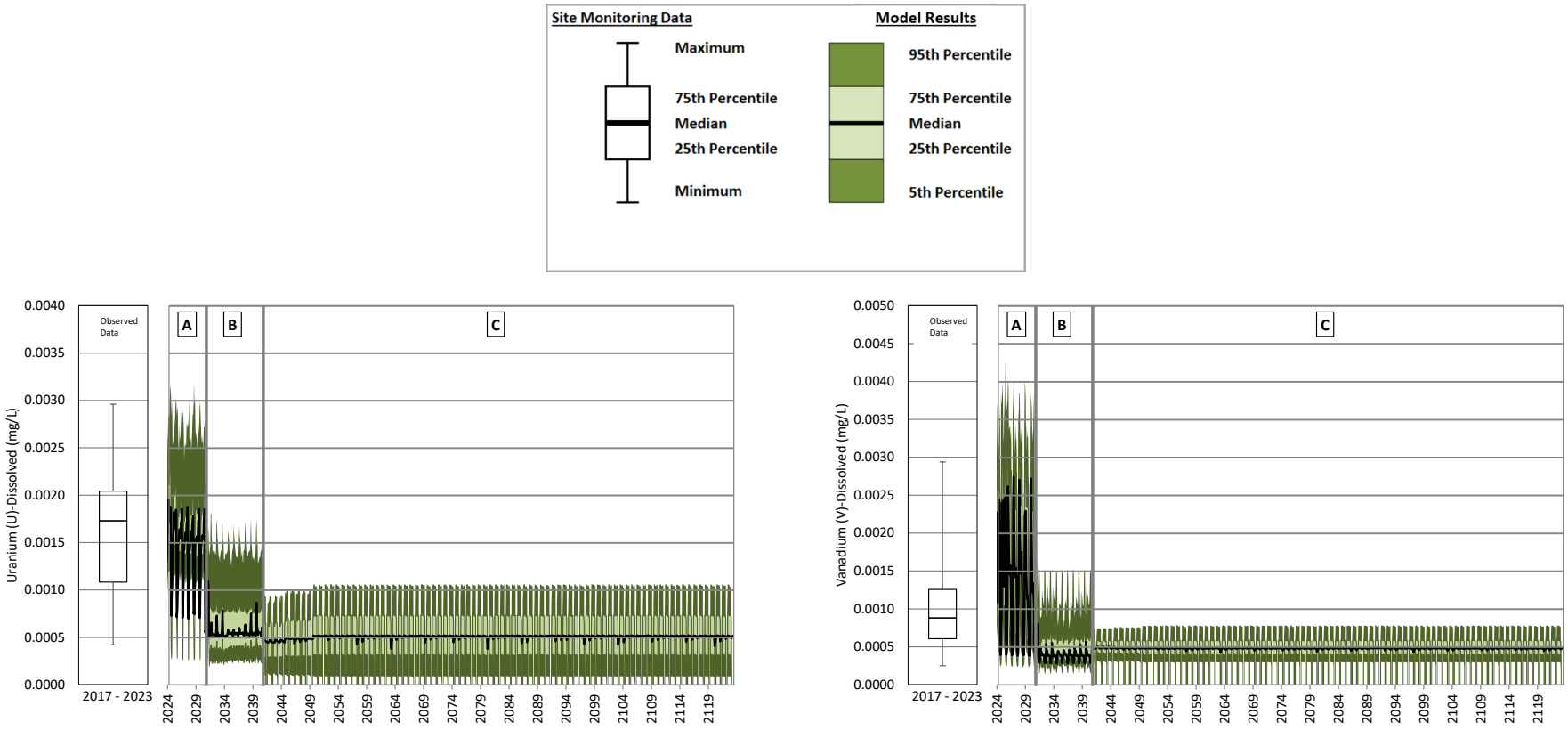

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **99: Central Collection Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

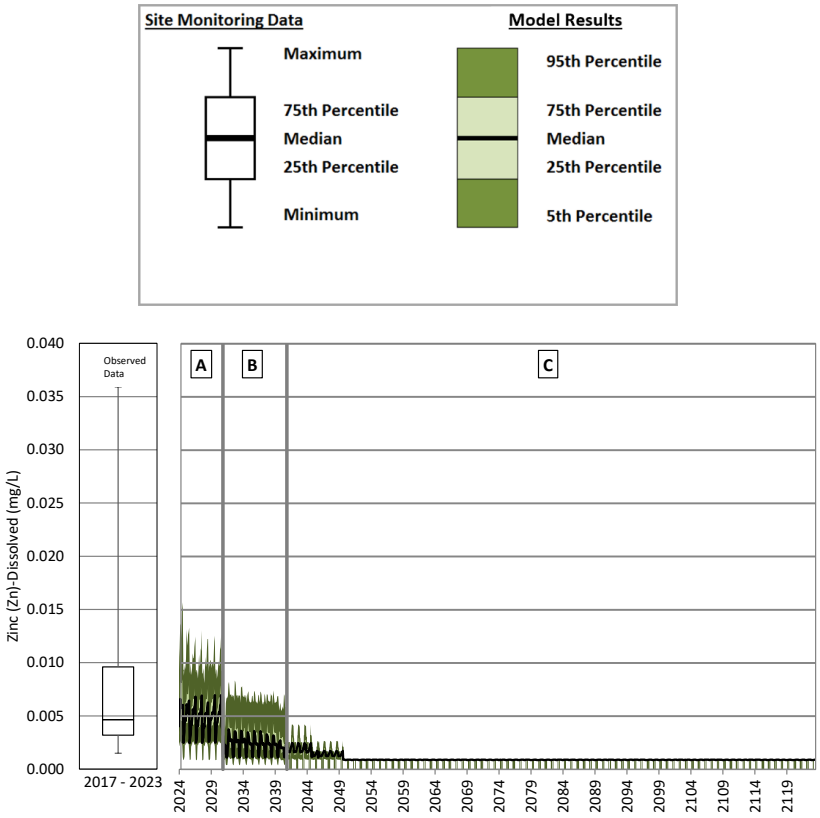

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **100: Central Collection Sump Operations, Closure and Post-closure – Dissolved Zinc**

Tailings Storage Facility Operations

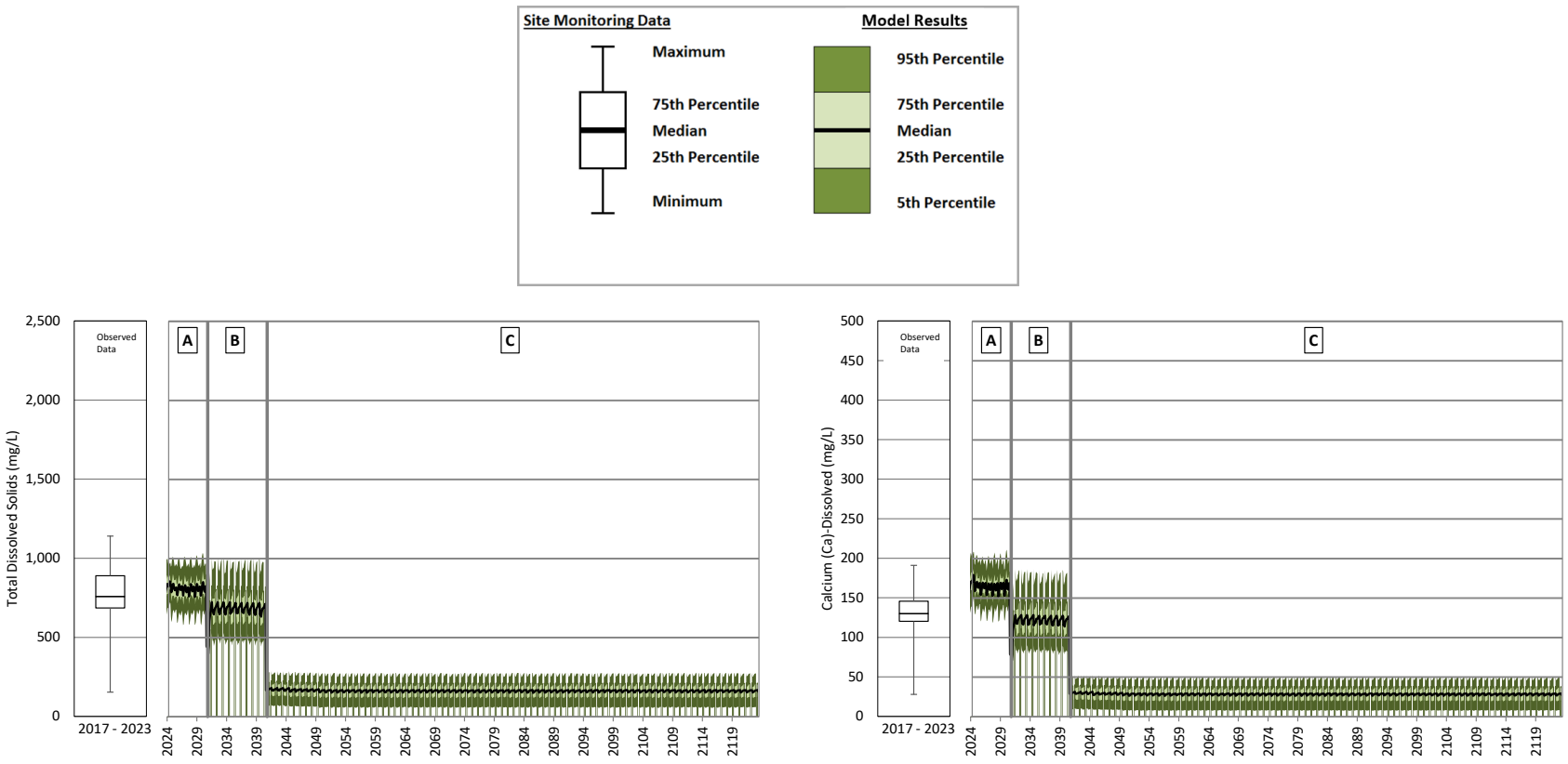

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **101: Tailings Storage Facility Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

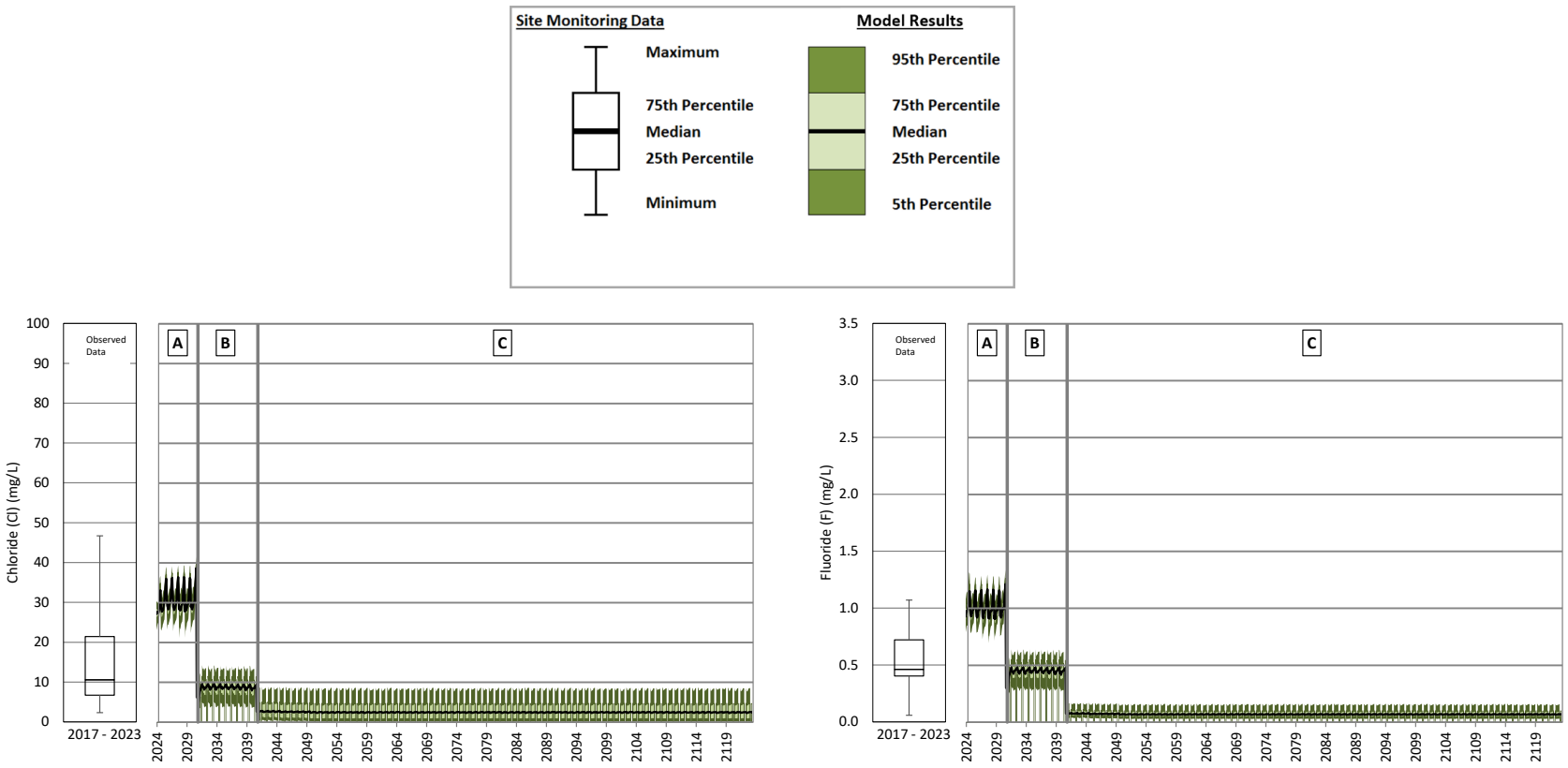

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **102: Tailings Storage Facility Operations, Closure and Post-closure – Chloride and Fluoride**

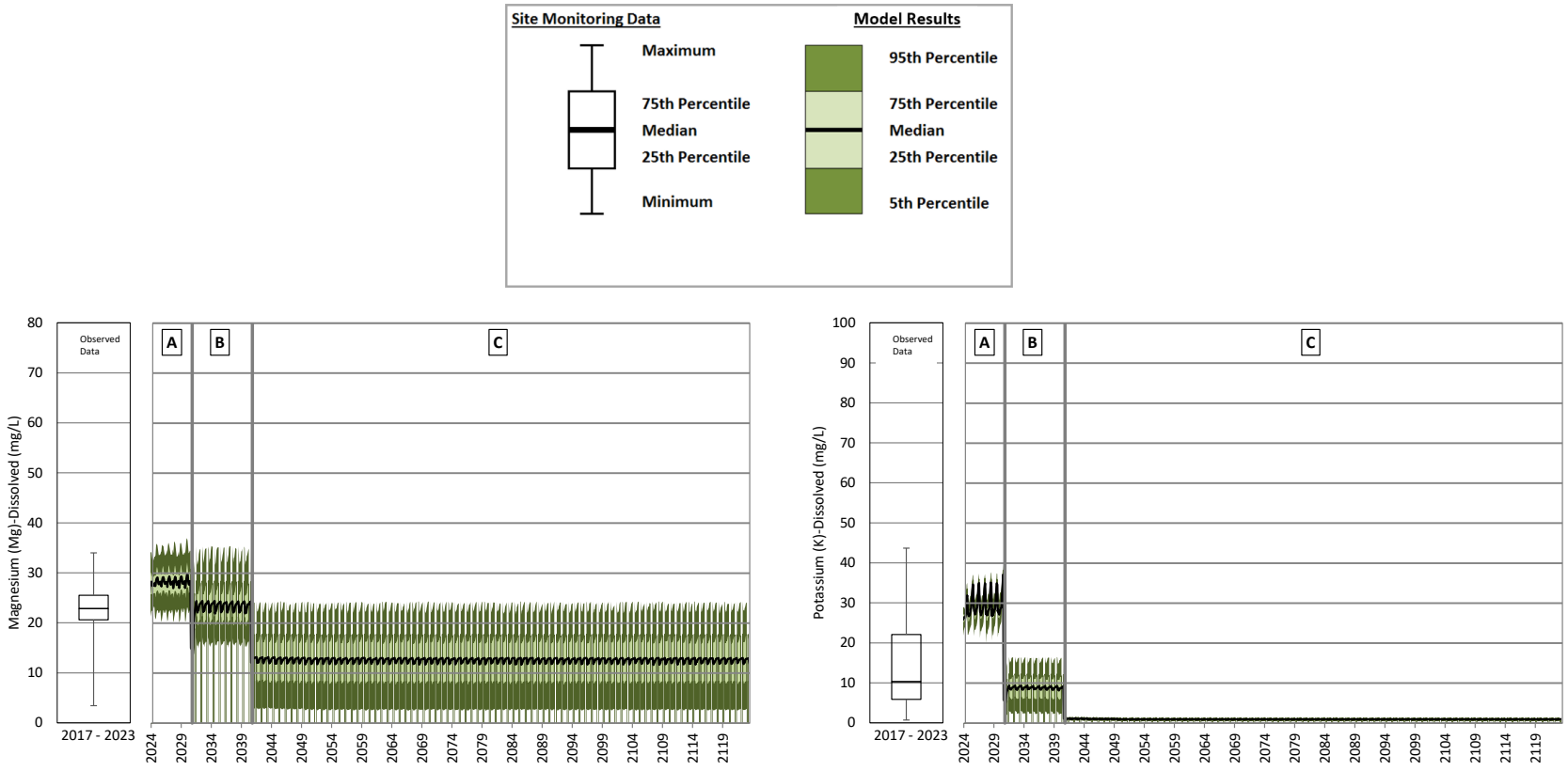

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **103: Tailings Storage Facility Operations, Closure and Post-closure – Magnesium and Potassium**

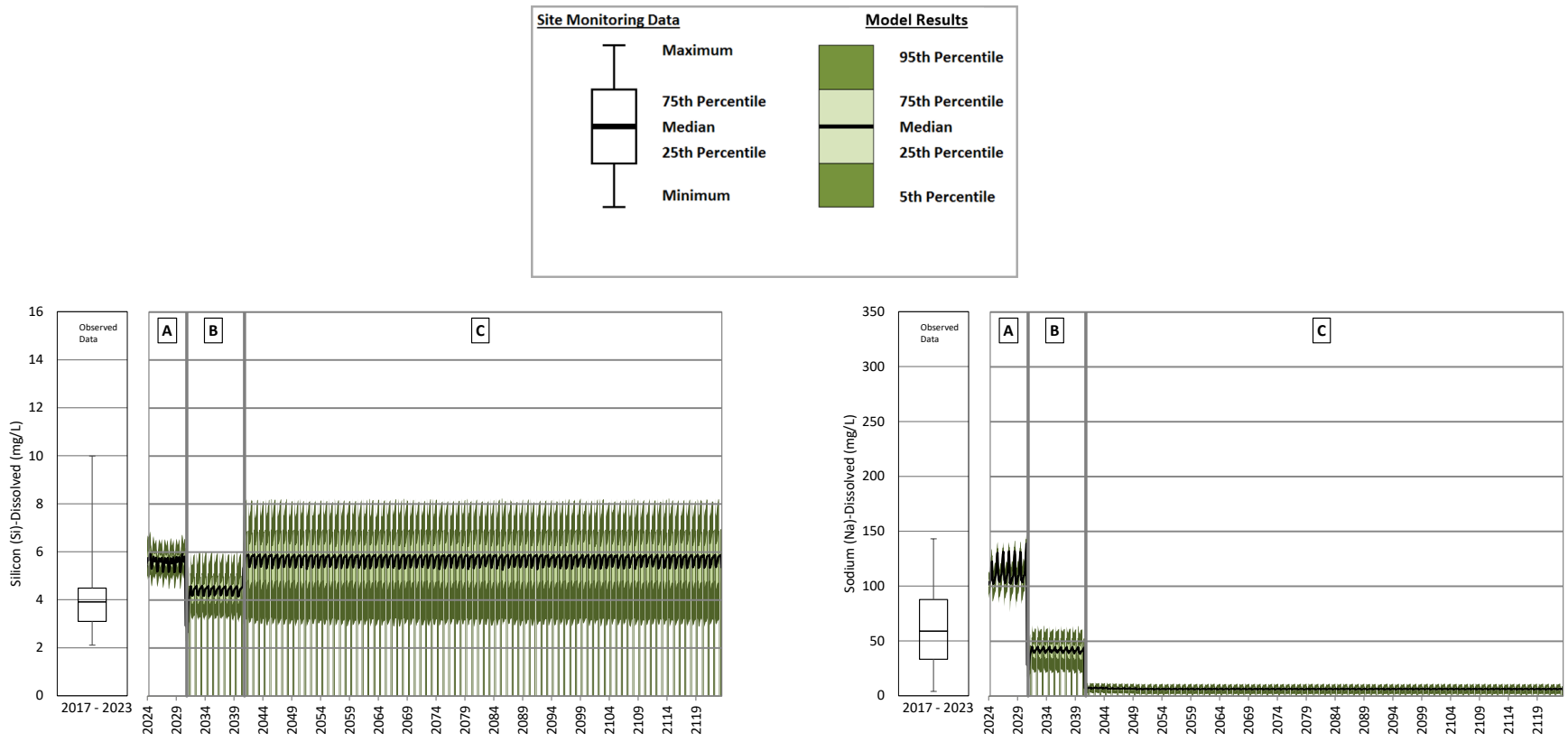

A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from closure to post-closure is caused by runoff from areas that were assigned the disturbed water quality input being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **104: Tailings Storage Facility Operations, Closure and Post-closure – Silicon and Sodium**

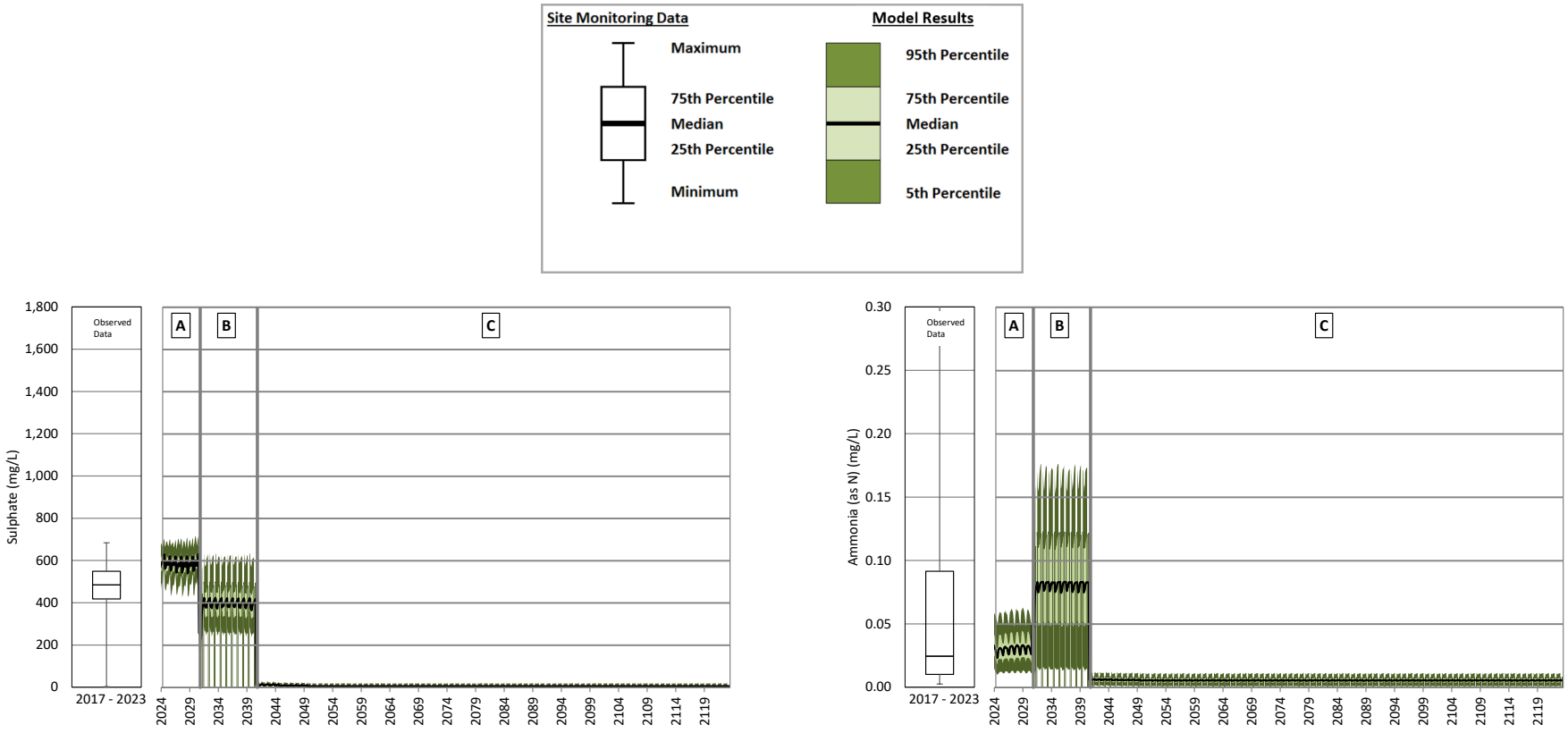

A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in total ammonia concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower total ammonia concentrations in the PETBP causes dilution of the total ammonia concentrations in the TSF during operations. Total ammonia concentrations decrease from closure to post-closure as runoff areas are remediated.

Figure B **105: Tailings Storage Facility Operations, Closure and Post-closure – Sulphate and Total Ammonia**

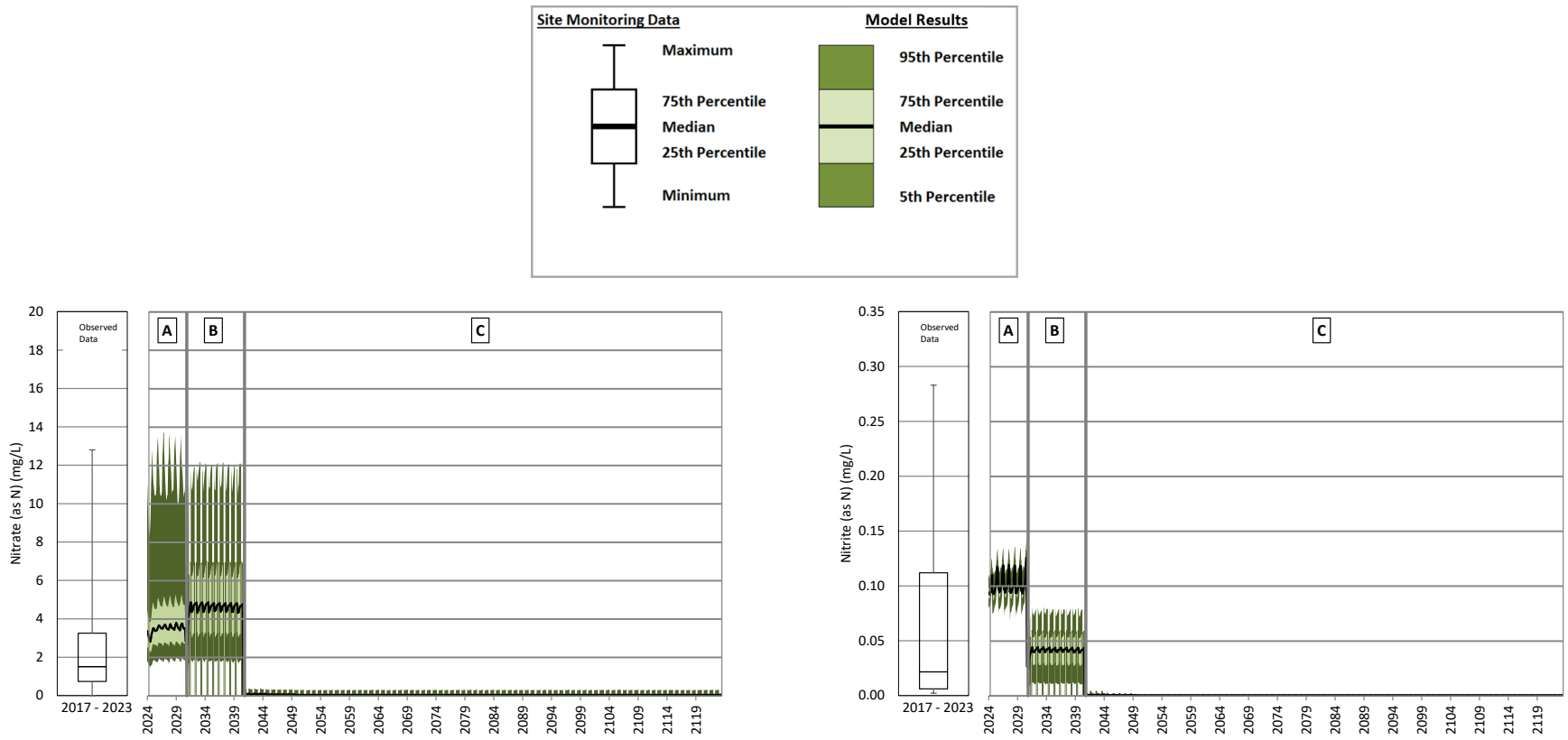

A = Operations; B = Closure; C = Post-closure

Note: The increase in nitrate concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower nitrate concentrations in the PETBP causes dilution of the nitrate concentrations in the TSF during operations. Nitrate concentrations decrease from closure to post-closure as runoff areas are remediated. Nitrite concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **106: Tailings Storage Facility Operations, Closure and Post-closure – Nitrate and Nitrite**

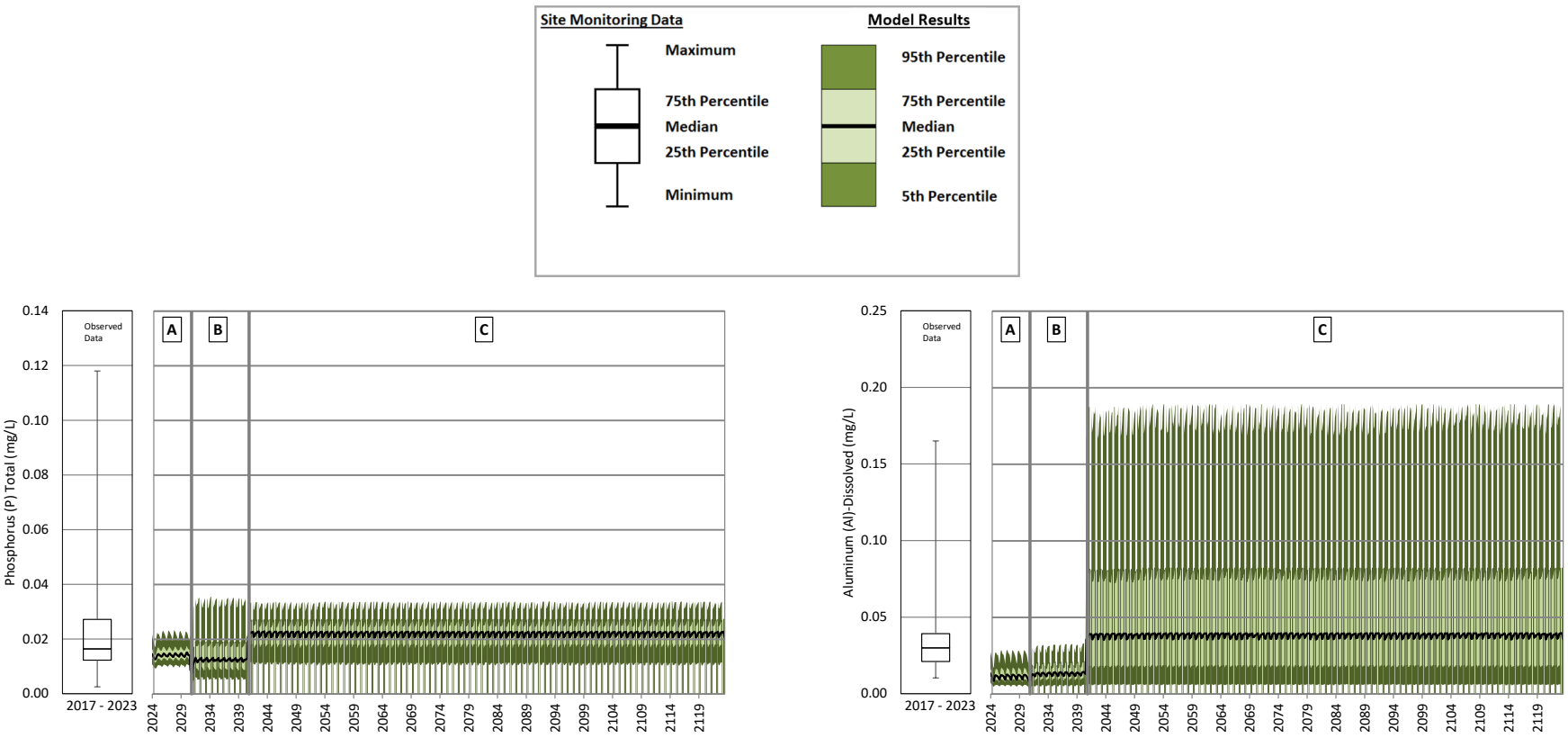

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **107: Tailings Storage Facility Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

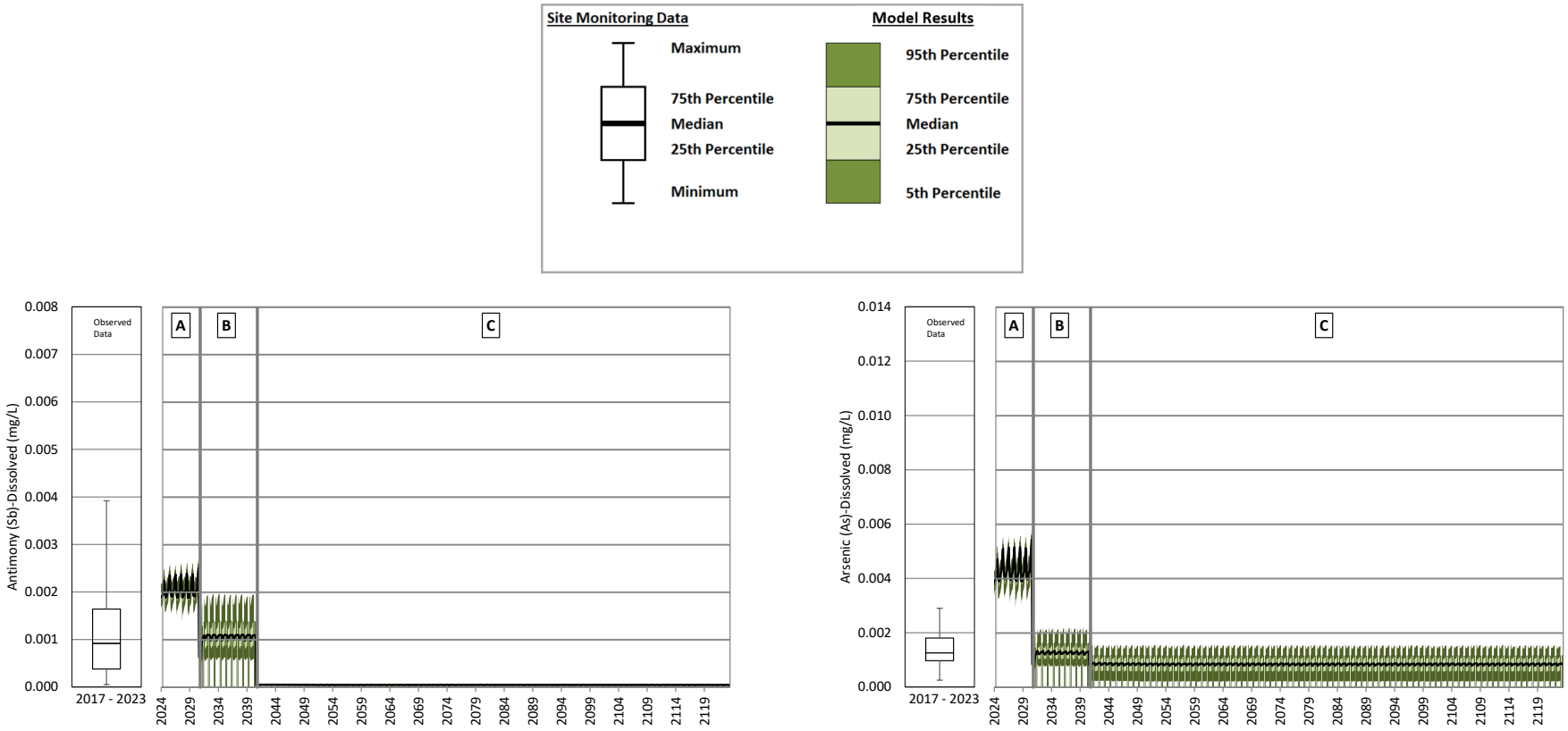

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **108: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

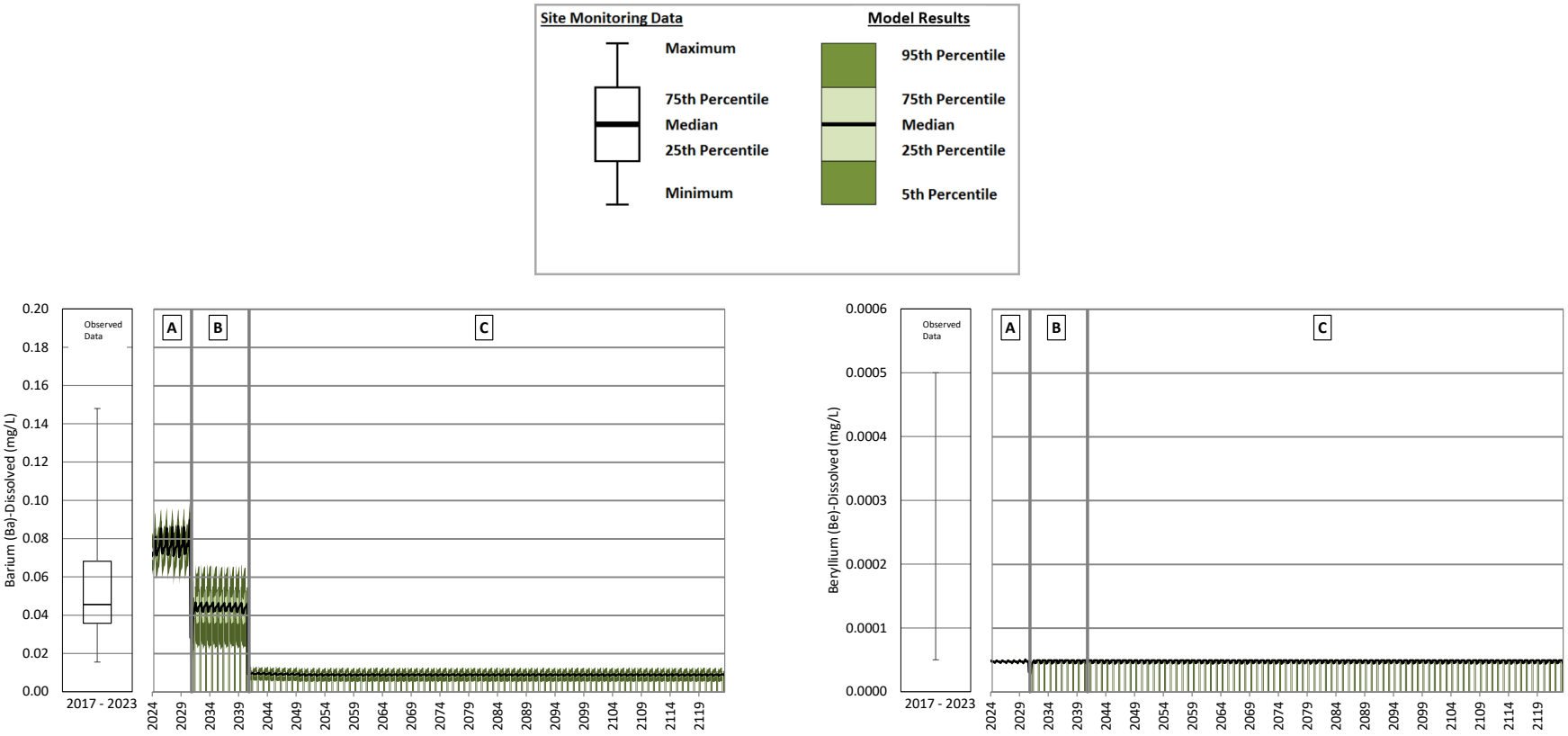

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **109: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

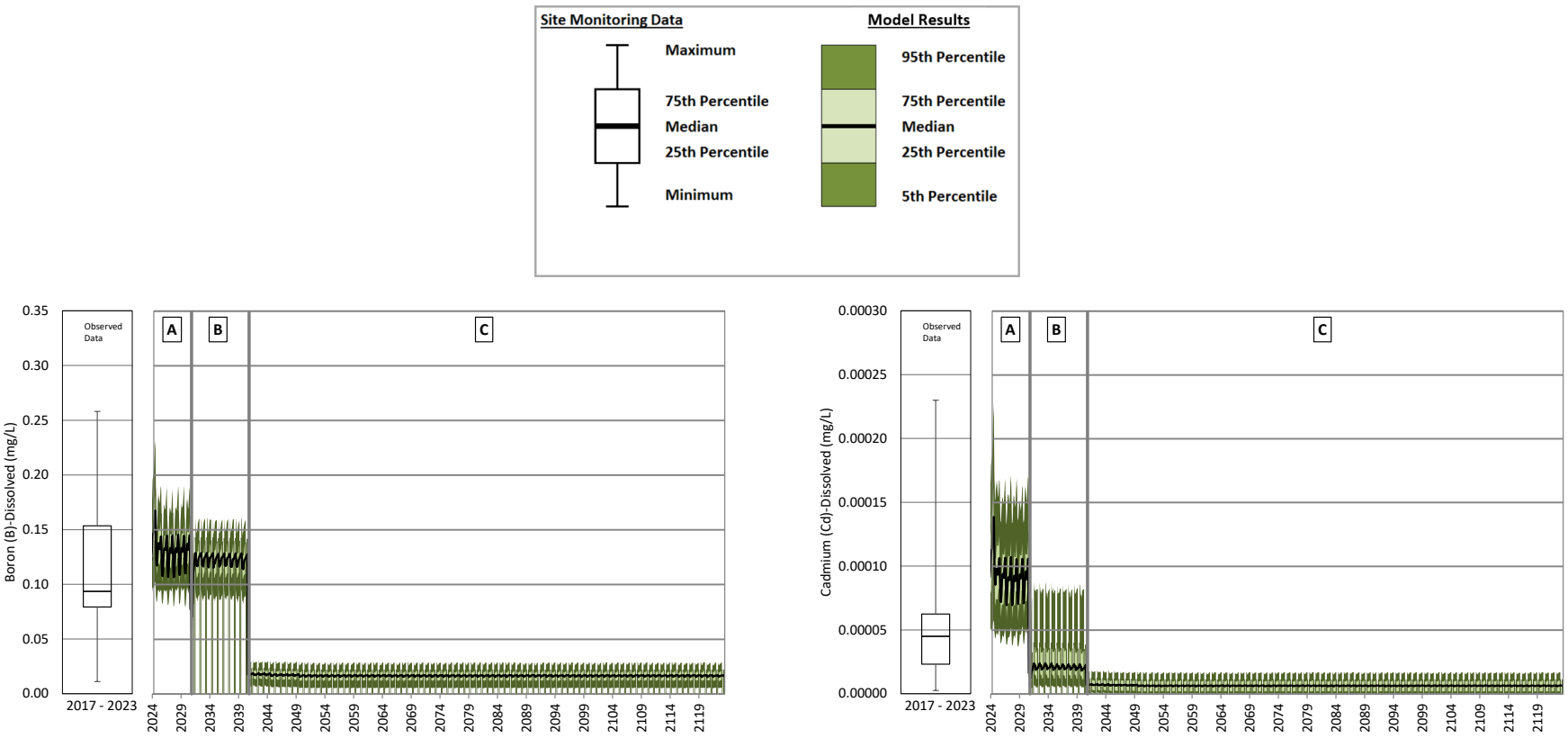

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **110: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

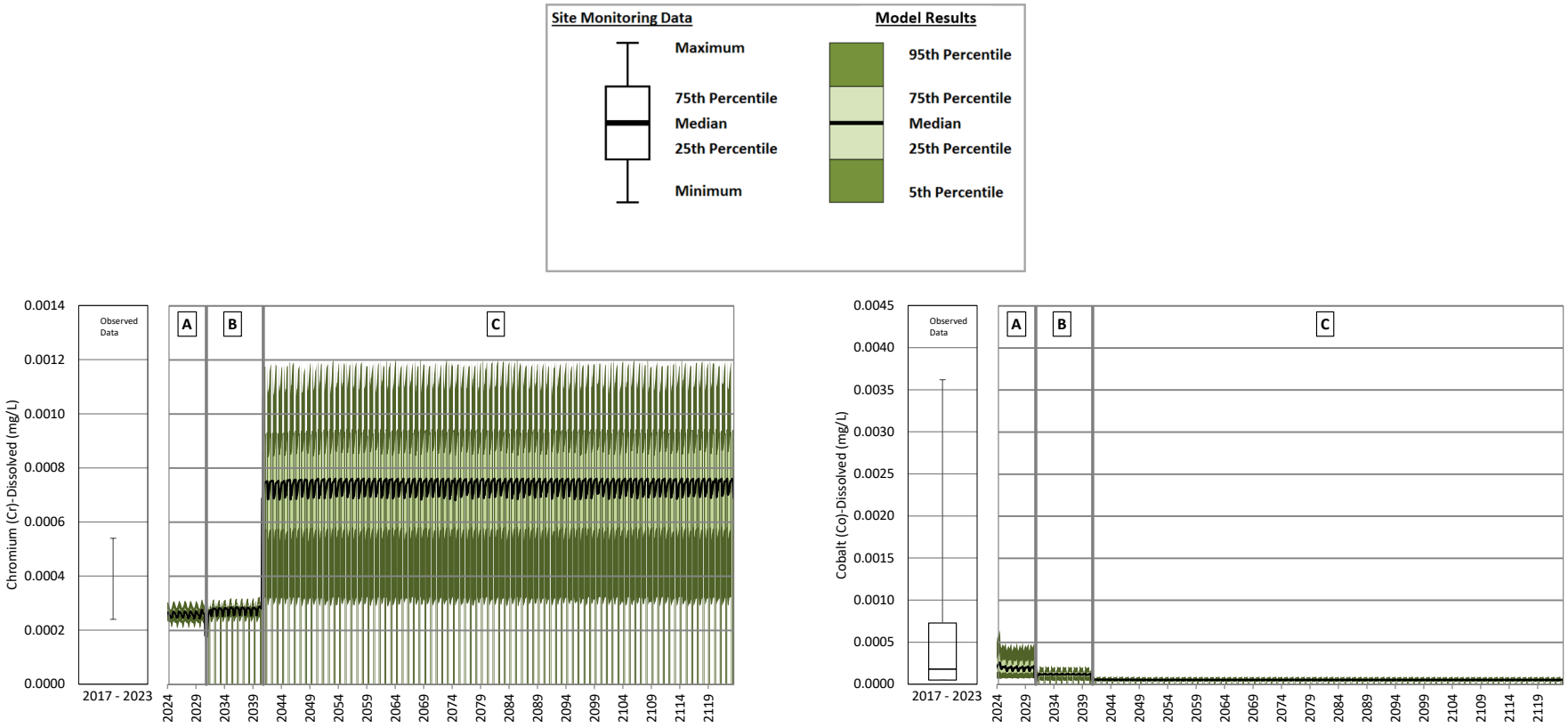

A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **111: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

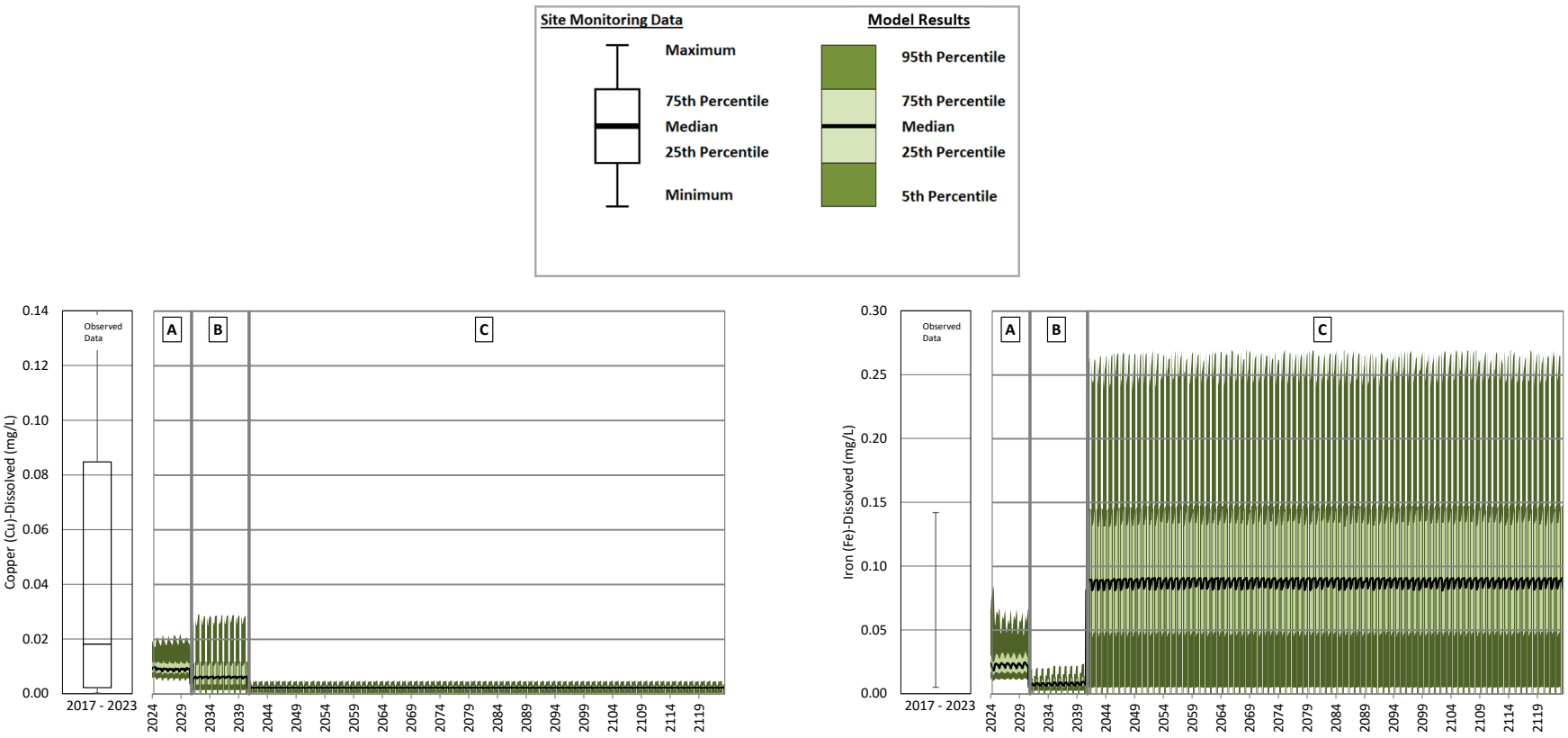

A = Operations; B = Closure; C = Post-closure

Note: The increase in dissolved copper concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the Tailings Storage Facility (TSF). Lower dissolved copper concentrations in the PETBP causes dilution of the dissolved copper concentrations in the TSF during operations. Dissolved copper concentrations decrease from closure to post-closure as runoff areas are remediated. The decrease in dissolved iron concentrations during closure is caused by the end of pumping from the PETBP to the TSF. Higher dissolved iron concentrations in the PETBP causes increased concentrations of dissolved iron concentrations in the TSF during operations. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input that has higher dissolved iron concentrations than contact water.

Figure B **112: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

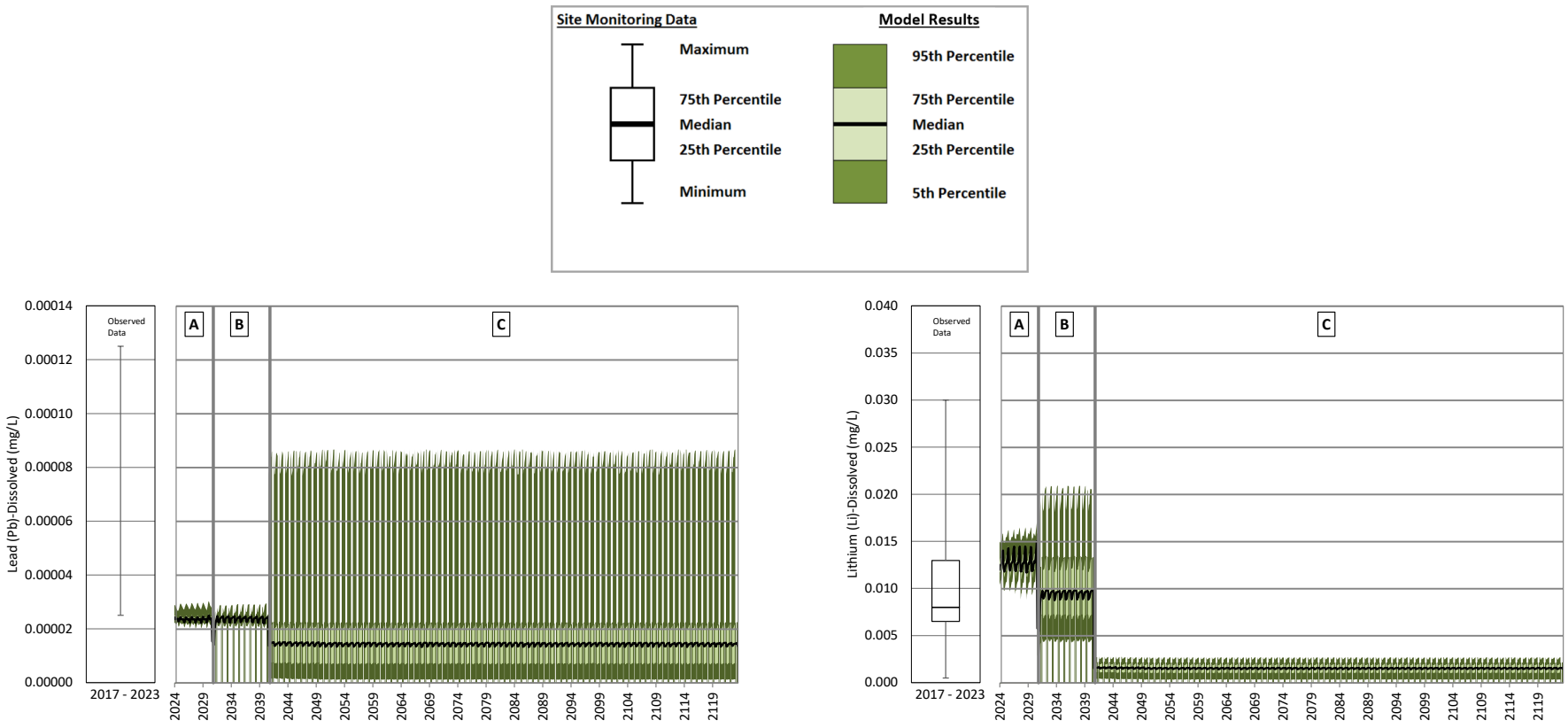

A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. The decrease in dissolved lithium concentrations from 2031 to 2032 is due to the end of pumping from the mill processing plant to the Tailings Storage Facility (TSF). The increase in dissolved lithium concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower dissolved lithium concentrations in the PETBP causes dilution of the dissolved lithium concentrations in the TSF during operations. Dissolved lithium concentrations decrease from closure to post-closure as runoff areas are remediated.

Figure B **113: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

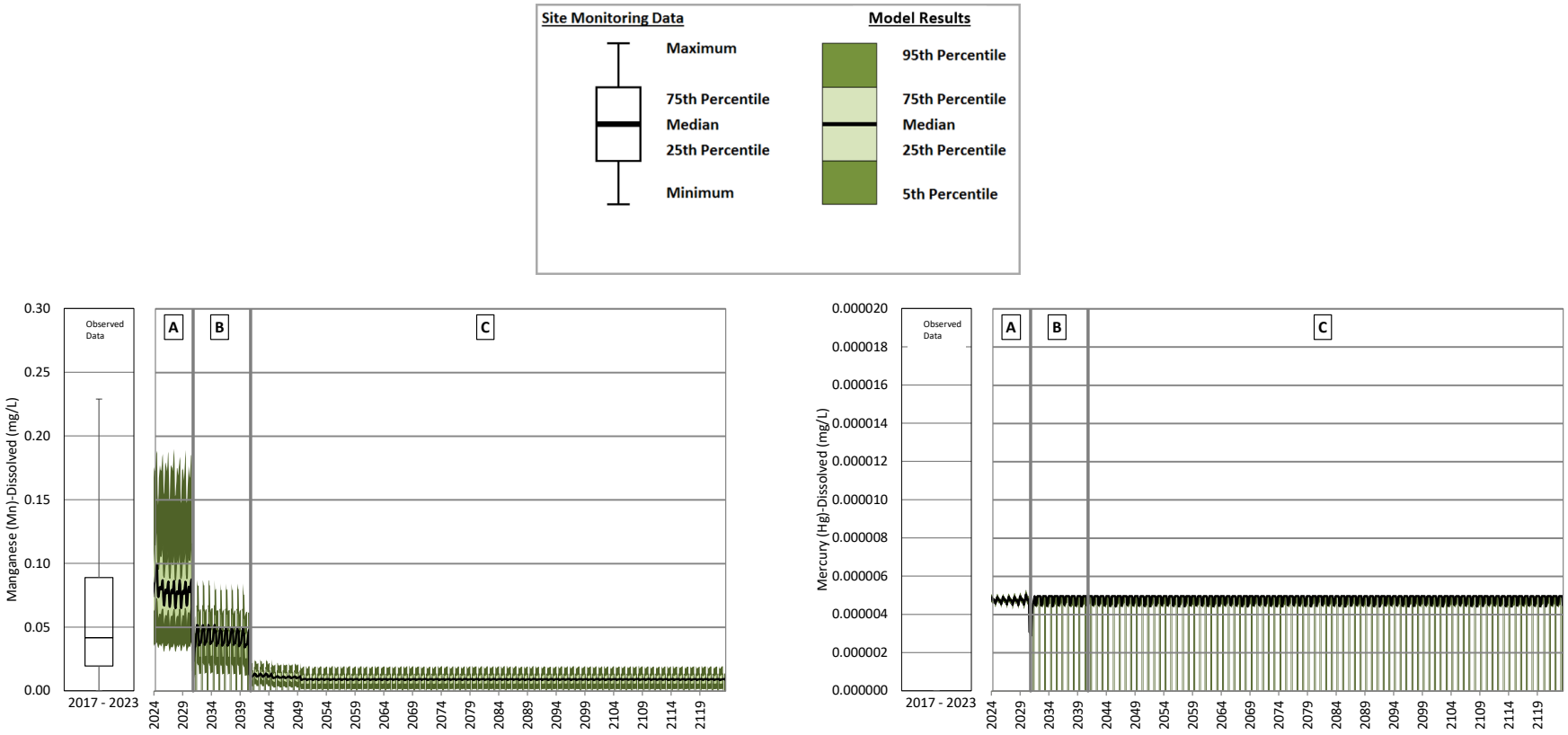

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **114: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

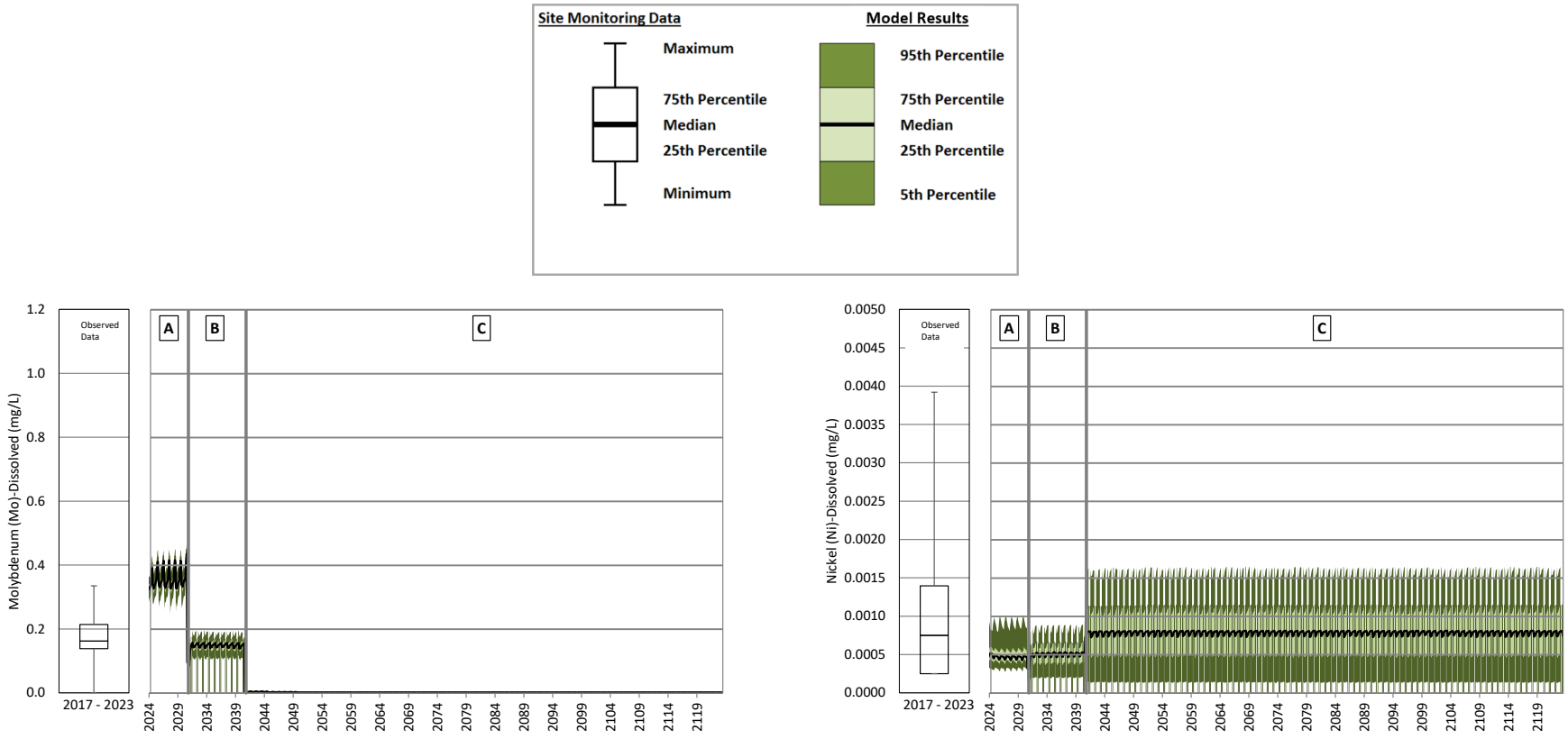

A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **115: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

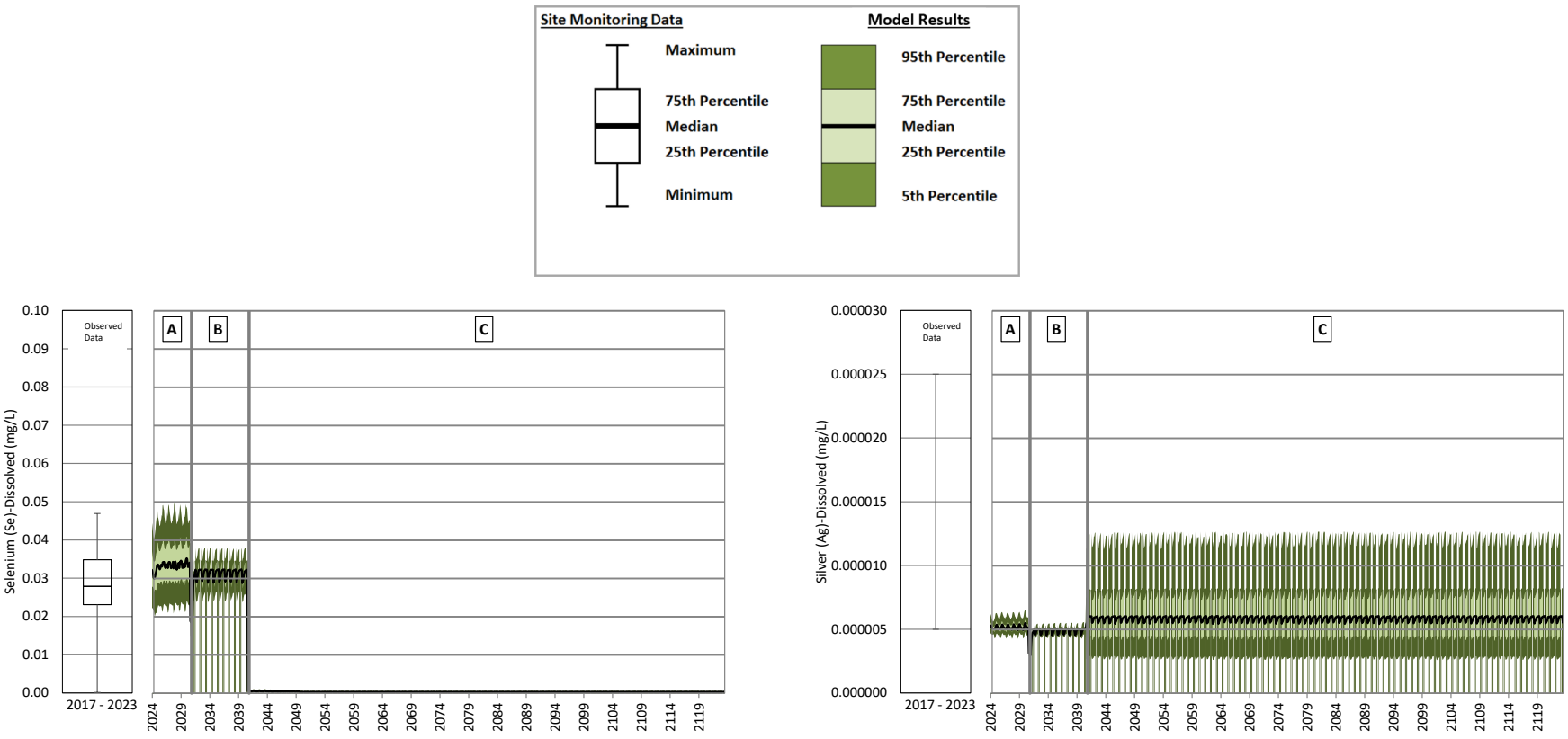

A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **116: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

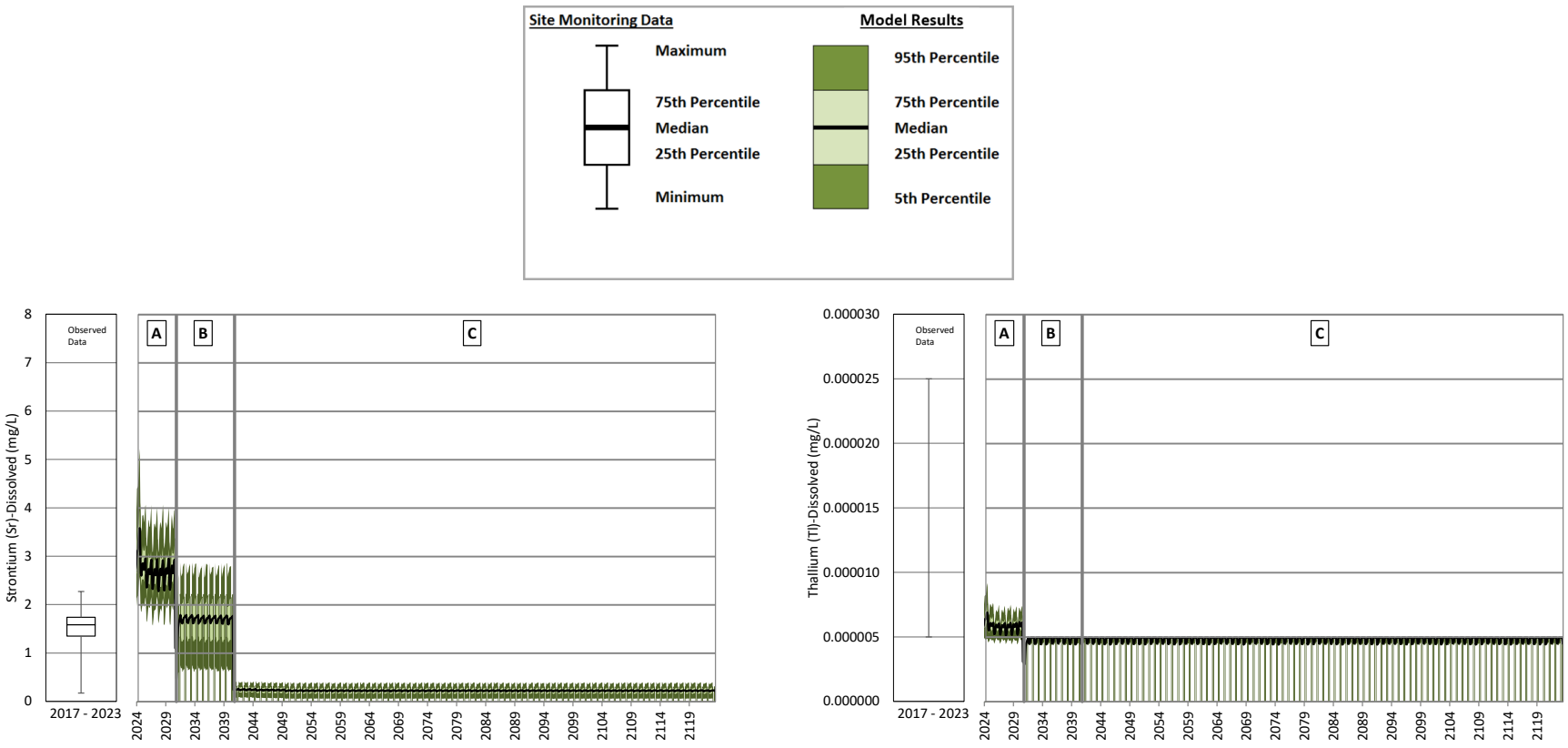

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **117: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

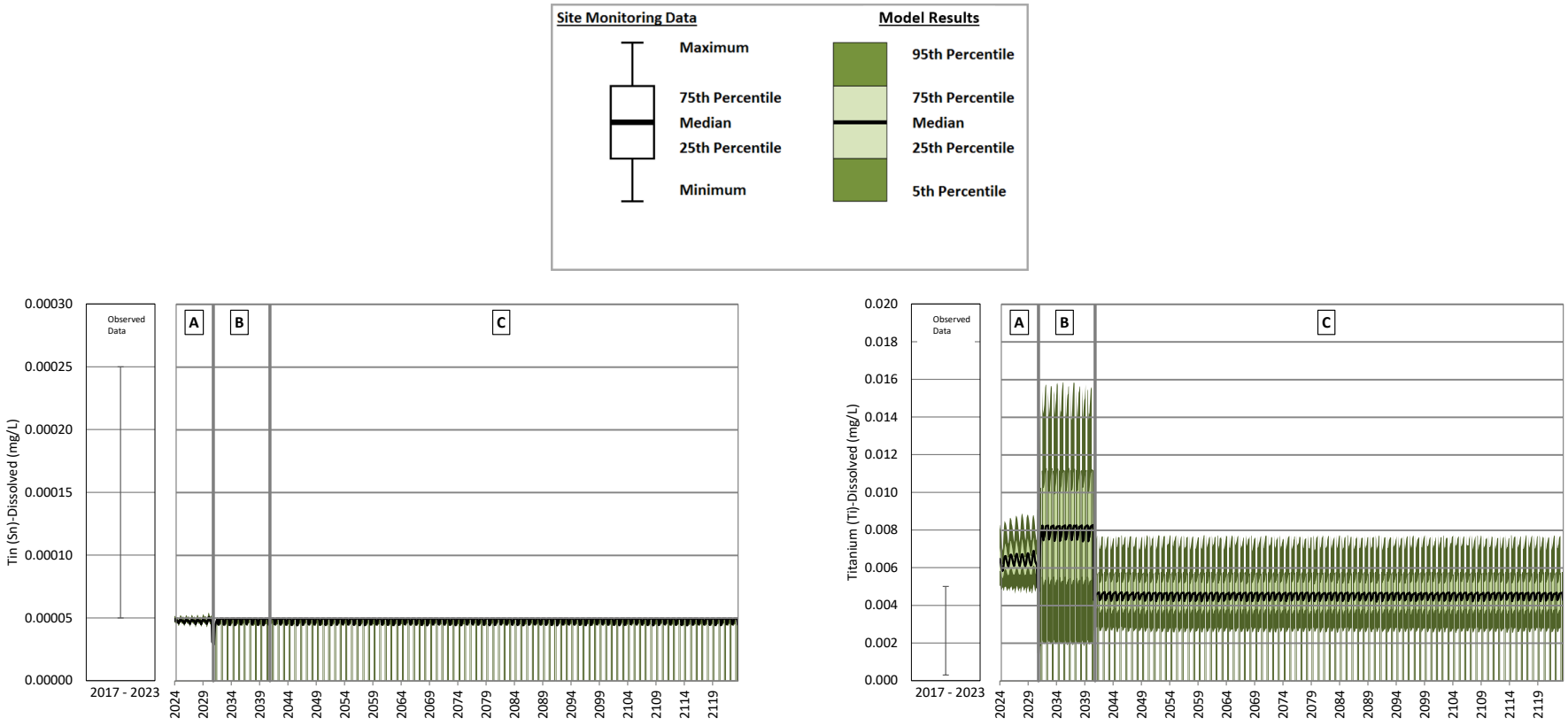

A = Operations; B = Closure; C = Post-closure

Note: The increase in dissolved titanium concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the Tailings Storage Facility (TSF). Lower dissolved titanium concentrations in the PETBP causes dilution of the dissolved titanium concentrations in the TSF during operations. Dissolved titanium concentrations decrease from closure to post-closure as runoff areas are remediated.

Figure B **118: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

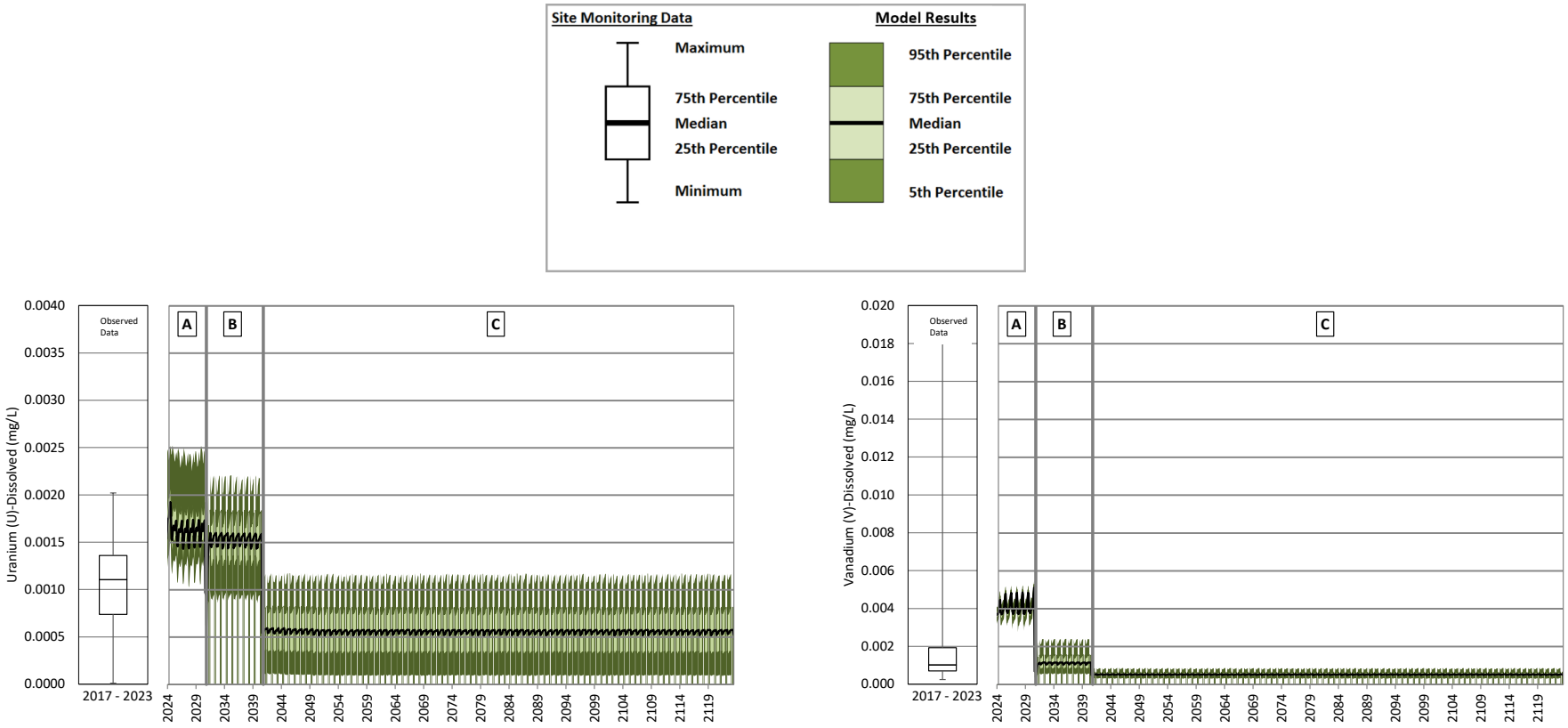

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **119: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

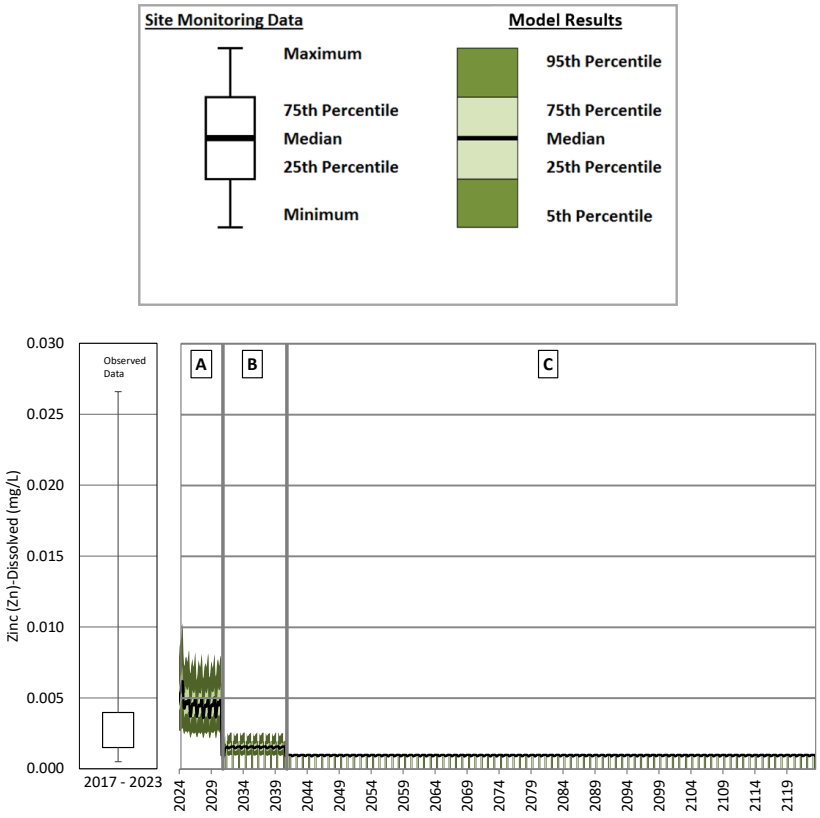

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **120: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Zinc**

Perimeter Embankment Till Borrow Pond Operations

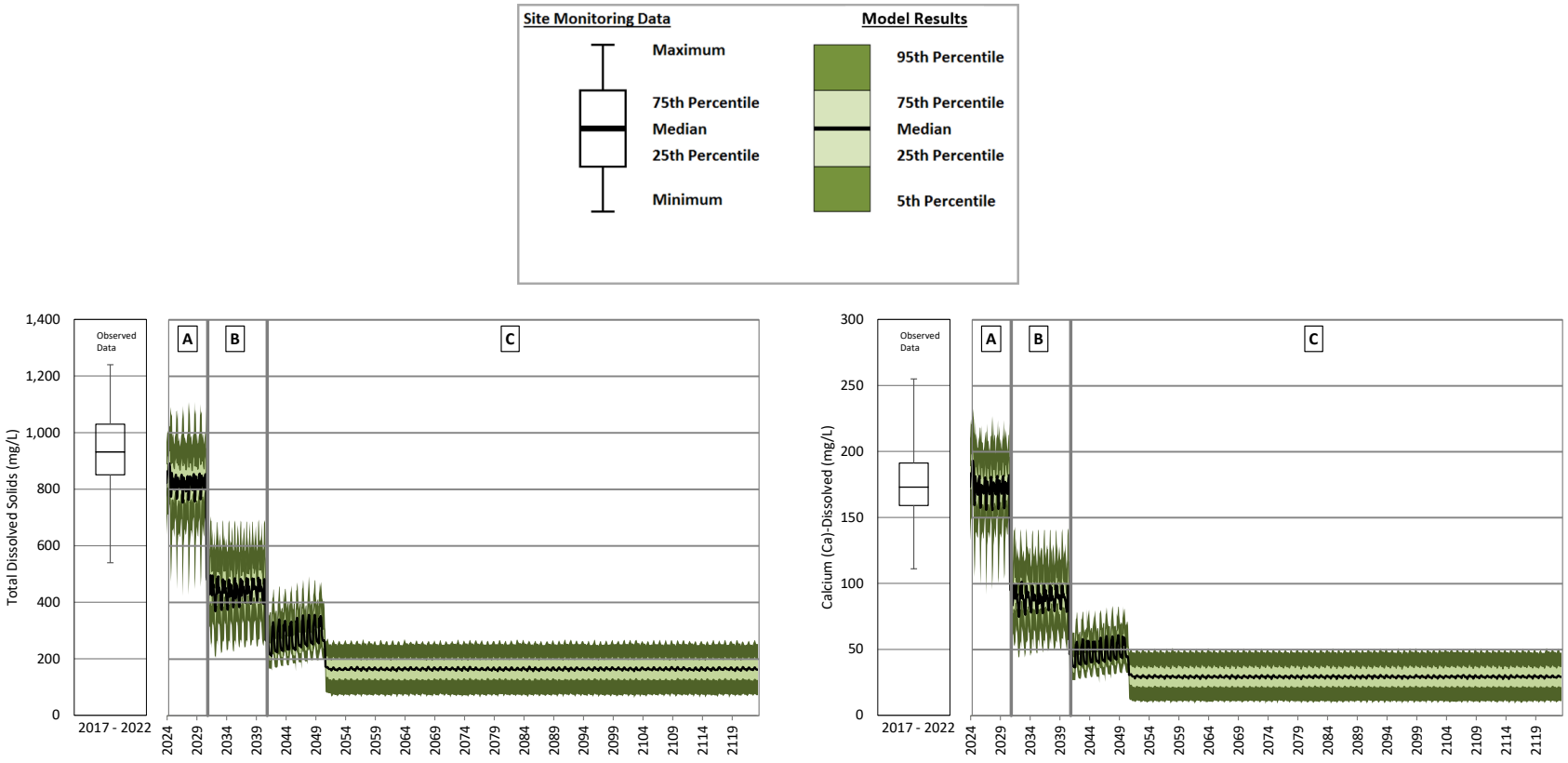

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **121: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

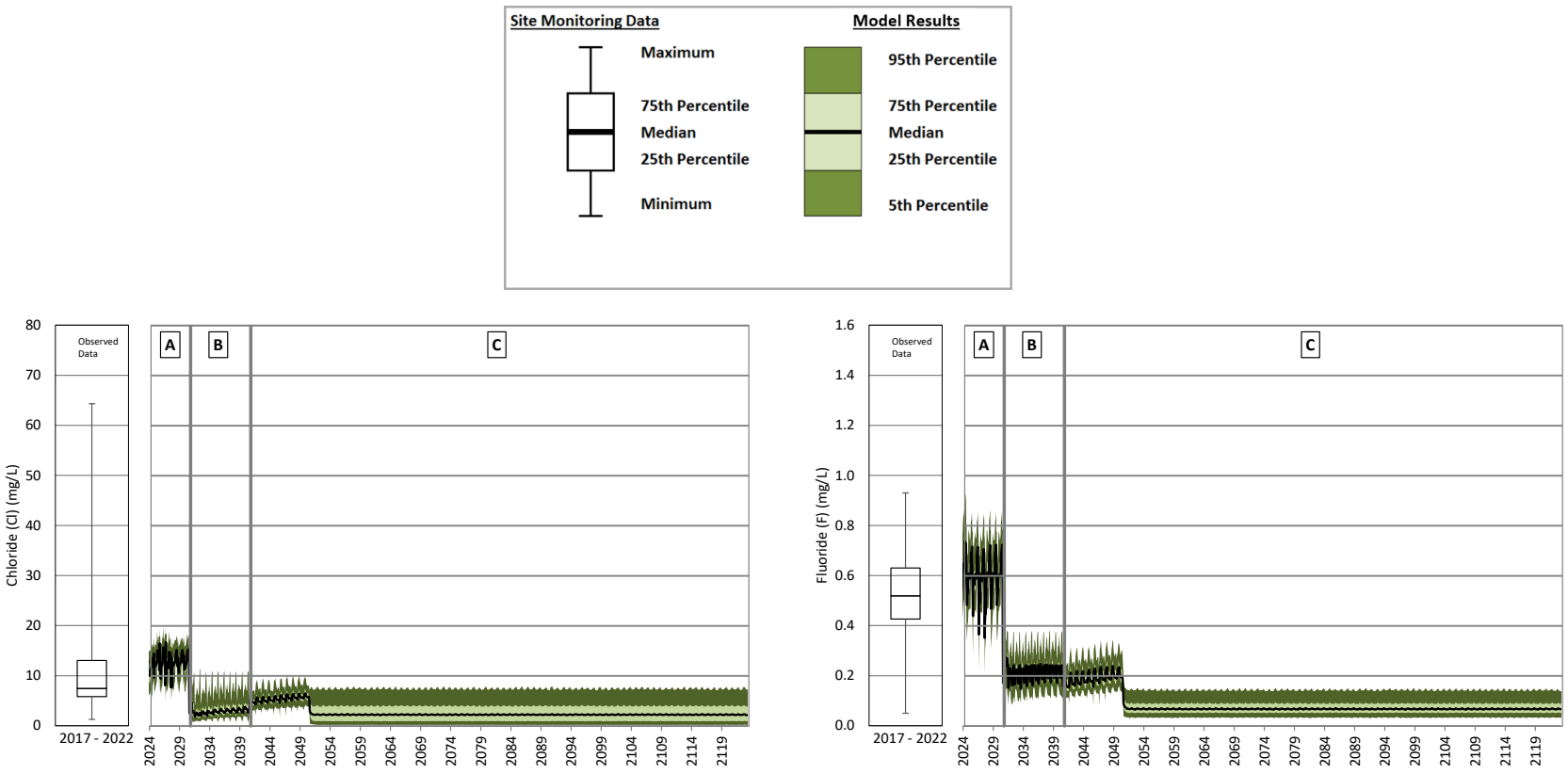

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **122: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Chloride and Fluoride**

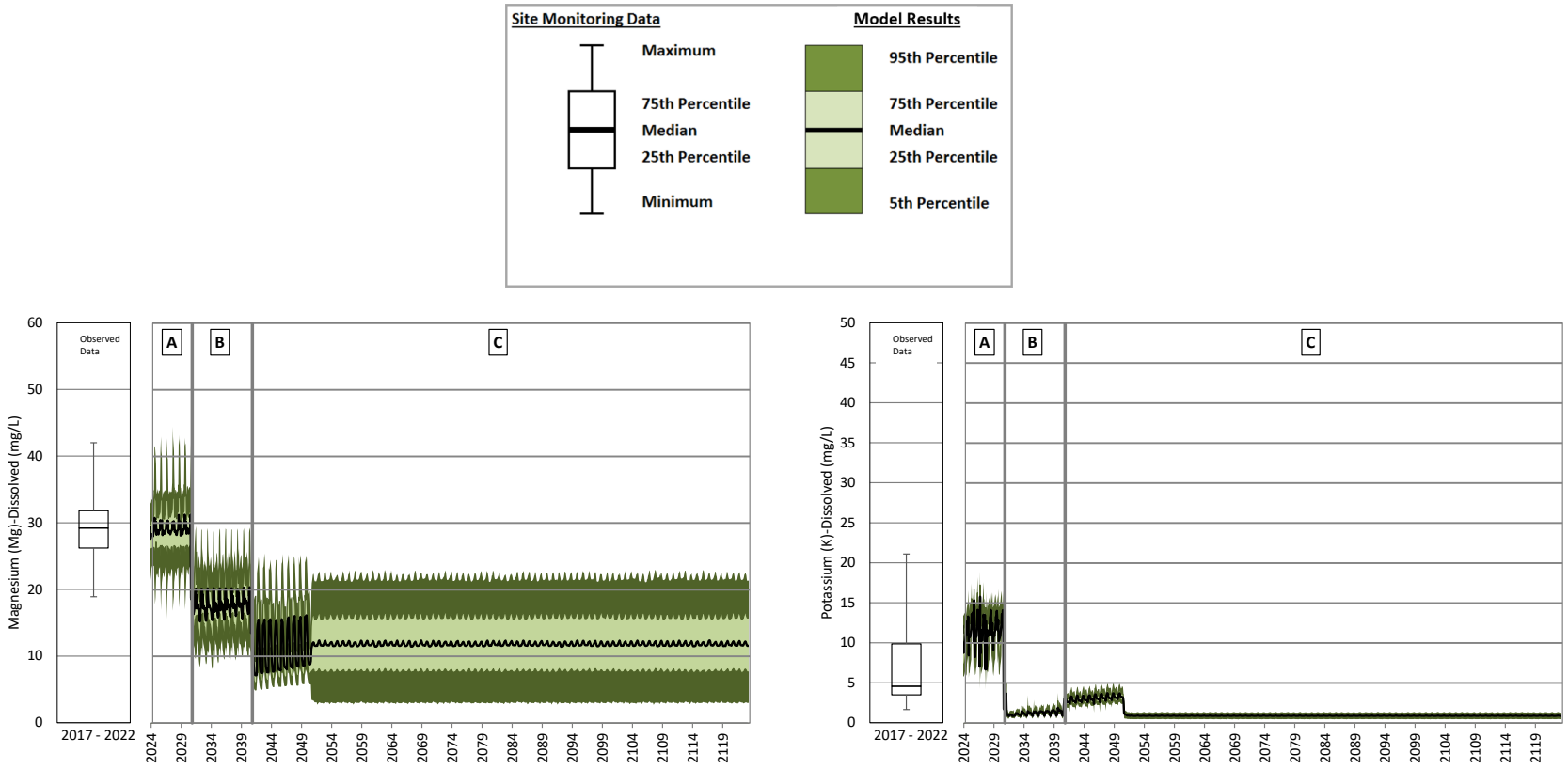

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **123: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Magnesium and Potassium**

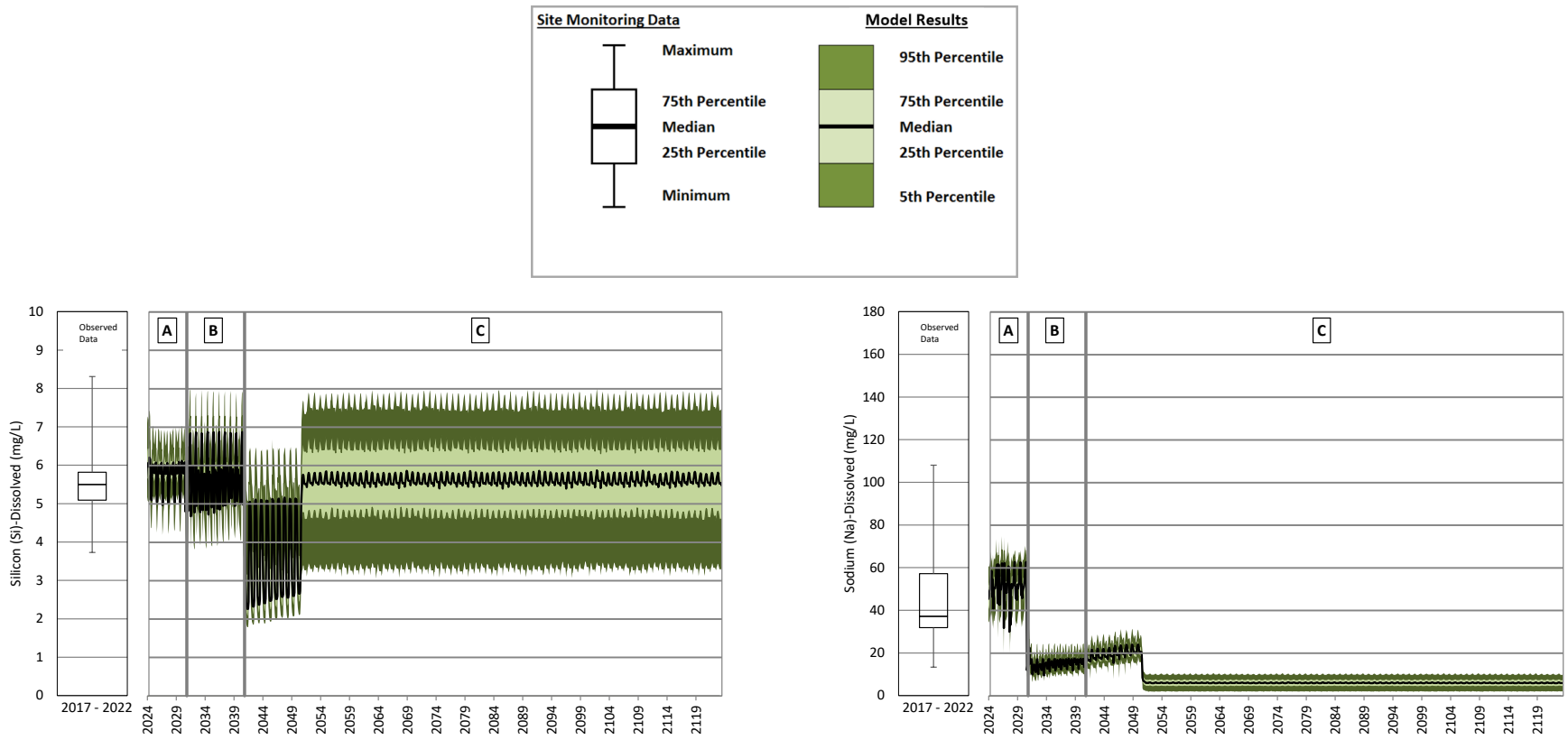

A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from operations to closure and post-closure is caused by runoff from areas being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in sodium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **124: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Silicon and Sodium**

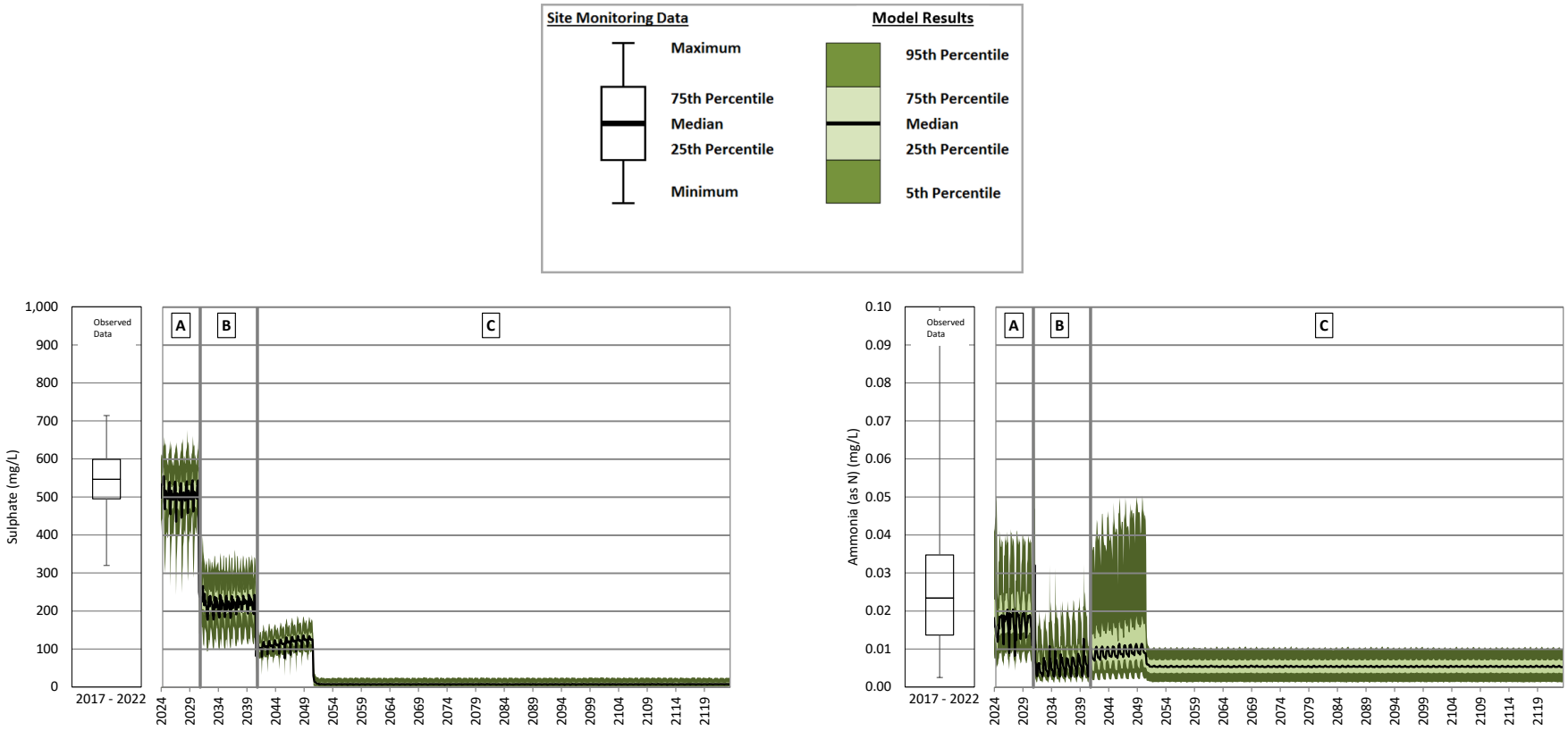

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **125: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**

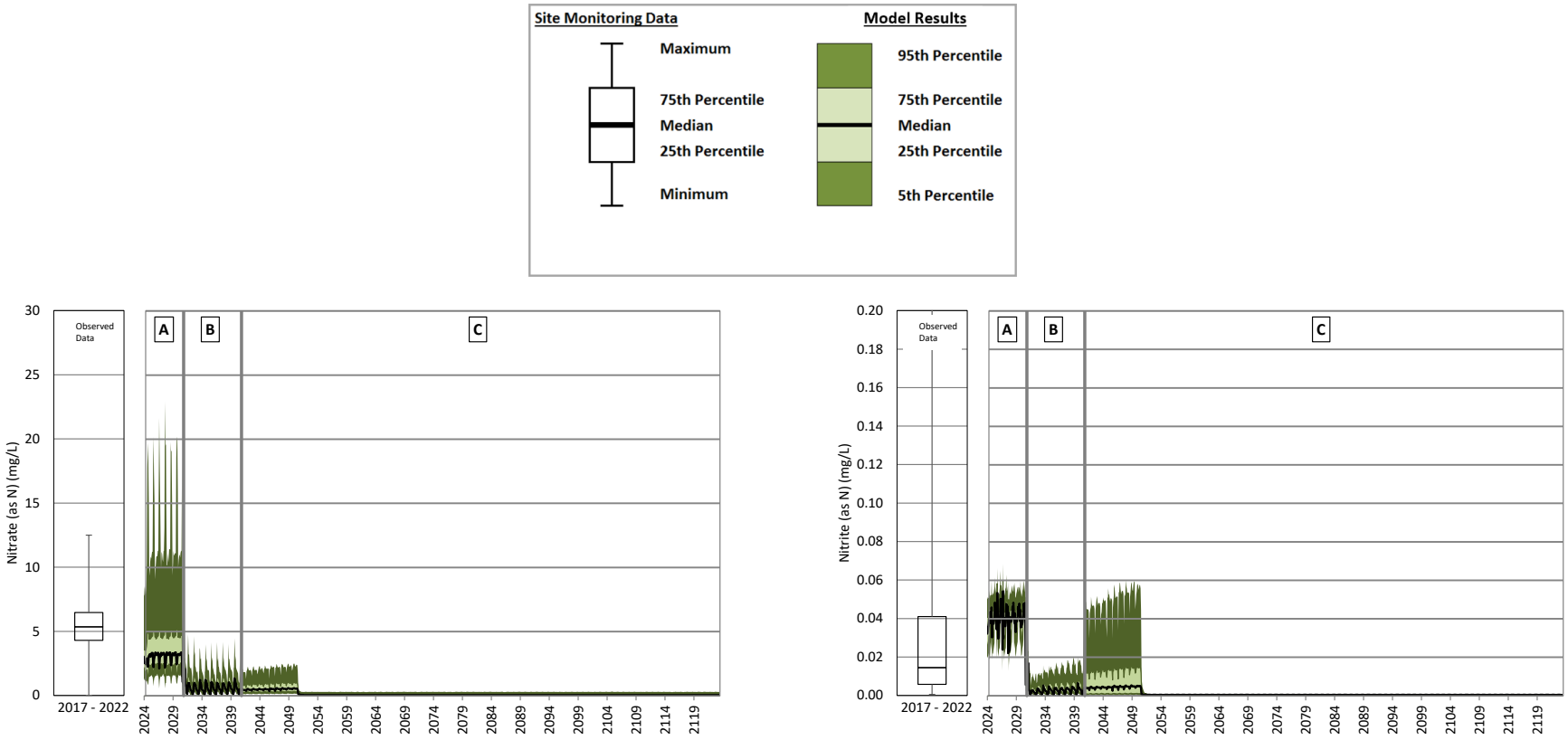

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **126: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Nitrate and Nitrite**

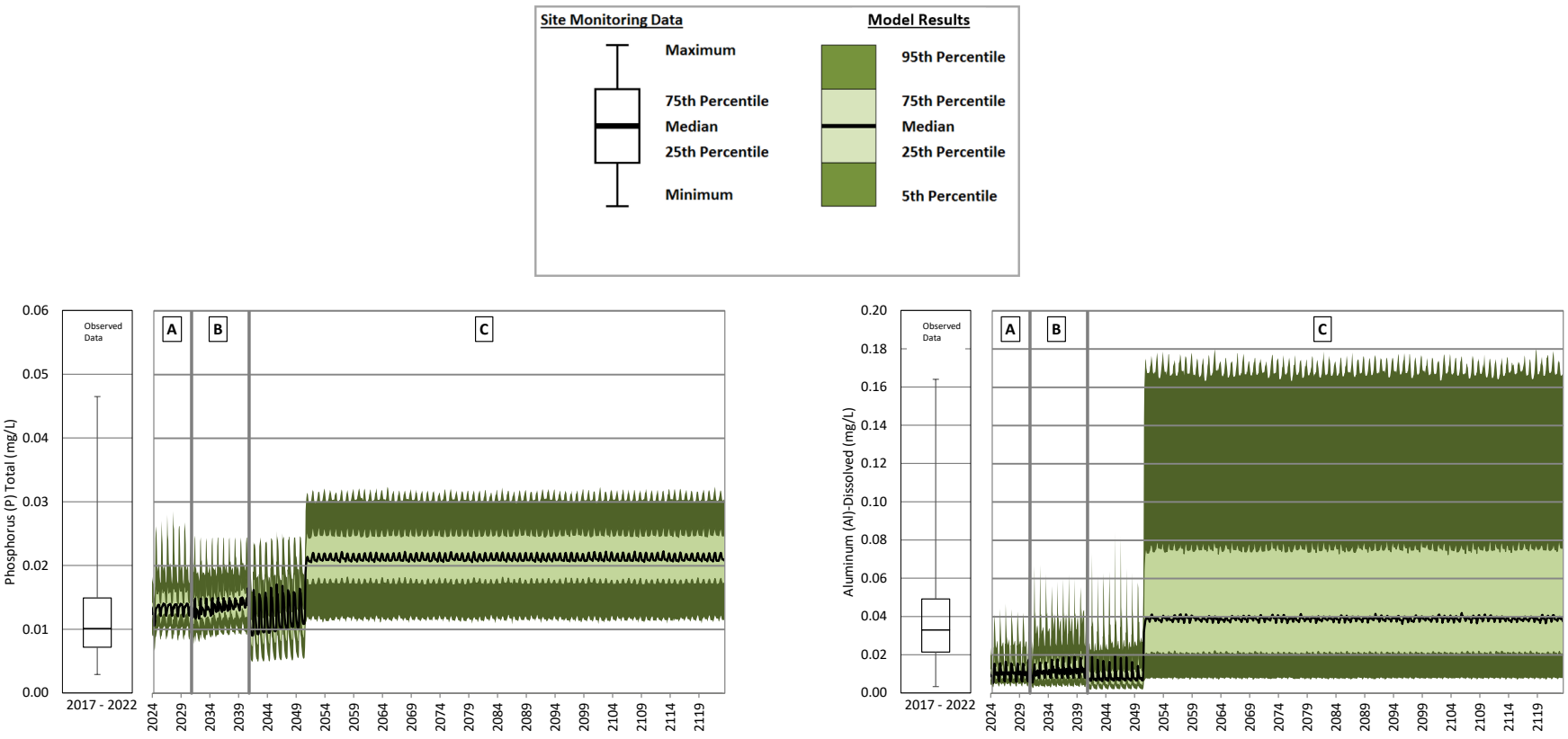

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **127: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

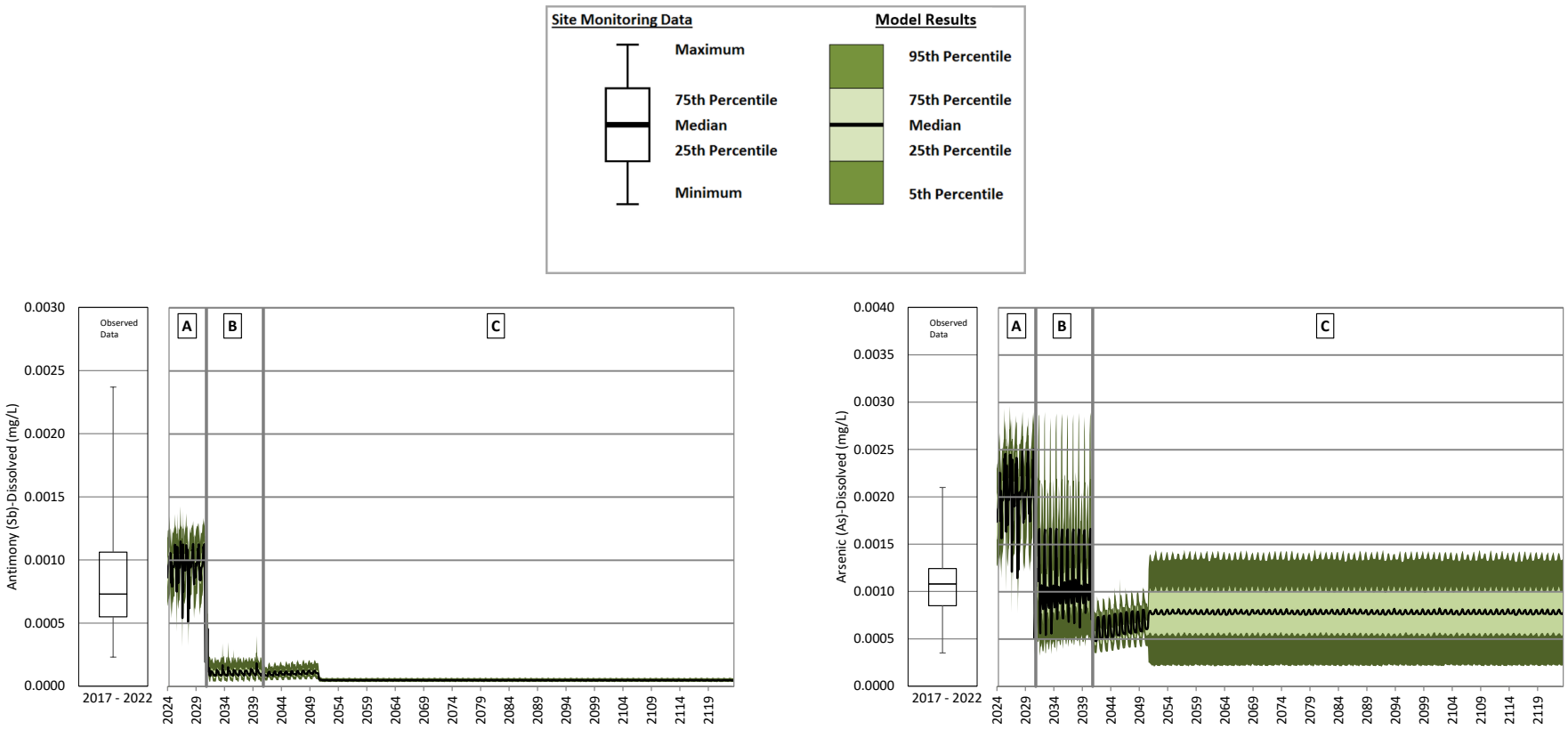

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **128: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

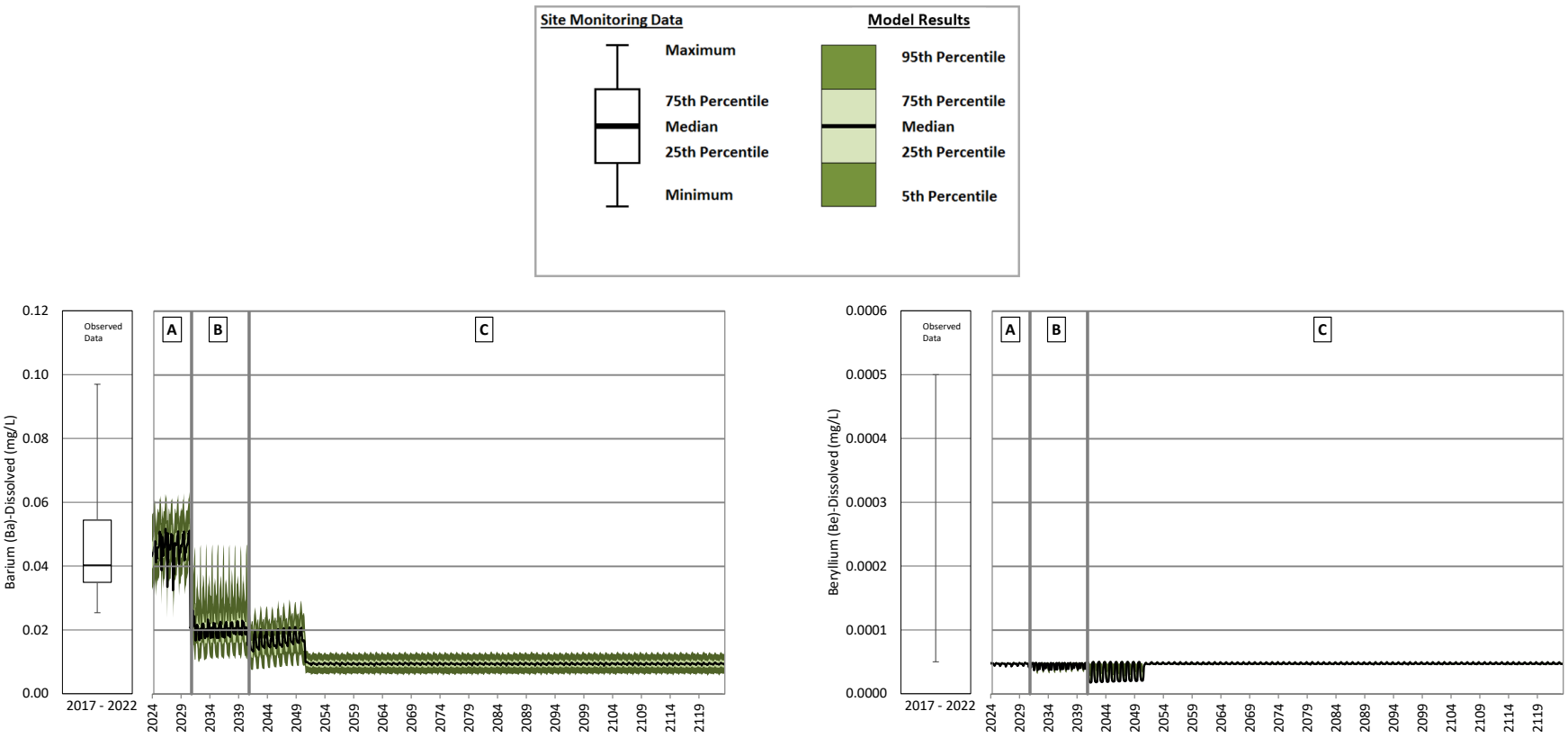

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **129: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

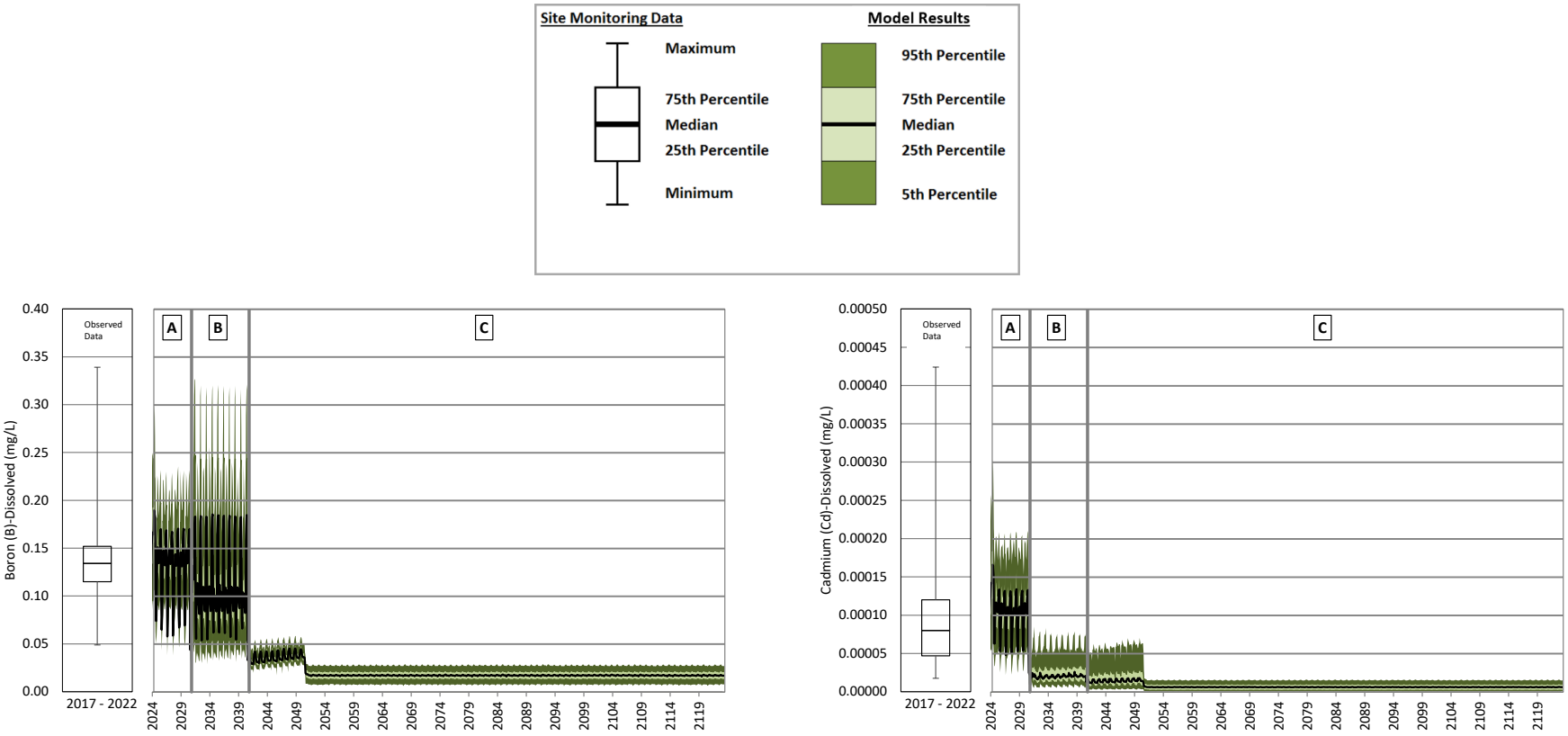

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **130: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

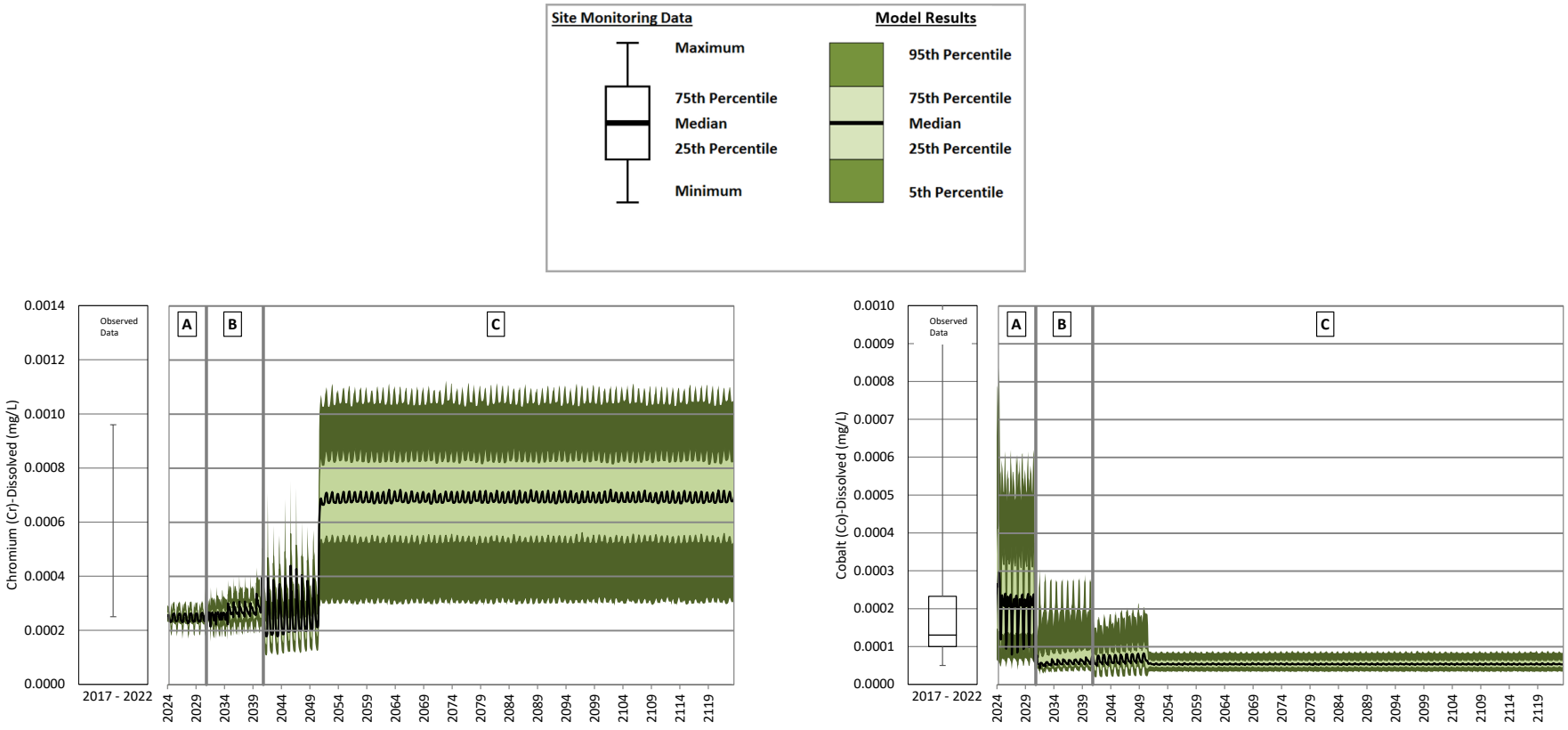

A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in cobalt concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **131: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

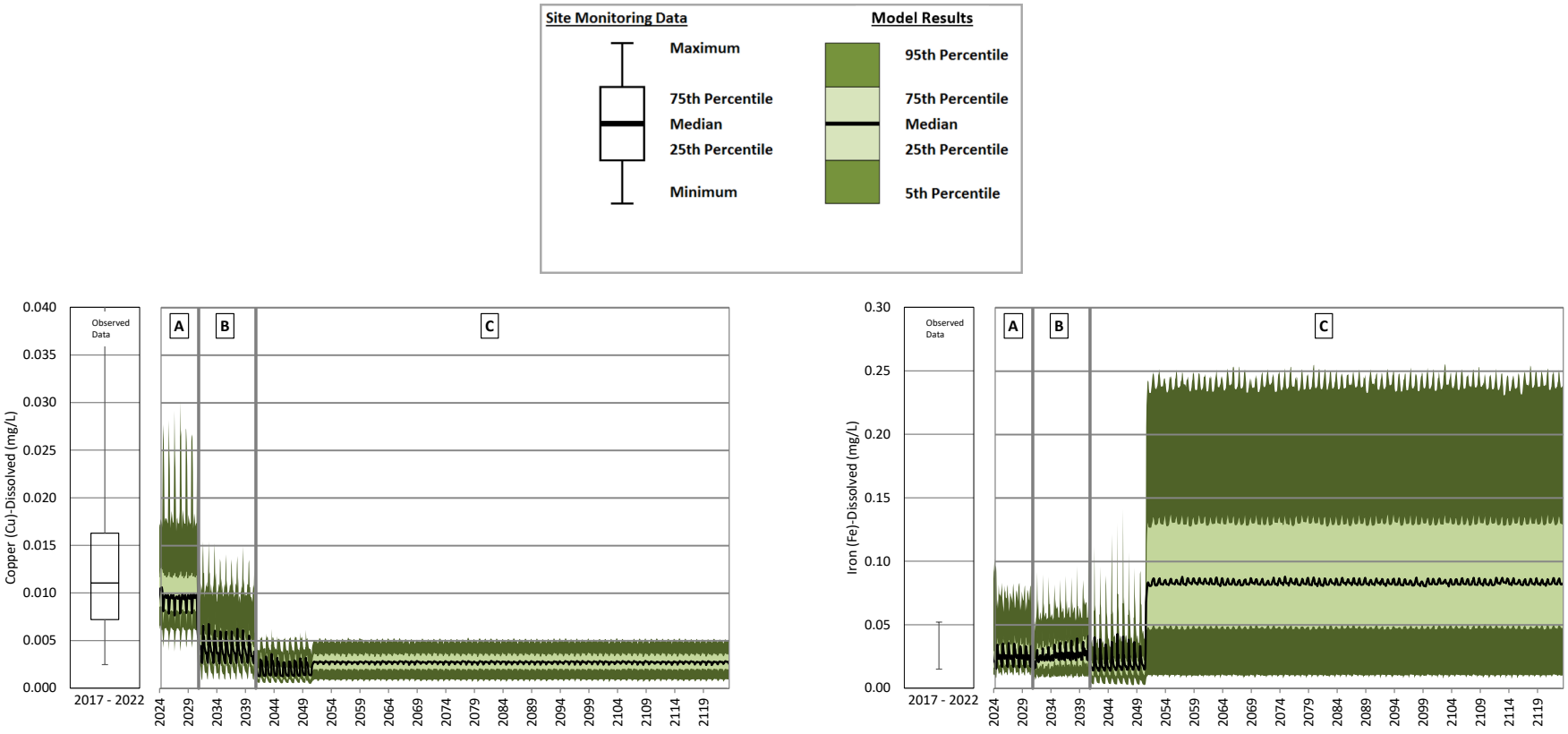

A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **132: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

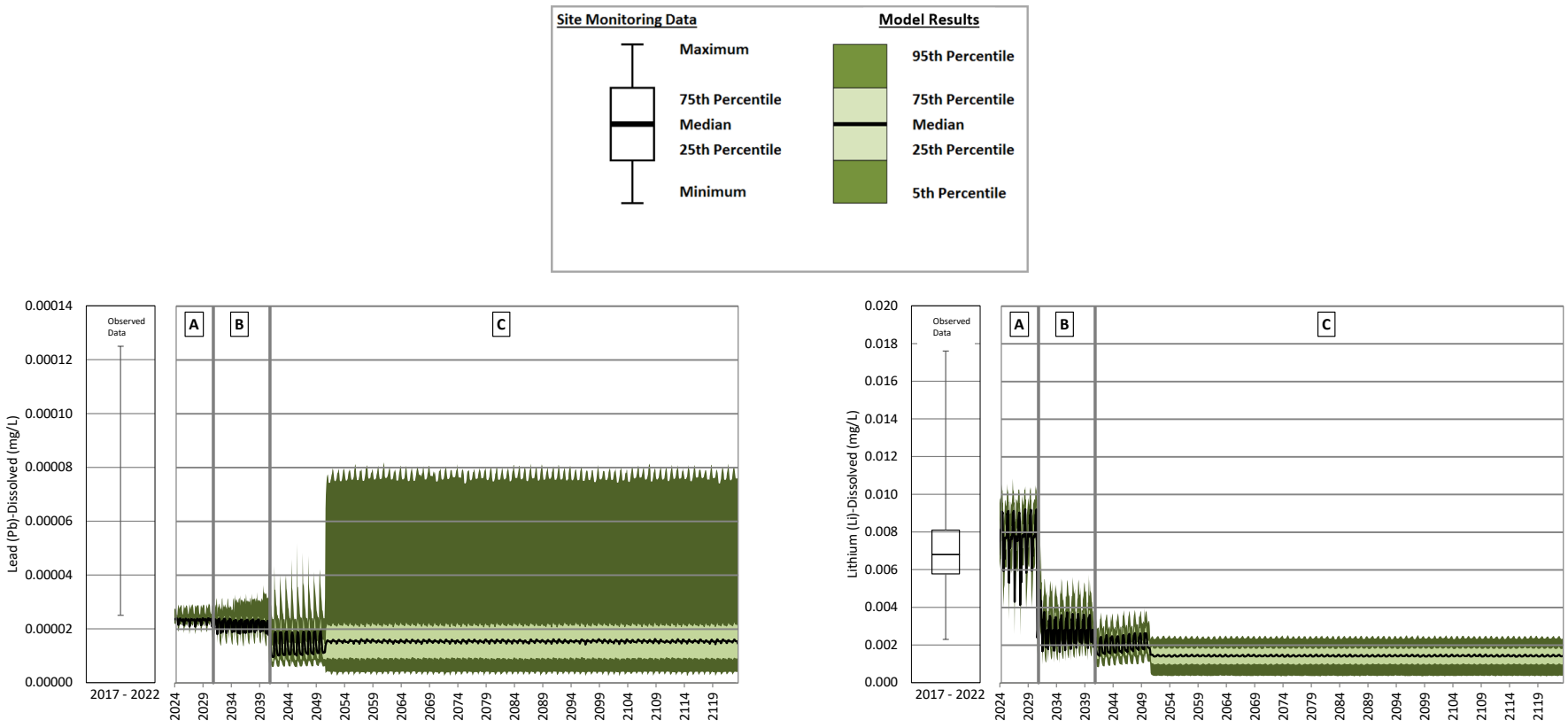

A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in lithium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **133: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

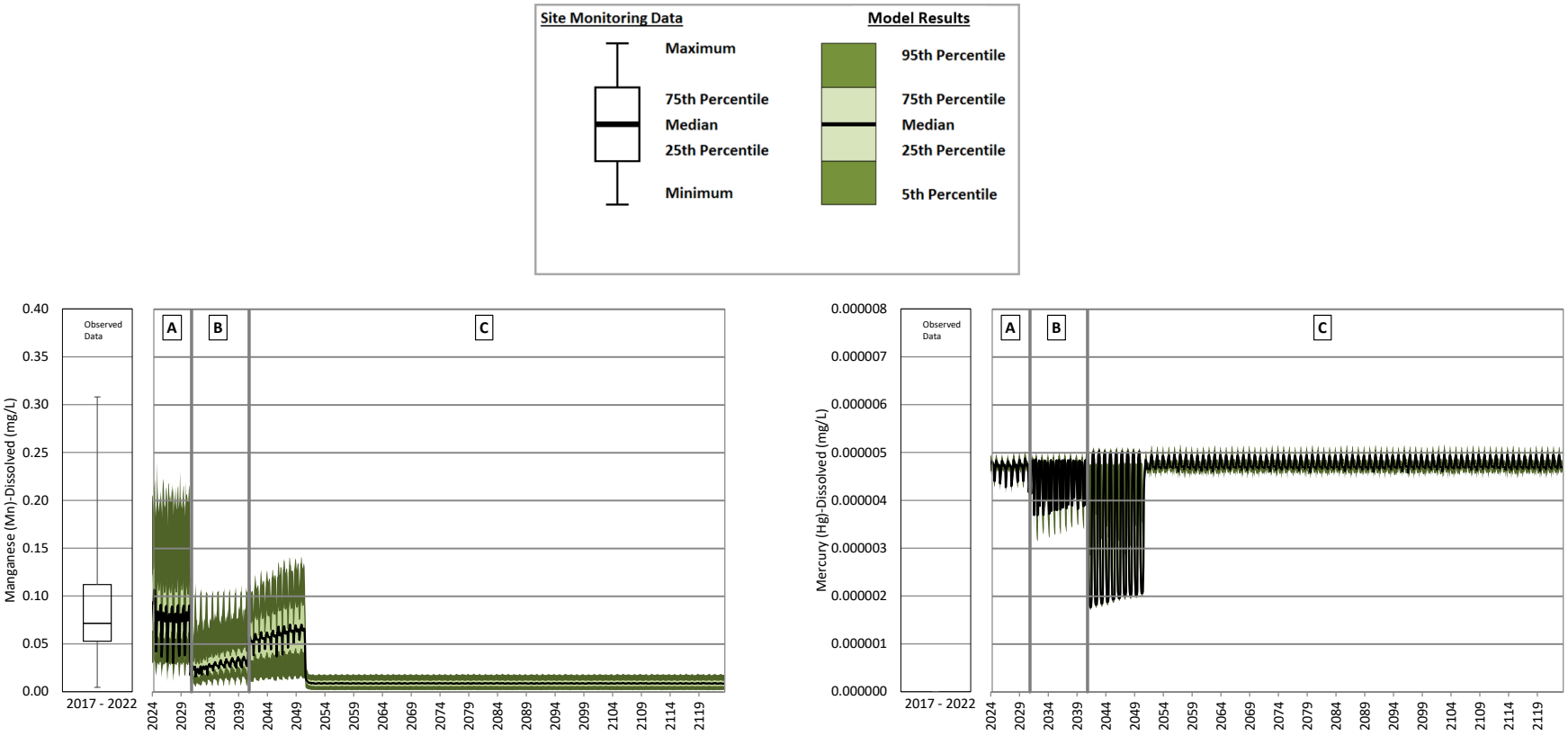

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **134: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

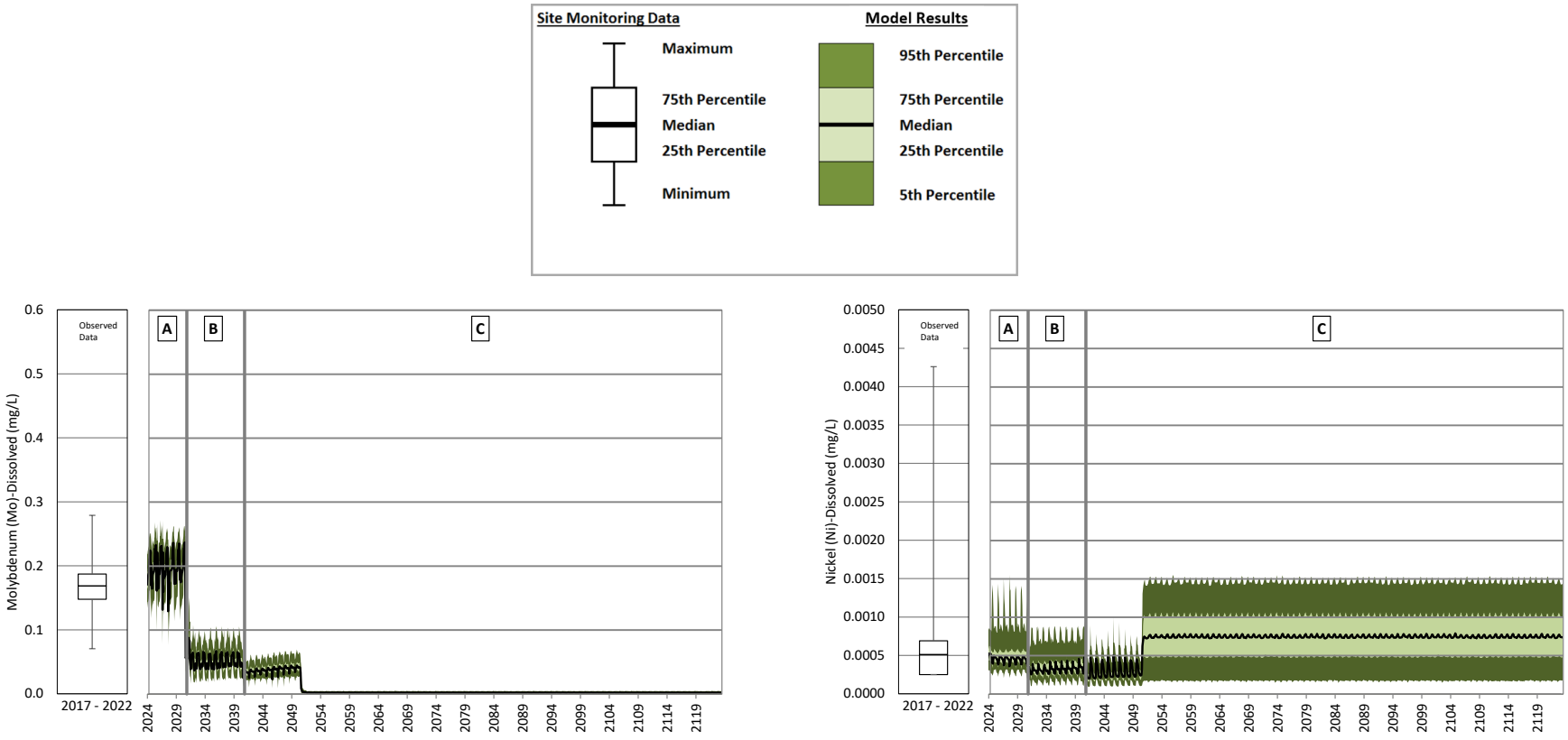

A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs. The increase in molybdenum concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **135: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

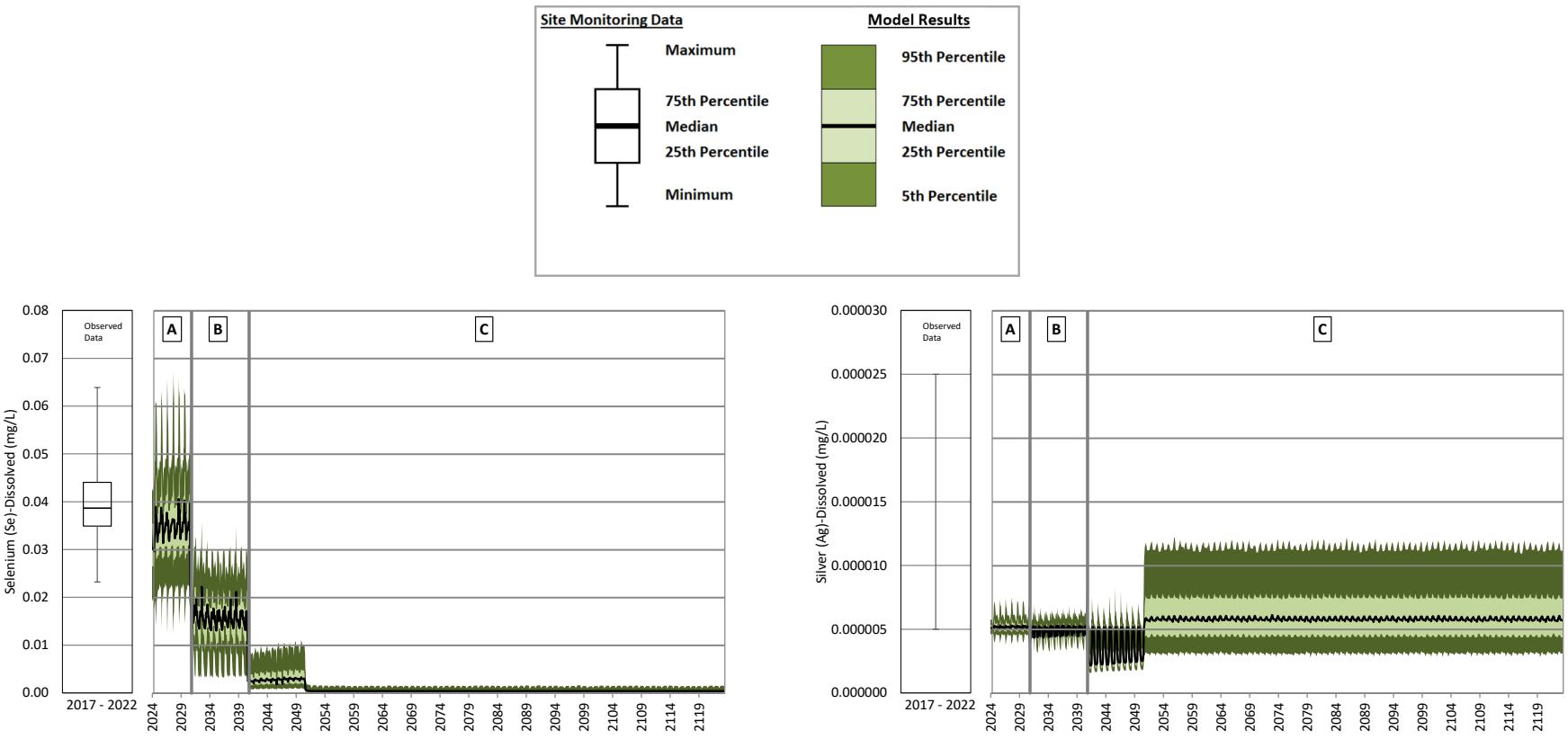

A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved silver concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs. The increase in selenium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **136: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

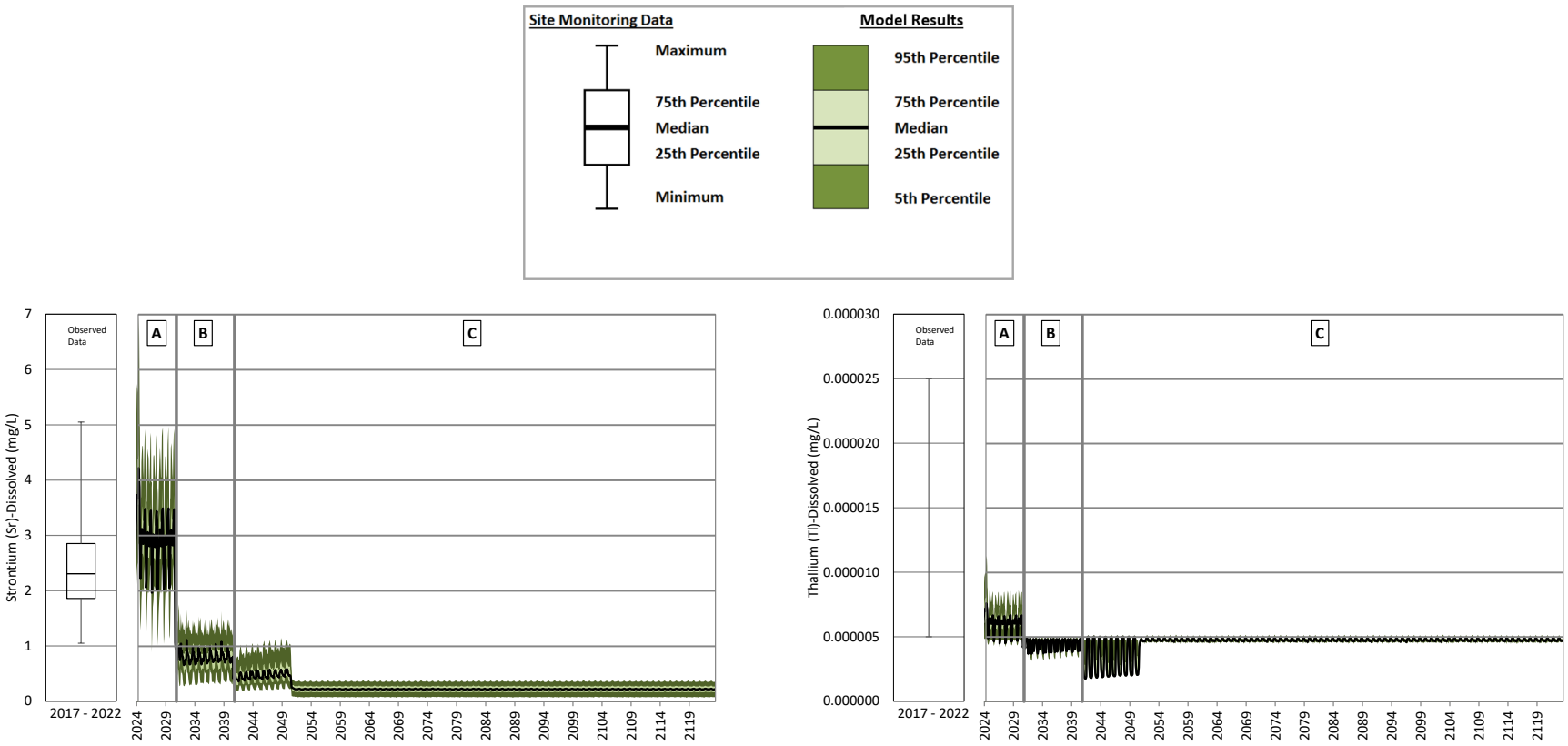

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **137: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

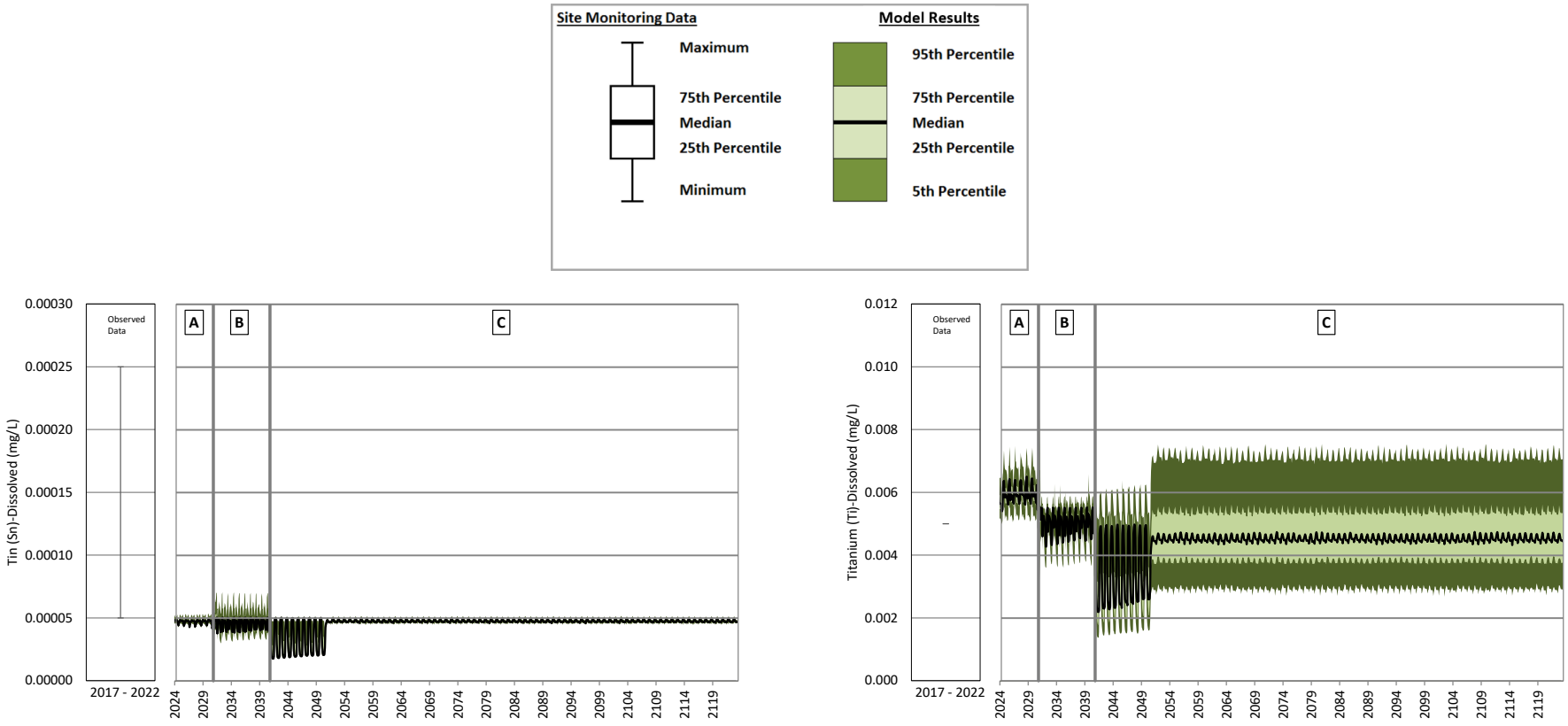

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Dissolved titanium concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **138: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

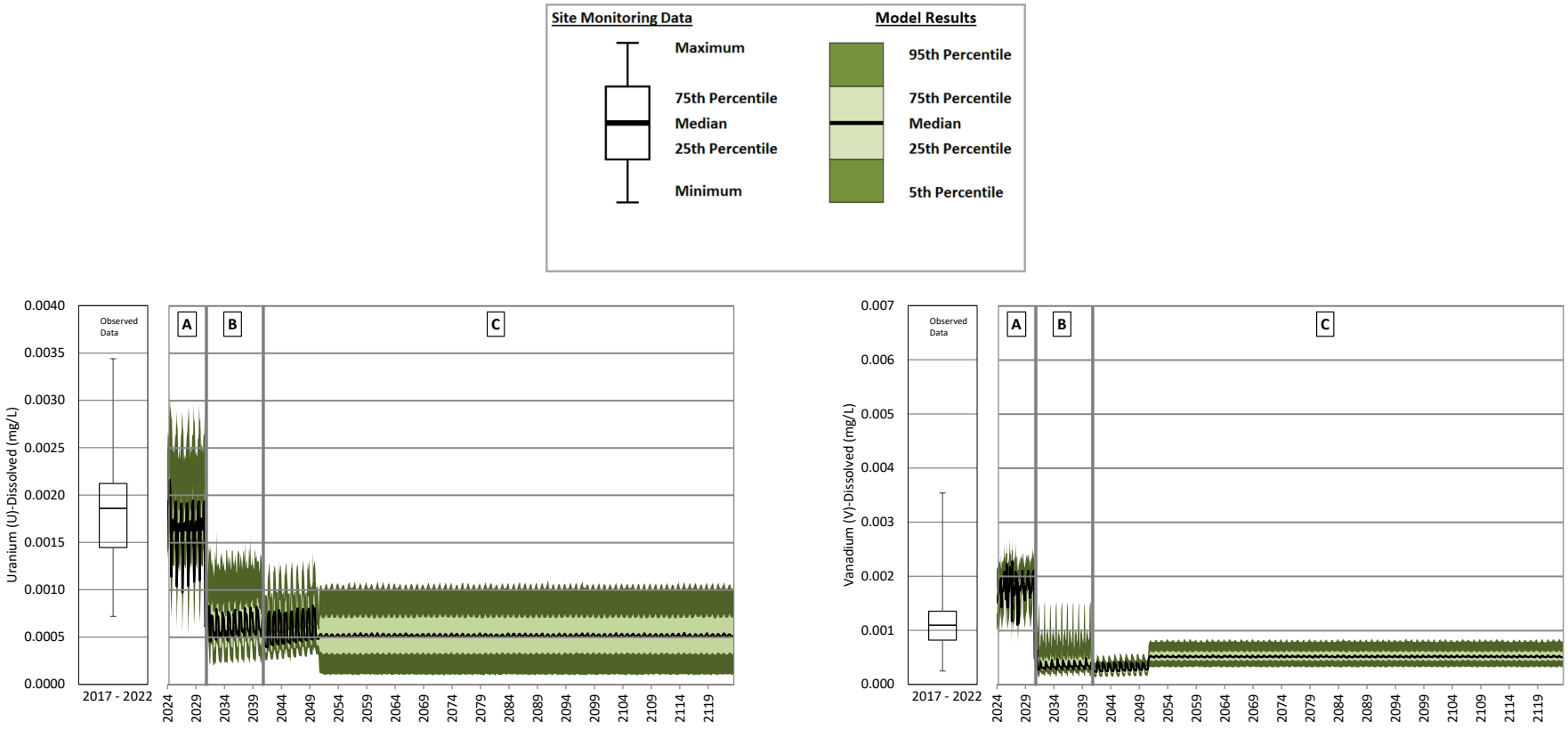

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **139: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

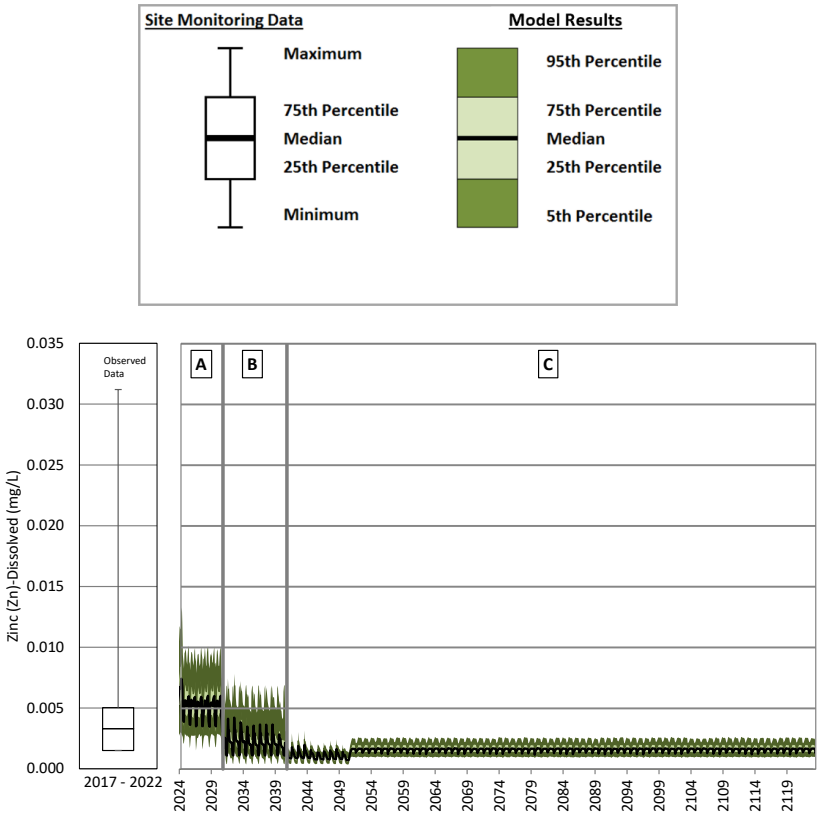

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **140: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Zinc**

9K Sump Operations

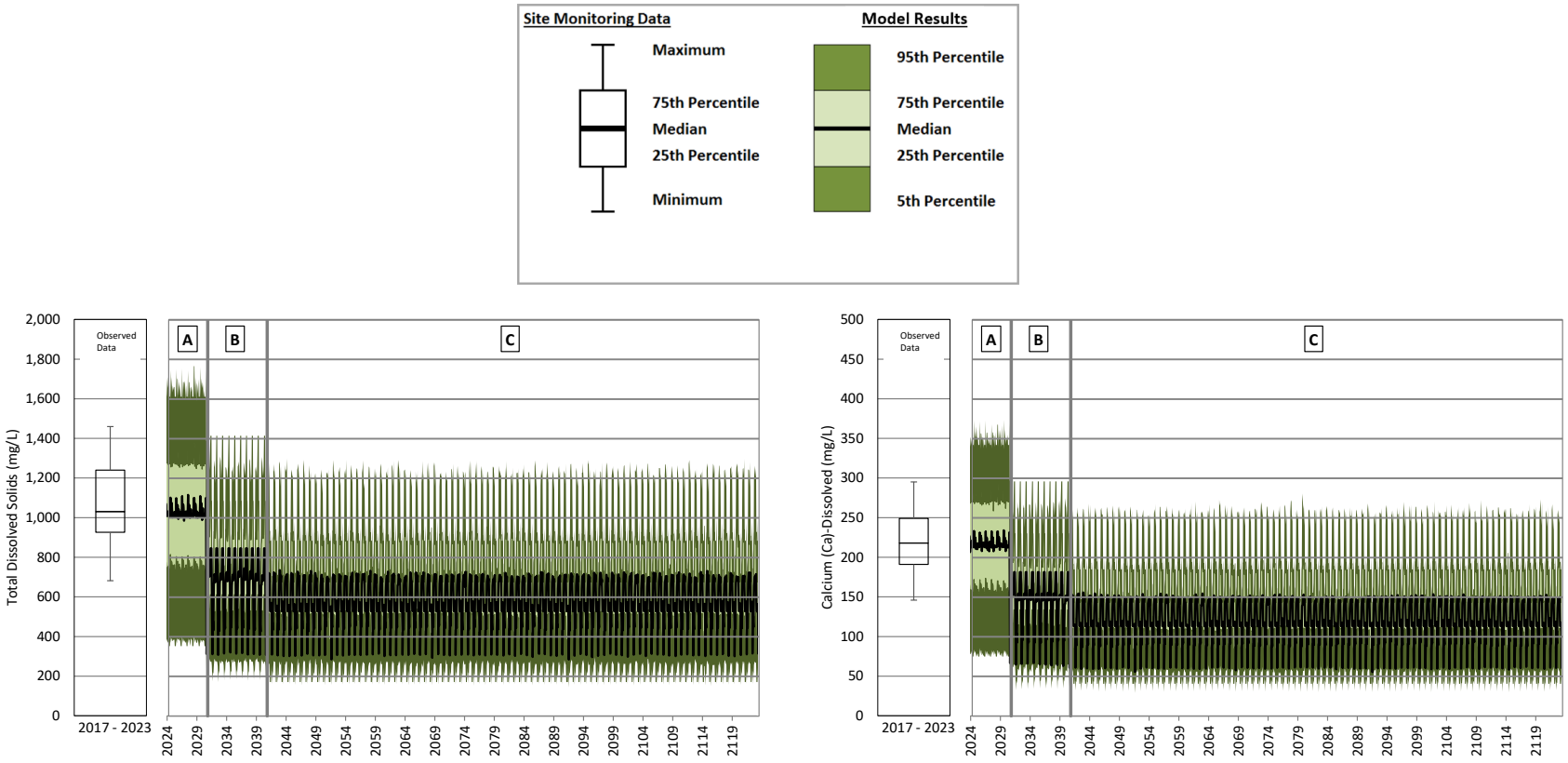

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **141: 9K Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

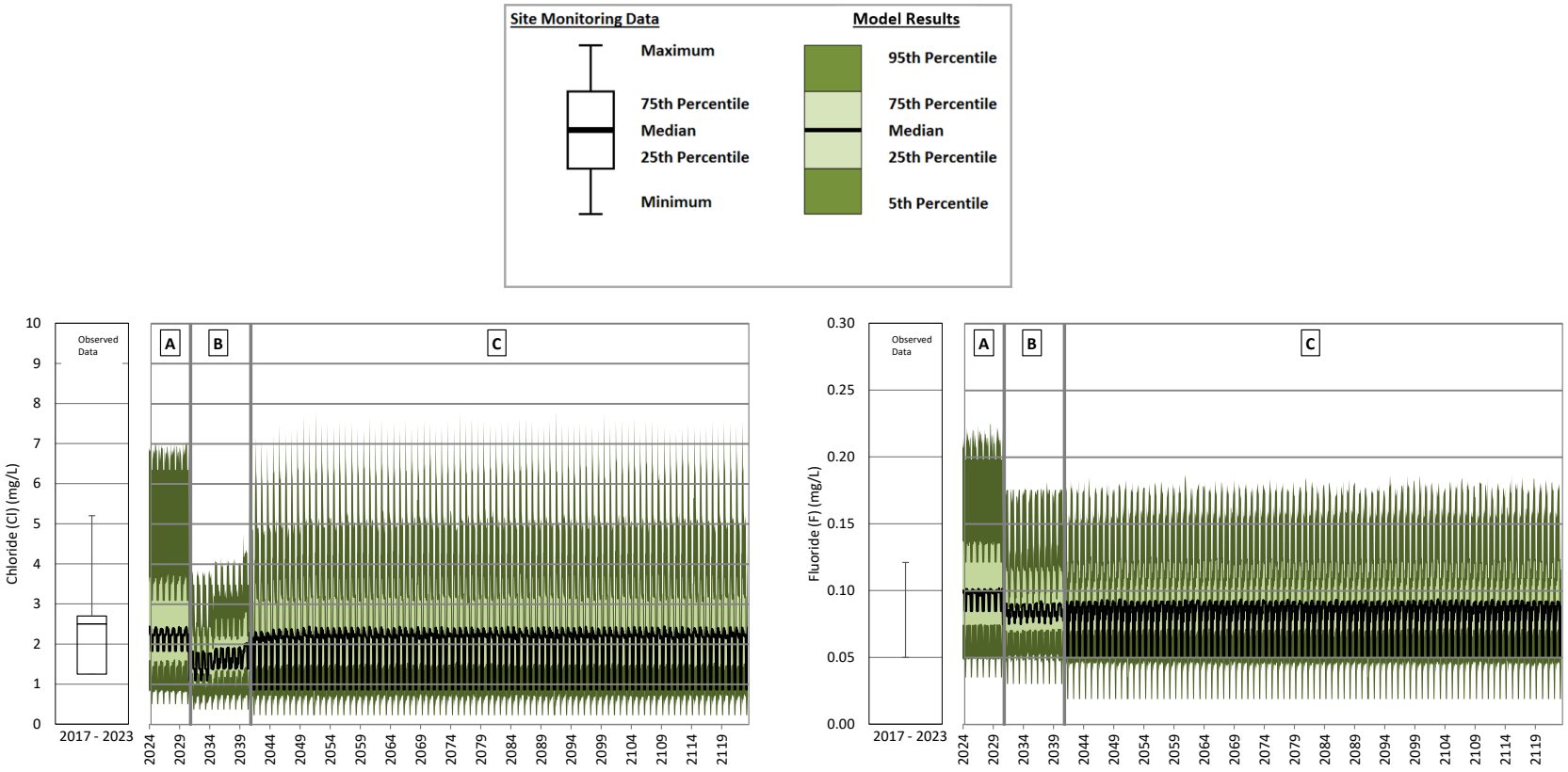

A = Operations; B = Closure; C = Post-closure

Note: Chloride concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for chloride than the disturbed runoff water quality input. Fluoride concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **142: 9K Sump Operations, Closure and Post-closure – Chloride and Fluoride**

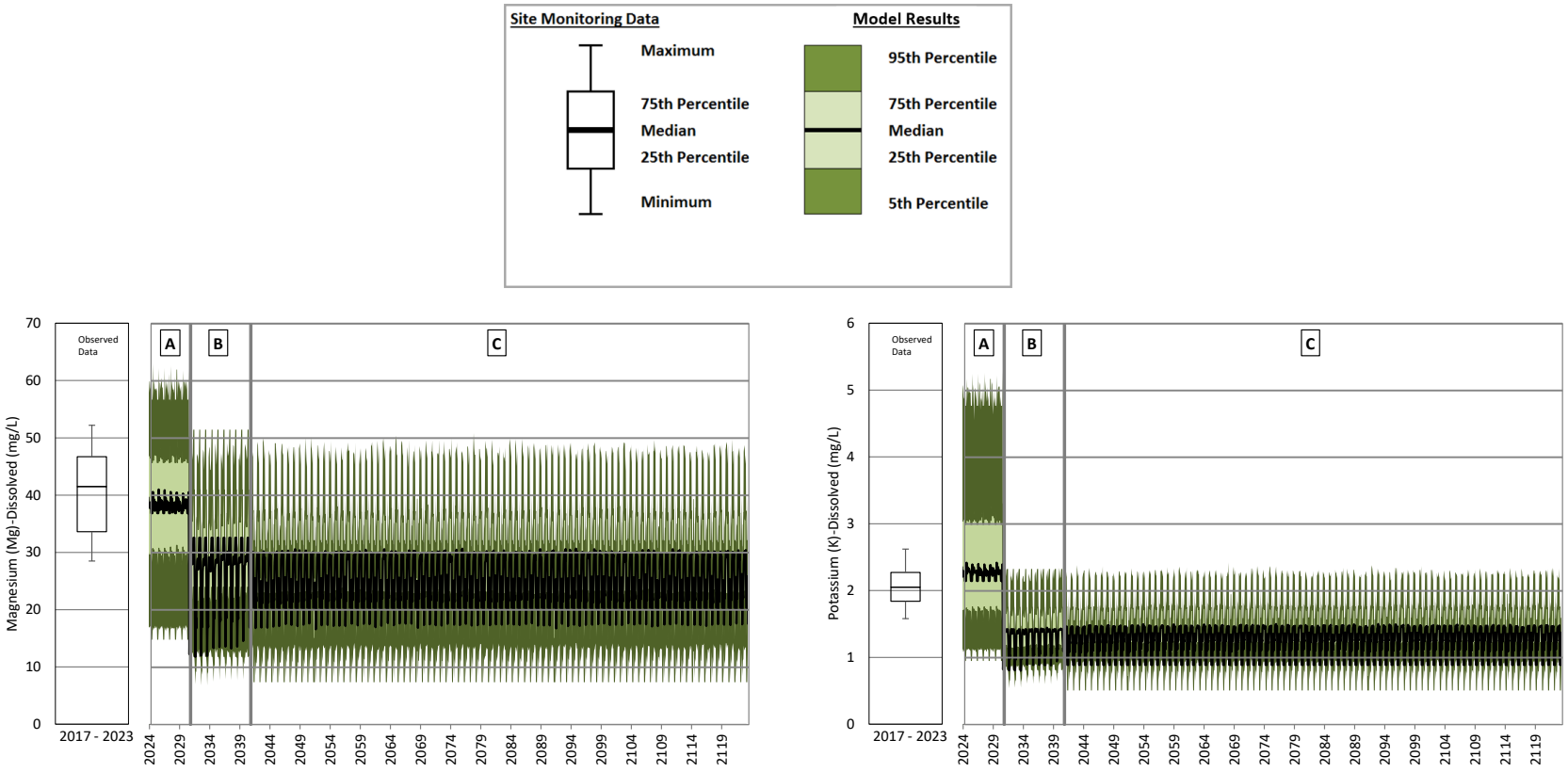

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **143: 9K Sump Operations, Closure and Post-closure – Magnesium and Potassium**

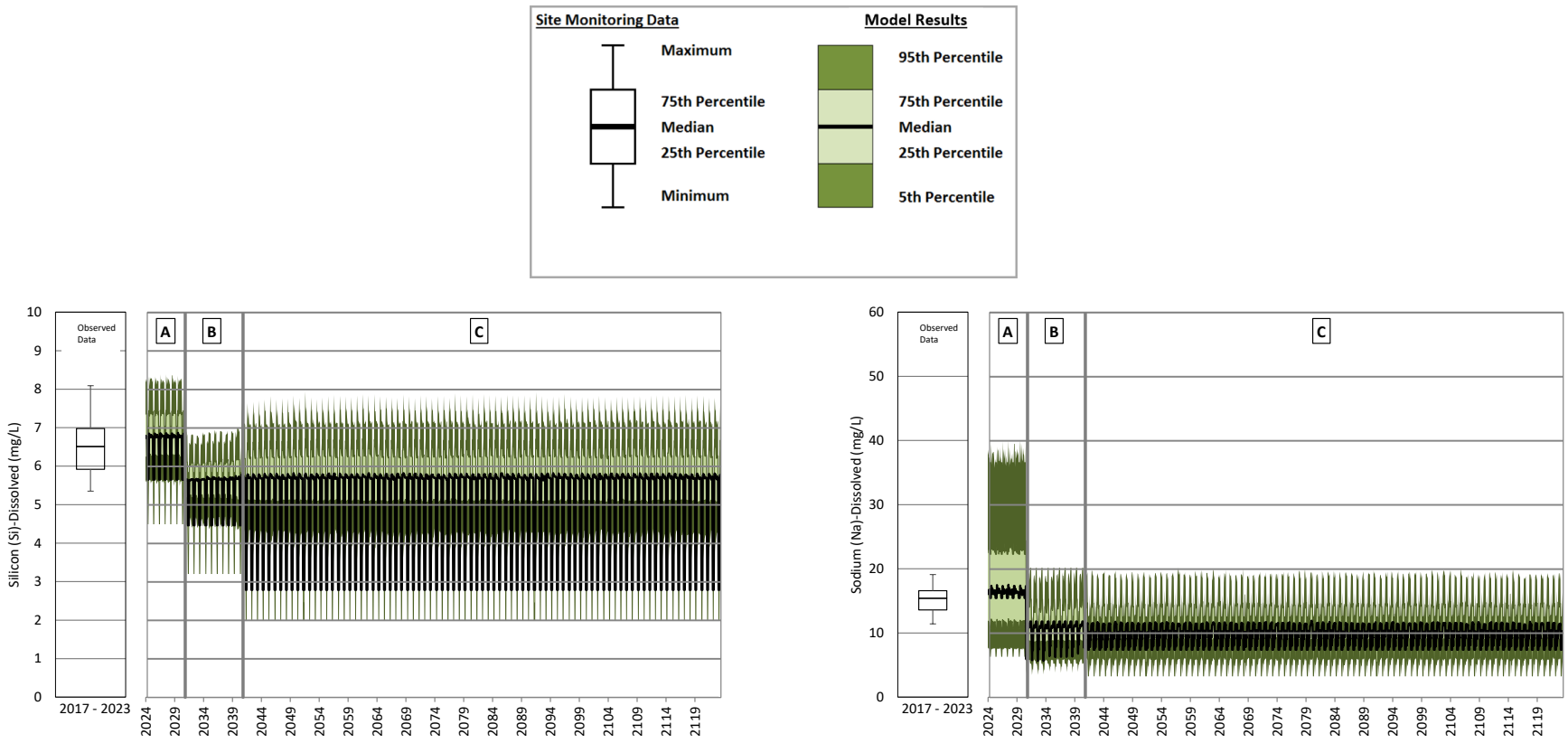

A = Operations; B = Closure; C = Post-closure

Note: Silicon concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **144: 9K Sump Operations, Closure and Post-closure – Silicon and Sodium**

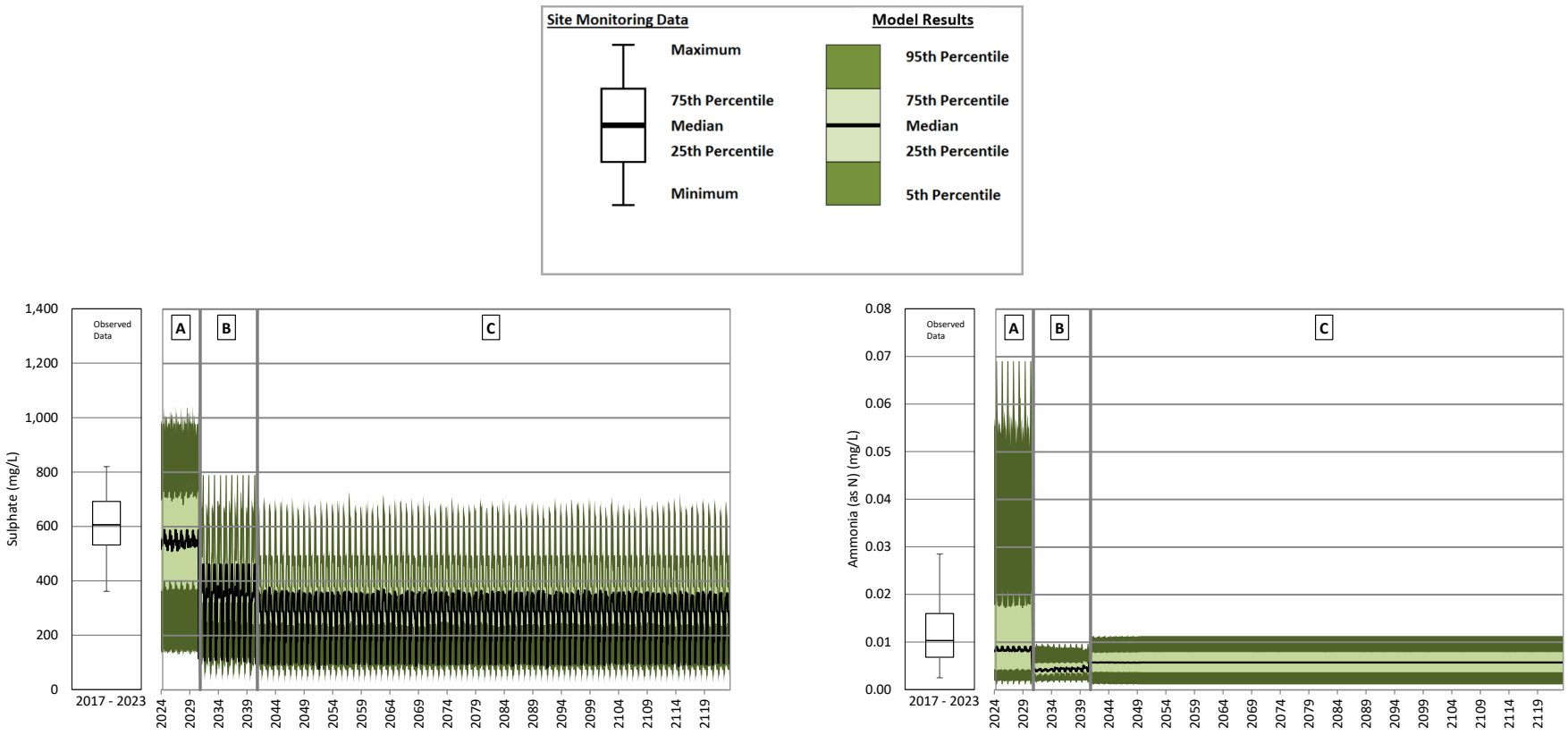

A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Total ammonia concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total ammonia than the disturbed runoff water quality input.

Figure B **145: 9K Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**

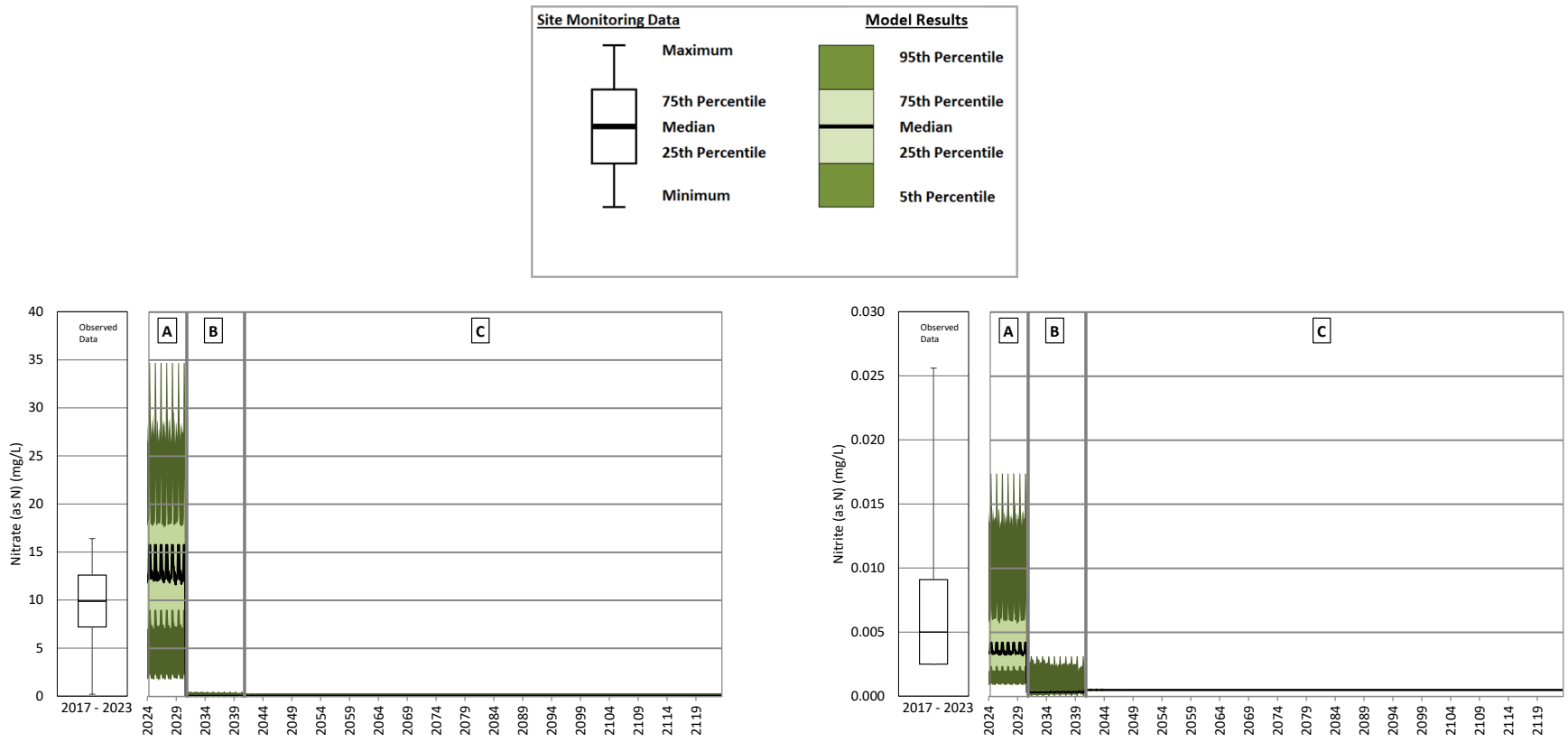

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **146: 9K Sump Operations, Closure and Post-closure – Nitrate and Nitrite**

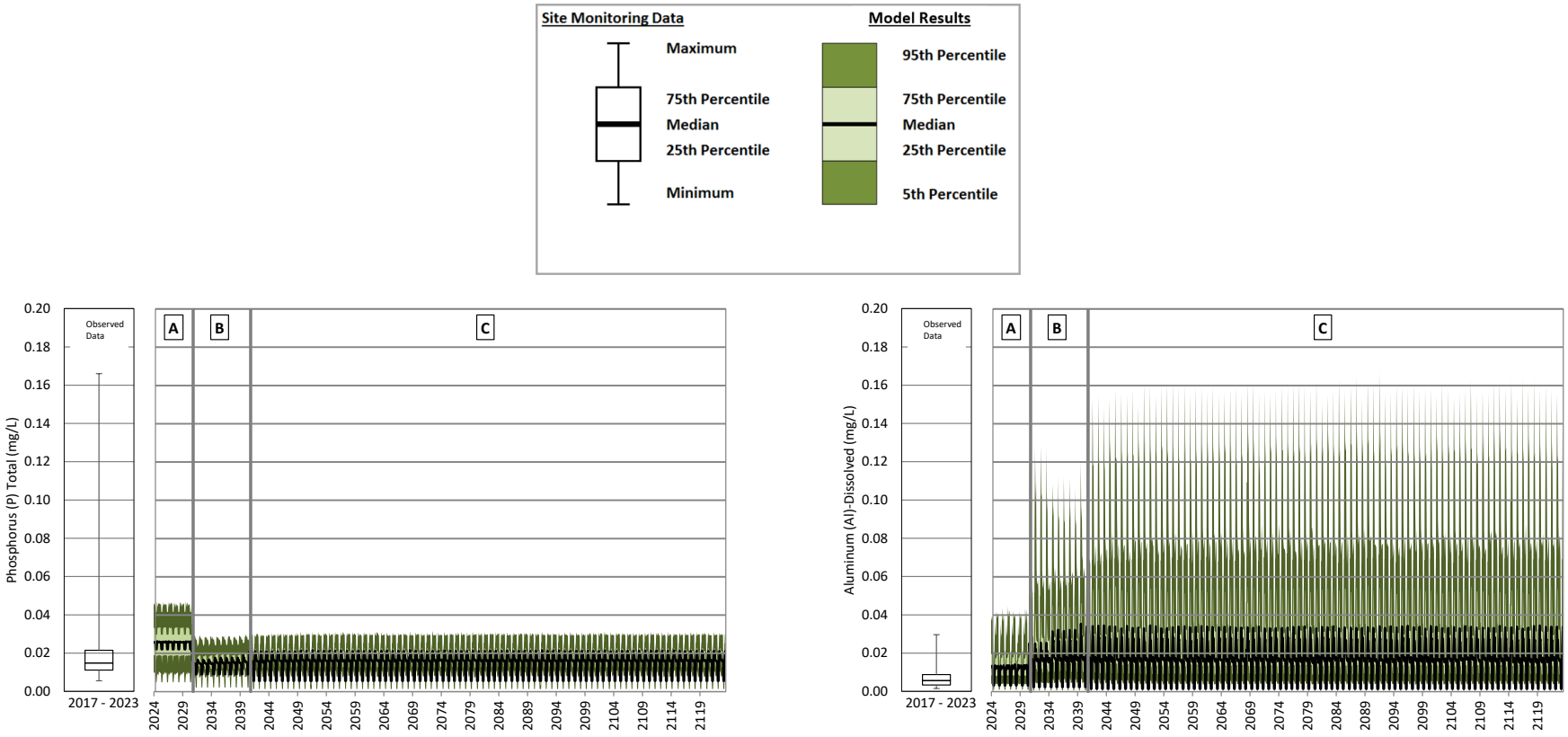

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **147: 9K Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

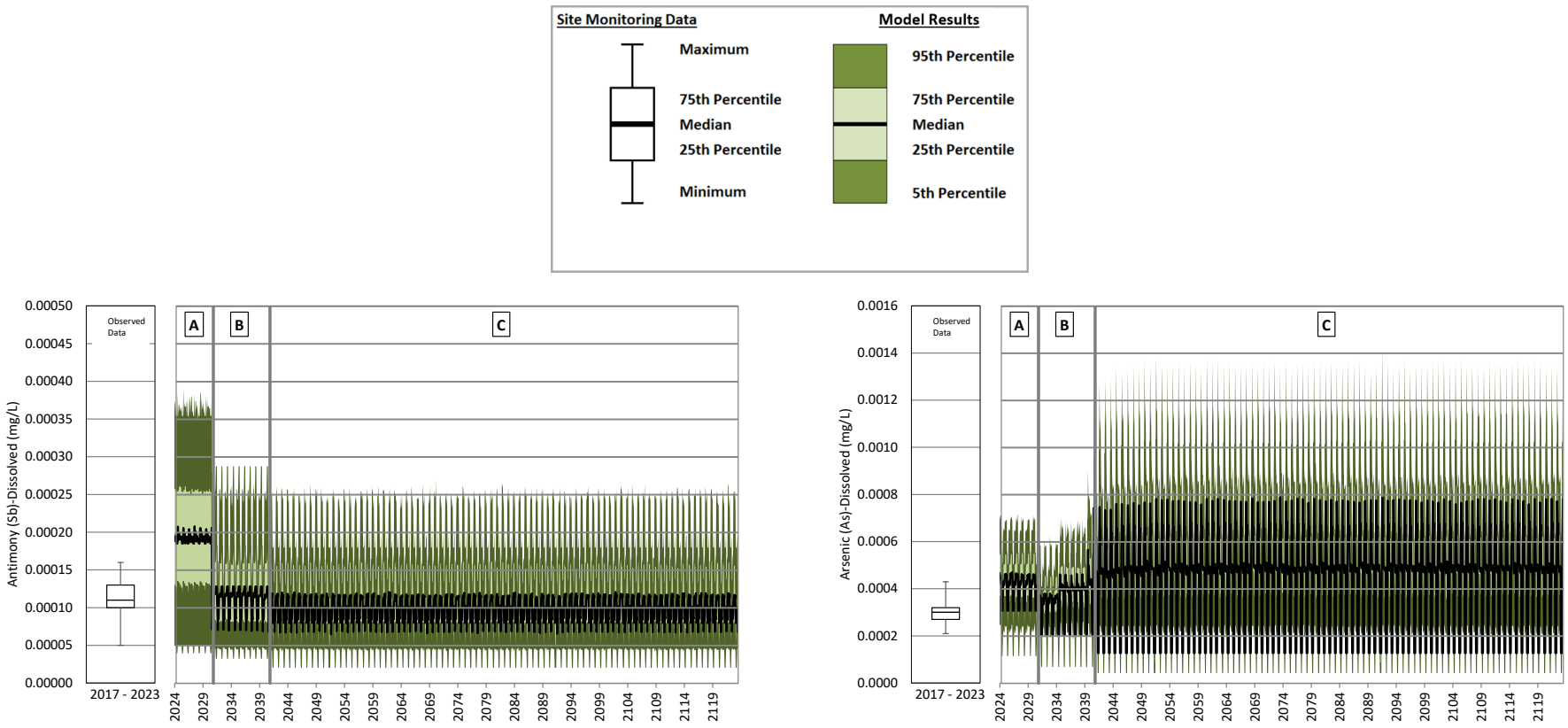

A = Operations; B = Closure; C = Post-closure

Note: Dissolved antimony concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved arsenic concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved arsenic than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **148: 9K Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

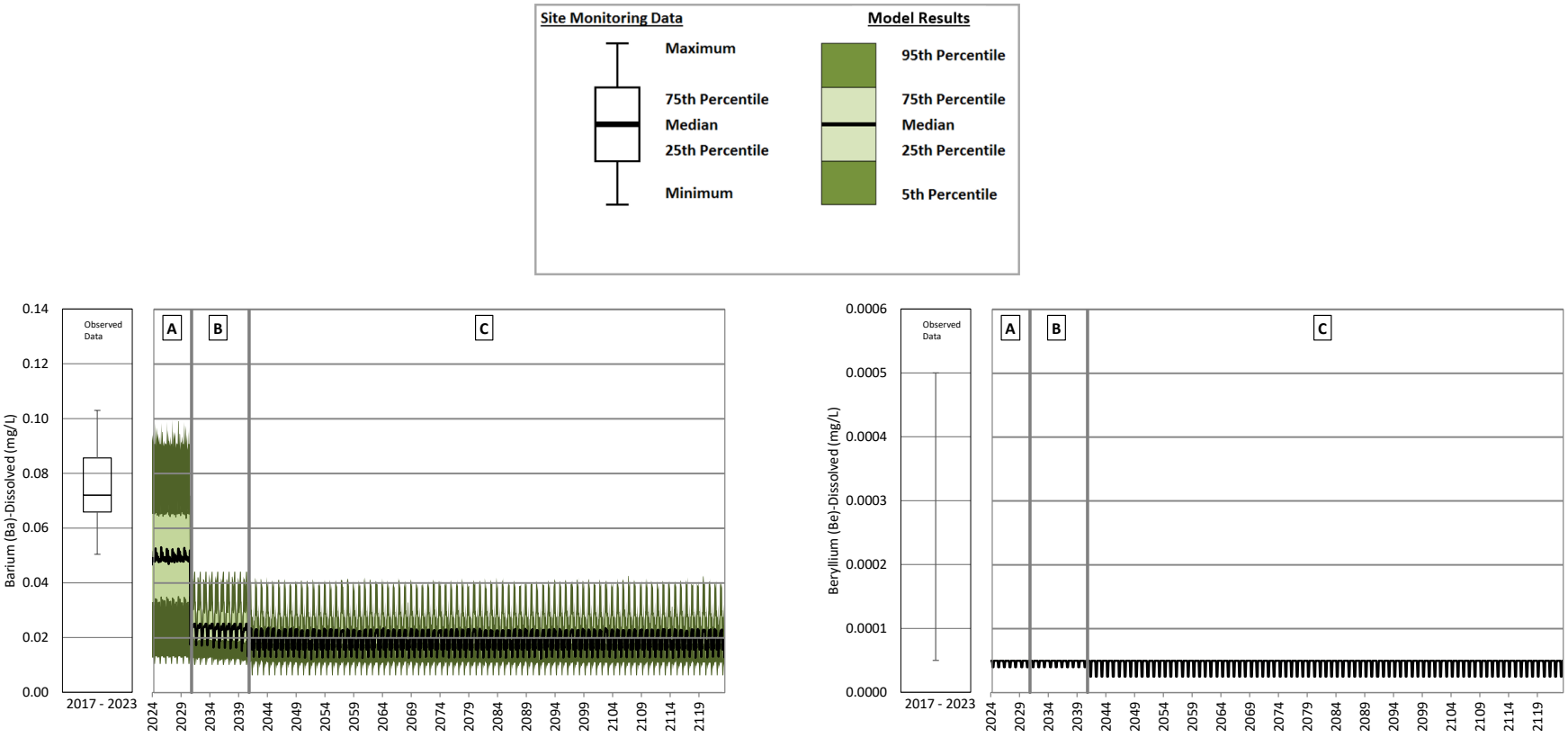

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **149: 9K Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

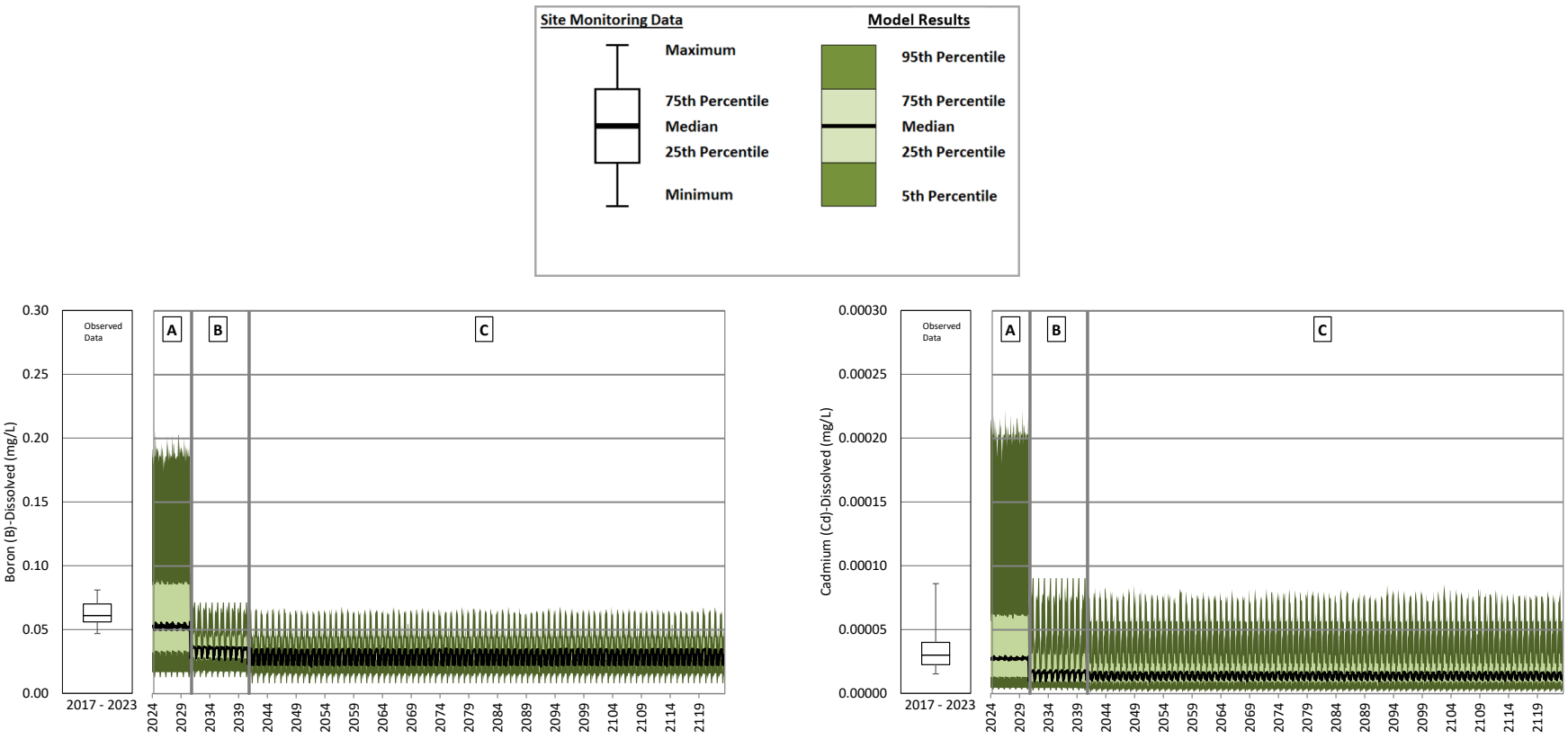

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **150: 9K Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

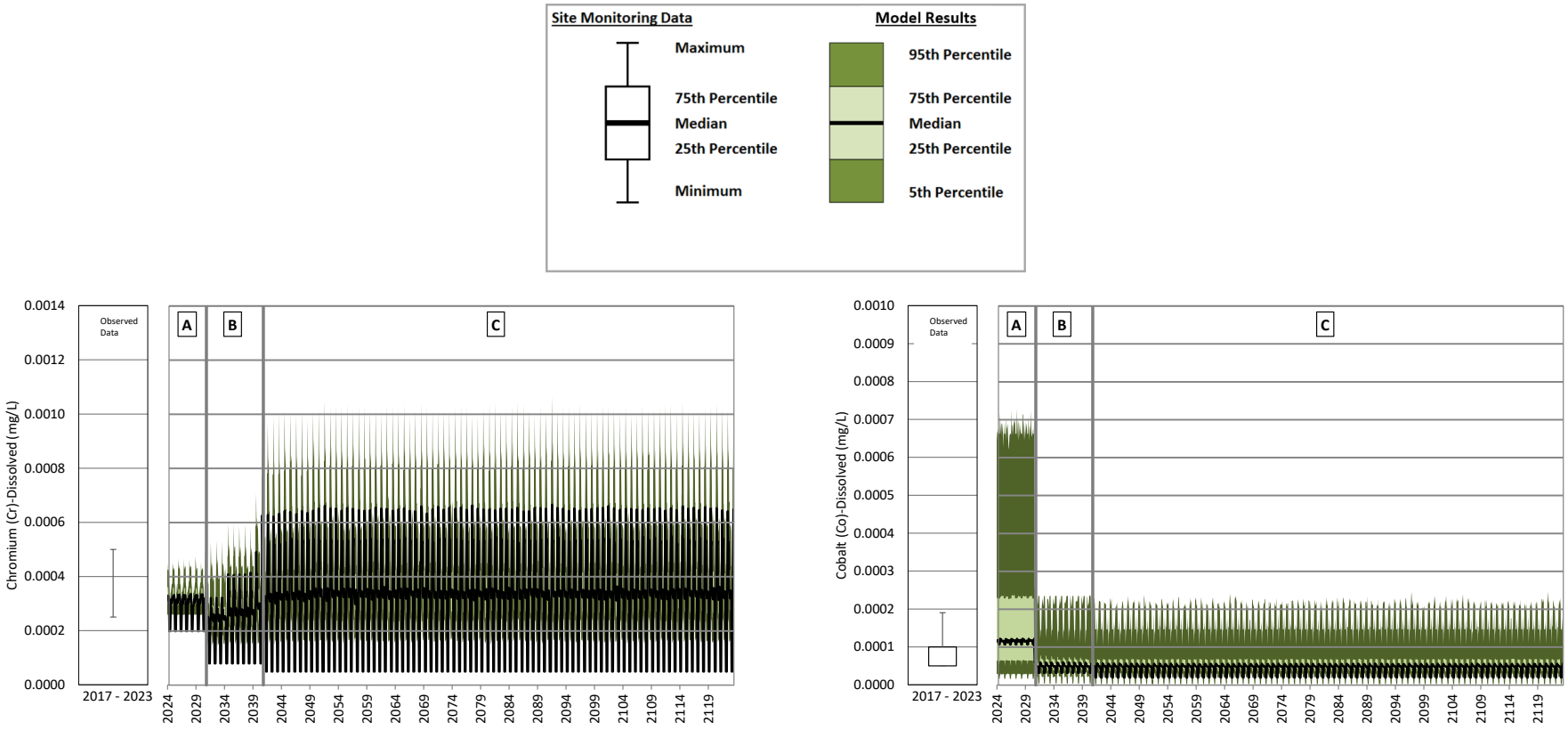

A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **151: 9K Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

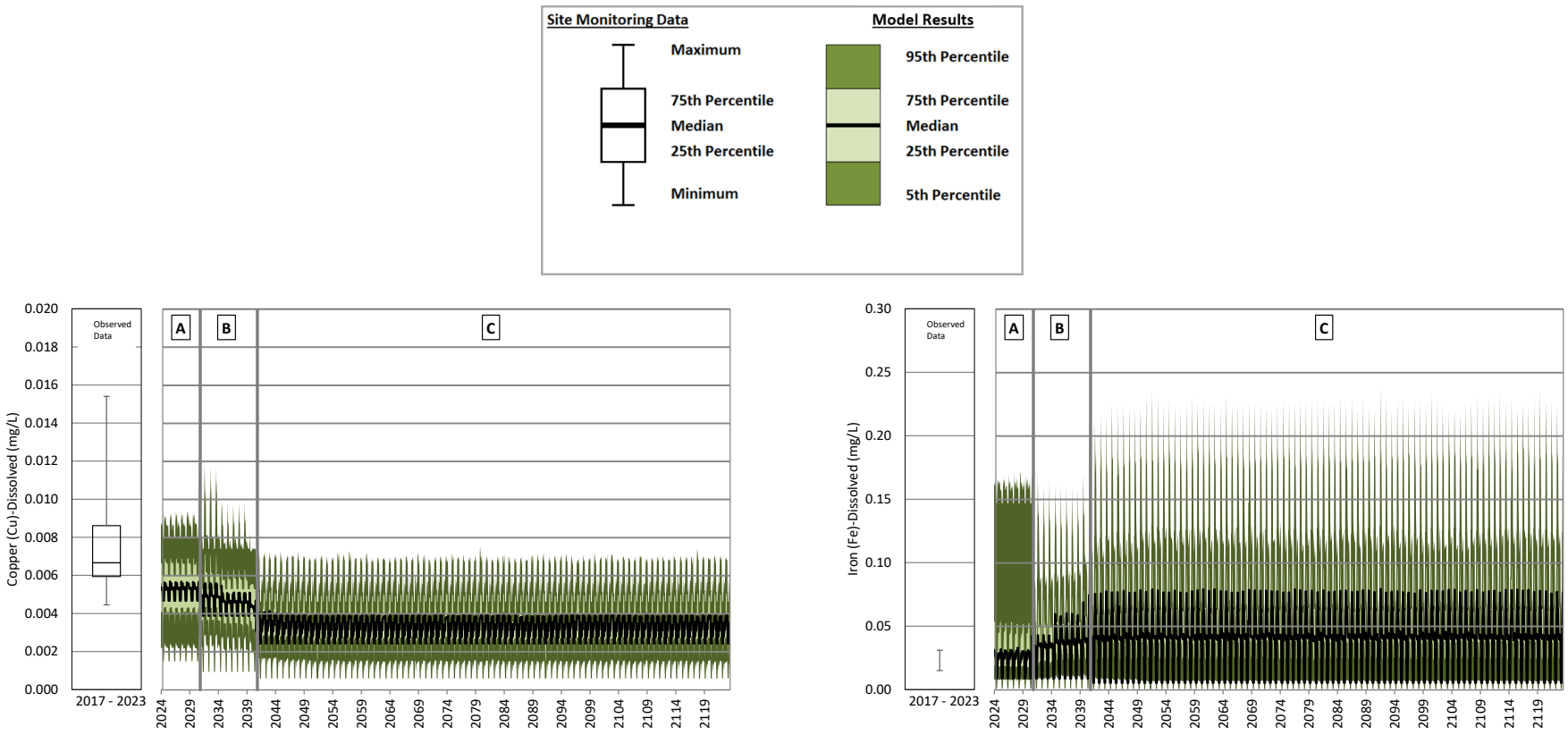

A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **152: 9K Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

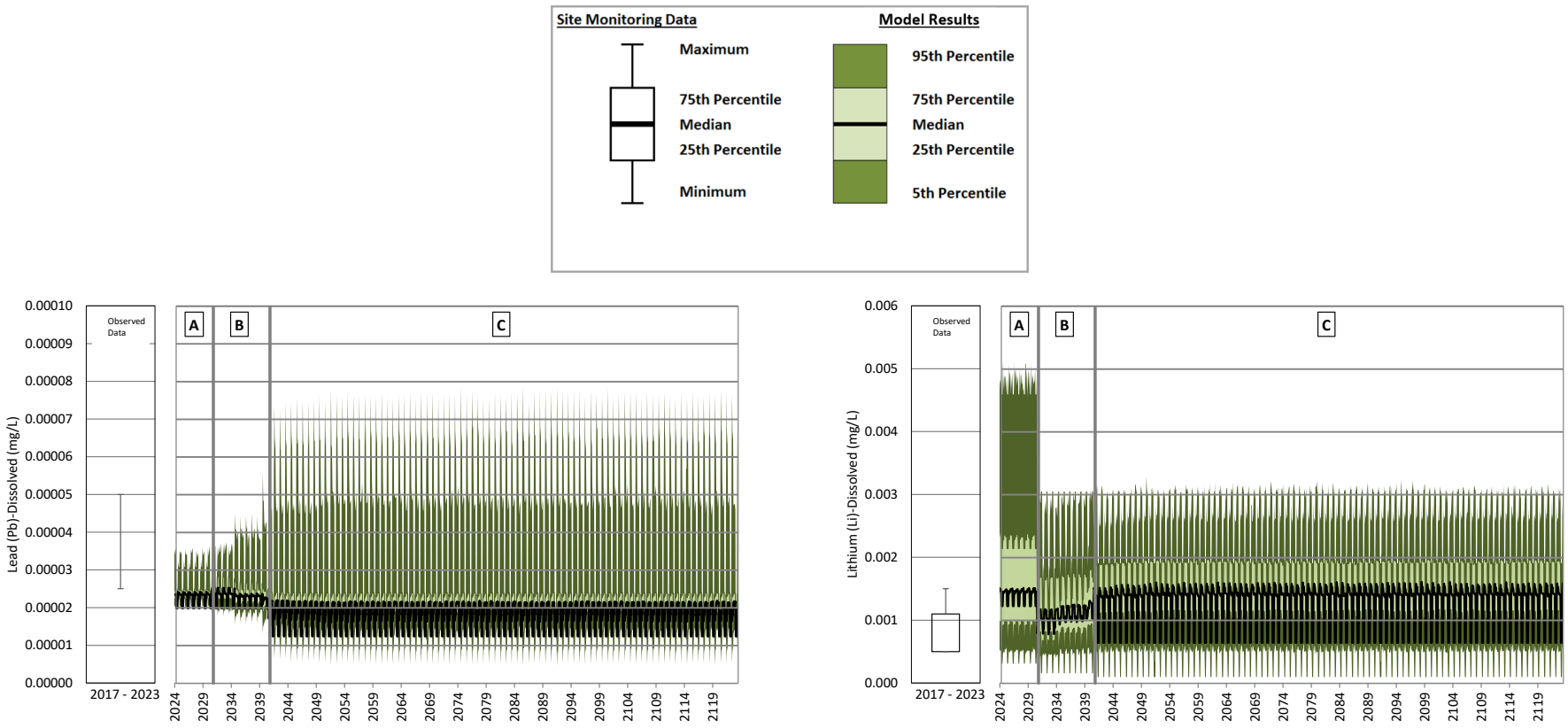

A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **153: 9K Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

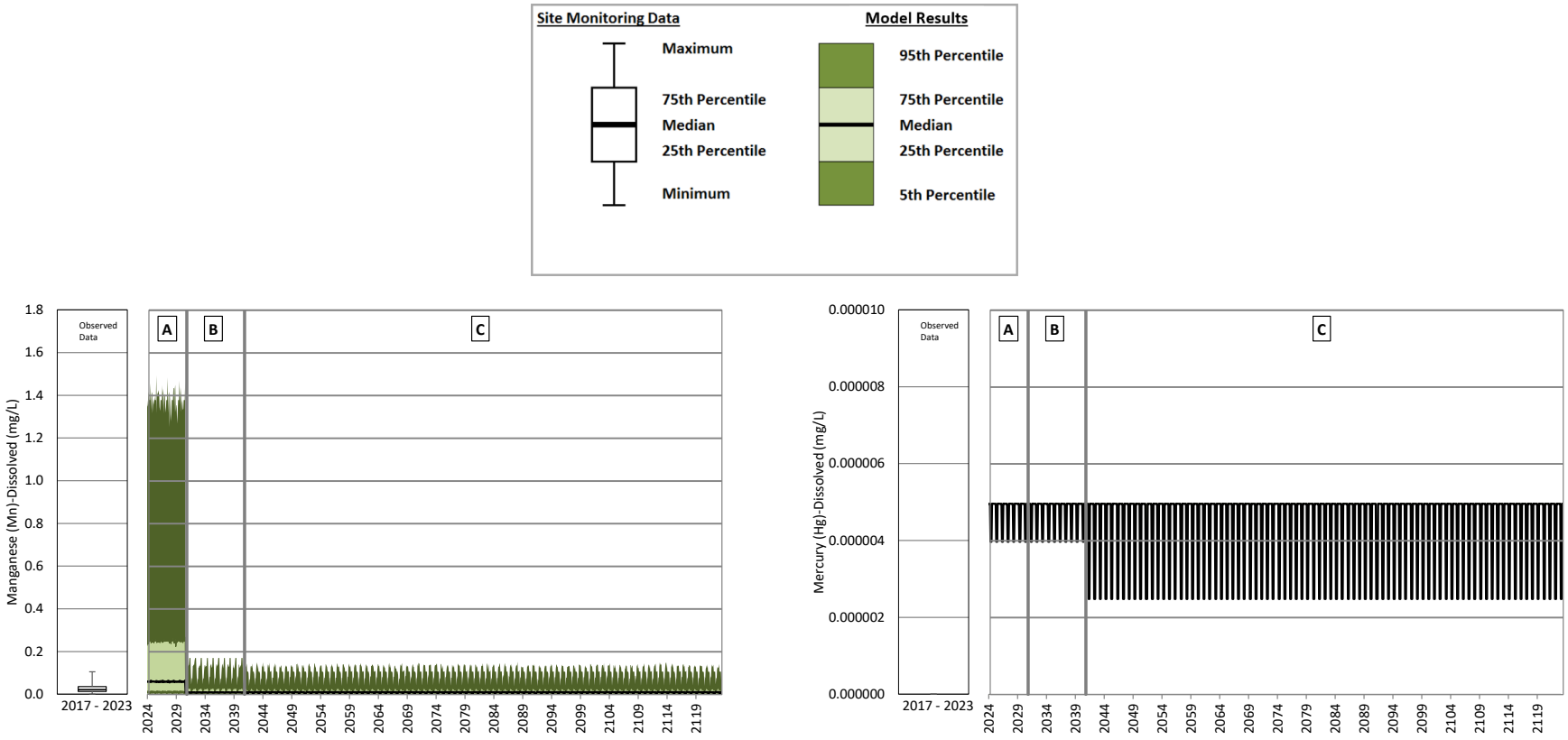

A = Operations; B = Closure; C = Post-closure

. Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **154: 9K Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

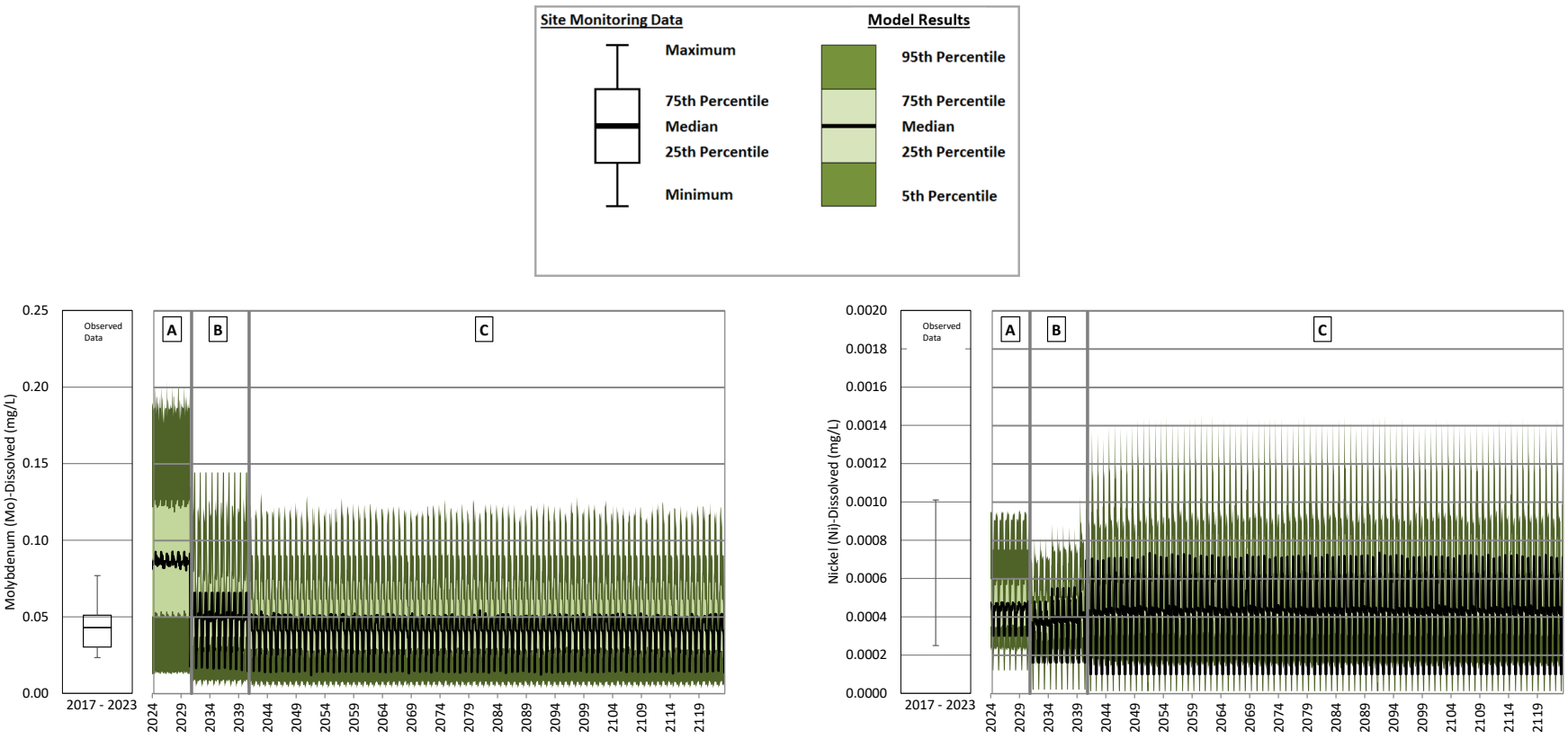

A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **155: 9K Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

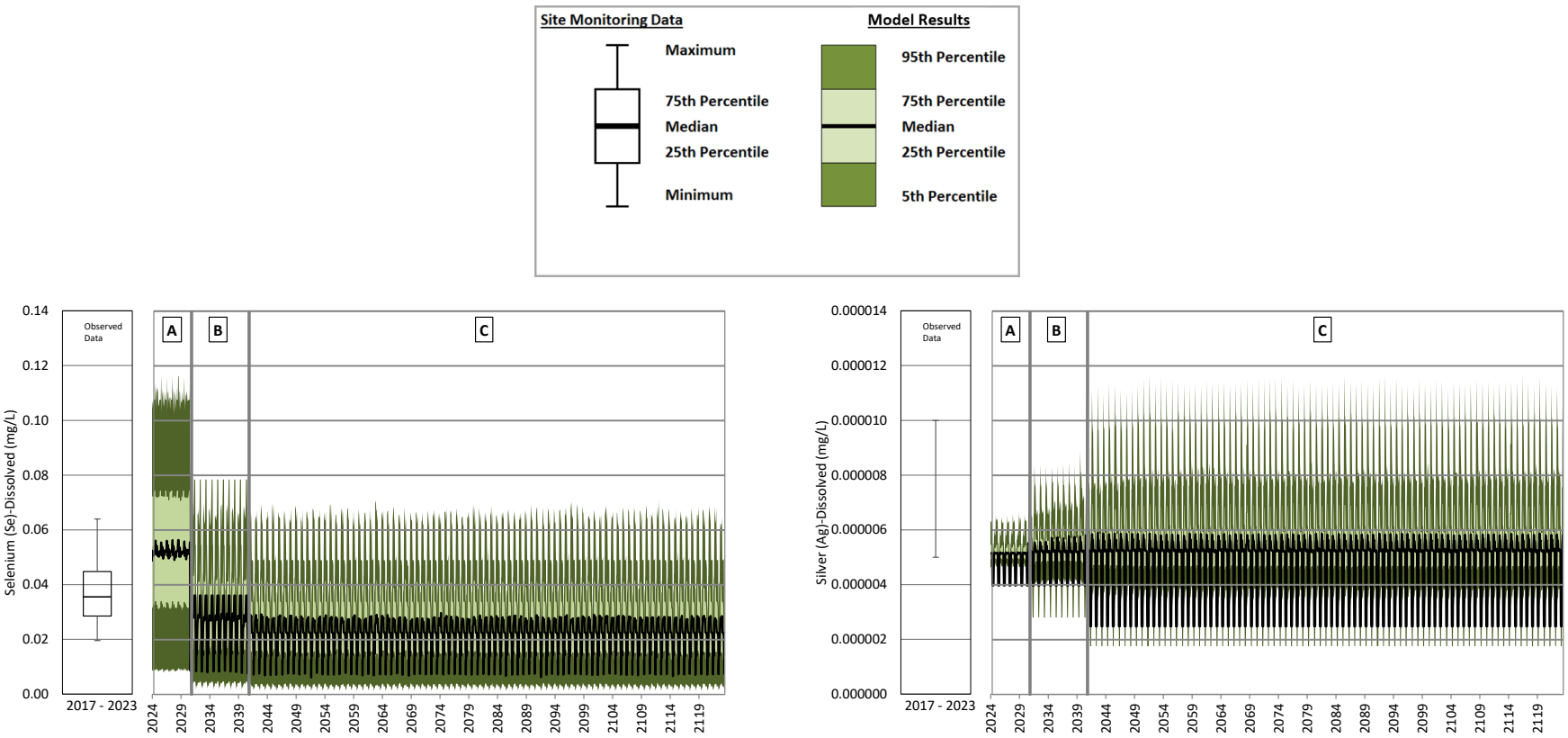

A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **156: 9K Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

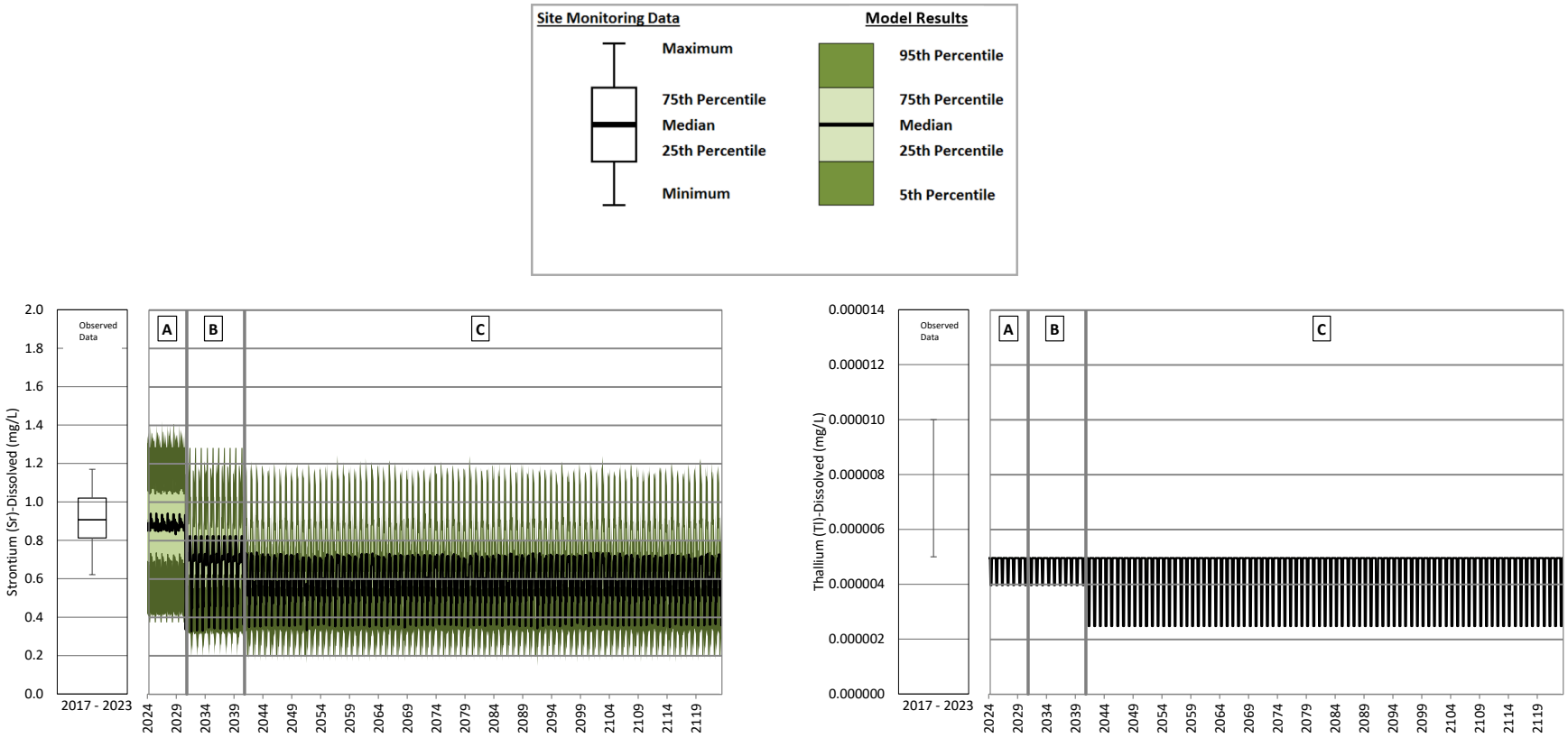

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **157: 9K Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

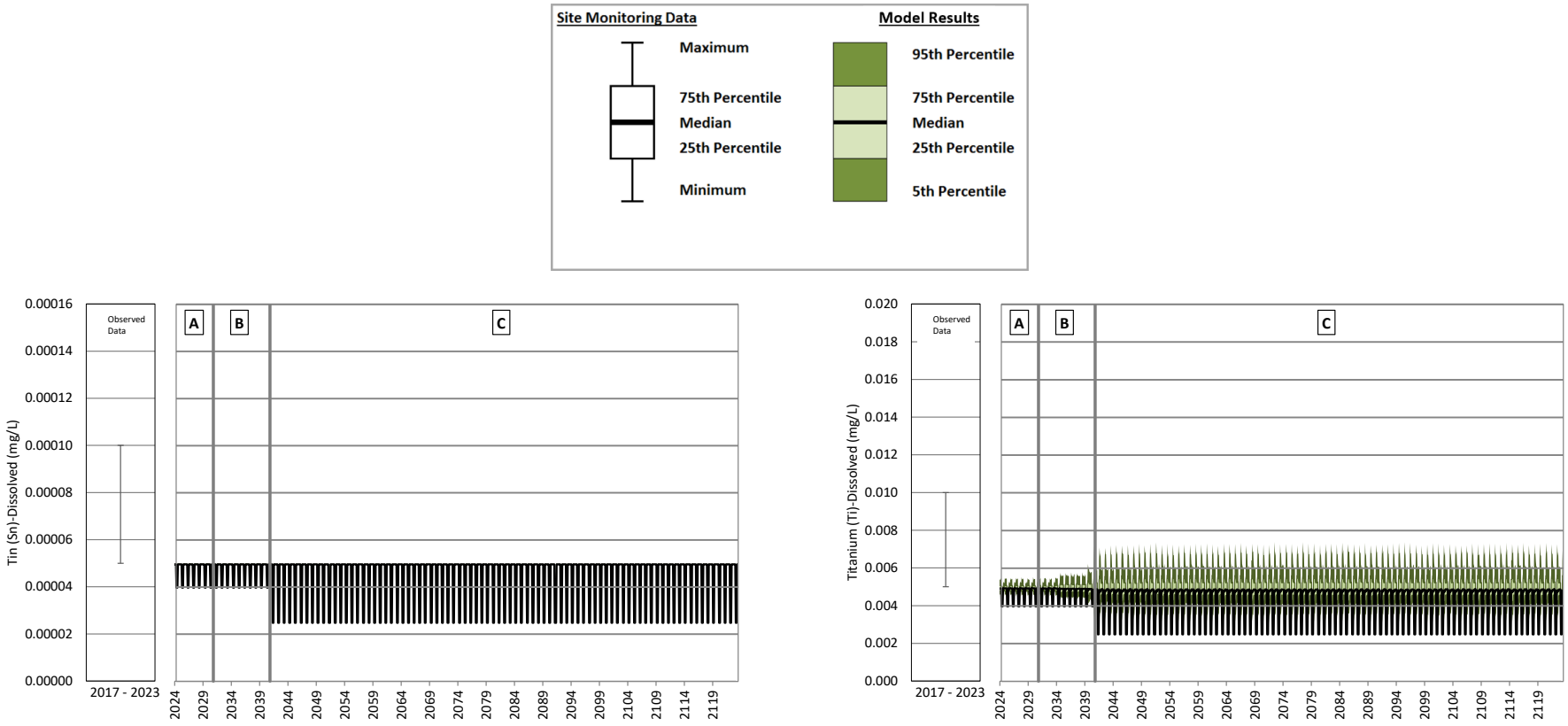

A = Operations; B = Closure; C = Post-closure

Note: Dissolved titanium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **158: 9K Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

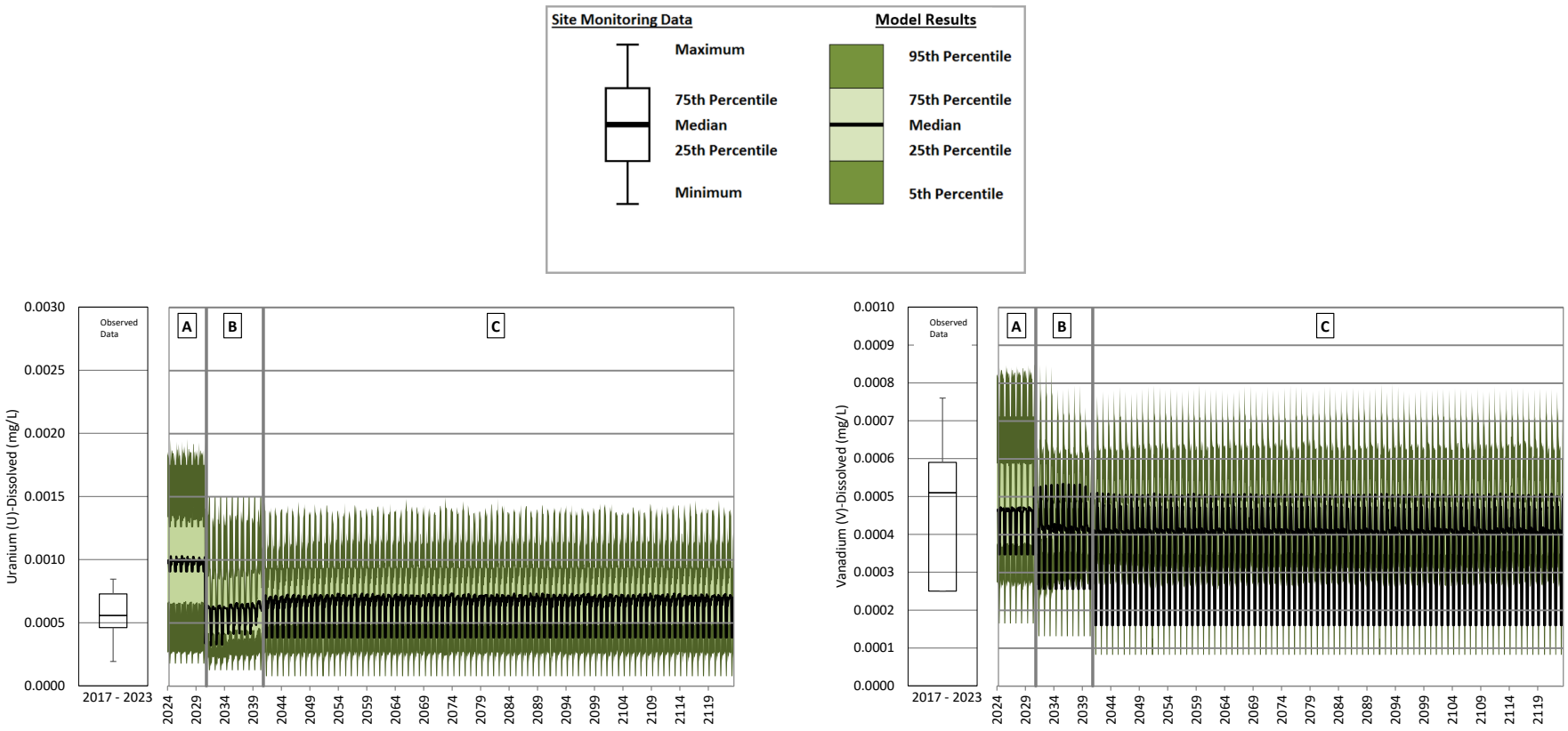

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **159: 9K Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

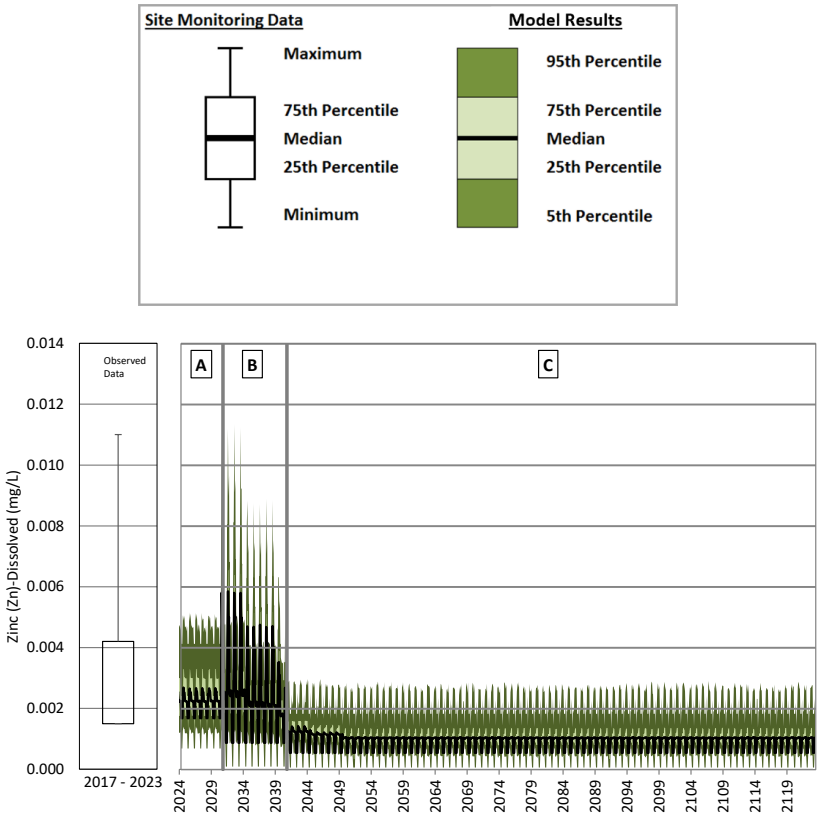

A = Operations; B = Closure; C = Post-closure

Note: Maximum dissolved zinc concentrations increase during closure when seepage from the Temporary NW PAG Stockpile changes from the PAG water quality input to the NAG water quality input. The NAG water quality input has higher dissolved zinc concentrations than the Pag water quality input. Dissolved zinc concentrations decrease from closure and post-closure as runoff areas are remediated.

Figure B **160: 9K Sump Operations, Closure and Post-closure – Dissolved Zinc**

Northwest Sump Operations

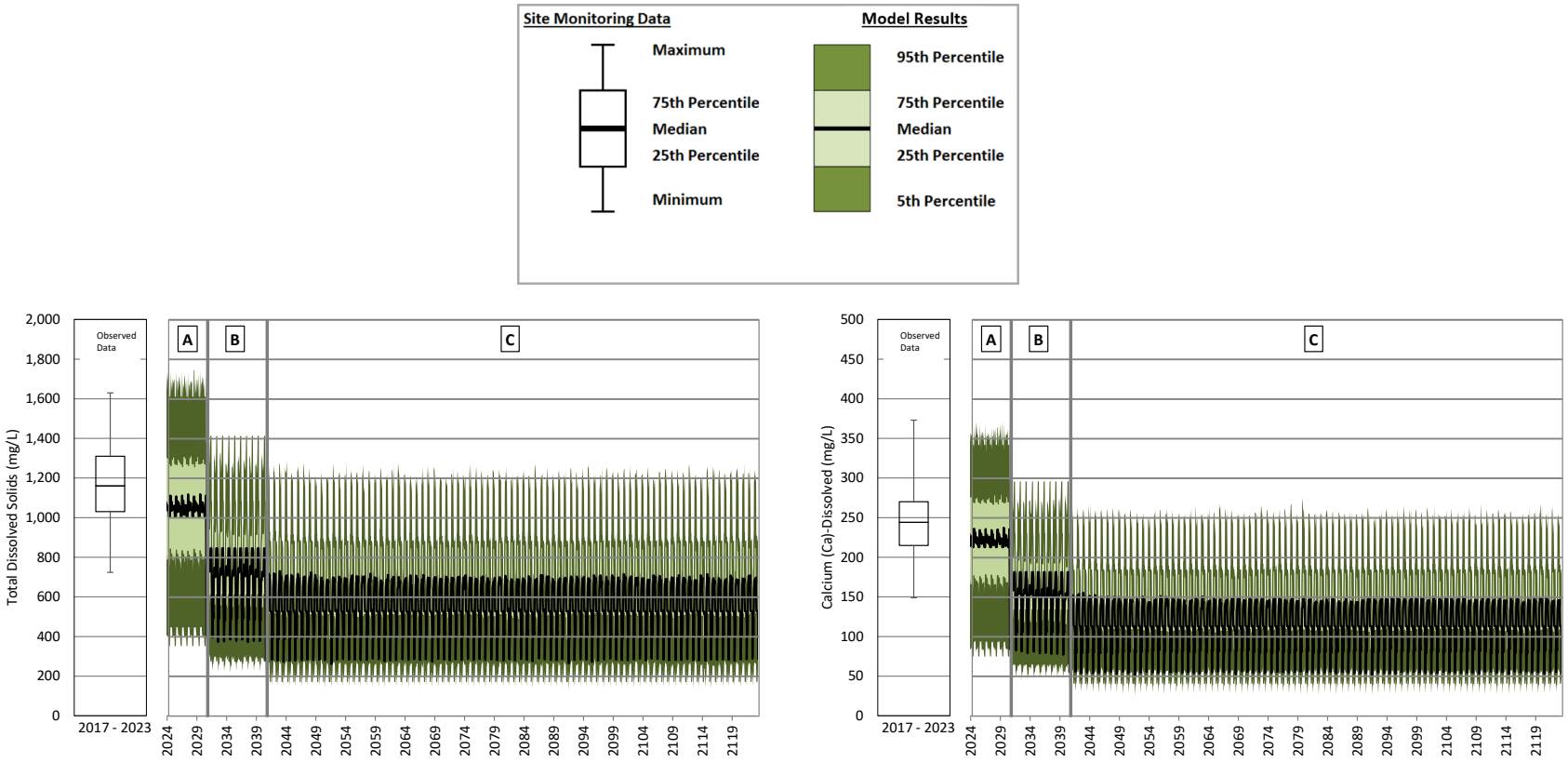

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **161: Northwest Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

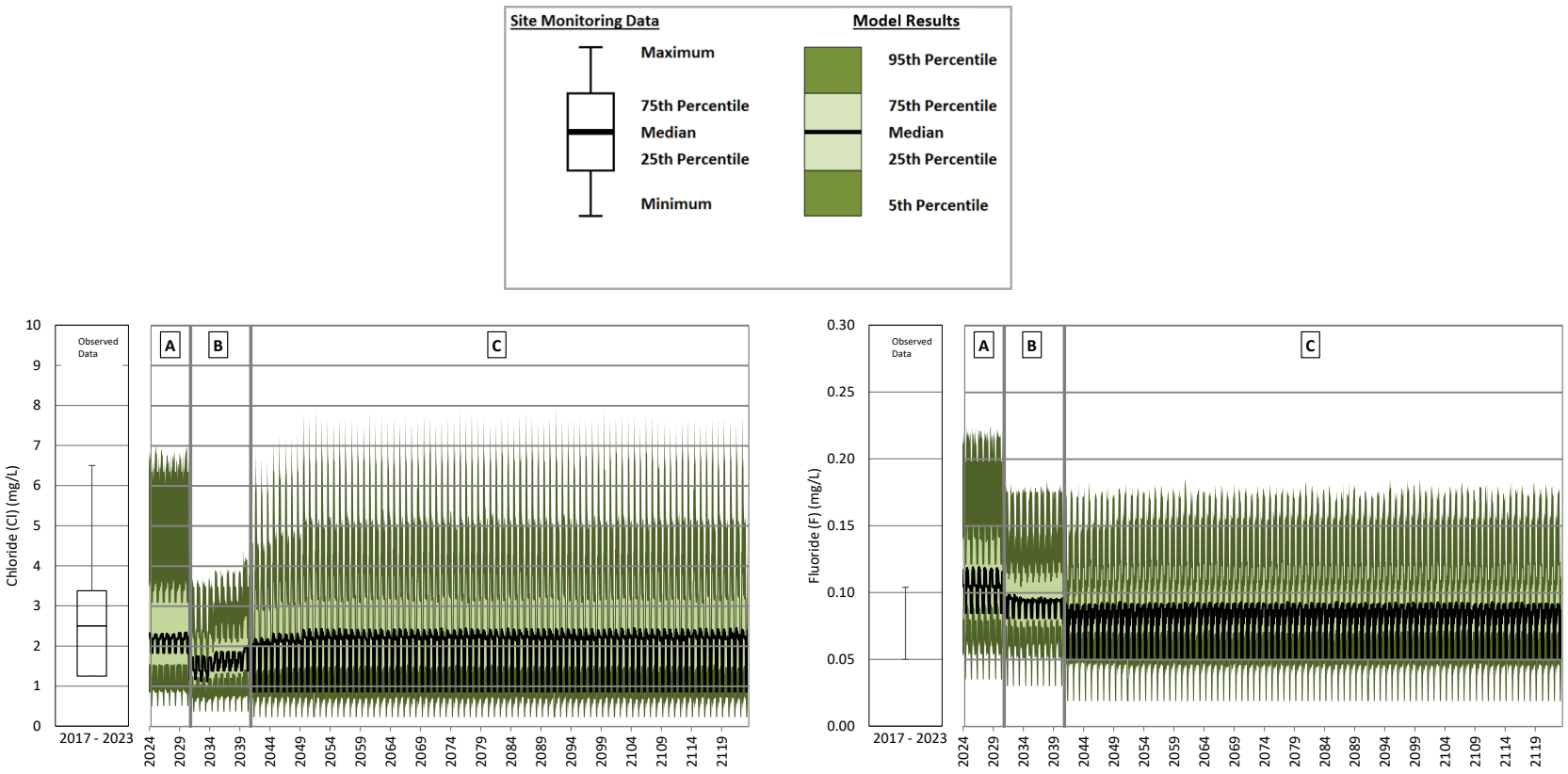

A = Operations; B = Closure; C = Post-closure

Note: Chloride concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for chloride than the disturbed runoff water quality input. Fluoride concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **162: Northwest Sump Operations, Closure and Post-closure – Chloride and Fluoride**

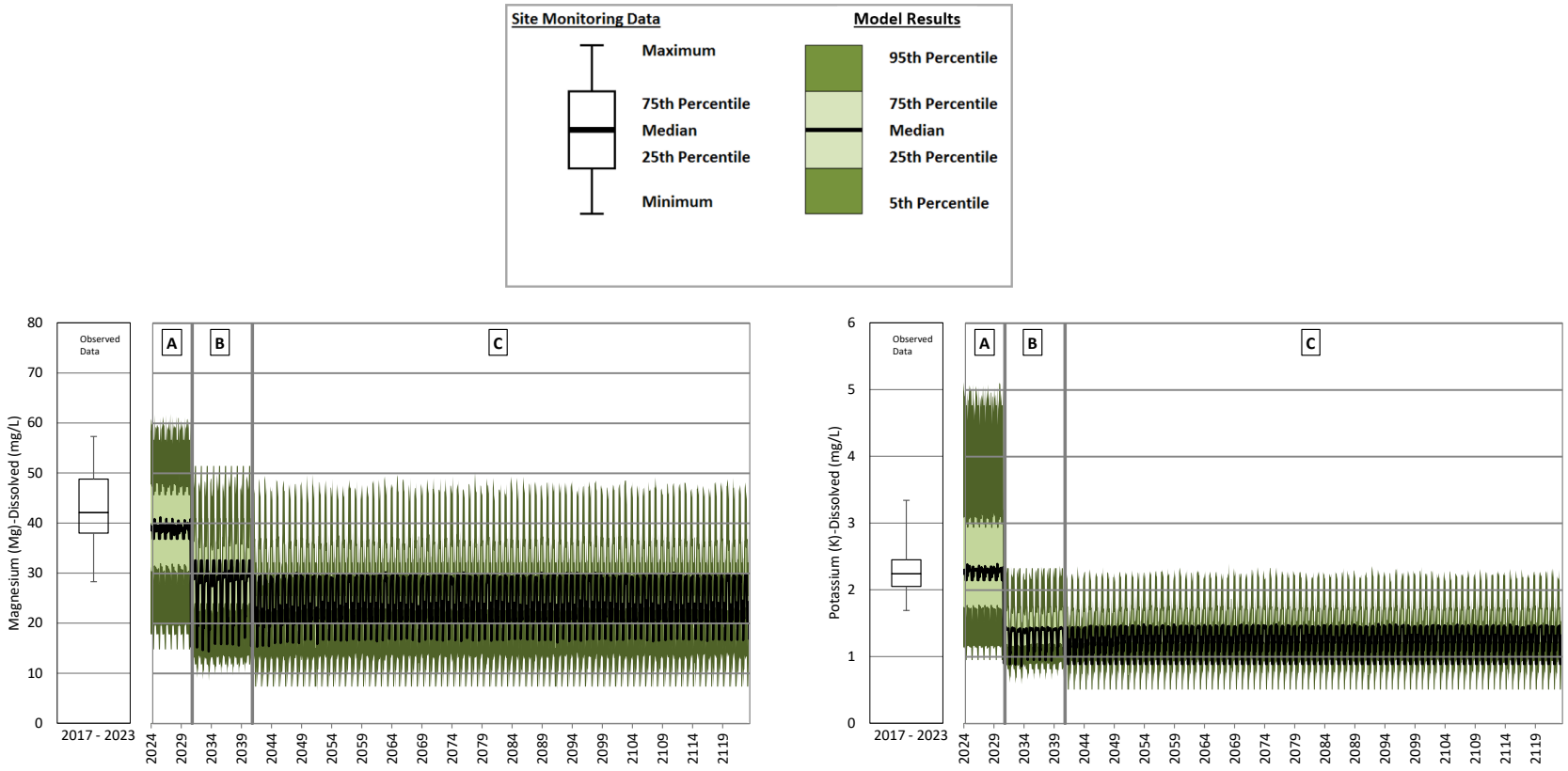

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **163: Northwest Sump Operations, Closure and Post-closure – Magnesium and Potassium**

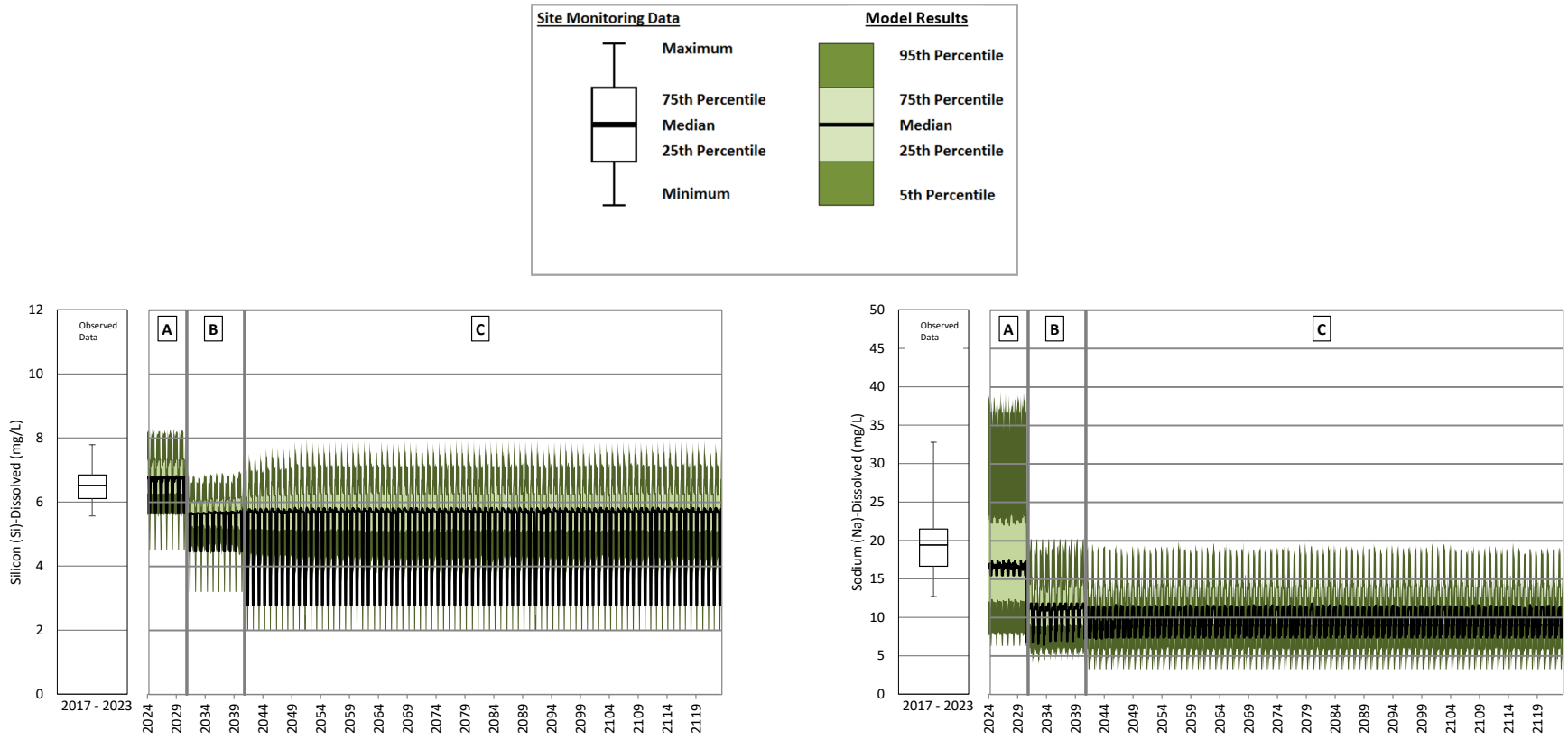

A = Operations; B = Closure; C = Post-closure

Note: Silicon concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **164: Northwest Sump Operations, Closure and Post-closure – Silicon and Sodium**

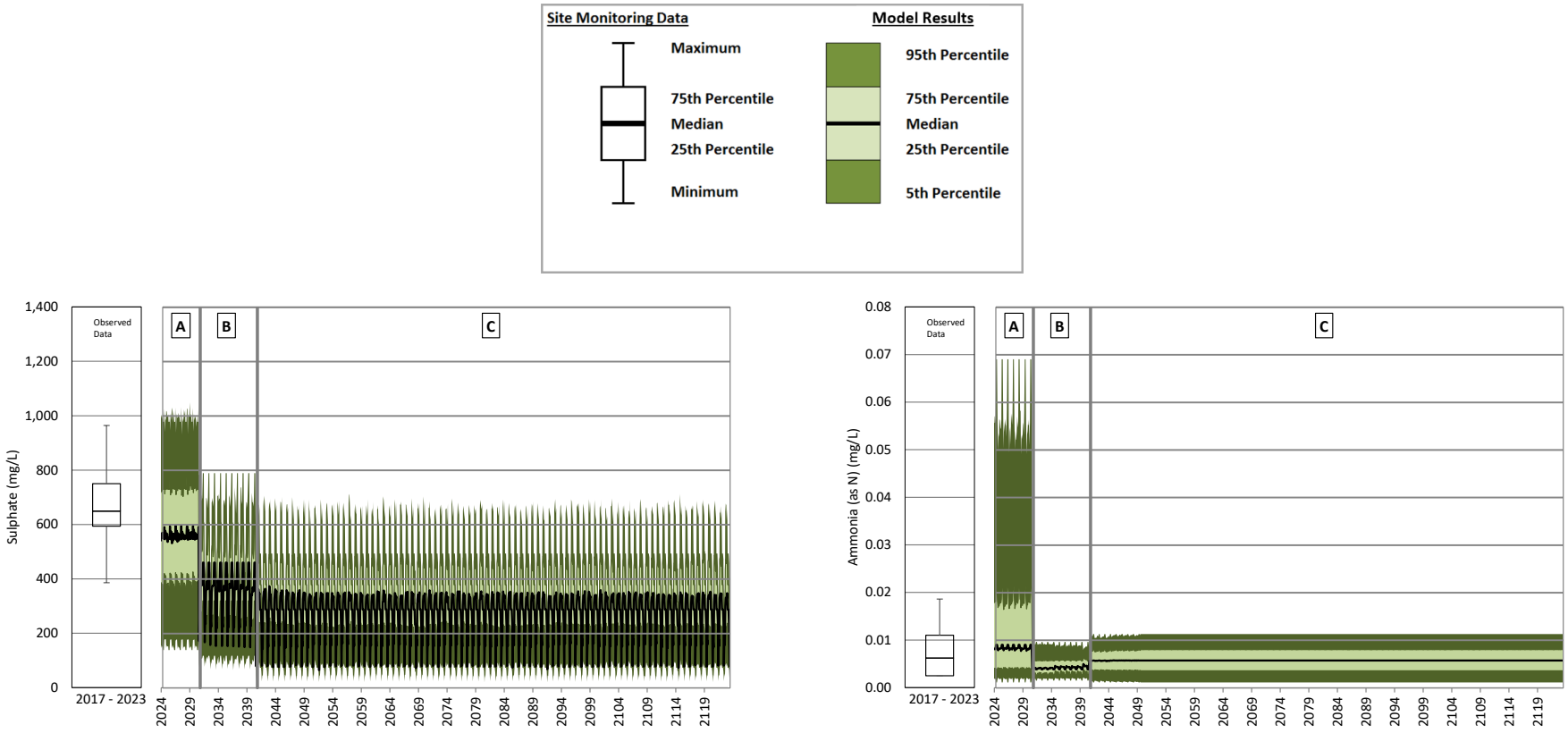

A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Total ammonia concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total ammonia than the disturbed runoff water quality input.

Figure B **165: Northwest Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**

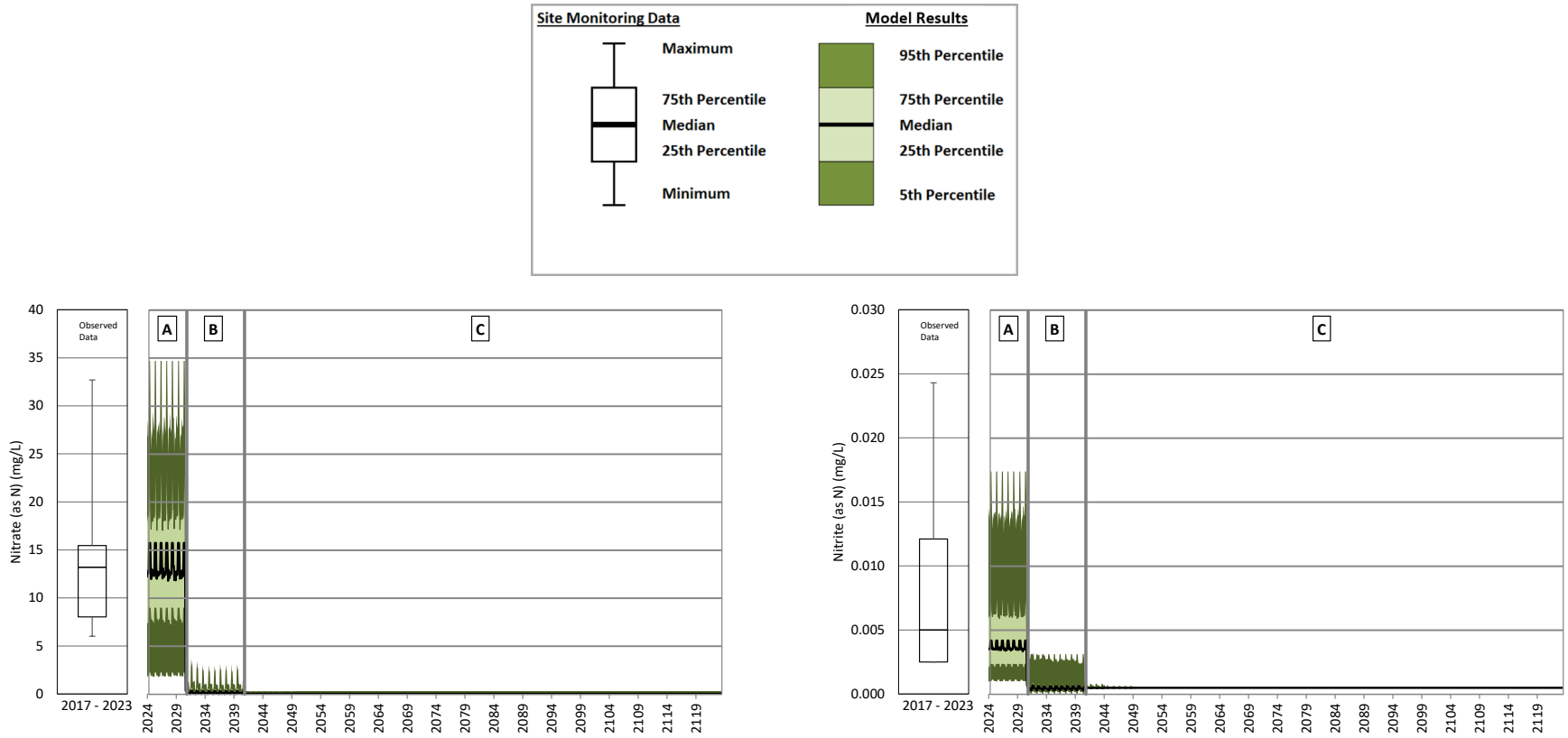

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **166: Northwest Sump Operations, Closure and Post-closure – Nitrate and Nitrite**

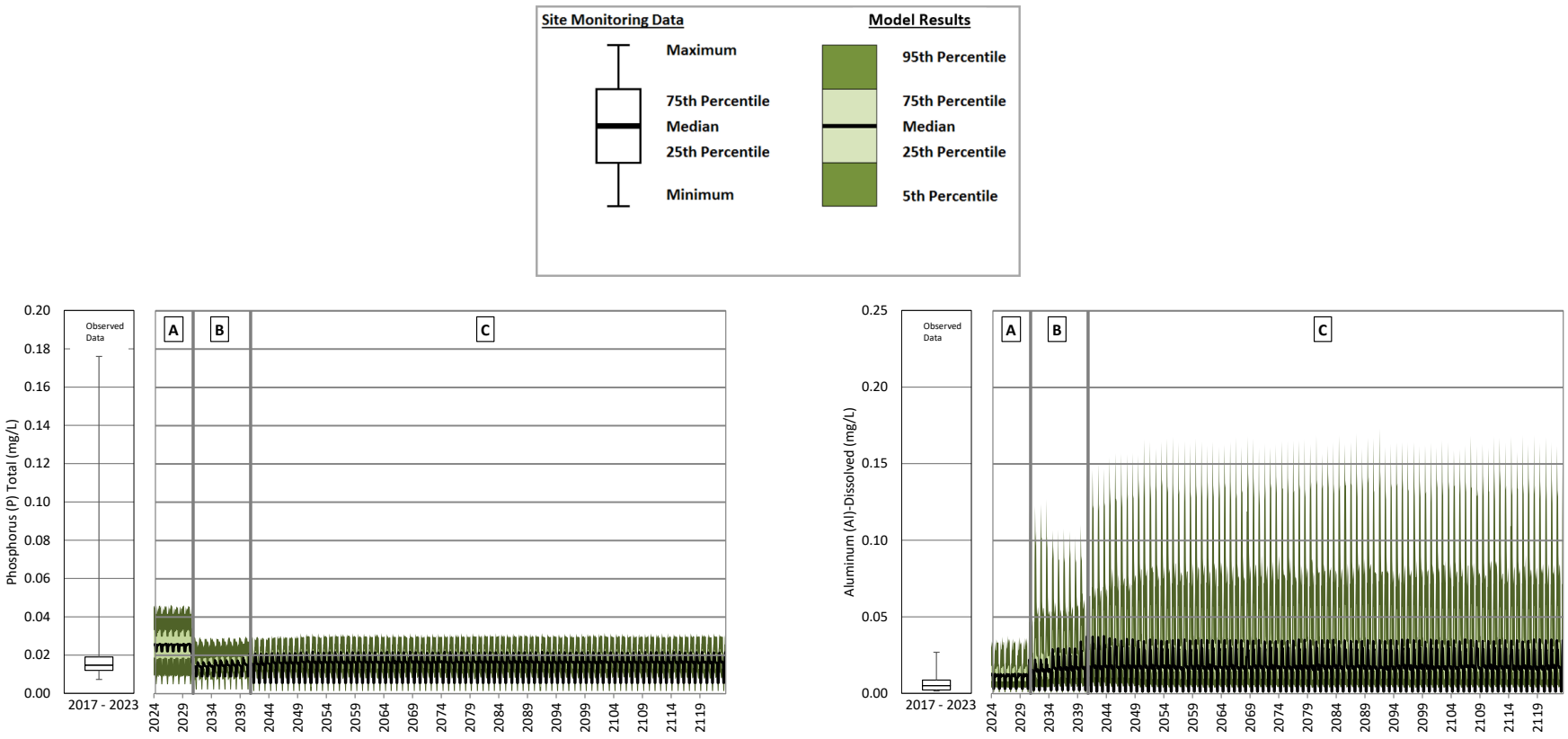

A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **167: Northwest Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

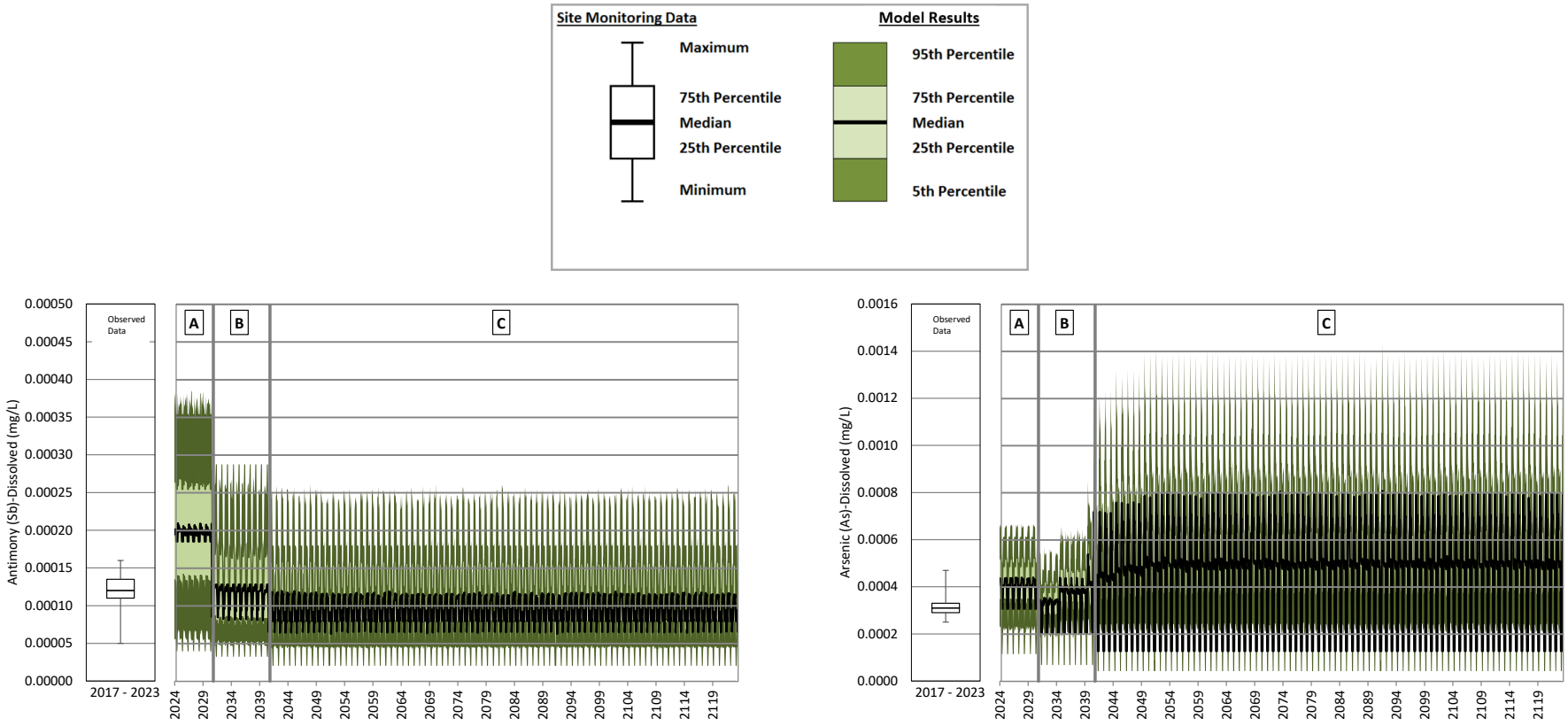

A = Operations; B = Closure; C = Post-closure

Note: Dissolved antimony concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved arsenic concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved arsenic than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **168: Northwest Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

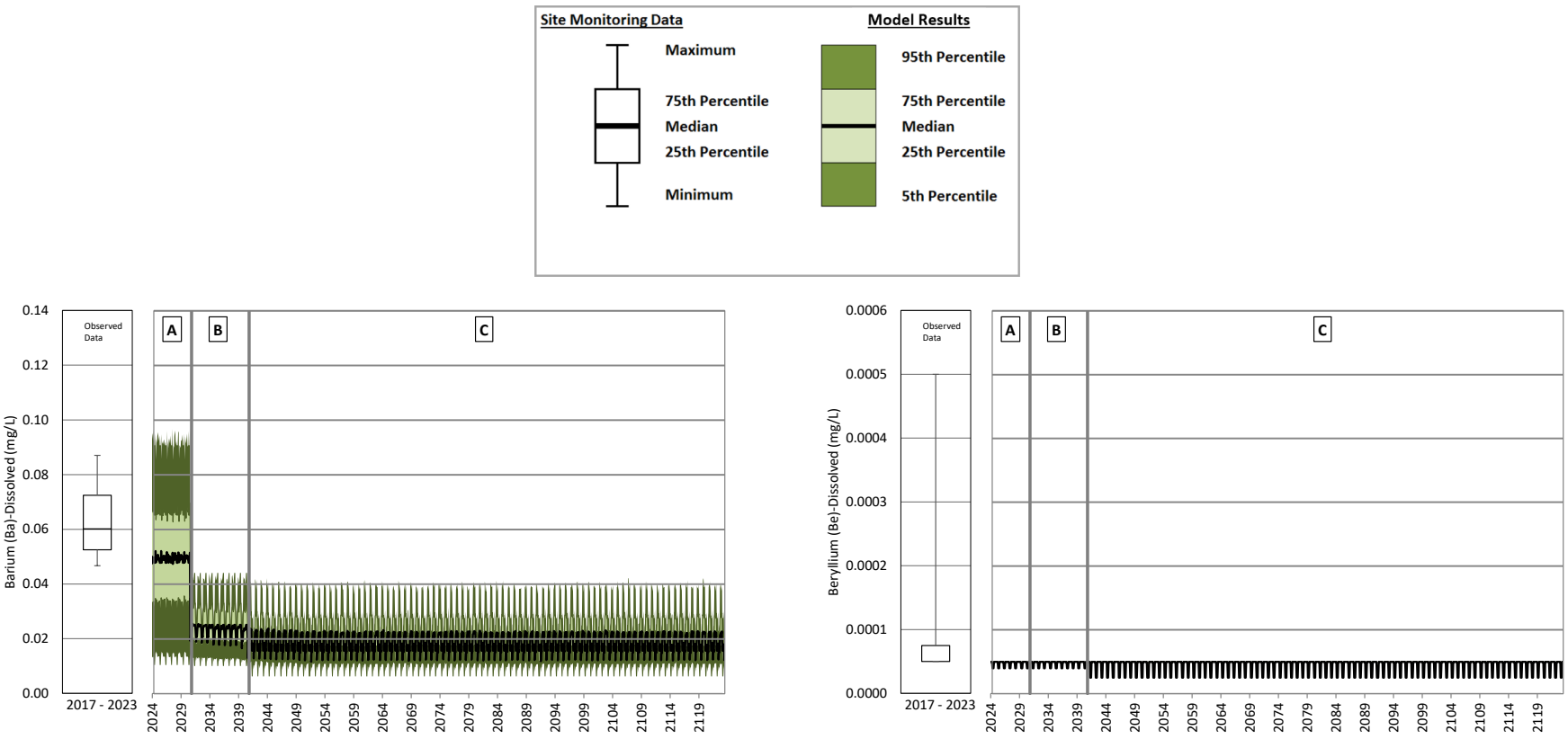

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **169: Northwest Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

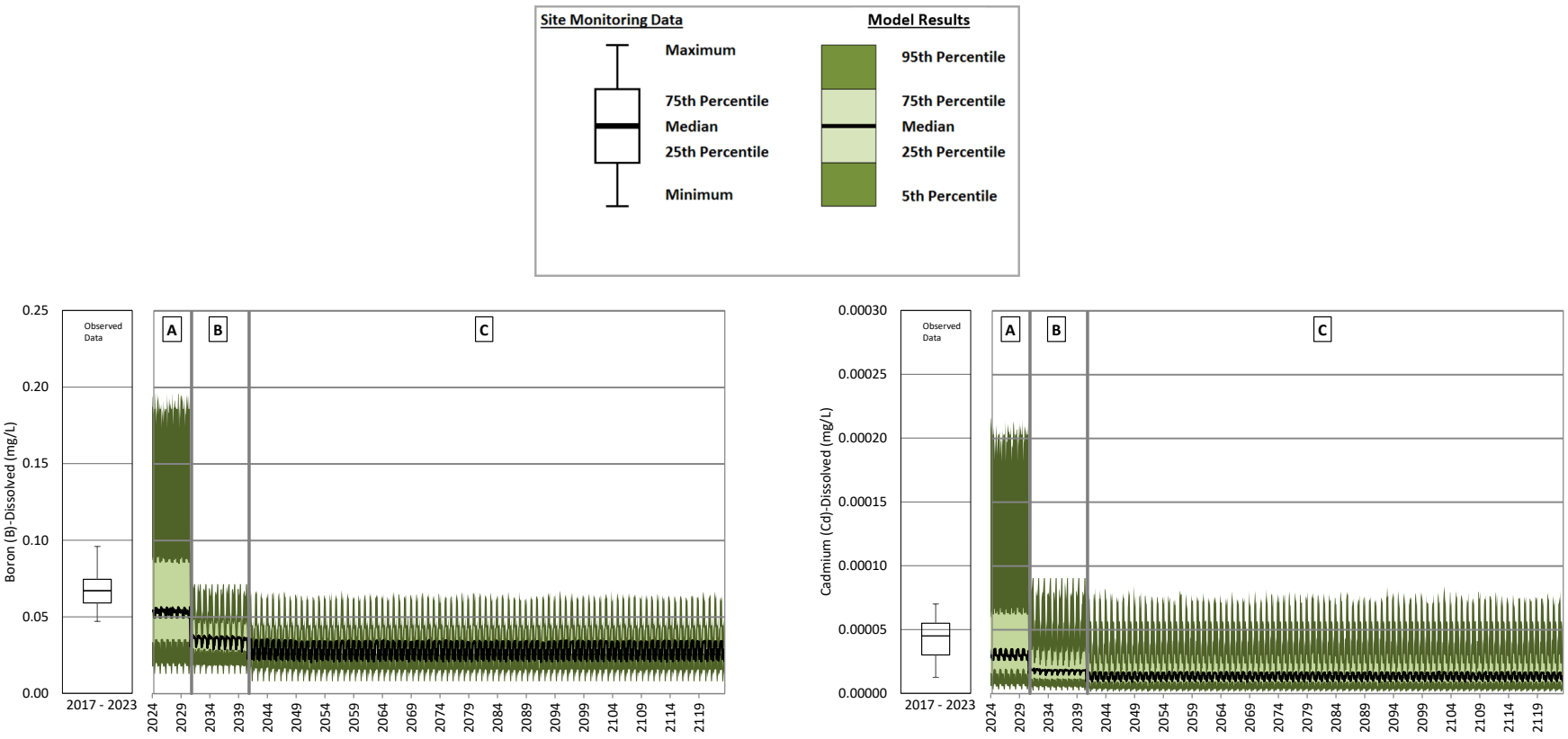

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **170: Northwest Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

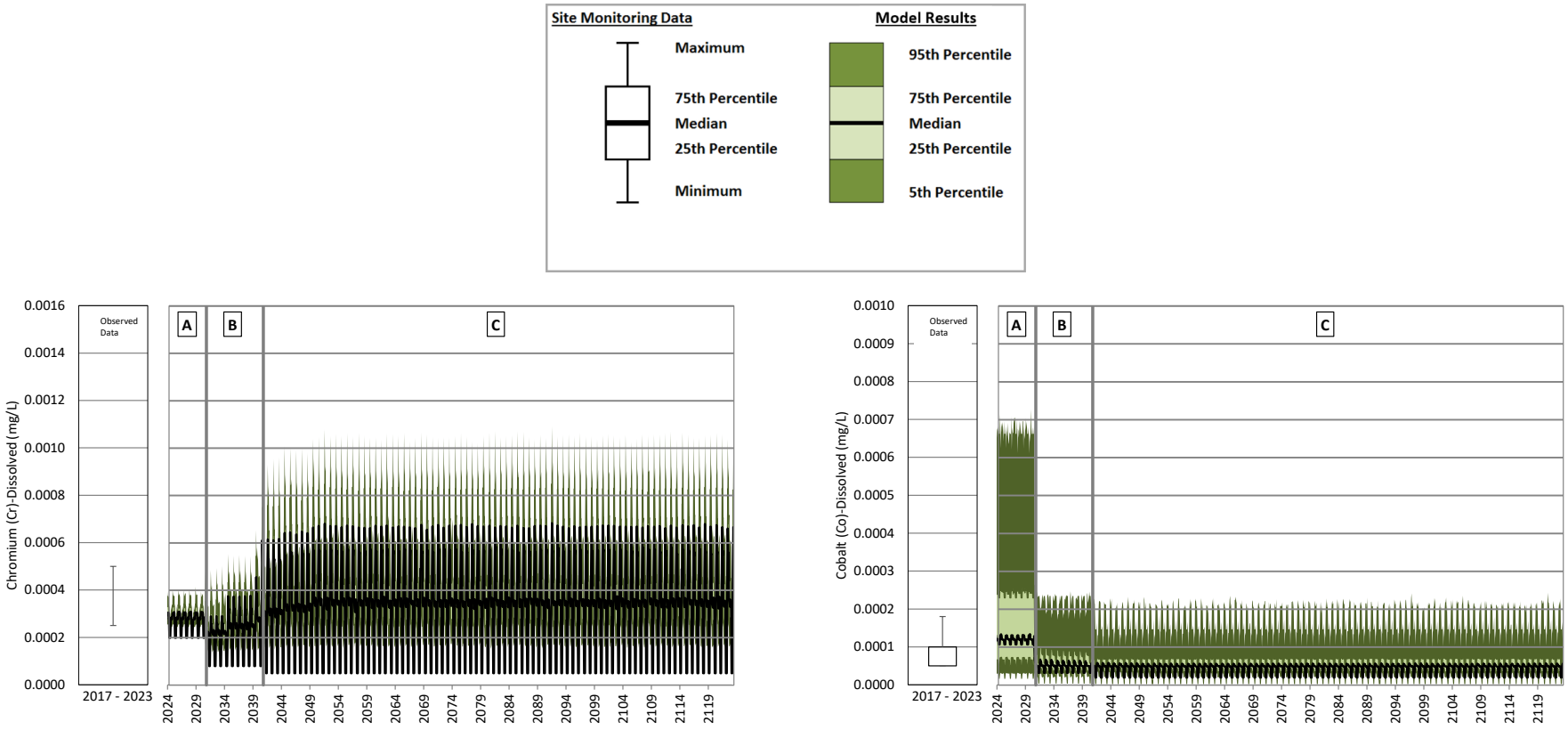

A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **171: Northwest Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

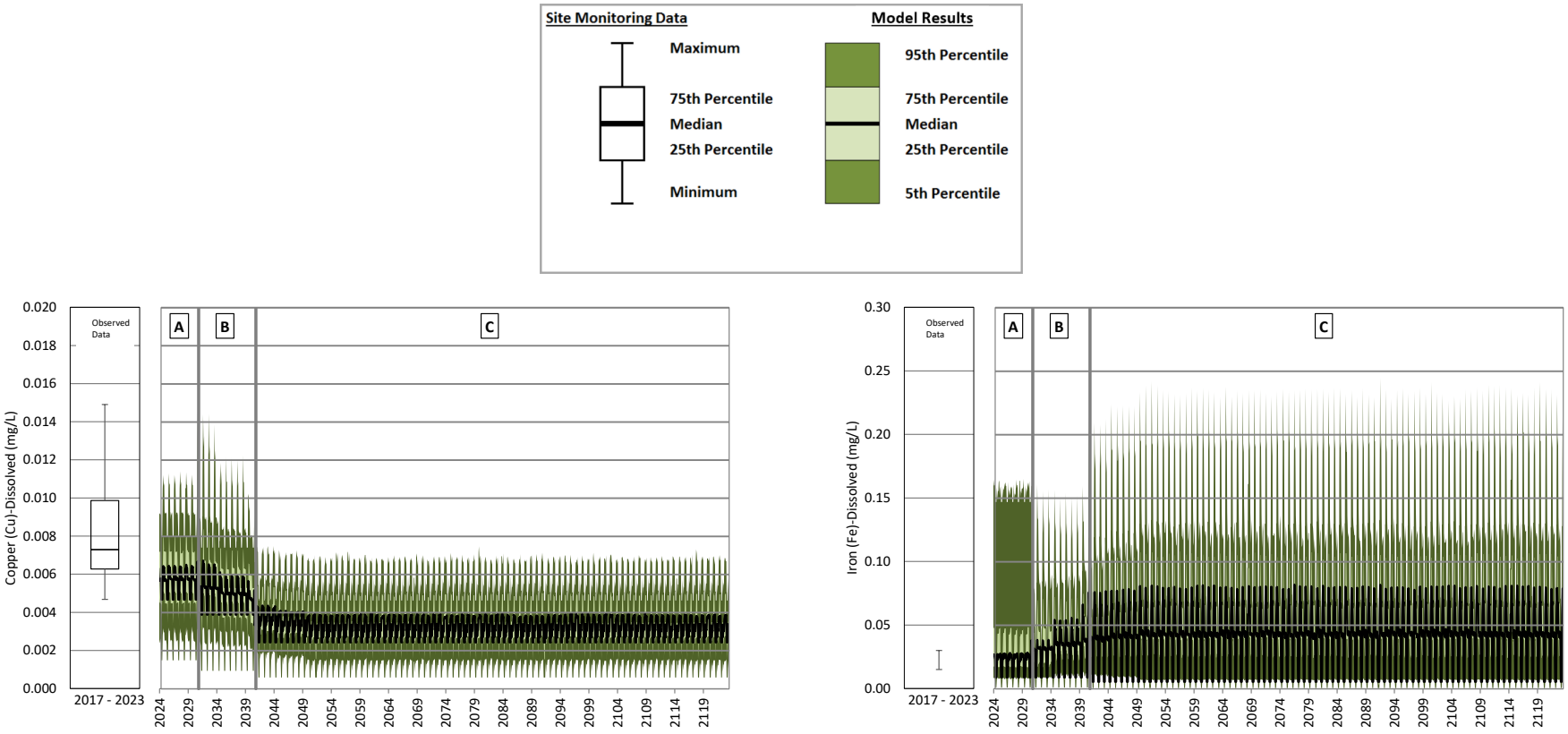

A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **172: Northwest Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

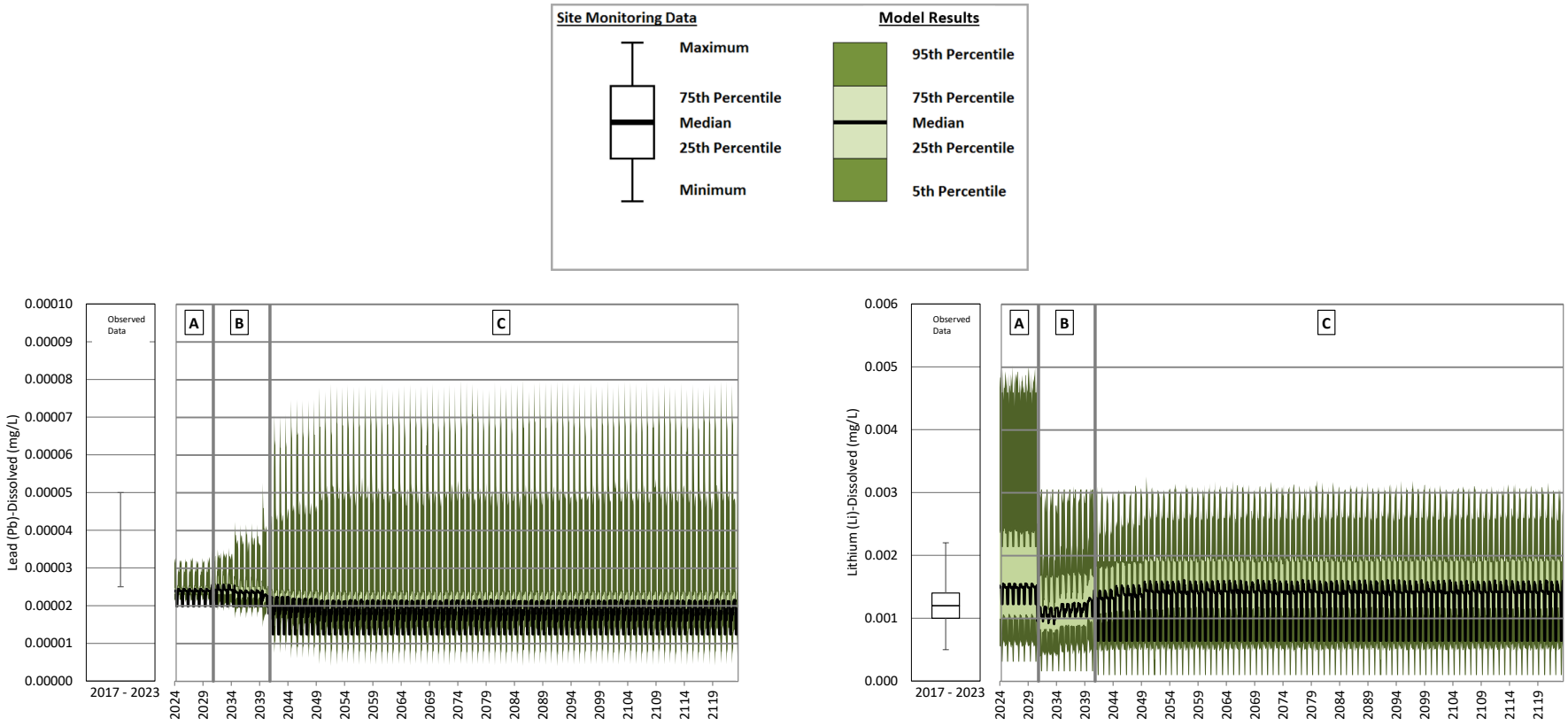

A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

Figure B **173: Northwest Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

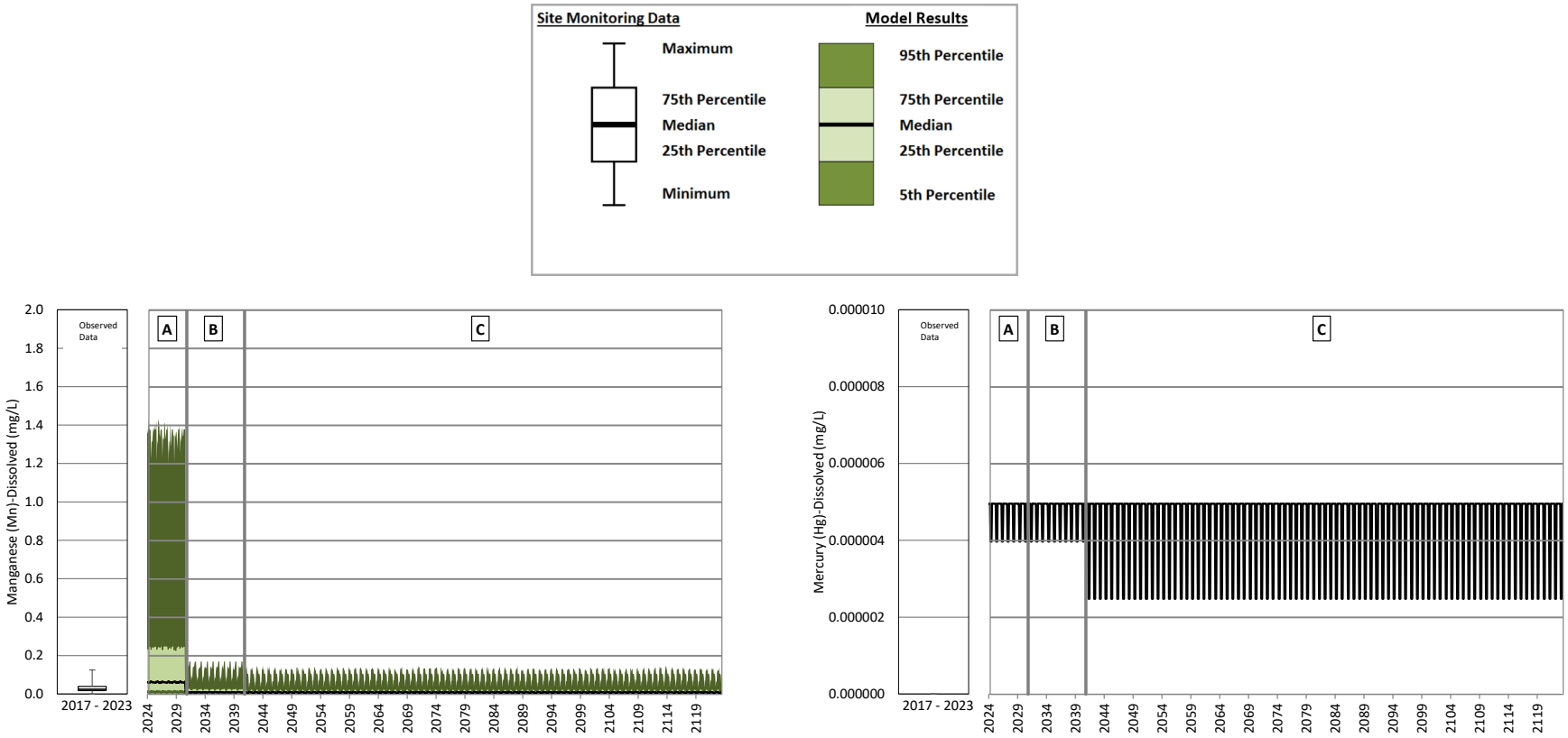

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **174: Northwest Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

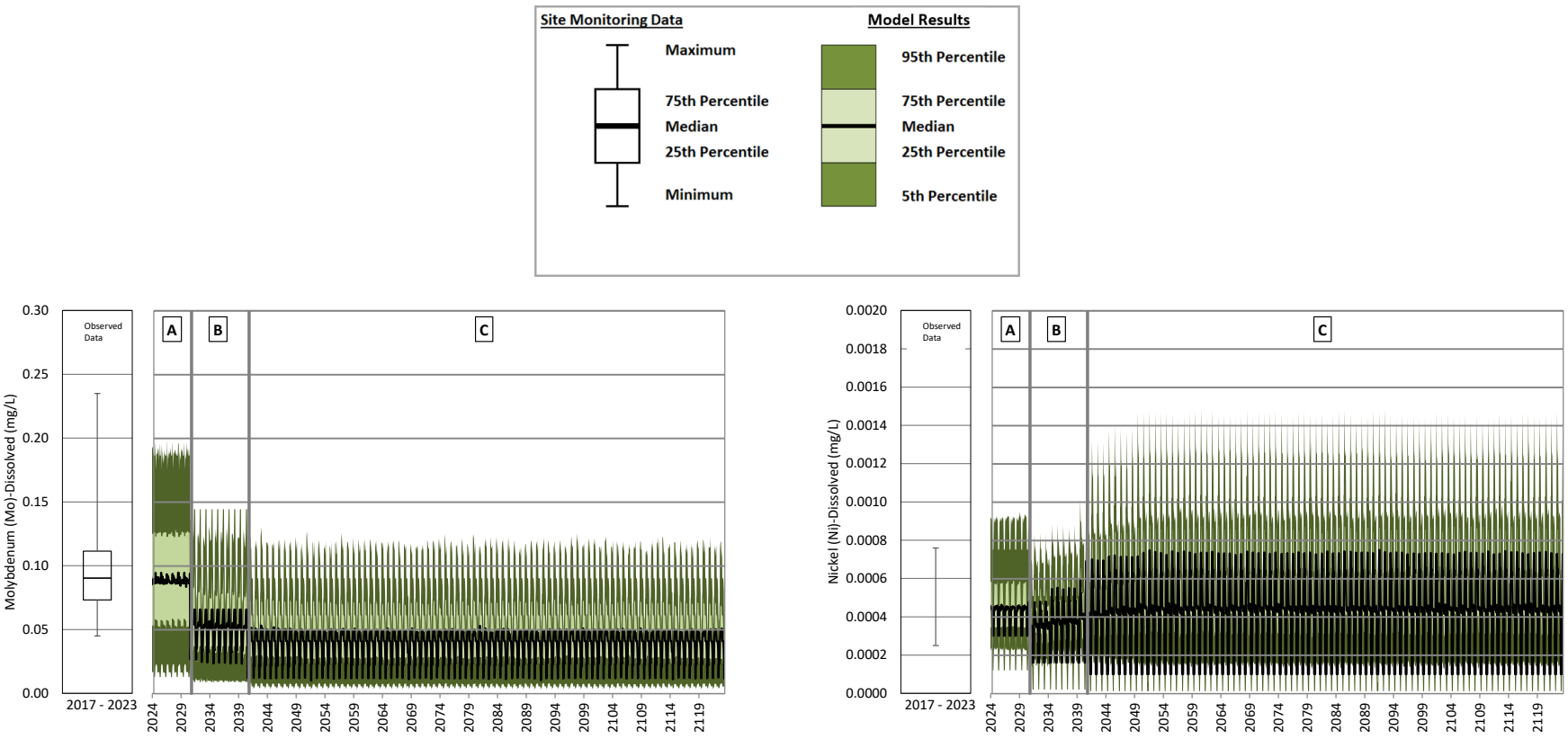

A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **175: Northwest Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

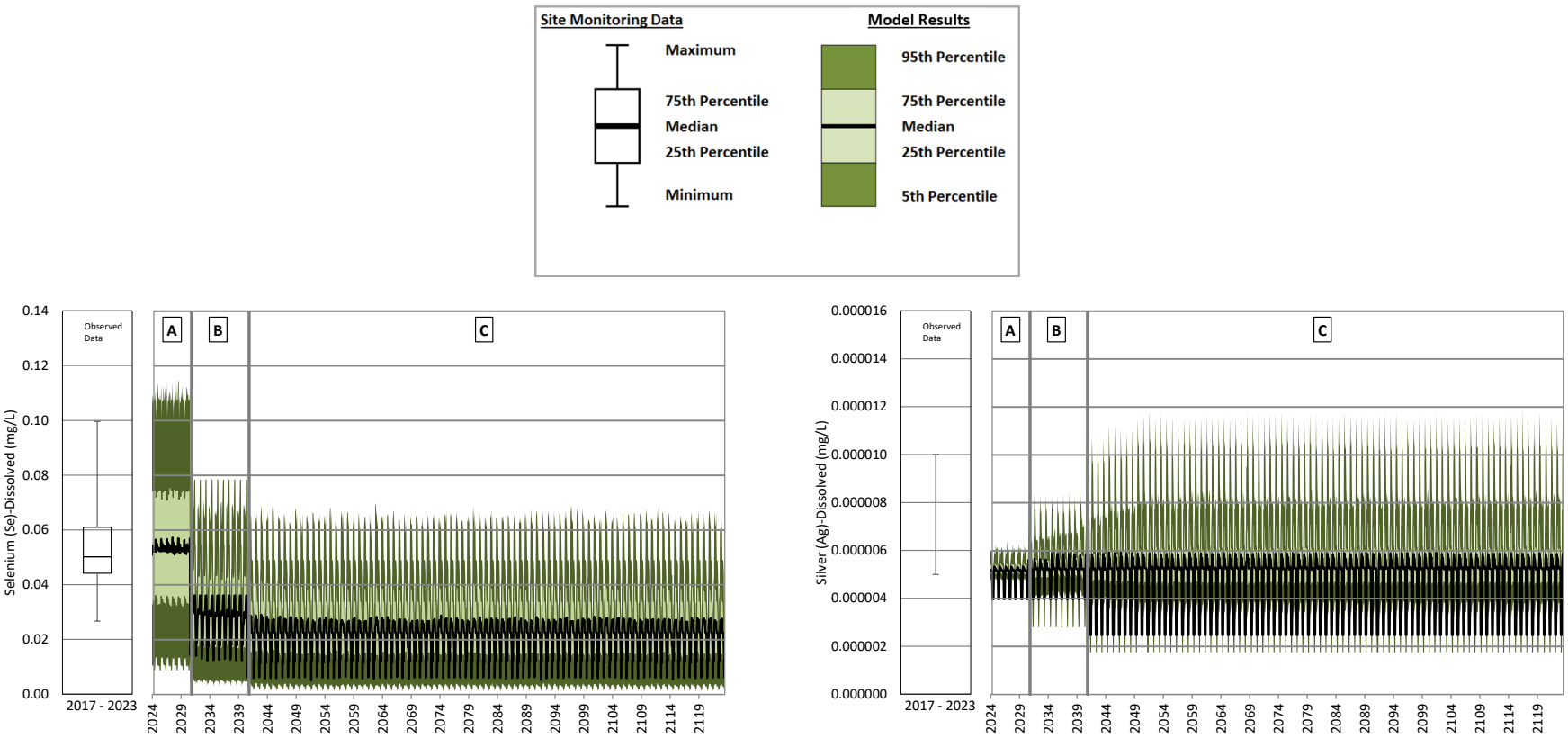

A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **176: Northwest Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

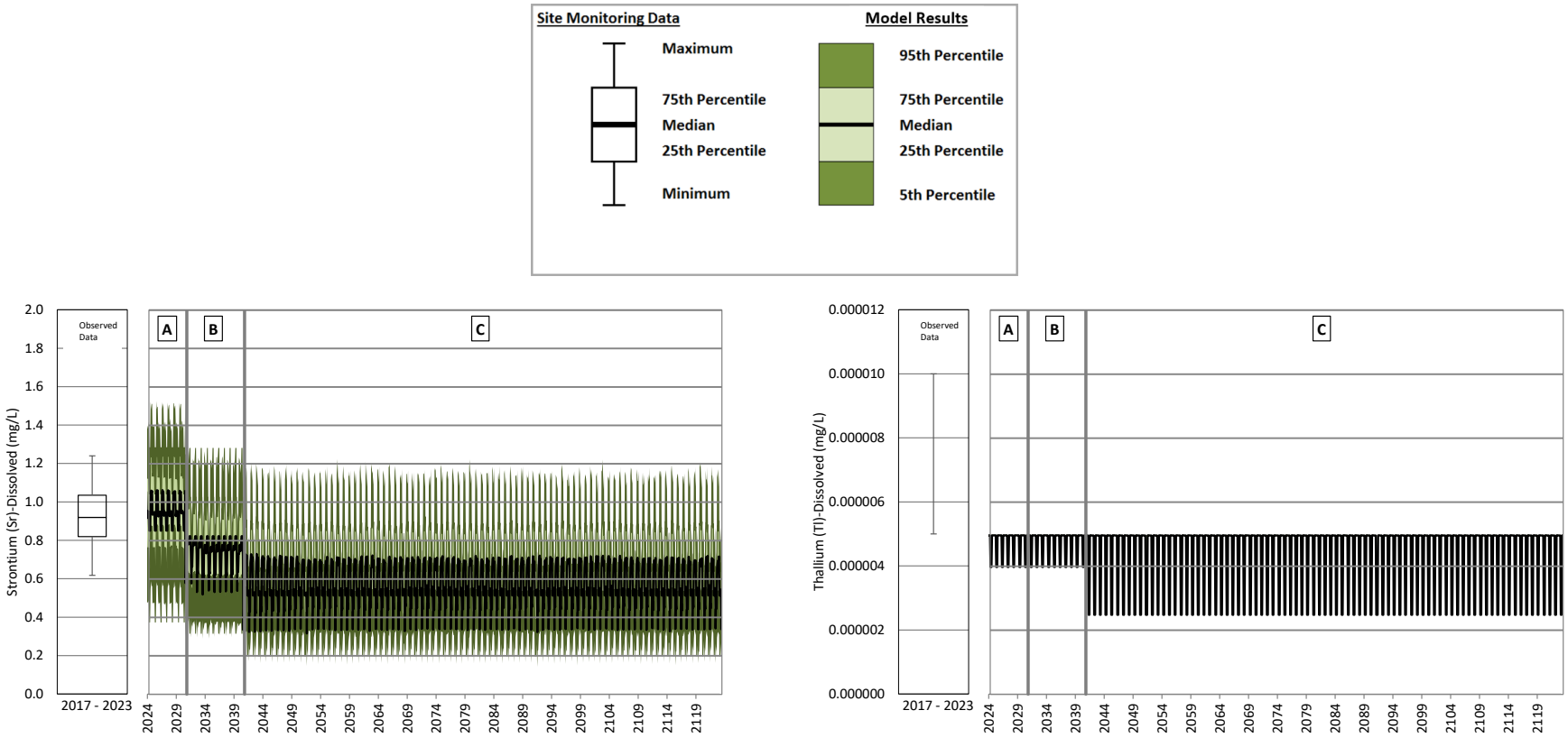

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **177: Northwest Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

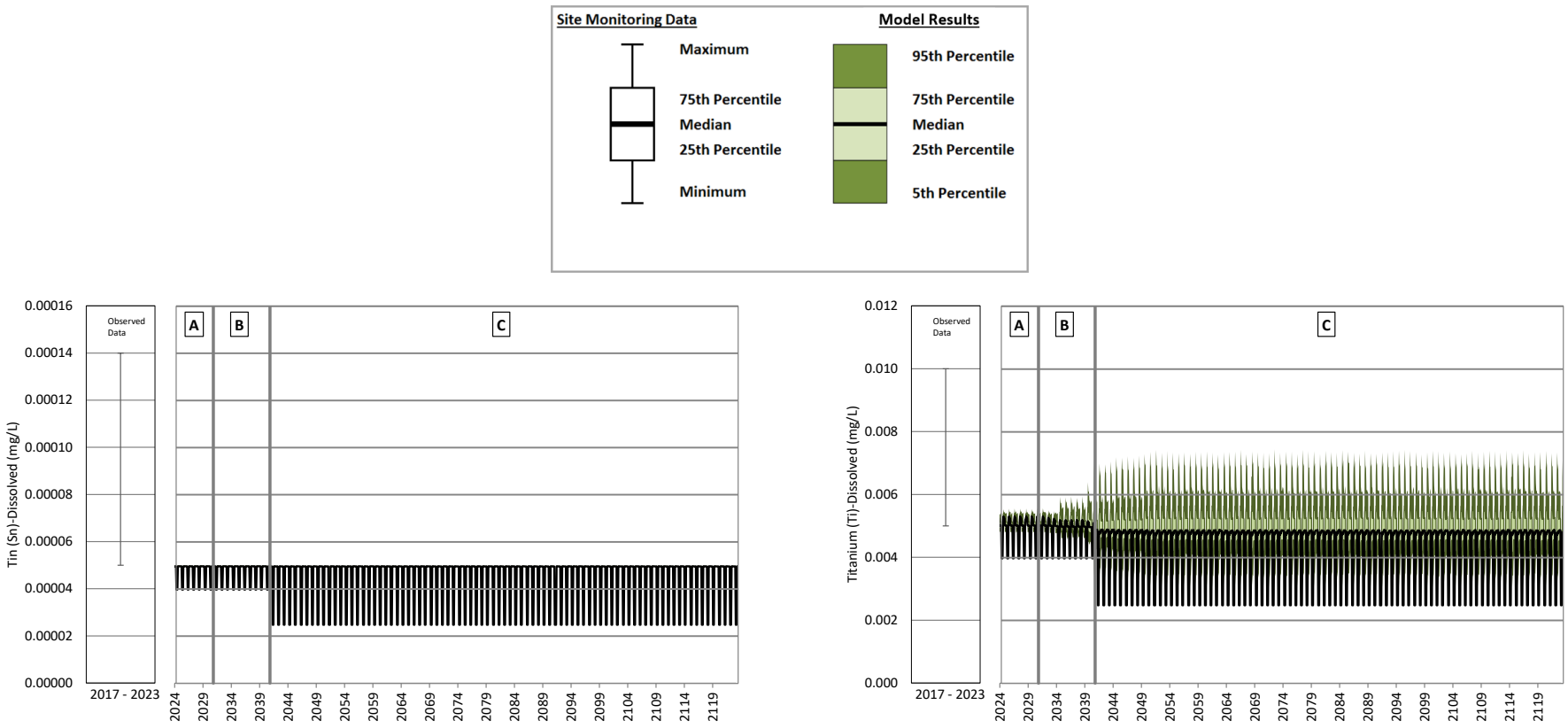

A = Operations; B = Closure; C = Post-closure

Note: Dissolved titanium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs.

Figure B **178: Northwest Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

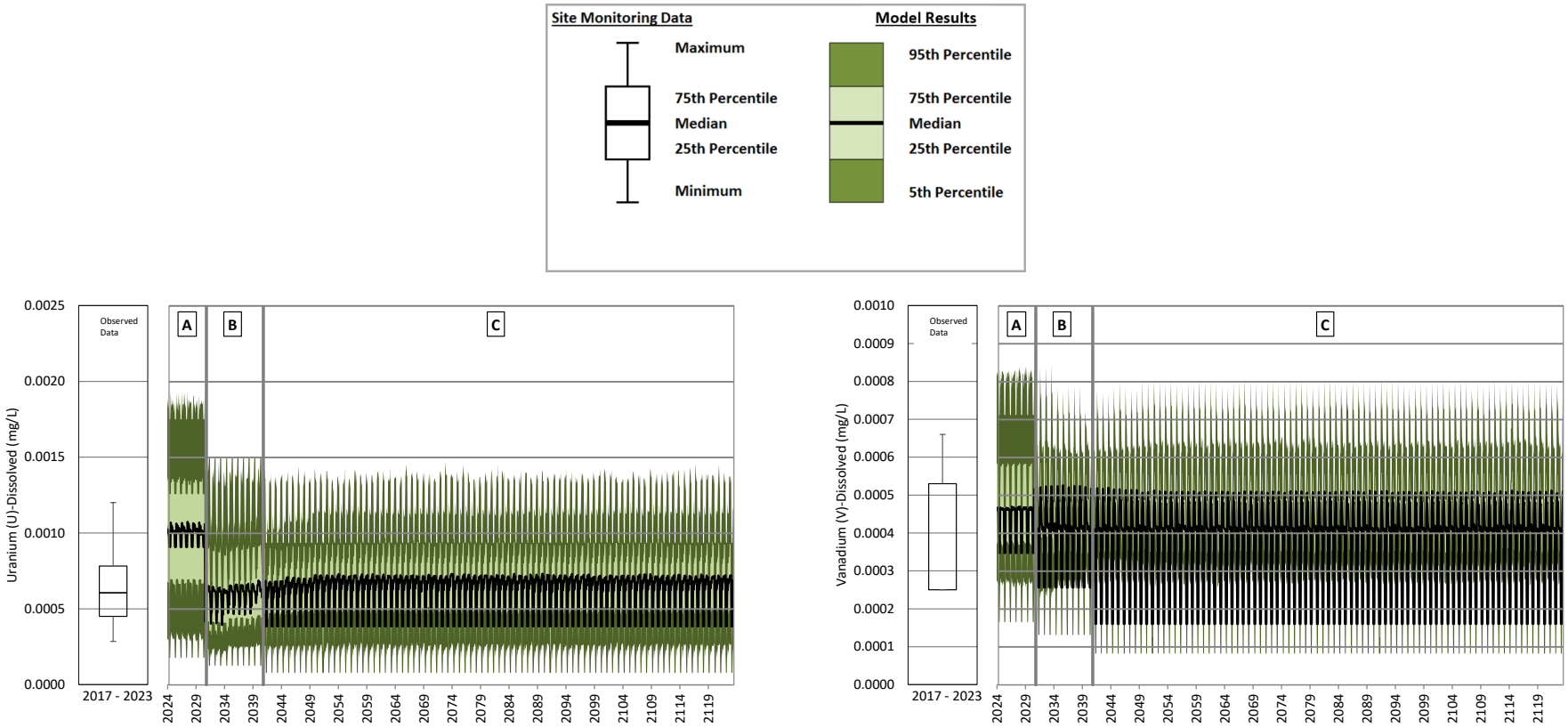

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **179: Northwest Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

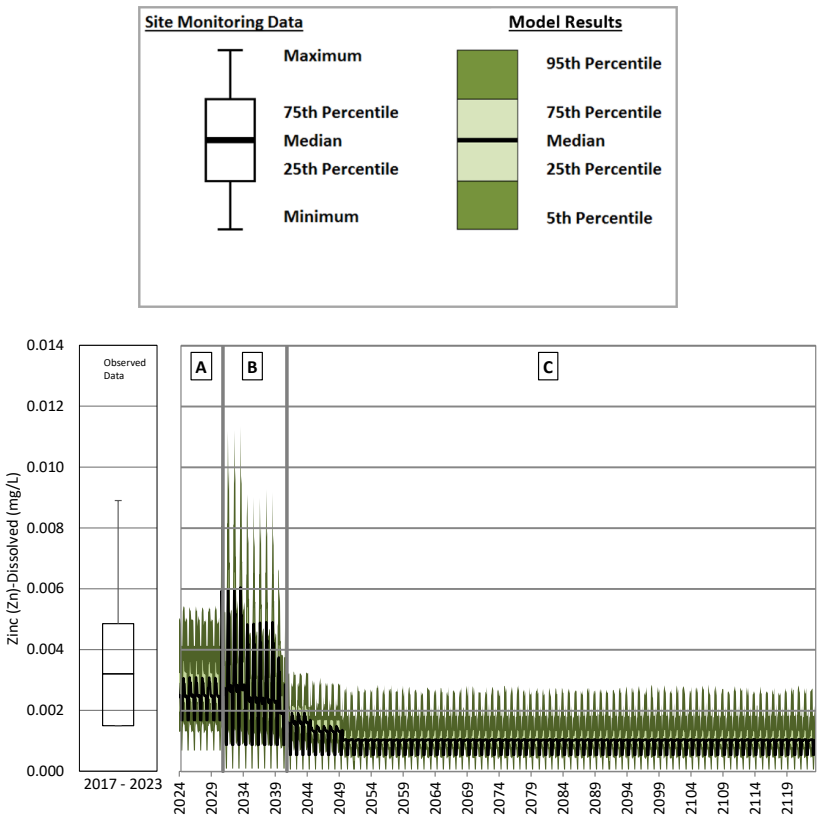

A = Operations; B = Closure; C = Post-closure

Note: Maximum dissolved zinc concentrations increase during closure when seepage from the Temporary NW PAG Stockpile changes from the PAG water quality input to the NAG water quality input. The NAG water quality input has higher dissolved sicn concentrations than the Pag water quality input. Dissolved zinc concentrations decrease from closure and post-closure as runoff areas are remediated.

Figure B **180: Northwest Sump Operations, Closure and Post-closure – Dissolved Zinc**

South Embankment Seepage Collection

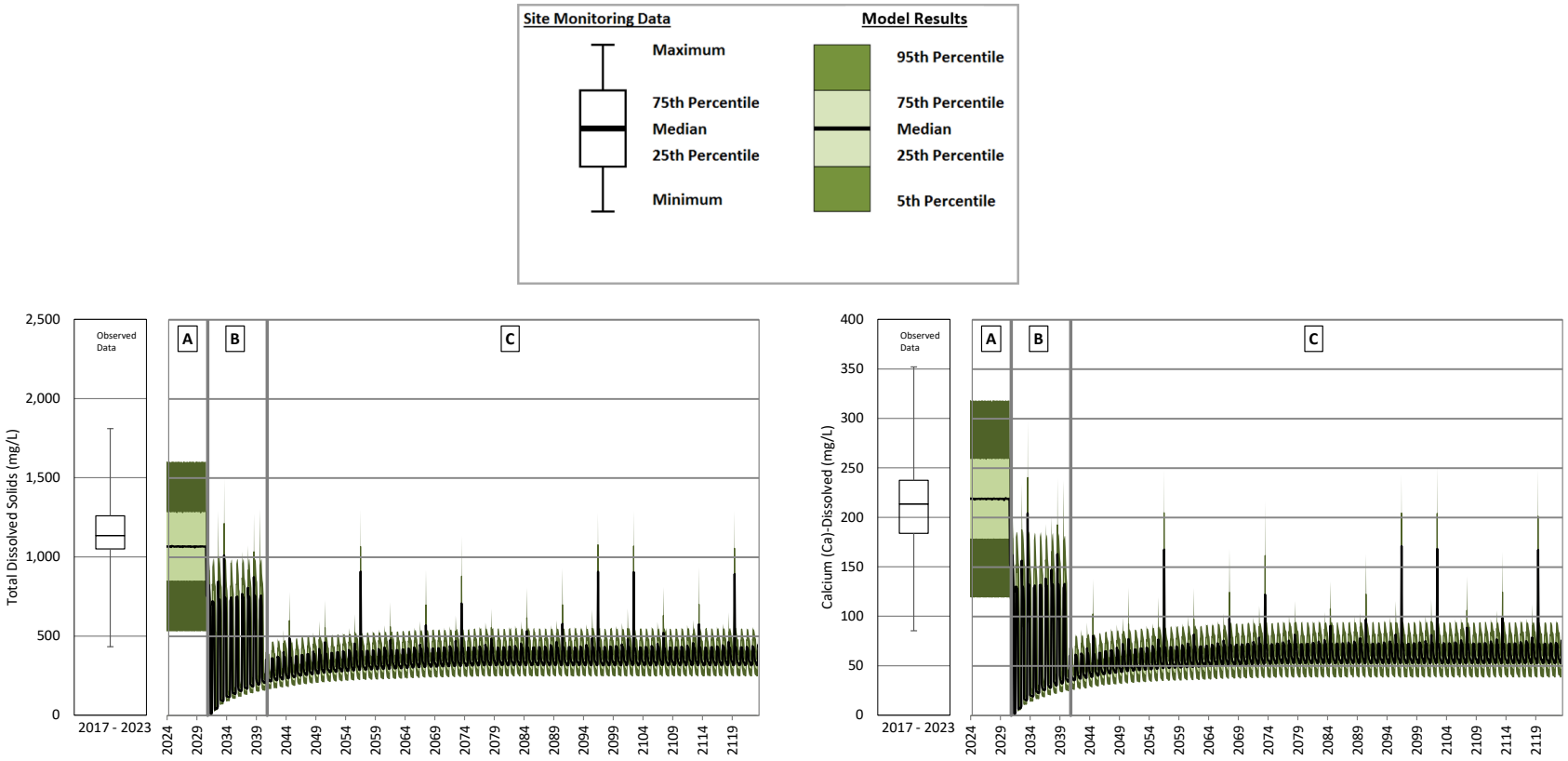

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **181: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

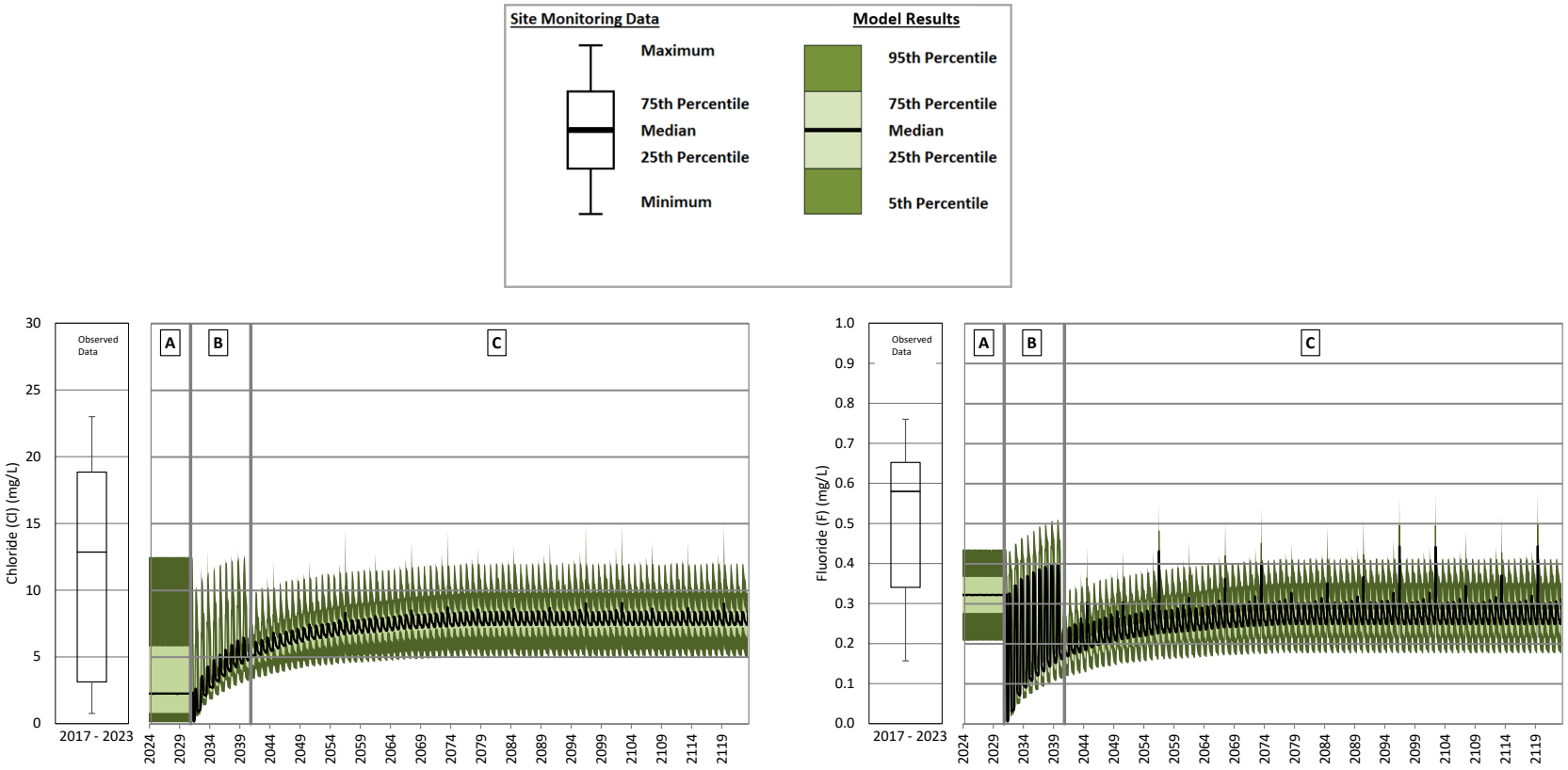

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **182: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Chloride and Fluoride**

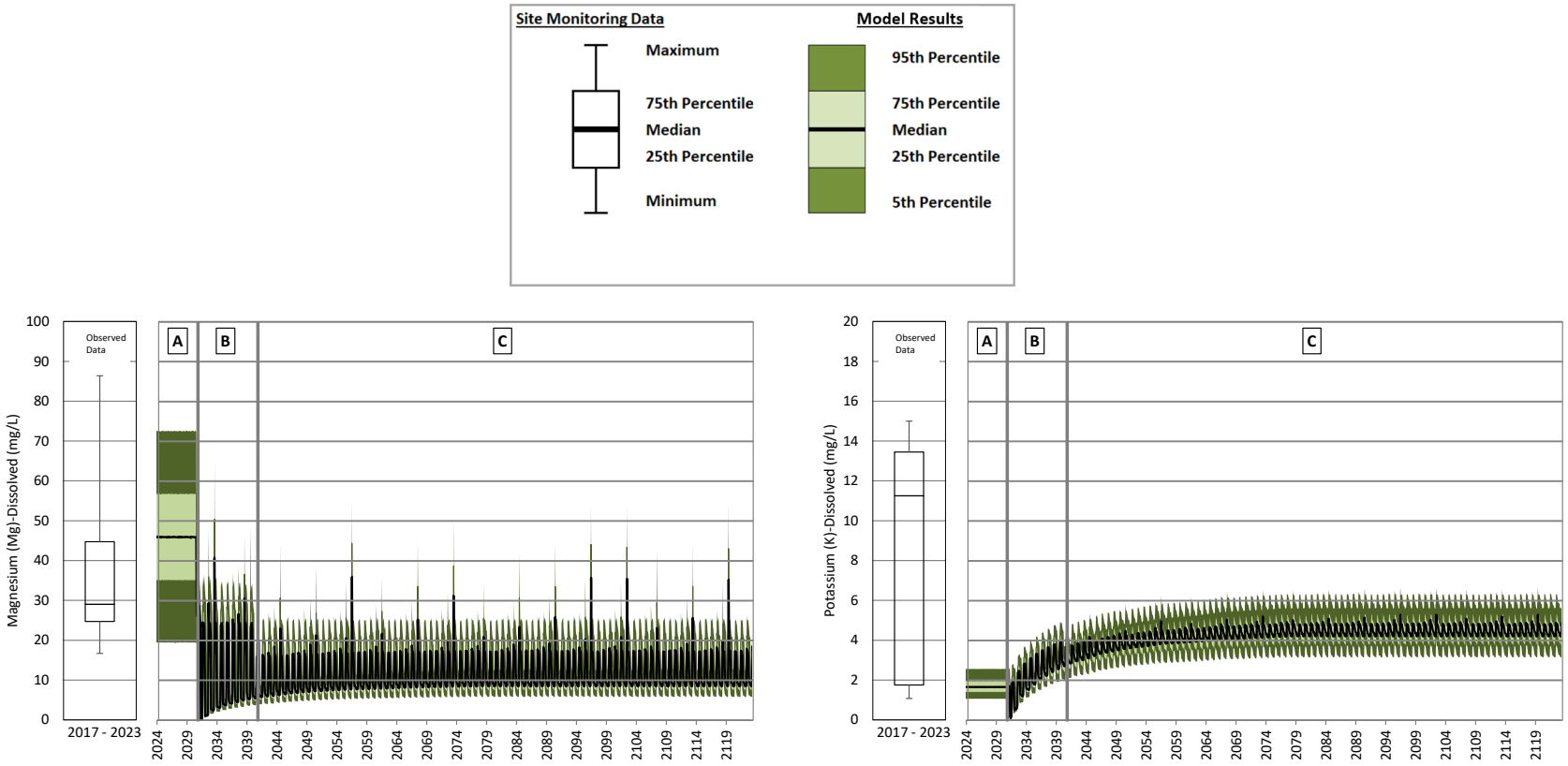

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **183: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Magnesium and Potassium**

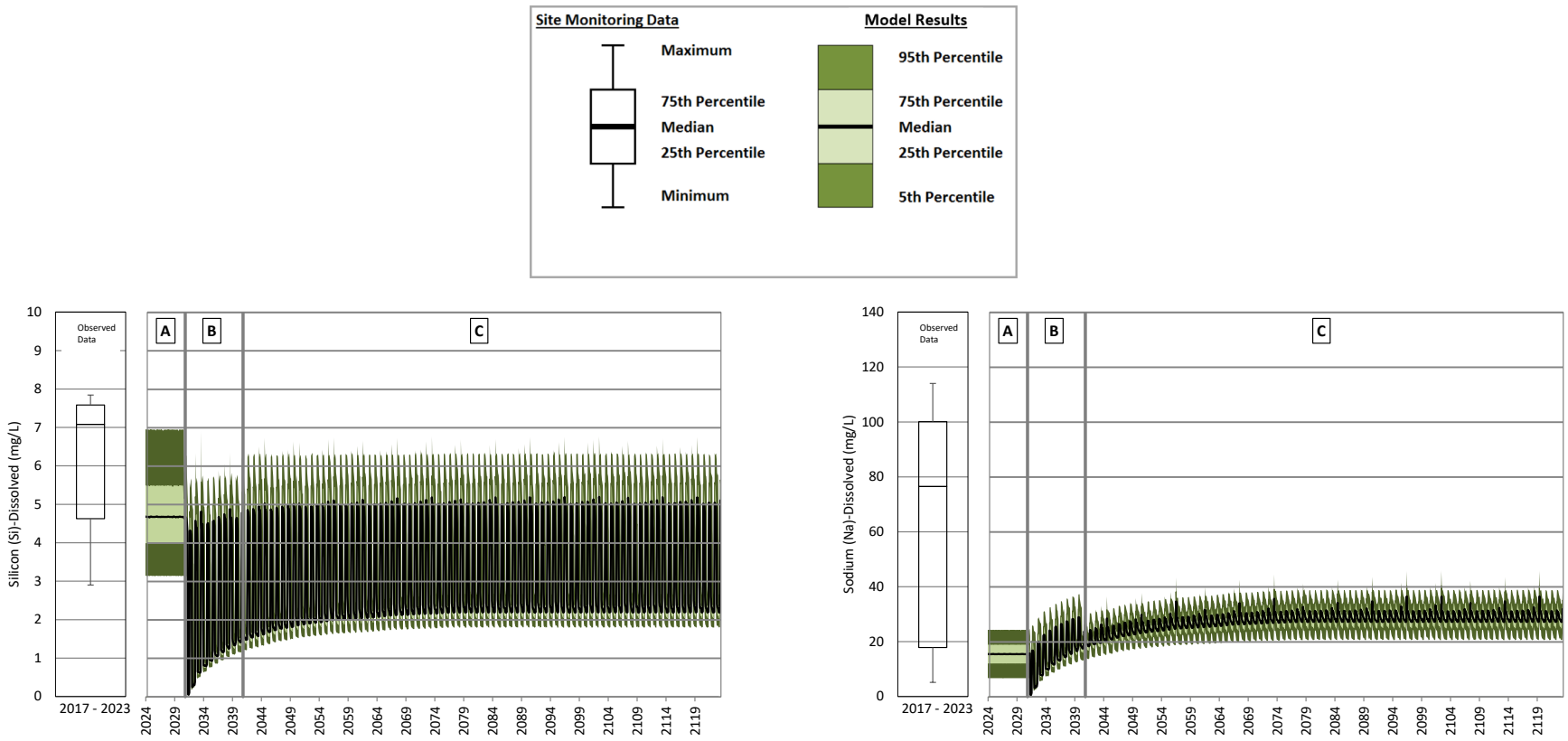

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **184: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Silicon and Sodium**

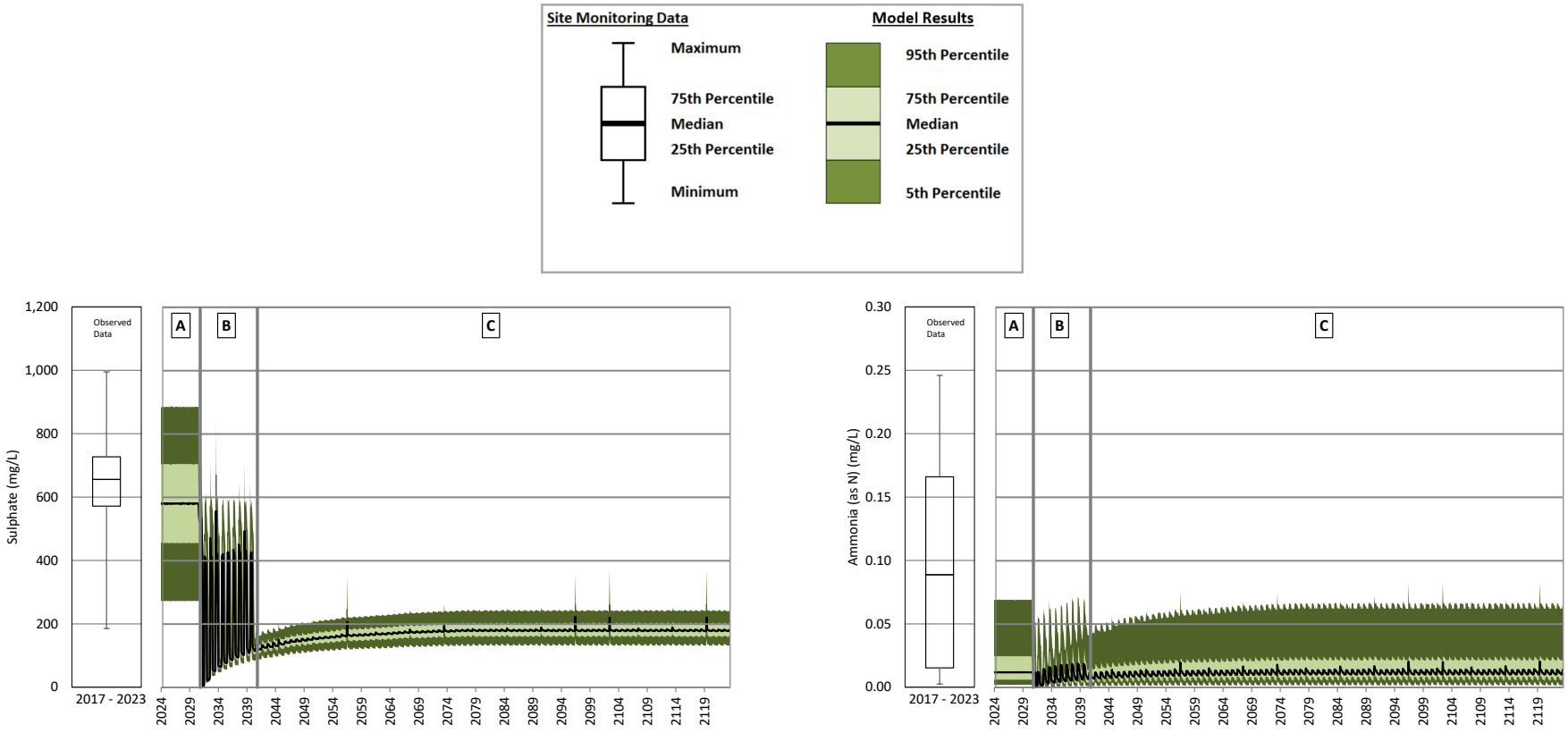

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **185: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**

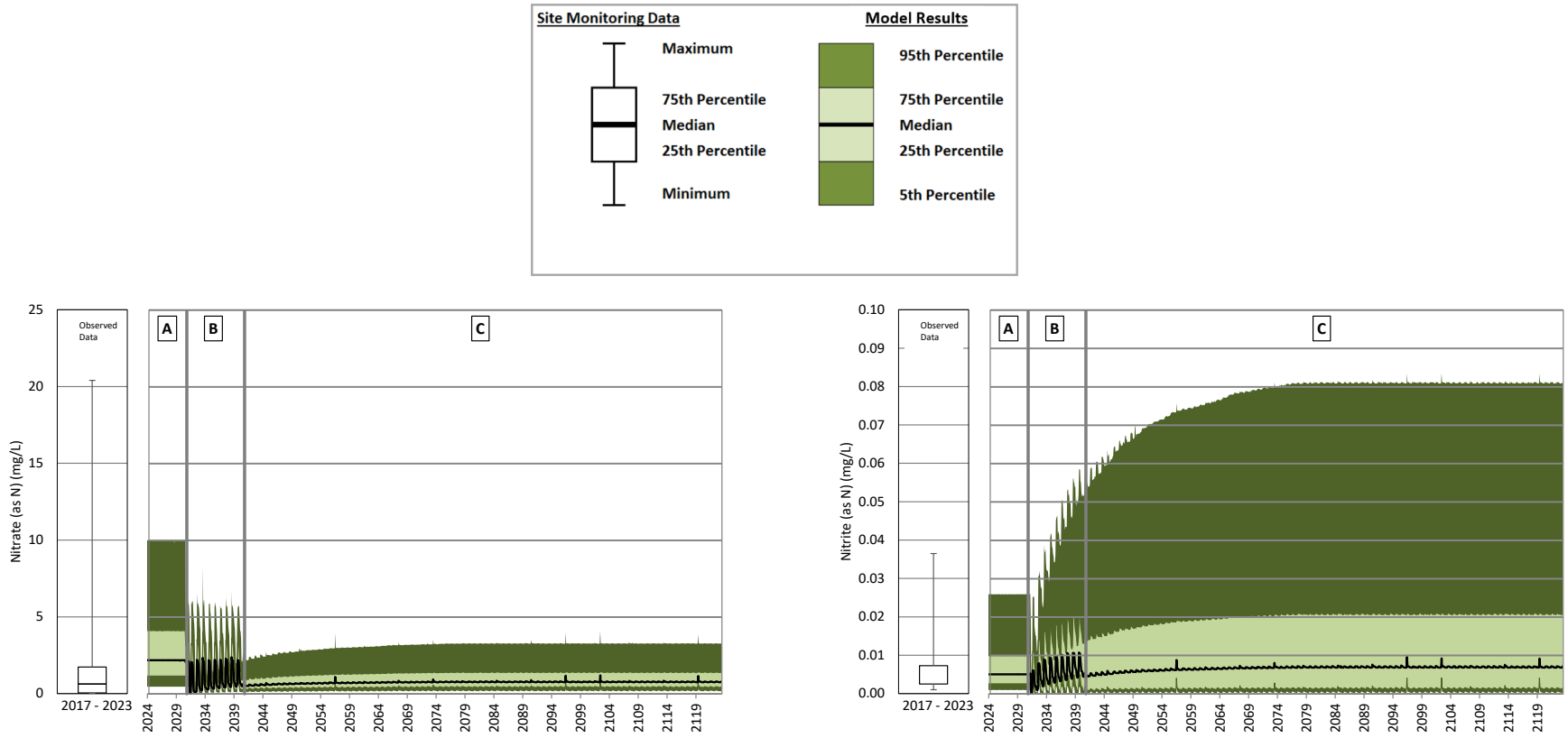

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **186: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Nitrate and Nitrite**

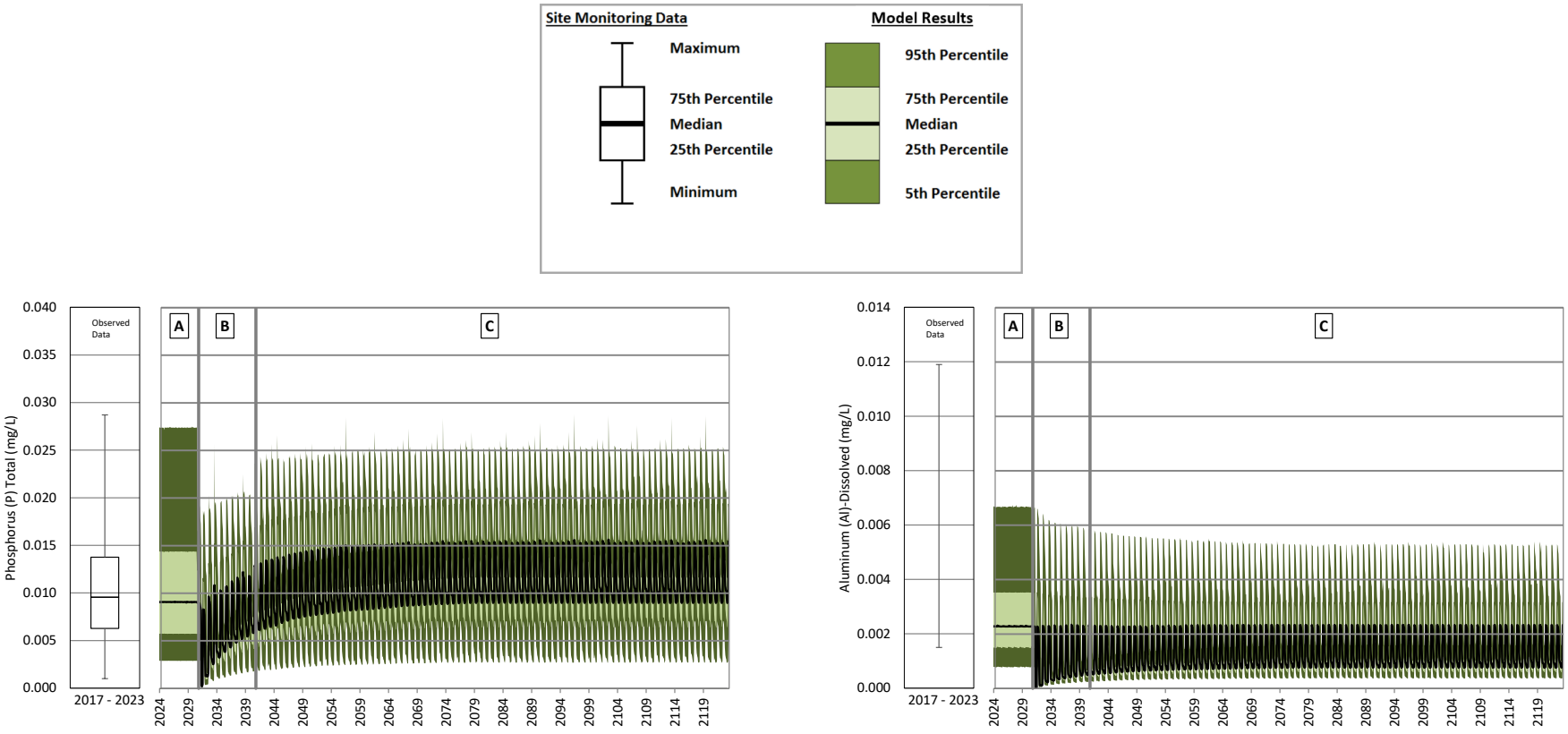

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in total phosphorus concentrations from 2031 to 2074 and the decrease in dissolved aluminum concentrations are due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **187: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

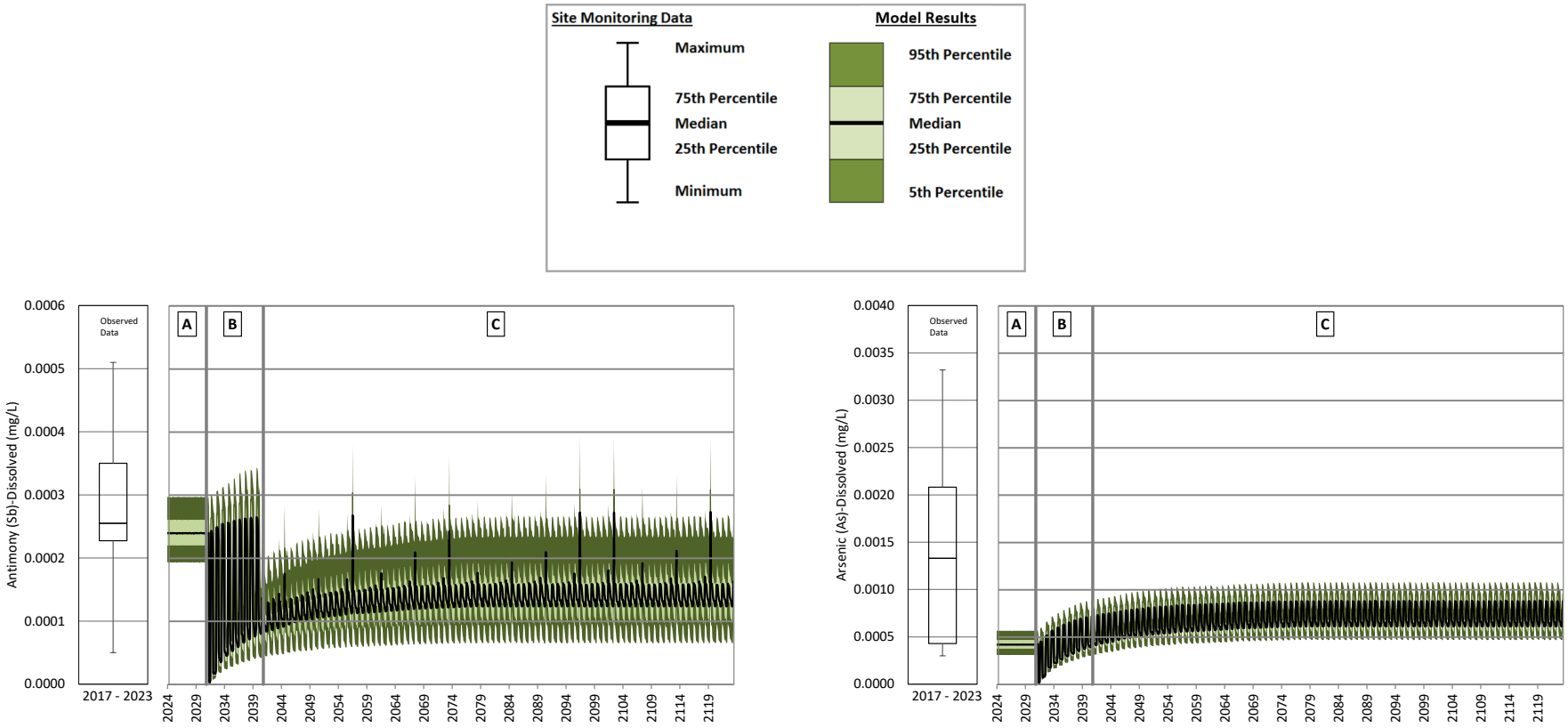

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **188: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

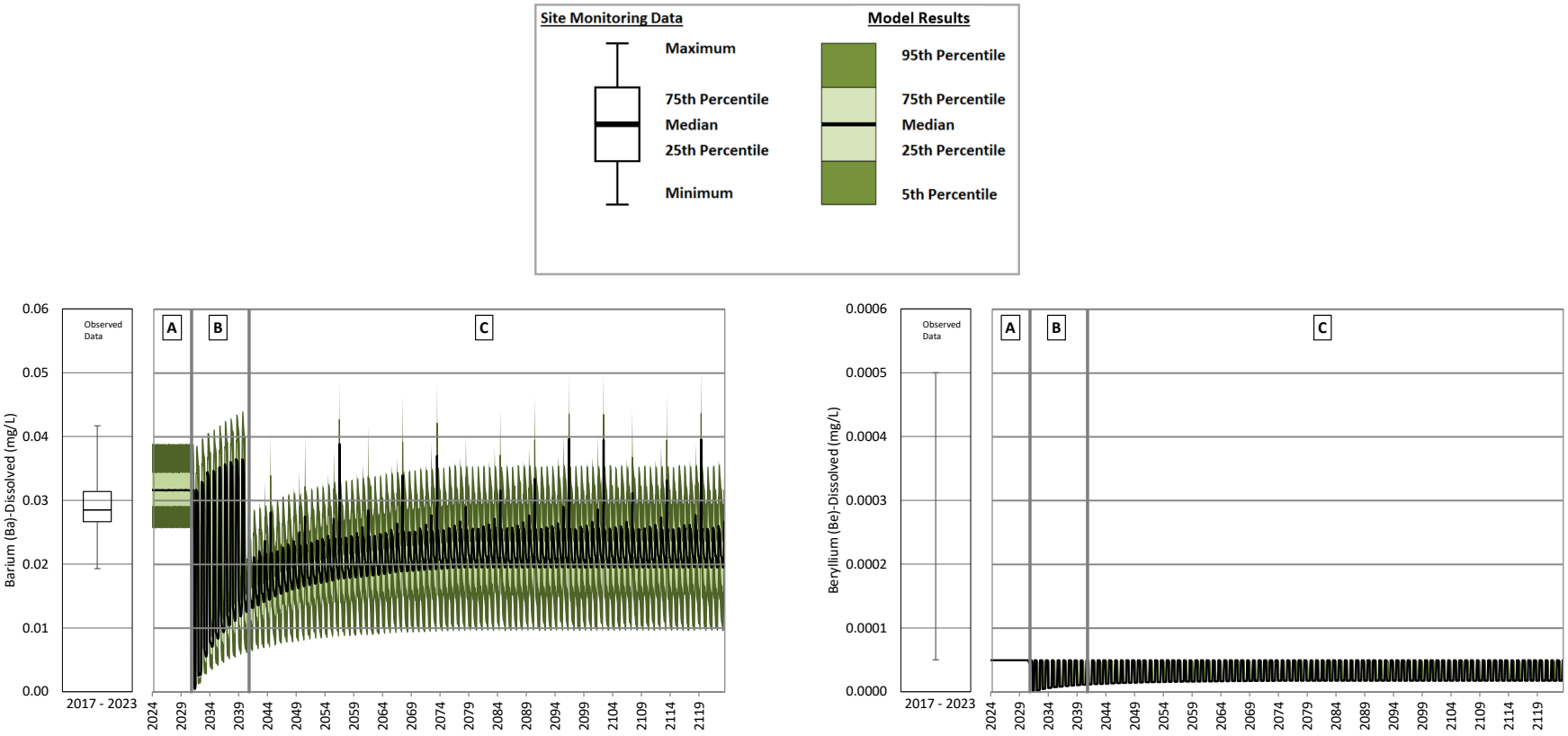

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **189: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

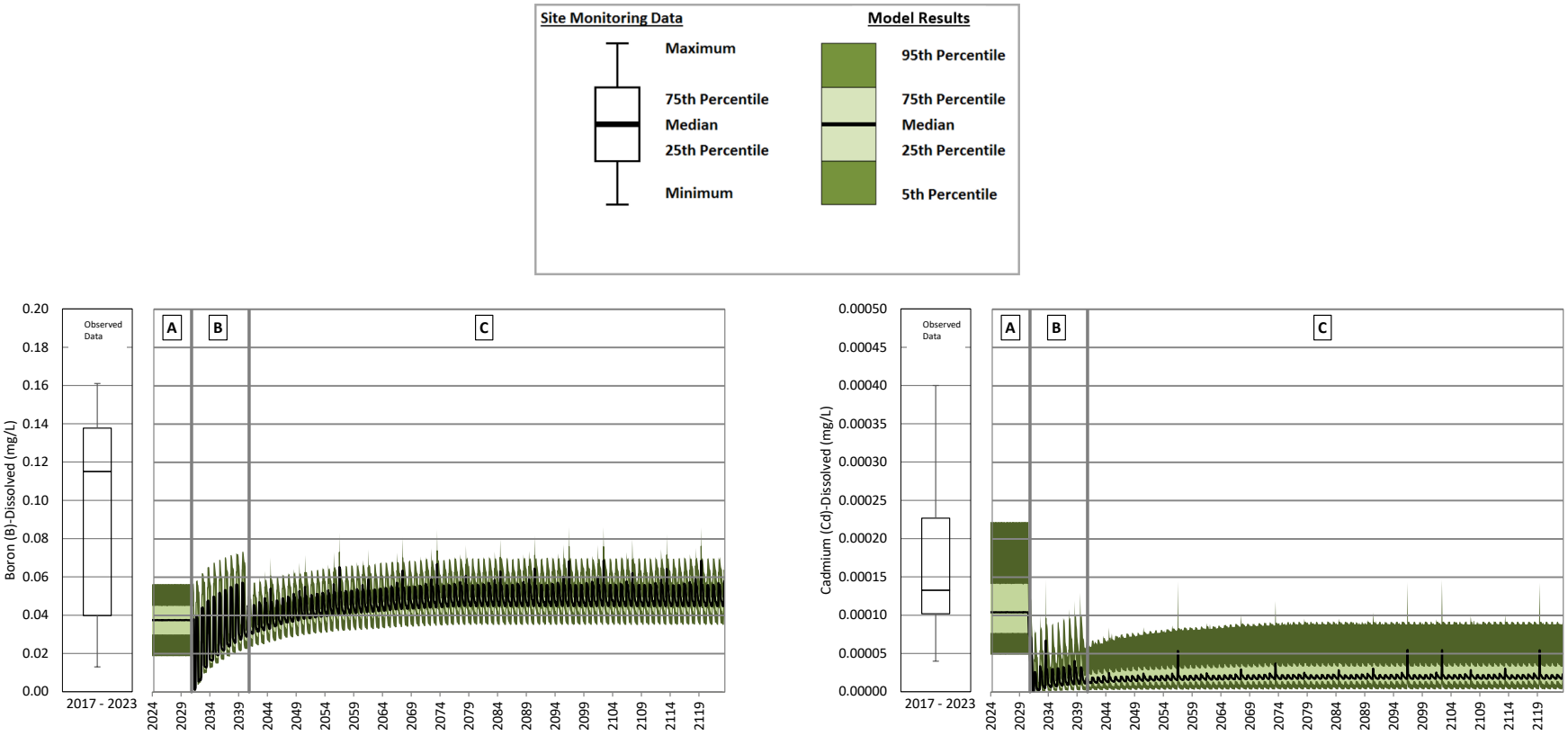

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **190: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

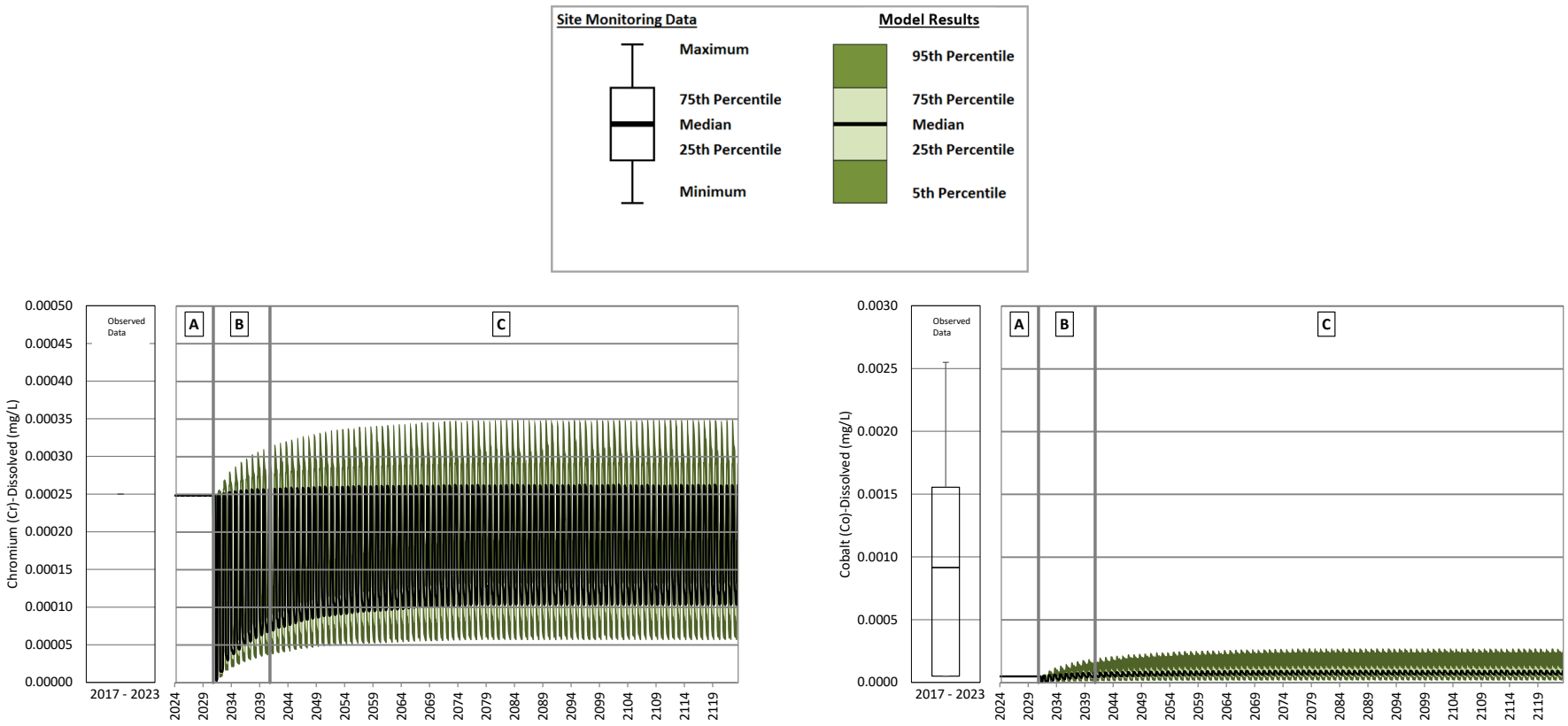

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **191: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

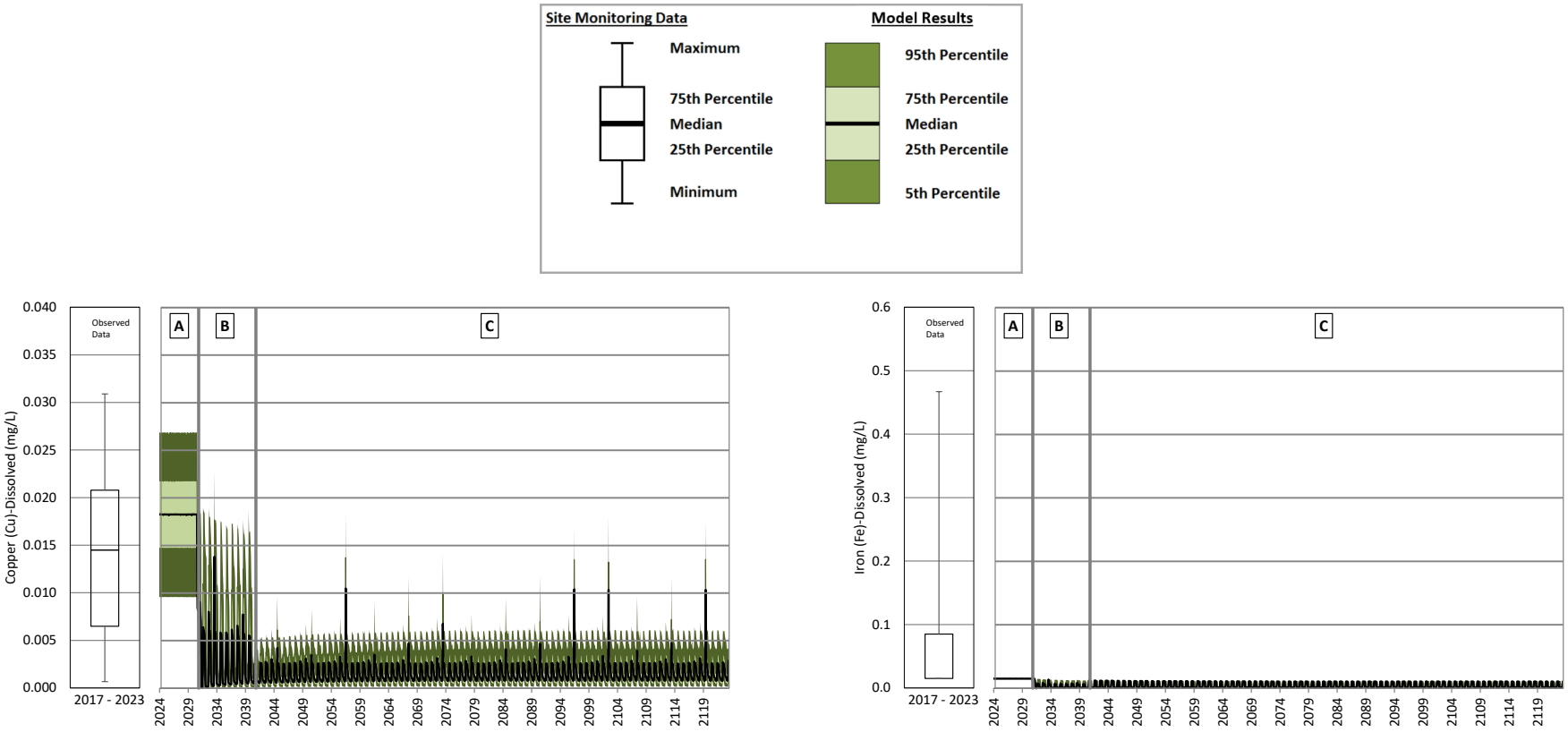

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **192: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

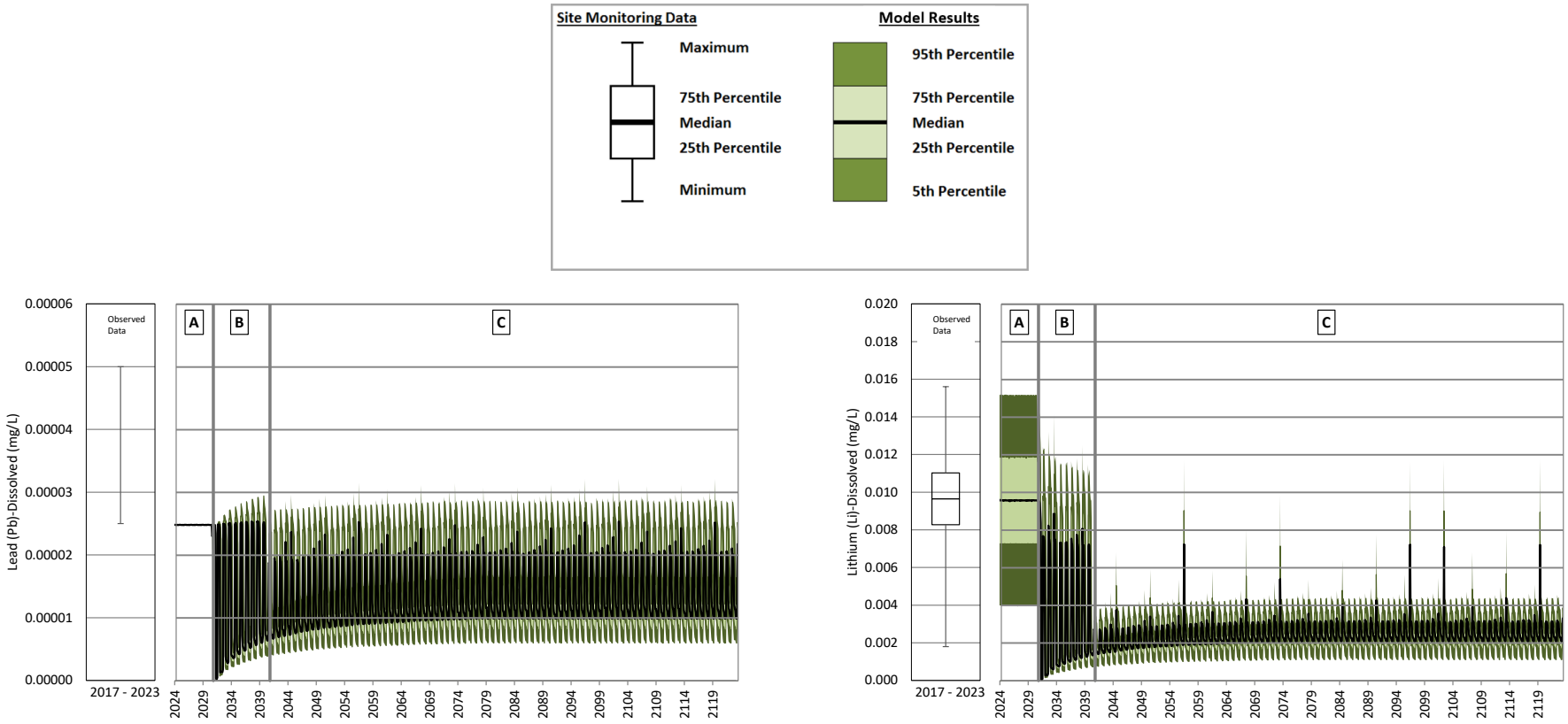

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **193: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

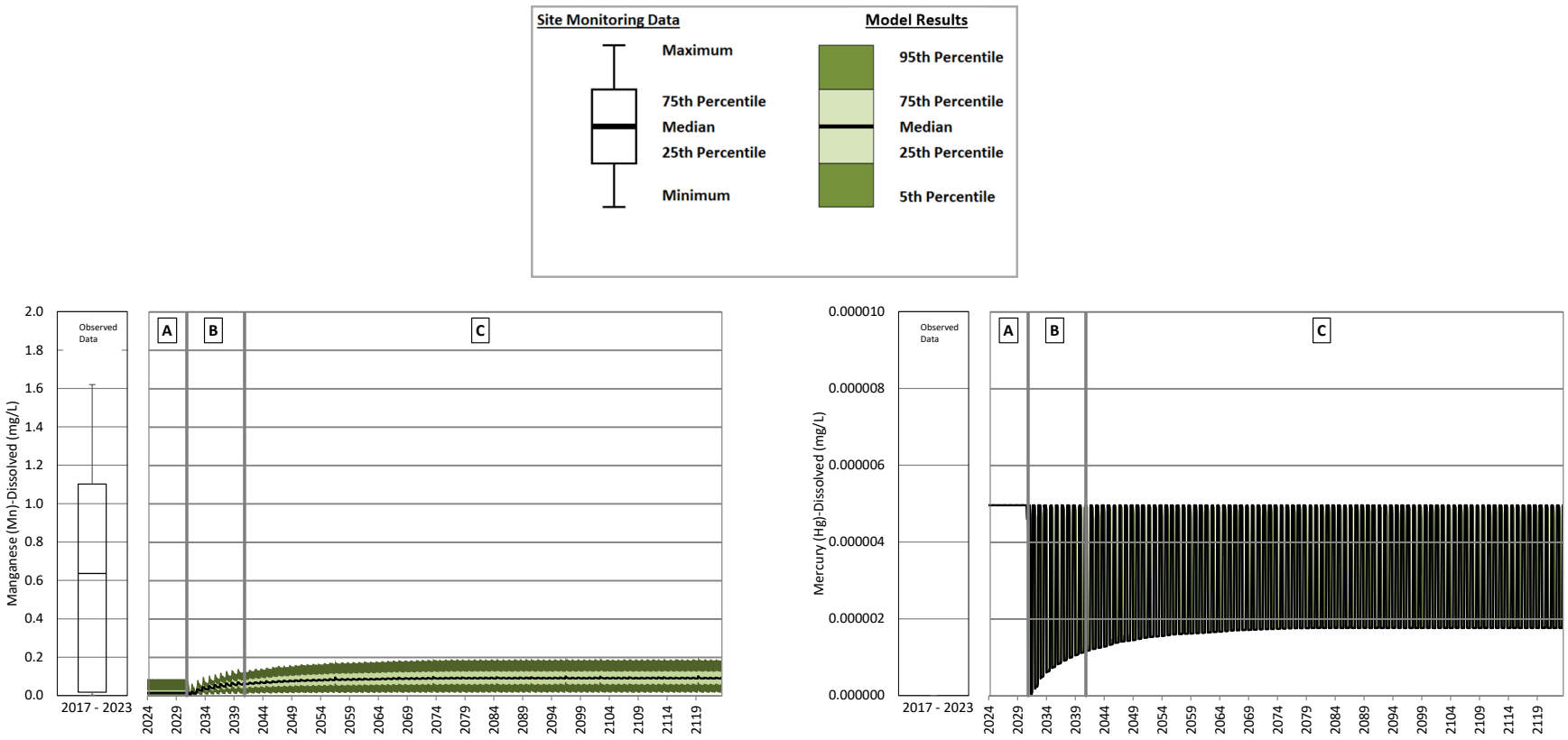

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **194: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

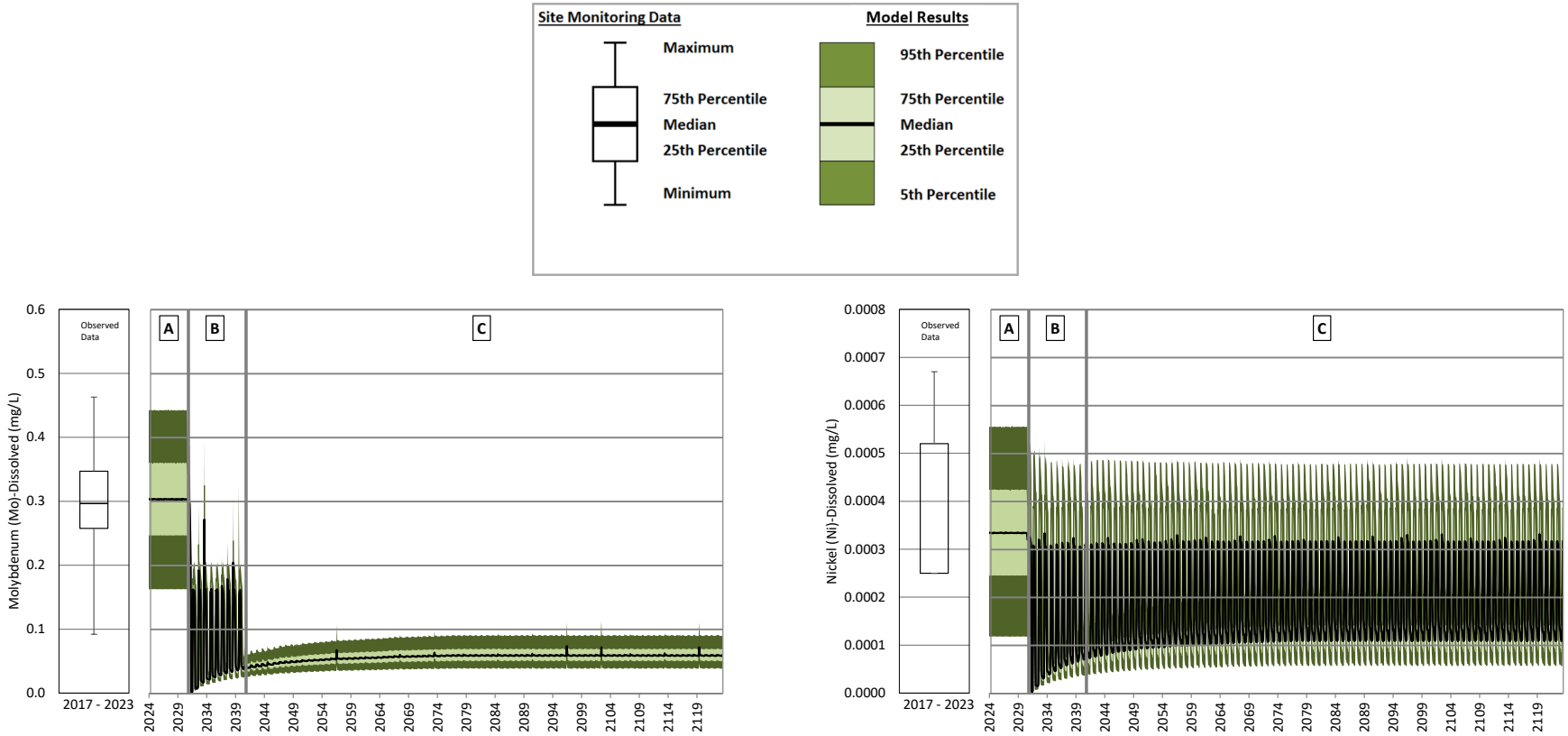

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **195: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

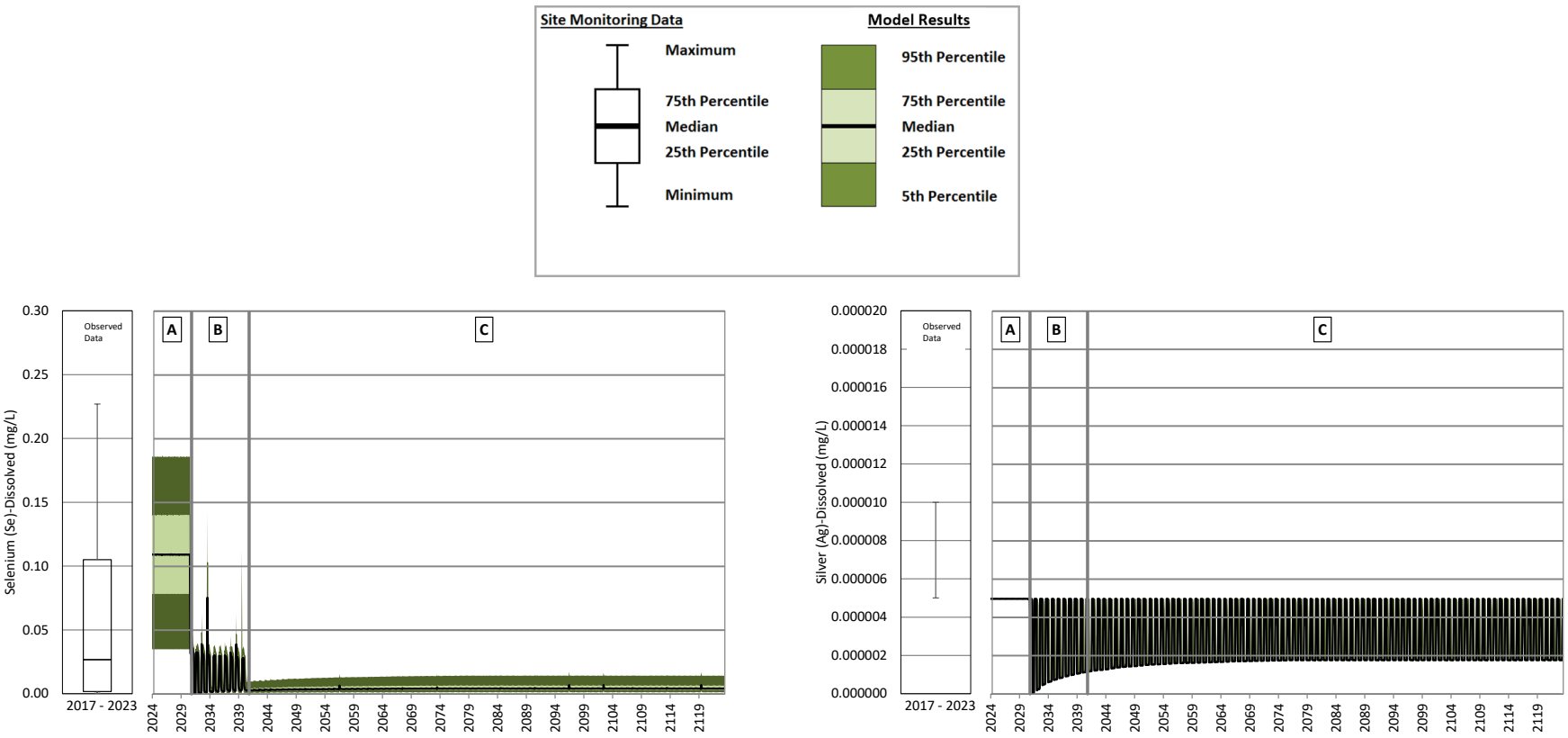

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **196: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

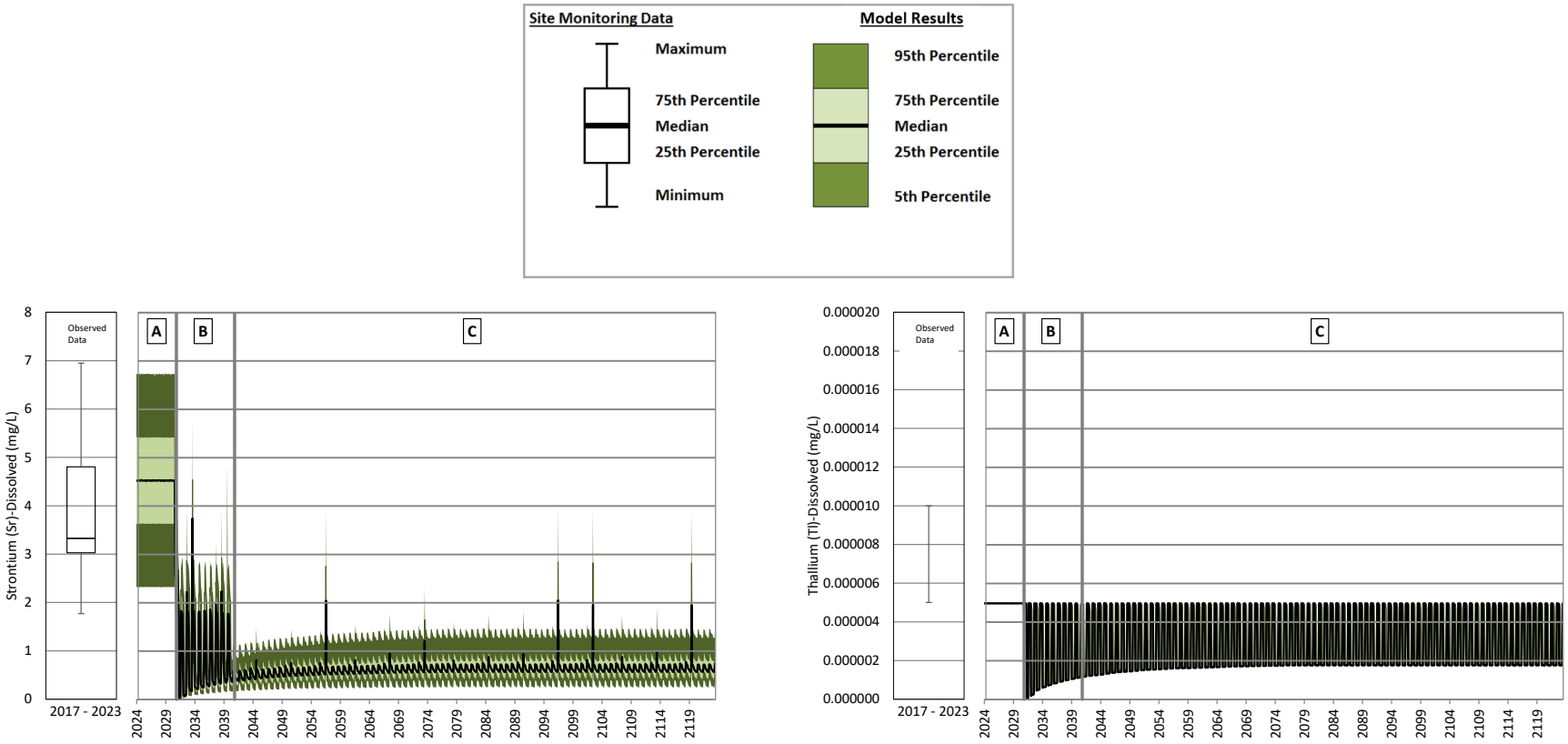

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **197: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

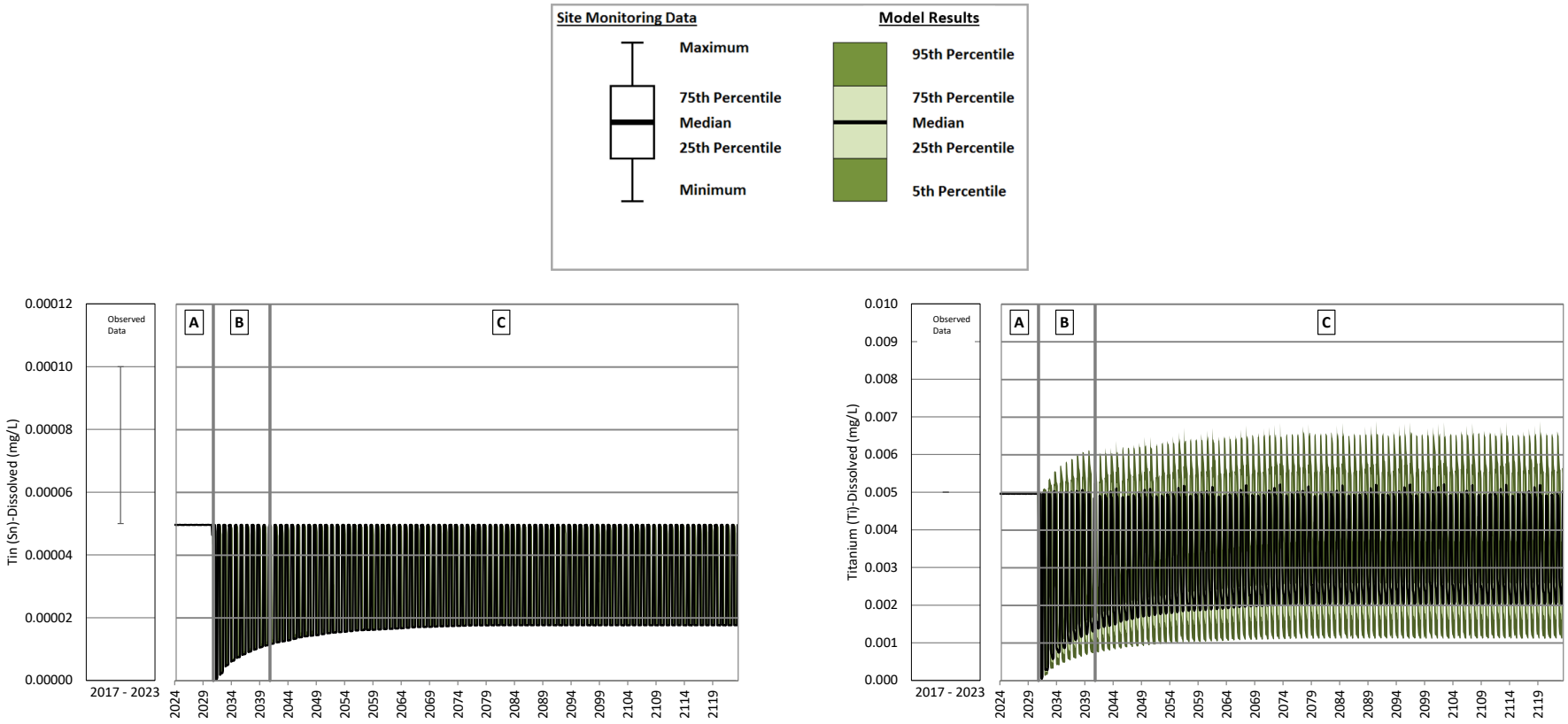

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **198: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

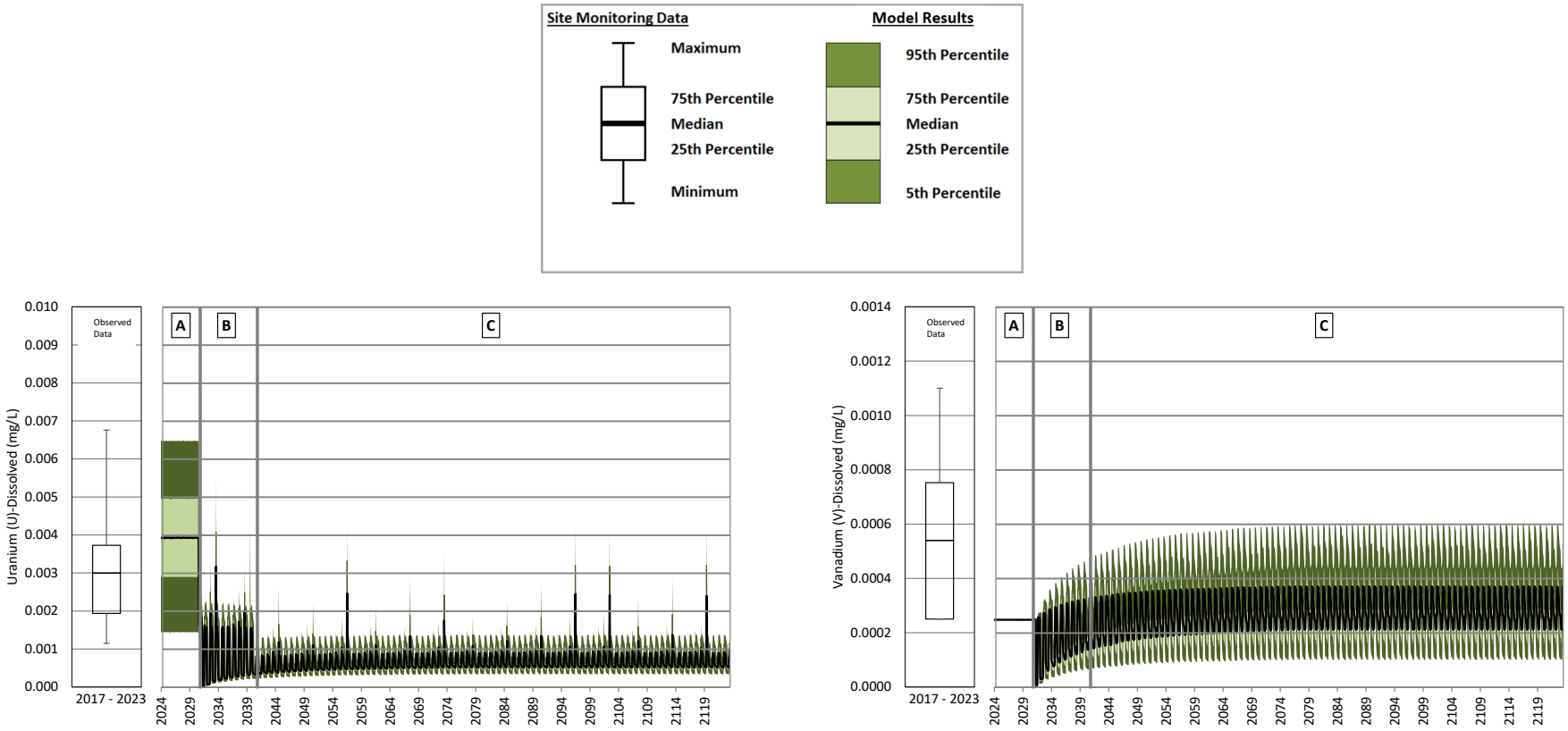

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **199: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

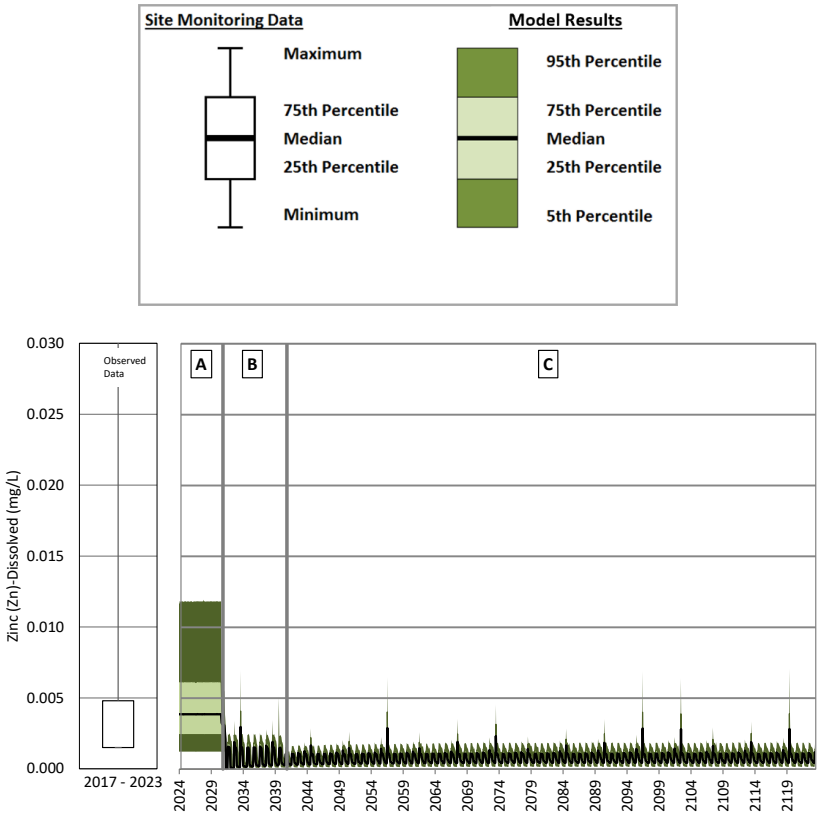

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **200: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Zinc**

Main Embankment Seepage Collection

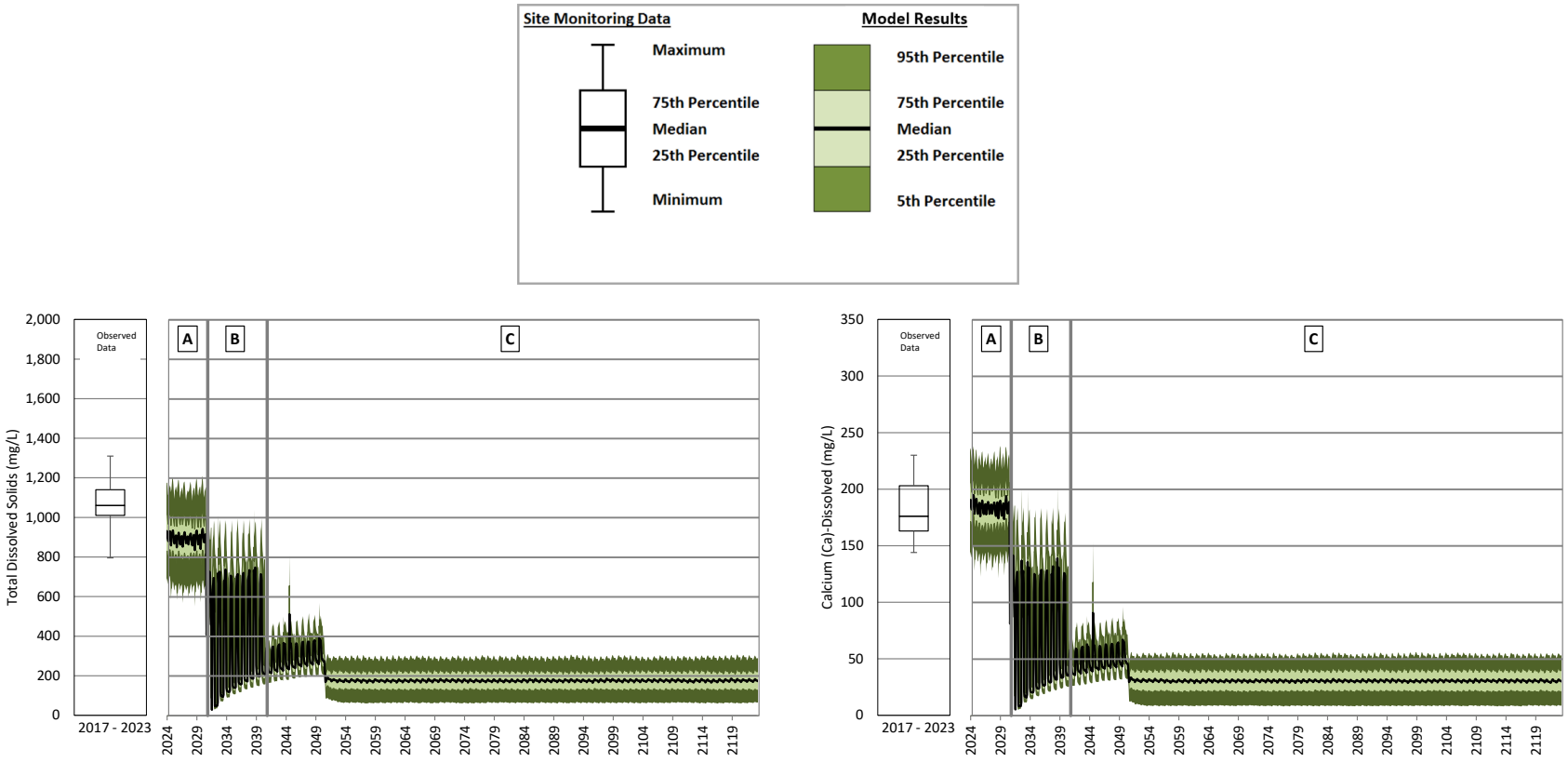

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **201: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

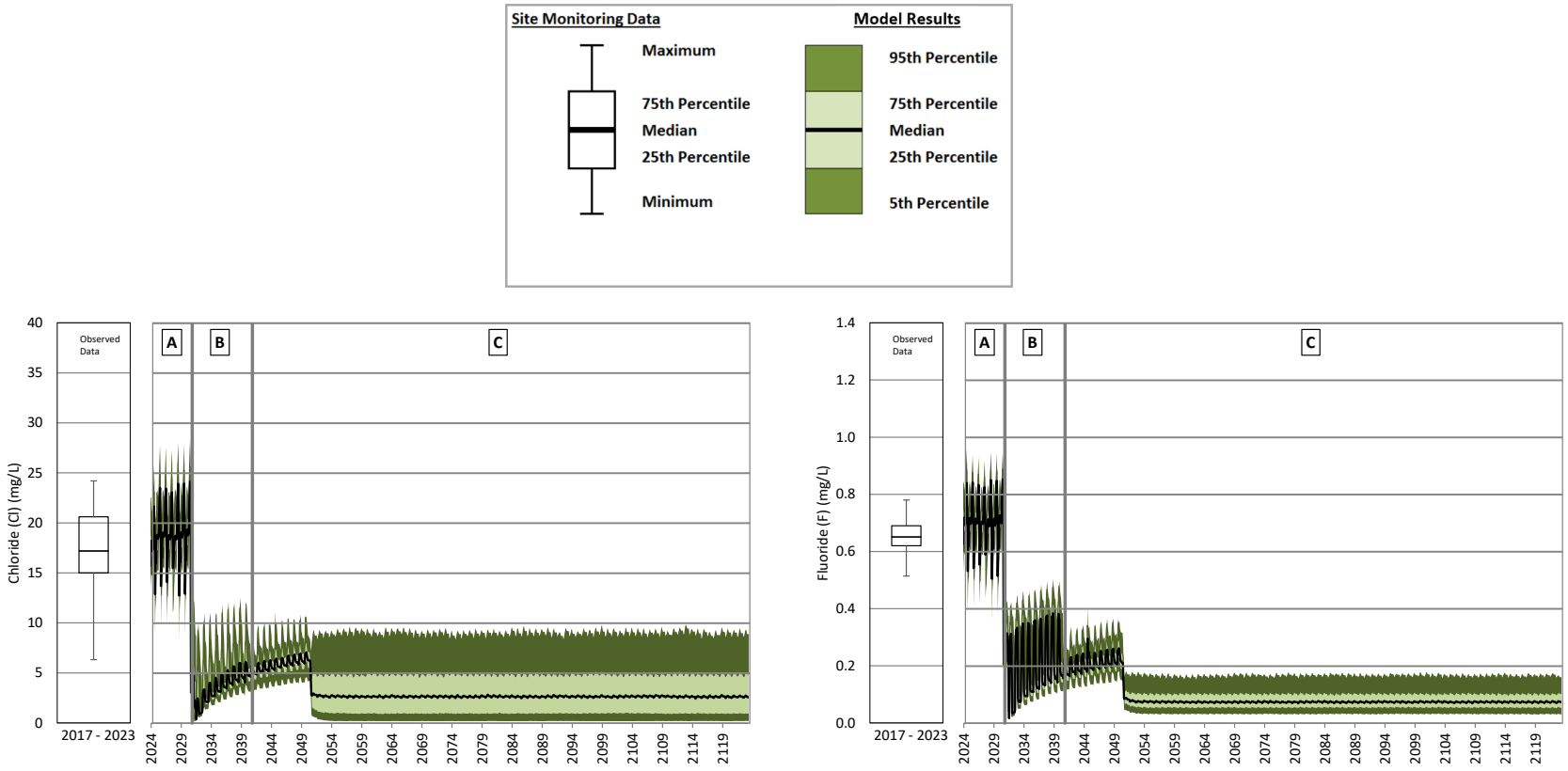

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **202: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Chloride and Fluoride**

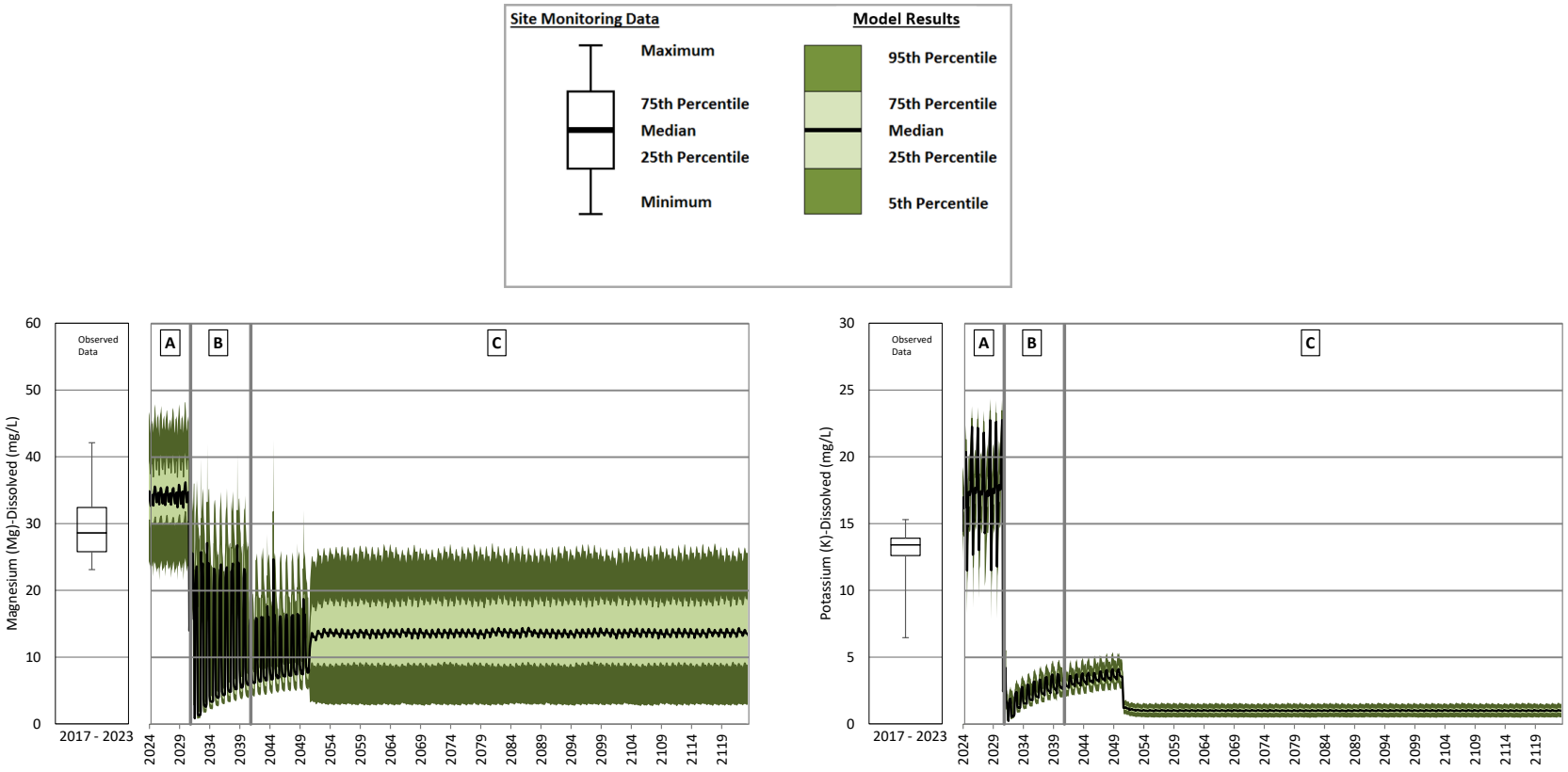

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **203: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Magnesium and Potassium**

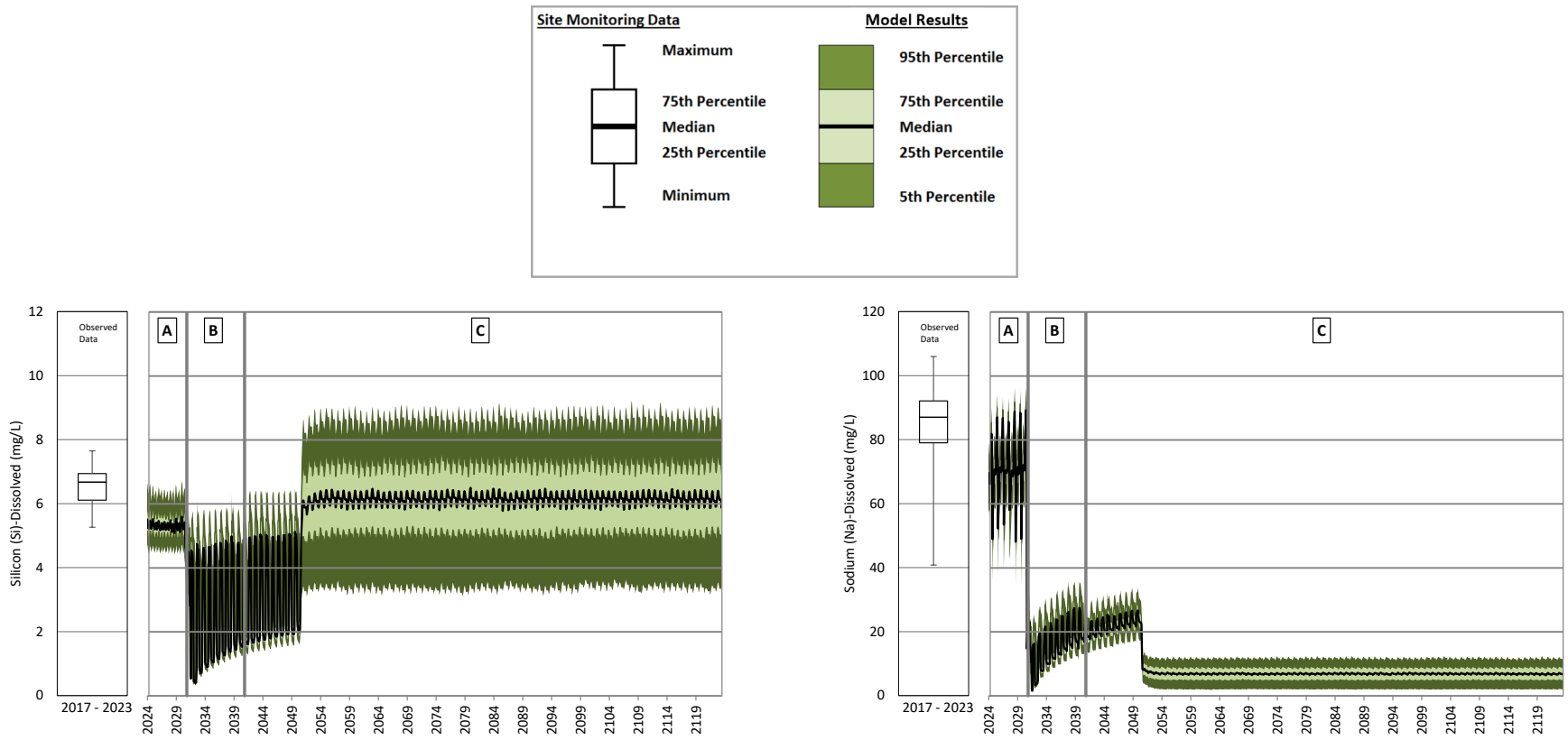

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Silicon concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input.

Figure B **204: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Silicon and Sodium**

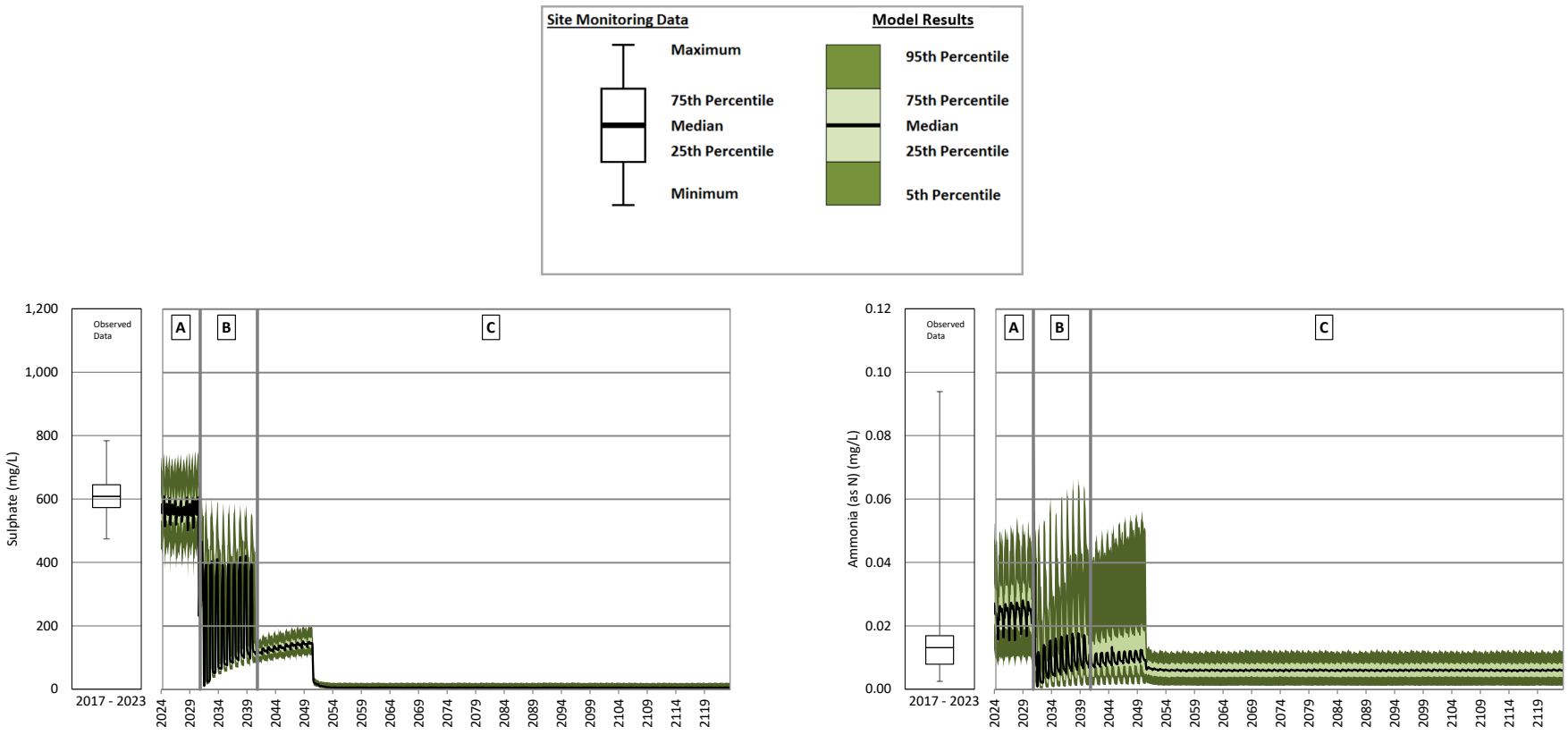

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **205: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**

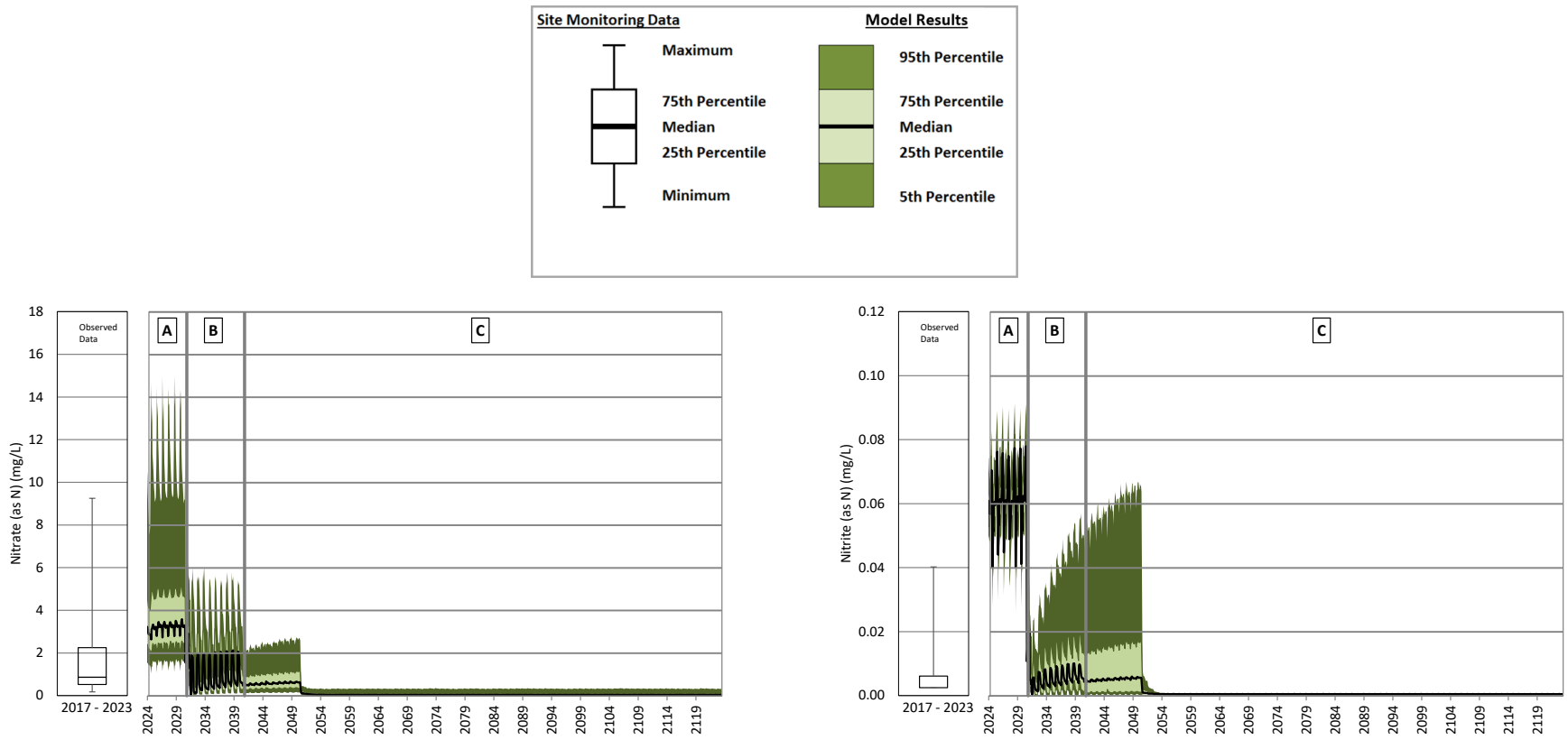

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **206: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Nitrate and Nitrite**

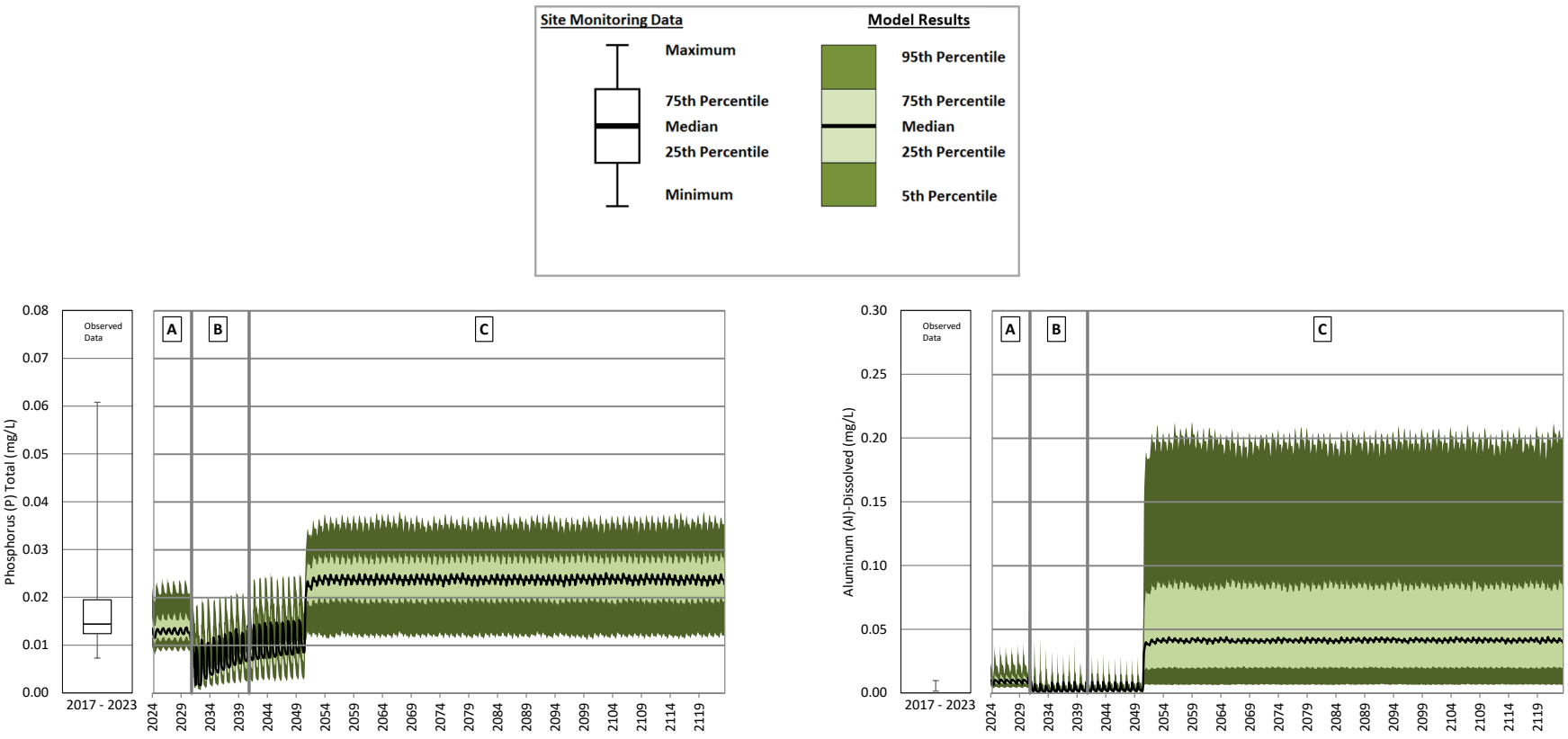

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Total phosphorus and dissolved aluminum concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolvedaluminum than the disturbed runoff water quality input.

Figure B **207: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

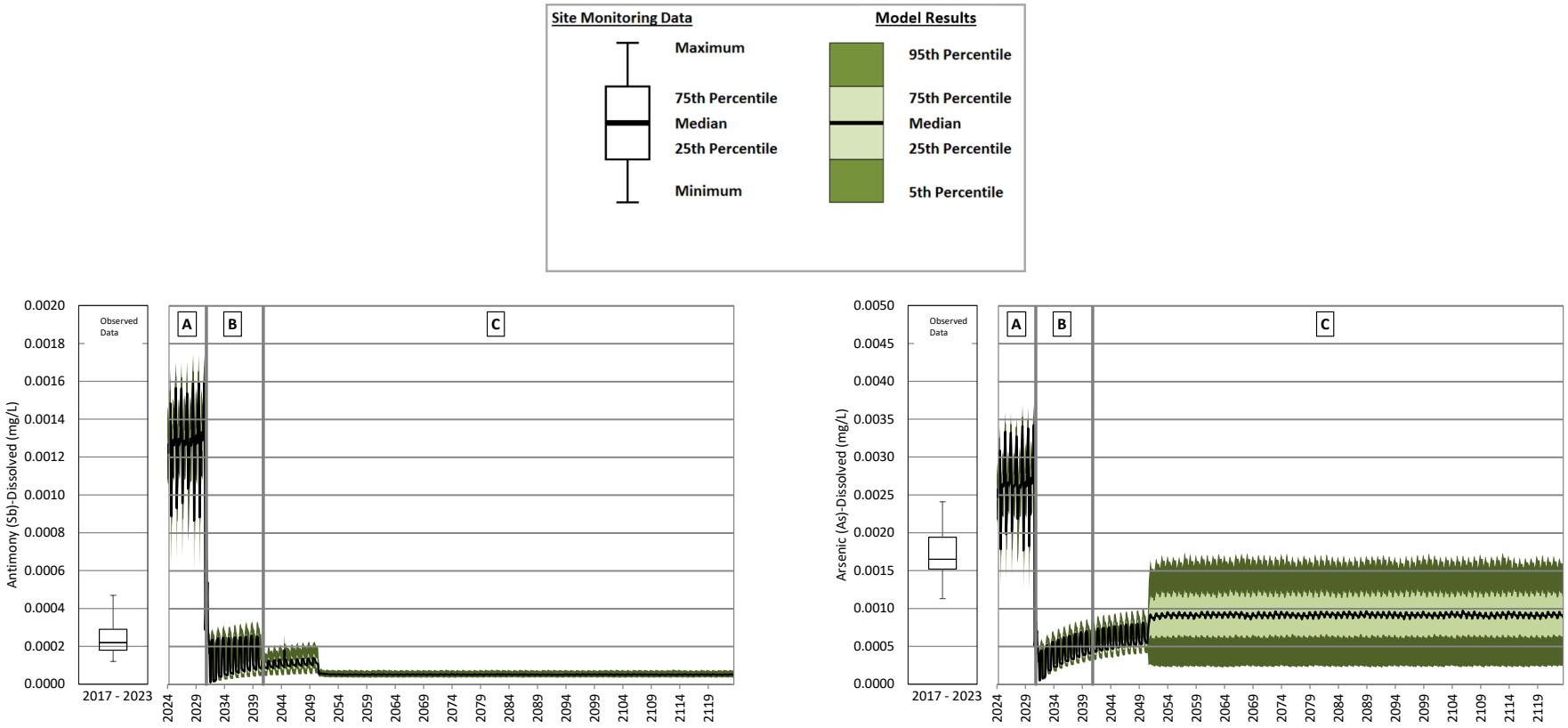

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved arsenic concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality input. .

Figure B **208: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

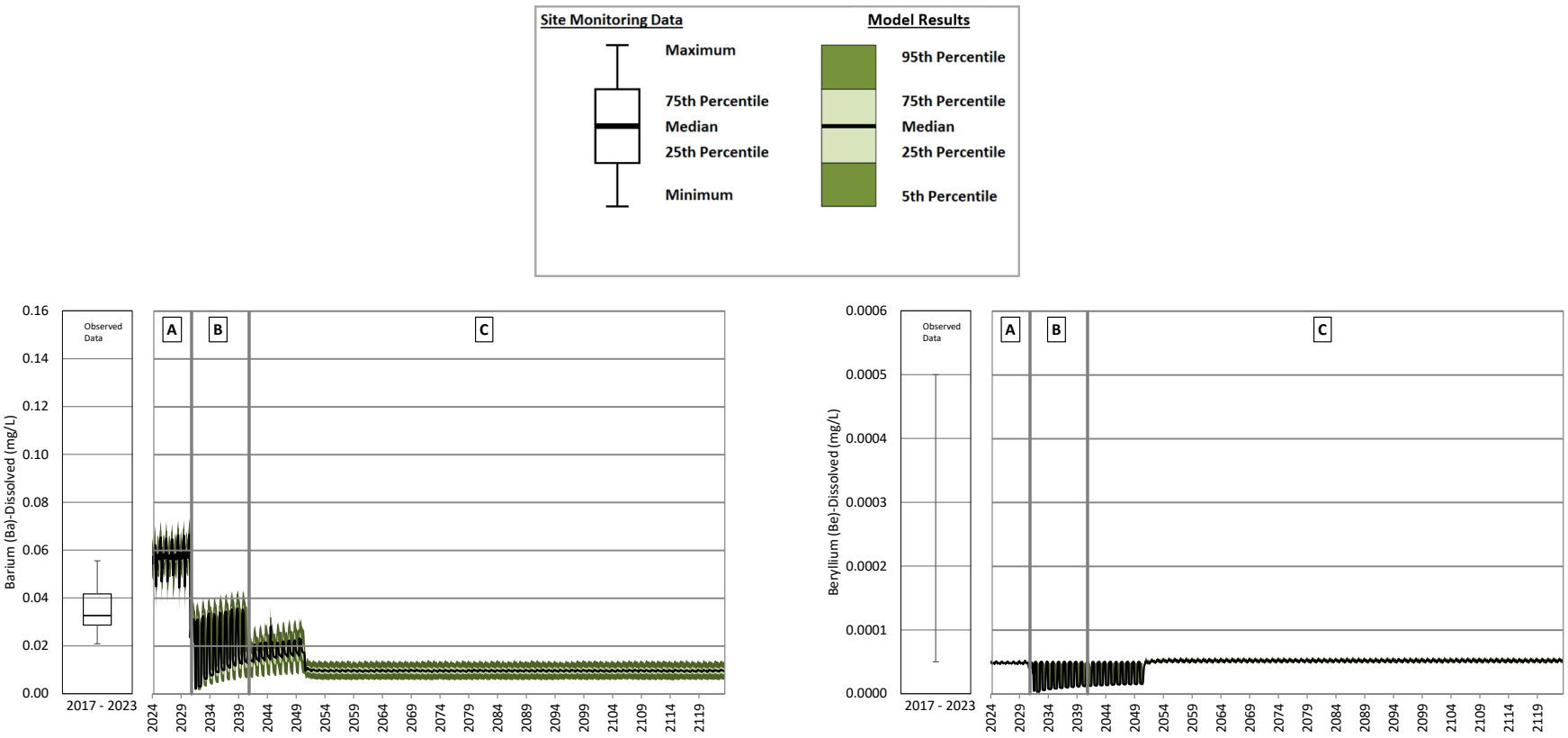

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **209: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

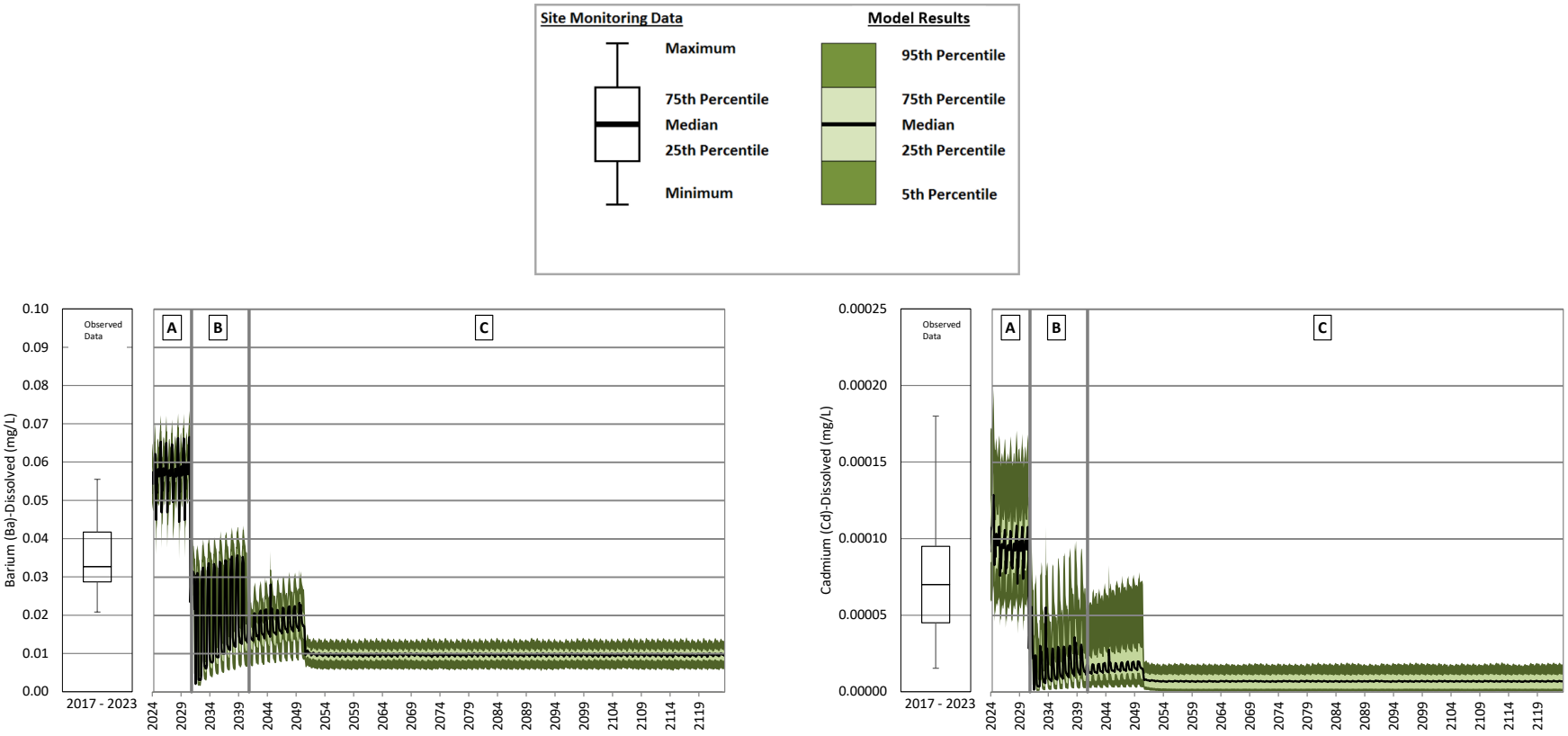

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **210: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

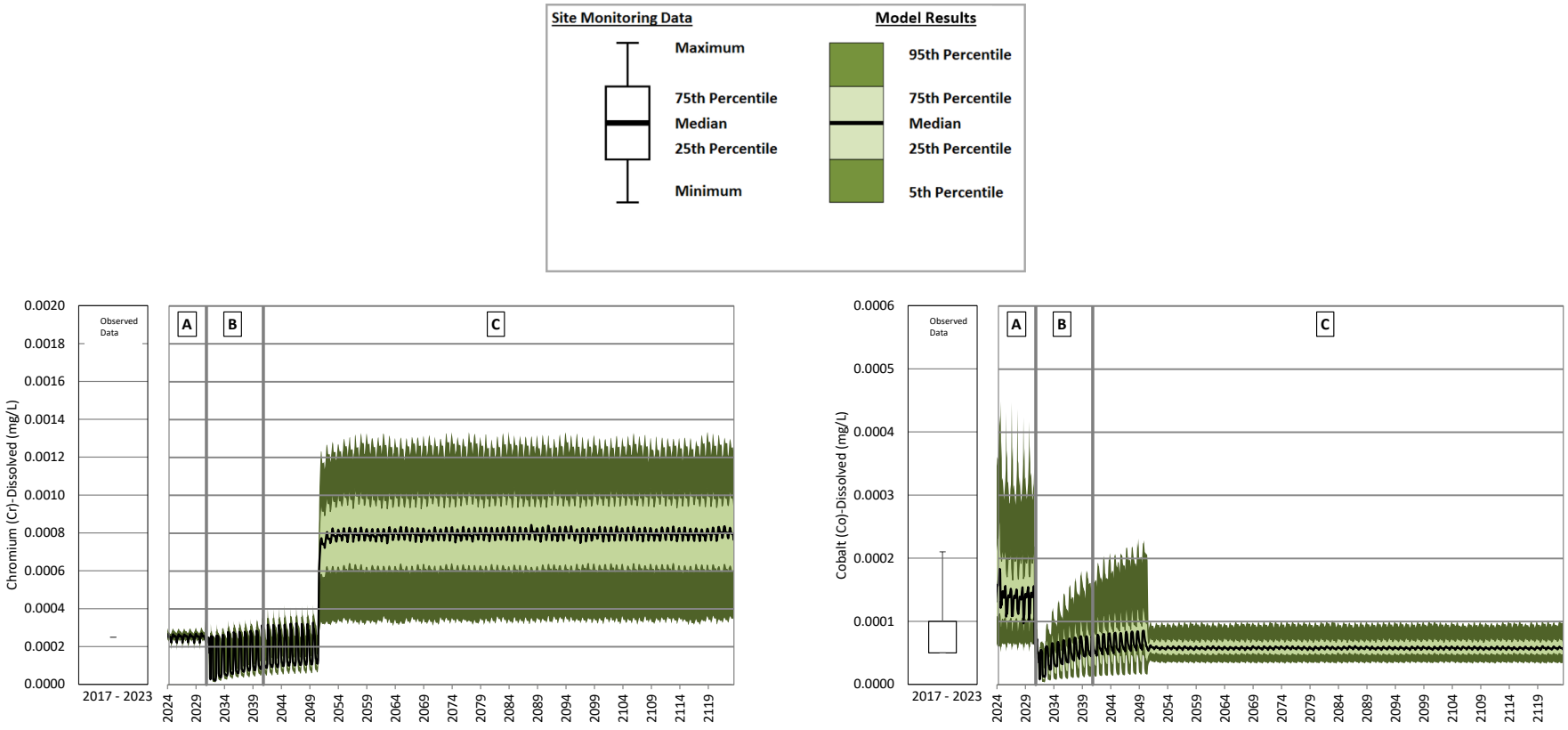

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved chromium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff water quality input.

Figure B **211: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

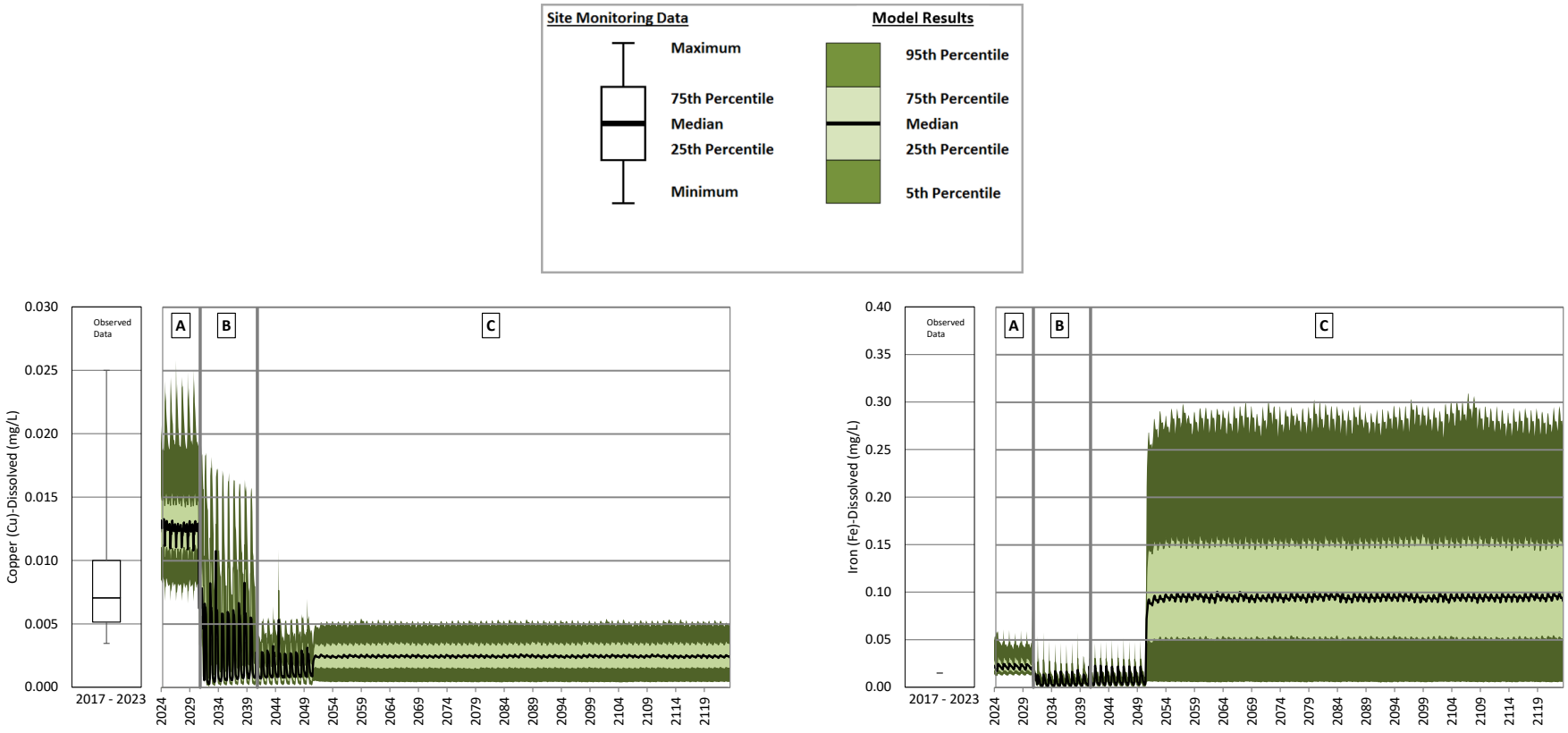

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved iron concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality input.

Figure B **212: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

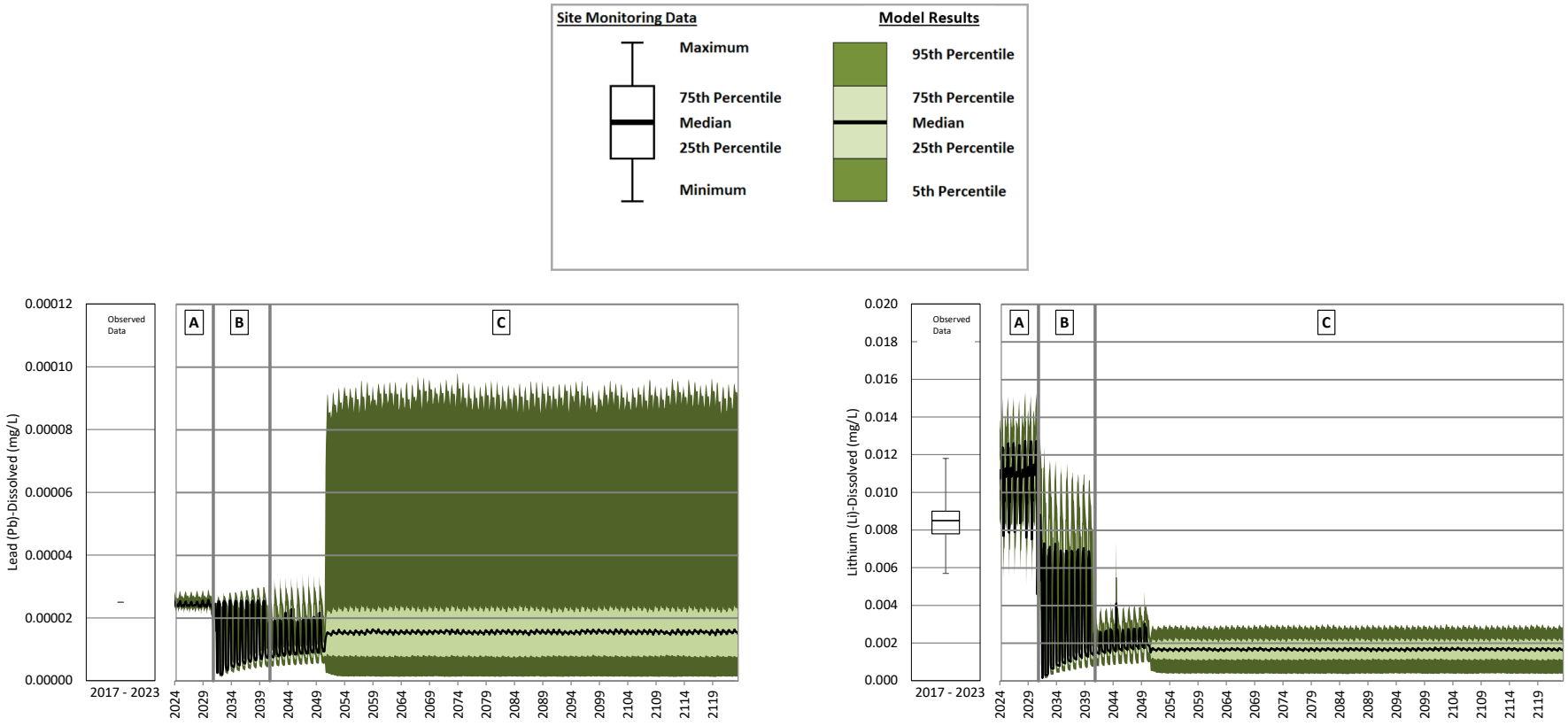

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved lead concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the disturbed runoff water quality input.

Figure B **213: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

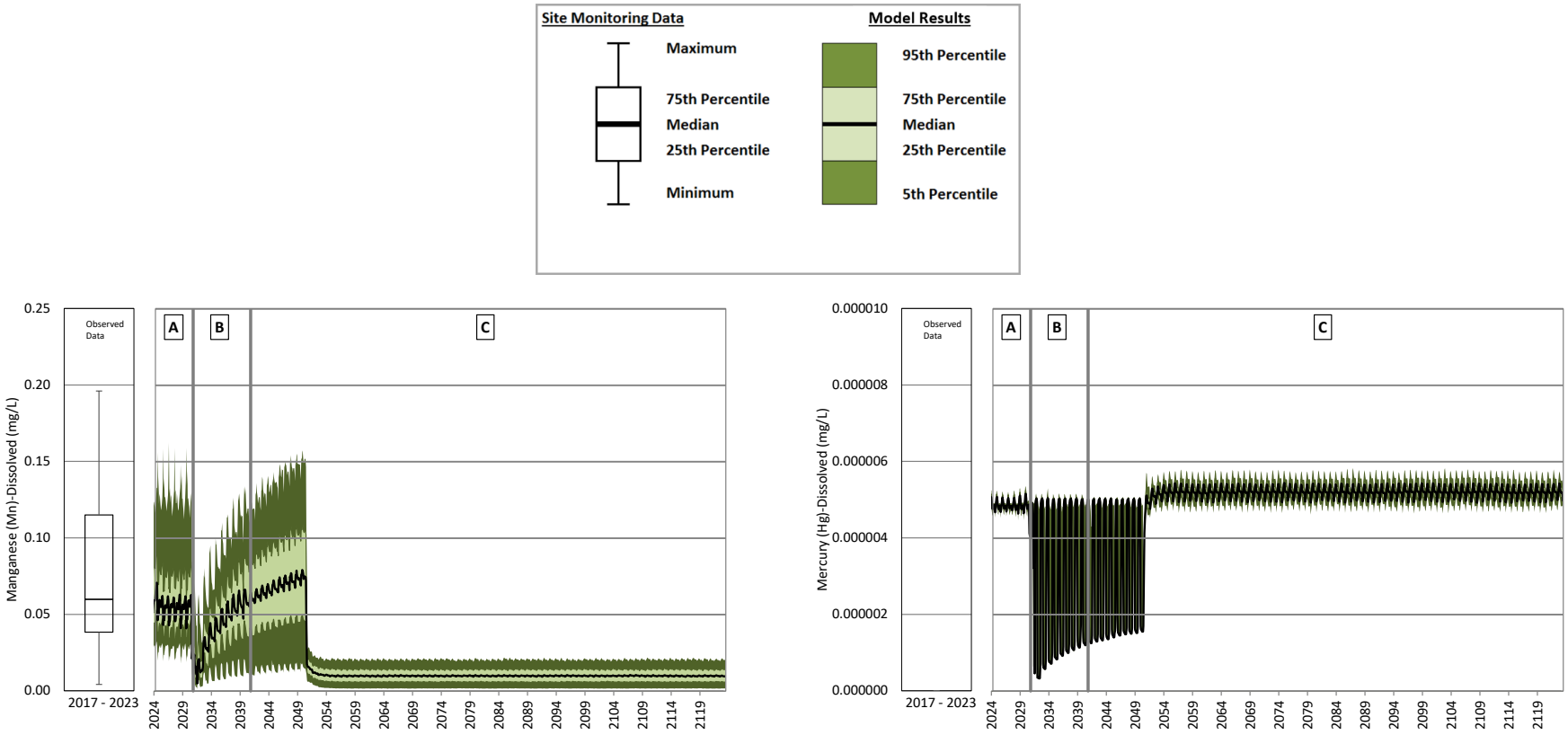

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **214: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

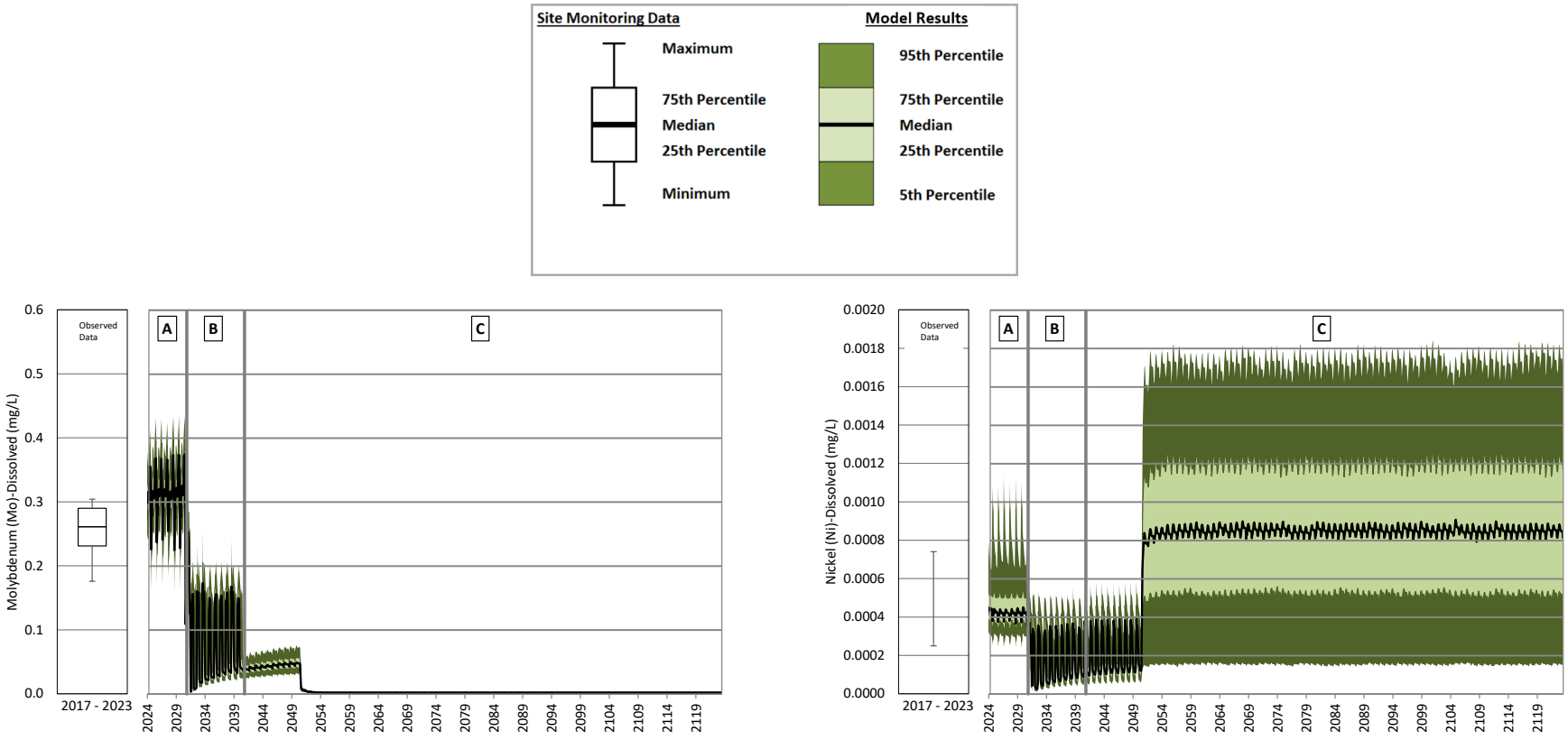

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved nickel concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality input.

Figure B **215: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

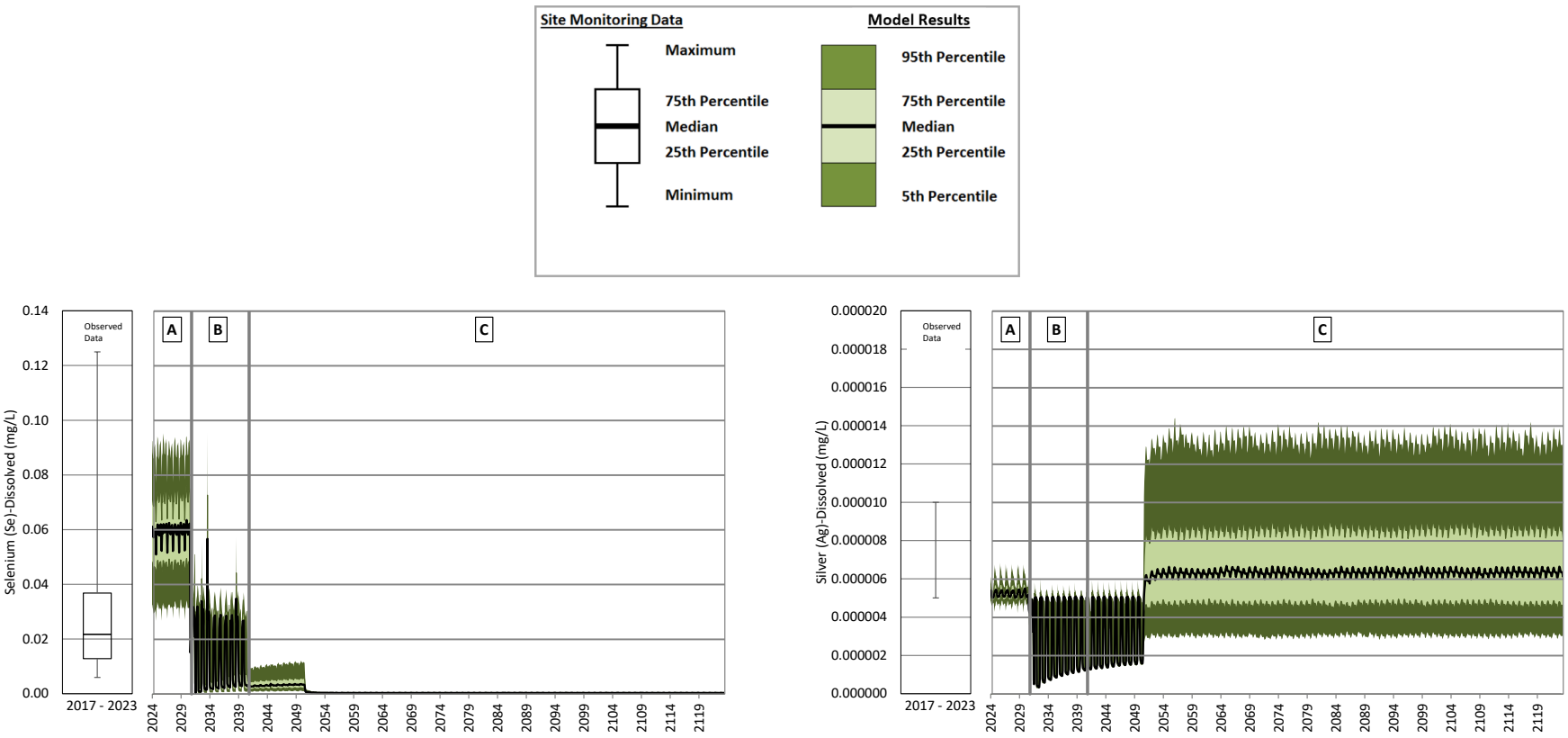

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved silver concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality input.

Figure B **216: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

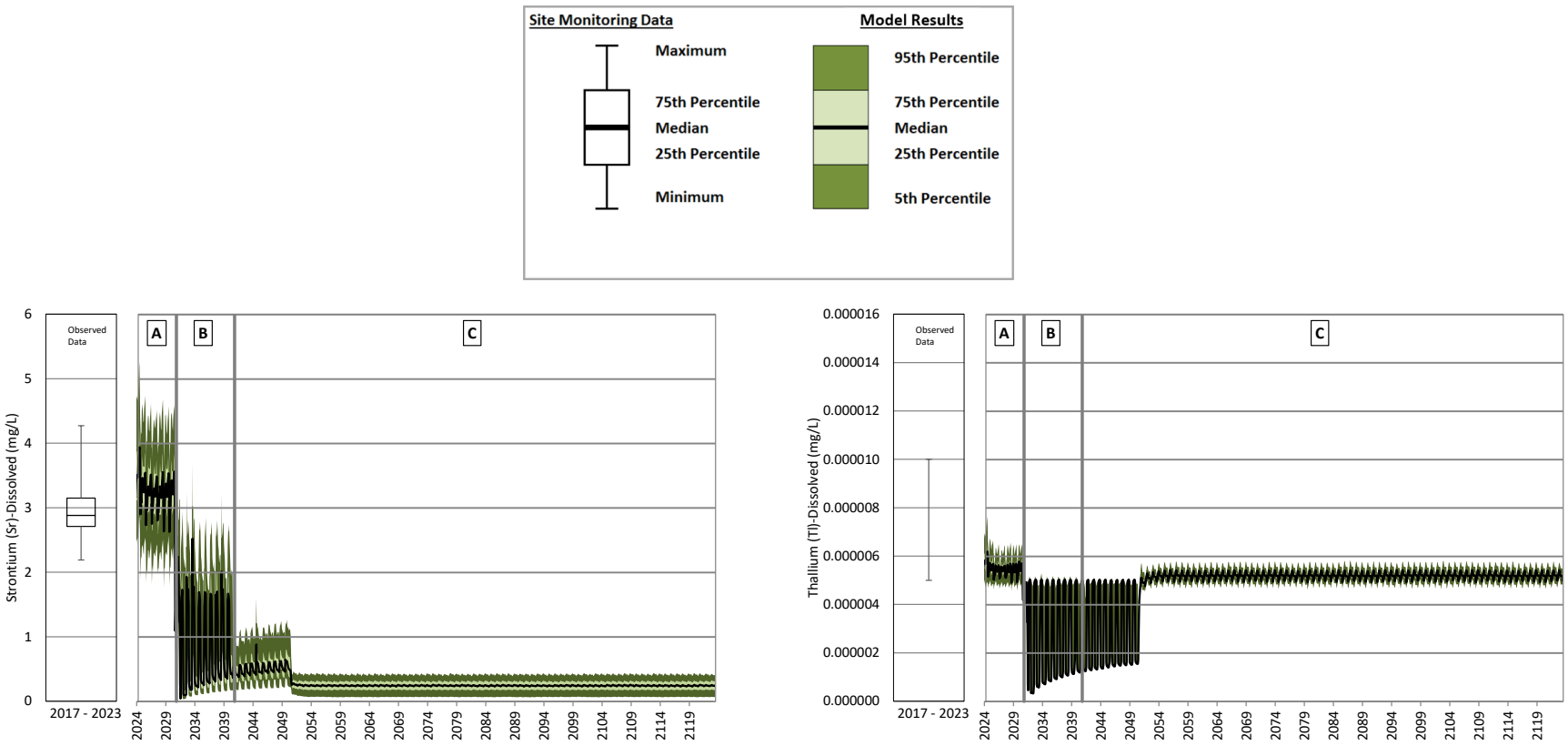

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **217: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

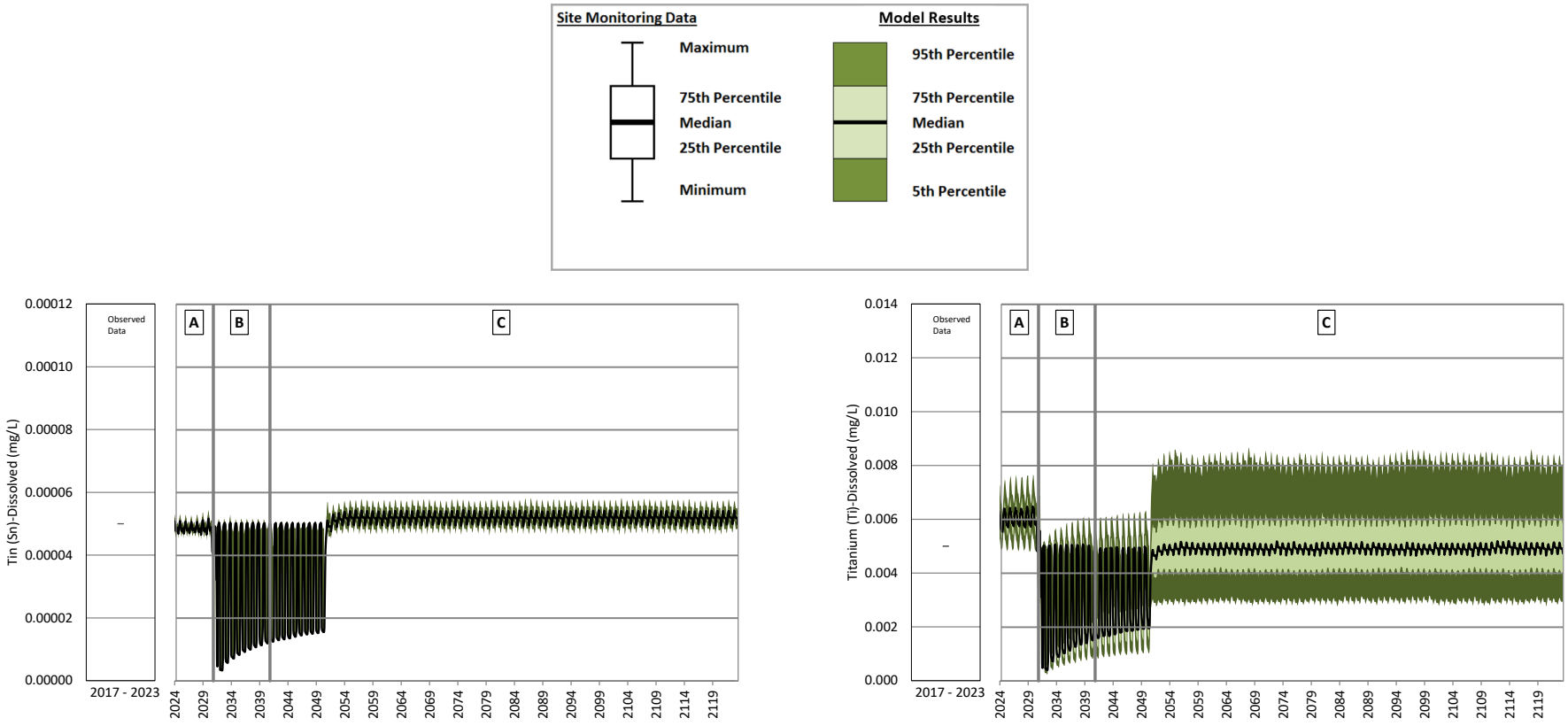

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved titanium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the disturbed runoff water quality input.

Figure B **218: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

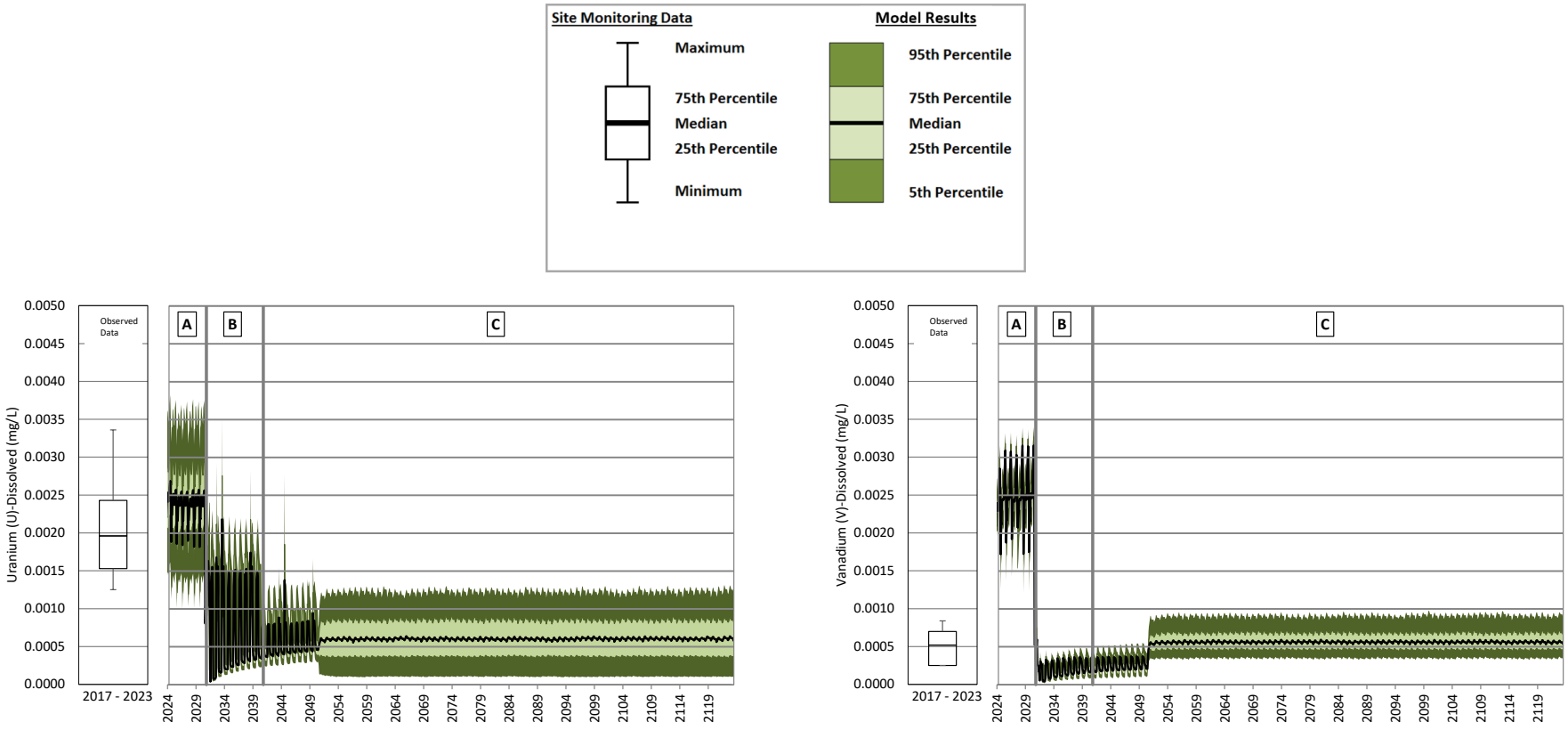

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved vanadium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved vanadium than the disturbed runoff water quality input.

Figure B **219: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

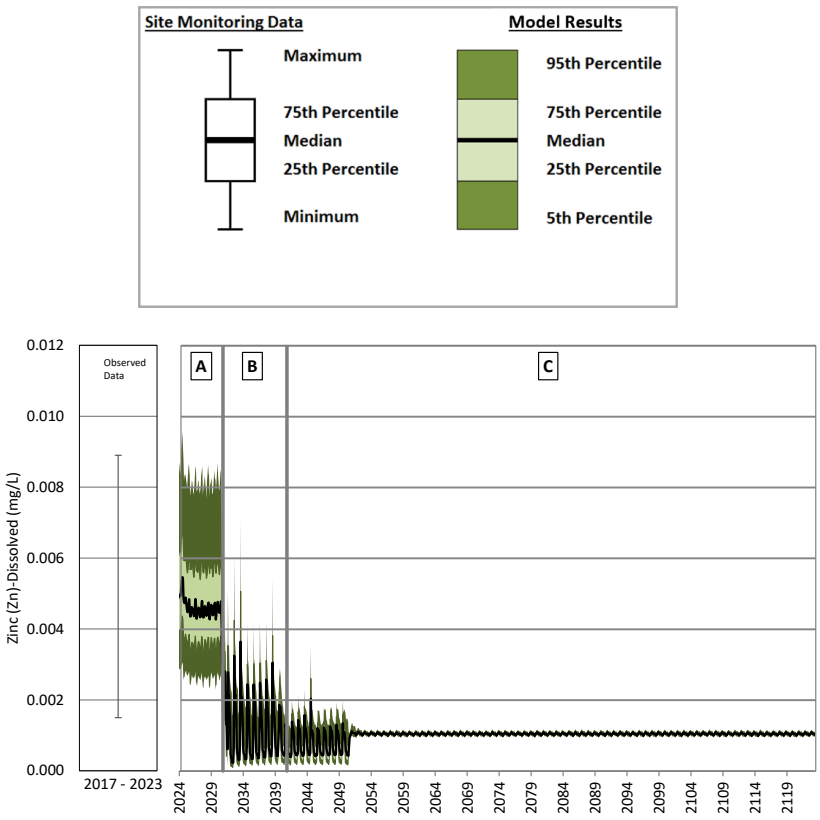

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **220: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Zinc**

Mine Drainage Creek Sump Operations

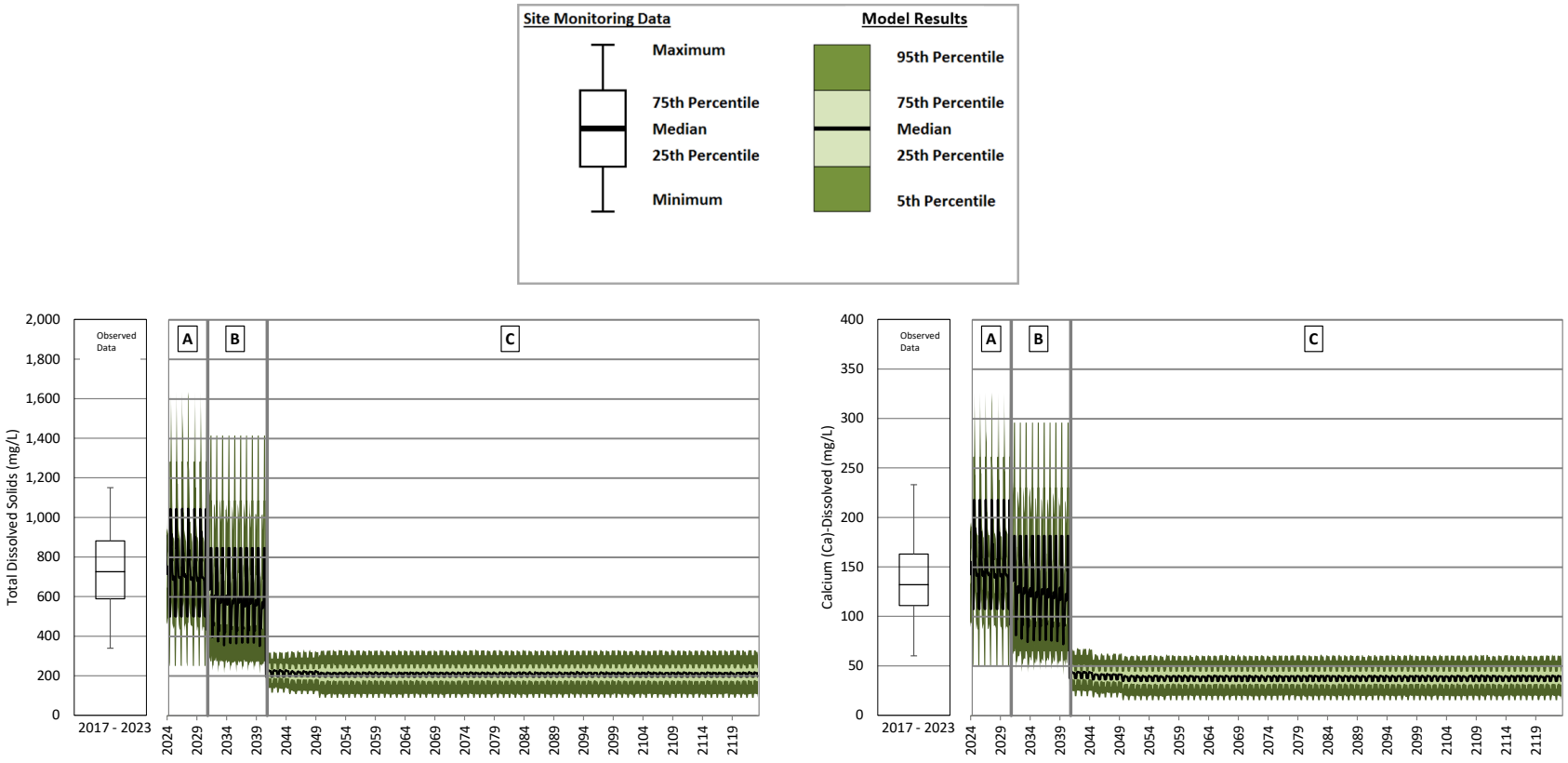

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **221: Mine Drainage Creek Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

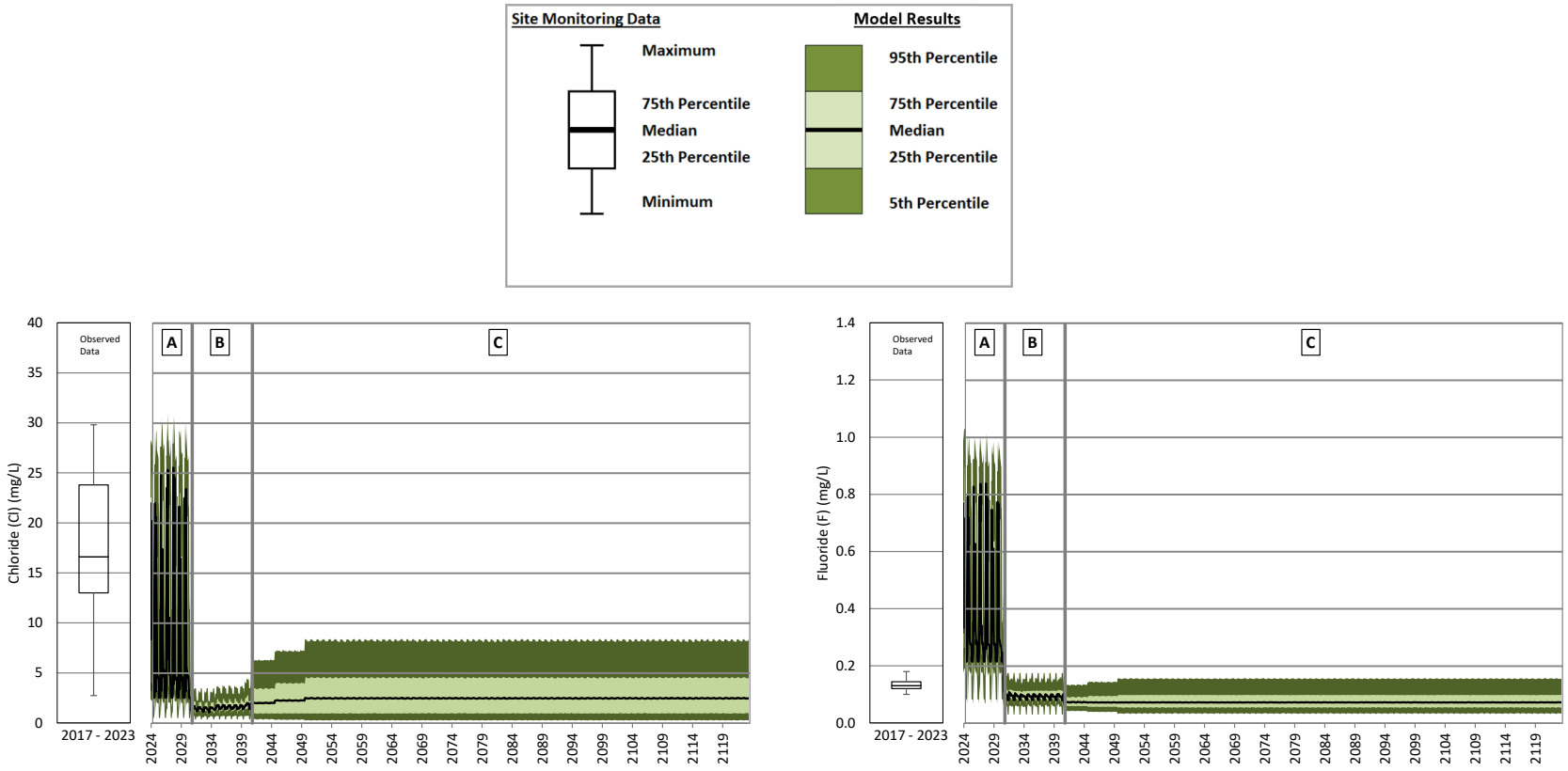

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Chloride and fluoride concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for chloride and fluoride than the disturbed runoff water quality inputs.

Figure B **222: Mine Drainage Creek Sump Operations, Closure and Post-closure – Chloride and Fluoride**

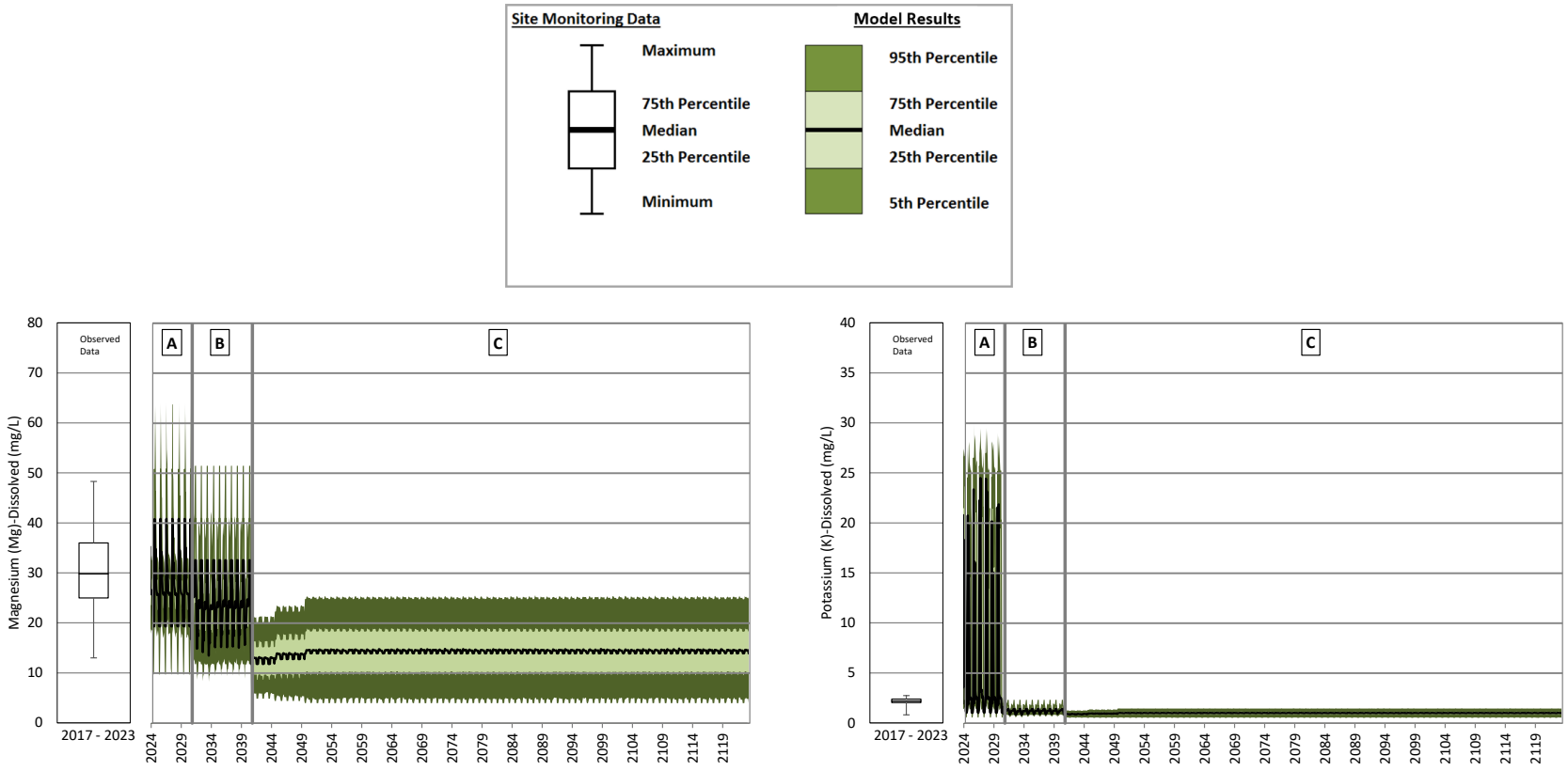

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Magnesium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for magnesium than the disturbed runoff water quality inputs.

Figure B **223: Mine Drainage Creek Sump Operations, Closure and Post-closure – Magnesium and Potassium**

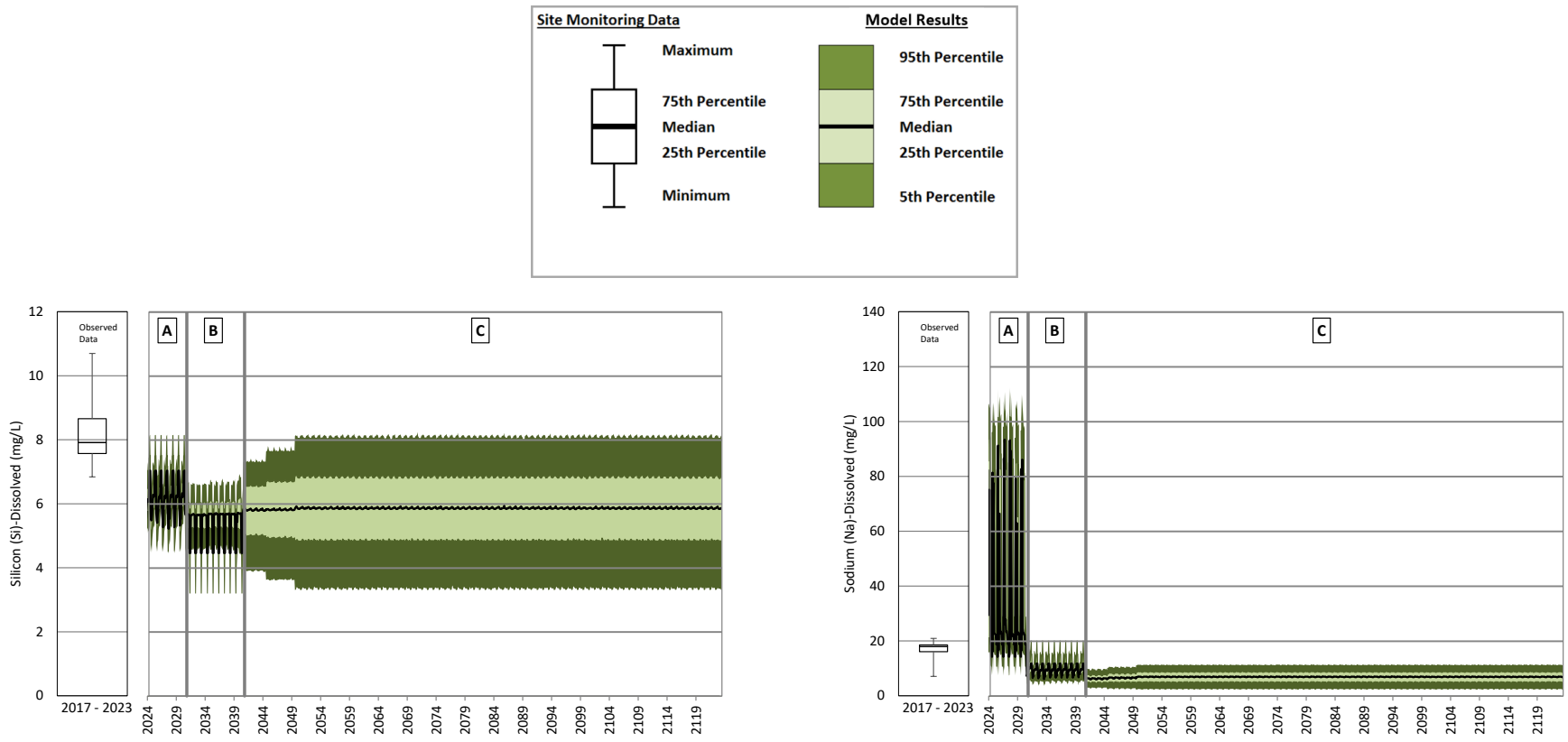

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Silicon concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for silicon than the disturbed runoff water quality inputs.

Figure B **224: Mine Drainage Creek Sump Operations, Closure and Post-closure – Silicon and Sodium**

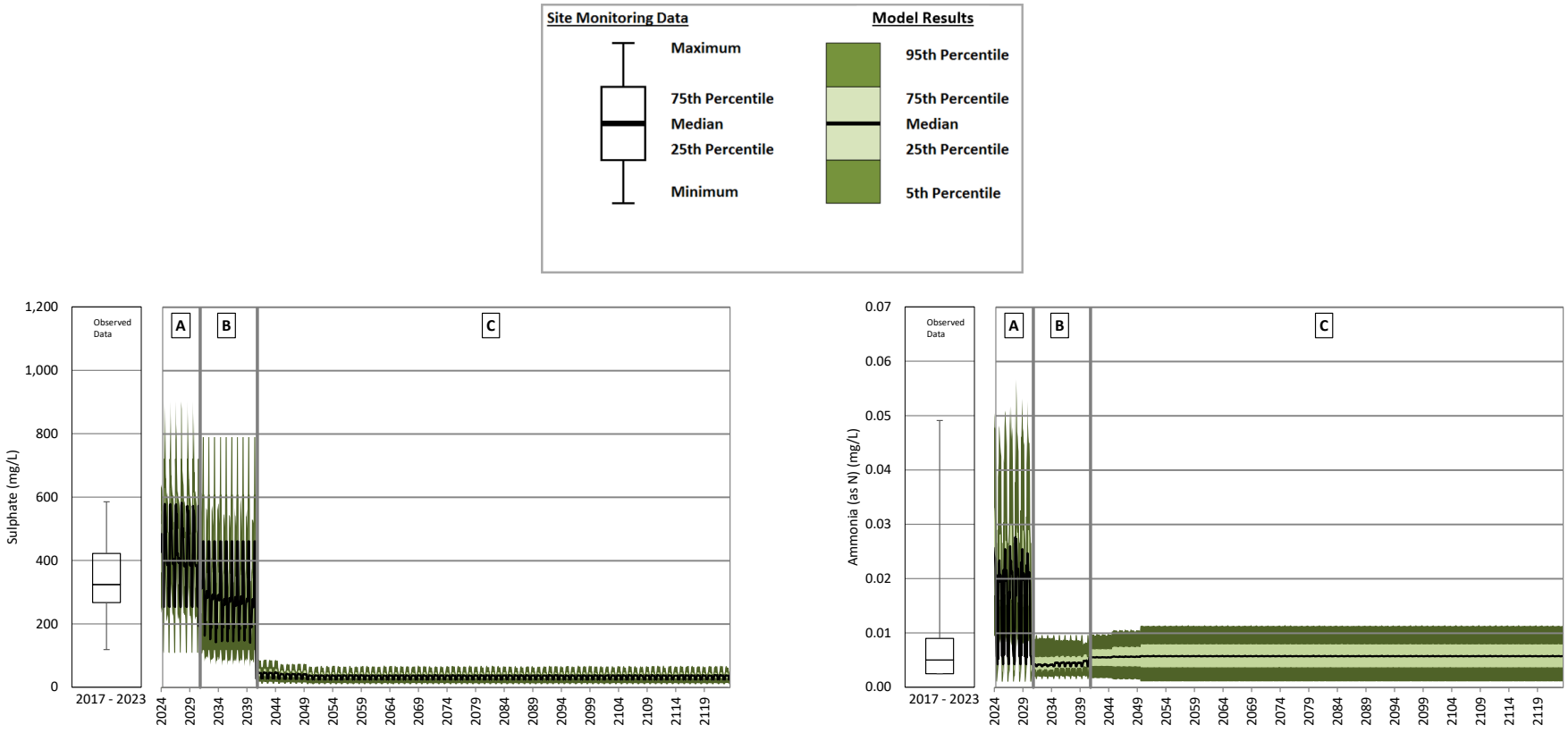

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total ammonia concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for total ammonia than the disturbed runoff water quality inputs.

Figure B **225: Mine Drainage Creek Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**

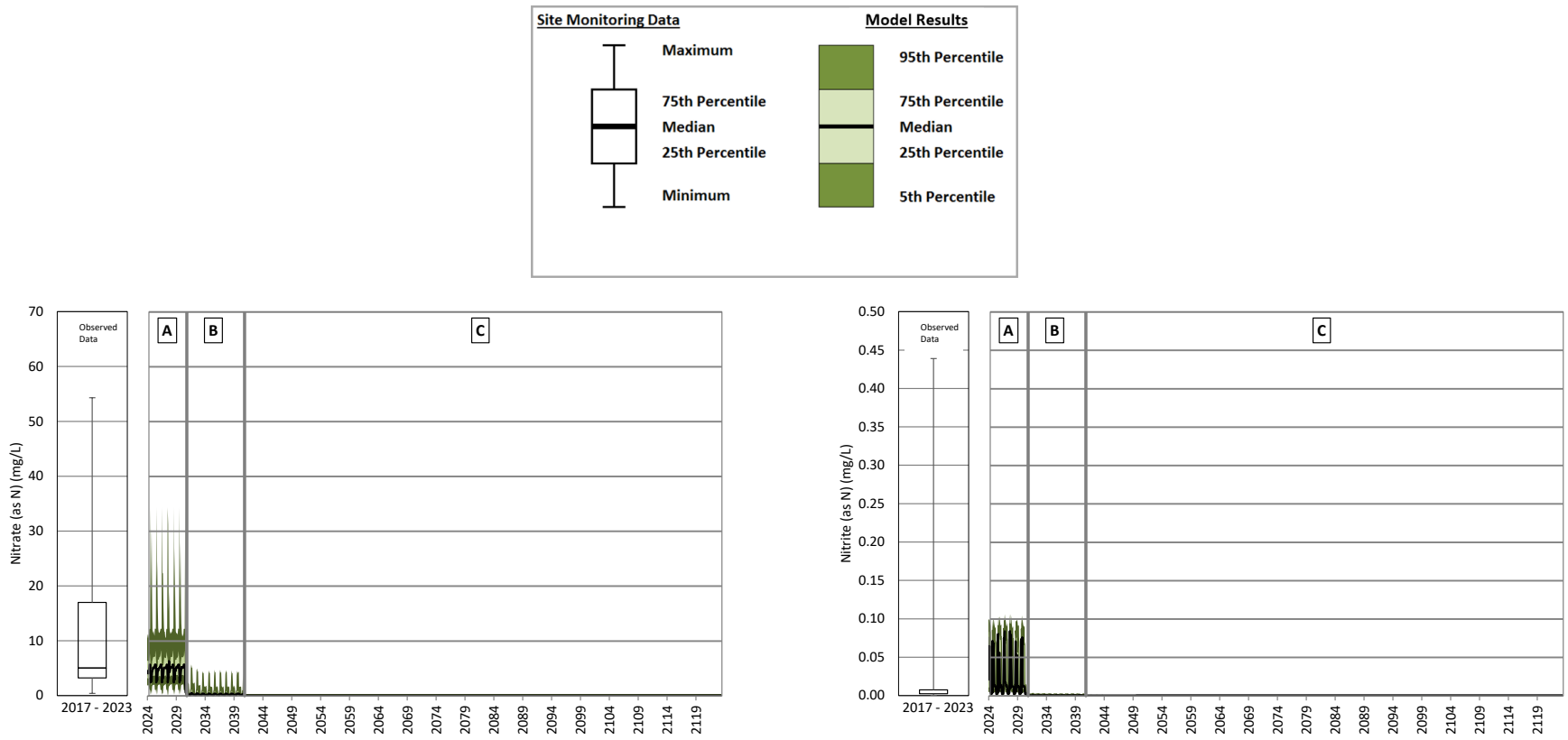

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **226: Mine Drainage Creek Sump Operations, Closure and Post-closure – Nitrate and Nitrite**

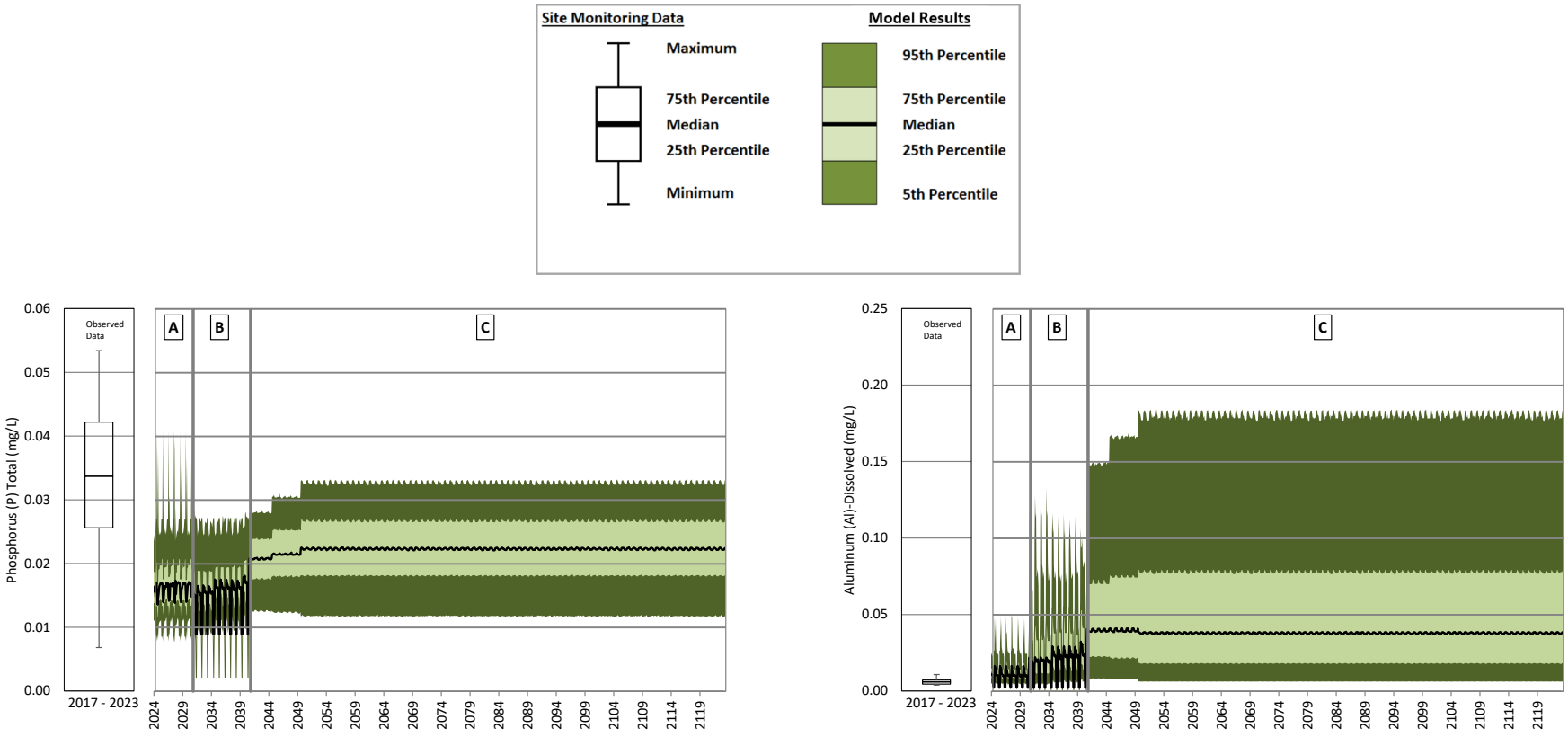

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total phosphorus and dissolved aluminum concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the disturbed runoff and NAG waste rock water quality inputs.

Figure B **227: Mine Drainage Creek Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

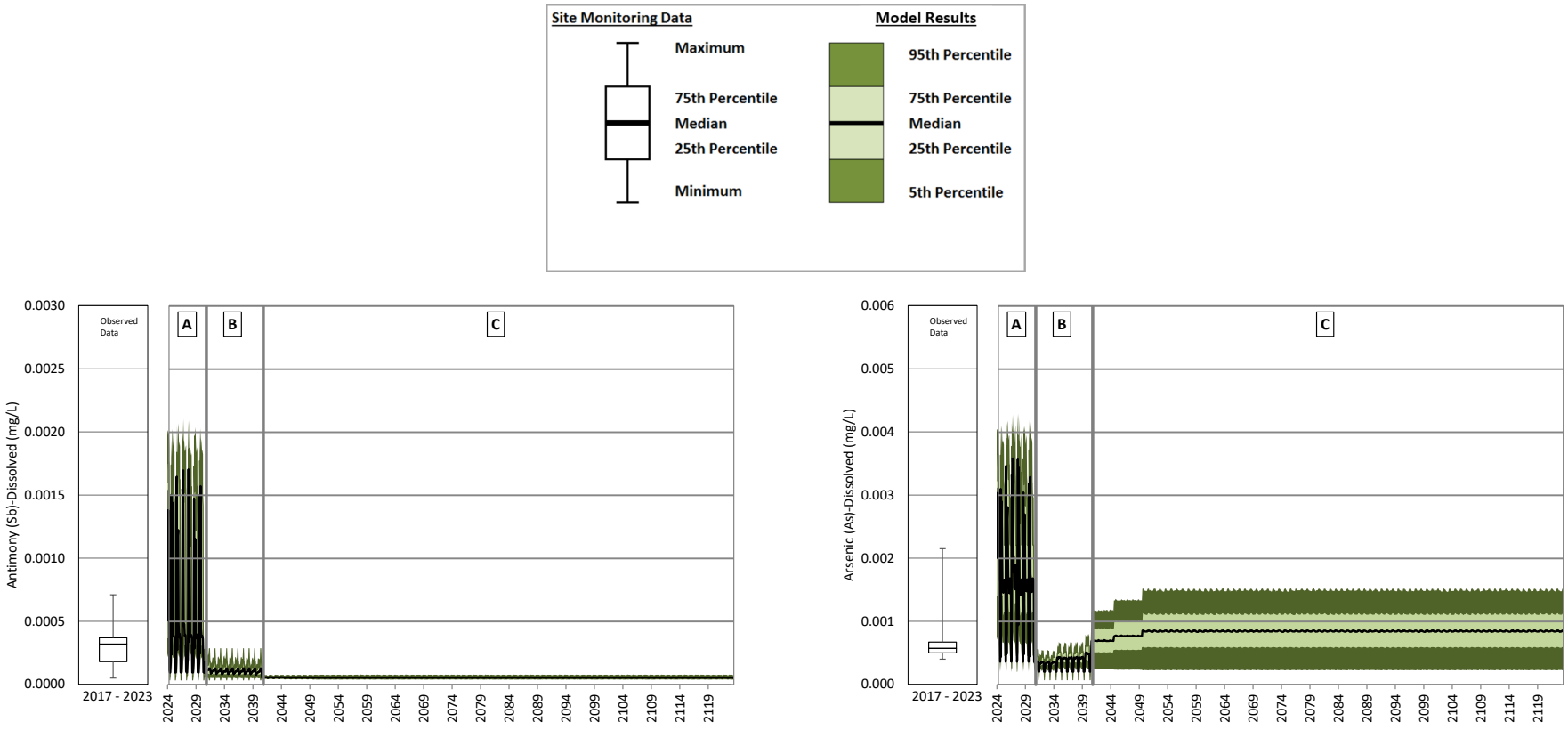

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved arsenic concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality inputs.

Figure B **228: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

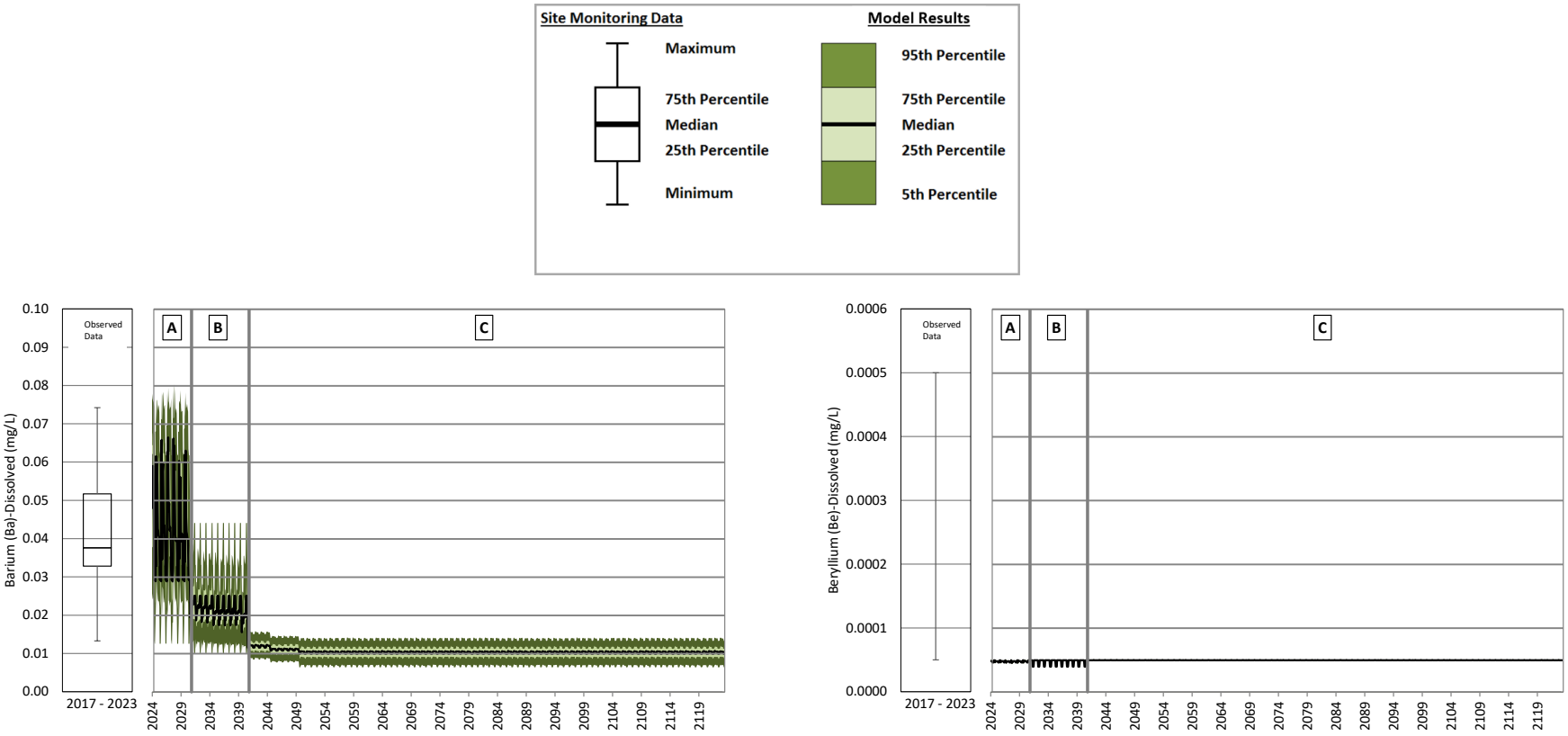

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **229: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

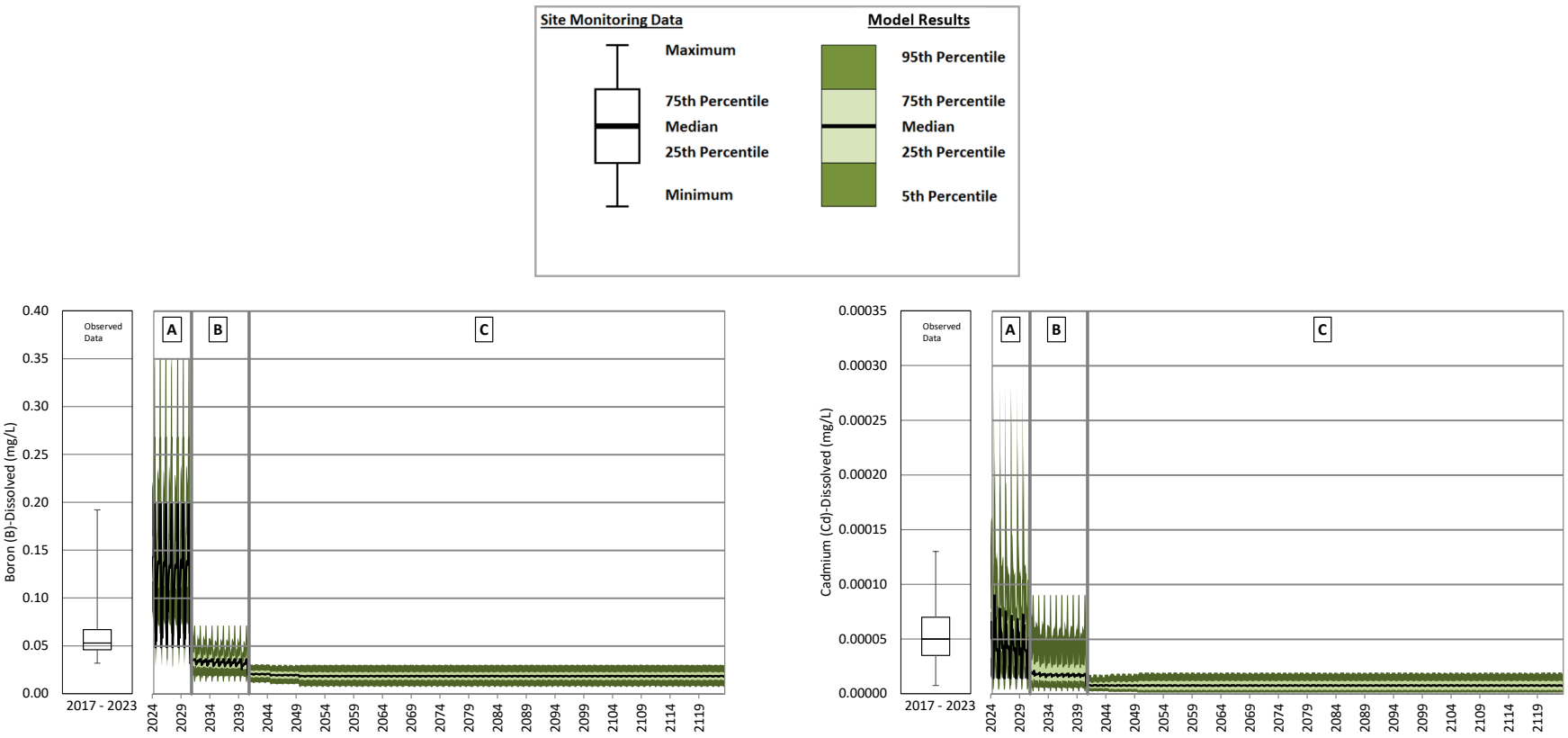

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **230: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

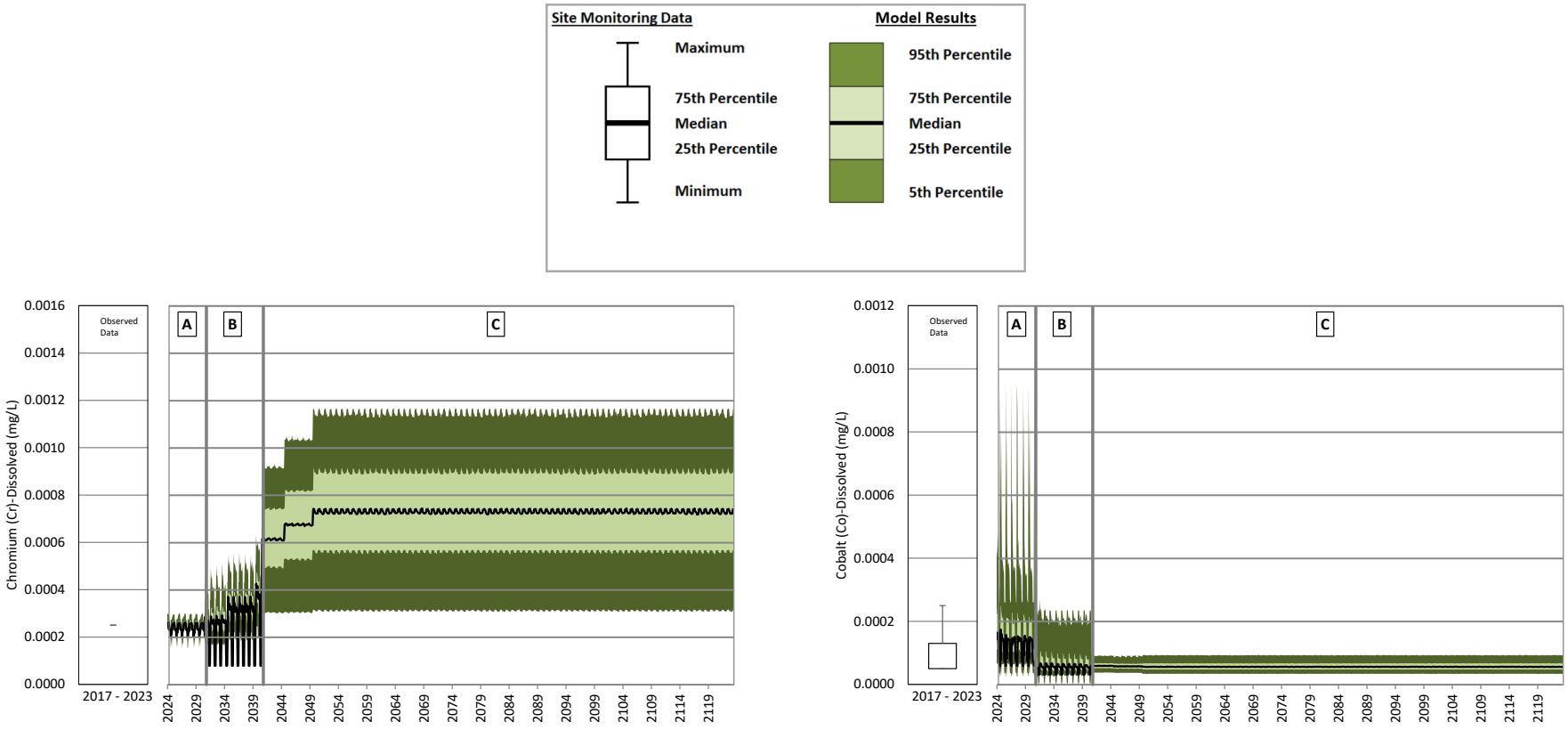

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved chromium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff and NAG waste rock water quality inputs.

Figure B **231: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

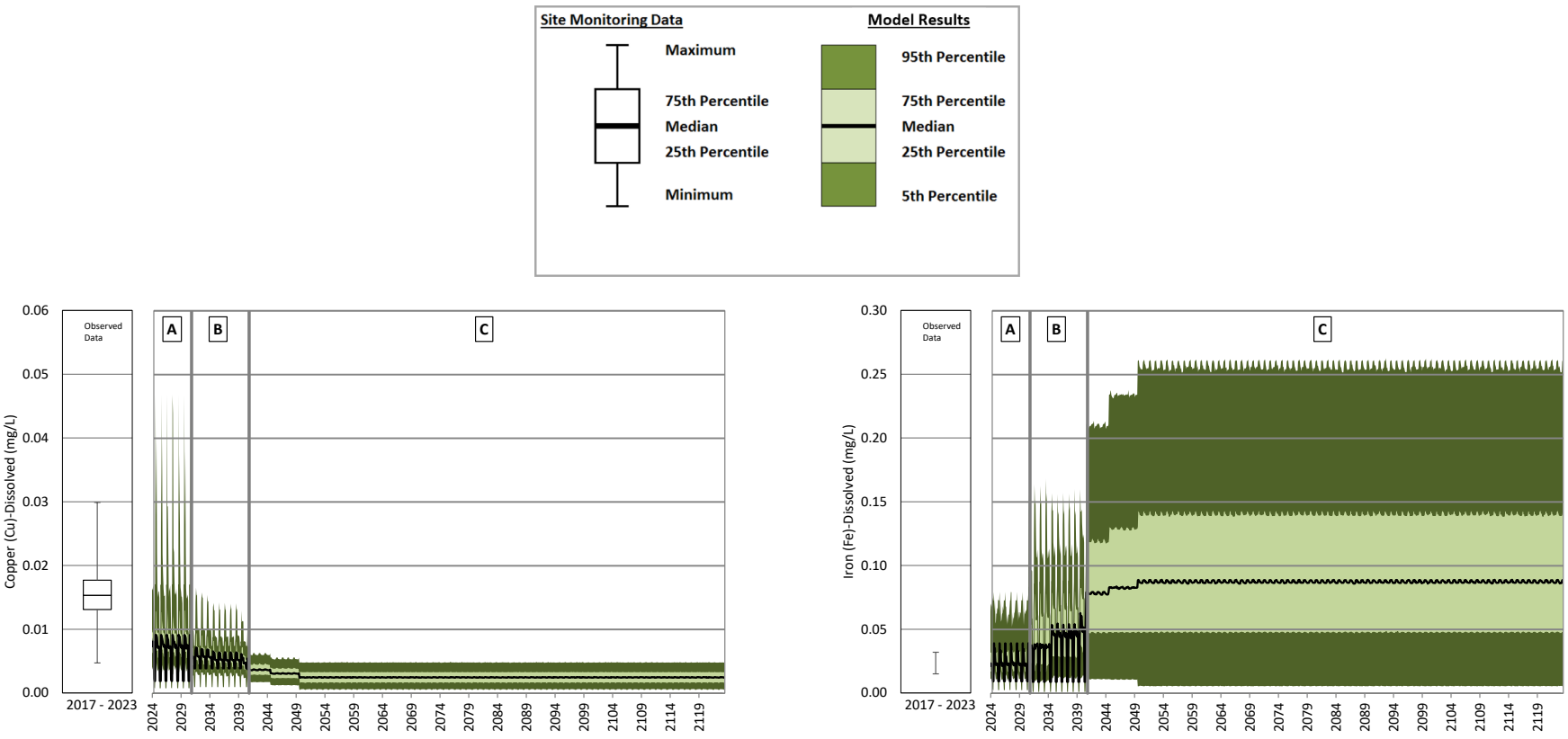

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved iron concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality inputs.

Figure B **232: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

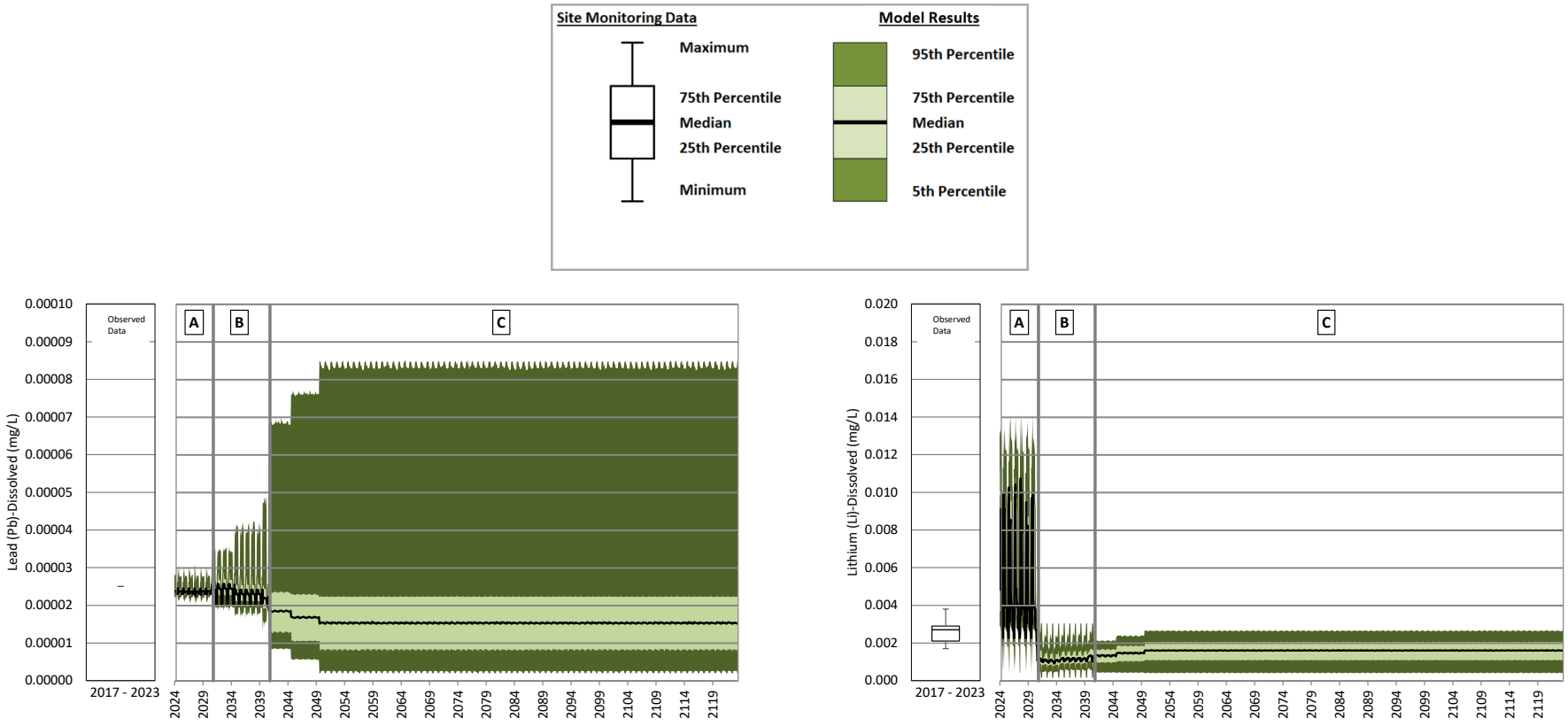

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved lead and lithium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved lead and lithium than the disturbed runoff water quality inputs.

Figure B **233: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

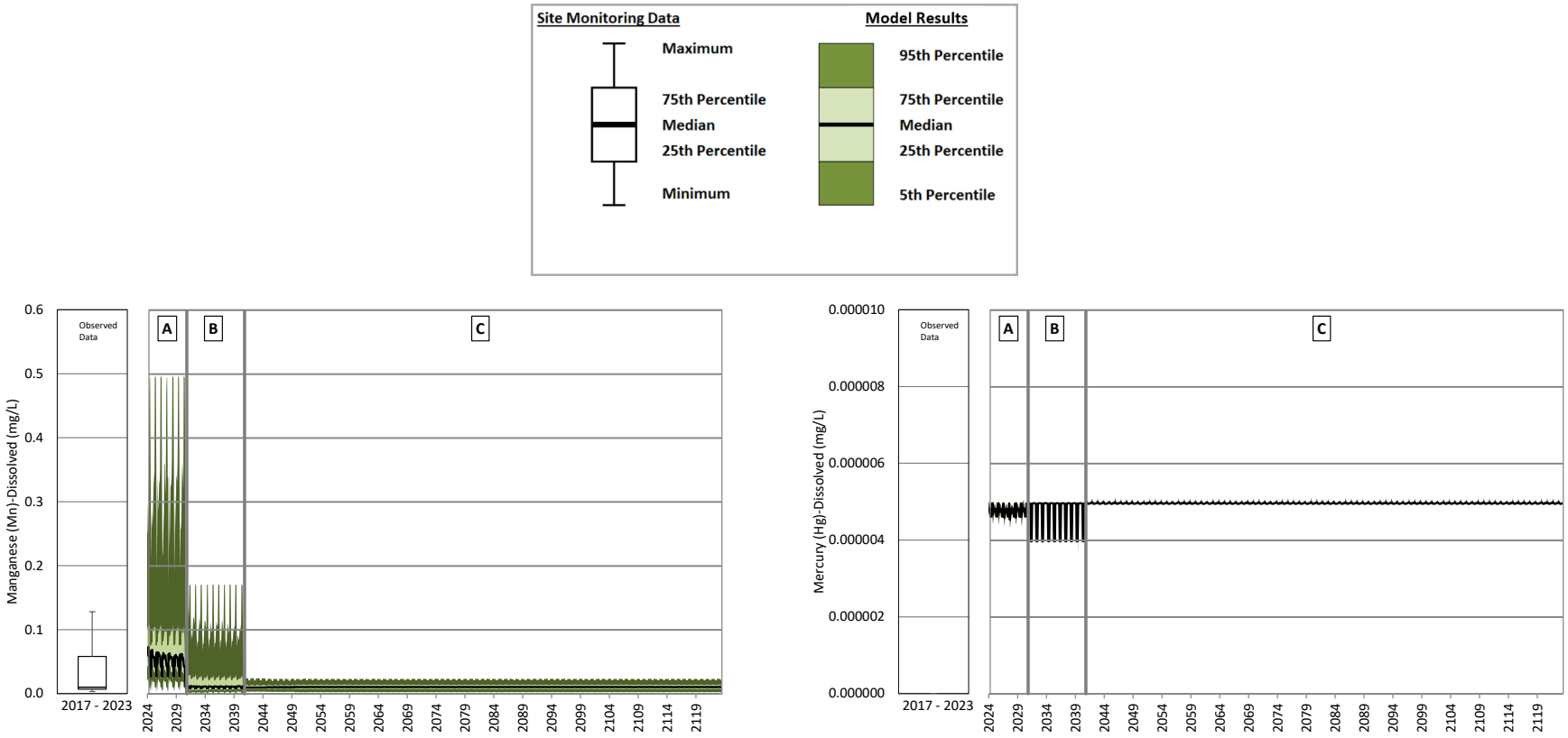

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **234: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

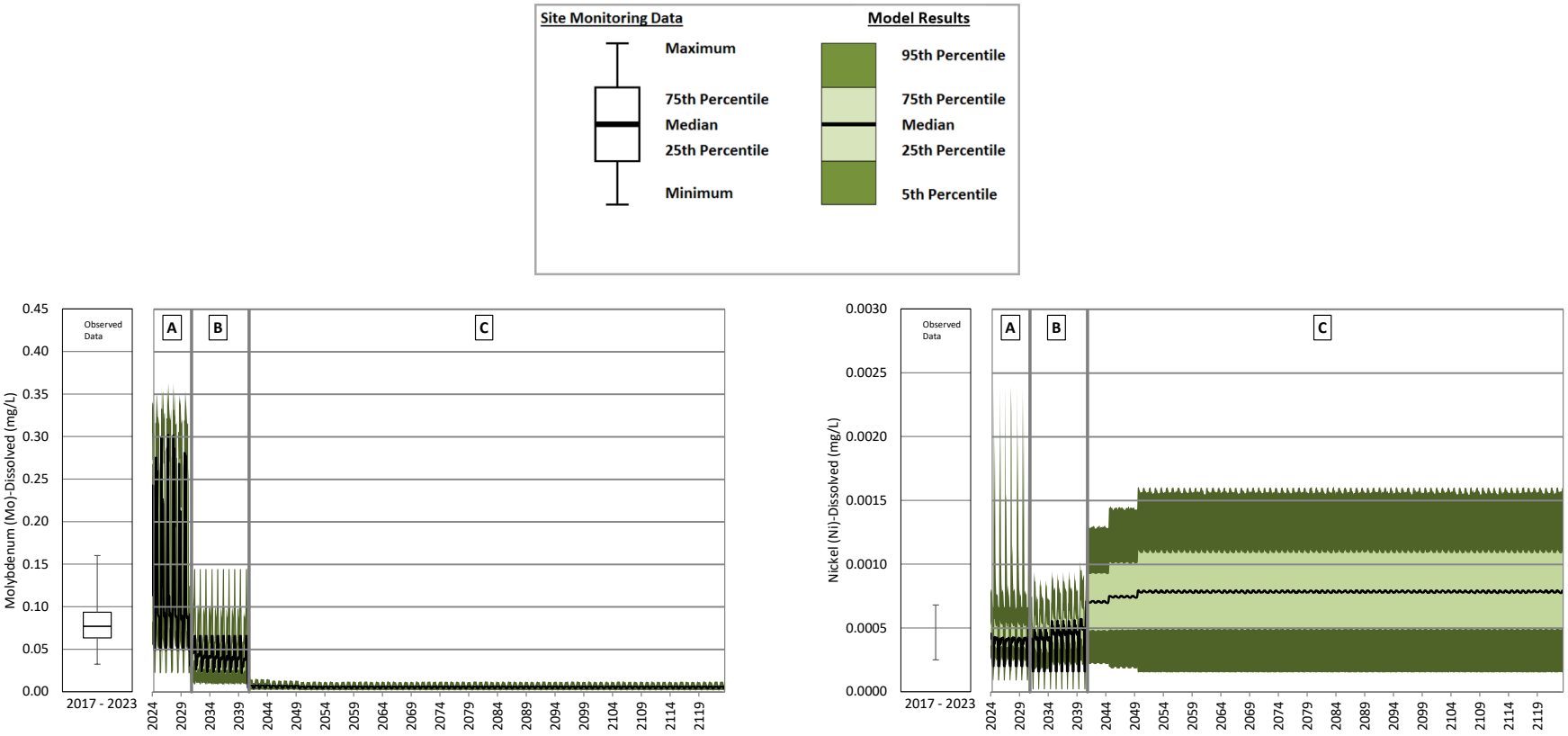

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved nickel concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality inputs.

Figure B **235: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

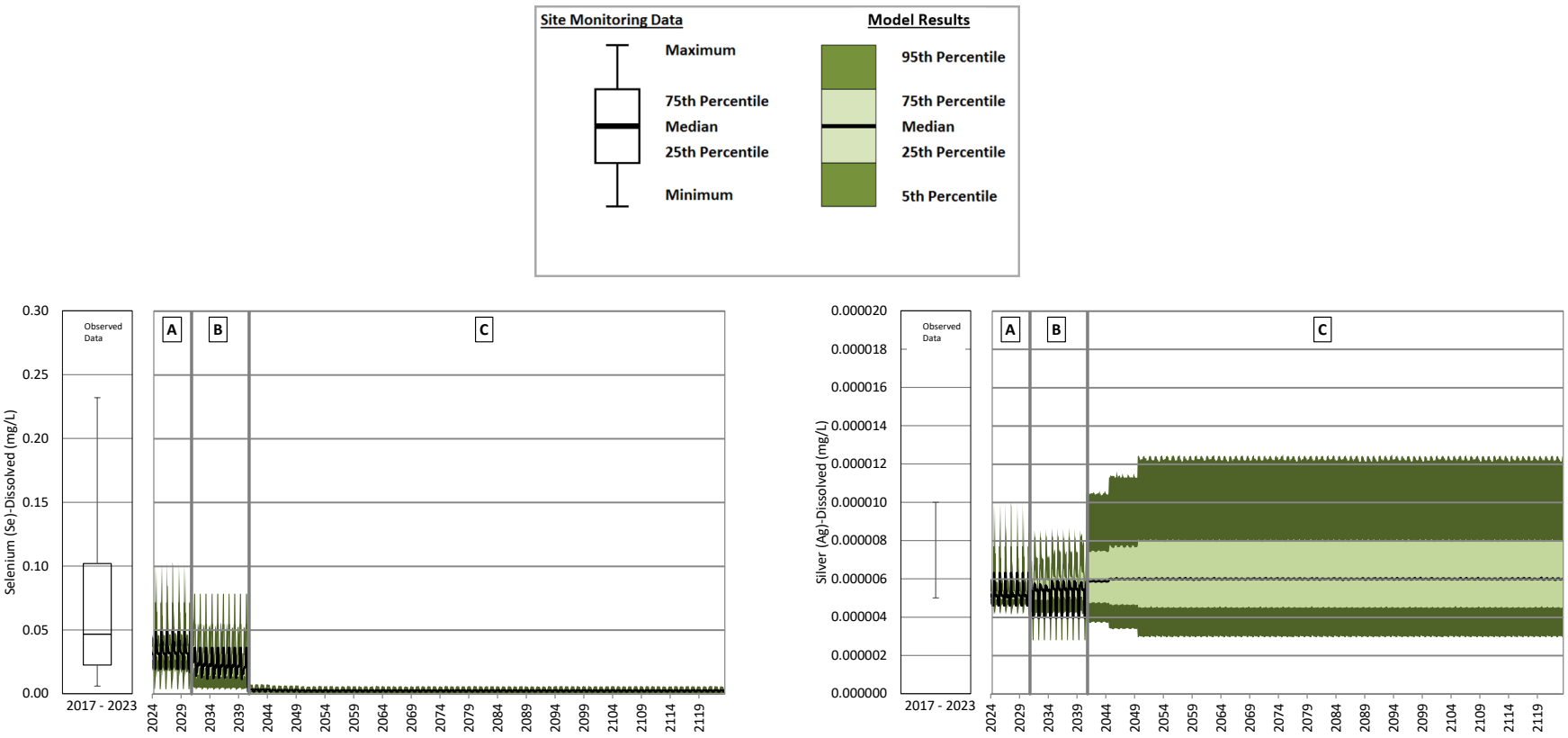

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved silver concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality inputs.

Figure B **236: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

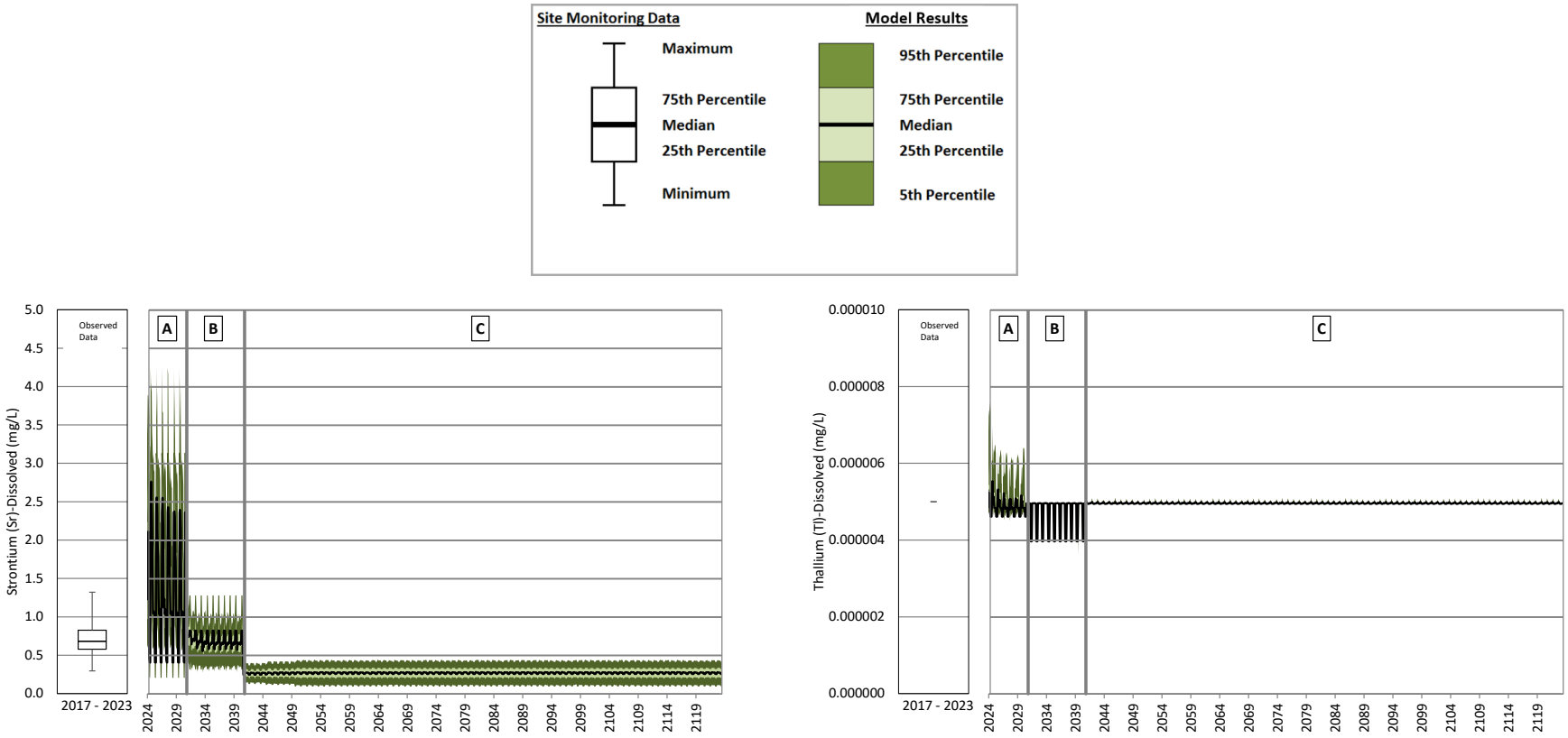

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **237: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

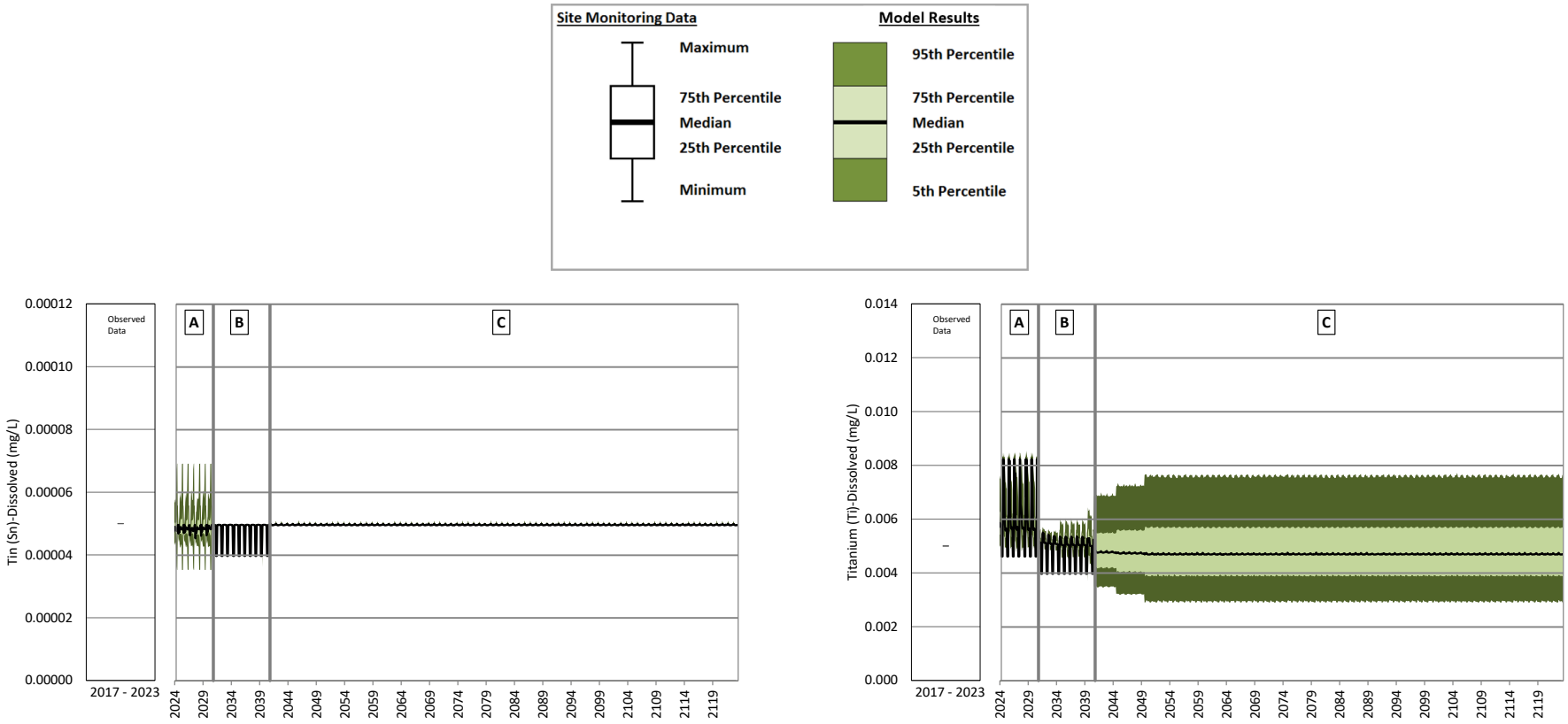

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved titanium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved titanium than the disturbed runoff water quality inputs.

Figure B **238: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

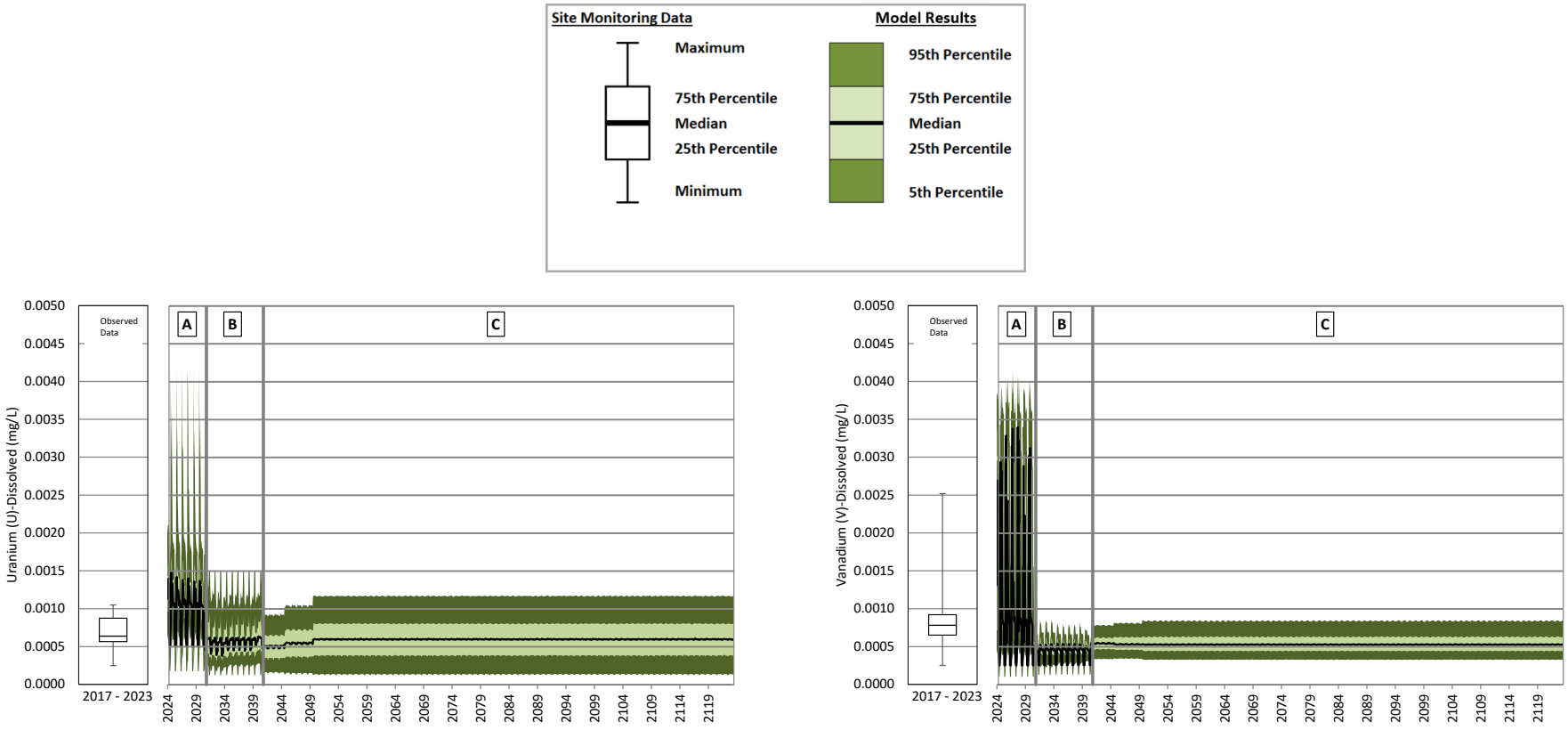

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved uranium and dissolved vanadium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved uranium and vanadium than the disturbed runoff water quality inputs.

Figure B **239: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

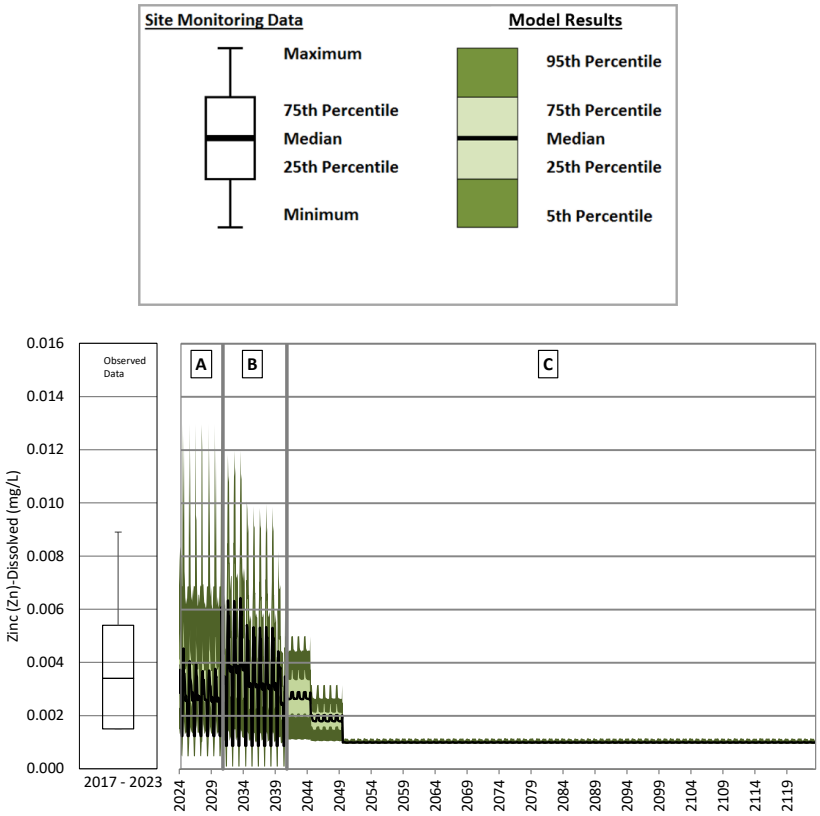

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **240: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Zinc**

Long Ditch Operations

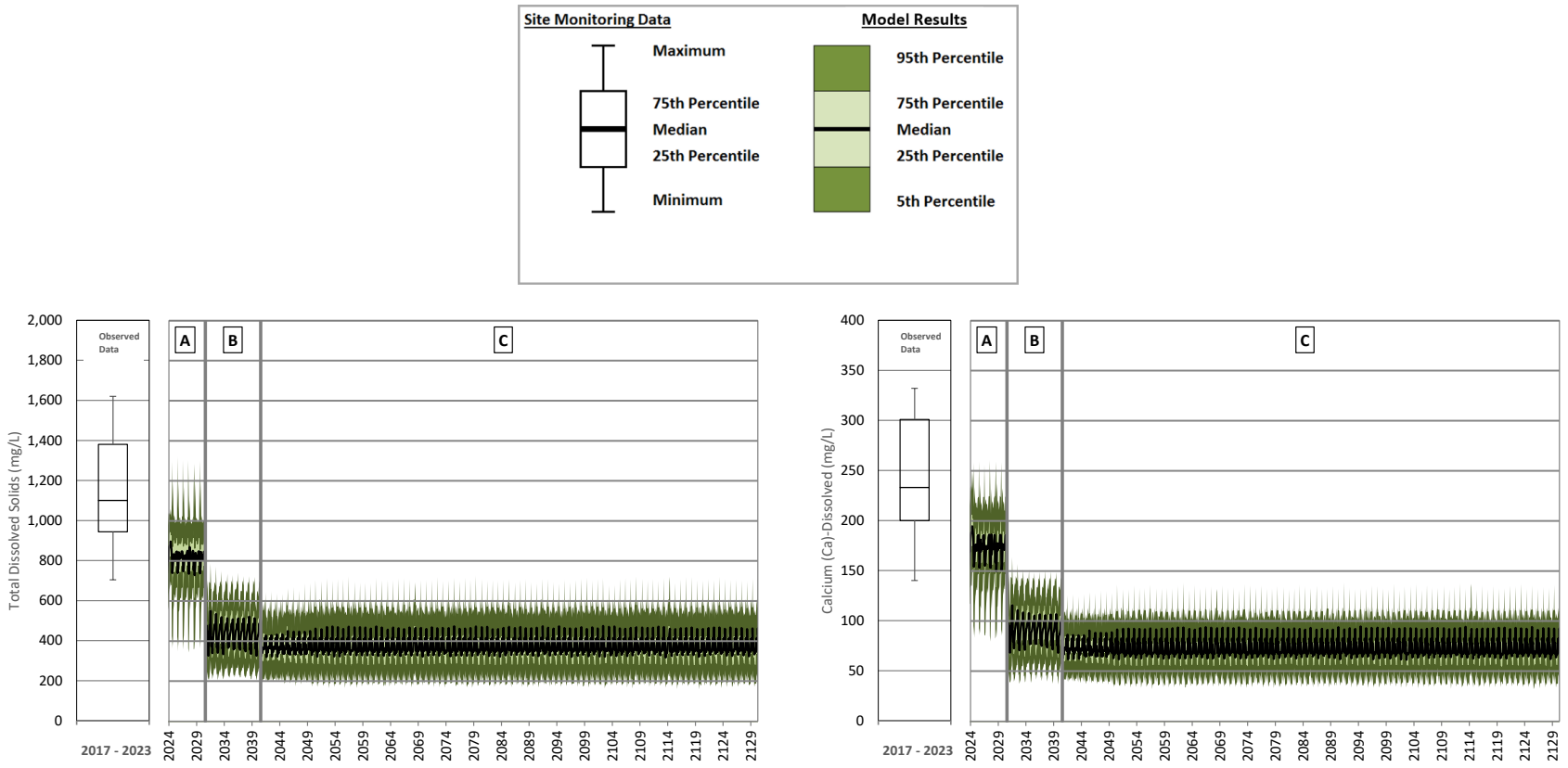

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **241: Long Ditch Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**

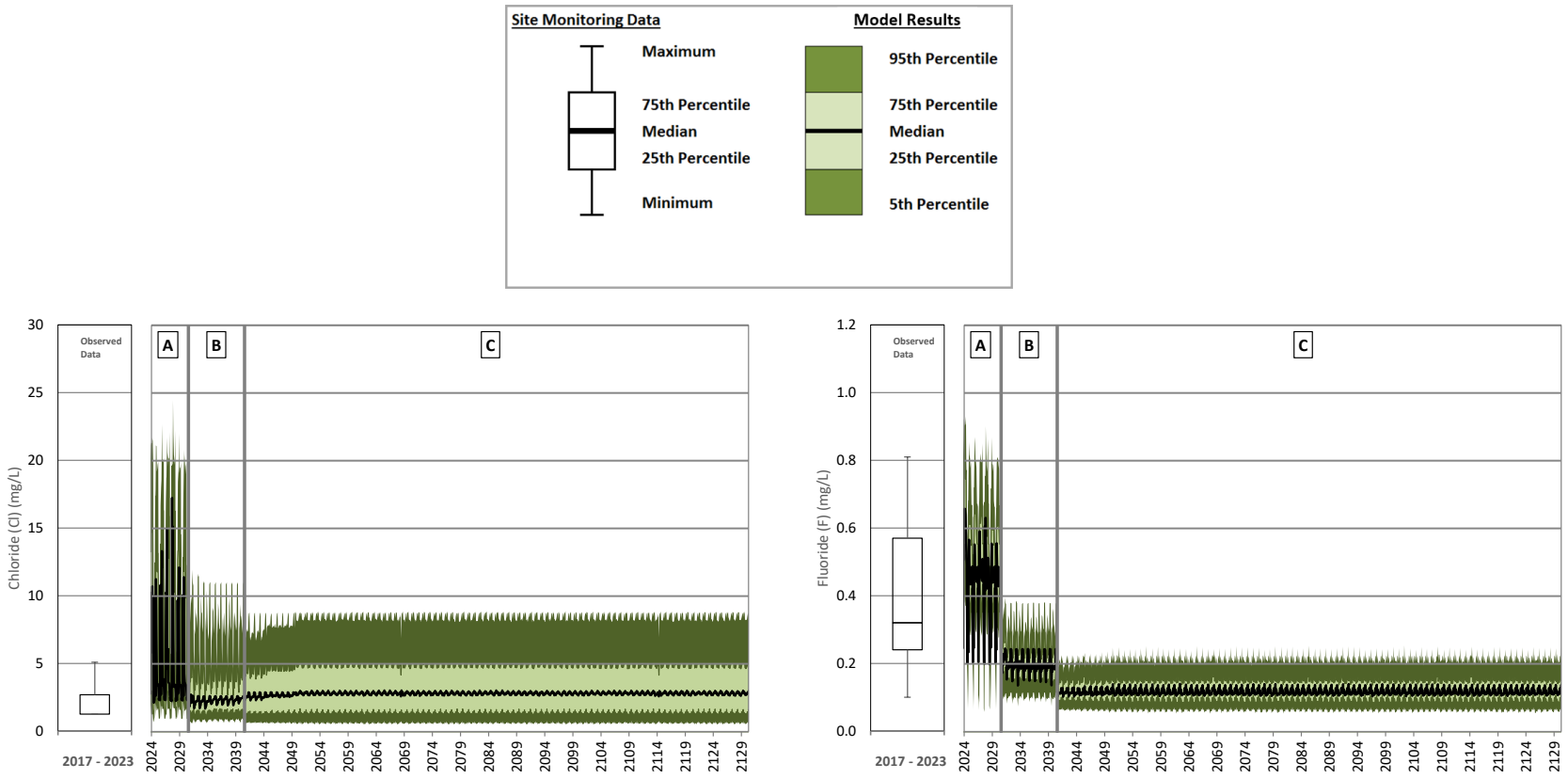

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Chloride and fluoride concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for chloride and fluoride than the disturbed runoff water quality inputs.

Figure B **242: Long Ditch Operations, Closure and Post-closure – Chloride and Fluoride**

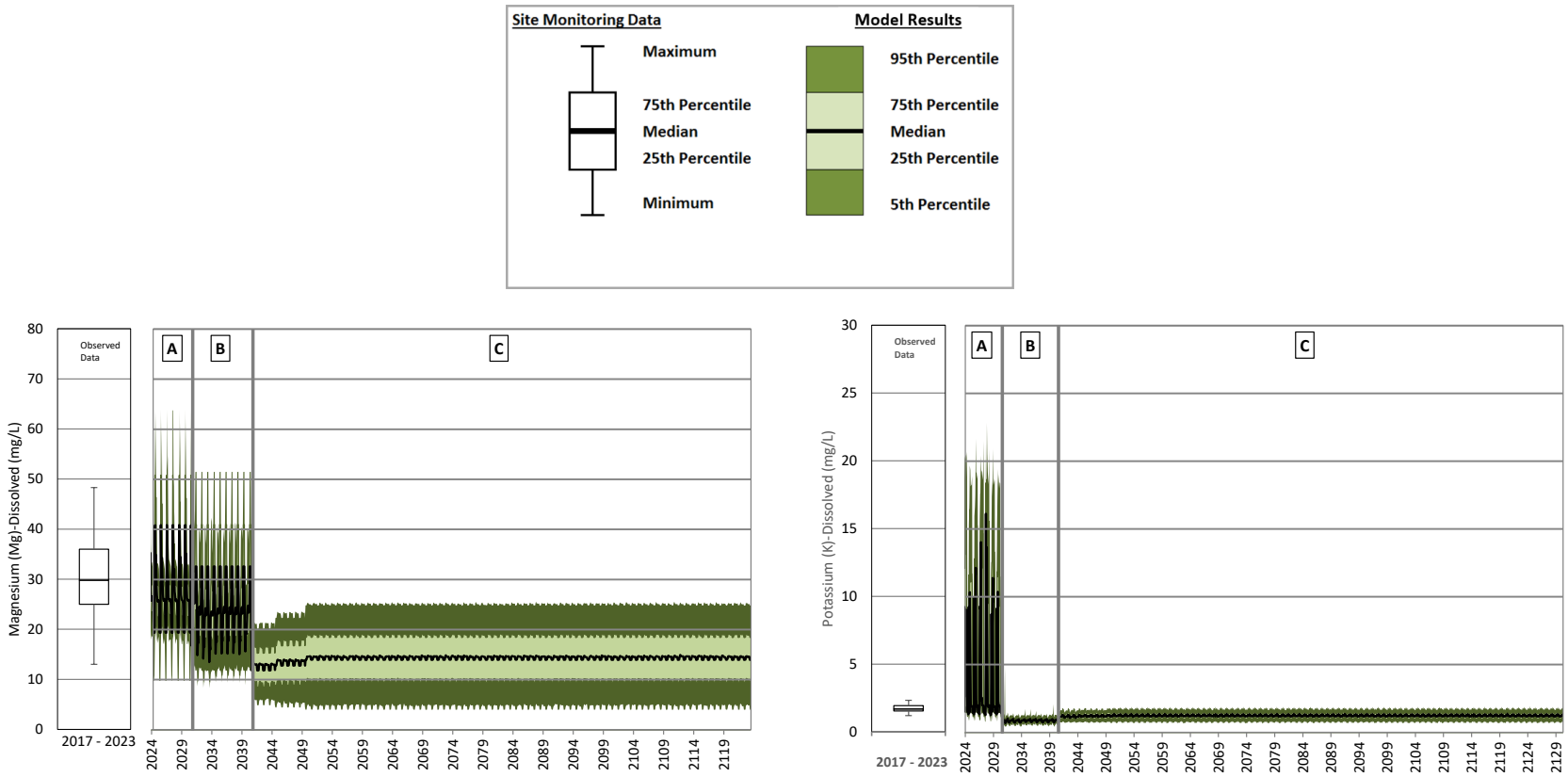

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Magnesium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for magnesium than the disturbed runoff water quality inputs.

Figure B **243: Long Ditch Operations, Closure and Post-closure – Magnesium and Potassium**

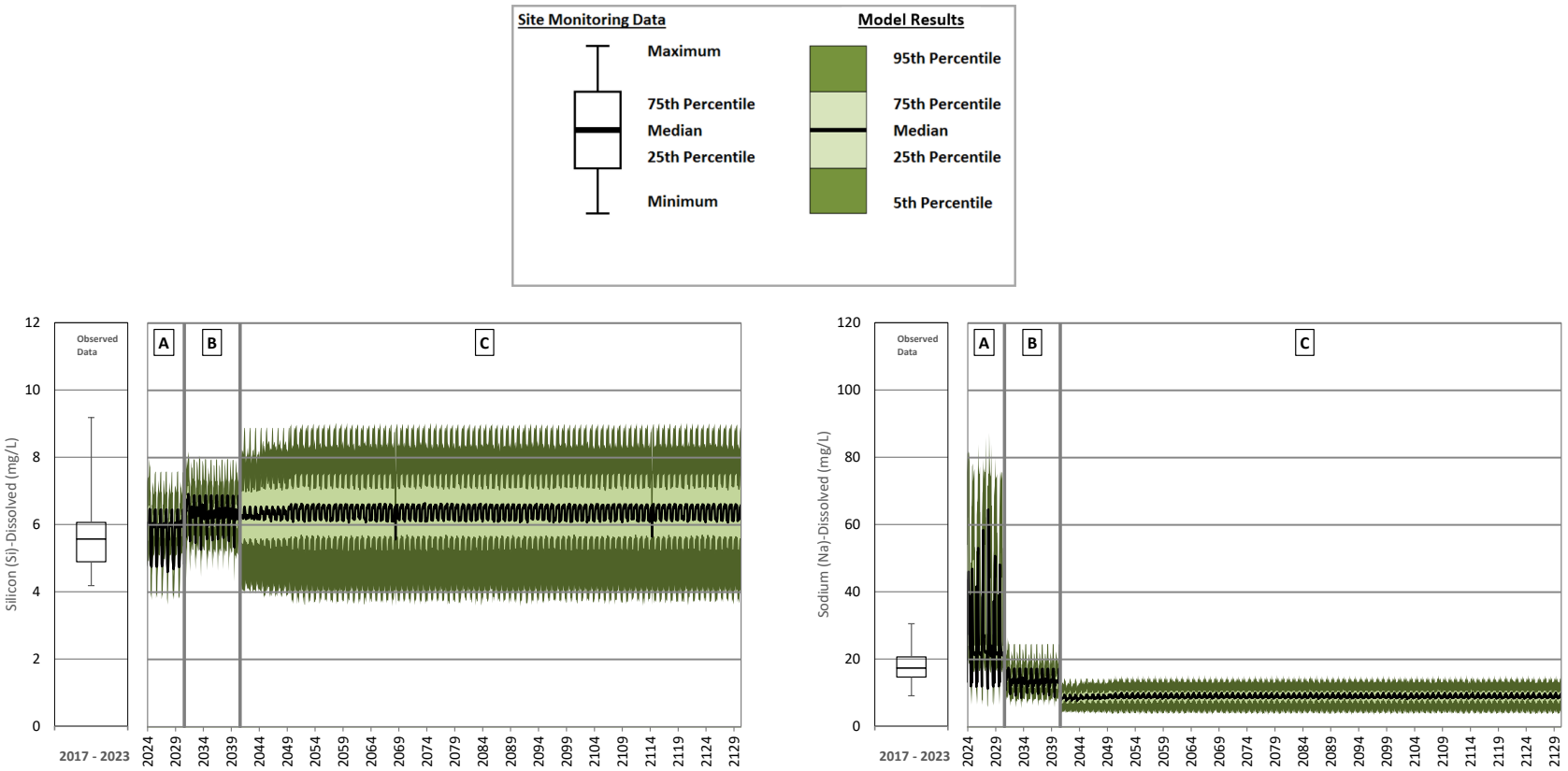

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Silicon concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for silicon than the disturbed runoff water quality inputs.

Figure B **244: Long Ditch Operations, Closure and Post-closure – Silicon and Sodium**

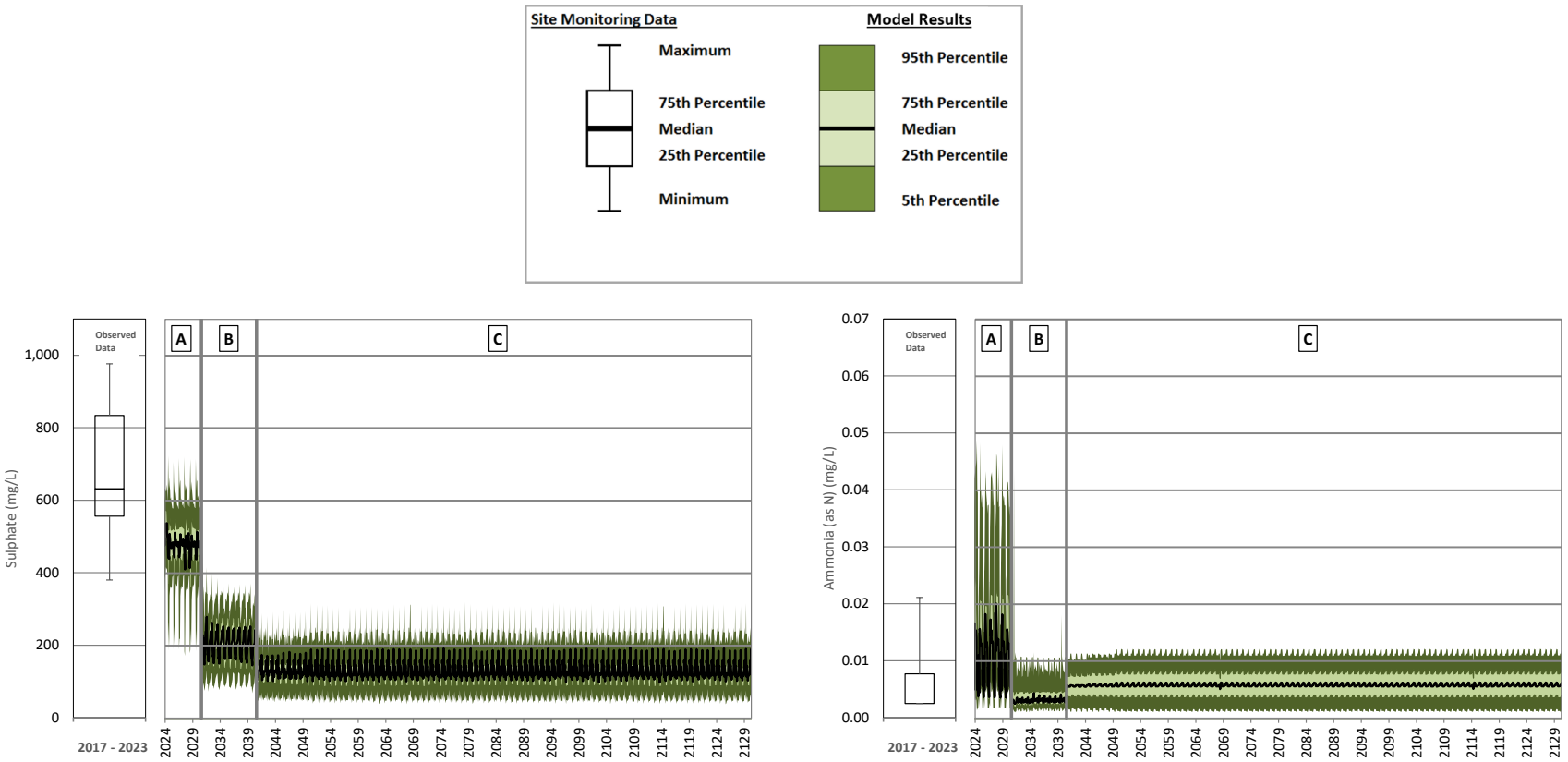

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total ammonia concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for total ammonia than the disturbed runoff water quality inputs.

Figure B **245: Long Ditch Operations, Closure and Post-closure – Sulphate and Total Ammonia**

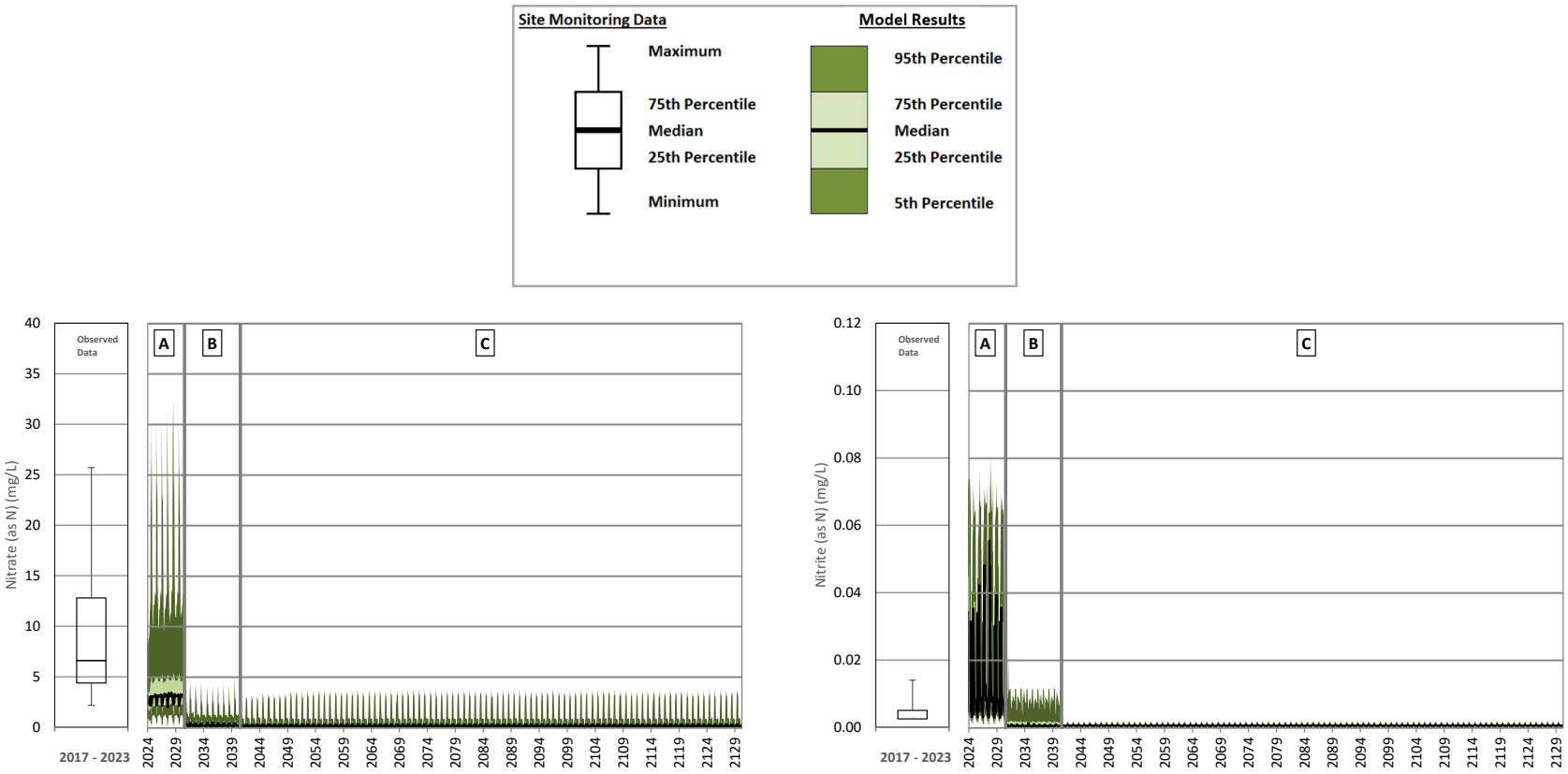

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **246: Long Ditch Operations, Closure and Post-closure – Nitrate and Nitrite**

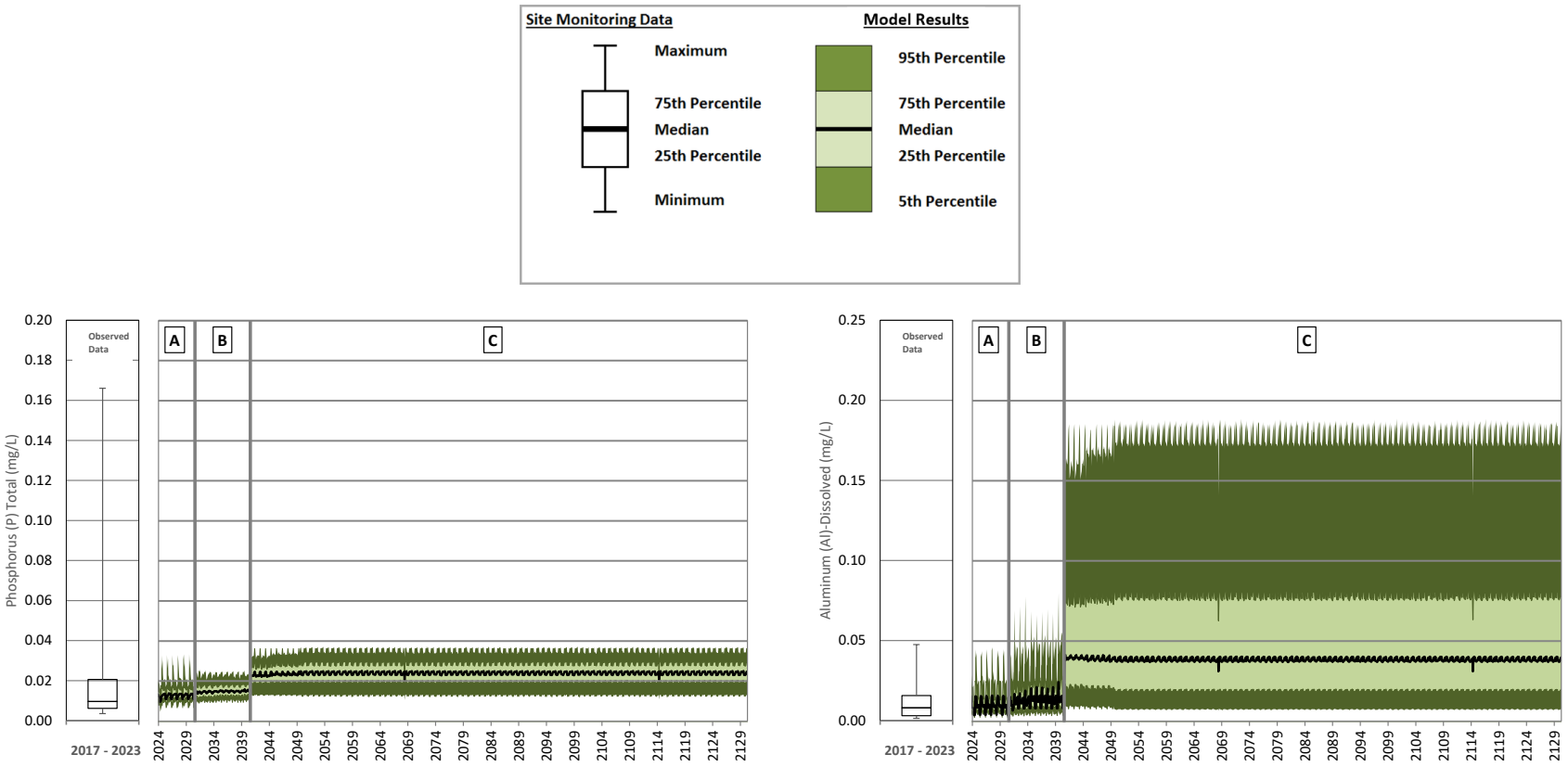

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total phosphorus and dissolved aluminum concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the disturbed runoff and NAG waste rock water quality inputs.

Figure B **247: Long Ditch Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**

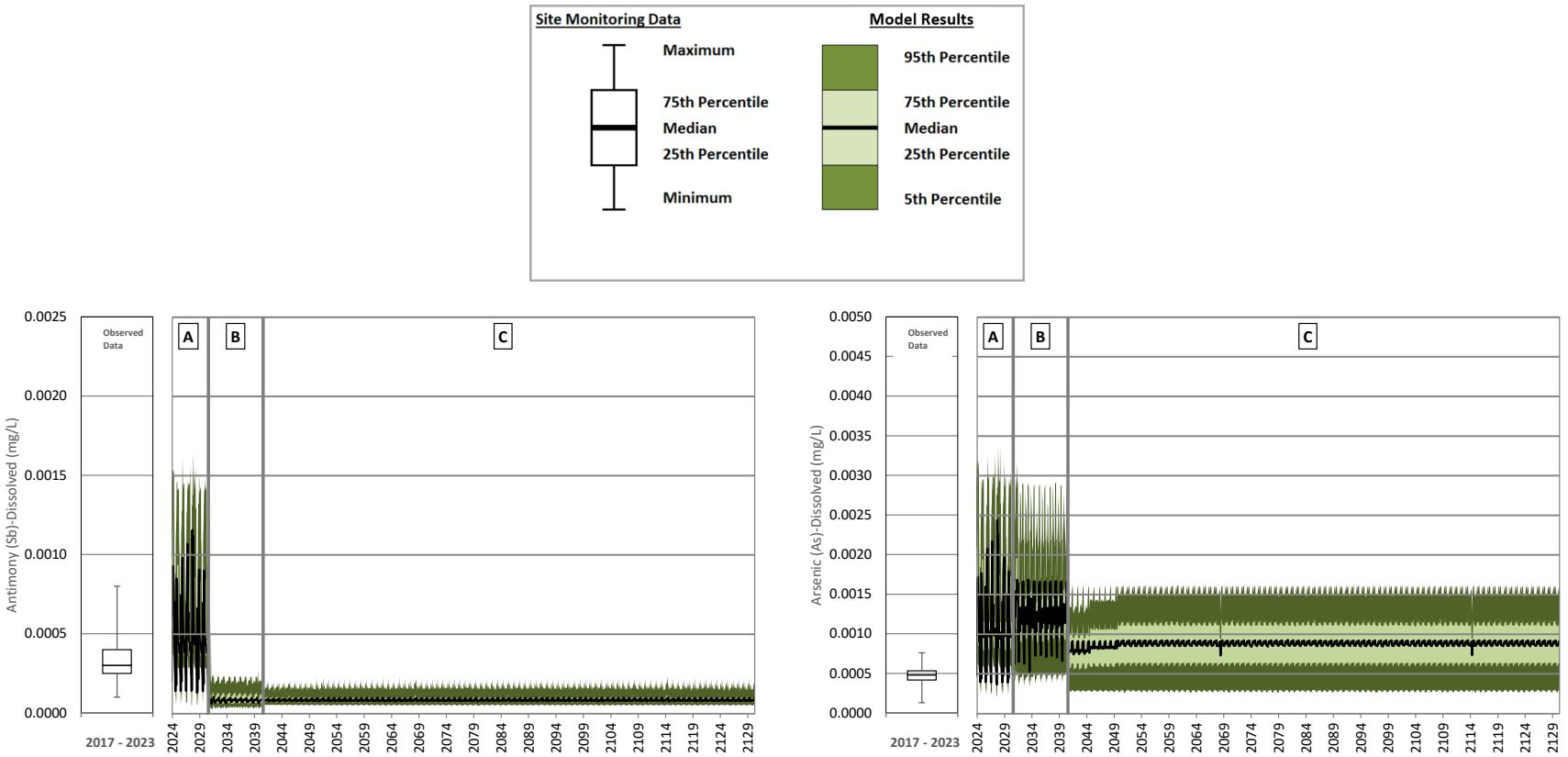

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved arsenic concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality inputs.

Figure B **248: Long Ditch Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**

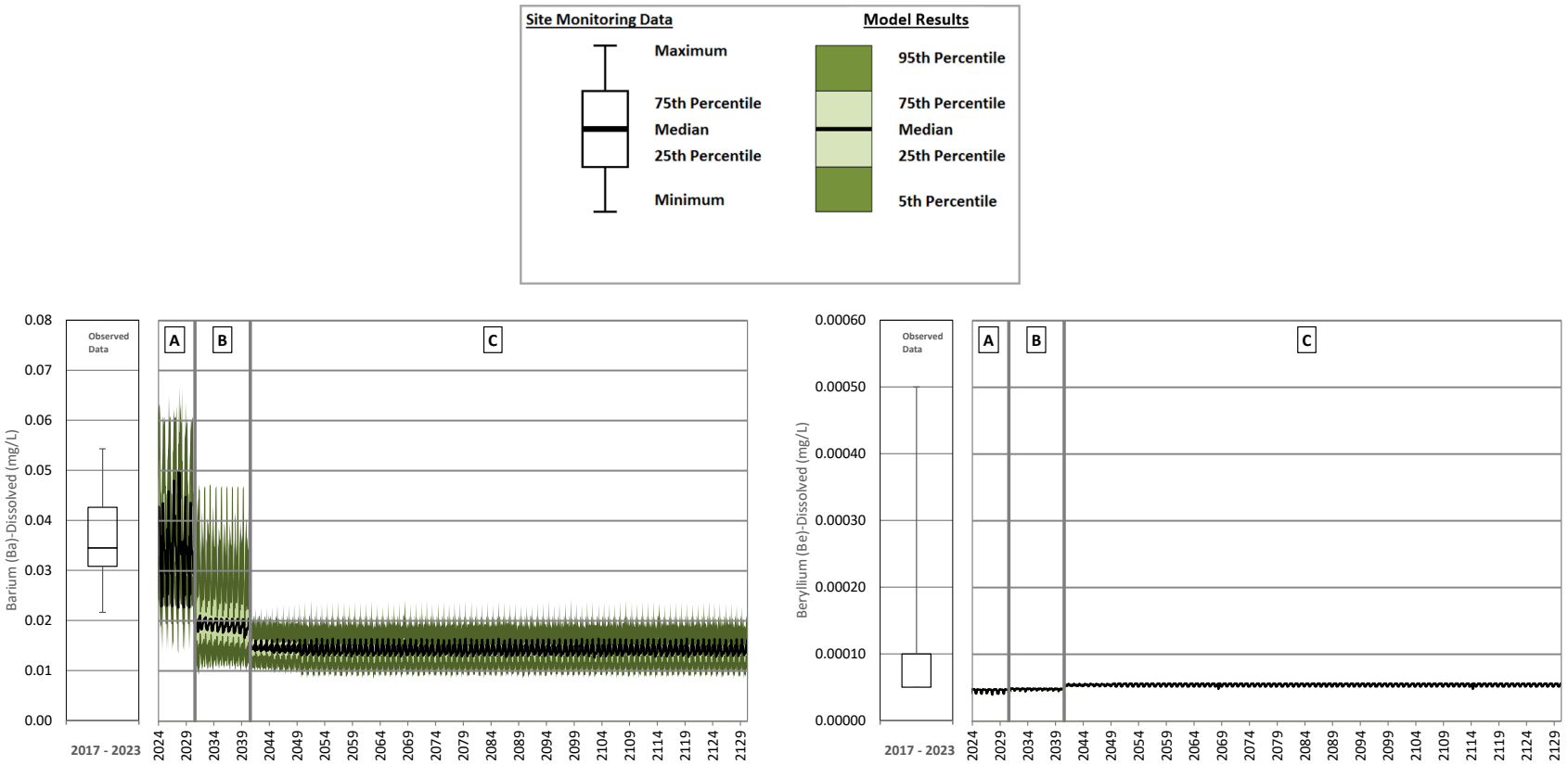

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **249: Long Ditch Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**

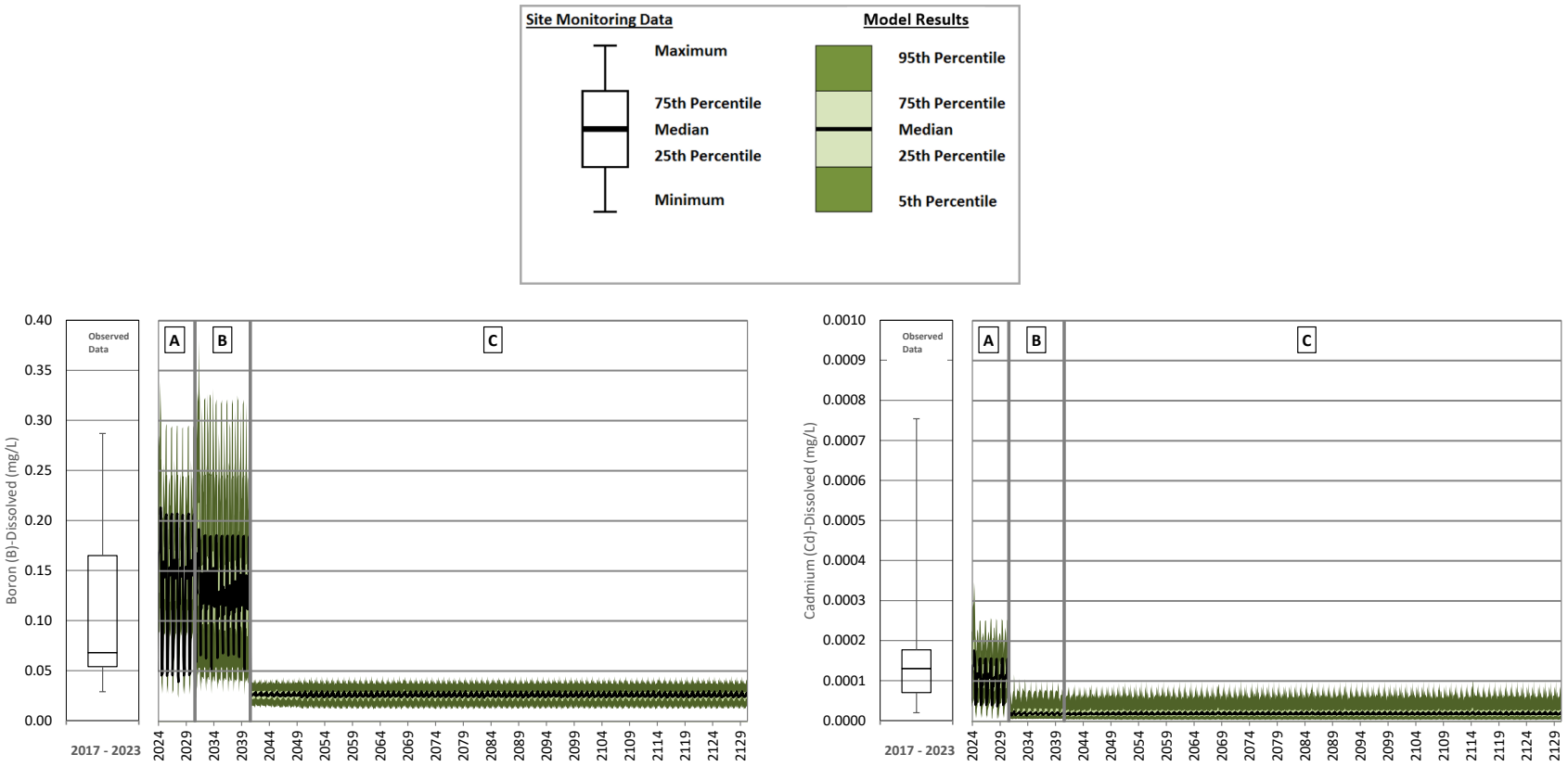

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **250: Long Ditch Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**

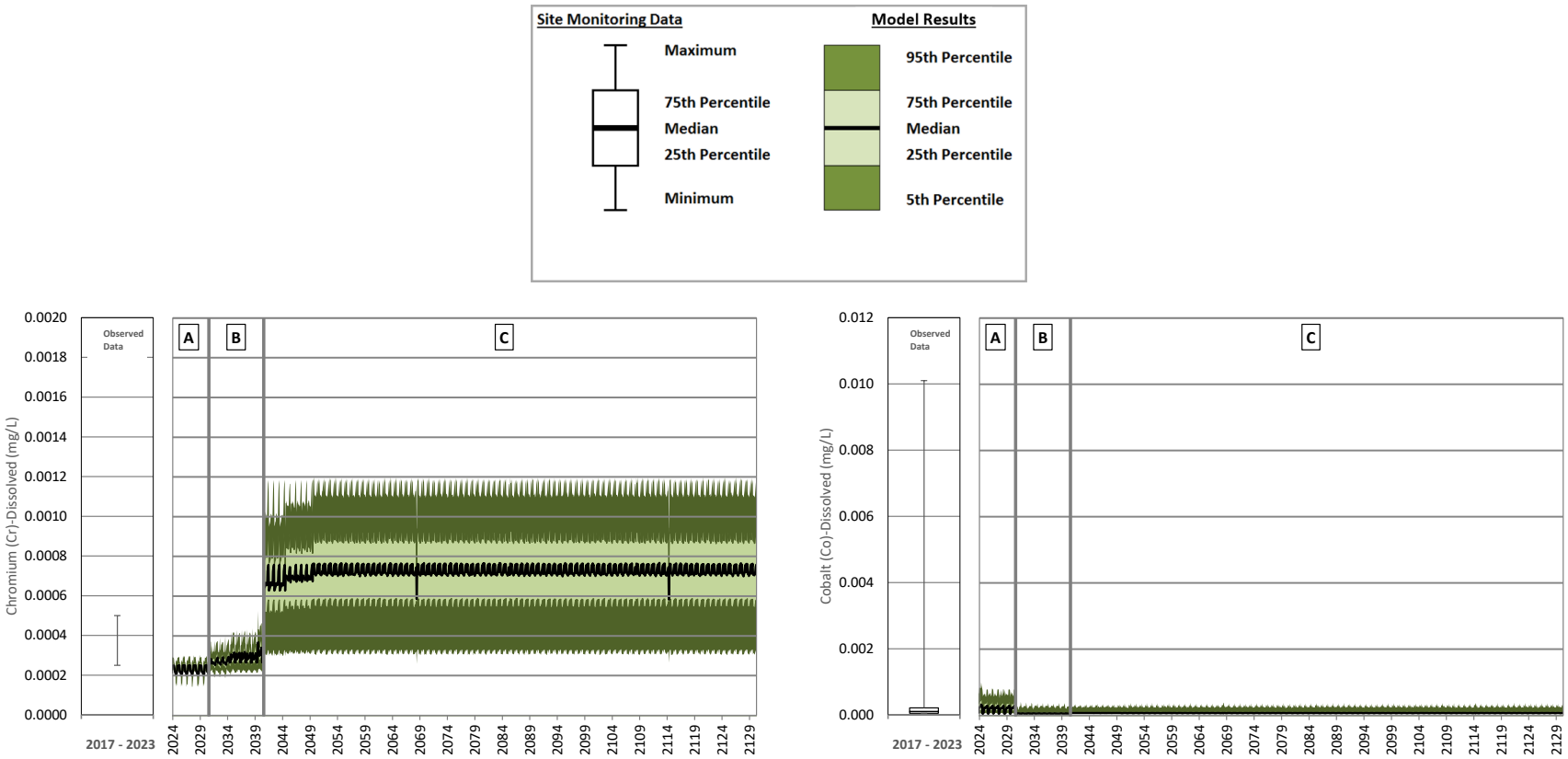

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved chromium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff and NAG waste rock water quality inputs.

Figure B **251: Long Ditch Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**

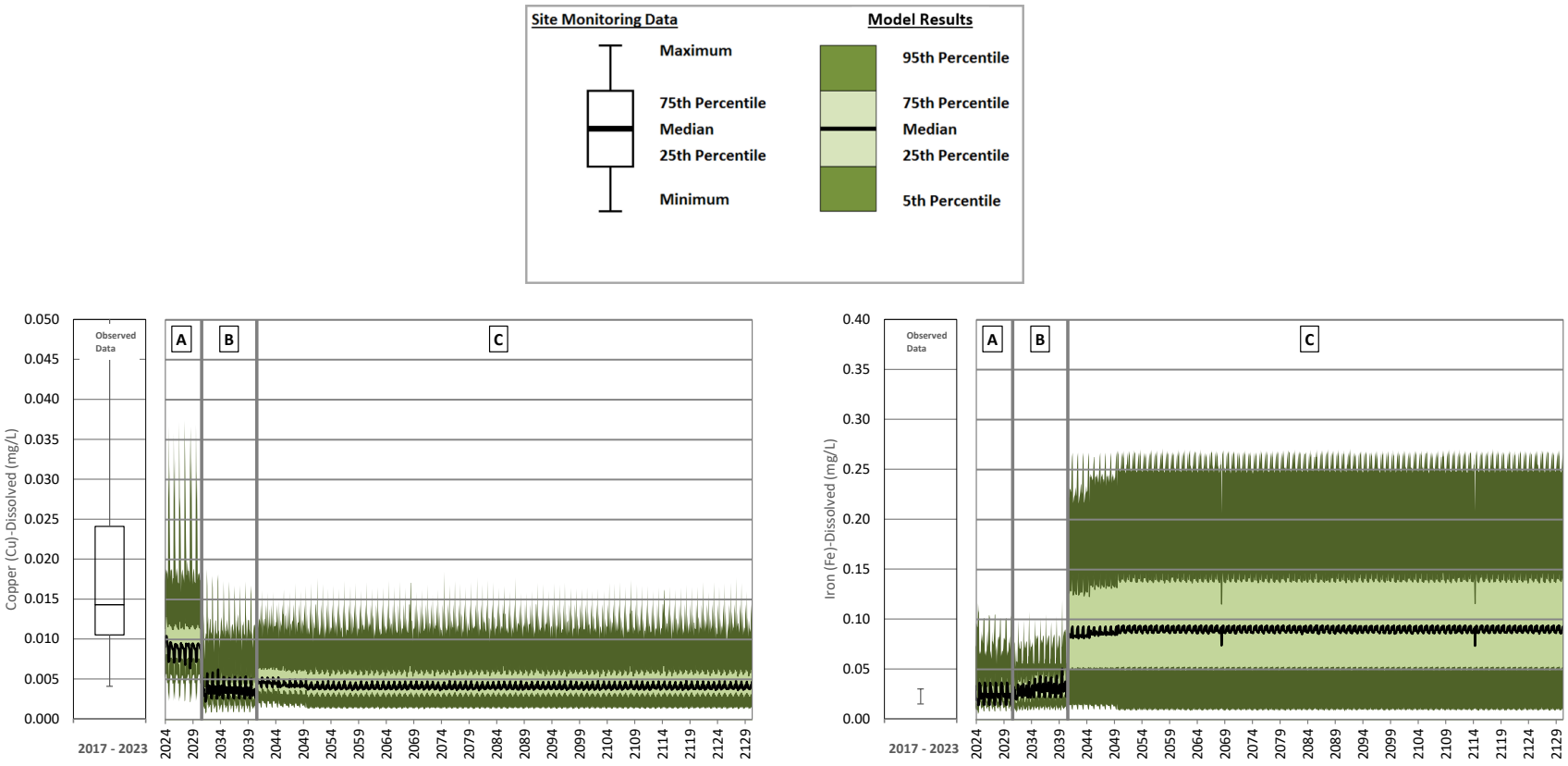

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved iron concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality inputs.

Figure B **252: Long Ditch Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**

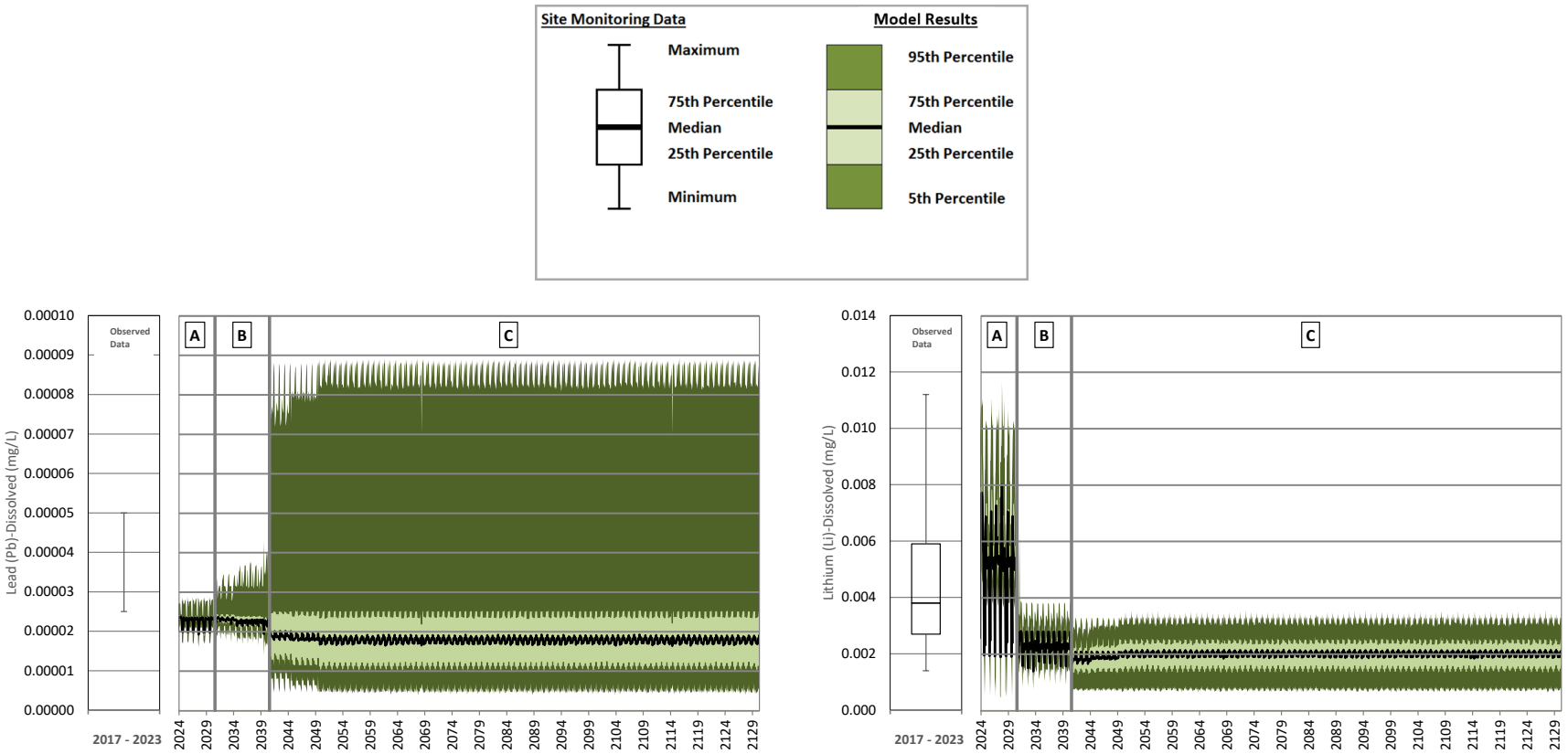

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved lead and lithium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved lead and lithium than the disturbed runoff water quality inputs.

Figure B **253: Long Ditch Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**

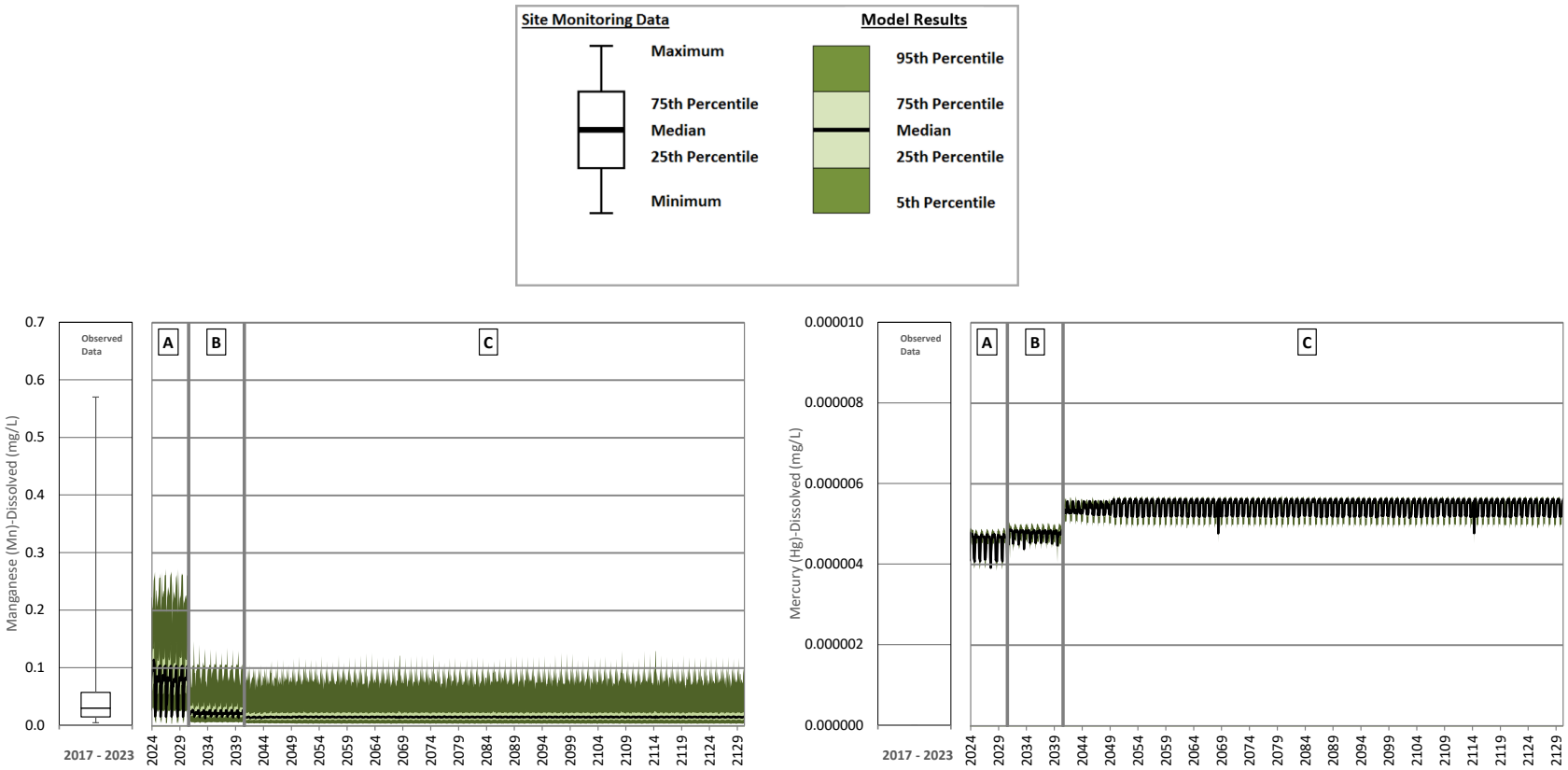

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **254: Long Ditch Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**

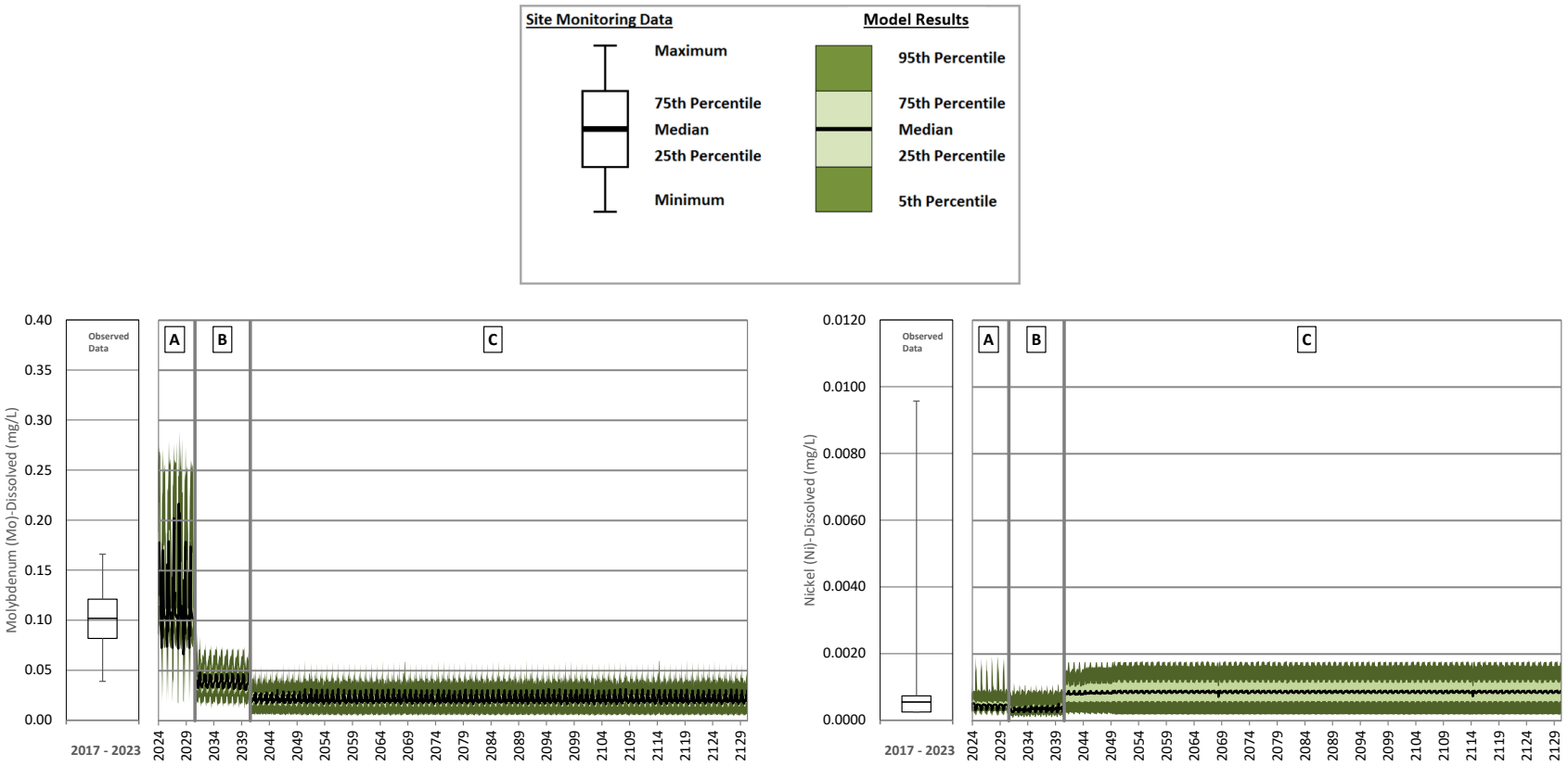

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved nickel concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality inputs.

Figure B **255: Long Ditch Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**

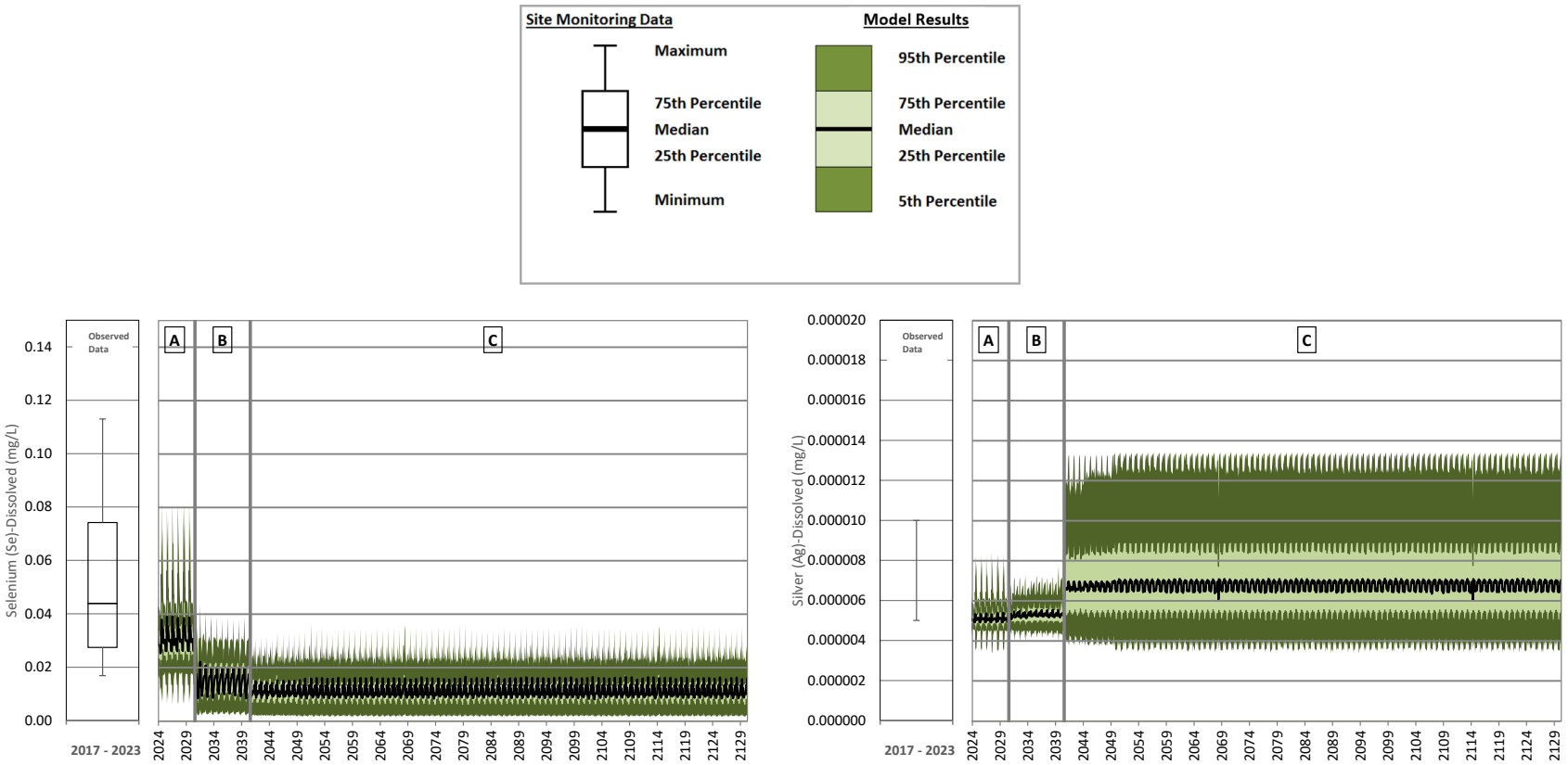

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved silver concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality inputs.

Figure B **256: Long Ditch Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**

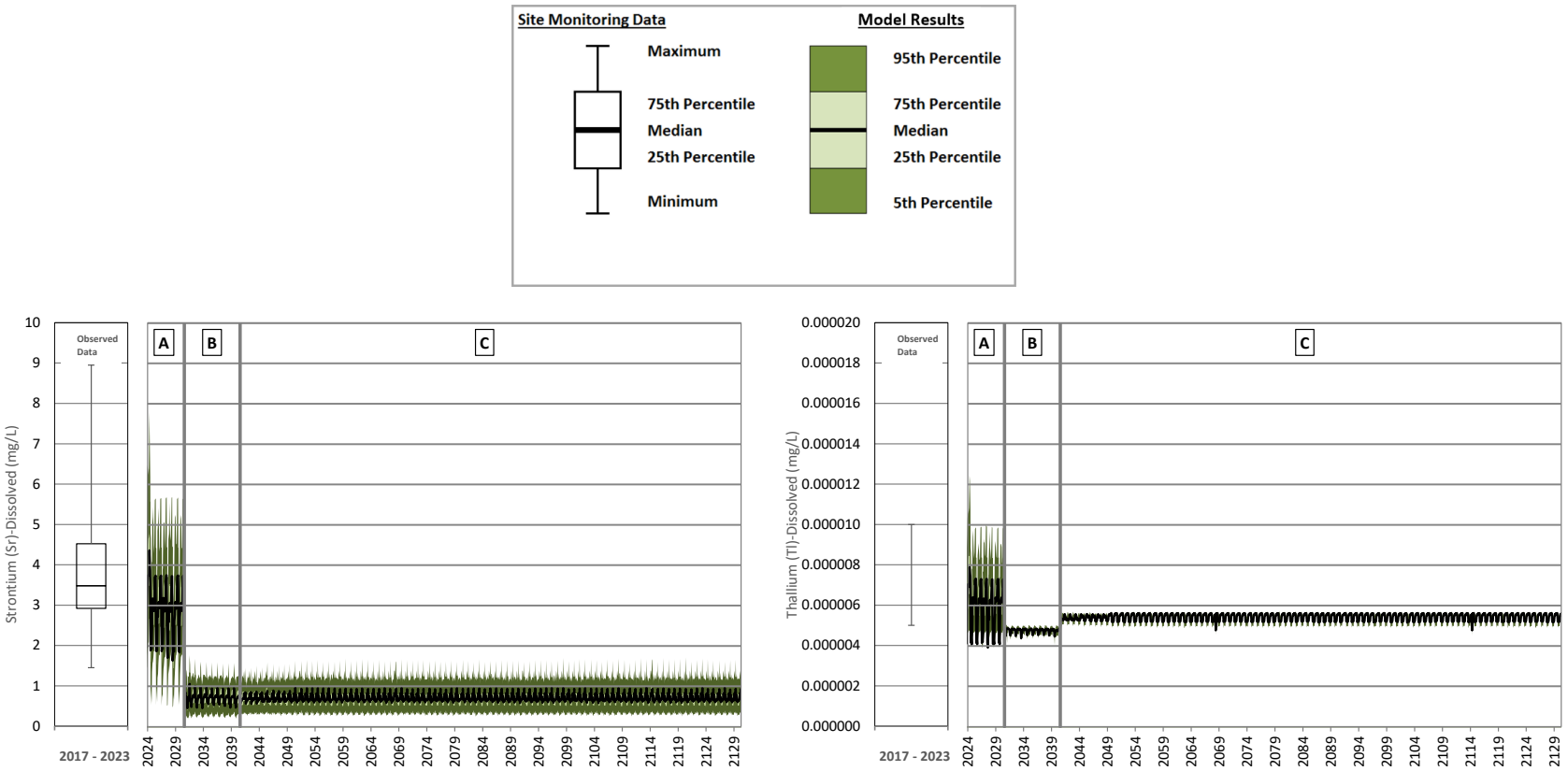

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **257: Long Ditch Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**

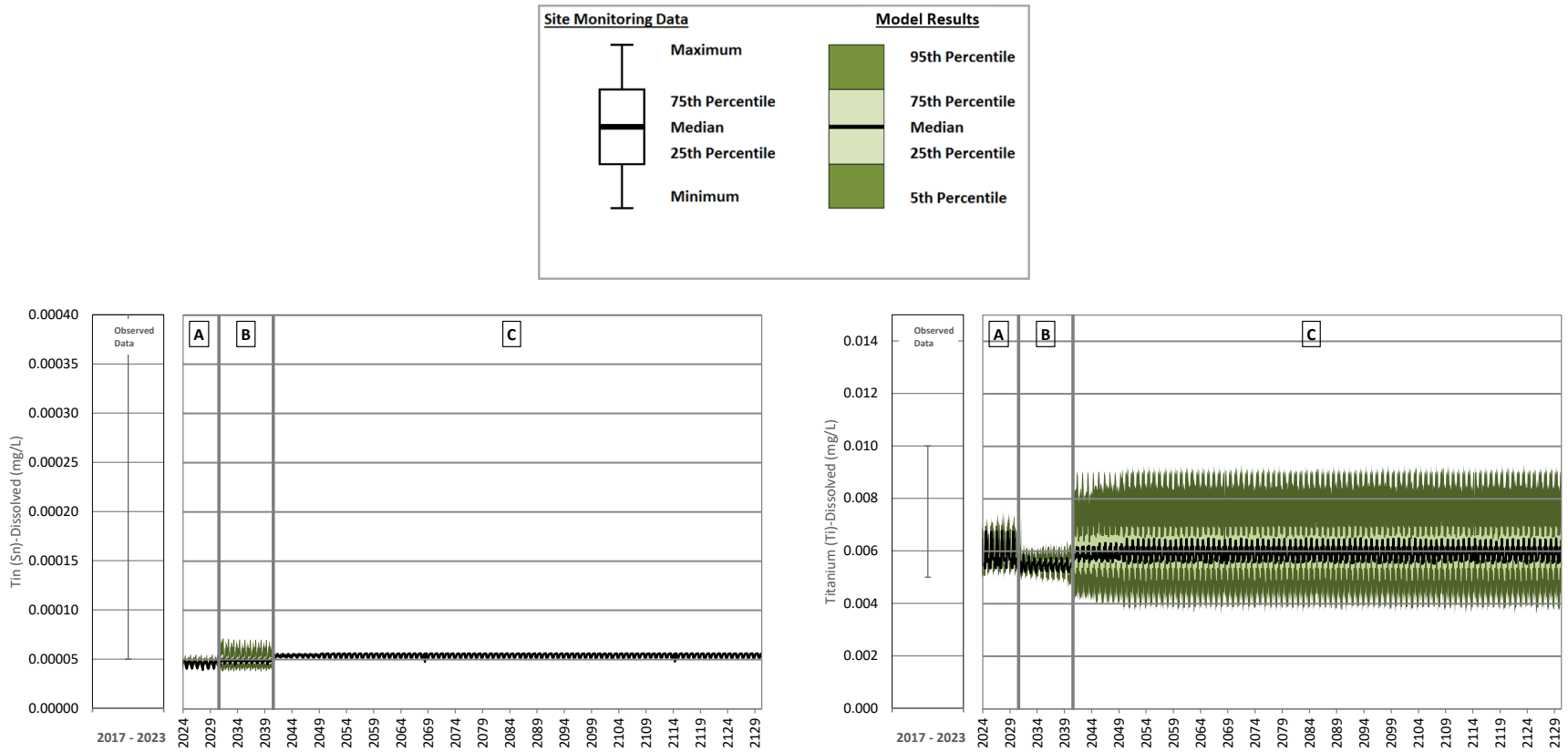

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved titanium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved titanium than the disturbed runoff water quality inputs.

Figure B **258: Long Ditch Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**

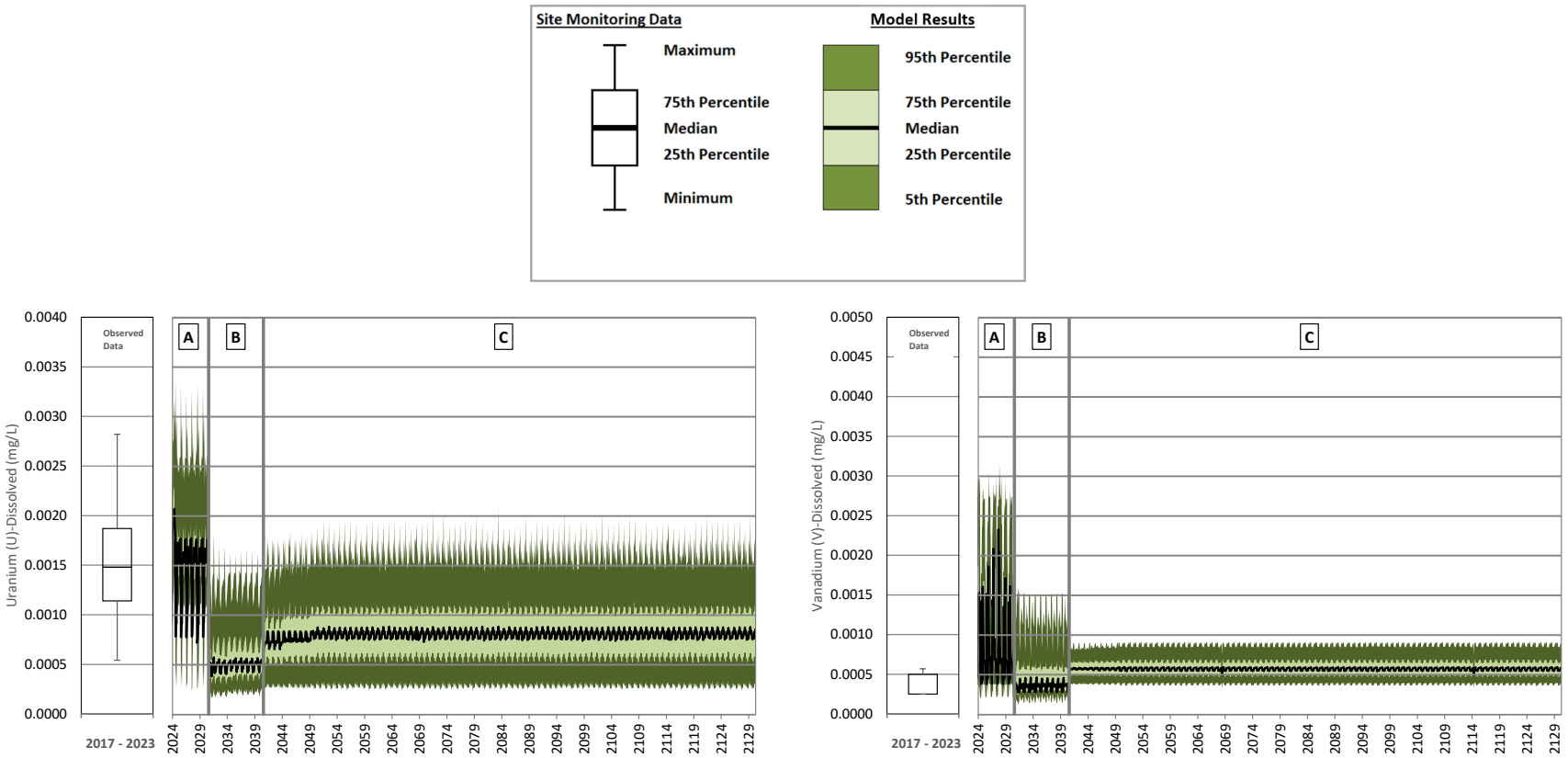

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved uranium and dissolved vanadium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved uranium and vanadium than the disturbed runoff water quality inputs.

Figure B **259: Long Ditch Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

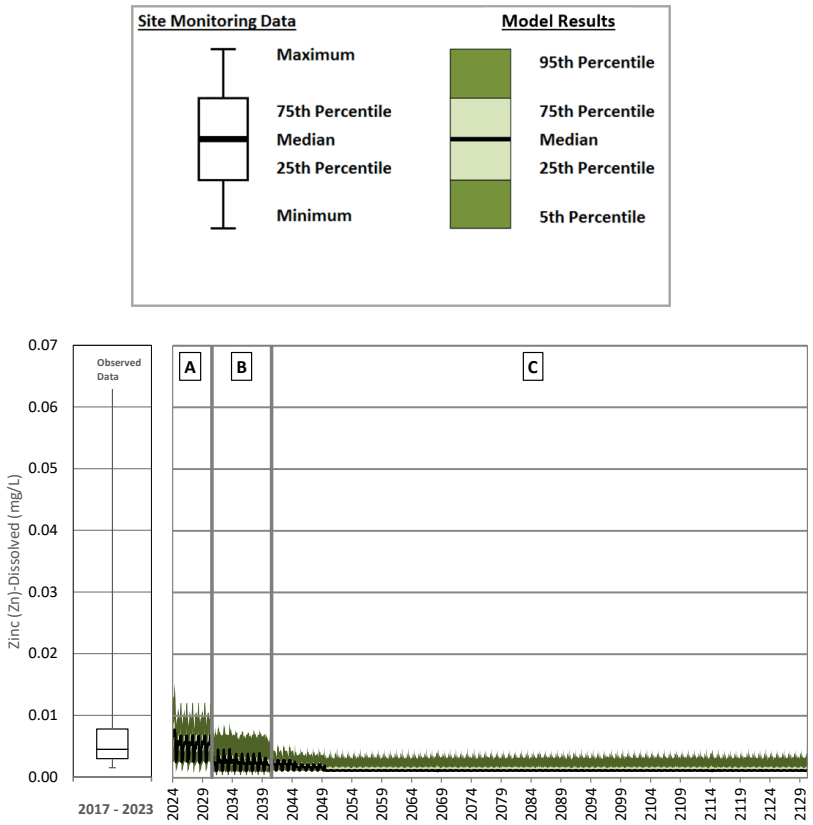

A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **260: Long Ditch Operations, Closure and Post-closure – Dissolved Zinc**



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APPENDIX 9-5: 2021 Discharge Management Plan

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2021 Annual Discharge Plan

Submitted to:

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
Mining Operations

and

Environment Canada

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
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Date: Dec. 15, 2021

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APPENDICES

APPENDIX A

Evaluation of Background Conditions, Mine Water Loading and Remaining Assimilative Capacity in Quesnel Lake – Mount Polley Mine

APPENDIX B

Evaluation of Background Water Quality Data in Quesnel Lake

APPENDIX C

Verification of Near Field Modelling in Quesnel Lake – Mount Polley Mine. Technical Memo

Document Revision and Review Control

Rev. No.	Revision	Date	Approved
0	Original	2018	CH
1	Annual review, updated dates	2019	AL
2	Annual review, updated dates	2020	AL
3	Annual review, added document revision/review table, updated dates	2021	GH

1 Introduction

1.1 Overview

On December 31, 2020, Mount Polley Mining Corporation (MPMC) received an amendment to Permit 11678 issued by the British Columbia (BC) Ministry of Environment and Climate Change Strategy (ENV) under the BC *Environmental Management Act* (*EMA*). The amendment authorizes, among other things, the discharge of treated effluent from the Mount Polley mine (the "Mine") site runoff and seepage collection water management systems until December 31, 2022 which reflects the operations phase contemplated under the currently authorized mine plan. The following effluent discharge locations were authorized:

- Quesnel Lake via direct pipeline until December 31, 2022.

This 2021 Annual Discharge Plan, required under Section 2.6 of *EMA* Permit 11678 is required to outline, among other items, the expected volume, timing, and quality of effluent released to Quesnel Lake, and plan the discharge in such a manner that avoids "pollution", as defined in *EMA* and as determined by the simple evaluation of parameter concentrations at the edge of the Initial Dilution Zone (IDZ) in Quesnel Lake. Parameter concentrations at the edge of the IDZ will be monitored using a model-based approach as part of a Trigger Response Plan (TRP) designed such that three key priorities (in order) will be met:

1. Protection of human safety (specifically, the safety of Mount Polley Mining Corporation Environmental Department monitors),
2. Protection of the environment and compliance with environmental laws, and
3. Related to bullet 2, the TRP has been designed to reflect the importance for MPMC to be able to effectively manage its site water balance so that it does not accumulate impounded water. The management of site water while minimizing water impoundment has been identified as an important priority not only by MPMC but also by First Nations, Ministry of Energy and Mines, BC ENV and our Independent Expert Review Panel (IERP).

These key priorities helped form the premises for the TRP and subsequent actions. Two major premises have formed the basis of the development of the TRP:

1. The TRP and the actions it contains must be implementable.
2. Modelling of dilution in the Quesnel Lake IDZ can reasonably rely on the near-field dispersion model (CORMIX – Golder) and far-field hydrodynamic model (Tetra Tech EBA) developed for Quesnel Lake.

This model-based TRP approach is in keeping with input from ENV and will help alleviate some of the safety concerns associated with sampling in inclement weather while providing reliable estimates of water quality at the edge of the IDZ.

The Mine's effluent discharge is also regulated by the *Metal and Diamond Mining Effluent Regulations* (*MDMER*) under the Federal *Fisheries Act*. This Plan has been developed for submission to ENV and Environment and Climate Change Canada (ECCC) to satisfy the applicable requirements of both *EMA* Permit 11678 and the *MDMER*.

1.2 EMA Permit 11678 Conditions

This Plan considers EMA Permit 11678 conditions and requirements pertaining to the Plan, as stipulated in *EMA* Permit 11678. Table 1 summarizes MPMC's mitigative and compliance responses to *EMA* Permit 11678 requirements which include:

- An outline of the expected volume, timing, and duration of effluent released to Quesnel Lake;
- Consideration or account of recent hydrology and snowpack information, mine water balance information, Polley Lake discharge control, and background water quality information;
- Demonstrate how the BCWQGs set out in column 2 of Table 1 of the permit will be met at the Edge of the IDZ in Quesnel Lake;
- A maximum turbidity target(s), as measured at the outlet of the treatment plant, which requires immediate reporting to the Director should the turbidity target(s) be exceeded for longer than one hour in duration;
- A trigger and response plan for treatment system shutdown(s), and/or for suspension or reduction of discharge, and for the resumption of the discharge, if the effluent discharge limits at the outlet of the treatment plant cannot be met, or if an objective for the Edge of Quesnel Lake IDZ cannot be met;
- Identification of the sources of mine water and the percent of each source in the total effluent discharge for each day;
- Demonstrate how the discharge will be managed to minimize suspended solids deposition into Quesnel Lake; and,
- Identification of equipment, including calibration and maintenance schedules related to continuous measurements of flow, turbidity, specific conductance and temperature.

Table 1. Requirements and Summary of Compliance and Mitigative Actions.

EMA Permit Requirement	MPMC Mitigative and Compliance Response
An outline of the expected volume, timing, and duration of effluent released to Quesnel Lake	Timing and volume for effluent discharge to Quesnel Lake depends on current climate conditions. Discharge will be managed via the MPMC Tailings Storage Facility (TSF) and the on-site Water Manager. Discharge volume will remain within permit limits.
Consideration or account of hydrology and snowpack information, mine water balance information, Polley Lake discharge control, and background water quality information	See Section 3.1 of this Annual Discharge Plan.
Demonstrate how the objectives set out in column 2 of Table 1 in the permit will be met at the Edge of the IDZ in Quesnel Lake	See Section 4.2 of this Annual Discharge Plan
A maximum turbidity target(s), as measured at the outlet of the treatment plant, which requires immediate reporting to the Director should the turbidity target(s) be exceeded for longer than one hour in duration	See Section 4.3 of this Annual Discharge Plan
A trigger and response plan for treatment system shutdown(s), and/or for suspension or reduction of discharge, and for the resumption of the discharge, if the effluent discharge limits at the outlet of the treatment plant cannot be met, or if an objective for the Edge of Quesnel Lake IDZ cannot be met	See Section 5.1 of this Annual Discharge Plan
Identification of the sources of mine water and the percent of each source in the total effluent discharge for each day	With regard to the source of effluent, this information is outlined in detail in the Technical Assessment Report (TAR) prepared in support of the *EMA* Permit 11678 application for the Long-term Water Management Plan (LTWMP) for the Mine site (the LTWMP being the subject of the April 7, 2017 amendment of *EMA* Permit 11678). A key consideration to this is in Appendix C of the TAR (Derivation of Geochemical Source Terms, SRK 2016). The similarities of the mineralized zones, including their host rocks, indicate that source terms can be appropriately developed on a site-wide basis rather than considering significant differences between the zones.
Demonstrate how the discharge will be managed to minimize suspended solids deposition into Quesnel Lake	See Section 3.4. of this Annual Discharge Plan

EMA Permit Requirement	MPMC Mitigative and Compliance Response
Identification of equipment, including calibration and maintenance related to continuous measurements of flow, turbidity, specific conductance and temperature.	See Section 3.5, Table 3. Summary of equipment, maintenance and calibration for continuous site measurements. of this Annual Discharge Plan

2 Effluent Treatment & Discharge System

2.1 Discharge System Components

Mine contact water is collected in a system of ditches located around the Mine site. The water, primarily rain and snow melt, ultimately reports to the Perimeter Embankment Till Borrow Pond (PETBP) from which it is pumped to the Water Treatment Plant (WTP). Treated contact water leaving the WTP flows by gravity through a buried 24" HDPE pipe to Quesnel Lake. At Quesnel Lake, the water is discharged into the lake through two twin diffusers (4 ports in total) with each of the twin diffusers located at depths of 45 meters and 50 meters.

In summary, the major infrastructure components associated with the collection, treatment, and discharge of mine contact water are:

1. Mine site contact water collection system (site-wide ditch system, sumps and pumps)
2. The PETBP
3. Veolia Actiflo^{TM} water treatment plant
4. 24" pipeline from the Veolia Actiflo^{TM} water treatment plant to Quesnel Lake
5. 2 depth staggered, dual port (4 ports in total), submerged diffusers in Quesnel Lake

The construction of the pipeline from the Veolia Actiflo^{TM} water treatment plant to the outfall of the Quesnel Lake diffusers was completed on November 24, 2017. All other works are as before, and were completed in the fall of 2015.

2.2 Water Treatment Plan (WTP)

As outlined in the LTWMP TAR site contact water, primarily originating as rain and snow melt, is conveyed through a site-wide ditch system to the PETBP (Golder 2016a). Water from the PETBP is pumped to the Veolia Actiflo^{TM} WTP, which is operated by qualified personnel 24/7. The Actiflo system is a flocculation/clarifier system which makes use of sand-ballasted lamellar settling to remove suspended solids present in the contact water. The WTP doses the raw water with coagulant to a tank where a polymer is injected to create floc particles. Microsand is added to ballast the flocculants, which move on to another tank that allows them to swell and mature. The water flows to the next stage, which uses lamella to clarify the water and promote fast settling of the microsand ballasted sludge. The clarified water is discharged and the sludge is separated from the microsand, the microsand being recycled for reuse. An in-line turbidity meter measures the turbidity every ten seconds and estimates the total suspended solids (TSS) using a calibrated algorithm based on a site-specific correlation between turbidity and TSS. If the effluent TSS is above 13 milligrams per liter (mg/L) for 1 minute there is an audible and visible alarm. If the effluent TSS is over 14 mg/L instantaneously, an alarm sounds to alert the operator and the WTP automatically goes into recirculation mode and ceases discharge to the pipeline.

2.3 Discharge System Locations

The diffusers, each of which are fitted with a "Y" splitter to two ports, are located at depth in Quesnel Lake at the following coordinates:

- 5,817,932 N and 601,747 E, and 5,817,935 N and 601,785 E.

3 Discharge Plan

3.1 Hydrology

The Mine area is drained by three main watersheds: Hazeltine Creek at Quesnel Lake, Edney Creek at Quesnel Lake, and Morehead Lake. The Hazeltine Creek watershed includes Polley Lake and the upstream Frypan Lake, and conveys all water from Polley Lake, the east side of the Mine area, and the area surrounding the Mine's TSF.

MPMC maintains a hydrological monitoring station on upper Hazeltine Creek that was originally installed by the Water Survey of Canada (08KH027). In general, the hydrology of Hazeltine Creek (and by extension, the Mine area), can be described as snowmelt-driven, with the majority of annual runoff occurring during freshet. Measured hydrology data for 2016 and early 2017 is included in Table 2, and compared to historic averages for rainfall (Golder 2016b), snowpack (estimated from Golder 2016b), snowmelt (estimated from Golder 2016b) and evaporation (Golder 2016b).

Table 2. Hydrology data including actual data from 2016 and early 2017, rolling average data from 2016 and early 2017, and historic averages for comparison.

Month	Rainfall (mm)			Snowpack (mm SWE)			Snowmelt (mm SWE)			Evaporation (mm)		
	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average
Jan-16	31.5	2.9	50.8	167.0	144.0	150.0	1.0	N/A	0.0	7.6	7.0	0.0
Feb-16	26.4	6.8	37.5	219.0	170.0	187.0	54.0	N/A	0.0	18.0	17.0	0.0
Mar-16	17.2	10.8	42.8	50.0	174.0	200.0	170.0	N/A	10.0	45.2	34.0	0.0
Apr-16	33.9	61.6	49.5	0.0	23.0	21.0	50.0	N/A	188.0	95.8	86.0	0.0
May-16	51.0	52.2	53.5	0.0	0.0	0.0	0.0	N/A	10.0	125.3	67.0	52.0
Jun-16	66.2	68.8	78.2	0.0	0.0	0.0	0.0	N/A	0.0	133.1	104.0	94.3
Jul-16	76.3	51.7	58.9	0.0	0.0	0.0	0.0	N/A	0.0	113.1	111.0	102.0
Aug-16	19.5	31.0	52.2	0.0	0.0	0.0	0.0	N/A	0.0	125.3	95.0	88.8
Sep-16	91.4	41.2	48.2	0.0	0.0	0.0	0.0	N/A	0.0	54.8	49.0	48.1
Oct-16	93.2	50.7	58.2	0.0	0.0	0.0	0.0	N/A	0.0	17.2	20.0	18.2
Nov-16	24.3	33.5	53.5	29.0	17.0	13.0	20.0	N/A	13.0	15.1	7.0	0.3
Dec-16	0.0	3.6	85.6	86.0	107.0	99.0	0.0	N/A	0.0	2.6	5.0	0.0
Jan-17	0.0	2.7	50.8	130.0	143.0	150.0	11.0	N/A	0.0	5.0	6.0	0.0
Feb-17	0.0	6.2	37.5	135.0	168.0	187.0	13.0	N/A	0.0	13.7	16.0	0.0
Mar-17	0.0	9.9	42.8	75.0	168.0	200.0	99.0	N/A	10.0	38.8	35.0	0.0

Snowpack measured as Snow Water Equivalent (SWE) at month end
mm = millimetres

3.2 Mine Water Balance

Contact water from roads, haul roads, waste rock dumps, and other Mine areas is managed by a series of ditches, sumps and pumps. Currently (June 2020), any contact water that requires storage on site (i.e., when flows exceed those able to be treated and discharged) is pumped to the TSF. Tailings and process water from the Mill report by gravity to the TSF.

The WTP sources water from the PETBP. Treated water from the WTP is discharged by gravity to Quesnel Lake via the installed pipeline (completed November 2017) to the two outfall pipes. Effluent discharge to the Hazeltine Creek channel ceased as of September 30, 2017. A map of the water collection infrastructure is provided in Figure 1.

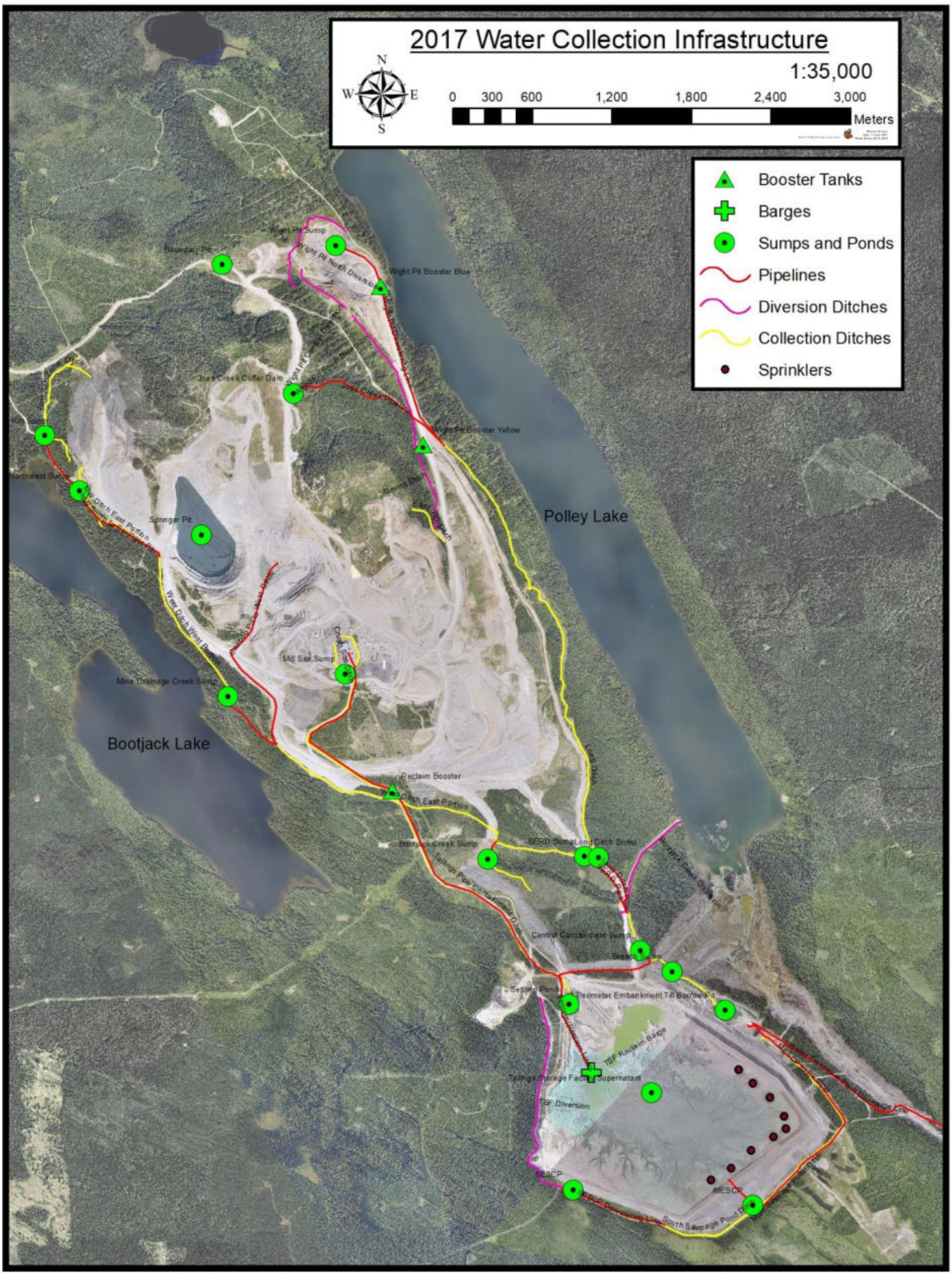

Figure 1. Water management infrastructure at the Mine.

3.3 Expected Volume, Timing, and Duration of Effluent Discharge

MPMC will discharge treated water in 2020 within the confines of *EMA* Permit 11678. Discharge of treated water to Quesnel Lake is limited to a maximum volume of 52,000 m^3/day, with an annual average of 29,000 m^3/day (Sections 1.2.1 and 1.2.2 of *EMA* Permit 11678). Discharge volumes are based on the maximum authorized instantaneous discharge rate of 0.6 m^3/s and maximum authorized annual average discharge rate of 0.33 m^3/s, respectively. The primary water sources for the WTP will be excess water collected and conveyed to the PETBP by the site contact water management systems and any water temporarily detained in the TSF.

With regard to snowpack, water volumes from snowpack and rainfall are aggregated in the maximum permitted discharge volumes, all of which report to Quesnel Lake through the subsurface diffusers and are subject to the flow limits imposed by the permit.

3.4 Management of Suspended Solids

The primary control method to minimize the discharge of suspended solids into Quesnel Lake is the WTP which is an active treatment system designed to remove suspended solids from influent water (Section 2.2).

The secondary method of reducing suspended solids and to reduce the potential for adverse effect on water quality is the utilization of significant engineered erosion control (e.g., armouring) as source control. These Best Management Practices (BMPs) are installed and constructed in the site-wide open flow ditch system. The mine also has an erosion and sediment control management plan for the whole of site.

3.5 Water Treatment

As detailed in Section 2.2, the main component of the treatment system is the Veolia Actiflo™ treatment plant, model ACP-650. The Actiflo™ clarifier system uses sand-ballasted settling to remove suspended solids present in the inflow (influent) water. The quality of influent water and effluent water is monitored within the treatment plant by a number of sensors, meters, and controllers. Table 3Table 3 provides a summary of equipment in the WTP, including calibration and maintenance equipment related to continuous measurements of flow, turbidity, and temperature.

Table 3. Summary of equipment, maintenance and calibration for continuous site measurements.

Equipment Type and Location	**Model Number**	**Calibration and Maintenance Requirements**
Turbidity Meter: Influent Pipe	HACH SS6 Surface Scatter Turbidimeter	Scheduled, periodic maintenance requirements of the SS6 Turbidimeter are minimal. Standardization checks should be performed on a monthly basis. Calibration should be performed at least every four (4) months by one of the methods provided in the Instrument Manual. Operation calibrates and checks weekly.
Electromagnetic Flowmeter: Effluent Pipe	Siemens Sitrans F M MAG 5100 W	The device is maintenance-free, although a periodic inspection must be carried out to check: • Ambient conditions • Seal integrity of the process connections, cable entries, and cover screws • Reliability of power supply, lightning protection, and grounds If required, Siemens will recalibrate the sensor using one of the calibration methods included in the Operating Instruction Manual.
Turbidity Sensor: Clarifier Tank	HACH Solitax® model TS-LINE sc	There are no maintenance requirements for the sensor once installed. Calibration for turbidity uses Formazin or StabCal® standard. Calibration for total suspended solids (TSS) is based on gravimetric TSS analysis with a correction factor. Operation calibrates and checks weekly.

Equipment Type and Location	Model Number	Calibration and Maintenance Requirements
pH Sensor (includes temperature and conductivity): Clarifier Tank	HACH Ryton® Sensor model DPD1R1	Maintenance requirements for the pH Sensor include cleaning the sensor and inspecting the sensor for damage every 90 days. Instructions on how to clean the sensor are in the User Manual. Automatic calibration identifies the buffer table corresponding to the chosen buffer and automatically calibrates the probe after it stabilizes. Alternatively, a manual calibration is performed by placing the pH Sensor in any buffer or sample with a known value and then entering that known value into the controller. Operation calibrates and checks weekly.
Flowmeter Signal Converter: Influent Pipe	Krohne IFC 010 Signal Converter	This is a signal converter and does not require any maintenance or calibration.
Universal Controller: Main Plant Controls	HACH sc200™	This is a signal controller and does not require any maintenance or calibration.

It should be noted that the WTP generates small volumes of sludge (precipitate) during active treatment. This material reports to a holding tank and is then pumped to a pond adjacent to the WTP. Typically, TSS is reduced from approximately 12 mg/L (influent) to approximately 7 mg/L (effluent) so 5 mg/L is considered "waste". This equates to approximately 5 m^3/1,000,000 m^3 of treated water. The sludge requires no further treatment as it is chemically inert.

3.6 Shutdown Criteria

The primary shutdown criterion for the WTP is based on TSS in the effluent. If TSS in the effluent reaches 14 mg/L, discharge to the pipeline is suspended until the level of TSS in the effluent drops to below this value. This is monitored using the automated in-line turbidity sensor and process logic controller, that will put the WTP into a recirculation mode if the limit is exceeded and then water is diverted back into the PETBP.

The secondary shutdown criterion is if laboratory analysis indicates an exceedance of any water quality parameters listed in Section 1.2.4 of *EMA* Permit 11678 at the end-of-pipe (as represented by the discharge from the WTP). Shutdown in that circumstance is operator-induced. In the event that water quality parameters at the edge of the IDZ (mid and near bottom samples) in Quesnel Lake (IDZ) exceed the quantities for those parameters set out in the final column in Table 4, the monitoring, reporting and response procedure will follow the TRP, described in more detail in Section Exceedances: Trigger Response Plan5.1 of this Plan. Sampling at the edge of the IDZ will only take place four times per year for ongoing model verification. It should be noted that the primary fail-safe to avoid any water quality exceedance with the end-of-pipe discharge or criteria listed in Table 4 at the IDZ is shutdown of the WTP, or, for shorter duration events an automated switch-over of the plant to a recirculation mode. Troubleshooting or additional monitoring would occur to identify and mitigate any problems leading to an increase in constituent levels at the end-of-pipe or the IDZ before the WTP would resume operations (Section 5.15).

4 Protection of the Receiving Environment

4.1 Background Water Quality

Background water quality in Quesnel Lake is summarized in Table 4 below.

In the last version of the Annual Discharge Plan (submitted on July 30, 2018 and approved on September 6, 2018), MPMC proposed to change the background water quality reference site from QUL-120a to QUL-2a (Table 4) as it has been shown to be not significantly different from location QUL-120a and poses less of a safety concern for sampling access (Golder 2018b). Location QUL-2a is the closest upgradient site to the discharge and water quality at a depth of 40 m was shown to be a better representation of what would be measured at the IDZ in Quesnel Lake in the absence of a discharge.

As summarized in the technical memo on evaluating background water quality data in Quesnel Lake (Golder, 2018b), all parameters at QUL-2a during 2016, met the Edge of Quesnel Lake IDZ limits established under Section 1.2.4 of *EMA* Permit 11678 with the exception of total copper, which was over the guideline in one sample and total phosphorus which was over the guideline in one sample.

Table 4. 2017 Background water quality information for Quesnel Lake (QUL-2a, 2017 data)

Parameter	Minimum	Average	Maximum	Edge of Quesnel Lake IDZ[1]
pH (in situ) (relative units)	7.83	7.90	7.95	n/a
Temperature (in situ) (Degrees Celsius)	2.70	7.22	17.83	n/a
Conductivity (in situ) (µs/cm)	97	108	120	n/a
Turbidity (in situ) (NTU)	0.17	0.35	1.30	n/a
Hardness (as $CaCO_3$) (mg/L)	47.4	51.7	54.3	n/a
Dissolved Oxygen (in situ) (mg/L)	8.7	11.1	12.7	n/a
Total Dissolved Solids (mg/L)	58	72	94	n/a
Total Suspended Solids (mg/L)	0.50	0.54	1.10	n/a
Total Sulphate (mg/L)	5.99	6.82	8.41	218
Total Ammonia (as N) (mg/L)	0.0025	0.0028	0.0085	0.18
Total Nitrate (as N) (mg/L)	0.047	0.124	0.154	3.0
Total Nitrite (as N) (mg/L)	0.0005	0.000535714	0.0015	0.02
Total Phosphorus (P) (mg/L)	0.001	0.001921429	0.005	0.01
Fluoride (F) (mg/L)	0.028	0.032	0.035	1.0
Total Arsenic (As) (mg/L)	0.00005	0.000107143	0.00014	0.005
Total Chromium (Cr) (mg/L)	0.00025	0.00025	0.00025	0.001
Total Copper (Cu) (mg/L)	0.00025	0.0008175	0.00205	0.0022 (30-day rolling average)
Total Iron (Fe) (mg/L)	0.015	0.017	0.037	1.0
Dissolved Iron (Fe) (mg/L)	0.015	0.015	0.015	0.35
Total Manganese (Mn) (mg/L)	0.0008	0.0013	0.0031	0.84
Total Molybdenum (Mo) (mg/L)	0.0002	0.000435786	0.000974	0.05
Total Silver (Ag) (mg/L)	0.000005	0.000005	0.000005	0.00005
Total Selenium (Se) (mg/L)	0.000077	0.000120	0.000209	0.002
Total Zinc (Zn) (mg/L)	0.0015	0.002132143	0.005	0.0075
Dissolved Aluminum (Al) (mg/L)	0.0047	0.006153571	0.0097	0.05
Dissolved Cadmium (Cd) (mg/L)	0.0000025	0.0000025	0.0000025	0.00013

(1) Edge of Quesnel Lake IDZ limits as established under Section 1.2.4 of EMA Permit 11678

Notes – where value is above the MDL, 0.5x the MDL is used in calculation, where values are all below MDL, then MDL is presented.

– DLs were substituted with 1/2 DL.

4.2 Predicted Water Quality

The TAR (Golder 2016a) included measures to manage the following water conveyances:

- Collection and temporary storage of all site contact water in the TSF
- Springer Pit dewatering
- Discharge of up to 0.6 m^3/s instantaneously and 0.33 m^3/s averaged annually of treated effluent to Quesnel Lake, via direct pipeline and two twin diffusers installed below the thermocline in Quesnel Lake (during the Quesnel Lake Discharge)

As part of the TAR, a water quality model was developed to predict the treated effluent chemistry of site discharge during operations and to evaluate the influence of the effluent discharge on Quesnel Lake (Golder 2016a). The model was developed using the GoldSim Contaminant Transport Module (GoldSim 2010). GoldSim is a graphical, object-oriented mathematical model where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors which control an engineered or natural system and predict the future performance of the system.

In GoldSim, each flow that could influence water quality was itemized and assigned a chemical profile based on site water quality monitoring data. The model was designed to track the volume and the mass load in the effluent discharge based on each water source (e.g., site runoff or pumped Mine flows) contributing to the discharge. Based on the quantity of these two parameters, the discharge water quality was calculated. A treatment efficiency was applied to the predicted discharge water qualities to evaluate the concentration of each parameter in the treated effluent.

The model was run stochastically using a Monte Carlo approach to bracket the range of effluent qualities that could occur. A probability distribution function was assigned to each source that could influence the discharge water quality and the model was run for 1,000 realizations on a monthly timestep, allowing the model to generate 1,000 unique values for each input. At each timestep, median and 95th percentile concentrations were calculated based on the 1,000 simulated values (referred to as "Scenario 1"). To account for potential changes in water chemistry over the long-term, a source-term based model was also used to simulate concentrations using the same water balance model (referred to as "Scenario 2").

The results of the model, accounting for treatment efficiency, were proposed as the effluent limits to be included in the application for amendment of *EMA* Permit 11678 for the Quesnel Lake Discharge. Depending on the water quality constituent, either Scenario 1 or Scenario 2 was used. In either case, the proposed *EMA* Permit 11678 limits were calculated such that treated effluent would not cause an exceedance of BC Water Quality Guidelines (WQGs) at the edge of the IDZ in Quesnel Lake, provided that natural conditions beyond MPMC's control do not cause WQG exceedances. It was assumed that such natural occurrences would be evaluated through monitoring associated with the Response Framework, which is part of the approved 2016 Comprehensive Environmental Monitoring Plan (CEMP) (MPMC 2018).

A Cornell Mixing Zone Expert System (CORMIX) model was developed to evaluate near-field concentrations within the Quesnel Lake IDZ, and a hydrodynamic model was also developed for Quesnel Lake (Tetra Tech 2015) to evaluate the concentrations of modelled parameters beyond the edge of the IDZ. Both models considered seasonality in the inputs with respect to effluent and ambient temperature and total dissolved solids (as they relate to water density) and wind currents (as they affect water currents). Both models predicted a wide range of dilution factors under various weather conditions, and the cautionary value of 40 was adopted for the TAR, reflecting the lower end of the range of predictions. In the TAR, the predicted dilution factor in the mixing zone in Quesnel Lake was applied to the proposed *EMA* Permit 11678 concentration limits to predict the concentrations beyond the edge of the IDZ. The resultant concentrations formed the basis of the impact assessment in the TAR. The outcomes of this assessment indicated the following:

- The predicted effluent was not acutely toxic; and
- The predicted concentrations at the edge of the IDZ in Quesnel Lake would not result in adverse effects to surface water quality.

Based on the information provided above, ENV approved the proposed effluent limits included in the TAR (Section 1.2.4 of *EMA* Permit 11678).

Discharge of treated site contact water from the Mine began on December 1, 2015, in accordance with the amendment of *EMA* Permit 11678 (November 29, 2015). Monitoring of the discharge and surface water quality has validated three of the models used to derive *EMA* Permit 11678 limits (water balance model, water quality model, and dispersion model). Based on this model validation, there is a high level of confidence that the effluent limits proposed in the TAR will not result in concentrations at the edge of the IDZ that are greater than BCWQGs. As part of the 2020 annual water management, it is expected that the BCWQGs will continue to be met at the edge of the IDZ in Quesnel Lake if MPMC continues to operate within the current end-of-pipe *EMA* Permit 11678 limits (Golder 2016b). While the effluent is not expected to result in water at the edge of the IDZ not meeting the BCWQGs, should background waters exceed the BCWQGs as they occasionally do because of, for example, seasonal events in tributary streams, then the water at the edge of the IDZ would reflect such natural lake conditions rather than the effluent discharge. MPMC will continue to sample at QUL-58 in accordance with the CEMP.

MPMC has previously attempted to locate the plume while in the field and, as expected (the model predicts a <3% chance of locating it), could not find a plume signature at the edge of the IDZ. MPMC has consulted with Tetra Tech who provided some additional advice and efforts based on that advice will be made towards plume identification while sampling. The challenges in identifying the plume in the field reflect the dispersion that is occurring.

In addition to being used for establishing the effluent limits included in the TAR, dispersion models will be used as part of the TRP to model dilution in the Quesnel Lake IDZ to determine compliance and to verify that water and effluent management by MPMC remains protective of the environment and compliant with environmental statutes. This model-based approach for the TRP will provide reliable water quality estimates at the IDZ while mitigating the safety risk associated with obtaining samples in the IDZ when it is unsafe to do so. The Quesnel Lake surface sample location at the edge of the IDZ (QUL-58), while appropriate as a monitoring point, is not a suitable compliance point as there are many other influences unrelated to the WTP discharge (especially in winter). An updated model validation shows that modelled dilution factors previously determined for *EMA* Permit 11678 amendment are still suitable for their intended use and that the overall dilution factor achieved by the effluent infrastructure is protective of Quesnel Lake (Golder 2018c).

An analysis of remaining assimilative capacity at the IDZ, taking into account contemporary background conditions and observed effluent has shown that while background concentrations limit some parameters and treated effluent limits others, the combination of background and effluent loading does not suggest exceedances to receiving environment limits set out in the final column of Table 4 (Golder 2018a). The results of the analysis showed that 14 of the 18 constituents remained below the receiving environment limits set out in the final column of Table 4 when viewed in aggregate (and therefore below BCWQGs at the IDZ) and the remaining constituents showed assimilative capacity on all days but one, for total copper, which fell to about 10% due to higher than normal Quesnel Lake background conditions.

Part of the monitoring approach will include ongoing analysis of the assimilative capacity at the IDZ, which demonstrates the relative loading percentages of background concentrations and effluent loading in comparison to the permit limit (Golder 2018a). Assimilative capacity will be monitored for all 18 constituents and reported through the use of a loading chart (Figure 2) in the quarterly report.

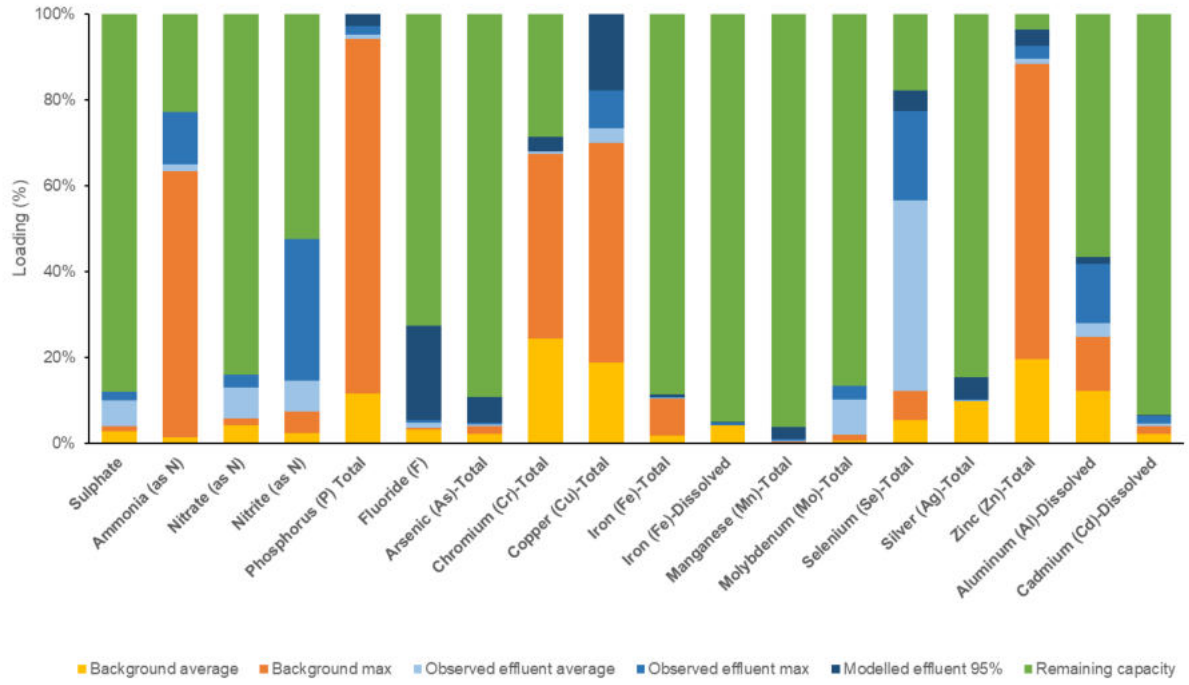

Figure 2. Calculated Assimilative Capacity of Constituents with Permit Limits

Interpretation of the loading chart must take into account that, while background concentrations tend to limit some parameters, treated effluent discharge tends to limit others. As well, when conservatively viewed in aggregate, constituents appear close to the receiving environment limits set out in the final column of Table 4 than when viewing the loading chart across individual days for a particular constituent.

Triggers will apply at the IDZ against the sampling completed four times per year (and subsequent sampling thereafter with respect to actions under the TRP), although it must be acknowledged that the data collected may not be representative of effluent discharge influences due to inputs from other sources (for example Horsefly River) that MPMC has no control over or responsibility for. This is detailed in the TRP in Section 5.1 of this Plan.

4.3 Turbidity Target Levels

MPMC has set target levels for turbidity at the edge of the IDZ in Quesnel Lake based on BCWQGs. Turbidity in Quesnel Lake should not exceed 5 NTU above the background on a 24-hour average basis, or 2 NTU above the background on a 30-day average basis (based on an average of five samples collected in 30 days). The first point of turbidity control remains at source where the water treatment plant monitors turbidity every 10 seconds with cautionary trigger levels programmed into the process logic controller. The system is automated such that if source turbidity is exceeded, the plant goes into recirculation mode (i.e., automatically stops discharging).

Regular monitoring and comparison to these levels is performed by MPMC. Further details of planned monitoring are presented in the CEMP (MPMC 2018).

5 Exceedances and Reporting

5.1 Exceedances: Trigger Response Plan

As detailed in the TAR (Golder 2016a), derivation of the effluent permit limits was based on attainment of Best Achievable Technology (BAT), attainment of the BCWQGs at the edge of the IDZ in Quesnel Lake and absence of acute lethality at the end-of-pipe. As such, compliance will be determined as follows:

- End-of-pipe (HAD-3): compliance with the effluent limits in EMA Permit 11678
- Quesnel Lake IDZ: execution of the Trigger and Response Plan set out in Section Edge of Quesnel Lake Initial Dilution Zone5.1.2 of this Annual Discharge Plan.

The model-based TRP approach helps to address several of the safety concerns associated with sampling in inclement weather while providing reliable but cautionary estimates of water quality at the edge of the IDZ. An updated model validation shows that modelled dilution factors previously determined for *EMA* Permit 11678 amendment continue to provide reasonable, though conservative predictions of water quality at the IDZ and that the overall dilution factor achieved by the effluent infrastructure is protective of Quesnel Lake (Golder 2018c).

Sampling in Quesnel Lake may be impeded if safety is considered to be a concern. If predicted/actual winds exceed 10 kilometres per hour (km/h), forecasted/actual thunderstorms or whitecaps are observed, sampling will not occur due to safety concerns. Strong winds that create greater than usual water currents also have the potential to prevent the collection of representative samples. During winter months, the West Arm of Quesnel Lake is often frozen over, partially frozen, or if it remains unfrozen, other vessels are typically absent. The presence of other mariners on the water is the main first response system that is used by the Canadian Coast Guard as part of vessel safety systems and absence of other mariners therefore increases safety risks (by increasing consequence) when on the water.

Modelling of dilution in the Quesnel Lake IDZ can reasonably rely on the near-field dispersion model (CORMIX – Golder) and far-field hydrodynamic model (Tetra Tech EBA) developed for Quesnel Lake. This provides a suitable means for effluent and receiving environment management that is not predicated on putting staff at risk. Ongoing confirmation of the suitability of this approach is also enabled through periodic monitoring when conditions safely allow.

It is normal for effluent volume and quality to fluctuate based on conditions of mining operations, weather, analytical precision and natural factors. Accordingly, a margin of safety between expected quality and permit limits has been incorporated into the modeling for the TAR and ultimately *EMA* Permit 11678 limits at the end-of-pipe. Considering this, the following TRP is conservatively protective of the environment (i.e., the approach is cautionary).

MPMC maintains a data management system that can be used for data monitoring purposes. All compliance and internal triggers are established in the database and an alert is automatically emailed to the Environmental Superintendent (and other qualified personnel) should an exceedance of a limit occur. As outlined in the CEMP, laboratory analytical data is uploaded to the database as soon as it is made available to the mine (or on the first working day thereafter).

Trigger response will be based on automatic exceedance alerts triggered by end-of-pipe (HAD-3) limit exceedances and on sampling undertaken at QUL-58 four times per year. Sampling at QUL-58 in combination with 5-sample 30-day frequency end-of-pipe (HAD-3) sampling will also be used in model verification.

Whenever safely possible, attempts will be made to sample at reference sites (QUL-2a and QUL-120a) during model verification.

Reference sites for background conditions have previously been QUL-120a and QUL-2a. However, location QUL-2a will be preferentially used due to better accessibility and safety. QUL-120a will be sampled annually.

Error! Reference source not found. provides a diagrammatic representation of the TRP decision-making process for end-of-pipe limits and Figure 4 provides a graphical representation of the TRP decision-making process for the receiving environment IDZ limits.

5.1.1 Effluent Limits (end-of-pipe)

MPMC maintains an end-of-pipe sampling point at the outlet of the WTP referenced as HAD-3 (EMS code E304230). This sample location is monitored at a 5-sample 30-day frequency as outlined in the CEMP (MPMC 2018). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, and required by Section 3.8.1 of *EMA* Permit 11678. It should be noted that under Levels 1 and 2, samples collected on the weekend (Friday to Sunday) cannot be shipped to the laboratory until the following Monday.

5.1.1.1 Level 1 Trigger: End-of-Pipe (HAD-3) 80% Early Warning Threshold– Monitoring and Response

Level 1 monitoring and response is undertaken should any parameter listed in Section 1.2.4 of *EMA* Permit 11678 exceed 80% of the discharge limit in the permit (with the exception of pH).

Level 1 monitoring and response is triggered when a database alert (automatically issued) indicates an exceedance of the 80% discharge limit. When this alert is received, the following response plan is initiated (flow chart representation in **Error! Reference source not found.**):

- Step 1: Collect effluent sample at HAD-3 and send for analysis.
- Step 2: Compare HAD-3 sample results to permit limits.
    - If sampling indicates levels less than 80%, proceed to Step 7.
    - If sampling indicates levels remain at or above 80%, proceed to Step 3.
- Step 3: Reduce discharge flows by 20% of the discharge at the time of the increased parameter values.
- Step 4: Review influent (E19) water quality data and compare to historic values.
- Step 5: Notify ENV Director of the Level 1 Alert.
- Step 6: Investigate cause and short term trends of rise in parameter values. Return to Step 1.
- Step 7: Once sampling indicates levels less than 80%, resume normal operations.
- Step 8: Document exceedance of the 80% target and investigation results in monthly report.

Sample(s) at HAD-3 will be collected as soon as reasonably possible. A "Priority" request will be made to the lab on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two or three business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped to the laboratory until the following Monday.

5.1.1.2 Level 2: End-of-Pipe (HAD-3) Permit Exceedance – Monitoring and Response

Level 2 monitoring and response is undertaken should any parameter, listed in Section 1.2.4 of *EMA* Permit 11678, exceed the compliance limit.

The Level 2 trigger is initiated by a database alert (automatically issued), or when review of the data indicates an exceedance of a permit limit. When this alert is received, the following response plan is initiated (flow chart representation in Figure 3):

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify ENV Director of exceedance
- Step 3: Collect samples of influent (E19) and effluent (HAD-3) and send for analysis. If weather conditions allow, collect sample at Quesnel Lake IDZ (QUL-58) and send for analysis.
    - Step 3a: If exceedance at QUL-58, proceed to Level 3 Alert (flow chart representation in Figure 4). If no exceedance, take no further action.
    - Step 3b: Compare HAD-3 sample results to permit limits.
        - If sampling indicates levels less than 80%, proceed to Step 5.
        - If sampling indicates levels at or above 80%, proceed to Step 3 of the Level 1 Alert.
        - If sampling indicates levels exceeding the permit limits, proceed to Step 4.
- Step 4: Investigate influent water quality and water treatment plant operations to determine cause of exceedance.
- Step 5: Notify ENV Director, and communicate progress and findings of investigation throughout the process.
- Step 6: Resume normal operation.
- Step 7: Submit exceedance investigation report to ENV Director

Sample(s) at HAD-3 will be collected as soon as reasonably possible. Sample(s) at QUL-58 will be collected as soon as reasonably possible, weather and safety permitting. A "Priority" request will be made to the laboratory on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two or three business days. Since sampling at QUL-58 may not be possible for safety reasons, resumption of the discharge during a Level 2 Alert will be dependent on the effluent (HAD-3) meeting the permit limits in Section 1.2.4. Concurrently, an investigation will be implemented to determine the cause of the exceedance of the permit limit.

Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in *EMA* Permit 11678 Section 4.3. This report will include:

a) All relevant test results related to the exceedance event(s),
b) An explanation of the most probable cause(s) of the exceedance(s), and
c) A plan to prevent similar exceedance(s).

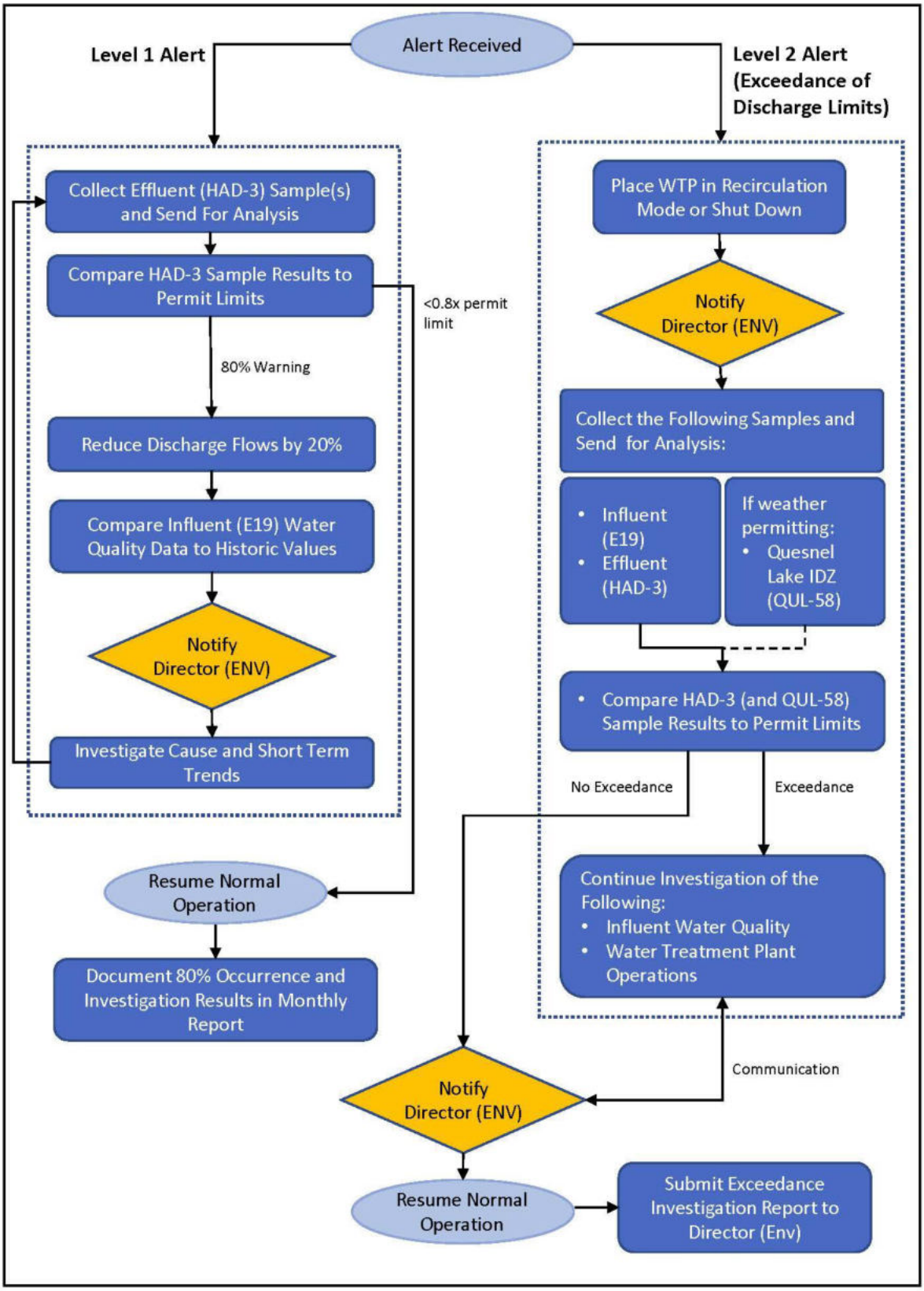

Figure 3. Flow chart representation of the TRP decision-making process for the treated effluent (end-of-pipe)

5.1.2 Edge of Quesnel Lake Initial Dilution Zone

MPMC maintains a sampling point at the edge of the IDZ referenced as QUL-58 (EMS code E304876). This sample location is monitored four times per year, as outlined in the CEMP (MPMC 2018). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, which is required by Section 3.8.1 of *EMA* Permit 11678. Ongoing sampling at QUL-58 will serve as a model verification for the near-field dispersion model (CORMIX – Golder).

5.1.2.1 Level 3: Exceedance of Receiving Environment Trigger Levels - Monitoring and Response

Level 3 monitoring and response is undertaken if any parameter listed in Section 1.2.4 of *EMA* Permit 11678 exceeds the receiving environment trigger levels set out in the right-most column of Table 4. Monitoring and response is triggered when a sample taken at QUL-58, either as part of routine sampling or following a Level 2 Alert, indicates an exceedance of these trigger levels. When this alert is received, the following response plan is initiated (flow chart representation in Figure 4):

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify ENV Director of exceedance
- Step 3: Determine if weather conditions allow samples to be taken on Quesnel Lake safely.
    - If yes, sample QUL-58 and QUL-2a and send for analysis.
    - If no, use HAD-3 sample and most recent QUL-2a sample to model water quality at QUL-58.
- Step 4: Compare modelled and measured (if available) QUL-58 results to receiving environment trigger levels.
    - If exceedance, proceed to Step 5.
    - If no exceedance, proceed to Step 8.
- Step 5: Continue investigation of Quesnel Lake water quality by comparing current water quality data to historic data and modelled (TAR) data and dilution modelling.
- Step 6: Use water quality data and dilution modelling to determine discharge rate based on assimilative capacity.
- Step 7: Based on data, and subject to any directions the Director may give:
    - If the data does not support resuming operations, return to Step 5.
    - Resume operation. If discharge rate is less than permitted discharge rate, return to Step 3 and repeat the analysis. Otherwise, proceed to Step 10.
- Step 8: Notify ENV Director.
- Step 9: Resume normal operation.
- Step 10: Submit exceedance investigation report to ENV Director.

Sample(s) at QUL-58 and at QUL-2a (background) will be collected as soon as reasonably possible, weather permitting. A "Priority" request will be made to the lab so that turn around time to receive analytical results for the sample is reduced to two or three business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped until the following Monday.

A review and comparison of the re-sample data with parameter concentrations at the reference station QUL-2a (located in the West Arm of Quesnel Lake), which will serve as a reference comparison, shall be made, and the Relative Percent Difference (RPD) shall be calculated.

- If the RPD is ≤ 20%, the sampling results are considered to be analytically indistinguishable from the reference concentrations. The dilution capacity of Quesnel Lake will be assumed to be diminished and discharge will only be resumed as described below.

- If the RPD is > 20%, then a review of the existing monitoring data for the effluent discharge, the edge of the IDZ, and other monitoring points outside the IDZ in the receiving environment (e.g., QUL-2a, Edney Creek, Hazeltine Creek) shall be undertaken. This review shall include an evaluation of the estimated dilution at the edge of the IDZ. The estimated dilution shall be compared with the dilution factors predicted in the TAR.
- If the dilution is less than the minimum dilution predicted in the TAR:
    - An evaluation of the effluent and ambient conditions shall be undertaken to resolve the discrepancy. Depending on the outcome, the evaluation may include an inspection of the outfall pipes and diffuser ports to confirm that they are intact.
    - MPMC shall investigate and present the findings to the ENV Environmental Protection Director identifying the likely cause of the low dilution and its remedy.
    - MPMC shall provide an Interim Discharge Plan to the ENV Environmental Protection Director that outlines interim measures to be undertaken by MPMC to manage the water balance in accordance with EMA Permit 11678 and any requirements under *Mines Act* Permit M-200.
- If the dilution is greater than the minimum dilution predicted in the TAR, it is assumed that background concentrations are elevated and the dilution capacity of Quesnel Lake is diminished. Discharge will be resumed only when resampling the effluent discharge (while in recirculation mode) and resampling at QUL-58 indicate that the receiving environment trigger levels can be met using the minimum dilution predicted in the TAR (i.e., the dilution capacity of Quesnel Lake is no longer predicted to be diminished). The flow rate of the effluent discharge can be managed accordingly depending on the sampling results.

When monitoring and analysis has determined the WTP is effectively treating water to meet the end-of-pipe permit limit, and the dilution model indicates that the IDZ does not exceed the Edge of the IDZ trigger levels in Table 4, the Director will be notified and the WTP effluent will be redirected to the discharge pipeline.

Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in EMA Permit 11678 Section 4.3. This report will include:

- All relevant test results related to the exceedance event(s),
- An explanation of the most probable cause(s) of the exceedance(s), and
- A plan to prevent similar exceedance(s).

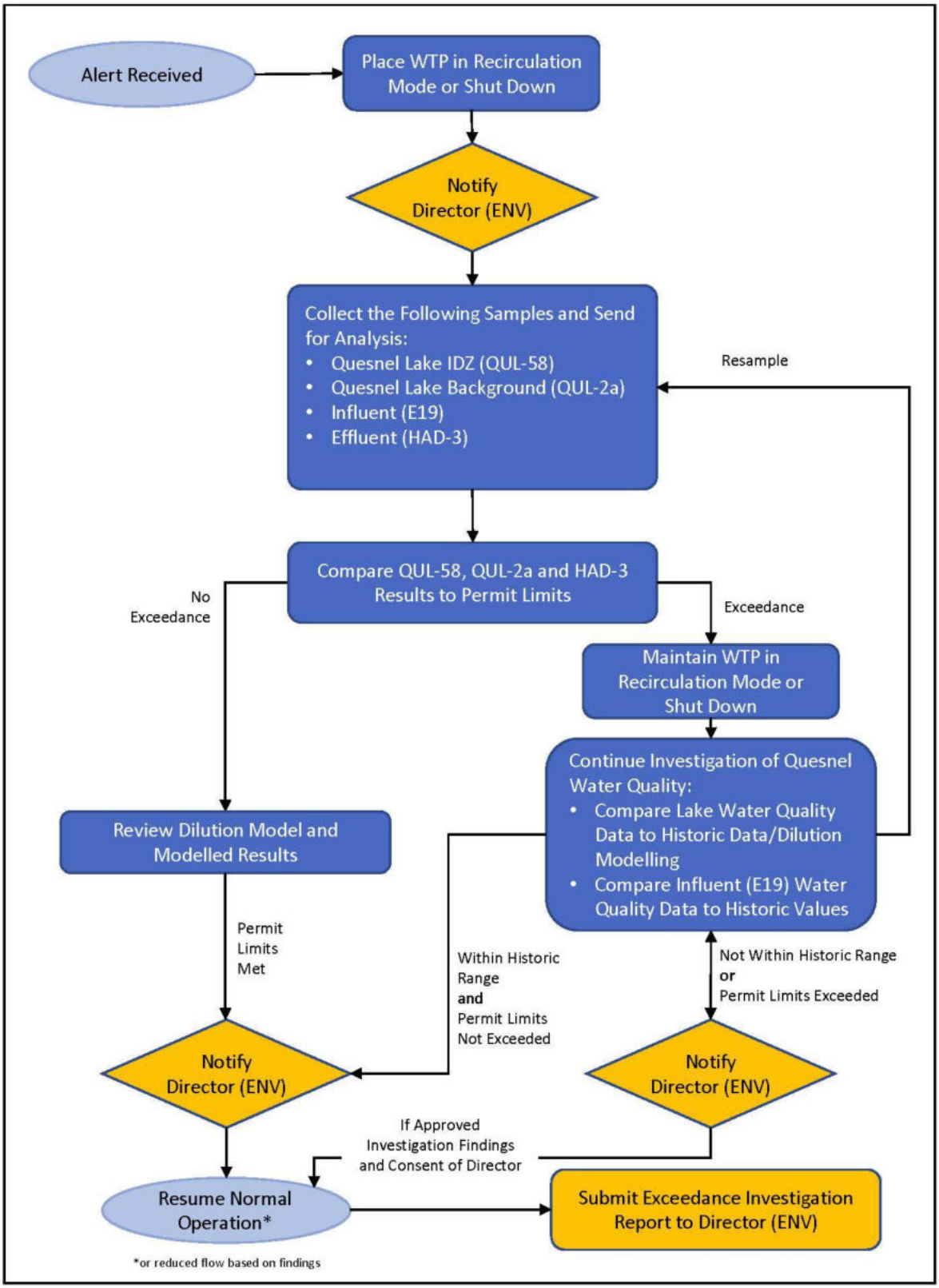

Figure 4. Flow chart representation of the TRP decision-making process for the receiving environment IDZ limits

5.2 Reporting: Ministry of Environment

In accordance with Section 4.0 of *EMA* Permit 11678, MPMC will submit required reports for each month that discharge occurs. Report shall include at a minimum:

- The volume of treated effluent discharged,
- a summary of continuous Turbidity readings of the treated effluent discharged, and
- the most recently available water quality results for the effluent discharged, including toxicity.
- Each monthly report shall be submitted within seven days of the end of previous month via email to EnvAuthorizationsReporting@gov.bc.ca.
- Each monthly report shall also contain and present all data submitted in the previous 2 monthly reports in a manner that would identify potential trends.

Any toxicity test failures, as defined and described in Section 4.4 of *EMA* Permit 11678, shall be reported to the ENV Environmental Protection Director as stipulated below. A sample is considered to have failed the specific toxicity test if:

- **96-hr LC50 Rainbow Trout:** Using 100% effluent concentration, more than 50% of the fish die within a 96 hour test period,
- **48-hr LC50 Daphnia magna:** Using 100% effluent concentration, more than 50% of the organisms die within a 48 hour test period,
- **7-day Ceriodaphnia dubia reproduction**: The water is determine to cause greater than 25% inhibition of survival and reproduction; or
- **7-day ELS toxicity test with a salmonid fish**: The water is determined to cause greater than 25% non-viable embryos.

MPMC will also notify the ENV Director of any non-compliance and take appropriate remedial action. MPMC will provide written confirmation of all non-compliance events within 24 hours of the original notification to the Director, and will follow up with a written report within 30 days, as described in Section 4.3 of *EMA* Permit 11678. In the case of the Edge of Quesnel Lake IDZ limits as outlined in Table 4, MPMC will notify the ENV Director of any exceedance and take appropriate action as outlined under the TRP (Section 5.1.2). MPMC will provide written confirmation of all Edge of Quesnel Lake IDZ limit exceedance events with 24 hours of the original notification to the Director, and will follow up with a written report on the steps taken under the TRP (Section 5.1.2) within 30 days and prior to resuming effluent discharge.

5.3 Reporting: Environment Canada

As required under *MDMER* Section 24 (1-2), the Inspector will be notified if effluent monitoring results show that concentrations exceed those limits for the parameters specified in *MDMER* Schedule 4; if the effluent is outside the pH range of 6.5 to 9.5; or, if the effluent is acutely lethal (greater than 50% mortality at 100% effluent concentration). A written report to the Inspector will follow within 30 days of the tests being completed.

If the effluent is determined to be acutely lethal, the effluent water quality samples will be characterized without delay and additional acute lethality sampling will be conducted as required under *MDMER* Section 15.

If deposits outside of the normal course of events occur, acute lethality testing will be completed as required by *MDMER* Section 14 (1). A written report meeting the requirements outlined in *MDMER* Section 31 will be submitted to the Inspector within 30 days.

5.4 Reporting: Local Communities

Reporting of any actions under this Plan will be in accordance with the Communication Plan developed under Section 2.11 of *EMA* Permit 11678.

6 References

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APPENDIX 9-6: Invasive Plant Management Plan

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Environmental Management Plan:

Invasive Plant Management Plan

Last Update: March 29, 2017

Document Review and Revision Control

Rev. No.	Review/Revision	Date	Author
0	Original	January 2014	GH
1	Update of site specific components and plans	July 9, 2015	KM
2	Update of site specific components and plans; updated to reflect current government regulations/documents; added document tracking and formatting to be consistent with other MPMC EMPs	March 29, 2016	KM
3	Annual Review	Dec. 2020	GH

1 Introduction

The BC Ministry of Forest, Lands and Natural Resource Operations (as per the British Columbia [BC] Inter-Ministry Invasive Plant Working Group) defines invasive plants as “non-native (alien) plants whose introduction into BC cause, or are likely to cause, economic or environmental damage, or harm to human health” (MFLNRO, 2014). The Invasive Species Council of BC has a similar definition, and notes that invasive plants can establish quickly and easily on both disturbed and un-disturbed sites, causing widespread negative economic, social, and environmental impacts (ISCBC, 2015).

Mining operations result in disturbed areas, which can be susceptible to invasion of invasive plants. Such invasions have the potential to hinder reclamation efforts or interfere with regional invasive plant management programs. To manage this risk, Mount Polley Mining Corporation (MPMC) has developed this Invasive Plant Management Plan (the “Plan”). The purpose of the Plan is to outline procedures for the prevention and, if necessary, control (mitigation) of the establishment of invasive plants or noxious weeds in the Mount Polley Mine (the “Mine”) area throughout the Mine project life, including closure.

1.1 Regulatory Framework

The BC *Weed Control Act* (RSBC, 1996) requires owners or occupiers of crown and private lands in BC (excluding those under federal jurisdiction) to control listed noxious weeds. As such, MPMC is under legal obligation to control these species. At the time of last update of this Plan, the BC Proposed Prohibited Noxious Weeds List (MFLNRO, 2016) was the most up to date applicable listing.

As per the BC *Mines Act* Section 10.7, mine land surfaces must be reclaimed to an approved end land use at closure, excluding lands that are not to be reclaimed, and the average land capability should be equal to or greater than the average land capability present prior to mining. While these requirements do not specifically mention invasive plants, they are inherently included; given the undesirable nature of invasive plants, their associated negative environmental and economic impacts, and the fact that invasive plants are non-native, such species are likely inconsistent with closure revegetation objectives and could result in a mining company not meeting their closure revegetation targets.

In addition, under MPMC’s *Mines Act* Permit M-200, the following additional specific conditions apply to invasive species management at the site:

- The Permittee shall manage and control invasive species that establish on the site and shall take reasonable efforts to ensure that invasive species do not move from the site to adjacent areas.
- The Permittee shall ensure that all seed mixes are certified as weed-free.
- Revegetation species shall be selected based on the principles of ecological succession and traditional use and cultural significance, including all reasonable efforts to use only native species unless short-lived agronomic species are required to temporarily control erosion or prevent ingress of invasive species.

While not associated with regulatory requirements, the Cariboo Chilcotin Coast Invasive Plant Council (CCCIPC) is a non-profit organization that coordinates the invasive plant management efforts of government agencies, individuals, communities and industry sectors, and promotes awareness and education about invasive plants in the region. Each year, the CCCIPC produces an Annual Strategic Plan (http://cccipc.ca/index.php/S=0/resources/regional-strategic-plans/) which incorporates provincial requirements (e.g., noxious weeds listings) and is to be used as a guide for invasive plant management activities and resource allocation in region.

2 Objectives

As described above, the purpose of the Plan is to outline procedures for the prevention and, if necessary, mitigation of the establishment of invasive plants or noxious weeds in the Mount Polley Mine area throughout the Mine project life and closure. The specific objectives are to:

- Control invasive plant establishment on the site, such that reclamation objectives are achieved. Reclamation objectives include establishing self-sustaining vegetative covers on disturbed areas at the Mine site with native vegetation this is appropriate to the target site series and consequently promotes the target end land use(s); and
- Implement invasive plant control measures consistent with the Regional Strategic Plan and the BC Proposed Prohibited Noxious Weeds List.

This Plan applies to the operations footprint of the Mine as well as areas being rehabilitated following the tailings dam embankment breach. However, only the Mine site is regulated under the BC *Mines Act* and associated items (e.g., permit requirements and land capability requirements) do not apply to breach rehabilitation areas. Instead, reclamation revegetation objectives for the breach area will be defined by the Remediation Plan due for submission in the third quarter of 2017.

The Plan follows the Plan, Do, Check, and Act cycle developed by the International Standards Organization guidelines. The cycle is described as follows:

- **PLAN** - identifies potential sources of invasive plant ingress that may challenge achieving the objectives of the program;
- **DO** - documents the prevention and control management practices in place at the Mine;
- **CHECK** - describes the monitoring procedures and methods for evaluating monitoring results against the objectives; and
- **ACT** - describes review of the management program and update of procedures based on monitoring results in order to promote its continuous improvement and mitigate identified deficiencies.

3 Plan: Identification of Potential Sources of Invasive Plant Ingress

Mining activities can facilitate the introduction or spread of invasive plants by removing native vegetation, which decreases competition for weedy plants, and creating exposed soil in disturbed areas. Exposed areas create a soil bed which may allow invasive plants to establish. These areas include:

- Soil stockpiles and areas from which the soil was salvaged;
- Soil applied to reclamation areas;
- Road and powerline construction and maintenance activities; and
- Exposed areas around the Mill site, maintenance areas and other associated infrastructure.

Table 1 provides an overview of potential sources of invasive plant ingress to the site. Each potential source is classified into if control is possible or not. If control is not possible, for example the movement of wildlife or wind transport of seed, only prevention methods (and, if necessary, mitigation measures) are applicable to management.

Table 1 Potential sources of invasive plant ingress and/or spread at the Mount Polley Mine site

Category	Source	Control Method Possible
Animals	Livestock	×
	Wildlife	×
Natural spread	Wind (long-distance)	×
	Rhizome spread or seed drop (short-distance)	✓ (within Mine site only)
Human-mediated spread	People – on-site (e.g., employees, and contractors)	✓
	People – off-site (e.g., tourists and recreationists; spread to areas immediately adjacent to site)	×
	Vehicles and equipment – on-site	✓
	Vehicles and equipment – off-site (spread to areas immediately adjacent to site)	×
Reclamation Activities	Application of soil from contaminated soil stockpiles	✓
	Use of contaminated seed or soil amendments	✓
	Use of contaminated soil amendments	✓

4 Do: Prevention and Control Measures

4.1 Preventative Measures

The primary goal involved in managing invasive plant infestations in the project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants and supports the ability to establish desired species during site reclamation activities.

MPMC is to implement the following best management practices for preventing invasive plant establishment on disturbed areas at the Mine, which are to minimize disturbance during all phases of the mining operation in order to limit the availability of exposed, un-vegetated ground to invasive plant seed deposition; and establish a vegetative cover as soon as possible after ground disturbance. Specifics for establishing ground cover vegetation are as follows:

- Seed ground disturbed due to construction or mining activity with a rapidly establishing seed mix for erosion protection and invasive plant control if reclamation of the area is not imminent. Active areas (e.g., open pits or areas without appropriate substrates for vegetation growth) at the Mine do not require invasive plant control as vegetation does not have a chance to become established;
- Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of mill site areas, storage and equipment yards; and generally any disturbed ground where invasive plant establishment is possible;
- Use only high quality grade seed in the reclamation and interim invasive plant control seed mixtures. Low quality grade seed may contain a higher portion of weed seed in the seed lot. At minimum, ensure that the seed used for revegetation is of the grade Common #1 Forage Mixture or Canada No. 1 Ground Cover Mixture.
- Assess soil amendments that may contain invasive plant seeds or propagules. This is currently only applicable to biosolids, and MPMC's supplier (Metro Vancouver) tests the material to verify that invasive plant seeds are not present.

MPMC typically conducts a seeding program annually in the spring and/or fall, and any disturbed areas (as described above) or areas that were previously seeded but lack appropriate native vegetative cover, should be added to the list of areas to be seeded.

4.2 Control Measures

If monitoring results (Section 5) show areas of invasive species infestation that are not consistent with the objectives of this Plan (Section 2), available control or mitigation options for managing established invasive plants include mechanical, biological, and chemical methods.

Mechanical methods include:

- Hand weeding or pulling (if plants are hand-pulled, propagules are to be removed from the site and disposed of in a way that does not allow the spread of seeds. i.e., burned, not composted);
- Mowing or cutting; and
- Burning.

Biological control agents are natural organisms that are another option for reducing invasive species populations. Typically, they are insects, nematodes, fungi or viruses that infect or invade the invasive plants and weaken the target species by decreasing seed production and reducing density. Biological control is only an option for select invasive species

Chemical control through application of herbicides will be the method of last resort because applications are limited by proximity to watercourses and can potentially have detrimental effects on native vegetation.

In addition to these mitigation methods, contingency control programs that could be reviewed for feasibility and implemented are:

- Inspection and/or cleaning of vehicles or equipment coming from offsite or moving from an infested area to an uninfested area within the site;
- Refraining from driving through areas infested with invasive plants;
- Limiting road maintenance to the road surface to retain vegetation along the roadsides;
- Keeping equipment yards and vehicle storage facilities free of invasive plants; and
- Training personnel on preventing invasive plant spread by checking and removing seeds from clothing and equipment.

It is important to note that majority of the invasive plants observed at the Mine are designated in the CCCIPC Regional Strategic Plans as “established” or are designated as non-native species (not invasive species), and management options are not implemented regionally because control of these species is not currently feasible. As such, MPMC does not actively manage these species, unless they are directly impeding reclamation efforts. These aforementioned control measures are listed as options for future use, as required, and are currently not a routine component of MPMC’s invasive plant management activities, as the Plan objectives are being met without their use.

Mitigation measures will focus on the “new invaders” and “containment” categories, as well as any “established” species if they are directly impeding reclamation efforts. Consistent with the Regional Strategic Plan, the treatment goal for “new invaders” is eradication (elimination of all individuals and their propagules), while the treatment objective for species listed for “containment” is prevention of invasive

plants from spreading to uninfested areas. For species that are impeding reclamation revegetation, but are regionally listed under “containment” or “established” categories, the primary option will be suppression (reduction in plant population size and abundance). These control measures generally follow the following process, based on the level of infestation:

1. Prevent new infestations from becoming established;
2. Eradicate small or isolated “satellite” infestations;
3. Contain the perimeter of large “core” infestations; and
4. Suppress the interior of large “core” infestations.

If control measures area applied in the future, any sites that have treatments applied will be monitored through the established methods (described in Section 5) in subsequent years to assess if treatment measures have been successful.

5 Check: Monitoring Program

The MPMC invasive plant monitoring program includes visual surveys conducted in combination with routine assessments of progressive reclamation sites and annual soil stockpiles inspections; invasive plant species present and their percent cover are documented and compiled with revegetation results.

In addition, more formal invasive plant inventories are to be conducted routinely at the Mine site. These inventories should encompass disturbed areas, including any that are undergoing reclamation, as well as adjacent undisturbed areas from which invasive plants could ingress. Inventories may be conducted by MPMC Environmental Department staff with sufficient expertise or an external consultant. Each inventory should include the following items, with the results presented in a report:

- Surveying and mapping of infestation locations, with a focus on reclamation areas and soil stockpiles;
- Identification of invasive plant species present;
- Assessment of the degree of invasive plant growth, distribution, and density present at infestation sites;
- Assessment of success of any prevention and control measures that were previously implemented;
- Recommendations for any prevention and control measures that should be implemented; and
- Recommendations for when the next inventory should be conducted.

Where possible, all assessments and inventories should take place in the late spring/early summer so that eradication measures can be undertaken prior to seed dispersal in late summer/early fall. Alternatively, assessments and inventories can be conducted in mid to late summer, when plants are readily identifiable, with interpretation of results to take place over winter and management applications to be implemented early the following growing season.

6 Act: Program Review and Continuous Improvement

Each year, the results of invasive species monitoring should be reviewed with respect to the objectives outlined in Section 2, and the Plan and associated site invasive plant management activities should be updated accordingly. Specific items that should be reviewed and associated actions are listed in Table 2. When the Plan is updated, it is to be submitted to the Ministry of Energy and Mine with the Annual Environmental and Reclamation Report. In addition, an update on invasive plant monitoring, prevention

and control activities at the Mine (including any pertinent results from progressive reclamation and soil stockpile inspections, and site invasive plant inventory reports) is to be included in the Annual Environmental and Reclamation Report each year.

Table 2 Invasive plant management program review process

Item to Review	Associated Actions
Verify that all seed mixes used were certified weed-free (i.e., comply with Canadian Food Inspection Agency standards).	If seed utilized is not certified weed-free (or invasive plants were suspected to be present in the seed mixtures used): • Change seed suppliers and/or seed mixtures.
Verify that all soil amendments (where appropriate) were tested to confirm they did not contain invasive plant propagules or seeds.	If soil amendments were not tested: • Conduct post-application assessments for any soil amendments not tested; • Discontinue use of any soil amendments not tested until appropriate testing has been completed; and • Plan appropriately to test all amendments prior to use in the future.
Verify that no invasive plants identified in monitoring are on provincial noxious weed lists.	If any noxious weeds are identified: • Implement appropriate control measures (Section 4.2), with the objective of eradication; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that all invasive plants identified in monitoring are being managed according to the most recent CCCIPC Annual Strategic Plan.	If invasive plant management is inconsistent with the Regional Strategic Plan: • Implement prevention and/or control actions (Section 4) until management actions are consistent with the Regional Strategic Plan; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that results from reclamation revegetation assessments are consistent with closure objectives (with respect to species composition and/or functional groups). If results are not consistent, verify that invasive plants are not a constraining factor. The prioritization matrix in Figure 1 can be used to aid in separating innocuous from disruptive species in reclamation areas and prioritize management actions accordingly.	If invasive plants are identified as a constraint to meeting revegetation objectives: • Delineate the specific species and areas of concern; • Implement prevention and/or control actions (Section 4) appropriate for the level of infestation, the life history of the identified invasive plants, and available control options; and • Ensure that measures taken and target native reclamation species are monitored in the identified reclamation areas as per the program in Section 5.

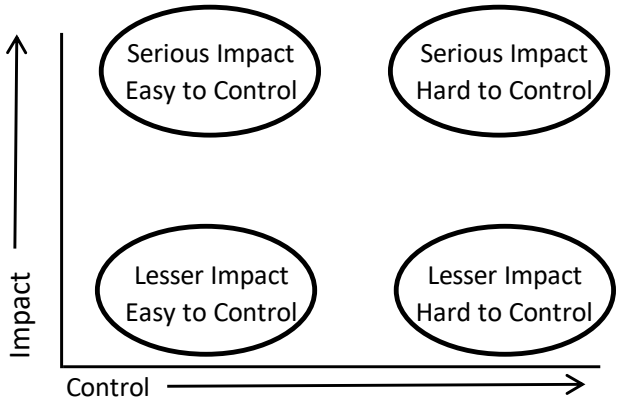

Figure 1 Invasive plant management prioritization matrix (adapted from USFWS, 2009)

7 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Supervisor):

- Be knowledgeable of, adhere to, and coordinate implementation of all aspects of this Plan;
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan;
- Ensure this Plan and monitoring data are reviewed annually and updated accordingly, with updates submitted in the Annual Environmental and Reclamation Report and appropriate management actions implemented;
- Be aware of high level mine planning to ensure that seeding of disturbed areas can be done in a timely manner and transport of soil is appropriately managed;
- Review updates to the MPMC *Mines Act* Permit 11678, BC *Mines* Act, CCCIPC Regional Strategic Plan and provincial noxious weed lists and regulations;
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including monitoring programs and reporting;
- Plan and budget for necessary invasive plant control measures;
- Obtain and permits or authorizations required for control measures that are implemented; and
- Ensure that individuals conducting monitoring, data interpretation, reporting, and planning and implantation of prevention and control measures have appropriate training.

Qualified individual conducting monitoring and reporting (e.g., Environmental Technician, contractor):

- Be knowledgeable of and adhere to all aspects of this Plan;
- Conduct assigned activities, such that all requirements of this Plan (at minimum) are met; and
- Have appropriate training and expertise for assigned components of this Plan.

Staff or contractors conducting control measures

- Have appropriate training and expertise for prevention and control actions they are implementing.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances and any transport of soil materials;
- Where possible, minimize the disturbance of vegetated areas; and
- Transmit relevant information related to the aforementioned points to the Mine Operations Supervisors.

Mine Operations Supervisors:

- Supervise operators such that new disturbances and soil handling are conducted as planned.

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APPENDIX 9-7: Wildlife Management Plan

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Wildlife Management Plan

Submitted to:

BC Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

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Prepared for:

Mount Polley Mining Corporation
Environmental Department

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Date: March 11, 2021

Document Review and Revision Control

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Signature Page

PREPARED BY:

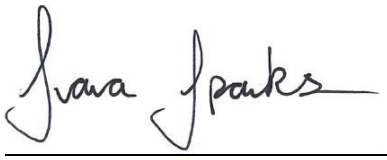

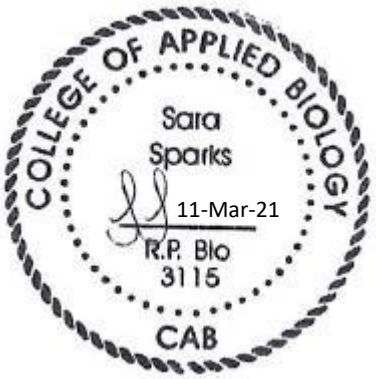

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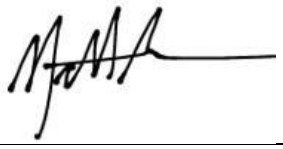

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1 INTRODUCTION

The Wildlife Management Plan (the Plan) was developed for the Mount Polley Mining Corporation (MPMC) for all operational activities of the Mount Polley Mine (the Facility). The Facility is located approximately 100 km northeast of the city of Williams Lake, British Columbia (BC), near the town of Likely, BC. For the purposes of this Plan, the term 'wildlife' will collectively refer to mammals, birds, amphibians, reptiles, and fish unless otherwise specified.

The objectives of the Plan are to:

- Meet the requirements of permits approved under the *Environmental Management Act* and *Mines Act*, in addition to all relevant provincial and federal wildlife regulations,
- Develop guidelines for minimizing the potential for mine-related impacts to wildlife at the Facility and its surrounding areas, with emphasis on protecting wildlife that have been designated as a *Species at Risk*,
- Describe concrete measures for how mine personnel can help minimize wildlife impacts through implementing best management practices, following protocols for specific types of wildlife encounters, and documenting and reporting observations,
- Ensure wildlife management is incorporated into the long-term goals of the Facility through comprehensive monitoring programs and reporting plans, recommendations for reclamation and closure planning, stakeholder consultation, and incorporation of adaptive management.

The Plan is a living document that may be periodically updated as new information becomes available or as authorizations and regulations change.

1.1 PERMIT REQUIREMENTS

The Plan is a component of the Comprehensive Environmental Management Plan (CEMP) which is a requirement of Permit 11678 issued under the provision of the *Environmental Management Act* (SBC 2003, c. 53.) by the BC Ministry of Environment and Climate Change Strategy (ECCCS, 2020). The implementation of wildlife monitoring programs that track the progress of wildlife and wildlife habitat impacted by mine-related activities is one of the objectives of the CEMP and is addressed in Section 5.4 of the Plan.

The Plan also addresses conditions outlined in the M-200 Permit issued under the provision of the *Mines Act* (RSBC 1996, c. 293) by the BC Ministry of Energy, Mines and Low Carbon Innovation, formerly known as the Ministry of Energy, Mines and Petroleum Resources (MEMPR, 2020). Conditions under the M-200 Permit include restrictions and requirements that protect wildlife and personnel (Section 5.3.1) and ensure wildlife habitat is incorporated into long-term land use goals during reclamation and closure planning (Section 5.5).

1.2 PROVINCIAL AND FEDERAL REGULATIONS

All phases of the Facility, including construction, operation, decommissioning, and reclamation, are regulated under the BC *Environmental Management Act* (EMA), BC *Mines Act*, as well as other legislation implemented by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) as outlined in MPMC (2019). The following provincial and federal *Acts* are additional legislation specifically relevant to wildlife and wildlife habitat:

- BC *Wildlife Act,*
- BC *Forest and Range Practices Act,*
- BC *Water Sustainability Act,*
- Canada's *Migratory Birds Convention Act,* and
- Canada's *Species at Risk Act.*

Not all the relevant *Acts* will be applicable for every activity carried out by MPMC. For further information on how the *Acts* relate to the management of specific wildlife and activities, refer to Section 3.0.

2 FACILITY DESCRIPTION

The Facility represents the permitted areas of the mine where most mine-related activities occur, as shown in Figure 1 of MEMPR (2020). The Facility generally includes:

- The tailings storage facility (TSF),
- The crusher and mill processing site, and,
- Operations areas (open pits, waste rock dumps, stockpiles, roads, etc.).

The Facility has been in a temporary Care and Maintenance phase since May 31, 2019. Care and Maintenance operations are focused primarily on general site maintenance to ensure that all pumps, sumps and water management systems are functioning as intended. Eleven full time employees work in four shifts, including day and night shifts. Environmental monitoring and sampling activities continue to be followed during the Care and Maintenance phase, as required by all permits. For further details regarding Facility operations, refer to the CEMP (MPMC, 2019).

2.1 TAILINGS STORAGE FACILITY (TSF)

The TSF at the Facility consists of tailings material and a single embankment made up of three dams, including the Main Embankment, Perimeter Embankment, and the South Embankment. During the TSF embankment failure that occurred on August 4, 2014, water (both supernatant and interstitial) was released from the TSF, resulting in much of the tailings within the TSF being exposed to the elements (i.e., no longer submerged).

The embankment failure of the Mount Polley TSF resulted in the deposition of tailings between Polley Lake and Hazeltine Creek (known as the Polley Flats); for the purpose of this Plan, the impacted areas between Polley Lake and Hazeltine Creek are also referred to as the Surrounding Areas (see Section 2.4).

2.2 CRUSHER AND MILL PROCESSING SITE

The crusher and mill processing site are comprised of the crusher and mill building, the coarse ore pile, tertiary pile, fine ore (mill feed) pile, and pebble pile. No crushing operations are conducted during the Care and Maintenance period.

2.3 PITS

Open pits at the Facility include the Cariboo and Springer Pits, while the waste rock dumps include the Temporary Northwest Potential Acid-Generating (PAG) Stockpile, North East Zone (NEZ) Rock Dump and the South East Rock Dump (SERD). Mineral extraction activities are not occurring during the Care and Maintenance period.

2.4 SURROUNDING AREAS

Surrounding Areas are defined as the areas outside the Facility (i.e., permitted mine area) that were impacted by the TSF embankment failure (Section 2.1), including Polley Flats and the Hazeltine Creek Corridor, which are now subject to ongoing remedial works and monitoring (Golder, 2017; MPMC, 2019). For the purpose of this Plan, the Surrounding Area will also refer to the primary road networks that connect to the Facility, such as the Morehead-Bootjack Forest Service Road (FSR), Gavin Lake Road, and Mitchell Bay Road.

The Surrounding Area is characterized by Interior Cedar Hemlock (ICH) biogeoclimatic (BEC) zone vegetation, which consists of Western red cedar, Douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch (MPMC, 2019). Much of the area has previously been harvested in commercial logging operations and is currently used for cattle grazing (MPMC, 2019).

2.4.1 Polley Flats

Polley Flats is located south of Polley Lake and east of the TSF embankment failure (Section 2.1). Prior to the TSF embankment failure, Polley Flats was an established wetland with a riparian vegetation community that encompassed approximately 900 m of the upstream portion of Hazeltine Creek, where it immediately drained from Polley Lake. The wetland, Hazeltine Creek corridor, and their associated riparian vegetation were significantly impacted by the release of water and tailings during the TSF embankment failure. The release deposited large volumes of mine-related materials into the Polley Flats wetland area and Hazeltine Creek corridor, stripping the riparian vegetation and native soil (Golder, 2017). Since the TSF embankment failure, MPMC has been conducting ongoing remediation of Polley Flats, including removal of tailings, wetland reconstruction, earth mounding, soil placement, planting native seeds, shrubs, and trees, and installing coarse woody debris (CWD; Golder, 2017; MPMC, 2019). Multiple avian nest boxes were also installed to increase nesting sites for secondary cavity-nesting species, such as Tree Swallows and Mountain Bluebirds.

2.4.2 Hazeltine Creek Corridor

Hazeltine Creek (WSC: 160-585700) commences from the southern point of Polley Lake (WSC: 160-585700) and subsequently drains southeast for 8.5 km before terminating at Quesnel Lake (WSC: 160). Edney Creek (WSC: 160-5857-038) and Bootjack Creek (WSC: 160-5857-487) are tributaries of Hazeltine

Creek and are located approximately 1 km and 8.5 km upstream of the confluence of Hazeltine Creek and Quesnel Lake (Pedersen, 1998; Province of BC, 2021).

Hazeltine Creek provided extensive spawning habitat for Sockeye Salmon and Rainbow Trout prior to the TSF embankment failure (Pedersen, 1998). Following the TSF embankment failure, Hazeltine and Edney Creek were re-channelized and armoured, and engineered log structures were installed to improve fish rearing habitat (Golder, 2017). Passive wetland (sediment settling) ponds were constructed near the Quesnel Lake confluence to improve water quality and increase wildlife forage (Golder, 2017). Rehabilitation of the riparian habitat was initiated by planting native trees, shrubs, and seeds, and by using landscape techniques to improve site growing conditions, such as mounding soil, spreading CWD, and adding mulch (Golder, 2017).

3 WILDLIFE REGULATION OVERVIEW

The following provincial and federal regulations are the most relevant legislation applicable to wildlife and wildlife habitat during the life of the mine and, along with the applicable permit conditions, are the foundation for the guiding principles in this document. Not all provincial and federal legislation will be applicable for every operational activity at the Facility. If there are any concerns regarding whether a specific activity will contravene one of the following regulations in this section, personnel should consult with the Operations Supervisor or Accountable Facility Representative for further clarification and guidance.

3.1.1 BC *Wildlife Act*

The BC *Wildlife Act* protects almost all vertebrate species from direct harm, except from activities that are authorized under regulation. The *Wildlife Act* includes provisions for wildlife prohibitions and authorizations, where applicable, such as:

- Hunting and trapping,
- Angling,
- Beaver dam removal,
- Attracting dangerous wildlife,
- Wildlife capture,
- Birds, nests and eggs,
- Transportation of wildlife,
- Accidental killing of wildlife,
- Destruction of animals,
- Endangered wildlife (Species at Risk), and
- Fines and penalties.

Section 34 of the BC *Wildlife Act* also provides specific instructions for the protection of birds, nests, and eggs, including for bird species not adopted under Canada's *Migratory Bird Convention Act* (MBCA). Under this section, it is an offence to possess, take, injure, molest, or destroy a bird, its egg, and its nest when occupied (*Wildlife Act*, RSBC 1996, c. 488., s. 34). Nests belonging to an eagle, peregrine falcon, gyrfalcon,

osprey, heron, or burrowing owl are also protected year-round regardless of occupancy (*Wildlife Act*, RSBC 1996, c. 488., s. 34).

Prior to initiating any activity that may be in contravention of the BC *Wildlife Act*, authorization under a provincial permit would be required. A permit associated with the listed activities under the *Act* are typically only authorized if the activity does not contravene a federal act (e.g., *MBCA*).

The Minister responsible for the BC *Wildlife Act* may designate a wildlife species as a *Species at Risk* subject to additional protection under the *Act*. Most species that have been designated as a *Species at Risk* in BC by the responsible Minister have been designated through Provincial Order under the BC *Forest and Range Practices Act* (FRPA) to enable conditions that will protect these species during forest and range activities on Crown land (see Section 3.1.2). However, only four species to date have been designated as a *Species at Risk* under the BC *Wildlife Act*. Refer to Table 1 in Section 4.0 for a list of the designated *Species at Risk* under the *Act* which have been previously documented in the Cariboo Region.

Mine activities that have the potential to impact wildlife should occur within the applicable timing windows, where possible, to avoid contravention of the BC *Wildlife Act* (see Section 5.1).

3.1.2 BC *Forest and Range Practices Act* (FRPA)

The Minister responsible for the BC *Wildlife Act* has the authority to issue a Provincial Order that identifies wildlife species that may require management and protection during activities that occur on Crown Land (Section 3.1.1). To date, most of these Orders have been established under Sections 11 and 13 of the *Government Actions Regulations* (BC Reg. 582/2004) of FRPA (SBC 2002, c. 69.). Wildlife species protected under FRPA through Provincial Order fall into one of two categories, including *Species at Risk* and Ungulates. Species in one of these two categories are subject to additional protection under FRPA during forest and range activities on Crown land through management of habitat areas, ungulate winter ranges, and implementation of general wildlife measures associated with the target species. A third category for *Regionally Important Wildlife* is still under consideration by the Minister.

The Order for the Ungulate category currently includes elk (*Cervus canadensis*), moose (*Alces americanus*), and three populations of Caribou (*Rangifer tarandus*), including the boreal, southern mountain, and northern mountain populations. For a summary of wildlife species that have been designated as a *Species at Risk* under FRPA in the Cariboo Region, refer to Table 1 in Section 4.0.

Activities governed by FRPA generally include timber harvesting, road construction, road maintenance, road use, road deactivation, silviculture treatments, collection of botanical forest products, fire use, control and suppression, or activities carried out under the BC *Forest Act*, a special use permit, or a road use permit (*Forest and Range Practices Act*, SBC 2002, c. 69.). Not all mining activity is expected to fall into the prescribed categories governed by FRPA; however, should any activity undertaken by the mine fall under FRPA's mandate, additional protection measures for the species identified by the Orders may apply.

3.1.3 BC *Water Sustainability Act* (WSA)

The BC *Water Sustainability Act* (WSA) provides protection for aquatic systems and fish habitat and includes mechanisms for authorizations to conduct work activities in and around streams (*Water Sustainability Act*, SBC 2014, c. 15.). Additional provisions for protecting and reducing risk to sensitive streams that contain fish are outlined in Sections 18 – 20 of the *Water Sustainability Regulation* (BC Reg. 36/2016). Work activities occurring in, or around, streams should target the appropriate Fisheries Timing Window to reduce the risk to aquatic organisms (see Section 5.1). Consultation with a Qualified Environmental Professional (QEP) may be required if additional instream mitigation is requested as part of the authorization to conduct the works.

3.1.4 Canada's *Species at Risk Act* (SARA)

Additional prohibitions may apply for species that have been designated as extirpated, endangered, or threatened under Schedule 1 of Canada's *Species at Risk Act* (SARA). It is prohibited to kill, harm, harass, capture, take, possess, collect, buy, sell, or trade any species listed under Schedule 1 of the *Act* (*Species at Risk Act*, SC 2002, c. 29., s. 32.). In addition, the damage or destruction of the residence (e.g., den, nest, etc.), or any part of the critical habitat of a listed species, is prohibited for endangered or threatened species, or for extirpated species that have a recovery strategy that recommends its reintroduction into the wild (*Species at Risk Act*, SC 2002, c. 29., s. 33., s. 58.). Critical habitat is defined as, "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" (*Species at Risk Act*, SC 2002, c. 29., s. 2(1).).

Except for listed aquatic species and listed bird species also protected under Canada's MBCA, prohibitions under SARA apply on federal lands only. However, a Federal Order can be issued to the Province by the Governor in Council requesting further intervention for a SARA-listed species on non-federal lands. Therefore, most terrestrial species that are listed under Schedule 1 of SARA, including their associated residence and critical habitat, fall within the jurisdiction of the Province and will be subject to protection measures that will vary depending on the recovery strategy for that species, scope of works, habitat present, and whether the species is part of a Federal Order that requires the Province to adopt the prohibitions of SARA on non-federal lands.

For a summary of wildlife species adopted under Schedule 1 of SARA that have been documented in the Cariboo Region, refer to Table 1 in Section 4.0.

3.1.5 Canada's *Migratory Bird Convention Act* (MBCA)

The MBCA protects most birds in Canada (including non-migratory species) through provisions outlined in the *Migratory Birds Regulations* (MBR) which stipulate that an individual must not (CRC, c. 1035., s. 5(1)):

- Capture, kill, take, injure or harass a migratory bird (i.e., a bird listed under the *Act*),
- Destroy, take or disturb an egg; or,
- Damage, destroy, remove or disturb a nest, nest shelter, eider duck shelter or duck box.

Permits authorizing some of the actions listed in Section 5(1) of the MBR is possible to obtain for certain activities, such as scientific research. However, there is no permitting process to undertake an activity that

may incidentally result in one of the actions outlined in Section 5(1) of the MBR, such as vegetation clearing. Therefore, incidental disturbance to breeding birds protected under the MBCA, including their eggs, young, and nests, constitutes a non-compliance under the MBCA. The best method of avoiding a non-compliance under the MBCA is to avoid work activities in an area where birds are actively breeding (see Section 5.1.2). When this option is not feasible, there are risk-management strategies that may be utilized as outlined in Section 5.2.1.

4 SPECIES AT RISK

In BC*, Species at Risk* are collectively managed under the BC *Wildlife Act*, the BC *FRPA*, and Canada's *SARA.* Wildlife that are designated as a *Species at Risk* may fall under one or more of these *Acts*. Prohibitions that may apply for species protected under these *Acts* are summarized in Section 3.0.

A list of *Species at Risk* adopted under provincial and/or federal legislation were narrowed down to highlight species that have the potential to occur at the Facility and in the Surrounding Areas, or within the Cariboo Region (BC CDC, 2021). However, *Species at Risk* that were determined to be primarily habitat specialists based on elevation or vegetation requirements (e.g., Bunchgrass BEC zone) in the Cariboo Region were excluded from the final list. Refer to Table 1 for the list of *Species at Risk* that were determined to have the highest potential of occurring at the Facility or in the Surrounding Areas.

Most species in Table 1 are not anticipated to be encountered on the grounds of the Facility. Instead, species in Table 1 are more likely to be encountered in transit to the mine, or in the Surrounding Areas. The exception may include barn swallows or *Myotis* (bat) species attempting to utilize anthropogenic structures for nesting and hibernacula. Refer to Section 5.2 for guidelines regarding wildlife encounters that have a higher potential of occurring at the Facility.

A number of wildlife species have been identified by the BC Conservation Data Centre as vulnerable (i.e., Blue or Red-listed) but have not yet been legally adopted under any statute. For a list of these species, refer to Appendix A.

Table 1. *Species at Risk* adopted under the BC *Wildlife Act*, BC *Forest and Range Practices Act* (FRPA), and/or Schedule 1 of Canada's *Species at Risk Act* (SARA)[1]

Wildlife Species			Adopted under Act? (YES / no)			Conservation Status	
English Name	Scientific Name	Category	FRPA	Wildlife Act	SARA	BC List[2]	SARA[3]
American Badger	*Taxidea taxus*	Mammal	YES	no	YES	Red	E (2018)
American White Pelican	*Pelecanus erythrorhynchos*	Bird	YES	YES	no	Red	no status
Barn Swallow	*Hirundo rustica*	Bird	no	no	YES	Blue	T (2017)
Black Swift	*Cypseloides niger*	Bird	no	no	YES	Blue	E (2019)
Bobolink[4]	*Dolichonyx oryzivorus*	Bird	no	no	YES	Blue	T (2017)
Bull Trout	*Salvelinus confluentus*	Fish	YES	no	no	Blue	no status
Caribou (Southern Mountain Pop.)	*Rangifer tarandus pop. 1*	Mammal	YES	no	YES	Red	T (2003)
Common Nighthawk	*Chordeiles minor*	Bird	no	no	YES	Yellow	T (2010)
Evening Grosbeak	*Coccothraustes vespertinus*	Bird	no	no	YES	Yellow	SC (2019)
Fisher	*Pekania pennanti*	Mammal	YES	no	no	no status	no status
Flammulated Owl[4]	*Psiloscops flammeolus*	Bird	YES	no	YES	Blue	SC (2003)
Great Blue Heron, *herodias* subspecies	*Ardea herodias herodias*	Bird	YES	no	no	Blue	no status
Grizzly Bear	*Ursus arctos*	Mammal	YES	no	YES	Blue	SC (2018)
Lewis's Woodpecker	*Melanerpes lewis*	Bird	YES	no	YES	Blue	T (2012)
Little Brown Myotis	*Myotis lucifugus*	Mammal	no	no	YES	Yellow	E (2014)
Long-billed Curlew	*Numenius americanus*	Bird	YES	no	YES	Blue	SC (2005)
Northern Myotis	*Myotis septentrionalis*	Mammal	no	no	YES	Blue	E (2014)
Olive-sided Flycatcher	*Contopus cooperi*	Bird	no	no	YES	Blue	T (2010)
Painted Turtle - Intermountain - Rocky Mountain Population	*Chrysemys picta pop. 2*	Reptile	no	no	YES	Blue	SC (2007)
Red-necked Phalarope	*Phalaropus lobatus*	Bird	no	no	YES	Blue	SC (2019)
Rusty Blackbird	*Euphagus carolinus*	Bird	no	no	YES	Blue	SC (2009)
Sharp-tailed Grouse, *columbianus* subspecies	*Tympanuchus phasianellus columbianus*	Bird	YES	no	no	Blue	no status
Short-eared Owl	*Asio flammeus*	Bird	YES	no	YES	Blue	SC (2012)
Western Grebe	*Aechmophorus occidentalis*	Bird	no	no	YES	Red	SC (2017)
Western Toad	*Anaxyrus boreas*	Amphibian	no	no	YES	Yellow	SC (2018)
Wolverine	*Gulo gulo*	Mammal	no	no	YES	no status	SC (2018)
Yellow-breasted Chat[4]	*Icteria virens*	Bird	YES	no	YES	Red	E (2003)

[1] BC CDC Search criteria: Vertebrates AND SARA Schedule 1 Status: True OR Identified Wildlife Status: True AND Area of Interest: User Defined Polygon. The exported BC CDC list was further filtered by comparing the results to the CDC mapped locations, COSEWIC distribution maps, and Habitat Wizard wildlife observation points.

[2] Based on Status designated by BC Conservation Data Centre – Yellow = Least Risk, Blue = Special Concern, Red = Endangered/Threatened.

[3] Based on Status designated under SARA – SC = Special Concern, T = Threatened, E = Endangered. The year the status was adopted is in brackets.

[4] These species are at the northern extent of their range but may occur periodically in the region as vagrants.

5 WILDLIFE MANAGEMENT

5.1 TIMING WINDOWS

Reduced Risk Timing Windows for fish and wildlife are intended to provide specific timing windows to target during operational planning to lower the potential for impacts to fish and wildlife. Least risk timing windows typically coincide with the breeding period for a given species, although they may also encompass other life history activities, such as juvenile dispersal and migration events. These timing windows do not guarantee that there will be zero risk to fish and wildlife during these periods, and do not authorize anyone to conduct or participate in activities that are contrary to any statute.

5.1.1 Fisheries Timing Window

To reduce the risk of contravening the WSA (see Section 3.1.3), all work activities that occur instream should utilize the appropriate fisheries timing window for the region. Fisheries timing windows (also referred to as in-stream work windows) apply to all fish-bearing streams and watercourses that have direct connectivity to fish-bearing waters downstream. Within the Central Cariboo District, all streams located at elevations less than 1325 m have a reduced risk timing window of **July 22 – August 15** to account for the presence of both spring and fall spawning fish species occupying the system (Province of BC, 2004). However, this timing window does not necessarily protect anadromous salmonids in freshwater systems; therefore, the regional Department of Fisheries and Oceans (DFO) should be consulted prior to working in any streams where salmon may be present to determine whether adjustments to the reduced risk timing window is required.

If instream works must occur outside the fisheries timing window, a Change Approval authorization may be required through MFLNRORD. In addition, the implementation of risk-management strategies under the direction of a QEP may be a condition of authorization.

5.1.2 Bird Nesting Window

To reduce the risk of contravening the BC *Wildlife Act* (see Section 3.1.1) and MBCA (see Section 3.1.5), any activity that may impact breeding birds, including their eggs and nests, should be conducted outside of the peak breeding period for birds in the region; for example, vegetation clearing or removal of buildings that birds are actively nesting on. The least-risk period for nesting birds in the region is from **August 12 – April 14,** which is the period when less than 5% of the majority of actively breeding birds in forest and wetland habitat are expected to be present within the region (ECCCS, 2018). In addition, any nest belonging to an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl is protected year-round regardless of whether the nest is active (*Wildlife Act*, RSBC 1996, c. 488., s. 34). Should an **inactive** nest belonging to one of these species require removal, authorization through MFLNRORD would be required.

If the peak nesting period cannot be avoided, additional risk-management strategies may be required under the direction of a QEP (see Section 5.2.1).

5.1.3 Amphibian and Reptile Window

An amphibian and reptile timing window has not been formally developed for the Cariboo Region. However, to avoid contravention of the BC *Wildlife Act* (see Section 4.1.1), operational activities should avoid areas where amphibian and reptile species have been confirmed hibernating, breeding or migrating. All amphibian species native to the Cariboo region require different habitat types (both aquatic and terrestrial) at different times of the year. Adult amphibians breed and lay eggs in freshwater, where they hatch into aquatic larvae, that grow and metamorphose into semiterrestrial juveniles. Highest risk periods for amphibians are typically related to movement of individuals between different habitat types, including migration of adults between aquatic breeding habitat and upland foraging or overwinter sites, or dispersal of juvenile amphibians from aquatic breeding sites to nearby terrestrial habitats. Although reptiles in the region, such as the Western Painted Turtle, Common Garter Snake, and Wandering Garter Snake, do not breed aquatically, their life history is also characterized by seasonal movements between different habitats. Due to both groups' heavy reliance on, and association with, freshwater habitats, any work in and around wetlands, streams, or small water bodies (including water-filled ditches), may also pose a risk of harm to individuals or damage to habitat. The highest risk period for amphibians and reptiles occurs between April 1 and September 30, when individuals of these species are expected to be active on the landscape (i.e., not hibernating) (BC MOE, 2017). Therefore, the reduced risk timing window for amphibians and reptiles is estimated to be **October 1 – March 31** for the Cariboo Region.

If amphibians or reptiles have the potential to be impacted by an activity, such as a clearing and grubbing, the completion of a survey under the direction of a QEP may be required to determine if amphibians, reptiles, or their habitats, are present, and/or at risk. If amphibians or reptiles cannot be avoided, a salvage that has been authorized by MFLNRORD through a General Wildlife Permit may be required so that amphibians or reptiles can be safely translocated from the site to nearby suitable habitat.

5.2 WILDLIFE ENCOUNTERS

To avoid contravention of the relevant wildlife legislation outlined in Section 3.0, wildlife-specific strategies may be required during human-wildlife encounters at the Facility, or within the Surrounding Areas. In most circumstances, allowing the animal to leave the area and reporting the incident to the Operations Supervisor or Accountable Facility Representative, will be the best course of action. In certain situations, further mitigation may be required based on the time of year, status of the species, and nature of the anticipated work activity. Individuals should consult with the Operations Supervisor or Accountable Facility Representative if they have any questions regarding protocols for a particular situation that involves a wildlife encounter. Additional in-house training may be required for some personnel to ensure they have the skills to safely handle human-wildlife conflicts, such as bear encounters, and identify sensitive wildlife features.

5.2.1 Birds

The majority of birds in BC are collectively protected under the BC *Wildlife Act*, Canada *MBCA*, and/or Canada's SARA, which generally acknowledge that birds are most vulnerable during the breeding period when adults are caring for nests, eggs, and young (see Sections 3.1.1 and 3.1.5). The following mitigation measures will be implemented if actively breeding birds are encountered at the Facility or in the Surrounding Areas:

- The destruction or disruption of migratory birds, nests, and eggs, is prohibited, including during travel to and from work sites. If destruction or disruption occurs in the form of incidental harm (i.e., unintentional), the incident will be immediately reported to the Operations Supervisor or Accountable Facility Representative.
- To reduce the risk of encountering and disturbing breeding birds, any activity that has the potential to disturb and harm birds, nests, eggs, or young, should be completed outside of the peak avian breeding period for the region (see Section 5.1.2). Vegetation clearing would be a common example of this.
- Report any active bird nests, or repeat observations of breeding pairs, to the Operations Supervisor or Accountable Facility Representative. Birds that are observed at the same location on consecutive days, hover in close proximity to humans, or display agitated behaviour such as persistent alarm-calling or dive-bombing (i.e., swooping down close, before veering away) are evidence that a breeding pair and nest may be present.
- If an active nest or established breeding pair continue to occupy an area of the Facility where the presence of personnel is only periodic and work activity is not constantly occurring (e.g., water sampling), the Accountable Facility Representative may recommend the installation of a buffer around the nest site to signal to other crew members to avoid the area to reduce disturbance. Only the periphery of the buffer should be marked and never the nest or nest tree, itself. Common buffer sizes used according to different avian groups, include (MFLNRO, 2013; MFLNRO, 2014):
    - Songbirds – 30 m radius,
    - Waterfowl – 100 m radius,
    - Swallow colonies – 50 m radius, and
    - Raptors: 100 – 500 m radius (species dependent)
- If an active nest or established breeding pair continue to occupy an area of the Facility where personnel will be regularly present for mine activities that occur for an extended period of time (e.g., geotechnical drilling), or the species is determined to be a designated *Species at Risk* from Table 1, the Accountable Facility Representative may consult with a QEP to determine the most suitable mitigation measures appropriate for the species, habitat, and magnitude of the anticipated disturbance.
- Report the presence of any stick nests to the Operations Supervisor or Accountable Facility Representative since some stick nests are protected year-round regardless of occupancy (see Section 3.1.1).
- Any birds nesting on anthropogenic structures (e.g., barn swallows and cliff swallows) must be allowed to finish nesting once nesting has commenced. If a building with intact barn swallow nests has been scheduled for demolition or removal outside the peak breeding period, consultation with MFLNRORD will be required since barn swallows (and their nests) are protected under Schedule 1 of SARA (see Section 3.1.4).

5.2.2 Mammals

Small and large mammals are regularly documented at the Facility, including black bears, coyotes, lynx, moose, and mule deer. Although the presence of some mammal species on the mine is to be expected due to the remote location of the Facility, the objective is to minimize interactions and, thereby, risks to personnel and animals. The following measures will be implemented if mammals are encountered at the Facility or in the Surrounding Areas:

- Reduce driving speeds to avoid a potential collision with mammal species, especially during hours at dawn and dusk when wildlife activity is heightened, and along known wildlife migration corridors; refer to Section 5.3.2 for further guidelines to prevent wildlife-vehicle collisions.
- Avoid approaching or feeding any mammal species. Food and waste should be securely stored in buildings, approved waste receptacles, or vehicles at all times; Refer to Section 5.3.3 for further guidelines on how to manage for wildlife attractants.
- If a mammal is a designated *Species at Risk* (e.g., caribou), as listed in Table 1 (Section 4.0), disturbance should be reduced to a minimum until the animal has left the area. If driving, temporarily stop the vehicle or pull over if it is safe to do so. If the animal has occupied a work area where mine activities are occurring, temporarily suspend works until the animal has moved out of the work area. All sightings of *Species at Risk* at the Facility should be reported to the Operations Supervisor or Accountable Facility Representative as soon as possible. If repeated observations of a *Species at Risk* occur at a specific location at the Facility, or in the Surrounding Areas, consultation with a QEP may be required to determine the appropriate course of action for that species.
- If a suspected residence (e.g., den or borrow) of a mammal species is encountered, a GPS coordinate will be collected (if possible) and the location will be immediately reported to the Operations Supervisor or Accountable Facility Representative. If there is evidence the suspected residence of a large mammal species is active due to the presence of recent scat, hair, and/or tracks, the crew will immediately leave the area of the residence until further instructions can be provided by the Accountable Facility Representative.
- If a kill site (e.g., carcass locations that will attract wildlife) or mineral lick (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) is discovered, immediately report the location to the Operations Supervisor or Accountable Facility Representative.
- If conflict wildlife, such as habituated bears or cougars, are observed at the Facility or in the Surrounding Areas, the observation should be reported to the Operations Supervisor or Accountable Facility Representative so that the regional Conservation Officer Service can be notified. Personnel should never attempt to engage with conflict wildlife.
- Mine personnel and visitors whose job responsibilities may place them in a situation where a bear encounter is possible must have bear safety awareness training and be trained on how to safely carry and deploy bear deterrents, such as bear spray.

5.2.3 Bats

Fourteen species of bat have the potential to occur within the Cariboo region, including the Northern Myotis and Little Brown Myotis which are both designated as Endangered under Schedule 1 of Canada's *SARA* (Section 4.0). Both the Northern Myotis and Little Brown Myotis have the potential to occur at the Facility or within the Surrounding Areas. Summer roost sites and winter hibernation sites (i.e., hibernacula) are critical for most bats to carry out their sensitive life stages (BC MOE, 2016), and therefore, preservation of these sites is important for the conservation of these species. Roosts may be found in the cavities or loose bark of trees, rock crevices, caves, cliffs, and anthropogenic structures, such as buildings and bridges (BC MOE, 2016).

The following measures will be implemented if bat presence is suspected or confirmed at the Facility or in the Surrounding Areas:

- If the presence of a bat roost or hibernacula is suspected at the Facility or in the Surrounding Areas, a GPS coordinate will be collected (if possible) and the location will be reported to the Operations Supervisor or Accountable Facility Representative.
- If the presence of a bat roost or hibernacula is suspected in an area scheduled for vegetation removal, further instruction will be required from the Accountable Facility Representative. A survey by a QEP may be necessary prior to initiating the works.
- If a natural cave feature is identified, a GPS coordinate will be collected (if possible) and the location will be reported to the Operations Supervisor or Accountable Facility Representative. No personnel shall attempt to enter a natural cave feature that has been identified.
- If bats are observed utilizing an anthropogenic structure at the Facility, the location will be reported to the Operations Supervisor or Accountable Facility Representative. Further recommendation for mitigation may be provided by the Accountable Facility Representative if there is concern bats and personnel will be in close proximity during work activities.
- Prior to removal of any buildings or structures at the Facility, a survey may be required by a QEP to ensure the building or structure is not being utilized by a designated *Species at Risk*, such as the Little Brown Myotis, which are known to use anthropogenic structures for roosting and overwintering.

5.2.4 Amphibians and Reptiles

Amphibians and reptiles rely on aquatic and terrestrial habitat to carry out their necessary biological functions. However, Western Toads and Painted Turtles are particularly vulnerable to road mortality due to the distance the two species will travel between breeding and overwintering grounds in the spring and fall (PWTWG, 2014; BC MOE, 2017); both are a designated *Species at Risk* in Table 1 (Section 4.0). Large congregations of Western Toads adults or juveniles crossing roadways can be a common phenomenon where roads bisect crucial aquatic (breeding) habitat and suitable upland (overwintering) habitat (PWTWG, 2014). In contrast, Painted Turtles rely on suitable aquatic habitat for overwintering and move to terrestrial habitats in the spring to breed (BC MOE, 2017). Painted Turtles exist in significantly lower numbers in the Cariboo Region compared to other amphibian and reptile species and should be reported if observed (BC MOE, 2017). The Common and Wandering garter snake have the potential to occur at the Facility and in the Surrounding Areas, and both species den communally in hibernacula.

Aquatic habitat, particularly riparian and wetland, are present in the Surrounding Areas around the Facility and, therefore, personnel should be aware that amphibians and reptiles have the potential to be present on commute roads. The following measures will be implemented to reduce the risk to amphibians and reptiles:

- Mine activities will consider the reduced-risk window for amphibians and reptiles during project planning, as outlined in Section 5.1.3. Activities that occur outside the reduced-risk window should determine the level of risk to amphibians and reptiles at the project location prior to commencing.
- If mine activities are occurring outside the reduced risk window in an area that has been determined to be high-risk for the presence of amphibians and reptiles, the Accountable Facility Representative may request that additional mitigation is implemented at the site, such as temporary installation of exclusion fencing to keep amphibians and reptiles out of the area of disturbance.
- If amphibians and reptiles are occurring inside the boundaries of the work site, an amphibian and reptile salvage may be required by a QEP under the authorization of a Wildlife Permit through MFLNRORD. Handling of amphibians and reptiles by unauthorized personnel is prohibited due to the potential to transfer disease between individuals and incidentally cause harm.
- Observations of large aggregations of amphibians, including migrations across roadways, will be immediately reported to the Operations Supervisor or Accountable Facility Representative so that further mitigation can be implemented, as necessary. Mitigation may include ensuring all personnel are aware to avoid that location, posting signage, installing temporary exclusion fencing, or having a QEP conduct an authorized salvage. The same procedures apply for a single observation of a Painted Turtle, which occur in lower numbers. Aggregations of snakes may indicate the presence of a hibernacula, which should also be similarly reported.
- Mine activities must not disturb any wetlands, streams or water features, including small, ephemeral (temporary) pools and water-filled ditches, as such habitats can provide important breeding, foraging, and hydration sites for amphibians.
- Any activities near aquatic habitats should protect shallow water areas and their vegetation from trampling and other disturbance; these areas serve as breeding habitat and cover for many amphibians.

5.3 General Best Management Practices

5.3.1 General Restrictions

To ensure compliance with Section D-12 of the M-200 permit, the following provisions and restrictions apply:

- No hunting or shooting shall occur within any area encompassed by the mine permit,
- No fishing or hunting shall occur while on company business, or while commuting to and from the mine for all MPMC personnel and contractors,

- Any exclusion fencing (e.g., electric fencing) that is installed shall be regularly maintained to ensure it is effectively functioning at all times that people are present on site.

To ensure compliance with all relevant wildlife regulations (Section 3.0), the following general provisions and restrictions apply:

- Feeding wildlife is strictly prohibited and is a direct violation of the BC *Wildlife Act* (Section 3.1.1). Feeding wildlife may result in wildlife becoming attracted to human foods and habituated to human presence, which can result in the creation of 'conflict wildlife' and have serious consequences for the animal and other people.
- Cooking outside and using outdoor cooking appliances is prohibited.
- Littering is prohibited. All garbage, including organic wastes (e.g., banana peels, pear cores, etc.), should be stored in wildlife-proof temporary containers and removed and appropriately disposed of off-site (see Section 5.3.3).
- Harassment of wildlife is strictly prohibited and is also a direct violation of the BC *Wildlife Act*. Harassment of wildlife can lead to the abandonment of habitat or the disruption of critical activities (e.g., nesting), and may result in injury to wildlife and/or humans.
- All potentially sensitive wildlife features, including bird nests, dens, roosts, hibernacula, kill sites (e.g., carcass locations that will attract wildlife), and mineral licks (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) will be reported to the Operations Supervisor or Accountable Facility Representative. The Accountable Facility Representative may implement measures to avoid or reduce adverse effects to known wildlife features from mine-related activities, which could include restricting the knowledge of the feature location to reduce traffic at the site and prevent vandalism.

5.3.2 Equipment and Vehicles

To reduce incidents of wildlife-vehicle collisions and near-misses at the Facility, the following general provisions and restrictions apply:

- The Accountable Facility Representative will be familiar with the BC Wildlife Collision Prevention Program (http://www.wildlifecollisions.ca/Default.aspx) and will be responsible for ensuring all mine personnel and visitors are orientated on best management practices for preventing wildlife collisions.
- When travelling to and from the mine, Facility personnel and visitors are required to report incidental wildlife observations. This information will be valuable in identifying areas where potential wildlife-vehicle collisions have a higher chance of occurring.
- Road signage that informs mine personnel (and other road users) to be attentive for wildlife will be established, as necessary. Signage will be placed where potential collisions are predicted (e.g., at known wildlife crossings, blind hills, blind corners, etc.) or have already occurred. All Facility personnel and visitors must obey traffics signs.
- On public gravel or forest service roads, the maximum speed limit is 60 km/hour or per posted signage. During poor road conditions when visibility and traction are reduced, personnel are encouraged to slow down and drive safely to the conditions.

- The maximum speed limit on the mine property is 40 km/hour in ideal driving conditions.
- Wildlife has the right-of-way, except in select circumstances when it is unsafe to apply the brake or come to a complete stop. When wildlife is present on a road, slow down or stop and allow the animal(s) to depart the roadway.
- Limit access to deactivated trails, seasonally or permanently, using signage and high visibility barricades.
- Report wildlife remains observed along access roads at the Facility, and in the Surrounding Areas, to the Operations Supervisor or Accountable Facility Representative. Wildlife carcasses have the potential to lure other wildlife onto the roadway, which may result in an increased likelihood of wildlife-vehicle collisions. MPMC will relay reports of wildlife remains along highways to the regional Conservation Officer Service.
- Wildlife-vehicle collisions that cause injury or death to wildlife must be reported immediately. If an animal is killed as a result of a vehicle collision, the Accountable Facility Representative will notify the regional Conservation Officer Service so the remains can be removed from the road in a timely fashion, suitably disposed of, and documented in an Incident Report. The RCMP must be notified if damage is greater than $1,000 or if there are human injuries. If an animal is injured as a result of a vehicle collision, the Accountable Facility Representative will contact the regional Conservation Officer Service to determine the best course of action (e.g., animal destruction). Some injured animals may present a safety hazard (e.g., bears, moose, deer, etc.); consequently, personnel should not approach injured animals.
- A near-miss animal-vehicle collision will be reported as an “incident” as this information will be important for determining high-risk collision areas that may require warning signage.

5.3.3 Waste Management

Garbage and food waste are wildlife attractants which may lure and create conflict wildlife, such as bears, foxes, and coyotes. In addition, wildlife attractants may include vegetation growing along the roadside (e.g., grasses), chemicals (e.g., gasoline), waste containers (e.g., empty fuel cannisters), and wildlife remains. Conflict wildlife can create unsafe working conditions for personnel and result in damage to facility structures and equipment.

The following waste management measures will be followed to reduce wildlife conflicts related to food waste and garbage:

- Adhere to the guidelines outlined in the General Restrictions (Section 5.3.1).
- Food waste, sewage, and mechanical maintenance waste (e.g., motor oil) will be handled and disposed of appropriately under the direction of the Accountable Facility Representative.
- Temporary recycling and garbage containers shall not be placed or stored outside.
- Wildlife incidents related to garbage or human food attractants will be promptly reported to the Accountable Facility Representative.
- Waste disposed of incorrectly will be reported promptly to the Accountable Facility Representative. The Accountable Facility Representative will affirm that any inappropriately disposed of waste, within and around the Facility, is correctly disposed of.

- Regular site inspections will be conducted of waste transfer areas to ensure site cleanliness, adequate bear-proofing features, and to document improper garbage storage.
- When seeding along road corridors is required at the Facility, the Accountable Facility Representative will select seed mixes that do not contain wildlife attractants (e.g., clover), as these can result in an increase in animal-vehicle collisions.

5.3.4 Reporting Wildlife Observations and Incidents

Observations of wildlife or wildlife incidents by mine personnel and visitors must be documented and reported to the Accountable Facility Representative. An observation is defined as physical observations of wildlife or identification of signs that wildlife may be present in the area (e.g., nests, scat, tracks, dens, etc.). An incident may include animal-vehicle collisions, strange behavior (e.g., the animal behaving aggressively or losing its fear of humans), close encounters on foot or within a vehicle, or witnessing deceased or wounded animals.

Reports of wildlife observations and incidents provide information that can help determine:

- Hazardous circumstances requiring intervention (e.g., conflict wildlife).
- Whether notification to the regional Conservation Officer Service is required (e.g., roadkill).
- If there are deficiencies in the conflict wildlife mitigation and waste management measures.
- Areas along roadways that are potential hotspots for animal-vehicle collisions and, thus, require warning signs.

5.3.4.1 Wildlife Observations

Observations of wildlife and wildlife habitat features (e.g., nests, dens, wildlife trees, cavities, etc.), provide important data on wildlife habitat usage and behavior patterns at the Facility and in the Surrounding Areas. Wildlife observations will be collected and documented by the Operations Supervisor who will forward the information to the Accountable Facility Representative. All observations will be reviewed to assess the potential for conflict wildlife and to ensure current guidelines are sufficient in protecting personnel and wildlife. Wildlife observations will be included in MPMC's annual reporting.

Most wildlife and wildlife habitat observations will be discussed at health and safety meetings. However, the location of sensitive wildlife habitat features (e.g., mineral licks) may be disclosed to a restricted number of mine personnel at the discretion of the Accountable Facility Representative.

5.3.4.2 Wildlife Incidents

Mine personnel and visitors are required to promptly notify wildlife incidents to the Operations Supervisor or Accountable Facility Representative, who may request the completion of an Incident Report. Incident Reports regarding wildlife will be reviewed for any evidence of conflict wildlife development, to ensure current guidelines are sufficient in protecting personnel and wildlife, and for annual reporting purposes.

5.4 WILDLIFE MONITORING

In accordance with the permit requirements outlined in Section 1.1, monitoring programs will be developed to evaluate the effects of mining-related activities on wildlife and wildlife habitat at the Facility and in the Surrounding Areas. Wildlife monitoring will also help determine the success of remediation works completed at Polley Flats and the Hazeltine Creek Corridor, as well as the success of any future remediation that is implemented to achieve long-term reclamation and closure objectives. All monitoring programs will incorporate adaptive management to optimize procedures and outcomes as new information becomes available. The design and development of specialized projects may be done in consultation with QEPs, as required.

An Ecological Risk Assessment was conducted for Polley Flats and the Hazeltine Creek Corridor in 2017 to determine the potential impact of heavy metals on biological receptors and to determine the direction of future remediation and monitoring efforts (Golder, 2016). The assessment determined that the risk of metal uptake was low in aquatic and terrestrial systems and was less likely to cause adverse impacts to wildlife than the effects of the physical disruption to functional habitat (Golder, 2016). For further details regarding wildlife monitoring requirements, refer to the CEMP (MPMC, 2019).

5.5 RECLAMATION PLANNING

MPMC has identified wildlife habitat as one of the primary land-use objectives during reclamation and closure planning, which will fulfill the requirements outlined in Section E-2 of the M-200 permit. Reclamation initiatives will utilize a variety of different strategies to achieve self-sustaining ecosystems that will create long-term habitat for wildlife, including soil amendments to improve soil conditions, revegetation of native species, enhanced landscape features that attract wildlife, and construction of habitat systems that provide ecosystem functions for many species. For further details on how wildlife habitat will be incorporated into long-term reclamation and closure planning, refer to the *Reclamation and Closure Plan Update* by MPMC (2017).

5.6 REPORTING REQUIREMENTS

A summary of the effectiveness of the Plan will be included in the annual reclamation report. In addition, summary reports of wildlife-related mitigation measures, incidents, and observations will be generated annually and will form the basis of adaptive management strategies to address compliance issues and conflict wildlife. These summary reports will be provided to MFLNRORD, First Nations, and community stakeholders upon request (Section 7.0).

6 RESPONSIBILITIES

The following sections summarize the responsibilities held by each of the employment levels at the Facility as they pertain to this Plan.

6.1 SENIOR MANAGEMENT REPRESENTATIVE: MINE MANAGER

The Senior Management Representative, or designate, is responsible for:

- Ensuring the required resources are in place to execute the Plan,
- Submitting the results of the Plan to all relevant Provincial agencies and First Nations groups.

6.2 ACCOUNTABLE FACILITY REPRESENTATIVE: ACTING GENERAL MANAGER

The Accountable Facility Representative, or designate, is responsible for:

- Reviewing the effectiveness of the current wildlife management measures at the Facility,
- Scheduling and coordinating the implementation of measures outlined in the Plan, and,
- Training site personnel and contractors on the Plan and ensuring best management practices are implemented,
- Ensuring additional in-house training is provided regarding protocols for wildlife encounters and sensitive wildlife features for personnel and contractors who may require it,
- Consolidating and reviewing all documentation and data regarding incidental wildlife observations, wildlife encounters, conflict-wildlife, sensitive wildlife features, and the presence of *Species at Risk* on site; this information will be reported to the Mine Manager,
- Communication of additional wildlife mitigation strategies that may be required prior to the initiation or continuation of mine activities.

6.3 OPERATIONS SUPERVISOR: GENERAL FOREMAN

The Operations Supervisor, or designate, is responsible for:

- Reviewing the effectiveness of the current Plan,
- Collecting all documentation and data from personnel regarding incidental wildlife observations, wildlife encounters, conflict-wildlife, sensitive wildlife features, and the presence of *Species at Risk*; this information will be forwarded to the Accountable Facility Representative,
- Implementation of additional wildlife mitigation strategies that may be required prior to the initiation or continuation of mine activities.

6.4 FACILITY PERSONNEL AND CONTRACTORS

All Facility Personnel and Contractors are responsible for:

- Following all the measures and guidelines outlined in this Plan and addressing any questions or concerns with the Operations Supervisor,
- Reporting all wildlife observations to the Operations Supervisor,
- Submitting a wildlife incident report in the event of a wildlife-collision or encounter with conflict-wildlife.

6.5 TECHNICAL SERVICES SUPERINTENDENT

The Technical Services Superintendent is responsible for:

- Providing feedback on the effectiveness of the current Plan at the Facility,
- Conducting internal audits of the guidelines and measures outlined in the Plan at the Facility,
- Coordinating external audits of the Plan at the Facility,
- Coordinating the wildlife monitoring programs, and,
- Reporting the results of the audits and monitoring programs to the regulatory authorities.

7 STAKEHOLDER CONSULTATION

In accordance with the MPMC Communication Plan as a condition of Permit 11678, environmental data will be shared with the Xatśūll First Nation, Williams Lake First Nation, Cariboo Regional District, and the Community of Likely. First Nation and community stakeholders will be provided avenues for discussing and communicating concerns regarding the Plan, including the implementation and results of the wildlife monitoring programs. For further details regarding First Nation and community stakeholder participation, refer to the *Communication Plan* by MPMC (2016).

8 ADAPTIVE MANAGEMENT

The Plan will be continually adapted based on the results of ongoing wildlife monitoring programs, reclamation planning, incident and summary reports, and employee education programs. The adaptive management framework recognizes that new information obtained from those sources of information should be used to inform future planning, decision-making, mitigation, and program design to help MPMC maintain compliance. An annual review of the Plan to determine the potential need for revisions will also be required to ensure adaptive management strategies can be successfully identified and integrated.

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Appendix A

Table of Wildlife Species with a Conservation Status in the BC Cariboo Region not legally Adopted under any Statute

Wildlife species documented in the BC Cariboo Region that have been given a conservation status by the BC Conservation Data Centre and/or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but have not been legally adopted under any statute[1]

Wildlife Species			Conservation Status	
English Name	**Scientific Name**	**Category**	**BC List[2]**	**COSEWIC[3]**
American Avocet	*Recurvirostra americana*	Bird	Blue	no status
American Bittern	*Botaurus lentiginosus*	Bird	Blue	no status
American Golden-Plover[4]	*Pluvialis dominica*	Bird	Blue	no status
Black-crowned Night-heron[4]	*Nycticorax nycticorax*	Bird	Blue	no status
Broad-winged Hawk[4]	*Buteo platypterus*	Bird	Blue	no status
California Gull[4]	*Larus californicus*	Bird	Blue	no status
Caspian Tern[4]	*Hydroprogne caspia*	Bird	Blue	NAR (1999)
Double-crested Cormorant[4]	Phalacrocorax auritus	Bird	Blue	NAR (1978)
Eared Grebe	*Podiceps nigricollis*	Bird	Blue	no status
Green Heron[4]	*Butorides virescens*	Bird	Blue	no status
Gyrfalcon[4]	*Falco rusticolus*	Bird	Blue	NAR (1987)
Horned Lark, *merrilli* subspecies[4]	*Eremophila alpestris merrilli*	Bird	Blue	no status
Northern Goshawk, *atricapillus* subspecies	*Accipiter gentilis atricapillus*	Bird	Blue	NAR (1995)
Rough-legged Hawk	*Buteo lagopus*	Bird	Blue	NAR (1995)
Short-billed Dowitcher[4]	*Limnodromus griseus*	Bird	Blue	no status
Surf Scoter[4]	*Melanitta perspicillata*	Bird	Blue	no status
Swainson's Hawk	*Buteo swainsoni*	Bird	Red	no status
Townsend's Big-eared Bat[4]	*Corynorhinus townsendii*	Mammal	Blue	no status
Tundra Swan	*Cygnus columbianus*	Bird	Blue	no status
Upland Sandpiper[4]	*Bartramia longicauda*	Bird	Red	no status
White-throated Swift[4]	*Aeronautes saxatalis*	Bird	Blue	no status

[1] BC CDC Search criteria: Vertebrates AND BC Conservation Status: Red (Extirpation, Endangered, or Threatened) OR Blue (Special Concern) AND Area of Interest: User Defined Polygon. The exported BC CDC list was further filtered by comparing the results to the CDC mapped locations, distribution maps, and Habitat Wizard wildlife observation points.

[2] Based on Status designated by the BC Conservation Data Centre: Blue = Special Concern, Red = Endangered/Threatened.

[3] Based on Status designated by the Committee on the Status of Endangered Wildlife in Canada: NAR = Not at Risk. The year the status was adopted is in brackets.

[4] These species are either at the northern extent of their range and occur infrequently in the region, or are more likely to occur while on migration or as vagrants.

APPENDIX 9-8: Chance Find Management Plan

REPORT

Chance Find Management Plan

Living Document

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Submitted by:

WSP Canada Inc.

840 Howe Street, #1000, Vancouver, British Columbia, V6Z 2M1, Canada

T: +1 604 685 9381

Reference No. 23590671-096-R-Rev0-81100

November 24, 2023

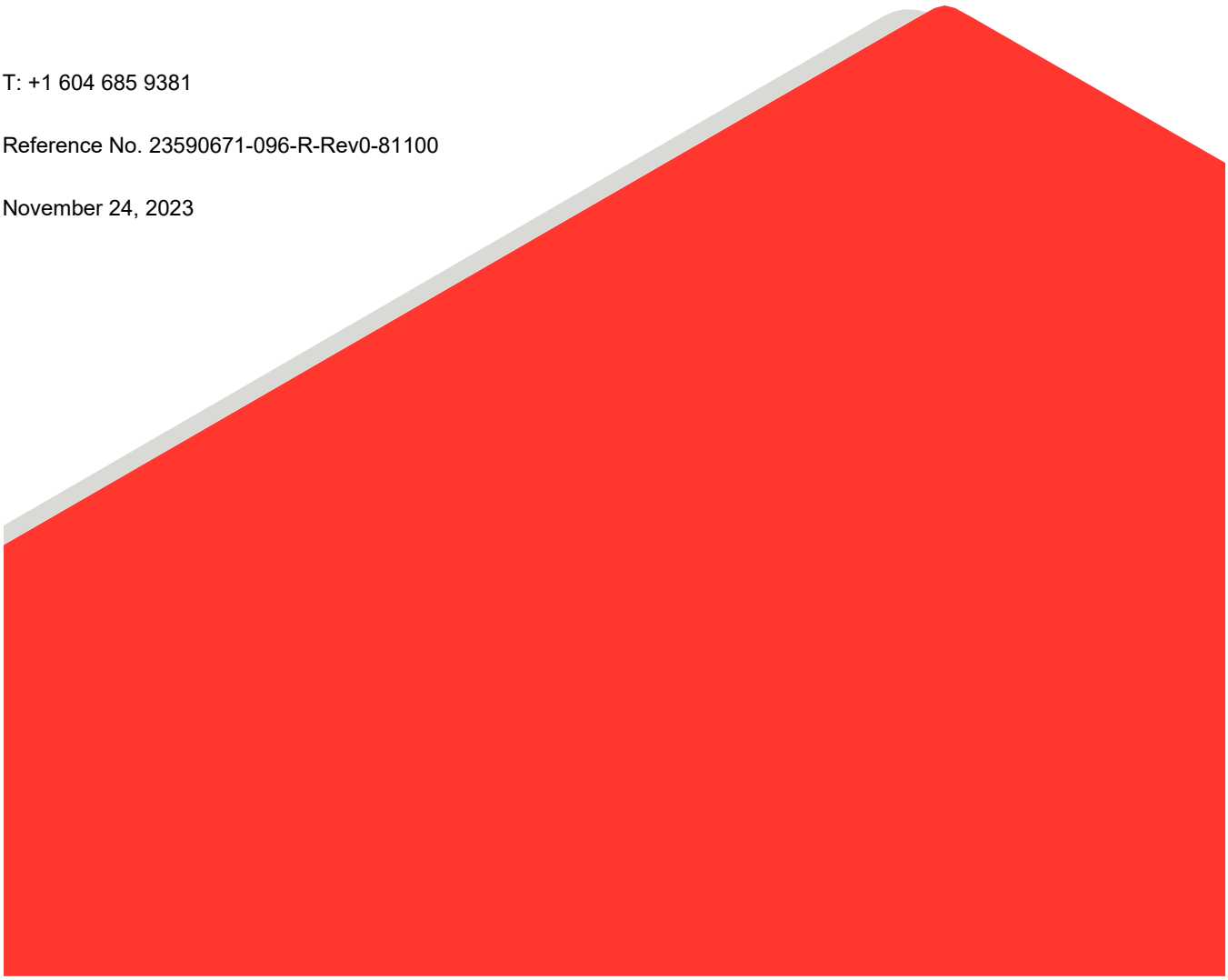

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1.0 INTRODUCTION

This document provides guidance and a communication plan in the event that Mount Polley Mining Corporation (Mount Polley) project activities inadvertently disturb or uncover archaeological deposits, human remains, or objects of historical importance.

Legislative protection for British Columbia's archaeological and heritage resources is provided by the *Heritage Conservation Act* (HCA) (R.S.B.C. 1996, Chapter 187). Under the HCA, a permit is required to search for or alter heritage sites or objects that represent physical evidence of human habitation or use before 1846. Certain site types, including burial places and rock art that have heritage value, are protected regardless of age, and heritage wrecks are protected if two or more years have passed from the date that the vessel or aircraft sank, was washed ashore or crashed. Sites that post-date 1846 are not automatically protected but may be afforded protection by an Order-In-Council, based on the site's heritage value to British Columbia, a community, or an aboriginal people.

Mount Polley engages in a variety of activities that require ground disturbance. Activities that may result in disturbance to a known heritage site require an Alteration Permit pursuant to Section 12.4 of the HCA. The permit will outline procedures for archaeological work during Project activities, if required. Such permits currently take approximately 32 weeks to procure and therefore planning for the management of such sites should take place well in advance of the commencement of disturbance. In most cases, disturbance would result from ground altering activities, but above-ground works could impact heritage sites such as structures, rock cairns, culturally modified trees, or other features.

Mount Polley projects also have the potential to disturb currently unrecorded heritage sites. The following step-by-step procedure is intended to guide Mount Polley in case heritage resources are unexpectedly encountered during project activities. The procedure includes basic archaeological site recognition criteria and reporting procedures. If archaeological assessment or monitoring is required as the result of a chance find, a Heritage Inspection Permit will be required under Section 12.2 of the HCA. A Heritage Inspection Permit will be obtained for the Mount Polley to facilitate chance find responses without delay.

2.0 DEFINITIONS

The following definitions apply to the content of this management plan:

Table 1: Definition of Terms

Term	Definition
Archaeology	The science concerned with the discovery and interpretation of the human past through the study of physical remains.
Archaeological Site	Any place where physical evidence of past human activity is found.
Artifact	Any object that has been modified or manufactured by humans. Artifacts can include tools, weapons, ornaments, utensils, and sculptures.
Cache Pit	Circular depressions, usually less than 3 metres in diameter, used for storing goods or food.
Chance Find	Heritage material that is unexpectedly encountered, typically during project-related activities.
Culturally Modified Tree	A tree that has been intentionally altered by Indigenous people through their traditional use of forest resources (for food, manufacture, or medicinal purposes) or in order to mark a trail
Heritage Site	Land, including land covered by water, that has heritage value to British Columbia, a community or an aboriginal people.
Heritage Value	The historical, cultural, aesthetic, scientific or educational worth or usefulness of a site or object.
Historical	Refers to a time period during which there are written records. This period of time is also referred to as post-contact. “Post Contact” refers to the time after the arrival of Europeans.
Petroglyph	An image that has been carved, incised, engraved, pecked, or ground into the surface of a rock.
Pictograph	An image that has been painted on a rock using organic and mineral pigments.
Rock cairn	A deliberately constructed pile of stones forming a mound, often marking a burial place.

3.0 SITE RECOGNITION CRITERIA

The following lists some criteria that may signal the presence of an archaeological or burial site. The list is not exhaustive, but it includes site indicators that may be expected within the Mount Polley mine site area. The Basic Archaeological Site Identification Guide (Appendix A) provides more detailed descriptions and photographs.

Archaeological Site Indicators

- Artifacts such as stone, bone, or antler tools. Artifacts may be formed implements, such as arrowheads or spear points (also known as projectile points), or simply scatters of chipped/flaked stone. Be aware of concentrations of chipped stone materials that are not otherwise present in the project area (e.g., dacite, tourmalinite, argillite, chert, chalcedony, obsidian).
- Rock art, specifically pictographs (paintings on stone) or petroglyphs (images pecked in stone).
- Small circular depressions (about 1 m to 4 m across) representing pit ovens, cache pits etc. – particularly if associated with trails, or if found in clusters.
- Large circular or oval depressions, representing house-pits.
- Buried or exposed hearths, represented by localized dense concentrations of charcoal and/or ash sometimes associated with fire broken rock, burnt bone, or soil.
- Caves or rock overhangs.
- Trails of possible heritage significance.
- Culturally modified trees, such as blazes and bark removal scars.

Burial Places

- Human remains.
- Stone cairns.
- Earthen mounds.
- Shallow depressions or low mounds at the base of talus slopes.
- Rectangular or oval depressions.

4.0 CHANCE FIND PROCEDURES FOR HERITAGE RESOURCES

4.1 Archaeological Sites or Objects

Step 1: If known or suspected archaeological deposits or objects are encountered, stop work immediately. Secure the find location.

Step 2: Contact the Chief Compliance Officer and the Environmental Coordinator. The Environmental Coordinator will contact a professional archaeologist for further guidance (see Sections 5.0 and 6.0). Do not move or otherwise disturb the artifacts or site deposits. Do not resume work until directed by the Environmental Coordinator. Be prepared to transmit detailed location information and images of the find/location (see form in Appendix C).

Step 3: The archaeologist will advise on further action.

Initial Action

Depending on the nature of the situation, one of the following responses is likely:

- Based on information provided by the on-site representative, it may be decided that there are no further concerns, allowing project activities to continue as planned.
- A field visit by an archaeologist may be recommended. If the find is confirmed to be of archaeological concern, the archaeologist will provide direction about the interim management of impacts at the location, including the staking or flagging off the affected location.
- The archaeologist will notify the Archaeology Branch and the appropriate Indigenous communities of the find. The Archaeology Branch will recommend follow-up actions, primarily through discussions with Mount Polley, Indigenous communities, and the archaeologist. The archaeologist will advise the Environmental Coordinator regarding the resumption of project activities at the location.

Follow-up Action

- The archaeologist will implement any follow-up actions recommended by the Archaeology Branch, including but not limited to, the filing of a British Columbia Archaeological Site Registration Form for entry to the Provincial Heritage Register and archaeological investigations or monitoring.
- Findings or incidents involving heritage resources will be reported to the Environmental Coordinator and documented in Mount Polley's Environmental Management System.

4.2 Human Remains

Should suspected human remains be identified during project activities, the following responses are required. See Appendix B for Archaeology Branch Found Human Remains Policy.

Step 1: If known or suspected human remains are encountered, **stop work immediately**. Immediately notify the Environmental Coordinator and the Chief Compliance Officer. Do not move or otherwise disturb the remains or artifacts present. Take notes of the incident and be prepared to transmit detailed information and a description of the find.

Step 2: Secure the site. If the site is in a busy location or has high public visibility, assign an employee to stand watch until the local policing authority or archaeologist arrives to prevent additional disturbance or removal of evidence. Ensure that the remains are treated with dignity and respect by all those at the scene, including limiting photography to that required by the local policing authority and the archaeologist. Cover any exposed remains with plastic sheeting, plain paper, or other clean and appropriate covering to protect them. Do not backfill.

Step 3: The Environmental Coordinator will contact the Project Archaeologist (see Sections 5.0 and 6.0). Do not move or otherwise disturb the remains or associated artifacts or sediments. Do not resume work until directed by the Project Archaeologist. If some remains may have been placed in a spoil pile, do not move the pile or continue to use it. If material thought to contain remains has been removed from site, try to isolate the spoil at its new location and discontinue further disturbance of the spoil until it can be more thoroughly examined by an archaeologist or forensic specialist. The archaeologist will contact the local policing authority, if necessary, as described below.

Step 4: A qualified archaeologist will advise on further action if the remains are archaeological in nature.

Initial Action

Depending on the nature of the situation, one of the following responses is likely:

- Based on a telephone description of the encounter and review of available images, it may be determined that the remains are not human, and project activities may continue as planned.
- Based on a telephone description of the encounter and review of available images, it may be determined that the remains are likely human, and the archaeologist will contact the local policing authority and the Coroner's Office. The Coroner will determine whether the remains are human, and, if human, whether they are of forensic concern.
- If forensic, the local policing authority will assume management of the scene and liaise directly with the Environmental Coordinator and Chief Compliance Officer.

If archaeological, the archaeologist will notify the Environmental Coordinator and the Chief Compliance Officer, the Archaeology Branch, and all Indigenous communities with an interest in the area. Consultations will follow to establish an appropriate procedure for handling the remains according to cultural protocols. The Archaeology Branch Policy for Found Human Remains (Appendix A) may be used to guide the discussions.

- If the remains are not of Indigenous ancestry, the archaeologist will notify cultural groups identified by the Archaeology Branch and will attempt to identify and contact an organization representing that cultural group.
- The Archaeology Branch, in consultation with the Environmental Coordinator, the Indigenous community or other cultural group (if applicable) and the archaeologist, will determine follow-up procedures, including:
  - Interim management of project impacts and activities at the location, including the staking or flagging-off of the affected location.
  - The need for complete documentation of the burial site.
  - Appropriate treatment of the human remains.
  - Management of future project activities.

Follow-up Action

- Report findings or incidents involving heritage resources to Mount Polley's Environmental Management System.
- The archaeologist will implement any follow-up actions recommended by the Archaeology Branch, including but not limited to, the filing of a British Columbia Archaeological Site Registration Form for entry to the Provincial Heritage Register.

5.0 COMMUNICATIONS PROTOCOL

- All communications should be made using email or telephone and should be documented, with written follow-up to concerned parties.
- All face-to-face meetings are to be documented, with minutes prepared for review and finalization by all parties.
- The proceedings of all meetings are confidential among the parties to the meeting and are not to be distributed.
- All media queries will be directed to the Environmental Coordinator who will notify the Company spokesman.
- All queries from Indigenous community members with an identified interest at the site will be directed to their Chief and Council or other designated organization. All other queries from Indigenous community members will be directed to the Environmental Coordinator.
- Site safety and security is the responsibility of Mount Polley; when implementing safety or security measures, input from the Archaeology Branch and the Project Archaeologist should be sought to help ensure additional impacts to the burial place do not inadvertently occur.

6.0 CONTACT NAMES AND NUMBERS

Table 2: Contact Name and Numbers – Current October 2023

Organization	Name	Title	Contact Information
Mount Polley	Gabriel Holmes	Environmental Coordinator	gholmes@mountpolley.com Mobile: +1 250-364-4939 Mine Site: +1 250-790-2215
Mount Polley	Don Parsons	Chief Compliance Officer	don.parsons@imperialmetals.com Direct: +1 604-488-2652 Mobile: +1 778-836-2652
Archaeology Branch	TBD	Project Officer (HCA Permit TBD)	TBD (update when known)
Williams Lake RCMP	n/a	n/a	575 Borland St Non-emergency Direct: +1 250 392-8707
WSP Canada Inc.	Chris Dodd	Senior Archaeologist	Chris.Dodd@wsp.com Mobile: +1 604-315-1351
WSP Canada Inc.	Andrew Mason	Senior Principal Archaeologist	Andrew.Mason2@wsp.com Mobile: +1 604-417-4259

7.0 LIMITATIONS AND USE OF CHANCE FIND MANAGEMENT PLAN

This document was prepared by WSP Canada Inc. for the exclusive use of Mount Polley and their contractors. Consistent with the intent of the *Heritage Conservation Act*, Mount Polley is advised that if unanticipated cultural materials or features are encountered during construction, all work in the immediate area should cease, and the guidelines for archaeological chance find management, as presented above, should be implemented.

Any use, reliance, or decisions made by third parties on the basis of this report are the sole responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report.

8.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust that the information contained in this report meets your present requirements. Please contact us if you have any questions or concerns regarding the above.

WSP Canada Inc.





Chris Dodd, BA, RPCA
Senior Archaeologist

Andrew Mason, MA, RPCA
Senior Principal Archaeologist

CD/ARM/lih/hp/sw

https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/096-r-81131-chance find management plan/rev0/23590671-096-r-rev0-81100-mount polley cfmp 24nov_23.docx

APPENDIX A

Basic Archaeological Site Identification

BASIC ARCHAEOLOGICAL SITE IDENTIFICATION GUIDE

Common criteria that may signal the presence of an archaeological site are noted below. The examples are not exhaustive but includes common site indicators that may be encountered within the Mount Polley Mining Corporation area of operations.

Artifact or Artifact Scatter

Portable object(s) manufactured or modified by human beings. These items may include chipped or ground stone objects or implements made from bone or antler (Photos 1 to 6).

Look for: Obviously formed stone objects or pieces of stone that have been chipped and/or ground in a non-natural way. Bone and antler artifacts will exhibit obvious modification (i.e., cutting, shaping, incision, etc.).

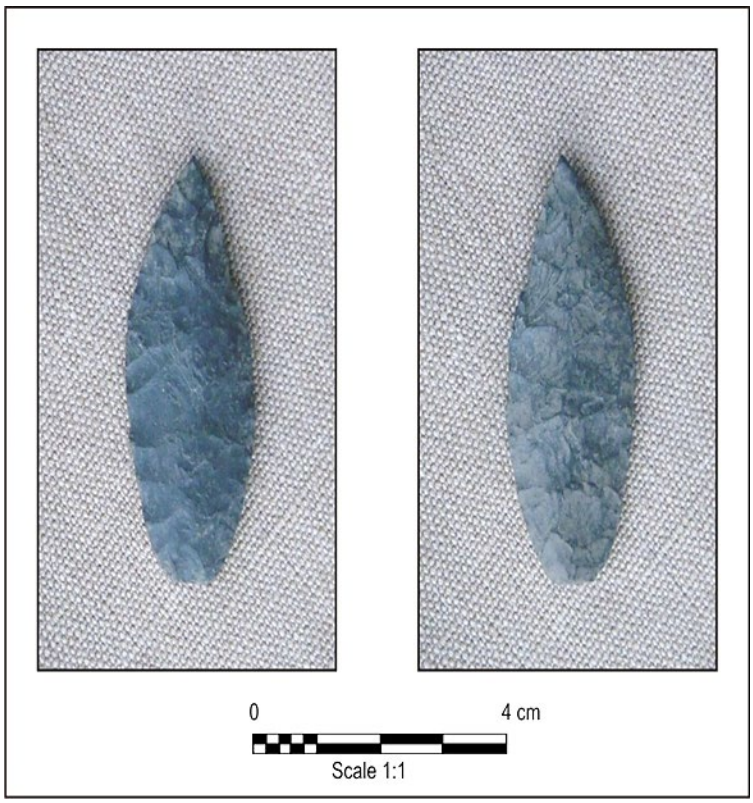

Photo 1: Projectile Point (© WSP Canada Inc.)



Photo 2: Scraper, Projectile Point, Key-shaped Drill (© WSP Canada Inc.)



Photo 3: Obsidian Knife. Obsidian is Volcanic Glass and is Extremely Sharp (© WSP Canada Inc.)



Photo 4: Bone and Antler Artifacts (© WSP Canada Inc.)



Photo 5: Pecked Stone Hand Maul (hammer) (© WSP Canada Inc.)



Photo 6: Chipped Stone Artifacts (flakes) (© WSP Canada Inc.)

Rock Art

Pictographs are paintings on rock and are the most common form of rock art in the region. The paint is often a mixture of ochre and rendered animal fat and is applied using a finger or stylus (Photo 7).



Photo 7: Pictograph (© WSP Canada Inc.)

Cultural Depressions

Cultural depressions range in size and function and may include: small circular depressions (about 1 m to 4 m across) representing pit ovens or food caches – particularly if associated with trails, or if found in clusters; and, large circular depressions (about 5 m to 20 m across) representing house-pits (Photos 8 to 10).



Photo 8: House-pit Depression (© WSP Canada Inc.)



Photo 9: Roasting or Cache Pit (© WSP Canada Inc.)



Photo 10: Roasting Pit in Profile (© Adam Gray)

Fire Cracked Rock (FCR) and Hearth Features

Fire cracked rock (FCR) is heat fractured stone resulting from rapid or alternate heating and cooling in campfires, or when using heated rocks to boil water in boiling pits. FCR is often associated with resource processing and/or food preparation (Photo 11). Hearth features are the remains of camp fires, indicates by dark stained soil, often with charcoal and ash (Photo 12).

Look for: concentrations of fractured rock, either in a hearth formation or dispersed with signs of being burnt in a fire, such as heavily oxidized surfaces sometimes reddish in color.



Photo 11: Fire Cracked Rock (© Andrew Mason)



Photo 12: Buried Fire Hearth (© WSP Canada Inc.)

Aboriginal Trails

Trails are often located in creek valleys and over saddles and ridges. Trails are often in association with other heritage sites such as campsites containing stone or bone artifacts, FCR, hearth features or cache pits (Photo 13).



Photo 13: Aboriginal Trail (© WSP Canada Inc.)

Burial Places

Burials take numerous forms which may include rock cairns, mound burials, and rectangular or oval depressions; however, many burial sites have no surface expression (Photos 14 and 15).



Photo 14: Burial Mounds (© WSP Canada Inc.)



Photo 15: Burial Cairn (© Andrew Mason)

APPENDIX B

Archaeology Branch Found Human Remains Policy

FOUND HUMAN REMAINS

Issued: September 22, 1999

Purpose

The purpose of this directive on found human remains is to provide guidelines to Archaeology Branch staff, archaeologists, other agencies and the public as to branch procedures for handling human remains that may be protected under the *Heritage Conservation Act* (1996, RSBC, Chap. 187), and to facilitate the respectful treatment of these remains.

Mandate

Pursuant to section 13(2)(b) of the *Heritage Conservation Act* (HCA), a permit is required under section 12 or 14 before a person can undertake any actions affecting a burial place of historical or archaeological value, human remains or associated heritage objects.

Authority

The Director of the Archaeology Branch and the Manager, Permitting and Assessment Section, have been authorized to exercise the powers of the Minister to issue permits under sections 12(2) and 14(2), as well as ministerial orders under section 14(4) where necessary for emergency conservation purposes.

Policy Statement

Upon notification of the discovery of human remains that are not of forensic concern, the Archaeology Branch will take steps to facilitate the respectful handling and disposition of those remains within the limits of existing funds and program priorities.

Procedures

The following procedures will normally apply in cases where human remains are discovered fortuitously through various land altering activities such as house renovations, road construction or natural erosion; or during archaeological studies conducted under an *HCA* permit:

1) Fortuitous Discoveries

In cases where the branch has been notified that human remains have been discovered by chance, the following procedures should normally apply:

- The Coroner's Office and local policing authority should be notified as soon as possible.
- The Coroner's Office should determine whether the matter is of contemporary forensic concern. The branch may provide information and advice that may assist in this determination.
- If the Coroner's Office determines the reported remains are not of forensic concern, the branch will attempt to facilitate disposition of the remain.
- If a cultural affiliation for the remains can be reasonably determined, the branch will attempt to contact an organization representing that cultural group.
- If remains are determined to be of aboriginal ancestry, the branch will attempt to contact the relevant First Nation(s).
- Generally, if remains are still interred and are under no immediate threat of further disturbance, they will not be excavated or removed.
- If the remains have been partially or completely removed, the branch will facilitate disposition.
- If removal of the remains is determined to be appropriate, they will be removed under authority of a permit issued pursuant to section 12 or 14, or an order under section 14 of the *HCA*, respecting the expressed wishes of the cultural group(s) represented to the extent this may be known or feasible.
- If circumstances warrant, the branch may arrange for a qualified physical anthropologist or an archaeologist with training in human osteology to provide an assessment of the reported remains in order to implement appropriate conservation measures.
- Analysis should be limited to basic recording and in-field observations until consultation between the branch and appropriate cultural group(s) has been concluded.

2) Permitted Archaeological Projects

In cases where human remains are encountered in the course of a permitted project, the Archaeology Branch should be contacted as soon as possible.

- The remains are to be handled in accordance with the methods specified in the permit, respecting the expressed wishes of the cultural group(s) represented, to the extent that these may be known or feasible.
- If the permit does not specify how remains are to be handled and if the cultural affiliation of the remains can be reasonably determined, the field director or permit-holder should attempt to contact an organization representing that group. The permit-holder or field director should advise the branch of the organization contacted, and any wishes expressed by that organization.
- The branch, in consultation with the appropriate cultural group(s), will determine disposition of the remains.
- Analysis should be limited to basic recording and in-field observations, until consultation between the branch and appropriate cultural group(s) has been concluded.

APPENDIX C

Archaeological Chance Find Documentation Form

Archaeological Chance Find Documentation	
Date and Time:	Location:
Time Work Stopped (if applicable):	UTM:
Recorder's Name:	Project Site:
Department/Company:	Find Surveyed (Y/N):
Position:	Depth Below Surface:
Incident Number/Site Number (if applicable):	
Archaeological Site Type:	
Disturbance Information:	Sketch Map:
Stratigraphic Information:	
Photographs Attached (Y/N): Site Map Attached (Y/N):	(include dimensions)
Name and Signature of Supervisor(s)/Manager(s):	
Follow-up Actions (if required):	
Communication Documentation (record: name, date, time, contact information, and details of conversation): (attach separate sheet if necessary)	



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APPENDIX 9-9: Mine Emergency Response Plan

Mount Polley Mining Corporation

an Imperial Metals company

Emergency Response Plan

This is a CONTROLLED Document.

Copies should not be made without the consent of the Safety department.

Revision August 2021

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1 OVERVIEW

1.1 Scope

Being prepared for a mine site emergency is critical in order to effectively respond and control any unexpected occurrence.

The following Mine Emergency Response Plan has been designed and developed for Mount Polley mine to coordinate and effectively respond to any and all mine emergencies.

This is a requirement of the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) 3.7.1

1.2 Definition of an Emergency

A current or imminent situation that requires prompt coordination of actions of trained personnel to protect health, safety, or welfare of people and to limit damage to property and to the environment.

1.3 Goals

- To identify and ensure adequate resources are available on site and off site in order to facilitate effective emergency response.
- To introduce and train management in the roles of the "Control Group"
- To introduce and train workers in the relevance of the Mine Emergency Response Plan.
- To ensure and maintain a high standard of emergency response training for mine personnel.

1.4 Training

For the ERP Training Program to be successful, with adequate revision of this Plan, it is necessary to establish a Drill Program. The Health and Safety, Environmental and any other operational areas will take part in the drills.

All personnel assigned specific duties within this plan shall review pertinent sections of the plan

All personnel in positions of leadership shall be trained in the Incident Command System

Emergency Response Drill Schedule

- LEVEL 1 Once every 6 months - Area specific evacuation practice
- LEVEL 2 Once every year / Mine Site wide Involving the Mine Rescue Team (ERT)
- LEVEL 3 Once every two years / Involving the ERT and Activating the Emergency Operation Centre

2 EMERGENCY RESPONSE PLAN MANAGEMENT

Mount Polley Mining Corporation shall designate an Emergency Response Plan Coordinator and Emergency Response Planning Committee who shall oversee the development, review and implementation of the Emergency Response Plan.

2.1 Emergency Response Plan Coordinator

The Emergency Response Plan Coordinator shall normally be the Senior Safety Coordinator or his designate.

2.2 Plan Audits and Revisions

The emergency response planning group will be comprised of the Mount Polley Occupational Health, Safety and Environment Committee members.

The ERP Planning Committee shall review the emergency response plan annually. The Emergency Response Plan shall also be reviewed following any incident, to determine if the planned response procedures were adequate or require revision. The planning committee shall be chaired by the Emergency Response Plan Coordinator.

Date	Rev.#	Revision	Originator
July 2019	#0	N/A	M Dyment
July 2020	#1		M Dyment
Aug 2020	#2		M Dyment
Dec 2020	#3	E2 Propane plan	M Dyment
Aug 2021	#4	Contact info	M Dyment

2.3 Emergency Response Plan Distribution

The Emergency Response Plan will be maintained as a secure document with limited printed copies. Digital copies will be stored on the Mount Polley Microsoft Teams network at General\Emergency Response Plans\Surface. Printed copies will be maintained in the following locations:

Copy	**Location**
1	Emergency Operations Center – 2nd Floor Boardroom
2	On-call Binder – Reception Desk
3	Mine Manager

3 COMMUNICATIONS

3.1 Level of Emergency

Mount Polley Mine Incident Reporting Policy requires that all levels of emergencies be reported immediately. Based on the level of emergency the Incident Commander and Safety Representative shall be notified as required.

EMERGENCY RESPONSE LEVELS
Level 1 "Low": Green
A "Low Level" emergency can be controlled by area personnel from the affected area.
Level 2 "Medium": Yellow
A "Medium Level" emergency cannot be handled by the personnel of the affected area. The Mine Rescue Team is required. It does not exceed the resources of the site. The Emergency Operations Group should be activated.
Level 3 "High": Red
A "High Level" incident is one which exceeds the resources available at the site and outside help, such as government, industry and or corporate, is required.

The highest severity rating for any individual risk factor determines the overall severity rating of the emergency.

3.2 Emergency Communications

EMERGENCY COMMUNICATION / INCIDENT NOTIFICATION

EMPLOYEE / BYSTANDER

Emergency Communications

1. By Radio on area radio frequency EMERGENCY – EMERGENCY –EMERGENCY - I have an Emergency
2. Report significant details of the incident

Provide the following information:

1. Your name, area and company
2. Location of the Emergency
3. Description of the Emergency
4. Number of injured persons if any and their health condition
5. Telephone number or radio frequency you will be monitoring
6. **Notify your Supervisor immediately**
    - DO NOT CALL the local media to report the emergency
    - DO NOT CALL the family or friends of the persons involved in the emergency (Management will take charge of making such calls)
    - DO NOT CALL the government agencies (Management will take charge of making such calls)

SUPERVISOR

On Scene Commander (OSC), Senior Area Supervisor present at the scene:

1. Confirms/Determines the Level or Emergency: Level 1 GREEN / 2 YELLOW / 3 RED
2. Informs Safety of the resources needed at the scene
3. Directs the on-scene activities
4. Initiates the dispatch of site based resources for the appropriate response:
    - Site Mine Rescue Personnel
    - First Aid
    - The on-call Health and Safety representative.
5. Contacts the Mine Manager or designate senior on call or the next higher level to report the Level of Emergency and response needs.

MANAGER

Manager
Incident Commander (IC), Mine Manager or Designate:

1. Confirms or Determines the Level of Emergency & assumes command at pre-designated Emergency Operations Center (2nd floor Boardroom).
2. Responsible for the overall management of an emergency.
3. Evaluates the emergency and determines the required level of response.
4. Confirms or initiates the dispatch of the resources for the appropriate response:
    - Site Mine Rescue personnel
    - First Aid
    - Ministry of Energy, Mines and Low Carbon Innovation
        - Senior Inspector of Mines, Health and Safety
    - RCMP - 911
    - BC Ambulance - 911
    - Forestry Fire Service etc.- 1-800-663-5555
    - Emergency Management BC – 1-800-663-3456
    - Williams Lake First Nation, Xatśūll First Nation

INITIAL RADIO AND TASK PROCEDURES WHEN AN EMERGENCY IS DECLARED
When an Emergency is called:
• **Radio Silence -** All non-essential radio communication are immediately ceased. Radio silence will remain in effect until lifted by the Incident Commander
• **Pit Operations 1 – Channel 5 -** is reserved for Emergency Incident Reporting, Management & High Priority Communications only
• **All Employees Monitor Pit Ops 1** to stay informed of the incident and listen for updates & instructions. Maintain radio silence unless you have a Priority Message
• **Cease High Risk Activities** in the initial stages of any reported emergency until a status can be determined by Management
• **Wait For Instruction -** Communications may be done with briefness on regular assigned channels to ask or receive instructions from your immediate Supervisor &/or Management
• **Prolonged Work Interruptions** will be at the discretion of the Incident Commander or his designate
• **Evacuation Ordered -** Proceed to designated Muster Points and report to your supervisor

3.3 Mount Polley Mine Radio Frequencies

Mount Polley Radio Communications				
Radio Channel	Area	Receive Mhz	Transmit Mhz	Full Private Line Mhz
Channel 5	Emergency/First-Aid	167.910	170.430	114.8
Channel 1	Tailings	170.670	170.670	
Channel 2	Mill	170.790	170.790	
Channel 3	Not Used			
Channel 4	Old Bootjack FSR	153.635	153.635	
Channel 5	Pit Ops 1 - Repeater	167.910	170.430	114.8
Channel 6	Pit Ops 2 – Repeater	162.075	167.055	131.8
Channel 7	Pit Talk Around	167.910	167.910	
Channel 8	Maintenance	166.020	166.020	
RR 25	Bootjack FSR	151.310	151.310	

3.4 Critical Personnel Contact Phone Numbers

Title	Name	Contact Information			
Interim General Manager	Don Parsons	Home:		Cell:	(778) 836-2652
		Office:	(604) 488-2652	Radio:	Channel 5
		E-mail:	Don.Parsons@ImperialMetals.com		
Technical Services Superintendent	Matt O'Leary	Home:		Cell:	(250) 274-0658
		Office:	(236) 317-4938	Radio:	Channel 5
		E-mail:	Mathieu.OLeary@MountPolley.com		
Mine Operations Superintendent	Joe Grant	Home:	(250) 296-4447	Cell:	(250) 644-0975
		Office:	(236) 317 4936	Radio:	Channel 5
		E-mail:	Joe.Grant@MountPolley.com		
Environmental Supervisor	Matt O'Leary	Home:		Cell:	(250) 274-0658
		Office:	(236) 317-4938	Radio:	Channel 5
		E-mail:	Mathieu.OLeary@MountPolley.com		
Mill Manager	Doug Ablett	Home:		Cell:	(250) 303-1479
		Office:	(236)317 4949	Radio:	Channel 5
		E-mail:	Doug.Ablett@MountPolley.com		
Safety Officer	Murray Dyment	Home:		Cell:	
		Office:	(236) 317-4940	Radio:	Channel 5
		E-mail:	Murray.Dyment@MountPolley.com		
Corporate President and CEO	Brian Kynoch	Home:		Cell:	(778) 836-7441
		Office:	(604) 488 2654	Radio:	
		E-mail:	Brian.Kynoch@ImperialMetals.com		
Corporate COO	Don Parsons	Home:		Cell:	(778) 836-2652
		Office:	(604) 488-2652	Radio:	
		E-mail:	Don.Parsons@ImperialMetals.com		

3.5 Outside Agency Critical Contact Numbers

Phone Numbers		
Agency Name	Primary Contact	Contact Information
Ministry of Energy, Mines and Low Carbon Innovation	*Phone: 1-888-348-0299*	*Email: MineIncidents@gov.bc.ca*
	Chris LeClair	778-220-2076 (Cell) 250-312-6728 (Office)
	Rory Cumming	250- 371- 7328 (Cell)
	Allan Chan	250-320-2948 (Cell) 250-312-6710 (Office)
Emergency Management BC	24 Hour Contact	1-800-663-3456
CANUTEC	**24 Hour Contact**	1-613-996-6666
BC Ministry of Environment	**Email**	EnvironmentalCompliance@gov.bc.ca
RCMP Williams Lake	**Emergency Contact** Non-Emergency Contact	**911** 250- 392-6211
BC Ambulance	**Emergency Contact**	911
Cariboo Memorial Hospital	**Emergency Department**	**250-392-4411 Ext 4000**
BC Wildfire Service	**Emergency Contact**	**1-800-663-5555**
Cariboo Regional District	**24 Hour EOC Emergency Contact**	**1-800-665-1636 and press 5**
T'exelc First Nation (Williams Lake First Nation)	Chief	250-302-1883 (Cell) 778-417-0194 (Office)
	Natural Resource Manager	250-305-8025 (Cell) 778-417-0191 (Office)
Xatśūll First Nation (Soda Creek Indian Band)	Chief	250-267-7464 (Cell) 250-989-2323 ext 125 (Office)
	Natural Resource Manager	250-267-7185 (Cell) 250-989-2323 ext 121 (Office) nrmanager@xatsull.com
Highland Helicopters Ltd	Williams Lake Base Quesnel Base	250-398-7142 250-249-9660

3.6 Media and Public Relations

During an emergency it is critical that all media and public communication be managed so that only accurate and required information is communicated to outside groups. All media and public communications will be handled by the Mine Manager or Designate. All requests for information shall be directed to Mine Manager or Designate. In the event of an emergency involving personal injury, specific focus should be given to notification of family members prior to public release.

The Shut Down of site external communications shall be determined by Mine Manager or Designate

4 PERSONNEL DUTIES AND RESPONSIBILITIES

4.1 General Responsibilities of Personnel

Anyone first finding or recognizing an emergency situation that would be cause for evacuation shall;

- Immediately report the emergency, pull the fire alarm and evacuate the building.
- Notify the supervisor of the emergency situation.
- Provide help until the appropriate response personnel arrive.
- Never place yourself or others in danger, especially during fires, electrical or chemical emergencies.
- If an alarm is sounded or you are instructed to do so, evacuate the area to designated assembly points and stay there until the "**All Clear**" signal is given.
- If an evacuation takes place, make sure you and any visitors you are responsible for are accounted for.
- If safe to do so, ensure that shutdown procedures for your area are completed prior to evacuation.

General Procedure G50 Evacuation Procedure shall be followed.

4.2 First aid Attendant

In the event of an emergency, the first aid attendant shall take over primary care of any injured workers. If Mine Rescue trained personnel are in command of an incident scene, the first aid attendant will take over care of the injured workers once the Mine Rescue personnel confirms the area is safe to approach.

4.3 Mine Rescue

4.3.1 Emergency Response Coordinator

The Emergency Response Coordinator or his designate must be contactable at all times, both during office hours and after hours. During office hours, the coordinator must be in close proximity to a radio or telephone.

The Emergency Response Coordinator will liaise with Incident Commander, Mine Rescue Personnel and Coordinate assistance for the incident and disseminates warnings and information as required.

Upon notification of an emergency The Emergency Response Coordinator will:

- Immediately report to the Emergency Operations Center
- Proceed to the mine rescue station and organize the emergency response personnel

- Coordinate the gathering of all required equipment and vehicles
- Ensure all required personal protective equipment is identified and utilized
- Brief the Mine Rescue personnel regarding the nature of the emergency and assigned duties
- Ensure that proper communication is established and maintained with all active Mine Rescue personnel throughout operation
- Ensure that a complete record is kept regarding assignments, communications and de-briefing

The Mine Rescue Personnel will seek the Emergency Response Coordinators approval prior to commencing any interventions that could endanger either Mine Rescue Team Members or other personnel.

4.3.2 Mine Rescue Team Captain

The Mine Rescue Team Captain reports directly to the Emergency Response Coordinator in an emergency. The Mine Rescue Team Captain directs the actions of the mine rescue team to rescue trapped or injured workers, protect the mine property from further damage, and rehab the affected area and equipment. The Captain has the right to refuse any task he considers an unacceptable risk to the team. The Mine Rescue Team Captain will be responsible for:

- knowing the Mine Recue Team Members available on site;
- knowing the locations and status of rescue vehicles;
- the direction and safety of team members during emergency situations.

4.3.3 Mine Rescue Personnel

In the event of an emergency all Mine Rescue Team Members report directly to the Mine Rescue Team Captain in the mine rescue training center for briefing. Once assessment of the incident has been completed by the Team Captain any team members not required will be returned to their duties and shall remain on call until needed or the incident has been controlled.

> **3.7.5 HSRC** The manager of an open pit mine employing more than 25 persons per shift shall ensure that
> (1) there is one fully trained and equipped mine rescue team, and
> (2) on every shift where more than 10 persons are working, there are four persons trained in mine rescue procedures.

4.3.4 Mine Rescue Equipment

An updated copy of the mine rescue equipment inventory shall be maintained in the mine rescue training center and on the mine rescue truck. These mine rescue inventories shall be inspected on a monthly basis with any changes to the inventory list being completed as soon as discrepancies are found. The Safety Officer will maintain these lists.

4.3.5 Mutual Aid

Mount Polley Mining Corporation does not currently have a Mutual Aid agreement.

All costs pertaining to rendering assistance from other mines or jurisdictions are the responsibility of the mine seeking assistance.

5 EMERGENCY INCIDENT COMMAND

5.1 Incident Command Roles "Control Group"

Incident Command System (ICS)

- In charge of all aspects of emergency management
- Performing command activities, such as establishing commander and the Incident Command Post
- Protecting life and property
- Setting objectives, strategies and incident action plan
- Controlling and accounting for personnel and equipment resources
- Establishing and maintaining an effective liaison with outside agencies and organizations

With the exception of the Incident Commander (IC), who shall always be designated, the following positions may be implemented by the Incident Commander based on the scope and requirements of the emergency. In smaller incidents the roles may be performed by the IC, but larger incidents may require the IC to establish Sections whose activities are to support the IC.

5.2 ICS - Chain of Command Flow Chart

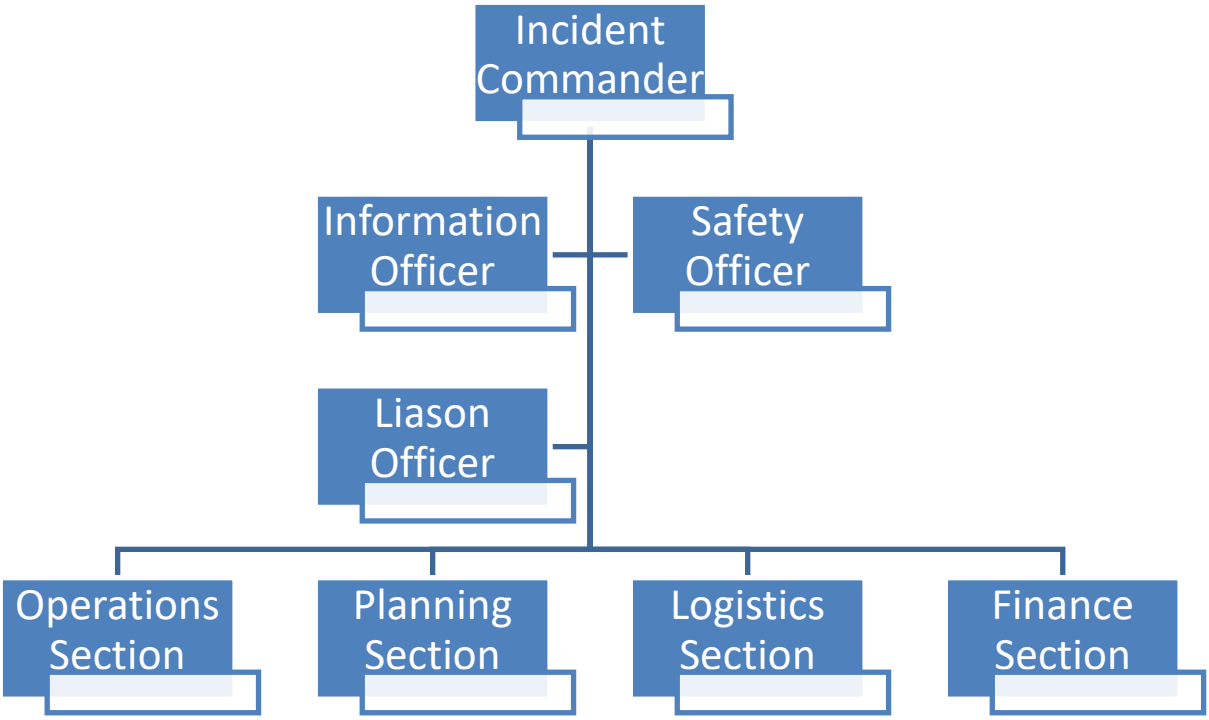

The Incident Commander will assign personnel to these positions.

6 EMERGENCY IDENTIFICATION, PREVENTION AND PROTECTION

6.1 General Evacuation

When an emergency occurs that is significant enough to affect the health and safety of employees in any work area, an evacuation of all areas may be required.

6.1.1 Responsibilities of Personnel

- Know the location of all the emergency exits in your work area, particularly the nearest one to you.
- When the alarm for the evacuation of your area is sounded and/or the notification is given by your supervisor, immediately stop what you are doing and go, in an orderly manner, directly to the areas designated Muster Point.
- When you leave your work site, CLOSE ALL DOORS AND WINDOWS. If you have enough time, close valves, shut off equipment, computers, office equipment and lights; safeguard confidential information by locking desks and file cabinets.
- If you are the last person to leave the area, check that all work areas are emptied of personnel, provided that circumstances and time allow you to do so.
- Personnel that work in critical areas of the process must perform the emergency shutdown procedures established for these areas.
- **WALK, DON'T RUN**. In an emergency, move fast but don't run. Remain in control, do not panic.
- Avoid smoke-filled environments. If a space that is full of smoke is the only exit route, crawl, escape through a window or if safe to do so remain in position and notify your supervisor of your location.
- Go to the muster Point assigned to your **work area**. Make sure that you establish contact with your supervisor (or the designated person) as soon as possible.
- Those people who know of lost personnel should immediately inform their supervisor.
- Do not re-enter the evacuated area or return to the scene of emergency to offer aid, unless the Incident Commander specifically requests your presence.

6.1.2 Muster Points

The Muster Points are designed to be used by personnel during an evacuation due to an emergency. Accommodations will be made to avoid exposure of the evacuees to the inclemency of the weather.

The following areas are designated Muster Points in the event of an emergency:

- **Outside Mine Rescue Training Center**
  All workers assigned to duties in the mill building, warehouse, admin
  Back-up Location: Employee parking lot
- **Outside the Crusher Maintenance shop**
  All workers assigned to duties in the Crusher building, Crusher Maintenance shop
  Back-up Location: Employee parking lot
- **South East Rock Dump (SERD)**
  All workers assigned to duties in the Pit and around the Tailings Storage Facility including The Water Treatment Plant
  Back-up Location: In-Pit Washrooms

In the event that an identified muster point cannot be used due to safety concerns the Incident Commander will designate alternate locations.
Generally a Muster Point is defined as an area that is:

- A minimum of 15 meters distance from the affected facility
- Located against the wind and uphill

6.1.3 Accounting for Personnel

All personnel working onsite shall sign in and out at the Mine Access Gate House.

The supervisor or most senior employee will be responsible for accounting for the personnel under their charge. This is done by performing the following steps:

- Ensuring that all the personnel leave their work area during the evacuation.
- When they have reached the designated Muster Point, perform a headcount of all personnel (employees, contractors, visitors, etc.) who were within the work area at the time of the emergency.
- The Daily Sign-In Sheet will be used for accounting of personnel during emergency situations. Once the head count has been completed, the supervisor must report any discrepancies in personnel, including any missing personnel and/or any individuals that normally work elsewhere.
- In turn, each supervisor will report to their next level of management until personnel information reaches the senior management person for each department at the assembly area.
- The senior management person for each department will account for all departmental personnel. This accounting should include all employees, contractors, delivery personnel, temporaries, and visitors under their supervision.

- Once all personnel have been accounted for the senior department representative shall communicate this information with Incident Command and Emergency Response Coordinator
- Departmental management at each assembly area should communicate with each other to determine the location of any missing personnel.
- If personnel are deemed to be missing, the Incident Commander and Emergency Response Coordinator should be contacted immediately.
- All supervisors shall keep their groups together at their respective assembly areas until the Incident Commander gives further instructions.

6.1.4 Search and Rescue

If a building has been evacuated, personnel shall not re-enter the building until the all clear signal is given, or directed to do so by the Incident Commander.

Mine Rescue trained personnel are permitted to enter an area that has been evacuated to perform search and rescue before the all-clear signal is given. Search and rescue is the responsibilities of the Mine Rescue personnel and will be conducted in accordance with their standard operating guidelines. The Mine Rescue Team Captain may enlist support from the Area Supervisor or their designate for knowledge of the area.

Note: There will be no search and rescue undertaken unless an adequate backup personnel are ready and standing by.

6.1.5 Pit Evacuation

Notification to evacuate the pit will be made through radios and may only be authorized by the supervisor. Instructions will be given for the operations personnel in charge of vehicles to move to the Assembly Points that have been determined to pose no danger.

The personnel who do not have any vehicle or do not have access to one (such as operators of drills, blasting equipment, etc.) will be picked up by light vehicles. It is very important that these workers wait at the designated Muster Point safely outside the emergency area.

6.1.6 Site Evacuation

The decision to conduct a full site evacuation will be made by the Incident Commander. The Incident Command Team will be responsible for arranging transportation off of the property.

- The Incident Commander must determine the final location of the evacuees.
- Transportation for the personnel must be coordinated.
- The headcount should be confirmed to ensure all personnel are accounted for.

Access and Egress to the Mine site

In the event that mine access road prevents any entry or egress of the mine site, the Incident Commander will refer to Appendix A – Site Evacuation Routes for alternate site evacuation routes. If all of these routes are compromised then other options, such as helicopter evacuation shall be considered.

6.1.7 End of the Emergency and Return to Work

The evacuated area must be left free of dangers. The Mine Rescue trained personnel will conduct a thorough inspection of the evacuated facilities. If there was a fire or if damage is found in the structures, the area must be inspected by Maintenance and Health and Safety personnel to determine if the area is safe to be occupied.

Once the area has been declared to be safe, the On Scene Commander will notify the Incident Commander of this circumstance so that he proceeds to stop the emergency signal. The Incident Commander will transmit the order to stop the emergency signal through all channels. Transmission will include a description of the evacuated areas with the key phrase:

"All clear"/you can return to the area".

This message must be repeated three consecutive times.

The employees may return to their work once the transmission of the end of the emergency has concluded.

A debriefing will be completed at the end of all emergencies. The debriefing session will be documented to address what was completed correctly and what improvements are needed. The Emergency Response Plan will be reviewed and, if necessary, revision made.

6.2 Medical Emergencies

6.2.1 Responsibilities

First on Scene Persons Duties

- Prior to accessing the scene ensure the area is safe. If unsafe to approach, immediate contact the supervisor to report the conditions.
- Quickly assess the situation determining the number of injured persons, the severity of injuries and what resources may be required to deal with the emergency situation.
- Immediately inform the area supervisor of the incident, including required resources.
- Give the supervisor the following information:
  - Your name
  - The location of the accident
  - The number of injured persons
  - The nature of the injuries
  - The best route to be used to approach the accident location
- The supervisor will contact the Incident Commander in order to dispatch the Mine Rescue Team.
- Do not move the injured unless they are in imminent danger.

- Restrict access to the scene by any unauthorized individuals and ensure security of any evidence.

On-Scene Commanders Duties

- At all times ensure the safety of personnel and emergency responders.
- Assess the accident scene.
- Contact the Incident Commander to apprise them of the situation, notify them of what additional resources may be required, and update the information whenever the situation changes or additional information becomes available.
- Have someone present assist you with the communications and recording of information & times. (Assign a Log Keeper)
- Control access to and preserve the emergency scene

- Note and record all details of the incident as soon as possible
- Prepare a report of the incident
- Get the names of eyewitnesses and others who may have relevant information.

Emergency Response Team Duties

- Respond to the scene as directed by the on scene or Incident Commander
- Apply appropriate care following protocols outline in training
- Initiate the request for any off-site resources as required (BC Ambulance, Fire Department)
- The Emergency Response Team Captain or Medic will keep the Emergency Response Coordinator or Incident Commander informed of any required resources
- Provide medical assistance and/or evacuate the patients(s) safely and quickly
- Preserve evidence and scene security

6.2.2 Transportation

MPMC procedure G03 Medical Evacuation shall be followed when any injured worker requires medical evacuation, either to meet BC Ambulance Service or to a medical facility.

6.2.3 Fatality

Personal injuries that result in fatalities require special action due to local law and conditions. If the injured party is clearly and definitely deceased, the remains are not to be moved until authorization is received from the RCMP, or the Coroner. Mount Polley Mine Manager or Designate is responsible for notifying the RCMP, Coroner and Ministry of Energy, Mines and Low Carbon Innovation (EMLI).

Due to the nature of fatalities, special emphasis shall be placed on securing the incident scene and all evidence. This shall be done to support investigating the accident, determining the causes and taking the necessary steps to prevent any reoccurrence.

All fatalities will be investigated by a Special Investigation Team made up of:

- The General Manager or his designate.
- The Superintendent of the Area Affected.
- The Senior Safety Coordinator
- The employee's supervisor
- JOHSEC Co-Chairs (Joint Occupation, Health, Safety and Environment Committee)
- Others, as determined by the General Manager / Health & Safety and as circumstances require, e.g. technical advisors

Work Related Fatality – Supervisors Duties

- The Supervisor ensures the barricading of the area surrounding the accident scene to guarantee evidence is preserved.
- The Supervisor ensures that the Health & Safety personnel are notified immediately.
- The Supervisor shall notify promptly the following people:
  - His immediate Supervisor
  - The Area Superintendent
  - Incident Commander
- The supervisor will confine the information to the facts of the accident, having made positive identification of the deceased. Radio discussions of the accident will be minimized and names will not be broadcast.
- The supervisor will preserve the accident scene and all physical information until relieved of this responsibility by the Health & Safety Representative, or employee he designated, or the Area Superintendent. Accident site visits will be limited to only necessary emergency response personnel, managers, and regulatory officials as required.
- The supervisor is responsible for completing a preliminary report of the accident. The Investigation Team will complete and distribute the final report as appropriate.

Work Related Fatality- Health and Safety Duties

- Ensure that the scene is properly preserved, documented and evidence collected.
- Health & Safety will initiate legal reporting, to all agencies that have authorization in the case. The Senior Safety Coordinator or his designate will follow up to ensure that appropriate notifications have taken place.
- The Senior Safety Coordinator will inform Mount Polley Mining Corporation's Senior Management.
- The Senior Safety Coordinator and other necessary management personnel will conduct a briefing session, if possible, with representatives from the local authorities prior to their inspection of the accident scene.
- The Senior Safety Coordinator will serve as a member of the Special Investigation Team.

- After all investigations have been completed, the Senior Safety Coordinator will prepare a final report of the accident in writing to the General Manager, and area Superintendents. He will also include copies to be sent to the local authorities after approval.
- No information will be given to any other source or agency without authorization from the General Manager.

Work Related Fatality – Department Superintendent Duties

- Ensure that the scene of the accident is secured and that no evidence can be tampered with
- Advise promptly the facts of the fatality to the Incident Commander.
- Stand ready to act as required or directed by the Incident Commander.
- Serve as a member of the Special Investigation Team.

Work Related Fatality – General Manager Duties

- Inform Mount Polley senior management and executive team of the occurrence.
- Ensure notification of the appropriate authorities is underway:
    - RCMP
    - Coroner
    - Ministry of Energy, Mines and Low Carbon Innovation
        - Local Inspector
        - Chief Inspector
    - Local JOHSEC (Joint Occupation, Health, Safety and Environment Committee)
- Ensure notification of next of kin occurs as soon as authorities allow
- Once the emergency is under control, the General Manager or his designate will visit the accident scene to assist in the investigation.
- The Incident Commander will return the accident site to its operational condition as soon as possible, being consistent with the requirements of Health, Safety and Reclamation Code.

6.3 Fire Emergencies

At all times be familiar with the evacuation routes of your work area. The best way to protect yourself is to be able to quickly evacuate a work area in the event of a fire or other emergency. Prior to fighting any fire, ensure that it is within the scope of your training and that you maintain a suitable exit route at all times. Large fire will be managed by the site Mine Rescue/Emergency Response Teams.

6.3.1 Fire Prevention

Automatic Fire Alarm: Site buildings are monitored through a fire alarm system. This system will activate and signal through audible bells and sirens for area evacuation.

Monthly fire suppression systems and handheld fire extinguisher inspections are essential to ensure the integrity of all systems.

Scheduled maintenance and repairs are imperative in order to maintain the integrity of fire suppression systems. Particular attention to housekeeping and observing the National Fire Code will ensure that fire protection remains effective at all times.
Combustibles shall not be stored inside buildings unless they are part of a work process.
Flammable materials such as paints and aerosols shall be stored in approved and appropriate storage cabinets.
Fire Extinguisher training: personnel shall be trained and familiar with safe use and application of Hand Held Fire Extinguishers.

6.3.2 Reporting and Extinguishing Small Fires

The site is equipped with hand-held fire extinguishers and fire hydrants for occupant first-response use on small fires. The initial response should be as follows:

- Warn occupants in the immediate fire area.
- Activate a fire alarm if one is nearby
- Activate any fire suppression systems that may be available.
- Attempt to extinguish the fire with a handheld fire extinguisher or fire hydrant if safe to do so.
- Notify the area supervisor via the appropriate radio channel.

Other Actions

- Relevant Supervisor is responsible for making sure that their area is evacuated.
- Regardless of the size of the fire, building occupants must assemble immediately at a designated Muster Point.
- All supervisors shall keep their groups together at their respective assembly areas until the Incident Commander gives further instructions.

6.3.3 Uncontrolled Fires

The following procedures apply to small fires that cannot be extinguished or fires that pose danger to human life/property or production.

- Warn occupants in the immediate fire area.
- Activate a fire alarm if one is nearby
- Activate any fire suppression systems that may be available.
- Notify area supervisor.
- Notify Mine Rescue trained personnel of the location and extent of the fire.

Mine Rescue Team (ERT)

- Responds to the emergency with the relevant equipment.
- Isolate the area and evacuate as many people as possible.
- Ensure rescue of trapped or injured workers.
- Provide firefighter measures within scope of training and request outside resources if required.

Isolating Utilities

The Incident Commander shall instruct the Mill Maintenance and Electrical department to Shut off and isolate power and other utilities to the fire area that could hinder emergency response.

Water Sources

- One of the most important factors to consider when fighting fire shall be maintaining an adequate supply of water and ensuring that alternate sources are readily available.

6.3.4 Wild Land Fires

Any range fire on mine property should be immediately reported to the area Supervisor. The area supervisor shall be responsible for summoning the help needed to extinguish the fire if necessary.

All responses to the fire will be coordinated by the Area Supervisor & Incident Commander. Response should be limited to extinguishing a small fire in its early stages. If the fire cannot be contained with the resources of the mine, response will be limited to protection of mine property.

The Site Manager should be notified of any major fire, or a fire that threatens life or mine property.

The main aim in responding to a Rangeland Fire is to:

- Report it to the area supervisor and Incident Command
- Evaluate the danger to personnel and infrastructure.
- Continual monitoring of the fire for direction, speed, size, smoke, etc.
- Allocation of resources as needed.
- Evacuate to a safe place accounting for all persons on site.
- Help with fire in area as situation warrants and as directed by Incident Command

BC Wildfire Service (BCFS) Wildfire Management Branch

The Wildfire Management Branch has the resources and personnel that are specially training to deal with wildfires. If required, the Incident Commander should initiate contact with the BC Wildfire Service as soon as possible during a wildfire event.

BC Wildfire Service contact line - 1-800-663-5555 or *5555 from a cellular phone

6.4 Hazardous Materials and Chemicals

6.4.1 Spill

For detailed information on Hazardous Materials and Chemical spills see the Spill Response Manual Appendix D

6.4.2 Training

Personnel assigned spill clean up duties must be trained in Hazardous Materials Spill Cleanup

6.4.3 Main Response Elements

Any reportable leak, spill, or release outside containment areas must be reported to the Environmental Department immediately. All external notification and reporting shall be conducted by the Environmental Superintendent or their designate. Containment and cleanup activities shall only be performed as directed by Environmental personnel.

6.4.4 Find and identify

- Mitigate the source of the spill
- Establish communications system
- Collect information
- Isolate the Emergency Scene

6.4.5 Notify

Hazardous Materials spills must be reported to the Environmental Department immediately.

6.4.6 Spill Assessment

See; Spill Response Manual 2019 Appendix D

6.5 Vehicle Incidents

There is a potential for vehicle accidents involving multiple casualties on the Mine-Access road. There would be a reasonably high risk of multiple casualties taking into consideration the volume of traffic and the mode of transportation, that being buses and multi-passenger vehicles.

Access control

One of the early priorities would be to prevent access to the scene by assigning 2 persons as guards, one at each end of the mine access road.
Travel into and out of the mine can then be restricted to essential and key personnel.

Emergency Response Personnel

If indeed there are multiple casualties it may be necessary for additional outside medical help. It would take a minimum of 1 hour for help to arrive from Williams Lake and if available, 30 minutes response from Likely; therefore, it is of the utmost importance that a “Triage station” be established so that casualties can be transported in the order of emergency medical importance.

Transportation

Consideration must be given to the situation where there are multiple casualties needing transportation to medical facilities in Williams Lake. If this is the case it may be necessary to facilitate the use of crew cabs or other multi-passenger vehicles as long as they can provide the necessary comfort for the casualties
The Designated First Aid Attendant is to respond to Medical Emergencies.
Where injuries require Medical Treatment follow procedure G03 Medical Evacuation
Where there are multiple casualties it may be necessary to establish a "Triage station" so that casualties can be transported in the order of emergency medical importance.

6.6 Land Movement

6.6.1 Prevention of Burial

Either a shift boss or a qualified person will examine dumps or stockpiles prior to any work being performed. Dumps, Stockpiles and Pit Walls will be monitored at intervals not to exceed four hours while in use.

The conditions noted shall be recorded in the daily logbook. Items of concern include:

6.6.1.1 Dumps and Stockpiles:

- Cracks appearing on the dump floor or face.
- Subsidence of the dump floor.
- Material hanging up on the face of the dump.
- Water flows or pooling

6.6.1.2 Pit Walls:

- Cracks developing along or near the edge.
- Cracks in the face.
- Overhangs developing on the bench face.
- Water flowing into the rock

If any of the above items are observed contact the Shift boss who will inspect the site and determine what actions are to be taken. In the event that the area appears unsafe do not enter and contact the Shift boss immediately for direction.

If cracks are observed on the rock dump floor the area shall be blocked off and monitored to determine if additional movement is occurring. Dumping in the area shall not recommence until the Shift Boss gives approval.

Overburden and soils piles will slough and compact as they are being built. Dumping shall take place back from the edge and dozed over. If bulging of the face or curved cracks are observed dumping shall cease in the area and the area shall be monitored for additional movement. Dumping in the area shall not recommence until the Shift Boss gives approval.

6.7 Tailings Storage Facility

6.7.1 Potential Emergencies

For detailed information on potential Tailings Storage Facility Emergencies see: MOUNT POLLEY MINE TAILINGS STORAGE FACILITY EMERGENCY PREPAREDNESS AND RESPONSE PLAN.

Located at the Mount Polley Microsoft Teams network at General \ Emergency Response Plans \ Tailings Storage Facility

6.8 Weather Related Emergencies and Natural Disasters

In severe weather, seismic, or other natural disaster situations personnel will keep away from high risk areas created by the condition.

Examples are:

- High winds or earth movement/permafrost subsidence - Stay away from power lines, high walls, and embankments that may be affected.
- Extreme precipitation (heavy snow or rain fall) - Keep personnel and equipment out of possible voids & high drift zones or flood areas in the case of heavy rain
- Heavy snow - Maintain accessibility for personnel and emergency equipment
- Lightning - Keep personnel out of non-protected elevated areas and other high-risk situations.

In the event of any severe weather conditions or other natural disaster situations the Mine Manager or Designate shall be notified.

6.9 Unplanned Explosions

Unscheduled Explosion – First on Scene Duties

- Call the relevant supervisor, report the situation, and follow their instructions.
- Assess the situation. Evacuate the affected area. Move to a safe vantage position. Do not endanger yourself or other rescuers.
- Stop all operations in the area until it is safe to resume.
- If there is anyone injured, follow the procedures herein for Injuries / Medical Accidents.
- If there is anyone in need of rescue, identify the need for the Mine Rescue team.
- Remain at the safe vantage position until relieved by the Supervisor and authorized to leave.
- Ensure that the Department Manager is informed of the emergency via radio or telephone.

Unscheduled Explosion - Supervisors Duties

- In the event of an unplanned detonation, ensure that the area is evacuated and secured. DO NOT ENTER the area except to rescue an injured person and then only if safe to re-enter (If possible, efforts should be made to get the Mine Rescue Team to the scene.)

- Proceed to a safe vantage position. Confirm the assessment of the situation with the First on Scene Person.
- Co-ordinate the immediate emergency response from the safe vantage position.
- Together with the Area Manager, decide on the Level of Emergency (LOE) warranted by the situation. Be prepared to change this if the situation escalates or diminishes in severity.
- Establish controls on all roads leading to the area.
- Prepare access to the scene for emergency services vehicles when it is safe for them to enter the area, and direct them to the scene.
- Ensure that the following personnel have been notified: Mine Operations Manager, Mine Operations Assistant Superintendent, Senior Safety Coordinator.
- See that the Mine Rescue Team is supported in their immediate response requirements.
- With the On Scene Commander, decide if additional off-site emergency services are required.
- When the situation is stabilized, assist the Manager with the investigation of the emergency.
- Ensure the area is secured.

Unscheduled Explosion – Area Superintendent Responsibilities

- Proceed to the scene of the emergency, if it is safe to do so, for an initial assessment.
- Consider secondary explosions, toxic gases, and structural collapses.
- Co-ordinate the response of various on-site specialists such as medical, fire, environmental, Mine Rescue Team, etc.
- Advise the Emergency Operations Group with details of the emergency, the immediate response taken, and if any risks remain.
- When the situation has stabilized, conduct an investigation of the causes, effects and response to the explosion, and prepare a written report.
- Security shall be assigned to control access to the affected area.

6.10 Bomb Threat

6.10.1 Bomb Threat - General Guidelines Procedures

Threat recipient:

- Make every effort to remain calm and relaxed.
- Record the call, if recording equipment is available.
- If a recording cannot be made, try to transfer the caller to the emergency number where a recording can be made.
- If unsuccessful, follow the guidelines in the Bomb/Threatening Call Record sheet to obtain as much information as possible from the person making the threat. **Attached at Appendix A**
- If the threat is in written form, put the letter and envelope in a plastic cover and refrain from unnecessary handling.

- Inform the Senior Safety Coordinator and Area Manager immediately after receiving the threat and wait for further instructions.
- If the caller indicates that the bomb is in the building that you are occupying, immediately start the evacuation process, taking the notes made during the threat call with you.

Observer of item suspected as a Bomb:

- Do not touch the device.
- Inform the Area manager as well as the Senior Safety Coordinator
- Start the orderly evacuation of the immediate area.

6.10.2 Responsibilities

On-Scene Commander's Duties

- Notify Internal Security and consider advice from the RCMP.
- Assess the situation and decide the following:
  - If a full or partial evacuation, or none at all, is warranted.
  - If a search is warranted and can be safely done.
  - When it is safe to reoccupy the site or office.
- Make sure everyone is accounted for at the designated assembly point for that area.

Mine Rescue Team Duties

- The Mine Rescue Team will respond with an ambulance, (if available) and appropriate rescue and firefighting equipment. These units will stand-by at the Incident Staging area where the On-Scene Commander (OSC) is located, at least 300 meters from the suspect device or location of threat.
- In the event of a detonation, when deemed safe to do so, normal Emergency Response procedures will be carried out.
- The Mine Rescue Team will provide the required fire/rescue/medical/search and recovery services and any other services as needed.
- The Mine Rescue Team does not participate in securing the bomb.

7 MINE WATER SUPPLY SYSTEM

- Mine site tap water is untreated and is not considered drinkable, bottled drinking water is provided and all sink tap locations are signed with “DO NOT DRINK TAP WATER”.
- Bottled Drinking water provided to site by Cool Clear Water, Williams Lake.
- All Mount Polley’s water samples are tested by ALS CANADA LTD.
- When maintenance tasks are required and unable to be completed by onsite personnel, then resources will be drawn from outside contractors.
- Interior health can be contacted in any emergency scenario to help with health risk assessments.



7.1 Potential Emergencies

7.1.1 Mechanical / Electrical water system failure

- Contact the General Manager or his designate (On Call Manager)
- Limit water usage on mine site
- Arrange for potable water to be trucked to site until the water well supply system is returned to operational condition
- Arrange for Sanitary stations
- Affect repairs

7.1.2 Water sampling test results outside acceptable parameters.

- Shut down water supply system
- Contact the General Manager or his designate (On Call Manager)
- Arrange for potable water to be trucked to site until the water well supply system is returned to operational condition
- Arrange for Sanitary stations
- Identify source of contamination
- Disinfect well system if applicable

8 MINE SITE ACCESS CONTROL DURING EMERGENCY OPERATIONS

During an emergency, access to the mine site shall be limited to persons and equipment necessary for support of the management of the incident. In order to facilitate site access control a guard will be positioned at a location on the Bootjack FSR that allows for traffic control. This position will normally be at KM 8 of the Bootjack FSR.

The following materials will be needed when deploying site access control:

- A log book to record all personnel being granted access to the site. This log shall record date, check-in/out time, name and company name
- Reliable communication with mine site
- Lighting for night operation
- Traffic control devices, reflective cones, flagging tape and/or barricades
- Warning signage for vehicle operators

Appendix A – Site Evacuation Routes - A

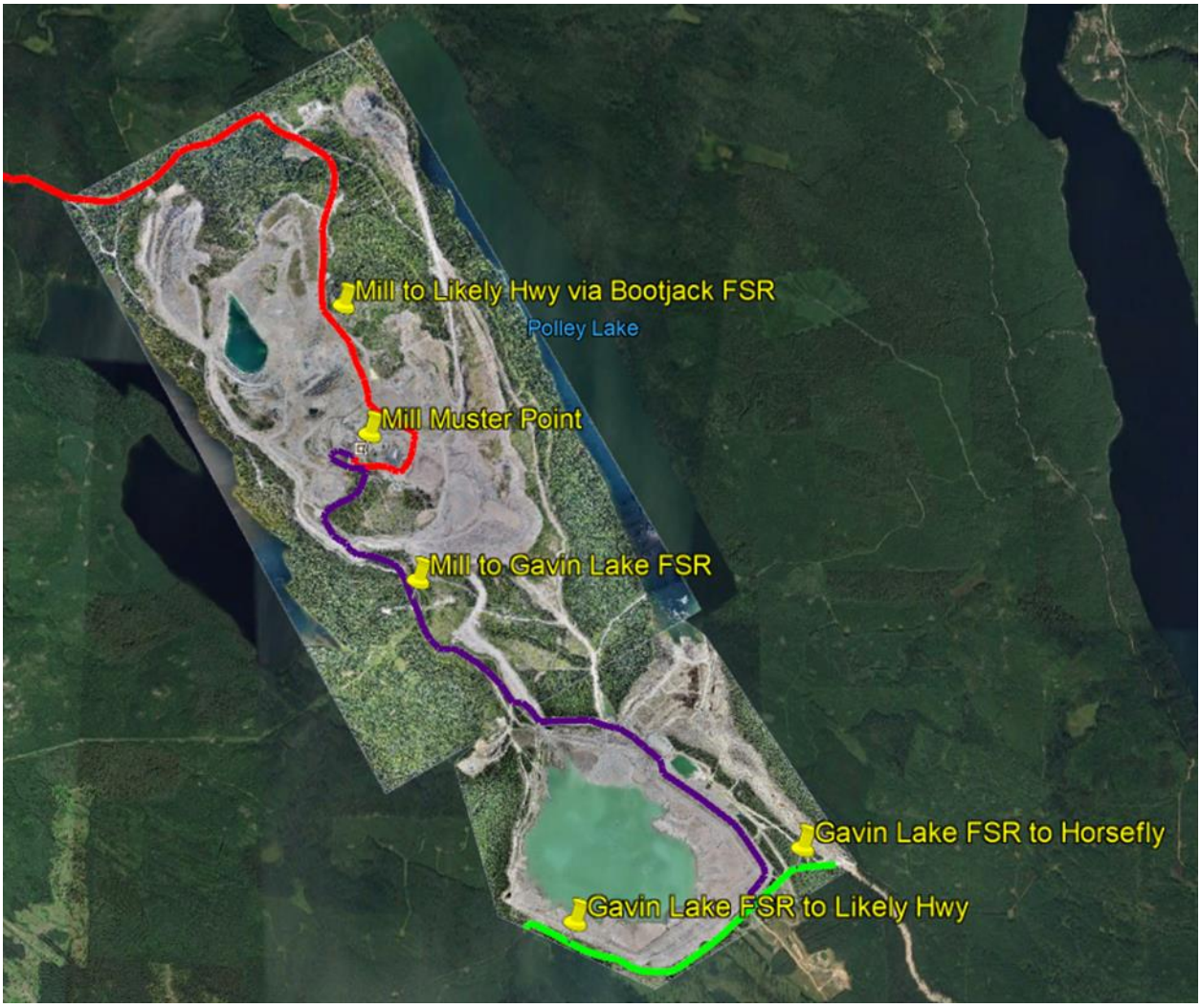

Appendix A – Site Evacuation Routes - B



Appendix A – Site Evacuation Routes - C



Appendix B - Mill Building Evacuation Routes

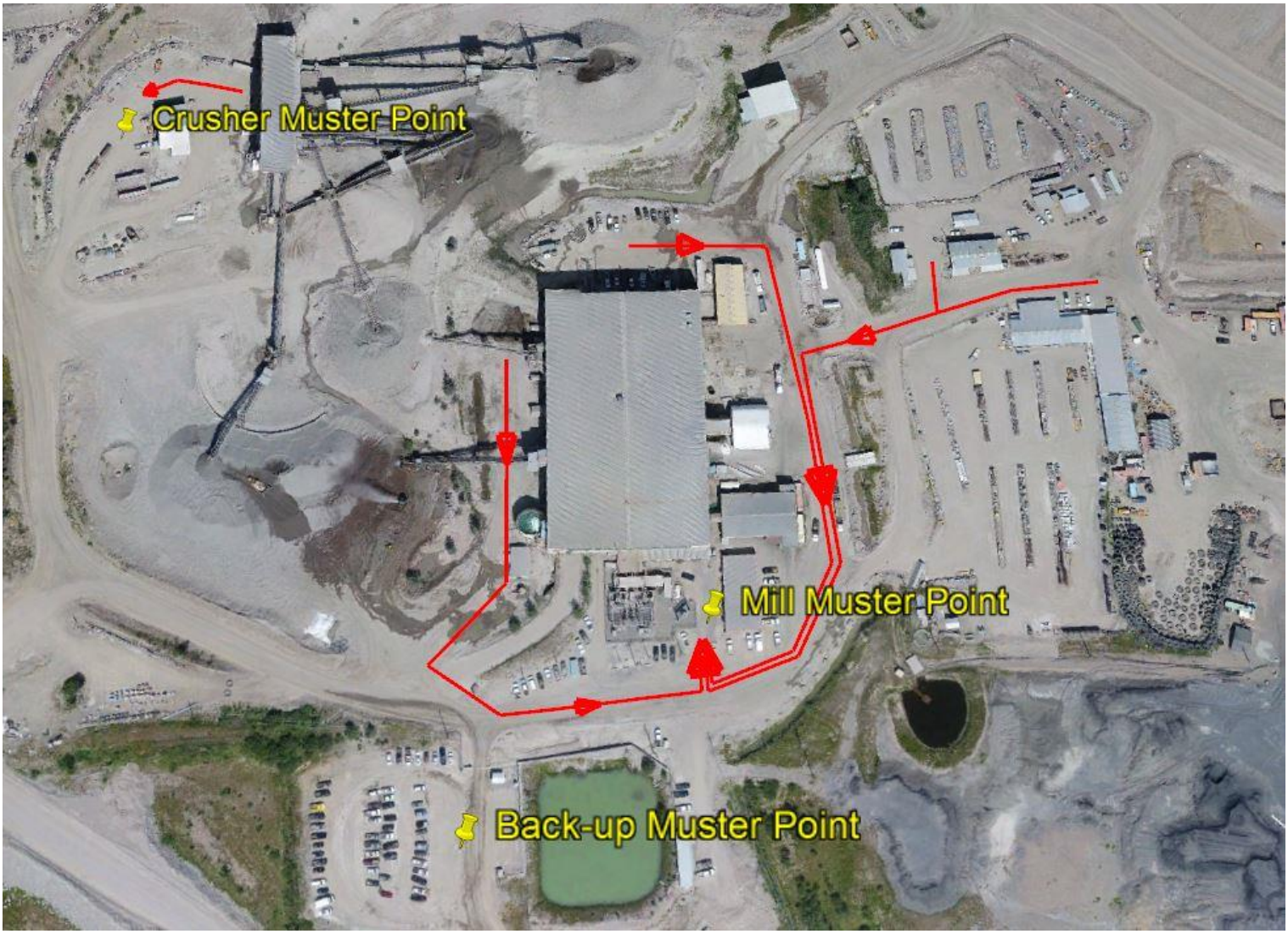

Appendix C – Water System Site Schematic

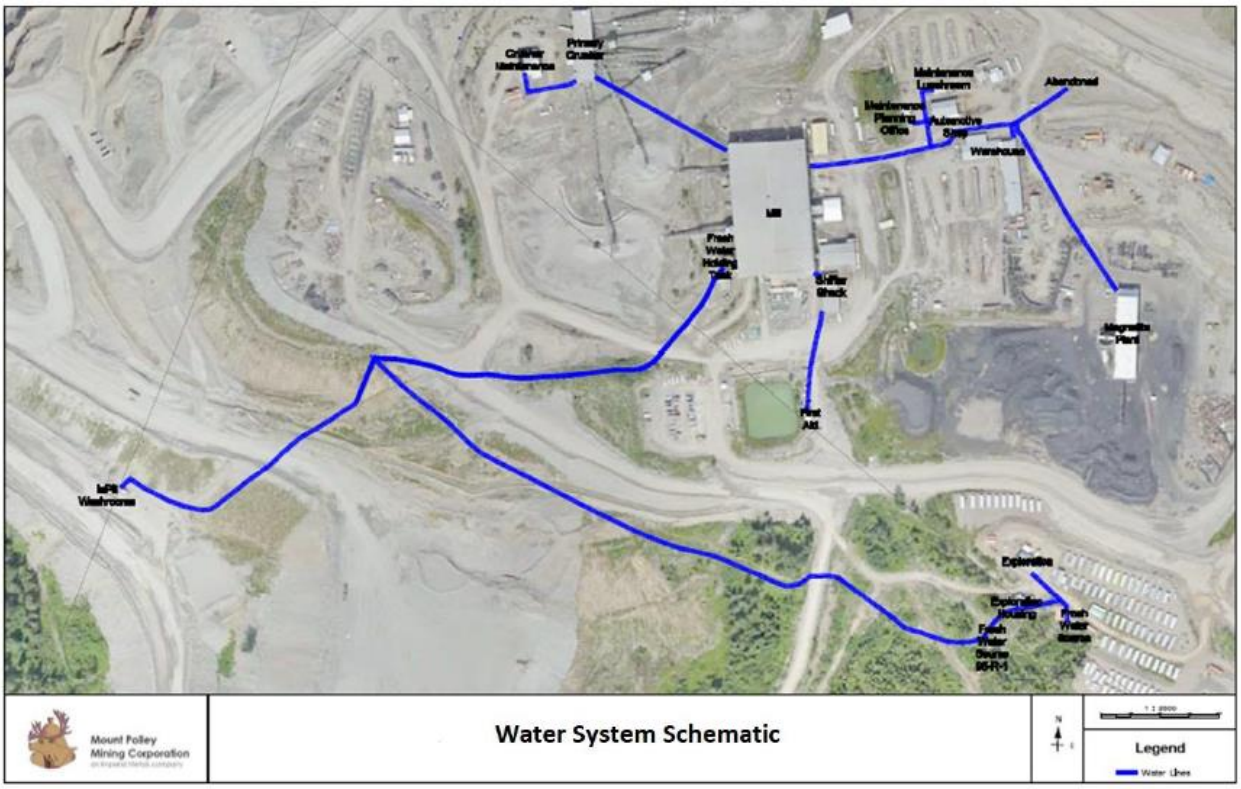

Appendix D – Emergency Spill Response Contingency Plan

Mount Polley

Mining Corporation



Emergency Spill Response Contingency Plan

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Mount Polley Mining Corporation
EMERGENCY RESPONSE PLAN

EFFECTIVE DATE: February 2005

REVISION DATE: March 2013, April 2014, March 2016, July 2019 , Aug 2020

1. Overview

1.1. Policy:

To ensure preparedness and to maximize valuable time in case of an emergency.

To confirm Mount Polley Mining Corporation commitment to operating its business at the highest standards to protect the health and safety of workers, the public, and the environment.

1.2. Definition of an Emergency

A current or imminent situation that requires prompt coordination of actions of trained persons to protect health, safety, or welfare of people and to limit damage to property and to the environment.

1.3. Definition of a Reportable Spill

- A release or discharge into the environment, not authorized under the BC *Environmental Management Act* of a substance in an amount equal to or greater than the amount listed in Appendix E.
- A release of mine influenced water of any volume (outside of permitted effluent discharge volumes) is reportable.
- A release or deposit any deleterious substance in any water.

1.4. Legal Definition:

A spill means any polluting substance whether gaseous, liquid or solid that, in the opinion of the minister, is capable of causing pollution if it were to:

- Escape into the air
- Be spilled onto any land or into any body of water, or
- Escape onto any land or into any body of water.

1.5. Objectives:

1. Ensure compliance with B.C. Environmental Management Act: Part 7
2. Ensure compliance with the Federal Metal Mining Effluent Regulation.
3. Ensure compliance with the Federal Transportation of Dangerous Goods Act.
4. Ensure compliance with the Federal Fisheries Act.
5. Outlines response strategies to spills of potentially hazardous substances at or near the mine-site.
6. Facilitate the rapid deployment of trained personnel to deal with spills so that the environmental impact and risk are minimized.
7. Provides Guidelines for Communicating environmental incidents and issues to corporate management
8. Ensure that responsible personnel are:

- Familiar with the Emergency Spill Response Contingency Plan.
- Aware and are trained in the potential hazards associated with the Plan.
- Understand and are trained in the responsibilities of Team Members.
- Locations of spill containment materials.
- Action Plan for respective substances.
- Reporting procedures.

1.6. Plan Audits and Revisions:

The Environmental Superintendent is responsible for conducting an annual review of this plan and revising it when necessary.

1.7. Training:

It is the responsibility of the Mine Manger or Designate, with the assistance of the Safety Department, to organize, coordinate and conduct training sessions of the mine-site Emergency Response Team Members.

2. Contact Numbers

2.1. Critical Personnel Contact Phone Numbers

For Critical Personnel Contact Phone Numbers see Critical Personnel Contact Phone Numbers Section 3.4 Mount Polley Mining Corporation Emergency Response Plan

2.2. Agency Critical Contact Phone Numbers

For Agency Critical Contact Phone Numbers see Outside Agency Critical Contact Numbers Section 3.5 Mount Polley Mining Corporation Emergency Response Plan

Government Agencies:

Emergency Management BC: 24 hour service:	**1-800-663-3456**
BC Ministry of Environment	
EnvironmentalCompliance@gov.bc.ca	
Ministry of Health (non-emergency health information)	811
Spill Response Advice:	
Canutec (Canadian Transport Emergency Centre)	1-613-996-6666
Canwest Propane	1 800-943-7678
Orica (Williams Lake)	1-250-398-2611
Quadra Chemical Reagent	1-604-940-2830
	1-888-940-2830
Anachemia Science	1-800-361-0209
Brenntag Canada Inc.	1-800-661-1830
	1-604-685-5036
Commercial Clean-Up Services:	
Triple P Sanitation:	1-250-392-4414
Gord's Septic Services	1-250-392-4647

Orville's Septic Service	1-250-395-4638
Arrow Transport	1-250-571-7764

2.3. Regulatory Reporting Numbers

The Emergency Contingency Plan Control Officer/Designate must contact Emergency Management BC.

1-800-663-3456

This is a 24-hour toll free number.

The Emergency Management BC Program staff will notify all concerned agencies, including the following, as appropriate:

BC Ministry of Environment	EnvironmentalCompliance@gov.bc.ca
Ministry of Health.	1-800-663-7867
Environment Canada (24hEmergency – report to BC Ministry of Justice)	1-800-663-3456
Environment Canada (Vancouver Office)	1-604-664-9100
Soda Creek Indian Band	1-250-989-2323
Williams Lake Indian Band	1-250-296-3507
BC Mines Inspector	1778-220-5852

3. Spills

3.1. Potential Spill Materials:

1. Gasoline
2. Diesel Fuel
3. Waste Oil
4. Coolant
5. Hydraulic Fluid
6. Mill Tailings
7. Propane
8. Lime
9. Mill Reagent NaHS
10. Acids
11. MIBC (W22)
12. Concentrate
13. Mine Influenced Water
14. Till/mud/soil/rock
15. IPAC

3.2. Potential Spill Types:

1. Minor spills from equipment due to leaks.
2. Minor spills from containers being damaged or knocked over.
3. Minor/Major spills from fueling stations.
4. Major spills from storage tanks outside the Mill.
5. Major spills from storage tanks inside the Mill.
6. Major spills form transportation and delivery vehicles.
7. Spills from slurry tailings line.
8. Releases of mine influenced water from water collection or transportation facilities.

3.3. Potential Spill Locations:

1. General Mine-site grounds.
2. Mill Building and surrounding areas.
3. Fueling station.
4. Access road to mine site.
5. Access road around mine site.
6. Open Pits.
7. Ditches and pipeline routes.
8. Water storage sumps and ponds.
9. Creeks, lakes and surface water bodies in and around the mine site, including the Hazeltine Creek effluent discharge site.

3.4. Spill Response Materials Locations

1. Light vehicle fuel island (Warehouse).
2. Fuel Island (beside the Crusher).
3. Maintenance areas (Pit Shop, Finning/Shovel Crew Laydown)
4. Springer Pit.(MDG)
5. Warehouse (Entrance and in yard, with spare materials in stock).
6. Lower Hazeltine
7. Reach 3 Creek Construction
8. Cold-Water Pump location (Weir)
9. 9K Sump
10. Mine Drainage Sump
11. CCS Sump
12. South Seepage Sump

3.5. Spill Assessment Potential

Transportation:

The area of greatest vulnerability for spills is transport related incidents resulting from road conditions, and mechanical failures. Contingency plans are filed by the Shipper of the transport company with Transport Canada and drivers are required to be in possession of these files in order to address these types of incidents.
Ensure that Shipping Paper is carried in the cabin of the transport vehicle.

The Company:

Undertakes to provide information to the Shipper on avoidance of poor road conditions and rescheduling of deliveries, if necessary.
Ensures to maintain the mine road conditions in as favourable condition as possible.
Provides the manpower and equipment required to control and minimize the effects on the environment.

Fuels:
Standard procedures are in effect for the safe unloading of fuels to storage tanks and safety berms are provided to contain spills at the storage facilities.
Emergency Contingency Plans for effective response to spills are addressed in this document.

Lime:
Unloading of granular quicklime from bulk tank trucks can result in spillage. These spillages, if any, will be cleaned up with a front-end loader and disposed of.

Explosives:
Transport, handling and transfer of explosives are addressed within the Emergency Contingency plan of this document. Explosive materials storage is in separate containers and conform to the Ministry of Mines and Transport Canada standards.

Tailings:
The tailings lines are protected by against vehicle collision. The pipeline is also contained in a ditch along the access road to the tailings pond.

Mine Influenced Water:
Site water collection sumps, ponds, and ditches, water transport pipes, and the Hazeltine Creek Discharge System, all have the potential to release water into the environment, possibly entering surface water bodies. Breaches may occur due extreme runoff events, physical damage to pipes or other facilities, or pump failure.

Hazeltine Creek Effluent Discharge System

The installation of continuous monitoring for conductivity, temperature, and flow provides employees with immediate notification of changes in the discharge. As well, the emergency “shut down” system will prevent the discharge of water which exceeds the set limits for continuous monitoring as defined by Mount Polley Mining Corp. the Metal Mines Effluent Permit, and Ministry of Environment PE-11678.

Pump failure triggers emergency "shut down" and all storage tanks are designed to overflow into existing effluent storage facilities.

Other Consumables:
All consumables are contained within their original shipment containers prior to transfer to end user containers. End user spillage Emergency Contingency Plans are addressed in this document.

4. Response

4.1. Contact Group

Spills of chemicals, fuels and other substances may occur as isolated events or they may occur with other emergencies such as fire, explosion, natural causes or accident.

A number of response personnel may be involved to protect mine property and the health and safety of mine personnel and the public.

The key persons involved during a spill occurrence would be as follows:

- The person discovering the spill, and his/her Supervisor.
- The General Manager or his designate (who may be the On-Call Supervisor if the General Manger cannot be reached outside of regular hours).
- The Area Superintendent.
- The Safety Department.
- Mine Rescue trained personnel
- The clean-up crews.

The responsibilities of key personnel are outlined in the Personnel Responsibilities section.

Applicable telephone numbers are kept current and posted at the mine-site.

4.2. First-On-The-Scene Personnel Responsibilities

4.2.1. Person discovering the spill:

- Assess the hazard to one's own health and safety and to others in the vicinity.

- If the risk of gas poisoning exists ensure to conduct atmospheric testing with the appropriate equipment prior to entry.

- If fire or explosion hazards are perceived immediately retreat to safe distance.

4.2.2. In both these situations:

- Barricade/Flag the area.
- Place physical guards at a safe distance.
- Warn others in the immediate vicinity of the situation.
- Notify the Area Supervisor IMMEDIATELY following initial response action.
- Arrange for appropriate operating equipment to be shut down, if applicable, to minimize the extent of the spill.
- If warranted, notify designated First Aid Attendant for first aid.
- Firefighting response will be trained site personnel backed up by Mine Rescue trained personnel.
- The Supervisor or the person discovering the spill with the following information must contact the General Manager or his designate IMMEDIATELY following initial response action:

  - Name of person discovering the spill.
  - The time of the spill.
  - The location of the spill.
  - The type of substance spilled.
  - The quantity of material been spilled.
  - The cause of the spill.
  - The weather conditions.
  - Perceived potential for hazard, and any injury to aquatic systems, wildlife or people.
  - Actions already taken.
  - Whether a fire or explosion hazard is deemed to exist.
  - Personnel already notified.
  - If the spill is contained.
  - Any environmental effects that have or could occur.
  - Any injuries.

Note:

Ensure every remedial action is taken safely and efficiently to stop and/or minimize the extent of the spill.

The Supervisor must remain in place to direct personnel and equipment upon instructions from the Command Post.

4.3. Levels of Emergency

Level 1- A spill that is **below the external reportable quantity** or an emergency where the **potential health and safety risks are low** (no employees are injured). Incidents that can be cleaned up or resolved with little impact on the mine and or environment. No command post is necessary in such an incident.

Level 2- A spill that is **above the external reportable quantity** or an emergency whereby the **health and safety of staff member(s) may be jeopardized**. It is a spill that requires the initiation of the emergency measures. No external help is needed in this situation but a command post may need to be established.

Level 3- A spill that is **above the external reportable quantity** or an emergency where there is **great potential health and safety risks**. There may be casualties. This type of emergency requires internal and (may require) external intervention. A command post may be set up both onsite and offsite.

	Is the spill above external report quantity?	**Potential Health and Safety Risk**	**Emergency Operations Center**	**External Support**
Level 1	**No**	**Low**	**No**	**No**
Level 2	**Yes**	**Maybe**	**Maybe**	**No**
Level 3	**Yes**	**Yes**	**Yes**	**Maybe / yes**

4.4. Main Response Elements

Find and Identify

Mitigate the source of the spill
Establish Communication System
Collect Information
Isolate the Emergency Scene

Notify

Site supervisors, managers, and employees (according to procedures outlined in this document)
Regulatory bodies and agencies as required (Ministry of Environment, Environment Canada, Provincial Emergency Program), if required.
Soda Creek Indian Band and Williams Lake Indian Band, if required.
Notification to public and media, if required.

Ensure Public Health and Safety Protection

Work with appropriate first responders
- Mine Rescue Team and site First Aid attendants
- Ambulance
- Fire Department
- Police
- Search and Rescue

Environmental Protection

Establish Spill Plan
Manage spill response equipment and resources
Conduct spill material clean up

Terminate the Incident

Complete an incident report

4.5. Personnel Responsibilities

General Manager/Designate:

Deploy response crews and equipment operators to undertake the actual clean-up and supervise their work. Notifies Corporate, Emergency Management BC, First Nations groups, and Media.

Maintain responsibility for the activities at the site of the spill.

Maintain contact with and co-ordinate work with the Environmental Superintendent, Terminates the Incident, conducts brief**.**

- Notifies Government Agencies.
- Monitors Environmental Impact.
- Establishes decontamination measures with safety coordinator.
- Update the Spill Contingency Plan as required, for all potentially hazardous materials, accurate names of personnel and phone numbers.
- Plan and co-ordinate required skills.
- Be responsible for assessing new spill hazards as they develop and take preventative actions, whether covered in the manual or not.
- Check and maintain the operating status of required response equipment, which may be required at a spill.
- Train emergency response personnel with respect to their duties, or work with the Safety Department to do so.

Superintendent of Affected Area:

- Has authority to direct response operations.
- Needs to clear incident action plan with the General Manager (or designate).
- Determines level of Incident.
- Assigns Command Post if necessary.
- Executes the incident action plan.
- Enforces worker safety and environmental protection.
- Briefs team on specific assignment.

Communications

Responsible for the communication and emergency assistance

Notifies emergency response personnel by telephone or radio in the event of an emergency

- Assigns scribe
- Records incident details and subsequent developments as they occur.
- Responsible for establishing communication and emergency assistance.
- Establishes external support system (if required)
- Assisting Safety Supervisor.
- Maintains communication contact with the work parties via walkie-talkies, signal horns, or other means

Health and Safety:

- Advises the incident commander on all aspects of health and safety on the site.
- Recommends stopping the work if any of the work operations threaten worker or public safety.
- Ensure proper PPE is used and maintained.
- Controls entry and exit at the access control points.
- Monitors onsite hazards and conditions.
- Enforces the Buddy system.
- Control the decontamination of all equipment, personnel and samples from the contaminated areas.
- Assist In the disposal of contaminated clothing and materials.
- Advise medical personnel of potential exposures and consequences.

4.6. Emergency Response Team Members:

- Consult the Mine Emergency Response Plan to review the site plan relative to building location of the spilled material and specific location of the material within the building/site.
- Consult the appropriate ACTION PLAN contained in this document, to review the properties of the spilled material and recommended response actions.
- If further information is required, contact one of the resource services listed in Heading 2 of this document.
- Assess the spill requirements for manpower, equipment, materials, tools and protective gear to contain the spill, in consideration of the resources available.
- Mobilize these resources and take responsibility for implementation of the response actions in the spill site.
- If the spill is too large or complex to be handled entirely by the Company's resources, call an appropriate group or agency listed on page 3 of this document.
- Contact the Area Superintendent to determine what, if any, sampling should be done and to discuss the spill and any environmental implications.

- Once the initial response action is underway, contact the General Manager or designate to review the situation and strategy.

Appendix A

Federal and provincial legislation provide for the regulation of an extensive list of products, substances or organisms classified as dangerous. The products fall into one of nine classes:

- Class 1 explosives



- Class 2 gases

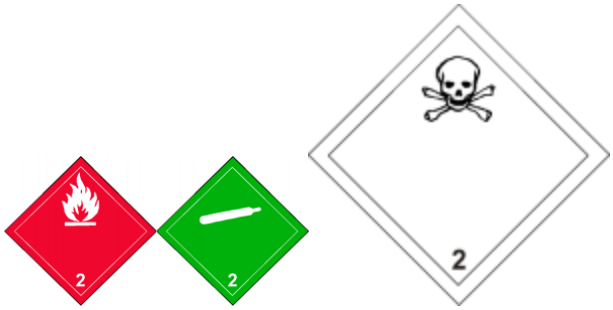

- Class 3 flammable liquids



- Class 4 flammable solids, spontaneously combustibles and substances that, on contact with water, emit flammable gases



- Class 5 oxidizing substances and organic peroxides



- Class 6 poisonous (toxic) and infectious substances





- Class 7 radioactive materials



- Class 8 corrosives



- Class 9 miscellaneous products or substances
  - miscellaneous identified dangerous goods
  - certain specified goods considered dangerous to the environment
  - dangerous

Appendix B

Hazardous Material Response Plan

H**azardous Material Response Plan**

Hazardous Materials Checklist

1. Isolate the Area and Deny Entry
   - ❑ Determine the Hazard Area Involved
   - ❑ Establish Control of the Hazard Area
   - ❑ Determine Incident Control Zones (Hot, Warm, Cold)
   - ❑ Advise All Units of Area to be Isolated

2. Identify and Verify the Materials Involved
   - ❑ Obtain Shipping Papers or Facility Documents (*only if safely possible*)
   - ❑ Write Down All Information Obtained
   - ❑ Verify the Source and Accuracy of all Information

3. Hazard and Risk Assessment
   - ❑ Evaluate the Following Concerns

     Health Physical Properties

     Flammability Chemical Properties

     Reactivity

   - ❑ Assess Container Integrity (Stress, Breach, Release, etc.)
   - ❑ Determine all Exposures
   - ❑ Estimate Likely Harm Without Intervention

4. Evaluate Protective Clothing and Equipment
    - ❑ Determine Proper Type and Level of Protective Clothing Required

Note: Structural Fire-Fighting Clothing Will Not Provide Protection

5. Coordinate Information and Resources

- ❑ Coordinate Information Between All Branches/Divisions/Groups
- ❑ Conduct Briefing of All Division/Group Officers to Develop Tactical Options
- ❑ Advise Incident Commander of Tactical Options and Recommendations

6. Control, Containment and Confinement

- ❑ Review Tactical Options With Entry Personnel
- ❑ Coordinated All Operations With the Safety Officer
    - ❑ Will Decontamination be Required After Entry Operations?
        - ❑ Yes Implement **Decontamination Procedures Prior to Entry**
        - ❑ No Continue

7. Decontamination Procedures
    - ❑ Decontamination Procedures Determined and Verified
    - ❑ Decon Area In Place and Fully Staffed

8. Entry Team Procedures

    (SOP's of the department supplying the hazardous materials technicians shall be used for all entries)

9. Termination Procedures

- ❑ Ensure All Personnel Are Briefed as Necessary
- ❑ Signs and Symptoms of Exposure Provided
- ❑ Personnel Exposures Documented

Initial Isolation/Protective Action

Hot- Exclusion Zone. Entry Team only

Warm- Decontamination, Properly trained & equipped personnel only

Cold- Staging & Operations

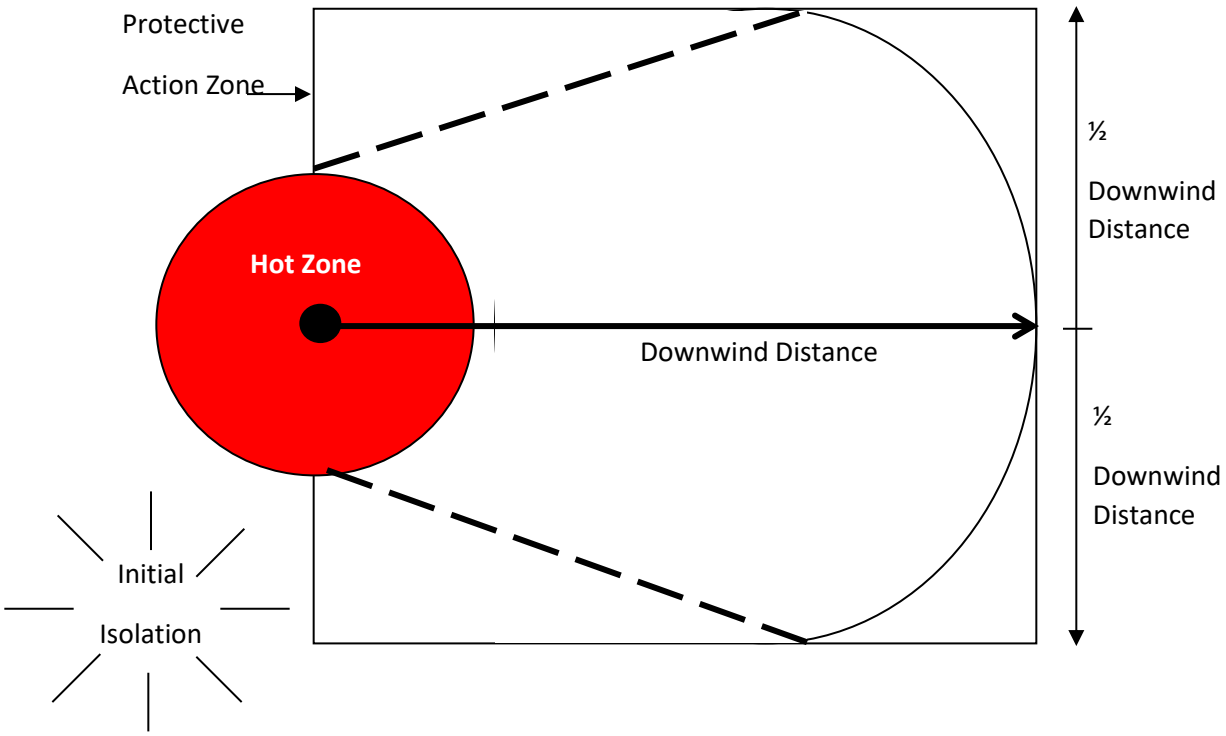



NFPA 704 HazMat*

Classification

Health Hazard
4-Deadlly
3-Extreme danger
2-Hazardous
1-Slightly hazardous
0-Normal material

Flammability
0-4

Fire Hazard
Flash Points
4-Below 73 F
3-Below 100 F
2-Below 200 F
1-Above 200 F
0-Will not burn

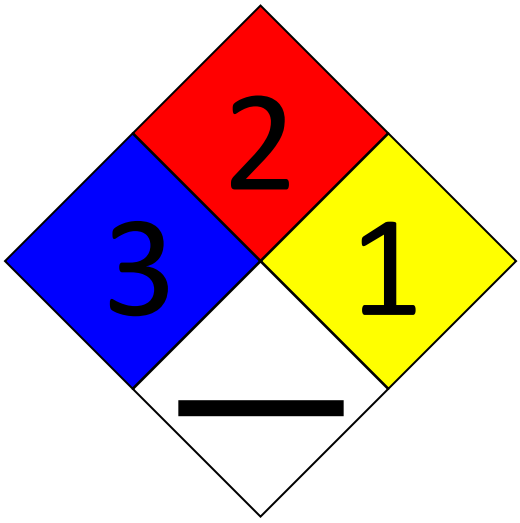

Health
0-4

Reactivity
0-4

(*Not intended to identify non-emergency health hazards)

Specific Hazard
Oxidizer OXY
Acid ACID
Alkali ALK
Corrosive COR
Simple Asphyxiant SA
Use NO WATER W
Radiation Hazard

Reactivity
4-May detonate
3-Shock and heat
may detonate
2-Violent Chemical change
1-Unstable if heated
0-Stable

Mount Polley Mining Corporation
EMERGENCY RESPONSE PLAN

Hazardous Materials Response Plan

Response Guide by TDG Hazardous Classification

Environmental Canada's Transportation of Dangerous Goods Act divides hazardous materials into nine major hazard classes. A hazard class is a group of materials that share a common major hazardous property, i.e., radioactivity, flammability, etc. These hazard classes include:

Class 1-Explosives

Class 2-Compressed Gases

Class 3-Flammable Liquids

Class 4-Flammable Solids

Class 5-Oxidizers

Class 6-Poisonous and Infectious Substances

Class 7-Radioactive Materials

Class 8-Corrosives

Class 9-Miscellaneous Hazardous Materials

Notes:

- In some emergency response procedures for TDG hazard classes, a distinction is made between bulk or package quantities. Packing Groups indicate the degree of danger of a product or substance, and are always shown in Roman Numerals: **I great danger, II moderate danger, III minor danger**

- Class 9, "Miscellaneous Hazardous Materials," refers to those materials that are hazardous but do not meet criteria for inclusion in the aforementioned classes.

Note: The material presented in this Response Guide has been written in accordance with industry standards. However, this guide cannot anticipate all possible emergency events or situations and emergency responses and therefore cannot be used without the competent review of the emergency response team and plant management. Conditions may develop in operations where standard methods will not suffice and nothing in this guide shall be interpreted as an obstacle to the experience, initiative, and ingenuity of the responders in overcoming the complexities that exist under actual emergency conditions. Responders should use all available resources to determine the appropriate strategies and tactics.

Class 1: Explosives

Definition

An explosive is any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, e.g., with a substantial instantaneous release of gas and heat.

General Emergency Response Procedures

1. Identify the material involved.
2. Keep non-essential people away (includes non-essential emergency service personnel).
3. Establish control zones (isolate area and deny entry).
4. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
5. Wear positive pressure SCBA and full protective clothing.
6. Avoid exposure to smoke, fumes, vapors, dust, or direct contact. The combustion products of some propellant explosives are poisonous.

7. Do not allow personnel to touch or move explosives. Explosives should be moved only under the advice and supervision of trained explosive personnel.

8. Contact local police or military bomb units.

9. When a hazmat team is requested to respond to a bomb threat involving hazardous materials, under no circumstances will the hazmat team conduct building or area searches even when hazardous materials are involved. The hazmat team will stage in a safe area, but not less than 200 meters feet from the incident scene.

10. The hazmat team will act as a technical resource for the bomb unit. This may involve the loaning of chemical protective clothing to bomb unit personnel, assistance in dressing, researching chemical data, etc.

Emergency Response Procedures-Fire

1. Do not fight fire in cargo or storage area containing explosives. Withdraw from the area and let the fire burn.

2. If a fire is near explosives, efforts should be taken to prevent the fire from reaching the explosives. For fires involving the motor, cab, or tires of vehicles transporting explosives, flood the area with water.

3. The application of water to burning Class A or B explosives may cause an explosion.

4. Evacuate the area:

    - Class A Explosives – 800 m in all directions.
    - Class B Explosives – 800 m in all directions.
    - Class C Explosives – 450 m in all directions.
    - Blasting Agents- 800 m in all directions.

5. Do not overhaul areas where explosives have burned or exploded.

6. Explosives that have been exposed to heat may be very shock sensitive. Keep all personnel away and do not move these containers.

7. When explosives are involved in fire or serious accidents on the roadways, Canutec (613) 996-6666 should be notified.

Class 2: Flammable Compressed Gases

Definition

A flammable material or mixture having a vapor pressure exceeding 40 psi absolute at 100° F.

General Emergency Response Procedures

1. Identify the material involved.
2. Keep non-essential people away (includes non-essential emergency service personnel.)
3. Establish control zones (isolate area and deny entry).
4. Stay upwind and keep out of low areas.
5. Ventilate confined areas before entering.
6. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.
7. Avoid exposure to gas.
8. Since the application of water to pools of liquefied gas will increase the vaporization rate, this is not usually a recommended practice.
9. If a tank truck or tank car is involved in fire, isolate 800 m in all directions.
10. Determine and implement appropriate decontamination procedures for personnel and equipment.
11. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not extinguish the fire unless the flow of gas can be stopped. The recommended means of extinguishing is to stop the flow.

2. If a leaking tank is involved in fire, cooling the tank with water may reduce the internal pressure and the rate of leakage. If sufficient water is available, use water spray to cool the tanks and adjacent combustibles affected by the heat of the fire. For massive fires, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.

3. Un-insulated pressure tanks may rupture violently if there is flame impingement on the vapor space at the top of the tank. If it can be done safely, remove all vehicles or containers not already burning.

4. Let tank, car, tank truck or storage tanks burn unless leak can be stopped.

5. Stay away from the ends of the tank exposed to heat or flame impingement.

6. Observe tanks for evidence of bulging or red hot spots in the metal, and listen for a rising sound from venting safety devices. These indicate that the tank may fail.

Emergency Response Procedures-Spill or Leak

1. Extinguish all sources of ignition in the vicinity (vehicles, traffic light control boxes, machinery, tar pots, etc.).

2. Flammable gases may be heavier or lighter than air. Determine the vapor density of the material from reference sources and use combustible gas detectors to determine the boundary of the gases. Survey the area where the gases are likely to accumulate. Common lighter-than-air flammable gases include:

    - Hydrogen
    - Acetylene
    - Hydrogen cyanide
    - Ammonia

- Methane
- Natural Gas
- Carbon Monoxide
- Ethylene (ethane)
- Propane is heaver and will tend to migrate to low laying areas. (Density 1.5)

3. Flammable gases may ignite and flash back to the opening from which the gas originated.

4. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicates the presence of flammable gases.

5. Do not enter the gas cloud. Be aware that the flammable gases extend beyond any visible cloud.

6. Water spray can be used to absorb water miscible gases, and water spray or explosion proof fans can be used to disperse gas clouds. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

7. If it can be done safely, locate all leaks and close valves or otherwise reduce the amount of leakage.

8. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.

9. Post guards and keep spectators at least 800 m away from leaks from tank cars, tank trucks, or large storage tanks containing compressed gas, liquefied gas, and cryogenics.

10. Wrecking operations or transfer of product should not begin until all the gas is dispersed. Confirmation of gas dispersal should be done with a combustible gas detector.

11. To prevent the build-up of static electricity, bond and ground the containers and equipment before product transfer.

12. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.

13. Empty tanks or tanks containing residue should be regarded as containing an ignitable gas-air mixture.

Class 3: Flammable Liquids

Definition

A liquid having a flash point below 140° F.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Eliminate ignition sources.

6. Ventilate confined areas before entering.

7. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all flammable liquid incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.
8. Avoid exposure to smoke, fumes, vapors, or direct contact.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority.

    - Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to dyking the storm, sewer, or water system ahead of the flow.

    - It may be appropriate to apply foam not only at the spill site, but also into the storm, sewer, or water system.

- To lessen the chances of ignition, it may be advisable to apply foam ahead of the flowing spill, either into storm drains or manholes down flow from the spill or down flow on the surface of open storm, sewer, or water systems.

10. If a tank truck or tank car is involved in fire, isolate 800 m in all directions.

11. Most flammable liquids float on water. Therefore, the application of water to a spill area may enable the flammable liquid to spread beyond the boundaries of the original incident.

12. The vapors of all flammable liquids are heavier than air. Therefore, in addition to eliminating ignition sources in the immediate spill area, the downwind area and adjacent low areas should be checked for sources of ignition and accumulations of flammable vapors.

13. Consider the need for additional resources and equipment (dyking material, absorbents, foam, over pack, containers, transfer equipment, private cleanup contractors, etc.).

14. Request sufficient foam supplies.

15. Determine and implement appropriate decontamination procedures for personnel and equipment.

16. Consult CANUTEC (1-613 996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. For small fires, use dry chemical, CO2, the appropriate foam or water spray.

2. For large fires use the appropriate foam or water spray. Water may be ineffective on low flash point flammable liquids.

3. If sufficient water is available, use water spray to cool tanks and adjacent combustibles affected by the heat of the fire. For massive fire, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.

4. If it can be done safely, remove any vehicles or containers not already burning.

5. Dig trenches or build dikes in the path of the burning liquids to confine the fire and protect exposures.

6. If vapors are burning at the valves, do not extinguish the fire unless re-ignition can be prevented.

7. Observe tanks for evidence of bulging or red hot spots in the metal. Listen for pinging sounds or loud noises from the tank that increases in intensity. Withdraw immediately in case or rising sound from venting safety device or discoloration of tank. These indicate that the tank may fail.

8. Do not puncture or rupture the shell of a transport vehicle involved in a fire as this may liberate more flammable liquid and extend the fire.

9. If safety relief valves are obstructed, try to reposition the tank to allow the valves to function properly, but only if this can be done safely.

Emergency Response Procedures-Spill or Leak

1. Extinguish or eliminate all sources of ignition in the vicinity (traffic light control boxes, machinery, vehicles, tar pots, etc.). Use combustible gas detectors to determine the boundaries of the vapors.

2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicated the presence or flammable vapors.

3. Keep oxidizing materials away from spilled flammable liquids.

4. Post guards and keep spectators at least 800 m away for leaks from tank cars, tank trucks or large storage containers.

5. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.

6. Do not allow flammable liquids to enter storm, sewer, or water systems.

7. Cover flammable liquids with appropriate foam to blanket the surface and reduce the rate of evaporation. When ambient temperatures are less than 100° F, combustible liquids will usually

not require blanketing to reduce vapors. Do not permit the runoff to enter storm, sewer, or water systems.

8. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

9. If it can be done safely, attempt to close valves or otherwise reduce the amount of leakage.

10. Since most flammable liquids float, for leaks near the bottom of the tank, water may be added to the tank to float the flammable liquid if the leak cannot be controlled or stopped. The water flow can be adjusted so that only water leaks out and the flammable liquid does not overflow the tank. This will provide time to offload the remaining flammable liquid.

11. Wrecking operations or transfer of product should not begin until the area is determined safe. A combustible gas detector should be used to check the area continually during the entire operation.

12. To prevent the buildup of static electricity, bond and ground containers and equipment before product transfer.

13. Empty tanks and tanks containing residue should be regarded as containing an ignitable vapor-air mixture.

14. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.

15. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.

16. Do not separate tractor units from their trailer, as the support gear on the trailer may fail.

Class 4: Flammable Solids

Definition

Any solid material, other an explosive, which under conditions normally incident to transportation is likely to cause fires through friction or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently it creates a serious transportation hazard.

Included in this class are spontaneously combustible and water reactive materials. Two materials shipped in bulk that can cause major problems for responders are phosphorous and sodium.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.

6. Avoid exposure to smoke, fumes, vapors, or direct contact. Toxic products may be produced from contact with water, heat, and other substances.

7. Consider the need for additional resources and equipment (dyking material, absorbents, foam, over pack containers, transfer equipment, private cleanup contractors, etc.).

8. If spilled material has entered storm or sewer systems, notify the proper authority.

9. Determine and implement appropriate decontamination procedures for personnel and equipment.

10. Consult CANUTEC (1-613 996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not use water or foam on water-reactive materials.

2. If it can be done safely, remove containers from fire area.

3. Chemical reference sources will indicate appropriate extinguishing agents. Agents such as dry chemical, soda ash, lime, or sand may be appropriate for use on water-reactive materials, but they must be moisture-free.

4. Water may be used to cool containers exposed to fire, but if the water contacts water-reactive materials, the incident could escalate rapidly.

Emergency Response Procedures-Spill or Leak

1. Keep ignition sources away.

2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.

3. If it can be done safely, attempt to close valves, plug, reposition containers, or otherwise reduce the amount of leakage.

4. Keep water-reactive materials dry and do not get water inside containers containing water-reactive materials.

5. Keep material out of storm, sewer, and water systems.

6. Dig trenches or build dikes around spills of water-reactive or environmentally damaging materials to prevent water from reaching them.

7. Powder spills can be covered with a plastic sheet or tarp to minimize spreading and prevent water/moisture contact.
   Warning: If the sun is shining directly on the plastic sheeting, moisture may collect on the underside of the sheeting, producing a reaction with water reactive materials.

Class 5: Oxidizers and Organic Peroxides

Definition

An oxidizer is a substance that yields oxygen readily to stimulate the combustion of other material.

Organic peroxide is an organic derivative of the inorganic compound hydrogen peroxide where organic radicals have replaced one or more of the hydrogen atoms. Organic peroxides readily release oxygen to stimulate the combustion of other materials.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.

6. Ventilate confined areas before entering.

7. Avoid exposure to smoke, fumes, dust, vapors, or direct contact. Burning oxidizers frequently produces toxic products.

8. Caution should be exercised when water is used on oxidizers, as most oxidizers are water-soluble and will produce solutions that can impregnate wood and other organic combustibles. Upon drying, these materials can spontaneously ignite and burn vigorously.

9. In accidents involving chlorates and other oxidizing materials, care is necessary to prevent ignition by friction or contact with acids.

10. When chlorates are mixed with organic matter, or even dust, a flammable mixture is formed.

11. Chlorates mixed with finely divided combustible material may burn with explosive violence.

12. Leaking of nitric acid, perchloric acid, or hydrogen peroxide may cause fire. These materials are also corrosive.

13. Organic peroxides generally have the special property that if they are heated beyond their transportation temperatures; they are likely to detonate.

14. Consider the need for additional resources and equipment (dyking materials, absorbents, foam, over pack containers, transfer equipment, private cleanup contractors, etc.)

15. If spilled material has entered storm or sewer systems, notify the proper authority.

16. Determine and implement appropriate decontamination procedures for personnel and equipment.

17. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. If it can be done safely, remove any containers not already burning.

2. Cool affected containers with flooding quantities of water. For massive fires, use unmanned monitors. If this is not possible, withdraw and let the fire burn. Runoff water must be contained for later analysis and proper disposal.

Emergency Response Procedures-Spill or Leak

1. Keep flammables, combustibles and organic materials away from spilled material.
2. Avoid contact with spilled material.

3. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.

4. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

5. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

6. Keep material out of storm, sewer, and water systems.

7. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.

8. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

Class 6: Pesticides and Poisons

Definition

Pesticides are chemical agents used to destroy pests.

Poisons are substances that, through chemical action, usually kill, injure, or impair an organism.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents.

- Due to the construction and materials used for firefighter turnout clothing, the clothing may actually absorb and hold the pesticide or poison if contact with the smoke, fumes, dust, vapors, or material occurs. The firefighter would be re-exposed each time the clothing were worn if proper decontamination operations were not performed.

- In most incidents involving pesticides or poisons, the chemical protective clothing carried on the hazmat team will be required for safe handling of the incident.

5. Stay upwind and keep out of low area. If you can smell pesticide, you are too close and not sufficiently protected.

6. Avoid exposure to smoke, fumes, vapors, dust or direct contact.

7. Determine signs and symptoms of exposure and advise all personnel operating at the site. Some symptoms may not become present for up to 48 hours following exposure.

8. Ventilate confined areas before entering. It is not advisable for fire personnel to enter tanks or other confined spaces that contain or have contained pesticides and/or poisons.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority. Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to dyking ahead of the flow.

10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Flush any contacted material from skin or clothing immediately.

12. Remove and isolate any contaminated clothing at the site and avoid spreading contamination to non-contaminated areas.

13. Consult CANUTEC (1-416-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Consider protecting exposures and allow the fire to burn. This may create less of a hazard to people and the environment, especially if runoff cannot be confined.

2. For small fires, use dry chemical, CO2, water spray or the appropriate foam.

3. For large fires use the appropriate foam or water spray.

4. Do not extinguish fire unless the flow can be stopped.

5. If sufficient water is available, use water spray to cool containers exposed to the fire.

6. Dike fire control water for later analysis and/or disposal.

Emergency Response Procedures-Spill or Leak

1. For a liquid pesticide spill, extinguish or eliminate all sources of ignition in the vicinity as many pesticides have flammable liquids as the carrier of the poison. Use combustible gas detectors to determine the boundary of the vapors if the pesticide is a flammable.
2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicates the presence of flammable vapors.

3. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

4. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer or water systems.

5. Keep material out of storm, sewer, and water systems.

6. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.

7. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

Class 6: Infectious Substances

Definition

Substances or materials hosting or contaminated by communicable pathogens. Examples include medical waste, laboratory samples, etc.

General Emergency Response Procedures

1. Identify the materials involved. Infectious substances include the red infectious waste bags and "sharps" containers from hospitals (sharps containers are used for the disposal of needles and other sharp instruments). Caution should be used if these containers are encountered.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and chemical protective clothing. Firefighter protective clothing will not provide adequate protection for all incidents involving infectious substances. The chemical protective clothing carried on the hazmat team may be required for safe handling of the incident.

5. Stay upwind and keep out of low areas.

6. Avoid exposure to smoke, fumes, vapors, or dust. Do not contact damaged containers or spilled material. Virus and disease-bearing substances are often present.

7. If leakage is discovered in transit, the vehicle must not be moved and the area must be isolated.

8. If spilled material has entered storm or sewer systems, notify the proper authority.

9. Implement appropriate decontamination procedures. A freshly mixed 10% or stronger bleach/water solution is an effective decontamination solution for most infectious substance exposures.

Emergency Response Procedures-Fire

1. If it can be done safely, remove containers from the fire area. Do not touch or move damaged containers.

2. Use dry chemical, soda ash, or lime for small fires.

Emergency Response Procedures-Spill or Leak

1. Cover damaged containers or spill area with dampened towel or rag, and keep wet with liquid bleach.

    - To decontaminate the area and equipment, a garden sprayer with a 10% bleach/water solution can used to spray exposed surfaces.

    - Recently mixed bleach/water solutions should be used, as premixed solutions lose their strength after a few days.

2. Dike spills for later disposal.

3. Keep material out of storm, sewer and water systems.

Class 7: Radioactive Materials

Definition

Radioactive materials contain charged particles (ions) and have a specific gravity greater than 0.002 microcuries per gram. These charged particles may cause damage to molecules, cells, or tissues. Atoms that emit ionizing radiation are said to be radioactive; radioactivity is the process whereby atomic changes, known as decay or disintegration, occur through the emission of ionizing radiation.

General Emergency Response Procedures

1. Identify the materials involved. Radioactive materials are often shipped in lead containers.

2. Keep people as far away as practical, at least 50 m upwind.

3. Establish control zones (isolate area and deny entry). Use radiation-monitoring devices to determine control zones and assess areas for contamination.

4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for radioactive incidents.

5. Avoid exposure to smoke, fumes, vapors, dusts or direct contact.

6. All personnel should utilize dosimeters. Zero dosimeters prior to use.

7. Entry should not be made until appropriate radiological personnel are on scene and the degree of radiation is known.

8. Enter Exclusion Zone only to save a life, and limit entry into the Exclusion Zone to the shortest possible time.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority.

10. Implement appropriate decontamination procedures for personnel and equipment.

11. Delay clean up until arrival or instructions of qualified radiation personnel.

12. Equipment used in the Exclusion Zone shall not be removed until appropriate decontamination procedures have been performed and the equipment has been monitored and declared clean.

13. Contact a radiological team for assistance and equipment.

14. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not move-damaged containers, but undamaged containers should be moved to a safe area if it can be done safely.

2. Assume the fire involves radioactive materials.

3. Avoid exposure to smoke, fumes, or dust. Airborne contamination is a great cause of concern for emergency responders. Stay upwind from the fire area.

4. Evacuate downwind area.
5. The fire should be extinguished as quickly as possible, with a minimum amount of water. Try not to disturb the radioactive containers.

6. Fight fire from a maximum distance. Do not allow personnel into the area after fire knockdown.

7. For massive fires, use unmanned monitors.

8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.

9. The fire area should not be overhead.

Emergency Response Procedures-Spill or Leak

1. Do not touch damaged containers or contact the spilled material.

2. Prevent spread of spilled material and keep it out of water systems and sewers. Dike far ahead of large spills to confine the material for later disposal.

Class 8: Corrosives

Definition

Any liquid or solid, including powders, that can destroy tissue, or a liquid that has a severe corrosion rate on steel or aluminum.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and chemical protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for corrosive incidents. The chemical protective clothing carried by the hazmat team may be required for the safe handling of most incidents involving corrosives.

5. Stay upwind and keep out of low areas.

6. Avoid exposure to smoke, fumes, vapors, dusts, or direct contact. Highly toxic fumes are often present.

7. Ventilate confined areas before entering.
8. Consider the need for additional resources and equipment (dyking material, absorbents, over pack containers, transfer equipment, private cleanup contractors, etc.).

9. If spilled material has entered storm or sewer systems, notify the proper authority.

10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Many corrosive chemicals react violently with water, liberating heat and toxic gases.

2. If it can be done safely, remove undamaged containers from the fire area.

3. Do not get water inside the container.

4. Use water to cool containers that are exposed to flame until well after the fire is out. Do not allow water to get inside container.

Emergency Response Procedures-Spill or Leak

1. Avoid contact with spilled material.

2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition into the area.

3. Do not apply water unless directed to do so. Contact with water may cause the generation of large quantities of vapors and heat.

4. Do not get water inside the container.

5. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers and do not put water on leak or spill area. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

6. Keep combustibles (wood, paper, oil, etc.) away from spilled material.

7. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal or recovery.

9. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

10. Keep material out of storm, sewer, or water systems.

11. Do not attempt neutralization. Neutralization may cause the production of vapors and heat, creating additional problems.

12. Do not attempt dilution. The quantity of water required to dilute one gallon of concentrated acid to a neutral pH of 7 is in the hundreds of thousands of gallons.

Specific Action Plan

Propane (UN1978)

Regulated by Environment and Climate Change Canada (ECCC) for the E2 regulations.

Uses

Fuel source for heating mine buildings such as mill, pit shop, warehouse and water treatment plant. Also used as fuel for forklift trucks

Location

Main Storage tank on east side of Mill building (Max storage capacity is 110,000 litres)

Water Treatment Plant Tank (Max storage capacity is 60,000 litres)

Properties

EXTREMELY FLAMMABLE.

Will be easily ignited by heat, sparks or flames.

Will form explosive mixtures with air.

Vapors from Propane are initially heavier than air and spread along ground.

Vapors may travel to source of ignition and flash back.

GASES UNDER PRESSURE- COMPRESSED GAS

Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.

Containers may explode when heated.

Ruptured cylinders may rocket.

HEALTH

Vapors may cause dizziness or asphyxiation without warning.

Some may be irritating if inhaled at high concentrations.

Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

Fire may produce irritating and/or toxic gases.

SAFETY

Keep away from heat, sparks, open flames, and hot surfaces.

No smoking.

Stay upwind, uphill and/or upstream.

Propane gas is heavier than air and will spread along the ground and collect in low or confined areas

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.

PROTECTIVE CLOTHING

Wear positive pressure self-contained breathing apparatus (SCBA).

Structural firefighters' protective clothing provides limited thermal protection.

Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

EVACUATION

Small Spill

Spill or leak- Evacuate area for at least 100 meters (330 feet) in all directions.

Large Spill

Consider initial downwind evacuation for at least 800 meters (1/2 mile).

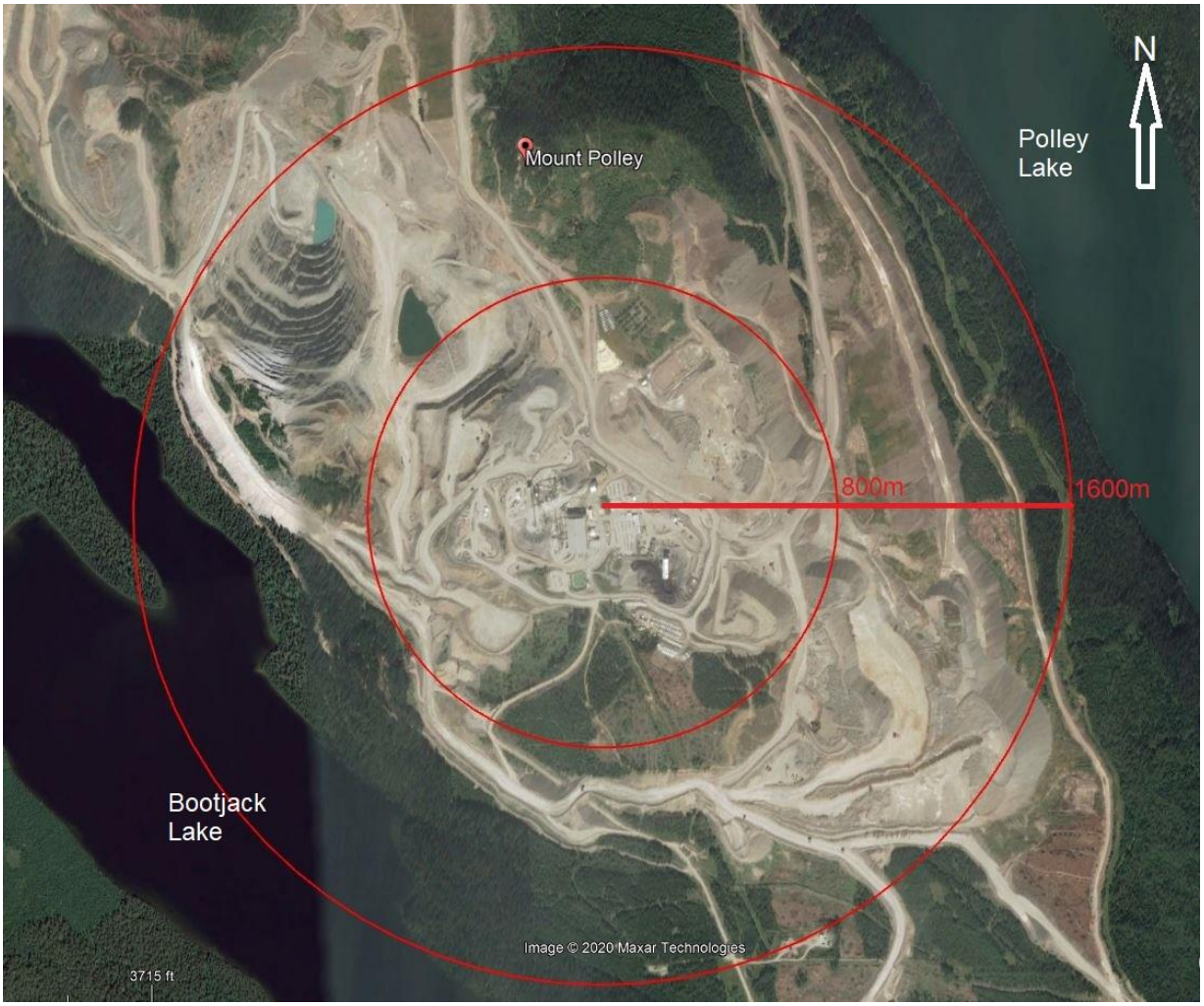

Evacuation map – Propane

FIRE

If tank or tank truck is involved in a fire, consider initial evacuation for 1600 meters in all directions.

ALWAYS stay away from tanks engulfed in fire.

SMALL FIRE

Dry chemical or CO2.

LARGE FIRE

For massive fire Evacuate from area and let fire burn.

Fight fire from maximum distance.

Water spray or fog.

If it can be done safely, move undamaged containers away from the area around the fire.

Cool containers with flooding quantities of water until well after fire is out.

Do not direct water at source of leak or safety devices; icing may occur.

Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

BLEVE (BOILING LIQUID EXPANDING VAPOR EXPLOSION)

A BLEVE occurs when a fire impinged or damaged tank fails to contain its internal pressure and explodes with a sudden product release.

The main hazards from a BLEVE are:

Fire: If the released substance is ignited, there is an immediate fireball.

Thermal radiation: At a distance of about 4 times the radius of a fireball, the heat radiated from a fireball is enough to burn exposed skin in 2 seconds. Wearing protective clothing limits the thermal radiation dose.

Blast: A concussive force caused by the sudden release of the pressurized substance. For a BLEVE occurring out in the open, the blast strength at a distance of 4 times the radius of a fireball can break window glass and may cause minor damage to buildings.

Projectiles: Tank failure can throw metal fragments over large distances. These fragments can and have been deadly.

The danger decreases as you move away from the BLEVE centre. The furthest-reaching hazard is projectiles

For additional information on Propane Hazards refer to Transport Canada Emergency Response Guidebook and Propane Safety Data Sheet (SDS)

Consult CANUTEC (1-613-996-6666) for product information and assistance.

SPILL OR LEAK

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.

All equipment used when handling the product must be grounded.

Do not touch or walk through spilled material.

Stop leak if you can do it without risk.

If possible, turn leaking containers so that gas escapes rather than liquid.

Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.

Do not direct water at spill or source of leak.

Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Isolate area until gas has dispersed.

FIRST AID

Call 911 or emergency medical service.

Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Move victim to fresh air if it can be done safely.

Give artificial respiration if victim is not breathing.

Administer oxygen if breathing is difficult.

Remove and isolate contaminated clothing and shoes.

Clothing frozen to the skin should be thawed before being removed.

In case of contact with liquefied gas, thaw frosted parts with lukewarm water.

In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.

Keep victim calm and warm.

Specific Action Plan

LIME

PROPERTIES:

White powder to granular.

Very alkaline; very corrosive to eye surfaces.

Effects of acute exposure - corrosive.

Effects of chronic exposure are burns, ulceration, and blindness.

ACTION STEPS:

Report spill.

Stop source if possible.

Contain spill materials.

Protect area.

Remove material.

Reclaim area.

Complete spill report.

NOTIFICATION:

Immediately notify the Area Supervisor.

INITIAL SPILL RESPONSE:

Stop spill at source, if possible.

Avoid dusting.

Keep spilled lime dry.

Prevent from entering watercourses.

If mixed with water, dyke and contain the milk of lime.

HAZARDS and ENVIRONMENTAL THREATS:

Heat generated when mixed with water.

Strong alkaline - protect self from exposure, especially eyes.

No environmental hazard.

ACTION FOR FIRE:

Shovel and contain dry material in containers.

Dyke and contain milk of lime and pump into proper mill circuit.

DISPOSAL:

Dispose of recovered solids by recycling material through the crushing circuit to the mill process.

Specific Action Plan

TAILINGS OR CONCENTRATES

PROPERTIES:

Maybe toxic when ingested and or the fumes, if any, are inhaled from residual milling components.

HAZARDS and ENVIRONMENTAL THREATS:

Will cover and kill vegetation.

May exhibit ARD properties overtime.

ACTION STEPS:

Report spill.

Stop source, if possible.

Contain spill, if possible.

Protect area.

NOTIFICATION:

Immediately notify your Area Supervisor.

INITIAL SPILL RESPONSE:

Stop the flow, if possible.

Prevent spills from entering watercourses

Contain spilled liquid using sand, straw, or commercial absorbents.

If raining cover with tarps

ACTION FOR FIRE:

Slightly flammable

RECOVERY:

Pump or scoop up material.

If necessary, contaminated soil should be excavated.

DISPOSAL:

Recovered spilled materials and contaminated soils should be disposed of in the tailing storage facility

Specific Action Plan

MINE INFLUENCED WATER
(NOT RELATED TO HAZELTINE CREEK DISCHARGE SYSTEM)

PROPERTIES:

Water that has been affected by mining or mineral processing and may contain elevated levels of metals, suspended solids, reagents, and other parameters, or a pH outside of the natural range.

HAZARDS and ENVIRONMENTAL THREATS:

May have a detrimental effect on aquatic or terrestrial environments and organisms. May cause erosion and deposition of sediment (on land or in creeks).

ACTION STEPS:

Report spill.

Stop source, if possible.

Contain spill, if possible.

Protect area.

NOTIFICATION:

Immediately notify your Area Superintendent.

INITIAL SPILL RESPONSE:

Stop the release using water diversions or pumps, or contain water using berms or sumps.

Prevent spills from entering watercourses.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

Use sediment and erosion control methods including, but not limited to, straw, sediment fence, and geotextiles and retention ponds to minimize erosion and limit sediment transport by water.

RECOVERY:

Pump any water out of emergency sumps or water storage facilities.

Re-vegetate any eroded areas.

Review root causes of the release, and implement changes to prevent a re-occurrence.

Specific Action Plan

MINE INFLUENCED WATER
(RELATED TO WTP Discharge System)

PROPERTIES:

Water that has been affected by mining or mineral processing and may contain elevated levels of metals, suspended solids, reagents, and other parameters, or a pH outside of the natural range.

HAZARDS and ENVIRONMENTAL THREATS:

May have a detrimental effect on aquatic or terrestrial environments and organisms. May cause erosion and deposition of sediment in the creek and alter creek morphology.

SYSTEM SPILL PREVENTION MECHANISMS:

In the event that trigger thresholds for conductivity, temperature or flow are exceeded in continuous monitoring of the discharge effluent, a warning will be issued to the Mill Control Room immediately through the Man Machine Interface. These trigger levels (set below permitted allowable levels) allow for the discharge system to be shut off or discharge rates reduced before any guidelines are exceeded.

Pump failure triggers an automatic “shut off”, and water storage tanks have automatic (and manual) overflow systems that drain water into existing effluent storage facilities.

NOTIFICATION:

Immediately notify the Area Superintendent.

In addition to regulatory notifications required for releases of mine influenced water, the Ministry of Environment must be notified of discharge guideline exceedances and Environment Canada must be notified (as outlined in Mount Polley Mining Corp.’s *Annual Discharge Plan,* PE-11678, and the Metal Mining Effluent Regulations).

INITIAL SPILL RESPONSE:

Immediately stop effluent discharge using the manual shut off valves (and tank drains if necessary).

If the release is due to physical damage to the discharge line, if possible, stop the release using water diversions, berms, sumps or pumps to prevent water from entering watercourses, and use sediment and erosion control materials and methods, such as straw, sediment fence, geotextiles, and retention ponds to minimize erosion and limit sediment transport by water.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

RECOVERY:

Pump any water out of emergency sumps or water storage facilities.

Re-vegetate any eroded areas.

Review root causes of the release, and implement changes to prevent a re-occurrence.

Specific Action Plan

RELEASE OF TILL/MUD/SOIL/ROCK

PROPERTIES:

Any form of rock, soil, or till, including mud and suspended till.

HAZARDS and ENVIRONMENTAL THREATS:

May cause deposition or morphological changes to watercourses and increase turbidity. May disturb vegetated areas and promote erosion. May have a detrimental effect on terrestrial or aquatic environments and organisms. Large transfers of material may be hazardous for humans.

ACTION STEPS:

Report incident.

Stop source, if possible and if area is safe.

Contain material, if possible and if area is safe.

Protect area.

NOTIFICATION:

Immediately notify your Area Superintendent.

INITIAL RESPONSE:

Stop the release using methods including berms or containment sumps.

Take action to protect any infrastructure or prevent further incidents (example: shut off water in dewatering pipelines that may be affected).

Prevent material from entering watercourses.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

Use sediment and erosion control methods including, but not limited to, straw, sediment fence, and geotextiles and retention ponds to minimize erosion and limit sediment transport by water.

RECOVERY:

Move material, as possible and as required (example: away from infrastructure).

Install long-term sediment and erosion control works, including re-vegetation of any eroded areas.

Restore aquatic habitats, as required.

Review root causes of the release, and implement changes to prevent a re-occurrence

Appendix C Protocol for Corporate Reporting of an Environmental Incident

A) Protocol for Corporate Reporting of an Environmental Incident:

1) Corporate reporting of an "environmental incident" is required when:

(a) Any environmental incident occurs that:

- Poses a serious or imminent threat to human health or to the environment.
- Precipitates an immediate, external reporting requirement to regulatory authorities.
- Requires a minimum expenditure of $Cdn25, 000 in materials and/or offsite technical or legal support.
- Is subject of an inquiry from the media.

(b) Any environmental event occurs when:

- An administrative or judicial enforcement action is taken.
- A notice of a citizen suit or other significant complaint from the public is received.
- A private lawsuit premised on personal injury or property damage is filed.
- A civil or criminal action is taken against any Mount Polley Mining Corp. employee, manager, officer or Director.

2) Protocol for Report

(a) The Area Superintendent will immediately notify the General Manager (or his designate).

(b) The general manager will notify the Company President. (CP)

(c) Consultation with the general manager will determine the extent of legal counsel involvement.

(d) The Area Superintendent will prepare a " Preliminary Draft Incident Report for the General Manager to authorize and fax as soon as possible to the CP. The "Final Incident Report" will be submitted once the investigation of the incident is complete.

B) Protocol for Communicating Environmental Issue

1) Corporate communication of an "environmental issue" is required when:

(a) A situation arises or an event occurs that has, in the opinion of the Area Superintendent, the potential to become an Environmental Incident as defined above.

2) Protocol for Communicating and Environmental Issue.

(a) When an issue becomes apparent, the Area Superintendent will inform the General Manager.

(b) Actions plans to mitigate a possible incident will be developed and approved by the General Manager.

(c) The General Manager will keep the CP informed of any issues with the potential to become " Incidents".

Appendix D Preliminary Incident Report

PRELIMINARY INCIDENT REPORT

Mount Polley Mining Corporation
Environmental Incident Report

Date of Incident:	**Date Incident Reported:**
Incident:	
Department:	**Supervisor:**

DESCRIPTION OF INCIDENT: (include detailed timeline of events)	
Date	
Time	
Time	
Time	
Time	

Include figures as required.
Maps
photos

NEXT STEPS:
Internal Root Cause Analysis

Environmental Assessment and Monitoring
Review of required monitoring
Long Term Mitigation
If required.
Signature of Area Supervisor: _____
Copies: Include names of all recipients of report

Appendix E Reportable Levels for Certain Substances

Item	Column 1	Column 2
	Substance spilled	**Specified amount**
1 **Ammonium Nitrate**	Class 1, Explosives as defined in section 2.9 of the Federal Regulations	Any quantity that could pose a danger to public safety or 50 kg
2	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	10 kg
4 **Propane**	Class 2.1, Flammable Gases, other than natural gas, as defined in section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in section 2.14 (c) of the Federal Regulations	5 kg
5 **Gasoline, MIBC, Diesel**	Class 3, Flammable Liquids as defined in section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in section 2.20 of the Federal Regulations	25 kg
7 **NaHS**	Class 5.1, Oxidizing Substances as defined in section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in section 2.24 (b) of the Federal Regulations	1 kg or 1 L
9	Class 6.1, Toxic Substances as defined in section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment

11	Class 7, Radioactive Materials as defined in section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12 **Acids**	Class 8, Corrosives as defined in section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in section 2.43 of the Federal Regulations	25 kg or 25 L
14	waste containing dioxin as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	leachable toxic waste as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the hazardous Waste Regulation	5 kg or 5 L
17	waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18 **Waste Oil**	waste oil as defined in section 1 of the Hazardous Waste Regulation	100 L
19	waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L
20	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	waste containing tetrachloroethylene as defined in section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	biomedical waste as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23 **Concentrate, Tailings, Lime**	A hazardous waste as defined in section 1 of the Hazardous Waste Regulation and not covered under items 1 – 22	25 kg or 25 L

24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas